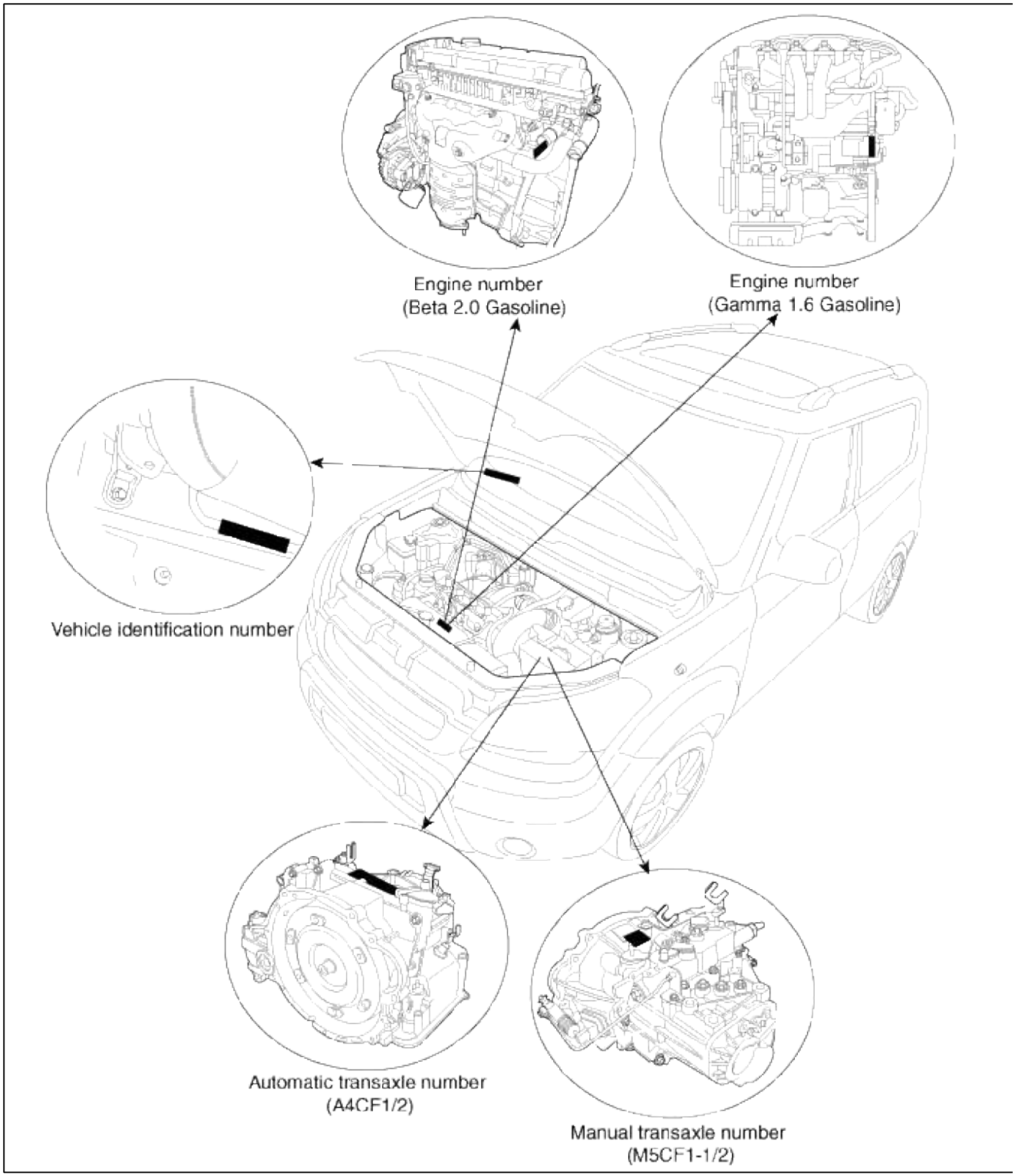
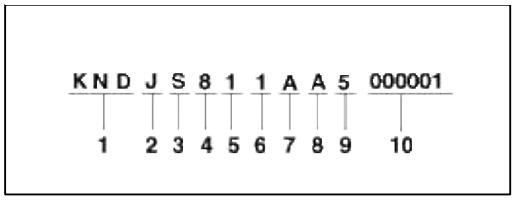
SOUL(AM) > 2010 > G 1.6 DOHC > General Information

General Information > General Information > General Information

Identification Number Locations



Identification Number Description
Vehicle Identification Number



1. World Manufacturer Identifier (WMI)
   - KNA : Passenger vehicle, MPV(Multipurpose Passenger Vehicle)/SUV(Sports Utility Vehicle)/RV(Recreational Vehicle)
   - KNC : Commercial vehicle (Van)
   - KND: MPV/SUV/RV (For U.S.A, Canada, Mexico)
   - KNH: Van
2. Vehicle line
   - J : SOUL
3. Model & Series
   - S : Low grade (L)
   - T : Middle-Low grade (GL)
   - U : Middle grade (GLS, JSL, TAX)
   - V : Middle-High grade (HGS)
   - W : High grade (TOP)
4. Body/Cabin type, Gross Vehicle Weight Rating
   KNA
   - 1 : Limousine
   - 2 : Sedan - 2 door
   - 3 : Sedan - 3 door
   - 4 : Sedan - 4 door
   - 5 : Sedan - 5 door
   - 6 : Coupe
   - 7 : Convertible
   - 8 : Wagon
   - 9 : Commercial Van
   - 0 : Pick-Up

   KNC (Commercial vehicle / Van)
   Except U.S.A, Canada, Mexico, Gulf Cooperation Council, China
   - X : Standard Cabin / Semi-Bonnet
   - Y : Double Cabin / Bonnet
   - Z : Super Cabin / Box

   For U.S.A, Canada, Mexico, Gulf Cooperation Council, China
   - 2 : Standard Cabin Class-H 4×2
   - 3 : Standard Cabin Class-E 4×2 / Semi-Bonnet Class-E 4×2
   - 4 : Standard Cabin Class-E 4×4 / Semi-Bonnet Class-E 4×4
   - 5 : Standard Cabin Class-F 4×2 / Semi-Bonnet Class-F 4×2
   - 6 : Standard Cabin Class-F 4×4 / Semi-Bonnet Class-F 4×4
   - 7 : Double Cabin Class-E 4×2 / Bonnet Class-E 4×2
   - 8 : Double Cabin Class-E 4×4 / Bonnet Class-E 4×4
   - 9 : Double Cabin Class-F 4×2 / Bonnet Class-F 4×2
   - 0 : Double Cabin Class-F 4×4 / Bonnet Class-F 4×4
   - A : Super Cabin Class-E 4×2 / Box Class-E 4×2
   - B : Super Cabin Class-E 4×4 / Box Class-E 4×4
   - C : Super Cabin Class-F 4×2 / Box Class-F 4×2
   - D : Super Cabin Class-F 4×4 / Box Class-F 4×4

KND
- 1 : Wagon 4×2 Class-A
- 2 : Wagon 4×2 Class-B
- 3 : Wagon 4×2 Class-C
- 4 : Wagon 4×2 Class-D
- 5 : Wagon 4×2 Class-E
- 6 : Wagon 4×2 Class-F
- 7 : Wagon 4×2 Class-G
- A : Wagon 4×4 Class-A
- B : Wagon 4×4 Class-B
- C : Wagon 4×4 Class-C
- D : Wagon 4×4 Class-D
- E : Wagon 4×4 Class-E
- F : Wagon 4×4 Class-F
- G : Wagon 4×4 Class-G

KNH
- 1 : Box
- 2 : Bonnet
- 3 : Semi-Bonnet

5. Restraint system, Brake system

KNA, KND

Except U.S.A, Canada, Mexico
- 0 : Both side - None
- 1 : Both side - Active belt
- 2 : Both side - Passive belt

For U.S.A, Canada, Mexico

Code	Seat belt	Front air bag		Knee air bag		Side air bag			Curtain air bag		
		Driver's	Passenger's	Driver's	Passenger's	1st row	2nd row	3rd row	1st row	2nd row	3rd row
A	○	○	○	×	×	○	×	×	○	○	×
B	○	○	○	×	×	×	×	×	×	×	×
C	○	○	○	×	×	○	×	×	○	○	○
D	○	○	○	×	×	○	○	×	○	○	×
E	○	○	×	×	×	×	×	×	×	×	×
F	○	○	○	×	×	○	×	×	×	×	×
N	○	×	×	×	×	×	×	×	×	×	×
H	○	○	○	○	×	○	×	×	○	○	○

KNC, KNH

Except U.S.A, Canada, Mexico
- 7 : Hydraulic brake system
- 8 : Pneumatic brake system
- 9 : Mixed brake system

For U.S.A, Canada, Mexico
- X : Hydraulic brake system
- Y : Pneumatic brake system
- Z : Mixed brake system

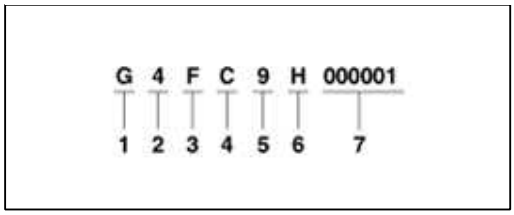
6. Engine type
   - 1 : Gasoline engine 1.6
   - 2 : Gasoline engine 2.0
7. Check digit or Driver's side & Transmission
   Except U.S.A, Canada, Mexico, Gulf Cooperation Council, China, Yemen
   - A : LHD & MT
   - B : LHD & AT
   - C : LHD & MT+Transfer
   - D : LHD & AT+Transfer
   - E : LHD & CVT
   - L : RHD & MT
   - M : RHD & AT
   - N : RHD & MT+Transfer
   - S : RHD & AT+Transfer
   - T : RHD & CVT

   For U.S.A, Canada, Mexico, Gulf Cooperation Council, China, Yemen
   - Check digit : 0 ~ 9, ×
8. Production year
   - A : 2010, B : 2011, C : 2012, D : 2013...
9. Plant of production
   - 6 : Sohari (Korea)
   - 5 : Hwasung (Korea)
   - 7 : Kwangju (Korea)
   - T : Seosan (Korea)
10. Vehicle production sequence number
    - 000001 ~ 999999

Paint Code

Code	Color
1D	Clear White
3D	Silver
IM	Titanium Silver
H5	Java Brown
9H	Cherry Black
A1	Vanilla Shake
1E	Tomato Red
I2	Moonlight Blue
Y1	Cocktail Orange
I7	Green tea Latte
1H	Blue Stone

Engine Number



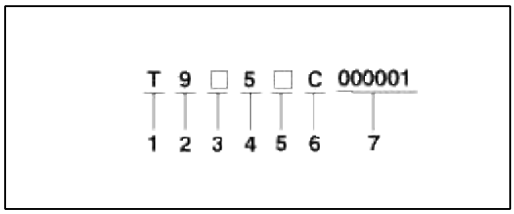
1. Engine fuel
   - G : Gasoline
2. Engine range
   - 4 : 4 cycle 4 cylinder

3 - 4. Engine development order and capacity
   - FC : Gamma engine, 1592 cc
   - GC : Beta - engine, 1975 cc

5. Production year
   - 9 : 2009, A : 2010, B : 2011, C : 2012, D : 2013...
6. Plant of production
   - A : Asan (Korea)
   - B : Beijing (China)
   - H : Hwasung (Korea)
   - K : Montgomery (U.S.A)
   - M : Chennai (India)
   - P : Poseung (Korea)
   - S : Sohari (Korea)
   - T : Izmit (Turkey)
   - U : Ulsan (Korea)
   - W : Shandong (China)
   - Z : Zilina (Slovakia)
   - 1 : Yancheng (China)
7. Engine production sequence number
   - 000001 ~ 999999

Transaxle Number

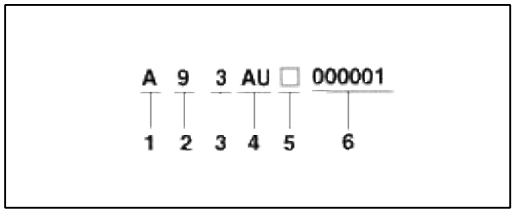
Manual



1. Model
   A. T : M5CF1-1
   B. V : M5CF2
2. Production year
   A. 9 : 2009, A : 2010, B : 2011, C : 2012, D : 2013...
3. Plant of production
4. Speed (5 or 6)
5. Reserve

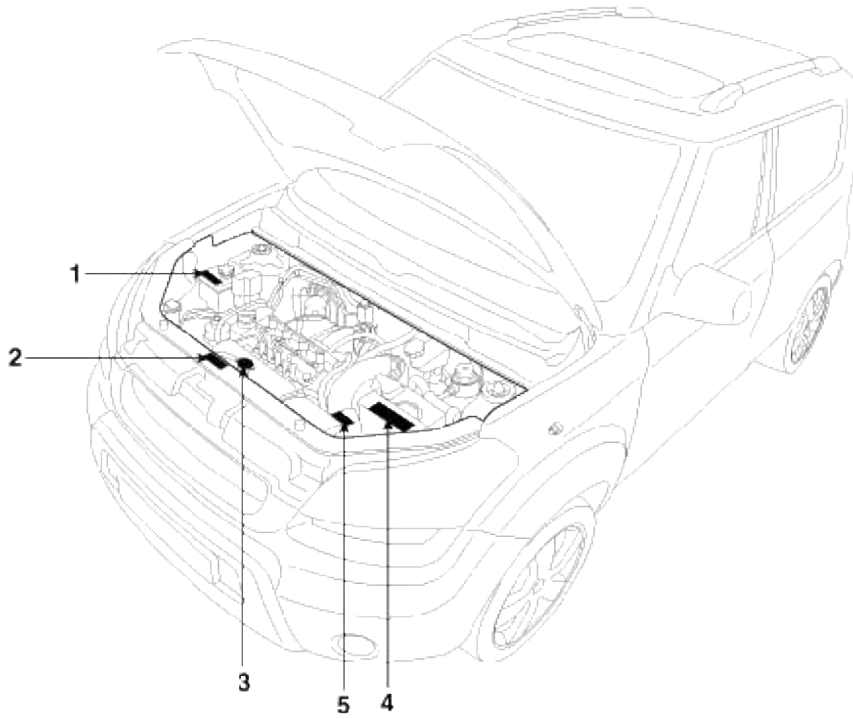
6. Gear ratio
   A. F : 4.267
   B. E : 4.188
7. Transaxle production sequence number
   - 000001 ~ 999999

Automatic



1. Model
   A. A : A4CF1
   B. B : A4CF2
2. Production year
   - 9 : 2009, A : 2010, B : 2011, C : 2012, D : 2013...
3. Gear ratio
   A. 6 : 4.619
   B. 3 : 4.375
4. Detailed classification
   A. AU : γ-1.6
   B. BV : β2-2.0
5. Spare
6. Transaxle production sequence number
   - 000001 ~ 999999

Warning / Caution Label Locations



1. Coolant level caution 2. Fan caution 3. Radiator cap caution	4. Battery caution 5. Air cleaner caution

Battery Caution Label Describtion



WARNING / CAUTION LABEL (CONT'D)

A.
Keep lighted cigarettes and all other flames or sparks away from the battery.

B.
Wear eye protection when charging or working near a battery. Always provide ventilation when working in an enclosed space.

- When lifting a plastic-cased battery, excesive pressure on acid to leak resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners.
- Never attempt to change the battery when the battery cables are connected.
- The electrical ignition system works with high voltage.
  Never touch these components with the engine running or the ignition switched on.

C.
Keep batteries out of the reach of children because batteries contain highly corrosive SULFURIC ACID. Do not allow battery acid to contact your skin, eyes, clothing or paint finish.

D.
If any electrolyte gets into your eyes, flush your eyes with clean water for at least 15 minutes and get immediate medical attention. If possible, continue to apply water with a sponge or cloth until medical attention is received. If electrolyte gets on your skin, throughly wash the contacted area. If you feel a pain or a burning sensation, get medical attention immediately.

E.
Always read the following instructions carefully when handing a battery.

F.
Hydrogen, which is a highly combustible gas, is always presents in battery cells and may explode if ignited.

G.
An improperly disposed battery can be harmful to the environment and human health.
Always confirm local regurations for battery disposal.

Handling And Storage The Battery

Battery Itself	• Batteries should be stored in cool, dry (27 degrees Celsius) places and out of direct sunlight. • MF batteries are tightly sealed to prevent acid leakage. However, tilting the battery to an angle of 45 degrees can cause acid to leak through the vents on the sides. Therefore, batteries should always be stored in their upright positions. Prevent placing any aqueous or solid (i.e. conductors) bodies on top of the battery. • It is extremely dangerous to use tools, such as hammers, on the battery terminals when connecting cables to the mounted battery.
Battery on Vehicle	• When storing the vehicle for long periods of time, make sure to remove the memory fuse at junction box to prevent natural discharging. • Also, run the engine for battery charging within 1 month if the memory fuse wasn't removed from the start of vehicle storing. If the memory fuse was removed, run the engine for battery charging within 3 months from the start of vehicle storing.

NOTE

After reconnecting or recharging a discharged battery, the ESP OFF indicator may illuminate.
In this case, turn the handle half way to the left and right whilst the ignition switch is in the ON position.
Then, restart the engine after the ignition is OFF.
The ESP OFF indicator may turn OFF.
If the ESP OFF indicator does not turn OFF, have the system checked refering to DTC. (Refer to the BR group.)

Lift And Support Points

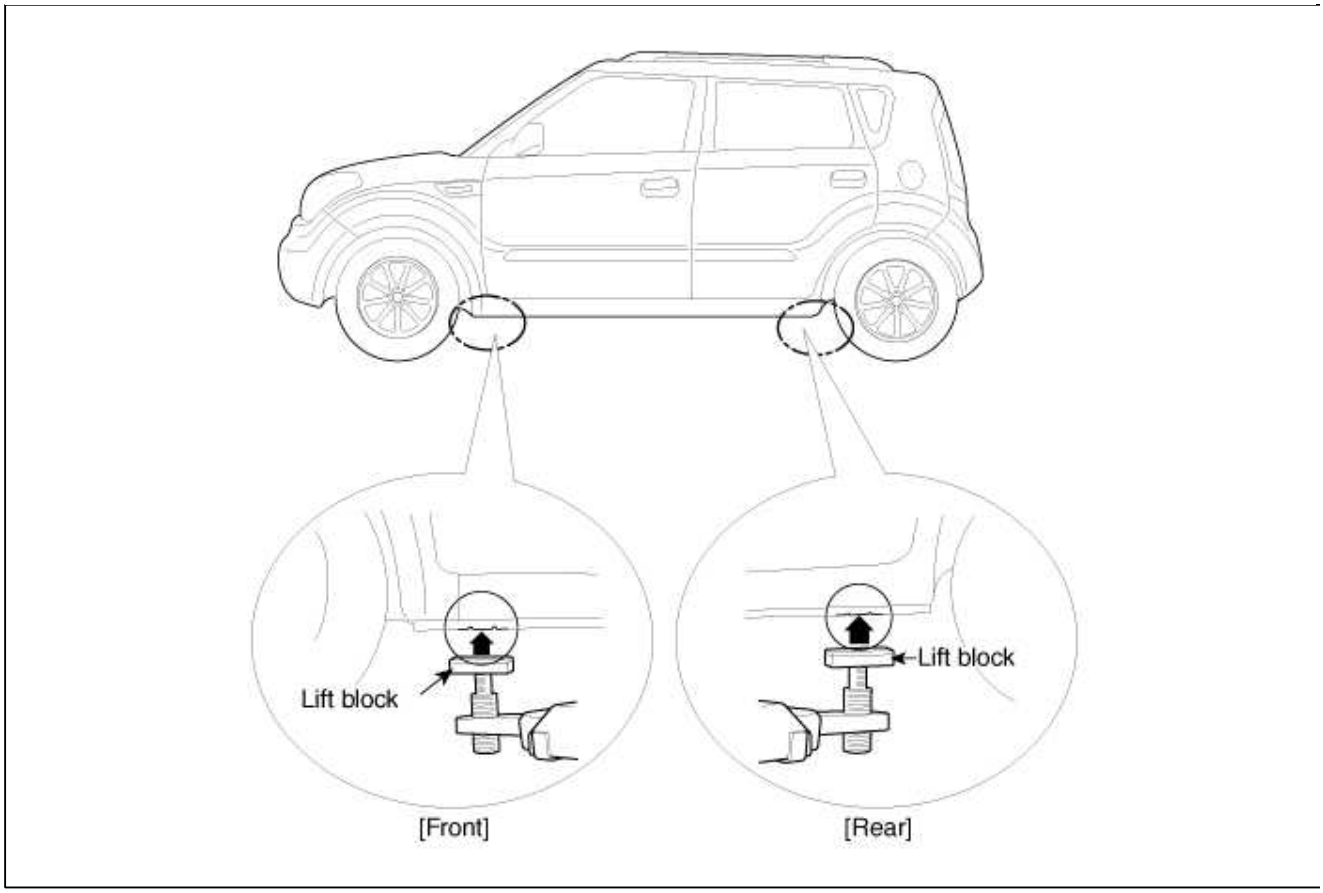
WARNING

When heavy rear components such as suspension, fuel tank, spare tire, tailgate and trunk lid are to be removed, place additional weight in the luggage area before hoisting. When substatial weight is removed from the rear of the vehicle, the center of gravity may change and can cause the vehicle to tip forward on the hoist.

NOTE

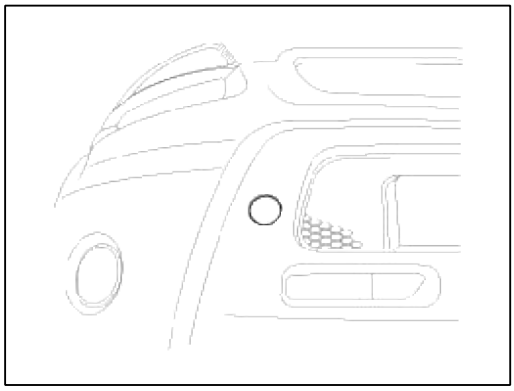
- Since each tire/wheel assembly weights approximately 30lbs (14kg), placing the front wheels in the luggage area can assist with the weight distribution.
- Use the same support points to support the vehicle on safety stands.

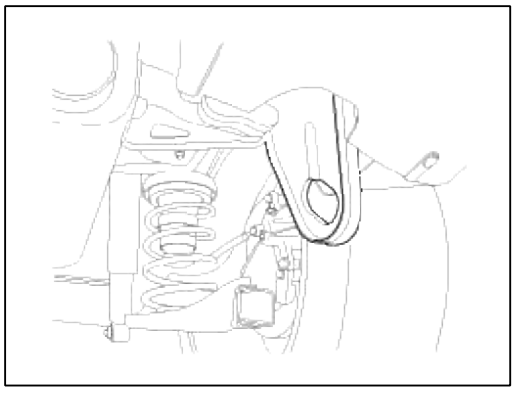
1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches (centimeters) and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height to inspect the lift points for secure support.



Towing

If the vehicle needs to be towed, call a professional towing service. Never tow vehicle with just a rope or chain. It is very dangerous.





Emergency Towing

There are three popular methods of towing a vehicle :

- The operator loads the vehicle on the back of truck. This is best way of transporting the vehicle.
- The tow truck uses two pivoting arms that go under the tires of the driving axle and lift them off the ground. The other two wheels remain on the ground.
- The tow truck uses metal cables with hooks on the ends. These hooks go around parts of the frame or suspension, and the cables lift that end of the vehicle off the ground. The vehicle's suspension and body can be seriously damaged if this method of towing is attempted.

If the vehicle cannot be transported by flat-bed, should be towed with the wheels of the drivig axle off the ground and do the following :

Manual Transaxle

- Release the parking brake.
- Shift the Transaxle to neutral

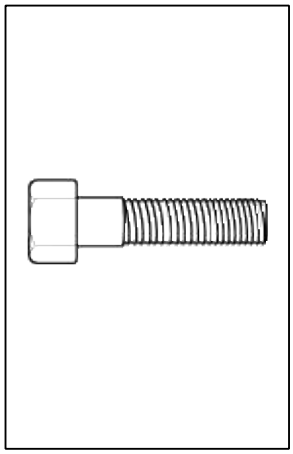
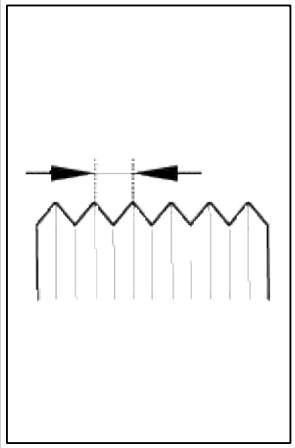
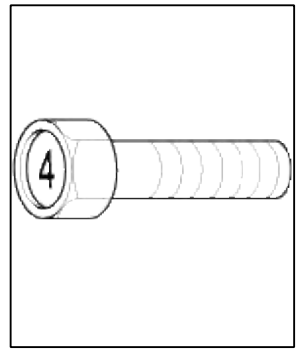
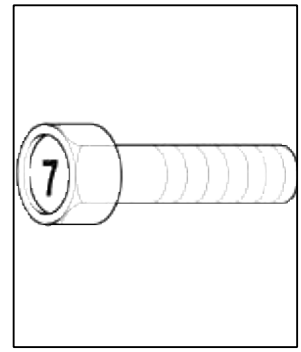
Automatic Transaxle

- Release the parking brake.
- Start the engine.
- Shift to [D] position, then [N] position.
- Turn off the engine.

CAUTION

- The vehicle equipped with full-time 4WD should be only transported on a flat-bed.
- Improper towing preparation will damage the transaxle. follow the above procedure exactly. If you cannot shift the transaxle or start the engine(automatic transaxle), your vehicle must be transported on a flatbed.
- It is the best to tow vehicle no farther than 30km (19miles), and keep the speed below 50km/h (30mph). (For the full-time 4WD vehicle, limit the towing to 1.5km (1mile) and 15km/h (10mph)
- Trying to lift or tow your vehicle by the bumpers will cause serious damage. The bumpers are not designed to support the vehicle's weight.

Tightening Torque Table Of Standard Parts

Bolt niminal diameter (mm)	Pich (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7
			
M5	0.8	3 ~ 4 (30 ~ 40, 2.2 ~ 2.9)	5 ~ 6 (50 ~ 60, 3.6 ~ 4.3)
M6	1.0	5 ~ 6 (50 ~ 50, 3.6 ~ 4.3)	9 ~ 11 (90 ~ 110, 6.5 ~ 8.0)
M8	1.25	12 ~ 15 (120 ~ 150, 9 ~ 11)	20 ~ 25 (200 ~ 250, 14.5 ~ 18.0)
M10	1.25	25 ~ 30 (250 ~ 300, 18 ~ 22)	30 ~ 50 (300 ~ 500, 22 ~ 36)

M12	1.25	35 ~ 45 (350 ~ 450, 25 ~ 33)	60 ~ 80 (600 ~ 800, 43 ~ 58)
M14	1.5	75 ~ 85 (750 ~ 850, 54 ~ 61)	120 ~ 140 (1,200 ~ 1,400, 85 ~ 100)
M16	1.5	110 ~ 130 (1,100 ~ 1,300, 80 ~ 94)	180 ~ 210 (1,800 ~ 2,100, 130 ~ 150)
M18	1.5	160 ~ 180 (1,600 ~ 1,800, 116 ~ 130)	260 ~ 300 (2,600 ~ 3,000, 190 ~ 215)
M20	1.5	220 ~ 250 (2,200 ~ 2,500, 160 ~ 180)	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)
M22	1.5	290 ~ 330 (2,900 ~ 3,300, 210 ~ 240)	480 ~ 550 (4,800 ~ 5,500, 350 ~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

NOTE

1. The torques shown in the table are standard values under the following conditions.
   - Nuts and bolts are made of galvanized steel bar.
   - Galvanized plain steel washers are inserted.
   - All nuts, bolts and plain washers are dry.
2. The torques shown in the table are not applicable.
   - When spring washers, toothed washers and the like are inserted.
   - If plastic parts are fastened.
   - If self-tapping screws or self-locking nuts are used.
   - If threads and surfaces are coated with oil.
3. Reduce the torque values to the indicated percentage of the standard value under the following conditions.
   - If spring washers are used : 85%
   - If threads and bearing surfaces are stained with oil : 85%

General Service Information

Protection Of The Vehicle

Always be sure to cover fenders, seats, and floor areas before starting work.

CAUTION

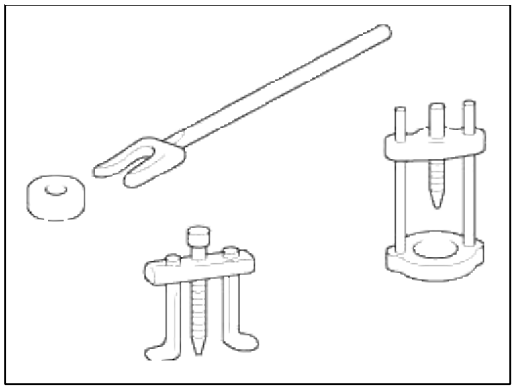
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched before driving the vehicle.

Preparation Of Tools And Mesuring Equipment

Be sure that all necessary tools and measuring equipment are available starting work.

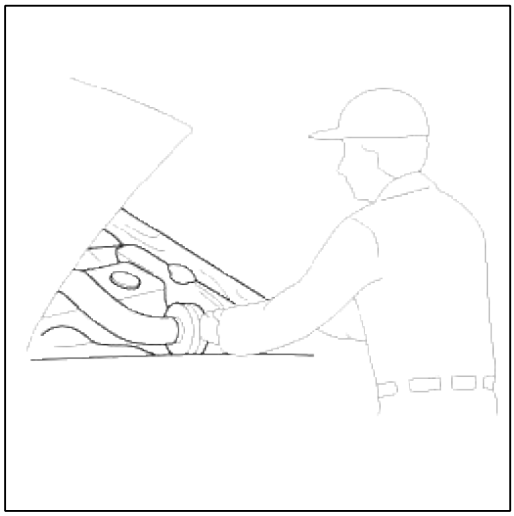
Special Tools

Use special tools when they are required.



Removal Of Parts

First find the cause of the problem and then determine whether removal or disassembly before starting the job.



Disassembly

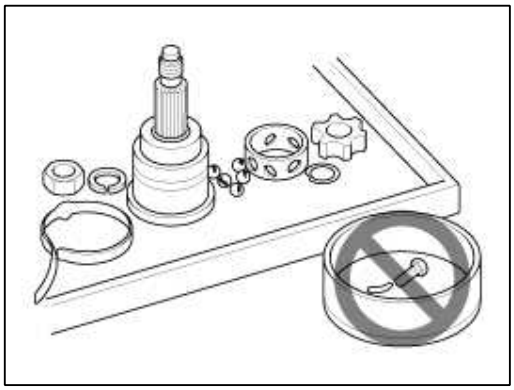
If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance.

1. **Inspection of parts**

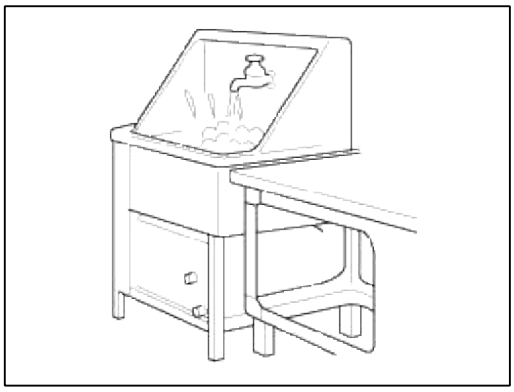
   Each part, when removed, should be carefully on suspected for malfunction, deformation, damage, and other problems.



2. **Arrangement of parts**
   All disassembled parts should be carefully arranged for effective reassembly.
   Be sure to separate and correctly identify the parts to be replaced from those that will be used again.



3. **Cleaning parts for reuse**
   All parts to be used again should be carefully and thoroughly cleaned by an appropriate method.



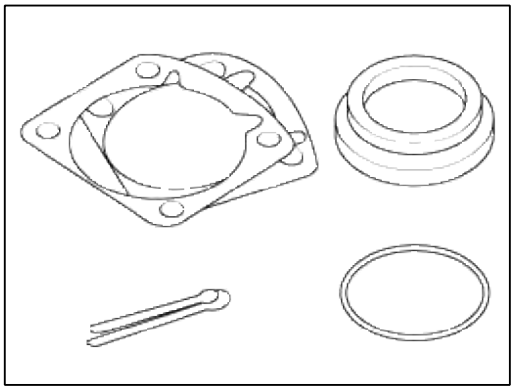
Parts
When replacing parts, use KIA genuine parts.



Replacement
Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.
If removed, the following parts should always be replaced with new ones.

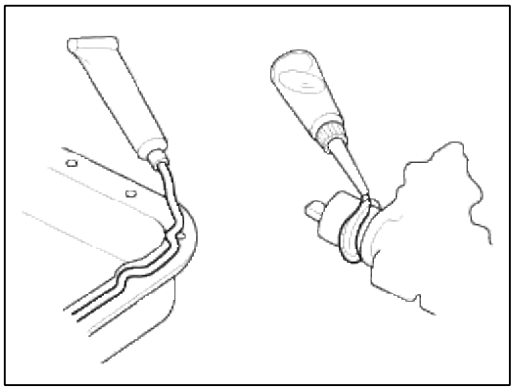
1. Oil seals
2. Gaskets

3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts



Depending on their location.

7. Sealant should be applied to gaskets.
8. Oil should be applied to the moving components of parts.
9. Specified oil or grease should be applied to the prescribed locations (oil seals, etc) before assembly.

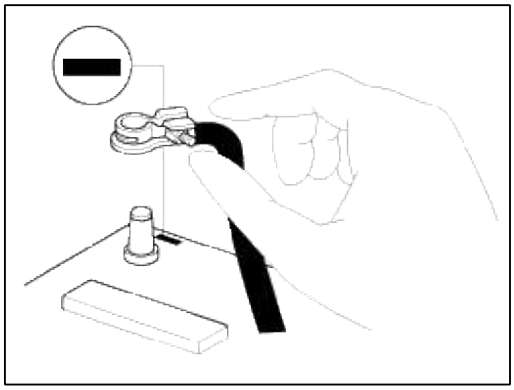


Adjustment

Use gauges and testers to adjust correctly the parts to standard values correctly.

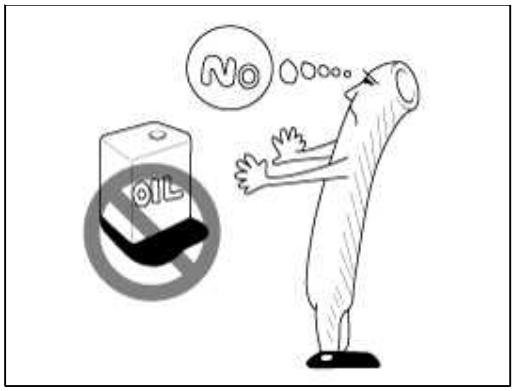
Electrical System

1. Be sure to disconnect the battery cable from the negative (-) terminal of the battery.
2. Never pull on the wires when disconnecting connectors.
3. Locking connectors will click when the connector is secure.
4. Handle sensors and relays carefully. Be careful not to drop them against other parts.



Ruber Parts And Tubes

Always prevent gasoline or from touching rubber parts or tubing.

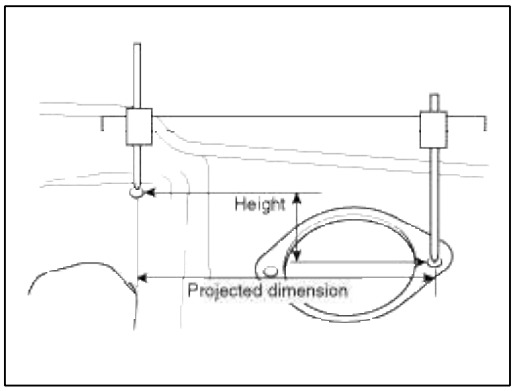


Measuring Body Dimensiongs

1. Basically, all measurements in this manual are taken with a tracking gauge.
2. When a measuring tape is used, check to be sure there is no elongation, twisting or bending.
3. For measuring dimensions, both projected dimensions and actual - measurement dimensions are used in this manual.

Dimensions Projected

1. These are the dimensions measured when the measurement points are projected from the vehicle's surface, and are the reference dimensions used for used for body alterations.
2. If the length of the tracking gauge probes is adjustable, measure it by lengthening one of two probes as long as the different value in height of the two surface.

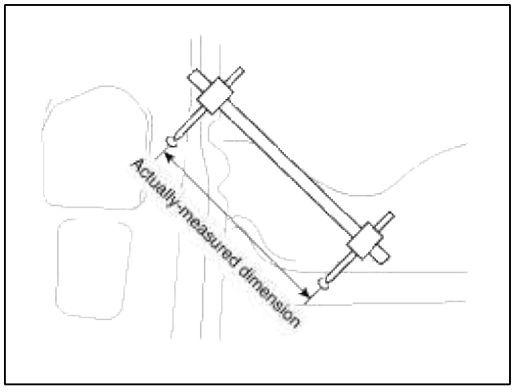


Measuring Actual Dimensions

1. These dimensions indicate the actual linear distance between measurement points, and are used as the reference dimensions when a tracking gauge is used for measurement.
2. First adjust both probes to the same length (A=A') before measurement.

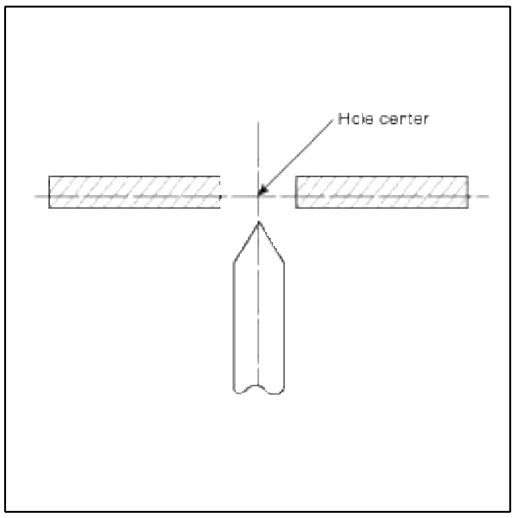
NOTE

Check the probes and gauge itself to make sure there is no free play.



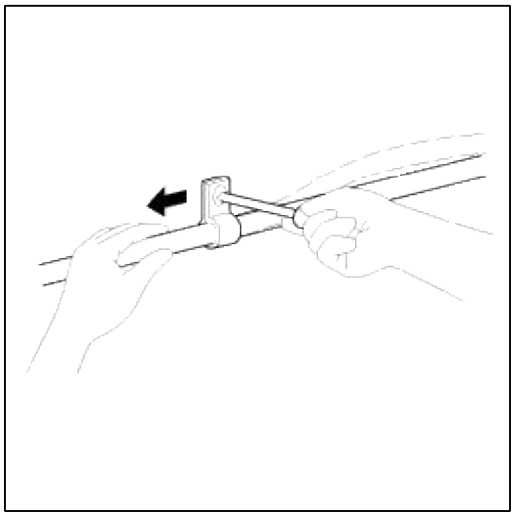
Measurement Point

Measurements should be taken at the center of the hole.



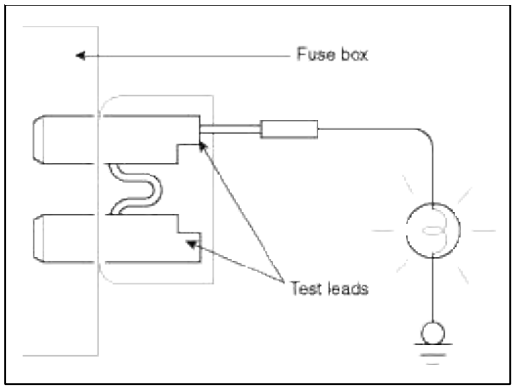
Checking Cables And Wires

1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounded parts to verify that there is complete continuity between their attaching bolt(s) and the vehicle's body.
7. Check for incorrect wiring.
8. Check that the wiring is so clamped to the prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, etc.)
9. Check that the wiring is clamped firmly to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vehicle body and the engine.



Check Fuses

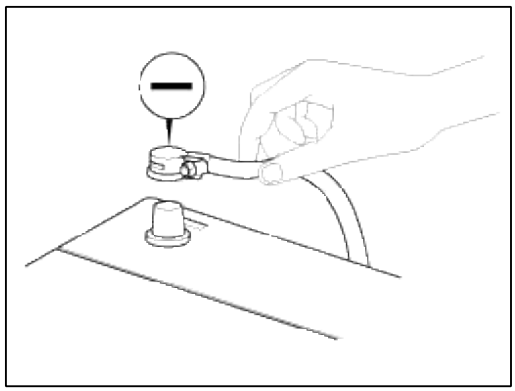
A blade type fuse test taps provided to allow checking the fuse itself without removing if from the fuse box. The fuse is good if the test lamp lights up when one lead is connected to the test taps (one at a time) and the other lead is grounded. (Turn the ignition switch so that the fuse circuit becomes operative)



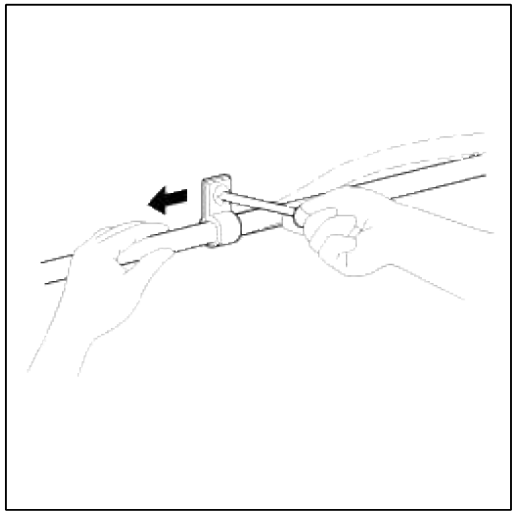
Serivicing The Electrical System

1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

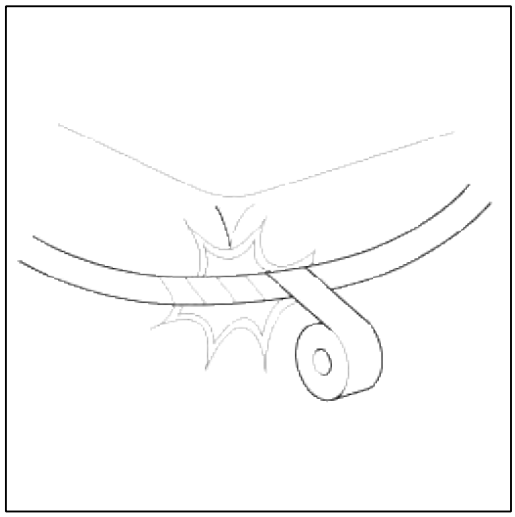
> NOTE
>
> In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained by the computer will be cleared. There fore, if necessary, record the diagnostic data before removing the battery cable.



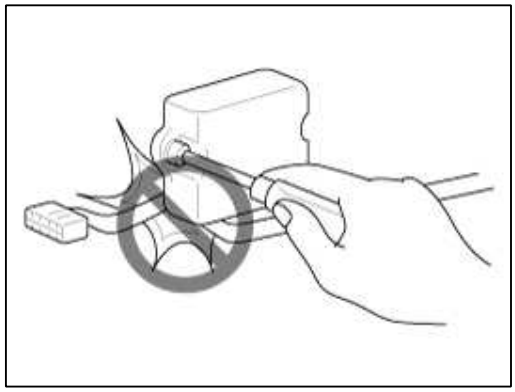
2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding parts and then secure the harness by using a clamp.



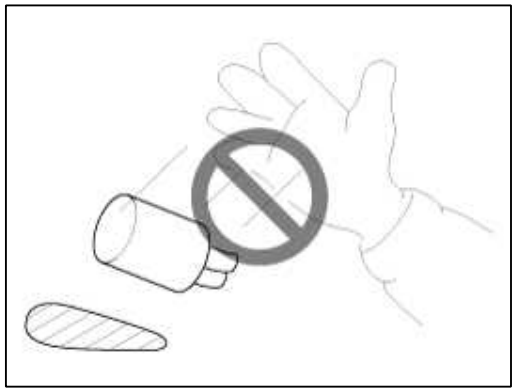
3. If any section of a wiring harness interferes with the edge of a parts, or a corner, wrap the section of the harness with tape or something similar in order to protect if from damage.



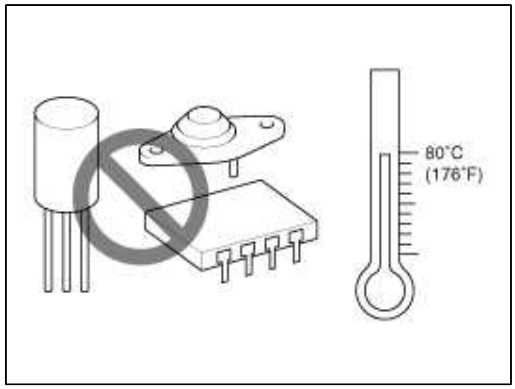
4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



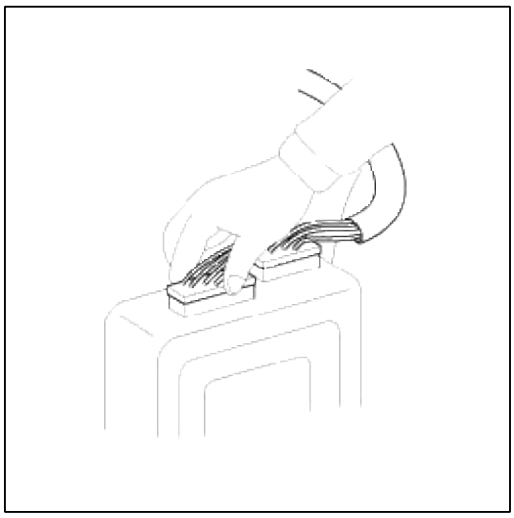
5. Never throw relays, sensors or electrical parts, or expose them to strong shock.



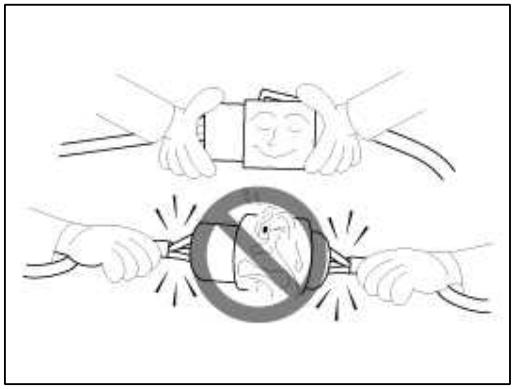
6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts before hand.



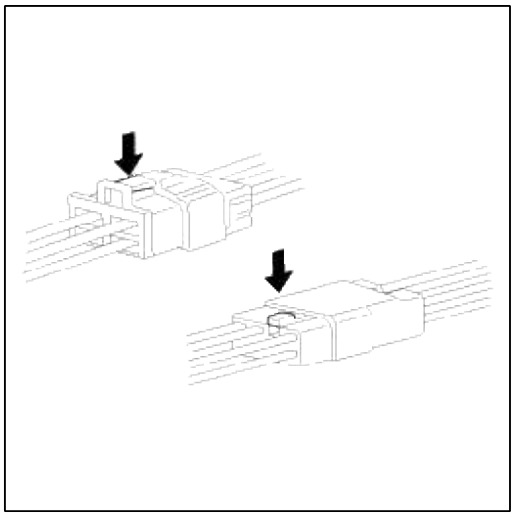
7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.



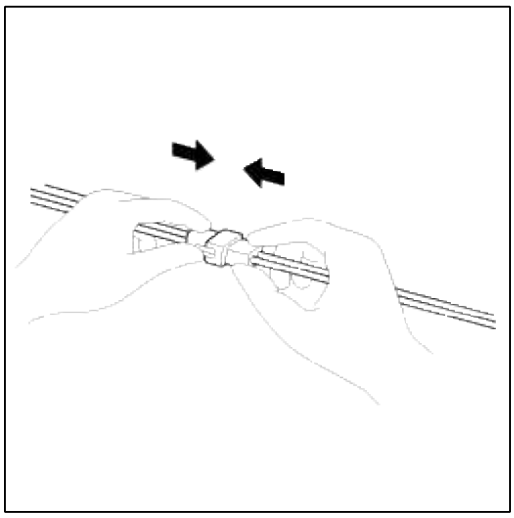
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



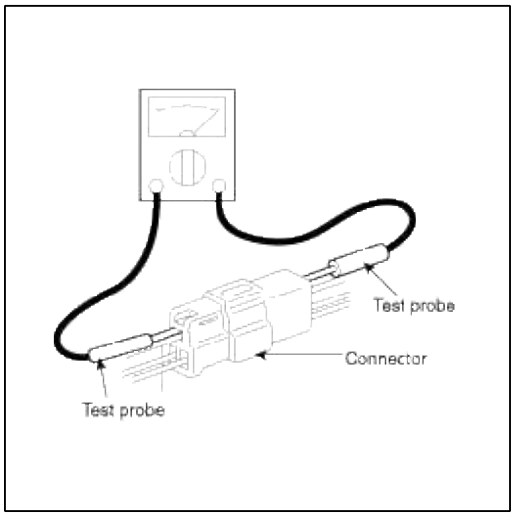
9. Disconnect connector which have catches by pressing in the direction of the arrows shown the illustration.



10. Connect connectors which have catches by inserting the connectors until they make a clicking sound.



11. When using a circuit tester to check continuity or voltage on connector terminals, insert the test probe into the harness side. If the connector is a sealed connector, insert the test probe through the hole in the rubber cap until contacts the terminal, being careful not to damage the insulation of the wires.



12. To avoid overloading the wiring, take the electrical current load of the optional equipment into consideration, and determine the appropriate wire size.

Noeminal size	SAE gauge No.	Permissible current	
		In engine compartment	Other areas
0.3mm²	AWG 22	-	5A
0.5mm²	AWG 20	7A	13A
0.85mm²	AWG 18	9A	17A
1.25mm²	AWG 16	12A	22A
2.0mm²	AWG 14	16A	30A
3.0mm²	AWG 12	21A	40A
5.0mm²	AWG 10	31A	54A

Precautions For Catalytic Converter

CAUTION

If a large amount of unburned gasoline flows into the converter, it may overheat and create a fire hazard. To prevent this observe the following precations and explain them to your customer.

1. Use only unleaded gasoline.
2. Do not run the engine while the car is at rest for a long time. Avoid running the engine at fast idle for more than 10minutes and idle speed for more than 20 minutes.
3. Do not measure engine compression for an extended time. Engine compression tests must be made as rapidly as possible. Remove the fuel pump relay before performing a compression test.
4. Do not dispose of used catalytic converter together with parts contaminated with gasoline or oil.

SOUL(AM) > 2010 > G 1.6 DOHC > Automatic Transaxle System

Automatic Transaxle System > General Information > Specifications

Specifications

Transaxle model		A4CF1
Engine model		Gasoline 1.6L
T/con		3 elements 2 phases 1 stage
T/con size (Φ)		236
O/PUMP type		Parachoid
T/M CASE type		Separated
Friction elements		Clutch: 3EA
		Brake: 2EA
		OWC : 1EA
Planetary gear		2EA
Gear ratio	1st	2.919
	2nd	1.551
	3rd	1.000
	4th	0.713
	Reverse	2.480
Final gear ratio		4.619
Fluid pressure balance piston		2EA
Stall speed		2,000~2,700 rpm
Accumulator		4EA
Solenoid valve		6EA (PWM:5EA, VFS:1EA)
Shift lever position		6 range (P,R,N,D,2,L)
Oil filter		1EA

- PWM : Pulse Width Modulation
- VFS : Variable Force Solenoid

Tightening Torques

Item	Nm	kgf.m	lb-ft
Shift cable bracket	15~22	1.5~2.2	10.8~15.9
Input shaft speed sensor	10~12	1.0~1.2	7.2~8.6
Output shaft speed sensor	10~12	1.0~1.2	7.2~8.6
Manual control lever	17~21	1.7~2.1	12.3~15.2
Inhibitor switch	10~12	1.0~1.2	7.2~8.6
Oil pan	10~12	1.0~1.2	7.2~8.6
Oil drain plug	40~50	4.0~5.0	28.9~36.1
Pressure check plug	8~10	0.8~1.0	5.8~7.2
Front roll support bracket bolt	50~65	5.0~6.5	36.2~47.0
Rear roll support bracket bolt	50~65	5.0~6.5	36.2~47.0
Transaxle support bracket bolt	60~80	6.0~8.0	43.4~57.8

Lubricants

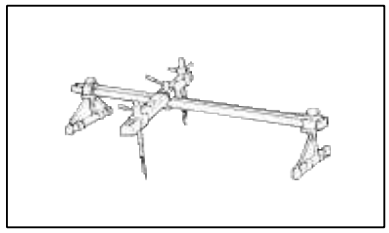
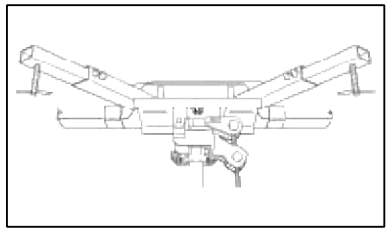
Item	Specified lubricant	Quantity
Transaxle fluid liter (US qt, lmp.qt)	GENUINE DIAMOND ATF SP-III or SK ATF SP - III	6.8 (7.2, 5.98)

Sealant

Item	Specified sealant
Rear cover Torque converter housing Oil pan	LOCTITE FMD-546

Automatic Transaxle System > General Information > Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
09200-38001 Engine support fixture		Removal and installation of the transaxle.
09624-38000 Crossmember supporter		Supporting of the crossmember.

Automatic Transaxle System > Automatic Transaxle System > Description and Operation

Description

The new small sized automatic transaxle (A4CF1) is for gasoline 1.6 engine.
The transaxle (A4CF1) has improved on the durability, fuel consumption and efficiency by the new main features as follows:

The new main features

1. The hydraulic centrifugal oil pressure balance piston.
2. The full line pressure variable control system.
3. The long travel damper clutch.
4. The disc type return spring.
5. The ultra flat torque converter.

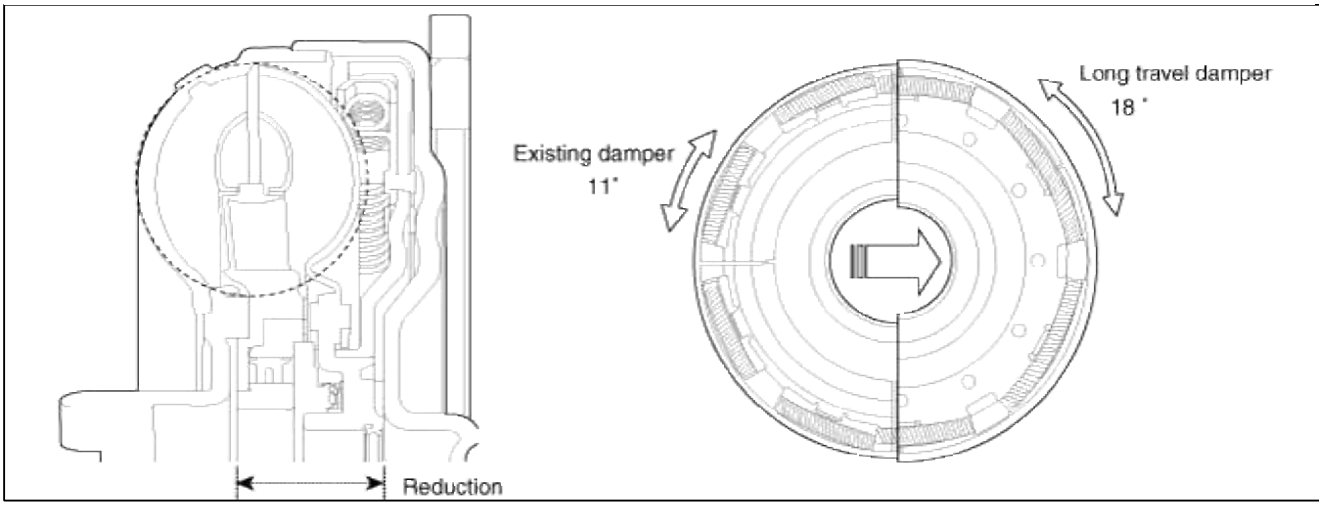
Functions

Item	Contents
Components	The full line pressure variable control operates in the valve body to improve the fuel consumption.
	The long travel damper clutch is applied to the torque converter to improve the engine revolution change reduction capability and the fuel consumption. (17~20°)
	The oil pump of the trochocentric type is changed to parachoid type to improve the processing and the capacity efficiency at the low RPM range.
	The disc type return spring is applied to the low&reverse brake to improve the durability and reduce the length.
	The hydraulic centrifugal oil pressure balance piston is applied to the inside of clutch to improve the durability and the shift control capability.
	The low noise gear and the gear teeth face grinding are applied to the transfer driven gear to improve the noise and the durability.
Electronic control system	The oil pressure value set by TCM is coupled with the engine torque so that the stable shift feeling can be improved.
	The engine torque reduction control operates effectively to improve the shift feeling and the durability.
	When shifting, the shift can skip from 1↔3 and 2↔4.
	The reverse clutch, not L/R brake is controlled when controlling the N→R shift so that the N→R shift feeling can be improved.
	The range of the damper clutch direct control expands to improve the fuel consumption.
	The current control chip is installed into the TCM to regulate the solenoid control current and control the oil pressure securely according to the change of the temperature and voltage.
	The FPC (Flexible Printed Circuit) harness is composed of thin and flat copper in insulating film, like electric wire.
	The tachometer is operated by the change of the frequency forwarded from the TCM to the instrument cluster, not vehicle speed sensor.

Mechanical system
Function
Torque Converter

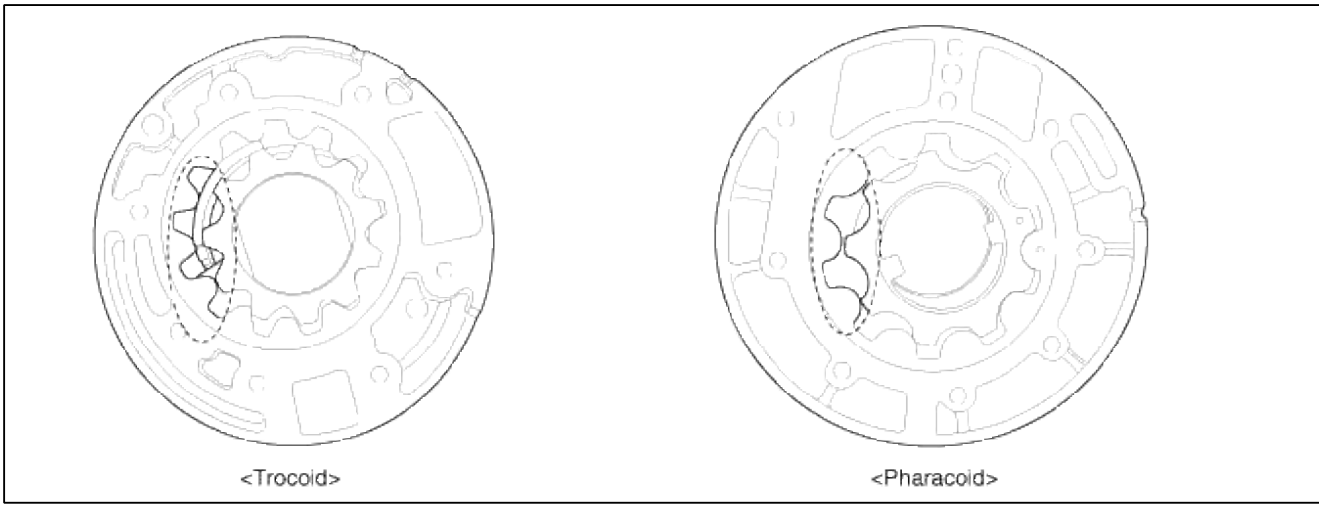
The torque converter is the power plant which delivers the power of engine to the automatic transaxle. It consists of 3 elements: 2 phases and 1 stage type.

- The flowing section portion of the torque converter changes the round type to the flat type to reduce the length of the torque converter.
- The maximum operating degree of the damper clutch installed inside the transaxle increases from 11° to 18° to improve the engine revolution change reduction capability and the fuel consumption.



Oil Pump

The oil pump is made of aluminum (the reaction shaft support) to reduce weight and selects the parachoid type to improve the processing and the capacity efficiency at the low RPM range.

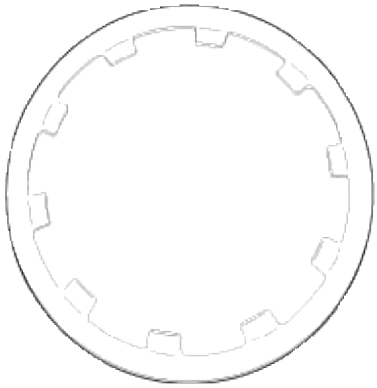


Brakes

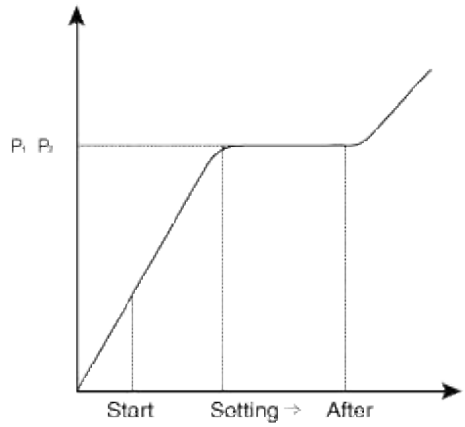
The automatic transaxle (A4CF1) uses the low and reverse brake and the second brake. The low and reverse brake is fixed by the low and reverse annulus gear and overdrive planetary carrier.

- The disc type return spring is applied to the low and reverse brake. It minimizes the slip of the friction material from the uniform spring operation power to improve the durability and reduce the length.

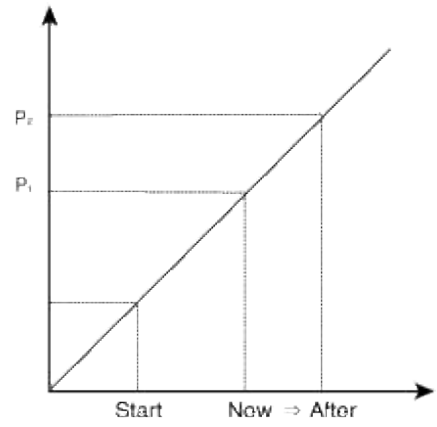
The overdrive sun gear is held on the transaxle case by the second brake.







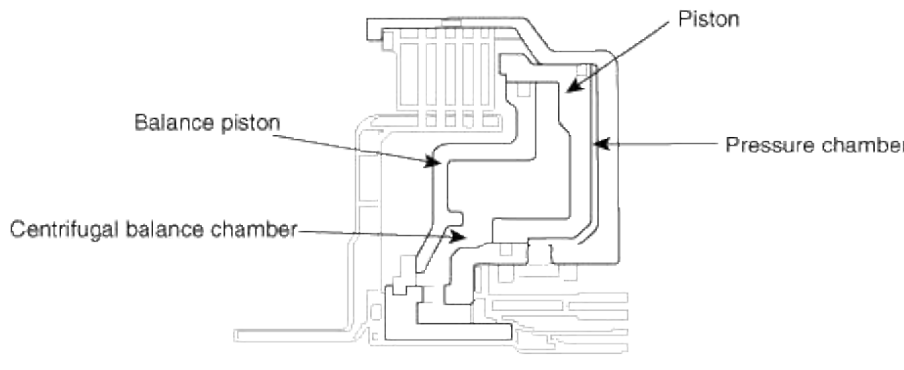
<Disc type return spring>



<Coil type return spring>

Clutch

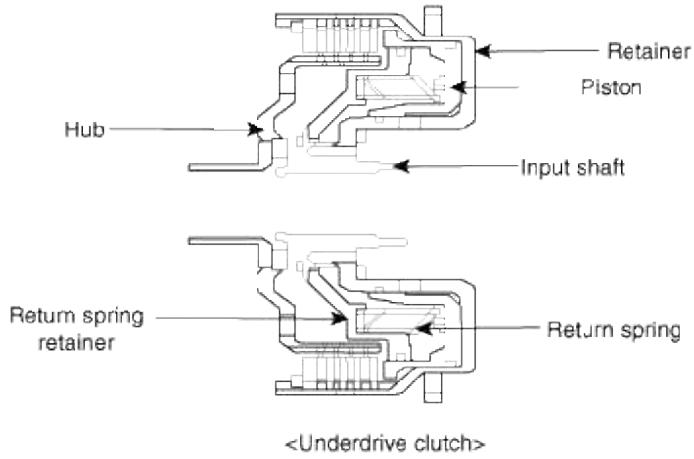
The multiple clutches and the one way clutch are used as the transaxle device.
The retainer of each clutch is composed of precision sheet metal parts for productivity and the light weight.
The hydraulic centrifugal oil pressure balance device resides inside the clutch assembly.
Generally, the oil remaining in the piston oil pressure chamber pushes the piston by the centrifugal force. The is oil filled in between the piston and the return spring retainer to prevent the piston from being pushed. This occurs by centrifugal force and both of the power is offset so that the piston doesn't move. As a result, this improves the durability and the shift control ability.



<Centrifugal balance device>

1. Underdrive Clutch

The driving force of input shaft is delivered to the underdrive sun gear.
The operating oil pressure in the underdrive clutch components operates between the piston and the retainer and pushes the piston to the clutch discs to deliver the driving force from the retainer to the hub.

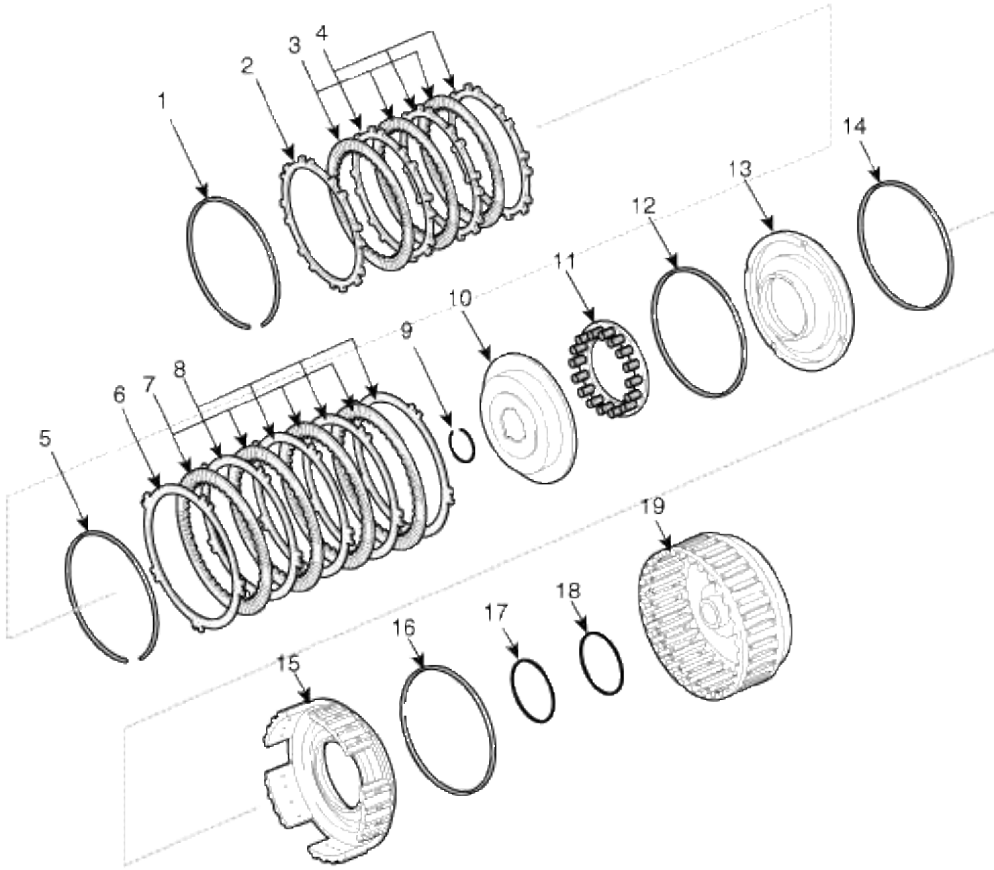


<Underdrive clutch>

2. Reverse clutch and overdrive clutch

The reverse clutch delivers the driving force of input shaft to the reverse sun gear.
The overdrive clutch delivers the driving force of input shaft to the overdrive planetary carrier and the low and reverse annulus gear.
The operating oil pressure of the reverse clutch operates between the reverse clutch retainer and reverse clutch piston and it has the whole overdrive clutch moved to deliver through the hub splines.

Structure Of The Reverse And The Overdrive Clutch

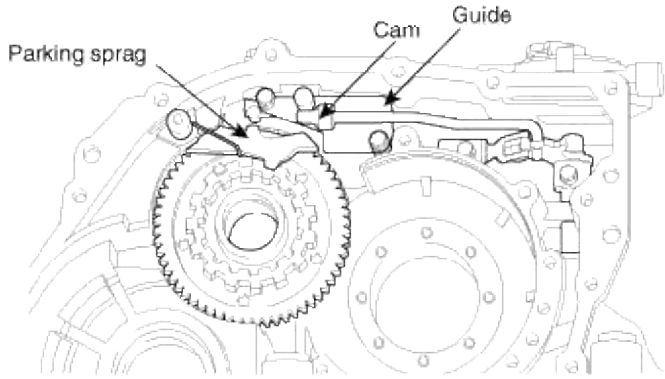


1. Snap ring	8. Clutch plate	15. Reverse clutch piston
2. Clutch reaction plate	9. Snap ring	16. D-ring
3. Clutch disc	10. Spring retainer	17. D-ring
4. Clutch plate	11. Return spring	18. D-ring
5. Snap ring	12. D-ring	19. Reverse clutch retainer
6. Clutch reaction plate	13. Overdrive clutch piston	
7. Clutch disc	14. D-ring	

Parking System

The parking system for A4CF1 model is the cam type.

The roller type installed to the existing new generation AT needs support to move the roller when operating the parking system. The cam type for A4CF1 model doesn't need the support and the structure is simpler. It only needs the guide to prevent from moving the cam idly.



<Parking system>

Operation

Hydraulic Control System

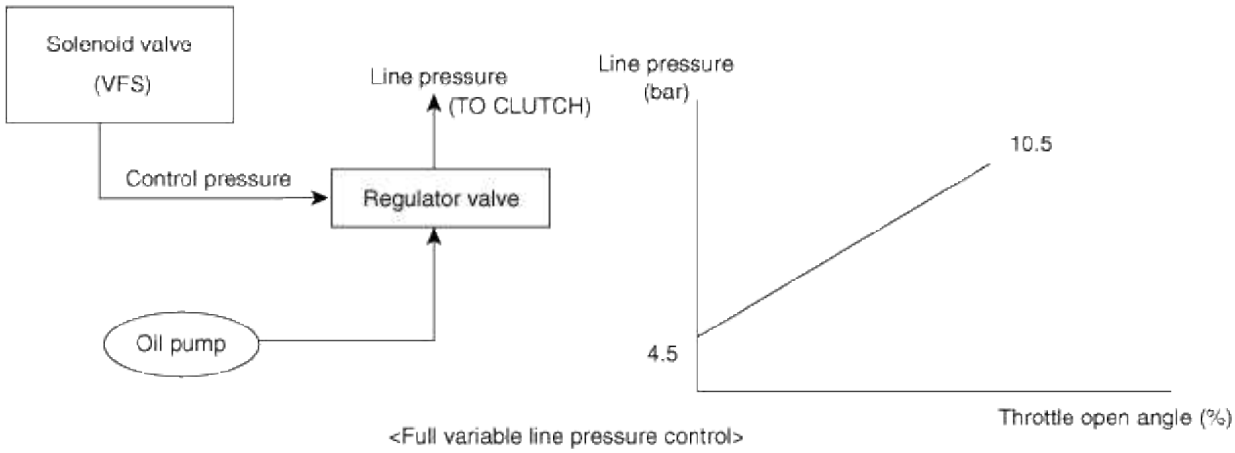
Main Features

The VFS (Variable Force Solenoid) installed in the valve body is applied to transaxle. VFS varies the line pressure from 4.5bar to 10.5bar according to throttle open angle and shift range to improve the fuel consumption and shift ability.

The reducing valve installed in the valve body makes the solenoid control pressure using the reducing pressure instead of the line pressure like the HIVEC transaxle.

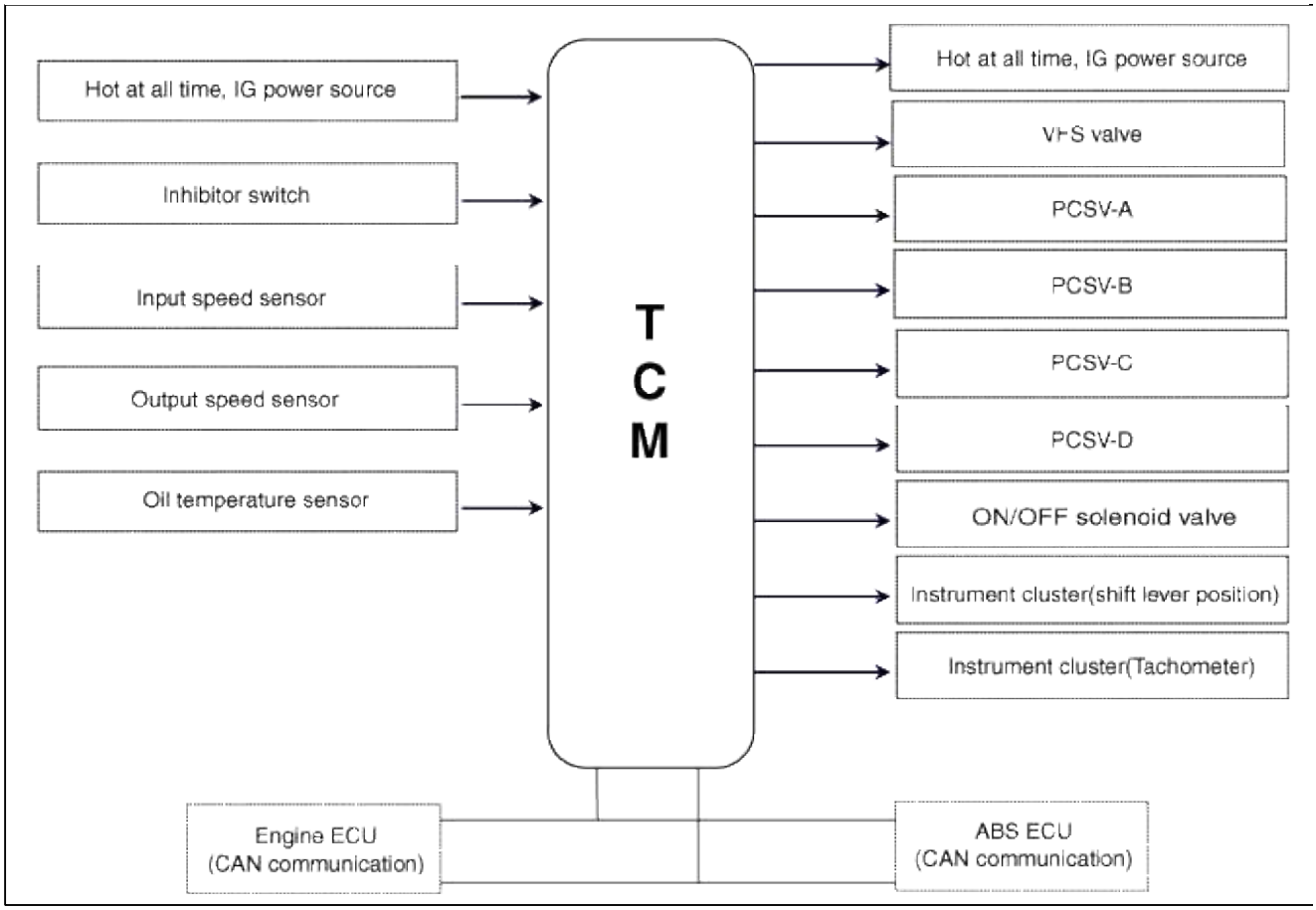
The material of spool valve in the valve body is changed from the steel to aluminum to reduce the oil leakage by the thermal expansion between the valve body and spool valve at the high temperature.

The switch valve, the solenoid valve and the fail safe valve are operated to drive the vehicle at 3rd speed and reverse even if an electronic control parts malfunction occurs.



<Full variable line pressure control>

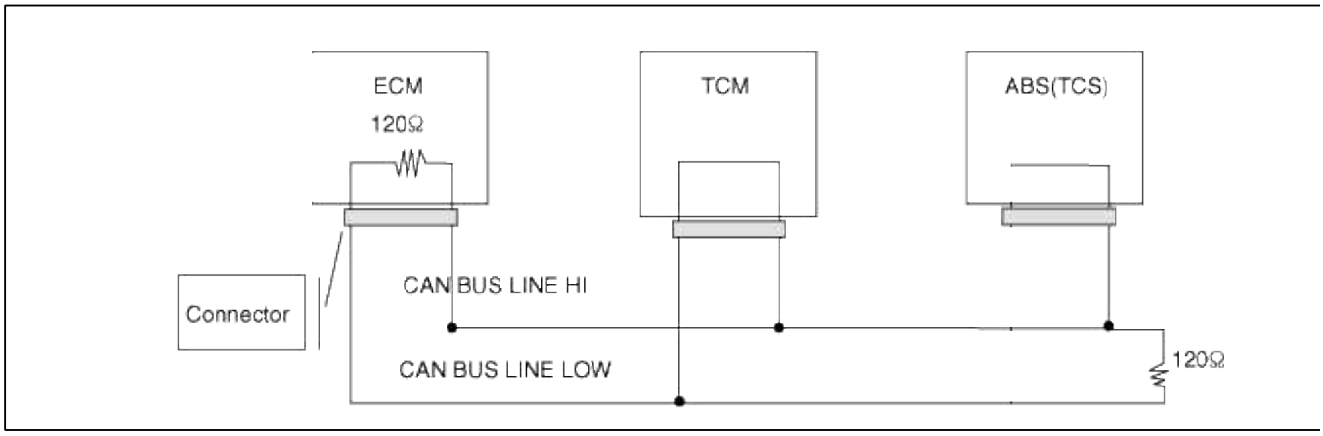
Electronic Control System



Sensor And Actuator Function

Item	Function
Input speed sensor	Detect the input shaft rpm(TURBINE RPM) at the OD/RVS retainer
Output speed sensor	Detect the output shaft rpm(T/F DRIVEN GEAR RPM) at the T/F driven gear
Engine rpm signal	Receive the engine rpm via CAN communication with ECM
Fluid temperature sensor	Detect the temperature of ATF through the thermistor
Brake switch	Detect the brake operation at the contact switch of the brake pedal
ON/OFF solenoid valve (SCSV-A)	Control the hydraulic passage for the shift control
VFS solenoid valve	Change the line pressure from 4.5 bar to 10.5 bar according to throttle open angle and shift ranges
PCSV-A(SCSV-B)	Control the OD or L/R hydraulic pressure to the pressure control valve for shift control
PCSV-B(SCSV-C)	Control the 2/4 or REV hydraulic pressure to the pressure control valve for shift control
PCSV-C(SCSV-D)	Control the UD hydraulic pressure to the pressure control valve for shift control
PCSV-D(DCCV)	Control the hydraulic pressure for the damper clutch control
Cluster	Send the signal of the current position of shift lever and vehicle speed

CAN Communication
Layout



ECM- TCM CAN Communication error management

No.	Item	Error management
1	Engine rpm	3,000 RPM
2	Engine torque	80%
3	Vehicle speed	0 km/h
4	A/C Switch	OFF
5	Engine coolant temperature	70°C
6	TPS	50%
7	Shift range hold signal	OFF

Automatic Transaxle System > Automatic Transaxle System > Repair procedures

Basic Inspection Adjustment

Transaxle Fluid Level

Inspection

1. Drive the vehicle until the fluid reaches normal operating temperature [70~80°C(158~176°F)].
2. Place the vehicle on a level surface.
3. Move the gear selector lever through all gear positions. This will fill the torque converter with trans fluid. Set the selector lever to the "N" (Neutral) position.
4. Before removing the oil level gauge, wipe all contaminants from around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.

NOTE

If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the brushes and friction materials, a transmission overhaul may be necessary.

5. Check that the fluid level is in the "HOT" mark on the oil level gauge. If fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" mark.

Automatic transaxle fluid :
DIAMOND ATF SP-III, SK ATF SP-III
Automatic transaxle fluid capacity:
6.8liter(7.2 US qt, 5.98lmp.qt)

NOTE

Low fluid level can cause a variety of abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles, which are compressible. Therefore, pressures will be erratic, causing delayed shifting, slipping clutches and brakes, etc. Improper filling can also raise fluid level too high. When the transaxle has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of automatic transaxle fluid. In either case, air bubbles can cause overheating, and fluid oxidation, which can interfere with normal valve, clutch, and brake operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

6. Insert the oil level gauge securely.

NOTE

When new, automatic transmission fluid should be red, The red dye is added so the assembly plant can identify it as transmission fluid and distinguish it from engine oil or antifreeze. The red dye, which is not an indicator of fluid quality, is not permanent. As the vehicle is driven the transmission fluid will begin to look darker. The color may eventually appear light brown.

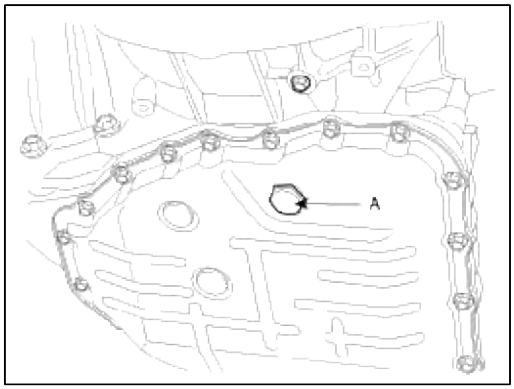
Replacement
If you do not have a fluid changer replace the fluid by the following procedure.
1. Disconnect the hose, which connects the transmission and the oil cooler (inside the radiator).
2. Start the engine and let the fluid drain out.

Running conditions : "N" range with engine idling

CAUTION

The engine should be stopped within one minute after it is started. If the fluid has all drained out before then, the engine should be stopped at that point.

3. Remove the drain plug(A) from the bottom of the transmission case to drain the fluid.



4. Install the drain plug via the gasket, and tighten it the specified torque.

Tightening torque :
40~50 Nm (4.0~5.0kgf.m, 28.9~36.2lb-ft)

5. Pour the new fluid in through the oil filler tube.

> CAUTION
>
> Stop pouring if the full volume of fluid cannot be poured in.

6. Repeat the procedure in step (2).

> NOTE
>
> Check the old fluid for contamination. If it has been contaminated, repeat the steps (5) and (6).

7. Pour the new fluid in through the oil filler tube.
8. Reconnect the hose (step 1) and firmly replace the oil level gauge.
   Wipe off any dirt around the oil level gauge and insert it into the filler tube.
9. Start the engine and run it at idle for 1~2 minutes.
10. Move the select lever through all positions, and then move it to the "N" or "P" position.
11. Drive the vehicle until the fluid temperature rises to the normal temperature (70~80°C(158~176°F)), and then check the fluid level again. The fluid level must be at the HOT mark.
12. Firmly insert the oil level gauge into the oil filler tube.

Torque Converter Stall Test

This test measures the maximum engine speed when theselect lever is at the "D" or "R" position and the torque converter stalls. This tests the operation of the torque converter, starter motor and one-way clutch operation and the holding performance of the clutches and brakes in the transmission.

> CAUTION
>
> Do not let anybody stand in front of or behind the vehicle while this test is being carried out.

1. Check the automatic transmission fluid level and temperature and the engine coolant temperature.
   A. Fluid level : At the HOT mark on the oil level gauge
   B. Fluid temperature : 80~100°C (176~212°F)
   C. Engine coolant temperature : 80~100°C (176~212°F)
2. Check both rear wheels (left and right).
3. Pull the parking brake lever on, with the brake pedal fully depressed.
4. Start the engine.

5. Move the select lever to the "D" position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

CAUTION

- The throttle should not be left fully open for any more than 5 seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 r/min to let the automatic transaxle fluid cool down before carrying out subsequent tests.
- Move the select lever to the "R" position and carry out the same test again.

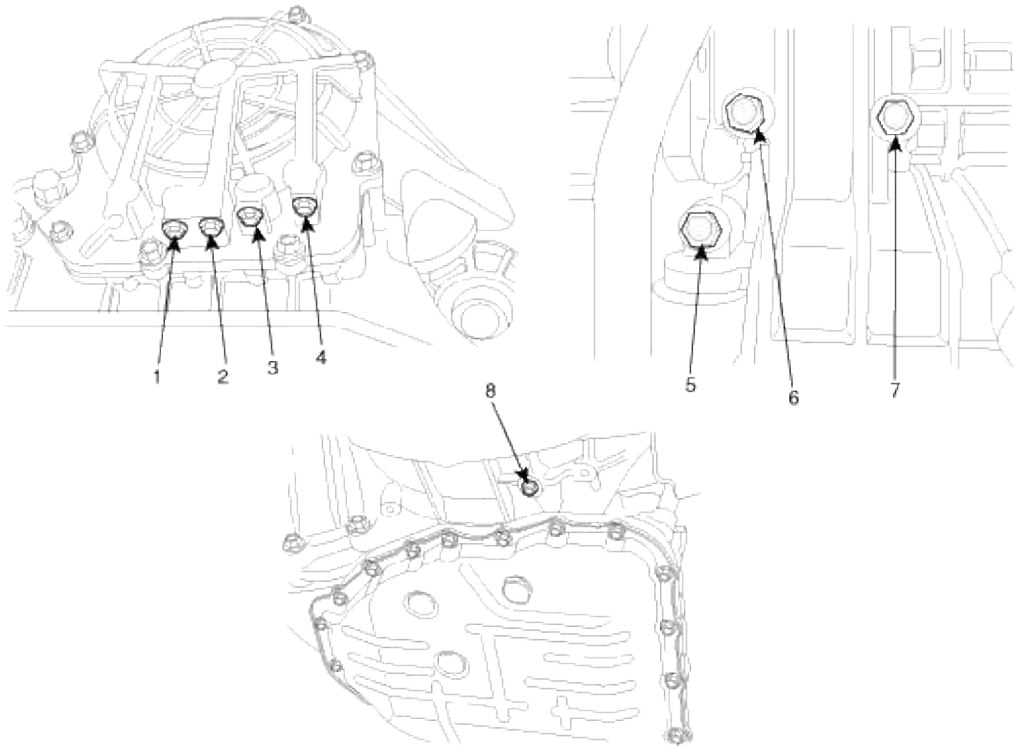
Stall rpm : 2,000~2,700 RPM

Range	Condition	Passable cause
R range slip	Reverse	REV in D range normal L/R in D range abnormal
D1 rang slip	D range 1st/ Sports mode 1st	L/R in reverse range abnormal UD in reverse range normal
D3 range slip	3rd gear hold	OD in 3rd gear slip (1st and 2nd gear normal)
Forwarding, reverse slip	D range, R range	Torque converter Oil pump, Manual valve in the valve Driving device abnormal

Hydraulic Pressure Test

1. Warm up the engine until the automatic transaxle fluid temperature is 80~100°C(176~212°F).
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the special tools(09452-21500, 09452-21000) oil pressure gauge to each pressure discharge port.
4. Measure the hydraulic pressure at each port under the conditions given in the standard hydraulic pressure table, and check that the measured values are within the standard value ranges.
5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.

A. Bottom side



Torques : 8~10Nm(80~100kgf.cm, 6~7lb-ft)

1. RED pressure port 2. OD pressure port 3. 2/4 pressure port 4. REV pressure port	5. DA pressure port 6. UD pressure port 7. LR pressure port 8. DR pressure port

Standard Hydraulic Pressure Table

No.	Shift range position	Operation					Measuring	Oil pressure (kgf/㎠)				
		PCSV-A	PCSV-B	PCSV-C	PCSV-D	ON/OFF		LR	2-4(2ND)	UD	OD	REV
1	D	0	100	0	0	ON	LR	10.5±0.2	0	10.5±0.2	0	0
2	↑	50	↑	↑	↑	↑	↑	5.6±0.4	↑	↑	↑	↑
3	↑	75	↑	↑	↑	↑	↑	1.0±0.3	↑	↑	↑	↑
4	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑	↑
5	↑	↑	0	↑	100	OFF	2-4(2ND)	0	10.5±0.2	↑	↑	↑
6	↑	↑	50	↑	↑	↑	↑	↑	5.3±0.4	↑	↑	↑
7	↑	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑
8	↑	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑
9	↑	0	↑	↑	↑	↑	OD	↑	↑	↑	10.5±0.2	↑
10	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	5.6±0.4	↑
11	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	1.0±0.3	↑
12	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0	↑
13	↑	↑	↑	0	0	↑	UD	↑	↑	10.5±0.2	↑	↑
14	↑	↑	↑	50	↑	↑	↑	↑	↑	5.8±0.4	↑	↑
15	↑	↑	↑	75	↑	↑	↑	↑	↑	1.0±0.3	↑	↑
16	↑	0	↑	100	↑	↑	↑	↑	↑	0	↑	↑
17	R	↑	0	↑	↑	ON	REV	17.7±0.8	↑	↑	↑	17.7±0.8
18	↑	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	8.7±0.8
19	↑	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.5
20	↑	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0

[Measure condition]
- Oil pump revolution : 2500rpm
- LPCSV Duty ratio : 0%

Note) The oil pressure values of "0" marked on the above table must measure less than 0.1kgf/㎠ when testing.

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

Automatic Transaxle System > Automatic Transaxle System > Troubleshooting

Troubleshooting

Diagnostic Trouble Codes (Inspection Procedure)

Check the Diagnostic Trouble Codes

1. Turn the ignition switch to OFF.
2. Connect the Hi-scan tool or GDS to the DLC connector for diagnosis.
3. Turn the ignition switch to ON.
4. Check the diagnostic trouble codes using the Hi-scan tool.

5. Read the output diagnostic trouble codes. Then follow the repair procedures according to the "DIAGNOSTIC TROUBLE CODE DESCRIPTION" on the following pages. Write down the codes and any freeze frame data which show the parameters or conditions of when the code was set.

NOTE

- A maximum of 5 diagnostic trouble codes (in the sequence of occurrence) can be stored in the Random Access Memory (RAM) incorporated within the control module.
- The same diagnostic trouble code can be stored one time only.
- If the number of stored diagnostic trouble codes or diagnostic trouble patterns exceeds 5, already stored diagnostic trouble codes will be erased in sequence, beginning with the oldest.
- Do not disconnect the battery until all diagnostic trouble codes or diagnostic trouble patterns have been read out, because all stored diagnostic trouble codes or diagnostic trouble patterns will be cancelled when the battery is disconnected.
- All diagnostic trouble codes are deleted from memory the 200th time the ATF temperature reaches 50°C(122°F) after memorization of the most recent diagnostic code.

6. Delete the diagnostic trouble code.
7. Disconnect the Hi-scan tool.

NOTE

DTC clearing should only be done with the scan tool.

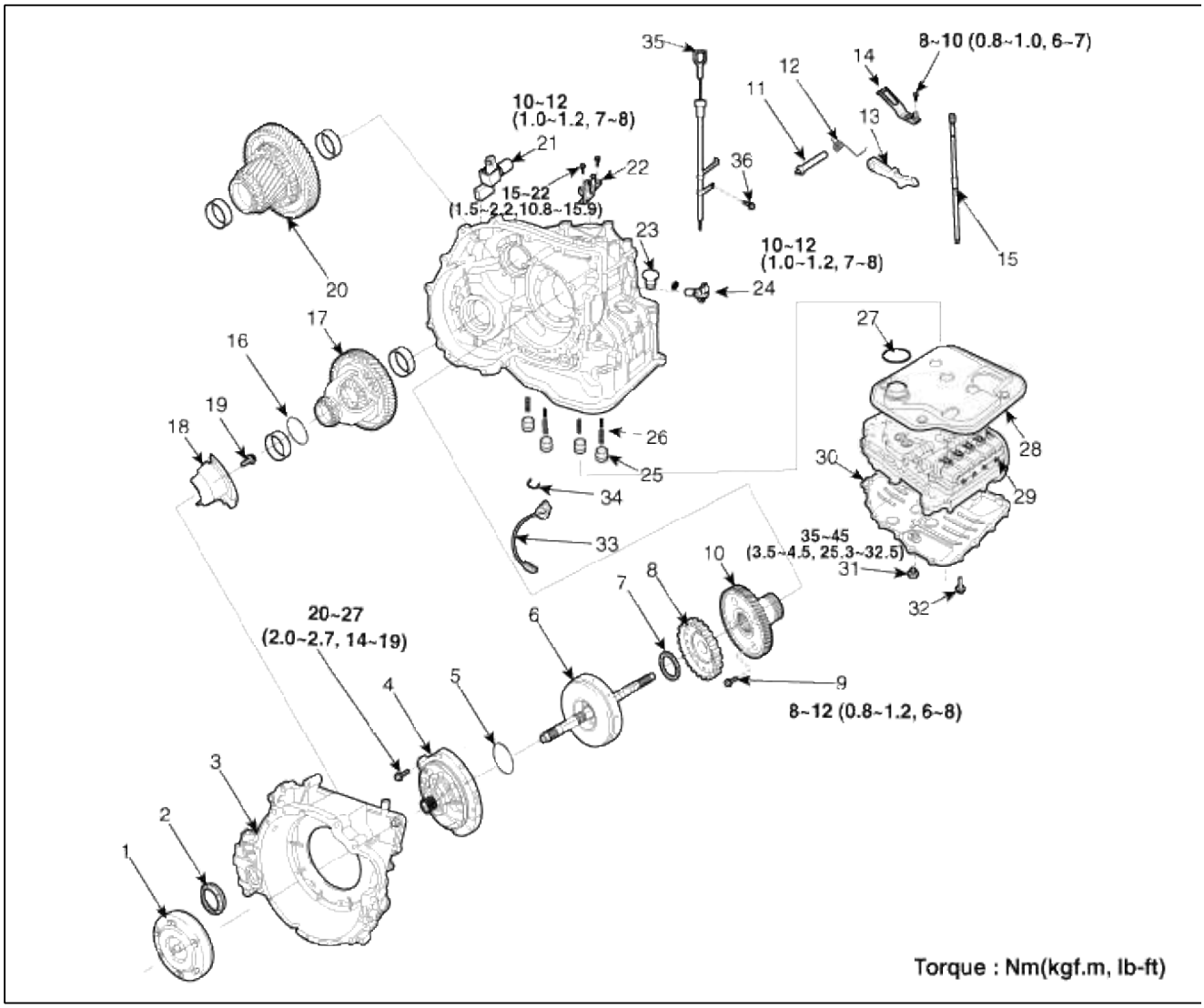
Diagnostic Trouble Code Table

No.	Code	Description	MIL	Remark
1	P0707	Transmission Range Sensor Circuit Low Input	●	
2	P0708	Transmission Range Sensor Circuit High Input	●	
3	P0712	Transmission Fluid Temperature Sensor 'A' Circuit Low Input	●	
4	P0713	Transmission Fluid Temperature Sensor 'A' Circuit High Input	●	
5	P0717	Input/Turbine Speed Sensor 'A' Circuit No Signal	●	
6	P0722	Output Speed Sensor Circuit No Signal	●	
7	P0731	Gear 1 Incorrect Ratio	●	
8	P0732	Gear 2 Incorrect Ratio	●	
9	P0733	Gear 3 Incorrect Ratio	●	
10	P0734	Gear 4 Incorrect Ratio	●	
11	P0741	Torque Converter Clutch Circuit Performance or Stuck Off	●	
12	P0742	Torque Converter Clutch Circuit Stuck On	●	
13	P0743	Torque Converter Clutch Circuit Electrical	●	
14	P0748	Pressure Control Solenoid Valve(VFS) 'A' Electrical		
15	P0750	Shift Control Solenoid Valve 'A'	●	
16	P0755	Shift Control Solenoid Valve 'B'	●	
17	P0760	Shift Control Solenoid Valve 'C'(2nd Brake Solenoid)	●	
18	P0765	Shift Control Solenoid Valve 'D'	●	

19	U0001	High Speed CAN Communication Bus off	●	
20	U0100	Lost Communication With ECM/PCM 'A'		

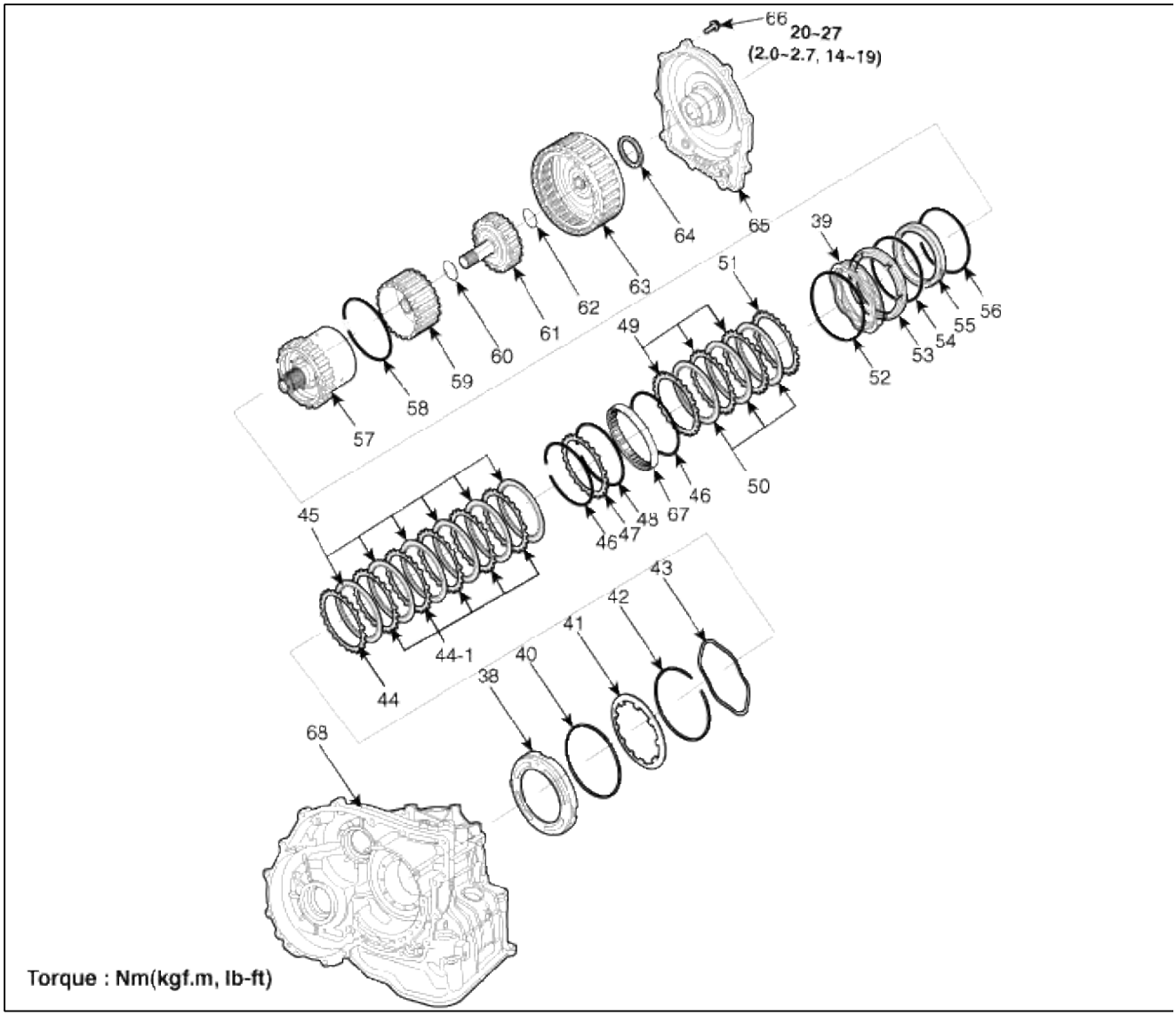
Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Components and Components Location

Components (1)



1. Torque converter	13. Parking sprag	25. Accumulator piston
2. Differential oil seal	14. Detent spring	26. Coil spring
3. Converter housing	15. Manual control shaft	27. O-ring
4. Oil pump	16. Spacer	28. Oil filter
5. Thrust washer	17. Differential	29. Valve body
6. Underdrive(U/D) clutch	18. Oil separate	30. Oil pan
7. Thrust bearing	19. Oil separate mounting bolt	31. Drain plug
8. Underdrive(U/D) clutch hub	20. Transfer driven gear	32. Valve body cover bolt
9. Transfer drive gear mounting bolt	21. Output speed sensor	33. Valve body connector
10. Transfer drive gear	22. Shift cable bracket	34. Valve body connector mounting clip
11. Parking sprag shaft	23. Plug	35. Oil level gauge
12. Sprag spring	24. Input speed sensor	36. Oil level gauge bracket bolt

Components (2)



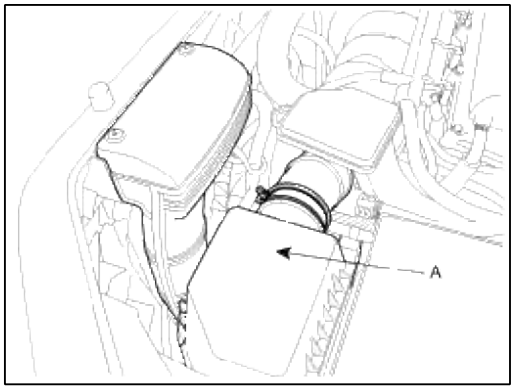
38. Low & reverse brake piston 39. 2ND brake return spring 40. Low & reverse brake spring retainer 41. Low & reverse brake return spring 42. Snap ring 43. Wave spring 44. Low & reverse pressure plate 44-1. Low & reverse brake plate 45. Low & reverse brake disc 46. Snap ring 47. Reaction plate 48. Snap ring	49. 2ND brake plate 50. 2ND brake disc 51. 2ND brake pressure plate 52. Snap ring 53. 2ND brake piston 54. D-ring 55. 2ND brake retainer 56. D-ring 57. Low & reverse planetary gear set 58. Snap ring	59. Reverse sun gear 60. Thrust bearing 61. Overdrive(O/D) hub 62. Thrust bearing 63. Reverse & Overdrive(O/D) clutch 64. Thrust bearing 65. Rear cover 66. Rear cover bolt 67. One way clutch inner race 68. Transmission case

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

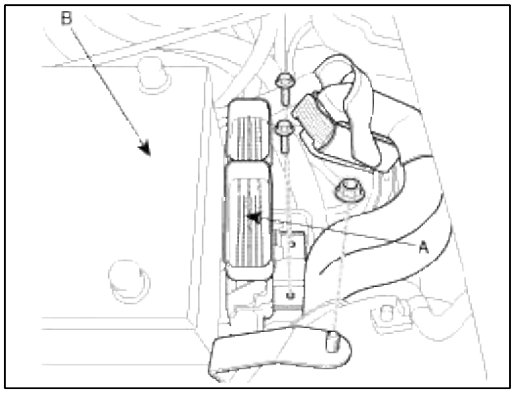
Removal

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

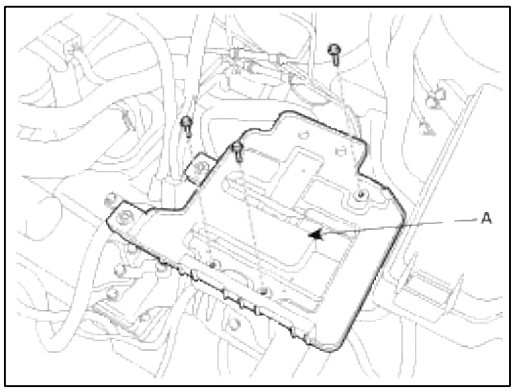
1. Disconnect the air duct (A).



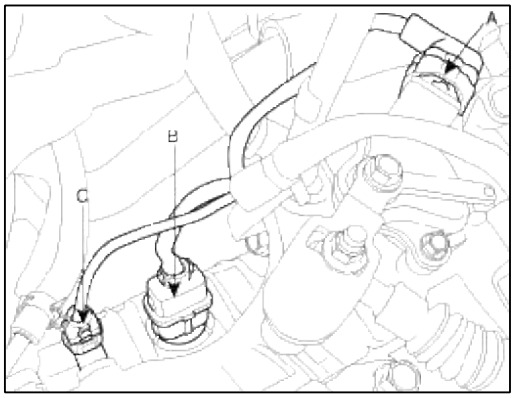
2. Disconnect the PCM connectors, remove the PCM (A), and remove the battery (B).



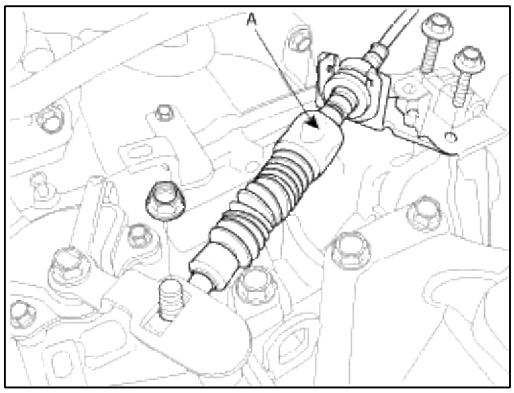
3. Remove the battery tray (A).



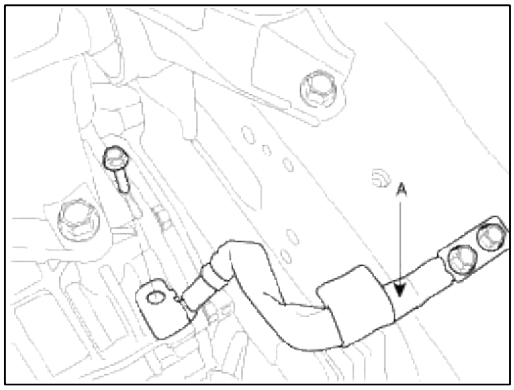
4. Disconnect the inhibiter switch connector (A), solenoid valve connector (B) and the input speed sensor connector (C).



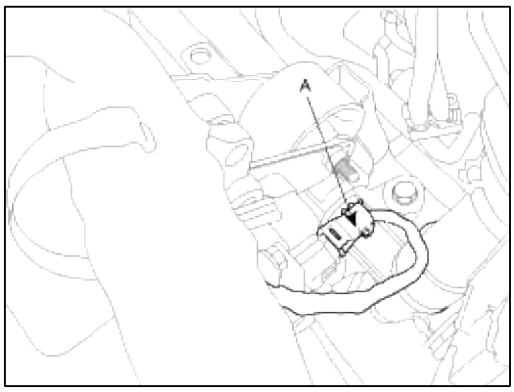
5. Remove the shift cable assembly (A).



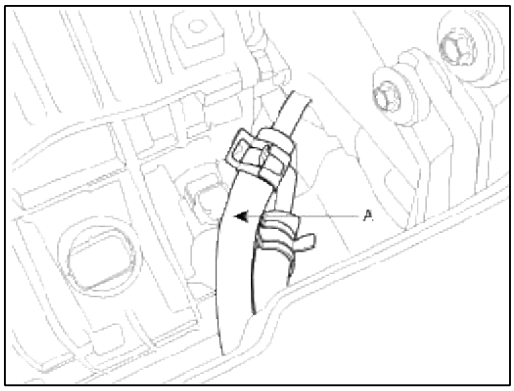
6. Remove the ground cable (A) by removing a bolt.



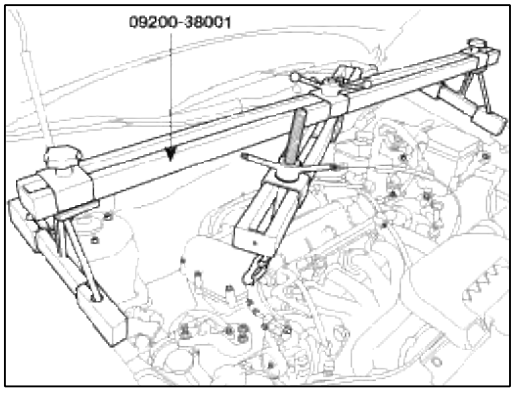
7. Disconnect the output speed sensor connector (A).



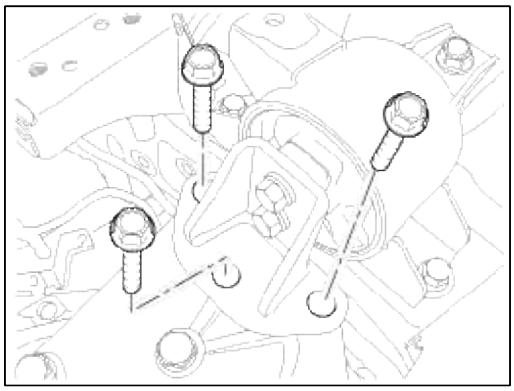
8. Remove the oil cooler hoses by moving clamps (A).



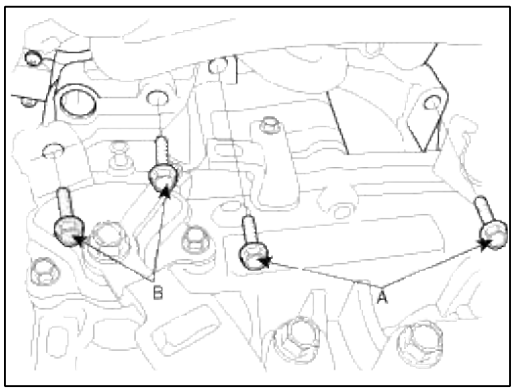
9. Install the special tools (09200-38001), the engine support fixture and the adapter on the engine assembly.



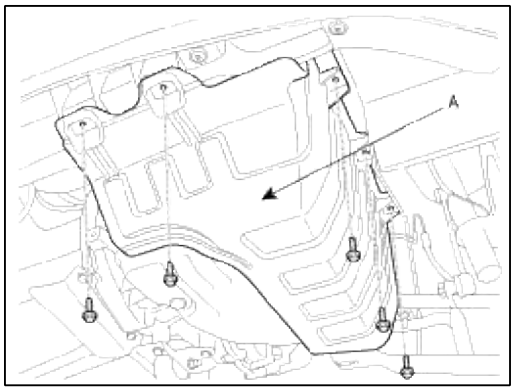
10. Remove the transaxle support bracket bolts(3ea).



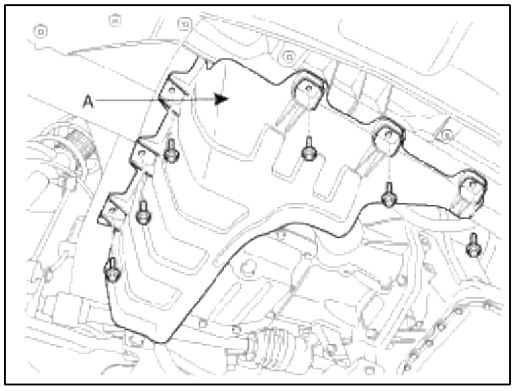
11. Remove the transaxle upper mounting bolts (A-2ea) and the starter motor mounting bolts (B-2ea).



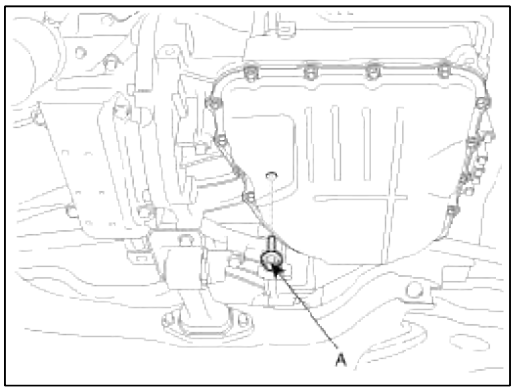
12. Remove the under shield covers(A).



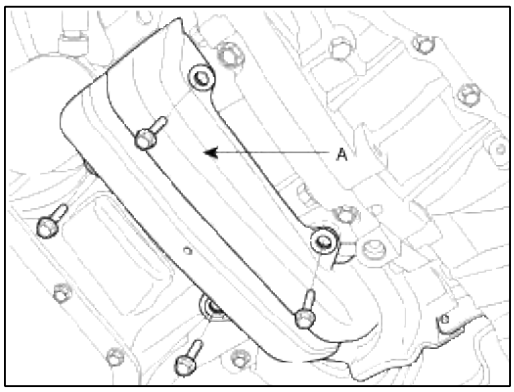
13. Remove the side mud cover (A).



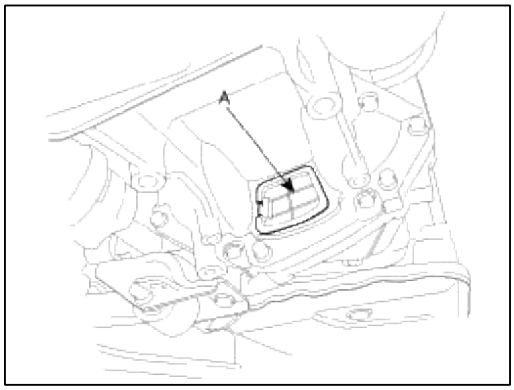
14. Drain the transalxe fluid by removing the drain plug (A).



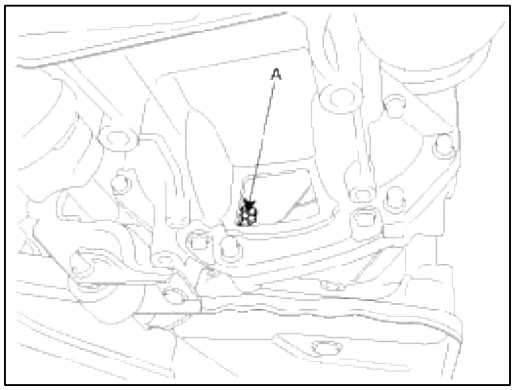
15. Remove the bracket (A).



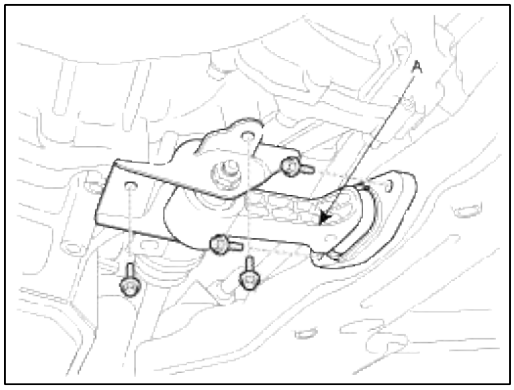
16. Disconnect the drive shafts from the transaxle. (refer to Front Driveshaft in DS group)
17. Remove the plastic dust cover (A).



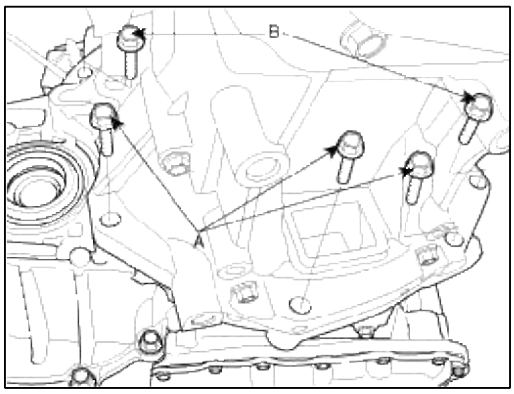
18. Remove the torque converter mounting bolts(A-3ea) by rotating the crankshaft.



19. Remove the roll stopper bracket by removing bolts(A).



20. Supporting the transaxle with a jack, remove the transaxle lower mounting bolts (A-3ea, B-2ea).



21. Lowering the jack slowly, remove the transaxle.

> CAUTION
>
> When removing the transaxle assembly, be careful not to damage any surrounding parts or body components.

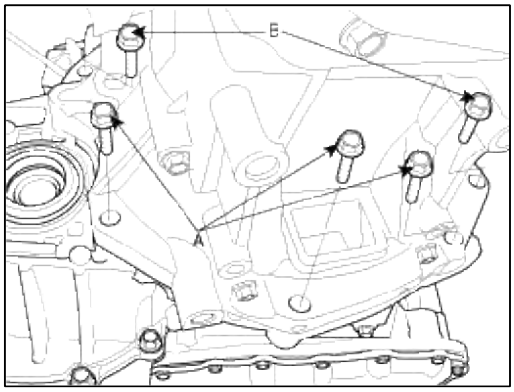
Installation

1. Raise the vehicle and use a transmission jack to install the transmission assembly from underneath.

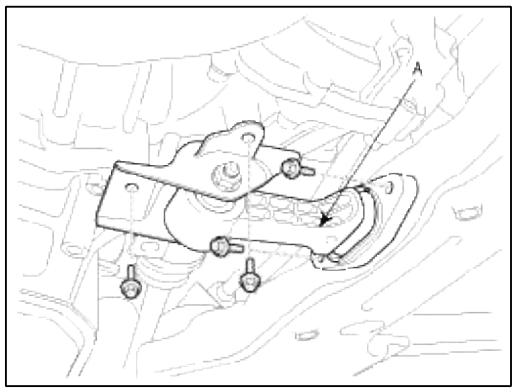
> CAUTION
>
> Be careful not to damage any surrounding parts or body components.

2. Install the transaxle lower mounting bolts (A-3ea, B-2ea) after fitting the transaxle assembly into the engine assembly.

Tightening torque :
[A] : 43~49Nm (4.3~4.9kgf.m, 31.1~35.4lb-ft)
[B] : 43~55Nm (4.3~5.5kgf.m, 31.1~39.8lb-ft)

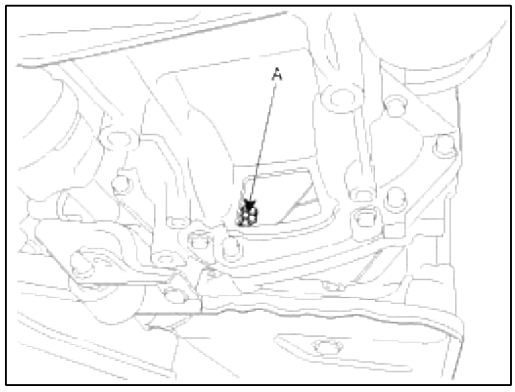


3. Install the roll stopper bracket(A).

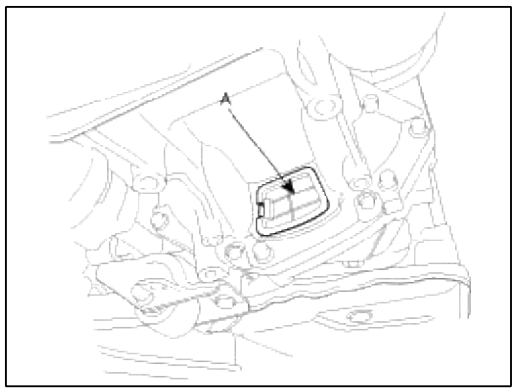


4. Install the torque converter assembly mounting bolts (A-3ea).

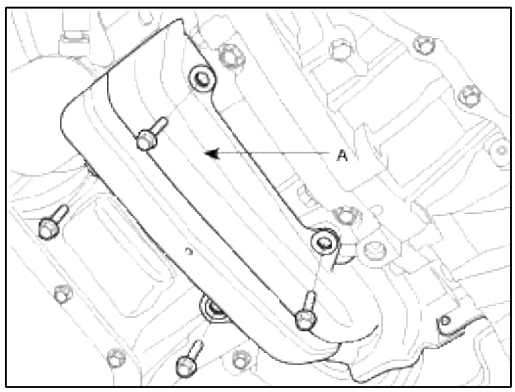
Tightening torque :
46~53 Nm (4.6~5.3 kgf.m, 33.3~38.3 lb-ft)



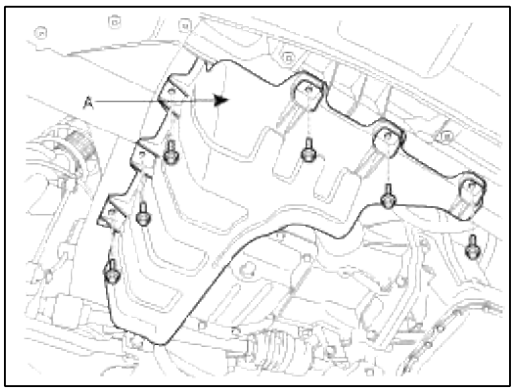
5. Install the plastic dust cover (A).



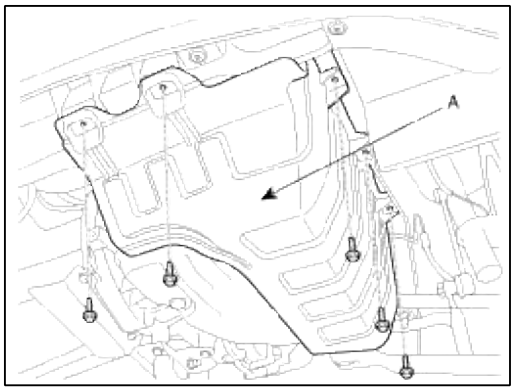
6. Connect the drive shafts to the transaxle. (refer to Front Driveshaft in DS group)
7. Install the bracket (A).



8. Install the side mud cover (A).

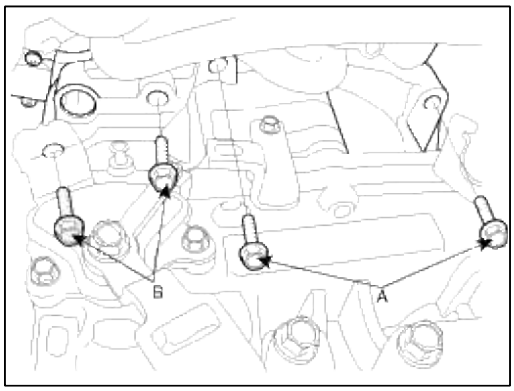


9. Install the under shield covers(A).



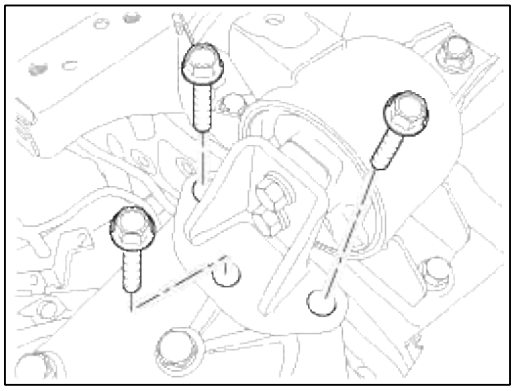
10. Install the transaxle upper mounting bolts (A-2ea) the starter motor mounting bolts (B-2ea).

Tightening torque :
[A] 60~80 Nm (6.0~8.0 kgf.m, 43.4~57.9 lb-ft)
[B] 43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)

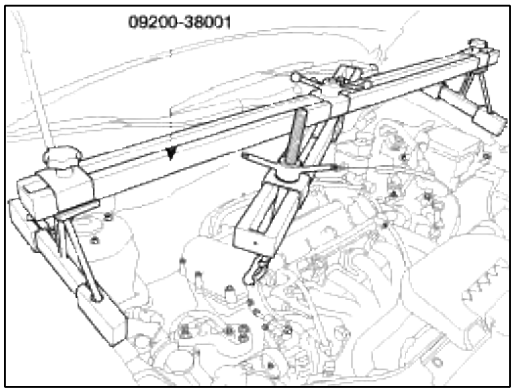


11. Install the transaxle insulator mounting bracket bolts(3ea).

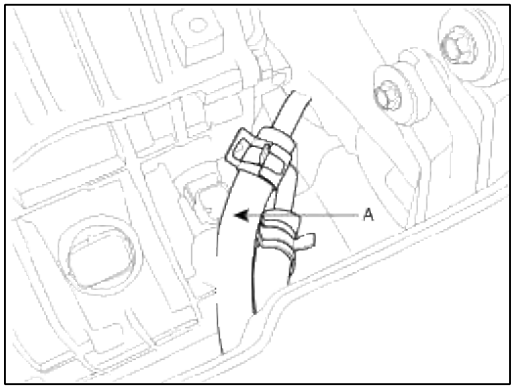
Tightening torque :
90~110 Nm (9~11 kgf.m, 65~79 lb-ft)



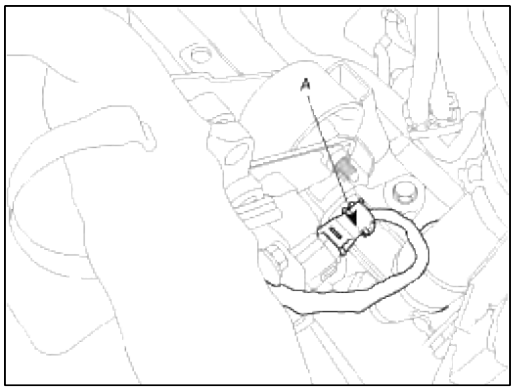
12. Remove the special tool (09200-38001).



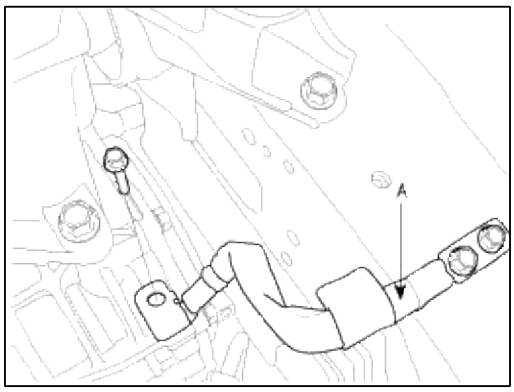
13. Connect the transaxle oil cooler hoses (A) to the tubes by fastening the clamps.



14. Install the output speed sensor connector (A).

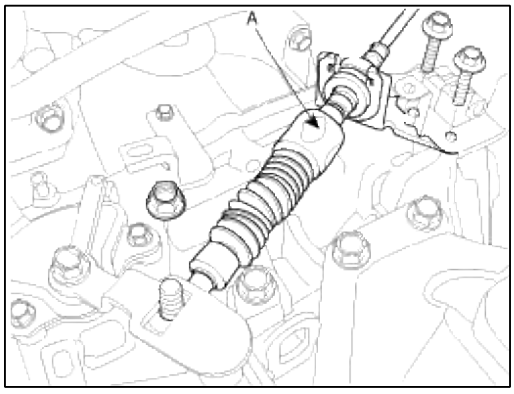


15. Install the ground cable (A) to transaxle.

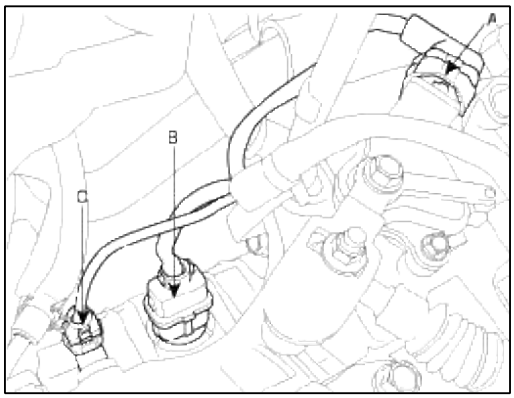


16. Install the shift cable assembly (A).

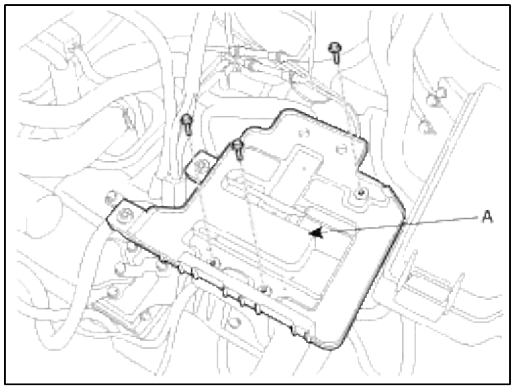
Tightening torque :
10~14Nm (1.0~1.4kgf.m, 7.2~10.1lb-ft)



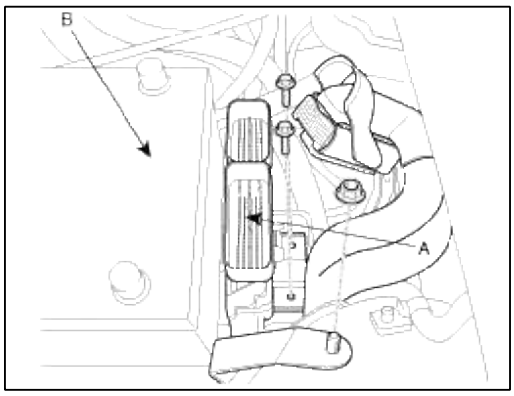
17. Connect the inhibiter switch connector (A), solenoid valve connector (B) and the input speed sensor connector(C).



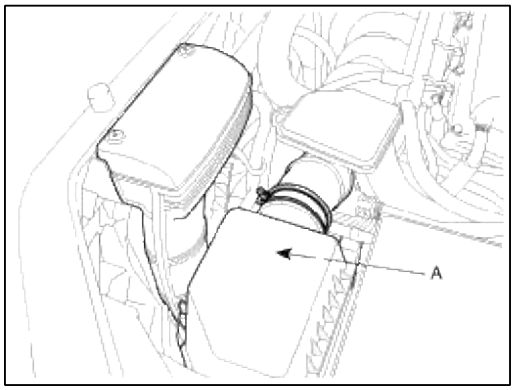
18. Install the battery tray (A).



19. After installiing the battery (B), install the PCM (A).



20. Connect the air duct (A).



21. After completing the installation perform the following procedure;
    A. Adjust the shift cable.
    B. Refill the transaxle fluid.
    C. Clean the battery posts and cable terminals with sandpaper and grease them to prevent corrosion before installing.

NOTE

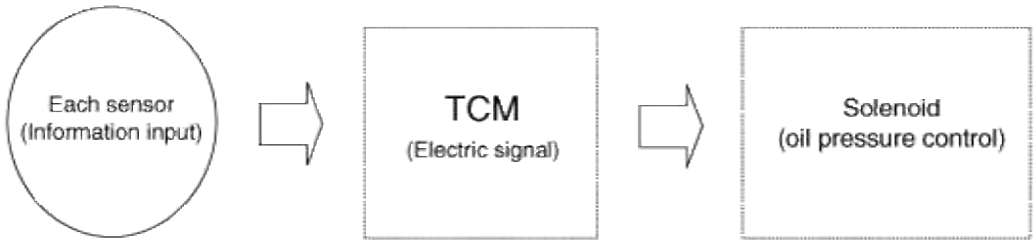
When replacing the automatic transaxle, reset the automatic transaxle's values by using the High- Scan Pro.

1. Connect the Hi-Scan Pro or GDS connector to the data link connector under the dash pad and power cable to the cigar jack under the center facia.
2. Turn the ignition switch on and power on the Hi-Scan Pro.
3. Select the vehicle's name.
4. Select 'AUTOMATIC TRANSAXLE'.

Automatic Transaxle System > Valve Body System > Solenoid valve > Description and Operation (A4CF2)

Description

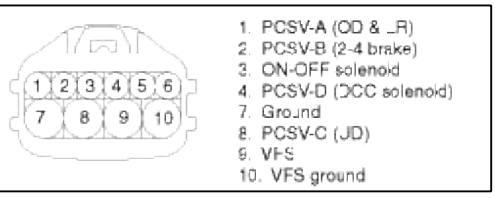
TCM calculates the best condition using the information from all kinds of sensors. If the solenoid valve receives the information on the oil pressure, the solenoid valve actuates according to the driving signal. All kinds of regulators in the valve body are controlled to change the oil passage and also the line pressure is controlled by TCM.

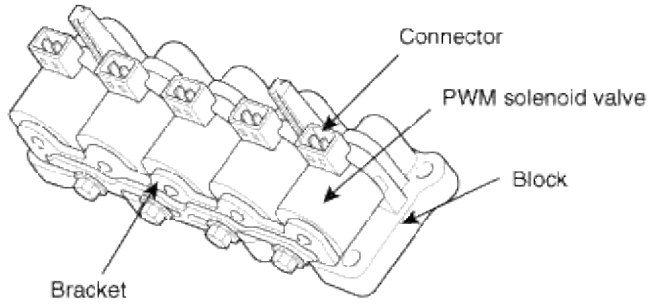


● PWM (Pulse Width Modulation) Solenoid Valve

Structure and functions

PWM solenoid valve is composed of five solenoid valves and the oil capacity in the solenoid valve is changed by the electric duty value of TCM. The oil pressure of the valve body and the torque converter engages or disengages the damper clutch. The solenoid valves send the operating oil pressure to the clutches and brakes at each range and also control the strength and weakness of oil pressure to reduce shock when shifting.



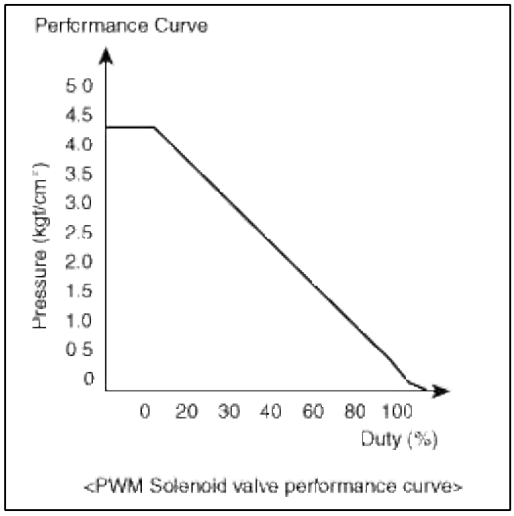


<PWM block assembly>

PWM (Pulse Width Modulation) solenoid

Range	PWM solenoid valve				
	PCSV-A (SCSV-B)	PCSV-B (SCSV-C)	PCSV-C (SCSV-D)	PCSV-D (DCCV)	ON, OFF (SCSV-A)
N, P	OFF	ON	ON	OFF	ON
1st	ON	ON	OFF	OFF	ON
2nd	ON	OFF	OFF	ON	OFF
3rd	OFF	ON	OFF	ON	OFF
4th	OFF	OFF	ON	ON	OFF
Reverse	OFF	OFF	ON	OFF	ON
LOW	OFF	ON	OFF	OFF	ON

PWM (Pulse Width Modulation) Solenoid Valve Control Feature

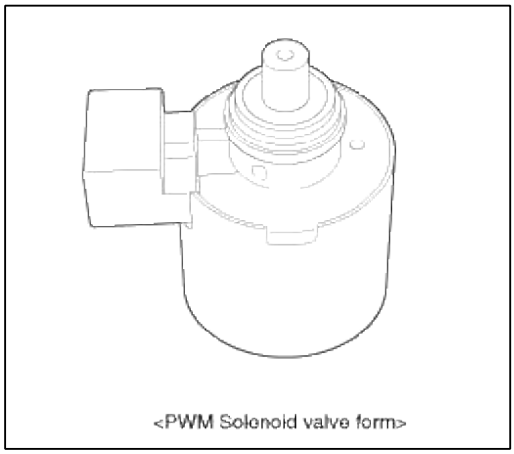


<PWM Solenoid valve performance curve>

PWM solenoid valve is controlled linearly according to the duty ratio.

Oil pressure range:
0~4.3 kgf/cm² (0~422kpa, 0~61.2psi)

Type	3way & Normal High
Input voltage	12V
Coil resistance	3.2±0.2Ω (at 25°C, 77°F)
Cycle	50Hz

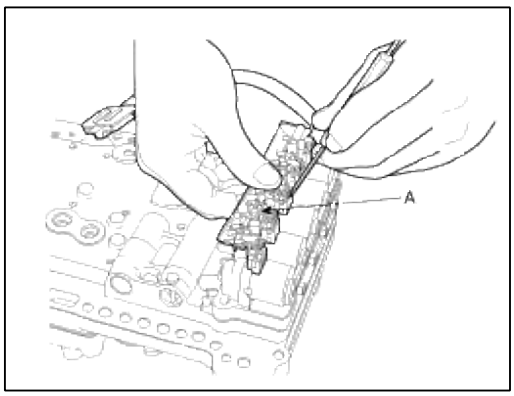

<PWM Solenoid valve form>

Automatic Transaxle System > Valve Body System > Solenoid valve > Repair procedures (A4CF2)

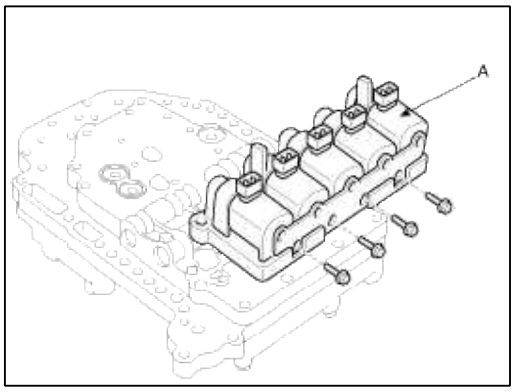
Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.

5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in overhaul manual)
8. Disconnect the main harness(A) from valve body.



9. Remove the solenoid valve assembly(A).



Installation

1. Install the solenoid valve.

> CAUTION
>
> Apply the ATF oil or White Vaseline to the O-ring to prevent damage.

2. Connect the solenoid valve connector to the valve body.

> CAUTION
>
> When connecting the solenoid valve connector, check the connector for rust, dirt, or oil, then clean and reconnect it.

3. Install the valve body. (Refer to Valve body's reassembly in overhaul manual)

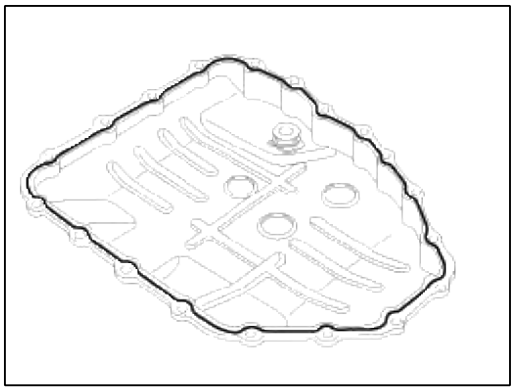
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the oil filter.

Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

5. Continue to apply liquid gasket at application points at the oil pan with Ø2.5mm (0.098in) thickness.

Liquid gasket Part name : Threebond 1281B



6. Tighten the mounting bolt with the specified torque after installing the oil pan.

Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

7. Install the drain plug.

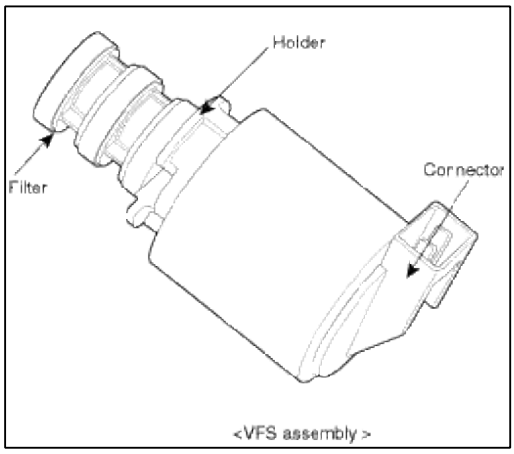
Tightening torque :
40~50Nm(4.0~5.0kgf.m, 28.9~36.2lb-ft)

8. Installation is the reverse of the removal.

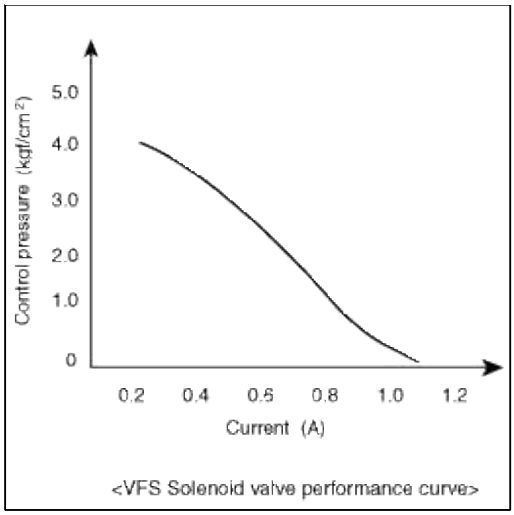
Automatic Transaxle System > Valve Body System > VFS(Variable Force Solenoid) Valve > Description and Operation (A4CF2)

Description

VFS valve controls the regulator valve and varies the line pressure from 4.5bar to 10.5bar according to the throttle open angle and the shift range. The holder is installed on the upper side of the case and the filter is installed to the two places on the holder outside to prevent in the strange material from flowing in the VFS.



VFS (Variable Force Solenoid) Valve Control Feature



<VFS Solenoid valve performance curve>

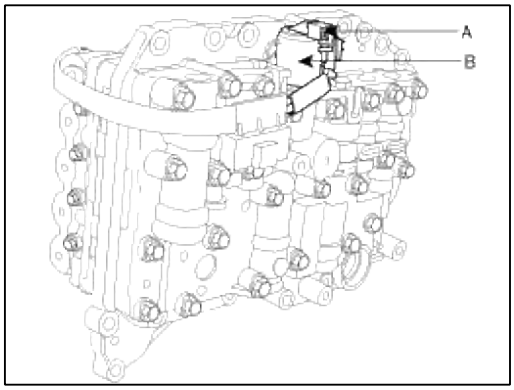
PWM solenoid valve is linear controlled according to the current value.

type	3way & Normal High
Input voltage	12V
Coil resistance	3.5±0.2Ω(at 25°C, 77°F)
Operating current	0 ~ 1200 mA

Automatic Transaxle System > Valve Body System > VFS(Variable Force Solenoid) Valve > Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in overhaul manual)
8. Disconnect the VFS solenoid valve connector (A).

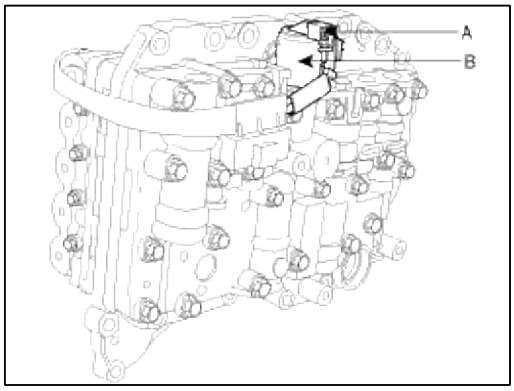


9. Remove the solenoid valve assembly (B).

Installation

1. Install the solenoid valve (B).

> CAUTION
>
> Apply the ATF oil or White Vaseline to the O-ring not to be damaged.



2. Connect the solenoid valve connector (A).

> CAUTION
>
> When connecting the solenoid valve connector, check the connector for rust, dirt, or oil, then reconnect it.

3. Install the valve body. (Refer to Valve body's reassembly in overhaul manual)

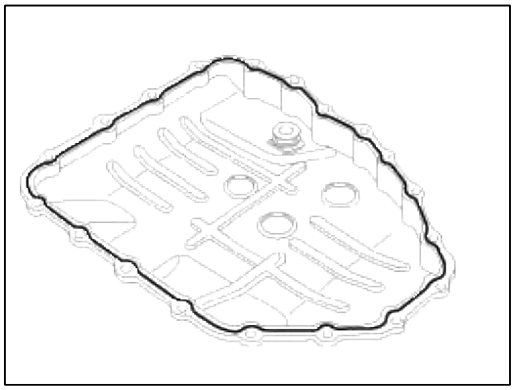
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the oil filter.

Tightening torque :
5~7Nm(0.5~0.7kgf.m, 4~5lb-ft)

5. Continue to apply liquid gasket at application points at the oil pan with Ø2.5mm (0.098in) thickness.

Liquid gasket Part name : Threebond 1281B



6. Tighten the mounting bolt with the specified torque after installing the oil pan.

Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

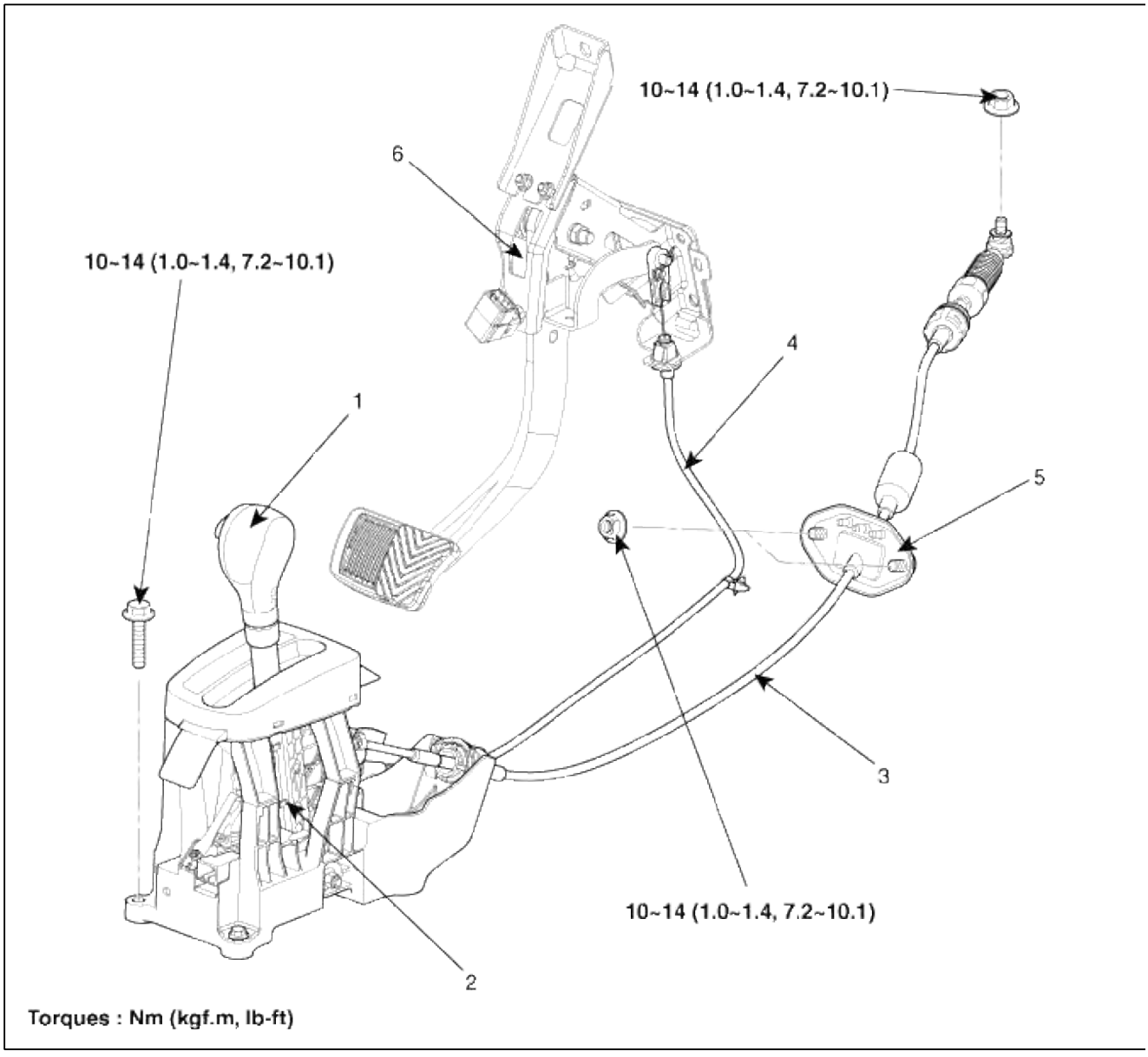
7. Install the drain plug.

Tightening torque :
40~50Nm(4.0~5.0kgf.m, 28.9~36.2lb-ft)

8. Installation is the reverse of the removal.

Automatic Transaxle System > Automatic Transaxle Control System > Shift Lever > Components and Components Location

Components

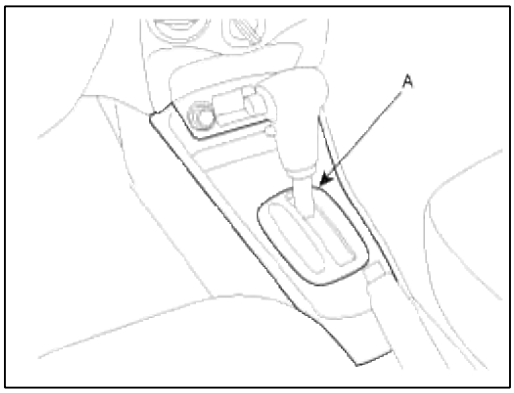


1. Shift lever knob 2. Shift lever assembly 3. Control cable assembly	4. Shift lock cably assembly 5. Retainer 6. Brake pedal assembly

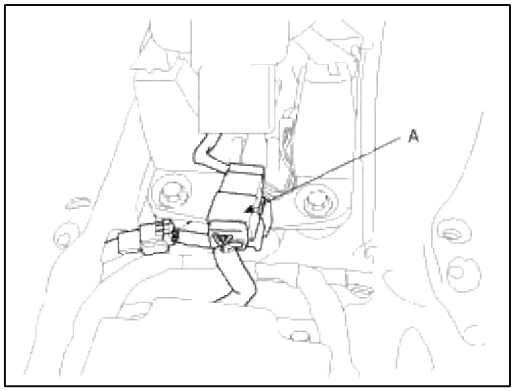
Automatic Transaxle System > Automatic Transaxle Control System > Shift Lever > Repair procedures

Removal

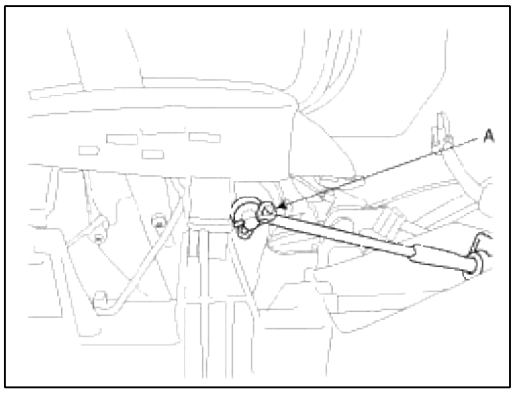
1. Remove the center console cover (A).



2. Remove the center console. (refer to Console in BD group)
3. Disconnect the connector (A).

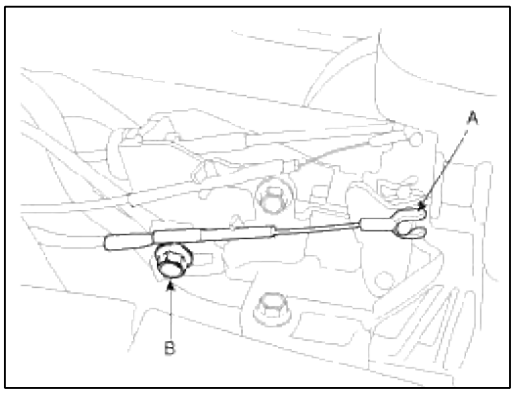


4. Remove the cotter pin (A) from the shift cable.

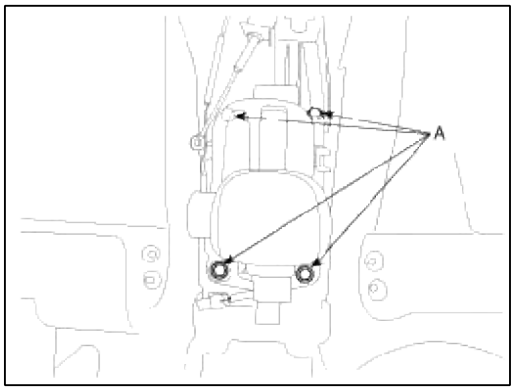


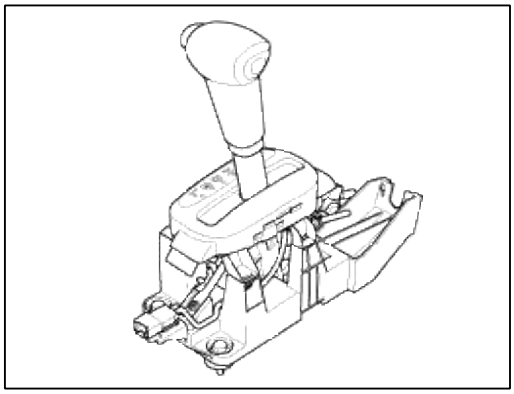
5. Remove the shift cable holder.
6. Remove the shift lock cable (A).

7. Remove the shift lock cable mounting nut (B).

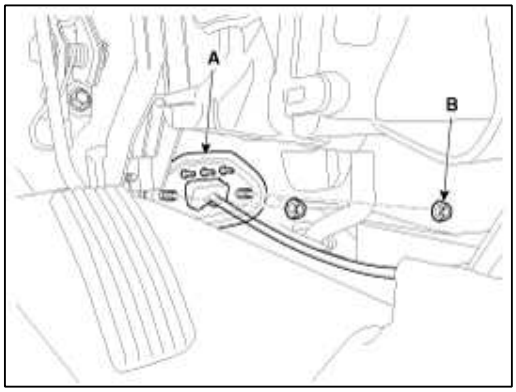


8. Remove the shift lever assembly by removing the bolts(4ea).





9. Remove the retainer (A) and nuts (B).



10. Remove the shift cable assembly from the transaxle. (refer to Automatic transaxle's removal)
11. Remove the shift cable assembly.

Inspection

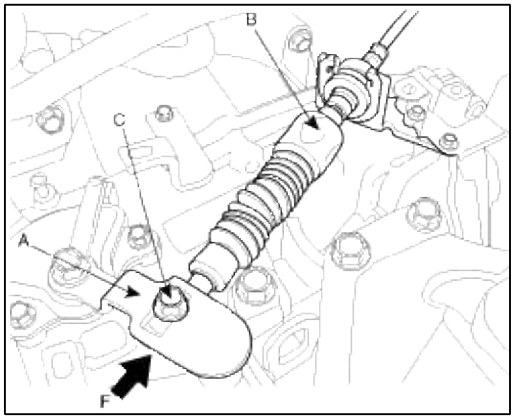
1. Check the shift cable for proper operation and for damage.
2. Check the boots for damage if boots are applied.

3. Check the boots for wear, abrasion, sticking, restricted movement or damage if boots are applied.
4. Check for the weak or damaged spring.

Adjustment

Adjusting the shift cable

1. Set the room side lever and the manual lever (A) to N position.
2. Push the shift cable (B) lightly to "F" direction shown to eliminate the free play.



3. Tighten the adjusting nut (C).

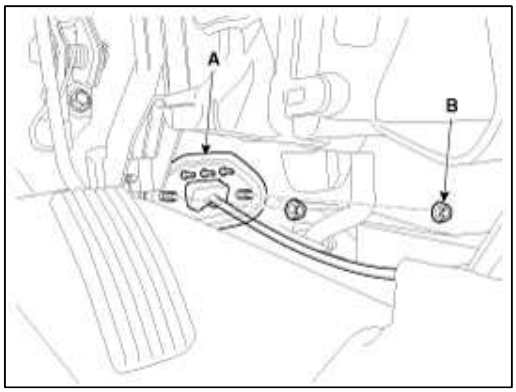
Tightening torque :
10~14Nm (1.0~1.4kgf.m, 7.2~10.1lb-ft)

4. Check that this part operates at each range of the manual lever corresponding to each position of the room lever.

Installation

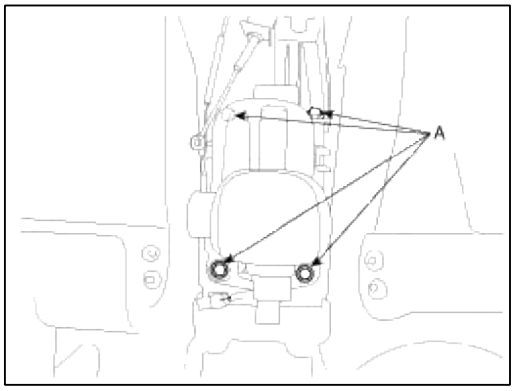
1. Install the shift cable assembly while the manual lever on the transaxle is placed in the neutral position. (refer to Automaic Transaxle Installation)
2. Install the retainer (A) and nuts (B).

Tightening torque :
10~14Nm (1.0~1.4kgf.m, 7.2~10.1lb-ft)

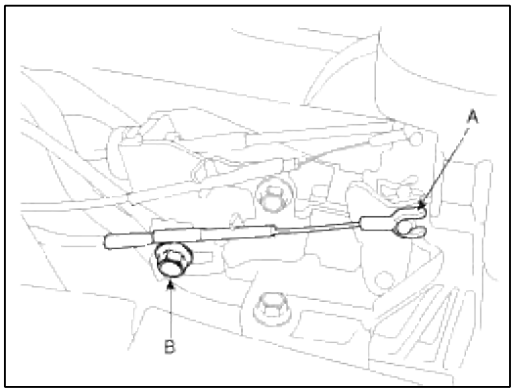


3. Install the shift lever assembly (A).

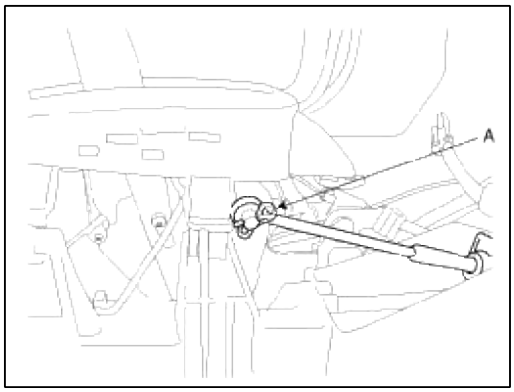
Tightening torque :
10~14Nm (1.0~1.4kgf.m, 7.2~10.1lb-ft)



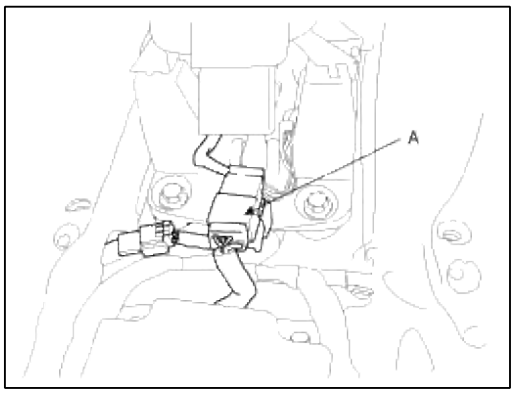
4. Install the shift lock cable mounting nut (B).



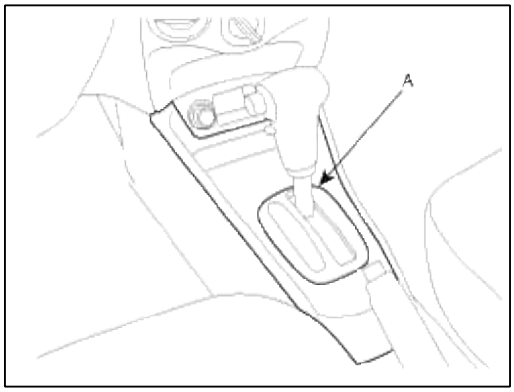
5. Install the shift lock cable (A).
6. Install the shift cabble holder.
7. Insert the cotter pin (A) from the shift cable.



8. Connect the connector (A).

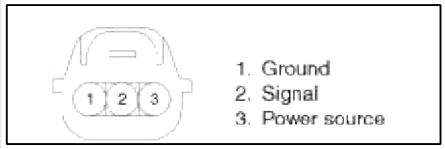


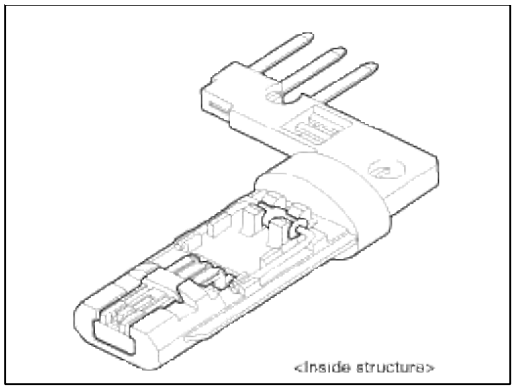
9. Install the center console. (refer to Console in BD group)
10. Install the center console cover (A).



Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Description and Operation (A4CF2)

Description

Sensor type	1. Type : HALL SENSOR 2. Operating voltage : DC 12V 3. Current consumption : 22mA (Max)
Function	1. Input speed sensor: Detect the input shaft rotation at the OD & REV retainer side to control oil pressure when shifting. 2. Feedback control, clutch-clutch control, damper clutch control, shift range control, incorrect ratio control and sensor trouble detection signal.
Connector	

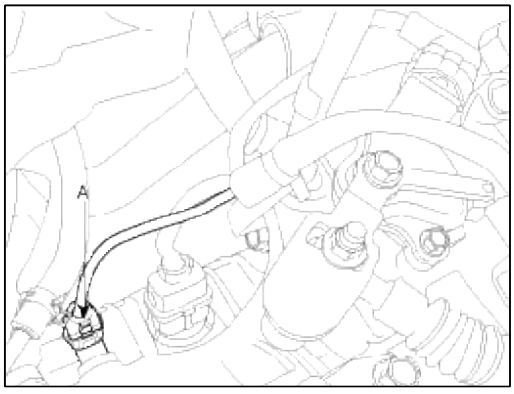


Item	Inspection item	Standard value
Air gap	Input speed sensor	0.035in(0.9mm)
Sensor resistance	Input speed sensor	Over 1 MΩ
Output voltage	HIGH	Over 4.8V
	LOW	Below 0.8V

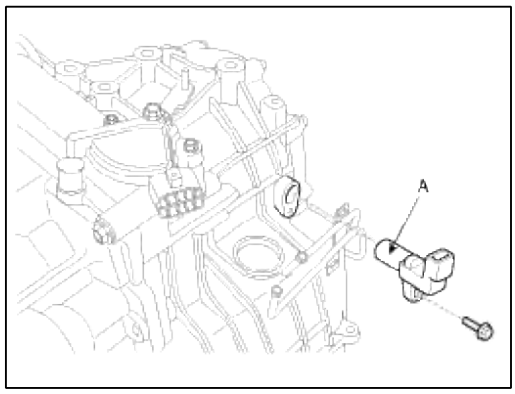
Automatic Transaxle System > Automatic Transaxle Control System > Input Speed Sensor > Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)
5. Remove the input speed sensor connector (A).



6. Remove the input speed sensor(A).



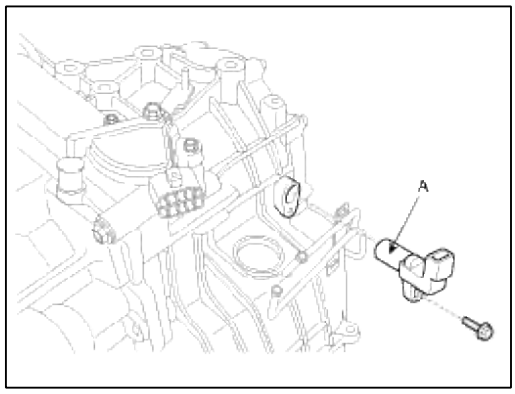
Installation

1. Install the new O-ring to the input speed sensor.
2. Install the input speed sensor (A).

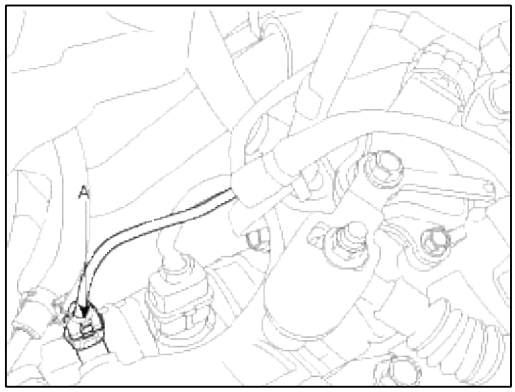
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

CAUTION

While installing the input shaft speed sensor, do not allow dust or other foreign particles to enter the transaxle.



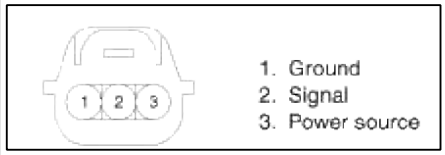
3. Check the connector for dust, dirt, or oil, and then connect the input speed sensor connector (A) securely.

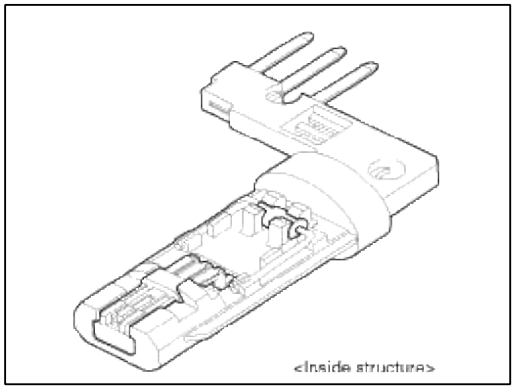


4. Installation is the reverse of removal.

Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Description and Operation (A4CF2)

Description

Sensor type	1. Type : HALL SENSOR 2. Output voltage : DC 12V 3. Current consumption : 22mA (Max)
Function	1. Output speed sensor : Detect the output shaft rpm(T/F DRIVEN GEAR RPM) at the T/F driven gear 2. Feedback control, clutch-clutch control, damper clutch control, shift range control, incorrect ratio control and sensor trouble detection signal.
Connector	



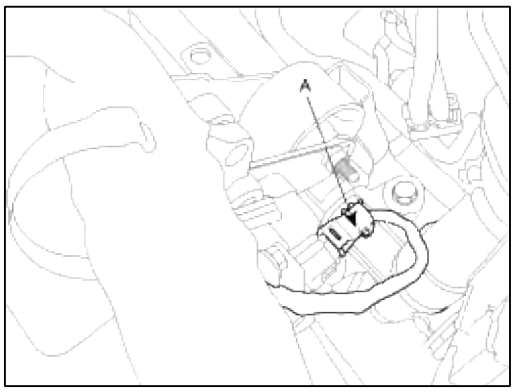
Item	Inspection item	Standard value
Air gap	Output speed sensor	0.025in(0.65mm)
Sensor resistance	Output speed sensor	Over 1 MΩ
Output voltage	HIGH	Over 4.8V
	LOW	Below 0.8V

Automatic Transaxle System > Automatic Transaxle Control System > Output Speed Sensor > Repair procedures (A4CF2)

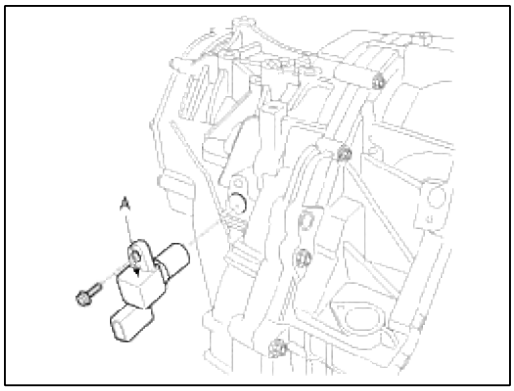
Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)

5. Remove the output speed sensor connector(A).



6. Remove the output speed sensor(A).



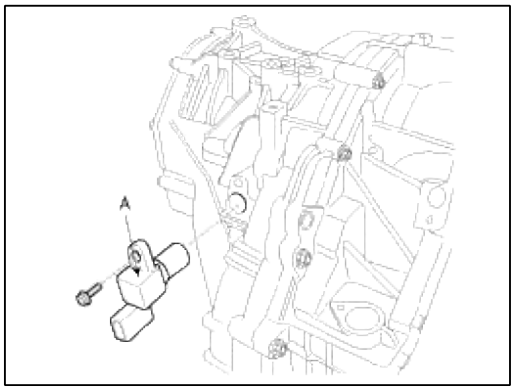
Installation

1. Install the new O-ring to the output shaft speed sensor.
2. Remove the output speed sensor (A).

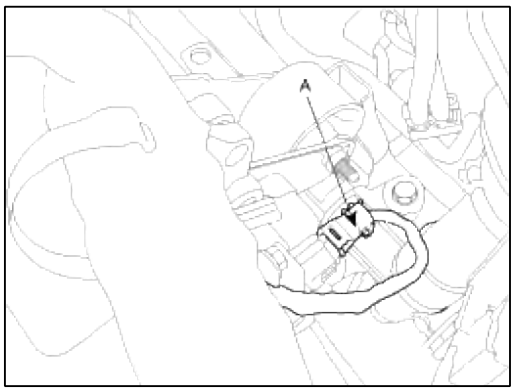
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

CAUTION

While installing the output speed sensor, do not allow dust or other foreign particles to enter the transaxle.



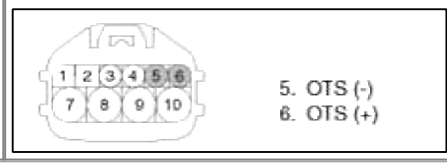
3. Check the connector for dust, dirt, or oil, then connect the output speed sensor connector (A) securely.



4. Installation is the reverse of removal.

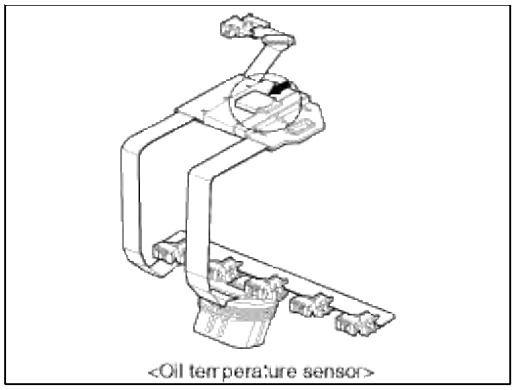
Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Description and Operation (A4CF2)

Description

Sensor type	1. Type : Thermister 2. Use available temperature :-40~160°C(-40~320°F)
Function and feature	1. Detect the temperature of ATF through the thermistor which is exposed outside. 2. When shifting the range, it is used as the oil pressure control information.
Connector	

Temp.[°C(°F)]	Resistance (KΩ)	Temp.[°C(°F)]	Resistance (KΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.4	100(212)	0.63
0(32)	18.6	120(248)	0.38
20(68)	8.1	140(284)	0.25
40(104)	3.8	160(320)	0.16
60(140)	1.98		

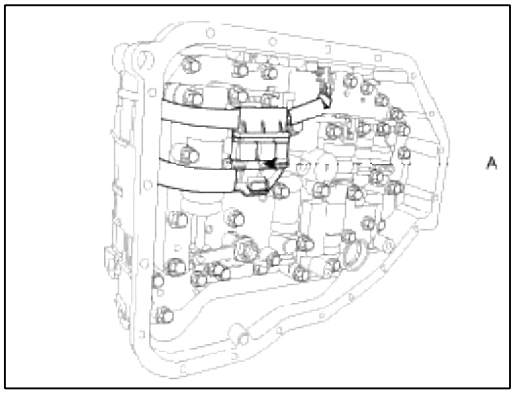
Installation Location



Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Repair procedures (A4CF2)

Removal

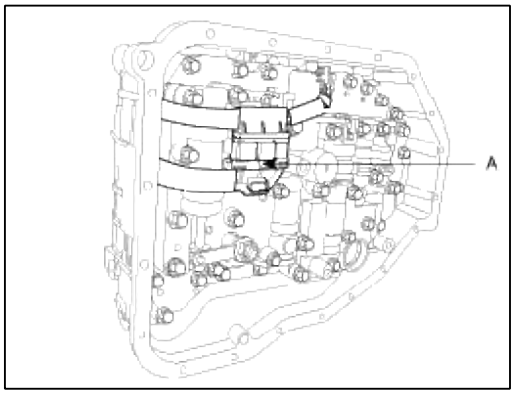
1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in overhaul manual)
8. Disconnect the main harness connector (A) from the valve body and remove oil temperature sensor.



Installation

1. Install oil temperature sensor and connect the main harness connector (A) to the valve body.

> CAUTION
>
> When connecting the oil temperature connector, check the connector for rust, dirt, or oil, then reconnect it.



2. Install the valve body. (Refer to Valve body's reassembly in overhaul manual)

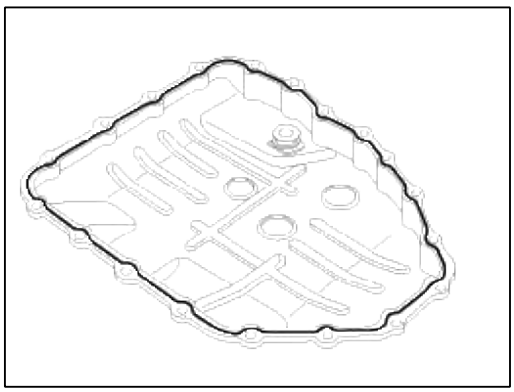
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

3. Install the oil filter.

Tightening torque :
5~7Nm(0.5~0.7kgf.m, 4~5lb-ft)

4. Continue to apply liquid gasket at application points at the oil pan with Ø0.098in(2.5mm) thickness.

Liquid gasket Part name : Threebond 1281B



5. Tighten the mounting bolt with the specified torque after installing the oil pan.

Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

6. Install the drain plug.

Tightening torque :
40~50Nm(4.0~5.0kgf.m, 28.9~36.2lb-ft)

7. Installation is the reverse of the removal.

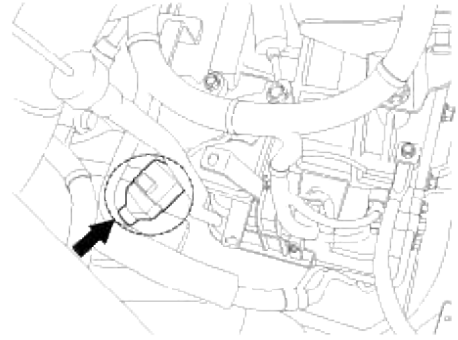
Automatic Transaxle System > Automatic Transaxle Control System > Inhibiter Switch > Description and Operation (A4CF2)

Description

Sensor type	1. Type : ROTARY 2. Available temperature range : -40~150°C(-40~320°F) 3. Tightening torque : 10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)
Function	Detect the position of select lever through the contact switch. It makes starting possible in "P" and "N".



1. P range
2. D range
3. L range
5. 2 range
6. N range
7. R range
8. Power supply IG1
9. Start circuit
10. Start circuit



<Installation location>

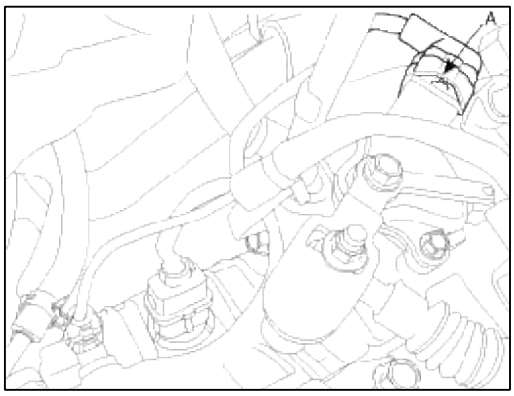
Terminal No. \ Shift lever	P	R	N	D	2	L
1	●					
2				●		
3						●
4						
5					●	
6			●			
7		●				
8	●	●	●	●	●	●
9	●		●			
10	●		●			

Automatic Transaxle System > Automatic Transaxle Control System > Inhibiter Switch > Repair procedures (A4CF2)

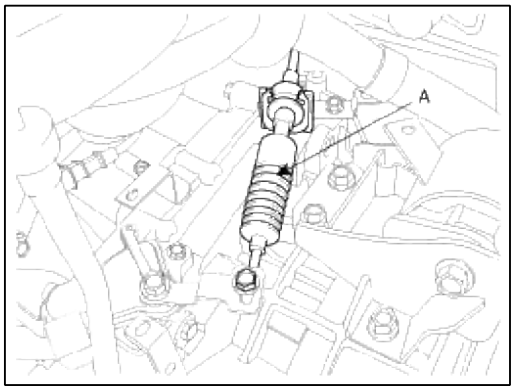
Removal

1. Remove the battery terminal.
2. Remove the battery and battery tray.
3. Remove the air duct.
4. Remove the air cleaner assembly. (Refer to Automatic transaxle's Removal)

5. Disconnect the inhibitor switch connector (A).



6. Remove the control cable(A) from the manual control lever.



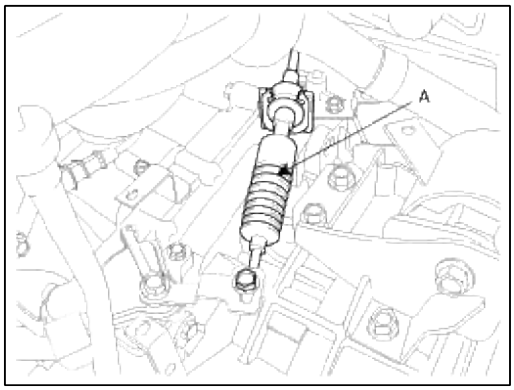
7. Remove the inhibitor switch and manual control lever.

Installation

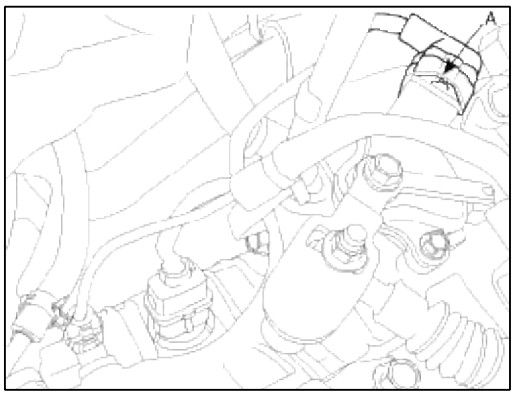
1. Set the inhibitor switch to the "N" position.
2. Set the inhibitor switch control shaft to the "N" position.
3. Install the inhibitor switch and manual control lever.

Tightening torque :
Shaft nut: 17~21Nm(1.7~2.1kgf.m, 12~15lb-ft)
Bolt(2EA): 10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the control cable (A) to the manual control lever.



5. Connect the inhibitor switch connector (A).



6. Installation is the reverse of the removal.
7. Turn the ignition switch ON after installation.
   Move the shift lever from "P" range to "L" range, and verify that the A/T gear position indicator follows the transaxle range switch.

SOUL(AM) > 2010 > G 1.6 DOHC > Body (Interior and Exterior)

Body (Interior and Exterior) > General Information > Specifications

Specifications

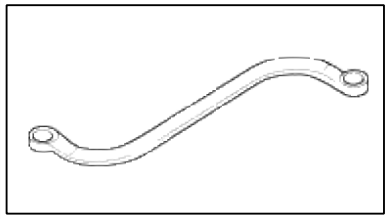
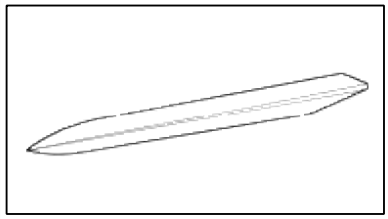
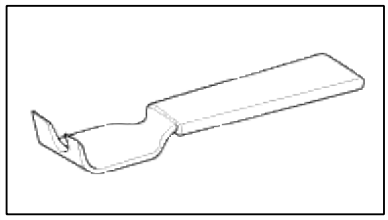
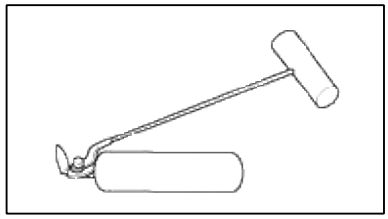
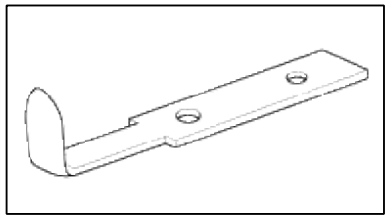
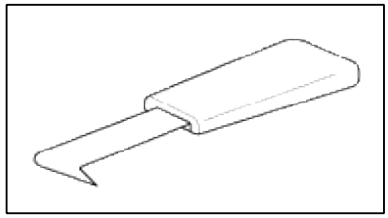
Hood	Type	Rear hinged, stay rod type
Front Door	Construction	Front hinged, full door construction
	Regulator system	X-arm type
	Locking system	Pin-fork system
Rear Door	Construction	Front hinged, full door construction
	Regulator system	X-arm type
	Locking system	Pin-fork system
Tailgate	Type	Inner hinged, gas lifter
Seat Belts	Front	3 point type with Emergency Locking Retractor (E.L.R)
	Rear	3 point type with Emergency Locking Retractor (E.L.R)

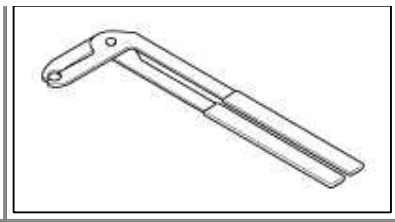
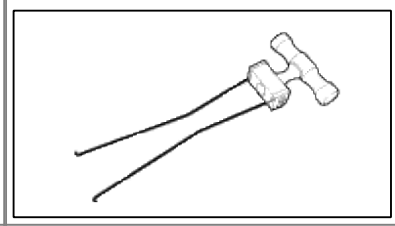
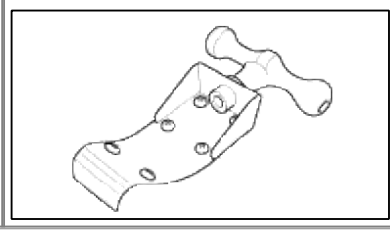
Tightening Torques

Items		N.m	Kgf.m	Lb-ft
Hood	Hood latch to body	6.9~10.8	0.7~1.1	5.1~8.0
Tailgate	Tailgate striker	21.6~26.5	2.2~2.7	15.9~19.5
	Tailgate latch	6.9~10.8	0.7~1.1	5.1~8.6
Front and rear doors	Checker to body	16.7~21.6	1.7~2.2	12.3~15.9
	Checker to door	6.9~10.8	0.7~1.1	5.1~8.0
Seat	Front seat mounting bolts	37.2~58.8	4.0~6.0	28.9~43.4
Seat belt	Front seat belt height adjuster	39.2~53.9	4.0~5.5	28.9~39.8
	Front seat belt buckle mounting bolt	39.2~53.9	4.0~5.5	28.9~39.8
	Front seat belt anchor mounting bolt	39.2~53.9	4.0~5.5	28.9~39.8
	Front seat belt lower anchor	39.2~53.9	4.0~5.5	28.9~39.8
	Front seat belt upper anchor	39.2~53.9	4.0~5.5	28.9~39.8
	Rear seat belt anchor attaching bolt	39.2~53.9	4.0~5.5	28.9~39.8
	Rear seat belt retractor mounting bolt	39.2~53.9	4.0~5.5	28.9~39.8

Body (Interior and Exterior) > General Information > Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
09793-21000 Door hinge adjusting wrench		Adjustment, removal and installation of the door hinge
09800-21000 Ornament remover		Trim removal
09853-31000 Headliner clip remover		Headliner clip removal
09861-31100 Sealant cut-out tool		Cutting windshield sealant (use with 09861-31200)
09861-31200 Sealant cutting blade		Cutting windshield sealant (use with 09861-31100)
09861-31000 Windshield molding remover		Windshield moding removal
09880-4F000		Hog ring clip installation

Hog ring clip installer		
09840-1M100 Air vent remover		Air vent removal
09840-1E100 Center fascia remover		Center fascia removal

Body (Interior and Exterior) > General Information > Troubleshooting

Troubleshooting

Symptom	Suspect Area	Remedy
Water leaks from sunroof	Dirt accumulation in drain tube	Remove dirt from drain
	Clogged drain tube	Blow air into drain to remove dirt
	Broken or dislocated drain tube, defective or cracked clip	Check tube installation and flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loose or deformed deflector, gaps in body work	Retighten adjust or replace
Noise heard when opening. closing sunroof	Foreign particles lodged in guide rail	Check drive cable and guide rails for foreign particles
	Loose guide rails and lid	Retighten
Motor runs but sunroof does not move or moves only partially	Foreign particles lodged in guide rail	Adjust or replace
	Incorrect engagement of motor pinion with drive cable	
	Decrease in motor`s clutch slipping force	

	Increased sunroof sliding resistanceor interference of sunroof with drive cables, weatherstrip, etc. due tomal adjustment of sunroof	
Noise in motor (clutch slipping noise from motor when sunroofIs fully opened or closed is not an unusual noise	Incorrect engagement of motor pinion with drive cable	Check pinion installation and retighten motor
	Worn out or damaged motor pinion bearing	Replace motor assembly
	Worn out or deformed drive cable	Replace
Door glass fails to operate up and down	Incorrect window glass installation	Adjust position
	Damaged or faulty regulator arm or regulator	Correct or replace
Door does not open or close completely	Incorrect door installation	Adjust position
	Defective door check assembly	Correct or replace
	Door hinge requires grease	Apply grease
Hood does not open or close completely	Striker and latch not properly aligned	Adjust
	Incorrectly installed hood	Adjust
	Incorrect hood bumper height	Adjust
Water leak through windshield end rear window	Defective seal	Fill with sealant
	Defective flange	Correct

Body (Interior and Exterior) > Body Dimensions > General Information

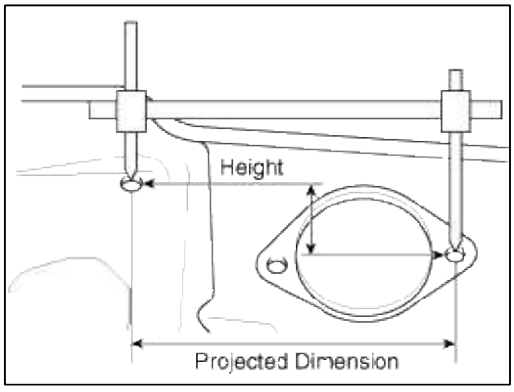
General

1. Basically, all measurements in this manual are taken with a tracking gauge.
2. When a measuring tape is used, check to be sure there is no elongation, twisting or bending.
3. For measuring dimensions, both projected dimension and actual-measurement dimension are used in this manual.

Measurement Method

Projected Dimensions

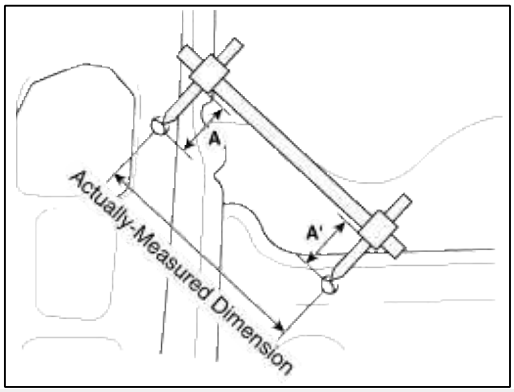
1. These are the dimensions measured when the measurement points are projected into the reference plane, and are the reference dimensions used for body alterations.
2. If the length of the tracking gauge probes are adjustable, make the measurement by lengthening one probe by the amount equivalent to the difference in height of the two surfaces.



Actual-Measurement Dimensions

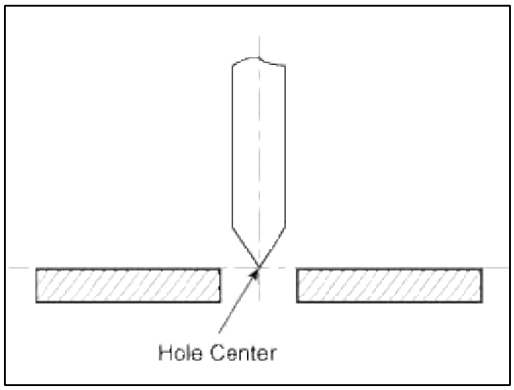
1. These dimensions indicate the actual linear distance between measurement points, and are the reference dimensions for use if a tracking gauge is used for measurement.
2. Measure by first adjusting both probes to the same length (A=A').

> CAUTION
>
> Check the probes and gauge itself to make sure there is no free play.



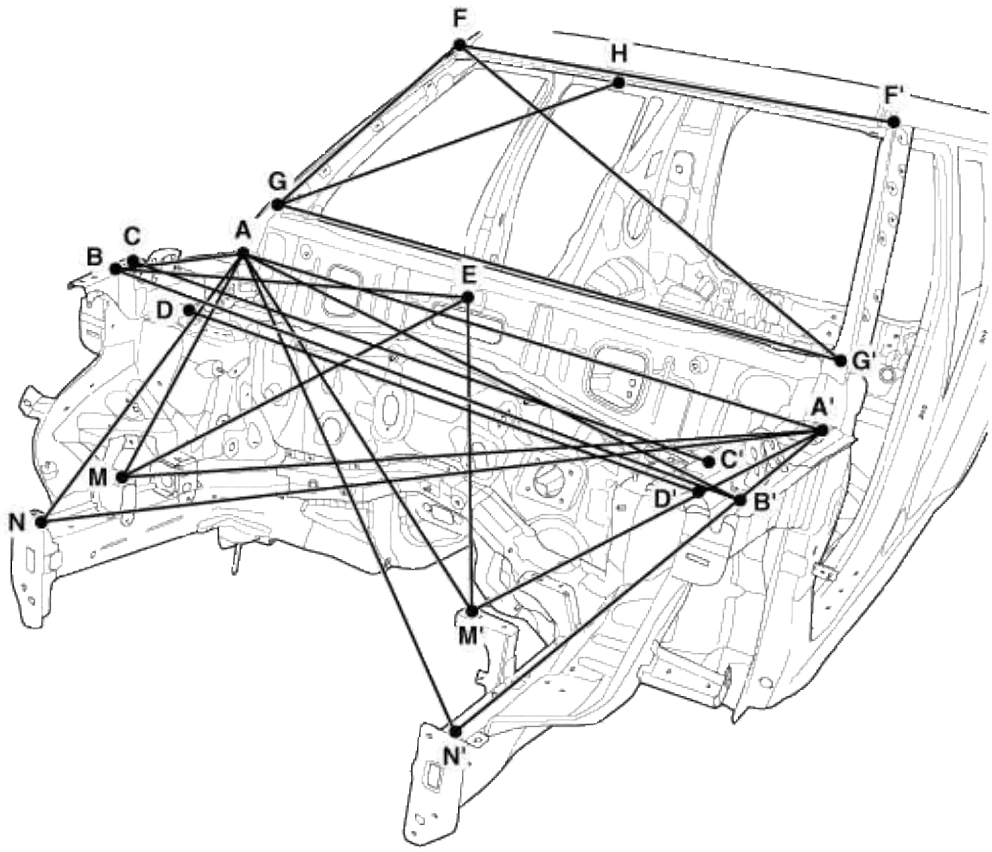
Measurement Point

1. Measurements should be taken at the hole center.



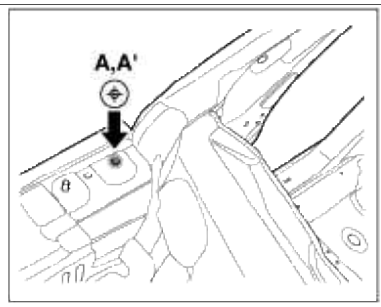
Body (Interior and Exterior) > Body Dimensions > Front Body > Body Repair

Front Body A

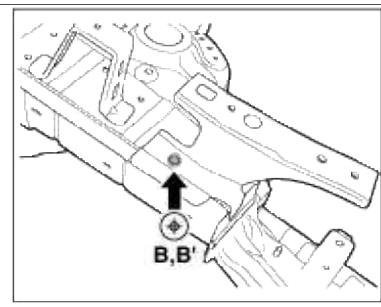


* These dimensions indicated in this figure are projected dimensions.

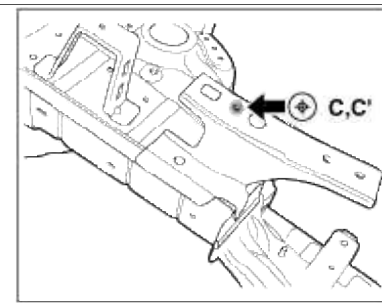
Point symbol	A-A'	A-B / A'-B'	A-B' / A'-B	B-B'	B-E / B'-E	C-C'	D-D'	F-F'
Length(mm)	1488	422	1531	1456	793	1361	1236	1184
Point symbol	F-G / F'-G'	F-G' / F'-G	G-G'	G-H / G'-H	A-M	A-M'	A-N	A-N'
Length(mm)	712	1483	1430	916	757	1283	938	1511
Point symbol	A'-M'	A'-M	A'-N'	A'-N	E-M	E-M'		
Length(mm)	762	1407	949	1526	806	703		



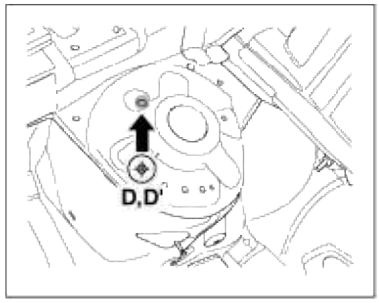
Hood hinge mounting hole (ø11)



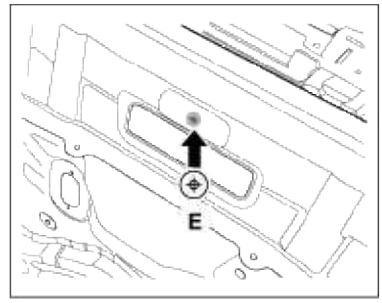
Tooling hole (ø10)



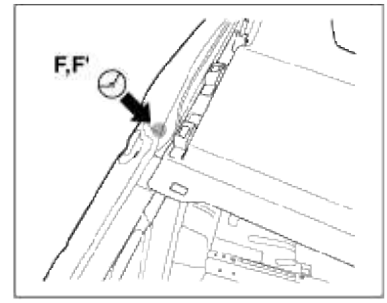
Fender mounting hole (ø6)



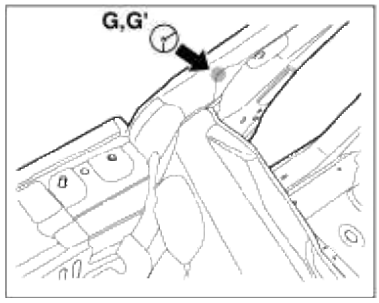
Front suspension mounting hole (ø8)



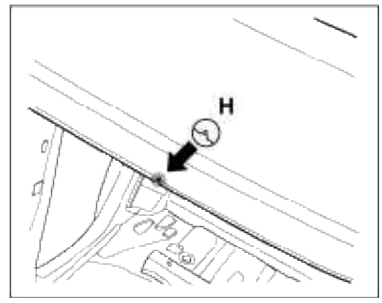
Cowl inner lower panel bracket mounting hole (ø8)



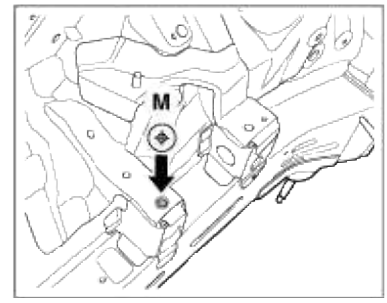
Front pillar outer panel corner



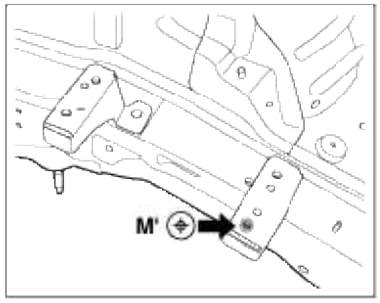
Front pillar outer panel corner



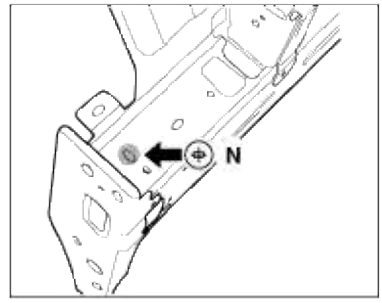
Roof panel outer outer notch



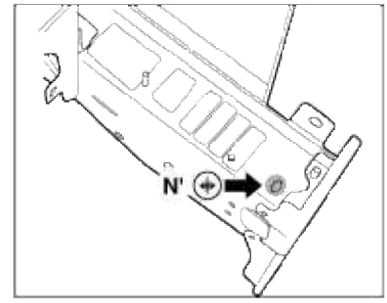
Engine mounting bracket hole (ø13)



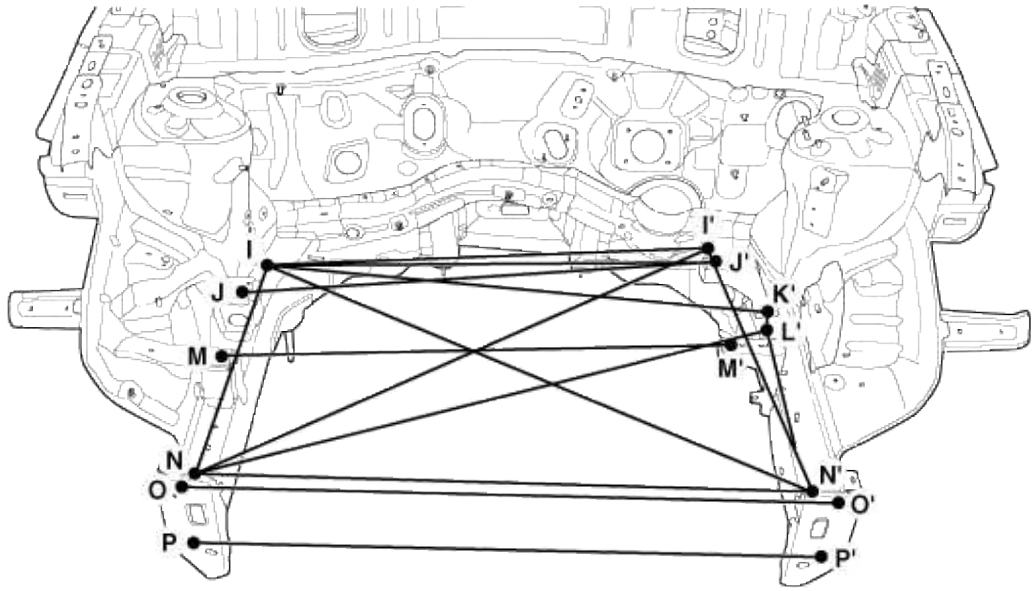
Battery tray leg bracket hole (ø9)



Wiring harness mounting hole (12X7)

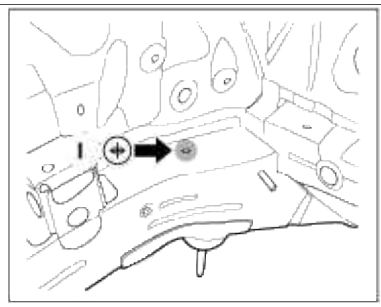


Wiring harness mounting hole (12X7)

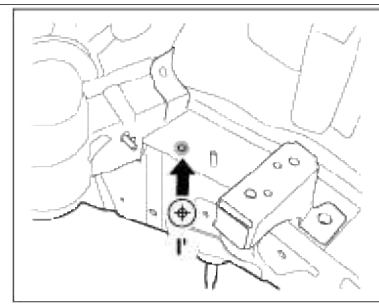


* These dimensions indicated in this figure are projected dimensions.

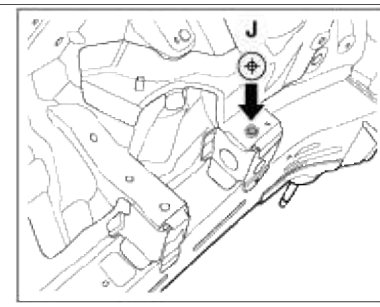
Point symbol	I-I'	I-K'	I-N'	I-N'	I'-N'	I'-N	J-J'	K'-J'
Length(mm)	906	952	533	1084	607	1093	841	165
Point symbol	L'-N'	L'-N	M-M'	N-N'	O-O'	P-P'		
Length(mm)	266	991	832	951	990	990		



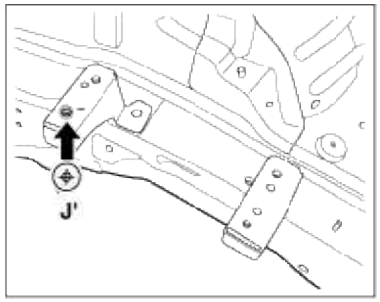
Wiring harness mounting hole
(12X7)



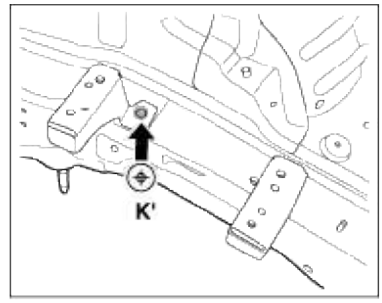
Front side member tooling hole
(ø9)



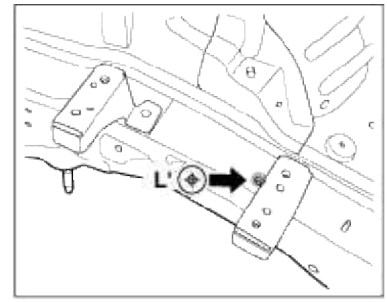
Engine mounting bracket hole
(ø13)



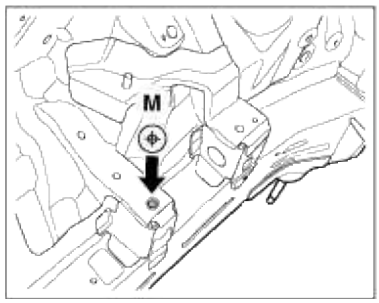
Battery tray leg bracket hole
(ø9)



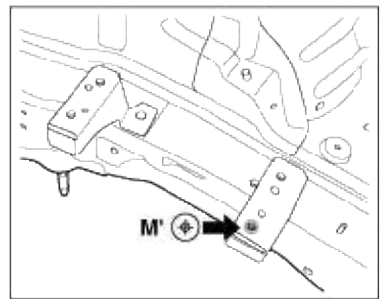
Front side member tooling hole
(ø12)



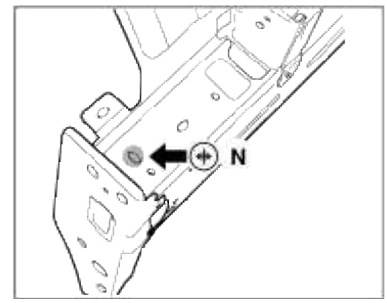
Transaxle mounting hole
(ø13)



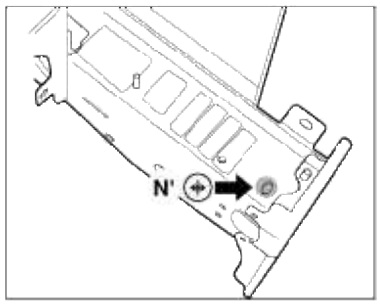
Engine mounting bracket hole
(ø13)



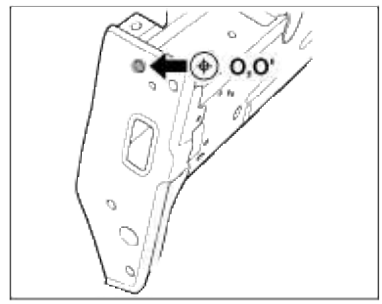
Battery tray leg bracket hole
(ø9)



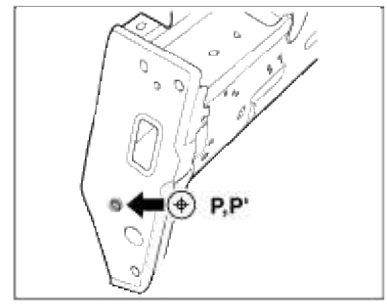
Wiring harness mounting hole
(12X7)



Wiring harness mounting hole
(12X7)



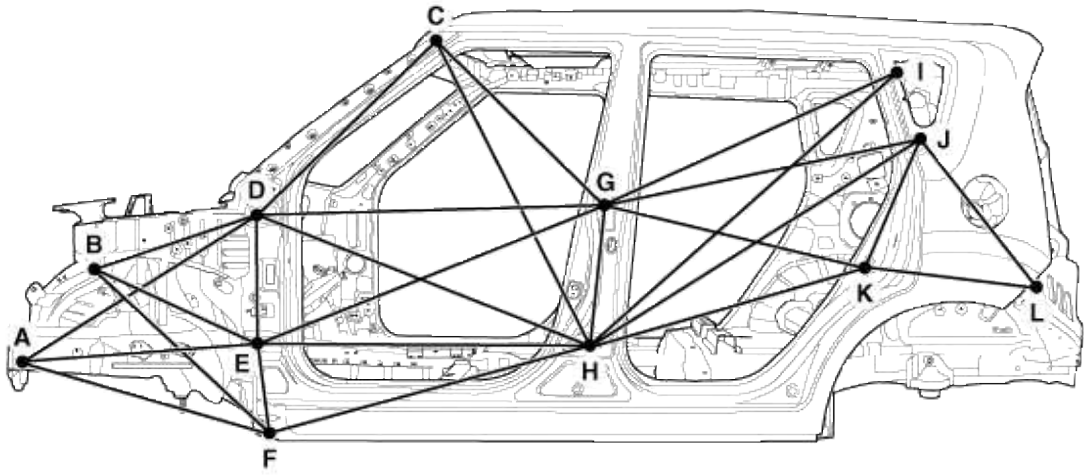
Front end module mounting hole
(ø12)



Front end module mounting hole
(ø12)

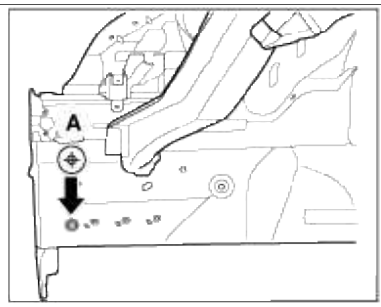
Body (Interior and Exterior) > Body Dimensions > Side Body > Body Repair

Side Body A

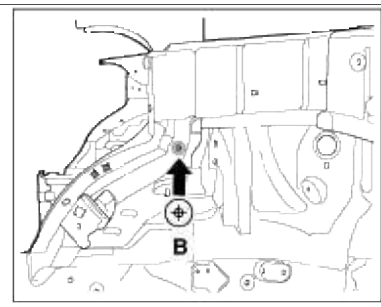


* These dimensions indicated in this figure are projected dimensions.

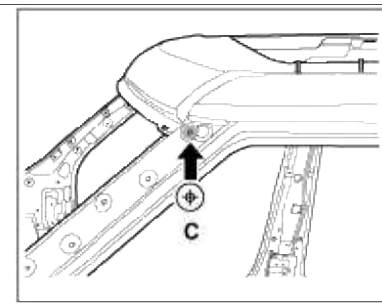
Point symbol	A-D	A-E	A-F	B-D	B-E	B-F	C-D	C-G
Length(mm)	1052	937	950	586	610	779	796	770
Point symbol	C-H	D-E	D-G	D-H	E-F	E-G	E-H	F-H
Length(mm)	1086	400	1080	1104	307	1161	1031	1066
Point symbol	G-H	G-I	G-J	G-K	H-I	H-J	H-K	J-K
Length(mm)	462	1023	1006	837	1298	1211	897	432
Point symbol	J-L	K-L						
Length(mm)	577	502						



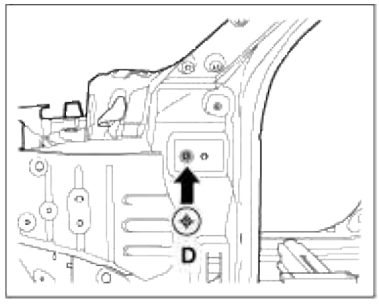
Front side member tooling hole (ø12)



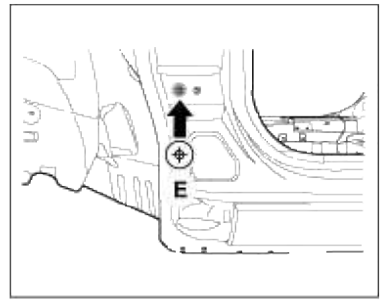
Fender apron panel tooling hole (ø7)



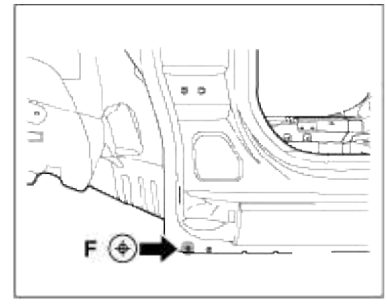
Front pillar trim mounting hole (ø8.5)



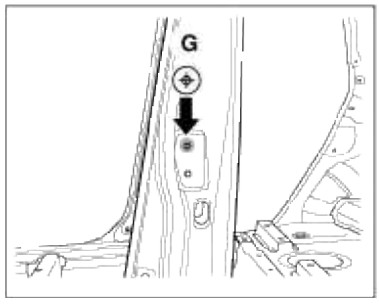
Front door upper hinge mounting hole (ø12)



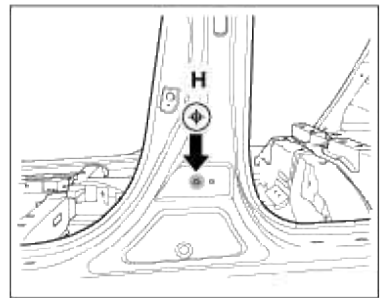
Front door lower hinge mounting hole (ø12)



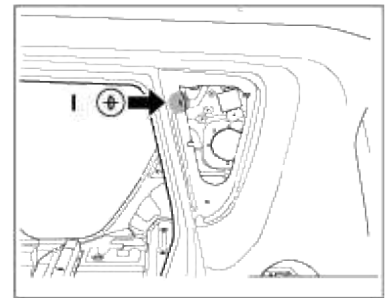
Fender mounting hole (ø10)



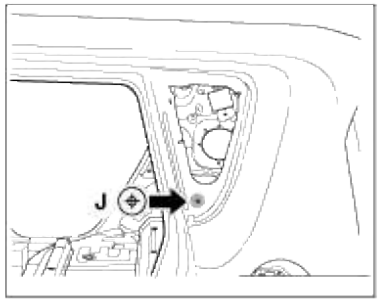
Rear door upper hinge mounting hole (ø12)



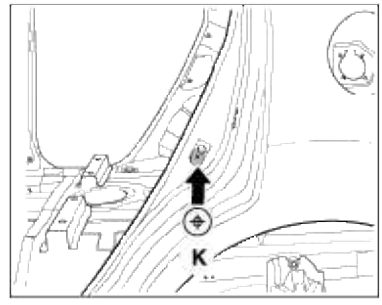
Rear door lower hinge mounting hole (ø12)



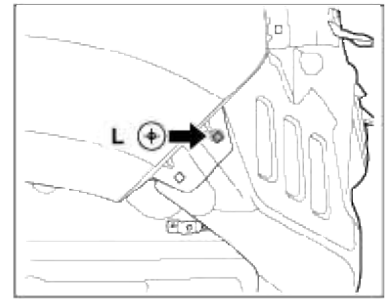
Quarter fixed glass mounting hole (12X5)



Quarter fixed glass mounting hole (ø8)

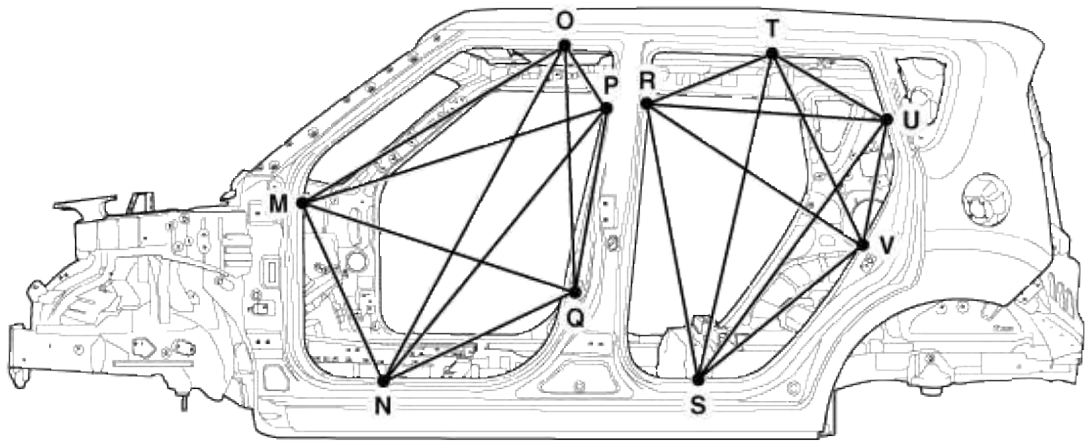


Rear door switch mounting hole (ø8)



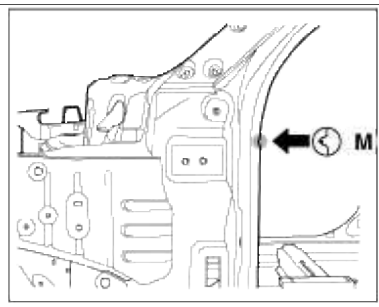
Rear bumper mounting hole (8.5X8.5)

Side Body B

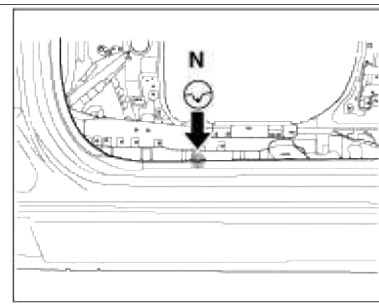


* These dimensions indicated in this figure are projected dimensions.

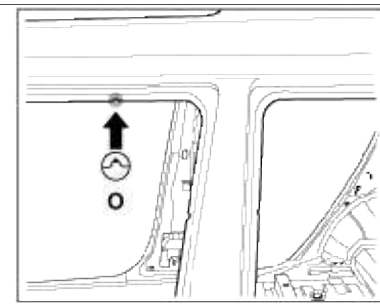
Point symbol	M-N	M-O	M-P	M-Q	N-O	N-P	N-Q	O-P
Length(mm)	596	964	995	899	1197	1099	673	254
Point symbol	O-Q	P-Q	R-S	R-T	R-U	R-V	S-T	S-U
Length(mm)	781	576	860	432	759	796	1059	1015
Point symbol	S-V	T-U	T-V	U-V				
Length(mm)	691	434	666	381				



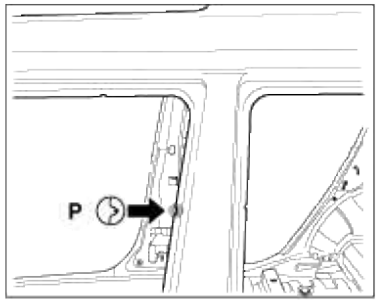
Side outer panel notch



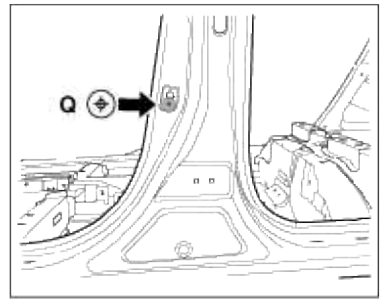
Side outer panel notch



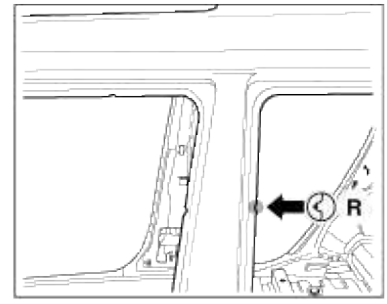
Side outer panel notch



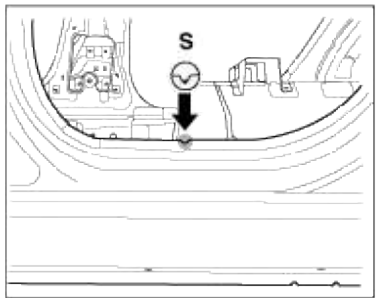
Side outer panel notch



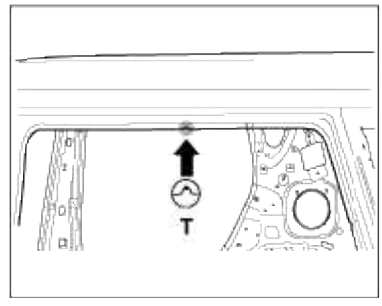
Front door switch mounting hole (ø9)



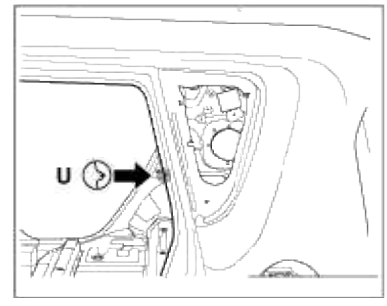
Side outer panel notch



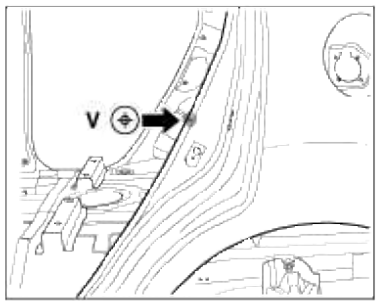
Side outer panel notch



Side outer panel notch



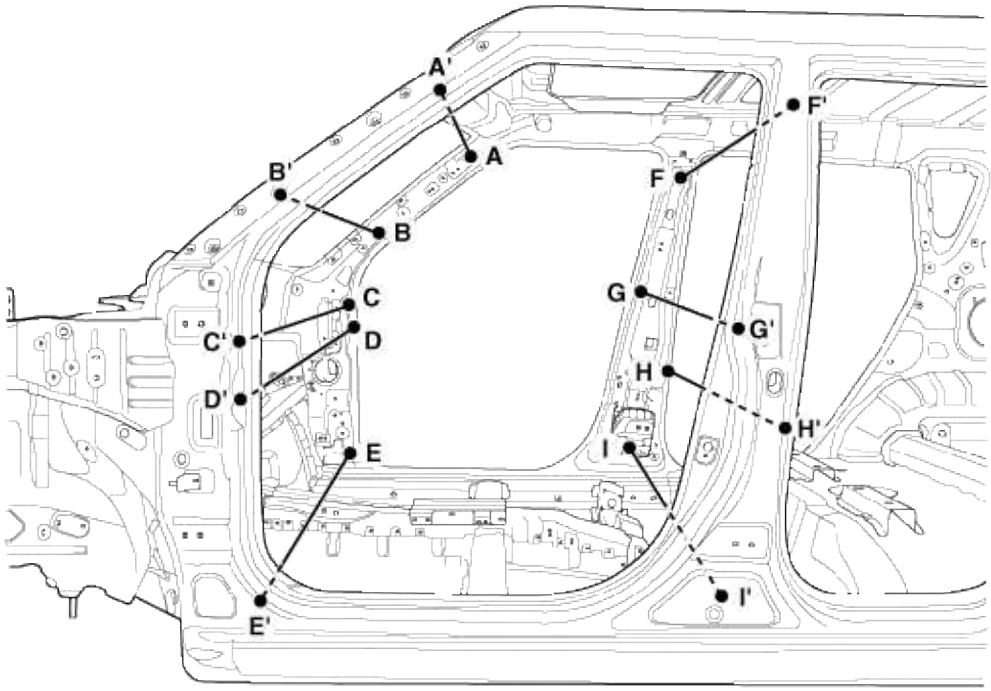
Side outer panel notch



Rear door striker retainer tooling hole (ø5)

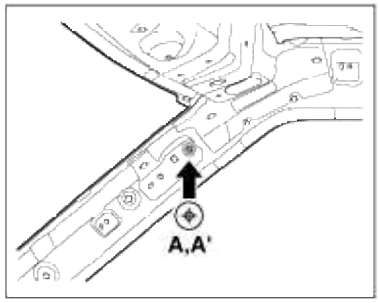
Body (Interior and Exterior) > Body Dimensions > Interior > Body Repair

Interior A

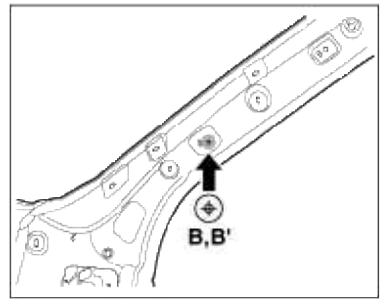


* These dimensions indicated in this figure are projected dimensions.

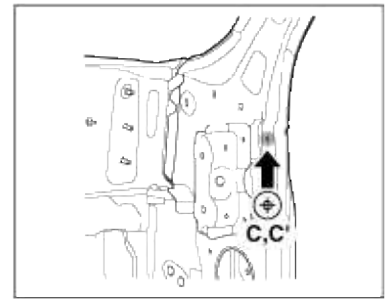
Point symbol	A-A'	B-B'	C-C'	D-D'	E-E'	F-F'	G-G'	H-H'
Length(mm)	1185	1336	1397	1470	1410	1239	1374	1487
Point symbol	I-I'							
Length(mm)	1375							



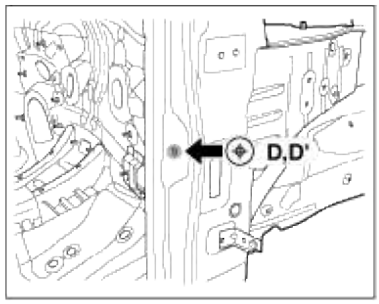
Front pillar trim mounting hole (ø8.5)



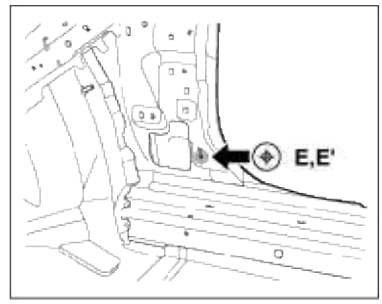
Curtain airbag mounting hole (ø7)



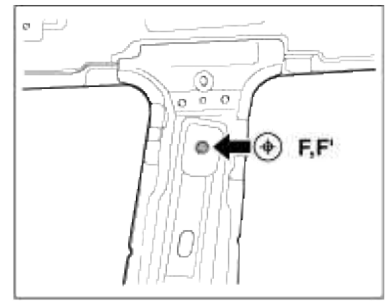
Cowl crossbar mounting hole (ø9)



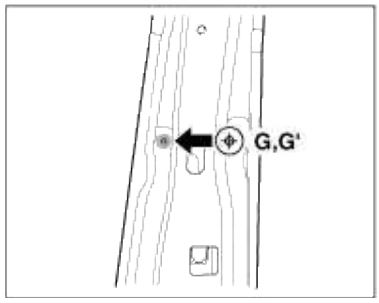
Front door checker mounting hole (ø13)



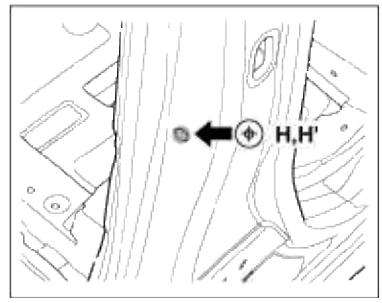
Cowl side trim mounting hole (ø7)



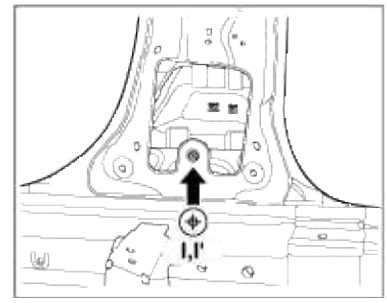
Front seatbelt anchor mounting hole (ø13)



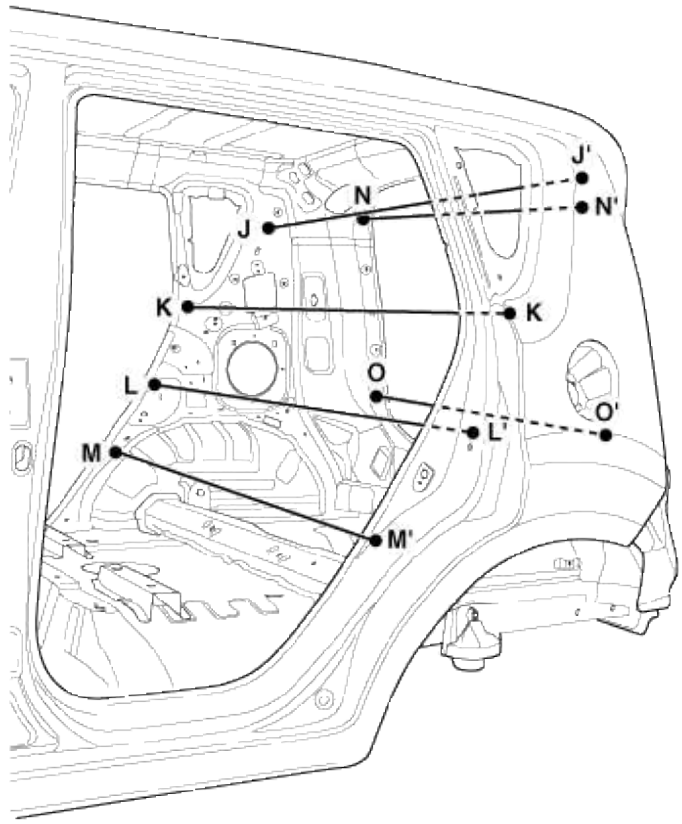
Center pillar trim mount ng hole (ø7)



Rear door checker mounting hole (ø13)

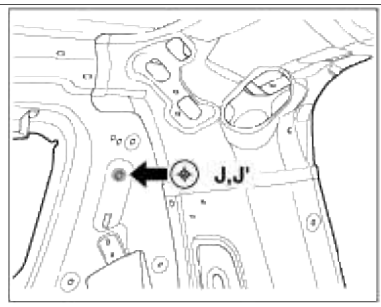


Front seatbelt retractor mounting hole (ø13)

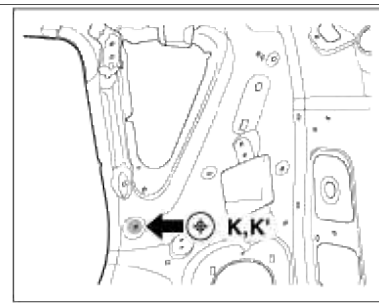


* These dimensions indicated in this figure are projected dimensions.

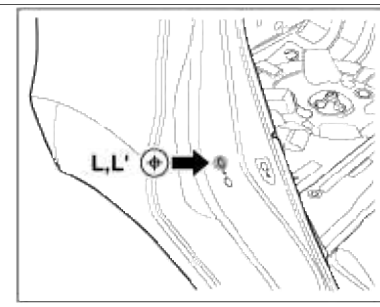
Point symbol	J-J'	K-K'	L-L'	M-M'	N-N'	O-O'		
Length(mm)	1255	1392	1530	1419	931	970		



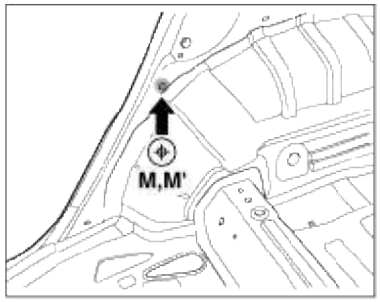
Quarter inner panel tooling hole
(ø16)



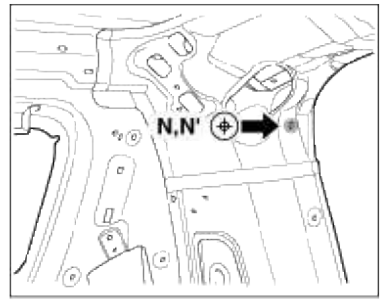
Rear pillar trim mounting hole
(ø6.6)



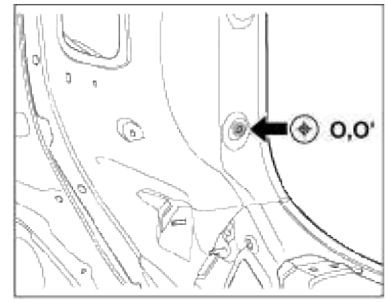
Rear door striker mounting hole
(ø13)



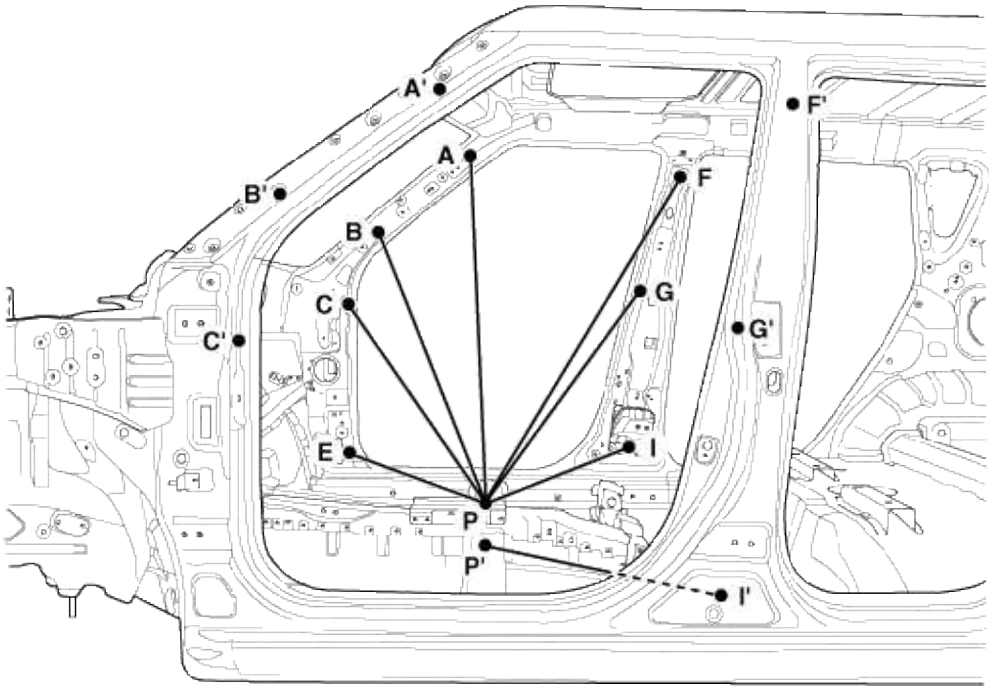
Wheel house panel tooling hole
(ø6)



Rear pillar trim mounting hole
(ø8.5)

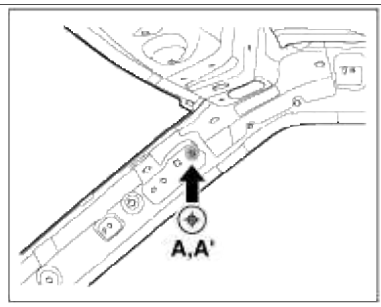


Transverse rear trim mounting hole
(ø8.5)

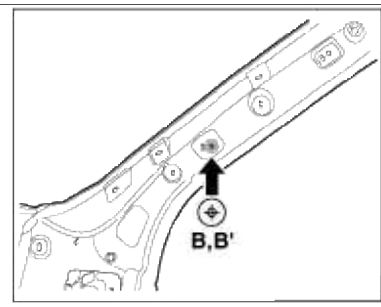


* These dimensions indicated in this figure are projected dimensions.

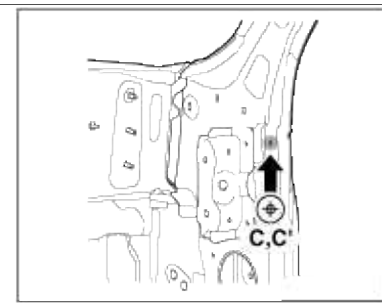
Point symbol	P-A / P'-A'	P-B / P'-B'	P-C / P'-C'	P-E / P'-E'	P-F / P'-F'	P-G / P'-G'	P-I	P'-I'
Length(mm)	1123	1002	894	707	1245	953	710	708



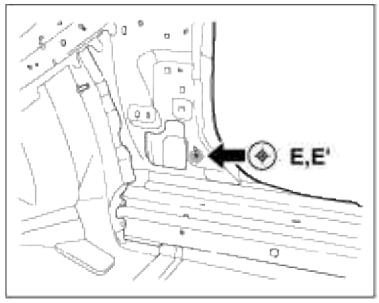
Front pillar trim mounting hole (ø8.5)



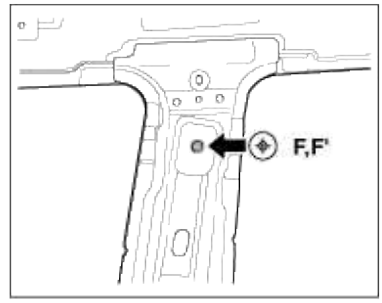
Curtain airbag mounting hole (ø7)



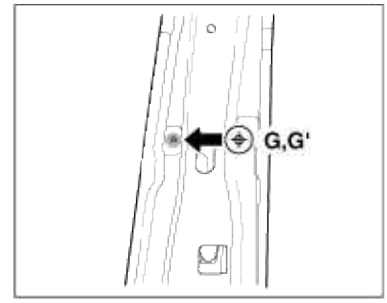
Cowl crossbar mounting hole (ø9)



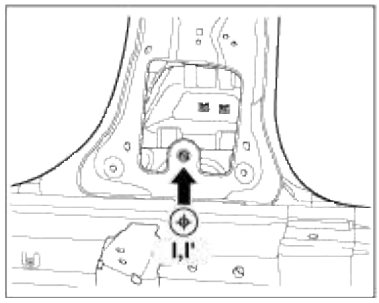
Cowl side trim mounting hole (ø7)



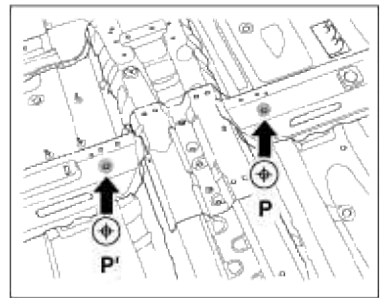
Front seatbelt anchor mounting hole (ø13)



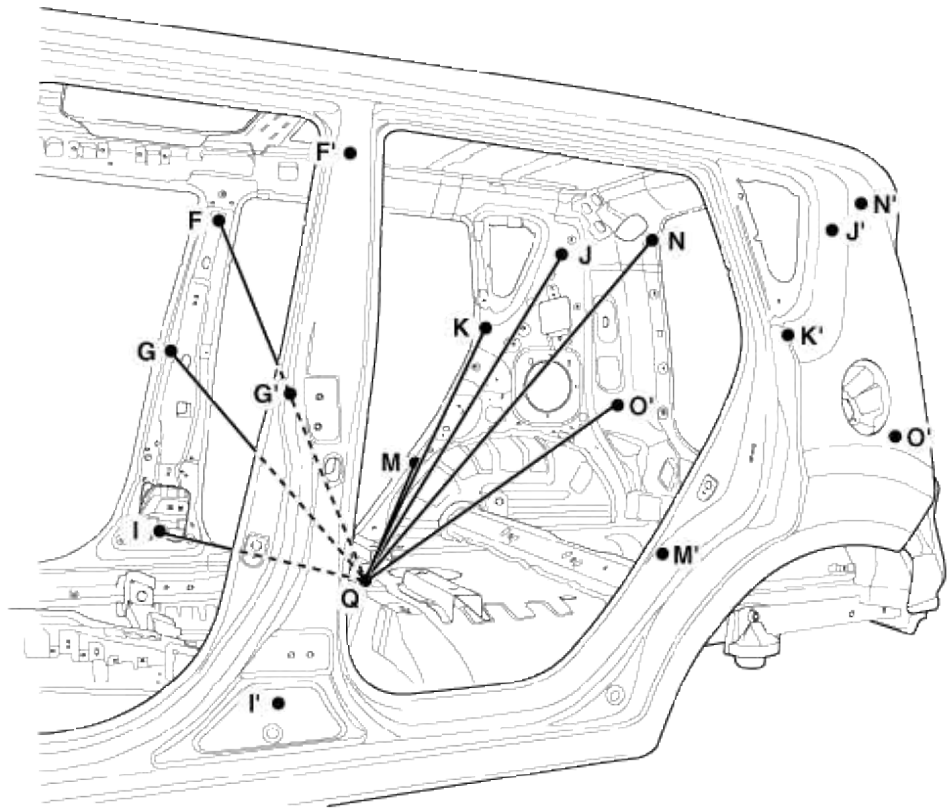
Center pillar trim mounting hole (ø7)



Front seatbelt retractor mounting hole (ø13)

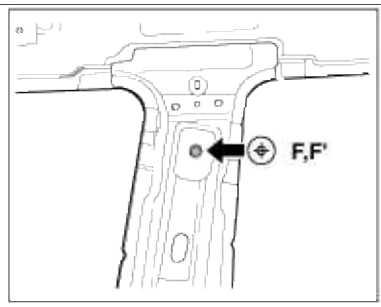


Front seat mounting hole (ø12)

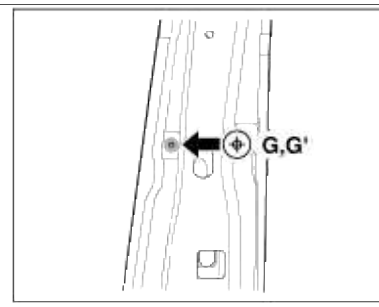


* These dimensions indicated in this figure are projected dimensions.

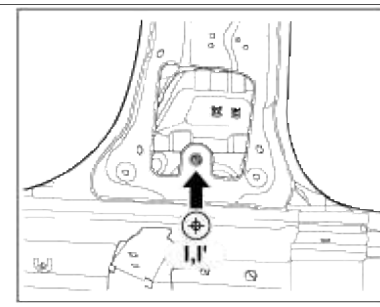
Point symbol	Q-F / Q-F'	Q-G / Q-G'	Q-I / Q-I'	Q-J / Q-J'	Q-K / Q-K'	Q-M / Q-M'	Q-N / Q-N'	Q-O / Q-O'
Length(mm)	1098	922	771	1364	1127	854	1473	1319



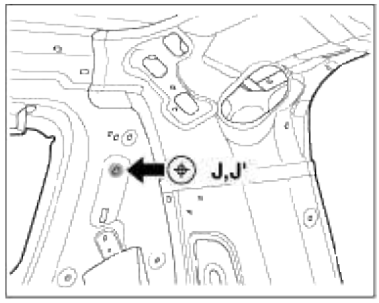
Front seatbelt anchor mounting hole (ø13)



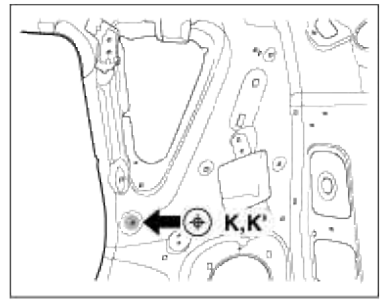
Center pillar trim mounting hole (ø7)



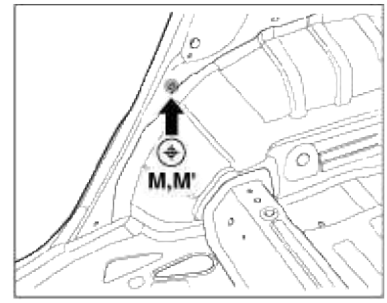
Front seatbelt retractor mounting hole (ø13)



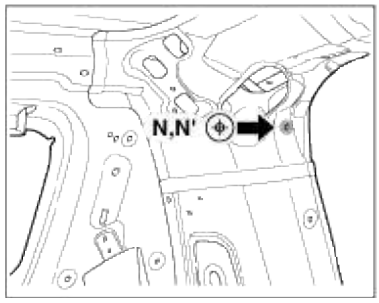
Quarter inner panel tooling hole (ø16)



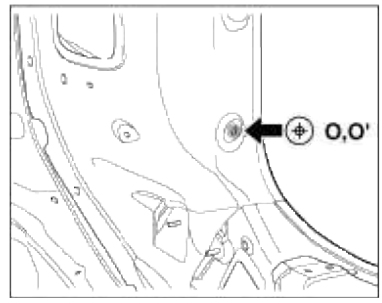
Rear pillar trim mounting hole (ø6.6)



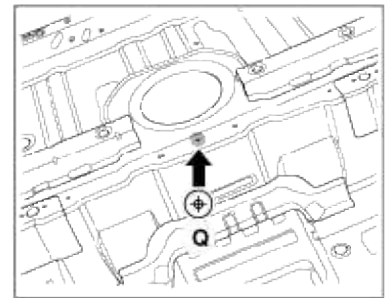
Wheel house panel tooling hole (ø6)



Rear pillar trim mounting hole (ø8.5)

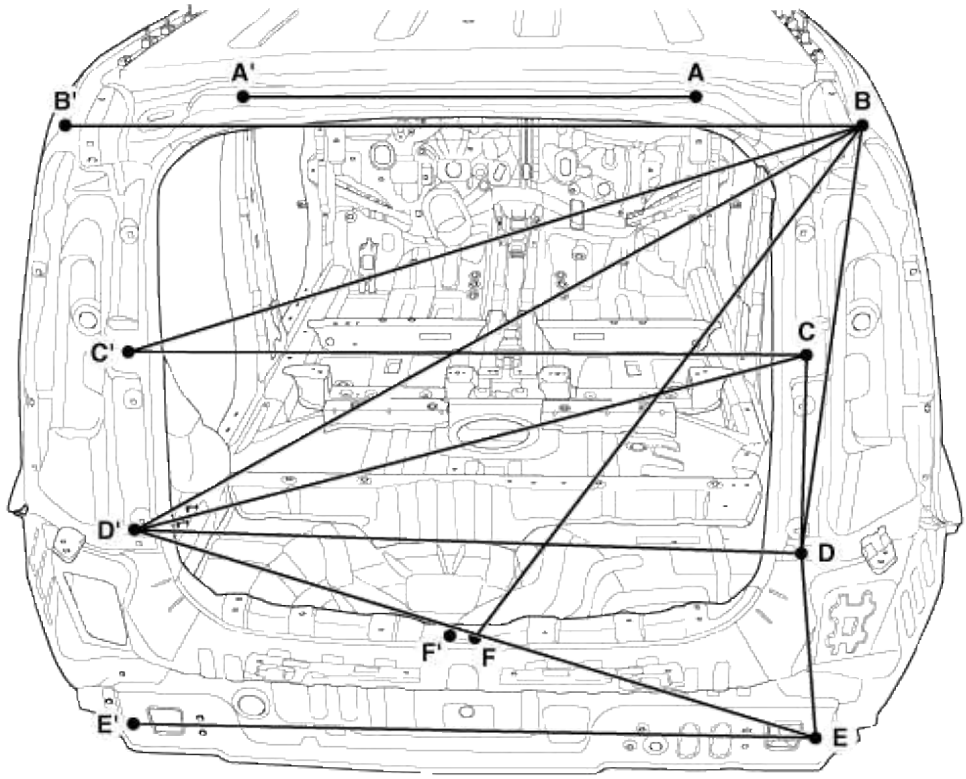


Transverse rear trim mounting hole (ø8.5)



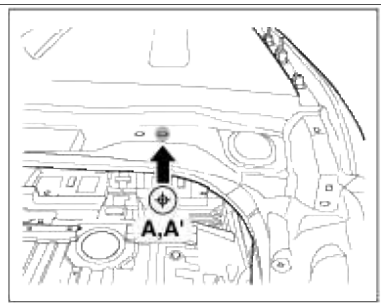
Fuel pump wire harness mounting hole (ø6)

Body (Interior and Exterior) > Body Dimensions > Rear Body > Body Repair

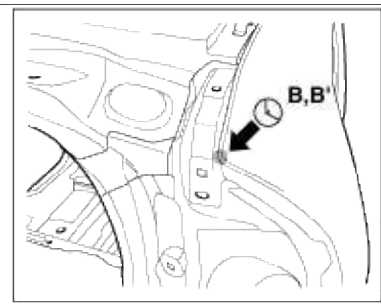


* These dimensions indicated in this figure are projected dimensions.

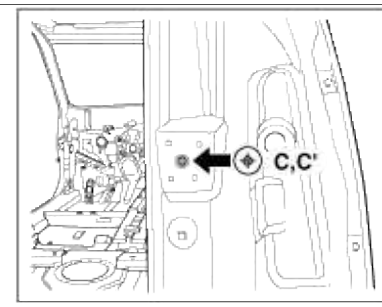
Point symbol	A-A'	B-B'	B-C' / B'-C	B-D / B'-D'	B-D' / B'-D	B-F / B'-F'	C-C'	C-D / C'-D'
Length(mm)	670	1151	1147	673	1298	971	1036	326
Point symbol	C-D' / C'-D	D-D'	D-E / D'-E'	D-E' / D'-E	E-E'			
Length(mm)	1102	1070	382	1203	1215			



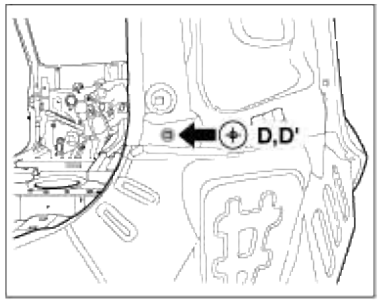
Tail gate hinge mounting hole
(ø12)



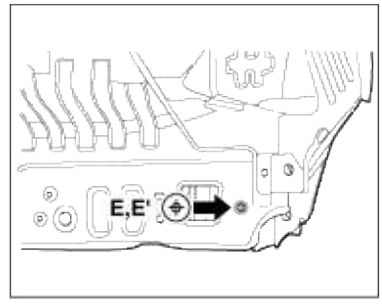
Side outer rear corner



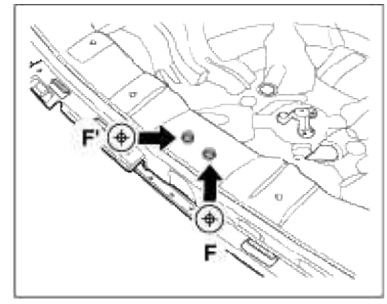
Tail gate lifter mounting hole
(ø12)



Rear bumper mounting hole
(8.5X8.5)



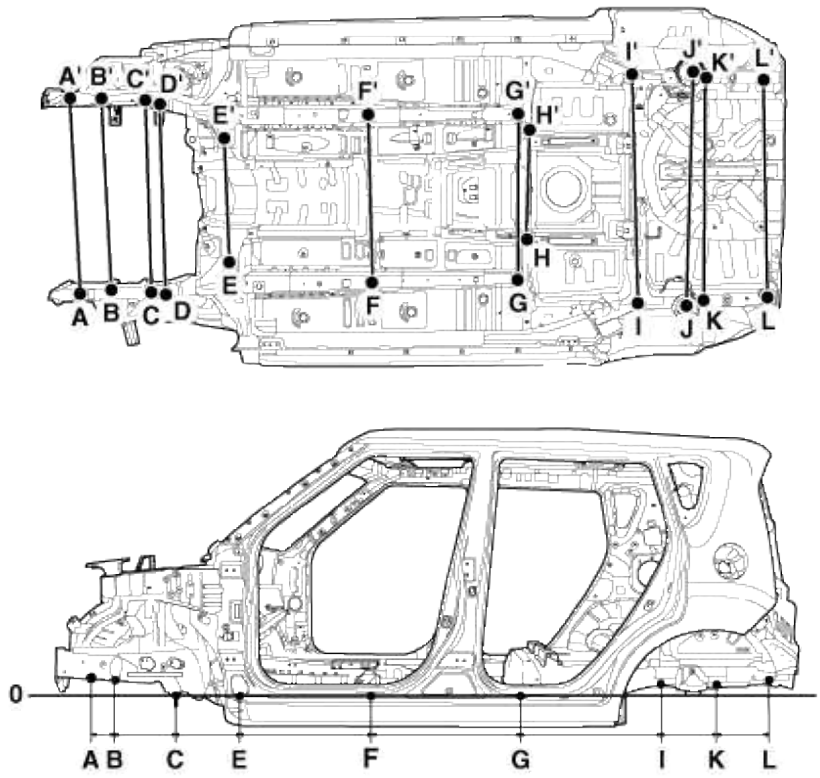
Back panel tooling hole
(ø11)



Tail gate striker mounting hole
(ø15)

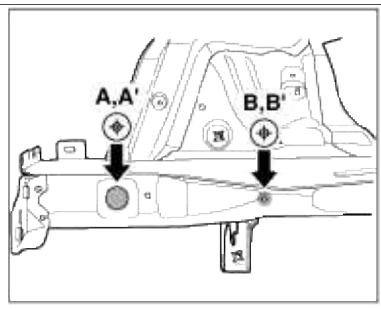
Body (Interior and Exterior) > Body Dimensions > Under Body > Body Repair

Projected Dimensions

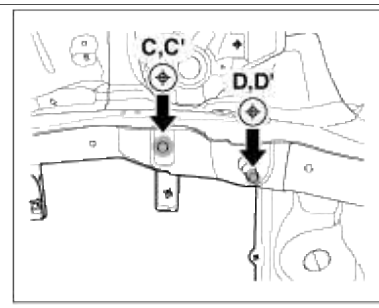


* These dimensions indicated in this figure are projected dimensions.

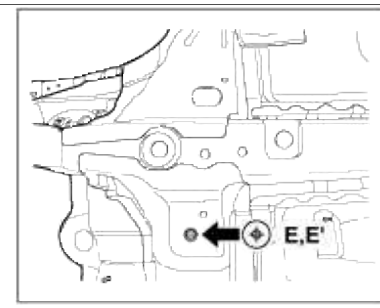
Point symbol	A-A'	B-B'	C-C'	D-D'	E-E'	F-F'	G-G'	H-H'
Length(mm)	965	960	943	900	570	774	760	512
Point symbol	I-I'	J-J'	K-K'	L-L'	0-A / 0-A'	0-B / 0-B'	0-C / 0-C'	0-E
Length(mm)	1097	1140	1088	1075	172 / 170	166 / 161	154 / 146	-22
Point symbol	0-F	0-G	0-I / 0-I'	0-K	0-L	A-B / A'-B'	B-C / B'-C'	C-D / C'-D'
Length(mm)	-10	-20	131 / 125	152	158	166 / 165	207 / 221	111 / 97
Point symbol	D-E / D'-E'	E-F / E'-F'	F-G / F'-G'	G-H / G'-H'	H-I / H'-I'	I-J / I'-J'	J-K / J'-K'	K-L / K'-L'
Length(mm)	329	660	675	45	554 / 539	239 / 254	72 / 74	347 / 302



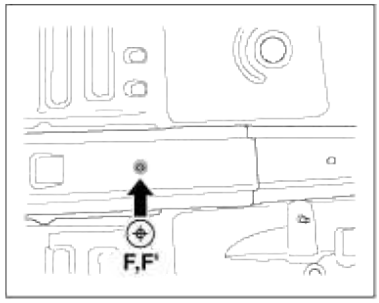
A: Tooling hole (ø25)
B: Tooling hole (ø6)



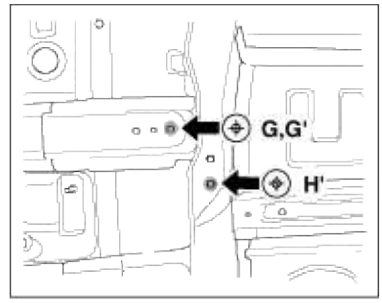
C: Tooling hole (ø12)
D: Front subframe bolt



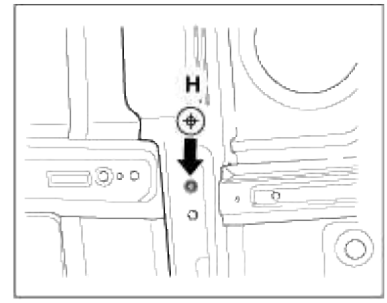
Front subframe mounting hole (ø16)



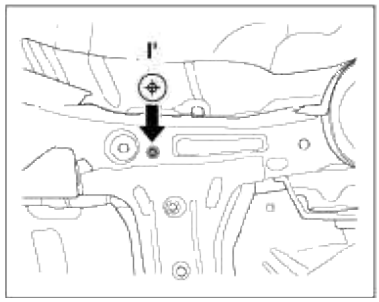
Tooling hole (ø8)



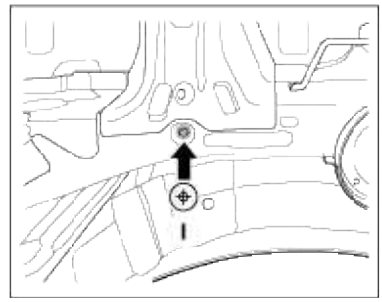
G: Parking brake bracket hole (ø9)
H: Fuel pump mounting hole (ø13)



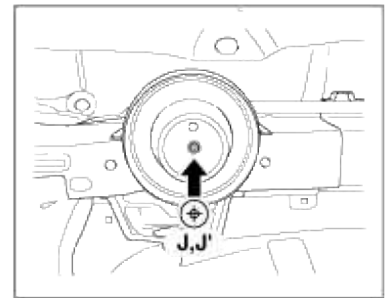
Fuel pump mounting hole (ø13)



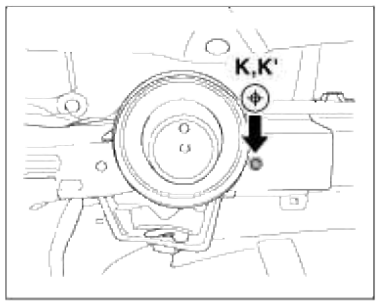
Tooling hole (ø11)



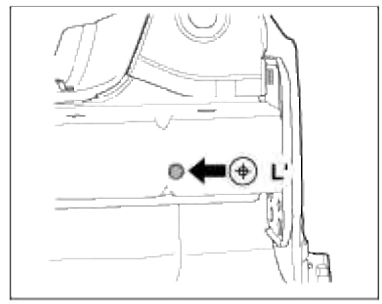
Tooling hole (ø10)



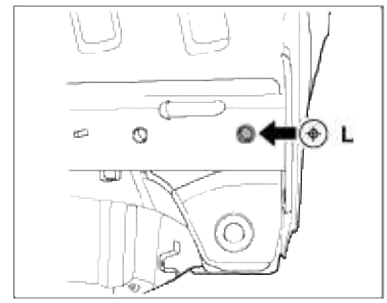
Rear suspension spring mounting hole (ø8.5)



Tooling hole (ø10)

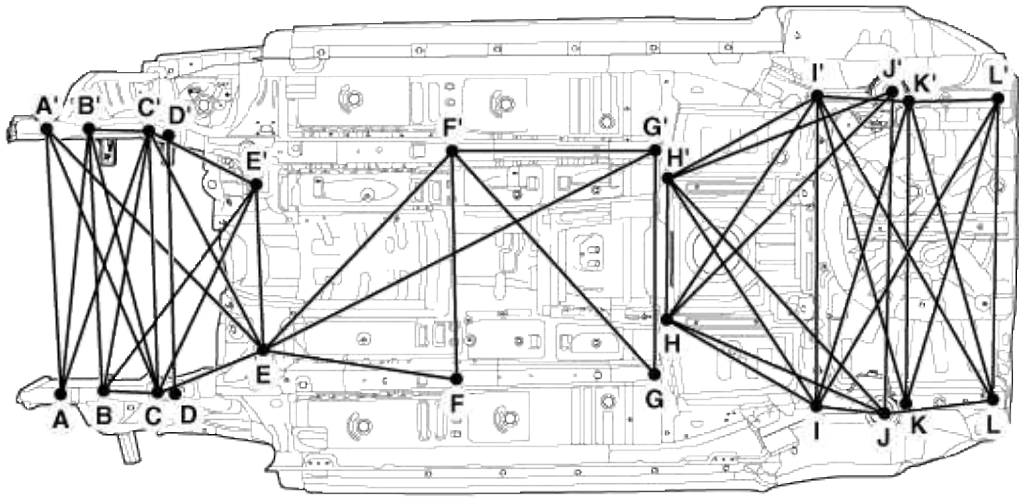


Tooling hole (ø10)



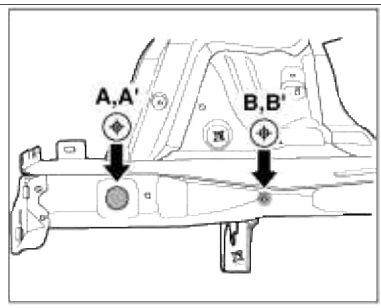
Towing hook mounting hole (ø16)

Actual-Measurement Dimensions

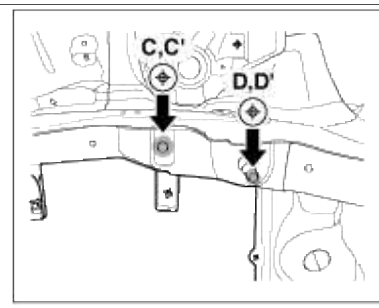


* These dimensions indicated in this figure are projected dimensions.

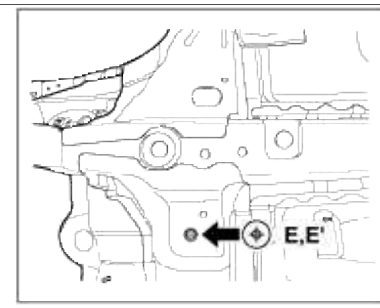
Point symbol	A-A'	B-B'	C-C'	D-D'	E-E'	F-F'	G-G'	H-H'
Length(mm)	965	960	943	900	570	774	760	512
Point symbol	I-I'	J-J'	K-K'	L-L'	A-B / A'-B'	A-B' / A'-B	A-C' / A'-C	A-E' / A'-E
Length(mm)	1097	1140	1088	1076	166	977	1028 / 1026	1134
Point symbol	B-C / B'-C'	B-C' / B'-C	B-E' / B'-E	C-E / C'-E'	C-E' / C'-E	E-F / E'-F'	E-F' / E'-F	E-G' / E'-G
Length(mm)	207 / 222	976 / 975	1019	510 / 494	894 / 883	668	942	1491
Point symbol	F-G / F'-G'	F-G' / F'-G	H-I / H'-I'	H-I' / H'-I	H-J / H'-J'	H-J' / H'-J	I-K / I'-K'	I-K' / I'-K
Length(mm)	675	1022	655 / 596	931 / 1020	874 / 836	1109 / 1183	312 / 329	1134 / 1143
Point symbol	I-L' / I'-L	K-L / K'-L'	K-L' / K'-L					
Length(mm)	1244 / 1282	347 / 302	1121 / 1138					



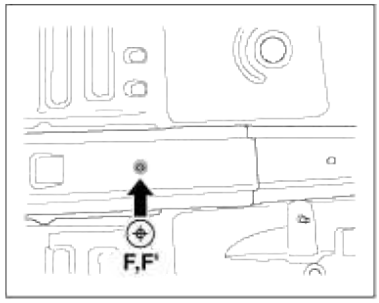
A: Tooling hole (ø25)
B: Tooling hole (ø6)



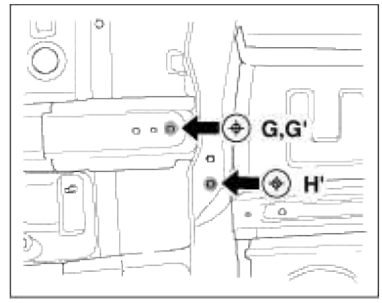
C: Tooling hole (ø12)
D: Front subframe bolt



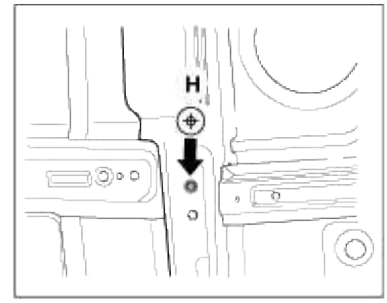
Front subframe mounting hole (ø16)



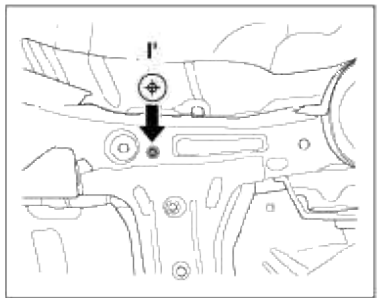
Tooling hole (ø8)



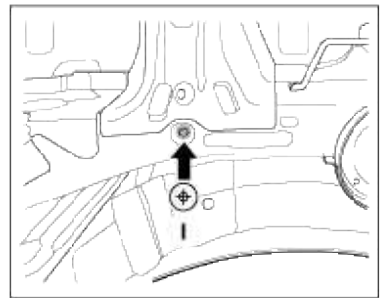
G: Parking brake bracket hole (ø9)
H: Fuel pump mounting hole (ø13)



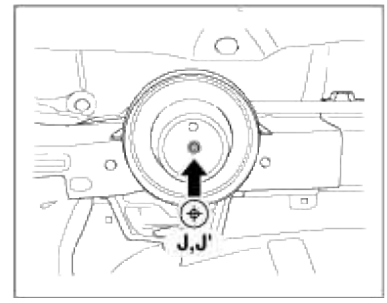
Fuel pump mounting hole (ø13)



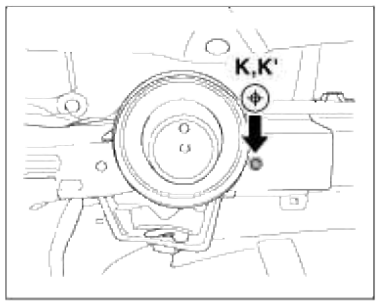
Tooling hole (ø11)



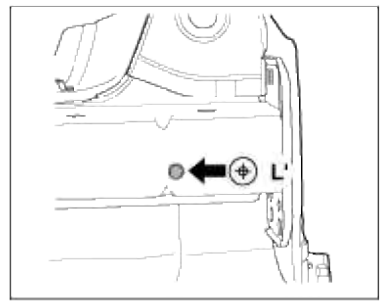
Tooling hole (ø10)



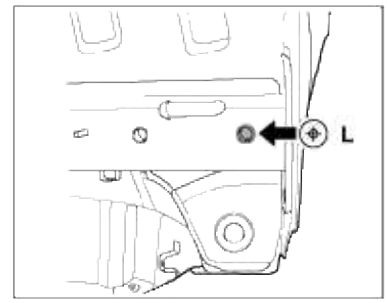
Rear suspension spring mounting hole (ø8.5)



Tooling hole (ø10)



Tooling hole (ø10)



Towing hook mounting hole (ø16)

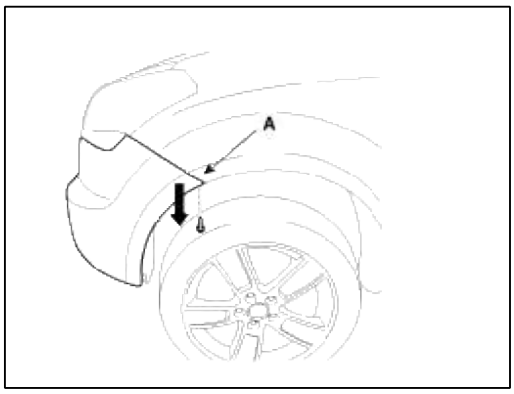
Body (Interior and Exterior) > Exterior > Fender > Repair procedures

Replacement

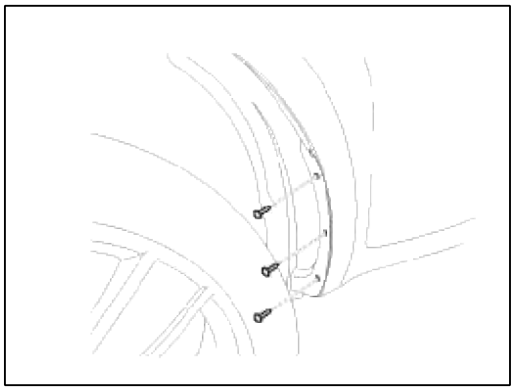
NOTE

- Be careful not to damage the hood and body.
- When removing the clips, use a clip remover.

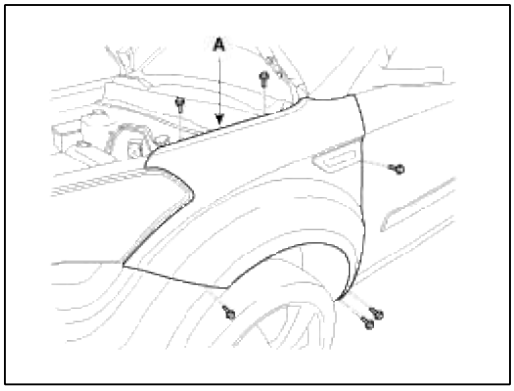
1. Remove the front bumper mounting screw (A).



2. Loose the mud guard mounting screws.



3. After loosening the fender mounting bolts, remove the fender (A).



4. Installation is the reverse of removal.

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

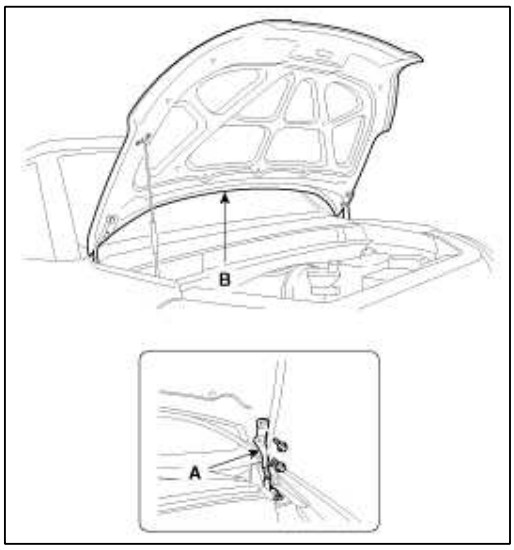
Replacement

Hood Assembly Replacement

NOTE

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

1. After loosening the hood hinge (A) mounting bolts, remove the hood (B).



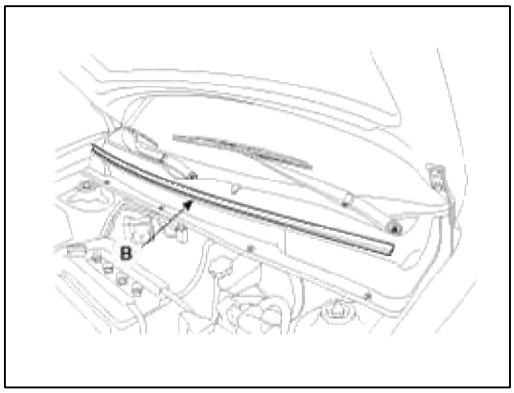
2. Installation is the reverse of removal.

NOTE

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

Hood Weatherstrip Replacement

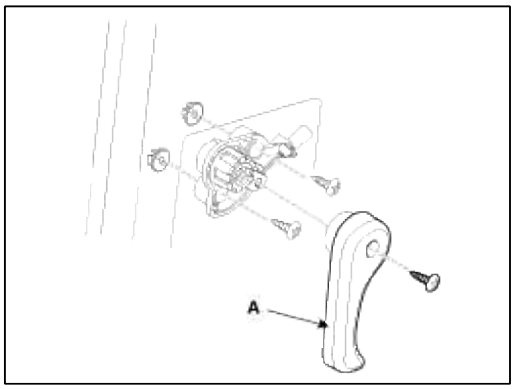
1. Remove the hood weatherstrip (B).



2. Installation is the reverse of removal.

Hood Release Handle Replacement

1. After loosening the mounting screw, then remove the hood release handle (A).



2. Installation is the reverse of removal.

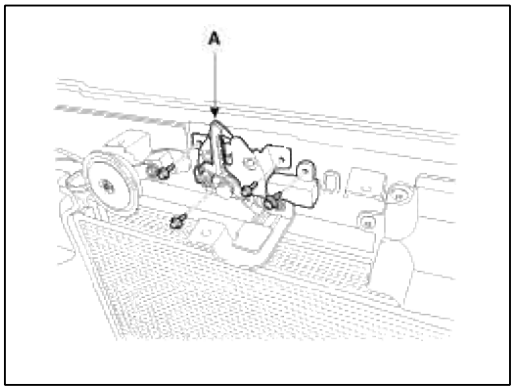
NOTE

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

Hood Latch Replacement

1. Remove the hood latch (A) mounting bolts.
2. Disconnect the hood latch cable and remove the latch.

Tightening torque :
6.9~10.8N.m (0.7~1.1kgf.m, 5.1~8.0 lb-ft)



3. Installation is the reverse of removal.

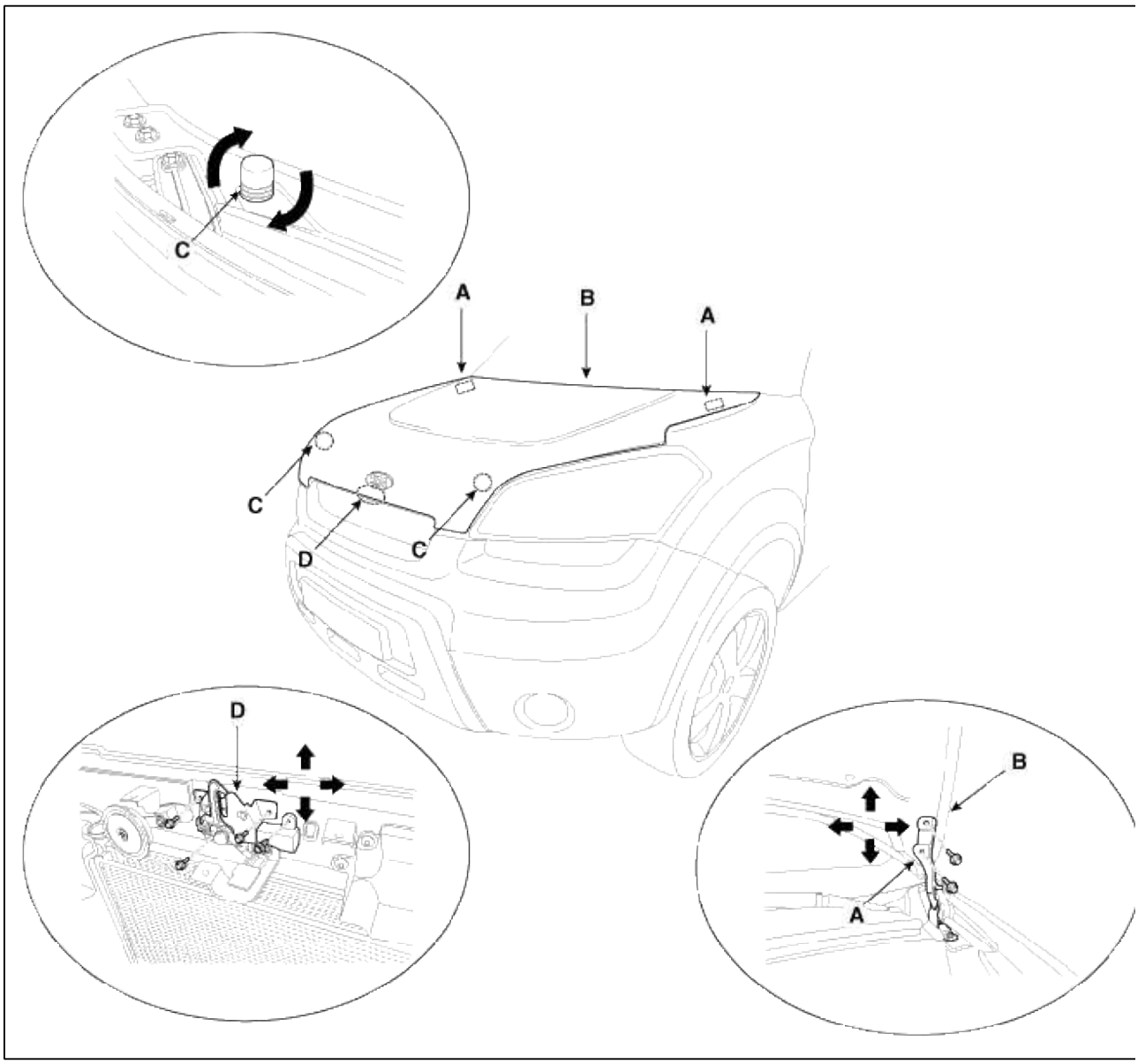
NOTE

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

Adjustment

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

3. After loosening the hood latch (D) mounting bolts, adjust the latch by moving it up or down, or right or left.



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

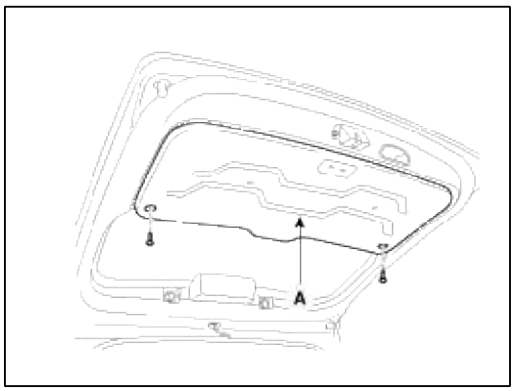
Replacement

Tailgate Trim Replacement

NOTE

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

1. After loosening the mounting screws,remove the tailgate trim (A).



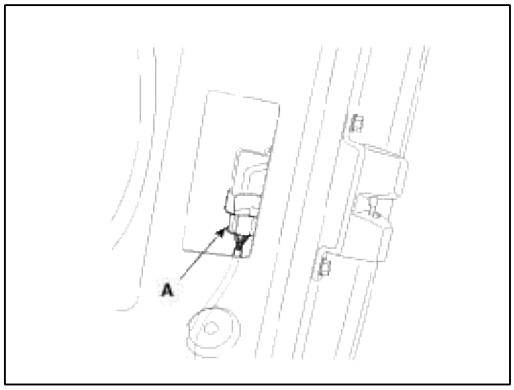
2. Installation is the reverse of removal.

NOTE

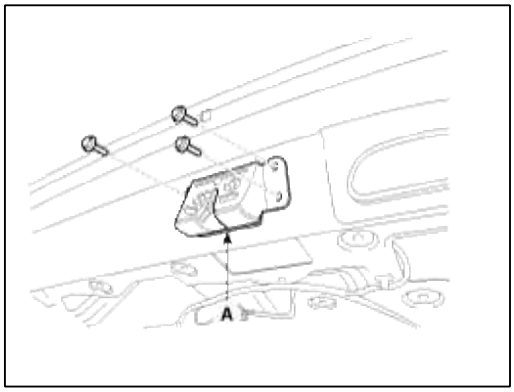
- Replace and damaged clips.

Latch Assembly Replacement

1. Remove the tailgate trim.
2. Disconnect the latch connector (A).



3. After loosening the mounting screws, then remove the latch assembly (A).



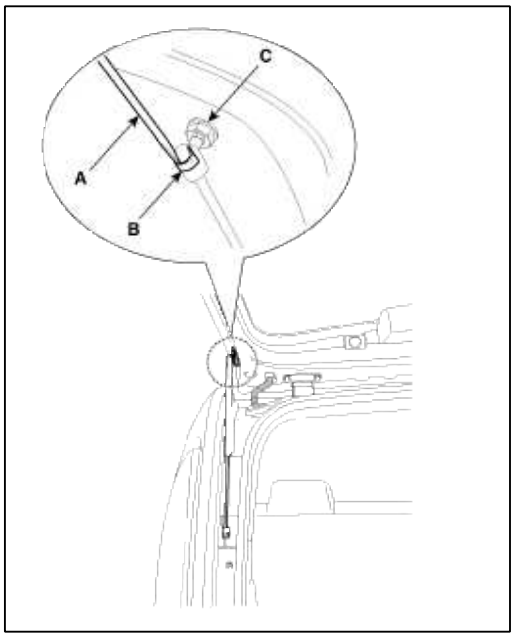
4. Installation is the reverse of removal.

NOTE

- Make sure the connector is connected properly and the connecting rod is connected properly.
- Make sure the tailgate opens properly and locks securely.

Tailgate Lifter Replacement

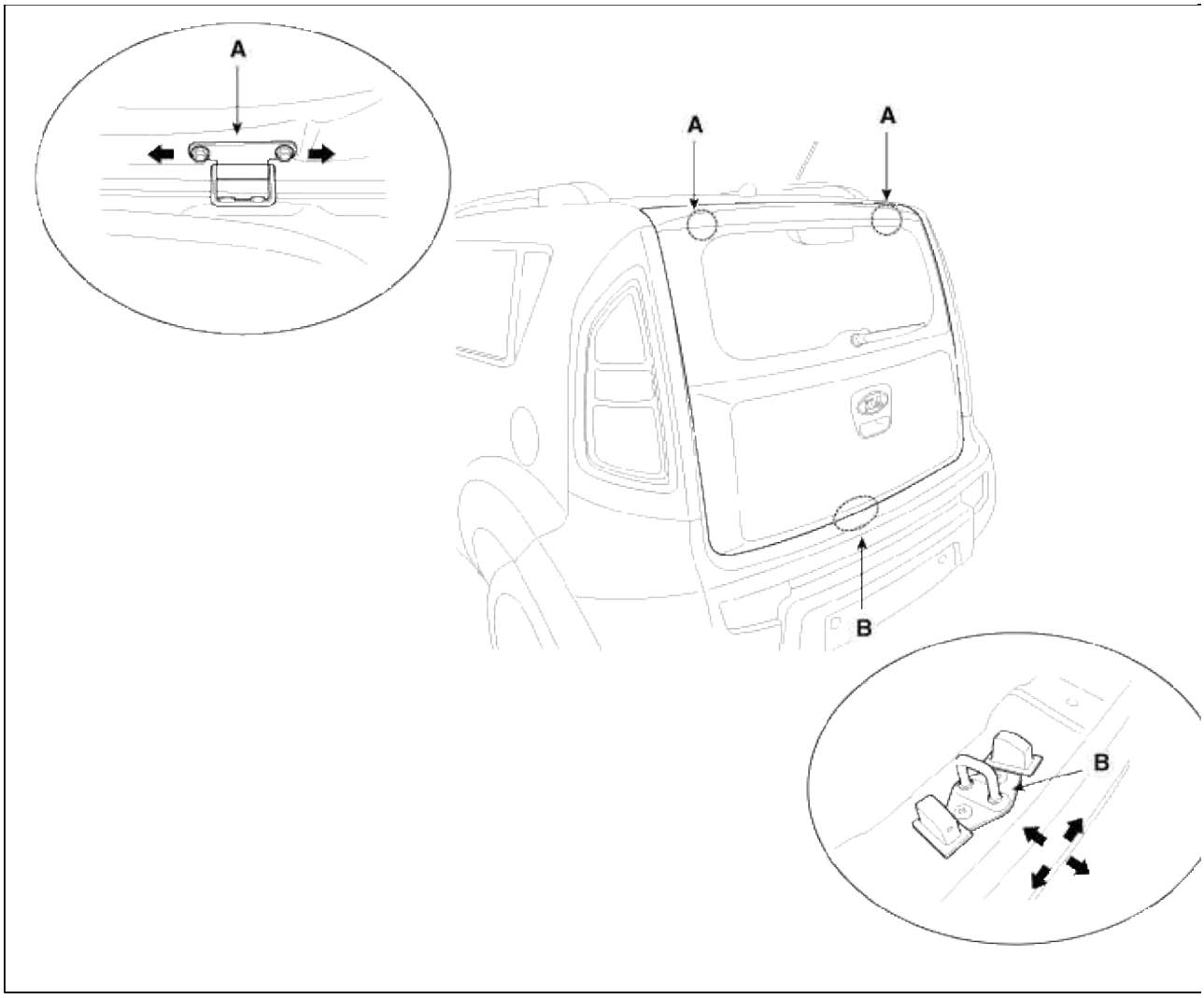
1. Using a screwdriver (A), lift up slightly both ends of the socket clips (B), and then remove the lifter from the bracket (C).



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

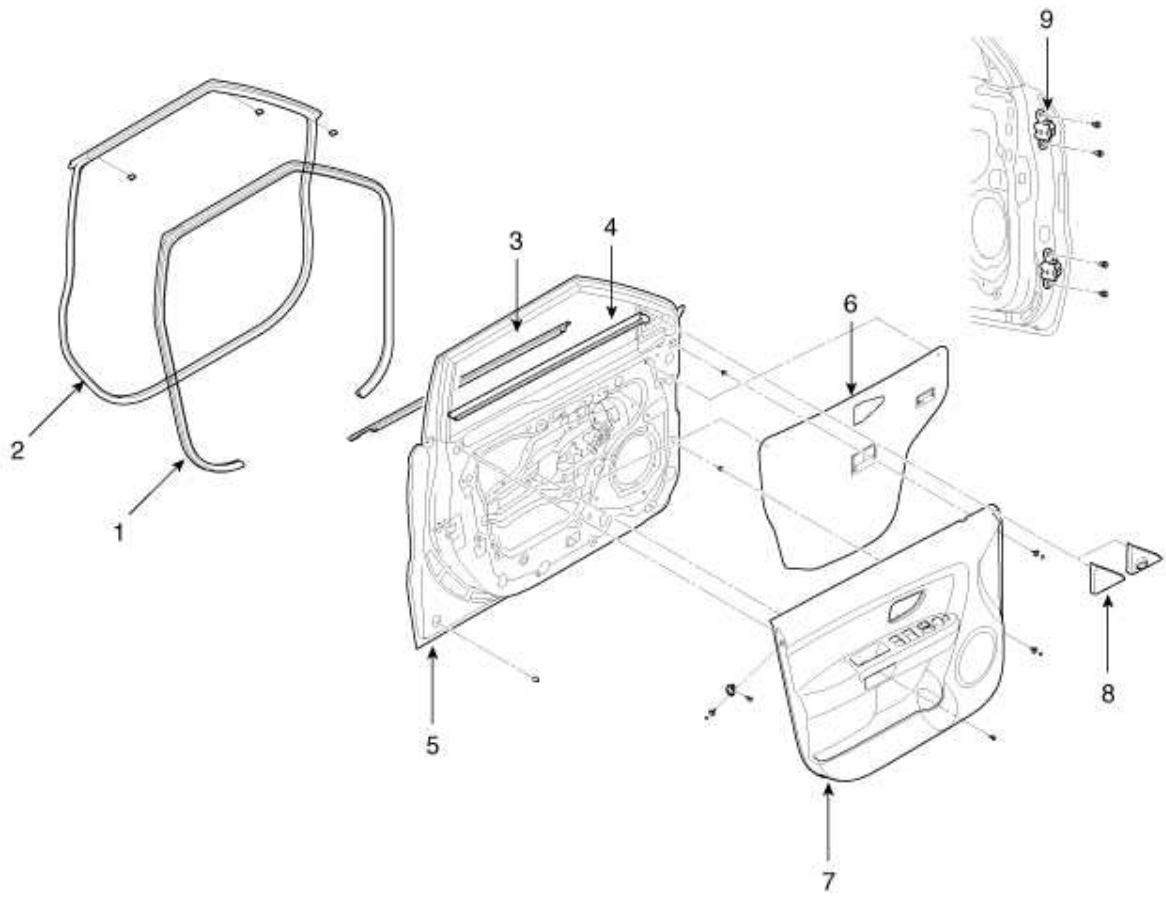
Adjustment

1. After loosening the tailgate hinge (A) mounting bolt, adjust the tailgate by moving it up or down, or right or left, then tighten the bolts.
2. Adjust the tailgate fit by turning the tailgate Over Slam Bumper and Side Bumper.
3. Adjust the striker (B) by moving it up or down, or right or left.

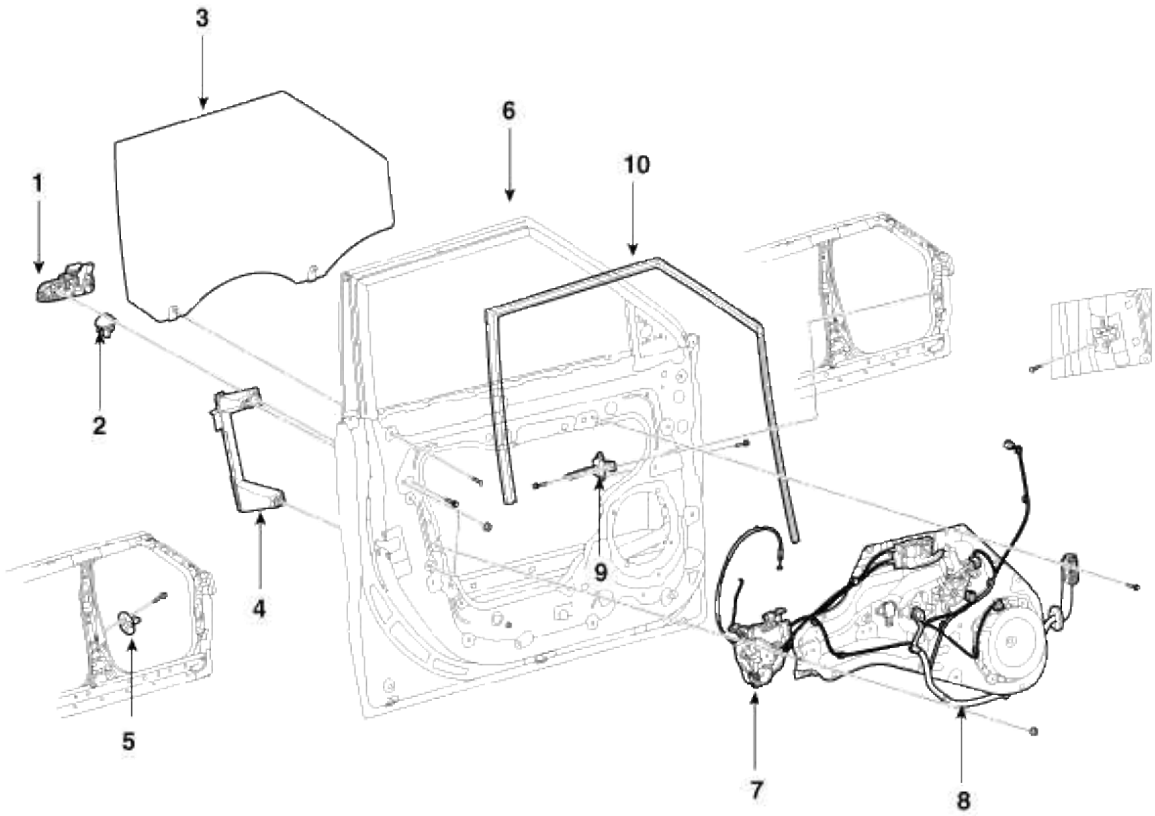


Body (Interior and Exterior) > Exterior > Front Door > Components and Components Location

Components



1. Body weatherstrip	4. Door glass weatherstrip	7. Door trim
2. Door weatherstrip	5. Door panel	8. Quadrant inner cover
3. Door belt weatherstrip	6. Door screen	9. Door hinge



1. Door outside handle	5. Door striker	8. Door module
2. Key lock cylinder	6. Door panel	9. Door checker
3. Window glass	7. Door latch	10. Glass run
4. Rear channel		

Body (Interior and Exterior) > Exterior > Front Door > Repair procedures

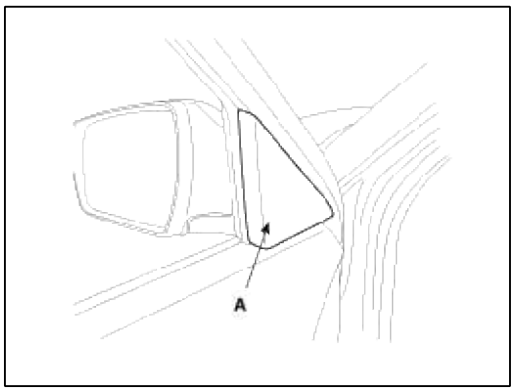
Replacements

Door Trim Replacement

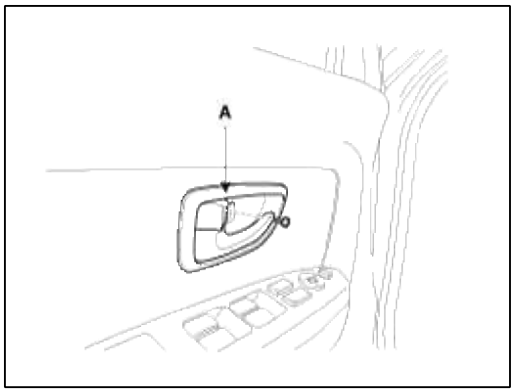
NOTE

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

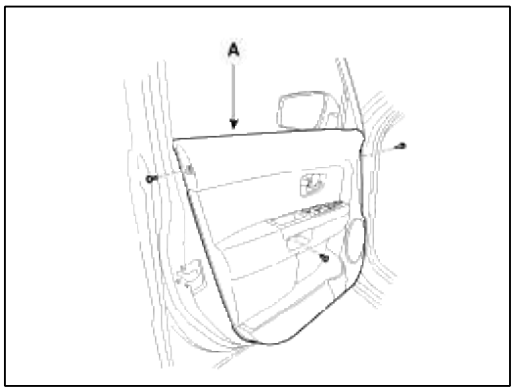
1. Remove the quadrant inner cover (A).



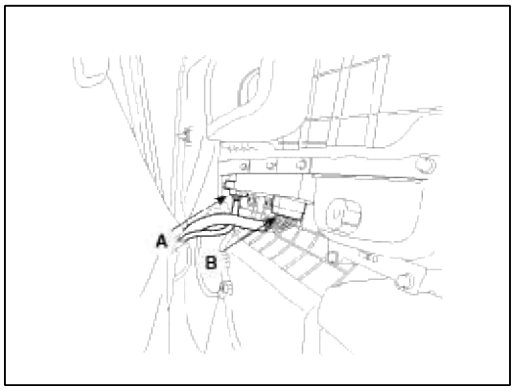
2. Remove the inside handle cover (A).



3. Loosen the door trim (A) mounting screws.
4. Release the clips that hold the door trim.



5. Disconnect the connectors (A) and (B).



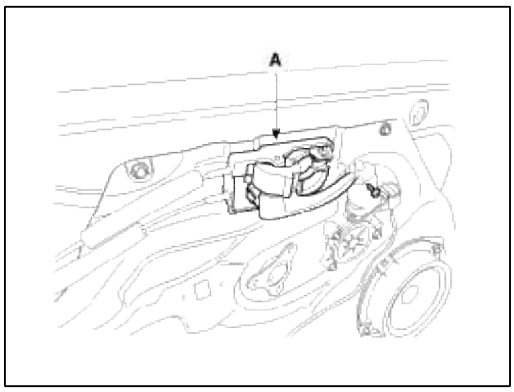
6. Installation is the reverse of removal.

NOTE

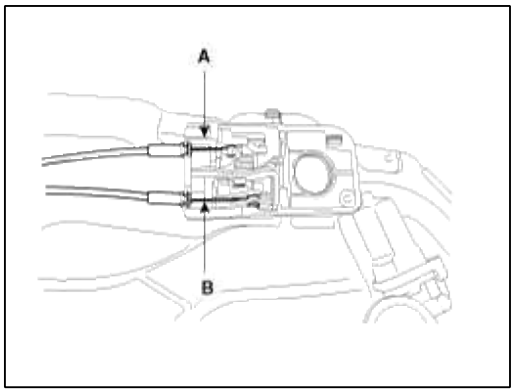
- Make sure of connectors is plugged in properly and each rod is connected securely.
- Make sure the door lock and opens properly.

Inside Handle Replacement

1. Remove the door trim
2. Loosen the mounting screw, then remove the inside handle (A).



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



4. Installation is the reverse of removal.

NOTE

- Make sure the door locks and opens properly.

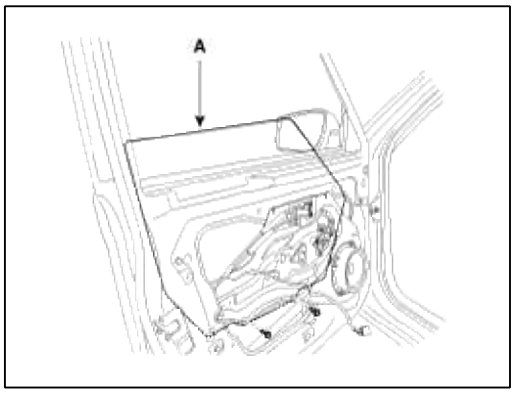
Glass Replacement

1. Remove the front door trim.
2. Remove the door screen.

NOTE

- Using the door switch to align the mounting hole with the hole on the door glass.
- If it is impossible, align the hole by hand after removing the motor.
- Be careful not to drop to glass and scratch the glass surface.

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



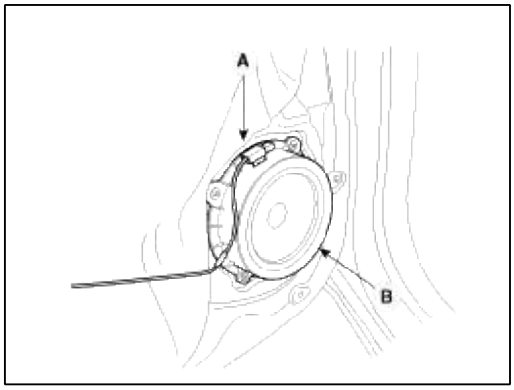
4. Installation is the reverse of removal.

NOTE

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

Speaker Replacement

1. Remove the door trim.
2. Drill out the rivets to remove the speaker (B) from the door module.
3. Disconnect the speaker connector (A).



4. Installation is the reverse of removal.

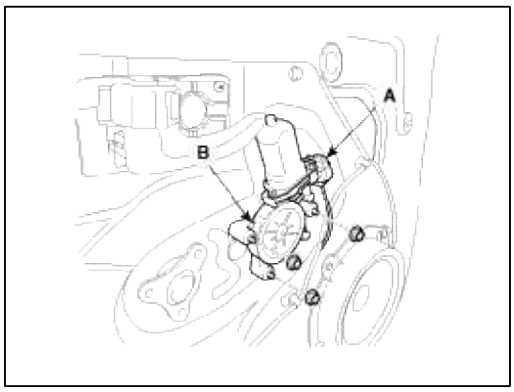
NOTE

- Use sheet metal screws to secure the speaker.

Power Window Motor Replacement

1. Remove the door trim.

2. After disconnecting the connector (A), remove the power window motor (B).



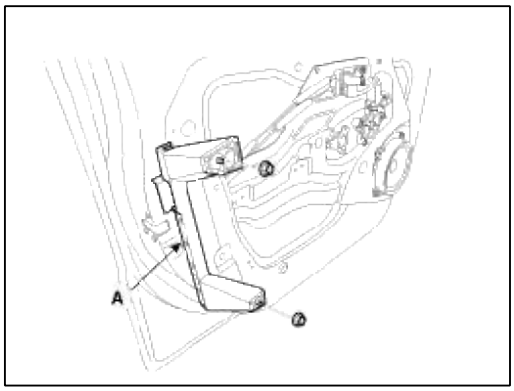
3. Installation is the reverse of removal.

NOTE

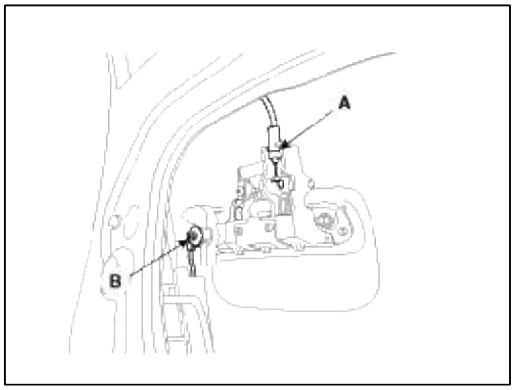
- Grease should be applied to areas where there is rotational parts and springs.
- Roll the glass up and down to see if it move freely without binding.

Door Module Assembly Replacement

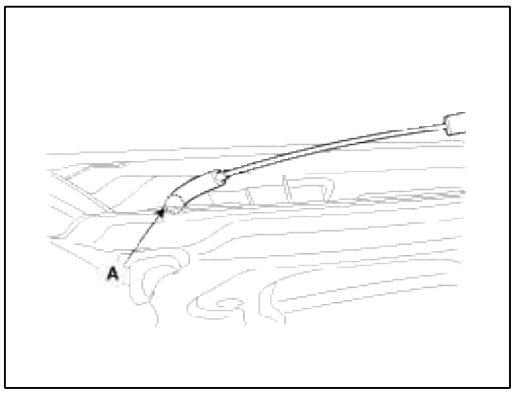
1. Remove the following parts.
   A. Door trim
   B. Window glass
2. Loosen the rear channel mounting nuts.
3. After disconnecting the glass molding, remove the rear channel (A).



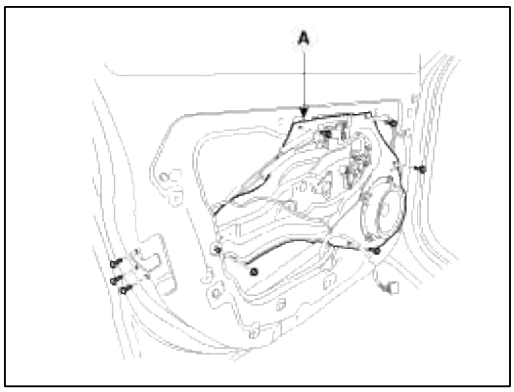
4. Disconnect the outside cable (A) and lock rod (B).



5. Disconnect the clip (A).



6. Loosen the door module mounting bolts, remove the door module (A).
7. Disconnect the connector .
8. Disconnect the door module wiring harness, remove the module assembly.



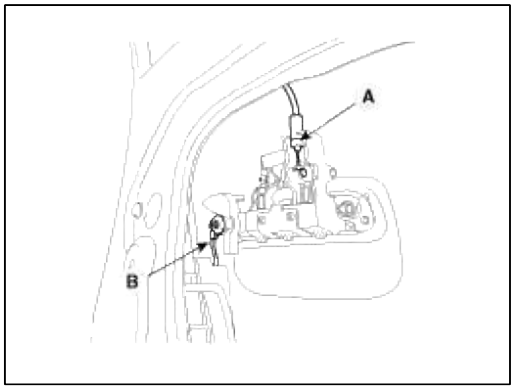
9. Installation is the reverse of removal.

NOTE

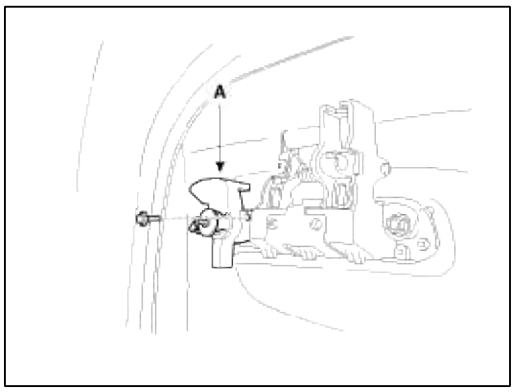
- The area of whole parts should be applied with sufficient grease.
- Make sure the connector are connected properly and each rod is connected securely.
- Make sure door lock operates and door open/close properly.

Out Side Handle Replacement

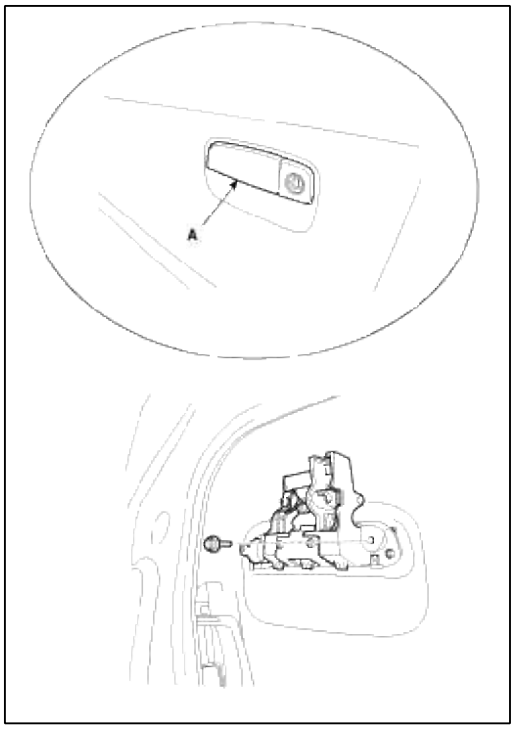
1. Remove the door trim.
2. Remove the door screen.
3. Disconnect the outside handle cable (A) and lock rod (B).



4. After loosening the mounting bolt, remove the key cylinder (A).



5. After loosening the mounting bolt, remove the outside handle (A).



6. Installation is the reverse of removal.

NOTE

- Make sure the door lock and open properly.

Adjustment

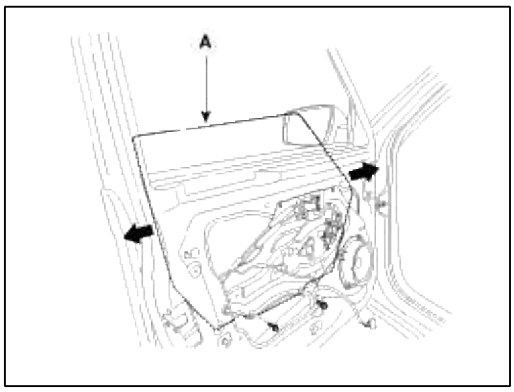
Glass Adjustment

NOTE

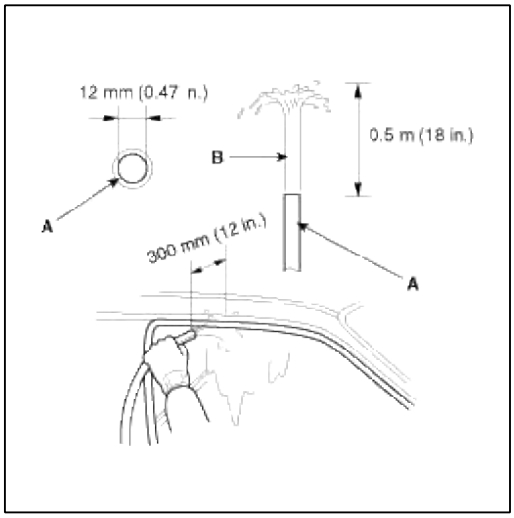
- Check the glass run channel for damage or deterioration, and replace them as needed.

1. Remove the following parts:
   A. Quadrant inner cover.
   B. Door trim.

2. Carefully move the glass (A) until the glass mounting bolts are visible(B), then loosen them.



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



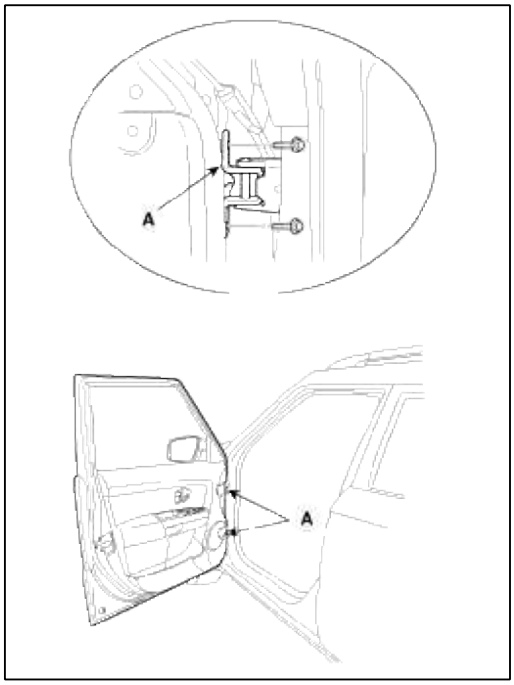
Door Position Adjustment

NOTE

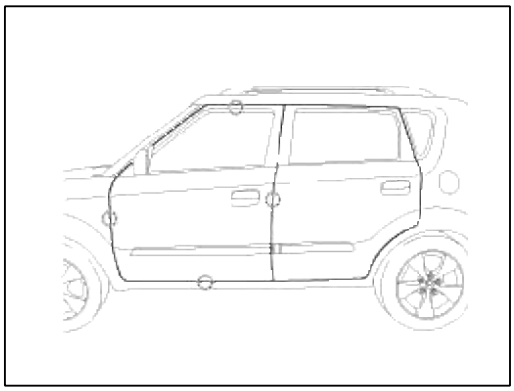
- After installing the door, check for a flush fit with the body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. Before adjusting, replace the mounting bolts.

1. Place the vehicle on a firm, level surface when adjusting the doors.

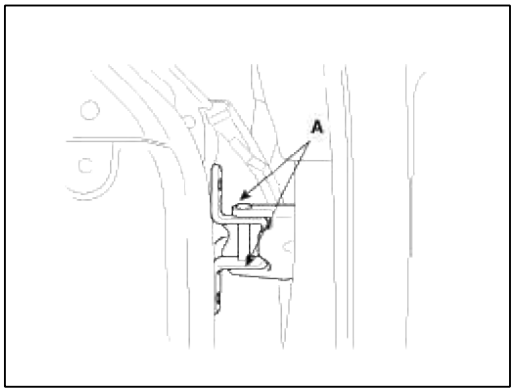
2. Adjust at the hinges (A):
   A. Loosen the door mounting bolts slightly, and move the door IN or OUT until it aligns flush with the body.
   B. Loosen the hinge mounting bolts slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.
   C. Place a shop towel on the jack to prevent damage to the door when adjusting the door.



3. Check that the door and body edges are parallel.



4. Grease the pivot portions of the hinges indicated by the arrows (A).

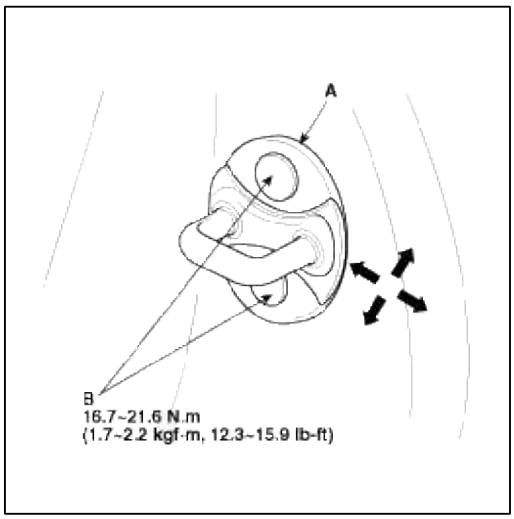


5. Check for water leaks.

Door Striker Adjustment

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

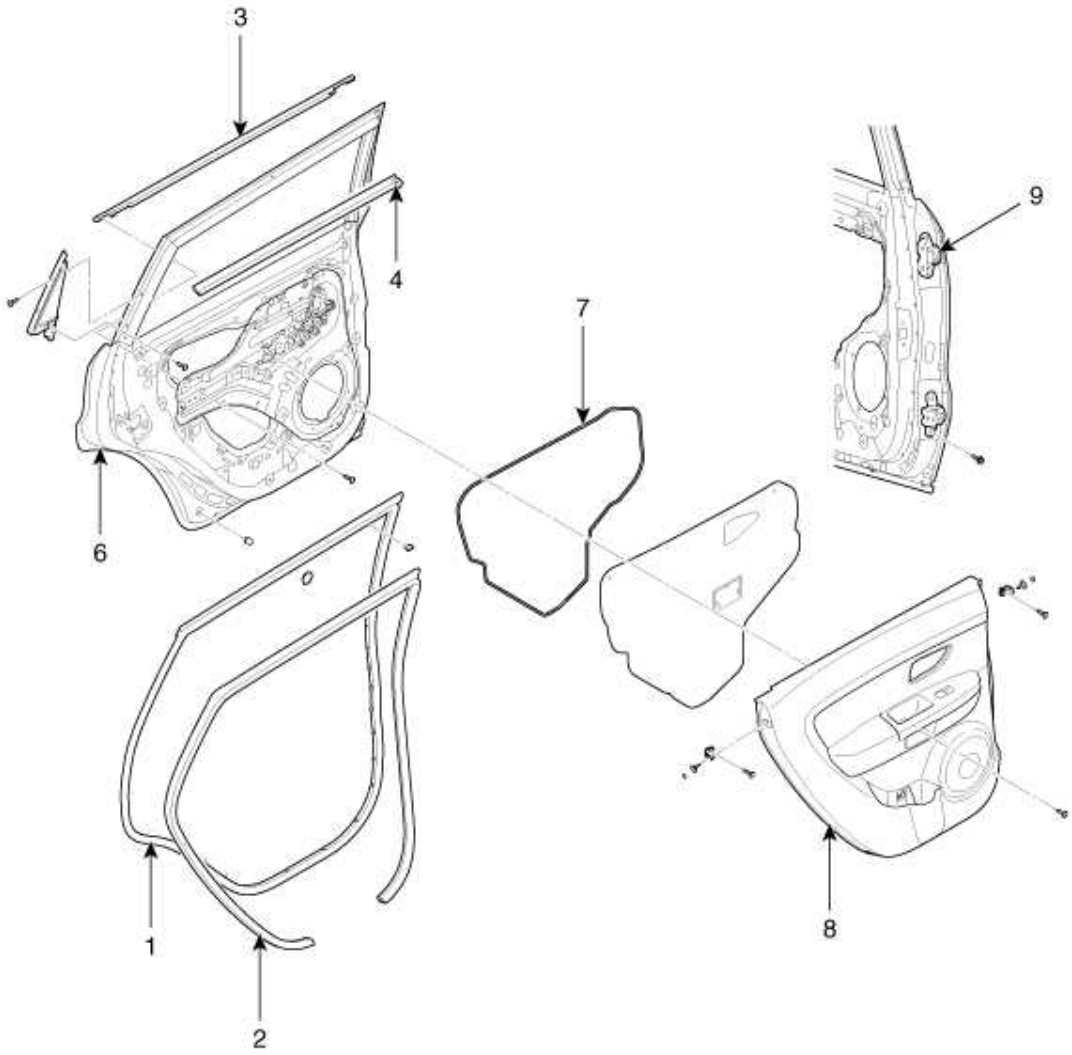
1. Loosen the screws (B), then insert a shop towel between the body and striker.



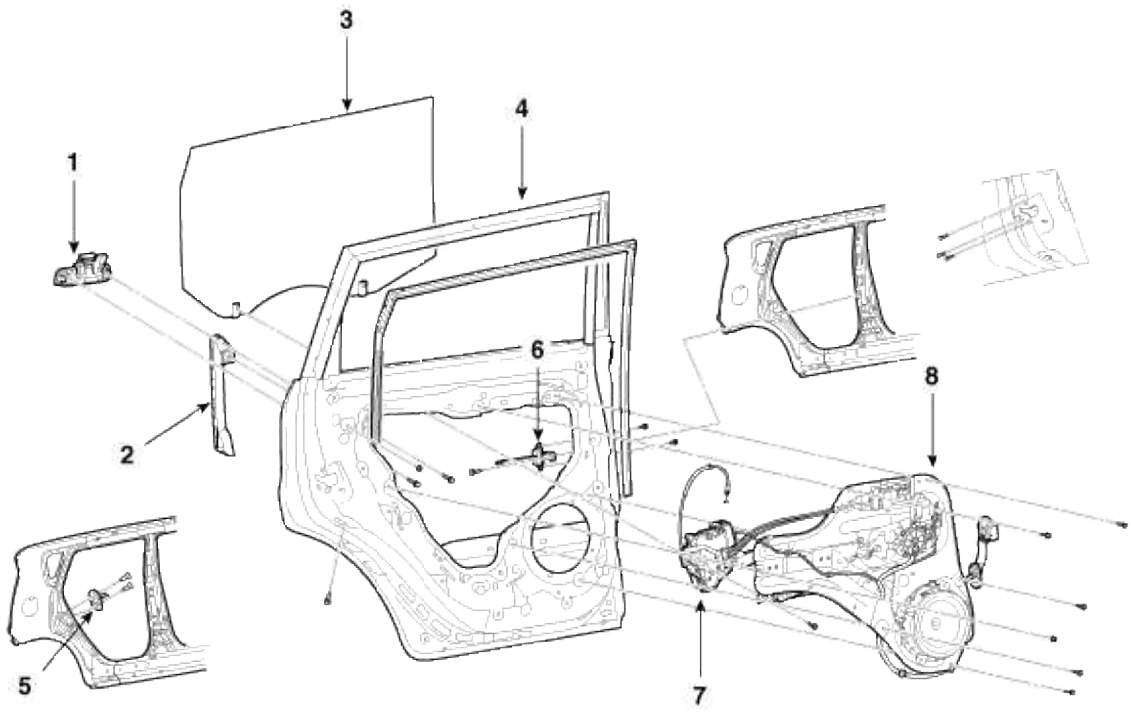
2. Lightly tighten the screws.
3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer. Do not tap the striker too hard.
4. Loosen the screws and remove the shop towel.
5. Lightly tighten the screws.
6. Hold the outer handle out, and push the door against the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

Body (Interior and Exterior) > Exterior > Rear Door > Components and Components Location

Components



1. Door weatherstrip	4. Door glass weatherstrip	7. Door screen
2. Body weatherstrip	5. Delta cover	8. Door trim
3. Door belt weatherstrip	6. Door panel	9. Door hinge



1. Door outside handle	4. Door panel	7. Door latch
2. Rear channel	5. Door striker	8. Door module
3. Window glass	6. Door checker	

Body (Interior and Exterior) > Exterior > Rear Door > Repair procedures

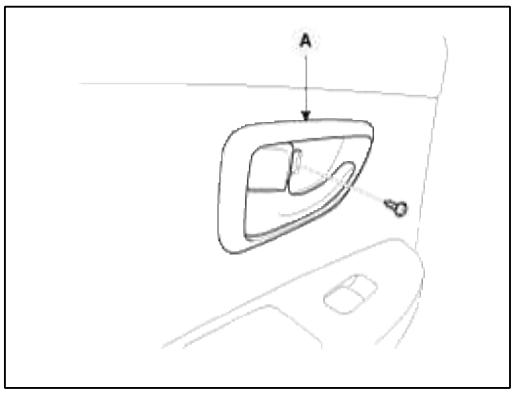
Replacement

Door Trim Replacement

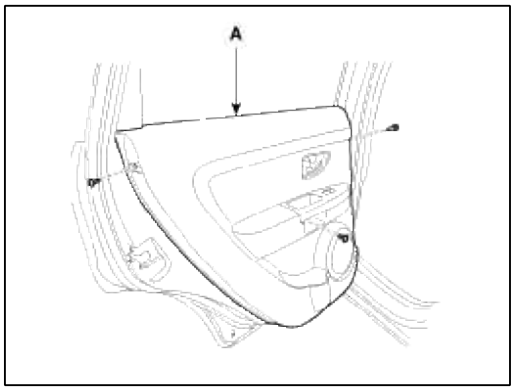
NOTE

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

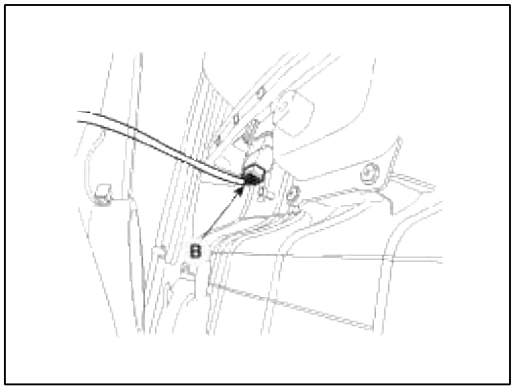
1. Remove the inside handle cover (A).



2. Loosen the door trim (A) mounting screws. Release the clips that hold the door trim.



3. Disconnect the connector (B).



4. Installation is the reverse of removal.

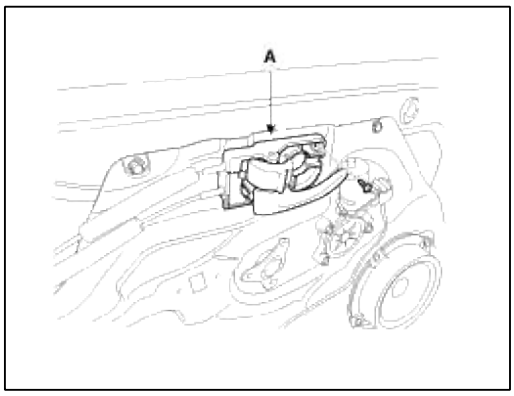
NOTE

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

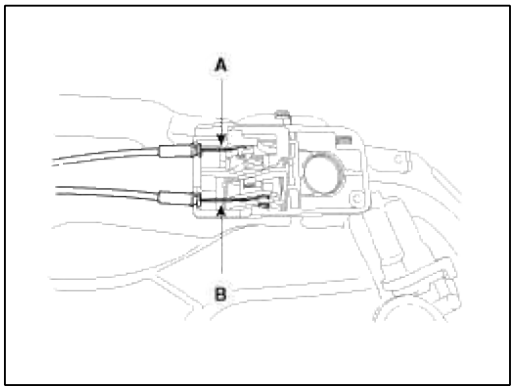
Inside Handle Replacement

1. Remove the door trim.

2. After loosening the mounting screw, remove the inside handle (A).



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



4. Installation is the reverse of removal.

NOTE

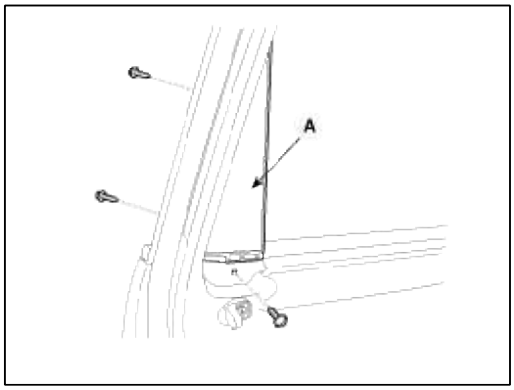
- Make sure the door locks and opens properly.

Glass Replacement

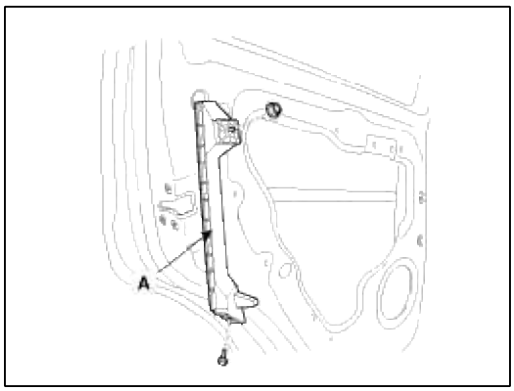
NOTE

- Put on gloves to protect your hands.

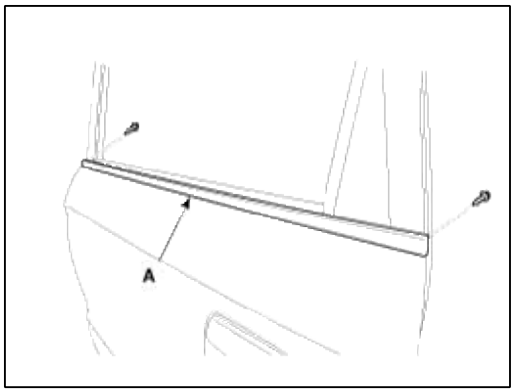
1. Remove the door trim.
2. Remove the door screen.
3. Remove the delta cover (A).



4. Remove the rear channel (A).



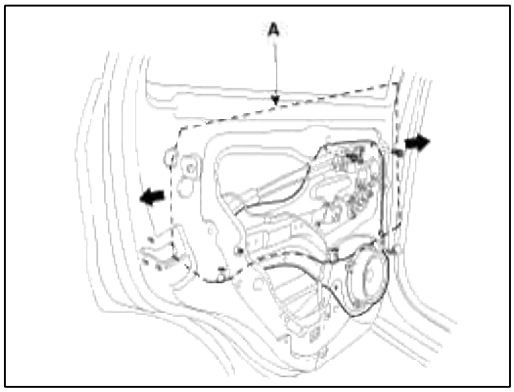
5. Remove the door belt weatherstrip (A).



CAUTION

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

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



7. Installation is the reverse of removal.

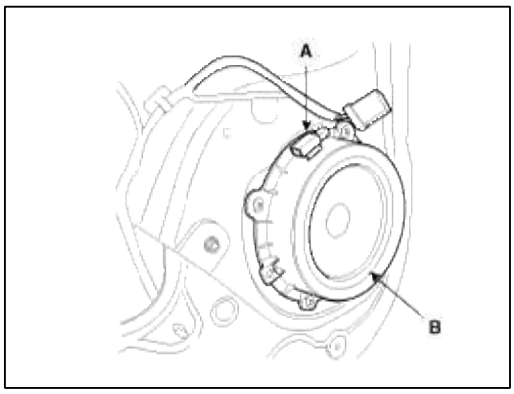
NOTE

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

Speaker Replacement

1. Remove the door trim.
2. Drill out the rivets to remove the speaker (B) from the door module.

3. Disconnect the speaker connector (A).



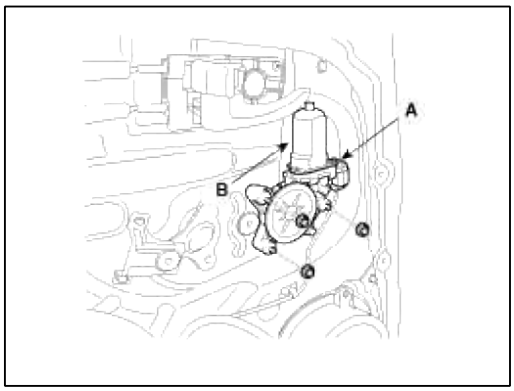
4. Installation is the reverse of removal.

NOTE

- Use sheet metal screws to secure the speaker.

Power Window Motor Replacement

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



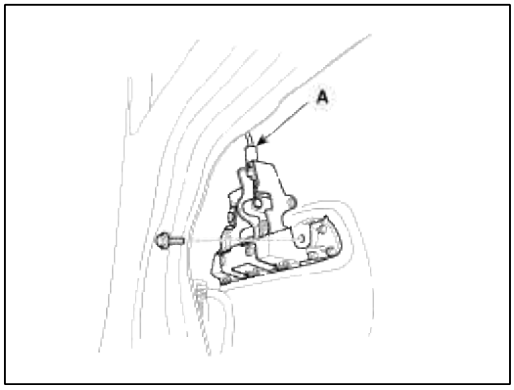
3. Installation is the reverse of removal.

NOTE

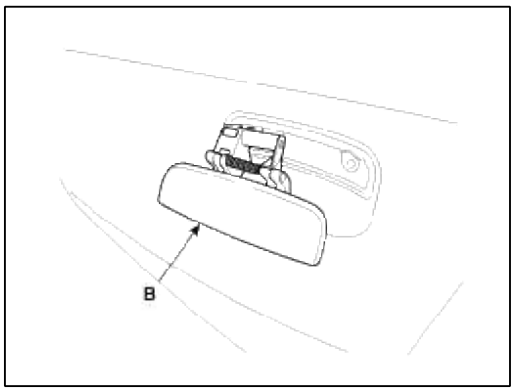
- The area of rotational parts and springs should be applied with sufficient grease.
- Roll the glass up down to see if it move freely without binding.

Out Side Handle Replacement

1. Disconnect the outside cable (A).
2. Loosen the mounting bolt.



3. Remove the outside handle (B).



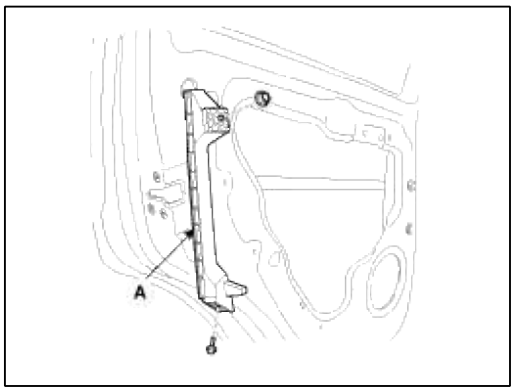
4. Installation is the reverse of removal.

NOTE

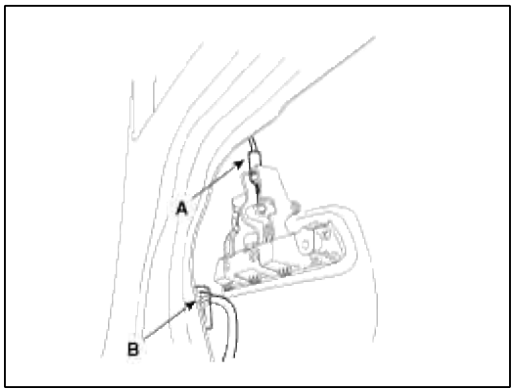
- Make sure door lock operates and door open/closes properly.

Module Assembly Replacement

1. Remove the following parts.
   A. Door trim.
   B. Door screen.
   C. Window Glass.
2. Remove the rear channel (A).

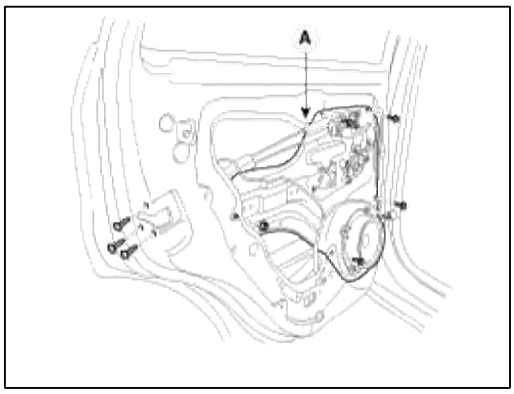


3. Disconnect the connector (B) and outside handle cable (A).



4. After loosening the door module mounting bolts, remove the door module (A).

5. Detach the clips, then remove the wiring harness.



6. Installation is the reverse of removal.

NOTE

- The area of whole parts should be applied with sufficient grease.
- Make sure the connector is plugged in properly and each rod is connected securely.
- Make sure the door lock and open properly.

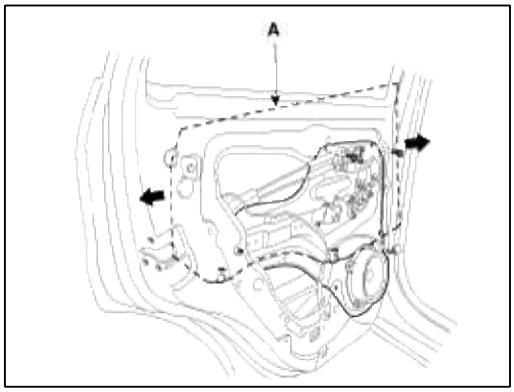
Adjustment

Glass Adjustment

NOTE

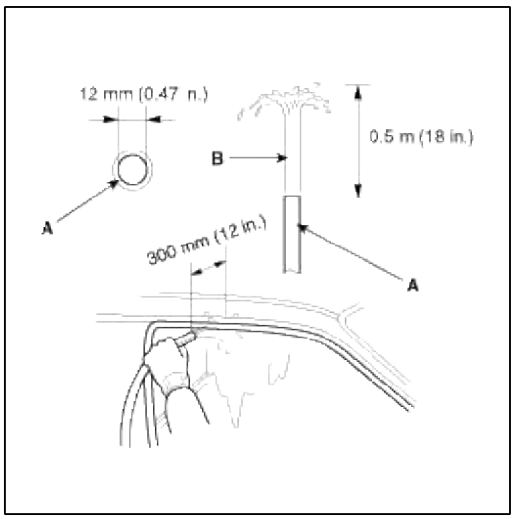
- Check the glass run channel for damage or deterioration, and replace them necessary.

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



3. Check that the glass moves smoothly.
4. Raise the glass fully, and check for gaps. Check that the glass contacts the glass run channel evenly.

5. Check for water leaks. Run water over the roof and on the sealing area as shown, and note these items:
   A. Use a 12mm (1/2Iin.) diameter hose (A).
   B. Adjust the rate of water flow as shown (B).
   C. Do not use a nozzle.
   D. Hold the hose about 300mm(12in.) away from the door (C).

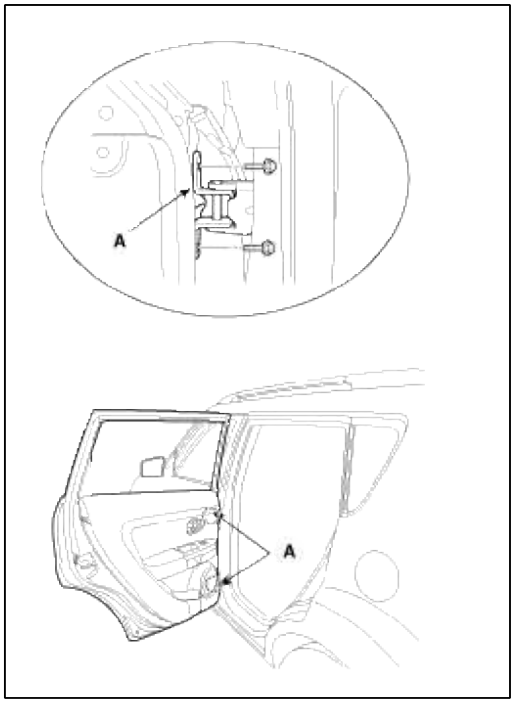


Door Position Adjustment

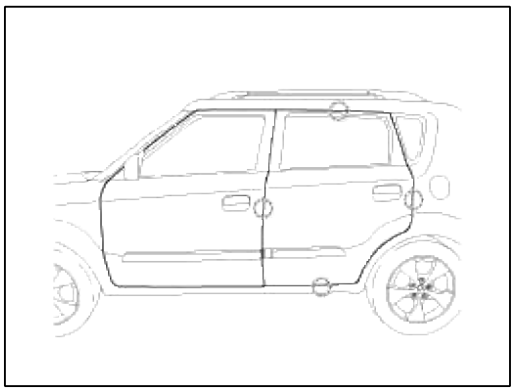
NOTE

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

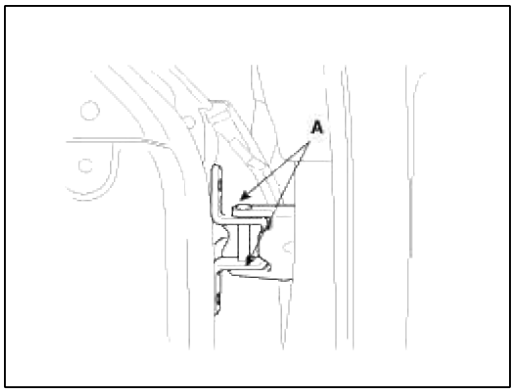
1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust at the hinges (A):
   A. Loosen the door mounting bolts slightly, and move the door IN or OUT until it aligns flush with the body.
   B. Loosen the hinge mounting bolts slightly, and move the door BACKWARD or FORWARD, UP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



3. Check that the door and body edges are parallel.



4. Grease the pivot portions of the hinges indicated by the arrows (A).

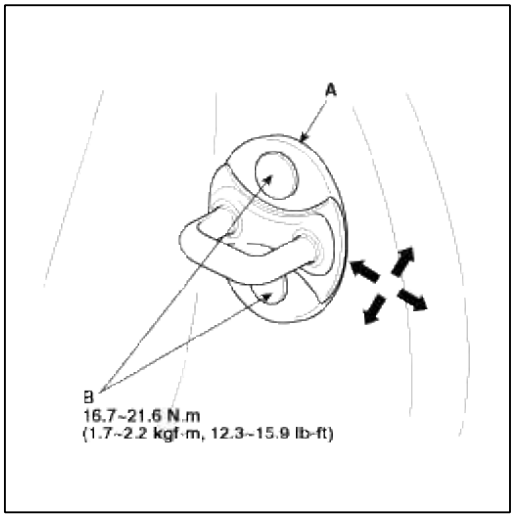


5. Check for water leaks.

Door Striker Adjustment

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

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



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

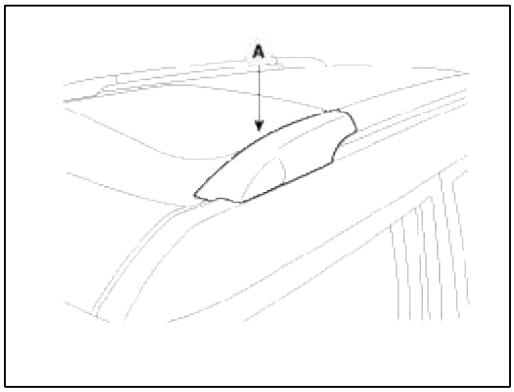
Body (Interior and Exterior) > Exterior > Body Side Moldings > Repair procedures

Replacement

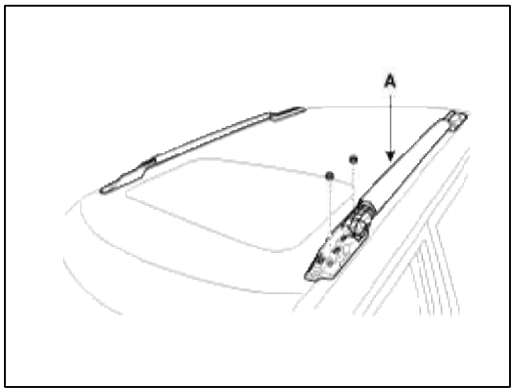
Roof Rack Replacement

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

1. Remove the roof rack cover (A).



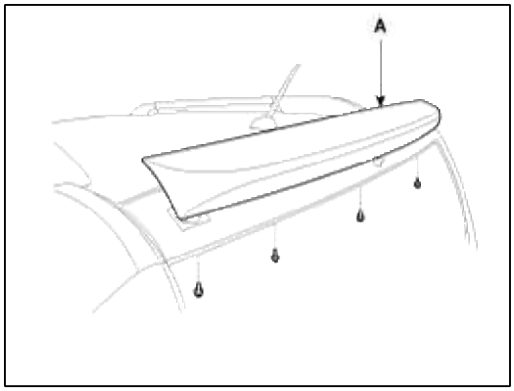
2. Remove the roof rack (A).



3. Installation is the reverse of removal.

Spolier Replacement

1. Remove the spolier (A).

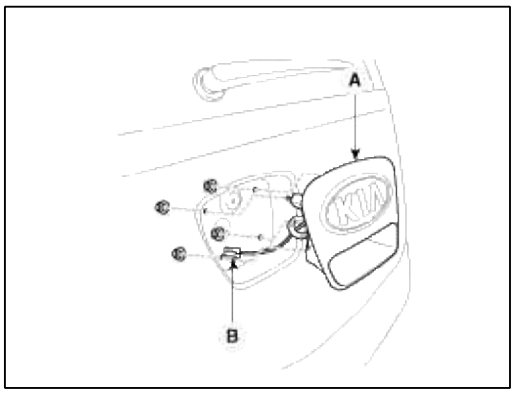


2. Installation is the reverse of removal.

Tailgate Handle Replacement

1. Remove the tailgate trim.
2. Remove the tailgate handle (A).

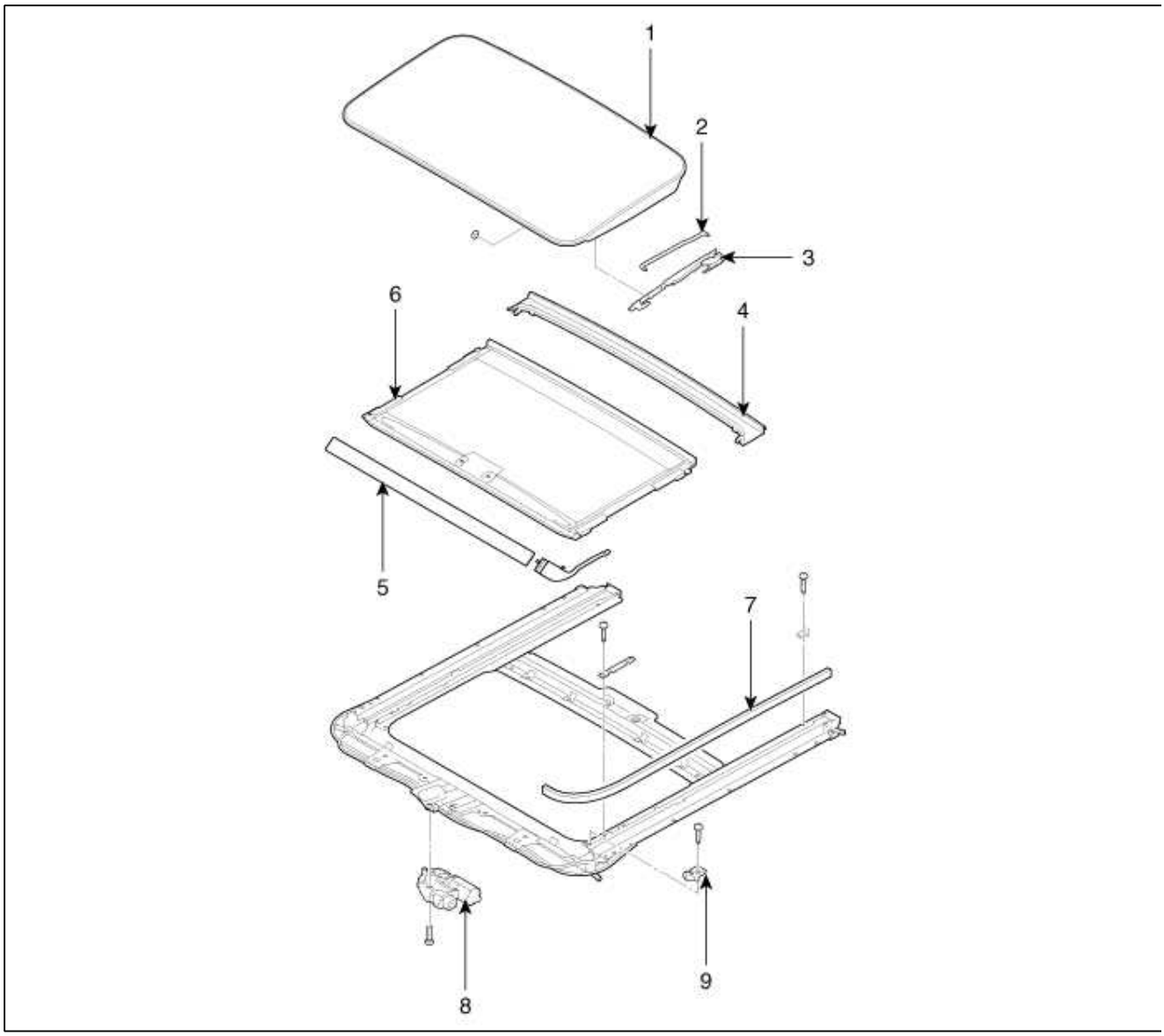
3. Disconnect the connector (B).



4. Installation is the reverse of removal.

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

Components



1. Glass	4. Guide assembly	7. Defector
2. Decoration cover	5. Drip rail	8. Motor
3. Drip link	6. Sunshade	9. Set bracket

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

Replacements

Glass Replacement

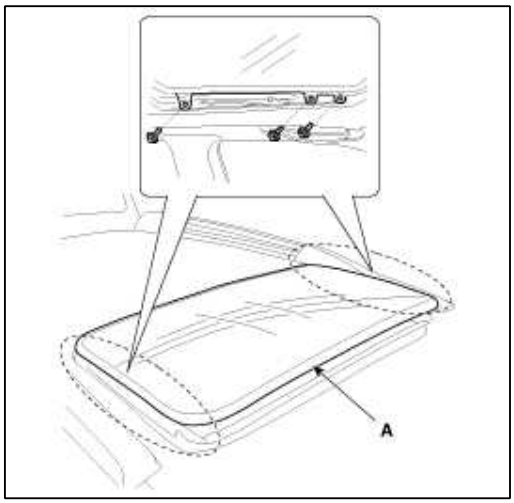
NOTE

- Put on glove to protect your hands.

1. Remove the glass (A) by lifting it up.

NOTE

- Do not damage the roof panel.



2. Installation is the reverse of removal.

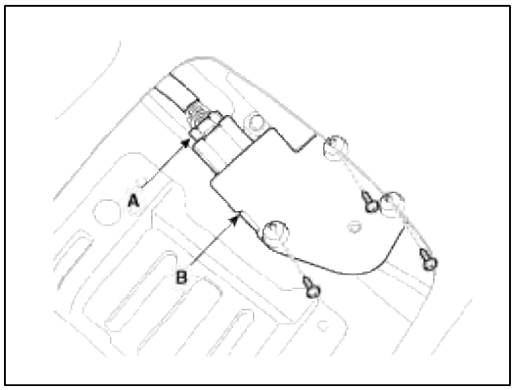
Motor Replacement

1. Remove the over head console.

NOTE

- Confirm the position of guide whether it is closed or not when you remove the motor.

2. Disconnect the motor connector (A), remove the screws and then remove the motor (B).



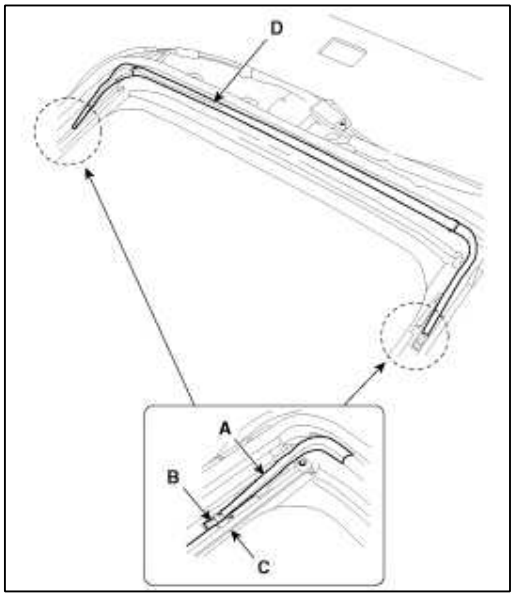
3. Installation is the reverse of removal.

NOTE

- Make sure to initialize the motor.

Deflector Replacement

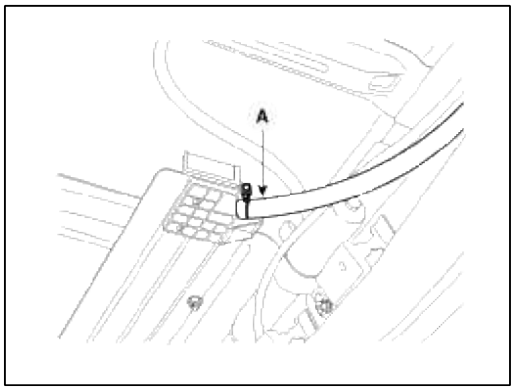
1. Open the glass fully.
2. Disconnect the deflector link (A) from the frame (B), and then remove the deflector (C).



3. Installation is the reverse of removal.

Sunroof Assembly Replacement

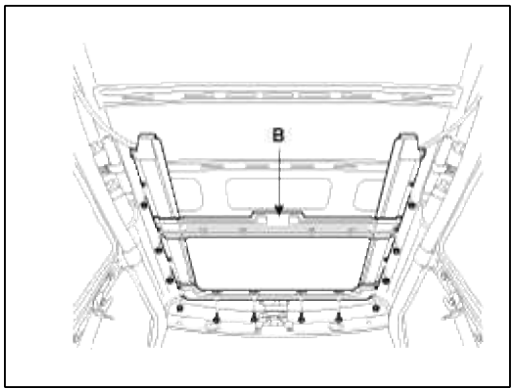
1. Remove the follwing parts.
   A. Door scuff trim.
   B. Front pillar trim.
   C. Center pillar trim.
   D. Rear pillar trim.
   E. Headlining.
   F. Sunroof glass.
2. Disconnect the drain tubes (A).



3. After loosening the mounding bolts and nuts, remove the sunroof assembly (B).

NOTE

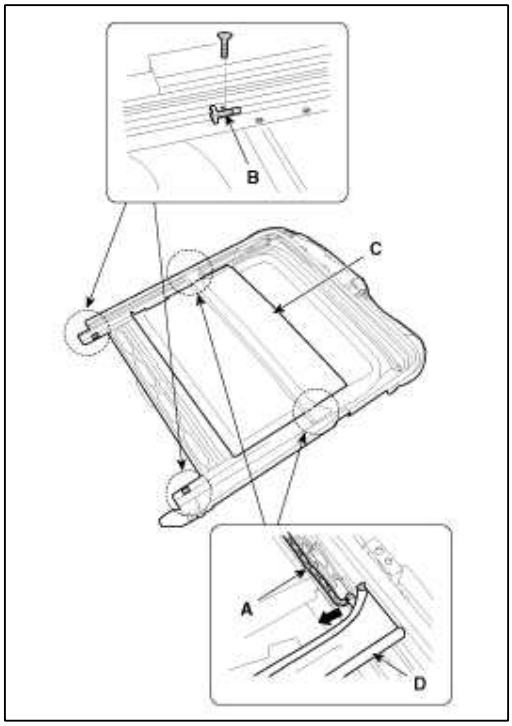
- Take care not to scratch the interior trims and other parts.



4. Installation is the reverse of removal.

Sunshade And Drip Rail Replacement

1. Remove the sunroof assembly.
2. Remove the drip link (A) and sunshade stopper (B).
3. Remove the sunshade (C) and drip rail (D).

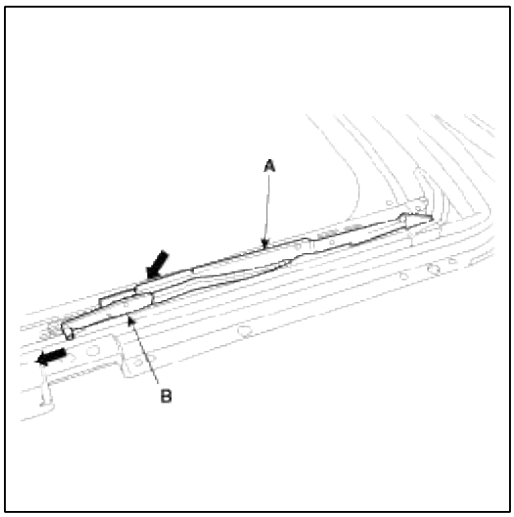


4. Installation is the reverse of removal.

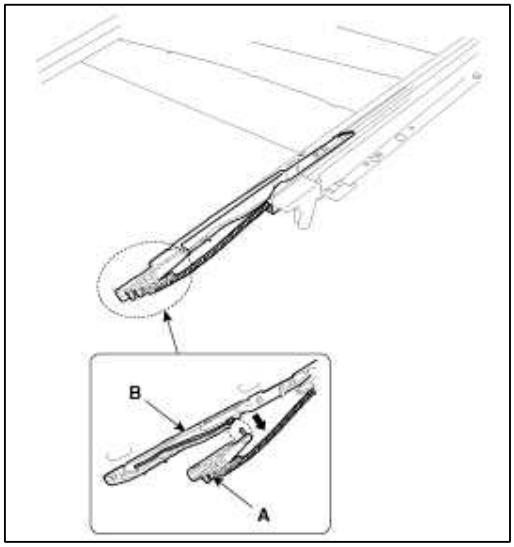
Guide Assembly Replacement

1. Remove the sunroof assembly.

2. Remove a guide assembly (A) after lowering a guide thoroughly by pushing a slide (B) to rear.



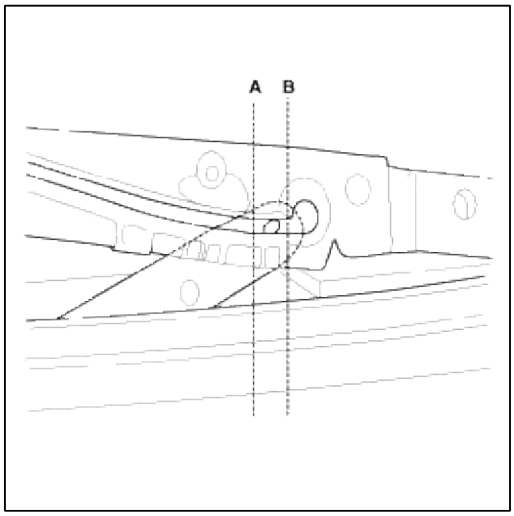
3. Remove the guide (A) and slide (B).



4. Installation is the reverse of removal.

NOTE

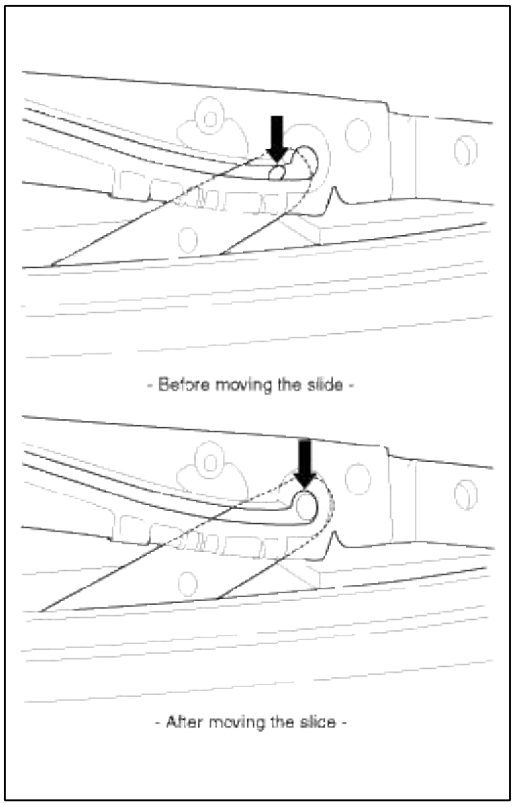
- Make sure to align the slide with the center of"A" and "B"
- Make sure to initialize the motor.



Adjustment

How To Initialize

1. Check that the glass has been installed.
   A. Finished height adjustment.
2. Push and hold the up switch.
   A. The slide moved 5mm forward after 15 seconds.



3. After moving the slide 5mm forward, turn OFF the switch and push the UP switch (Keeping pushing the switch of continuous operation)
   A. When the motor initialization os successful, the sunroof should fully side open and close on time.
4. When the sunroof is closed completely, turn OFF the UP switch initialize the motor completely.

When To Initialize The Motor

1. Fist operation after the vehicle is manufactured.
2. If the initial setting is erased or a physical or el ecectrical malunction.
3. After using the manual handle.

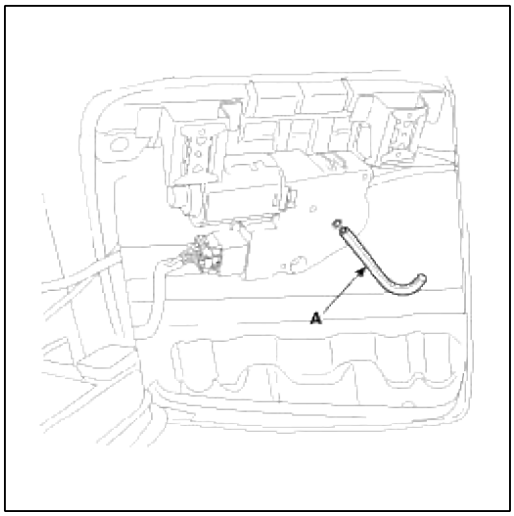
Operating The Sunroof Emergency Handle

1. Use the sunroof emergency handle to close or open the sunroof manually if the sunroof cannot be operated electronically due to motor or controller electrical malfunction.
   A. Use this function to open or close the sunroof, before driving the vehicle, if the sunroof cannot be operated due to failure of the sunroof motor or controller.

2. Operating method
   A. Remove the overhead console
   B. Push the emergency handle up into the hexagonal drive (A) of the sunroof motor. You must push hard enough to disengage the motor clutch; otherwise the emergency handle will slip due to incomplete fit in the motor.
   C. Carefully turn the emergency handle clockwise to close the sunroof.
   D. After closing the sunroof, wiggle the handle back and forth as you remove the tool from the motor, to ensure the motor clutch reengages.
   E. A 5mm hex socket may be used in place of the emergency handle, with a" Speeder" type handle.

CAUTION

- Do not use power tools to operate the sunroof.
- Damage to the components may occur.



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

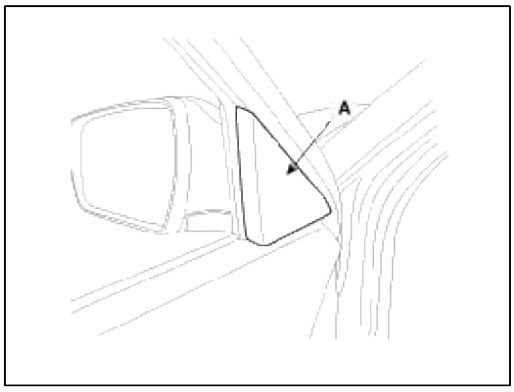
Replacement

Outside Rear View Mirror Relplacement

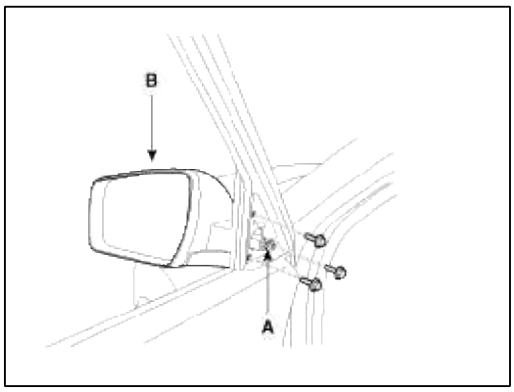
NOTE

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

1. Remove the quadrant inner cover (A).



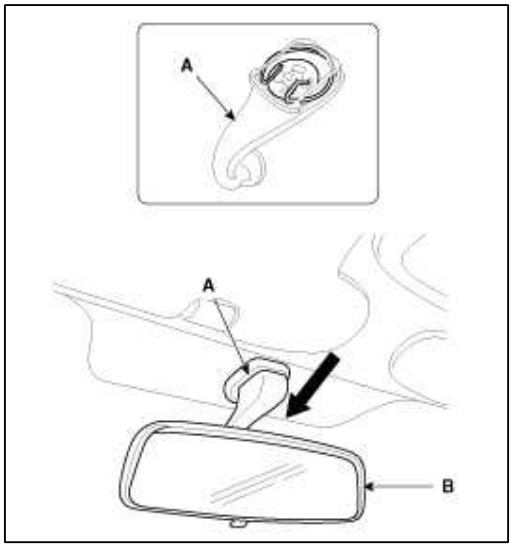
2. After disconnecting the connector (A), remove the outside rear view mirror (B).



3. Installation is the reverse of removal.

Inside Rear View Mirror Replacement

1. Push the inside rear view mirror base (A) down to remove to inside rear view mirror assembly (B).



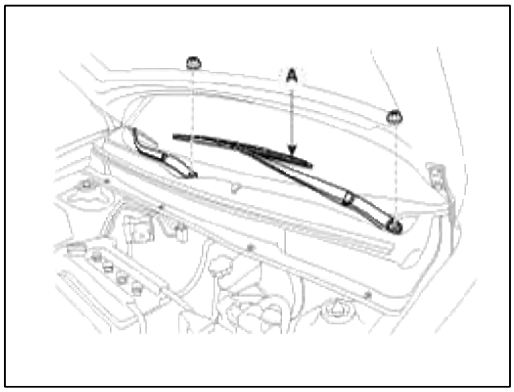
2. Installation is the reverse of removal.

Body (Interior and Exterior) > Exterior > Cowl Top Cover > Repair procedures

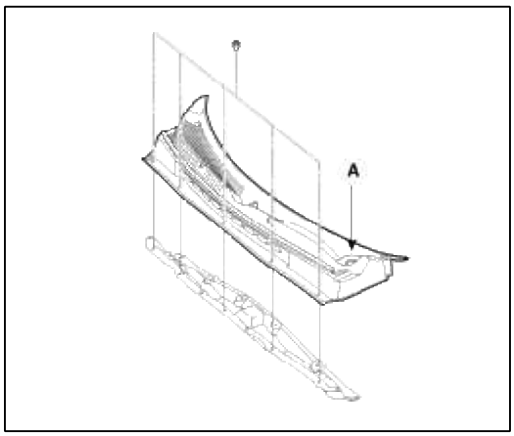
Replacement

Cowl Top Cover Replacement

1. Remove the wiper (A).



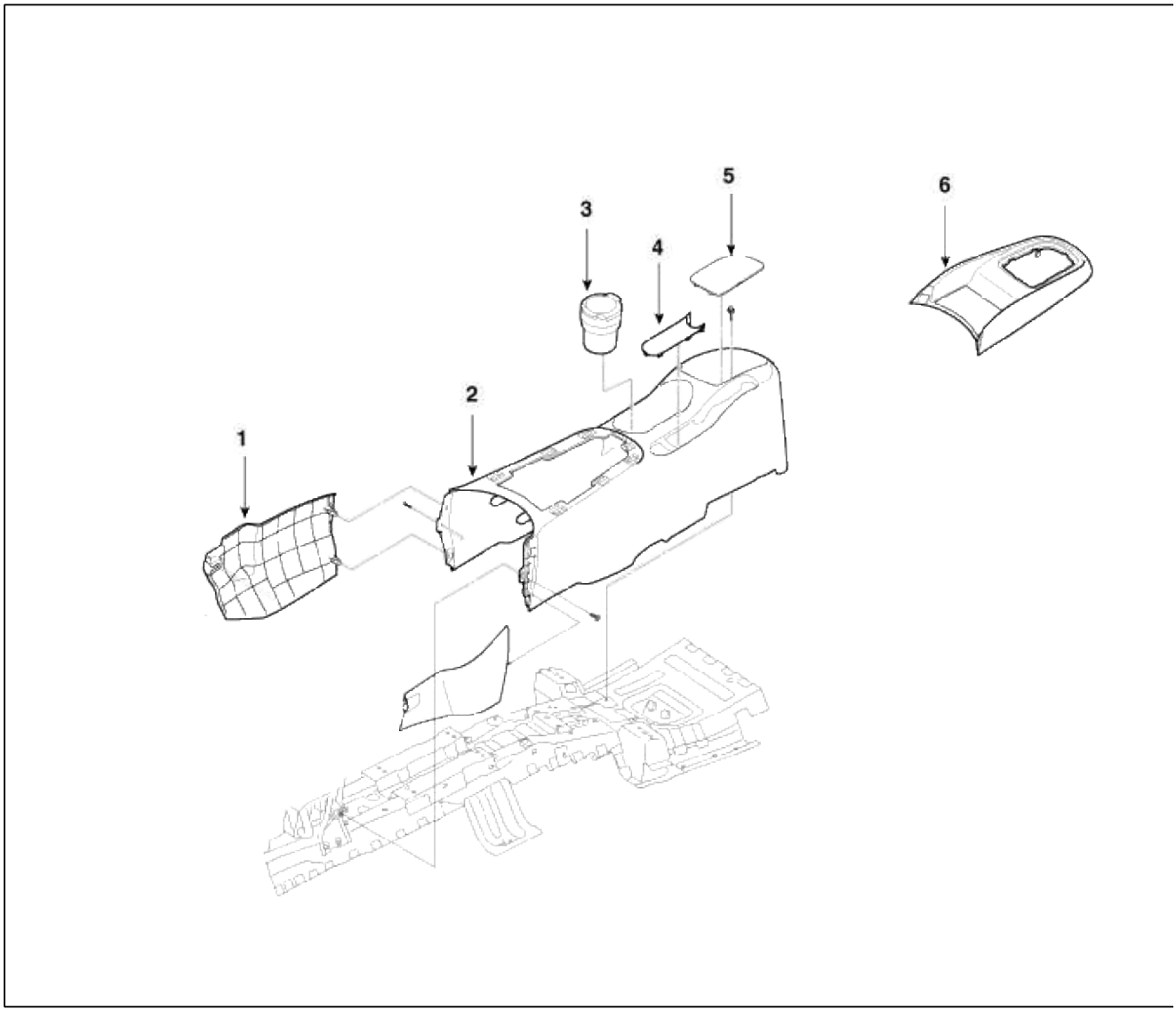
2. Detach the clips, then remove the cowl top cover (A).



3. Installation is the reverse of removal.

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

Components



1. Console side cover 2. Front floor console 3. Astray	4. Parking brake cover 5. Pad 6. Console upper cover

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

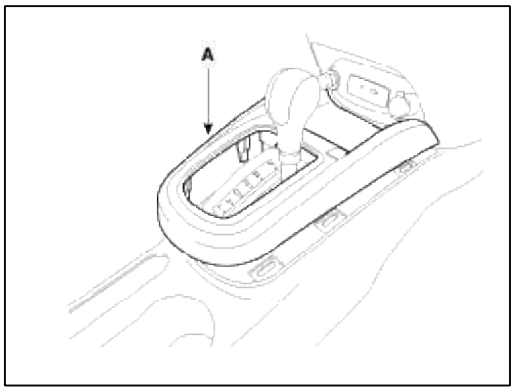
Replacement

Floor Console Replacement

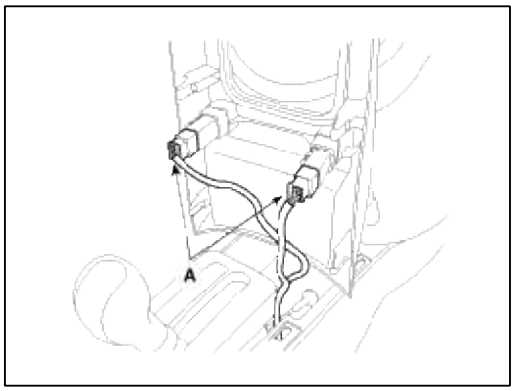
NOTE

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

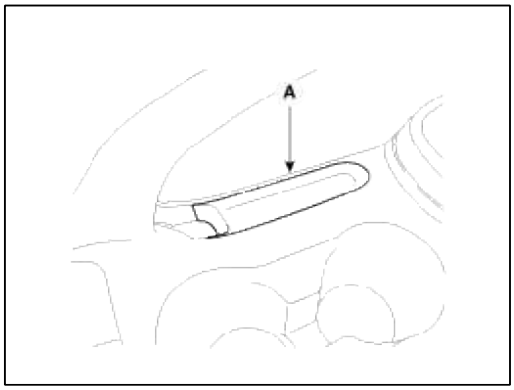
1. Remove the upper cover (A).



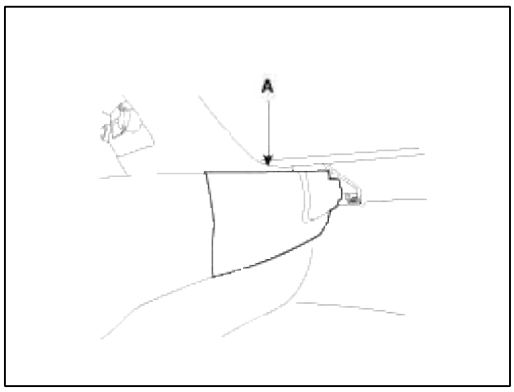
2. Disconnect the connector (A).



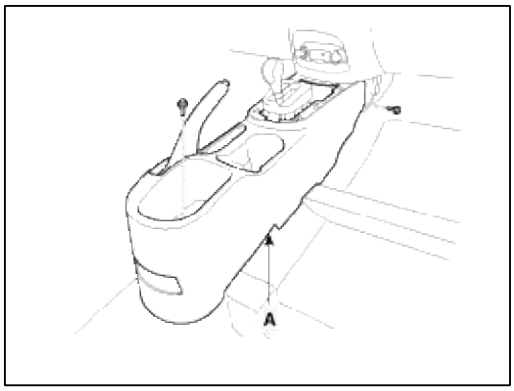
3. Remove the parking brake cover (A).



4. Remove the console side cover (A).



5. After loosening the console mounting screws, remove the floor console assembly (A).



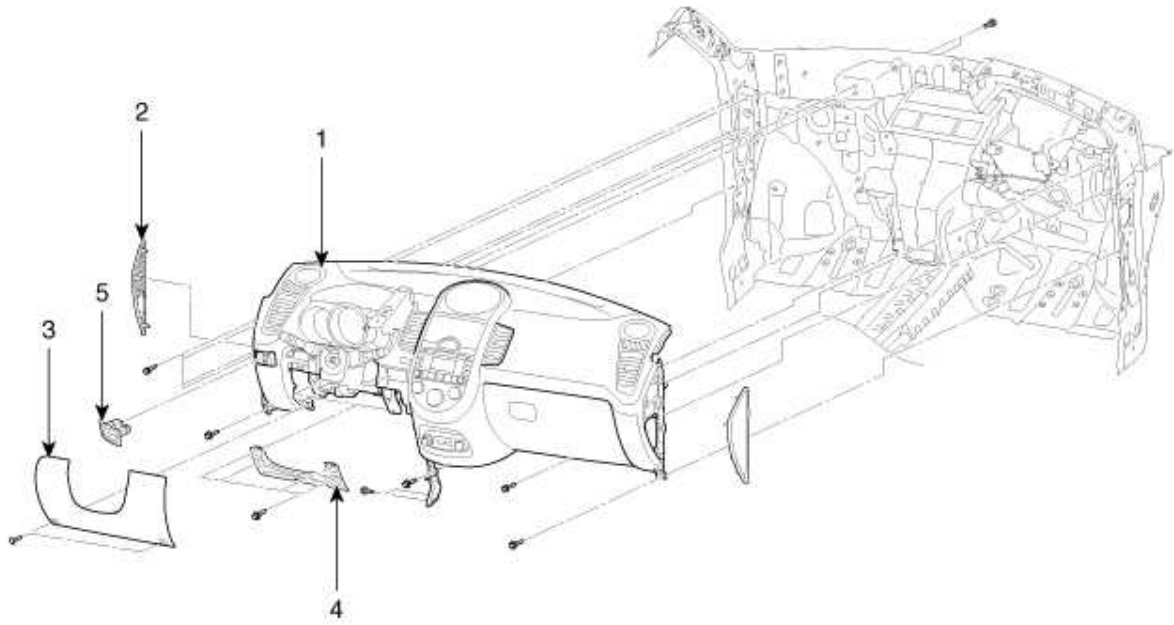
6. Installation is the reverse of removal.

NOTE

- Make sure the connector is plugged in properly.
- Replace any damage clips.

Body (Interior and Exterior) > Interior > Crash Pad > Components and Components Location

Components



1. Main crash pad 2. Crash pad side cover 3. Crash pad lower panel	4. Reinforecing panel 5. Switch assembly

Body (Interior and Exterior) > Interior > Crash Pad > Repair procedures

Replacement

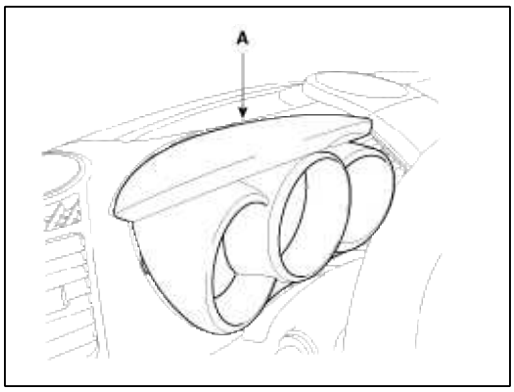
Cluster Fascia Replacement

NOTE

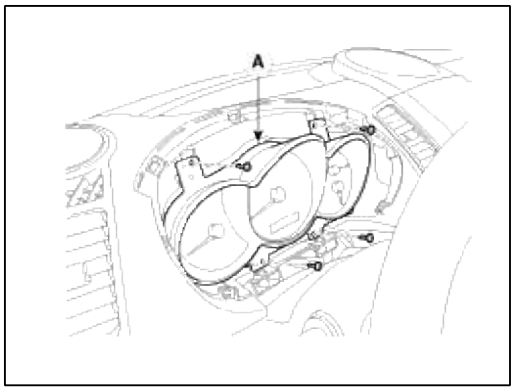
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Tilt the steering column down.

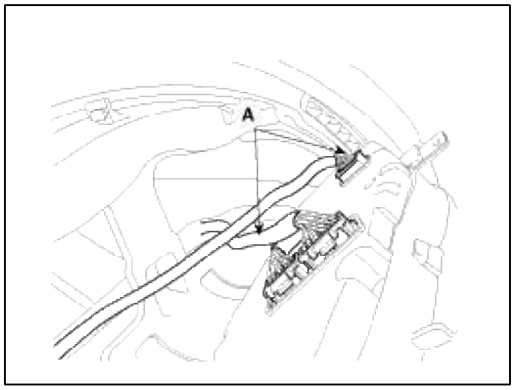
2. Remove the cluster fascia panel (A).



3. After loosening the mounting screws, remove the cluster fascia (A).



4. Disconnect the connector (A).



5. Installation is the reverse the removal.

NOTE

- Make sure the connector is plugged in properly.

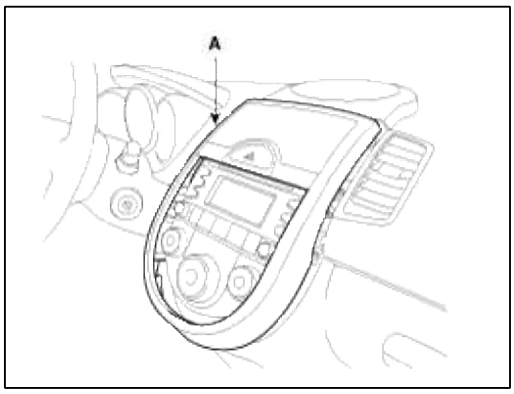
Center Fascia Panel Replacement

1. Put the SST (09840-1E100) into the space between the center fascia (A) and crash pad.

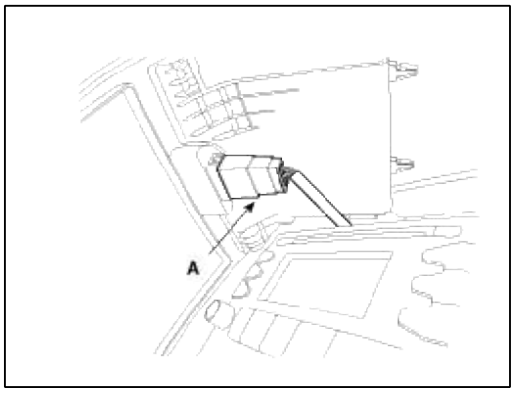
NOTE

- Be care not to damage the center facia and crash pad.
- Put the SST into the area as indicated by the arrows.
- To prevent the scratch, apply protective tapes to the center fascia panel and its related parts.

2. Separate the center facia panel (A) from the crash pad by pulling the SST (09840-1E100).



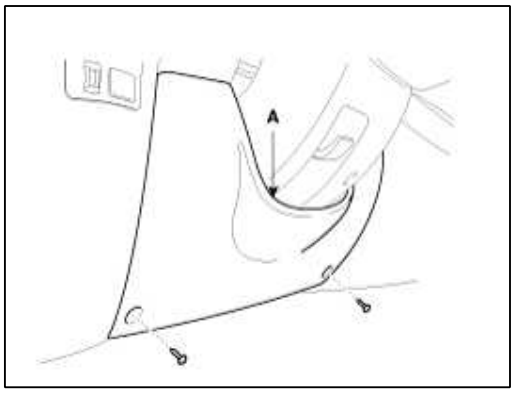
3. Disconnect the connector (A).



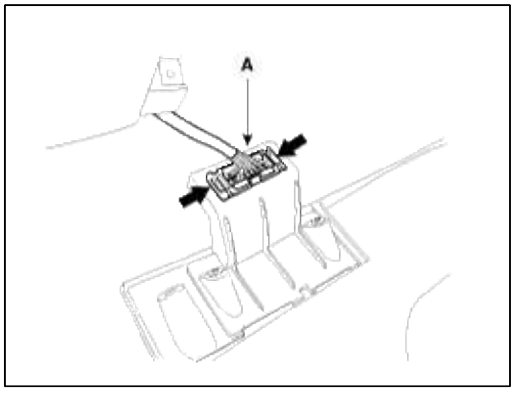
4. Installation is the reverse the removal.

Lower Panel Replacement

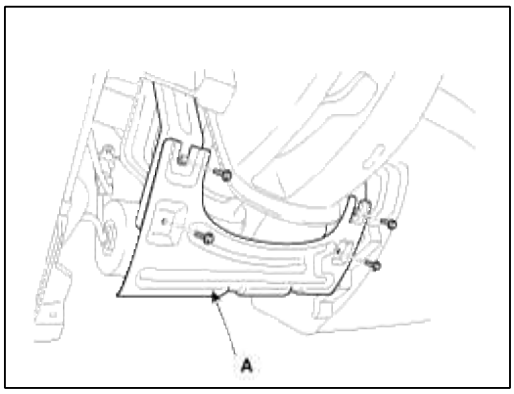
1. After loosening the crash pad lower panel mounting screws, remove the lower panel (A).



2. Disconnect the connector (A).



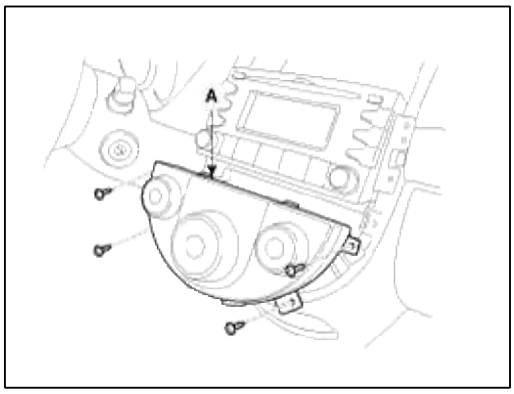
3. After loosening the mounting bolts, then remove the reinforcing panel (A).



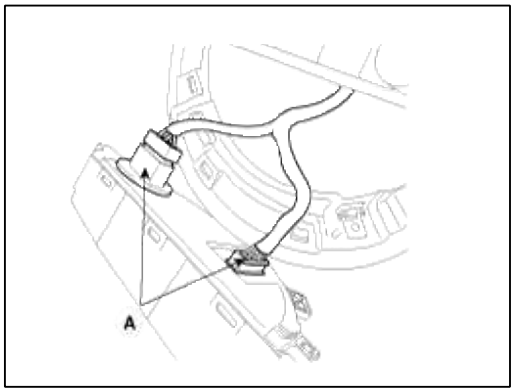
4. Installation is the reverse of removal.

Audio Assembly Replacement

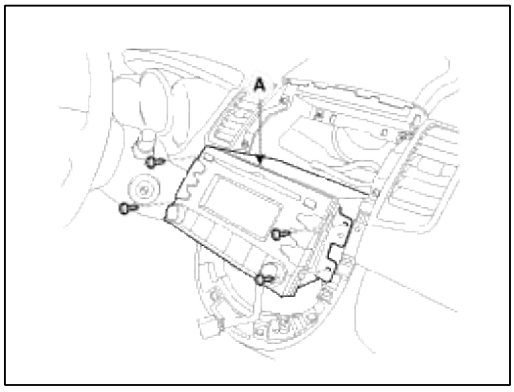
1. Remove the center fascia panel.
2. After loosening the heater control unit mounting screws, remove the heat control unit (A).



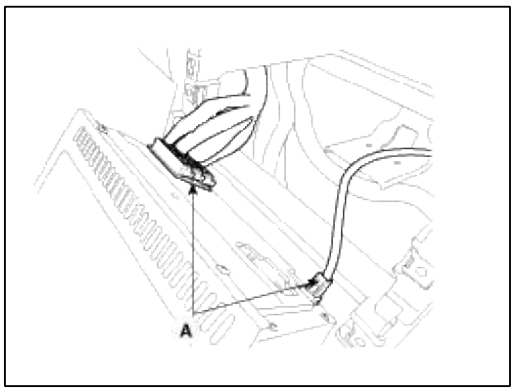
3. Disconnect the heat control unit connector (A).



4. After loosening the audio assembly mounting screws, then remove the audio assembly (A).



5. Disconnect the audio connectors (A).



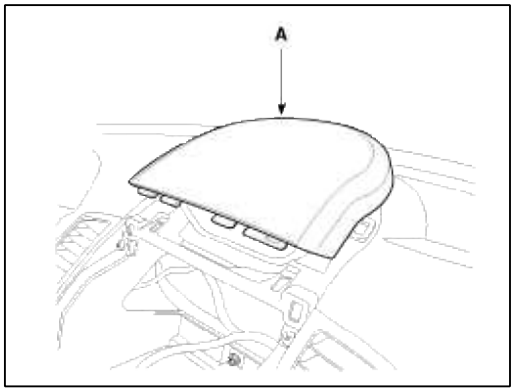
6. Installation is the reverse of removal.

NOTE

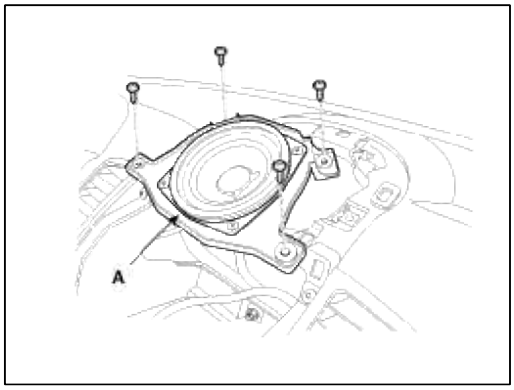
- Make sure the connector is plugged in properly.

Center Speaker Replacement

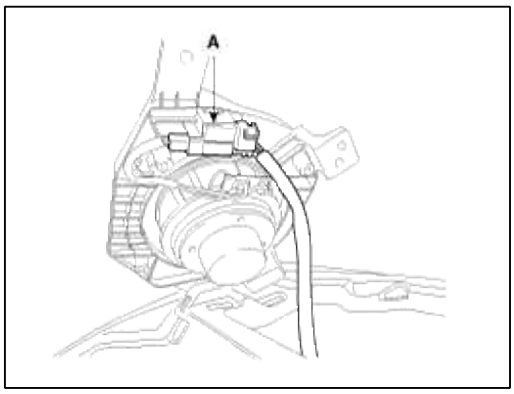
1. Remove the grill (A).



2. After loosening the mounting screws, remove the speaker (A).



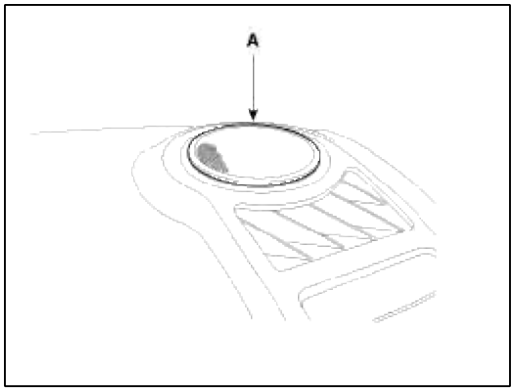
3. Disconnect the speaker connector (A).



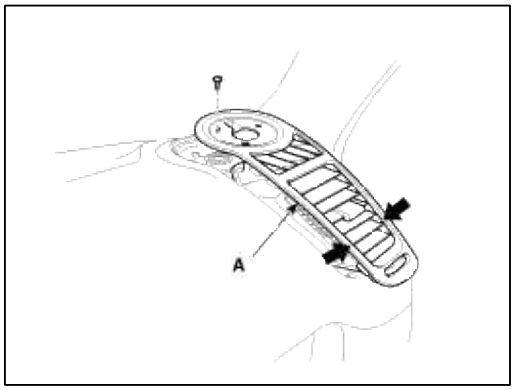
4. Installation is the reverse of removal.

Speaker Replacement

1. Remove the grill (A).



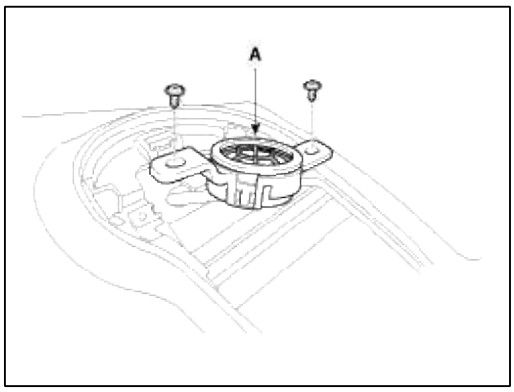
2. Loosen the mounting screw.
3. Insert the air vent remover (09840-1M100) into the air vent hole and pull the air vent (A) remover.



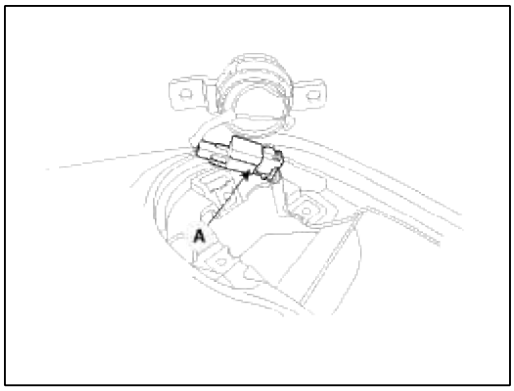
CAUTION

- To prevent the damage to the air vent, the air vent remover should be used to grab the side of the air vent.

4. After loosening the mounting screws, remove the speaker (A).



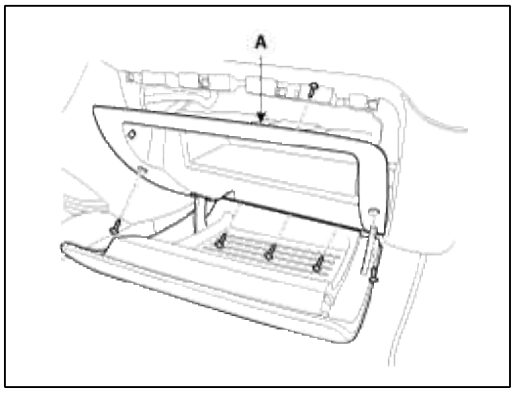
5. Disconnect the speaker connector (A).



6. Installation is the reverse of removal.

Glove Box Replacement

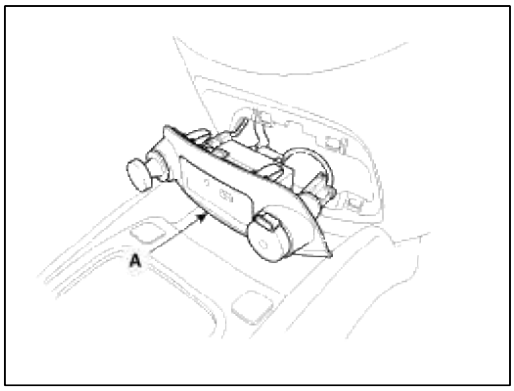
1. Open the glove box.
2. After loosening the mounting screws, remove the glove (A).



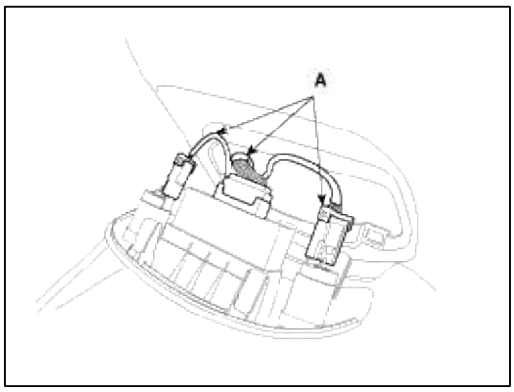
3. Installation is the reverse of removal.

Lower Tray Replacement

1. Remove the lower tray (A).



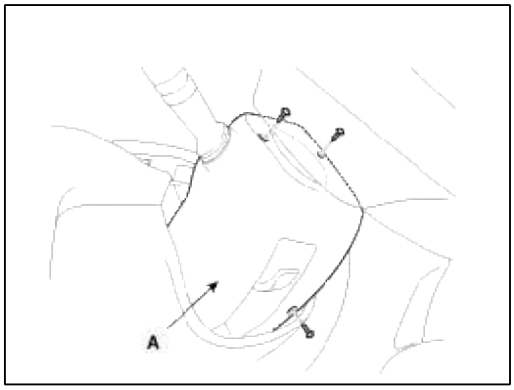
2. Disconnect the connector (A).



3. Installation is the reverse of removal.

Steering Column Shroud Replacement

1. After loosening the mounting screws, remove the shroud (A).



2. Installation is the reverse of removal.

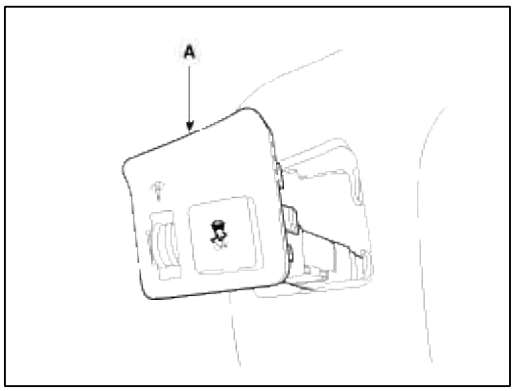
Crash Pad Replacement

NOTE

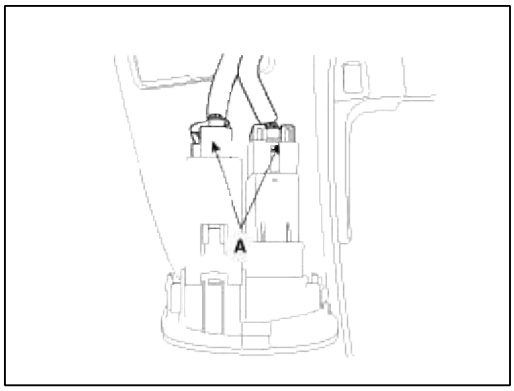
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the following items.
   A. Front seat
   B. Cluster fascia panel, cluster
   C. Audio assembly
   D. Glove box
   E. Crash pad side cover
   F. Front pillar trim
   G. Cowl side trim

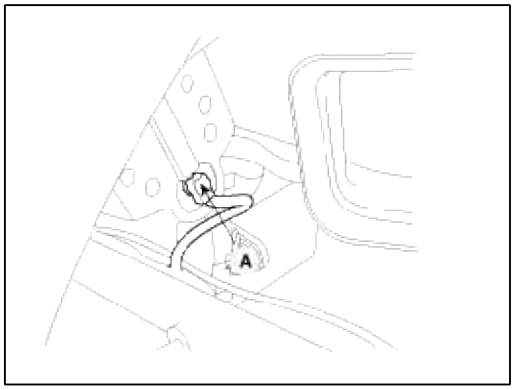
2. Remove the switch assembly (A).



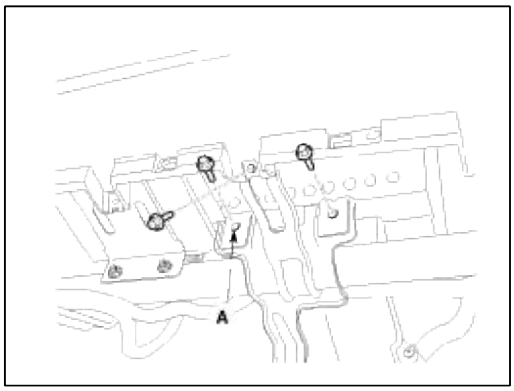
3. Disconnect the connector (A).



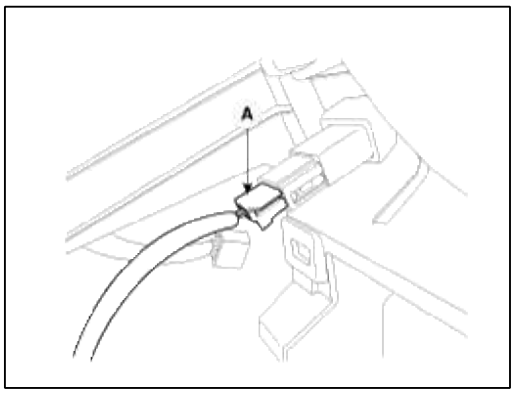
4. Disconnect the passenger`s air bag connector (A).



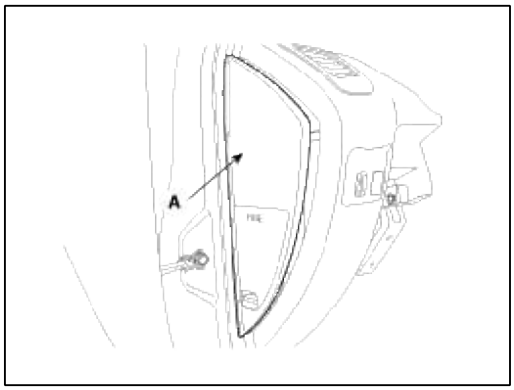
5. Remove the passenger’s air bag mounting bolt (A).



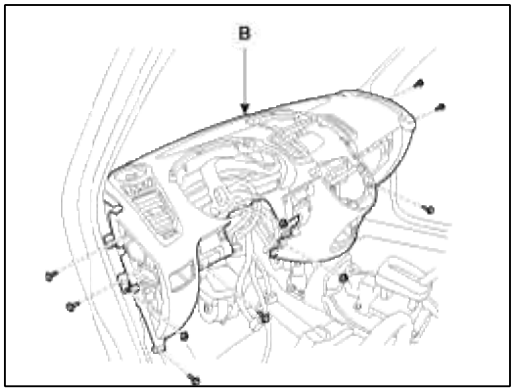
6. Disconnect the connector (A).



7. Remove the crash pad side pad (A).



8. Loosen the bolts and nuts, then remove the crash pad (B).



9. Installation is the reverse of removal.

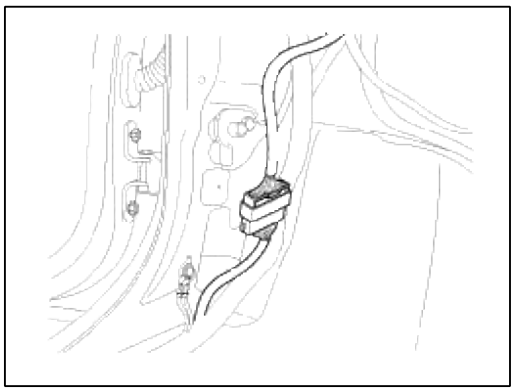
NOTE

- Make sure the crash pad fits onto the guide pins correctly.
- Before tightening the bolts, make sure the crash pad wire harnesses are not pinched.
- Make sure the connectors are plugged in properly, and the antenna lead is connected properly.
- Enter the anti- theft code for the radio, then enter the customer`s radio station presets.

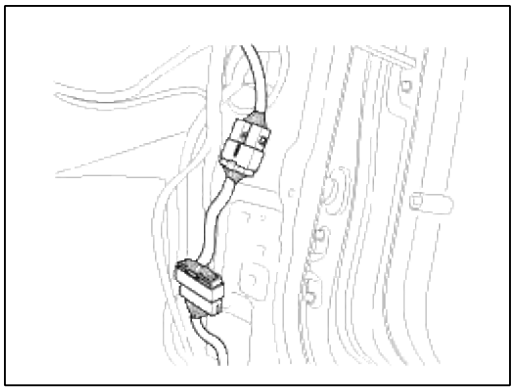
Cowl Cross Bar Replacement

1. Remove the front seat.
2. Remove the floor console.
3. Remove the crash pad.
4. Remove the cowl top cover.
5. Remove the steering column.

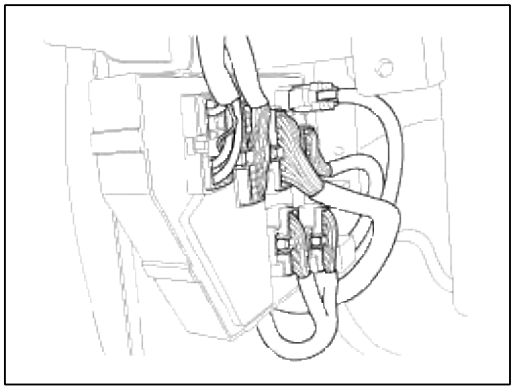
6. Disconnect the driver’s connectors.



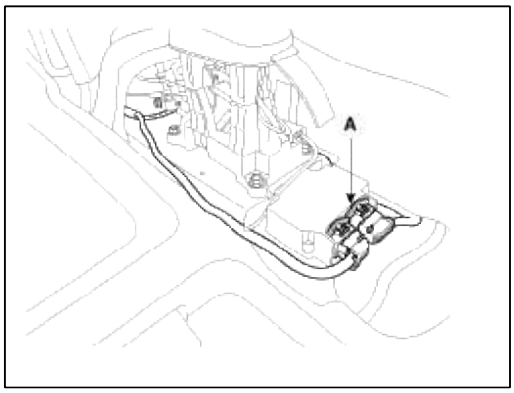
7. Disconnect the passenger’s connectors.



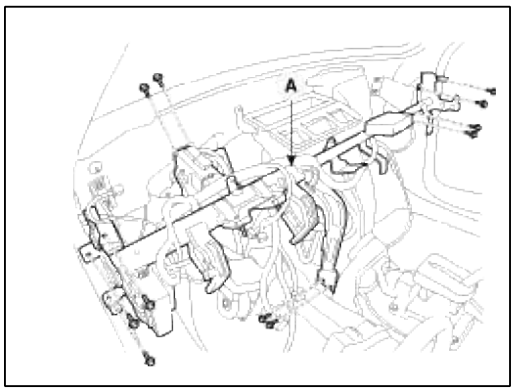
8. Disconnect the connectors.



9. Disconnect the air bag connector (A).



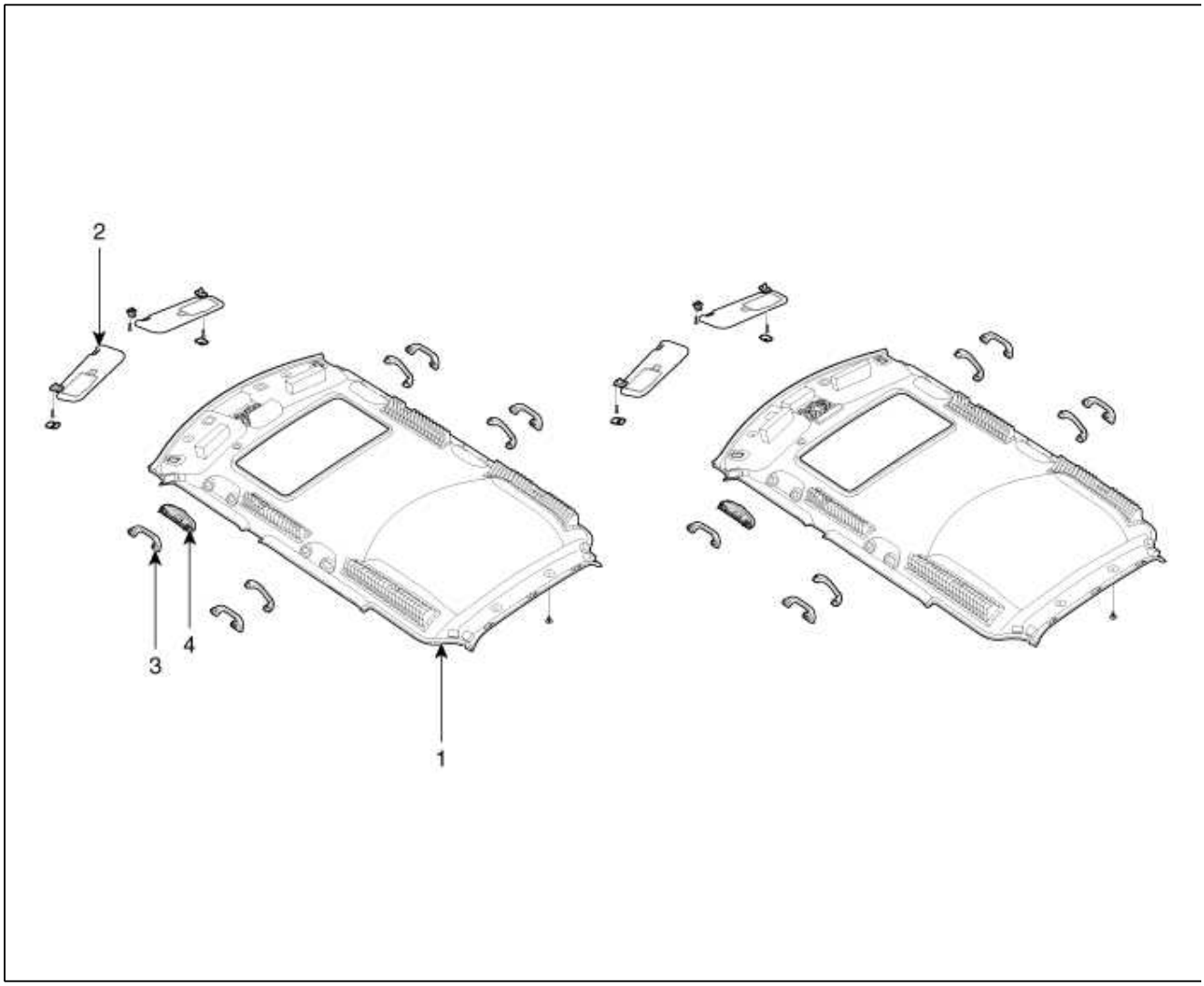
10. After loosening the mounting bolts, remove the cowl cross bar (A).



11. Installation is the reverse of removal.

Body (Interior and Exterior) > Interior > Roof Trim > Components and Components Location

Components



1. Roof trim 2. Sunvisor	3. Assist handle 4. Sunglass case

Body (Interior and Exterior) > Interior > Roof Trim > Repair procedures

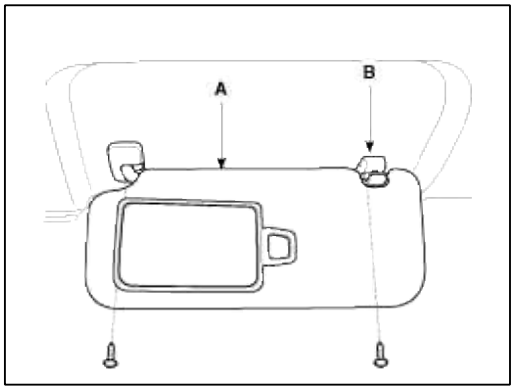
Replacement

Sunvisor Replacement

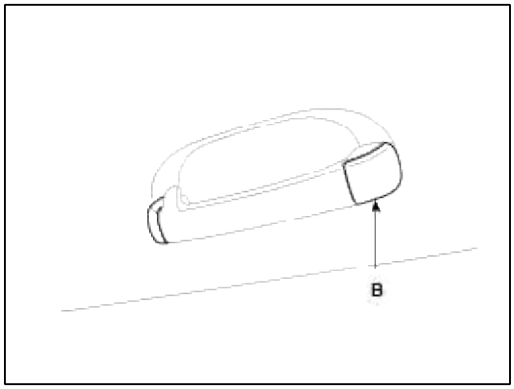
NOTE

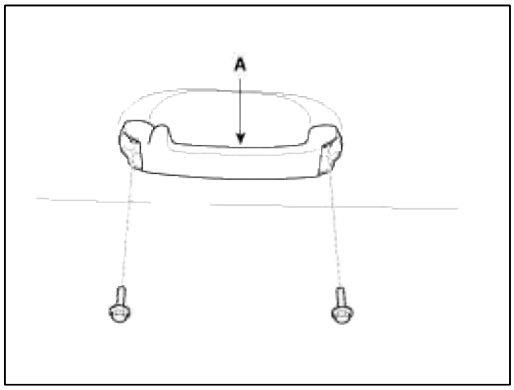
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

1. Remove the sunvisor
   A. Remove the sunvisor (A) and holder (B) from each side.



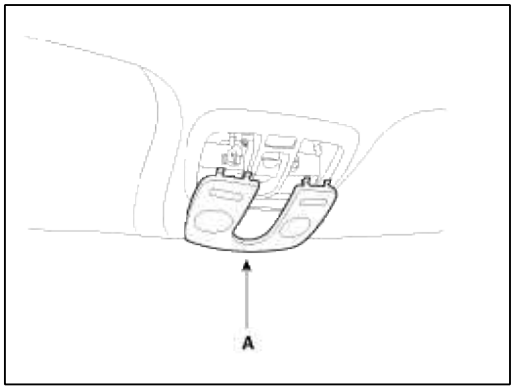
2. Remove the assist handle
   A. Remove the covers (B), and remove the screws, then remove the assist handle (A).



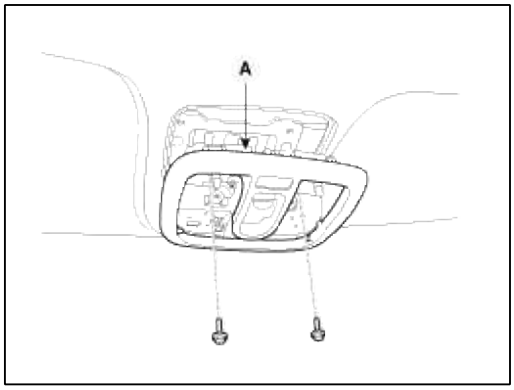


3. Remove the overhead console.

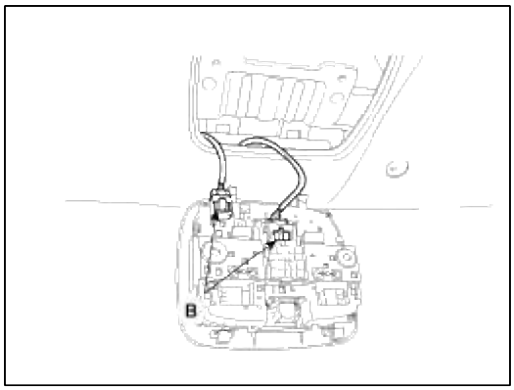
A. Remove the cover (A).



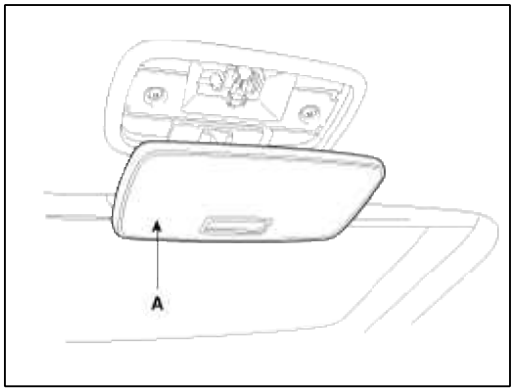
B. After loosening the overhead console mounting screws, remove the overhead console lamp (A).



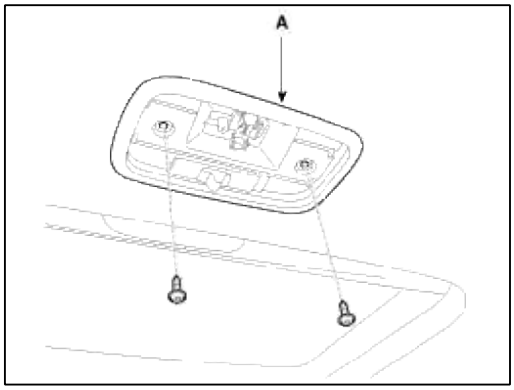
C. Disconnect the connector (B).



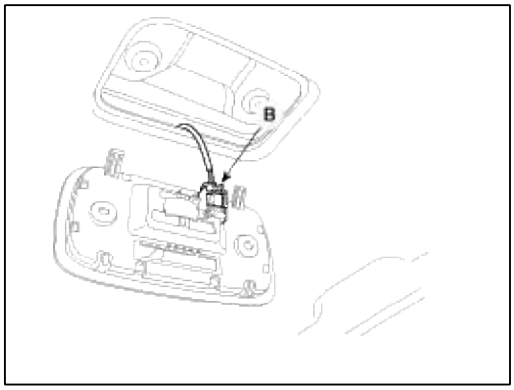
4. Remove the room lamp.
   A. Remove the lens (A).



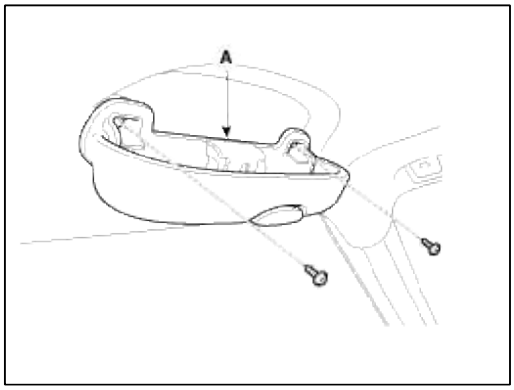
   B. Remove the screws.
   C. Pull out the room lamp (A).



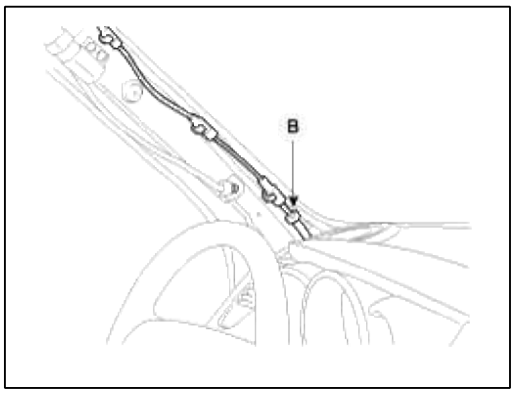
   D. Disconnect the connector (B).



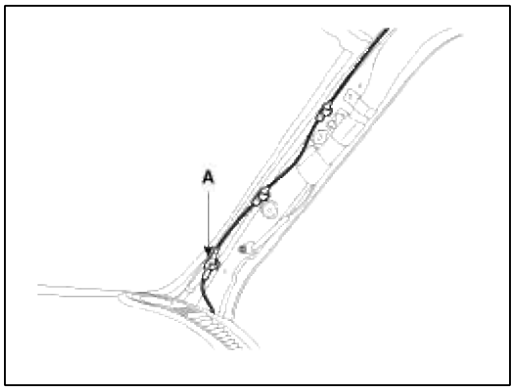
5. After loosening the mounting screws, remove the sunglass case (A).



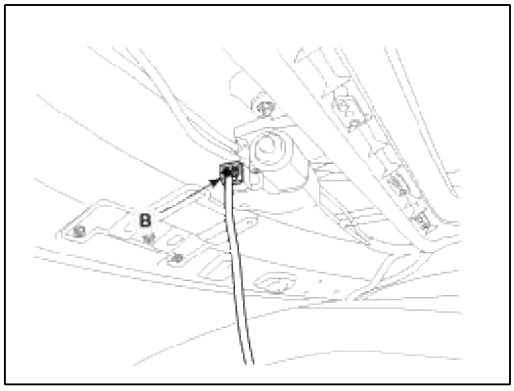
6. Disconnect the connector (B).



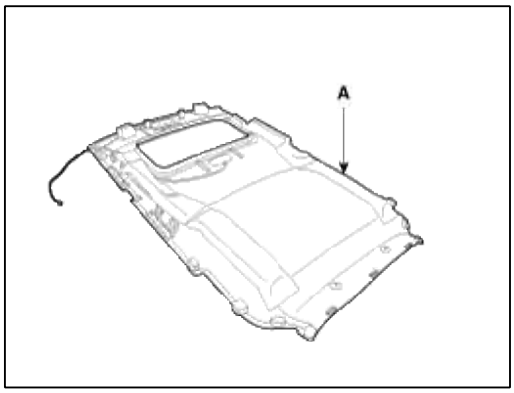
7. Disconnect the connector (A).



8. Disconnect the sunroof motor connector (B).



9. Remove the roof trim (A).



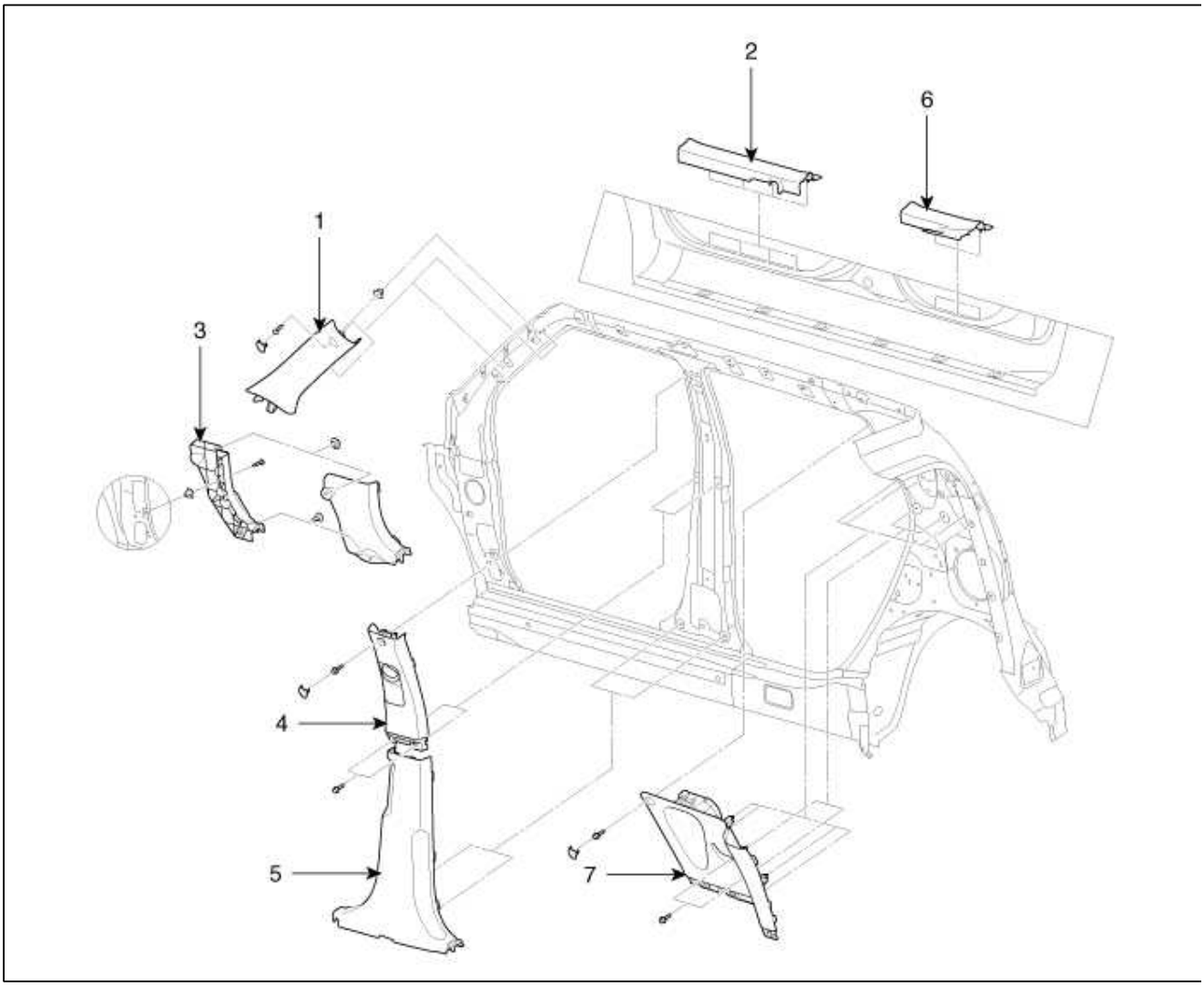
10. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

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

Components



1. Front pillar trim	5. Center lower pillar trim
2. Front door scuff trim	6. Rear door scuff trim
3. Cowl side trim	7. Rear pillar trim
4. Center upper pillar trim	

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

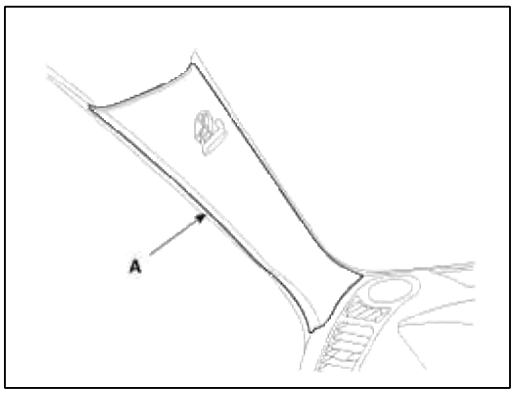
Replacement

Front Pillar Trim Replacement

NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. After loosening the mounting screw, remove the front pillar trim (A).



2. Installation is the reverse of removal.

NOTE

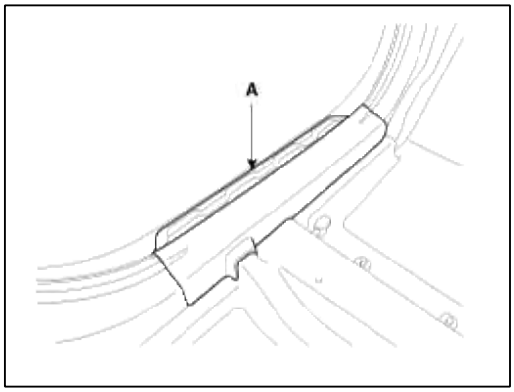
- Replace any damage clips.

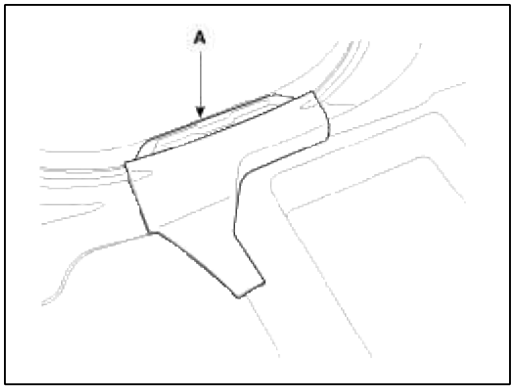
Door Scuff Trim Replacement

NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the door scuff trim (A).





2. Installation is the reverse of removal.

NOTE

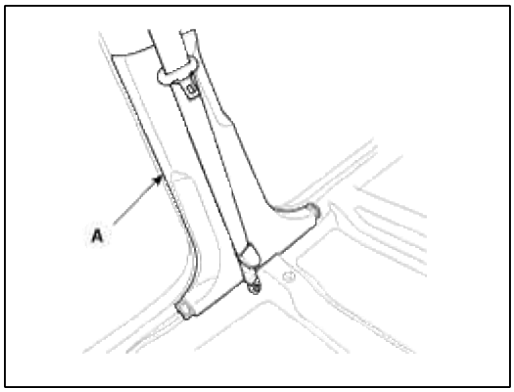
- Replace any damage clips.

Center Piller Trim Replacement

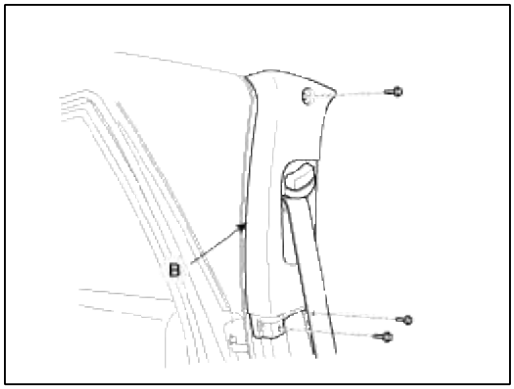
NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the front seat belt lower anchor.
2. Remove the front door scuff trim and rear door scuff trim.
3. Remove the center lower trim (A).



4. Remove the center upper trim (B).



5. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

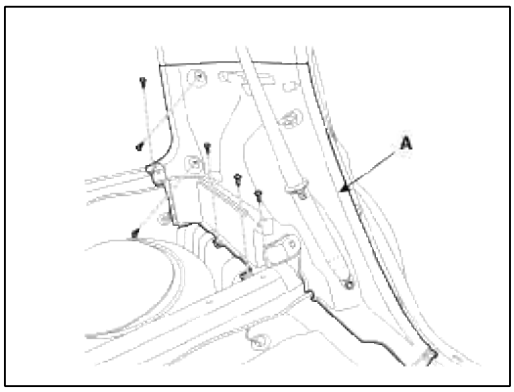
Rear Pillar Trim Replacement

NOTE

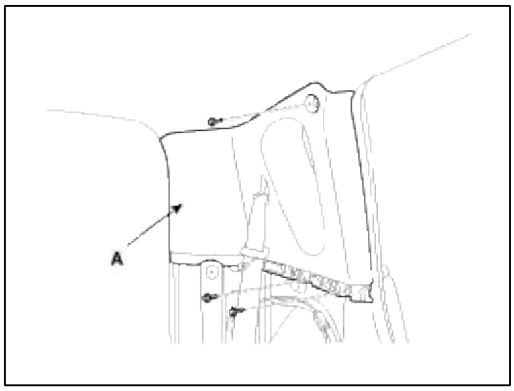
- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the rear seat.
2. Remove the rear door scuff trim.

3. Remove the luggage side trim (A).



4. Remove the rear pillar trim (A).



5. Installation is the reverse of removal.

NOTE

- Replace any damage clips.

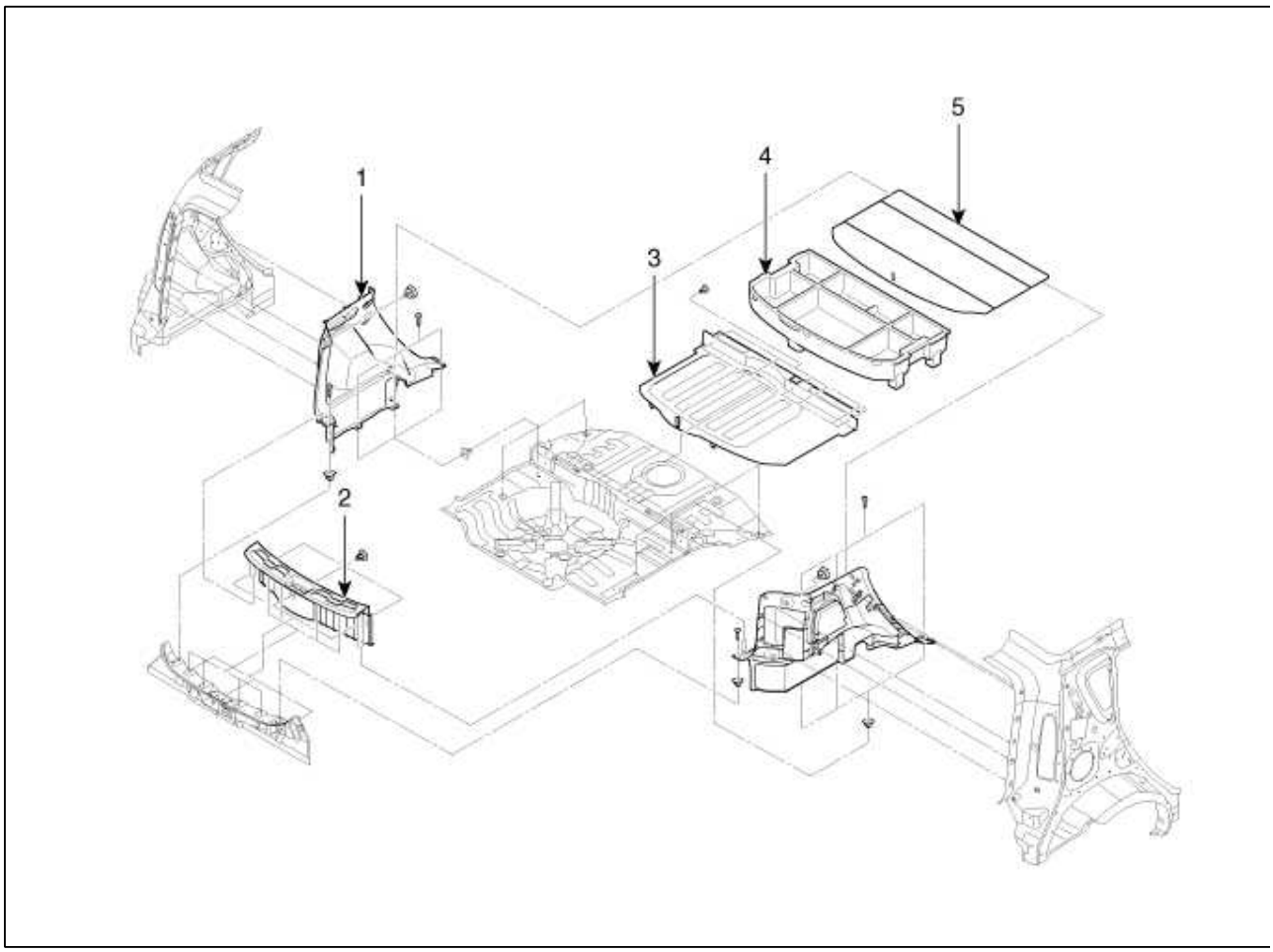
Luggage Side Trim Replacement

NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the rear seat.
2. Remove the rear seat belt lower anchor.
3. After loosening the mounting screws, remove the luggage side trim.

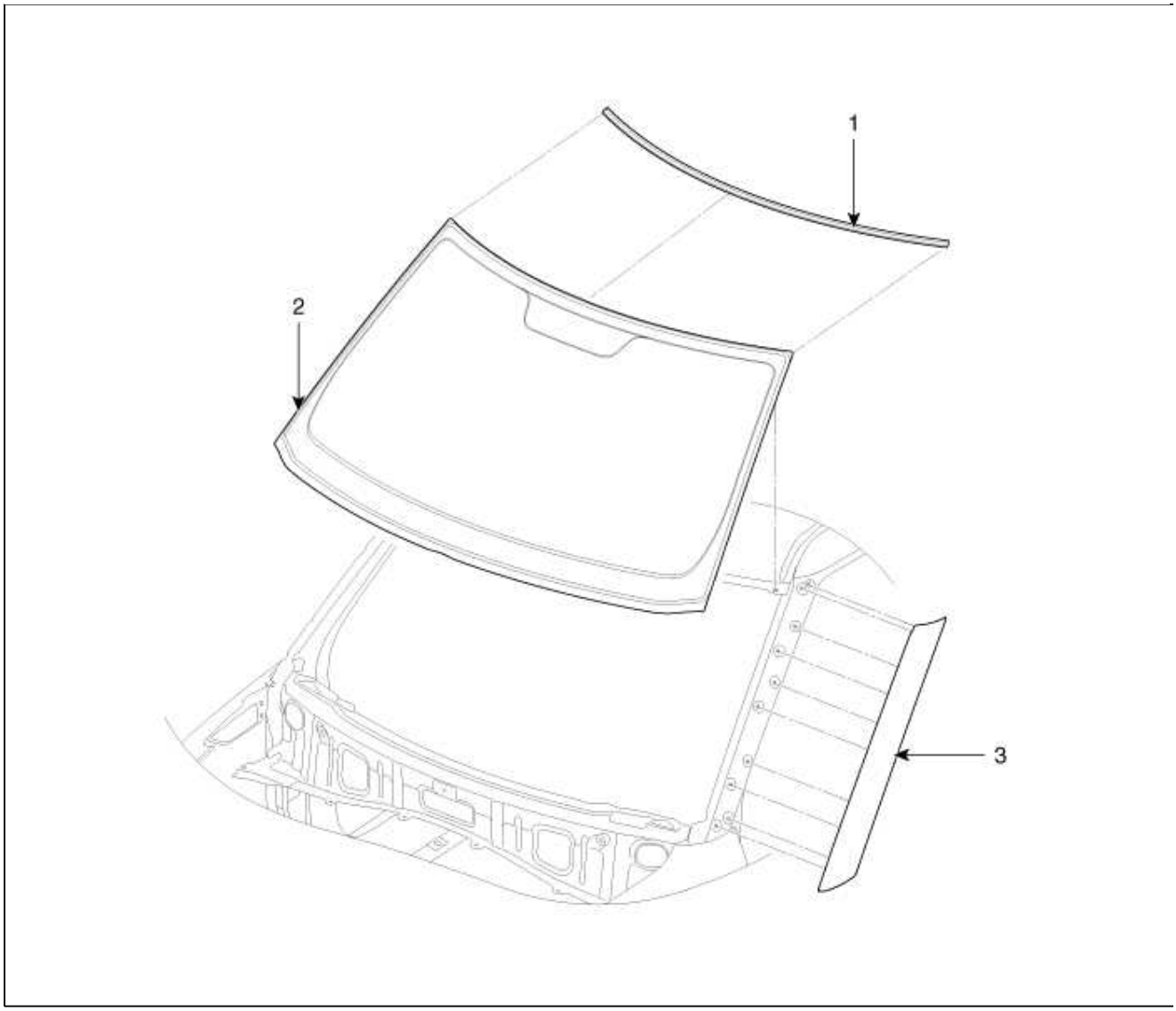
4. Installation is the reverse of removal.



1. Luggage side trim 2. Transverse trim 3. Floor mat	4. Floor box 5. Floor box cover

Body (Interior and Exterior) > Interior > Windshield Glass > Components and Components Location

Components



1. Windshield molding 2. Windshield glass	3. Front pillar garnish

Body (Interior and Exterior) > Interior > Windshield Glass > Repair procedures

Replacement

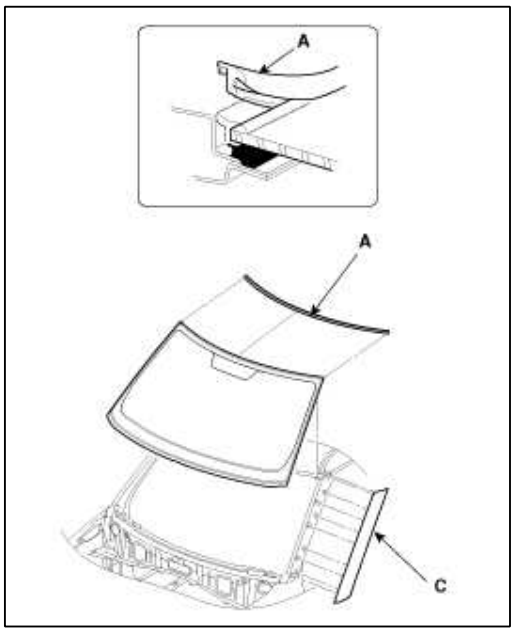
Removal

NOTE

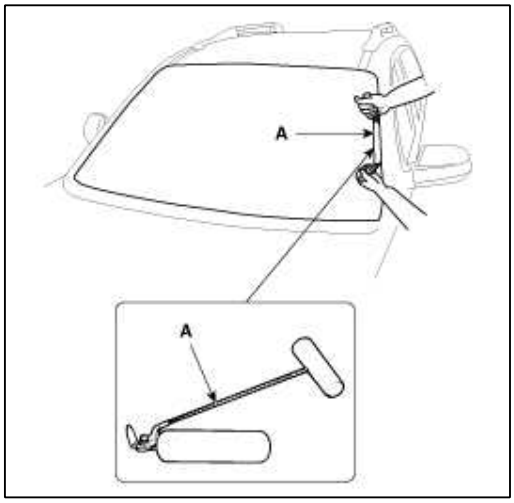
- Put on gloves to protect your hands.
- Use seat covers to avoid damaging any surfaces.

1. Remove the following items.
   A. Front pillar trim, both sides.
   B. Windshield wiper arms and cowl cover (Refer to page BE-"Windshield wiper").
   C. Inside rear view mirror.
2. Remove the front pillar garnish (C).

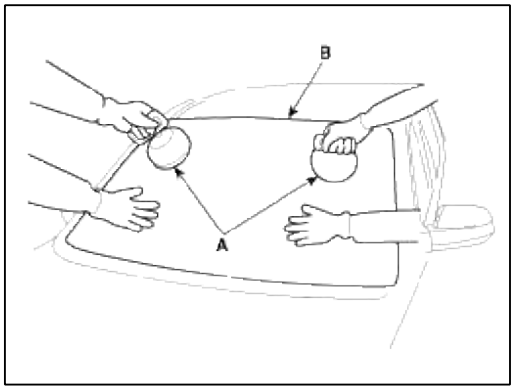
3. Remove the windshield glass upper molding (A).Remove the spacer.



4. Cut out the windshield sealant using the sealant cutting tool (A)(09861-31100).



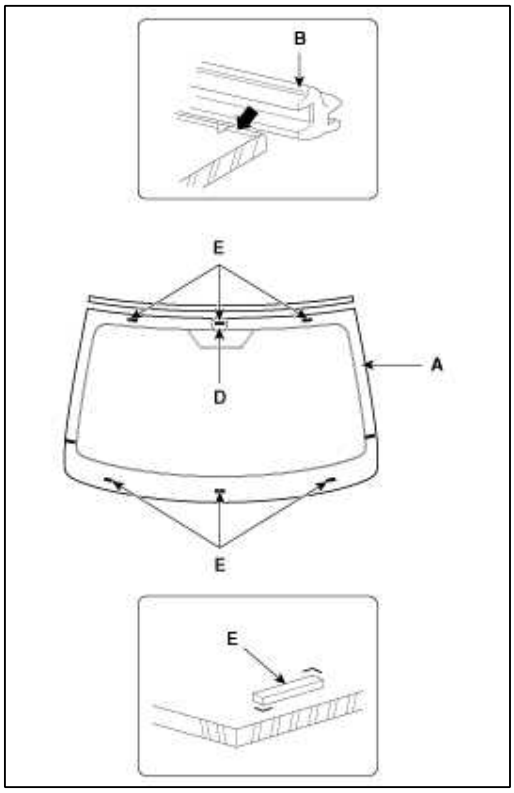
5. Remove the windshield (A) carefully using the glass holder (B).



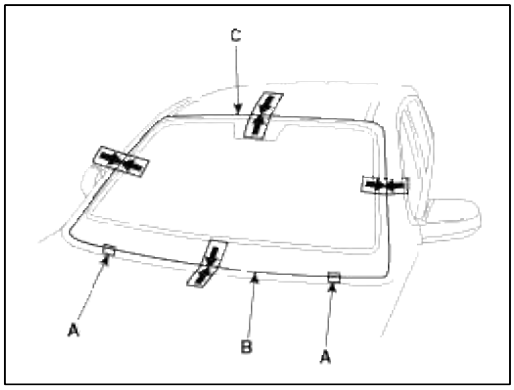
Installtion

1. With a scraper, scrape the old adhesive smooth to a thickness of about 2mm (0.08 in.) on the bonding surface around the entire windshield opening flange:
   A. Do not scrape down to the painted surface of the body; damaged paint will interfere with proper bonding.
   B. Remove the rubber dam and fastereners from the body.
   C. Mask off surrounding surfaces before painting.

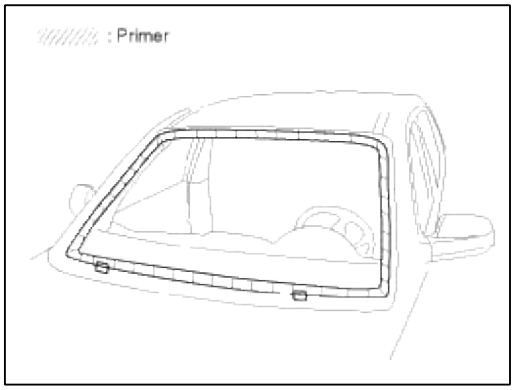
2. Clean the bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.
3. Install the winshield (A) upper molding (B) and fasteners (E).



4. Install the spacer (A) install the windshield glass (B) temporarily with marking sure to position them on the center, and then place the alignment mark (C).
5. Remove the windshield.



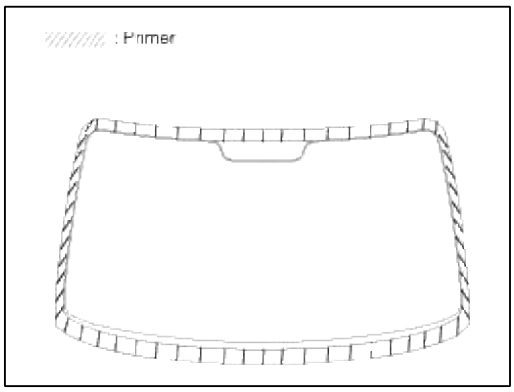
6. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes.
   A. Do not apply glass primer to the body, and be careful not to mix up glass and body primer sponges.
   B. Never touch the primed surfaces with your hands.
   C. Mask off the dashboard before painting the flange.



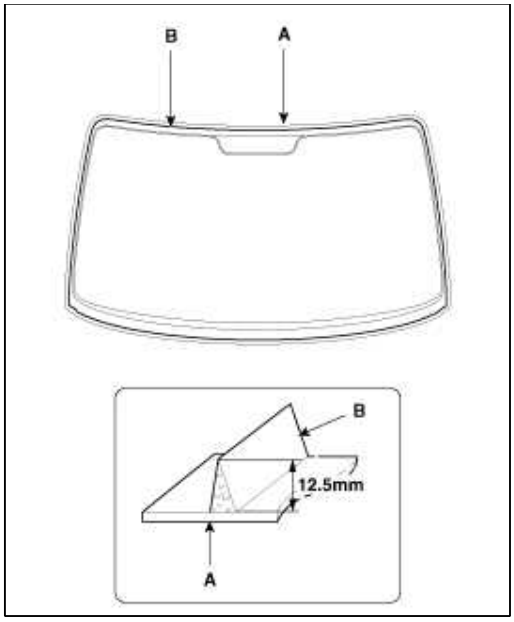
7. Apply a light coat of glass primer to the outside of the fasteners.

NOTE

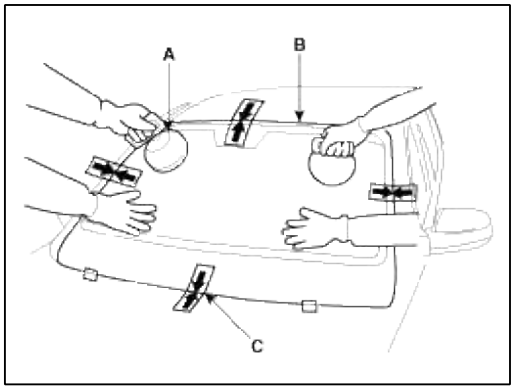
- Never touch the primed surface with your hand. If you do, the adhesive may not bond to the glass properly, causing a leak after the windshield glass is installed.
- Do not apply body primer to the glass.
- Keep water, dust, and abrasive materials away from the primer.



8. Pack adhesive into the cartridge without air pockets to ensure continuous delivery. Put the cartridge in a caulking gun, and run a bead of adhesive (A) around the edge of the windshield (B) between the fastener and molding as shown. Apply the adhesive within 30 minutes after applying the glass primer. Make a slightly thicker bead at each corner.



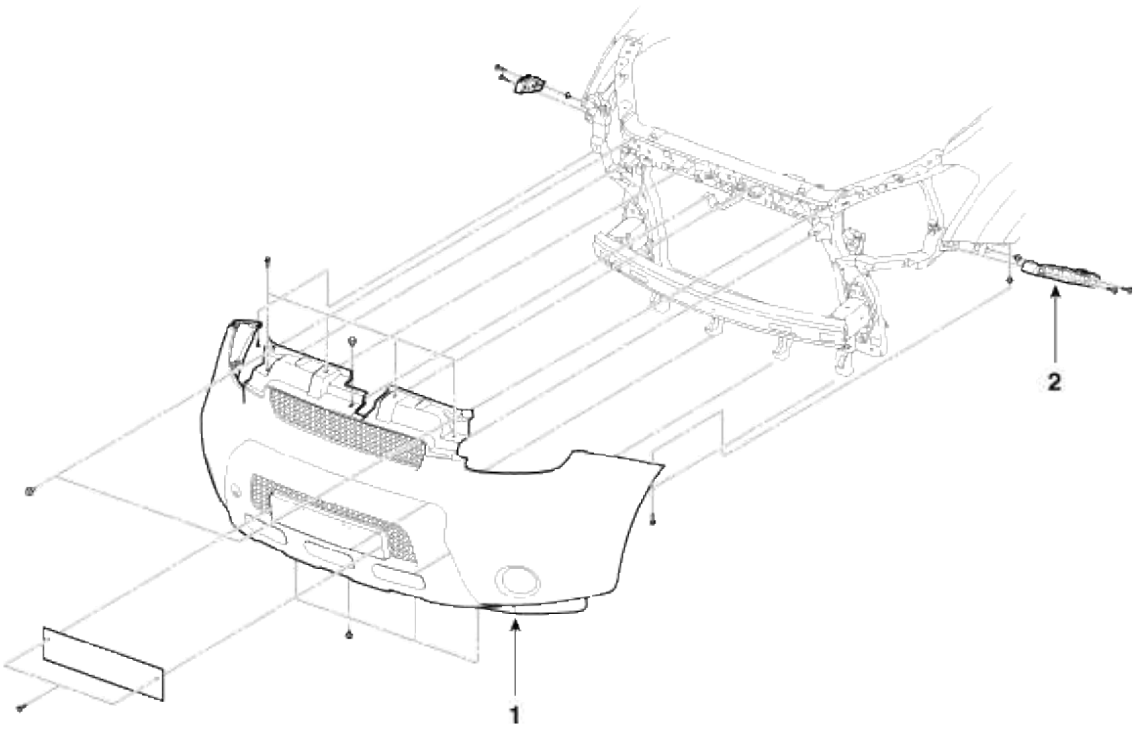
9. Use suction cups (A) to hold the windshield over the opening, align it with the alignment marks (B) made in step 15, and set it down on the adhesive. Lightly push on the windshield until its edges are fully seated on the adhesive all the way around. Do not open or close the doors until the adhesive is dry.



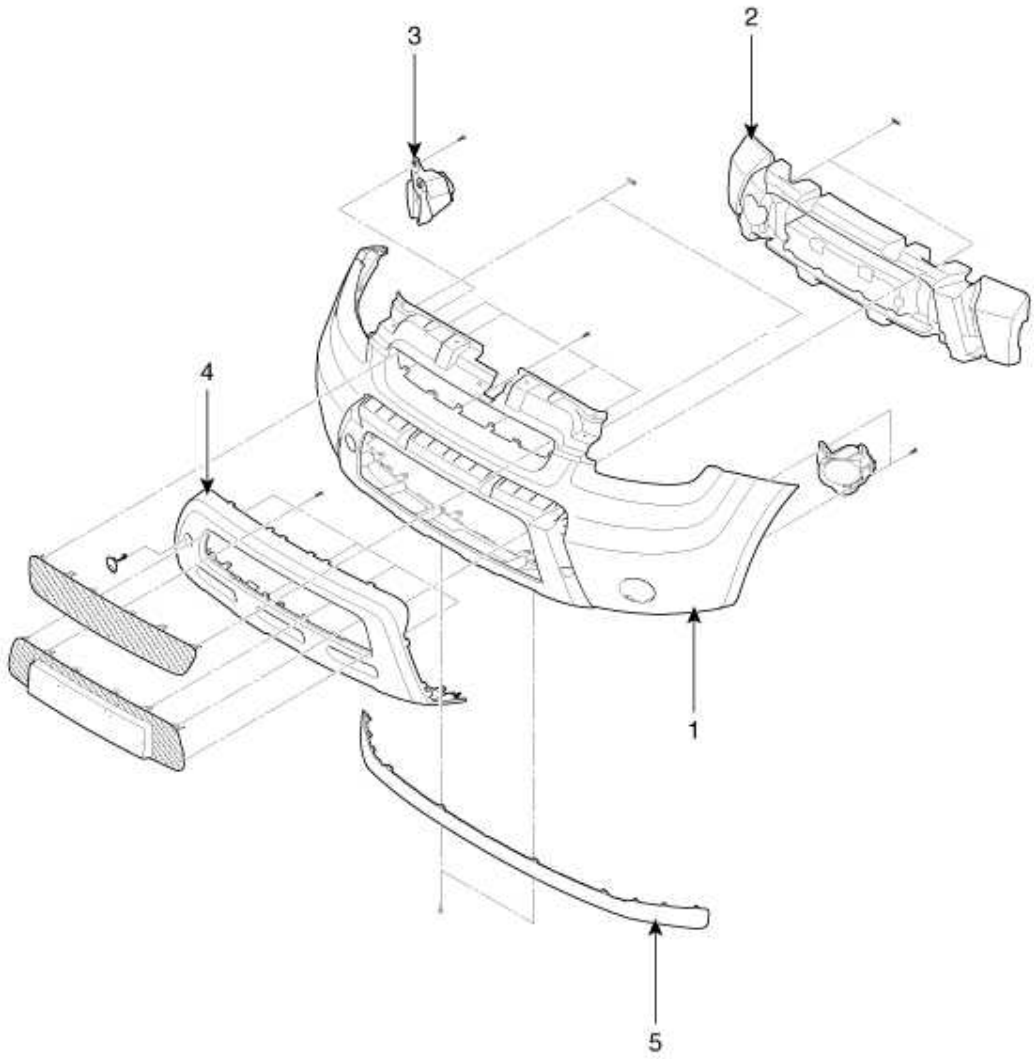
10. Scrape or wipe the excess adhesive off with a putty knife or towel. To remove adhesive from a painted surface or the windshield, wipe with a soft shop towel dampened with alcohol.
11. Let the adhesive dry for at least one hour, then spray water over the windshield and check for leaks. Make leaking areas, and let the windshield dry, then seal with sealant:
    A. Let the vehicle stand for at least four hours after windshield installation. If the vehicle has to be used within the first four, it must be driven slowly.
    B. Keep the windshield dry for the first hour after installation.
12. Reinstall all remaining removed parts. Install the rearview mirror after the adhesive has dried thoroughly. Advise the customer not to do the following things for two the three days:
    A. Slam the door with all the windows rolled up.
    B. Twist the body excessively (such as when going in and out of driveways at an angle or driving over rough, uneven roads)

Body (Interior and Exterior) > Bumper > Front Bumper > Components and Components Location

Components



1. Front bumper cover	2. Front bumper side bracket



1. Front bumper cover 2. Energy absorber 3. Fog lamp	4. Bumper 5. Bumper lip

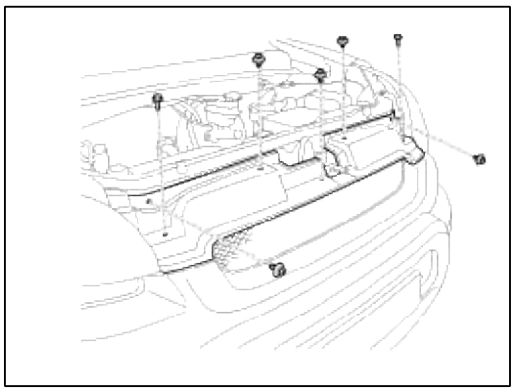
Body (Interior and Exterior) > Bumper > Front Bumper > Repair procedures

Replacement

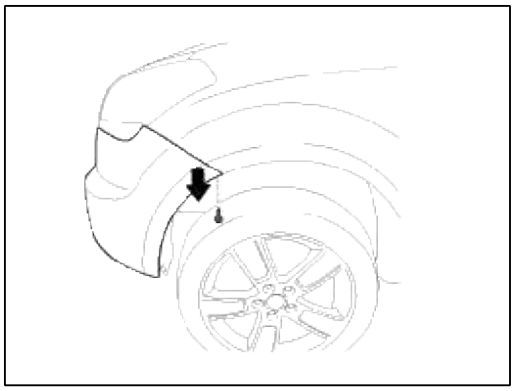
NOTE

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not bend or scratch the cover and other parts.

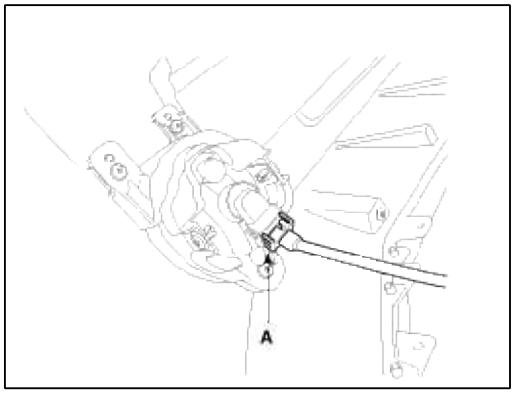
1. Remove the radiator upper mounting clips.



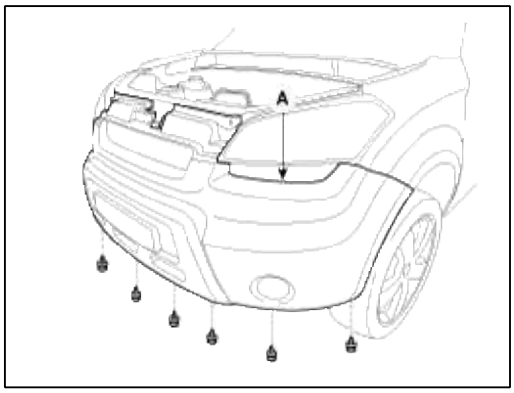
2. Remove the screw.



3. Disconnect the fog lamp connector (A).



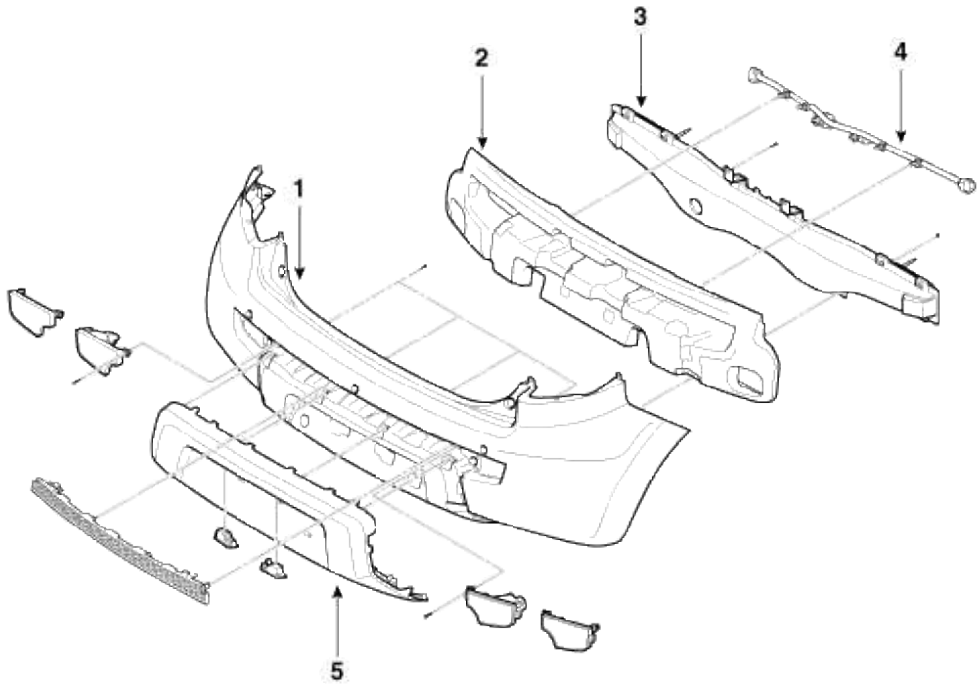
4. Remove the front bumper cover (A).



5. Installation is the reverse of removal.

Body (Interior and Exterior) > Bumper > Rear Bumper > Components and Components Location

Components



1. Rear bumper cover 2. Energy absorber 3. Bumper rail	4. Wiring harness 5. Bumper

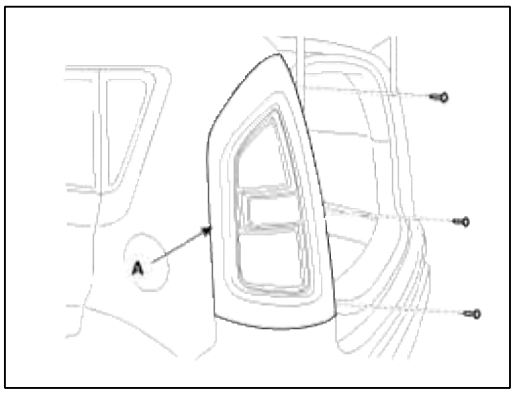
Body (Interior and Exterior) > Bumper > Rear Bumper > Repair procedures

Replacement

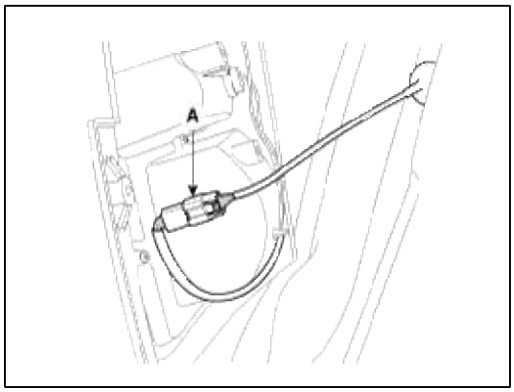
NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts your hands.
- Put on gloves to protect your hands.
- Take care not bend or scratch the cover and other parts.

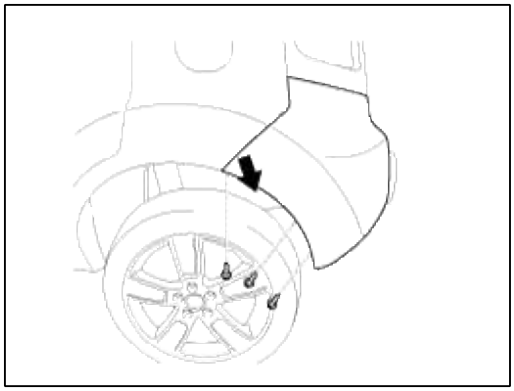
1. Remove the combination lamp (A).



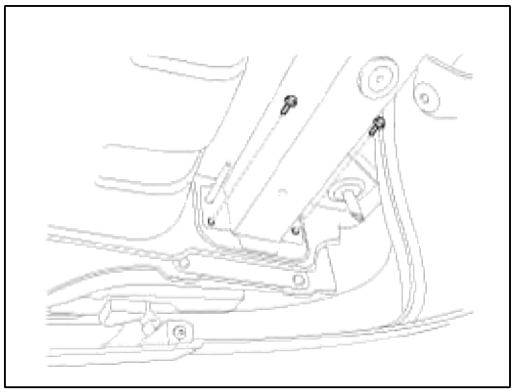
2. Disconnect the connector (A).



3. Remove the screw.

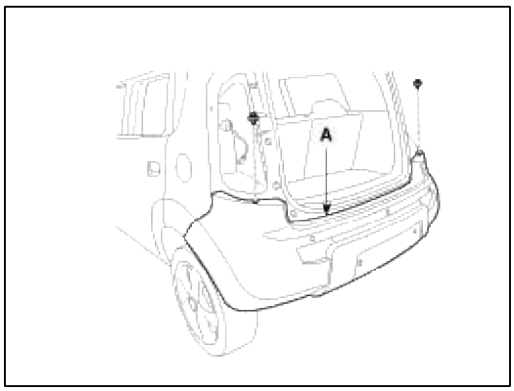


4. Remove the mounting bolts.

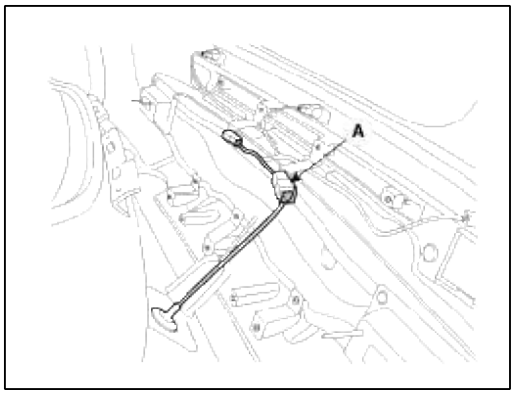


5. Loosen the rear bumper cover screws and clips.

6. Remove the rear bumper cover (A).



7. Disconnect the connector (A).



8. Installation is the reverse of removal.

NOTE

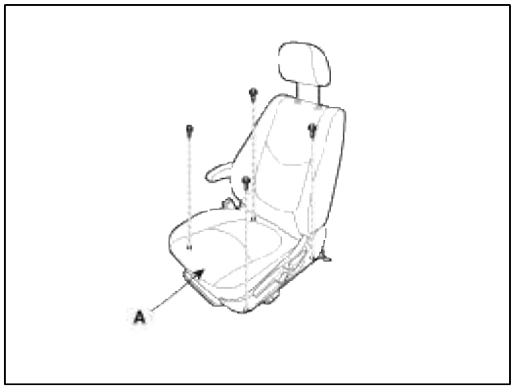
- Replace any damage clips.

Body (Interior and Exterior) > Seat & Power Seat > Front Seat > Repair procedures

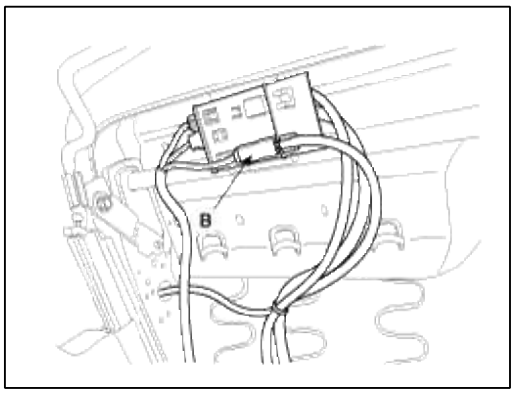
Replacement

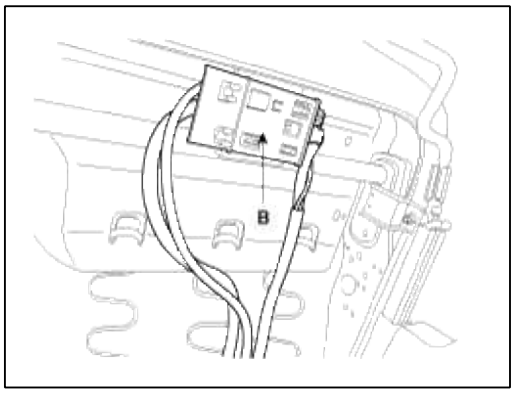
Seat assembly replacement

1. After loosening the seat assembly mounting bolts, remove the seat assembly (A).



2. Disconnect the connectors (B), and remove the seat assembly.





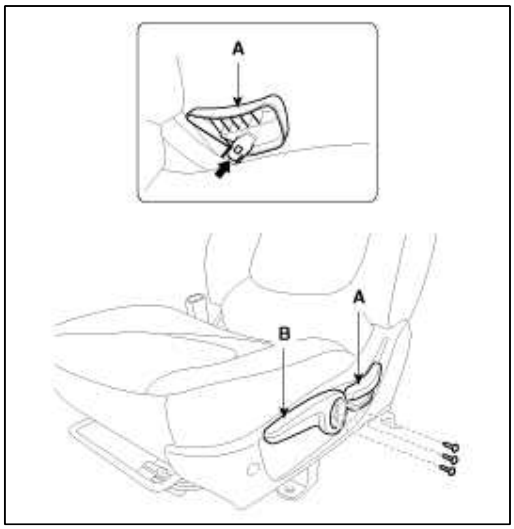
CAUTION

SEAT MOUNTING BOLT INSTALLATION PROCEDURE (manual seat only)

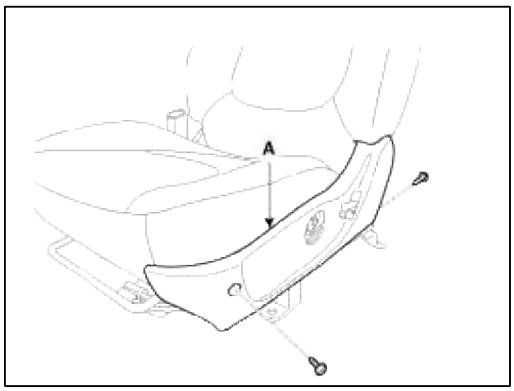
- Set the into the most rearward position. check that each slide is locked, and then tighten the front mounting bolt temporarily.
- Set the seat into most forward position. check that each slide is locked, and then tighten the rear mounting bolt completely.
- Set the seat into the most rearward position. Tighten the front mounting bolt completely.
- Check that the seat operates forward and back smoothy and it properly locks in position

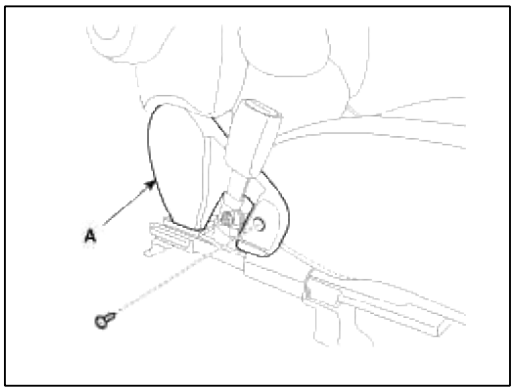
Recliner Cover Replacement

1. Remove the height adjuster knob (B) and recliner (A).



2. Loosen the recliner mounting screw and clip, remove the recliner cover (A).

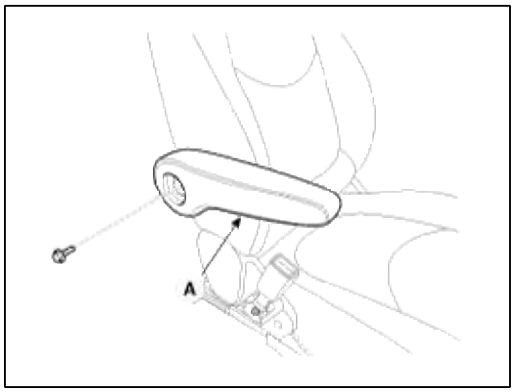




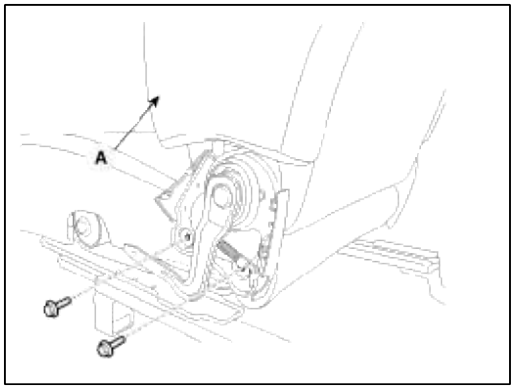
3. Installation is the reverse of removal.

Seat Back Cover Replacement

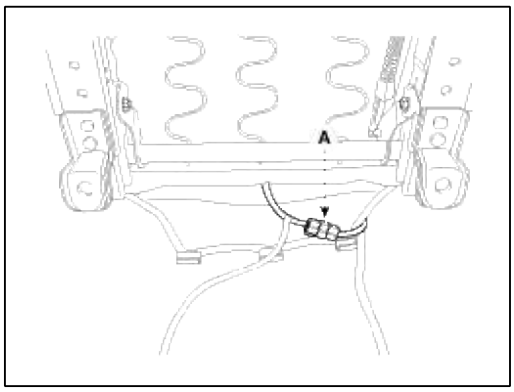
1. Remove front seat assembly.
2. Remove the headrest.
3. Loosen the armrest mounting bolt, remove the armrest (A).



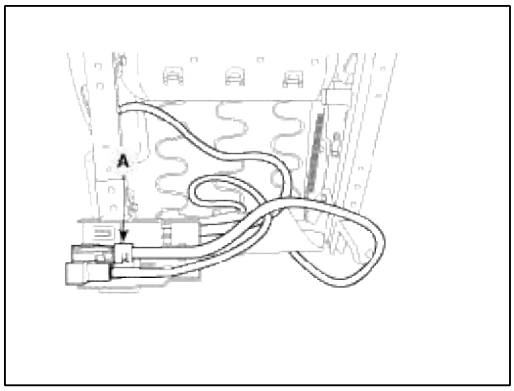
4. Remove the seat back assembly (A).



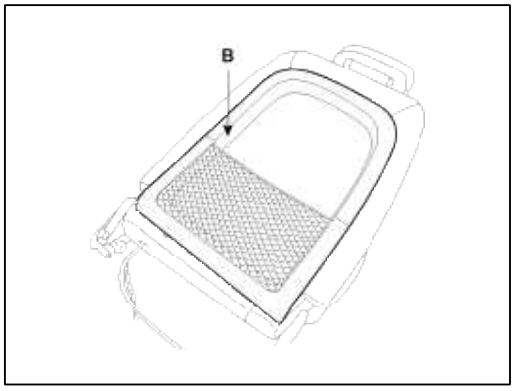
5. Disconnect the connector (A).



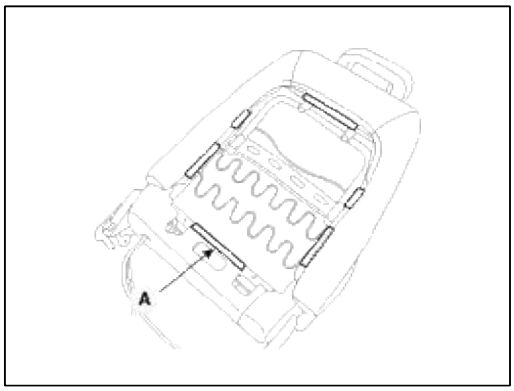
6. Disconnect the air bag wiring (A).



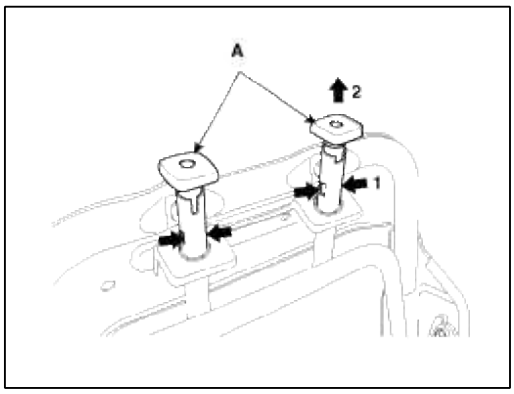
7. Remove the seat back panel (B).



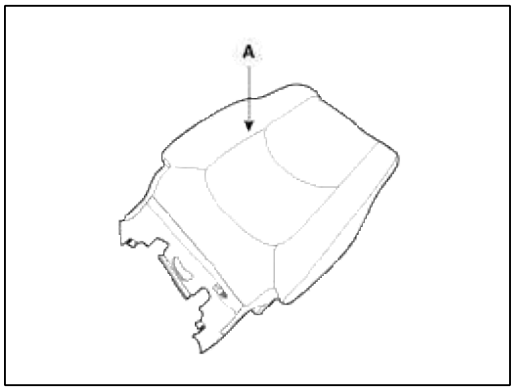
8. Disconnect the protector (A) from the back frame.



9. Remove the headrest and headrest guide (A).



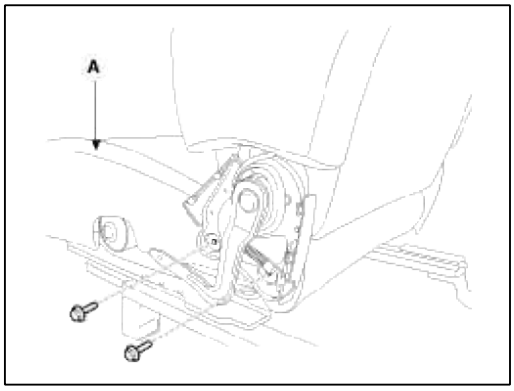
10. After removing the hogring clip on the front of seat back and remove the seat back cover (A).



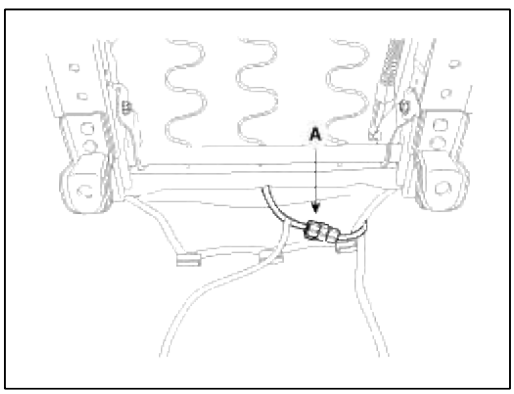
11. Installation is the reverse of removal.

Seat Cushion Cover Replacement

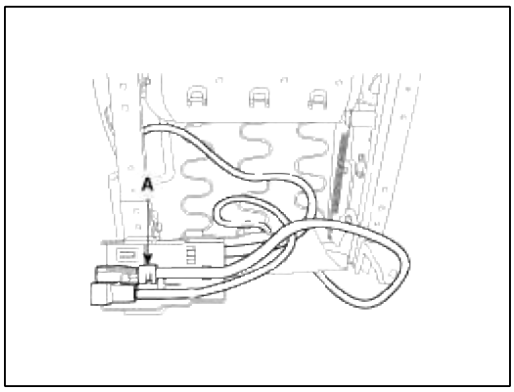
1. Remove front seat assembly.
2. Remove the recliner cover.
3. Remove the seat cushion assembly (A).



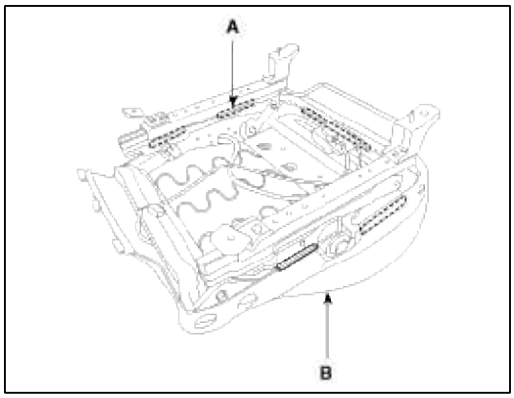
4. Disconnect the heater connector (A).



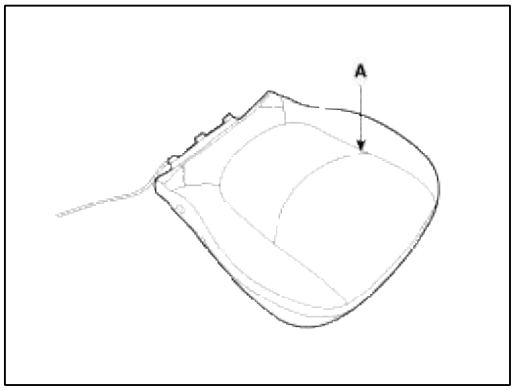
5. Disconnect the air bag wiring (A).



6. After disconnect the protector (A), then remove the seat cushion (B).



7. After removing the hogring clips on the front of seat cushion and remove the seat cushion cover (A).



8. Installation is the reverse of removal.

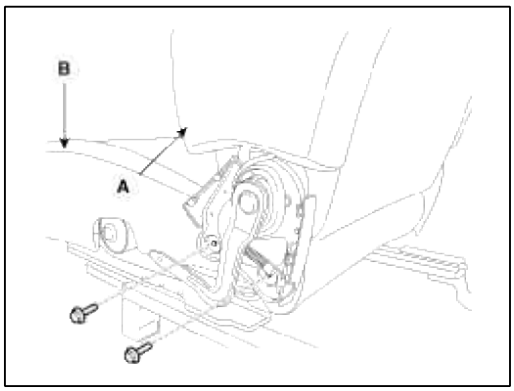
Seat Frame Replacement

1. Remove the following items.
   A. Recliner cover.
   B. Seat back panel.
   C. Headrest guide.

2. After removing the mounting bolts, then disconnect the seat back frame (A) and seat cushion frame (B).

NOTE

- Remove the side air bag for replacing side air bag installation seat.
- Before service, be fully aware of precautions and service procedure relevant to air bag (Refer to page RT-Airbag)



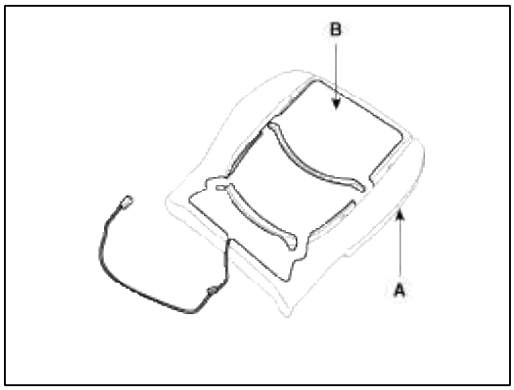
3. Remove the seat back cover.
4. Remove the seat cushion cover.
5. Installation is the reverse of removal.

Seat Cushion Heater Replacement

1. Remove the seat cushion cover.
2. Cut the heater (B) attached to the pad (A), as shown in the picture.

CAUTION

- Take care not to damage the slave pad.sponge.



3. Install the seat cushion cover.
   A. Detach the paper from the back of the heater assembly.
   B. Attach the heater to the main part of the sponge.

CAUTION

- Be sure to match the heater with main appearance.

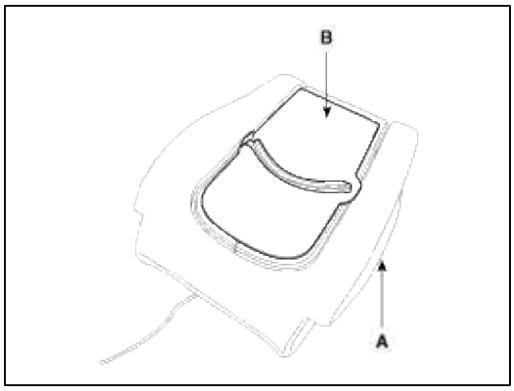
Seat Back Heater Replacement

1. Remove the seat back cover.

2. Cut the heater (B) attached to the pad (A), as shown in the picture.

CAUTION

- Take care not to damage the slave pad.



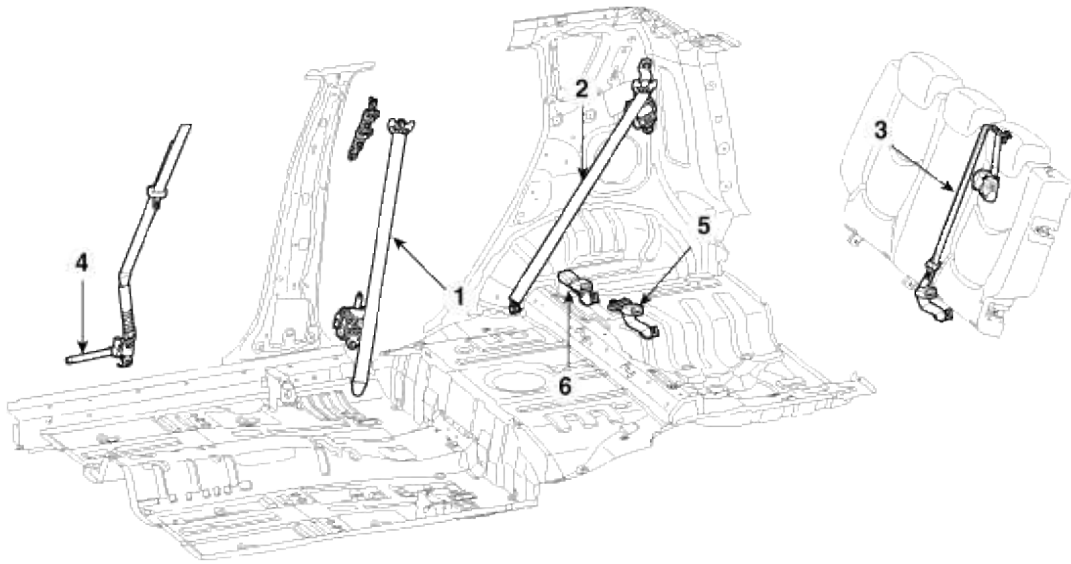
3. Install the seat back cover.
   A. Detach the paper from the back of the heater assembly.
   B. Attach the heater to the main part of the sponge.

CAUTION

- Be sure to match the heater with main appearance.

Body (Interior and Exterior) > Seat Belt > Front Seat Belt > Components and Components Location

Components



1. Front seat belt	4. Front seat belt buckle
2. Rear seat belt	5. Rear center 2-point seat belt
3. Rear center 3-point seat belt	6. Rear center seat buckle

Body (Interior and Exterior) > Seat Belt > Front Seat Belt > Repair procedures

Replacement

Front Seat Belt Replacement

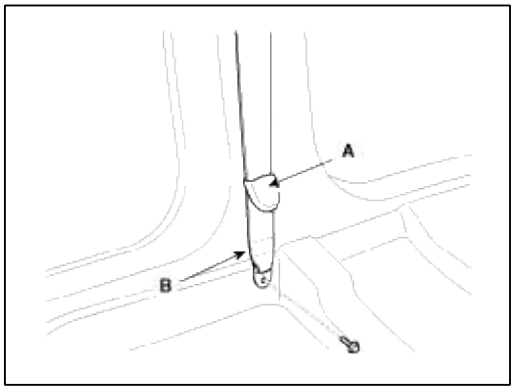
CAUTION

- When installing the belt, make sure not to damage the pretensioner.

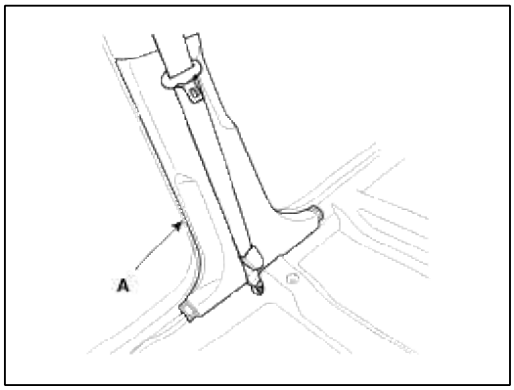
1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the following items fist.
   A. Front seat assembly.
   B. Door scuff trim.

3. After raise the lower anchor cover (A), loosen the lower anchor mounting bolt (B).

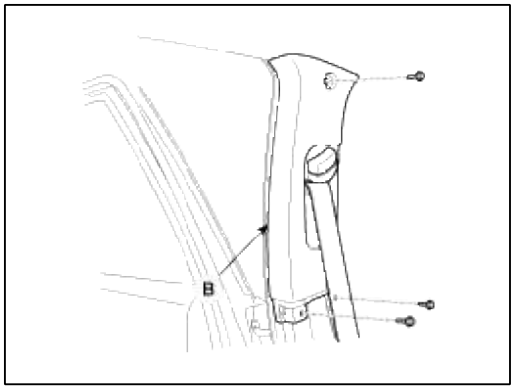
Tightening torque :
39.2~53.9 N.m (4.0~5.5kgf.m, 28.9~39.8lb-ft)



4. Remove the center pillar lower trim (A).



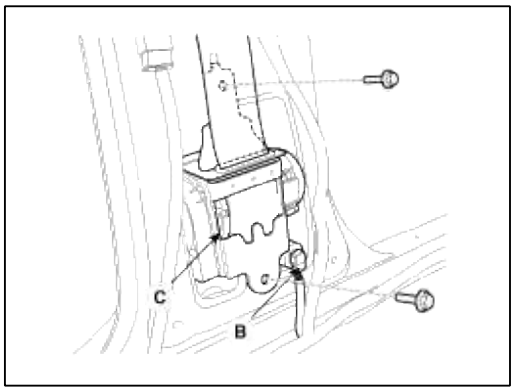
5. Remove the center pillar upper trim (B).



6. Remove the upper anchor (A).



7. After disconnecting the pretensioner connector lock pin, remove the pretensioner squib connector (B), Loosen the mounting bolt, then remove the pretensioner (C).

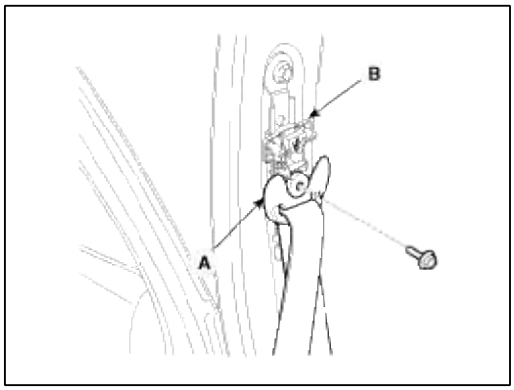


8. Installation is the reverse of removal.

Hight adjuster replacement

1. Remove the following items first.
   A. Front seat assembly.
   B. Door scuff trim.
   C. Front seat belt.
   D. Center pillar trim.
2. Remove the upper anchor (A).
3. After loosening the mounting bolt, then remove the height adjuster (B).

Tightening torque :
39.2~53.9 N.m (4.0~5.5kgf.m, 28.9~39.8lb-ft)



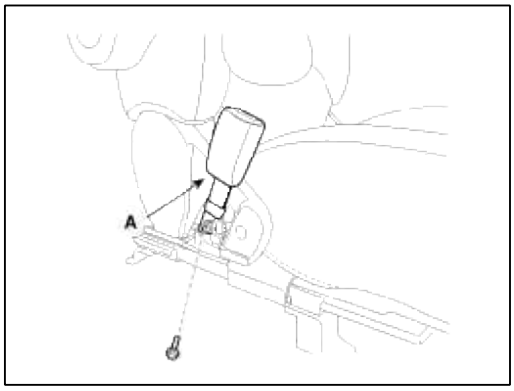
4. Installation is the reverse of removal.

Front Seat Belt Buckle Replacement

1. Remove the following items first.
   A. Front seat assembly.
2. Remove the wire harness of buckle from seat.

3. Remove the seat belt buckle (A).

Tightening torque :
39.2~53.9 N.m (4.0~5.5kgf.m, 28.9~39.8lb-ft)



4. Installation is the reverse of removal.

Body (Interior and Exterior) > Seat Belt > Rear Seat Belt > Repair procedures

Replacement

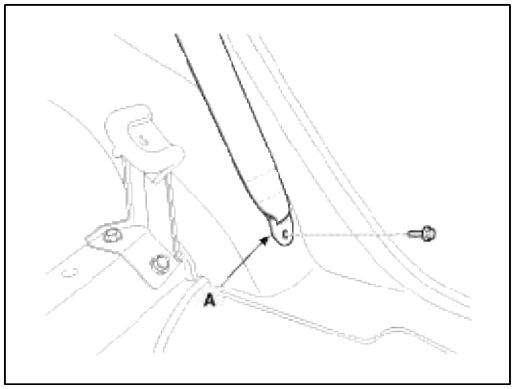
Seat belt relacement

CAUTION

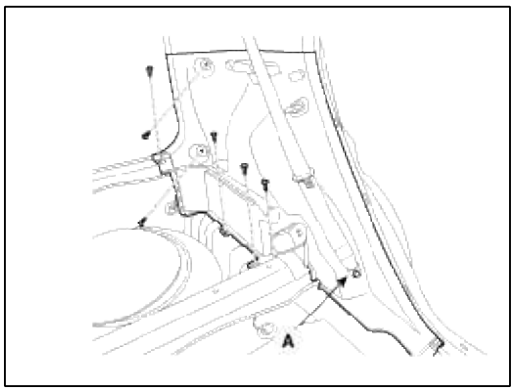
- When installing the belt, make sure not to damaged the pretensioner.

1. Remove the following items first.
   A. Rear seat assembly.
   B. Rear door scuff trim.
   C. Tranverse trim.
2. Remove the lower anchor (A).

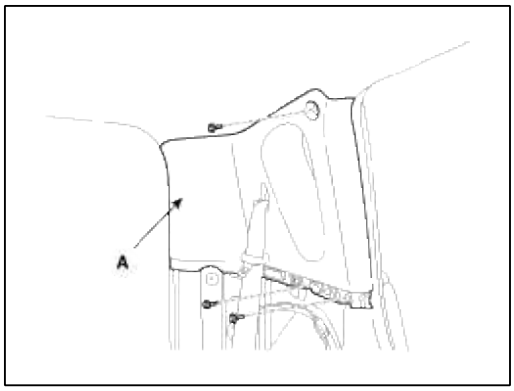
Tightening torque :
39.2~53.9 N.m (4.0~5.5kgf.m, 28.9~39.8lb-ft)



3. Remove the luggage side trim (A).

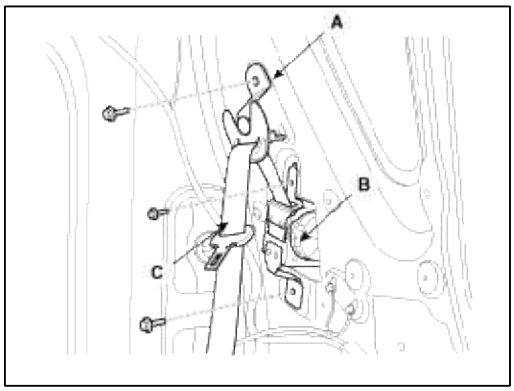


4. Remove the rear pillar trim (A).



5. After loosening the retractor (B) mounting bolt, remove the rear seat belt (C).
6. Remove the upper anchor (A).

Tightening torque :
39.2~53.9 N.m (4.0~5.5kgf.m, 28.9~39.8lb-ft)



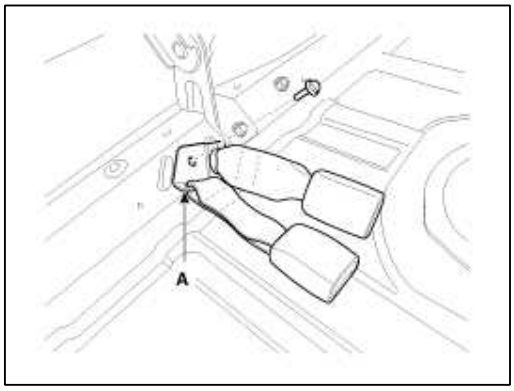
7. Installation is the reverse of removal.

Rear Seat Belt Buckle Replacement

1. Remove the rear seat assembly.

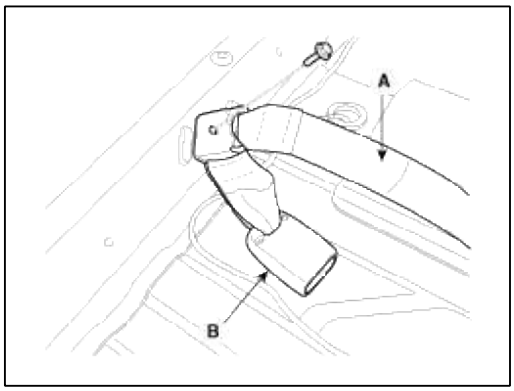
2. Remove the seat belt buckle (A).

Tightening torque :
39.2~53.9 N.m (4.0~5.5kgf.m, 28.9~39.8lb-ft)



3. Loosen the mounting bolt, remove the center seat belt (A) and buckle (B).

Tightening torque :
39.2~53.9 N.m (4.0~5.5kgf.m, 28.9~39.8lb-ft)



4. Installation is the reverse of removal.

SOUL(AM) > 2010 > G 1.6 DOHC > Body Electrical System

Body Electrical System > General Information > General Information

General Troubleshooting Information

Before Troubleshooting

1. Check applicable fuses in the appropriate fuse/relay box.
2. Using the battery checker (MCR-570 KIT), check the battery for damage, state of charge, and clean and tighten connections.
   (Refer to the Engine Electrical System - "Battery")

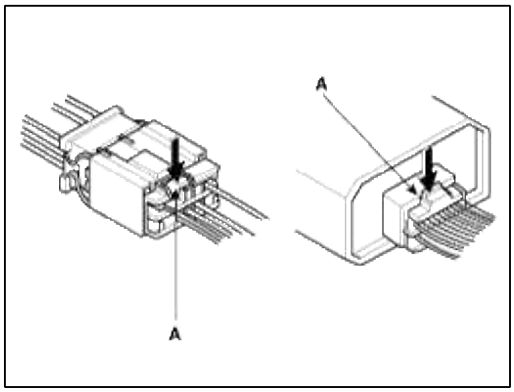
NOTE

- Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
- Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely damage the wiring.

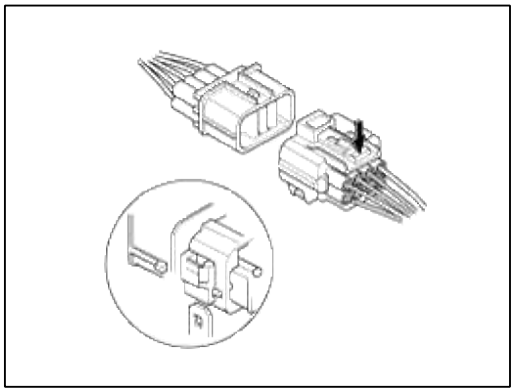
3. Check the alternator belt tension.

Handling Connectors

1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).

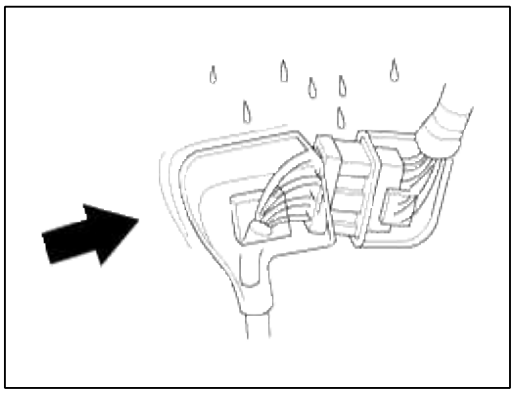


4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).

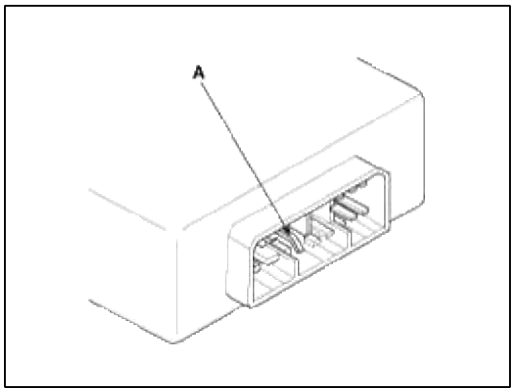


6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.

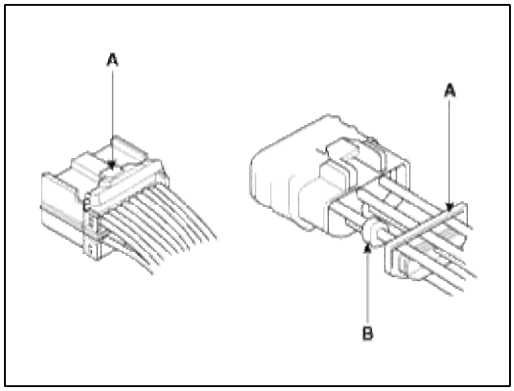
7. Always reinstall plastic covers.



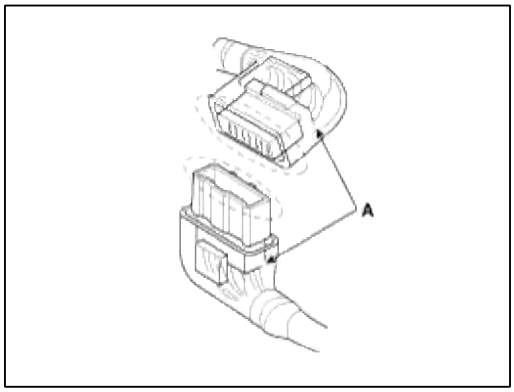
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



9. Check for loose retainer (A) and rubber seals (B).

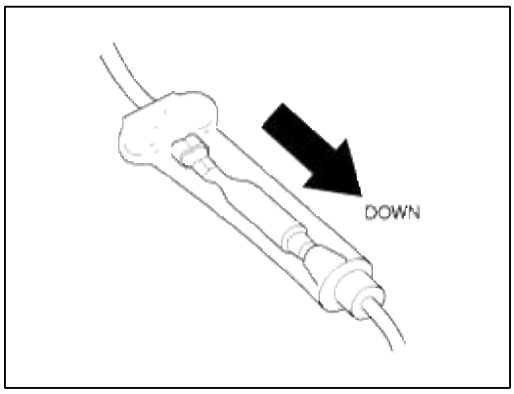


10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.



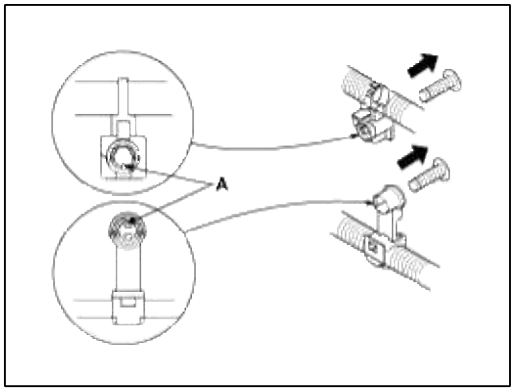
11. Insert the connector all the way and make sure it is securely locked.

12. Position wires so that the open end of the cover faces down.

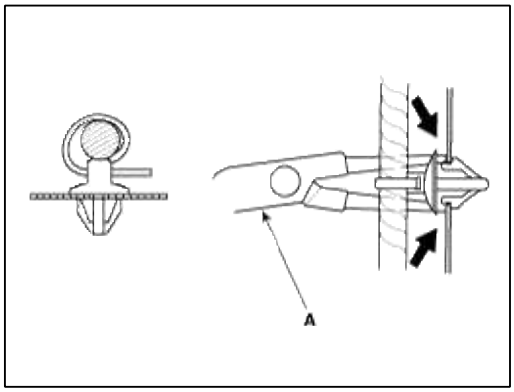


Handling Wires And Harnesses

1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).

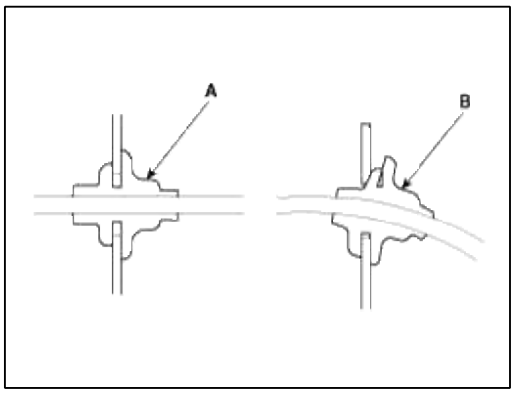


3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



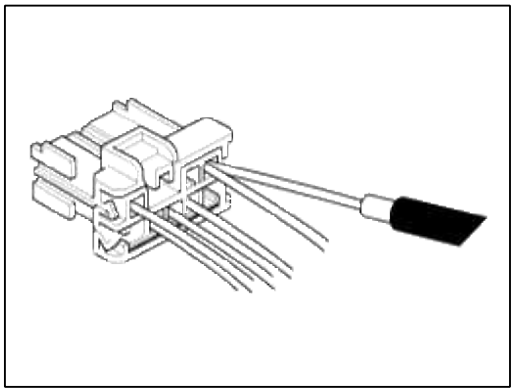
4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.

6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).

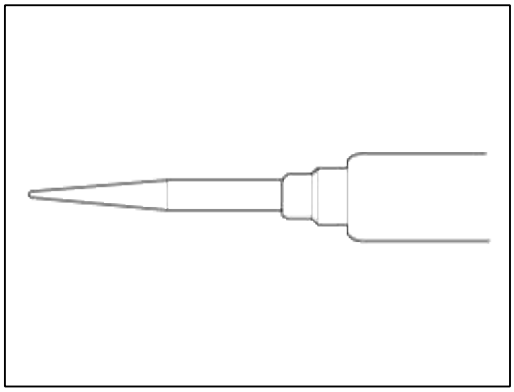


Testing And Repairs

1. Do not use wires or harnesses with broken insulation.
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.
3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the remover tool from the wire side (except waterproof connector).



5. Use a probe with a tapered tip.
   Refer to the user's guide in the wiring repair kit (Pub No. : TRK 015.)



Five-step Troubleshooting

1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.

3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.
5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Battery Reset

Description

When reconnecting the battery cable after disconnecting, recharging battery after discharged or installing the memory fuse located on the driver's side panel after removing, be sure to reset systems mentioned on the below table.
In addition, when replacing or reinstalling their fuses after removing, they should be reset according to the below table. Please refer to the below table when servicing.

System	Resetting
Sunroof	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, the sunroof system must be reset according to the procedure below. 1) Turn the ignition switch to the ON position. 2) According to the position of the sunroof, do the following. - In case the sunroof is closed completely or tilted: Push the sunroof control lever upward until the sunroof tilts completely upward. - In case the sunroof is open: Push the sunroof control lever forward until the sunroof closes completely. Push the sunroof control lever upward until the sunroof tilts completely upward. 3) Release the sunroof control lever. 4) Push the sunroof control lever upward until the sunroof has returned to the original tilt position after it is raised a little higher than the maximum tilt position. Then, release the lever. 5) Push the sunroof control lever upward until the sunroof operates as follows; TILT DOWN → SLIDE OPEN → SLIDE CLOSE Then, release the lever.
Trip computer	When the battery is disconnected and reconnected, the set functions of the trip computer become initialized. So, you need to explain this information to the customer.
Clock	Whenever the battery terminals or related fuses are disconnected, you must reset the time. When the ignition switch is in the ACC or ON position, the clock buttons operate as follows: 1. Press the SETUP button for more than 1 second. If the audio is turned on, push the SETUP button and select the clock mode turning the TUNE knob. 2. Adjust the hour and press the ENTER button to set. 3. Use the same method to adjust the minute and press the ENTER button to complete.
Audio	When the battery is disconnected and reconnected, the customer's radio stations become initialized. So, you need to record the customer's radio stations prior to service, and after service, set the customer's radio stations into the audio.

Body Electrical System > Audio > Specifications

Specification

Audio

Item		Specification	
Model		Radio/CD/MP3 (Internal Amp)	Radio/CD/MP3 (External Amp)
Power supply		DC 14.4V	
Rated output		Min 14W	
Antenna		80PF 75Ω	
Tuning type		PLL synthesized type	
Frequency range / Channel space	FM	87.5~107.9 MHz / 200KHz	
	AM	530~1710 KHz (10KHz)	

Speaker

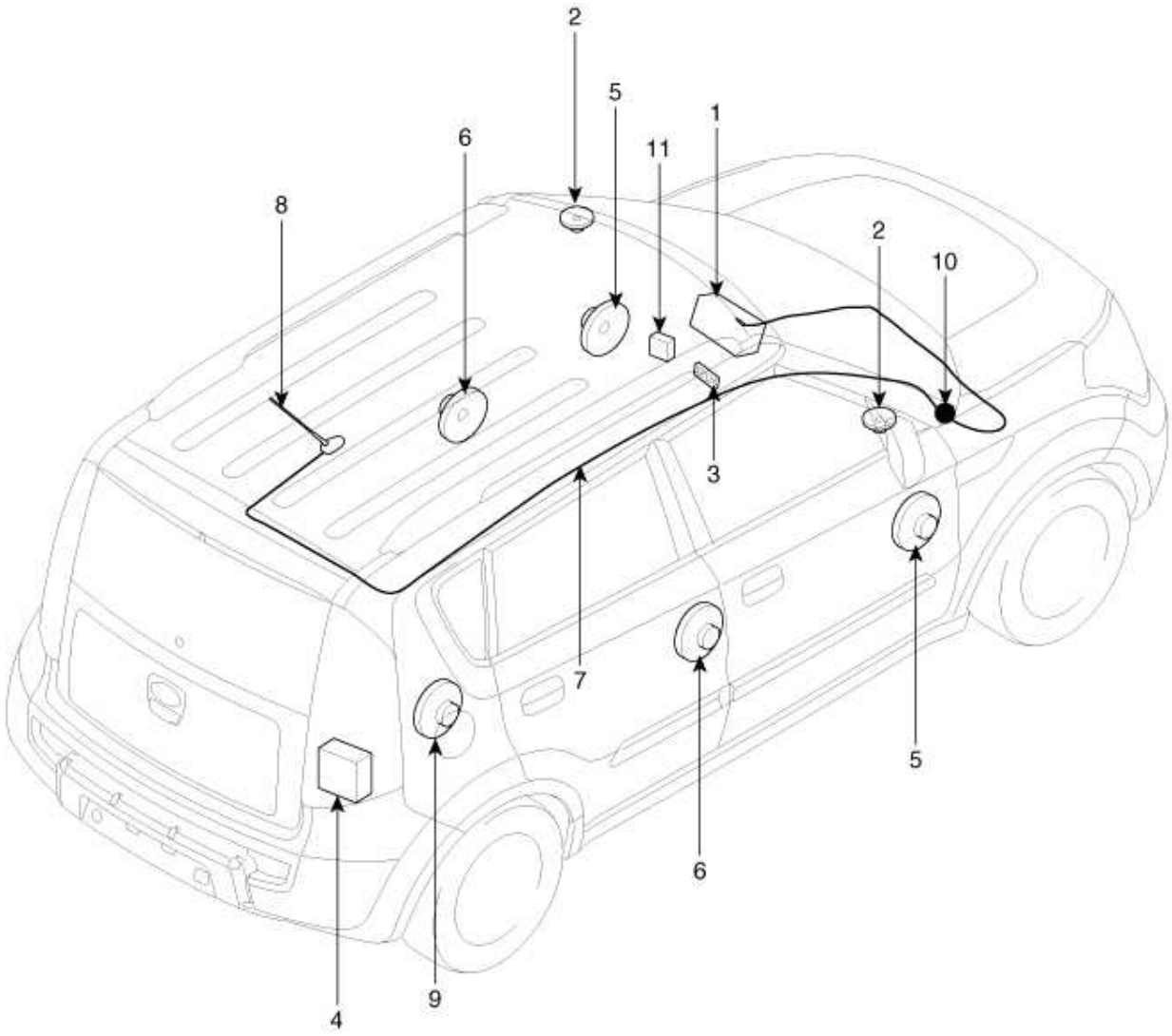
Item		Specification
Input Power (W)	Front	20 (Max. 40)
	Rear	20 (Max. 40)
	Tweeter	20 (Max. 40)
	Center	20 (Max. 40)
	Woofer	20 (Max. 40)
Speaker Impedance (Ω)	Front	4.0 ± 0.6, 2.0 ± 0.3 (External Amp)
	Rear	4.0 ± 0.6, 2.0 ± 0.3 (External Amp)
	Tweeter	4.0 ± 0.6
	Center	2.0 ± 0.3
	Woofer	2.0 ± 0.3
Speaker Number		8

External Amplifier

Item	Specification
Power Supply	DC 14.4V
Output Power (W)	315W (45×7CH)
LOAD Impedance (Ω)	2

Body Electrical System > Audio > Components and Components Location

Component Location



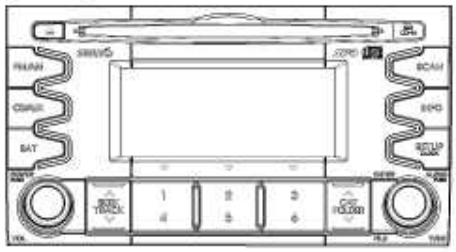
1. Audio unit	7. Antenna feeder cable
2. Tweeter speaker	8. Roof antenna
3. AUX Jack / USB Port	9. Woofer speaker
4. External amplifier	10. Antenna cable connector
5. Front door speaker	11. Advanced lighting speaker unit
6. Rear door speaker	

Body Electrical System > Audio > Audio Unit > Components and Components Location

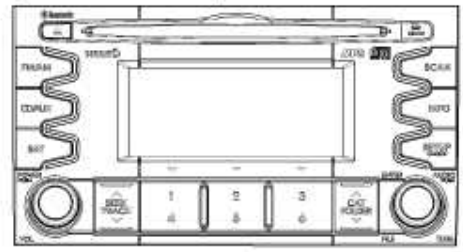
Components

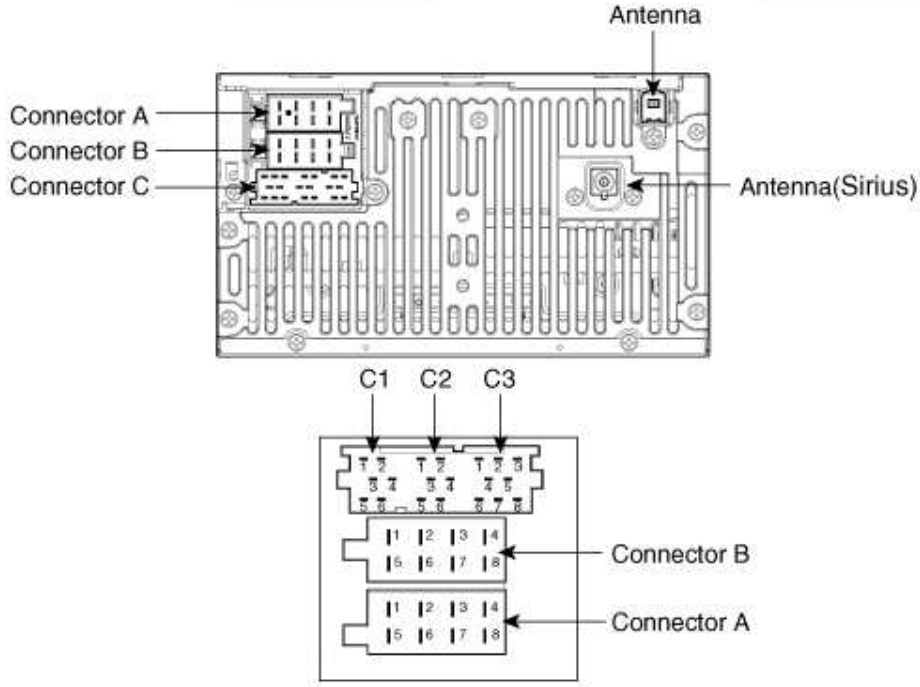
[Radio/CD/MP3]

[Sirius]



[Sirius/Bluetooth]

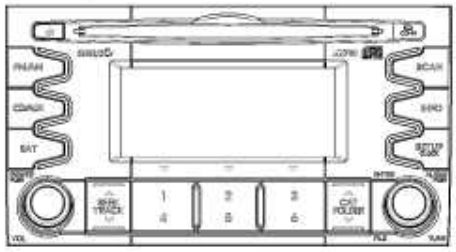




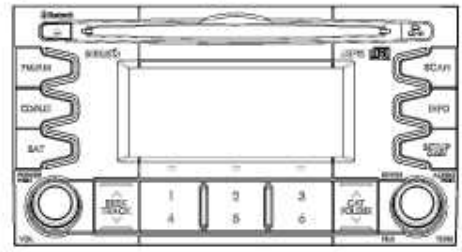
NO	Connector A	Connector B	Connector C1	Connector C2	Connector C3
1	Speed	Speaker RR+	MIC +	AUX R IN	E. AMP mute
2	ILL (+)	Speaker FR+	MIC -	AUX L IN	USB D-/iPod TX
3	Remote anntena	Speaker FL+	EQ select	AUX REF	CAN low
4	Batt +	Speaker RL+	Detent	AUX detect	USB D+/iPod RX
5	Temp	Speaker RR-	Tel mute	Remote contl +	IPOD/USB GND
6	ACC	Speaker FR-	GND	Remote GND	Remote E.AMP
7	ILL (-)	Speaker FL-			USB/IPOD VDO
8	Power GND	Speaker RL-			CAN high

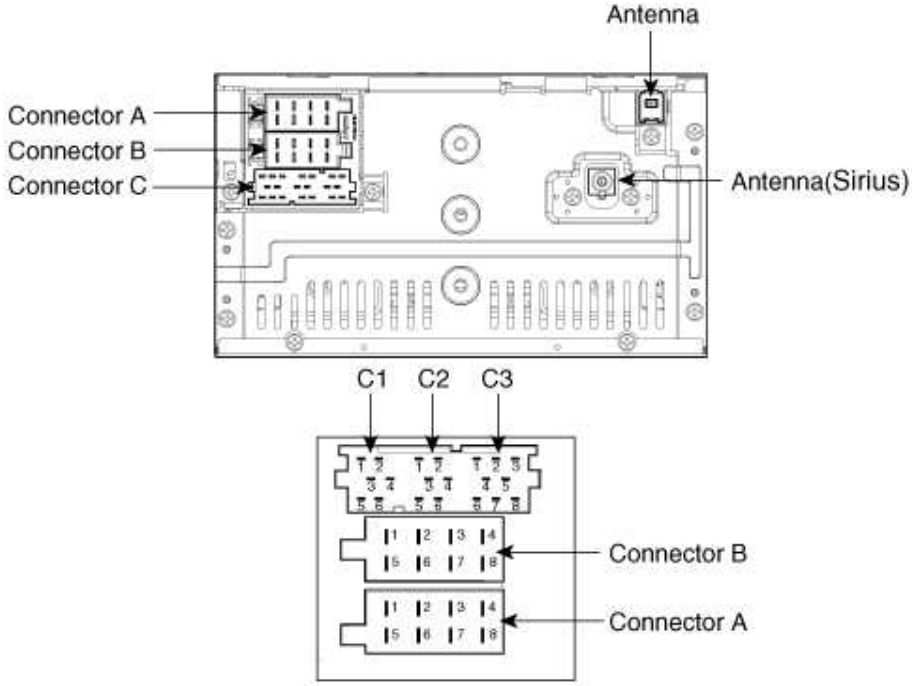
[Radio/CDC/MP3/Ex. Amp]

[Sirius]



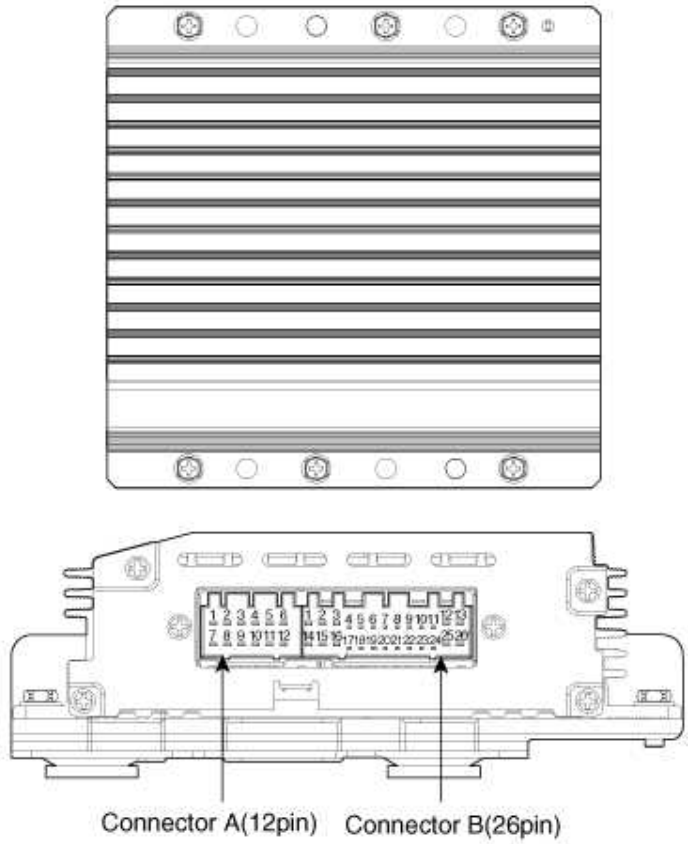
[Sirius/Bluetooth]





NO	Connector A	Connector B	Connector C1	Connector C2	Connector C3
1	Speed	Speaker RR+	MIC +	AUX R IN	E. AMP mute
2	ILL (+)	Speaker FR+	MIC -	AUX L IN	USB D-/iPod TX
3	Remote anntena	Speaker FL+	EQ select	AUX REF	CAN low
4	Batt +	Speaker RL+	Detent	AUX detect	USB D+/iPod RX
5	Temp	Speaker RR-	Tel mute	Remote contl +	IPOD/USB GND
6	ACC	Speaker FR-	GND	Remote GND	Remote E.AMP
7	ILL (-)	Speaker FL-			USB/IPOD VDO
8	Power GND	Speaker RL-			CAN high

[External Amplifier]



NO	Connector A
1	Tweeter R out +
2	Tweeter L out +
3	Rear right out +
4	Rear left out +
5	-
6	Center out +
7	Tweeter R out -
8	Tweeter L out -
9	Rear right out -
10	Rear left out -
11	-
12	Center out -

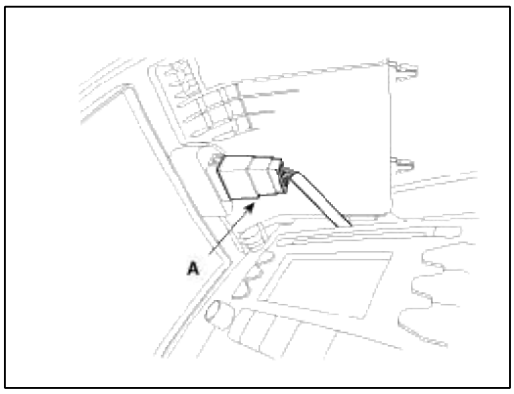
NO	Connector B	NO	Connector B
1	Front right out +	14	Front right out -
2	Front left out +	15	Front left out -
3	-	16	-
4	-	17	-
5	-	18	-
6	Rear left in +	19	Rear left in -
7	Rear right in +	20	Rear right in -
8	Front left in +	21	Front left in -
9	Front right in +	22	Front right in -
10	Mode	23	-
11	Remote	24	Mute
12	GND	25	GND
13	B+	26	B+

Body Electrical System > Audio > Audio Unit > Repair procedures

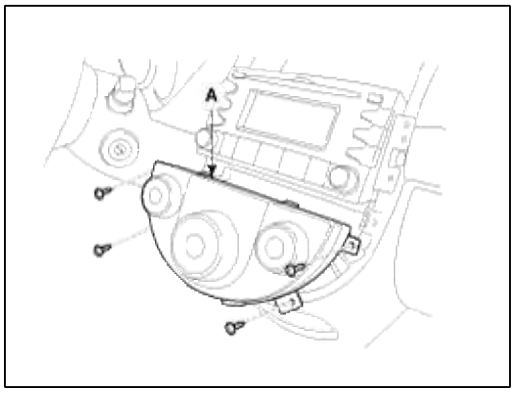
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad center facia panel.
   (Refer to the Body group - "Crash pad")

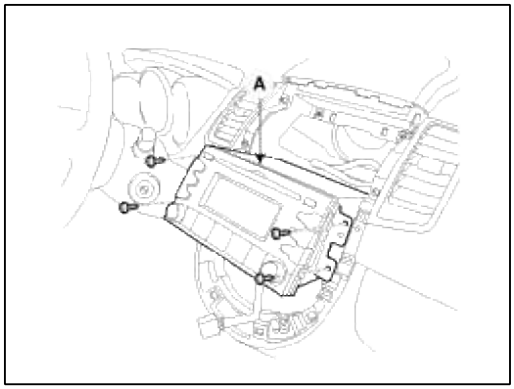
3. Disconnect the connector(A) from the crash pad center facia panel.



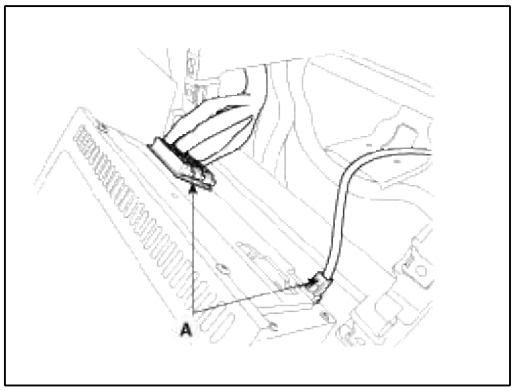
4. Remove the heater control unit(A).



5. Remove the mounting bolts then remove the audio unit(A).

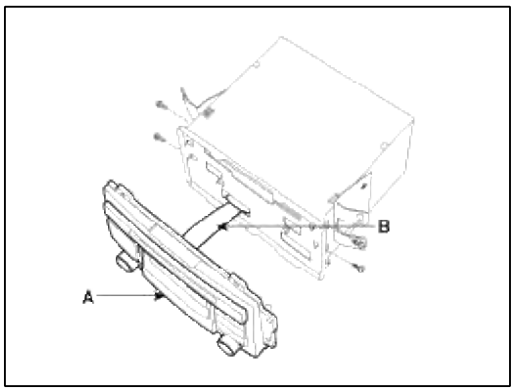


6. Disconnect the audio connectors and cable(A).

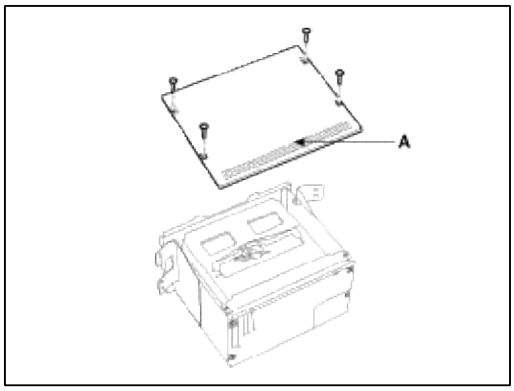


Disassembly

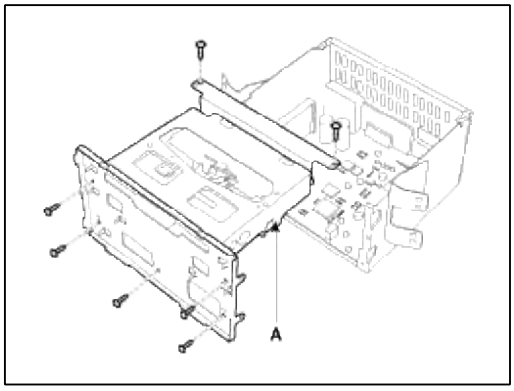
1. Disassemble the front panel(A) then disconnect the connector(B) between the unit and front panel.



2. Remove the top cover(A) after loosening 4 screws.



3. Disassemble the deck (A) from the unit after removing the connector and screws.



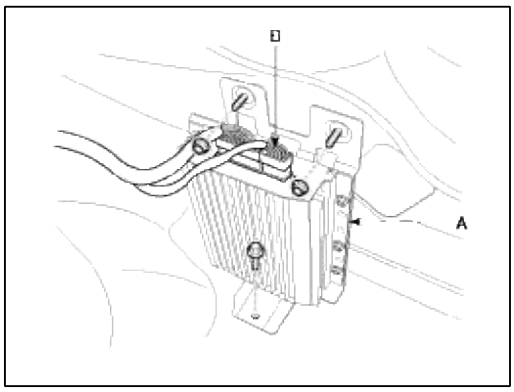
Reassembly

1. Reassemble the deck to the audio unit.
2. Reassemble the top cover.
3. Reassemble the front panel and connect the connector.

External Amplifier

1. Remove the right side trunk trim and disconnecting the connector.
   (Refer to the Body group - "Interior trim")

2. Remove the external amplifier(A) after loosening the nuts (2EA), bolt (1EA) and connector (B).



Installation

1. Connect the audio unit connectors and cable.
2. Install the audio unit.
3. Install the crash pad center facia panel.
4. Install the upper tray.
5. Check the audio system.

NOTE

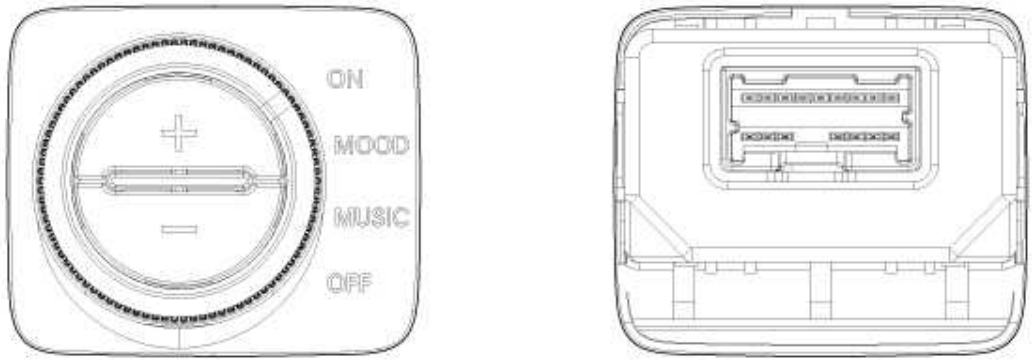
- Make sure the audio head unit connectors are plugged in properly, and the antenna cable is connected properly.

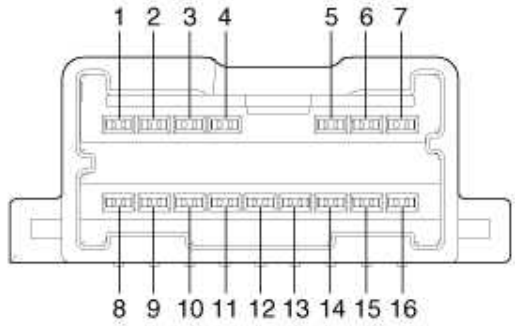
External Amplifier

1. Install the external amplifier and connect the external amplifier connector.
2. Install the right side trunk trim.

Body Electrical System > Audio > Speakers > Components and Components Location

Components

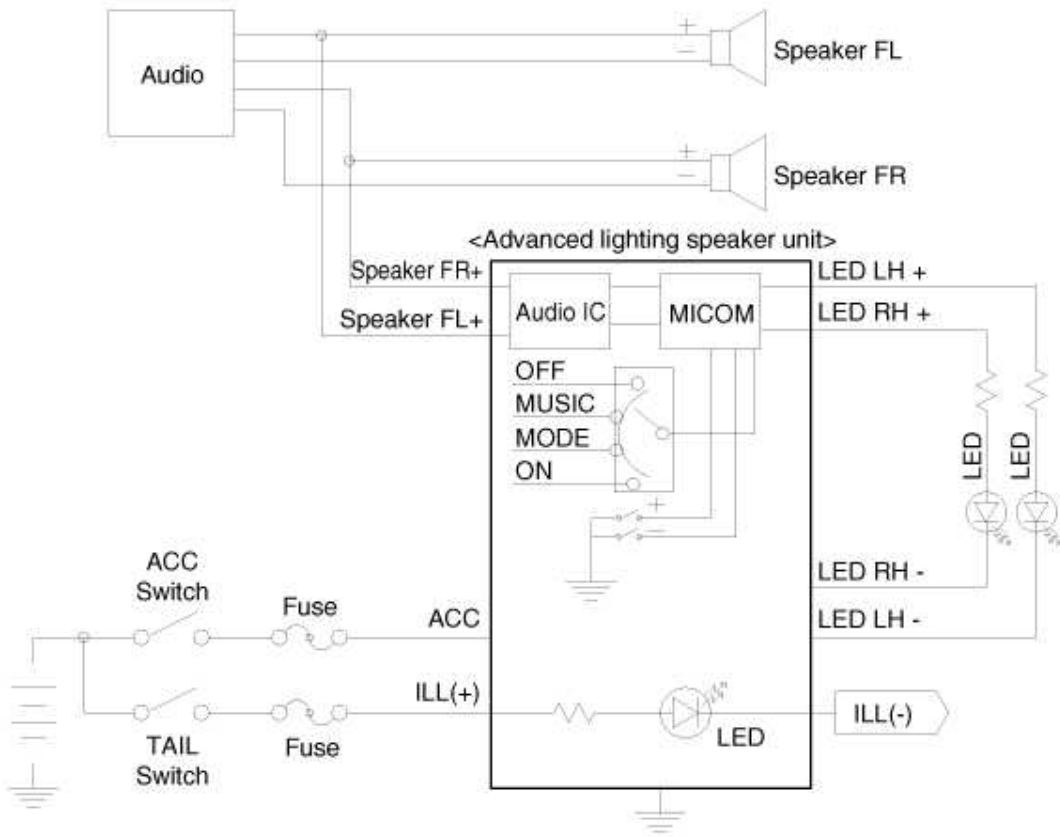




NO	Description	NO	Description
1	Speaker FR+	9	-
2	-	10	GND
3	Remote Ext. AMP	11	Illumination -
4	LED LH +	12	LED LH -
5	LED RH +	13	LED RH -
6	ACC	14	-
7	-	15	-
8	Speaker FL+	16	Illumination +

Body Electrical System > Audio > Speakers > Schematic Diagrams

Circuit diagram



Body Electrical System > Audio > Speakers > Description and Operation

Description

Advanced lighting speaker

The advanced lighting speaker that lights around the front speaker is adjusted by turning the knob.

- ON : The light turns on.
- MOOD : The light shade changes automatically at regular interval.
- MUSIC : The light blinks or changes shade according to the sound of audio.
- OFF : The light turns off.
- +/- : When the lights are on, push the illumination button to adjust the light intensity.

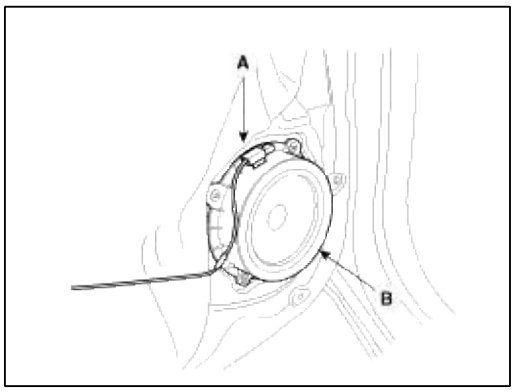
Body Electrical System > Audio > Speakers > Repair procedures

Removal

Front Speaker

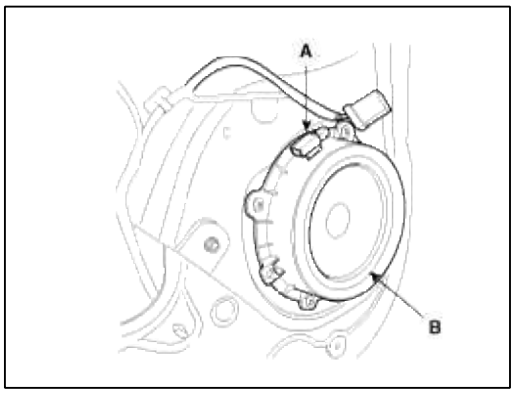
1. Remove the front door trim.
   (Refer to the Body group - "Front door")

2. Remove the front speaker (B) after removing 4 rivets and connector (A).



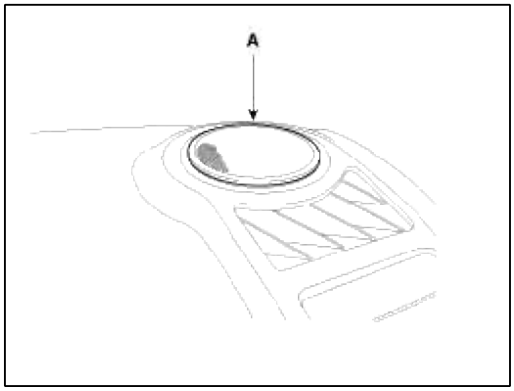
Rear Speaker

1. Remove the rear door trim.
   (Refer to the Body group - "Rear door")
2. Remove the rear speaker (B) after removing 4 rivets and connector (A).

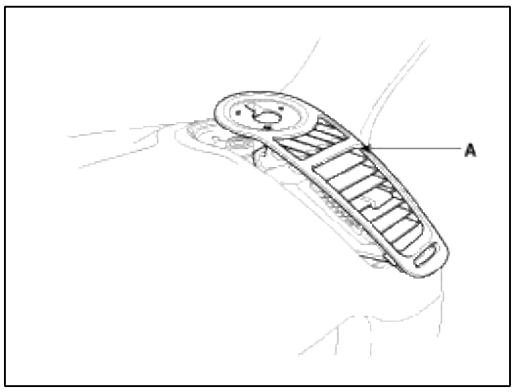


Tweeter Speaker

1. Remove the speaker grill (A) and screw (1EA).
   (Refer to the Body group - "Main crash pad")



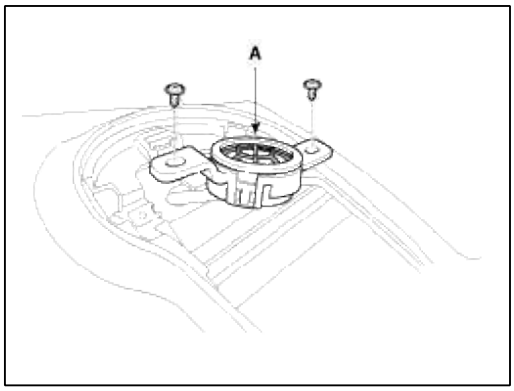
2. Remove the tweeter speaker cover (A).

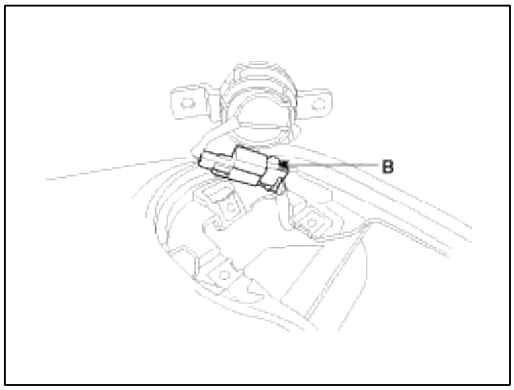


NOTE

- To prevent the damage to the air vent, the 09840-1M100 Air Vent Remover should be used to grab the sides of the air vent.

3. Remove the tweeter speaker (A) after removing the screw (2EA) and connector (B).

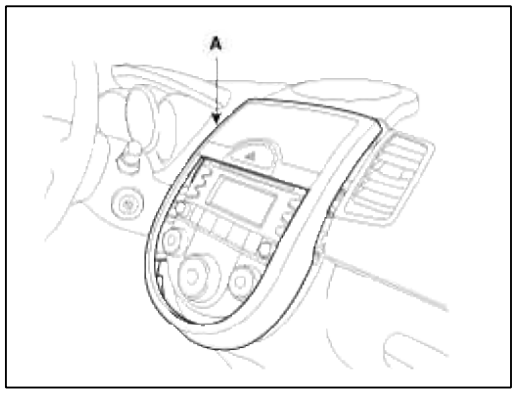




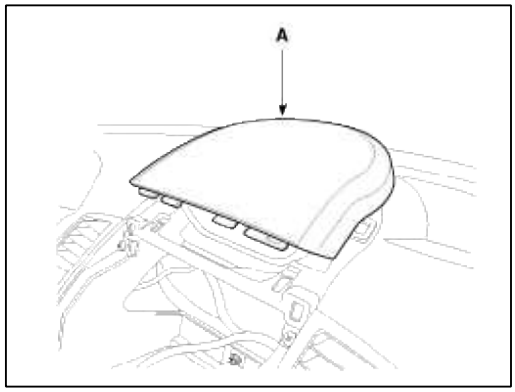
Center Speaker

1. Disconnect the negative (-) battery terminal.

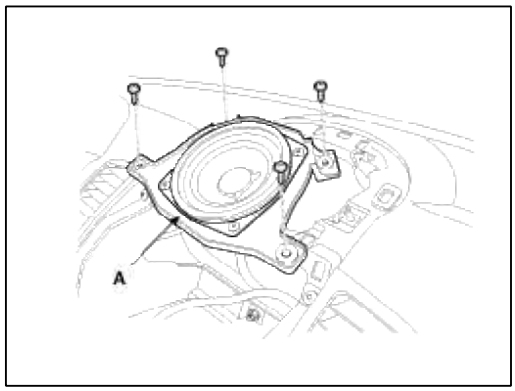
2. Remove the crash pad center facia panel (A).
   (Refer to the Body group - "Crash pad")

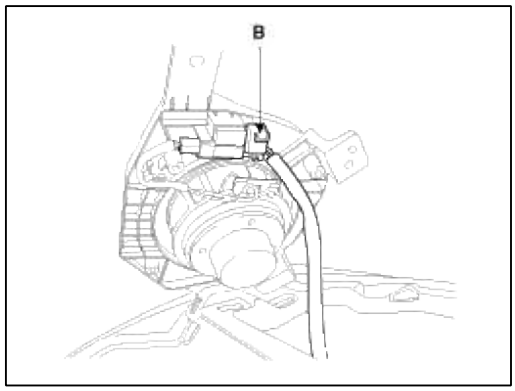


3. Remove the center speaker grill (A).



4. Remove the center speaker (A) after removing the screws (4EA) and connector (B).

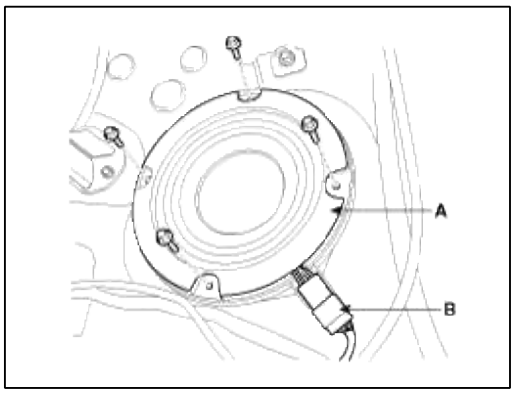




Woofer Speaker

1. Remove the right luggage side trim and disconnecting the connector.
   (Refer to the Body group - Interior trim)

2. Remove the woofer speaker (A) after removing the screws (4EA) and connector (B).



Installation

Front Speaker

1. Install the front speaker.
2. Install the front door trim.

Rear Speaker

1. Install the rear speaker.
2. Install the rear door trim.

Tweeter Speaker

1. Install the tweeter speaker after connecting the tweeter speaker connector.
2. Install the tweeter speaker cover and grill.

Center Speaker

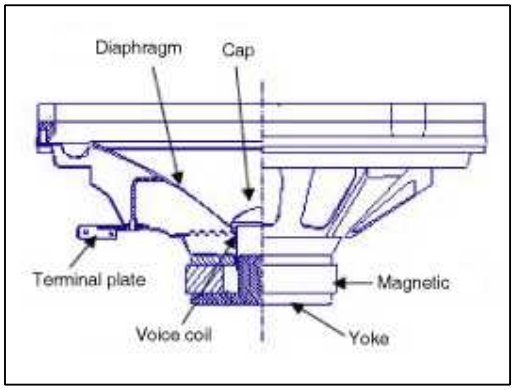
1. Install the center speaker and grill.
2. Install the crash pad center facia panel.
3. Connect the negative (-) battery terminal.

Woofer Speaker

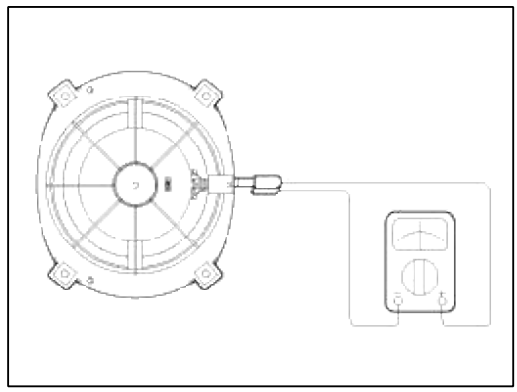
1. Install the woofer speaker.
2. Install the right side trunk trim.

Inspection

1. Troubleshooting for Speaker
   (1) Basic inspection of speaker
   Inspect the sound from speaker. Make sure the electrical connector is connected and the speaker mounting screws are tight to remove vibration.



(2) Case Troubleshooting

No.	Case	Inspection/Remedy
1	Trembling sound	1. Before replacing the speaker, inspect that the mounting screw is installed normally. 2. After re-installing the speaker, verify that no trembling sound is heard. 3. When hearing a trembling sound again, replace the speaker with new one.
2	Noise	1. Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2. In case of radio static, check if there is a noise from cassette. 3. When a noise is heard when using the radio and cassette, replace the speaker with new one. NOTE If there is static only when using the radio, poor radio reception may be the cause. The speakers would not be the cause.
3	Poor working	Inspection of the wiring connection between the audio unit and the speaker 1. Before replacing the speaker, inspect the wiring connection between the audio unit and the speaker. 2. Check the supplying power to the speaker and the resistance, then inspect the sound quality. ■ Specified impedance : 2 ~ 4Ω  3. If the speaker works poorly, replace it with new one.

CAUTION

- Use care when dealing with speakers.
- Speakers can be damaged by: Impact by droping or hitting the speaker.
- Keep liquids away from the speaker
- Use caution - diaphragm is paper which is easy torn by impact and external force.
- Speakers are not covered by the manufacturer's warranty if lthe audio system is modified in any way.

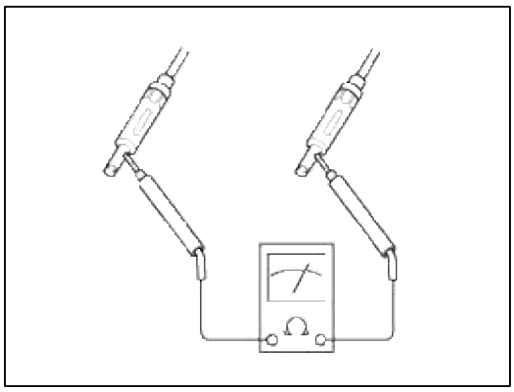
Body Electrical System > Audio > Antenna > Repair procedures

Inspection

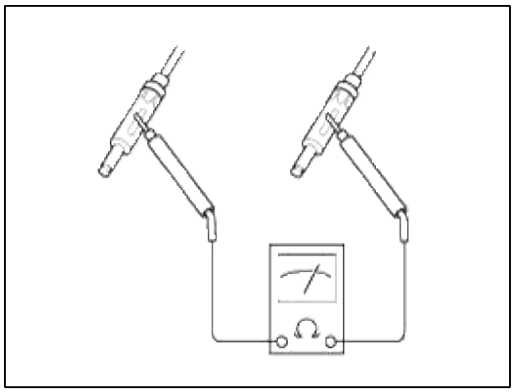
Antenna Cable

1. Remove the antenna jack from the audio unit and antenna.

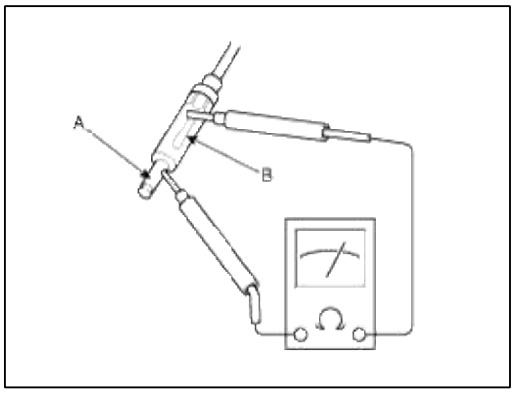
2. Check for continuity between the center poles of antenna cable. There sould be continuity.



3. Check for continuity between the outer poles of antenna cable. There should be continuity.



4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.

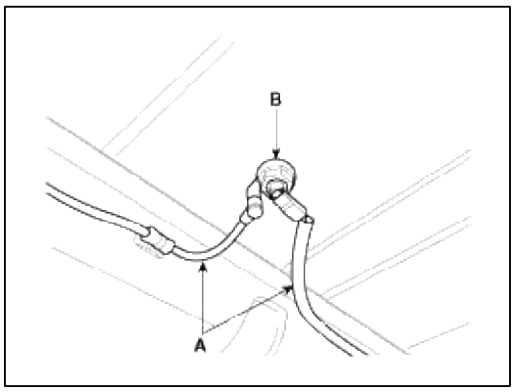


6. If there is continuity, replace the antenna cable.

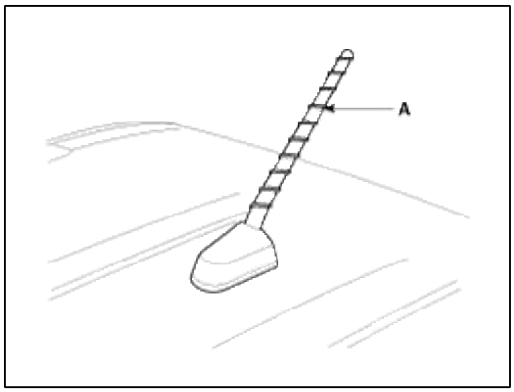
Removal

1. Remove the rear roof trim.
   (Refer to the Body group - "Roof trim")

2. Disconnect the connector and cable (A) and nut (B) from the roof antenna.



3. Remove the roof antenna(A).



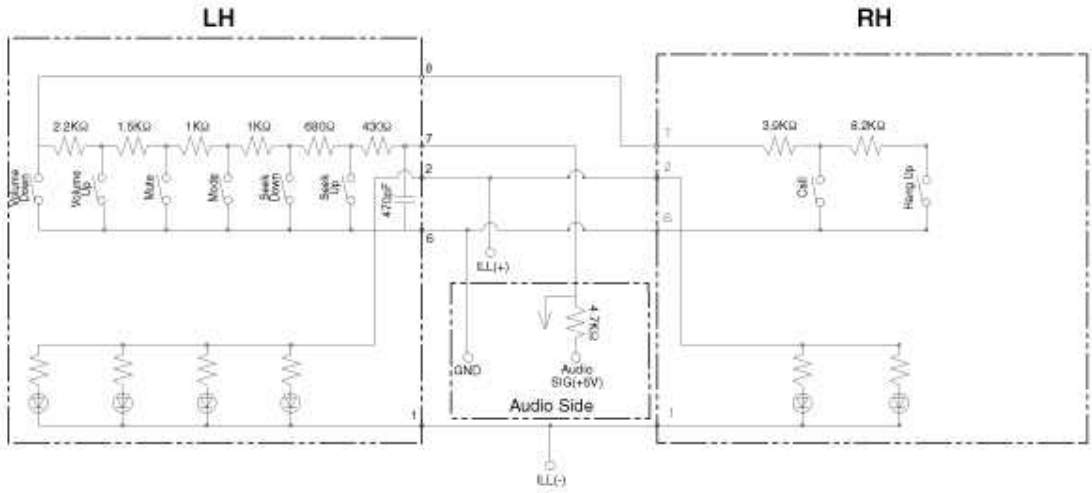
Installation

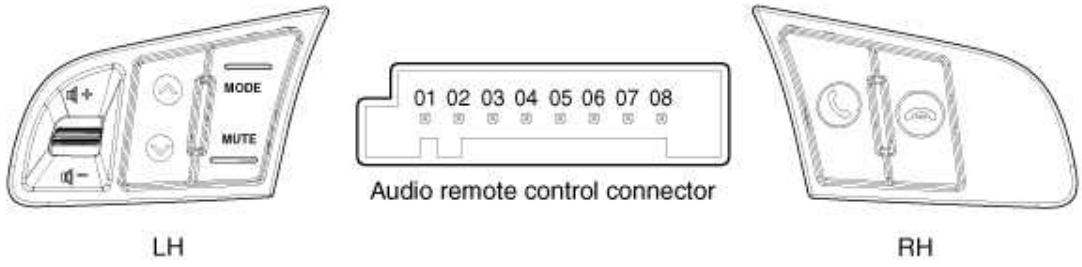
1. Connect the roof antenna cables and connectors.
2. Install the rear roof trim.

Body Electrical System > Audio > Audio Remote control > Schematic Diagrams

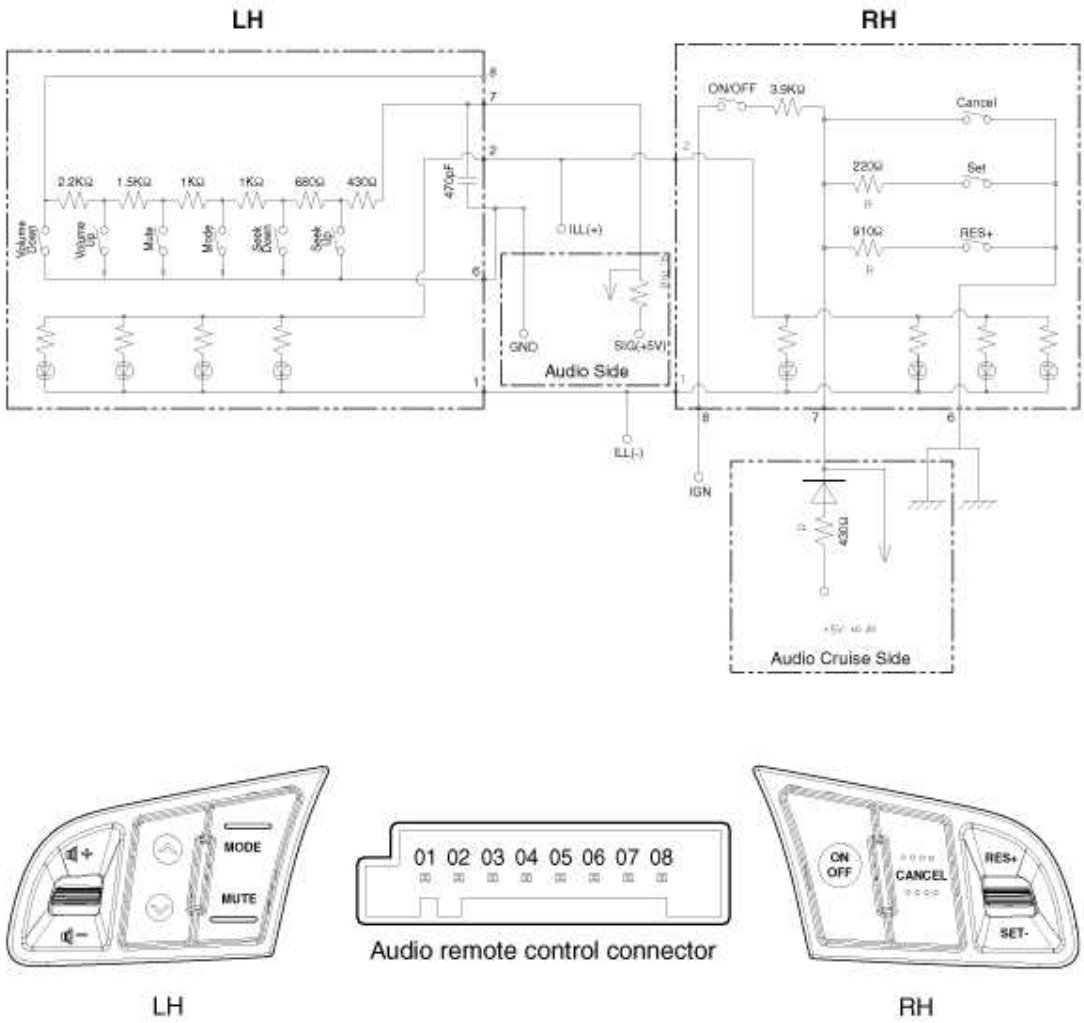
Circuit Diagram

[Audio + Hands free]





[Audio + Cruise]

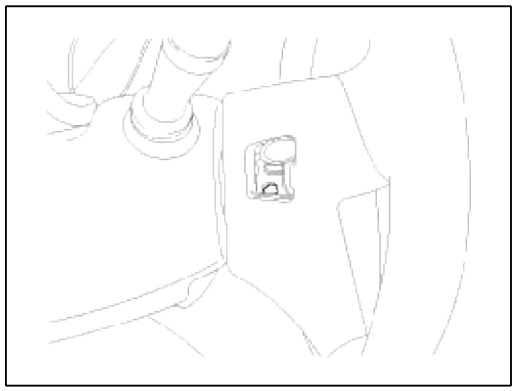


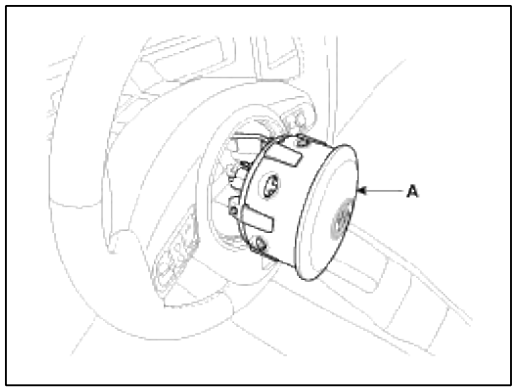
Body Electrical System > Audio > Audio Remote control > Repair procedures

Removal

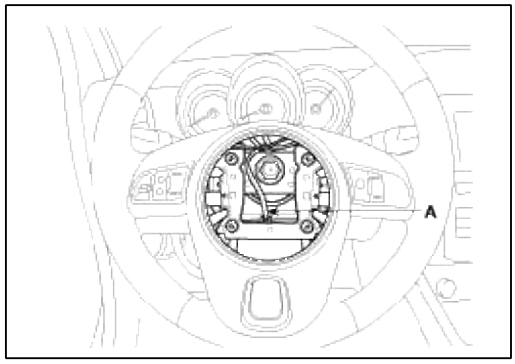
1. Disconnect the negative (-) battery terminal.

2. Remove the driver airbag module (A).
   (Refer to the Airbag group - "Airbag module and clock spring")

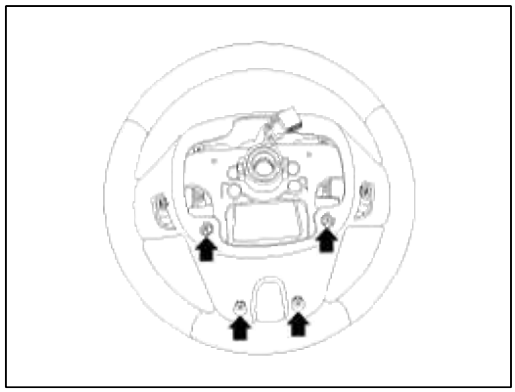




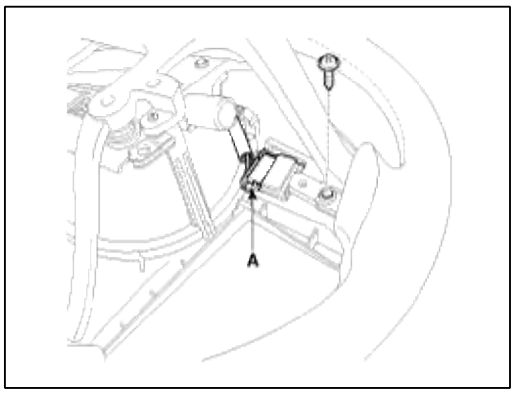
3. Remove the steering wheel after loosening the nut and disconnecting the connector (A).



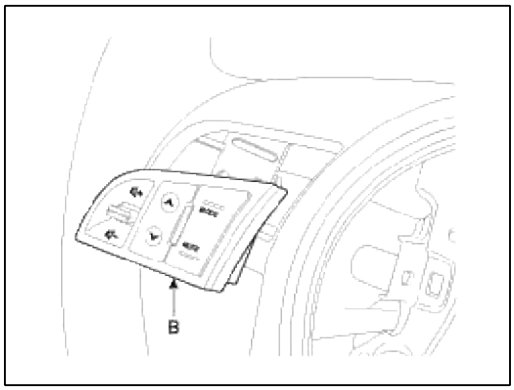
4. Loosen the screws (4EA) on the opposite side of the steering wheel.



5. Disconnect the audio remote control switch connector(A).



6. Remove the audio remote control switch(B).

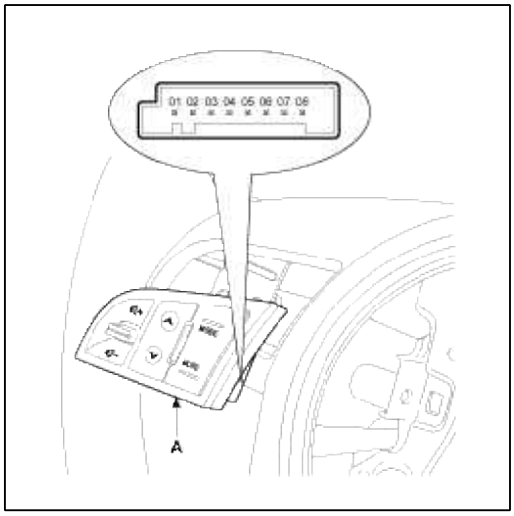


Installation

1. Install the audio remote control switch on the steering wheel.
2. Connect the audio remote control switch connector.
3. Install the steering wheel.
4. Install the driver airbag module.

Inspection

1. Check for resistance between No.6 and No.7 terminals in each switch position.

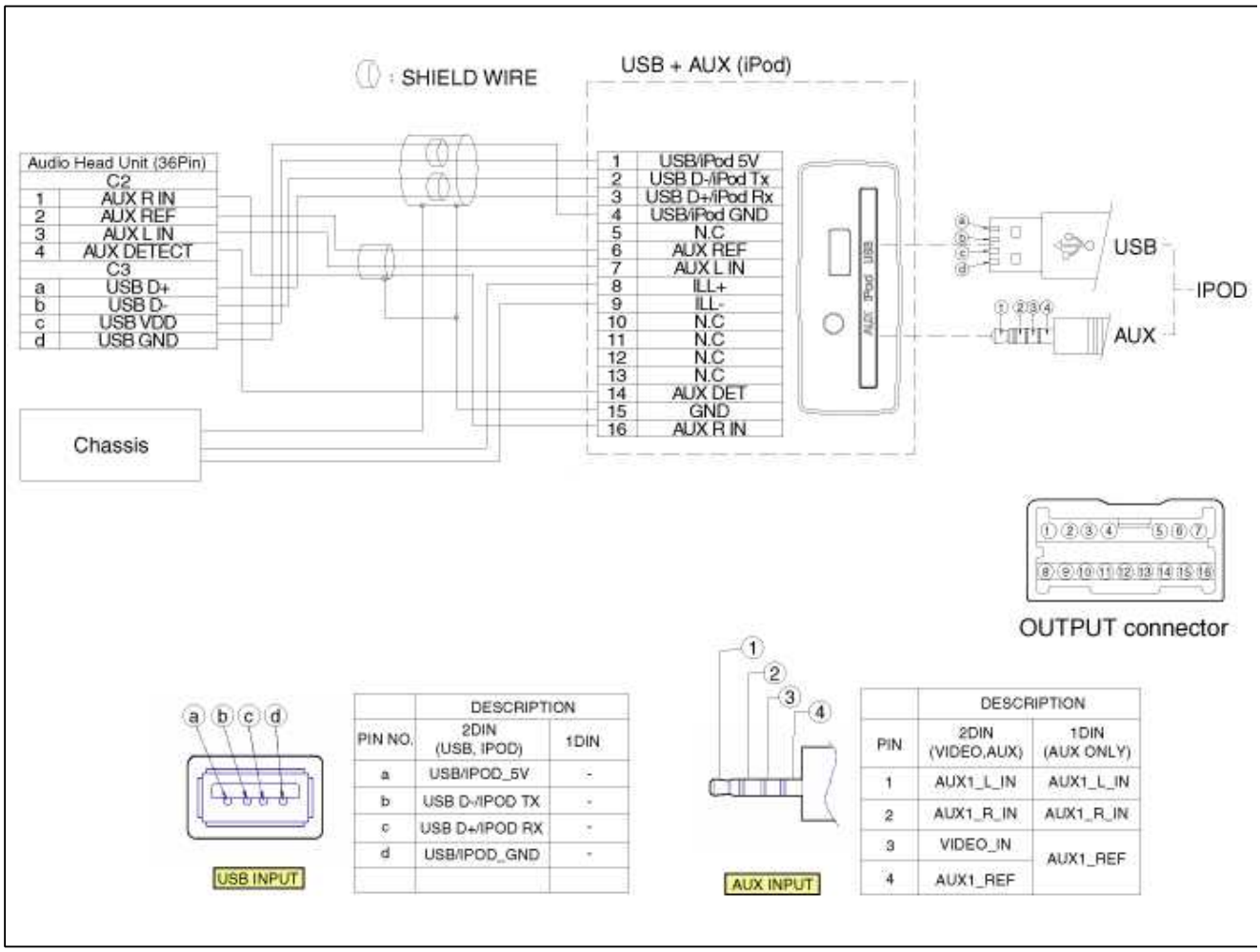


[Audio System]

Switch	Connector terminal	Resistance (±1%)
VOLUME DOWN	6-7	6.81 kΩ
VOLUME UP	6-7	4.61 kΩ
MODE	6-7	2.11 kΩ
SEEK DOWN	6-7	1.11 kΩ
SEEK UP	6-7	430 Ω
MUTE	6-7	3.11 kΩ

Body Electrical System > Audio > AUX(Auxiliary) jack > Schematic Diagrams

Circuit Diagram



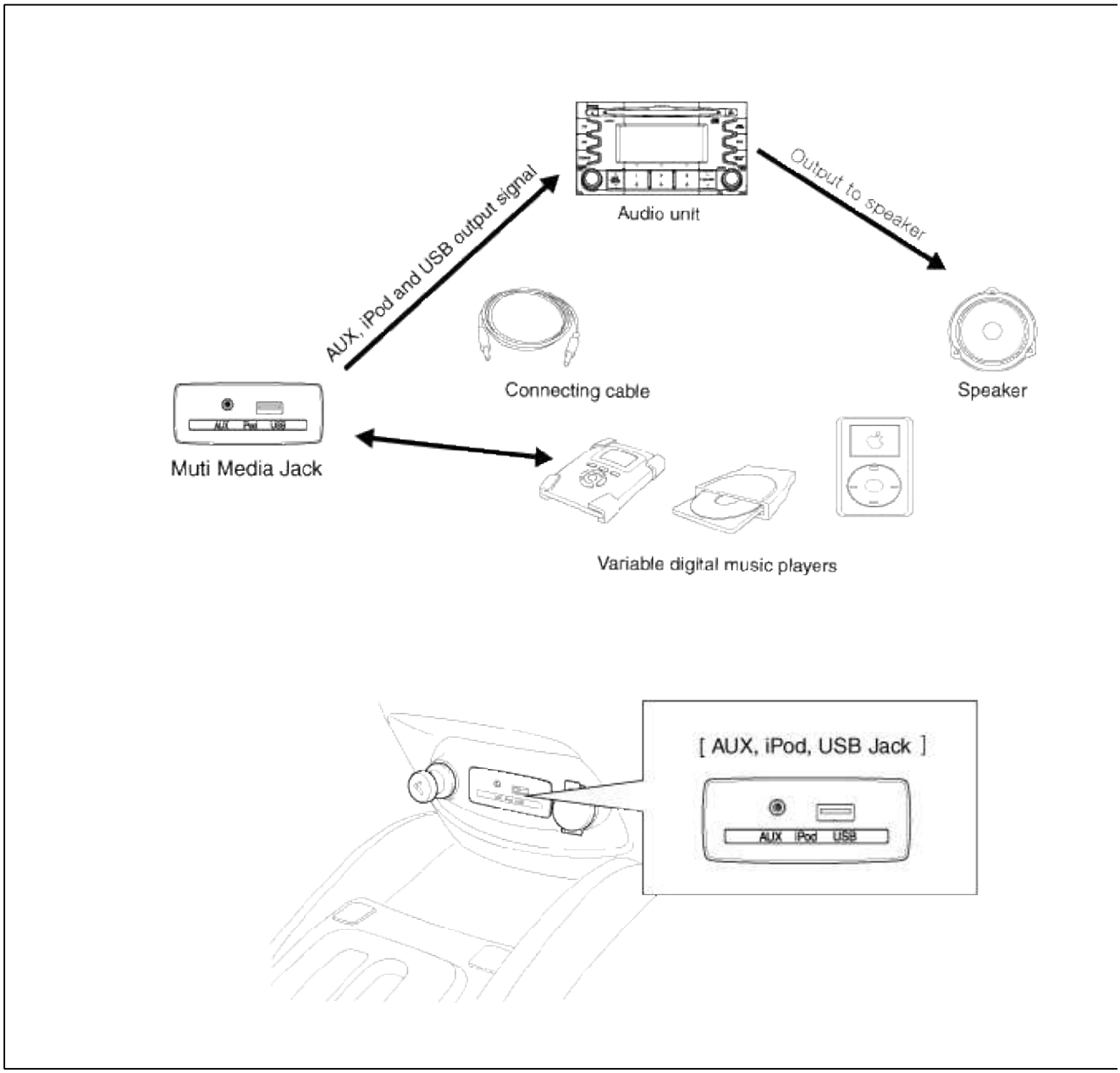
Body Electrical System > Audio > AUX(Auxiliary) jack > Description and Operation

Description

The AUX, iPod and USB JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPod, earphone, USB memory stick, CD player and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added option.

In case of distortions from media connected to the AUX source, the audio unit may not be defect but the output

level of the used media does not match the specification of the AUX input.

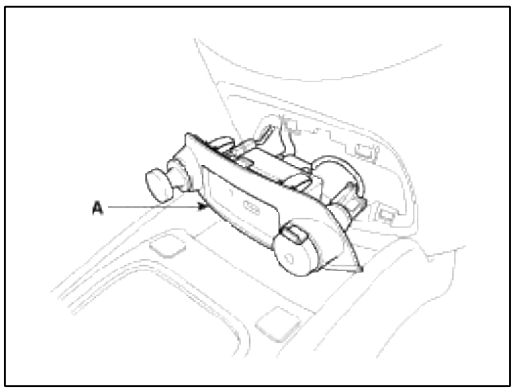


Body Electrical System > Audio > AUX(Auxiliary) jack > Repair procedures

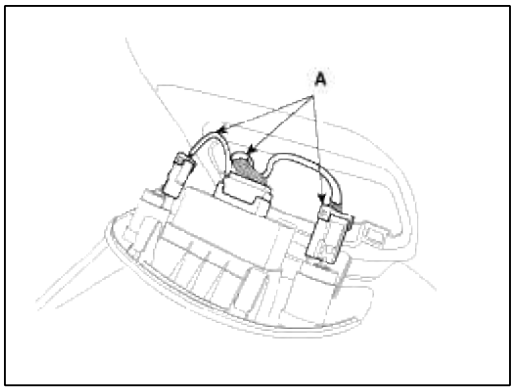
Removal

Multi Media Jack

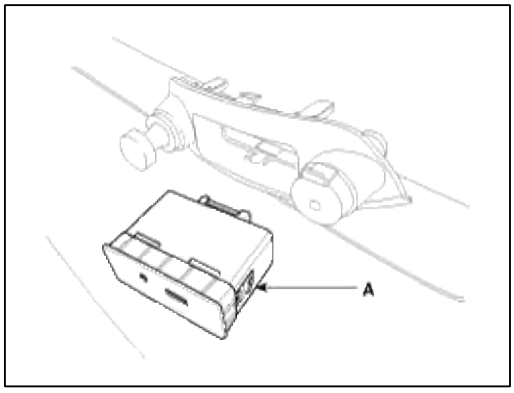
1. Remove the multi media jack assembly from main creah pad (A) by using the trim remover tool.



2. Disconnect the jack assembly connector(A)



3. Remove the Multi Media Jack (A).



Installation

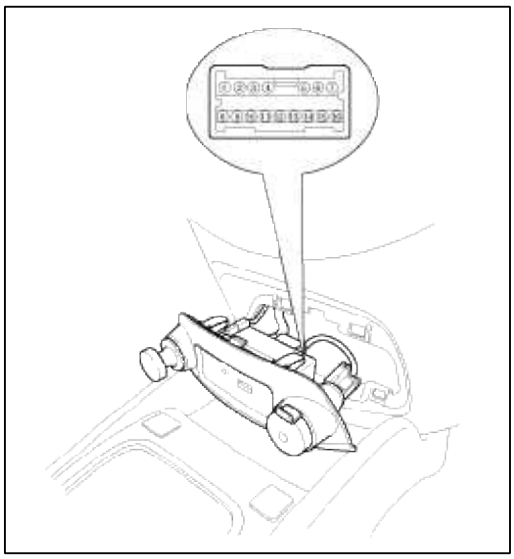
Multi Media Jack

1. Connect the Multi Media Jack connector.
2. Install the Multi Media Jack.

Inspection

1. Disconnect the negative(-) battery terminal.

2. Disconnect the Multi Media Jack connector after from the floor console.



To inspect USB/IPOD port, check the voltage between NO.1 and 4 terminal of USB/iPod input port at AUX input.

Standard value : 5V

To inspect AUX Jack, check the voltage between NO.14 terminal of Jack output connector and NO.4 terminal of USB/iPod input port at AUX input.

Standard value : 5V

Body Electrical System > Audio > SIRIUS Radio > Description and Operation

Description

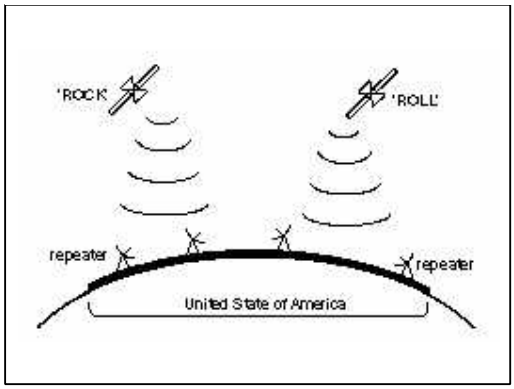
Introduction to SIRIUS radio

SIRIUS-Radio is a Satellite Based Radio Broadcast System that operates around 2.3 GHz from two 15,000 watts satellites; The service covers US and Canada. But the service in Canada is not guaranteed.

Due to the limitations of satellite transmission, the signal is not able to penetrate buildings, so it cannot effectively cover dense urban areas. The terrestrial repeater network extends SDARS coverage and allows providers to reach the greatest number of subscribers and provide quality coverage. The repeaters receive the SIRIUS signal directly from the satellites and then re-transmit it to SIRIUS radios anywhere.

SIRIUS provides digitalized radio programs in terms of channels. Each channel is a program that the user can tune to. A category is a group of channels. Examples of categories are classical, news and sports.

SIRIUS is a paid service. That means users have to make a subscription to SIRIUS before they can enjoy the programs. However, SIRIUS does give some free-to-air channels. The users can listen to one of them without making any subscription.



Function

Activation

In order to extend or reactivate your subscription to SIRIUS Satellite Radio, you will need to contact SIRIUS Customer Care at 888-539-7474.

Have your 12 digit SID (Sirius Identification Number)/ESN (Electronic Serial Number) ready.

To retrieve the SID/ESN, turn on the radio, press the [SAT] button and tune to channel zero.

Please note that the vehicle will need to be turned on, in Sirius mode, and have an unobstructed view of the sky in order for the radio to receive the activation signal.

1. SATELLITE RADIO Selection Button(SIRIUS Satellite Radio)

Press the [SAT] button to switch to SIRIUS Satellite Radio. It cycles through the different bands as noted below.

SAT1 → SAT2 → SAT3 → SAT1 →...

2. Channel Selection Button

- Press [TRACK] or [SEEK] button Press [TRACK] or [SEEK] button previous or next channel.
- Press [TRACK] or [SEEK] button for 0.8 or longer to continuously move to previous or next channel.
- If "CATEGORY" Icon is displayed at the top of the screen, channel up/down is done through the channels within current category.

3. Preset Selection Button

- Push [1]~[6] buttons less than 0.8 second to play the channel saved in each button.
- Hold down the preset button for 0.8 second or longer to save current channel. An audible beep will play to confirm the preset is stored.

4. SCAN Button

- When the button is pressed, it automatically scans the radio stations upwards.
- The SCAN feature steps through each channel, starting from the initial channel, for ten seconds.
- Press the [SCAN] button again to stop the scan feature and to listen to the currently selected channel.
- If "CATEGORY" Icon is displayed at the top of the screen, channel changing is done through the channels in current category.

5. TUNE Knob and ENTER Button

While listening to SIRIUS broadcast, rotate this knob to the right or left to search other channels while listening to current channels and push this knob to select what you want to listen to. (Turn to the right to search higher channels and left lower channels)

6. CAT/FOLDER Button

- Press [CAT] or [FOLDER] button to enter the Category List Mode, it displays cateogry items and highlights the category that currently tuned channel belongs to.
- On Category List Mode, press these buttons to navigate category list.
- Press [ENTER] Button to select the lowest channel in highlighted category.
- If channel is selected by selecting category CATEGORY Icon is displayed at the top of the screen.

7. INFO Selection Button

Displays the information of the channel currently played by in the order of Artist/ Song title → Category/Channel name → Composer(if available) → Artist/Song title → Category/Channel name →... (ART/TITLE Selection)
Displays the information of the channel currently played by in the order of Category/Channel name → Artist/Song title → Composer(if available) → Category/Channel name → Artist/Song title →... (CAT/CH Selection) (If there is no information of COMPOSER NAME, it returns to main display.)
8. SETUP Button
Press this button to adjust to the SCROLL, SDVC, SIRIUS and adjustment mode. If no action is taken for 5 seconds after pressing the button, it will return to the previous radio mode.(After entering SETUP mode, move between items using the left,right and PUSH functions of the TUNE button.)
The setup item changes from SCROLL → SDVC → SIRIUS → SCROLL →...

Body Electrical System > Audio > SIRIUS Radio > Troubleshooting

Troubleshooting

1. Antenna Error
If this message is displayed, the antenna or antenna cable is broken or unplugged. Please consult with your Kia dealership.
2. Acquiring Signal
If this message is displayed, it means that the antenna is covered and that the SIRIUS Satellite Radio signal is not available. Ensure the antenna is uncovered and has a clear view of the sky.

Body Electrical System > Audio > Troubleshooting

Troubleshooting

Customer Complaint Analysis Check Sheet

TROUBLE IN	☐ ALL ☐ AM ☐ FM ☐ Sirius ☐ CD ☐ MP3 ☐ CD changer ☐ AMP ☐ Others
TROUBLE OCCURS	☐ Always ☐ Engine start ☐ Engine Running ☐ Cold ☐ Warm ☐ Sometimes ☐ Most of the time ☐ Engine off
TYPE OF TROUBLE	☐ Will not play ☐ Weak ☐ Squealing noise ☐ Display/illumination poor ☐ CD skips & jumps ☐ CD will not eject or insert ☐ Others (Describe) :
OTHERS	▶ Customer complaint contents : ▶ Have you checked customer's defects :
* Using the customer complaint analysis check sheet for reference, ask the customer for as much detail as possible about the problem.	

There are six areas where a problem can occur: wiring harness, the radio, the CD player, and speaker. Troubleshooting enables you to confine the problem to a particular area.

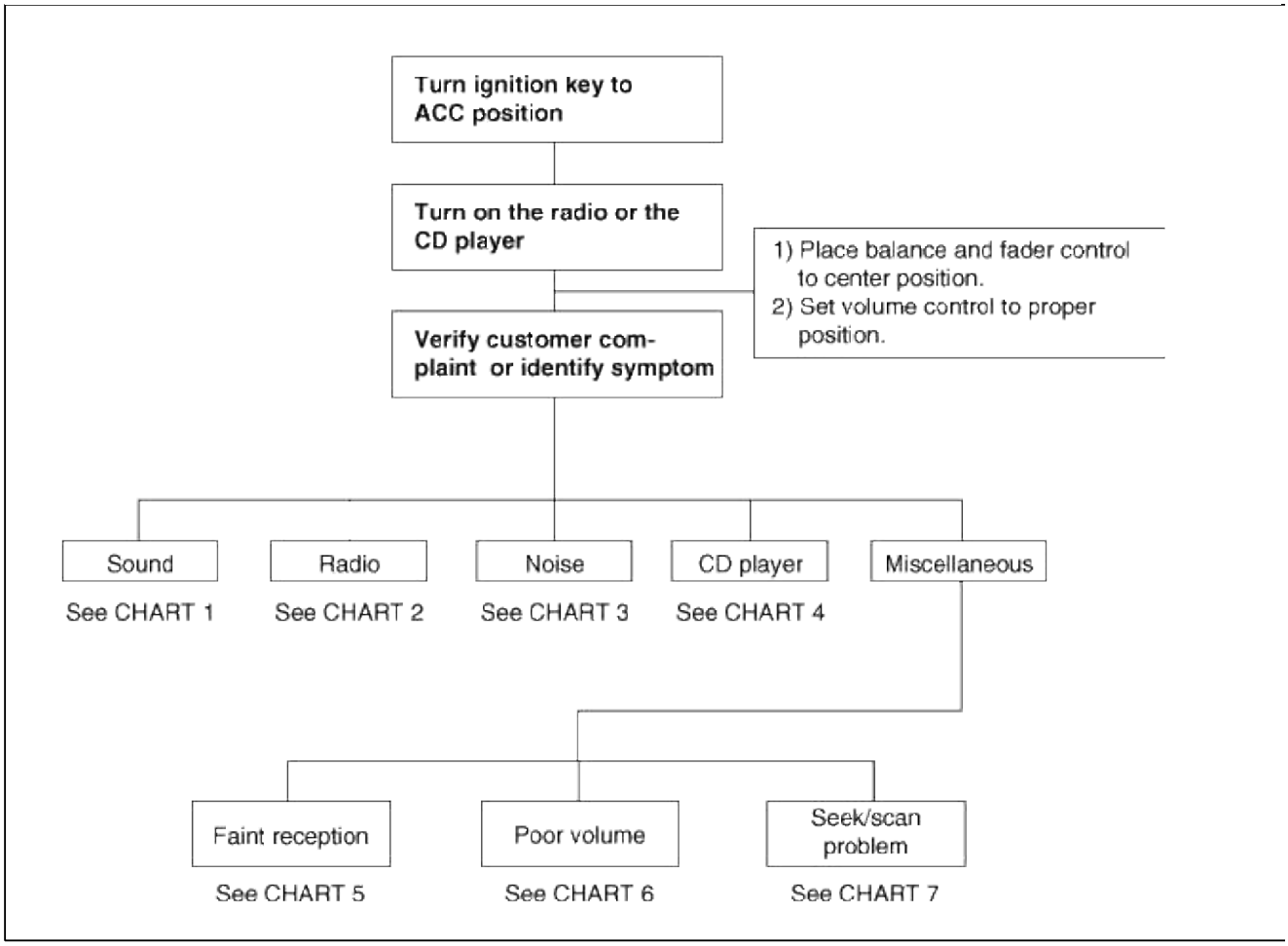
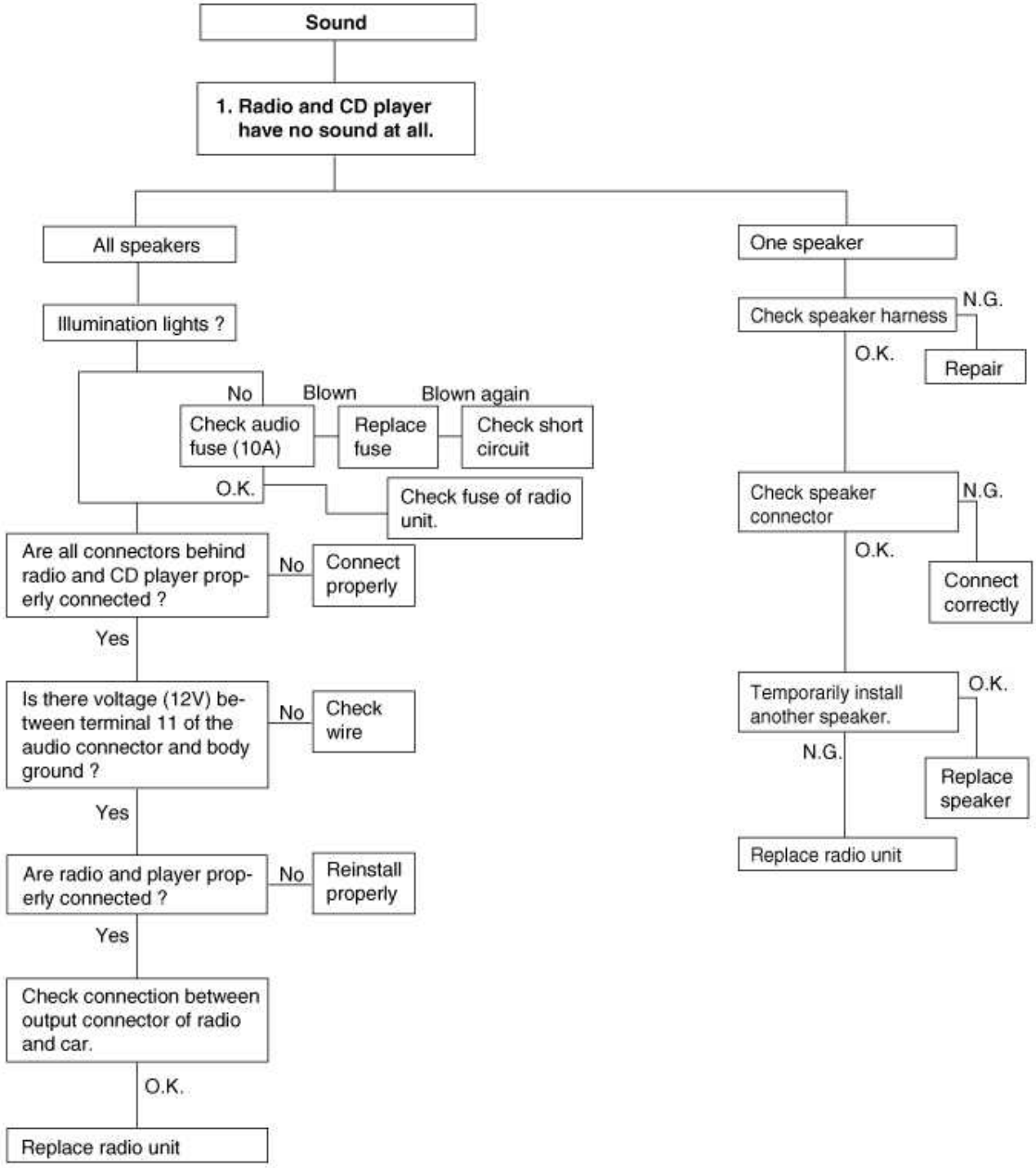
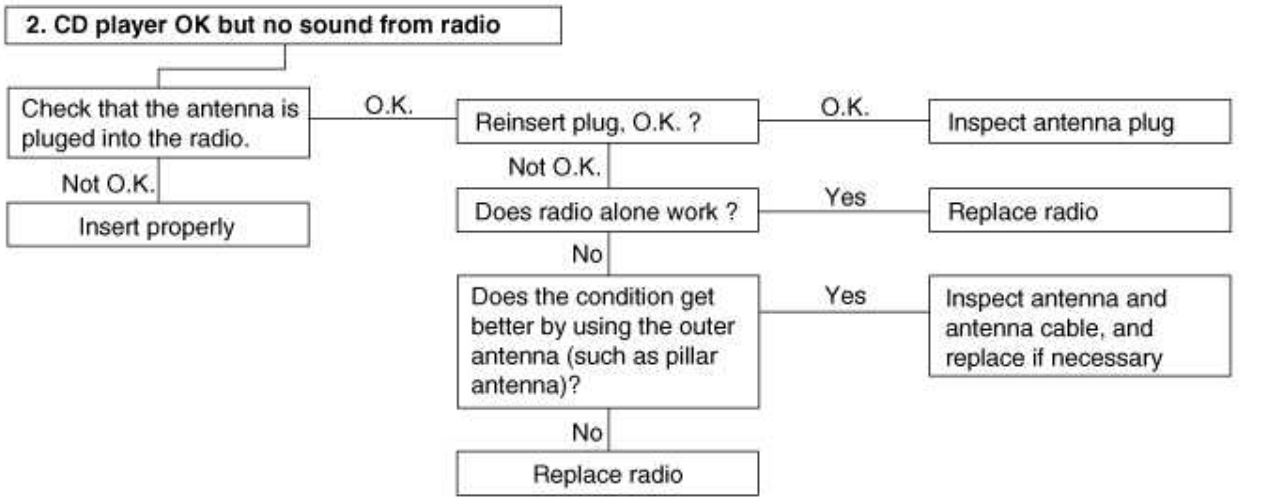

Turn ignition key to ACC position
Turn on the radio or the CD player
1) Place balance and fader control to center position.
2) Set volume control to proper position.
Verify customer complaint or identify symptom
Sound
See CHART 1
Radio
See CHART 2
Noise
See CHART 3
CD player
See CHART 4
Miscellaneous
Faint reception
See CHART 5
Poor volume
See CHART 6
Seek/scan problem
See CHART 7

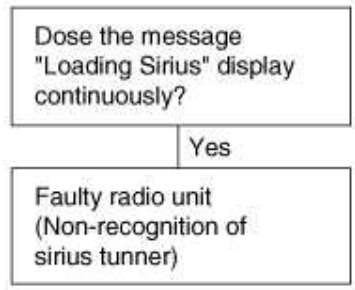
Chart 1

1. RADIO


Sound
1. Radio and CD player have no sound at all.
All speakers
Illumination lights ?
No
Blown
Blown again
Check audio fuse (10A)
Replace fuse
Check short circuit
O.K.
Check fuse of radio unit.
Are all connectors behind radio and CD player properly connected ?
No
Connect properly
Yes
Is there voltage (12V) between terminal 11 of the audio connector and body ground ?
No
Check wire
Yes
Are radio and player properly connected ?
No
Reinstall properly
Yes
Check connection between output connector of radio and car.
O.K.
Replace radio unit
One speaker
Check speaker harness
N.G.
O.K.
Repair
Check speaker connector
N.G.
O.K.
Connect correctly
Temporarily install another speaker.
O.K.
N.G.
Replace speaker
Replace radio unit


2. CD player OK but no sound from radio
Check that the antenna is pluged into the radio.
O.K.
Reinsert plug, O.K. ?
O.K.
Inspect antenna plug
Not O.K.
Insert properly
Not O.K.
Does radio alone work ?
Yes
Replace radio
No
Does the condition get better by using the outer antenna (such as pillar antenna)?
Yes
Inspect antenna and antenna cable, and replace if necessary
No
Replace radio

2. Sirius


Dose the message "Loading Sirius" display continuously?
Yes
Faulty radio unit (Non-recognition of sirius tunner)

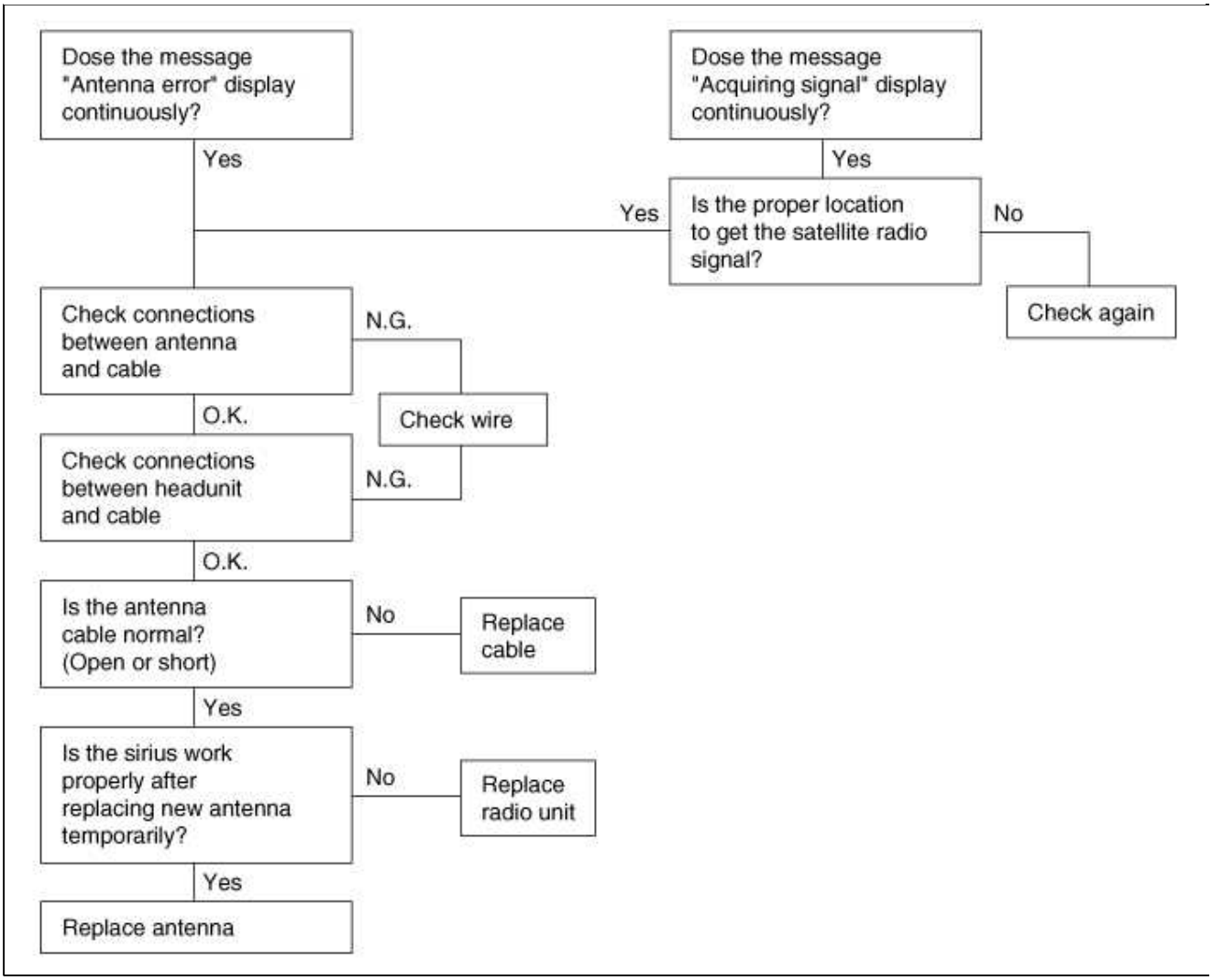

Dose the message "Antenna error" display continuously?
Yes
Dose the message "Acquiring signal" display continuously?
Yes
Is the proper location to get the satellite radio signal?
Yes
No
Check again
Check connections between antenna and cable
N.G.
Check wire
O.K.
Check connections between headunit and cable
N.G.
O.K.
Is the antenna cable normal? (Open or short)
No
Replace cable
Yes
Is the sirius work properly after replacing new antenna temporarily?
No
Replace radio unit
Yes
Replace antenna

Chart 2

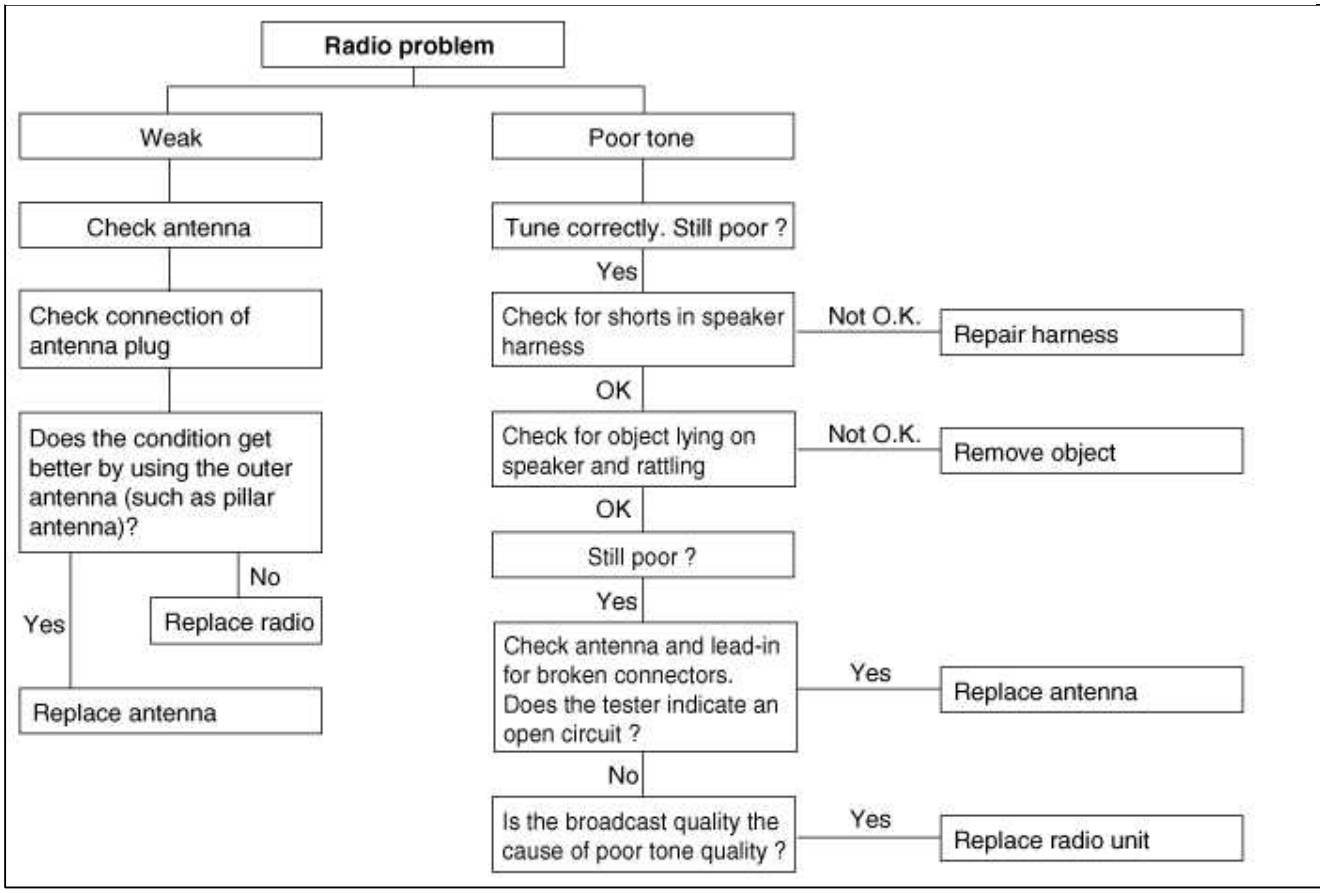

Radio problem
Weak
Check antenna
Check connection of antenna plug
Does the condition get better by using the outer antenna (such as pillar antenna)?
No
Yes
Replace radio
Replace antenna
Poor tone
Tune correctly. Still poor ?
Yes
Check for shorts in speaker harness
Not O.K.
Repair harness
OK
Check for object lying on speaker and rattling
Not O.K.
Remove object
OK
Still poor ?
Yes
Check antenna and lead-in for broken connectors. Does the tester indicate an open circuit ?
Yes
Replace antenna
No
Is the broadcast quality the cause of poor tone quality ?
Yes
Replace radio unit

Chart 3

1. RADIO

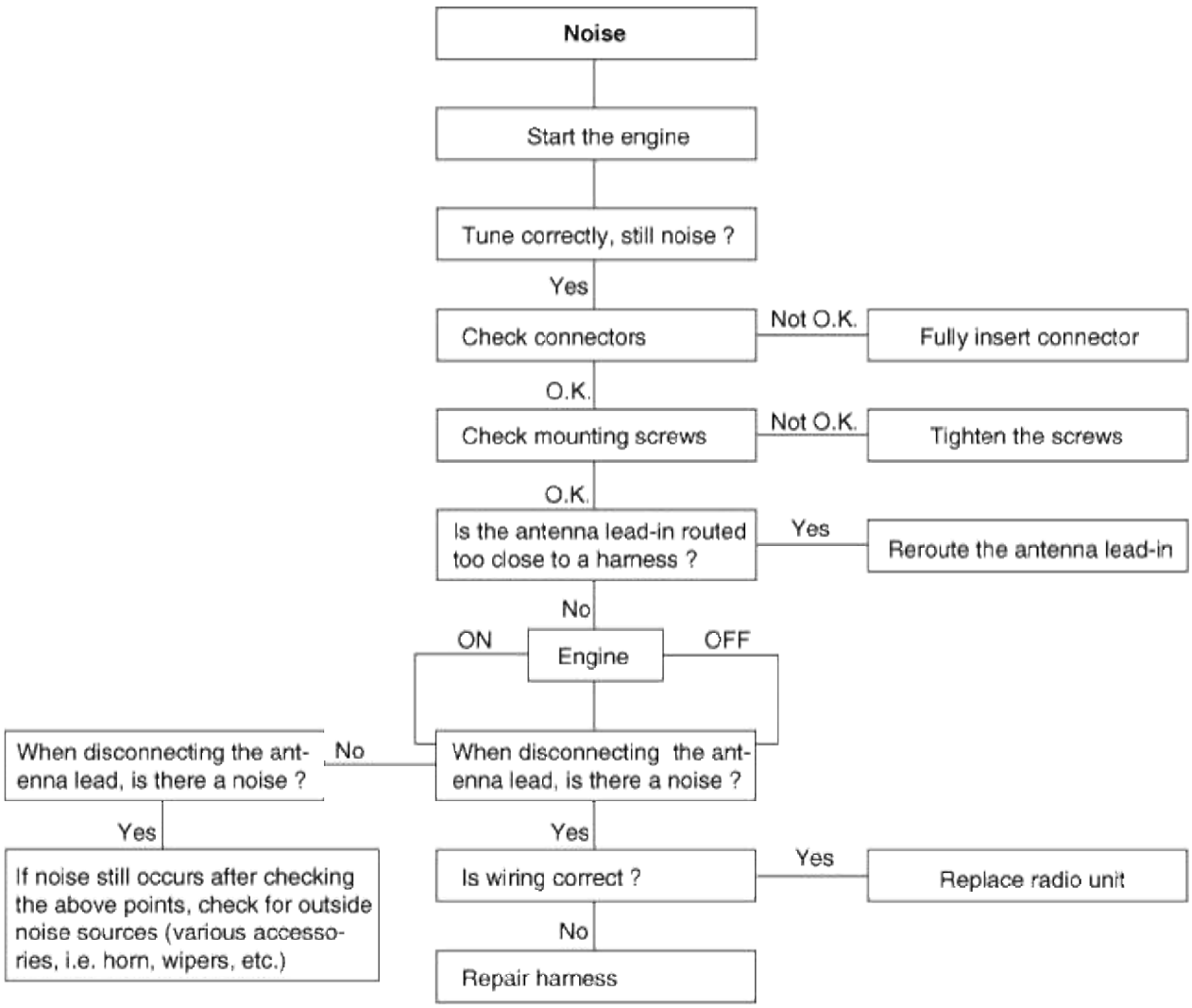
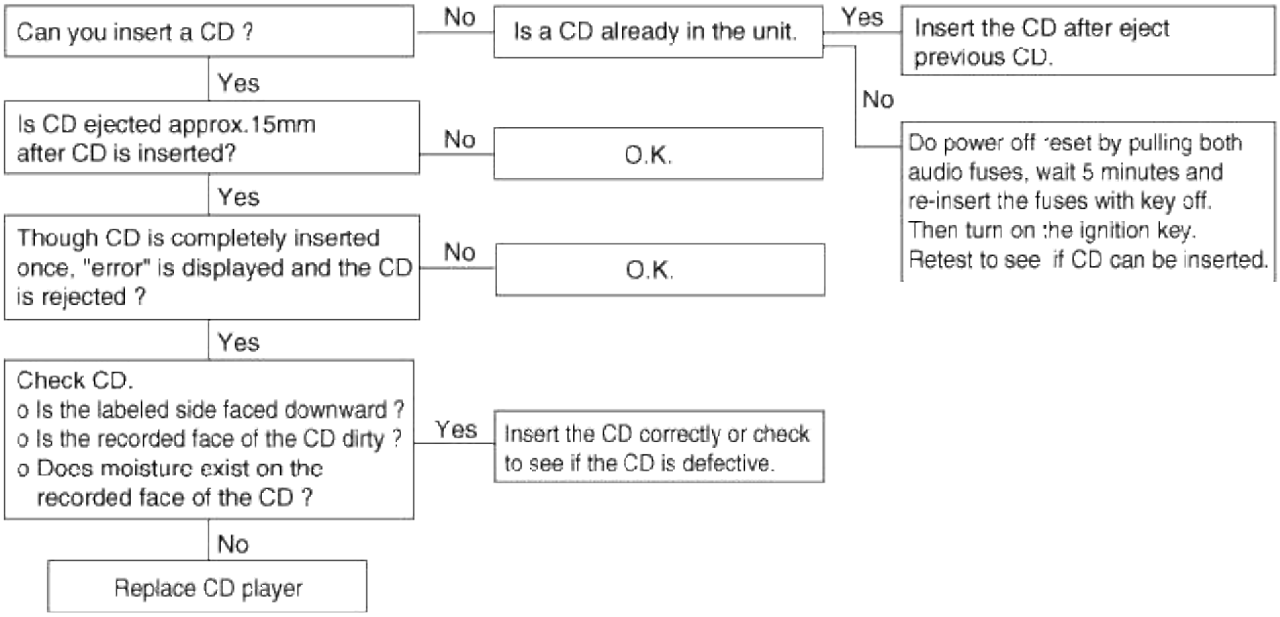
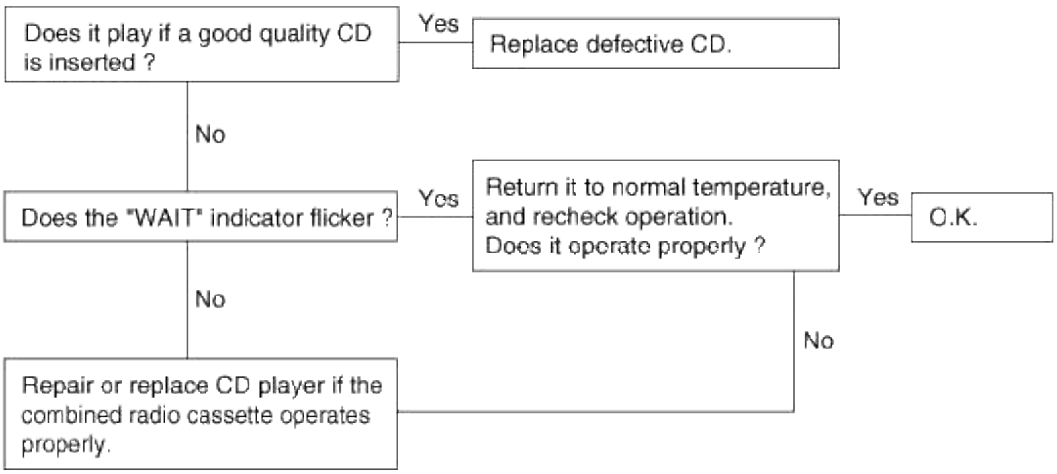


Chart 4

1. CD WILL NOT BE ACCEPTED

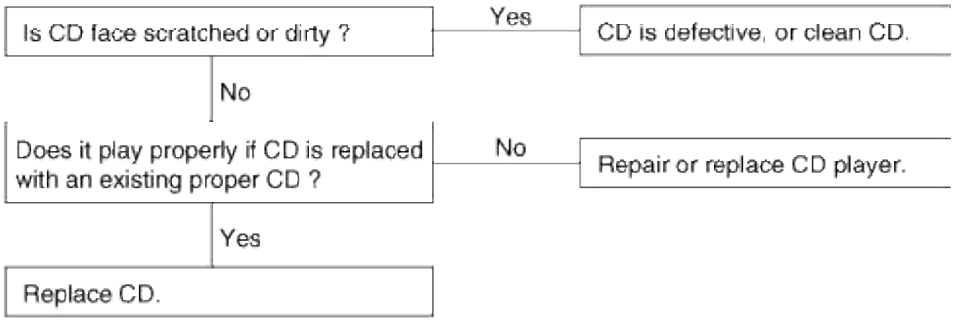


2. NO SOUND

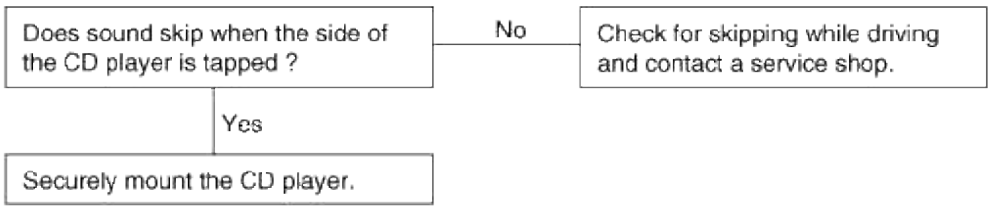


3. CD SOUND SKIPS

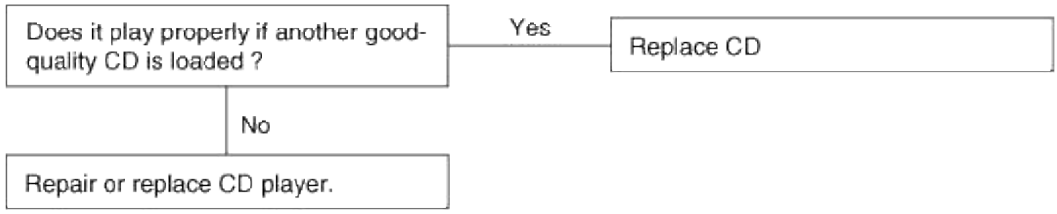
1) Sound sometimes skips when parking.



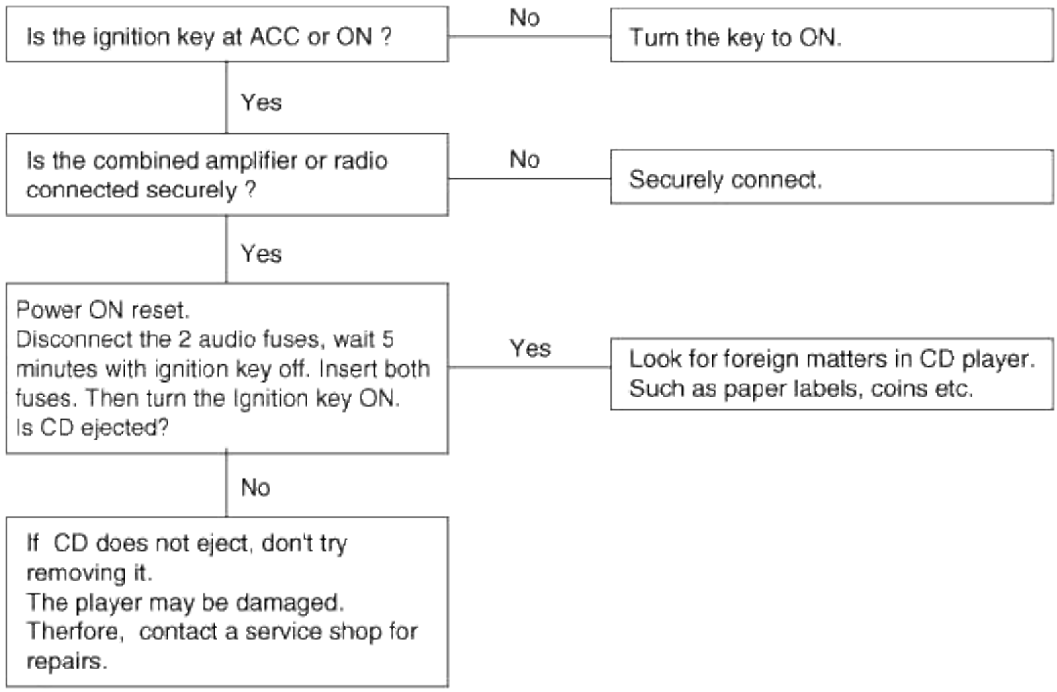
2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)



4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER

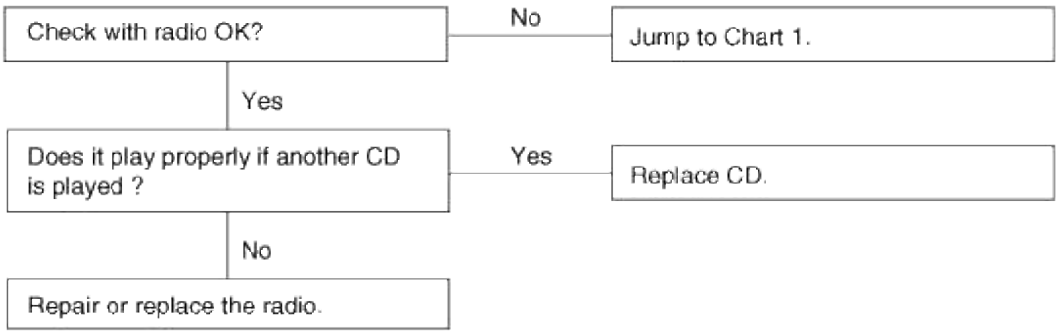


Chart 5

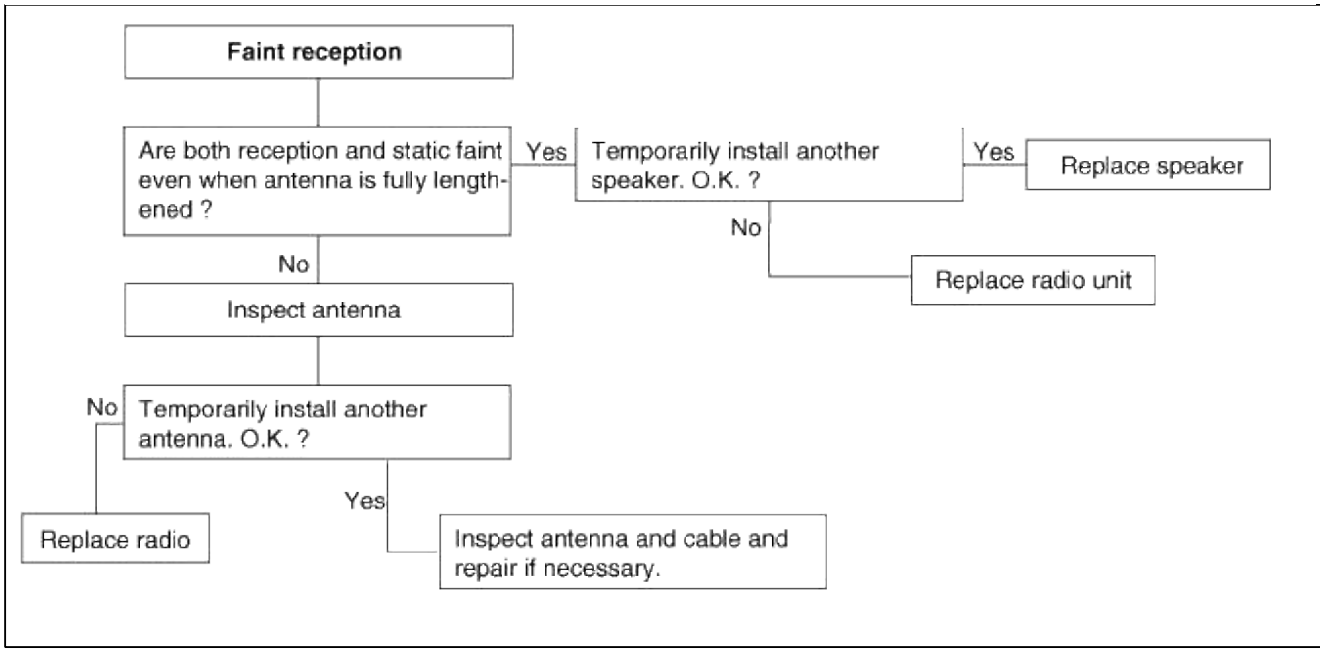


Chart 6

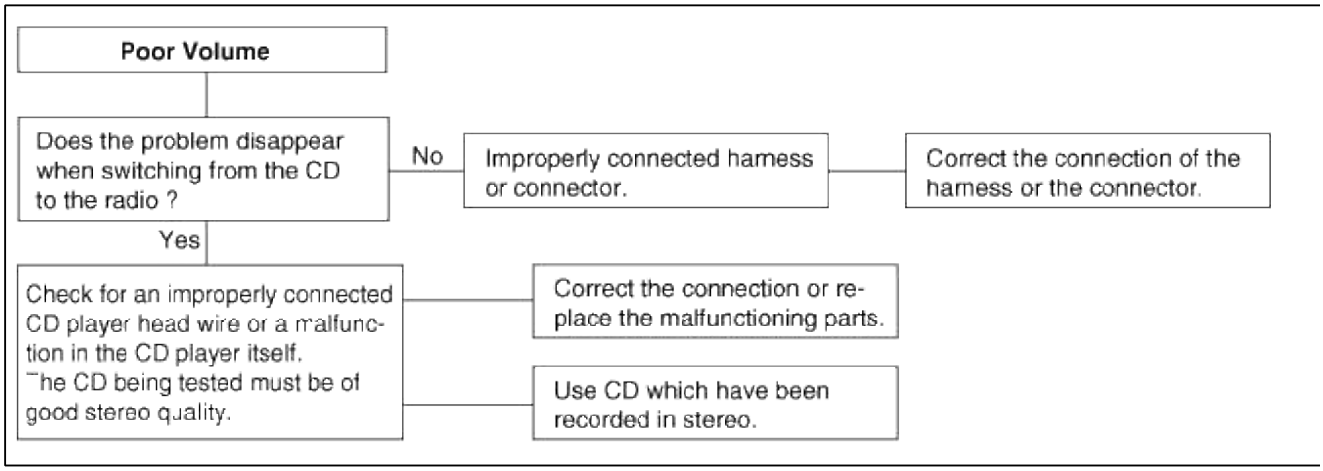
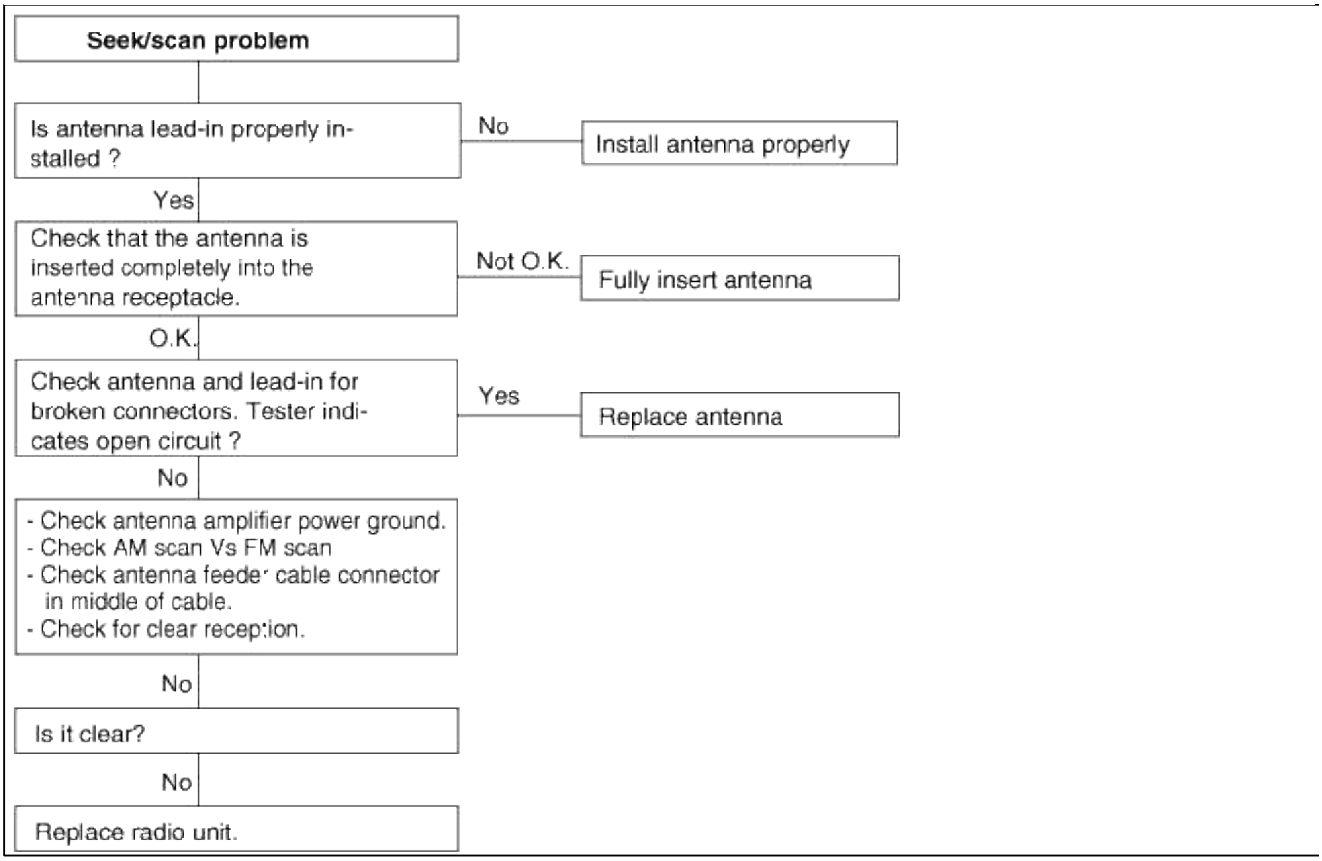


Chart 7



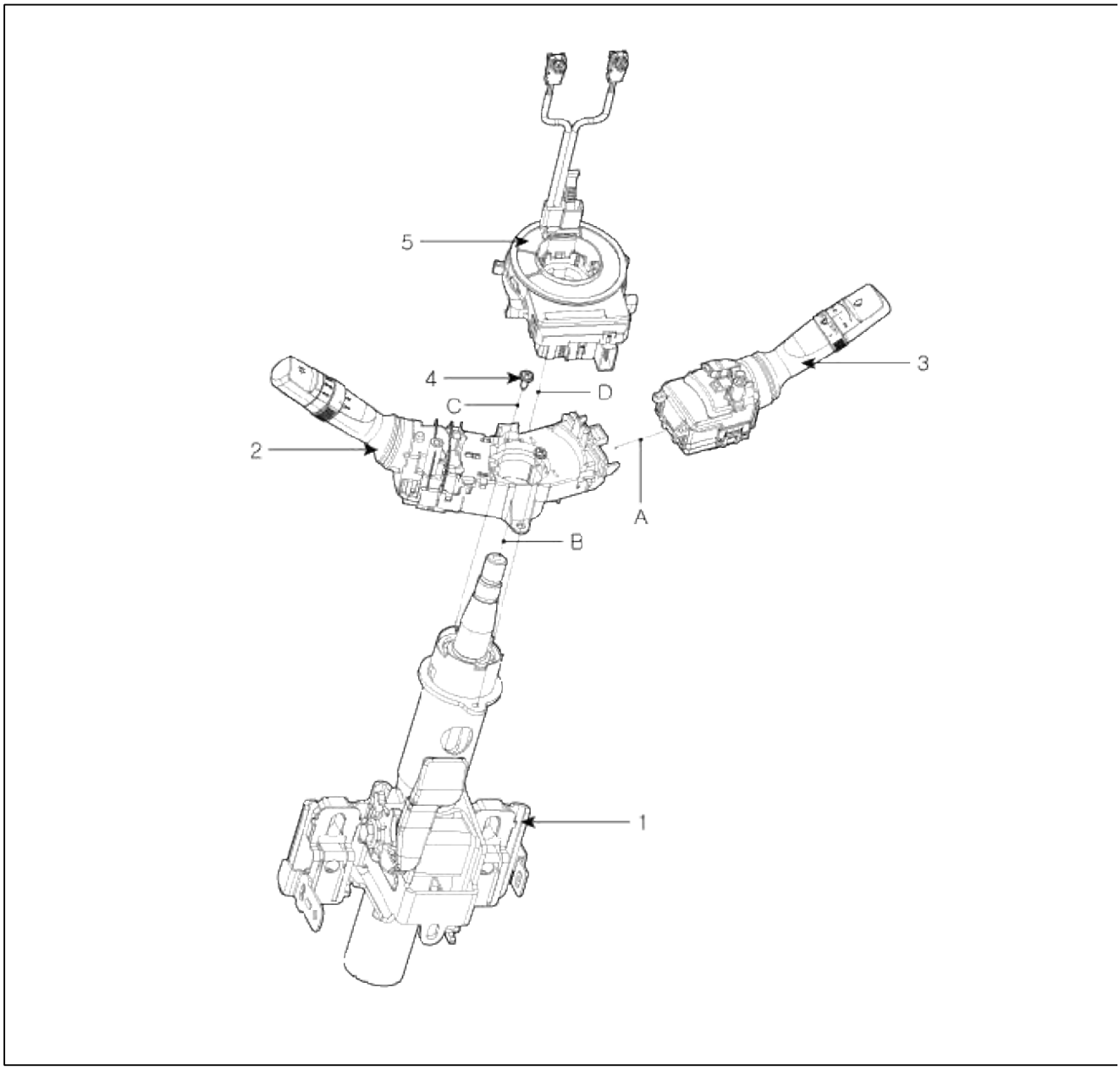
Body Electrical System > Multifunction switch > Specifications

Specifications

Items		Specifications
Rated voltage		DC 12V
Operating temperature range		-30°C ~ +80°C (-22 ~ +176°F)
Rated load	Dimmer & passing switch	High : 0.2A (Relay load) Low : 0.2A (Relay load) Passing : 0.2A (Relay load)
	Lighting switch	Lighting : 0.2A (Relay load)
	Turn signal switch	6.6 ± 0.5A (Lamp load)
	Wiper & mist switch	High : 4.5A (Motor load) Low : 4.5 A (Motor load) Intermittent : 0.22±0.05A(Relay Load) Lock : Max. 28A (Motor load) Mist : 4A (Motor load)
	Fog lamp switch	0.2A (Relay load)
	Rear wiper & Washer	Wiper : 1A (Relay load) Washer : 4A (Motor load)

Body Electrical System > Multifunction switch > Components and Components Location

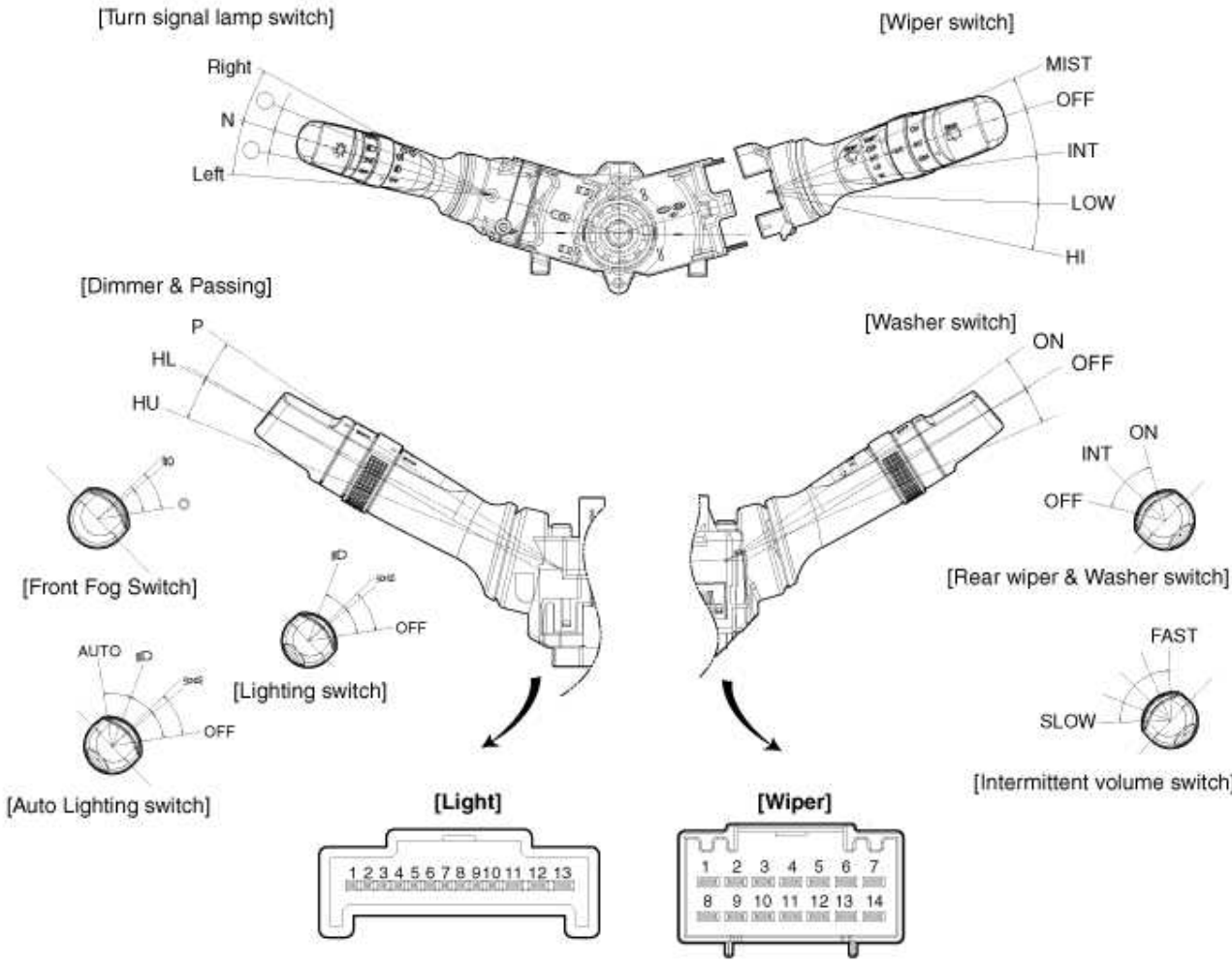
Component (1)



<Installation order : A→B→C→D>

1. Steering column shaft 2. Lighting switch 3. Wiper and washer switch	4. Screw 5. Clock spring

Component (2)



Circuit connection

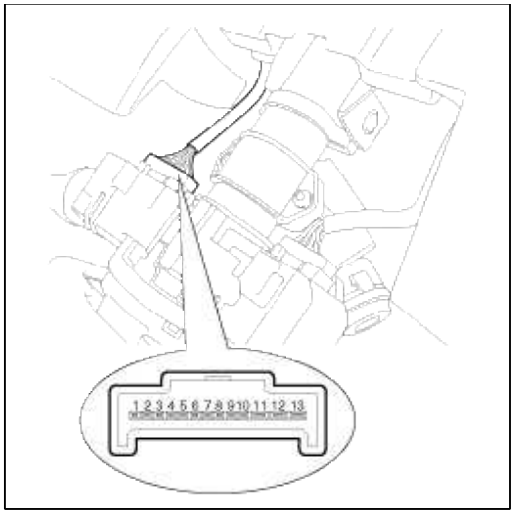
Connector Name	Terminal No.	Description	Connector Name	Terminal No.	Description
Light	1	Tail lamp switch	Wiper	1	Mist switch
	2	Lighting switch ground		2	Wiper parking
	3	Auto light switch		3	Wiper Low speed
	4	Head lamp switch		4	Intermittent volume base
	5	Fog switch base		5	Intermittent time base
	6	Front fog lamp switch		6	Rear wiper switch
	7	-		7	Rear wiper INT
	8	Head lamp low beam		8	Intermittent wiper switch
	9	Head lamp high beam		9	Wiper High speed
	10	Dimmer switch base		10	Front washer & wiper IGN
	11	Turn signal lamp (LH) switch		11	Front washer switch
	12	Turn signal base		12	Rear wiper & washer IGN
	13	Turn signal lamp (RH) switch		13	Rear washer
				14	-

Body Electrical System > Multifunction switch > Repair procedures

Inspection

Lighting Switch Inspection

1. With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch



Lighting Switch (Auto Light)

Terminal / Position	1	4	3	2
OFF				
I	○			○
II	○	○		○
AUTO			○	○

Lighting Switch

Terminal / Position	1	4	2
OFF			
I	○		○
II	○	○	○

Dimmer And Passing Switch

Terminal / Position	2	9	8	10
HU		○		○
HL			○	○
P	○	○		○

HU : Head lamp high beam
HL : Head lamp low beam
P : Head lamp passing switch

Turn Signal Switch

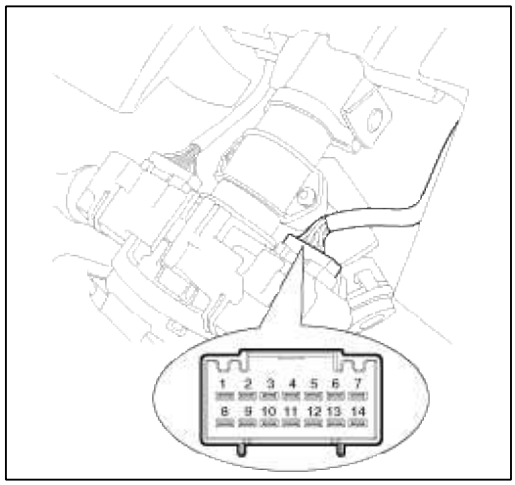
Hazard switch / Turn signal switch \ Terminal		13	11	12
OFF	L		○	○
	N			
	R	○		○

Front Fog Lamp

Terminal / Position	5	6
OFF		
ON	○	○

Wiper And Washer Switch Inspection

1. With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



Wiper Switch

Terminal / Position	3	9	2	8	10	1	4	5
MIST	○		○		○	○		
OFF	○		○					
INT	○		○		○	○		○
LOW	○				○			
HI		○			○			

Washer Switch

Terminal / Position	11	10
OFF		
ON	○	○

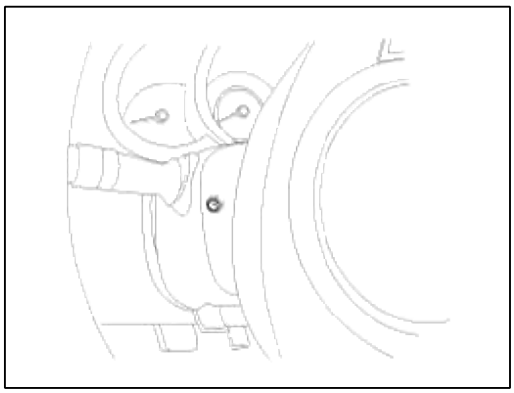
Rear Wiper & Washer Switch

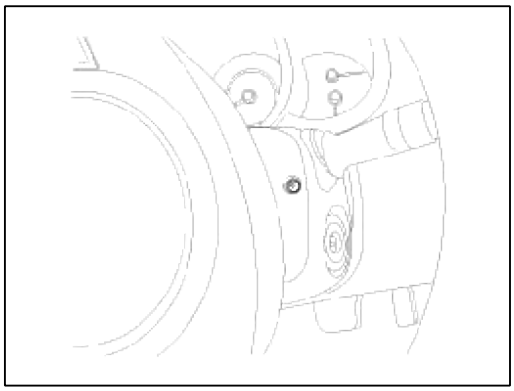
Terminal / Position	12	7	6	13
WIPER(ON)	○		○	
INT	○	○		
OFF				
WASHER(ON)	○			○

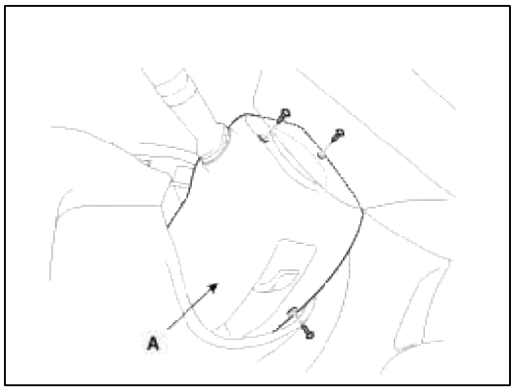
Removal

1. Disconnect the negative (-) battery terminal.

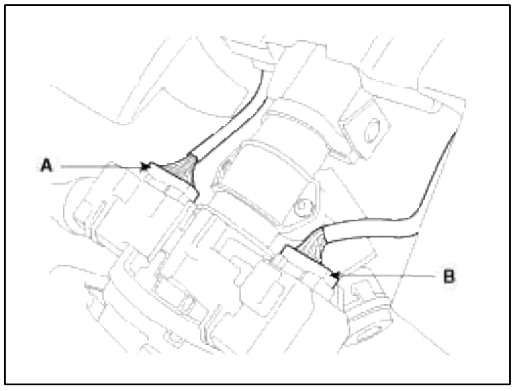
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws.







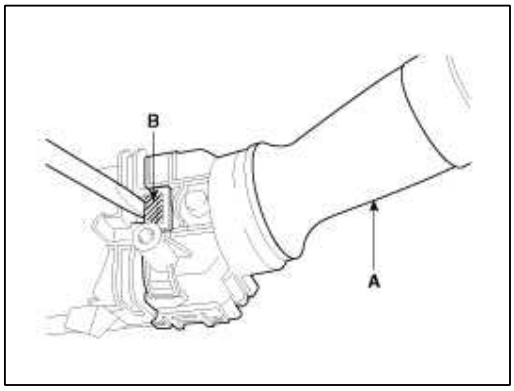
3. Disconnect the light switch connector (A) and the wiper switch connector (B).



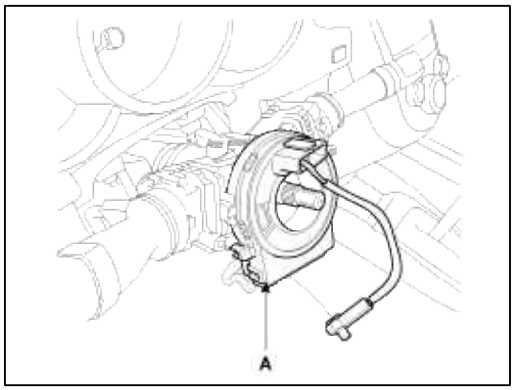
4. Remove the wiper switch (A) by pushing the lock pin (B).

NOTE

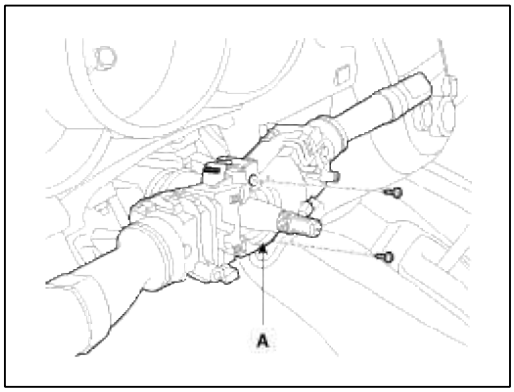
when removing the wiper & washer switch only, release the lock of wiper switch without removing the steering wheel.



5. Remove the clock spring(A).



6. Loosen the screws from the multifunction switch assembly.
7. Remove the multifunction switch assembly(A) after loosening the connectors.

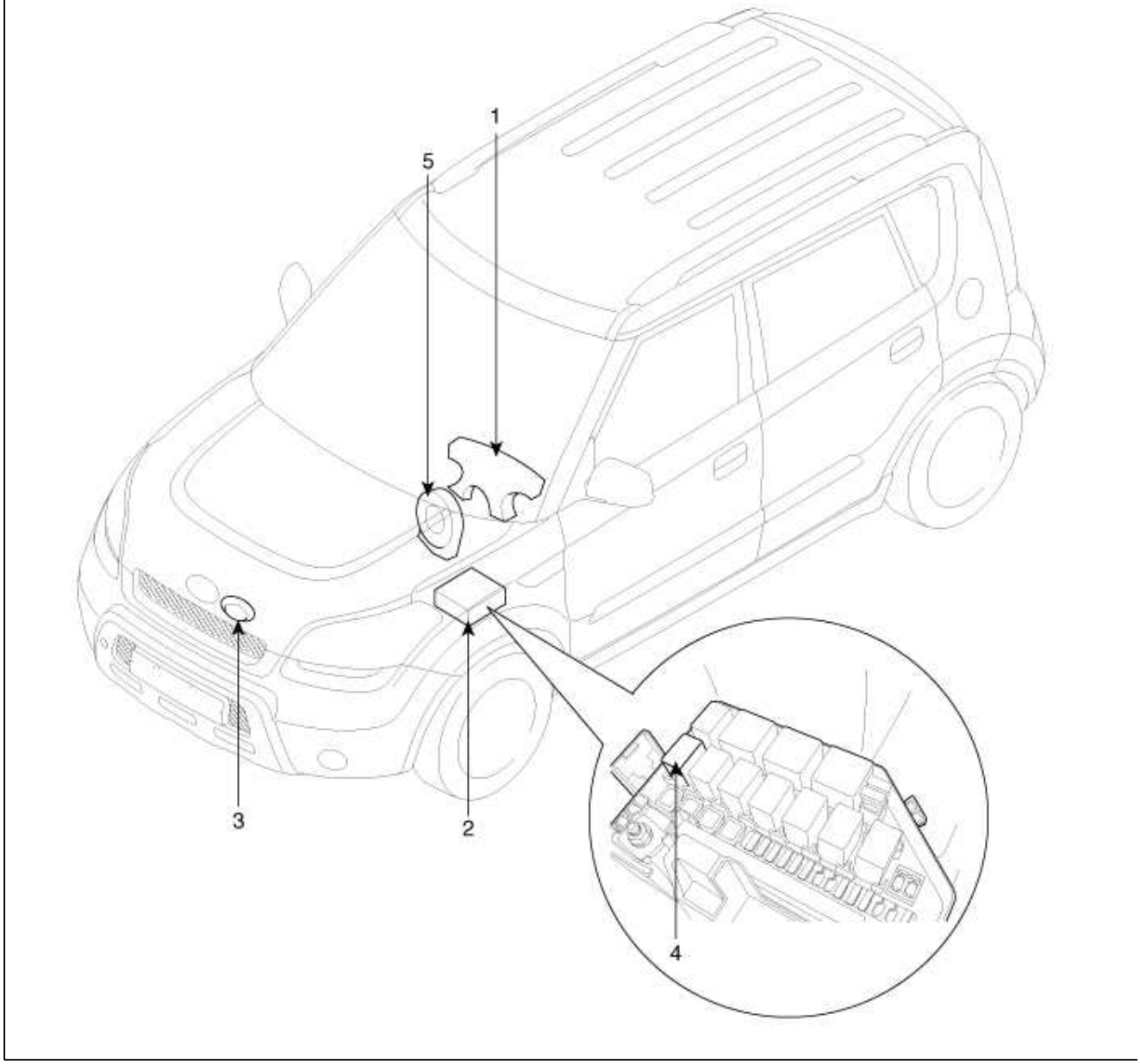


Installation

1. Install the wiper switch then connect the lighting switch connector.
2. Install the lighting switch then connect the wiper switch connector.
3. Install the steering column upper and lower shrouds.

Body Electrical System > Horn > Components and Components Location

Component Location



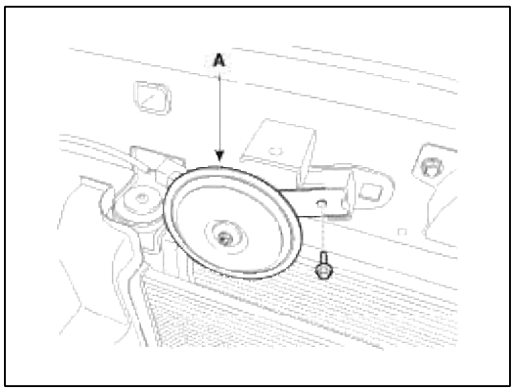
1. Horn switch 2. Relay box (Engine room compartment) 3. Horn (High pitch - Single)	4. Horn relay 5. Clock spring

Body Electrical System > Horn > Repair procedures

Removal

1. Remove the front bumper.
   (Refer to the Body group - "Front bumper")

2. Remove the bolts and disconnect the horn connectors, then remove the high pitch horn (A) and high pitch (B).



Installation

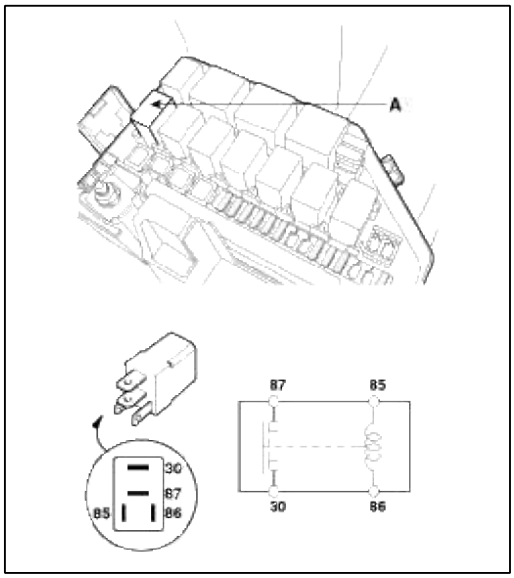
1. Install the horns after connecting the horn connectors.
2. Install the front bumper.
   (Refer to the Body group - "Front bumper")

Inspection

Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The horn should make a sound. If the horn fails to make a sound, replace it.

Horn Relay Inspection

1. Remove the horn relay (A) from the engine room relay box.
2. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
3. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



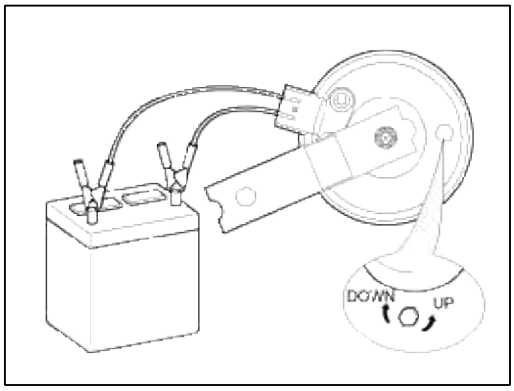
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Adjustment

1. Operate the horn, and adjust the tone to a suitable level by turning the adjusting screw.

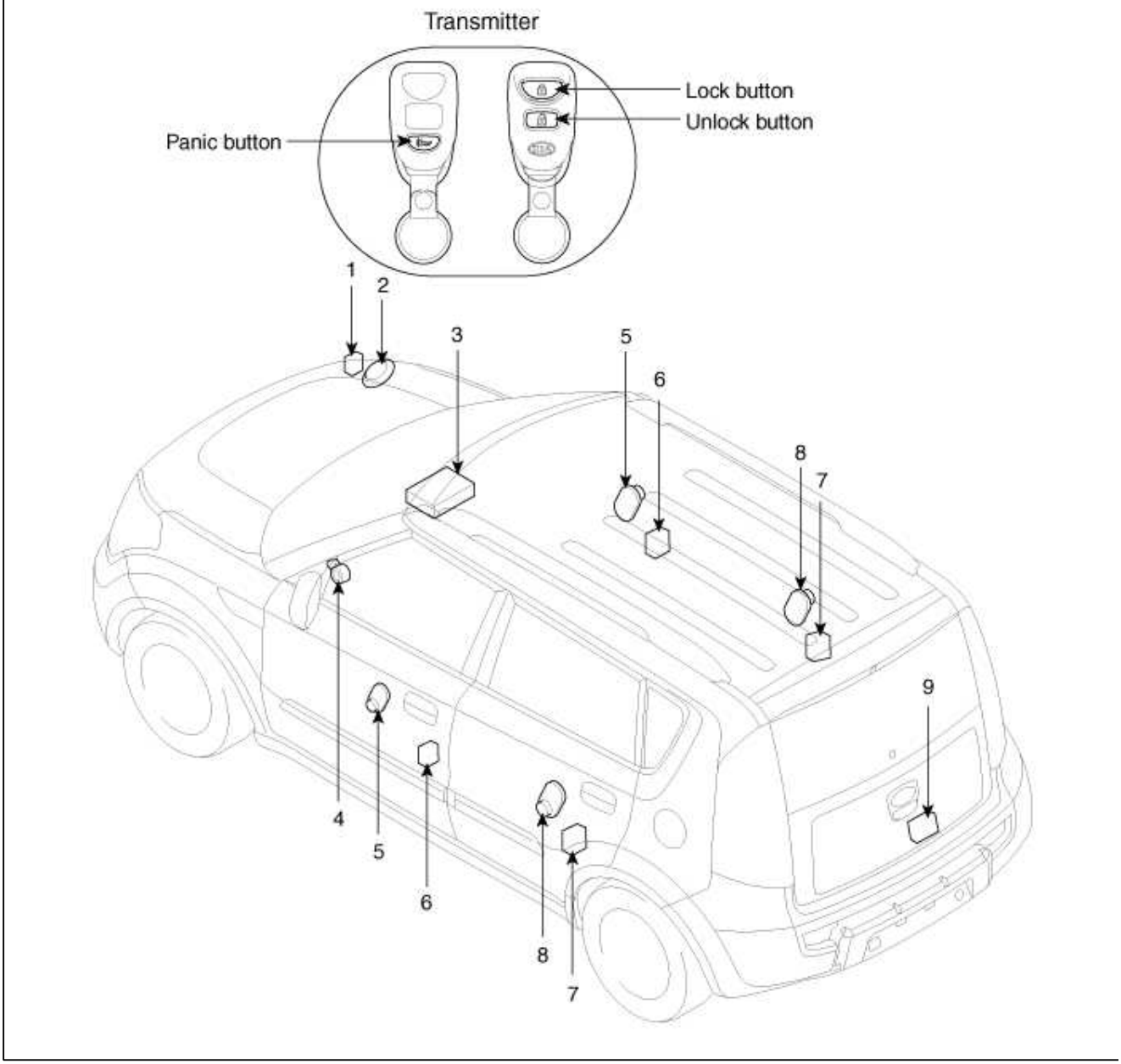
NOTE

After adjustment, apply a small amount of paint around the screw head to keep it from loosening.



Body Electrical System > Keyless Entry And Burglar Alarm > Components and Components Location

Component Location



1. Hood switch 2. Burglar horn 3. Body control module 4. Key warning switch 5. Front door motor	6. Front door lock actuator & switch 7. Rear door lock actuator & switch 8. Rear door motor 9. Tailgate actuator & switch

Body Electrical System > Keyless Entry And Burglar Alarm > Description and Operation

Description

Keyless Entry System

The keyless entry system allows you to lock and unlock the vehicle with the remote transmitter. When you push the LOCK button, all doors lock. When you push the UNLOCK button again, all doors unlock.

The room lamp, if its switch is in the center position, will come on when you press the UNLOCK button. If you do

not open a door, the light will go off in about 30 seconds, the doors will automatically relock, and the burglar alarm system will rearm. If you relock the doors with the remote transmitter within 30 seconds, the light will go off immediately.

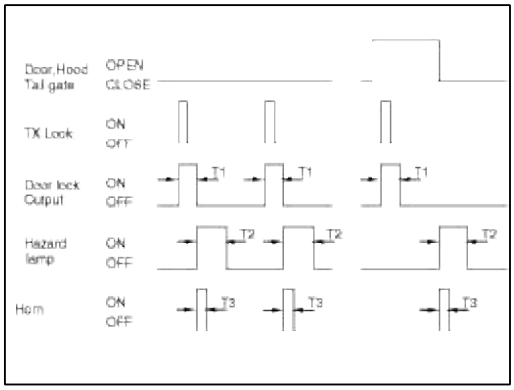
You cannot lock or unlock the doors with the remote transmitter if the key is in the ignition switch.

The system will signal you when the doors lock and unlock by flashing the hazard lamp once when they lock and closed, and twice when they unlock.

Function

Remote keyless entry

1. If Key is pulled out form cylinder and TX LOCK signal is received at any Door Close state, turn Lock output ON, Hazard lamp output ON one time for 1sec, Horn output ON for T3 one time after confirming Door lock.
2. If TX LOCK signal is received at any one of Door, Hood and Tail gate is opened, turn LOCK output ON and Hazard lamp and horn output is not operated.
3. If OPEN →CLOSE after (2), turn Hazard lamp and Horn output ON one time for T3.
4. If Door is not opened after TX UNLOCK signal receiving, turn LOCK & Horn output ON one time for T3. Also, If TX UNLOCK signal receive within 30sec, extend 30sec.
   But, If Key in sw ON or IGN1 ON or IGN2 ON after TX UNLOCK within 30sec, 30sec TIMER is cleared.
5. If TX UNLOCK signal is received, turn UNLOCK output ON and Hazard lamp output ON 2times.(0.5sec ON/OFF cycle)



T1 : 0.5 ± 0.1sec, T2 : 1.0 ± 0.2sec

T3 : 50.0 ± 5msec

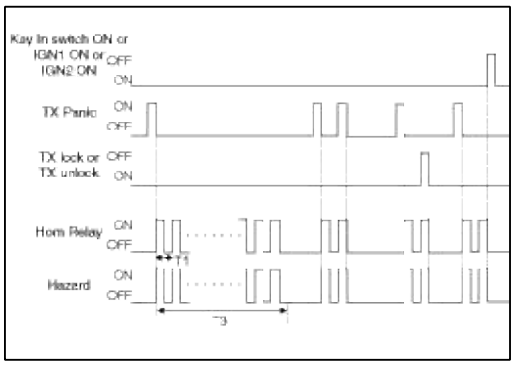
Panic alarm

This is a function of PANIC ALARM in vehicles using Horn Relay and Hazard Relay.

On condition of Key In Switch = OFF, IGN1 = OFF, IGN2 = OFF, SMK(RKE PAINC) operation is started when inputting PANIC of TX and stopped on condition of situations below.

1. When inputting TX LOCK
2. When inputting TX UNLOCK
3. When inputting PANIC
4. When inputting TX TAIL GATE UNLOCK (Only EUROPE)
5. When inputting Key In SWITCH=ON or IGN1=ON or IGN2=ON
6. After finishing PANIC ALARM operation
7. When Driver Door Key Unlock SWITCH ON
8. When Assist Door Key Unlock SWITCH ON
9. When Driver Door Key Lock SWITCH ON

10. When Assist Door Key Lock SWITCH ON



T1 : 0.9 ± 0.1sec, T2 : 27 ± 3sec

Transmitter(TX) Spec

1. Transmission Distance : 30m or more from outside of the car
2. Registration procedure of the transmitter
   (1) In registration mode, it shall be possible to register up to Max 4EA.
   (2) At re-registration, data are registered newly after deleting the previous TX DATA

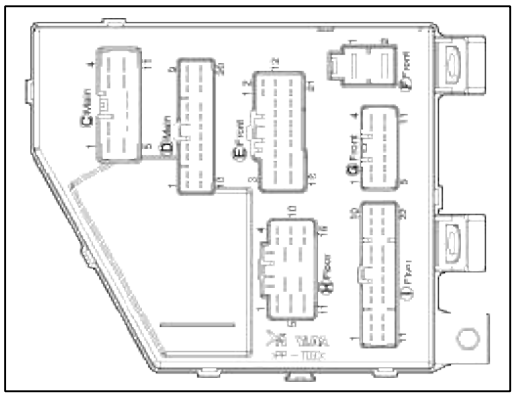
No.	Saved CODE	CODE to change	Changed CODE
1	A	C	C (A is deleted)
2	A, B, C, D	E	E (A, B, C, D is deleted)
3	A, B	C, D, E	C, D, E
4	A, B	C, C, D	C

   (3) For the registration procedures by using Hi-scan tool, refer to "TRANSMITTER CODE REGISTRATION".
3. Transmitter signal & Receiver Spec
   (1) Transmission signal
      A. Transmit relevant transmission DATA (Transmission frame) twice by pushing TX switch.
      B. Only LOCK signal is output when pushing TX LOCK switch and UNLOCK switch at the same time.

Body Electrical System > Keyless Entry And Burglar Alarm > Repair procedures

Inspection

Door Lock Relay

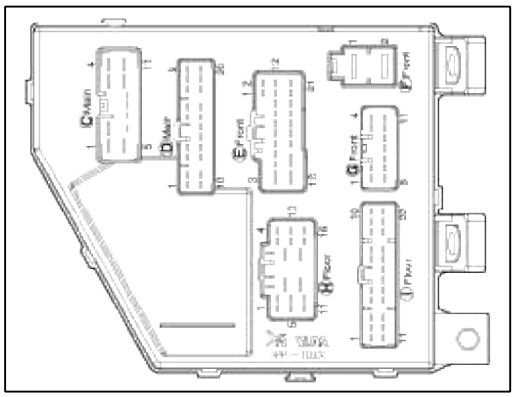


Terminal / Power	F-1	H-6	F-1	H-3
Disconnected			○	○
Connected	○	○	⊖	⊕

Check for continuity between the terminals.

1. There should be continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-H.
2. There should be no continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power is disconnected.

Door Unlock Relay



Terminal / Power	F-1	H-5	F-1	H-9
Disconnected			○	○
Connected	○	○	⊖	⊕

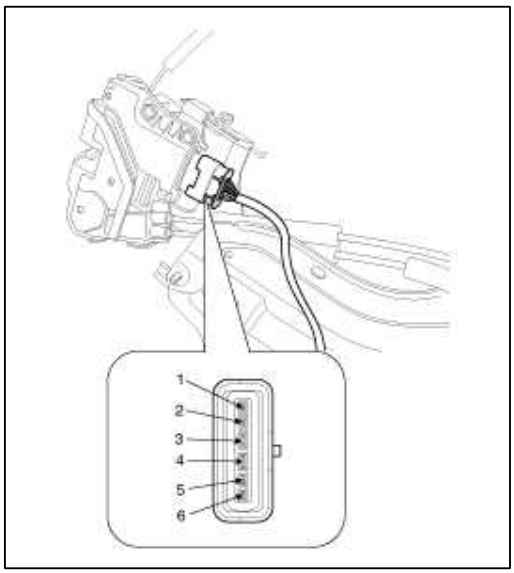
Check for continuity between the terminals.

1. There should be continuity between the No.1 terminals in the I/P-F and No.5 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.9 terminals in the I/P-H.
2. There should be no continuity between the No.1 terminals in the I/P-F and No.5 terminals in the I/P-H when power is disconnected.

Front Door Lock Actuator

1. Remove the front door trim.
   (Refer to the Body group - "Front door")
2. Remove the front door module.
   (Refer to the Body group - "Front door")

3. Disconnect the connectors from the actuator.

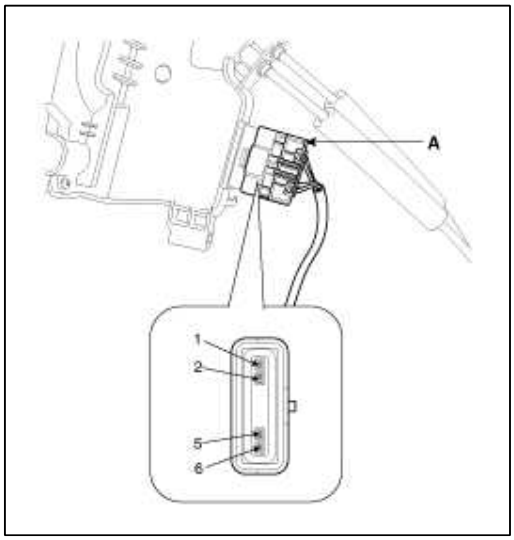


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	1
LH	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
RH	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Rear Door Lock Actuator

1. Remove the rear door trim.
   (Refer to the Body group - "Rear door")
2. Remove the rear door module.
   (Refer to the Body group - "Rear door")
3. Disconnect the connectors from the actuator (A).

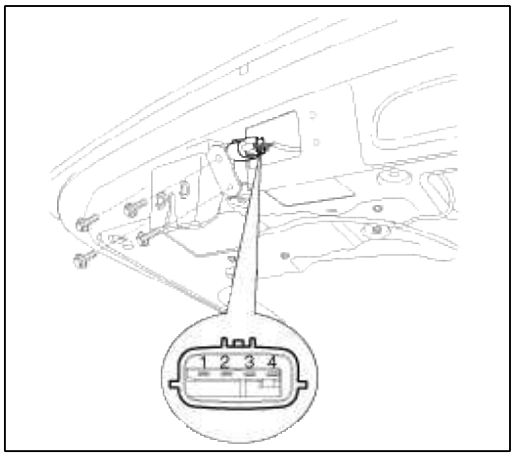


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	1
LH	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
RH	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim.
   (Refer to the Body group - "Tail gate")
2. Disconnect the 4P connector from the actuator.

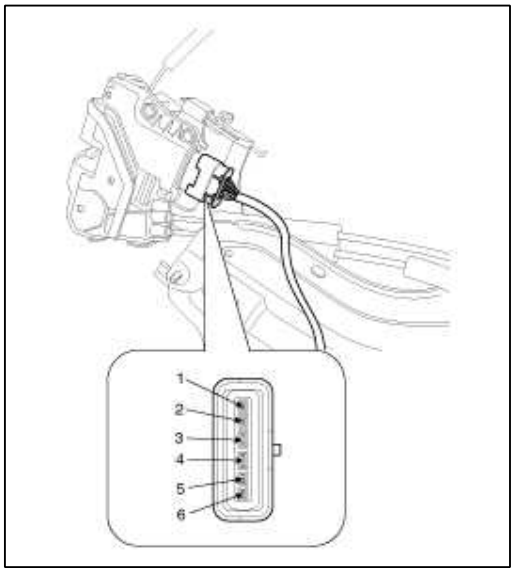


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

1. Remove the front door trim.
   (Refer to the Body group - "Front door")
2. Remove the front door module.
   (Refer to the Body group - "Front door")
3. Disconnect the connectors from the actuator.

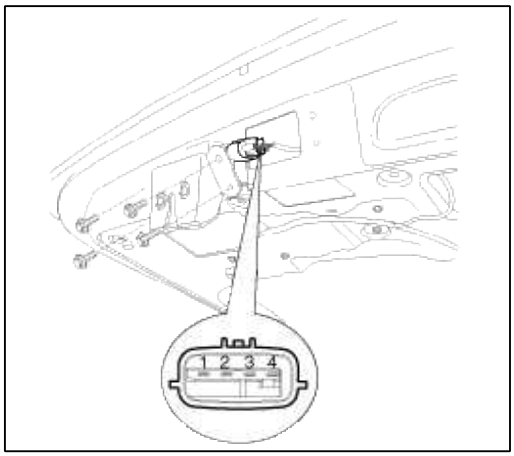


4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

Position		Terminal 4	3	6
LH	Lock		○	○
	Unlock	○		○
RH	Lock		○	○
	Unlock	○		○

Tailgate Switch

1. Remove the tailgate trim.
   (Refer to the Body group - "Tail gate")
2. Disconnect the 4P connector from the actuator.

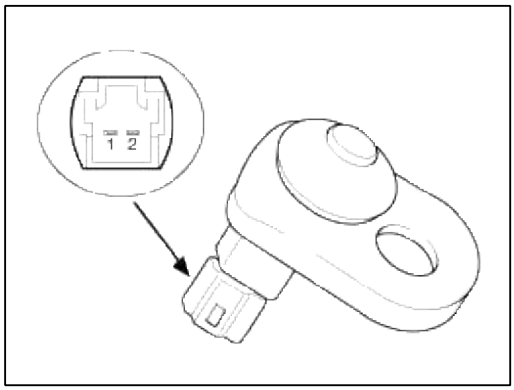


3. Check for continuity between the terminals in each switch position according to the table.

Position	Terminal 1	2
Lock		
Unlock	○	○

Door Switch

Remove the door switch and check for continuity between the terminals.

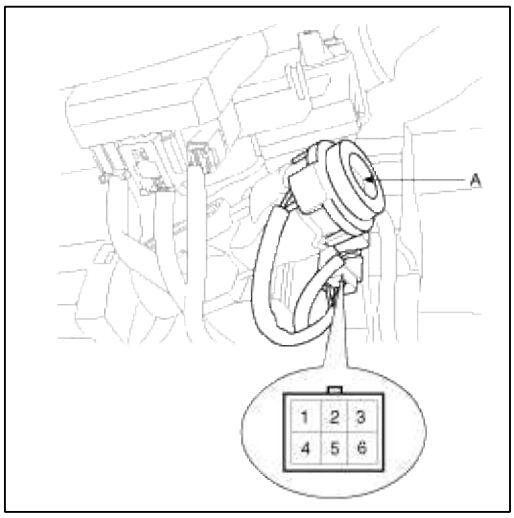


Position	Terminal 1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

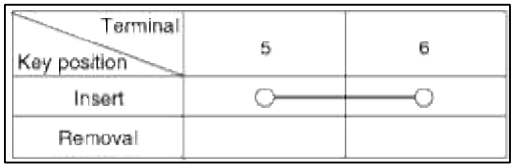
Key In Switch

1. Remove the crash pad lower panel.
   (Refer to Body group - "Crash pad")

2. Disconnect the 6P connector from the key warning switch.



3. Check for continuity between the terminals in each position according to the table.



Body Electrical System > Keyless Entry And Burglar Alarm > Transmitter > Specifications

Specifications

Item	Specification
Rated voltage	DC 3V
Service voltage range	DC 2.5V ~ 3.2V
Temperature range	-4°F ~ 140°F (-20°C ~ +60°C)
Modulation method	FSK
Keyless entry transmitterPower source	CR2032 (Lithium 3V battery, 1EA)
Transmissible distance	30m or more
Life of battery	2 years or more (at 20 times per day)
Button	4 (Door lock, Door unlock, Tailgate, Panic)
Transmission frequency	315 MHz

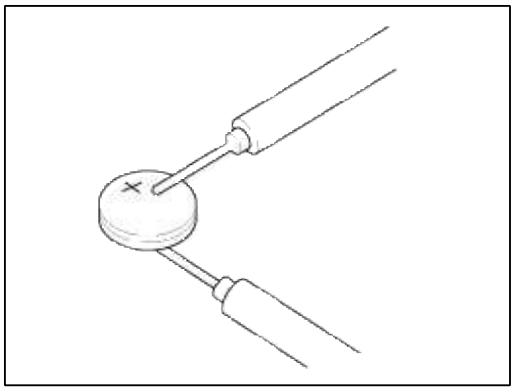
Body Electrical System > Keyless Entry And Burglar Alarm > Transmitter > Repair procedures

Inspection

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.

2. Remove the battery and check voltage if the red light doesn't flicker.

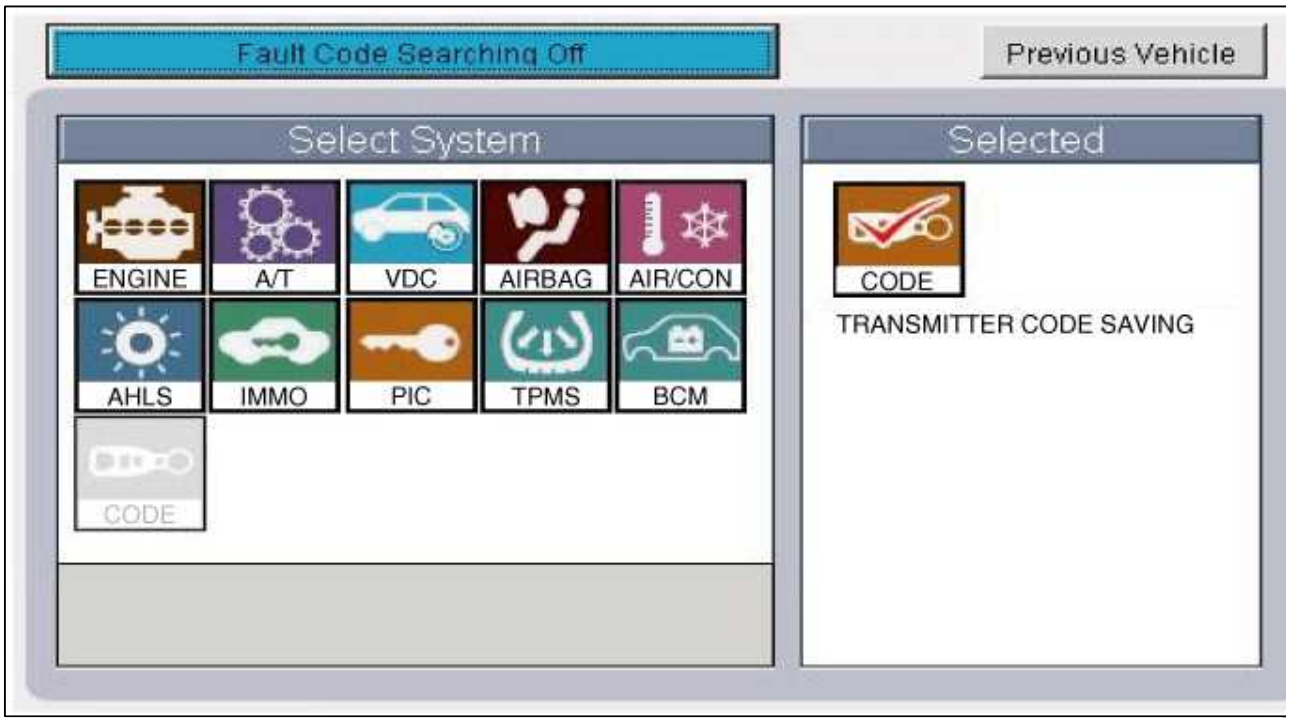
Standard voltage : 3V



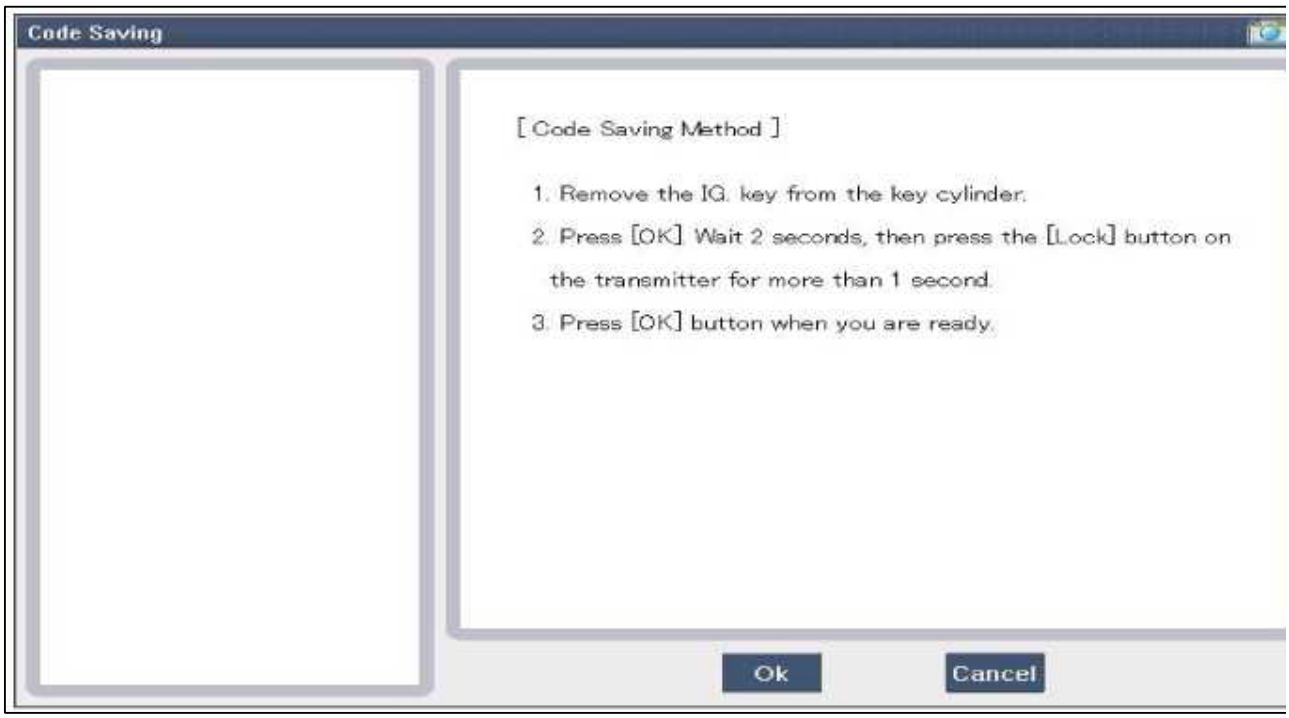
3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors.
5. If the transmitter is fails, replace only the transmitter.

Transmitter Code Registration (Using GDS)

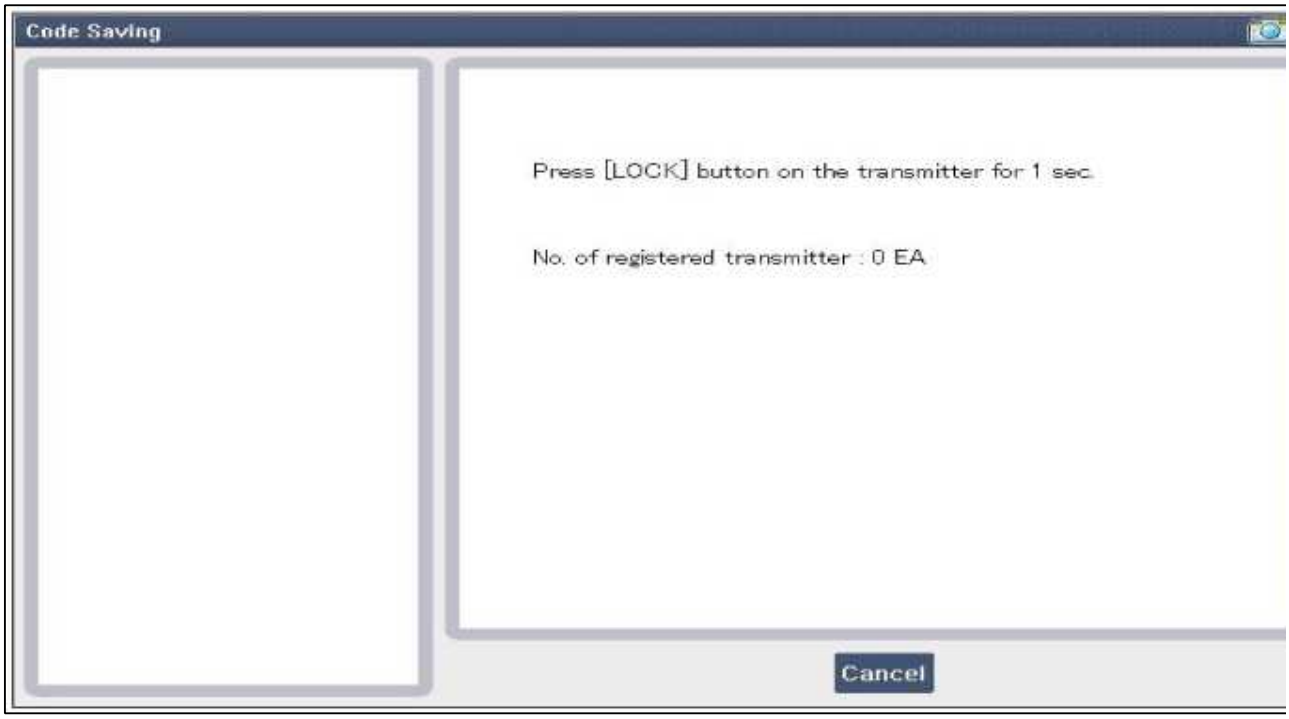
1. Connect the DLC cable of GDS to the data link connector (16 pins) in driver side crash pad lower panel, turn the GDS ON.
2. Select the vehicle model and then do "CODE SAVING".

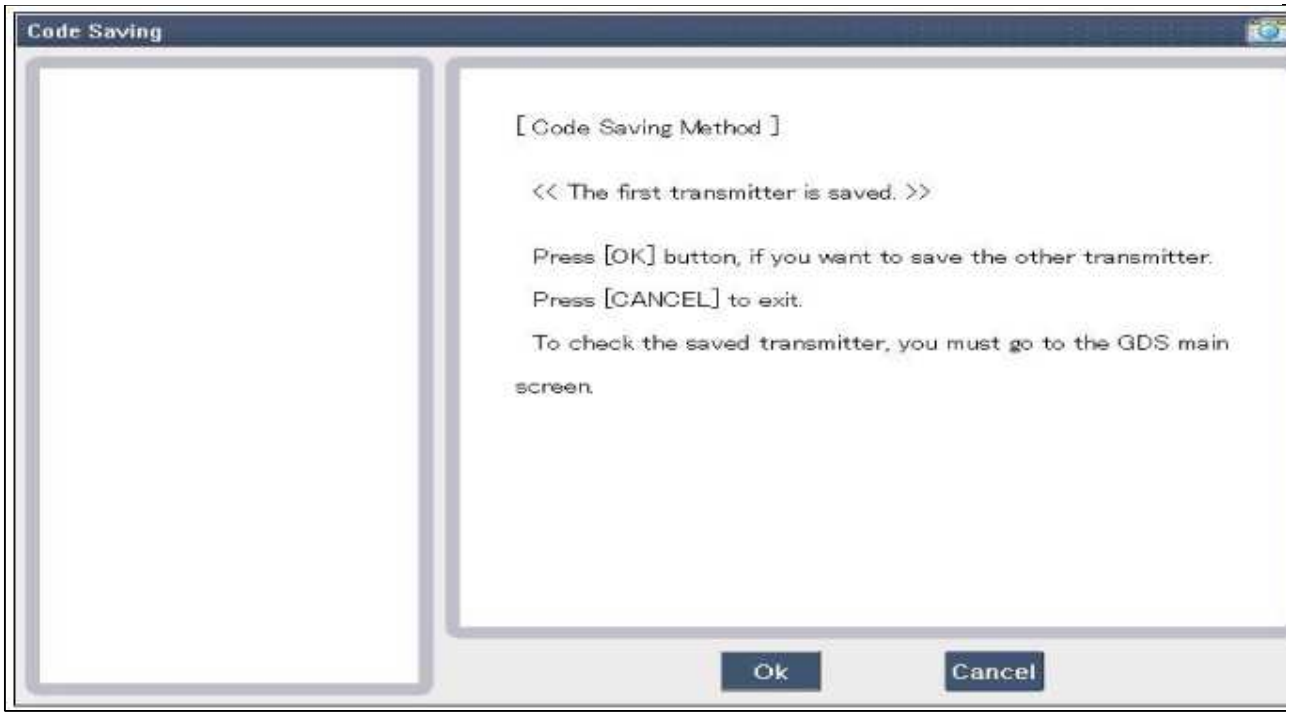


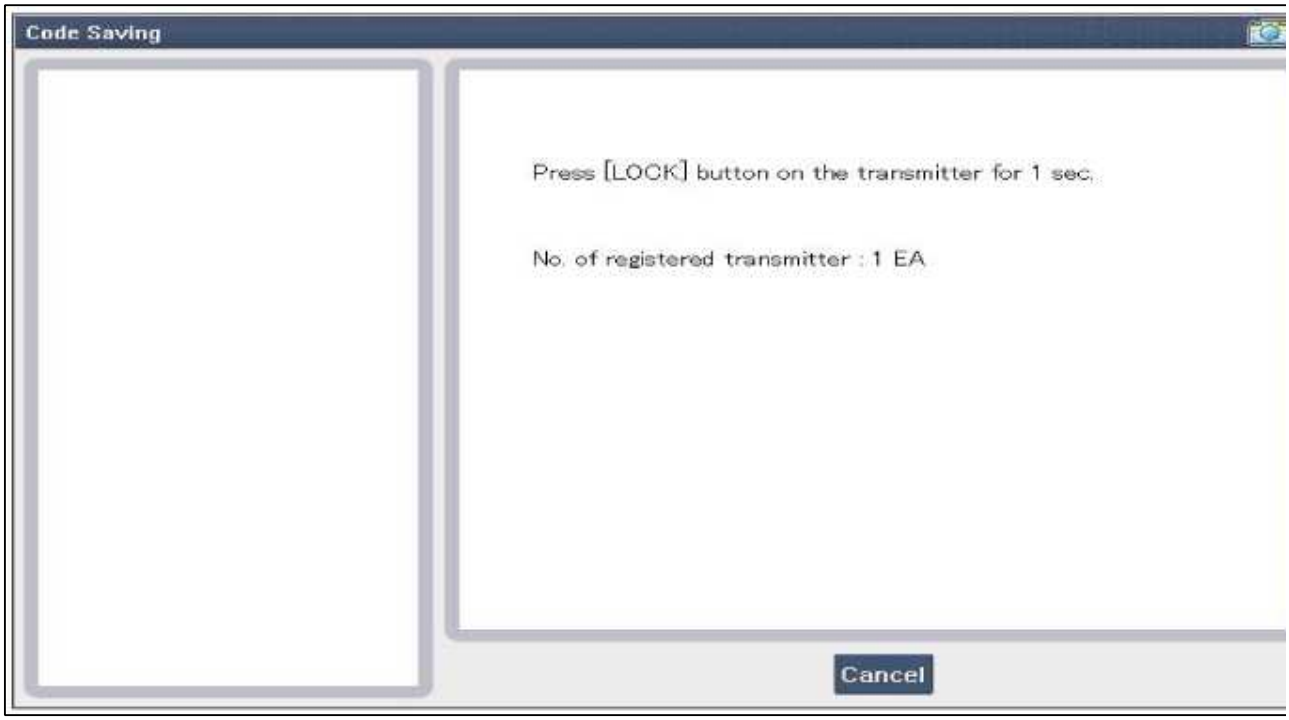
3. After selecting "CODE SAVING" menu, button "OK" key, then the screen will be shown as below.

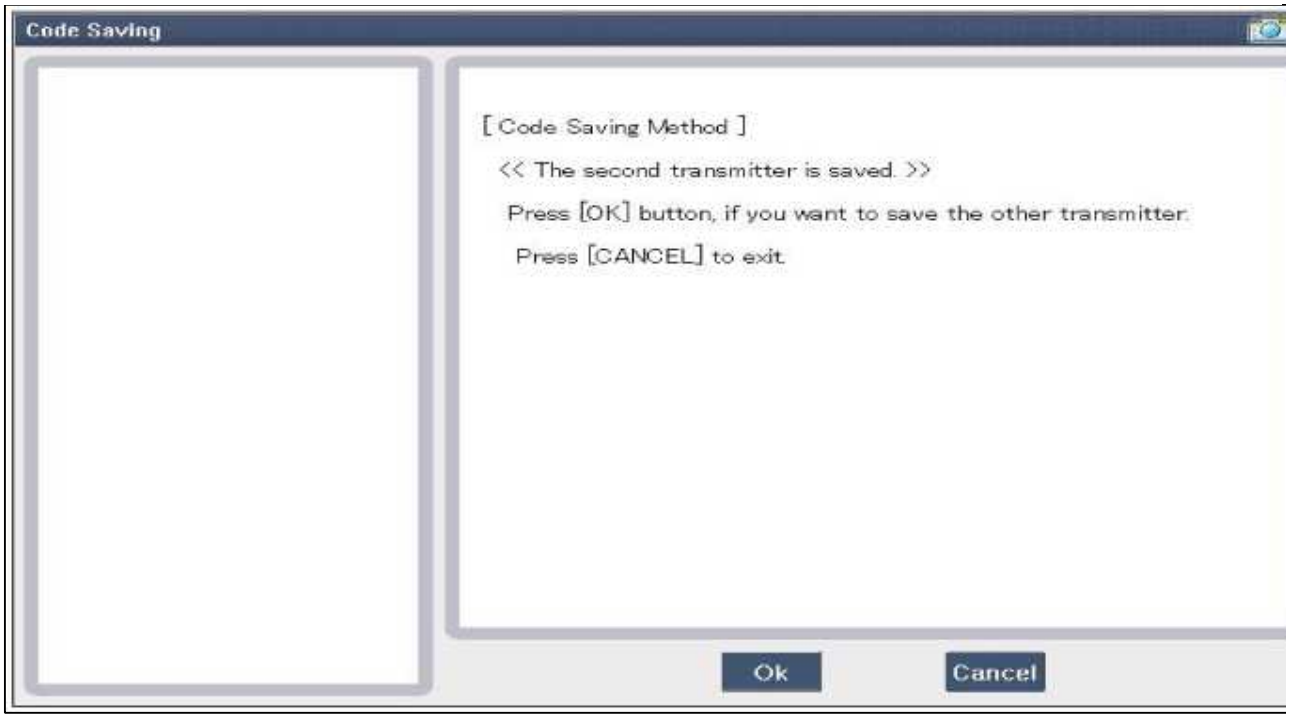


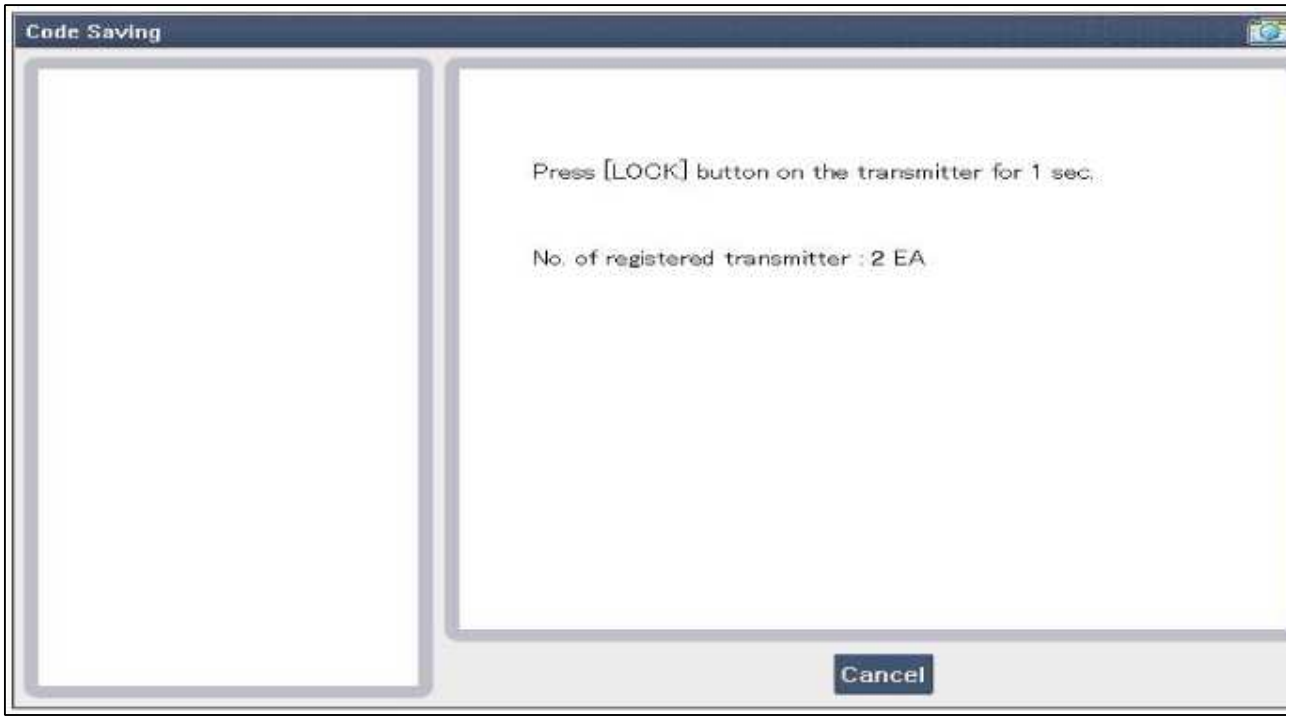
4. After removing the ignition key from key cylinder, push "OK" key to proceed to the next mode for code saving. Follow steps 1 to 4 and then code saving is completed.

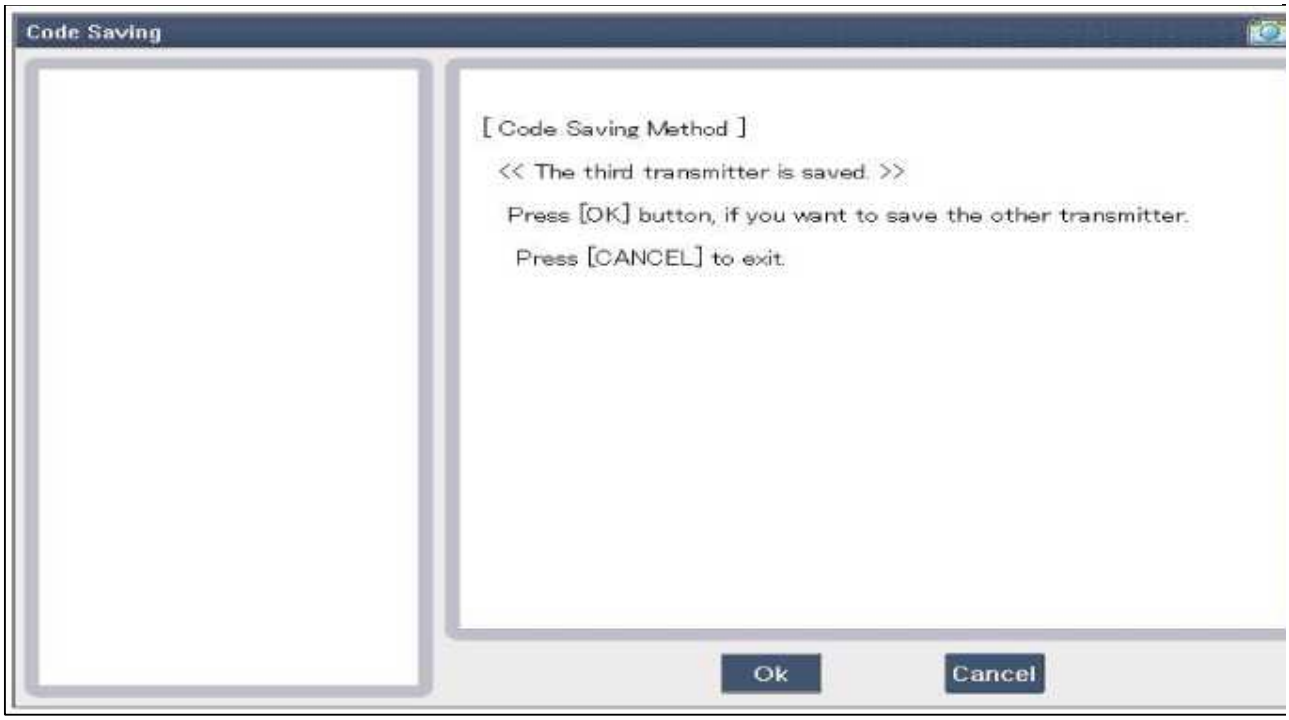


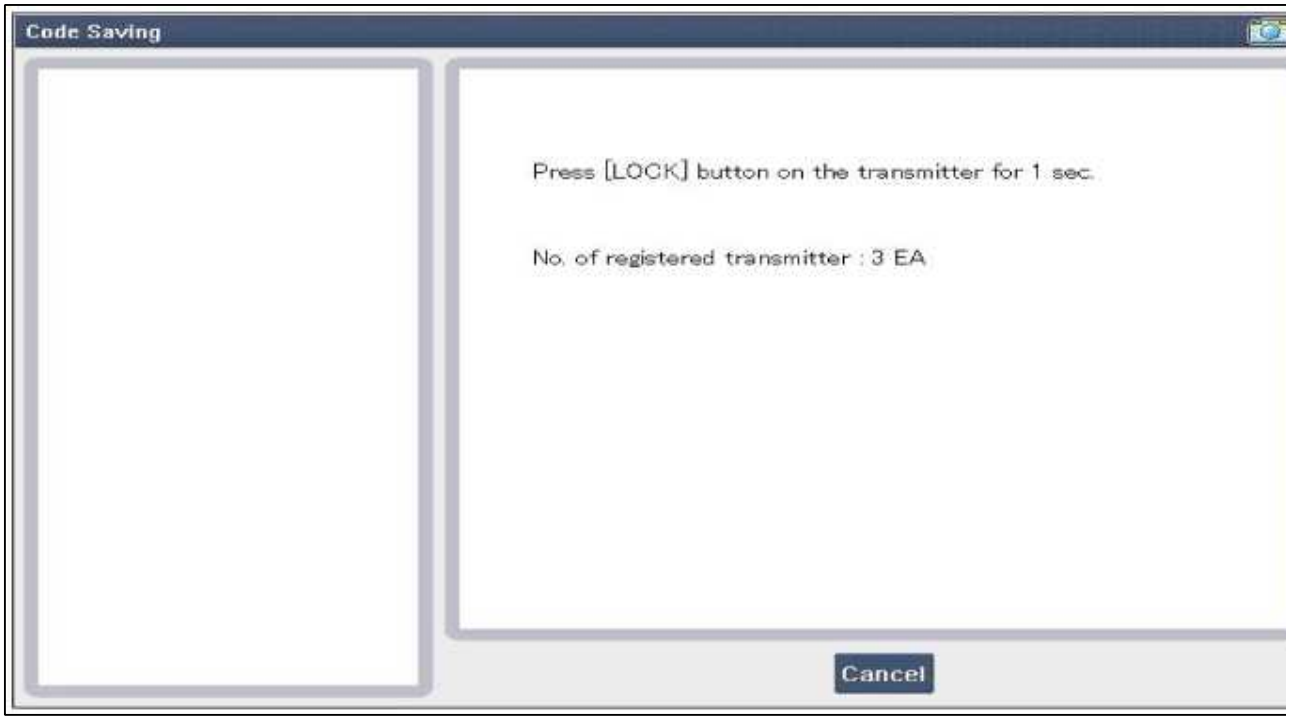

Code Saving
[Code Saving Method]
<< The first transmitter is saved. >>
Press [OK] button, if you want to save the other transmitter.
Press [CANCEL] to exit.
To check the saved transmitter, you must go to the GDS main screen.
Ok
Cancel

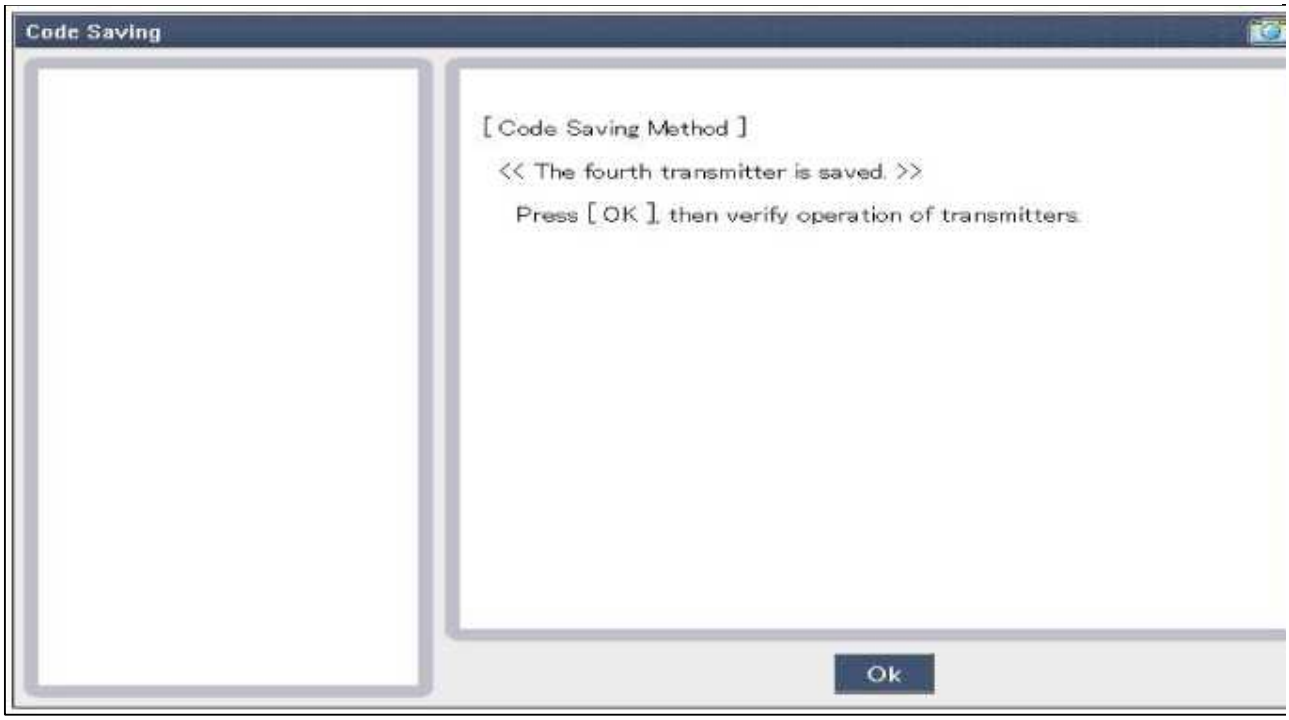

Code Saving
Press [LOCK] button on the transmitter for 1 sec.
No. of registered transmitter : 1 EA
Cancel

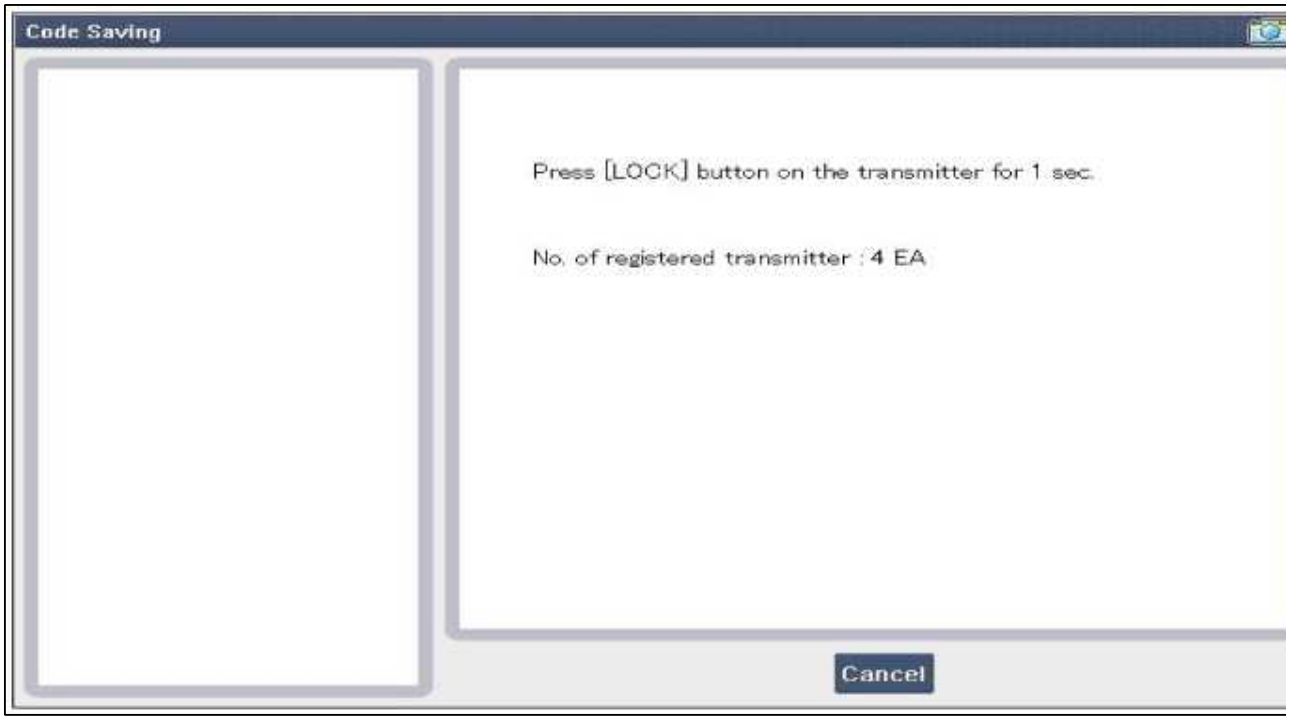

Code Saving
[Code Saving Method]
<< The second transmitter is saved. >>
Press [OK] button, if you want to save the other transmitter.
Press [CANCEL] to exit.
Ok
Cancel


Code Saving
Press [LOCK] button on the transmitter for 1 sec.
No. of registered transmitter : 2 EA
Cancel


Code Saving
[Code Saving Method]
<< The third transmitter is saved. >>
Press [OK] button, if you want to save the other transmitter.
Press [CANCEL] to exit.
Ok
Cancel


Code Saving
Press [LOCK] button on the transmitter for 1 sec.
No. of registered transmitter : 3 EA
Cancel





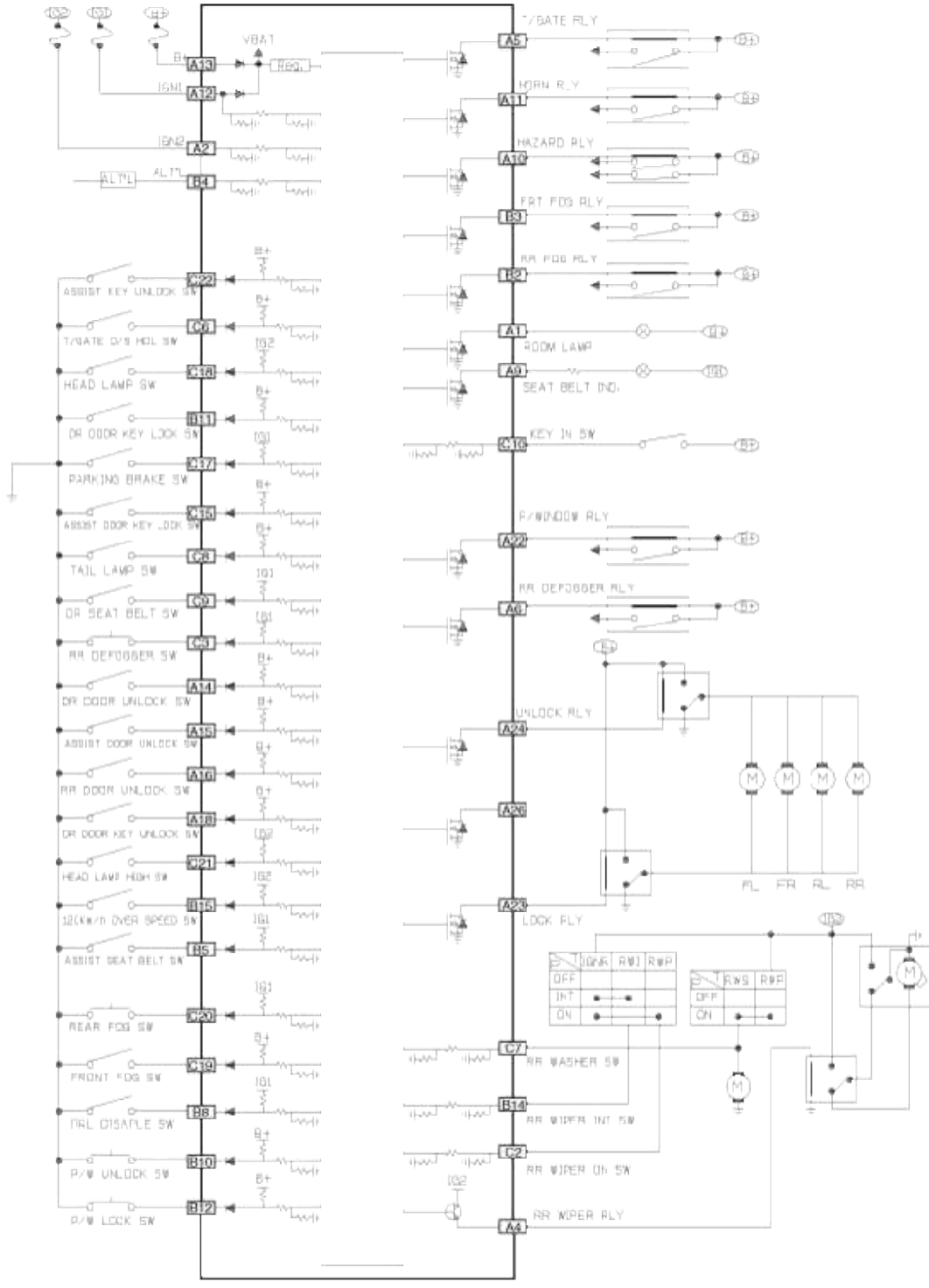
Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Specifications

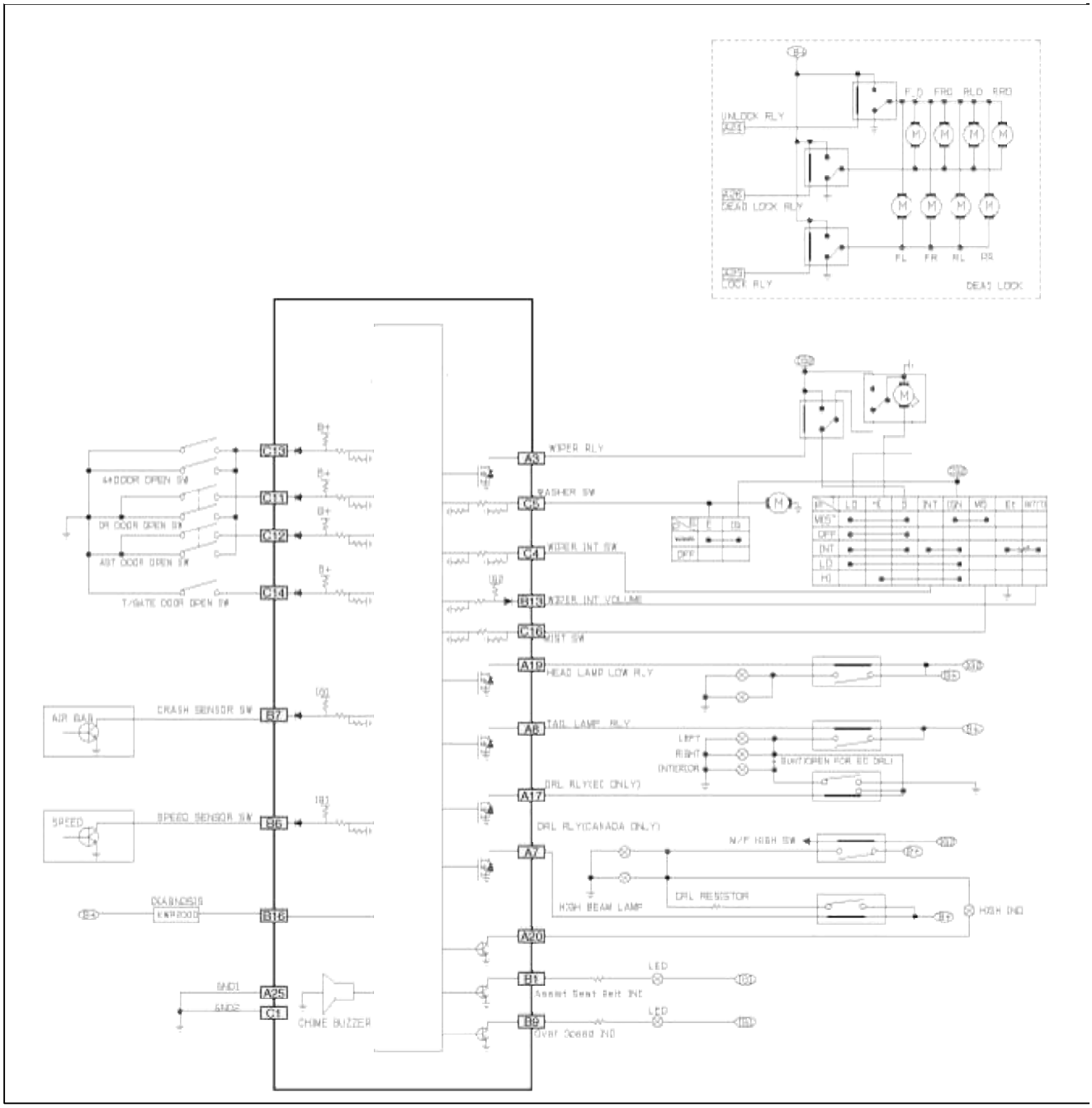
Specifications

Item	Requirement	Remark
Rated voltage	DC 12V	Shall activate normally in these range.
Operating voltage range	DC 9 ~ 16V	
Operating temperature range	-30°C ~ +80°C	
Storage temperature range	-40°C ~ +85°C	
Insulation resistance	100Mohm or more (measured with 500V MEGGER)	Specify as well as parts that insulation like PCB, moisture-proof COATING is required
Dark Current	Max 4mA (KEYLESS) Max 3mA (NON-KEYLESS)	Measure when the state, all output loads are OFF and there are no Input SW(including TX operation) changes, continues 2sec.

Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Schematic Diagrams

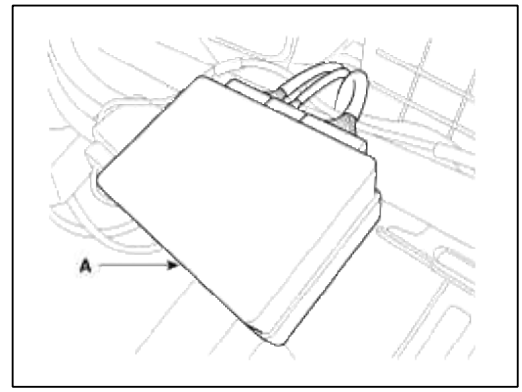
Circuit Diagram


VBAT
IGN1
IGN2
ALTFL
T/GATE RLY
HORN RLY
HAZARD RLY
FRT FOG RLY
RR FOG RLY
ROOM LAMP
SEAT BELT IND
KEY IN SW
P/WINDOW RLY
RR DEFOGGER RLY
UNLOCK RLY
LOCK RLY
RR WASHER SW
RR WIPER INT SW
RR WIPER ON SW
RR WIPER RLY
ASSIST KEY UNLOCK SW
T/GATE O/S HDL SW
HEAD LAMP SW
DR DOOR KEY LOCK SW
PARKING BRAKE SW
ASSIST DOOR KEY LOCK SW
TAIL LAMP SW
DR SEAT BELT SW
RR DEFOGGER SW
DR DOOR UNLOCK SW
ASSIST DOOR UNLOCK SW
RR DOOR UNLOCK SW
DR DOOR KEY UNLOCK SW
HEAD LAMP HIGH SW
120KM/H OVER SPEED SW
ASSIST SEAT BELT SW
REAR FOG SW
FRONT FOG SW
PRL DISABLE SW
P/W UNLOCK SW
P/W LOCK SW
FL
FR
RL
RR



Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Description and Operation

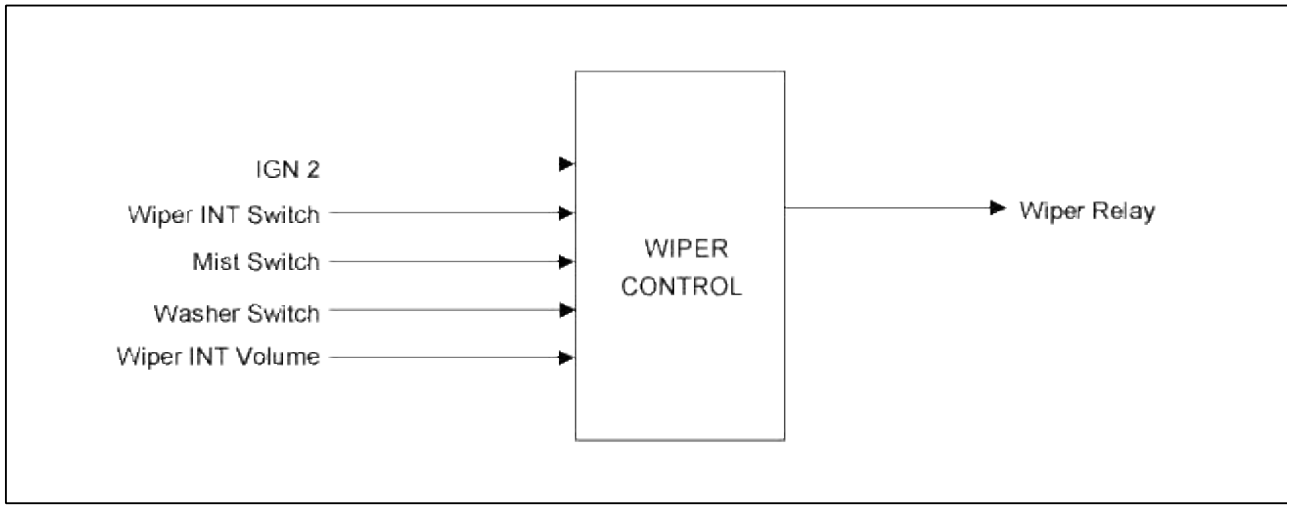
Description

Body control module (A) receives various input switch signals controlling time and alarm functions for Variant INT wiper, MIST wiper, rear wiper & washer, seat belt warning(reminder), over speed warning, tail lamp auto cut, DRL, front fog lamp, decayed room lamp, rear defoger timer, power window timer, central lock/unlock, tail gate release control, IGN key reminder, crash door unlock, keyless entry, panic.	

Function

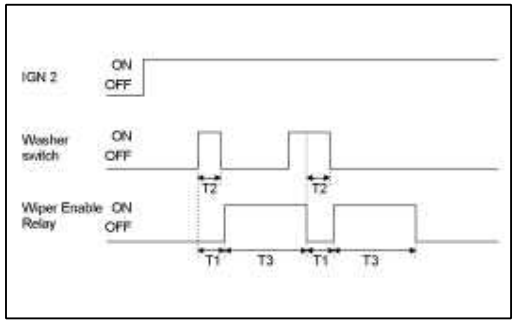
Wiper Control

1. Wiper Data Flow



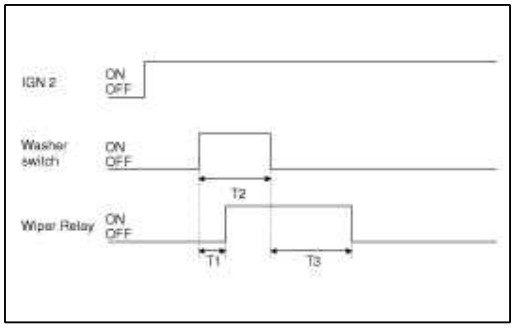
2. Washer Interlocking Wiper

(1) Turn Wiper switch ON after T1 when turning Washer switch on at the status of IGN2 ON and if the input of Washer switch is between 0.06 and 0.2sec, turn the output of Wiper relay OFF after T3. But, ignore the input the input of Washer switch after operating Washer interlocking wiper.



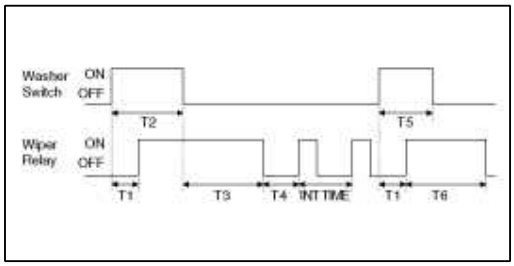
T1 : 0.3±0.03sec, T2 : 0.06~0.2sec, T3 : 0.7±0.1sec, T2 is less than 0.06sec : T3=0

(2) Turn Wiper relay ON after T1 when turning Washer switch ON at the status of IGN2 ON and if the input of Washer switch is more than 0.2sec, turn the output of wiper relay off for 2.5 ~ 3.8sec after turning washer switch OFF.
But, ignore the input of Washer switch occurred while Washer interlocking Wiper is being operated and accept it from the input of Washer switch after operating Washer interlocking Wiper.



T1 : 0.3 ± 0.03s, T2 : more than 0.2sec,
T3 : 2.5 ~ 3.8s

(3) Turn the output of WASHER INTERLOCKING WIPER when Washer switch is turned ON for more than 0.2sec during the operation of INT WIPER. If Washer switch is turned on for less than 0.2sec, turn the output of Wiper Relay once.

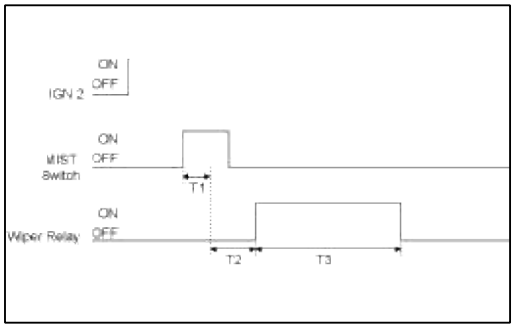


T1 : 0.3 ± 0.03s, T2 : more than 0.2s,
T3 : 2.5 ~ 3.8s, T4 : INT TIME - 0.7s,
T5 : 0.06 ~ 0.2s, T6 : 0.7 ± 0.1s

(4) In case of starting (IGN1 ON & IGN2 OFF) ignore the input of Washer switch.

3. Mist Interlocking Wiper

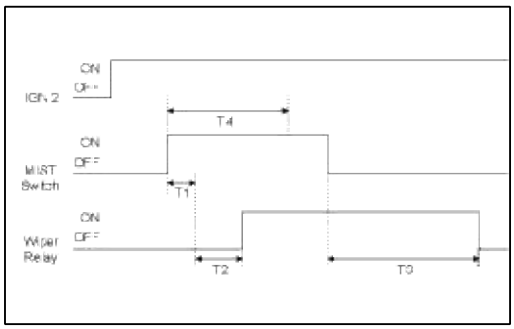
(1) Turn the output of Wiper Relay for 700ms when Mist switch ON at the status of IGN2 ON.



T1 : Min 60 ms, T2 : Max 100ms,
T3 : 700 ± 100ms

(2) If the input of Mist switch is continuous (for more than 700ms), keep the condition of Wiper Relay is ON and if Mist switch is turned OFF turn the output of Wiper Relay for 700ms from that point.

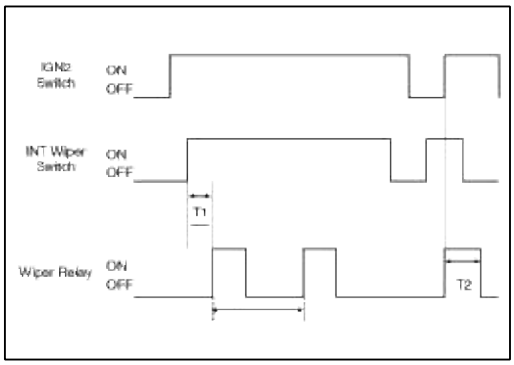
(3) Ignore the input of Mist switch while operating WIPER by INT WIPER, WASHER Interlocking WIPER.



T1 : Min 60 ms, T2 : Max 100ms,
T3 : 700 ± 100ms, T4 : 700ms

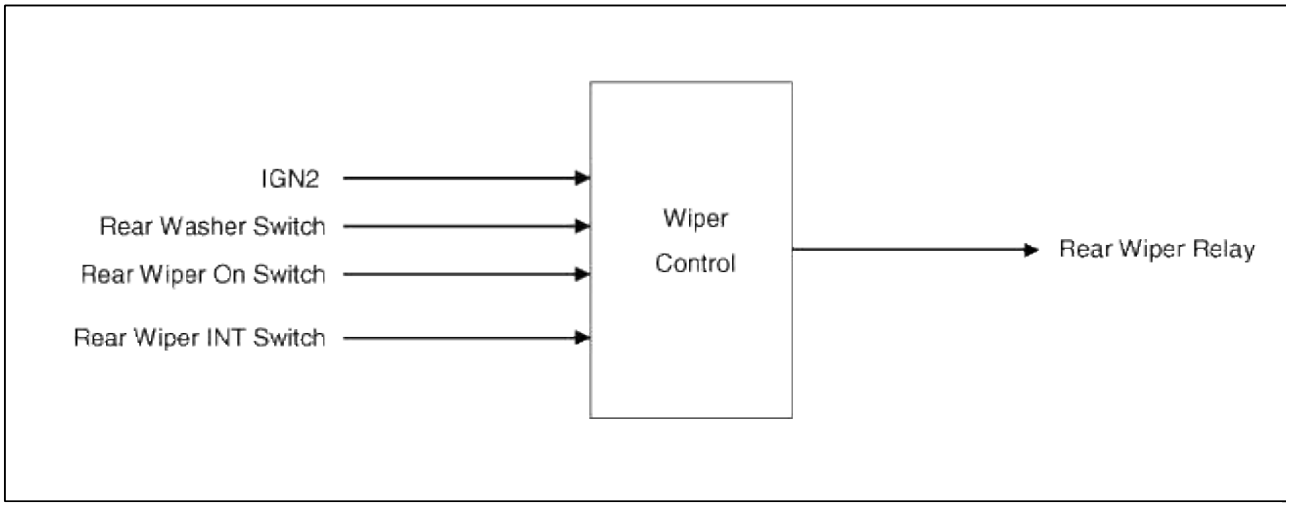
4. Variable INT Wiper

Variable INT Wiper is operated by INT volume when the input of INT WIPER switch is ON at the status of IGN2 ON.



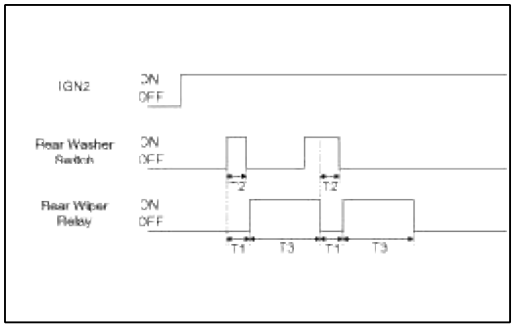
T1 : 0.3sec MAX, T2 : 0.7 ± 1SEC
T3 : T2 + pause time

5. Rear Wiper Control



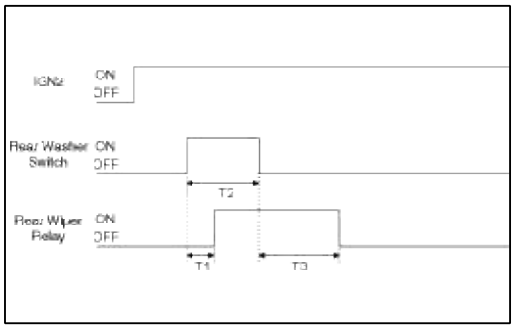
6. Rear Washer Inter Locking Rear Wiper

(1) Rear Wiper Realy is turned ON after T1 When Rear Washer switch is turned ON at the status of IGN2 ON. If input of Rear Washer switch is less than 0.2sec and more than 0.06sec, Rear Wiper Realy is turned OFF after T3. Ignore the input of Rear Washer switch operating Rear Washer interlocking Rear Wiper accepts the input of Rear Washer switch after the operating Rear Washer interlocking Rear Wiper.



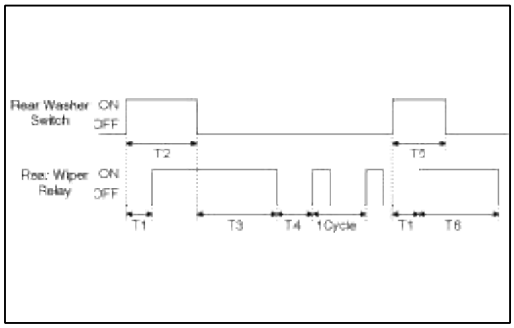
T1 : 0.3 ± 0.03sec, T2 : 0.06 ~ 0.2sec
T3 : 0.7 ± 0.1sec, T2 is less than 0.06sec : T3=0

(2) Rear Wiper Relay is turned ON after T1 When Rear Washer switch is turned ON at the status of IGN2 ON. If input of Rear Washer switch is more than 0.2sec, output of Rear Wiper Relay is turned OFF after output of Rear Wiper Relay is turned ON for more than 2.5sec and less than 3.8sec after Rear Washer switch OFF. Ignore the input of Rear Washer switch operating Rear Washer interlocking Rear Wiper accept the input of Rear Washer switch after the operating Rear Washer interlocking Rear Wiper.



T1 : 0.3 ± 0.03sec, T2 : more than 0.2sec
T3 : 2.5 ~ 3.8sec

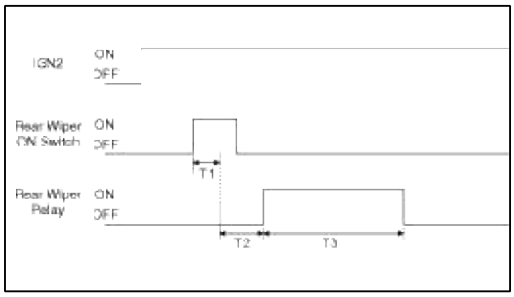
(3) If the input of Rear Washer switch is more than 0.2sec operating Rear Wiper INT, output of Rear Washer interlocking Rear Wiper is turned ON. If the input of Rear Washer is less than 0.2sec, turn the output of Rear Washer interlocking Rear Wiper once.



T1 : 0.3 ± 0.03sec, T2 : more than 0.2sec,
T3 : 2.5 ~ 3.8sec, T4 : 1Cucle -0.7sec,
T5 : 0.06 ~ 0.2sec, T6 : 0.7 ± 0.1sec

7. Rear Wiper ON

(1) IF Rear Wiper ON switch is ON at the status of IGN2 ON, the output of Rear Wiper Relay is turned ON for 700ms.

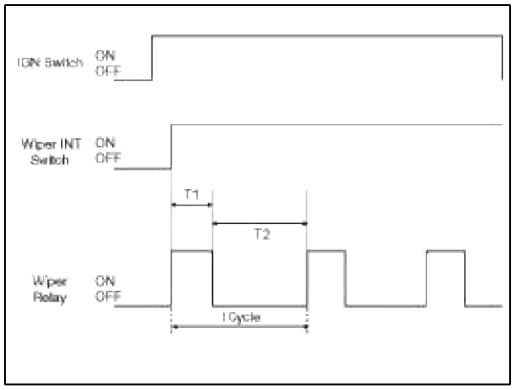


T1 : Min 60ms, T2 : Max 100ms,
T3 : 700 ± 100ms

(2) If the input of Rear Wiper ON switch is continuous (for more than 700ms), keep the condition of Rear Wiper Relay ON is ON and if Rear Wiper ON switch is turned OFF turn the output of Rear Wiper Relay for 700ms from that point.

8. Rear Wiper INT

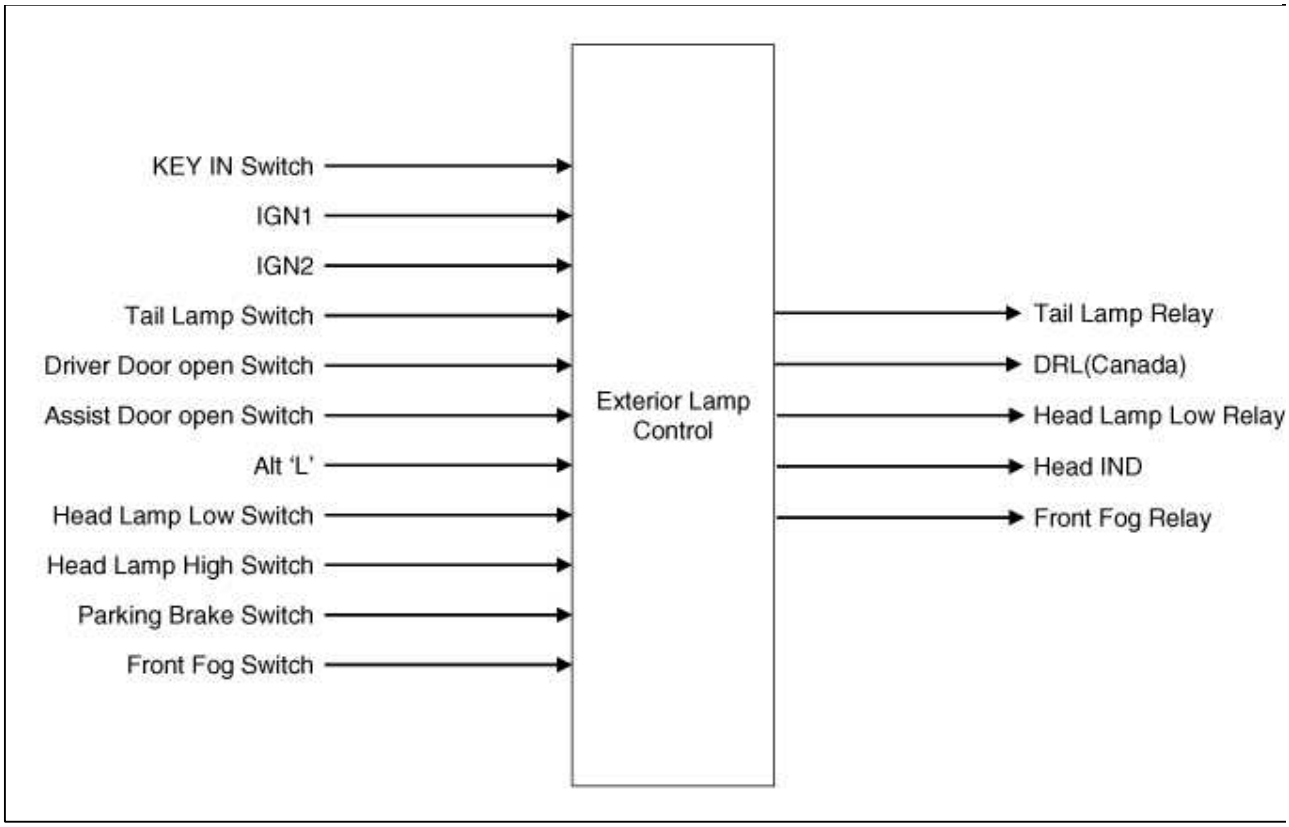
(1) If Rear Wiper INT switch is turned ON, Rear Wiper Relay is operated in a cycle (0.7sec ON & 6sec OFF).



T1 = 0.7s ± 0.1s, T2=6s ± 0.6s

Lamp Control

1. Exterior Lamp Control Data Flow



2. Tail Lamp Auto Cut

(1) Turn IGN KEY OFF when turning Tail Lamp switch ON after turning IGN KEY ON and turn Tail Lamp Relay OFF(automatic blackout) when Driver Door open switch is opened.

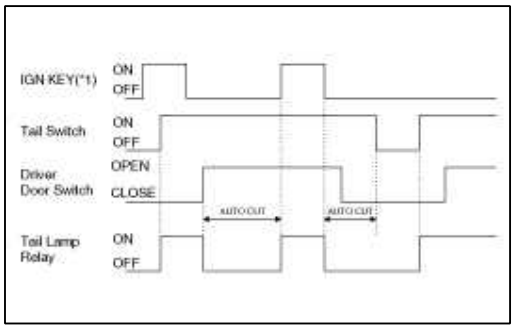
(2) Also, Tail Lamp Relay OFF(automatic blackout) even though IGN KEY is turned OFF after opening Driver Door open switch at the condition that IGN KEY is ON..

(3) When turning Tail Lamp switch ON again form OFF after the automatic blackout, Tail Lamp Relay will be turned ON and AUTO CUT function will be cancelled.

(4) When turning IGN KEY ON after the automatic blackout, Tail Lamp Relay will be turned ON and AUTO CUT function will be cancelled.

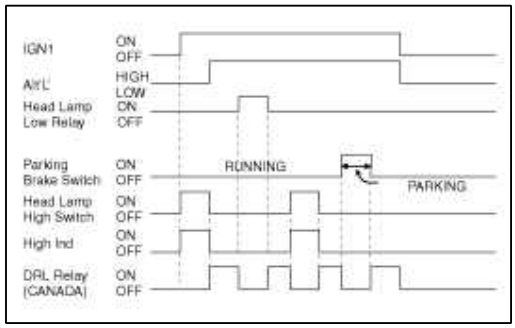
(5) AUTO CUT will be kept when removing or installing B+ at the status of AUTO CUT.

(6) Tail Lamp Relay will be kept turning OFF though Driver Door open switch is closed from opened at the status of AUTO CUT.

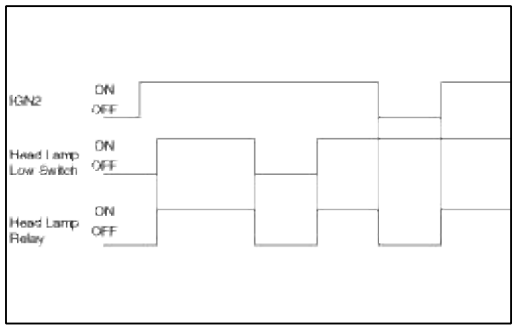


*1 IGN KEY ON : (Push Knob SW or Key In SW ON or IGN 1 ON or IGN 2 ON)
IGN KEY ON : (Push Knob SW and Key In SW OFF and IGN 1 OFF and IGN 2 OFF)

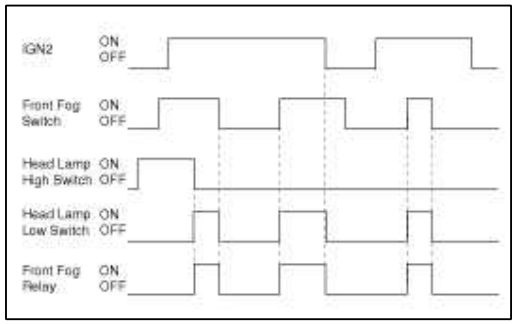
3. Daytime Running Lamps
   (1) If Alt 'L'is High, DRL control put in operation.
   (2) If Head Lamp Low Relay is turned ON or Head Lamp High Switch is turned ON during DRL control operating, DRL control is cancelled.



4. Head Lamp Low
   (1) If Head Lamp switch is turned ON at the status of IGN2 ON, output of Head Lamp Low Relay is turned ON.
   (2) If IGN2 is turned OFF or Head Lamp switch is turn OFF, output of Head Lamp Low Relay is turned OFF.

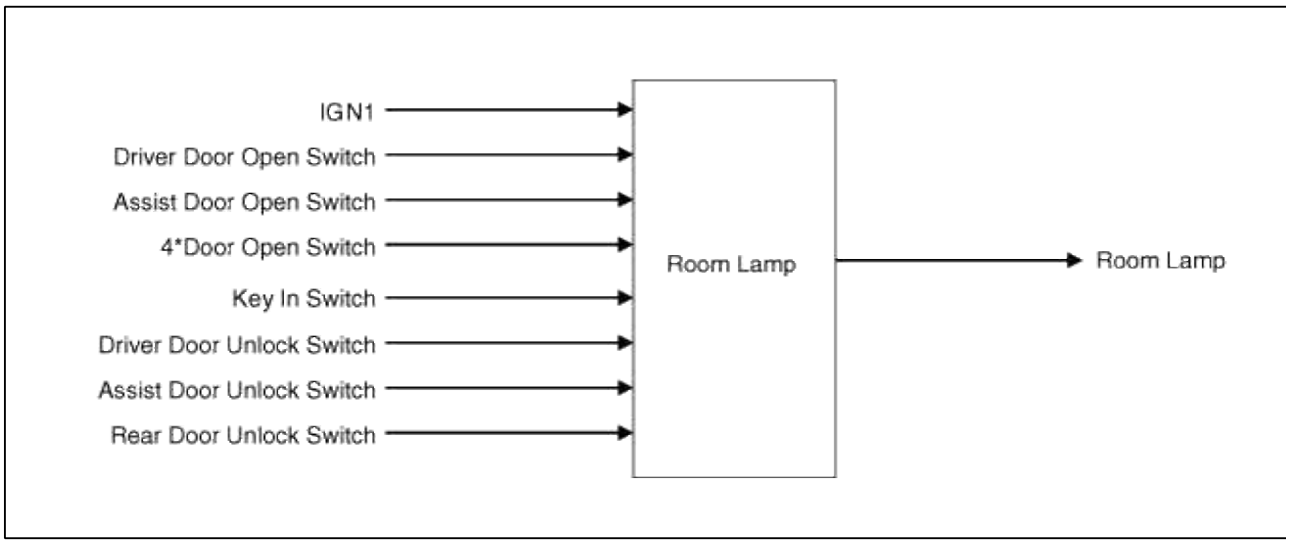


5. Front Fog Lamp
   (1) If IGN2 ON, Head Lamp Low Relay ON, Head Lamp High Switch OFF and Front Fog Switch ON, turn Front Fog Relay ON.
   (2) Turn Front Fog Relay OFF excluding this condition.



Interior Room Lamp

1. Interrior Room Lamp Data Flow



2. Decayed Room Lamp & Keyless Unlock Timer
   When removing or installing the Battery
   (1) Start Room Lamp on the state of 20min, if the DOOR is OPENED.
   (2) Start Room Lamp when it is OFF if the DOOR is CLOSED.

3. Room Lamp Off
   (1) Condition 1

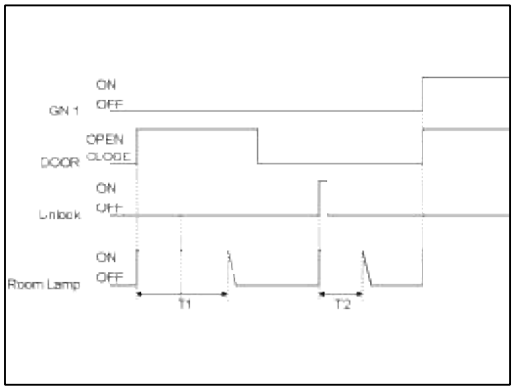
State	Description
Initial condition	Room Lamp OFF and DOOR CLOSE
Event	UNLOCK by TX(Transmitter) or key In ON → OFF
Action	Room Lamp ON for 30± 3 sec.

   (2) Condition 2

State	Description
Initial condition	Room Lamp OFF
Event	Any DOOR OPEN for over 0.1 sec. when ALL DOORS are closed
Action	ROOM LAMP ON for 20 min

(3) Condition 3

State	Description
Initial condition	Room Lamp OFF and IGN1 OFF
Event	IGN1 ON and DOOR OPEN for over 0.1 sec.
Action	ROOM LAMP ON



T1 : 20 ± 1min, T2 :30 ± 3sec

4. Room Lamp On for 30s

(1) Condition 1

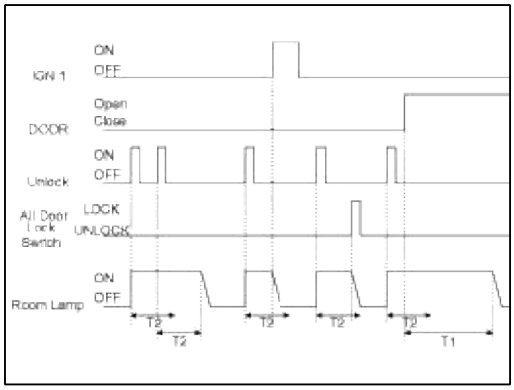
State	Description
Initial condition	ROOM LAMP ON for 30s and IGN1 OFF
Event	DOOR OPEN for over 0.1 sec. when ALL DOORS are closed.
Action	ROOM LAMP ON for 20min

(2) Condition 2

State	Description
Initial condition	ROOM LAMP ON for 30s and IGN1 OFF
Event	UNLOCK by TX
Action	ROOM LAMP ON for 30s

(3) Condition 3

State	Description
Initial condition	ROOM LAMP ON for 30s and IGN1 OFF
Event	IGN1=ON, or after 30sec, or ALL DOOR UNLOCK → LOCKED or TX LOCK & ALL DOORS CLOSED & ALL DOOR LOCKED
Action	The state go to ROOM LAMP DECAYING state Room Lamp decaying for 2 ± 0.2 sec and OFF



T1 : 20 ± 1min, T2 : 30 ± 3sec

5. Room Lamp On for 20min

(1) Condition 1

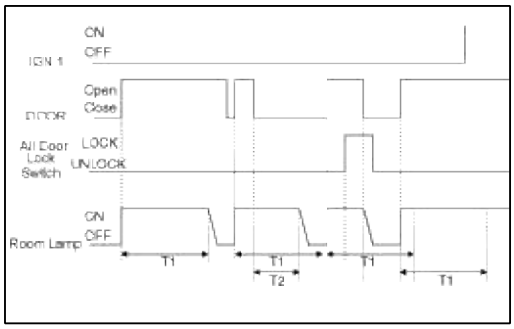
State	Description
Initial condition	Room Lamp ON for 20min and IGN1 OFF
Event	IGN1 ON
Action	ROOM LAMP ON

(2) Condition 2

State	Description
Initial condition	Room Lamp ON for 20min and IGN1 OFF
Event	DOOR CLOSE and ALL DOOR LOCK Or after 20min
Action	ROOM LAMP DECAYING for 2 ± 0.2 sec and OFF

(3) Condition 3

State	Description
Initial condition	ROOM LAMP ON for 20min and IGN1 OFF
Event	DOOR CLOSE
Action	ROOM LAMP ON for 30s



T1 :20 ± 1min, T2 : 30 ± 3sec

6. Room Lamp Decaying

(1) Condition 1

State	Description
Initial condition	ROOM LAMP DECAYING and IGN1 OFF
Event	DOOR OPEN for over 0.1 sec. when All doors are closed
Action	ROOM LAMP ON for 20min

(2) Condition 2

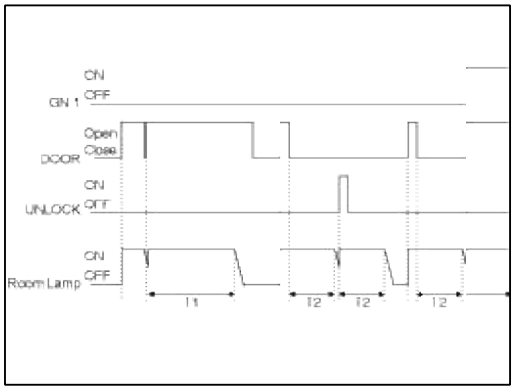
State	Description
Initial condition	ROOM LAMP DECAYING and IGN1 OFF and DOOR CLOSE
Event	UNLOCK by TX
Action	ROOM LAMP ON for 30s

(3) Condition 3

State	Description
Initial condition	ROOM LAMP DECAYING
Event	After decaying
Action	ROOM LAMP OFF

(4) Condition 4

State	Description
Initial condition	ROOM LAMP DECAYING
Event	IGN1 ON and DOOR OPEN for 0.1 sec.
Action	ROOM LAMP ON



T1 : 20 ± 1min, T2 : 30 ± 3sec.

7. Room Lamp On

(1) Condition 1

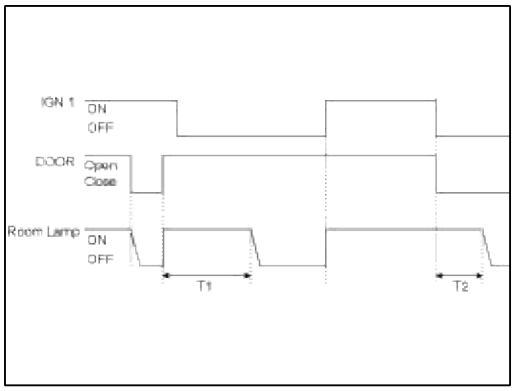
State	Description
Initial condition	Room Lamp ON and IGN1 ON and DOOR OPEN
Event	DOOR CLOSE
Action	ROOM LAMP DECAYING for 2 ± 0.2 sec. and OFF

(2) Condition 2

State	Description
Initial condition	Room Lamp ON and IGN1 ON and DOOR OPEN
Event	IGN1 OFF
Action	ROOM LAMP ON for 20min

(3) Condition 3

State	Description
Initial condition	Room Lamp ON and IGN1 ON and DOOR OPEN
Event	DOOR CLOSE and IGN1 OFF
Action	ROOM LAMP ON for 30s



T1 : 20 ± 1min, T2 : 30 ±3sec

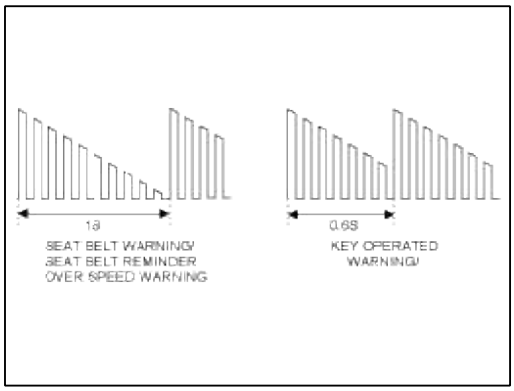
NOTE

1. ROOM LAMP should not be flickered when turning IGN1 ON.
2. Exposure for the ROOM LAMP should be more than 32 steps.

8. Buzzer Control

(1) SPECIFICATION of BUZZER SOUND

	Frequency	Frequency DUTY	Cycle	Sound pressure	Remark
SEAT BELT WARNING/ SEAT BELT REMINDER OVER SPEED WARNING	800Hz	50%	1.0s	70±10dB	Decreasing sound
KEY OPERATED WARNING	800Hz	50%	0.6s	70±10dB	Decreasing sound



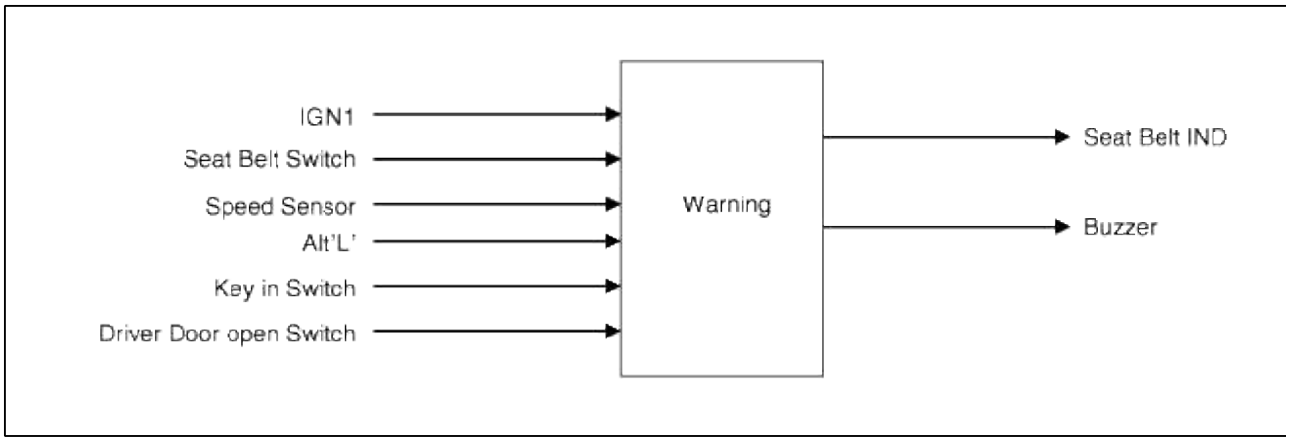
(2) Priority :
S/BELT WARNING/SEAT BELT REMINDER > OVER SPEED WARNING > KEY OPERATED WARNING

(3) Keep the output up to the OFF cycle when turning the output OFF.

(4) Measurement distance for sound pressure: 1.0 m

Warning Control

1. Warning Control Data Flow



2. Seat Belt Warning Timer

(1) From State IGN1 Off (Default State)

State	Description
Initial condition	IGN1 OFF
Event	Driver side seat belt is belted and IGN1 ON
Action	- Start Bulb check 6 seconds driver indicator blinking - The automaton state is changed to IGN1 ON DRIVER BELTED

State	Description
Initial condition	IGN1 OFF
Event	Driver side seat belt is unbelted and IGN1 ON
Action	- Start Bulb check 6 seconds driver indicator blinking - Start Bulb check 6 seconds buzzer warning - If ALT L=ON then start ALT L 6s indicator blinking & ALT L 6s buzzer - The automaton state is changed to IGN1 ON DRIVER UNBELTED

(2) From State IGN1 On Driver Belted

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	IGN1 OFF
Action	- Stop Bulb check 6 seconds driver indicator blinking - Stop ALT L 6 seconds driver indicator blinking - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	Driver side seat belt is unbelted
Action	- Start Normal 6 seconds driver indicator blinking - Start Normal 6 seconds buzzer warning - The automaton state is changed to IGN1 ON DRIVER UNBELTED

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	ALT L 0 → 1
Action	- Start ALT L 6 seconds driver indicator blinking

(3) From State IGN1 On Driver Unbelted

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	IGN1 OFF
Action	- Stop Bulb check 6 seconds driver indicator blinking - Stop Normal 6 seconds driver indicator blinking - Stop ALT L 6 seconds driver indicator blinking - Stop ALT L 6 seconds buzzer warning - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	Driver side seat belt is belted
Action	- Stop Normal 6 seconds driver indicator blinking - Stop ALL 6 seconds buzzer warning - The automaton state is changed to IGN1 ON DRIVER BELTED

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	Vehicle Speed ≥ 10km/h
Action	- Start buzzer and driver indicator Pattern (10 times (6sec ON/24sec OFF) + 6sec ON) - The automaton state is changed to PATTERN

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	ALT'L 0 → 1
Action	- Start ALT L 6seconds driver indicator blinking & ALT L 6seconds buzzer warning

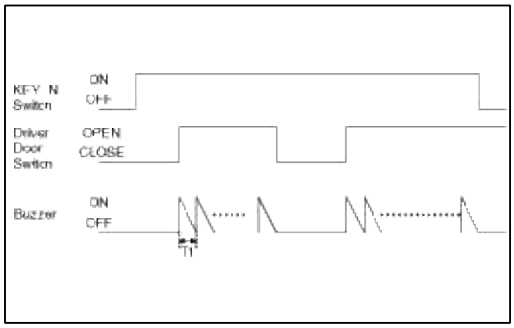
(4) From State Pattern

State	Description
Initial condition	PATTERN
Event	IGN1 OFF
Action	- Stop Buzzer and driver indicator Pattern - Stop ALL 6s driver indicator blinking - Stop ALL 6s buzzer warning - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	PATTERN
Event	Driver side seat belt is belted
Action	- Stop Buzzer and driver indicator Pattern - Stop Normal 6s driver indicator blinking - Stop ALL 6s buzzer warning - The automaton state is changed to IGN1 ON DRIVER BELTED

State	Description
Initial condition	PATTERN
Event	Vehicle Speed ≤ 5km/h
Action	- Stop Buzzer and driver indicator Pattern - If 6s buzzer period, after 6s warning stop Pattern - The automaton state is changed to IGN1 ON DRIVER UNBELTED

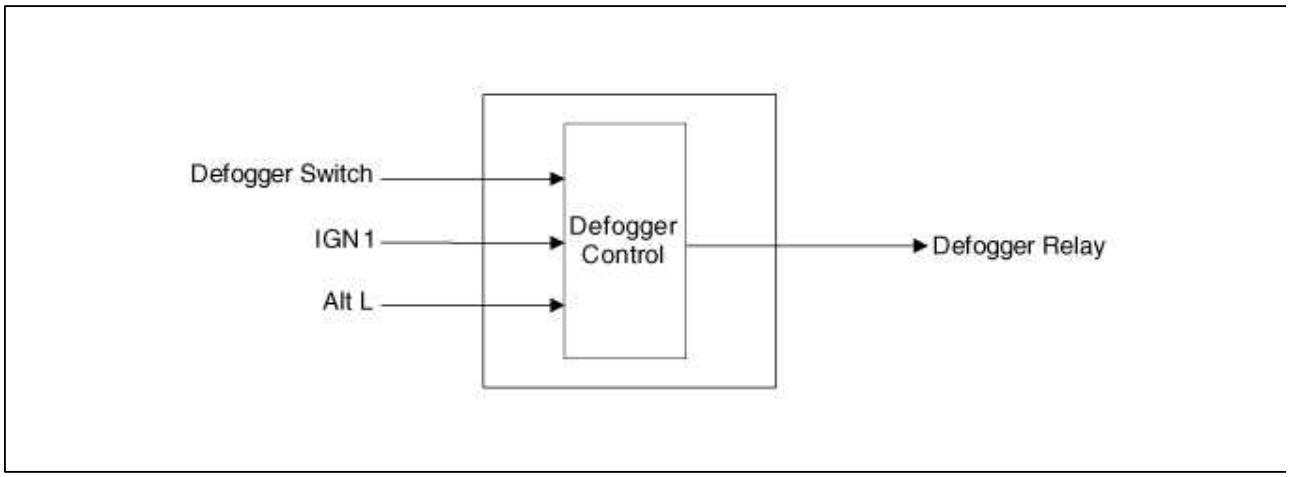
3. Key Operated Warning
   (1) When Driver Door Switch is ON at the status of KEY IN ON, Buzzer will be outputted per 0.6sec continuously.
   (2) If KEY IN turns OFF or Driver Door Switch is CLOSED during Buzzer output, the output will turn OFF.
   (3) When IGN1 turns ON while outputting, the output will be stopped.



T1 : 0.6 ± 0.1sec

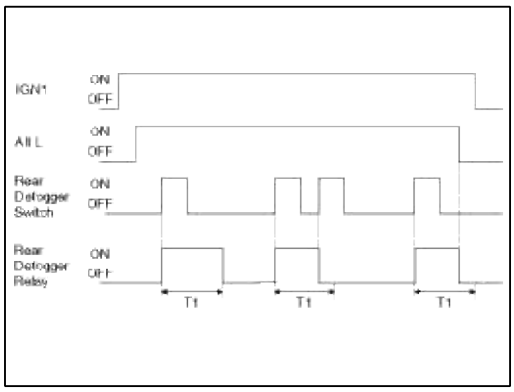
Rear Defogger Timer Control

1. Rear Defogger Control Data Flow



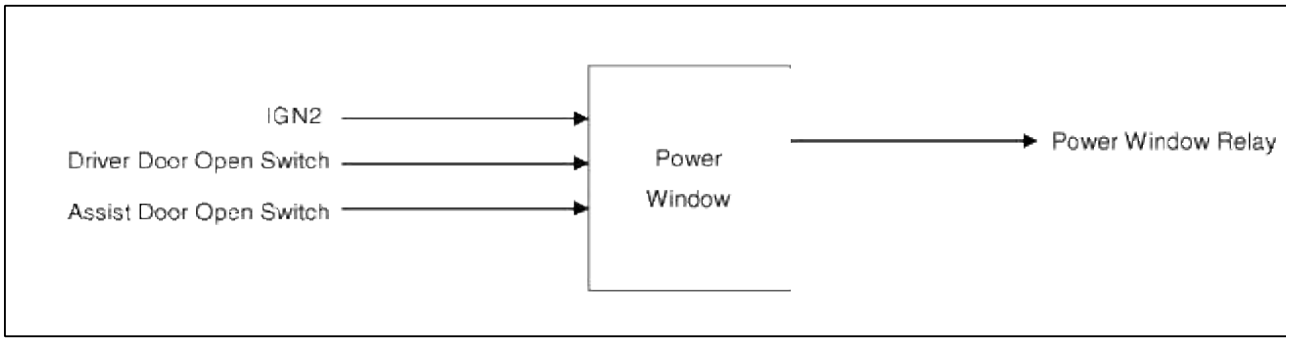
2. Rear Defogger Timer
   (1) With the Enging Running (charging voltage at Alt 'L' terminal, 12v at IGN1) and the Rear Defogger turned on, the Rear Defogger relay will stay ON for 20min.
   (2) If Rear Defogger switch turns ON again while Rear Defogger relay output is ON, turn Rear Defogger relay output OFF.
   (3) The Defogger will turn OFF if there is no charging voltage at Alt 'L' or there is not 12v at ING1 even though the Rear Defogger relay output is ON.
   (4) If Alt'L' is over 10 Volts Engine is RUNNING (Alt'L' ON) and if Alt'L' is less than 5 Volts ENGINE is STOPPED (Alt'L' OFF). Also, AltL is between 5 and 10 Volts, keep the previous condition.

(5) Rear Defogger relay should not be outputted when turning Alt'L' ON while Rear Defogger switch is pressed.



T1 : 20 ± 1min

3. Power Window Timer

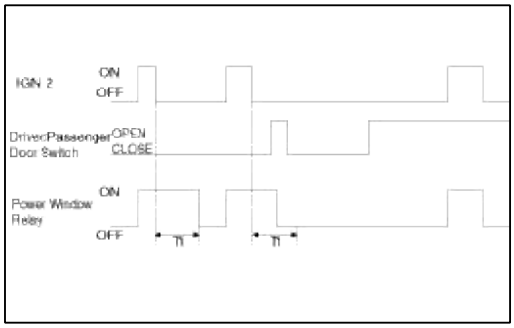


(1) Turn Power window Relay output ON when turning IGN2 ON.

(2) Turn Power window Relay output OFF after keeping Power window Relay output for 30sec when IGN2 is OFF.

(3) Turn Power window Relay OFF immediately when opening Driver Door Switch or Passenger Door Switch within the condition (2) above.

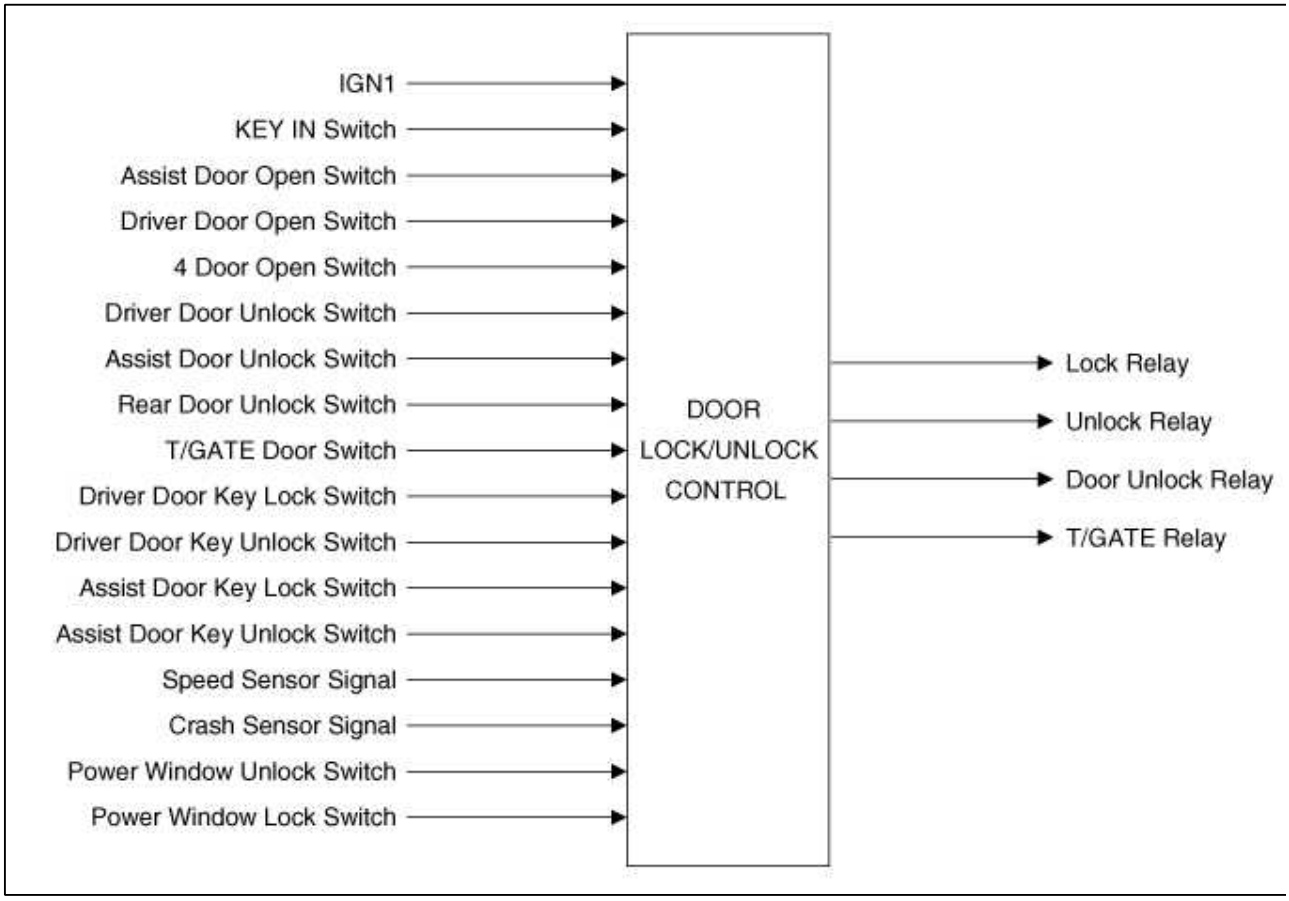
(4) Turn Power window Relay output OFF when IGN2 is OFF while Driver Door Switch or Passenger Door Switch is open.



T1 : 30 ± 3sec

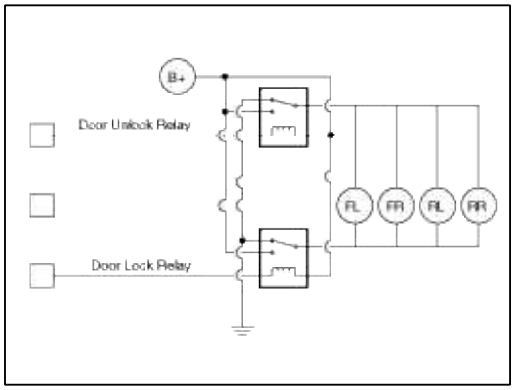
Door Lock/unlock Control

1. Door Lock/unlock Control Data Flow



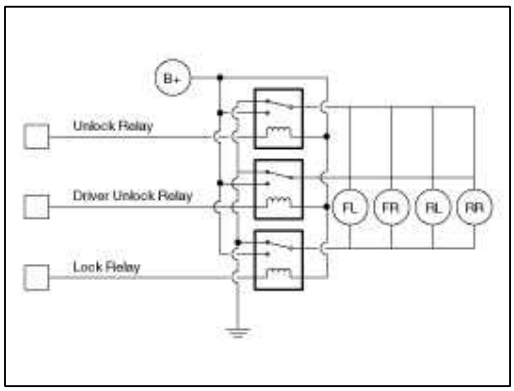
2. Door Lock/unlock Relay Control

(1) NON-APPLICABLE SPEC FOR 2-TURN



Mode	Unlock Relay	Driver Door Unlock Relay	Lock Relay
CENTRAL LOCK	OFF	NC	ON
CENTRAL UNLOCK	ON	NC	OFF

(2) 2-Turn Unlock Spec (For North America)



Mode	Unlock Relay	Driver Unlock Relay	Lock Relay
CENTRAL LOCK	OFF	OFF	ON
CENTRAL UNLOCK	ON	ON	OFF
DRIVER UNLOCK	OFF	ON	OFF

(3) Turn the present output OFF immediately when reciprocal output is requested while outputting and start outputting reciprocally in 100ms. However, output the last request if there is request for output during the delay of 100ms.

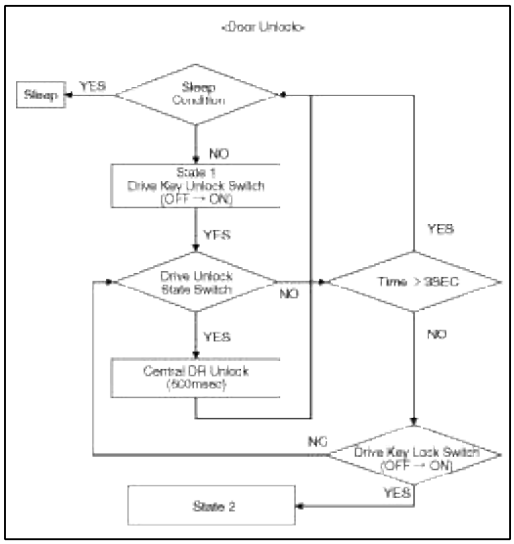
(4) Execute LOCK output and ignore UNLOCK output when the condition for LOCK and UNLOCK is occurred at the same time.

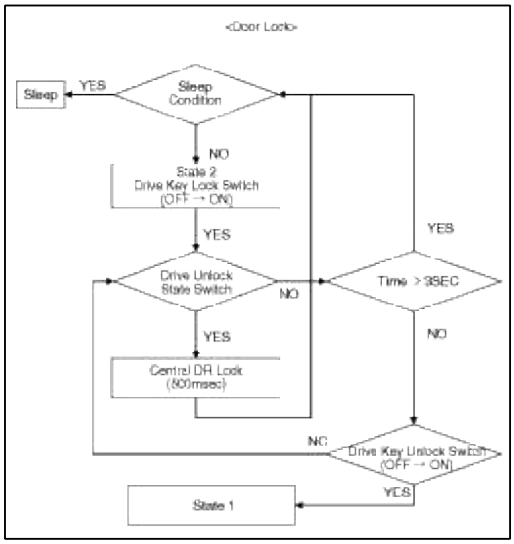
(5) Execute Driver Door Unlock output by the Unlock Relay output when Unlock Relay is requested during Driver Unlock Relay output.(For North America)

3. Door Key Lock/unlock

(1) In case of DOOR KEY LOCK (UNLOCK) signal of driver's seat, handle as KEY LOCK (UNLOCK) of driver's seat is inputted if the knob in the driver's seat is LOCKED (UNLOCKED) after checking it for 3s.

(2) In case of DOOR KEY LOCK (UNLOCK) signal of the passenger seat, handle as KEY LOCK (UNLOCK) of the passenger seat is inputted if the knob in the passenger seat is LOCKED (UNLOCKED) after checking it for 3s.





4. Central Door Lock/unlock

(1) If Driver Door Key Lock Switch or Passenger Door Key Lock Switch turns ON, turn Door Lock Relay output ON during T1. But prohibit the output when KEY IN ON and IGN1 are ON.

(2) When Driver Door Key Unlock and Passenger Door Key Unlock turn ON, turn Door Unlock Relay and Driver Door Unlock Relay output ON during T1.

(3) Turn CENTRAL LOCK *1) ON during T1 when receiving TX LOCK signal.
But ignore LOCK input when Driver Door SW or Passenger Door SW is ON.

(4) Turn CENTRAL UNLOCK *2) ON during T1 when receiving TX UNLOCK signal.

(5) LOCK/UNLOCK by SAFETY KNOB is not interlock (Mechanical operation).

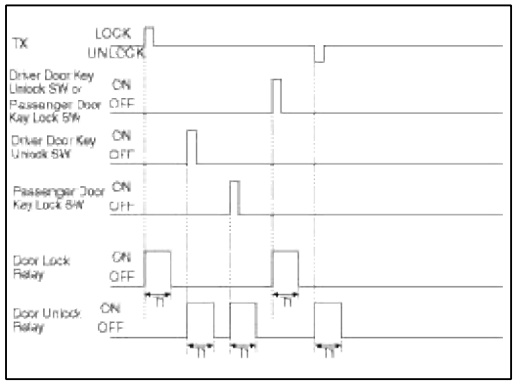
(6) Malfunction should be free when joining BATTERY (Also malfunction should be free at the location of Key In Switch ON).

(7) Input which is less than 60msec should not be received (KEY LOCK/UNLOCK Switch).

(8) Do not execute the output of DOOR LOCK (UNLOCK) by KNOB change.

(9) If Power Window Lock Switch is ON, turn Lock Relay output ON for T1. (NORTH AMERICA)

(10) If Power window Lock Switch is ON, turn CENTRAL UNLOCK output ON for T1. (NORTH AMERICA) But, inhibit operating by Power window Unlock Switch at Lock state by TX.
*1) CENTRAL LOCK : Refer to control mode for each Spec.
*2) CENTRAL LOCK : Refer to control mode for each Spec.



T1 : 0.5 ± 0.1sec

5. 2-Turn Unlock

(1) If Driver Door Key Unlock Switch turns OFF from ON within T1 after Driver Door Key Unlock Switch turns ON from OFF(Driver Door Unlock Switch becomes UNLOCKED mechanically and does not output BCM.), turn Driver Unlock Relay, Unlcok Relay(Central Unlock) output ON duting T2.

(2) If TX UNLOCK is received within T1 after Driver Door Key Unlock Switch turns ON from OFF (Driver Door Unlcok Switch becomes UNLOCKED mechanically and does not output BCM.), turn Driver Unlock Relay and Unlock Relay(Central Unlock) output ON during T2.

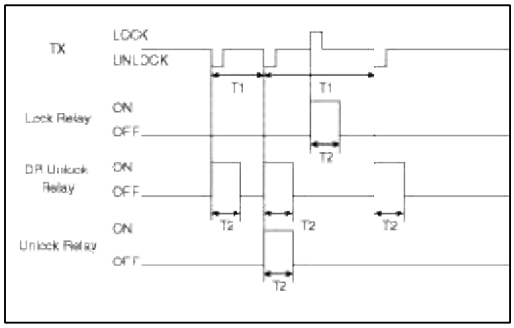
(3) Turn Driver Unlock Relay output ON during T2 when receiving TX UNLOCK signal. However, turn Driver Unlock Relay, Unlock Relay (Central Unlock) output duting T2 if TX UNLOCK is received within T1.

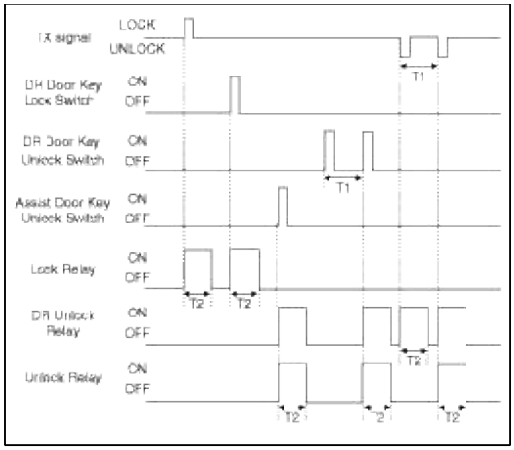
(4) Also, turn Driver Unlock Relay, Unlock Relay (Central Unlock) ON during T2 in case that Driver Door Key Unlock Switch turns ON from OFF within T1 after receiving TX UNLOCK.

(5) Regard as the same TX even though different signal which is registered within T1 is received.

(6) If turn Lock Relay output ON by TX Lock or Driver/Assist Key lock Switch, T1 is initialized.

(7) Assist Key Unlock Switch turns ON from OFF, turn Driver Unlock Relay and Unlock Relay (Central Unlock) output ON during T2.





T1 : 4 ± 1sec, T2 : 0.5 ± 0.1sec

6. IGN Key Reminder

(1) This function will not be operated if the speed of cars exceeds 3km/h.

(2) Perform Unlock Relay output for 1s after 0.5s when the condition becomes to be KEY IN = ON& Driver Door open Switch = OPEN & Driver Door Unlock Switch = LOCK(Regions for North America).

(3) Perform Driver Unlock Relay output for 1s after 0.5s when the condition becomes to be KEY IN = ON & Driver Door open Switch = OPEN & Driver Door Unlock Switch = LOCK.(Spec for North America ONLY)

(4) Perform Unlock Relay output for 1s in 0.5s when the condition becomes to be KEY IN = ON & Assist Door Open Switch =OPEN & Assist Door Unlock Switch = LOCK.

(5) Output CENTRAL UNLOCK for 1s in 0.5s based on (4) if (1), (3) and (4) are satisfied.

(6) Output UNLOCK up to 3 times(excluding output for 1s) if LOCK condition is maintained though UNLOCK output is performed for 1s by (2), (3), (4)(cycle for 1s: 0.5s ON/OFF).

(7) Try UNLOCK once when DOOR is CLOSED while keeping LOCK condition after performing (6).

(8) Output Driver Unlock Relay once only for 1s when Driver Door open Switch is closed within 0.5s since Driver Door Unlock Switch is changed from UNLOCK to LOCK during KEY IN = ON(North America SPEC ONLY).

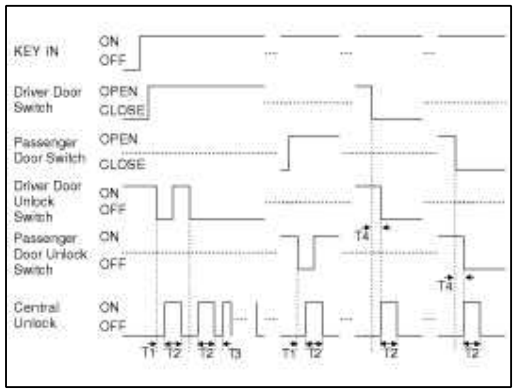
(9) Output CENTRAL UNLOCK once only for 1s when Assist Door Open Switch is closed within 0.5s since Assist Door Unlock Switch is changed from UNLOCK to LOCK during KEY IN = ON.

(10) Output Driver Unlock Relay for 1s when Driver Door Unlock Switch becomes LOCK from UNLOCK within 0.5s since Driver Door open Switch is changed from OPEN to CLOSE during KEY IN = ON(North America SPEC ONLY)

(11) Output CENTRAL UNLOCK once only for 1s if Assist Door Unlock Switch becomes to be LOCK from UNLOCK within 0.5s since Assist Door Open Switch is changed from OPEN to CLOSE during KEY IN = ON.

(12) Jugde if RETRY output is performed or not at the point of the beginnig of RETRY output(in 1.5s from the initial UNLOCK output).

(13) Output UNLOCK though the condition is not kept for 0.5sec after realizing that of UNLOCK. But, do not output UNLOCK in case that KEY IN is OFF at the point of 0.5s passed after realizing the condition by the change of UNLOCK → LOCK in Driver Door Unlock Switch or Assist Door Unlock Switch.



T1, T3 : 0.5 ± 0.1sec, T2 : 1 ± 0.1sec,
T4 : 0.5sec Max
** KEY IN ON : Key In ON or IGN1 ON or IGN2 ON
KEY IN OFF : Key In OFF and IGN1 OFF and IGN2 OFF

7. Crash Door Unlock

(1) Always perform CENTRAL UNLOCK output whenever Crash Sensor signal is inputted(Duty 20%±10%) while IGN1 is ON. (But ignore Sensor input during 5sec output.)

(2) Jugde Sensor Fail if Crash Sensor signal is more than T3, Crash Door Unlock is not operated.

(3) Keep CENTRAL UNLOCK output fot the time left though IGN1 turns OFF from ON while outputting CENTRAL UNLOCK.

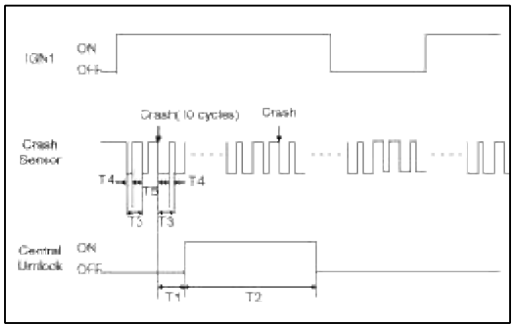
(4) Do not output CENTRAL UNLOCK if IGN1 switch turns ON from OFF after Crash Sensor signal is already inputted..

(5) Output CENTRAL UNLOCK during T3 Driver Door Unlock switch or Assist Door Unlock switch or Rear Door Unlock switch turns to LOCK from UNLOCK after outputting CENTRAL UNLOCK.

(6) Do not perform AUTO DOOR LOCK function at the condition of CRASH UNLOCK.

(7) CRASH DOOR UNLOCK function has priority to LOCK/UNLOCK control by other functions.

(8) Ignore the request for LOCK/UNLOCK by other functions while or after outputting CRASH DOOR UNLOCK. But, control LOCK/UNLOCK by other functions if IGN1 switch becomes OFF.



T1 : Min 40ms, T2 : 5 ± 0.5s,
T3 : 20 ± 2ms, T4 : 16 ± 2ms,
T5 : 4 ± 2ms

Tailgate Release Control

1. Permission Mode State

State	Description
Initial condition	No permission state
Event	DR Door Unlock switch ON
Action	The state goes to permission state

State	Description
Initial condition	30s permission state
Event	DR Door Unlock switch ON
Action	The state goes to permission state

State	Description
Initial condition	Permission state
Event	When vehicle speed is under 5km/h, T/Gate switch ON
Action	Tail Gate Relay ON for 0.5sec The state goes to permission state

2. No Permission State

State	Description
Initial condition	30s Permission state
Event	T/GATE TIMER IS EXPIRED or LOCK command by RKE & Driver Lock state or T/gate open to close
Action	The state goes to NO permission state

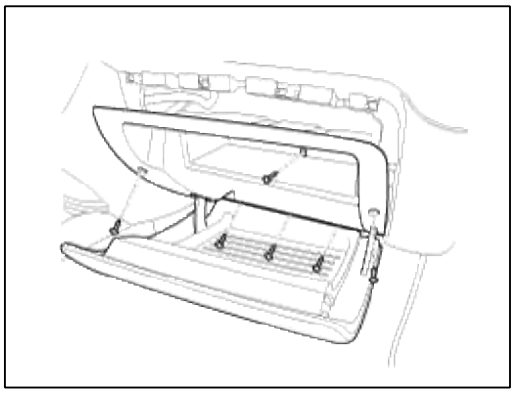
State	Description
Initial condition	Permission state
Event	DR Door Unlock switch OFF
Action	The state goes to NO permission state

Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Repair procedures

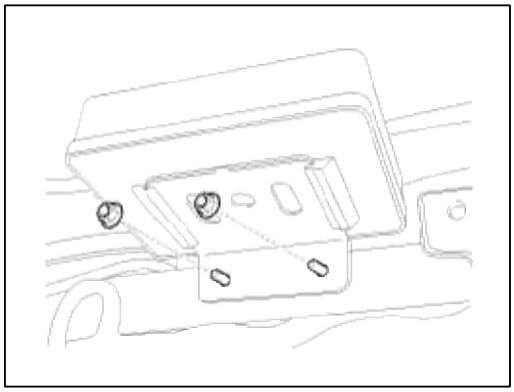
Removal

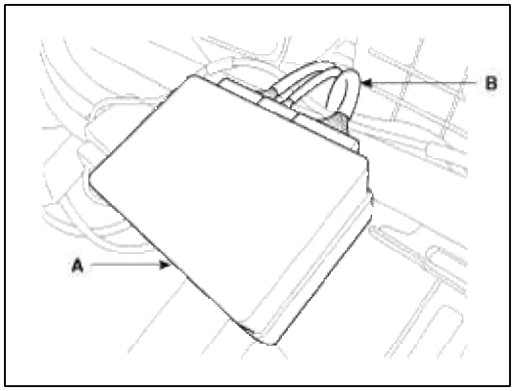
1. Disconnect the negative (-) battery terminal.

2. Remove the glove box.
   (Refer to the Body group - "Crash pad")



3. Remove the BCM (A) after removing the connector (B) and nuts (2EA).



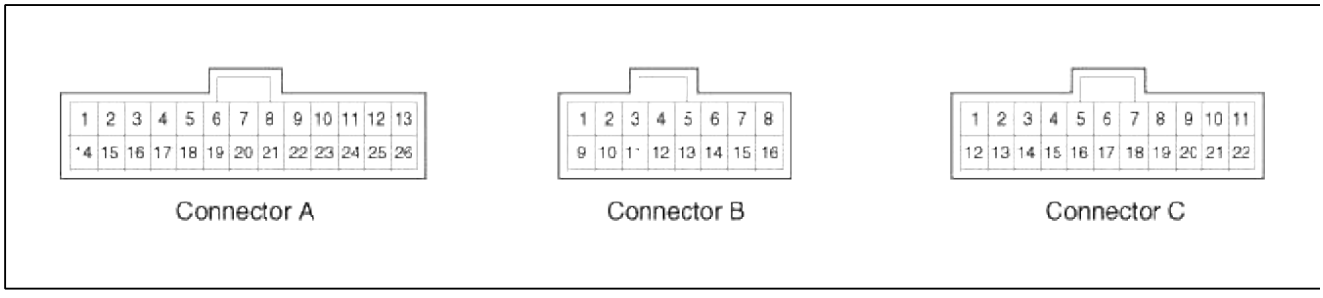


Installation

1. Install the BCM after connecting the connector.
2. Install the glove box.

Inspection

BCM Connectors



PIN NO.	Connector A	Connector B	Connector C
1	Room lamp	Assist seat belt IND	GND 2
2	IG 2	-	Rear wiper ON switch
3	Wiper relay	Front fog relay	Rear defogger switch
4	Rear wiper relay	ALT L	Wiper INT switch
5	T/Gate relay	Assist seat belt switch	Washer switch
6	Rear defogger relay	Speed sensor	T/Gate outside handle switch
7	DRL relay (Canada)	Crash sensor	Rear washer switch
8	Tail lamp relay	DRL disable switch	Tail lamp switch
9	Seat belt indicator	-	Seat belt switch
10	Hazard relay	Power window unlock switch	Key in switch
11	Horn relay	Driver door key lock switch	Driver door open switch
12	IG 1	Power window lock switch	Assist door open switch
13	B +	Wiper INT volume	4 door open switch
14	Driver door unlock switch	Rear wiper INT switch	Tail Gate door switch
15	Assist door unlock switch	-	Assist door key lock switch
16	Rear door unlock switch	Diagnosis	MIST switch
17	-		Parking brake switch
18	Driver door key unlock switch		Head lamp switch
19	Head lamp low relay		Front fog switch
20	High indicator		Rear fog switch
21	-		Head lamp high switch
22	Power window relay		Assist key unlock switch
23	Lock relay		
24	Unlock relay		
25	GND 1		
26	Driver unlock relay		

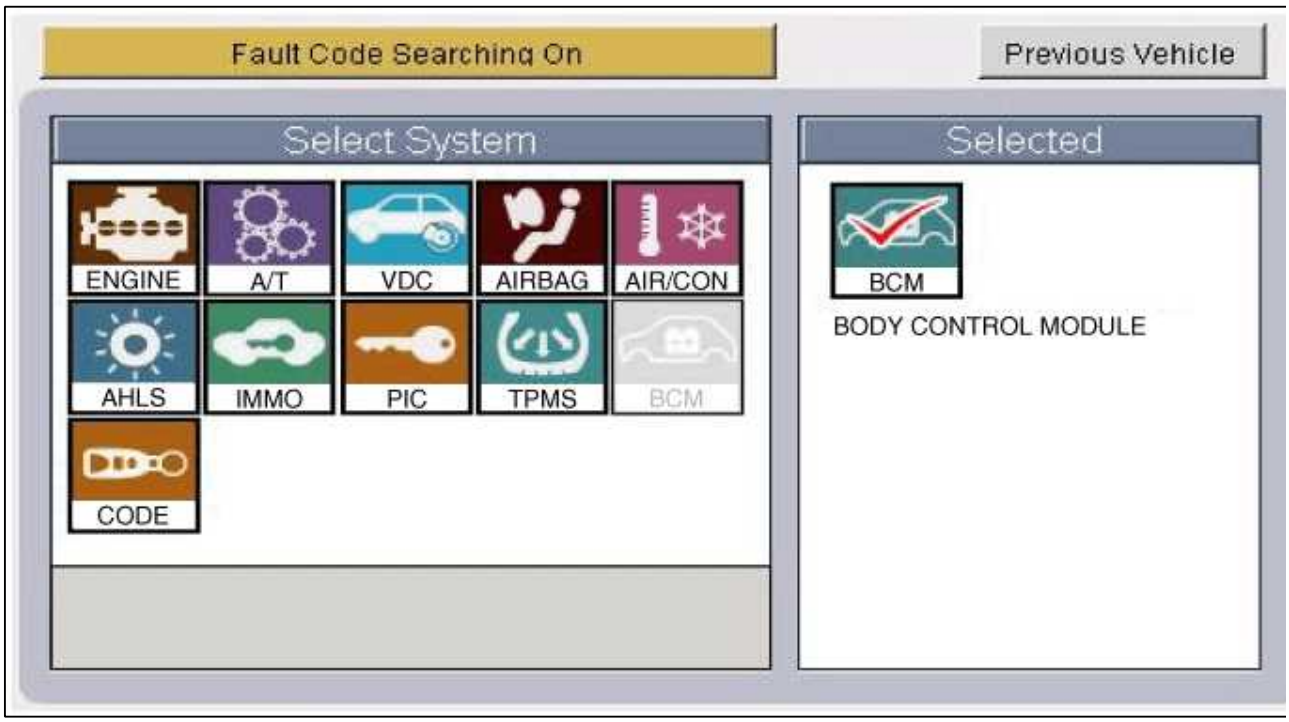
BCM Logic Output

PIN Name	Capacity	Availability in Power
Horn relay	DC 12V 200mA(indective load)	B+
Hazard relay	DC 12V 200mA(indective load)	B+
Room lamp	DC 12V 30W LAMP	B+
Defogger relay	DC 12V 200mA(indective load)	B+
Unlock relay	DC 12V 200mA(indective load)	B+
Lock relay	DC 12V 200mA(indective load)	B+
Dead lock relay/ Drive door unlock relay	DC 12V 200mA(indective load)	B+
Power window relay	DC 12V 200mA(indective load)	B+
Front fog relay	DC 12V 200mA(indective load)	B+
Tail lamp relay	DC 12V 200mA(indective load)	B+
Head lamp relay	DC 12V 200mA(indective load)	IG2
Wiper realy	DC 12V 200mA(indective load)	IG2
Seat belt indicator lamp	DC 12V 1.2W(LED)	IG1
Assist seat belt indicator lamp	DC 12V 1.2W(LED)	IG1
K line communication		B+
Internal chime buzzer		B+
Tail gate relay	DC 12V 200mA(indective load)	B+
Over speed indicator lamp	DC 12V 1.2W(LED)	IG1
DRL (Canada) relay	DC 12V 200mA(indective load)	B+
Rear wiper relay	DC 12V 200mA(indective load)	IG2

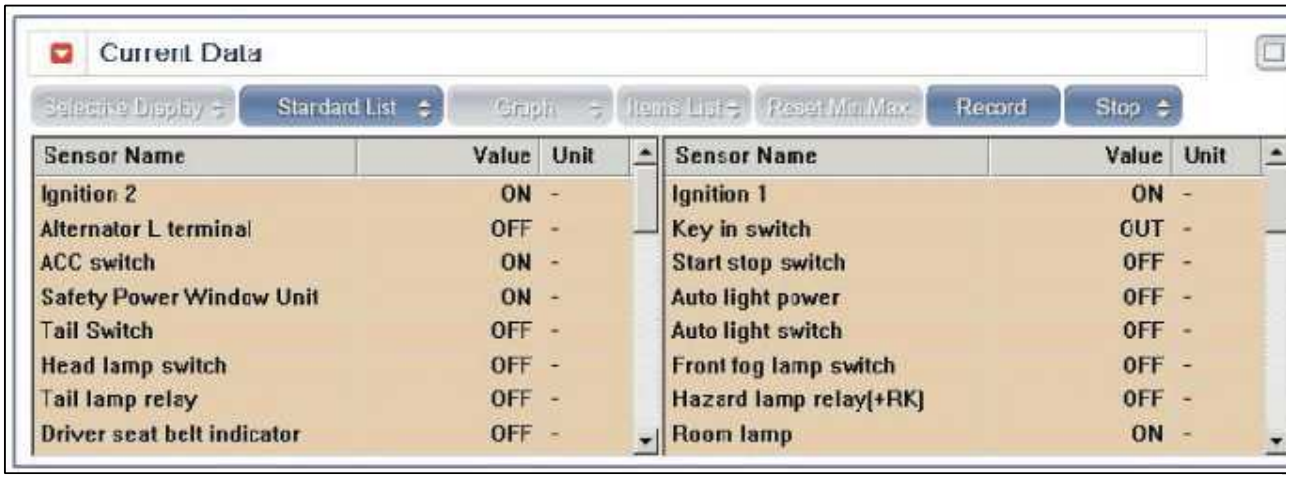
Trouble Diagnostics When Using Diagnosis Tool

1. The body control system can be diagnosed by using the GDS.
   The BCM communicates with the GDS which then displays inputs and outputs along with codes.

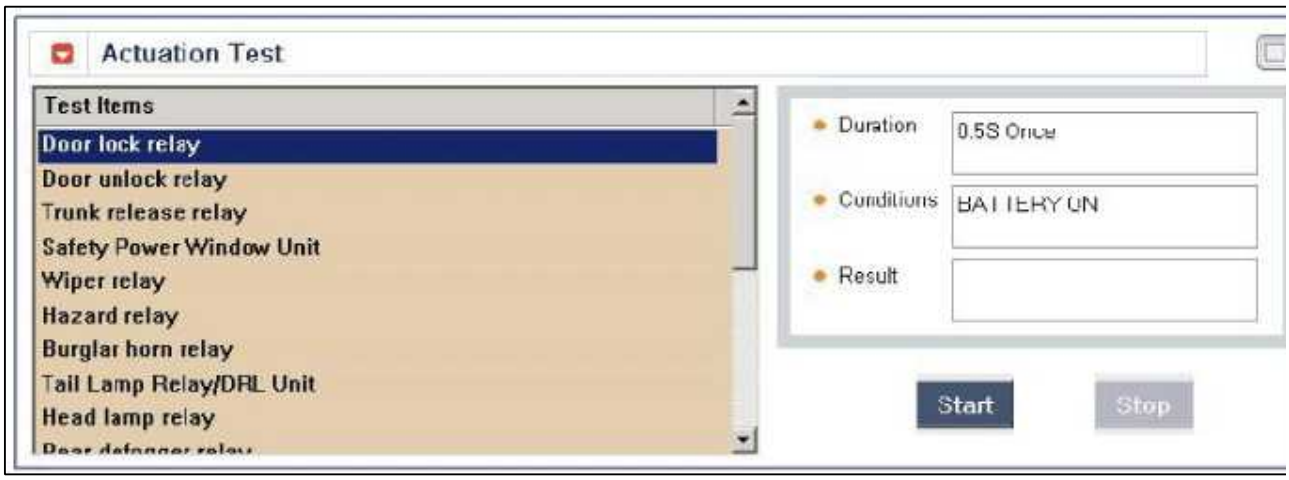
2. To diagnose the BCM function, select the menu of model and body control module.

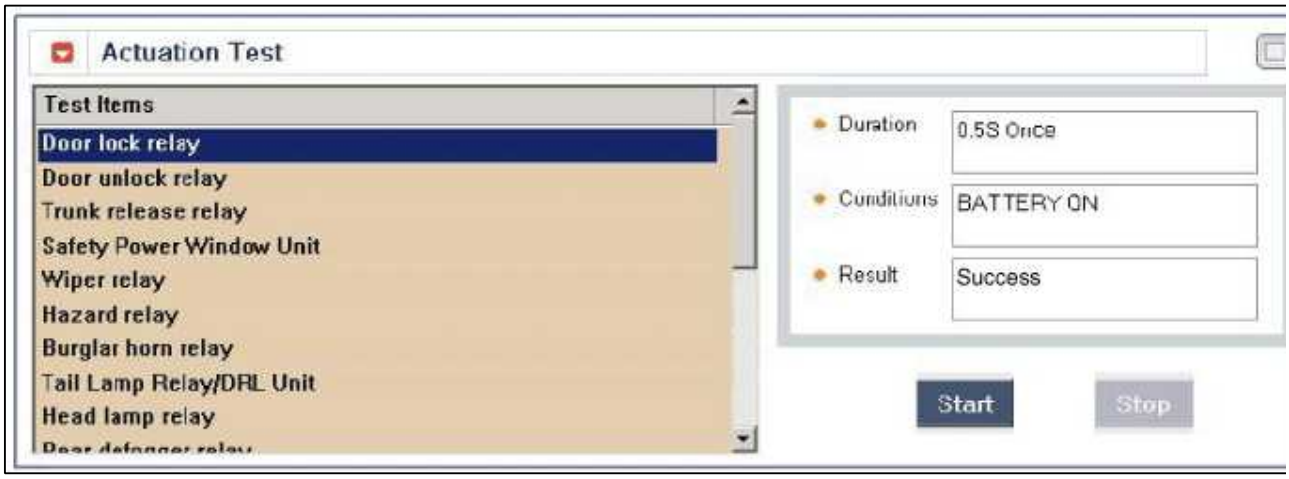


3. To consult the present input/out value of BCM, "Current DATA". It provides information of BCM input/output conditions of power supply, turn signal/brake lamp, headlamp, door locks, outside mirror, wiper, auto-light and transmitters etc.



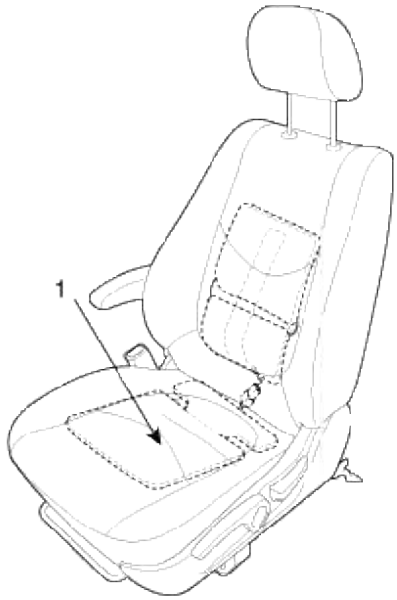
4. To perform functional test on BCM outputs, select "ACTUATION TEST"

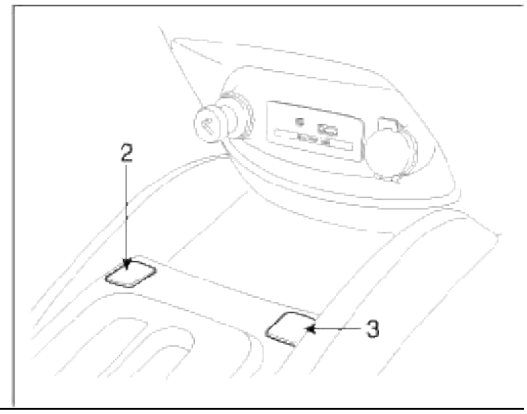




Body Electrical System > Seat Electrical > Components and Components Location

Component Location





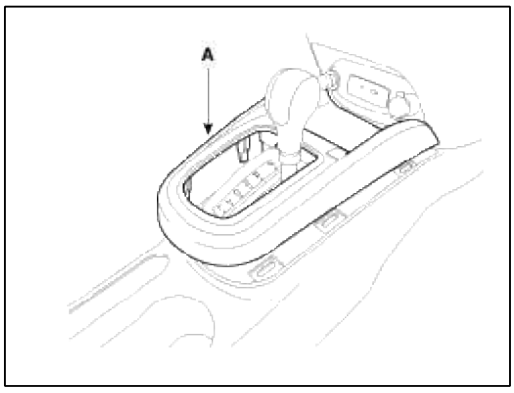
1. Seat warmer 2. Seat warmer switch (LH)	3. Seat warmer switch (RH)

Body Electrical System > Seat Electrical > Seat Heater Switch > Repair procedures

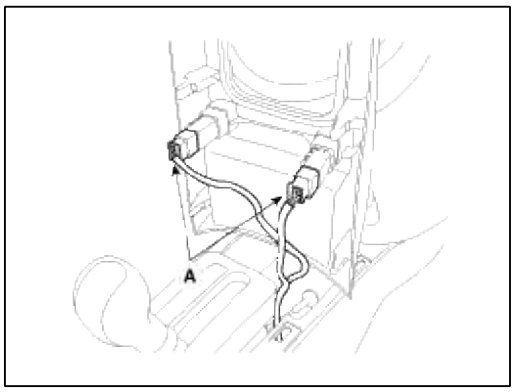
Inspection

Front Seat Warmer Switch

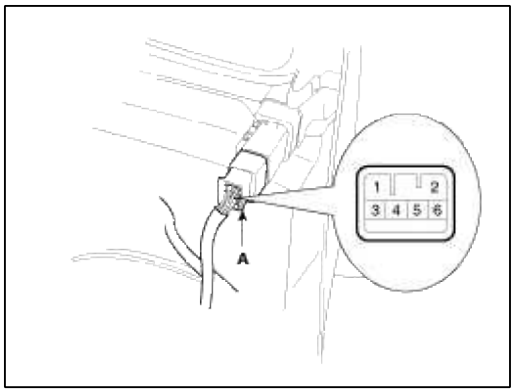
1. Disconnect the negative (-) battery terminal.
2. Remove the floor console upper cover(A).
   (Refer to the Body group - "Console")



3. Disconnect the seat heater switch connectors.



4. Check for continuity between the terminals (A) in each switch position according to the table.

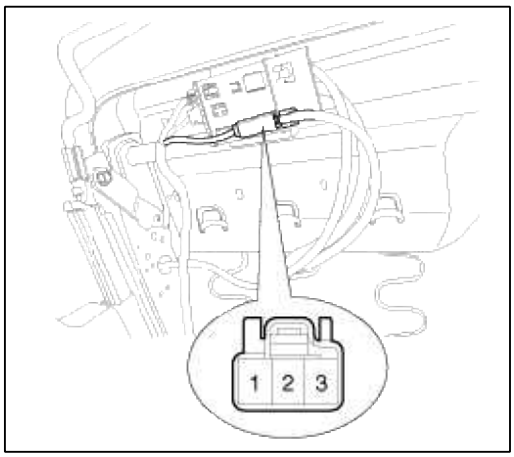


Position / Terminal	ON	OFF	REMARK
1			
3			IND+
4			
5			IND-
6			ILL+
2			ILL-

Body Electrical System > Seat Electrical > Seat Heater > Repair procedures

Inspection

1. Check for continuity and measure the resistance between No.1 terminal and No.3 terminal of connector.



Standard value
Leather seat : 2.4Ω ± 10% / set
Fabric seat : 3.24Ω ± 10% / set

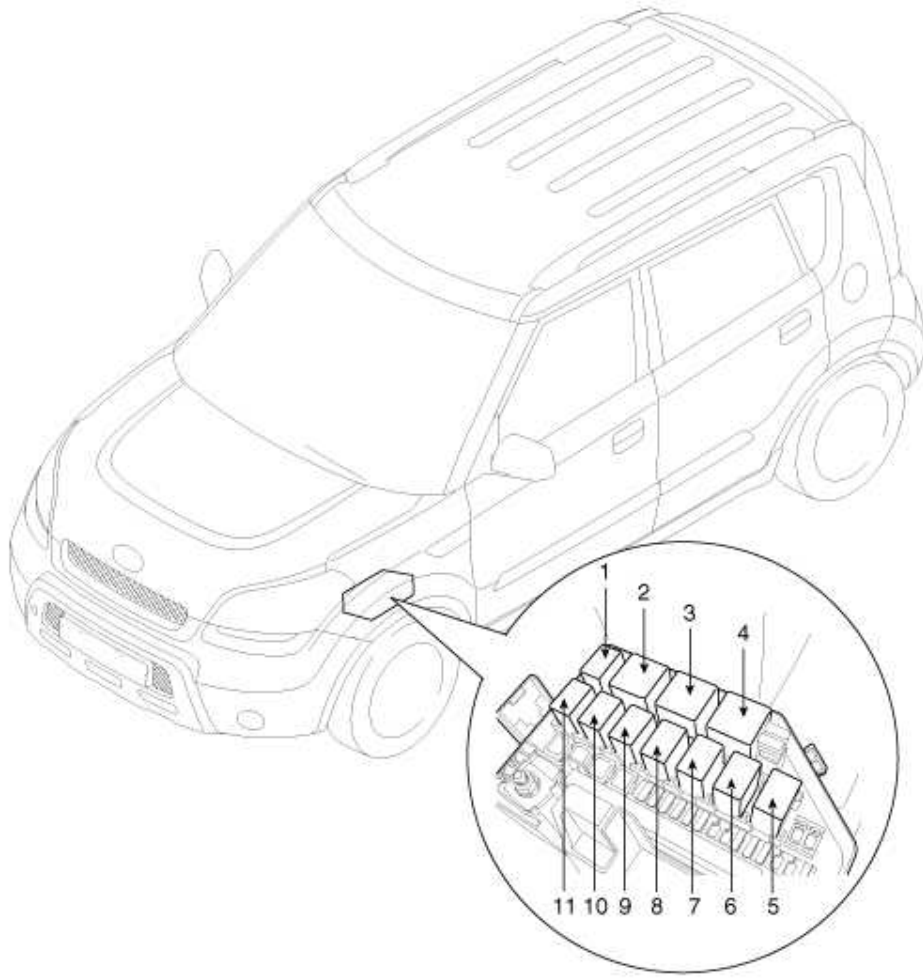
2. Operate the seat warmer after connecting the connectors, and then check the thermostat by measuring the temperature of seat surface.

Standard value
ON : 34 ± 5°C (93.2 ± 9°F)
OFF : 43 ± 4°C (109.4 ± 7°F)

Body Electrical System > Fuses And Relays > Components and Components Location

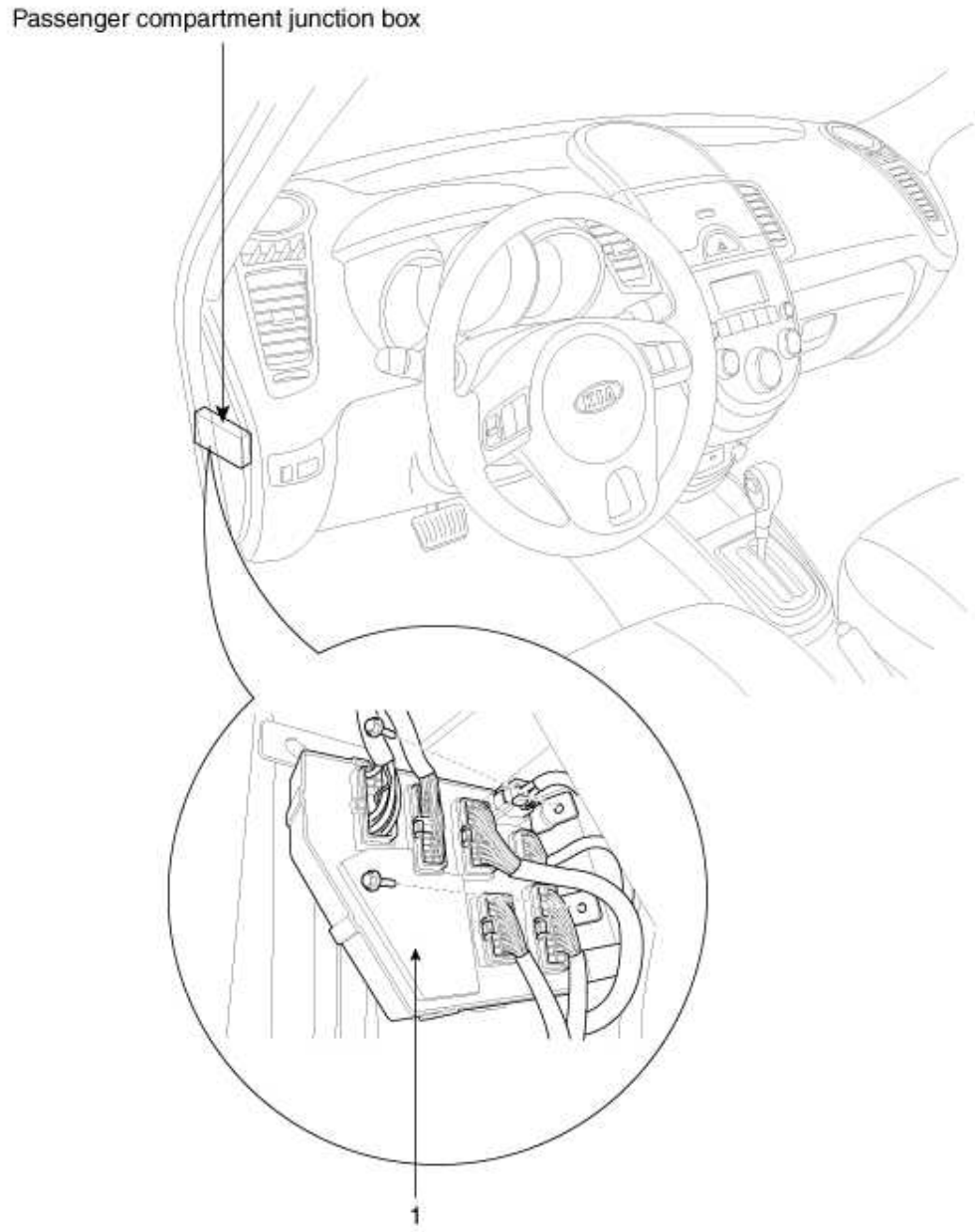
Component Location

[Engine room relay box]



1. Wiper relay (Front) 2. Blower relay 3. Fuel pump relay 4. Main relay 5. Condenser fan relay (High) 6. Condenser fan relay (Low)	7. Head lamp relay (High) 8. Head lamp relay (Low) 9. Start relay 10. A/C relay 11. Horn relay

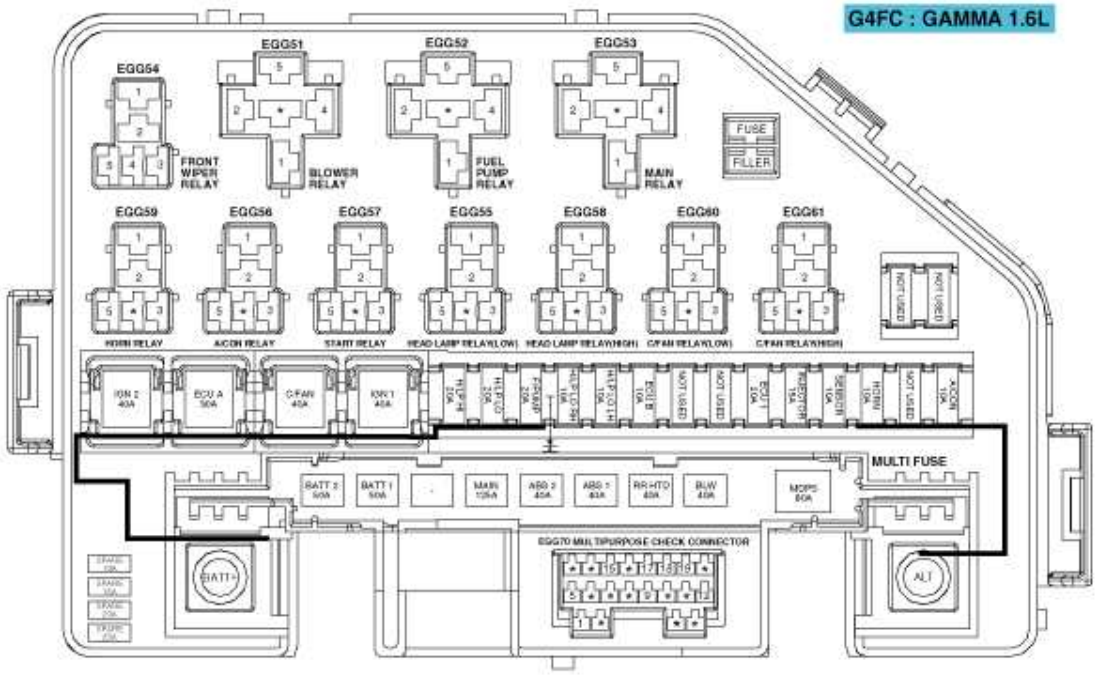
[Passenger compartment relay]



1. Tail lamp relay, Power window relay, Rear heater relay, Door unlock relay, Door lock relay, Hazard relay, Rear wiper relay, Front fog relay, Tailgate relay, DRL relay

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Components and Components Location

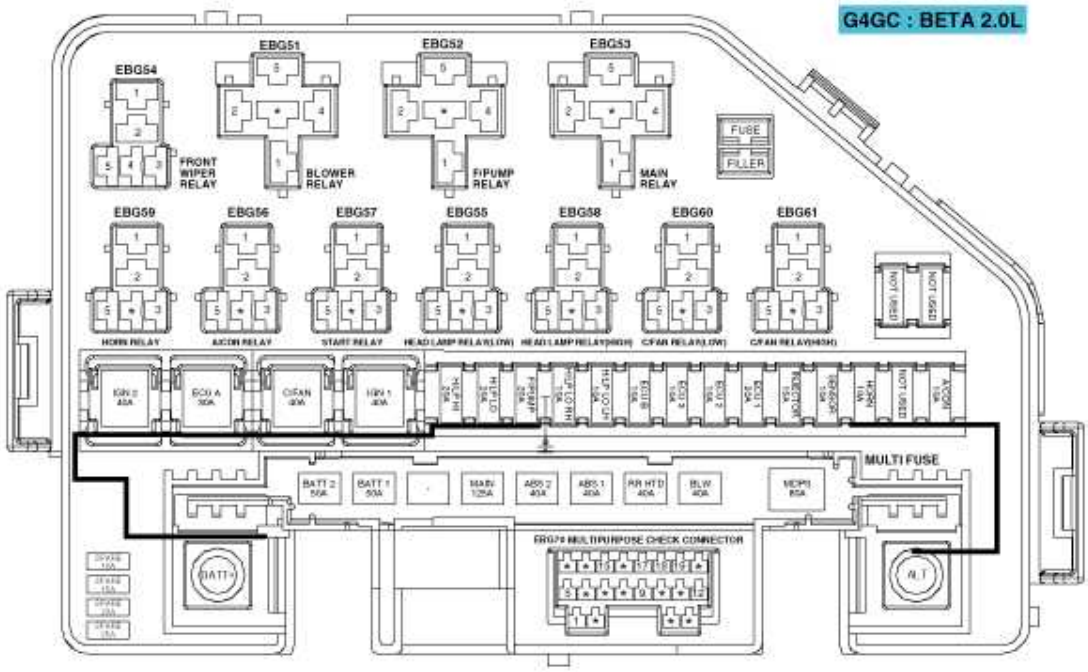
Component Location



E/R FUSE & RELAY BOX

Description		(A)	Circuit Protected
MULTI FUSE	BATT 2	50A	I/P Junction Box (Relay - Tail Lamp, Fuse - TAIL LH 10A, TAIL RH 10A, S/ROOF 20A, STOP LP 15A, DR LOCK 20A AMP 25A, T/GATE OPEN 15A, (FOG LP(FR)) 15A, (FOG LP(RR)) 10A, Power Connector - MEMORY 10A, AUDIO 15A)
	BATT 1	50A	I/P Junction Box (Relay - Power Window, Fuse - P/WDW LH 25A, P/WDW RH 25A, F/MIRROR 10A, HAZARD LP 15A)
	MAIN	125A	Generator, Fuse (ABS 2 40A, ABS 1 40A, RR HTD 40A, BLW 40A, MDPS 80A, A/CON 10A)
	ABS 2	40A	ABS Control Module, ESC Control Module
	ABS 1	40A	ABS Control Module, ESC Control Module
	RR HTD	40A	I/P Junction Box (Rear Defogger Relay)
	BLW	40A	Blower Relay
	MDPS	80A	-
FUSE	IGN 2	40A	Ignition Switch, Start Relay
	ECU A	30A	Main Relay, ECU B 10A
	C/FAN	40A	C/Fan Relay (High), C/Fan Relay (Low)
	IGN 1	40A	Ignition Switch
	H/LP HI	20A	Head Lamp Relay (High)
	H/LP LO	20A	Head Lamp Relay (Low)
	F/PUMP	20A	Fuel Pump Relay
	H/LP LO RH	10A	Head Lamp RH
	H/LP LO LH	10A	Head Lamp LH, Instrument Cluster (Low Beam IND.)
	ECU B	10A	ECM, PCM
	ECU 1	20A	ECM, PCM
	INJECTOR	15A	Injector #1 ~ #4, Idle Speed Control Actuator, Immobilizer Module, Canister Close Valve
	SENSOR	10A	A/Con Relay, C/Fan Relay (High/Low), Camshaft Position Sensor, Canister Purge Solenoid Valve, Oil Control Valve Oxygen Sensor Up/Down, Stop Lamp Switch
	HORN	10A	Horn Relay
	A/CON	10A	A/Con Relay

※USE THE DESIGNATED FUSE ONLY



E/R FUSE & RELAY BOX

Description		(A)	Circuit Protected
MULTI FUSE	BATT 2	50A	I/P Junction Box (Relay - Tail Lamp, Fuse - TAIL LH 10A, TAIL RH 10A, S/ROOF 20A, STOP LP 15A, DR LOCK 20A, AMP 25A, T/GATE OPEN 15A, (FOG LP(FR)) 15A, (FOG LP(RR)) 10A, Power Connector - MEMORY 10A, AUDIO 15A)
	BATT 1	50A	I/P Junction Box (Relay - Power Window, Fuse - P/WDW LH 25A, P/WDW RH 25A, F/MIRROR 10A, HAZARD LP 15A)
	MAIN	125A	Generator, Fuse (ABS 2 40A, ABS 1 40A, RR HTD 40A, BLW 40A, MDPS 80A, A/CON 10A)
	ABS 2	40A	ABS Control Module, ESC Control Module
	ABS 1	40A	ABS Control Module, ESC Control Module
	RR HTD	40A	I/P Junction Box (Rear Defogger Relay)
	BLW	40A	Blower Relay
	MDPS	80A	EPS Control Module
FUSE	IGN 2	40A	Ignition Switch, Start Relay
	ECU A	30A	Main Relay, ECU B 10A
	C/FAN	40A	C/Fan Relay (High), C/Fan Relay (Low)
	IGN 1	40A	Ignition Switch
	H/LP HI	20A	Head Lamp Relay (High)
	H/LP LO	20A	Head Lamp Relay (Low)
	F/PUMP	20A	F/Pump Relay
	H/LP LO RH	10A	Head Lamp RH
	H/LP LO LH	10A	Head Lamp LH, Instrument Cluster (Low Beam IND.)
	ECU B	10A	PCM
	ECU 3	10A	-
	ECU 2	10A	-
	ECU 1	20A	PCM, Ignition Coil
	INJECTOR	15A	Immobilizer Module, Idle Speed Control Actuator, Injector #1-4, Canister Close Valve
	SENSOR	10A	Camshaft Position Sensor, Oil Control Valve, Oxygen Sensor(Up/Down), Canister Purge Solenoid Valve, Stop Lamp Switch A/Con Relay, C/Fan Relay (High/Low), Crankshaft Position Sensor
	HORN	10A	Horn Relay
	A/CON	10A	A/Con Relay

※USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Pull out the relay from the engine compartment relay box.

Power Relay (Type A)

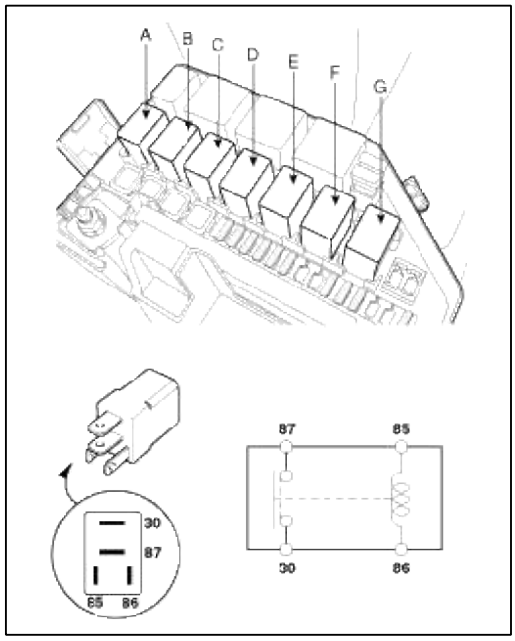
Check for continuity between the terminals.

A : Horn relay

B : A/C relay

C : Start relay
D : Head lamp relay (Low)
E : Head lamp relay (High)
F : Condenser pan relay (Low)
G : Condenser pan relay (High)

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

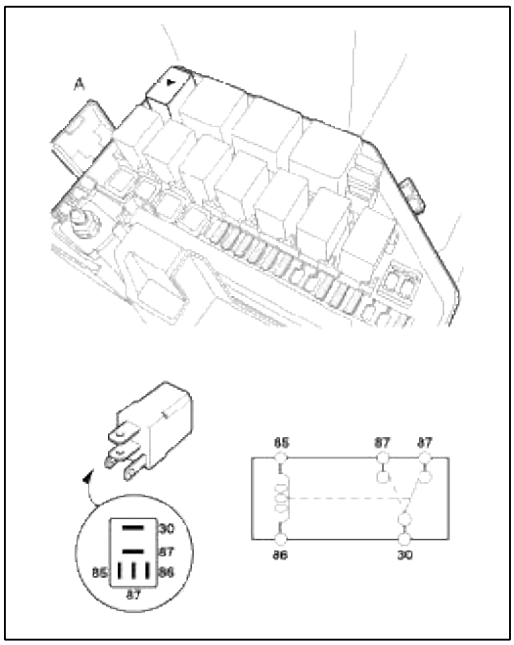
Power Relay (Type B)

Check for continuity between the terminals.

A : Wiper relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.

2. There should be continuity between the No.30 and No.87 terminals when power is disconnected.



Terminal / Power	85	86	30	87	87
Disconnected			○	○	○
Connected	⊖	⊕	○	○	

Power Relay (Type C)

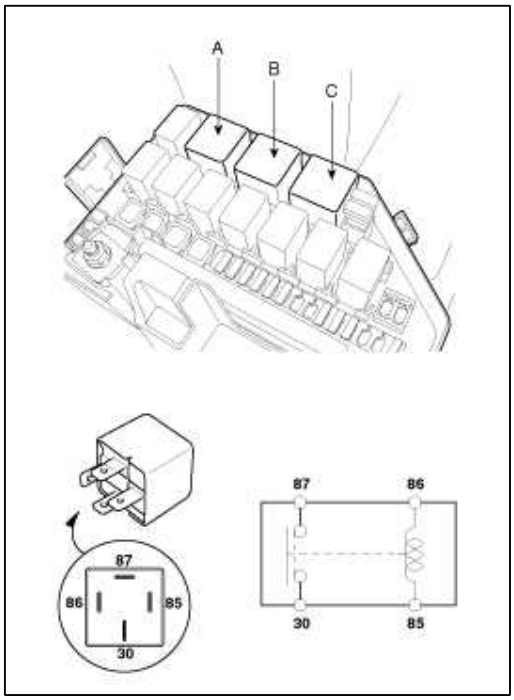
Check for continuity between the terminals.

A : Blower relay

B : Fuel pump realy

C : Main relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.

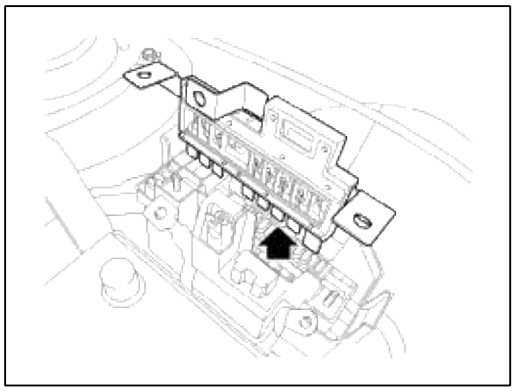


Terminal / Power	86	85	87	30
Disconnected	○	○		
Connected	⊖	⊕	○	○

Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Multi Fuse

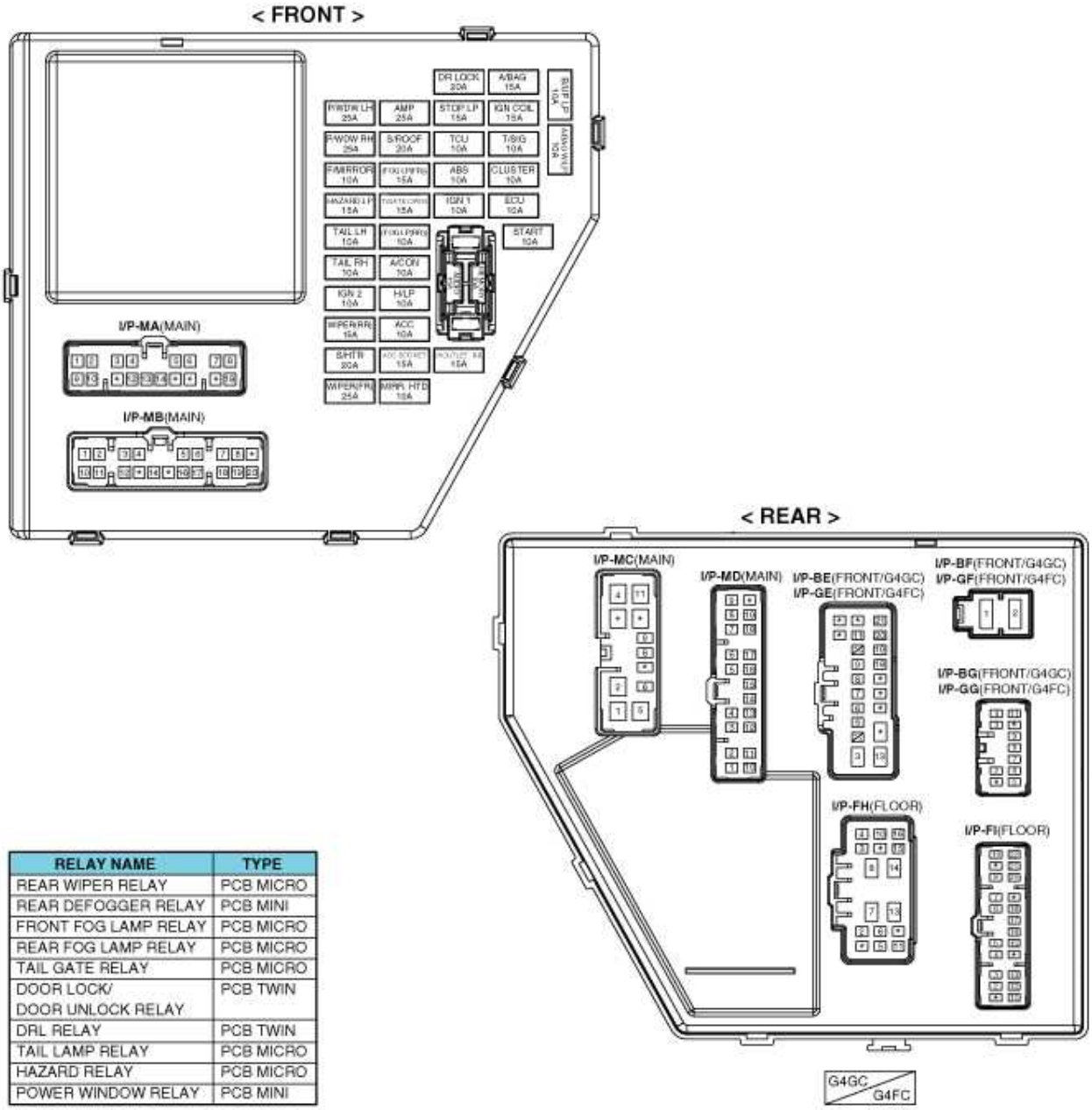


CAUTION

- Multi fuse is needed to replace in the mass when it damaged only one fuse.
- When replace the multi fuse, refer to the "Engine compartment - component location" diagram exactly.
- Use the multi fuse capacities for each circuit correctly.

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Components and Components Location

Component Location



RELAY NAME	TYPE
REAR WIPER RELAY	PCB MICRO
REAR DEFOGGER RELAY	PCB MINI
FRONT FOG LAMP RELAY	PCB MICRO
REAR FOG LAMP RELAY	PCB MICRO
TAIL GATE RELAY	PCB MICRO
DOOR LOCK/ DOOR UNLOCK RELAY	PCB TWIN
DRL RELAY	PCB TWIN
TAIL LAMP RELAY	PCB MICRO
HAZARD RELAY	PCB MICRO
POWER WINDOW RELAY	PCB MINI

※ USE THE DESIGNATED FUSE & RELAY ONLY

CIRCUIT

Description		(A)	Circuit Protected
P/WDW LH		25A	Power Window Main Switch, Rear Power Window Switch LH
P/WDW RH		25A	Power Window Main Switch, Passenger Power Window Switch, Rear Power Window Switch RH
F/MIRROR		10A	Data Link Connector
HAZARD LP		15A	Hazard Relay, Hazard Switch
TAIL LH		10A	Rear Combination Lamp LH, Head Lamp LH, License Lamp
TAIL RH		10A	Rear Combination Lamp RH, Head Lamp RH, Rheostat Detent, AUX & USB Jack, Hazard Switch, ESC Switch Instrument Cluster (ILL.), Instrument Cluster (IND.), Mood Lamp Switch, Power Window Main Switch, Audio Driver/Passenger Seat Warmer Switch, Shift Lever Switch, A/C Control Module, Multifunction Switch (Remocon)
IGN 2		10A	BCM, Electro Chromic Mirror, Sunroof Control Module
WIPER(RR)		15A	Rear Wiper Relay, Rear Wiper Motor, Multifunction Switch (Wiper)
S/HTR		20A	Driver/Passenger Seat Warmer Switch
WIPER(FR)		25A	E/R Fuse & Relay Box (Front Wiper Relay), Front Wiper Motor, Multifunction Switch (Wiper)
AMP		25A	AMP
S/ROOF		20A	Sunroof Control Module
(FOG LP(FR))		15A	Front Fog Lamp Relay
T/GATE OPEN		15A	Tail Gate Relay, DRL Relay
(FOG LP(RR))		10A	Rear Fog Lamp Relay
A/CON		10A	A/C Control Module, E/R Fuse & Relay Box (Head Lamp Relay (High), Blower Relay
H/LP		10A	E/R Fuse & Relay Box (Head Lamp Relay (Low))
ACC		10A	Audio, Mood Lamp Switch, Power Outside Mirror Switch
ACC SOCKET		15A	Cigarette Lighter, Front Power Outlet
MIRR. HTD		10A	ECM/PCM (G4FC), Driver/Passenger Power Outside Mirror Motor, A/C Control Module
DR LOCK		20A	Door Lock Relay, Door Unlock Relay, 2 Turn Unlock Relay
STOP LP		15A	Stop Lamp Switch, E/R Fuse & Relay Box (Multipurpose Check Connector)
TCU		10A	Vehicle Speed Sensor (M/T), Pulse Generator 'A', Pulse Generator 'B', PCM, Shift Lever Switch
ABS		10A	ABS Control Module, ESC Control Module, ESC Switch, Steering Angle Sensor E/R Fuse & Relay Box (Multipurpose Check Connector)
IGN 1		10A	Tire Pressure Monitoring Module, Multifunction Switch (Remocon), Audio
POWER CONNECTOR	AUDIO	15A	Audio
	MEMORY	10A	BCM, Instrument Cluster (IND.), A/C Control Module, Tire Pressure Monitoring Module, Door Warning Switch Overhead Console Assembly (Map Lamp), Center Room Lamp, Luggage Lamp

CIRCUIT

Description	(A)	Circuit Protected
P/OUTLET. RR	15A	Rear Power Outlet
A/BAG	15A	SRS Control Module, Weight Classification Module
IGN COIL	15A	Condenser, Ignition Coil #1 – #4
T/SIG	10A	Hazard Switch
CLUSTER	10A	BCM, Instrument Cluster (IND.), A/C Control Module
ECU	10A	ECM, PCM
START	10A	E/R Fuse & Relay Box (Start Relay)
B/UP LP	10A	Back-up Lamp Switch (M/T), Transaxle Range Switch (A/T), Cruise Control Module
A/BAG W/LP	10A	Instrument Cluster (Air Bag IND.)

※ USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Repair procedures

Inspection

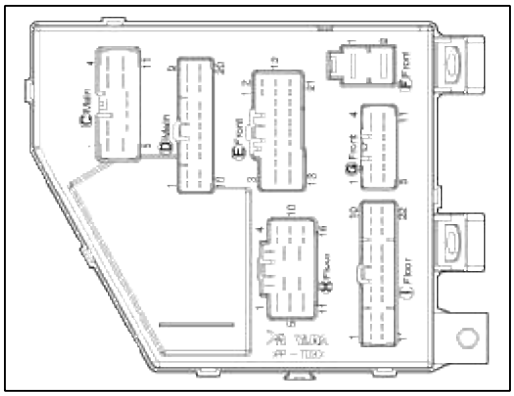
Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Passenger Compartment Relay

1. Disconnect the negative(-) battery terminal.

2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the junction box.



Power Window

Check for continuity between the terminals.

1. There should be continuity between the No.2 terminal in the I/P-F and the No.8 or 14 terminal in the I/P-H when power and ground are connected to the No.2 terminal in the I/P-F and the No.9 terminal in the I/P-A.
2. There should be no continuity between the No.2 terminal in the I/P-F and the No.8 or 14 terminal in the I/P-H when power is disconnected.

Tail Lamp

Check for continuity between the terminals.

1. There should be continuity between the No.1 terminal in the I/P-F and the No.17(LH) or 16(RH) terminal in the I/P-I when power and ground are connected to the No.1 terminal in the I/P-F and the No.18 terminal in the I/P-A.
2. There should be no continuity between the No.1 terminal in the I/P-F and the No.17(LH) or 16(RH) terminal in the I/P-I when power is disconnected.

Tailgate Lid Open

Check for continuity between the terminals.

1. There should be continuity between the No.1 terminal in the I/P-F and the No.16 terminal in the I/P-I when power and ground are connected to the No.14 terminal in the I/P-A and the No.1 terminal in the I/P-F.
2. There should be no continuity between the No.1 terminal in the I/P-F and the No.16 terminal in the I/P-I when power is disconnected.

Rear Heater

Check for continuity between the terminals.

1. There should be continuity between the No.13 terminal in the I/P-E and the No.7 terminal in the I/P-H when power and ground are connected to the No.13 terminal in the I/P-E and the No.11 terminal in the I/P-D.
2. There should be no continuity between the No.13 terminal in the I/P-E and the No.7 terminal in the I/P-H when power is disconnected.

Rear Wiper

Check for continuity between the terminals.

1. There should be continuity between the No.1 terminals in the I/P-C and No.20 terminals in the I/P-I when power and ground are connected to the No.1 terminals in the I/P-A and No.2 terminals in the I/P-A.
2. There should be no continuity between the No.1 terminals in the I/P-C and No.20 terminals in the I/P-I when power is disconnected.

Hazard Lamp

Check for continuity between the terminals.

1. There should be continuity between the No.2 terminals in the I/P-F and No.5 or 6 terminals in the I/P-A when power and ground are connected to the No.2 terminals in the I/P-F and No.4 terminals in the I/P-A.
2. There should be no continuity between the No.2 terminals in the I/P-F and No.5 or 6 terminals in the I/P-A when power is disconnected.

Front Fog

Check for continuity between the terminals.

1. There should be continuity between the No.1 terminals in the I/P-F and No.11 terminals in the I/P-G when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-A.
2. There should be no continuity between the No.1 terminals in the I/P-F and No.11 terminals in the I/P-G when power is disconnected.

Door Lock

Check for continuity between the terminals.

1. There should be continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-H.
2. There should be no continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power is disconnected.

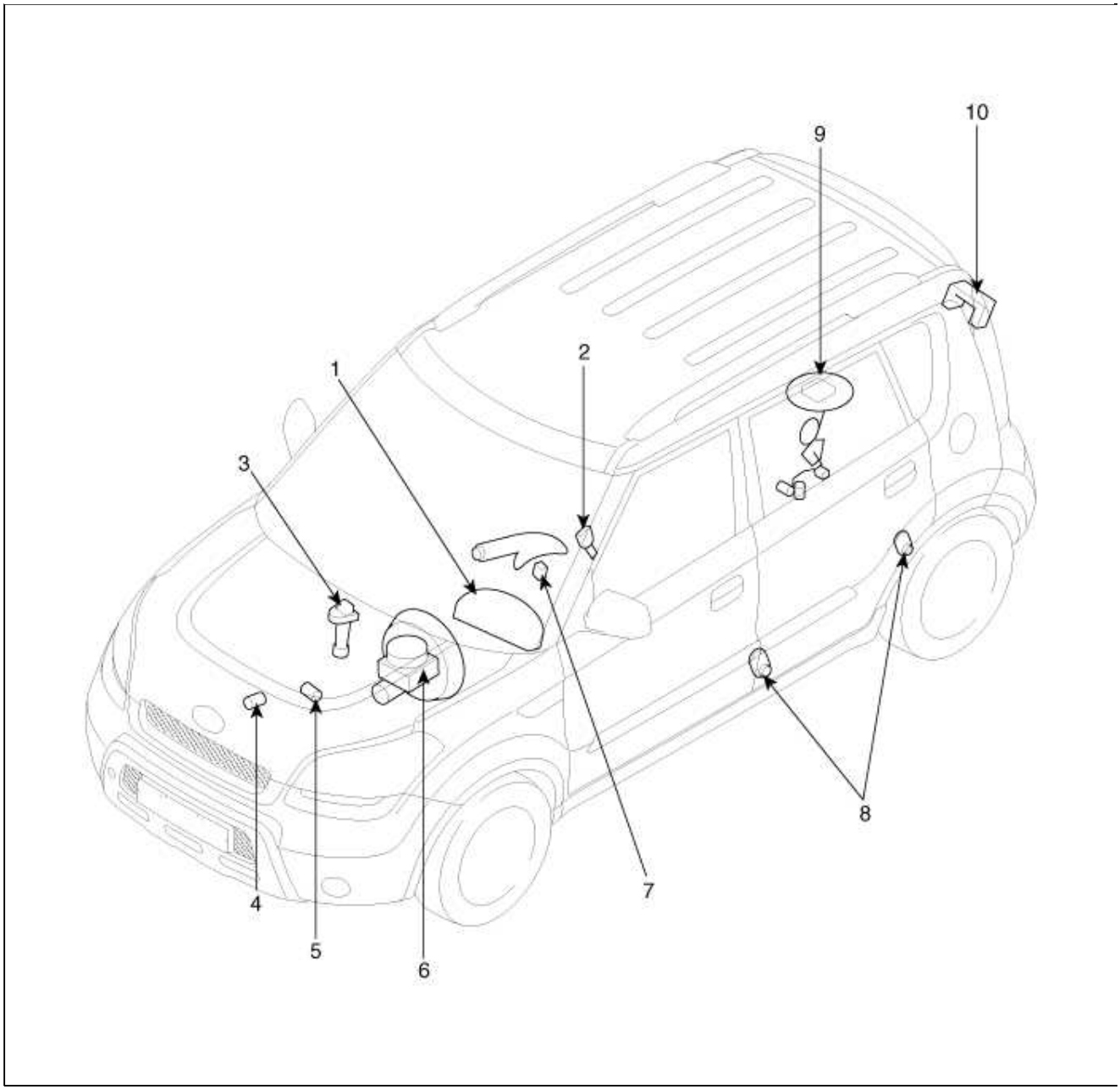
Door Unlock

Check for continuity between the terminals.

1. There should be continuity between the No.1 terminals in the I/P-F and No.5 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.9 terminals in the I/P-H.
2. There should be no continuity between the No.1 terminals in the I/P-F and No.5 terminals in the I/P-H when power is disconnected.

Body Electrical System > Indicators And Gauges > Components and Components Location

Component Location

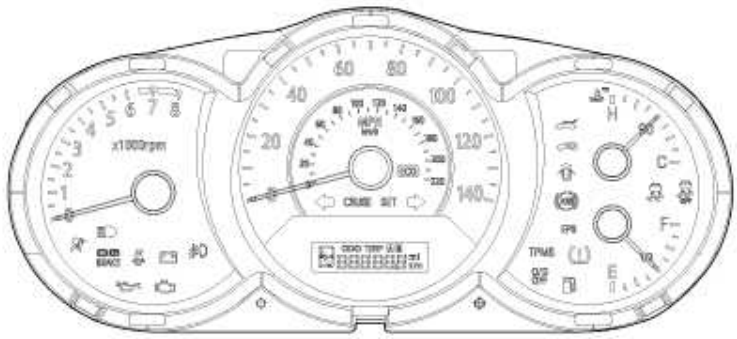


1. Cluster assembly 2. Seat belt switch 3. Vehicle speed sensor 4. Engine coolant temperature sender 5. Oil pressure switch	6. Brake fluid level warning switch 7. Parking brake switch 8. Door switch 9. Fuel gauge sender 10. Tailgate switch

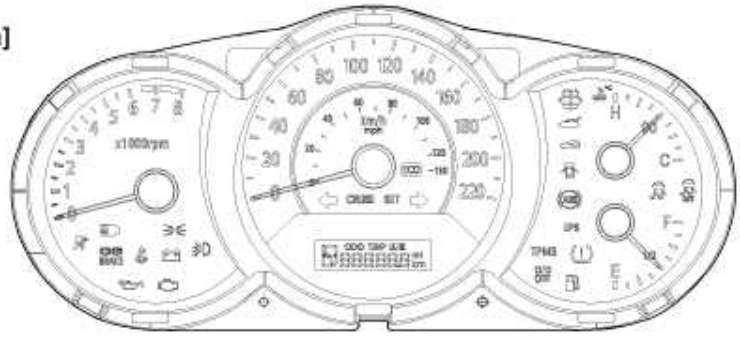
Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location

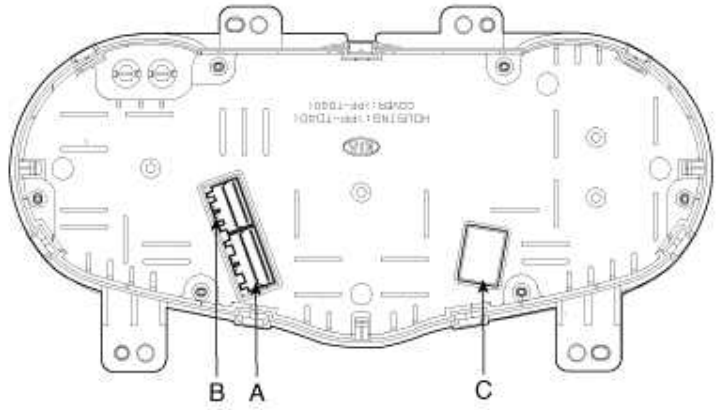
Components

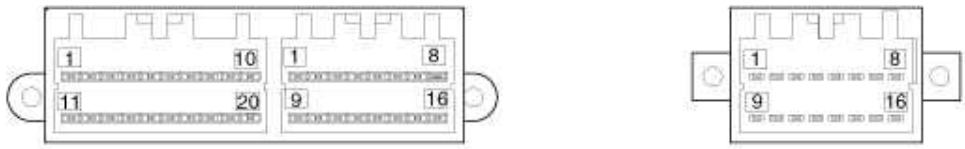
[USA]



[Canada]







Connector A Connector B Connector C

Instrument Cluster

Pin No	Connector A	Connector B	Connector C
1	Detent	Power GND	O/D OFF
2	ILL+	-	TPMS Diagnosis
3	Battery charge	-	TPMS TREAD
4	Oil pressure	Head lamp (Low)	EPS
5	Check engine	Tail lamp ON	Washer Low
6	P brake	Seat belt	Immobilizer
7	Airbag input -	Front fog	Trunk open
8	Airbag supply +	-	Door open
9	High beam input +	Cruise	P
10	High beam GND	Turn signal L	R
11	ILL-	Fuel -	PWM
12	Diagnosis	Signal GND	D
13	Tachometer	CAN high	N
14	Speed	CAN low	ABS/EBD
15	Reset/ mode	Battery	ESC OFF
16	Fuel gage	IGN 1	ESC
17	Temperature gage		
18	Over speed		
19	Turn signal R		
20	Set(Cruise)		

Body Electrical System > Indicators And Gauges > Instrument Cluster > Description and Operation - Revised

ECO driving system

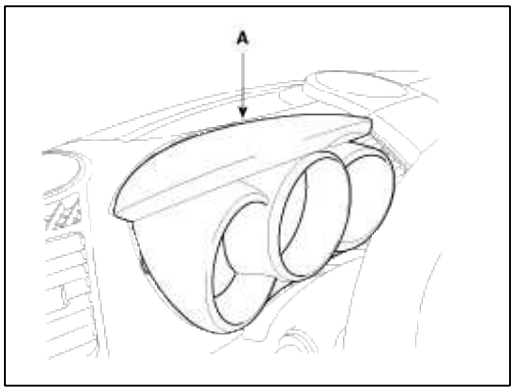
This system is designed to encourage eco-driving by providing real-time feedback to the driver.
The ECO indicator light assists you to drive in the most economical way.
The green indicator comes on when you drive with high fuel efficiency.
The fuel efficiency depends on driver's driving habit and road condition.
The system stops operation when the transaxle is in the P,R,N position or sports mode, or instantaneous fuel consumption mode is selected.

Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

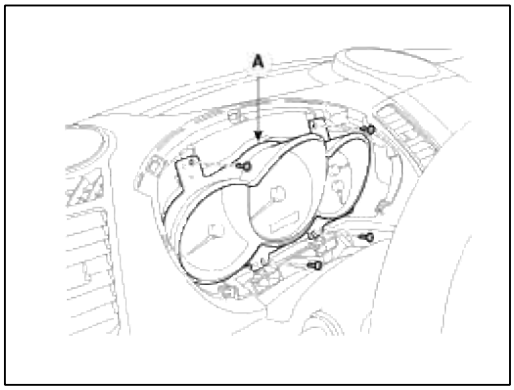
Removal

1. Disconnect the negative (-) battery terminal.

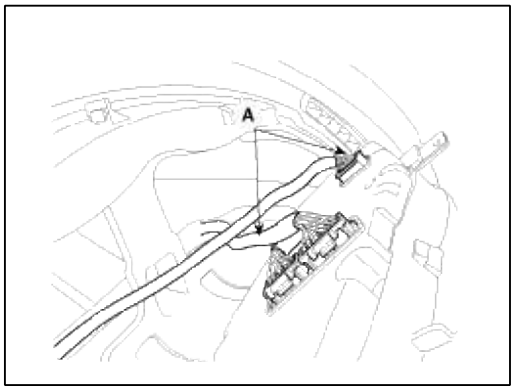
2. Remove the cluster fascia panel (A).
(Refer to the Body group - "Crash pad")



3. Remove the cluster fascia (A) from the housing after removing 4 screws.



4. Disconnect the cluster fascia connecters(A) and then remove the cluster.



Installation

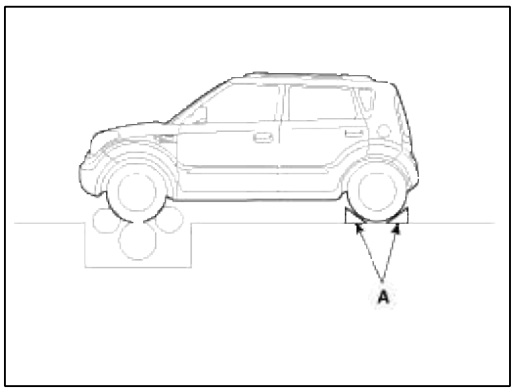
1. Connect the cluster connector.
2. Install the cluster assembly.
3. Install the center facia panel.

Inspection

Speedometer

1. Adjust the pressure of the tires to the specified level.

2. Drive the vehicle onto a speedometer tester. Use wheel chocks(A) as appropriate.



3. Check if the speedometer indicator range is within the standard values.

CAUTION

Do not operate the clutch suddenly or increase/ decrease speed rapidly while testing.

NOTE

Tire wear and tire over or under inflation will increase the indication error.

[km/h - Canada]

Velocity (km/h)	20	40	60	80	100
Tolerance (km/h)	+1.8 +0.5	+2.5 +1.0	+3.1 +1.5	+4.2 +2.0	+5.3 +2.5
Velocity (km/h)	120	140	160	180	200
Tolerance (km/h)	+6.3 +3.0	+7.4 +3.5	+8.5 +4.0	+9.5 +4.5	+10.5 +5.0

[MPH - USA]

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	+1.0 +0.3	+1.5 +0.5	+2.1 +1.0	+3.2 +1.5
Velocity (MPH)	80	100	120	-
Tolerance (MPH)	+4.3 +2.0	+5.4 +2.5	+6.4 +3.0	-

Tachometer

1. Connect the scan tool to the diagnostic link connector or install a tachometer.

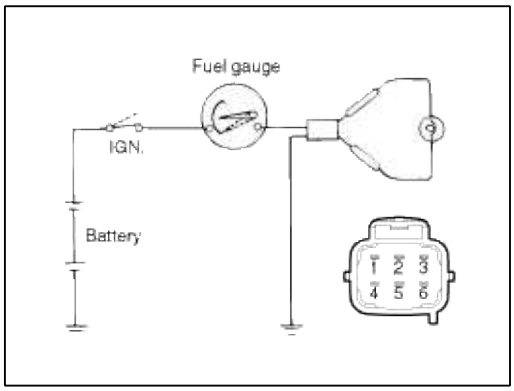
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

> CAUTION
>
> 1) Reversing the connections of the tachometer will damage the transistor and diodes inside.
> 2) When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution (rpm)	1,000	2,000	3,000	4,000
Tolerance (rpm)	±100	±125	±150	±150
Revolution (rpm)	5,000	6,000	7,000	8,000
Tolerance (rpm)	±150	±180	±210	±230

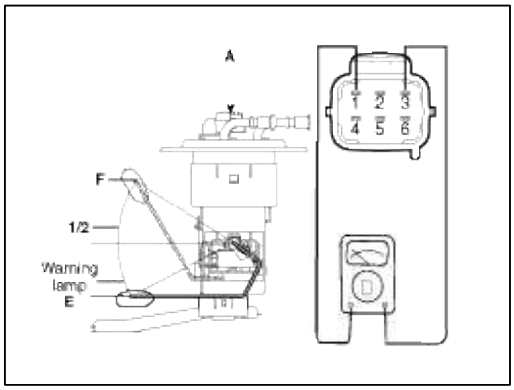
Fuel Gauge

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 watt, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



Fuel Gauge Sender

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

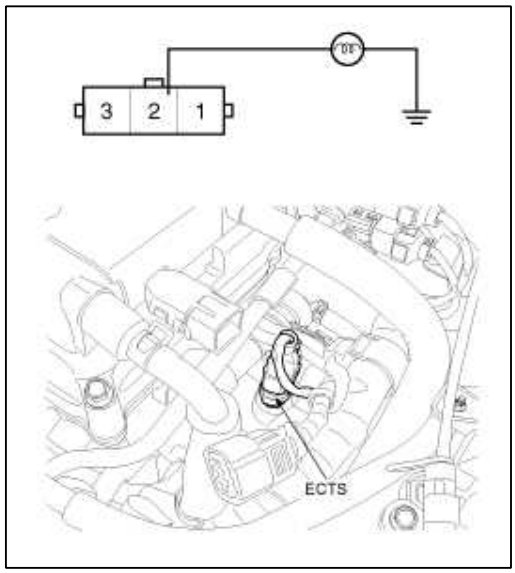
Position	Resistance(Ω)
E	184 ± 1Ω
Warning lamp	170 ± 1Ω
1/2	66.2 ± 1Ω
Sender (F)	15 ± 1Ω

3. If the height resistance is unsatisfied, replace the fuel sender as an assembly.

> CAUTION
>
> After completing this test, wipe the sender dry and reinstall it in the fuel tank.

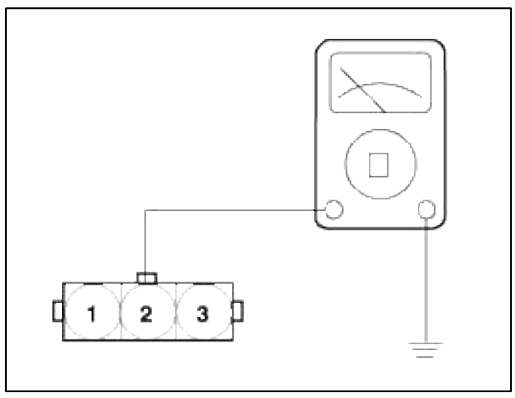
Engine Coolant Temperature Gauge

1. Disconnect the wiring connector (A) from the engine coolant temperature sender in the engine compartment.
2. Connect a 12V, 3.4 wattages test bulb between the harness side connector 2 terminal and ground.
3. Turn the ignition switch ON.
4. Verify that the test bulb flashes and that the indicator moves to HOT position.
   If operation is not as specified, replace the cluster (Engine coolant temperature gauge). Then recheck the system.



Engine Coolant Temperature Sender

1. Using an ohmmeter, measure the resistance between the terminal 2 and ground.

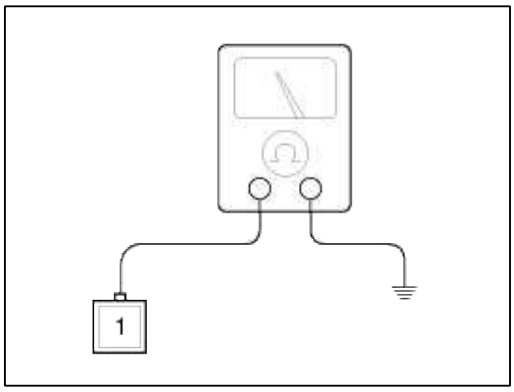


2. If the resistance value is not as shown in the table, replace the temperature sender.

Temp °F(°C)	140 (60)	185 (85)	230 (110)	257 (125)
Resistance (Ω)	161	58	26	17

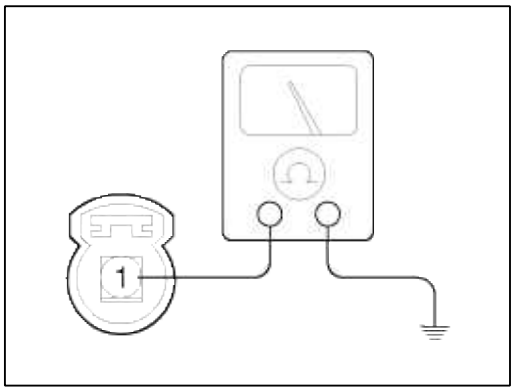
Oil Pressure Switch

1. Check that there is continuity between the oil pressure switch terminal and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



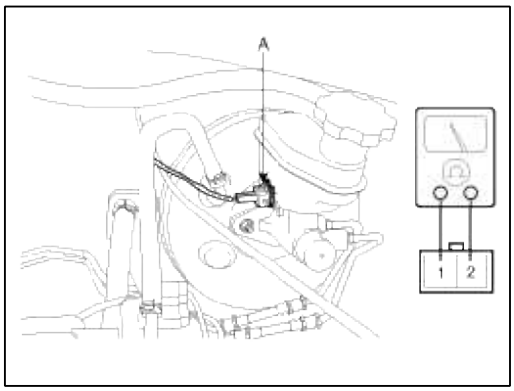
Oil Pressure Warning Lamp

1. Disconnect the connector from the warning switch and ground the terminal on the wire harness side connector.
2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect the wire harness.



Brake Fluid Level Warning Switch

1. Remove the connector (A) from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



Brake Fluid Level Warning Lamp

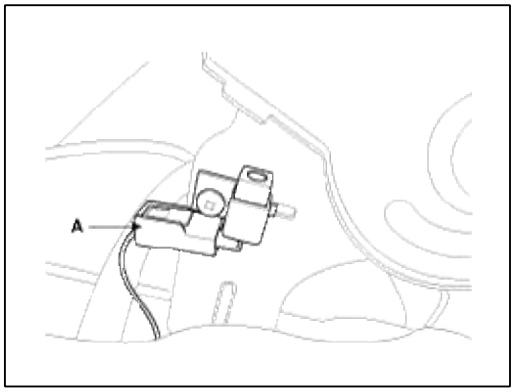
1. Ignition "ON".

2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

Parking Brake Switch

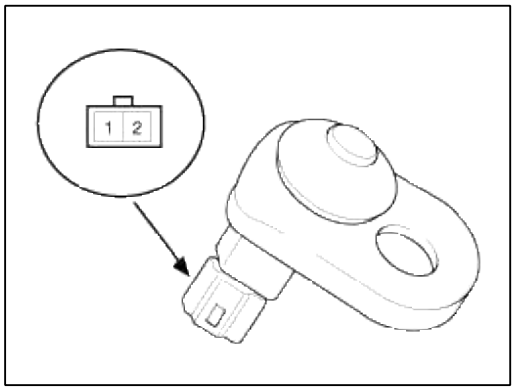
The parking brake switch is a pull type. It is located at the side of the parking brake lever.

1. Check that there is continuity between the terminal and switch body with the switch (A) ON.
2. Check that there is no continuity between the terminal and switch body with the switch OFF.
   If continuity is not as specified, replace the switch or inspect its ground connection.



Door Switch

Remove the door switch and check for continuity between the terminals.



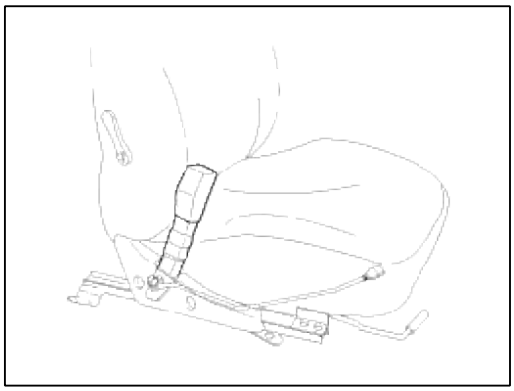
Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

Seat Belt Switch

1. Remove the connector from the switch.

2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



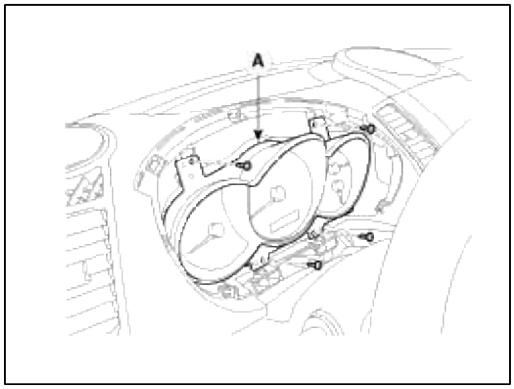
Seat Belt Warning Lamp

With the ignition switch turned ON, verify that the lamp glows.

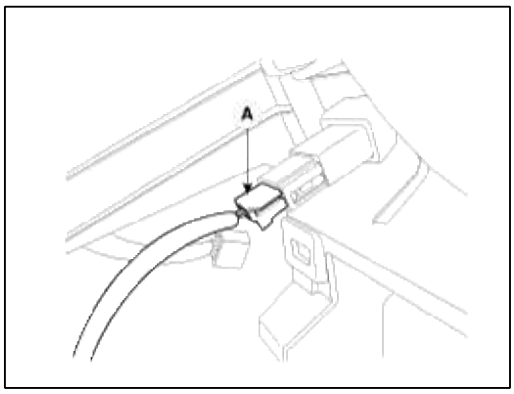
Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

Trip Switch

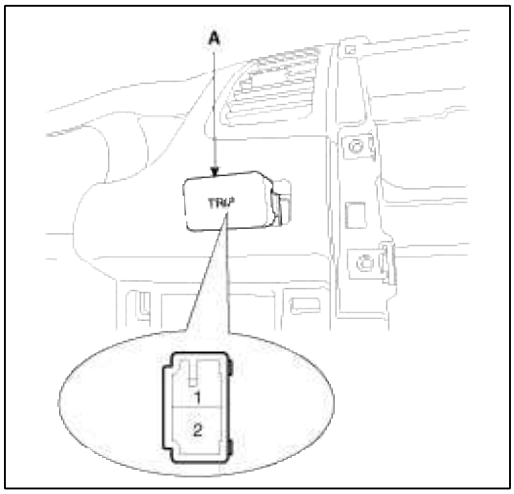
1. Disconnect the negative (-) battery terminal.
2. Remove the cluster (A).
   (Refer to the Body group - " Crash pad")



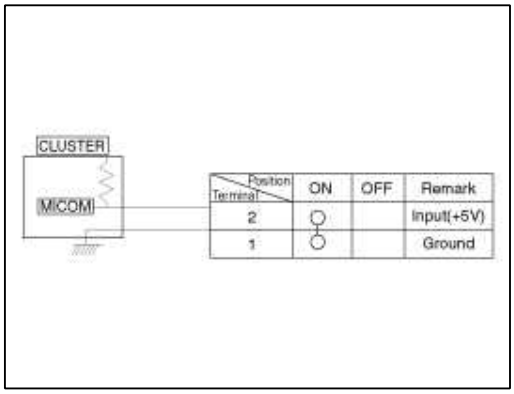
3. Remove the trip switch connector (A) from the main crash pad.



4. Remove the trip switch (A).



5. Check for continuity between the terminals in each switch position according to the table.



Body Electrical System > Indicators And Gauges > Troubleshooting

Troubleshooting

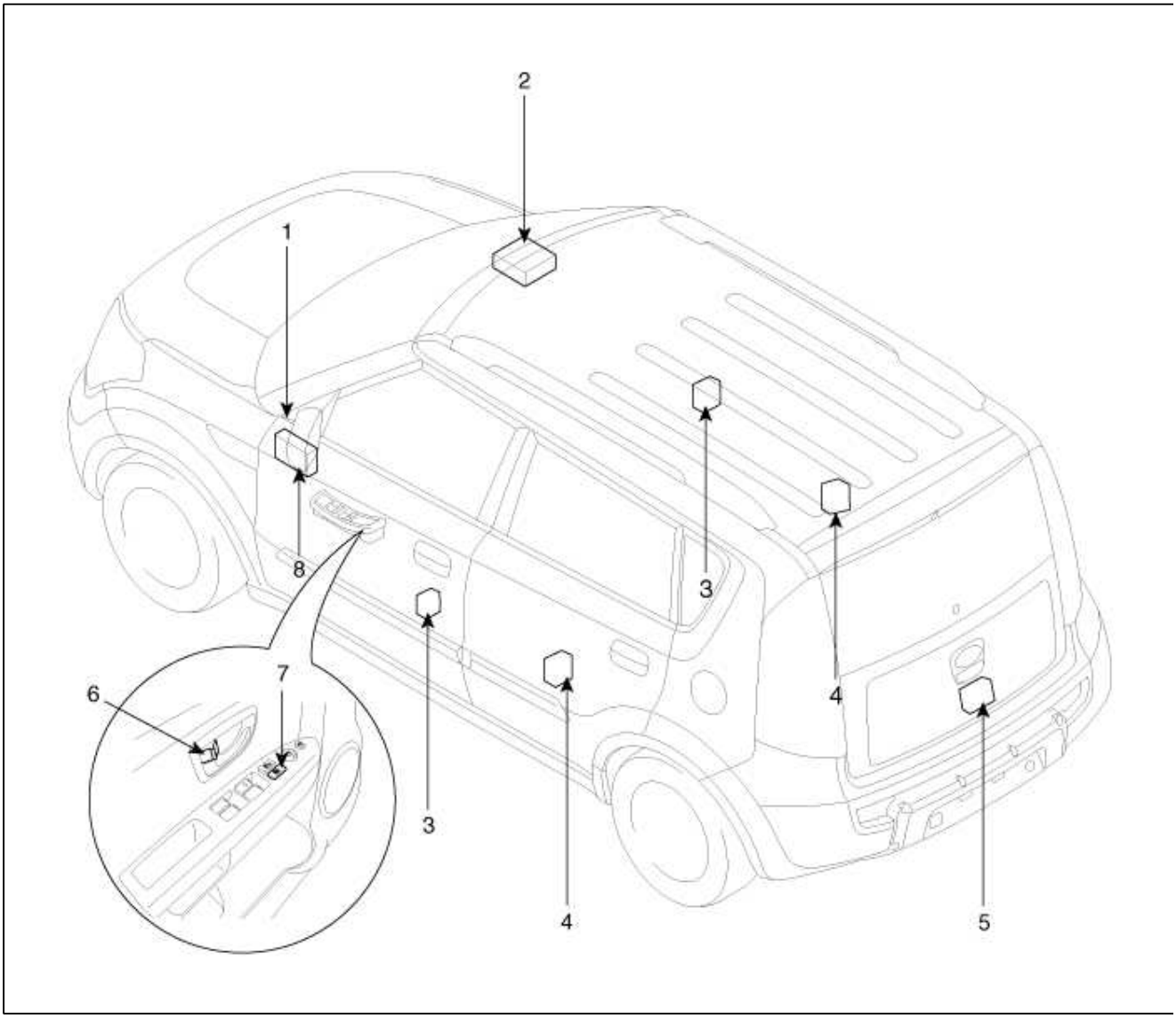
Symptom	Possible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	Vehicle speed sensor faulty	Check vehicle speed sensor
	Wiring or ground faulty	Repair if necessary

Tachometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge
	Water temperature sender faulty	Check sender
	Wiring or ground faulty	Repair if necessary
Oil pressure warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Parking brake warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Open door warning lamp and tailgate warning lamp do not light up	Memory fuse (15A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse

	Bulb burned out	Replace bulb
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Body Electrical System > Power Door Locks > Components and Components Location

Component Location



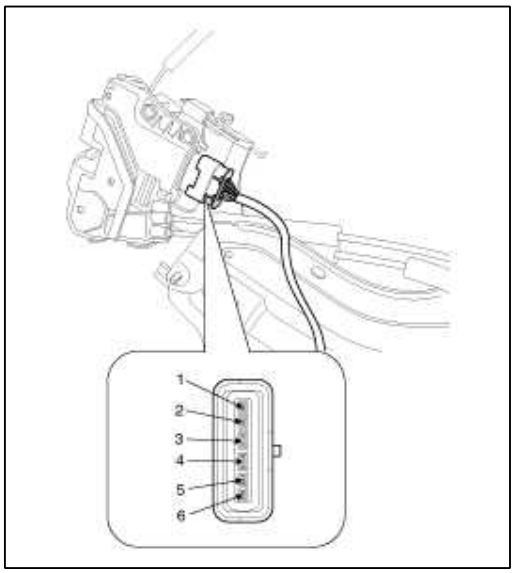
1. Passenger compartment junction box (Door lock/unlock relay)	5. Tailgate actuator & switch
2. Body control module (BCM)	6. Door lock knob
3. Front door lock actuator & switch	7. Door lock switch
4. Rear door lock actuator & switch	8. Passenger compartment junction box (Tailgate relay)

Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

Inspection

Front Door Lock Actuator

1. Remove the front door trim.
   (Refer to the Body group - "Front door")
2. Remove the front door module.
   (Refer to the Body group - "Front door")
3. Disconnect the connectors from the actuator.

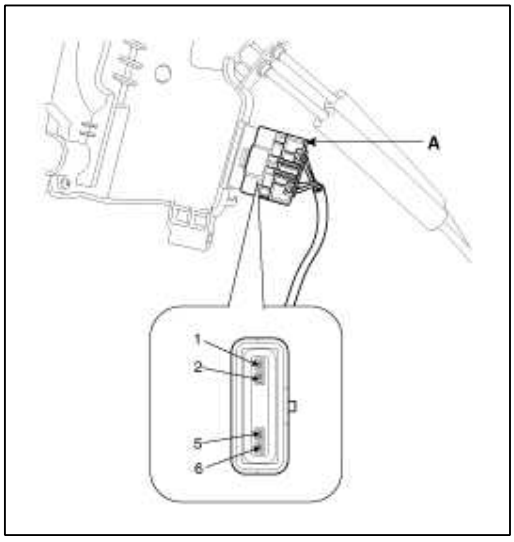


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	1
LH	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
RH	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Rear Door Lock Actuator

1. Remove the rear door trim.
   (Refer to the Body group - "Rear door")
2. Remove the rear door module.
   (Refer to the Body group - "Rear door")
3. Disconnect the connectors from the actuator (A).

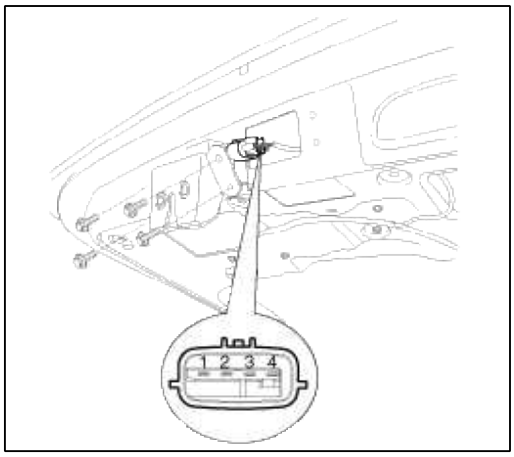


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		1	2
LH	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖
RH	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim.
   (Refer to the Body group - "Tail gate")
2. Disconnect the 4P connector from the actuator.

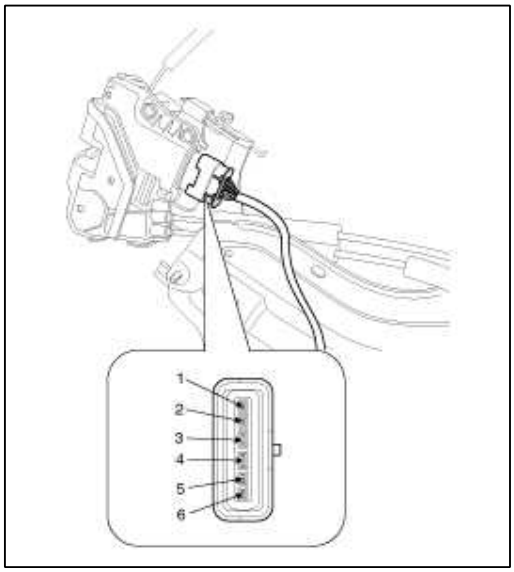


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

1. Remove the front door trim.
   (Refer to the Body group - "Front door")
2. Remove the front door module.
   (Refer to the Body group - "Front door")
3. Disconnect the connectors from the actuator.

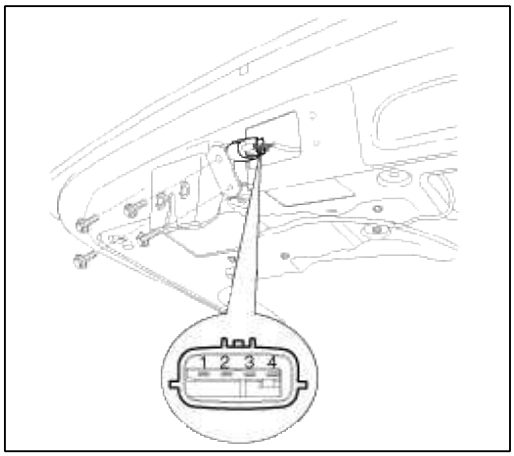


4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

Position		Terminal 4	3	6
LH	Lock		○	○
	Unlock	○		○
RH	Lock		○	○
	Unlock	○		○

Tailgate Switch

1. Remove the tailgate trim.
   (Refer to the Body group - "Tail gate")
2. Disconnect the 4P connector from the actuator.



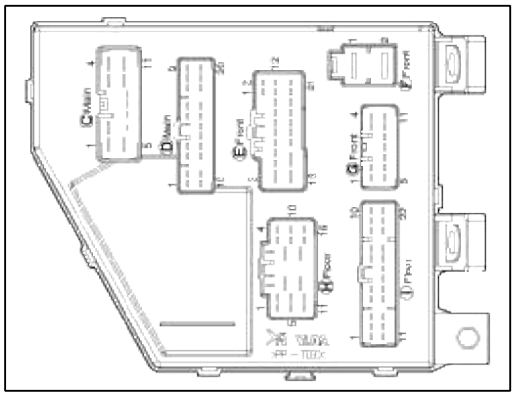
3. Check for continuity between the terminals in each switch position according to the table.

Position	Terminal 1	2
Lock		
Unlock	○	○

Body Electrical System > Power Door Locks > Power Door Lock Relay > Repair procedures

Inspection

Door Lock Relay

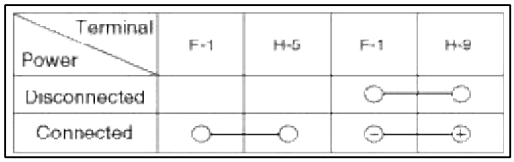


Power	Terminal F-1	H-6	F-1	H-3
Disconnected			○	○
Connected	○	○	⊖	⊕

Check for continuity between the terminals.

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-H.
5. There should be no continuity between the No.1 terminals in the I/P-F and No.6 terminals in the I/P-H when power is disconnected.

Door Unlock Relay



Check for continuity between the terminals.

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 terminals in the I/P-F and No.5 terminals in the I/P-H when power and ground are connected to the No.1 terminals in the I/P-F and No.9 terminals in the I/P-H.
5. There should be no continuity between the No.1 terminals in the I/P-F and No.5 terminals in the I/P-H when power is disconnected.

Tailgate Open

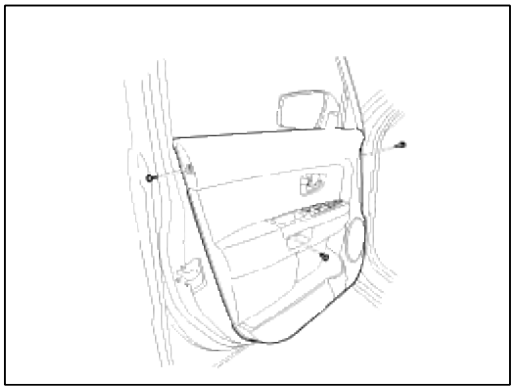
1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 terminal in the I/P-F and the No.16 terminal in the I/P-I when power and ground are connected to the No.14 terminal in the I/P-A and the No.1 terminal in the I/P-F.
5. There should be no continuity between the No.1 terminal in the I/P-F and the No.16 terminal in the I/P-I when power is disconnected.

Body Electrical System > Power Door Locks > Power Door Lock Switch > Repair procedures

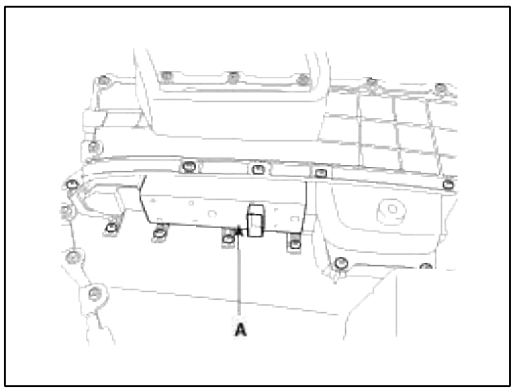
Inspection

Driver Door Lock Switch

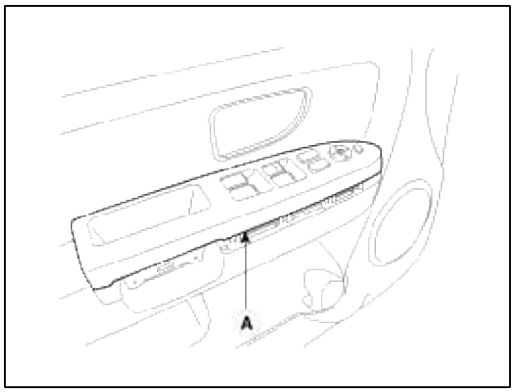
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch.
   (Refer to the Body group - "Front door")



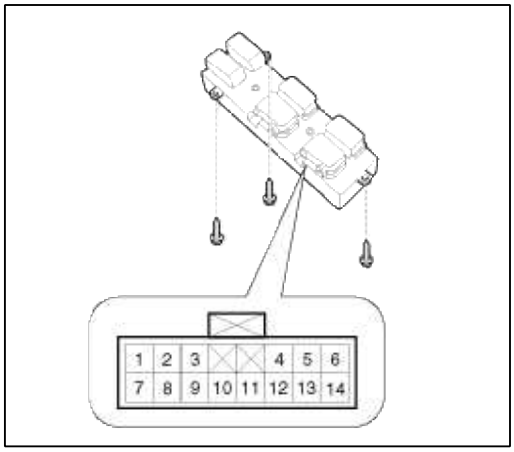
3. Remove the screws from the switch module (A).



4. Remove the power door switch module (A).



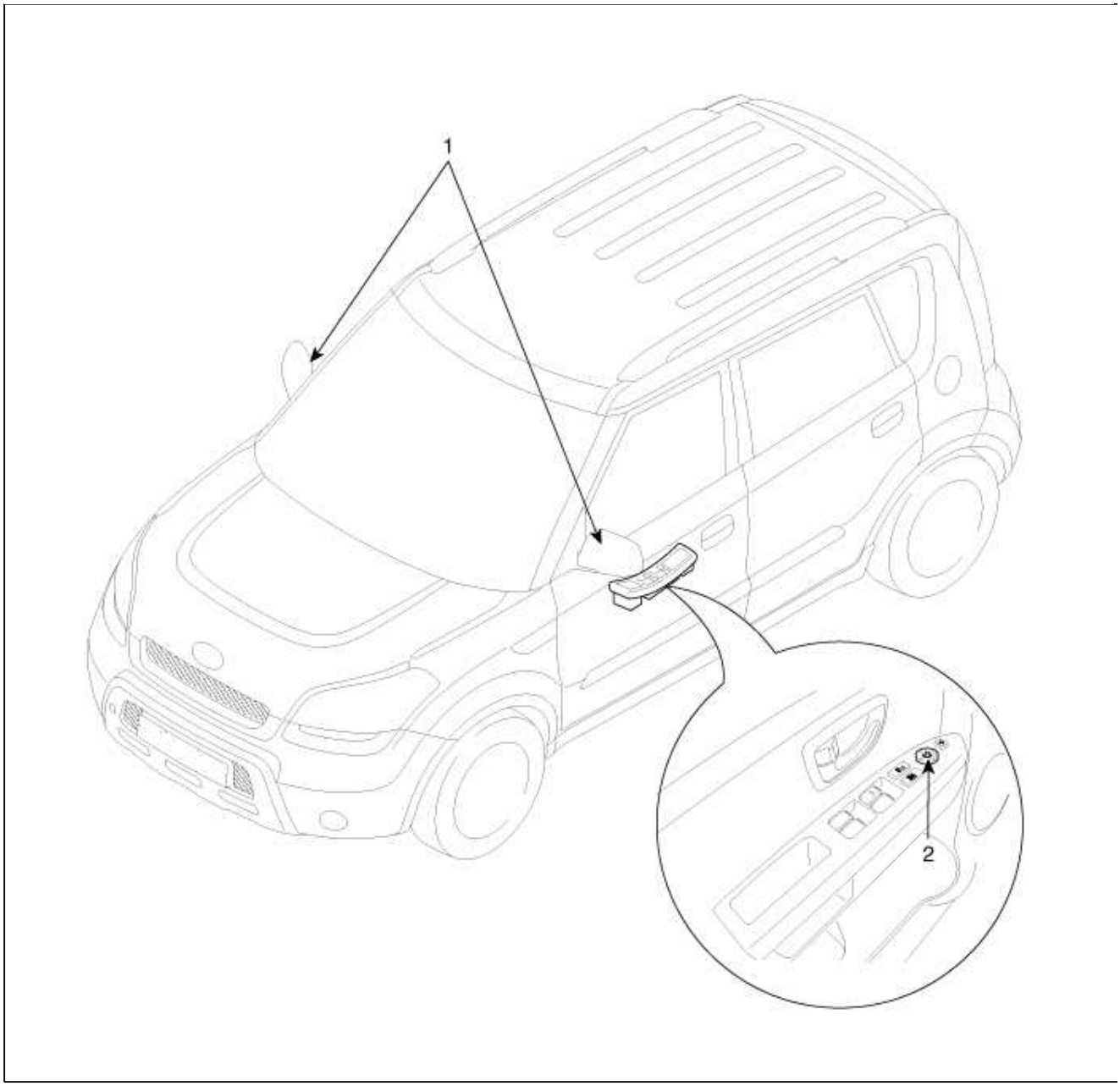
5. Check for continuity between the terminals in each switch position according to the table.



Terminal / Position	4	10	11
LOCK		○——	——○
UNLOCK	○——	——○	

Body Electrical System > Power Door Mirrors > Components and Components Location

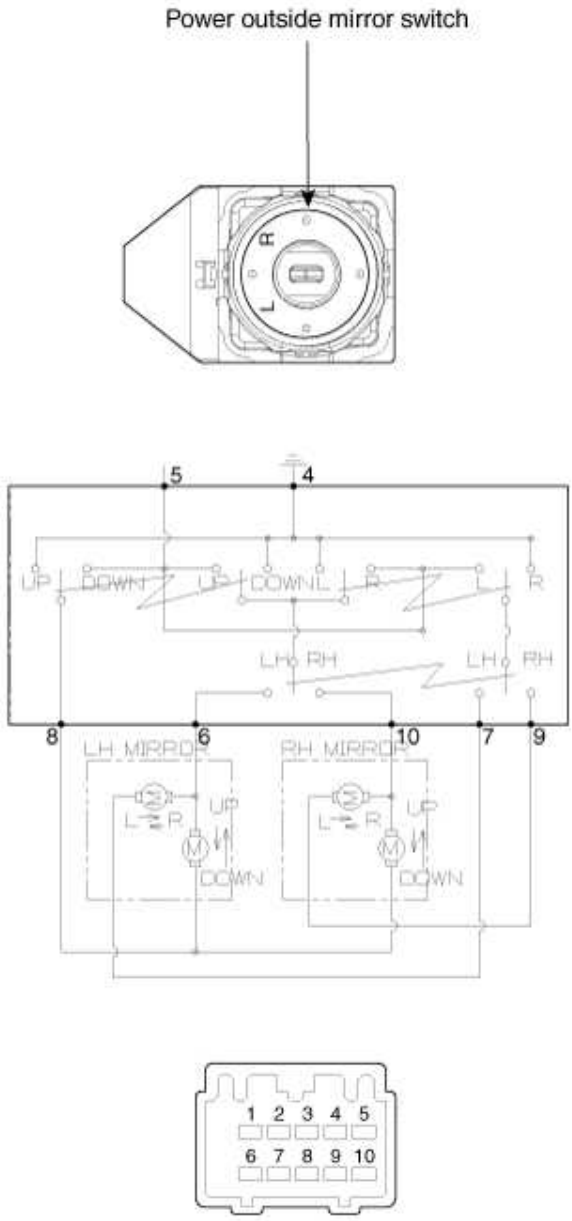
Component Location



1. Power door mirror	2. Power door mirror switch

Body Electrical System > Power Door Mirrors > Power Out Side Mirror Switch > Components and Components Location

Components

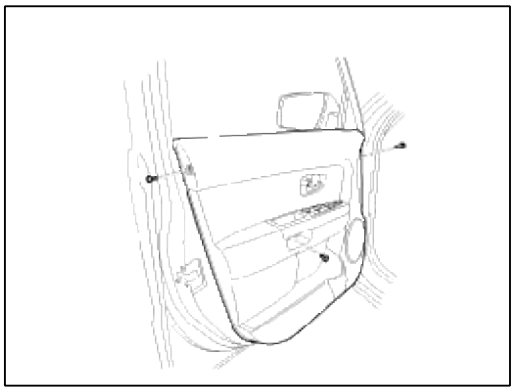


Body Electrical System > Power Door Mirrors > Power Out Side Mirror Switch > Repair procedures

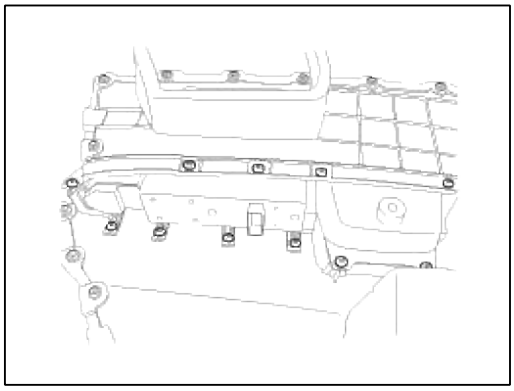
Inspection

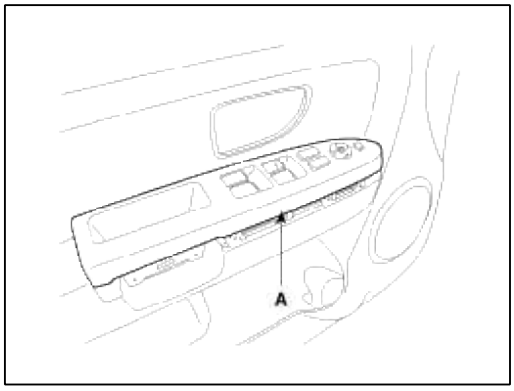
1. Disconnect the negative (-) battery terminal.

2. Remove the front door trim and power window switch module.
   (Refer to the Body group - "Front door")

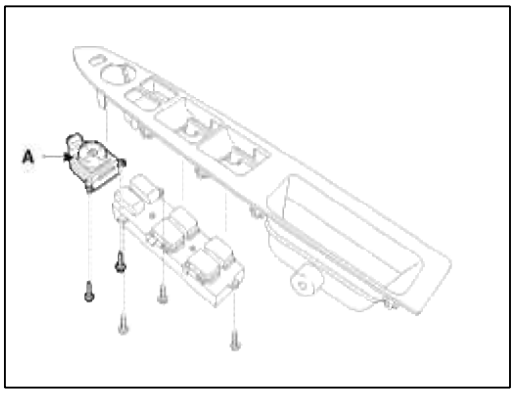


3. Remove the power door switch module (A) after removing the screws.



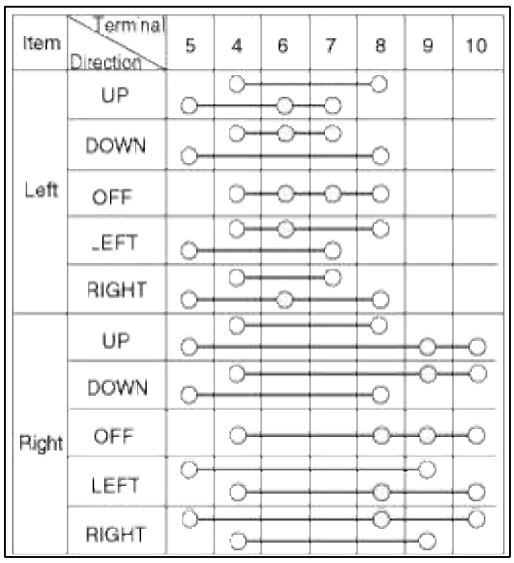


4. Remove the power door mirror switch (A).



5. Check for the continuity between terminals of power door mirror switch according to the table.

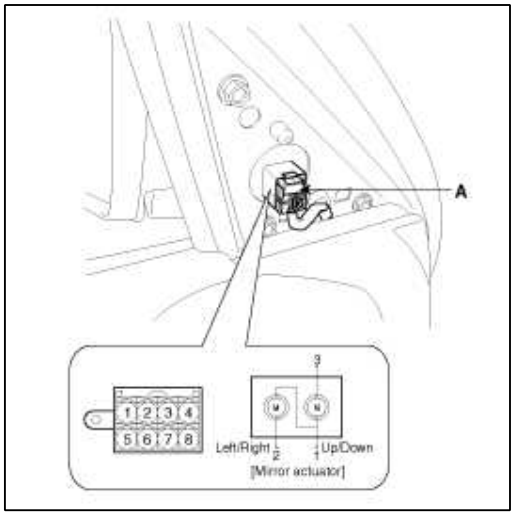
6. Check for continuity between the terminals in each switch position according to the table.

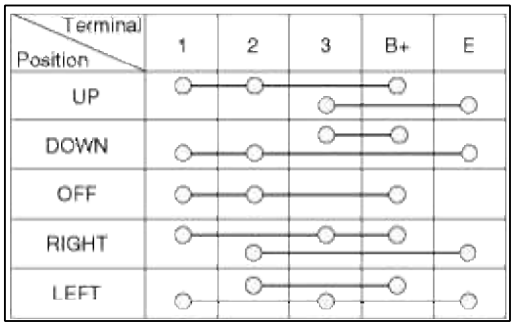


Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

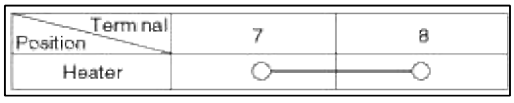
Inspection

1. Remove the front door quadrant inner cover. Take care not to damage fixing clips.
   (Refer to the Body group - "Front door")
2. Disconnect the power door mirror connector (A) from the harness.
3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



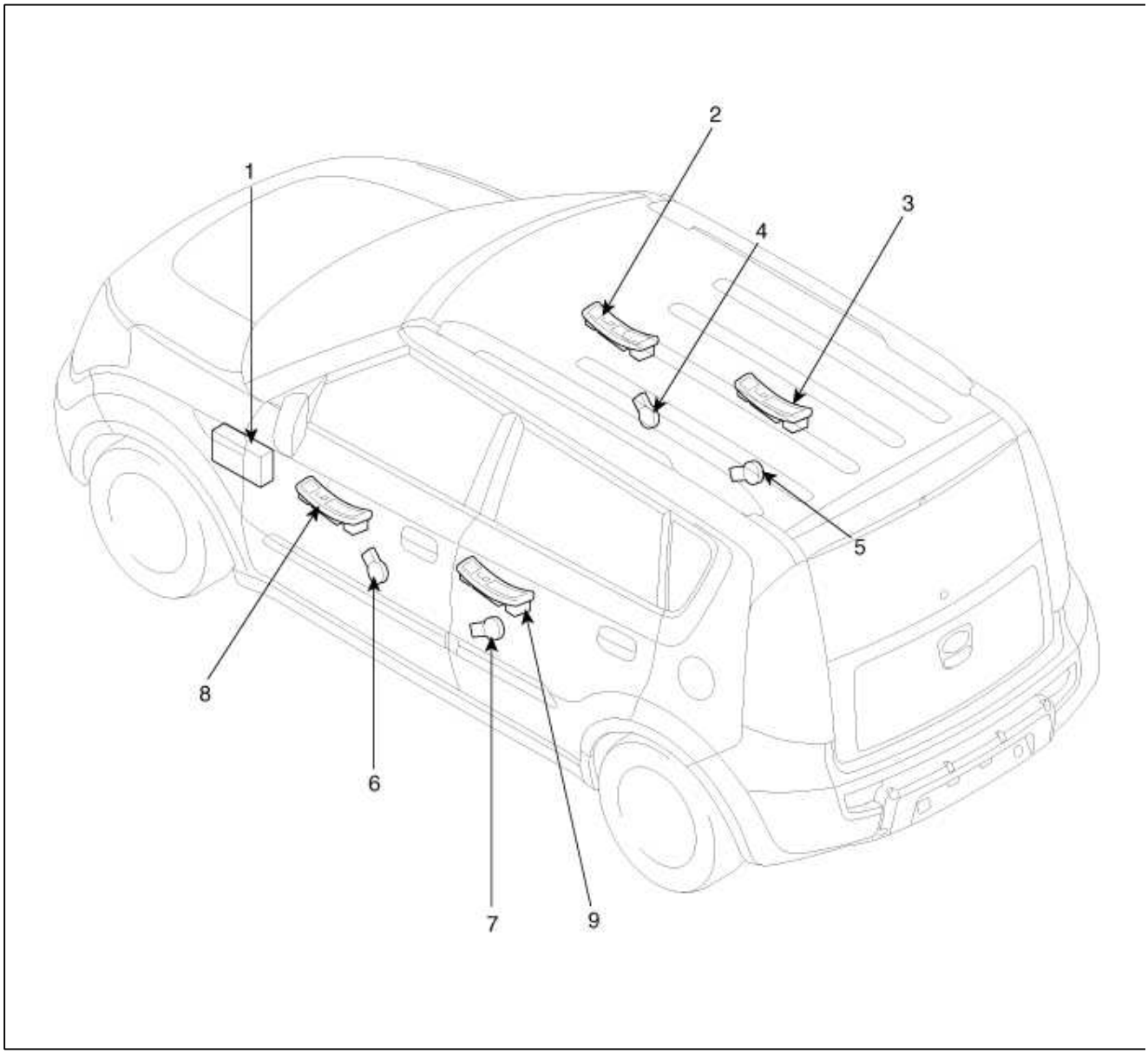


Mirror Heater



Body Electrical System > Power Windows > Components and Components Location

Component Location



1. Instrument panel junction box (Power window relay) 2. Passenger window switch 3. Rear window switch 4. Front window motor 5. Rear window motor	6. Front window motor 7. Rear window motor 8. Driver power window main switch 9. Rear window switch

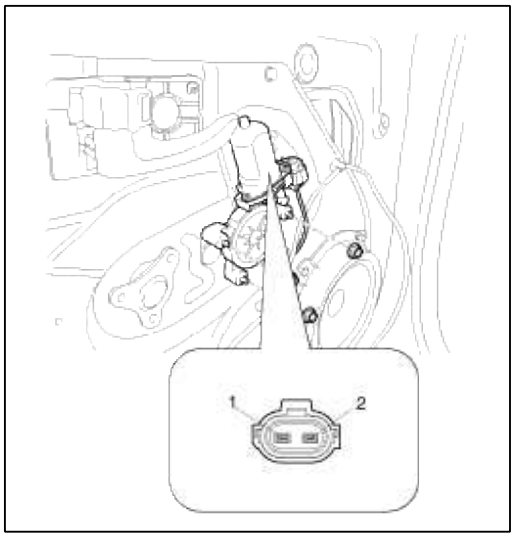
Body Electrical System > Power Windows > Power Window Motor > Repair procedures

Inspection

Front Power Window Motor

1. Remove (-) negative battery terminal.

2. Remove the front door trim.
   (Refer to the Body group - "Front door")
3. Disconnect the connector from the motor.

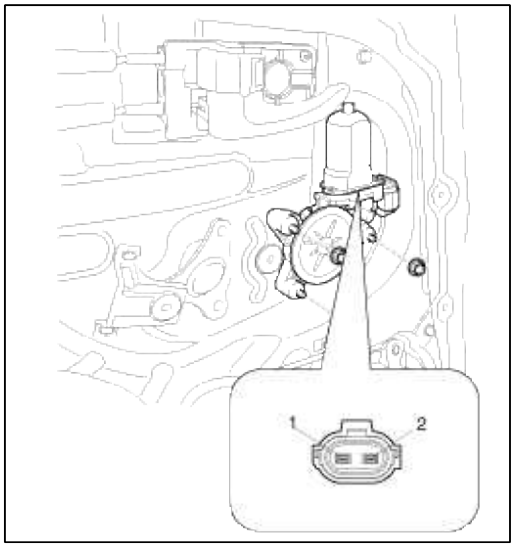


4. Connect the motor terminals directly to a 12 volt battery and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Position		Terminal	1	2
Left	UP	Clockwise	⊕	⊖
	DOWN	Counter-clockwise	⊖	⊕
Right	DOWN	Clockwise	⊖	⊕
	UP	Counter-clockwise	⊕	⊖

Rear Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the rear door trim.
   (Refer to the Body group - "Rear door")
3. Disconnect the connector from the motor.



4. Connect the motor terminals directly to a 12 volt battery and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

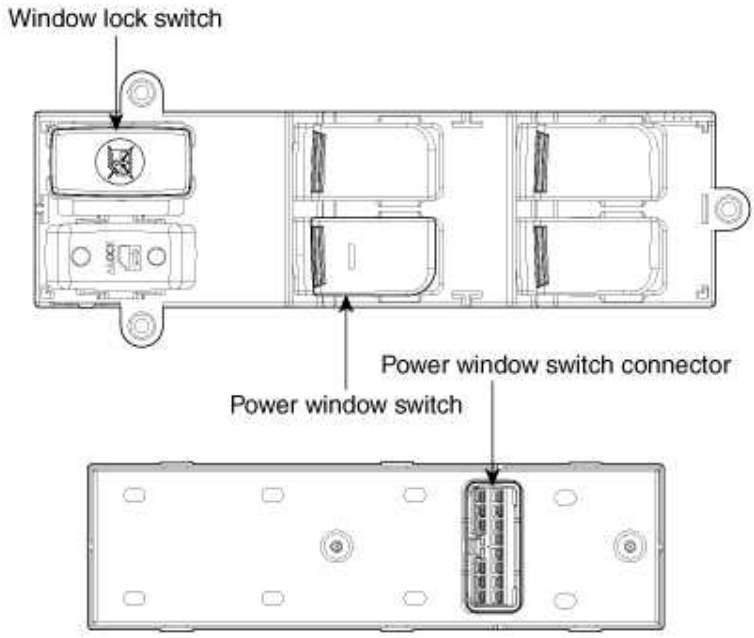
Position		Terminal	1	2
Left	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕
Right	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊖	⊖

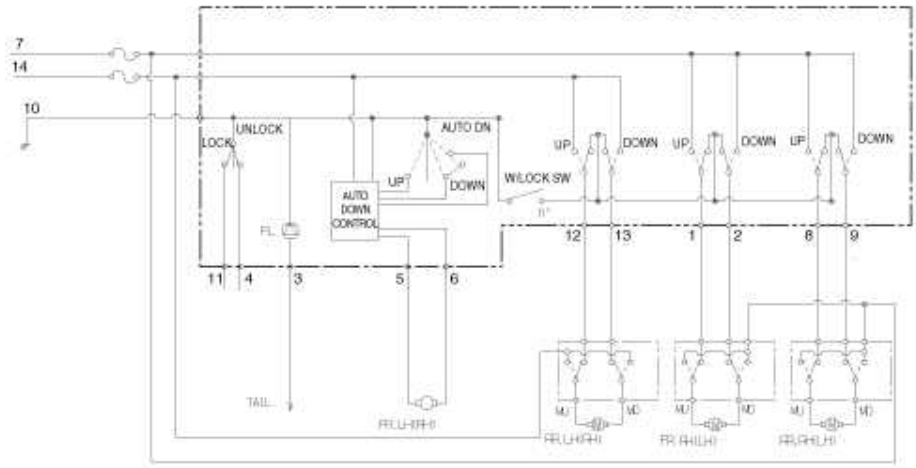
Body Electrical System > Power Windows > Power Window Switch > Components and Components Location

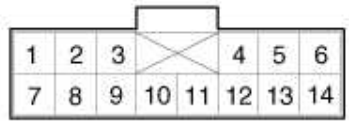
Components

Power Window Main Switch

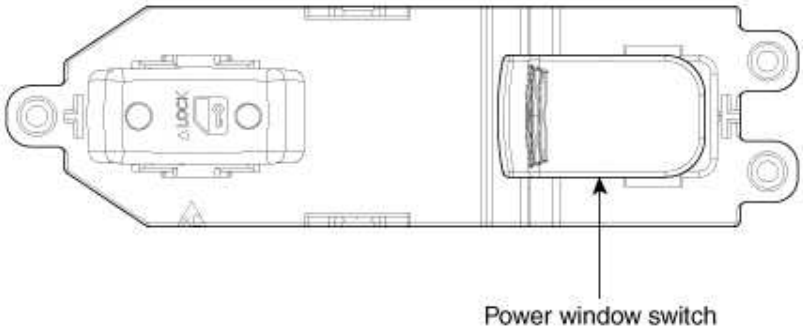
[Driver Power Window]



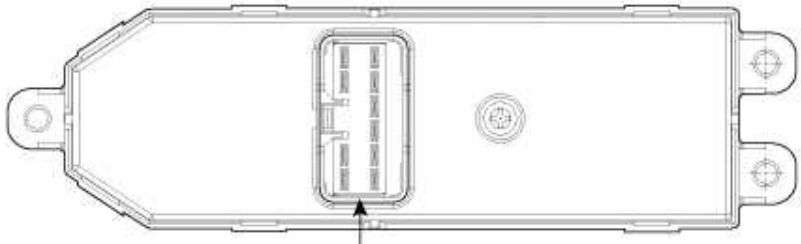




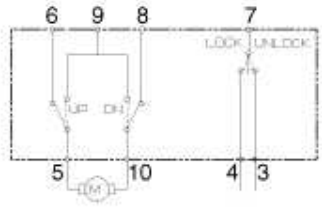
[Assist Power Window Switch]



Power window switch

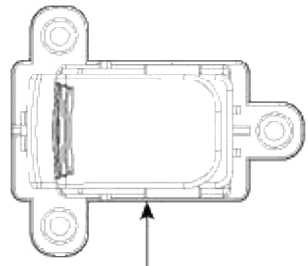


Assist power window switch connector

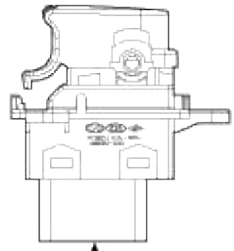


1	2			3	4
5	6	7	8	9	10

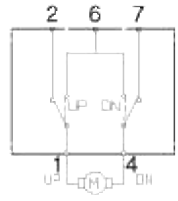
Rear Power Window Switch



Rear power window switch



Rear power window switch connector





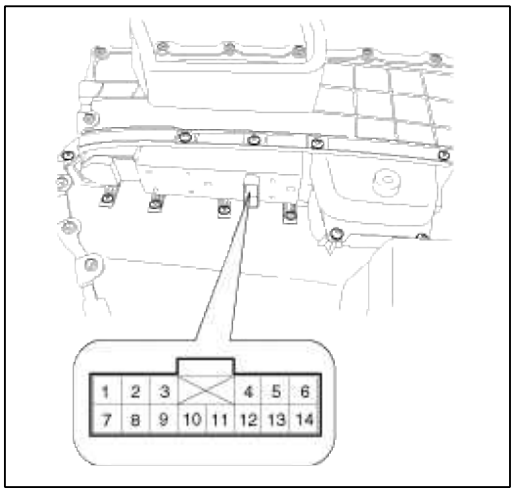
Body Electrical System > Power Windows > Power Window Switch > Repair procedures

Inspection

Power Window Main Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to the Body group - "Front door")
3. Disconnect the connector from the switch.

4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.



[Auto Down]

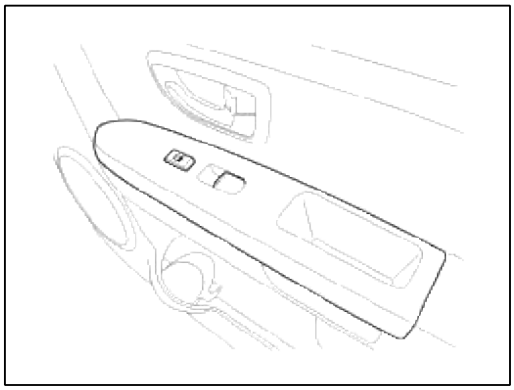
Terminal / Position	11	10	4
Lock	○	○	
Unlock		○	○

[Auto Down Power Window]

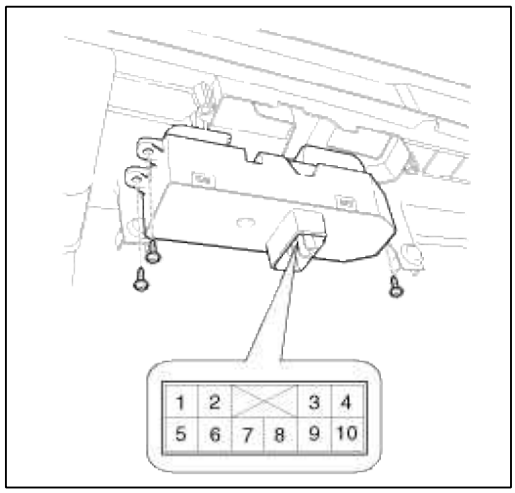
Terminal / Position	Front left				Front right			
	5	6	10	14	1	2	7	10
UP	○	○	○		○	○		○
OFF	○	○	○		○	○		○
DOWN	○	○		○	○	○		○
Terminal / Position	**Rear left**				**Rear right**			
	10	12	13	14	7	8	9	10
UP	○		○	○	○	○	○	
OFF	○	○	○			○	○	○
DOWN	○	○	○		○	○		○

Passenger Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch module. (Refer to the Body group - "Front door")

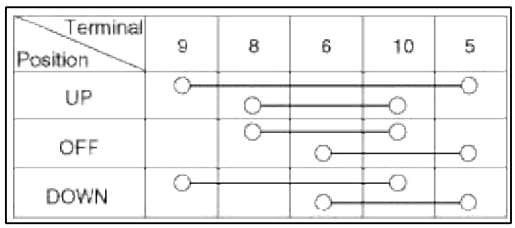


3. Disconnect the connector from the switch.



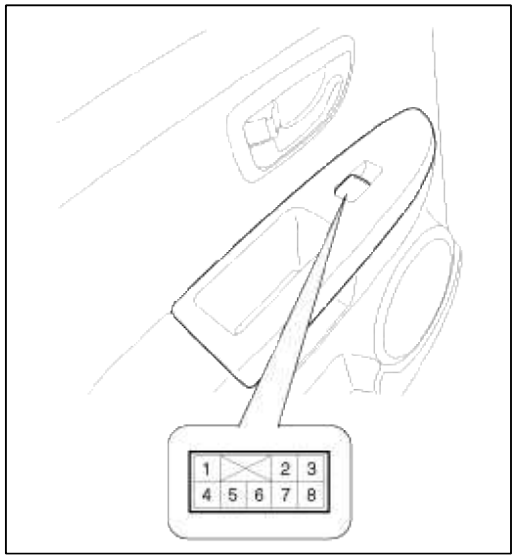
4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

[Manual Power Window]



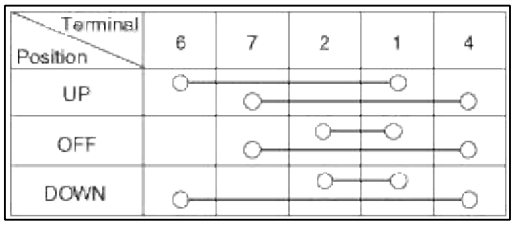
Rear Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim.
   (Refer to the Body group - "Rear door")
3. Disconnect the 8P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

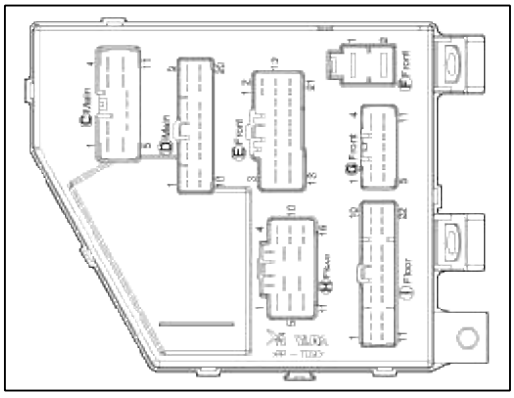
[Manual Power Window]

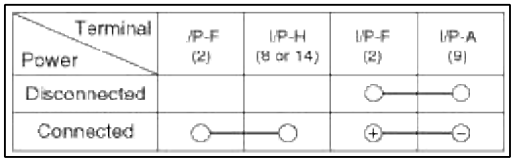


Body Electrical System > Power Windows > Power Window Relay > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body group - "Crash pad")
3. Remove the junction box.
4. Check for continuity between the terminals.
5. There should be continuity between the No.2 in the I/P-F and No.8 or 14 terminal in the I/P-H when power and ground are connected to the No.2 terminal in the I/P-F and No.9 terminal in the I/P-A.
6. There should be no continuity between the No.2 terminal in the I/P-F and No.8 or 14 terminal in the I/P-H when power is disconnected.

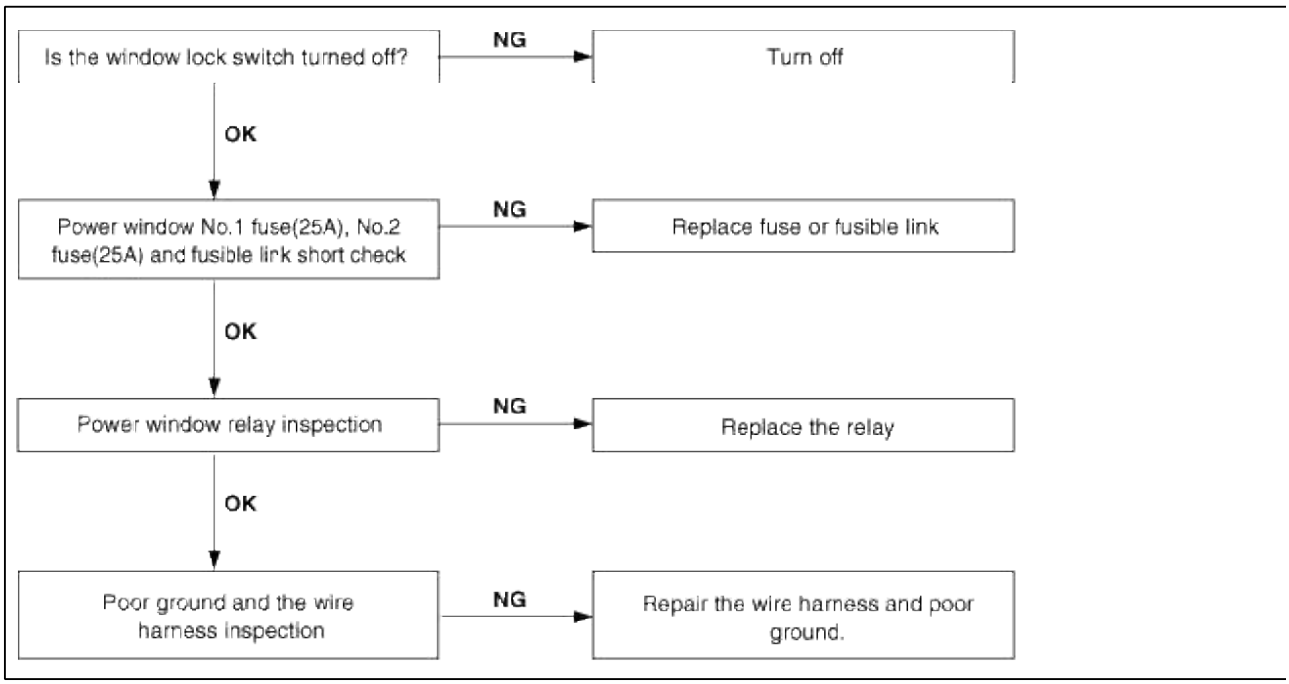




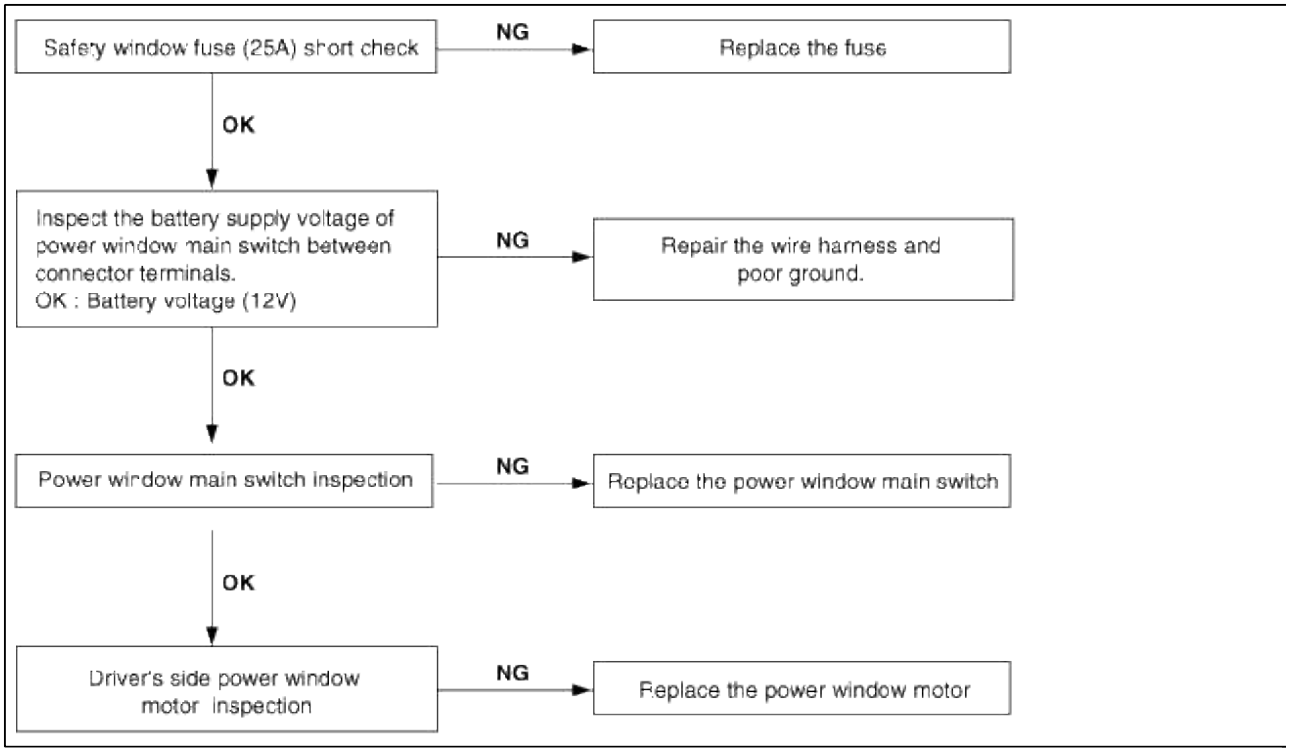
Body Electrical System > Power Windows > Troubleshooting

Troubleshooting

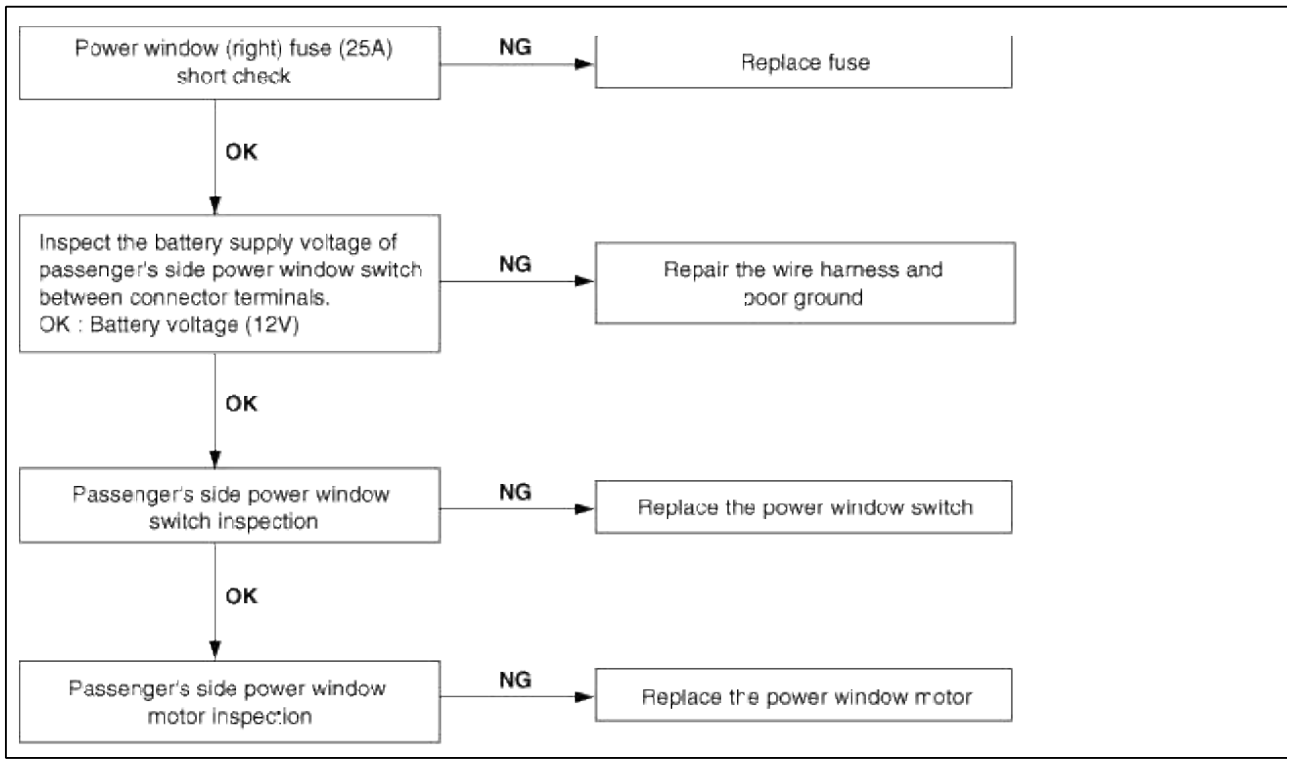
1. No windows operate from the main switch on the driver's door.



2. Driver's side window does not operate.

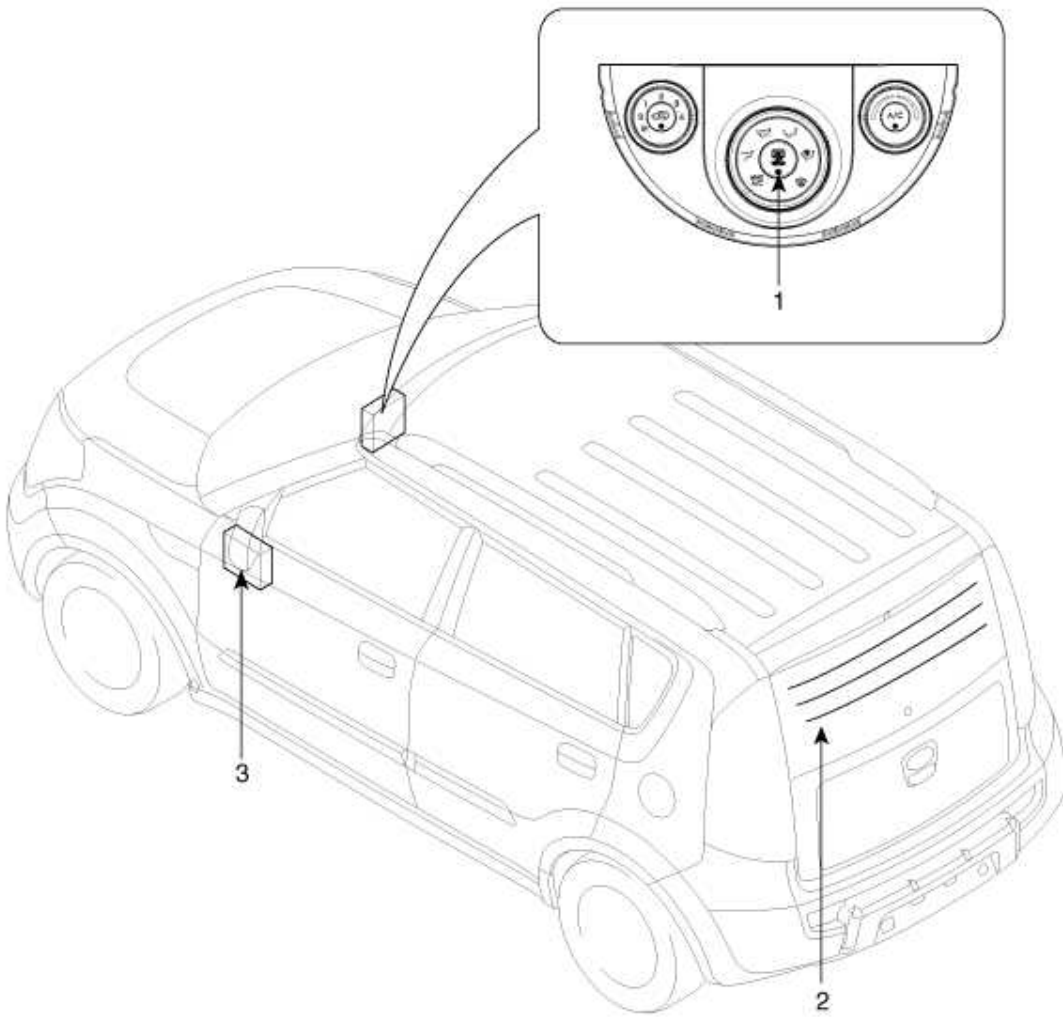


3. Passenger's side window does not operate.



Body Electrical System > Rear Glass Defogger > Components and Components Location

Component Location



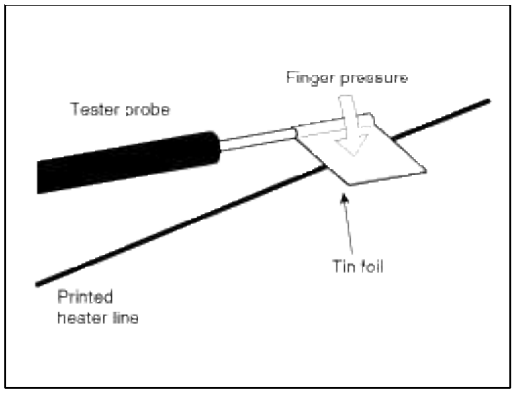
1. Rear window defogger switch 2. Rear window defogger	3. Passenger compartment junction box

Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Printed Heater > Repair procedures

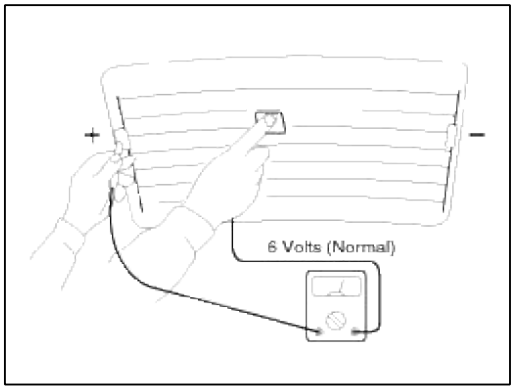
Inspection

CAUTION

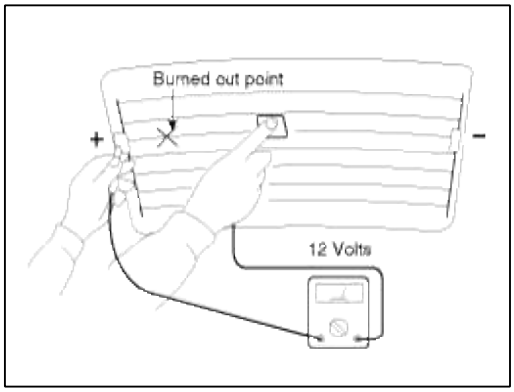
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



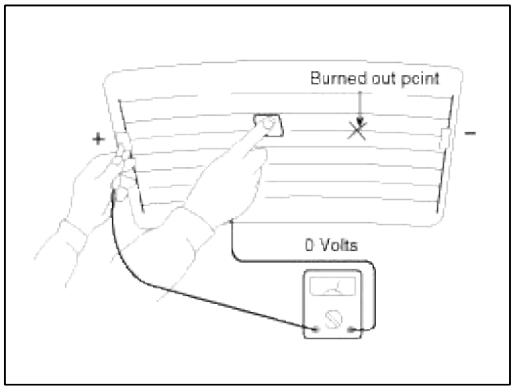
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



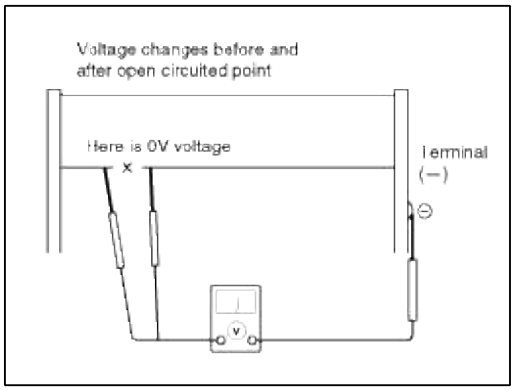
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



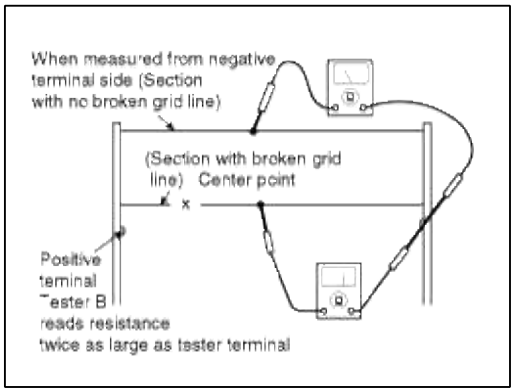
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.

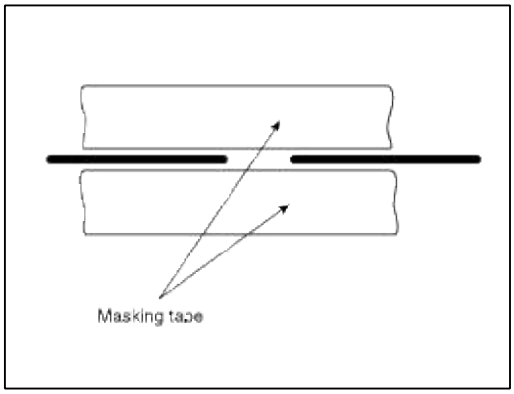


Repair Of Broken Heater Line

Prepare the following items :

1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Using a thin brush :

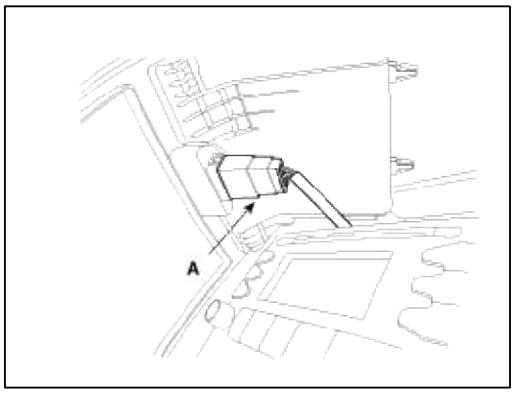
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



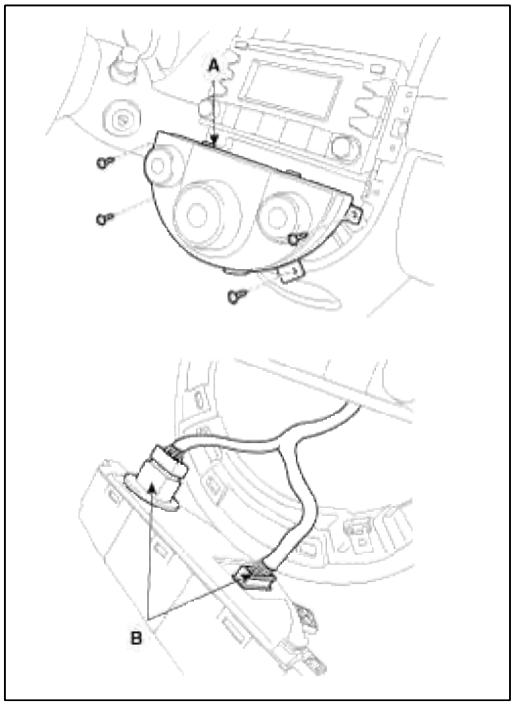
Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Switch > Repair procedures

Inspection

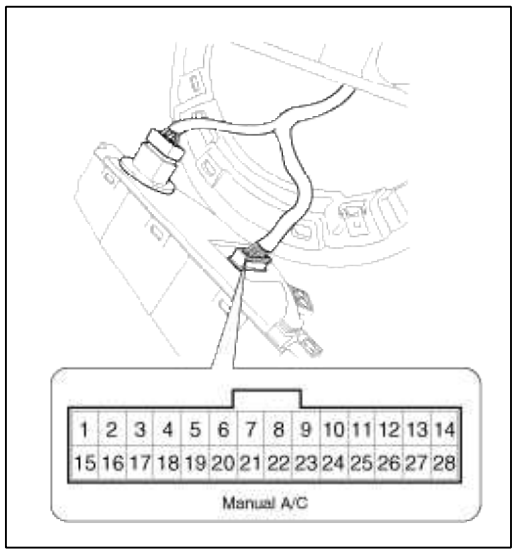
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel after removing upper tray. Take care not to damage fixing clips. (Refer to the Body group - "Crash pad")
3. Disconnect hazard lamp connector (A).



4. Remove the heater control unit (A) after removing the screws (4EA) and connector (B).



5. Using an ohmmeter, inspect the continuity between the terminals after removing controller.

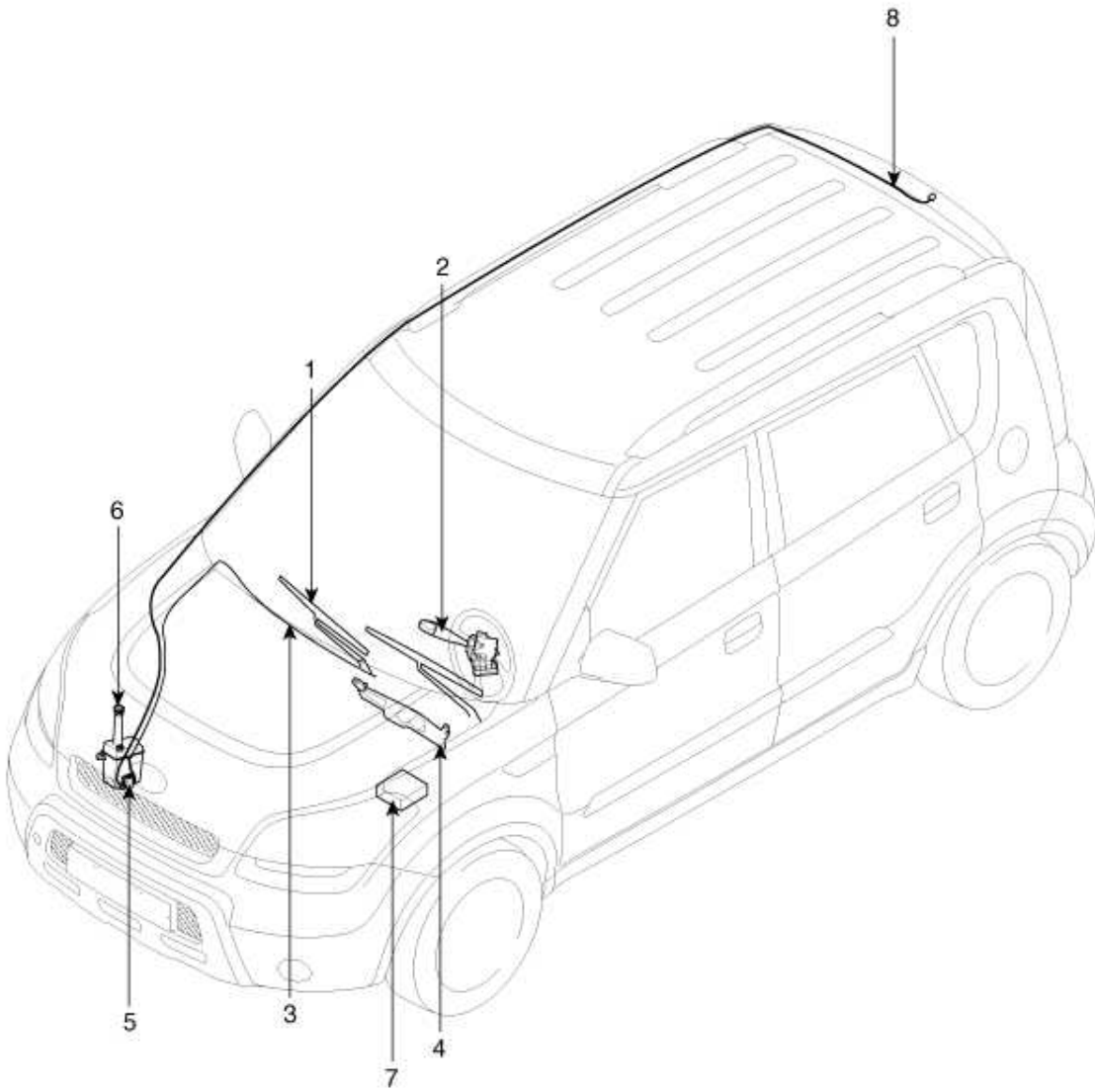


[Manual A/C]

Terminal / Position	25	GND
ON(PUSH)	○	○
OFF(FREE)		

Body Electrical System > Windshield Wiper/Washer > Components and Components Location

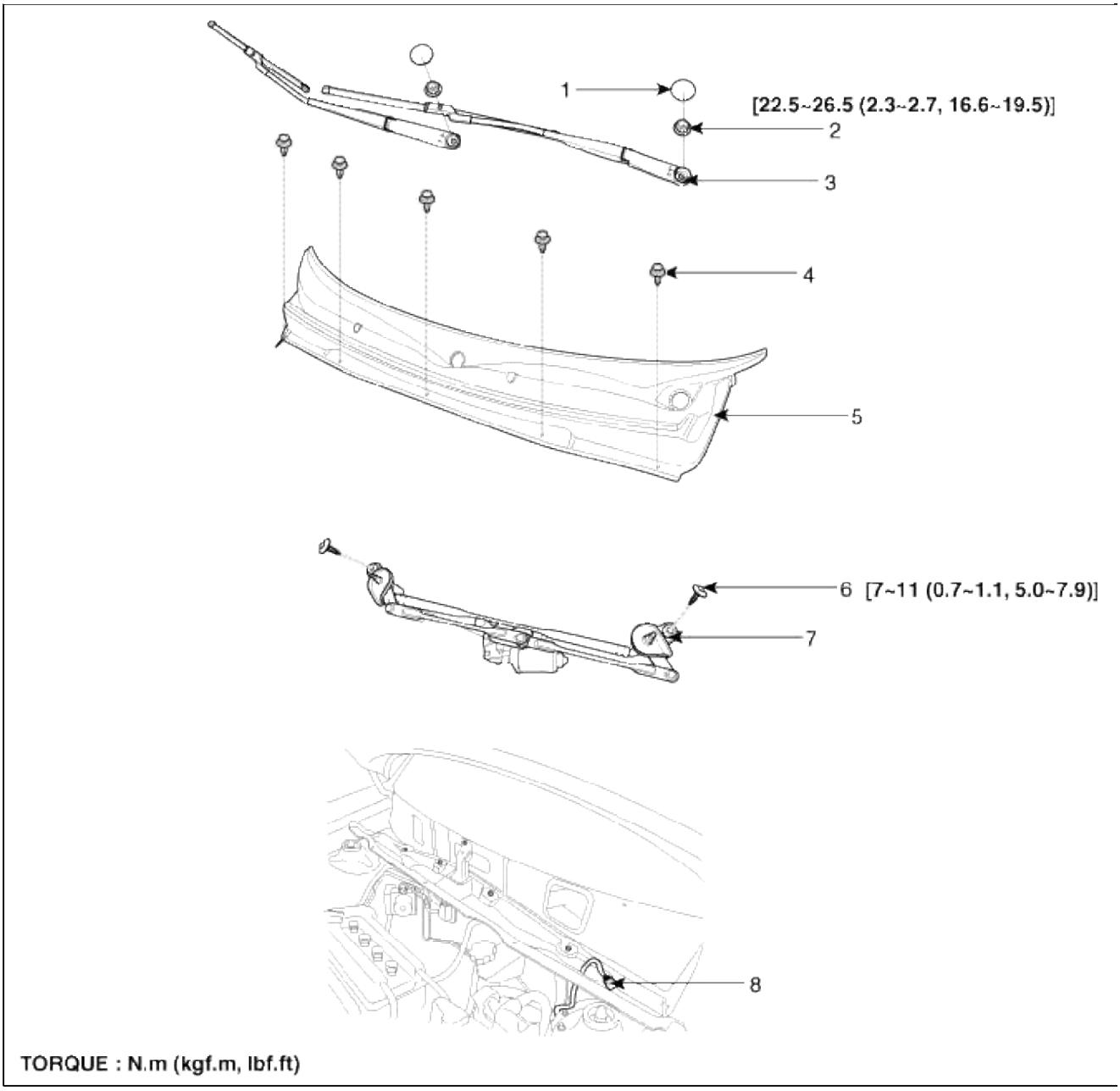
Component Location



1. Windshield wiper arm & blade 2. Wiper & washer switch 3. Windshield washer hose 4. Windshield wiper motor & linkage	5. Washer motor 6. Washer reservoir 7. Wiper relay (Engine room relay box) 8. Rear washer hose

Body Electrical System > Windshield Wiper/Washer > Windshield Wiper-Washer Switch > Components and Components Location

Component Location



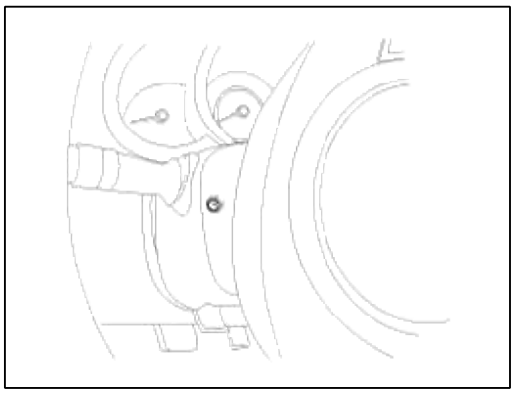
1. Cap 2. Nut 3. Wiper arm & blade 4. Retainer	5. Cowl top cover 6. Bolt 7. Wiper motor & linkage assembly 8. Wiper motor connector

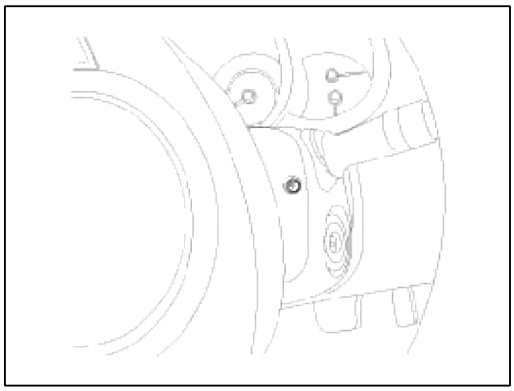
Body Electrical System > Windshield Wiper/Washer > Windshield Wiper-Washer Switch > Repair procedures

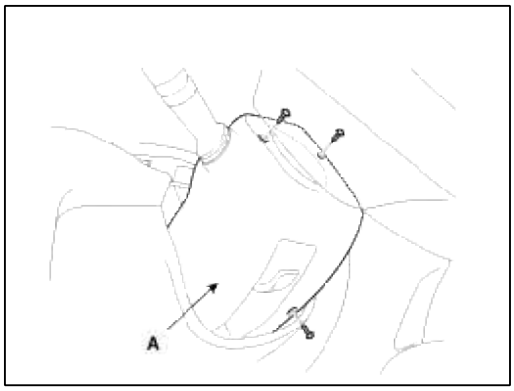
Removal

1. Disconnect the negative (-) battery terminal.

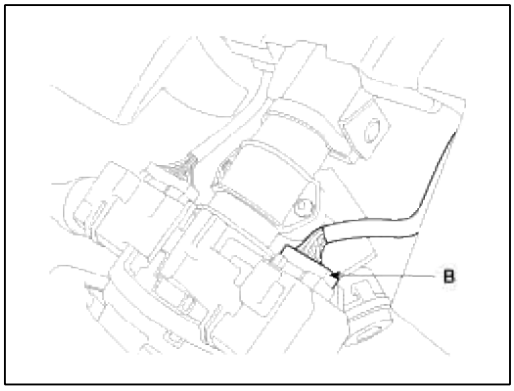
2. Remove the steering column upper and lower shrouds (A) after loosening 3 screws.

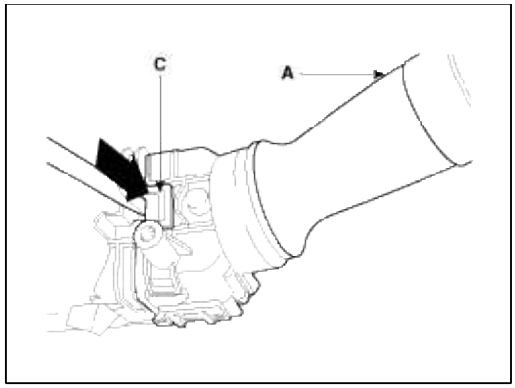






3. Remove the wiper switch (A) after disconnecting the connector(B) with pushing the lock pin (C).



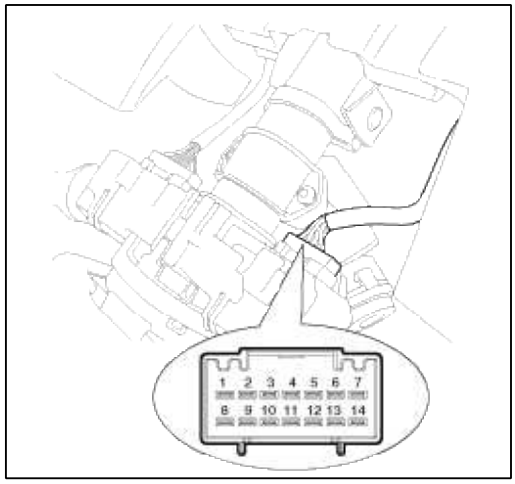


Installation

1. Install the windshield wiper switch.
2. Connect the wiper switch connector.
3. Install the steering column upper and lower shrouds.

Inspection

1. With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



Wiper Switch

Position \ Terminal	3	9	2	8	10	1	4	5
MIST	○		○		○	○		
OFF	○		○					
INT	○		○		○	○	○	○
LOW	○				○			
HI		○			○			

Washer Switch

Position \ Terminal	11	10
OFF		
ON	○	○

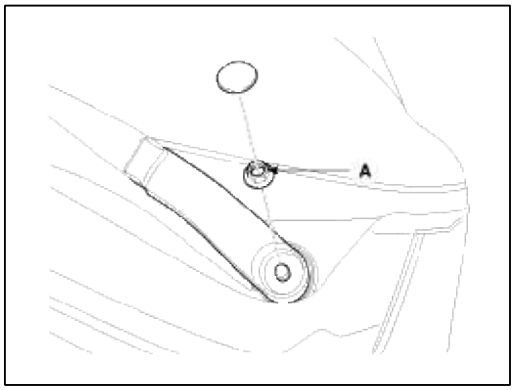
Rear Wiper & Washer Switch

Terminal / Position	12	7	6	13
WIPER(ON)	○		○	
INT	○	○		
OFF				
WASHER(ON)	○			○

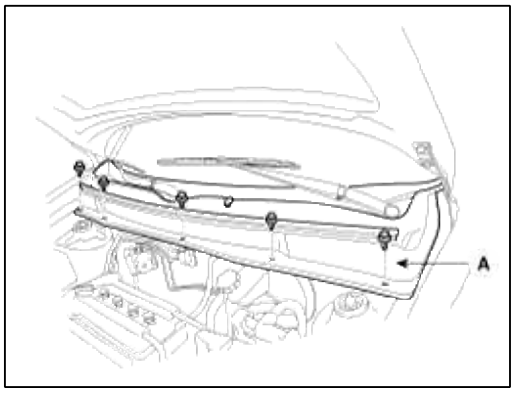
Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures

Removal

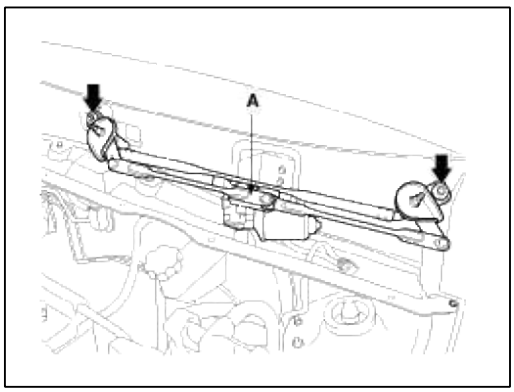
1. Remove the windshield wiper arm and blade after removing a nut (A).

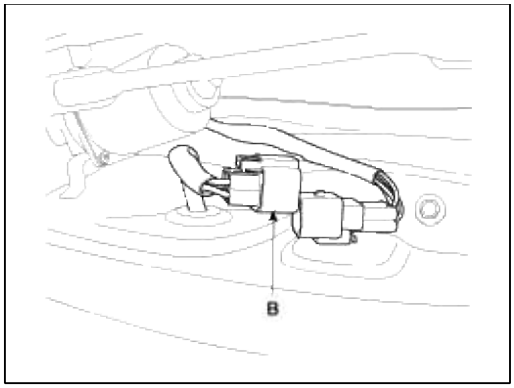


2. Remove the weather strip and the cowl top cover (A) after removing 5 retainers.



3. Remove the windshield wiper motor and linkage assembly(A) after removing 2 bolts. Disconnect the wiper motor connector (B) from the wiper motor & linkage assembly.





Installation

1. Install the wiper motor and linkage assembly and then connect the wiper motor connector.

TORQUE : 7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)

2. Install the cowl top cover.
3. Install the windshield wiper arm and blade.

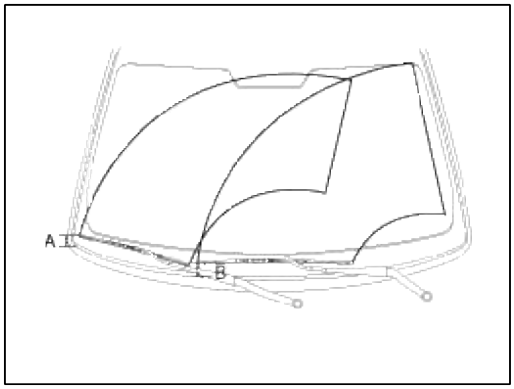
TORQUE : 22.5~26.5 Nm (2.3~2.7 kgf.m, 16.6~19.5 lbf.ft)

NOTE

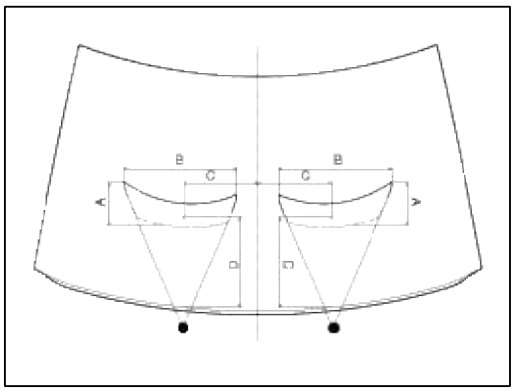
- The windshield wiper motor must be cycled to make sure that it is in the park position. If necessary, adjust the wiper arm and blade.

4. Install the wiper arm and blade to the specified position.

Specified position	A	B
Distance [in (mm)]	1.57~1.77 (40~45)	1.18~1.37 (30~35)



5. Set the cowl top cover on the specified spray position.

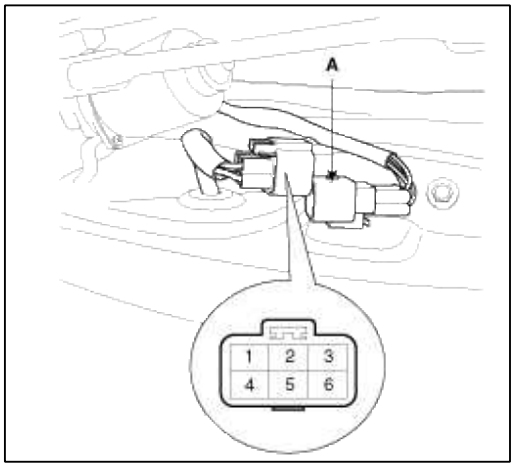


Specified position	Distance (mm)	Distance (in)
A	111~171	4.37~6.73
B	326~426	12.8~16.7
C	246	9.68
D	310	12.2

Inspection

Speed Operation Check

1. Remove the connector(A) from the wiper motor.
   (1. Blank, 2. Battery+, 3. Parking, 4. High, 5. GND, 6. Low)

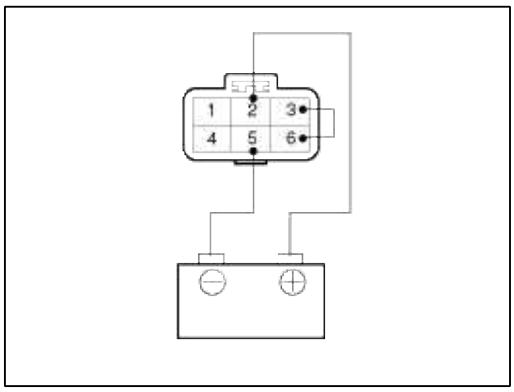


2. Attach the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 6.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 4.
5. Check that the motor operates at high speed.

Automatic Stop Operation Check

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 4.
3. Connect terminals 3 and 6.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 5.

5. Check that the motor stops running at the off position.



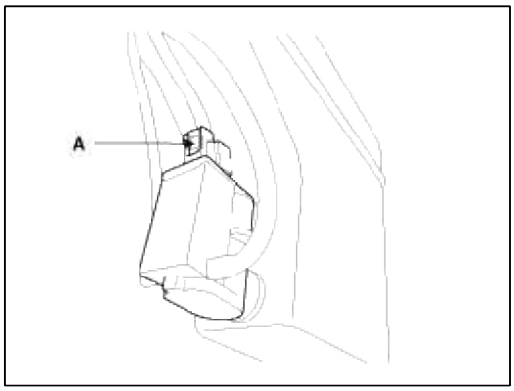
Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

Removal

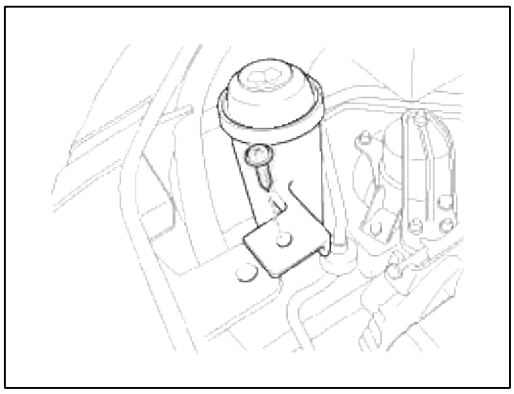
CAUTION

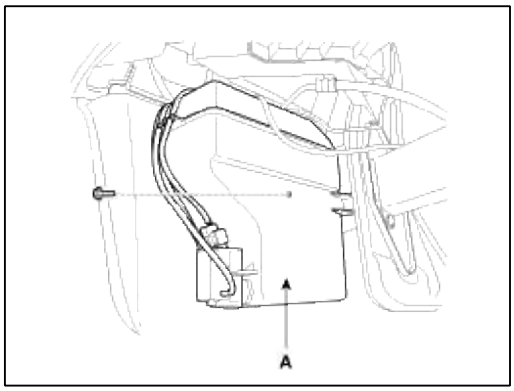
- When servicing the washer pump, be careful not to damage the washer pump seal.
- Do not operate the washer pump before filling the washer reservoir.
  Failure to do so could result in premature pump failure.

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.
   (Refer to Body group - Front bumper)
3. Remove the washer hose and the washer motor connector (A).



4. Remove the washer reservoir (A) after removing bolts.





Installation

1. Install the washer reservoir.

> NOTE
>
> Before installing the pump motor, check the filter for foreign material or contamination. if necessary, clean the filter into the pump motor.

2. Install the washer motor and connect the washer hose, the motor and level sensor connector.
3. Install the front bumper cover.

Inspection

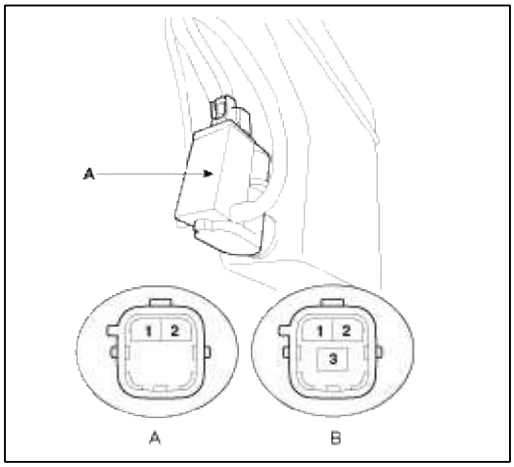
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

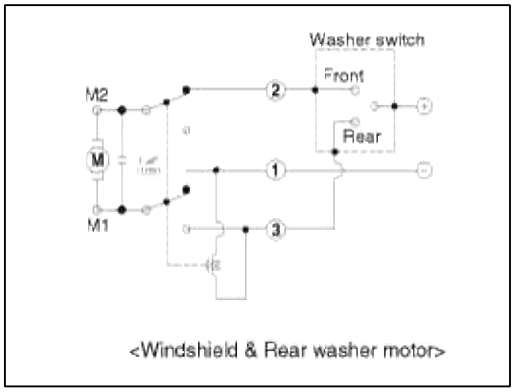
> NOTE
>
> Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.

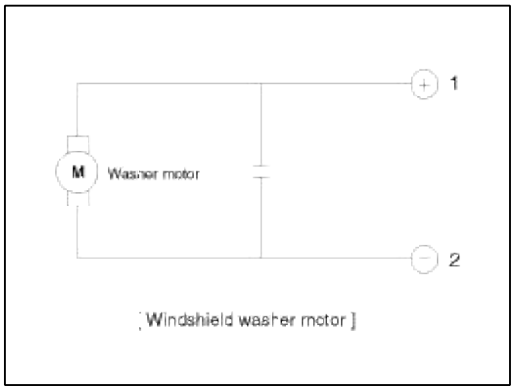
4. If they are abnormal, replace the washer motor (A).

Pin	Front washer (A)	Front & Rear washer (B)
1	Windshield washer (+)	Windshield washer (+)
2	Ground	Ground
3	-	Rear washer (+)





<Windshield & Rear washer motor>

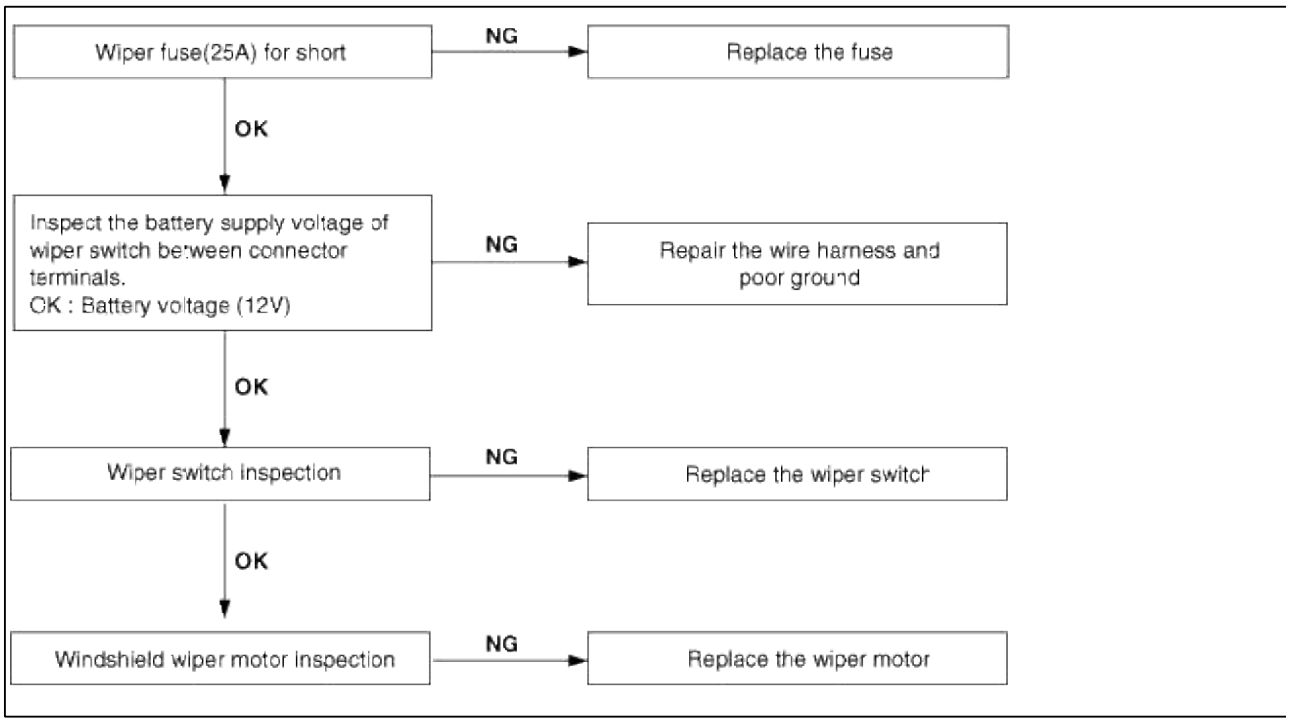


[Windshield washer motor]

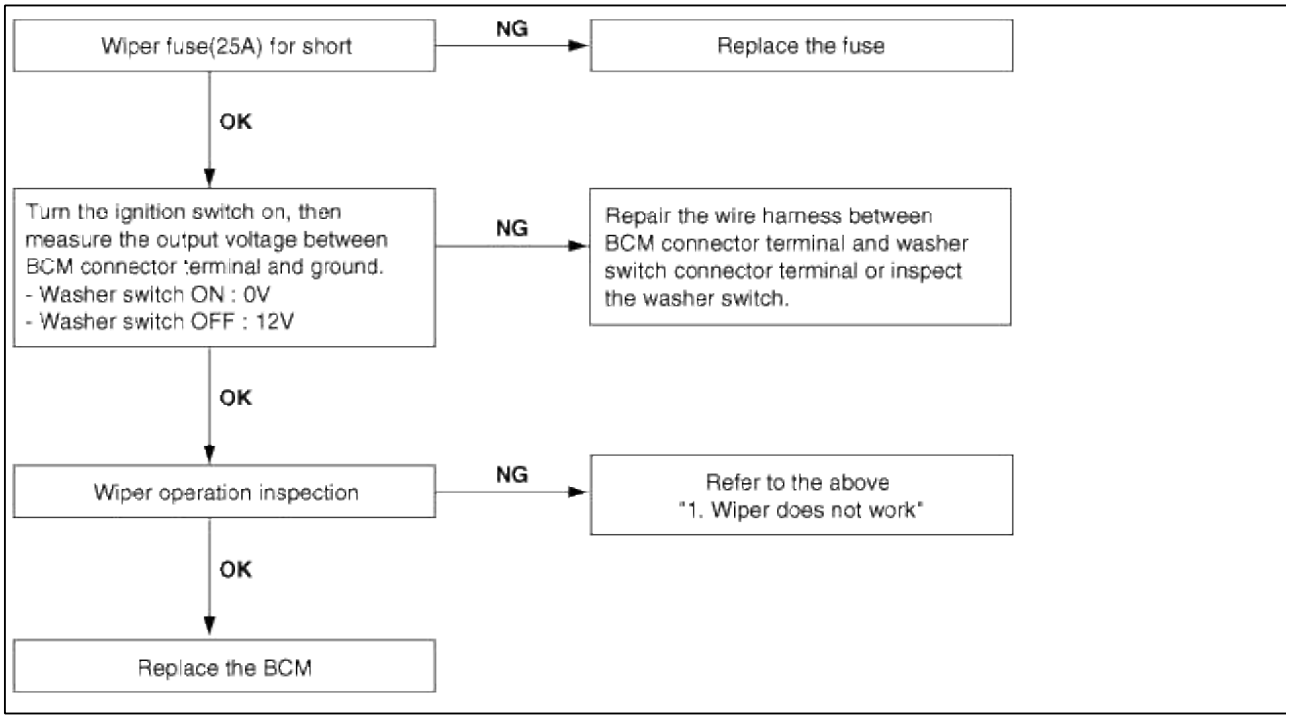
Body Electrical System > Windshield Wiper/Washer > Troubleshooting

Troubleshooting

1. Wiper low and wiper high do not work.

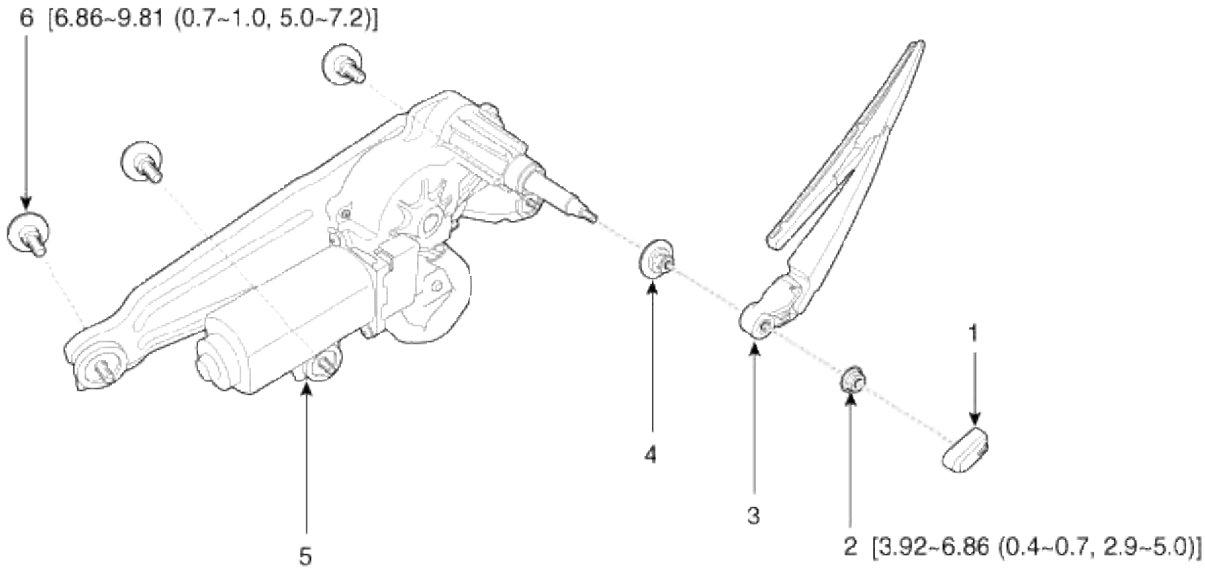


2. When washer switch is on, wiper does not work.



Body Electrical System > Rear Wiper/Washer > Components and Components Location

Component Location



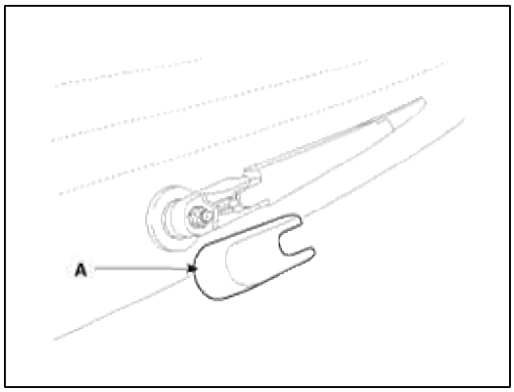
TORQUE : N.m (kg.cm, lb.ft)

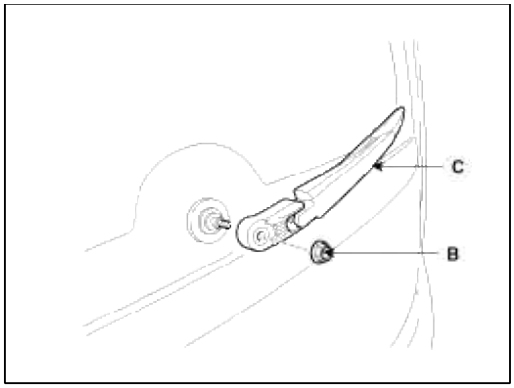
1. Head cap 2. Nut 3. Rear wiper arm & Blade	4. Packing (rubber) 5. Rear wiper motor assembly 6. Bolt

Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Repair procedures

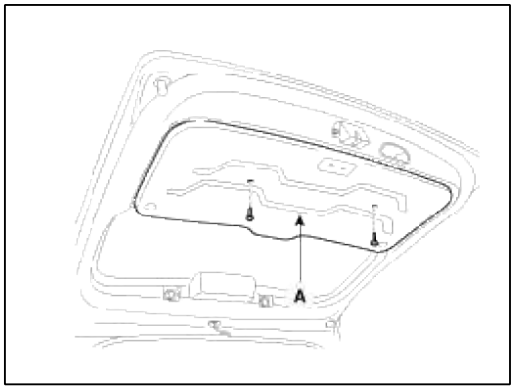
Removal

1. Detach the wiper cap (A), then remove the rear wiper arm (C) after removing a nut (B).

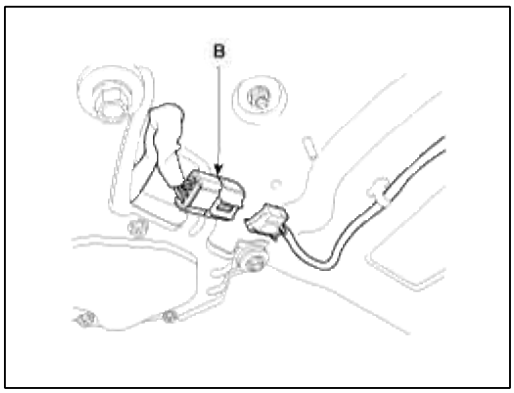


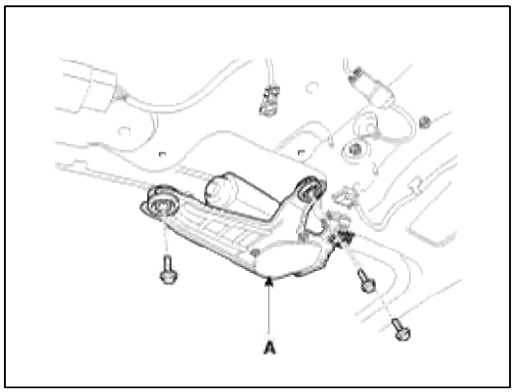


2. Open the tailgate then remove the tailgate trim.

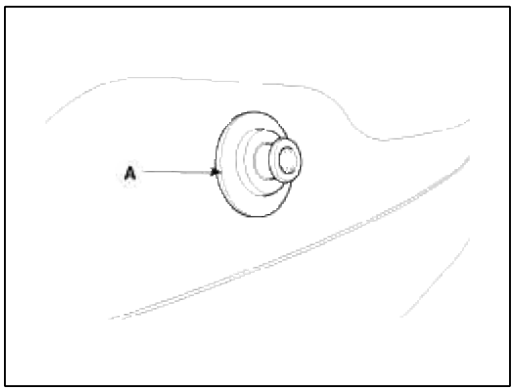


3. Disconnect the rear wiper motor connector (4P) (B) then remove the rear wiper motor (A) after removing 3 bolts.





4. Remove the rubber packing (A).



Installation

1. Install the rubber packing.
2. Install the rear wiper motor assembly.

Tightening torque :
6.86 ~ 9.81N.m (0.7 ~ 1.0kgf.m, 5.0 ~ 7.2lb-ft)

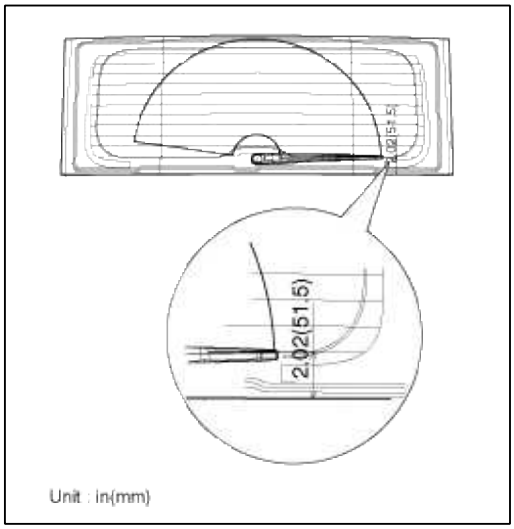
3. Intall the tailgate trim.
4. Install the rear wiper arm and rear wiper arm cap.

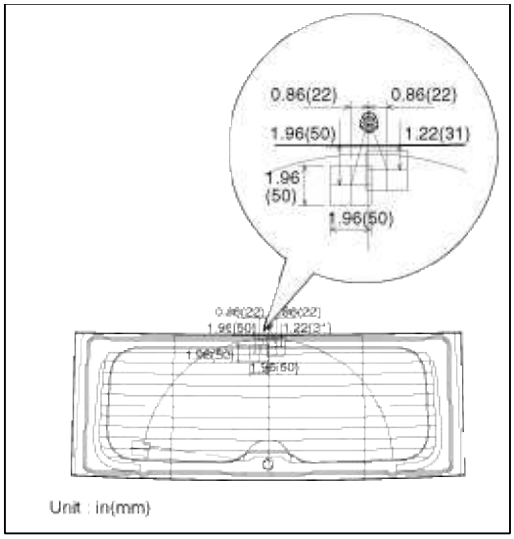
Tightening torque :
3.92 ~ 6.86N.m (0.4 ~ 0.7kgf.m, 2.9 ~ 5.0lb-ft)

NOTE

Before installation, be sure that the rear wiper motor is in the park position.
Turn the wiper switch ON and OFF to allow the rear wiper motor to cycle and stop in the park position.

5. Set the rear wiper blade and to the lowest defogger heat line and tailgate glass.
6. Set the rear washer nozzle on the specified spray position.

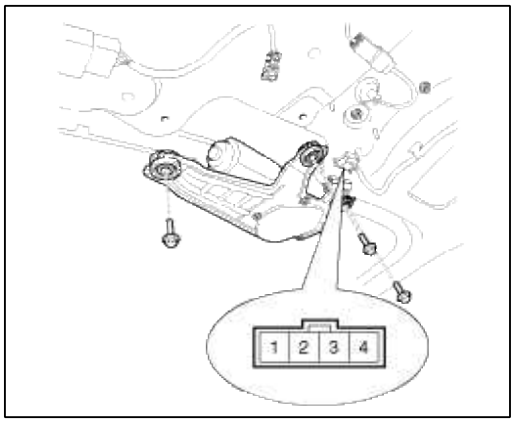




Inspection

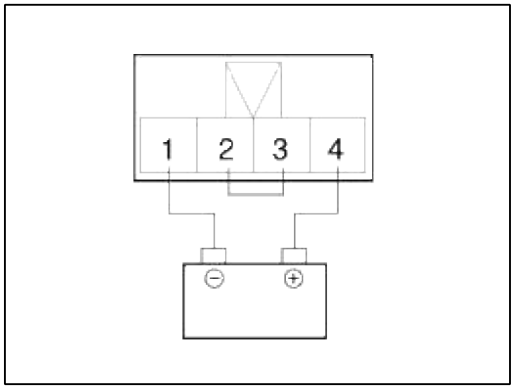
Rear Wiper Motor

1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 4 and 1 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.
   (1. B+, 2. Parking, 3. Switch , 4. GND)



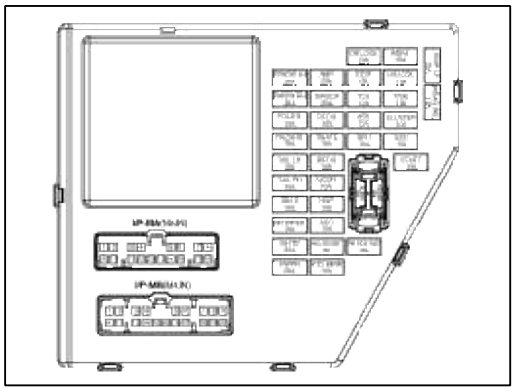
Automatic Stop Operation Check

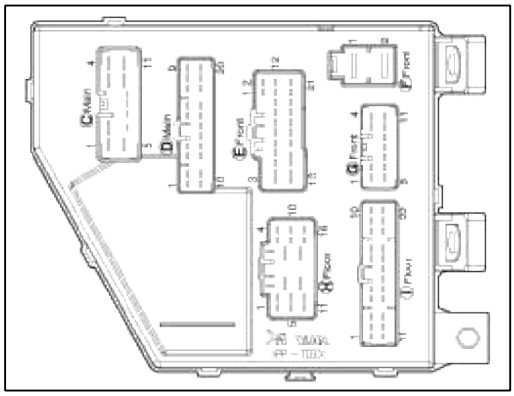
1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 2.
3. Connect terminals 2 and 3.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 1.
5. Check that the motor stops running at the off position.



Body Electrical System > Rear Wiper/Washer > Rear Wiper Relay > Repair procedures

Inspection





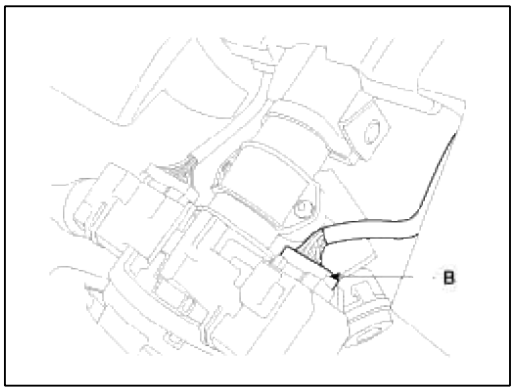
Check for continuity between the terminals.

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 terminals in the I/P-C and No.20 terminals in the I/P-I when power and ground are connected to the No.1 terminals in the I/P-A and No.2 terminals in the I/P-A.
5. There should be no continuity between the No.1 terminals in the I/P-C and No.20 terminals in the I/P-I when power is disconnected.

Body Electrical System > Rear Wiper/Washer > Rear Washer Switch > Repair procedures

Inspection

1. With the rear wiper & washer switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



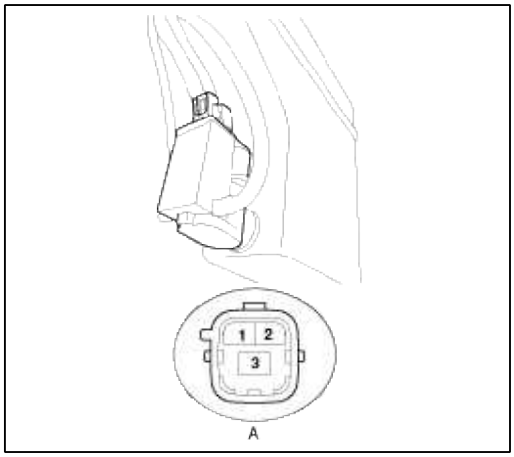
Rear Wiper & Washer Switch

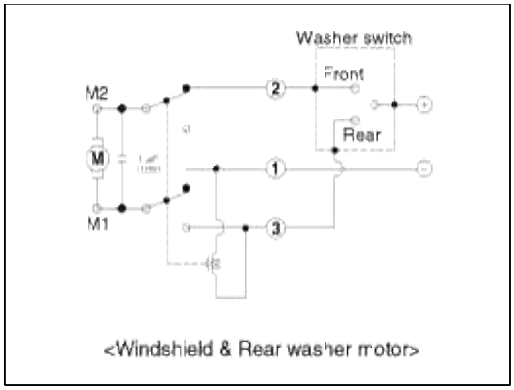
Terminal / Position	12	7	6	13
WIPER(ON)	○		○	
INT	○	○		
OFF				
WASHER(ON)	○			○

Body Electrical System > Rear Wiper/Washer > Rear Washer Motor > Repair procedures

Inspection

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Remove the front bumper cover. (Refer to the Body group- Front bumper)
3. Connect positive (+) and negative (-) battery cables to terminals 3 and 1 respectively to see that the washer motor runs and water is pumped.
4. Check that the motor operates normally.
   Replace the motor if it operates abnormally.
   A : Front & rear washer
   1. Windshield washer (+), 2. Ground, 3. Rear washer (+)



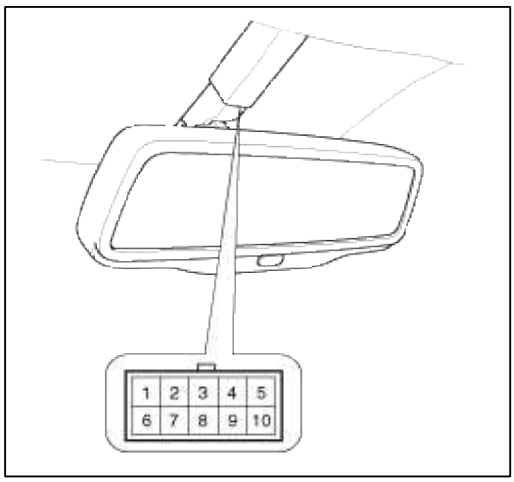


<Windshield & Rear washer motor>

Body Electrical System > Electro chromic Inside Rear View Mirror > Description and Operation

Description

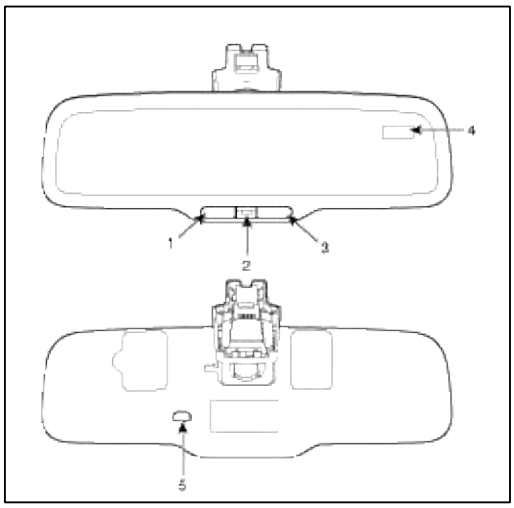
The ECM (Electro Chromic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night, in order the user not to be dazzled by the light. The front looking sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 10~70%. But, when the reverse gear is engaged, it stops functioning.



Pin NO.	Description
1	Camera power (-)
2	ECM (+)
3	Camera power (+)
4	Video signal (-)
5	Video signal (+)
6	-
7	ECM (-)
8	GND
9	R range signal
10	IGN power (+12V)

1. The front looking sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.

(1. Mirror button2. Rearward looking sensor3. Compass button4. Direction indicator5. Front looking sensor)

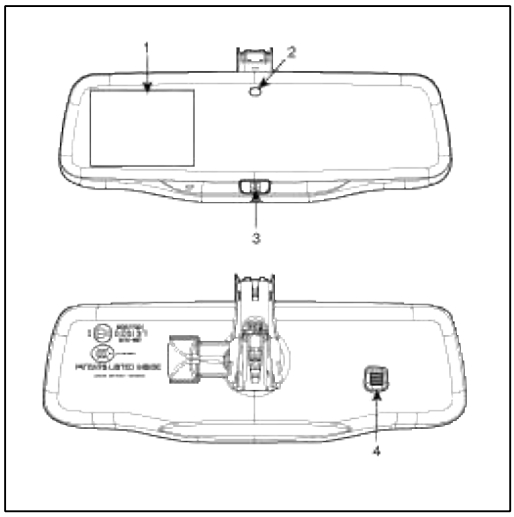


Reverse Display Room Mirror

Description

The back view camera system, located on the tailgate, provides a video image (which appears in the rear view mirror) of the area behind the vehicle. It adds assistance to the driver while reversing or reverse parking the vehicle. To use the back view camera system, place the transmission in R (Reverse); an image will display on the left portion of the rear view mirror. The area displayed on the screen may vary according to the vehicle orientation and/or road condition.

1. Rear camera display
2. Rearward sensor
3. Power button
4. Forward sensor



Use the side mirrors and back view mirror to get better coverage on both sides and rear of the vehicle. When shifting out of reverse and into any other gear, the image will remain on for a few seconds before it shuts off to assist in parking or trailer hookup.

The camera lens for the back view camera system is located on the tailgate, near the tailgate handle. Keep the lens clean so the video image remains clear and undistorted. Clean the lens with a soft, lint-free cloth and non-abrasive

cleaner.

NOTE

If the back view camera system image is not clear or seems distorted, it may be covered with water droplets, snow, mud or any other substance. If this occurs, clean the camera lens before using the reverse camera system.

WARNING

The back view camera system is a reverse aid supplement device that still requires the driver to use it in conjunction with the back view mirror and the side mirrors for maximum coverage.

WARNING

Objects that are close to either corner of the bumper or under the bumper, might not be seen on the screen due to the limited coverage of the back view camera system.

WARNING

Backup as slow as possible since higher speeds might limit your reaction time to stop the vehicle.

WARNING

Do not use the back view camera system with the tailgate open.

If the back end of the vehicle is hit or damaged, then check with your authorized dealer to have your rear video system checked for proper coverage and operation.

Nighttime and dark area use

At night time or in dark areas, the back view camera system relies on the reverse lamp lighting to produce an image. Therefore it is necessary that both reverse lamps are operating in order to get a clear image in the dark. If either of the lamps are not operating, stop using the back view camera system, at least in the dark, until the lamp(s) are replaced and functioning.

Automatic-dimming Function

To protect your vision during nighttime driving, your mirror will automatically dim upon detecting glare from the vehicles traveling behind you. The auto-dimming function can be controlled by the Dimming ON/OFF Button :

1. Pressing and holding the Feature Control button for more than 3 but less than 6 seconds turns the auto-dimming function OFF which is indicated by the green Status Indicator LED turning off.
2. Pressing and holding the Feature Control button again for more than 3 but less than 6 seconds turns the auto-dimming function ON which is indicated by the green Status Indicator LED turning on.

NOTE

The mirror defaults to the "ON" position each time the vehicle is started.

Body Electrical System > Electro chromic Inside Rear View Mirror > Repair procedures

Inspection

Check it by the procedure below to see if the function of the ECM is normal.

1. Turn the ignition key to the "ON" position.
2. Cover the forward looking sensor to stop functioning.
3. Head a light to the rearward looking sensor.

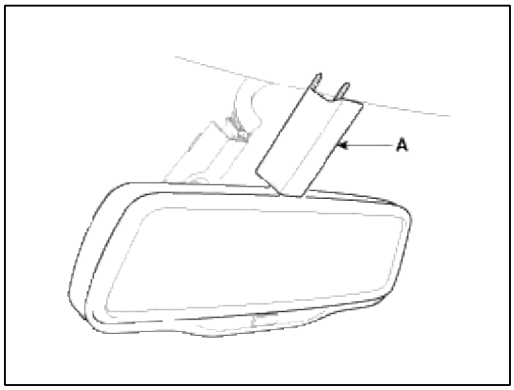
4. The ECM should be darkened as soon as the rearward looking sensor detects the light.

> NOTE
>
> If this test is performed in daytime, the ECM may be darkened as soon as the forward looking sensor is covered.

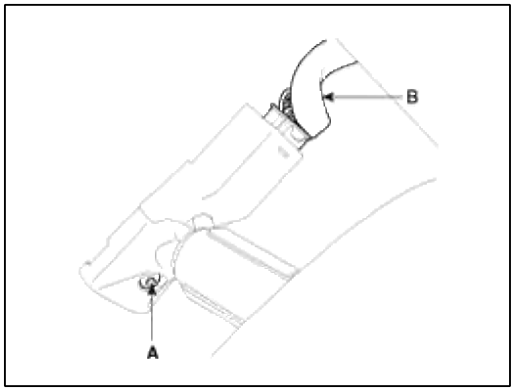
5. When the reverse gear is engaged, the ECM should not be darkened.
   When heading lights to both the forward looking and rearward looking sensors, the ECM should not be darkened.

Removal

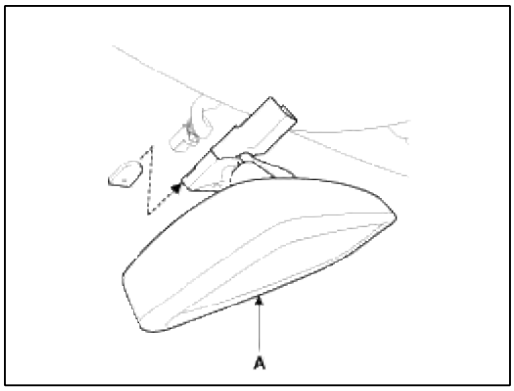
1. Remove the mirror wire cover(A).



2. Disconnect the inside rear view mirror connector(B) and screw (A).



3. Remove the inside rear view mirror pulling it upside carefully.

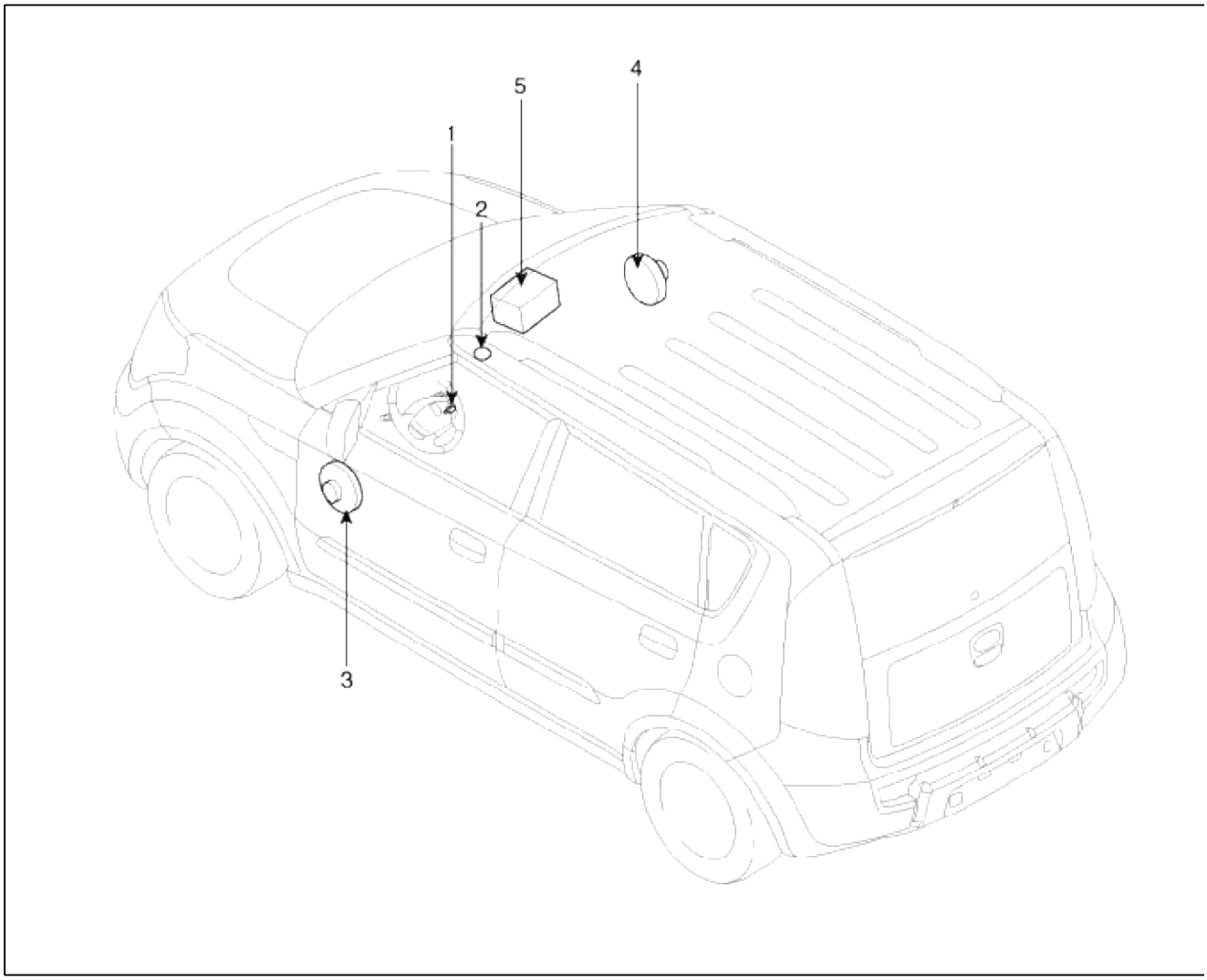


Installation

1. Install the inside rear view mirror.
2. Connect the inside rear view mirror connector.
3. Install the mirror wire cover.

Body Electrical System > Hands Free System > Components and Components Location

Components



1. Hands free call switch 2. Mic 3. Front left speaker	4. Front right speaker 5. Audio head unit (hands free control)

There is no hands free jack. This system supports Bluetooth(wireless system).

Body Electrical System > Hands Free System > Description and Operation

Function

General Feature

- This system supports Bluetooth, a wireless system that allows you to make or receive calls without taking your hands from the steering wheel and without using cables to connect the phone and system.

- The phone must be paired to the system before using the hands-free feature.
  Only one linked cellular phone can be used with the system at a time. The system is available in English, US Spanish, or Canadian French languages.

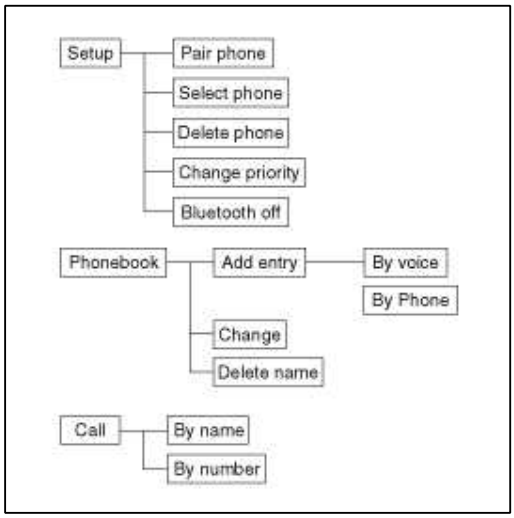
> CAUTION
>
> If the vehicle is moving do not use a cellular phone or connect the Bluetooth phone.

> NOTE
>
> Some Bluetooth devices do not offer a perfect compatibility with this system.

Voice Recognition Activation

- The voice recognition engine containedin the Bluetooth System can be activatedin the following conditions:
  - Button Activation
  The voice recognition system will beactive when the button is pressed and after the sound of a Beep.
  - Active Listening
  The voice recognition system will beactive for a period of time when the Voice Recognition system has askedfor a customer response.
- The system can recognize single digits from zero to nine while number greaterthan ten will not be recognized.
- If the command is not recognized, the system will announce "Pardon" or Noinput voice signal from microphone. (Noresponse)
- The system shall cancel voice recogntionmode in following cases : When pressing the button and saying cancel following the beep. When not making a call and pressing the button. When voice recognition has failed 3 consecutive times.
- At any time if you say "help", the system will announce what commands are available.

Menu tree



Phone Setup

Pairing phone

To use the hands-free system, you need to register your phone in the system. Up to 5 phones can be registered in the system.

1. Press the button.
2. Say "Set Up".
3. Say "Pair Phone".
4. Say "Yes".
5. Say the name of the contact.
6. Say "Yes".

7. The Pairing procedure of the cellularphone varies according to each cellularphone.

NOTE

The system may not function in the following cases:
If 5 phones have already been registered.If the system cannot communicate with the phone.

To connect phone

The registered phones can be selected. When the system connects to Bluetooth, the phone previously used is automatically selected. Select a different phone if necessary. Only the selected phone can be used with the hands-free system.

1. Press the button.
2. Say "Set Up".
3. Say "Select Phone".
4. Say the name of the contact or the number of the contact.
5. Say "Yes".

NOTE

The system may not function in the following cases:
If the phone is not found.
If the system does not recognize the voice command.

Deleting phone

The registered phones can be deleted.

1. Press the button.
2. Say "Set Up".
3. Say "Delete Phone".
4. Say the name of the contact, the number of the contact or "Delete all phone".
5. Say "Yes".

Receiving a phone call

When receiving a phone call, a ring toneis audible and the system changes into telephone mode.
When receiving a phone call, the phone number and the message "Incoming" will be displayed.

- Do either one of the following:
  Press the send switch to take the call. Press the end switch to refuse the call.
- To adjust the ring volume, push "+" or "-" on the steering volume controls.
  Volume adjustment cannot be madeusing the audio system.
- To transfer a call to the phone:
  The received call can be transferred from the hands-free system to the cellularphone that is connected to Bluetooth.
  For details, please refer to you user's manual for the cellular phone or go to the Key matrix in this manual (next page).

Talking on the phone

When talking on the phone, the display will differ depending on whether or not the vehicle is in motion.
Number and "active call" is displayed.
When the call is finished, press the end switch.

NOTE

In the following situations, your voice may not reach the other party:

1. Talk alternately with the other partyon the phone. If you talk at the sametime, the voice may not reach eachother parties. (This is not a malfunction.)(It is not a malfunction.)
2. Keep the volume of receiving voice to a low level. Otherwise, high volumes may result in an echo. When you talk on the phone, speak clearly towards the microphone.
3. When driving on a rough road.
4. When driving at high speeds.
5. When the window is open.
6. When the air conditioning vents are facing the microphone.
7. When the sound of the air conditioning fan is loud.

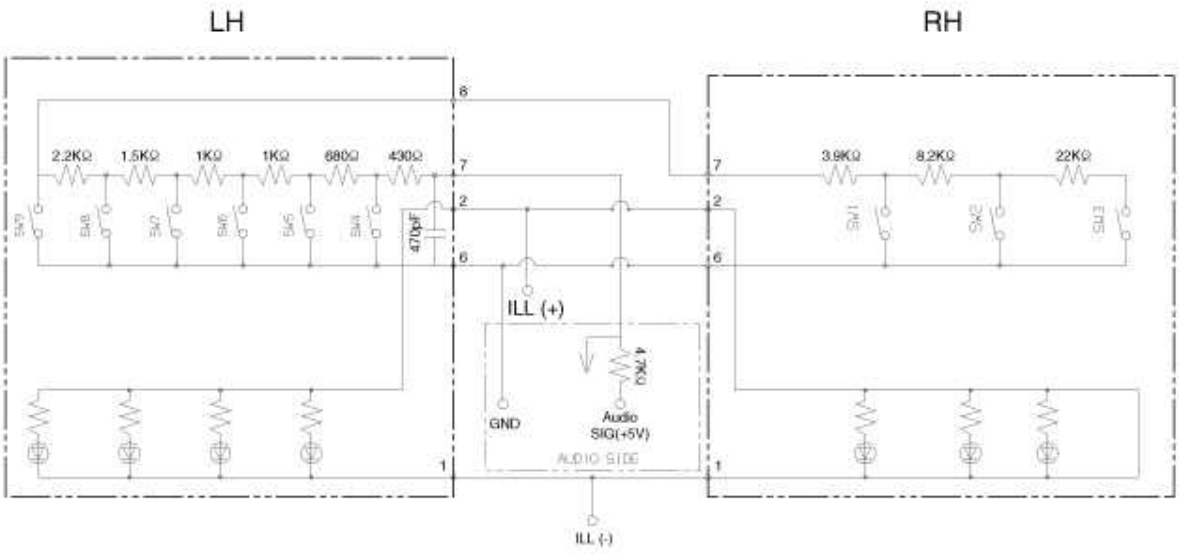
Key matrix

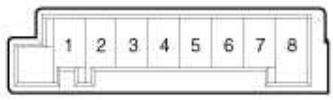
No.	KEY		Class							
			Paired H/P Empty	Disconnected	Connected		Incoming Call	Outgoing Call	Active Call	Active Call
					Normal mode	BT SETUP menu				
1		SHORT	Not Paired	Not Connecting	-	-		-	2nd call 1st Call:waiting 2nd Call:active	2nd Call 2nd Call:waiti 1st Call:activ
		LONG	-	-	-	-	-	-	Transfer call:secret cal	
2		SHORT	VR MODE Cancel	VR MODE Cancel	VR MODE Cancel	VR MODE Cancel	Reject Call	End Call	End Call	End Call
		LONG [10sec]	-	-	Speaker Adaptation (Only English)	Speaker Adaptation (Only English)	-	-	-	-
3		SHORT	Active	Active	Active	Active	-	-	-	-
		LONG [10sec]	Change language	Change language	Change language	Change language	-	-	-	-

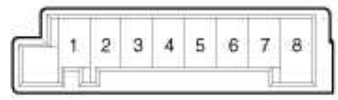
Body Electrical System > Hands Free System > Hands Free Switch > Schematic Diagrams

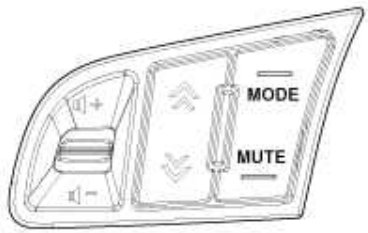
Circuit Diagram

[Audio + Bluetooth hands free]

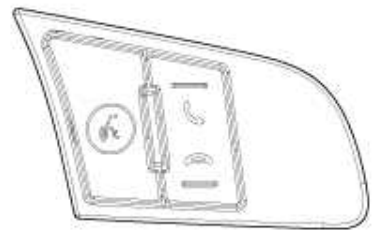






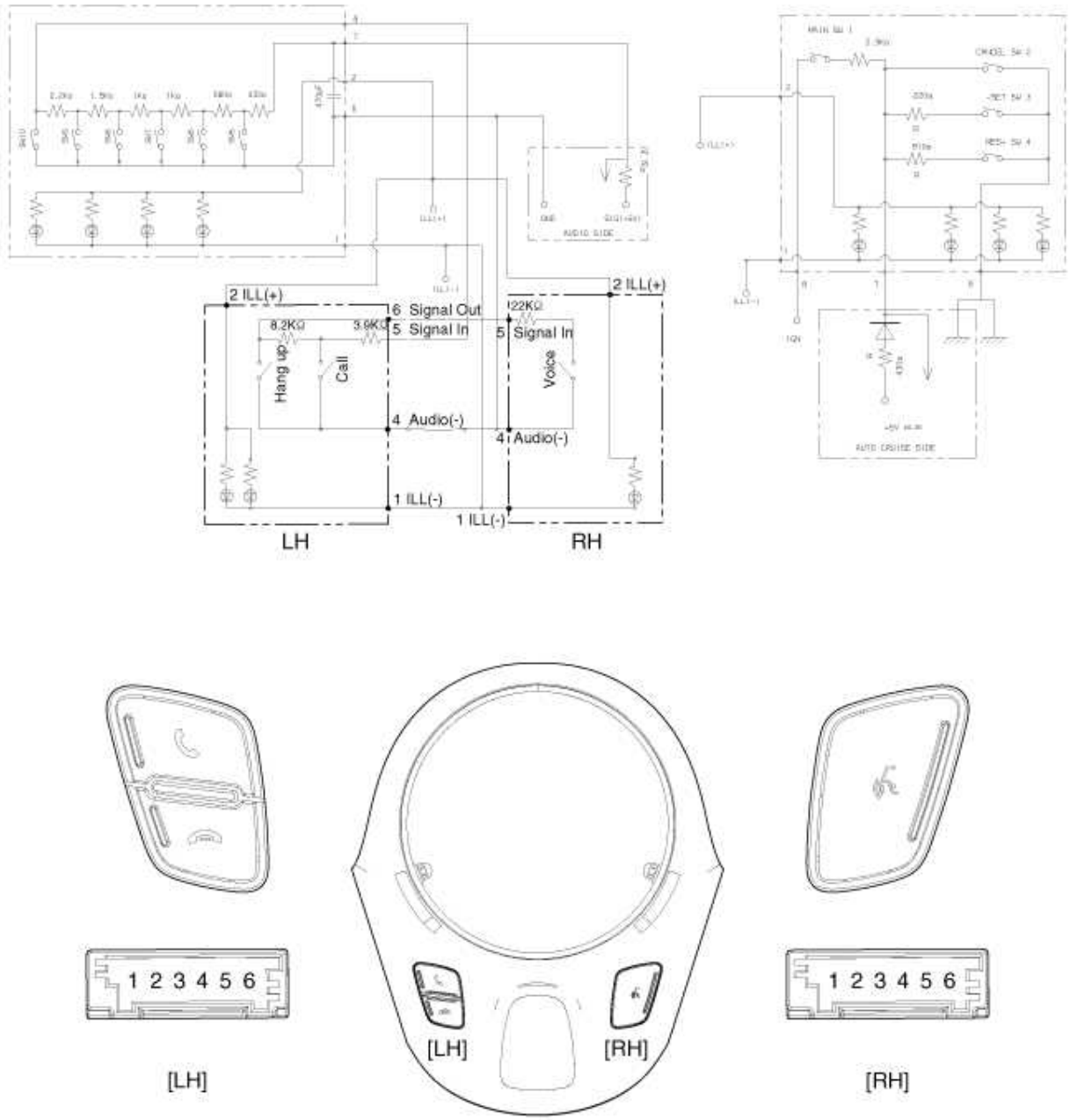


[LH]



[RH]

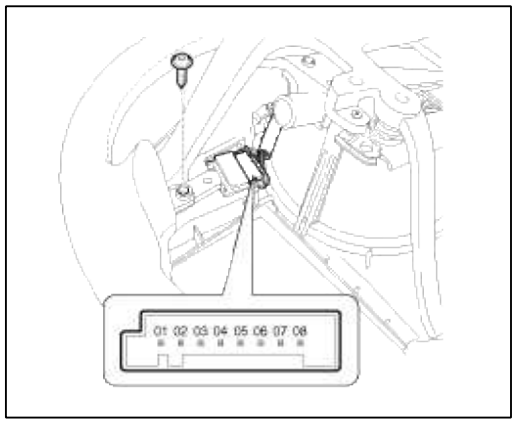
[Audio + Cruise + Bluetooth hands free]



Body Electrical System > Hands Free System > Hands Free Switch > Repair procedures

Inspection

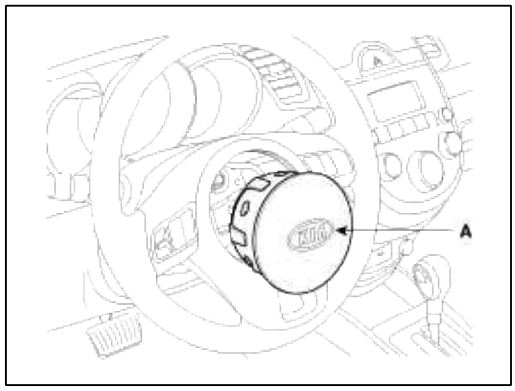
1. Check the hands free remote control switch for resistance between No.3 and No.4 terminals in each switch position.



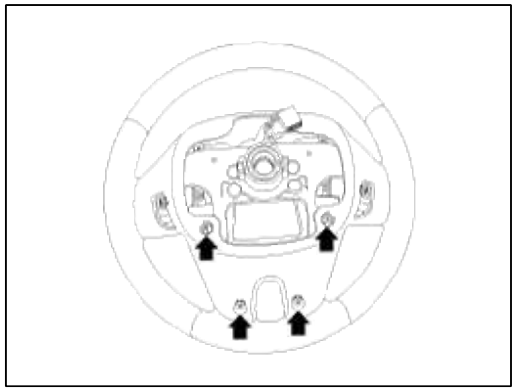
Switch	Connector terminal	Resistance (±5%)
HANG UP	6 - 7 (RH)	18.91 kΩ
CALL	6 - 7 (RH)	10.71 kΩ
VOICE Recognition	6 - 7 (RH)	40.91 kΩ

Removal

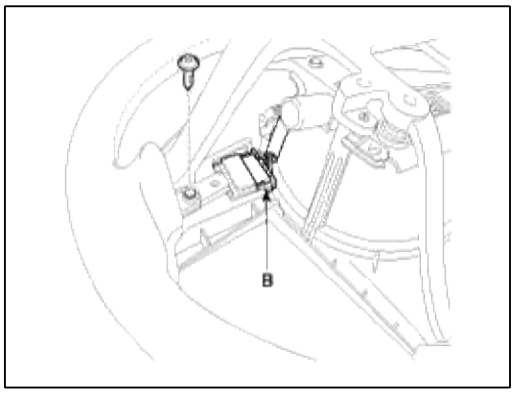
1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module(A).
   (Refer to the airbag group)

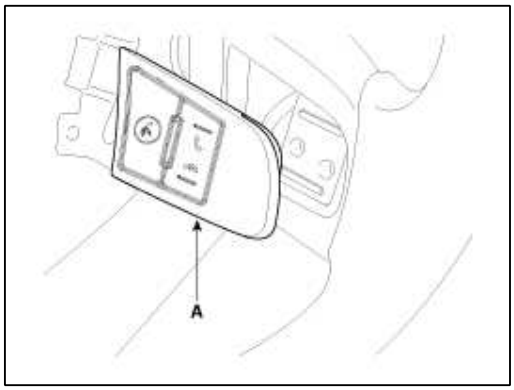


3. Remove the steering wheel.
   (Refer to ST group - "Steering column & shaft")
4. Remove the steering wheel cover after loosening the 4 screws.



5. Remove the hands free remote control switch(A) after removing the steering wheel remote control switch connector(B) and 2 screws.





Installation

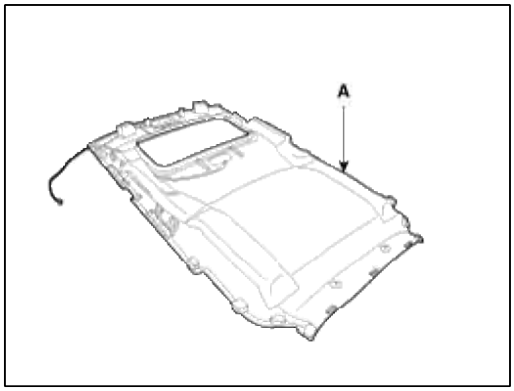
1. Reassemble the steering wheel remote control switch after connecting the connector.
2. Reassemble the steering wheel.
3. Reassemble the driver airbag module.

> NOTE
>
> Make sure the hands free remote control switch and the airbag module connectors are plugged in properly.

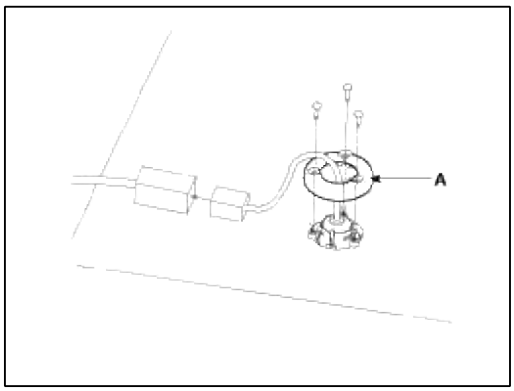
Body Electrical System > Hands Free System > Hands Free Mic > Repair procedures

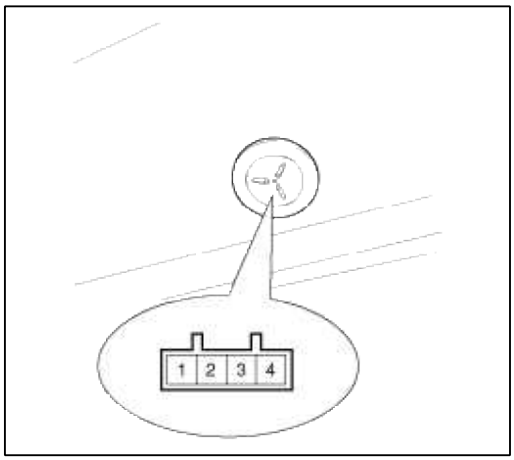
Inspection

1. Disconnect the negative(-) battery terminal.
2. Remove the roof trim(A).
   (Refer to the Body group - "Roof trim")

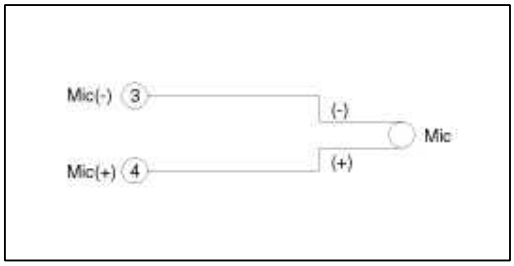


3. Remove the hands free mic(A) after loosening the connector and screw(3EA) from loof top.





4. Check the continuity of Mic between terminals.



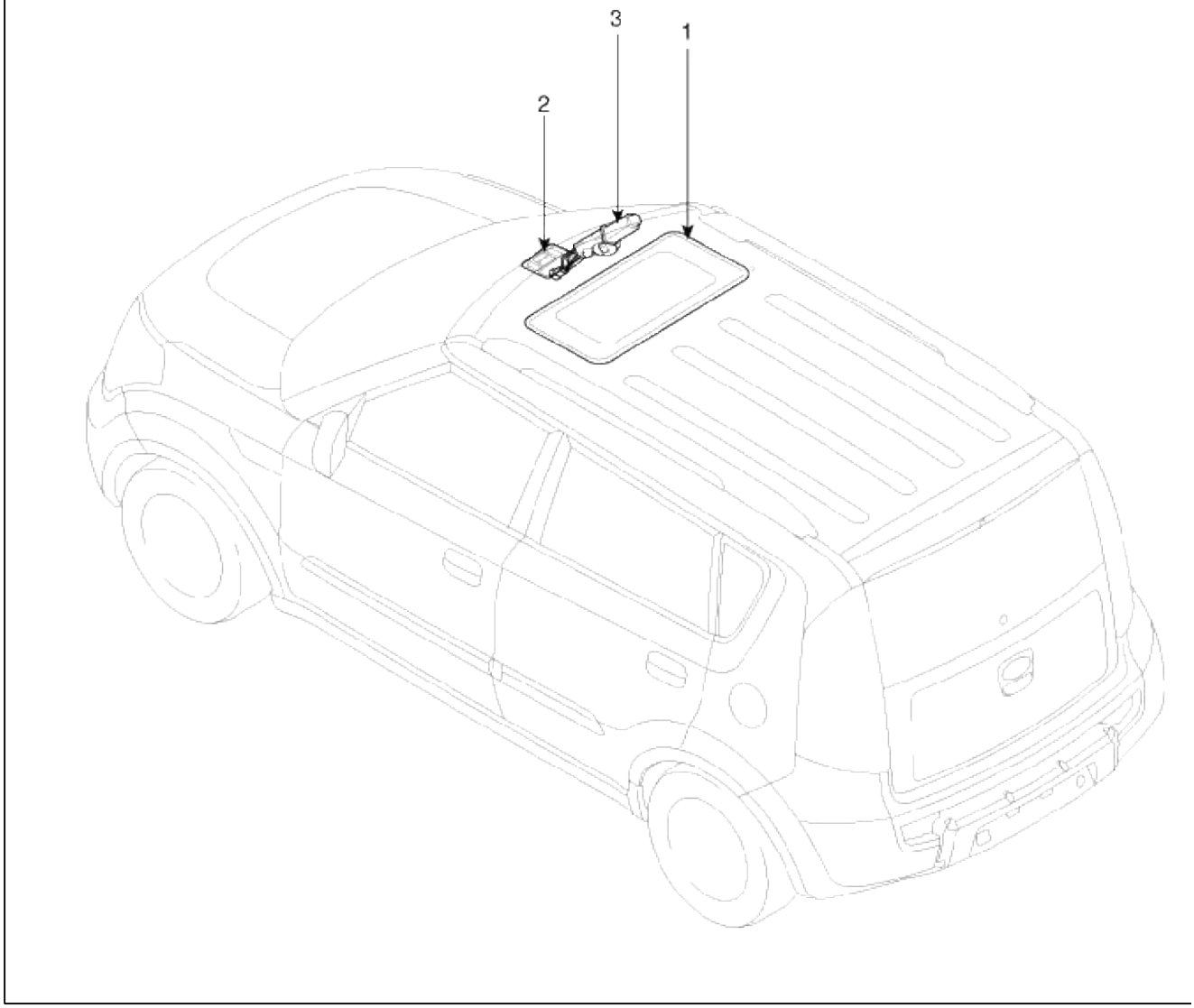
Body Electrical System > Hands Free System > Troubleshooting

Troubleshooting

Problem	Possible cause	Solution
Not pairing	Bluetooth device of Car is not discoverable mode	Enter Bluetooth pairing (searching) mode
	User's phone is Bluetooth off mode	User's phone set Bluetooth on
	Making an attempt pairing others bluetooth system	Check Bluetooth device name and address (12 word) to attempt paring Ex) 000B24FFF123
	Pass key error	Input the passkey displayed on the audio screen into the phone.
	5 phones have already been registered.	Delete paired phone list
	Bluetooth system cannot communicate with the phone.	Refer to IOP sheet IOP : Inter-operability
Not connection	User's phone or Bluetooth device of Car dose not register Bluetooth device to connect	Retry pairing
	Bluetooth system cannot communicate with the phone.	Waiting 1minute then Retry connection or phone power off/on. Refer to IOP sheet
Not redial	User phone system issue	Push the 2 times Send button
Not accept call	User phone system issue	Refer to IOP sheet
Not dialing	User's phone playing other menu (internet, mp3, game, etc..)	Stop other menu then set normal mode
	Bluetooth system cannot communicate with the phone	Refer to IOP sheet

Body Electrical System > Sun Roof > Components and Components Location

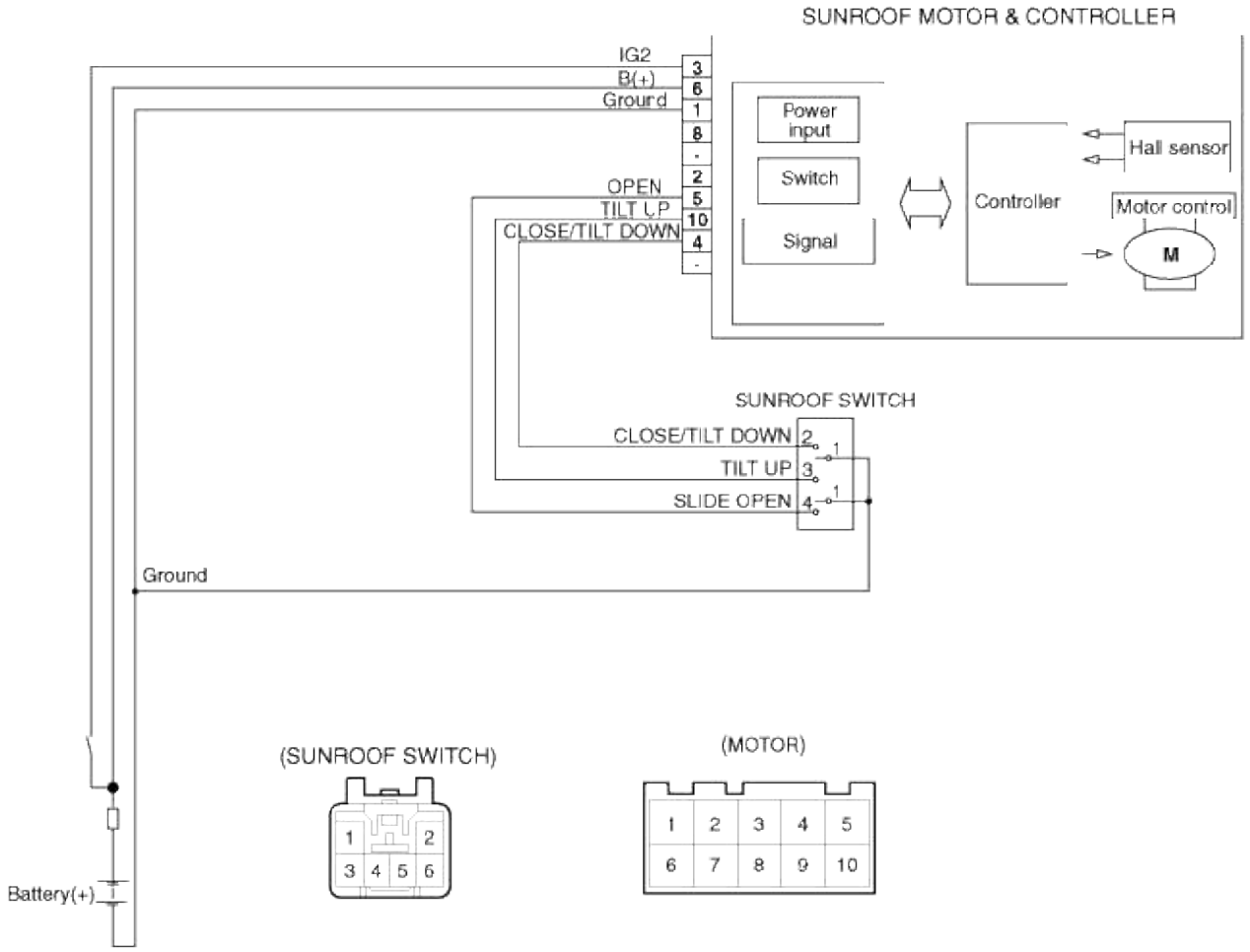
Component Location



1. Sunroof 2. Sunroof switch	3. Sunroof motor & controller

Body Electrical System > Sun Roof > Schematic Diagrams

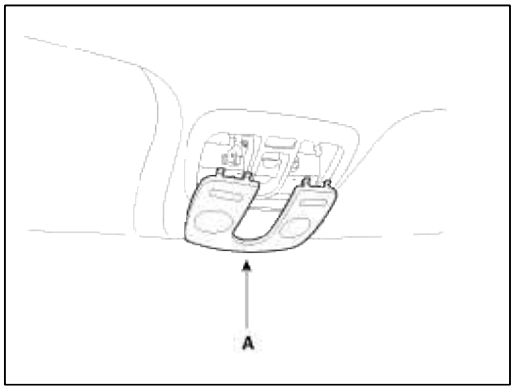
Circuit Diagram



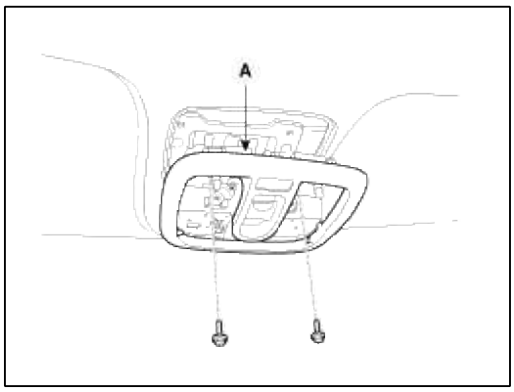
Body Electrical System > Sun Roof > Sunroof Switch > Repair procedures

Inspection

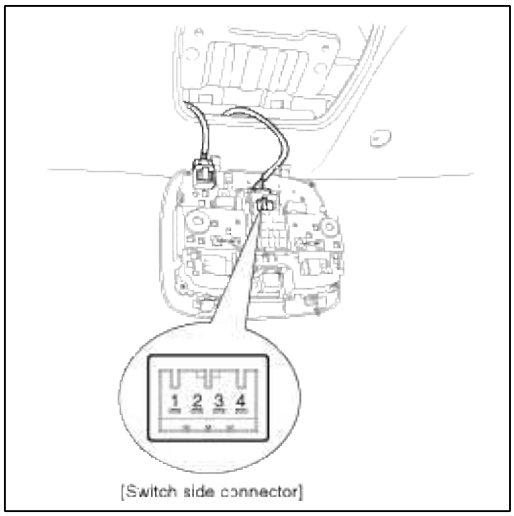
1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the overhead console lamp with a flat-tip screwdriver.



3. Remove the over head console lamp (A) after removing the screws (2EA).



4. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.



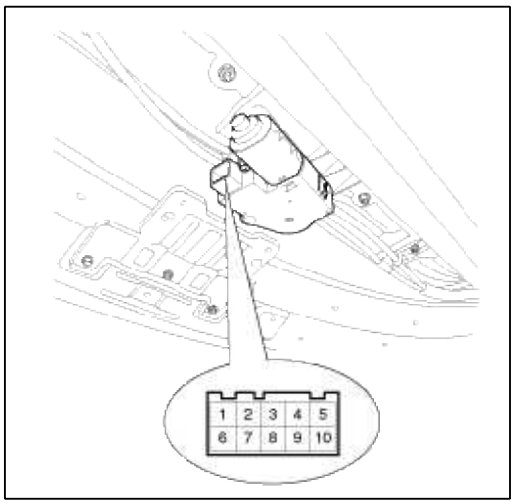
Position \ Terminal	1	2	4	3
TILT UP	○			○
CLOSE/ TILT DOWN	○		○	
SLIDE OPEN	○	○		

Body Electrical System > Sun Roof > Sunroof Motor > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console and roof trim.
   (Refer to the Body group - "Roof trim")

3. Remove the sunroof motor after removing the screws (3EA) and connector (10P).



4. Ground the terminals as below table, and check that the sunroof unit operates as below table.

Position \ Terminal	3	4	5	10
TILT UP	⊕			⊖
SLIDE CLOSE/DOWN	⊕	⊖		
SLIDE OPEN	⊕		⊖	

5. Make these input tests at the connector
   if any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the sunroof motor must be faulty; replace it.

Terminal	Test condition	Test : Desired result
3	IG2 ON	Check for voltage to ground : There should be battery voltage
1	Under all conditions	Check for continuity to ground : There should be continuity.
6	Under all conditions	Check for voltage to ground : There should be battery voltage.

Resetting The Sunroof

Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows :

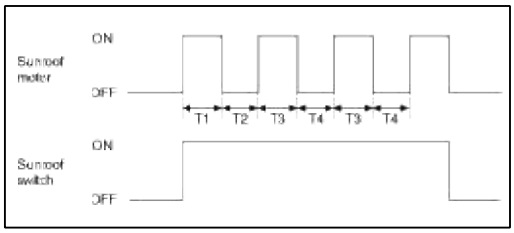
1. Turn the ignition key to the ON position.
2. According to the position of the sunroof, do as follows.
   (1) In case that the sunroof has closed completely or been tilted :
   Press the TILT button until the sunroof has tilted upward completely.
   (2) In case that the sunroof has slide-opened :
   Press and hold the CLOSE button for more than 5 seconds until the sunroof has closed completely.
   Press and hold the CLOSE button for more than 5 seconds after the sunroof has closed completely. Press the TILT button until the sunroof has tilted upward completely.
3. Release the TILT button.
4. Press and hold the TILT button once again until the sunroof has returned to the original position of TILT after it is raised a little higher than the maximum TILT position.
   When this is complete, the sunroof system is reset.

Protecting Motor From Overheating

In order to protect the sunroof motor from overheating from continuous motor operation, the sunroof ECU controls

the Run-time and Cool-time of the motor as follows:

1. The Sunroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st run-time(120 ± 10sec.).
3. The continuous operation of motor stops after the 1st Run-time(120 ± 10sec.).
4. Then Motor is not operated for the 1st Cool-time(18 ± 2sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2sec.) at the continued motor operation after 1st Cool-time(18 ± 2sec.)
6. The continuous operation of motor stops operating after the 2nd Run-time(10 ± 2sec.)
7. Motor is not operated for the 2nd Cool-time(18 ± 2sec.).
8. Motor repeats the 2nd run-time and 2nd cool-time at the continued motor operation.
   A. In case that motor is not operated continuously, the run-time is increased.
   B. The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

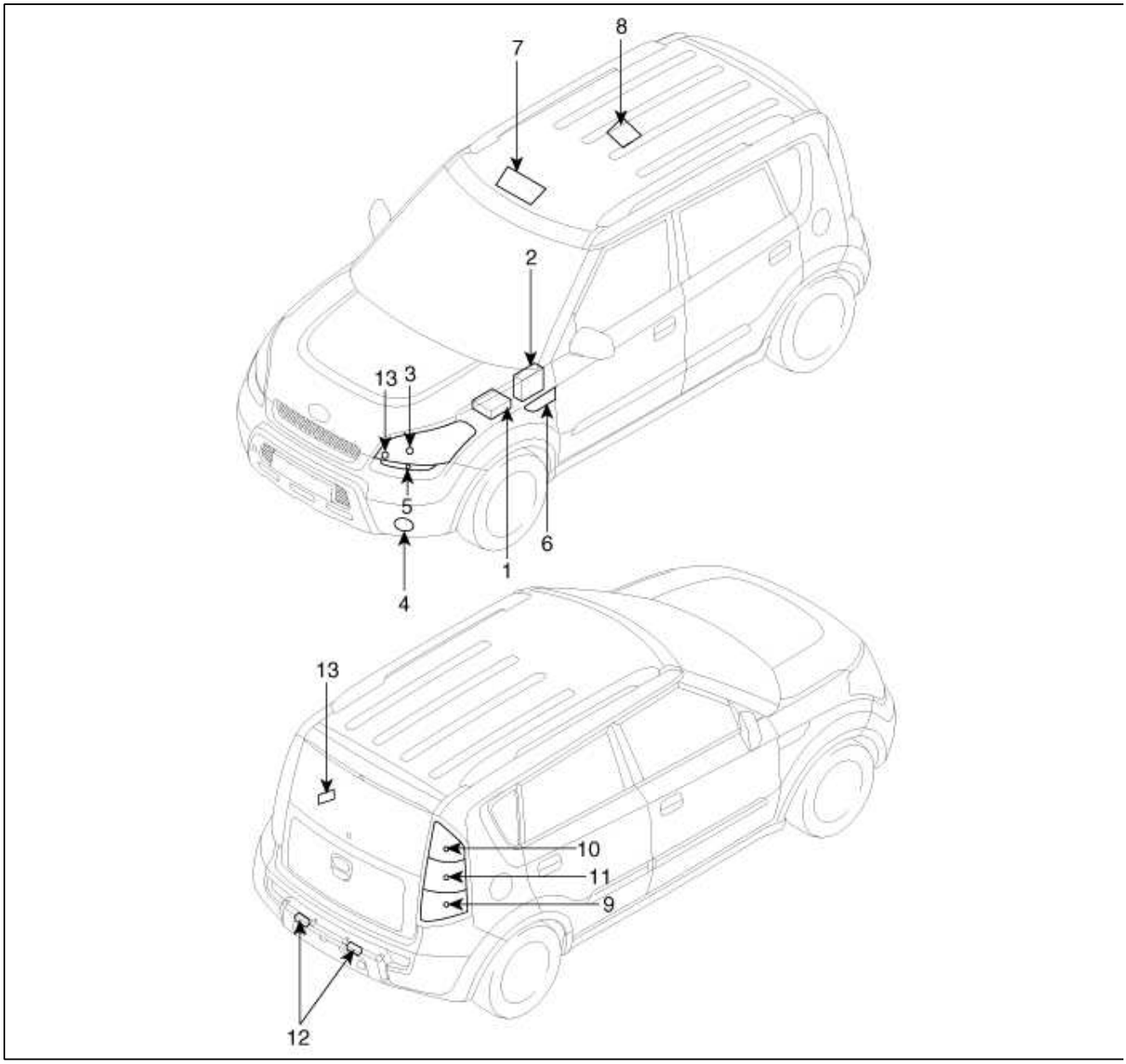
Body Electrical System > Lighting System > Specifications

Specification

Items	Bulb Wattage (W)
Head lamp (High/Low)	60/55
Front turn signal lamp	27
Front fog lamp	35
Position lamp	5
Rear stop/tail lamp	27/8
Back up lamp	16
Rear turn signal lamp	27
License plate lamp	5
Side marker	5
Room lamp	10
Overhead console lamp	10
High mounted stop lamp	5
Luggage room lamp	5
Turn signal lamp - Outside mirror	5

Body Electrical System > Lighting System > Components and Components Location

Component Location



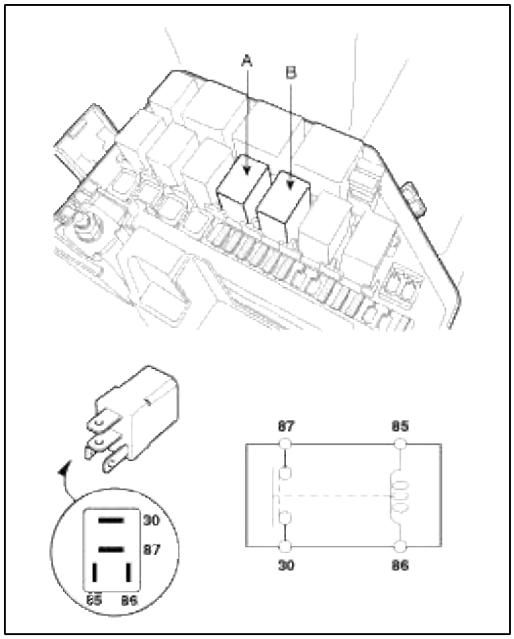
1. Engine room junction box (Head lamp Low/High, Fog lamp relay) 2. Passenger compartment junction box (Tail lamp relay,Hazard relay) 3. Head lamp (Low/High) 4. Front fog lamp 5. Front turn signal lamp 6. Side marker	7. Over head lamp 8. Room lamp(Center) 9. Tail/Stop lamp 10. Rear turn signal lamp 11. Back up lamp 12. License plate lamp 13. Luggage room lamp

Body Electrical System > Lighting System > Head Lamps > Repair procedures

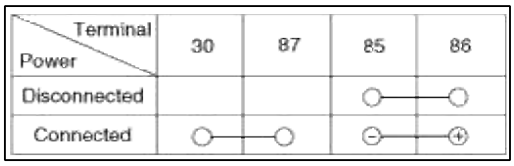
Inspection

Head Lamp Relay / Front Lamp Relay

1. Disconnect the negative(-) battery terminal.
2. Pull out the relay from the engine compartment relay box.
   A : Head lamp(Low) relay
   B : Head lamp (High) relay

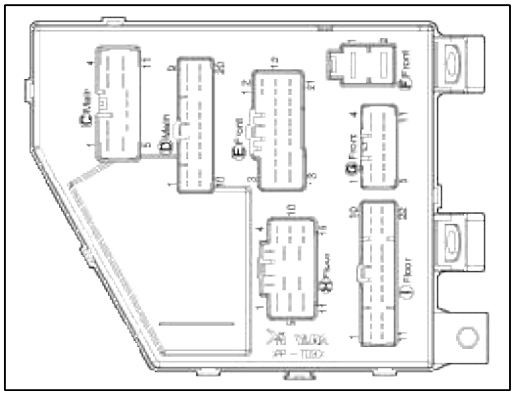


3. Check for continuity between terminals. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.86 and No.85 terminals.
4. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.



Tail Lamp

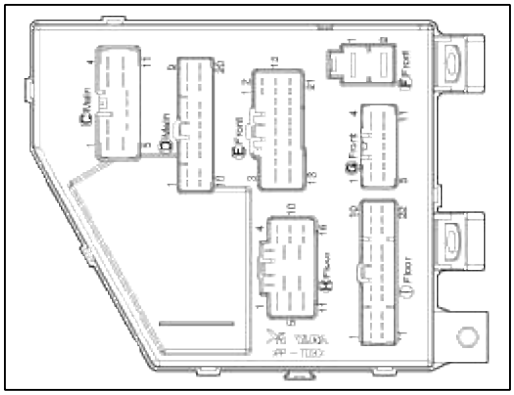
1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the junction box.



4. Check for continuity between the terminals.
   (1) There should be continuity between the No.1 terminal in the I/P-F and the No.17(LH) or 16(RH) terminal in the I/P-I when power and ground are connected to the No.1 terminal in the I/P-F and the No.18 terminal in the I/P-A.
   (2) There should be no continuity between the No.1 terminal in the I/P-F and the No.17(LH) or 16(RH) terminal in the I/P-I when power is disconnected.

Front Fog Lamp

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the junction box.



4. Check for continuity between the terminals.
   (1) There should be continuity between the No.1 terminals in the I/P-F and No.11 terminals in the I/P-G when power and ground are connected to the No.1 terminals in the I/P-F and No.3 terminals in the I/P-A.
   (2) There should be no continuity between the No.1 terminals in the I/P-F and No.11 terminals in the I/P-G when power is disconnected.

Adjustment

Head Lamp Aiming Instructions

CAUTION

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

NOTE

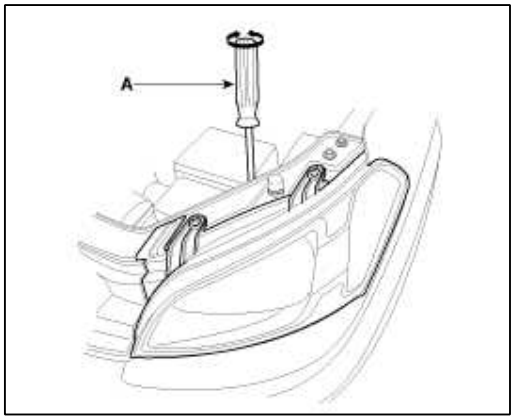
If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.

4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.
   Make vertical(A) adjustments to the lower beam using the adjusting wheel.

Condition	Aiming Direction
	A
Turning Clockwise	UP
Turning Counter clockwise	DOWN

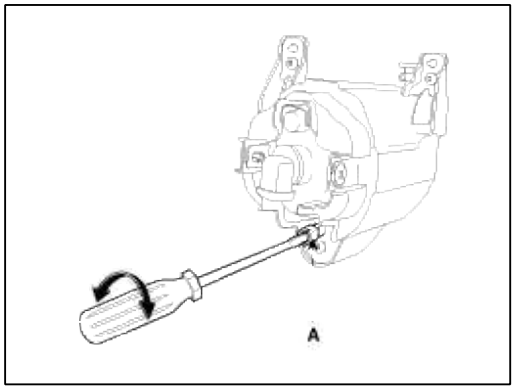


Front Fog Lamp Aiming

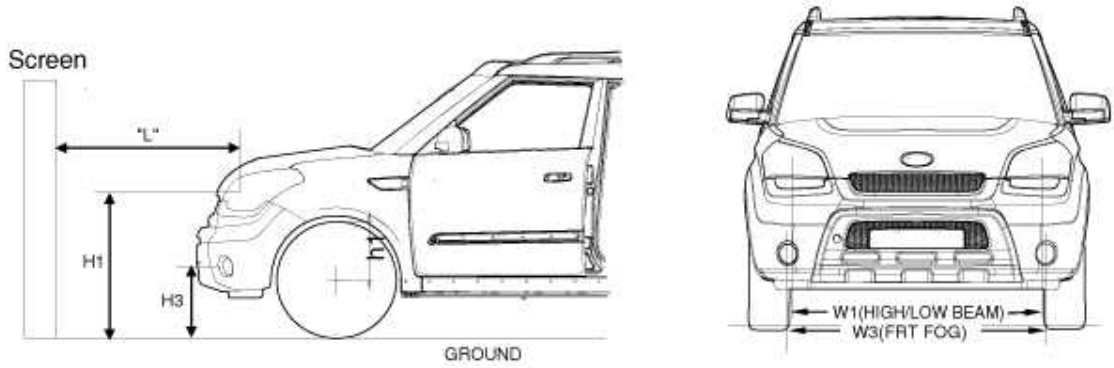
The front fog lamps should be aimed as the same manner of the head lamps aiming.

With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear (A).

Condition	Aiming Direction
Turning Clockwise	DOWN
Turning Counter clockwise	UP



Head Lamp And Fog Lamp Aiming Point

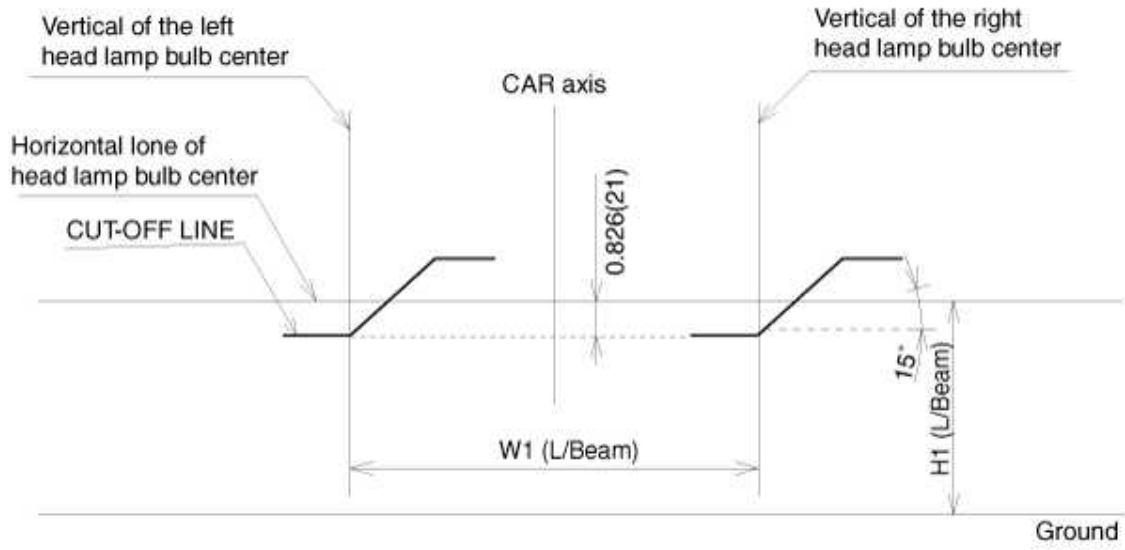


H1 : Height between the head lamp bulb center and ground (Low/High beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (Low/High beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen
h1 : Ride height

Unit : in (mm)

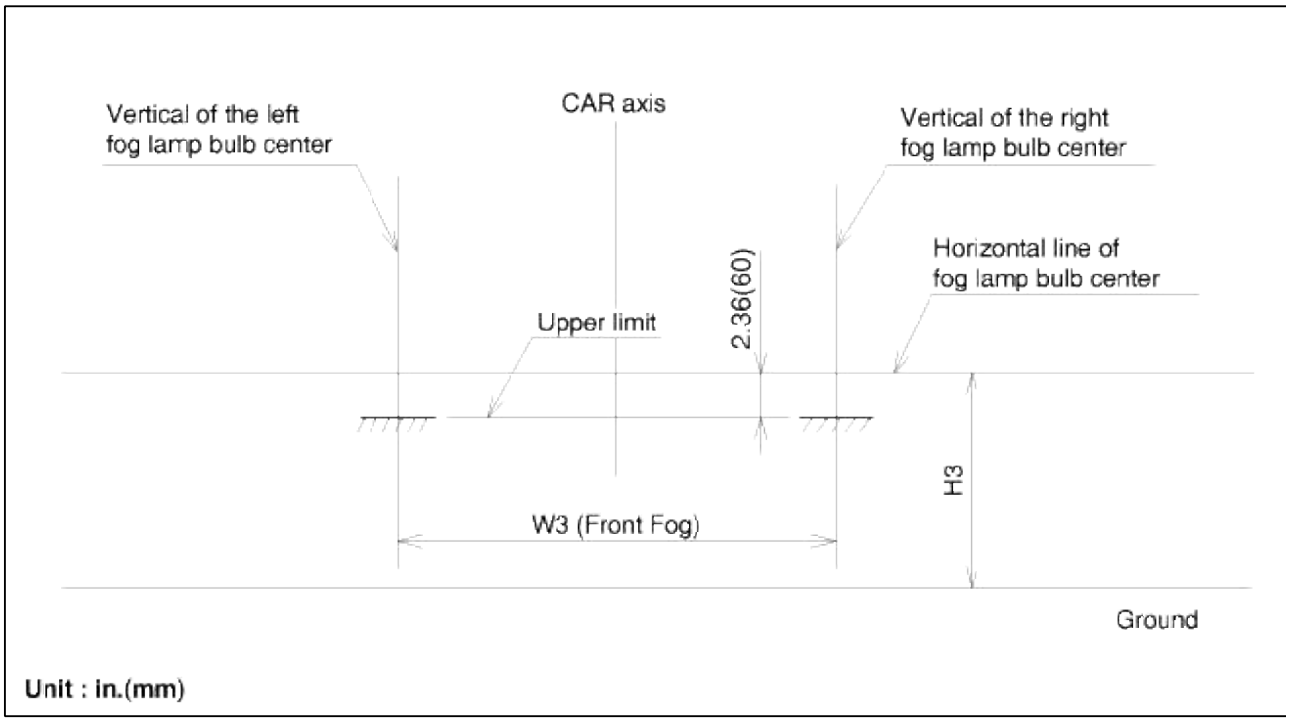
Vehicle condition	H1	H3	W1	W3	L
Without driver	33.4(849)	15.1(383)	47.8(1214)	52.6(1338)	118.1(3000)
With driver	33.2(843)	14.8(377)			

1. Turn the low beam on with driver.
   The cut-off line should be projected in the allowable range shown in the picture.
   In case of equipping with the manual leveling device, set the leveling device switch on the "O" position.



Unit : in.(mm)

2. Turn the front fog lamp on with driver.
   The cut-off line should be projected in the allowable range shown in the picture.



Removal

CAUTION

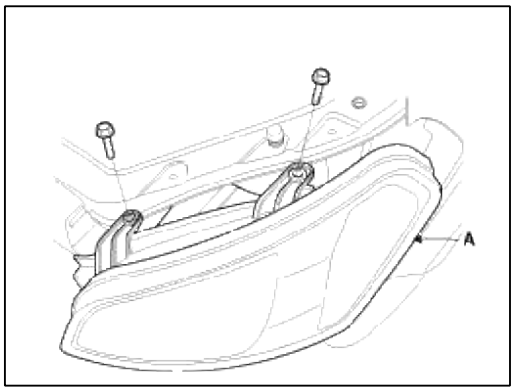
Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

NOTE

The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.
Removing bulb for an extended period of time may affect headlamp bulb performance.
Contaminants may enter the headlamp assembly where they can settle on the lens and reflector.
Never turn on the head lamps with the bulb removed from the headlamp assembly.

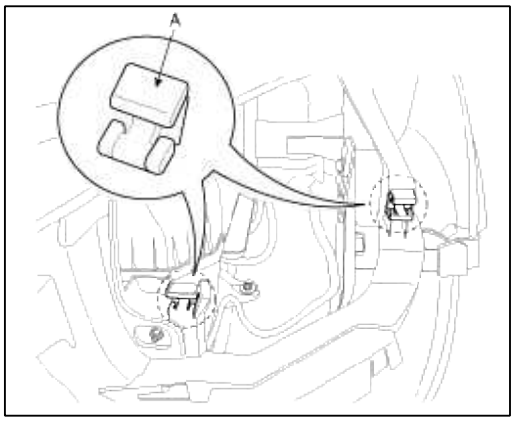
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper. (Refer to the Body group - "Front bumper")

3. Loosen the mounting bolts (2EA) of head lamp. Remove the head lamp assembly (A) after disconnecting the lamp connectors.

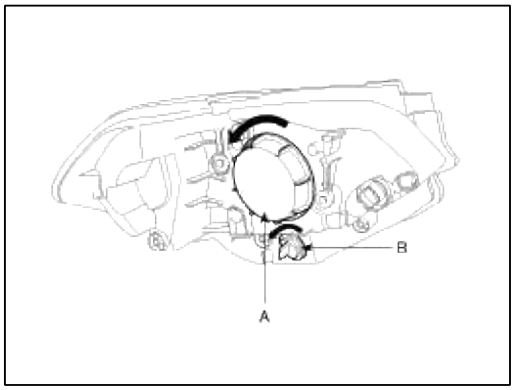


NOTE

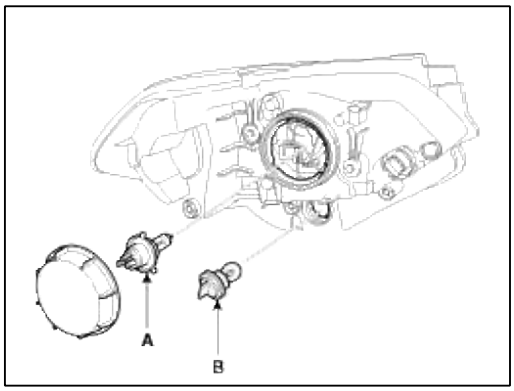
Take care that retaining clip (A) is not to be damaged.



4. Remove the bulb caps from the head lamp assembly after turning in the counter clock-wise direction.
   A : Head lamp low/high bulb
   B : Turn signal bulb cab



5. Remove the head lamp bulbs after releasing the lock of the set spring.
   A : Head lamp low/high bulb, B : Turn signal bulb



Installation

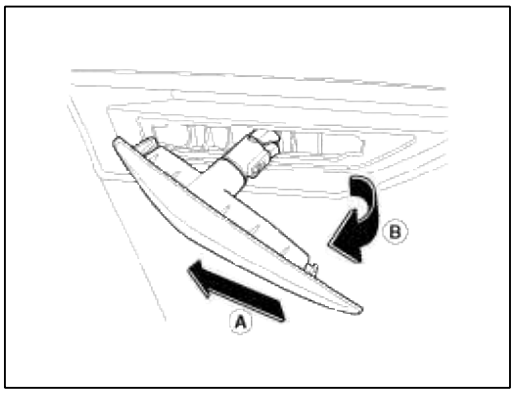
1. Install the head lamp bulbs.
2. Install the head lamp bulb caps.
3. Install the head lamp assembly after connecting the lamp connector.

Body Electrical System > Lighting System > Turn Signal Lamp > Repair procedures

Removal

Side marker

1. Disconnect the negative (-) battery terminal.
2. Push the side marker lamp assembly in the direction of (A) and then pull it in the direction of (B).



CAUTION

Be careful not to damage the fixing clip.

3. Replace the lamp bulb.

Installation

Side marker

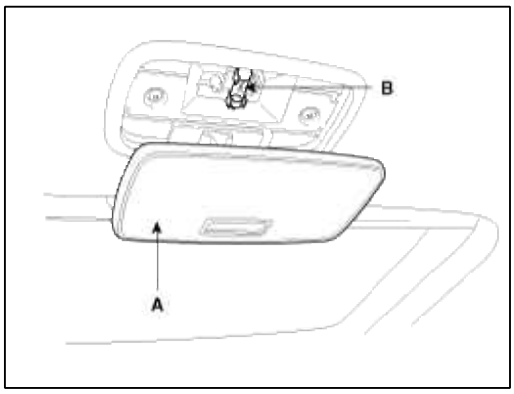
1. Install the lamp bulb.
2. Install the the side marker lamp assembly.

Body Electrical System > Lighting System > Room Lamp > Repair procedures

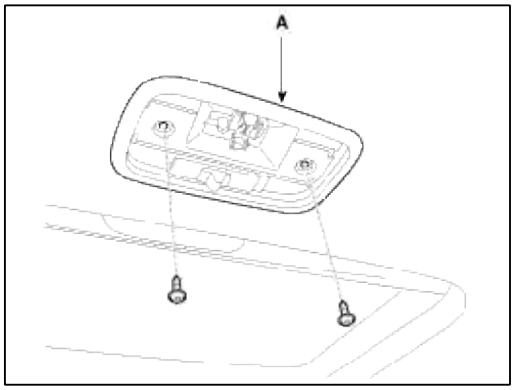
Removal

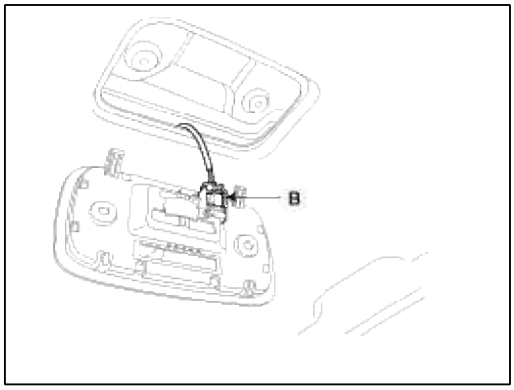
1. Disconnect the negative (-) battery terminal.

2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver then remove the bulb (B).



3. Loosen the fixing screw (2EA) and disconnect the 3P connector(B). And then remove the room lamp assembly (A).



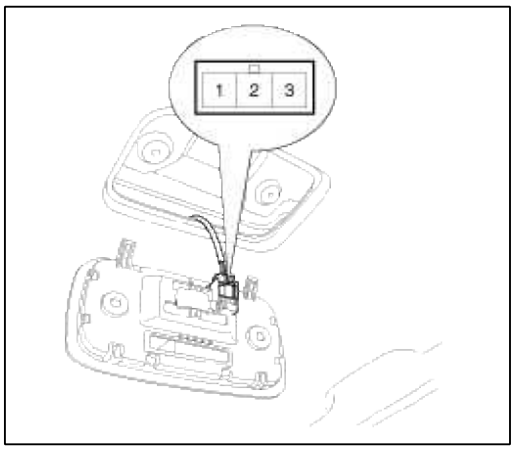


Installation

1. Install the room lamp assembly after connecting the lamp connector.
2. Install the lamp lens after assembling the bulb.

Inspection

1. Remove the room lamp assembly then check for continuity between terminals.

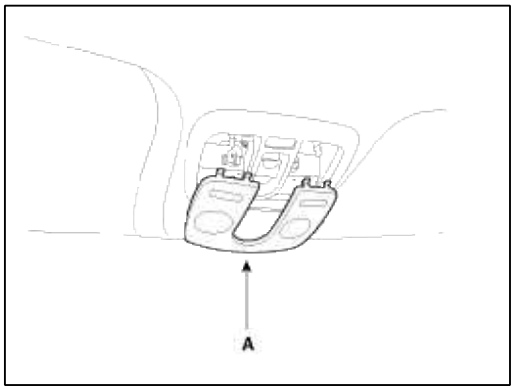


Terminal / Position	1	3	2
DOOR		○—(M)—○	
ON	○—(M)—○		
OFF			

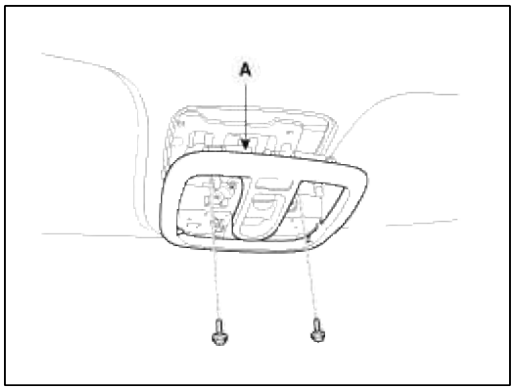
Body Electrical System > Lighting System > Overhead Console Lamp > Repair procedures

Removal

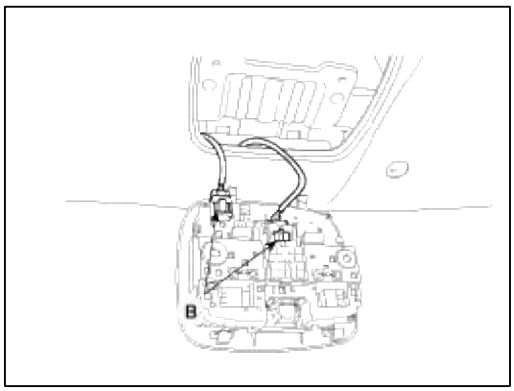
1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver.

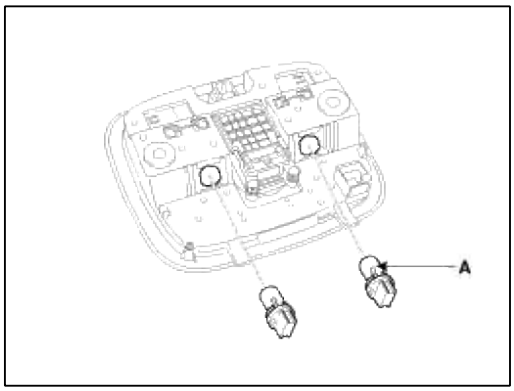


3. Loosen the fixing screw (2EA) and remove the overhead console lamp (A).



4. Disconnect the sunroof switch and lamp connector (B) and then remove the overhead console lamp (A).



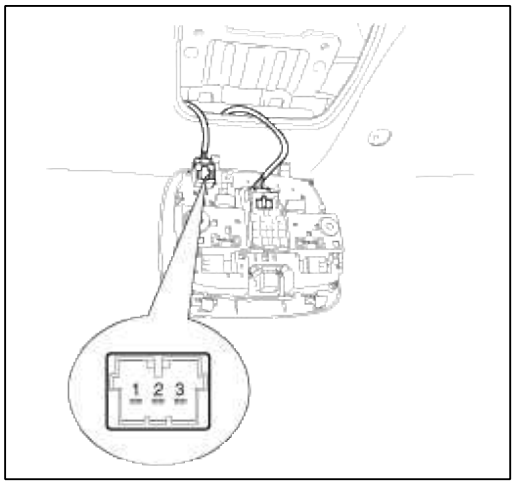


Installation

1. Install the overhead console lamp after connecting the sunroof switch and lamp connector.
2. Install the lens after tightening 2 screws.

Inspection

Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.



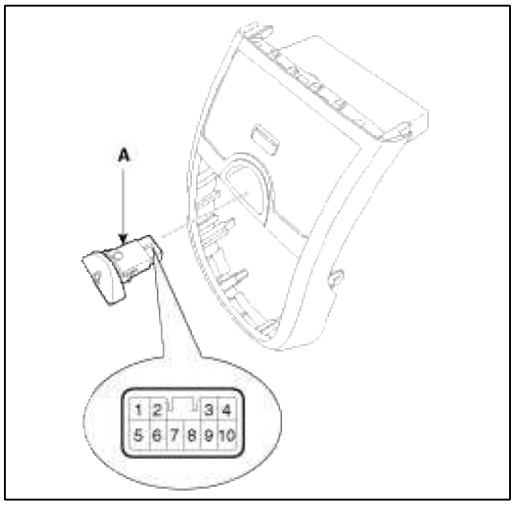
Sort / Position / Terminal	Map lamp switch				Door Switch	
	LH		RH			
	ON	OFF	ON	OFF	ON	OFF
1	○		○		○	
2	○		○		○	
3					○	

Body Electrical System > Lighting System > Hazard Lamp Switch > Repair procedures

Inspection

Hazard Lamp Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad center facia panel.
   (Refer to the Body group - "Crash pad")
3. Disconnect the hazard lamp switch connector (A).



4. Operate the switch and check for continuity between terminals with an ohmmeter.

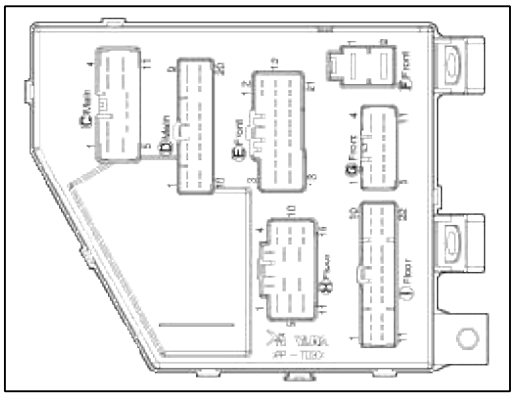
Terminal / Position	OFF	ON	Remark
5	○		IGN
7		○	Battery
8	○	○	Common
6		○	F BATT
10		○	Right
9		○	Left
2	○	~ ○	Illumination +
3	○		Illumination -

Hazard Lamp Relay

Check for continuity between the terminals.

1. There should be continuity between the No.2 terminals in the I/P-F and No.5 or 6 terminals in the I/P-A when power and ground are connected to the No.2 terminals in the I/P-F and No.4 terminals in the I/P-A.

2. There should be no continuity between the No.2 terminals in the I/P-F and No.5 or 6 terminals in the I/P-A when power is disconnected.

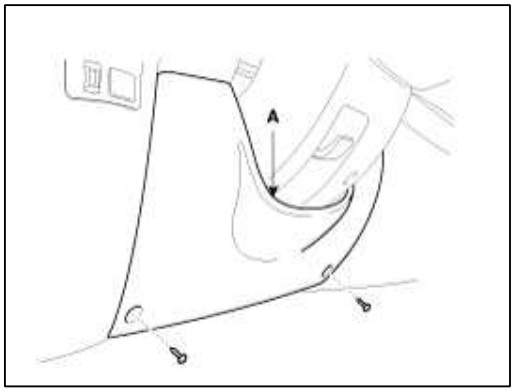


Terminal / Position	I/P-F (2)	I/P-A (5 or 6)	I/P-F (2)	I/P-A (4)
Power off			○	○
Power on	○	○	⊖	⊕

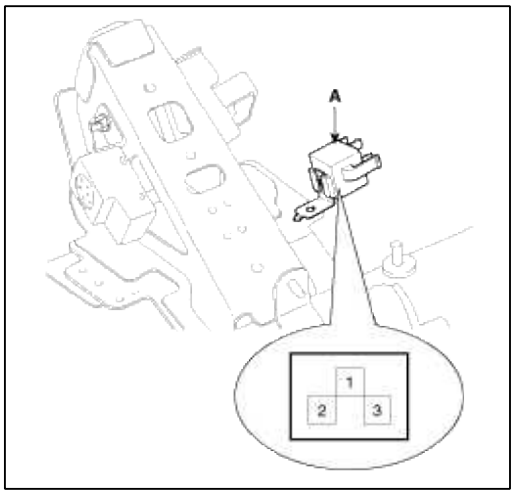
Body Electrical System > Lighting System > Flasher Unit > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the main crash pad (A).
   (Refer to Body group - "Main crash pad")



3. Remove the flasher unit (A).



4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.

5. Connect the two turn signal lamps in parallel to terminals 1 and 3. Check that the bulbs turn on and off.

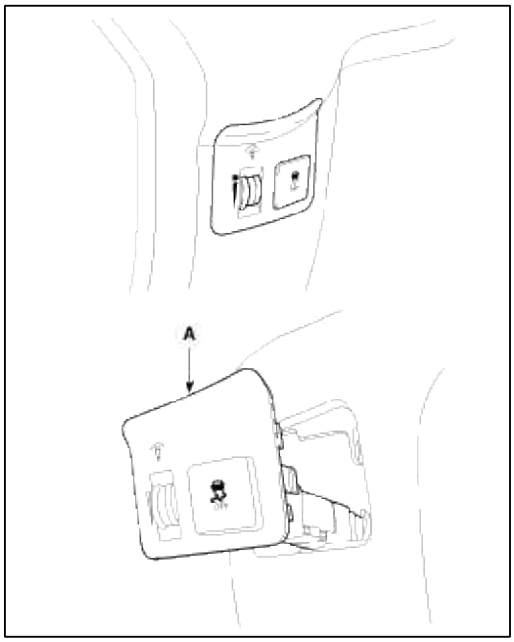
NOTE

The turn signal lamps should flash 60 to 120 times per minute. If one of the front or rear turn signal lamps has an open circuit, the number of flashes will be more than 120 per minute. If operation is not as specified, replace the flash unit.

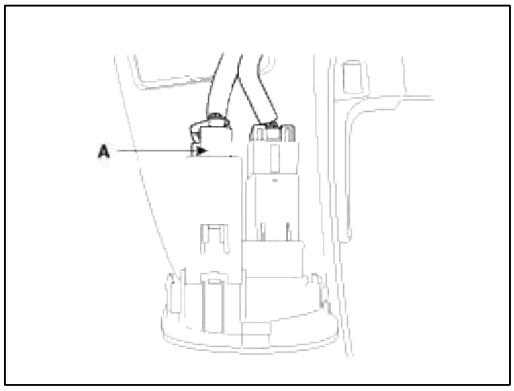
Body Electrical System > Lighting System > Rheostat > Repair procedures

Inspection

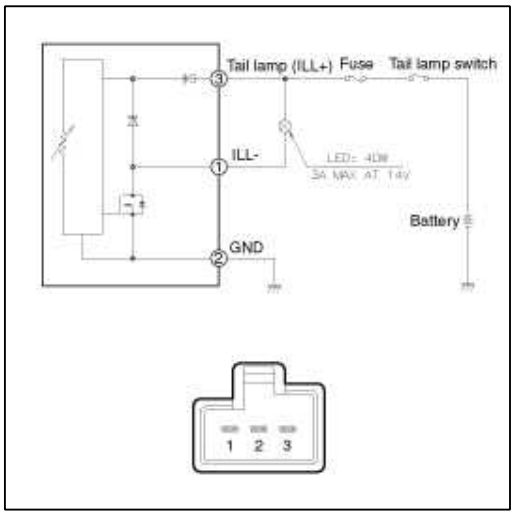
1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad switch assembly (A) by using the trim remover tool. (Refer to the group - "Main crash pad")



3. Disconnect the rheostat switch connector (A).



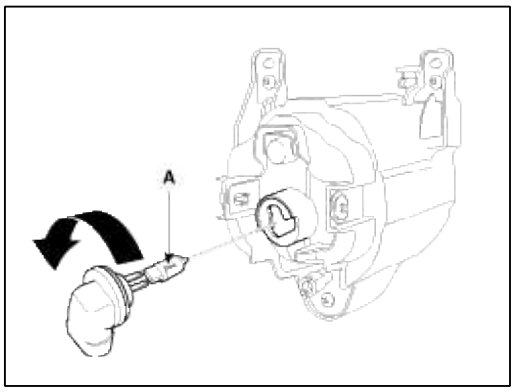
4. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.



Body Electrical System > Lighting System > Front Fog Lamps > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper.
   (Refer to the Body group - "Bumper")
3. Remove the front fog lamp bulb (A) turning in the counter clock-wise direction.



Installation

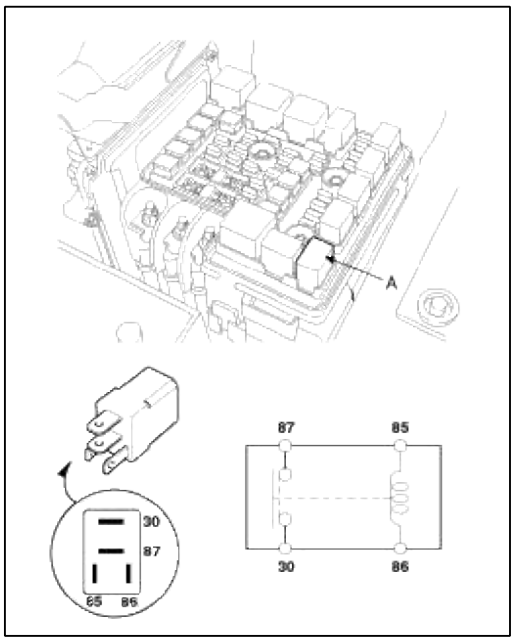
1. Install the front fog lamp bulb.
2. Connect the front fog lamp connector.
3. Install the front side cover.

Inspection

Front Fog Lamp Relay

1. Disconnect the negative(-) battery terminal.
2. Pull out the front fog lamp relay(A) from the engine compartment relay box.
3. Check for continuity between terminals. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.85 and No.86 terminals.

4. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.



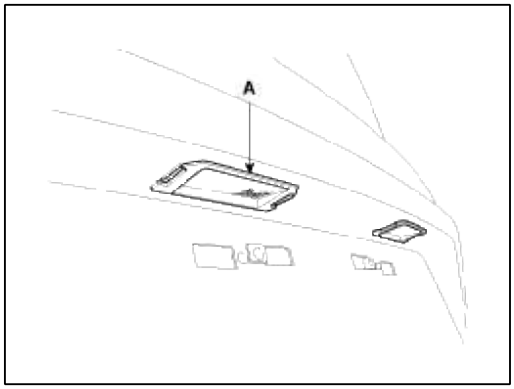
Terminal / Power	F-1	G-11	A-3	F-1
Disconnected			○	○
Connected	○	○	⊖	⊕

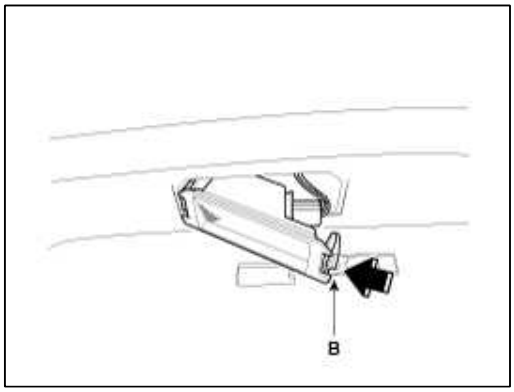
Body Electrical System > Lighting System > License Lamps > Repair procedures

Removal

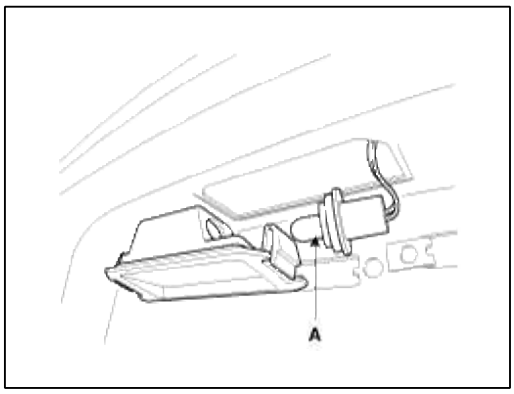
License Lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens(A) by pushing the clip(B).



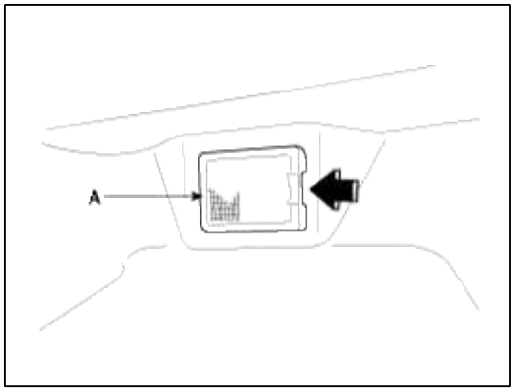


3. Replace the bulb (A).

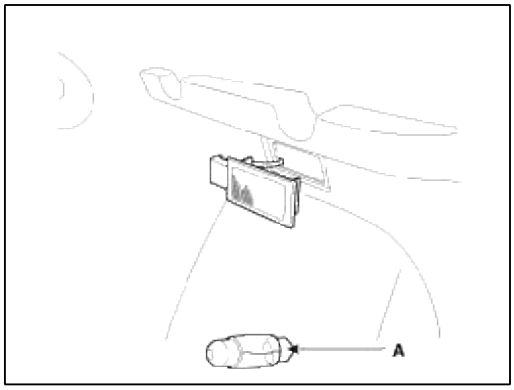


Luggage Room Lamp

1. Disconnect the negative(-) battery terminal.
2. Remove the luggage room lamp lens(A) from the luggage side trim.



3. Remove the bulb(A).



Installation

License Lamp

1. Install the bulb.
2. Install the license lamp lens.

Luggage Room Lamp

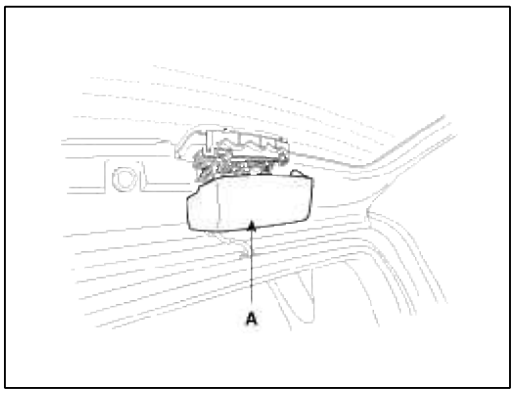
1. Install the bulb.
2. Install the luggage room lamp lens.

Body Electrical System > Lighting System > High Mounted stop lamp > Repair procedures

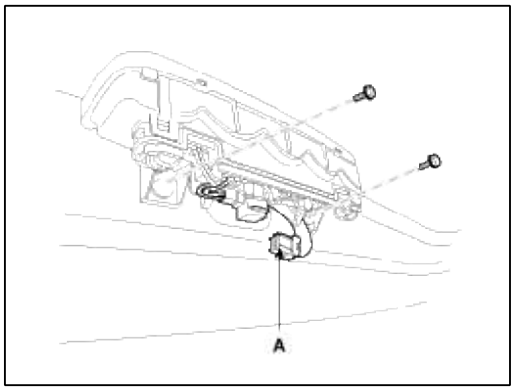
Removal

1. Disconnect the negative(-) battery terminal.

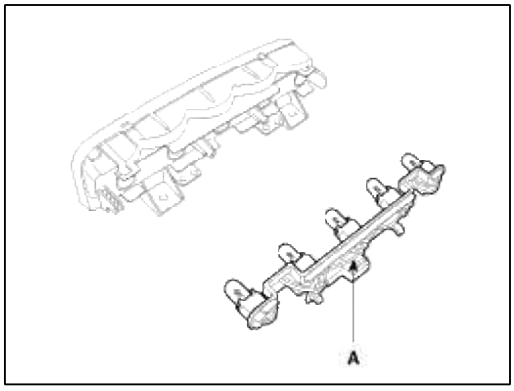
2. Remove the high mounted stop lamp cover (A).



3. Remove the connector (A) and bolts.



4. Replace the bulbs (A).



Installation

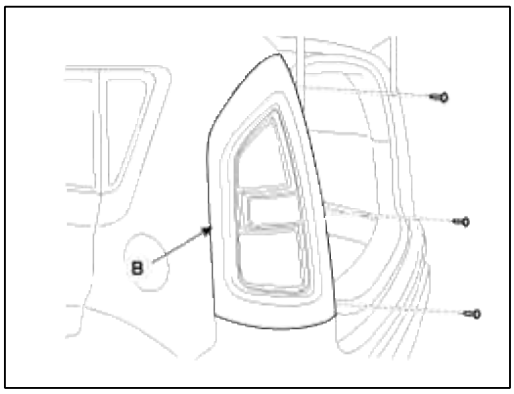
1. Install the high mounted stop lamp and connector.
2. Install the high mounted stop lamp cover.

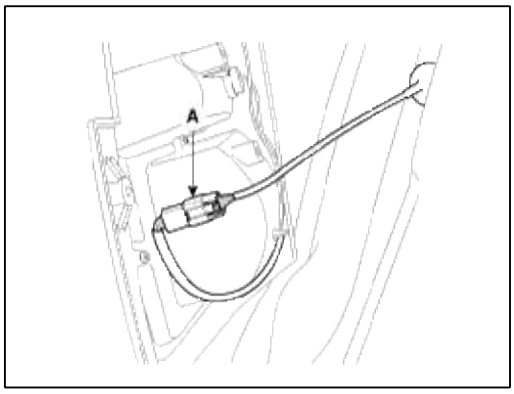
Body Electrical System > Lighting System > Rear combination lamp > Repair procedures

Removal

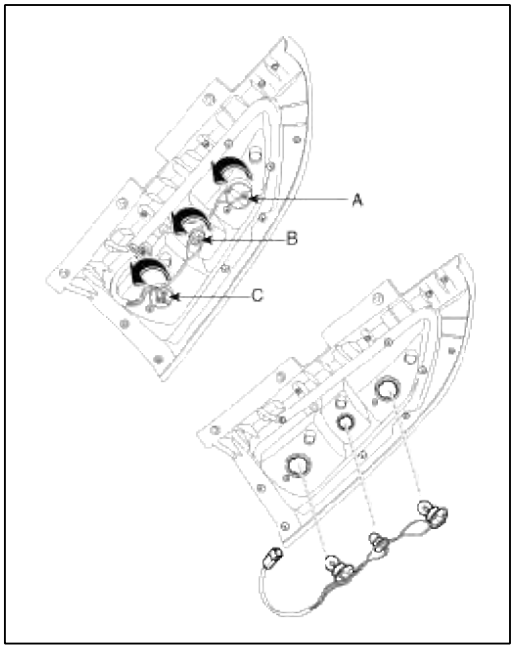
1. Disconnect the negative (-) battery terminal.

2. Remove the rear combination lamp assembly (B) after removing connector (A) and screw (3EA).





3. Replace the lamp bulbs after turning in the counter clock-wise direction.
   A: Turn signal lamp
   B: Back up lamp
   C: Tail / Stop lamp



Installation

1. Connect the lamp connector after assembling the bulb.
2. Install the rear combination lamp assembly.

Body Electrical System > Lighting System > Troubleshooting

Troubleshooting

Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Head lamp fuse (LOW:10A, HIGH:20A) blown	Check for short and replace fuse
	Head lamp fuse (10A) blown	Check for short and replace fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	Tail lamp fuse (10A) blown	Check for short and replace fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (15A) blown	Check for short and replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
Instrument lamps do not light (Tail lamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (15A) blown	Check for short and replace fuse

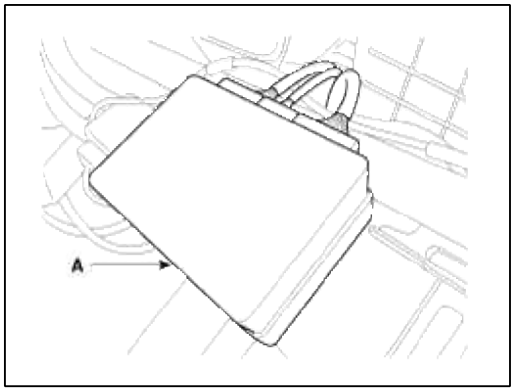
	Flasher unit faulty	Check flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
	Flasher unit faulty	Check flasher unit
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (15A) blown	Check for short and replace fuse
	Room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (15A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Rear fog lamps do not light	Bulb burned out	Replace bulb
	Rear fog lamp fuse (10A) blown	Check for short and replace fuse
	Rear fog lamp fuse (10A) blown	Check for short and replace fuse
	Rear fog lamp switch faulty	Check switch
	Rear fog lamp relay faulty	Check relay
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tailgate room lamp does not light	Bulb burned out	Replace bulb

	Room lamp fuse (10A) blown	Check for short and replace fuse
	Tailgate room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

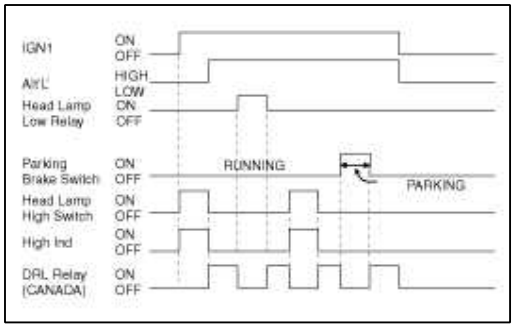
Body Electrical System > Daytime Running Lights > DRL Control Module > Repair procedures

Inspection

1. The daytime running unit is integrated in the BCM (A).



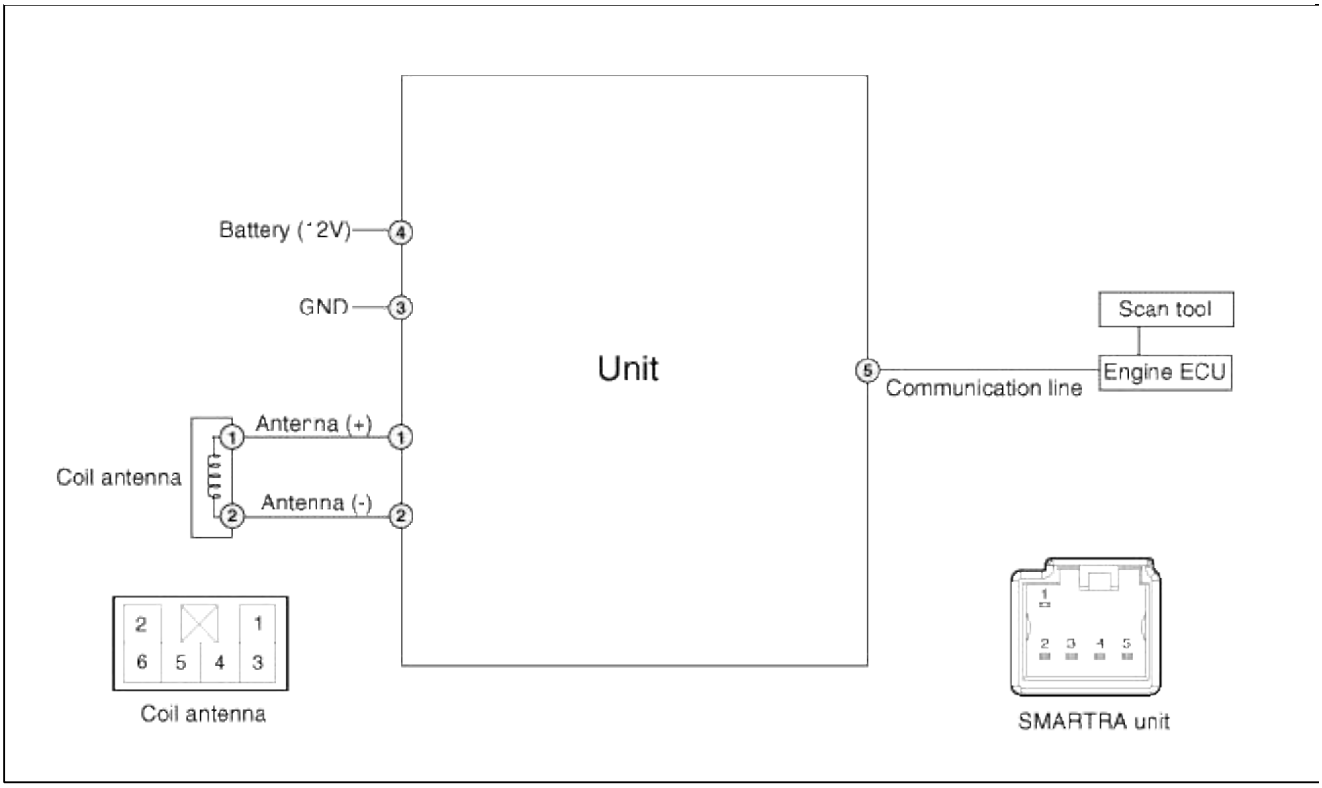
2. Check that the light operate according to the following timing chart.
   (1) If Alt 'L'is High, DRL control put in operation.
   (2) If Head Lamp Low Relay is turned ON or Head Lamp High Switch is turned ON during DRL control operating, DRL control is cancelled.



3. If the daytime running light is not operated well, Inspect the connector and terminals to be sure they are all making good contact.
   If the terminals are bent, loose or corroded, repair them as necessary, and recheck the system.
   If the terminals look OK, go to step 4.
4. Make these input tests at the connector by using ETM.
   If any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the I/P (Instrument panel) junction box must be faulty; replace it.

Body Electrical System > Immobilizer System > Schematic Diagrams

Circuit Diagram

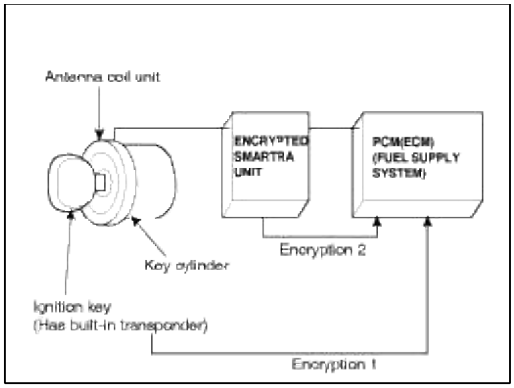


Body Electrical System > Immobilizer System > Description and Operation

Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

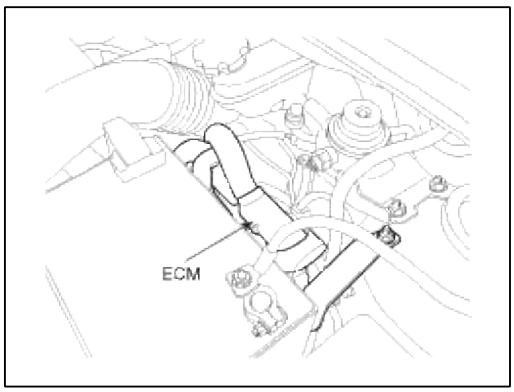
1. Encrypted SMARTRA type immobilizer
   A. The SMARTRA system consists of a passive challenge - response (mutual authentication)transponder located in the ignition key, an antenna coil, an encoded SMARTRA unit, an indicator light and the PCM(ECM).
   B. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.
   C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit to the PCM(ECM).
   D. If the proper key has been used, the PCM(ECM) will energize the fuel supply system. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the SMARTRA unit has recognized the code sent by the transponder.
   E. If the wrong key has been used and the code was not received or recognized by the PCM(ECM) the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.
   F. If it is necessary to rewrite the PCM(ECM) to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
   G. The immobilizer system can store up to eight key codes.
   H. If the customer has lost his key, and cannot start the engine, contact Hyundai motor service station.



Components Operations

PCM (Power Train Control Module)

1. The PCM(ECM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the PCM(ECM). ERN (Encrypted Randorn Number) value between EMS and encrypted smartra unit is checked and the validity of coded key is decided by EMS.

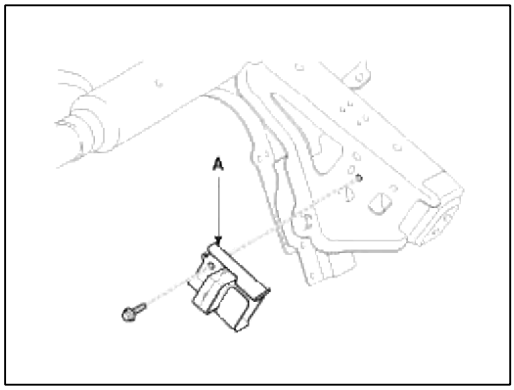


ENCRYPTED SMARTRA unit (A)

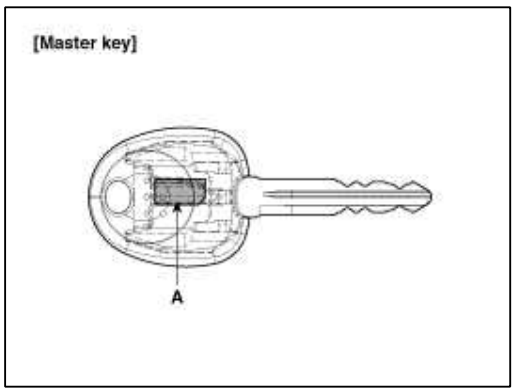
The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad close to center cross bar.

The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.

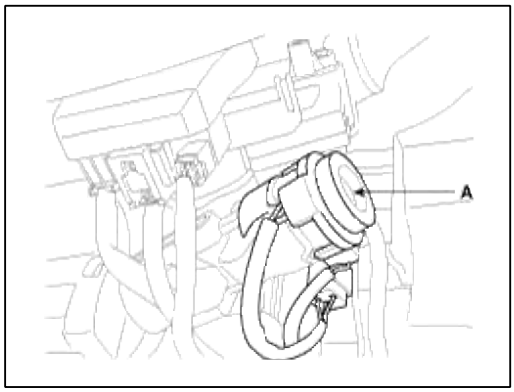
The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.



TRANSPONDER (Built-in keys)
The transponder (A) has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.



Antenna coil
The antenna coil (A) has the following functions.
- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA.
  It is located directly in front of the steering handle lock.



Body Electrical System > Immobilizer System > Repair procedures

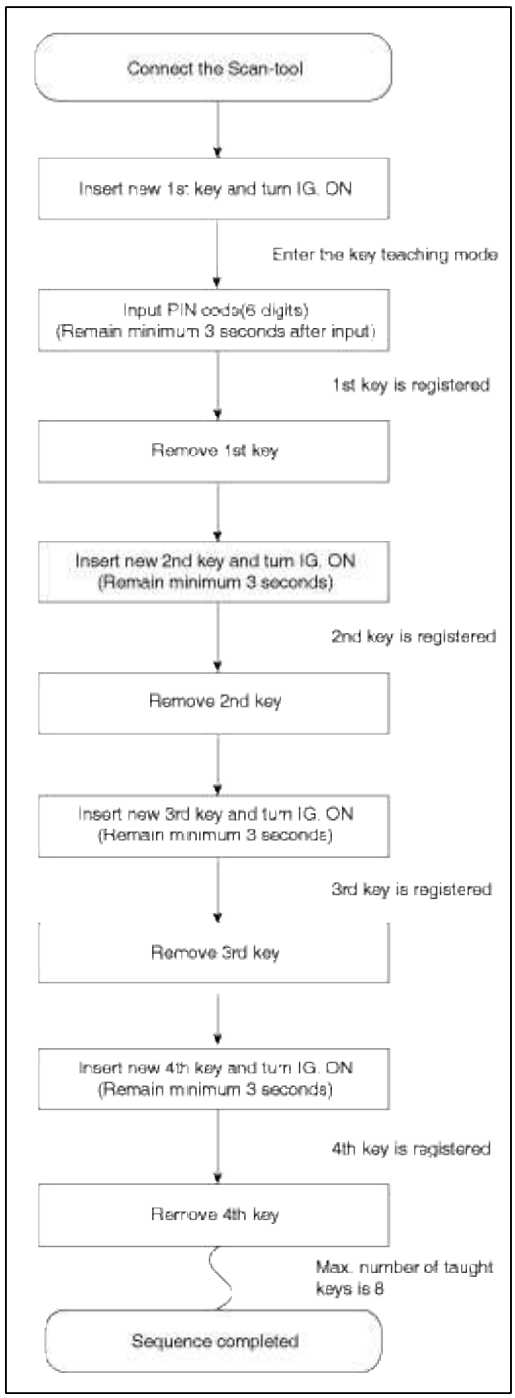
Teaching Procedures

1. Key Teaching Procedure
   Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehic owner.
   The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. Th "virgin" PCM(ECM) stores the vehicle specific data and the key teaching can be started. The "learnt" PCM(ECM compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can pr If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the re of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. reconnecting the battery, the timer starts again for one hour.
   The key teaching is done by ignition on with the key and additional tester commands. The PCM(ECM) stores the relevant data in the EEPROM and in the transponder. Then the PCM(ECM) runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.
   If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and t EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder)

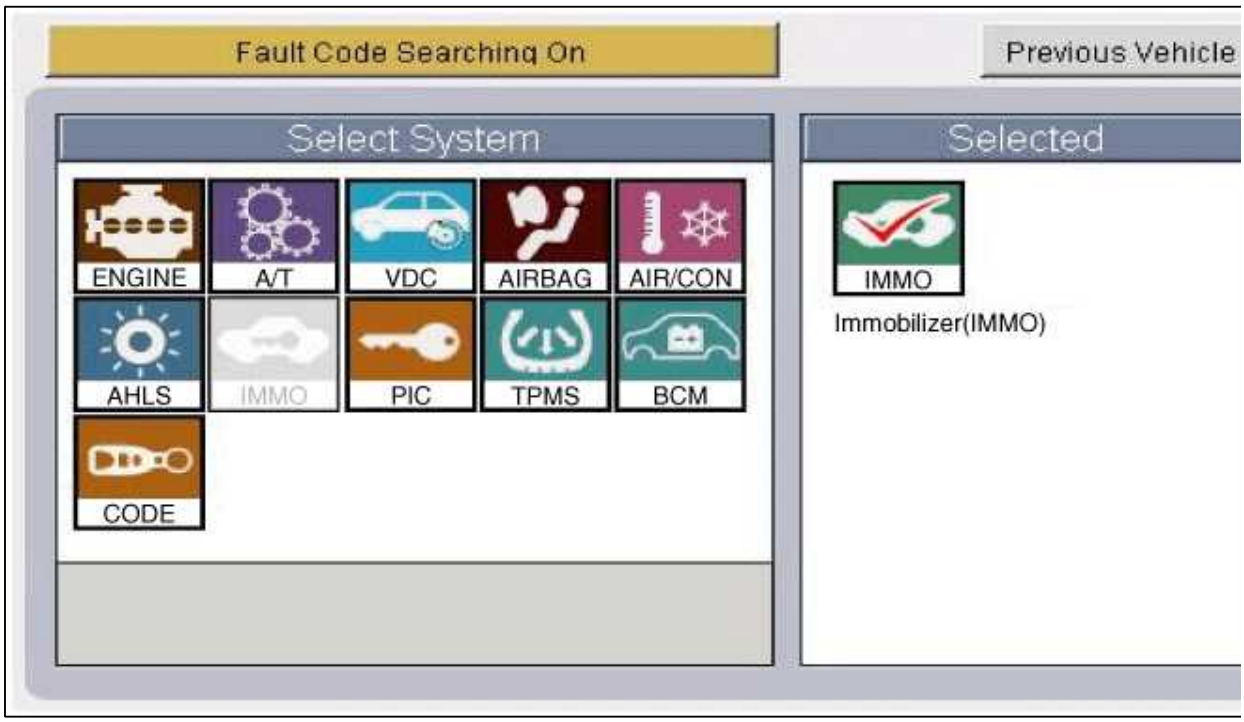
The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognize the PCM(ECM). This rejects the key and a message is sent to the tester.
The PCM(ECM) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key c invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the PCM(ECM) detects different authenticators of a transponder and an PCM(ECM), the key is considered to be inv
The maximum number of taught keys is 8
If an error occurs during the Immobilizer Service Menu, the PCM(ECM) status remains unchanged and a specific code is stored.
If the PCM(ECM) status and the key status do not match for teaching of keys, the tester procedure will be stoppe a specific fault code will be stored at PCM(ECM).

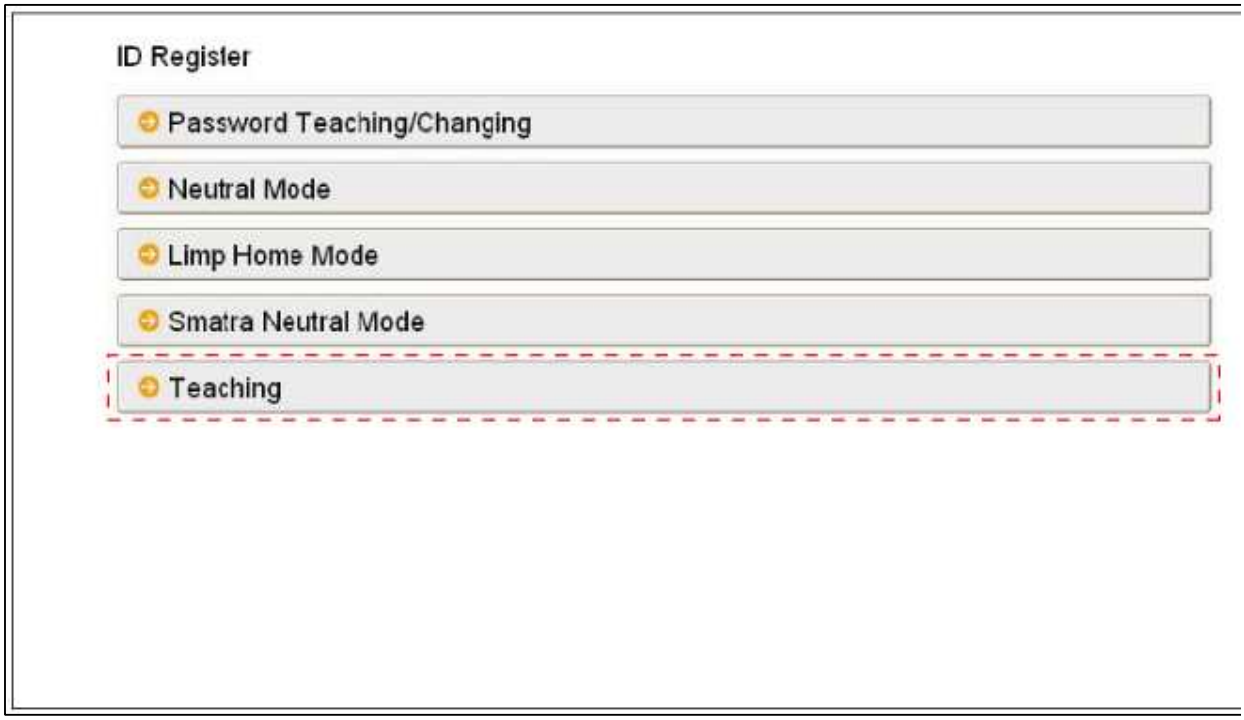
NOTE

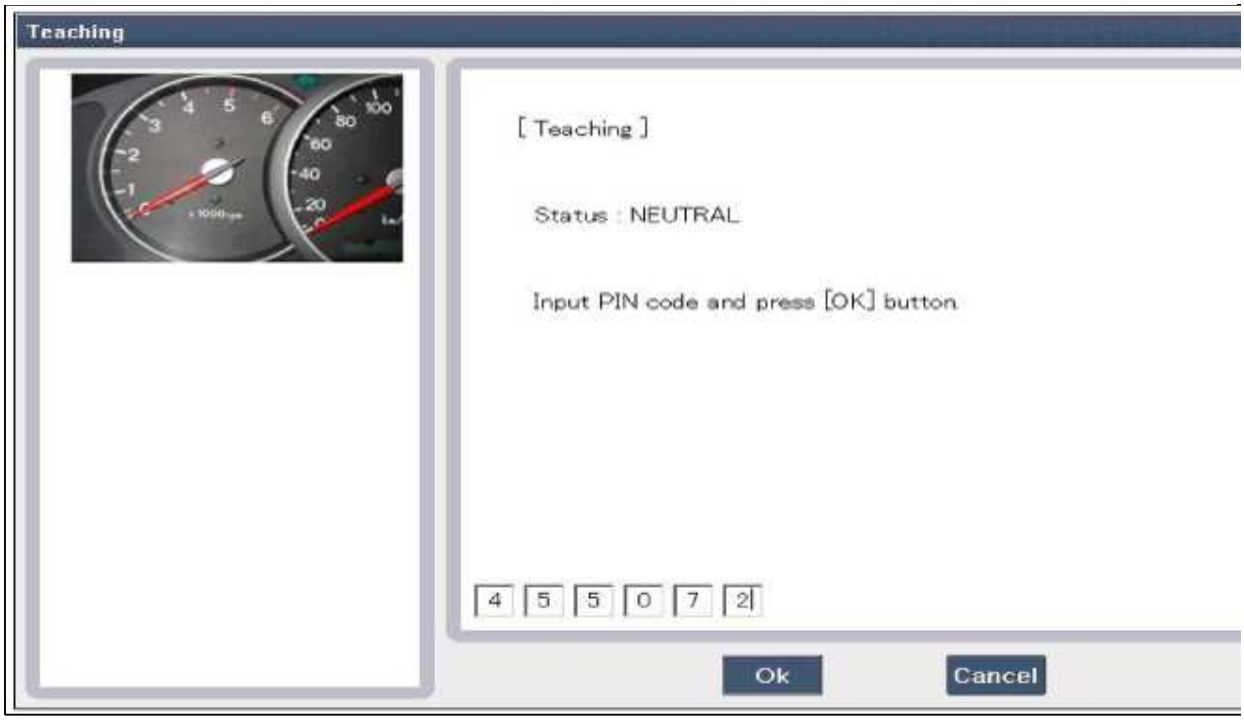
When teaching the 1st key, Smartra regists at the same time.



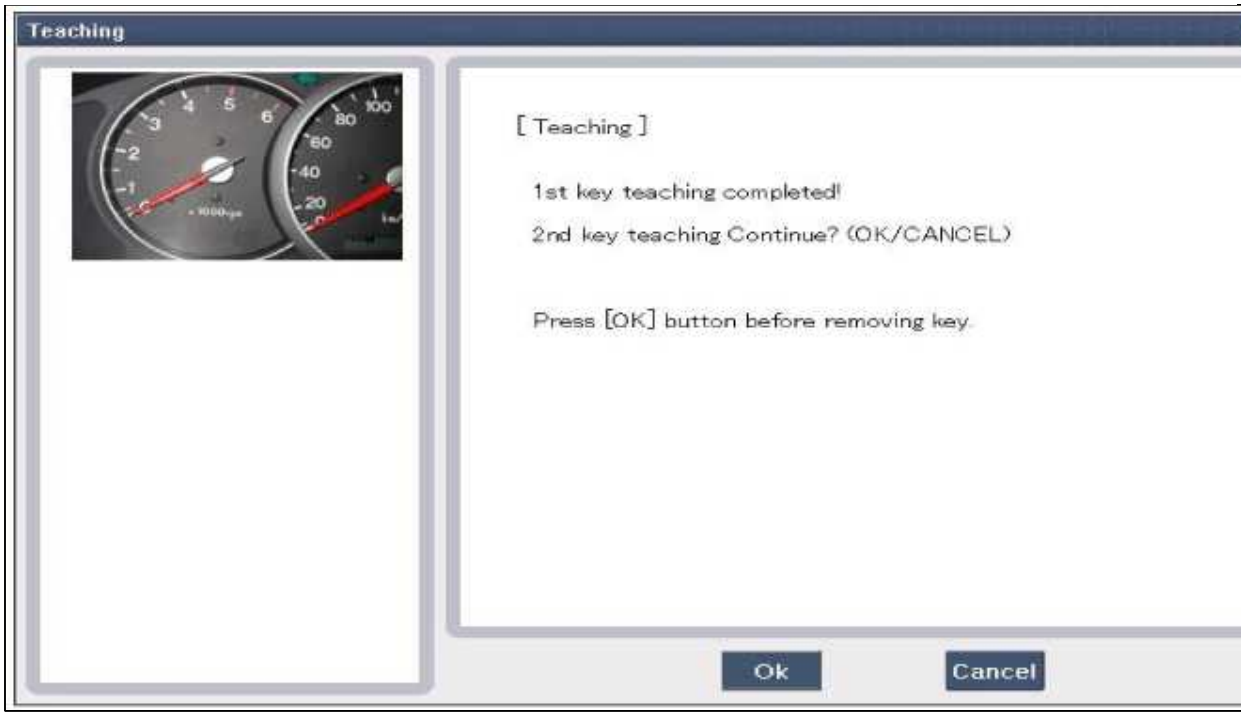
(1) PCM(ECM) learnt status.

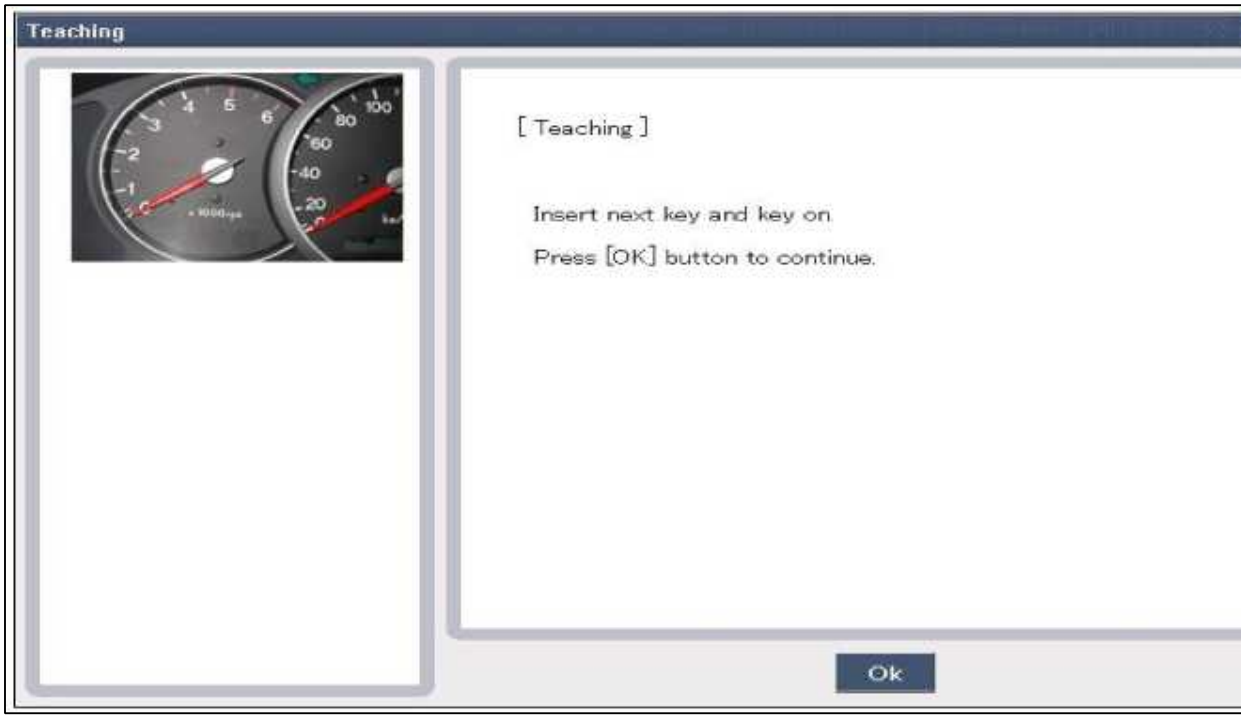


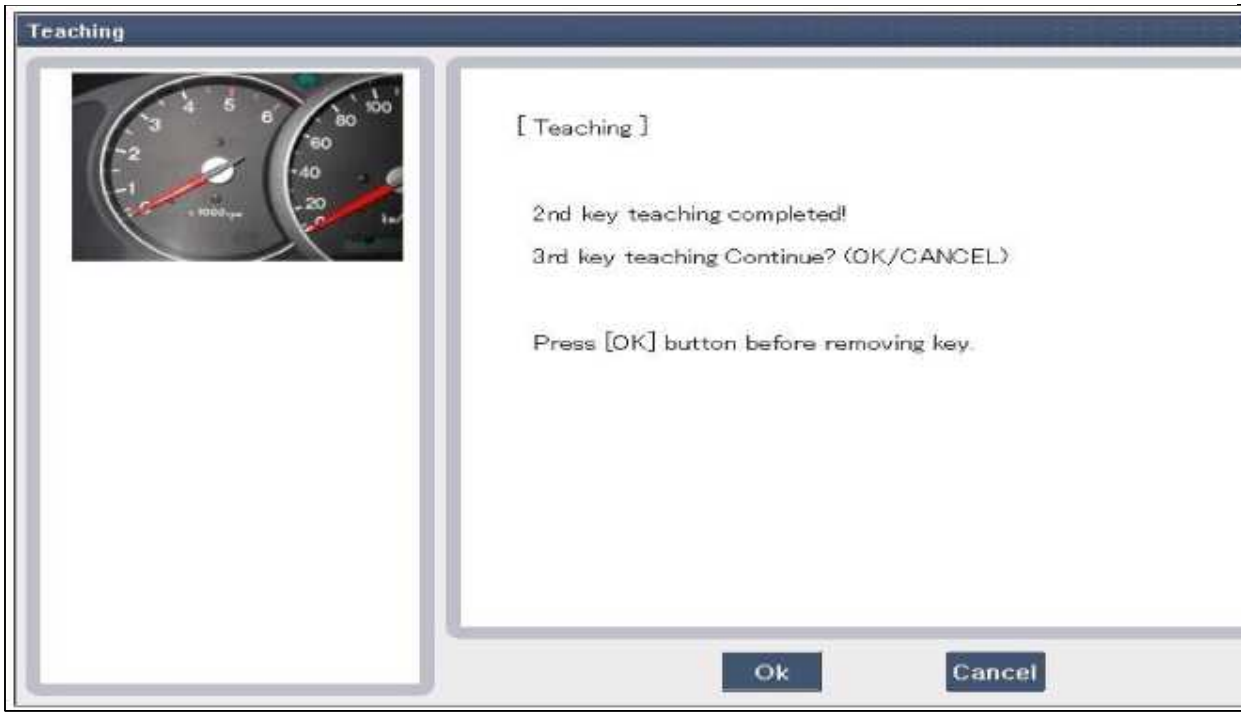


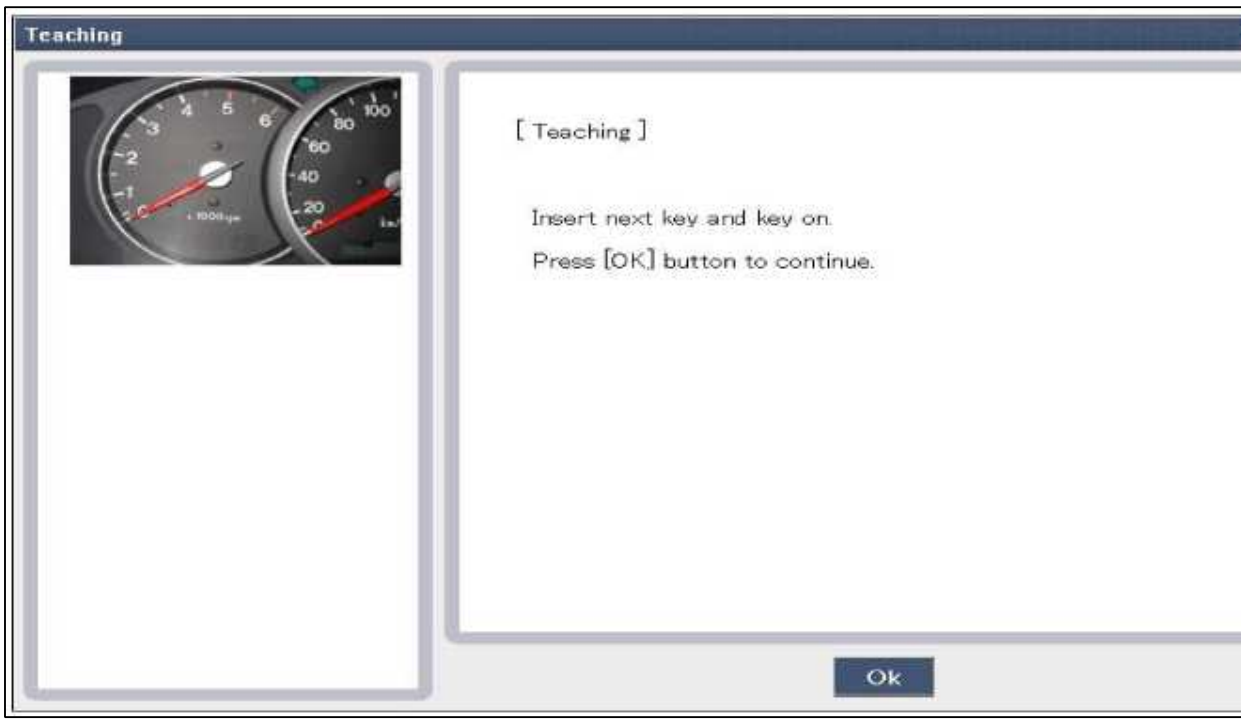

Teaching
[Teaching]
Status : NEUTRAL
Input PIN code and press [OK] button
4 5 5 0 7 2
Ok
Cancel

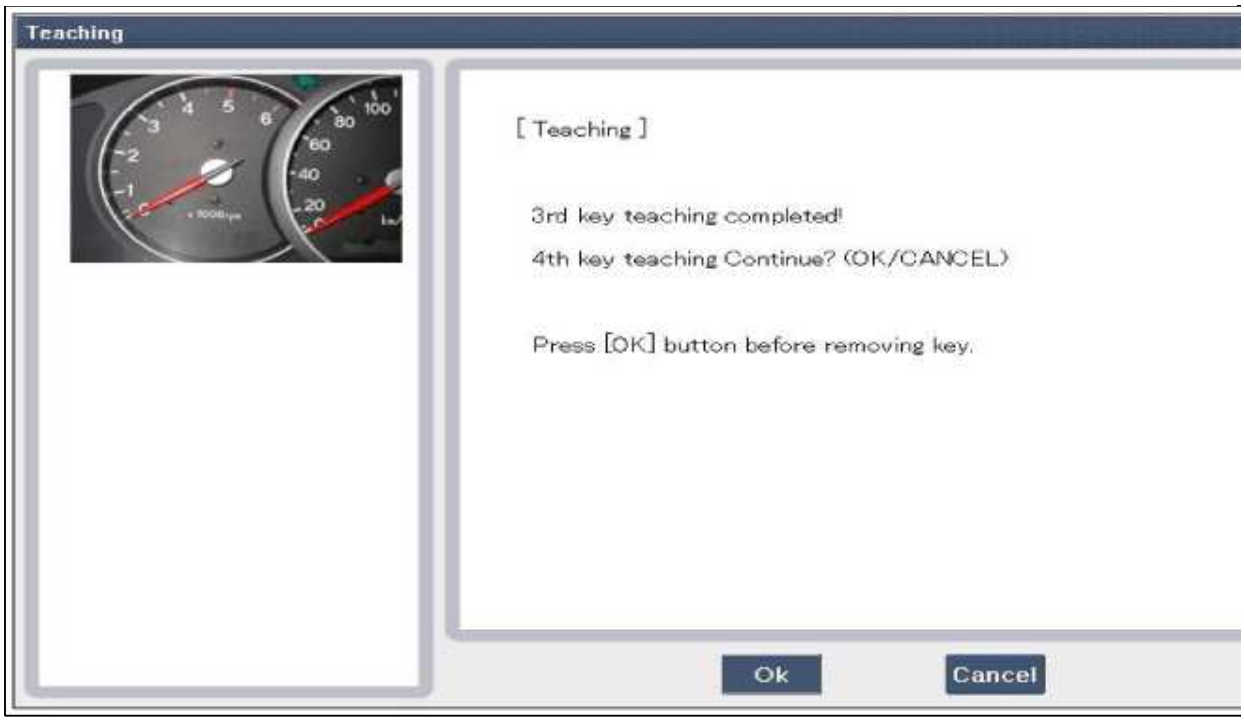

Teaching
[Teaching]
1st key teaching
Continue? (OK/CANCEL)
Ok
Cancel

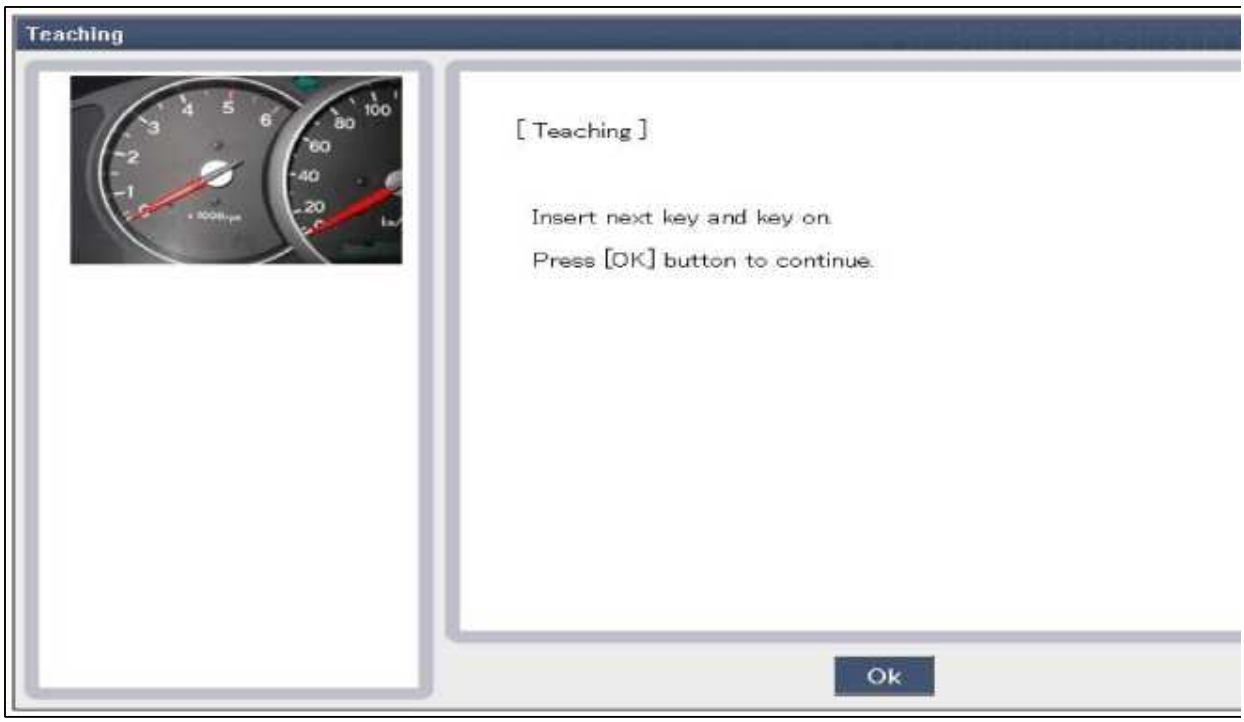

Teaching
[Teaching]
1st key teaching completed!
2nd key teaching Continue? (OK/CANCEL)
Press [OK] button before removing key.
Ok
Cancel

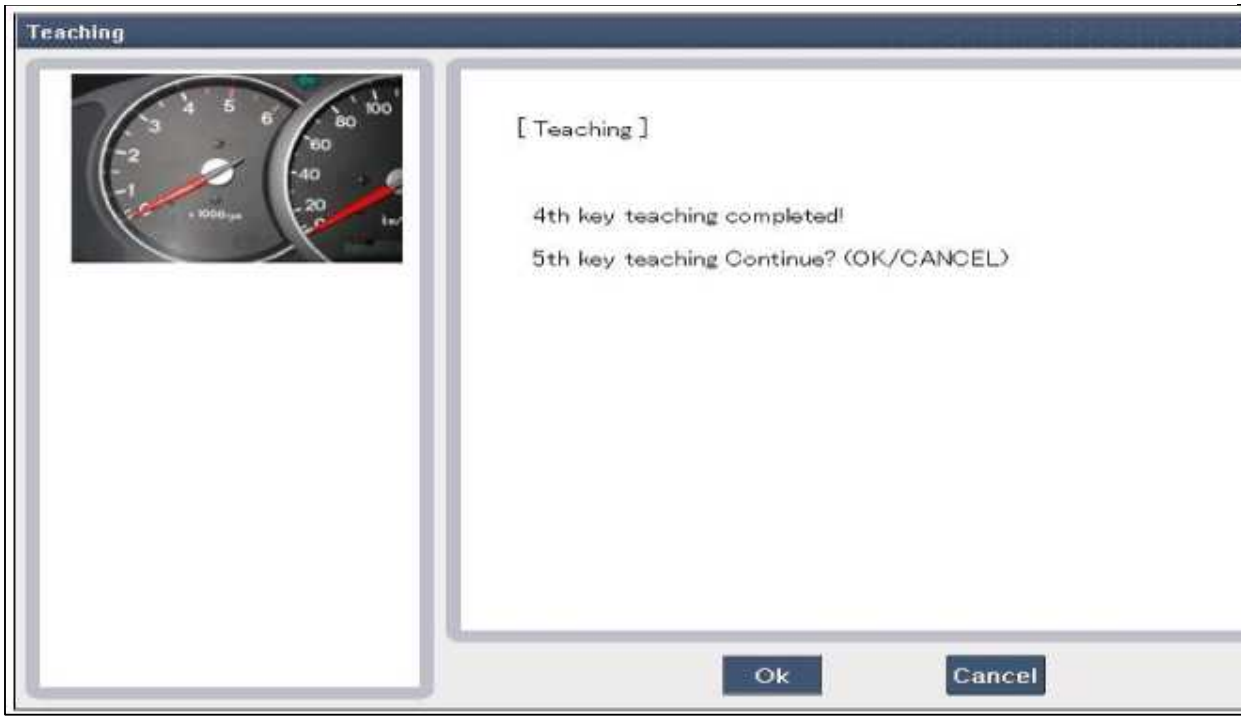

Teaching
[Teaching]
Insert next key and key on.
Press [OK] button to continue.
Ok


Teaching
[Teaching]
2nd key teaching completed!
3rd key teaching Continue? (OK/CANCEL)
Press [OK] button before removing key.
Ok
Cancel


Teaching
[Teaching]
Insert next key and key on.
Press [OK] button to continue.
Ok


Teaching
[Teaching]
3rd key teaching completed!
4th key teaching Continue? (OK/CANCEL)
Press [OK] button before removing key.
Ok
Cancel


Teaching
[Teaching]
Insert next key and key on.
Press [OK] button to continue.
Ok



(2) PCM(ECM) virgin status.

After replacing new "PCM(ECM)" scan tool displays that PCM(ECM) is virgin status in Key Teaching mode. "VIRGIN" status means that PCM(ECM) has not matched any PIN code before.

Password Teaching/changing

1. User Password Teaching Procedure

The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.

The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to an PCM(ECM), the status of the password is "virgin" No limp home function is possible.

The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"

The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuously or intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

2. User password teaching

ID Register

- Password Teaching/Changing
- Neutral Mode
- Limp Home Mode
- Smatra Neutral Mode
- Teaching

Password Teaching/Changing

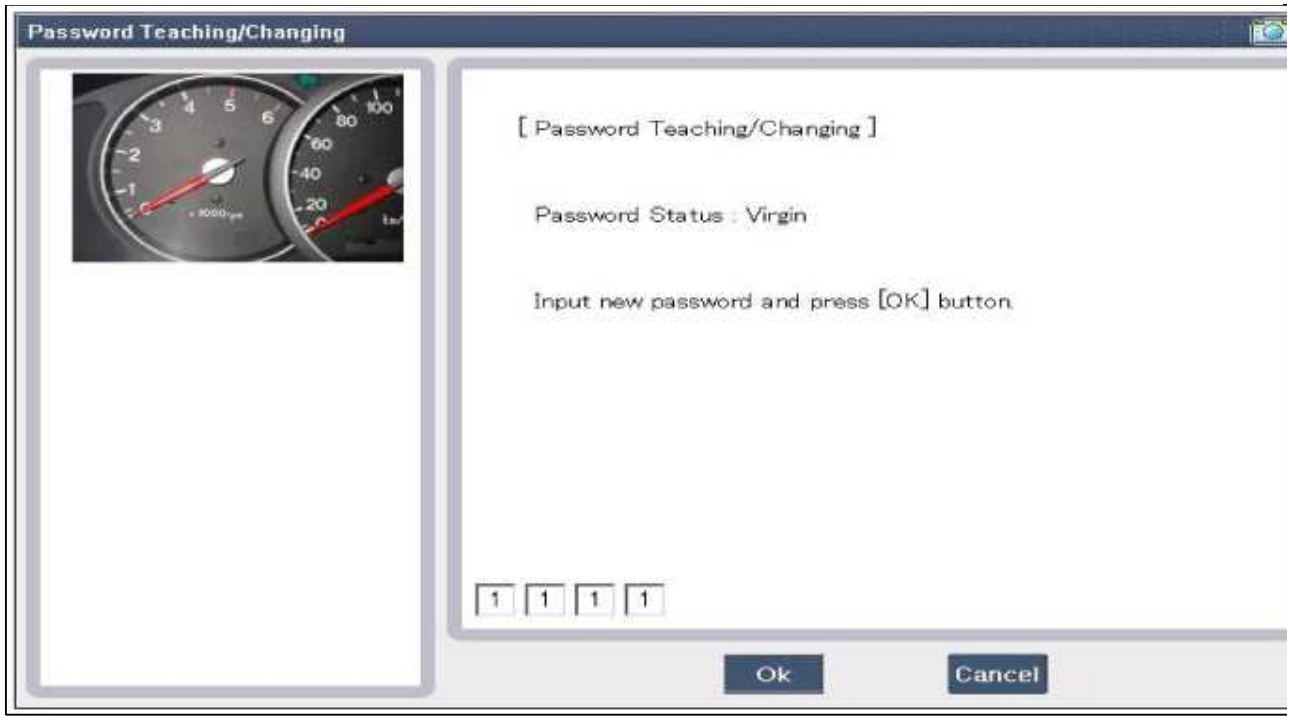


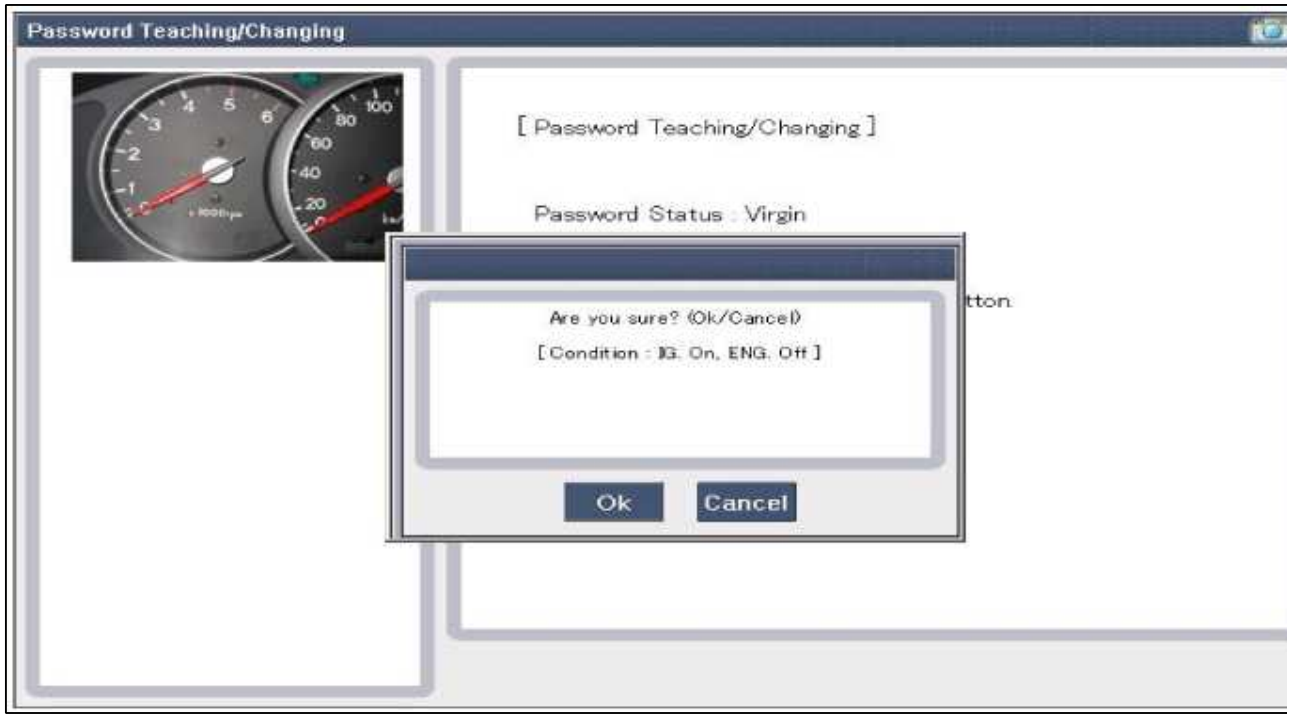
[Password Teaching/Changing]

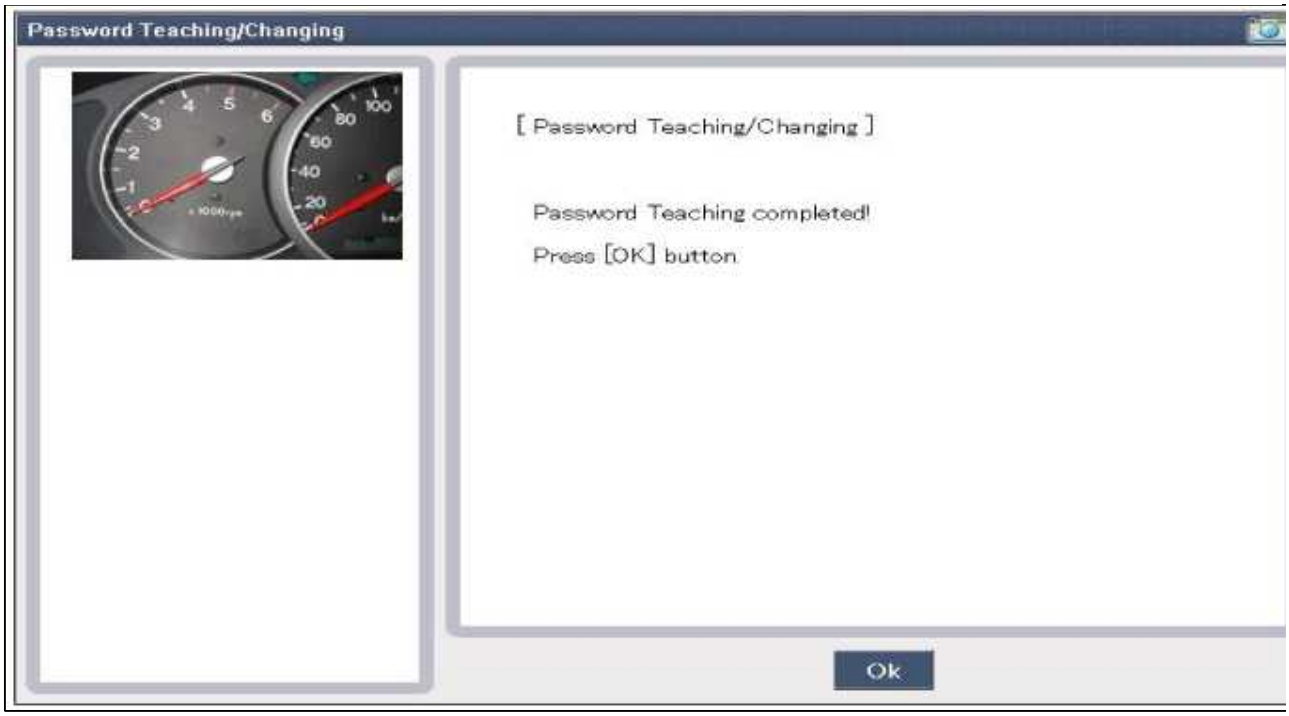
Password Status : Virgin

Input new password and press [OK] button.

Ok Cancel

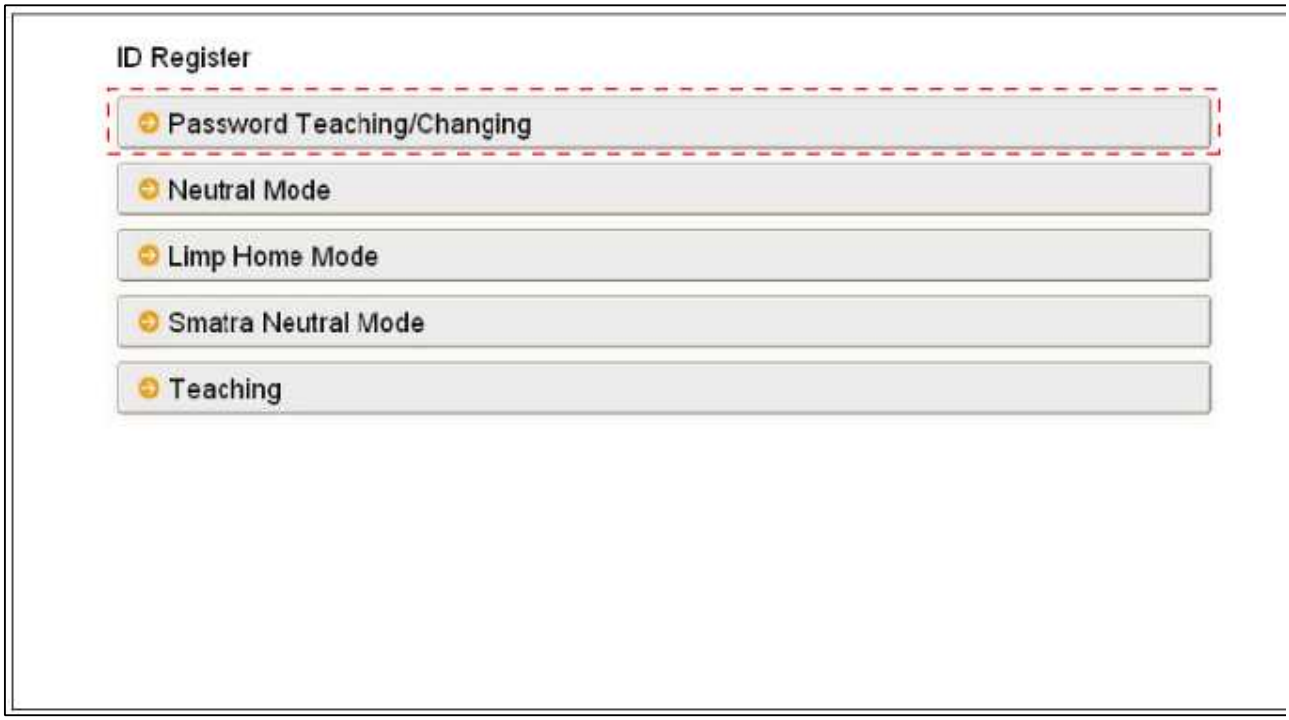

Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Virgin
Input new password and press [OK] button.
1 1 1 1
Ok
Cancel

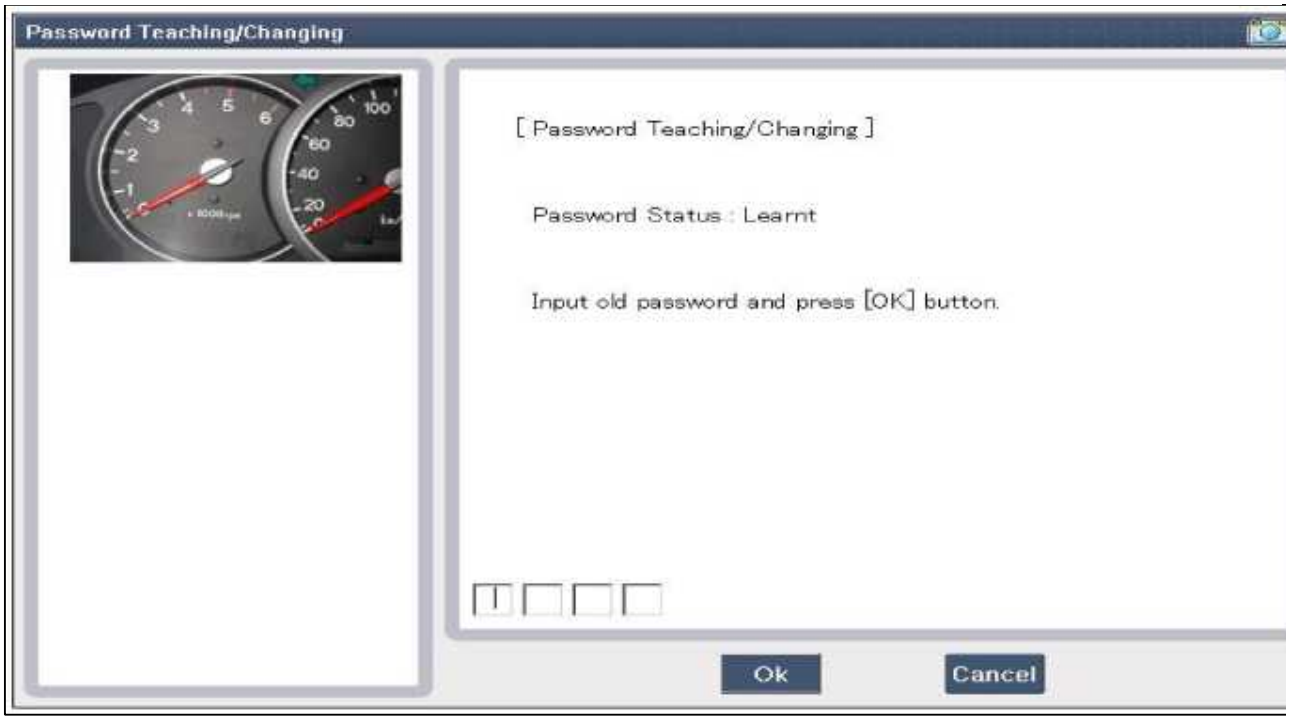

Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Virgin
Are you sure? (Ok/Cancel)
[Condition : IG. On, ENG. Off]
Ok
Cancel

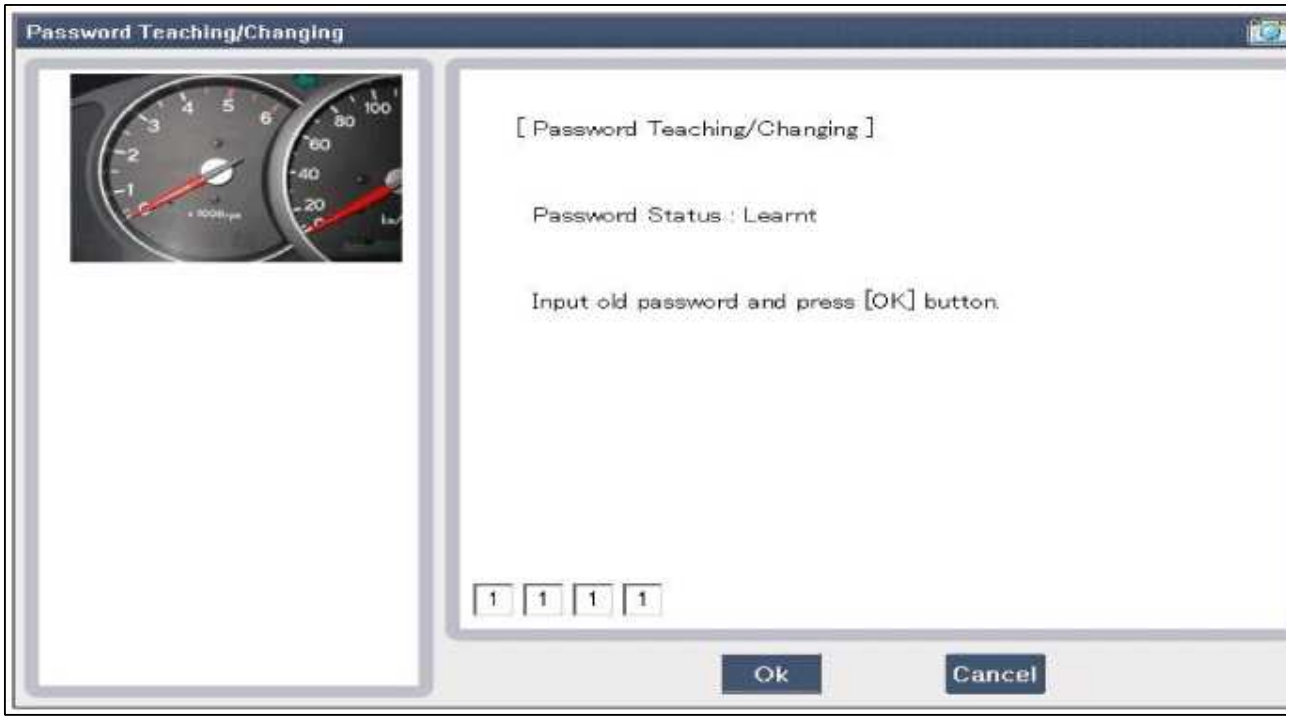


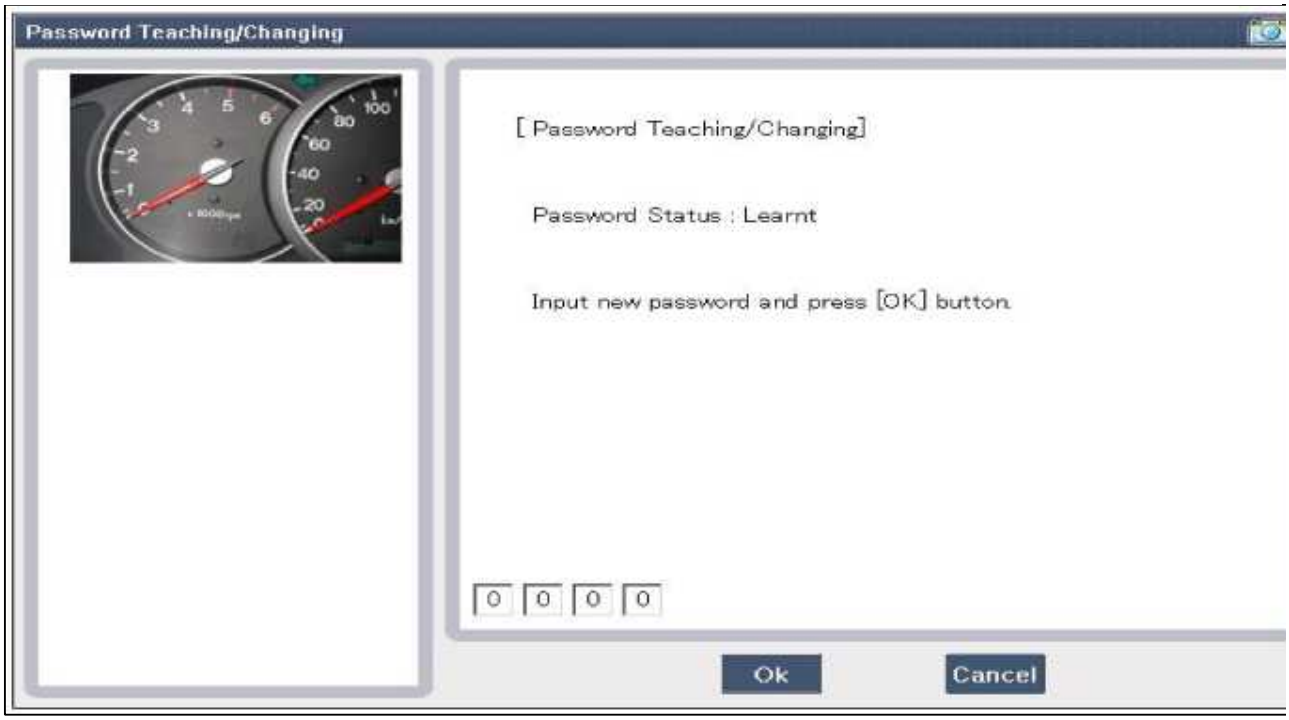
In case of putting wrong password, retry from first step after 10 seconds.

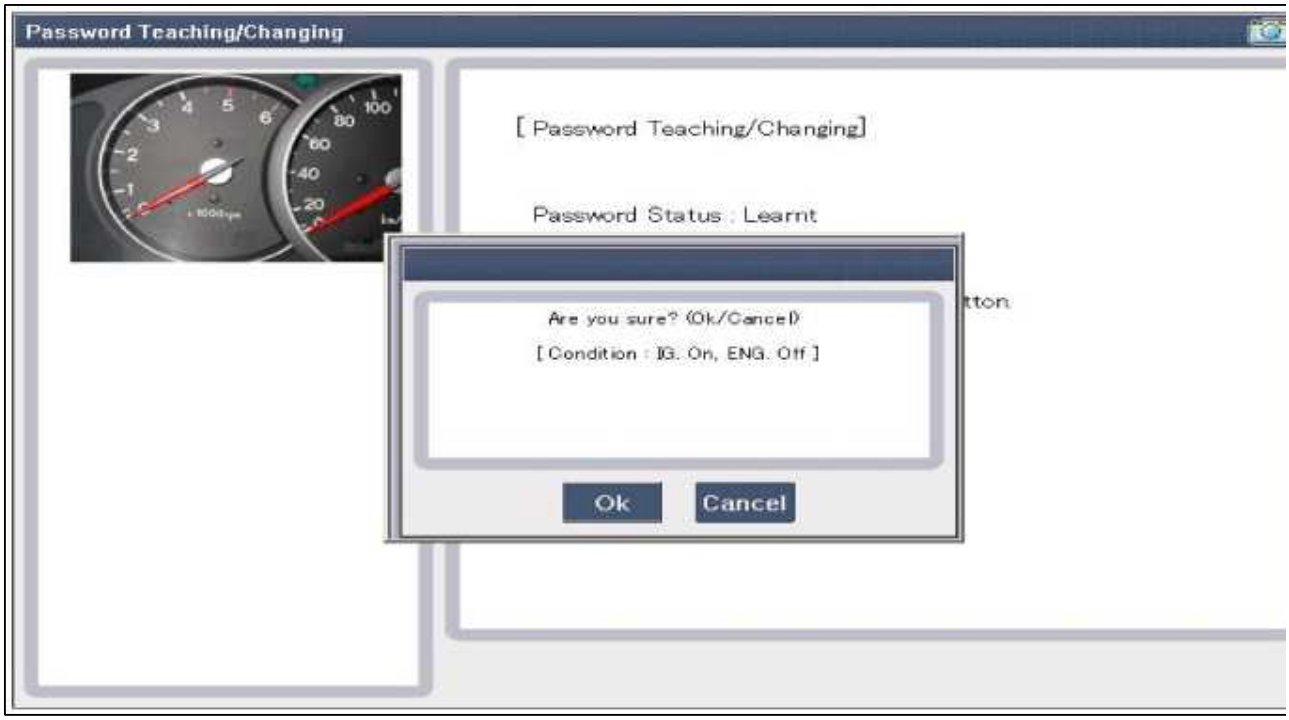
3. User password changing

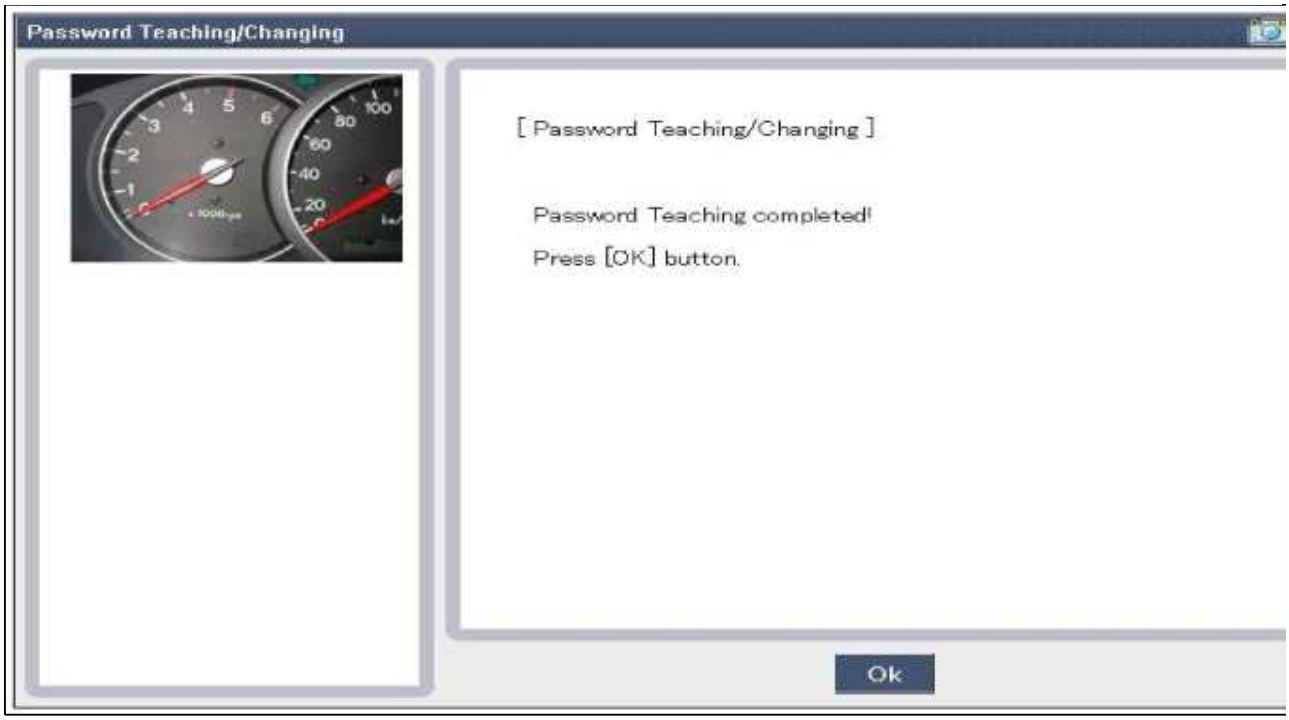



Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Input old password and press [OK] button.
1
Ok
Cancel


Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Input old password and press [OK] button.
1 1 1 1
Ok
Cancel


Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Input new password and press [OK] button
0 0 0 0
Ok
Cancel

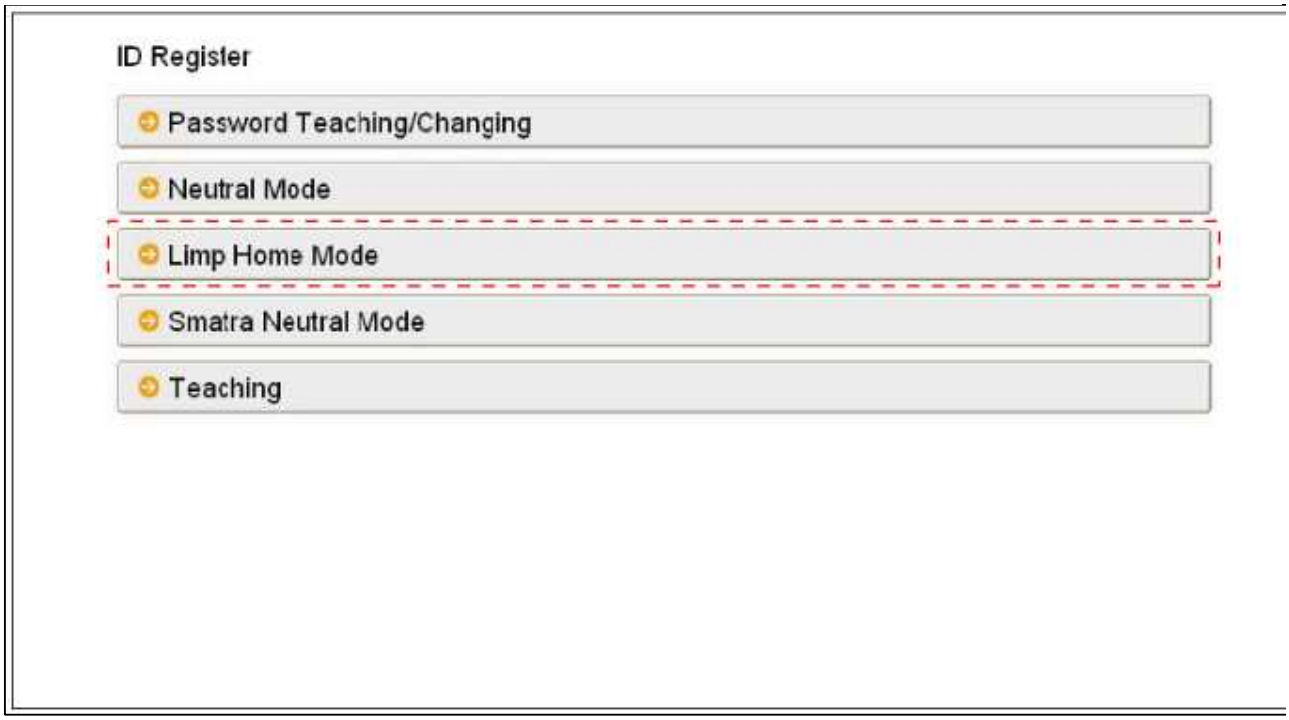

Password Teaching/Changing
[Password Teaching/Changing]
Password Status : Learnt
Are you sure? (Ok/Cancel)
[Condition : IG. On, ENG. Off]
Ok
Cancel

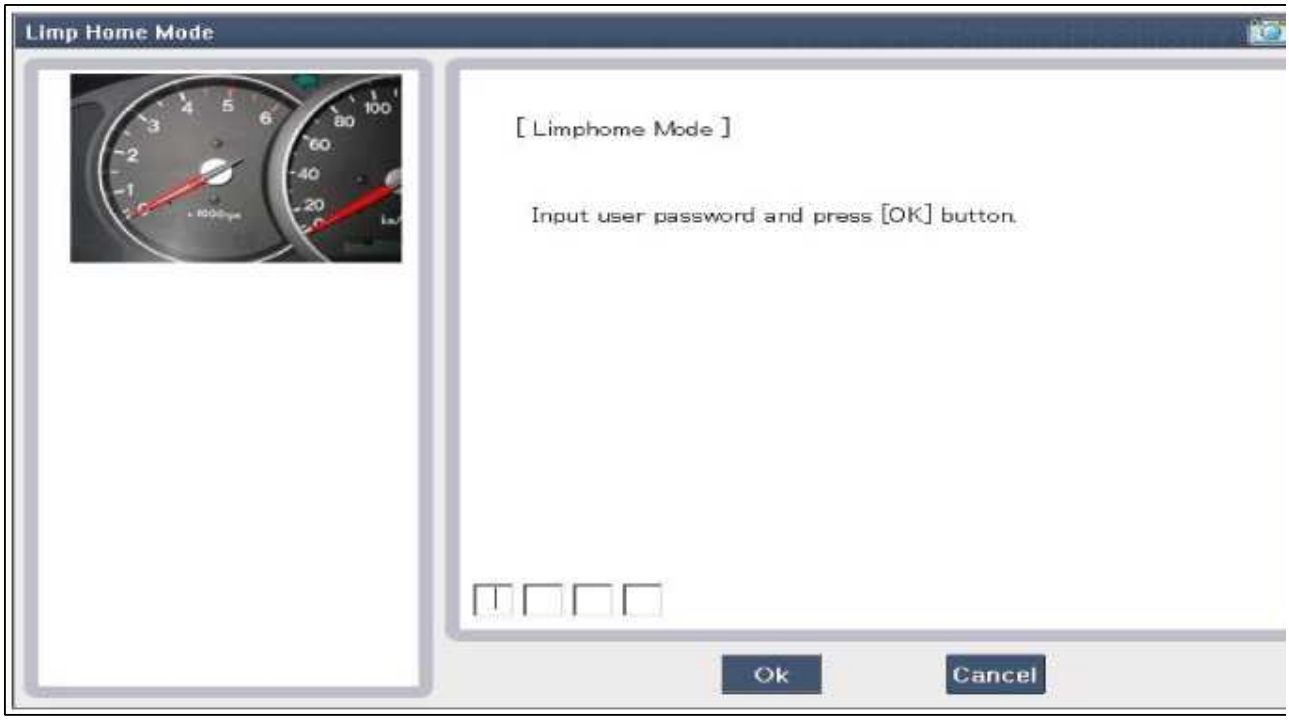


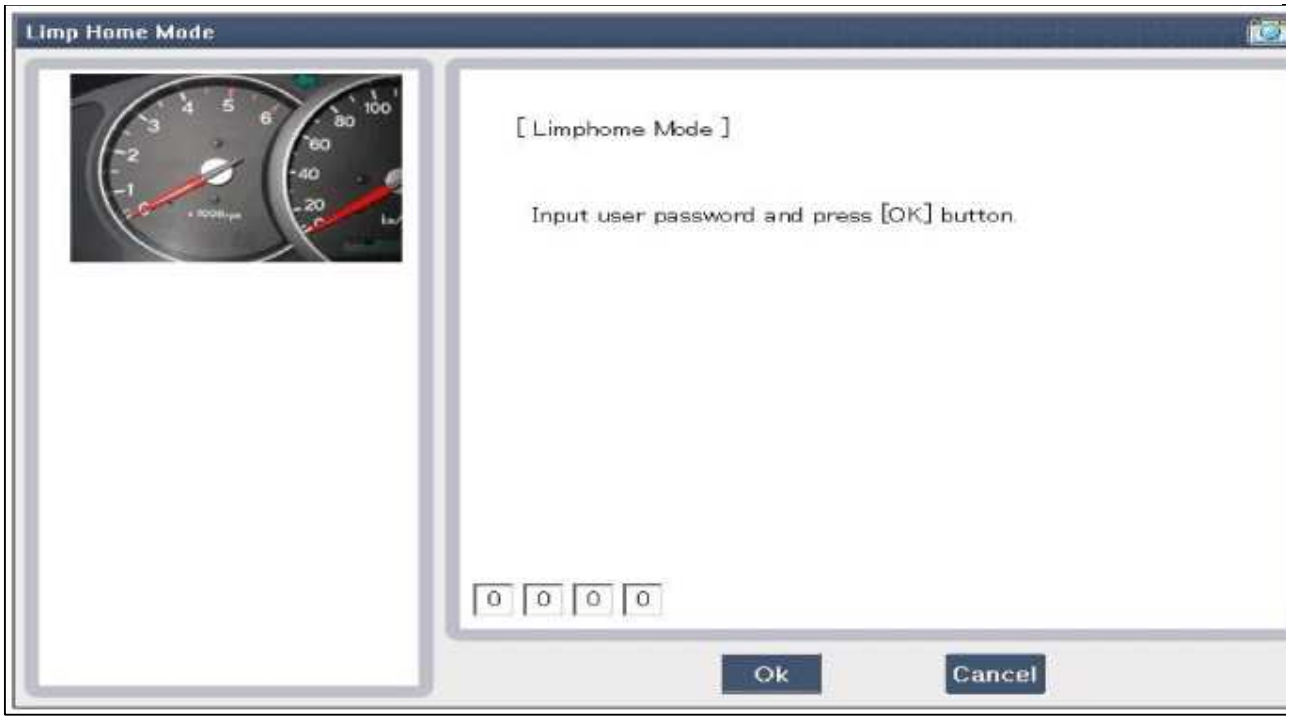
Limp Home Function

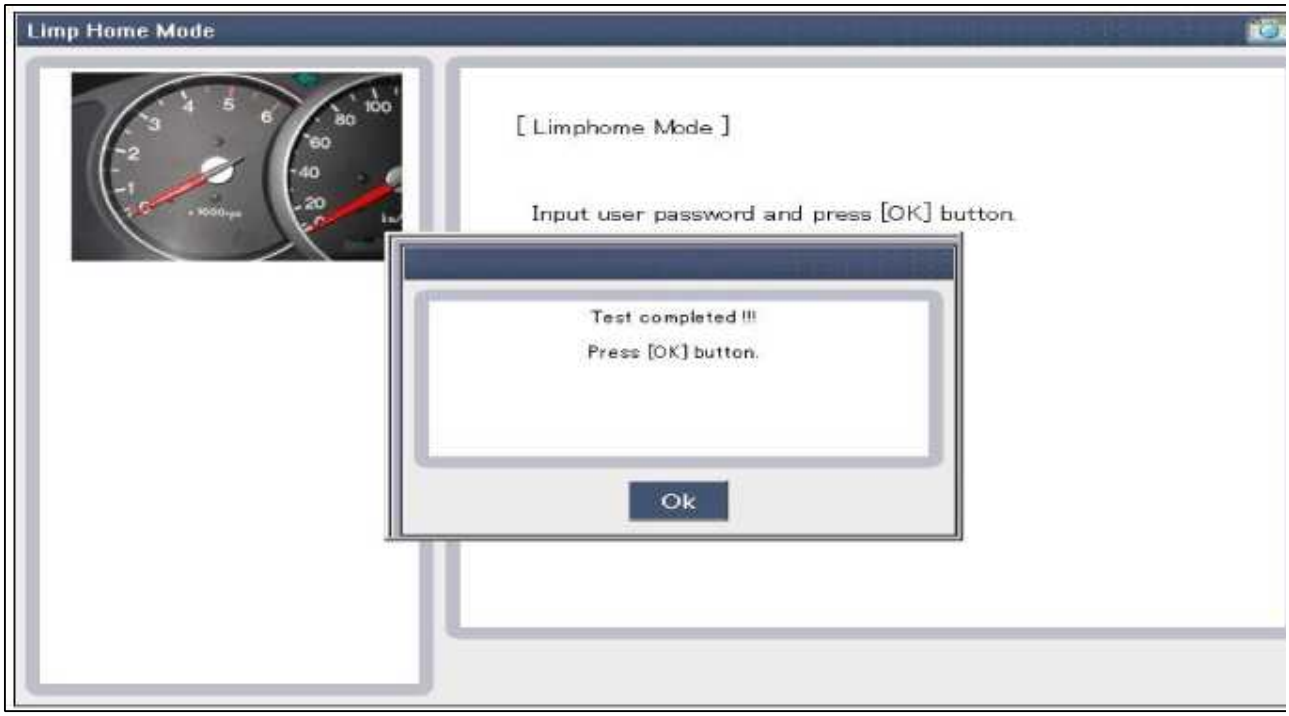
1. Limp Home By Tester

   If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) before. This password can be selected by the vehicle owner and is programmed at the service statio
   The user password can be sent to the PCM(ECM) via the special tester menu.
   Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is corre the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.
   If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour. Disconnecti the battery or any other action cannot reduce this time. After connecting the battery to the PCM(ECM), the timer starts again for one hour.


ID Register
Password Teaching/Changing
Neutral Mode
Limp Home Mode
Smatra Neutral Mode
Teaching


Limp Home Mode
[Limphome Mode]
Input user password and press [OK] button.
Ok
Cancel



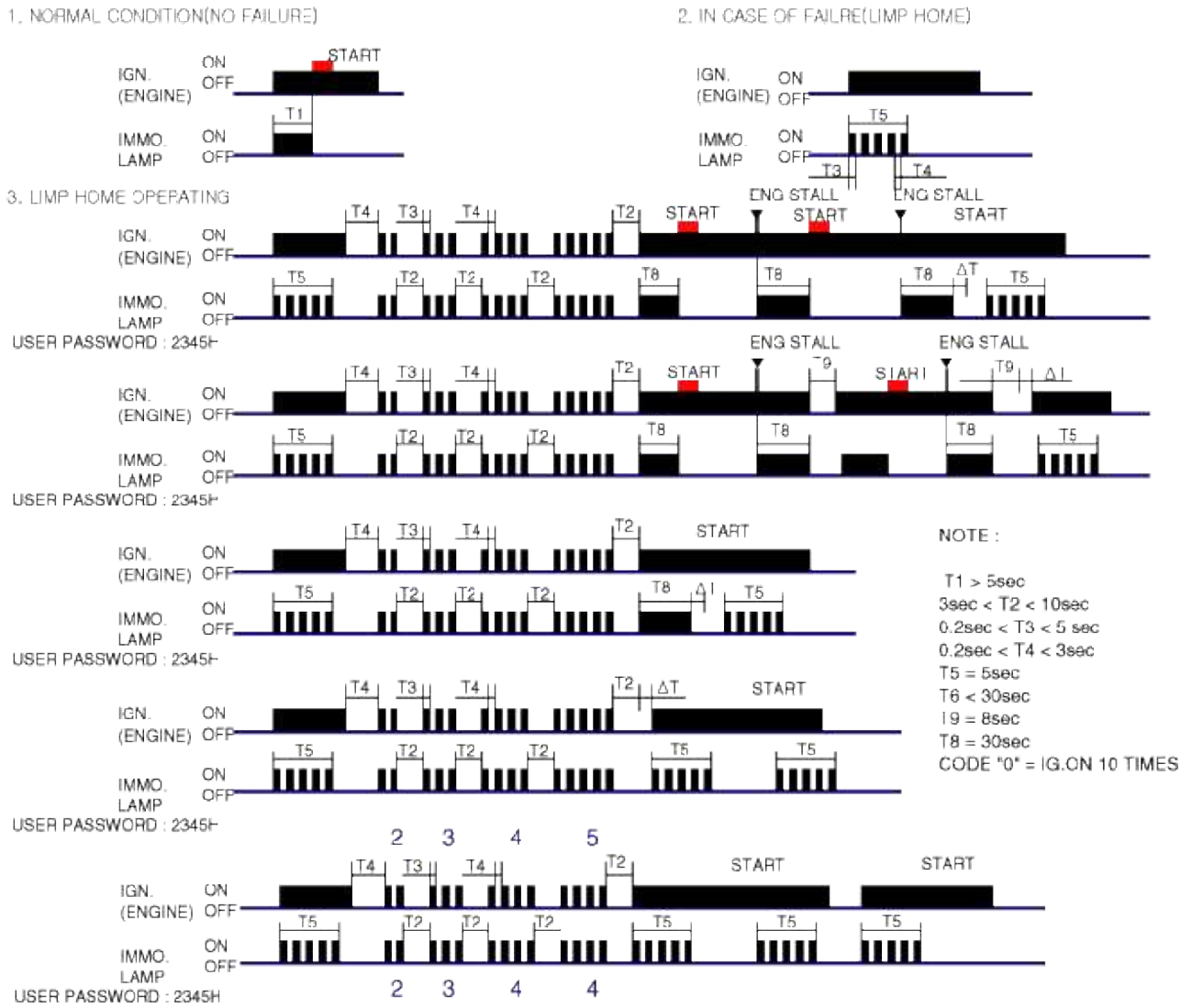


2. Limp Home By Ignition Key

The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.

After ignition off, the PCM(ECM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



Replacement

Problems And Replacement Parts:

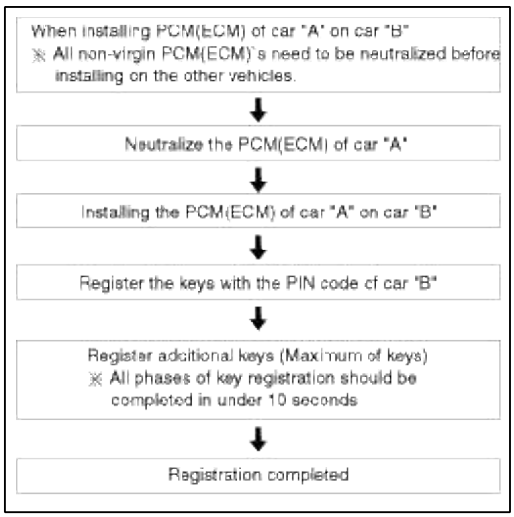
Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	PCM(ECM)	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, PCM(ECM)	YES
SMARTRA unit does not work	SMARTRA unit	YES

Replacement Of Ecm And Smartra

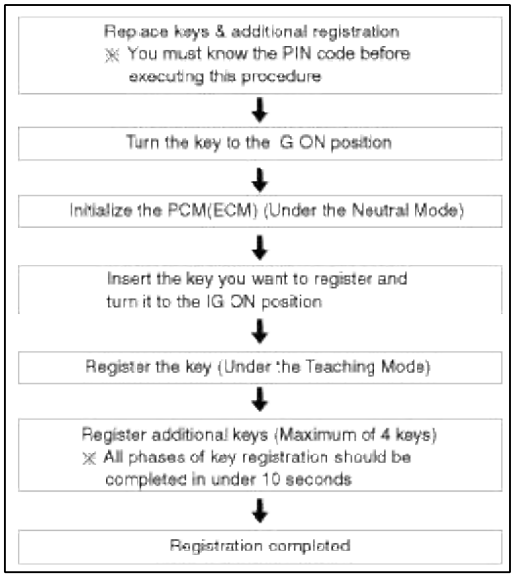
In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught

to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder. In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one and smartra need teaching.

1. Things to remember before a replacement (PCM(ECM))



2. Things to remember before a replacement (Keys & Additional registration)



NOTE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
   (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
   Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

Neutralizing Of ECM

The PCM(ECM) can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM(ECM).

The teaching of keys follows the procedure described for the virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.

This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach keys.

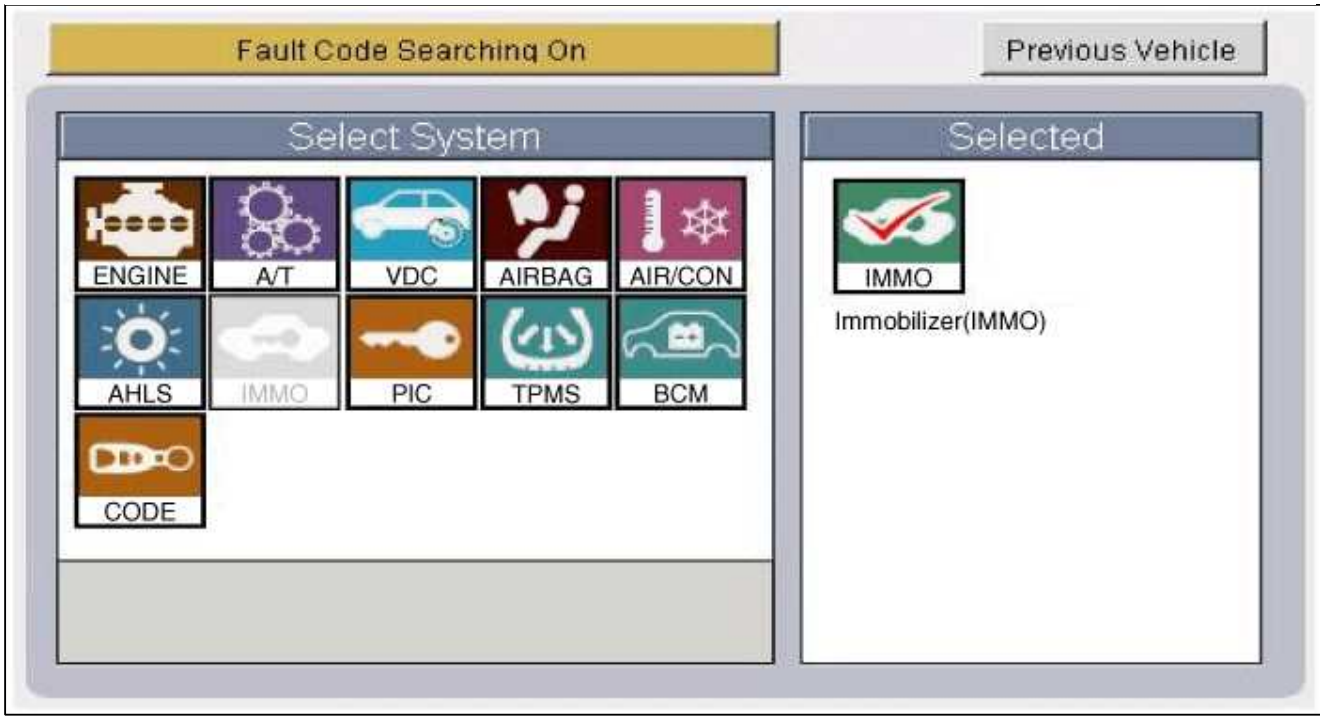
(Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner.

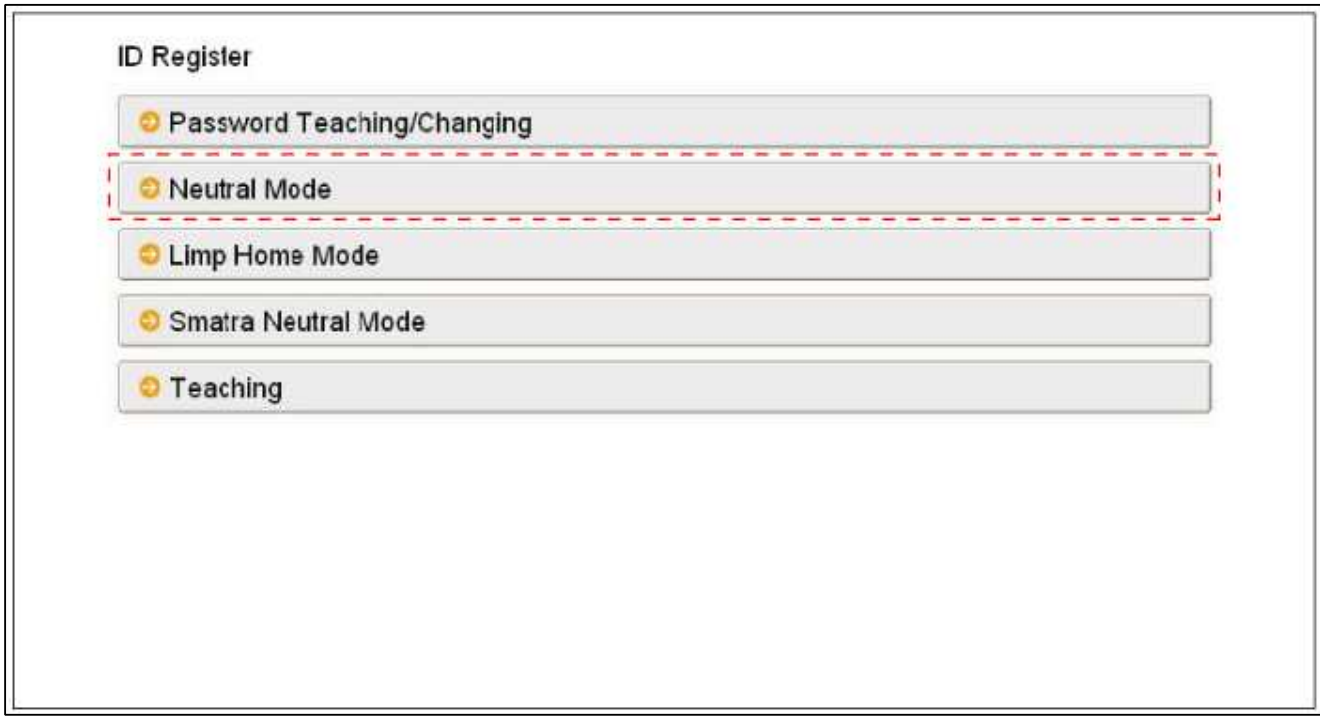
If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

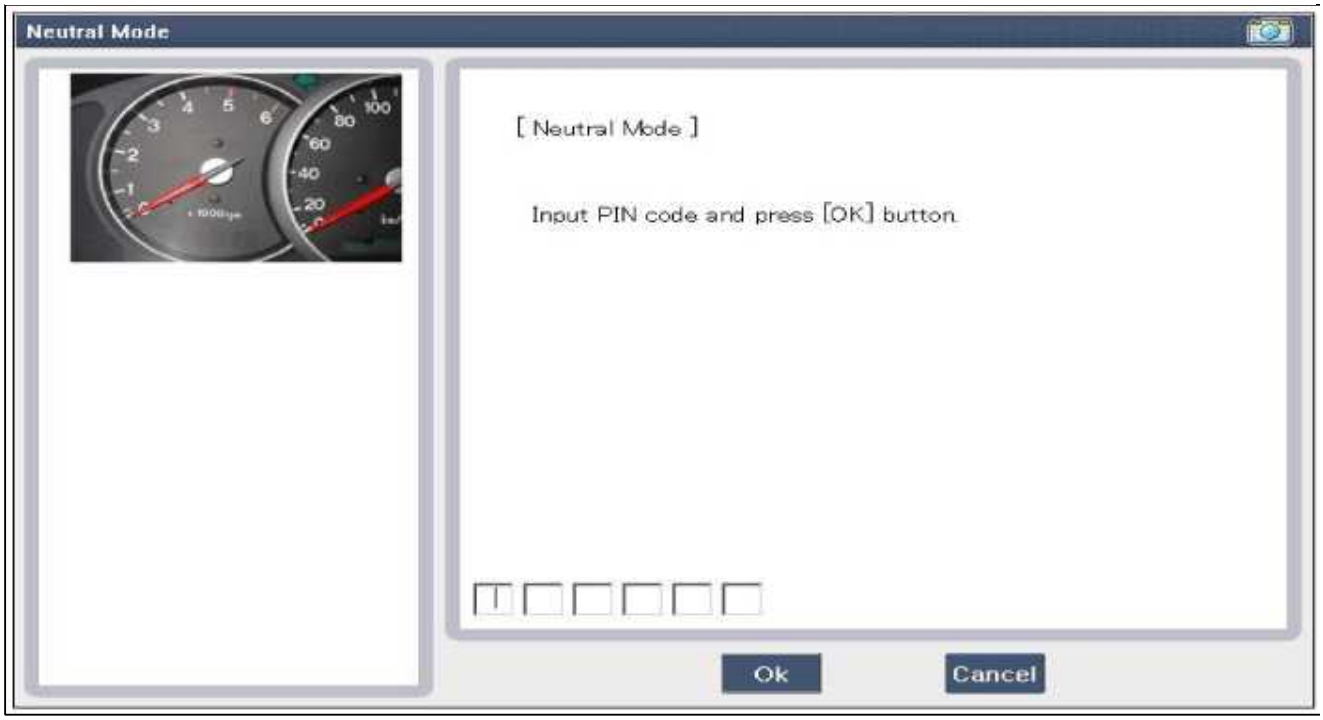
NOTE

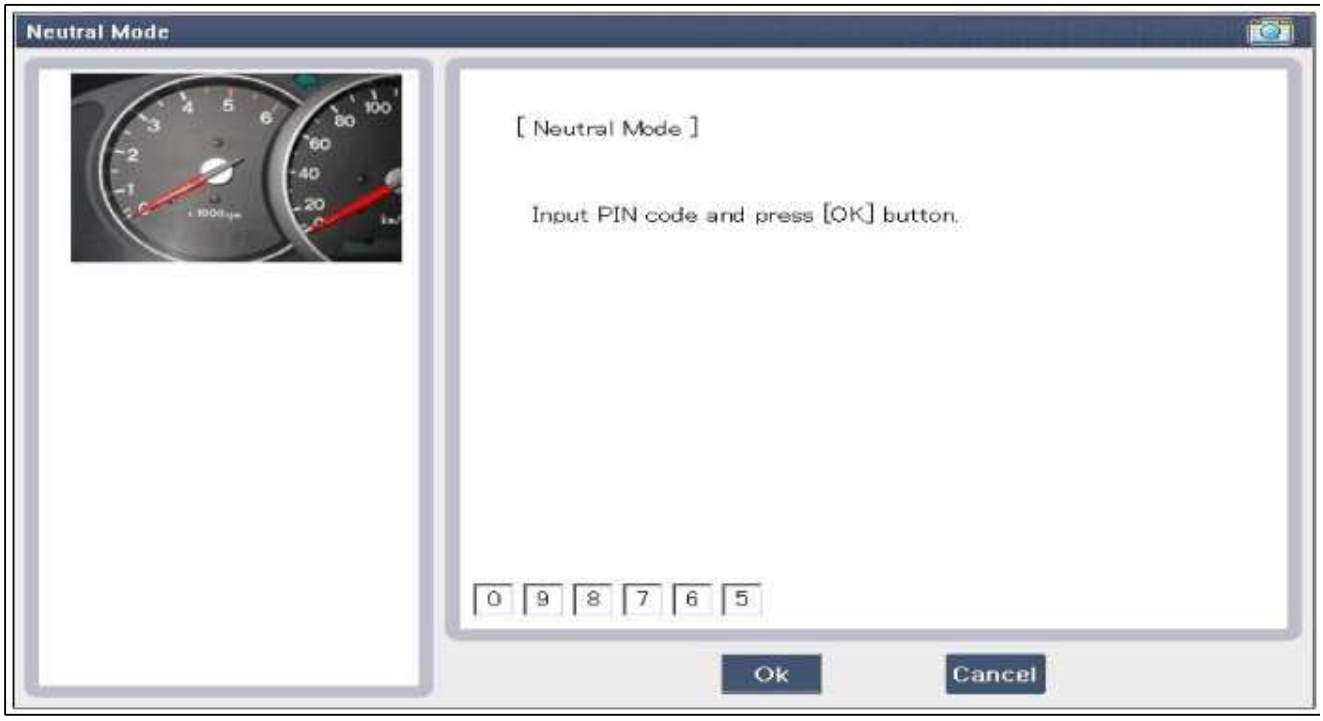
- Neutralizing setting condition
  - In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
    : PIN code (6) & user password (4) deletion.
    : Locking of ECM (except key teaching permission)
- Neutralizing meaning:
  - PIN Code(6) & User P/Word(4) deletion
  - Locking of EMS(except Key Learning permission)

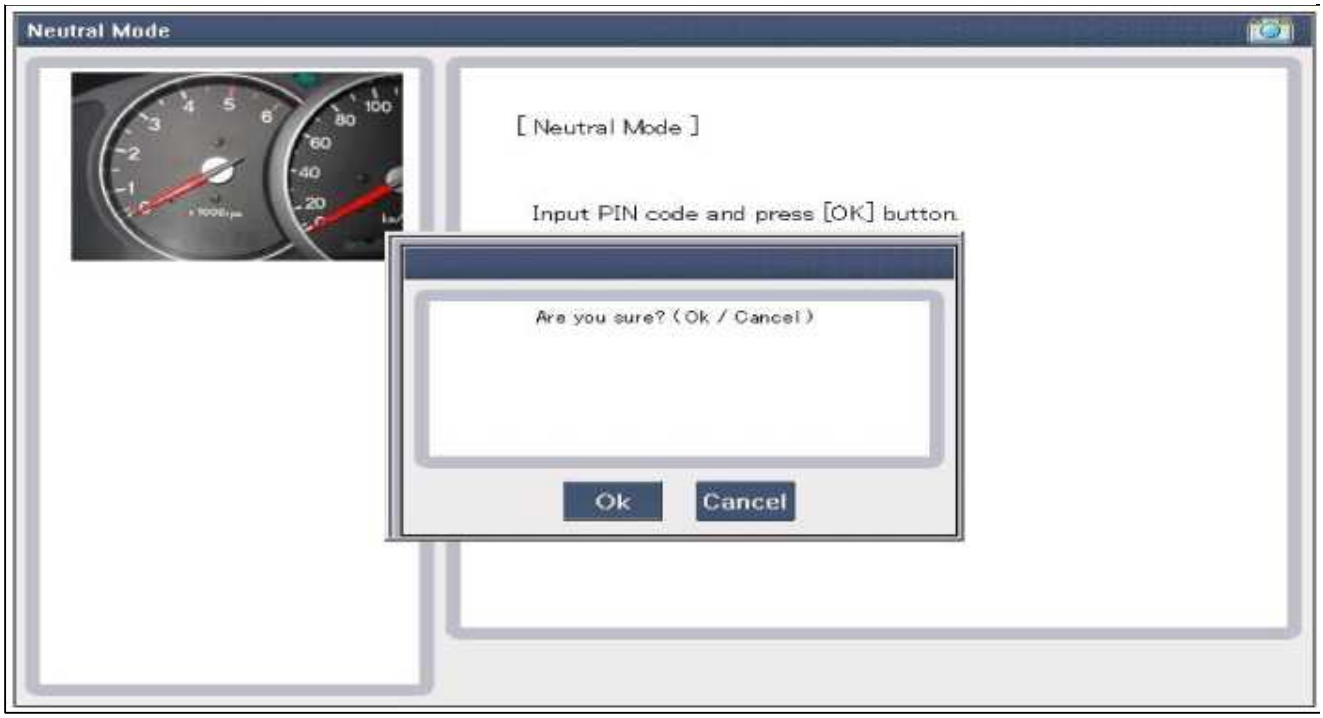
Function / EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No

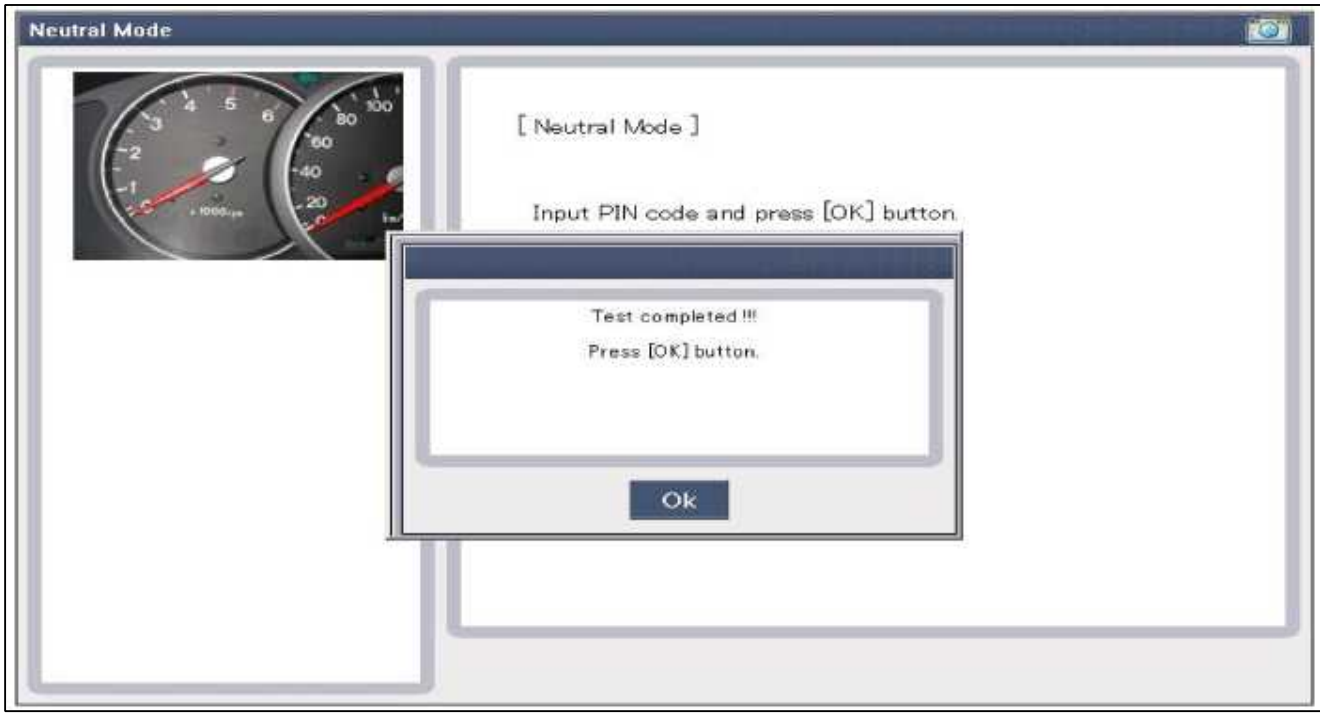

Fault Code Searching On
Previous Vehicle
Select System
ENGINE
A/T
VDC
AIRBAG
AIR/CON
AHLS
IMMO
PIC
TPMS
BCM
CODE
Selected
IMMO
Immobilizer(IMMO)

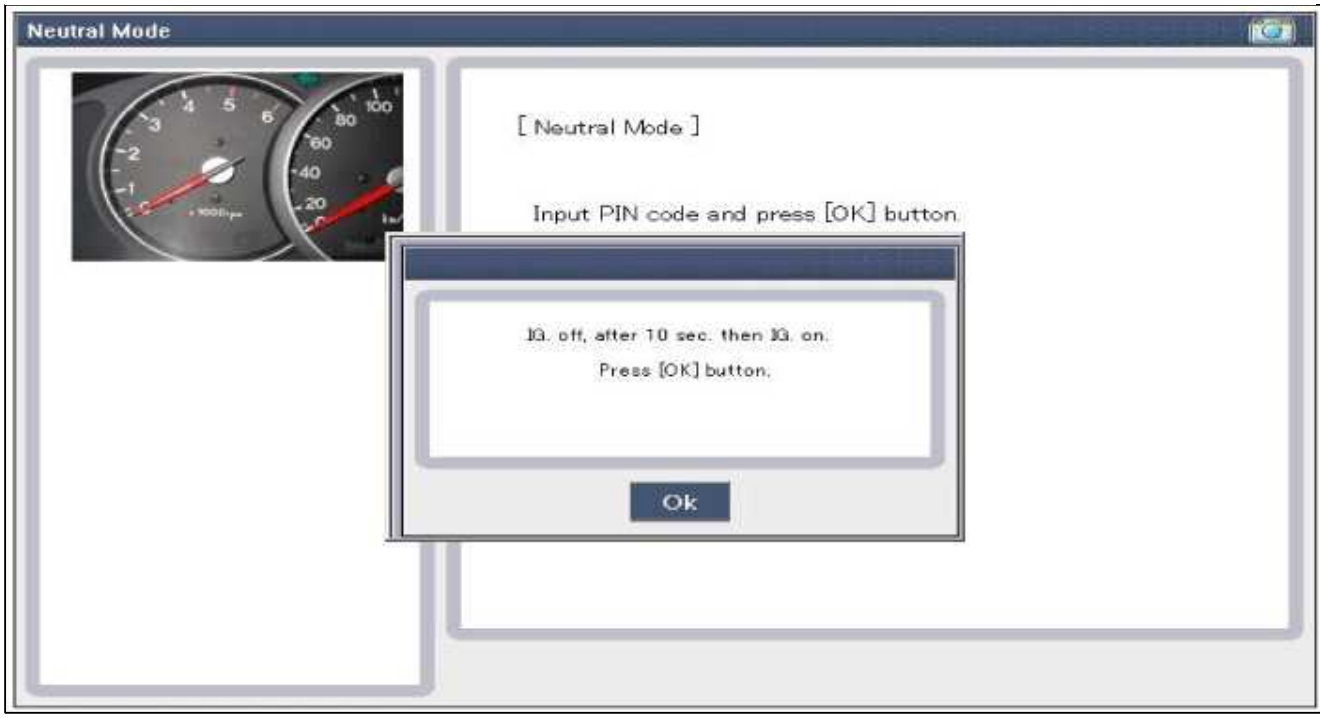

ID Register
Password Teaching/Changing
Neutral Mode
Limp Home Mode
Smatra Neutral Mode
Teaching

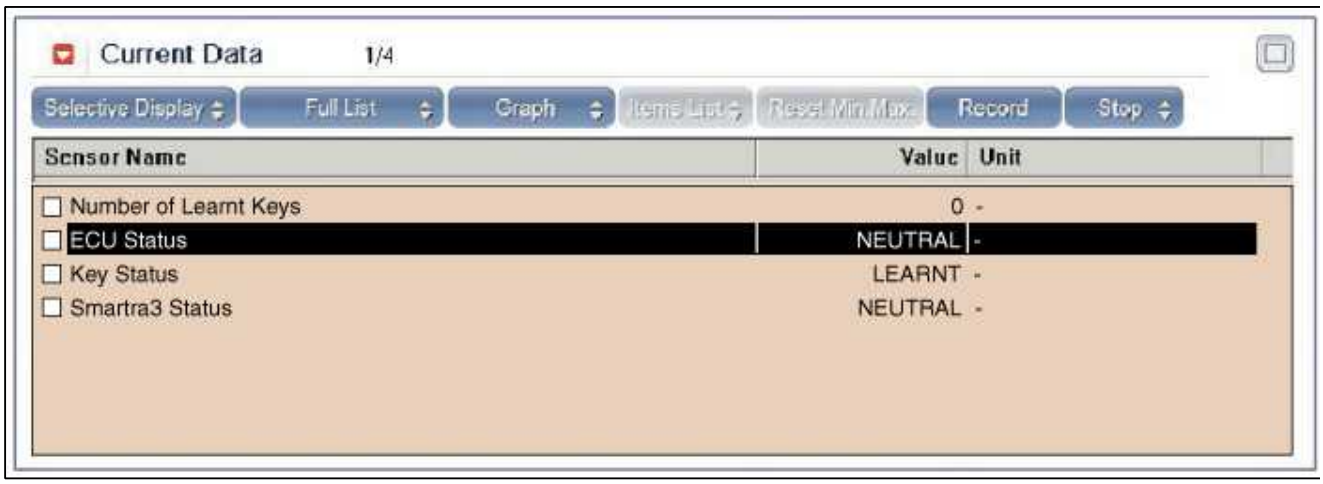

Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
Ok
Cancel


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
0 9 8 7 6 5
Ok
Cancel


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
Are you sure? (Ok / Cancel)
Ok
Cancel


Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
Test completed !!!
Press [OK] button.
Ok





Neutralizing Of SMARTRA

The EMS can be set to the status "neutral" by tester

Ignition key (regardless of key status) is inserted and after IGN ON. If receiving the correct vehicle password from GST, SMARTRA can be neutralized. The neutralization of SMARTRA is possible if DPN is same as the value inputted by GST.

In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice ignition".

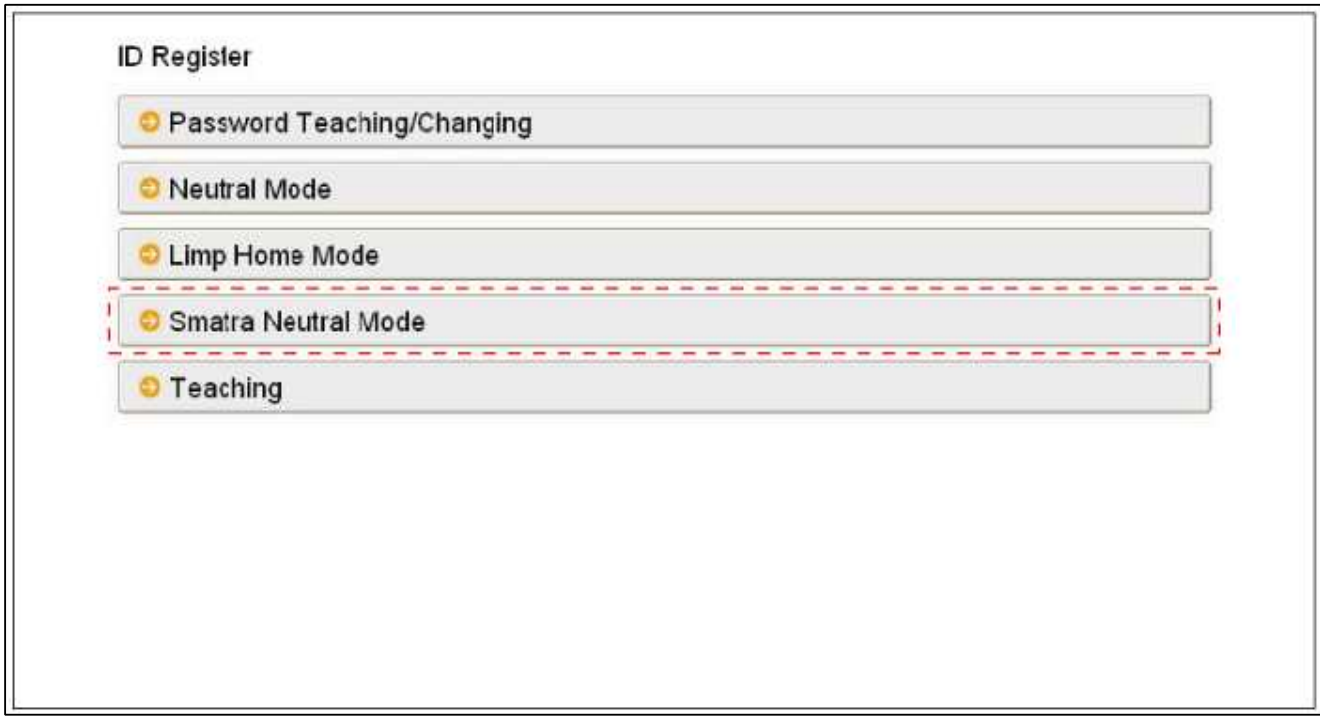
In case of changing the vehicle password, new virgin transponder must be only used. And in case of virgin key, after Learning the key of vehicle password, it can be used.

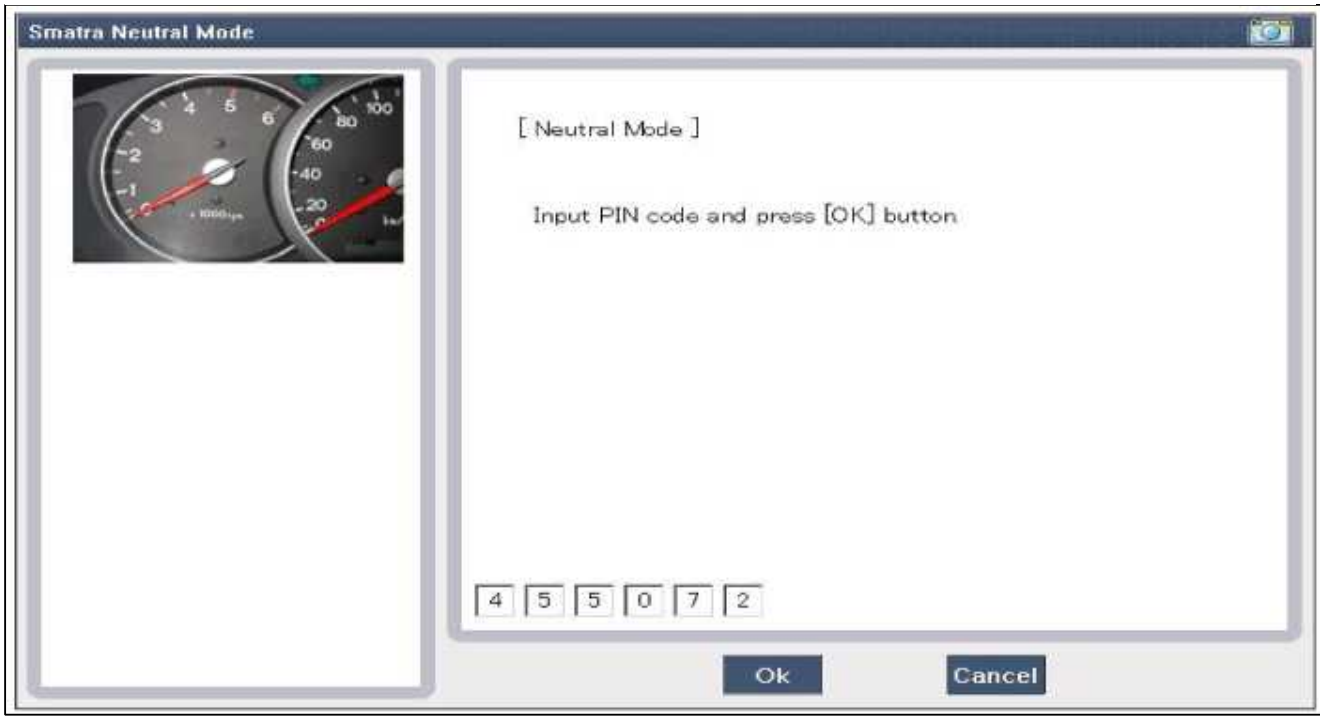
If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

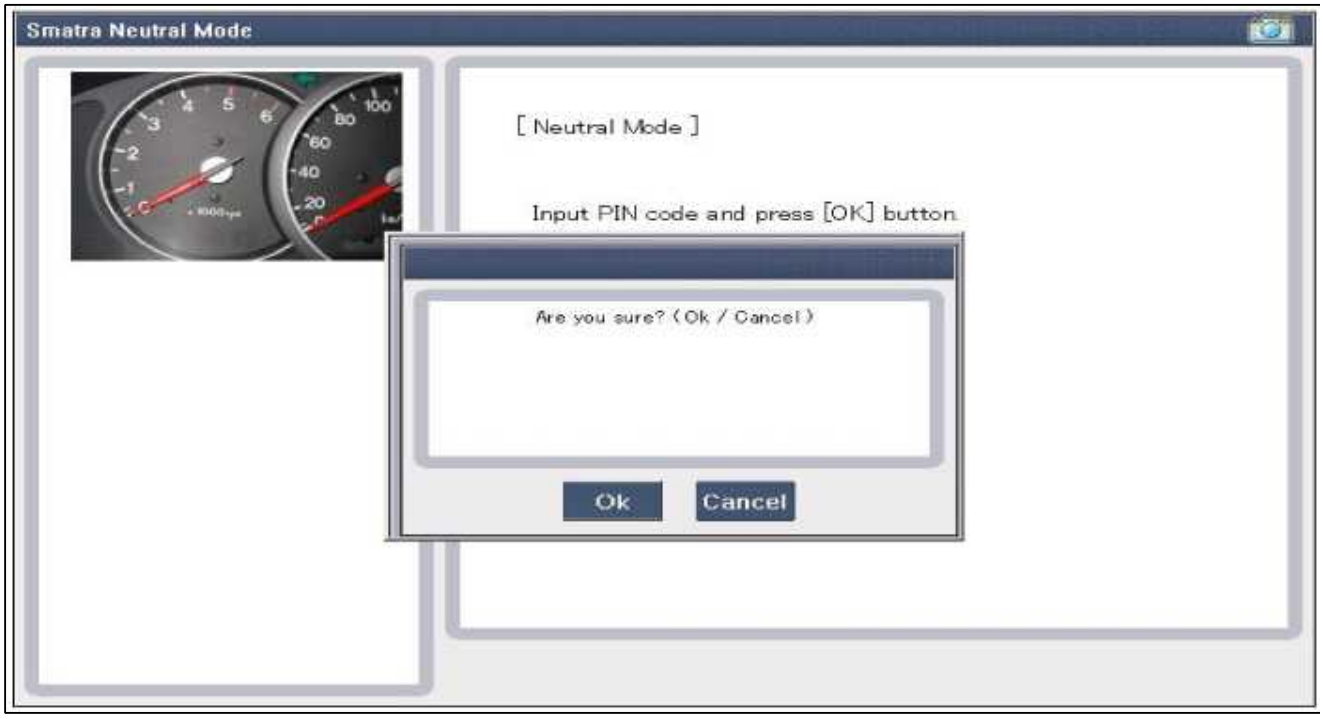
NOTE

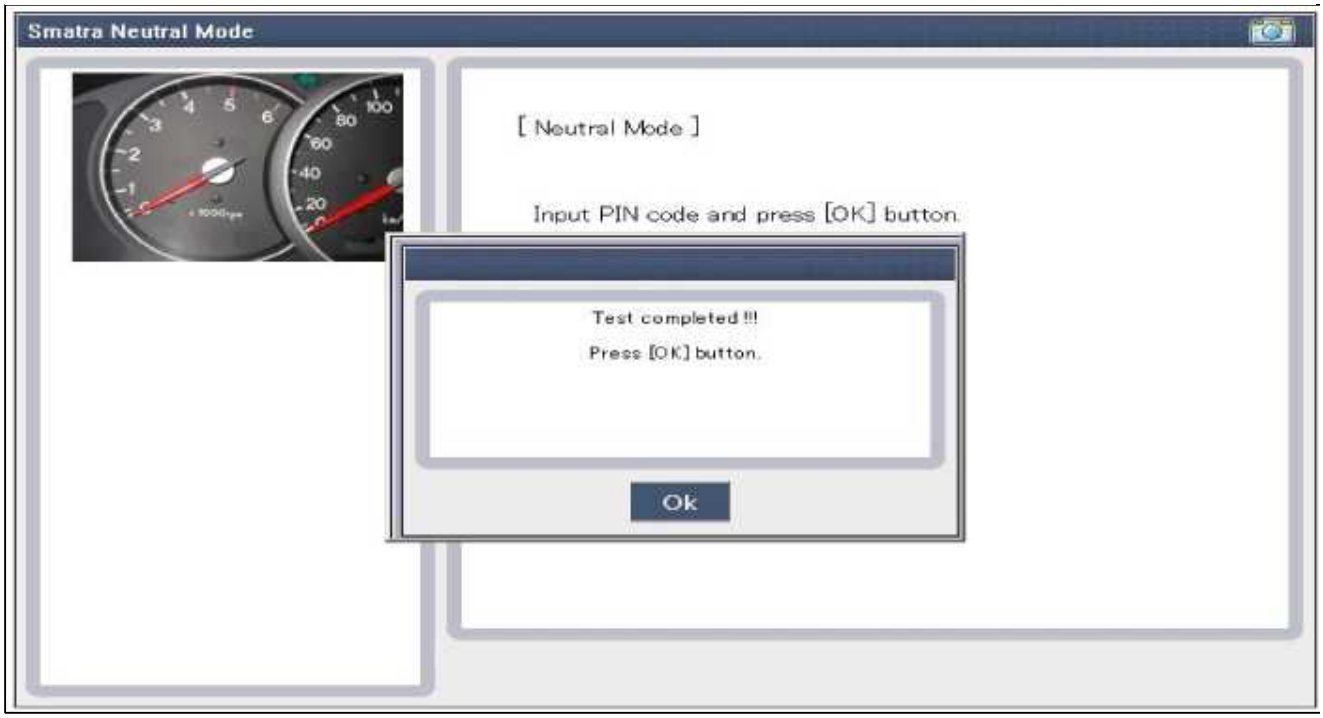
- Neutralizing Setting condition :
  - In case of "SMARTRA status", "Learnt"
  - Input correct Pin code by tester
- Neutralizing meaning :
  - Vehicle password(DPN Code) & SEK Code deletion.
  - Permission of New DPN Learning.

Function / SMARTRA	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	Yes (EMS learnt)	No	Yes	No

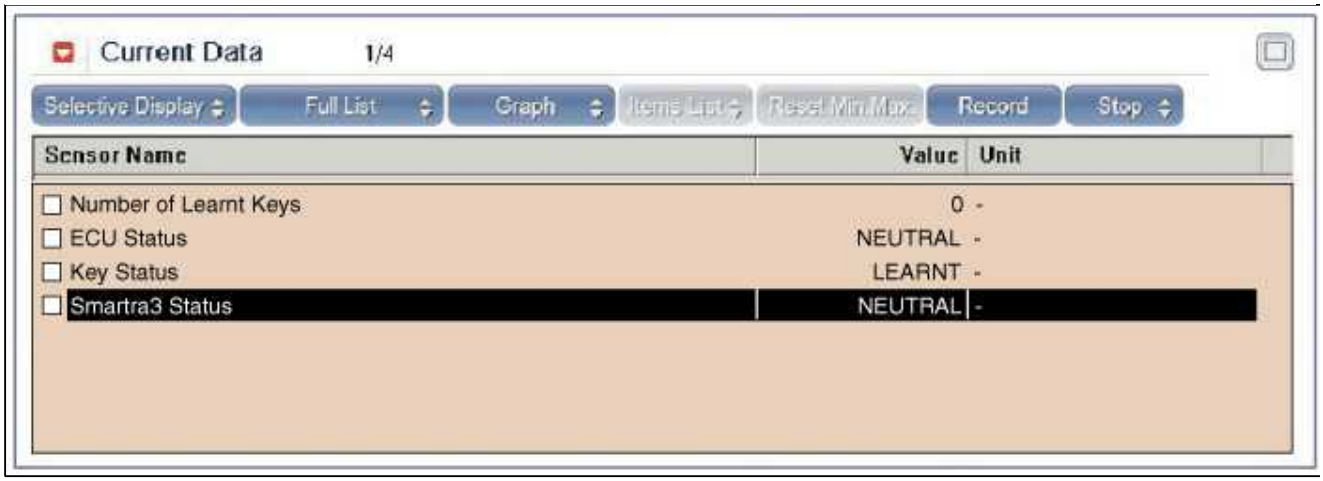



Smatra Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button
4 5 5 0 7 2
Ok
Cancel


Smatra Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button
Are you sure? (Ok / Cancel)
Ok
Cancel


Smatra Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
Test completed !!!
Press [OK] button.
Ok


Smatra Neutral Mode
[Neutral Mode]
Input PIN code and press [OK] button.
IG. off, after 10 sec. then IG. on.
Press [OK] button.
Ok



Body Electrical System > Immobilizer System > Troubleshooting

Diagnosis Of Immobilizer Faults

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function.

The following table shows the assignment of immobilizer related faults to each type:

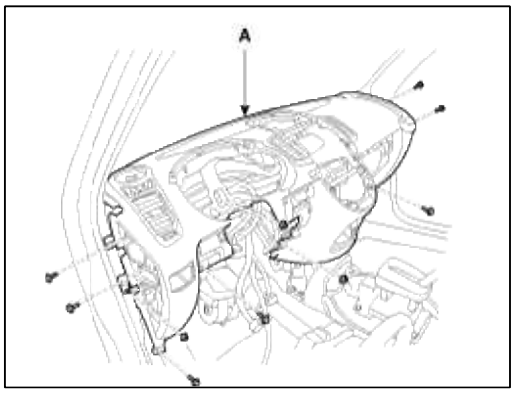
Immobilizer Related Faults	Fault types	Diagnostic codes
PCM(ECM) fault	1. Non-Immobilizer-EMS connected to an Immobilizer	P1610
Transponder key fault	1. Transponder not in password mode 2. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	1. Transponder programming error	P1675 (Transponder programming error)
SMARTRA fault	1. Invalid message from SMARTRA to PCM(ECM)	P1676 (SMARTRA message error)
SMARTRA fault	1. Virgin SMARTRA at learnt EMS 2. Neutral SMARTRA at learnt EMS 3. Incorrect the Authentication of EMS and SMARTRA 4. Locking of SMARTRA	P169A (SMARTRA Authentication fail)
SMARTRA fault	1. No response from SMARTRA 2. Antenna coil error 3. Communication line error (Open/Short etc.) 4. Invalid message from SMARTRA to PCM(ECM)	P1690 (SMARTRA no response)
Antenna coil fault	1. Antenna coil open/short circuit	P1691 (Antenna coil error)
Immobilizer indicator lamp fault	1. Immobilizer indicator lamp error (Cluster)	P1692 (Immobilizer lamp error)

Transponder key fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the magnetic field (Antenna coil)	P1693 (Transponder no response error/invalid response)
PCM(ECM) fault	1. Request from PCM(ECM) is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (PCM(ECM) message error)
PCM(ECM) internal permanent memory (EEPROM) fault	1. PCM(ECM) internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1695 (PCM(ECM) memory error)
Invalid key fault	1. Virgin transponder at PCM(ECM) status "Learnt" Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail)	P1696 (Authentication fail)
Hi-Scan fault	1. Hi-Scan message error	P1697
Locked by timer	1. Exceeding the maximum limit of Twice IGN ON (32 times)	P1699 (Twice IG ON over trial)

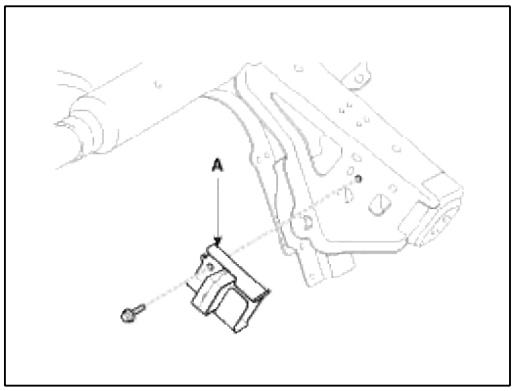
Body Electrical System > Immobilizer System > Immobilizer Control Unit > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the main crash pad (A).
   (Refer to the Body group - "Crash pad")



3. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening a nut.



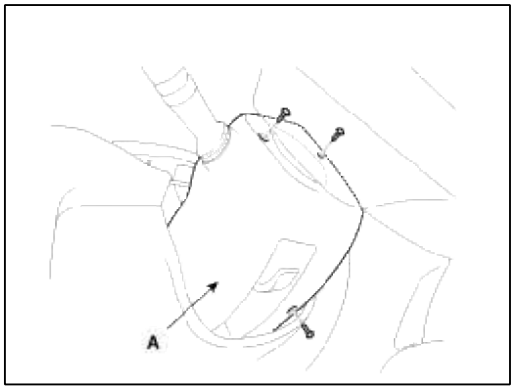
Installation

1. Install the immobilizer control unit after connecting the unit connector.
2. Install the crash pad.

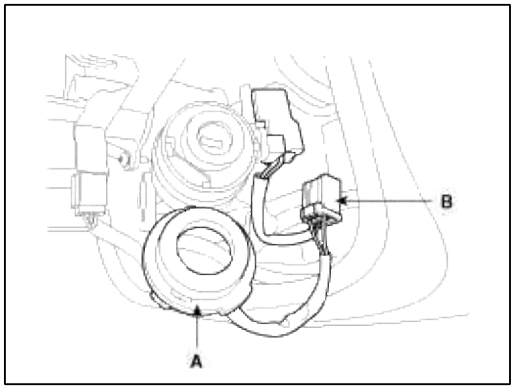
Body Electrical System > Immobilizer System > Antenna Coil > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A).



3. Disconnect the 6P connector (B) of the coil antenna and then remove the coil antenna (A) after loosening the screw.



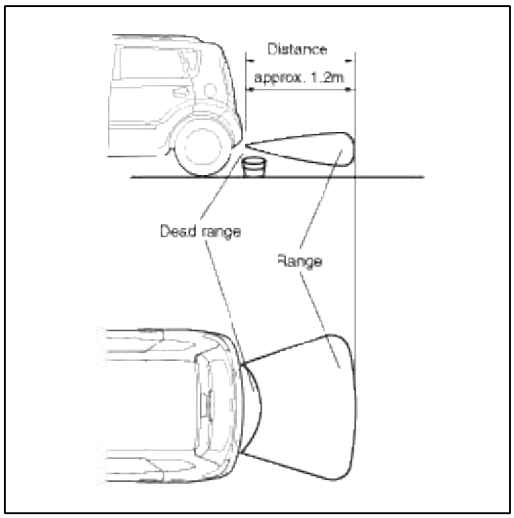
Installation

1. Install the coil antenna and connect the 6P connector.
2. Install the steering column upper and lower shrouds.

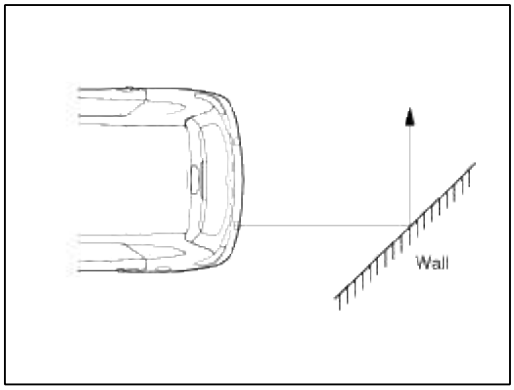
Body Electrical System > Rear Parking Assist System > General Safety Information and Caution

Warning

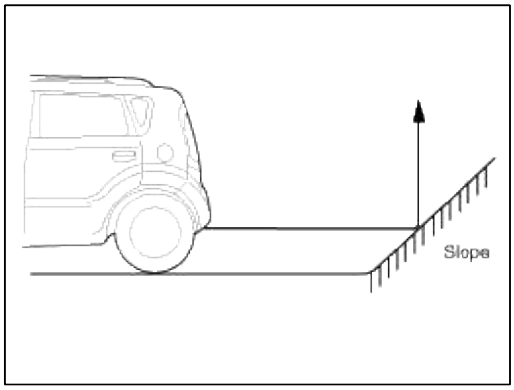
1. Range detected by back sensors is limited.
   Watch back before reversing.
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.
3. Besides there are some materials unable to be detected even in detection range as follows.
   (1) Needles, ropes, rods, or other thin objects.
   (2) Cotton, snow and other material absorbing ultrasonic wave(for example, fire extinguisher device covered with snow)



4. Reversing toward the sloped walls.



5. Reversing toward the sloped terrain.



6. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Be sure to check for the safety.
   Ultrasonic sensor cannot discriminate among glass, stake, and rock.
7. Sensors may not operate correctly in the below conditions.
   Ensure sensors clean from mud or dirt.
   (1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water. Do not wipe or scrape sensor with a rod or a hard object.
   (2) If the sensor is frozen, alarm may not operate until sensor thaws.
   (3) If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.
   (4) When heavy cargo is loaded in tailgate, it changes the vehicle balance, which reduces the detection range.
   (5) When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.
   (6) Under heavy rain.
   (7) When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite of no barrier)
   (8) If radio antenna is installed at the rear.
   (9) If the vehicle rear wiring is re-routed or electrical component is added at the rear part.
   (10) Vehicle balance is changed due to the replacement of the rear spring.
   (11) The unit will operate normally when the vehicle speed is 5km/h or less. Above the speed, the unit may not operate normally.
8. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.
9. Be careful not to apply shock during sensor installation on the transmission or reception unit.
10. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not the change the transmission and reception unit wiring. Tagging the transmission side and reception side, it may cause malfunction.
11. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.
12. Be careful that heating or sharp objects shall not touch ultrasonic sensor surface.
    Besides do not cover the sensor opening or press the sensor.

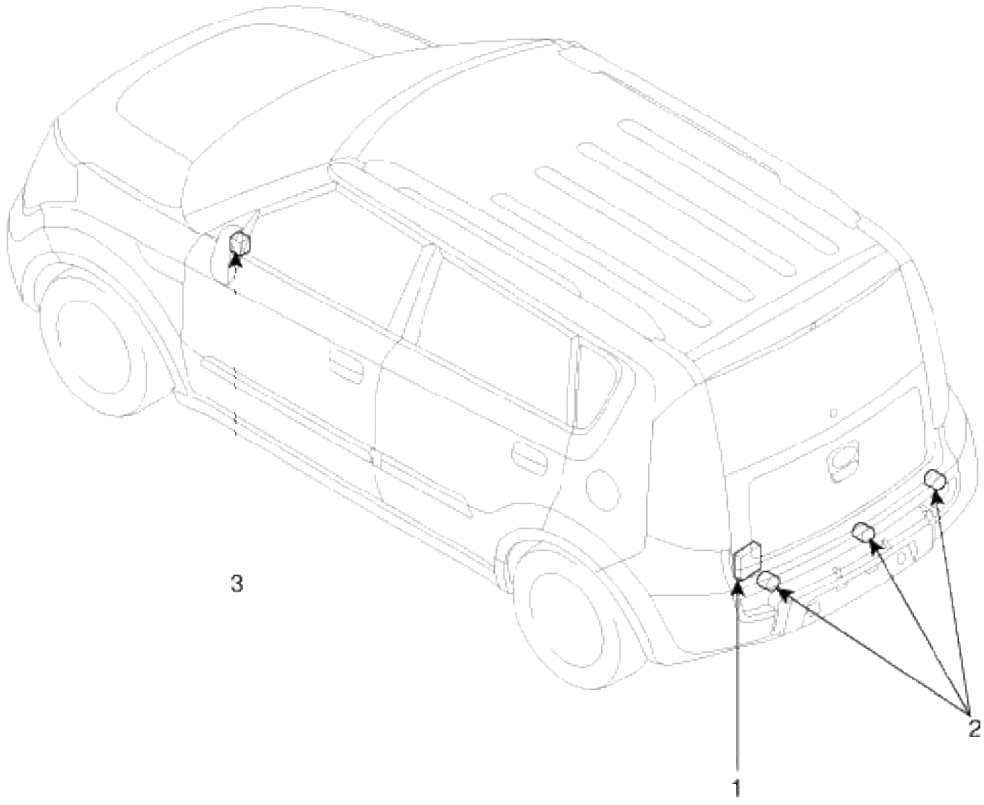
Body Electrical System > Rear Parking Assist System > Specifications

Specification

Item		Specification
Rear parking assist system control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 600 mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage rating	DC 8 V
	Detecting range	40 cm ~ 120 cm
	Operation voltage	DC 9 ~ 16 V
	Operation current	MAX 20 mA
	Operation temperature	-30°C ~ + 80°C
	Beam width	Horizontal : 100±5°(70cm), Vertical : 50±5°(50cm)
	Number of sensors	4 (Right, center, Left)
Piezo buzzer	Voltage rating	DC 12 V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.2±0.5 KHz
		Sound level : MIN 70 dB (DC 13V /m)

Body Electrical System > Rear Parking Assist System > Components and Components Location

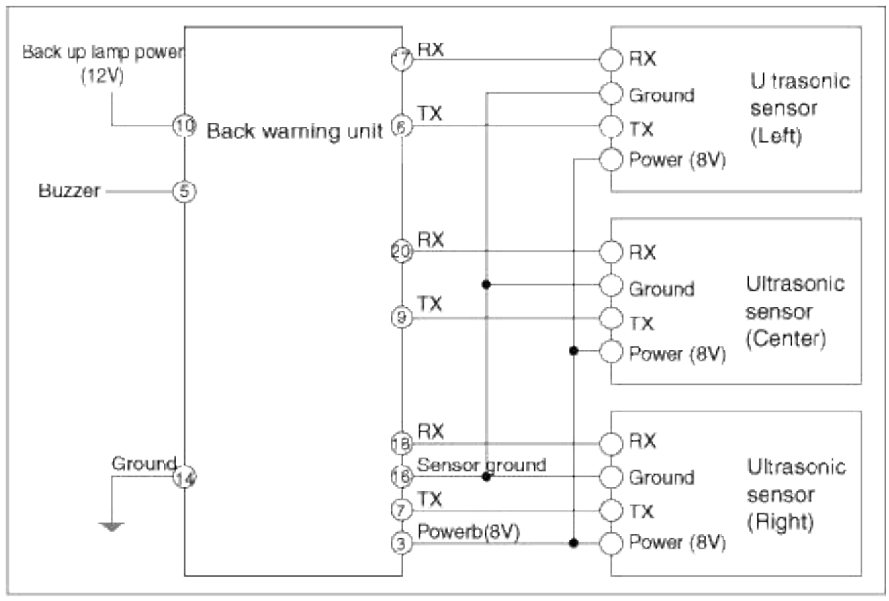
Component Location

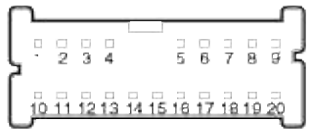


1. Rear parking assist system control unit 2. Ultrasonic sensor	3. Buzzer

Body Electrical System > Rear Parking Assist System > Schematic Diagrams

Circuit Diagram





(Rear parking assist system con:rol unit connoctor)



(Ultrasonic sensor connector)

Pin configuration

Pin No.	Signal	Test : Desired result
3	Sensor power	8V (While operating)
5	Buzzer	0V (While operating)
6	TX - Sensor(Left)	0~3V voltage change (Inspect waveform)
7	TX - Sensor(Right)	0~3V voltage change (Inspect waveform)
9	TX - Sensor(Center)	0~3V voltage change (Inspect waveform)
10	Back up lamp power	12V (While shifting to "R")
14	Ground	0V
16	Sensor ground	0V
17	RX - Sensor(Left)	0~1V voltage change (Inspect waveform)
18	RX - Sensor(Right)	0~1V voltage change (Inspect waveform)
20	RX - Sensor(Center)	0~1V voltage change (Inspect waveform)

PIN NO	SIGNAL
1	TX
2	8V
3	GND
4	RX

Body Electrical System > Rear Parking Assist System > Description and Operation

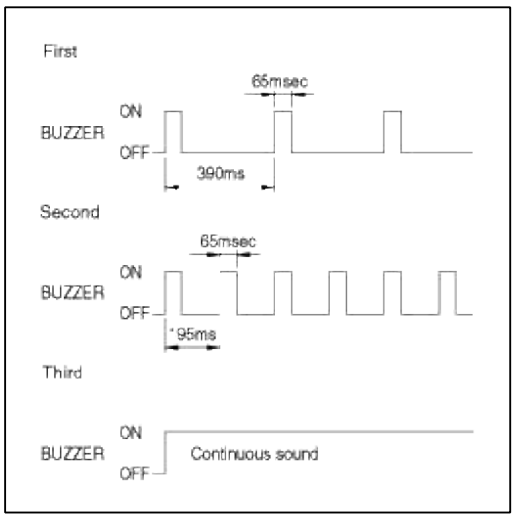
Description

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, rear parking assist system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third alarm).

Alarm Range

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate

alarm.
First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm ± 15cm
Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm ± 10cm
Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm ± 10cm



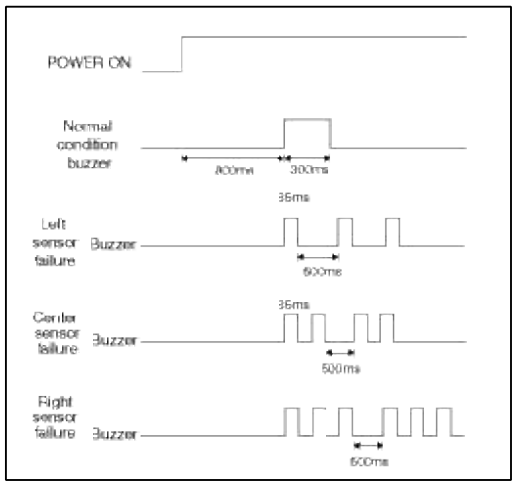
NOTE

1. Time tolerance of the above waveform : Time ± 10%
2. At nearer distance than 40cm, detection may not occur.
3. Alarm will be generated with vehicle reversing speed 10km/h or less.
   For moving target, maximum operation speed shall be target approach speed of 10km/h.
4. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
5. Misalarm may occur in the following conditions.
   - Irregular road surface, gravel road, reversing toward grass.
   - Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
   - When a wireless transmitter is used near to the sensor.
   - Dirt on the sensor.
   - Sequential alarm may not occur due to the reversing speed or the target shape.

Body Electrical System > Rear Parking Assist System > Troubleshooting

Diagnosis
1. Operate with ignition switch on and shift the lever to position "R"
2. Then it checks the system condition.
   If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.8 seconds from power approval. In case of system failure, then it indicates the failed point as follows.
   A. Left sensor failure : beep-beep-beep
   B. Center sensor failure : beep beep-beep beep-beep beep
   C. Right sensor failure: beep beep beep-beep beep beep-beep beep beep
3. Alarm is generated 3 times sequentially.

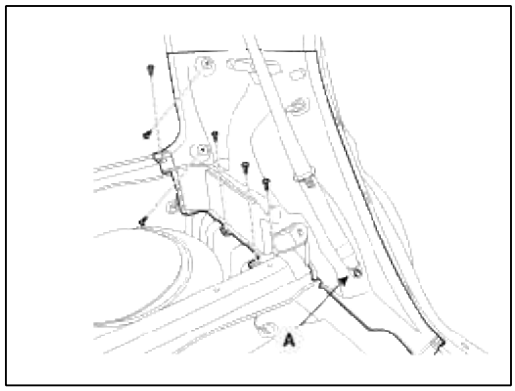
4. Effective operation range is 10km/h or less for the vehicle speed.



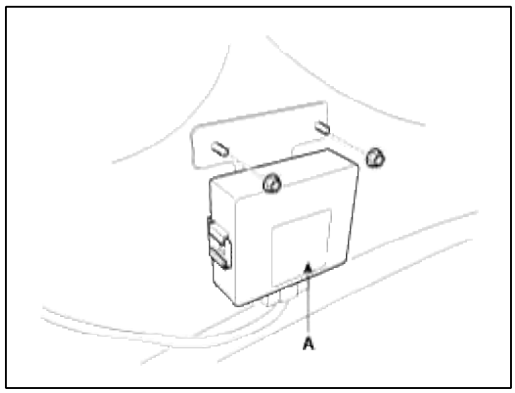
Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the left side trim(A) of the trunk room.
   (Refer to the Body group - "Interior trim")



3. Loosen a mounting nut and disconnect the connector.
4. Remove the rear parking assist system control unit (A).



Installation

1. Install the rear parking assist system control unit.
2. Install the left side trim.

Body Electrical System > Rear Parking Assist System > Parking Assist Sensor > Description and Operation

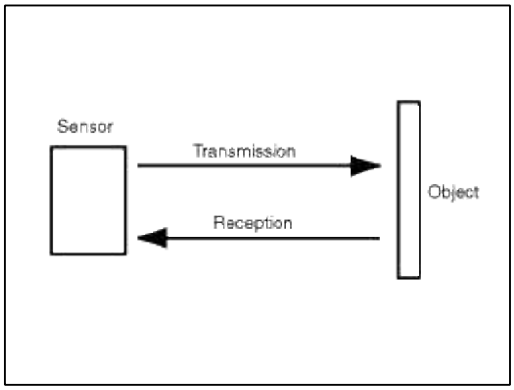
Operation Principle

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

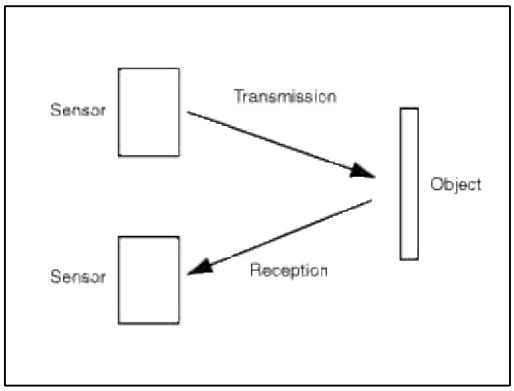
Distance Detection Type

Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



Measurement Principle

Rear parking assist system is a complementary device for reversing. Rear parking assist system detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

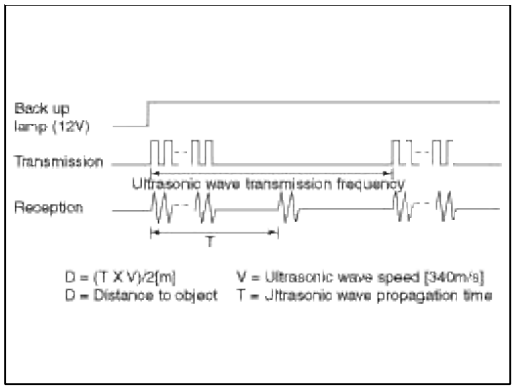
The propagation speed formula of ultrasonic wave in air is following :

$v=331.5 + 0.6t$ (m/s)

v=ultrasonic wave propagation speed

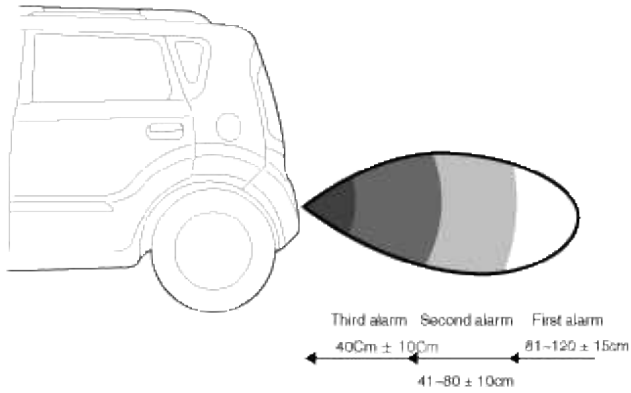
t=ambient temperature

The basic principle of distance measurement using ultrasonic wave is :



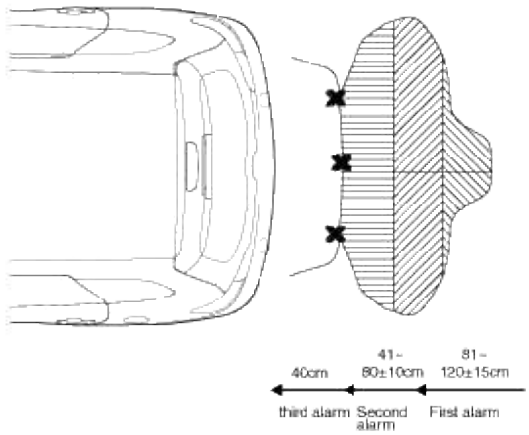
Sensor Detection Range

[Vertical range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10Cm
2. Detection tolerance
   At 40cm :45° ± 15°
   At 80cm : 30° ± 15°
   At 120cm : 20° ± 15°
3. At nearer distance than 40cm detection may occur
4. Measurement condition : Room temperature (20℃), 140mm diameter, 1m length rod.

[Horizontal range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10cm
2. Detection tolerance
   At 80cm : 90° + 20°
   At 120cm : 10° + 20°
3. At nearer distance than 40Cm detection may occur.
4. Measurement condition : Room temperature (20℃), 140mm diameter, 1m length rod.

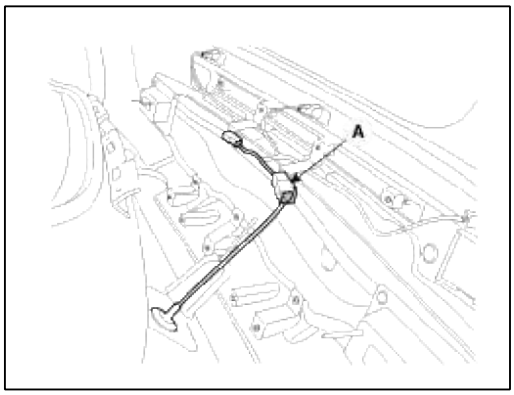
NOTE

1. 14cm (dia.) plastic rod is used for the test target.
2. The test result may differ by a different target object.
3. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
4. The following object may not be detected.
   - Sharp object or thin object like rope.
   - Cotton sponge, snow or other materials absorbing sonic wave.
   - Smaller objects than 14cm (dia.), 1m length.

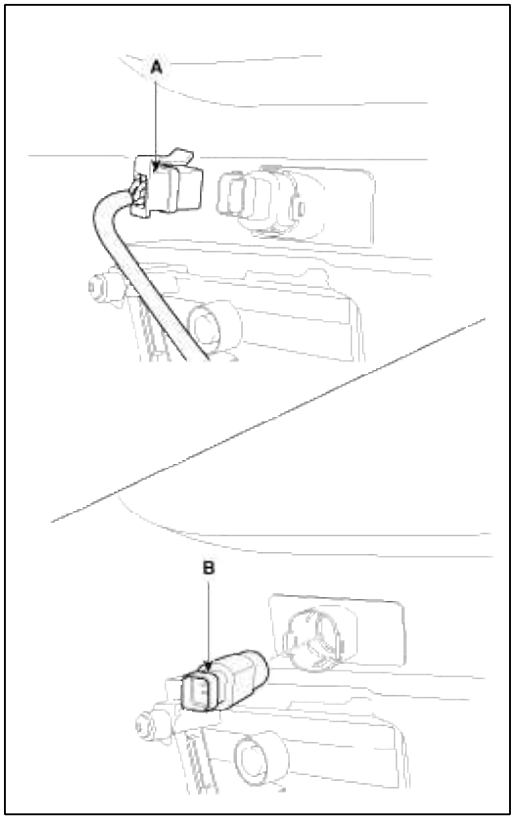
Body Electrical System > Rear Parking Assist System > Parking Assist Sensor > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to the Body group - "Rear bumper")
3. Disconnect the connectors (A) from the rear bumper.



4. Disconnect the sensor connector (A) at the inside of the rear bumper, and then remove the sensor (B) from the housing.



Installation

1. Connect the connector, and then install the sensor.
2. Install the rear bumper.

Body Electrical System > Rear Parking Assist System > Buzzer > Repair procedures

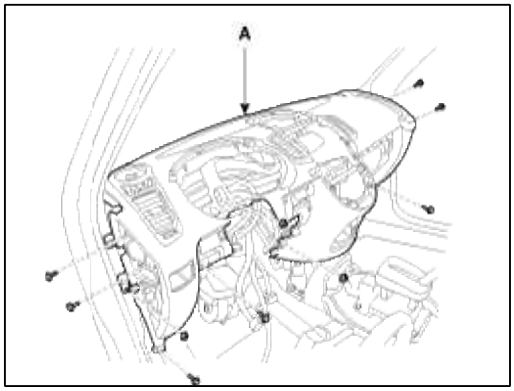
Inspection

Test the buzzer by connecting battery voltage to the 1 terminal and ground the 2 terminal.

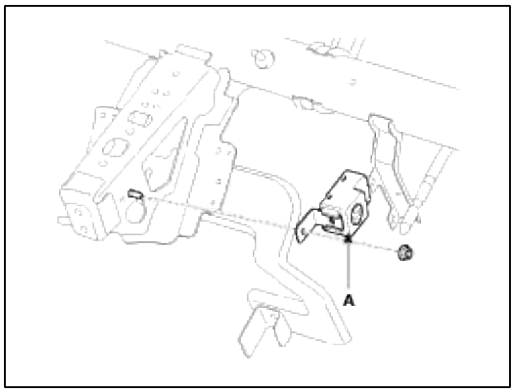
The buzzer should make a sound. If the buzzer fails to make a sound, replace it.

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the main crash pad (A).
   (Refer to the Body group - "Crash pad")



3. Remove the buzzer (A) after loosening the nut and disconnecting the 2P connector.



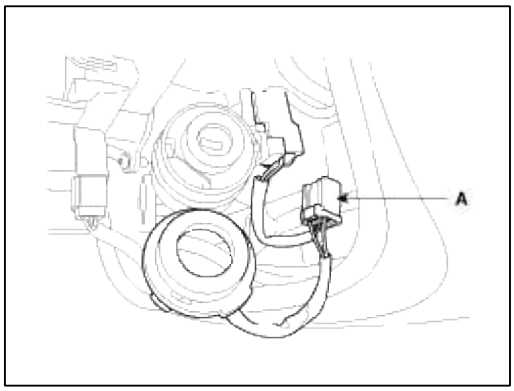
Installation

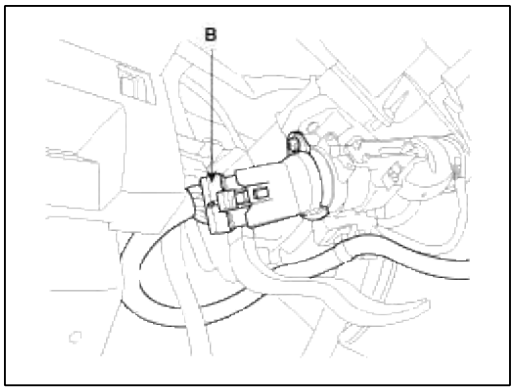
1. Connect the connector, and then install the buzzer.
2. Install the main crash pad.

Body Electrical System > Ignition Switch Assembly > Repair procedures

Inspection

1. Disconnect the ignition switch connector (B) and key warning switch connector (A) from under the steering column.





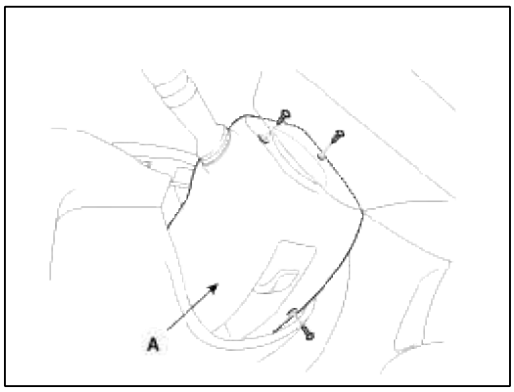
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

TERMINAL / POSITION / KEY		IGNITION SWITCH (B)						STEERING		KEY WARNING SWITCH (A)		KEY HOLE ILLUMINATION(A)	
		2	4	6	5	3	1	TRAVEL	TRAVEL	5	6	3	4
LOCK	REMOVAL							LOCK					
	INSERT							LOCK	UNLOCK				
ACC	INSERT	○	○					UNLOCK		○	○		
ON	INSERT	○	○	○	○	○		UNLOCK		○	○		
START	INSERT	○	○	○	○	○	○	UNLOCK		○	○		

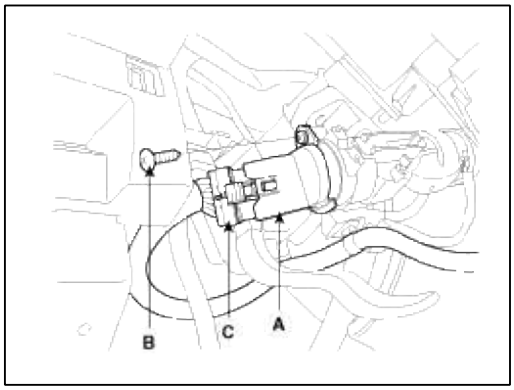
Removal

1. Disconnect the negative (-) battery terminal.

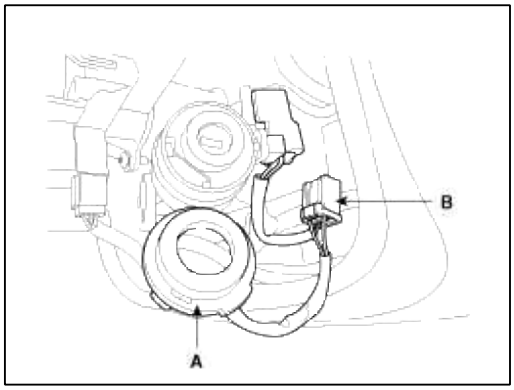
2. Remove the steering column upper and lower shrouds (A).



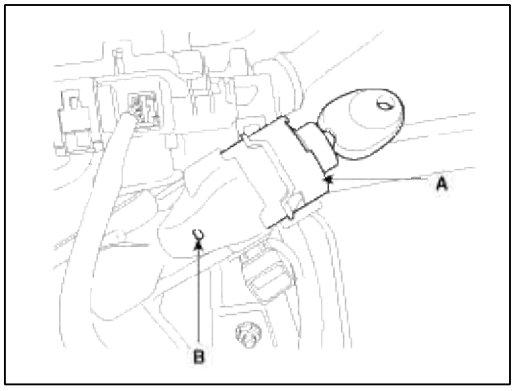
3. Remove the ignition switch (A) after loosening the screw (B) with IG ON and disconnecting the 6P connector (C).



4. Remove the door warning switch and key illumination lamp (A) after loosening the screw and disconnecting the 6P connector (B).



5. If it is necessary to remove the key lock cylinder (A), remove the interlock cable.And then remove the key lock cylinder after pushing lock pin (B) with key ACC.



Installation

1. Install the key lock cylinder.
2. Install the interlock cable.

NOTE

Install procedure for interlock cable

1. After setting key interlock cable and IGN lock assembly, fix the key interlock cable with pre-assembled set screw.
2. Install interlock cable in position.
3. Turn the key "Lock" state, and check the A/T change lever P position.

NOTE

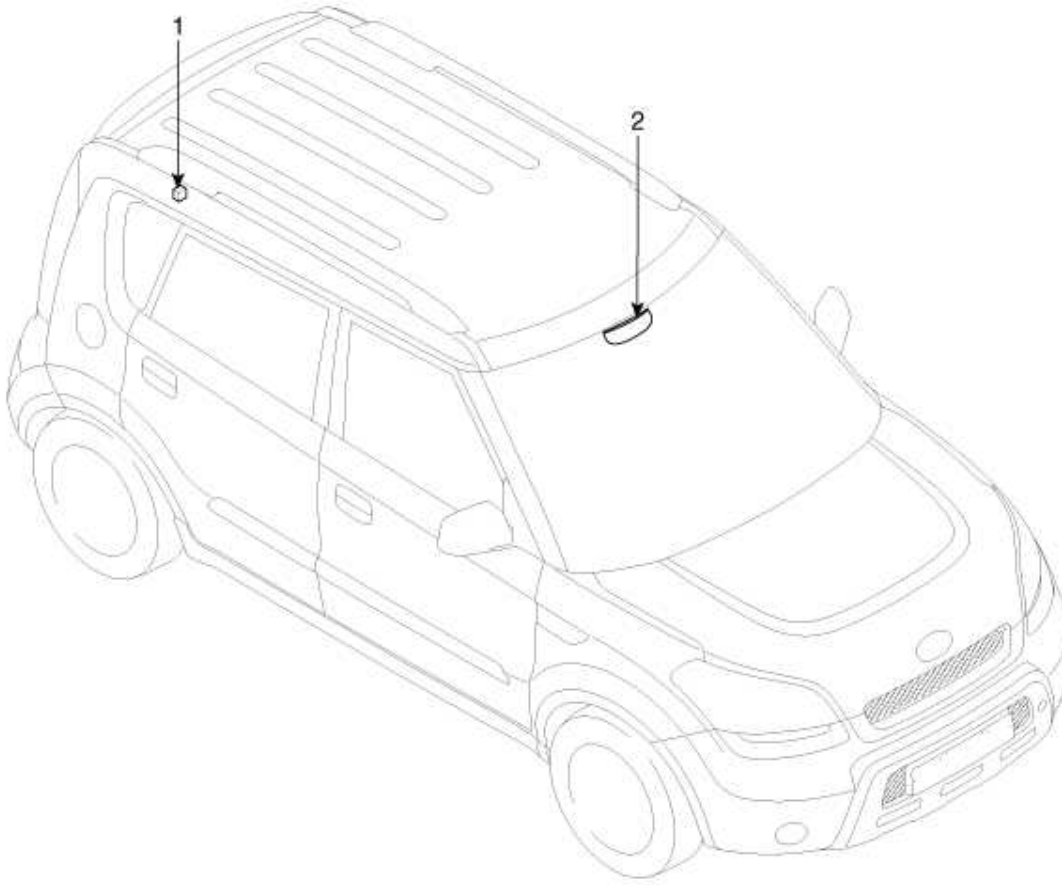
Check point of the key interlock system.

1. At "Lock" position, and brake pedal depressed, push button cannot be operated.
2. Key must not be turned to "Lock", except "P" position of A/T change lever.
3. At "P" position of A/T change lever, key must be turned to "Lock" smoothly.

3. Install the door warning switch and key illumination lamp.
4. Install the ignition switch.
5. Install the steering column shrouds.

Body Electrical System > Back View Camera System > Components and Components Location

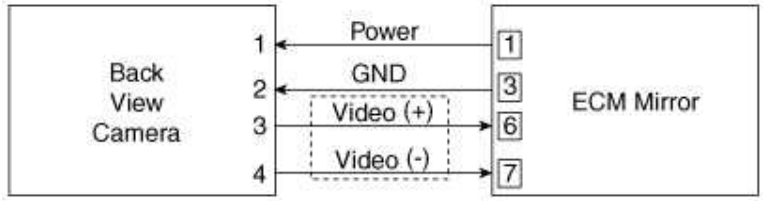
Component Location



1. Back view camera	2. ECM mirror

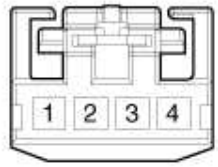
Body Electrical System > Back View Camera System > Schematic Diagrams

Circuit Diagram





Back view camera connector



Pin no.	Name
1	Video (-)
2	Video (+)
3	Ground
4	Power

Body Electrical System > Back View Camera System > Description and Operation

Description

Back view camera will activate when the backup light is ON with the ignition switch ON and the shift lever in the R position.

This system is a supplemental system that shows behind the vehicle through the AV monitor or ECM mirror while backing-up.

WARNING

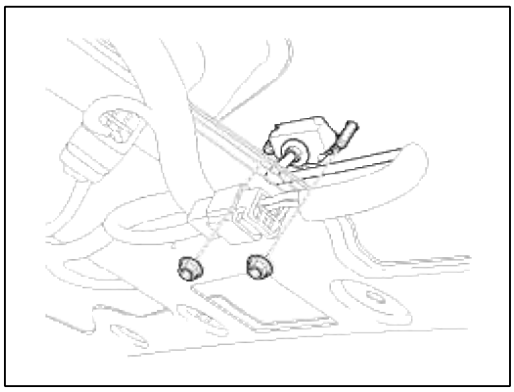
This system is a supplementary function only. It is the responsibility of the driver or always check the inside/ outside rearview mirror and the area behind the vehicle before and while backing up because there is a dead zone that can't see through the camera.

Body Electrical System > Back View Camera System > Repair procedures

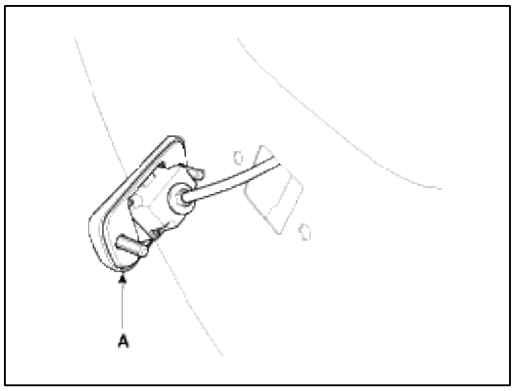
Removal

1. Remove the tailgate trim after removing the screws and clips.
   (Refer to the Body group - "Tailgate")

2. Remove the connector and nuts(2EA).



3. Remove the back view camera(A).



Installation

1. Install the back view camera.
2. Install the tailgate trim.

SOUL(AM) > 2010 > G 1.6 DOHC > Brake System

Brake System > General Information > Specifications

Specifications

Item	Specification	
Master cylinder Type Piston stroke Fluid level warning sensor	 Tandem type 45 mm (1.77 in) Provided	
Proportioning valve (CBS) Cut-in pressure (Split point) Decompression ration	 20 kg/cm² (1.96 Mpa, 284.5 psi) 0.27 : 1	
Brake booster Type Boosting ratio	 Vacuum 9 : 1	
Front brake (Disc) Type Disc O.D. Disc I.D. Disc thickness Pad thickness Cylinder type Cylinder I.D.	ABS/ESC Floating type with ventilated disc 280 mm (11.02 in) 172 mm (6.77 in) 26 mm (1.02 in) 11 mm (0.43 in) Single piston Ø57.0 mm (2.24 in)	CBS Floating type with ventilated disc 270 mm (10.63 in) 166 mm (6.54 in) 26 mm (1.02 in) 11 mm (0.43 in) Single piston Ø54.0 mm (2.13 in)
Rear brake (Disc) Type Disc O.D. Disc I.D. Disc thickness Pad thickness Cylinder type Cylinder I.D.	 Floating type with solid disc 262 mm (10.31 in) 185 mm (7.28 in) 10 mm (0.39 in) 10 mm (0.39 in) Single piston Ø30.0 mm (1.22 in)	
Rear brake (Drum) Type Drum I.D. Brake lining thickness Clearance adjustment	 Leading trailing Ø203.2 mm (8.00 in) 5.14 mm (0.20 in) Automatic	
Parking brake (Disc type) Actuation Type Drum I.D.	 DIH (Drum in hat) Lever 168 mm(6.61 in)	

NOTE

O.D. : Outer Diameter
I.D : Inner Diameter

Specification(ABS)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-40 ~ 120 °C (-40 ~ 248°F)	
	Motor power	210 W	
Warning lamp	Min. operating Voltage	12V	
	Max. Current consumption	Max. 100mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 20V	
	Output current low	5.9 ~ 8.4mA	
	Output current high	11.8~ 16.8mA	
	Output range	1 ~ 2500 Hz	
	Tone wheel	46 teeth	
	Air gap	Front : 0.5 ~ 1.5 mm Rear : 0.5 mm	

Specification (ESC)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	Total control (ABS, EBD, TCS, ESC)
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16V	
	Operating Temperature	-40 ~ 120°C(-40 ~ 248°F)	
	Motor power	270W	
Warning lamp	Min. Operating Voltage	12V	
	Max. Current consumption	Max. 100mA	
Active Wheel speed sensor	Supply voltage	DC 4.5 ~ 20V	
	Output current low	5.9 ~ 8.4mA	
	Output current high	11.8~ 16.8mA	
	Output range	1 ~ 2500Hz	
	Tone wheel	47 teeth	
	Air gap	Front : 0.5 ~ 1.5 mm Rear : 0.5 mm	
	Operating Voltage	8 ~ 16V	

Steering Wheel Angle Sensor	Current consumption	Max. 100mA	
	Output measurement range	-780 ~ +799.9°	
	Operating Angular velocity	1500°/sec	
Yaw rate& Lateral G sensor (CAN TYPE)	Operating Voltage	10 V ~ 16V	
	Current Consumption	Max. 150mA	
	Yaw rate sensor measurement range	-75 ~ 75°/sec	
	Lateral G sensor measurement range	-1.5 ~ 1.5gN	

Service Standard

Item	Standard value
Brake pedal height	194 mm (7.64 in)
Brake pedal stroke	135 mm (5.31 in)
Stop lamp switch outer case to pedal stopper clearance	1 ~ 2 mm (0.039 ~ 0.047 in)
Brake pedal free play	3 ~ 8 mm (0.08 ~ 0.20 in)
Booster push rod to master cylinder piston clearance	0.6 ~ 1.4 mm (at 500 mmHg vacuum)
Parking brake lever stroke when lever assembly is pulled with 196N (20Kg, 44lb force)	5 ~ 7 clicks
Front disc brake pad thickness	11 mm (0.43 in.)
Front disc thickness	26 mm (1.02 in)
Rear disc brake pad thickness	10 mm (0.35 in)
Rear disc brake disc thickness	10 mm (0.39 in)
Rear brake lining thickness	Disc Brake : 2.6 mm (0.10 in) Drum Brake : 5.14 mm (0.20 in)

Tightening Torques

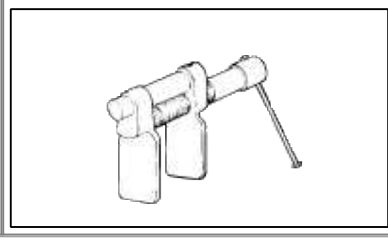
Item	N.m	kgf.m	lb-ft
Master cylinder to booster mounting nut	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Brake booster mounting nut	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Bleeder screw	6.9 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Brake tube to HECU-CBS/ABS	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Brake tube to HECU-ESC	18.6 ~ 22.6	1.9 ~ 2.3	13.7 ~ 16.6
Caliper guide rod bolt	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Caliper mounting bolt (Front)	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Caliper mounting bolt (Rear)	63.7 ~ 73.6	6.5 ~ 7.5	47.0 ~ 54.3
Brake hose to caliper	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal member assembly bracket mounting nut	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Brake pedal member assembly bracket mounting bolt	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Stop lamp switch mounting nut	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
HECU mounting bracket bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
HECU bracket mounting nut	10.8 ~ 13.7	1.1 ~ 1.4	8.0 ~ 10.1
Yaw rate & Lateral G sensor mounting bolt	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0

Lubricant

Item	Recommended lubricant	Quantity
Brake fluid	DOT 3 or DOT 4	As required
Brake pedal bushing and brake pedal bolt	Chassis grease	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease	As required
Caliper guide rod bolt and boot	AI-11P grease	Front : 1.2 ~ 1.7g Rear : 0.8 ~ 1.3g

Brake System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09581 - 11000 Piston expander		Pushing back of the front disc and rear disc brake piston

Brake System > General Information > Troubleshooting

Troubleshooting

Problem Symptoms Table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the possible cause of the problem. Check each part in order. If necessary, replace these parts.

Symptom	Suspect Area	Remedy
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Master cylinder (Faulty)	Repair Air bleeding Replace Replace
Brake drag	1. Brake pedal free play (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Pad or lining (Cracked or distorted) 5. Piston (Stuck) 6. Piston (Frozen) 7. Return spring (Faulty) 8. Booster system (Vacuum leaks) 9. Master cylinder (Faulty)	Adjust Adjust Repair Replace Replace Replace Replace Replace Replace
Brake pull	1. Piston (sticking) 2. Pad or lining (Oily) 3. Piston (Frozen) 4. Disc (Scored) 5. Pad or lining (Cracked or distorted)	Replace Replace Replace Replace Replace
Hard pedal but brake inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Pad or lining (Oily) 6. Pad or lining (Glazed) 7. Disc (Scored) 8. Booster system (Vacuum leaks)	Repair Air bleeding Replace Replace Replace Replace Replace Replace
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen)	Replace Retighten

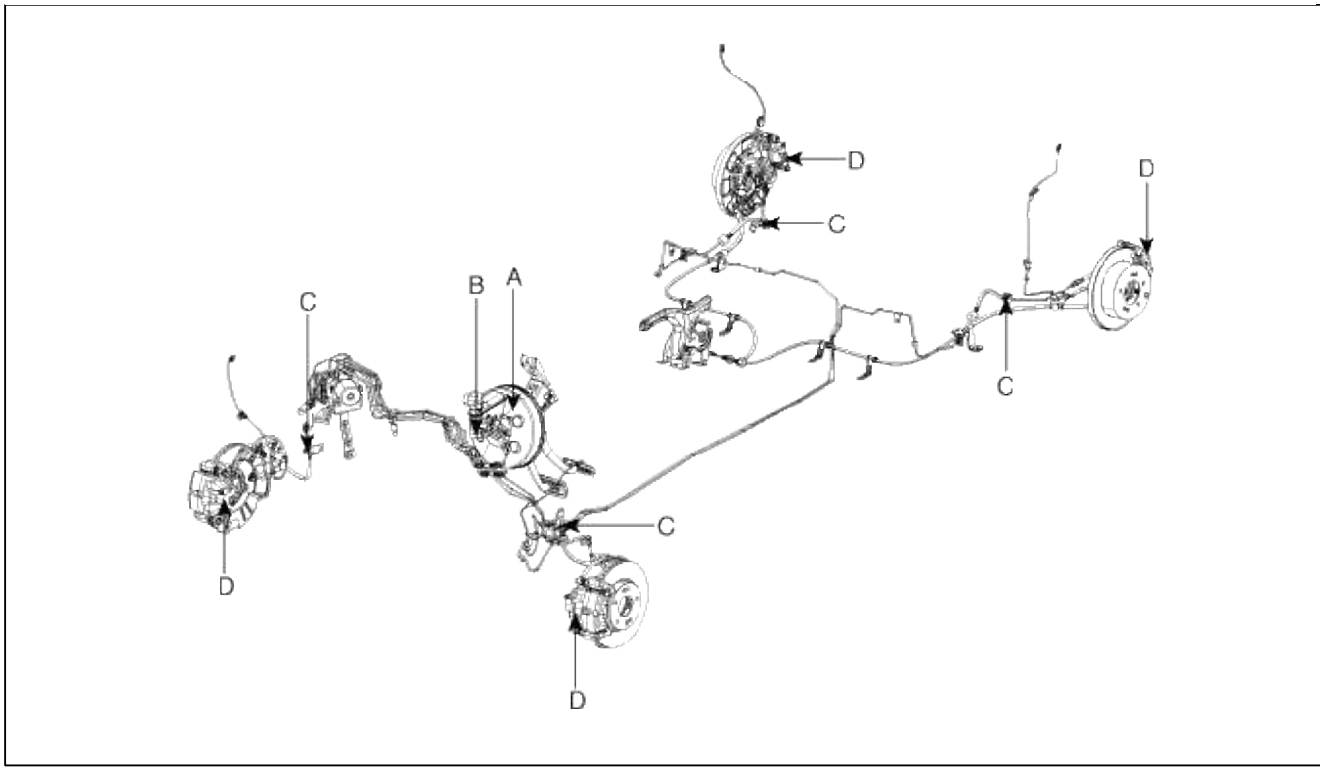
	3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Return spring (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage)	Replace Replace Clean Replace Replace Replace Replace
Brake fades	1. Master cylinder	Replace
Brake vibration, pulsation	1. Disc (Excessive thickness variation) 2. Disc (Faulty run-out) 3. Disc (Uneven worn or crack) 4. Pad or lining (Uneven worn and contact) 5. Caliper (Faulty pad sliding)	Replace Replace Replace Replace Replace
Brake chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

Brake System > Brake System > Repair procedures

Operation and Leakage Check

Check all of the following items

Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster(Refer to "Brake Booster Operating Test" in this group). Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	• Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage. • Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke.
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled.



Brake System Bleeding

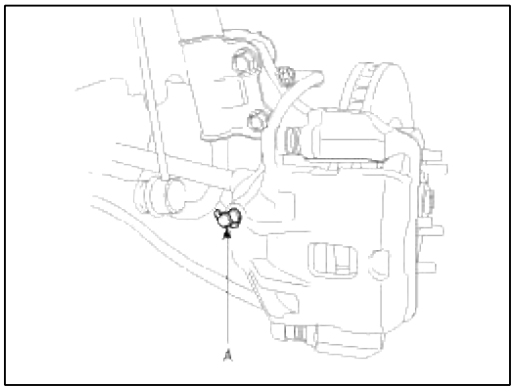
CAUTION

- Do not reuse the drained fluid.
- Always use genuine DOT3/DOT4 brake Fluid.
  Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

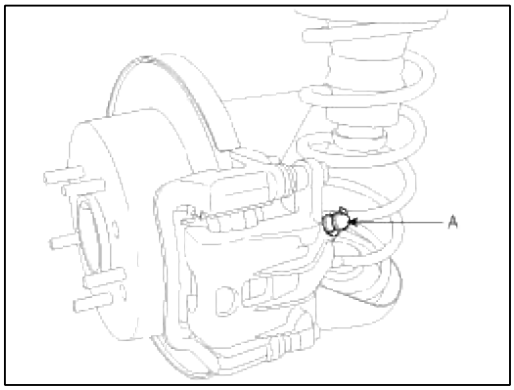
1. Make sure the brake fluid in the reservoir is at the MAX(upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply pressure.

3. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.

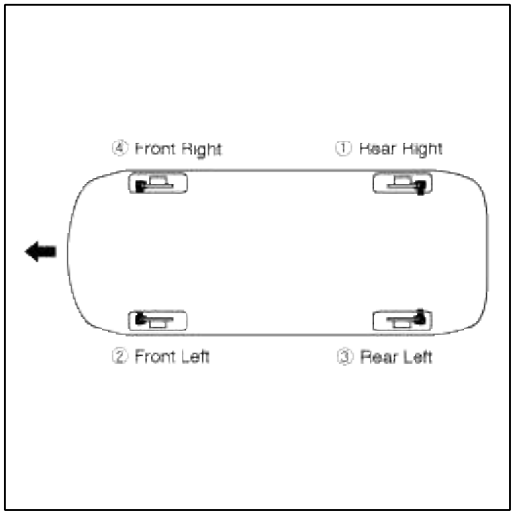
Front



Rear



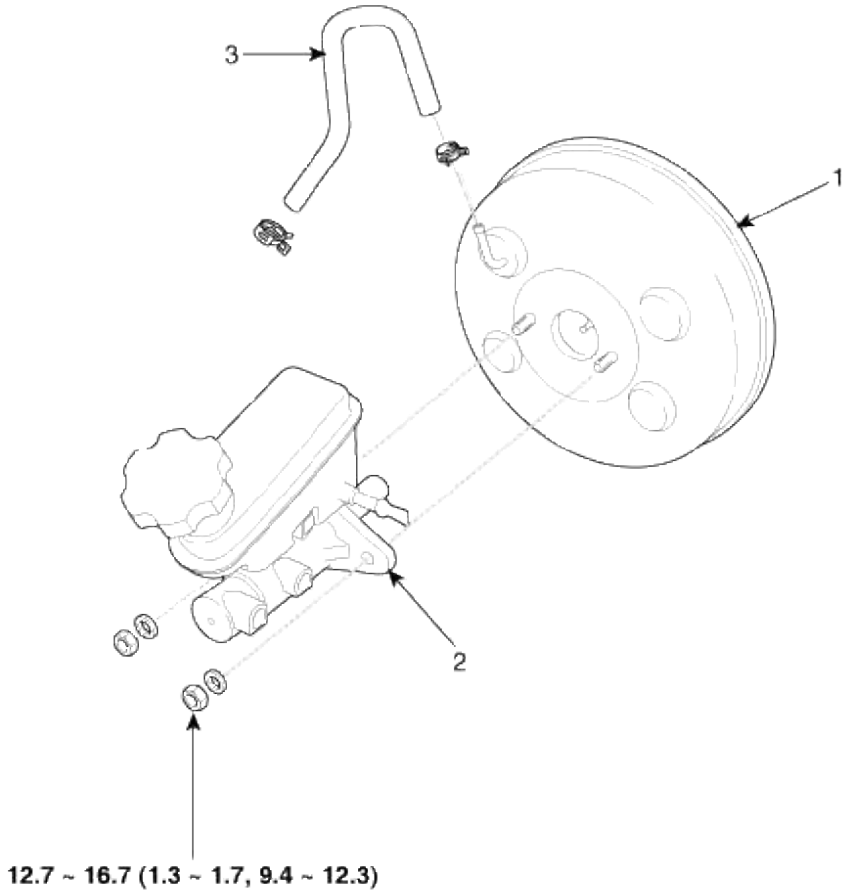
4. Repeat the procedure for wheel in the sequence shown below until air bubbles no longer appear in the fluid.



5. Refill the master cylinder reservoir to MAX(upper) level line.

Brake System > Brake System > Brake Booster > Components and Components Location

Components



Torque : N.m (kgf.m, lb-ft)

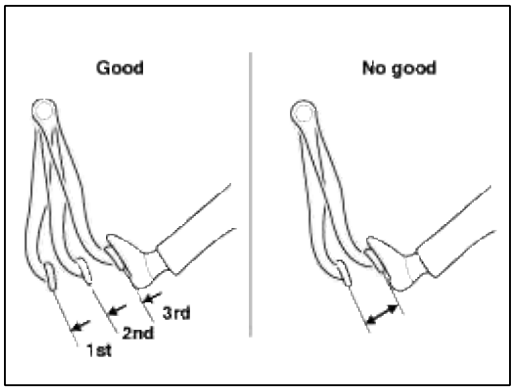
1. Brake booster
2. Master cylinder assembly
3. Vacuum hose

Brake System > Brake System > Brake Booster > Repair procedures

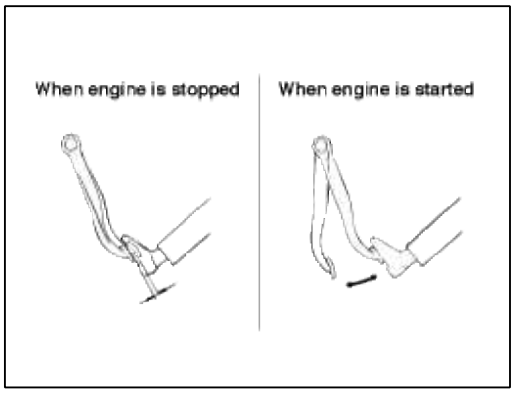
Brake Booster Operating Test

For simple checking of the brake booster operation, carry out the following tests.

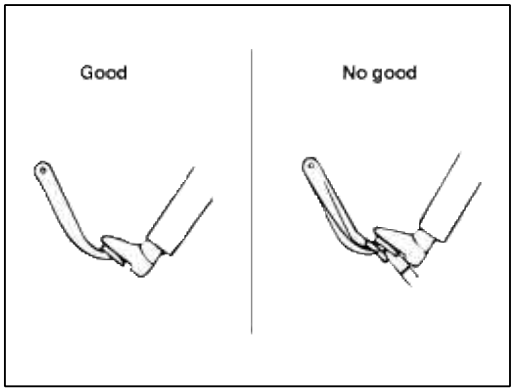
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is inoperative.



2. With the engine stopped, step on the brake pedal several times.
   Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is inoperative.



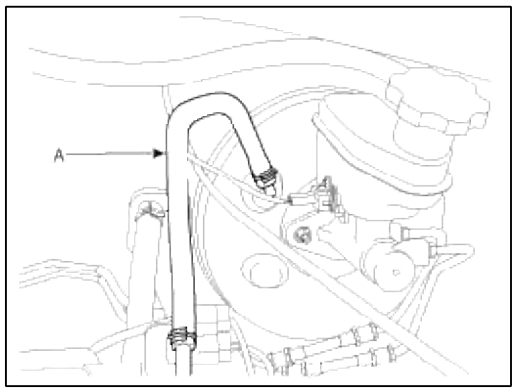
3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is inoperative.
   If the above three tests are okay, the booster performance can be determined as good.
   Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for malfunction.



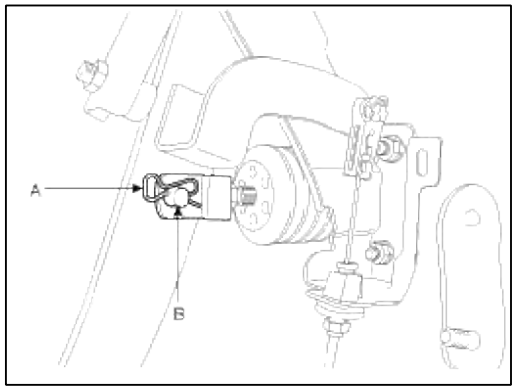
Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.

2. Disconnect the vacuum hose (A) from the brake booster.

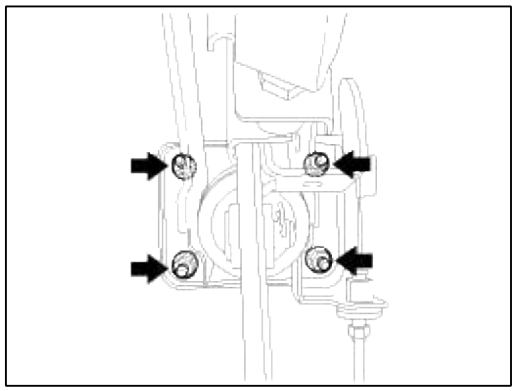


3. Remove the master cylinder. (Refer to Master cylinder)
4. Remove the snap pin (A) and clevis pin (B).

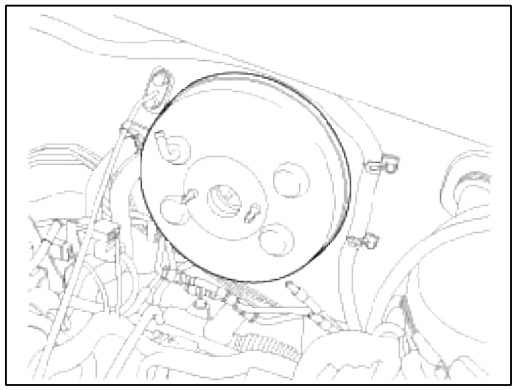


5. Remove the mounting nuts.

Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



6. Remove the brake booster.



Inspection

1. Inspect the check valve in the vacuum hose.

> CAUTION
>
> Do not remove the check valve from the vacuum hose.

2. Check the boot for damage.

Installation

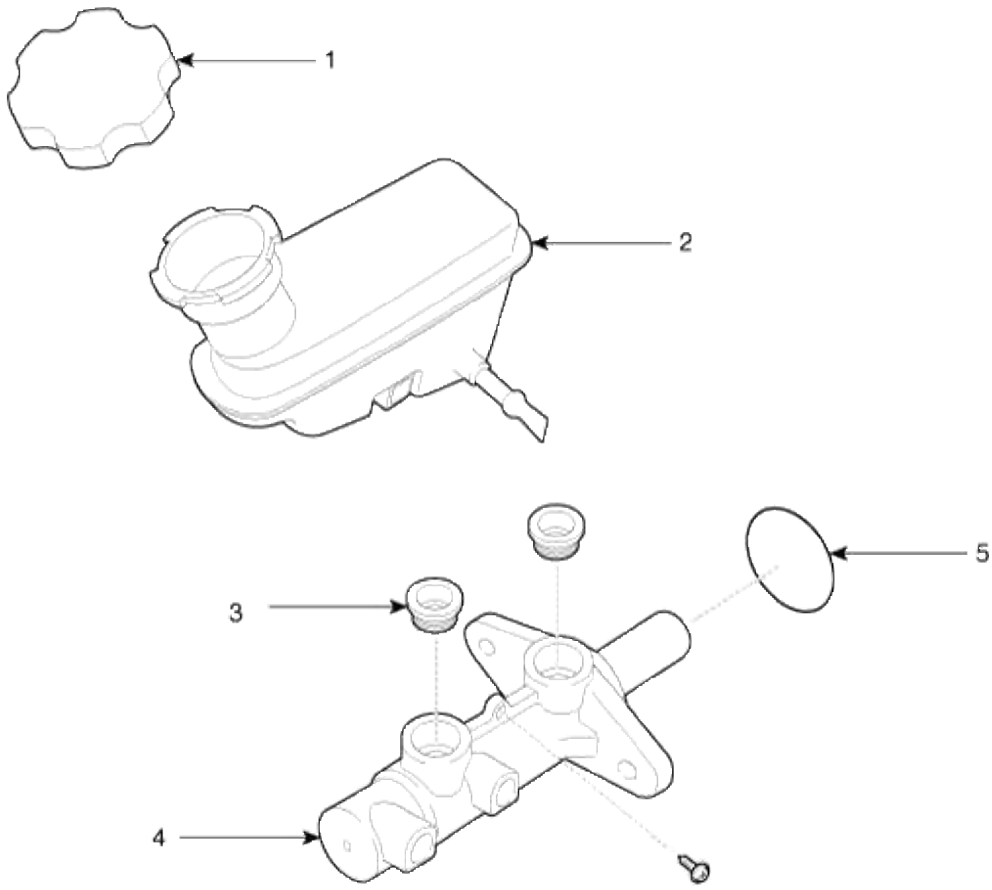
1. Installation is the reverse of removal.

> CAUTION
>
> - Before installing the pin, apply the grease to the joint pin.
> - Use a new snap pin whenever installing.

2. After installing, bleed the brake system. (Refer to Brake system bleeding)
3. Adjust the brake pedal height and free play.
   (Refer to Brake pedal height and free play adjustment)

Brake System > Brake System > Master Cylinder > Components and Components Location

Components



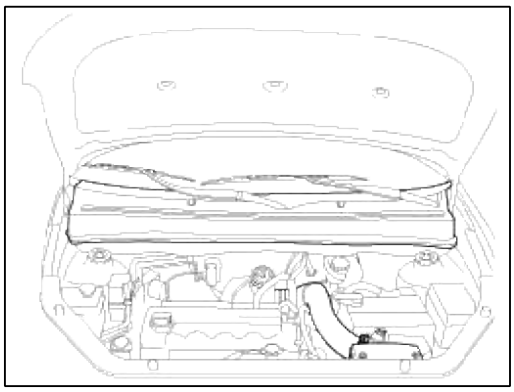
1. Reservoir cap 2. Reservoir 3. Grommet	4. Master cylinder body 5. O-Ring

Brake System > Brake System > Master Cylinder > Repair procedures

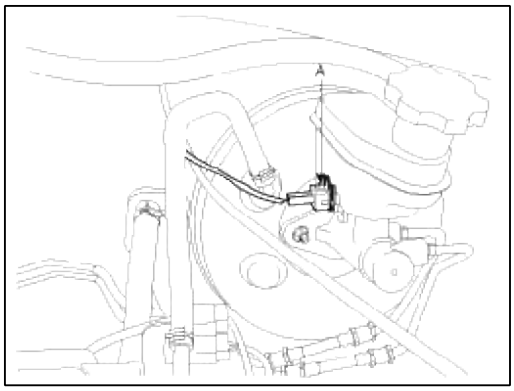
Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.

2. Remove the cowl top cover. (Refer to the Body group-Cowl top Cover)



3. Disconnect the brake fluid level switch connector (A) from the reservoir.

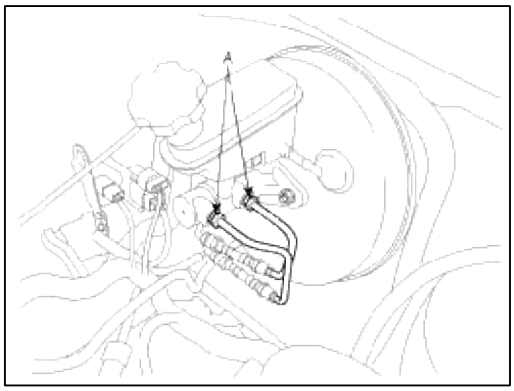


4. Remove the brake fluid from the master cylinder reservoir with a syringe.

> CAUTION
>
> • Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

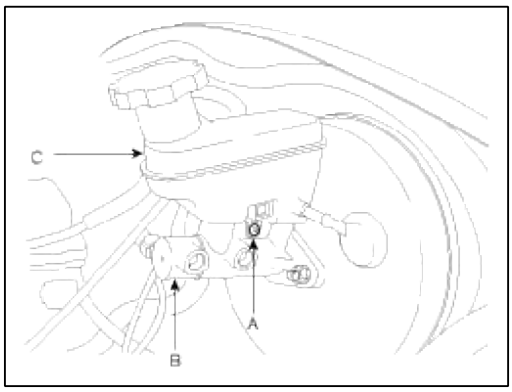
5. Disconnect the brake tube (A) from the master cylinder by loosening the tube flare nut.

Tightening torque :
CBS/ABS : 12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m , 9.4 ~ 12.3lb-ft)
ESC : 18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



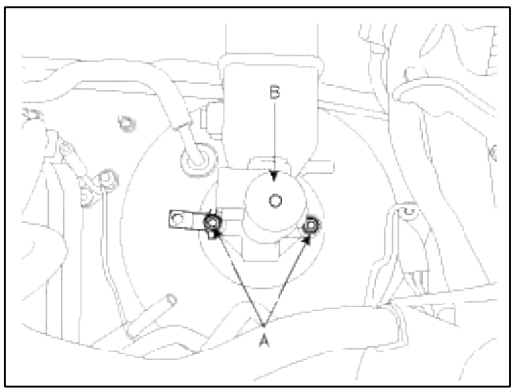
6. Remove the clutch hose. (MT Only)

7. Remove the reservoir (C) from the master cylinder (B), after removing mounting screw (A).



8. Remove the two grommets.
9. Remove the master cylinder (B) from the brake booster after loosening the mounting nuts (A).

Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)



Installation

1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to Brake system bleeding)

Brake System > Brake System > Proportioning Valve > Description and Operation

Description

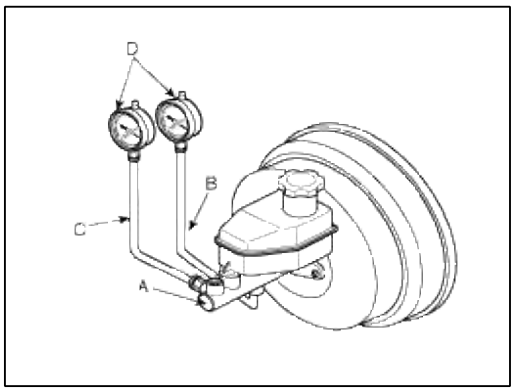
Do not disassemble the proportioning valve. The proportioning valve makes the ideal distribution of fluid pressure to the front and rear brakes to prevent the brakes from skidding in the event of rear wheel lock up and to obtain higher brake efficiency within the range of service brake application.

Brake System > Brake System > Proportioning Valve > Repair procedures

Inspection

1. Remove the front brake tube (B) and rear brake tube (C) from the master cylinder (A).

2. Connect two pressure gauges (D); one to the output valve of the front (B) and rear (C) brake.



NOTE

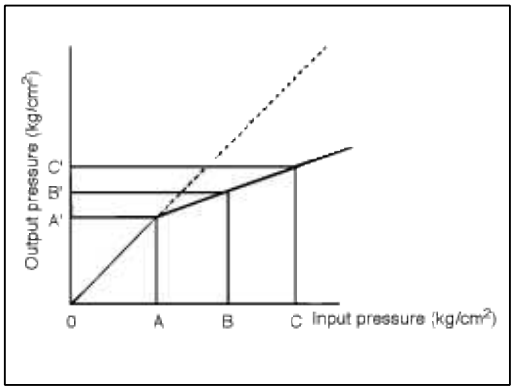
Be sure to bleed the system after connecting the pressure gauges.

3. With the brake applied, measure the front pressure and the rear pressure. If the measured pressures are within the specified range as illustrated, the proportioning valve is good.
4. Reconnect the brake lines in their original positions and bleed the brake system.

NOTE

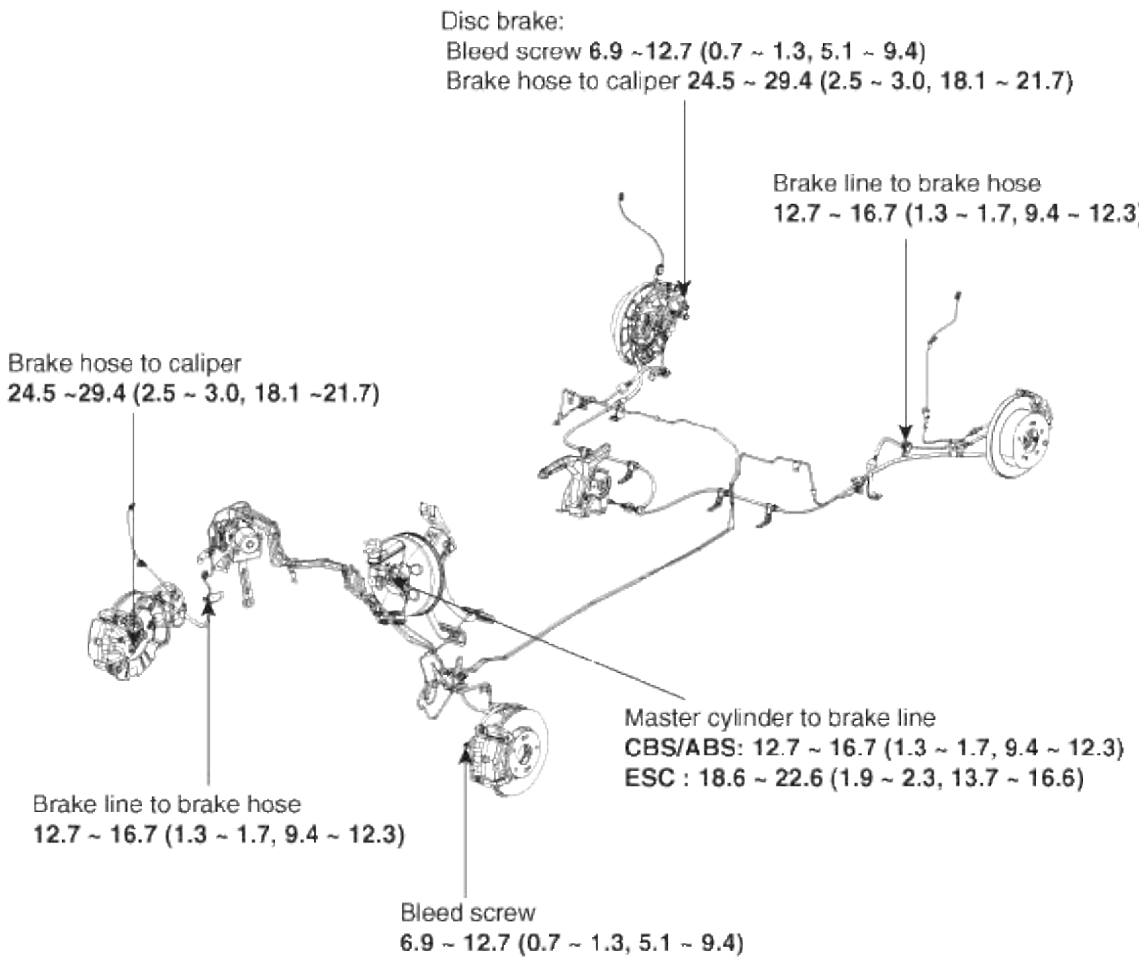
This table shows characteristics of the proportioning valve as the pressure increases.

Front (Output of master cylinder)	Rear (Output of proportioning valve)
A : 20 kg/cm² (1.96 MPa, 285 psi)	A' : 20 kg/cm² (1.96 MPa, 285 psi)
B : 80 kg/cm² (7.85 MPa, 1138 psi)	B' : 36.2 ± 2 kg/cm² (3.55 ± 0.20 MPa, 515 ± 28 psi)
B : 140 kg/cm² (13.73 MPa, 1991 psi)	B' : 52.4 ± 4 kg/cm² (5.14 ± 0.39 MPa, 745 ± 57 psi)



Brake System > Brake System > Brake Line > Components and Components Location

Components



Torque : Nm (kgf.m, lb-ft)

WARNING

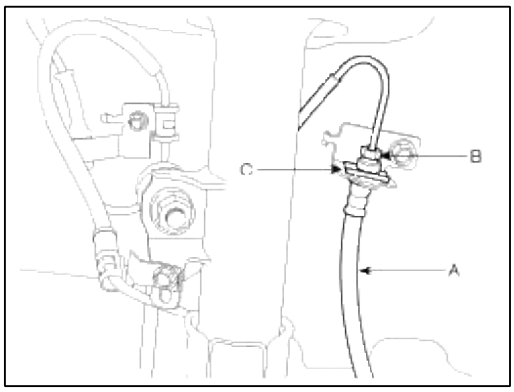
When installing brake hose, be sure to comply with the torque specification to prevent twisted hose.

Brake System > Brake System > Brake Line > Repair procedures

Removal

1. Remove the wheel & tire.

2. Remove the brake hose clip (C).



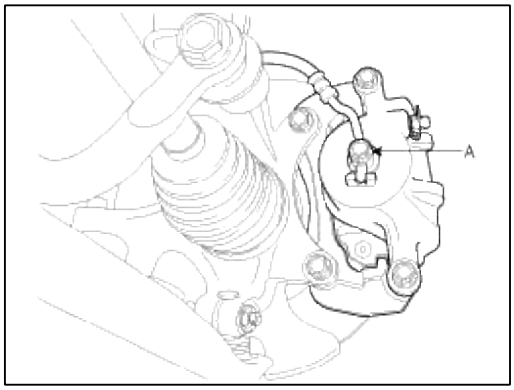
3. Disconnect the brake tube by loosening the tube flare nut (B).

Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)

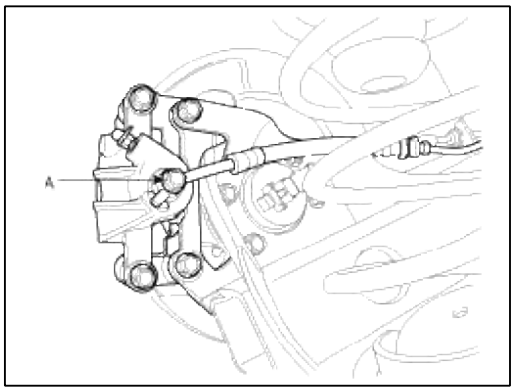
4. Disconnect the brake hose from the brake caliper by loosening the bolt (A).

Tightening torque :
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)

Front



Rear



Inspection

1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damage and fluid leakage.
3. Check the brake tube flare nuts for damage and fluid leakage.

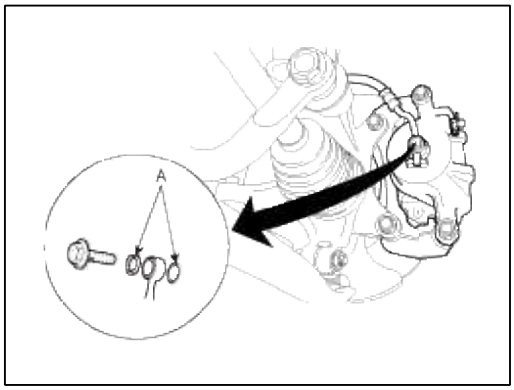
4. Check the brake hose mounting bracket for crack or deformation.

Installation

1. Installation is the reverse of removal.

CAUTION

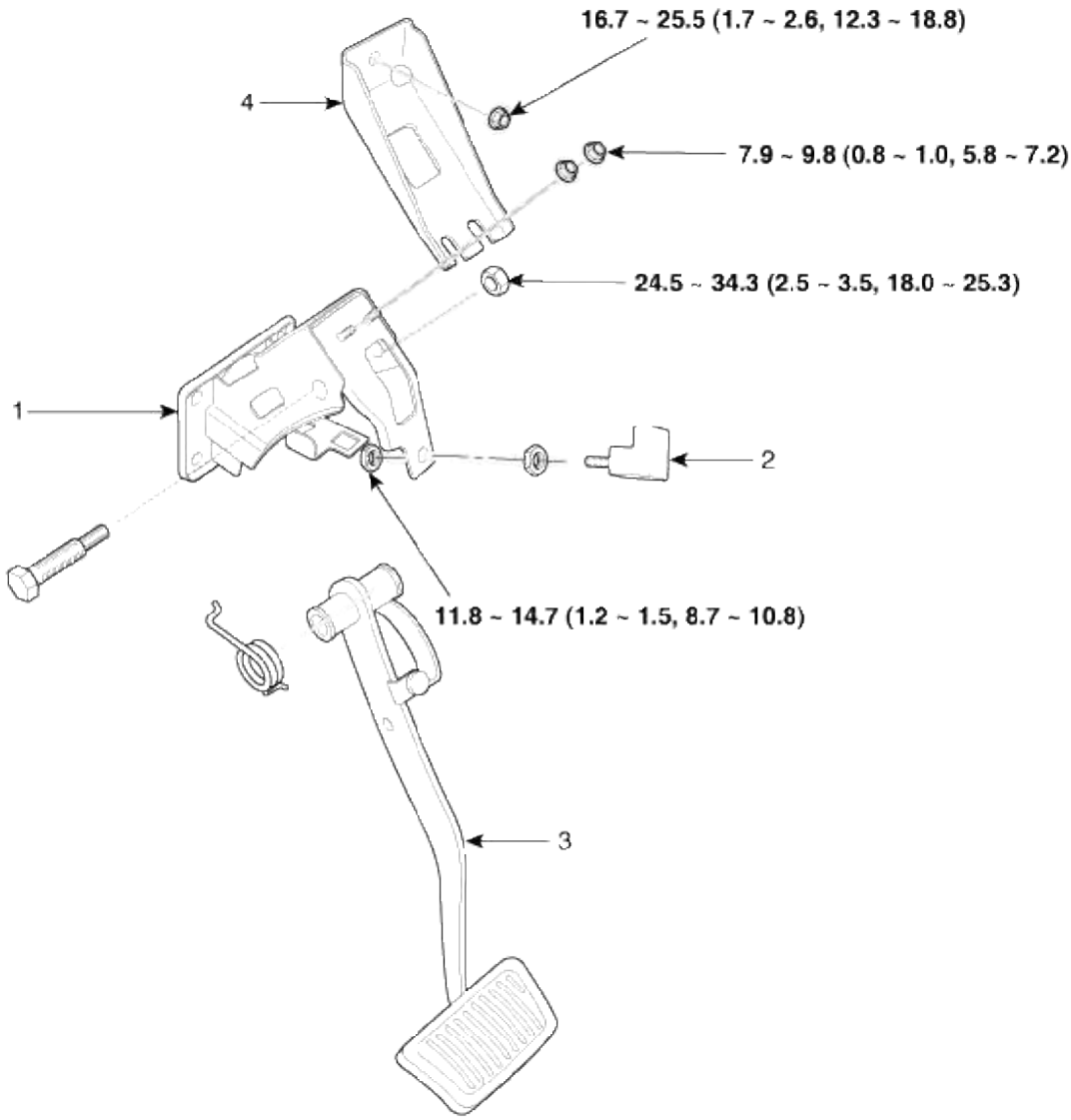
Use a new washer(A) whenever installing.



2. After installation, bleed the brake system. (Refer to Brake system bleeding)
3. Inspect for brake fluid leaks.

Brake System > Brake System > Brake Pedal > Components and Components Location

Components



Torque : N.m (kgf.m, lb-ft)

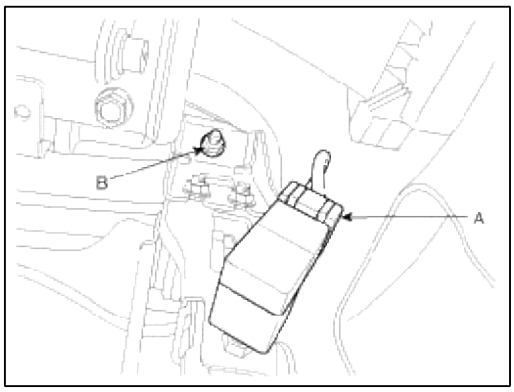
1. Brake pedal member assembly 2. Stop lamp switch	3. Brake pedal 4. Mounting bracket

Brake System > Brake System > Brake Pedal > Repair procedures

Removal

1. Remove the lower crash pad. (Refer to the Body group- crash pad).

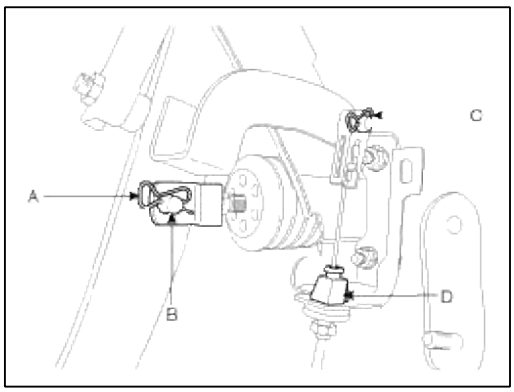
2. Disconnect the stop lamp switch connector (A).



3. Remove the mounting bracket bolt (B).

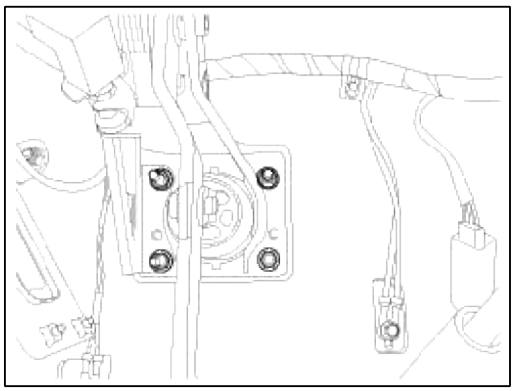
Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)

4. Remove the snap pin (A) and clevis pin (B).



5. Remove the shift lock cable after removing the snap pin (C) and the clip (D).
6. Remove the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

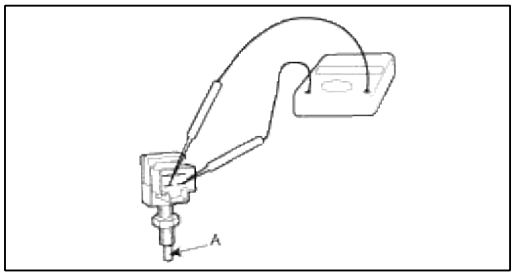
Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



Inspection

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.

4. Check the stop lamp switch.
   (1) Connect a circuit tester to the connector of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
   (2) The stop lamp switch is in good condition if there is no continuity when plunger(A) is pushed.



Installation

1. Installation is the reverse of removal.

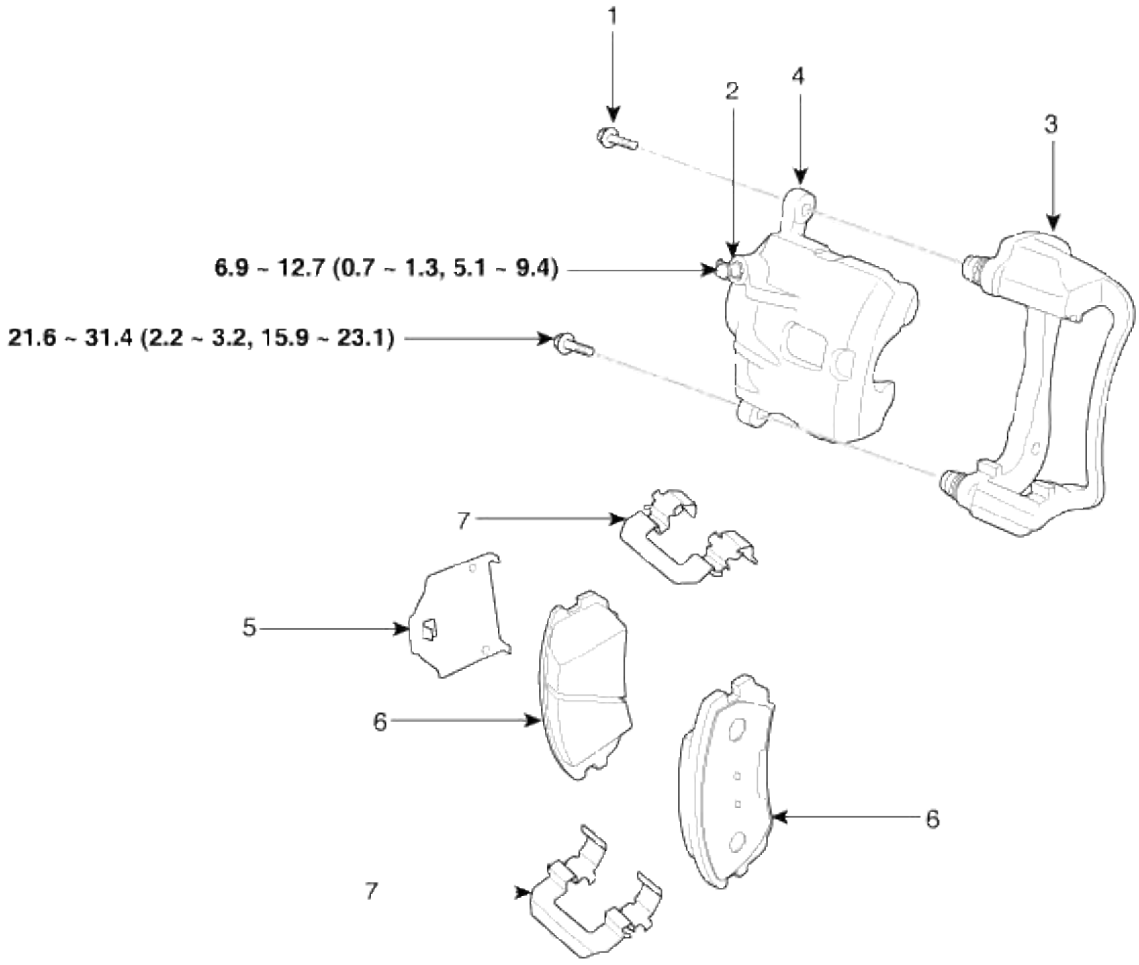
CAUTION

- Before installing the pin, apply the grease to the clevis pin.
- Use a new snap pin whenever installing.

2. Check the brake pedal operation.

Brake System > Brake System > Front Disc Brake > Components and Components Location

Components



1. Guide rod bolt 2. Bleed screw 3. Caliper bracket 4. Caliper body	5. Inner pad shim 6. Brake pad 7. Pad retainer

Brake System > Brake System > Front Disc Brake > Repair procedures

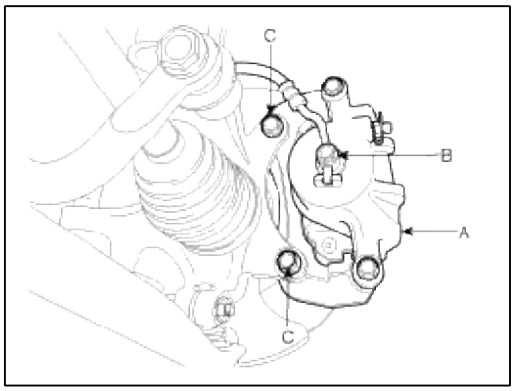
Removal

1. Remove the front wheel & tire.

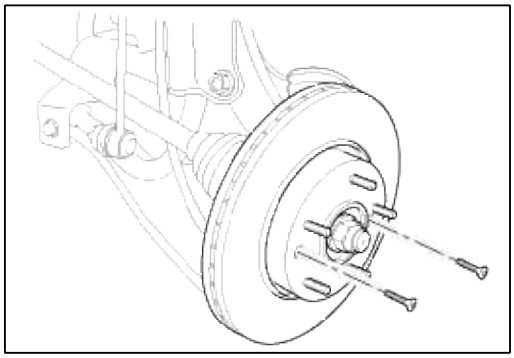
Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

2. Loosen the hose eye-bolt (B) and caliper mounting bolts (C), then remove the front caliper assembly (A).

Tightening torque
Brake hose to caliper(B):
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)
Caliper assembly to knuckle(C):
78.5 ~ 98.1N.m (8.0 ~ 10.0kgf.m, 57.9 ~ 72.3lb-ft)



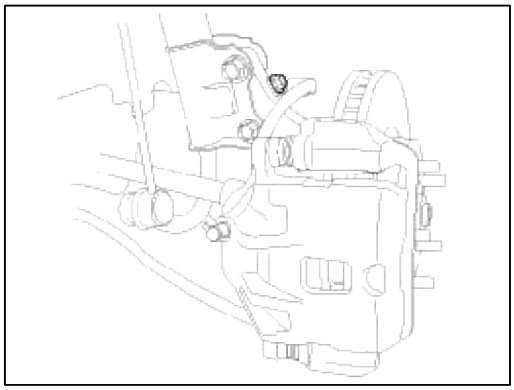
3. Remove the front brake disc by loosening the screws.



Replacement

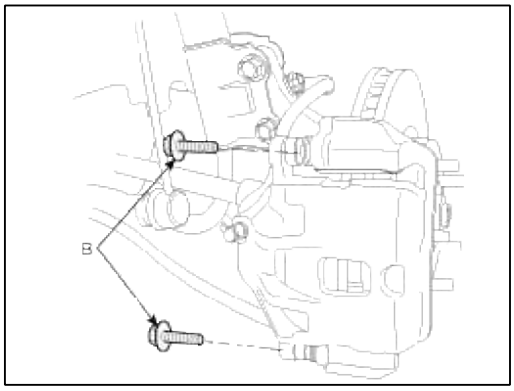
Front Brake Pads

1. Remove the brake hose mounting bracket knuckle mounting part.

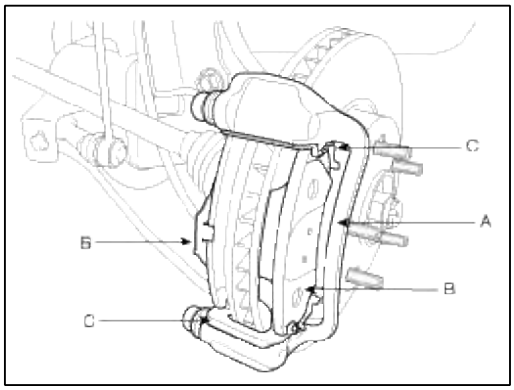


2. Loosen the guide rod bolt (B) and pivot the caliper up out of the way.

Tightening torque :
21.6 ~ 31.4N.m (2.2 ~ 3.2kgf.m, 15.9 ~ 23.1lb-ft)



3. Replace pad shim (B), pad retainers (C) and brake pads (B) in the caliper bracket (A).

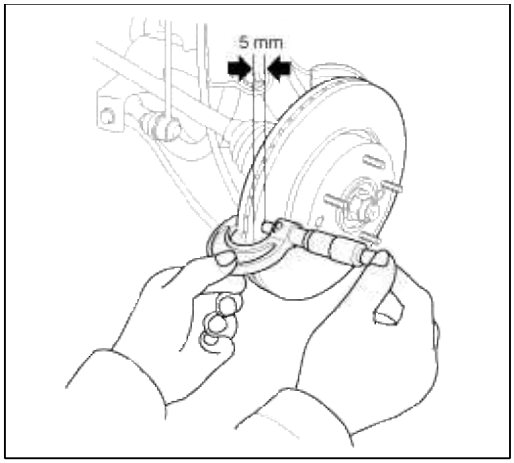


Inspection

Front Brake Disc Thickness Check

1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Remove all rust and contamination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) from the brake disc outer circle.

Brake disc thickness
Standard: 26mm (1.02in)
Service limit: 24.4mm (0.96in)
Deviation: Less than 0.005mm (0.0002in)



4. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

Front Brake Pad Check

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

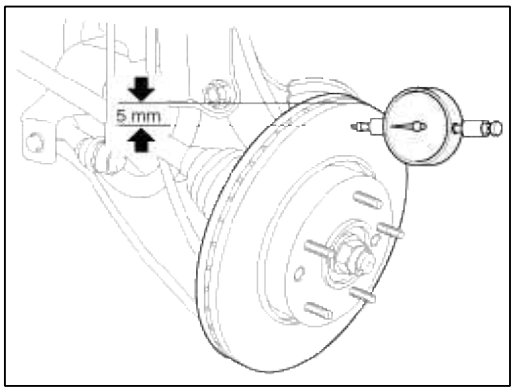
Pad thickness
Standard value : 11mm (0.43in)
Service limit : 2.0mm (0.0787in)

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

Front Brake Disc Runout Check

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout
Limit : 0.025mm (0.00098in.) or less (new one)



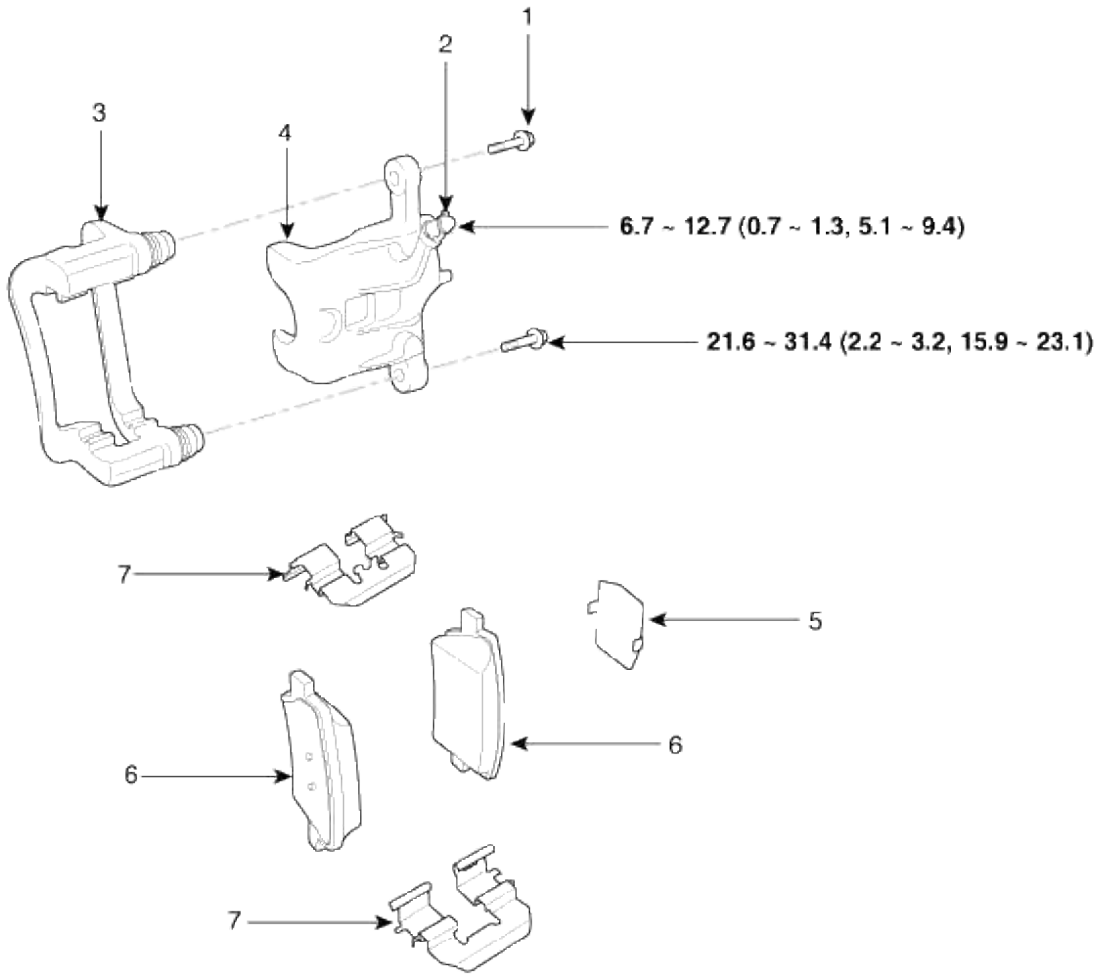
2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the replacement brake disc runout exceeds the limit specification rotate the 180° and check again.
4. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.
3. After installation, bleed the brake system. (Refer to Brake system bleeding)

Brake System > Brake System > Rear Disc Brake > Components and Components Location

Components



Torque : N.m (kgf.m, lb-ft)

1. Guide rod bolt 2. Bleed screw 3. Caliper bracket 4. Caliper body	5. Inner pad shim 6. Brake pad 7. Pad retainer

Brake System > Brake System > Rear Disc Brake > Repair procedures

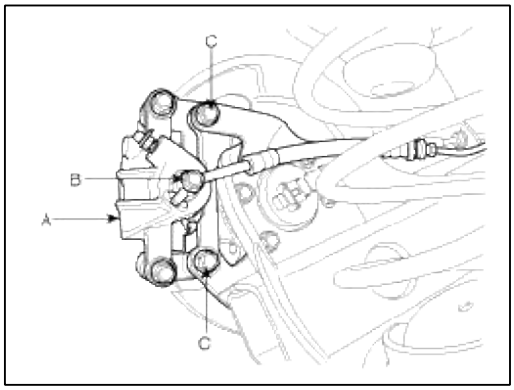
Removal

1. Remove the rear wheel & tire.

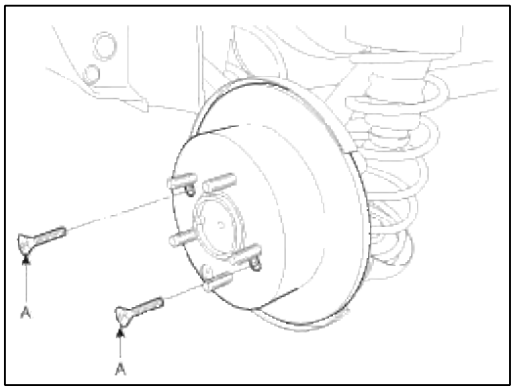
Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

2. Loosen the hose eye-bolt (B) and caliper mounting bolts (C), then remove the rear caliper assembly (A).

Tightening torque
Brake hose to caliper(B):
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)
Caliper assembly to carrier(C):
63.7 ~ 73.6N.m (6.5 ~ 7.5kgf.m, 47.0 ~ 54.3lb-ft)



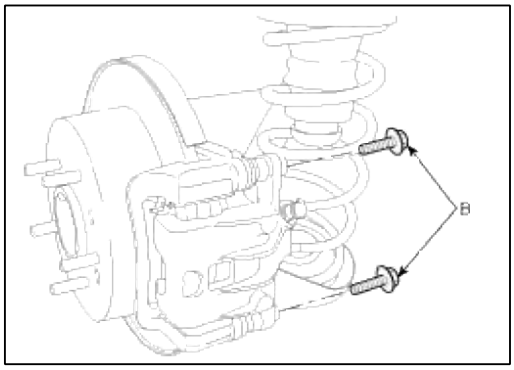
3. Remove the rear brake disc by loosening the screws (A).



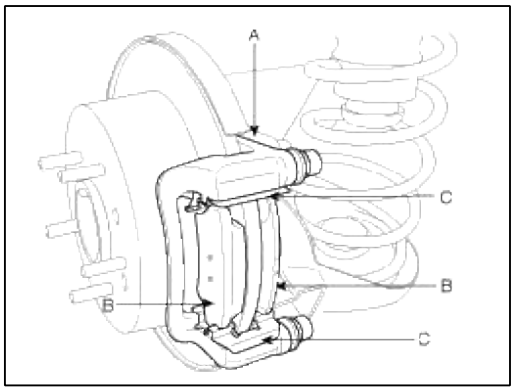
Replacement
Rear Brake Pads

1. Loosen the guide rod bolt (B) and pivot the caliper up out of the way.

Tightening torque :
21.6 ~ 31.4N.m (2.2 ~ 3.2kgf.m, 15.9 ~ 23.1lb-ft)



2. Replace pad shim, pad retainers (C) and brake pads (B) in the caliper bracket (A).

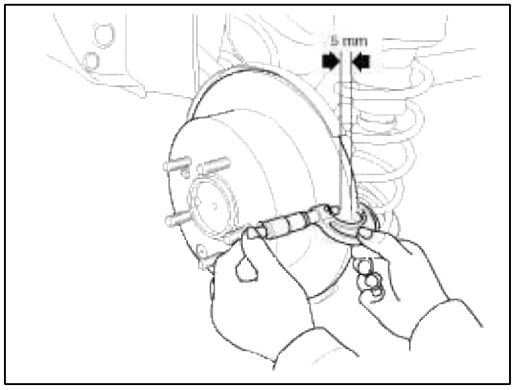


Inspection

Rear Brake Disc Thickness Check

1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Remove all rust and contamination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) from the brake disc outer circle.

Brake disc thickness
Standard: 10mm (0.39in)
Service limit: 8.4mm (0.33in)
Deviation: less than 0.01mm (0.00039in)



4. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

Rear Brake Pad Check

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

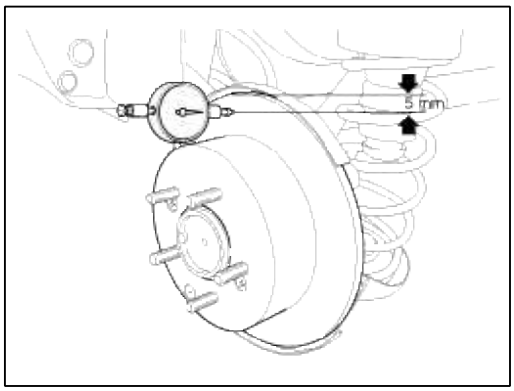
Pad thickness
Standard value: 10mm (0.39 n)
Service limit: 2.0 mm (0.0787 in)

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

Rear Brake Disc Runout Check

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout
Limit: 0.05mm (0.00197in.) or less (new one)



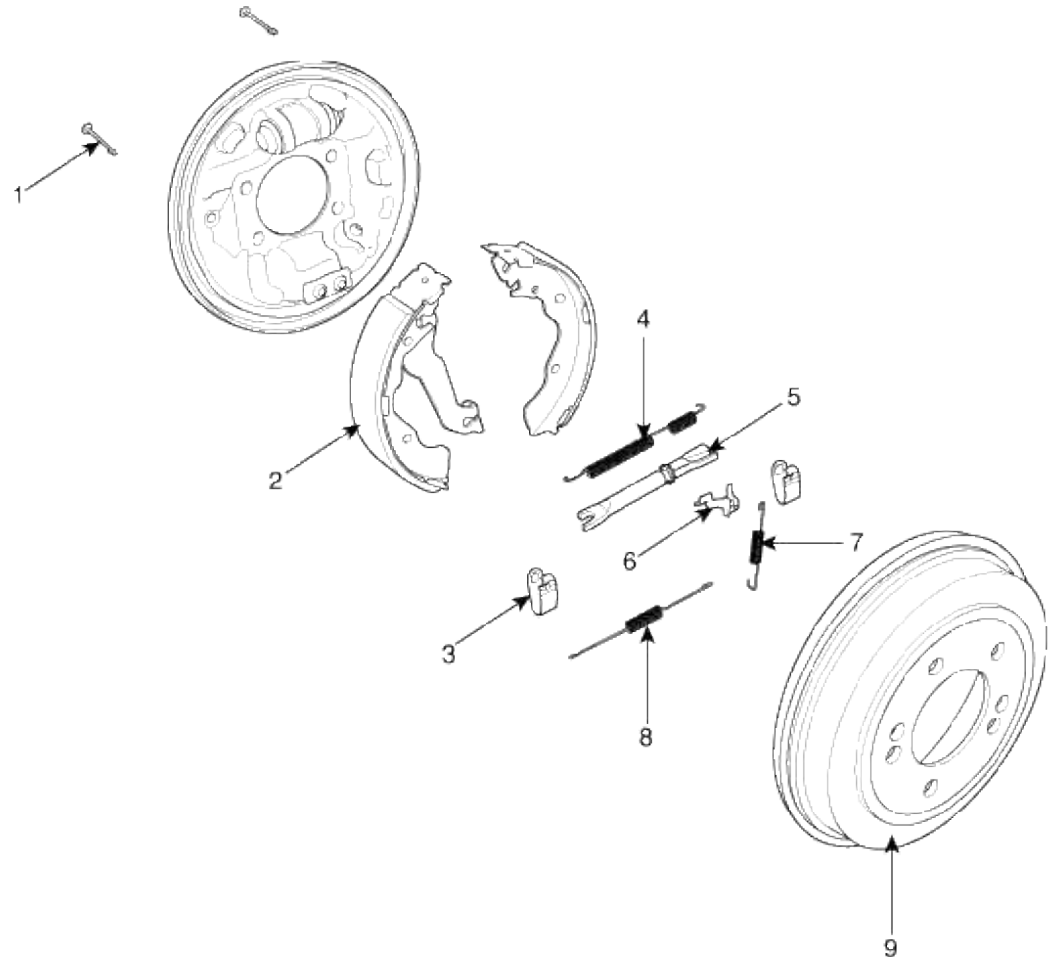
2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the runout again.
3. If the replacement brake disc runout exceed the limit specification rotate the 180° and check again.
4. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.
3. After installation, bleed the brake system. (Refer to Brake system bleeding)

Brake System > Brake System > Rear Drum Brake > Components and Components Location

Components



1. Shoe hold down pin	6. Adjusting lever
2. Shoe	7. Adjusting lever spring
3. Shoe hold spring	8. Lower return spring
4. Upper return spring	9. Brake drum
5. Shoe adjuster	

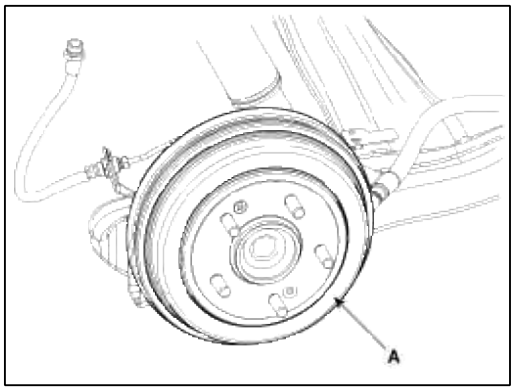
Brake System > Brake System > Rear Drum Brake > Repair procedures

Removal

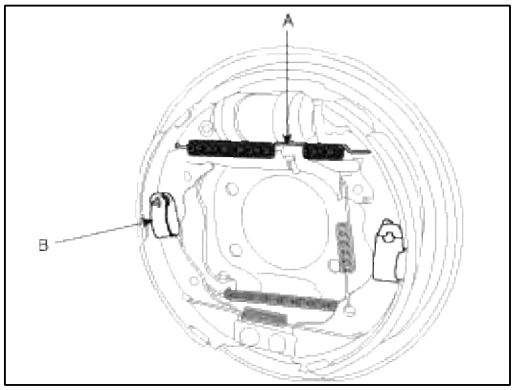
CAUTION

- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

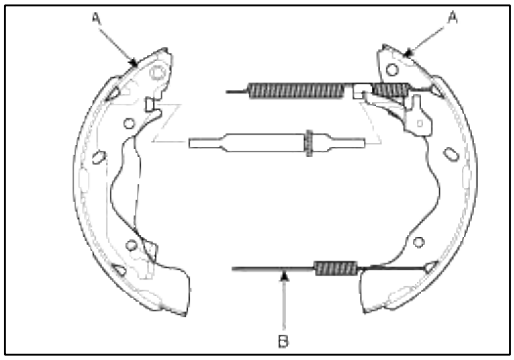
1. Release the parking brake.
2. Remove the rear tire and wheel.
3. Remove the rear brake drum (A).



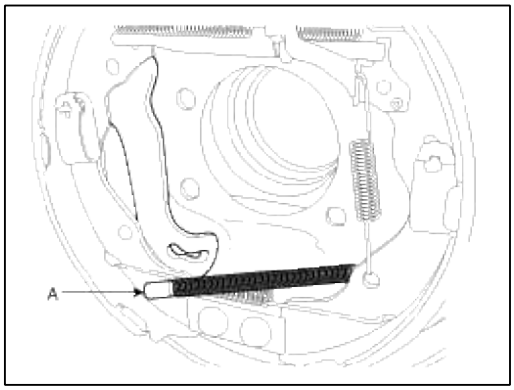
4. Remove the shoe hold spring and shoe hold pin (B).
5. Remove the upper return spring (A).



6. Lower the brake shoe assembly (A), and remove the lower return spring (B). Make sure not to damage the dust cover on the wheel cylinder.

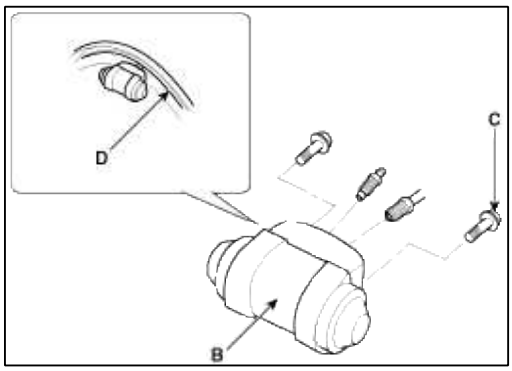


7. Remove the parking brake cable (A) from the brake assembly.



8. Remove the brake shoe assembly.
9. Disconnect brake tubes (A) from the wheel cylinder (B).

10. Remove the bolt (C) and the wheel cylinder (B) from the backing plate (D).

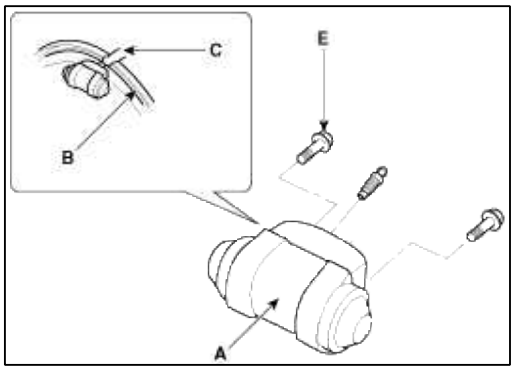


Installation

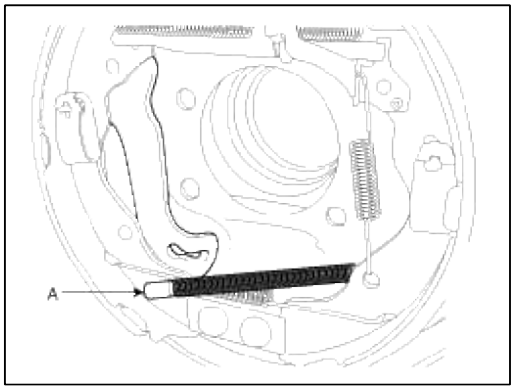
NOTE

- Do not spill brake fluid on the vehicle: it may damage the paint; if brake fluid does contact the paint. Wash it off immediately with water.
- To prevent spills, cover the hose joints with rags or shop towels.
- Use only a genuine wheel cylinder special bolt.

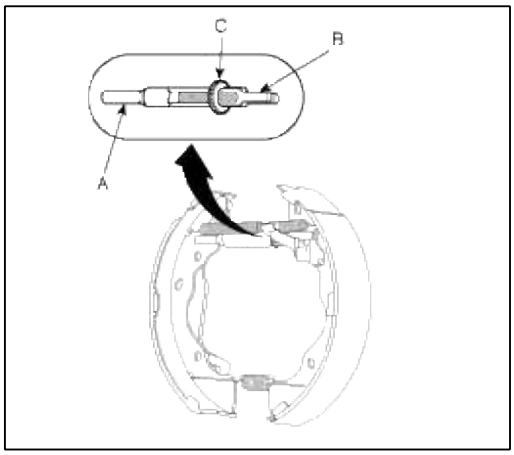
1. Apply sealant (C) between the wheel cylinder (A) and backing plate (B), and install the wheel cylinder.



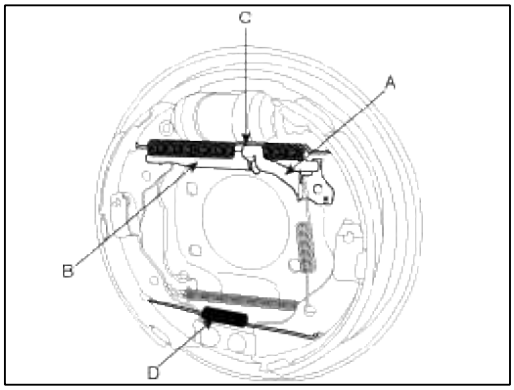
2. Connect the brake tubes (D) to the wheel cylinder.
3. Connect the parking brake cable (A) to the brake assembly.



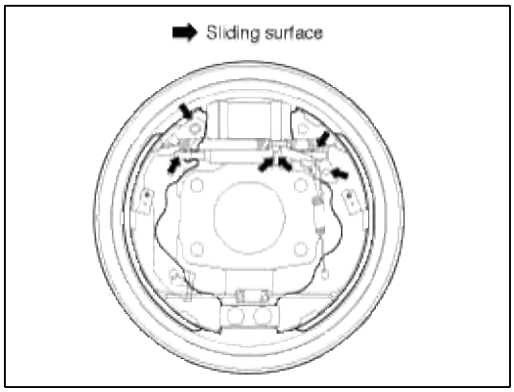
4. Clean the threaded portions of adjuster sleeve (A) and push rod female (B). Coat the threads of the adjuster assembly with grease. To shorten the clevises, turn the adjuster bolt (C).



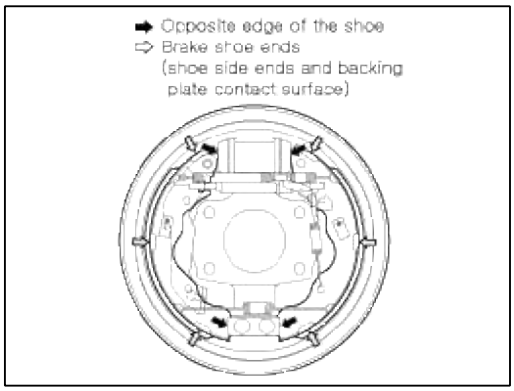
5. Hook the shoe adjuster lever (A), then install it to the brake shoe.



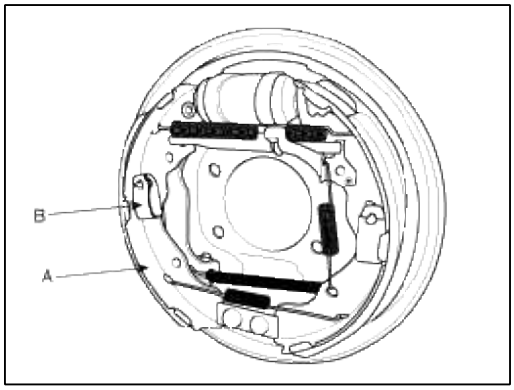
6. Install the adjuster assembly (B) and upper return spring (C) as right direction. Be careful not to damage the wheel cylinder dust covers.
7. Install the lower return spring (D).
8. Apply brake cylinder grease or equivalent rubber grease to the sliding surfaces shown. Don't get grease on the brake linings.



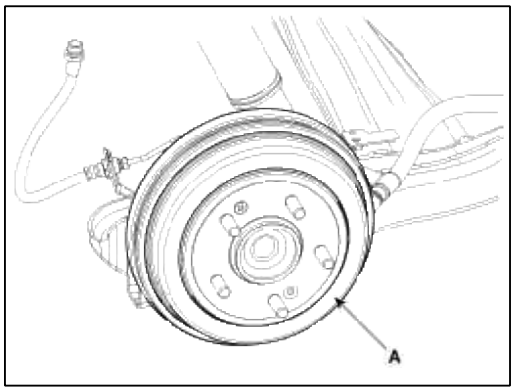
9. Apply brake cylinder grease or equivalent rubber grease to the brake shoe ends and opposite edges of the shoes shown. Don't get grease on the brake linings.



10. Install the brake shoes (A) onto the backing plate. Be careful not to damage the wheel cylinder dust covers.
11. Install the shoe hold down pins (B) and the shoe hold down springs.



12. Install the rear brake drum (A).



13. If the wheel cylinder has been removed, bleed the brake system.
14. Depress the brake pedal several times to set the self-adjusting brake.
15. Adjust the parking brake.

Inspection

CAUTION

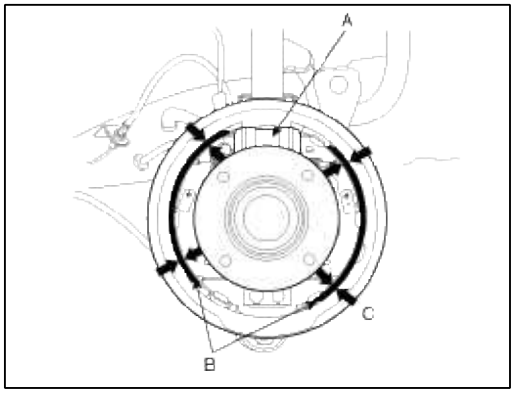
- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

NOTE

- Contaminated brake linings or drums reduce stopping ability.
- Block the front wheels before jacking up the rear of the vehicle.

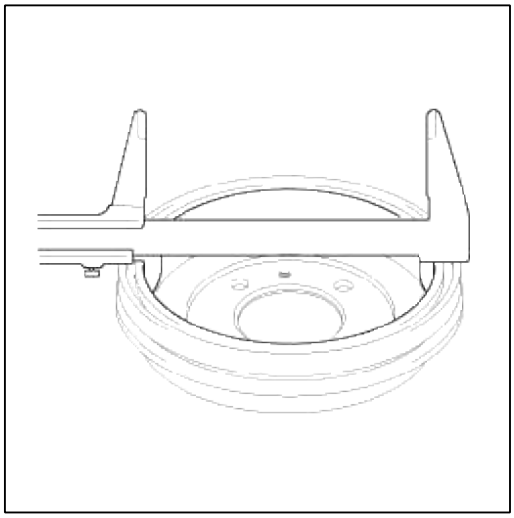
1. Raise the rear of the vehicle, and make sure it is securely supported.
2. Release the parking brake, and remove the rear brake drum.
3. Check the wheel cylinder (A) for leakage.
4. Check the brake linings (B) for cracking, glazing, wear, and contamination.
5. Measure the brake lining thickness (C).
   Measurement does not include brake shoe thickness.

Brake lining thickness
Standard : 5.14mm (0.202in)
Service limit : 1.0mm (0.039in)



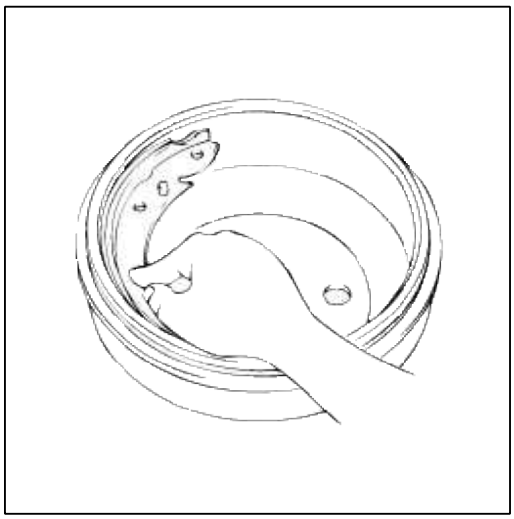
6. If the brake lining thickness is less than the service limit, replace the brake shoes as a set.
7. Check the bearings in the hub unit for smooth operation. If it requires servicing, replace it.
8. Measure the inside diameter of the brake drum with inside vernier calipers.

Drum inside diameter
Standard : 203.2mm (8.0in)
Service limit : 205.2mm (8.08in)
Drum roundness
Service limit : 0.06mm (0.00236in)



9. If the inside diameter of the brake drum is more than the service limit, replace the brake drum.
10. Check the brake drum for scoring, grooves, and cracks.

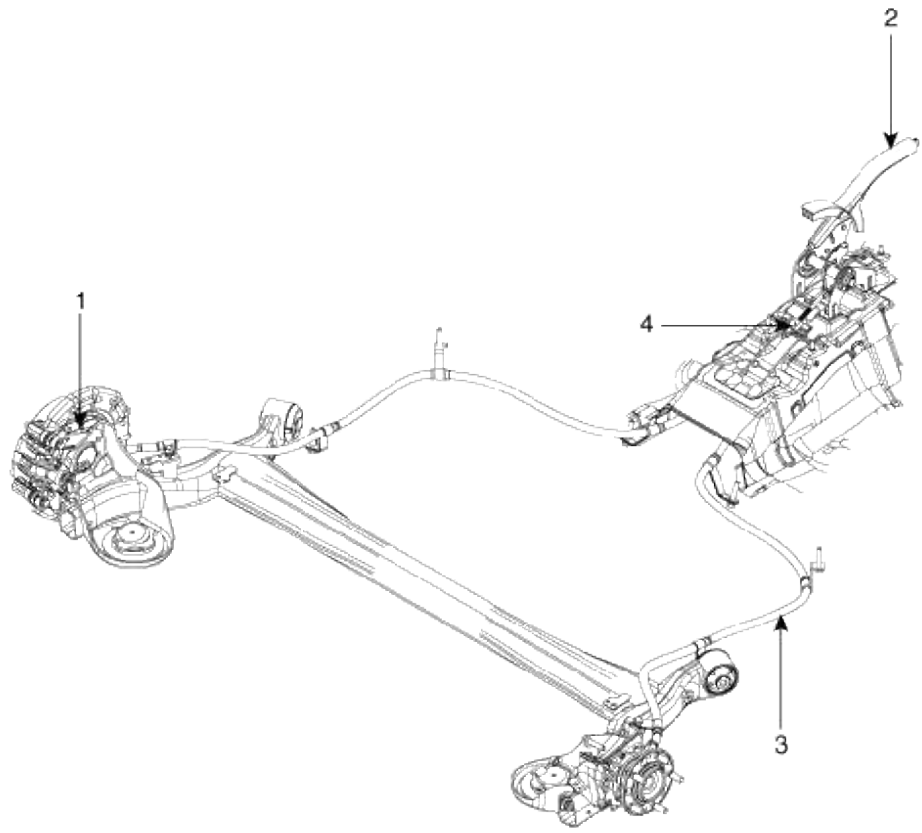
11. Inspect the brake lining and drum for proper contact.



12. Inspect the wheel cylinder outside for excessive wear and damage.
13. Inspect the backing plate for wear or damage.

Brake System > Parking Brake System > Parking Brake Assembly > Components and Components Location

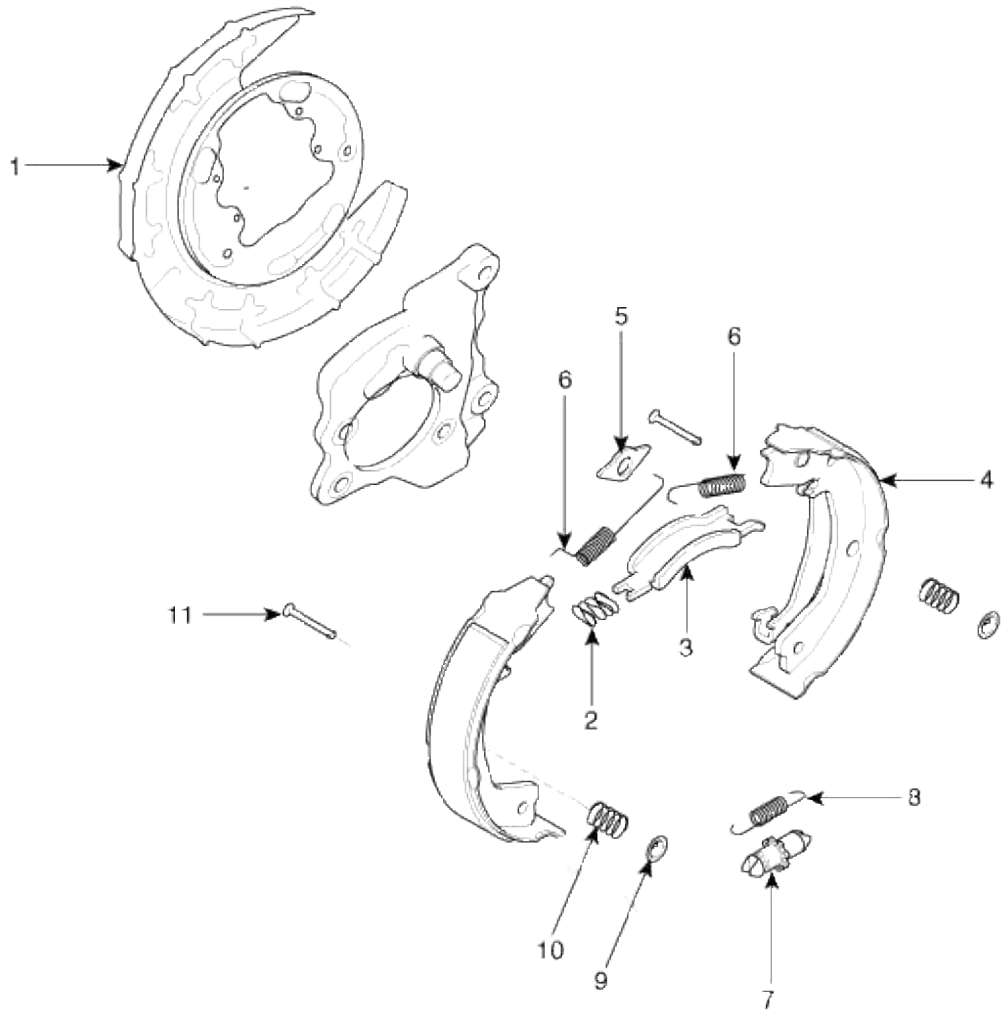
Component Location



1. Parking brake 2. Parking brake lever	3. Parking brake cable 4. Equalizer assembly

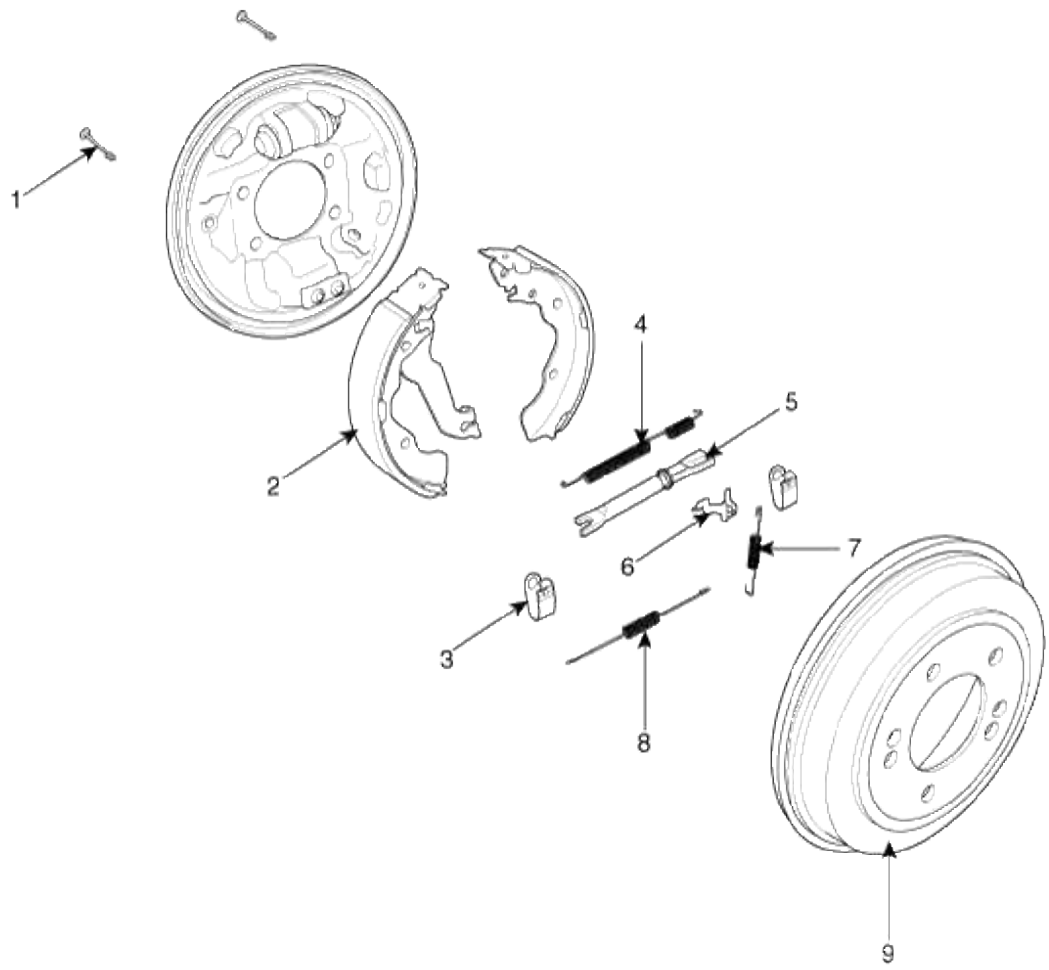
Component

Disc Brake Type



1. Back plate 2. Strut spring 3. strut 4. Shoe & lining 5. Shoe guie	6. Return spring 7. Adjuster 8. Return spring 9. Cup washer 10. Shoe hold down spring

Drum Brake Type



1. Shoe hold down pin	6. Adjusting lever
2. Shoe	7. Adjusting lever spring
3. Shoe hold spring	8. Lower return spring
4. Upper return spring	9. Brake drum
5. Shoe adjuster	

Brake System > Parking Brake System > Parking Brake Assembly > Repair procedures

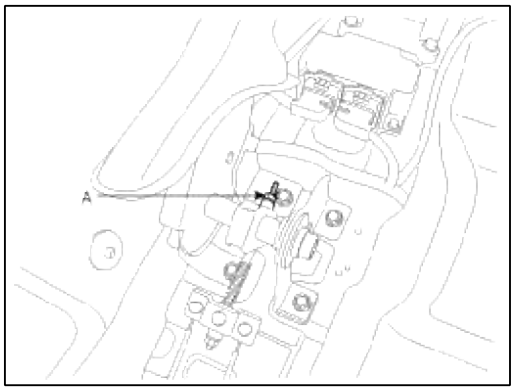
Removal

Parking Brake Lever

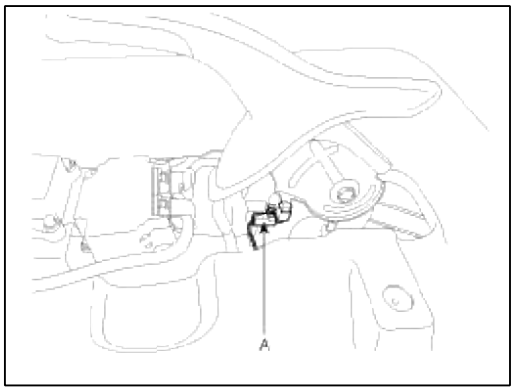
NOTE

The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

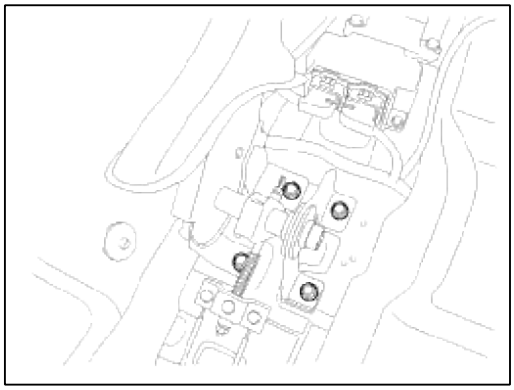
1. Remove the floor console. (Refer to Body group. -"Floor console")
2. Loosen the adjusting nut (A) and the parking brake cables.



3. Disconnect the connector (A) of parking brake switch.



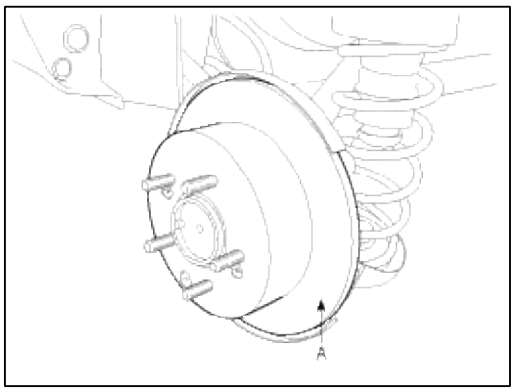
4. Remove the parking brake lever assembly after removing the 4 bolts shown.



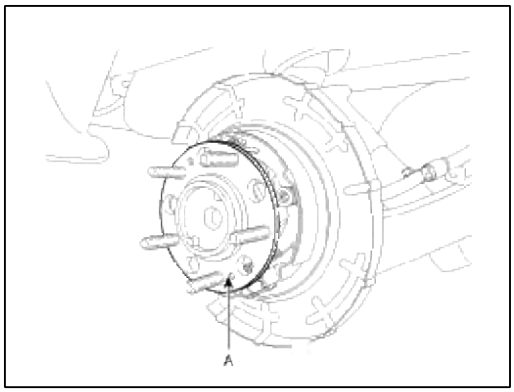
Parking Brake Shoe (Disc Brake Type)

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel, then remove the brake caliper. (Refer to "Rear disc brake removal")

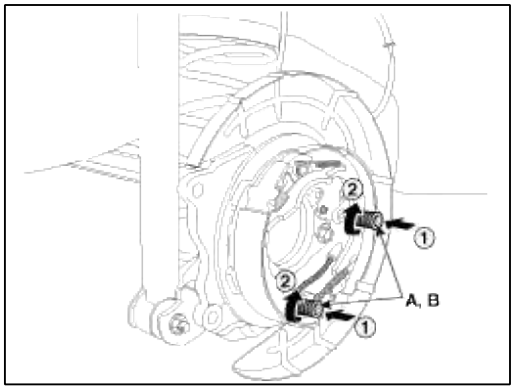
3. Remove the brake Disc (A).



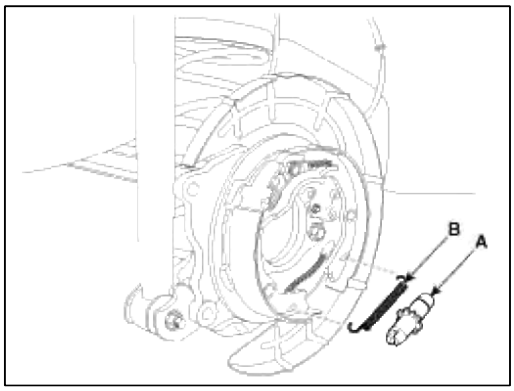
4. Remove the rear hub unit bearing (A).



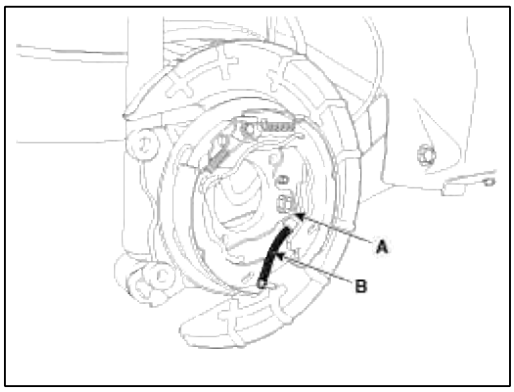
5. Remove the shoe hold down pin (A) and the spring (B) by pushing the retainer spring and turning the pin.



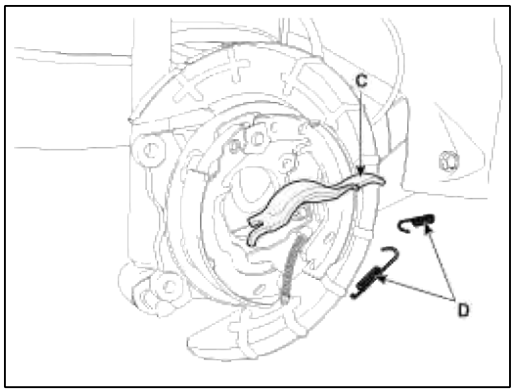
6. Remove the adjuster assembly (A) and the return spring (B).



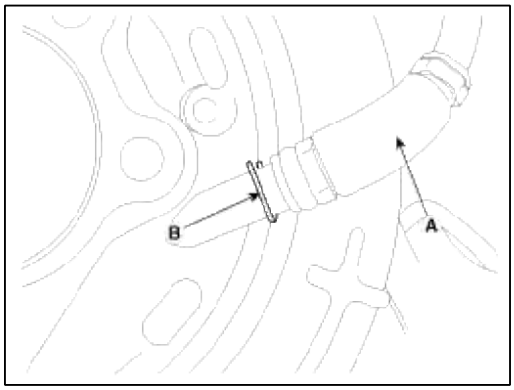
7. Remove the parking brake cable (B) from the brake shoe (A).



8. Remove the strut (C) and the strut spring (D).

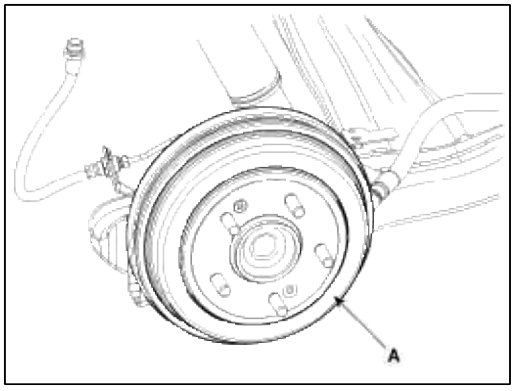


9. Remove the brake shoe.
10. Remove the parking brake cable retaining (B), from the parking brake cable (A).

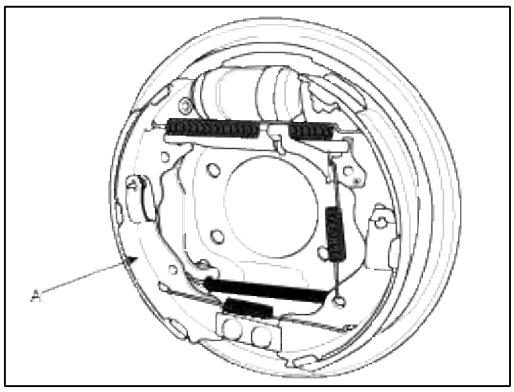


Parking Brake Shoe (Drum Brake Type)

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel, then remove the brake drum (A).



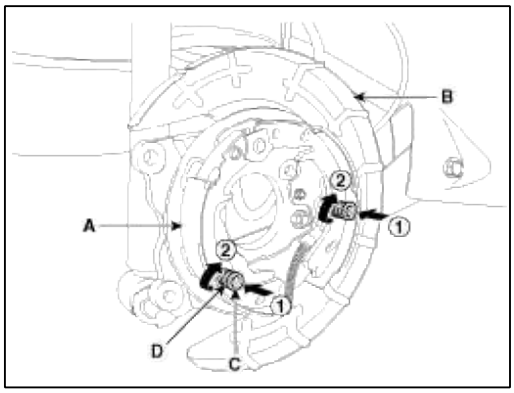
3. Remove the brake shoe (A). (Refer to "Rear drum brake removal")



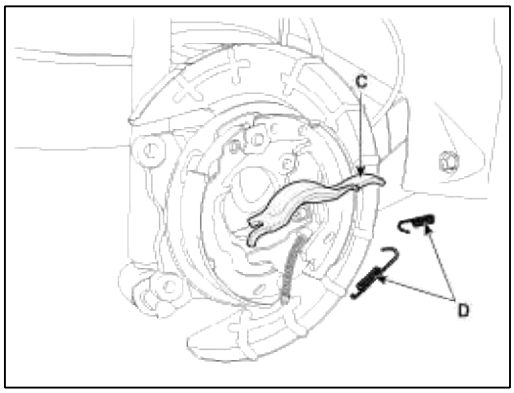
Installation

Parking Brake Shoe (Disc Brake Type)

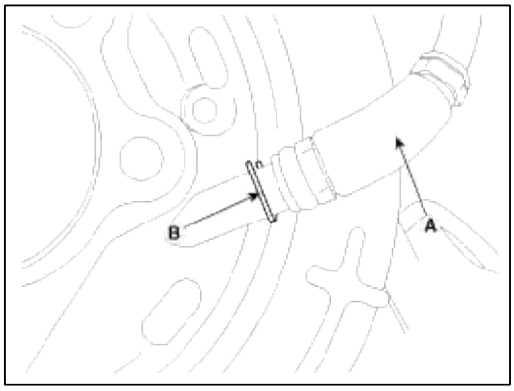
1. Install the brake shoe(A) to the back plate(B).



2. Install the shoe hold down pin(C) and the spring(D) by pushing the retainer spring (D) and turning the pins.
3. After installing the strut (A) and upper return spring (B), install the adjuster assembly (C) and the lower return spring (D).

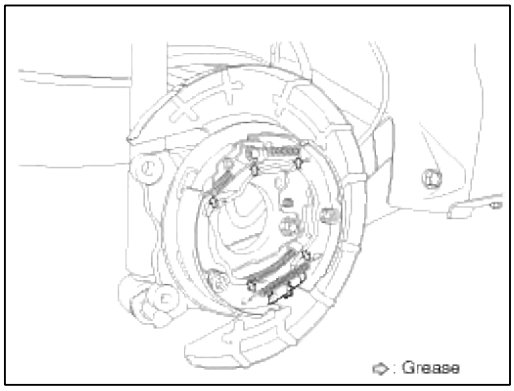


4. Install the parking brake cable (A), then install the retaining (B).

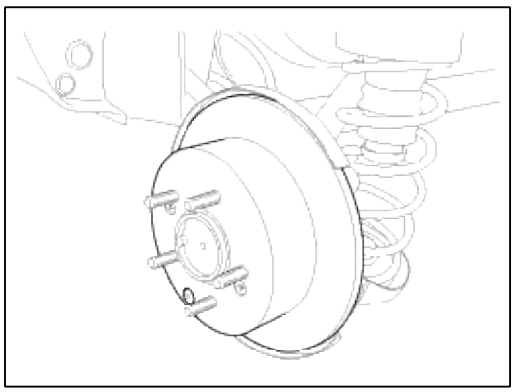


5. Apply a coating of the specified grease to each sliding parts of parking brake as shown.

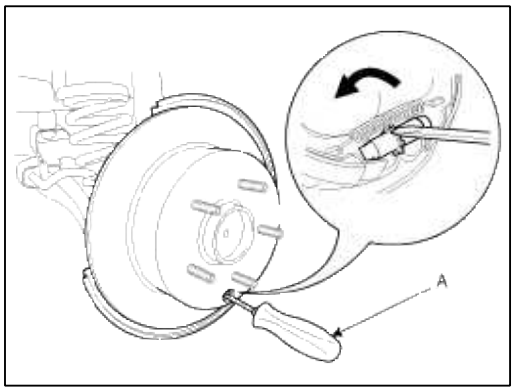
Specified grease :
Multi purpose grease SAE J310, NLGI No.2



6. Install the rear brake disc, then adjust the rear brake shoe clearance.
   (1) Remove the plug from the disc.



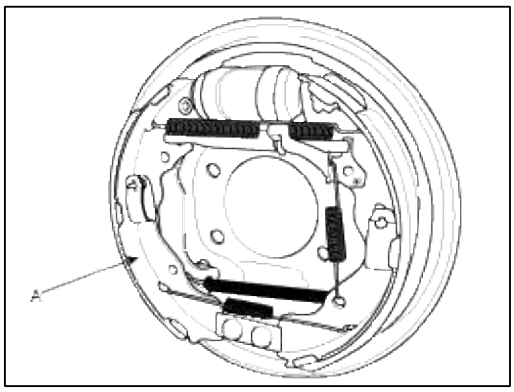
   (2) Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 3 ~ 5 notches in the opposite direction.



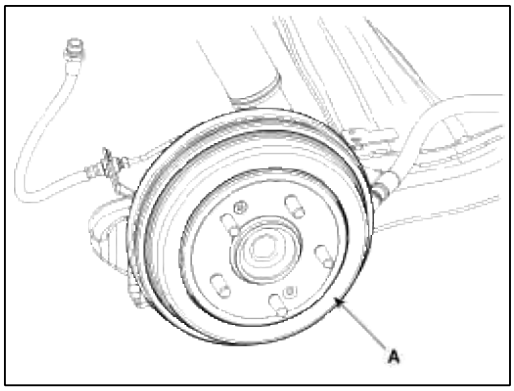
7. Install the brake caliper. (Refer to "Rear brake installation")
8. Install the tire and wheel.
9. Adjust the parking brake lever.

Parking Brake Shoe (Drum Brake Type)

1. Install the brake shoe (A). (Refer to "Rear drum brake installation")



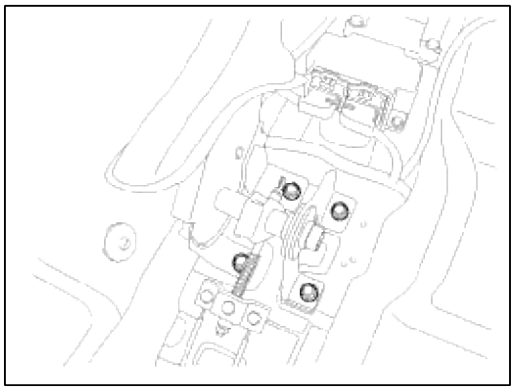
2. Install the brake drum (A).



3. Depress the brake pedal several times to set the self-adjusting brake.
4. Adjust the parking brake lever.

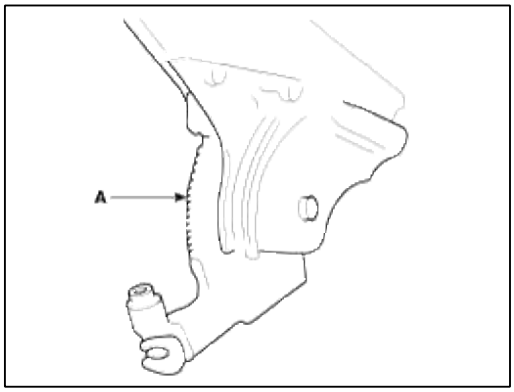
Parking Brake Lever

1. Install the parking brake lever assembly, then tighten the mounting bolts.



2. Apply a coating of the specified grease to each sliding parts (A) of the ratchet plate or the ratchet pawl.

Specified grease :
Multi purpose grease SAE J310, NLGI No.2

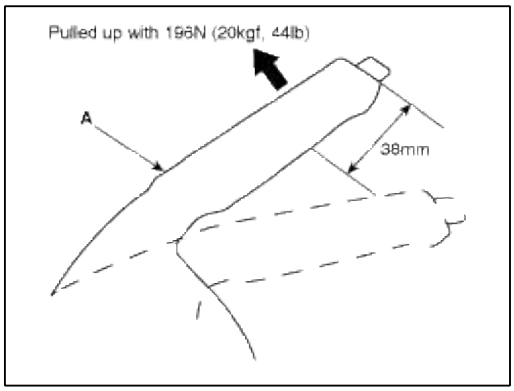


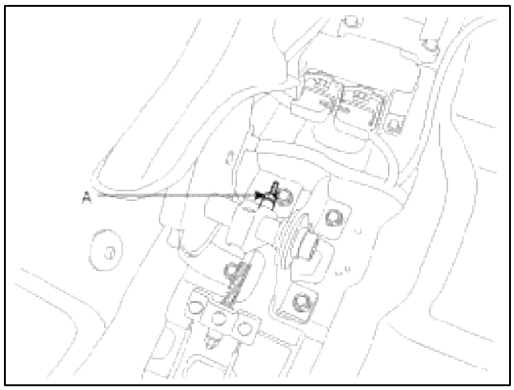
3. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :
5 ~ 7 cliks (Pull the lever with 20kg)

NOTE

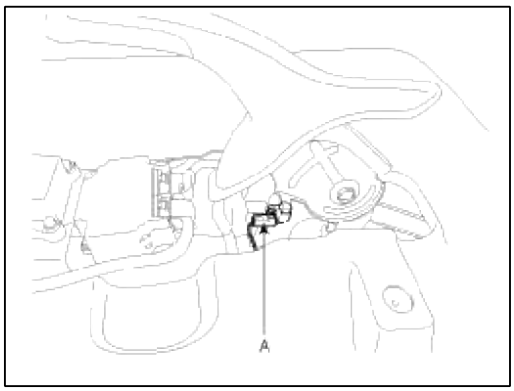
After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke. (Refer to "Parking brake shoe installation")





4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.

6. Reconnect the connector (A) of parking brake switch.



NOTE

Inspect the continuity of parking brake switch.

When the brake lever is pulled : continuity
When the brake lever is released : no continuity

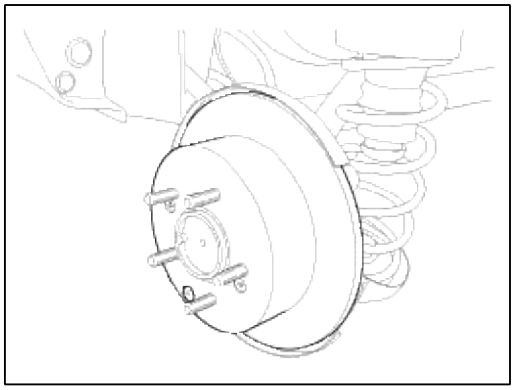
7. Install the floor console. (Refer to Body group - "Floor console")

Adjustment

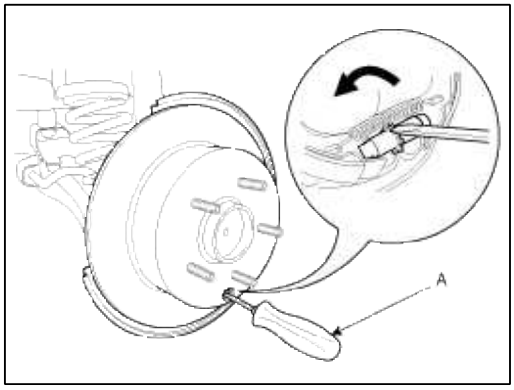
Parking Brake Shoe Clearance Adjustment

Disc Brake Type

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the plug from the disc.



4. Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 3~5 notches in the opposite direction.



Parking Brake Shoe Clearance Adjustment

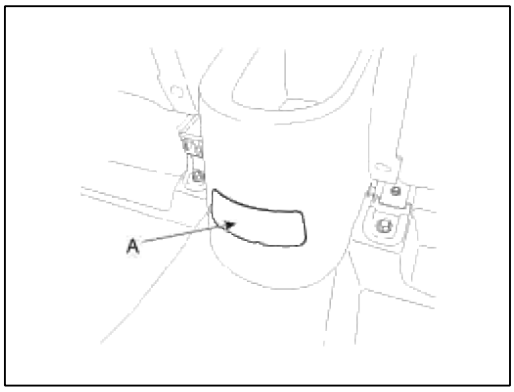
Drum Brake Type

1. Depress the brake pedal several times to set the self-adjusting brake.

> NOTE
>
> For Drum Brake type, shoe clearance is automatically adjusted by the adjuster and adjusting lever.

Parking Brake Lever Stroke Adjustment

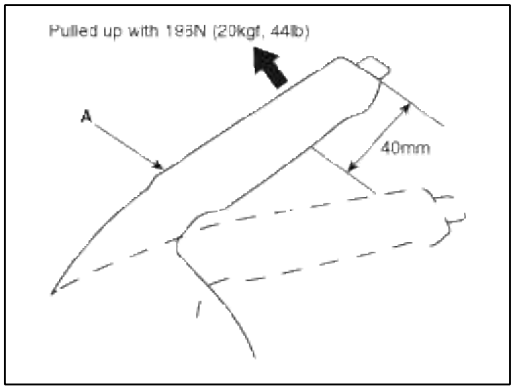
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the floor console rear cover(A).

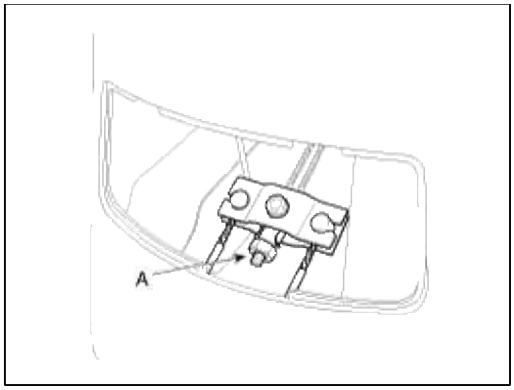


3. Adjust the parking brake lever stroke by turning adjusting nut (A).

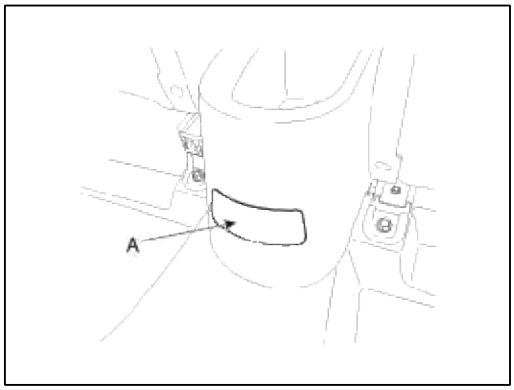
Parking brake lever stroke :
5~7 cliks (Pull the lever with 20kg)

> NOTE
>
> After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke. (Refer to "Parking brake shoe installation")



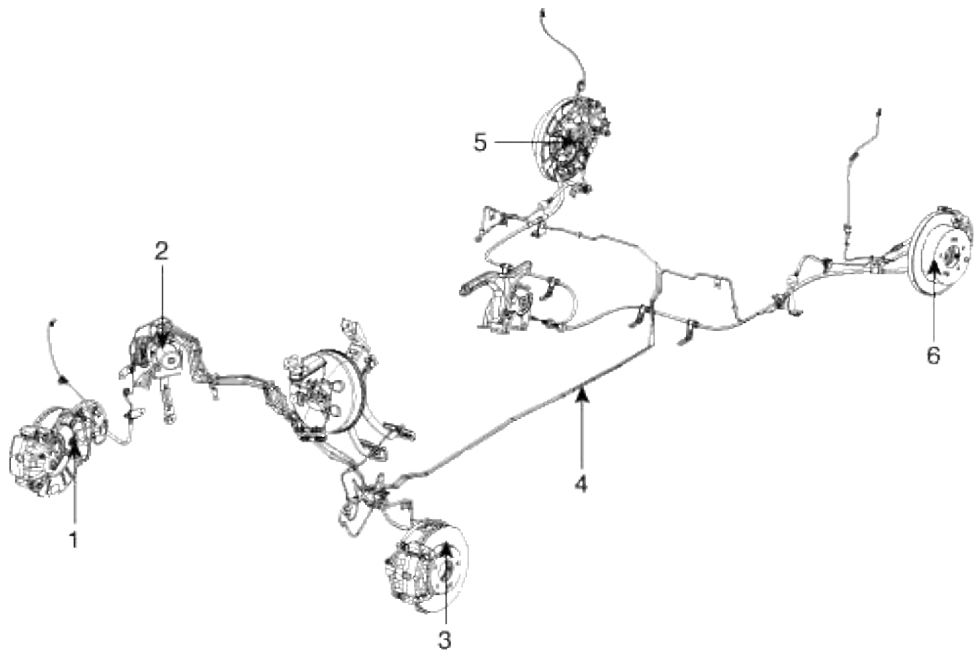


4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Install the floor console rear cover(A).



Brake System > ABS(Anti-Lock Brake System) > Components and Components Location

Components



1. Front right wheel speed sensor 2. ABS control module (HECU) 3. Front left wheel speed sensor	4. Hydraulic line 5. Rear right wheel speed sensor 6. Rear left wheel speed sensor

Brake System > ABS(Anti-Lock Brake System) > Description and Operation

Description

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)

This specification is for the wiring design and installation of ABS/ESC ECU.

This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor,the wheel speed sensors attached to each wheel.
- Control of braking force / traction force / yaw moment.

- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

Installation position : engine compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

Operation

The ECU shall be put into operation by switching on the operating voltage (IGN).

On completion of the initialization phase, the ECU shall be ready for operation.

In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

Wheel sensor signal processing

The ECU shall receive wheel speed signal from the four active wheel sensors.

The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the ECU.

Solenoid valve control

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.

The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

Voltage limits

- Overvoltage
  When overvoltage is detected(above 17 ± 0.5 V), the ECU switches off the valve relay and shuts down the system.
  When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.
- Undervoltage
  In the event of undervoltage(below 10V), ABS control shall be inhibited and the warning lamp shall be turned on.
  When voltage is returned to operating range, the warning lamp is switched off and ECU returns to normal operating mode.

Pump motor checking

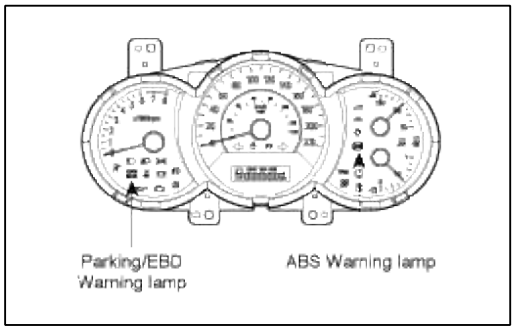
The ECU performs a pump motor test at a speed of 15 km/h(9 MPH) once after IGN is switched on.

Diagnostic interface

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.

The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU in the test line of manufactories (Air-bleeding line or Roll and Brake Test line).

Warning lamp

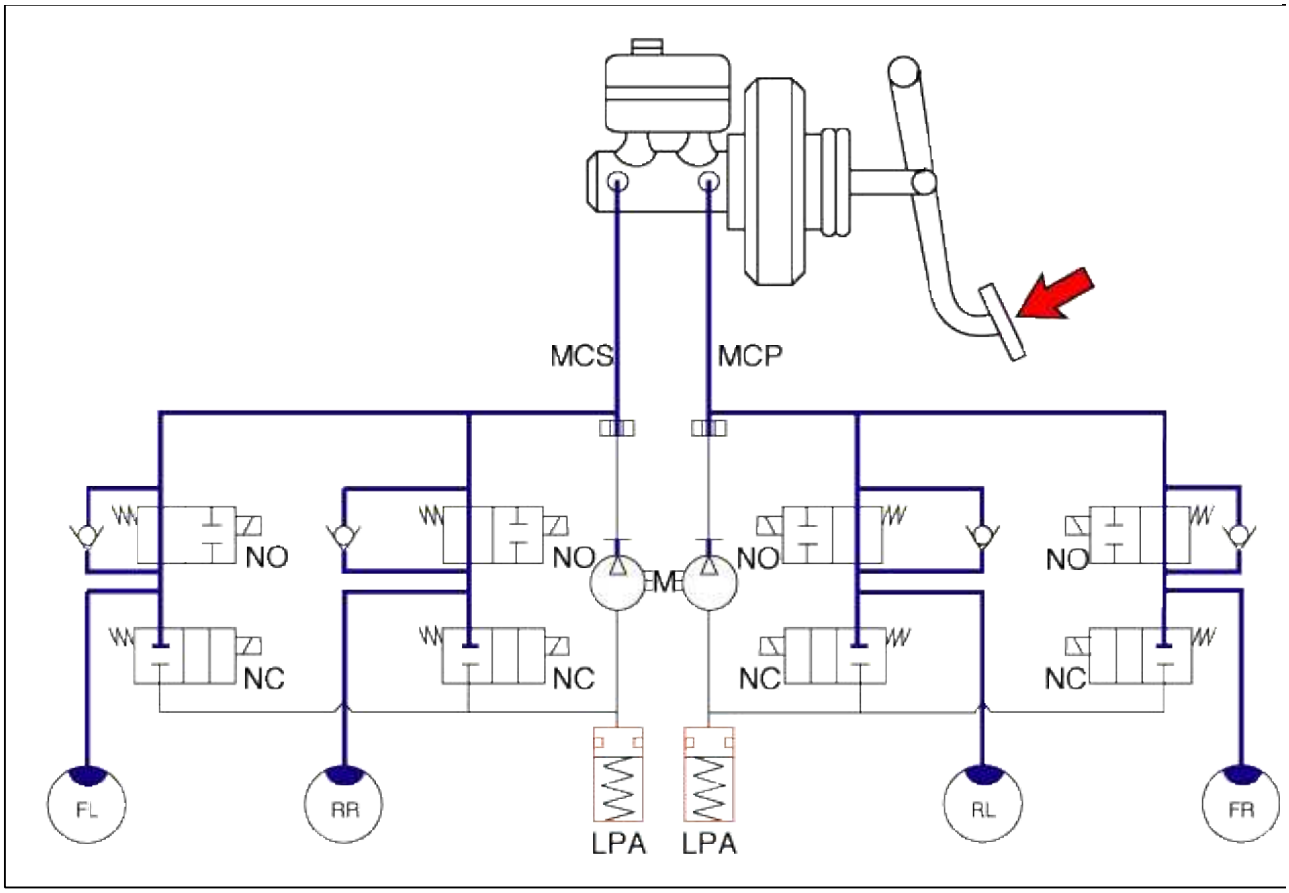


1. ABS Warning Lamp
   The active ABS warning lamp indicates the self-test and failure status of the ABS.
   The ABS warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. In the event of inhibition of ABS functions by failure.
   C. During diagnostic mode.
   D. When the ECU Connector is separated from ECU.
2. PARKING/EBD warning lamp
   The active EBD warning lamp indicates the self-test and failure status of the EBD.
   However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.
   The EBD warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. When the Parking Brake Switch is ON or brake fluid level is low.
   C. When the EBD function is out of order.
   D. During diagnostic mode.
   E. When the ECU Connector is separated from ECU.

ABS Control

1. NORMAL BRAKING without ABS
   Under the normal braking, voltage is not supplied to solenoid valve, inlet valve is opened and outlet valve is closed
   When the brake is depressed, brake fluid is supplied to the wheel cylinder via solenoid valve to activate the brake.
   When the brake is released, brake fluid goes back to the master cylinder via inlet valve and check valve.

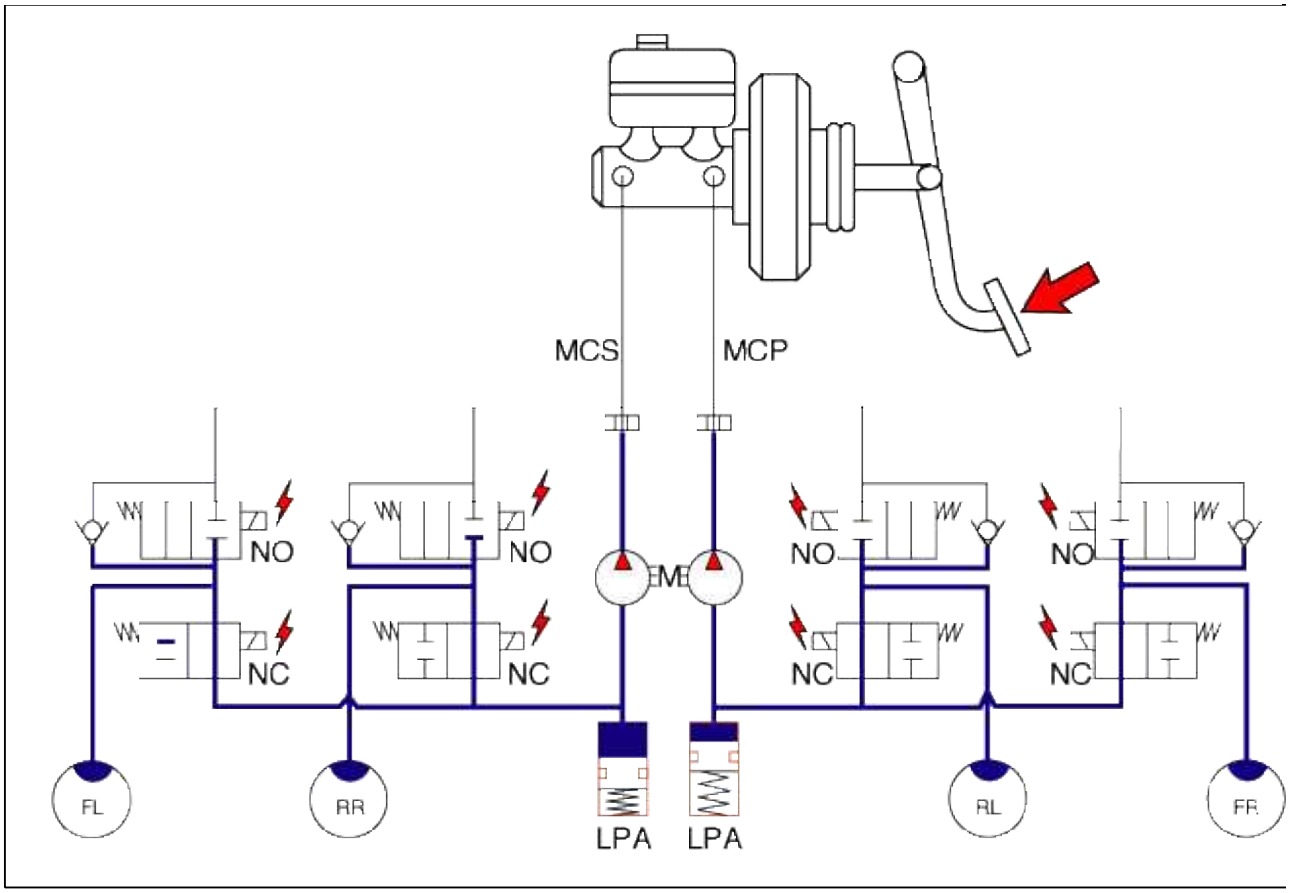
Solenoid valve	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	Open	Master cylinder Wheel cylinder	OFF
Outlet valve (NC)	OFF	Close	Wheel cylinder Reservoir	



2. Dump Mode

Under the emergency braking, if the wheels start to lock up, HECU sends a signal to the solenoid valve to decreas the brake fluid, then voltage is supplied to each solenoid. At this time inlet valve is closed and brake fluid is blocke from the master cylinder. Conversely outlet valve is opened and brake fluid passes through wheel cylinder to reservoir, resulting in pressure decrease.

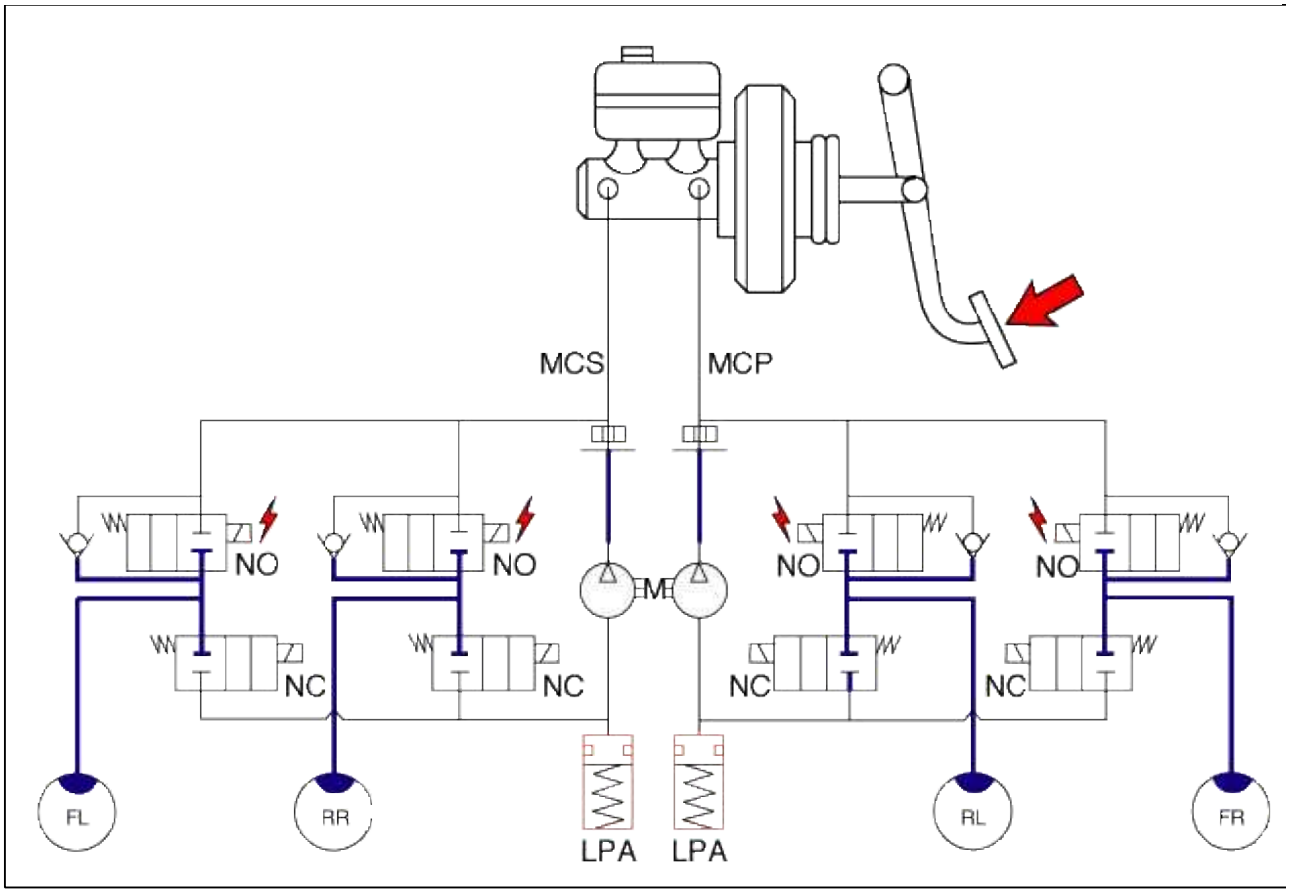
Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	ON	Close	Master cylinder Wheel cylinder	ON
Outlet valve (NC)	ON	Open	Wheel cylinder Reservoir	



3. Hold Mode

When the brake fluid pressure is maximally decreased in wheel cylinder, HECU sends a signal to solenoid valve to keep the fluid pressure, voltage is supplied to inlet valve but it is not supplied to outlet valve. At this time inlet and outlet valves are closed and brake fluid is kept in wheel cylinder.

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	ON	Close	Master cylinder Wheel cylinder	OFF
Outlet valve (NC)	OFF	Close	Wheel cylinder Reservoir	

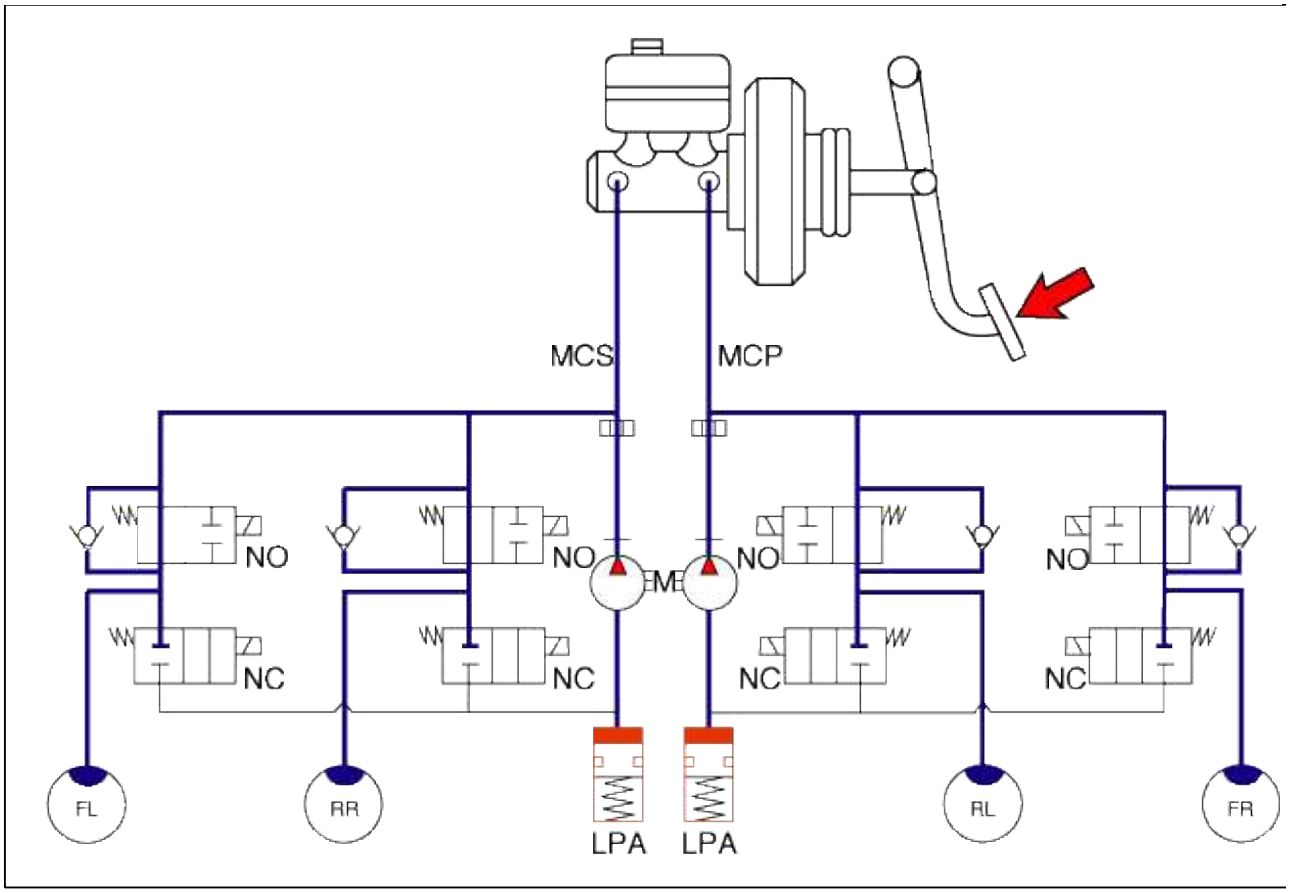


4. Increase Mode

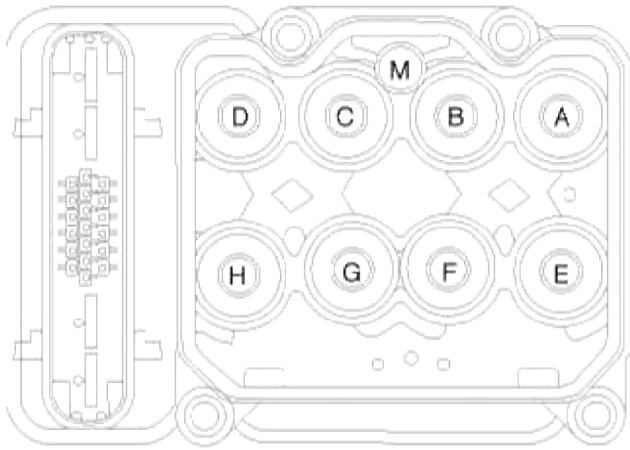
If HECU determines there's no lock-up in the wheel, HECU cuts voltage to solenoid valve. So voltage is not supplied to each solenoid valve, brake fluid passes through the inlet valve to wheel cylinder, resulting in pressure increase.

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	Open	Master cylinder Wheel cylinder	ON
Outlet valve (NC)	OFF	Close	Wheel cylinder Reservoir	

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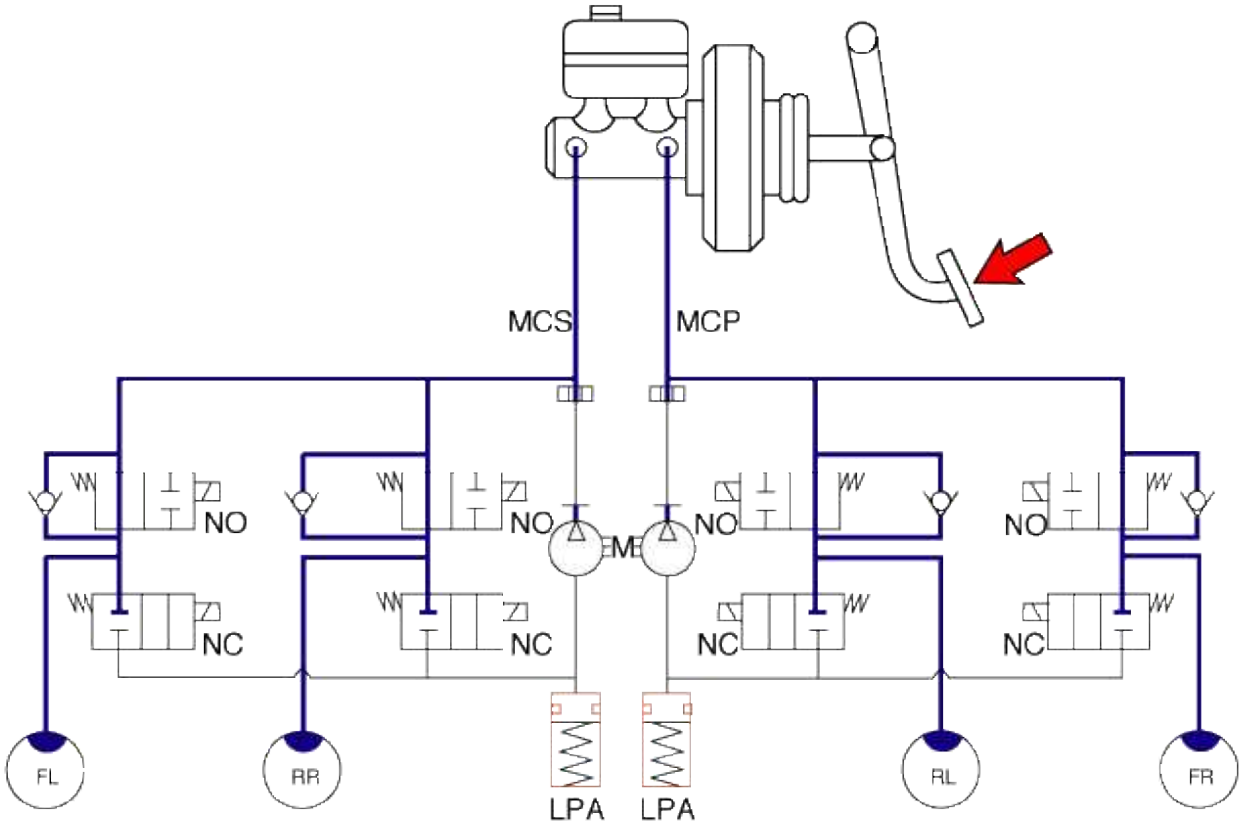
ABS HECU External Diagram



A : INLET VALVE (FR)
B : INLET VALVE (RL)
C : INLET VALVE (RR)
D : INLET VALVE (FL)
E : OUTLET VALVE (FR)
F : OUTLET VALVE (RL)
G : OUTLET VALVE (RR)
H : OUTLET VALVE (FL)
M : MOTOR Connector

Hydraulic System Diagram

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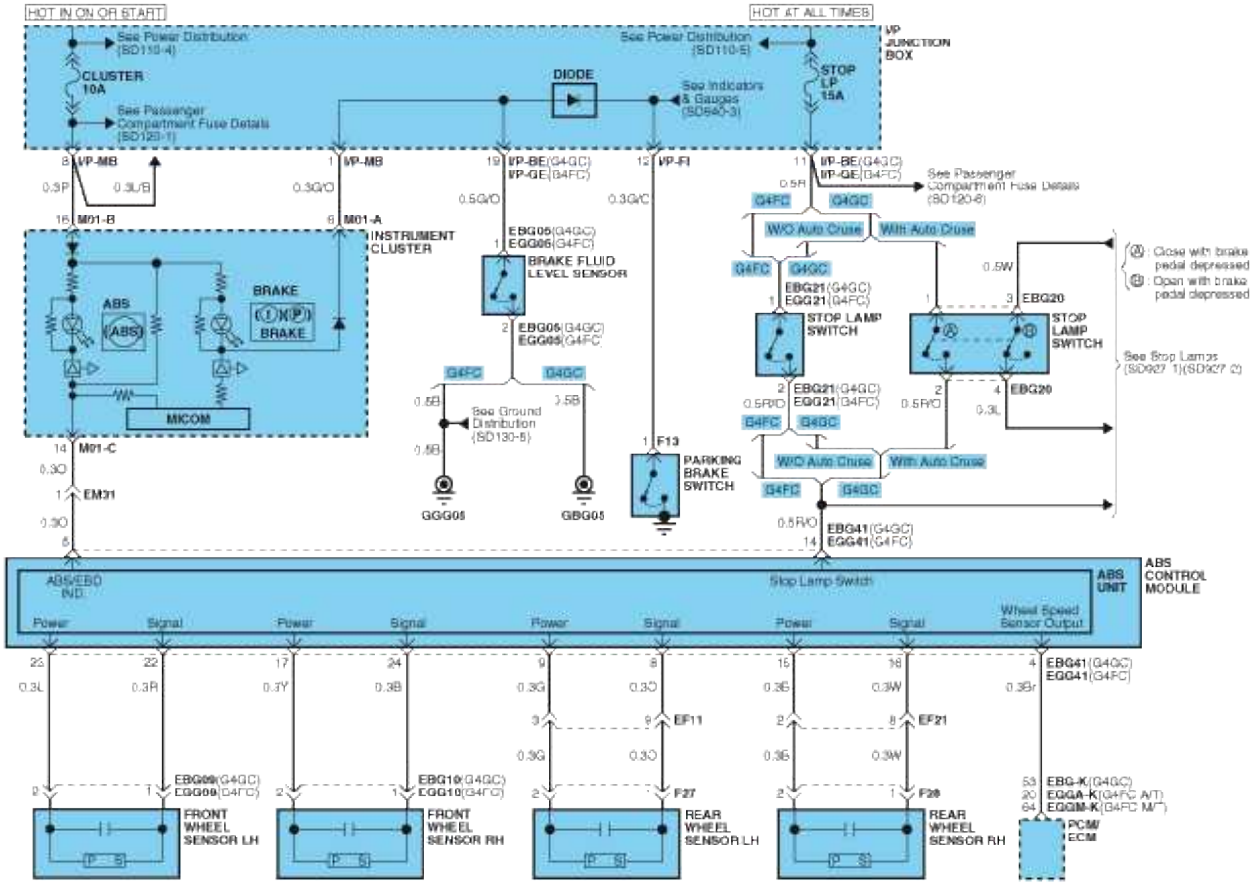


MCP : Primary master cylinder
MCS : Secondary master cylinder
LPA : Low pressure accumulator

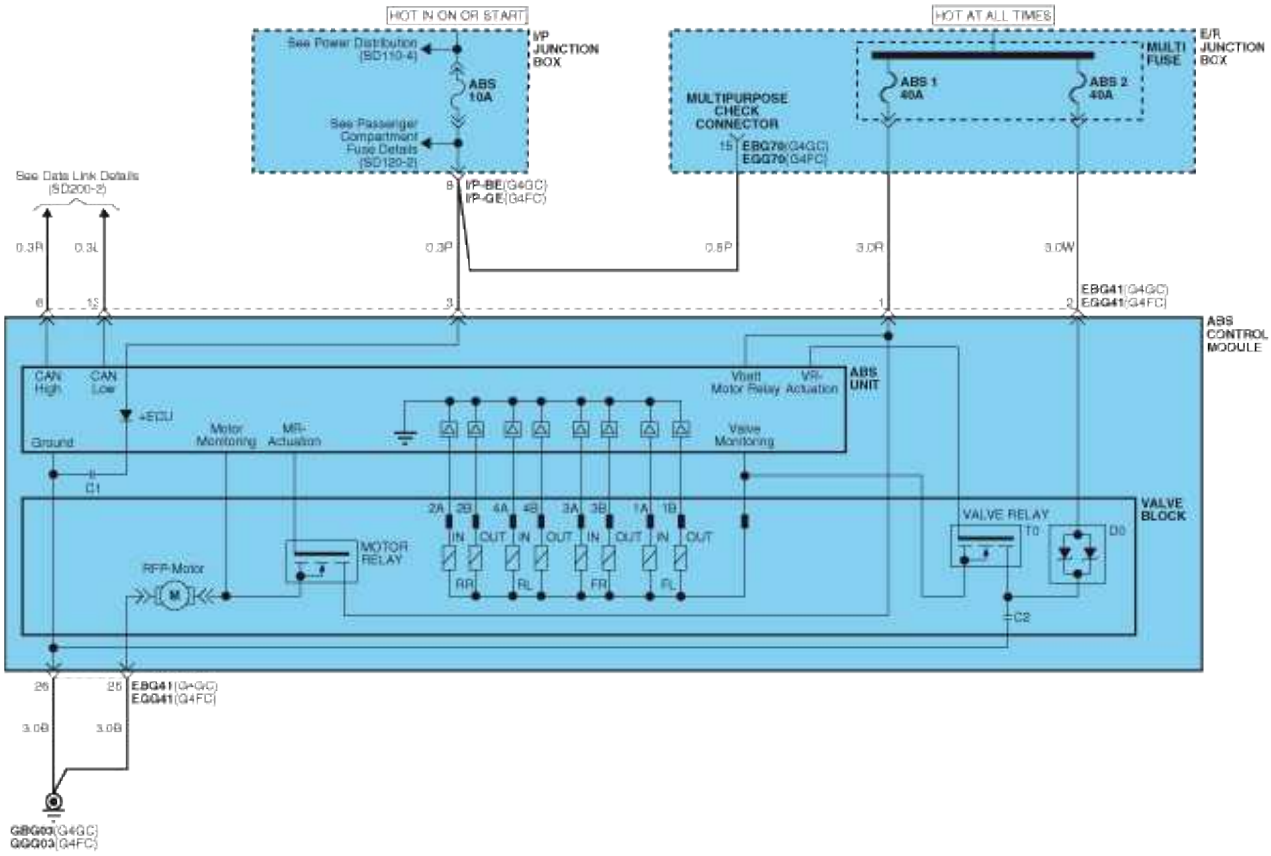
M : Motor pump
NO : Normal open valve
NC : Normal close valve

Brake System > ABS(Anti-Lock Brake System) > Schematic Diagrams

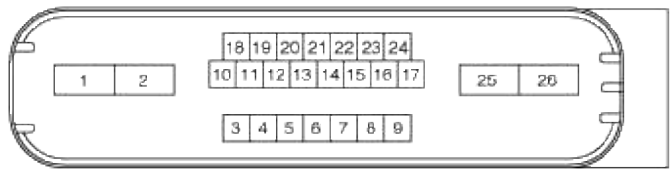
Circuit Diagram - ABS(1)



Circuit Diagram - ABS(2)



ABS Connector Input / Output

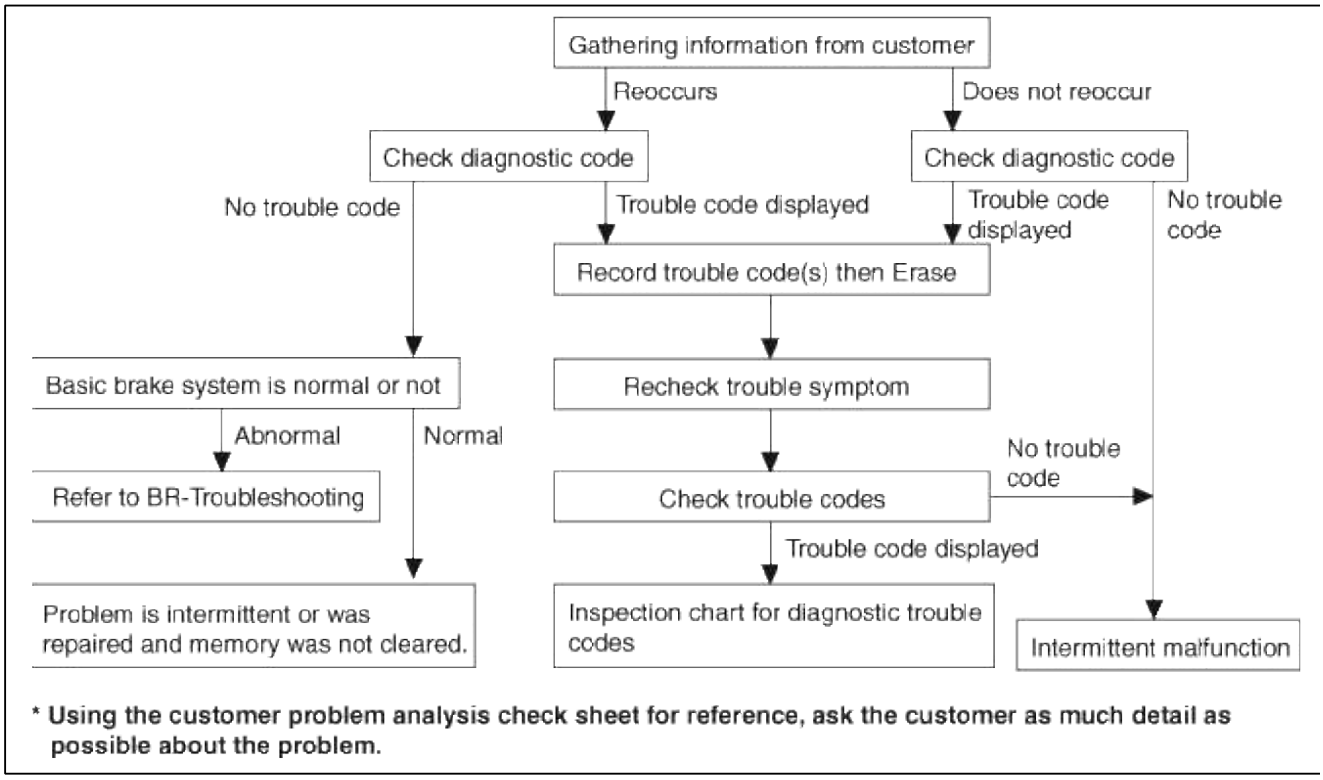


Connector Terminal		Specification	Remark
No	Description		
3	IGNITION1( )	Over voltage range: 17 ± 0.5V Operating voltage range: 9.5 ± 0.5V < V < 17 ± 0.5V Low voltage range: 7.0 ± 0.5V < V < 9.5 ± 0.5V Nominal current : I < 300mA Hardware shutdown voltage : V < 6.0V	
2	POS. BATTERY.(SOLENOID)	Max leakage current : I < 0.8mA Operating voltage range: 9.5 ± 0.5V < V < 17 ± 0.5V Nominal current : I < 40A	
1	POS, BATTERY.(MOTOR)	Operating voltage range: 9.5 ± 0.5V < V < 16.5 ± 0.5V Peak current : I < 100A Nominal current : I < 40A Max leakage current : I < 0.2mA	
26	GROUND	Rated current : I < 300mA Nominal current : I < 40A	
25	PUMP MOTOR GROUND	Peak current : I < 100A Nominal current : I < 40A	
14	BRAKE LIGHT SWITCH	Input voltage low: 0V ≤ V ≤ 3.0V Input voltage High: 7.0V ≤ V ≤ 16.0V	
23	SENSOR FRONT LEFT POWER	Output voltage : IGN[V] ± 1V Output current : Max 30mA	
17	SENSOR FRONT RIGHT POWER		
9	SENSOR REAR LEFT POWER		
15	SENSOR REAR RIGHT POWER		
22	SENSOR FRONT LEFT SIGNAL	Input current LOW : 5.9 ~ 8.4mA Input current HIGH : 11.8 ~ 16.8mA Frequency range : 1 ~ 2500Hz Input duty : 50 ± 20%	
24	SENSOR FRONT RIGHT SIGNAL		
8	SENSOR REAR LEFT SIGNAL		
16	SENSOR REAR RIGHT SIGNAL		
13	CAN BUS LINE (LOW)		
6	CAN BUS LINE (HIGH)		
4	SENSOR FRONT RIGHT OUTPUT	Nominal current : I < 16mA External pull up resister : 1kΩ < R Output duty : 50 ± 20%	
5	ABS/EBD W/LAMP DRIVE	Nominal current : I < 200mA(12V) Operating voltage : 0 ~ 18V Min. Shunt resistance : 500kΩ Max. Output voltage (Low) : 0.5V	

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Brake System > ABS(Anti-Lock Brake System) > Troubleshooting

Standard flow of diagnostic troubleshooting



Notes with regard to diagnosis
The condition listed in the following table are not abnormal.

Condition	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

ABS Check sheet

ABS Check Sheet

Inspector's Name

Customer's Name		**License No.**	
		License Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	**Odometer**	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurence of Problem	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	☐ Intermittent (times a day)
	ABS Warning Light Abnormal	☐ Remains ON ☐ Does not light up

Diagnostic Trouble Code Check	**1st Time**	☐ Normal Code ☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code ☐ Malfunction Code (Code)

Problem symptoms table

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Symptom	Suspect Area
ABS does not operate.	Only when 1.~4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.
ABS does not operate intermittently.	Only when 1.~4. are all normal and the problem is still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the normal code is output. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.
Communication with GDS is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line
Communication with GDS is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU

CAUTION

During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

ABS Does Not Operate.

Detecting condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection

1. Connect the GDS with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
3. Is the normal code output?

NO	Check the power source circuit.
YES	Erase the DTC and recheck using scan tool.

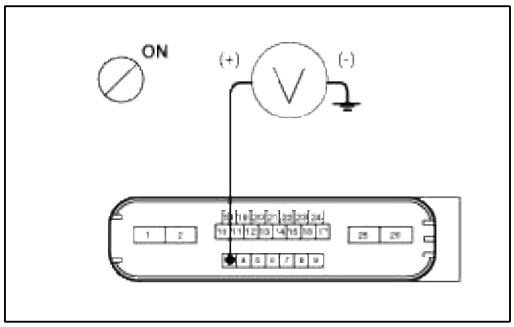
Check the power source circuit

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 3 of the ABS control module harness side connector and body ground.

Specification: approximately B+

3. Is the voltage within specification?

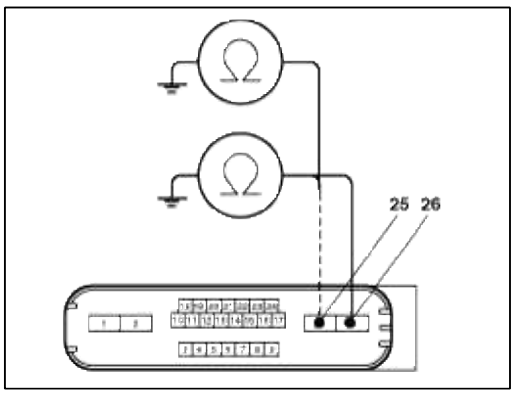
YES	Check the ground circuit.
NO	Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



Check the ground circuit

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 25, 26 of the ABS control module harness side connector and ground point.
3. Is there continuity?

YES	Check the wheel speed sensor circuit.
NO	Repair an open in the wire and ground point.



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Check the wheel speed sensor circuit
1. Refer to the DTC troubleshooting procedures.
2. Is it normal?

YES	Check the hydraulic circuit for leakage.
NO	Repair or replace the wheel speed sensor.

Check the hydraulic circuit for leakage
1. Refer to the hydraulic lines.
2. Inspect leakage of the hydraulic lines.
3. Is it normal?

YES	The problem is still occurring, replace the ABS control module.
NO	Repair the hydraulic lines for leakage.

ABS Does Not Operate (Intermittently).

Detecting condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection
1. Connect the GDS with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
3. Is the normal code output?

NO	Check the wheel speed sensor circuit.
YES	Erase the DTC and recheck using scan tool.

Check the wheel speed sensor circuit
1. Refer to the DTC troubleshooting procedures.
2. Is it normal?

YES	Check the stop lamp switch circuit.
NO	Repair or replace the wheel speed sensor.

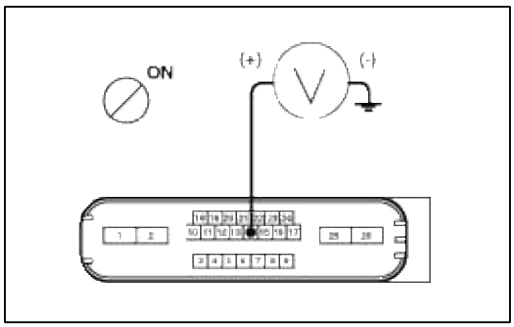
Check the stop lamp switch circuit
1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.

2. Measure the voltage between terminal 14 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification : approximately B+

3. Is the voltage within specification?

YES	Check the hydraulic circuit for leakage.
NO	Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.



Check the hydraulic circuit for leakage

1. Refer to the hydraulic lines.
2. Inspection leakage of the hydraulic lines.
3. Is it normal?

YES	The problem is still occurring, replace the ABS control module.
NO	Repair the hydraulic lines for leakage.

Communication with Scan-Tool is not possible.
(Communication with any system is not possible)

Detecting condition

Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	- An open in the wire - Poor ground - Faulty power source circuit

Inspection procedures

Check The Power Supply Circuit For The Diagnosis

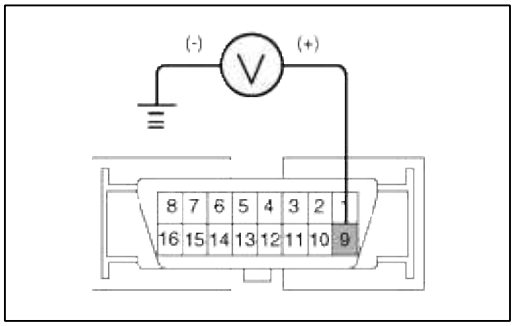
1. Measure the voltage between terminal 9 of the data link connector and body ground.

Specification : approximately B+

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2. Is voltage within specification?

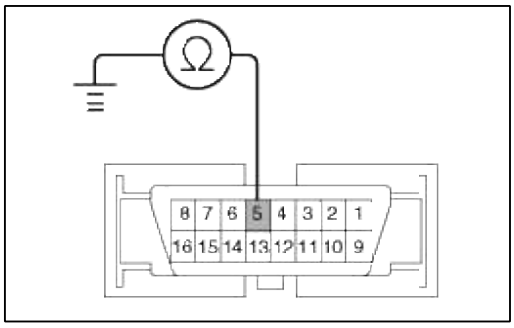
YES	Check the ground circuit for the diagnosis.
NO	Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.



Check the ground circuit for the diagnosis

1. Check for continuity between terminal 5 of the data link connector and body ground.
2. Is there continuity?

NO	Repair an open in the wire between terminal 5 of the data link connector and ground point.



Communication with Scan Tool is not possible.
(Communication with ABS only is not possible)

Detecting condition

Trouble Symptoms	Possible Cause
When communication with GDS is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Faulty HECU - Faulty power source circuit

Inspection procedures

Check for Continuity in the Diagnosis Line

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 7 of the ABS control module connector and 1 of the data link connector.
3. Is there continuity?

YES	Check the power source of ABS control module.
NO	Repair an open in the wire.

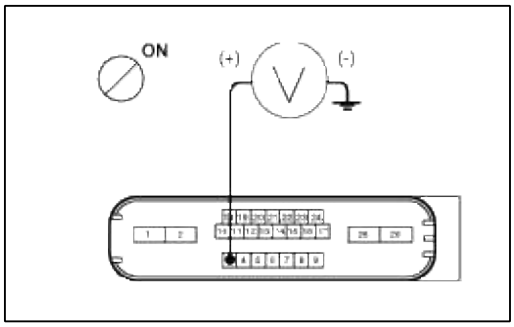
Check the power source of ABS control module

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 3 of the ABS control module harness side connector and body ground.

Specification : approximately B+

3. Is voltage within specification?

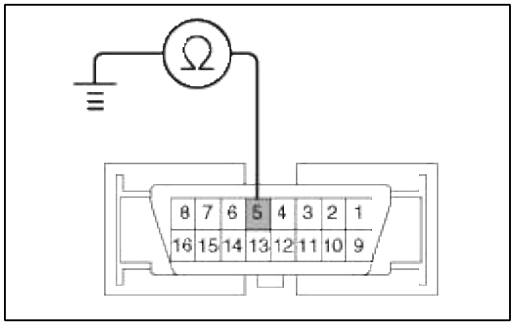
YES	Check for poor ground.
NO	Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



Check for poor ground

1. Check for continuity between terminal 5 of the data link connector and ground point.

YES	Replace the ABS control module and recheck.
NO	Repair an open in the wire or poor ground.



When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

Detecting condition

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check.Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	- Faulty ABS warning lamp bulb - Blown fuse is related to ABS in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

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Inspection procedures

Problem verification

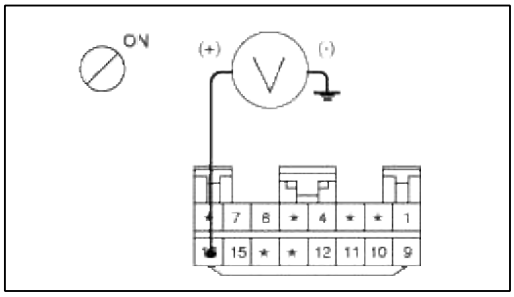
1. Disconnect the connector from the ABS control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

YES	Inspect again after replacing the ABS HECU.
NO	Check the power source for the ABS warning lamp.

Check the power source for the ABS warning lamp

1. Disconnect the instrument cluster connector (M01-B) and turn the ignition switch ON.
2. Measure the voltage between terminal (M01-B) 16 of the cluster harness side connector and body ground.

Specification : approximately B+



3. Is voltage within specification?

YES	Check the CAN circuit resistance for ABS warning lamp.
NO	Check for blown fuse.

Check for blown fuse

1. Check continuity of fuse (10A) from the engine compartment junction block.
2. Is there continuity?

YES	Repair an open in the wire between cluster fuse and 16 of cluster connector(M01-B).
NO	Replace the blown fuse.

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

Detecting condition

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	- An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

Inspection procedures

Check DTC Output

1. Connect the GDS to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using Scan Tool.
3. Is DTC output?

YES	Repair circuit indicated by code output.
NO	Check instrument cluster.

Check instrument cluster

1. Disconnect the cluster connector and turn the ignition switch ON.
2. Does the ABS warning lamp remains ON?

YES	Replace the instrument cluster.
NO	Check for open the wire.

Check for open in the wire

1. Check for continuity in the wire between cluster and ABS control module.
2. Is there continuity?

YES	Replace the ABS control module and recheck.
NO	Repair an open in the wire between cluster and ABS control module.

Bleeding of Brake System

This procedure should be followed to ensure adequate bleeding of air and filling of the ABS unit, brake lines and master cylinder with brake fluid.

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

> CAUTION
>
> If there is any brake fluid on any painted surface, wash it off immediately.

> NOTE
>
> When pressure bleeding, do not depress the brake pedal.
> Recommended fluid..... DOT3 or DOT4

2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the GDS to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the GDS screen.

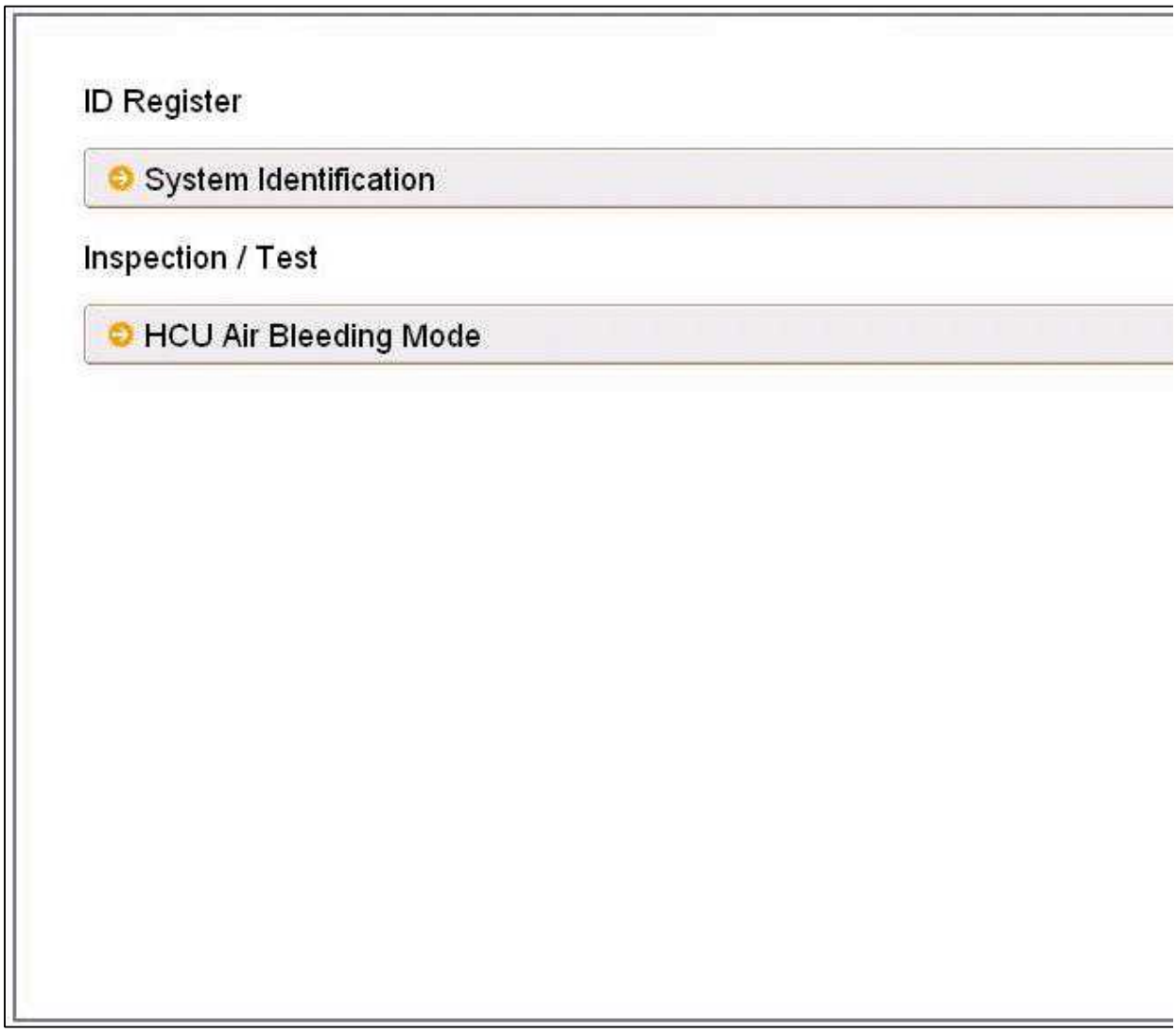
> CAUTION
>
> You must obey the maximum operating time of the ABS motor with the GDS to prevent the motor pump from b

(1) Select vehicle name.

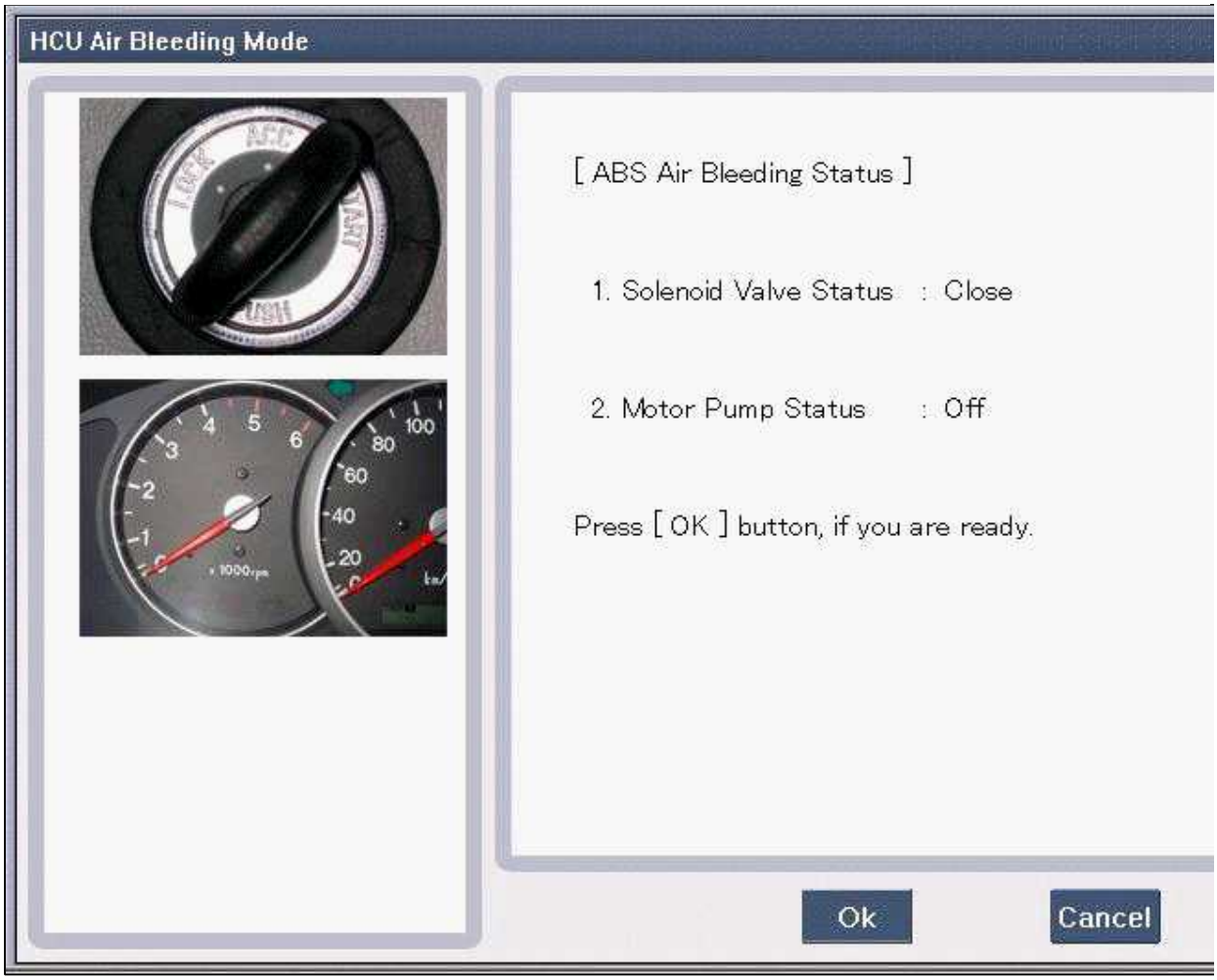
(2) Select Anti-Lock Brake system.

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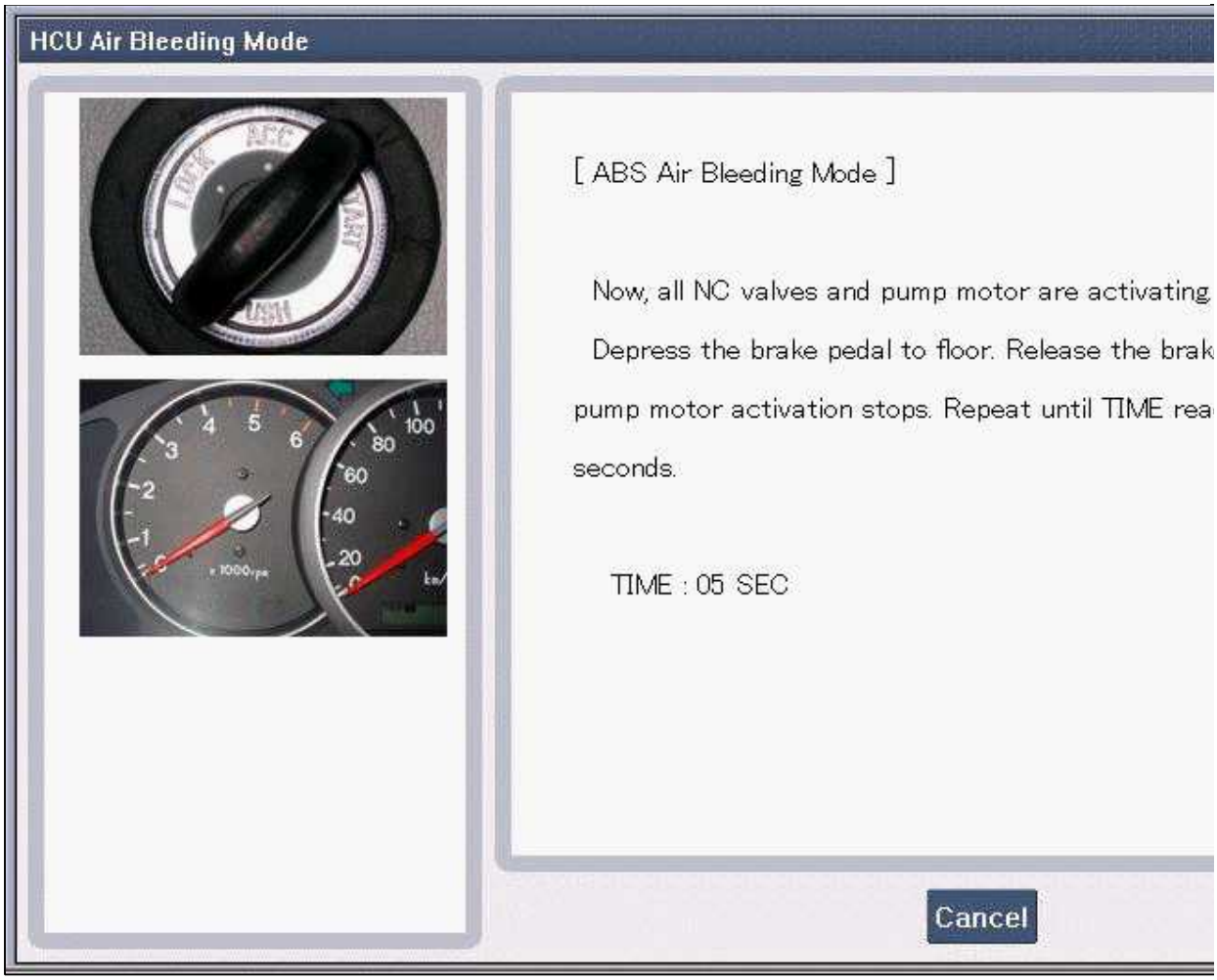
(3) Select HCU air bleeding mode.



(4) Press "OK" to operate motor pump and solenoid valve.



(5) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)

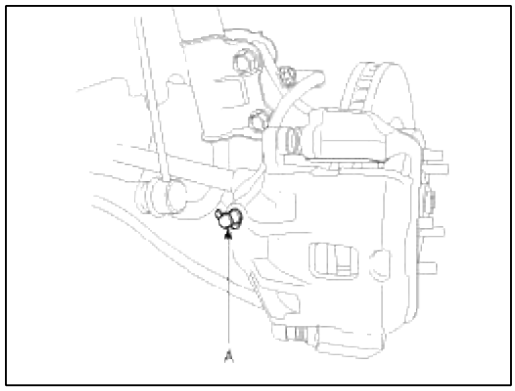


(6) Perform the air bleeding.

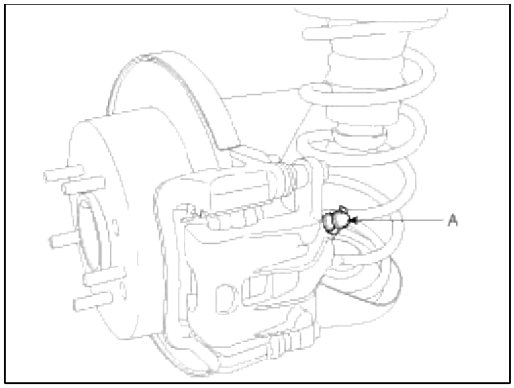


5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw(A).

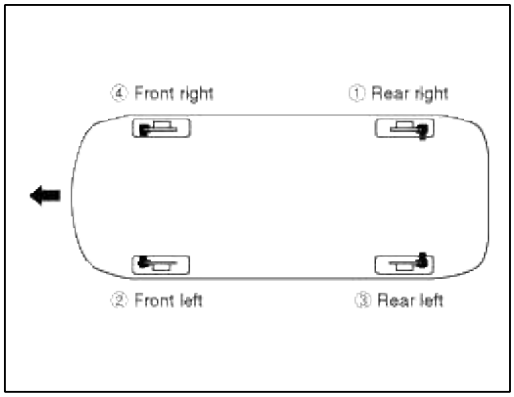
Front



Rear



6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.

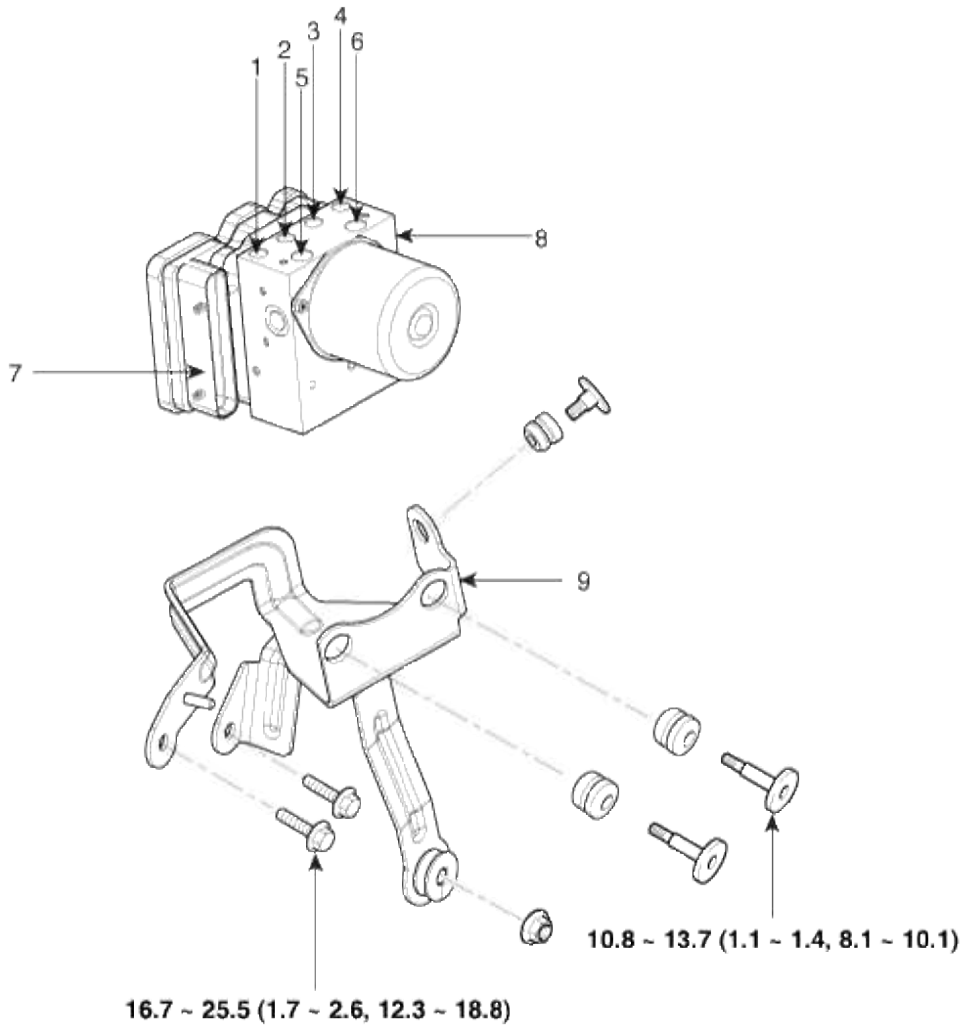


7. Tighten the bleeder screw.

Bleed screw tightening torque:
6.9 ~ 12.7N.m (0.7 ~ 1.3kgf.m, 5.1 ~ 9.4lb-ft)

Brake System > ABS(Anti-Lock Brake System) > ABS Control Module > Components and Components Location

Components



Torque : N.m (kgf.m, lb-ft)

1. Front-left tube 2. Rear -right tube 3. Rear-left tube 4. Front-right tube 5. MC2	6. MC1 7. ABS control module connector 8. ABS control module (HECU) 9. Bracket

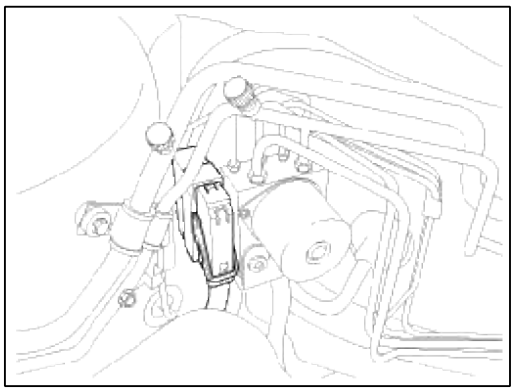
Brake System > ABS(Anti-Lock Brake System) > ABS Control Module > Repair procedures

Removal

1. Turn the ignition switch OFF and disconnect the negative (-) battery cable.

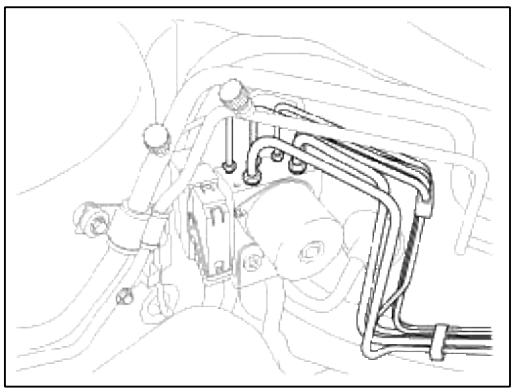
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2. Pull up the lock of the ABS control unit connector, then disconnect the connector.



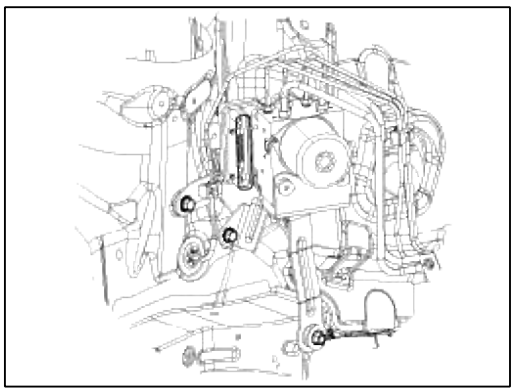
3. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.

Tightening torque:
ABS : 12.7 ~ 16.7N.m(1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)
ESP : 18.6 ~ 22.6N.m(1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



4. Loosen the ABS HECU bracket bolt(3EA), then remove HECU and bracket.

Tightening torque:
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



CAUTION

1. Never attempt to disassemble the HECU.
2. The HECU must be transported and stored in.
3. Never shock to the HECU.

5. Remove the 3 bolts, then remove the bracket from HECU.

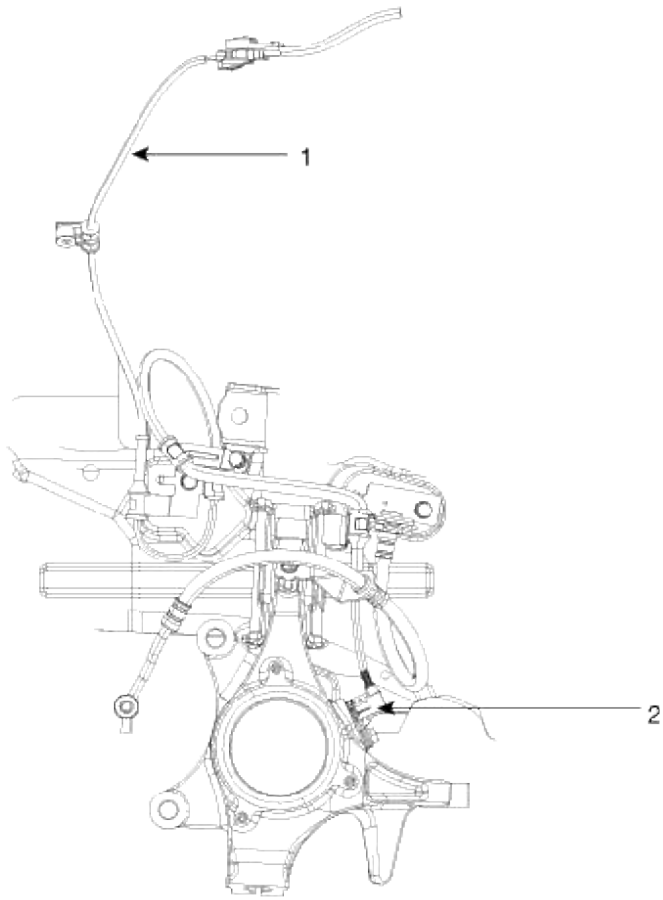
Tightening torque:
10.8 ~ 13.7N.m (1.1 ~ 1.4kgf.m, 8.0 ~ 10.1lb-ft)

Installation

1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and nuts to the specified torque.

Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Components and Components Location

Components



1. Front wheel speed sensor cable
2. Front wheel speed sensor

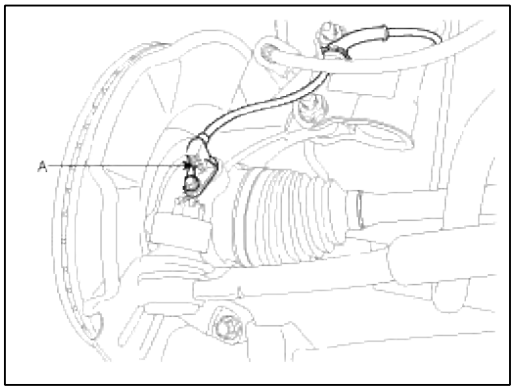
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Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Repair procedures

Removal

1. Remove the front wheel speed sensor mounting bolt (A).

Tightening torque:
6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



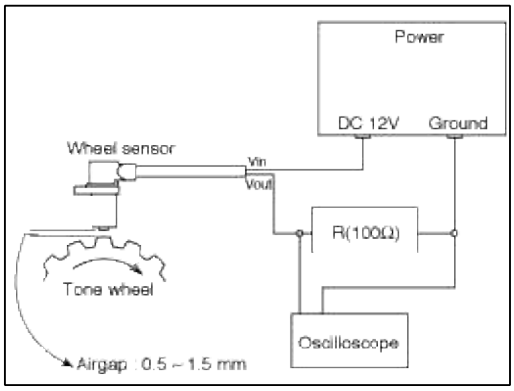
2. Remove the front wheel guard.
3. Disconnect the front wheel speed sensor connector. And remove the front wheel speed sensor.
4. Installation is the reverse of removal.

Inspection

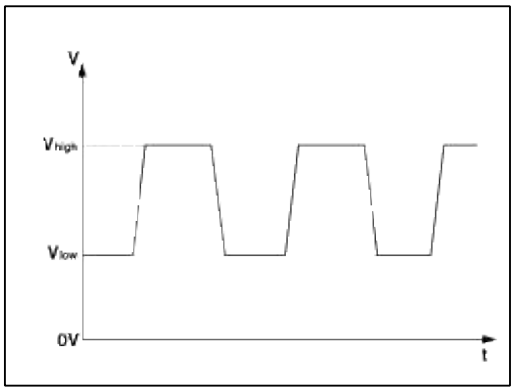
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resister must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

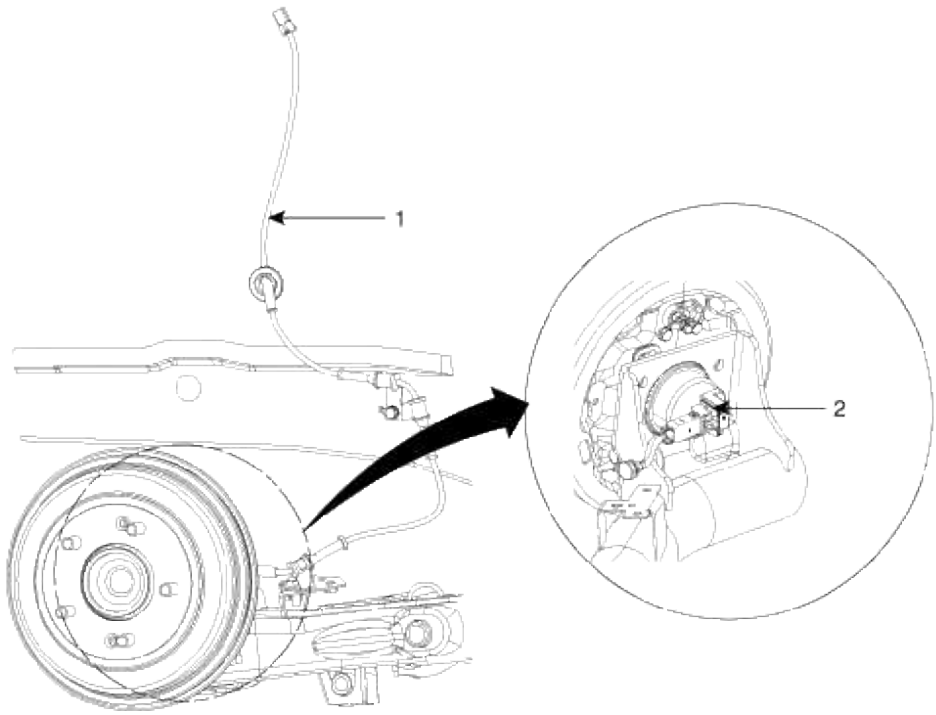


V_low : 0.59V ~ 0.84V
V_high : 1.18V ~ 1.68V
Frequency range : 1 ~ 2,500Hz

Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Components and Components Location

Components

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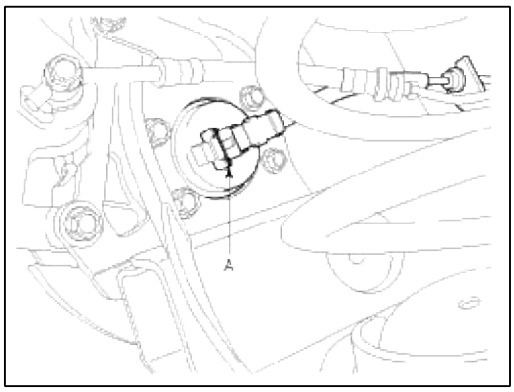


1. Rear wheel speed sensor cable
2. Rear wheel speed sensor

Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Repair procedures

Removal

1. Remove the connector after(A) removing the rear wheel speed sensor clip.

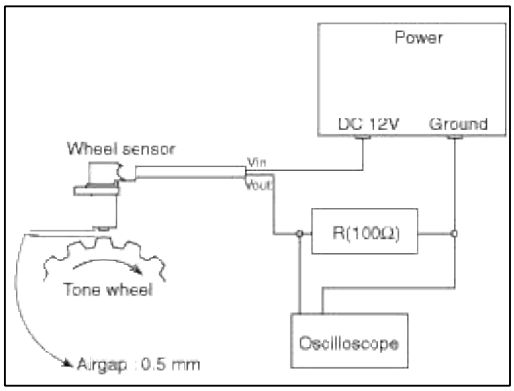


2. Remove the rear wheel speed sensor. (Refer to Driveshaft and axle group - Rear axle assembly)
3. Installation is the reverse of removal.

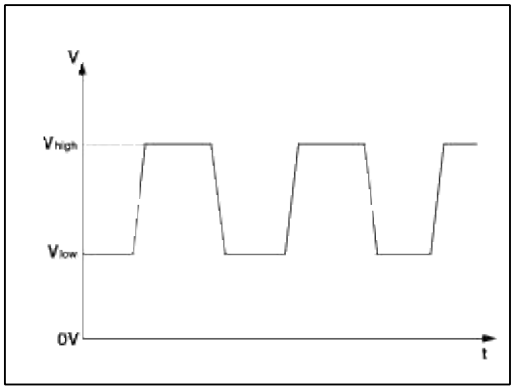
Inspection

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> **CAUTION**
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resister must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



V_low : 0.59V ~ 0.84V
V_high : 1.18V ~ 1.68V
Frequency range : 1 ~ 2,500Hz

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Brake System > ABS(Anti-Lock Brake System) > EBD(Electronic Brake-force Distribution) > Description and Operation

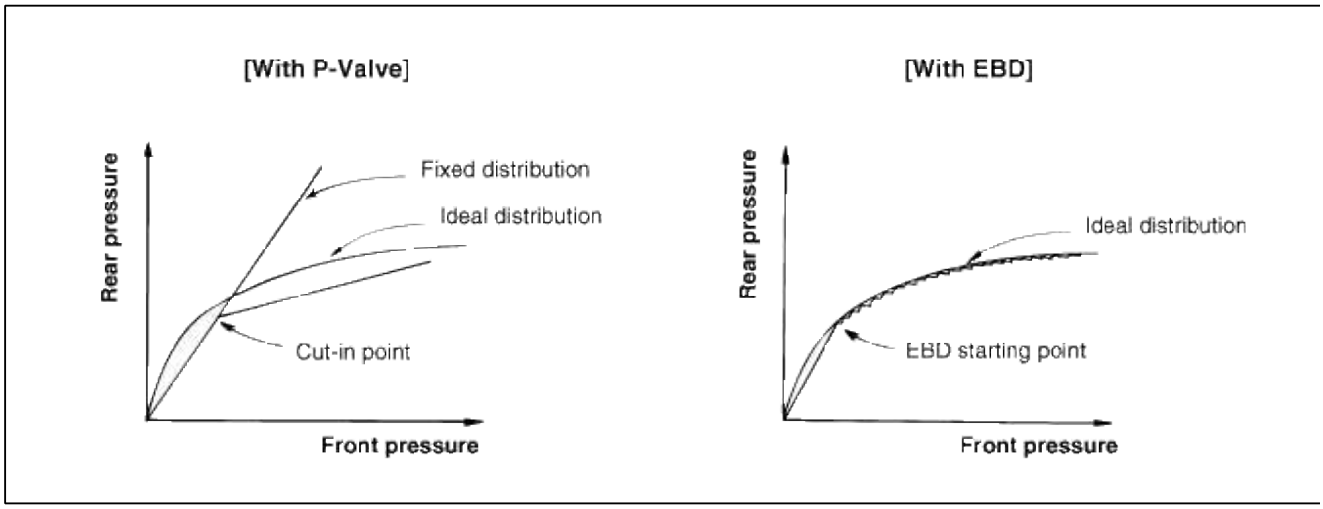
EBD (Electronic brake-force distribution) Operation

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the Maximum braking effectiveness by the rear wheels.
It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.
The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.
The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution tothe rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.
If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

Advantages

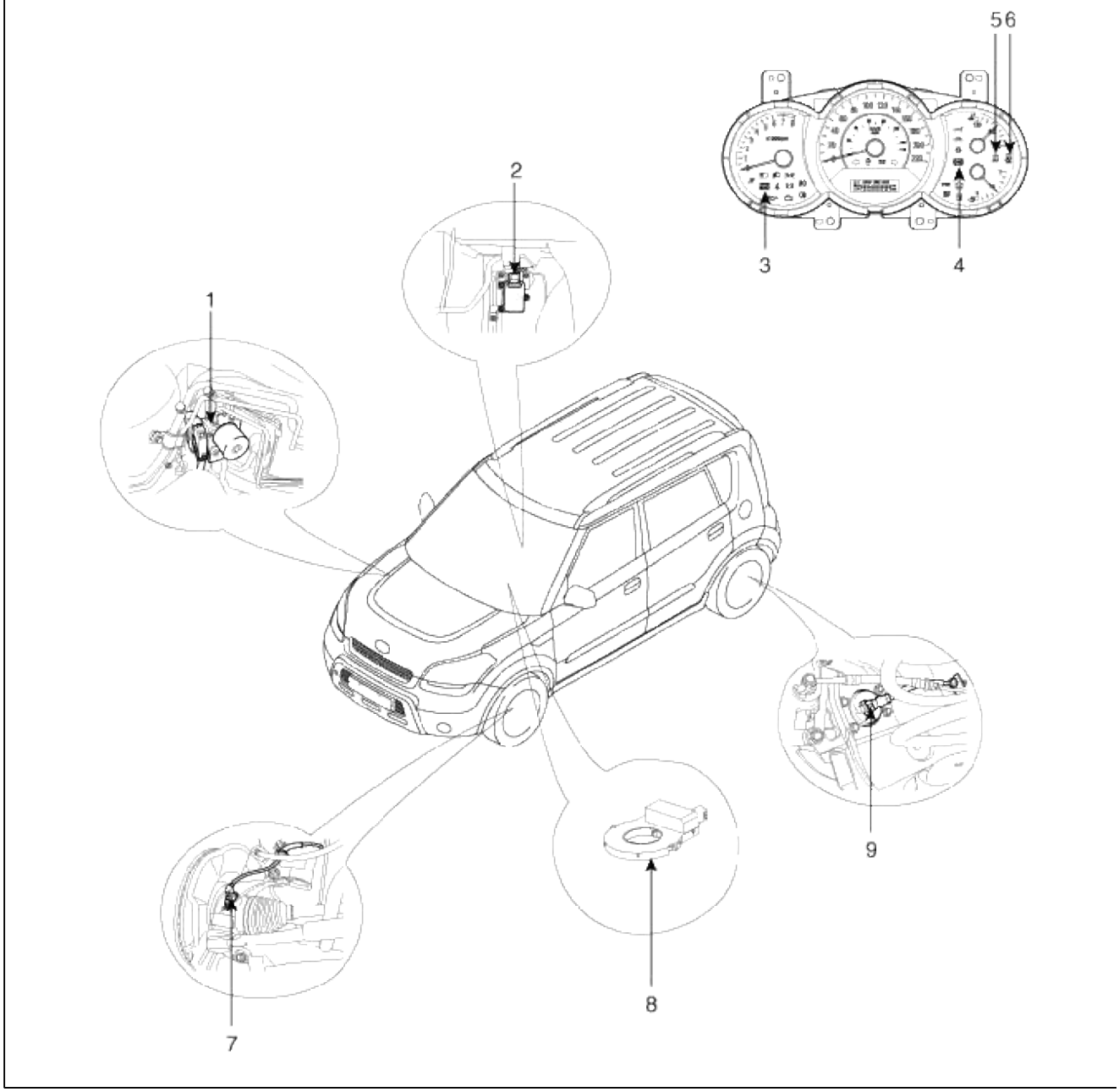
- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.
- Failure recognition by the warning lamp.

Comparison between proportioning valve and EBD



Brake System > ESC(Electronic Stability Control) System > Components and Components Location

Components



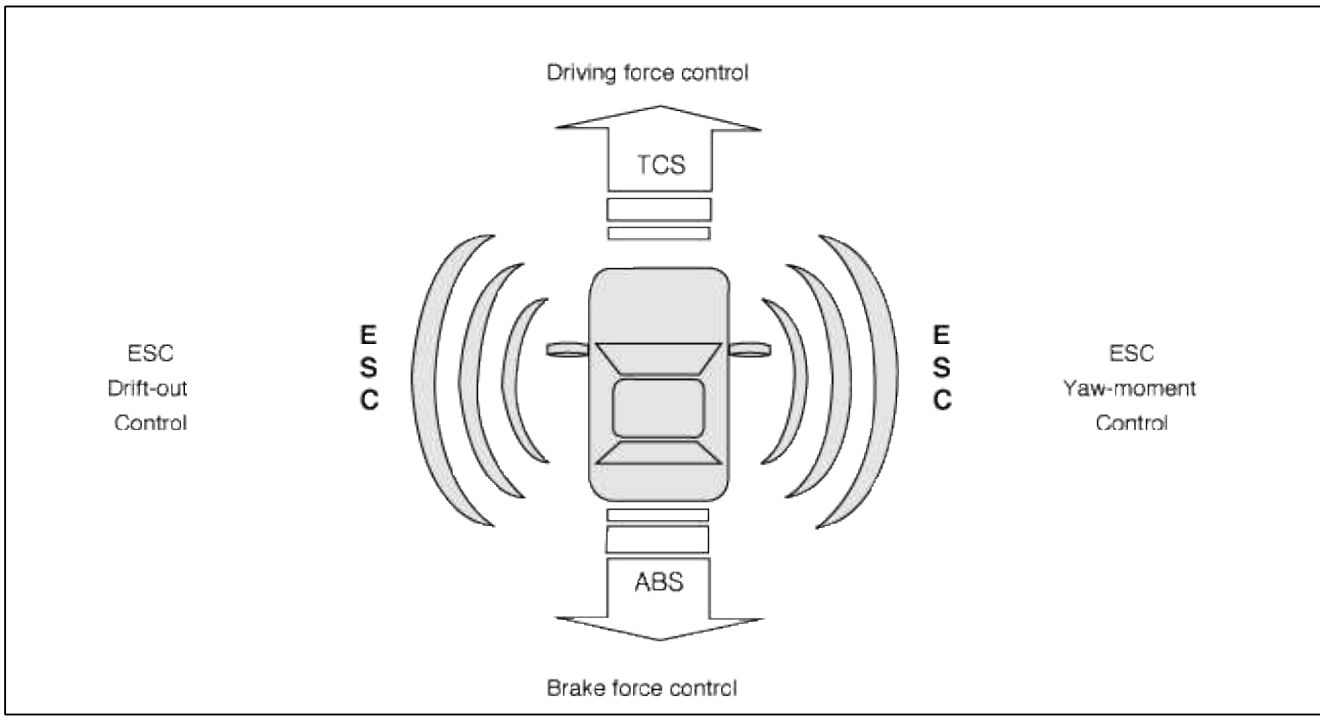
1. HECU module 2. Yaw rate & Lateral G sensor 3. Parking brake/EBD warning lamp 4. ABS warning lamp 5. ESC function / warning lamp	6. ESC OFF lamp 7. Front wheel speed sensor 8. Steering angle sensor 9. Rear wheel speed sensor

Brake System > ESC(Electronic Stability Control) System > Description and Operation

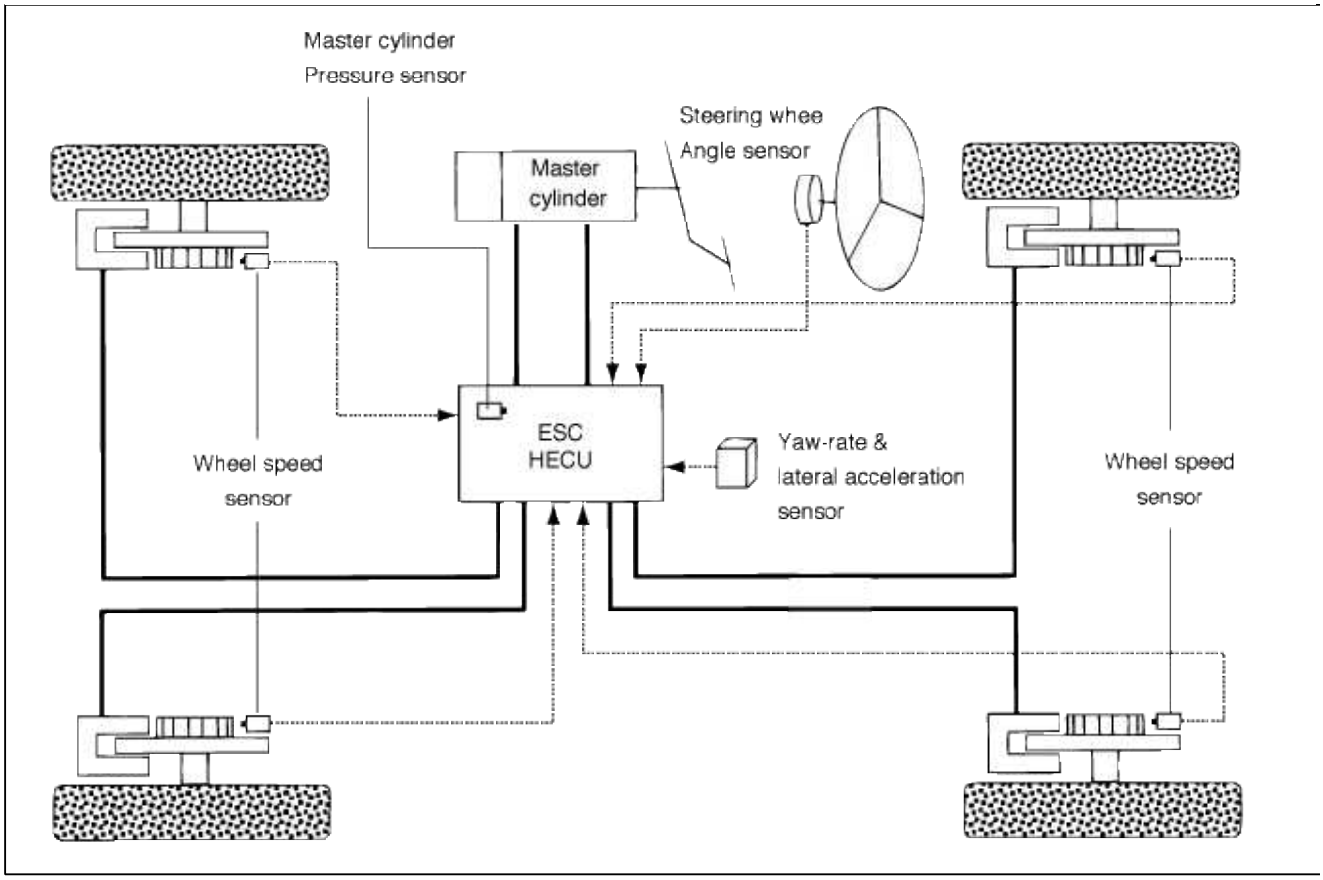
Description of ESC

Optimum driving safety now has a name : ESC, the Electronic Stability Control.
ESC is based on the MGH 40 ABS Hydraulic System. ESC recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no need for actuating the brake or the gas pedal.

ESC adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and EDC functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.
ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.
The electronic control unit incorporates the technological experience accumulated in connection with the MGH 40 system, but has been substantially expanded in terms of capacity and monitoring concept in order to permit the additional sensor signals and calculations to be processed and converted into corresponding valve, pump and engine control commands. Two 16-bit processors and one 8-bit processor, which monitor each other, cooperate to handle these requirements.
Of course, the stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESC function in response to a command by the driver.
In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.

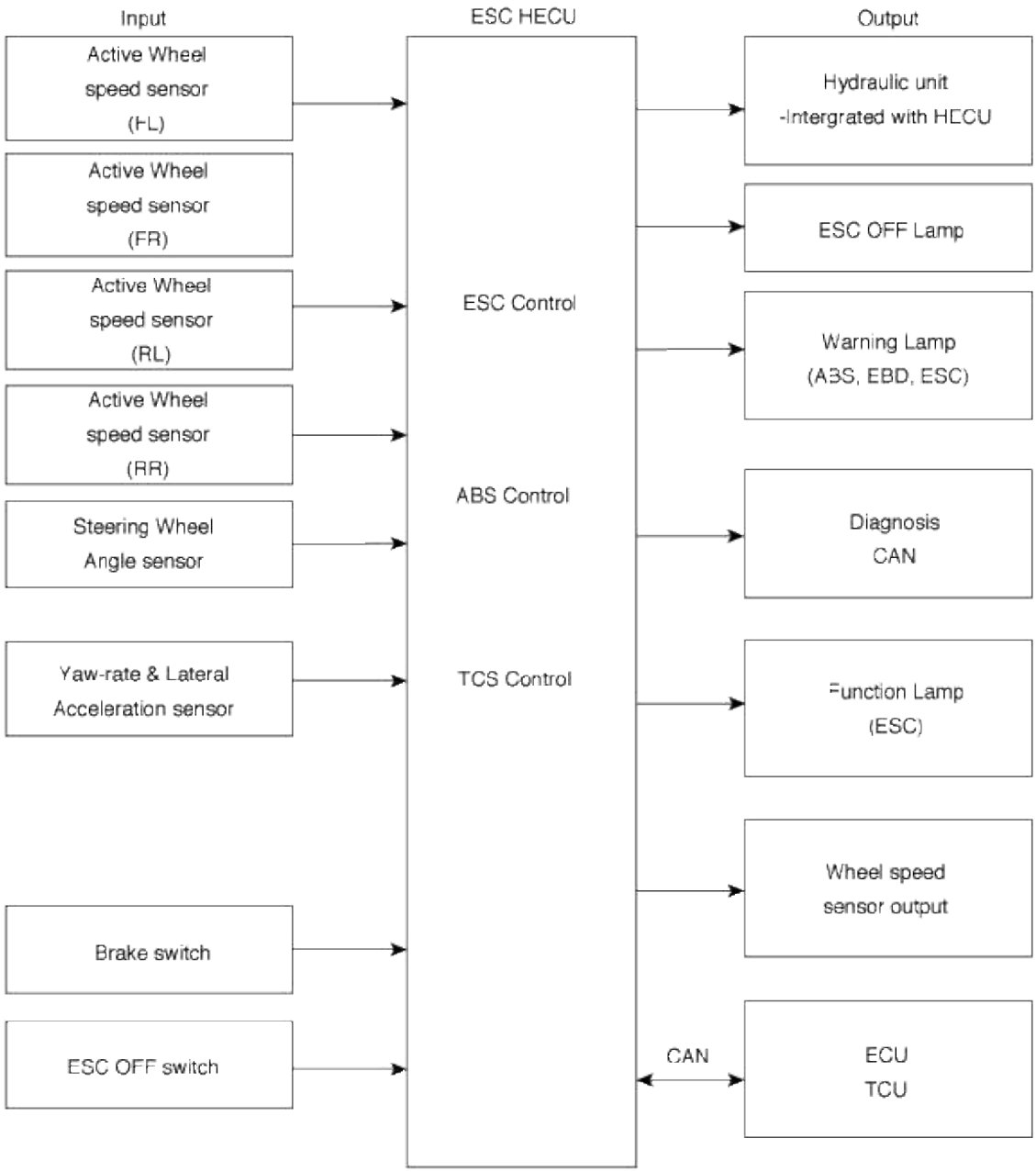


Description of ESC control
ESC system includes ABS/EBD, TCS and AYC function.
ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square wave.By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels.And, the ECU judges whether the ABS/EBD should be actuated or not.
TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication.TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.
After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis)If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESC warning lamp. (fail-safe warning)



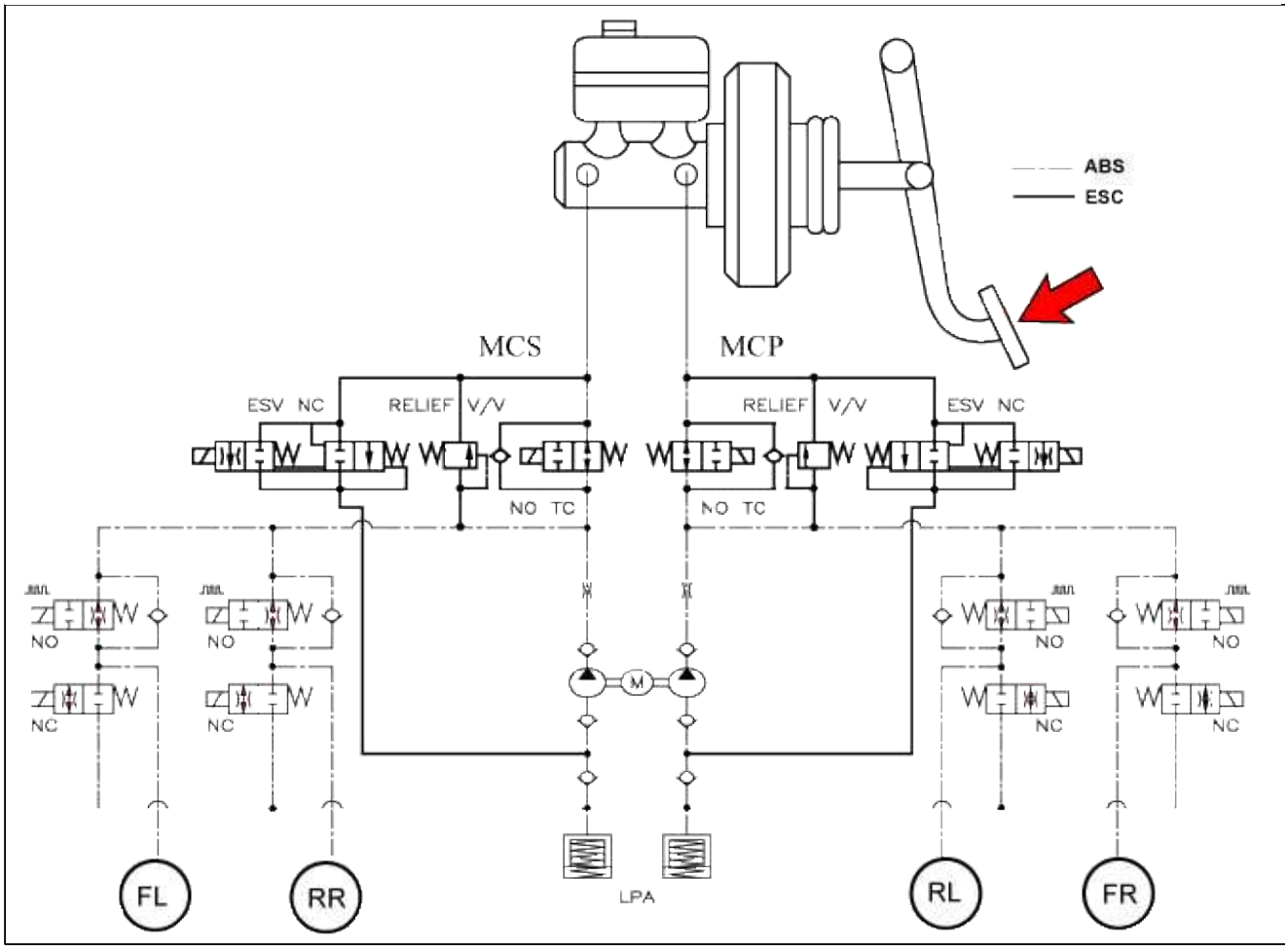
Input and output diagram

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ESC Operation mode

ESC Hydraulic system diagram



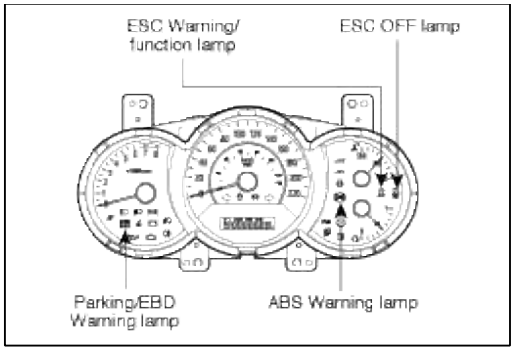
1. ESC Non-operation : Normal braking.

Solenoid valve	Continuity	Valve	Motor pump	TC Valve
IN (NO)	OFF	OPEN	OFF	OFF
OUT (NC)	OFF	CLOSE		

2. ESC operation

Solenoid valve		Continuity	Valve	Motor pump	TC Valve
Understeering (Only inside of rear wheel)	IN(NO)	OFF	OPEN	ON	ON
	OUT(NC)	OFF	CLOSE		
Oversteering (Only outside of front wheel)	IN(NO)	OFF	OPEN		
	OUT(NC)	OFF	CLOSE		

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ABS Warning lamp

The active ABS warning lamp indicates the self-test and failure status of the ABS .The ABS warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.

EBD/Parking brake warning lamp

The active EBD warning lamp indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order .
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.

ESC Warning lamp (ESC system)

The ESC warning lamp indicates the self-test and failure status of the ESC.

The ESC warning lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESC functions by failure.
- During diagnostic mode.

ESC Function lamp (ESC system)

The ESC function lamp indicates the self-test and operating status of the ESC.

The ESC Function lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESC control is operating. (Blinking - 2Hz)

ESC OFF lamp (ESC System)

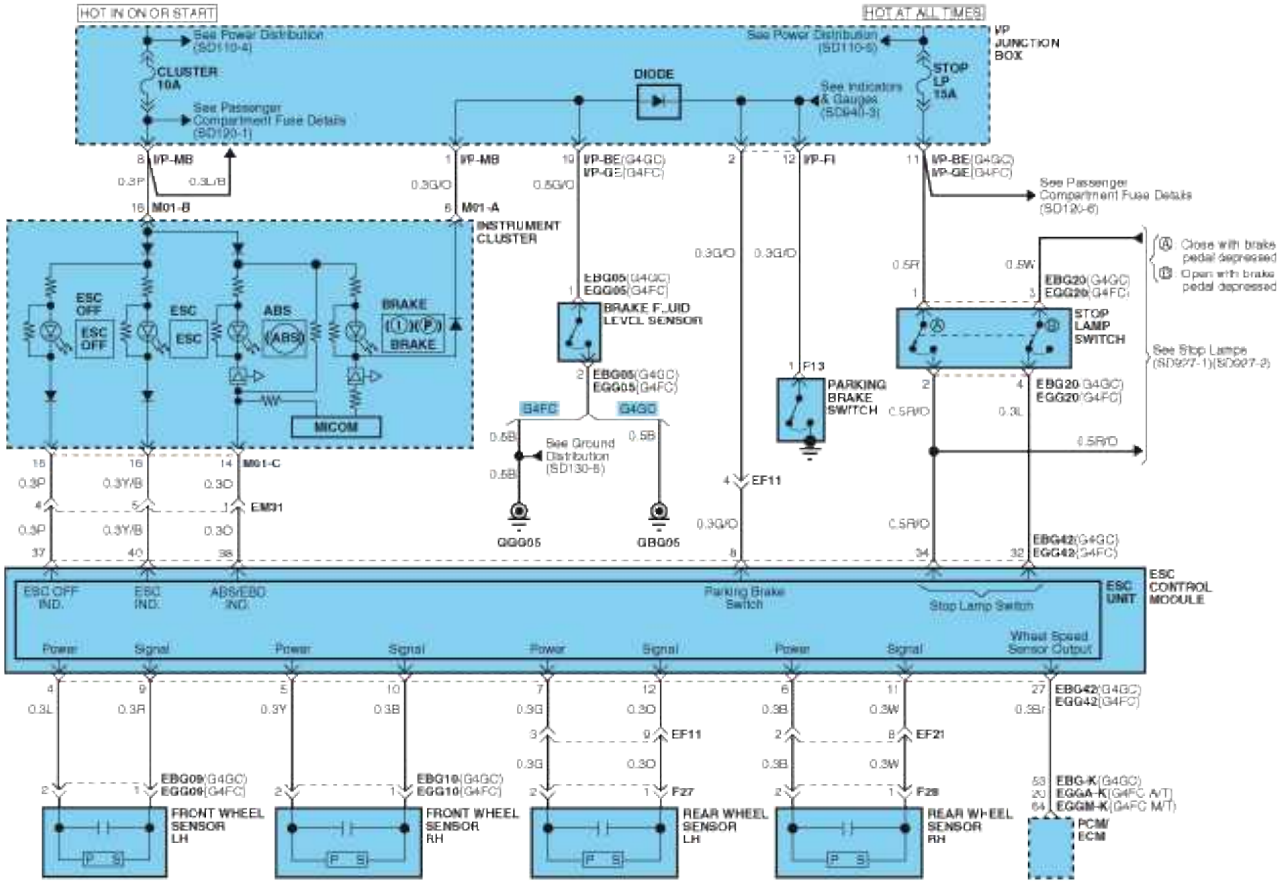
- When the driver truns off the ESC function with the on/off switch.

ESC OFF switch (ESC system)

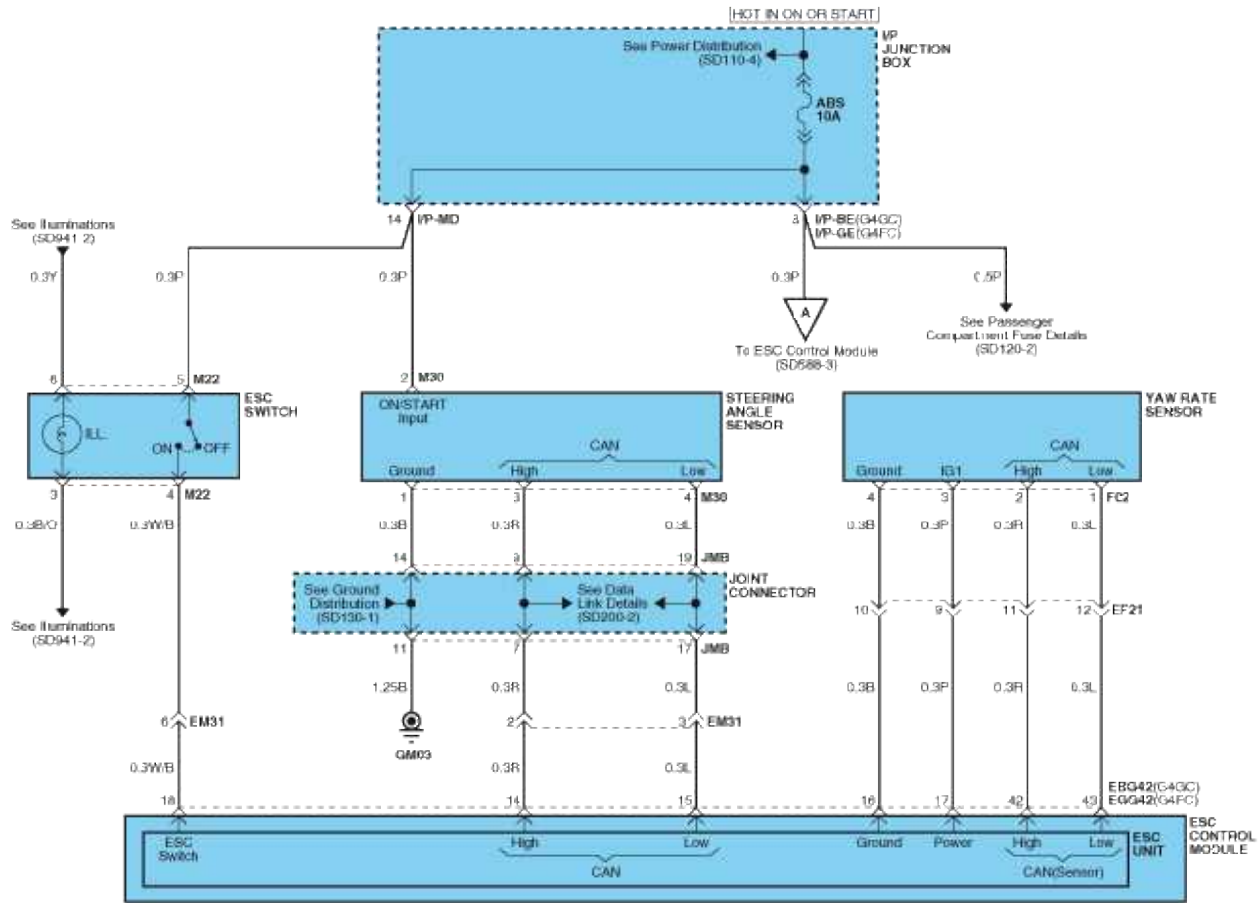
The ESC On/Off Switch shall be used to toggle the ESC function between On/Off states based upon driver input. The On/Off switch shall be a normally open, momentary contact switch.Closed contacts switch the circuit to ignition. Initial status of the ESC function is on and switch toggle the state.

Brake System > ESC(Electronic Stability Control) System > Schematic Diagrams

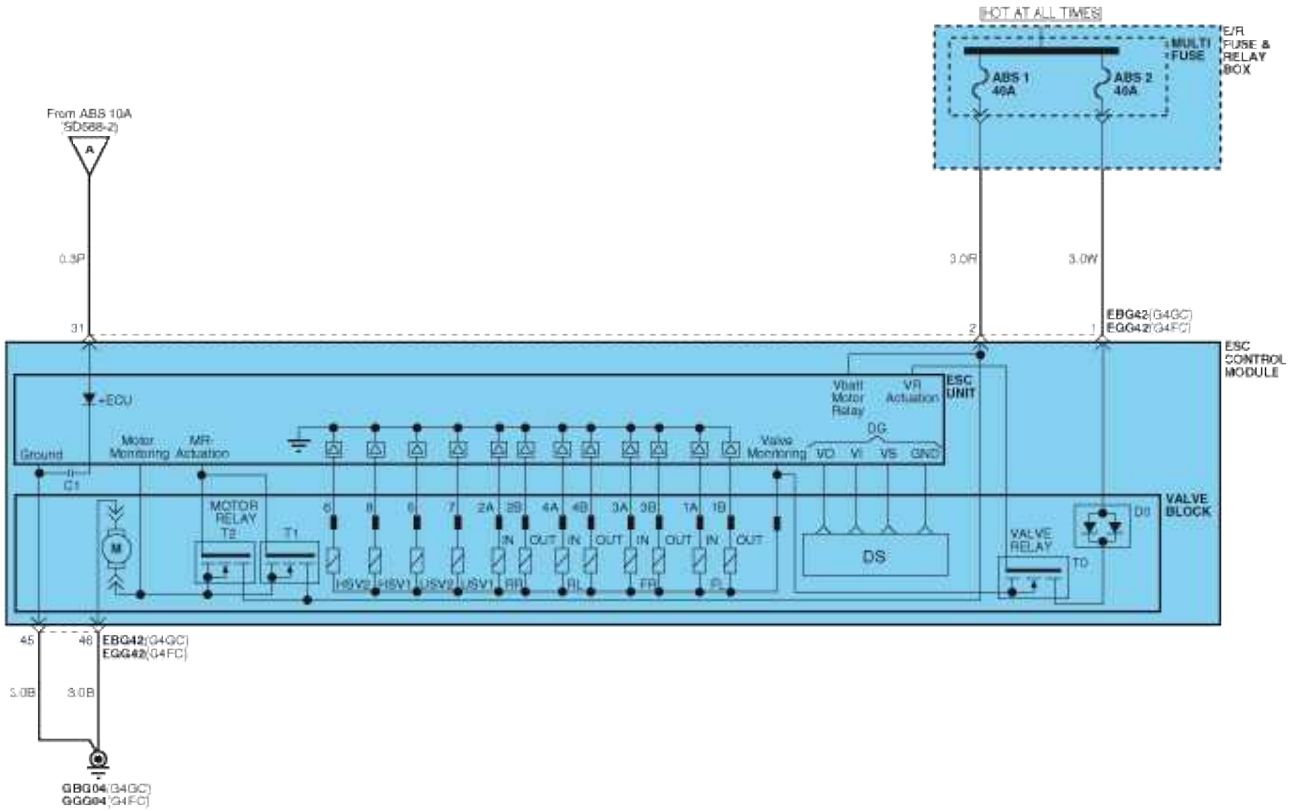
Circuit Diagram - ESC(1)



Circuit Diagram - ESC(2)



Circuit Diagram - ESC(3)



ESC Connector Input/Output



Connector Terminal		Specification	Remark
No	Description		
31	IGNITION1(+)	Over voltage range : 17 ± 0.5V Operating voltage range : 9.5 ± 0.5V < V < 17 ± 0.5V Low voltage range : 7.0 ± 0.5V < V < 9.5 ± 0.5V	

		Nominal current : I < 500mA	
1	POS.BATTERY.(SOLENOID)	Max leakage current : I < 0.8mA Operating voltage range : 9.5 ± 0.5V < V < 17 ± 0.5V Nominal current : I < 40A Hardware shutdown voltage : V < 6.0V	
2	POS.BATTERY.(MOTOR)	Operating voltage range: 9.5 ± 0.5V < V < 16.5 ± 0.5V Peak current : I < 100A Nominal current : I < 40A Max leakage current : I < 0.2mA	
46	GROUND	Rated current : I < 500mA Nominal current: I < 40A	
45	PUMP MOTOR GROUND	Peak current : I < 100A Nominal current : I < 40A	
16	YAW & LATERAL G SENSOR GROUND	Rated current : I <150mA	
17	YAW SENSOR POWER	Max Output current : I < 150mA Max Output voltage : V(IGN) ± 1V	
34	BRAKE LIGHT SWITCH	Input voltage (Low) : 0V ≤ V ≤ 3.0V Input voltage (High) : 7.0V ≤ V ≤ 16.0V	
32	BRAKE SWITCH		
8	PARKING BRAKE SWITCH	Input voltage (Low) : 0V ≤ V_Low ≤ 3.0V Input voltage (High) : 7.0V ≤ V_High ≤ 16.0V Max input current : I < 10mA	
27	SENSOR FRONT RIGHT OUTPUT	Nominal current : I < 16mA External pull up resistance :1 KΩ < R Output duty :50 ± 20%	
18	ESC ON/OFF SWITCH	Input voltage (Low) : 0V ≤ V ≤ 3.0V Input voltage (High) : 7.0V ≤ V ≤ 16.0V Max input current: : I <10mA	
15	CAN BUS LINE(LOW)		
14	CAN BUS LINE(HIGH)		
4	SENSOR FRONT LEFT POWER	Output voltage : IGN (V) ± 1V Output current : Max 30mA	
5	SENSOR FRONT RIGHT POWER		
7	SENSOR REAR LEFT POWER		
6	SENSOR REAR RIGHT POWER		
9	SENSOR FRONT LEFT SIGNAL	Input current LOW : 5.9 ~ 8.4mA Input current HIGH :11.8 ~ 16.8mA Frequency range :1 ~ 2500Hz Input duty : 50 ± 20%	
10	SENSOR FRONT RIGHT SIGNAL		
12	SENSOR REAR LEFT SIGNAL		
11	SENSOR REAR RIGHT SIGNAL		

42	SENSOR CAN BUS LINE (High)		
43	SENSOR CAN BUS LINE (Low)		
37	ESC OFF LAMP DRIVE	Nominal current : I < 200mA (12V) Voltage range : 0 ~ 18 V Min. shunt resistance : 500KΩ Max Output voltage (Low) : 0.5V	
38	AS/EBS W/LAMP DRIVE		
40	ESC FUNCTION W/LAMP DRIVER		

Brake System > ESC(Electronic Stability Control) System > Troubleshooting

Failure Diagnosis

1. In principle, ESC and TCS controls are prohibited in case of ABS failure.
2. When ESC or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESC failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESC is not installed.

Memory of Fail Code

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as far as the HCU power is on. (X)

Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.

Countermeasures In Fail

1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

Warning Lamp ON

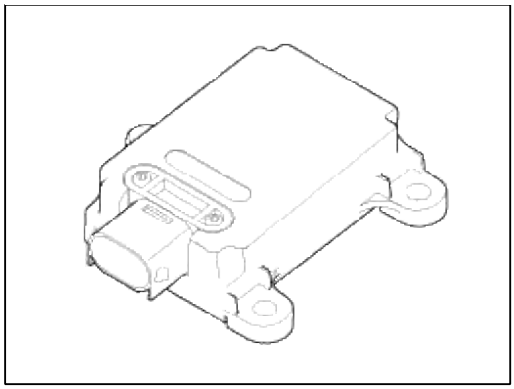
1. ESC warning lamp turn on for 3sec after IGN ON.
2. ESC function lamp blinks when ESC Act.
3. ESC OFF lamp turn on in case of
   A. ESC Switch OFF
   B. 3sec after IGN ON

Brake System > ESC(Electronic Stability Control) System > Yaw-rate and Lateral G Sensor > Description and Operation

Description

When the vehicle is turning with respect to a vertical axis the yaw rate sensor detects the yaw rate electronically by the vibration change of plate fork inside the yaw rate sensor.
If yaw velocity reaches the specific velocity after it detects the vehicle' yawing, the ESC control is reactivated.
The later G sensor senses vehicle's lateral G. A small element inside the sensor is attached to a deflectable lever arm by later G.
Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G.
It interchanges signals with HECU through extra CAN line which only used for communication between HECU and sensor.

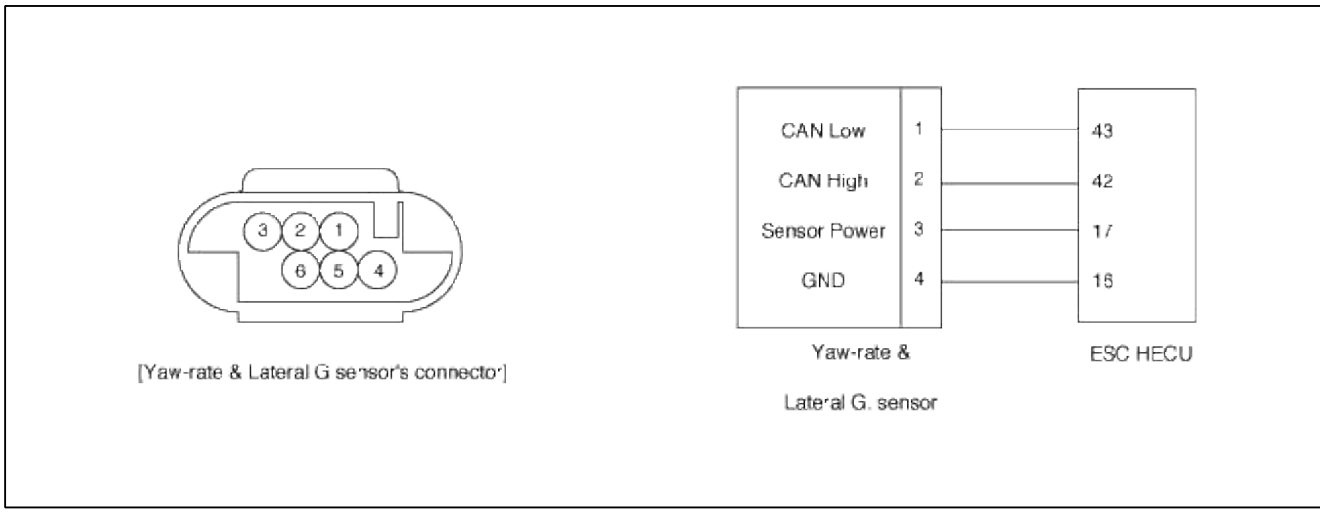
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Specifications

Description		Specification	Remarks
Operating voltage		10 ~ 16V	
Output signal		CAN Interface	
Operating temperature		-40 ~ 85°C(-40 ~ 185°F)	
Yaw-rate sensor	Measurement range	-75 ~ 75°/sec	
	Frequency response	18 ~ 22Hz	
Lateral G sensor	Measurement range	-1.5 ~ 1.5g	
	Frequency response	50Hz±60%	

External Diagram



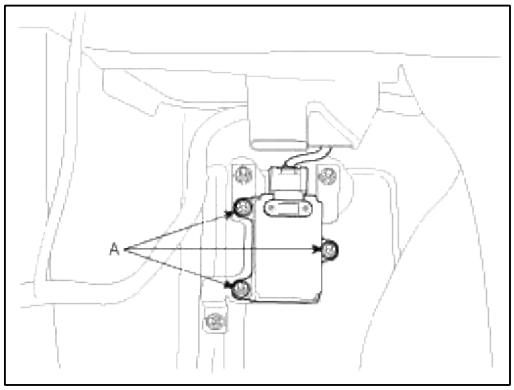
Brake System > ESC(Electronic Stability Control) System > Yaw-rate and Lateral G Sensor > Repair procedures

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the passenger seat assembly. (Refer to the Body group - Seat)

3. Clear away the floor mat.
4. Disconnect the yaw rate & lateral G sensor connector.
5. Remove the mounting bolts (A).

Tightening torque:
7.9 ~ 10.8N.m (0.8 ~ 1.1kgf.m, 5.8 ~ 8.0Ib-ft)



6. Installation is the reverse of removal.

Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Description and Operation

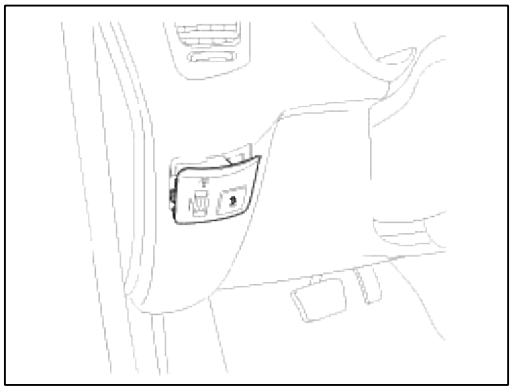
Description

1. The ESC OFF switch is for the user to turn off the ESC system.
2. The ESC OFF lamp is on when ESC OFF switch is engaged.

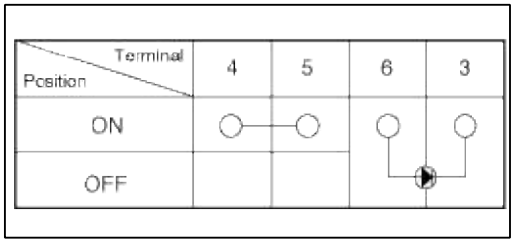
Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Repair procedures

Inspection

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the lower crash pad switch assembly by using the scraper and then disconnect the connectors.



3. Check the continuity between the switch terminals as the ESC OFF switch is engaged.

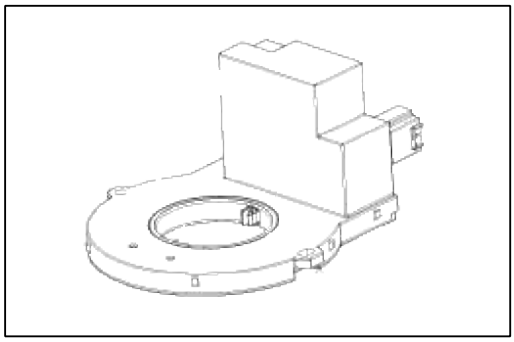


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Brake System > ESC(Electronic Stability Control) System > Steering Wheel Angle Sensor > Description and Operation

Description

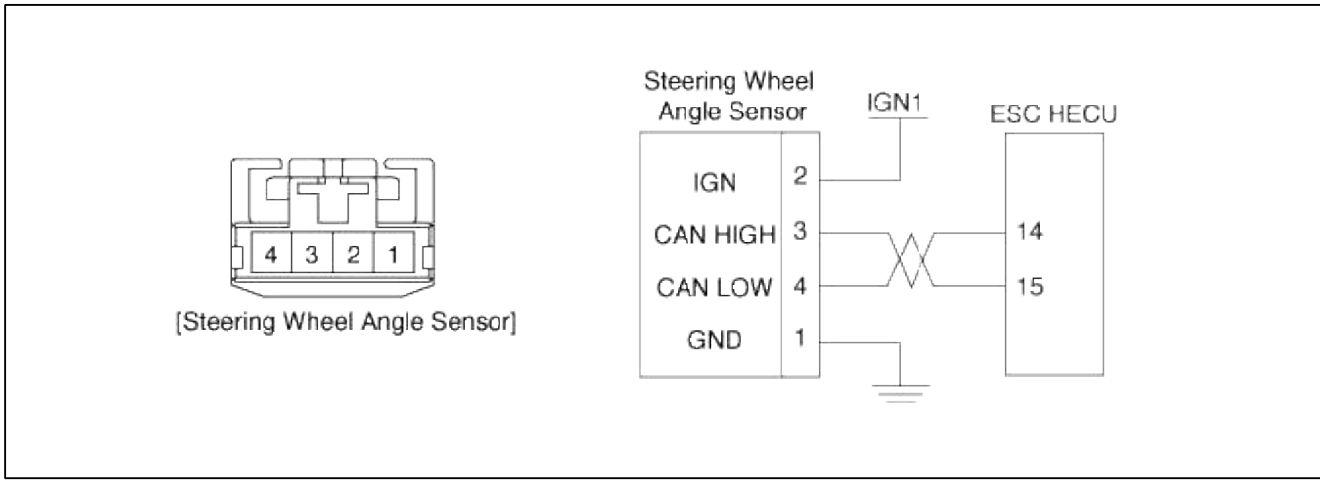
Steering Wheel Angle Sensor detects rotating direction of the vehicle. Rotating direction detected by the sensor is communicated with HECU as CAN signal involving information about the angle through CAN communication line. HECU detects speed of the steering wheel handling and the angle with this CAN signal. HECU also uses this signal as the input signal to control anti-roll.



Specification

Description		Specification
Operating voltage		9 ~ 16V
Operating temperature		-30 ~ 75°C(-22 ~ 167°F)
Current consumption		Max.100mA
Measuring range	Angle	-780 ~ 779.9°
	Angular velocity	1016°/sec
Output signal		CAN Interface

Circuit Diagram



Calibration (Setting up the zero angle)

Steering Wheel Angle Sensor of a absolute angle type (CAN type) measures the angle under the standard of the zero angle set.

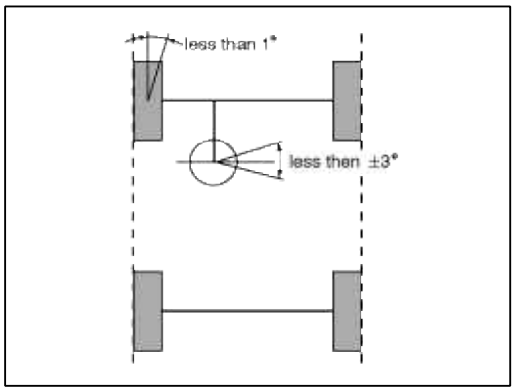
Calibration must be performed as following cases.

- Replacement of the Steering Wheel Angle Speed Sensor

- Replacement or repair of the Steering column
- Detection of DTC codes (C1260, C1261)
- Replacement of the sensor cluster
- Replacement of HECU

Calibration procedure

Perform wheel alignment and stand the steering wheel in a line within ±3°error.



1. Connect the scan tool.(CAN line or OBD connector)
2. Turn ignition switch on.
3. Press calibration button of the Steering Wheel Angle Sensor.
4. HECU calibration procedure is performed.
   (Calibration records, DTC codes erasure)
5. Turn ignition switch off after calibration procedure.
6. Confirm success or failure of calibration.
   A. Warning lamp must not be lighted when driving test (Turning left and right).
   B. The ESC system will light the ESC warning lamp when the system detects a sensor error.

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SOUL(AM) > 2010 > G 1.6 DOHC > Clutch System

Clutch System > General Information > Specifications

Specifications

Item	Specification
Clutch operation method	Hydraulic type
Clutch disc Type Facing diameter (outside x inside)mm (in)	Single dry with diaphragm • Gasoline 1.6 : Ø215 × Ø145 (Ø8.5 × Ø5.7) • Gasoline 2.0 : Ø225 × Ø150 (Ø8.9 × Ø5.9)
Clutch cover assembly Type	Diaphragm spring strap
Clutch release cylinder * I.D. mm (in)	20.64 (0.81)
Clutch master cylinder * I.D. mm(in)	15.87 (0.62)

* I.D: Inside diameter

Service Standard

Item	Standard value
Clutch disc thickness [When free]	8.35 ± 0.3 mm (0.329 ± 0.012 in)
Clutch pedal height [With carpet]	168.7 mm (6.64 in)
Clutch pedal free play	6 ~ 13 mm (0.24 ~ 0.51 in)
Clutch pedal stroke	GAMMA : 140mm, BETA/U : 145mm
	Limit
Clutch disc rivet depth	1.1 mm (0.043 in)
Diaphragm spring end height difference	0.5 mm (0.02 in)
Clutch master cylinder clearance to piston	0.15 mm (0.006 in)

Tightening Torques

Item		Nm	kgf.m	lb-ft
Clutch pedal to pedal support member (Clutch pedal bracket)		25 ~ 35	2.5 ~ 3.5	12.3 ~ 18.8
Clutch pedal support member to master cylinder		17 ~ 26	1.7 ~ 2.6	12.3 ~ 18.8
Clutch tube flare nut		13 ~ 17	1.3 ~ 1.7	9.4 ~ 12.3
Clutch tube bracket		8 ~ 12	0.8 ~ 1.2	10.8 ~ 15.9
Clutch release cylinder		15 ~ 22	1.5 ~ 2.2	10.8 ~ 15.9
Clutch release cylinder union bolt		25 ~ 35	2.5 ~ 3.5	18.1 ~ 25.3
Clutch cover assembly	Gasoline(6ea)	15 ~ 22	1.5 ~ 2.2	10.8 ~ 15.9
Ignition lock switch nut		12 ~ 15	1.2 ~ 1.5	8.7 ~ 10.8

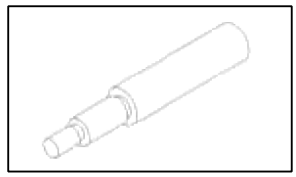
Lubricants

Items	Specified lubricants	Quantity
Contact surface of release bearing and fulcrum of clutch release fork	CASMOLY L9508	As required
Inner surface of clutch release bearing	CASMOLY L9508	As required
Inner surface of clutch release cylinder and outer circumference of piston and cup	Brake fluid DOT 3 or DOT 4	As required
Inner surface of clutch disc spline	CASMOLY L9508	As required
Inner surface of clutch master cylinder and outer circumference of piston assembly	Brake fluid DOT 3 or DOT 4	As required
Clutch master cylinder push rod, clevis pin and washer	Wheel bearing grease SAE J310, NLGI No.2V	As required
Clutch pedal shaft and bushings	Chassis grease SAE J310a, NLGI No.1	As required
Contact portion of release fork to release cylinder push rod	CASMOLY L9508	As required
Input shaft spline	CASMOLY L9508	As required

Clutch System > General Information > Special Service Tools

Special Service Tools

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Tool (Number and name)	Illustration	Use
09411-11000 Clutch disc guide		Installation of the clutch disc.

Clutch System > General Information > Troubleshooting

Troubleshooting

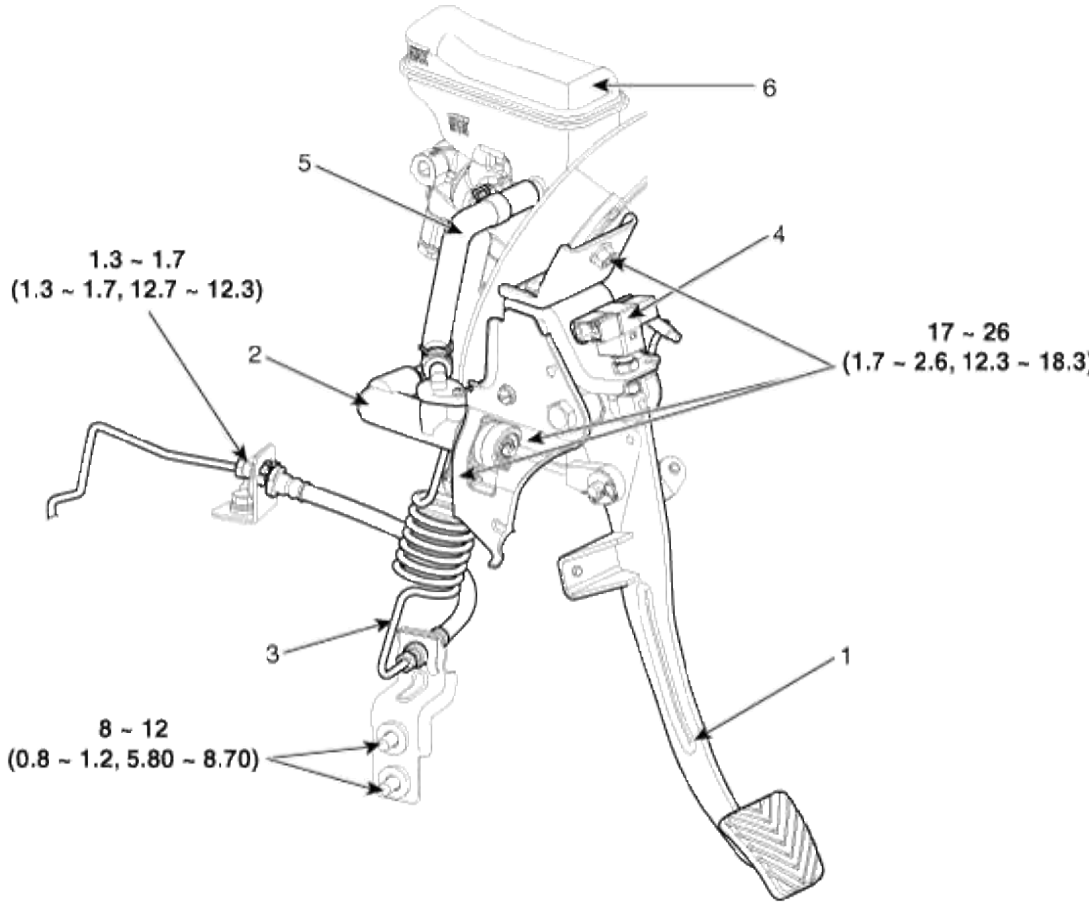
Trouble symptom		Suspect area	Remedy
Clutch slipping • Car will not respond to engine speed during acceleration • Insufficient vehicle speed • Lack of power during uphill driving		Insufficient pedal free play	Adjust
		Clogged hydraulic system	Correct or replace parts
		Excessive wear of clutch disc facing	Replace
		Hardened clutch disc facing, or oil on surface	Replace
		Damaged pressure plate or flywheel	Replace
		Weak or broken pressure spring	Replace
Difficult gear shifting (gear noise during shifting)		Excessive pedal free play	Replace
		Hydraulic system fluid leaks, air trapping or clogging	Repair or replace parts
		Unusual wear or corrosion of the clutch disc spline	Replace
		Excessive vibration (distortion) of the clutch disc	Replace
Clutch noisy	When the clutch is not used	Insufficient play of the clutch pedal	Adjust
		Excessive wear of the clutch disc facing	Replace
	A noise is heard after the clutch is disengaged	Unusual wear and/ or damage of the release bearing	Replace
	A noise is heard when the clutch is disengaged	Insufficient grease on the sliding surface of the bearing sleeve	Repair
		Improperly installed clutch assembly or bearing	Repair
Hard pedal effort		Insufficient lubrication of the clutch pedal	Repair
		Insufficient lubrication of the spline part of clutch disc	Repair
		Insufficient lubrication of the clutch release lever shaft or fork	Repair
Hard to shift or will not shift		Excessive clutch pedal free play	Replace

	Faulty of the clutch release cylinder	Repair the release cylinder
	Clutch disc out of place, runout is excessive or lining broken	Inspect the clutch disc
	Spline on the input shaft or clutch disc dirty or burned	Repair as necessary
	Faulty of the clutch pressure plate	Replace the clutch cover
Clutch slips	Insufficient clutch pedal free play	Adjust the pedal free play
	Clogged of the hydraulic system	Repair or replace parts
	Clutch disc lining oily or worn out	Inspect the clutch disc
	Faulty pressure plate	Replace the clutch cover
	Binding of the release fork	Inspect the release fork
Clutch grabs/chatters	Clutch disc lining oily or worn out	Inspect the clutch disc and replace if necessary
	Faulty the pressure plate	Replace the clutch cover
	Bent clutch diaphragm spring	Replace the clutch cover
	Worn or broken torsion spring	Replace the clutch disc
	Engine mounts loose	Repair as necessary
Clutch noisy	Damaged the clutch pedal bushing	Replace the clutch pedal bushing
	Loose part inside housing	Repair as necessary
	Worn or dirty release bearing	Replace the replace bearing
	Sticking release fork or linkage	Repair as necessary

Clutch System > Clutch System > Components and Components Location

Components

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Torque : Nm (kgf.m, lb-ft)

1. Clutch Pedal Assembly 2. Clutch Master Cylinder Assembly 3. Clutch Tube Assembly	4. Ignition Lock Switch 5. Clutch Fluid Hose 6. Brake Fluid Reservoir Tank

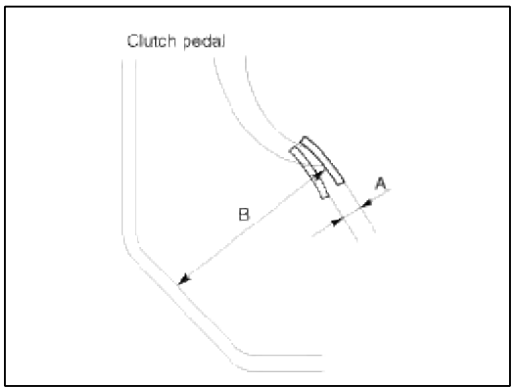
Clutch System > Clutch System > Repair procedures

Service Adjustment Procedure

Clutch Pedal Inspection And Adjustment

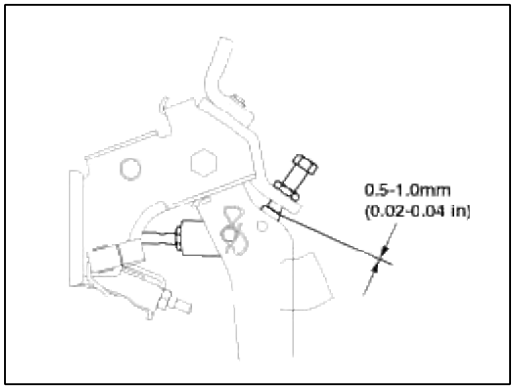
1. Measure the clutch pedal height (from the face of the pedal pad to the floorboard) and the clutch pedal clevis pin play (measured at the face of the pedal pad.)

Standard value
(A) : 6 ~ 13 mm (0.24~0.51 in)
(B) : 168.7 mm (6.64 in)



2. If the clutch pedal freeplay and height is not within the standard value range, adjust as follows:
   (1) Turn and adjust the bolt within the standard value, then secure by tightening the lock nut.

> NOTE
>
> If the clutch pedal height is lower than the standard value, loosen the bolt and adjust the push rod. After adjustment, tighten the bolt so that the clearance with pedal stopper becomes 0.5mm(0.02 in) to 1.0mm (0.04 in) and secure with lock nut.



   (2) Turn the push rod to agree with the standard value and then secure the push rod with the lock nut.

> CAUTION
>
> When adjusting the clutch pedal height or the clutch pedal play, be careful not to push the push rod toward the master cylinder.

3. If the clutch pedal free play and the distance between the clutch pedal and the floor board, do not meet with the standard values when the clutch is disengaged, it may be the result of either air in the hydraulic system or a faulty clutch master cylinder.

Bleeding

Whenever the clutch tube, the clutch hose, and/or the clutch master cylinder have been removed, or if the clutch pedal is spongy, bleed the system.

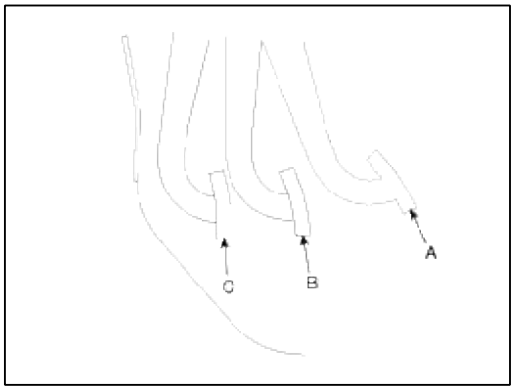
> CAUTION
>
> Use the specified fluid. Avoid mixing different brands of fluid.

Specified fluid: SAE J1703 (DOT 3 or DOT 4)

1. Loosen the bleeder screw(A) at the clutch release cylinder.
2. Depress the clutch pedal slowly until all air is expelled.
3. Hold the clutch pedal down until the bleeder is retightened.
4. Refill the clutch master cylinder with the specified fluid.

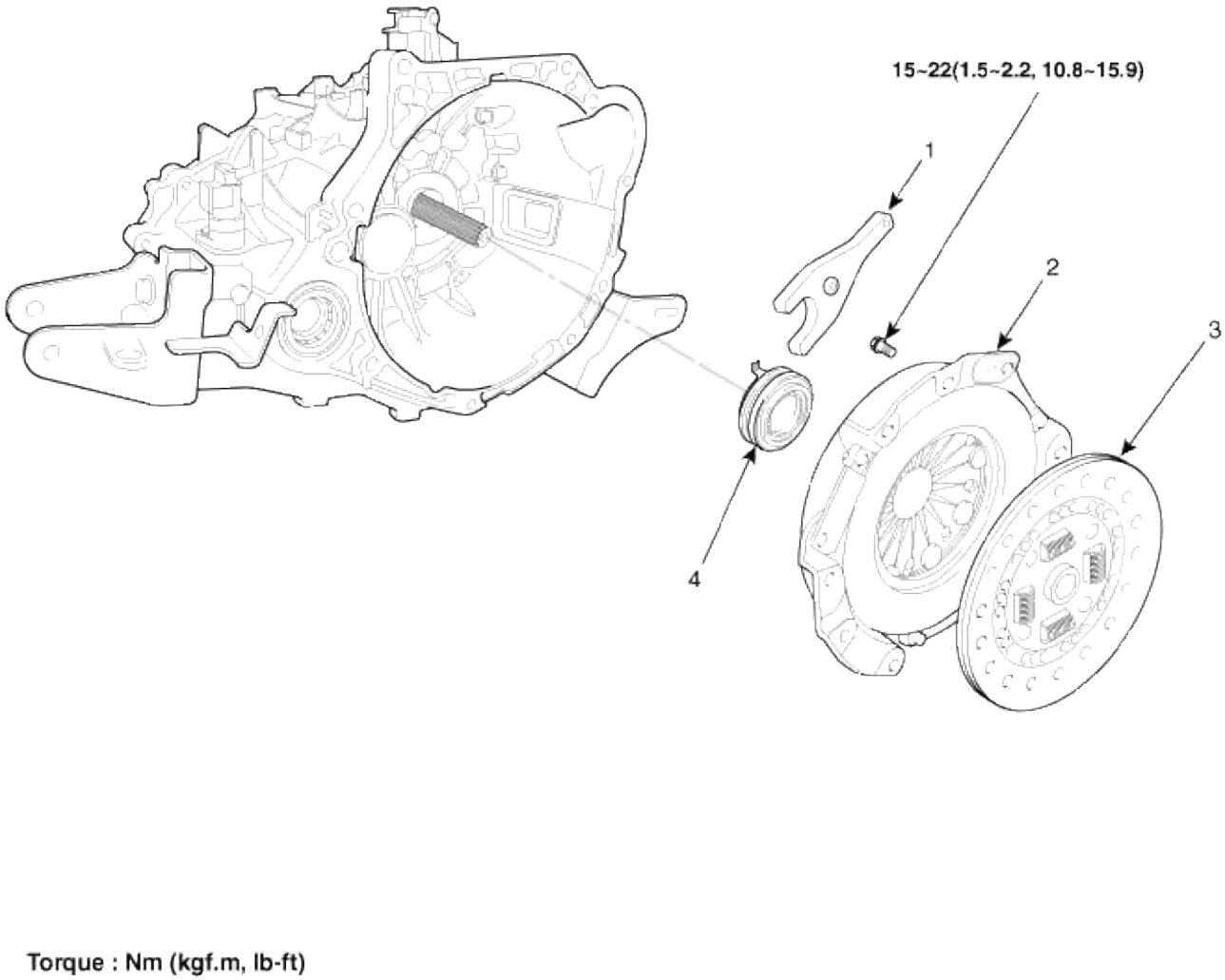
CAUTION

The rapidly-repeated operation of the clutch pedal in B-C range may disrupt the release cylinder's position. During the bleeding operation, press the clutch pedal to the floor after it returns to the "A" point.



Clutch System > Clutch System > Clutch Cover And Disc > Components and Components Location

Components



1. Clutch release fork 2. Clutch assembly cover	3. Clutch disk assembly 4. Clutch release bearing

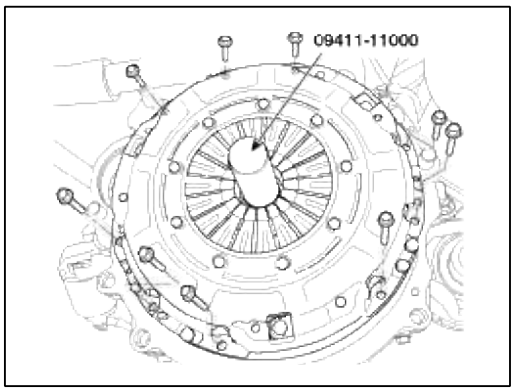
Clutch System > Clutch System > Clutch Cover And Disc > Repair procedures

Removal

1. Remove the transaxle assembly. (Refer to Manual transaxle's removal in MT group)

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2. Insert the special tool (09411-11000) in the clutch disc to prevent the disc from shifting.



3. Loosen the bolts(Gasoline : 6ea, Diesel : 9ea) which attach the clutch cover to the flywheel in a star pattern. Loosen the bolts in succession, one or two turns at a time, to avoid bending the cover.

> NOTE
>
> Do not clean the clutch disc or the release bearing with cleaning solvent.

Inspection

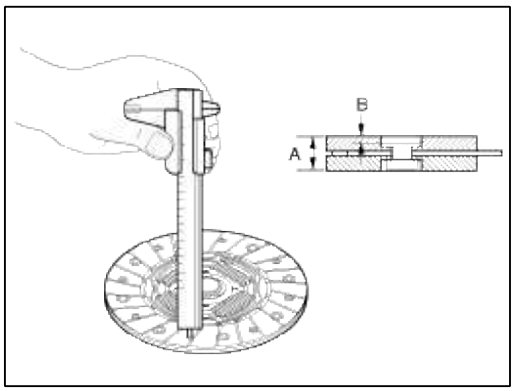
Clutch cover assembly

1. Check the diaphragm spring end for wear and uneven height.
2. Check the pressure plate surface for wear, cracks and color change.
3. Check the rivets for looseness and replace the clutch cover assembly if necessary.

Clutch disc

1. Check the clutch facing for loose rivets, uneven contact, deterioration due to seizure, adhesion of oil, or grease, and replace the clutch disc if defective.
2. Measure the thickness of the disc when free.

Standard value
Clutch disc thickness(A)[when free]
Clutch disc rivet depth(B)
: refer to 'SERVICE STANDARD' in GENERAL section.



3. Check for the torsion spring play and damage and if defective, replace the clutch disc.
4. Clean the splines on the input shaft and install the clutch disc.
   If the disc does not slide smoothly or if play is excessive, replace the clutch disc and/or the input shaft.

Clutch release bearing

CAUTION

The release bearing is packed with grease. Do not use cleaning solvent or oil.

Standard grease : CASMOLY L9508

1. Check the bearing for seizure, damage or abnormal noise. Also check the diaphragm spring contacting points for wear.
2. Replace the bearing if the release fork contacting points are worn abnormally.

Clutch release fork

If there is abnormal wear at the point of contact with the bearing, replace the release fork assembly.

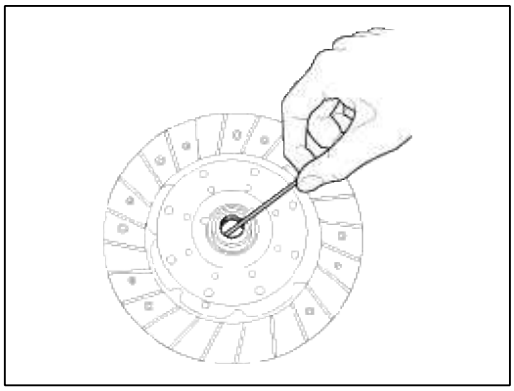
Installation

1. Apply multipurpose grease to the spline of the disc.

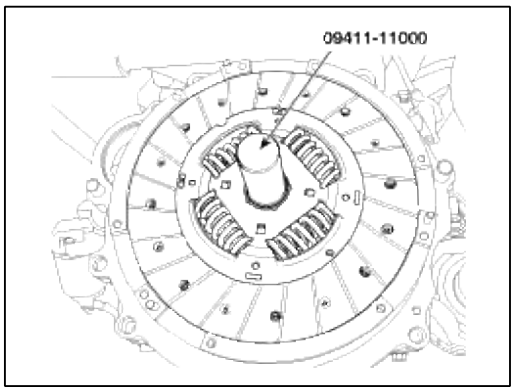
Grease: CASMOLY L 9508

CAUTION

When installing the clutch, apply grease to each part, but be careful not to apply excessive grease.
It can cause clutch slippage and vibration (shudder).



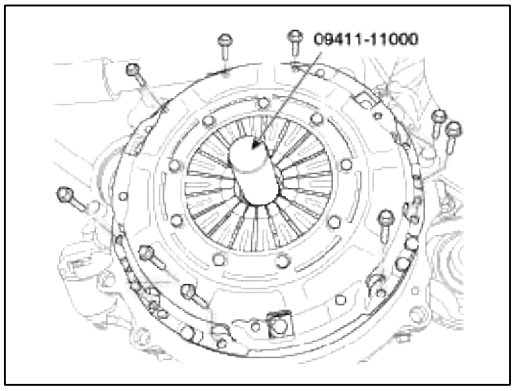
2. Temporarily install the clutch disc assembly to the flywheel using the special tool (09411-11000).



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3. Tighten the bolts one or two steps at a time in a star pattern.

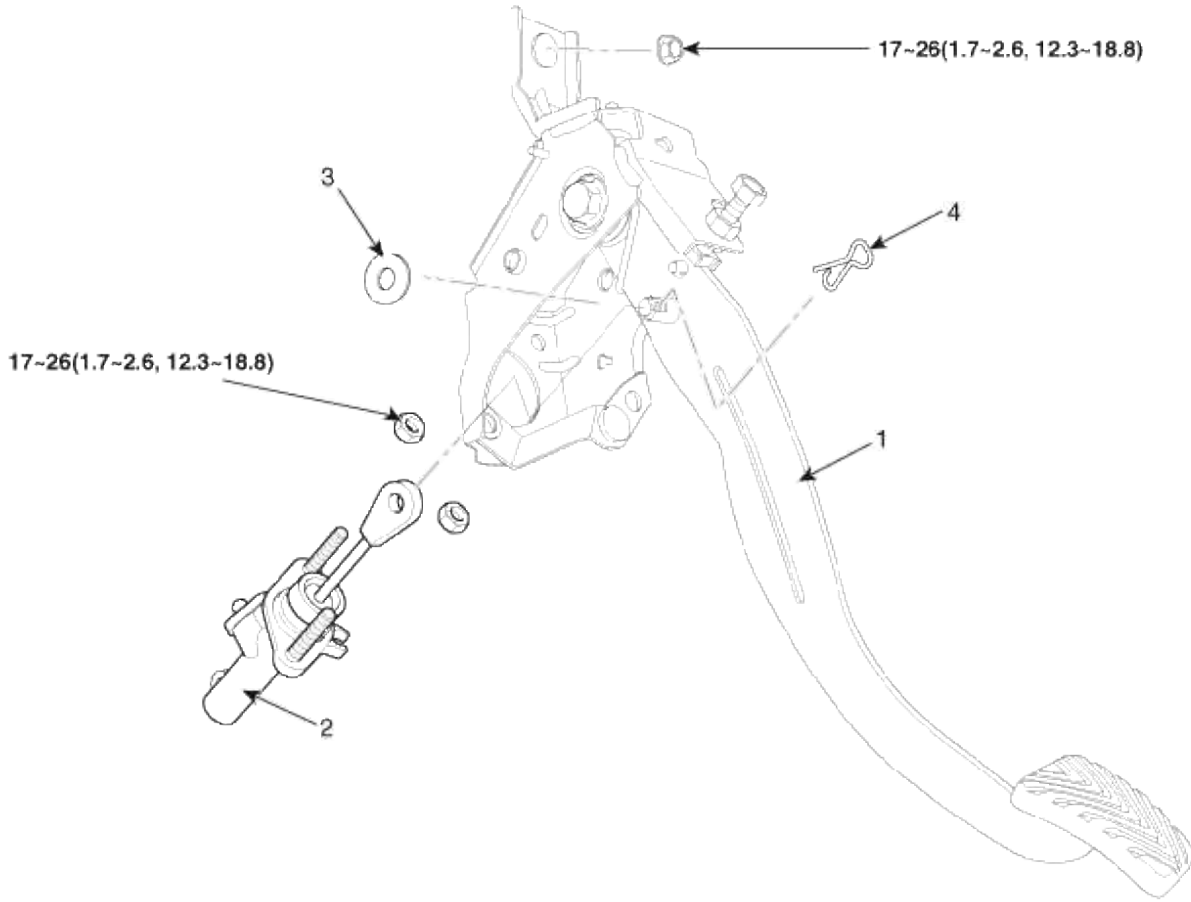
Tightening torque
: 15 ~ 22 Nm (1.5 ~ 2.2 kgf.m, 10.9 ~ 16.0 lb-ft)



4. Remove the clutch disc guide (09411-11000).
5. Install the transaxle assembly to the engine. (Refer to Manual transaxle's installation in MT group)

Clutch System > Clutch System > Clutch Master Cylinder > Components and Components Location

Components



1. Cluch pedal assembly 2. Cluch master cylinder assembly	3. Washer 4. Snap pin

Clutch System > Clutch System > Clutch Master Cylinder > Repair procedures

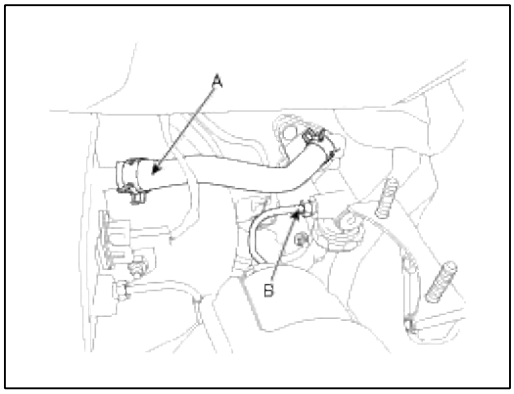
Removal

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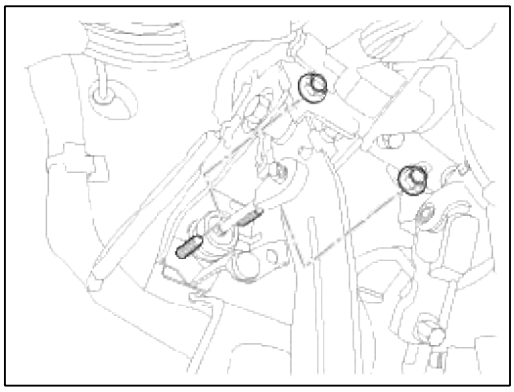
1. Remove the flexible hose (A) connected to brake reserve tank from the master cylinder.

NOTE

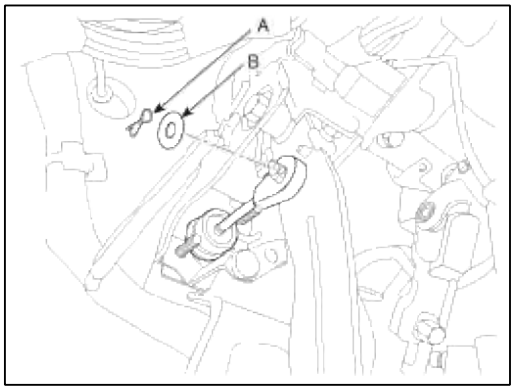
In advance remove the ECU and battery.
Put aside the fuel pump by disconnecting the connectors and remove the mounting nuts.



2. Disconnect the clutch tube (B) from the master cylinder.
3. Remove the drive lower cover. (refer to BD group)
4. Remove the clutch pedal mounting nuts.



5. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer (B).



Diassembly

1. Remove the piston stop ring.
2. Pull out the push rod and piston assembly.

3. Remove the reserve tank band, reserve tank cap, and reserve tank.

> NOTE
>
> Use care not to damage the master cylinder body and piston assembly.
> Do not disassemble the piston assembly.

Inspection

1. Check the inside of the cylinder body for rust, pitting or scoring.
2. Check the piston cup for wear or distortion.
3. Check the piston for rust, pitting or scoring.
4. Check to make sure the clutch line tube is not clogged or restricted in any way.
5. Measure the master cylinder inside diameter and the piston outside diameter with a cylinder gauge micrometer.

> NOTE
>
> Measure the inside diameter of the master cylinder at three places (bottom, middle, and top) in a perpendicular direction.

6. If the master cylinder-to-piston clearance exceeds the limit, replace the master cylinder and/or piston assembly.

Limit : 0.15 mm (0.006 in)

Reassembly

1. Apply the specified fluid to the inner surface of the master cylinder body and to the entire periphery of the piston assembly.

Specified fluid : Brake fluid DOT 3 or DOT 4

2. Install the piston assembly.
3. Install the piston snap ring.
4. Install the push rod assembly.

Installation

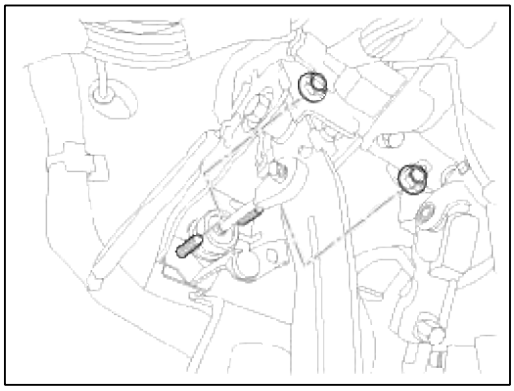
1. Apply the specified grease to the snap pin and washer.

Wheel bearing grease : SAE J310, NLGI No.2

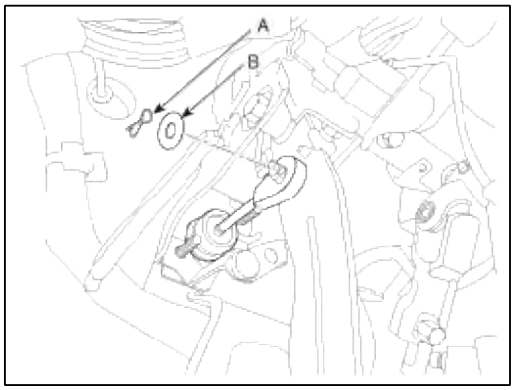
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2. Install the clutch pedal mounting nuts.

Tightening torque
: 17 ~ 26Nm (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8Ib-ft)



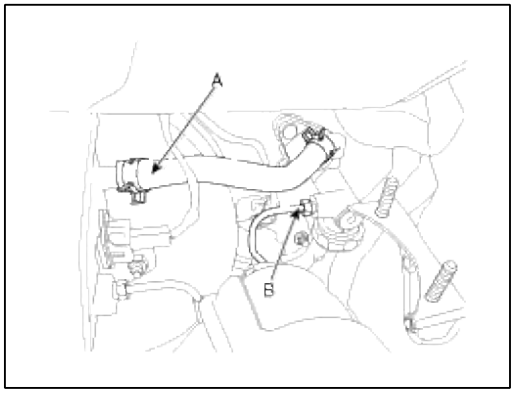
3. Connect the push rod to the clutch pedal by installing the snap pin (A) and washer (B).



4. Install the driver lower cover. (refer to BD group)
5. Connect the flexible hose (A) of the brake reserve tank to the master cylinder.

NOTE

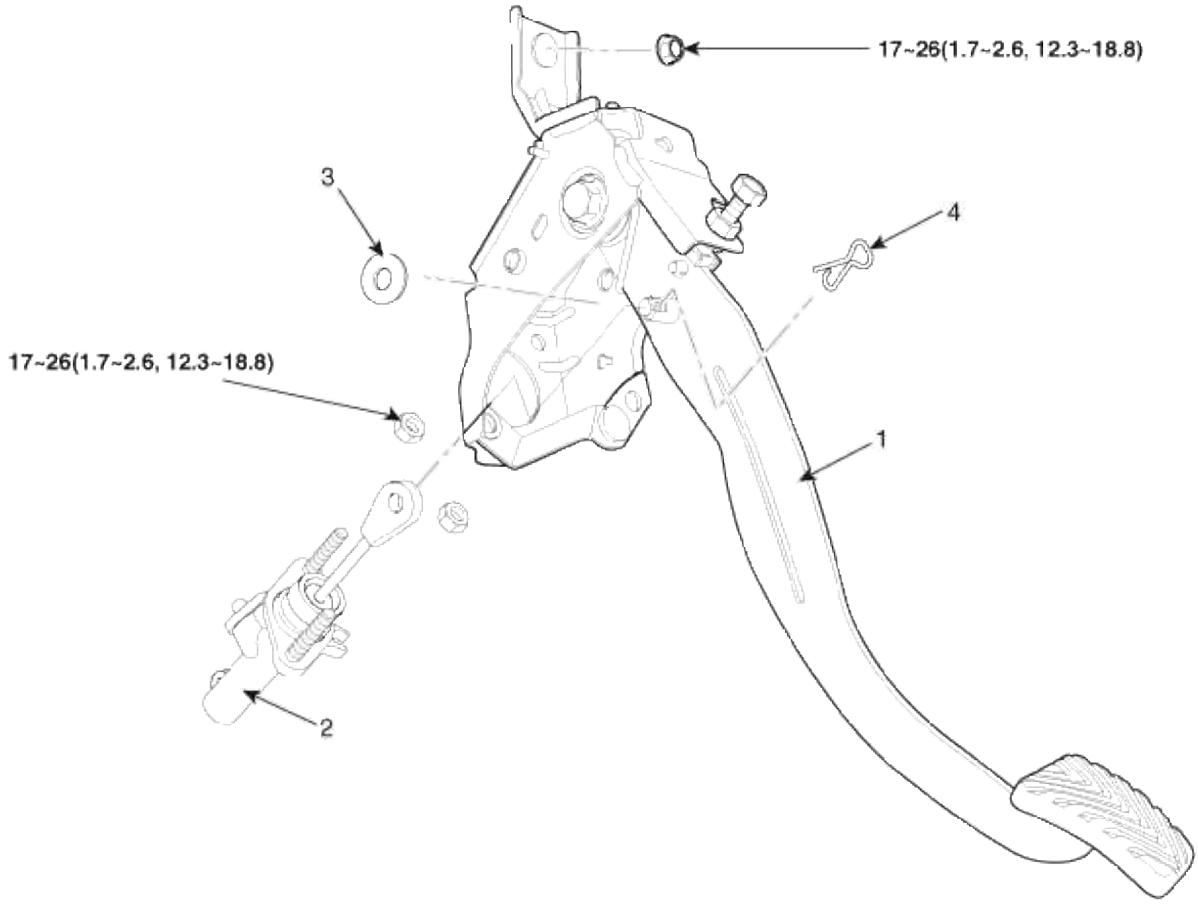
Install the fuel pump, ECU and the battery in order.



6. Connect the clutch tube (B) to the master cylinder.
7. Bleed the air in the clutch system.(refer to Bleeding in Serive Adjustment Procedure)

Clutch System > Clutch System > Clutch Pedal > Components and Components Location

Components



1. Cluch pedal assembly 2. Cluch master cylinder assembly	3. Washer 4. Snap pin

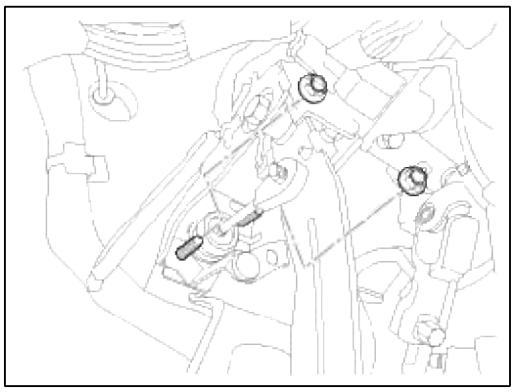
Clutch System > Clutch System > Clutch Pedal > Repair procedures

Removal

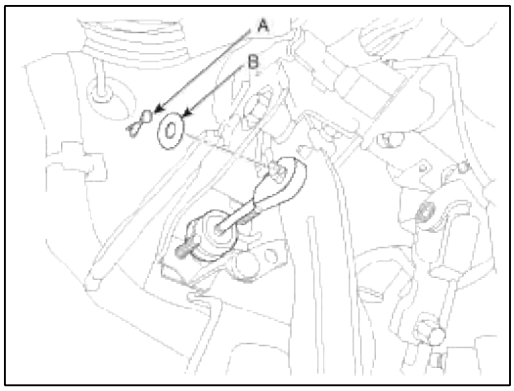
1. Remove the driver lower cover. (refer to BD group)
2. Remove the clutch pedal bracket bolt from the body.

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3. Remove the clutch pedal mounting nuts.



4. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer (B).



5. Remove the pedal bracket nuts.

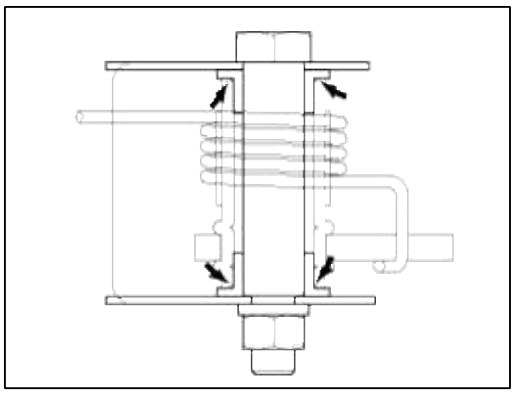
Inspection

1. Check the pedal shaft and bushing for wear.
2. Check the clutch pedal for bending or torsion.
3. Check the return spring for damage or deterioration.
4. Check the pedal pad for damage or wear.

Installation

1. Apply the specified grease to the clutch pedal and bushings.

Chassis grease : SAE J310a, NLGI No.1

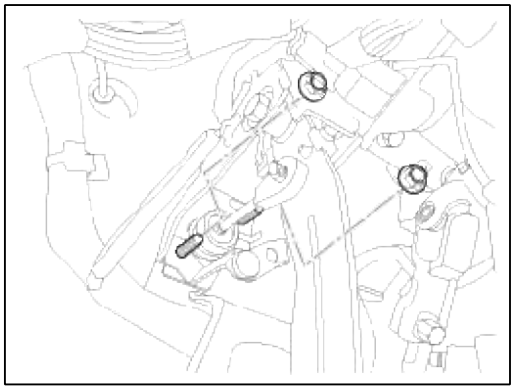


2. Apply the specified grease to the snap pin and washer.

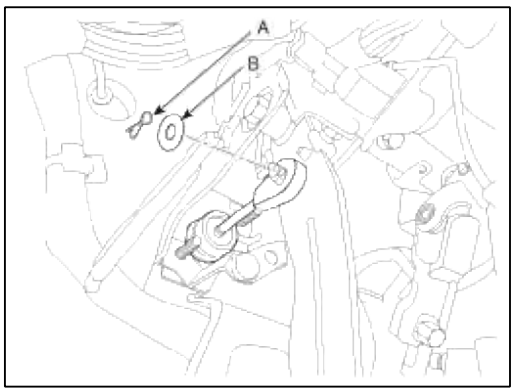
Wheel bearing grease : SAE J310, NLGI No.2

3. Install the pedal bracket nuts.
4. Install the clutch pedal mounting nuts (A-2ea).

Tightening torque
: 17 ~ 26Nm (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8Ib-ft)



5. Connect the push rod to the clutch pedal by installing the snap pin (A) and washer (B).

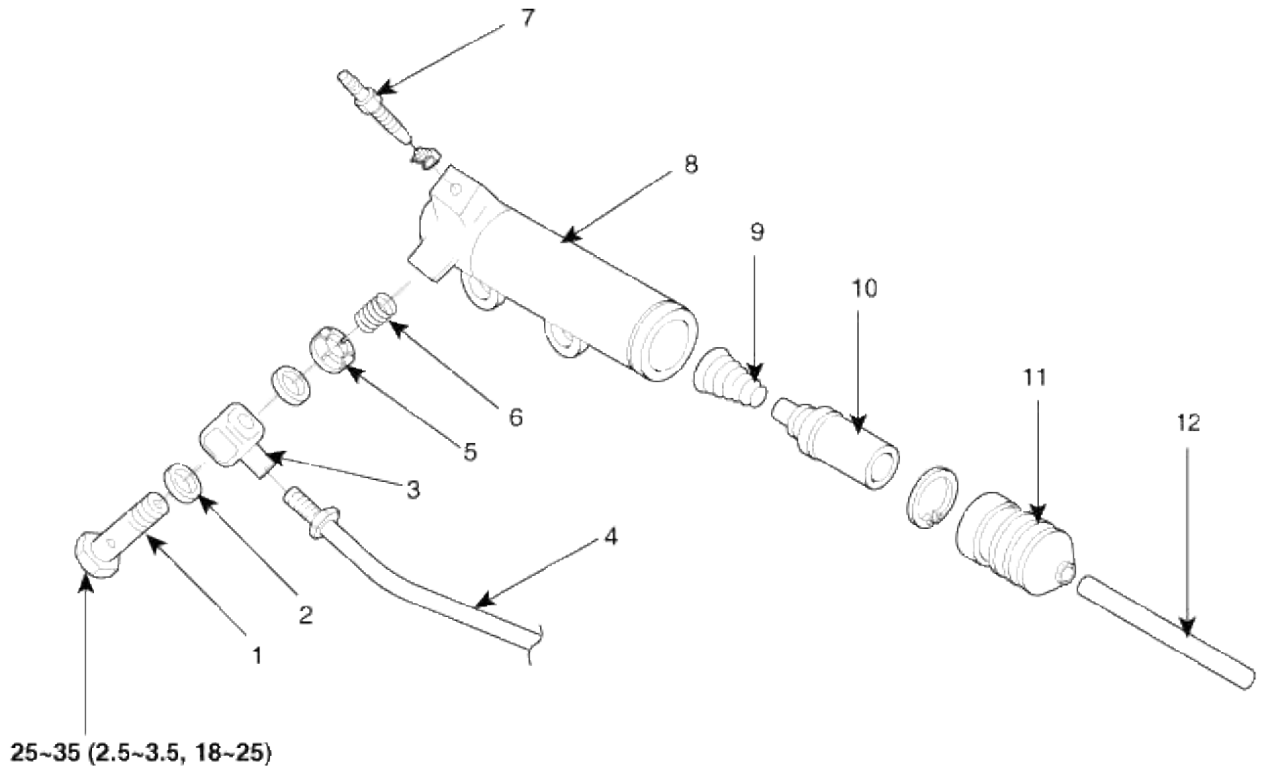


6. Install the clutch pedal bracket bolt to the body.
7. Install the driver lower cover. (refer to BD group)

Clutch System > Clutch System > Clutch Release Cylinder > Components and Components Location

Components

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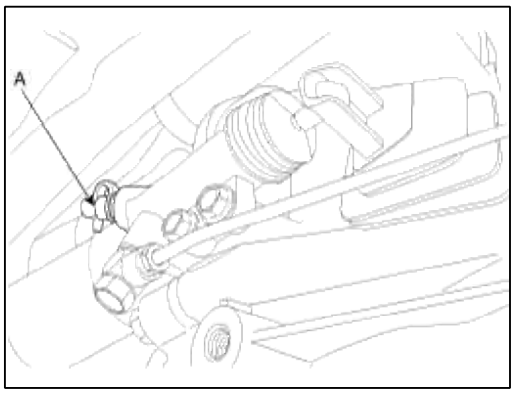
Torque : Nm (kgf.m, lb-ft)

1. Union bolt 2. Gasket 3. Tube joint 4. Clutch tube 5. Valve plate 6. Valve spring	7. Bleeder screw 8. Release cylinder 9. Return spring 10. Piston 11. Boot 12. Push rod

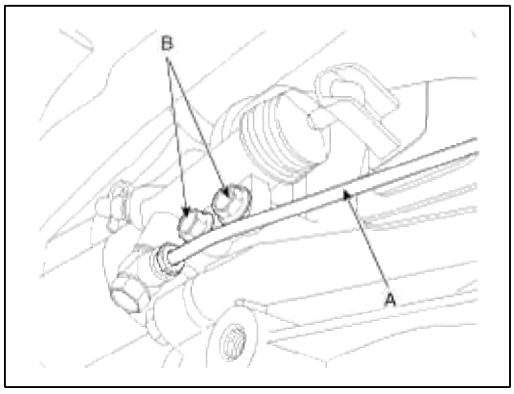
Clutch System > Clutch System > Clutch Release Cylinder > Repair procedures

Removal

1. Drain the brake fluid through the bleed plug (A).



2. Disconnect the clutch tube (A).



3. Remove the two clutch release cylinder mounting bolts (B-2ea).

Inspection

1. Check the release cylinder bore for rust and damage.
2. Check the clutch release cylinder for fluid leakage.
3. Check the clutch release cylinder boots for damage.

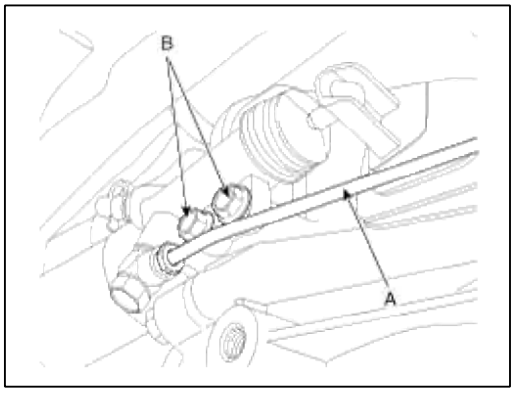
Installation

1. Coat the clutch clevis push rod specified grease.

Specified grease : CASMOLY L9508

2. Install the release cylinder mounting bolts (B-2ea).

Tightening torque
: 15 ~ 22Nm (1.5 ~2.2 kgf.m, 10.8 ~ 15.9 lb-ft)



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3. Install the clutch tube (A).
4. Bleed the air in the clutch system. (Refer to Bleeding in Service Adjustment Procedure)

SOUL(AM) > 2010 > G 1.6 DOHC > Driveshaft and axle

Driveshaft and axle > General Information > Specifications

Specification

Engine	T/M	Joint type		Max. permissible angle	
		Outer	Inner	Outer	Inner
Diesel 1.6	M/T	BJ	TJ	43°	21°
	A/T	BJ	TJ	43°	21°
Gasoline 2.0	M/T	BJ	TJ	43°	21°
	A/T				
Gasoline 1.6	M/T	BJ	TJ	43°	21°
	A/T	BJ	TJ	43°	21°

Tightening torque

Item			
	Nm	Kgf.m	lb-ft
Hub nuts	90 ~ 110	9.0 ~ 11.0	65 ~ 80
Driveshaft lock nut	240.2 ~ 269.6	24.5 ~27.5	177.2 ~ 198.9
Strut assembly to knuckle	100 ~ 120	10.0 ~12.0	72 ~ 87
Lower arm to knuckle	60 ~ 72	6.0 ~ 7.2	43 ~ 52
Tie rod end castle nut	16 ~ 34	1.6 ~ 3.4	12 ~ 25
Front caliper to knuckle	65 ~ 75	6.5 ~ 7.5	47 ~ 54
Rear caliper to carrier	65 ~ 75	6.5 ~ 7.5	47 ~ 54
Rear carrier to torsion axle	70 ~ 90	7.0 ~ 9.0	51 ~ 65

CAUTION

Replace self-locking nuts with new ones after removal.

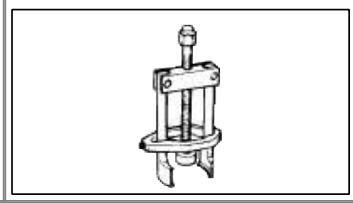
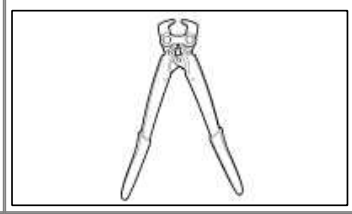
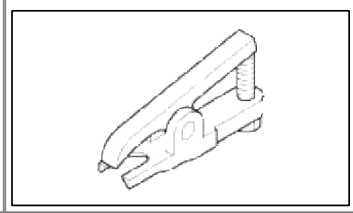
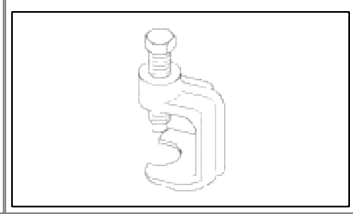
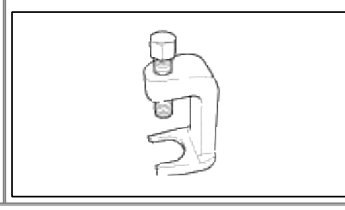
Lubricants

Engine		Lubricants	Quantity
Diesel 1.6(MT/AT)	BJ	RBA	100g
	TJ	CW-13 TJ	130g
Gasoline 2.0 (MT/AT)	BJ	RBA	90g
	TJ	CW-13 TJ	125g
Gasoline 1.6(MT/AT)	BJ	RBA	90g
	TJ	CW-13 TJ	125g

Driveshaft and axle > General Information > Special Service Tools

Special Service Tools

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Tool(Number and Name)	Illustration	Use
09495-33000Puller		Removal of spider assembly from a drive shaft.
09495-3K000Band installer		Installation of ear type boot band
09568-34000Ball joint remover		Removal of the rear upper arm ball joint
09568-4A000Ball joint remover		Removal of the tie rod end ball joint
09568-2J100 Ball joint puller		Remover of ball joint

Driveshaft and axle > General Information > Troubleshooting

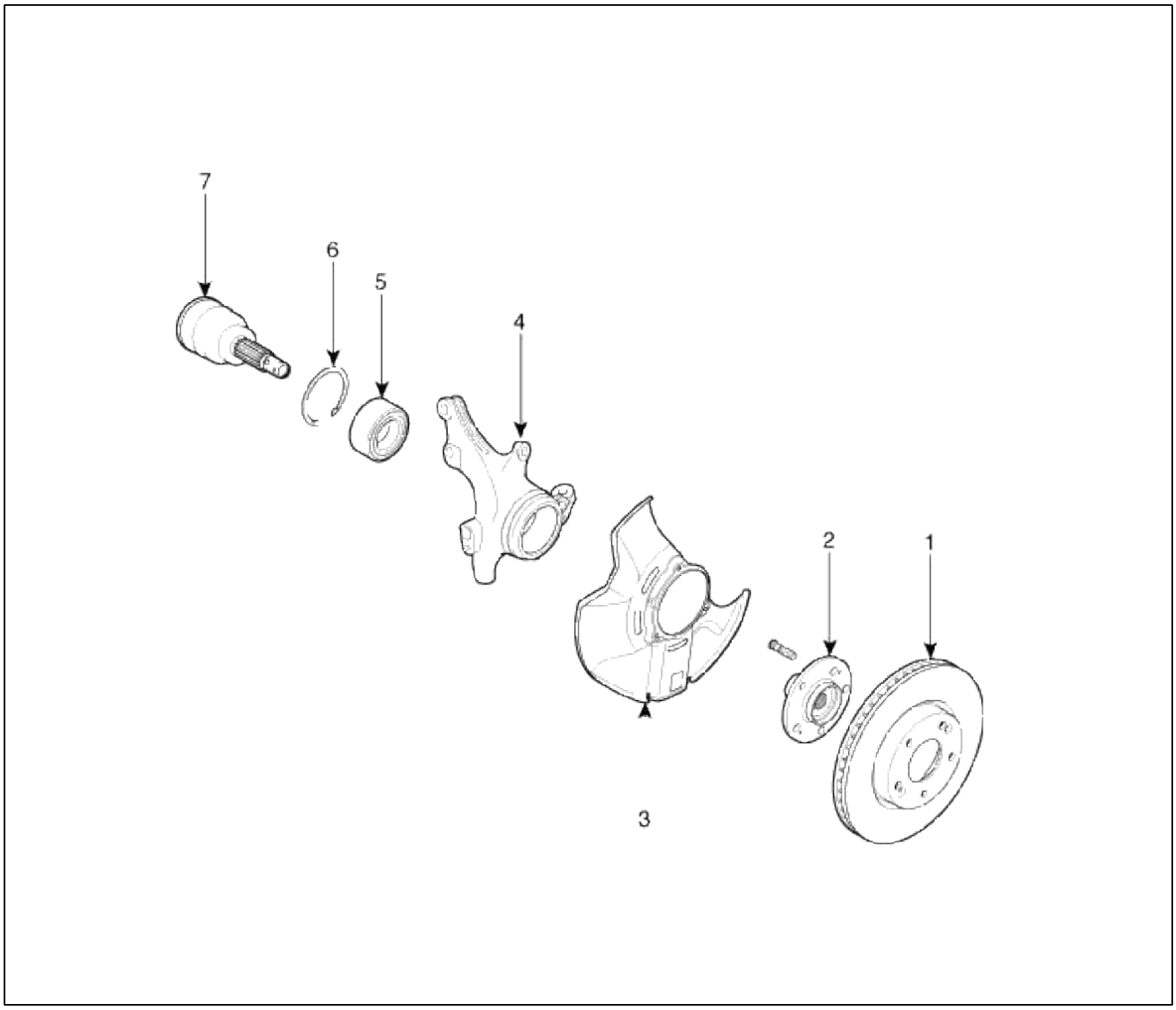
Troubleshooting

Trouble Symptom	Probable cause	Remedy
Vehicle pulls to one side	Scoring of driveshaft ball joint	Replace
	Wear, rattle or scoring of wheel bearing	Replace
	Defective front suspension and steering	Adjustment or Replace
Vibartion	Wear, damage or bending of driveshaft	Replace
	Driveshaft rattle and hub serration	Replace
	Wear, rattle or scratching of wheel bearing	Replace
Shimmy	Defective wheel balance	Adjustment or Replace
	Defective front suspension and steering	Adjustment or Replace
Excessive noise	Wear, damage or bending of driveshaft	Replace
	Rattle of driveshaft and worn hub splines	Replace

	Wear, rattle or scoring of wheel bearing	Replace
	Loose hub nut	Adjustment or Replace
	Defective front suspension and steering	Adjustment or Replace

Driveshaft and axle > Front Axle Assembly > Front Hub / Knuckle > Components and Components Location

Components



1. Brake disc 2. Hub 3. Dust cover 4. Knuckle	5. Wheel bearing 6. Snap ring 7. Driveshaft

Driveshaft and axle > Front Axle Assembly > Front Hub / Knuckle > Repair procedures

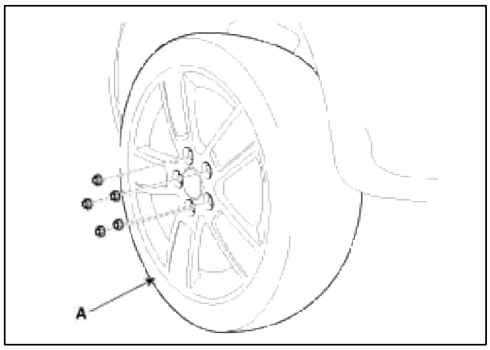
Replacement

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.

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2. Remove the front wheel and tire(A) from front hub .

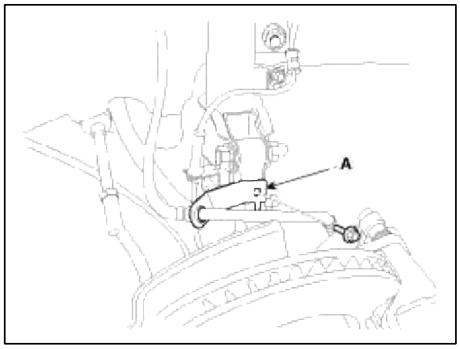
Tightening torque:
90 ~ 110 N.m (9 ~ 11 Kgf.m, 65 ~ 80 lb.ft)



CAUTION

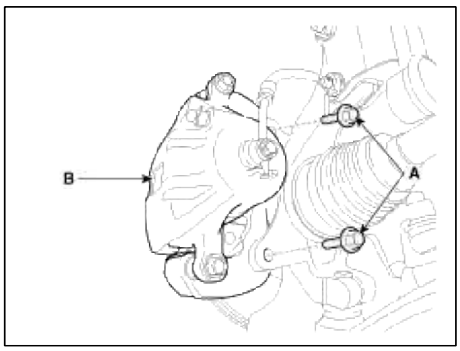
Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake hose mounting bracket(A).

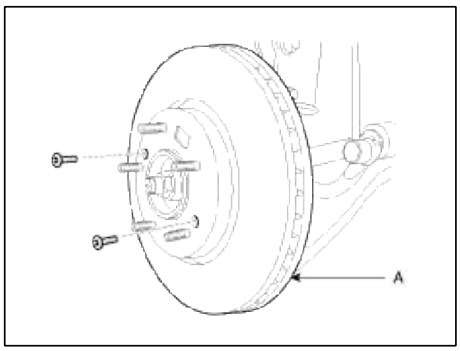


4. Remove the brake caliper mounting bolts (A), and hold the weight of the brake caliper assembly (B) with a wire so that the weight is not hold on by the brake hose.

Tightening torque:
90 ~ 110 N.m (9 ~ 11 Kgf.m, 65 ~ 80 lb.ft)

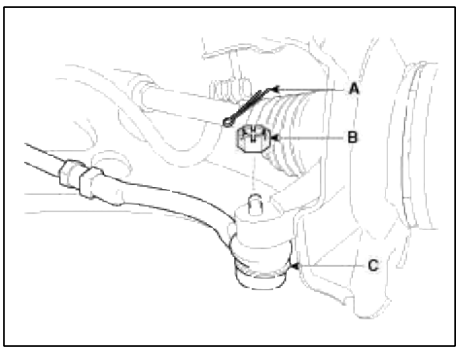


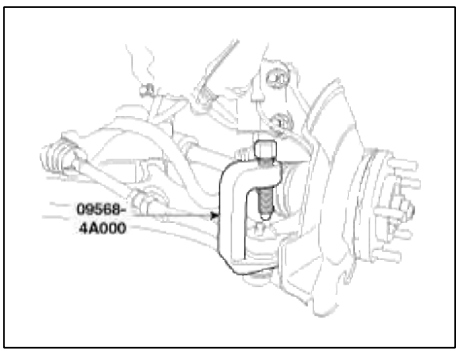
5. Loosen the front brake disc mount screw and then remove the front brake disc(A).



6. Remove the tie rod end ball joint from the knuckle.
   (1) Remove the split pin(A).
   (2) Remove the castle nut(B).
   (3) Disconnect the ball joint(C) from knuckle using the special tool (09568-4A000 or 09568-2J100).

Tightening torque:
16 ~ 34 N.m (1.6 ~ 3.4 Kgf.m, 12 ~ 25 lb.ft)

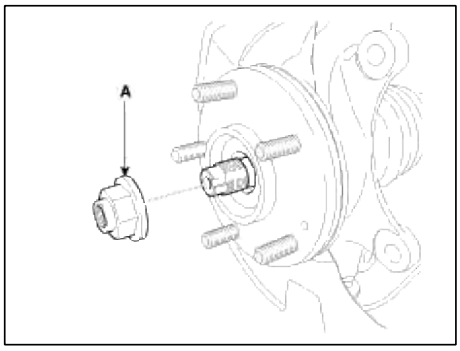




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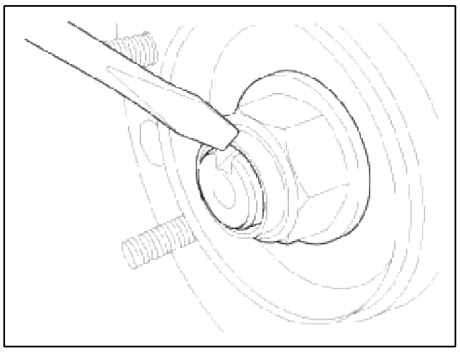
7. Remove the driveshaft nut (A) from the front hub.

Tightening torque:
240.2 ~ 269.6 N.m (24.5 ~ 27.5 Kgf.m, 177.2 ~ 197.9 lb.ft)



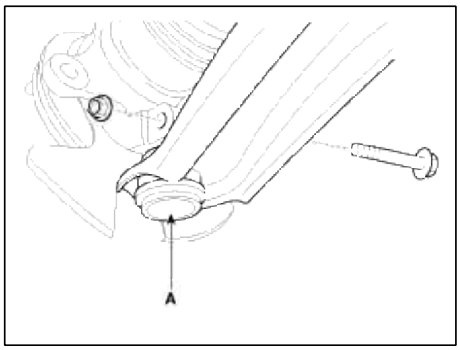
CAUTION

- The driveshaft lock nut should be replaced with new ones.
- After installation driveshaft lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.

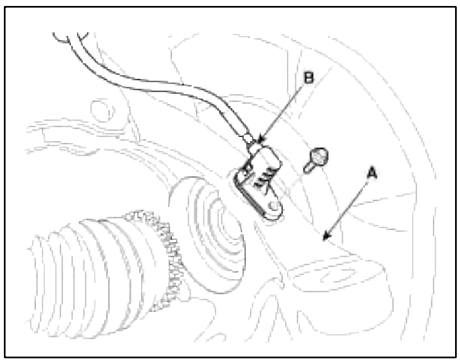


8. Remove the lower arm(A) from the knuckle.

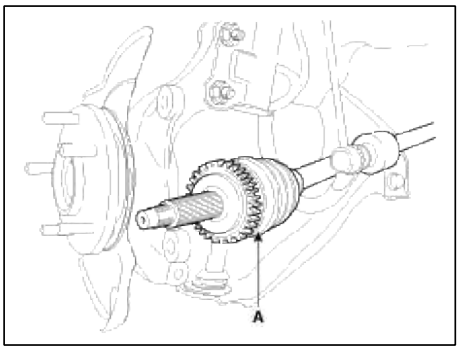
Tightening torque:
60 ~ 72 N.m (6 ~ 7.2 Kgf.m, 43 ~ 52 lb.ft)



9. Loosen the mount bolt and then remove the wheel speed sensor(B) from knuckle(A).

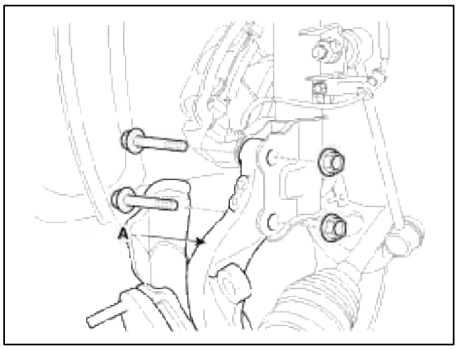


10. Disconnect the driveshaft (A) from the front hub assembly..

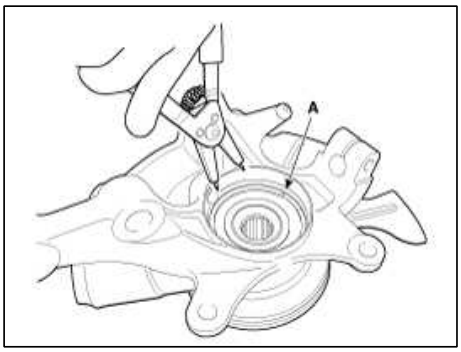


11. Loosen the strut mount bolts and then remove the knuckle assembly(A).

Tightening torque:
100 ~ 120 N.m (10 ~ 12 Kgf.m, 72 ~ 87 lb.ft)



12. Remove the snap ring (A).



13. Install in the reverse order of removal.

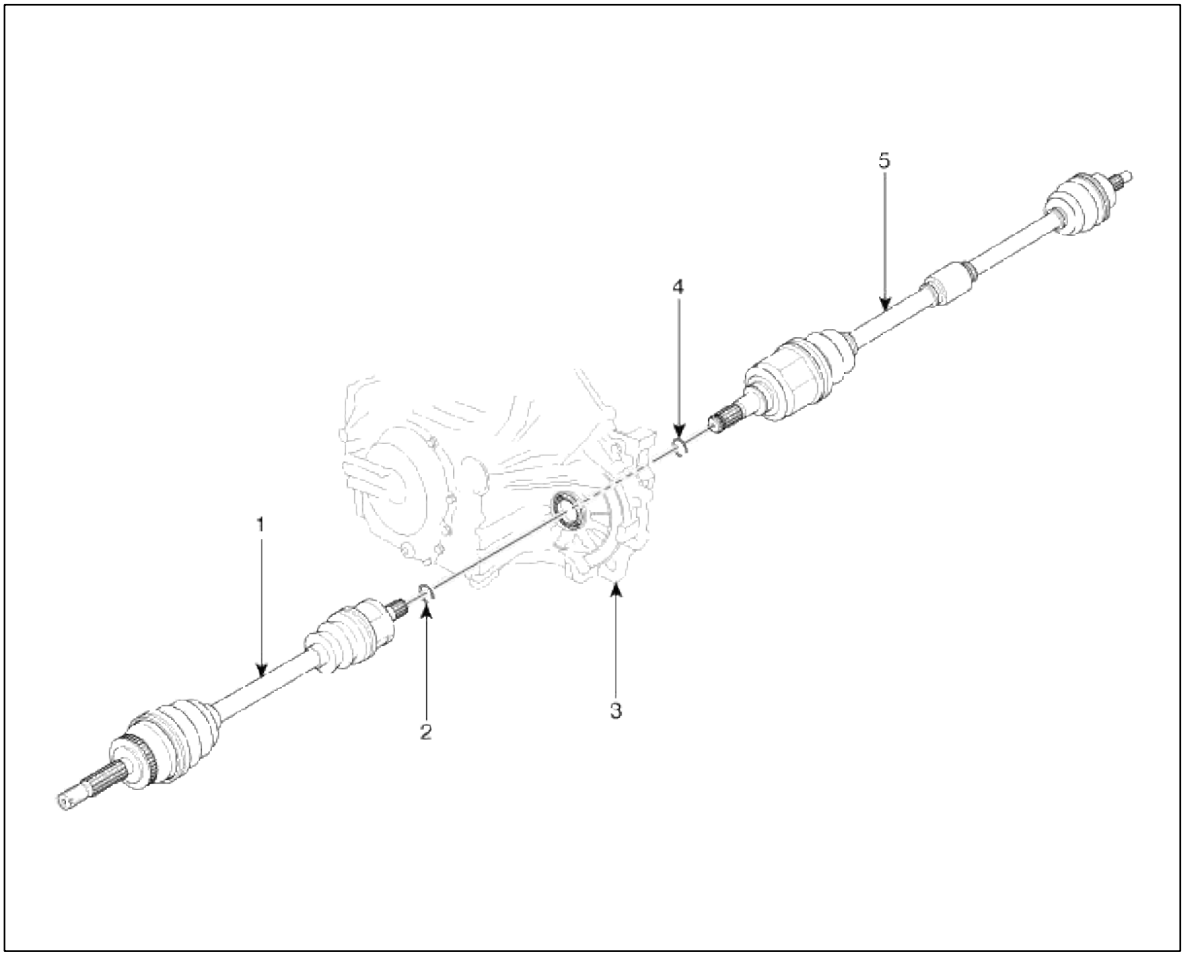
Inspection

1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the knuckle for cracks
4. Check the bearing for cracks or damage.

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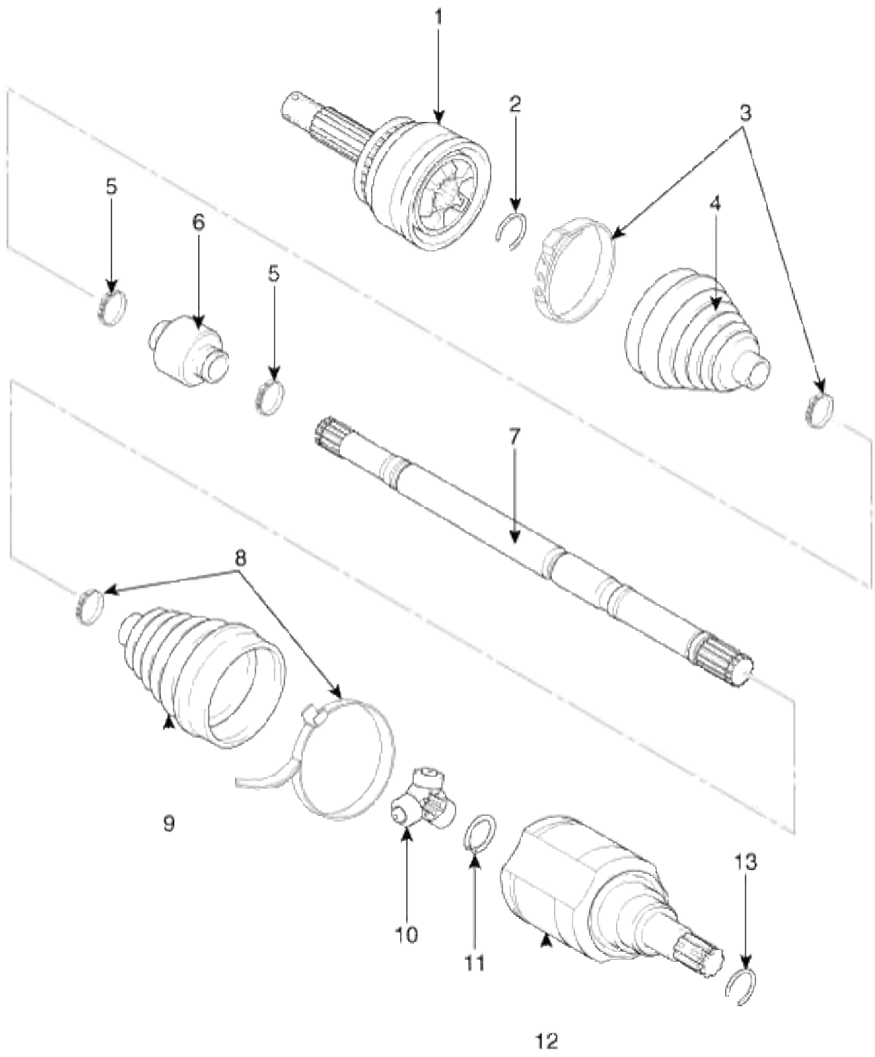
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location

Component location



1. Driveshaft(LH)	4. Circlip
2. Circlip	5. Driveshaft(RH)
3. Transaxle	

Components



1. BJ assembly 2. BJ circlip 3. BJ boot band 4. BJ boot	5. Dynamic damper band 6. Dynamic damper 7. Shaft 8. TJ boot band	9. TJ boot 10. Spider assembly 11. Snap ring 12. TJ Housing	13. TJ circlip

Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures

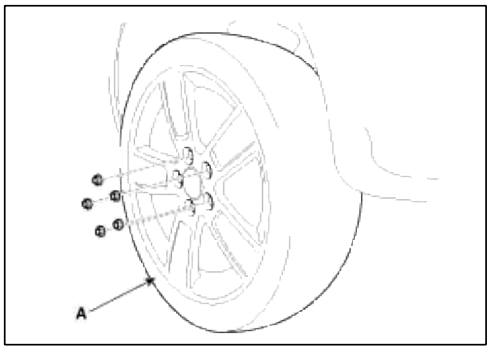
Replacement

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.

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2. Remove the front wheel and tire(A) from front hub .

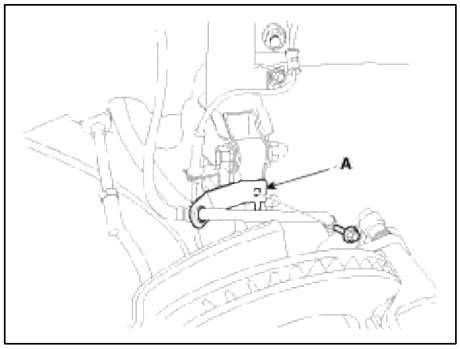
Tightening torque:
90 ~ 110 N.m (9 ~ 11 Kgf.m, 65 ~ 80 lb.ft)



CAUTION

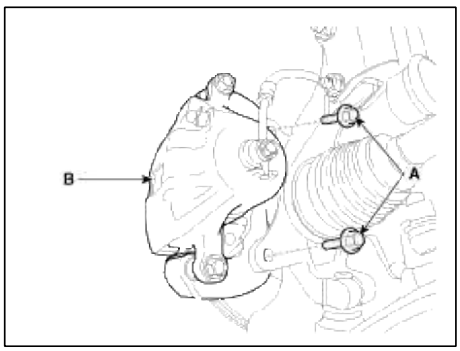
Be careful not to damage to the hub bolts when removing the front wheel and tire (A).

3. Remove the brake hose mounting bracket(A).

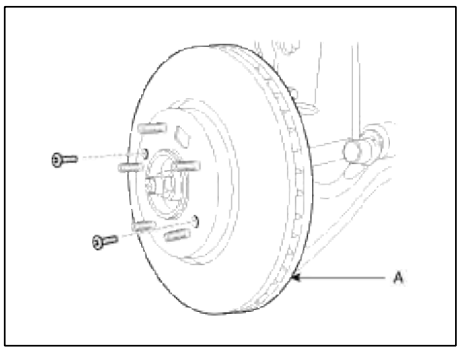


4. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire.

Tightening torque :
90 ~ 110 N.m (9 ~ 11 Kgf.m, 65 ~ 80 lb.ft)

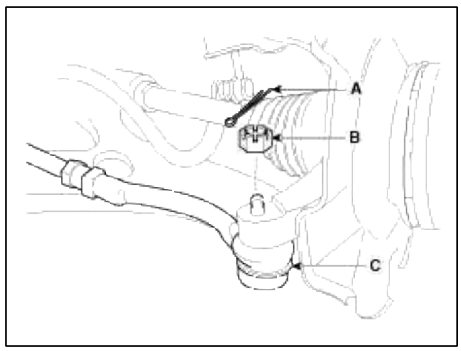


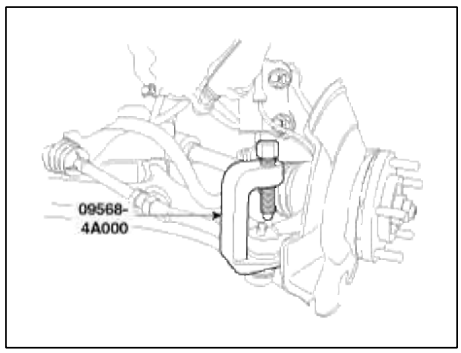
5. Loosen the front brake disc mount screw and then remove the front brake disc(A).



6. Remove the tie rod end ball joint from the knuckle.
   (1) Remove the split pin(A).
   (2) Remove the castle nut(B).
   (3) Disconnect the ball joint(C) from knuckle using the special tool (09568-4A000 or 09568-2J100).

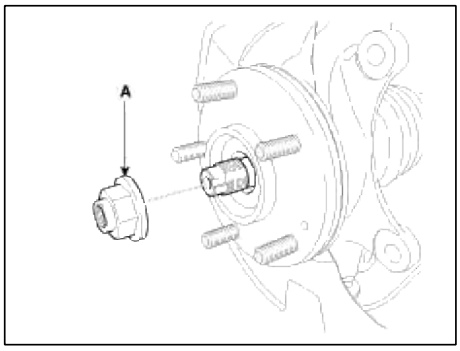
Tightening torque:
16 ~ 34 N.m (1.6 ~ 3.4 Kgf.m, 12 ~ 25 lb.ft)





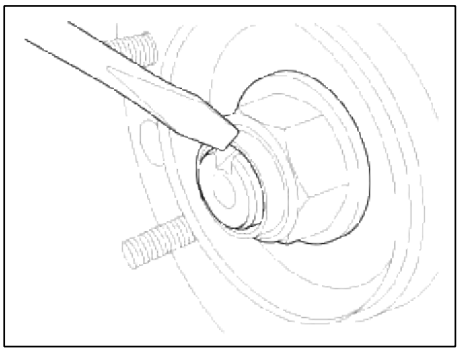
7. Remove driveshaft nut(A) from the front hub under applying the break.

Tightening torque:
240.2 ~ 269.6 N.m (24.5 ~ 27.5 Kgf.m, 177.2 ~ 197.9 lb.ft)



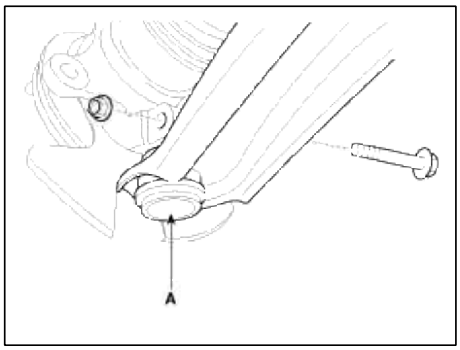
CAUTION

- The driveshaft lock nut should be replaced with new ones.
- After installation driveshaft lock nut, stake the lock nut using a chisel and hammer as shown in the illustration below.

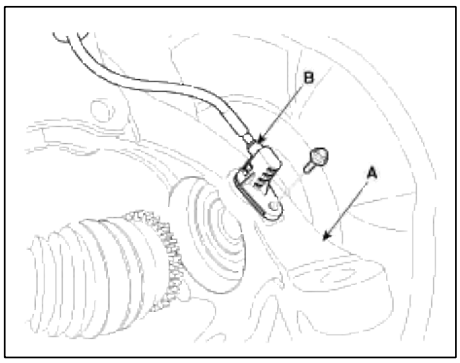


8. Remove the lower arm(A) from the knuckle.

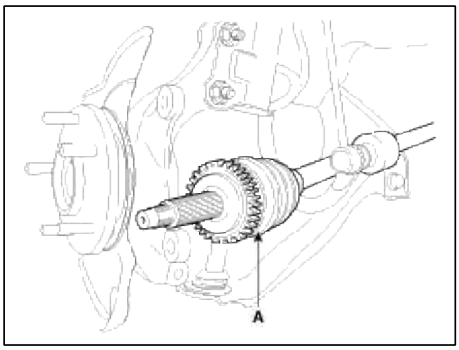
Tightening torque:
60 ~ 72 N.m (6 ~ 7.2 Kgf.m, 43 ~ 52 lb.ft)



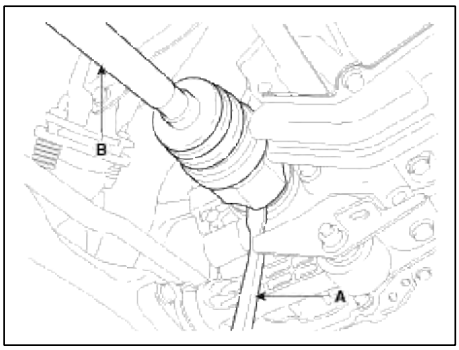
9. Loosen the mount bolt and then remove the wheel speed sensor(B) from knuckle(A).



10. Disconnect the driveshaft (A) from the front hub assembly..



11. Insert a pry bar(A) between the transaxle case and joint case, and separate the drive shaft(B) from the transaxle case.



12. Install in the reverse order of removal.

CAUTION

- Use a pry bar(A) being careful not to damage the transaxle and joint.
- Do not insert the pry bar(A) too deep, as this may cause damage to the oil seal.
- Do not pull the driveshaft by excessive force it may cause components inside the joint kit to dislodge resulting in a torn boot or a damaged bearing.
- Plug the hole of the transaxle case with the oil seal cap to prevent contamination.
- Support the driveshaft properly.
- Replace the retainer ring whenever the driveshaft is removed from the transaxle case.

Inspection

1. Check the driveshaft boots for damage and deterioration.
2. Check the driveshaft spline for wear or damage.
3. Check that there is no water or foreign material in the joint.
4. Check the spider assembly for roller rotation, wear or corrosion.
5. Check the groove inside the joint case for wear or corrosion.
6. Check the dynamic damper for damage or cracks.

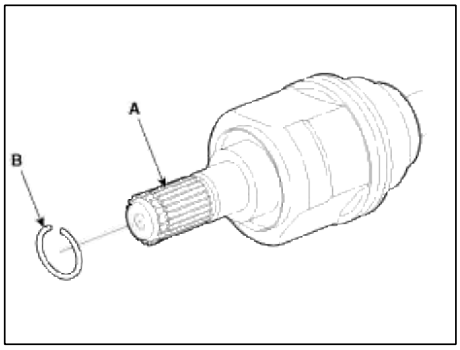
Disassembly

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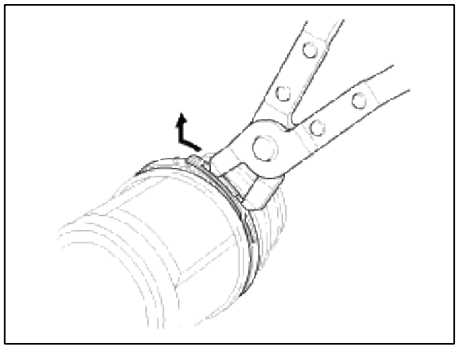
CAUTION

- Do not disassemble the BJ assembly.
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

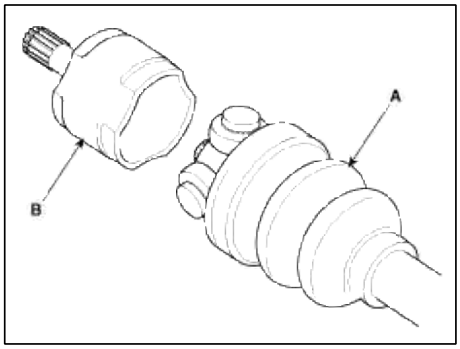
1. Remove the circlip (B) from the driveshaft spline (A).



2. Remove both boot bands from the transaxle side joint(TJ) case.

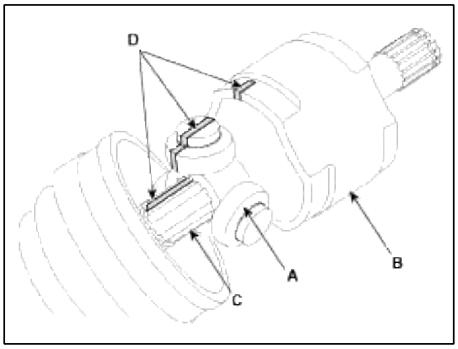


3. Pull out the boot from transaxle side joint case (B).
4. While dividing joint(TJ) boot (A) of the transaxle side, wipe the grease in TJ housing (B) and clean them.

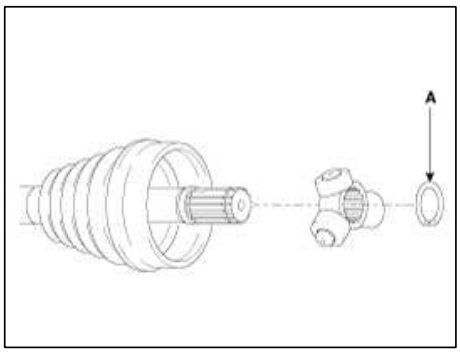


CAUTION

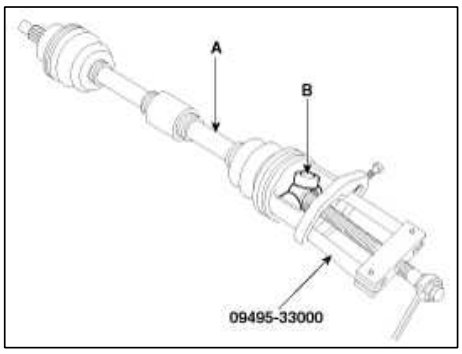
Make alignment marks on spider roller assembly (A), TJ housing (B), and shaft spline (C) to aid reassembly.



5. Remove the snap ring (A) and spider roller assembly from the shaft.



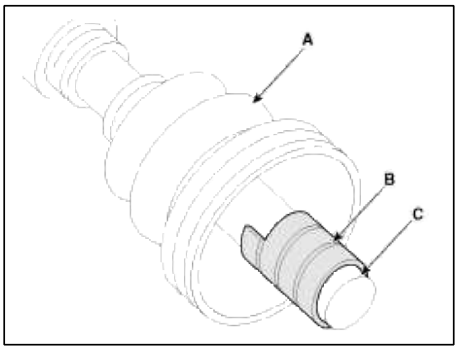
6. Remove the spider assembly (B) from the driveshaft (A) using the special tool (09495-33000).



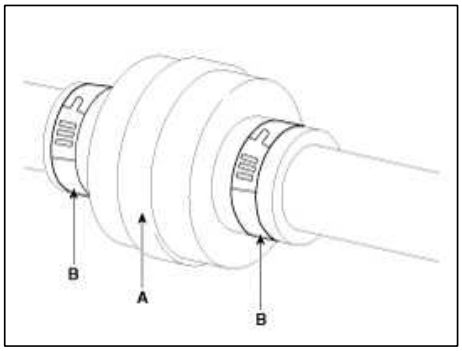
7. Clean the spider assembly.
8. Remove the boot (A) of the transaxle side joint(TJ).

CAUTION

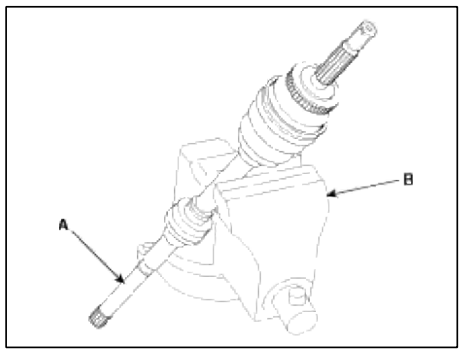
For reusing the boot (A), wrap tape (B) around the driveshaft splines (C) to protect the boot (A).



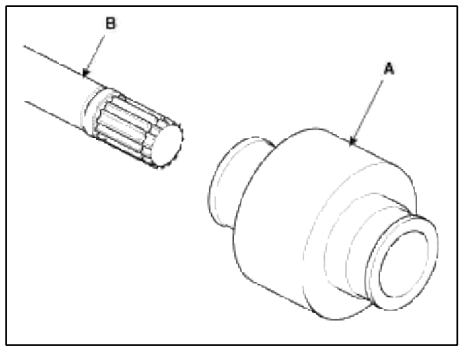
9. Using a plier or flat-tipped (-) screwdriver, remove clamp (B) on both sides of the dynamic damper (A).



10. Hold the driveshaft (A) with a vice (B) as illustrated.

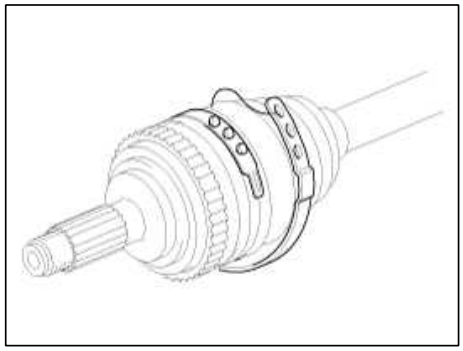


11. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.
12. Saperate the dynamic damper (A) from the shaft (B) carefully.

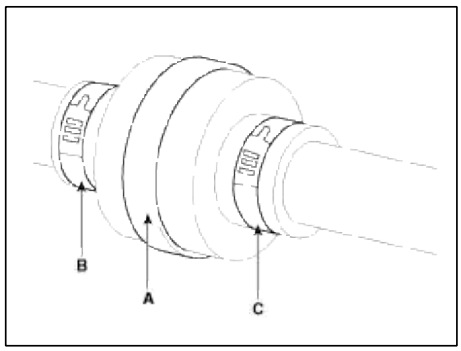


Reassembly

1. Wrap tape around the driveshaft spline(TJ) to prevent damage to the boots.
2. Apply grease to the joint boot on the side of the wheel and install the boot.
3. Install the clamp.

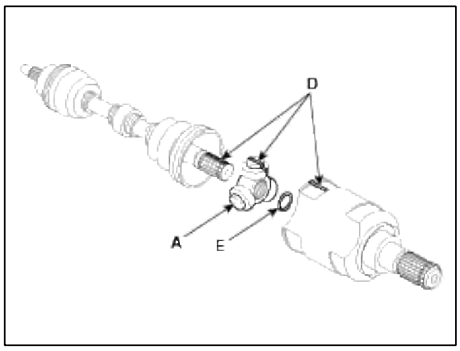


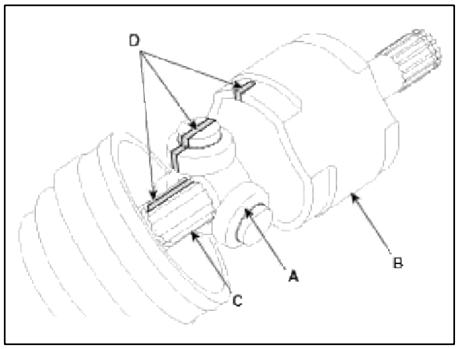
4. To install the dynamic damper(A), keep the shaft(B) in a straight line and assemble the dynamic damper with the bands(C).



5. Assemble the transaxle side joint boot and bands.

6. Using the alignment marks (D) made during disassembly as a guide, install the spider assembly (A) and snap ring (B) on the driveshaft splines (C).



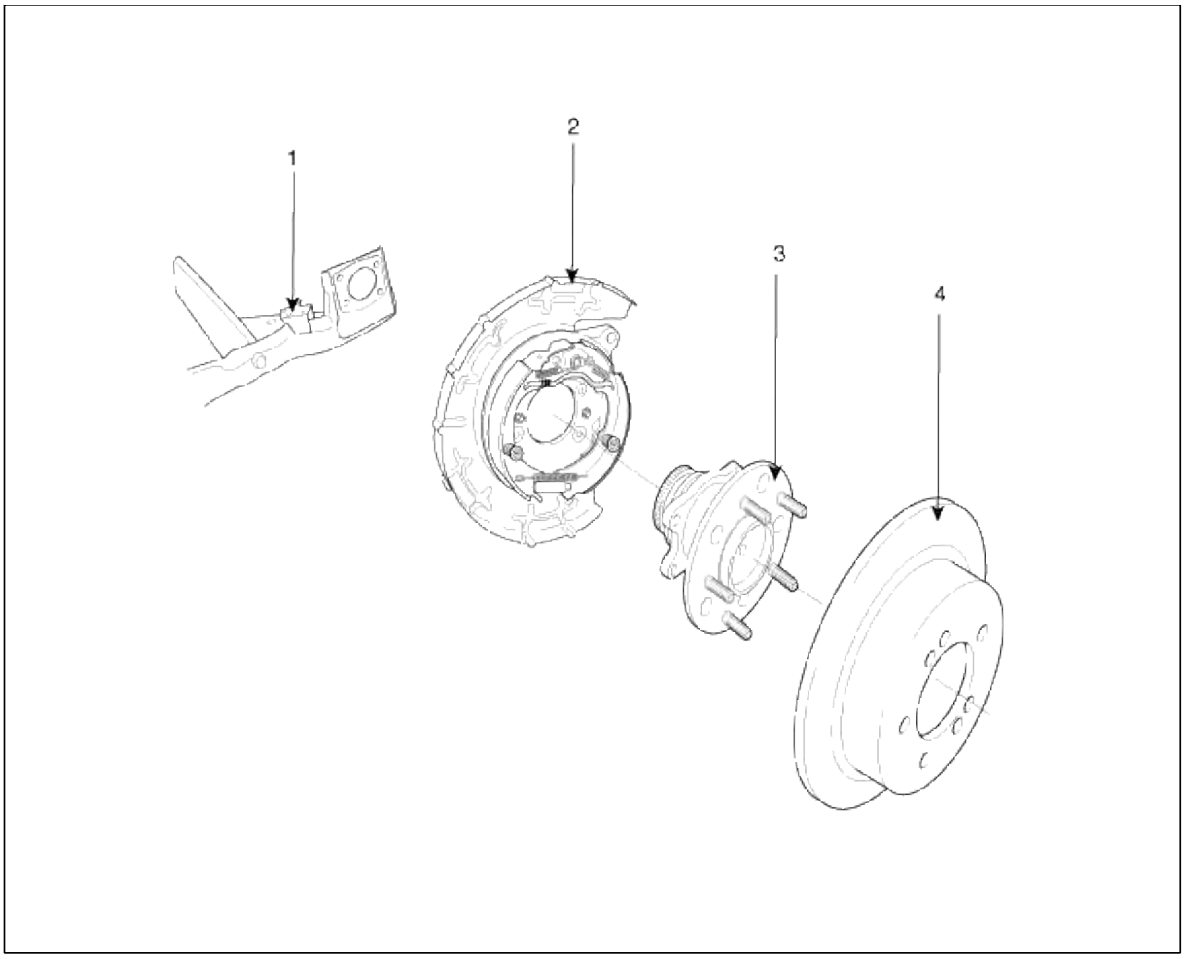


7. Add specified grease to the joint boot as much as it was wiped away at inspection.
8. Install the both boot band.

Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Components and Components Location

Components

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1. Rear torsion beam assembly 2. Rear drum brake assembly	3. Rear wheel hub assembly 4. Rear brake disc

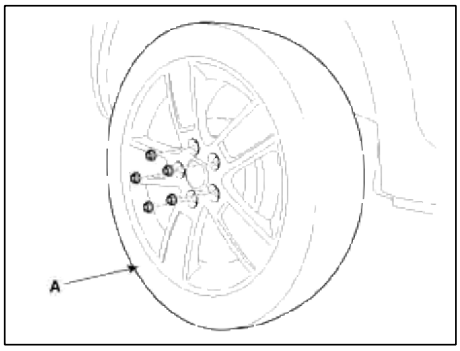
Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Repair procedures

Replacement

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.

2. Remove the rear wheel and tire(A) from rear hub .

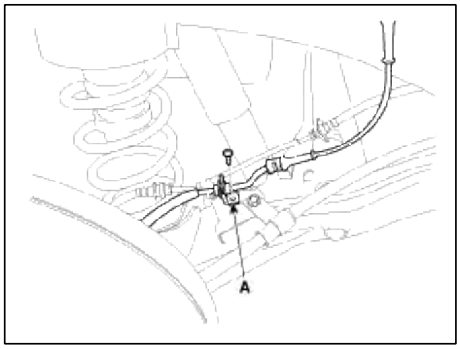
Tightening torque:
90 ~ 110 N.m (9 ~ 11 Kgf.m, 65 ~ 80 lb.ft)



CAUTION

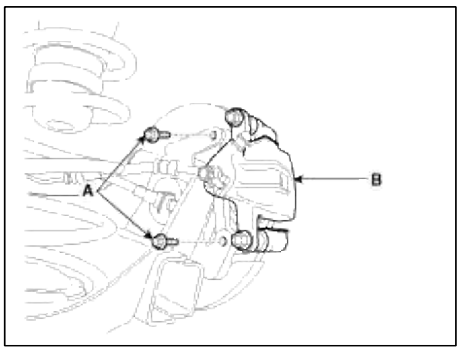
Be careful not to damage to the hub bolts (C) when removing the rear wheel and tire (A).

3. Loosen the mount bolt and then remove the brake mount bracket(A).



4. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire as shown in the illustration.

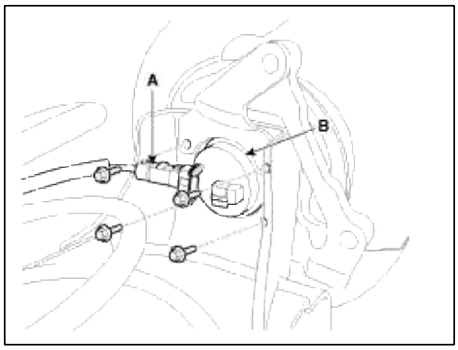
Tightening torque:
65 ~ 75 N.m (6.5 ~ 7.5 Kgf.m, 47 ~ 54 lb.ft)



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5. Disconnect the wheel speed sensor connector(A) and then remove the hub bearing(B).

Tightening torque:
70 ~ 90 N.m (7 ~ 9 Kgf.m, 51 ~ 65 lb.ft)



6. Install in the reverse order of removal.

Inspection

1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the rear axle carrier for cracks
4. Check the bearing for cracks or damage.

SOUL(AM) > 2010 > G 1.6 DOHC > Emission Control System

Emission Control System > General Information > Description and Operation

Description

Emissions Control System consists of three major systems.

- The Crankcase Emission Control System prevents blow-by gas from releasing into the atmosphere. This system recycles gas back into the intake manifold (Closed Crankcase Ventilation Type).
- The Evaporative Emission Control System prevents evaporative gas from releasing into the atmosphere. This system burns gas at appropriate engine operating condition after gathering it in the canister.
- The Exhaust Emission Control System converts the three pollutants [hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx)] into harmless substances by using the 3-way catalytic converter.

Emission Control System > General Information > Specifications

Specifications

Purge Control Solenoid Valve (PCSV)

Specification

Item		Specification
Coil Resistance (Ω)	1.6 DOHC	16 [20°C(68°F)]
	2.0 DOHC	14 ~ 18 [20°C(68°F)]

Fuel Tank Pressure Sensor (FTPS)

Type: Piezo-Resistive Pressure Sensor

Specification

Pressure (kPa)	Output Voltage (V)
-6.67	0.5
0	2.5
+6.67	4.5

Canister Close Valve (CCV)

Specification

Item	Specification
Coil Resistance (Ω)	15.5 ~ 18.5 [20°C(68°F)]

Tightening Torques

Item		kgf.m	N.m	lb-ft
Positive Crankcase Ventilation (PCV) Valve installation	1.6 DOHC	0.18 ~ 0.29	1.8 ~ 2.8	1.3 ~ 2.1
	2.0 DOHC	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Canister Close Valve (CCV) installation bolt		0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Fuel Tank Air Filter installation bolt		0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3

Emission Control System > General Information > Troubleshooting

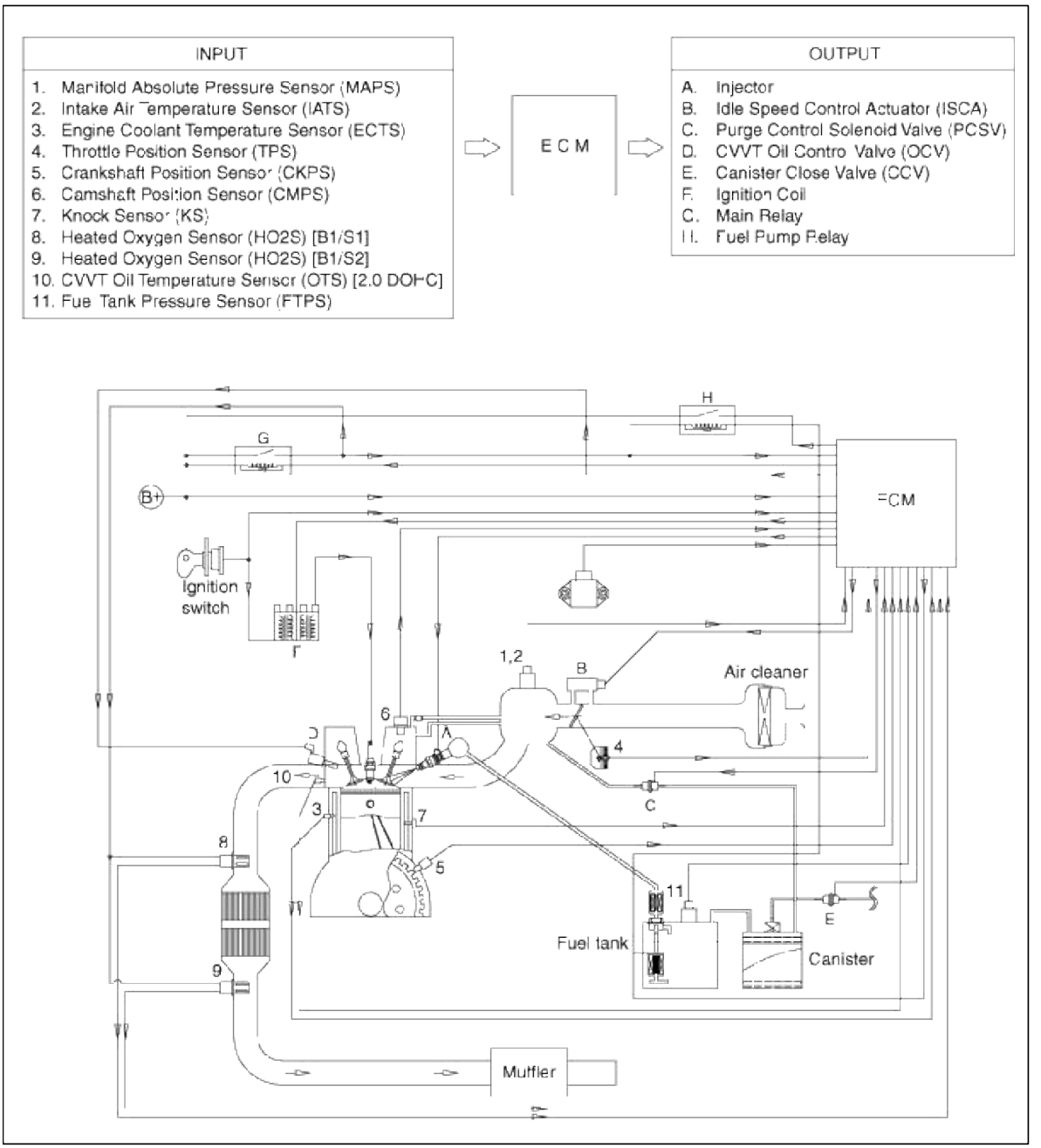
Troubleshooting

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Symptom	Suspect area
Engine will not start or stuggle to start	Vapor hose damaged or disconnected
Engine stuggles to start	Malfunction of the Purge Control Solenoid Valve
Rough idle or engine stalls	Vapor hose damaged or disconnected
	Malfunction of the PCV valve
Rough idle	Malfunction of the Evaporative Emission Control System
Excessive oil consumption	Positive crankcase ventilation line clogged

Emission Control System > General Information > Schematic Diagrams

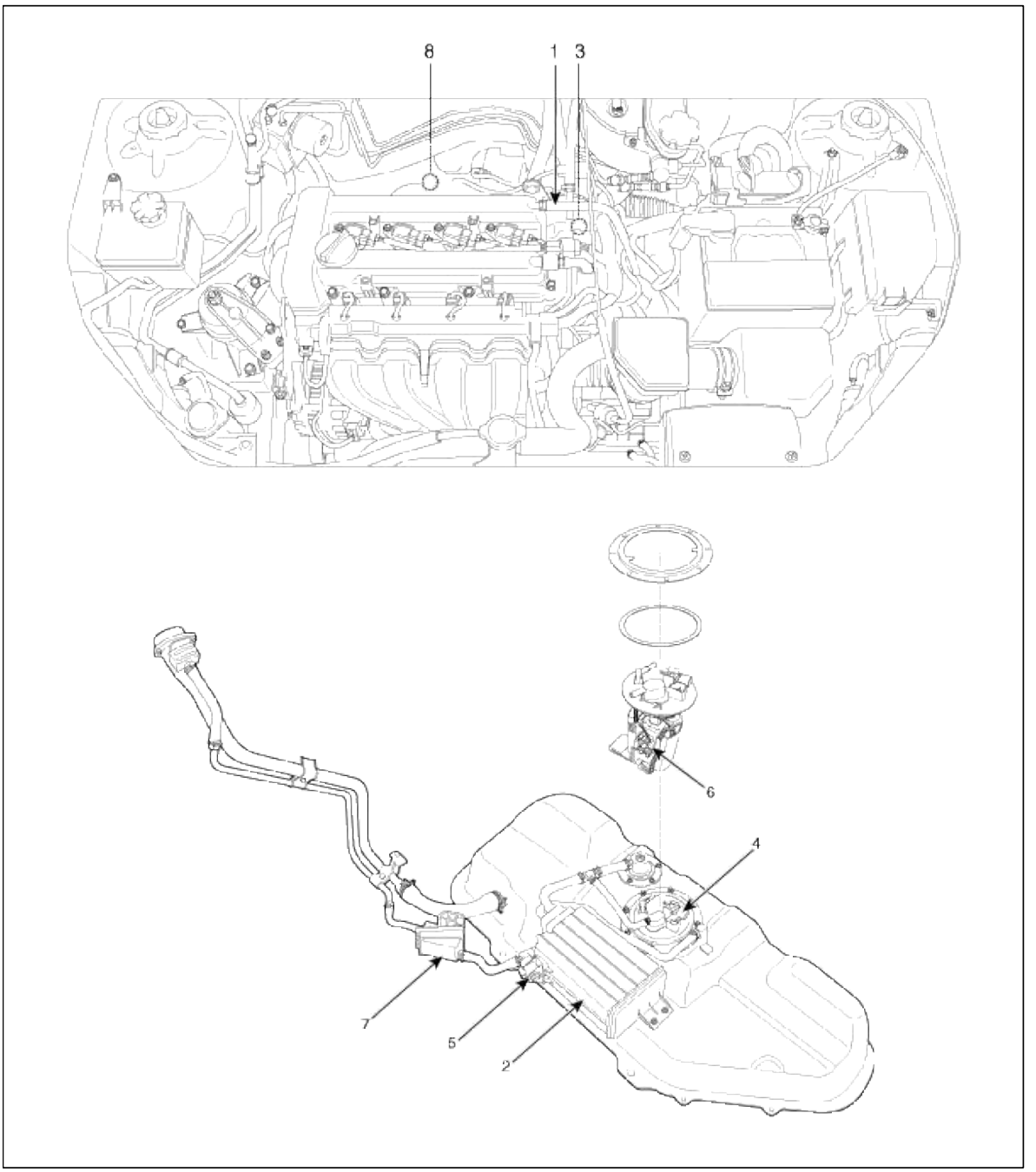
Schematic Diagram



Emission Control System > General Information > Components and Components Location

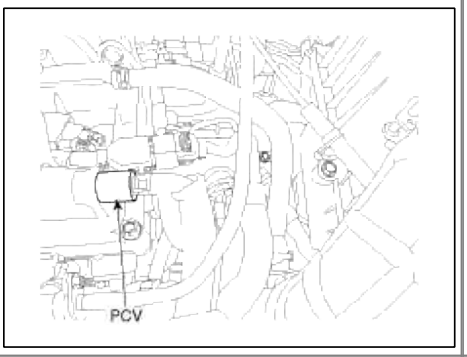
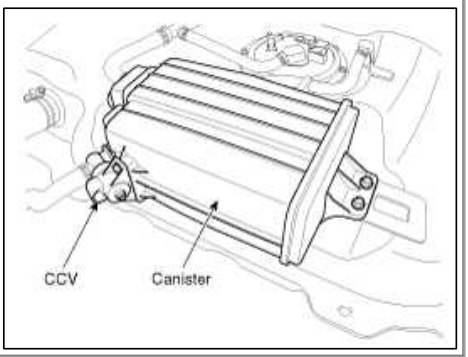
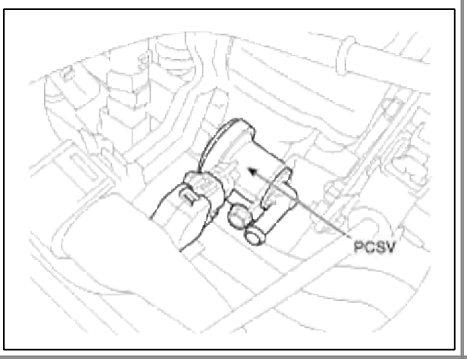
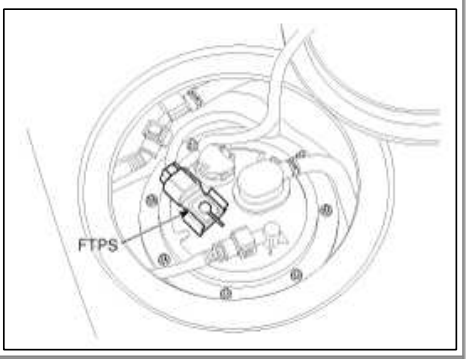
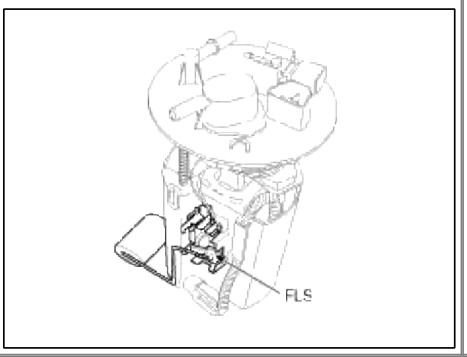
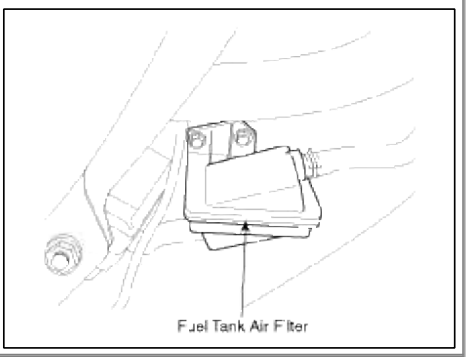
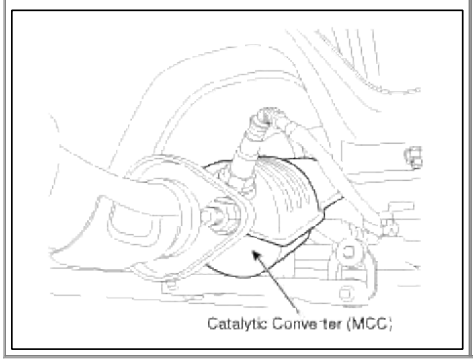
Components Location

[1.6 DOHC]

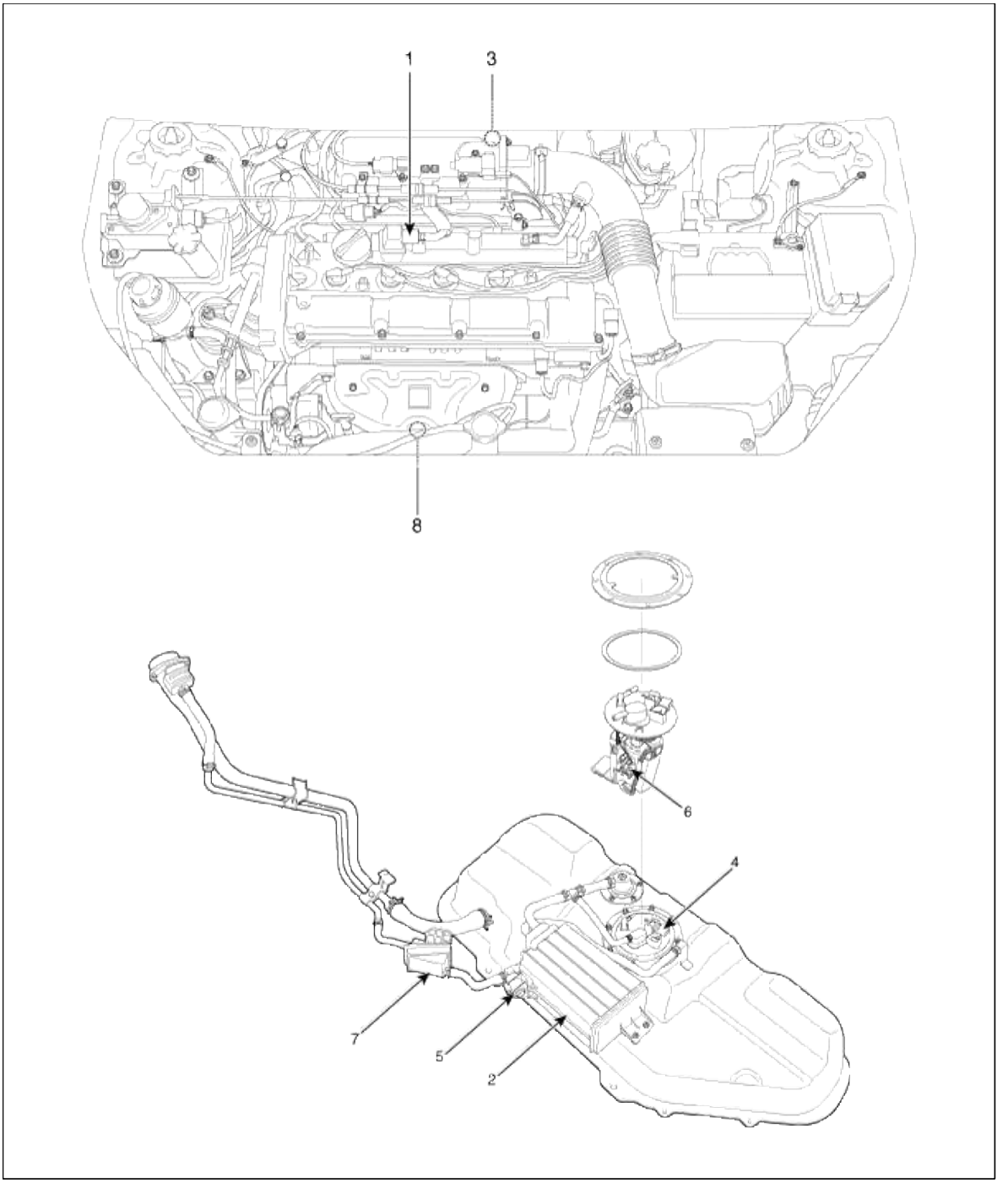


1. PCV Valve 2. Canister 3. Purge Control Solenoid Valve (PCSV) 4. Fuel Tank Pressure Sensor (FTPS)	5. Canister Close Valve (CCV) 6. Fuel Level Sensor (FLS) 7. Fuel Tank Air Filter 8. Catalytic Converter (MCC)

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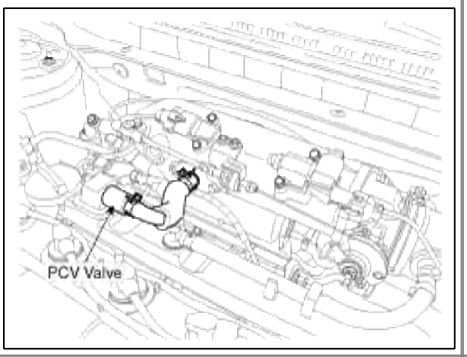
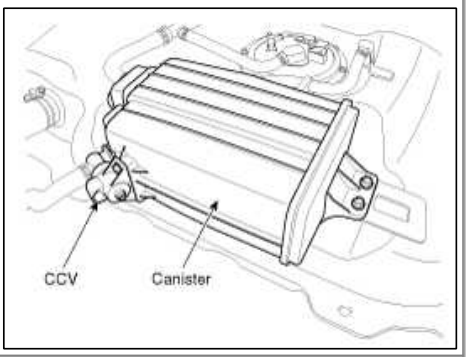
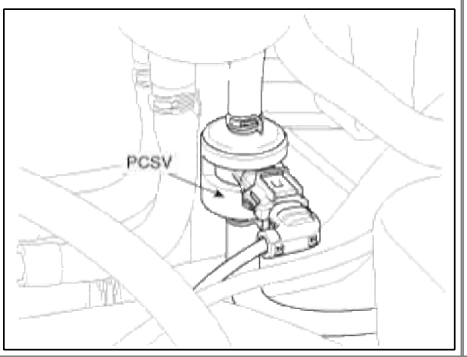
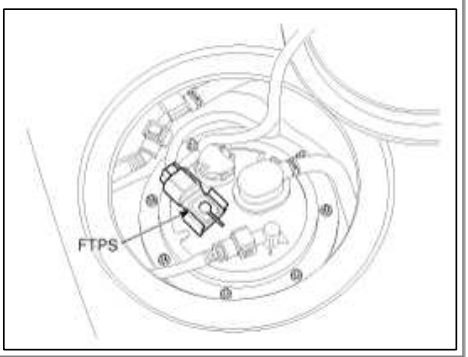
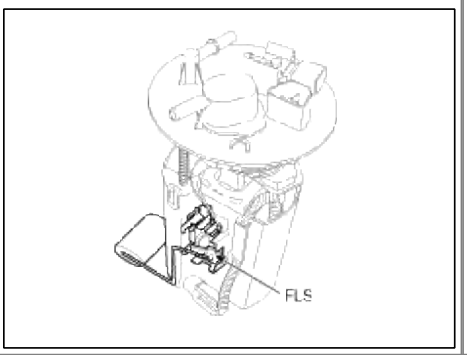
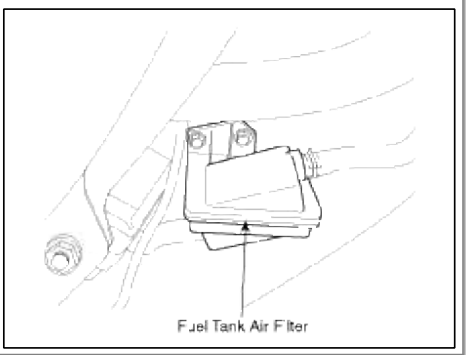
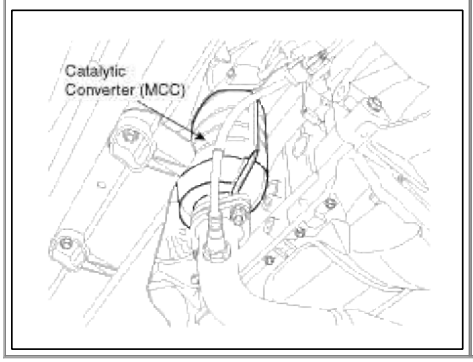
1. PCV Valve	2. Canister 5. Canister Close Valve (CCV)
	
3. Purge Control Solenoid Valve (PCSV)	4. Fuel Tank Pressure Sensor (FTPS)
	
6. Fuel Level Sensor (FLS)	7. Fuel Tank Air Filter
	
8. Catalytic Converter (MCC)	
	

[2.0 DOHC]



1. PCV Valve 2. Canister 3. Purge Control Solenoid Valve (PCSV) 4. Fuel Tank Pressure Sensor (FTPS)	5. Canister Close Valve (CCV) 6. Fuel Level Sensor (FLS) 7. Fuel Tank Air Filter 8. Catalytic Converter (MCC)

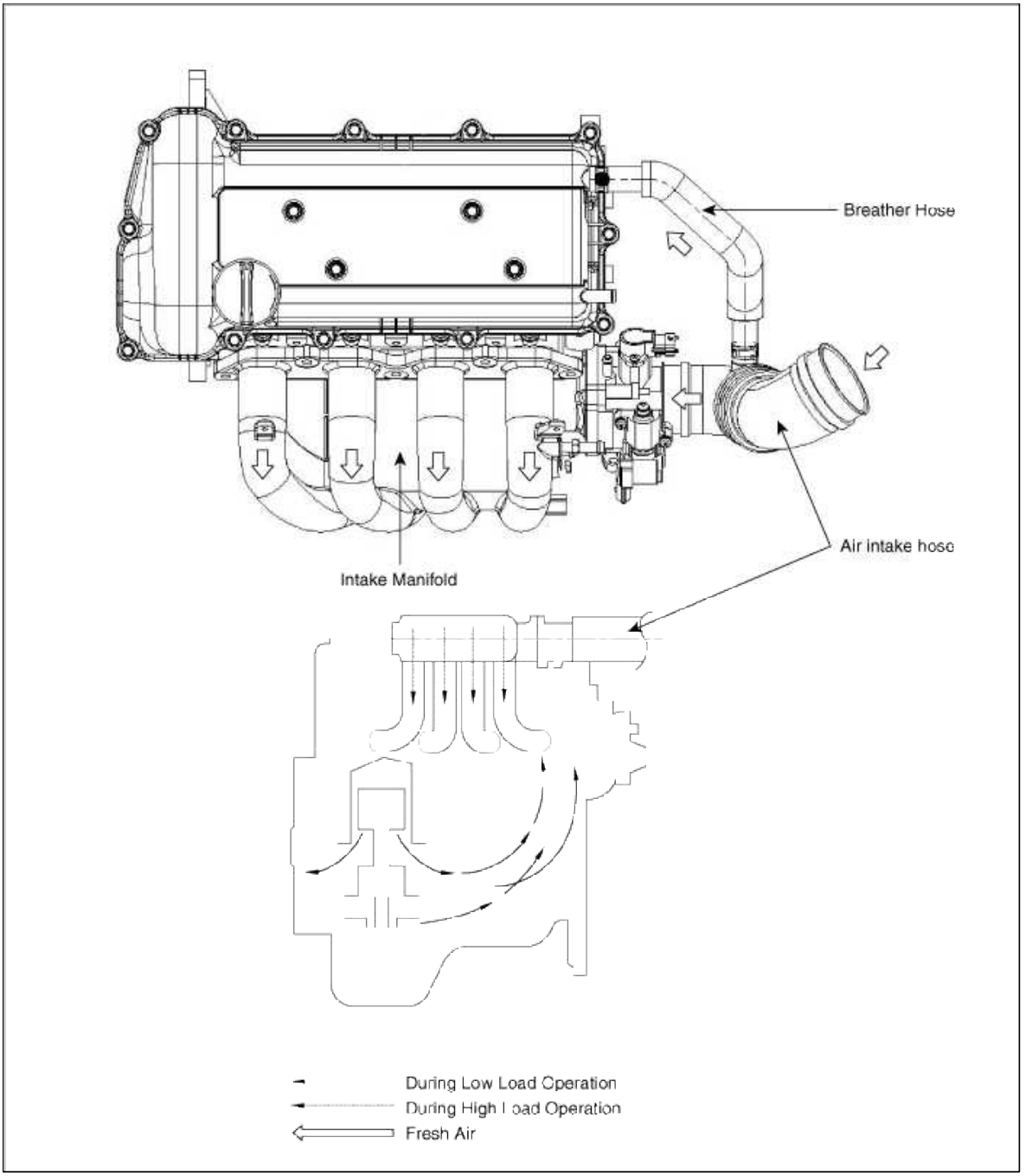
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1. PCV Valve	2. Canister 5. Canister Close Valve (CCV)
	
3. Purge Control Solenoid Valve (PCSV)	4. Fuel Tank Pressure Sensor (FTPS)
	
6. Fuel Level Sensor (FLS)	7. Fuel Tank Air Filter
	
8. Catalytic Converter (MCC)	
	

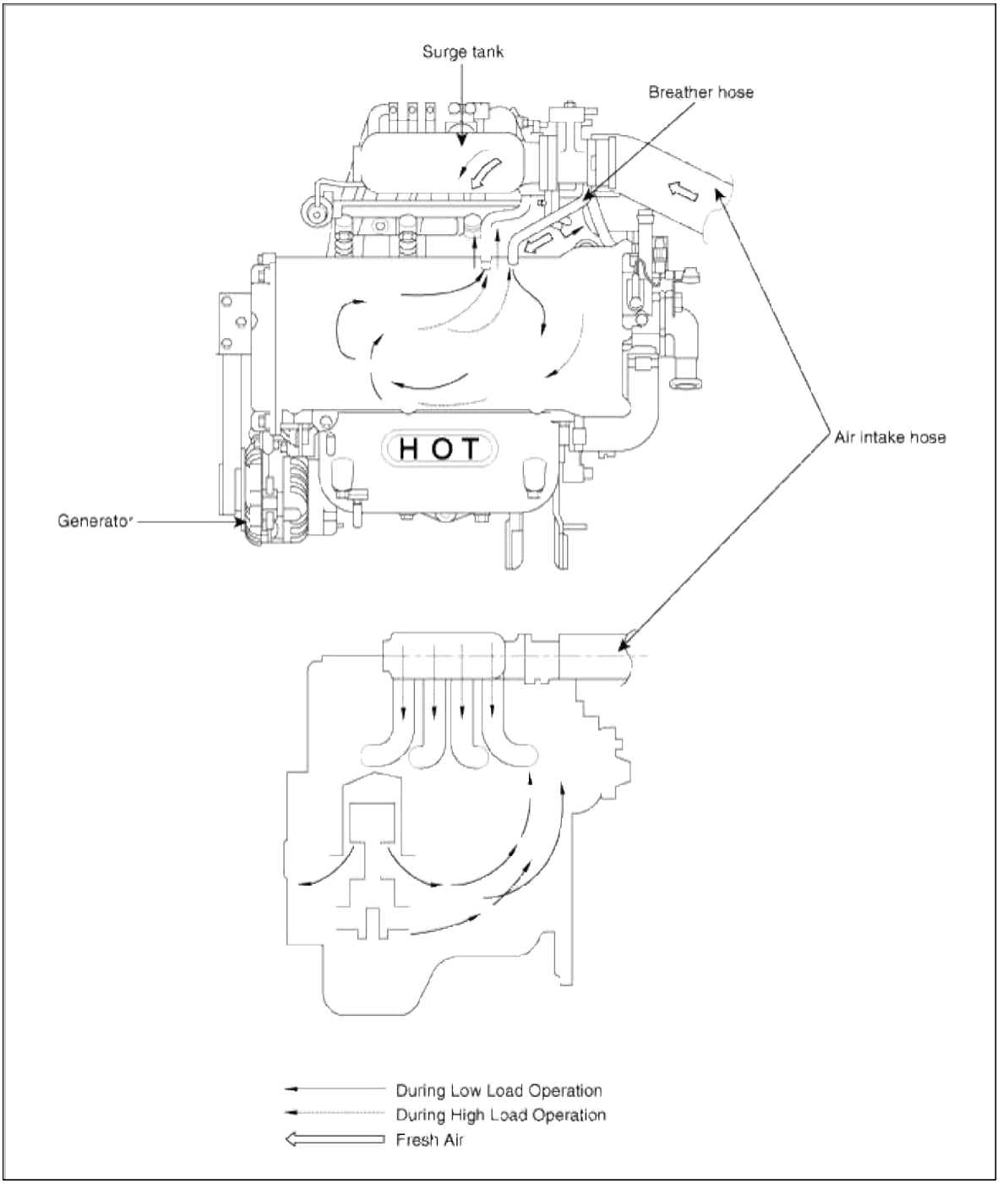
Emission Control System > Crankcase Emission Control System > Schematic Diagrams

Schematic Diagram

[1.6 DOHC]


Breather Hose
Air intake hose
Intake Manifold
During Low Load Operation
During High Load Operation
Fresh Air

[2.0 DOHC]



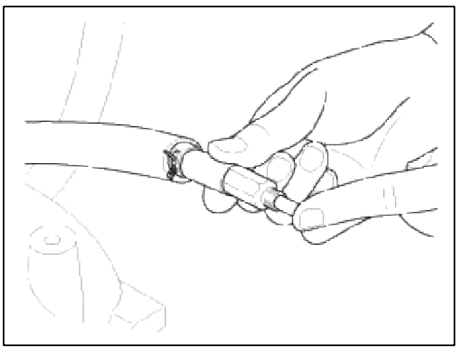
Emission Control System > Crankcase Emission Control System > Repair procedures

Inspection

1. After disconnecting the vapor hose from the PCV valve, remove the PCV valve.
2. Reconnect the PCV valve to the vapor hose.

3. Run the engine at idle, then put a finger over the open end of the PCV valve and make sure that intake manifold vacuum can be felt.

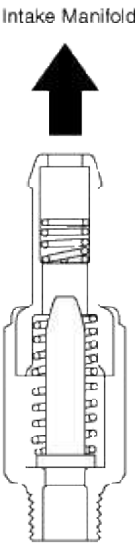
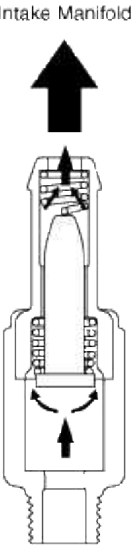
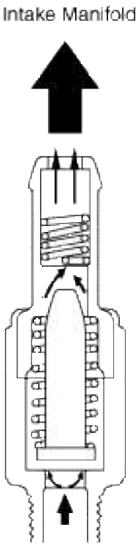
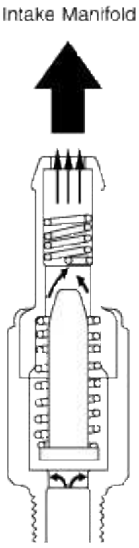
> NOTE
>
> The plunger inside the PCV valve will move back and forth at vacuum.



4. If the vacuum is not felt inspect PCV operation, if operating correctly clean or replace the vapor hose.

Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Description and Operation

Operation Principle

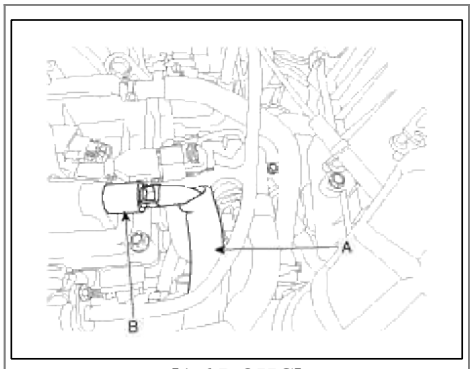
Engine Condition	Not Running	Idling or Decelerating	Normal Operation	Accelerating and High Load
Vacuum in Intake Manifold	0	High	Moderate	Low
PCV Valve	Close	Slightly Open	Properly Open	Fully Open
Blow-by Gas Flow	0	Small	Medium	Large
Schematic Diagram				

Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Repair procedures

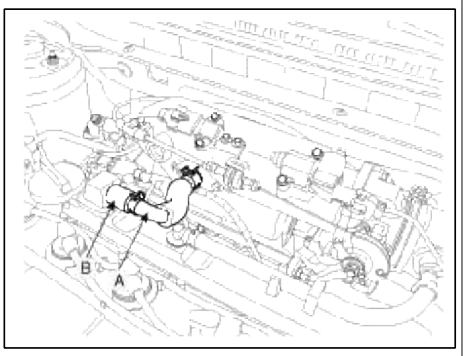
Removal

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1. Disconnect the vapor hose (A).



[1.6 DOHC]

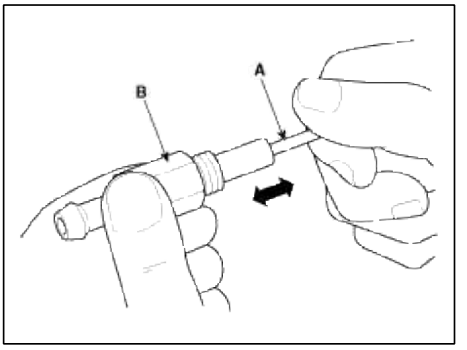


[2.0 DOHC]

2. Remove the PCV valve (B).

Inspection

1. Insert a thin stick (A) into the PCV valve (B) from the threaded side to check that the plunger movement.



NOTE

If the plunger does not move (PCV valve is clogged), clean or replace the valve.

Installation

1. Installation is reverse of removal.

PCV Valve installation:
[1.6 DOHC]
1.8 ~ 2.8 N.m (0.18 ~ 0.29 kgf.m, 1.3 ~ 2.1 lb-ft)
[2.0 DOHC]
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

Emission Control System > Evaporative Emission Control System > Description and Operation

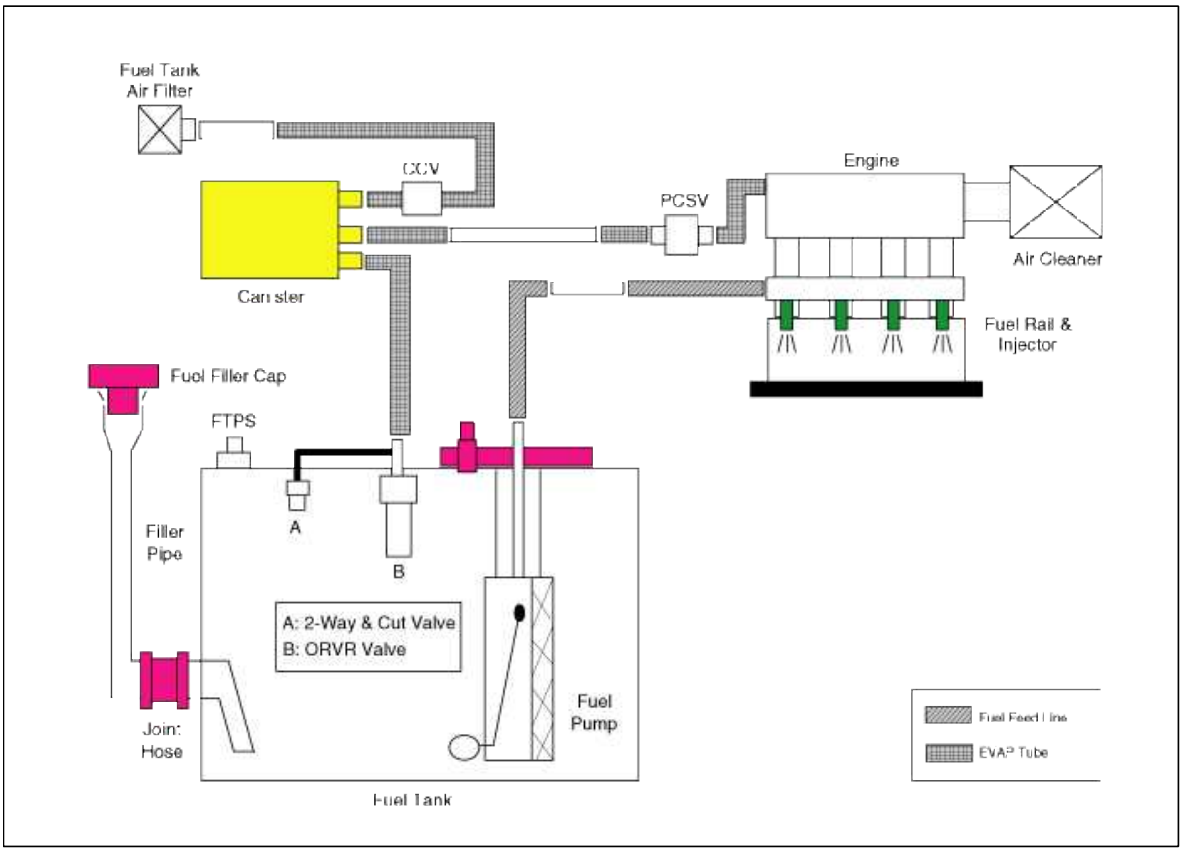
Description

The Evaporative Emission Control System prevents fuel vapor stored in fuel tank from vaporizing into the atmosphere. When the fuel evaporates in the fuel tank, the vapor passes through vent hoses or tubes to a canister filled with charcoal.

The canister temporarily holds the vapor in the charcoal. The ECM will control the system in oder to draw the gathered vapor into the combustion chambers during certain operating conditions. Engine manifold vacuum is used to draw the vapor into intake manifold.

Emission Control System > Evaporative Emission Control System > Schematic Diagrams

Schematic Diagram



Canister

The Canister is filled with charcoal and absorbs evaporated fuel vapor from the fuel tank. The gathered fuel vapor in canister is drawn into the intake manifold by the ECM/PCM when appropriate conditions are set.

Purge Control Solenoid Valve (PCSV)

The Purge Control Solenoid Valve (PCSV) is installed in the passage connecting the canister to the intake manifold. It is a duty type solenoid valve and is operated by ECM/PCM signal.

To draw the absorbed vapor into the intake manifold, the ECM/PCM will open the PCSV, otherwise the passage remains closed.

Fuel Filler Cap

A ratchet tightening device in the threaded fuel filler cap reduces the chances of incorrect installation, when sealing the fuel filler. After the gasket on the fuel filler cap and the fill neck flange make contact, the ratchet produces a loud clicking noise indicating the seal has been set.

Fuel Tank Pressure Sensor (FTPS)

The Fuel Tank Pressure Sensor (FTPS) is an integral part of the monitoring system. The FTPS checks Purge Control Solenoid Valve (PCSV) operation and leaks in the Evaporative Emission Control System by monitoring pressure and vacuum level in the fuel tank during PCSV operating cycles.

Canister Close Valve (CCV)

The Canister Close Valve (CCV) is located between the canister and the fuel tank air filter. It closes off the air inlet to the canister for the Evaporative Emissions System and also prevents fuel vapors from escaping from the Canister when the vehicle is not operating.

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Evaporative System Monitoring

The Evaporative Emission Control Monitoring System monitors fuel vapor generation, evacuation, and a leakage check step. At first, the OBD-II system checks if vapor generation due to fuel temperature is small enough to start monitoring. Then it evacuates the evaporative system by means of PCSV with ramp in order to maintain a certain vacuum level. The final step is to check if there is vacuum loss by any leakage of the system.

Vapor Generation Checking

During the stabilization period, the PCSV and the CCV are closed. The system pressure is measured as starting pressure (DP_A). After a certain defined period (T1), the system pressure (DP_B) is measured again and the difference from the starting pressure is calculated. If this difference (DP_B - DP_A) is bigger than the threshold, there should be excessive vapor pressure and the monitor is aborted for next check. On the contrary, if the difference is lower than the negative threshold, the PCSV is regarded as having a malfunction such as clogged at open position.

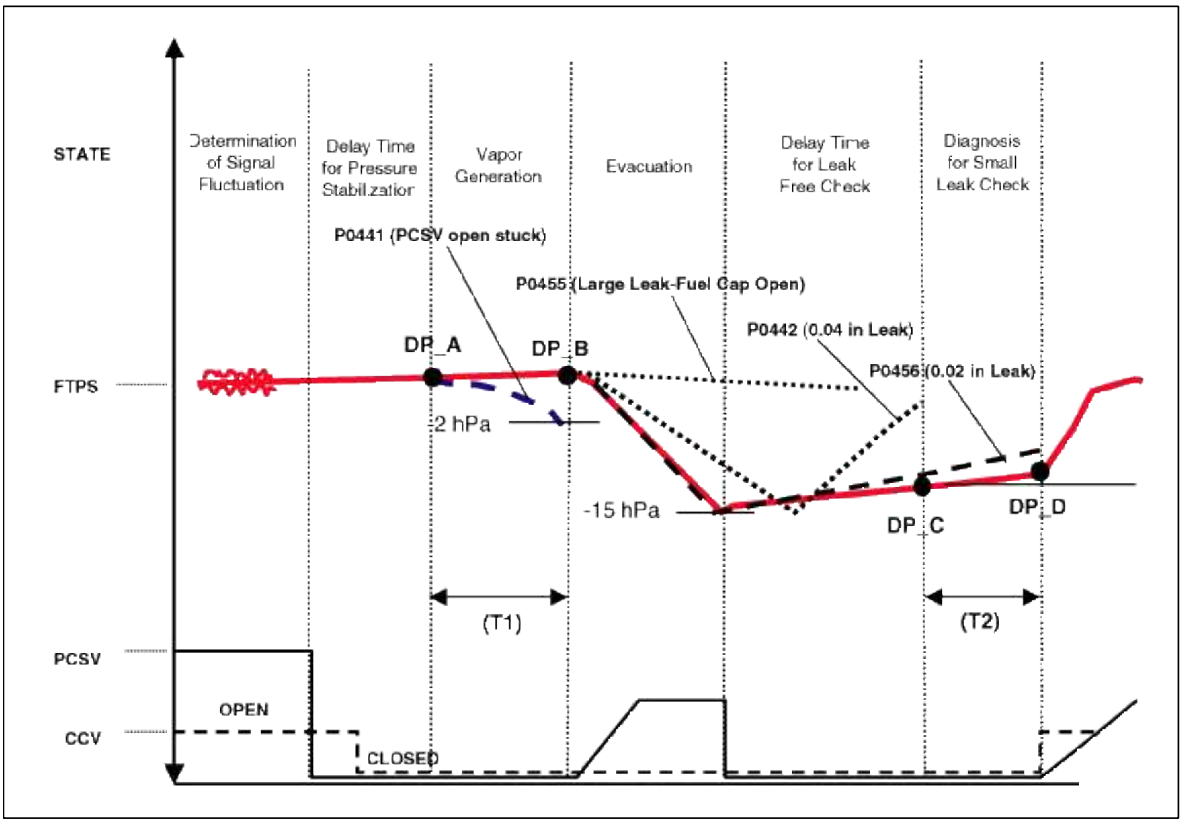
Evacuation

The PCSV is opened with a certain ramp for the pressure to reach down to a certain level. If the pressure can't be lowered below a threshold, the system is regarded as having a fuel cap-open or having a large leak.

Leaking Checking

The PCSV is closed and the system waits for a period to get stabilized pressure. During checking period (T2), the system measures the beginning and the end of the system pressure (DP_C, DP_D). The diagnosis value is the pressure difference corrected by the natural vapor generation (DP_B - DP_A) rate from the vapor generation check step.

Evaporative System Monitoring

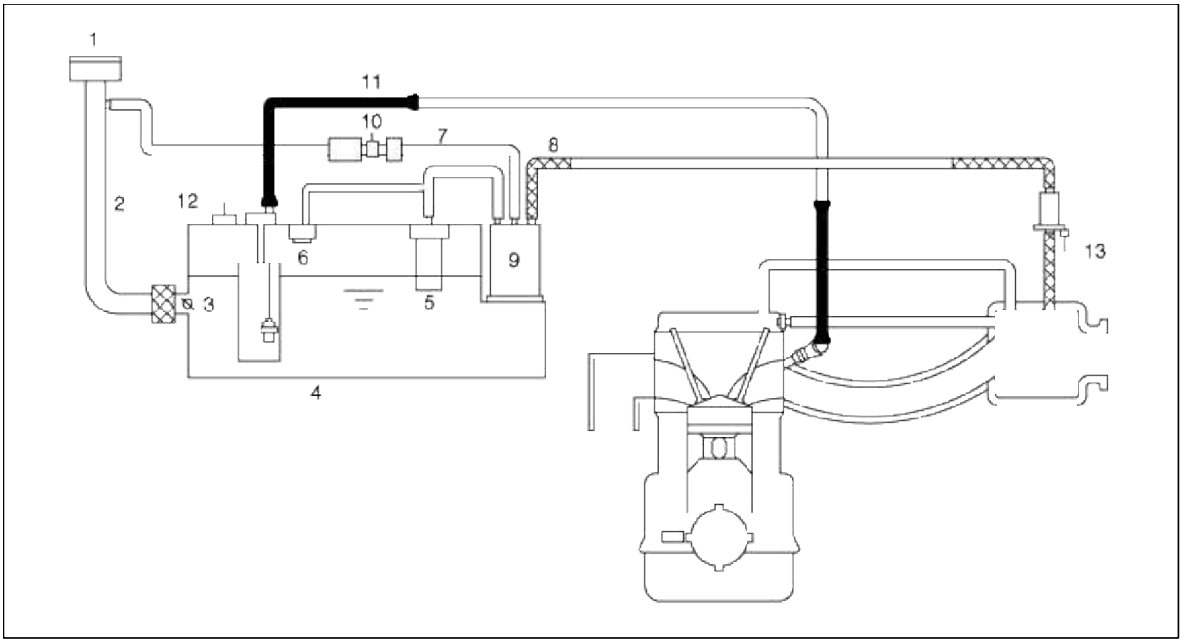


Evaporative And ORVR Emission Control System

This system consists of a fill vent valve, fuel shut-off valve, fuel cut valve (for roll over), two way valve (pressure/vacuum relief), fuel liquid/vapor separator which is installed beside the filler pipe, charcoal canister which is mounted under the rear floor LH side member and protector, tubes and miscellaneous connections.

While refueling, ambient air is drawn into the filler pipe so as not to emit fuel vapors in the air. The fuel vapor in the tank is then forced to flow into the canister via the fill vent valve. The fuel liquid/vapor separator isolates liquid fuel and passes the pure vapor to the charcoal canister.

While the engine is operating, the trapped vapor in the canister is drawn into the intake manifold and then into the engine combustion chamber. Using this purge process, the charcoal canister is purged and recovers its absorbing capability.



1. Fuel Filler Cap 2. Fuel Filler Pipe 3. Fuel Shut-OFF Valve 4. Fuel Tank 5. ORVR Valve 6. 2-Way & Cut Valve 7. Evaporative Hose	8. Evaporative Hose 9. Canister 10. Canister Close Valve (CCV) 11. Fuel Feed Line 12. Fuel Tank Pressure Sensor (FTPS) 13. Purge Control Solenoid Valve (PCSV)

Emission Control System > Evaporative Emission Control System > Repair procedures

Inspection

[System Inspection]

1. Disconnect the vapor hose from the throttle body and connect a vacuum pump to the nipple on the throttle body.
2. Check the following points with applied vacuum using a vacuum pump.

· At Cold Engine [Engine Coolant Temperature < 60°C(140°F)]

Engine Operating Condition	Applied Vacuum	Result
Idle	0.5kgf/cm² (50kPa,7.3psi)	Vacuum is held
3,000rpm		

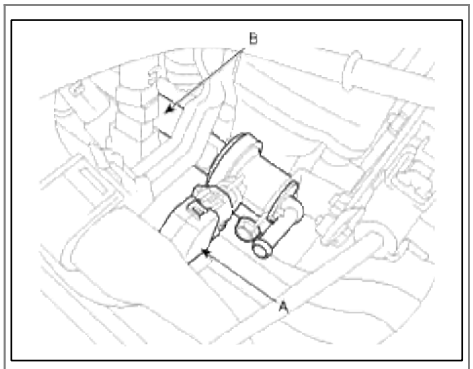
· At Warmed Engine [Engine Coolant Temperature > 80°C(176°F)]

Engine Operating Condition	Applied Vacuum	Result
Idle	0.5kgf/cm² (50kPa,7.3psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
In 3 minutes after engine start at 3,000 rpm	0.5kgf/cm² (50kPa,7.3psi)	Vacuum will be held momentarily, after which, it will be released

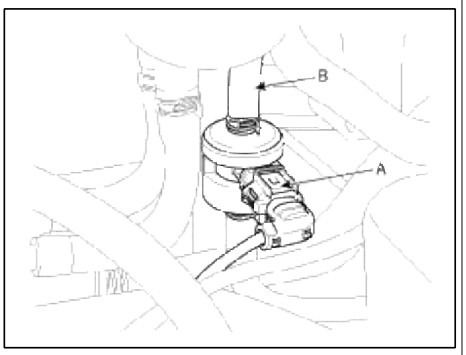
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[PCSV Inspection]

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the PCSV connector (A).



[1.6 DOHC]



[2.0 DOHC]

3. Disconnect the vapor hose (B) which is connected to the intake manifold from the PCSV.
4. After connecting a vacuum pump to the nipple, apply vacuum.
5. With the PCSV control line grounded, check the valve operation with battery voltage applied to the PCSV(Open) and removed(Closed).

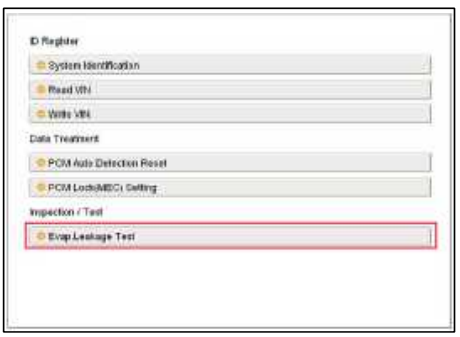
Battery Voltage	Valve	Vacuum
Connected	Open	Released
Disconnected	Close	Maintained

6. Measure the coil resistance of the PCSV.

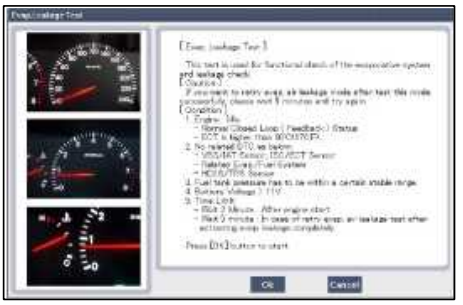
Specification:
[1.6 DOHC] 16Ω [20°C(68°F)]
[2.0 DOHC] 14.0 ~ 18.0Ω [20°C(68°F)]

[EVAP. Leakage Test]

1. Select "Evap. Leakage Test".



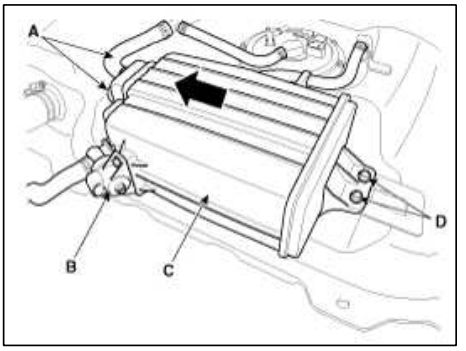
2. Proceed with the test according to the screen introductions.



Emission Control System > Evaporative Emission Control System > Canister > Repair procedures

Removal

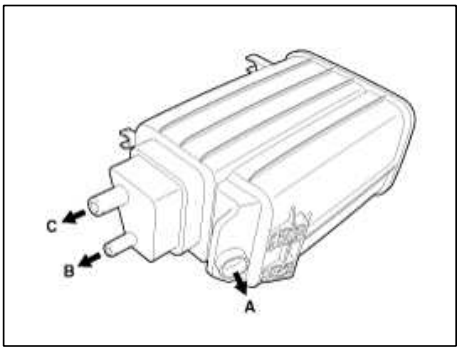
1. Remove the fuel tank. (Refer to "Fuel tank" in this group.)
2. Disconnect the vapor hoses (A).
3. Remove the canister close valve (B) after removing the installation bolts.



4. Remove the canister (C) in the direction of the arrow after removing the installation bolts (D).

Inspection

1. Check for the following items visually.
   A. Cracks or leakage of the canister
   B. Loose connection, distortion, or damage of the vapor hose/tube



A: To Fuel Tank Air Filter
B: To Intake Manifold
C: To Fuel Tank

Installation

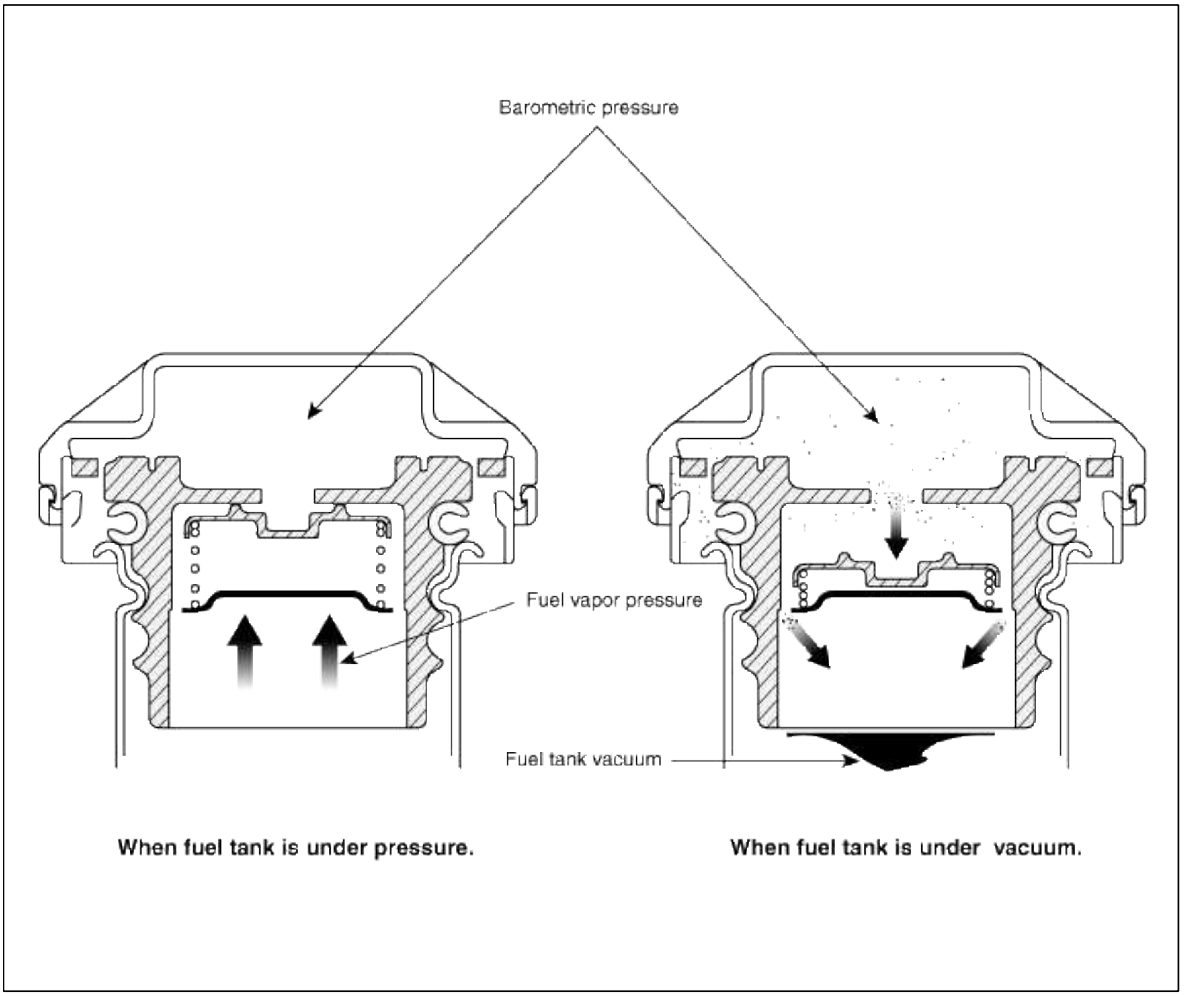
Installation is the reverse of removal.

Emission Control System > Evaporative Emission Control System > Fuel Filler Cap > Description and Operation

Description

A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which seals the fuel filler. After the gasket on the fuel filler cap and the filler neck flange contact each other, the ratchet produces a

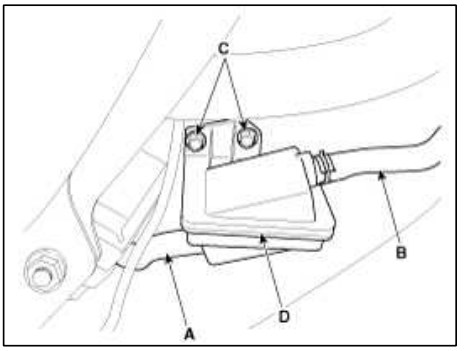
loud clicking noise indicating the seal has been set.



Emission Control System > Evaporative Emission Control System > Fuel Tank Air Filter > Repair procedures

Replacement

1. Lift the vehicle.
2. Disconnect the vapor hoses (A,B) from the fuel tank air filter.



3. After removing the installation bolt (C), remove the fuel tank air filter (D).
4. Install a new fuel tank air fiter.

Emission Control System > Exhaust Emission Control System > Description and Operation

Description

Exhaust emissions (CO, HC, NOx) are controlled by a combination of engine modifications and the addition of special control components.

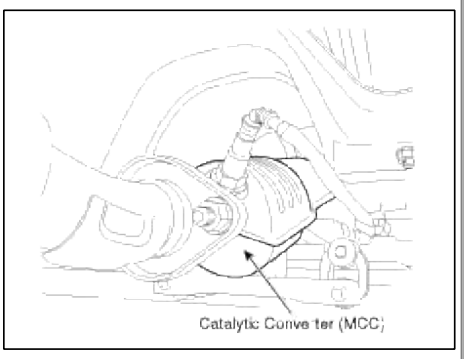
Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system.
These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good drivability and fuel economy.
Air/Fuel Mixture Control System [Multiport Fuel Injection (MFI) System]
The MFI system uses signals from the heated oxygen sensor to activate and control the injector installed in the manifold for each cylinder, thus precisely regulating the air/fuel mixture ratio and reducing emissions.
This in turn allows the engine to produce exhaust gas of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants [hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx)] into harmless substances. There are two operating modes in the MFI system.

1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

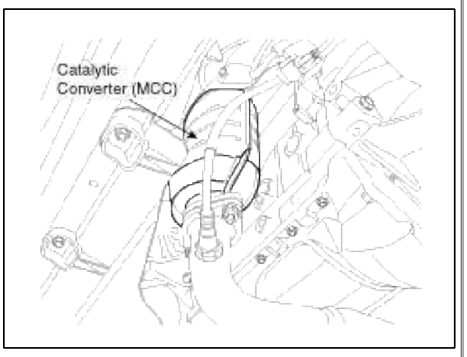
Emission Control System > Exhaust Emission Control System > Catalytic Converter > Description and Operation

Description

The catalytic converter of the gasoline engine is a three way catalyst. It oxidizes carbon monoxide and hydrocarbons (HC), and separates oxygen from the oxides of nitrogen (NOx).
There are two types of three-way catalyst; Palette type and Monolith type.



[1.6 DOHC]

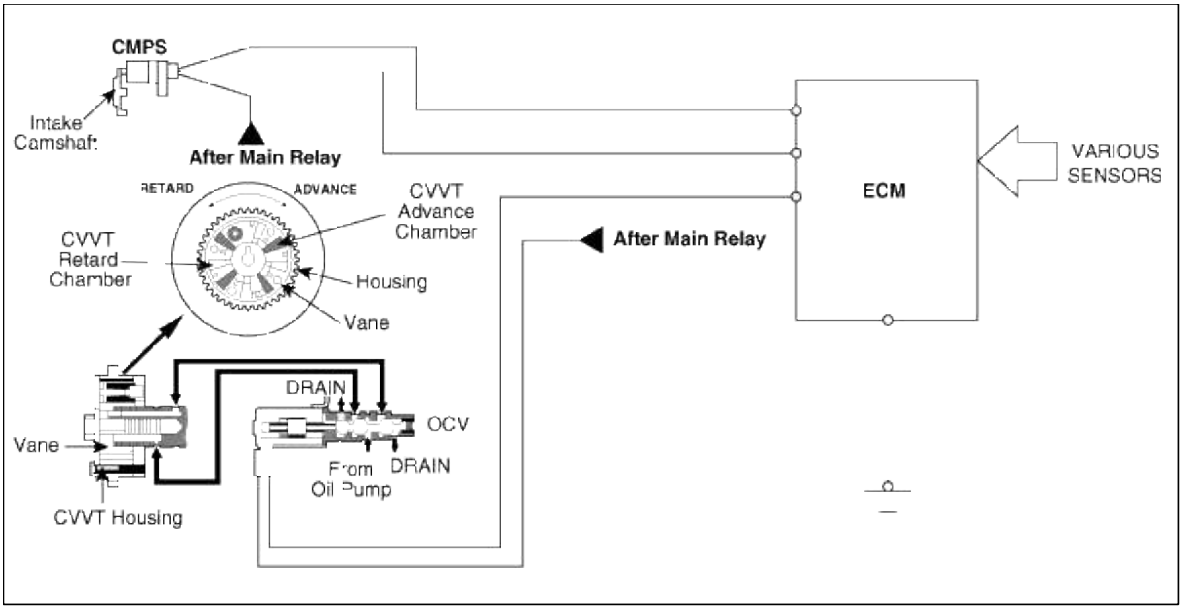


[2.0 DOHC]

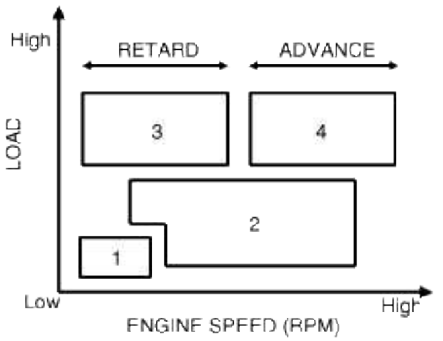
Emission Control System > Exhaust Emission Control System > CVVT (Continuously Variable Valve Timing) System > Description and Operation

Description

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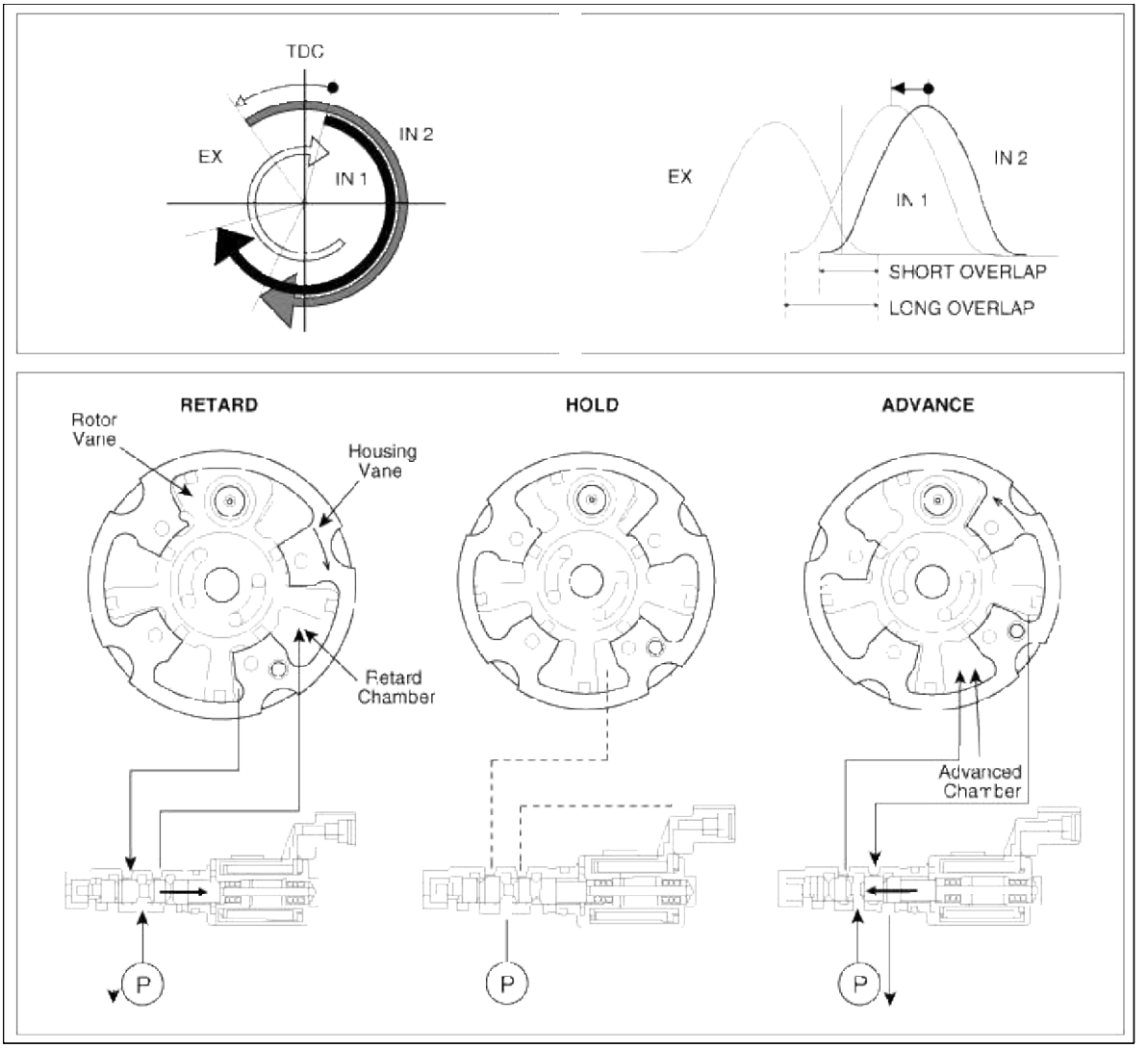
The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.
The intake valve timing is optimized by the CVVT system depending on engine rpm.
This CVVT system improves fuel efficiency and reduces NOx emissions at all levels of engine speed, vehicle speed, and engine load by EGR effect because of valve over-lap optimization.
The CVVT changes the phase of the intake camshaft via oil pressure.
It changes the intake valve timing continuously.



Driving Condition	Intake Valve Timing	Effect
Light load (1)	Retard	Stable combustion
Part load (2)	Advance	Enhanced fuel economy and exhaust emissions
High load& Low rpm (3)	Advance	Enhanced torque
High load& High rpm (4)	Retard	Enhanced Power

Operation Principle

The CVVT system makes continuous intake valve timing changes based on operating conditions.
Intake valve timing is optimized to allow the engine to produce maximum power.
Cam angle is advanced to obtain the EGR effect and reduce pumping loss. The intake valve is closed quickly to reduce the entry of the air/fuel mixture into the intake port and improve the changing effect.
The system reduces cam advance at idle, stabilizes combustion, and reduces engine speed.
If a malfunction occurs, the CVVT system control is disabled and the valve timing is fixed at the fully retarded position.



1. The above figure shows the relative operation structures of the housing vane to the rotor vane.
2. When the CVVT is held in a certain control angle, its oil is replenished as it leaks by the oil pump.

The OCV (CVVT Oil Control Valve) spool location at this time is as follows.

Oil pump → Advance oil chamber (Little by little open the inflow side to the advance oil chamber) → Almost close the drain side

Be sure there might be a difference in the position according to the engine running state (rpm, oil temperature, and oil pressure).

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SOUL(AM) > 2010 > G 1.6 DOHC > Engine Electrical System

Engine Electrical System > General Information > Specifications

Specifications

Ignition System

Items		Specification
Ignition coil	Primary resistance	0.7 ± 15 % (Ω)
	Secondary resistance	-
Spark plugs (Unleaded)	Type	RER8MC
	Gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433in.)

Starting System

Items			Specification
Starter	Rated voltage		12.V, 0.9 kW
	No. of pinion teeth		8
	No-load characteristics	Voltage	11.5V
		Ampere	60 MAX
		Speed	5500 rpm, MIN
	Commutator diameter	Standard	32.9 ~ 33.0 mm (1.2953 ~ 1.2992in.)
	Under cut depth	Standard	0.7 ~ 0.9 mm (0.0275 ~ 0.0354in)
		Limit	0.4 mm (0.0157in)

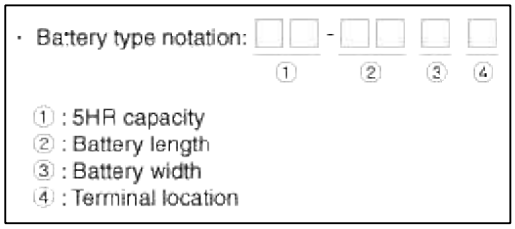
Charging System

Items		Specification
Alternator	Type	Battery voltage sensing
	Rate voltage	13.5 V, 90A
	Speed in use	1,000 ~ 18,000 rpm
	Voltage regulator	IC Regulator built-in type
	Regulator setting voltage	14.55 ± 0.2 V (At 20°C full chareged batt)
	Temperature compensation	-7 ± 3 mV / °C
Battery	Type	36-20GL
	Cold cranking amperage [at -18°C(-0.4°F)]	410 A
	Reserve capacity	80 min

	Specific gravity [at 20°C(68°F)]	1.280 ± 0.01

CAUTION

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- RESERVE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80.1°F).



Engine Electrical System > General Information > Troubleshooting

Troubleshooting

Ignition system

Symptom	Suspect area	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch	Inspect ignition lock switch, or replace as required
	Ignition coil	Inspect ignition coil, or replace as required
	Spark plugs	Inspect spark plugs, or replace as required
	Ignition wiring disconnected or broken	Repair wiring, or replace as required
	Spark plugs cable	Inspect cable, or replace as required
Rough idle or stalls	Ignition wiring	Repair wiring, or replace as required
	Ignition coil	Inspect ignition coil, or replace as required
	Spark plugs cable	Inspect cable, or replace as required
Engine hesitates / poor acceleration	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required
	Ignition wiring	Repair wiring, or replace as required
Poor mileage	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required

Charging system

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Symptom	Suspect area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off.	Fuse blown	Check fuses
	Light burned out	Replace light
	Wiring connection loose	Tighten loose connection
	Electronic voltage regulator	Replace voltage regulator
Charging warning indicator does not go out with engine running. (Battery requires frequent recharging)	Drive belt loose or worn	Adjust belt tension or replace belt
	Battery cable loose, corroded or worn	Inspect cable connection, repair or replace cable
	Electronic voltage regulator or alternator	Replace voltage regulator or alternator
	Wiring	Repair or replace wiring
Overcharge	Electronic voltage regulator	Replace voltage regulator
	Voltage sensing wire	Repair or replace wiring
Discharge	Drive belt loose or worn	Adjust belt tension or replace belt
	Wiring connection loose or short circuit	Inspect wiring connection, repair or replace wiring
	Electronic voltage regulator or alternator	Replace voltage regulator or alternator
	Poor grounding	Inspect ground or repair
	Worn battery	Replace battery

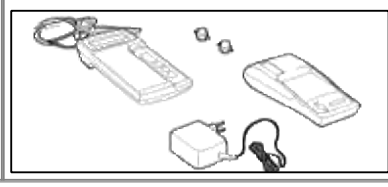
Starting system

Symptom	Suspect area	Remedy
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Transaxle range switch (Vehicle with automatic transaxle only)	Refer to TR group-automatic transaxle
	Fuse blown	Replace fuse
	Starter motor faulty	Replace
	Ignition switch faulty	Replace
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Starter motor faulty	Replace
Starter keeps running	Starter motor	Replace
	Ignition switch	Replace
Starter spins but engine will not	Short in wiring	Repair wiring

crank	Pinion gear teeth broken or starter motor	Replace
	Ring gear teeth broken	Replace fly wheel or torque converter

Engine Electrical System > General Information > Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
Micro-570 Battery checker		- Check the battery condition - Check the charging and starting system

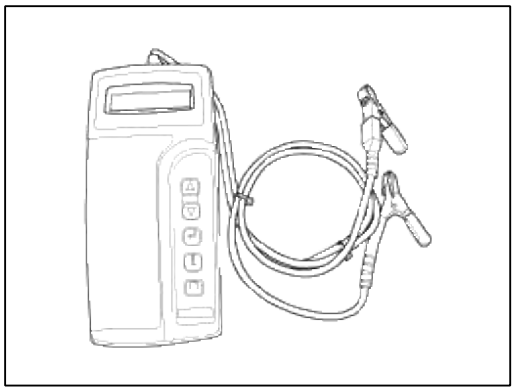
Engine Electrical System > General Information > General Information

The Micro 570 Analyzer

The MICRO 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

CAUTION

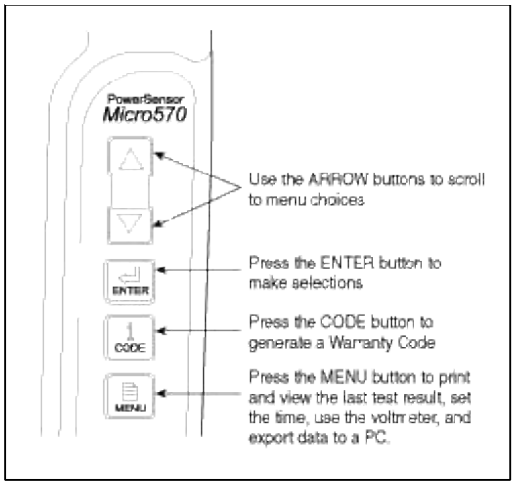
Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.



Keypad

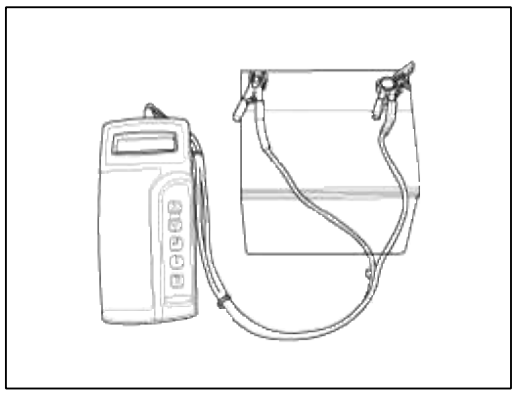
TheMICRO570 button on the key pad provide the following functions :

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Battery Test Procedure

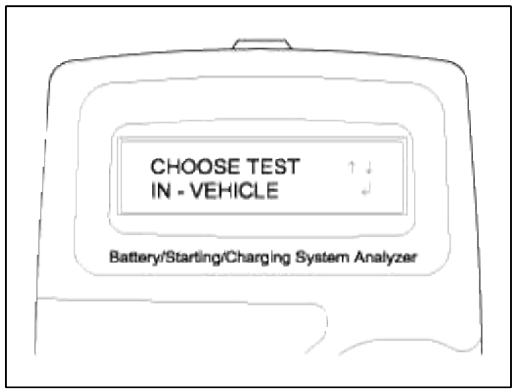
1. Connect the tester to the battery.
   A. Red clamp to battery positive (+) terminal.
   B. Black clamp to battery negative (-) terminal.



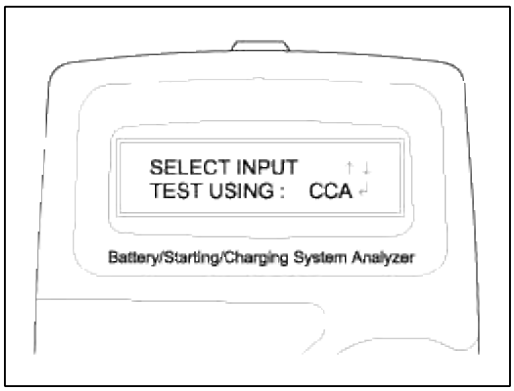
CAUTION

Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN A VEHICLE" or "OUT OF A VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



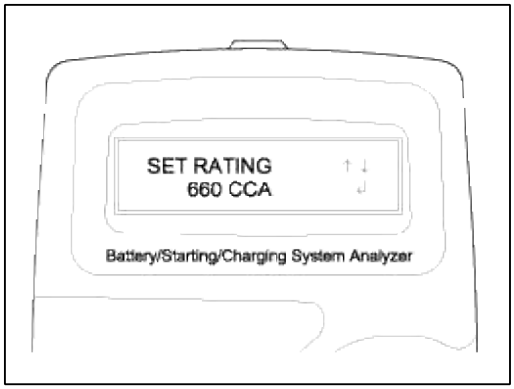
3. Choose either CCA or CCP and press the ENTER button.



NOTE

- CCA : Cold cranking amps, is an SAE specification for cranking batteried at -0.4°F (-18°C).
- CCP : Cold cranking amps, is an SAE specification for korean manufacturer's for cranking batteried at -0.4°F (-18°C).

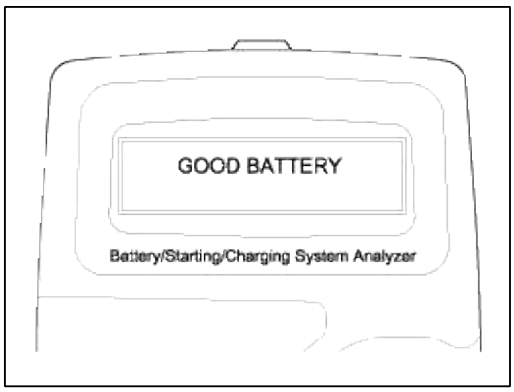
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



NOTE

The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

5. The tester (Micro570) displays battery test results including voltage and battery ratings.
A relevant action must be given according to the test results by referring to the battery test results as shown in the table below.



NOTE

The battery ratings (CCA) displayed on the tester must be identical to the ratings marked on battery label.

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6. To conduct starter test, continuously, press ENTER.

Battery Test Results

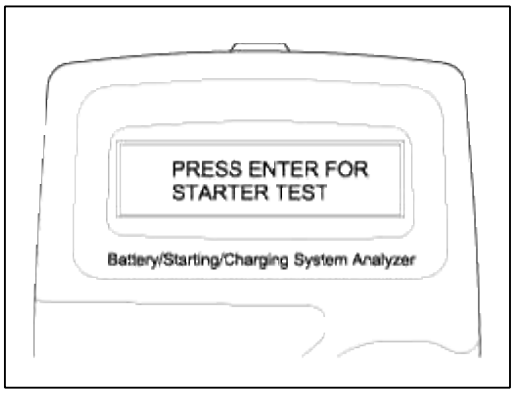
Result On Printer	Remedy
Good battery	No action is required
Good recharge	Battery is in a good state Recharge the battery and use
Charge & Retest	Battery is not charged properly - Charge and test the battery again (Failure to charge the battery fully may read incorrect measurement value)
Replace battery	- Replace battery and recheck the charging system. (Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery)
Bad cell-replace	- Charge and retest the battery. And than, test results may cause "REPLACE BATTERY", replace battery and recheck the charging system

WARNING

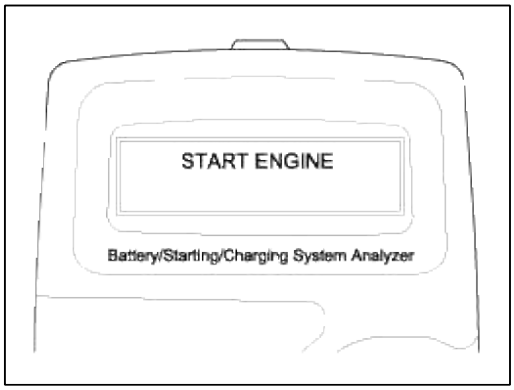
Whenever filing a claim for battery, the print out of the battery test results must be attached.

Starter Test Procedure

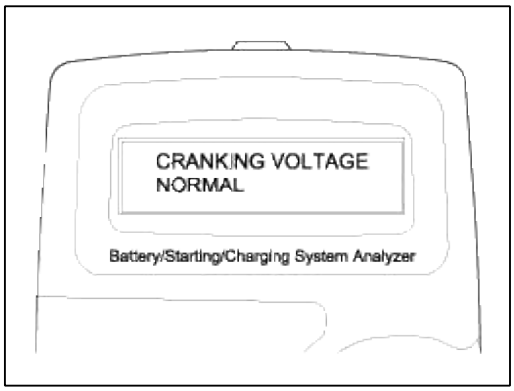
1. After the battery test, press ENTER immediately for the starter test.



2. After pressing ENTER key, start the engine.



3. Cranking voltage and starter test results will be displayed on the screen.
   Take a relevant action according to the test results by referring to the starter test results as given below.



4. To continue charging system test, press ENTER.

Starter Test Results

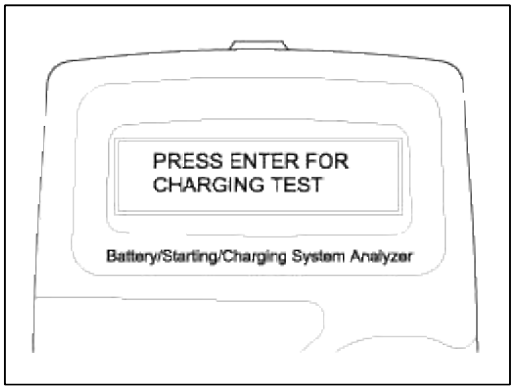
Result On Printer	Remedy
Cranking voltage normal	System shows a normal starter draw
Cranking voltage low	Cranking voltage is lower than normal level - Check starter
Charge battery	The state of battery charge is too low to test - Charge the battery and retest
Replace battery	- Replace battery - If the vehicle is not started though the battery condition of "Good and fully charged" is displayed. - Check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. - If the engine does crank, check fuel system.

NOTE

When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.

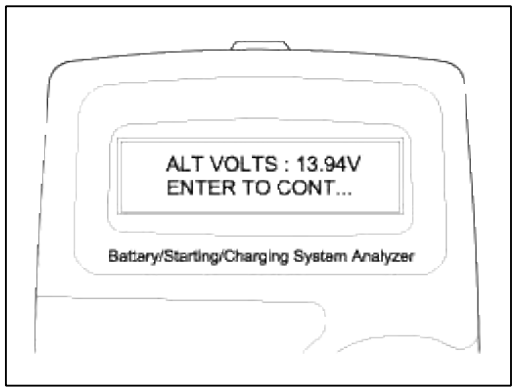
Charging System Test Procedure

1. Press ENTER to begin charging system test.

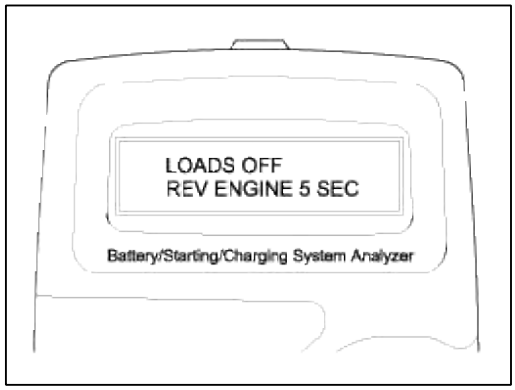


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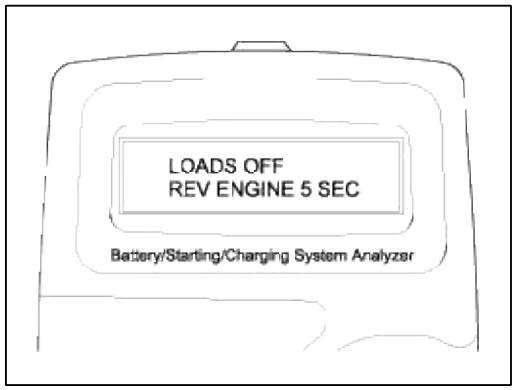
2. If ENTER button is pressed, the tester displays the actual voltage of alternator.
   Press ENTER to test the charging system.



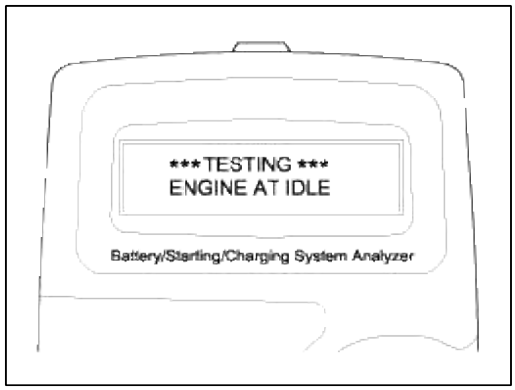
3. Turn off all electrical load and rev engine for 5 seconds with pressing the accelerator pedal.



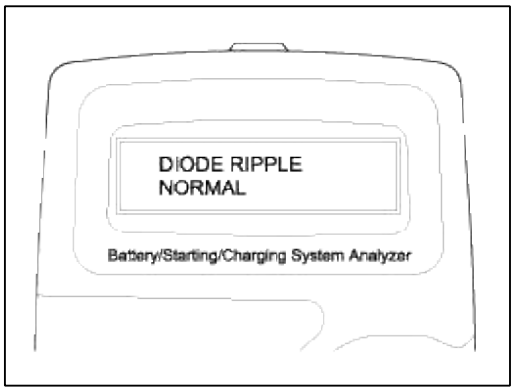
4. Press ENTER.



5. The MICRO 570 analyzer charging system output at idle for comparison to other readings.



6. Take a relevant action according to the test results by referring to the table below after shutting off the engine and disconnect the tester clamps from the battery.



Charging System Test Results

Result On Printer	Remedy
Charging system normal / Diode ripple normal	Charging system is normal
No charging voltage	Alternator does not supply charging current to battery - Check belts, connection between alternator and battery Replace belts or cable or alternator as necessary
Low charging voltage	Alternator does not supply charging current to battery and electrical load to system fully - Check belts and alternator and replace as necessary
High charging voltage	The voltage from alternator to battery is higher than normal limit during voltage regulating. - Check connection and ground and replace regulator as necessary - Check electrolyte level in the battery
Excess ripple detected	One or more diodes in the alternator is not functioning properly - Check alternator mounting and belts and replace as necessary

Engine Electrical System > Ignition System > Description and Operation

Descrition

Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are pre-programmed in the memory of the ECM (Engine Control Module). The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.

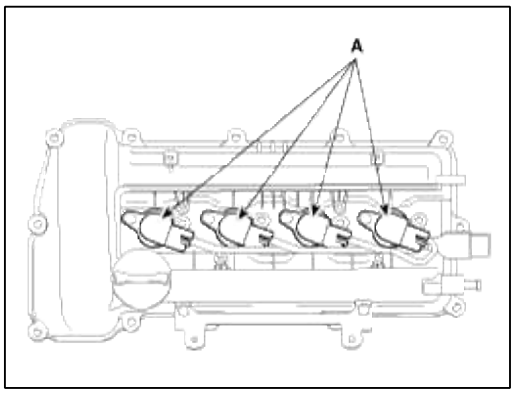
Engine Electrical System > Ignition System > Repair procedures

On-vehicle Inspection

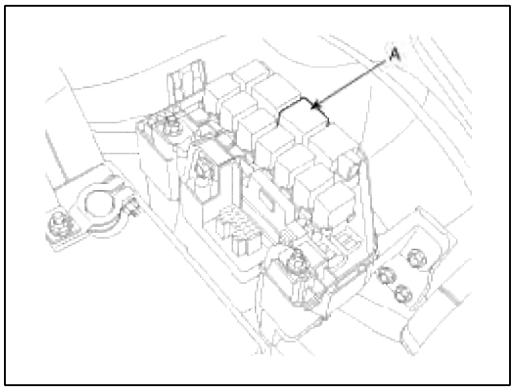
Spark Test

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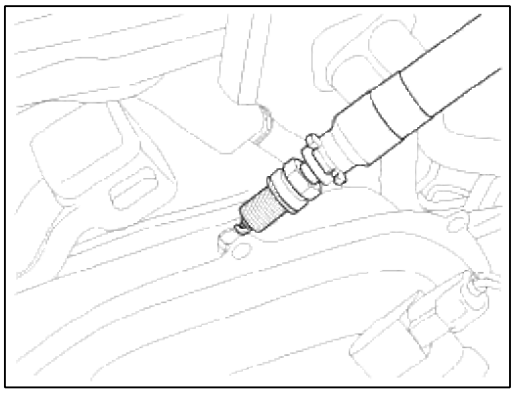
1. Remove the ignition coils(A).



2. Remove the fuel pump relay(A) from the fuse box for fuel not to be injected while checking.



3. Using a spark plug socket, remove the spark plug.
4. Install the spark plug to the ignition coil.
5. Ground the spark plug to the engine.



6. Check if spark occurs while engine is being cranked.

> NOTE
>
> Do not crank engine for more then 5~10 seonds.

7. Inspect all the spark plugs.
8. Using a spark plug socket, install the spark plug.
9. Install the ignition coil.

Tightening torque :
9.8 ~11.8 Nm (1.0~1.2 kgf.m, 7.2~8.7 Ib-ft)

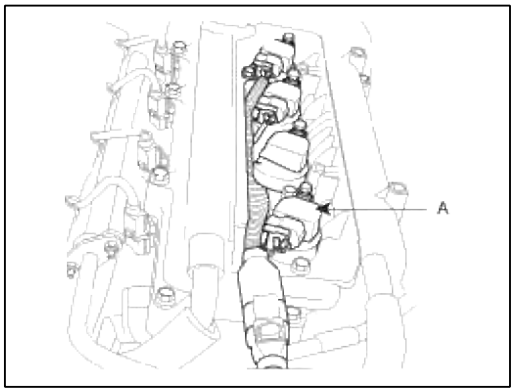
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10. Install a engine center cover and a engine cover.

Tightening torque :
7.8 ~11.8 Nm (0.8~1.2 kgf.m, 5.8~8.7 Ib-ft)

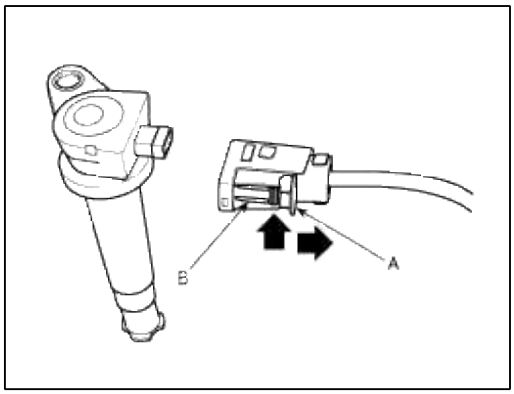
Inspect Spark Plug

1. Remove the ignition coil(A).



NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).



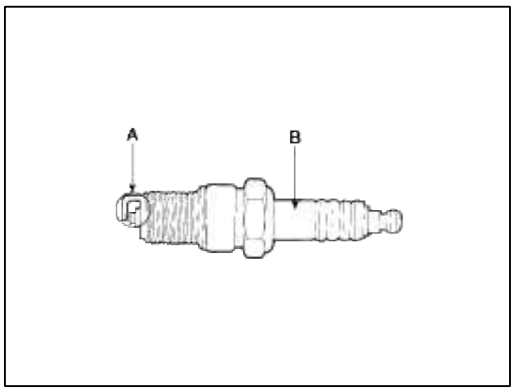
2. Using a spark plug socket, remove the spark plug.

CAUTION

Be careful that no contaminates enter through the spark plug holes.

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3. Inspect the electrodes (A) and ceramic insulator (B).

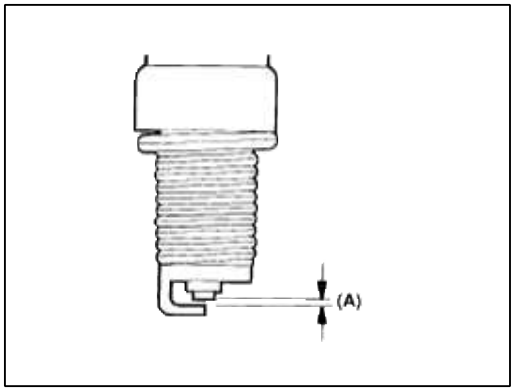


Inspection Of Electrodes

Condition	Dark deposits	White deposits
Description	- Fuel mixture too rich - Low air intake	- Fuel mixture too lean - Advanced ignition timing - Insufficient plug tightening torque

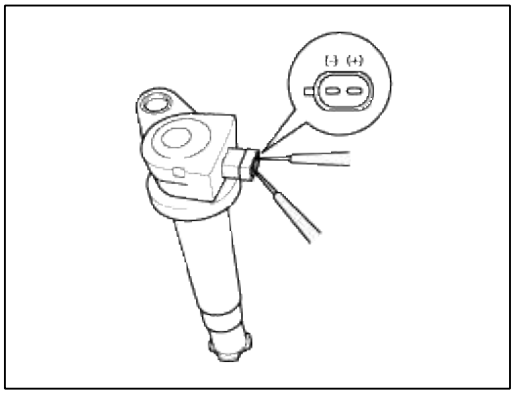
4. Check the electrode gap (A).

Standard
1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)



Inspect Ignition Coil

1. Measure the primary coil resistance between terminals (+) and (-).



Standard value: 0.75Ω ± 15%

Engine Electrical System > Charging System > Description and Operation

Description

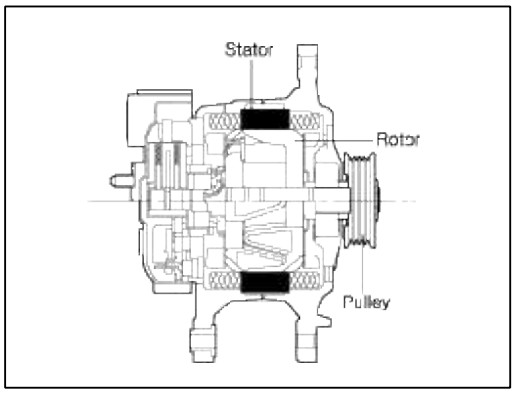
The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

The Alternator has eight built-in diodes, each rectifying AC current to DC current.

Therefore, DC current appears at alternator "B" terminal.

In addition, the charging voltage of this alternator is regulated by the battery voltage detection system.

The alternator is regulated by the battery voltage detection system. The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.



Engine Electrical System > Charging System > Repair procedures

On-vehicle Inpection

CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Never disconnect the battery while the engine is running.

Check The Battery Terminals And Fuses

1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

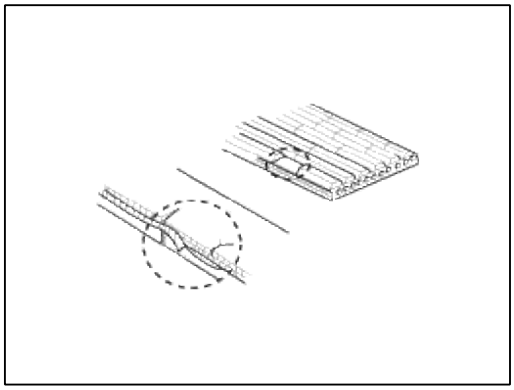
Inspect Drive Belt

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1. Visually check the belt for excessive wear, frayed cords etc.
   If any defect has been found, replace the drive belt.

NOTE

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



2. Measure drive belt tension and adjust it if necessary.

Drive belt tension measurement and adjustment

Belt tension measurement

Measure the belt tension using a mechanical tension gauge or a sonic tension meter.

Tension

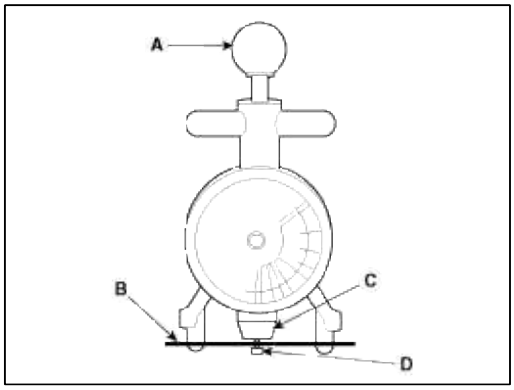
New belt: 882.6 ~ 980.7N (90 ~ 100kg, 198.4 ~ 220.5lb)
Used belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)

CAUTION

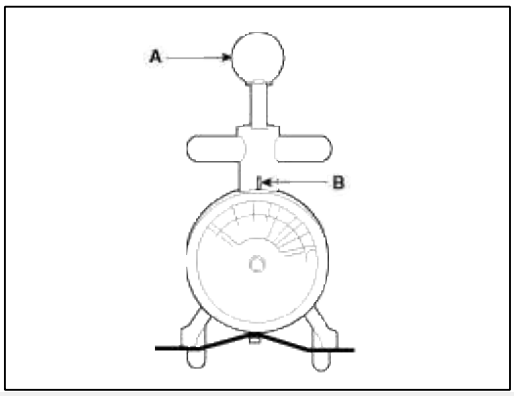
- If the engine has run for 5 minutes or more, the belt tension must be adjusted as a used belt.
- When installing the V-ribbed belt, all grooves on the pulley should be covered with belt ribs.
- A loose belt causes slip noise.
- Too tight belt cause bearing of alternator and water pump to damage.

Using a mechanical tension gauge (BT-33-73F, BTG-2 type)

1. While pressing the handle (A) of the gauge, insert the belt (B) between pulley and pulley (or idler) into the gap between spindle (C) and hook (D).



2. After releasing the handle (A), read a value on the dial pointed by the indicator (B).



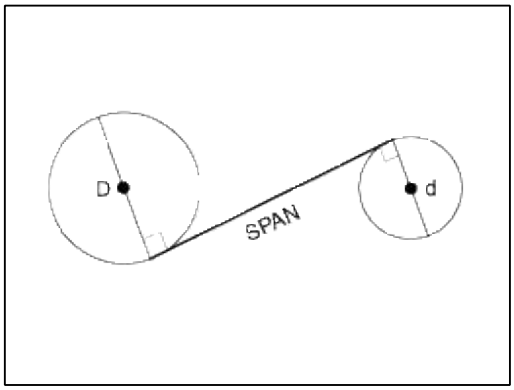
Using a sonic tension meter (U-505/507 type)

1. Input the belt specifications into the tension meter.

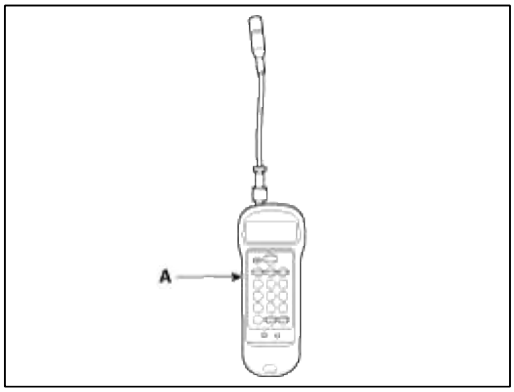
Belt type	Location of measurement	Input data		
		M (Mass, g/m.rib)	W (Width, rib)	S (Span, mm)
With A/C	Crankshaft pulley to A/C compressor pulley	013.4	006.0	178.9
Without A/C	Idler to alternator pulley	013.4	006.0	Actual measurement value

NOTE

Measurement of S (Span) : Caculate average value after measuring the distance 3~4 times.



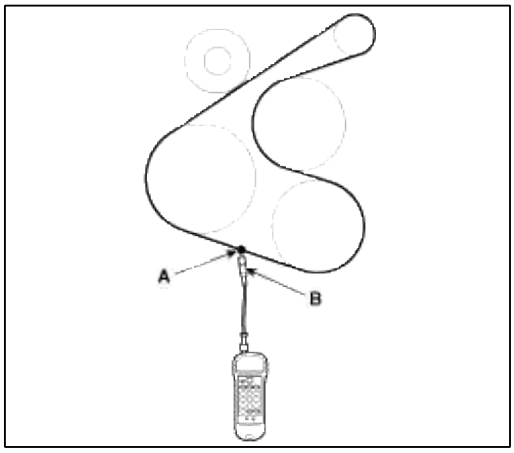
D : Idler
d : Alternator pulley



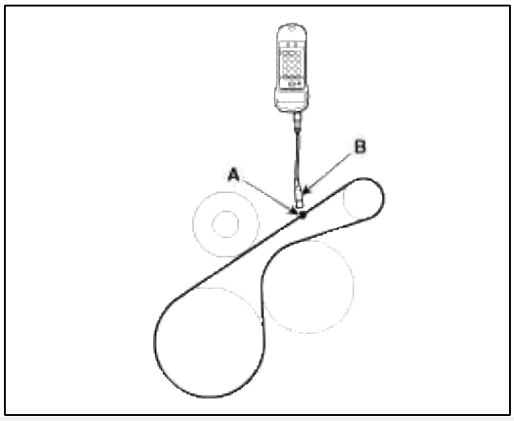
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2. Locate the micro phone (B) close to the center of belt span (A) and bounce the belt by finger 2~3 times. Read a value on the display.

[With A/C]

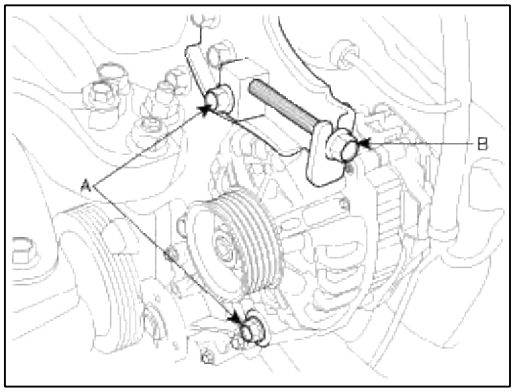


[Without A/C]



If adjustment is necessary:

1. Loosen the mounting bolts (A).
2. Tighten the adjusting bolt(B) clockwise in loose tension ; loosen the bolt counterclockwise in high tension.



3. Recheck tension of the belt.
4. After adjusting tension, tighten the through bolts.

Tightening torque

12mm (0.47in) bolt : 19.6 ~ 26.5 Nm (2.0 ~ 2.7 kgf.m, 14.5 ~ 19.5 Ib-ft)
14mm (0.55in) bolt : 29.4 ~ 41.2 Nm (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 Ib-ft)

Visually Check Alternator Wiring And Listen For Abnormal Noises

1. Check that the wiring is in good condition.

2. Check that there is no abnormal noise from the alternator while the engine is running.

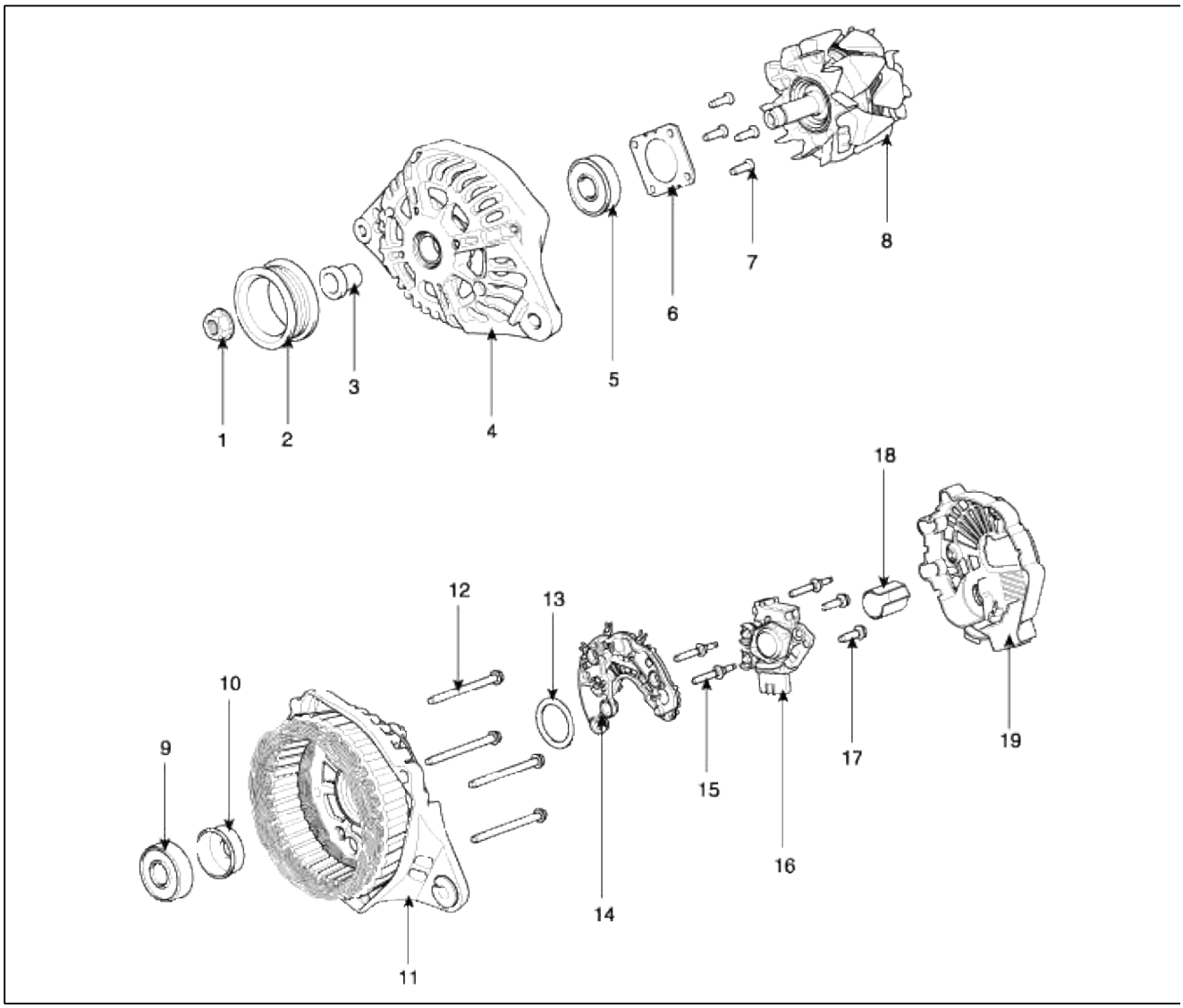
Check Discharge Warning Light Circuit

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.

If the light does not go off as specified, troubleshoot the discharge light circuit.

Engine Electrical System > Charging System > Alternator > Components and Components Location

Components



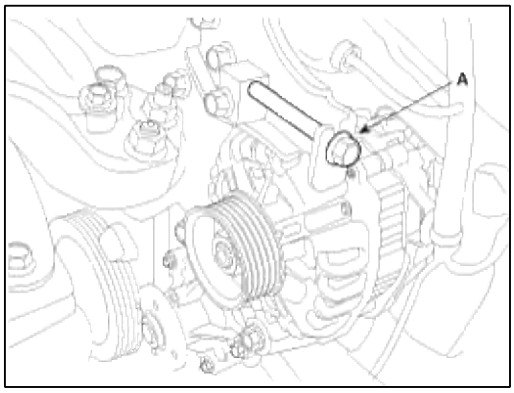
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1. Nut	11. Rear cover
2. Pulley	12. Bolts
3. Spacer	13. Seal
4. Front cover assembly	14. Rectifier assembly
5. Front bearing	15. Stud bolts
6. Bearing cover	16. Brush holder assembly
7. Bearing cover bolt	17. Brush holder bolts
8. Rotor	18. Slip ring guide
9. Rear bearing	19. Cover
10. Bearing cover	

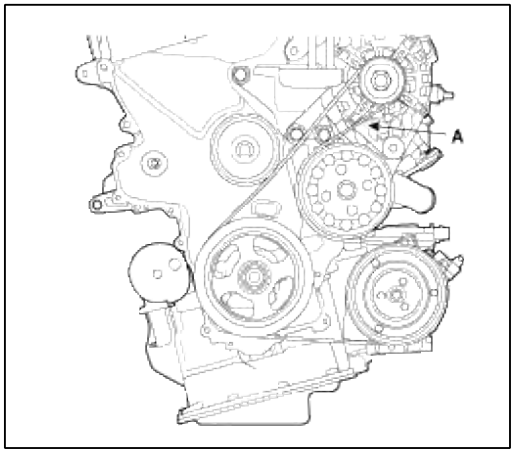
Engine Electrical System > Charging System > Alternator > Repair procedures

Replacement

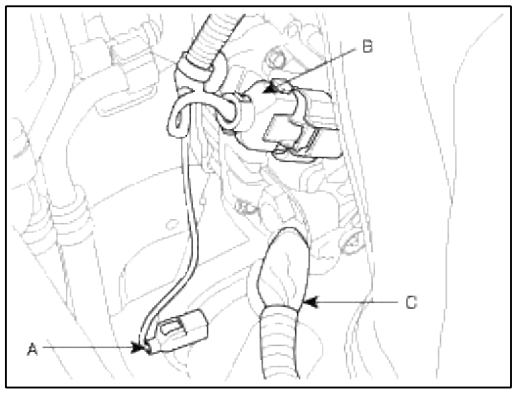
1. Disconnect the battery negative terminal first, then the positive terminal.
2. Loosen the drive belt tension adjusting bolt (A).



3. Remove the drive belt (A).

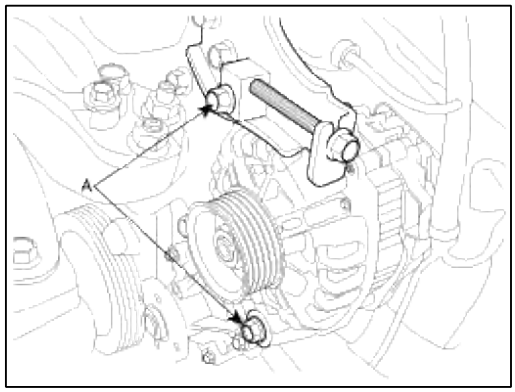


4. Disconnect the air compressor connector(A) and the alternator connector (B), and remove the cable (C) from alternator "B" terminal.



5. Pull out the through bolt (A) and then remove the alternator.

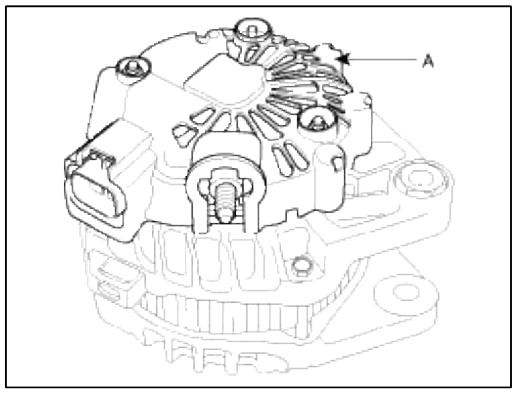
Tightening torque :
19.6~26.5 Nm (2.0~2.7 kgf.m, 14.5~19.5 Ib-ft)-12mm bolt
29.4~41.2 Nm (3.0~4.2 kgf.m, 21.7~30.4 Ib-ft)-14mm bolt



6. Installation is the reverse order of removal.
7. Adjust the alternator belt tension after installation.

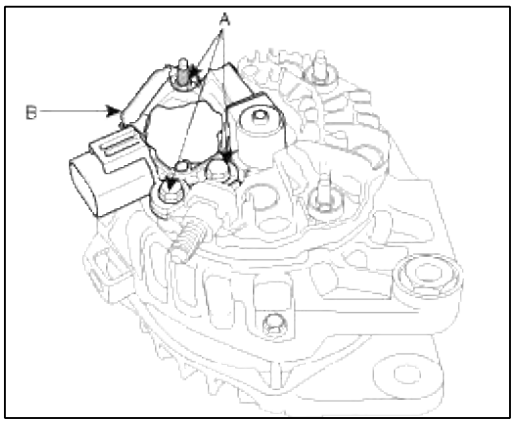
Disassembly

1. Remove the alternator cover(A).

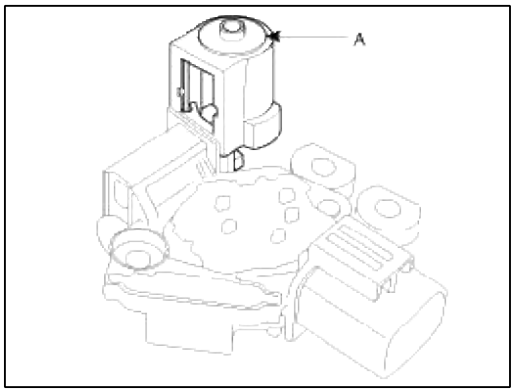


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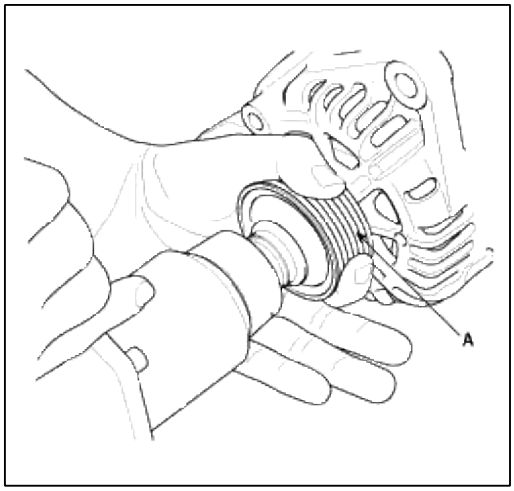
2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



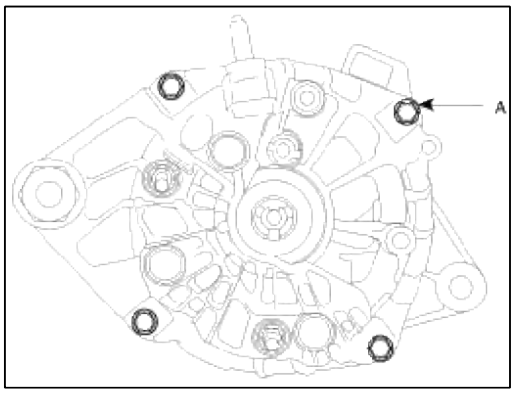
3. Remove the slip ring guide(A).



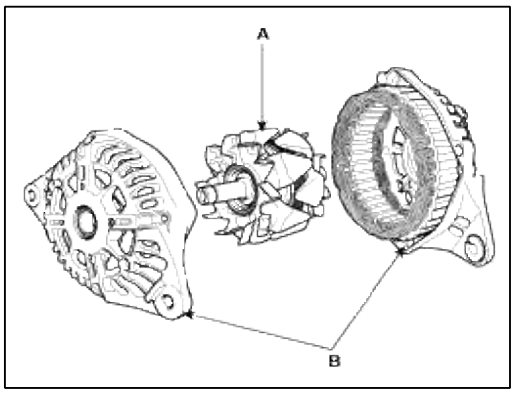
4. Remove the nut, pulley(A) and spacer.



5. Loosen the 4 through bolts(A).



6. Disconnect the rotor(A) and cover(B).

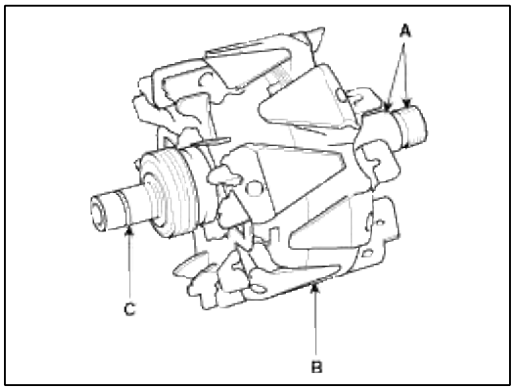


7. Reassembly is the reverse of disassembly.

Inspection

Rotor

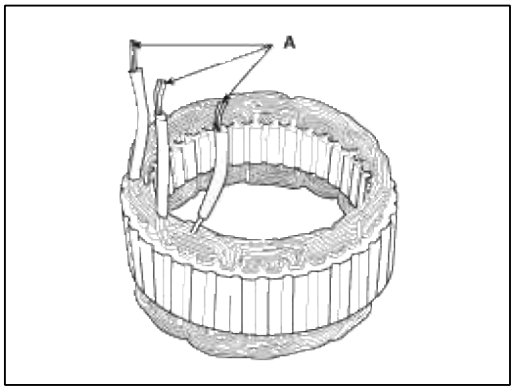
1. Check that there is continuity between the slip rings (C).



2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (A).
3. If the rotor fails either continuity check, replace the alternator.

Stator

1. Check that there is continuity between each pair of leads (A).



2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the alternator.

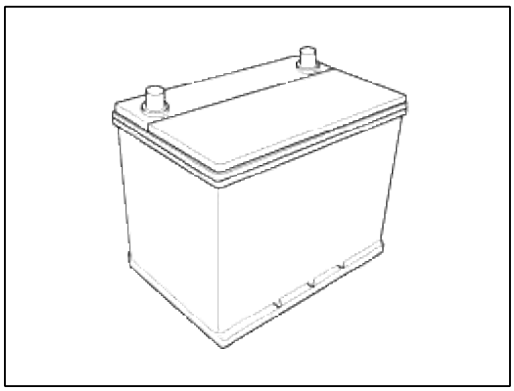
Engine Electrical System > Charging System > Battery > Description and Operation

Description

1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.

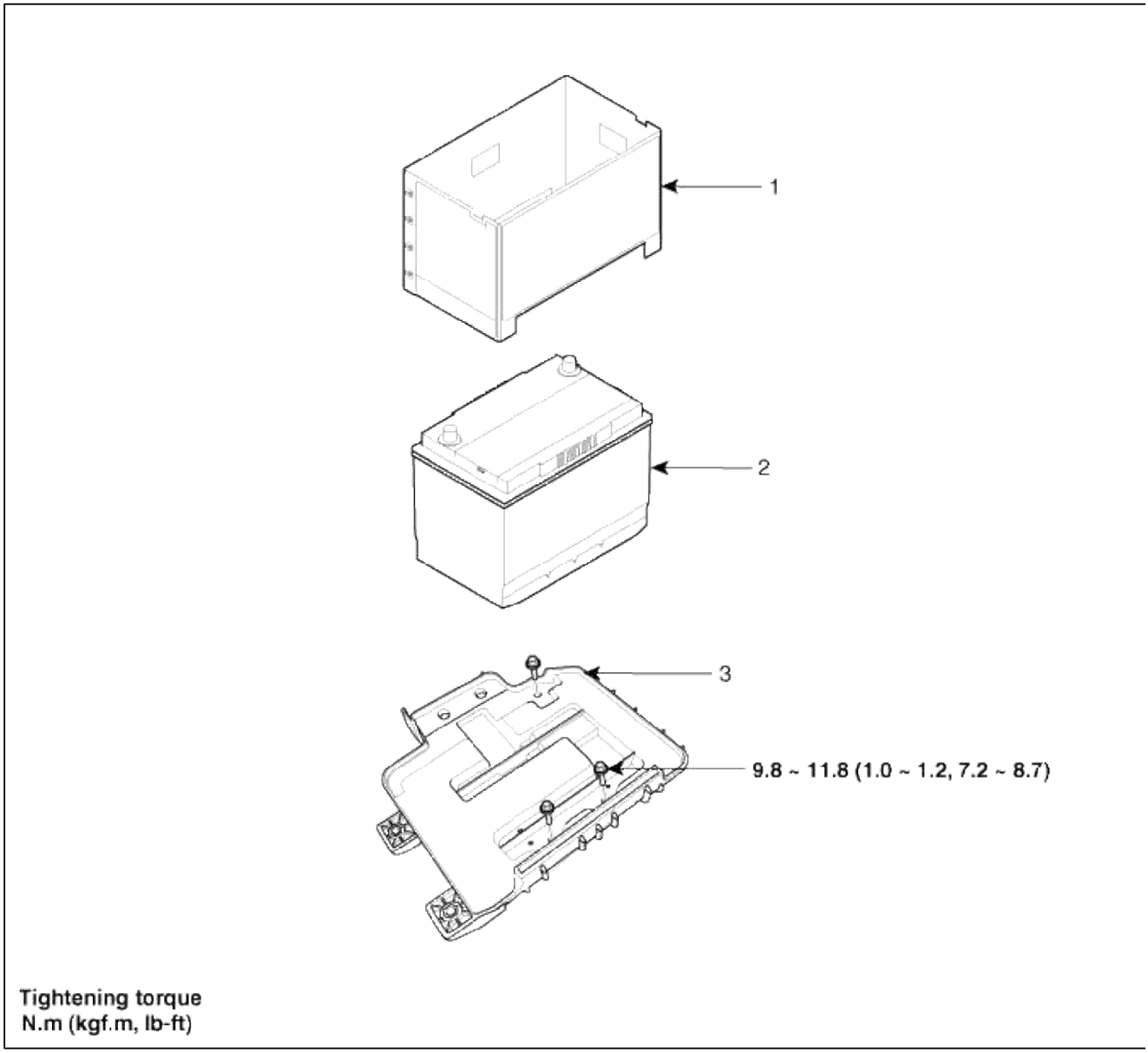
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3. The battery is completely sealed, except for small vent holes in the cover.



Engine Electrical System > Charging System > Battery > Components and Components Location

Components

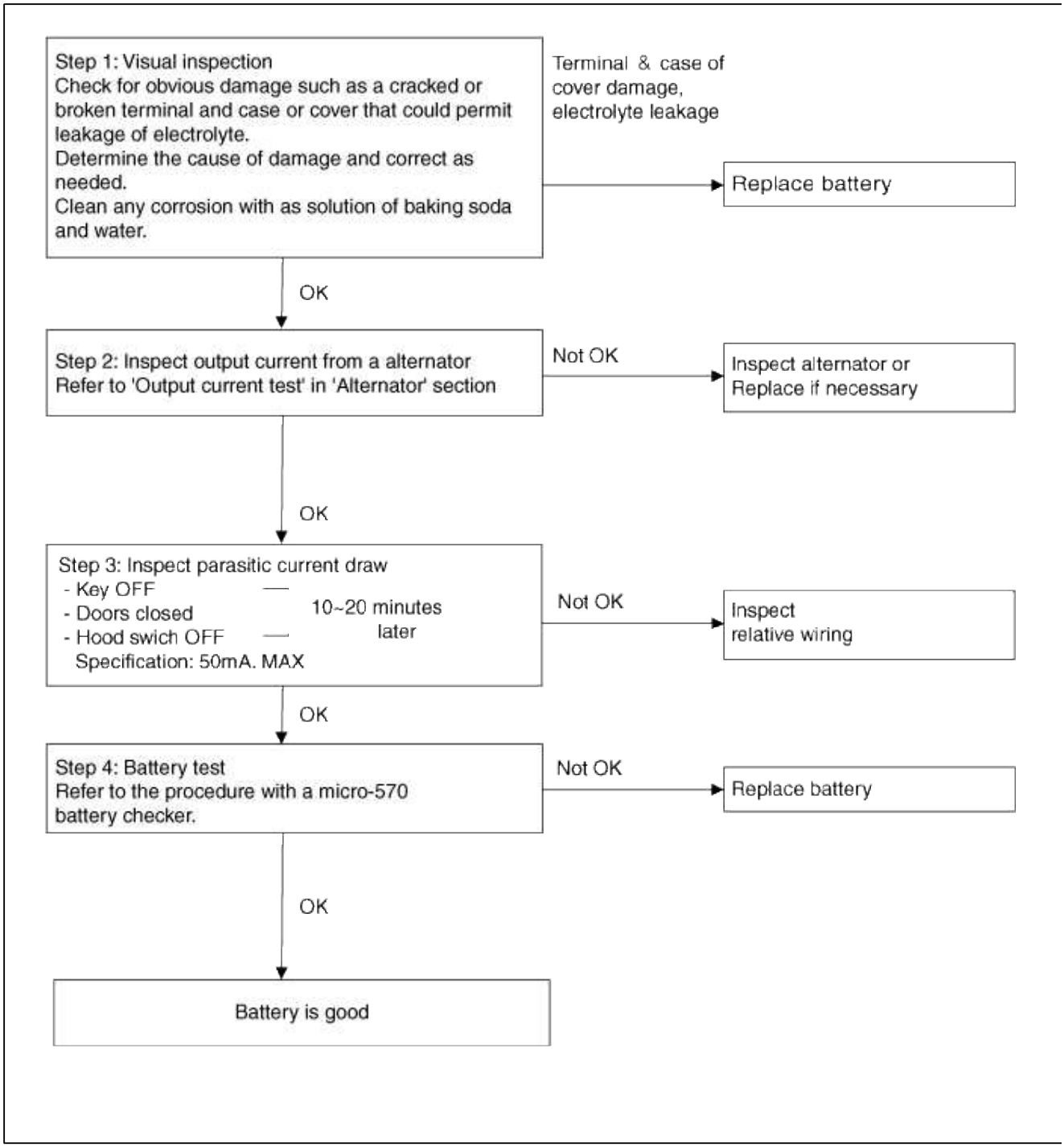


1. Battery insulation pad 2. Battery	3. Battery tray

Engine Electrical System > Charging System > Battery > Repair procedures

Inspection

Battery Diagnostic Flow



Vehicle parasitic current inspection

1. Turn the all electric devices OFF, and then turn the ignition switch OFF.

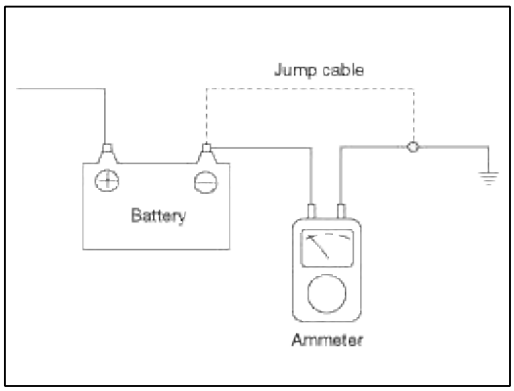
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2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.
   (3) Close the doors or remove the door switches.
3. Wait a few minutes until the vehicle's electrical systems go to sleep mode.

> NOTE
>
> For an accurate measurement of a vehicle parasitic current, all electriacl systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10~20 minutes.

4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

> CAUTION
>
> Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.
> To prevent the battery from being reset during the inspection,
> 1) Connect a jump cable between the battery (-) terminal and the ground cable.
> 2) Disconnect the ground cable from the battery (-) terminal.
> 3) Connect an ammeter between the battery (-) terminal and the ground cable.
> 4) After disconnecting the jump cable, read the current value of the ammeter.



5. Read the current value of the ammeter.
   A. If the parasitic current is over the limit value, search for abnormal circuit by removing a fuse one by one and checking the parasitic current.
   B. Check the parasitic current again, and search for suspected unit by removing a unit connected with the abnormal circuit one by one.

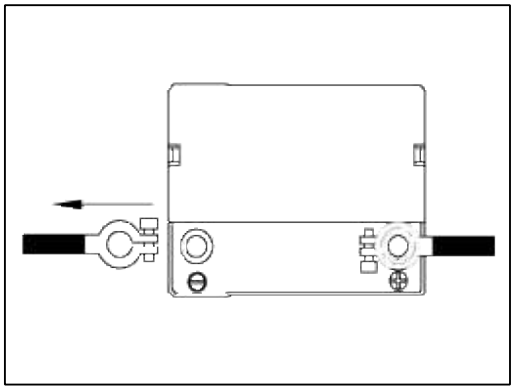
Limit value (after 10~20 min.) : Below 50mA

Cleaning

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).

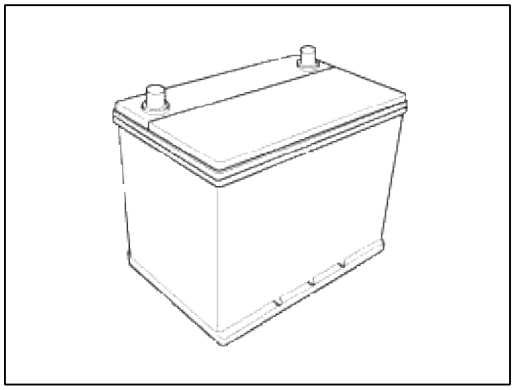
3. Remove the battery from the vehicle.

> **CAUTION**
>
> Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte.
> Heavy rubber gloves (not the household type) should be wore when removing the battery.



4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

> **CAUTION**
>
> When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.
> A spark will occur when the circuit is broken. Keep open flames away form battery.



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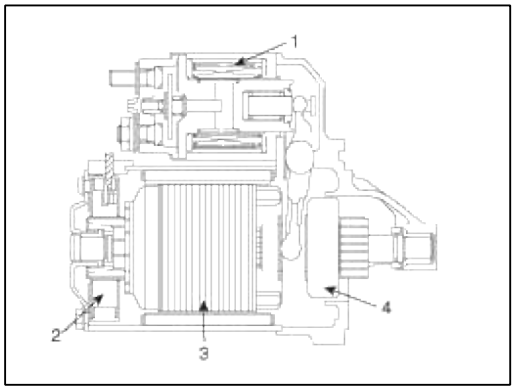
NOTE

After disconnecting then reconnecthing the battery negative cable, reset some parts that require the reset procedures. (Refer to BE group - General Information)

Engine Electrical System > Starting System > Description and Operation

Description

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.
When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.
The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.
The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



1. Solenoid
2. Brush
3. Armature
4, Over running clutch

Engine Electrical System > Starting System > Repair procedures

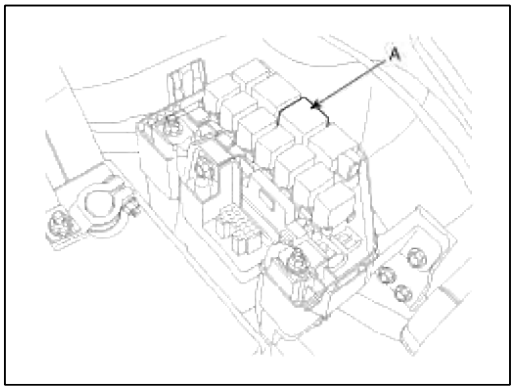
Troubleshooting

Starter Circuit

NOTE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay(A) from the fuse box.

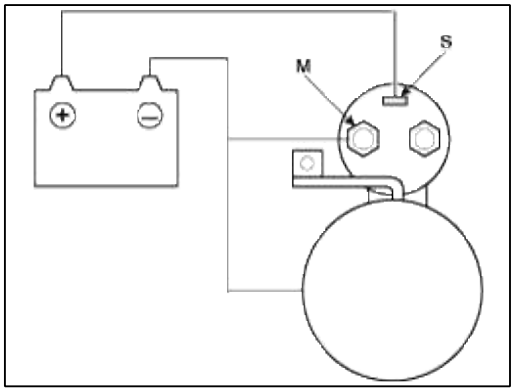


2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START"
   If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.
   If it won't disengage from the ring gear when you release key, check for the following until you find the cause.
   A. Solenoid plunger and switch malfunction.
   B. Dirty pinion gear or damaged overrunning clutch.
3. Check the battery condition. Check electrical connections at the battery, battery negative cable connected to the body, engine ground cables, and the starter for looseness and corrosion. Then try starting the engine again.
   If the starter cranks normally the engine, repairing the loose connection repaired the problem. The starting system is now OK.
   If the starter still does not crank the engine, go to next step.
4. Disconnect the connector from the S-terminal of solenoid. Connect a jumper wire from the B-terminal of solenoid to the S-terminal of solenoid.
   If the starter cranks the engine, go to next step.
   If the starter still does not crank the engine, remove the starter, and repair or replace as necessary.
5. Check the following items in the order listed until you find the open circuit.
   A. Check the wire and connectors between the driver's under-dash fuse/relay box and the ignition switch, and between the driver's under-dash fuse/relay box and the starter.
   B. Check the ignition switch (Refer to BE group - ignition system)
   C. Check the transaxle range switch connector or ignition lock switch connector.
   D. Inspect the starter relay.

Stater Solenoid Test

1. Disconnect the field coil wire from the M-terminal of solenoid switch.
2. Connect the battery (+) line to the S-terminal and (-) line to the M-terminal and the stater body.

> CAUTION
>
> This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

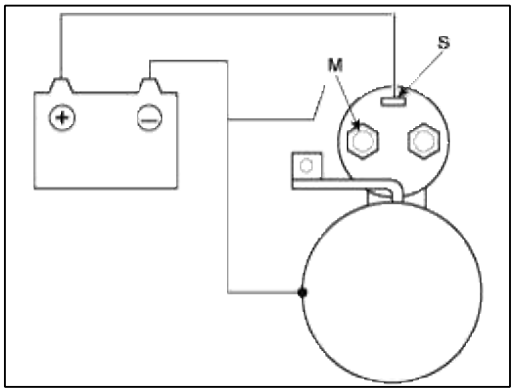


3. Connect the field coil wire to the M-terminal.
4. If the pinion moves out, the pull-in coil of solenoid is working properly.
   If the pinion does not move, replace the magnetic switch.
5. Disconnect the (-) line from the M-terminal.

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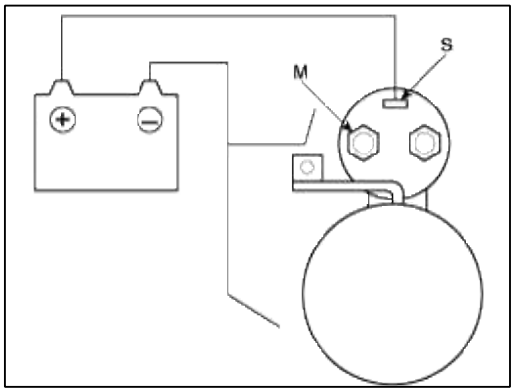
6. If the pinion doesn't have moved, the hold-in coil of the solenoid is working properly.

> CAUTION
>
> This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.



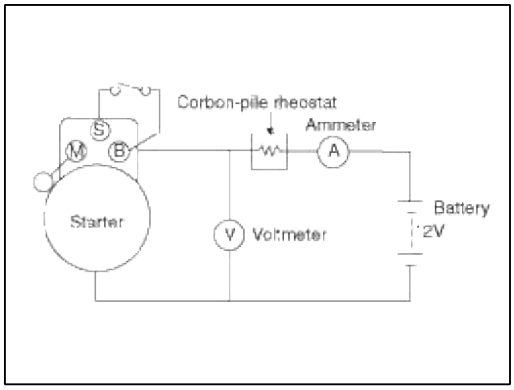
7. If the pinion goes back in its original position when you disconnecting the (-) line from the body, the system must be in good condition.

> CAUTION
>
> This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.



Free Running Test

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostats shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.



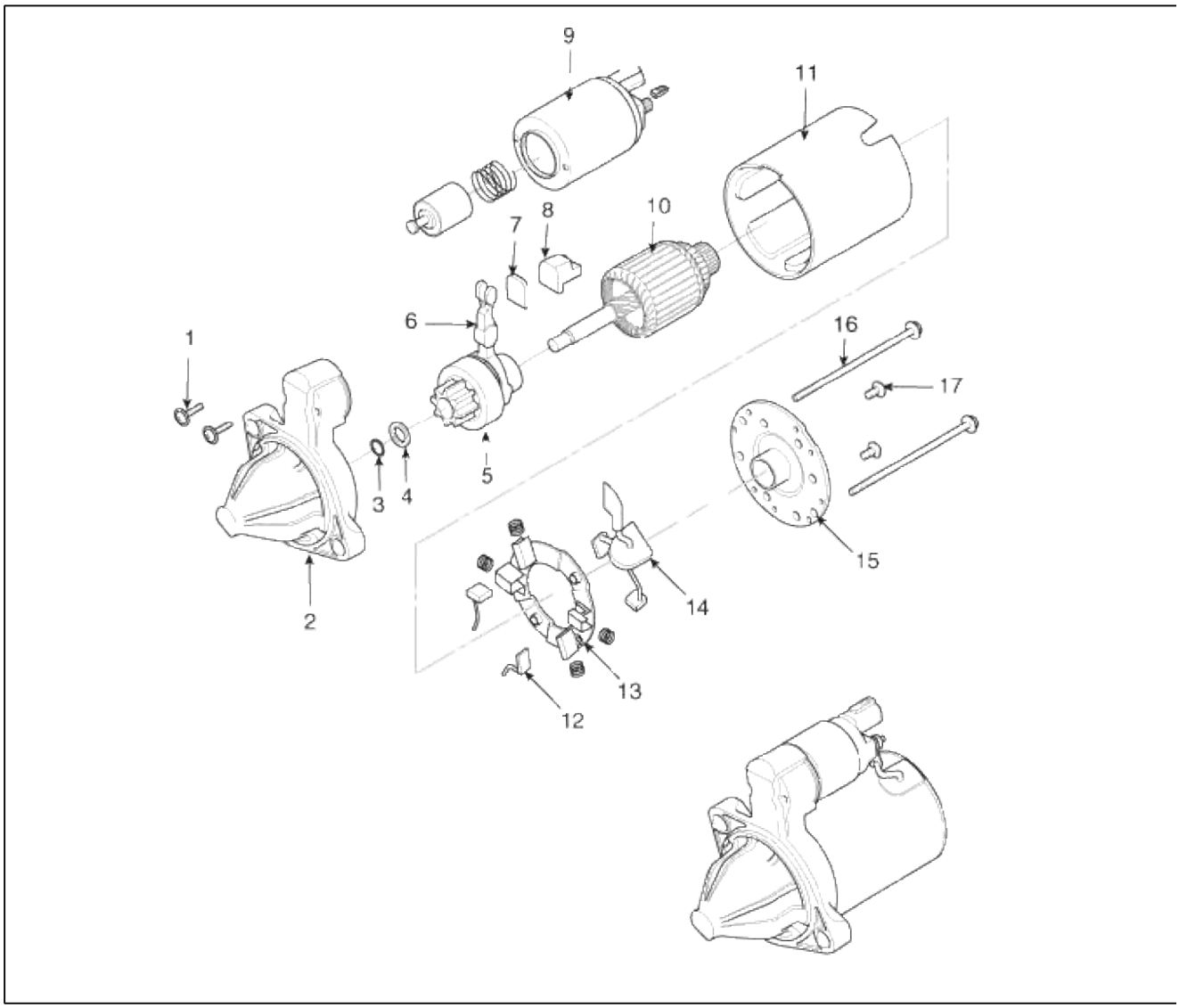
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11volts.

7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Current : 60A MAX
Speed : 5500 rpm. MIN

Engine Electrical System > Starting System > Starter > Components and Components Location

Components



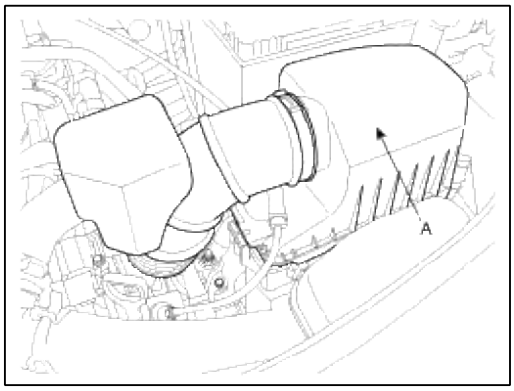
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1. Screw (for solenoid) 2. Front bracket 3. Stop ring 4. Stopper 5. Overrun clutch 6. Lever 7. Lever plate 8. Lever packing 9. Magnet switch	10. Armature 11. Yoke assembly 12. Brush (-) 13. Brush holder assembly 14. Brush (+) 15. Rear bracket 16. Through bolts 17. Screw (for brush holder)

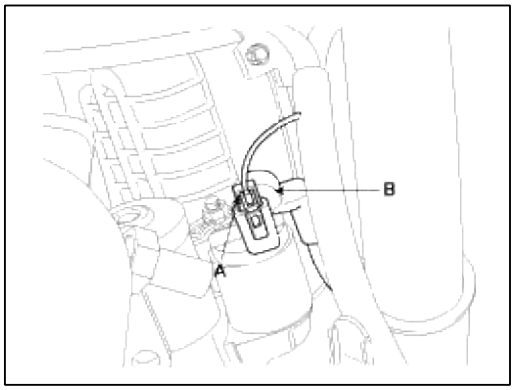
Engine Electrical System > Starting System > Starter > Repair procedures

Replacement

1. Disconnect the battery negative cable.
2. Remove the air cleaner assembly (A).



3. Disconnect the starter cable (B) from the B terminal on the solenoid, then disconnect the connector (A) from the S terminal.



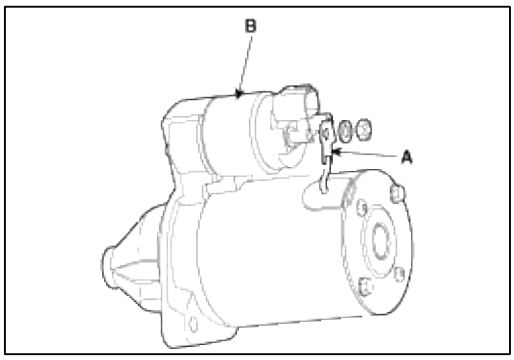
4. Remove the 2 bolts holding the starter, then remove the starter.

Tightening torque :
42.2~53.9 Nm (4.3~5.5 kgf.m, 31.1~39.8 Ib-ft)

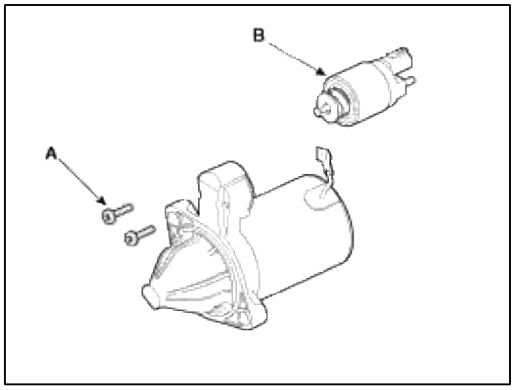
5. Installation is the reverse of removal.
6. Connect the battery negative cable to the battery.

Disassembly

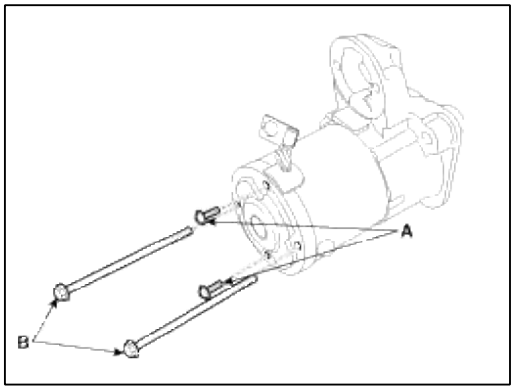
1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



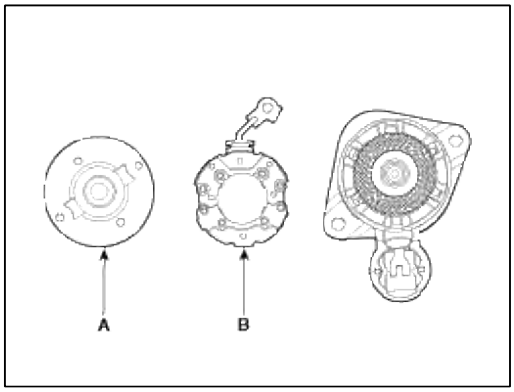
2. After loosening the 2 screws (A), detach the magnet switch assembly (B).



3. Loosen the brush holder mounting screw (A) and through bolts (B).

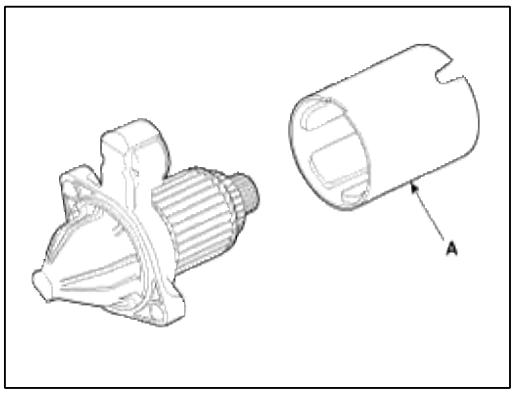


4. Remove the rear bracket (A) and brush holder assembly (B).

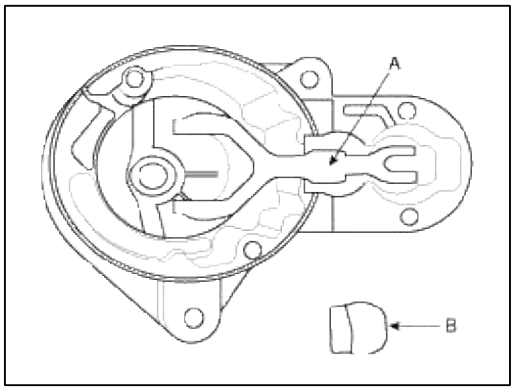


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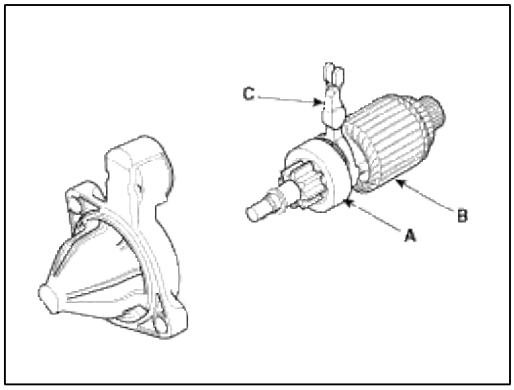
5. Remove the yoke (A).



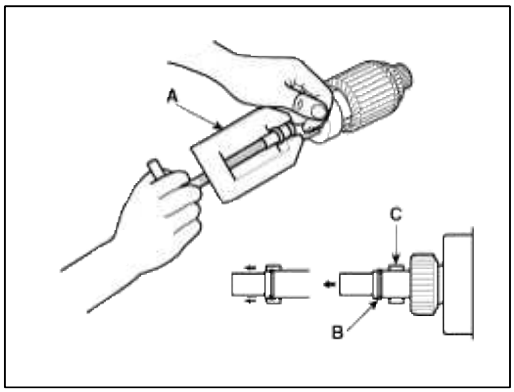
6. Remove the, lever plate (A) and packing (B).



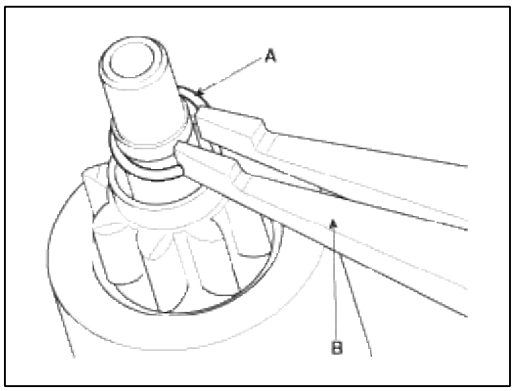
7. Remove the overrunning clutch (A), armature (B) and lever (C).



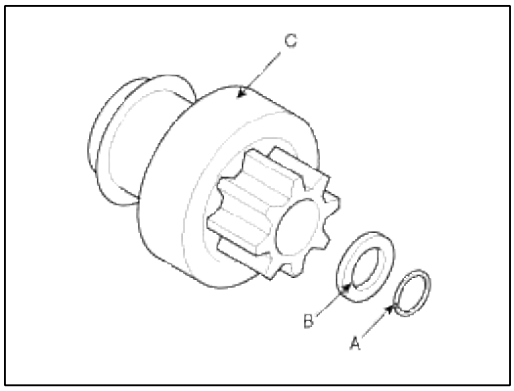
8. Press the stopper (A) using a socket (B).



9. After preparing to remove the stop ring (A) using stopper pliers (B).



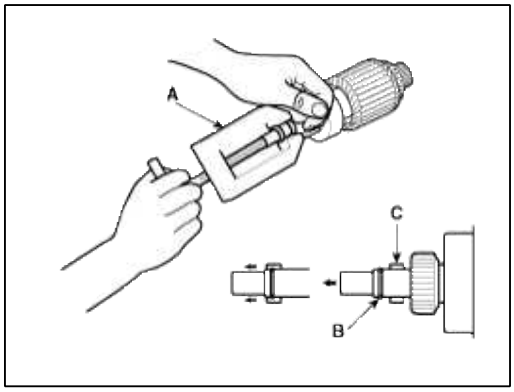
10. Remove the stop ring (A), stopper (B), overrunning clutch (C).



11. Reassembly is the reverse of disassembly.

NOTE

Using a suitable pulling tool (A), pull the stop ring (B) over the stopper (C).



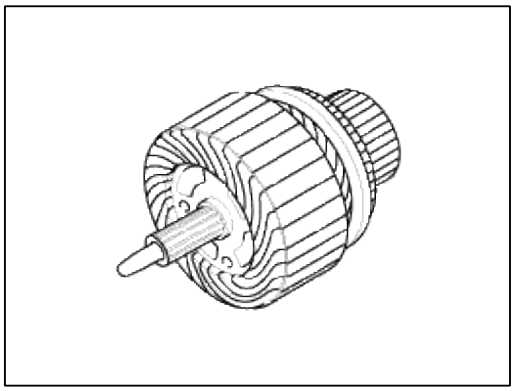
Inspection

Armature Inspection And Test

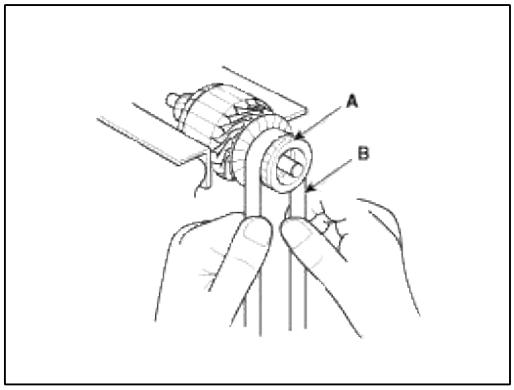
1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.

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3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.

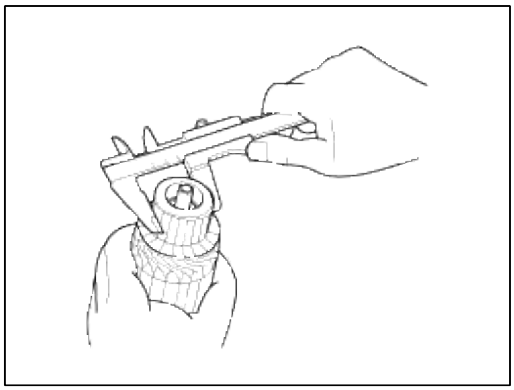


4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



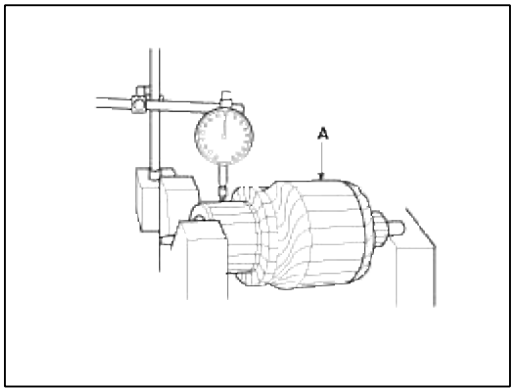
5. Check the commutator diameter. If the diameter is below the service limit, replace the armature.

Commutator diameter
Standard (New) : 32.9 ~ 33.0 mm (1.2953 ~ 1.2992in.)



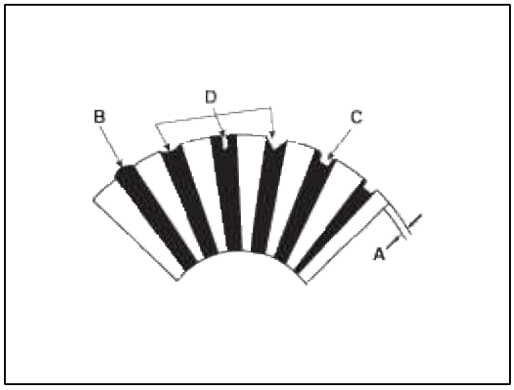
6. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator run out is not within the service limit, replace the armature.

Commutator runout
Standard (New): 0.05mm (0.0020in.) max
Service limit: 0.1mm (0.0039in.)

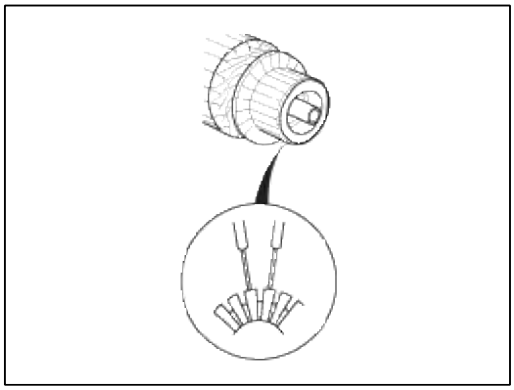


7. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

Commutator mica depth
Standard (New) : 0.5 mm (0.0197 in.)
Service limit : 0.2mm (0.0079 in.)

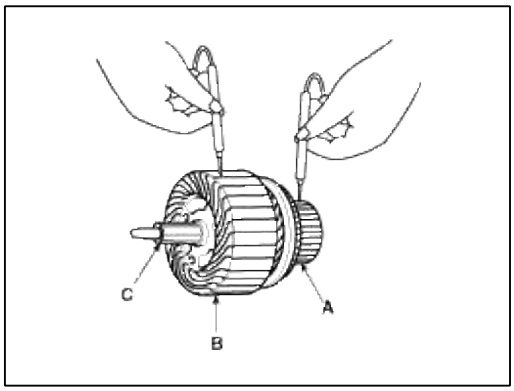


8. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



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9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



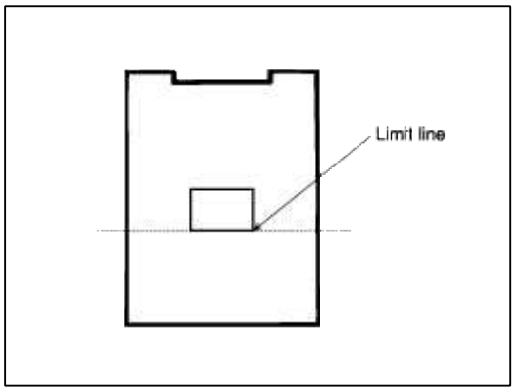
Inspect Starter Brush

Brushes that are worm out, or oil-soaked, should be replaced.

Bruch length

Standard : 12.3 mm (0.4843 in)

Service linit : 5.5 mm (0.2165 in)



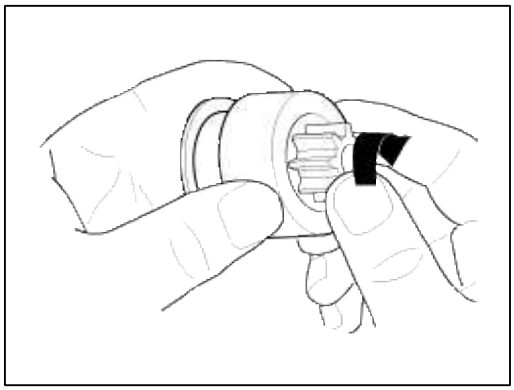
NOTE

To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.

Inspect Overrunning Clutch

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.

2. Rotate the overrunning clutch both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction of it locks in both directions, replace it.



3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

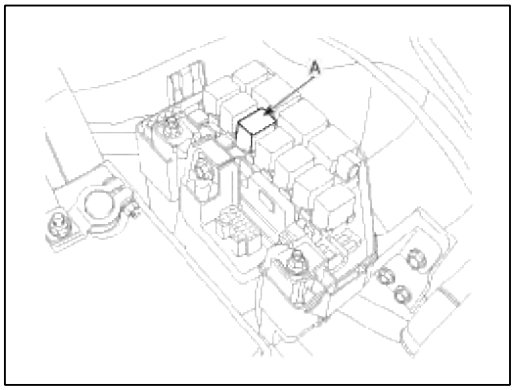
Cleaning

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a cloth or air.
   Any solvent should not be used.

Engine Electrical System > Starting System > Starter Relay > Repair procedures

Inspection

1. Remove the fuse box cover.
2. Remove the starter relay (A).

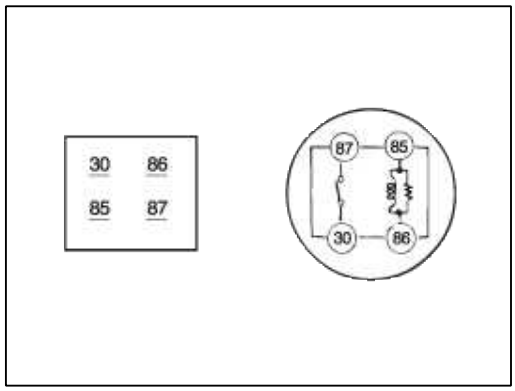


3. Using an ohmmeter, check that there is continuity between each terminal.

Terminal	Continuity
30 - 87	NO
85 - 86	YES

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4. Apply 12V to terminal 85 and ground to terminal 86.
   Check for continuity between terminals 30 and 87.



5. If there is no continuity, replace the starter relay.
6. Install the starter relay.
7. Install the fuse box cover.

SOUL(AM) > 2010 > G 1.6 DOHC > Engine Mechanical System

Engine Mechanical System > General Information > Specifications

Specifications

Description		Specifications	Limit
General			
Type		In-line, DOHC	
Number of cylinders		4	
Bore		77mm (3.0315in)	
Stroke		85.44mm (3.3638in)	
Total displacement		1,591 cc (97.09 cu.in)	
Compression ratio		10.5 : 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens	ATDC 10°/BTDC 40°	
	Closes	ABDC 63°/ABDC 13°	
Exhaust valve	Opens	BBDC 40°	
	Closes	ATDC 3°	
Cylinder head			
Flatness of gasket surface		Less than 0.05mm (0.0020in)	
Camshaft			
Cam height	Intake	43.85mm (1.726in)	
	Exhaust	42.85mm (1.687in)	
Journal outer diameter (Intake, Exhaust)		22.964 ~ 22.980mm (0.9041 ~ 0.9047in)	
Camshaft cap oil clearance		0.027 ~ 0.058mm (0.0011 ~ 0.0023in)	0.1mm (0.0039in)
End play		0.10 ~ 0.20mm (0.0039 ~ 0.0079in)	
Valve			
Valve length	Intake	93.15mm (3.6673in)	
	Exhaust	92.6mm (3.6457in)	
Stem outer diameter	Intake	5.465 ~ 5.480mm (0.2152 ~ 0.2157in)	
	Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2154in)	
Face angle		45.25° ~ 45.75°	

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Thickness of valve head (margin)	Intake	1.1mm (0.0433in)	0.8mm (0.0315in)
	Exhaust	1.26mm (0.0496in)	1.0mm (0.0394in)
Valve stem to valve guide clearance	Intake	0.020 ~ 0.047mm (0.0008 ~ 0.0019in)	0.10mm (0.0039in)
	Exhaust	0.030 ~ 0.054mm (0.0012 ~ 0.0021in)	0.15mm (0.0059in)
Valve guide			
Length	Intake	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
	Exhaust	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
Valve spring			
Free length		44.0mm (1.7323in)	
Out of squareness		Less than 1.5°	
Cylinder block			
Cylinder bore		77.00 ~ 77.03mm (3.0315 ~ 3.0327in)	
Flatness of gasket surface		Less than 0.05mm (0.0020in) / Less than 0.02mm (0.0008in) 100mm×100mm	
Piston			
Piston outer diameter		76.97 ~ 77.00mm (3.0303 ~ 3.0315in)	
Piston to cylinder clearance		0.020 ~ 0.040mm (0.0008 ~ 0.0016in)	
Ring groove width	No. 1 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in)	1.26mm (0.0496in)
	No. 2 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in)	1.26mm (0.0496in)
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in)	2.05mm (0.0807in)
Piston ring			
Side clearance	No.1 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0028in)	0.1 mm (0.0039in)
	No.2 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0028in)	0.1 mm (0.0039in)
	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in)	0.2 mm (0.0079in)
End gap	No. 1 ring	0.14 ~ 0.28mm (0.0055 ~	0.30mm (0.0118in)

		0.0110in)	
	No. 2 ring	0.30 ~ 0.45mm (0.0118 ~ 0.0177in)	0.50mm (0.0197in)
	Oil ring	0.20 ~ 0.70mm (0.0079 ~ 0.0276in)	0.80mm (0.0315in)
Piston pin			
Piston pin outer diameter		18.001 ~ 18.006mm (0.7087 ~ 0.7089in)	
Piston pin hole inner diameter		18.016 ~ 18.021mm (0.7093 ~ 0.7095in)	
Piston pin hole clearance		0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end hole inner diameter		17.974 ~ 17.985mm (0.7076 ~ 0.7081in)	
Piston pin press-in load		500~1,500 kg (1,102 ~ 3,306 lb)	
Connecting rod			
Connecting rod big end inner diameter		45.000 ~ 45.018mm (1.7717 ~ 1.7724in)	
Connecting rod bearing oil clearance		0.018 ~ 0.036mm (0.0007 ~ 0.0014in)	0.060mm (0.0024in)
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)	0.35m (0.0138in)
Crankshaft			
Main bearing oil clearance	No. 1, 2, 3, 4, 5	0.006 ~ 0.024mm (0.0002 ~ 0.0009in)	0.05mm (0.0020in)
End play		0.05 ~ 0.25mm (0.0020 ~ 0.0098in)	0.3mm (0.0118in)
Engine oil			
Oil quantity	Total	3.7L (3.91US qt, 3.26lmp qt)	When replacing a short engine or a block assembly
	Oil pan	3.0L (3.17US qt, 2.64lmp qt)	
	Drain and refill	3.3L (3.49US qt, 2.90lmp qt)	Including oil filter
Oil quality	Recommendation	5W-20/GF4&SM	If not available, refer to the recommended API or ILSAC classification and SAE viscosity number.
	Classification	API SL, SM or above ILSAC GF3, GF4 or above	Satisfy the requirement of the API or ILSAC classification.

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	SAE viscosity grade	Recommended SAE viscosity number	Refer to the "Lubrication System"
Oil pressure (at 1000rpm)		100kPa (1.0kg/cm², 14.5psi) or above	Oil temperature in oil pan : 110±2°C (230± 36°F)
Cooling system			
Cooling method		Forced circulation with water pump	
Coolant quantity		6.5L (6.86US qt., 5.71lmp qt.)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82 ± 1.5°C (179.6 ± 2.7°F)	
	Full opening temperature	95°C (203°F)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kgf/cm², 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	MAX. 6.86 kpa(0.07kgf/cm², 1.00 psi)	
Water temperature sensor			
Type		Thermister type	
Resistance	20°C (68°F)	2.45±0.14 kΩ	
	80°C (176°F)	0.3222 kΩ	

Tightening Torques

Item	Quantity	N.m	kgf.m	lb-ft
Cylinder block				
Engine support bracket bolts (engine side)	4	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Ladder frame bolts	13	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Connecting rod cap bolt	8	(17.7~21.6) + (88~92°)	(1.8~2.2) + (88~92°)	(13.0~15.9) + (88~92°)
Crankshaft main bearing cap bolt	10	(17.7~21.6) + (88~92°)	(1.8~2.2) + (88~92°)	(13.0~15.9) + (88~92°)
Flywheel bolts(M/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Drive plate bolts(A/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Timing chain system				
Timing chain and oil pump assembly cover bolt(M6×20)	10	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt(M6×38)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7

Timing chain and oil pump assembly cover bolt(M8×22)	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Idler pulley assemlby bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Timing chain tensioner arm bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft pully bolt	1	127.5 ~ 137.3	13.0 ~ 14.0	94.0 ~ 101.3
Timing chain tensioner bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cylinder head				
Engine cover bolt	4	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Cylinder head cover bolt	16	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Camshaft bearing cap bolt(M6)	16	11.8 ~ 13.7	1.2 ~ 1.4	8.7 ~ 10.1
Camshaft bearing cap bolt(M8)	4	18.6 ~ 22.6	1.9 ~ 2.3	13.7 ~ 16.6
Cylinder head bolt	10	(17.7~21.6) + (90~95°) + (100~105°)	(1.8~2.2) + (90~95°) + (100~105°)	(13.0~15.9) + (90~95°) + (100~105°)
Cooling system				
Water pump pulley bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water temperature control assembly mounting bolts	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water inlet fitting nut	2	18.6 ~ 23.5	1.9~ 2.4	13.7 ~ 17.4
Heater pipe mounting bolts/Nuts(M6)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Heater pipe mounting bolt(M8)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Engine coolant temperature sensor(ECTS)	1	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Oil pan bolt	11	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Oil screen bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pressure switch	1	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil level gauge assembly mounting bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Intake and exhaust system				
Intake manifold and cylinder head mounting nut	5	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold and cylinder head mounting nut	9	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Oxygen sensor mounting	2	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Exhaust manifold heat cover	6	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9

Exhaust manifold and cylinder block, ladder frame mounting bolts	4	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Air cleaner lower cover mounting	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Exhaust manifold and catalytic convertor mounting nut	2	43.1 ~ 45.1	4.4 ~ 4.6	31.8 ~ 33.3
Center muffler and main muffler mounting nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Exhaust manifold stay mounting bolts	3	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4

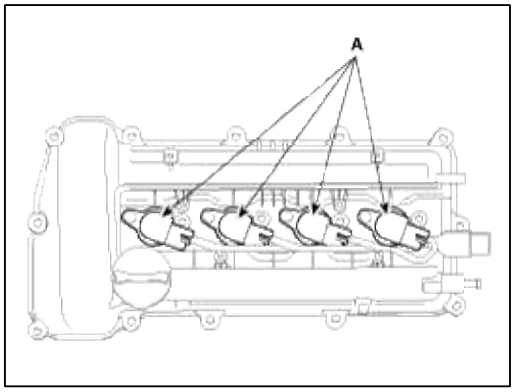
Engine Mechanical System > General Information > Repair procedures

Compession Pressure Inspection

NOTE

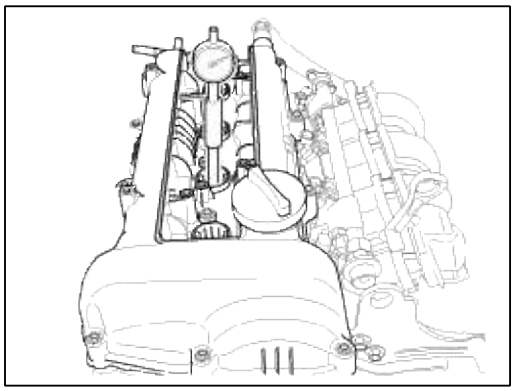
If the there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position.
2. Remove the engine center cover.
3. Remove the ignition coil (A).



4. Remove the spark plugs.
   Using a 16mm plug wrench, remove the 4 spark plugs.

5. Check the cylinder compression pressure.
   (1) Insert a compression gauge into the spark plug hole.



   (2) Set the throttle plate in the wide-open position.
   (3) While cranking the engine, measure the compression pressure.

> NOTE
>
> Always use a fully charged battery to obtain engine speed of 250rpm or more.

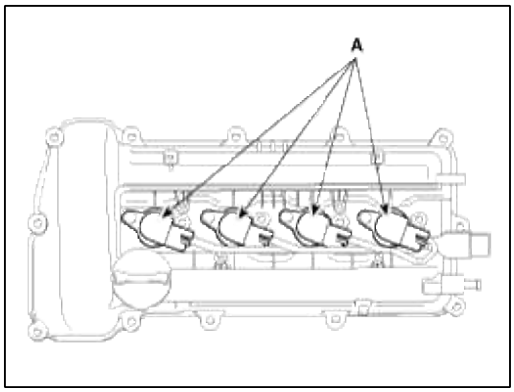
   (4) Repeat step 1) through 3) for each cylinder.

> NOTE
>
> This measurement must be done in as short time as possible.

Compression pressure
Standard : 1225.83kPa (12.5kg/cm², 177.79psi) (200~250 rpm)
Minimum : 1078.73kPa (11.0kg/cm², 156.46psi)
Difference between each cylinder :
98kPa (1.0kg/cm², 14psi) or less

   (5) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat step 1) through 3) for cylinders with low compression.
      A. If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
      B. If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

6. Install the spark plugs.
7. Install the ignition coil(A).



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8. Install the engine center cover.

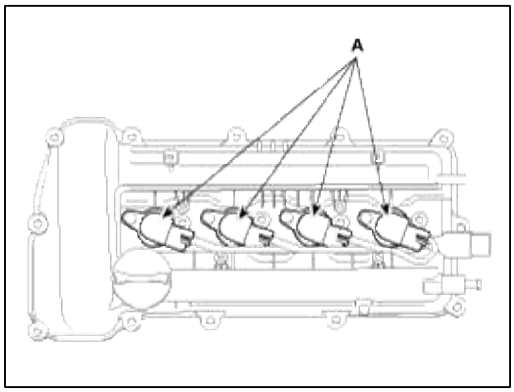
Tightening torque :
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)

Valve Clearance Inspection And Adjustment

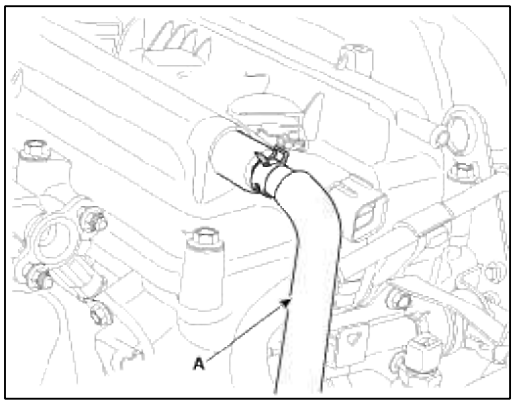
NOTE

Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C) and cylinder head is installed on the cylinder block.

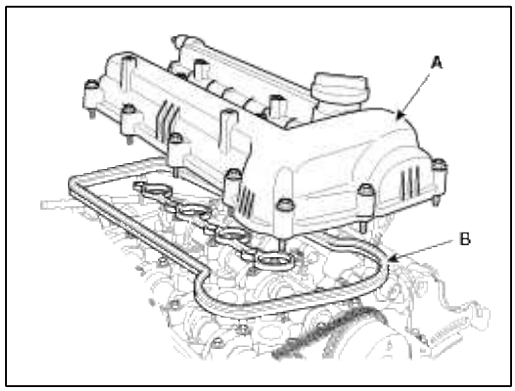
1. Remove the engine center cover.
2. Remove the cylinder head cover.
   (1) Disconnect the ignition coil (A).



   (2) Disconnect the P.C.V hose(A).



(3) Loosen the cylinder head cover bolts and then remove the cover(A).

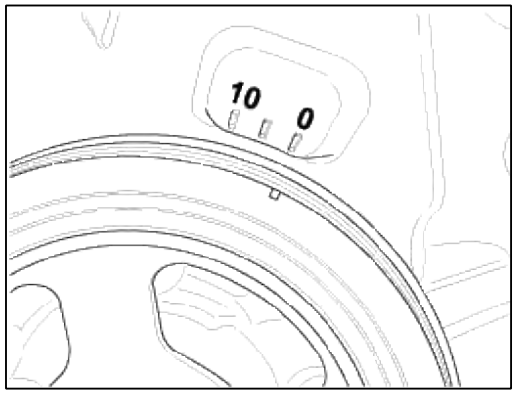


CAUTION

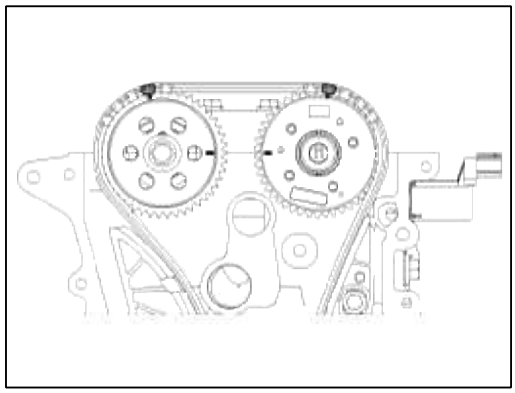
Do not reuse the disassembled gasket.

3. Set No.1 cylinder to TDC/compression.

(1) Turn the crankshaft pulley and align its groove with the timing mark of the timing chain cover.

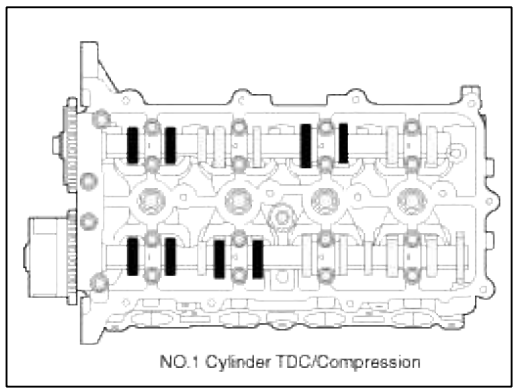


(2) Check that the marks of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft one revolution (360°).



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4. Inspect the valve clearance.
   (1) Check only the intake valves of the 1st and 2nd cylinders and exhaust valves of the 1st and 3rd cylinders for their clearance.
      A. Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.

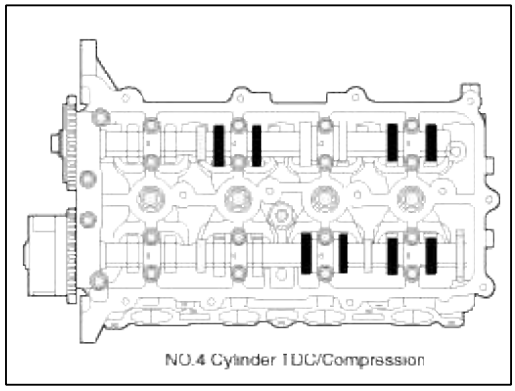


      B. Record the out-of-specification valve clearance measurements. They will be used later to determine the required tappet for adjusting.

Valve clearance specification (Engine coolant temperature : 20°C [68°F])
Limit
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0091in.)
Exhaust : 0.22 ~ 0.28mm (0.0087 ~ 0.0110in.)

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   (2) Turn the crankshaft pulley one revolution (clockwise 360°) and align its groove with timing mark of the timing chain cover.
   (3) Check the intake valves of the 3rd and 4th cylinders and exhaust valves of the 2nd and 4th cylinders for their clearance.



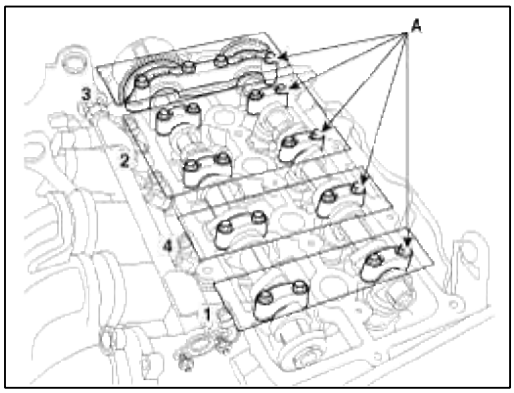
5. Adjust the intake and exhaust valve clearance.
   (1) Set the No.1 cylinder to the TDC/compression position.
   (2) Put paint marks on the timing chain links (2 places) that meet with the timing marks of the intake, exhaust camshaft sprockets.
   (3) Remove the exhaust camshaft sprocket bolt.
   (4) Remove the service hole bolt of the timing chain cover.

> CAUTION
>
> The bolt must not be reused once it has been assembled.

   (5) Insert a thin rod in the service hole of the timing chain cover and release the ratchet.

(6) Remove the exhaust camshaft sprocket.

(7) Remove the camshaft bearing caps(A) with the order below.



(8) Remove the exhaust camshaft.

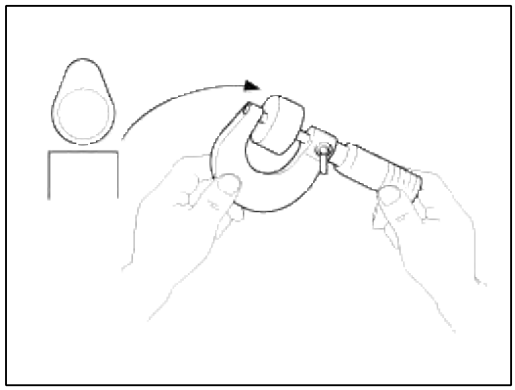
(9) Remove the intake camshaft and CVVT module.

> CAUTION
>
> When disconnecting the timing chain from the camshaft timing sprocket, hold the timing chain.

(10) Tie a timing chain with a string.

> CAUTION
>
> Be careful not to drop anything inside timing chain cover.

(11) Measure the thickness of the removed tappet using a micrometer.



(12) Calculate the thickness of a new tappet so that the valve clearance comes within the specificified value.

Valve clearance (Engine coolant temperature : 20°C)
T : Thickness of removed tappet
A : Measured valve clearance
N : Thickness of new tappet
Intake : N = T + [A - 0.20mm(0.0079in.)]
Exhaust : N = T + [A-0.25mm (0.0098in.)]

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(13) Select a new tappet with a thickness as close as possible to the caculated value.

NOTE

Shims are available in 41size increments of 0.015mm (0.0006in.) from 3.00mm (0.118in.) to 3.600mm (0.1417in.)

(14) Place a new tappet on the cylinder head.

(15) Hold the timing chain, and place the intake camshaft and CVVT module assembly.

(16) Align the matchmarks on the timing chain and camshaft timing sprocket.

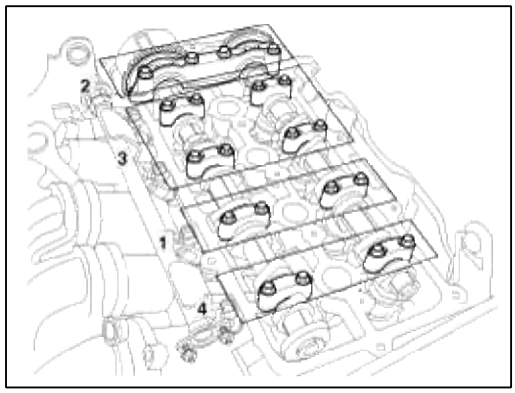
(17) Install the exhaust camshaft.

(18) Install the exhaust camshaft sprocket.

Tightening torque :
63.7 ~ 73.5N.m (6.5 ~ 7.5kgf.m, 47.0 ~ 54.2lb-ft)

(19) Install the camshaft bearing caps with the order below.

Tightening torque :
M6 bolts :
11.8 ~ 13.7N.m (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)
M8 bolts :
18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



(20) Install the service hole bolt.

Tightening torque :
11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lb-ft)

(21) Turn the crankshaft two turns in the operating direction(clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks.

(22) Recheck the valve clearance.

Valve clearance (Engine coolant temperature : 20°C)
[Specification]
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0091in.)
Exhaust : 0.22 ~ 0.28mm (0.0087 ~ 0.0110in.)

Engine Mechanical System > General Information > Troubleshooting

Troubleshooting

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression . Repair or replace as required.
	Worn crankshaft thrust bearings.	Replace the crankshaft and bearings as required.
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem can cause the valve not to close properly.)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and MLA.
Engine misfire with coolant consumption.	• Faulty cylinder head gasket and/or cracking or other damage to the cylinder head and engine block cooling system. • Coolant consumption may or may not cause the engine to overheat.	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. • Repair or replace as required.
Engine misfire with excessive oil consumption.	Worn valves, valve guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	Inspection the cylinder for a loss of compression. Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity.	Drain the oil. Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	Inspect the thrust bearing and crankshaft. Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	Inspect the camshaft lobes. Replace the camshaft and valve lifters as required.

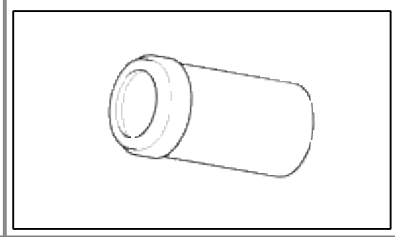
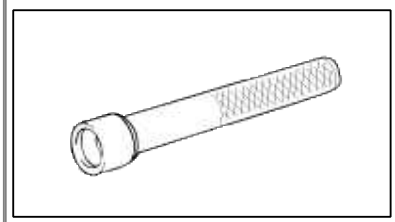
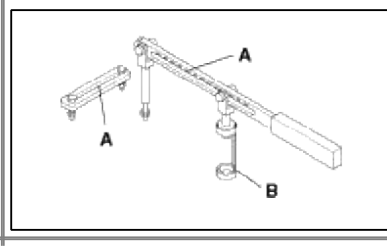
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	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.)	Inspect the valves and valve guides, then repair as required.
Lower engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace damaged components as required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	Inspect the oil pan. Inspect the oil pump screen. Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	Inspect the oil pump screen. Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	Inspect the piston and cylinder bore. Repair as required.
	Excessive piston pin-to-bore clearance.	Inspect the piston, piston pin and the connecting rod. Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation.	Verify the piston pins and connecting rods are installed correctly. Repair as required.
Engine noise under load.	Low oil pressure.	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals. • The cylinder block crankshaft bearing bore.
Engine will not crank.		Remove spark plugs and check for fluid.

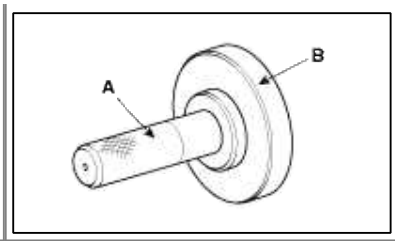
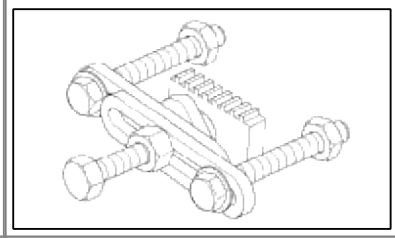
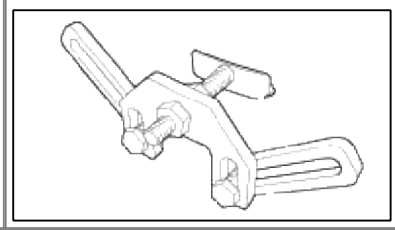
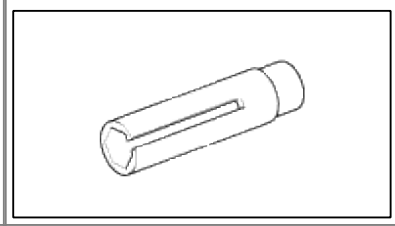
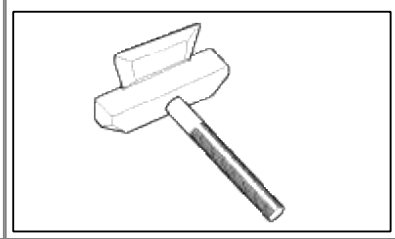
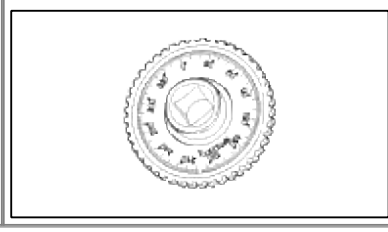
(crankshaft will not rotate)	Hydraulically locked cylinder. • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder.	Inspect for broken head gasket. Inspect for cracked engine block or cylinder head. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain gears.	Inspect timing chain and gears. Repair as required.
	Foreign material in cylinder. • Broken valve. • Piston material. • Foreign material.	Inspect cylinder for damaged components and/or foreign materials. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair or replace as required.
	Bent or broken connecting rod.	Inspect connecting rods. Repair or replace as required.
	Broken crankshaft.	Inspect crankshaft. Repair or replace as required.

Engine Mechanical System > General Information > Special Service Tools

Special Service Tools

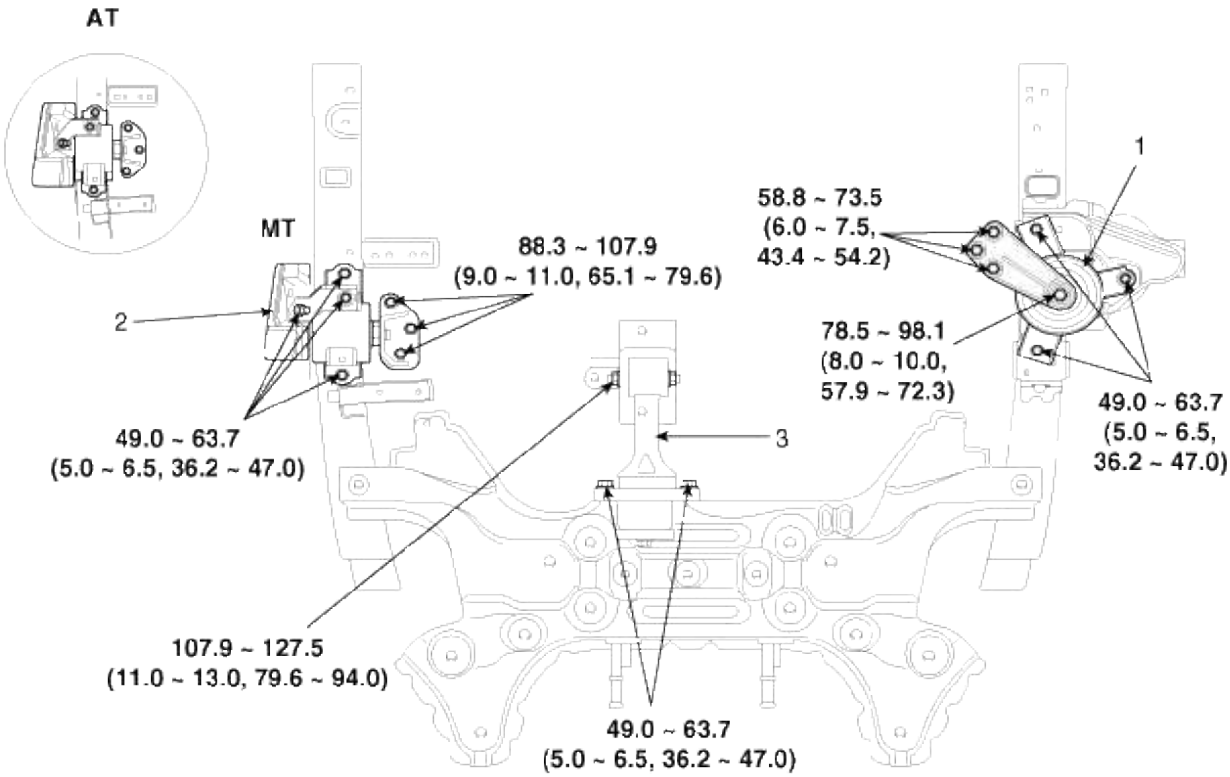
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09455-21200)		Installation of the front oil seal
Valve stem oil seal installer (09222-2B100)		Installation of the valve stem oil seal
Valve spring compressor and holder A : (09222-3K000) B : (09222-3K100)		Removal and installation of the intake or exhaust valve

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Crankshaft rear oil seal installer A : (09231-H1100) B : (09231-2B200)		Installation of the crankshaft rear oil seal
Ring gear stoppper (09231-2B100)		Removal and installation of crankshaft pulley bolt.
Ring gear stopper (09231-3D100)		Removal and installation of crankshaft pulley bolt.
Engine coolant temperature sensor socket wrench (09221-25100)		Removal and installation of engine coolant sensor
Oil pan remover (09215-3C000)		Removal of oil pan
Torque angle adapter (09221-4A000)		Installation of bolts & nuts needing an angular method

Engine Mechanical System > Engine And Transaxle Assembly > Engine Mounting > Components and Components Location

Components



Torque : N.m (kgf.m, lb-ft)

1. Engine mounting bracket 2. Transaxle mounting bracket	3. Rear roll stopper

Engine Mechanical System > Engine And Transaxle Assembly > Engine And Transaxle Assembly > Repair procedures

Removal

CAUTION

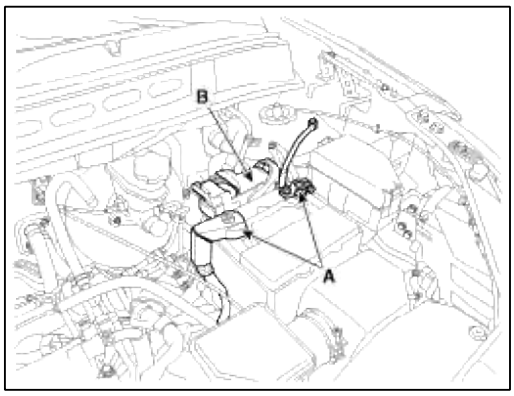
- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE

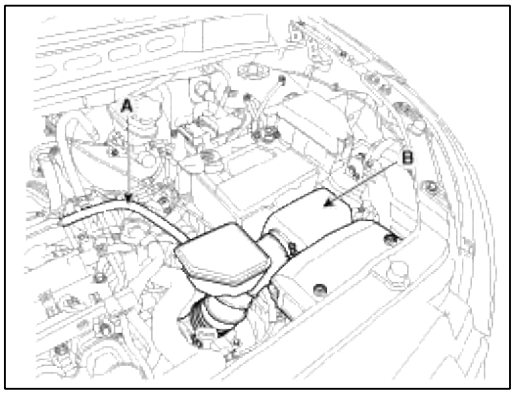
Mark all wiring and hoses to avoid misconnection.

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1. Disconnect the battery terminal (A) and ECM connector (B).

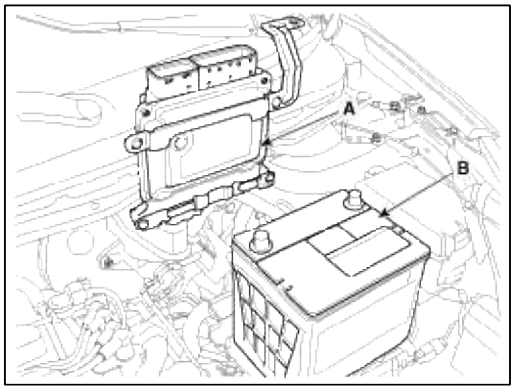


2. Disconnect the breather hose (A) and then, remove the air cleaner assembly (B).



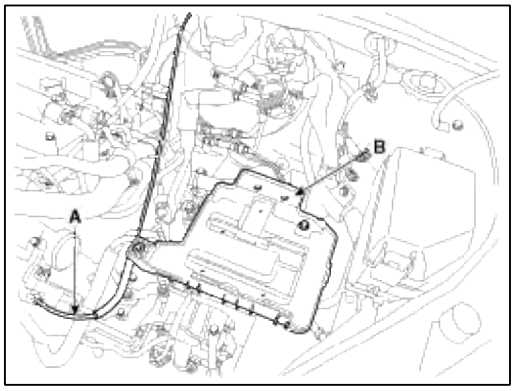
3. Remove the ECM (Engine Control Module) (A) and the battery (B).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

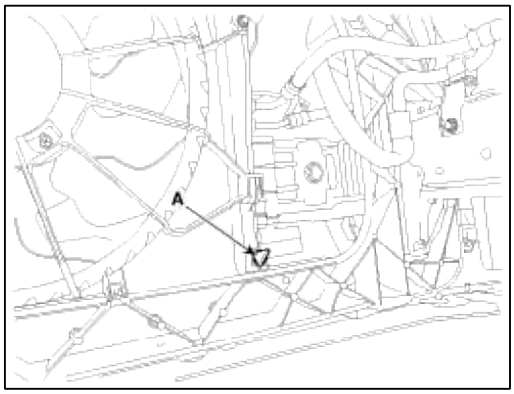


4. Disconnect the throttle cable (A) and then, remove the battery tray (B).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



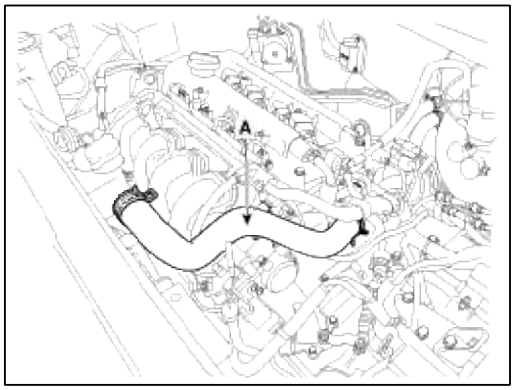
5. Loosen the drain plug (A), and drain the coolant.



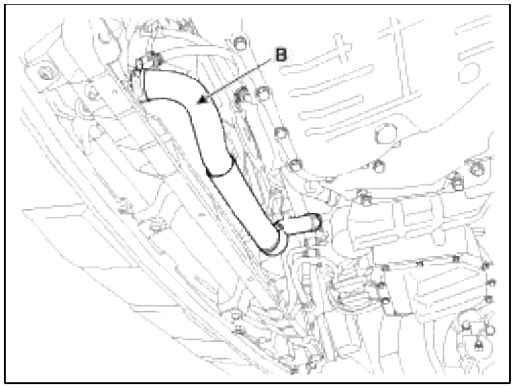
NOTE

Remove the radiator cap to speed draining.

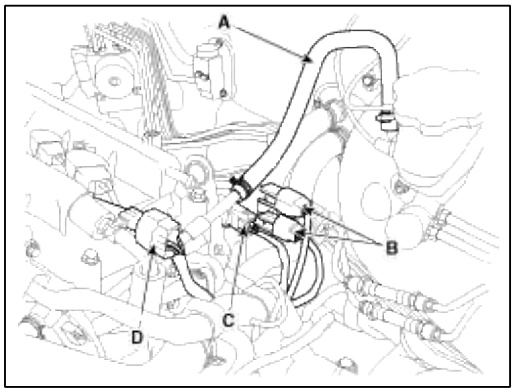
6. Recover the refrigerant and remove the high & low pressure pipe. (Refer to Air conditioning system in HA Group.)
7. Remove the radiator upper hose (A) and lower hose (B).



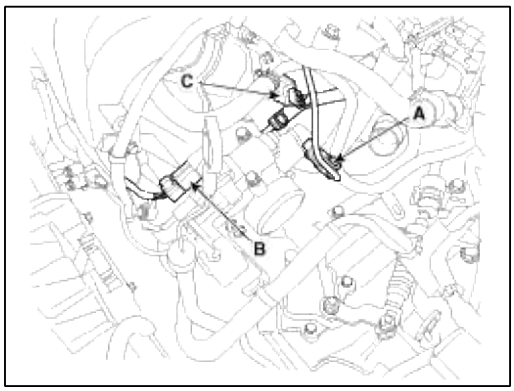
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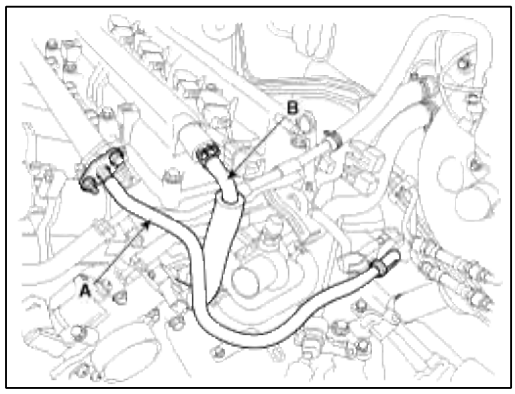
8. Disconnect the wiring connectors, harness clamps and hoses from the engine.
   (1) Disconnect the brake booster vacuum hose (A).
   (2) Disconnect the oxygen sensor connectors (B).
   (3) Disconnect the condenser connector (C).
   (4) Disconnect the ignition coil connector (D).
   (5) Disconnect the ECT (Engine Coolant Temperature) sensor connector.
   (6) Disconnect the PCSV (Purge Control Solenoid Valve) connector and the PCSV hose.



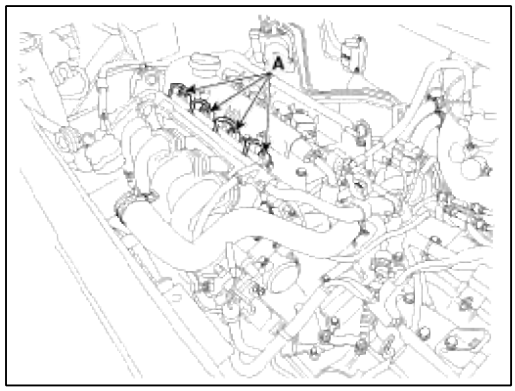
   (7) Disconnect the TPS (Throttle Position Sensor) connector (A).
   (8) Disconnect the ISA (Idle Speed Actuator) connector (B).
   (9) Disconnect the CMP (Camshaft position sensor) connector (C).



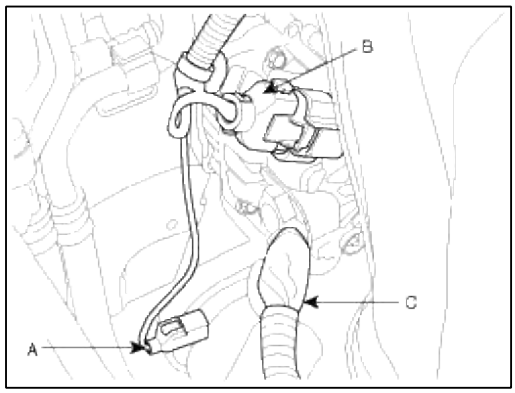
(10) Disconnect the fuel hose (A) and the PCV hose (B).



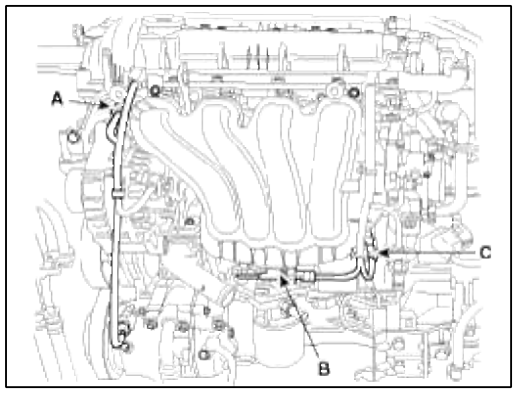
(11) Disconnect the injector connectors (A).



(12) Disconnect the compressor connector (A), the alternator connector (B) and the 'B' terminal cable (C).

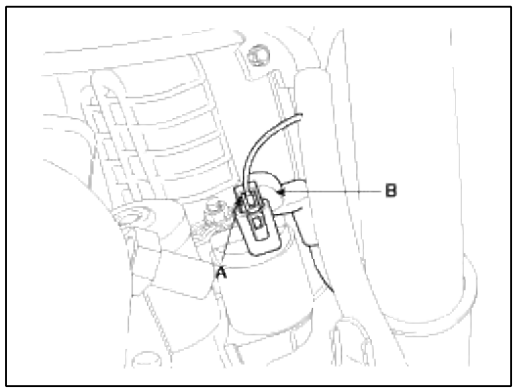


(13) Disconnect the OCV connector (A), the knock sensor connector (B) and the MAP sensor connector (C).



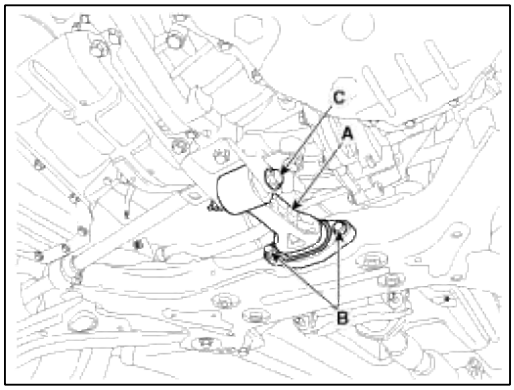
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(14) Disconnect the starter connector (A) and the 'B' terminal cable (B).



9. Remove the transaxle wire harness connectors and control cable from the transaxle. (Refer to AT or MT group).
10. Remove the drive shafts. (Refer to Drive shaft In DS group)
11. Remove the stabilizer bar link. (Refer to SS group)
12. Remove the rear roll stopper (A).

Tightening torque :
Bolts (B) :
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.1 ~ 47.0lb-ft)
Bolt (C) :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

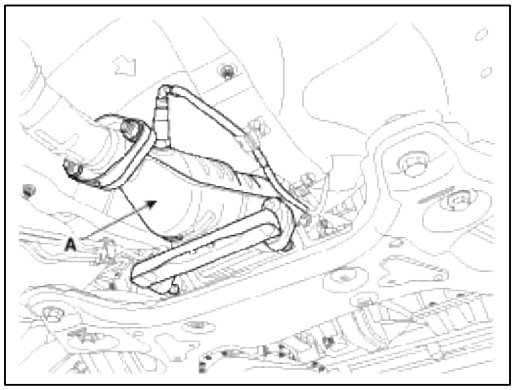


NOTE

Mark the rear roll stopper direction for proper installation.

13. Remove the front muffler (A).

Tightening torque :
39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)



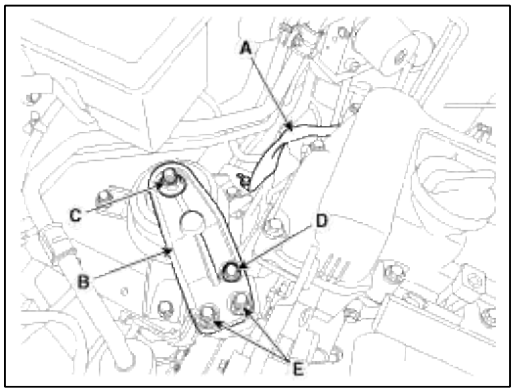
14. Using a floor jack, support the engine and transaxle assembly.

WARNING

- After removing the mounting bolt (engine and transaxle), the engine and transaxle assembly may fall downward, and so support them securely with floor jack.
- Verify that the hoses and connectors are disconnected before removing the engine and transaxle assembly.

15. Disconnect the ground cable (A) and then, remove the engine mounting bracket (B).

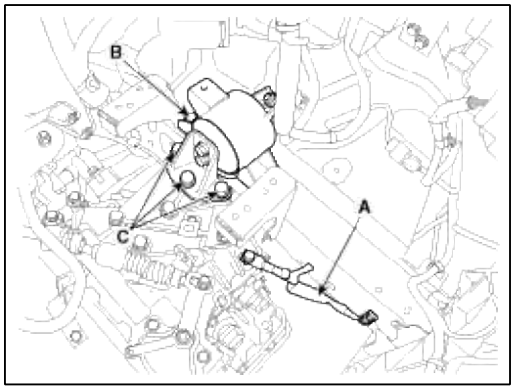
Tightening torque :
Nut (C) :
78.5 ~ 98.1 N.m (8.0 ~ 10.0 kgf.m, 57.9 ~ 72.3 lb-ft)
Bolt (D) & Nuts (E) :
58.8 ~ 73.5 N.m (6.0 ~ 7.5 kgf.m, 43.4 ~ 54.2 lb-ft)



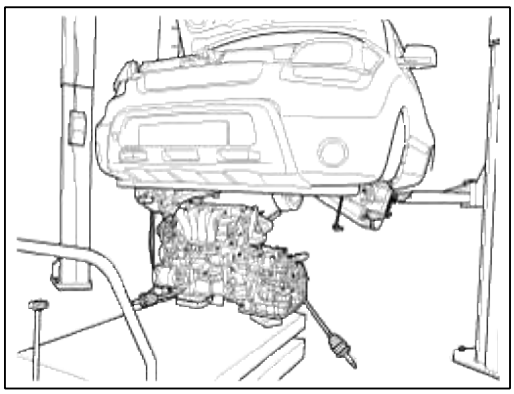
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16. Disconnect the ground cable (A) and then, remove the transaxle mounting bracket (B).

Tightening torque :
Bolts (C) :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



17. Remove the engine and transaxle assembly by lifting vehicle.



CAUTION

When remove the engine and transaxle assembly, be careful not to damage any surrounding parts or body components.

Installation

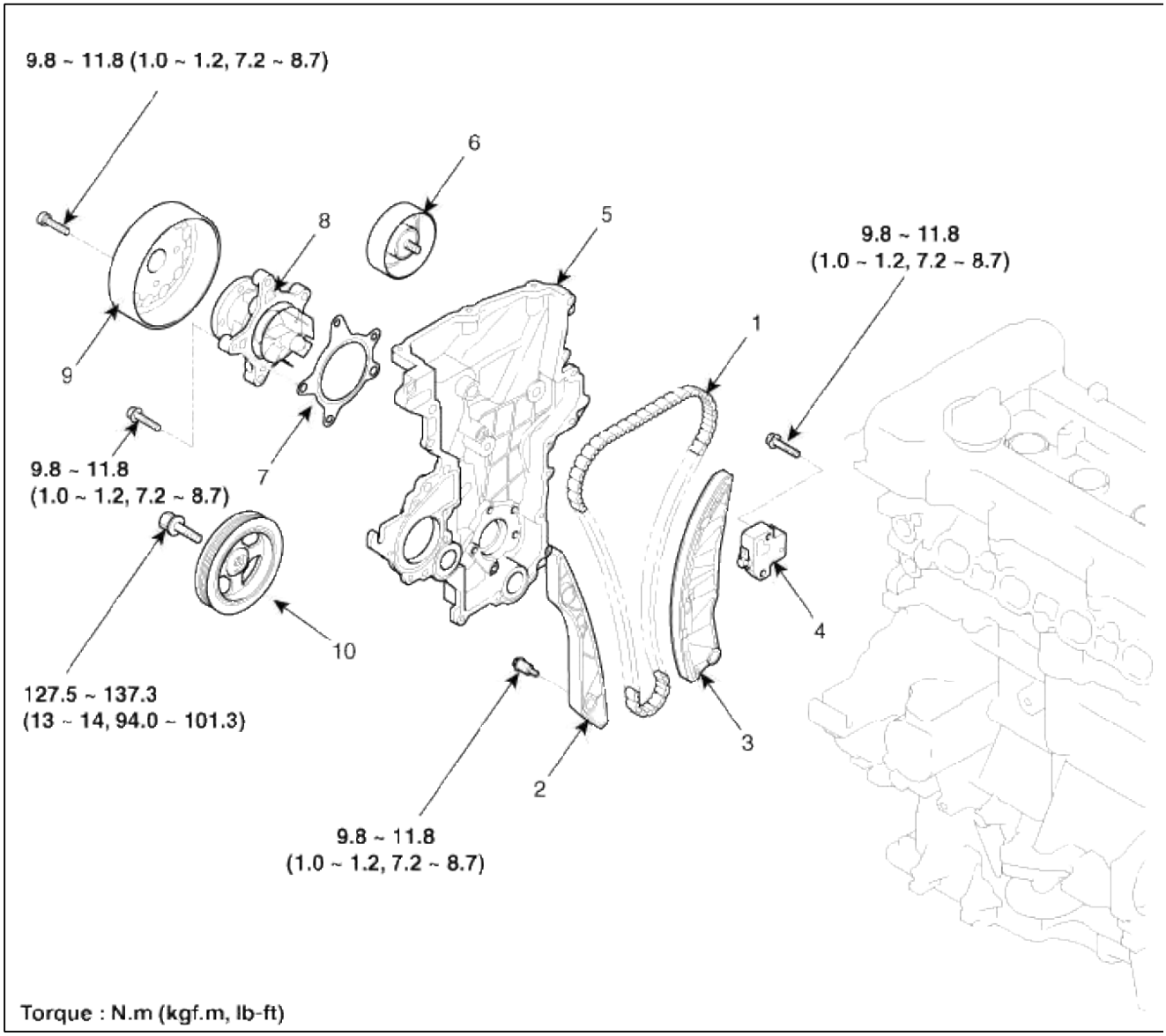
Installation is in the reverse order of removal.
Perform the following :

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator and reservoir tank with engine coolant.
- Bleed air from the cooling system
  - Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
  - Turn Off engine. Check the coolant level and add coolant if needed. This will allow trapped air to be removed from the cooling system.
  - Put the radiator cap on tightly, then run engine again and check for leaks.
- Clean the battery posts and cable terminals with sandpaper, assemble them and then apply grease to prevent corrosion.
- Inspect for fuel leakage.

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

Engine Mechanical System > Timing System > Timing Chain > Components and Components Location

Components



1. Timing chain	6. Drive belt idler
2. Timing chain guide	7. Water pump gasket
3. Timing chain arm	8. Water pump
4. Timing chain auto tensionr	9. Water pump pulley
5. Timing chain cover	10. Crank shaft pulley

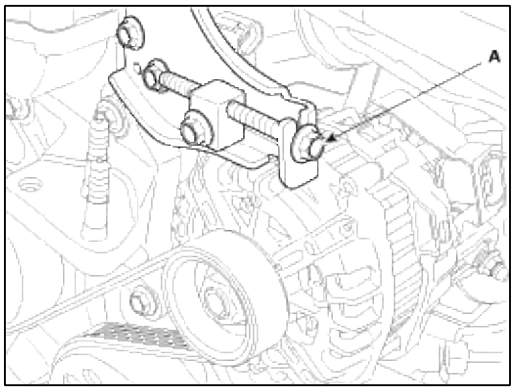
Engine Mechanical System > Timing System > Timing Chain > Repair procedures

Removal

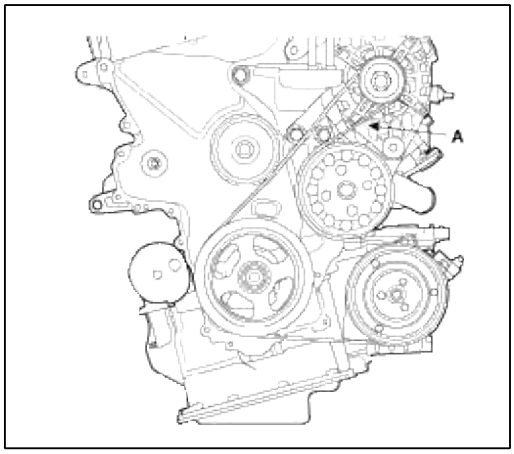
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Engine removal is not required for this procedure.

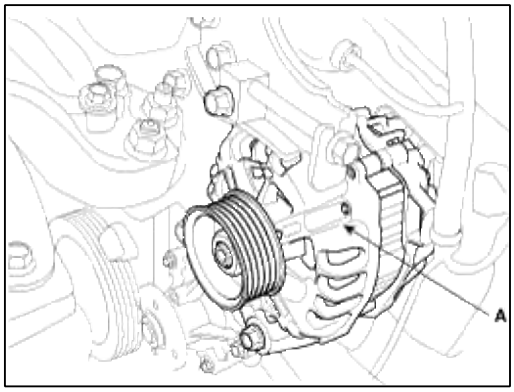
1. Loosen the water pump pulley bolt and the drive idler mounting bolt.
2. Loosen the alternator tension adjusting bolt(A) to loosen tension.



3. Remove the alternator drive belt(A).

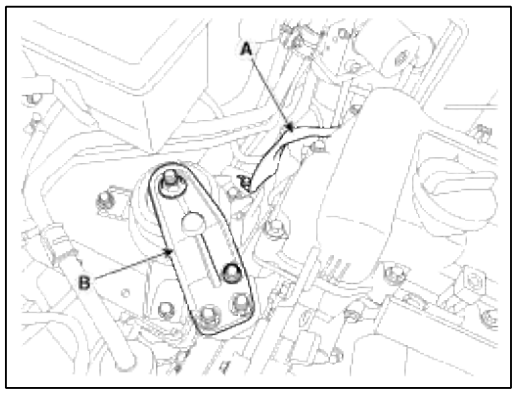


4. Remove the alternator(A). (Refer to Altemator in EE Group).



5. Remove the RH front wheel.

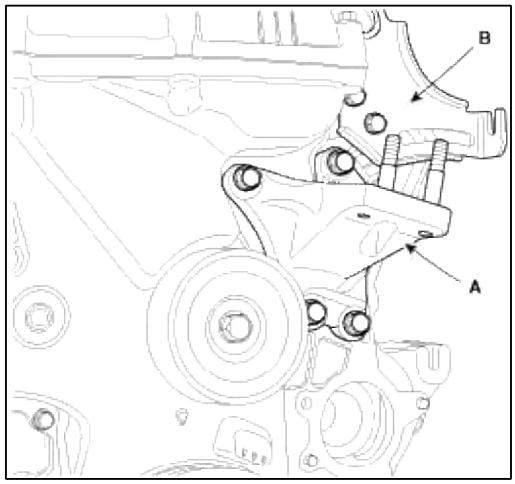
6. Remove the engine mounting bracket(A).



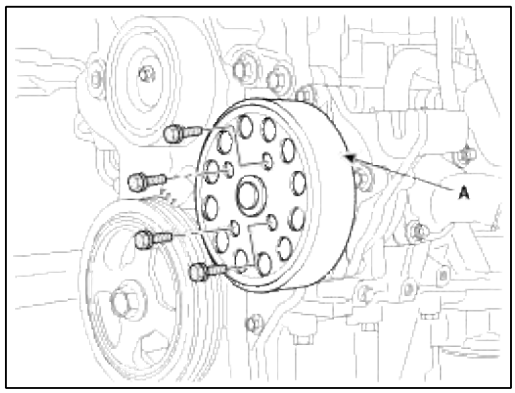
NOTE

Support the engine with a jack not to be tilted.

7. Remove the alternator bracket(B).
8. Remove the engine support bracket(A).

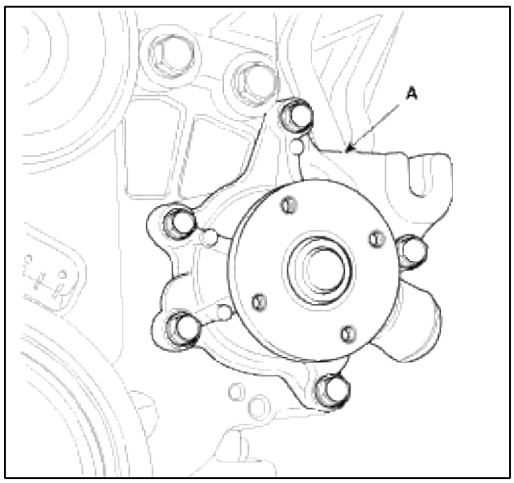


9. Remove the water pump pulley(A).

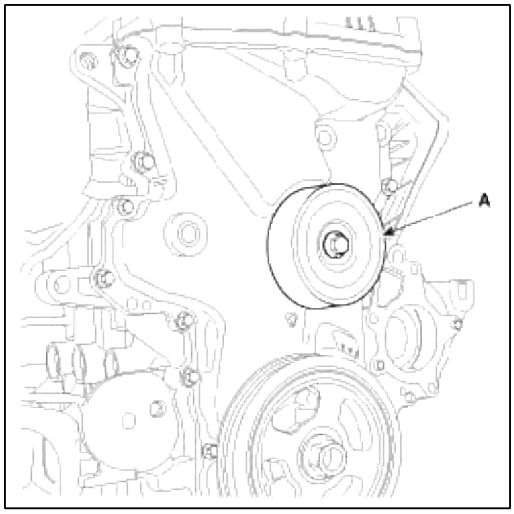


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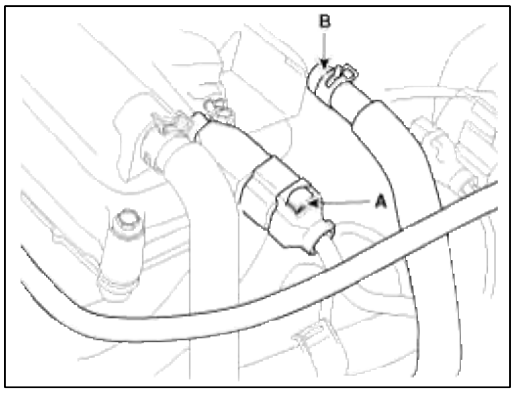
10. Remove the water pump(A).



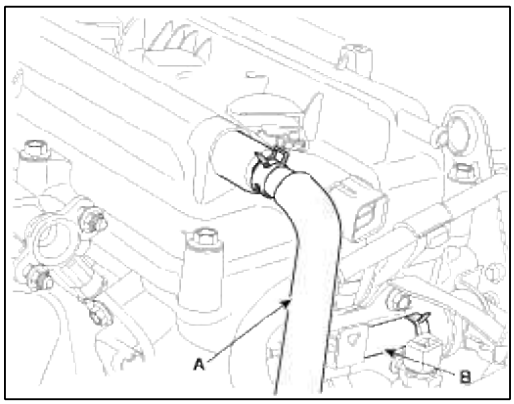
11. Remove the drive belt idler(A).



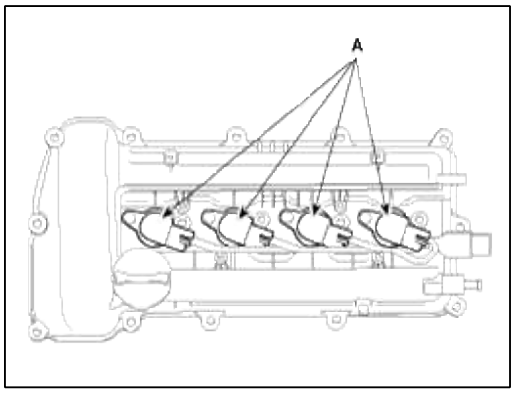
12. Disconnect the ignition coil connector(A) and the breather hose(B).



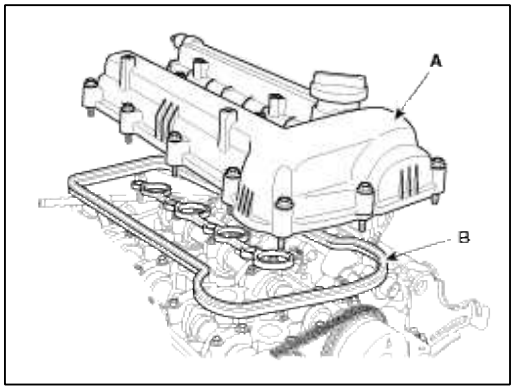
13. Disconnect the positive crankcase ventilation(PCV) hose(A) and PCSV hose(B).



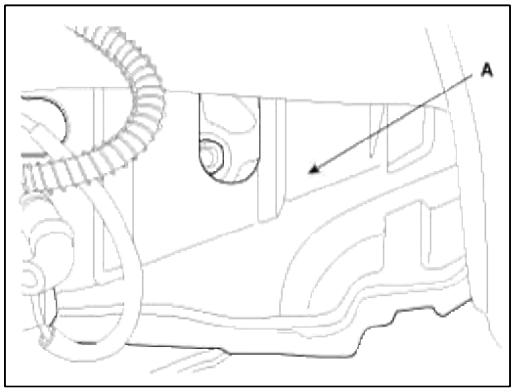
14. Remove the ignition coils(A).



15. Remove the cylinder head cover(A) with its gasket(B).

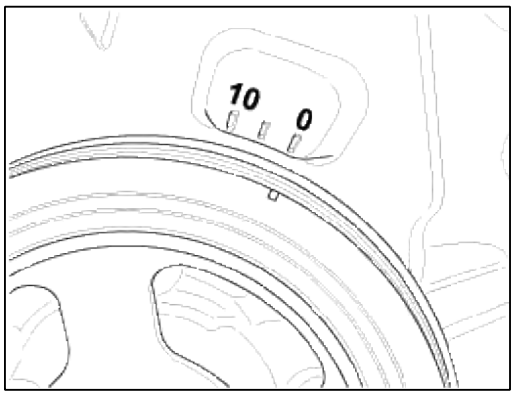


16. Remove side cover.

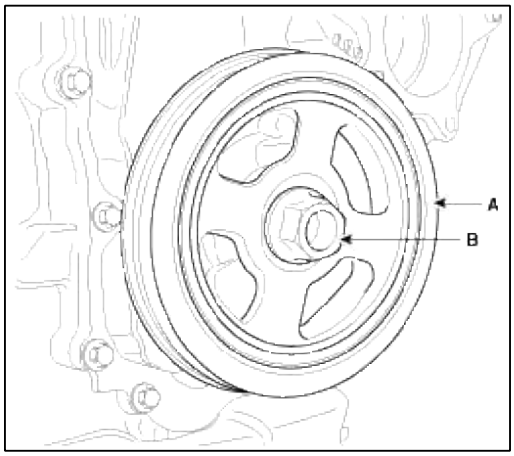


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17. Turn the crankshaft pulley clockwise, and align its groove with the timing mark of the timing chain cover.



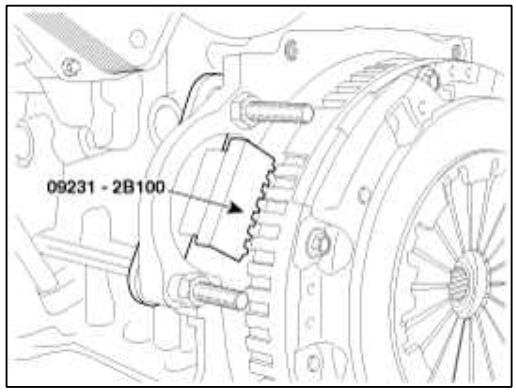
18. Remove the crankshaft bolt(B) and crankshaft pulley(A).



NOTE

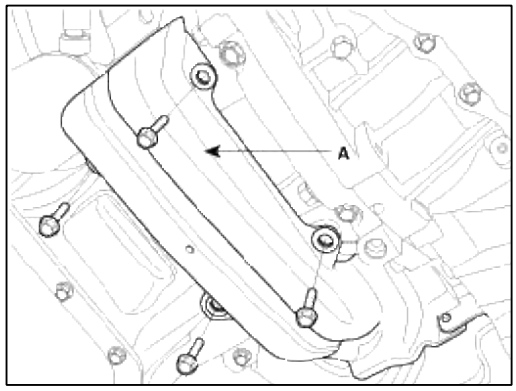
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

- Install the SST (09231-2B100) to hold the ring gear after removing the starter.

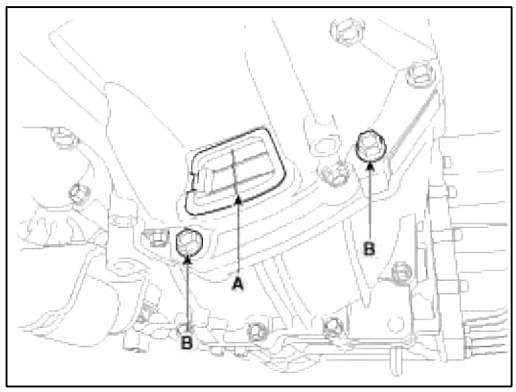


- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

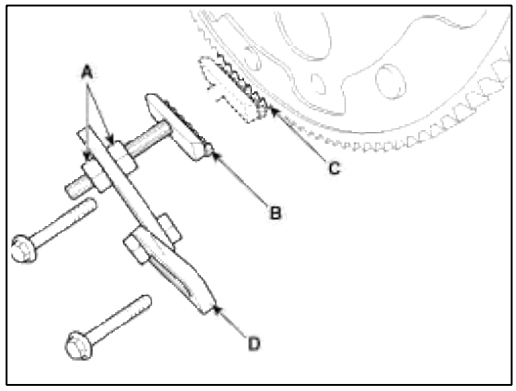
1. Remove the bracket (A).



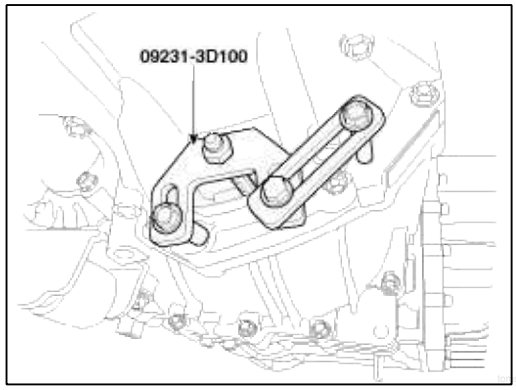
2. Remove the dust cover (A) on the bottom of the ladder frame and unfasten the transaxle mounting bolt (B).



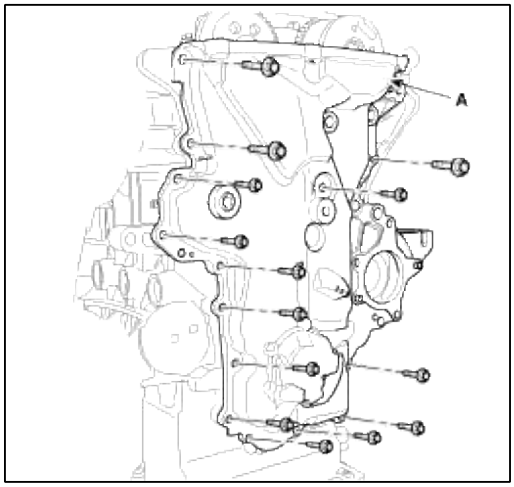
3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Adjust the angle of the links (D) so that the bolt 70mm (2.7559in.) can be fastened to the original mounted hole.



5. Install the SST (09231-3D100) using the mounting bolts and spacers. Tighten the bolts and nuts of the holder and links securely.

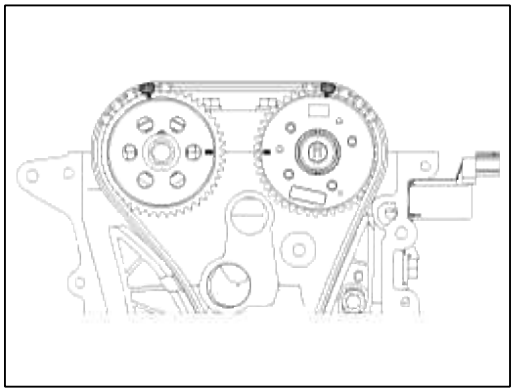


19. Remove the timing chain cover(A).

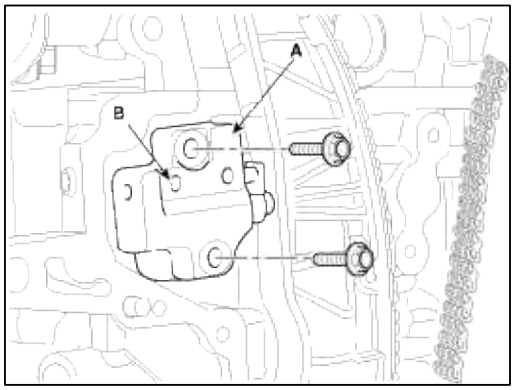


20. Align the timing marks of the camshaft sprocket with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.
    (1) Check the dowel pin of the crankshaft for facing upside of the engine at this monent.

> CAUTION
>
> Put paint marks on the timing chain links(3 places) that meet with the timing marks of the camshaft sprockets(In, Ex : 2) and the crankshaft sprocket.

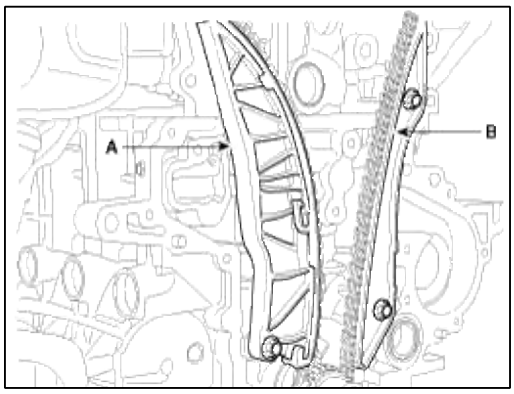


21. Remove the hydraulic tensioner(A).

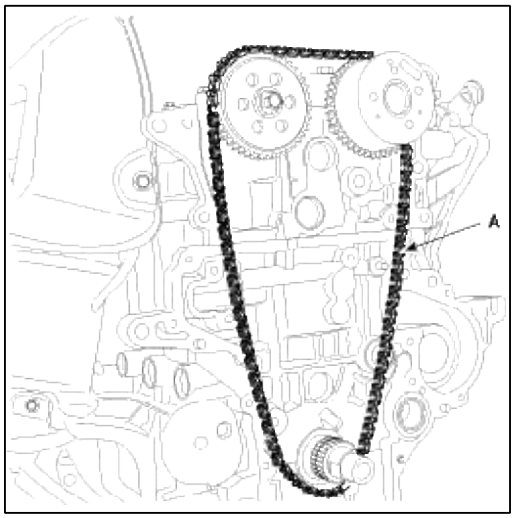


> CAUTION
>
> Before removing the tensioner, fix the piston of the tensioner with a pin through the hole(B) at TDC.

22. Remove the timing chain tensioner arm(A) and guide(B).



23. Remove the timing chain(A).



Inspection

Sprockets, Hydraulic Tensioner, Chain Guide, Tensioner Arm

1. Check the camshaft sprocket, crankshaft sprocket teeth for abnormal wear, cracks or damage. Replace if necessary.
2. Check a contact surface of the chain tensioner arm and guide for abnormal wear, cracks or damage. Replace if necessary.
3. Check the hydraulic tensioner for its piston stroke and ratchet operation. Replace if necessary.

Belt, Idler, Pulley

1. Check the idler for excessive oil leakage, abnormal rotation or vibration. Replace if necssery.
2. Check belt for maintenance and abnormal wear of V-ribbed part. Replace if necssery.
3. Check the pulleys for vibration in rotation, oil or dust deposit of V-ribbed part. Replace if necssery.

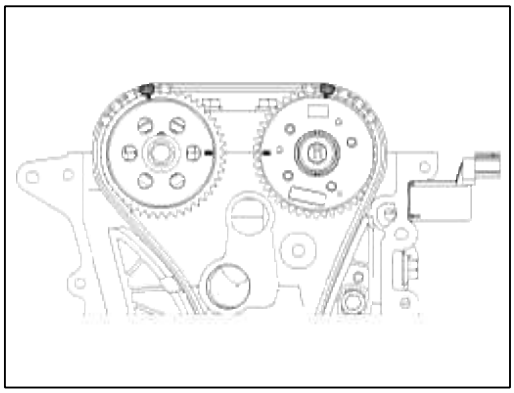
NOTE

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water and steam.

Installation

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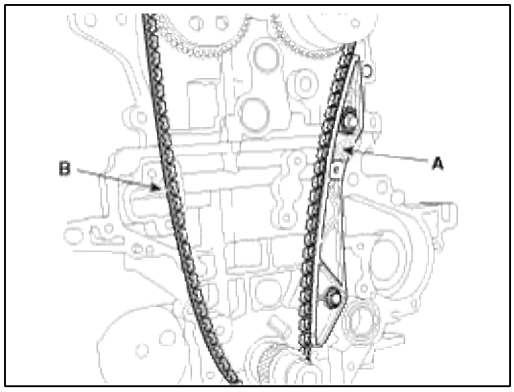
1. Align the timing marks of the camshaft sprocket with the upper sureface of the cylinder head to make No.1 cylinder be positioned at TDC.



(1) Check the dowel pin of the crankshaft for facing upside of the engine at this monent.

(2) Install the timing chain guide(A).

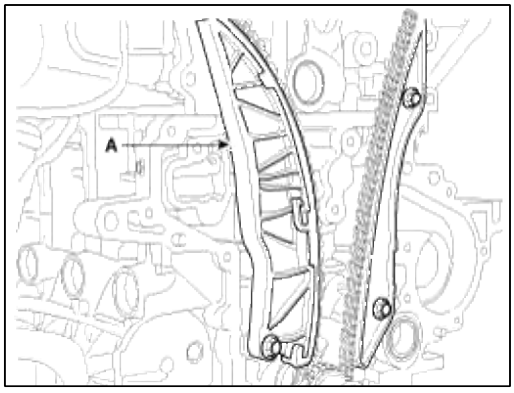
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



(3) When installing a timing chain, align the timing marks on the sprockets with paint marks of the chain.
Order : Crankshaft sprocket → Timing chain guide → Intake camshaft sprocket → Exhaust camshaft sprocket.

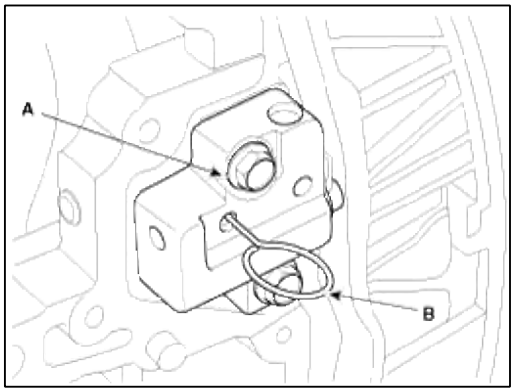
2. Install the chain tensioner arm(A).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



3. Install the hydraulic tensioner(A) and remove the pin(B).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

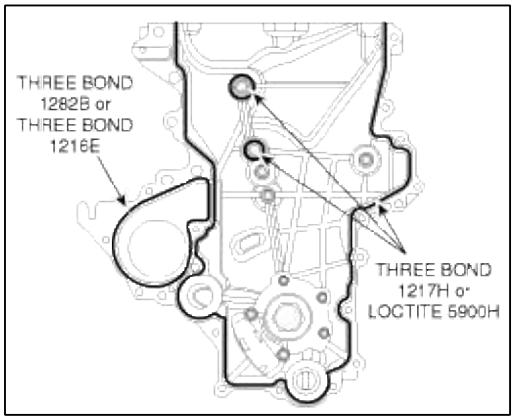


NOTE

Recheck the top dead center(TDC) marks on the crankshaft and camshaft.

4. Install the timing chain cover(A).
   (1) Before installing, remove the hardened sealant from the cylinder block and ladder frame surface.
   (2) Apply the liquid gasket(TB 1217H or LOCTITE 5900H) on the surface between the cylinder head and the cylinder block.

Width : 3 ~ 5mm(0.1181~0.1969in.)



   (3) Apply the liquid gasket, THREE BOND 1282B or THREE BOND 1216E on the water pump contact parts of the timing chain cover and THREE BOND 1217H or LOCTITE 5900H on the rest parts. Reassemble the cover(A) within 5 minutes.

Width : 3.5 ~ 4.5 mm (0.1378 ~ 0.1772 in.)

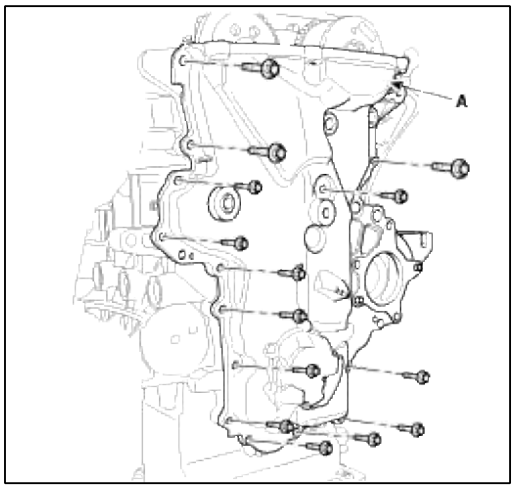
CAUTION

Remove oil or dust on the surface surely.

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(4) Align the dowel pin of the cylinder block and the holes of the oil pump.

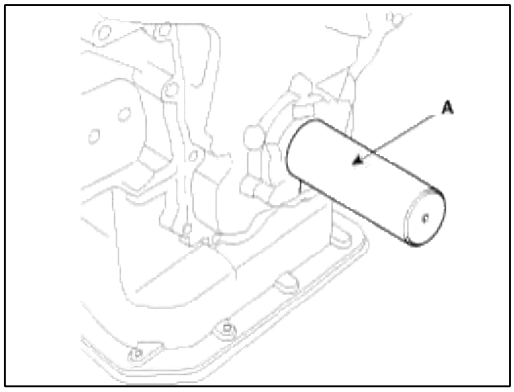
Tightening torque :
12mm bolts :
18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)
10mm bolts :
9.8 ~ 11.8 Nm (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



CAUTION

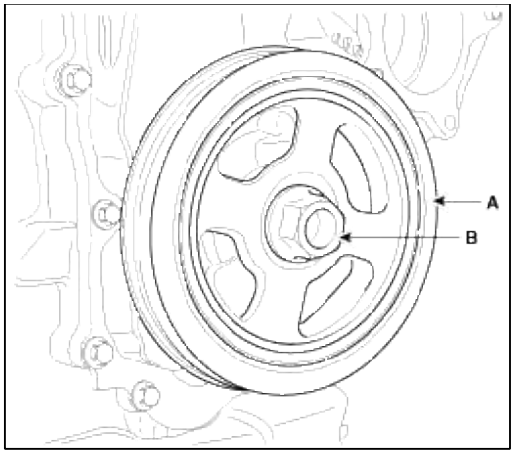
After the installation, do not crank engine or apply pressure on the cover for half an hour.

5. Using the SST(09455-21200), reassemble the timing chain cover oil seal(A).



6. Install the crankshaft pulley(A).

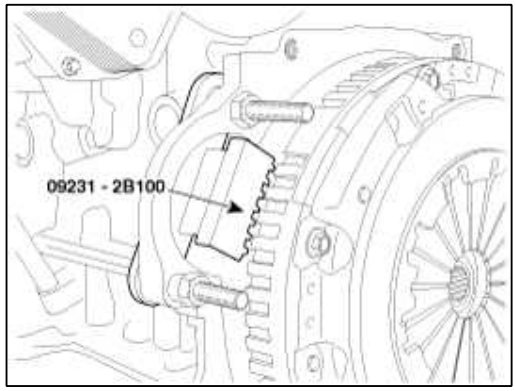
Tightening torque :
127.5 ~ 137.3N.m (13.0 ~ 14.0kgf.m, 94.0 ~ 101.3lb-ft)



NOTE

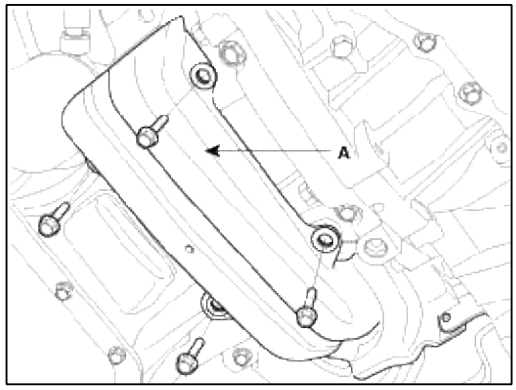
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

- Install the SST (09231-2B100) to hold the ring gear after removing the starter.



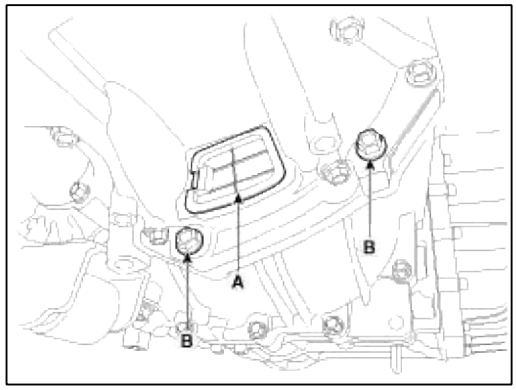
- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

1. Remove the bracket (A).

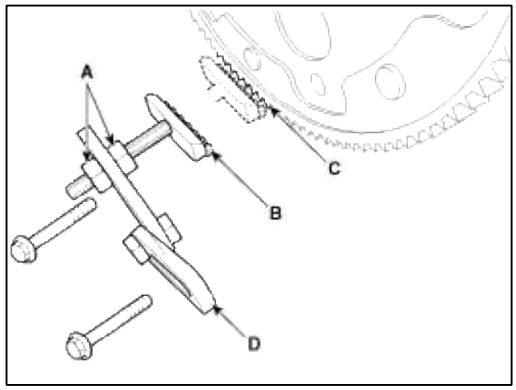


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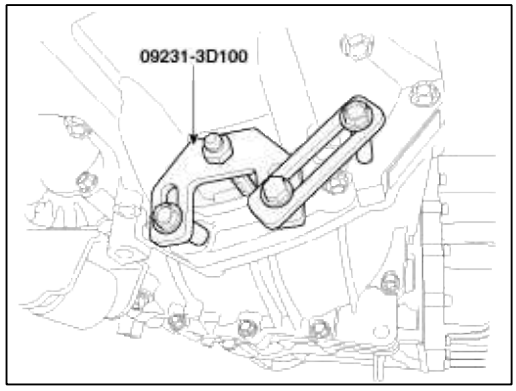
2. Remove the dust cover (A) on the bottom of the ladder frame and unfasten the transaxle mounting bolt (B).



3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Adjust the angle of the links (D) so that the bolt 70mm (2.7559in.) can be fastened to the original mounted hole.

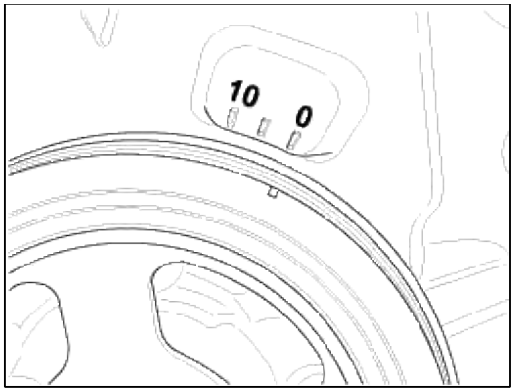


5. Install the SST (09231-3D100) using the mounting bolts and spacers. Tighten the bolts and nuts of the holder and links securely.



NOTE

When installing the pulley, the groove on the pulley should be positioned outside.

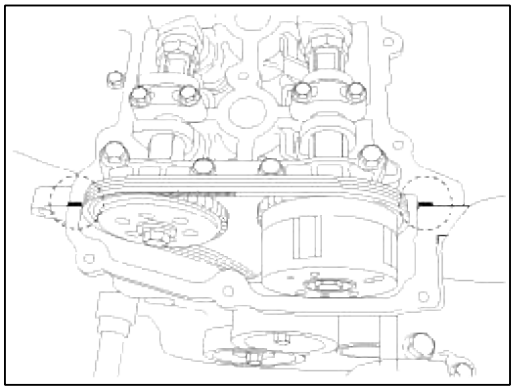


7. Install side cover.

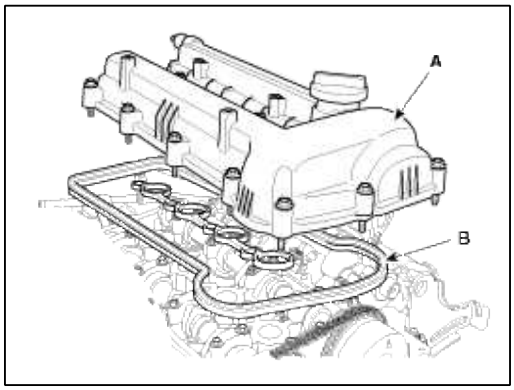
Tightening torque :
8.8 ~ 10.8 N.m (0.9 ~ 1.1 kgf.m, 6.5 ~ 8.0 lb-ft)

8. Install the front right wheel and tire.
9. Before installing the cylinder head cover, remove oil, dust or hardened sealant from the timing chain cover and the cylinder head upper surface.
10. After applying the liquid gasket, THREE BOND 1217H or LOCTITE 5900H on the cylinder head cover, reassemble the cover within five minutes.

Width : 2.0 ~ 2.5mm(0.0787~0.0984in.)



11. Install the cylinder head cover(A) with a new gasket(B).



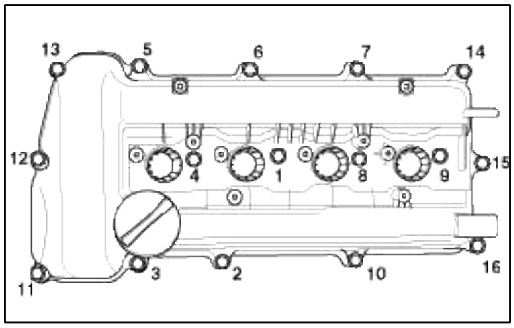
CAUTION

Do not reuse the disassembled gasket.

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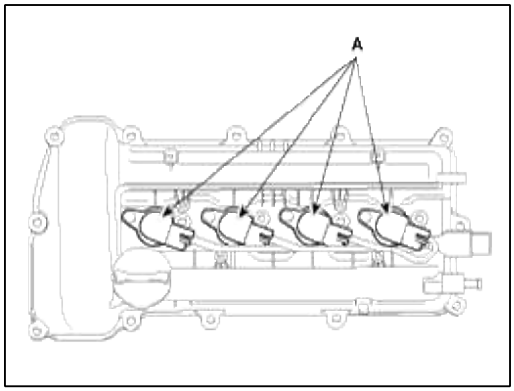
12. Tighten the cylinder head cover bolts(A) with the order and steps.

Tightening torque :
1st step - 3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lb-ft)
2nd step - 7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

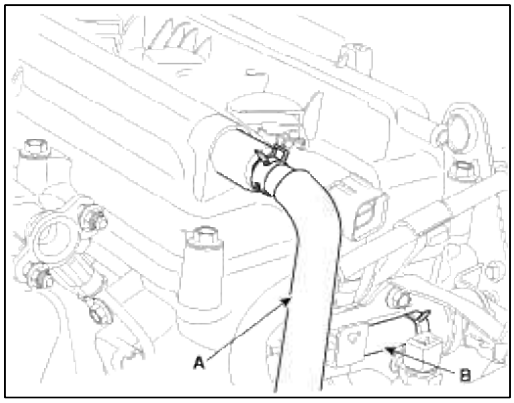


13. Install the ignition coils(A).

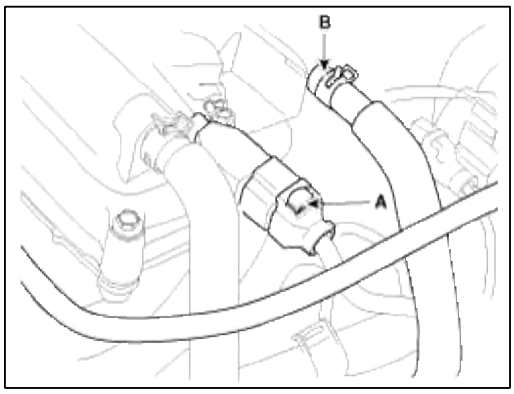
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



14. Install the positive crankcase ventilation(PCV) hose(A) and the positive and PCSV hose(B).

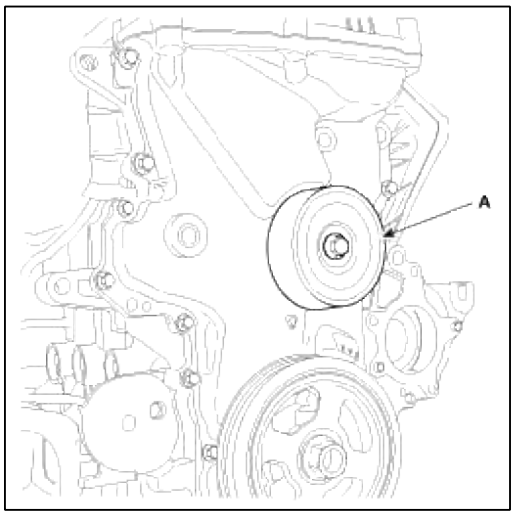


15. Connect the ignition coil connector(A) and the breather hose(B).



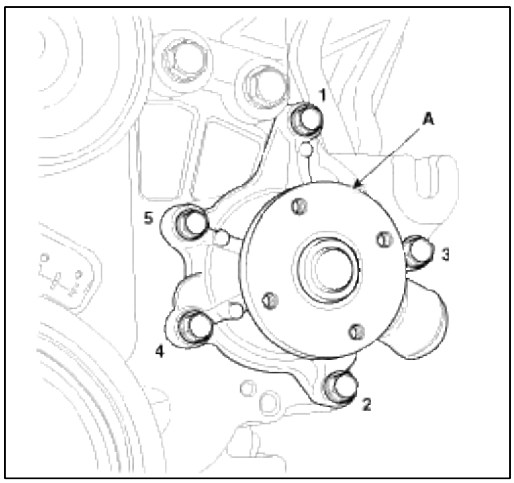
16. Install the drive belt idler(A).

Tightening torque :
42.2 ~ 53.9 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)



17. Install the water pump(A) with a gasket.
Tighten bolts with the order below.

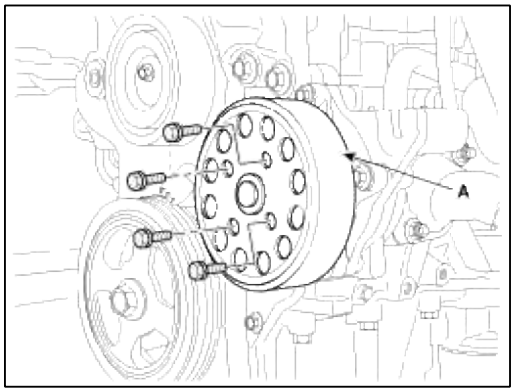
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



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18. Install the water pump pulley(A).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



CAUTION

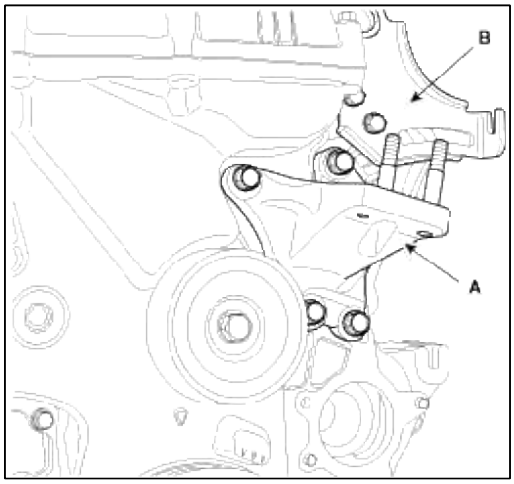
Tighten the bolts diagonally.

19. Install the engine support bracket(A).

Tightening torque :
29.4 ~ 41.2 N.m (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 lb-ft)

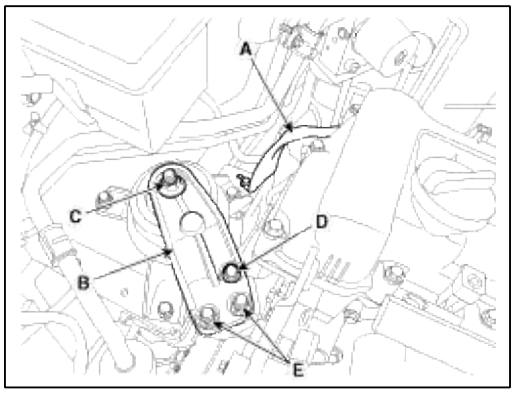
20. Install the alternator bracket(B).

Tightening torque :
19.6 ~ 26.5 N.m (2.0 ~ 2.7 kgf.m, 14.5 ~ 19.5 lb-ft)

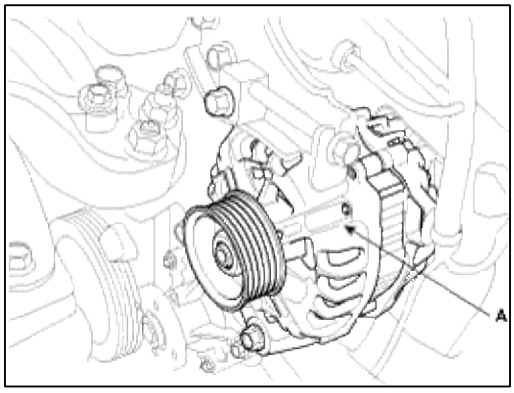


21. Install the engine mounting bracket(A).

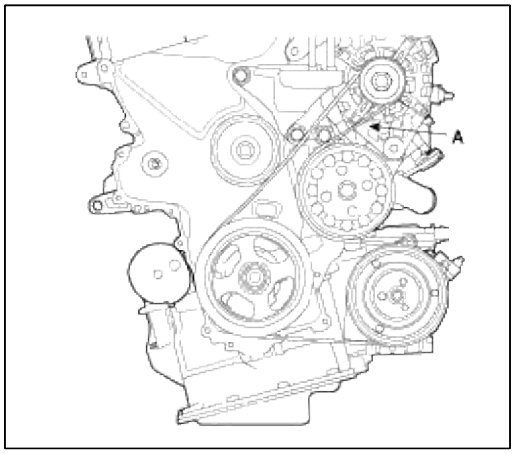
Tightening torque :
Nut(C):
78.5 ~ 98.1 N.m (8.0 ~ 10.0 kgf.m, 57.9 ~ 72.3 lb-ft)
Bolt(D) and Nuts(E) :
58.8 ~ 73.5 N.m (6.0 ~ 7.5 kgf.m, 43.4 ~ 54.2 lb-ft)



22. Install the alternator(A) and pretighten the mounting bolts.



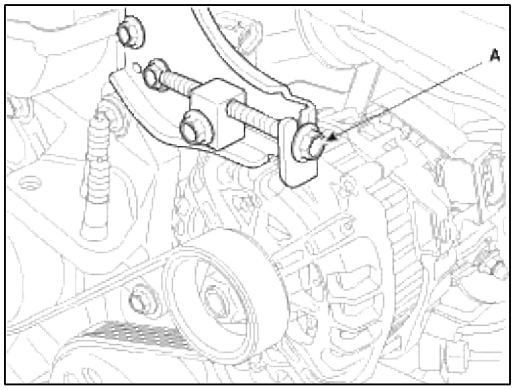
23. Install the drive belt(A).



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24. Adjust tension by tightening the alternator tension adjust bolt(A). (Refer to Charging system in EE Group)

Tension
New belt: 882.6 ~ 980.7N (90 ~ 100kg, 198.4 ~ 220.5lb)
Used belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)

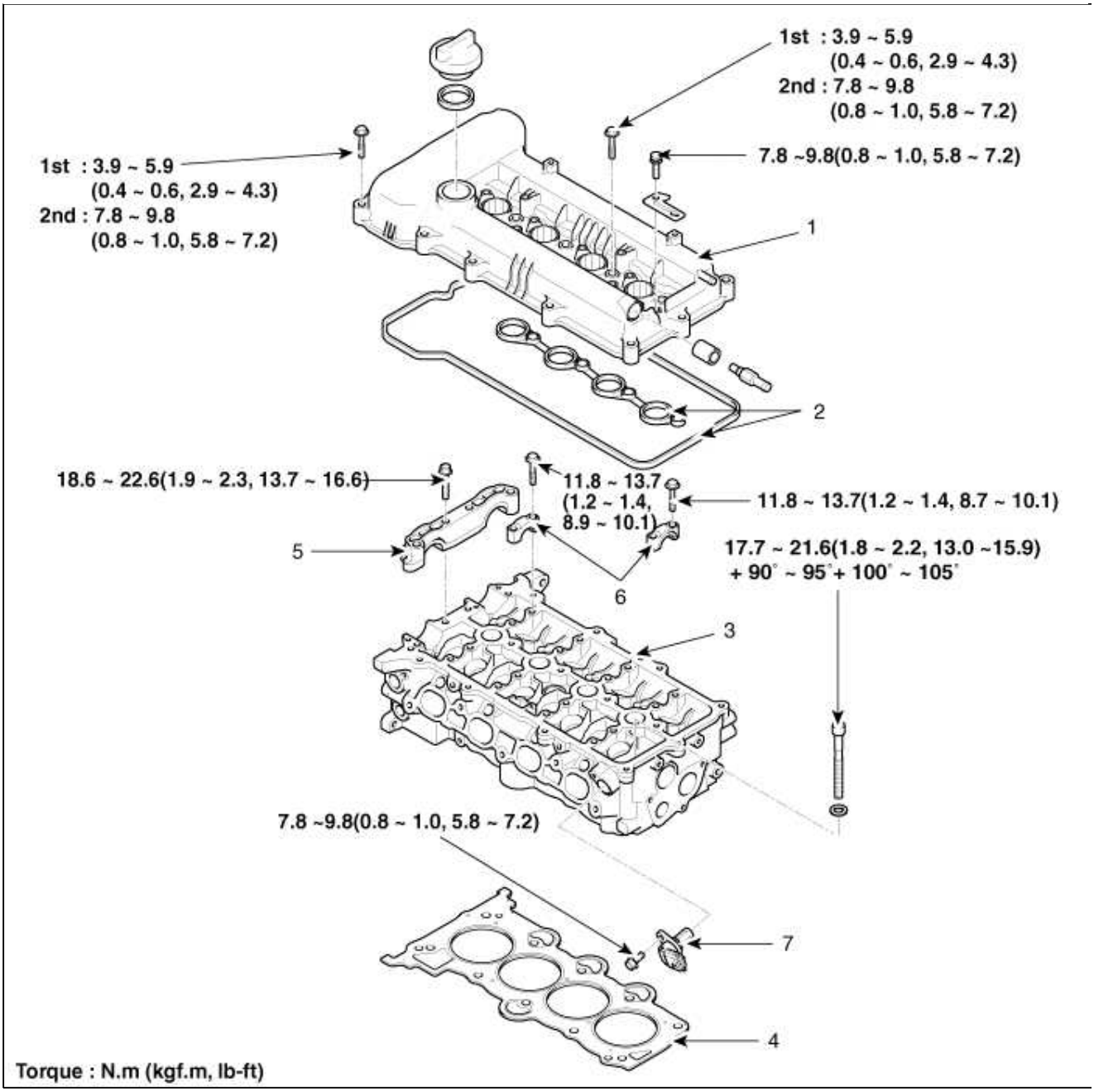


25. Tighten the alternator mounting bolts.

Tightening torque :
12mm bolt :
19.6 ~ 26.5 N.m (2.0 ~ 2.7 kgf.m, 14.5 ~ 19.5 lb-ft)
14mm bolt :
29.4 ~ 41.2 N.m (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 lb-ft)

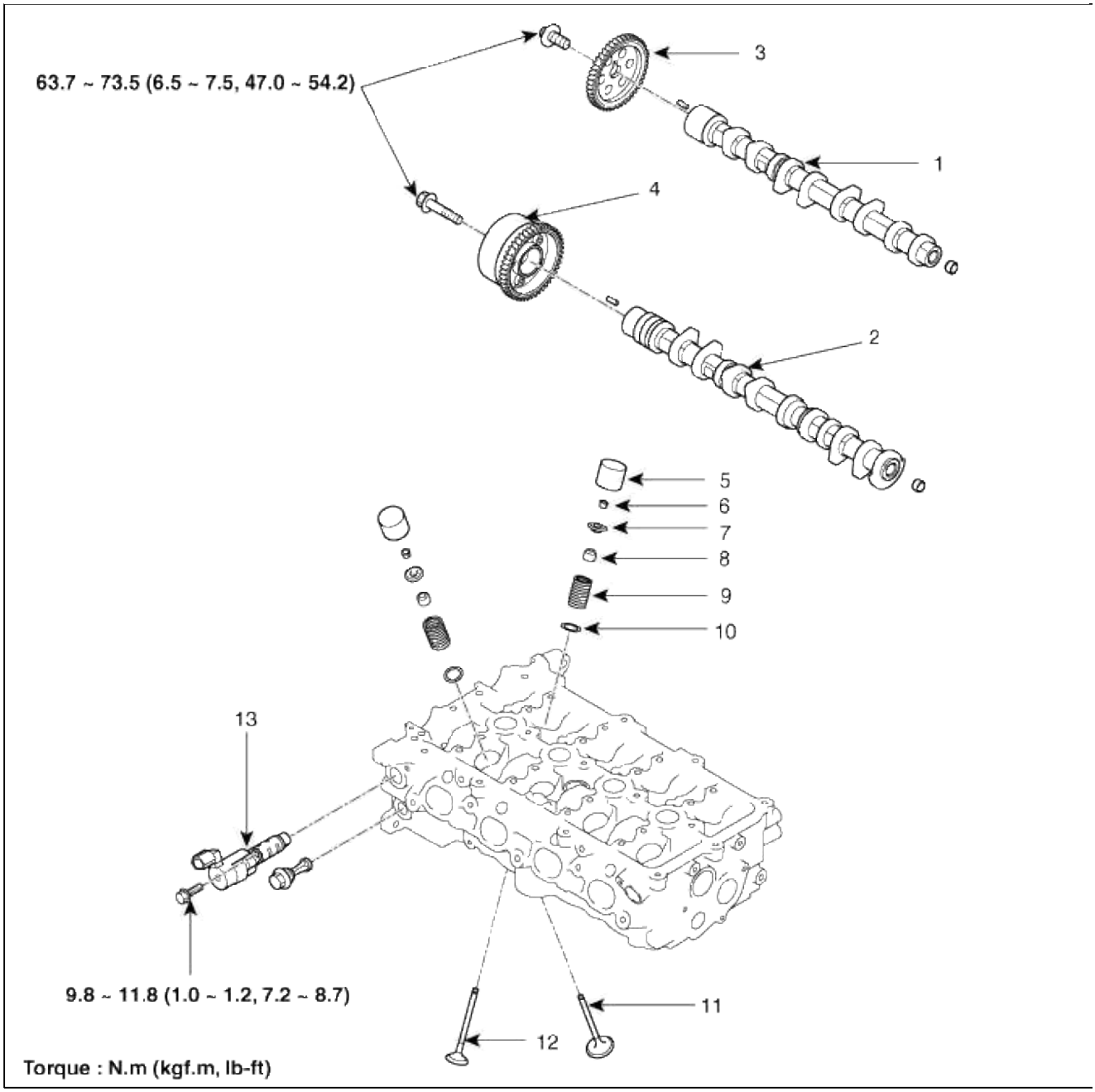
Engine Mechanical System > Cylinder Head Assembly > Cylinder Head > Components and Components Location

Components



1. Cylinder head cover 2. Cylinder head cover gasket 3. Cylinder head assembly 4. Cylinder head gasket	5. Camshaft front bearing cap 6. Camshaft bearing cap 7. Camshaft position sensor

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1. Exhaust camshaft 2. Intake camshaft 3. Exhaust camshaft sproket 4. CVVT assembly 5. Mechanical Lash Adjuster(MLA) 6. Retainer lock 7. Retainer	8. Valve stem seal 9. Valve spring 10. Valve spring seat 11. Intake valve 12. Exhaust valve 13. Oil Control Valve(OCV)

Engine Mechanical System > Cylinder Head Assembly > Cylinder Head > Repair procedures

Removal

Engine removal is not required for this procedure.

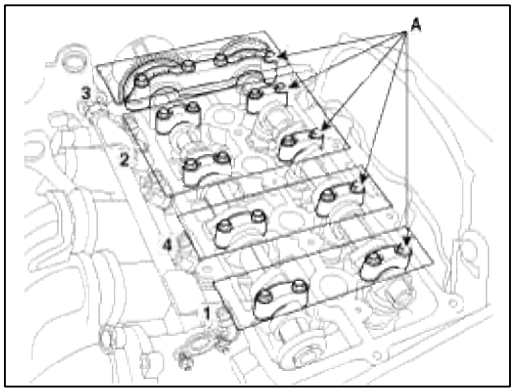
CAUTION

- Use Fender cover to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

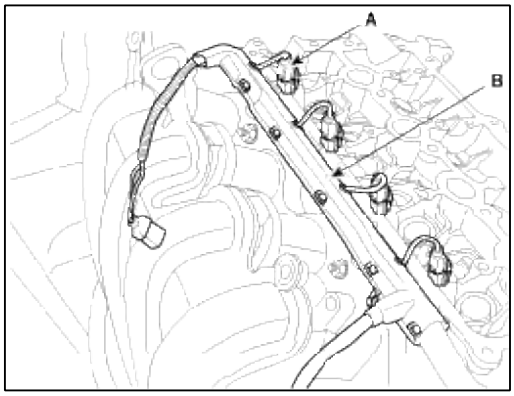
NOTE

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

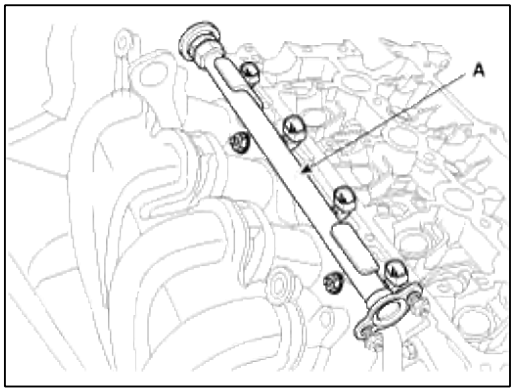
1. Remove the timing chain.
   (Refer to Timing system in this group)
2. Remove the camshaft bearing caps(A) with the order below.



3. Remove the injector connectors(A) and the harness bracket(B).



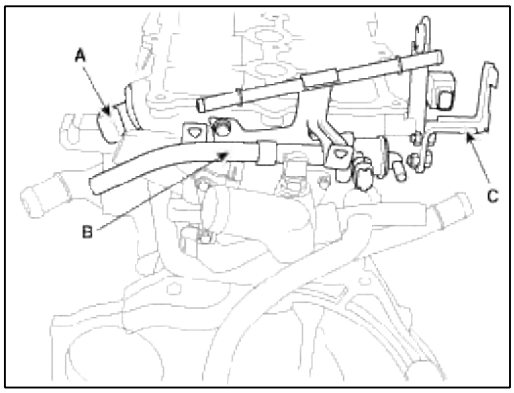
4. Remove the delivery pipe(A).



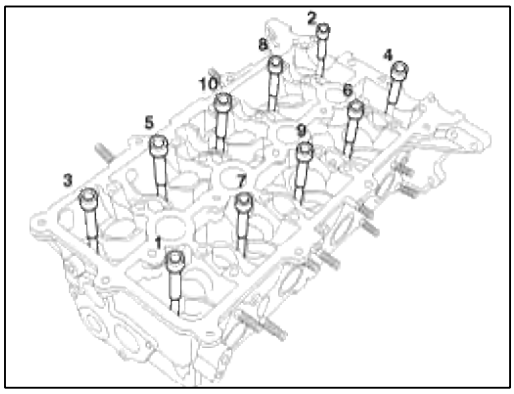
5. Remove the exhaust manifold assembly. (Refer to Intake and exhaust system in this group)
6. Remove the intake manifold module assembly. (Refer to Intake and exhaust system in this group)

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7. Disconnect the camshaft position sensor(CMP) connector(A) and remove the purge control solenoid valve(PCSV) bracket(B) and the module hanger bracket(C).



8. Remove the water temperature control assembly and the oil control valve(OCV).
9. Remove the cylinder head bolts, then remove the cylinder head.
   (1) Uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.



> CAUTION
>
> Head warpage or cracking could result from removing bolts in an incorrect order.

   (2) Lift the cylinder head from the cylinder block and put the cylinder head on wooden blocks.

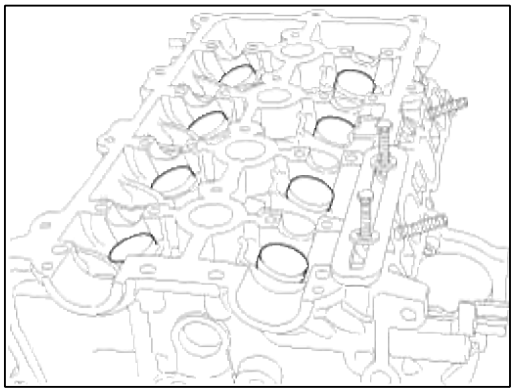
> CAUTION
>
> Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

Disassembly

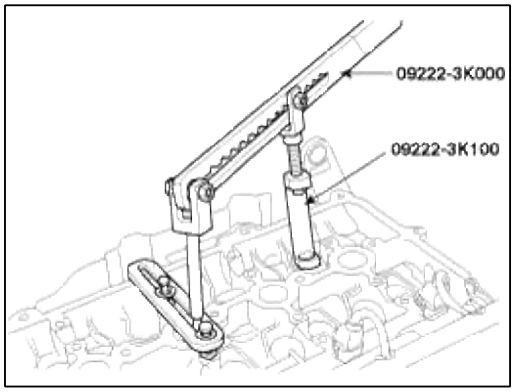
> NOTE
>
> Identify MLA(Mechanical lash adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove the MLAs(A).

> CAUTION
>
> When removing MLAs, mark all the MLAs for their rearrangement.



2. Remove the valves.
   (1) Using the SST (09222 - 3K000, 09222 - 3K100), compress the valve spring and remove the retainer lock.



   (2) Remove the spring retainer.
   (3) Remove the valve spring.
   (4) Remove the valve.
   (5) Remove the valve stem seal.
   (6) Using a magnetic finger, remove the spring seat.

> CAUTION
>
> Do not reuse the valve stem seals.

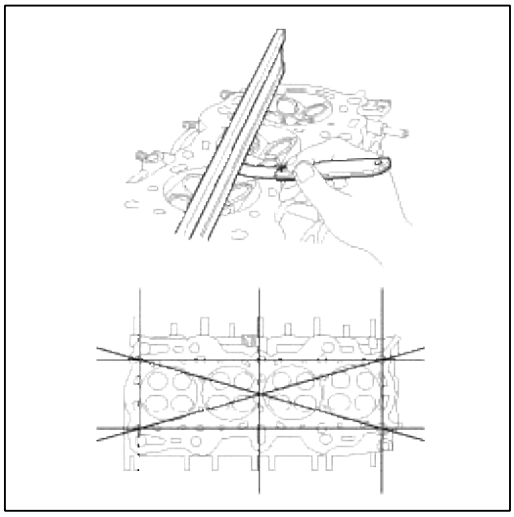
Inspection

Cylinder Head

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1. Inspect for flatness.
   Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block and the manifolds for warpage.

Flatness of cylinder head gasket surface
Standard : Less than 0.05mm (0.0020in)

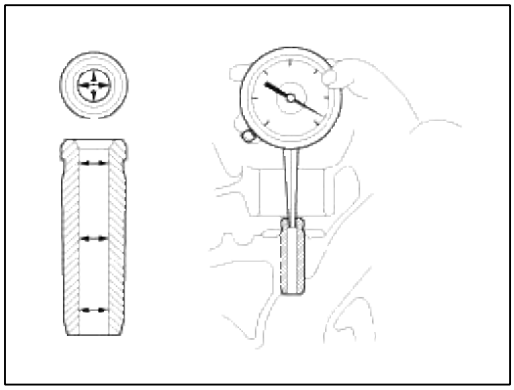


2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

Valve And Valve Spring

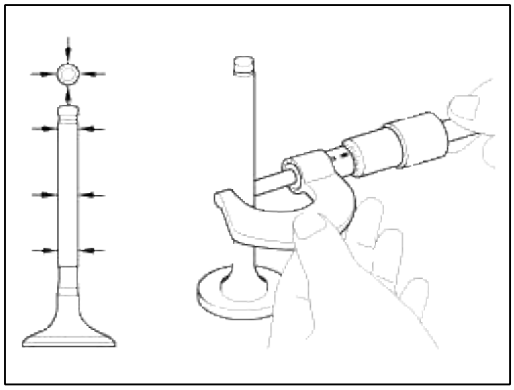
1. Inspect the valve stems and valve guides.
   (1) Using a caliper gauge, measure the inner diameter of valve guide.

Valve guide inner diameter :
5.500 ~ 5.512mm (0.2165 ~ 0.2170in)



(2) Using a micrometer, measure the outer diameter of valve stem.

Valve stem outer diameter
Intake : 5.465 ~ 5.480mm (0.2152 ~ 0.2157in)
Exhaust : 5.458 ~ 5.470mm (0.2149 ~ 0.2154in)



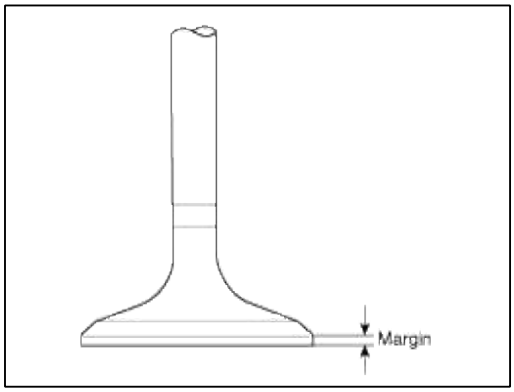
(3) Subtract the valve stem outer diameter measurement from the valve guide inner diameter measurement.

Valve stem- to-guide clearance
Intake : 0.020 ~ 0.047mm (0.0008 ~ 0.0019in)
Exhaust : 0.030 ~ 0.054mm (0.0012 ~ 0.0021in)

If the clearance is greater than specification, replace the valve or the cylinder head.

2. Inspect the valves.
(1) Check the valve is ground to the correct valve face angle.
(2) Check that the surface of valve for wear.
If the valve face is worn, replace the valve.
(3) Check the valve head margin thickness.
If the margin thickness is less than minimum, replace the valve.

Margin
Standard
Intake : 1.1mm (0.0433in)
Exhaust : 1.26mm (0.0496in)



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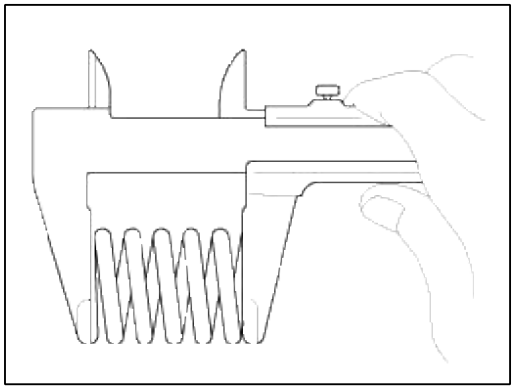
(4) Check the length of valve.

Valve length
Standard
Intake : 93.15mm (3.6673 in)
Exhaust : 92.60mm (3.6457 in)

(5) Check the surface of valve stem tip for wear.
If the valve stem tip is worn, replace the valve.

3. Inspect the valve seats.
   (1) Check the valve seat for evidence of overheating and improper contact with the valve face. If the valve seat is worn, replace the cylinder head.
   (2) Check the valve guide for wear. If the valve guide is worn, replace the cylinder head.
4. Inspect the valve springs.
   (1) Using a steel square, measure the out-of-square of valve spring.
   (2) Using a vernier calipers, measure the free length of valve spring.

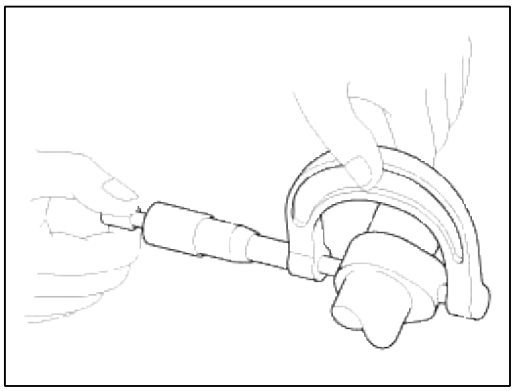
Valve spring
Standard
Free height : 44mm (1.7323in)
Out of square : Less than 1.5°



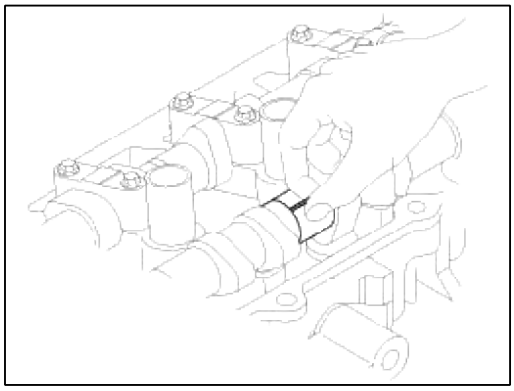
Camshaft

1. Inspect the cam height.
   Using a micrometer, measure the cam height.

Cam height
Intake : 43.85mm (1.7264in)
Exhaust : 42.85mm (1.6870in)



   If the cam lobe height is less than specified, replace the camshaft.
2. Inspect the camshaft journal clearance.
   (1) Clean the bearing caps and camshaft journals.
   (2) Place the camshafts on the cylinder head.
   (3) Lay a strip of plastigage across each of the camshaft journal.



   (4) Install the bearing caps and tighten the bolts with specified torque.

Tightening torque :
M6 bolts :
11.8 ~ 13.7Nm (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)
M8 bolts :
18.6 ~ 22.6Nm (1.9 ~ 2.3 kgf.m, 13.7 ~ 16.6lb-ft)

CAUTION

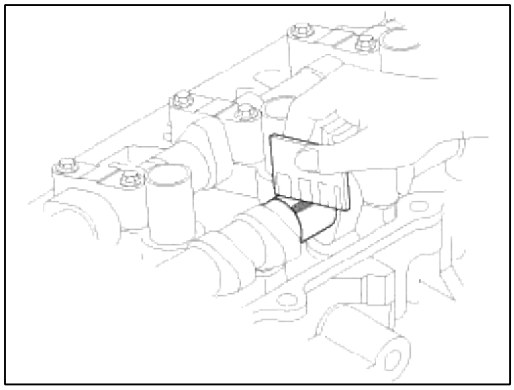
Do not turn the camshaft.

   (5) Remove the bearing caps.

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(6) Measure the plastigage at its widest point.

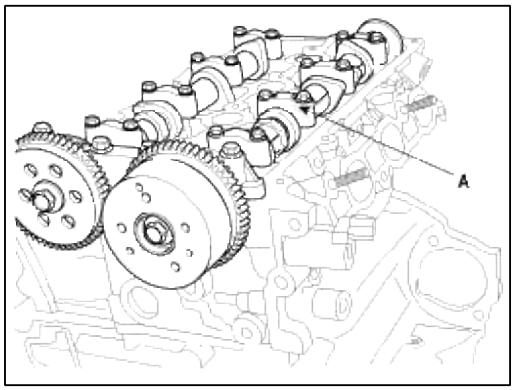
Bearing oil clearance
Standard : 0.027 ~ 0.058mm (0.0011 ~ 0.0023in)
Limit : 0.1mm (0.0039in)



If the oil clearance is greater than specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

3. Inspect the camshaft end play.
(1) Install the camshafts.
(2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play
Standard : 0.1 ~ 0.2mm (0.0039 ~ 0.0079in)



If the end play is greater than specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(3) Remove the camshafts.

Continuous Variable Valve Timing(CVVT) Assembly

1. Inspect the Continuous variable valve timing(CVVT) assembly.
   (1) Fix the Continuous variable valve timing(CVVT) with its camshaft in a vice.
   (2) Check that the CVVT assembly will not turn. If it is not turned, it is in normal condition.
   (3) Apply vinyl tape to all the parts except the one hole.
   (4) Using an air gun, apply the pressure, 147.10kpa (1.5kg/cm², 21.33psi) in the hole. This makes the lock pin in maximum retarded state released.

> NOTE
>
> • Wrap around it with a shop rag and the likes, because the oil splashes.
> • After releasing the pin, you can turn the CVVT assembly for advance by hand.
> • If there may be much air leakage, the pin can not be released.

   (5) Under the condition of 3), turn the CVVT assembly to the advance angle side with your hand.
      A. Depending on the air pressure, the CVVT assembly will turn to the advance side.
      B. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.
   (6) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

Standard : Movable smoothly in the range about 25°

   (7) Turn the CVVT assembly with your hand counterclockwise and lock it at the maximum delay angle position.

Reassembly

> NOTE
>
> • Thoroughly clean all parts to be assembled.
> • Before installing the parts, apply fresh engine oil to all sliding and rotating surface.
> • Replace oil seals with new ones.

1. Install the valves.
   (1) Install the spring seats.
   (2) Using the SST (09222 - 2B100), push in a new oil seal.

> NOTE
>
> Do not reuse old valve stem oil seals.
> Incorrect installation of the seal could result in oil leakage past the valve guides.

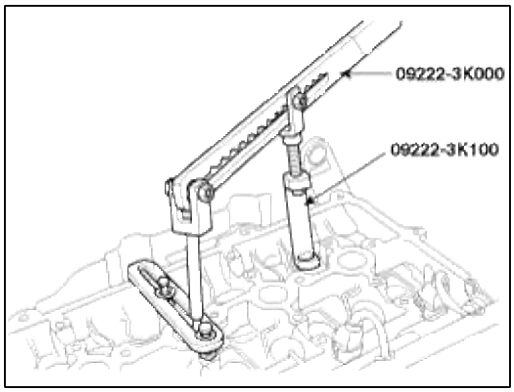
> CAUTION
>
> Intake valve stem seals are different from exhaust ones in type. Do not reassembly ones in the other's places.

   (3) Install the valve, valve spring and spring retainer, after applying engine oil at the end of each valve.

> NOTE
>
> When installing valve springs, the enamel coated side should face the valve spring retainer.

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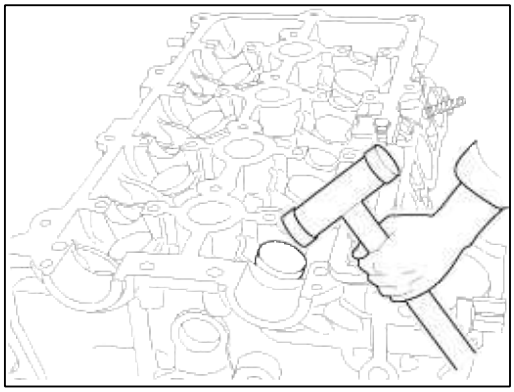
2. Using the SST(09222 - 3K000, 09222 - 3K100), compress the spring and install the retainer locks.
   After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



CAUTION

When installing the SST, use the torque, 1.2kgf.m or less.

3. Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.



4. Install the MLA(Mechanical lash adjuster)s.
   Check that the MLA rotates smoothly by hand.

NOTE

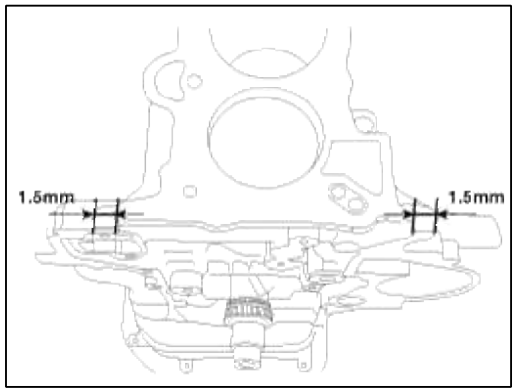
All the MLAs should be installed in its original position.

Installation

NOTE

- Thoroughly clean all parts to be assembled.
- Always use a new cylinder head and manifold gasket.
- Always use a new cylinder head bolt.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set the No.1 piston at TDC.

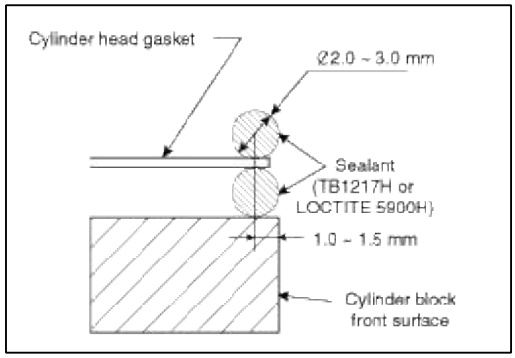
1. Install the cylinder head assembly.
   (1) Before installing, remove the hardened sealant from the cylinder block and cylinder head surface.
   (2) Before installing the cylinder head gasket, apply sealant on the upper surface of the cylinder block and reassemble the gasket within five minutes.



NOTE

Refer to the illustration for applying sealant.

Width : 2.0 ~ 3.0mm(0.0787~0.1181in.)
Position : 1.0 ~ 1.5mm(0.0394~0.0591in.)
Specification : TB 1217H or LOCTITE 5900H



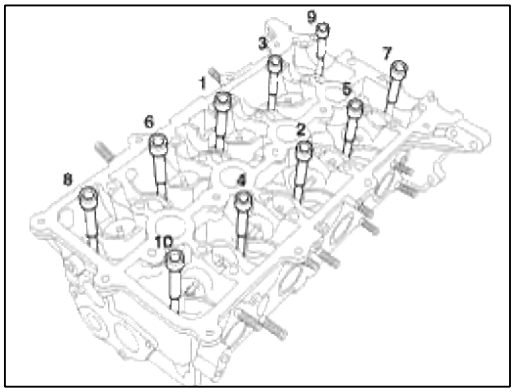
   (3) After installing the cylinder head gasket on the cylinder block, apply sealant on the upper surface of the cylinder head gasket and reassemble in five minutes.

2. Place the cylinder head carefully not to damage the gasket.

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3. Install the cylinder head bolts with washers.
   (1) Tighten the 10 cylinder head bolts, in several passes, in the sequence shown.

Tightening torque :
1st step - 17.7~21.6 N.m (1.8 ~ 2.2 kgf.m, 13.0~15.9 lb-ft)
2nd step - 90°~95°
3rd step - 100°~105°

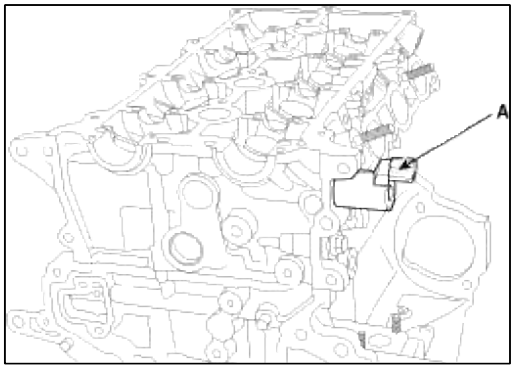


CAUTION

Always use new cylinder head bolts.

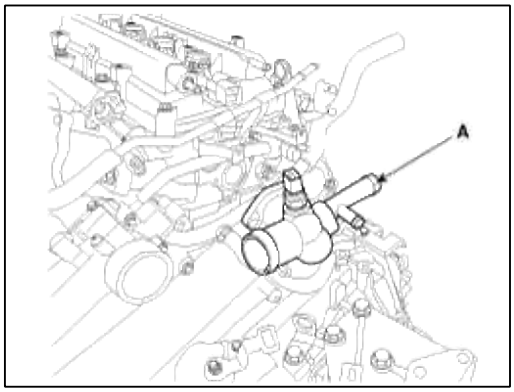
4. Install the oil control valve(OCV)(A).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

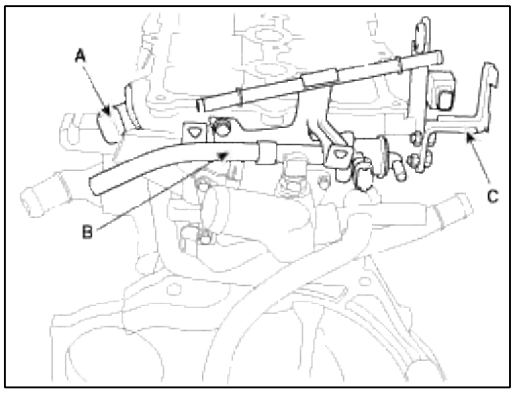


5. Install the water temperature control assembly(A).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

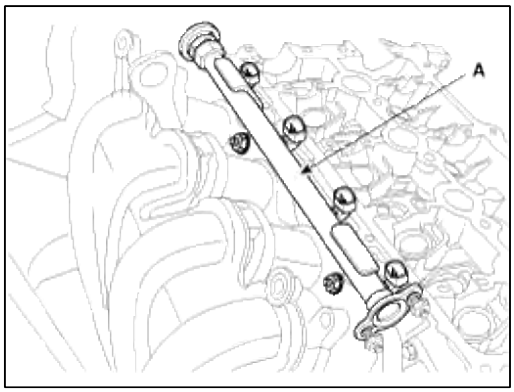


6. Connect the camshaft position sensor(CMP) connector(A) and install the purge control solenoid valve(PCSV) bracket(B) and the module hanger bracket(C).



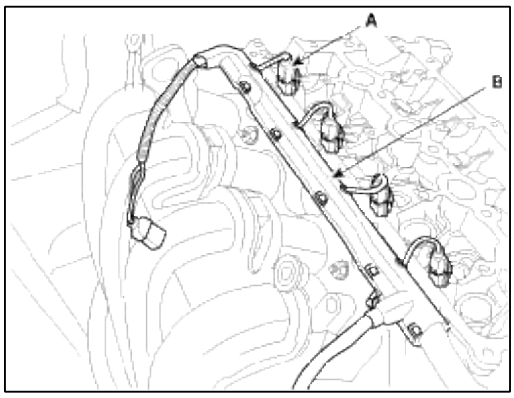
7. Install the intake manifold module assembly. (Refer to Intake and exhaust system in this group)
8. Install the exhaust manifold assembly. (Refer to Intake and exhaust system in this group)
9. Install the delivery pipe assembly(A).

Tightening torque :
19.6 ~ 24.5N.m (2.0 ~ 2.5kgf.m, 14.4 ~ 18.0lb-ft)



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10. Install the injector connector(A) and harness bracket(B).



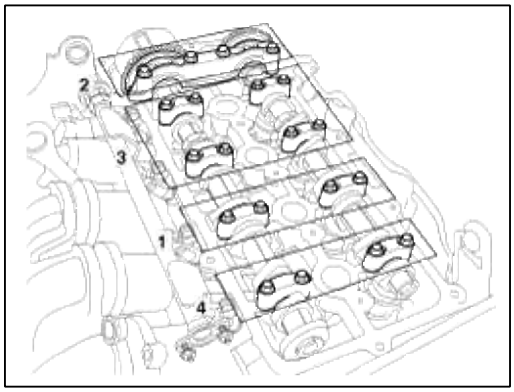
11. Install the camshafts.
    (1) Before installing, apply engine oil on journals.

> CAUTION
>
> Do not make oil flow down to the front side of the cylinder head.

    (2) After installing, check the valve clearance.

12. Install the camshaft bearing caps with the order below.

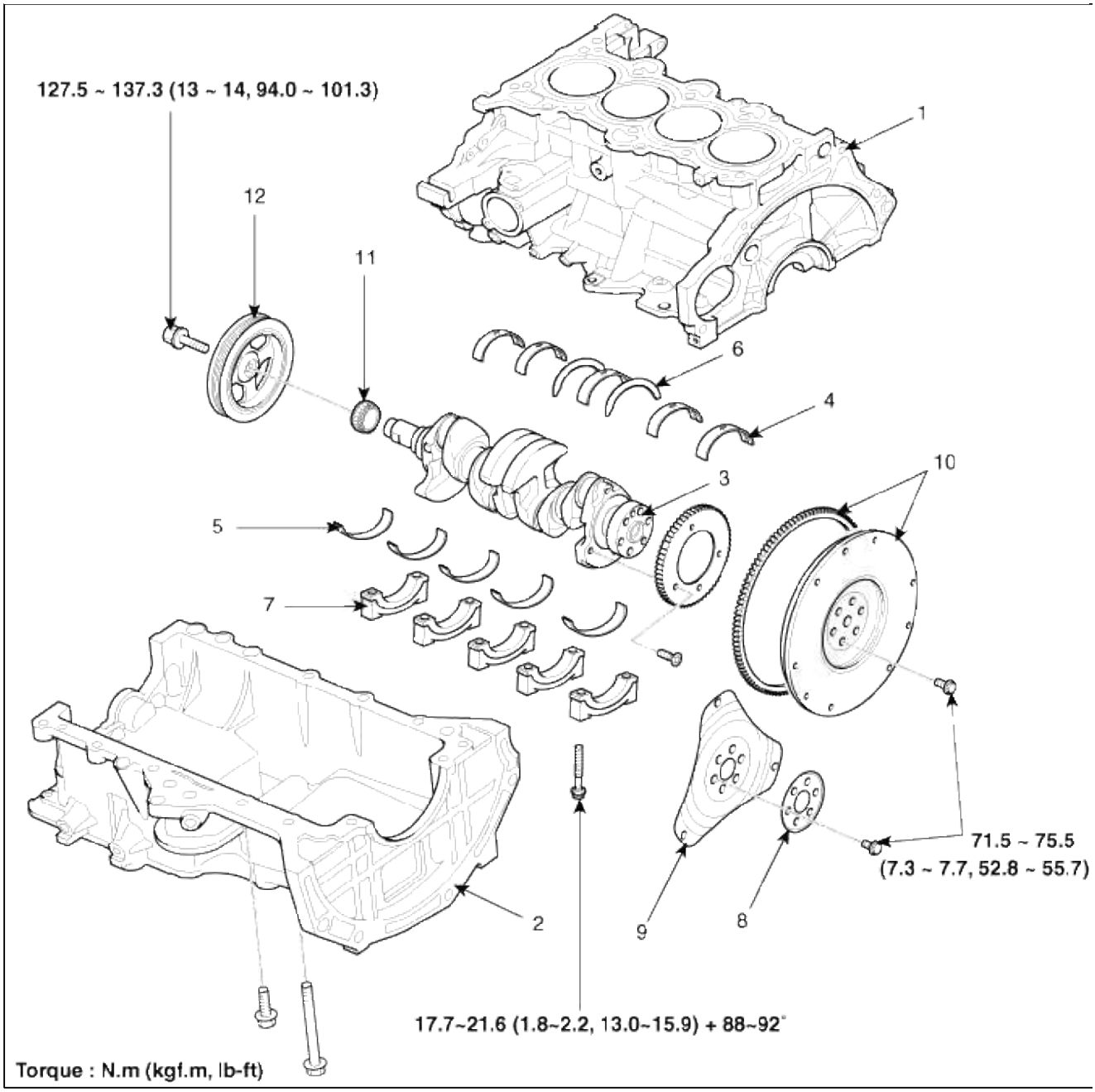
Tightening torque :
M6 bolts - 11.8 ~ 13.7N.m (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)
M8 bolts - 18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



13. Install the intake and exhaust manifold.
    (Refer to Intake and Exhaust system in this group)
14. Install the timing chain.
    (Refer to Timing system in this group)

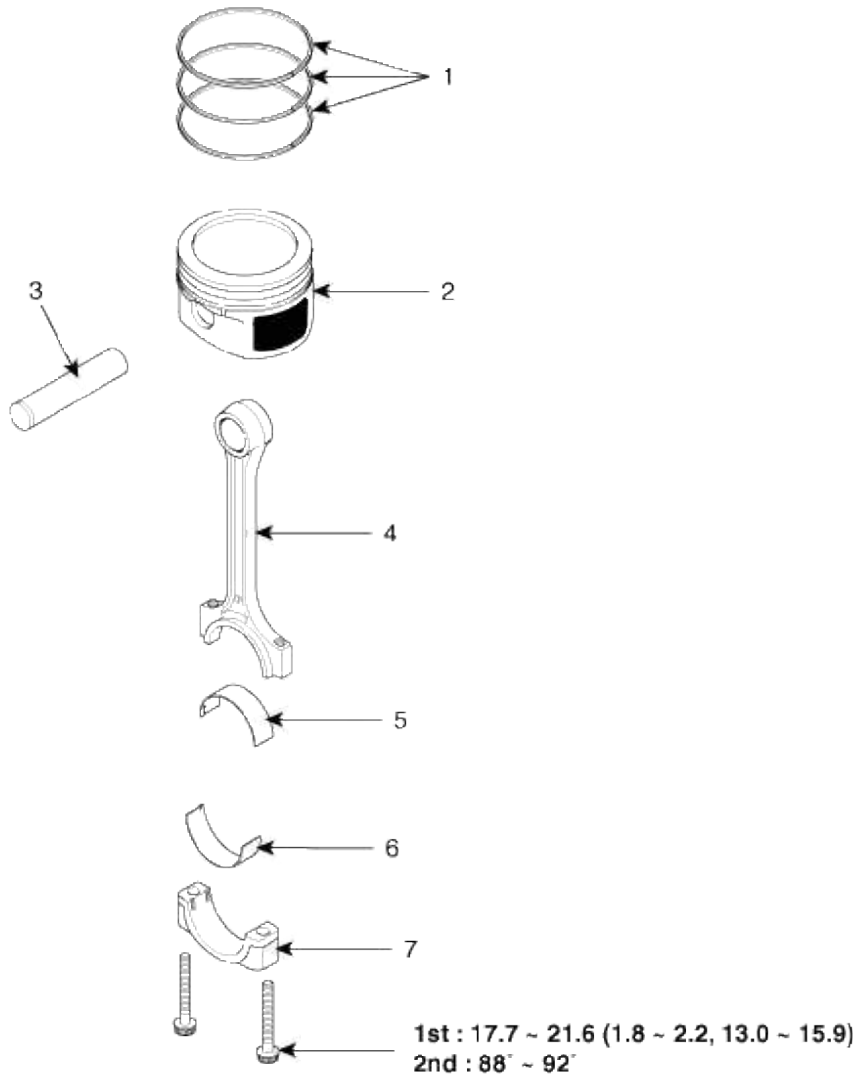
Engine Mechanical System > Cylinder Block > Cylinder Block > Components and Components Location

Components



1. Cylinder block	5. Crankshaft lower bearing	9. Drive plate
2. Ladder freme	6. Thrust bearing	10. Fly wheel & ring gear
3. Crankshaft	7. Main bearing cap	11. Crankshaft sproket
4. Crankshaft upper bearing	8. Adapter plate	12. Crankshaft pulley

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Torque : N.m (kgf.m, lb-ft)

1. Piston ring 2. Piston 3. Piston pin 4. Connecting rod	5. Connecting rod upper bearing 6. Connecting rod lower bearing 7. Connecting rod bearing cap

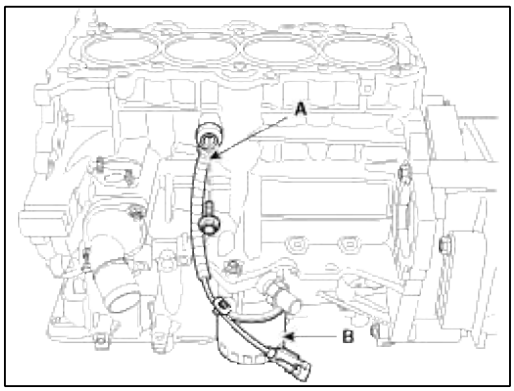
Engine Mechanical System > Cylinder Block > Cylinder Block > Repair procedures

Disassembly

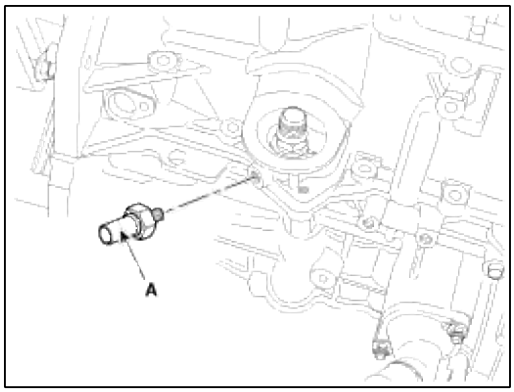
Engine removal is required for this procedure. (Refer to Engine and transaxle assembly removal in this group)

1. M/T : Remove the fly wheel.
2. A/T : Remove the drive plate.
3. Install the engine to engine stand for disassembly.
4. Remove the timing chain. (Refer to Timing chain in this group)
5. Remove the cylinder head. (Refer to Cylinder head in this group)
6. Remove the oil level gauge tube.

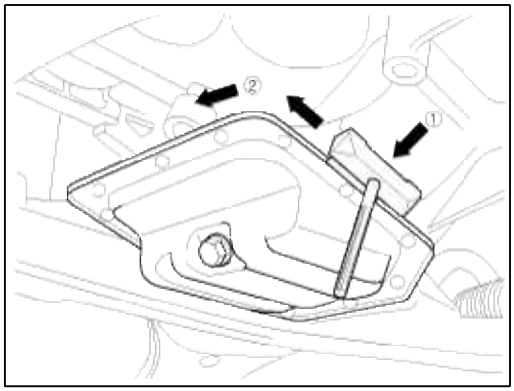
7. Remove the knock sensor(A) and the oil filter(B).



8. Remove the oil pressure switch(A).



9. Using the SST (09215-3C000), remove the oil pan (A).

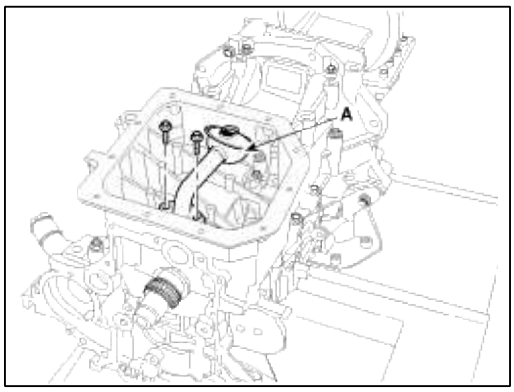


CAUTION

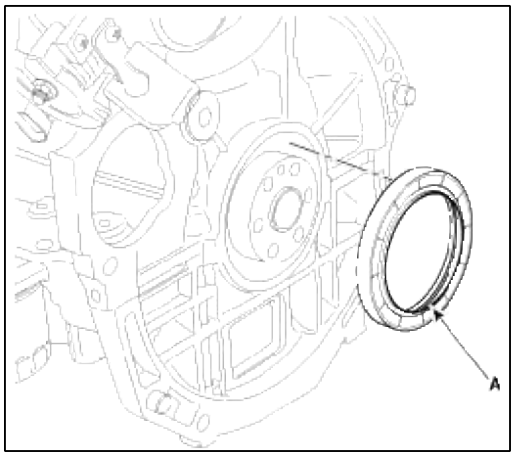
- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It is result in damage of the SST.

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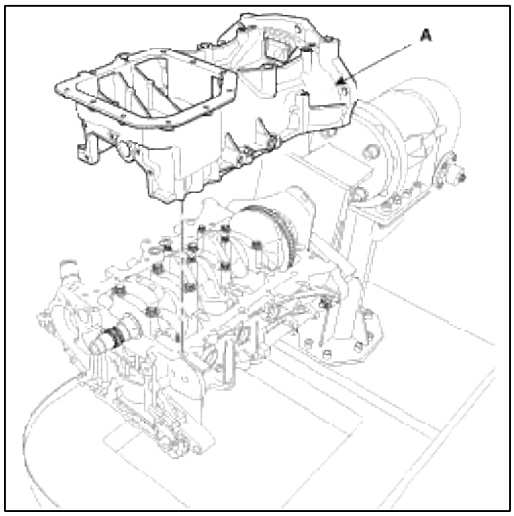
10. Remove the oil screen(A).



11. Remove the rear oil seal(A).



12. Remove the ladder frame(A).



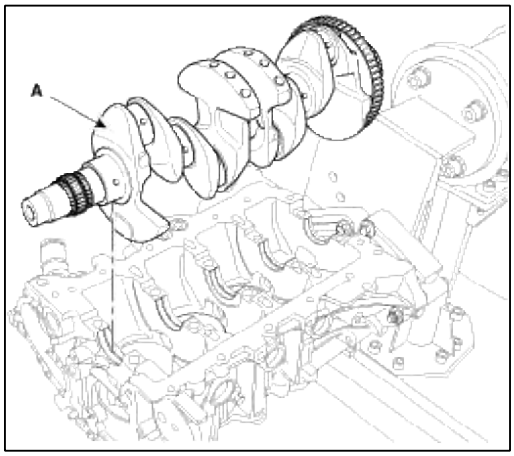
13. Check the connecting rod end play.
14. Remove the connecting rod caps and check oil clearance.
15. Remove the piston and connecting rod assemblies.
    (1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
    (2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

> NOTE
>
> • Keep the bearings, connecting rod and cap together.
> • Arrange the piston and connecting rod assemblies in the correct order.

16. Remove the crankshaft bearing cap and check oil clearance.

17. Check the crankshaft end play.
18. Lift the crankshaft(A) out of the engine, being careful not to damage journals.

> NOTE
>
> Arrange the main bearings and thrust bearings in the correct order.



19. Check fit between piston and piston pin.
    Try to move the piston back and forth on the piston pin.
    If any movement is felt, replace the piston and pin as a set.
20. Remove the piston rings.
    (1) Using a piston ring expander, remove the 2 compression rings.
    (2) Remove the 2 side rails and oil ring by hand.

> NOTE
>
> Arrange the piston rings in the correct order only.

21. Remove the connecting rod from the piston.
    Using a press, remove the piston pin from piston.
    (Press-in load : 500 ~ 1,500kg(1,102 ~ 3,306lb))

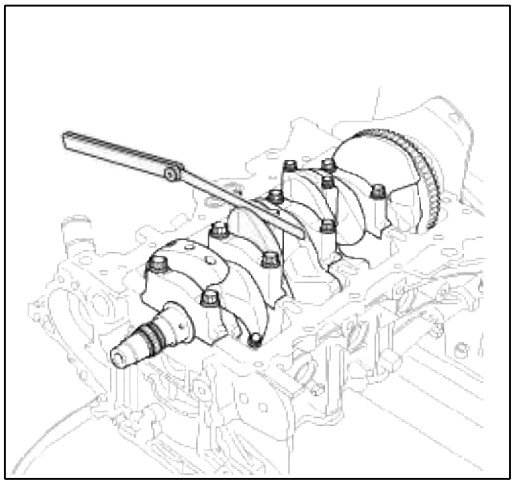
Inspection

Connecting Rod And Crankshaft

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1. Check the connecting rod end play.
   Using feeler gauge, measure the end play while moving the connecting rod back and forth.

End play
Standard : 0.1 ~ 0.25mm (0.0039 ~ 0.0098in)
Maximum : 0.35mm (0.0138in)



A. If out-of-tolerance, install a new connecting rod.
B. If still out-of-tolerance, replace the crankshaft.

2. Check the connecting rod bearing oil clearance.
   (1) Check the match marks on the connecting rod and cap are aligned to ensure correct reassembly.
   (2) Remove the 2 connecting rod cap bolts.
   (3) Remove the connecting rod cap and lower bearing.
   (4) Clean the crankshaft pin journal and bearing.
   (5) Place a plastigage across the crankshaft pin journal.
   (6) Reinstall the lower bearing and cap, and tighten the bolts. Do not reuse the bolts.

Tightening torque :
17.7 ~ 21.6N.m (1.8 ~ 2.2kgf.m, 13.0 ~ 15.9lb-ft) + 88 ~ 92°

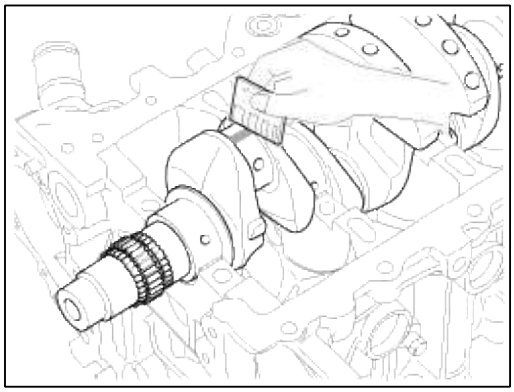
NOTE

Do not turn the crankshaft.

   (7) Remove the 2bolts, connecting rod cap and lower bearing .

(8) Measure the plastigage at its widest point.

Standard oil clearance
0.032 ~ 0.052mm (0.0013 ~ 0.0020in)



(9) If the measurement from the plastigage is too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark.
Recheck the oil clearance.

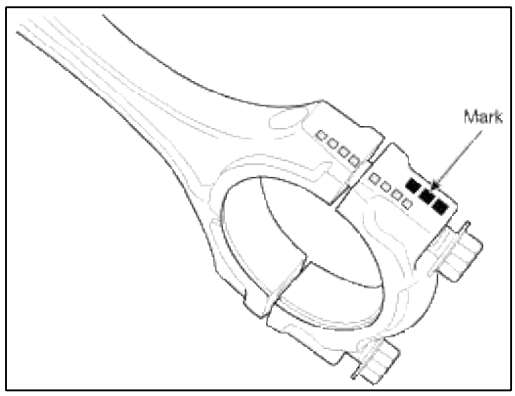
> CAUTION
>
> Do not file, shim, of scrape the bearings or the caps to adjust clearance.

(10) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing.
Recheck the oil clearance.

> NOTE
>
> If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and restart over.

> CAUTION
>
> If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Connecting Rod Mark Location

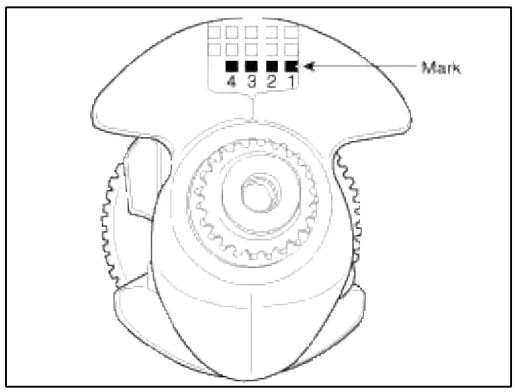


Discrimination Of Connecting Rod

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Mark	Connecting rod big-end inner diameter
A, 0	45.000 ~ 45.006mm (1.7717 ~ 1.7719in)
B, 00	45.006 ~ 45.012mm (1.7719 ~ 1.7721in)
C, 000	45.012 ~ 45.018mm (1.7721 ~ 1.7724in)

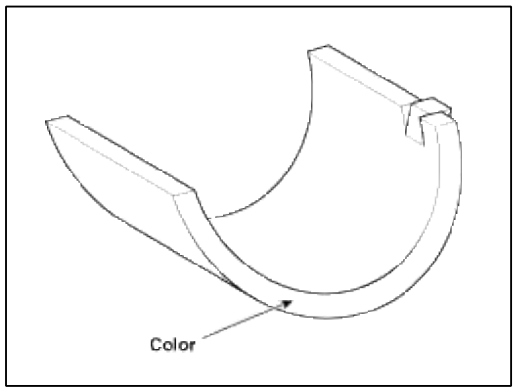
Crankshaft Pin Diameter Mark Location



Discrimination Of Crankshaft Pin Diameter

Mark	Crankshaft pin outer diameter
1	41.972 ~ 41.966mm (1.6524 ~ 1.6522in)
2	41.966 ~ 41.960mm (1.6522 ~ 1.6520in)
3	41.960 ~ 41.954mm (1.6520 ~ 1.6517in)

Connecting Rod Bearing Color Location



Discrimination Of Connecting Rod Bearing

Mark	Color	Connecting rod bearing thickness
A	Blue	1.514 ~ 1.517mm (0.0596 ~ 0.0597in)
B	Black	1.511 ~ 1.514mm (0.0595 ~ 0.0596in)
C	None	1.508 ~ 1.511mm (0.0594 ~ 0.0595in)
D	Green	1.505 ~ 1.508mm (0.0593 ~ 0.0594in)
E	Red	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

(11) Select the bearing by using selection table.

Connecting Rod Bearing Selection Table

		Connecting rod mark		
		A, 0	B, 00	C, 000
Crank shaft pin journal mark	1	E (Red)	D (Green)	C (None)
	2	D (Green)	C (None)	B (Black)
	3	C (None)	B (Black)	A (Blue)

3. Check the connecting rods.

(1) When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.

(2) Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.

(3) Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod :
0.05mm / 100mm (0.0020in / 3.94in) or less
Allowable twist of connecting rod :
0.1mm / 100mm (0.0039in / 3.94in) or less

NOTE

When the connecting rods installed without bearings, there should be no difference on side surface.

4. Check the crankshaft bearing oil clearance.

(1) To check main bearing-to-journal oil clearance, remove the main bearing caps and lower bearings.

(2) Clean each main journal and lower bearing with a clean shop towel.

(3) Place one strip of plastigage across each main journal.

(4) Reinstall the lower bearings and caps, then tighten the bolts.

Tightening torque :
1st - 17.7 ~ 21.6N.m (1.8 ~ 2.2kgf.m, 13.0 ~ 15.9lb-ft)
2nd - 88° ~ 92°

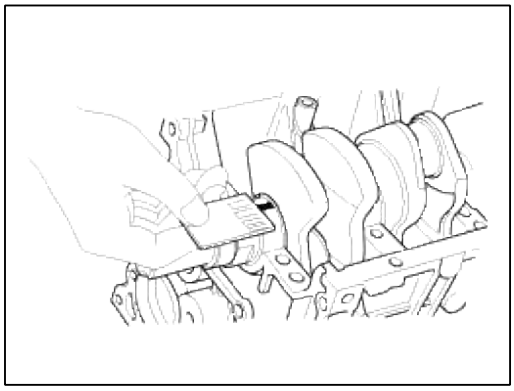
NOTE

Do not turn the crankshaft.

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(5) Remove the cap and lower bearing again, and measure the widest part of the plastigage.

Standard oil clearance :
No.1, 2, 3, 4, 5 : 0.021 ~ 0.042mm (0.0008 ~ 0.0017in)



(6) If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. (Refer to crankshaft main bearing selection table in this Group).
Recheck the oil clearance.

CAUTION

Do not file, shim, or scrape the bearings or the cap to adjust clearance.

(7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing. (Refer to crankshaft main bearing selection table in this Group).
Recheck the oil clearance.

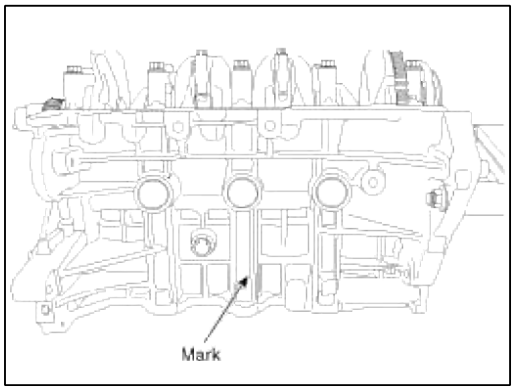
NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

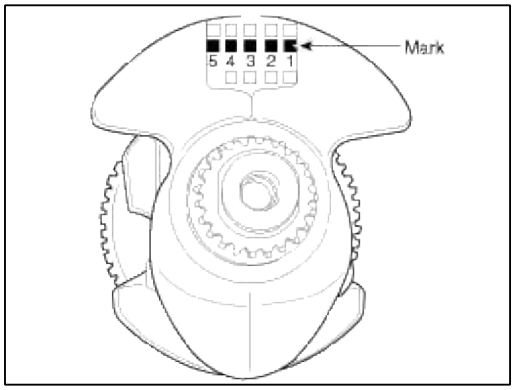
Cylinder block crankshaft journal bore mark location
Letters have been stamped on the side surface of the block as a mark for the size of each of the 5 main journal bores.
Use them, and the numbers or letters stamped on the crank (marks for main journal size), to choose the correct bearings.



Discrimination Of Cylinder Block Crankshaft Journal Bore

Mark	Cylinder block crankshaft journal bore inner diameter
A	52.000 ~ 52.006mm (2.0472 ~ 2.0475in)
B	52.006 ~ 52.012mm (2.0475 ~ 2.0477in)
C	52.012 ~ 52.018mm (2.0477 ~ 2.0479in)

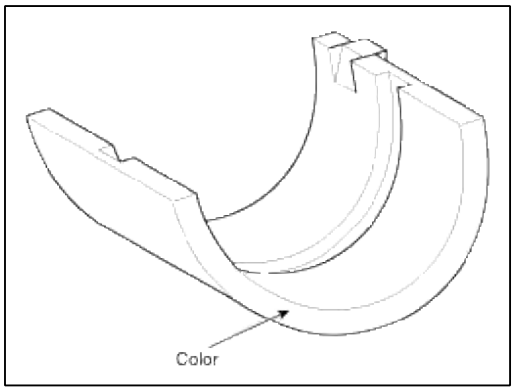
Crankshaft Main Journal Mark Location



Discrimination Of Crankshaft Main Journal

Mark	Crankshaft main journal outer diameter
1	47.960 ~ 47.954mm (1.8882 ~ 1.8879in)
2	47.954 ~ 47.948mm (1.8879 ~ 1.8877in)
3	47.948 ~ 47.942mm (1.8877 ~ 1.8875in)

Crankshaft Main Bearing Color Location



Discrimination Of Crankshaft Main Bearing

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Mark	Color	Crankshaft main bearing thickness
		No.1, 2, 3, 4, 5
A	Blue	2.026 ~ 2.029mm (0.0798 ~ 0.0799in)
B	Black	2.023 ~ 2.026mm (0.0796 ~ 0.0798in)
C	None	2.020 ~ 2.023mm (0.0795 ~ 0.0796in)
D	Green	2.017 ~ 2.020mm (0.0794 ~ 0.0795in)
E	Red	2.014 ~ 2.017mm (0.0793 ~ 0.0794in)

(8) Select the bearing by using selection table.

Crankshaft Main Bearing Selection Table

		Cylinder block crankshaft journal bore mark		
		A	B	C
Crank shaft main journal mark	1	E (Red)	D (Green)	C (None)
	2	D (Green)	C (None)	B (Black)
	3	C (None)	B (Black)	A (Blue)

5. Check the crankshaft end play.
   Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

End play
Standard: 0.05 ~ 0.25mm (0.0020 ~ 0.0098in)
Limit : 0.30mm (0.0118in)

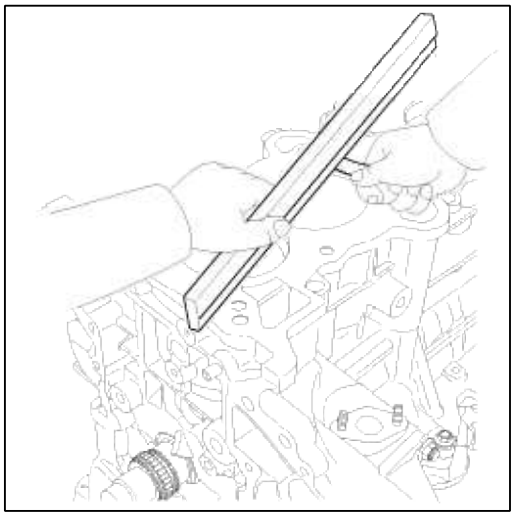
If the end play is greater than maximum, replace the center bearing.

Cylinder Block

1. Remove the gasket material.
   Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
2. Clean the cylinder block
   Using a soft brush and solvent, thoroughly clean the cylinder block.

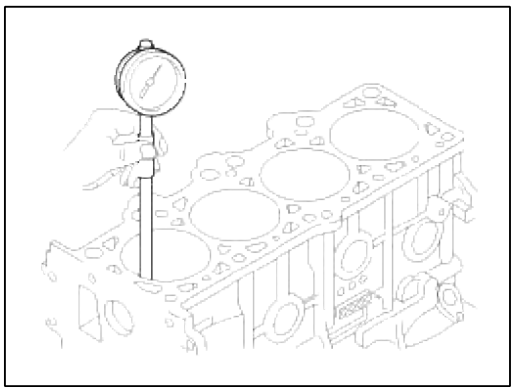
3. Inspect the top surface of cylinder block for flatness.
   Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface
Standard :
Less than 0.05mm (0.0020in)
Less than 0.02mm (0.0008in) - 100mm × 100mm



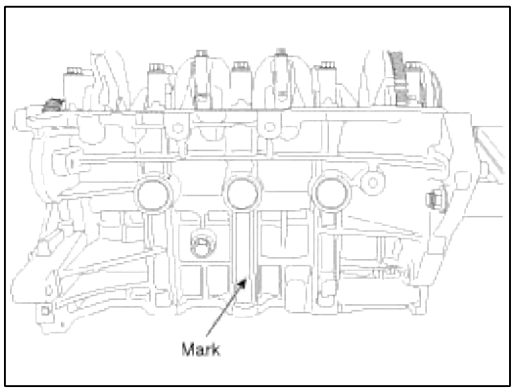
4. Inspect the cylinder bore.
   Visually check the cylinder for vertical scratchs.
   If deep scratchs are present, replace the cylinder block.
5. Inspect the cylinder bore diameter.
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial direction.

Standard diameter :
77.00 ~ 77.03mm (3.0315 ~ 3.0327in)



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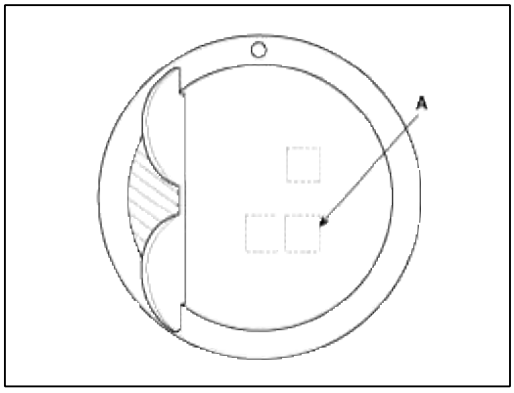
6. Check the cylinder bore size code on the cylinder block side surface.



Discrimination Of Cylinder Bore Size

Mark	Cylinder bore inner diameter
A	77.00 ~ 77.01mm (3.0315 ~ 3.0319in)
B	77.01 ~ 77.02mm (3.0319 ~ 3.0323in)
C	77.02 ~ 77.03mm (3.0323 ~ 3.0327in)

7. Check the piston size mark(A) on the piston top face.



Discrimination Of Piston Outer Diameter

Mark	Piston outer diameter
A	76.97 ~ 76.98mm (3.0303 ~ 3.0307in)
B	76.98 ~ 76.99mm (3.0307 ~ 3.0311in)
C	76.99 ~ 77.00mm (3.0311 ~ 3.0315in)

8. Select the piston related to cylinder bore class.

Piston -to-cylinder clearance :
0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

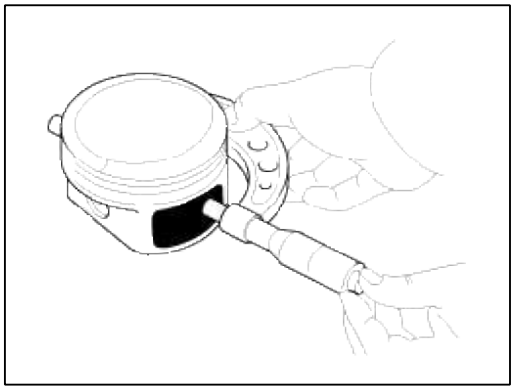
Piston And Piston Rings

1. Clean the piston.
   (1) Using a gasket scraper, remove the carbon from the piston top.
   (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
   (3) Using solvent and a brush, thoroughly clean the piston.

   > NOTE
   >
   > Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 33.9mm(1.5697in) from top land of the piston.

   Standard diameter :
   76.97 ~ 77.00mm (3.0303 ~ 3.0315in)



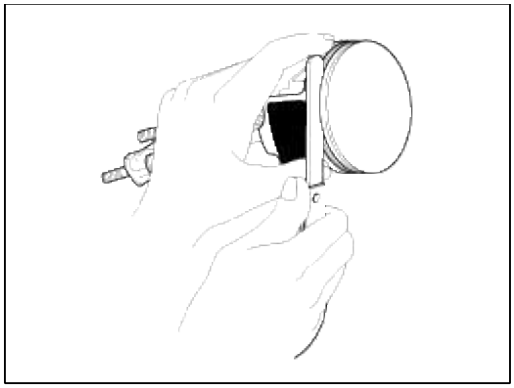
3. Calculate the difference between the cylinder bore inner diameter and the piston outer diameter.

   Piston-to-cylinder clearance :
   0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

4. Inspect the piston ring side clearance.
   Using a feeler gauge, measure the clearance between new piston ring and the wall of ring groove.

   Piston ring side clearance
   No.1 ring : 0.03 ~ 0.07mm (0.0012 ~ 0.0028in)
   No.2 ring : 0.03 ~ 0.07mm (0.0012 ~ 0.0028in)
   Oil ring : 0.06 ~ 0.15mm (0.0024 ~ 0.0059in)
   Limit
   No.1 ring : 0.1mm (0.0039in)
   No.2 ring : 0.1mm (0.0039in)
   Oil ring : 0.2mm (0.0079in)

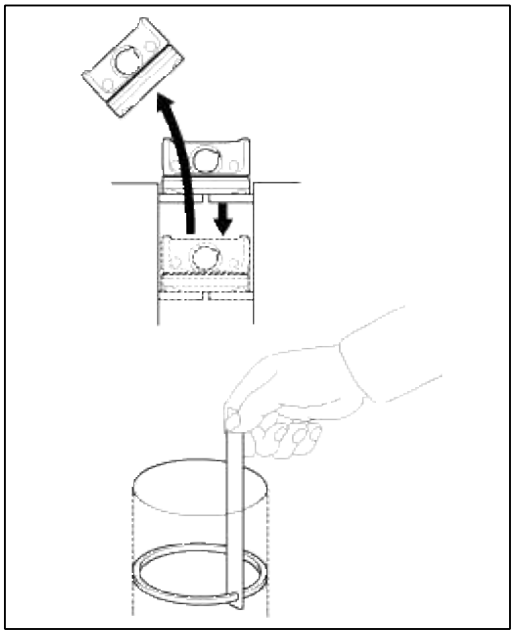
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If the clearance is greater than maximum, replace the piston.

5. Inspect the piston ring end gap.
   To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston rings. If the gap is too large, recheck the cylinder bore inner diameter. If the bore is over the service limit, the cylinder block must be rebored.

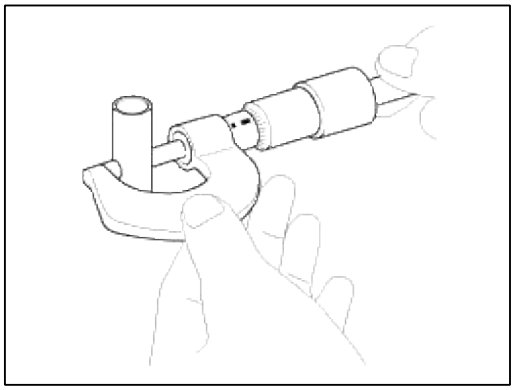
Piston ring end gap
Standard
No.1 ring : 0.14 ~ 0.28mm (0.0079 ~ 0.0138in)
No.2 ring : 0.30 ~ 0.45mm (0.0118 ~ 0.0177in)
Oil ring : 0.20 ~ 0.70mm(0.0079 ~ 0.0276in)
Limit
No.1 ring : 0.3mm(0.0118in)
No.2 ring : 0.5mm(0.0197in)
Oil ring : 0.8mm(0.0315in)



Piston Pins

1. Measure the outer diameter of piston pin

Piston pin diameter :
18.001 ~ 18.006mm (0.7087 ~ 0.7089in)



2. Measure the piston pin-to-piston clearance.

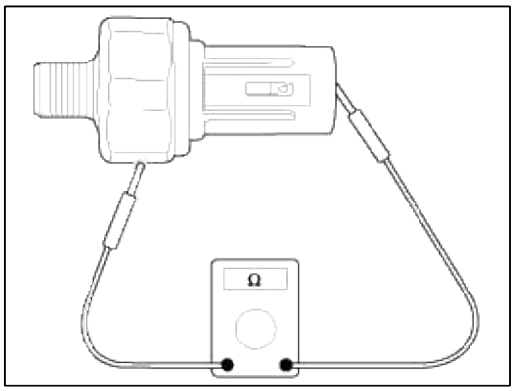
Piston pin-to-piston clearance :
0.010 ~ 0.020mm (0.0004 ~ 0.0008in)

3. Check the difference between the piston pin outer diameter and the connecting rod small end inner diameter.

Piston pin-to-connecting rod interference :
-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)

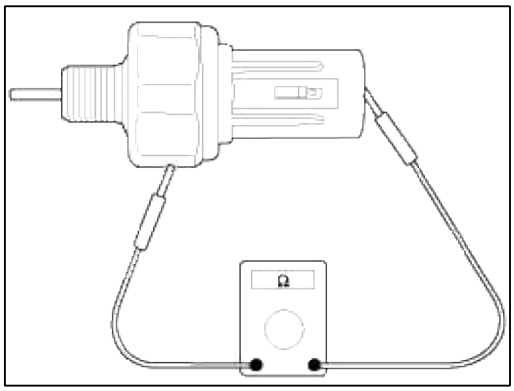
Oil Pressure Switch

1. Check the continuity between the terminal and the body with an ohmmeter. If there is no continuity, replace the oil pressure switch.



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2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.



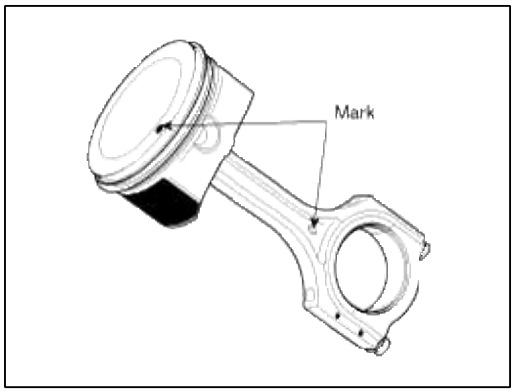
3. If there is no continuity when a 49.0kpa (0.5kg/cm², 7.1psi) is applied through the oil hole, the switch is operating properly.
   Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

Reassembly

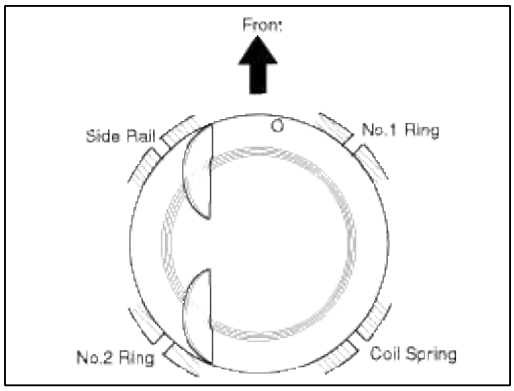
NOTE

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

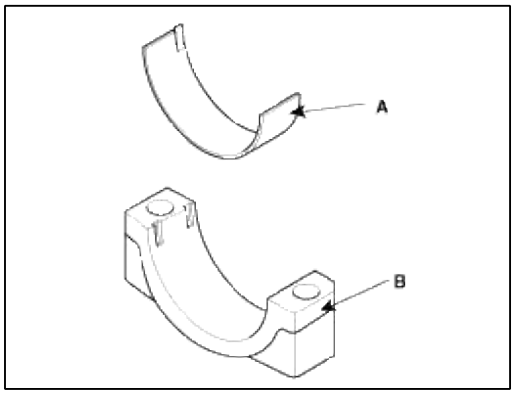
1. Assemble the piston and connecting rod.
   (1) Use a hydraulic press for installation
   (2) The piston front mark and the connecting rod front mark must face the timing chain side of the engine.



2. Install the piston rings.
   (1) Install the oil ring expander and 2 side rails by hand.
   (2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
   (3) Position the piston rings so that the ring ends are as shown.



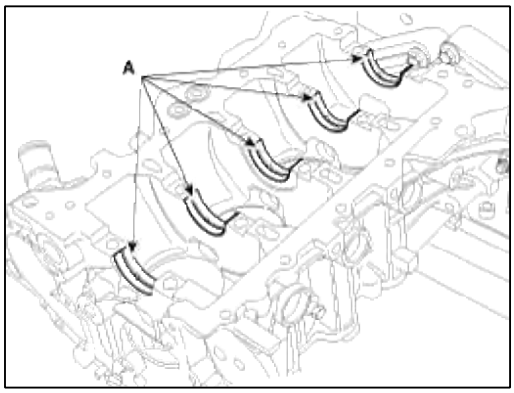
3. Install the connecting rod bearings.
   (1) Align the bearing(A) claw with the groove of the connecting rod or connecting rod cap(B).
   (2) Install the bearings(A) in the connecting rod and connecting rod cap(B).



4. Install the crankshaft main bearings.

> NOTE
>
> Upper bearings have an oil groove of oil holes ; Lower bearings do not.

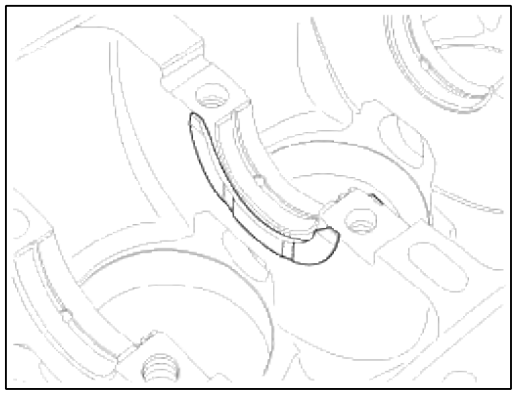
   (1) Align the bearing claw with the claw groove of the cylinder block, push in the five upper bearings(A).



   (2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

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5. Install the thrust bearing.
   Install the thrust bearing(A) on the No.3 journal position of the cylinder block with the oil grooves facing outward.



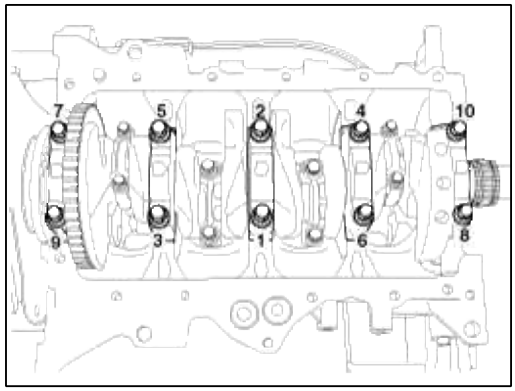
6. Place the crankshaft on the cylinder block.
7. Place the main bearing caps on the cylinder block.
8. Install the main bearing cap bolts.

> NOTE
>
> The main bearing cap bolts are tightened in 2 progressive steps.
> If any of the bearing cap bolts in broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads and under the bearing cap bolts.

(2) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

Tightening torque :
1st - 17.7 ~ 21.6N.m (1.8 ~ 2.2kgf.m, 13.0 ~ 15.9lb-ft)
2nd - 88° ~ 92°



> CAUTION
>
> Do not reuse the main bearing cap bolts.

(3) Check that the crankshaft turns smoothly.

9. Check the crankshaft end play.

10. Install the piston and connecting rod assemblies.

NOTE

Before installing the piston, apply a coat of engine oil to the ring grooves and cylinder bores.

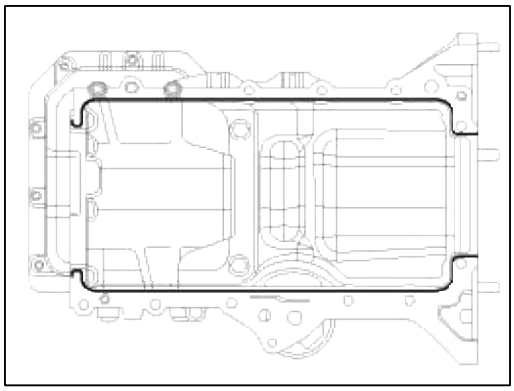
(1) Install the ring compressor, check that the rings are securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.

(2) Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.

(3) Install the rod caps with bearings, and tighten the bolts.(Do not reuse the bolts).

Tightening torque :
1st - 17.7 ~ 21.8N.m (1.8 ~ 2.2kgf.m, 13.0 ~ 15.9lb-ft)
2nd - 88° ~ 92°

11. Apply the sealant on the ladder frame.



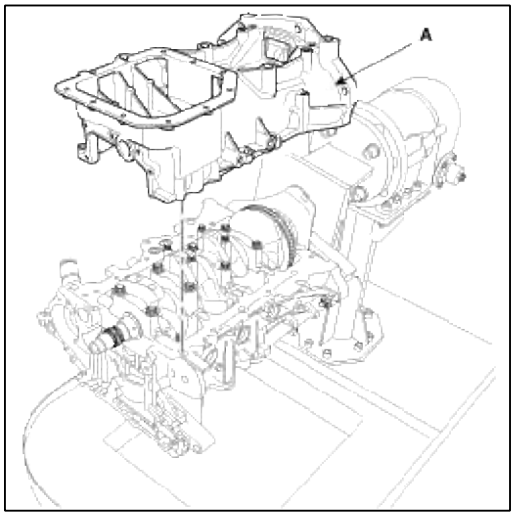
NOTE

- Apply the sealant, THREE-BOND 1217H or LOCTITE 5900H on the ladder frame rail portion and install it with in five minutes.
  If when sealant is applied to cylinder block bottom position, sealant position to be same with positon that is applied to ladder frame rail position.
- Apply sealant along the inner line of the bolt holes.

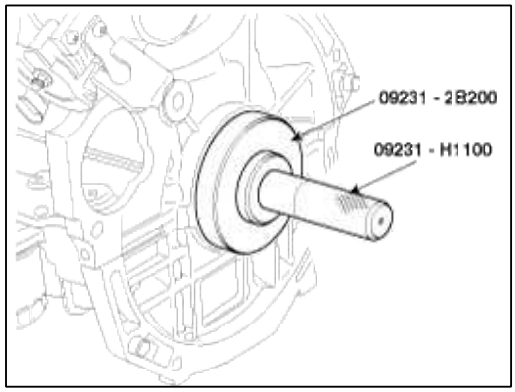
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12. Install the ladder frame(A).

Tightening torque :
18.6 ~ 24.2N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)

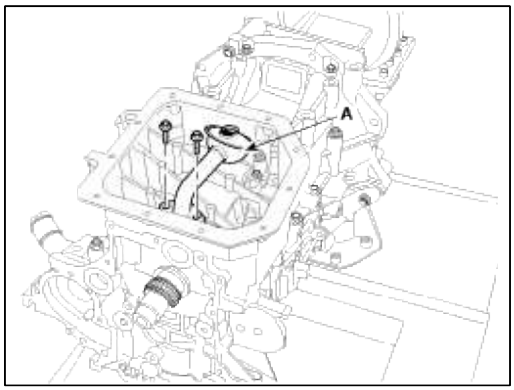


13. Install the rear oil seal.
    (1) Apply engine oil to a new oil seal lip.
    (2) Using the SST(09231-H1100, 09231-2B200) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



14. Install the oil screen.
    Install a new gasket and oil screen with 2 bolts.

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



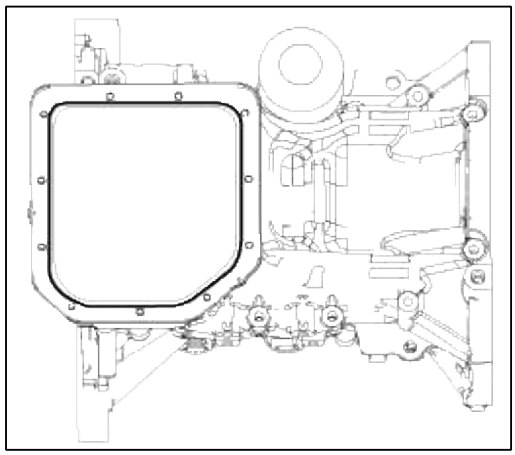
15. Install the oil pan.

(1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

> NOTE
>
> Check that the mating surfaces are clean and dry before applying liquid gasket.

(2) Apply liquid gasket with the width of Ø3mm, starting 1mm-away position from the inner rounding of the oil pan rail.

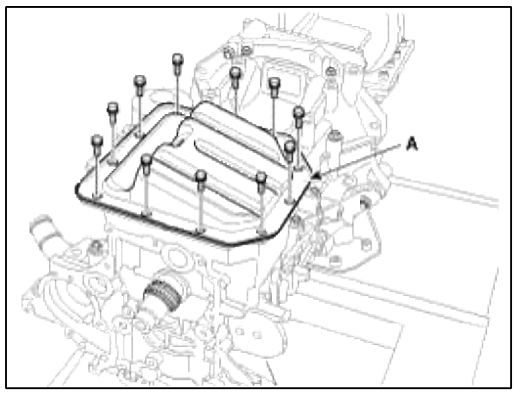
Liquid gasket : TB 1217H or LOCTITE 5900H



> NOTE
>
> - To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
> - Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
> - After assembly, wait at least 30 minutes before filling the engine with oil.

(3) Install the oil pan(A) with the bolts.
Uniformly tighten the bolts in several passes.

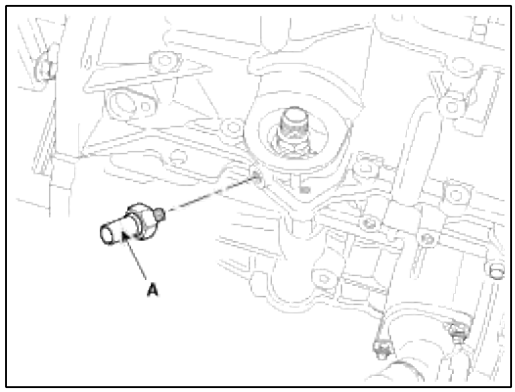
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



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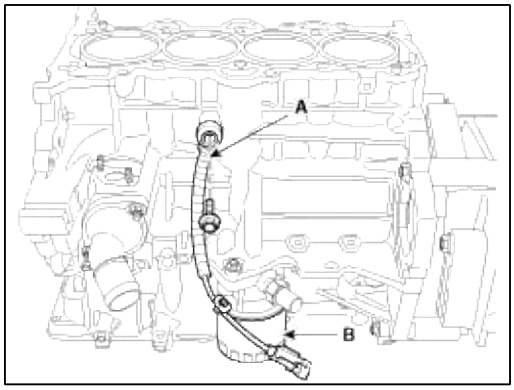
16. Install the oil pressure switch.
    (1) Apply adhesive to 2 or 3 threads.
    (2) Install the oil pressure switch(A).

Tightening torque :
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)



17. Install the knock sensor(A) and the oil filter(B).

Tightening torque :
16.7 ~ 26.5N.m (1.7 ~ 2.7kgf.m, 12.3 ~ 19.5lb-ft)



18. Install the oil level gauge tube.
    (1) Install a new O-ring on the oil level gauge tube.
    (2) Apply engine oil on the O-ring.
    (3) Install the oil level gauge tube with the bolt.

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

19. Install the cylinder head. (Refer to Cylinder head in this group)
20. Install the timing chain. (Refer to Timing chain in this group)
21. Remove the engine stand.
22. A/T :install the drive plate.

Tightening torque :
71.6 ~ 75.5N.m (7.3 ~ 7.7kgf.m, 52.8 ~ 55.7lb-ft)

23. M/T :install the fly wheel.

Tightening torque :
71.6 ~ 75.5N.m (7.3 ~ 7.7kgf.m, 52.8 ~ 55.7lb-ft)

24. Install the engine. (Refer to Engine and transaxle assembly in this group)

Engine Mechanical System > Cooling System > Coolant > Repair procedures

Engine Coolant Refilling And Bleeding

WARNING

Never remove the radiator cap when the engine is hot.
Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

CAUTION

When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts of the paint. If any coolant spills, rinse it off immediately.

1. Remove the radiator cap.
2. Loosen the drain plug, and drain coolant.
3. Tighten the radiator drain plug securely.
4. Remove the coolant reservoir tank. Drain the coolant and reinstall the coolant reservoir tank. Fill the coolant reservoir tank to the "F" mark with coolant mixture.(coolant 5 : water 5)
5. Fill coolant mixture into the radiator to the base of filler neck. Gently squeeze the upper/lower hoses of radiator so as to bleed air easily.

NOTE

- Mix the recommended antifreeze with an equal amount of water in a clean container.
- Use only genuine antifreeze/coolant.
- For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion of freezing.
- Coolant concentration greater then 60% will impair cooling efficiency and are not recommended.

CAUTION

- Do not mix different brands of antifreeze/coolants.
- Do not use additional rust inhibitors or antirust products; they may not be compatible with the coolant.

6. Start engine and allow coolant mixture to circulate.
   When the cooling fan operates and coolant circulates, refill coolant through the radiator filler neck.
7. Repeat 6 until the cooling fan 3~5 times and bleed air sufficiently out of the cooling system.
8. Install the radiator cap and fill the reservoir tank to the "F" line with coolant.
9. Run the vehicle under idle until the cooling fan operates 2~3 times.
10. Stop the engine and allow coolant to cool.

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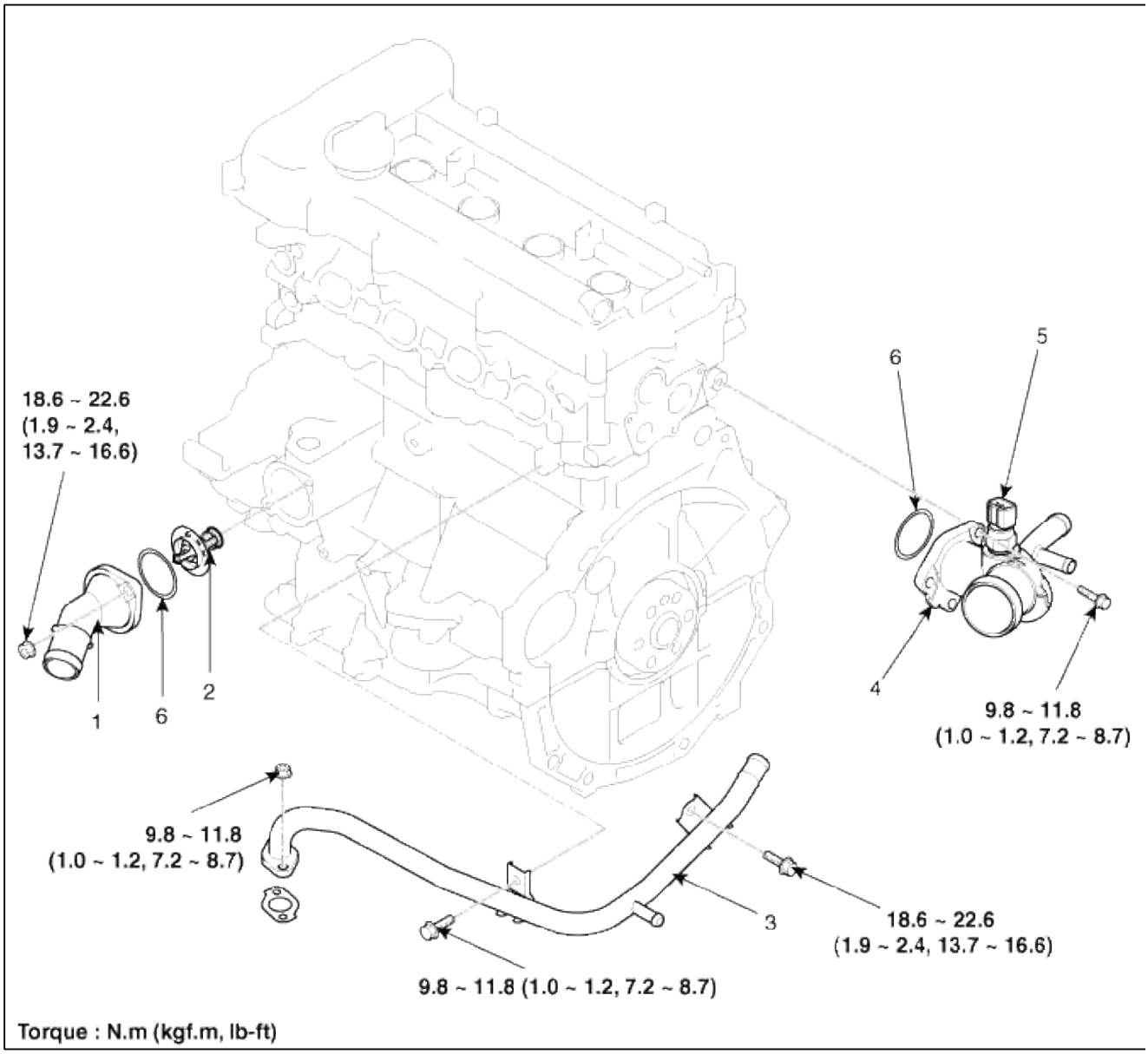
11. Repeat steps 6 to 11 until the coolant level stays constant and all air is bleed out of the cooling system.

> NOTE
>
> Recheck the coolant level in the reservoir tank for 2~3 days after replacing coolant.

Coolant capacity :
6.5 L (6.86 US qt, 5.71 lmp qt)

Engine Mechanical System > Cooling System > Thermostat > Components and Components Location

Components



1. Water inlet fitting 2. Thermostat 3. Heater pipe	4. Water temp control assembly 5. Water temperature sensor 6. O-ring

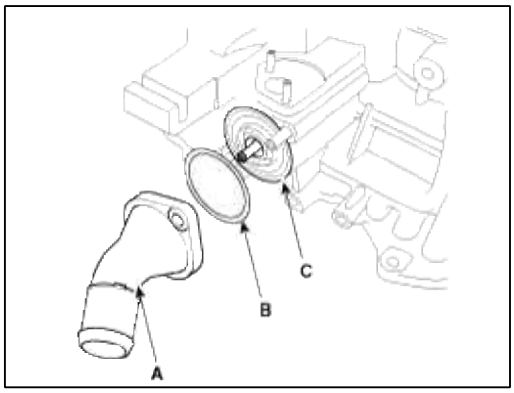
Engine Mechanical System > Cooling System > Thermostat > Repair procedures

Removal

NOTE

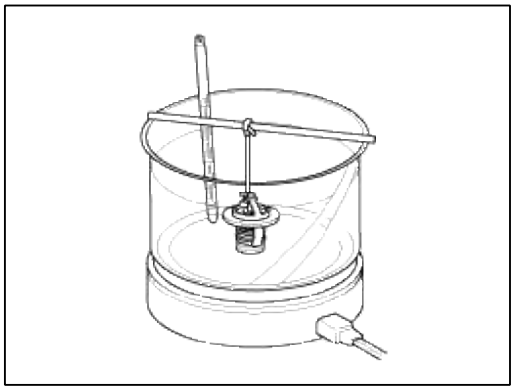
Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

1. Drain engine coolant so that its level would be under the thermostat height.
2. Remove the radiator lower hose.
3. Remove the water inlet fitting (A), O-ring (B) and thermostat (C).



Inspection

1. Immerse the thermostat in water and gradually heat the water.



2. Check the valve opening temperature.

Valve opening temperature : 82±1.5°C (179.6±2.7°F)
Full opening temperature : 95°C (203°F)

If the valve opening temperature is not as specified, replace the thermostat.

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3. Check the valve lift.

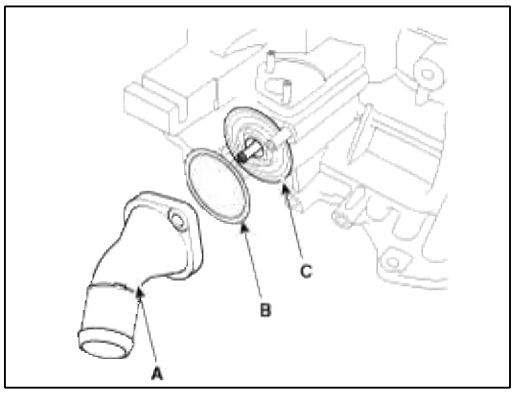
Valve lift : 8mm(0.3in) or more at 95°C (203°F)

If the valve lift is not as specified, replace the thermostat.

Installation

1. Place the thermostat in the block.
   (1) Install the thermostat(B) with the jiggle valve upward.
   (2) Install the new O-ring (B).
2. Install the water inlet fitting(A).

Tightening torque :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



3. Fill with engine coolant.
4. Start engine and check for leaks.

Engine Mechanical System > Cooling System > Thermostat > Troubleshooting

Troubleshooting

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the thermostat gasket	Check the mounting bolts	• Check the torque of the mounting bolts	• Retighten the bolts and check leakage again.
		Check the gasket for damage	• Check gasket or seal for damage	• Replace gaskets and reuse the thermostat.
Cooled excessively	• Low heater performance (cool air blowed-out) • Thermogauge indicates 'LOW'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage.	• After refilling coolant, recheck.
		GDS check&Starting engine	• Check DTCs • Check connection of the fan clutch or the fan motor. If the fan clutch is always connected, there will be a noise at idle.	• Check the engine coolant sensor, wiring and connectors. • Replace the componants.

		Remove the thermostat and inspect	• Check if there are dusts or chips in the thermostat valve. • Check adherence of the thermostat.	• Clean the thermostat valve and reuse the thermostat. • Replace the thermostat, if it doesn't work properly.
Heated excessively	• Engine overheated • Thermogauge indicates 'HI'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage. Be careful when removing a radiator cap of the overheated vehicle. • Check air in cooling system.	• After refilling coolant, recheck. • Check the cylinder head gaskets for damage and the tightening torque of the mounting bolts.
		GDS check&Starting engine	• Check DTCs • Check the fan motor performance as temperature varies. • Check if the fan clutch slips. • Check the water pump adherence or impeller damaged.	• Check the engine coolant sensor, wiring and connectors. • Check the fan motor, the relay and the connector. • Replace the fan clutch, if it doesn't work properly. • Replace the water pump, if it doesn't work properly.
		Immerse the thermostat in boiling water and inspection.	• After removing the thermostat, check it works properly. Check the thermostat opens at the valve opening temperature.	• Replace the thermostat, if it doesn't work properly.

Engine Mechanical System > Cooling System > Water pump > Repair procedures

Removal

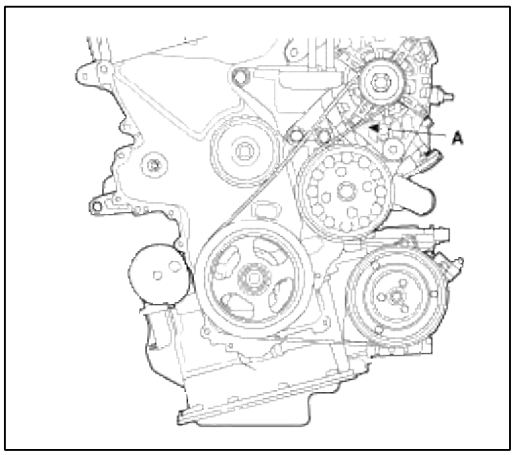
Water Pump

1. Drain engine coolant.

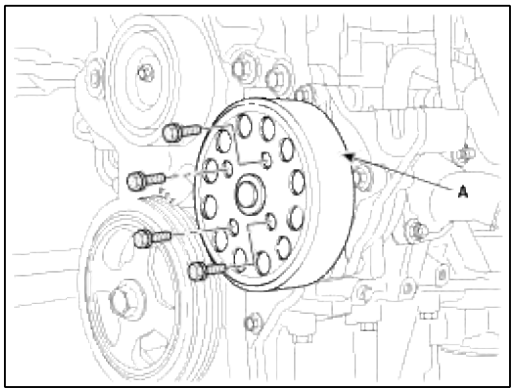
> WARNING
>
> System is under high pressure when the engine is hot.
> To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

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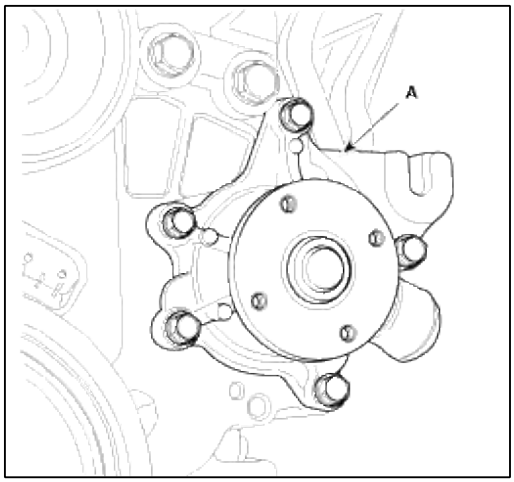
2. Remove the drive belt(A).



3. Remove the water pump pulley(A).



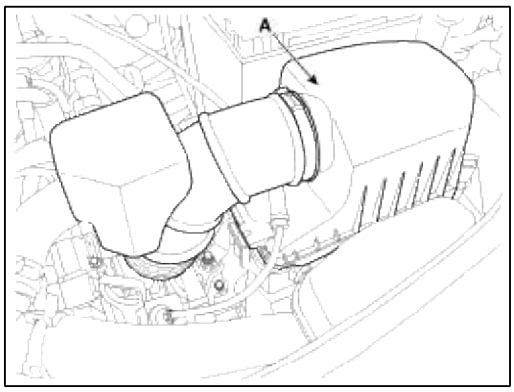
4. Remove the water pump(A).



Water Temperature Control Assembly

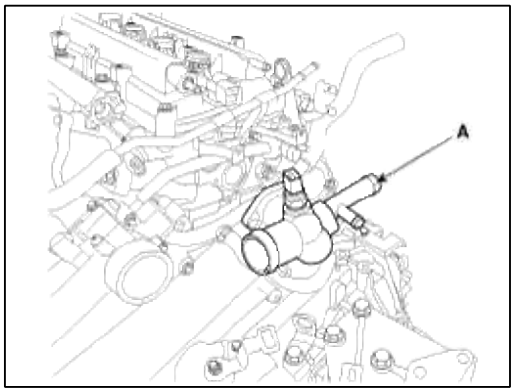
1. Drain engine coolant.

2. Remove the air cleaner assemlby.



3. Remove the water temperature control assemlby(A).

Tightening torque :
9.8 ~ 11.7N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



4. To install, reverse the removal orders.

> CAUTION
>
> Clean the surface of the water temperature control assembly before installing.

Inspection

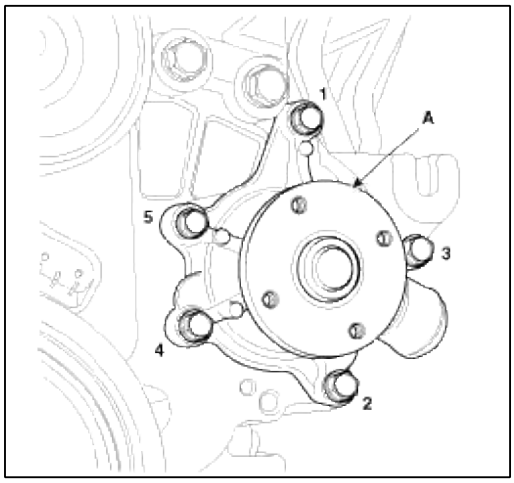
1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly and gasket.

> NOTE
>
> A small amount of "weeping" from the bleed hole is normal.

Installation

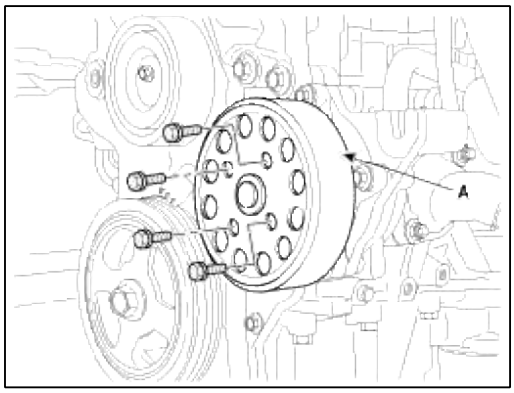
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1. Install the water pump.
   (1) Install the water pump(A) and a new gasket with the bolts.
   Tighten the bolts with the order blow.



   (2) Install the water pump pulley(A) with the four bolts.

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



CAUTION

Tighten the bolts diagonally.

2. Install the drive belts.
3. Fill with engine coolant.
4. Start engine and check for leaks.
5. Recheck engine coolant level.

Engine Mechanical System > Cooling System > Water pump > Troubleshooting

Troubleshooting

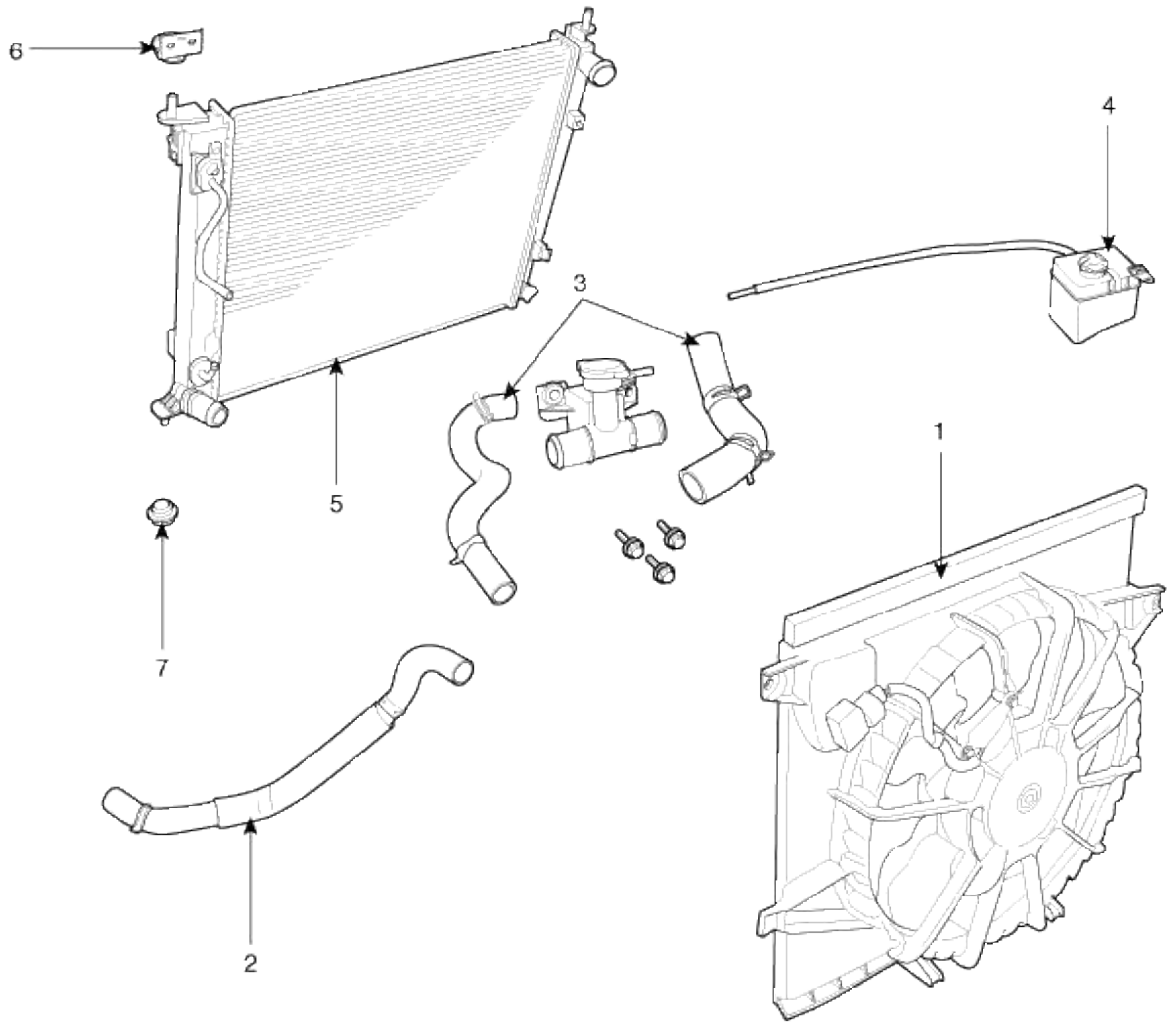
Water Pump

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the bleed hole of the water pump	Visually check	• Check leaks after about ten-minute warming up.	• If coolant still leaks, replace a water pump.
				• If leakage stops, reuse the water pump (Do not replace the pump with a new one).
	• From gaskets or bolts		• Check the tightening of the water pump mounting bolts.	• Retighten the mounting bolts.
			• Check damage of gaskets or inflow of dust.	• Replace the gasket and clean dust off.
	• From outer surface of water pump		• Check the material or any cracks of the water pump.	• Poor material. If any crack found, replace the water pump.
Noise	• From bearings • From mechanical seals • Impeller interference	Inspection with a stethoscope	• After starting the engine, check noise with a stethoscope.	• If there is no noise, reuse the water pump(do not replace it).
				• If there is any noise from the water pump, remove the drive belt and recheck.
		Inspection after removing a drive belt	• After removing a water pump and a drive belt, check noise again.	• If there is noise, reuse the water pump. Check other drive line parts.
				• If there is no noise, replace the water pump with a new one.
		Inspection after removing a water pump	• After removing a water pump and a drive belt, check noise again.	• If there is any interference between them, replace the water pump with a new one.
Overheating	• Damaged impeller • Loosened impeller	Loosened impeller	• Corrosion of the impeller wing	• Check engine coolant. • Poor coolant quality / Maintenance check
			• Impeller seperation from the shaft	• Replace the water pump.

Engine Mechanical System > Cooling System > Radiator > Components and Components Location

Components

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1. Cooling fan 2. Radiator lower hose 3. Radiator upper hose 4. Reservoir tank	5. Radiator 6. Radiator upper mounting bracket 7. Mounting insulator

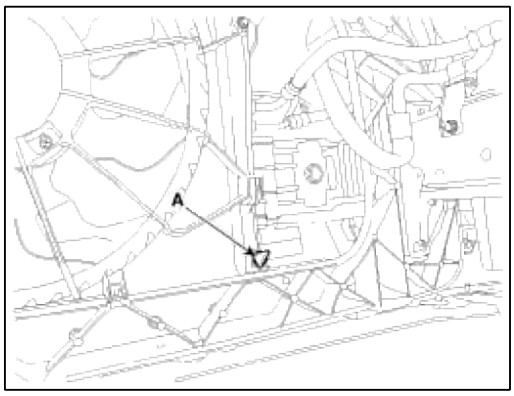
Engine Mechanical System > Cooling System > Radiator > Repair procedures

Removal

WARNING

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

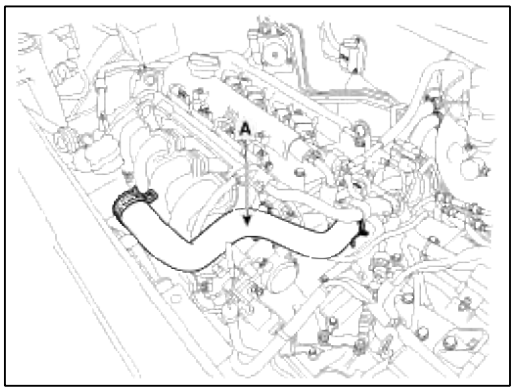
1. Loosen the drain plug (A), and then drain the coolant.

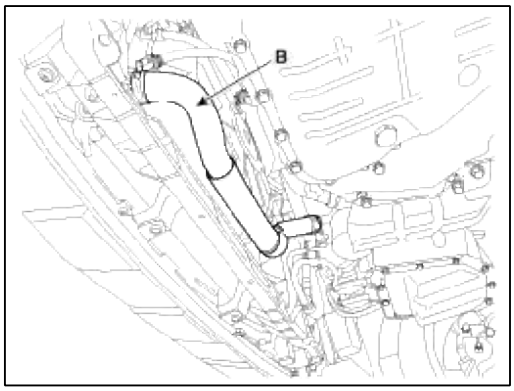


NOTE

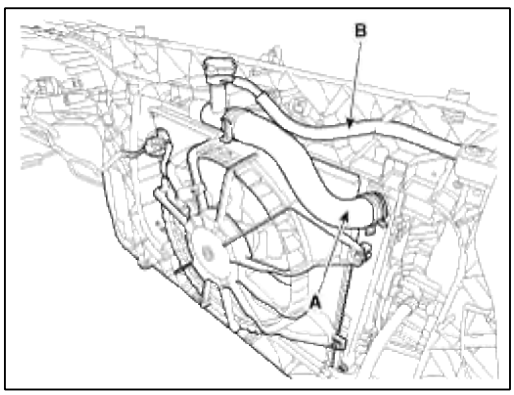
Remove the radiator cap to speed draining.

2. Remove the radiator upper hose (A) and lower hose (B).





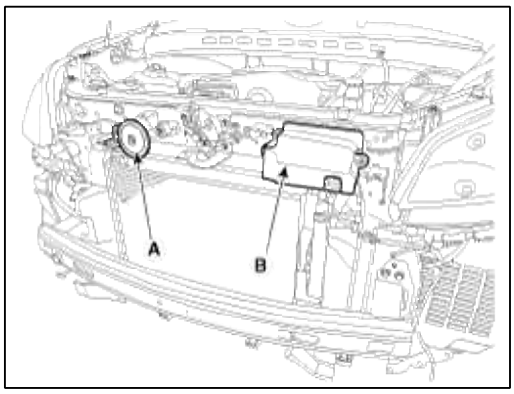
3. Remove the radiator upper hose (A) and reservoir hose (B).



4. Remove the front bumper. (Refer to DB group)

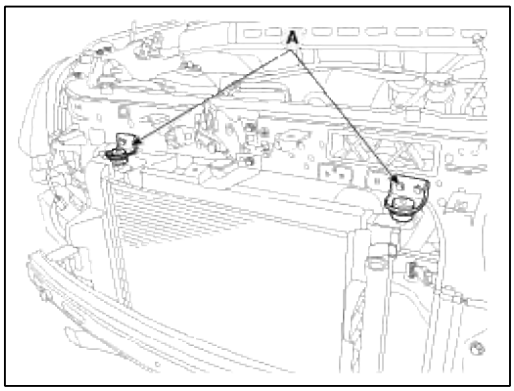
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5. Remove the horn (A) and the bracket cover (B).



6. Remove the radiator mounting brackets (A).

Tightening torque :
6.9 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 8.0lb-ft)



7. After pulling back the condenser fixing bracket and then, remove the radiator assembly.
8. Installation is reverse order of removal.

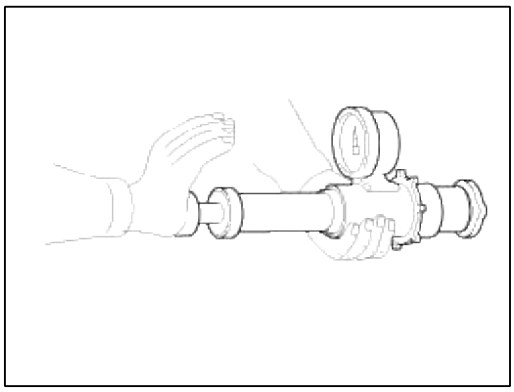
NOTE

- Bleed air from the cooling system
  - Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
  - Turn Off engine. Check the coolant level and add coolant if needed. This will allow trapped air to be removed from the cooling system.
  - Put the radiator cap on tightly, then run engine again and check for leaks.

Inspection

Radiator Cap Testing

1. Remove the radiator cap, wet its seal with engine coolant, then install it on a pressure tester.



2. Apply a pressure of 93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi).
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

Radiator Leakge Test

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.
2. Apply a pressure tester to the radiator and apply a pressure of 93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

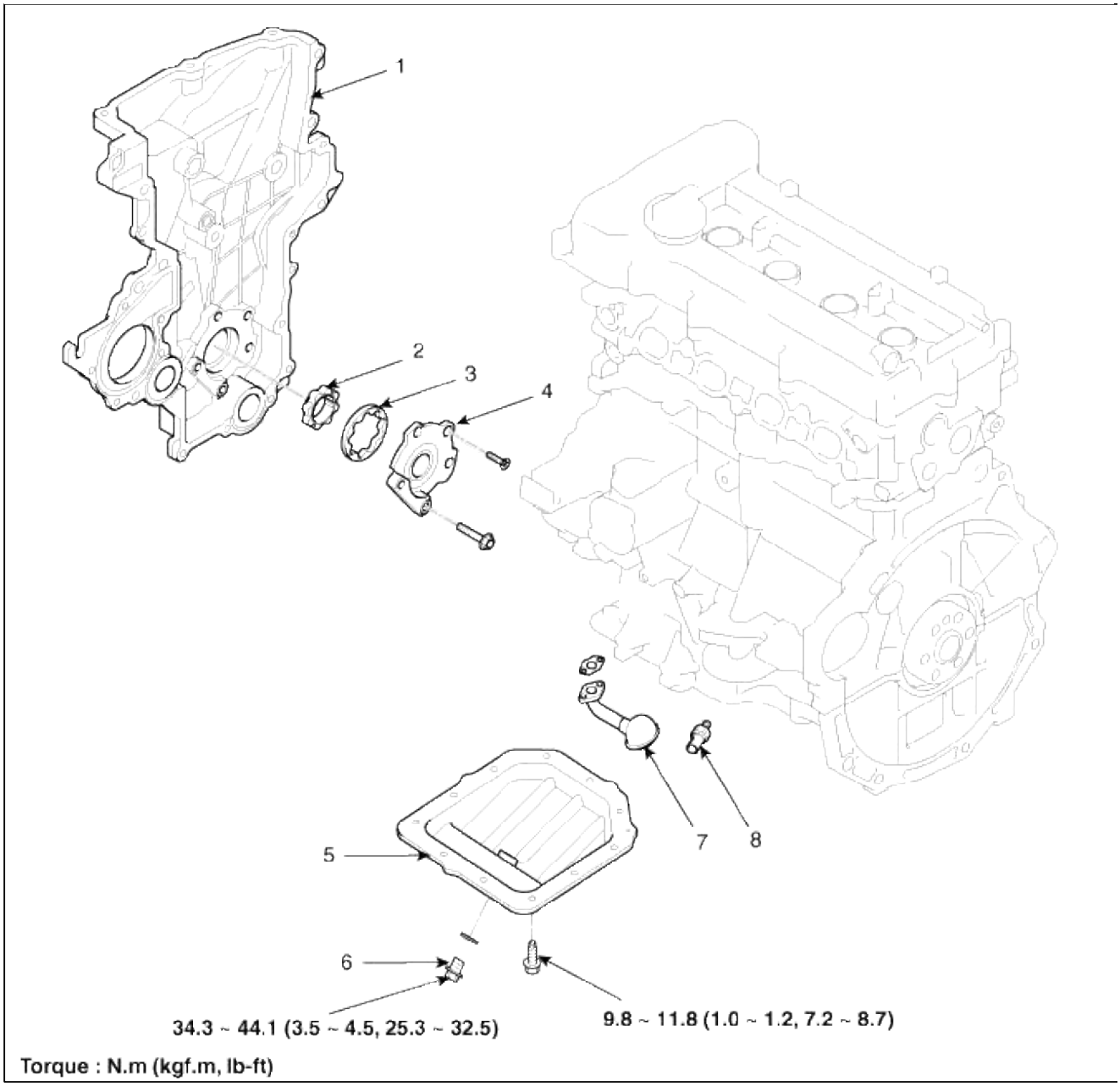
NOTE

Check for engine oil in the coolant and/or coolant in the engine oil.

Engine Mechanical System > Lubrication System > Oil Pump > Components and Components Location

Components

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1. Timing chain cover	5. Oil pan
2. Inner roter	6. Oil drain plug
3. Outer roter	7. Oil screen
4. Pump cover	8. Oil pressure gauge

Engine Mechanical System > Lubrication System > Engine Oil > Repair procedures

Oil And Filter Replacement

CAUTION

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.

1. Drain the engine oil.
   (1) Remove the oil filler cap.
   (2) Remove the oil drain plug, and drain the oil into a container.
2. Replace the oil filter.
   (1) Remove the oil filter.
   (2) Check and clean the oil filter installation surface.
   (3) Check the part number of the new oil filter is as same as old one.
   (4) Apply clean engine oil to the gasket of a new oil filter.
   (5) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
   (6) Tighten it with the torque below.

Tightening torque :
11.8 ~ 15.7N.m (1.2 ~ 1.6kgf.m, 8.7 ~ 11.6lb-ft)

3. Refill with engine oil.
   (1) Clean and install the oil drain plug with a new gasket.

Tightening torque :
34.3 ~ 44.1N.m (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lb-ft)

   (2) Fill with fresh engine oil.

Capacity
Total : 3.7L (3.91US qt, 3.26lmp qt)
Oil pan : 3.0L (3.17US qt, 2.64lmp qt)
Drain and refill in cluding oil filter :
3.3L (3.49US qt, 2.90lmp qt)

   (3) Install the oil filler cap.
4. Start engine and check for oil leaks.
5. Recheck the engine oil level.

Inspection

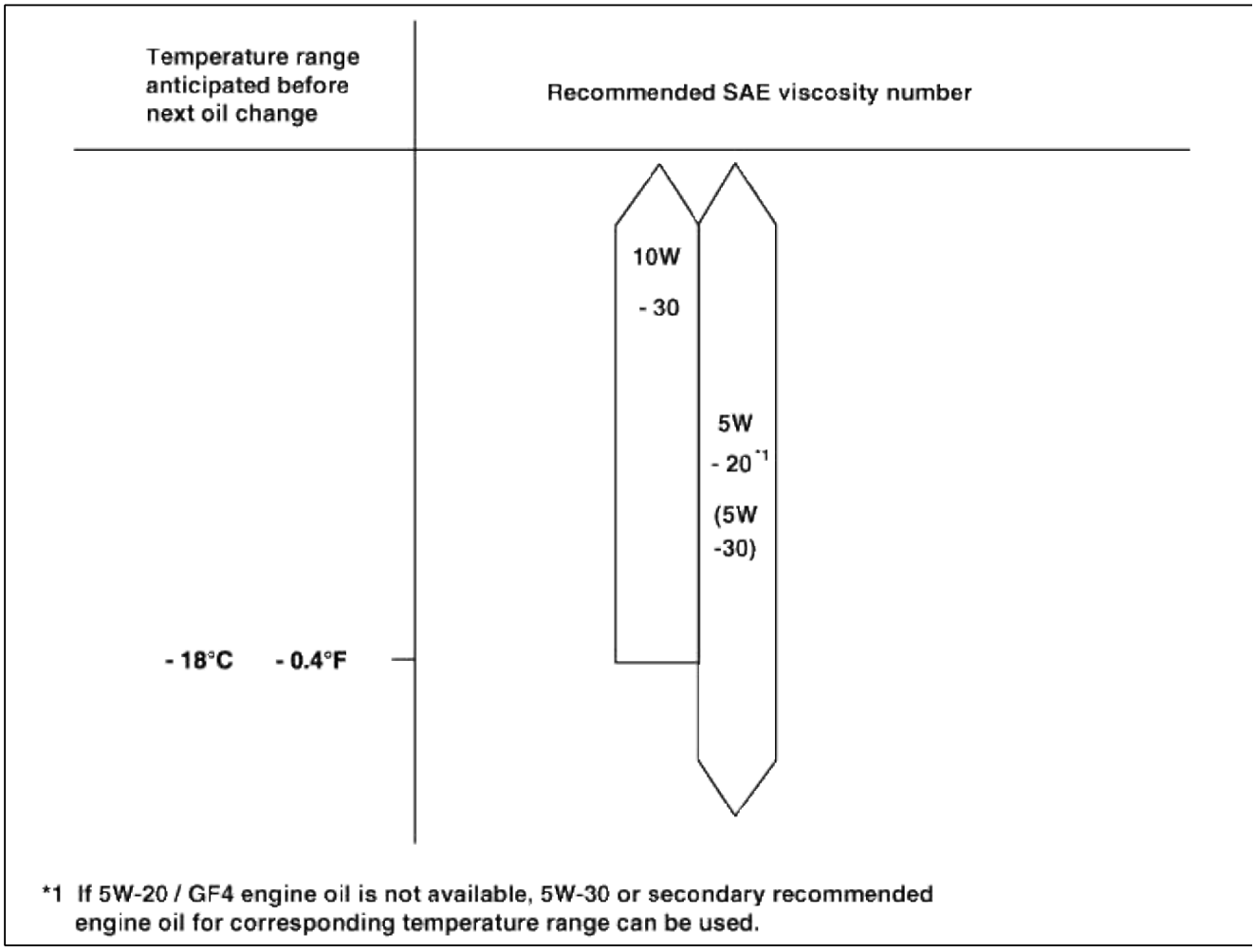
1. Check the engine oil quality.
   Check the oil deterioration, entry of water, discoloring of thinning.
   If the quality is visibly poor, replace the oil.

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2. Check the engine oil level.
   After warning up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks in the dipstick.
   If low, check for leakage and add oil up to the "F" mark.

> NOTE
>
> Do not fill with engine oil above the "F" mark.

Selection Of Engine Oil
Recommendation : 5W-20/GF4&SM (If not available, refer to the recommended API or ILSAC classification and SAE viscosity number.)
API classification : SL, SM or above
ILSAC classification : GF3, GF4 or above
SAE viscosity grade : Refer to the recommended SAE viscosity number.



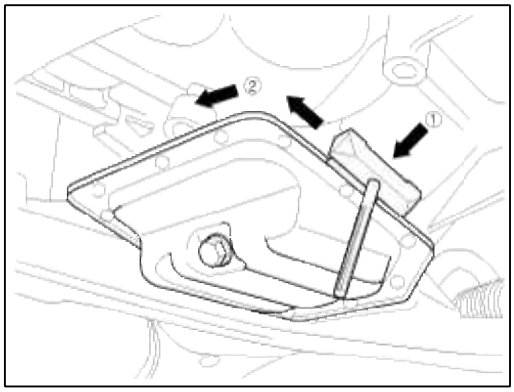
*1 If 5W-20 / GF4 engine oil is not available, 5W-30 or secondary recommended engine oil for corresponding temperature range can be used.

> NOTE
>
> For best performance and maximum protection of all types of operation, select only those lubricants which :
> 1. Satisfy the requirement of the API or ILSAC classification.
> 2. Have proper SAE grade number for expected ambient temperature range.
> 3. Lubricants that do not have both an SAE grade number and API or ILSAC service classification on the container should not be used.

Engine Mechanical System > Lubrication System > Oil Pan > Repair procedures

Removal

1. Drain engine oil.
2. Using the SST(09215-3C000) and remove the oil pan.



CAUTION

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of ① arrow.
- After tapping the SST with a plastic hammer along the direction of ② arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not turn over the SST abruptly without tapping. It be result in damage of the SST.

Installation

1. Install the oil pan.
   (1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

NOTE

Check that the mating surfaces are clean and dry before applying liquid gasket.

   (2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.

Liquid gasket : TB 1217H or LOCTITE 5900H

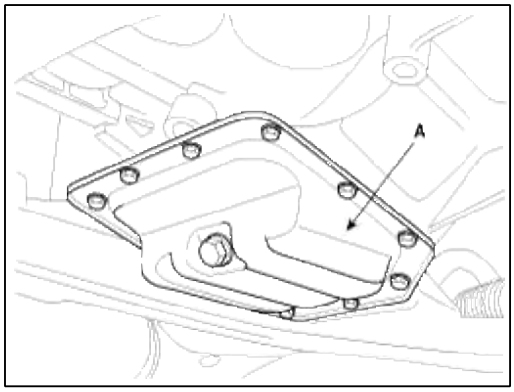
NOTE

- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

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(3) Install the oil pan(A) with the bolts.
Uniformly tighten the bolts in several passes.

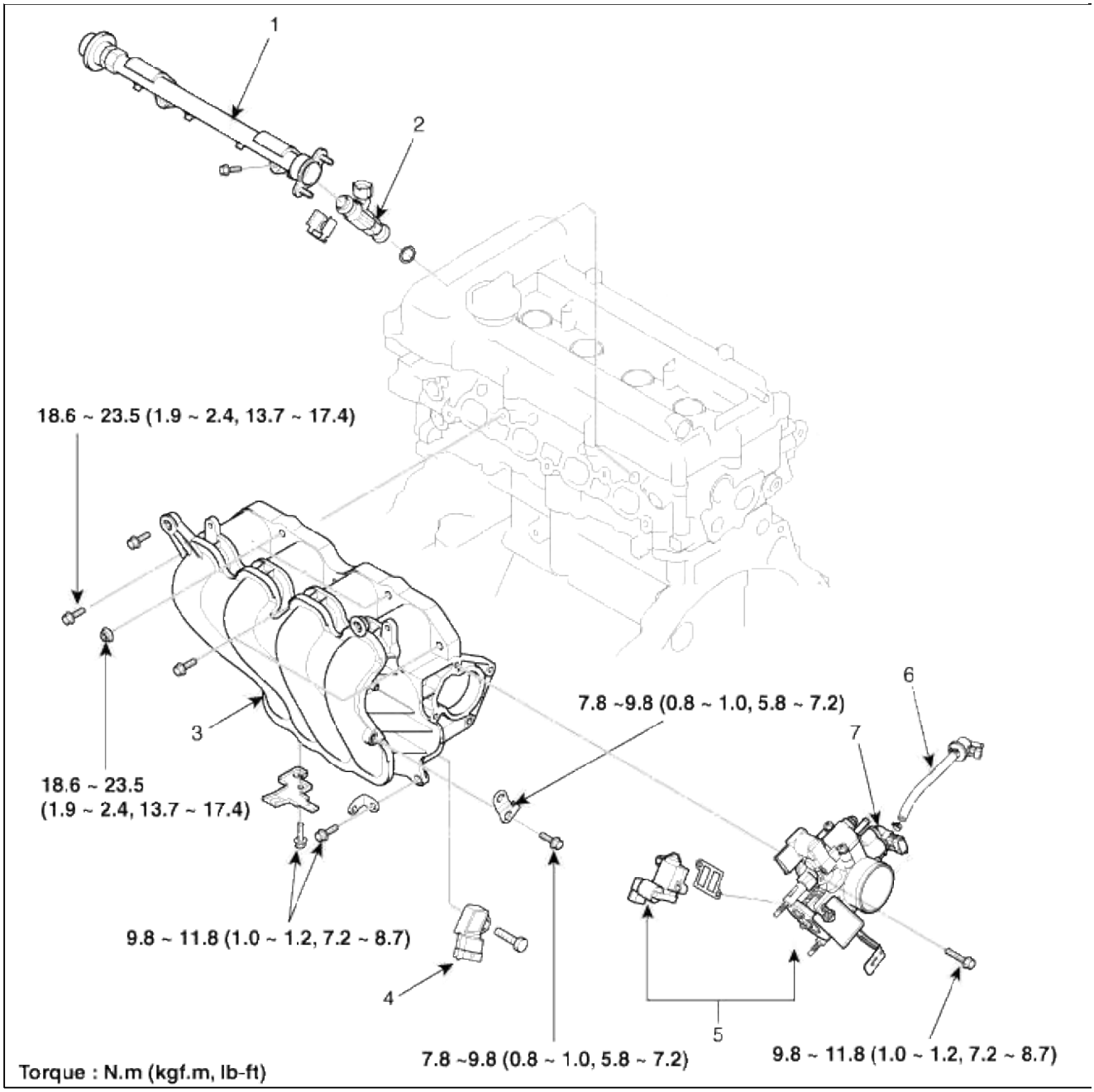
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



2. Refill engine oil.

Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Components and Components Location

Components



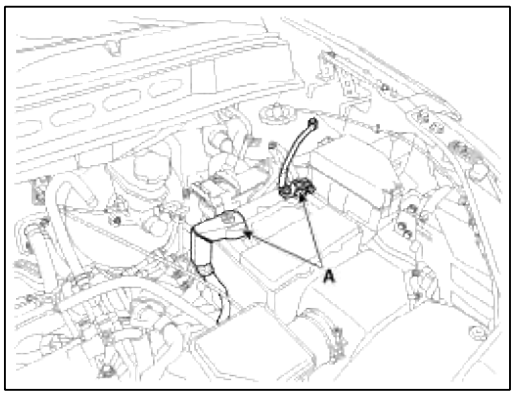
1. Delivery pipe 2. Injector 3. Intake manifold 4. MAP semsor	5. Throttle body 6. Water hose 7. Throttle position sensor(TPS)

Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Repair procedures

Removal

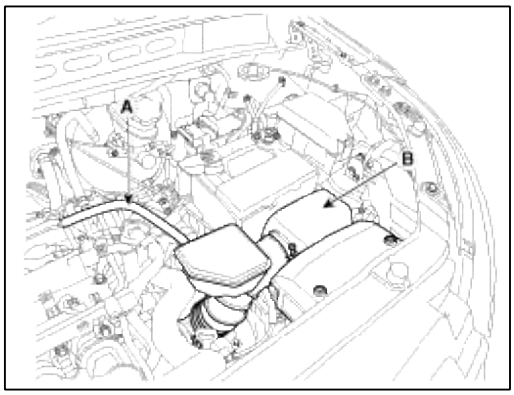
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1. Disconnect the battery terminal (A).

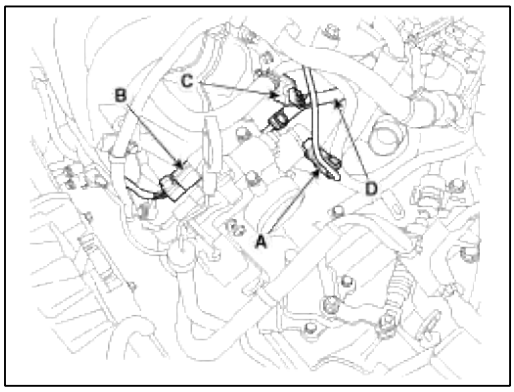


2. Disconnect the breather hose (A) and then, remove the air cleaner assembly (B).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

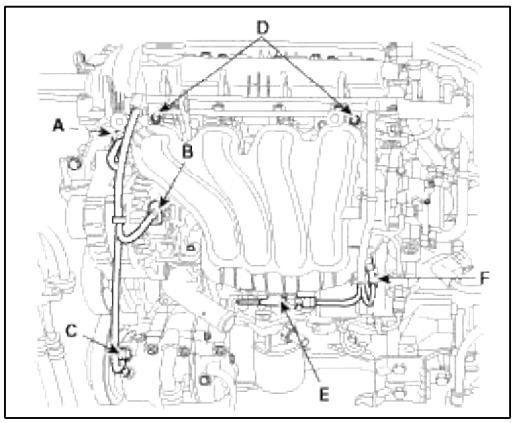


3. Disconnect the wiring connectors and harness clamps.
   (1) Disconnect the TPS (Throttle Position Sensor) connector (A).
   (2) Disconnect the ISA (Idle Speed Actuator) connector (B).
   (3) Disconnect the CMP (Camshaft position sensor) connector (C).
   (4) Disconnect the PCSV hose (D).



   (5) Disconnect the OCV connector (A), the alternator connector (B).
   (6) Disconnect the compressor connector (C).
   (7) Remove the ignition coil harness mounting bolts (D).

(8) Remove the knock sensor bracket (E) and disconnect MAP sensor connector (F).

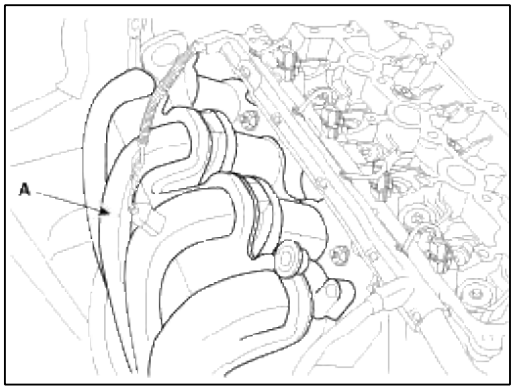


4. Remove the oil level gauge (A).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

5. Remove the intake manifold assembly (A).

Tightening torque :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



6. To install, reverse the removal order.

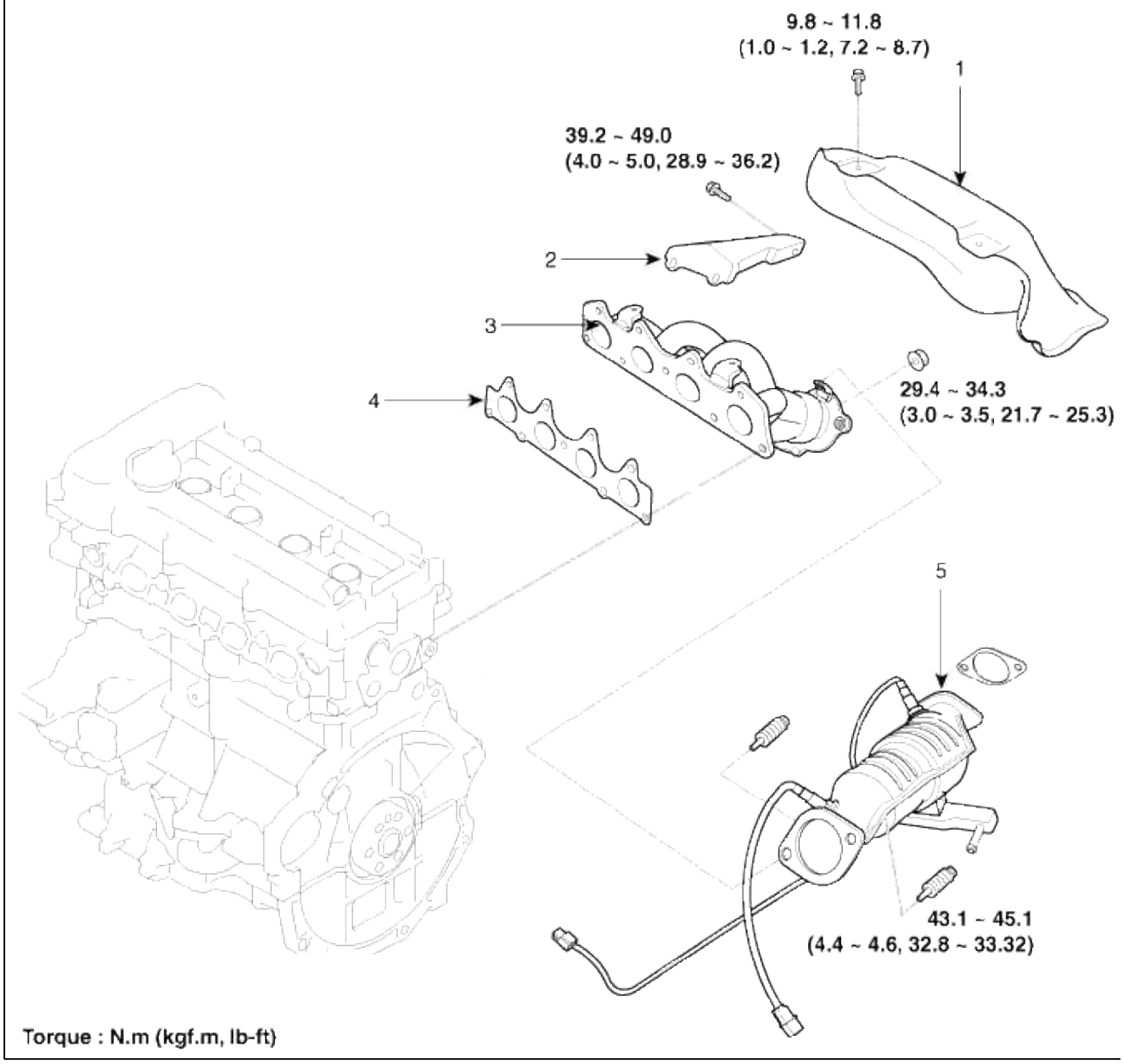
NOTE

Check that the intake manifold gasket for cracks or damage. Replace as necessary.

Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Components and Components Location

Components

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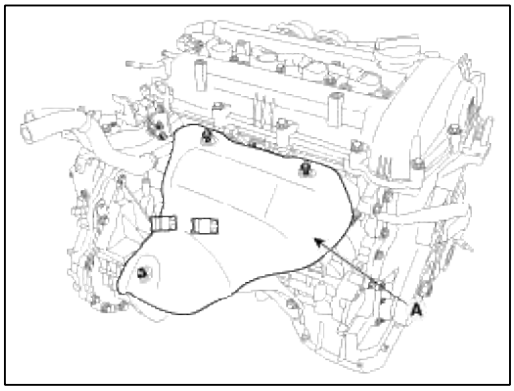
1. Heat protector 2. Exhaust manifold stay 3. Exhaust manifold	4. Gasket 5. Catalytic convertor

Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Repair procedures

Removal

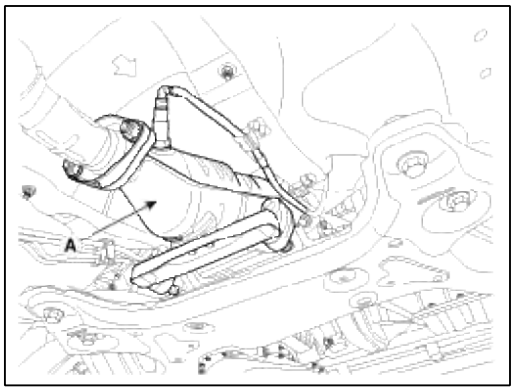
1. Disconnect the oxygen sensor connectors and then, remove the heat protector (A).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



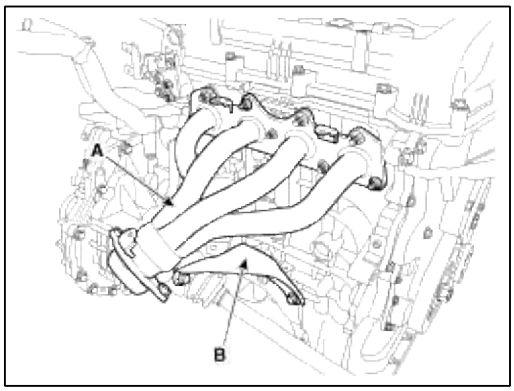
2. Remove the catalytic converter (A).

Tightening torque :
Bolts : 43.1 ~ 45.1N.m (4.4 ~ 4.6kgf.m, 31.8 ~ 33.3lb-ft)
Nuts : 39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



3. Remove the exhaust manifold stay (B) and the exhaust manifold(A) with its gasket.

Tightening torque :
Nuts (A) : 39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)
Bolts (B) : 29.4 ~ 34.3N.m (3.0 ~ 3.5kgf.m, 21.7 ~ 25.3lb-ft)

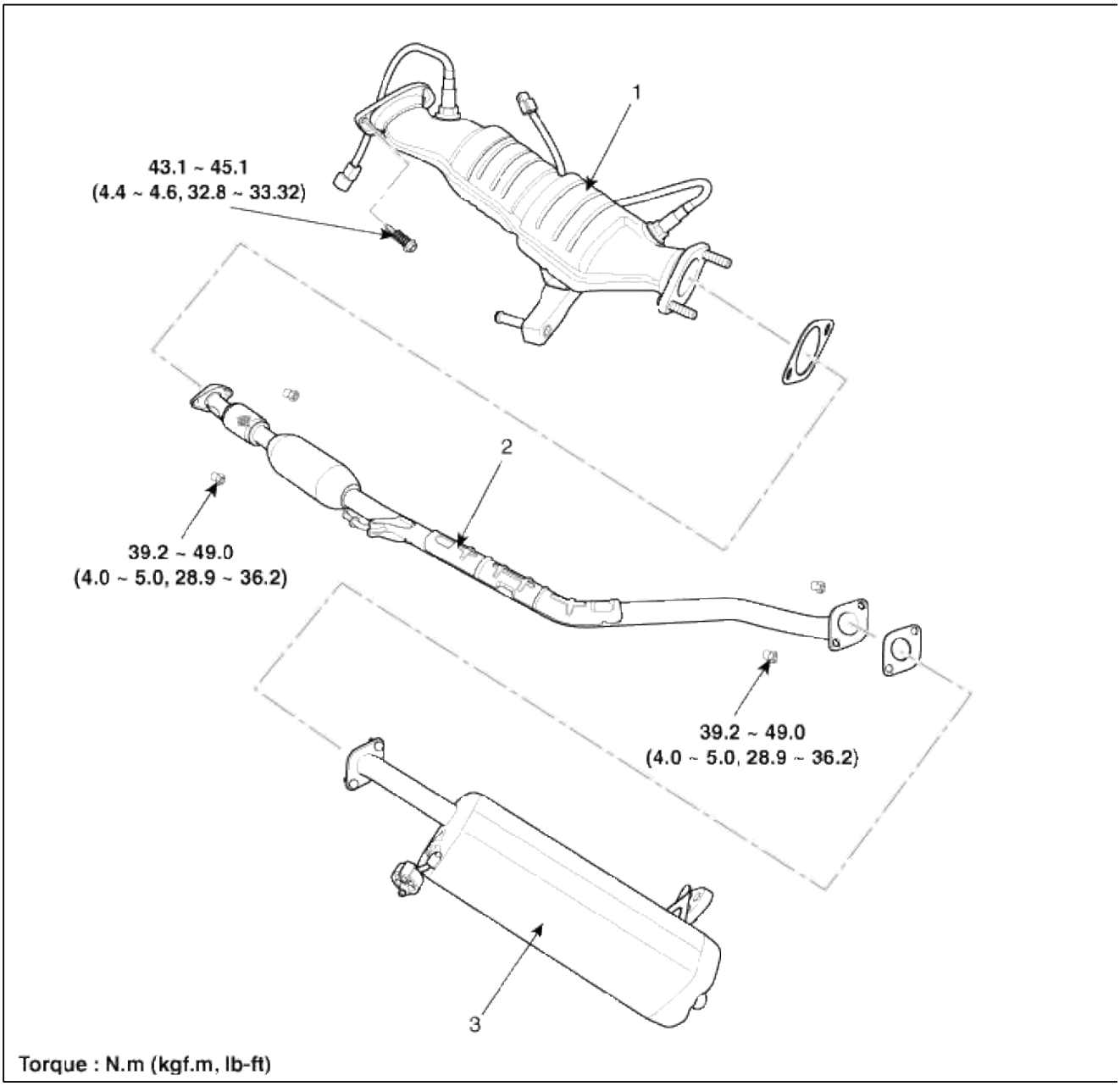


4. Installation is reverse order of removal.

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Engine Mechanical System > Intake And Exhaust System > Muffler > Components and Components Location

Components



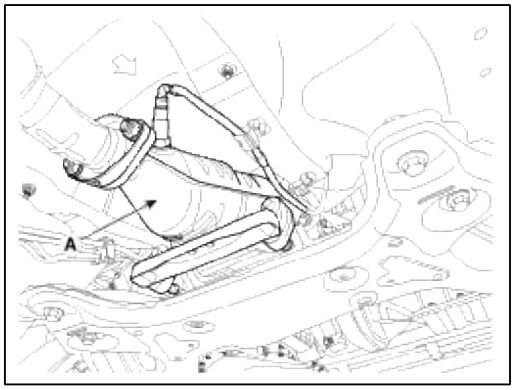
1. Catalytic convertor 2. Center muffler	3. Main Muffler

Engine Mechanical System > Intake And Exhaust System > Muffler > Repair procedures

Removal

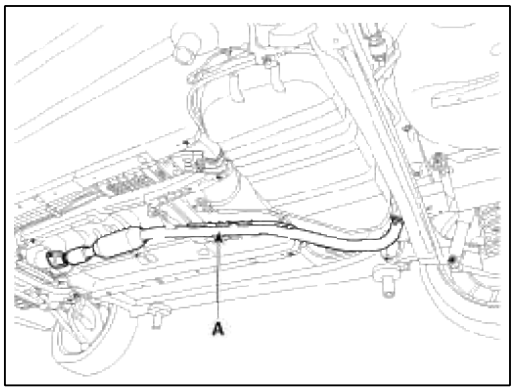
1. Remove the catalytic converter (A).

Tightening torque :
Bolts : 43.1 ~ 45.1N.m (4.4 ~ 4.6kgf.m, 31.8 ~33.3lb-ft)
Nuts : 39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~36.2lb-ft)



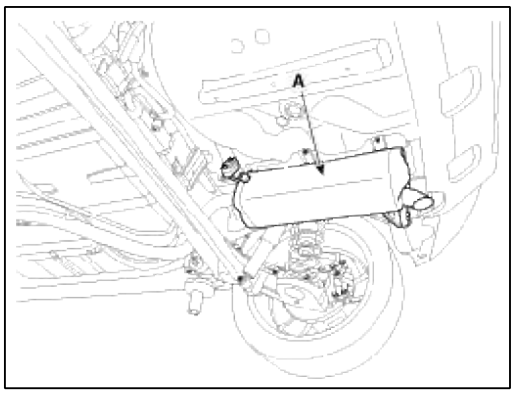
2. Remove the center muffler (A).

Tightening torque :
39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~36.2lb-ft)



3. Remove the main muffler (A).

Tightening torque :
39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~36.2lb-ft)



SOUL(AM) > 2010 > G 1.6 DOHC > Fuel System

Fuel System > General Information > Specifications

Specifications

Fuel Delivery System

Items	Specification	
Fuel Tank	Capacity	48 lit. (12.7 U.S gal., 50.7 U.S.qt., 42.2 Imp.qt.)
Fuel Filter	Type	Paper type
Fuel Pressure Regulator	Regulated Fuel Pressure	338 ~ 348 kpa (3.45 ~ 3.55 kgf / cm², 49.0 ~ 50.5 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor
Fuel Return System	Type	Returnless

Sensors

Manifold Absolute Pressure Sensor (MAPS)

Type: Piezo-resistive pressure sensor type

Specification

Pressure (kPa)	Output Voltage (V)
20.0	0.79
46.7	1.84
101.32	4.0

Intake Air Temperature Sensor (IATS)

Type: Thermistor type

Specification

Temperature [°C(°F)]	Resistance (kΩ)
-40(-40)	40.93 ~ 48.35
-30(-22)	23.43 ~ 27.34
-20(-4)	13.89 ~ 16.03
-10(14)	8.50 ~ 9.71
0(32)	5.38 ~ 6.09
10(50)	3.48 ~ 3.90
20(68)	2.31 ~ 2.57
25(77)	1.90 ~ 2.10
30(86)	1.56 ~ 1.74
40(104)	1.08 ~ 1.21

60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

Engine Coolant Temperature Sensor (ECTS)
Type: Thermistor type
Specification

Temperature [°C(°F)]	Resistance (kΩ)
-40(-40)	48.14
-20(-4)	14.13 ~ 16.83
0(32)	5.79
20(68)	2.31 ~ 2.59
40(104)	1.15
60(140)	0.59
80(176)	0.32

Throttle Position Sensor (TPS)
Type: Variable resistor type
Specification

Throttle Angle	Output Voltage (V)
C.T	0.25 ~ 0.9
W.O.T	Min. 4.0V

Items	Specification
Sensor Resistance (kΩ)	1.6 ~ 2.4 [20°C(68°F)]

Heated Oxygen Sensor (HO2S)
Type: Zirconia (ZrO2) type
Specification

A/F Ratio (λ)	Output Voltage (V)
Rich	0.6 ~ 1.0
Lean	0 ~ 0.4

Item	Specification
Heater Resistance (Ω)	Approx. 9.0 [20°C (68°F)]

Camshaft Position Sensor (CMPS)
Type: Hall effect type

Crankshaft Position Sensor (CKPS)
Type: Magnetic field sensitive Type

Item	Specification
Coil Resistance (Ω)	774 ~ 946 [20°C (68°F)]

Knock Sensor (KS)
Type: Piezo-electricity type
Specification

Item	Specification
Capacitance (pF)	950 ~ 1,350
Resistance(MΩ)	4.87

Fuel Tank Pressure Sensor (FTPS)
Type: Piezo-Resistive Pressure Sensor
Specification

Pressure (kPa)	Output Voltage (V)
-6.67	0.5
0	2.5
+6.67	4.5

Actuators
Injector
Number: 4
Specification

Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 [20°C (68°F)]

Idle Speed Control Actuator (ISCA)
Type: Double coil type
Specification

Item	Specification
Closing Coil Resistance (Ω)	14.6 ~ 16.2 [20°C (68°F)]
Opening Coil Resistance (Ω)	11.1 ~ 12.7 [20°C (68°F)]

Duty (%)	Air Flow Rate (/h)
15	0.5 ~ 1.4
35	4.6 ~ 8.0
70	25.0 ~ 32.0
96	33.0 ~ 40.0

Purge Control Solenoid Valve (PCSV)

Specification

Item	Specification
Coil Resistance (Ω)	16.0 [20°C (68°F)]

CVVT Oil Control Valve (OCV)

Specification

Item	Specification
Coil Resistance (Ω)	6.9 ~ 7.9 [20°C (68°F)]

Canister Close Valve (CCV)

Specification

Item	Specification
Coil Resistance (Ω)	15.5 ~ 18.5 [20°C (68°F)]

Ignition Coil

Type: Stick type

Specification

Item	Specification
Primary Coil Resistance (Ω)	0.75 ± 15 [20°C (68°F)]
Secondary Coil Resistance (kΩ)	7.0 ± 15 [20°C (68°F)]

Service Standard

Items	Specification		
Ignition Timing	BTDC 6° ± 10°		
Idle Speed	A/CON OFF	Neutral,N,P-range	660 ± 100 rpm
		D-range	660 ± 100 rpm
	A/CON ON	Neutral,N,P-range	660 ± 100 rpm
		D-range	690 ± 100 rpm

Tightening Torques

Engine Control System

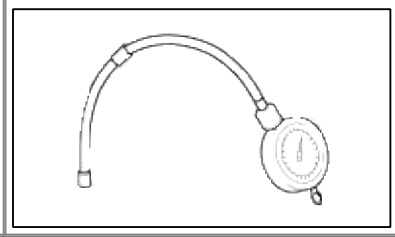
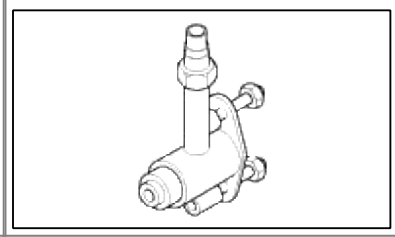
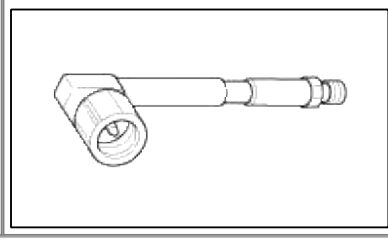
Item	kgf.m	N.m	lb-ft
ECM installation nut	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
ECM bracket installation bolt	2.0 ~ 3.0	19.6 ~ 29.4	14.5 ~ 21.7
ECM bracket installation nut	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Manifold absolute pressure sensor installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Engine coolant temperature sensor installation	3.0 ~ 4.0	29.4 ~ 39.2	21.7 ~ 28.9
Throttle position sensor installation screw	0.15 ~ 0.25	1.5 ~ 2.5	1.1 ~ 1.8
Crankshaft position sensor installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Camshaft position sensor installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Knock sensor installation bolt	1.9 ~ 2.5	18.6 ~ 24.5	13.7 ~ 18.1
Heated oxygen sensor (Bank 1 / Sensor 1) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Heated oxygen sensor (Bank 1 / Sensor 2) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Idle speed control actuator installation bolt	0.6 ~ 0.8	5.9 ~ 7.8	4.3 ~ 5.8
CVVT Oil control valve installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Ignition coil installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Canister close valve installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Throttle body installation bolt/nut	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7

Fuel Delivery System

Item	kgf.m	N.m	lb-ft
Fuel tank installation bolt	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
Fuel tank installation nut	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
Fuel pump installation nut	0.2 ~ 0.3	2.0 ~ 2.9	1.4 ~ 2.2
Fuel tank air filter installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Filler-neck assembly installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Filler-neck assembly installation screw	0.6 ~ 0.7	5.6 ~ 6.9	4.3 ~ 5.1
Delivery pipe installation bolt	2.0 ~ 2.5	19.6 ~ 24.5	14.5 ~ 18.1

Fuel System > General Information > Special Service Tools

Special Service Tools

Tool(Number and name)	Illustration	Application
09353-24100 Fuel Pressure Gauge		Measuring the fuel line pressure
09353-38000 Fuel Pressure Gauge Adapter		Connection between the delivery pipe and fuel feed line
09353-24000 Fuel Pressure Gauge Connector		Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000)

Fuel System > General Information > Troubleshooting

Basic Troubleshooting

Basic Troubleshooting Guide

1	**Bring Vehicle to Workshop**

2	**Analyze Customer's Problem**

- Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	**Verify Symptom, and then Check DTC and Freeze Frame Data**

- Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC).
- Record the DTC and freeze frame data.

NOTE

To erase DTC and freeze frame data, refer to Step 5.

4	**Confirm the Inspection Procedure for the System or Part**

- Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	**Erase the DTC and Freeze Frame Data**

WARNING

NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET".

6	**Inspect Vehicle Visually**

- Go to Step 11, if you recognize the problem.

7	**Recreate (Simulate) Symptoms of the DTC**

- Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.
- If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.

8	**Confirm Symptoms of Problem**

- If DTC(s) is/are not displayed, go to Step 9.
- If DTC(s) is/are displayed, go to Step 11.

9	**Recreate (Simulate) Symptom**

- Try to recreate or simulate the condition of the ma function as described by the customer.

10	**Check the DTC**

- If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE.
- If DTC(s) occur(s), go to Step 11.

11	**Perform troubleshooting procedure for DTC**

12	**Adjust or repair the vehicle**

13	**Confirmation test**

14	**END**

Customer Problem Analysis Sheet

1. VEHICLE INFORMAITON

VIN No.		Transmission	☐ M/T ☐ A/T ☐CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile	CPF (Diesel Engine)	☐ With CPF ☐ Without CPF

2. SYMPTOMS

☐ Unable to start	☐ Engine does not turn over ☐ Incomplete combustion ☐ Initial combustion does not occur
☐ Difficult to start	☐ Engine turns over slowly ☐ Other_____
☐ Poor idling	☐ Rough idling ☐ Incorrect idling ☐ Unstable idling (High:_____ rpm, Low: _____rpm) ☐ Other
☐ Engine stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C ON ☐ Shifting from N to D-range ☐ Other_____
☐ Others	☐ Poor driving (Surge) ☐ Knocking ☐ Poor fuel economy ☐ Back fire ☐ After fire ☐ Other

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other_____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other_____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Hough road ☐ Other_____
Engine temperature	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temperature
Engine operation	☐ Starting ☐ Just after starting (____min) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other_____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)		☐ Remains ON ☐ Sometimes lights up ☐ Does not light
DTC	Normal check (Pre-check)	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data
	Check mode	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data

5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

Basic Inspection Procedure

Measuring Condition of Electronic Parts' Resistance

The measured resistance at high temperature after vehicle running may be high. So all resistance must be measured at ambient temperature (20°C, 68°F), unless stated otherwise.

NOTE

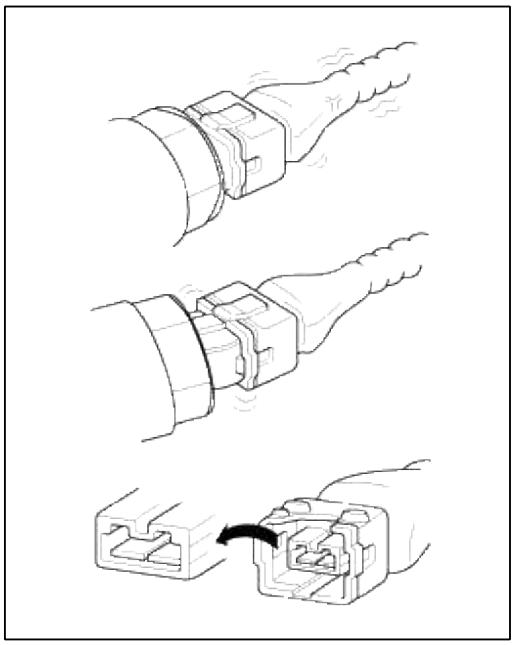
The measured resistance except at ambient temperature (20°C, 68°F) is a reference value.

Intermittent Problem Inspection Procedure

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again

during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, the technician should thoroughly make out a "Customer Problem Analysis Sheet" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● Tap Test

1) Sensors and Actuators
: Lightly tap on the sensors, actuators or relays with finger.

> WARNING
>
> Hitting with a hard object may break sensors, actuators or relays.

2) Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

● Simulating Heat

1) Heat components suspected of causing the malfunction with a hair dryer or other heat source.

> WARNING
>
> • DO NOT heat components to the point where they may be damaged.
> • DO NOT heat the ECM directly.

● Simulating Water Sprinkling

1) Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

> WARNING
>
> DO NOT sprinkle water directly into the engine compartment or electronic components.

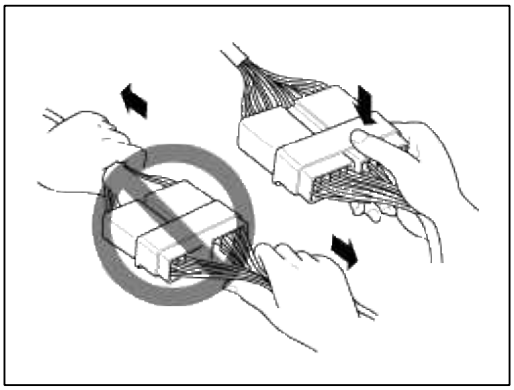
● Simulating Electrical Load

1) Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, rear window defogger, etc.).

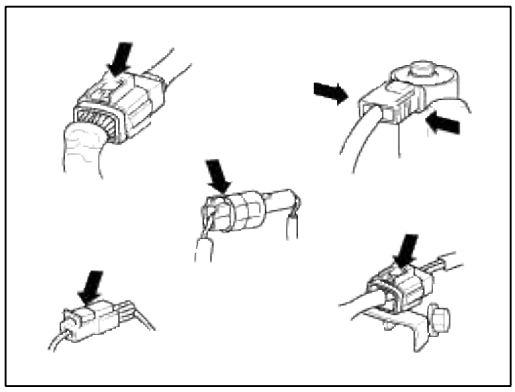
Connector Inspection Procedure

1. Handling of Connector

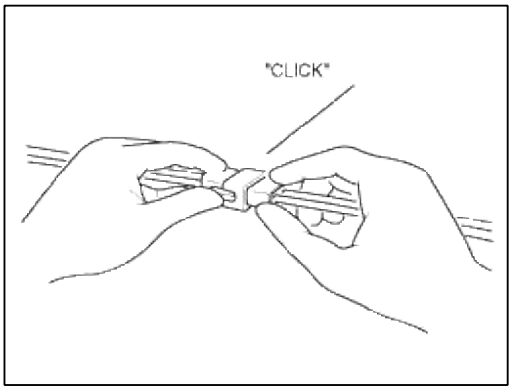
A. Never pull on the wiring harness when disconnecting connectors.



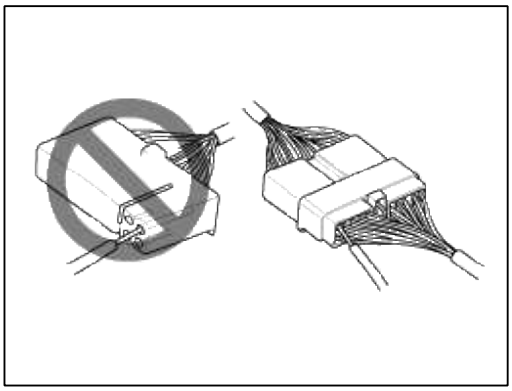
B. When removing the connector with a lock, press or pull locking lever.



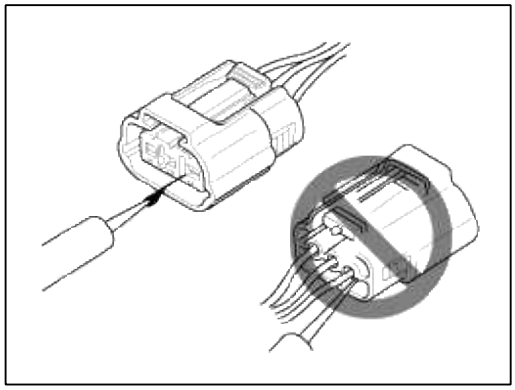
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



D. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



E. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



NOTE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

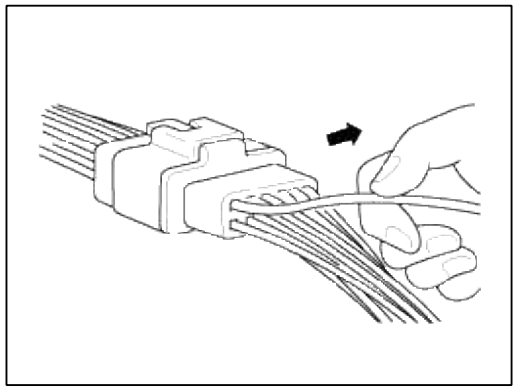
2. Checking Point for Connector

A. While the connector is connected:
Hold the connector, check connecting condition and locking efficiency.

B. When the connector is disconnected:
Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.
Visually check for rust, contamination, deformation and bend.

C. Check terminal tightening condition:
Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

D. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



3. Repair Method of Connector Terminal

A. Clean the contact points using air gun and/or shop rag.

NOTE

Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

B. In case of abnormal contact pressure, replace the female terminal.

Wire Harness Inspection Procedure

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.

6. If the covering of wire harness is damaged; secure, repair or replace the harness.

Electrical Circuit Inspection Procedure

● Check Open Circuit

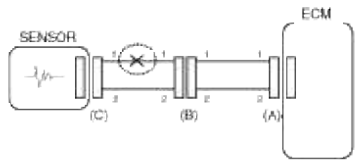
1. Procedures for Open Circuit

A. Continuity Check

B. Voltage Check

If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1



2. Continuity Check Method

NOTE

When measuring for resistance, lightly shake the wire harness above and below or side to side.

Specification (Resistance)

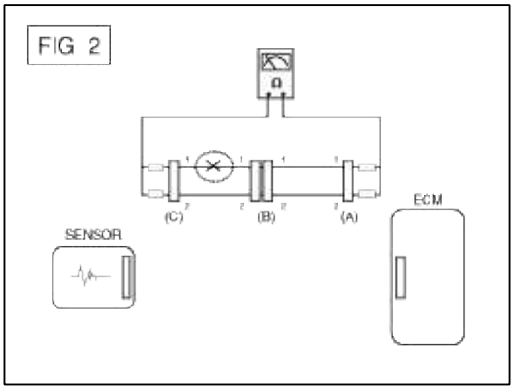
1Ω or less → Normal Circuit

1MΩ or Higher → Open Circuit

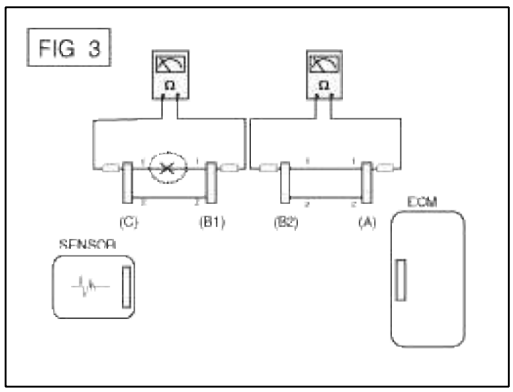
A. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].

In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2

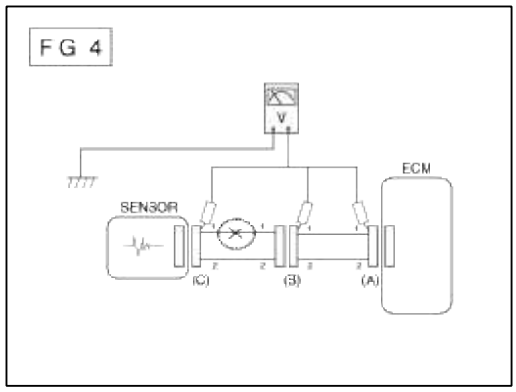


B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).



3. Voltage Check Method

A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].
The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

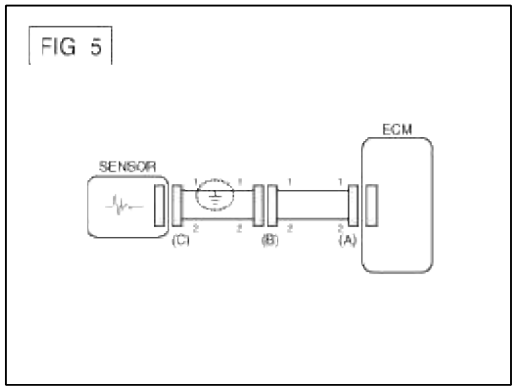


● Check Short Circuit

1. Test Method for Short to Ground Circuit

A. Continuity Check with Chassis Ground

If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing Step 2 (Continuity Check Method with Chassis Ground) as shown below.



2. Continuity Check Method (with Chassis Ground)

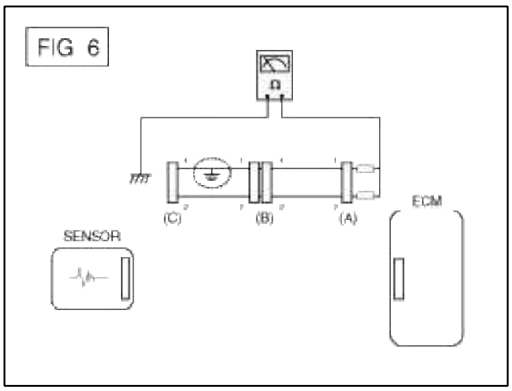
NOTE

Lightly shake the wire harness above and below, or side to side when measuring the resistance.

Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

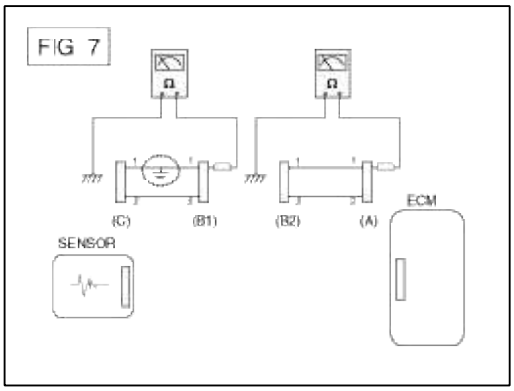
A. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].
The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

FIG 6



B. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].
The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

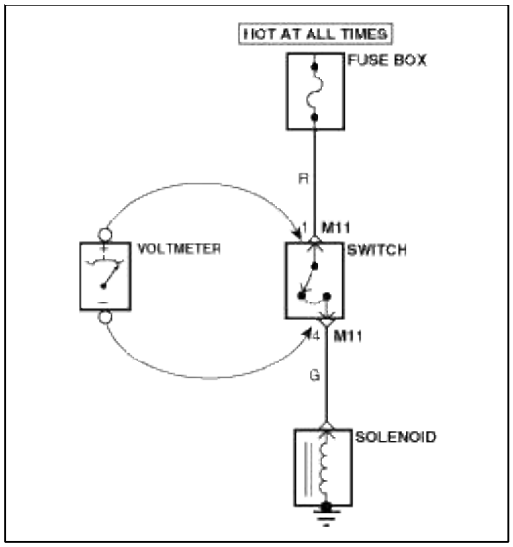
FIG 7



● Testing For Voltage Drop

This test checks for voltage drop along a wire, or through a connection orswitch.

1) Connect the positive lead of a voltmeter to the end of the wire (or to the side of the connector or switch) closest to the battery.
2) Connect the negative lead to the other end of the wire. (or the other side of the connector or switch)
3) Operate the circuit.
4) The voltmeter will show the difference in voltage between the two points. A difference, or drop of more than 0.1 volts (50mV in 5V circuits), may indicate a problem. Check the circuit for loose or dirty connections.



Symptom Troubleshooting Guide Chart

Main symptom	Diagnostic procedure	Also check for
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECT sensor and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	1. Check the fuel pressure 2. Check the Injector 3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECT sensor and circuit (Check DTC)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body	• DTC

	3. Check the ignition circuit 4. Check the ECT Sensor and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving habitsIs · A/C on full time or the defroster mode on? · Are tires at correct pressure? · Is excessively heavy load being carried? · Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECT sensor and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe · Pinched, kinked or blocked? · Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

Fuel System > Engine Control System > Description and Operation

OBD-II review

1. Overview

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in california beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, Exhust Gas Recirculation (EGR) system and additional emission related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the fault and the need for repair of the emission control system. Associated with the MIL was a fault code or Diagnostic Trouble Code (DTC) idenfying the specific area of the fault.

The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations were followed until 1999 when the federal regulations were used.

The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.

The diagnostic executive is a computer program in the Engine Control Module (ECM) or PowertrainControl Module (PCM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeze frame data and scan tool interface.

Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM,

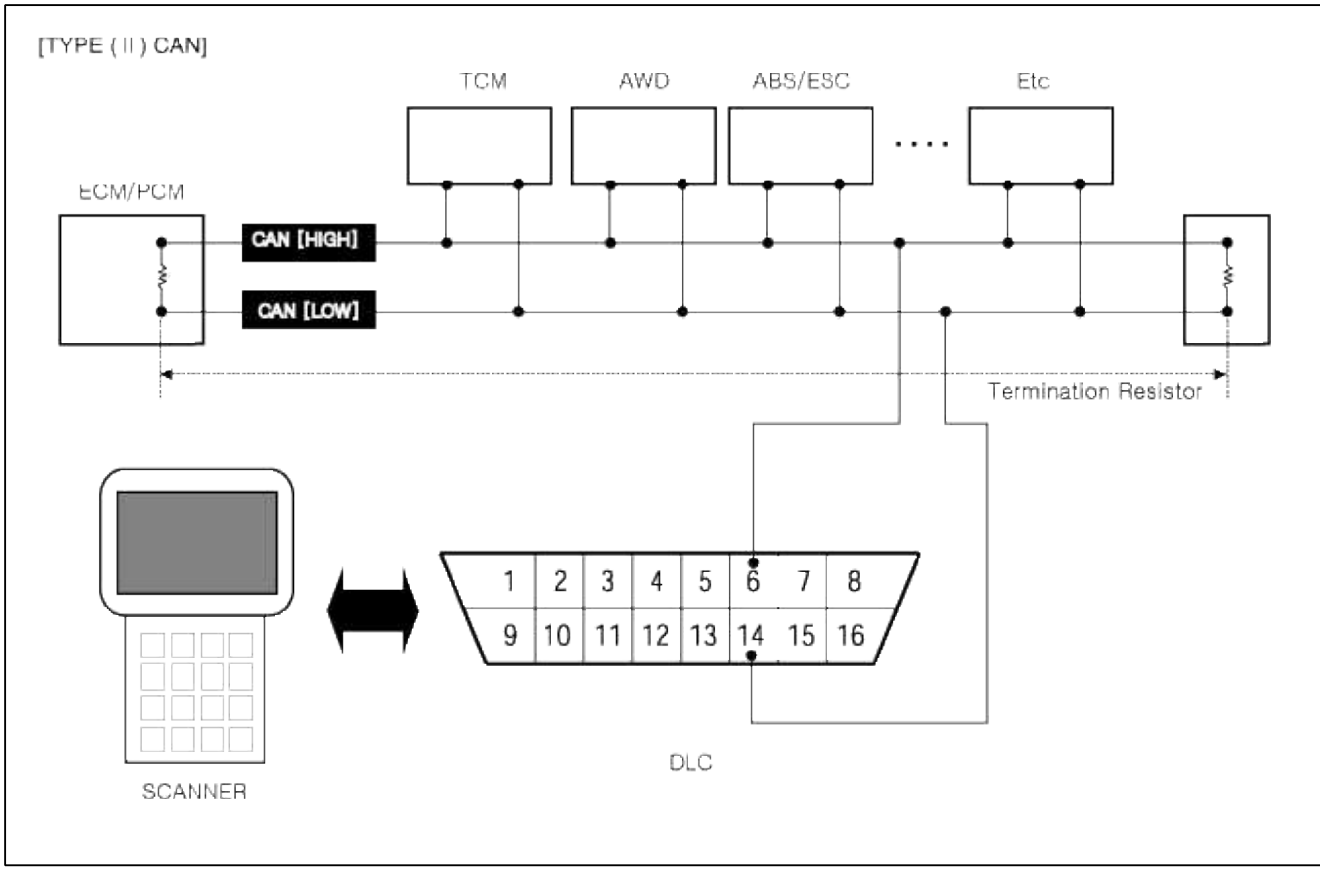
load and warm status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.

The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM) or Powertrain Control Module(PCM).

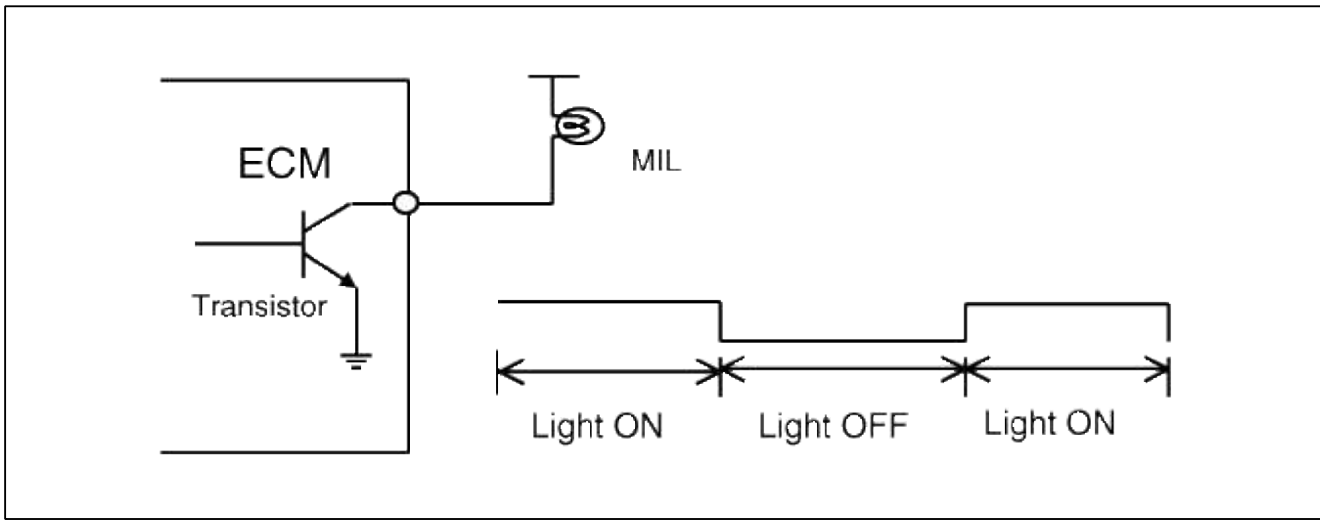
The ECM or PCM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random access memory, and others), the ECM or PCM generates output signals to control various relays, solenoids and actuators.

2. Configuration of hardware and related terms

1) GST (Generic scan tool)



2) MIL (Malfunction indication lamp) - MIL activity by transistor



The Malfunction Indicator Lamp (MIL) is connected between ECM or PCM-terminal Malfunction Indicator Lamp

and battery supply (open collector amplifier).
In most cars, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit.
Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.
At ignition ON and engine revolution (RPM)< MIN. RPM, the MIL is switched ON for an optical check by the driver.
3) MIL illumination
When the ECM or PCM detects a malfunction related emission during the first driving cycle, the DTC and engine data are stored in the freeze frame memory. The MIL is illuminated only when the ECM or PCM detects the same malfunction related to the DTC in two consecutive driving cycles.
4) MIL elimination
● Misfire and Fuel System Malfunctions:
For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.
● All Other Malfunctions:
For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.
5) Erasing a fault code
The diagnostic system may erase a fault code if the same fault is not re-registered in at least 40 engine warm-up cycles, and the MIL is not illuminated for that fault code.
6) Communication Line (CAN)
- Bus Topology : Line (bus) structure
- Wiring : Twisted pair wire
- Off Board DLC Cable Length : Max. 5m
- Data Transfer Rate
- Diagnostic : 500 kbps
- Service Mode (Upgrade, Writing VIN) : 500 or 1Mbps)

7) Driving cycle
A driving cycle consists of engine start up, and engine shut off.
8) Warm-up cycle
A warm-up cycle means sufficient vehicle operation such that the engine coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit.
9) Trip cycle
A trip means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system except catalyst efficiency or evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.
10) DTC format
- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.

The letter of the beginning of the DTC identifies the function of the monitored device that has failed. A "P" indicates a powertrain device, "C" indicates a chassis device. "B" is for body device and "U" indicates a network or data link code. The first number indicates if the code is generic (common to all manufacturers) or if it is manufacturer specific. A "0" & "2" indicates generic, "1" indicates manufacturer-specific. The second number indicates the system that is affected with a number between 1 and 7.

The following is a list showing what numbers are assigned to each system.

1. Fuel and air metering
2. Fuel and air metering(injector circuit malfunction only)
3. Ignition system or misfire
4. Auxiliary emission controls
5. Vehicle speed controls and idle control system
6. Computer output circuits
7. Transmission

The last two numbers of the DTC indicates the component or section of the system where the fault is located.

11) Freeze frame data

When a freeze frame event is triggered by an emission related DTC, the ECM or PCM stores various vehicle information as it existed the moment the fault ocurred. The DTC number along with the engine data can be useful in aiding a technician in locating the cause of the fault. Once the data from the 1st driving cycle DTC ocurrence is stored in the freeze frame memory, it will remain there even when the fault ocurrs again (2nd driving cycle) and the MIL is illuminated.

- Freeze Frame List

1) Calculated Load Value
2) Engine RPM
3) Fuel Trim
4) Fuel Pressure (if available)
5) Vehicle Speed (if available)
6) Coolant Temperature
7) Intake Manifold Pressure (if available)
8) Closed-or Open-loop operation
9) Fault code

3. OBD-II system readiness tests

1) Catalyst monitoring

The catalyst efficiency monitor is a self-test strategy within the ECM or PCM that uses the downstream Heated Oxygen Sensor (HO2S) to determine when a catalyst has fallen below the minimum level of effectiveness in its ability to control exhaust emission.

2) Misfire monitoring

Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering, or poor compression. Any combustion that does not occur within the cylinder at the proper time is also a misfire. The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalyst from permanent damage and to alert the customer of an emission failure or an inspection maintenance failure by illuminating the MIL . When a misfire is detected, special software called freeze frame data is enabled. The freeze frame data captures the operational state of the vehicle when a fault is detected from misfire detection monitor strategy.

3) Fuel system monitoring

The fuel system monitor is a self-test strategy within the ECM or PCM that monitors the adaptive fuel table The fuel control system uses the adaptive fuel table to compensate for normal variability of the fuel system components caused by wear or aging. During normal vehicle operation, if the fuel system appears biased lean or rich, the adaptive value table will shift the fuel delivery calculations to remove bias.

4) Engine cooling system monitoring

The cooling system monitoring is a self-test strategy within the ECM or PCM that monitors ECTS (Engine Coolant Temperature Sensor) and thermostat about circuit continuity, output range, rationality faults.

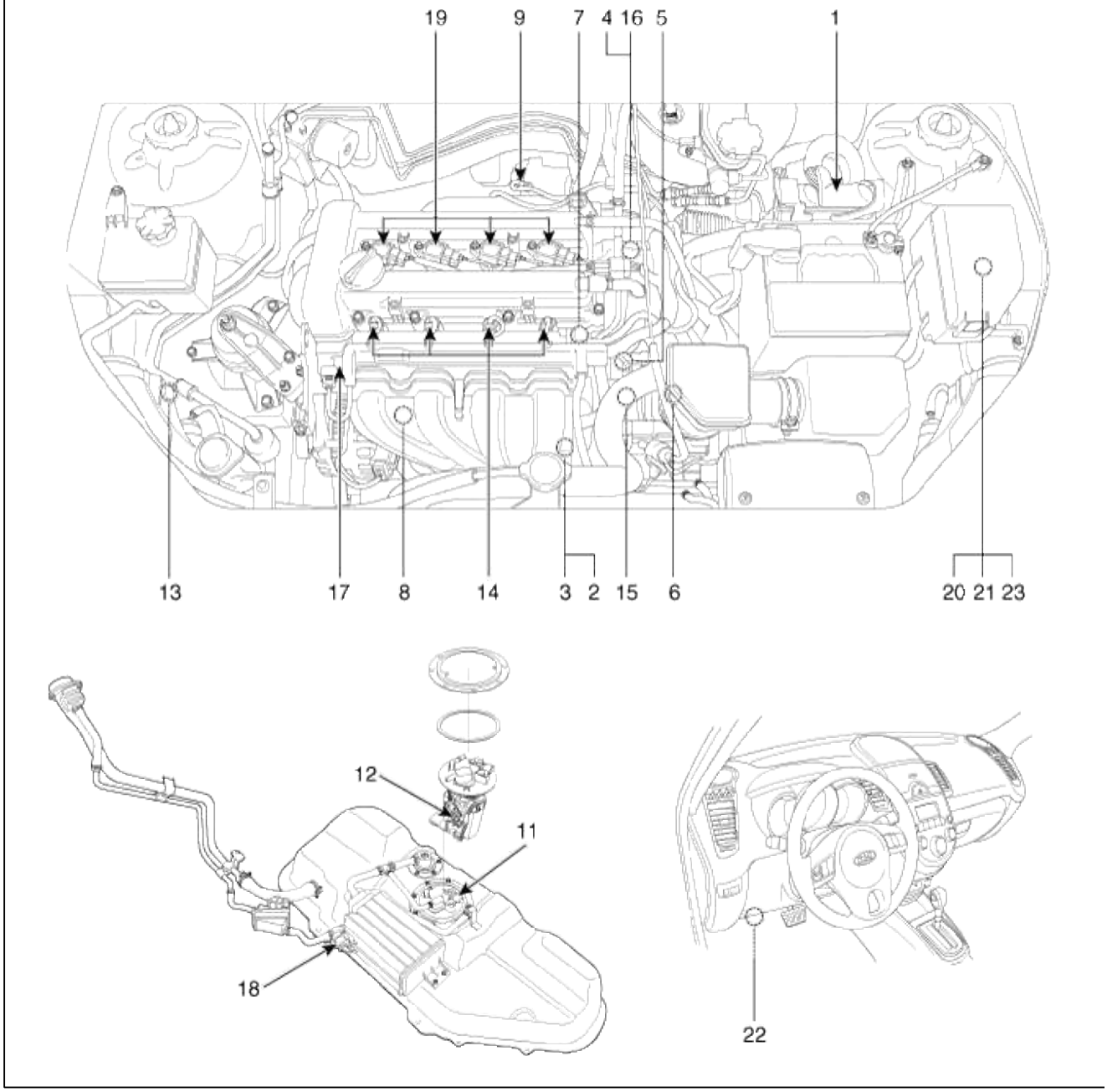
5) O2 sensor monitoring

OBD-II regulations require monitoring of the upstream Heated O2 Sensor (H2OS) to detect if the deterioration of the sensor has exceeded thresholds. An additional HO2S is located downstream of the Warm-Up Three Way

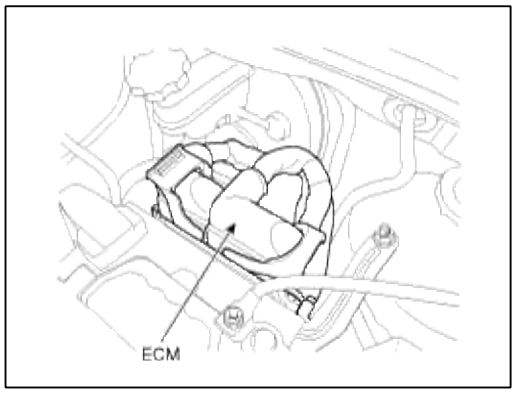
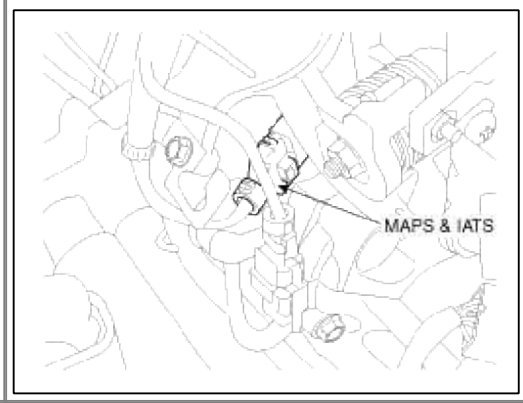
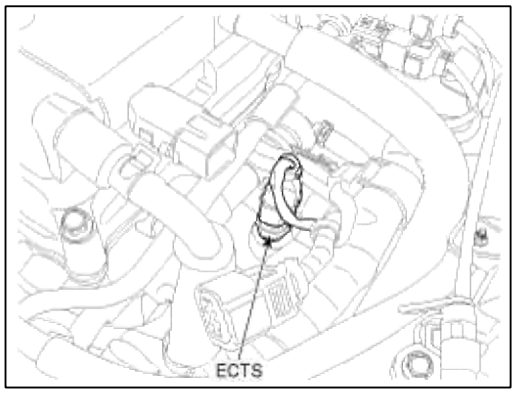
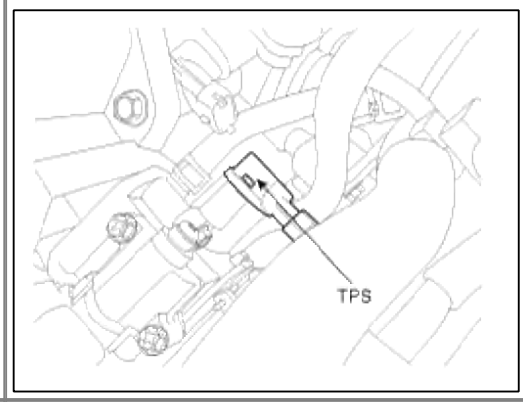
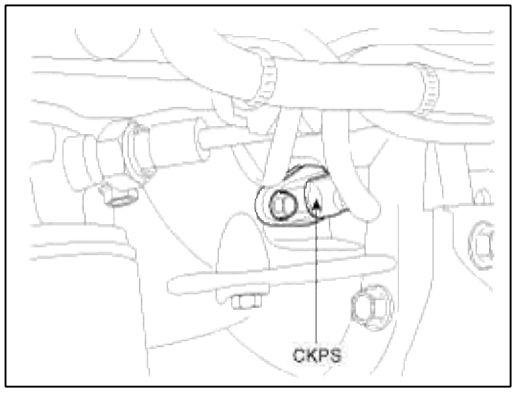
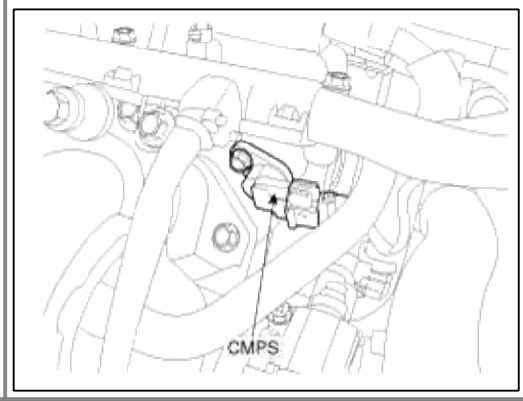
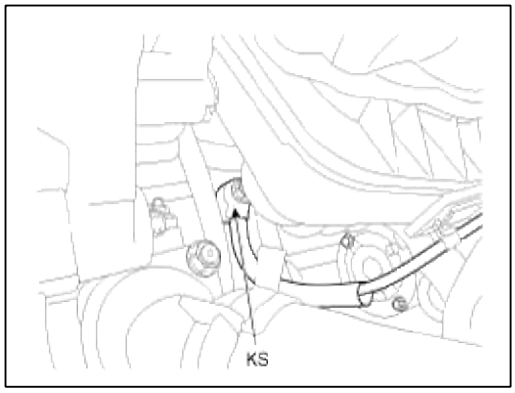
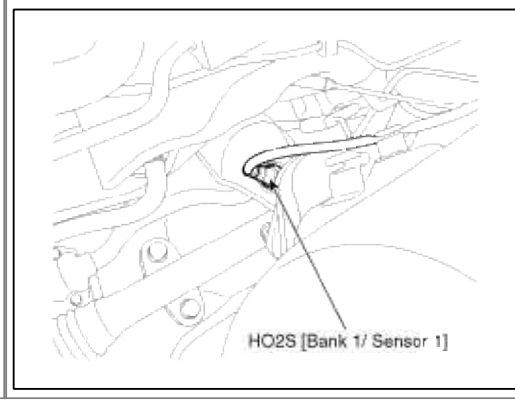
Catalytic Converter (WU-TWC) to determine the efficiency of the catalyst.
Although the downstream H2OS is similar to the type used for fuel control, it functions differently. The downstream HO2S is monitored to determine if a voltage is generated. That voltage is compared to a calibrated acceptable range.
6) Evaporative emission system monitoring
The EVAP. monitoring is a self-test strategy within the ECM or PCM that tests the integrity of the EVAP. system. The complete evaporative system detects a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.040 inch and 0.020 inch diameter orifice.
7) Air conditioning system monitoring
The A/C system monitoring is a self-test strategy within the ECM or PCM that monitors malfunction of all A/C system components at A/C ON.
8) Comprehensive components monitoring
The comprehensive components monitoring is a self-test strategy within the ECM or PCM that detects fault of any electronic powertrain components or system that provides input to the ECM or PCM and is not exclusively an input to any other OBD-II monitor.
9) A/C system component monitoring
Requirement:
If a vehicle incorporates an engine control strategy that alters off idle fuel and/or spark control when the A/C system is on, the OBD II system shall monitor all electronic air conditioning system components for malfunctions that cause the system to fail to invoke the alternate control while the A/C system is on or cause the system to invoke the alternate control while the A/C system is off.
Additionally, the OBD II system shall monitor for malfunction all electronic air conditioning system components that are used as part of the diagnostic strategy for any other monitored system or component.
Implementation plan:
No engine control strategy incorporated that alters offidle fuel and/or spark control when A/C system is on.
Malfuction of A/C system components is not used as a part of the diagnostic strategy for other monitored system or component.

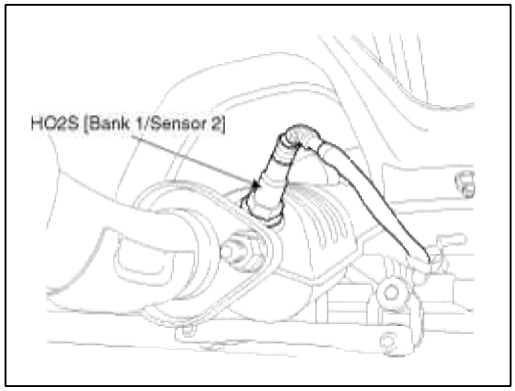
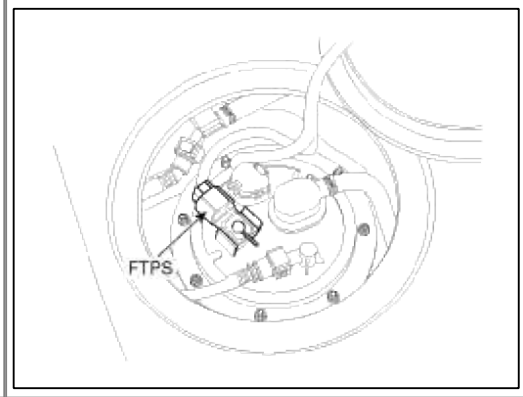
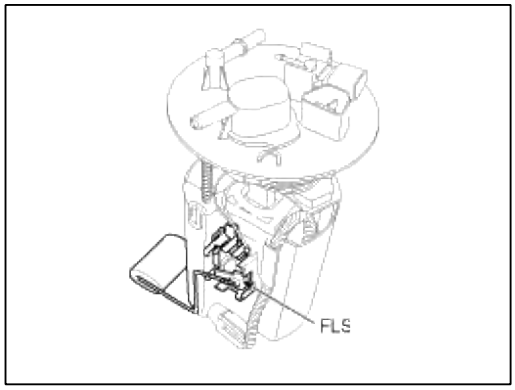
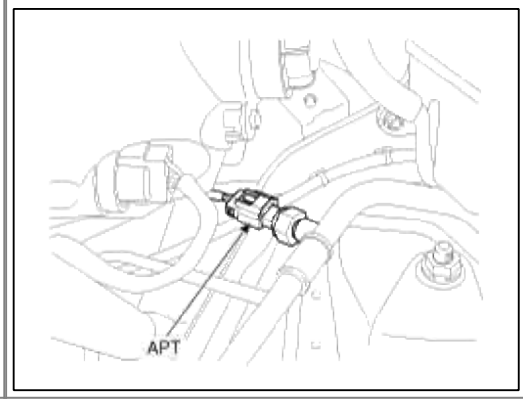
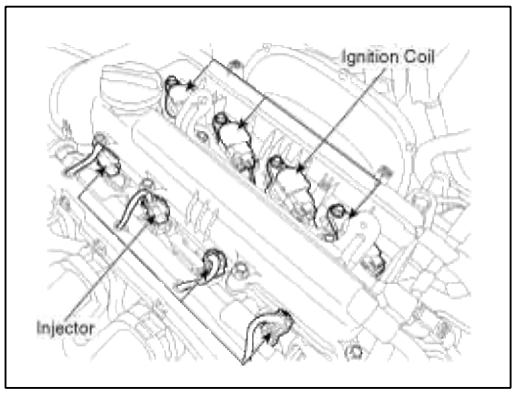
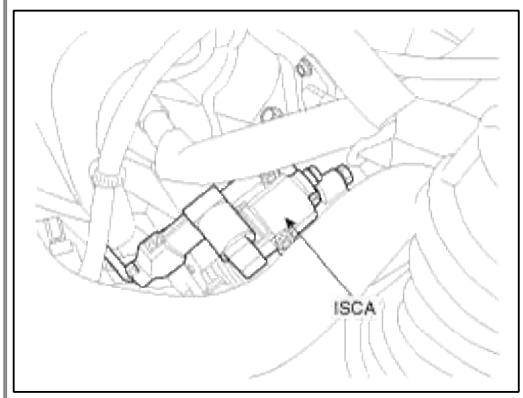
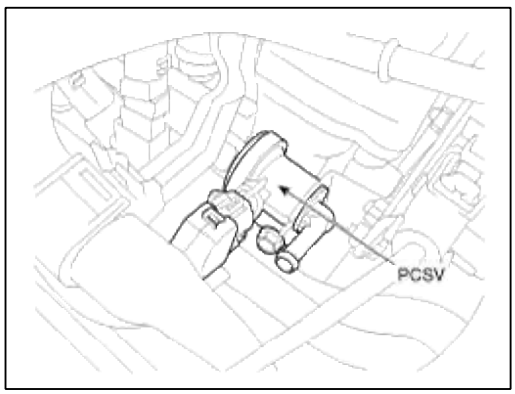
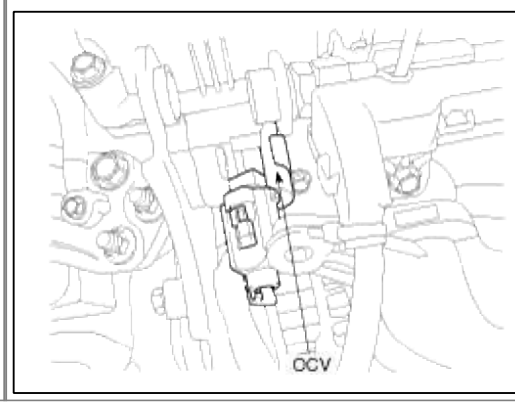
Fuel System > Engine Control System > Components and Components Location

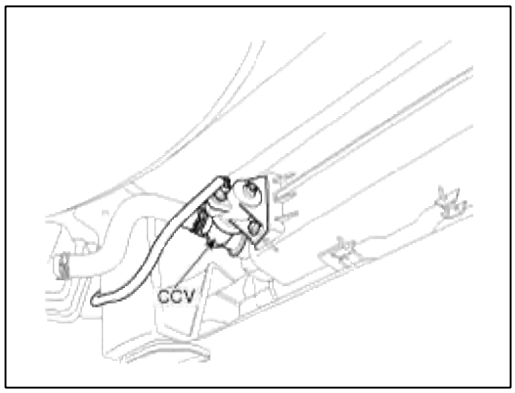
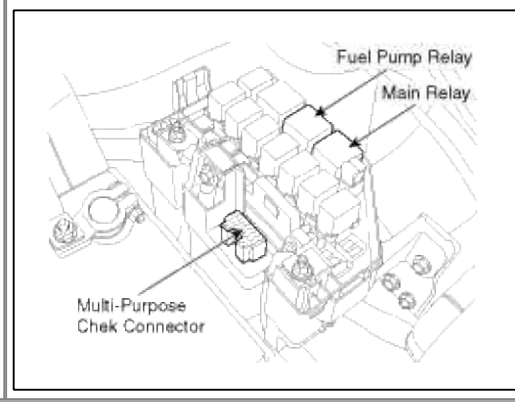
Components Location



1. Engine Control Module (ECM) 2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS) 4. Engine Coolant Temperature Sensor (ECTS) 5. Throttle Position Sensor (TPS) 6. Crankshaft Position Sensor (CKPS) 7. Camshaft Position Sensor (CMPS) 8. Knock Sensor (KS) 9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] 10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] 11. Fuel Tank Pressure Sensor (FTPS) 12. Fuel Level Sensor (FLS)	13. A/C Pressure Transducer (APT) 14. Injector 15. Idle Speed Control Actuator (ISCA) 16. Purge Control Solenoid Valve (PCSV) 17. CVVT Oil Control Valve (OCV) 18. Canister Close Valve (CCV) 19. Ignition Coil 20. Main Relay 21. Fuel Pump Relay 22. Data Link Connector (DLC) 23. Multi-Purpose Check Connector

1. Engine Control Module (ECM)	2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS)
	
4. Engine Coolant Temperature Sensor (ECTS)	5. Throttle Position Sensor (TPS)
	
6. Crankshaft Position Sensor (CKPS)	7. Camshaft Position Sensor (CMPS)
	
8. Knock Sensor (KS)	9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
	

10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]	11. Fuel Tank Pressure Sensor (FTPS)
	
12. Fuel Level Sensor (FLS)	13. A/C Pressure Transducer (APT)
	
14. Injector 19. Ignition Coil	15. Idle Speed Control Actuator (ISCA)
	
16. Purge Control Solenoid Valve (PCSV)	17. CVVT Oil Control Valve (OCV)
	

18. Canister Close Valve (CCV)	20. Main Relay 21. Fuel Pump Relay 23. Multi-Purpose Check Connector
	

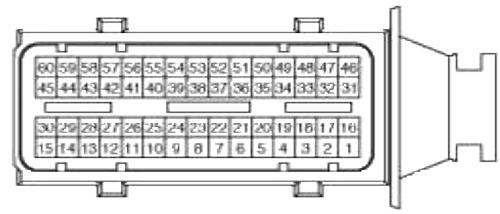
Fuel System > Engine Control System > Engine Control Module (ECM) > Schematic Diagrams

ECM Terminal And Input/Output signal

ECM Harness Connector (A/T)



Connector [EGGA-K]



Connector [EGGA-A]

ECM Terminal Function (A/T)

Connector [EGGA-K]

Pin No.	Description	Connected to
1	Power Ground	Chassis Ground
2	Power Ground	Chassis Ground
3	Power Ground	Chassis Ground
4	Battery voltage supply after main relay	Main Relay
5	Battery voltage supply after main relay	Main Relay
6	Battery voltage supply after main relay	Main Relay
7	-	
8	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
9	Sensor ground	Heated Oxygen Sensor (Sensor 2)
10	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)

11	-	
12	-	
13	Heated Oxygen Sensor (Sensor 2) signal input	Heated Oxygen Sensor (Sensor 2)
14	-	
15	-	
16	-	
17	Alternator load signal input	Alternator
18	-	
19	-	
20	Vehicle speed signal input	ABS/ESP Control Module [With ABS/ESP]
21	-	
22	Electric Load signal input	Defrost
23	A/C Switch "ON" signal input	A/C Switch
24	For Autotransaxle Control	
25	For Autotransaxle Control	
26	For Autotransaxle Control	
27	For Autotransaxle Control	
28	For Autotransaxle Control	
29	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
30	Sensor ground	A/C Pressure Transducer (APT)
31	Sensor ground	Heated Oxygen Sensor (Sensor 1)
32	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
33	-	
34	-	
35	Heated Oxygen Sensor (Sensor 1) signal input	Heated Oxygen Sensor (Sensor 1)
36	-	
37	-	
38	Sensor ground	Camshaft Position Sensor (CMPS)
39	-	
40	-	
41	Camshaft Position Sensor signal input	Camshaft Position Sensor (CMPS)
42	-	
43	-	
44	Power Steering Switch signal input	Power Steering Switch
45	-	

46	A/C thermal switch signal input	A/C Thermal Switch
47	For Autotransaxle Control	
48	For Autotransaxle Control	
49	For Autotransaxle Control	
50	For Autotransaxle Control	
51	Sensor ground	Throttle Position Sensor (TPS)
52	-	
53	Fuel Level Sensor signal input	Fuel Level Sensor (FLS)
54	-	
55	-	
56	-	
57	For Autotransaxle Control	
58	-	
59	-	
60	For Autotransaxle Control	
61	For Autotransaxle Control	
62	For Autotransaxle Control	
63	-	
64	For Autotransaxle Control	
65	For Autotransaxle Control	
66	For Autotransaxle Control	
67	For Autotransaxle Control	
68	For Autotransaxle Control	
69	-	
70	For Autotransaxle Control	
71	For Autotransaxle Control	
72	For Autotransaxle Control	
73	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
74	-	
75	Throttle Position Sensor signal input	Throttle Position Sensor (TPS)
76	-	
77	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)
78	-	
79	A/C Pressure Transducer signal input	A/C Pressure Transducer (APT)
80	For Autotransaxle Control	

81	For Autotransaxle Control	
82	For Autotransaxle Control	
83	For Autotransaxle Control	
84	For Autotransaxle Control	
85	-	
86	For Autotransaxle Control	
87	For Autotransaxle Control	
88	For Autotransaxle Control	
89	For Autotransaxle Control	
90	For Autotransaxle Control	
91	For Autotransaxle Control	
92	For Autotransaxle Control	
93	For Autotransaxle Control	
94	For Autotransaxle Control	

Connector [EGGA-A]

Pin No.	Description	Connected to
1	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)
2	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)
3	Fuel Tank Pressure Sensor singnal input	Fuel Tank Pressure Sensor (FTPS)
4	-	
5	-	
6	Idle Speed Control Actuator [OPEN] control output	Idle Speed Control Actuator (ISCA)
7	-	
8	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
9	Main Relay control output	Main Relay
10	-	
11	Battery voltage supply after ignition switch	Ignition Switch
12	CAN [HIGH]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
13	-	
14	-	
15	Knock Sensor signal input	Knock Sensor (KS)
16	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)
17	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)
18	-	

19	-	
20	-	
21	Cooling Fan Relay [Low] control output	Cooling Fan Relay [Low]
22	Idle Speed Control Actuator [CLOSE] control output	Idle Speed Control Actuator (ISCA)
23	Cooling Fan Relay [High] control output	Cooling Fan Relay [High]
24	Fuel consumption signal output	Trip Computer
25	Engine speed signal output	Tachometer (Cluster)
26	-	
27	CAN [LOW]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
28	-	
29	-	
30	Sensor ground	Knock Sensor (KS)
31	-	
32	Immobilizer lamp control output	Immobilizer Lamp
33	Heated Oxygen Sensor (Sensor 2) Heater control output	Heated Oxygen Sensor (Sensor 2)
34	Heated Oxygen Sensor (Sensor 1) Heater control output	Heated Oxygen Sensor (Sensor 1)
35	Fuel Pump Relay control output [With Immobilizer]	Fuel Pump Realy
	Canister Close Valve control output [Without Immobilizer]	Canister Close Valve (CCV)
36	Injector (Cylinder #3) control output	Injector (Cylinder #3)
37	Fuel Pump Relay control output [Without Immobilizer]	Fuel Pump Relay
	Canister Close Valve control output [With Immobilizer]	Canister Close Valve (CCV)
38	A/C Compressor Relay control output	A/C Compressor Relay
39	-	
40	Crankshaft Position Sensor [A] signal input	Crankshaft Position Sensor (CKPS)
41	-	
42	Sensor power (+5V)	Fuel Tank Pressure Sensor (FTPS)
43	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)
44	Immobilizer communication line	Immobilizer Control Module
45	Wheel Speed Sensor [A] signal input	Wheel Speed Sensor (WSS) [Without ABS/ESP]
46	-	
47	-	

48	Injector (Cylinder #4) control output	Injector (Cylinder #4)
49	CVVT Oil Control Valve control output	CVVT Oil Control Valve (OCV)
50	Injector (Cylinder #1) control output	Injector (Cylinder #1)
51	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)
52	Injector (Cylinder #2) control output	Injector (Cylinder #2)
53	-	
54	-	
55	Crankshaft Position Sensor [B] signal input	Crankshaft Position Sensor (CKPS)
56	Battery Power (B+)	Battery
57	Sensor power (+5V)	A/C Pressure Transducer (APT)
58	Sensor power (+5V)	Throttle Position Sensor (TPS)
59	-	
60	Wheel Speed Sensor [B] signal input	Wheel Speed Sensor (WSS) [Without ABS/ESP]

ECM Terminal Input/Output Signal (A/T)

Connector [EGGA-K]

Pin No	Description	Condition	Type	Level	Test Result
1	Power Ground	Idle	DC	Max. 50mV	0V
2	Power Ground	Idle	DC	Max. 50mV	3.6mV
3	Power Ground	Idle	DC	Max. 50mV	3.6mV
4	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	200mV
		IG ON		Battery Voltage	12.9V
5	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	200mV
		IG ON		Battery Voltage	12.9V
6	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	200mV
		IG ON		Battery Voltage	12.9V
7	-				
8	Sensor ground	Idle	DC	Max. 50mV	16mV
9	Sensor ground	Idle	DC	Max. 50mV	6.2mV
10	Manifold Absolute Pressure Sensor signal input	IG ON	DC	3.9 ~ 4.1V	4.09V
		Idle		0.8 ~ 1.6V	1.44V
11	-				
12	-				
13	Heated Oxygen Sensor (Sensor 2) signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	860mV
				Lean: Max. 0.4V	10mV
14	-				

15	-				
16	-				
17	Alternator load signal input	Idle	Pulse	Hi: Battery Voltage	13.2V
				Lo: Max. 1.5V	1.34V
18	-				
19	-				
20	Vehicle speed signal input	Idle	Pulse	Hi: Min. 4.5V	12.2V
				Lo: Max. 1.0V	0V
					Freq: 72.2Hz
		Vehicle Run (30km/h)		Hi: Min. 4.5V	12.2V
				Lo: Max. 1.0V	0V
					Freq: 212Hz
21	-				
22	Electric Load signal input				
23	A/C Switch "ON" signal input	S/W OFF	DC	Max. 1.0V	20mV
		S/W ON		Battery Voltage	12.48V
24	For Autotransaxle Control				
25	For Autotransaxle Control				
26	For Autotransaxle Control				
27	For Autotransaxle Control				
28	For Autotransaxle Control				
29	Sensor ground	Idle	DC	Max. 50mV	9.2mV
30	Sensor ground	Idle	DC	Max. 50mV	6.2mV
31	Sensor ground	Idle	DC	Max. 50mV	6.8mV
32	Intake Air Temperature Sensor signal input	Idle	DC	0 ~ 5.0V	1.89V
33	-				
34	-				
35	Heated Oxygen Sensor (Sensor 1) signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	884mV
				Lean: Max. 0.4V	8mV
36	-				
37	-				
38	Sensor ground	Idle	DC	Max. 50mV	12mV
39	-				
40	-				

41	Camshaft Position Sensor signal input	Idle	Pulse	Hi: Battery Voltage	13.72V
				Lo: Max. 0.5V	200mV
42	-				
43	-				
44	Power Steering Switch signal input				
45	-				
46	A/C thermal switch signal input	A/C S/W OFF	DC	Max.1.0V	200mV
		A/C S/W ON		Battery Voltage	12.6V
47	For Autotransaxle Control				
48	For Autotransaxle Control				
49	For Autotransaxle Control				
50	For Autotransaxle Control				
51	Sensor ground	Idle	DC	Max. 50mV	11.2mV
52	-				
53	Fuel Level Sensor signal input	IG ON	DC	0 ~ Battery Voltage	2.14V
54	-				
55	-				
56	-				
57	For Autotransaxle Control				
58	-				
59	-				
60	For Autotransaxle Control				
61	For Autotransaxle Control				
62	For Autotransaxle Control				
63	-				
64	For Autotransaxle Control				
65	For Autotransaxle Control				
66	For Autotransaxle Control				
67	For Autotransaxle Control				
68	For Autotransaxle Control				
69	-				
70	For Autotransaxle Control				
71	For Autotransaxle Control				
72	For Autotransaxle Control				
73	Sensor ground	Idle	DC	Max. 50mV	16.8mV

74	-				
75	Throttle Position Sensor signal input	C.T	Analog	0.25 ~ 0.9V	0.34V
		W.O.T		Min. 4.0V	4.43V
76	-				
77	Engine Coolant Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	1.43V
78	-				
79	A/C Pressure Transducer signal input	A/C ON	Analog	Max. 4.8V	1.88V
80	For Autotransaxle Control				
81	For Autotransaxle Control				
82	For Autotransaxle Control				
83	For Autotransaxle Control				
84	For Autotransaxle Control				
85	-				
86	For Autotransaxle Control				
87	For Autotransaxle Control				
88	For Autotransaxle Control				
89	For Autotransaxle Control				
90	For Autotransaxle Control				
91	For Autotransaxle Control				
92	For Autotransaxle Control				
93	For Autotransaxle Control				
94	For Autotransaxle Control				

Connector [EGGA-A]

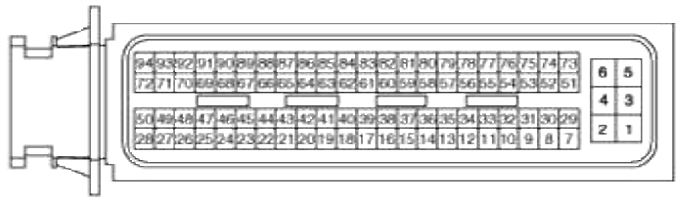
Pin No.	Description	Condition	Type	Level	Test Result
1	Ignition Coil (Cylinder #2) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	372V
				ON Voltage: Max. 2.0V	1.1V
2	Ignition Coil (Cylinder #4) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	372V
				ON Voltage: Max. 2.0V	1.1V
3	Fuel Tank Pressure Sensor signal input	Idle	DC	0.4 ~ 4.6V	2.45V
4	-				
5	-				

6	Idle Speed Control Actuator [OPEN] control output	Idle	Pulse	Hi: Battery Voltage	13.8V
				Lo: Max. 1.0V	20mV
7	-				
8	Purge Control Solenoid Valve control output	Active Inactive	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	120mV
9	Main Relay control output	Relay OFF	DC	Battery Voltage	12.78V
		Relay ON		Max. 1.0V	860mV
10	-				
11	Battery voltage supply after ignition switch	IG OFF	DC	Max. 1.0V	3.2mV
		IG ON		Battery Voltage	12.68V
12	CAN [HIGH]	RECESSIVE	Pulse	2.0 ~ 3.0V	2.5V
		DOMINANT		2.75 ~ 4.5V	3.58V
13	-				
14	-				
15	Knock Sensor signal input	Knocking	Variable Frequency		
		Normal			
16	Ignition Coil (Cylinder #3) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	366V
				ON Voltage: Max. 2.0V	1.1V
17	Ignition Coil (Cylinder #1) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	352V
				ON Voltage: Max. 2.0V	1.1V
18	-				
19	-				
20	-				
21	Cooling Fan Relay [Low] control output	Relay OFF	DC	Battery Voltage	14.12V
		Relay ON		Max. 1.0V	61.6mV
22	Idle Speed Control Actuator [CLOSE] control output	Idle	Pulse	Hi: Battery Voltage	13.8V
				Lo: Max. 1.0V	200mV
23	Cooling Fan Relay [High] control output	Relay OFF	DC	Battery Voltage	14.01V
		Relay ON		Max. 1.0V	52.6mV
24	Fuel consumption signal output	Idle	Pulse	Hi: Battery Voltage	13.8V
				Lo: Max. 0.5V	200mV

25	Engine speed signal output	Idle	Pulse	Hi: Battery Voltage	14.0V
				Lo: Max. 0.5V	20mV
				Freq.: 20 ~ 60Hz	22Hz
26	-				
27	CAN [LOW]	RECESSIVE	Pulse	2.0 ~ 3.0V	2.5V
		DOMINANT		0.5 ~ 2.25V	1.5V
28	-				
29	-				
30	Sensor ground	Idle	DC	Max. 50mV	
31	-				
32	Immobilizer lamp control output	Lamp OFF	DC	Battery Voltage	12.6V
		Lamp ON		Max. 1.0V	20mV
33	Heated Oxygen Sensor (Sensor 2) Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	220mV
34	Heated Oxygen Sensor (Sensor 1) Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	220mV
35	Fuel Pump Relay control output [With Immobilizer]	Relay OFF	DC	Battery Voltage	12.8V
		Relay ON		Max. 1.0V	400mV
	Canister Close Valve control output [Without Immobilizer]	Active	Pulse	Hi: Battery Voltage	14.2V
		Inactive		Lo: Max. 1.0V	45mV
36	Injector (Cylinder #3) control output	Idle	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	40mV
				Vpeak: Max. 80V	73.6V
37	Fuel Pump Relay control output [Without Immobilizer]	Relay OFF	DC	Battery Voltage	12.8V
		Relay ON		Max. 1.0V	400mV
	Canister Close Valve control output [With Immobilizer]	Active	Pulse	Hi: Battery Voltage	14.2V
		Inactive		Lo: Max. 1.0V	45mV
38	A/C Compressor Relay control output	Relay OFF	DC	Battery Voltage	14.1V
		Relay ON		Max. 1.0V	400mV
39	-				
40	Crankshaft Position Sensor [A] signal input	Idle		Vp_p: Min. 1.0V	6.48V
41	-				
42	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	
		IG ON		4.8 ~ 5.2V	

43	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	3.6mV
		IG ON		4.8 ~ 5.2V	5.02V
44	Immobilizer communication line	When communicating after IG ON	Pulse	Hi: Min. 8.5V	12.51V
				Lo: Max. 3.5V	1.17V
45	Wheel Speed Sensor [A] signal input	Vehicle Run	SINE Wave	Vp_p: Min. 0.2V	
46	-				
47	-				
48	Injector (Cylinder #4) control output	Idle	Pulse	Hi: Battery Voltage	13.6V
				Lo: Max. 1.0V	336mV
				Vpeak: Max. 80V	69.7V
49	CVVT Oil Control Valve control output	Idle	Pulse	Hi: Battery Voltage	14.9V
				Lo: Max. 1.0V	36.2mV
50	Injector (Cylinder #1) control output	Idle	Pulse	Hi: Battery Voltage	13.6V
				Lo: Max. 1.0V	336mV
				Vpeak: Max. 80V	69.7V
51	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Battery Voltage	11.51V
		Lamp ON		Max. 1.0V	663mV
52	Injector (Cylinder #2) control output	Idle	Pulse	Hi: Battery Voltage	13.6V
				Lo: Max. 1.0V	336mV
				Vpeak: Max. 80V	69.7V
53	-				
54	-				
55	Crankshaft Position Sensor [B] signal input	Idle	SINE Wave	Vp_p: Min. 1.0V	6.48V
56	Battery Power (B+)	Always	DC	Battery Voltage	12.23V
57	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	3.6mV
		IG ON		4.9 ~ 5.1V	5.02V
58	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	3.6mV
		IG ON		4.9 ~ 5.1V	5.02V
59	-				
60	Wheel Speed Sensor [B] signal input	Vehicle Run	SINE Wave	Vp_p: Min. 0.2V	

ECM Harness Connector (M/T)



Connector [EGGM-K]

ECM Terminal Function (M/T)

Connector [EGGM-K]

Pin No.	Description	Connectedto
1	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)
2	Power Ground	Chassis Ground
3	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)
4	-	
5	-	
6	Battery voltage supply after main relay	Main Relay
7	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)
8	A/C thermal switch signal input	A/C Thermal Switch
9	-	
10	Power Steering Switch signal input	Power Steering Switch
11	Knock Sensor signal input	Knock Sensor (KS)
12	Sensor ground	Throttle Position Sensor (TPS)
13	-	
14	-	
15	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
16	Sensor ground	Heated Oxygen Sensor (Sensor 2)
17	Sensor ground	Camshaft Position Sensor (CMPS)
18	Immobilizer communication line	Immobilizer Control Module
19	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)
20	-	
21	-	
22	Main Relay control output	Main Relay
23	Cooling Fan Relay [High] control output	Cooling Fan Relay [High]
24	Injector (Cylinder #3) control output	Injector (Cylinder #3)
25	Idle Speed Control Actuator [CLOSE] control output	Idle Speed Control Actuator (ISCA)

26	-	
27	-	
28	Cooling Fan Relay [Low] control output	Cooling Fan Relay [Low]
29	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)
30	A/C Switch "ON" signal input	A/C Switch
31	Electric Load signal input	Defrost
32	Sensor ground	Knock Sensor (KS)
33	Sensor ground	A/C Pressure Transducer (APT)
34	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
35	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
36	Heated Oxygen Sensor (Sensor 2) signal input	Heated Oxygen Sensor (Sensor 2)
37	-	
38	Sensor ground	Heated Oxygen Sensor (Sensor 1)
39	Throttle Position Sensor signal input	Throttle Position Sensor (TPS)
40	A/C Pressure Transducer signal input	A/C Pressure Transducer (APT)
41	-	
42	-	
43	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
44	-	
45	A/C Compressor Relay control output	A/C Compressor Relay
46	Fuel Pump Relay control output [Without Immobilizer]	Fuel Pump Relay
	Canister Close Valve control output [With Immobilizer]	Canister Close Valve (CCV)
47	Injector (Cylinder #2) control output	Injector (Cylinder #2)
48	Immobilizer lamp control output	Immobilizer Lamp
49	Fuel Pump Relay control output [With Immobilizer]	
	Canister Close Valve control output [Without Immobilizer]	Canister Close Valve (CCV)
50	-	
51	Power Ground	Chassis Ground
52	-	
53	-	
54	Heated Oxygen Sensor (Sensor 1) signal input	Heated Oxygen Sensor (Sensor 1)
55	-	
56	-	
57	-	

58	Wheel Speed Sensor [A] signal input	Wheel Speed Sensor (WSS) [Without ABS/ESP]
59	Sensor power (+5V)	A/C Pressure Transducer (APT)
60	Sensor power (+5V)	Throttle Position Sensor (TPS)
61	-	
62	CAN [LOW]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
63	Camshaft Position Sensor signal input	Camshaft Position Sensor (CMPS)
64	Vehicle speed signal input	ABS/ESP Control Module [With ABS/ESP]
65	-	
66	Alternator load signal input	Alternator
67	Engine speed signal output	Tachometer (Cluster)
68	Injector (Cylinder #4) control output	Injector (Cylinder #4)
69	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
70	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)
71	Heated Oxygen Sensor (Sensor 2) Heater control output	Heated Oxygen Sensor (Sensor 2)
72	Heated Oxygen Sensor (Sensor 1) Heater control output	Heated Oxygen Sensor (Sensor 1)
73	Power Ground	Chassis Ground
74	-	
75	-	
76	-	
77	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)
78	-	
79	Wheel Speed Sensor [B] signal input	Wheel Speed Sensor (WSS) [Without ABS/ESP]
80	Sensor power (+5V)	Fuel Tank Pressure Sensor (FTPS)
81	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)
82	Battery Power (B+)	Battery
83	Battery voltage supply after ignition switch	Ignition Switch
84	CAN [HIGH]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
85	-	
86	Crankshaft Position Sensor [B] signal input	Crankshaft Position Sensor (CKPS)
87	Crankshaft Position Sensor [A] signal input	Crankshaft Position Sensor (CKPS)
88	Fuel consumption signal output	Trip Computer
89	-	
90	Idle Speed Control Actuator [OPEN] control output	Idle Speed Control Actuator (ISCA)

91	Injector (Cylinder #1) control output	Injector (Cylinder #1)
92	CVVT Oil Control Valve control output	CVVT Oil Control Valve (OCV)
93	-	
94	-	

ECM Terminal Input/Output Signal (M/T)

Connector [EGGM-K]

Pin No.	Description	Condition	Type	Level	Test Result
1	Ignition Coil (Cylinder #1) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	352V
				ON Voltage: Max. 2.0V	1.1V
2	Power Ground	Idle	DC	Max. 50mV	0mV
3	Ignition Coil (Cylinder #3) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	366V
				ON Voltage: Max. 2.0V	1.1V
4	-				
5	-				
6	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	200mV
		IG ON		Battery Voltage	12.9V
7	Ignition Coil (Cylinder #4) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	372V
				ON Voltage: Max. 2.0V	1.1V
8	A/C thermal switch signal input	A/C S/W OFF	DC	Max. 0.5V	200mV
		A/C S/W ON		Battery Voltage	12.6V
9	-				
10	Power Steering Switch signal input				
11	Knock Sensor signal input	Knocking	Variable Frequency		
		Normal			
12	Sensor ground	Idle	DC	Max. 50mV	11.2mV
13	-				
14	-				
15	Sensor ground	Idle	DC	Max. 50mV	16mV
16	Sensor ground	Idle	DC	Max. 50mV	6.2mV
17	Sensor ground	Idle	DC	Max. 50mV	12mV

18	Immobilizer communication line	When communicating after IG ON	Pulse	Hi: Min. 8.5V	12.51V
				Lo: Max. 3.5V	1.17V
19	Manifold Absolute Pressure Sensor signal input	IG ON	DC	3.9 ~ 4.1V	4.09V
		Idle		0.8 ~ 1.6V	1.44V
20	-				
21	-				
22	Main Relay control output	Relay OFF	DC	Battery Voltage	12.78V
		Relay ON		Max. 1.0V	860mV
23	Cooling Fan Relay [High] control output	Relay OFF	DC	Battery Voltage	14.01V
		Relay ON		Max. 1.0V	52.6mV
24	Injector (Cylinder #3) control output	Idle	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	40mV
				Vpeak: Max. 80V	73.6V
25	Idle Speed Control Actuator [CLOSE] control output	Idle	Pulse	Hi: Battery Voltage	13.8V
				Lo: Max. 1.0V	200mV
26	-				
27	-				
28	Cooling Fan Relay [Low] control output	Relay OFF	DC	Battery Voltage	14.12V
		Relay ON		Max. 1.0V	61.6mV
29	Ignition Coil (Cylinder #2) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	372V
				ON Voltage: Max. 2.0V	1.1V
30	A/C Switch "ON" signal input	A/C S/W OFF	DC	Max. 1.0V	20mV
		A/C S/W ON		Battery Voltage	12.48V
31	Electric Load signal input				
32	Sensor ground	Idle	DC	Max. 50mV	
33	Sensor ground	Idle	DC	Max. 50mV	6.2mV
34	Sensor ground	Idle	DC	Max. 50mV	6.4mV
35	Sensor ground	Idle	DC	Max. 50mV	16.8mV
36	Heated Oxygen Sensor (Sensor 2) signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	860mV
				Lean: Max. 0.4V	10mV
37	-				

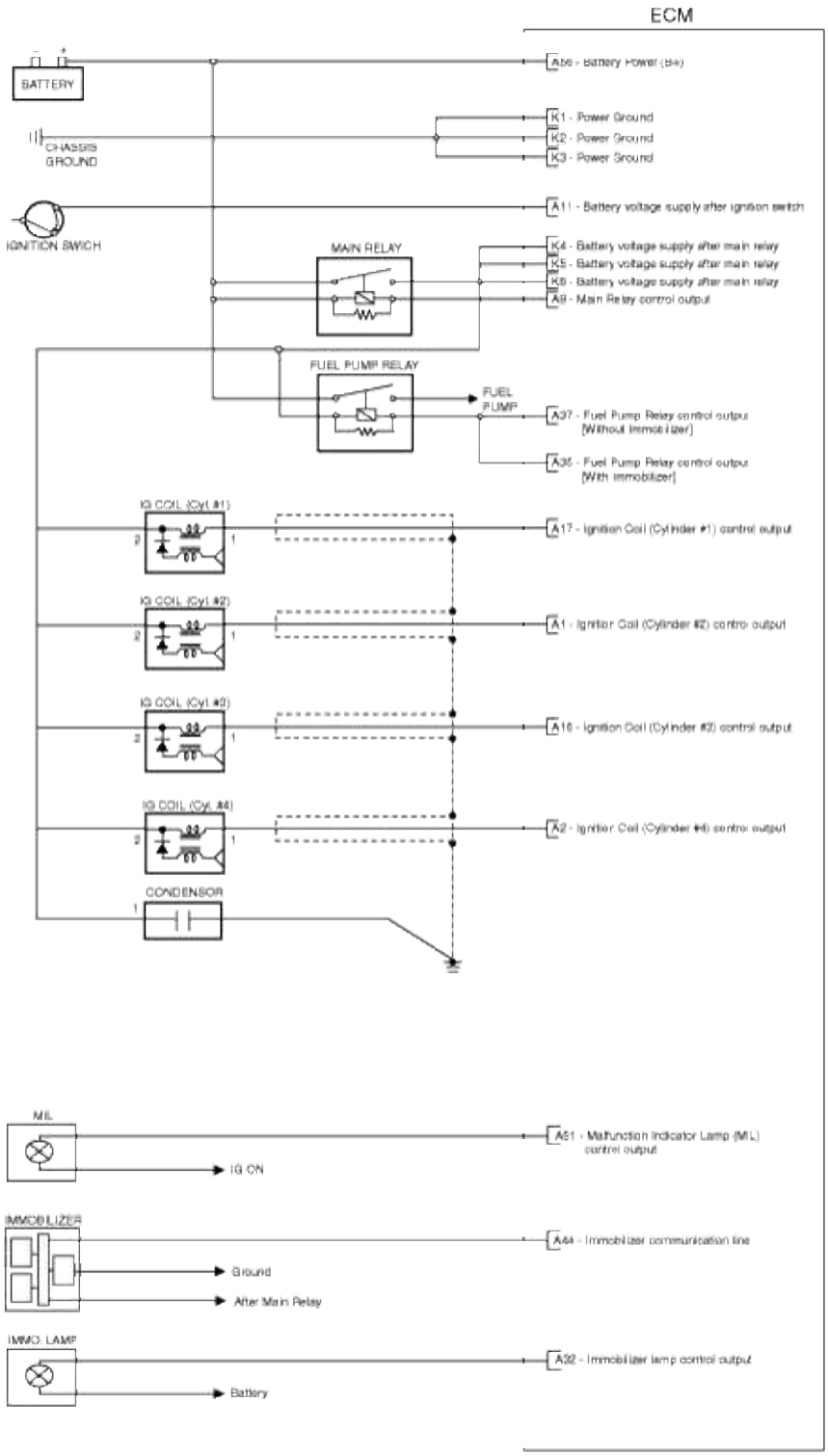
38	Sensor ground	Idle	DC	Max. 50mV	6.8mV
39	Throttle Position Sensor signal input	C.T	Analog	0.2 ~ 0.7V	0.34V
		W.O.T		Min. 4.0V	4.43V
40	A/C Pressure Transducer signal input	A/C ON	Analog	Max. 4.8V	1.88V
41	-				
42	-				
43	Intake Air Temperature Sensor signal input	Idle	DC	0.2 ~ 4.8V	1.89V
44	-				
45	A/C Compressor Relay control output	Relay OFF	DC	Battery Voltage	14.1V
		Relay ON		Max. 1.0V	400mV
46	Fuel Pump Relay control output [Without Immobilizer]	Relay OFF	DC	Battery Voltage	12.8V
		Relay ON		Max. 1.0V	400mV
	Canister Close Valve control output [With Immobilizer]	Active	Pulse	Hi: Battery Voltage	14.2V
		Inactive		Lo: Max. 1.0V	45mV
47	Injector (Cylinder #2) control output	Idle	Pulse	Hi: Battery Voltage	13.6V
				Lo: Max. 1.0V	336mV
				Vpeak: Max. 80V	69.7V
48	Immobilizer lamp control output	Lamp OFF	DC	Battery Voltage	12.6V
		Lamp ON		Max. 1.0V	20mV
49	Fuel Pump Relay control output [With Immobilizer]	Relay OFF	DC	Battery Voltage	12.8V
		Relay ON		Max. 1.0V	400mV
	Fuel Pump Relay control output [Without Immobilizer]	Relay OFF	DC	Battery Voltage	12.8V
		Relay ON		Max. 1.0V	400mV
50	-				
51	Power Ground	Idle	DC	Max. 50mV	3.6mV
52	-				
53	-				
54	Heated Oxygen Sensor (Sensor 1) signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	884mV
				Lean: Max. 0.4V	8mV
55	-				
56	-				
57	-				
58	Wheel Speed Sensor [A] signal input	Vehicle Run	SINE Wave	Vp_p: Min. 0.2V	

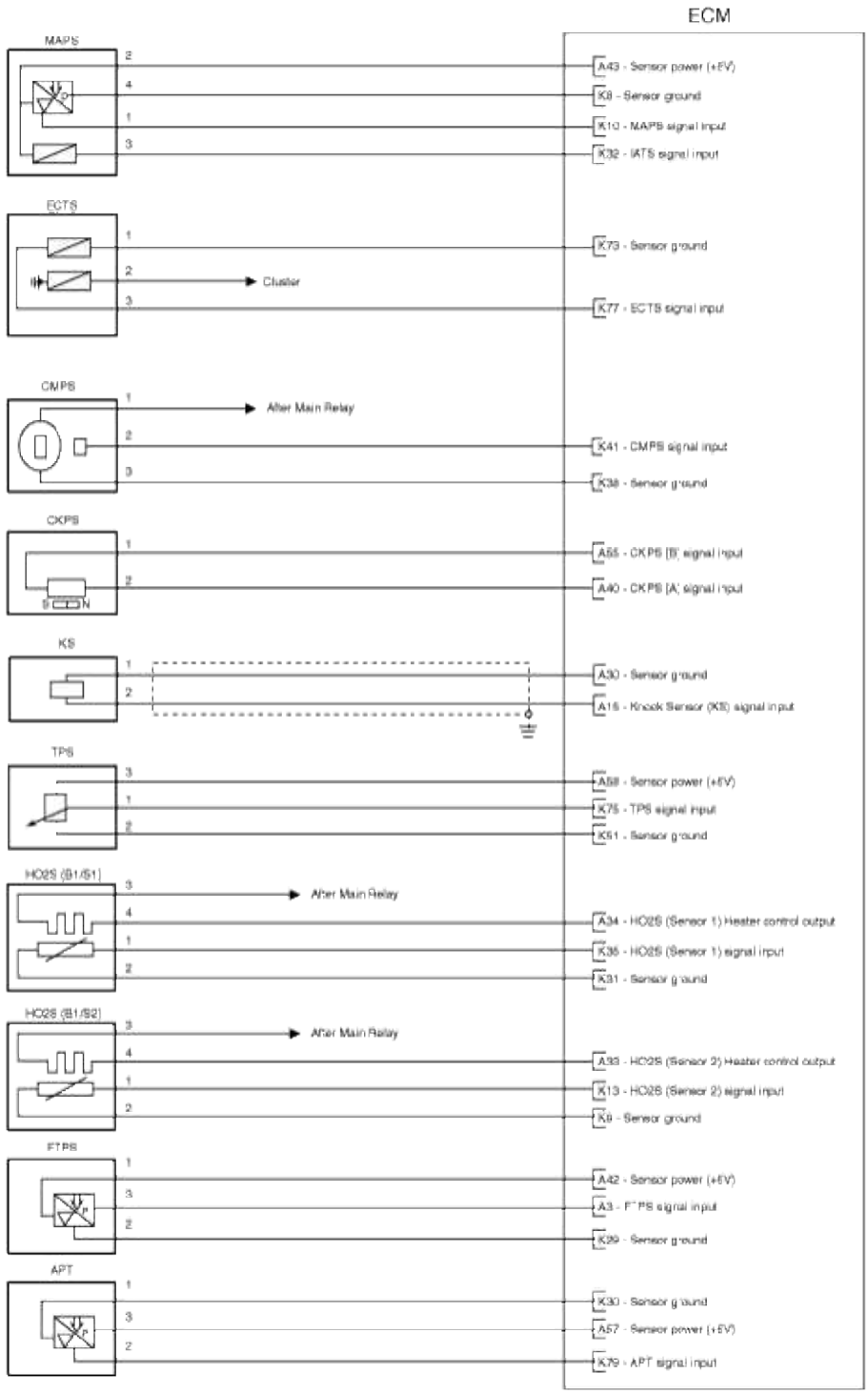
59	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	3.6mV
		IG ON		4.9 ~ 5.1V	5.02V
60	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	3.6mV
		IG ON		4.9 ~ 5.1V	5.02V
61	-				
62	CAN [LOW]	RECESSIVE	Pulse	2.0 ~ 3.0V	2.5V
		DOMINANT		0.5 ~ 2.25V	1.5V
63	Camshaft Position Sensor signal input	Idle	Pulse	Hi: Battery Voltage	13.72V
				Lo: Max. 0.5V	200mV
64	Vehicle speed signal input	Idle	Pulse	Hi: Min. 4.5V	12.2V
				Lo: Max. 1.0V	0V
					Freq.: 72.2Hz
		Vehicle Run (30km)		Hi: Min. 4.5V	12.2V
				Lo: Max. 1.0V	0V
					Freq.: 212Hz
65	-				
66	Alternator load signal input	Idle	Pulse	Hi: Battery Voltage	13.2V
				Lo: Max. 1.5V	1.34V
67	Engine speed signal output	Idle	Pulse	Hi: Battery Voltage	14.0V
				Lo: Max. 0.5V	20mV
				Freq.: 20 ~ 26Hz	22Hz
68	Injector (Cylinder #4) control output	Idle	Pulse	Hi: Battery Voltage	13.6V
				Lo: Max. 1.0V	336mV
				Vpeak: Max. 80V	69.7V
69	Purge Control Solenoid Valve control output	ActiveInactive	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	120mV
70	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Battery Voltage	11.51V
		Lamp ON		Max. 1.0V	663mV
71	Heated Oxygen Sensor (Sensor 2) Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	220mV
72	Heated Oxygen Sensor (Sensor 1) Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	220mV
73	Power Ground	Idle	DC	Max. 50mV	3.6mV
74	-				
75	-				
76	-				

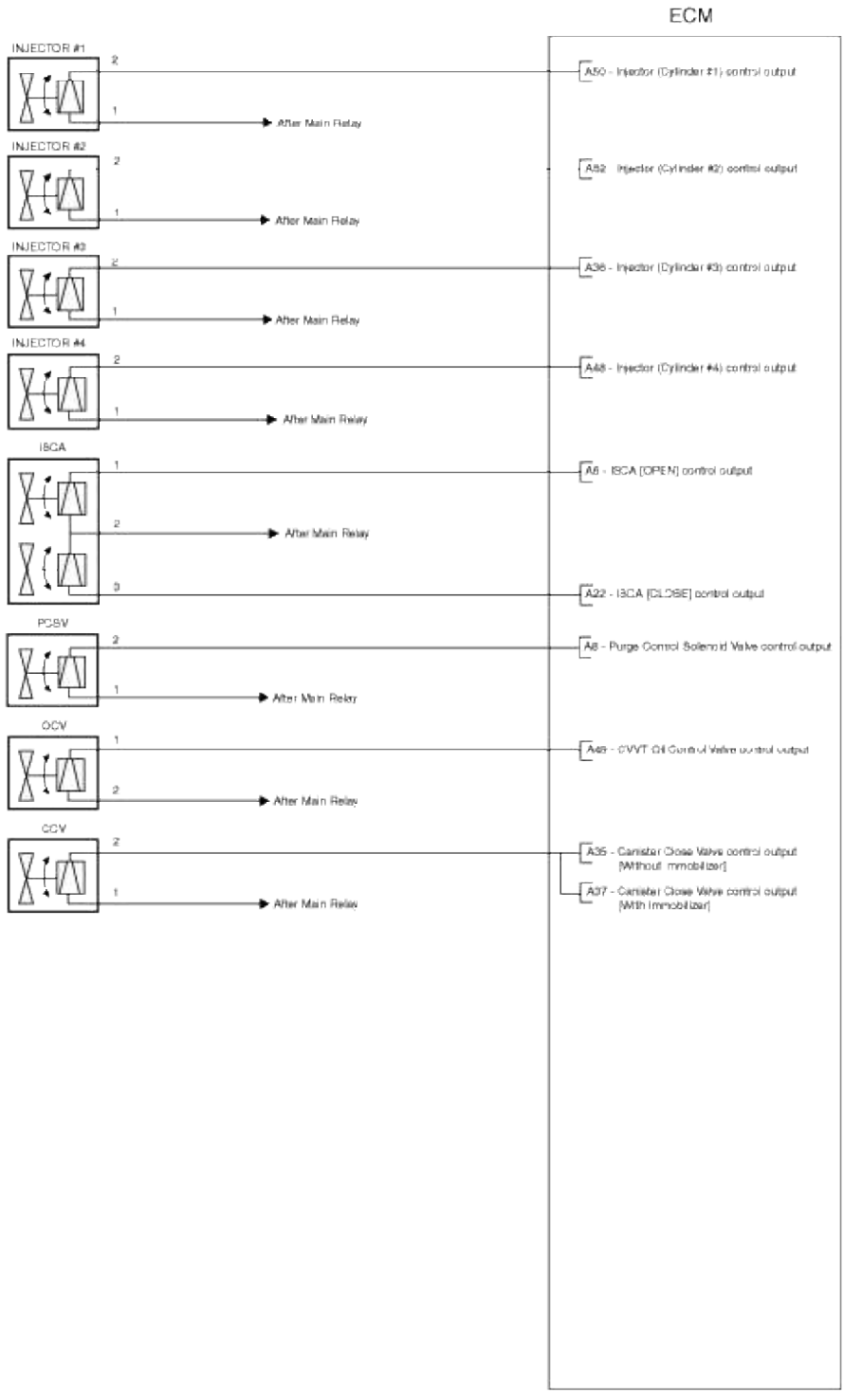
77	Engine Coolant Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	1.43V
78	-				
79	Wheel Speed Sensor [B] signal input	Vehicle Run	SINE Wave	Vp_p: Min. 0.2V	
80	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	3.6mV
		IG ON		4.9 ~ 5.1V	5.02V
81	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	3.6mV
		IG ON		4.8 ~ 5.2V	5.02V
82	Battery Power (B+)	Always	DC	Battery Voltage	12.23V
83	Battery voltage supply after ignition switch	IG OFF	DC	Max. 1.0V	3.2mV
		IG ON		Battery Voltage	12.68V
84	CAN [HIGH]	RECESSIVE	Pulse	2.0 ~ 3.0V	2.5V
		DOMINANT		2.75 ~ 4.5V	3.58V
85	-				
86	Crankshaft Position Sensor [B] signal input	Idle	SINE Wave	Vp_p: Min. 1.0V	6.48V
87	Crankshaft Position Sensor [A] signal input	Idle	SINE Wave	Vp_p: Min. 1.0V	6.48V
88	Fuel consumption signal output	Idle	Pulse	Hi: Battery Voltage	1.3.8V
				Lo: Max. 0.5V	20mV
89	-				
90	Idle Speed Control Actuator [OPEN] control output	Idle	Pulse	Hi: Battery Voltage	13.8V
				Lo: Max. 1.0V	20mV
91	Injector (Cylinder #1) control output	Idle	Pulse	Hi: Battery Voltage	13.6V
				Lo: Max. 1.0V	336mV
				Vpeak: Max. 80V	69.7V
92	CVVT Oil Control Valve control output	Idle	Pulse	Hi: Battery Voltage	14.9V
				Lo: Max. 1.0V	36.2mV
93	-				
94	-				

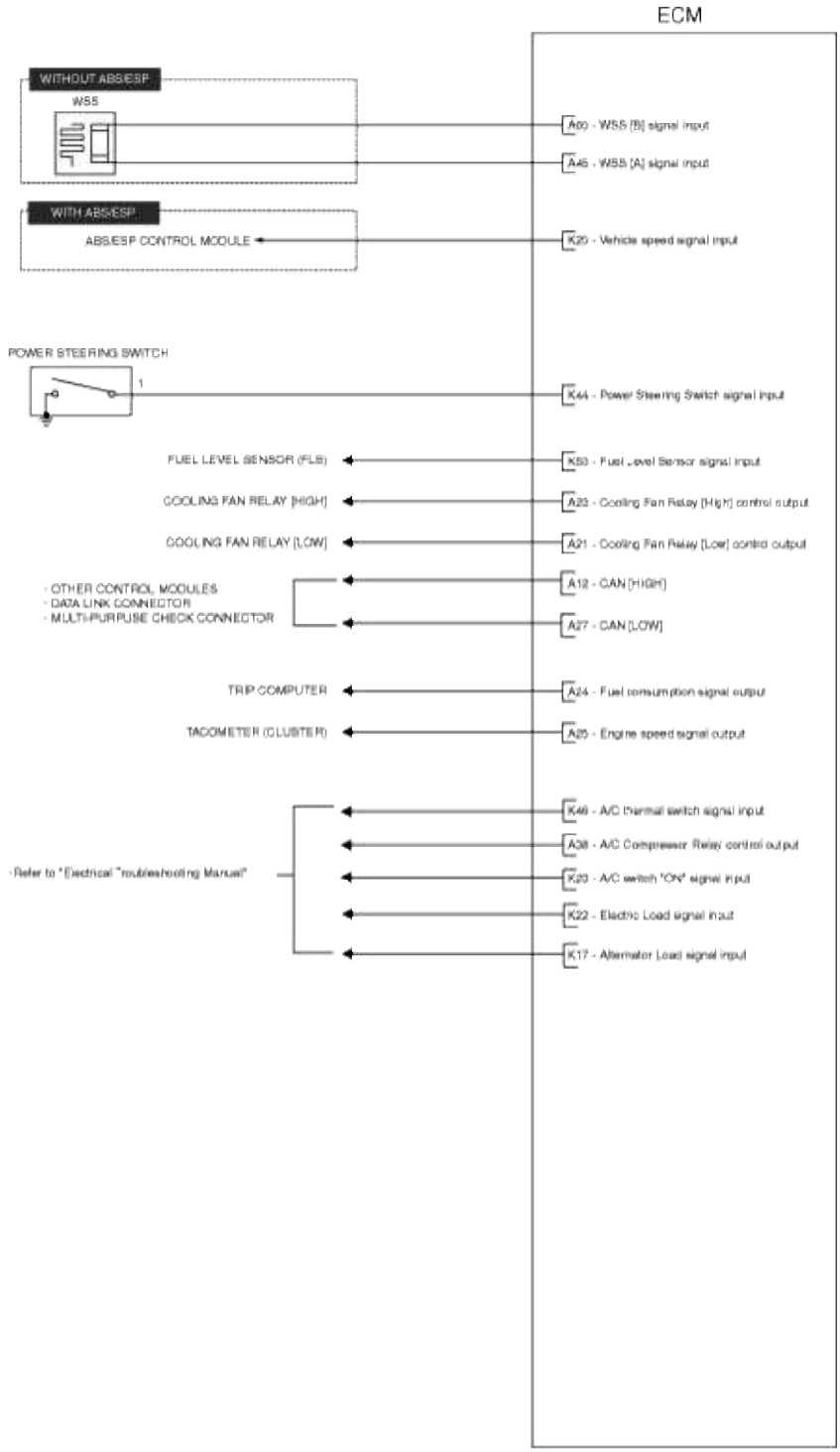
Circuit Diagram

[A/T]

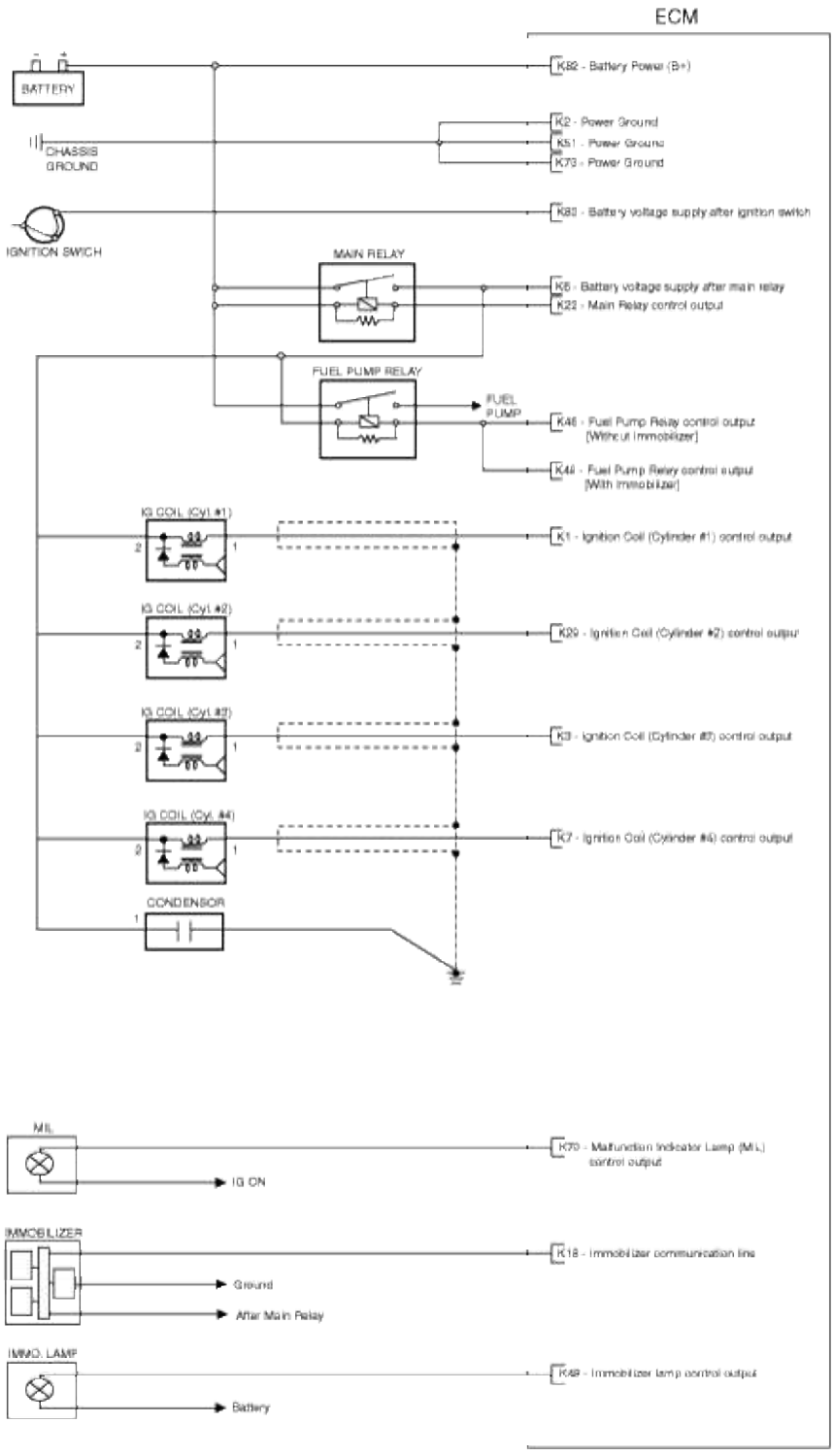

ECM
BATTERY
CHASSIS GROUND
IGNITION SWITCH
MAIN RELAY
FUEL PUMP RELAY
FUEL PUMP
IG COIL (Cyl. #1)
IG COIL (Cyl. #2)
IG COIL (Cyl. #3)
IG COIL (Cyl. #4)
CONDENSOR
MIL
IG ON
IMMOBILIZER
Ground
After Main Relay
IMMO. LAMP
Battery
A56 - Battery Power (B+)
K1 - Power Ground
K2 - Power Ground
K3 - Power Ground
A11 - Battery voltage supply after ignition switch
K4 - Battery voltage supply after main relay
K5 - Battery voltage supply after main relay
K6 - Battery voltage supply after main relay
A9 - Main Relay control output
A37 - Fuel Pump Relay control output [Without Immobilizer]
A35 - Fuel Pump Relay control output [With Immobilizer]
A17 - Ignition Coil (Cylinder #1) control output
A1 - Ignition Coil (Cylinder #2) control output
A16 - Ignition Coil (Cylinder #3) control output
A2 - Ignition Coil (Cylinder #4) control output
A51 - Malfunction Indicator Lamp (MIL) control output
A44 - Immobilizer communication line
A32 - Immobilizer lamp control output

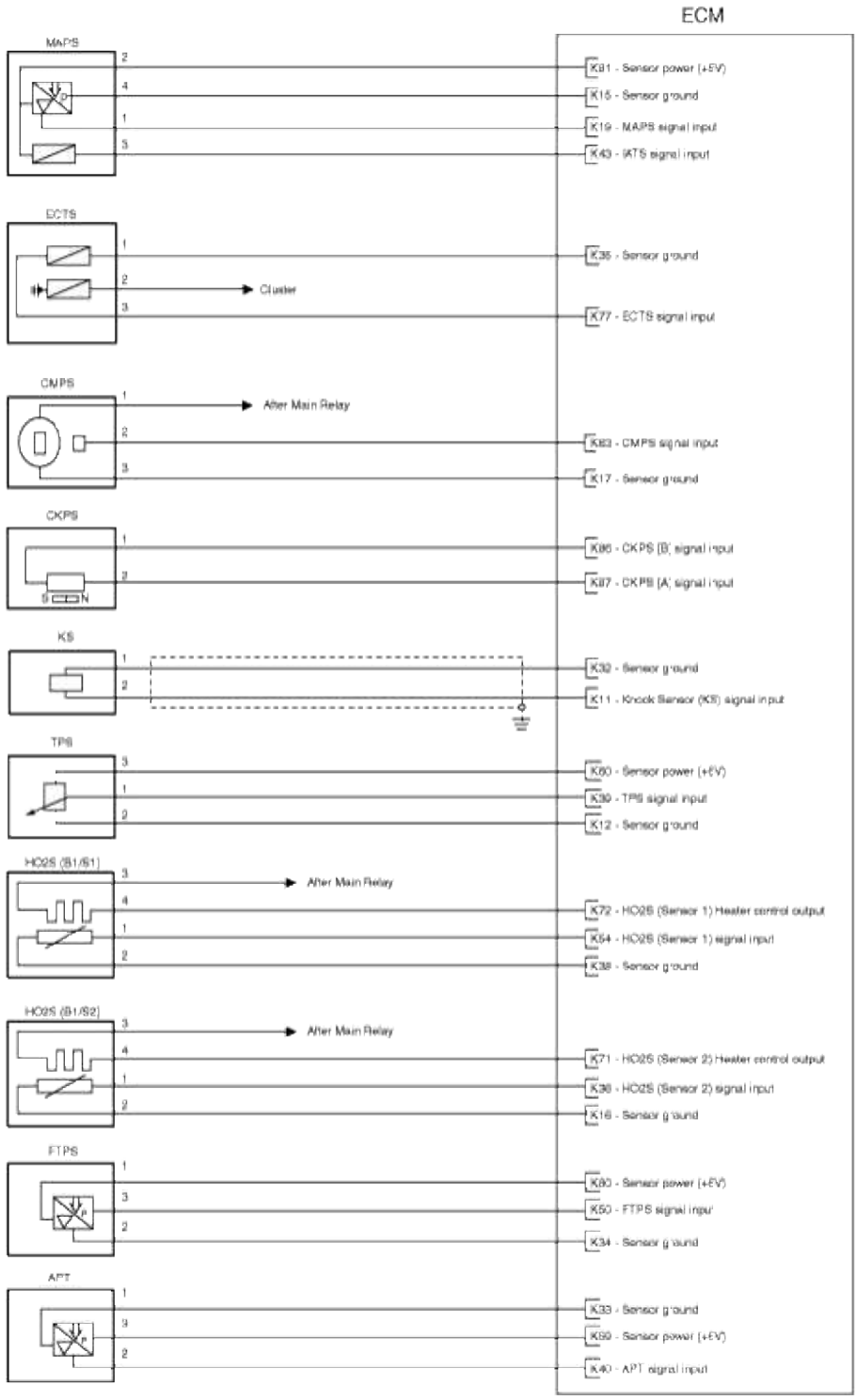

ECM
MAPS
2
4
1
3
A43 - Sensor power (+5V)
K8 - Sensor ground
K10 - MAPS signal input
K32 - IATS signal input
ECTS
1
2
3
Cluster
K73 - Sensor ground
K77 - ECTS signal input
CMPS
1
2
3
After Main Relay
K41 - CMPS signal input
K38 - Sensor ground
CKPS
1
2
A55 - CKPS [B] signal input
A40 - CKPS [A] signal input
KS
1
2
A30 - Sensor ground
A15 - Knock Sensor (KS) signal input
TPS
3
1
2
A58 - Sensor power (+5V)
K75 - TPS signal input
K51 - Sensor ground
HO2S (B1/S1)
3
4
1
2
After Main Relay
A34 - HO2S (Sensor 1) Heater control output
K35 - HO2S (Sensor 1) signal input
K31 - Sensor ground
HO2S (B1/S2)
3
4
1
2
After Main Relay
A33 - HO2S (Sensor 2) Heater control output
K13 - HO2S (Sensor 2) signal input
K9 - Sensor ground
FTPS
1
3
2
A42 - Sensor power (+5V)
A3 - FTPS signal input
K29 - Sensor ground
APT
1
3
2
K30 - Sensor ground
A57 - Sensor power (+5V)
K79 - APT signal input

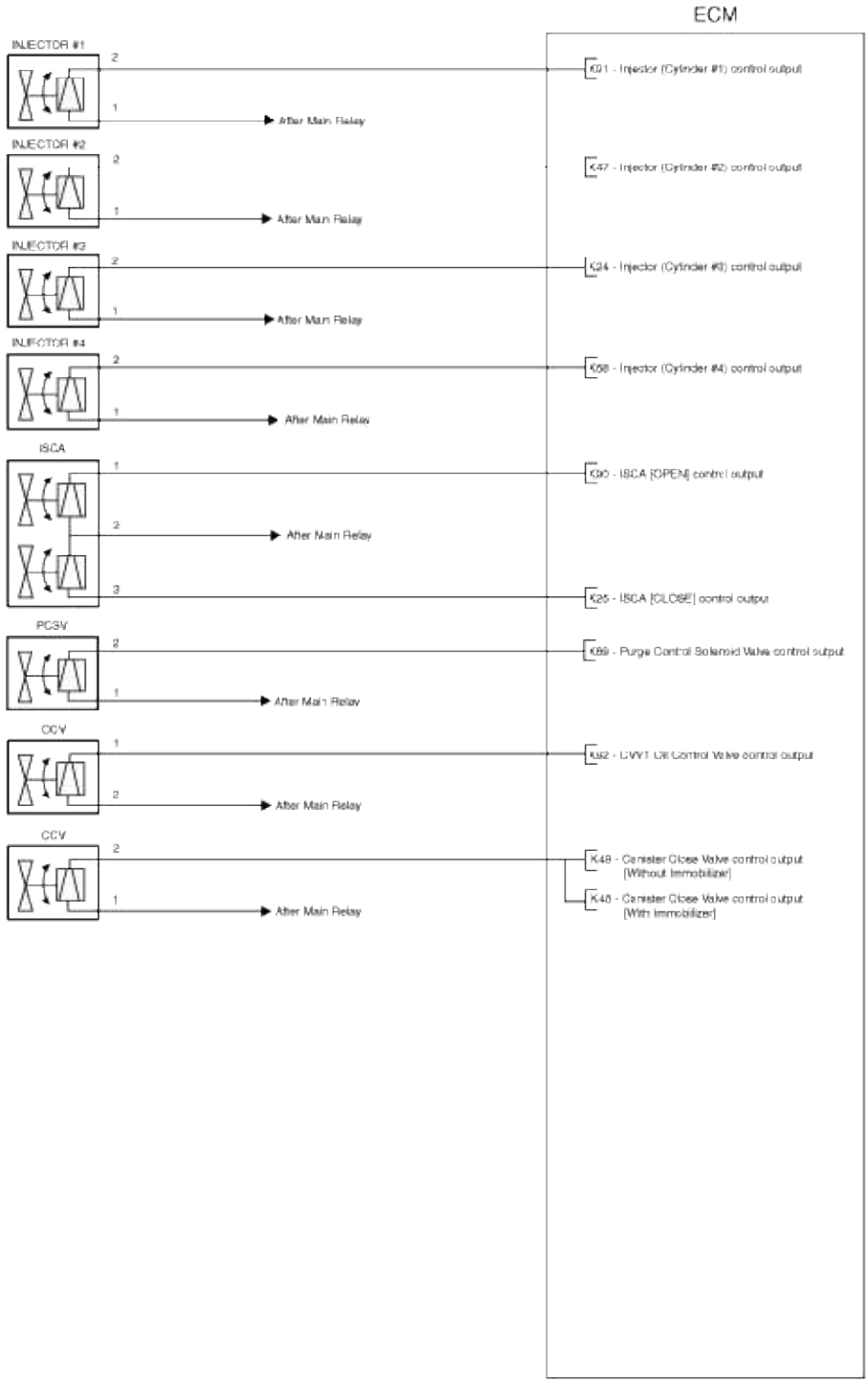

ECM
INJECTOR #1
2
1
After Main Relay
A50 - Injector (Cylinder #1) control output
INJECTOR #2
2
1
After Main Relay
A52 - Injector (Cylinder #2) control output
INJECTOR #3
2
1
After Main Relay
A36 - Injector (Cylinder #3) control output
INJECTOR #4
2
1
After Main Relay
A48 - Injector (Cylinder #4) control output
ISCA
1
2
3
After Main Relay
A6 - ISCA [OPEN] control output
A22 - ISCA [CLOSE] control output
PCSV
2
1
After Main Relay
A8 - Purge Control Solenoid Valve control output
OCV
1
2
After Main Relay
A49 - OVVT Oil Control Valve control output
CCV
2
1
After Main Relay
A35 - Canister Close Valve control output [Without immobilizer]
A37 - Canister Close Valve control output [With immobilizer]

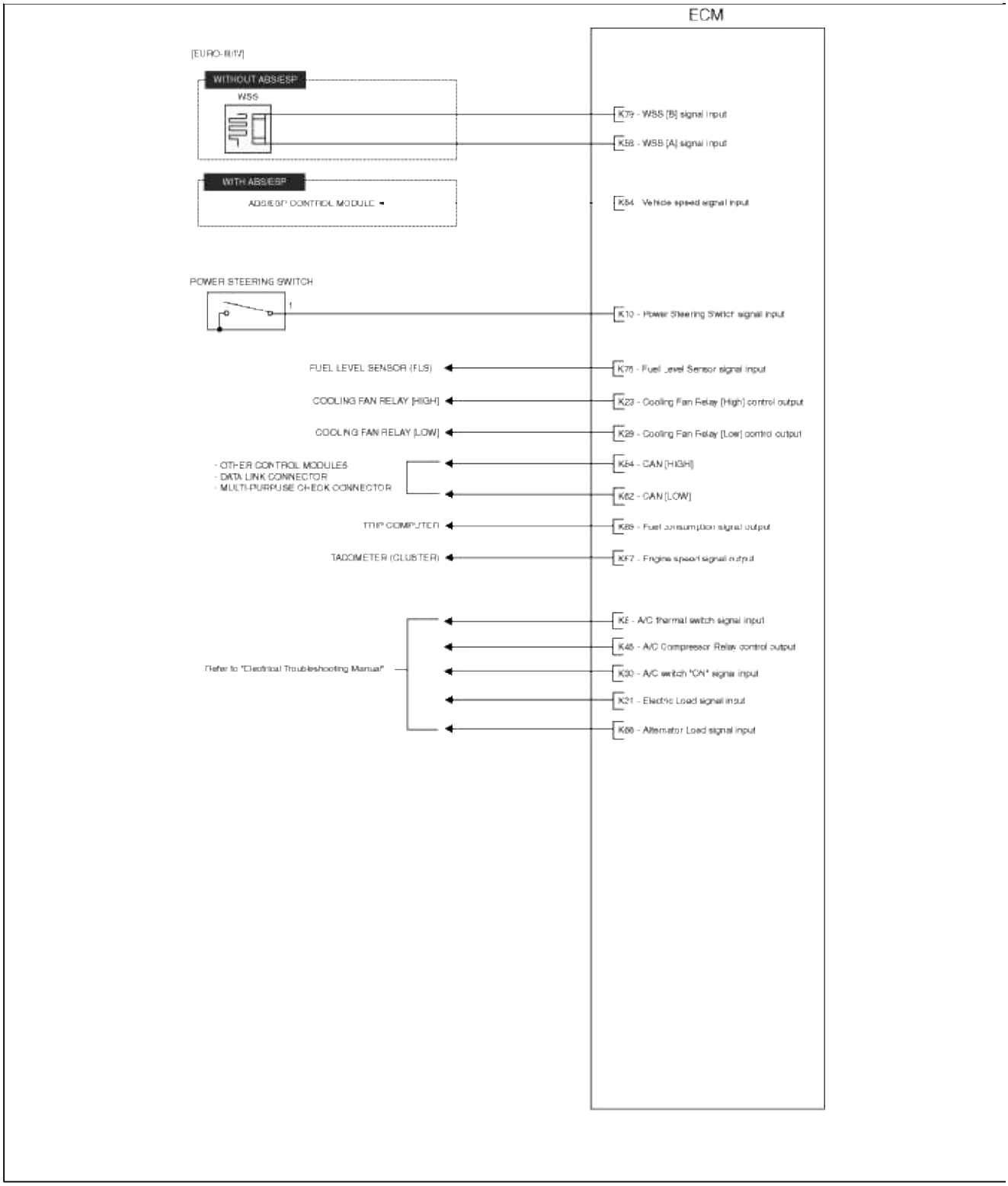

ECM
WITHOUT ABS/ESP
WSS
A09 - WSS [B] signal input
A46 - WSS [A] signal input
WITH ABS/ESP
ABS/ESP CONTROL MODULE
K29 - Vehicle speed signal input
POWER STEERING SWITCH
1
K44 - Power Steering Switch signal input
FUEL LEVEL SENSOR (FLS)
K53 - Fuel Level Sensor signal input
COOLING FAN RELAY [HIGH]
A23 - Cooling Fan Relay [High] control output
COOLING FAN RELAY [LOW]
A21 - Cooling Fan Relay [Low] control output
- OTHER CONTROL MODULES
- DATA LINK CONNECTOR
- MULTI-PURPUSE CHECK CONNECTOR
A12 - CAN [HIGH]
A27 - CAN [LOW]
TRIP COMPUTER
A24 - Fuel consumption signal output
TACOMETER (CLUSTER)
A25 - Engine speed signal output
- Refer to "Electrical "troubleshooting Manual"
K46 - A/C thermal switch signal input
A38 - A/C Compressor Relay control output
K20 - A/C switch "ON" signal input
K22 - Electric Load signal input
K17 - Alternator Load signal input

[M/T]


ECM
BATTERY
CHASSIS GROUND
IGNITION SWICH
MAIN RELAY
FUEL PUMP RELAY
FUEL PUMP
IG COIL (Cyl. #1)
IG COIL (Cyl. #2)
IG COIL (Cyl. #3)
IG COIL (Cyl. #4)
CONDENSOR
K82 - Battery Power (B+)
K2 - Power Ground
K51 - Power Ground
K73 - Power Ground
K83 - Battery voltage supply after ignition switch
K6 - Battery voltage supply after main relay
K22 - Main Relay control output
K46 - Fuel Pump Relay control output [Without Immobilizer]
K44 - Fuel Pump Relay control output [With Immobilizer]
K1 - Ignition Coil (Cylinder #1) control output
K29 - Ignition Coil (Cylinder #2) control output
K3 - Ignition Coil (Cylinder #3) control output
K7 - Ignition Coil (Cylinder #4) control output
MIL
IG ON
K79 - Malfunction Indicator Lamp (MIL) control output
IMMOBILIZER
Ground
After Main Relay
K18 - Immobilizer communication line
IMMO. LAMP
Battery
K49 - Immobilizer lamp control output


ECM
MAPS
2
4
1
3
K61 - Sensor power (+5V)
K15 - Sensor ground
K19 - MAPS signal input
K43 - IATS signal input
ECTS
1
2
3
Cluster
K35 - Sensor ground
K77 - ECTS signal input
CMPS
1
2
3
After Main Relay
K83 - CMPS signal input
K17 - Sensor ground
CKPS
1
2
S
N
K86 - CKPS (B) signal input
K87 - CKPS (A) signal input
KS
1
2
K32 - Sensor ground
K11 - Knock Sensor (KS) signal input
TPS
3
1
2
K60 - Sensor power (+5V)
K39 - TPS signal input
K12 - Sensor ground
HO2S (B1/S1)
3
4
1
2
After Main Relay
K72 - HO2S (Sensor 1) Heater control output
K54 - HO2S (Sensor 1) signal input
K38 - Sensor ground
HO2S (B1/S2)
3
4
1
2
After Main Relay
K71 - HO2S (Sensor 2) Heater control output
K36 - HO2S (Sensor 2) signal input
K16 - Sensor ground
FTPS
1
3
2
K80 - Sensor power (+5V)
K50 - FTPS signal input
K34 - Sensor ground
APT
1
3
2
K33 - Sensor ground
K59 - Sensor power (+5V)
K40 - APT signal input


ECM
INJECTOR #1
2
1
After Main Relay
K91 - Injector (Cylinder #1) control output
INJECTOR #2
2
1
After Main Relay
K47 - Injector (Cylinder #2) control output
INJECTOR #3
2
1
After Main Relay
K24 - Injector (Cylinder #3) control output
INJECTOR #4
2
1
After Main Relay
K68 - Injector (Cylinder #4) control output
ISCA
1
2
3
After Main Relay
K80 - ISCA [OPEN] control output
K25 - ISCA [CLOSE] control output
PCSV
2
1
After Main Relay
K69 - Purge Control Solenoid Valve control output
OCV
1
2
After Main Relay
K82 - OCV1 Oil Control Valve control output
CCV
2
1
After Main Relay
K48 - Canister Close Valve control output [Without Immobilizer]
K48 - Canister Close Valve control output [With Immobilizer]



Fuel System > Engine Control System > Engine Control Module (ECM) > Repair procedures

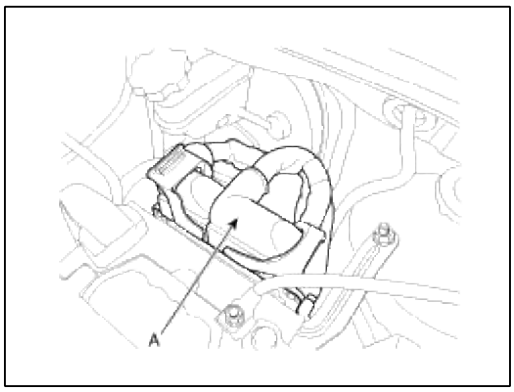
Removal

CAUTION

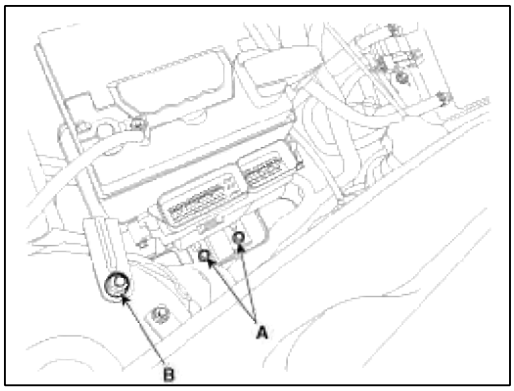
- In the case of the vehicle equipped with immobilizer, perform "Key Teaching" procedure together (Refer to "Immobilizer" in BE group).

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.

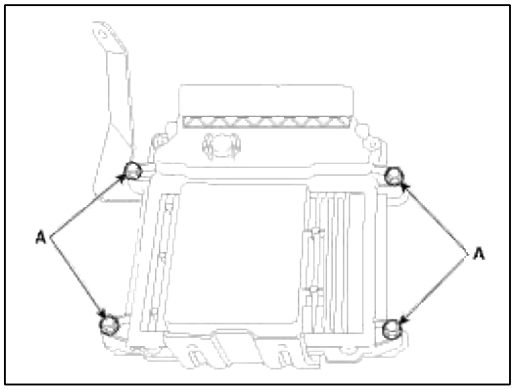
2. Disconnect the ECM connector (A).



3. Remove the bracket installation bolts (A) and the nut (B).



4. Remove the installation bolts (A), and then remove the ECM from the bracket.



Installation

CAUTION

- In the case of the vehicle equipped with immobilizer, perform "Key Teaching" procedure together (Refer to "Immobilizer" in BE group).

Installation is reverse of removal.

ECM installation nut:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
ECM bracket installation bolt:
19.6 ~ 29.4 N.m (2.0 ~ 3.0 kgf.m, 14.5 ~ 21.7 lb-ft)
ECM bracket installation nut:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

ECM Problem Inspection Procedure

1. TEST ECM GROUND CIRCUIT: Measure the voltage drop between ECM and chassis ground using the backside of ECM harness connector. The ECM harness should be connected to the ECM and the ECM must be powered up. If the problem is found, repair it.

   Specification: below 1Ω

2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminals on ECM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, replace the ECM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the ECM.
4. RE-TEST THE ORIGINAL ECM : Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to Intermittent Problem Procedure in Basic Inspection Procedure)

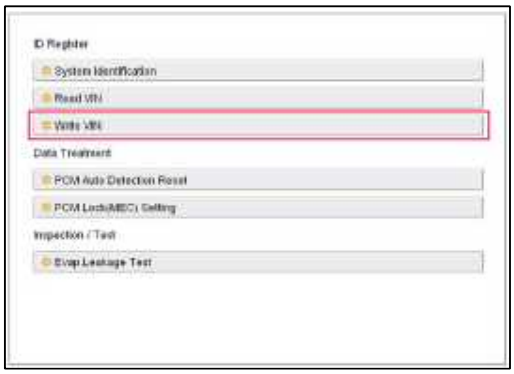
VIN Programming Procedure

VIN (Vehicle Identification Number) is a number that has the vehicle's information (Maker, Vehicle Type, Vehicle Line/Series, Body Type, Engine Type, Transmission Type, Model Year, Plant Location and so forth. For more information, please refer to the group "GI" in this SERVICE MANUAL). When replacing an ECM, the VIN must be programmed in the ECM. If there is no VIN in ECM memory, the fault code (DTC P0630) is set.

CAUTION

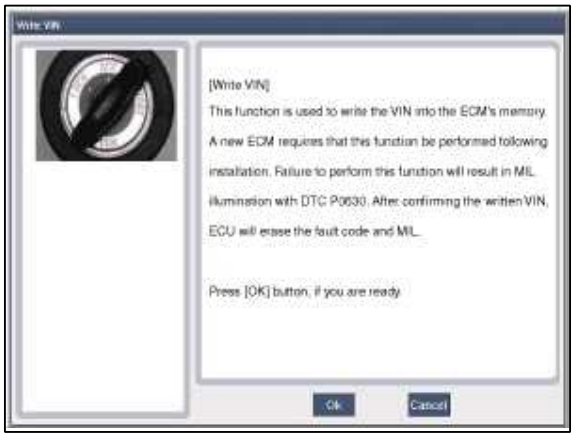
The programmed VIN cannot be changed. When writing the VIN, confirm the VIN carefully

1. Select "VIN Writing" function in "Vehicle S/W Management".
2. Select "Write VIN" in "ID Resister".



3. Input the VIN.

> WARNING
>
> Before inputing the VIN, confirm the VIN again because the programmed VIN cannot be changed.



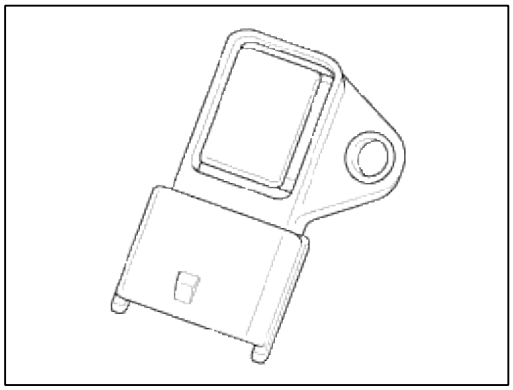
4. Turn the ignition switch OFF, then back ON.

Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Description and Operation

Description

Manifold Absolute Pressure Sensor (MAPS) is a speed-density type sensor and is installed on the surge tank. It senses absolute pressure of the surge tank and transfers the analog signal proportional to the pressure to the ECM. By using this signal, the ECM calculates the intake air quantity and engine speed.

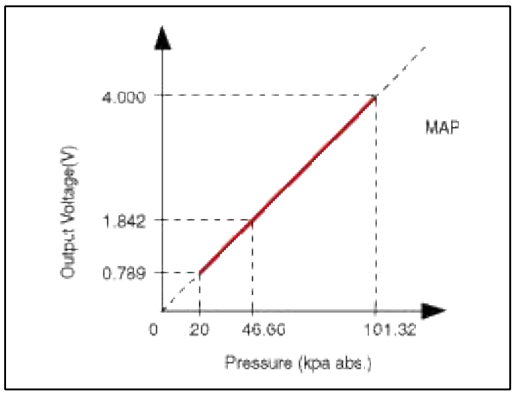
The MAPS consists of a piezo-electric element and a hybrid IC amplifying the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. Because 100% vacuum and the manifold pressure apply to both sides of the sensor respectively, this sensor can output analog signal by using the silicon variation proportional to pressure change.



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Specifications

Specification

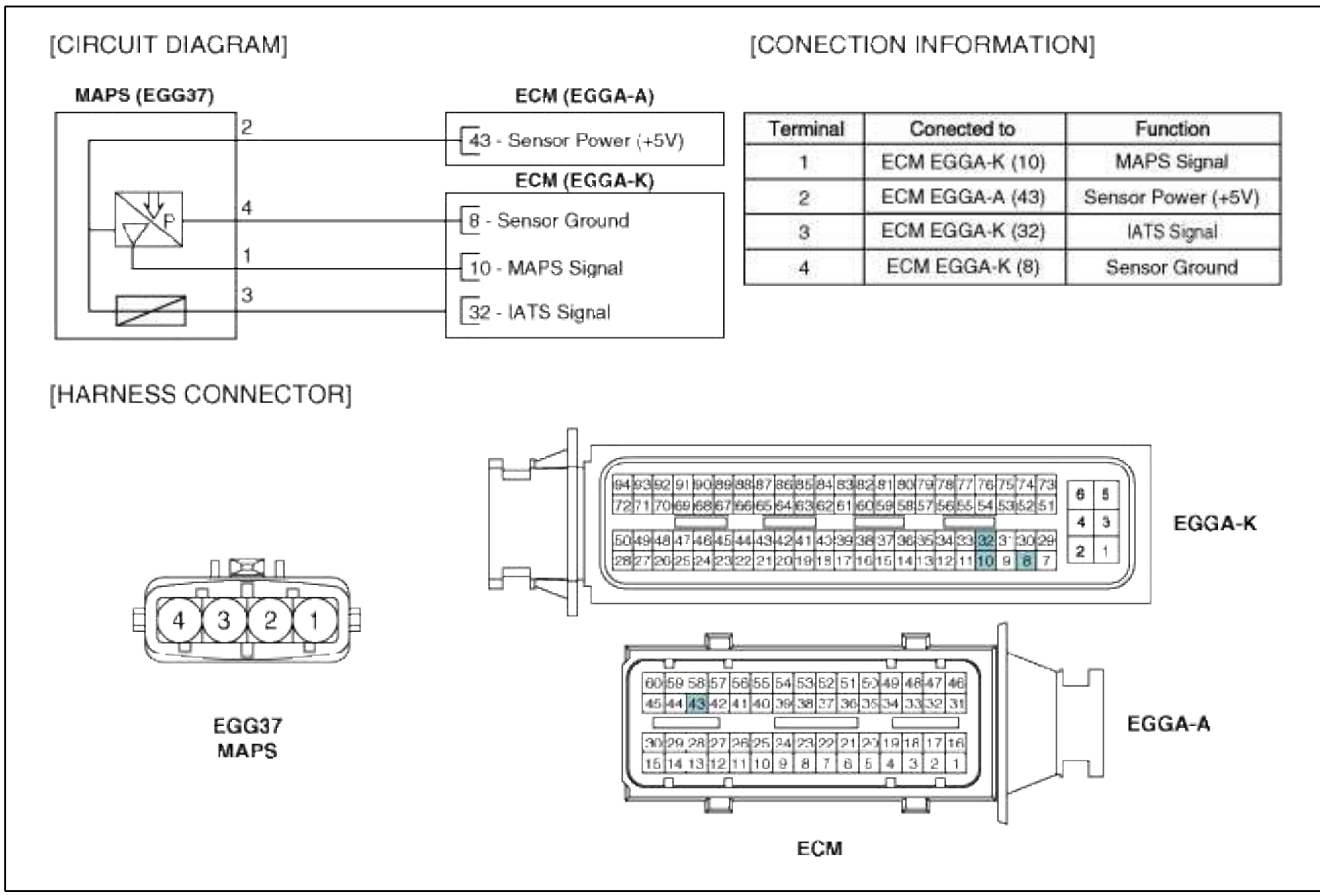
Pressure (kPa)	Output Voltage (V)
20.0	0.79
46.66	1.84
101.32	4.0



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Schematic Diagrams

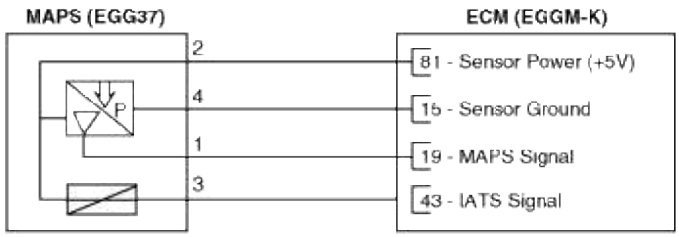
Circuit Diagram

[A/T]



[M/T]

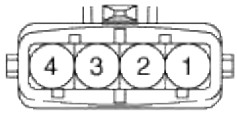
[CIRCUIT DIAGRAM]



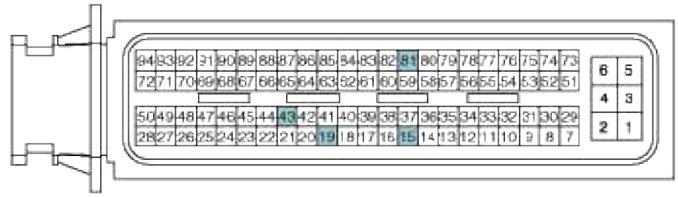
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGM-K (19)	MAPS Signal
2	ECM EGGM-K (81)	Sensor Power (+5V)
3	ECM EGGM-K (43)	IATS Signal
4	ECM EGGM-K (15)	Sensor Ground

[HARNESS CONNECTOR]



EGG37
MAPS



EGGM-K
ECM

Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Repair procedures

Inspection

1. Connect a scan tool on Data Link Connector (DLC).
2. Check MAPS output voltage at idle and IG ON.

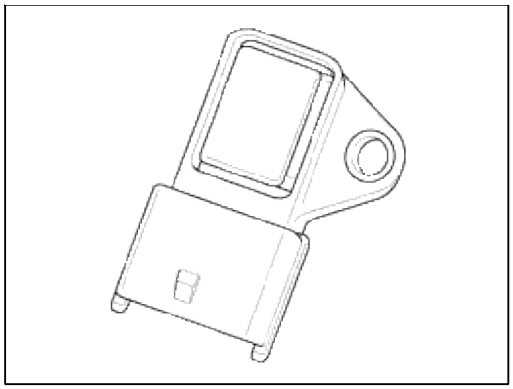
Condition	Output Voltage (V)
IG ON	3.9 ~ 4.1
Idle	0.8 ~ 1.6

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Description and Operation

Description

Intake Air Temperature Sensor (IATS) is included inside Manifold Absolute Pressure Sensor and detects the intake air temperature.

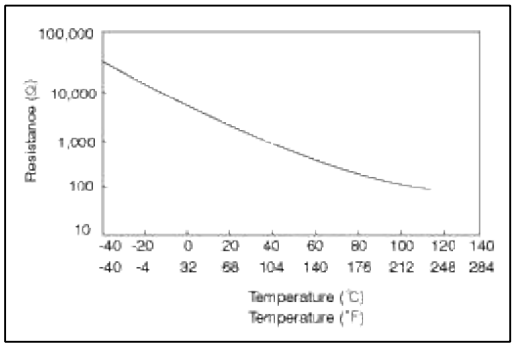
To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the ECM uses not only MAPS ignal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) Thermister and it's resistance changes in inverse proportion to the temperature.



Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Specifications

Specification

Temperature [°C(°F)]	Resistance(kΩ)
-40 (-40)	40.93 ~ 48.35
-30 (-22)	23.43 ~ 27.34
-20 (-4)	13.89 ~ 16.03
-10 (14)	8.50 ~ 9.71
0 (32)	5.38 ~ 6.09
10 (50)	3.48 ~ 3.90
20 (68)	2.31 ~ 2.57
25 (77)	1.90 ~ 2.10
30 (86)	1.56 ~ 1.74
40 (104)	1.08 ~ 1.21
60 (140)	0.54 ~ 0.62
80 (176)	0.29 ~ 0.34



Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Schematic Diagrams

Circuit Diagram

[A/T]

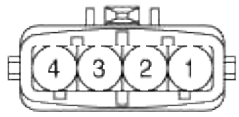
[CIRCUIT DIAGRAM]



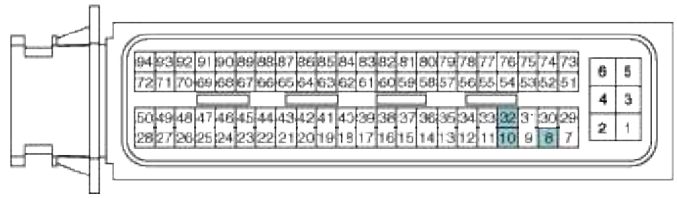
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGA-K (10)	MAPS Signal
2	ECM EGGA-A (43)	Sensor Power (+5V)
3	ECM EGGA-K (32)	IATS Signal
4	ECM EGGA-K (8)	Sensor Ground

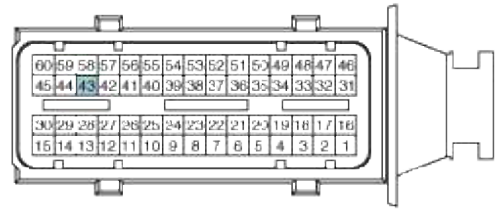
[HARNESS CONNECTOR]



EGG37
MAPS



EGGA-K

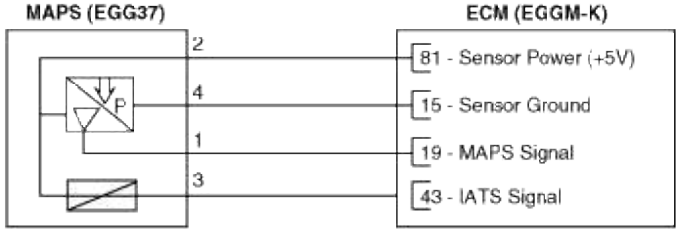


EGGA-A

ECM

[M/T]

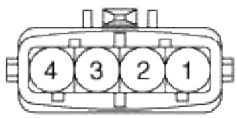
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGM-K (19)	MAPS Signal
2	ECM EGGM-K (81)	Sensor Power (+5V)
3	ECM EGGM-K (43)	IATS Signal
4	ECM EGGM-K (15)	Sensor Ground

[HARNESS CONNECTOR]



EGG37
MAPS



EGGM-K
ECM

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect IATS connector.
3. Measure resistance between IATS terminals 3 and 4.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

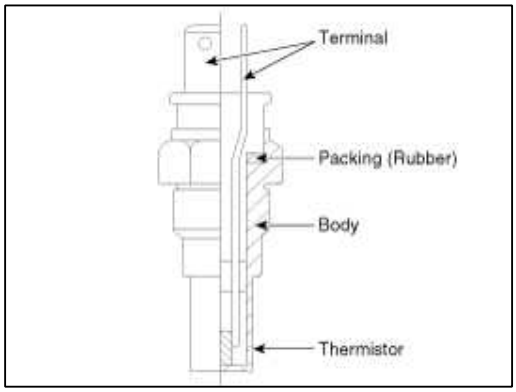
Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Description and Operation

Description

Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature.

The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference +5V is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes.

During cold engine operation, the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Specifications

Specification

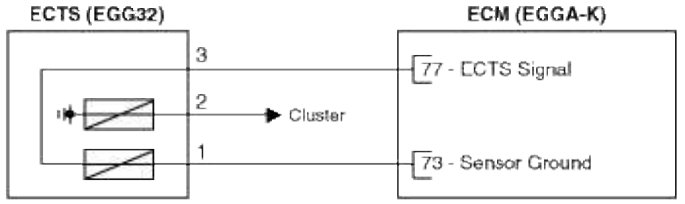
Temperature [°C(°F)]	Resistance(kΩ)
-40(-40)	48.14
-20(-4)	14.13 ~ 16.83
0(32)	5.79
20(68)	2.31 ~ 2.59
40(104)	1.15
60(140)	0.59
80(176)	0.32

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Schematic Diagrams

Circuit Diagram

[A/T]

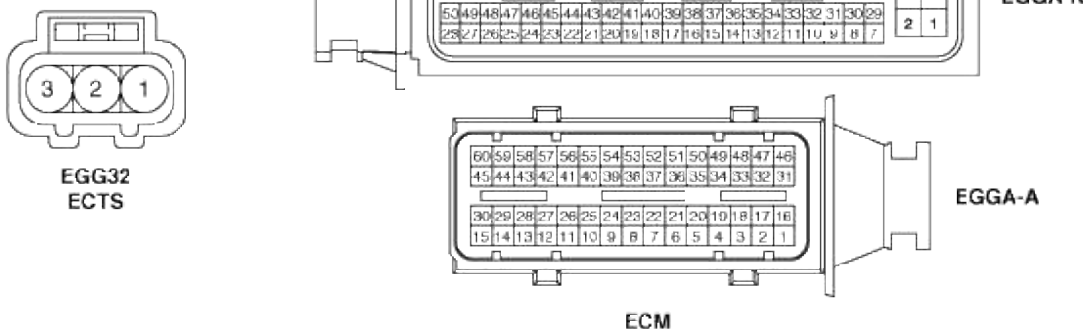
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

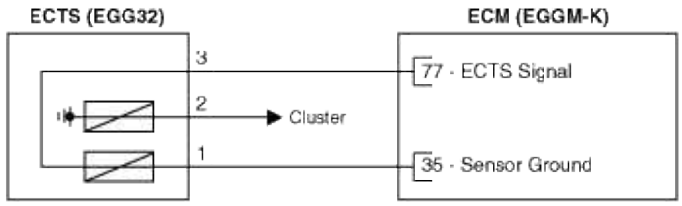
Terminal	Conected to	Function
1	ECM EGGA-K (73)	Sensor Ground
2	Cluster	
3	ECM EGGA-K (77)	ECTS Signal

[HARNESS CONNECTOR]



[M/T]

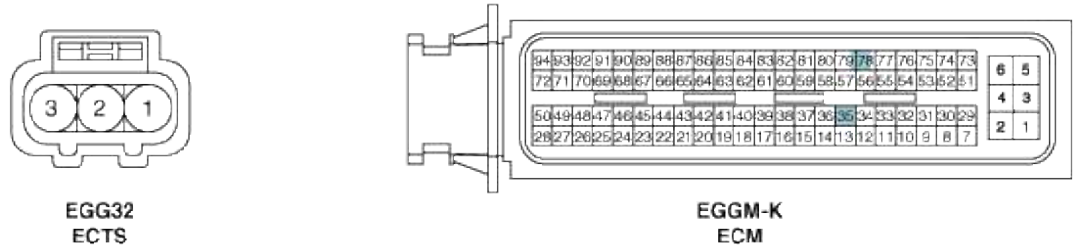
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGM-K (35)	Sensor Ground
2	Cluster	
3	ECM EGGM-K (77)	ECTS Signal

[HARNESS CONNECTOR]



Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Repair procedures

Inspection

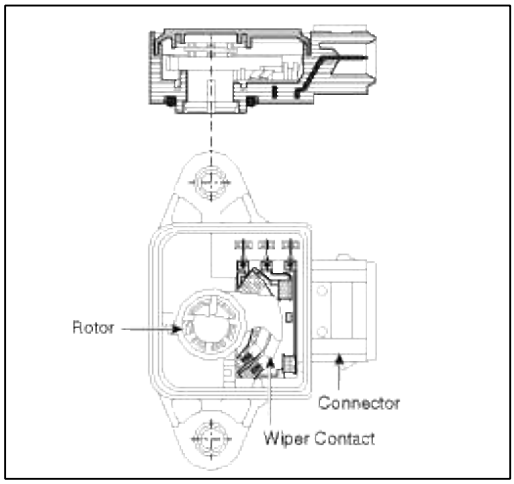
1. Turn ignition switch OFF.
2. Disconnect ECTS connector.
3. Remove the ECTS.
4. Measure resistance between ECTS terminals 1 and 3.
5. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Throttle Position Sensor (TPS) > Description and Operation

Description

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) which is changed according to the throttle angle.
During acceleration, the TPS resistance between the reference +5V and the signal terminal decreases and output voltage increases; during deceleration, the TPS resistance increases and TPS output voltage decreases. The TPS output voltage will vary from 0.25~0.9V at closed throttle to minimum 4.0V at wide-open throttle.
The ECM determines operating conditions such as idle (closed throttle), part load, acceleration / deceleration, and wide-open throttle by using the TPS signal. Also the ECM uses the Manifold Absolute Pressure Sensor (MAPS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.



Fuel System > Engine Control System > Throttle Position Sensor (TPS) > Specifications

Specification

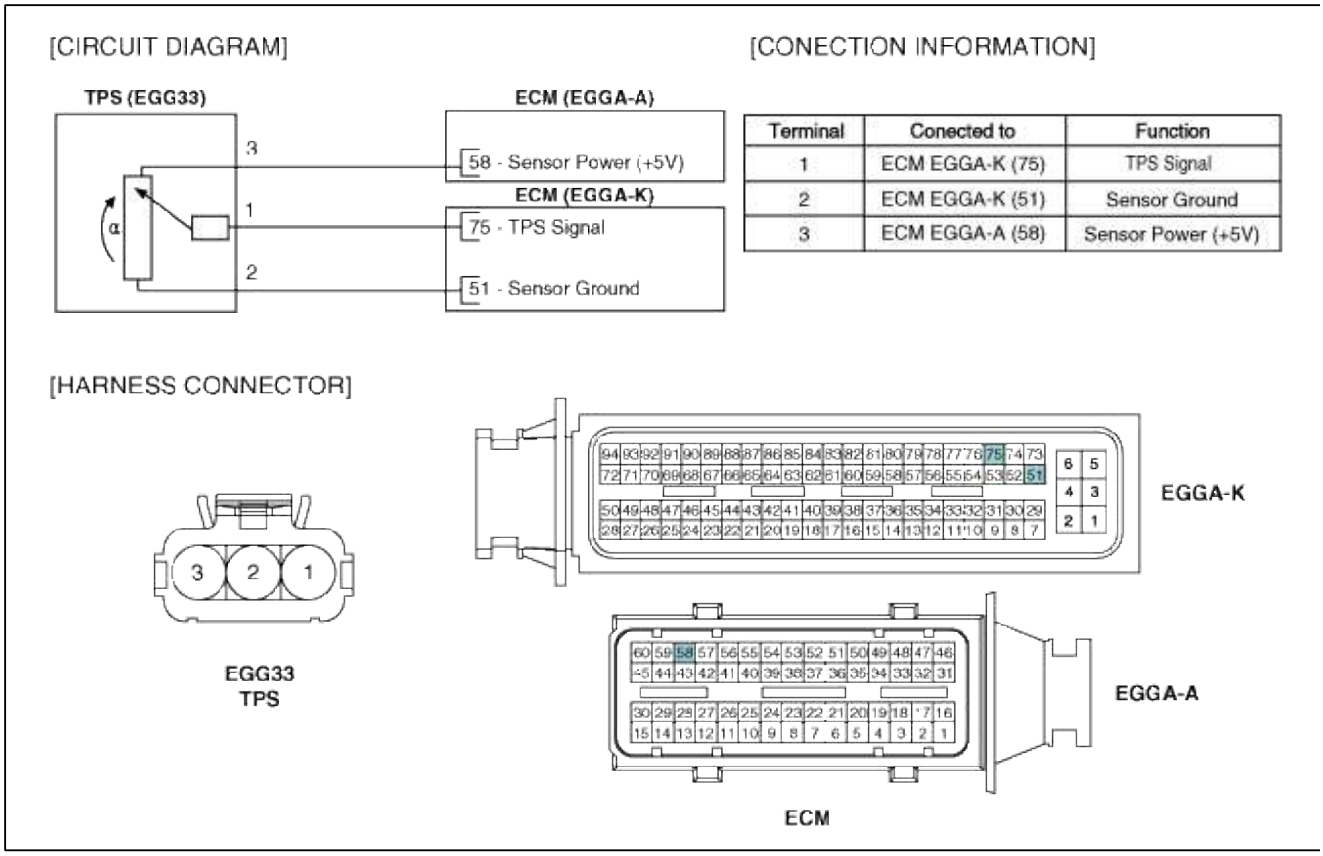
Throttle Angle	Output Voltage(V)
C.T	0.25 ~ 0.9
W.O.T	Min. 4.0

Item	Specification
Sensor Resistance(kΩ)	1.6 ~ 2.4 [20°C(68°F)]

Fuel System > Engine Control System > Throttle Position Sensor (TPS) > Schematic Diagrams

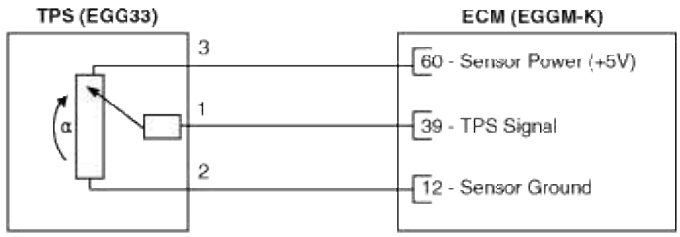
Circuit Diagram

[A/T]



[M/T]

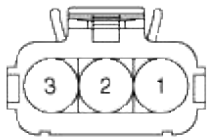
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGM-K (39)	TPS Signal
2	ECM EGGM-K (12)	Sensor Ground
3	ECM EGGM-K (60)	Sensor Power (+5V)

[HARNESS CONNECTOR]



EGG33
TPS



EGGM-K
ECM

Fuel System > Engine Control System > Throttle Position Sensor (TPS) > Repair procedures

Inspection

1. Connect a scan tool on the Data Link Connector (DLC).
2. Start engine and check output voltages of TPS at C.T and W.O.T.

Specification: Refer to “Specification”

3. Turn ignition switch OFF and disconnect the scan tool from the DLC.
4. Disconnect TPS connector and measure resistance between TPS terminals 2 and 3.

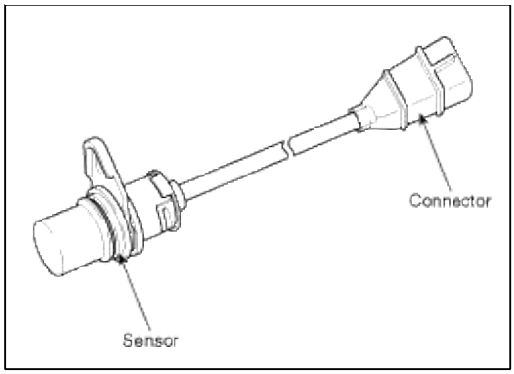
Specification: Refer to “Specification”

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Description and Operation

Description

Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, the engine may stop because of CKPS signal missing. This sensor is installed on the cylinder block or the transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs.

The target wheel consists of 58 slots and 2 missing slots on 360 degrees CA (Crank Angle).



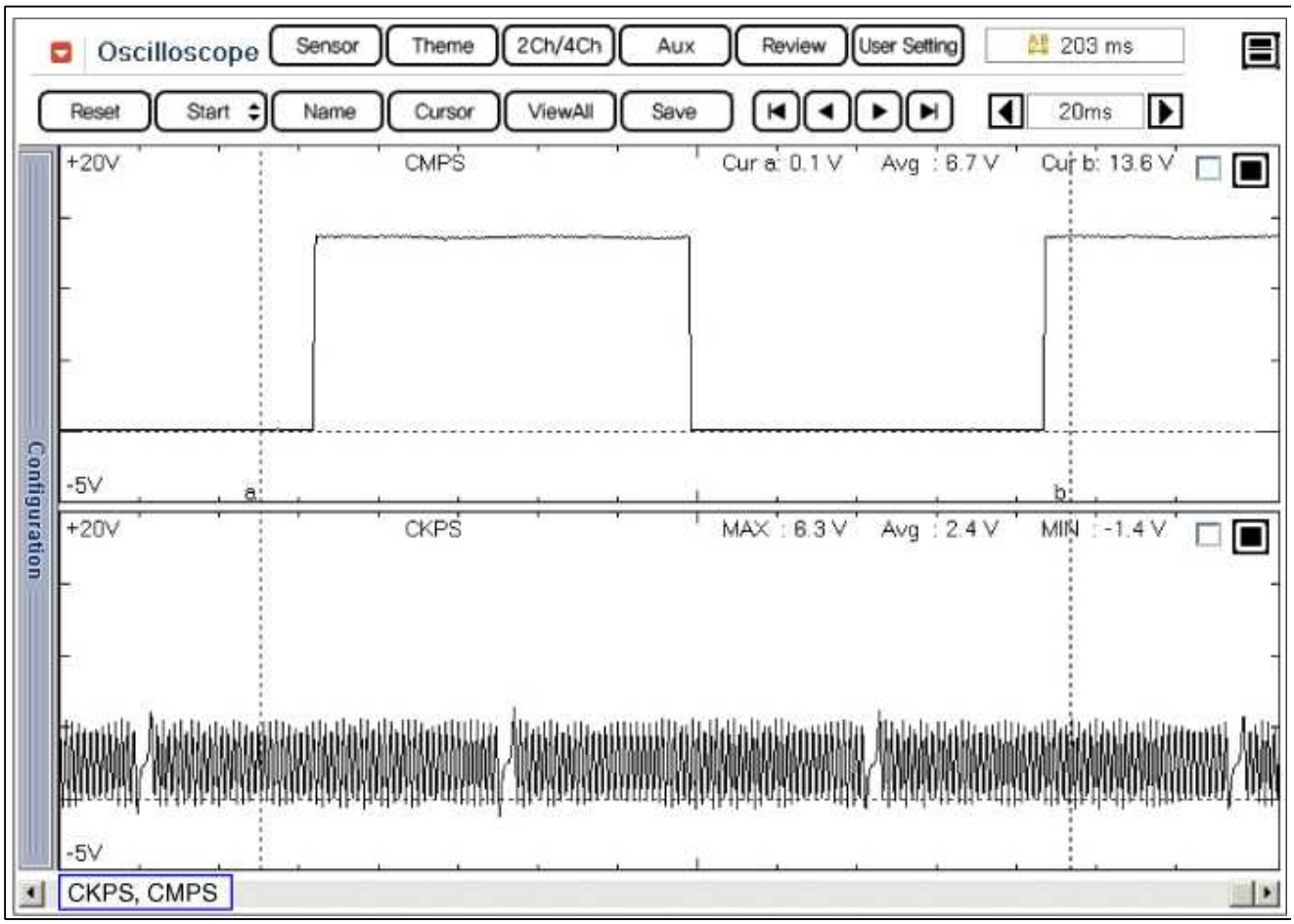
Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Specifications

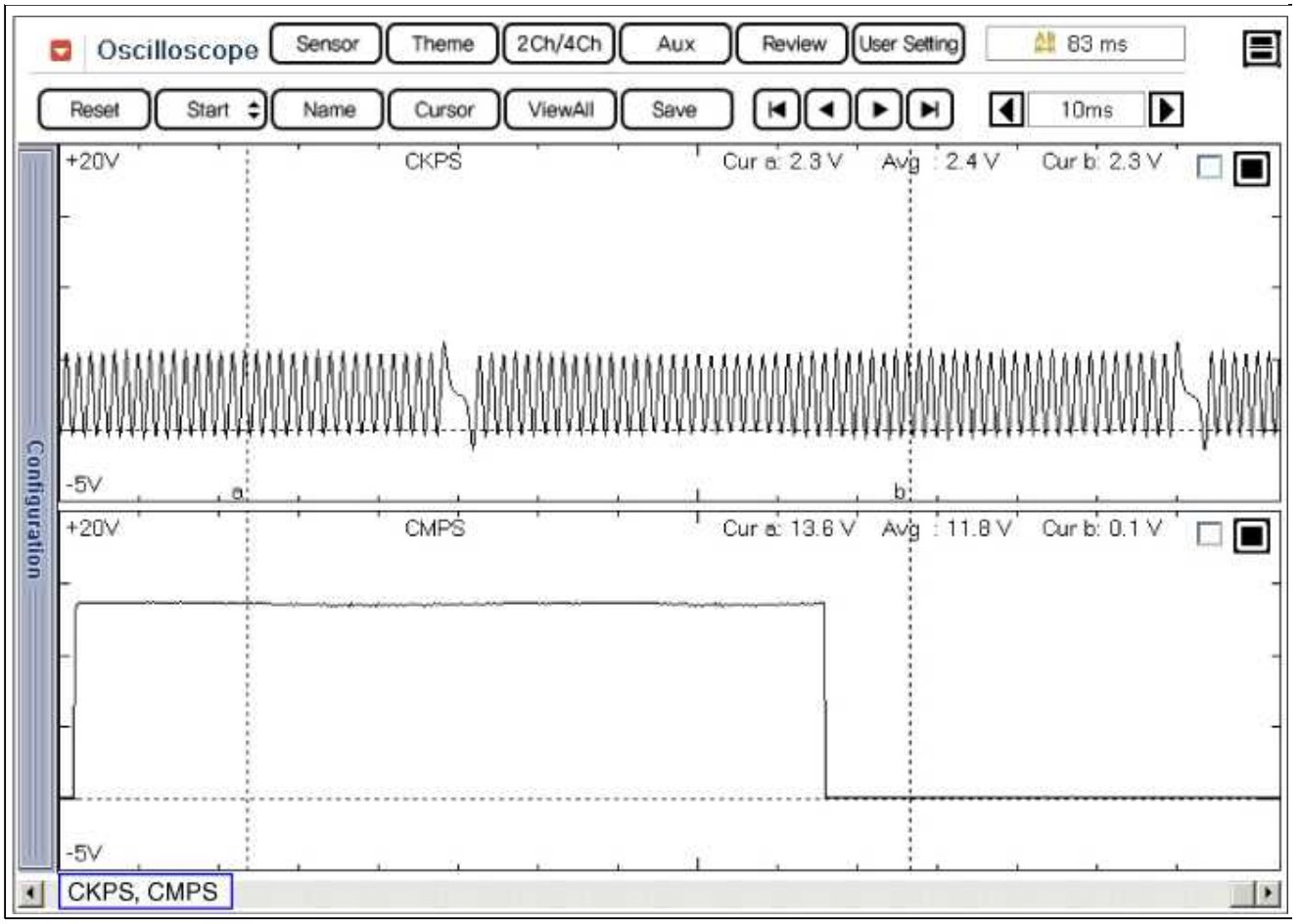
Specification

Item	Specification
Coil Resistance(Ω)	774 ~ 946 [20°C (68°F)]

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Troubleshooting

Waveform



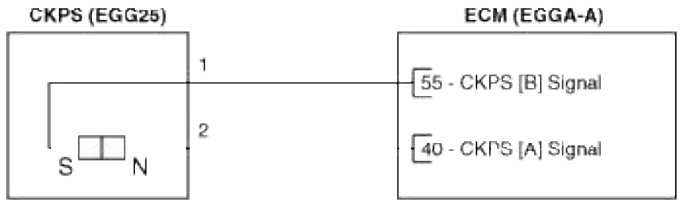


Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Schematic Diagrams

Circuit Diagram

[A/T]

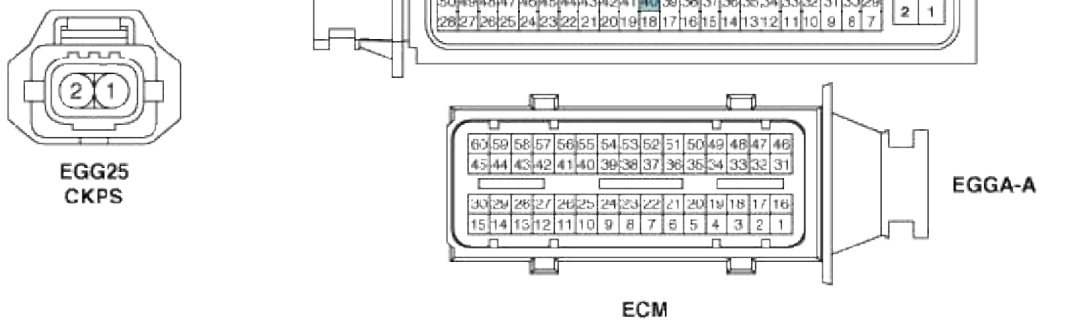
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

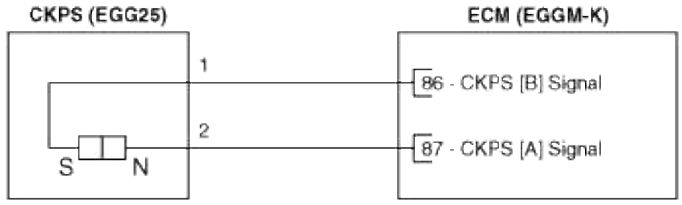
Terminal	Conected to	Function
1	ECM EGGA-A (55)	CKPS [B] Signal
2	ECM EGGA-A (40)	CKPS [A] Signal

[HARNESS CONNECTOR]



[M/T]

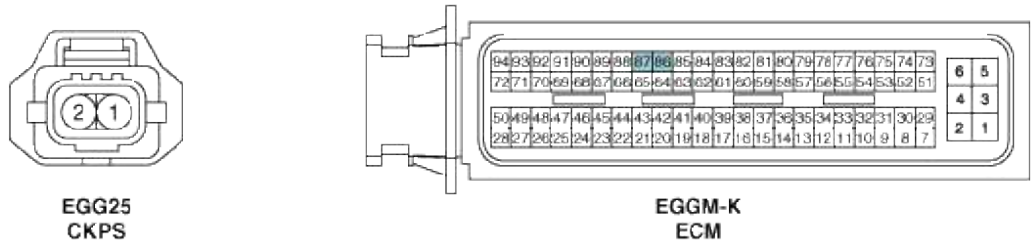
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGM-K (86)	CKPS [B] Signal
2	ECM EGGM-K (87)	CKPS [A] Signal

[HARNESS CONNECTOR]



Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Repair procedures

Inspection

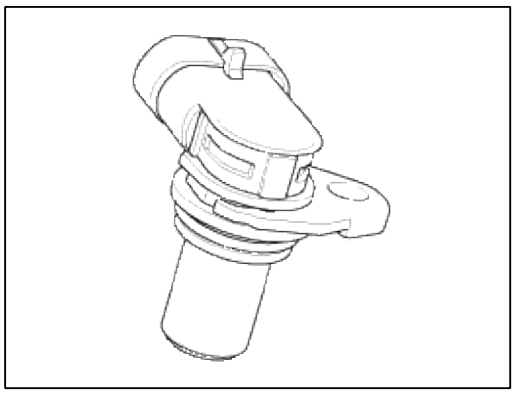
1. Check signal waveform of CKPS and CMPS using a scan tool.

Specification: Refer to “Waveform”

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Description and Operation

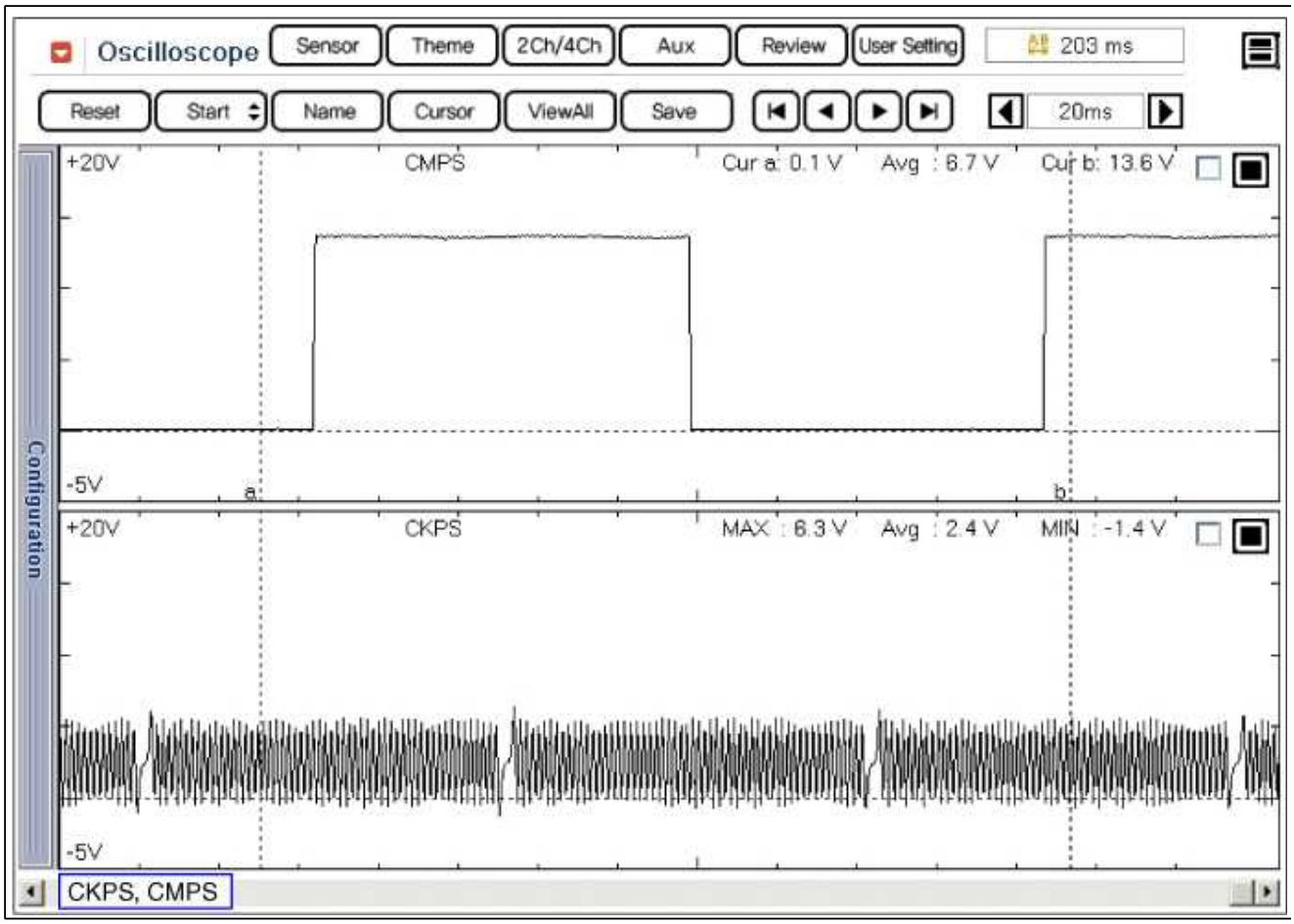
Description

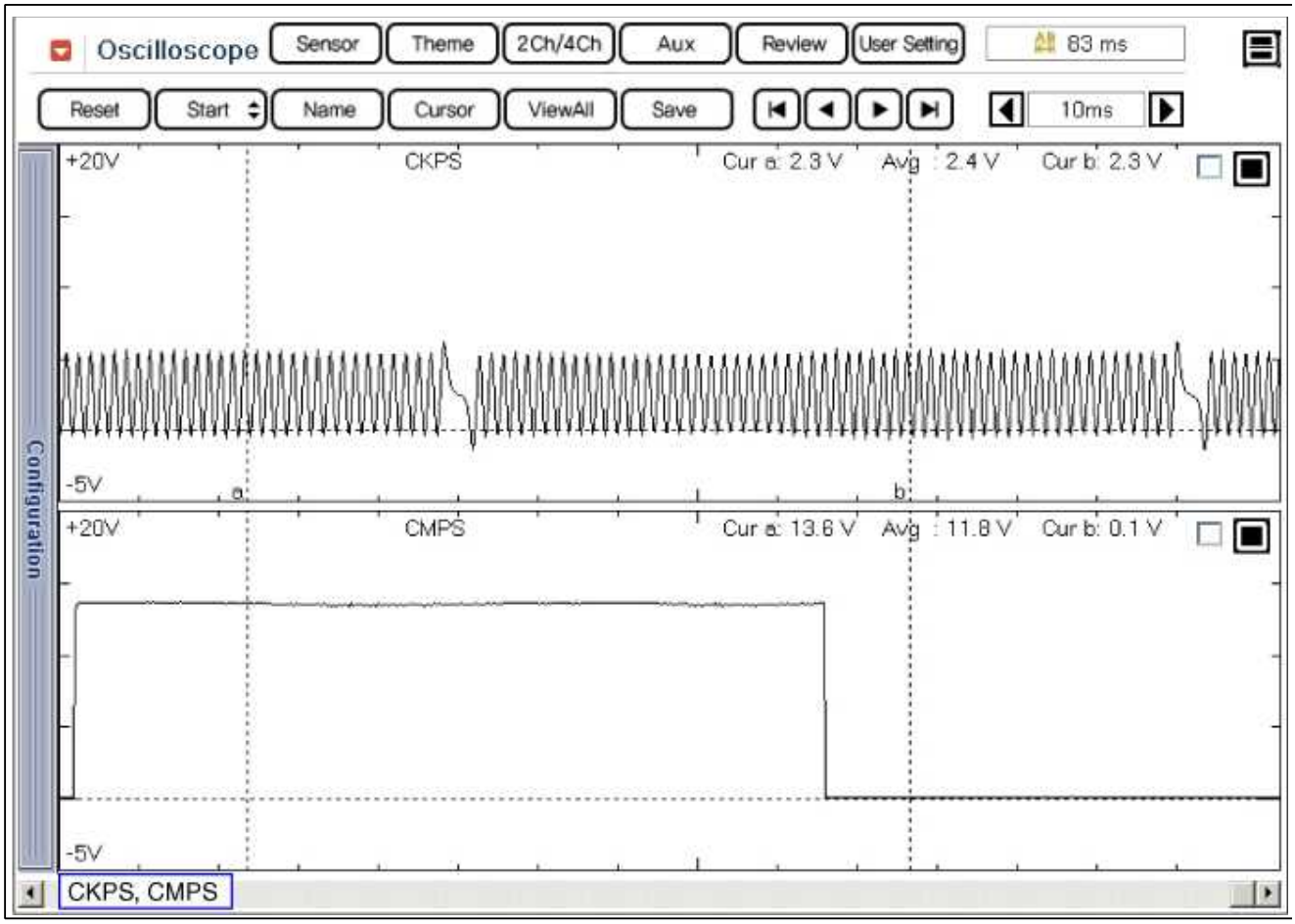
Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element.
It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.
The CMPS is installed on engine head cover and uses a target wheel installed on the camshaft. The Cam Position sensor is a hall-effect type sensor. As the target wheel passes the Hall sensor, the magnetic field changes in the sensor. The sensor then switch a signal which creates a square wave.



Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Troubleshooting

Waveform



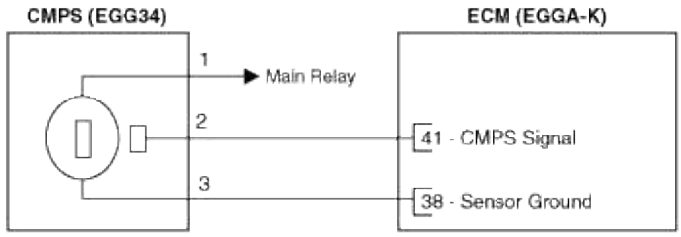


Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Schematic Diagrams

Circuit Diagram

[A/T]

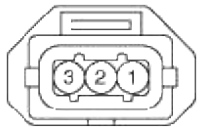
[CIRCUIT DIAGRAM]



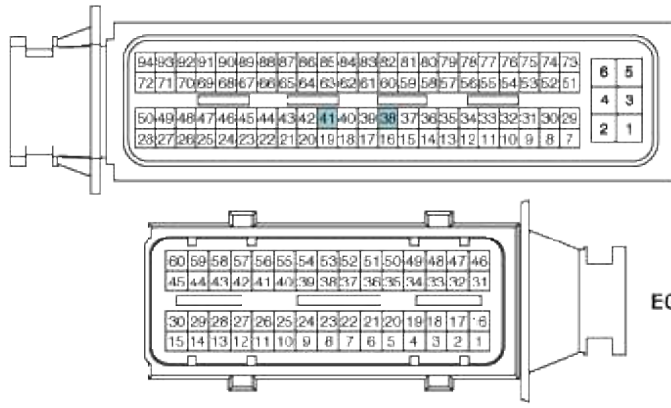
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-K (41)	CMPS Signal
3	ECM EGGA-K (38)	Sensor Ground

[HARNESS CONNECTOR]

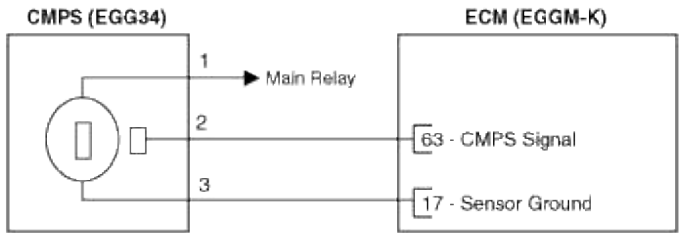


EGG34
CMPS



[M/T]

[CIRCUIT DIAGRAM]



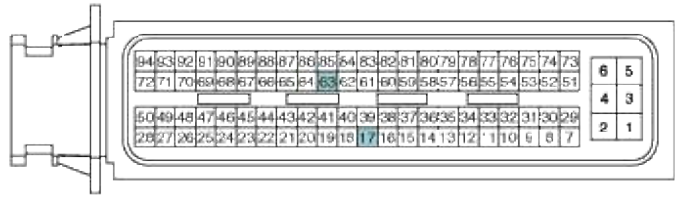
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-K (63)	CMPS Signal
3	ECM EGGM-K (17)	Sensor Ground

[HARNESS CONNECTOR]



EGG34
CMPS



EGGM-K
ECM

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Repair procedures

Inspection

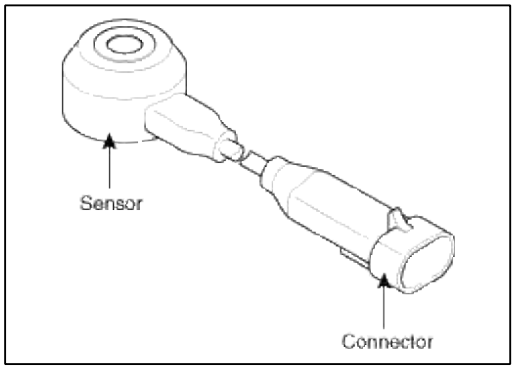
1. Check signal waveform of CKPS and CMPS using a scan tool.

Specification: Refer to “Waveform”

Fuel System > Engine Control System > Knock Sensor (KS) > Description and Operation

Description

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) is installed on the cylinder block and senses engine knocking.
When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. When a knock occures, the sensor produces voltage signal. The ECM retards the ignition timing when knocking occures. If the knocking disappears after retarding the ignition timing, the ECM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.



Fuel System > Engine Control System > Knock Sensor (KS) > Specifications

Specification

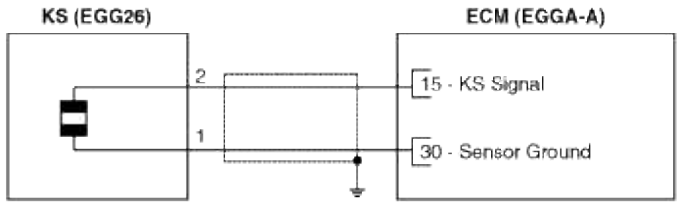
Item	Specification
Capacitance(pF)	950 ~ 1,350
Resistance (MΩ)	4.87

Fuel System > Engine Control System > Knock Sensor (KS) > Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



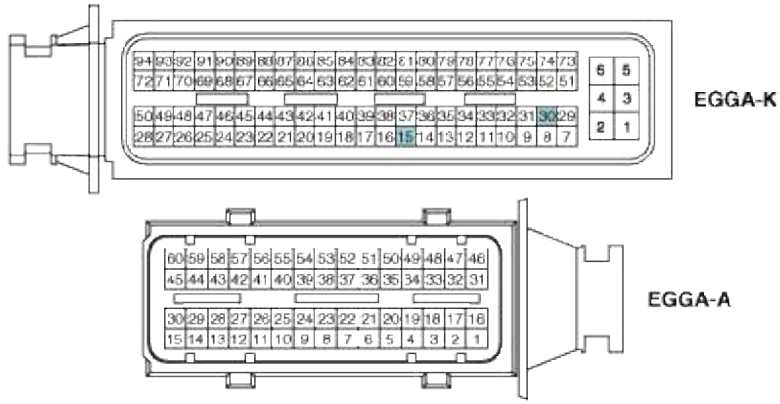
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGA-A (30)	Sensor Ground
2	ECM EGGA-A (15)	Knock Sensor Signal

[HARNESS CONNECTOR]

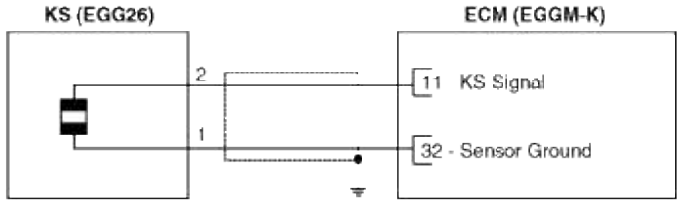


EGG26
KNOCK SENSOR



[M/T]

[CIRCUIT DIAGRAM]



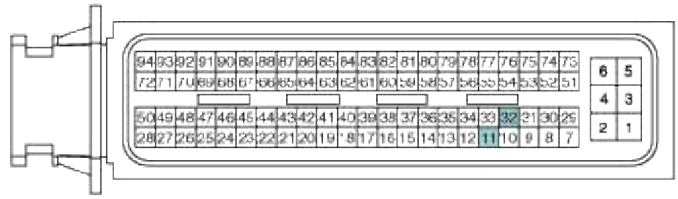
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGM-K (32)	Sensor Ground
2	ECM EGGM-K (11)	Knock Sensor Signal

[HARNESS CONNECTOR]



EGG26
KNOCK SENSOR



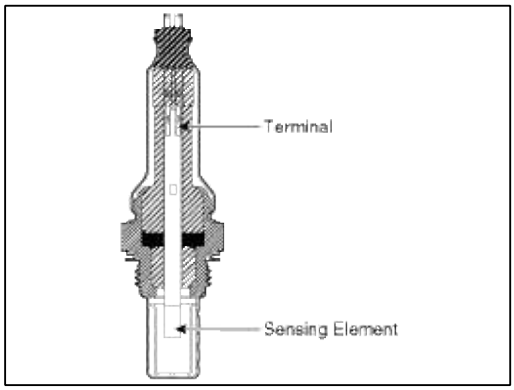
Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Description and Operation

Description

Heated Oxygen Sensors (HO2S) consists of zirconium and alumina and are installed both upstream and downstream of the Manifold Catalytic Converter (MCC).

The sensor looks at the difference between the oxygen in the atmosphere with the oxygen in the exhaust gas. The greater the difference in oxygen, the higher the voltage produced by the sensor. When A/F ratio is rich it generates approximately +1V and when the A/F rationis lean it is near 0V.

The sensor must be hot in order to operate normally. To keep it hot, the sensor has a heater which is controlled by the ECM via a duty cycle signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Specifications

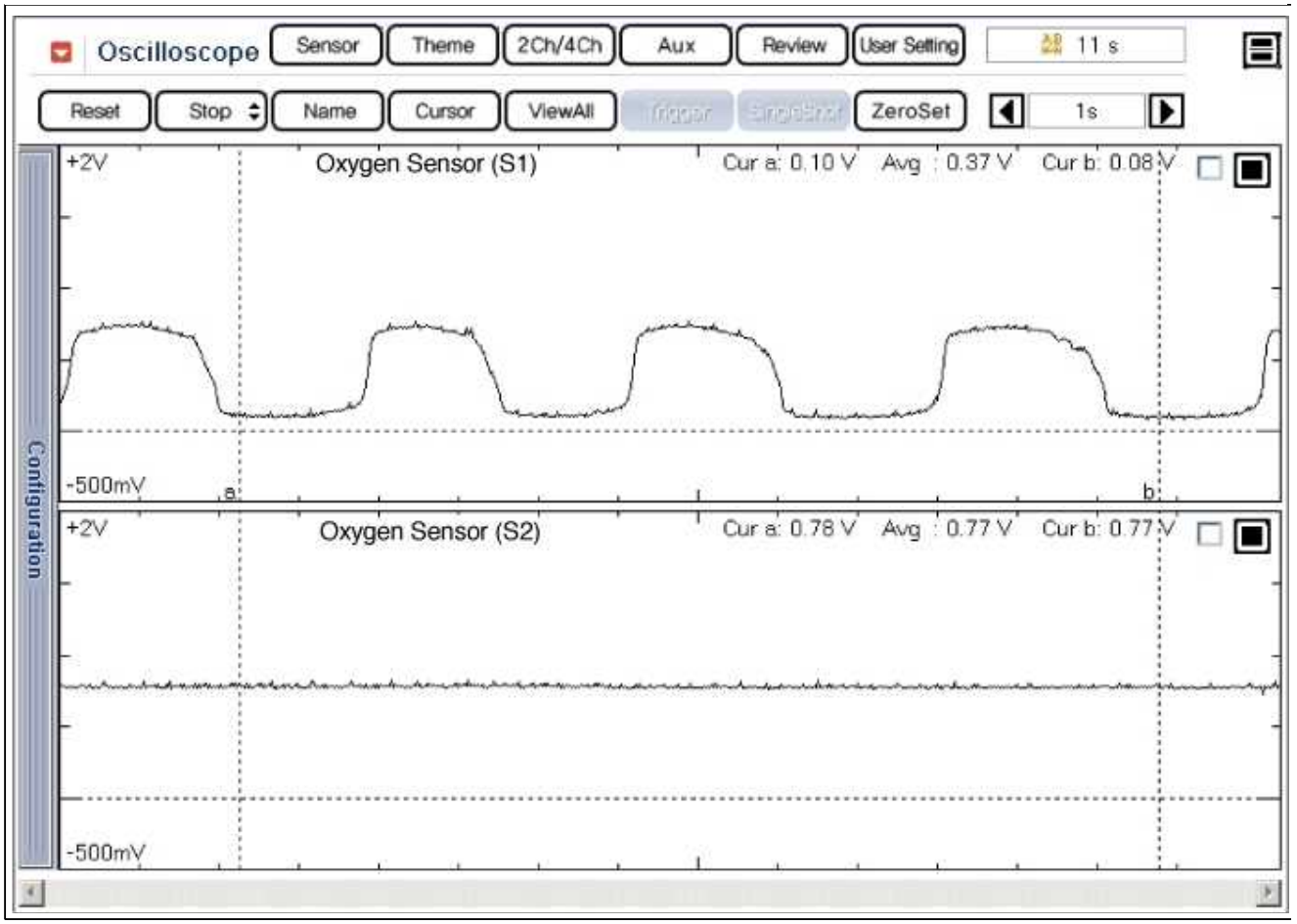
Specification

A/F Ratio (λ)	Output Voltage(V)
Rich	0.6 ~ 1.0
Lean	0 ~ 0.4

Item	Specification
Heater Resistance(Ω)	Approx. 9.0 [20°C (68°F)]

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Troubleshooting

Waveform

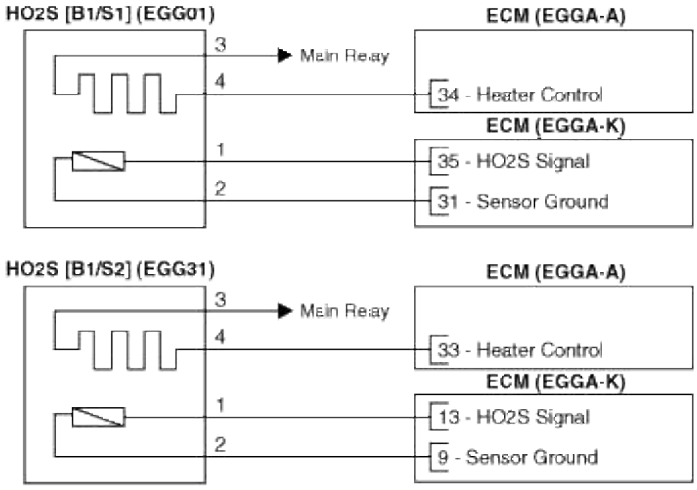


Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

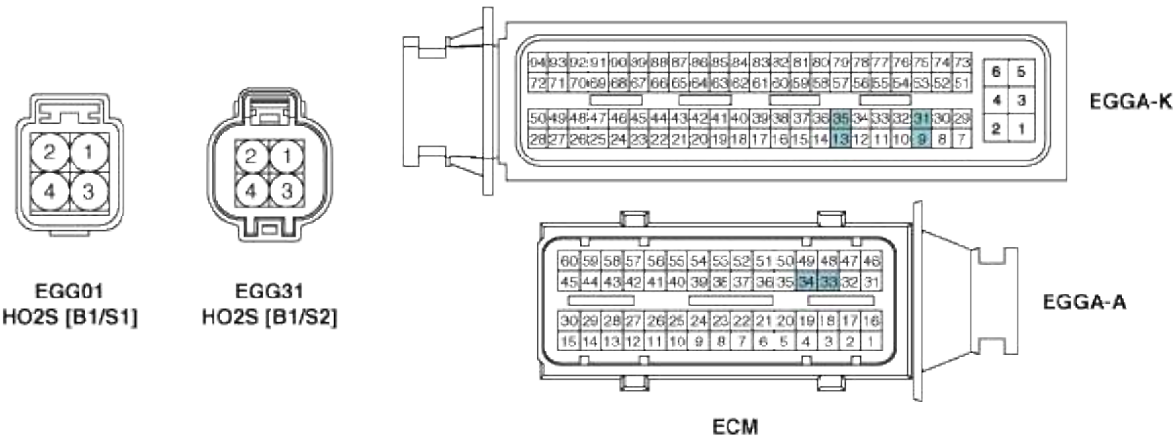
HO2S [B1/S1] (EGG01)

Terminal	Conected to	Function
1	ECM EGGA-K (35)	HO2S [B1/S1] Signal
2	ECM EGGA-K (31)	Sensor Ground
3	Main Relay	Battery Power (B+)
4	ECM EGGA-A (34)	Heater Control

HO2S [B1/S2] (EGG31)

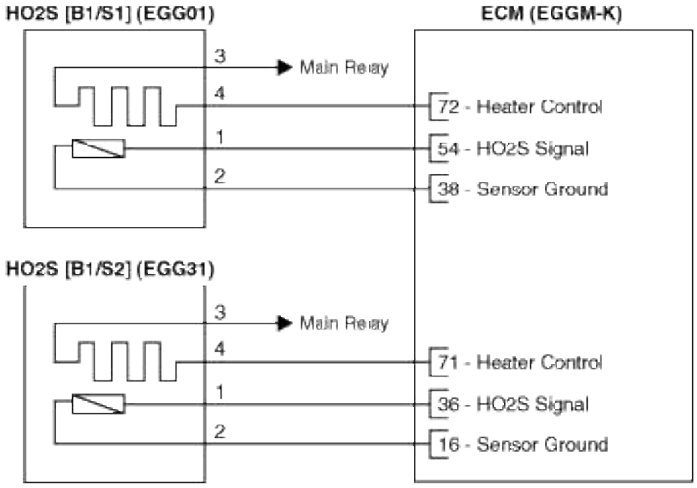
Terminal	Conected to	Function
1	ECM EGGA-K (13)	HO2S [B1/S2] Signal
2	ECM EGGA-K (9)	Sensor Ground
3	Main Relay	Battery Power (B+)
4	ECM EGGA-A (33)	Heater Control

[HARNESS CONNECTOR]



[M/T]

[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

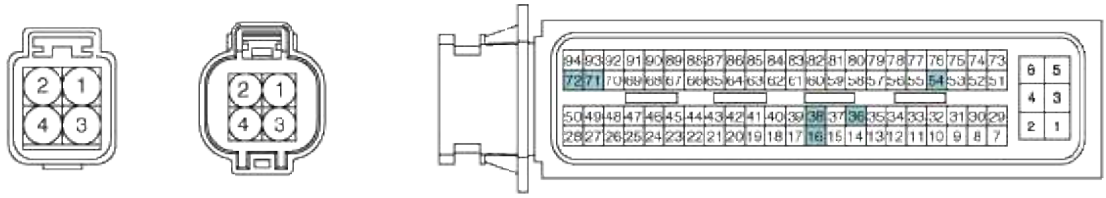
HO2S [B1/S1] (EGG01)

Terminal	Conected to	Function
1	ECM EGGM-K (54)	HO2S [B1/S1] Signal
2	ECM EGGM-K (38)	Sensor Ground
3	Main Relay	Battery Power (B+)
4	ECM EGGM-K (72)	Heater Control

HO2S [B1/S2] (EGG31)

Terminal	Conected to	Function
1	ECM EGGM-K (36)	HO2S [B1/S2] Signal
2	ECM EGGM-K (16)	Sensor Ground
3	Main Relay	Battery Power (B+)
4	ECM EGGM-K (71)	Heater Control

[HARNESS CONNECTOR]



Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Repair procedures

Inspection

1. Check signal waveform of HO2S using a scan tool.

Specification: Refer to "Waveform"

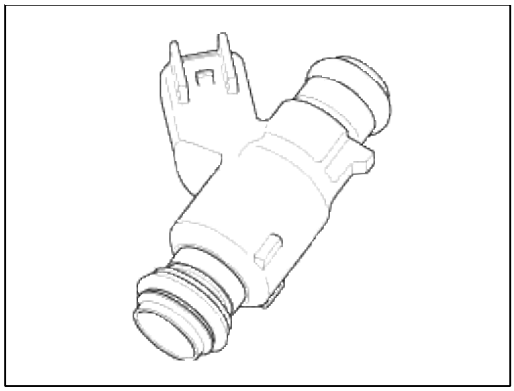
2. Disconnect the HO2S connector.
3. Measure resistance between HO2S heater terminals 3 and 4.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Injector > Description and Operation

Description

Based on information from various sensors, the ECM can calculate the fuel amount to be injected. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of injection time. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.



Fuel System > Engine Control System > Injector > Specifications

Specification

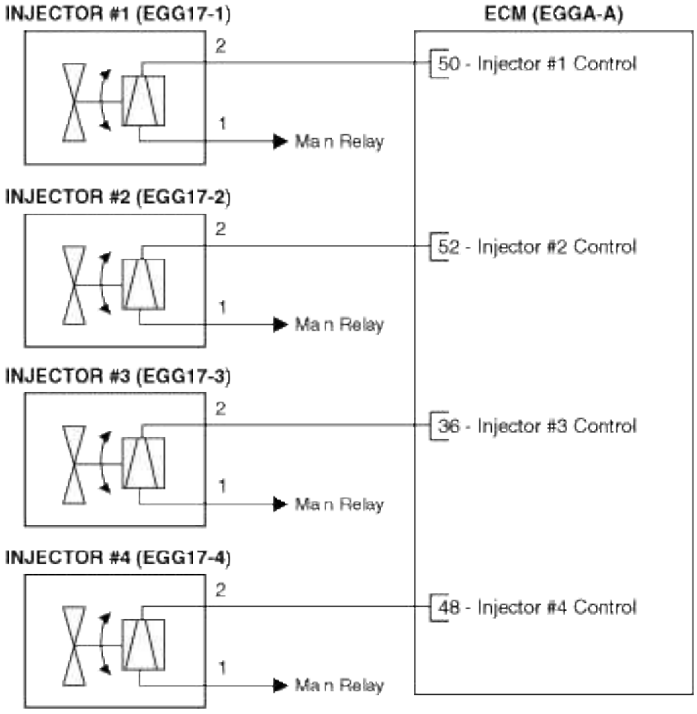
Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 [20°C(68°F)]

Fuel System > Engine Control System > Injector > Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

INJECTOR #1 (EGG17-1)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-A (50)	Injector #1 Control

INJECTOR #2 (EGG17-2)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-A (52)	Injector #2 Control

INJECTOR #3 (EGG17-3)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-A (36)	Injector #3 Control

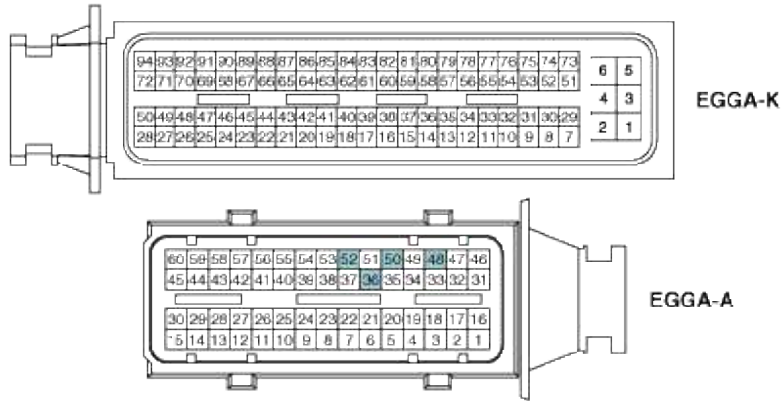
INJECTOR #4 (EGG17-4)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-A (48)	Injector #4 Control

[HARNESS CONNECTOR]



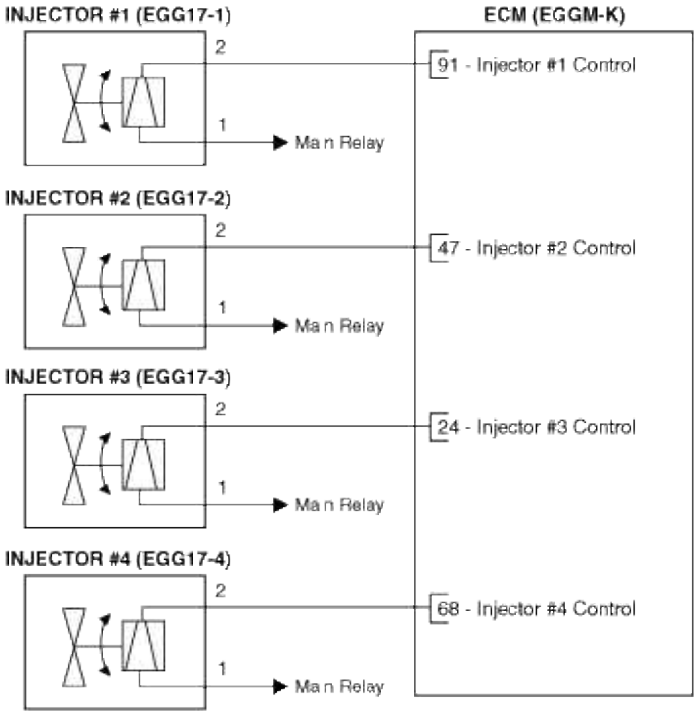
EGG17-1,2,3,4
INJECTOR #1,2,3,4



ECM

[M/T]

[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

INJECTOR #1 (EGG17-1)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-K (91)	Injector #1 Control

INJECTOR #2 (EGG17-2)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-K (47)	Injector #2 Control

INJECTOR #3 (EGG17-3)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-K (24)	Injector #3 Control

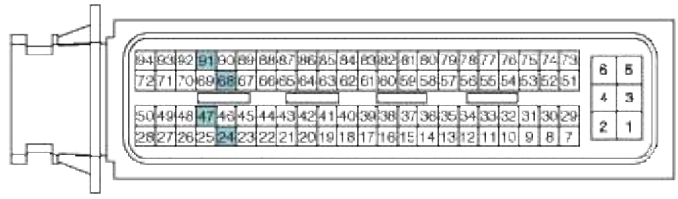
INJECTOR #4 (EGG17-4)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-K (68)	Injector #4 Control

[HARNESS CONNECTOR]



EGG17-1,2,3,4
INJECTOR #1,2,3,4



EGGM-K
ECM

Fuel System > Engine Control System > Injector > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect injector connector.
3. Measure resistance between injector terminals 1 and 2.
4. Check that the resistance is within the specification.

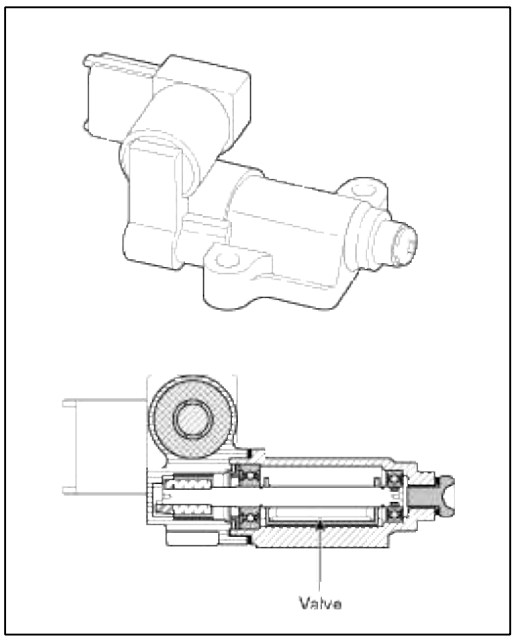
Specification: Refer to “Specification”

Fuel System > Engine Control System > Idle Speed Control Actuator (ISCA) > Description and Operation

Description

The Idle Speed Control Actuator (ISCA) is installed on the throttle body and controls the intake airflow that bypasses the throttle plate to keep constant engine speed when the throttle valve is closed.
The function of the ISCA is to maintain idle speed according to various engine loads and conditions, and also to

provide additional air during starting.
The ISCA consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by-pass airflow into the engine.



Fuel System > Engine Control System > Idle Speed Control Actuator (ISCA) > Specifications

Specification

Item	Specification
Opening Coil Resistance (Ω)	14.6 ~ 16.2 [20°C(68°F)]
Closing Coil Resistance (Ω)	11.1 ~ 12.7 [20°C(68°F)]

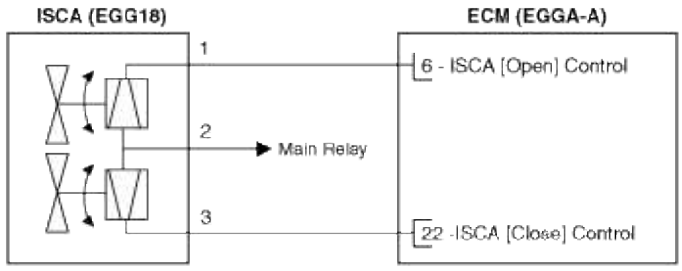
Duty (%)	Air Flow Rate (/h)
15	0.5 ~ 1.4
35	4.6 ~ 8.0
70	25.0 ~ 32.0
96	33.0 ~ 40.0

Fuel System > Engine Control System > Idle Speed Control Actuator (ISCA) > Schematic Diagrams

Circuit Diagram

[A/T]

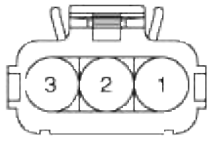
[CIRCUIT DIAGRAM]



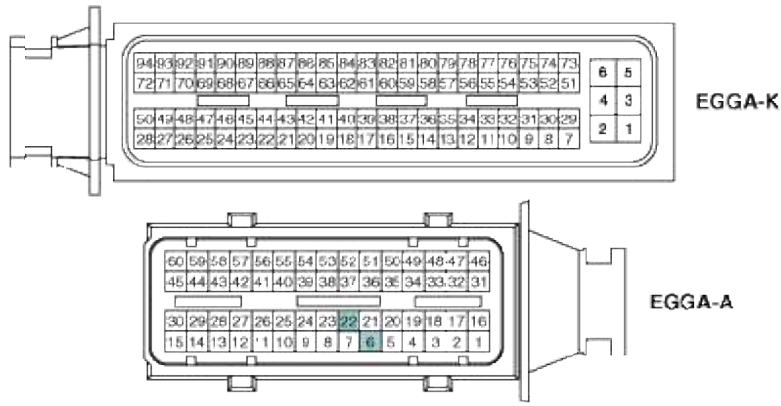
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGA-A (6)	ISCA [Open] Control
2	Main Relay	Battery Power (B+)
3	ECM EGGA-A (22)	ISCA [Close] Control

[HARNESS CONNECTOR]

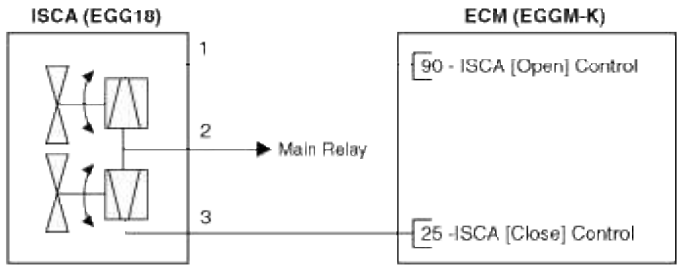


EGG18
ISCA



[M/T]

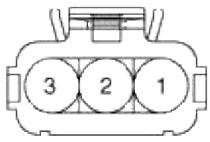
[CIRCUIT DIAGRAM]



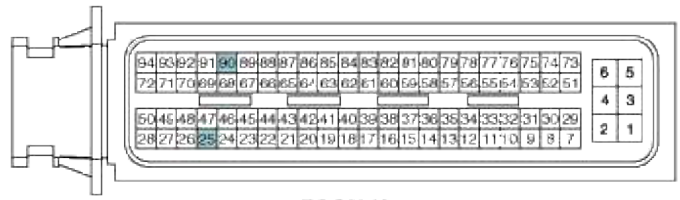
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGM-K (90)	ISCA [Open] Control
2	Main Relay	Battery Power (B+)
3	ECM EGGM-K (25)	ISCA [Close] Control

[HARNESS CONNECTOR]



EGG18
ISCA



EGGM-K
ECM

Fuel System > Engine Control System > Idle Speed Control Actuator (ISCA) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect ISCA connector.
3. Measure resistance between ISCA terminals 2 and 1 [Opening Coil].
4. Measure resistance between ISCA terminals 2 and 3 [Closing Coil].

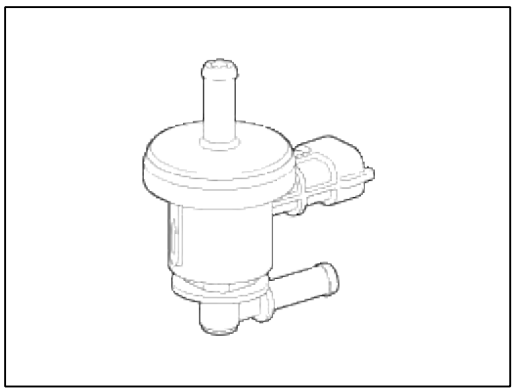
5. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Description and Operation

Description

Purge Control Solenoid Valve (PCSV) is a solenoid valve and is installed on the surge tank and controls the passage between the canister and the intake manifold.
The evaporative gases gathered in the canister are delivered to the intake manifold when the PCSV is open by ECM control signal. The PCSV is a normally closed valve.



Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Specifications

Specification

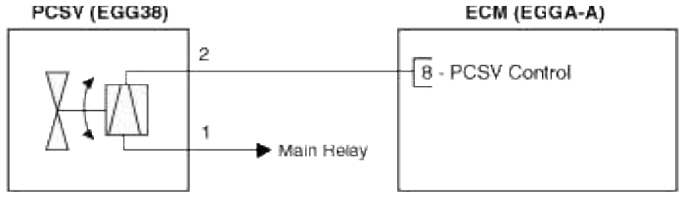
Item	Specification
Coil Resistance (Ω)	16.0 [20°C(68°F)]

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]



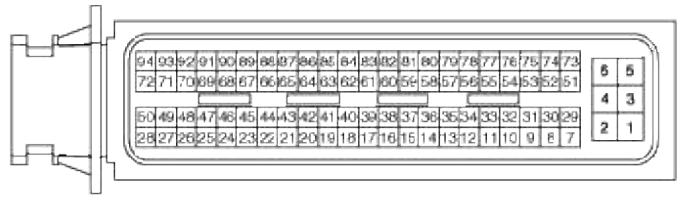
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGA-A (8)	PCSV Control

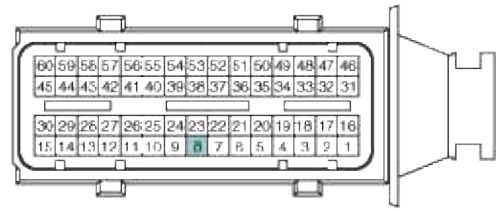
[HARNESS CONNECTOR]



EGG38
PCSV



EGGA-K

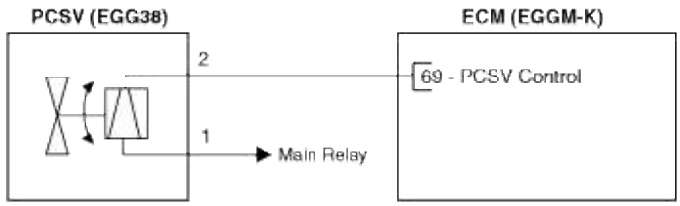


EGGA-A

ECM

[M/T]

[CIRCUIT DIAGRAM]



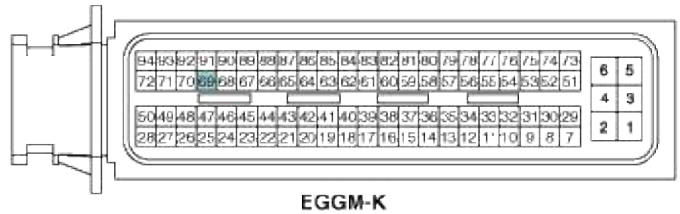
[CONECTION INFORMATION]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM EGGM-K (69)	PCSV Control

[HARNESS CONNECTOR]



EGG38
PCSV



EGGM-K
ECM

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect PCSV connector.
3. Measure resistance between PCSV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

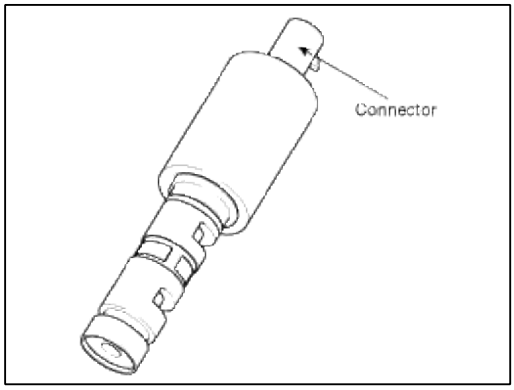
Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Description and Operation

Description

The Continuously Variable Valve Timing (CVVT) system controls the amount of valve overlap by varying the amount of oil flow into a phaser assembly mounted on the intake camshaft through ECM control of an oil control valve.

As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements.

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Specifications

Specification

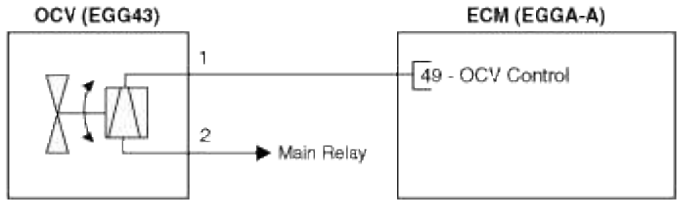
Item	Specification
Coil Resistance (Ω)	6.9 ~ 7.9 [20°C(68°F)]

Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Schematic Diagrams

Circuit Diagram

[A/T]

[CIRCUIT DIAGRAM]

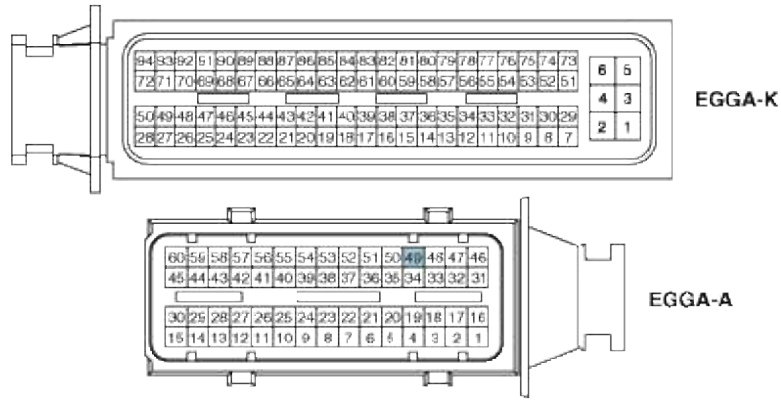


[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGA-A (49)	OCV Control
2	Main Relay	Battery Power (B+)

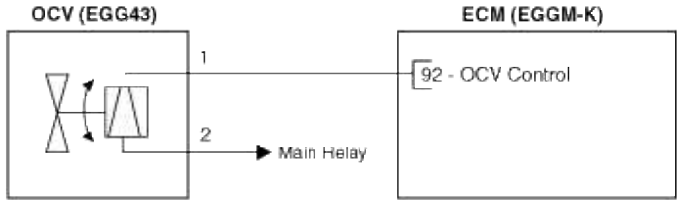
[HARNESS CONNECTOR]





[M/T]

[CIRCUIT DIAGRAM]

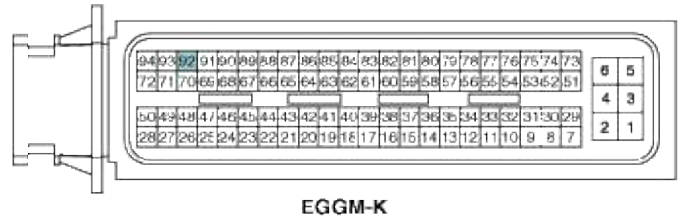


[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM EGGM-K (92)	OCV Control
2	Main Relay	Battery Power (B+)

[HARNESS CONNECTOR]





Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Repair procedures

Inspection

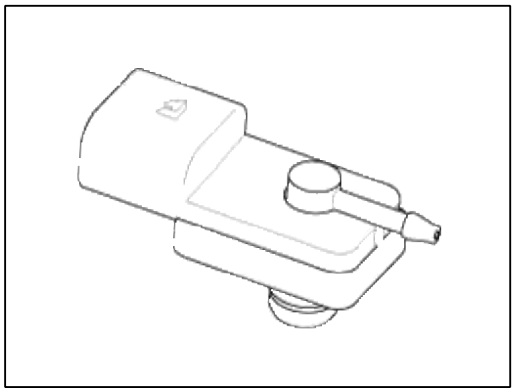
1. Turn ignition switch OFF.
2. Disconnect OCV connector.
3. Measure resistance between OCV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Description and Operation

Description

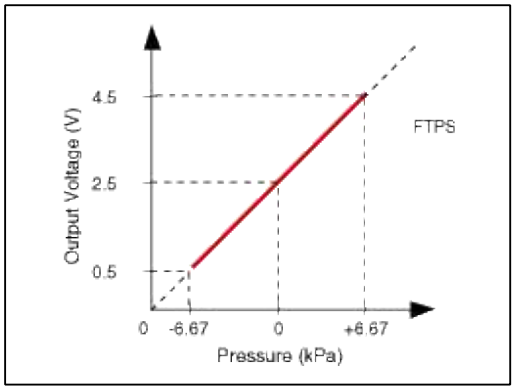
Fuel Tank Pressure Sensor (FTPS) is a component of the evaporative emission control system and is installed on the fuel tank, the fuel pump, or the canister. It checks the purge control solenoid valve operation and detects a leakage of the system.



Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Specifications

Specification

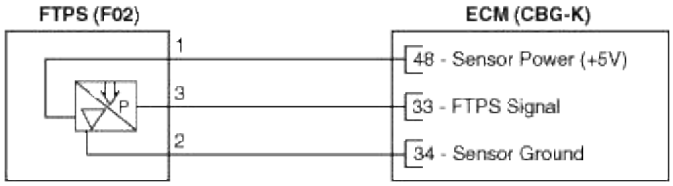
Pressure (kPa)	Output Voltage (V)
-6.67	0.5
0	2.5
+6.67	4.5



Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]



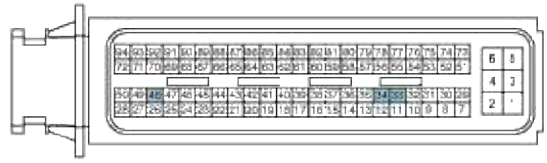
[Connection Information]

Terminal	Connected to	Function
1	ECM CBG-K (48)	Sensor Power (+5V)
2	ECM CBG-K (33)	FTPS Signal
3	ECM CBG-K (34)	Sensor Ground

[Harness Connector]



F02
FTPS



CBG-K
ECM

Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Repair procedures

Inspection

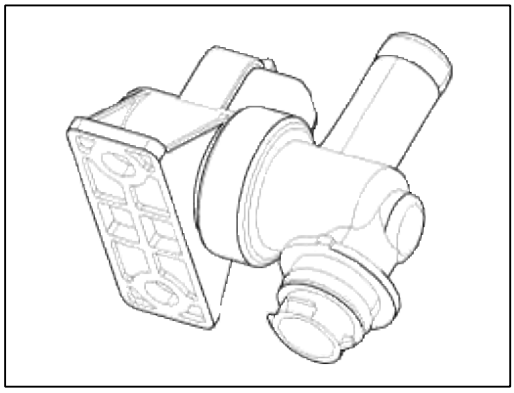
1. Connect a scantool on the Data Link Connector (DLC).
2. Measure the output voltage of the FTPS.

Specification: Refer to "Specification"

Fuel System > Engine Control System > Canister Close Valve (CCV) > Description and Operation

Description

Canister Close Valve (CCV) is installed on the canister ventilation line. It seals evaporative emission control system by shutting the canister from the atmosphere when leakage detecting system operates.



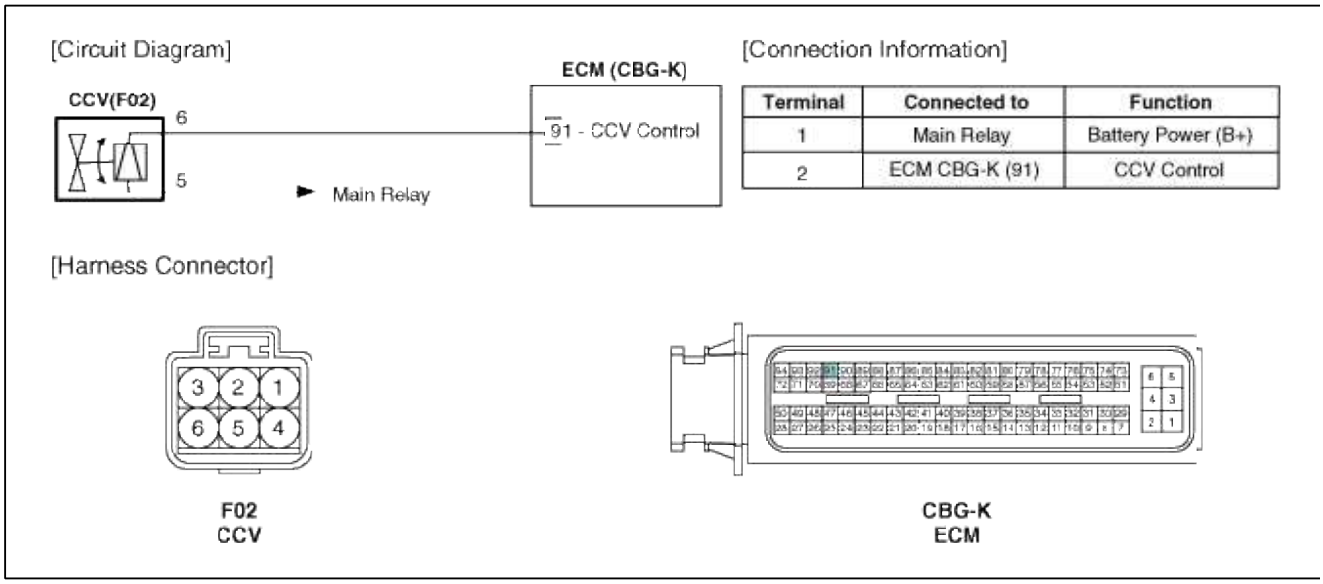
Fuel System > Engine Control System > Canister Close Valve (CCV) > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	15.5 ~ 18.5 (20°C)

Fuel System > Engine Control System > Canister Close Valve (CCV) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Canister Close Valve (CCV) > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the CCV connector.
3. Measure resistance between the CCV terminal 5 and6.
4. Check that the resistance is within the specification.

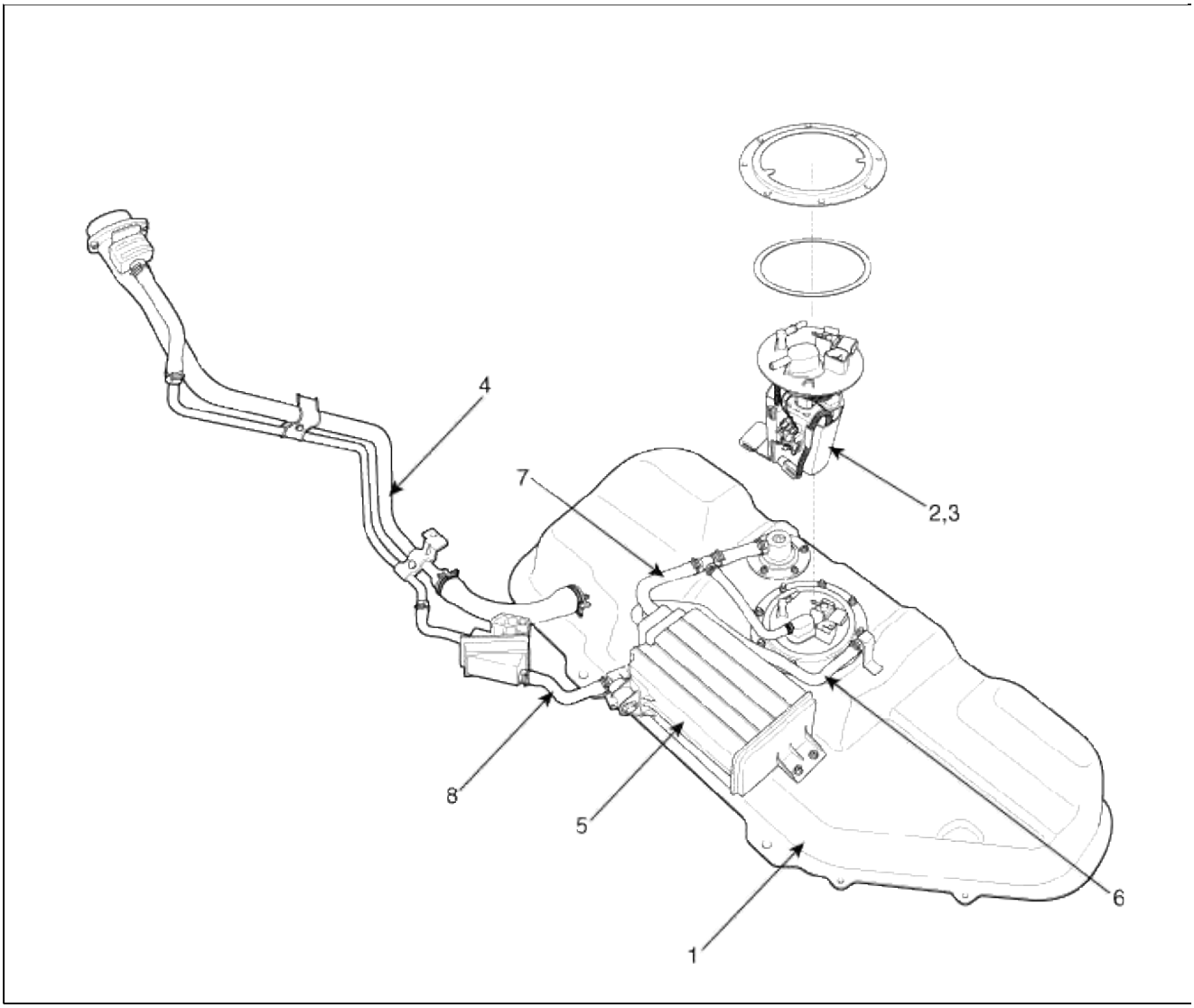
Specification: Refer to "Specification"

5. Disconnect the vapor hose connected with the canister from the CCV.
6. Connect a vacuum pump to the nipple.
7. Ground the CCV control line and apply battery voltage to the CCV power supply line.
8. Apply vacuum and check the valve operation.

Specification: Vacuum maintained

Fuel System > Fuel Delivery System > Components and Components Location

Component Location



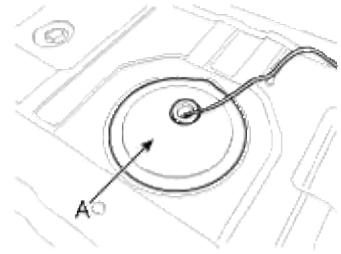
1. Fuel Tank 2. Fuel Pump (Including Fuel Filter) 3. Fuel Pressure Regulator 4. Fuel Filler Pipe	5. Canister 6. Vapor Hose (Canister → Intake Manifold) 7. Vapor Hose (Canister ↔ Fuel Tank) 8. Ventilation Hose (Canister ↔ Atmosphere)

Fuel System > Fuel Delivery System > Repair procedures

Fuel Pressure Test

1. PREPARING

1. Remove the rear seat cushion (Refer to "SEAT" in BD group).
2. Open the service cover (A).

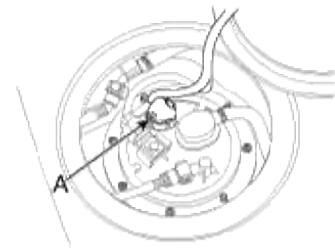


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



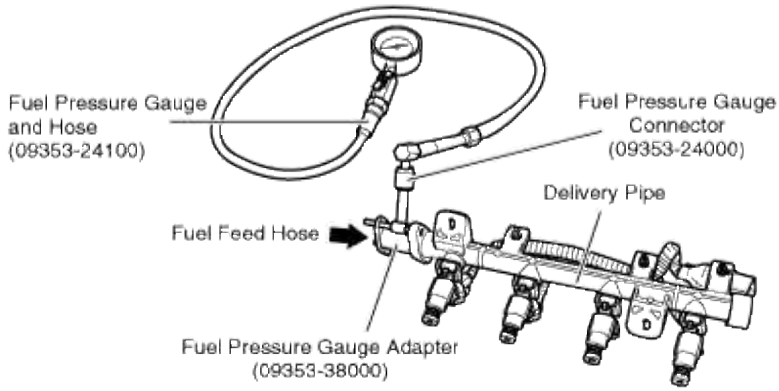
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

1. Disconnect the fuel feed hose from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gage Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gage Connector (09353-24000) to the Fuel Pressure Gage Adapter (09353-38000).
4. Connect the Fuel Pressure Gage and Hose (09353-24100) to Fuel Pressure Gage Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gage Adapter (09353-38000).



4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESSURE TEST

1. Diconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 333 ~ 345 kpa (3.4 ~ 3.5 kgf/㎠, 48.4 ~ 50.0 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor sealing of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gage reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gage reading drops and perform the necessary repairs using the table below.

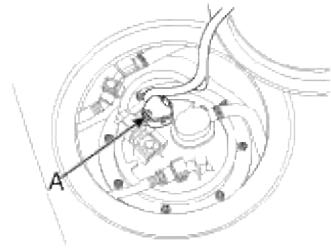
Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

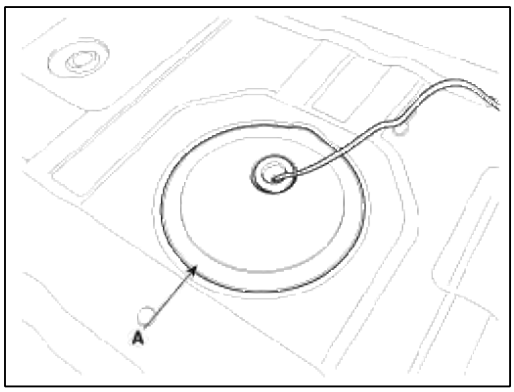
8. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

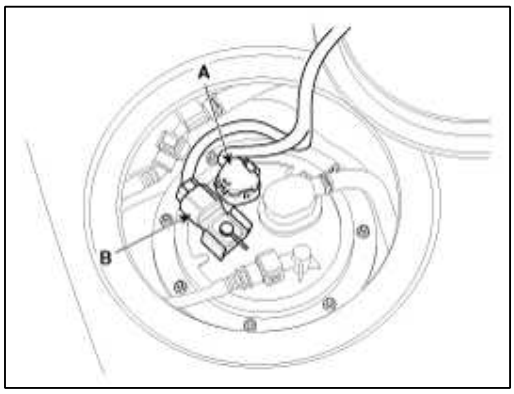
Fuel System > Fuel Delivery System > Fuel Tank > Repair procedures

Removal

1. Preparation
   (1) Remove the rear seat cushion (Refer to "Seat" in BD group).
   (2) Open the service cover (A).



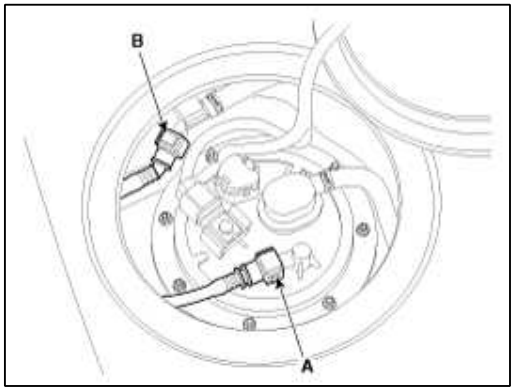
(3) Disconnect the fuel pump connector (A) and the fuel tank pressure sensor connector (B).



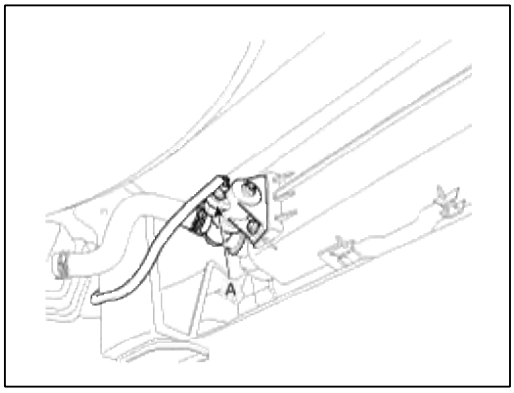
(4) Start the engine and wait until the fuel engine has stalled.

(5) After engine stalls, turn the ignition switch to OFF position.

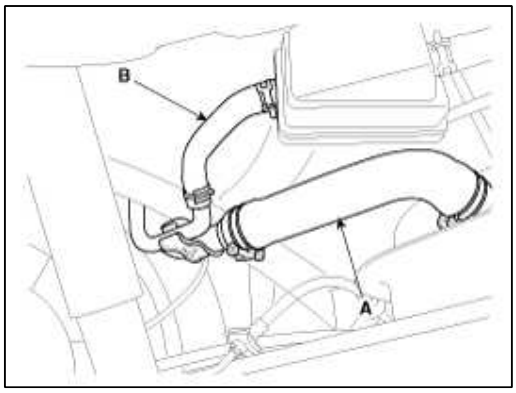
2. Disconnect the fuel feed quick-connector (A) and the vapor tube quick-connector (B).



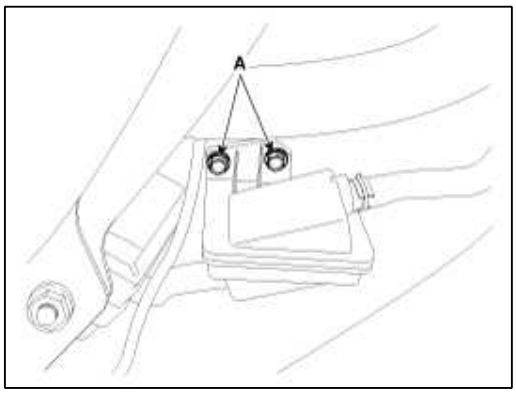
3. Lift the vehicle and support the fuel tank with a jack.
4. Disconnect the canister close valve connector (A).



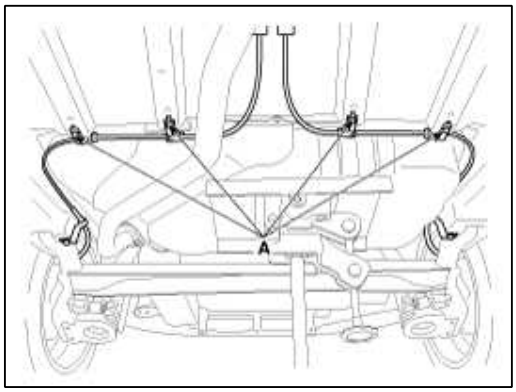
5. Remove the center muffler (Refer to "Intake And Exhaust System" in EM group).
6. Disconnect the fuel filler hose (A) and the ventilation hose (B).



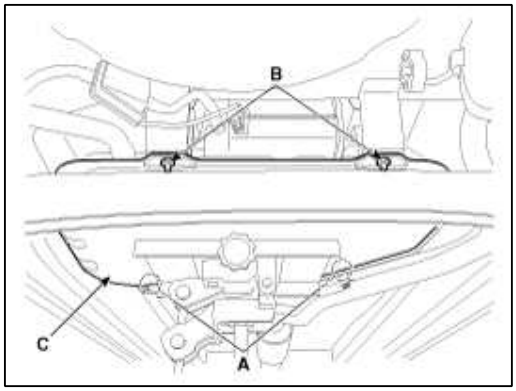
7. Remove the fuel tank air filter installation bolt (A).



8. Remove the brake line bracket mounting bolt (A).



9. Remove the fuel tank mounting bolts (A) and nuts (B), and then remove the fuel tank (C).



Installation

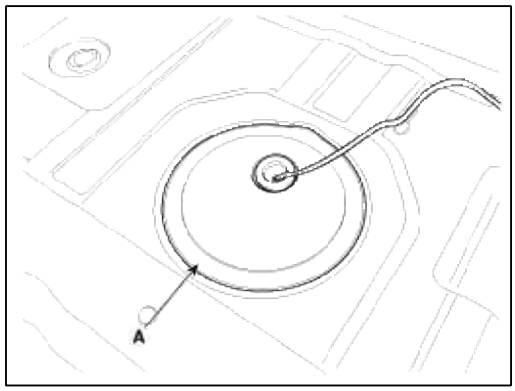
Installation is reverse of removal.

Fuel tank installation bolt:
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)
Fuel tank installation nut:
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)
Fuel tank air filter installation bolt:
3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

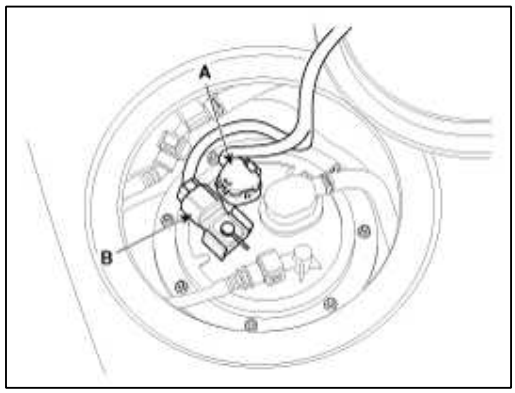
Fuel System > Fuel Delivery System > Fuel Pump > Repair procedures

Removal

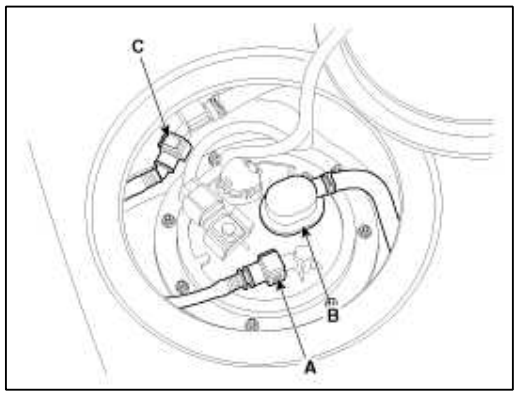
1. Preparation
   (1) Remove the rear seat cushion (Refer to "Seat" in BD group).
   (2) Open the service cover (A).



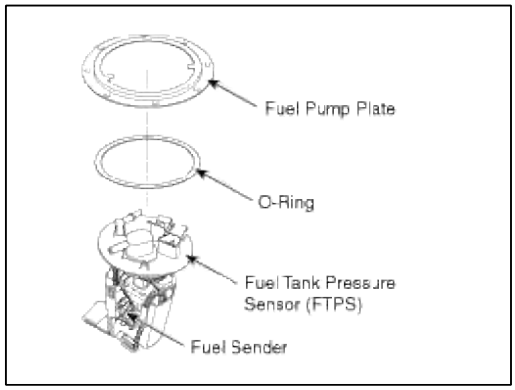
   (3) Disconnect the fuel pump connector (A) and the fuel tank pressure sensor connector (B).



   (4) Start the engine and wait until fuel in fuel line is exhausted.
   (5) After engine stalls, turn the ignition switch to OFF position.
2. Disconnect the fuel feed tube quick-connector (A), the vapor hose (B) and the vapor tube quick-connector (C).



3. Remove the fuel pump installation nuts and remove the fuel pump assembly.



Installation

Installation is reverse of removal.

Fuel pump installation nut: 2.0 ~ 2.9 N.m (0.2 ~ 0.3 kgf.m, 1.4 ~ 2.2 lb-ft)

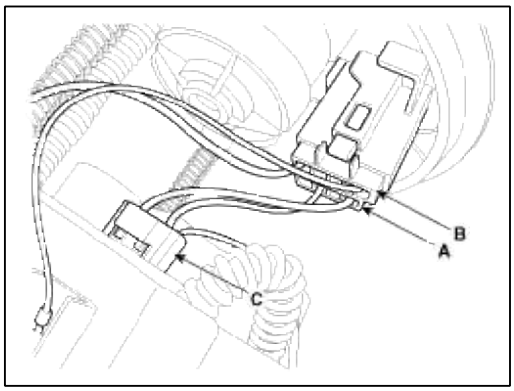
CAUTION

When installing the fuel pump module, be careful not to get the seal-ring entangled.

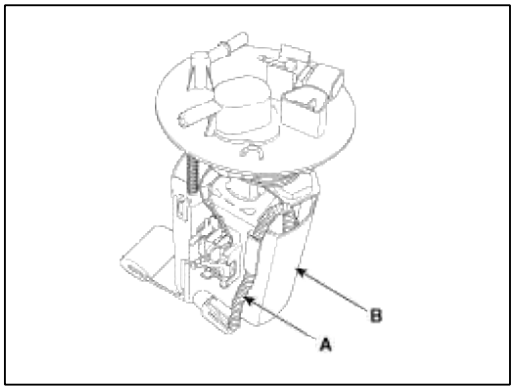
Fuel System > Fuel Delivery System > Fuel Filter > Repair procedures

Replacement

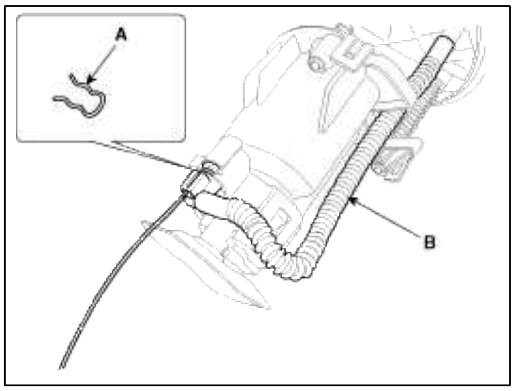
1. Remove the fuel pump (Refer to “Fuel Pump” in this group).
2. Disconnect the electric pump wiring connector (A) and the fuel sender wiring connector (B).



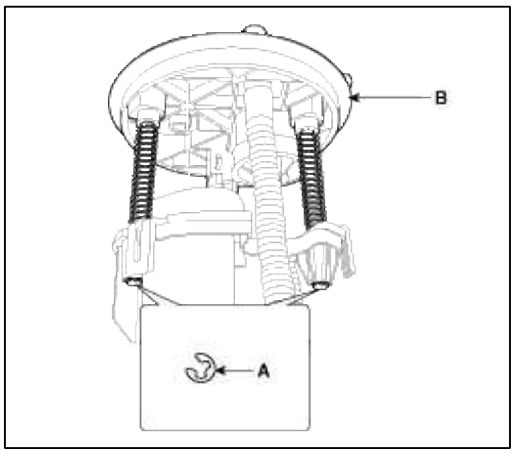
3. Disconnect the electric pump wiring connector (C) from the pump.
4. Disconnect the fuel tube (A).



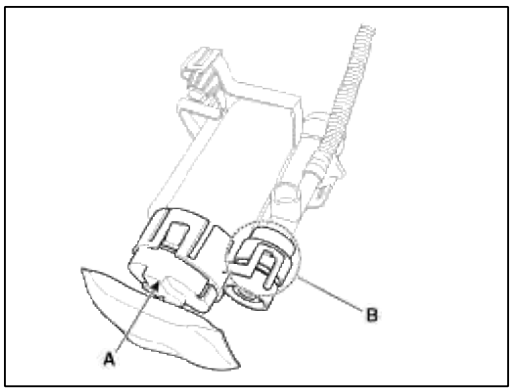
5. Remove the reservior-cup (B) after releasing the fixing hooks.
6. Disconnect the fuel tube (B) after removing the fixing clip (A).

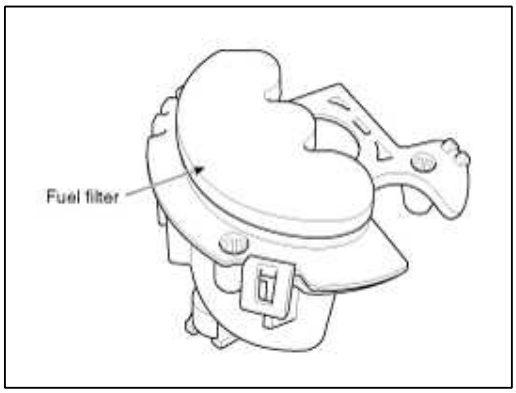


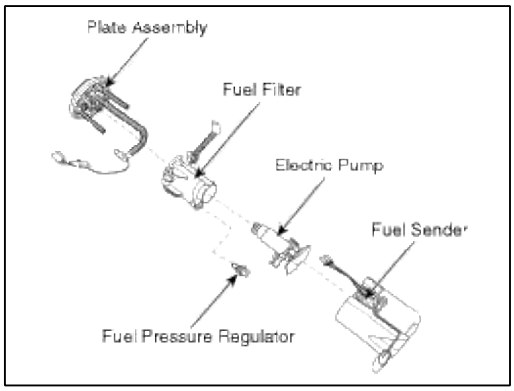
7. Remove the plate assembly (B) after removing the cushion pipe fixing clip (A).



8. Remove the pump & pre-filter assembly (A) and the fuel pressure regulator (A) from the fuel filter.



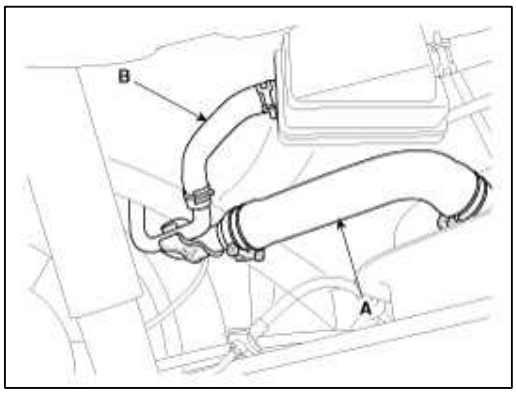




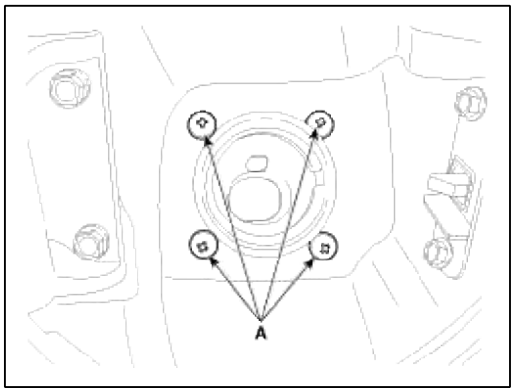
Fuel System > Fuel Delivery System > Filler-Neck Assembly > Repair procedures

Removal

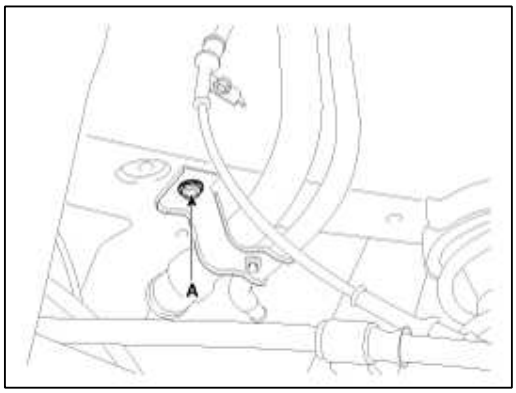
1. Disconnect the fuel filler hose (A) and the ventilation hose (B) from the fuel tank air filter.



2. Open the fuel filler door and unfasten the filler-neck assembly mounting screws (A).



3. Remove the rear-LH wheel, tire, and the inner wheel house.
4. Remove the bracket mounting bolt (A) and remove the filler-neck assembly.



Installation

1. Installation is reverse of removal.

Filler-neck assembly installation bolt:
3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)
Filler-neck assembly installation screw:
5.6 ~ 6.9 N.m (0.6 ~ 0.7 kgf.m, 4.3 ~ 5.1 lb-ft)

SOUL(AM) > 2010 > G 1.6 DOHC > Heating,Ventilation, Air Conditioning

Heating,Ventilation, Air Conditioning > General Information > Specifications

Air conditioner

Item		Specification
Compressor	Type	VS12
	Oil type & Capacity	FD46XG(PAG) 100 ± 10cc
	Pulley type	5PK-TYPE
	Displacement	126cc/rev
Condenser	Heat rejection	12,300min
APT(A/C pressure transducer)	The method to measure the pressure	Voltage = 0.00878835 * Pressure + 0.37081095
Expansion valve	Type	Block
Refrigerant	Type	R-134a
	Capacity [oz.(g)]	19.4 ± 0.88 (550 ± 25)

Blower unit

Item		Specification
Fresh and recirculation	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	0~4 (Manual)
	Speed control	Blower resistor(Manual)
Air filter	Type	Particle filter

Heater and evaporator unit

Item		Specification
Heater	Type	Pin & Tube type
	Heating capacity	4,500 - 5%
	Mode operating method	Actuator
	Temperature operating method	Actuator
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	ON : 3.0 ± 0.5 (37.4 ± 32.9), OFF: 1.0 ± 0.5 (33.8 ± 32.9)

Heating,Ventilation, Air Conditioning > General Information > Troubleshooting

Problem symptoms table

Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor.

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

After correcting the malfunction, check the complete system to ensure that performance is satisfactory.

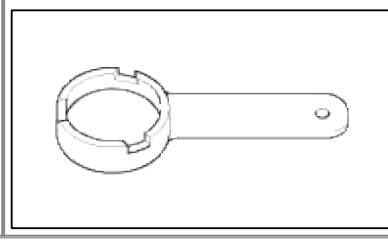
Standard:

Symptom	Suspect Area
No blower operation	1.Blower fuse 2.Blower relay 3.Blower motor 4.Power mosfet 5.Blower speed control switch 6.Wire harness
No air temperature control	1.Engine coolant capacity 2.Heater control assembly
No compressor operation	1.Refrigerant capacity 2.A/C Fuse 3.Magnetic clutch 4.Compressor 5.A/C pressure transducer 6.A/C switch 7.Evaporator temperature sensor 8.Wire harness
No cool air	1.Refrigerant capacity 2.Refrigerant pressure 3.Drive belt 4.Magnetic clutch 5.Compressor 6.A/C pressure transducer 7.Evaporator temperature sensor 8.A/C switch 9.Heater control assemblyWire harness
Insufficient cooling	1.Refrigerant capacity 2.Drive belt 3.Magnetic clutch 4.Compressor 5.Condenser 6.7.8.Expansion valve 9.Evaporator 10.Refrigerant lines 11.A/C pressure transducer 12.Heater control assembly
No engine idle-up when A/C switch ON	1.Engine ECM 2.Wire harness
No air inlet control	1. Heater control assembly
No mode control	1.Heater control assembly 2.Mode actuator

No cooling fan operation	1.Cooling fan fuse 2.Fan motor 3.Engine ECM 4.Wire harness

Heating,Ventilation, Air Conditioning > General Information > Special Service Tools

Special tools

Tool (Number and name)	Illustration	Use
09977-29000 Disc & hub assembly bolt remover		Removal and installation of disc & hub assembly

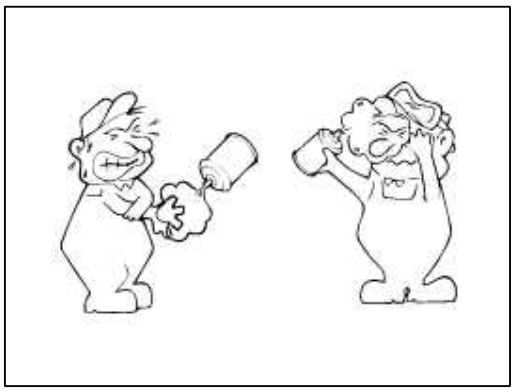
Heating,Ventilation, Air Conditioning > Air conditioning System > General Safety Information and Caution

Instructions

When Handling Refrigerant

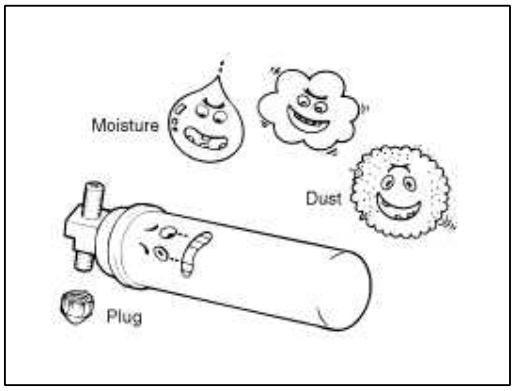
1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. You should wear safety goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, it can freeze the eye. Wash the eye with clean water immediately. Contact a doctor if refrigerant has contacted the eye.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check storage temperature is below 52°C (126°F)
4. An electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed:
   A. When removing refrigerant components from a vehicle, cap the components immediately to prevent entry of moisture.
   B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   D. Use the recommended lubricant from a sealed container only.

7. If an accidental discharge of refrigerant occurs, ventilate the work area before resuming work.



When replacing parts ON A/C system

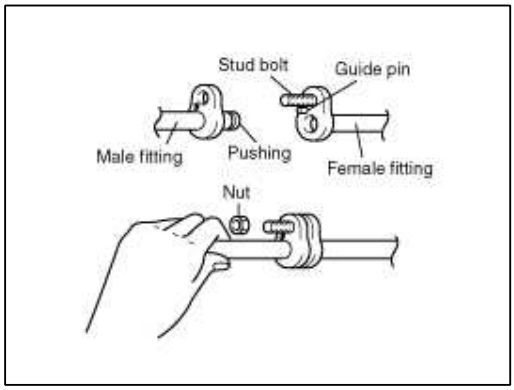
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a Replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



When Installing Connecting Parts

Flange with guide pin

Check the new O-ring for damage (use only the specified) and lubricate by using compressor oil. Tighten the nut to specified torque.



Size	Tightening torque [N.m (kg.m, lbf.ft)]	
	General bolt, nut	
	4T	7T
M6	5 - 6(0.5 - 0.6, 3.6 - 4.3)	9 - 11(0.9 - 1.1, 6.5 - 7.9)
M8	12 - 14(1.2 - 1.4, 8.7 - 10)	20 - 26(2.0 - 2.6, 14 - 18)
M10	25 - 28(2.5 - 2.8, 18 - 20)	45 - 55(4.5 - 5.5, 32 - 39)
Size	Flange bolt, nut	
	4T	7T
M6	5 - 7(0.5 - 0.7, 3.6 - 5.0)	8 - 12(0.8 - 1.2, 5.8 - 8.6)
M8	10 - 15(1.0 - 1.5, 7 - 10)	19 - 28(1.9 - 2.8, 14 - 20)
M10	21 - 31(2.1 - 3.1, 15 - 22)	39 - 60(3.9 - 6.0, 28 - 43)

NOTE

- T means tensile intensity, which is stamped on the head of bolt only numeral.

Handling tubing and fittings

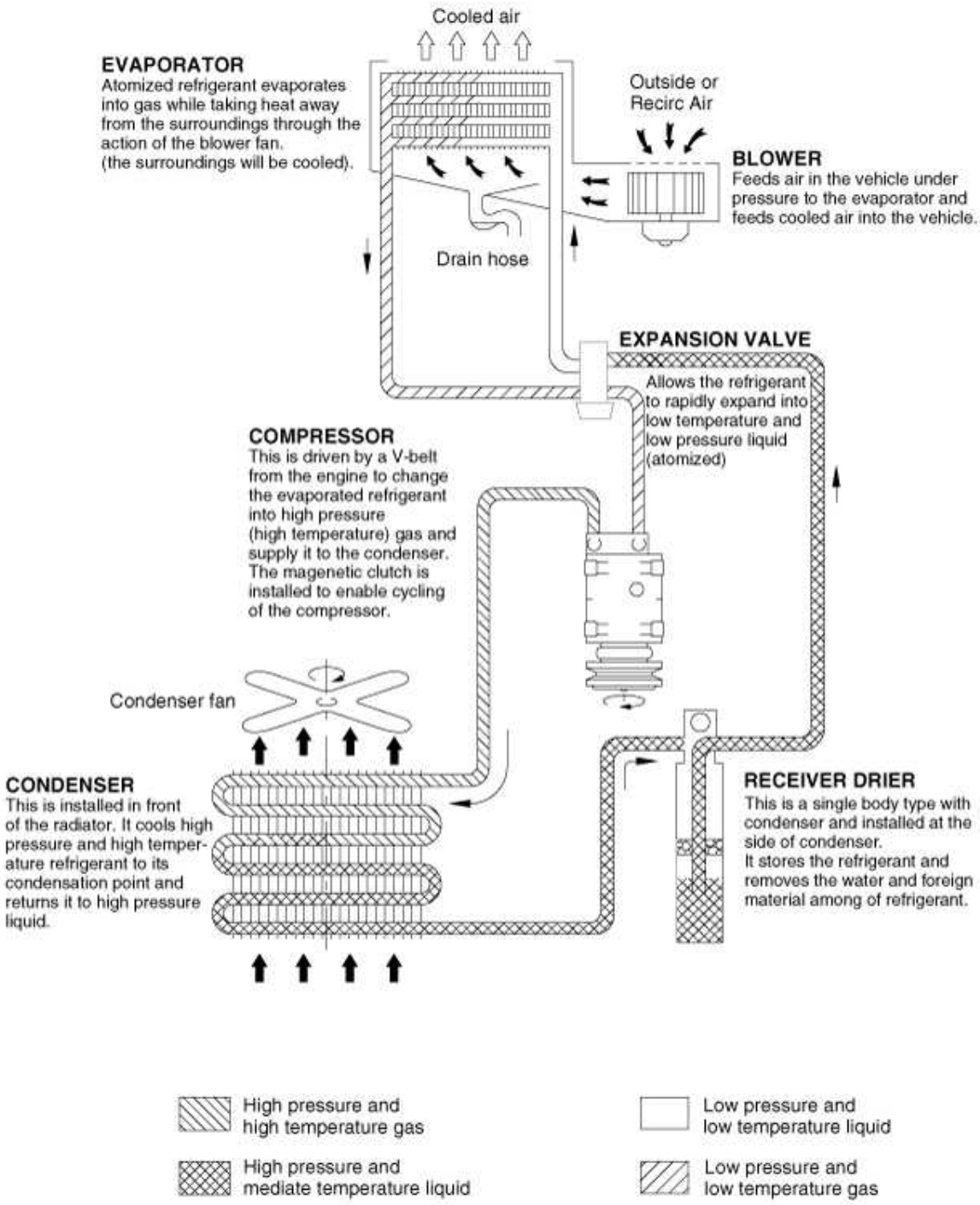
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

The Following precautions must be observed

1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines and components in parts stock should be capped or sealed until they are ready to be used.
4. Never attempt to bend formed lines to fit. Use the correct line for the installation you are servicing.
5. All tools, including the refrigerant dispensing manifold, the gauge set manifold and test hoses, should be kept clean and dry.

Heating,Ventilation, Air Conditioning > Air conditioning System > Description and Operation

Refrigeration cycle



Heating,Ventilation, Air Conditioning > Air conditioning System > Repair procedures

Refrigerant system service basics

Refrigerant recovery

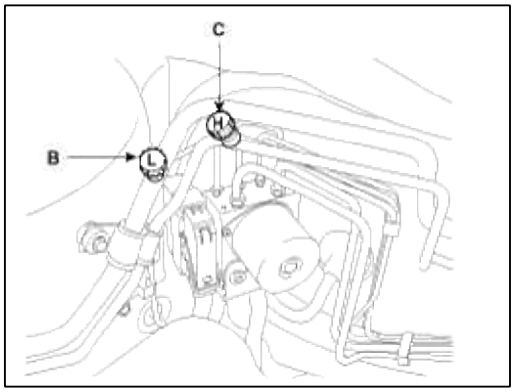
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

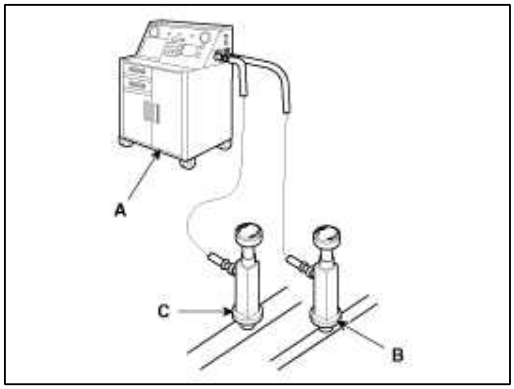
CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or oil vapor.

If accidental system discharge occurs, ventilate work area before resume of service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.





2. Measure the amount of refrigerant oil removed from the A/C system after the recovery process is completed. Be sure to install the same amount of new refrigerant oil back into the A/C system before charging.

System evacuation
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

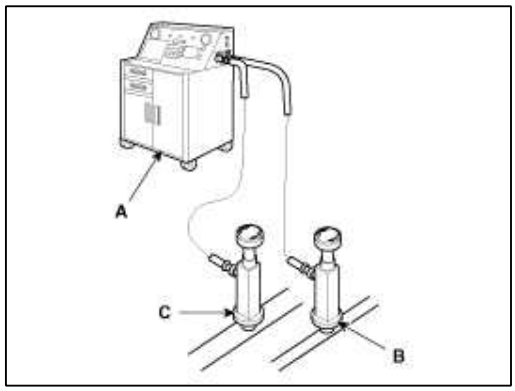
CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resume of service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. When an A/C System has been opened to the atmosphere, such as during installation or repair, it must be evacuated using an R-134a refrigerant Recovery/Recycling/Charging System. (If the system has been open for several hours, the receiver/dryer should be replaced, and the system should be evacuated for several hours.) A vacuum pulls air out and boils the moisture out of the system. The system must be on a vacuum long enough to boil off the moisture. Running the engine with the AC off and the hood lowered can shorten the evacuation time.

2. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



3. If the low-pressure does not reach more than 93.3 kPa (700 mmHg, 27.6 in.Hg) in 10 minutes, there is probably a leak in the system. Partially charge the system, and check for leaks (see Leak Test.).
4. Remove the low pressure valve from the low-pressure service port.

System charging

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

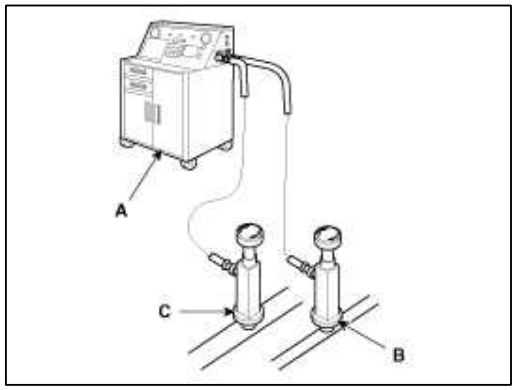
CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resume of service.

Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) as shown, following the equipment manufacturer's instructions.



2. Add the same amount of new refrigerant oil to system that was removed during recovery. Use only specified refrigerant oil. Charge the system with 19.4±0.88 oz. (550±25g)of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

Refrigerant leak test

Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

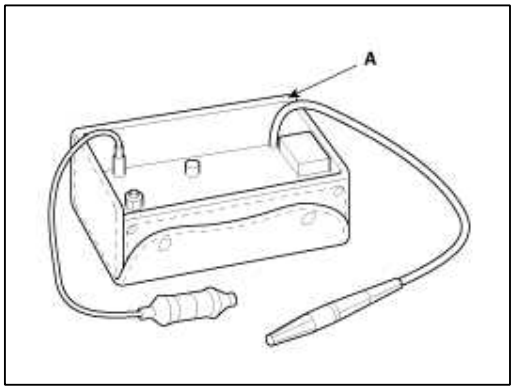
NOTE

In order to use the leak detector properly, read the manual supplied by the manufacturer.

If a gas leak is detected, proceed as follows:

1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector (A).

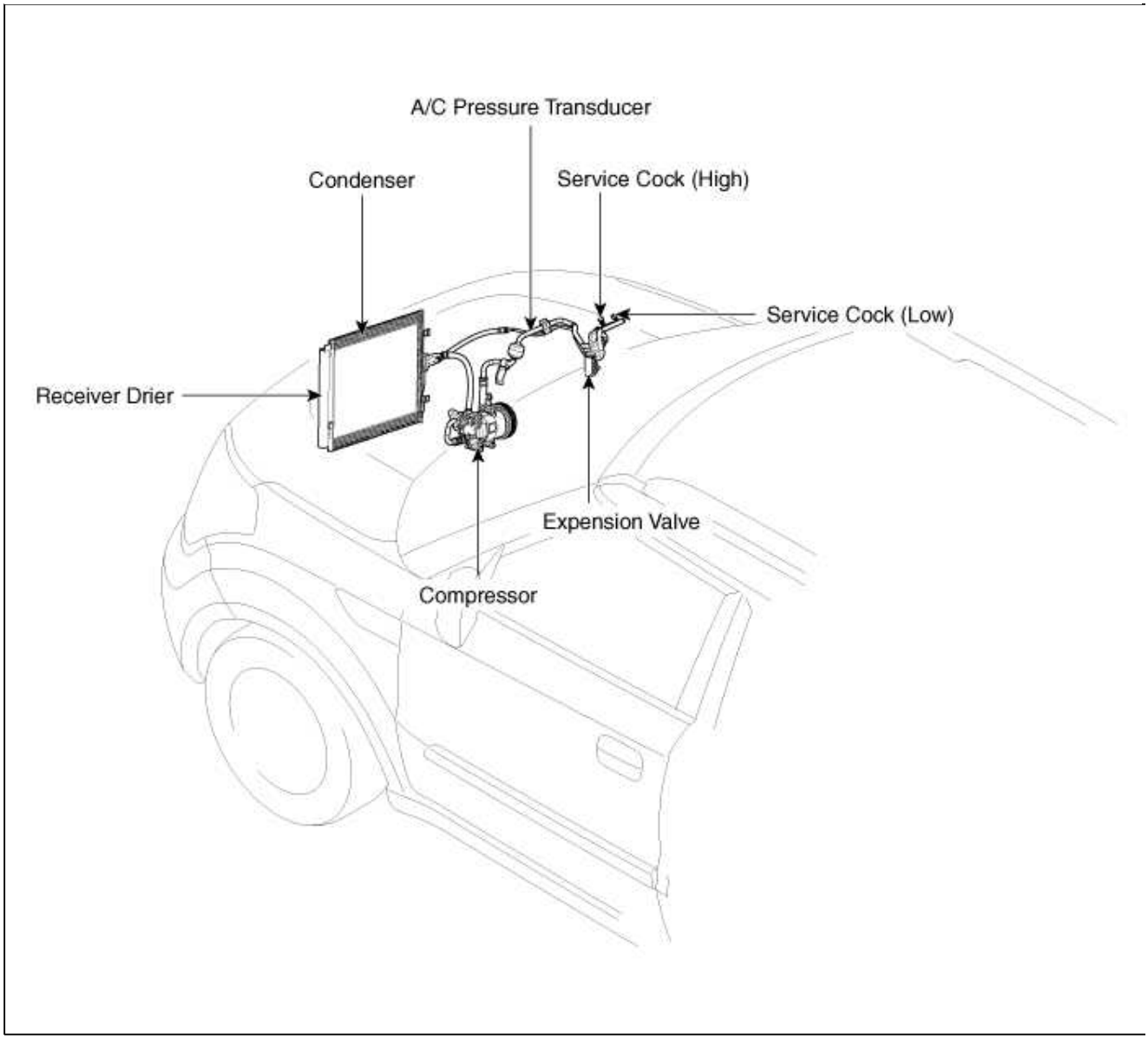
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.
3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.



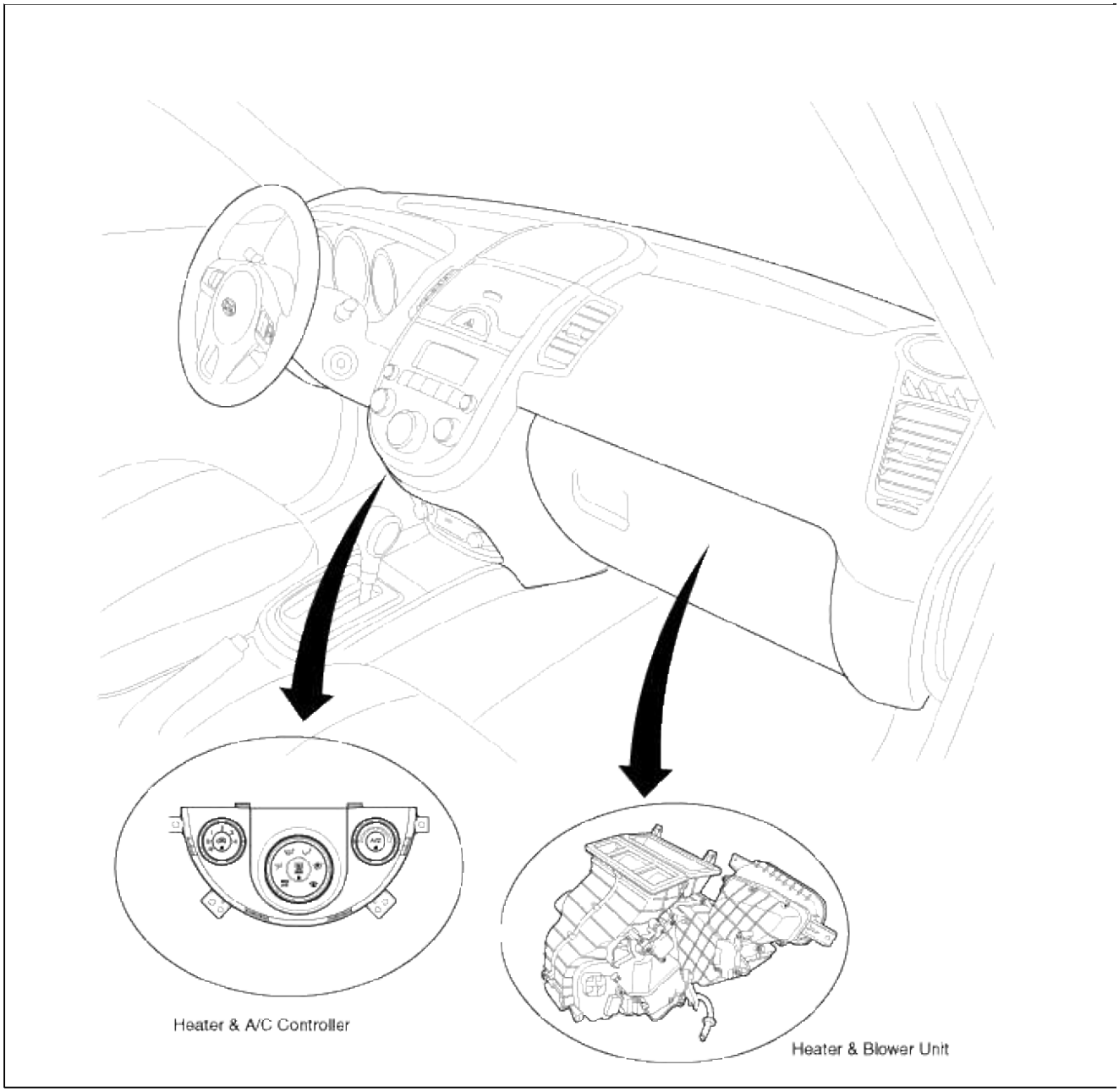
Heating,Ventilation, Air Conditioning > Air conditioning System > Components and Components Location

Component Locaiton Index

Engine room


A/C Pressure Transducer
Condenser
Service Cock (High)
Service Cock (Low)
Receiver Drier
Expension Valve
Compressor

Interior



Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor oil > Repair procedures

Oil Specification

1. The HFC-134a system requires synthetic (PAG) compressor oil whereas the R-12 system requires mineral compressor oil. The two oils must never be mixed.
2. Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

Handling of Oil

1. The oil should be free from moisture, dust, metal powder, etc.
2. Do not mix with other oil.
3. The water content in the oil increases when exposed to the air. After use, seal oil from air immediately. (HFC-134a Compressor Oil absorbs moisture very easily.)
4. The compressor oil must be stored in steel containers, not in plastic containers.

Compressor oil check

The oil used to lubricate the compressor is circulating with the refrigerant.

Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

Oil total volume in system : 100±10cc (3.52±0.34 fl.oz)

Oil Return Operation

There is close affinity between the oil and the refrigerant.

During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

1. Open all the doors and the engine hood.
2. Start the engine and air conditioning switch to "ON" and set the blower motor control knob at its highest position.
3. Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
4. Stop the engine.

Replacement of Component Parts

When replacing system component, add the following amount of oil to the component to be installed.

Component parts to be installed	Amount of Oil
Evaporator	50 cc (1.70 fl.oz)
Condenser	30 cc (1.02 fl.oz)
Receiver/dryer	30 cc (1.02 fl.oz)
Refrigerant line (One piece)	10 cc (0.34 fl.oz)

For compressor Replacement, subtract the volume of oil drained from the removed compressor from the specified volume, and drain the calculated volume of oil from the new compressor:

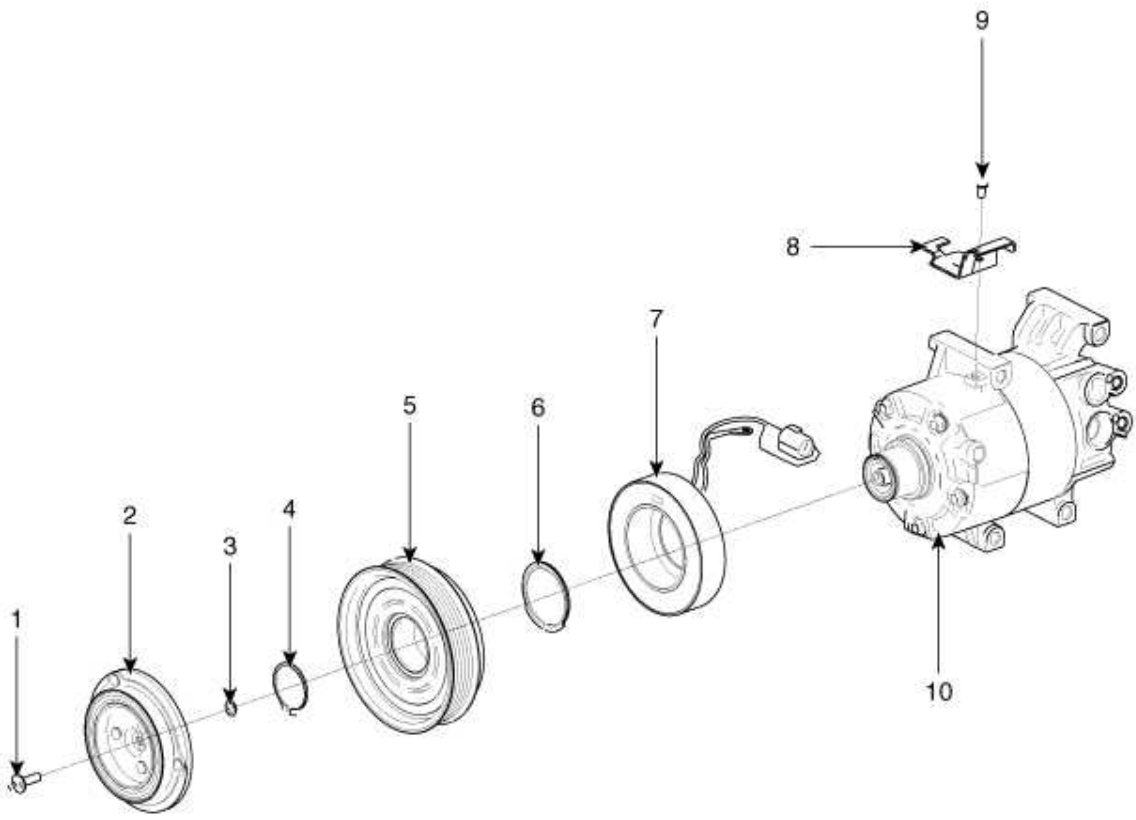
The specified volume - volume of removed compressor = volume to drain from the new compressor.

NOTE

- Even if no oil is drained from the removed compressor, don’t drain more than 50cc from new compressor.

Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Components and Components Location

Components



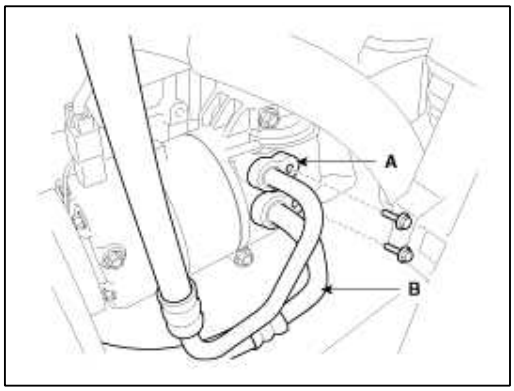
1. Bolt 2. Disc & hub assembly 3. Shim 4. Retainer ring (pulley) 5. Pulley	6. Retainer ring (Field coil) 7. Field coil 8. Connector bracket 9. Screw 10. Compressor assembly

Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Repair procedures

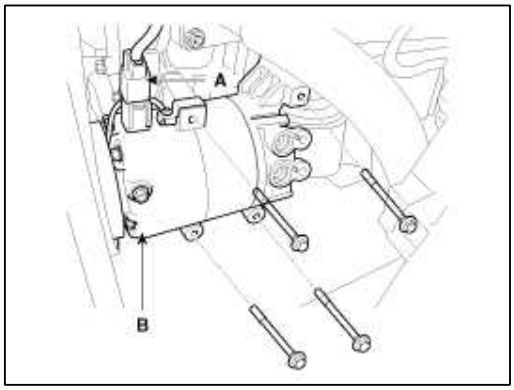
Removal

1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station.
4. Loosen the drive belt.

5. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

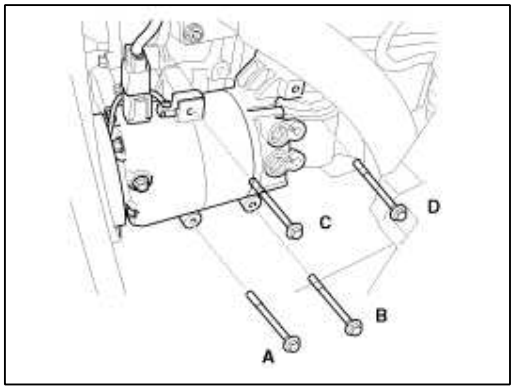


6. Disconnect the compressor clutch connector (A), and then remove 4 mounting bolts and the compressor (B).



Installation

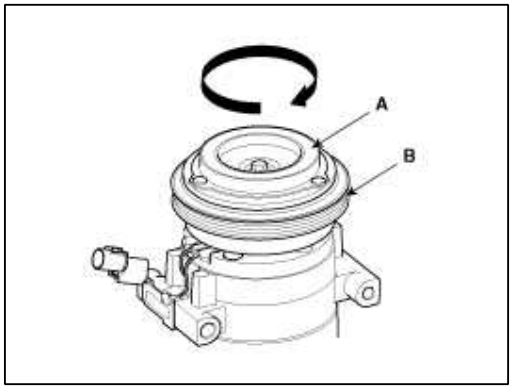
1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.



2. Install in the reverse order of removal, and note these items.
   A. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume, Subtract the volume of drained oil from 100cc(3.52 oz.) the result is the amount of oil you should drain from the new compressor (through the suction fitting).
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
   D. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
   E. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.
   F. Adjust the drive belt.
   G. Charge the system and test its performance.

Inspection

1. Check the plated parts of the disc & hub assembly (A) for color changes, peeling or other damage. If there is damage, replace the clutch set.
2. Check the pulley (B) bearing play and drag by rotating the pulley by hand. Replace the clutch set with a new one if it is noisy or has excessive play/drag.

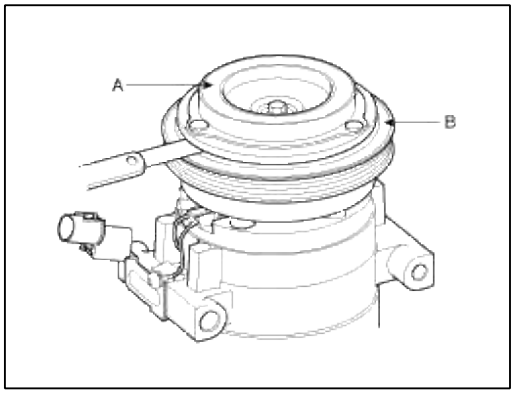


3. Measure the clearance between the pulley (B) and disc & hub assembly (A) all the way around. If the clearance is not within specified limits, remove the disc & hub assembly and add or remove shim (gap washer) as needed to increase or decrease clearance.

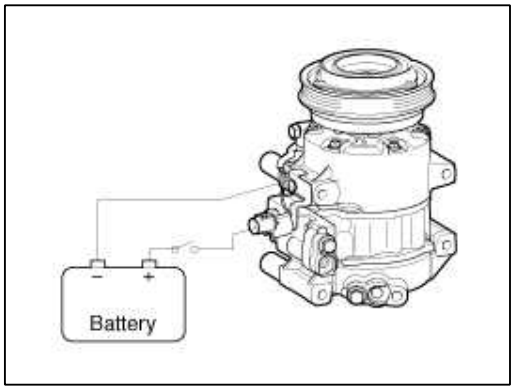
Clearance: 0.45 ± 0.1mm (0.018 ± 0.004 in.)

NOTE

The shims (gap washers) are available in seven thicknesses: 0.7mm, 0.8mm, 0.9mm, 1.0mm, 1.1mm, 1.2mm and 1.3mm.



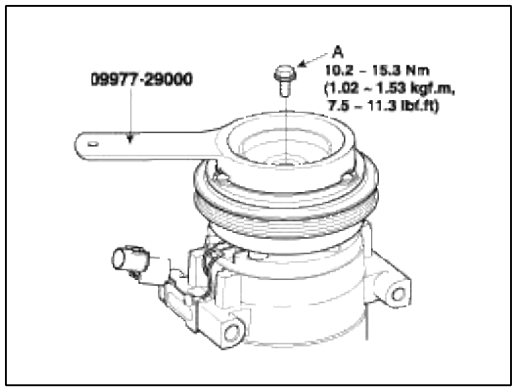
4. Check operation of the magnetic clutch.Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body.Check the magnetic clutch operating noise to determine the condition.



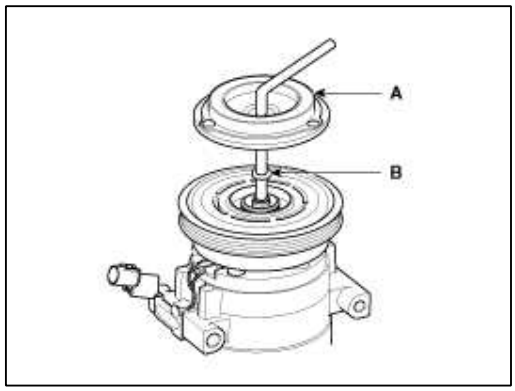
Disassembly

1. Remove the center bolt (A) while holding the disc & hub assembly with a commercially available disc & hub assembly bolt remover; Special tool number 09977-29000.

TORQUE : 10~15N.m (1.02~1.53kgf.m, 7.37~11lbf.ft)



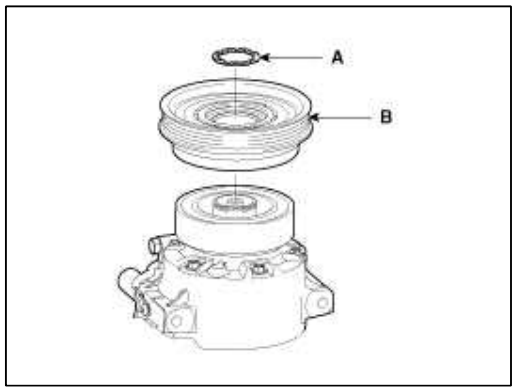
2. Remove the disc & hub assembly (A) and shim (gap washer) (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub assembly, and recheck its clearance.



3. When removing the field coil, remove retainer ring (A) with retainer ring pliers.

NOTE

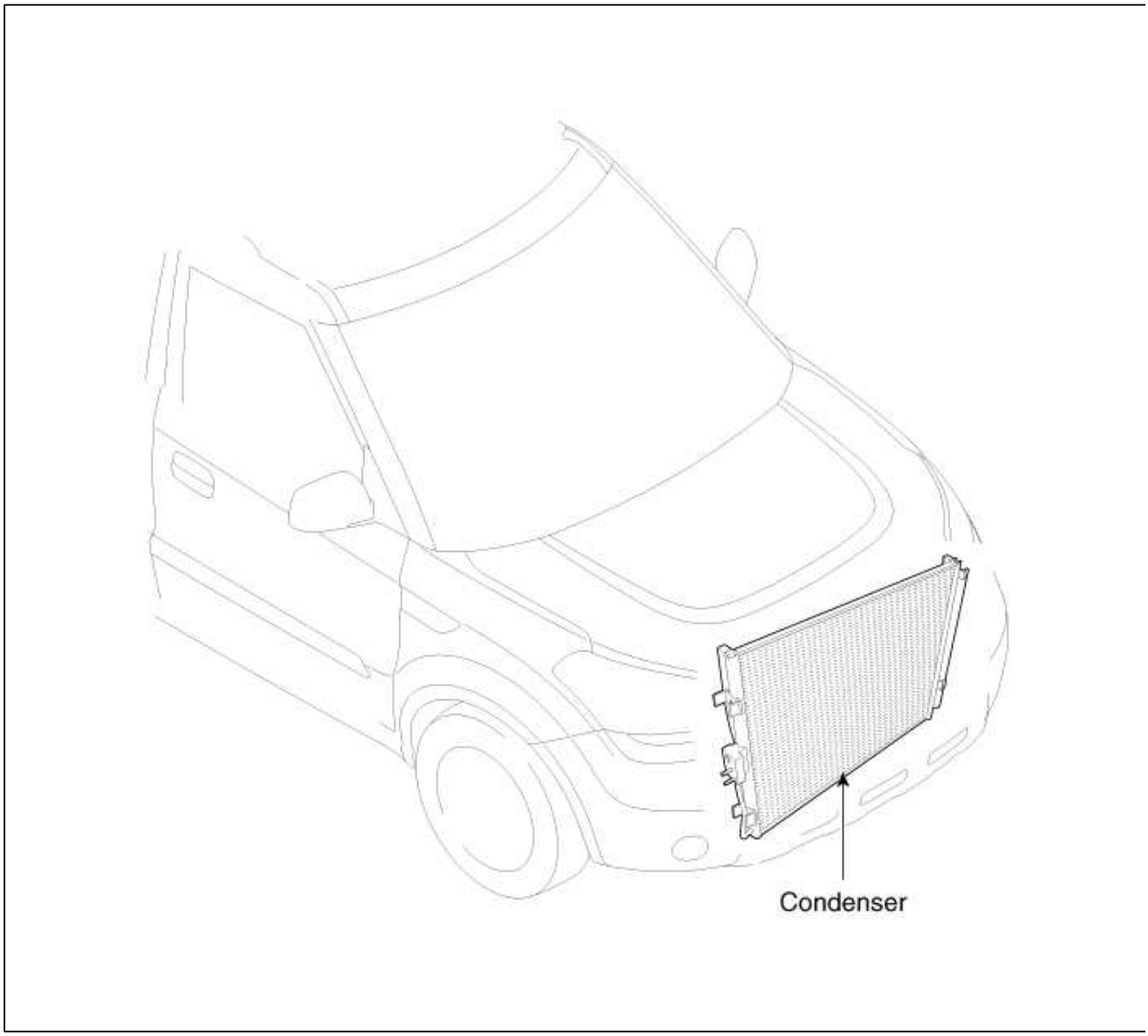
- Be careful not to damage the pulley (B) and compressor during removal/installation.
- Once retainer ring (A) is removed, replace it with a new one.



4. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
   A. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
   B. Install new retainer rings, and make sure they are fully seated in the groove.
   C. Make sure that the pulley turns smoothly after its reassembled.

Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Components and Components Location

Component location



Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Repair procedures

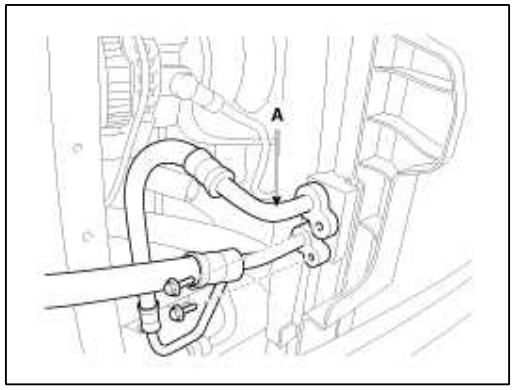
Inspection

1. Check the condenser fins for clogging and damage. If clogged, clean them with water, and blow them with compressed air. If bent, gently bend them using a screwdriver or fin tool.
2. Check the condenser connections for leakage, and repair or replace it, if required.

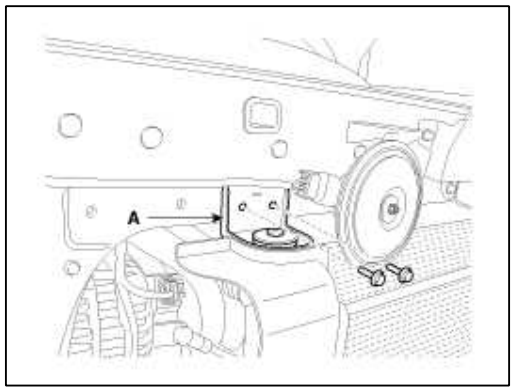
Replacement

Condenser Assembly

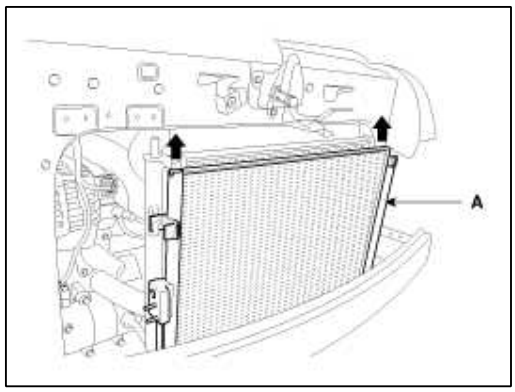
1. Recover the refrigerant with a recovery/ recycling/ charging station .
2. Disconnect the negative (-) battery terminal.
3. Remove the front bumper. (Refer to BD group-front bumper)
4. Disconnect the refrigerant line(A).



5. Remove the mount bumper(A).



6. Remove the condenser (A) by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser.

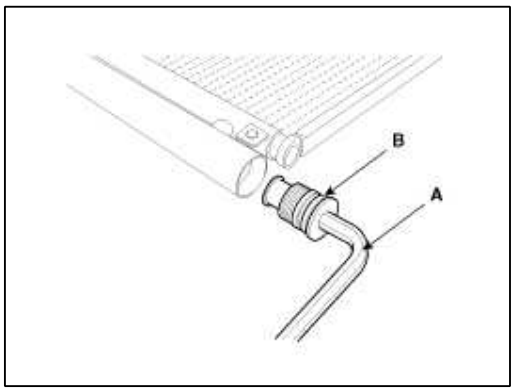


7. Install in the reverse order of removal, and note these items :
   A. If you're installing a new condenser, add refrigerant oil FD46XG.
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. Be careful not to damage the radiator and condenser fins when installing the condenser.
   D. Be sure to install the lower mount cushions of condenser securely into the holes.
   E. Charge the system, and test its performance.

Desiccant

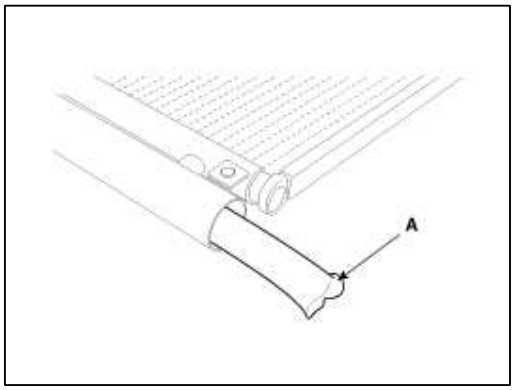
Replacement

1. Remove the condenser, and then remove the bottom cap (B) with L wrench (A) from the condenser.



TORQUE : 20~25N.m (2.0~2.5kgf•m, 14.5~18.2lb-ft)

2. Remove the desiccant (A) from condenser using a long nose plier. Check for crumbled desiccant and clogged bottom cap filter.



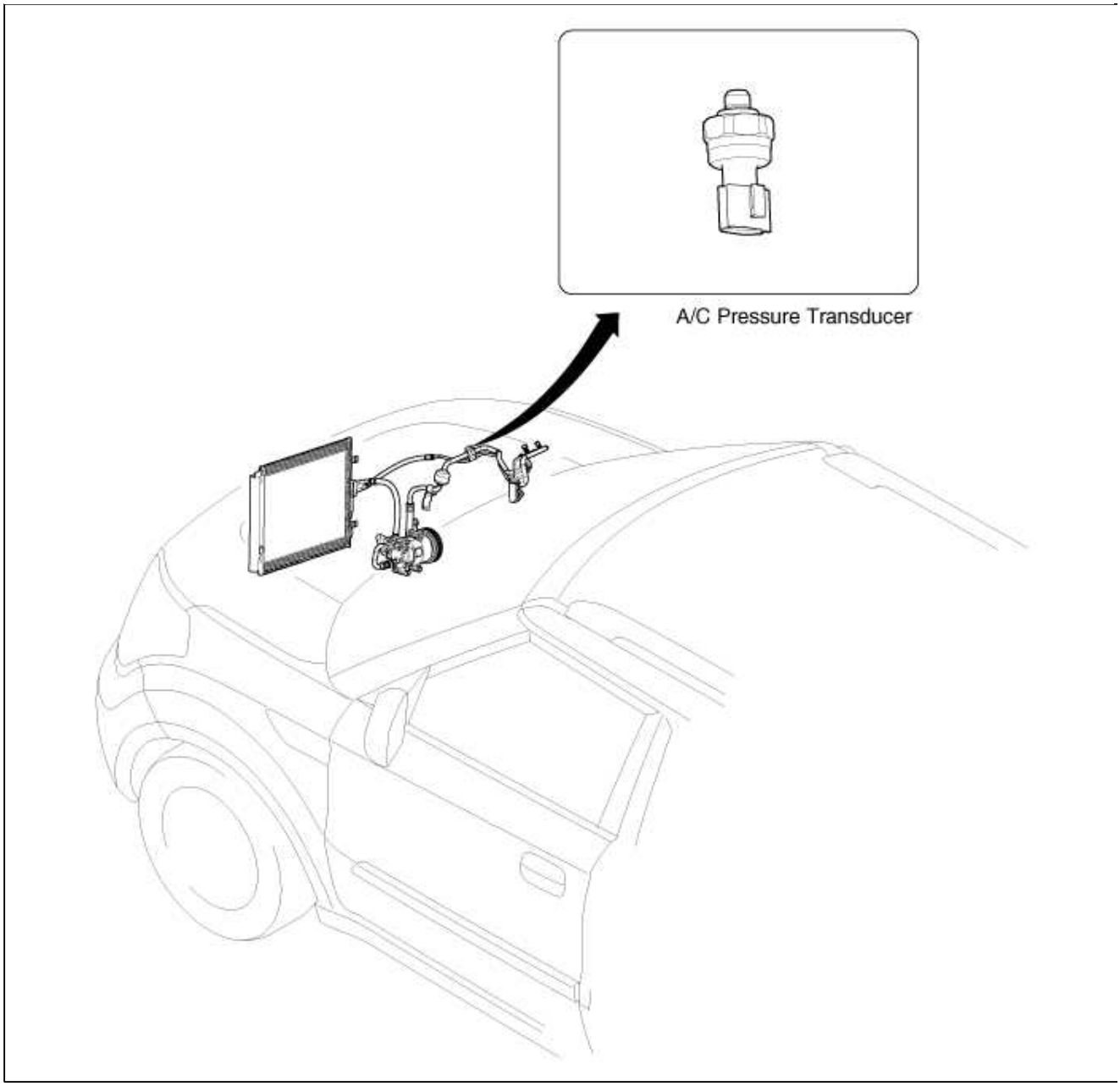
3. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
4. Insert the new desiccant into the receiver drier tank. The desiccant must be kept sealed until it is installed.
5. Install the new bottom cap to the condenser.

NOTE

- Always replace the desiccant and bottom cap at the same time.
- Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
- Be careful not to damage the radiator and condenser fins when installing the condenser.
- Be sure to install the lower mount cushions of condenser securely into the holes.
- Charge the system, and test its performance.

Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Components and Components Location

Component Location



Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Description and Operation

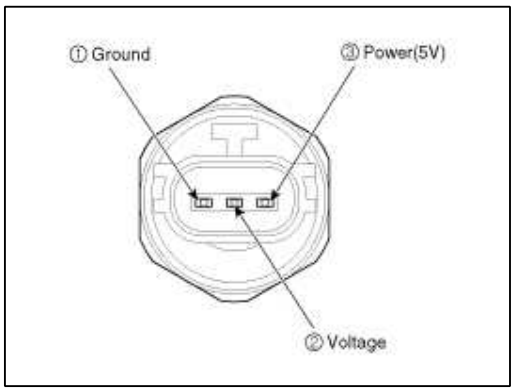
Description

The A/C pressure transducer converts the pressure in the high pressure line into a voltage signal. The engine ECU uses this signal to control the compressor and the cooling fan. The Engine ECU will stop the operation of the compressor when the temperature of refrigerant line is too high or too low.

Heating,Ventilation, Air Conditioning > Air conditioning System > A/C pressure transducer > Repair procedures

Inspection

1. Measure the pressure of high pressure line by voltage output between NO.1 and NO.2 terminals



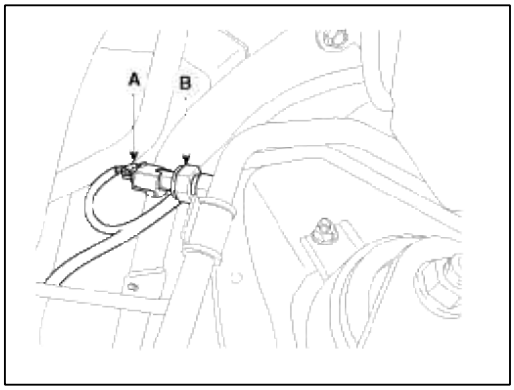
2. Determin if the voltage is within spec.

Voltage = 0.00878835 * Pressure + 0.37081095 [PSIA]

3. If the measured voltage value is not within specification, replace the A/C pressure transducer.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/charging station.
3. Disconnect A/C pressure transducer connector (3P) (A).
4. Remove the A/C pressure transducer(B).



CAUTION

- Take care that liquid & suction pipe are not bent.

5. Installation is the reverse order of removal.

TORQUE : 10~12N.m (1.0~1.2kgf.m, 7.4~8.8lbf.ft)

Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Description and Operation

Description

The evaporator temperature sensor will detect the evaporator core temperature. The controler uses this signal to stop the compressor relay in order to prevent evaporator freezing.

Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect evaporator temperature sensor.
3. Using the multimeter, Measure resistance between terminal "1" and "2" of evaporator temperature sensor

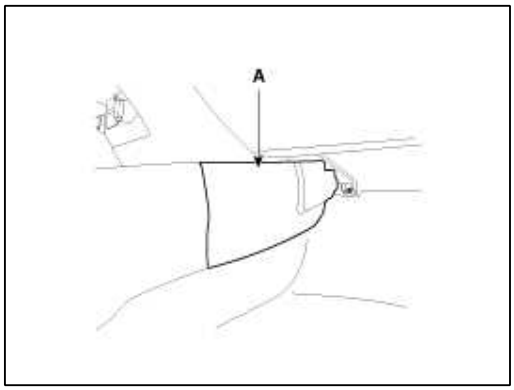
Specification

Coolant temperature [°C(°F)]	Resistance (kΩ)	Voltage (V)
-10(14)	43.35	2.96
0(32)	27.62	2.40
10(50)	18.07	1.88
20(68)	12.11	1.44
30(86)	8.30	1.08
40(104)	5.81	0.81
50(122)	4.15	0.61

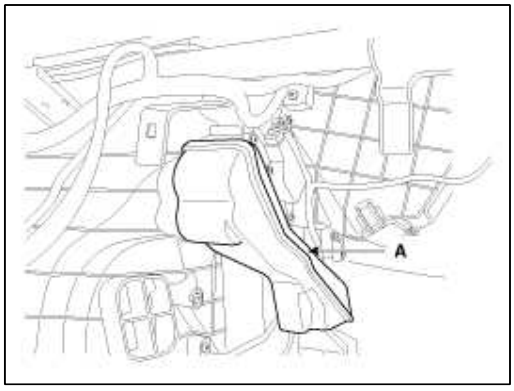
4. If the measured resistance is not within specification, replace the evaporator temperature sensor.
5. If the evaporator temperature sensor resistance in within specs. check the voltage between pins 1 and 2 of the harness. If the reading is not 5v, repair/replace harness and controler

Replacement

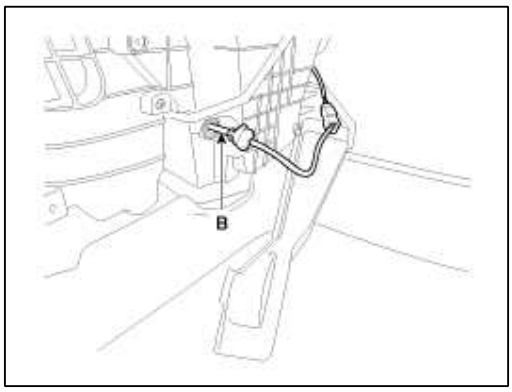
1. Remove the crash pad lower panel (A).



2. Remove the shower duct(A).



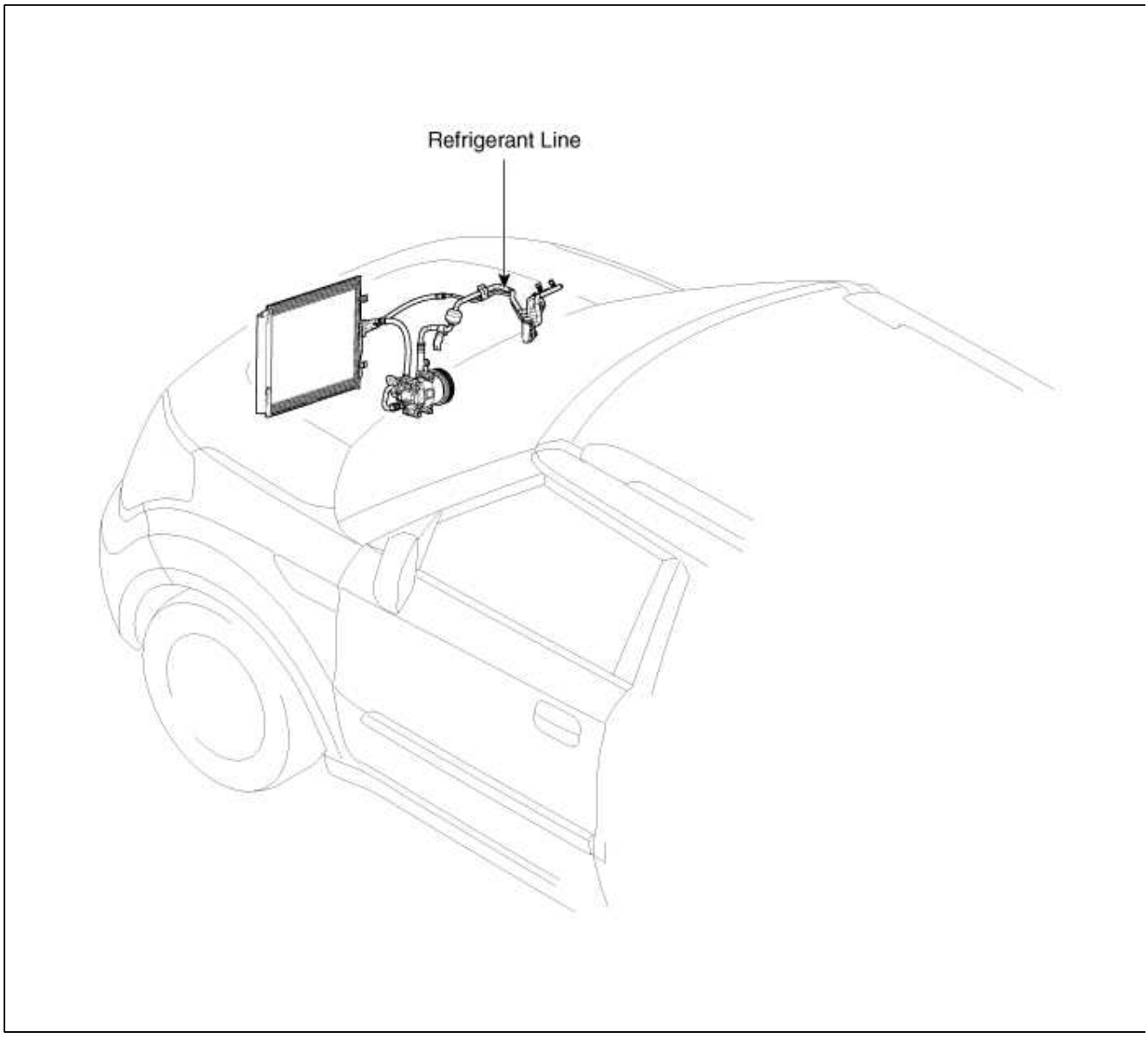
3. Remove the evaporator temperature sensor (B), by pulling it after rorating 90° in a counter clock wise direction.



4. Installation is the reverse order of removal

Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Components and Components Location

Component location



Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Repair procedures

Replacement

1. Discharge refrigerant from refrigeration system .
2. Replace faulty tube or hose.

> CAUTION
>
> • Cap the open fittings immediately to keep moisture or dirt out of the system.

3. Tighten joint of bolt or nut to specified torque

> CAUTION
>
> • Connections should not be torque tighter than the specified torque.

Part tightened	N.m	Kgf.m	lbf.ft
Condenser - Discharge hose	8 ~ 12	0.8~1.2	5.8 ~ 8.7
Condenser - Liquid tube			
Compressor - Discharge hose			
Compressor - Suction hose			
Expansion valve - Evaporator			

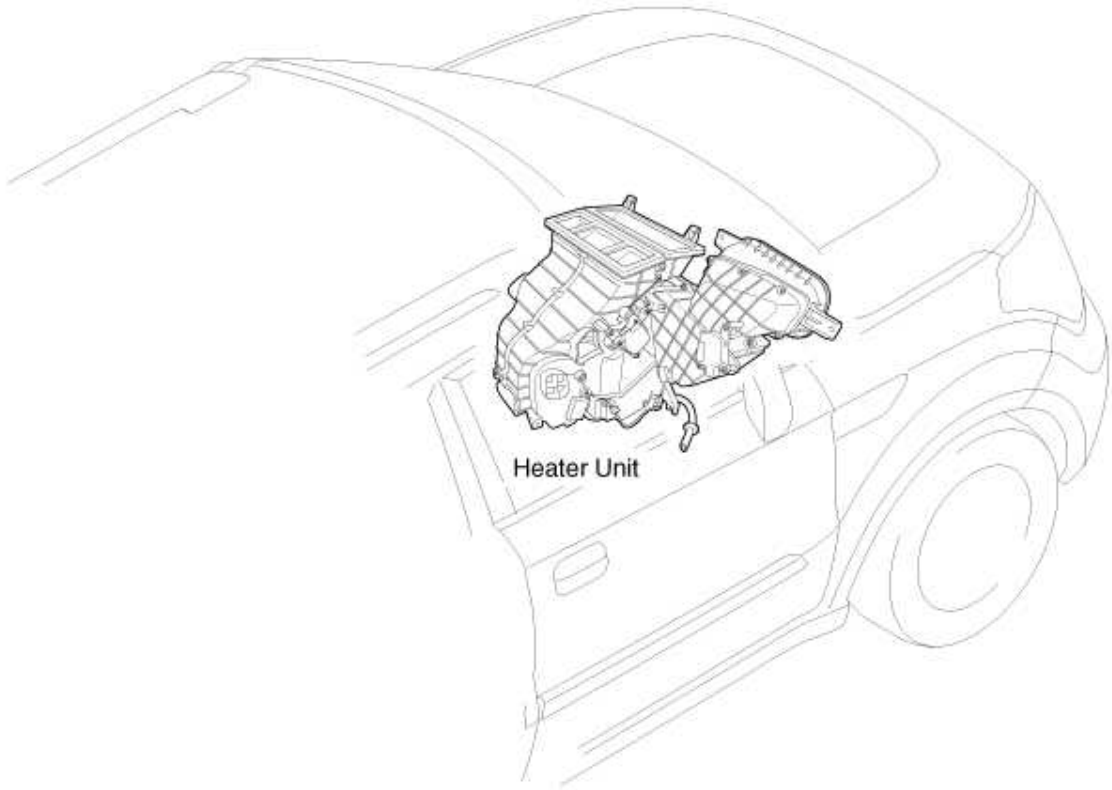
4. Evacuate the system and charge system with refrigerant.

Specified amount: 550 ± 25g (19.4 ± 0.88 oz.)

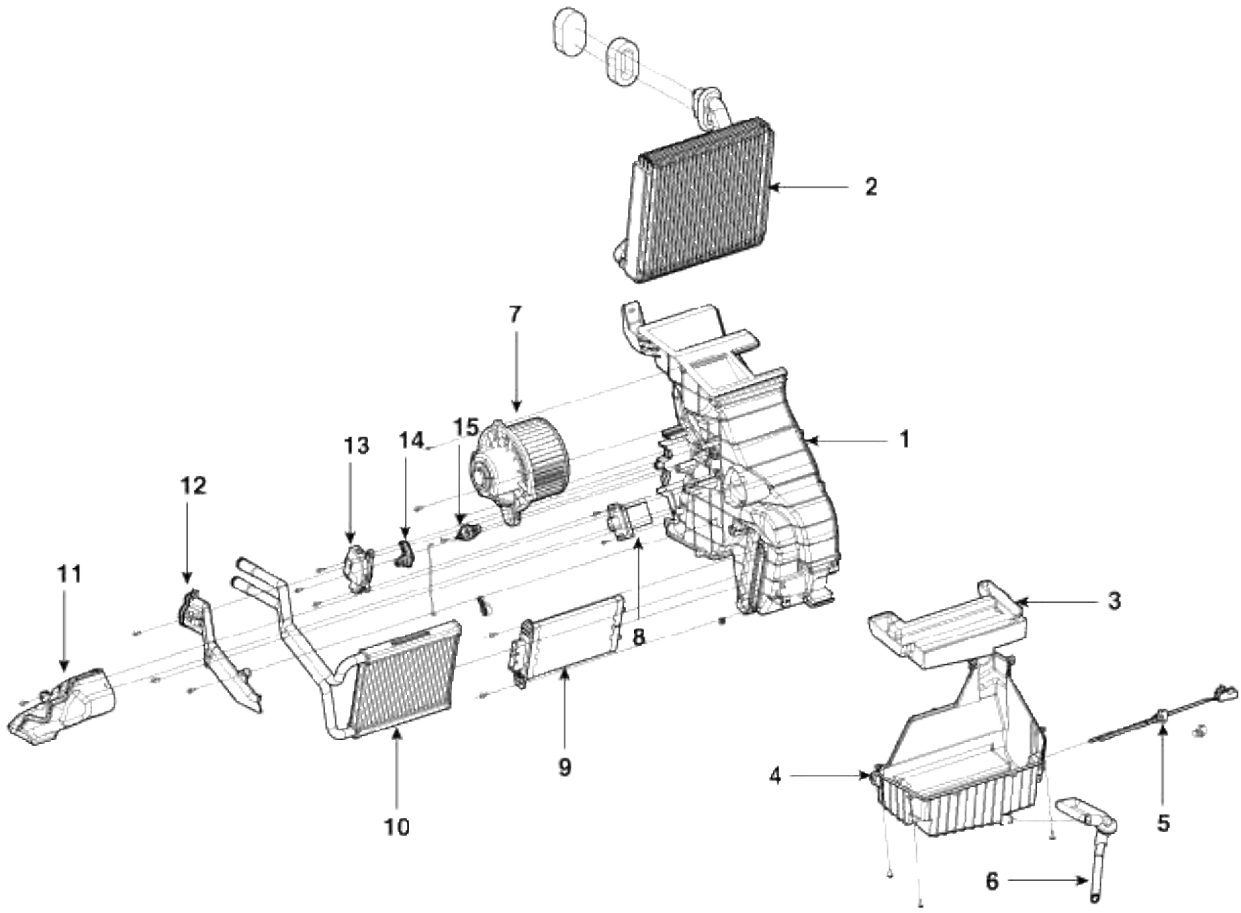
5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant .
6. Inspect A/C operation.

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Components and Components Location

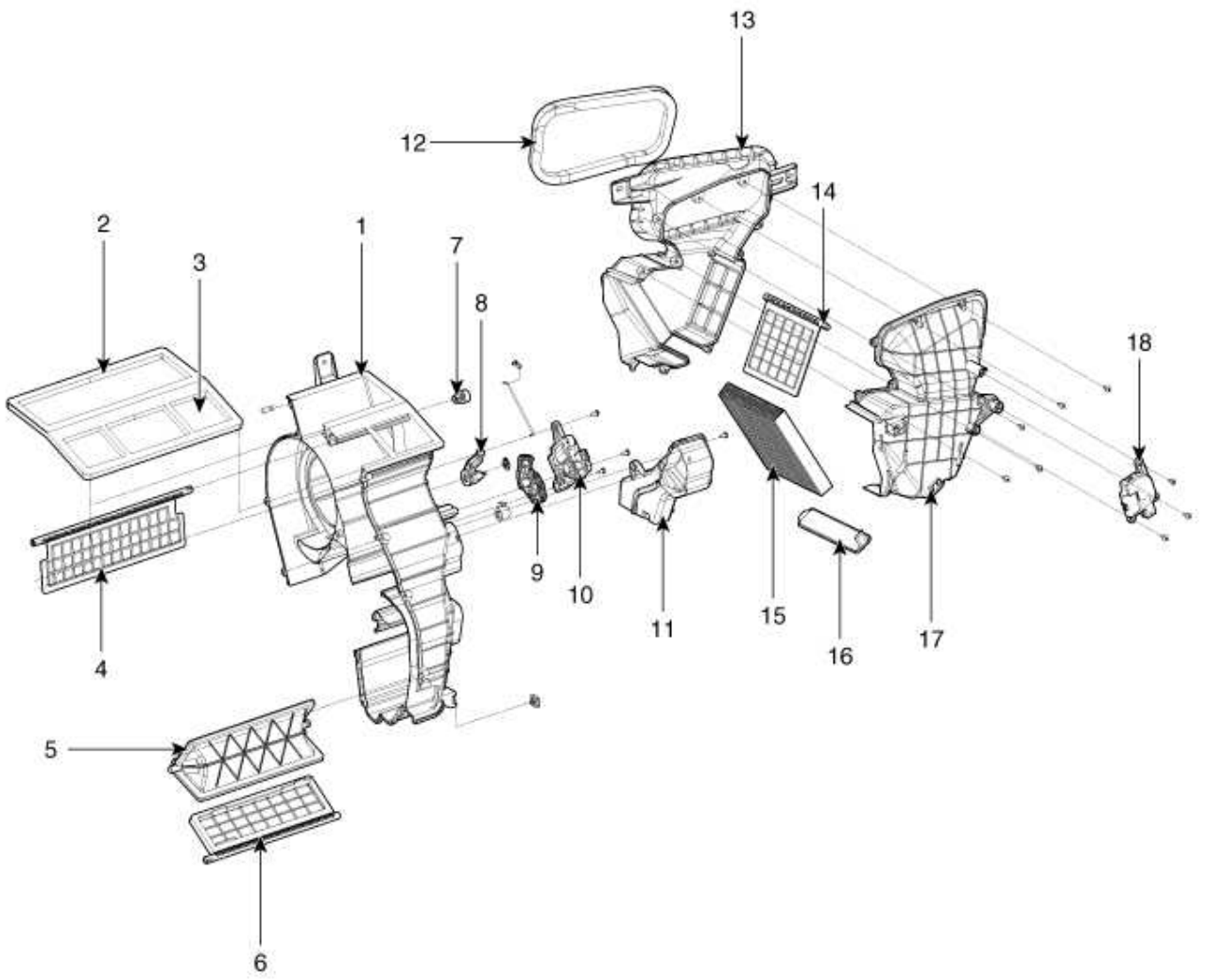
Component Location



Compoment



1. Heater case (LH)	6. Drain hose	11. Shower duct (LH)
2. Evaporator core	7. Blower motor	12. Heter core cover
3. Evaporator lower insulator	8. Blower resistor	13. Temp control actuator
4. heater lower case	9. PTC core	14. Vent door lever
5. Evaporator temp sensor	10. Heater core	15. Temp door lever



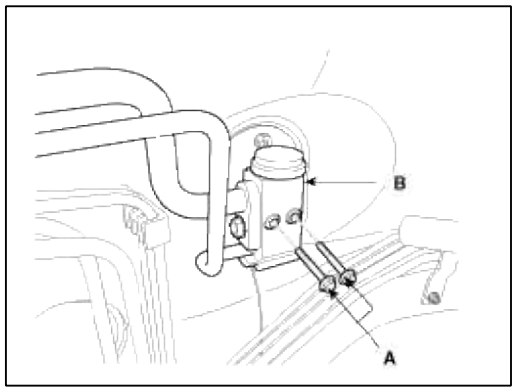
1. Heater case (RH) 2. Duct seal 1 3. Duct seal 2 4. Vent door 5. Floor door	6. Temp door 7. Vent arm 8. Vent door lever 9. Mode cam 10. Mode actuator	11. Shower duct (RH) 12. Intake seal 13. Inlet duct case 14. Inlet door 15. Climate control air filter	16. Air filter cover 17. Inlet duct case 18. Intake actuator

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Repair procedures

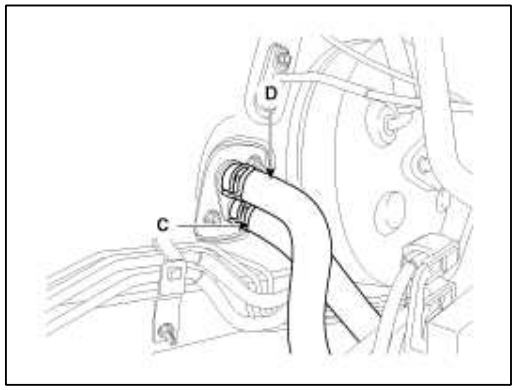
Replacement

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.

4. Remove the bolts (A) and the expansion valve (B) from the evaporator core.
   Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



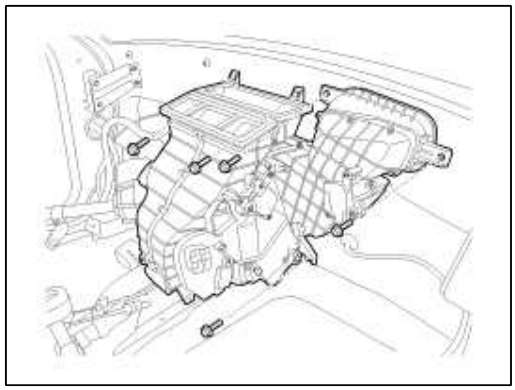
5. Disconnect the inlet (C) and outlet (D) heater hoses from the heater unit.



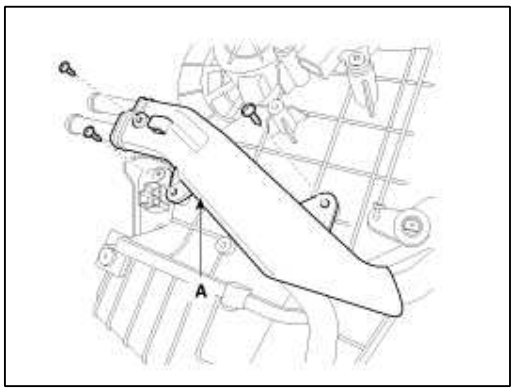
CAUTION

- Engine coolant will spill when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

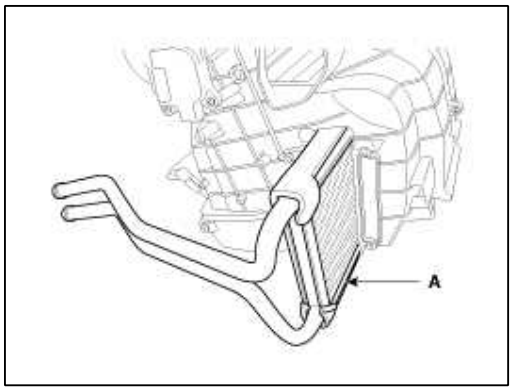
6. Remove the crash pad (Refer to BD group-Crash pad).
7. Remove the cowl cross bar assembly. (Refer to BD group-Cross member)
8. Remove the heater & blower unit(A) after loosening mounting bolts.



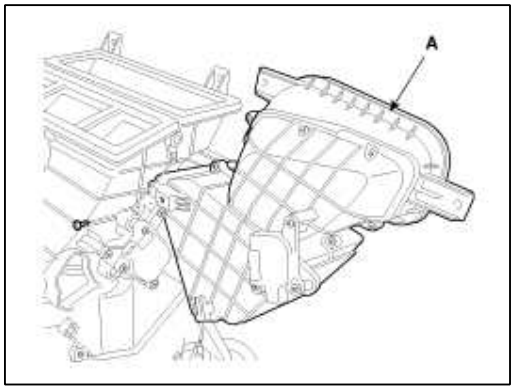
9. Remove the cover (A).



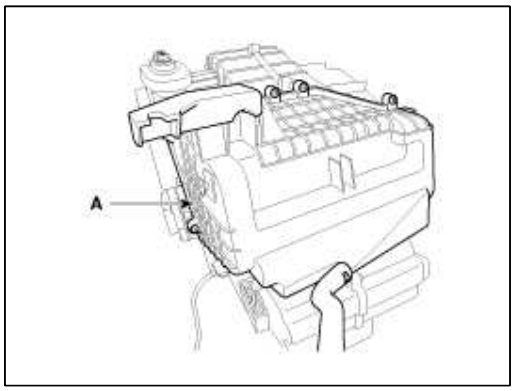
10. Be careful that the inlet and outlet pipe are not bent during heater core removal, and pull out the heater core(A).



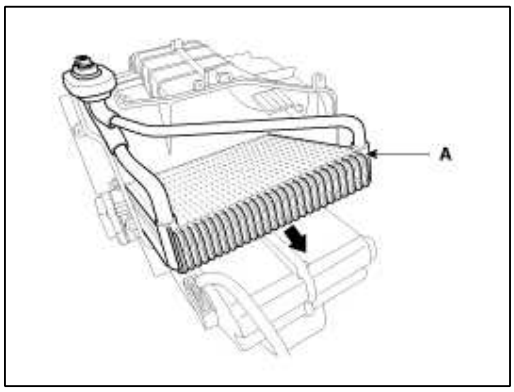
11. Remove the intake assembly(A).



12. Remove the heater unit lower case(A).



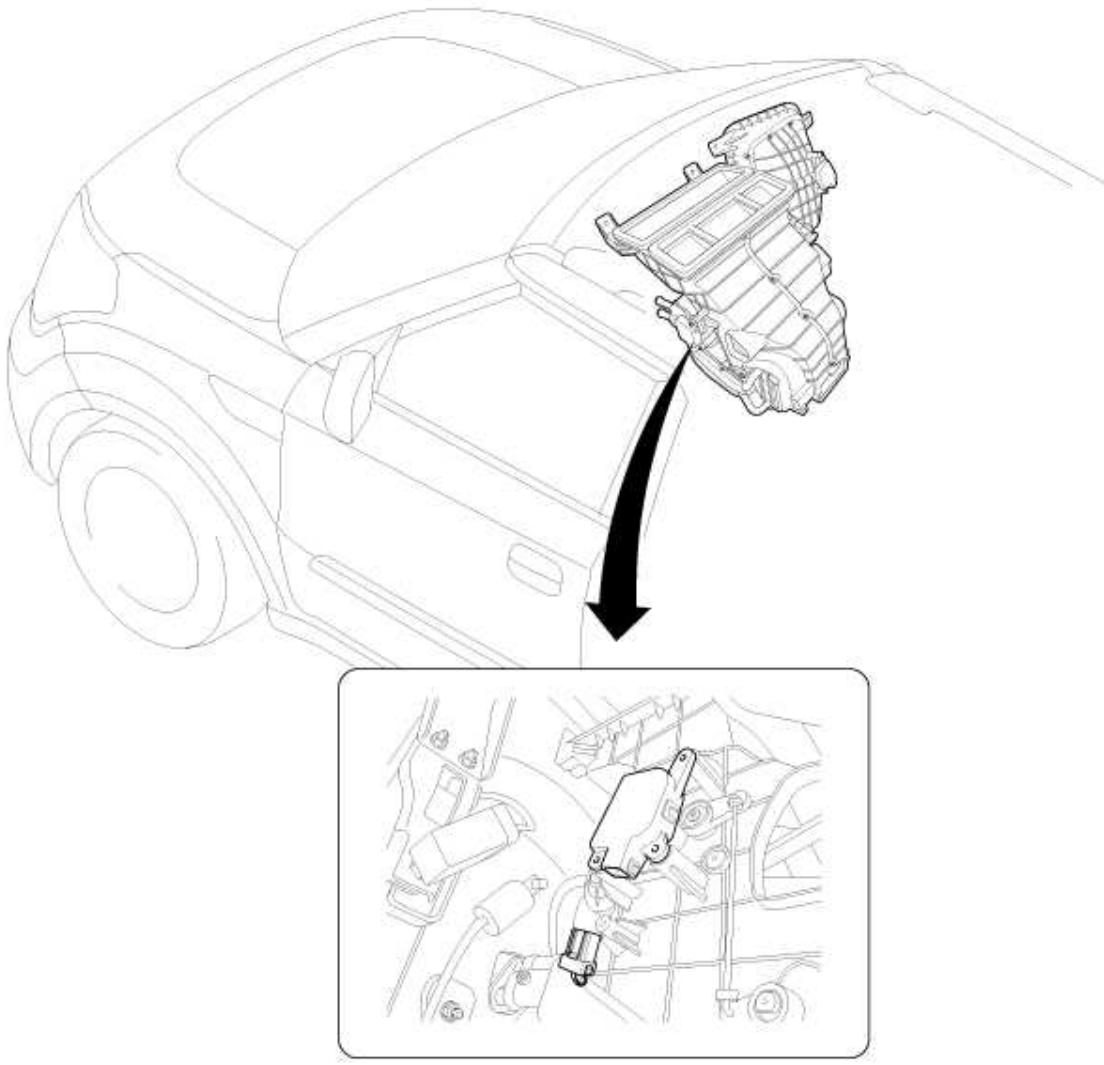
13. Remove the evaporator core(A).



14. Installation is the reverse order of removal, and note these items :
    A. If you're installing a new evaporator, add refrigerant oil (ND-OIL8).
    B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing. Be sure to use the right O-rings for R-134a to avoid leakage.
    C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    D. Do not spill the refrigerant oil on the vehicle ; it may damage paint ; if the refrigerant oil contacts the paint, wash off immediately.
    E. Apply sealant to the grommets.
    F. Make sure that there is no air leakage.
    G. Charge the system and test its performance.
    H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    I. Refill the cooling system with engine coolant.

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Components and Components Location

Component Location



Temperature Control Actuator

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Description and Operation

Description

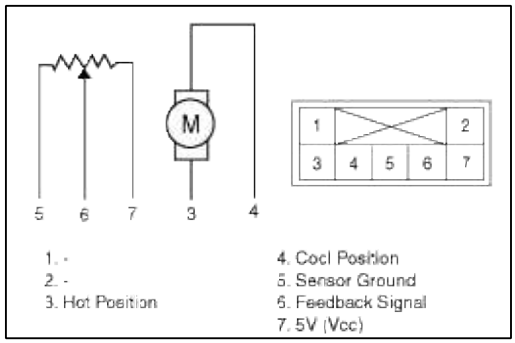
1. Heater unit includes mode control actuator and temperature control actuator.
2. The HVAC uses the temperature control actuator to control the vent temperature. The temperature control actuator is located on the heater unit.. A command from the HVAC control unit adjusts the position of the temperature door.

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Repair procedures

Inspection

1. Ignition "OFF"
2. Disconnect the connector of temperature control actuator.

3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 3 and grounding terminal 4.
   Verify that the temperature control actuator operates to the cool position when connecting in the reverse.



4. With the connector connected to the actuator, check the voltage between terminals 5 and 6 while the temperature door is in both the hot and cold positions.

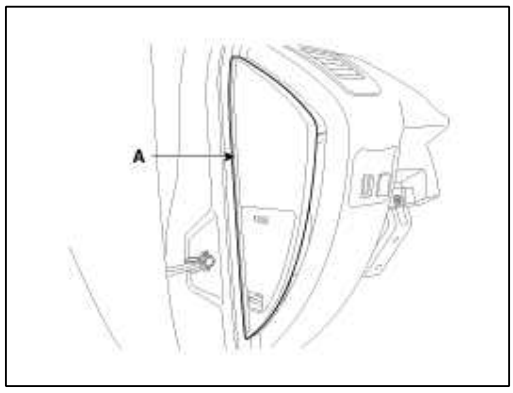
   Specification

Door position	Voltage (5-6)	Error detecting
Max. cooling	0.45 ± 0.15V	Low voltage :0.1V or less
Max. heating	4.55 ± 0.15V	High voltage :4.9V or more

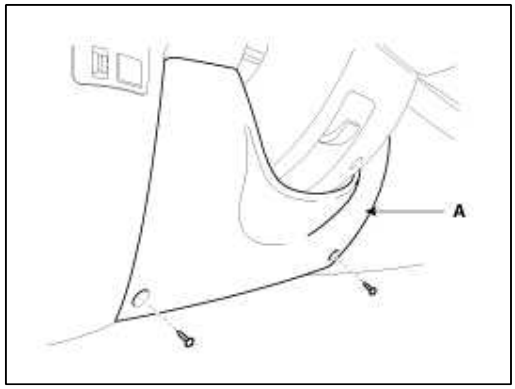
   * This potentiometer is a feedback sensor used by the control unit to track the position of the actuator door.
5. If the measured voltage is not specification, substitute with a known-good temperature control actuator and check for proper operation.
6. If the problem is corrected, replace the temperature control actuator.

Replacement

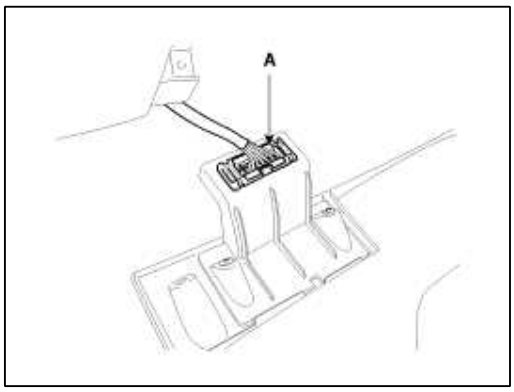
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



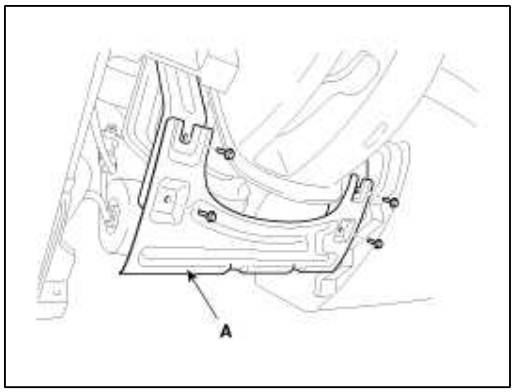
3. Loosen the mount screw and then remove the crashpad lower panel (A).



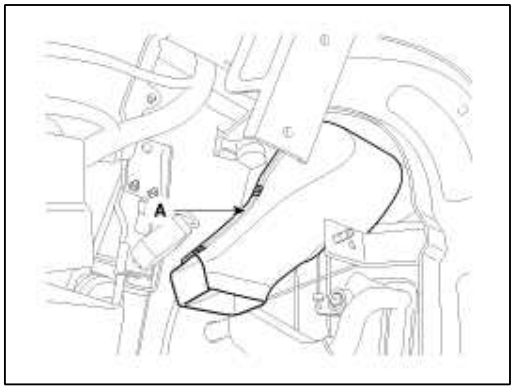
4. Disconnect the connector(A).



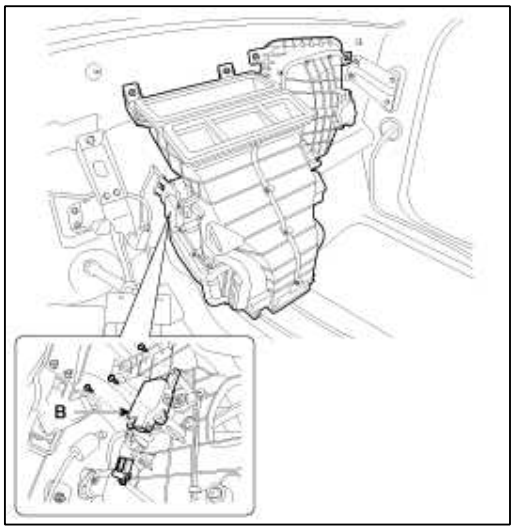
5. After loosening the mounting bolts, then the reinforcing panel (A).



6. Remove the shower duct(A).



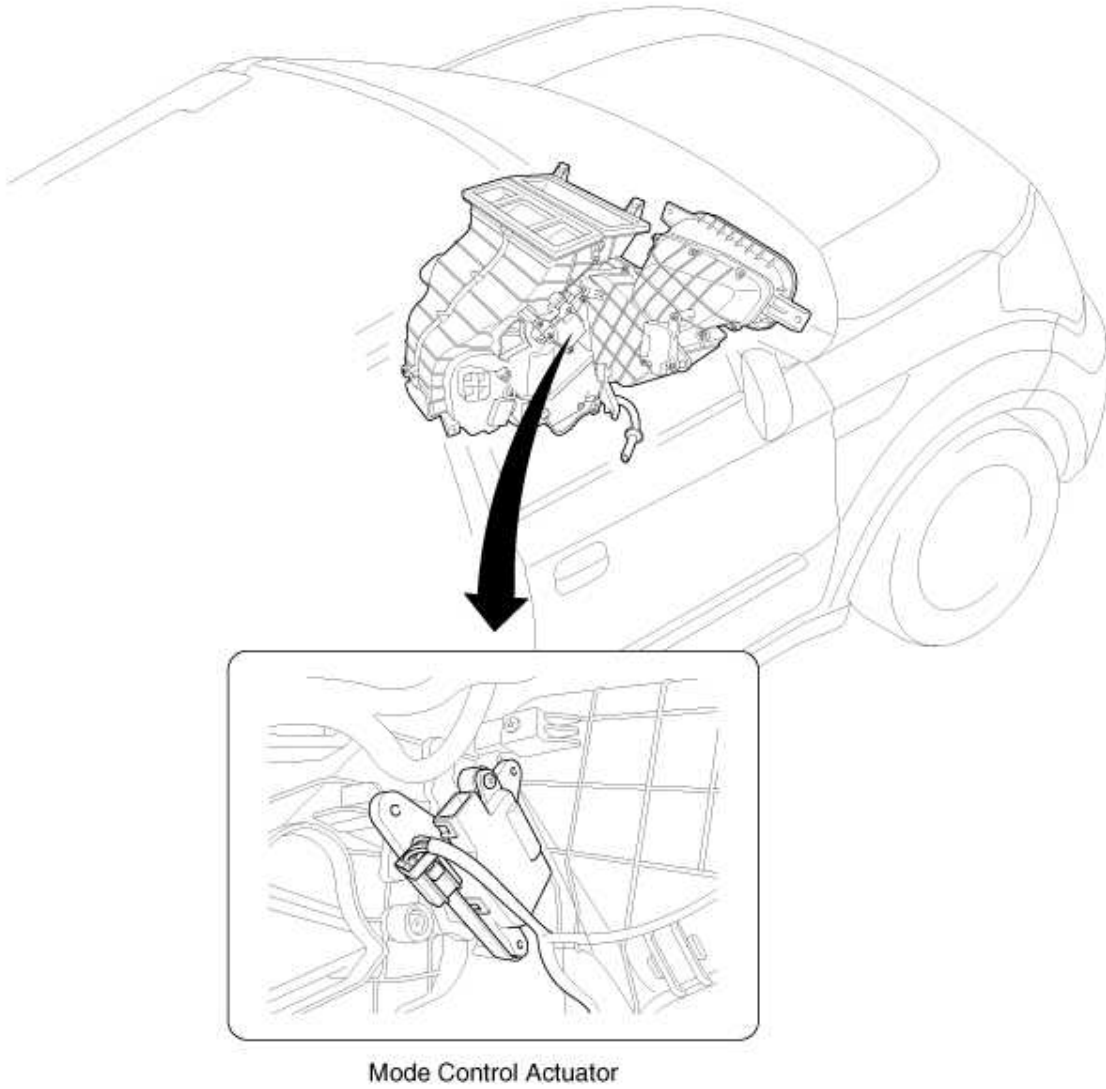
7. Loosen the mounting screw and then remove the temperature control actuator (B).



8. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Components and Components Location

Component Location



Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Description and Operation

Description

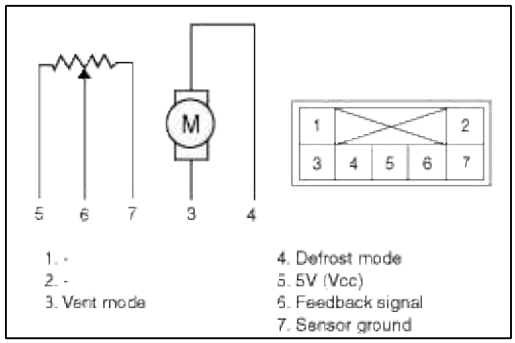
The mode control actuator is located at the heater unit.
It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Repair procedures

Inspection

1. Ignition "OFF”
2. Disconnect the connector of mode control actuator.

3. Verify that the mode control actuator operates to the defrost mode when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse.



5. Check the voltage between terminals 6 and 7.

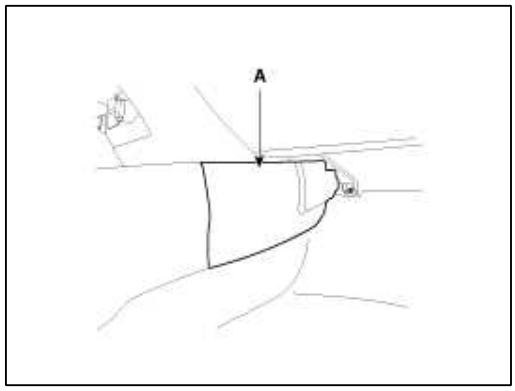
Door position	Voltage (6-7)	Error detecting
Vent	0.3 ± 0.15V	Low voltage :0.1V or less
Defrost	4.7 ± 0.15V	High voltage :4.9V or more

* It will feedback current position of actuator to controls.

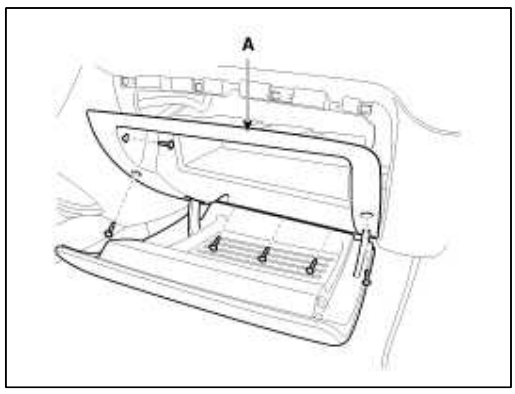
6. If the measured resistance is not within specification, replace the evaporator temperature sensor.
7. If the evaporator temperature sensor resistance in within specs. check the voltage between pins 5 and 7 of the harness. If the reading is not 5v, repair/replace harness and controler

Replacement

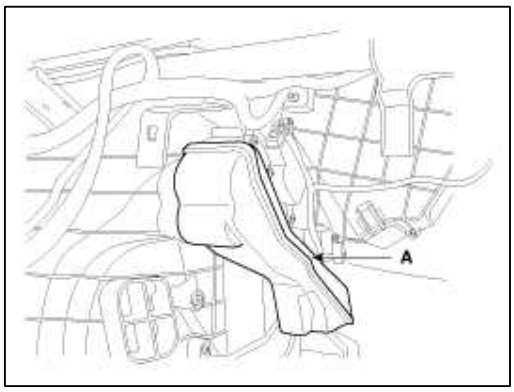
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower cover (A).



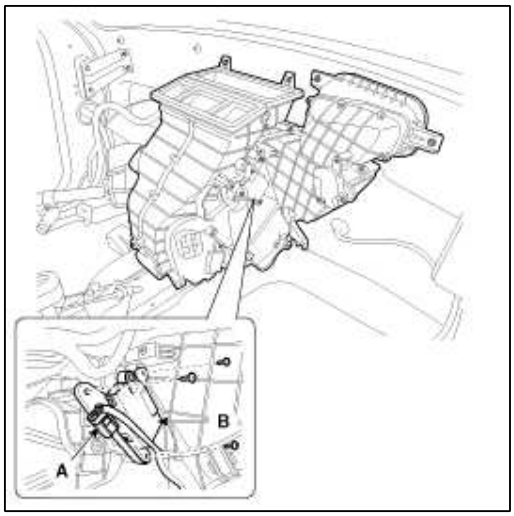
3. Loosen the mount screw and then remove the glove box (A)



4. Remove the shower duct(A).



5. Loosen the mounting screw and then remove the temperature control actuator (B).

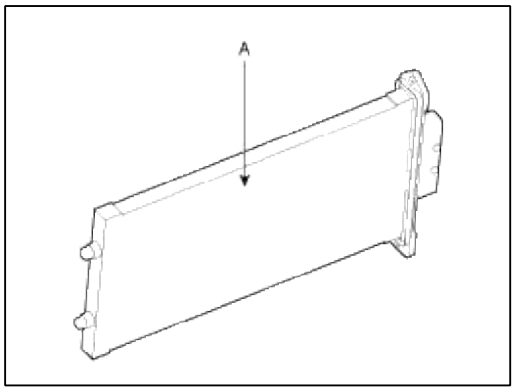


6. Installation is the reverse order of removal.

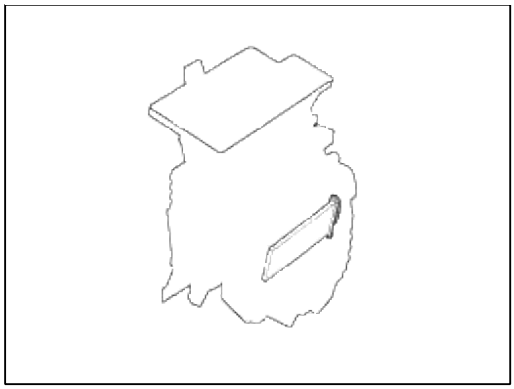
Heating,Ventilation, Air Conditioning > Heater > Positive Temperature Coefficient Heater > Description and Operation

Description

PTC (Positive Temperature Coefficient) heater (A) is an electric heater using a PTC element as an auxiliary heating device that supplements deficiency of interior heat source in highly effective diesel engine (U engine).

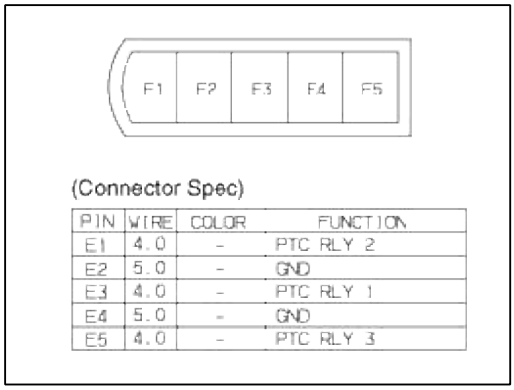


An electric heater heats up the interior by directly heating the air that passes through the heater.
PTC = positive Temperature Coefficient
The name itself implies that the element has a proportional resistance change sensitive to temperature. PTC heater is installed at the exit or the backside of heater core.



Operation Principle

ECM outputs a PTC on signal. Operate PTC from 1st setting to 3rd setting with an interval of 15 seconds.
Heat up the air, which passes through a heater core.



(Connector Spec)

PIN	WIRE	COLOR	FUNCTION
E1	4.0	-	PTC RLY 2
E2	5.0	-	GND
E3	4.0	-	PTC RLY 1
E4	5.0	-	GND
E5	4.0	-	PTC RLY 3

Operation Condition

Judge the condition by ambient temperature is below 5°C, coolant temperature is below 70°C, and battery voltage is above 11V and engine RPM is above 700RPM.

Heating,Ventilation, Air Conditioning > Heater > Positive Temperature Coefficient Heater > Repair procedures

Inspection

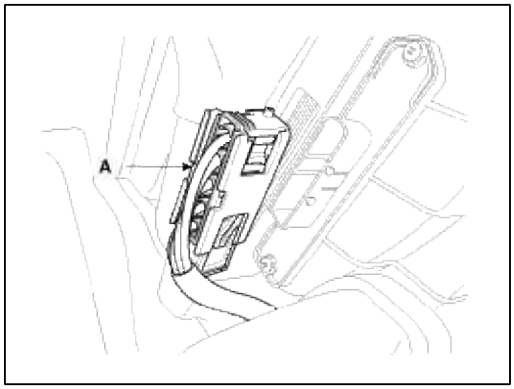
Inspect the PTC operation by confirmation logic as below.

1. Entering method
   (1) Set the floor mode, maximum heating
   (2) Turn off the blower switch
   (3) Press the intake button more than 5 times.
   (4) Indicator of entire button is flashed with an interval of 0.5 seconds continuously (Manual).
   Graphics of the entire LCD display switch on and off with an interval of 0.5 seconds continuously (Automatic)
   (5) Confirm the PTC operation by operating the blower switch
   Manual: 1~4 step, Automatic: 1~8step.
   (6) Each PTC relay is operated with an interval of 3 seconds.
   (7) Execute the PTC operation by confirmation logic for 30 seconds.

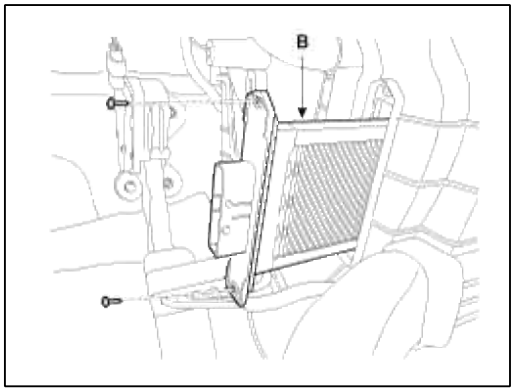
2. Cancellation method
   (1) Select the A/C button or intake button.
   (2) IG "OFF"
   (3) Cancel the logic after 30 seconds automatically.
3. If the PTC operation is not operated, substitute with a known-good PTC and check for proper operation. If the problem is corrected, replace the PTC.

Replacement

1. Remove the crash pad lower panel(Refer to BD group-Center console)
2. Disconnect the PTC connector(A).



3. Loosen the mount screw and then remove the PTC heater(B).

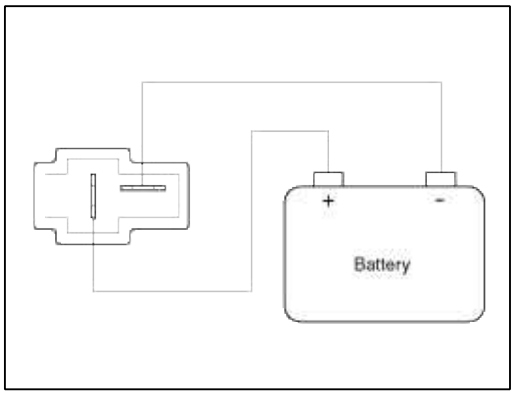


4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Repair procedures

Inspection

1. Connect the battery voltage and check the blower motor rotation.

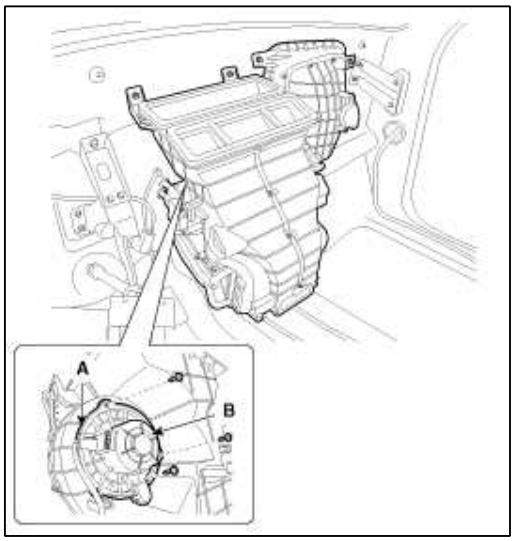


2. If the blower does not work on High Speed with the battery jumper wires attached, replace the blower motor.

3.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crashpad(refer to BD group-crashpad)
3. Disconnect the connector (A) of the blower motor.
4. Remove the blower motor (B) after loosening the mounting screws.

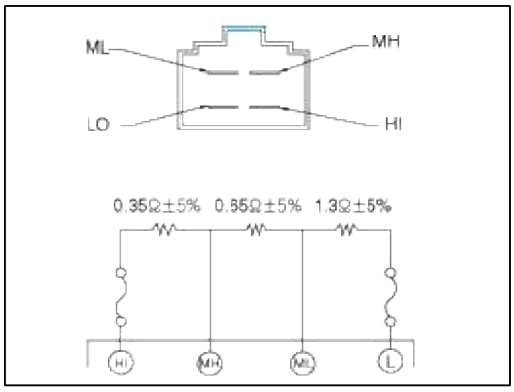


5. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Resistor > Repair procedures

Inspection

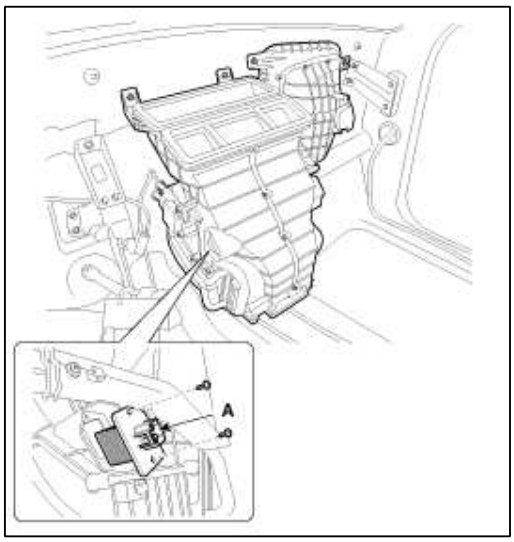
1. Measure terminal-to-terminal resistance of the blower resistor.
2. If measured resistance is not within specification, the blower resistor must be replaced. (After removing the resistor)



Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crashpad lower pannel.(refer to BD group-crash pad)

3. Disconnect the connector and then remove the blower resistor (A).



4. Installation is the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Climate control air filtar > Description and Operation

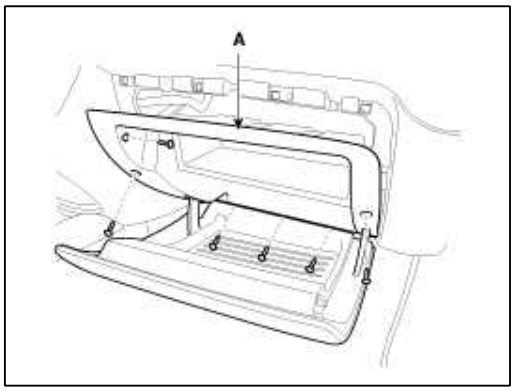
Description

This vehicle may or may not be equipped with a particle filter which eliminates foreign materials and odor.

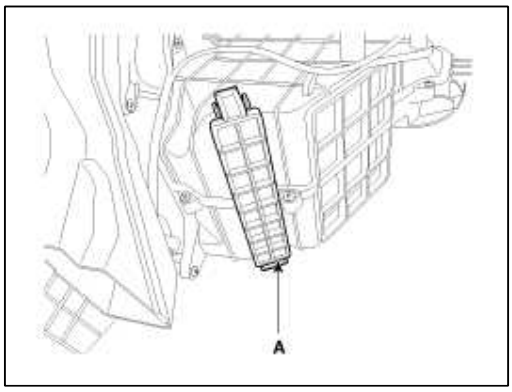
Heating,Ventilation, Air Conditioning > Blower > Climate control air filtar > Repair procedures

Replacement

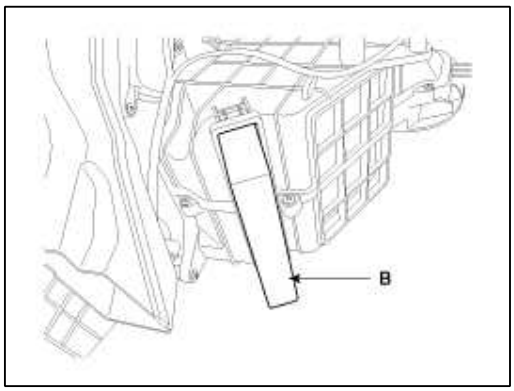
1. Loosen the mount screw and then remove the glove box (A).



2. Remove the filter cover (A) with pushing the knob.



3. Replace the air filter (B), install it after making sure of the direction of air filter.



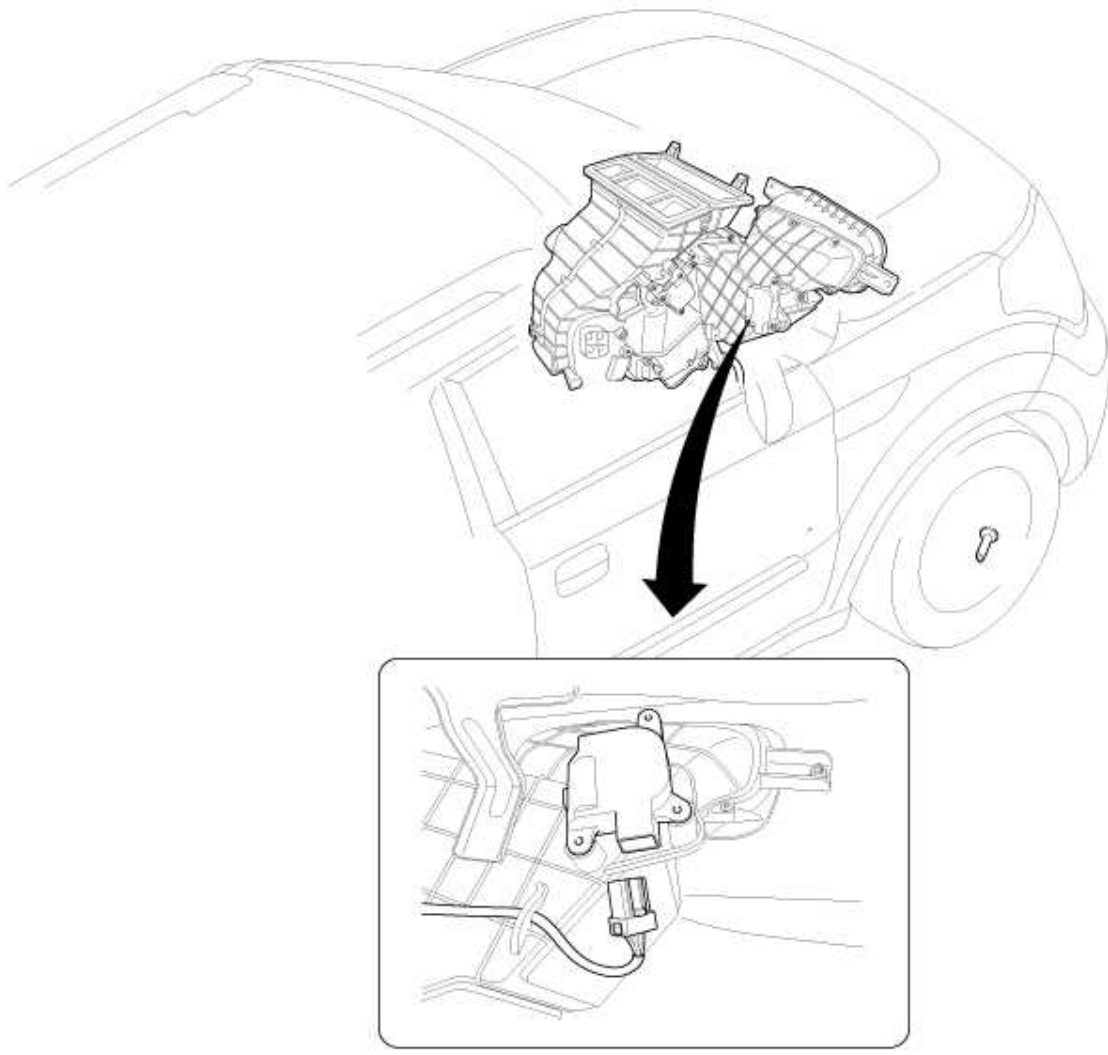
4. Installation is the reverse order of removal.

NOTE

- In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Components and Components Location

Component Location



Intake Actuator

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Description and Operation

Description

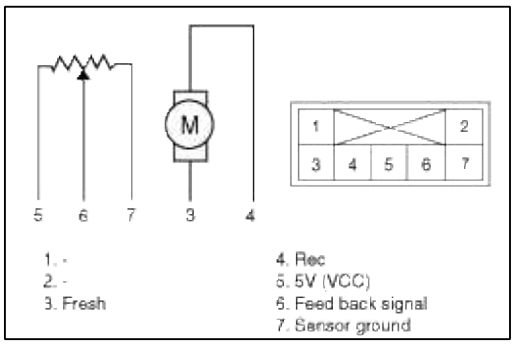
1. The intake actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Repair procedures

Inspection

1. Ignition "OFF”
2. Disconnect the intake actuator connector.
3. Verify that the actuator operates to the recirculation position when connecting 12V to the terminal 3 and grounding terminal 4.

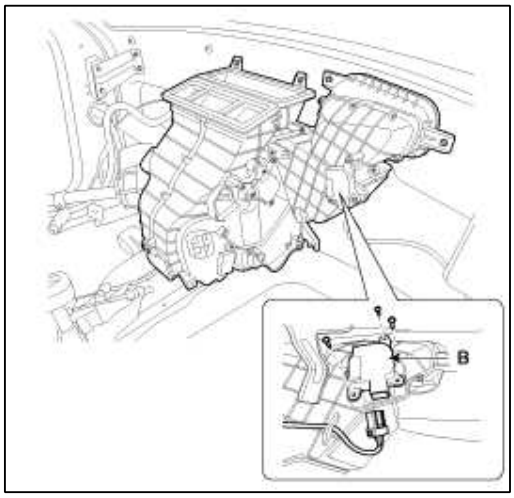
4. Verify that the intake actuator operates to the fresh position when connecting in the reverse.



5. If the measured resistance is not within specification, replace the evaporator temperature sensor.
6. If the evaporator temperature sensor resistance in within specs. check the voltage between pins 5 and 7 of the harness. If the reading is not 5v, repair/replace harness and controler

Replacement

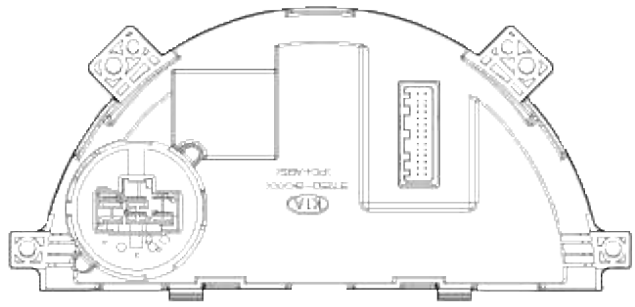
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad (Refer to BD group-crash pad).
3. Disconnect the intake actuator connector.
4. Loosen the mounting screw and then remove the intake actuator (B) from the blower unit.

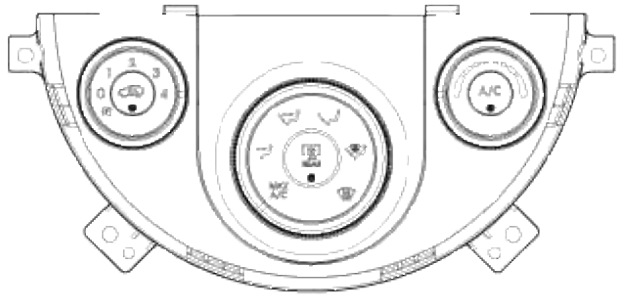


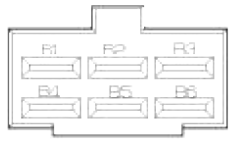
5. Installation is the reverse order of removal.

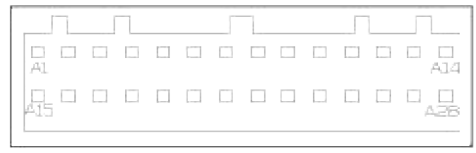
Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Manual) > Components and Components Location

Component









Connector Pin Function

Connector	Pin no	Function	Connector	Pin no	Function
Connector(A)	1	Tail (ILL+)	Connector(B)	1	GND
	2	Battery		2	MID HIGH
	3	A/C Output (Thermo)		3	MID LOW
	4	Mode actuator (Vent)		4	HIGH
	5	Mode actuator (Def)		5	LOW
	6	Temp actuator(Cool)		6	-
	7	Temp actuator(Warm)			

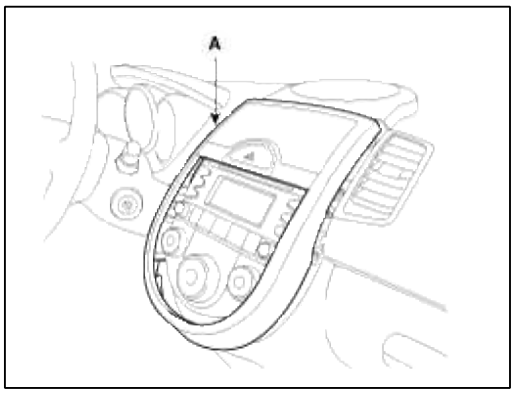
8	Intake actuator(Fre)	
9	Intake actuator(Rec)	
10	HTD	
11	Sensor REF(+5V)	
12	Blower ON signal	
13	-	
14	Rheostat (ILL-)	
15	IGN2	
16	-	
17	PTC relay2	
18	PTC relay3	
19	Temp actuator F/B	
20	Mode actuator F/B	
21	Intake actuator(Def)	
22	Evaporator sensor(+)	
23	Blower ON signal	
24	A/C Select signal	
25	Rear defog S/W	
26	Sensor GND	
27	PTC ON signal(Low)	
28	GND	

Heating,Ventilation, Air Conditioning > Controller > Heater & A/C Control Unit(Manual) > Repair procedures

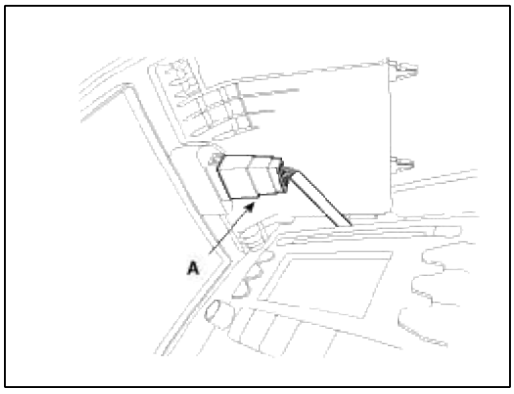
Replacement

1. Disconnect the negative (-) battery terminal.

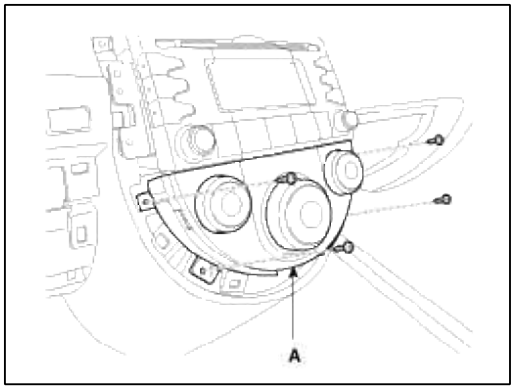
2. Use a panel/facia tool to pull the center facia panel(A).



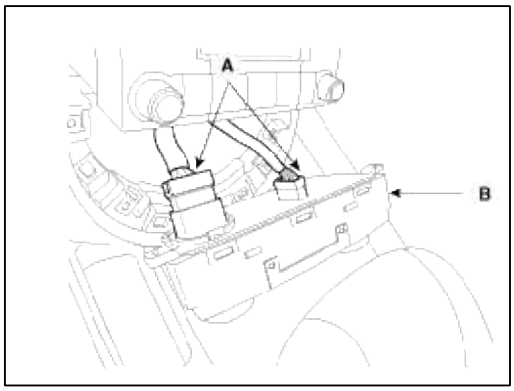
3. Disconnect the connector(A) and then remove the center facia panel.



4. Remove the heater & A/C controller (A) from center facia panel.



5. Disconnect the connector(A) and then remove the controller (B).



6. Installation is the reverse order of removal.

SOUL(AM) > 2010 > G 1.6 DOHC > Manual Transaxle System

Manual Transaxle System > General Information > Specifications

Specifications

Transaxle type		M5CF1-1
Engine type		Gasoline 1.6
Gear ratio	1st	3.615
	2nd	1.962
	3rd	1.286
	4th	0.971
	5th	0.839
	Reverse	3.545
Final gear ratio		4.267

Tightening Torques

Items	Nm	kgf.m	lb-ft
Oil drain plug	60~80	6.0~8.0	43.4~57.8
Oil filler plug	60~80	6.0~8.0	43.4~57.8
Shift control cable bracket	15~22	1.5~2.2	10.8~15.9
Roll rod support bracket bolt	50~65	5.0~6.5	36.2~47.0
Transaxle support bracket bolts	60~80	6.0~8.0	43.4~57.8

WARNING

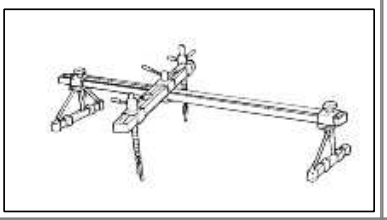
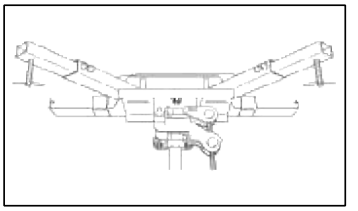
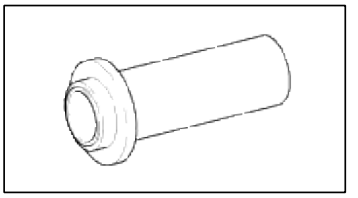
Always follow torque tightening levels. Failure to follow such levels can result in parts breaking if over-tightened or loosening if under-tightened. In either case, serious personal injury or death could result to vehicle occupants.

Lubricants

Items	Recommnend lubricant	Quantity
Transaxle gear oil	SAE 75W/85 API GL-4 TGO-7(MS517-14)	1.9ℓ(2.0US qt, 1.67lmp qt)
Air breather	MS721-38	As requried
Transaxle housing	MS721-40 or MS721-38	As requried
Surface of release fork and bearing	Grease (CASMOLY L9508)	As requried

Manual Transaxle System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09200-38001 Engine support fixture		Removal and installation of the transaxle
09624-38000 Crossmember supporter		Supporting of crossmember
09452-21200 Oil seal installer		Installation of differential oil seal

Manual Transaxle System > General Information > Troubleshooting

Troubleshooting

Symptom	Probable cause	Remedy
Vibration, noise	Loose or damaged transaxle and engine mounts	Tighten or replace mounts
	Inadequate shaft end play	Correct end play
	Worn or damaged gears	Replace gears
	Inadequate grade of oil	Replace with specified oil
	Low oil level	Replenish
	Inadequate engine idle speed	Adjust idle speed
Oil leakage	Broken or damaged, oil seal or O-ring	Replace control cable oil seal or O-ring
Hard shift	Faulty control cable	Replace control cable
	Poor contact or wear of synchronizer ring and gear cone	Correct or replace
	Inadequate grade of oil	Replace with specified oil
Jumps out of gear	Worn gear shift fork or broken poppet spring	Replace shift fork or poppet spring
	Synchronizer hub-to-sleeve spline clearance too large	Replace synchronizer hub and sleeve

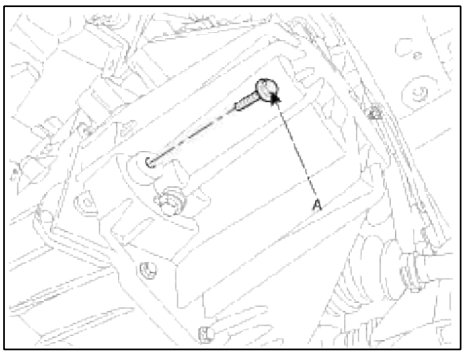
Manual Transaxle System > Manual Transaxle System > Repair procedures

Service Adjustment Procedure

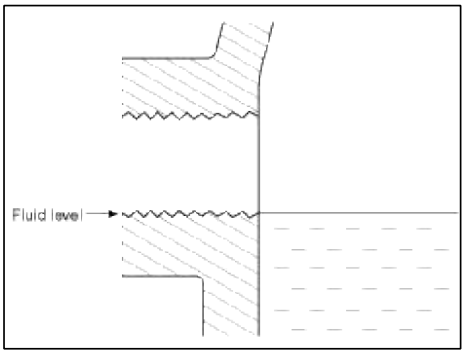
Transaxle gear oil level

Inspection
Inspect each component for evidence of leakage.
Check the gear oil level by removing the filler plug.
If the oil is contaminated, it is necessary to replace it with new oil.

1. Remove oil filler plug(A).



2. Check level with finger.
   Oil level must be up to fill the hole, if not, add oil until it runs over.

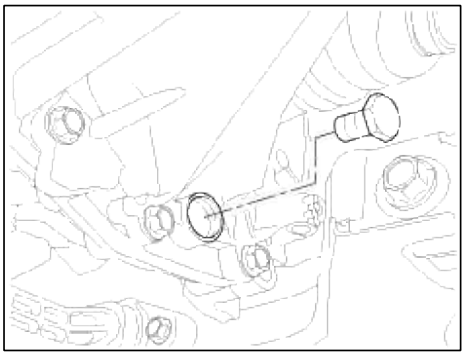


3. Install filler plug.

Tightening torque :
60~80 Nm (6.0~8.0 kgf.m, 43.4~57.8 lb-ft)

Replacement

1. With the vehicle parked on a level surface, remove the drain plug.
2. Drain the transaxle oil after loosening the drain plug (A).



3. Install the drain plug with new washer.

Tightening torque :
60~80 Nm (6.0~8.0 kgf.m, 43.4~57.8 lb-ft)

4. Add new oil through the fille plug hole and, fill it just below the plug opening.

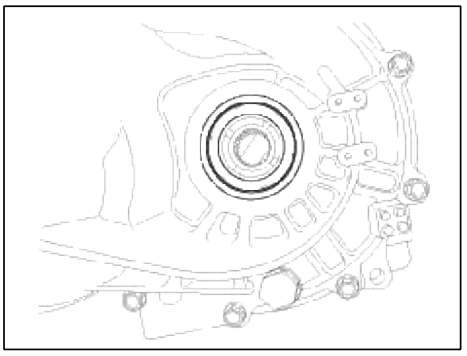
Standard oil : SAE 75W/85, API GL-4
Oil capacity : 1.9ℓ(2.0US qt, 1.67lmp qt)

Driveshaft Oilseal

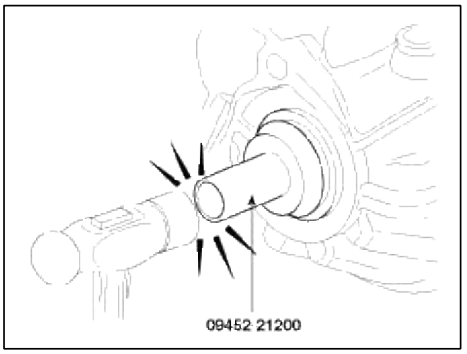
Replacement

1. Disconnect the drive shaft from the transaxle. (refer to Drive shaft in DS group)

2. Using a flat-tip screwdriver, remove the oil seal.

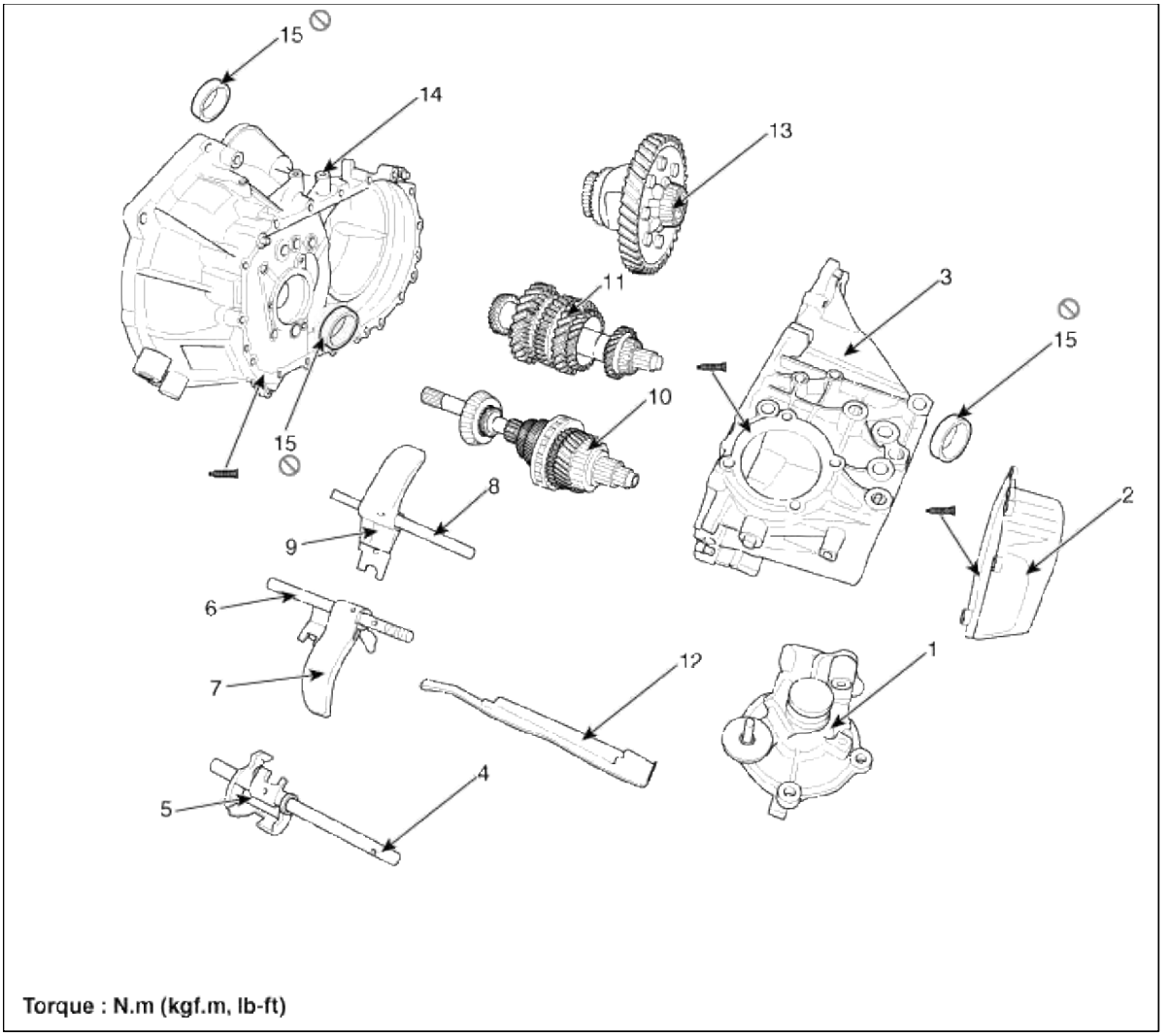


3. Using the special tool(09452-21200), tap the drive shaft oil seal into the transaxle.



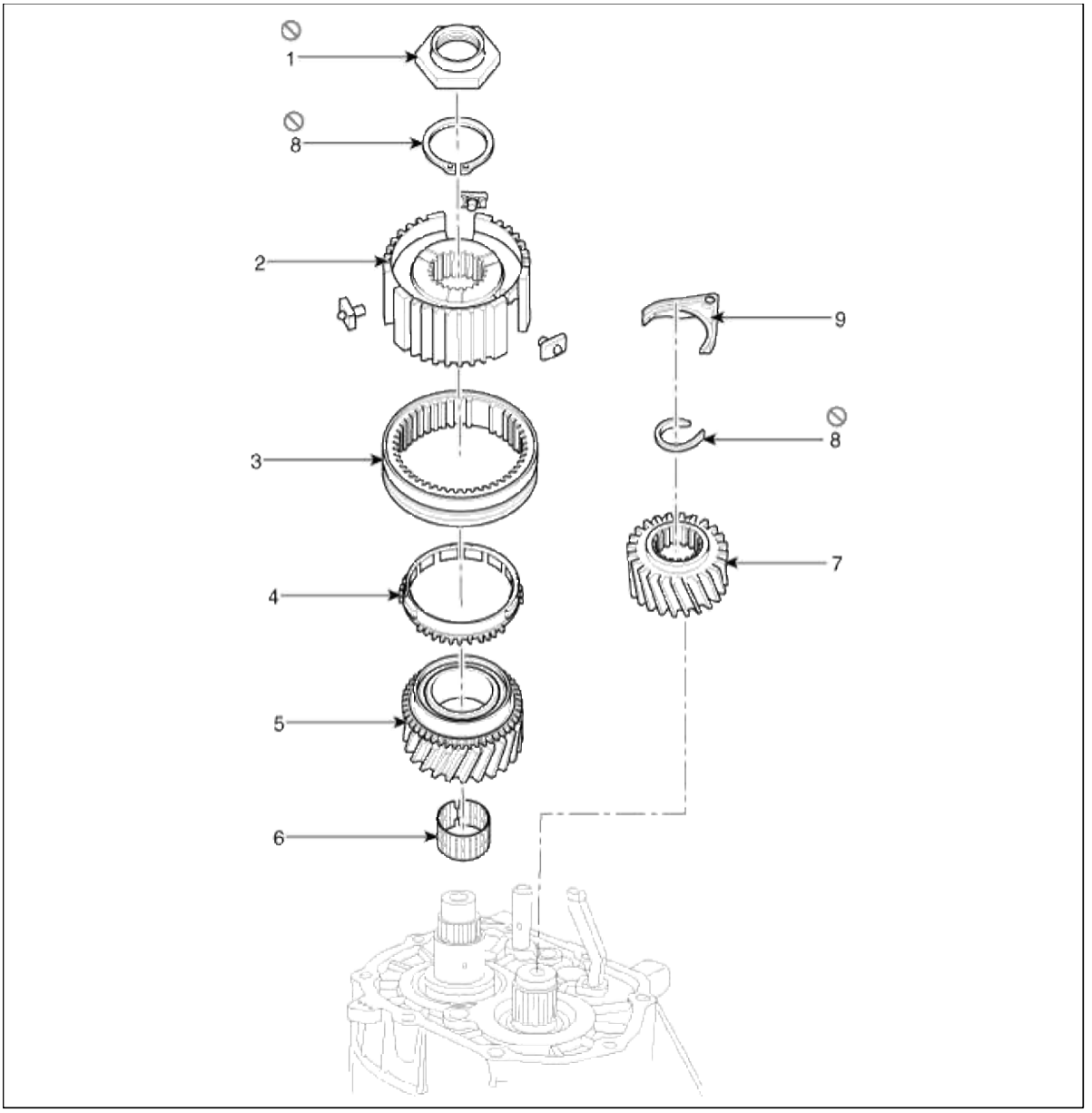
Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Components and Components Location

Components (1)



1. Control shaft complete	6. 3&4th shift rail	11. Output shaft assembly
2. Rear cover	7. 3&4th shift fork	12. Oil guide
3. Transaxle case	8. 1&2nd shift rail	13. Differential assembly
4. 5th shift rail	9. 1&2nd shift fork	14. Clutch housing
5. Reverse shift rug	10. Input shaft assembly	15. Oil seal

Components (2)



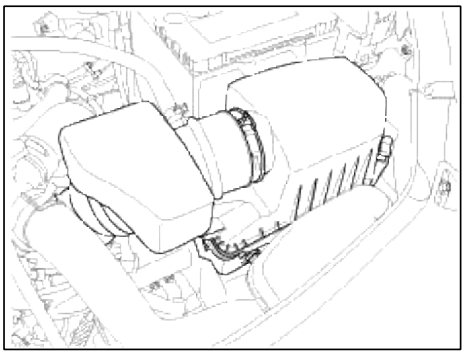
1. Lock nut 2. 5th synchronizer hub 3. 5th synchronizer sleeve 4. 5th synchronizer ring 5. 5th gear (input)	6. Needle roller bearing 7. 5th gear (output) 8. Snap ring 9. 5th shift fork

Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Repair procedures

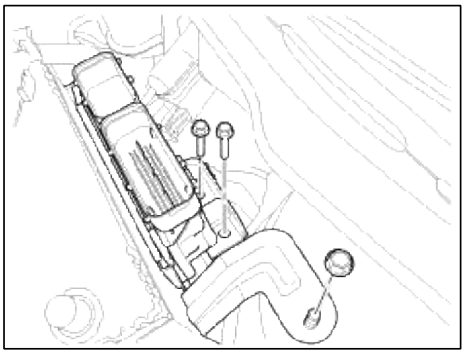
Removal

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

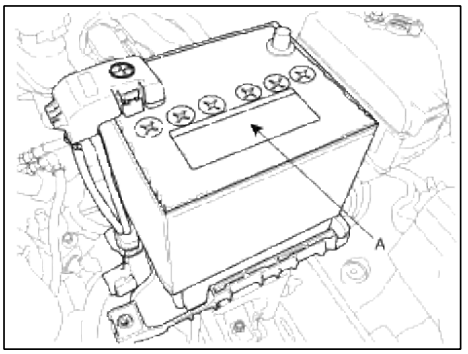
1. Remove the air cleaner assembly and the intake hose by removing the bolts and the clamps.



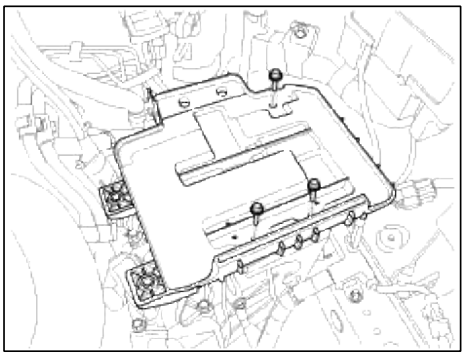
2. Remove the ECU by removing the bolts(2ea) and a nut.



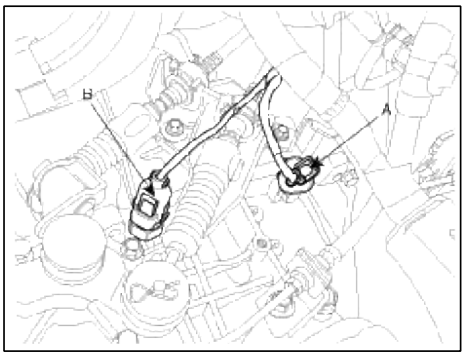
3. Remove the battery (A).



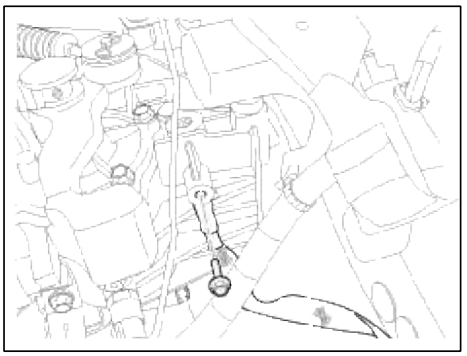
4. Remove the battery tray by removing the bolts(3ea).



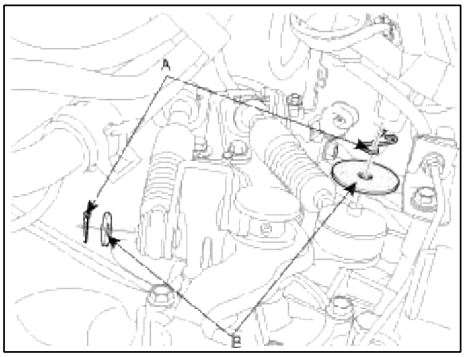
5. Disconnect the vehicle speed sensor connector (A) and the back lamp switch connector (B).



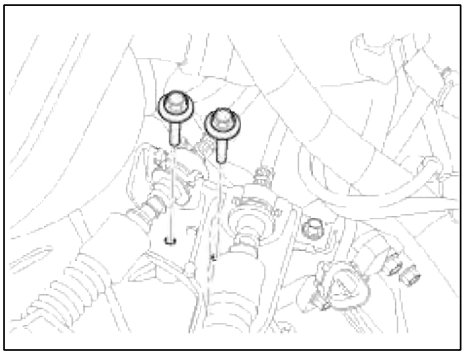
6. Remove the ground wire by removing a bolt.



7. Remove the snap pins (A) and clips (B).

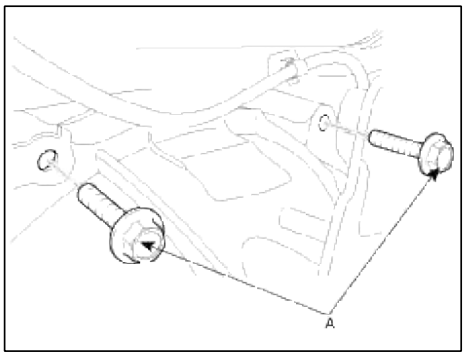


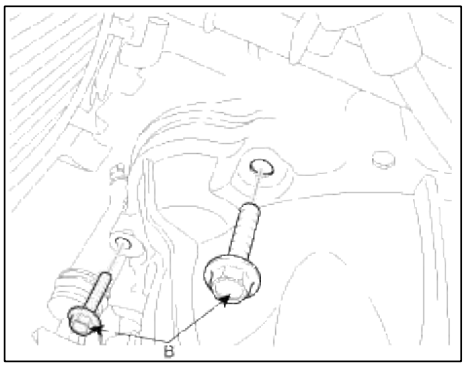
8. Remove the control cable bracket by removing bolts(3ea).



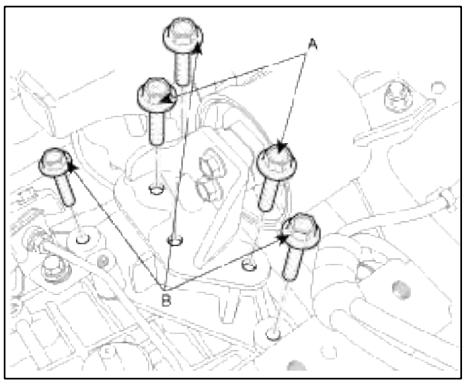
9. Using the special tool (09200-38001), support the engine assembly safely.

10. Remove the transaxle upper mounting bolts (A-2ea) and the starter motor mounting bolts (B-2ea).

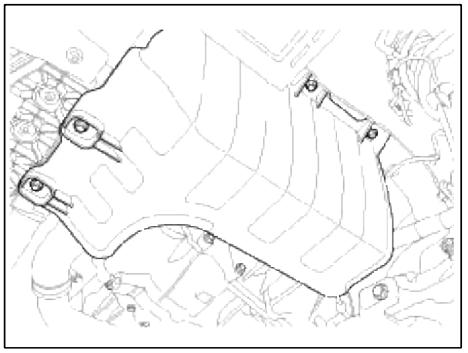




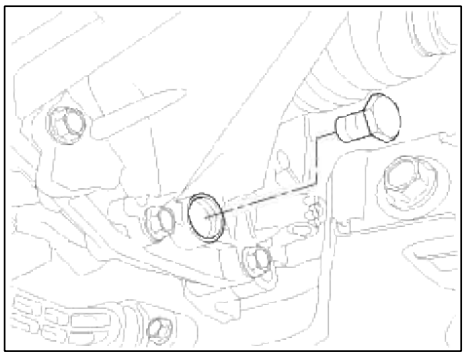
11. Remove the transaxle support bracket bolts (A-3ea,B-3ea).



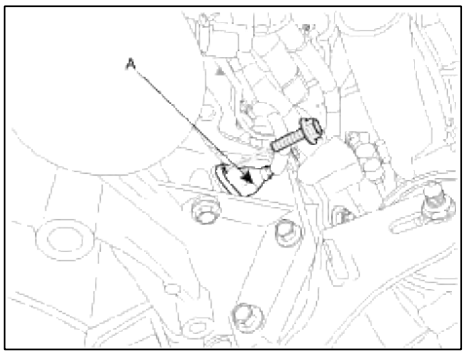
12. Lifting up the vehicle.
13. Remove the front wheels and tires.
14. Remove the lower arm ball joint mounting nut and the stabilizer link mounting nut from the front knuckles. (refer to Front suspension system in SS group)
15. Remove the under shield cover.



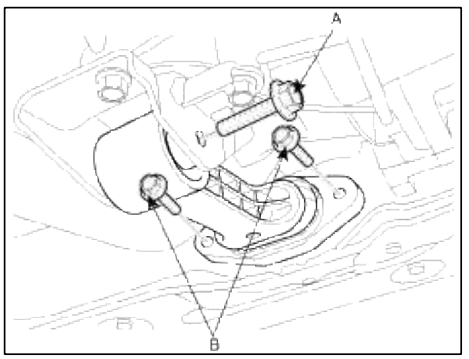
16. Drain the transalxe fluid by removing the drain plug.



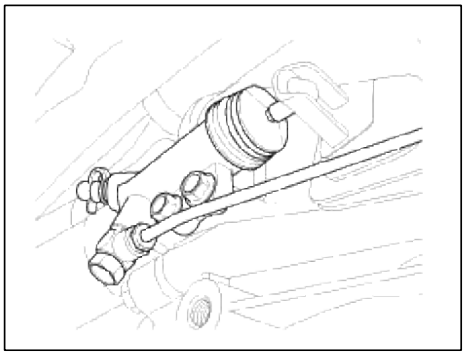
17. Disconnect the drive shafts from the transaxle. (refer to Front Driveshaft in DS group)
18. Remove the CKP sensor (A) by removing a bolt.



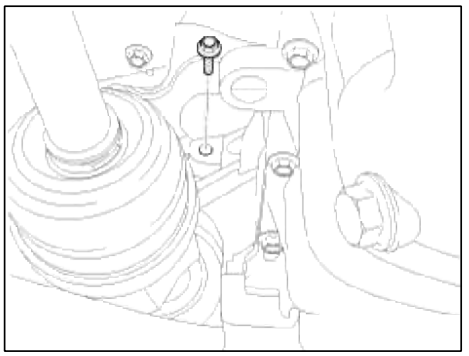
19. Remove the roll stopper bracket by removing bolts(A-1ea,B-2ea).



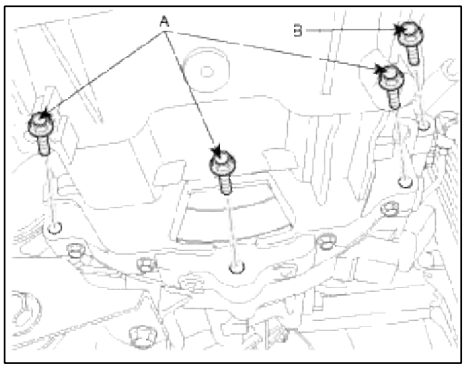
20. Remove the clutch release cylinder assembly.



21. Remove the bolt left in the engine side.



22. Supporting the transaxle with a jack, remove the transaxle lower mounting bolts(A-3ea, B-1ea).

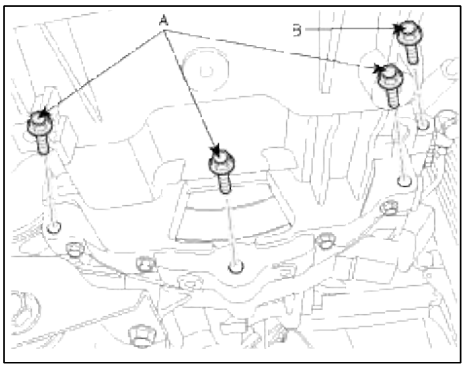


23. Lowering the jack slowly, remove the transaxle.

Installation

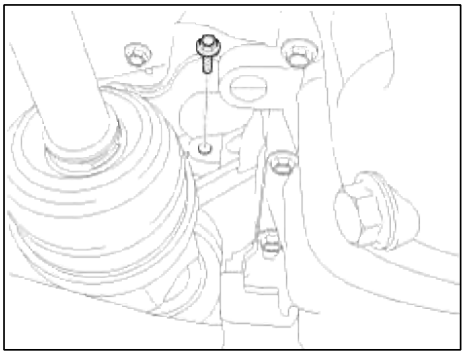
1. Install the transaxle lower mounting bolts (A-3ea,B-1ea) after fitting the transaxle assembly into the engine assembly.

Tightening torque :
[A] 35~50 Nm (3.5~5.0 kgf.m, 25.3~36.2 lb-ft)
[B] 43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)



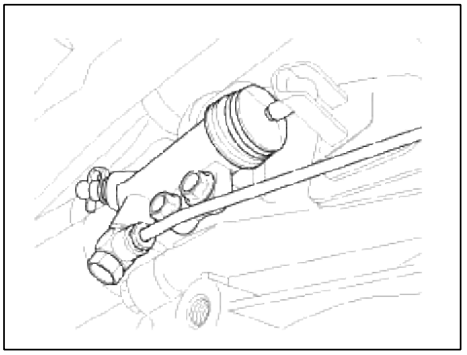
2. Install the bolt left in the engine side.

Tightening torque :
43~55 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)



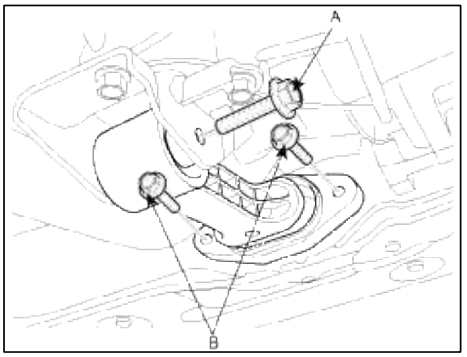
3. Install the clutch release cylinder assembly.

Tightening torque :
15~22 Nm (1.5~2.2 kgf.m, 10.8~15.9 lb-ft)

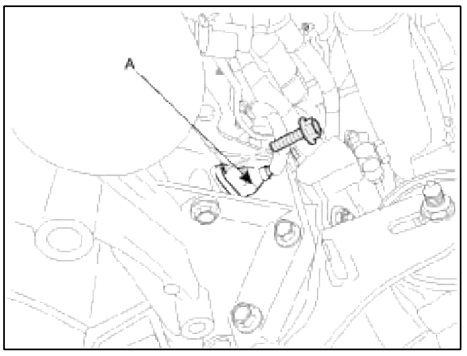


4. Install the roll stopper bracket by installing bolts(A-1ea,B-2ea).

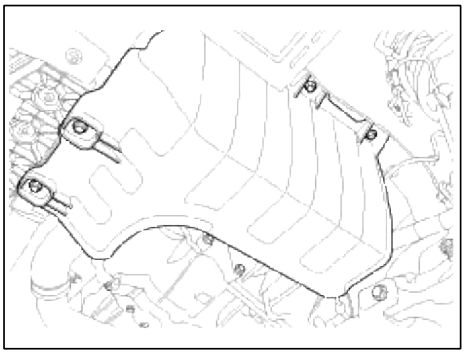
Tightening torque :
[A] 90~110 Nm (9~11 kgf.m, 65~79 lb-ft)
[B] 50~65 Nm (5.0~6.5 kgf.m, 36.2~47.0 lb-ft)



5. Install the CKP sensor (A) by installing a bolt.

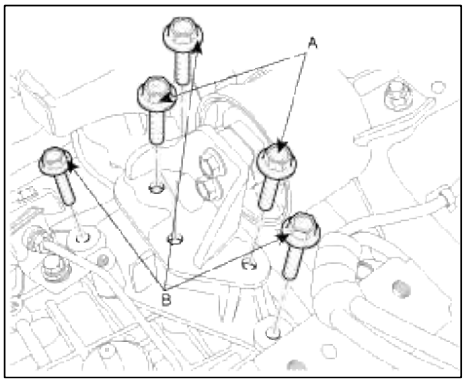


6. Connect the drive shafts to the transaxle. (refer to Front Driveshaft in DS group)
7. Refill the transaxle fluid through the filler hole. (refer to Service Adjustment Procedure)
8. Install the under shield cover.



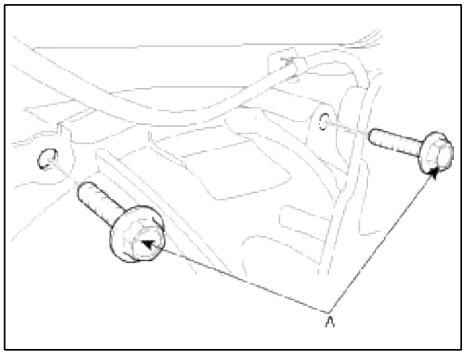
9. Install the lower arm ball joint mounting nut and the stabilizer link mounting nut to the front knuckles. (refer to Front suspension system in SS group)
10. Install the front wheels and tires. (refer to installation in SS group)
11. Install the transaxle support bracket bolts (A-3ea,B-3ea).

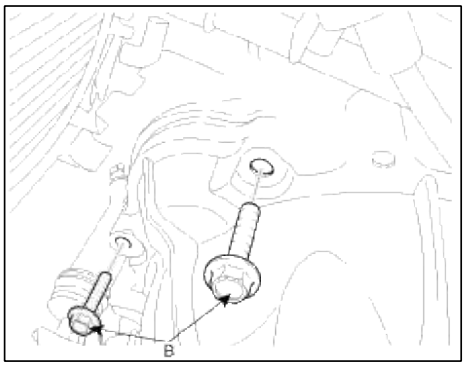
Tightening torque :
[A] 70~95 Nm (7.0~9.5 kgf.m, 50.6~68.7 lb-ft)
[B] 60~80 Nm (6.0~8.0 kgf.m, 43.4~57.9 lb-ft)



12. Install the transaxle upper mounting bolts (A-2ea) the starter motor mounting bolts (B-2ea).

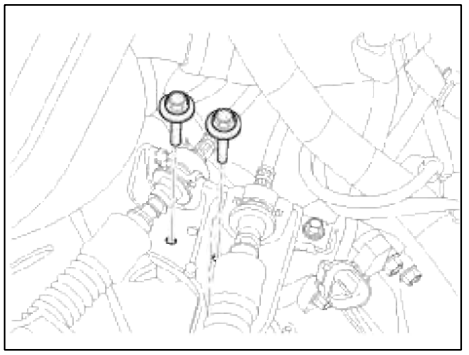
Tightening torque :
[A] 60~80 Nm (6.0~8.0 kgf.m, 43.4~57.9 lb-ft)
[B] 39~60 Nm (3.9~6.0 kgf.m, 28.2~43.4 lb-ft)



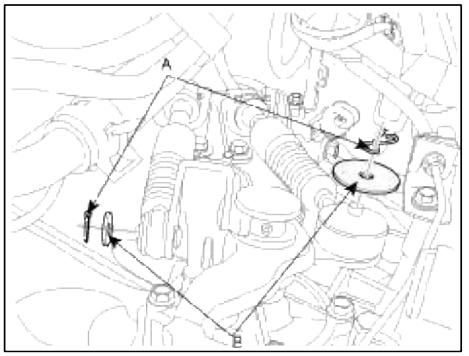


13. Put aside the engine support fixture (09200-38001).
14. Install the control cable bracket by installing bolts(3ea).

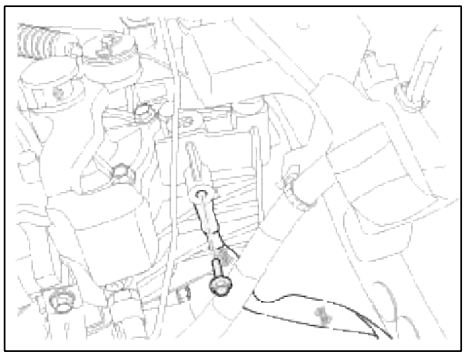
Tightening torque :
15~22 Nm (1.5~2.2 kgf.m, 10.8~15.9 lb-ft)



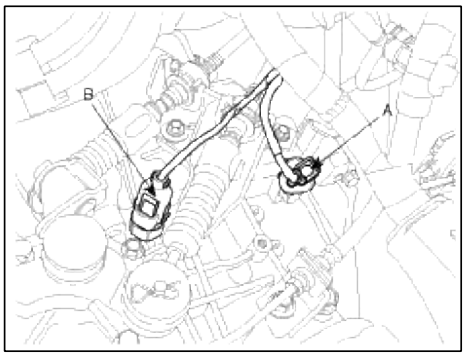
15. Install the clips (B) and pins (A).



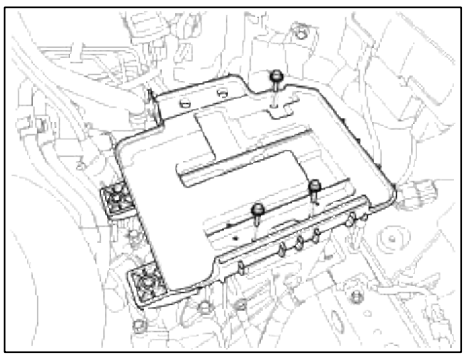
16. Install the ground wire by installing a bolt.



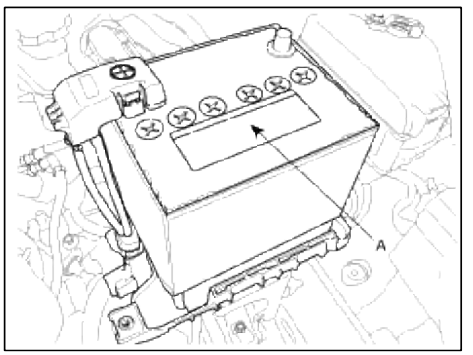
17. Connect the vehicle speed sensor connector (A) and the back lamp switch connector (B).



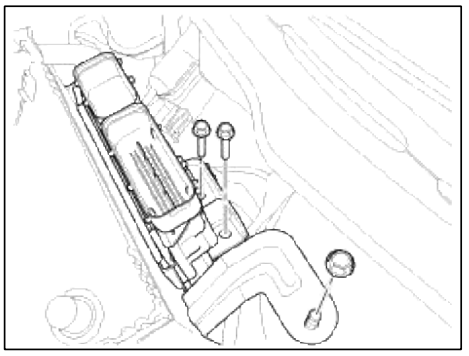
18. Install the battery tray by installing the bolts(3ea).



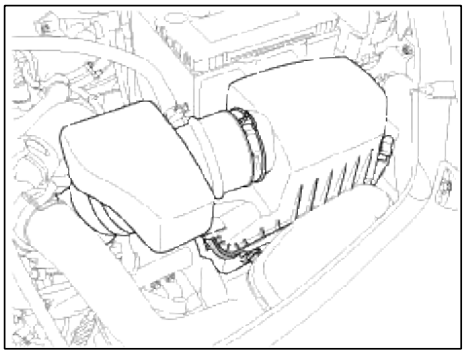
19. Install the battery (A).



20. Install the ECU by installing the bolts(2ea) and a nut.

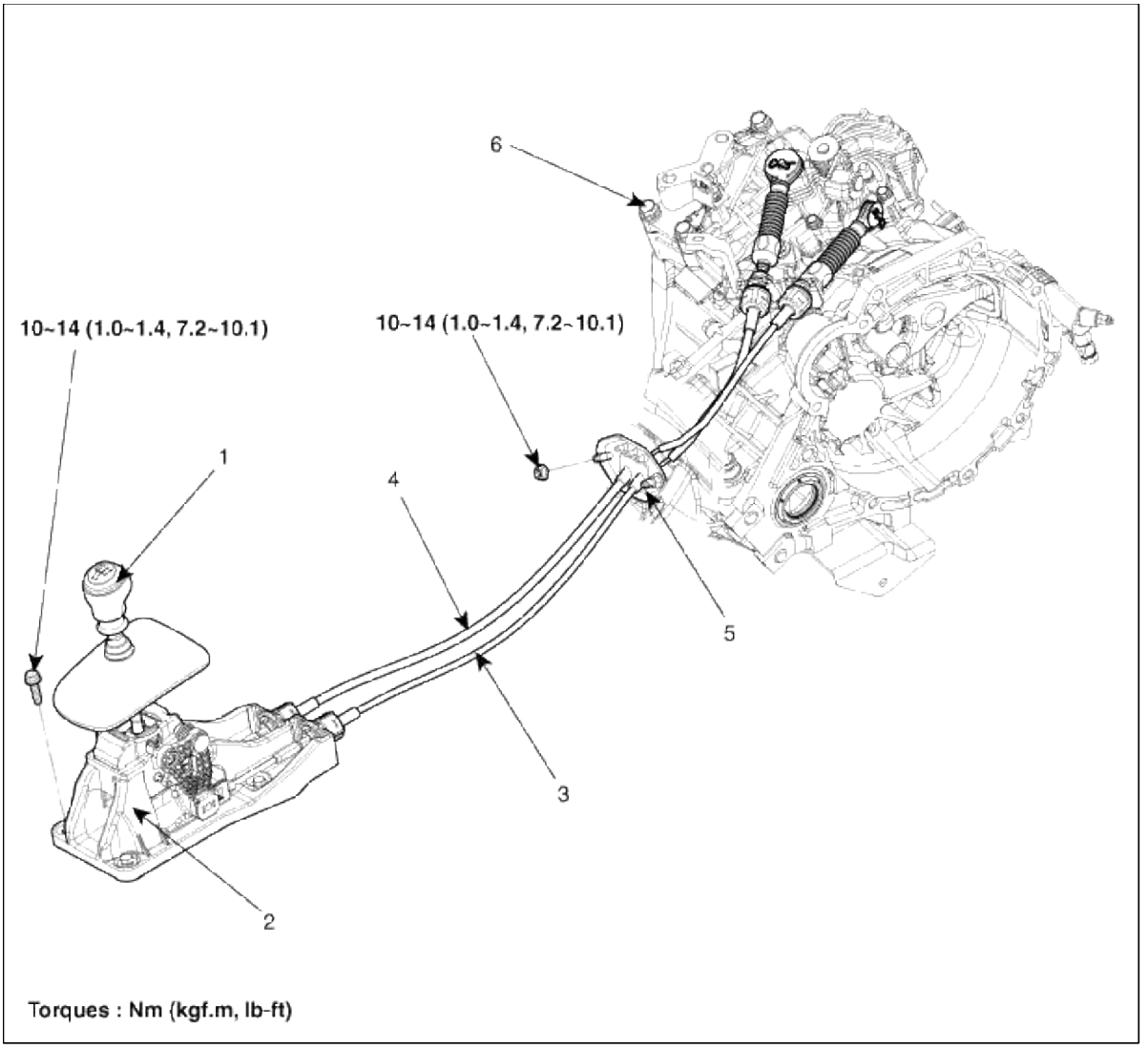


21. Install the air cleaner assembly and the intake hose by installing the bolts and the clamps.



Manual Transaxle System > Manual Transaxle Control System > Shift Lever > Components and Components Location

Components

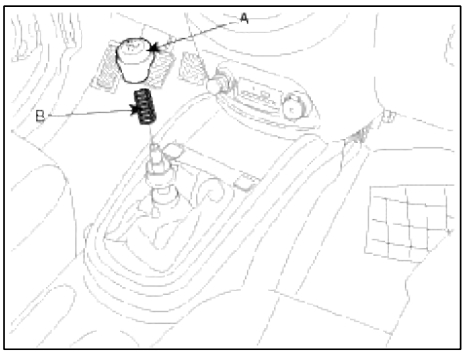


1. Shift lever knob 2. Shift lever assembly 3. Select cable assembly	4. Shift cable assembly 5. Retainer 6. Manual transaxle assembly

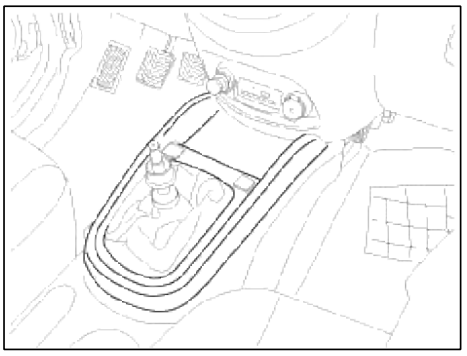
Manual Transaxle System > Manual Transaxle Control System > Shift Lever > Repair procedures

Removal

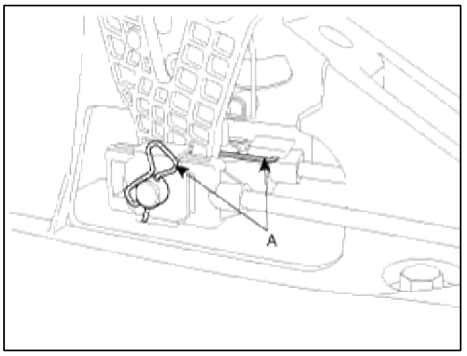
1. Remove the shift lever knob (A) by turning the knob, the spring (B).



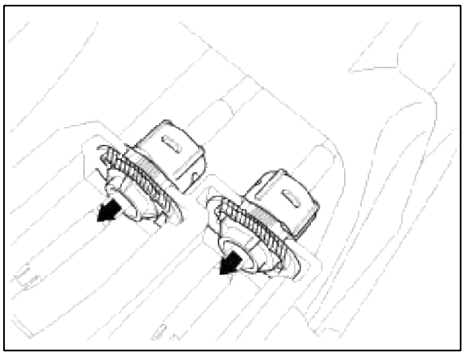
2. Remove the shift boot.



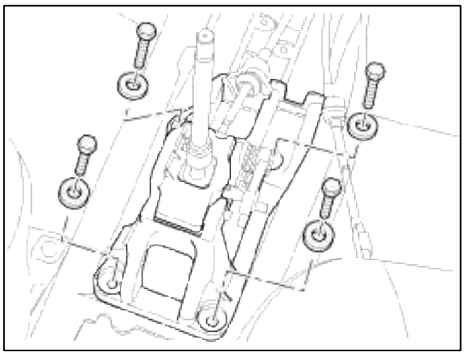
3. Remove the center console.(refer to Console in BD group)
4. Remove the snap pin (A) and remove the select cable assembly.



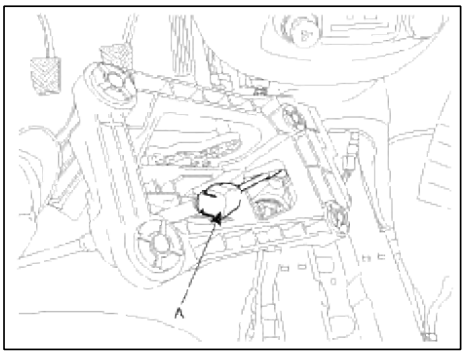
5. Remove the cable assembly by pulling the marking parts.



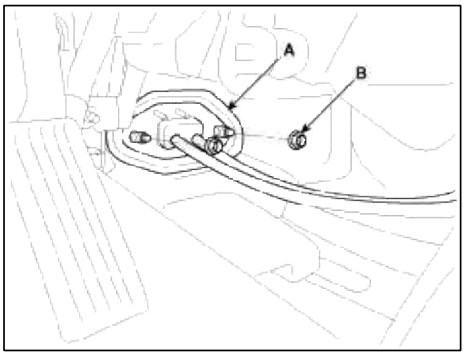
6. Remove the shift lever assembly by removing the bolts (4ea).



7. Remove the shift cable assembly (A) by loosening the clip.



8. Remove the retainer (A) and nuts (B).



9. Remove the select and shift cable assembly from the transaxle. (refer to Manual Transaxle removal).

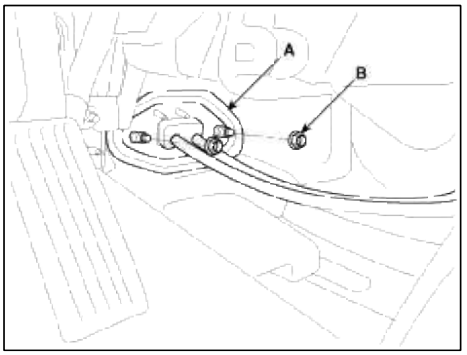
Inspection

1. Check the select cable for proper operation and for damage.
2. Check the shift cable for proper operation and for damage.
3. Check the boots for damage.
4. Check the boots for wear abrasion sticking, restricted movement or damage.
5. Check for the weak or damaged spring.

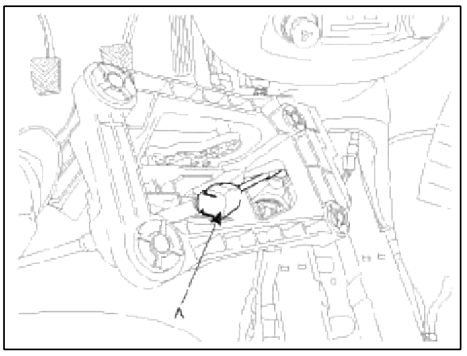
Installation

1. Install the cable assembly placing the select and shift lever in neutral position. (Refer to Transaxle installation).
2. Install the retainer (A) and nuts (B).

Tightening torque :
10~14Nm (1.0~1.4kgf.m, 7.2~10.1lb-ft)

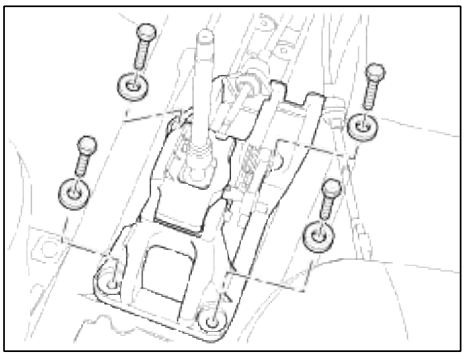


3. Install the shift cable with the clip (A) to the shift lever.

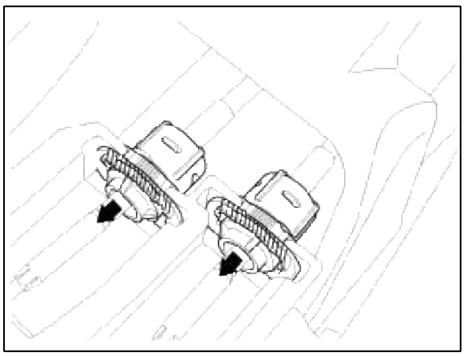


4. Install the shift lever assembly by installing the bolts (4ea).

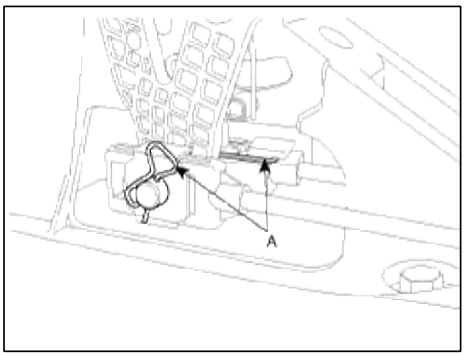
Tightening torque :
10~14Nm (1.0~1.4kgf.m, 7.2~10.1lb-ft)



5. Install the cable with the clip to the shift lever.

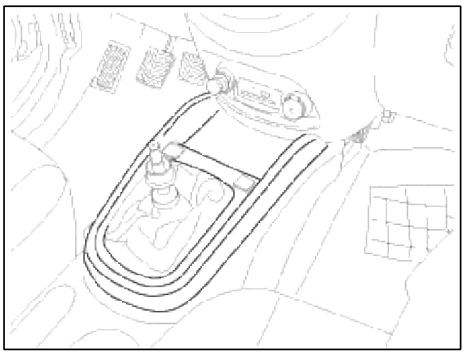


6. Install the snap pin (A) to hold the select cable assembly.

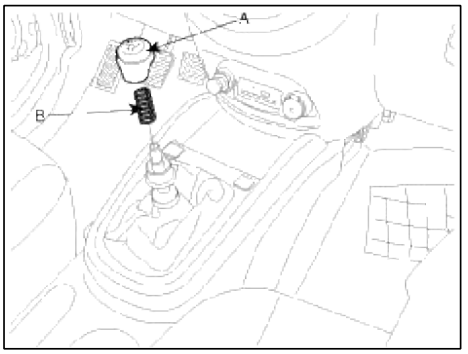


7. Install the center console. (Refer to Console in BD group)

8. Install the shift boot.



9. Install the spring(B) and the shift lever knob (A) by turning the knob.



Manual Transaxle System > Manual Transaxle Control System > Back-up Lamp Switch > Description and Operation

Description

Back up lamp switch is pushed by the reverse lug sliding when shifting reverse, and switches the back up lamp.

Manual Transaxle System > Manual Transaxle Control System > Back-up Lamp Switch > Specifications

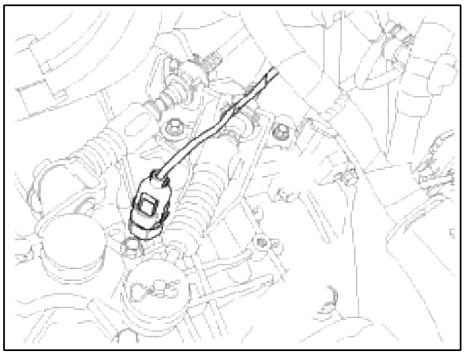
Specificaitons

1. Current voltage : 12V
2. Working voltage : 10~15V
3. Operating force : 1.0 kg +0.2kg Max. (at 2mm stroke position)
4. Voltage drop : Max 0.15V with rated load before test, Max 0.24V with rated load after test
5. Working temperature : -30°C ~ 80°C

Manual Transaxle System > Manual Transaxle Control System > Back-up Lamp Switch > Repair procedures

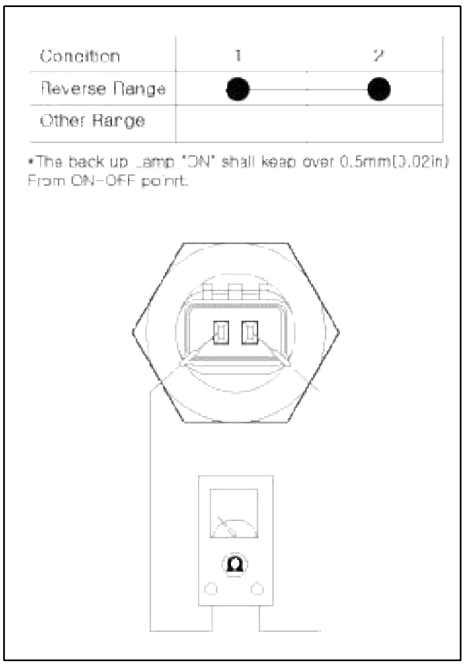
Inspection

1. Disconnect the back up lamp switch connector.



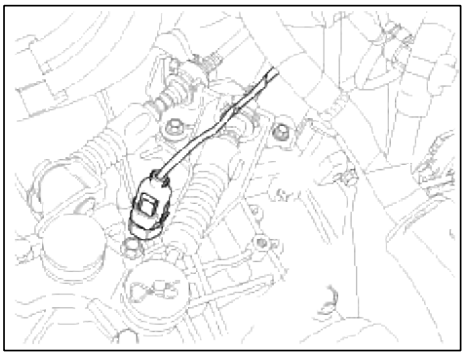
2. Check the continuity between no. 1 and 2 terminals of backup lamp switch.
   When the shift lever is in reverse, there should be contunuity.

3. If necessary, repair or replace the backup lamp switch.



Replacement

1. Disconnect the back up lamp switch connector.



2. Remove the back up lamp switch.
3. Install new back up lamp switch, then connect the connector.

Tightening torque :
30~35 Nm (3.0~3.5 kgf.m, 21.7~25.3 lb-ft)

SOUL(AM) > 2010 > G 1.6 DOHC > Restraint

Restraint > General Information > General Information

General

The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger, side airbag and belt pretensioner in certain frontal or side collisions.

The SRS (Airbag) consists of ; a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit ; side airbag modules located in the front seat contain the folded cushion and an inflator unit ; curtain airbag modules located inside of the headliner which contains folded cushions and inflator units. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measure the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

SRSCM (SRS Control Module)

SRSCM will detect front impact with front impact sensor, and side impact with side impact sensor, and determine airbag module deployment.

1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provide ignition voltage for 2 front airbag ignition circuits and the internal operation voltage of the SRSCM. If the internal operation voltage is below critical value setting, it will perform resetting.
2. Back up power supply: SRSCM has separate back up power supply, that will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
3. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure while vehicle power supply is on, system failure may be checked with trouble codes using scan tool. (Hi- Scan)
4. Airbag warning lamp on: Upon detecting error, the module will transmit signal to SRSCM indicator lamp located at cluster. MIL lamp will indicate driver SRS error. Upon ignition key on, SRS lamp will turn on for about six seconds.
5. Trouble code registration: Upon error occurrence in system, SRSCM will store DTC corresponding to the error. DTC can be cleared only by Hi-Scan. However, if an internal fault code is logged or if a crash is recorded the fault clearing should not happen.
6. Self diagnostic connector: Data stored in SRSCM memory will be output to Hi-Scan or other external output devices through connector located below driver side crash pad.
7. Once airbag is deployed, SRSCM should not be used again but replaced.

Restraint > General Information > Specifications

Specification

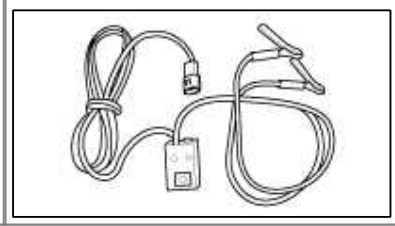
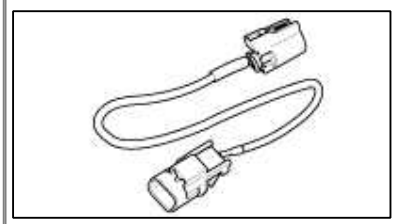
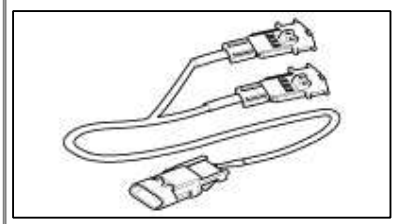
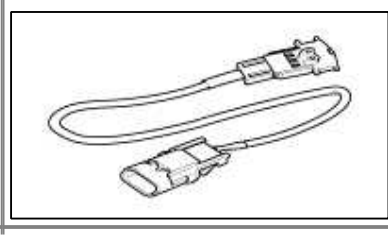
Item	Resistance (Ω)
Driver Airbag (DAB)	1.6 ~ 6.0
Passenger Airbag (PAB)	1.6 ~ 6.0
Side Airbag (SAB)	1.6 ~ 6.0
Curtain Airbag (CAB)	1.6 ~ 6.0
Seat Belt Pretensioner (BPT)	1.6 ~ 6.0

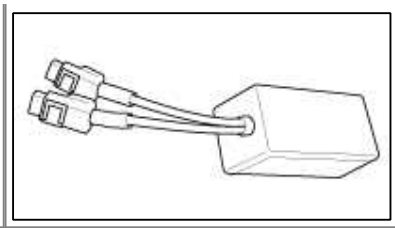
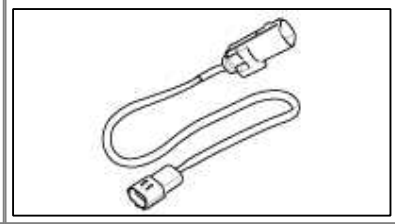
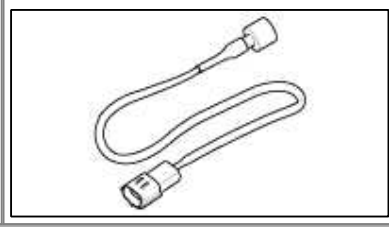
Tightening Torques

Item	Nm	kgf.m	lb-ft
Driver Airbag (DAB)	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0
Passenger Airbag (PAB)	7.8 ~ 8.8	0.8 ~ 0.9	5.8 ~ 6.5
Curtain Airbag (CAB)	10.8 ~ 14.7	1.1 ~ 1.5	8.0 ~ 10.8
Side Airbag (SAB)	5.9 ~ 7.8	0.6 ~ 0.8	4.3 ~ 5.8
SRSCM	7.8 ~ 9.8	0.8 ~ 1.0	5.7 ~ 7.3
Front Impact Sensor (FIS) Mounting nut	7.8 ~ 9.8	0.8 ~ 1.0	5.7 ~ 7.3
Side Impact Sensor (SIS) Mounting Bolt	7.8 ~ 9.8	0.8 ~ 1.0	5.7 ~ 7.3

Restraint > General Information > Special Service Tools

Special Service Tools

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-3F100		Use with deployment tool. (SAB)
Deployment adapter 0957A-38510		Use with deployment tool. (DAB, PAB)
Deployment adapter 0957A-38500		Use with deployment tool. (CAB, BPT)

Dummy 0957A-38200		Simulator to check the resistanceof each wiring harness
Dummy adapter 0957A-3F000		Use with dummy (SAB)
Dummy adapter 0957A-2G000		Use with dummy (DAB, PAB, CAB, BPT)

DAB : Driver Airbag
PAB : Passenger Airbag
SAB : Side Airbag
CAB : Curtain Airbag
BPT : Seat Belt Pretensioner

Restraint > General Information > General Safety Information and Caution

Precautions

General Precautions

Please read the following precautions carefully before performing the airbag system service.
Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

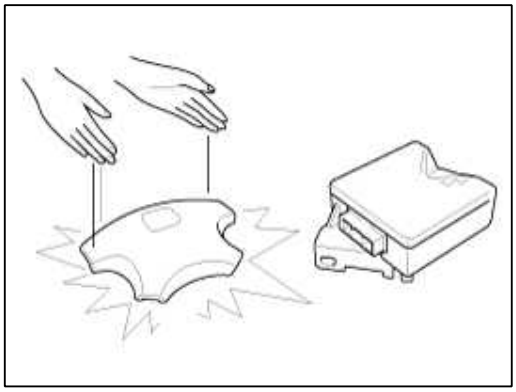
- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

NOTE

The contents in the memory are not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality. Do not install used SRS parts from another vehicle. Use only new parts when making SRS repairs.

- Carefully inspect any SRS part before you install it. Do not install any part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.



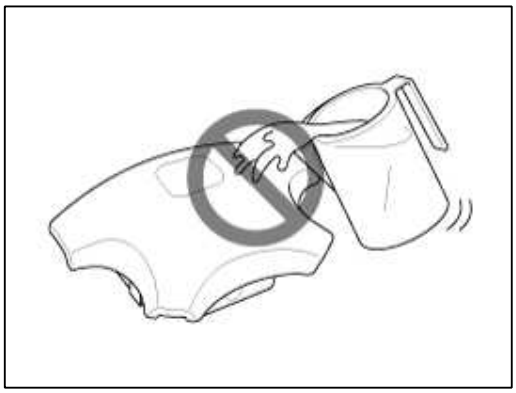
- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

Airbag Handling and Storage

Do not disassemble the airbags; it has no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.

For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.



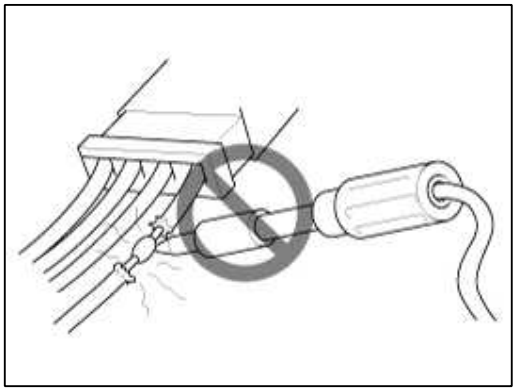
- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85 C/185 F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRS unit or the side impact sensors or front impact sensors whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
- During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRS unit and the side impact sensor and the front impact sensors. The airbags could accidentally deploy and cause damage or injury.
- Replace the front airbag module, SRSCM, FIS when deploying the front airbag. Replace the airbag wiring when the airbag wiring get damaged. Replace the side airbag module, the curtain airbag module, SRSCM, SIS when deploying the side airbag. Replace the airbag when the airbag wiring get damaged.
- After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRS unit and the side impact sensors. If there is any damage, replace the SRS unit, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRS unit, the front impact sensor or the side impact sensors.
- Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRS unit.

- Be sure the SRS unit, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
- Do not spill water or oil on the SRS unit, or the front impact sensor or the side impact sensors and keep them away from dust.
- Store the SRS unit, the front impact sensor and the side impact sensors in a cool (15 ~ 25 C/ 59 ~ 77 F) and dry (30 ~ 80% relative humidity, no moisture) area.

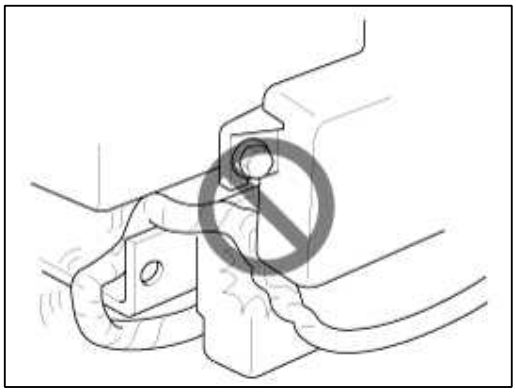
Wiring Precautions

SRS wiring can be identified by special yellow outer covering. Observe the instructions described in this section.

- Never attempt to modify, splice, or repair SRS wiring. If there is an open or damage in SRS wiring, replace the harness.



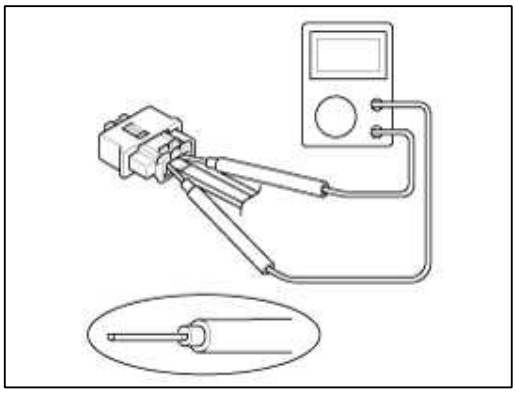
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- Make sure all SRS ground locations are clean, and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

Precautions for Electrical Inspections

- When using electrical test equipment, insert the probe of the tester into the wire side of the connector. Do not insert the probe of the tester into the terminal side of the connector, and do not tamper with the connector.



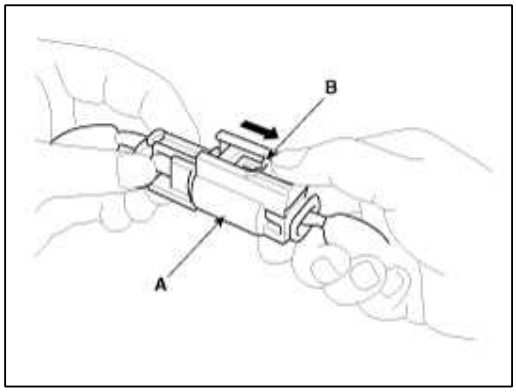
- Use a u-shaped probe. Do not insert the probe forcibly.

- Use specified service connectors for troubleshooting.
  Using improper tools could cause an error in inspection due to poor metal contact.

Spring-laded Lock Connector
Some SRS system connectors have a spring-loaded lock.
Airbag Connector

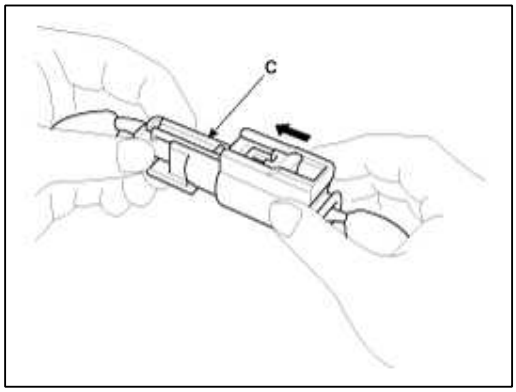
Disconnecting

To release the lock, pull the spring-loaded sleeve (A) and he slider (B), while holding the opposite half of the connector.
Pull the connector halves apart. Be sure to pull on the sleeve and not on the connector half.



Connecting

Hold both connector halves and press firmly until the projection(C) of the sleeve-side connector clicks to lock.



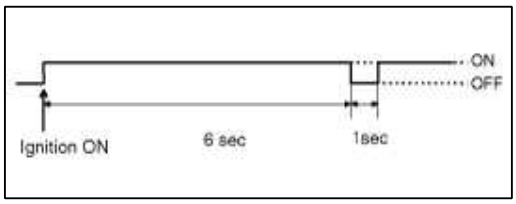
Restraint > General Information > Description and Operation

Warning Lamp Activation

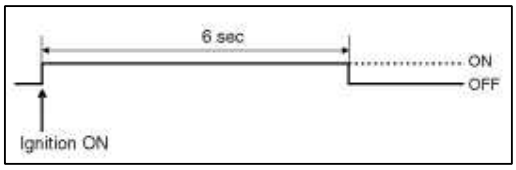
Warning lamp behavior after ignition ON

As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.
The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward.
However, in order to indicate the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.
If the variant coding is not performed, the airbag warning lamp is periodically blinking (ON: 0.5sec., OFF: 0.5sec.).
If the variant coding is normally performed, the airbag warning lamp normally operates.

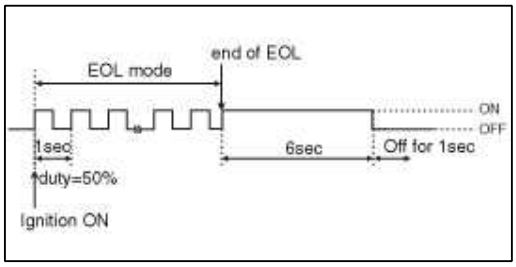
1. Active fault or historical fault counter is greater or equal to 10



2. Normal or historical fault counter is less than 10.



3. SRSCM Variant Coding not performed.



SRSCM Independent warning lamp activation

There are certain fault conditions in which the SRSCM cannot function and thus cannot control the operation of the standard warning lamp. In these cases, the standard warning lamp is directly activated by appropriate circuitry that operates independently of the SRSCM. These cases are:

1. Loss of battery supply to the SRSCM : warning lamp turned on continuously.
2. Loss of internal operating voltage : warning lamp turned on continuously.
3. Loss of Microprocessor operation : warning lamp turned on continuously.
4. SRSCM not connected : warning lamp turned on continuously through the shorting bar.

Telltale Lamp Activation

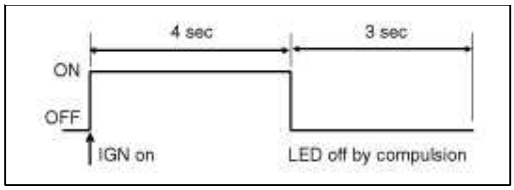
The Telltale Lamp indicates the Passenger Airbag(PAB) enabled and disabled status based on occupant status of passenger seat. If the passenger seat is empty or occupied with infant or child restraint system with 1 year old child, the Passenger Airbag is disabled and the Telltale Lamp is turned ON to inform the driver that the PAB is disabled. As soon as operating voltage is applied to the SRSCM ignition input, the SRSCM activates telltale lamp turn.

Occupant status information and telltale ststus are as below table.

Occupant Status	Telltale Lamp	PAB
Empty	ON	Disabled
Infant or Child restraint system with 1 year old	ON	Disabled
Adult or Child age 12 and over*1	OFF	Enabled
Defect	OFF	Enabled

*1) When a smaller child than the same agesits in the front passenger seat, the system may recognize him/her as an infant depending on his/her physique or posture.

After ignition on, telltale lamp will turn on for 4 seconds and turn off for 3 seconds during the initialization phase and be turned off afterward until receipt of first valid suppression message from OCS system.



Restraint > General Information > Repair procedures

Component Replacement after Deployment

NOTE

Before doing any SRS repairs, use the GDS to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Front impact sensors
- SRS wiring harnesses
- Inspect the clock spring for heat damage.
  If any damage found, replace the clock spring.

When the side/curtain airbag(s) deployed after a collision, replace the following items.

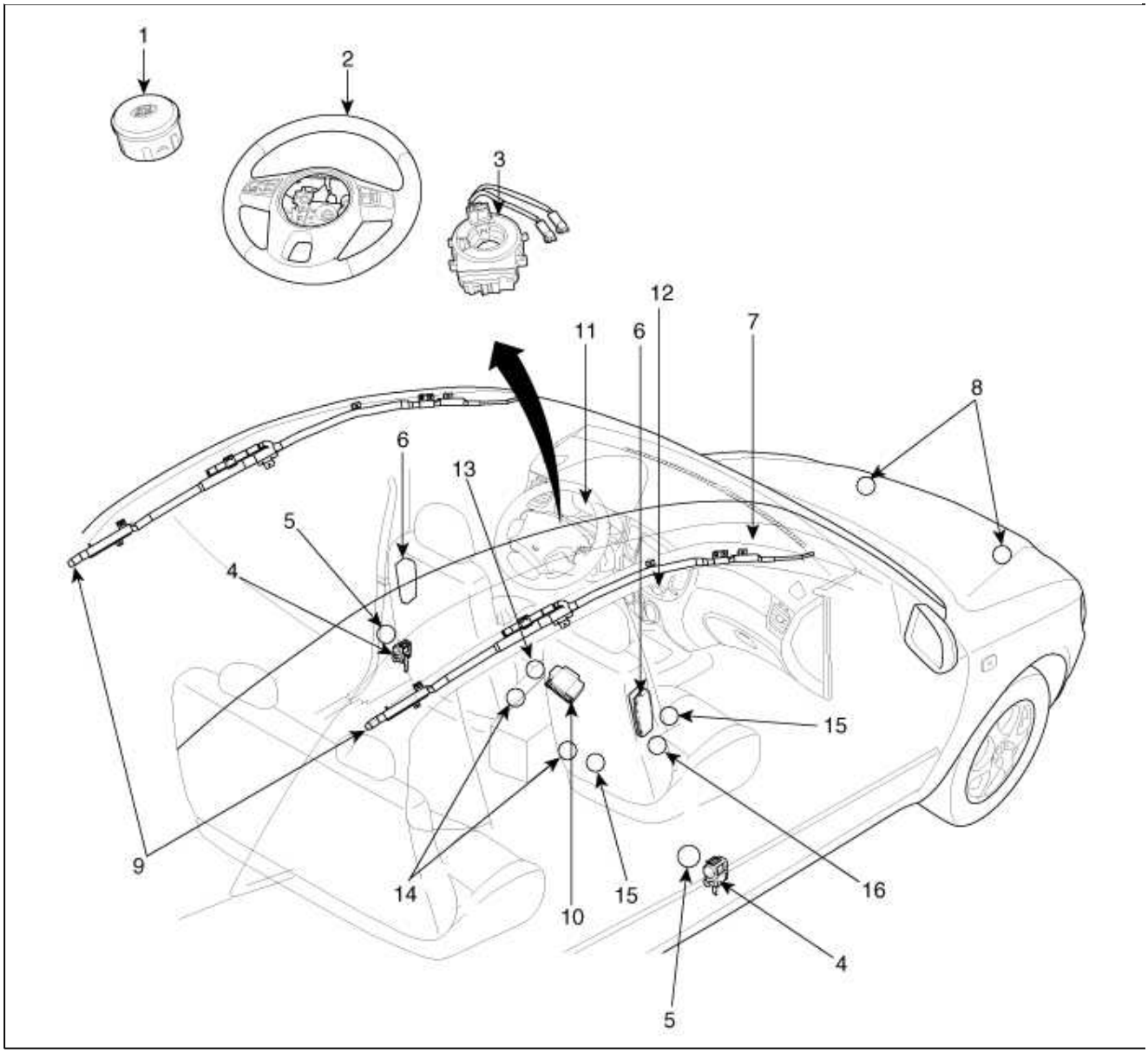
- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

After the vehicle is completely repaired, confirm the SRS airbag system is OK.

- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

Restraint > General Information > Components and Components Location

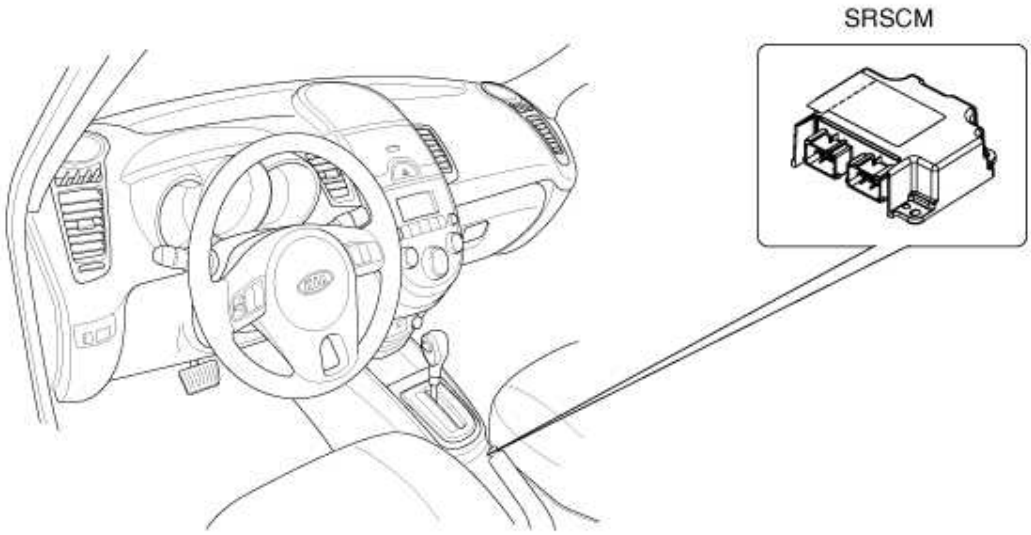
Components



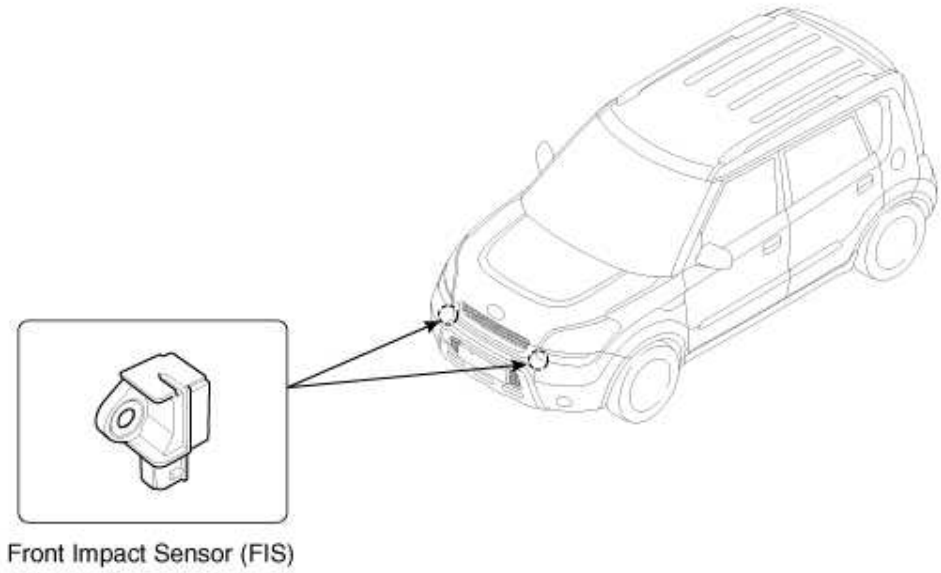
1. Driver Airbag (DAB) 2. Steering Wheel 3. Clock Spring 4. Seat Belt Pretensioner (BPT) 5. Side Impact Sensor (SIS) 6. Side Airbag (SAB) 7. Passenger Airbag (PAB) 8. Front Impact Sensor (FIS)	9. Curtain Airbag (CAB) 10. Supplemental Restraint System Control Module(SRSCM) 11. Airbag Warning Lamp 12. Telltale Lamp 13. Seat Track Position Sensor(STPS) 14. Seat Belt Buckle Switch 15. Weight Sensor 16. Weight Classification System(WCS) Module

Components Location

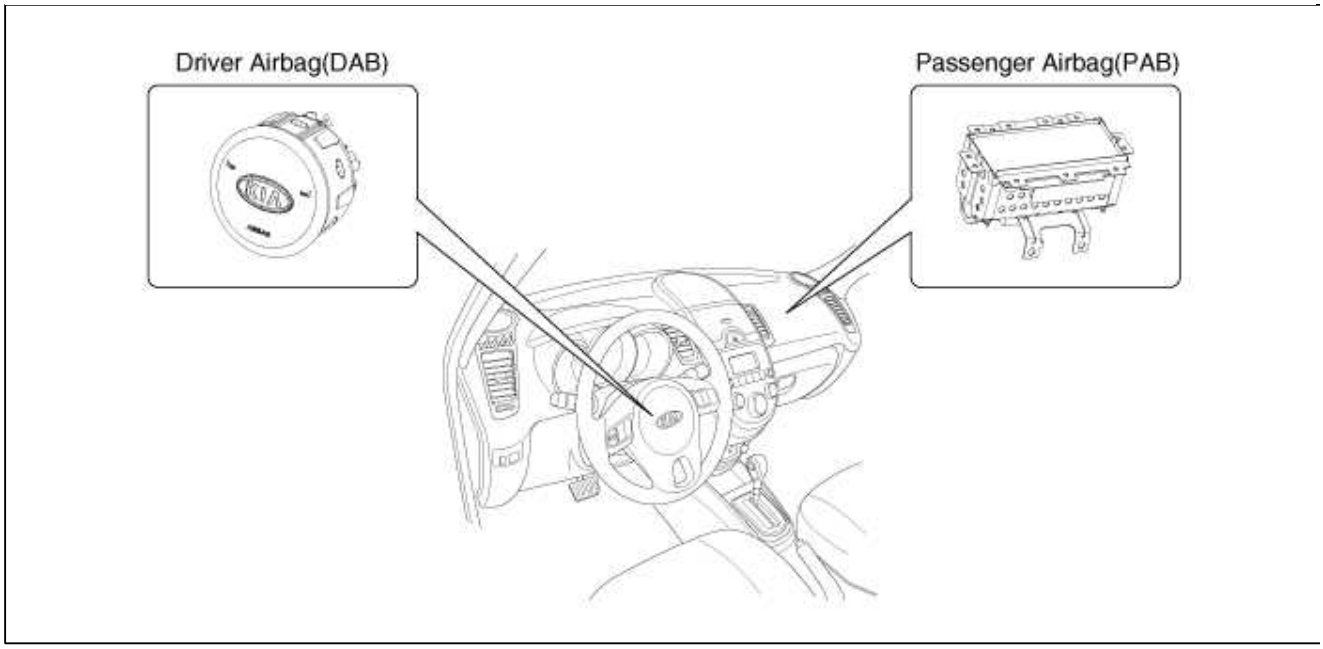
Supplemental Restraint System Control Module (SRSCM)



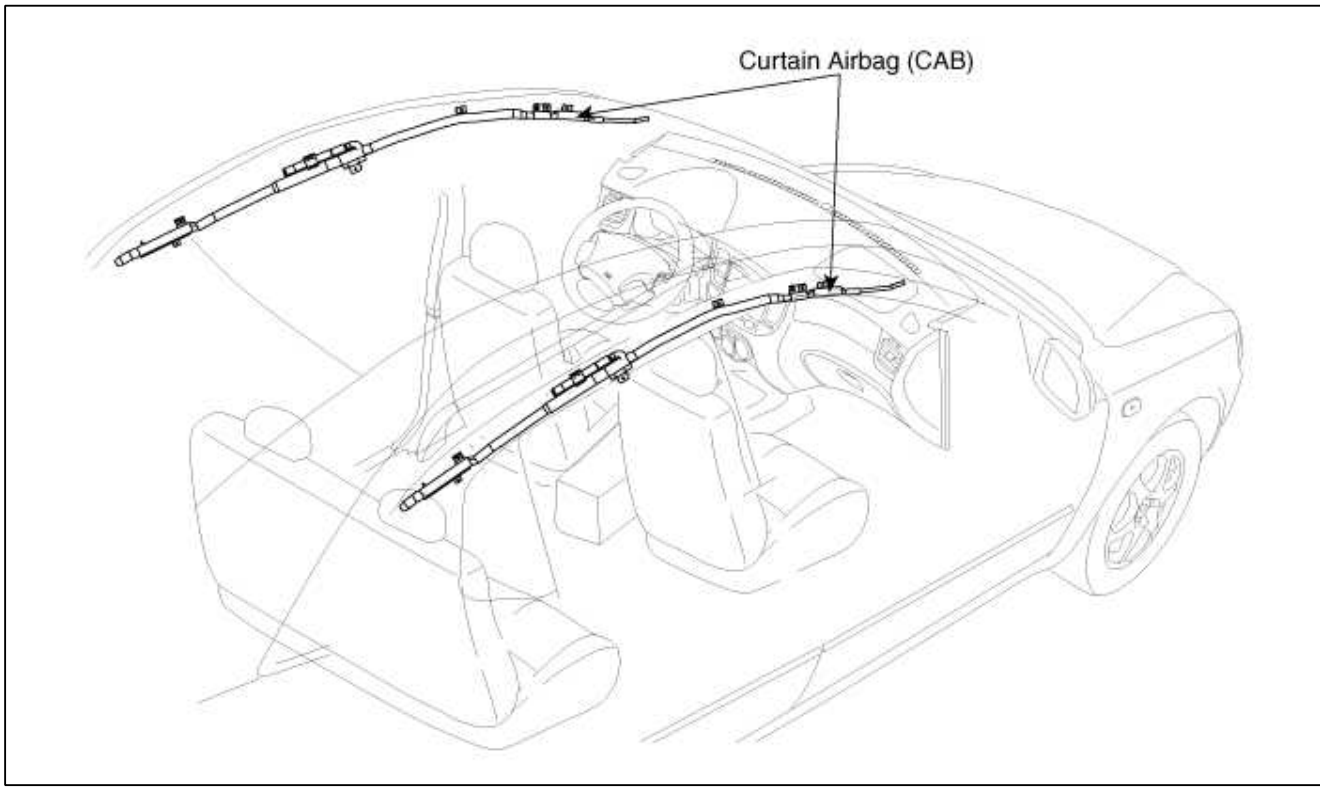
Front Impact Sensor (FIS)



Driver Airbag (DAB) / Passenger Airbag (PAB)



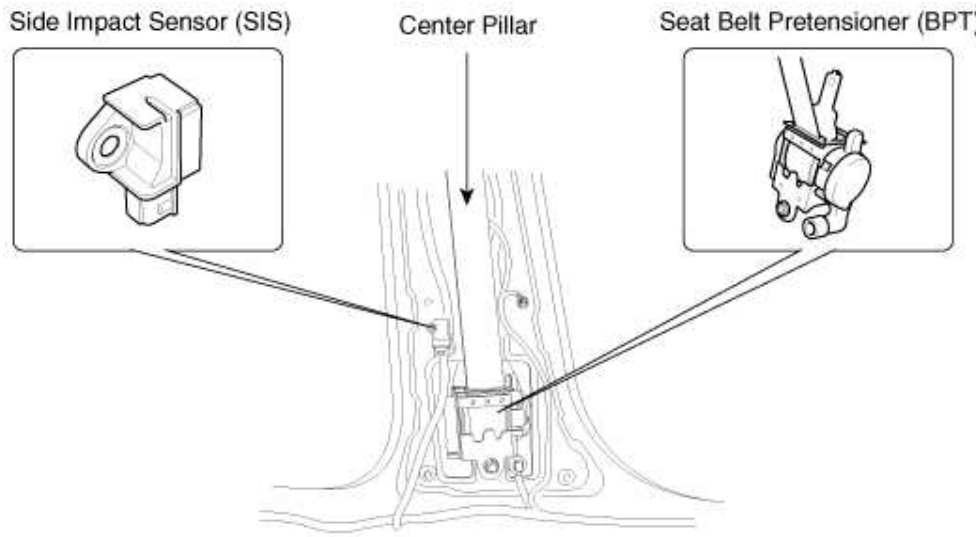
Curtain Airbag (CAB)



Side Airbag (SAB)



Seat Belt Pretensioner (BPT)/Side Impact Sensor (SIS)



Restraint > SRSCM > SRS Control Module (SRSCM) > Description and Operation

Description

The primary purpose of the SRSCM (Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag deployment is required, the SRSCM must supply sufficient power to the pretensioners and airbag igniters to initiate deployment.

The SRSCM determines that an impact may require deployment of the pretensioners and airbags from data obtained from impact sensors and other components in conjunction with a safing function.

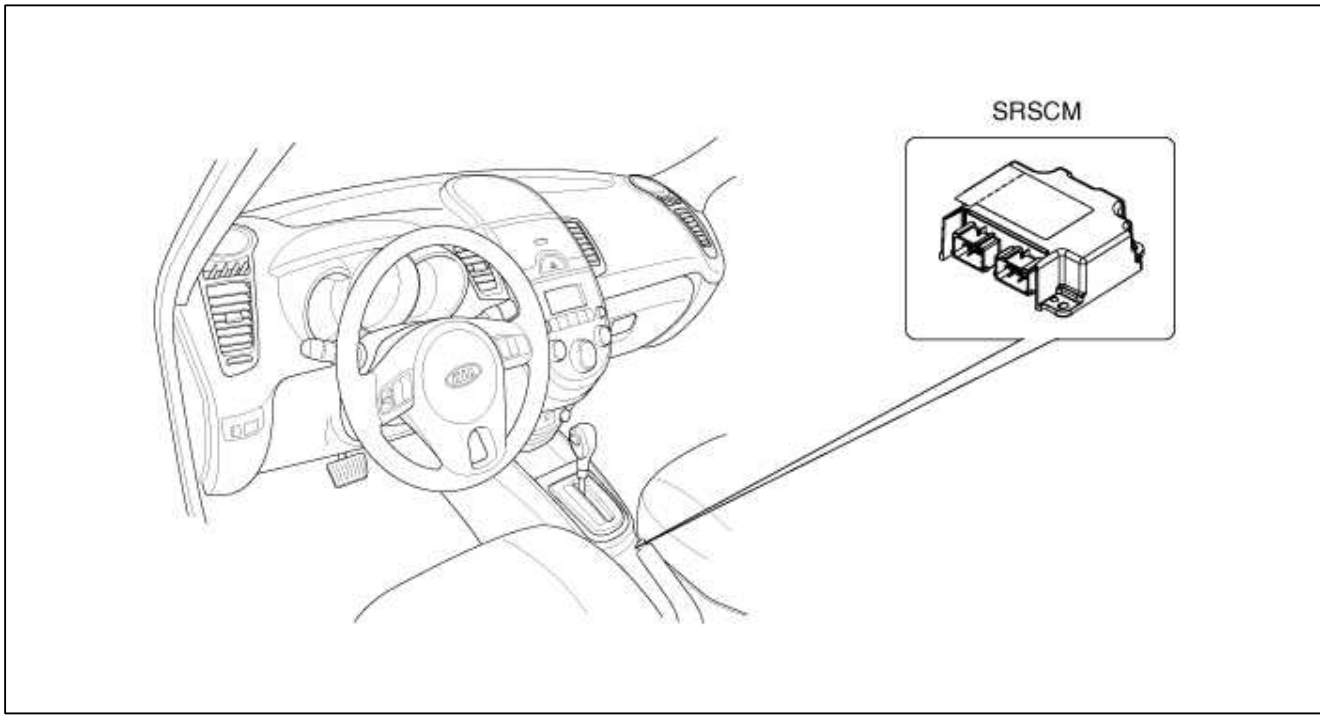
The SRSCM will not be ready to detect a crash or to activate the restraint system devices until the signals in the SRSCM circuitry stabilize.

It is possible that the SRSCM could activate the safety restraint devices in approximately 7 seconds but is

guaranteed to fully function after prove-out is completed.
The SRSCM must perform a diagnostic routine and light a system readiness indicator at key-on. The system must perform a continuous diagnostic routine and provide fault annunciation through a warning lamp indicator in the event of fault detection. A serial diagnostic communication interface will be used to facilitate servicing of the restraint control system.

Restraint > SRSCM > SRS Control Module (SRSCM) > Components and Components Location

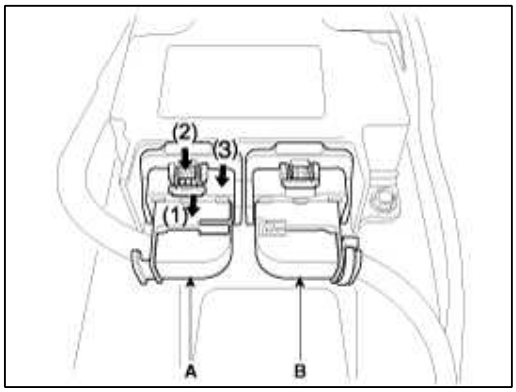
Components



Restraint > SRSCM > SRS Control Module (SRSCM) > Repair procedures

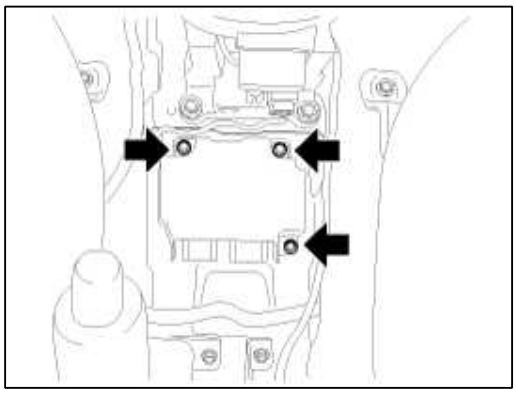
Removal

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Disconnect the DAB, PAB, SAB, CAB and BPT connectors.
4. Remove the floor console. (Refer to the Body group - console)
5. Pull the lock (1) forward. Pull the lever (3) after pressing the lever lock (2). Disconnect the airbag system control module (SRSCM) connector (A) and (B).



6. Disconnect the SRSCM harness connector(A) and (B) from the SRSCM.

7. Remove the SRSCM mounting bolts(3EA) from the SRSCM, then remove the SRSCM.



Installation

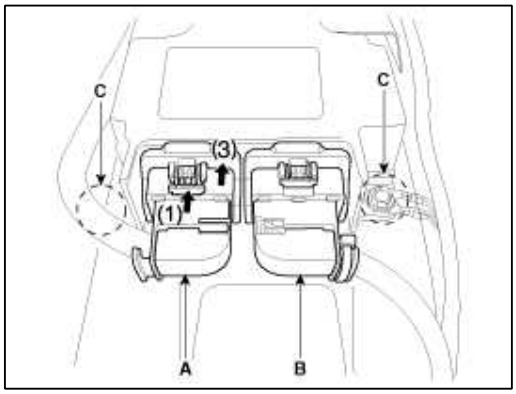
1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Install the SRSCM with the SRSCM mounting bolts.

Tightening torque (SRSCM Mounting Bolt)
: 7.8 ~ 9.8 Nm (0.8 ~ 1.0 kgf.m, 5.7 ~ 7.3 lb.ft)

NOTE

Use new mounting bolts when replacing the SRSCM after a collision.

4. Connect the SRSCM connector (A) and (B) by pushing the lever (3) and lock (1) completely.



NOTE

When installing the airbag wiring harness, ground points(C) must be installed.

5. Install the floor console. (Refer to the Body group - console)
6. Connect the DAB, PAB, SAB, CAB and BPT connectors.
7. Reconnect the battery negative cable.
8. After installing the SRSCM, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Variant coding

After replacing the SRSCM with a new one, MUST perform the “Variant Coding” procedure.

NOTE

1. On SRSCM variant coding mode, the airbag warning lamp is periodically blinking (ON: 0.5sec., OFF: 0.5sec.) until the coding is normally completed.
2. If the variant coding is failed, DTC B1762 (ACU Coding Error) will be displayed and the warning lamp will be turned on.
   In this case, perform the variant coding procedure again after confirming the cause in “DTC Fault State Information”.
   Variant Coding can be performed up to 255 times, but if the number of coding work exceeds 255 times, DTC B1683 (Exceed Maximum coding Number) will be displayed and SRSCM must be replaced.
3. If the battery voltage is low (less than 9V) before performing the Variant Coding, DTC B1762 will be displayed only. In this case, charge the battery before anything else, and then perform the variant coding procedure.
   Because, although Variant Coding is normally performed, DTC B1762 and low battery are displayed.

Variant coding Procedure

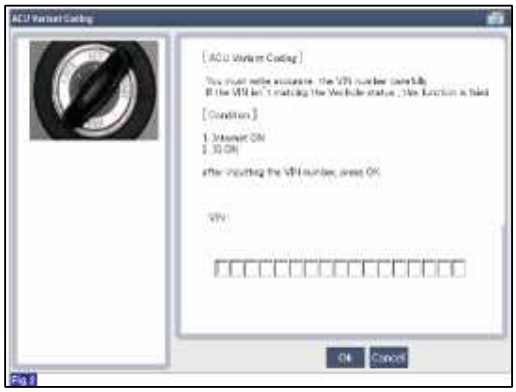
■ On-Line type on GDS

1. Ignition "OFF", connect scantool.
2. Ignition "ON" & Engine "OFF" select vehicle name and airbag system.
3. Select Variant coding mode.
4. Follow steps on the screen as below.

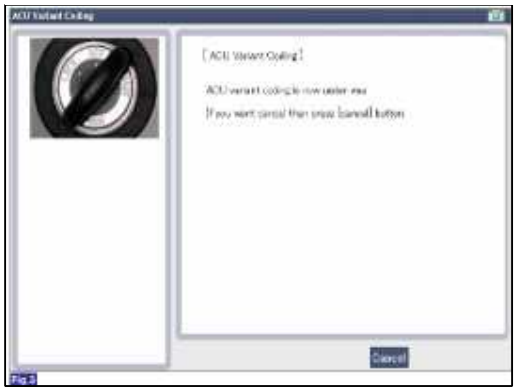
1) Initial ACU Variant Coding screen



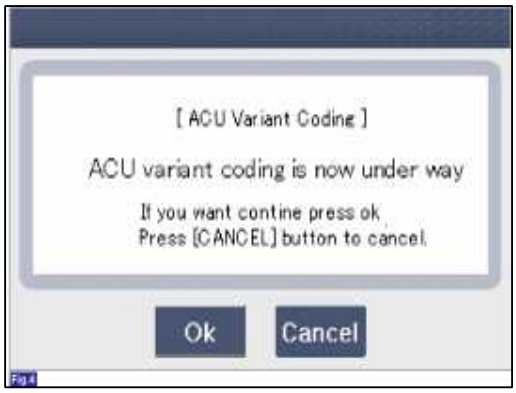
2) VIN Code entering screen



3) Variant coding's proceeding screen-1



4) Variant coding's proceeding screen-2



5) Variant coding is completed



NOTE

1) Screen of Retrying the Variant coding after finishing variant coding

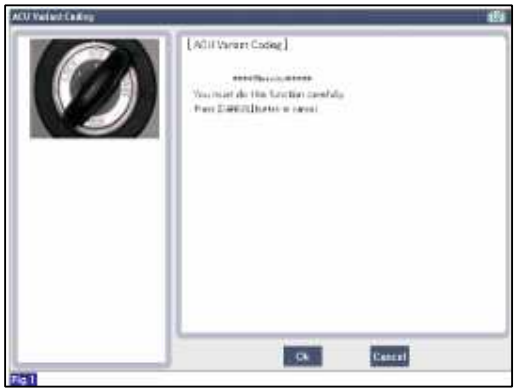


2) Screen of communication failure



■ Off-line type on GDS (This can be used when not connecting to internet)

1) Initial ACU Variant Coding screen



2) ACU CODING Code entering screen



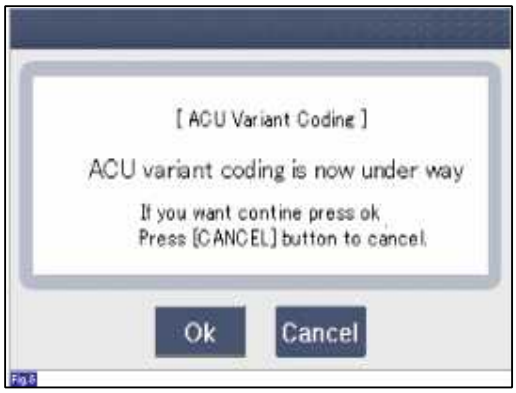
3) Screen of rechecking ACU CODING code's entering



4) Variant coding's proceeding screen-1



5) Variant coding's proceeding screen-2



6) Variant coding is completed



NOTE

1) Screen of Retrying the Variant coding after finishing variant coding



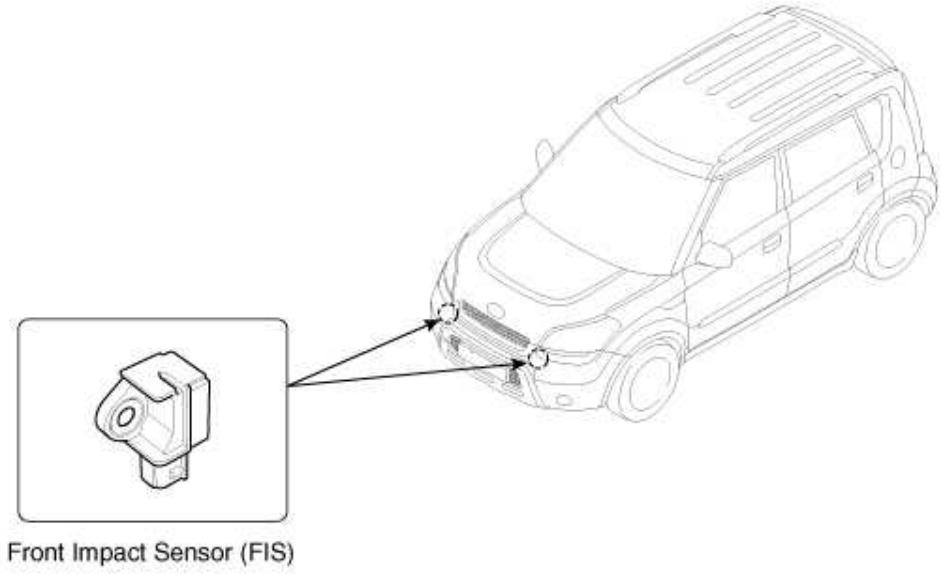
Restraint > SRSCM > Front Impact Sensor (FIS) > Description and Operation

Description

The Front Impact Sensor (FIS) is installed in the Front End Module (FEM). They are remote sensors that detect acceleration due to a collision at its mounting location. The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collision. The Front Impact Sensor (FIS) sends acceleration data to the SRSCM.

Restraint > SRSCM > Front Impact Sensor (FIS) > Components and Components Location

Components



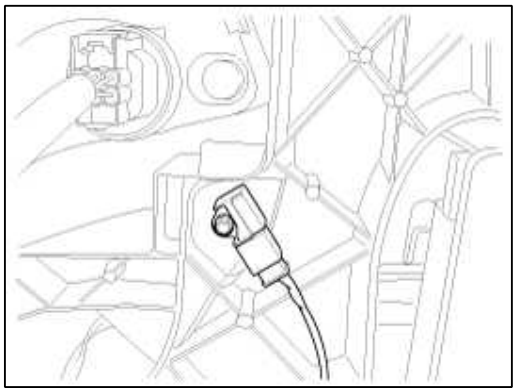
Restraint > SRSCM > Front Impact Sensor (FIS) > Repair procedures

Removal

CAUTION

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Disconnect the Front Impact Sensor connector.
3. Remove the Front Impact Sensor mounting bolt.



4. Remove the Front Impact Sensor.

Installation

CAUTION

- Do not turn the ignition switch ON and do not contact the battery cable while replacing the front impact sensor.

1. Install the new Front Impact Sensor.
2. Tighten the Front Impact Sensor mounting bolt.

Tightening torque
: 7.8 ~ 9.8 Nm (0.8 ~ 1.0 kgf.m, 5.7 ~ 7.3 lb.ft)

3. Connect the Front Impact Sensor connector.
4. Reconnect the battery negative cable.
5. After installing the Front Impact Sensor, confirm proper system operation:
   A. Turn the ignition switch ON the SRS indicator light should be turned on for about six seconds and then go off.

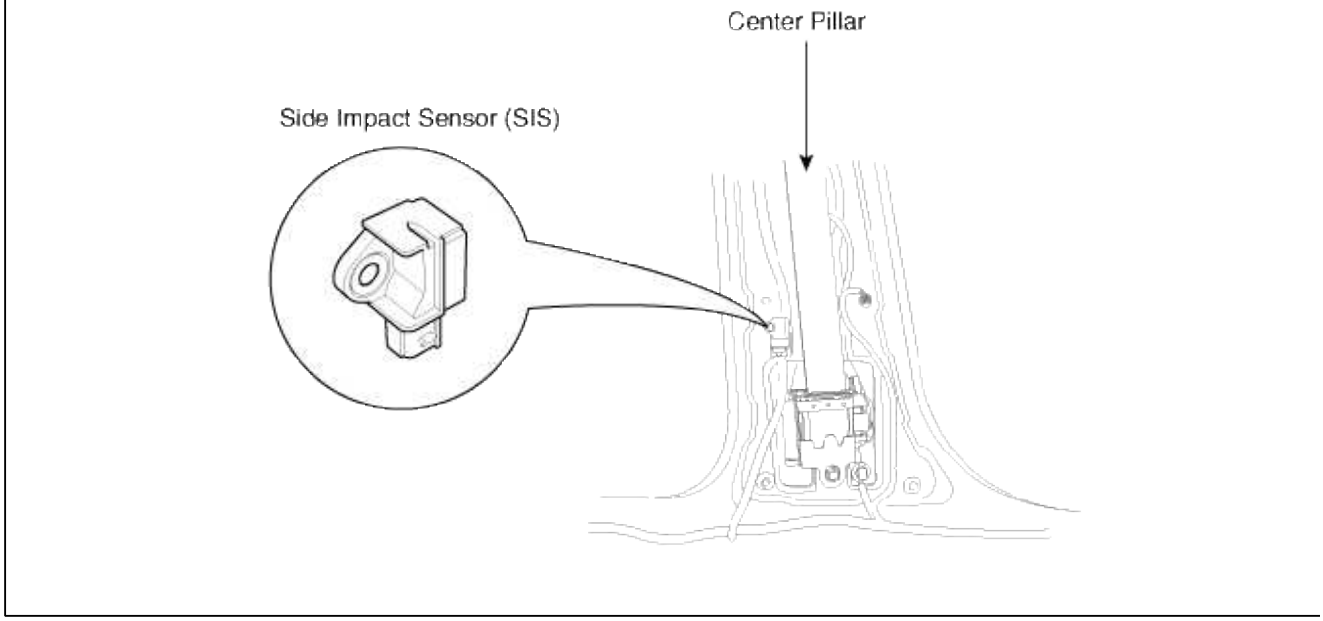
Restraint > SRSCM > Side Impact Sensor (SIS) > Description and Operation

Description

The Side Impact Sensor (SIS) system consists of two front SIS which are installed inside the Center Pillar (LH and RH).
They are remote sensors that detect acceleration due to collision at their mounting locations. The primary purpose of the Side Impact Sensor (SIS) is to provide an indication of a collision. The Side Impact Sensor (SIS) sends acceleration data to the SRSCM.

Restraint > SRSCM > Side Impact Sensor (SIS) > Components and Components Location

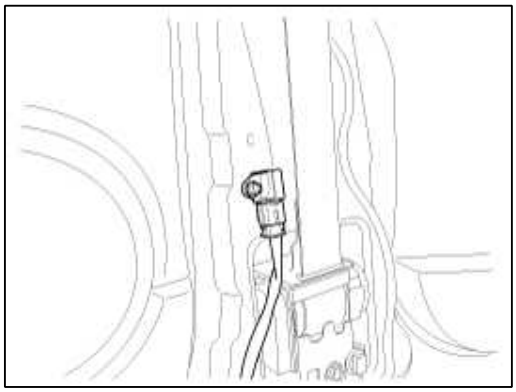
Components



Restraint > SRSCM > Side Impact Sensor (SIS) > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the door scuff trim. (Refer to the Body group- Intorior trim)
3. Remove the center pillar trim. (Refer to the Body group- Interior trim)
4. Disconnect the side impact sensor connector.
5. Loosen the side impact sensor mounting bolt and remove the side impact sensor.



Installation

CAUTION

- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new side impact sensor with the bolt then connect the SRS harness connector to the side impact sensor.

Tightening torque
: 7.8 ~ 9.8 Nm (0.8 ~ 1.0 kgf.m, 5.7 ~ 7.3 lb.ft)

2. Install the center pillar trim. (Refer to the Body group - Interior trim)
3. Install the door scuff trim. (Refer to the Body group - Inter trim)

4. Reconnect the battery negative cable.
5. After installing the side impact sensor, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator light should be turned on for about six seconds and then go off.

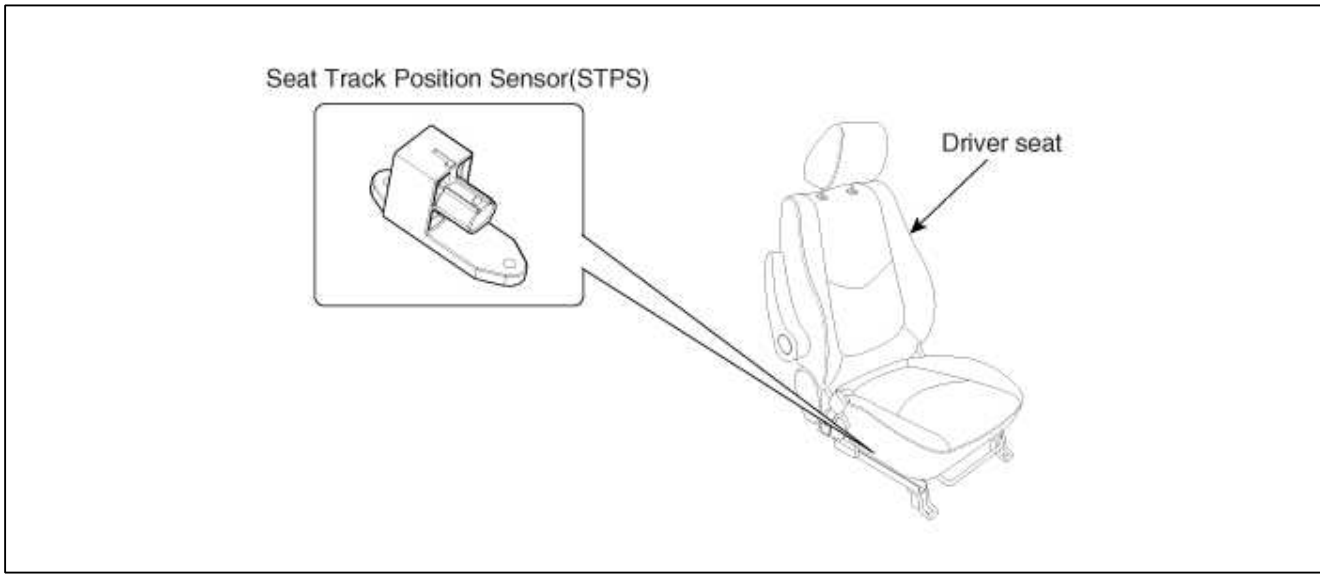
Restraint > SRSCM > Seat Track Position Sensor (STPS) > Description and Operation

Description

The STPS operates via a non-contacting magnetic proximity sensing device combined with a simple electronic circuit resulting in the ability of producing two separate and distinct logic level signals.
The STPS output signal is altered by the proximity of a separate ferro-magnetic shunt, which is linked via the seat track. The logic signal produced is the result of the proximity device being activated or deactivated.
When the seat is in the forward position zone of the track, the sensor gives a low current (prohibit) signal. When the seat is in the rear positon zone of the track, it gives a high current (enable) signal.

Restraint > SRSCM > Seat Track Position Sensor (STPS) > Components and Components Location

Components

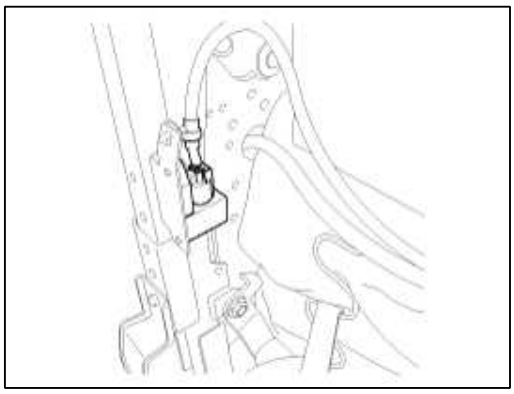


Restraint > SRSCM > Seat Track Position Sensor (STPS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front seat assembly. (Refer to BD group)

3. Loosen the two STPS screws, then remove the STPS after disconnecting the STPS connector.



Installation

CAUTION

Be sure to install the harness wires not to be pinched or interfered with other parts.

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
3. Install the STPS with two screws.
4. Install the front seat assembly. (Refer to BD group)
5. Reconnect the battery negative cable.
6. After installing the Seat Track Position Sensor, confirm proper system operation:
   Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.

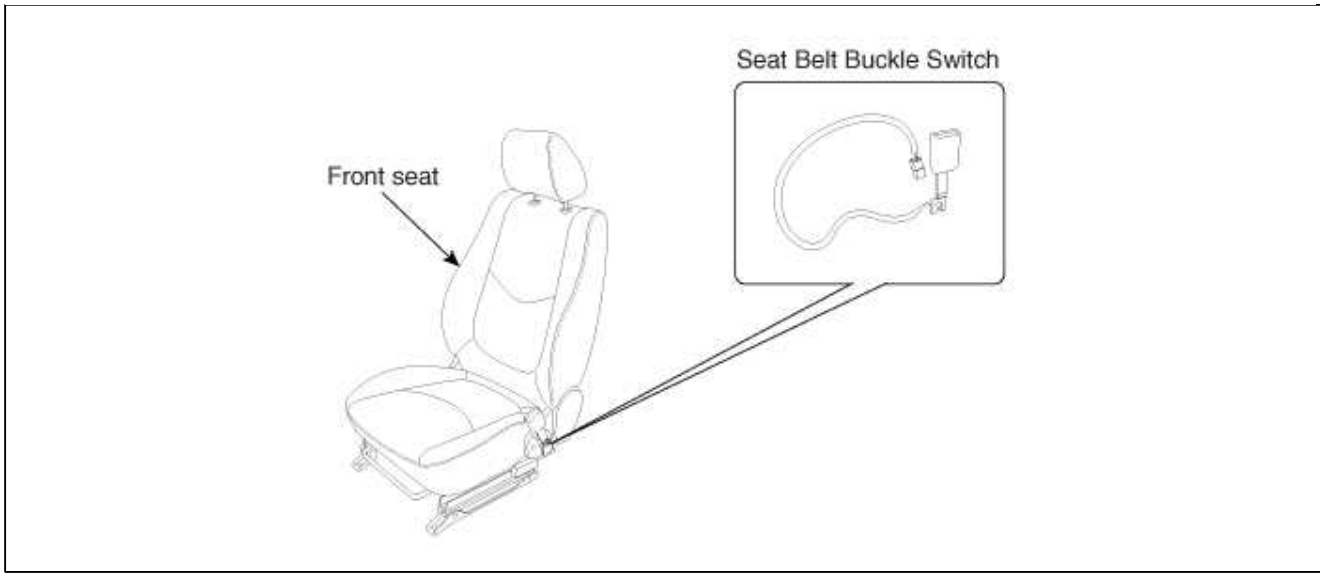
Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Description and Operation

Description

The SRSCM shall monitor the status of the driver and front passenger seat belt buckle. The SRSCM provides one pin each for the driver and front passenger seat belt buckle status input. The seat belt buckle circuit operates from internal boost voltage supplied by the SRSCM, and uses chassis ground for the signal return. The buckle status shall modify the SRSCM deployment. If the buckle status is unbuckled, the corresponding pretensioner will be deactivated.

Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Components and Components Location

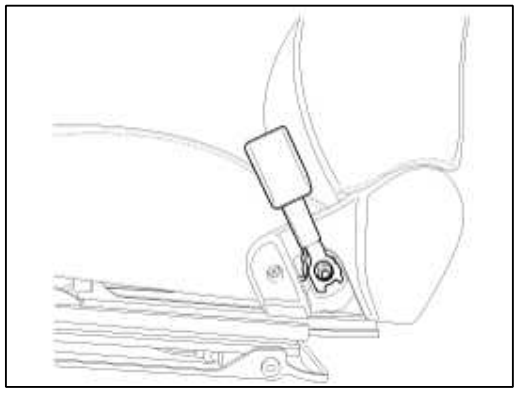
Components



Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front seat assembly. (Refer to the Body group - Seat)
3. Loosen the seat belt buckle mounting bolt and remove the seat belt buckle switch.



Installation

CAUTION

Be sure to install the harness wires not to be pinched or interfered with other parts.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the ignition key from the vehicle.
3. Install the seat belt buckle switch.

Tightening Torque
: 39.2 ~53.9 Nm (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb.ft)

4. Install the front seat assembly. (Refer to the Body group - Seat)
5. Reconnect the battery negative cable.
6. After installing the Seat Belt Buckle Switch, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.

Restraint > SRSCM > Occupant Classification Sensor (OCS) > Description and Operation

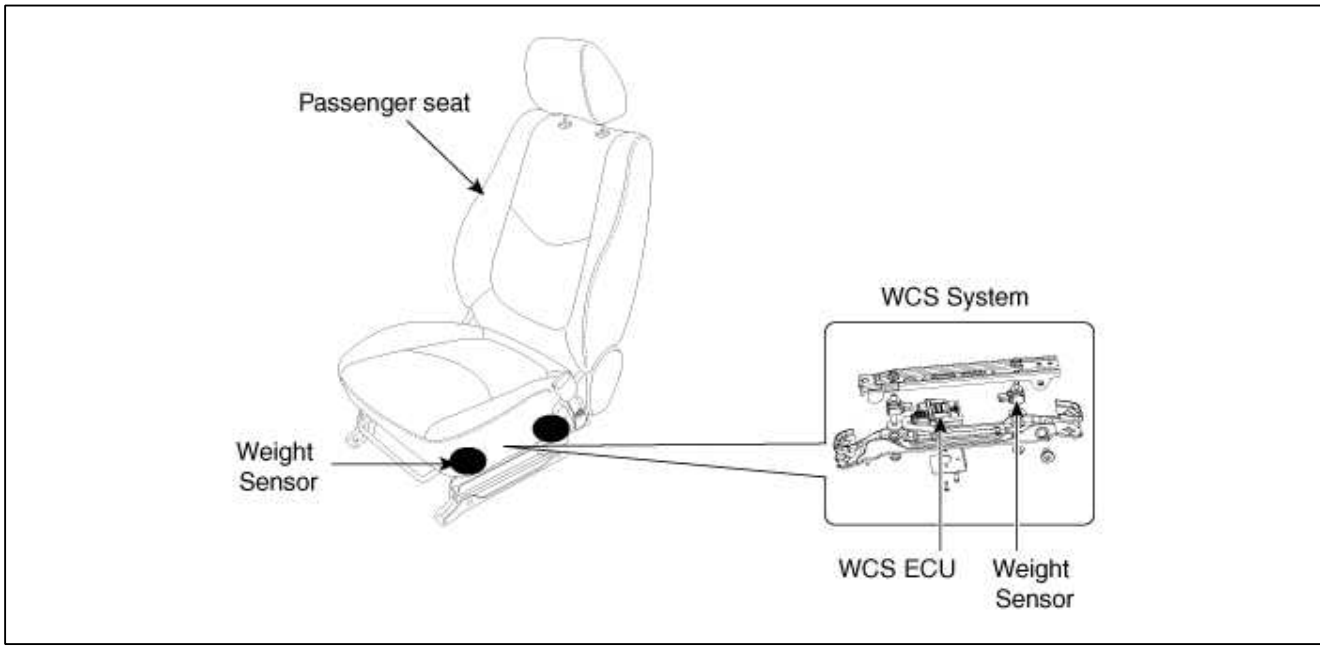
Description

In contrast to the initial one-stage airbag systems, newer restraint systems involve complex logic to select, or alternatively suppress, various levels of safety system deployment. Inherent to an Advanced Restraint System is the ability to discern information regarding passenger occupancy. It is intended that these inputs be provided through the WCS.

The object of such safety system is to reduce the risk and level of injuries by automatically adapting the airbag(s) and seat belt pretensioner to the driving status of the vehicle, its occupants, and the crash severity. The current WCS covered in this specification continually senses and classifies the front passenger side seat. The Occupant Classification System described in this section is Weight Classification System(WCS) of strain gauge type. It consist of 2 weight sensors and ECU which is classifying weight of occupant. It is installed on the seat track assembly.

Restraint > SRSCM > Occupant Classification Sensor (OCS) > Components and Components Location

Components



Restraint > SRSCM > Occupant Classification Sensor (OCS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front passenger seat assembly.
   (Refer to the Body group - Seat)
3. Remove the ODS assembly.
   (Refer to the Body group - Seat)

Installation

NOTE

ODS(Occupant Detection System) is utilizing a robust weight measuring technology. Thus, if any of the following conditions occur, WCS reset and accuracy check should be performed.

- The occupant classification ECU or any of the sensors is replaced.
- The vehicle is brought to the repair shop due to an accident or a crash even though the severity seems to be minor.
- The telltale lamp is not illuminated when the passenger seat is not occupied.
- The telltale lamp is delayed more than 10 seconds to be turned off when an adult passenger seats in.
- The passenger seat is removed from the vehicle and reassembled.
- Any accessories (side table, seatback table and seat cover, etc) are replaced or installed.

1. Install the ODS in the front passenger seat assembly.
   (Refer to the Body group - Seat)
2. Install the front passenger seat assembly. (Refer to the Body group - Seat)
3. Reconnect the battery negative cable.
4. After installing ODS, perform the WCS reset and accuracy check with the scantool.

NOTE

Check that seat is not occupied and empty before performing the operation. Make sure that the back pocket is empty. In order to perform the accuracy check, the command zero operation should be finished normally. Make sure the procedure be finished normally.

(1) Adjust the seat position according to the table below.

Item	Remark
Seat track position	Rearmost position
Seat recliner angle	Normal (upright)
Head rest position	Lowest position
Lifter position	Lowest position

Make sure seat belt not to be buckled, and the belt tension be normal.

(2) Connect the scantool connector to the data link connector located under the crash pad.

(3) Turn the ignition switch on and power on the scantool.

(4) Perform the WCS reset by using the scantool.
[System selection screen]
Vehicle Selection_Airbag_Weight Classification System_WCS RESET_ENTER
(then, Completed is displayed)

(5) Perform the accuracy check by using the scantool.
[System selection screen]
Vehicle Selection_Airbag_Weight Classification System_WCS RESET_ESC

(6) Confirm the measured weight is within the standard value. And then press "ESC".

specification : -2.0kg ~ 2.0kg (-4.4lb ~ 4.4lb)

(7) Place a 37kg (81.57lb) weight on the passenger front seat.

(8) Confirm that the result of accuracy check is within the standard value.

specification : 31kg ~ 43kg (68.34lb ~ 94.79lb)

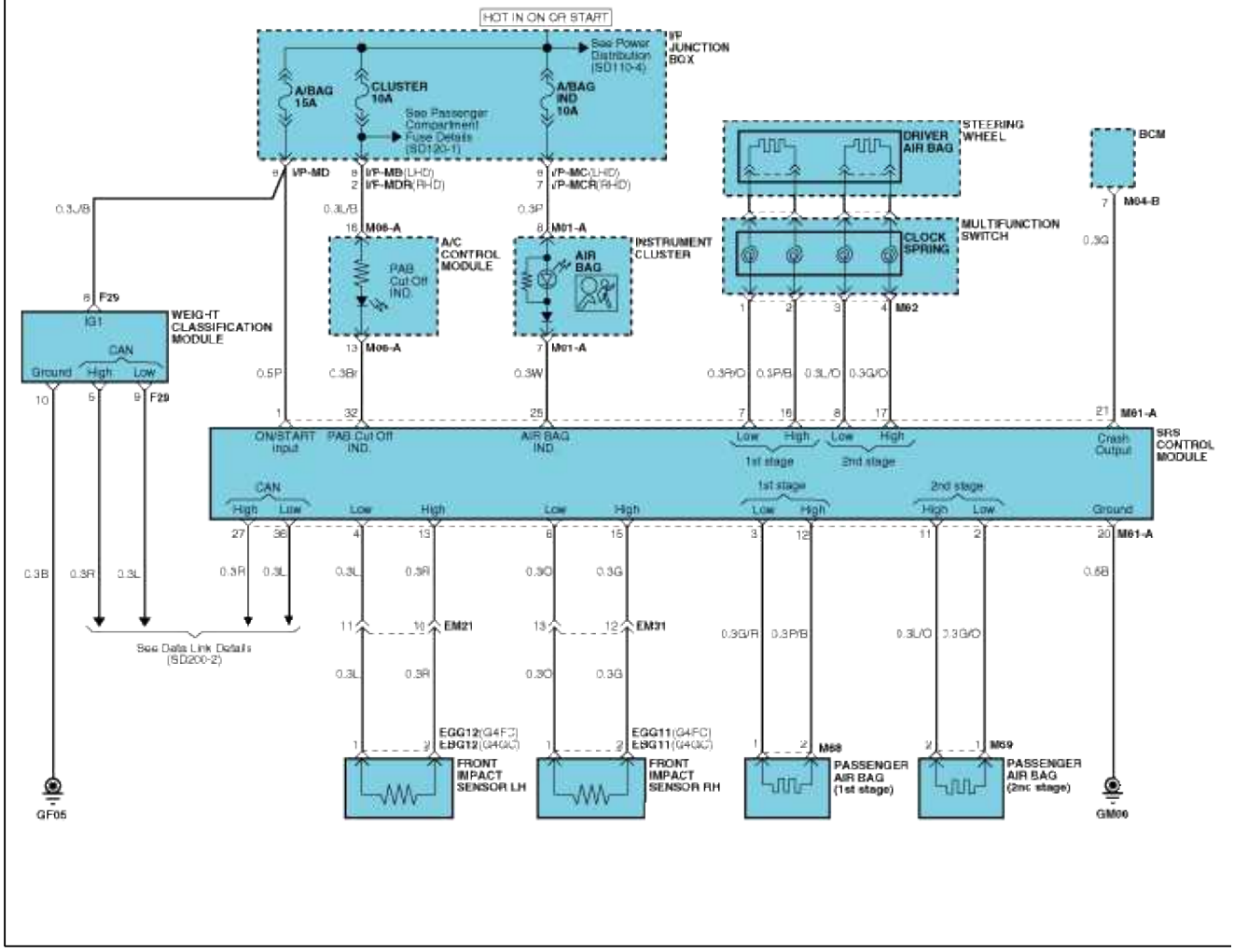
NOTE

- When performing the accuracy check, use a solid metal weight and place it at the center of the seat. If the weight made from liquid is used or the weight slides, the check result may not accurate, and could result in unwanted fail
- When the measured weight deviates from the standard value, check again all the fastening bolts are tightened properly. And make sure there is no interference. During the tightening, be careful not to deform the seat rail or seat structure. If the accuracy check is still not inside the standard value, replace the seat leg assembly.
- When WCS reset operation not finished normally, replace the seat leg assembly.

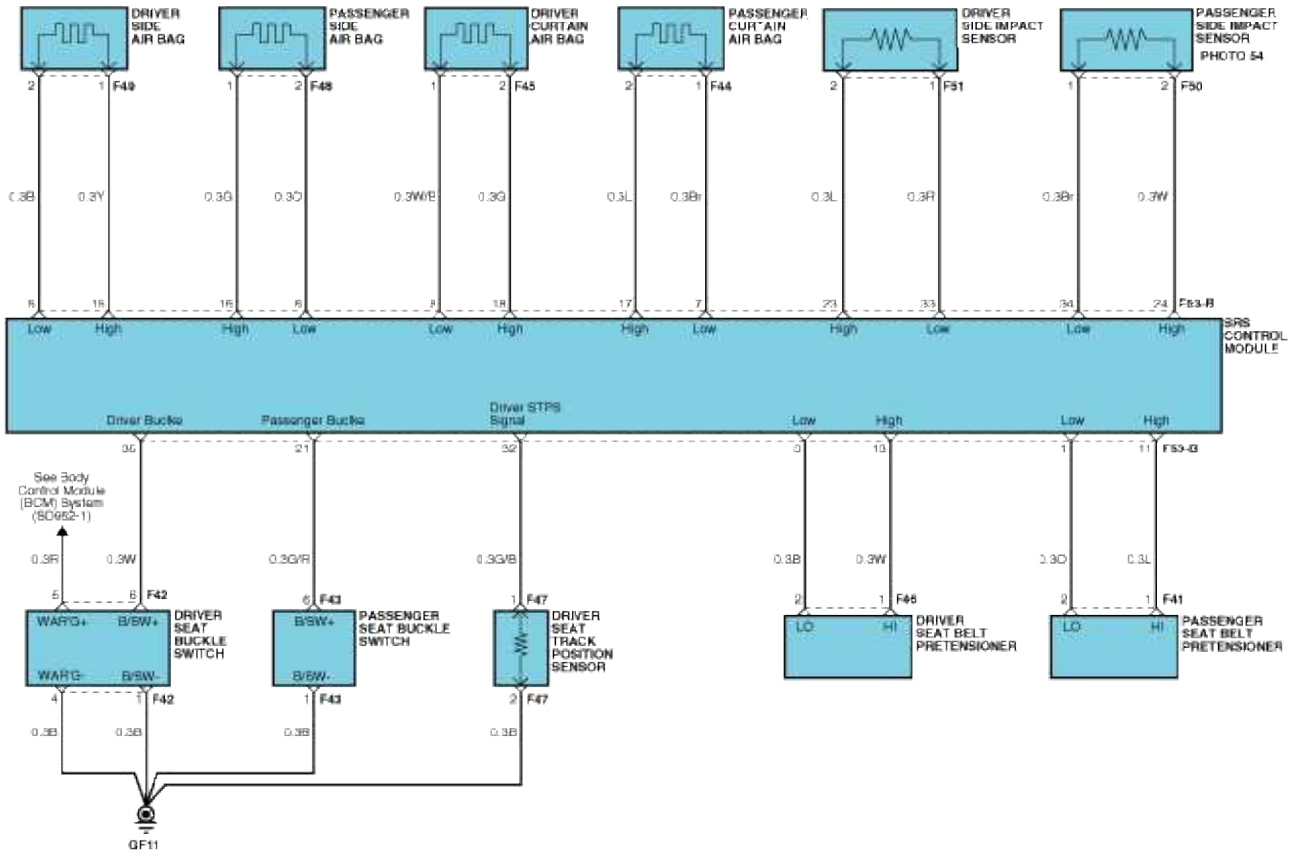
5. After installing the ODS, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.
   B. Telltale lamp will turn on for 4 seconds and be turned off for 3 seconds. After the 7 seconds, it shall remain off if the ODS does not require suppression and the passenger airbag is enabled.

Restraint > SRSCM > Schematic Diagrams

Circuit Diagram (1)

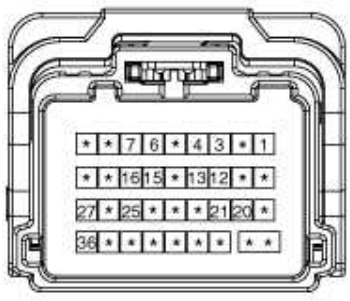


Circuit Diagram (2)

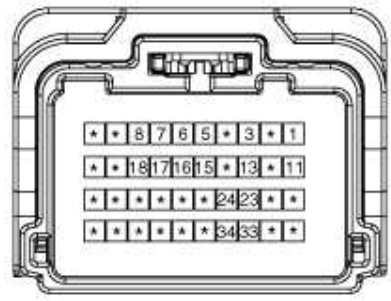


SRSCM Connector Terminal

Harness Connector



Connector A



Connector B

Pin	Function (Connector A)	Pin	Function (Connector B)
1	Ignition	1	Passenger Seat Belt Pretensioner Low

2	(2nd stage) Passenger Airbag Low	2	-
3	(1st stage) Passenger Airbag Low	3	Driver Seat Belt Pretensioner Low
4	Driver Front Impact Sensor Low	4	-
5	-	5	Driver Side Airbag Low
6	Passenger Front Impact Sensor Low	6	Passenger Side Airbag Low
7	(1st stage) Driver Airbag Low	7	Passenger Curtain Airbag Low
8	(2nd stage) Dirver Airbag Low	8	Driver Curtain Airbag Low
9	-	9	-
10	-	10	-
11	(2nd stage) Passeng Airbag High	11	Passenger Seat Belt Pretensioner High
12	(1st stage) Passenger Airbag High	12	-
13	Driver Front Impact Sensor High	13	Driver Seat Belt Pretensioner High
14	-	14	-
15	Passenger Front Impact Sensor High	15	Driver Side Airbag High
16	(1st stage) Driver Airbag High	16	Passenger Side Airbag High
17	(2nd stage) Driver Airbag High	17	Passenger Curtain Airbag High
18	-	18	Driver Curtain Airbag High
19	-	19	-
20	Ground	20	-
21	Crash Output	21	Passenger Seat Belt Buckle Switch
22	-	22	-
23	-	23	Driver Side Impact Sensor High
24	-	24	Passenger Side Impact Sensor High
25	Airbag Warning Lamp	25	-
26	-	26	-
27	CAN-High	27	-
28	Short Bar	28	-
29	Short Bar	29	-
30	-	30	-
31	-	31	-

32	Telltale Warning Lamp	32	Driver Seat Track-Position Sensor
33		33	Driver Side Impact Sensor Low
34	-	34	Passenger Side Impact Sensor Low
35	-	35	Driver Seat Belt Buckle Switch
36	CAN-Low	36	-
		37	-
		38	-
		39	-
		40	-

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation

Description

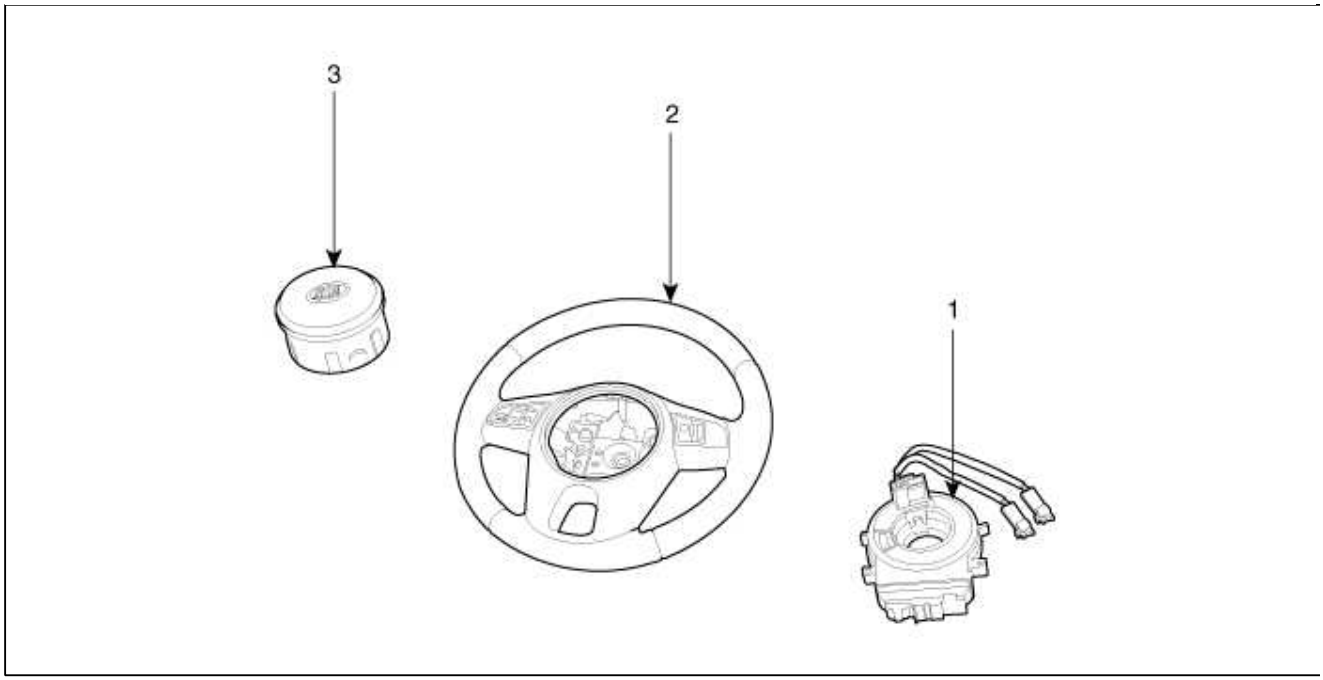
Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clock spring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB).

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Components and Components Location

Components

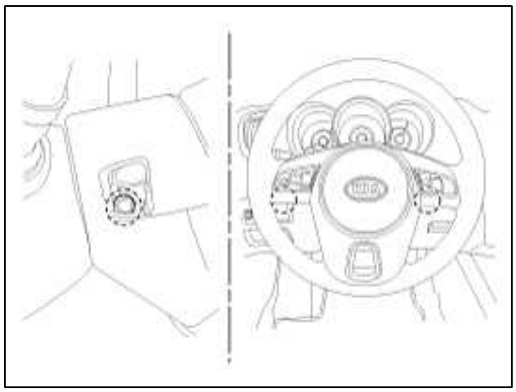


1. Driver Airbag (DAB) 2. Steering Wheel	3. Clock Spring

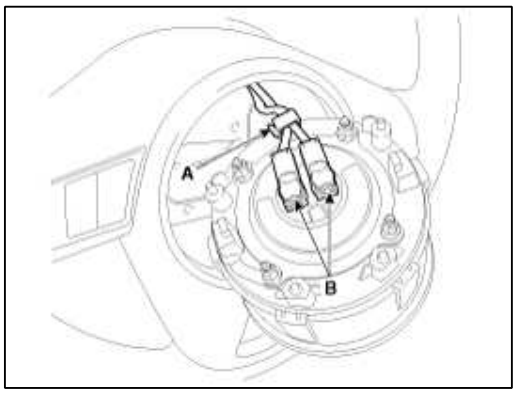
Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the steering wheel low cover cap.
3. Remove the driver airbag module mounting bolts(2EA).



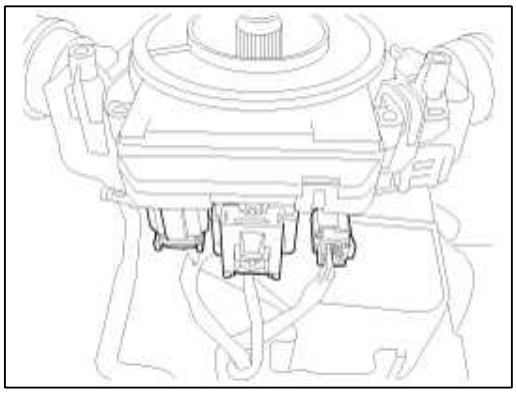
4. Remove the wiring fixing clip(A) and disconnect airbag module connector (B).



5. Disconnect the horn connector.
6. Separate the airbag module from the steering wheel.

> CAUTION
>
> The removed airbag module should be stored in aclean, dry place with the pad cover face up.

7. Remove the steering wheel and steering wheel column cover. (Refer to the Steering System group- Steering Column and Shaft)
8. Disconnect the clock spring and horn connector, then remove the clock spring.



Inspection

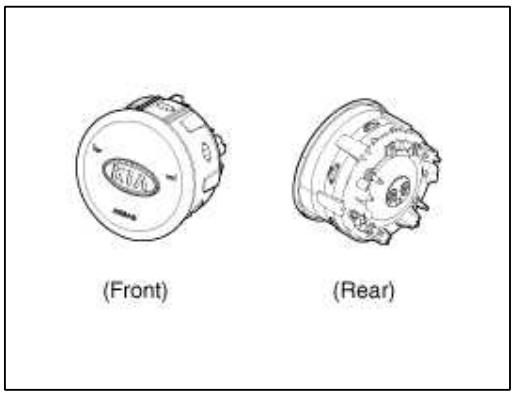
Driver Airbag (DAB)

If any improper parts are found during the following inspection, replace the airbag module with a new one.

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.

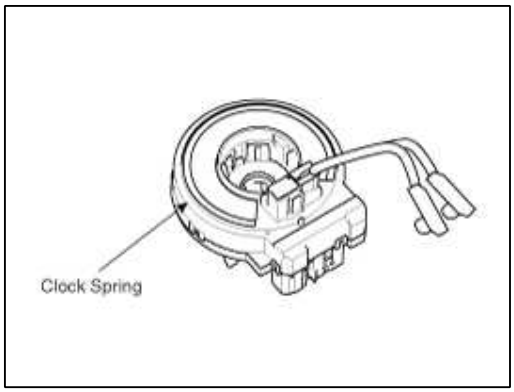
4. Check airbag inflator case for dents, cracks or deformities.



5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

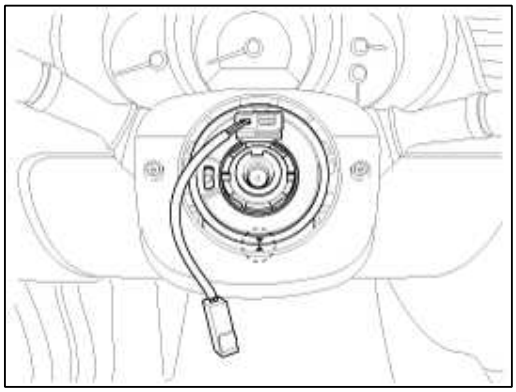
Clock Spring

1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
2. Check connectors and protective tube for damage, and terminals for deformities.



Installation

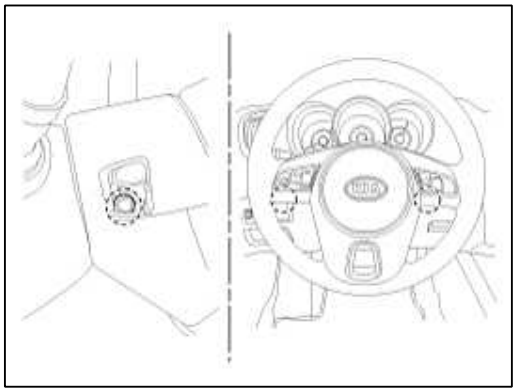
1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Connect the clock spring harness connector and horn harness connector to the clock spring.
4. Set the center position by getting marks between the clock spring and the cover into line. Make an array the mark ( ) by turning the clock spring clockwise to the stop and then 2 revolutions counterclockwise.



5. Install the steering wheel column cover and the steering wheel. (Refer to the Steering System group- Steering Column and Shaft)
6. Connect the Driver Airbag (DAB) module connector and horn connector, and then install the Driver Airbag (DAB) module on the steering wheel.

7. Secure the Driver Airbag (DAB) with the new mounting bolts.

Tightening torque
: 7.8 ~ 10.8 Nm (0.8 ~ 1.1 kgf.m, 5.8 ~ 8.0 lb.ft)



8. Connect the battery negative cable.
9. After installing the airbag, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
   B. Make sure horn button works.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Description and Operation

Description

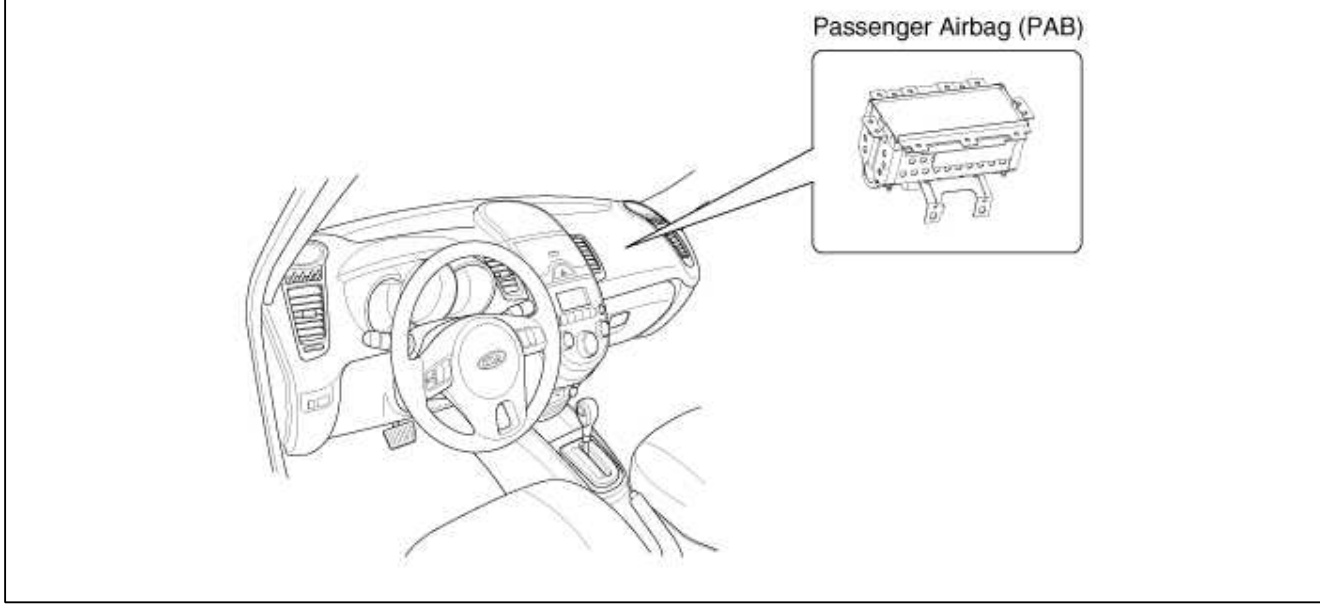
The passenger Airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Components and Components Location

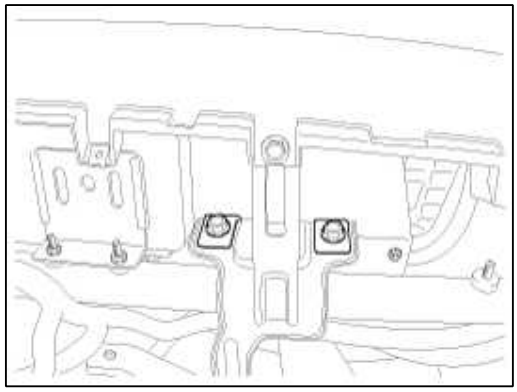
Components



Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box and glove box housing. (Refer to the Body group- crash pad).
3. Disconnect the passenger airbag connector and remove the passenger airbag mounting bolt.

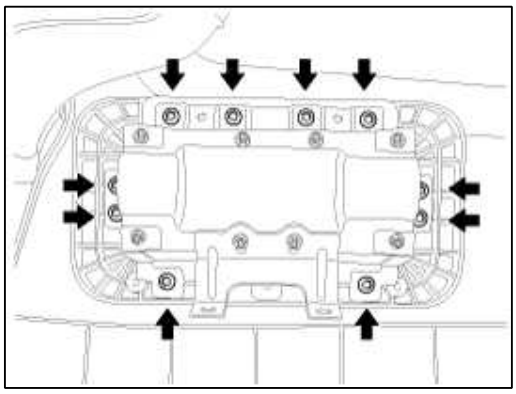


4. Remove the crash pad. (Refer to the Body group- crash pad).

> NOTE
>
> Replace the crash pad which is damaged while PAB is deployed.

5. Remove the heater duct from the Crash pad.

6. Remove the mounting screws(10EA) from the Crash pad. Then remove the passenger airbag.



CAUTION

The removed airbag module should be stored in a clean, dry place with the airbag cushion up.

Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Place a Passenger airbag on the Crash pad and tighten the Passenger airbag mounting screws.
4. Install the heater duct to the Crash pad.
5. Install the Crash pad. (Refer to the Body group- crash pad)
6. Tighten the PAB mounting bolt.

Tightening torque
: 7.8 ~ 8.8 Nm (0.8 ~ 0.9 kgf.m , 5.8 ~ 6.5 lb.ft)

7. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
8. Reinstall the glove box housing and glove box. (Refer to the Body group- crash pad)
9. Reconnect the battery negative cable.
10. After installing the Passenger Airbag (PAB), confirm proper system operation:
    A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Side Airbag (SAB) Module > Description and Operation

Description

The Side Airbags (SAB) are installed inside the front seat and protect the driver and front passenger from danger when side crash occurs. The SRSCM determines deployment of side airbag by using Side Impact Sensor (SIS) signal.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Side Airbag (SAB) Module > Components and Components Location

Components



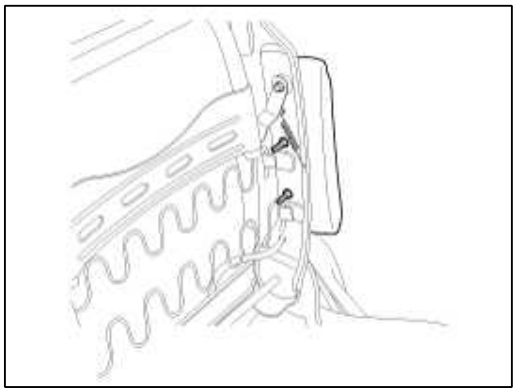
Restraint > Airbag Module > Side Airbag (SAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the front seat assembly. (Refer to the Body group- Seat)
3. Remove the seat back cover. (Refer to the Body group- Seat)

> NOTE
>
> When the front side airbag deployed after a collision, replace the seat back as an assembly.

4. Loosen the SAB mounting nuts and remove the SAB module.



> WARNING
>
> The removed airbag module should be stored in a clean and dry place with the cushion side up.

Installation

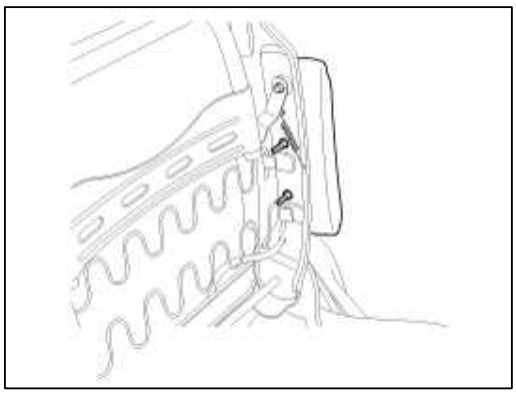
> CAUTION
>
> Be sure to install the harness wires not to be pinched or interfered with other parts.

NOTE

- Do not open the lid of the side airbag cover.
- Use a new mounting nuts when you replace a side airbag.
- Make sure that the airbag assembly cover is installed properly. Improper installation may prevent the proper deployment.

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Place a Side Airbag (SAB) on the side airbag frame and tighten the side airbag mounting nuts (2EA).

Tightening torque
: 5.9 ~ 7.8 Nm (0.6 ~ 0.8 kgf.m , 4.3 ~ 5.8 lb.ft)



4. Install the new seat back cover. (Refer to the Body group- Seat)
5. Install the front seat assembly, and then connect the Side Airbag (SAB) harness connector.
6. Recline and slide the front seat forward fully, make sure the harness wires are not pinched of interfering with other parts.
7. Reconnect the battery negative cable.
8. After installing the Side Airbag (SAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Description and Operation

Description

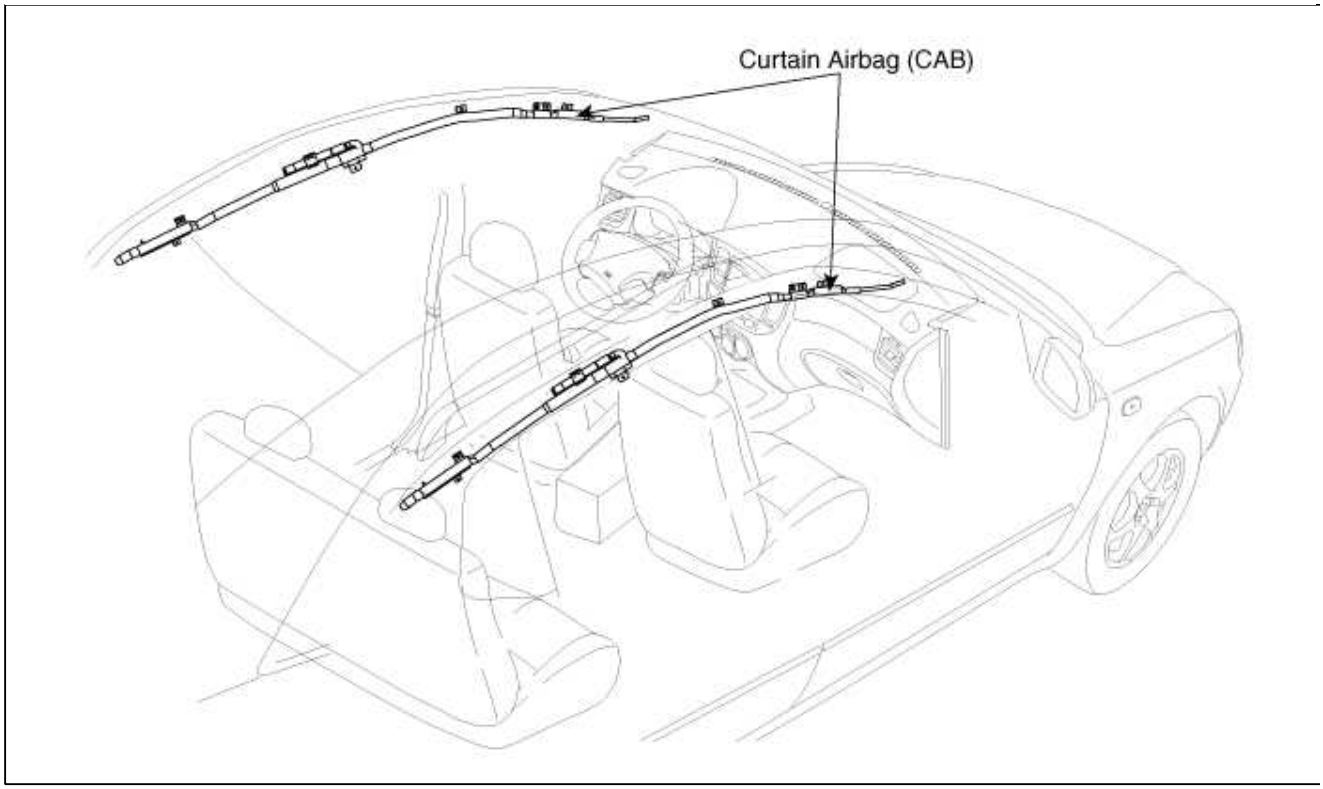
Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passenger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

CAUTION

Never attempt to measure the circuit resistance of the airbag module even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Components and Components Location

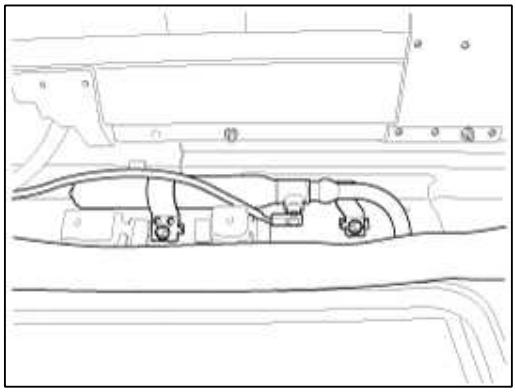
Components



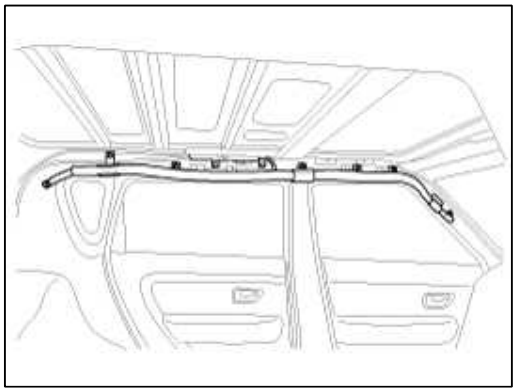
Restraint > Airbag Module > Curtain Airbag (CAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the Interior trim. (Refer to the Body group - Interior trim)
3. Remove the headlining (Refer to the Body group - Roof trim)
4. Disconnect the Curtain Airbag harness connector.



5. After loosening the mounting bolts and nuts remove the curtain airbag.



Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Tighten the Curtain Airbag (CAB) mounting bolts.

Tightening torque
: 10.8 ~ 14.7 Nm (1.1 ~ 1.5 kgf.m, 8.0 ~ 10.8 lb.ft)

CAUTION

- Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.

4. Connect the CAB connector.
5. Install the headlining. (Refer to the Body group - Roof trim)
6. Install the Interior trim. (Refer to the Body group - Interior trim)
7. Reconnect the battery negative cable.
8. After installing the Curtain Airbag (CAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Airbag Module Disposal > Description and Operation

Airbag Disposal

Special tool required

Deployment tool 0957A-34100A

Before scrapping any airbags or side airbags (including those in a whole vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped. If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

Deploying airbags in the vehicle

If an SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag is securely mounted.

3. Confirm that the special tool is functioning properly by following the check procedure.
   (1) Driver's Airbag :
      A. Remove the driver's airbag and install the SST (0957A-38500).
      B. Install the driver's airbag on the steering wheel.
   (2) Front Passenger's Airbag :
      A. Remove the glove box, and then disconnect the 2P connector between the front passenger's airbag and SRS main harness.
      B. Install the SST(0957A-38500).
   (3) Side Airbag :
      A. Disconnect the 2P connector between the side airbag and side wire harness.
      B. Install the SST (0957A-3F100).
   (4) Curtain Airbag :
      A. Disconnect the 2P connector between the curtain airbag and wire harness.
      B. Install the SST (0957A-38500).
   (5) Seat Belt Pretensioner :
      A. Disconnect the 2P connector from the seat belt pretensioner.
      B. Install the SST (0957A-38500).
4. Place the deployment tool at least thirty feet (10meters) away from the airbag.
5. Connect a 12 volt battery to the tool.
6. Push the tool's deployment switch. The airbag should deploy (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)
7. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

Deploying the airbag out of the vehicle

If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows:

1. Confirm that the special is functioning properly by following the check procedure on this page.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

Disposal Of Damaged Airbag

1. If installed in a vehicle, follow the removal procedure of driver's airbag front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Description and Operation

Description

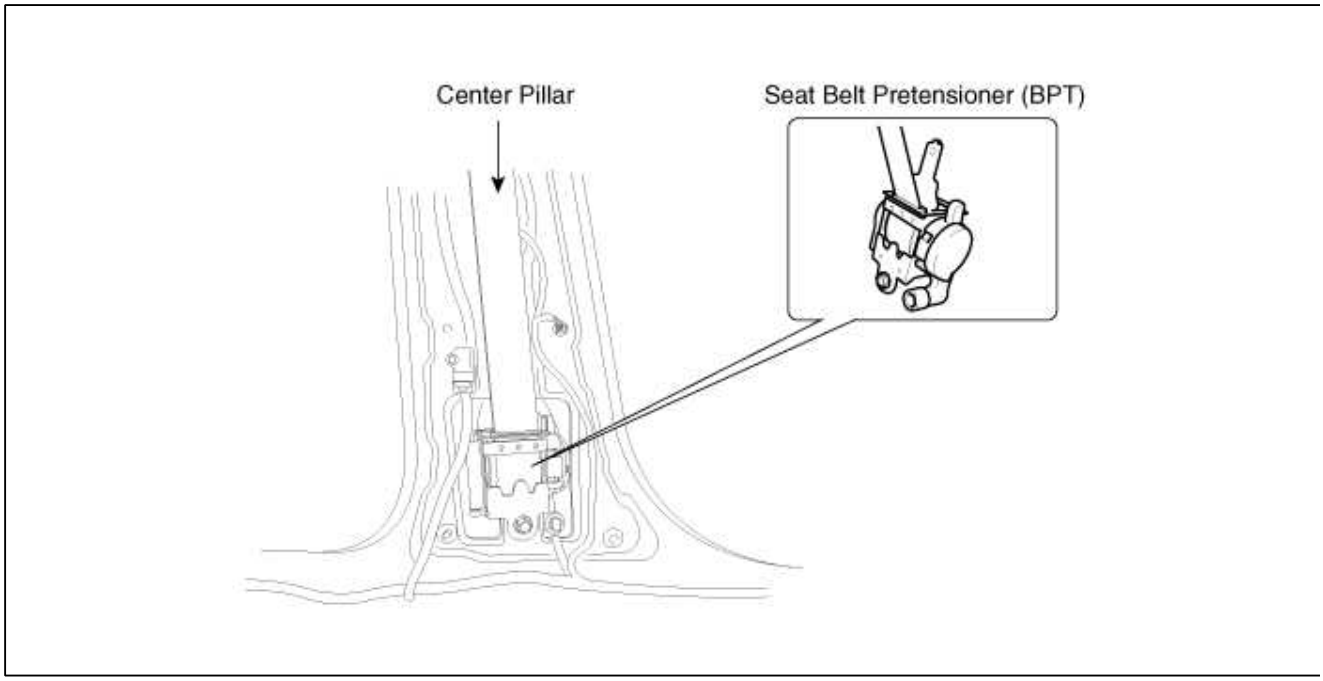
The Seat Belt Pretensioners (BPT) are installed inside Center Pillar (LH & RH). When a vehicle crashes with a certain degree of frontal impact, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupants by retracting the seat belt webbing. This prevents the front occupants from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.

CAUTION

Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Components and Components Location

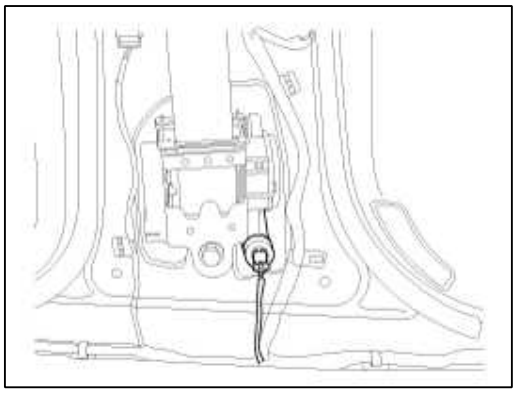
Components



Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the lower anchor bolt. (Except Anchor Pretensioner)
3. Remove the following parts. (Refer to the Body group - Interior trim)
   A. Door scuff trim
   B. Center pillar trim
4. Remove the upper anchor bolt.
5. Disconnect the Seat Belt Pretensioner connector.



6. Loosen the Seat Belt Pretensioner mounting bolt and remove the Seat Belt Pretensioner.

Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Install the Seat Belt Pretensioner (BPT) with a bolt.

4. Connect the Seat Belt Pretensioner (BPT) connector.

Tightening torque
: 39.2 ~ 53.9 Nm (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb.ft)

5. Install the upper anchor bolts.

Tightening torque
: 39.2 ~ 53.9 Nm (4.0 ~ 5.5 kgf.m, 28.9 ~39.8 lb.ft)

6. Install the following parts. (Refer to the Body group- Interior trim)
   A. Center pillar trim
   B. Door scuff trim
7. Install the lower anchor bolts.

Tightening torque
: 39.2 ~ 53.9 Nm (4.0 ~ 5.5 kgf.m, 28.9 ~39.8 lb.ft)

8. Reconnect the battery negative cable.
9. After installing the Seat Belt Pretensioner (BPT), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

SOUL(AM) > 2010 > G 1.6 DOHC > Steering System

Steering System > General Information > Specifications

Specifications

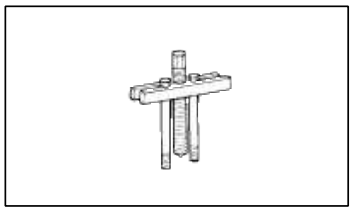
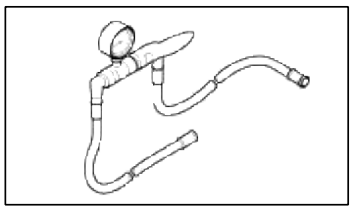
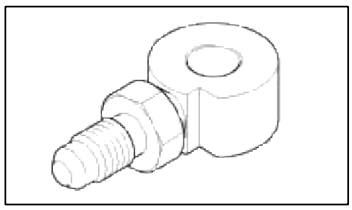
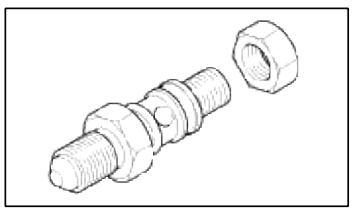
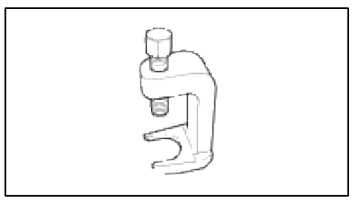
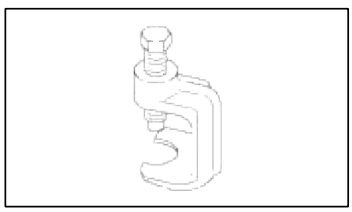
Item		Specification
Type		Motor driven Power Steering
		Hydraulic Power Steering System
Steering gear	Type	Rack & Pinion
	Rack stroke	140 ± 1mm
Steering angle (Max.)	Inner	38.4° ± 1°30'
	Outer	30.8°
Power steering pump	Type	Vane
	Relief pressure	88 ~ 93 Kgf/cm²
Power steering oil		PSF - 3

Tightening Torques

Item	Tightening torque		
	N.m	kgf.m	lb-ft
Hub nuts	90 ~ 110	9.0 ~ 11.0	65 ~ 80
Steering column mounting bolts and nuts	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13.0
Bolt connecting universal joint to pinion	30 ~ 35	3.0 ~ 3.5	22 ~ 25
Tie rod end castle nut	24 ~ 34	2.4 ~ 3.4	17 ~ 25
Steering gear box mounting bolts	60 ~ 80	6.0 ~ 8.0	43 ~ 58

Steering System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09561-11001 Steering wheel puller		Removal of steering wheel
09572-21000 Oil pressure gauge		Measurement of oil pressure (Use with 09572-22100, 09572-21200)
09572-22100 Oil pressure gauge adaptor		Measurement of oil pressure (Use with 09572-21000, 09572-21200)
09572-21200 Oil pressure gauge adaptor		Measurement of oil pressure (Use with 09572-21000, 09572-22100)
09568-2J100 Ball joint puller		Separation of tie-rod end ball joint
09568-4A000 Ball joint remover		Removal of the tie rod end ball joint

Steering System > General Information > Repair procedures

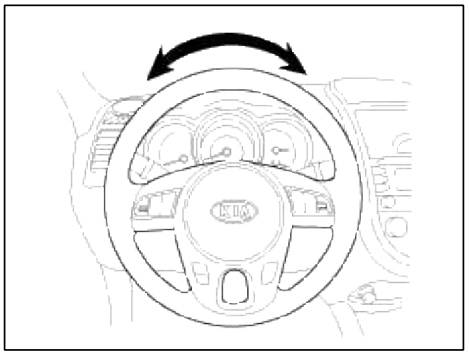
Adjustment

Steering Wheel Play Inspection

1. Turn the steering wheel so that the front wheels can face straight ahead.

2. Measure the distance the steering wheel can be turned without moving the front wheels.

Standard value: 30mm (1.18in.) or less

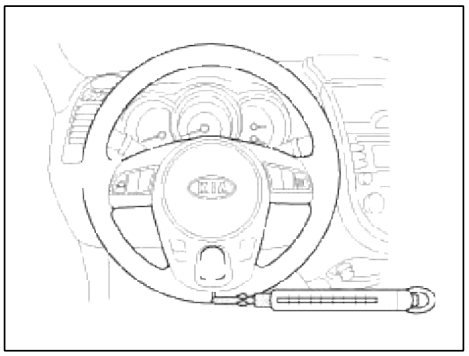


3. If the play exceeds standard value, inspect the steering column, shaft, and linkages.

Checking stationary steering effort

1. Position the vehicle on a level surface and place the steering wheel in the straight ahead position.
2. Start the engine and turn the steering wheel from lock to lock several times to warm up the power steering fluid.
3. Attach a spring scale to the steering wheel. With the engine speed 900 ~ 1100rpm, pull the scale and read it as soon as the tires begin to turn.

Standard value: 3.0kgf or less



4. If the measured value exceeds standard value, inspect the power steering gear box and pump.

Power steering fluid replacement

CAUTION

Always use genuine power steering fluid. Using other type of power steering fluid or ATF can cause increased wear and poor steering in cold weather.

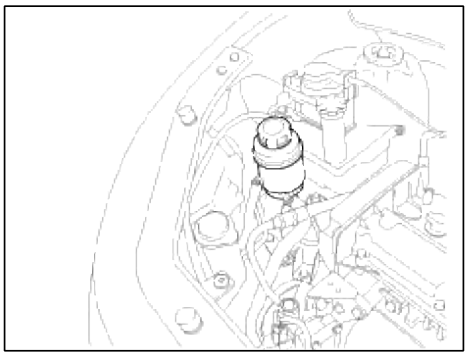
1. Raise the reservoir and then disconnect the return hose to drain the reservoir. Take care not to spill the fluid on the body and parts. Wipe off any spilled fluid at once.
2. Connect a tube of suitable diameter to the disconnected return hose, and put the hose end in a suitable container.
3. Jack up the front wheels and turn the steering wheel from the lock to lock until fluid stops running out of the tube.
4. Reconnect the return hose to reservoir
5. Fill the reservoir with the power steering fluid and then bleed the power steering system.

Air bleeding

CAUTION

Always use genuine power steering fluid. Using other type of power steering fluid or ATF can cause increased wear and poor steering in cold weather.

1. Fill the reservoir with the power steering fluid up to the level of 'COLD MAX' marked on the reservoir.



NOTE

While conducting the following operations, keep replenishing the reservoir so that the fluid level can be always between the 'COLD MAX' and the 'COLD MIN' marked on the reservoir.

2. Jack up the front wheels.
3. Crank the engine 1 ~ 2times by turning the ignition key very quickly from the 'On' position to the 'Start' position, but do not start the engine.

CAUTION

Be careful not to start the engine. If starting the engine before performing the steps 3 through 4, it may cause an abnormal noise during power steering pump operation.

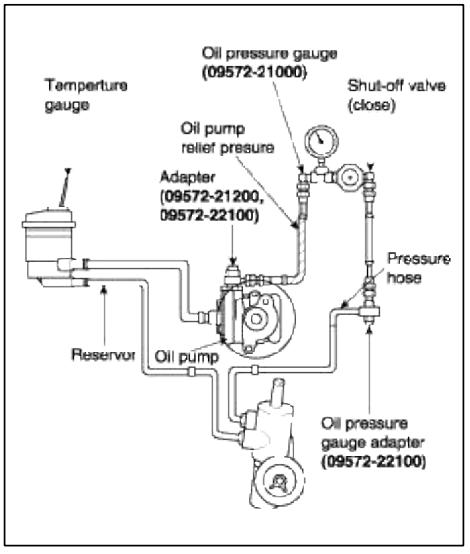
4. Turn the steering wheel from lock to lock 5 ~ 6 times for 15 ~ 20 seconds.
5. Start the engine and keep turning the steering wheel from lock to lock until air bubbles stop appearing in the reservoir with the engine idle.
6. Check the color and level of the power steering fluid in the reservoir and then replenish the reservoir up to the 'COLD MAX' level as required.

NOTE

If the fluid level moves up and down when turning the steering wheel, the fluid overflows out of the reservoir when the turning off the engine or the fluid has white color, it indicates that air bubbles have not been removed sufficiently from the power steering system. Therefore, repeat the steps 5 through 6 as required.

Oil pump relief pressure test

1. Disconnect the pressure tube from the power steering pump and then install the special tools between the pump and the pressure tube as illustration below.



2. Start the engine and turn the steering wheel several times so that the fluid temperature can rise to approx. 50 ~ 60 C (122 F).
3. Set the engine speed to approx. 1000rpm.

4. Close the shut-off valve of the special tools and measure the fluid pressure.

Relief pressure:
88 ~ 93kgf/cm² (1325 ~ 1400psi, 9.1 ~ 9.6Mpa)

CAUTION

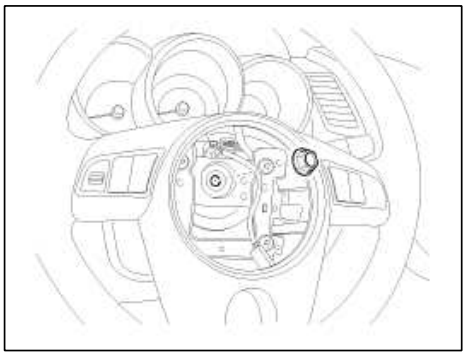
Do not keep the shut-off valve on the pressure gauge closed for longer than 10 seconds.

5. Remove the special tools, and than connect the pressure tube to the pump by tightening the eye bolt.
6. Bleed the power steering system.

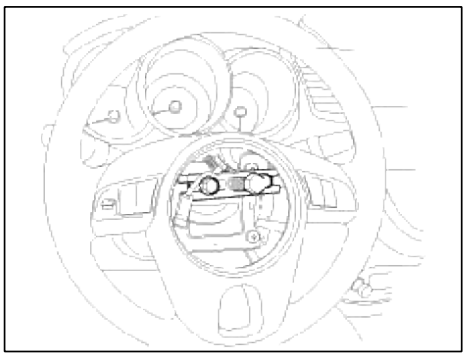
Steering System > Steering Column and shaft > Steering Column and Shaft > Repair procedures

Replacement

1. Disconnect the battery negative cable from the battery and then wait for at least 30 seconds.
2. Turn the steering wheel so that the front wheels can face straight ahead.
3. Remove the airbag module. (Refer to RT group)
4. Loosen the steering wheel lock nut.



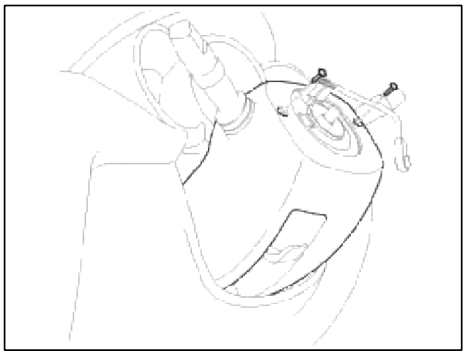
5. Remove the steering wheel from the steering column shaft by using a SST (09561-11001).



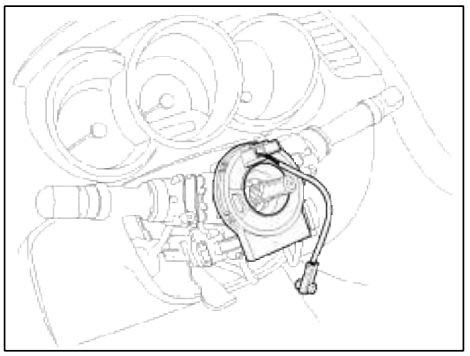
CAUTION

Do not hammer on the steering wheel to remove it; it may damage the steering column.

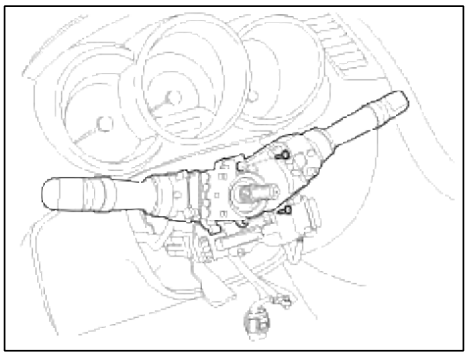
6. Remove the steering column upper and lower shroud.



7. Remove the clock spring.

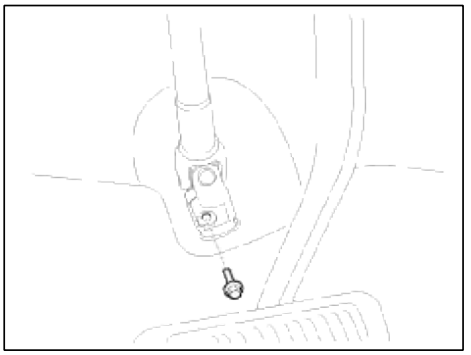


8. Loosen the screw and then remove the multifunction switches.



9. Remove the lower crash pad. (Refer to BD group)
10. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

Tightening torque :
30 ~ 35 N.m (3.0 ~ 3.5 kgf.m, 22 ~ 25 lb-ft)



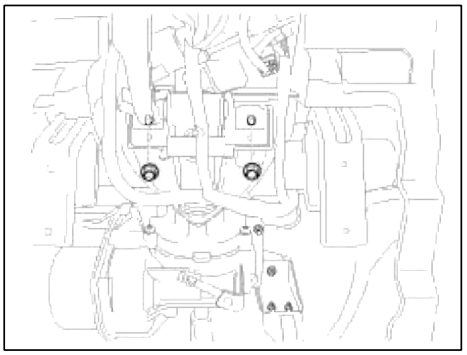
CAUTION

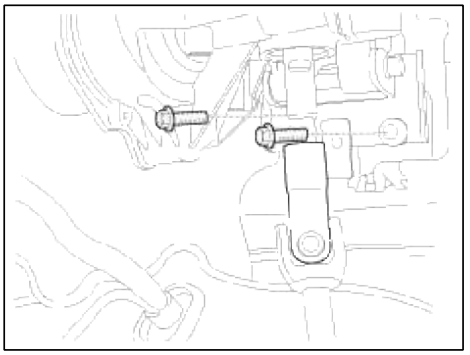
Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

11. Disconnect all connectors connected the steering column.

12. Remove the steering column & EPS unit assembly by loosening the mounting bolts and nuts.

Tightening torque :
13 ~ 18 N.m (1.3 ~ 1.8 kgf.m, 9 ~ 13 lb-ft)





13. Installation is the reverse of the removal.

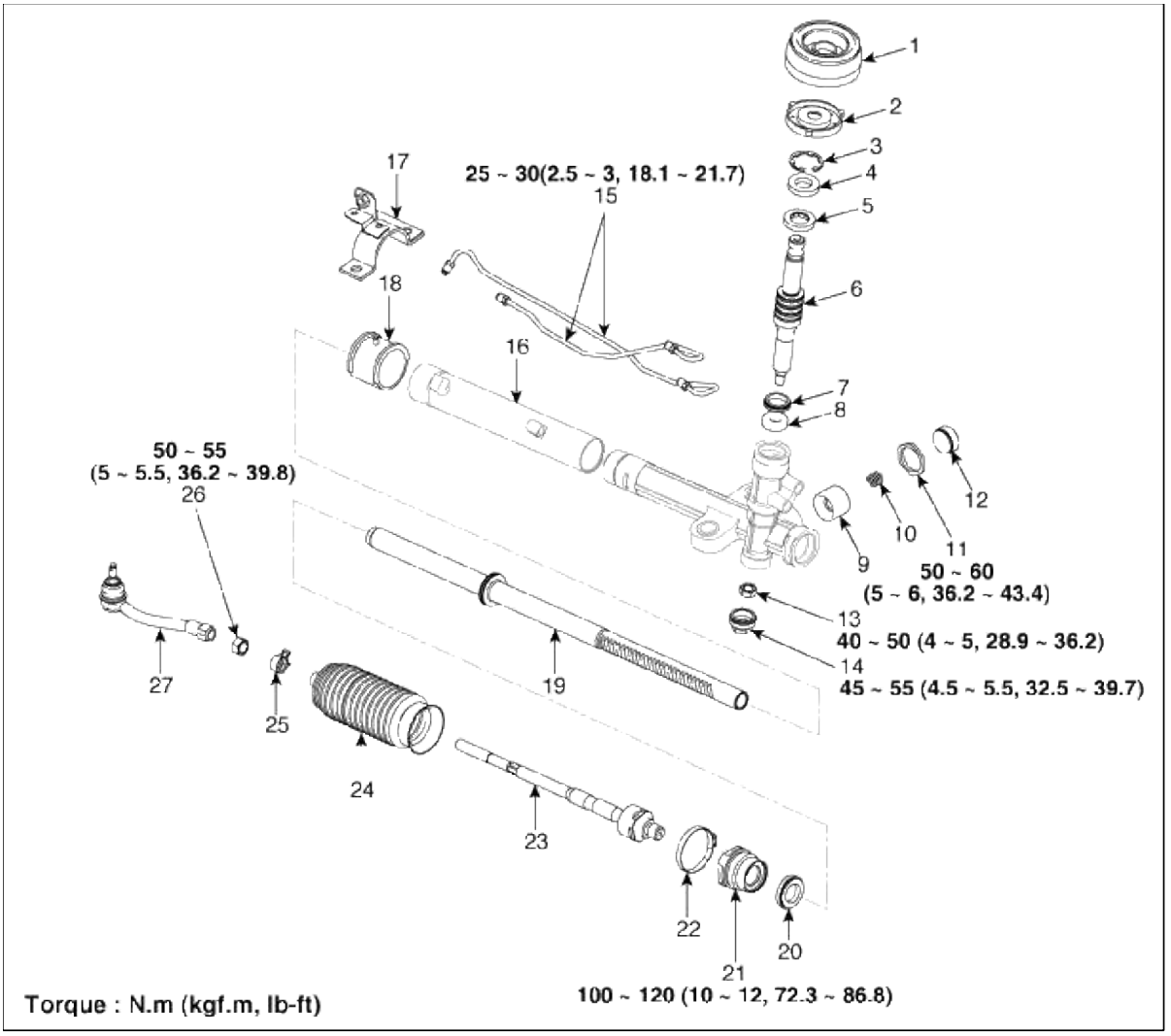
> CAUTION
>
> When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

Inspection

1. Check the steering column for damage and deformation.
2. Check the steering column for damage and deformation.
3. Check the join bearing for damage and wear.
4. Check the tilt bracket for damage and cracks.
5. Check the key lock assembly for proper operation and replace it if necessary.

Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Components and Components Location

Components



1. Protector rubber	8. Needle bearing	15. Feed tube	22. Bellows band
2. Dust cap	9. Rack support yoke	16. Rack housing	23. Tie rod
3. Snap ring	10. Rack support spring	17. Mounting bracket	24. Bellows
4. Input shaft seal	11. Lock nut	18. Mounting isolator	25. Bellows clip
5. Input shaft bearing	12. Yoke plug	19. Rack	26. Lock nut
6. Pinion valve assembly	13. Pinion locking nut	20. Oil seal	27. Tie rod end
7. Pinion seal	14. Pinion plug	21. Rack stopper	

Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Repair procedures

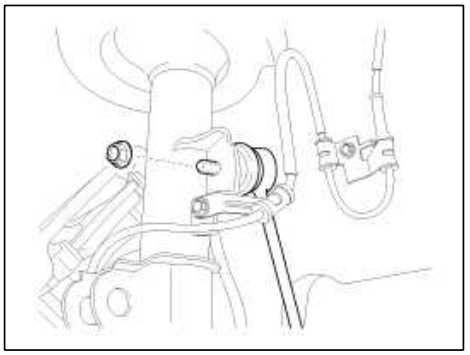
Replacement

1. Remove the front wheel & tire.

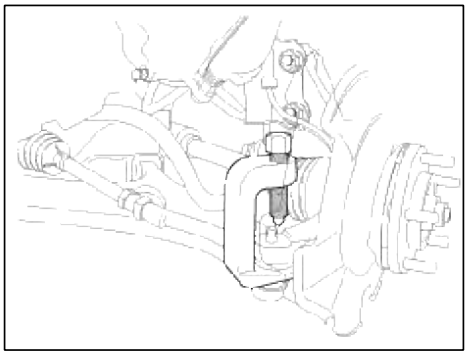
Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Disconnect the stabilizer link with the front strut assembly after loosening the nut.

Tightening torque :
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

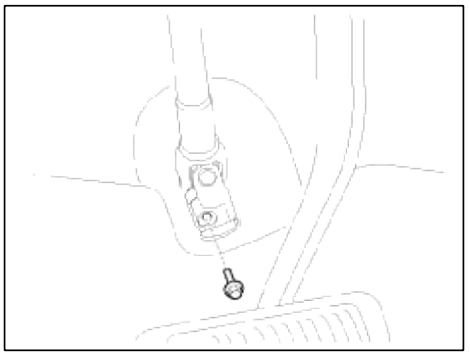


3. Disconnect the tie-rod end with the knuckle using a SST (09568-2J100 or 09568-4A000).



4. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

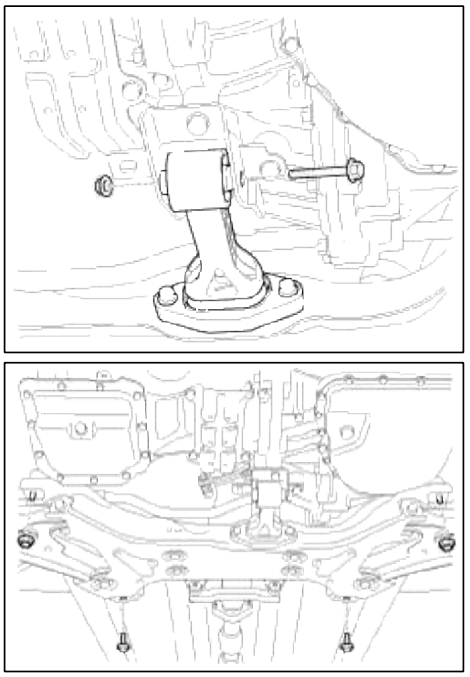
Tightening torque :
30 ~ 35N.m (3.0 ~ 3.5kgf.m, 22 ~ 25lb-ft)



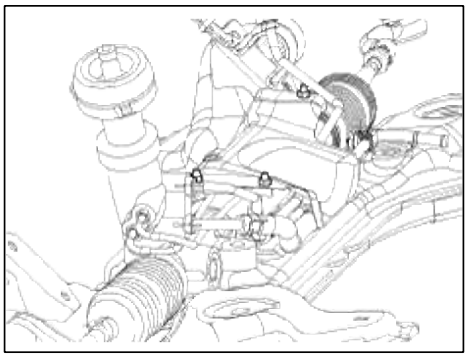
CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

5. Remove the cross member from the body by loosening the mounting bolts and nuts.



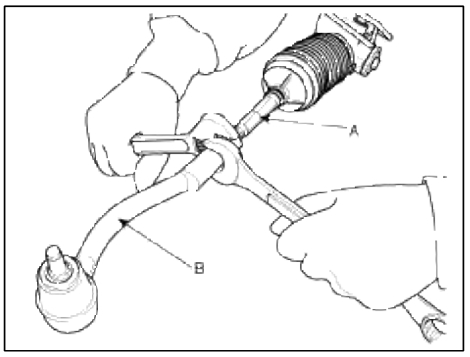
6. Remove steering gearbox from the cross member by loosening the bracket mounting bolts.



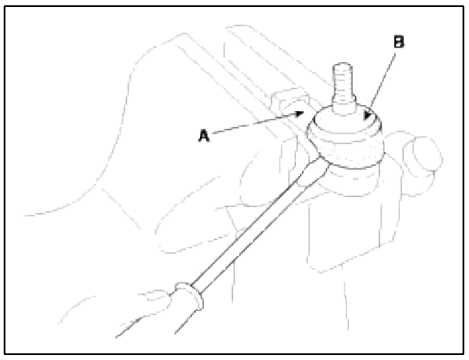
7. Remove steering gearbox from the cross member by loosening the mounting bolts.
8. Installation is the reverse of the removal.

Disassembly

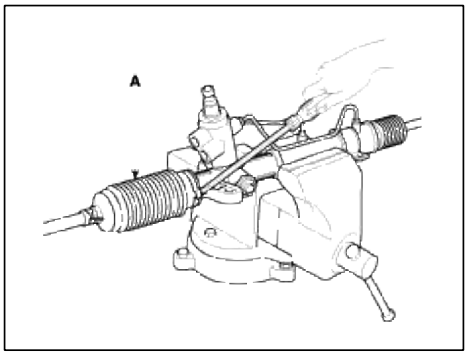
1. Remove the tie rod end (B) from the tie rod (A).



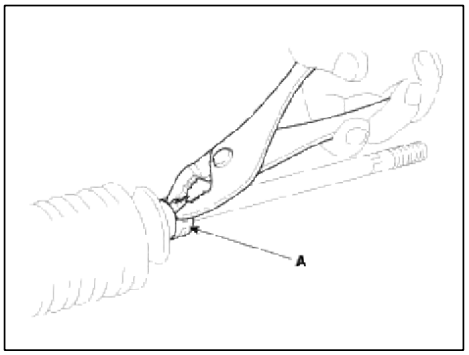
2. After mounting the tie rod end(A) in a vise, remove the dust cover(B) from the ball joint.



3. Remove the bellows band(A).



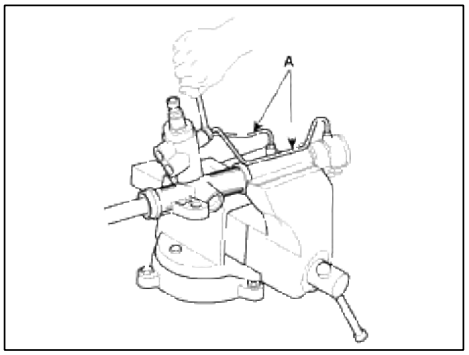
4. Remove the bellows clip(A).



5. Pull the bellows out toward the tie rod.

> NOTE
>
> Check for rust on the rack when the bellows are replaced.

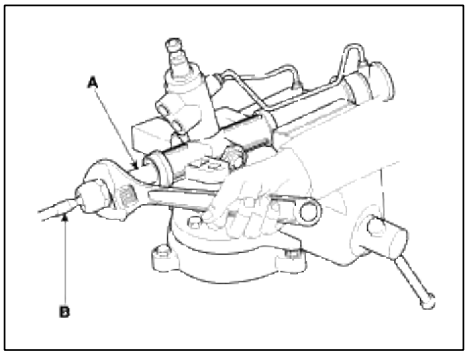
6. Remove the feed tube (A) from the rack housing.



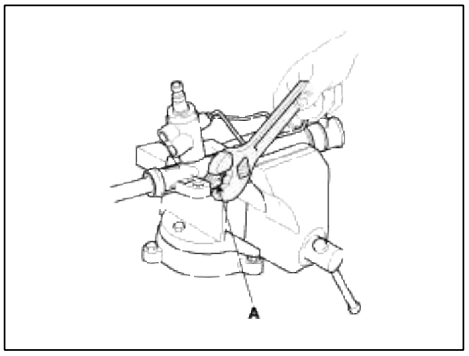
7. While moving the rack slowly, drain the fluid from the rack housing.

8. Remove the tie rod(B) from the rack(A).

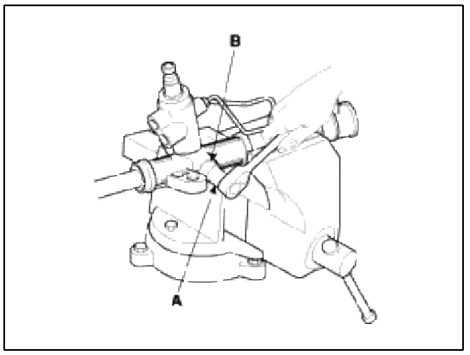
> CAUTION
>
> Remove the tie rod(B) from the rack(A), taking care not to twist the rack.



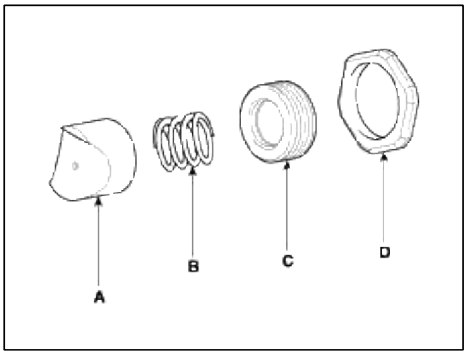
9. Remove the yoke plug locking nut(A).



10. Remove the yoke plug(B) with a 14mm socket(A).

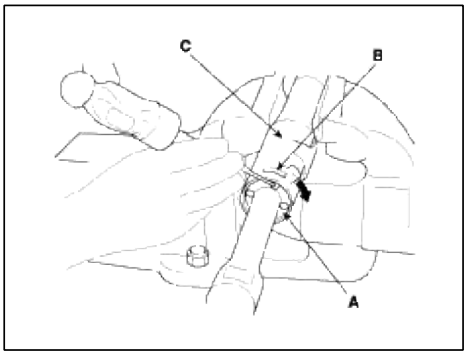


11. Remove the lock nut(D), yoke plug(C), rack support spring(B) and rack support yoke(A) from the gear box.

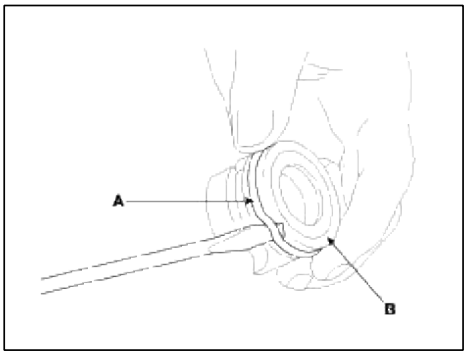


12. When the end of the circlip comes out of the notched hole of the housing rack cylinder, turn the rack stopper counterclockwise and remove the circlip.

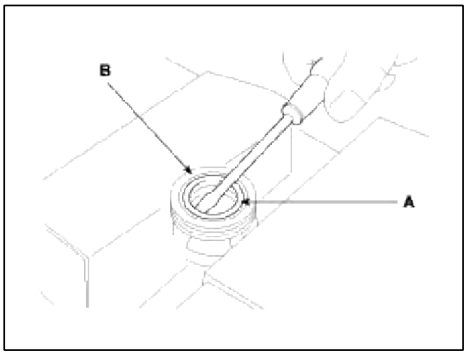
> CAUTION
>
> Be careful not to damage the rack.



13. Remove the rack bushing and rack from the rack housing.
14. Remove the oil seal (B) from the rack bushing (A).



15. Remove the oil seal(B) from the rack bushing(A).

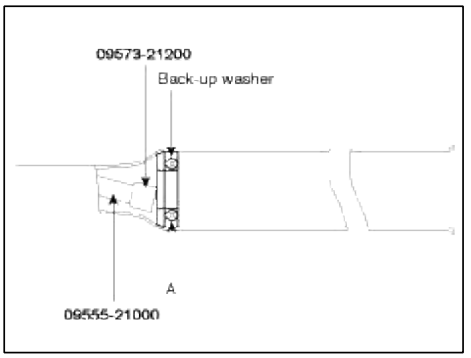


16. Remove the valve body from the valve body housing with a soft hammer.
17. Using the special tool, remove the oil seal and ball bearing from the valve body housing.
18. Remove the oil seal and O-ring from the rack housing.

> CAUTION
>
> Be careful not to damage the pinion valve cylinder inside of the rack housing.

19. Using the special tool (09573-21200, 09555-21000), remove the oil seal (A) from the rack housing.

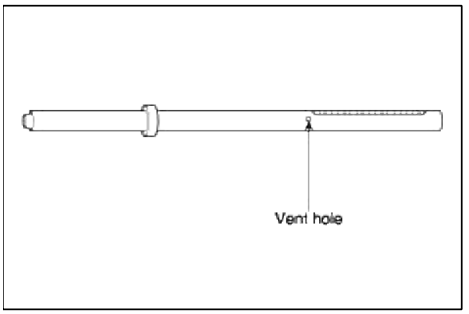
> CAUTION
>
> Be careful not to damage the rack cylinder inside of the rack housing.



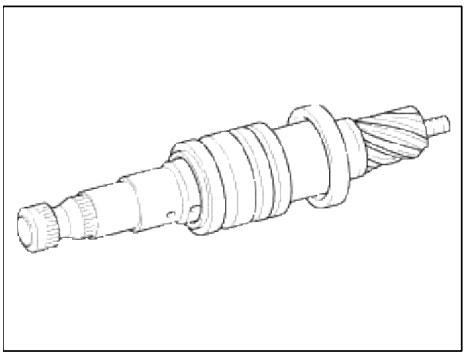
20. Reassembly is the reverse of the disassembly.

Inspection

1. Rack
   (1) Check for rack tooth face damage or wear.
   (2) Check for oil seal contact surface damage.
   (3) Check for rack bending or twisting
   (4) Check for oil seal ring damage or wear.
   (5) Check for oil seal damage or wear.



1. Pinion valve
   (1) Check for pinion gear tooth face damage or wear.
   (2) Check for oil seal contact surface damage.
   (3) Check for seal ring damage or wear.
   (4) Check for oil seal damage or wear.

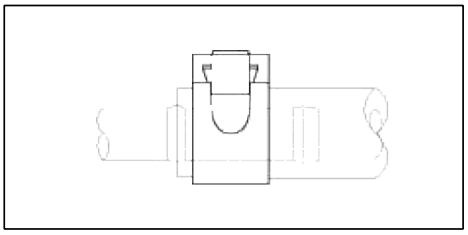


1. Bearing
   (1) Check for seizure or abnormal noise during a bearing rotation.
   (2) Check for excessive play.
   (3) Check for missing needle bearing rollers.
2. Others
   (1) Check for damage of the rack housing cylinder bore.
   (2) Check for boot damage, cracking or aging.

Steering System > Hydraulic Power Steering System > Power Steering Hoses > Repair procedures

Replacement

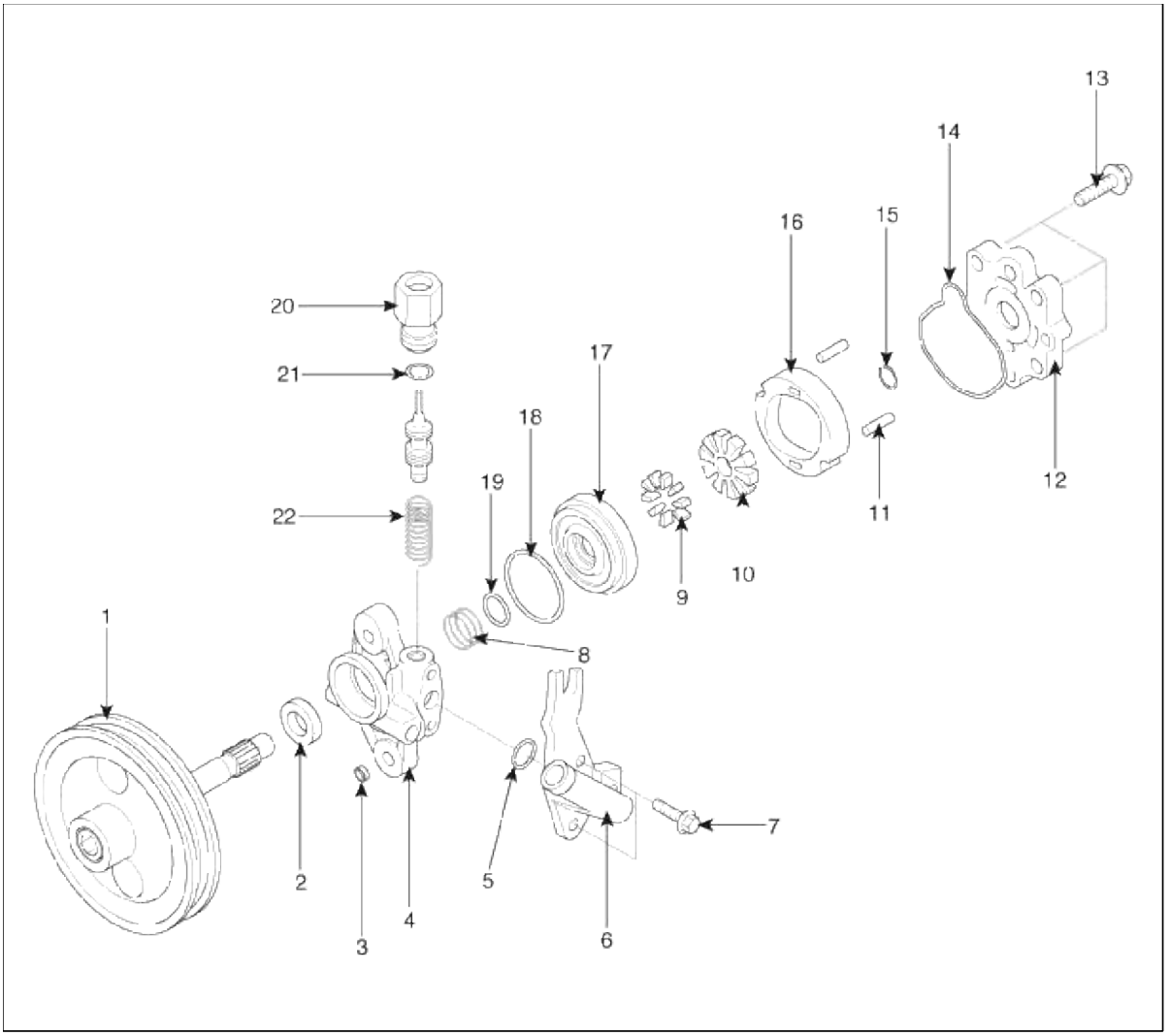
- Refer to the components illustration during removal or installation.
- When installing, be sure to connect between hose to tube using a clamp as shown in the illustration.



- Check all clamps for deterioration or deformation; replace with the clamps new one if necessary.
- Add the recommended power steering fluid and bleed the power steering system.

Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Components and Components Location

Components



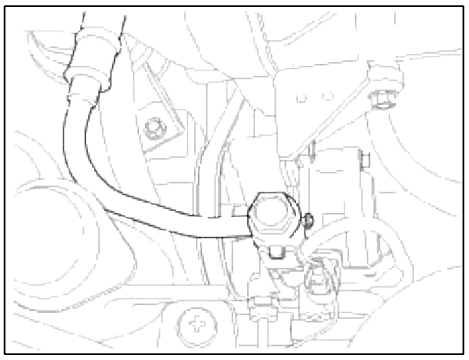
1. Pulley & driveshaft assembly	9. Vane	17. Oil pump side plate
2. Oil seal	10. Rotor	18. O-ring (Outer)
3. Bush	11. Cam ring	19. O-ring (Inner)
4. Front housing	12. Oil pump cover assembly	20. Connector
5. O-ring	13. Mounting bolt	21. O-ring
6. Suction pipe	14. O-ring	22. Spring
7. Mounting bolt	15. Bush	
8. Side plate spring	16. Cam ring	

Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Repair procedures

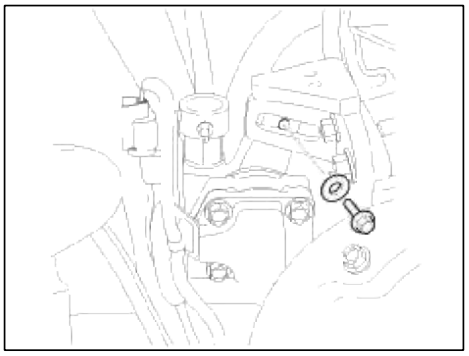
Replacement

1. Drain the power steering fluid.
2. Remove the drive belt.

3. Remove the pressure hose from the oil pump and the suction hose from the suction pipe.



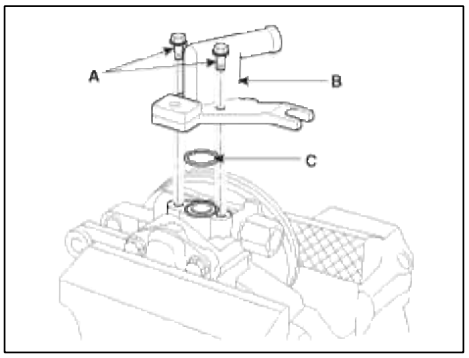
4. Loosen the mounting bolts and then remove the power steering pump.



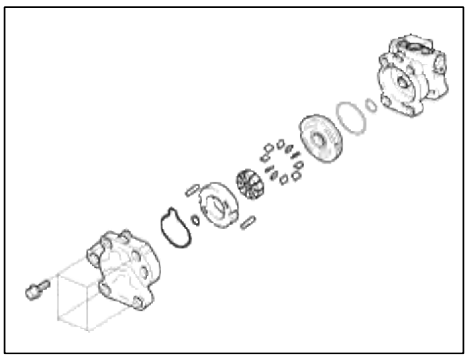
5. Installation is the reverse of the removal.

Disassembly

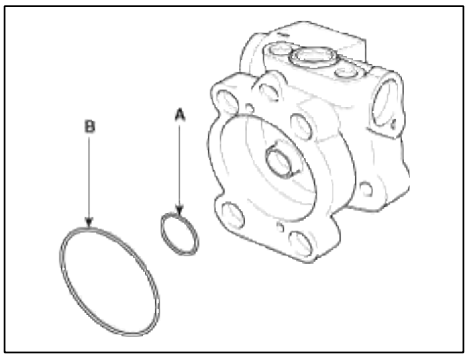
1. Remove two two bolts(A) from the oil pump body, and then remove the suction pipe(B) and O-ring(C).



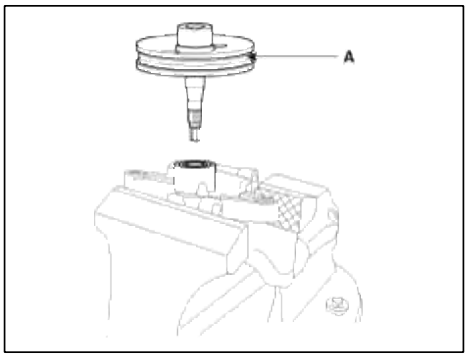
2. Loosen the four bolts and remove the oil pump cover assemb ly.
3. Remove the cam ring.
4. Remove the rotor and vanes.
5. Remove the oil pump side plate.



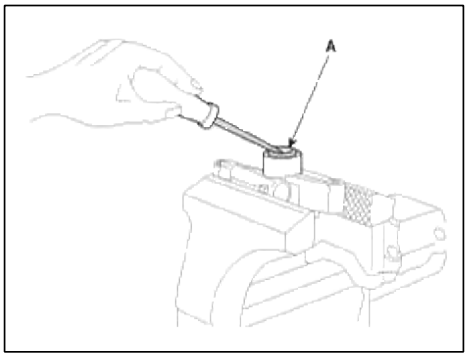
6. Remove the inner O-ring(A) and outer O-ring(B).



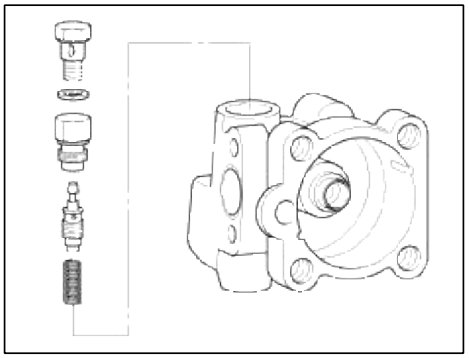
7. Remove the snap ring and take out the pulley and the drive shaft assembly(A).



8. Remove the oil seal(A) from the oil pump body.



9. Remove the connector from the oil pump body, and take out the flow control valve and the flow control spring.

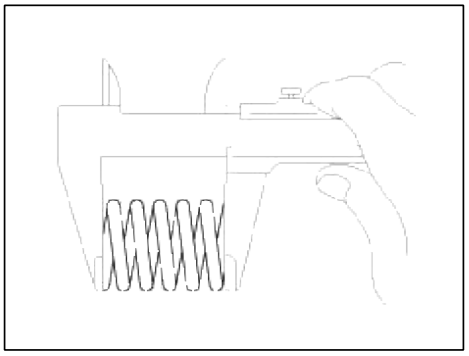


Inspection

1. Check that the flow control valve is not bent.
2. Check the shaft for wear and damage.
3. Check the grooves of the rotor and vanes for stratified abrasion.
4. Check the contact surface of the cam ring and vanes for stratified abrasion.
5. Check vanes for damage.
6. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

7. Check the free length of the flow control spring.

Free length of the flow control spring : 36.5 mm (1.4in)



SOUL(AM) > 2010 > G 1.6 DOHC > Suspension System

Suspension System > General Information > Specifications

Specifications

Front Suspension

Item		Specification
Suspension type		Mac Pherson Strut
Shock absorber	Type	Gas
Coil spring	Free Height [I.D. color]	313.6mm (Yellow – Yellow)
		298.8mm (White – Yellow)
		306.3mm (Yellow – Green)
		292.4mm (Yellow – Red)

Rear Suspension

Item		Specification
Suspension type		Coupled Torsion Beam Axle
Shock absorber	Type	Gas
Coil spring	Free Height [I.D. color]	301.3mm (Blue - 1)
		303.5mm (Yellow - 1)
		287.1mm (Red – 1)
		294.8mm (Gray – 1)

Wheel & Tire

Item		Specification
Wheel	Aluminum	6.5J x 16
		7.0J x 18
	Steel	6.0J x 15
Tire		195/65 R15
		205/55 R16
		225/45 R18
Tire pressure		2.3kg/cm² (33psi)

Wheel Alignment

Front

Item		Specification	
		Front	Rear
Toe-in	Total	-0.2°~0.2°	0.4°±0.2°
	Individual	-0.1°~0.1°	0.2°±0.1°
Camber		-0.5°±0.5°	-1.5°±0.5°
Caster		3.4°±0.5°	-
King-pin		12.53°±0.5°	-

Tightening Torques

Front Suspension

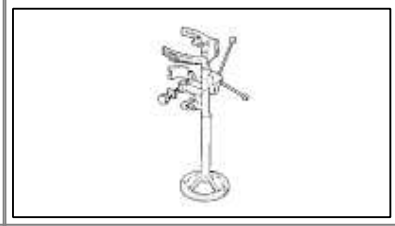
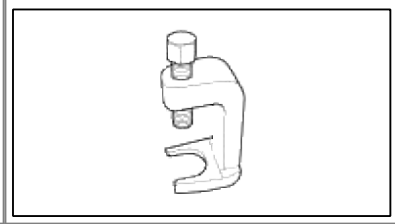
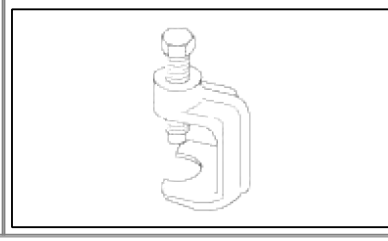
Item	Tightening torque		
	Nm	Kgf.m	lb-ft
Hub nuts	90 ~ 110	9 ~ 11	65 ~ 80
Lower arm to sub frame	160 ~ 180 /100 ~ 120	16 ~ 18 /10 ~ 12	115 ~ 130 /72 ~ 87
Tie rod end castle nut	24 ~ 34	2.4 ~ 3.4	72 ~ 87
Steering gear box to sub frame	60 ~ 80	6 ~ 8	43 ~ 58
Stabilizer bar to stabilizer link	100 ~ 120	10 ~ 12	72 ~ 87
Stabilizer bar to sub frame	45 ~ 55	4.5 ~ 5.5	32 ~ 40
Stabilizer bar to front strut assembly	100 ~ 120	10 ~ 12	72 ~ 87
Front strut assembly to front axle	140 ~ 160	14 ~ 16	101 ~ 115

Rear Suspension

Item	Tightening torque		
	Nm	Kgf.m	lb-ft
Hub nuts	90 ~ 110	9.0 ~ 11.0	65 ~ 80
Shock absorber to body	100 ~ 120	10.0 ~12.0	72 ~ 87
Shock absorber to torsion beam axle	100 ~ 120	10.0 ~12.0	72 ~ 87
Torsion beam axle to body	100 ~ 120	10.0 ~ 12.0	72 ~ 87

Suspension System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09546-26000 Strut spring compressor		Compression of coli spring
09568-2J100 Ball joint puller		Remover of ball joint
09568-4A000 Ball joint remover		Removal of the tie rod end ball joint

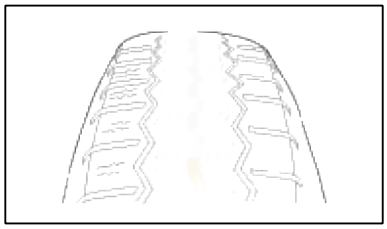
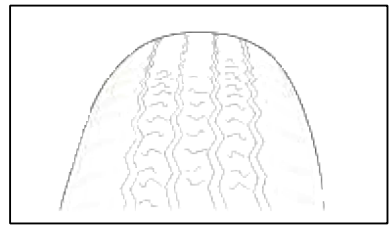
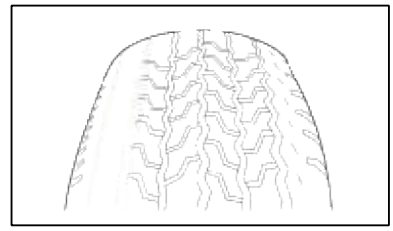
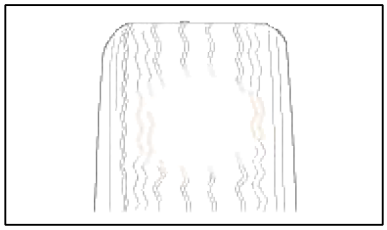
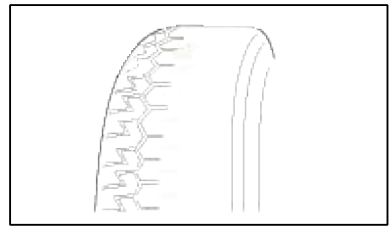
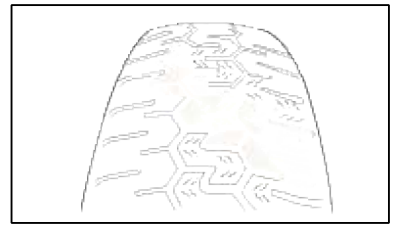
Suspension System > General Information > Troubleshooting

Troubleshooting

Symptom	Possible cause	Remedy
Hard steering	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Low tire pressure No power assist	Correct Replace Adjust Repair and replace
Poor return of steering wheel to center	Improper front wheel alignment	Correct
Poor or rough ride	Improper front wheel alignment Malfunctioning shock absorber Broken or worn stabilizer Broken or worn coil spring Worn lower arm bushing	Correct Repair or replace Replace Replace Replace the lower arm assembly
Abnormal tire wear	Improper front wheel alignment Improper tire pressure Malfunctioning shock absorber	Correct Adjust Replace
Wandering	Improper front wheel alignment Poor turning resistance of lower arm ball joint Loose or worn lower arm bushing	Correct Repair Retighten or replace

Vehicle pulls to one side	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Broken or worn coil spring Bent lower arm	Correct Replace Replace Repair
Steering wheel shimmy	Improper front wheel alignment Poor turning resistance of lower arm ball joint Broken or worn stabilizer Worn lower arm bushing Malfunctioning shock absorber Broken or worn coil spring	Correct Replace Replace Replace Replace Replace
Bottoming	Broken or worn coil spring Malfunctioning shock absorber	Replace Replace

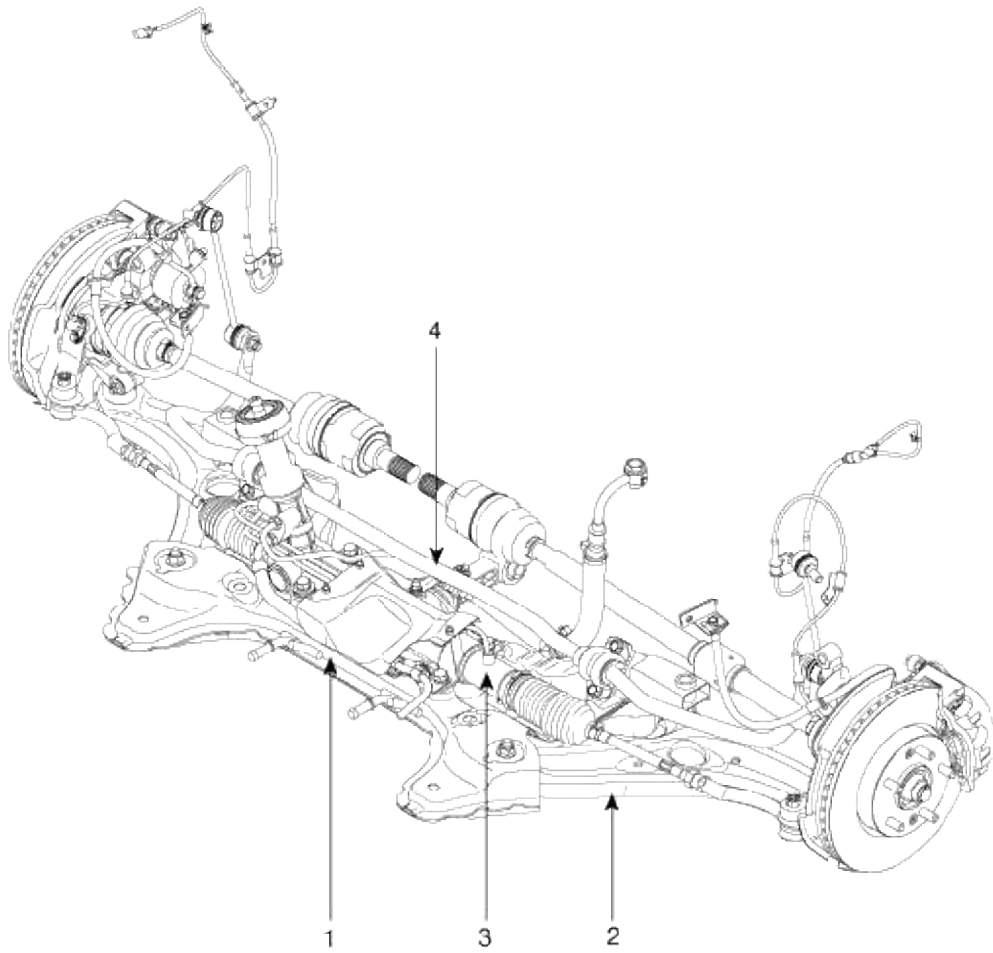
Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in Neutral is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.
Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Perform a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions

Wheel and tire diagnosis		
Rapid wear at the center	Rapid wear at both shoulders	Wear at one shoulder
		
• Center-tread down to fabric due to excessive over inflated tires • Lack of rotation • Excessive toe on drive wheels • Heavy acceleration on drive	• Under-inflated tires • Worn suspension components • Excessive cornering speeds • Lack of rotation	• Toe adjustment out of specification • Camber out of specification • Damaged strut • Damaged lower arm
Partial wear	Feathered edge	Wear pattern
		

• Caused by irregular burrs on brake drums	• Toe adjustment out of specification • Damaged or worn tie rods • Damaged knuckle	• Excessive toe on non-drive wheels • Lack of rotation

Suspension System > Front Suspension System > Components and Components Location

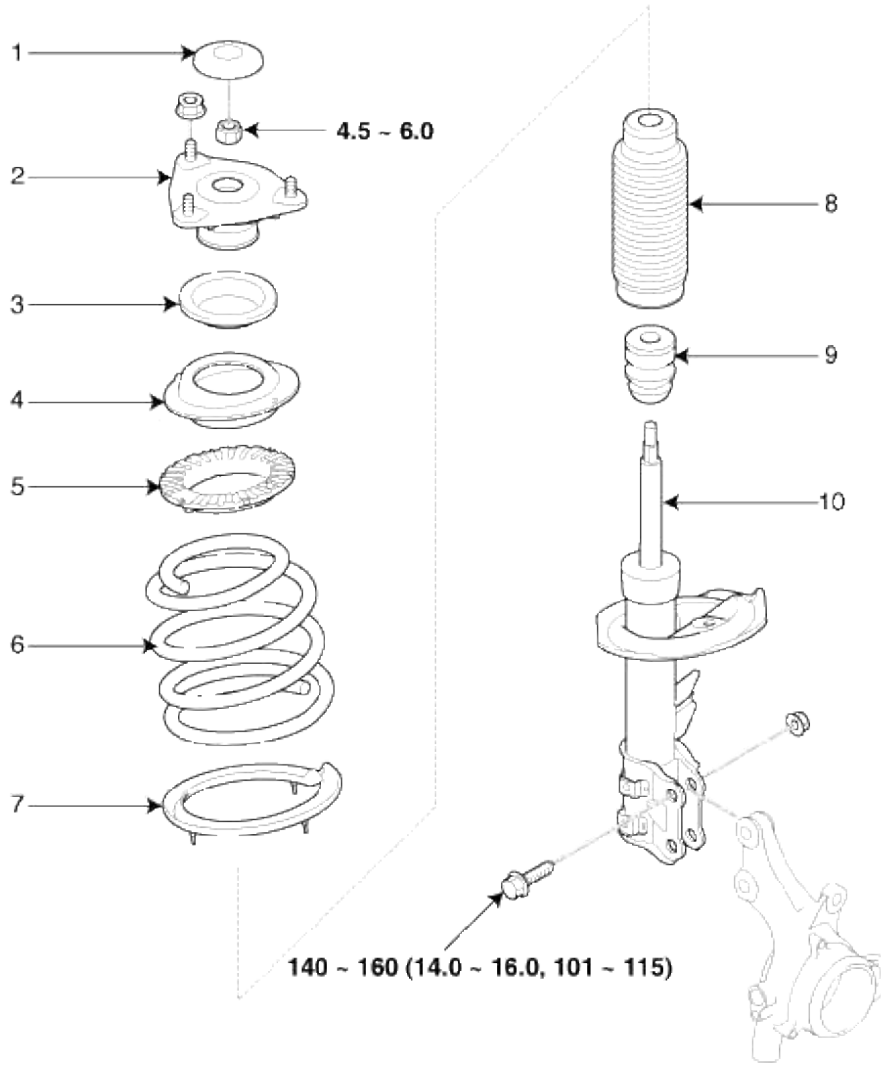
Components



1. Sub frame
2. Lower Arm
3. Steering gear box
4. Stabilizer Bar

Suspension System > Front Suspension System > Front Strut Assembly > Components and Components Location

Components



Torque : N.m (kgf.m, lb-ft)

1. Insulator cap 2. Insulator assembly 3. Strut bearing 4. Spring upper seat 5. Spring upper pad	6. Coil spring 7. Spring lower pad 8. Dust cover 9. Bumper rubber 10. Strut assembly

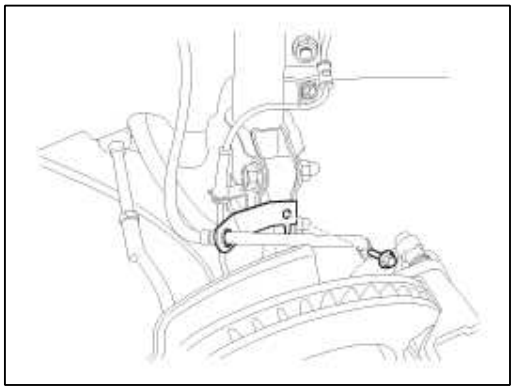
Suspension System > Front Suspension System > Front Strut Assembly > Repair procedures

Replacement

1. Remove the front wheel & tire.

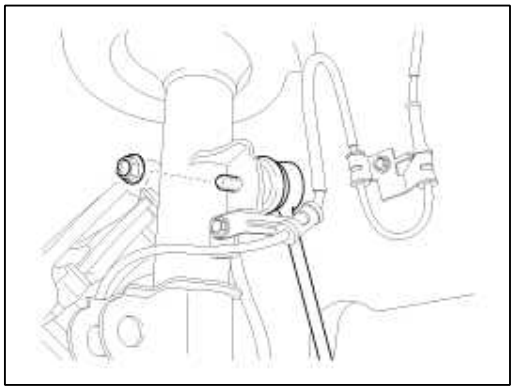
Tightening torque :
90 ~ 110 N.m (9.0 ~ 11.0 kgf.m, 65 ~ 80 lb-ft)

2. Remove the brake hose and the wheel speed sensor bracket from the front strut assembly by loosening the mounting bolts.

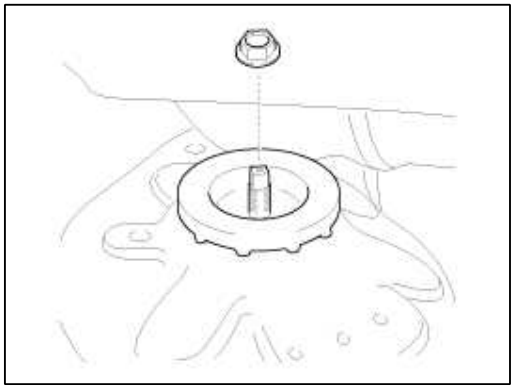


3. Disconnect the stabilizer link with the front strut assembly after loosening the nut.

Tightening torque :
100 ~ 120 N.m (10.0 ~ 12.0 kgf.m, 72 ~ 87 lb-ft)

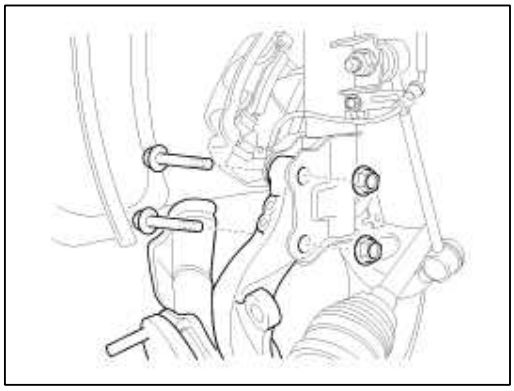


4. Loosen the strut mounting nuts.



5. Disconnect the front strut assembly with the knuckle by loosening the bolt & nut.

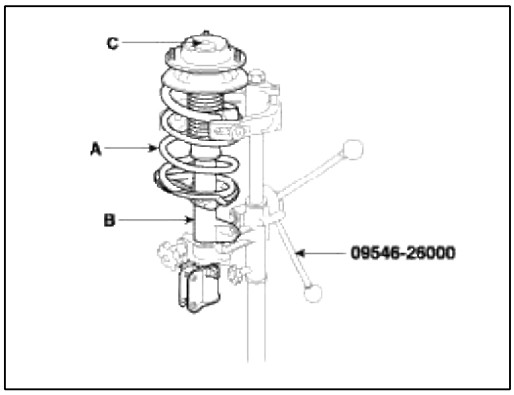
Tightening torque :
140 ~ 160 N.m (14.0 ~ 16.0 kgf.m, 101 ~ 115 lb-ft)



6. Installation is the reverse of removal.

Disassembly

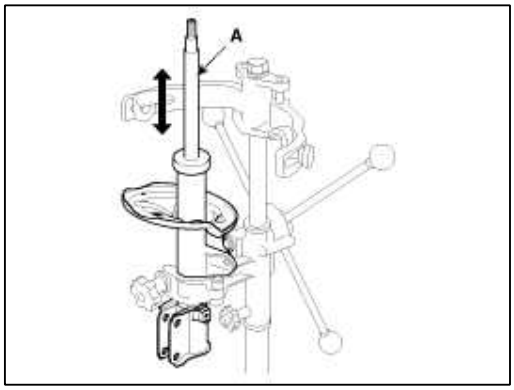
1. Using the special tool (09546-26000), compress the coil spring (A) until there is only a little tension of the spring on the strut.



2. Remove the self-locking nut (C) from the strut assembly (B).
3. Remove the insulator, spring seat, coil spring and dust cover from the strut assembly.

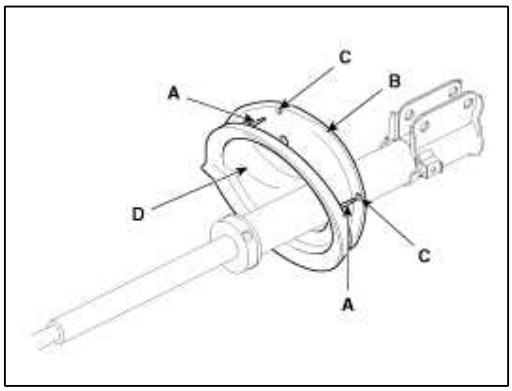
Inspection

1. Check the strut insulator bearing for wear or damage.
2. Check rubber parts for damage or deterioration.
3. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.



Reassembly

1. Install the spring lower pad (D) so that the protrusions (A) fit in the holes (C) in the spring lower seat (B).

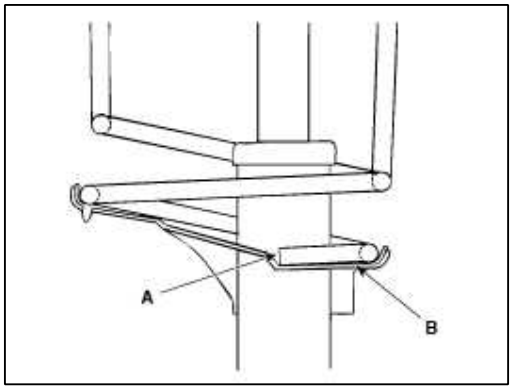


2. Compress coil spring using special tool (09546-26000).
   Install compressed coil spring into shock absorber.

NOTE

1) Indicated two identification color marks on the coil spring one follows model option (see page SS-2) the other follows load classification according to the below.
   Pay attention to distiuguish between the two marks and then install them.
2) Install the coil spring wth the idemtification mark directed toward the knuckle.

3. After fully extending the piston rod, install the spring upper seat and insulator assembly.
4. After seating the upper and lower ends of the coil spring (A) in the upper and lower spring seat grooves (B) correctly, tighten new self-locking nut temporarily.



5. Remove the special tool (09546-26000).
6. Tighten the self-locking nut to the specified torque.

Tightening torque :
40 ~ 55 Nm (4.0 ~ 5.5 kgf·m, 29 ~ 40 lb-ft)

Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

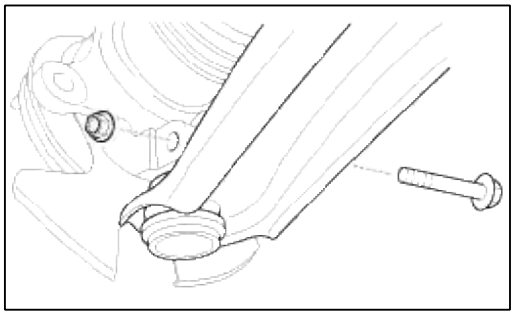
Replacement

1. Remove the front wheel & tire.

Tightening torque :
90 ~ 110 N.m (9.0 ~ 11.0 kgf.m, 65 ~ 80 lb-ft)

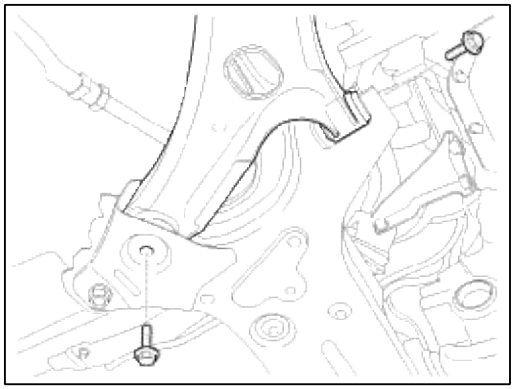
2. Remove the lower arm ball joint mounting bolts.

Tightening torque :
58.8 ~ 70.6 N.m (6.0 ~ 7.2 kgf.m, 43.4 ~ 52.1 lb-ft)



3. Remove the lower arm mounting bolts.

Tightening torque :
160 ~ 180 N.m (16.0 ~ 18.0 kgf.m, 115 ~ 130 lb-ft)
100 ~ 120 N.m (10.0 ~ 12.0 kgf.m, 72 ~ 87 lb-ft)



4. Installation is the reverse of removal.

Inspection

1. Check the bushing for wear and deterioration.
2. Check the lower arm for deformation.
3. Check the all bolts and nuts.

Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures

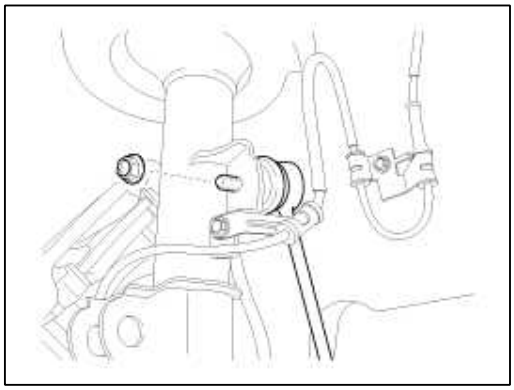
Replacement

1. Remove the front wheel & tire.

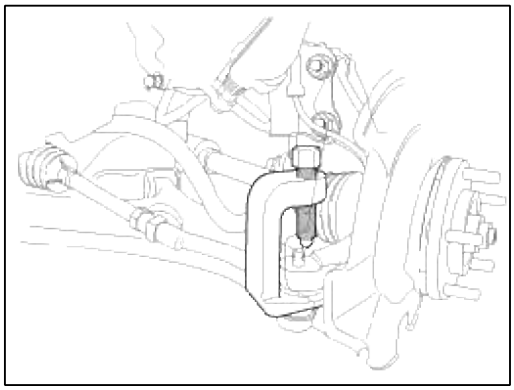
Tightening torque :
90 ~ 110 N.m (9.0 ~ 11.0 kgf.m, 65 ~ 80 lb-ft)

2. Disconnect the stabilizer link with the front strut assembly after loosening the nut.

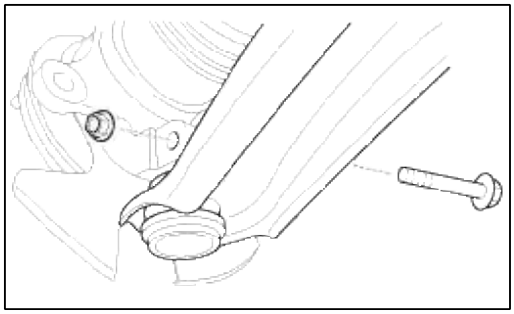
Tightening torque :
100 ~ 120 N.m (10.0 ~ 12.0 kgf.m, 72 ~ 87 lb-ft)



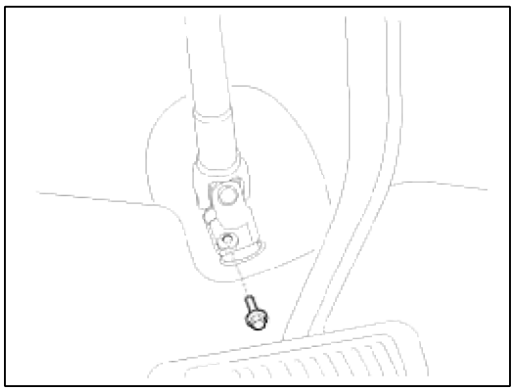
3. Disconnect the tie-rod end with the knuckle using a SST (09568-2J100 or 09568-4A000).



4. Remove the two bolts for lower arm ball joint.



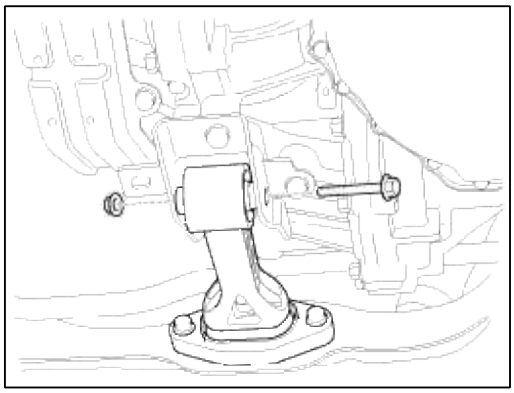
5. Loosen the bolt and then disconnect the universal joint assembly from the pinion of the steering gear box.

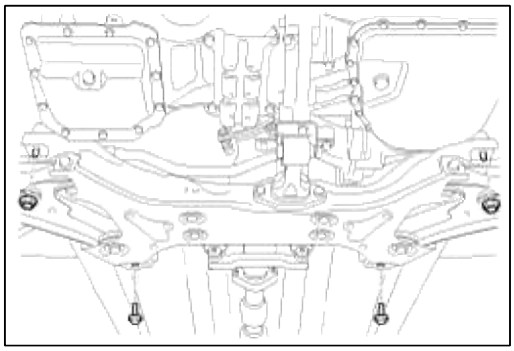


CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

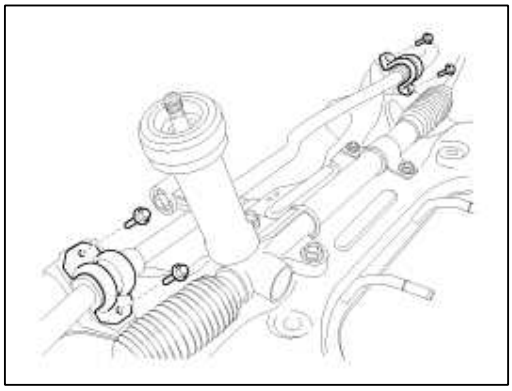
6. Remove the cross member from the body by loosening the mounting bolts and nuts.



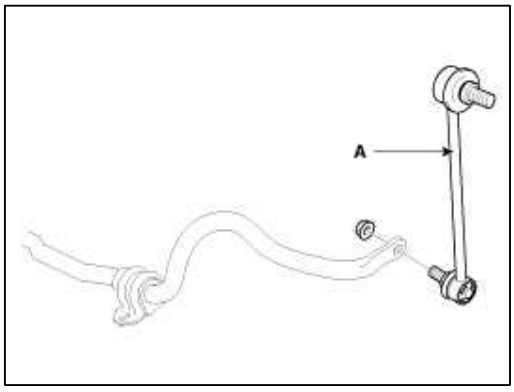


7. Remove the stabilizer from the cross member by loosening the bracket mounting bolts.

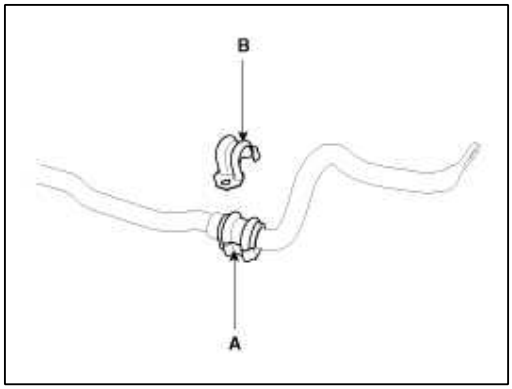
Tightening torque :
45 ~ 55 N.m (4.5 ~ 5.5 kgf.m, 32 ~ 40 lb-ft)



8. Disconnect the stabilizer link (A) with the stabilizer bar by loosening the nut.



9. Remove the bushing (A) and the bracket (B) from the stabilizer bar.



10. Installation is the reverse of removal.

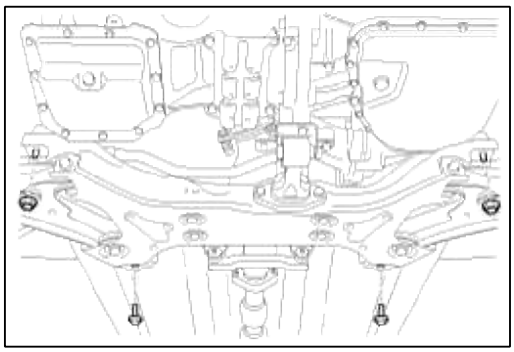
Inspection

1. Check the bushing for wear and deterioration
2. Check the front stabilizer bar for deformation.
3. Check the front stabilizer link ball joint for damage.

Suspension System > Front Suspension System > Sub Frame > Repair procedures

Replacement

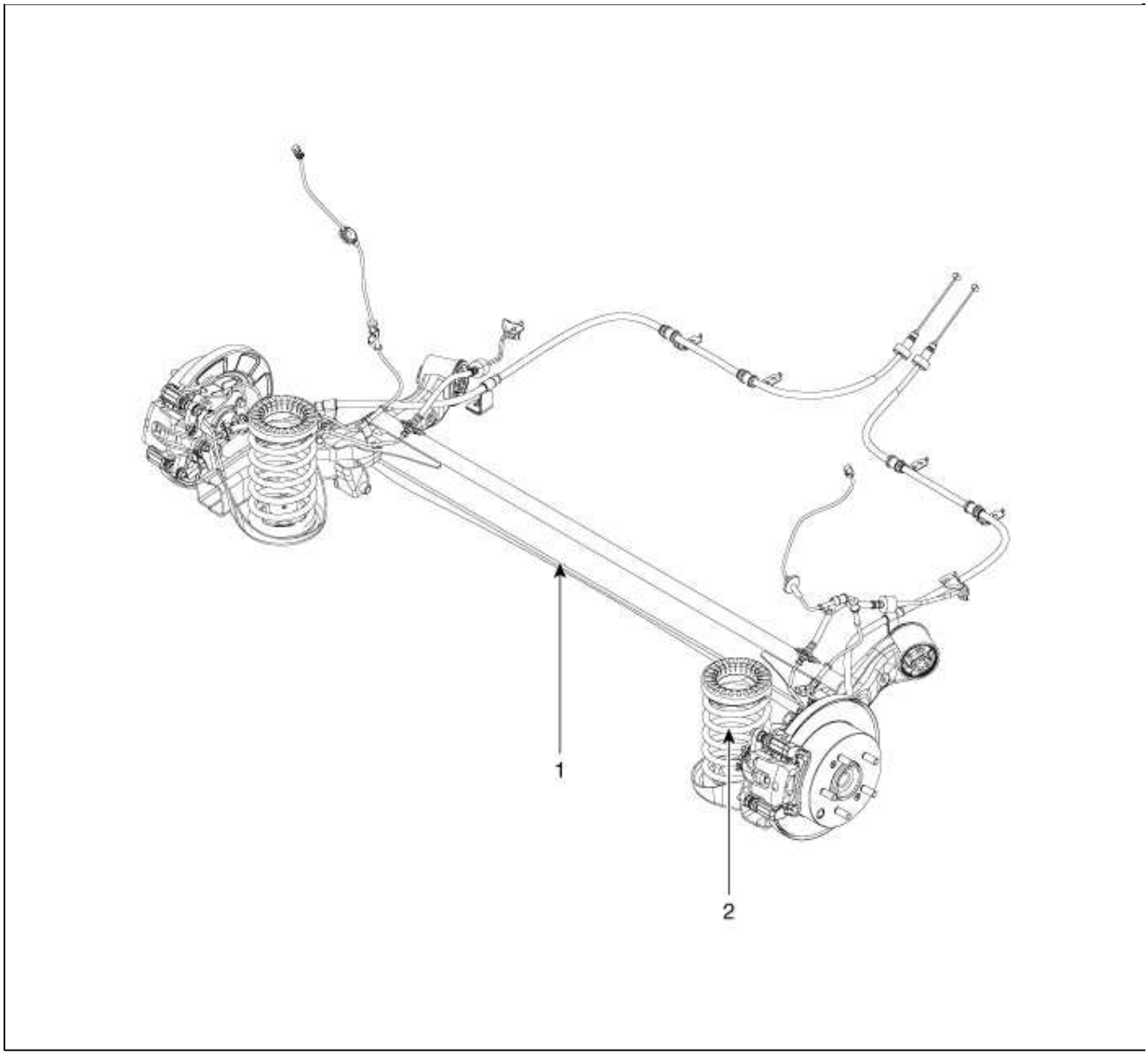
1. Remove the sub frame. (Refer to front stabilizer)



2. Remove the front lower arm.
3. Remove the front strut assembly.
4. Remove the front stabilizer.
5. Remove the steering gear box.
6. Installation is the reverse of removal.

Suspension System > Rear Suspension System > Components and Components Location

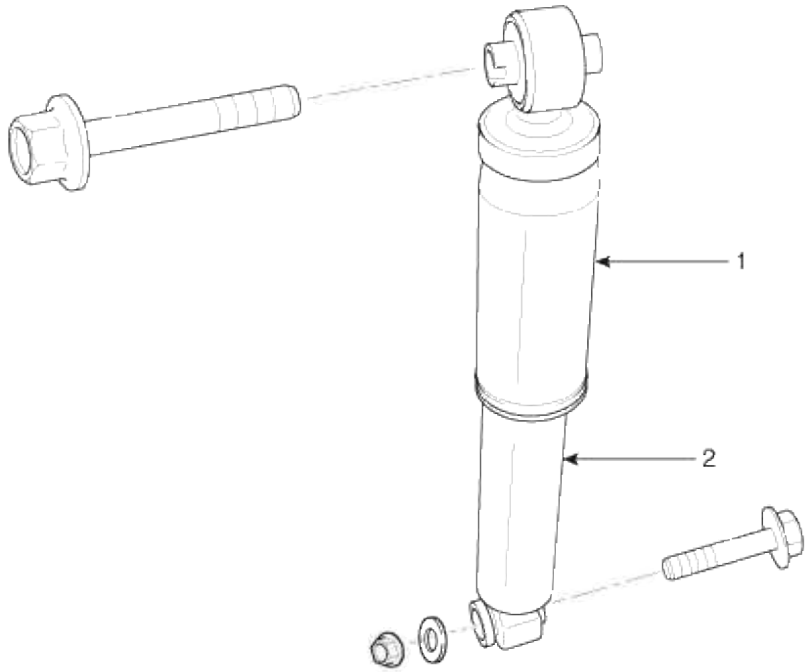
Components



1. Torsion beam axle
2. Coil spring assembly

Suspension System > Rear Suspension System > Rear Shock Absorber > Components and Components Location

Components



1. Dust cover
2. Shock absorber

Suspension System > Rear Suspension System > Rear Shock Absorber > Repair procedures

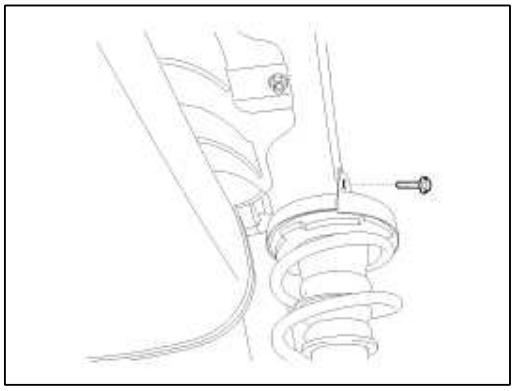
Replacement

1. Remove the rear wheel & tire.

Tightening torque :
90 ~ 110 N.m (9.0 ~ 11.0 kgf.m, 65 ~ 80 lb-ft)

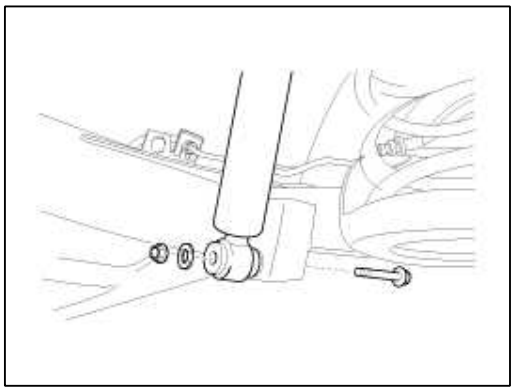
2. Remove the rear shock absorber from the frame by loosening the bolt.

Tightening torque :
100 ~ 120 N.m (10.0 ~ 12.0 kgf.m, 72 ~ 87 lb-ft)



3. Remove the rear shock absorber from the torsion beam axle by loosening the nut.

Tightening torque :
100 ~ 120 N.m (10.0 ~ 12.0 kgf.m, 72 ~ 87 lb-ft)



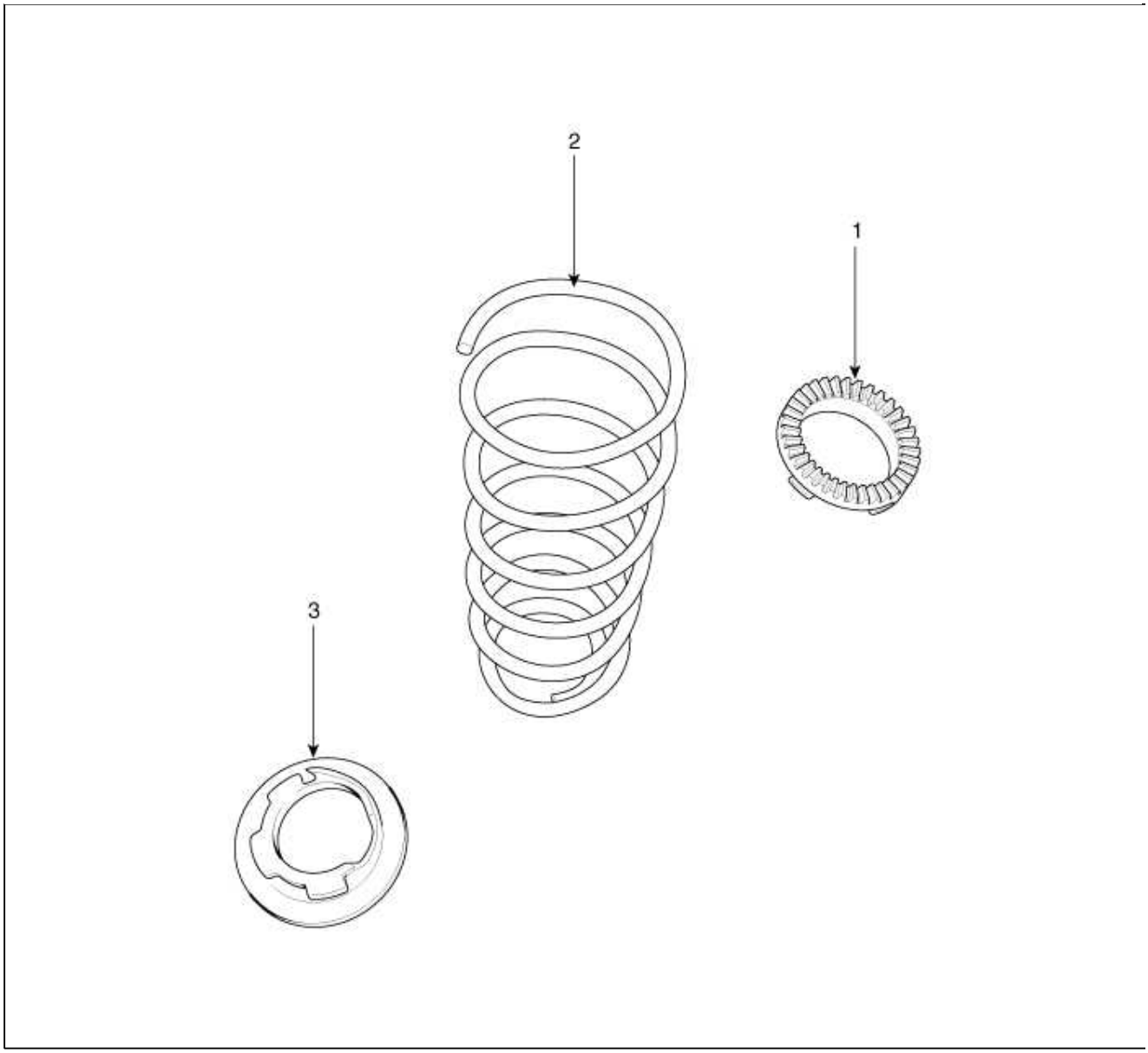
4. Installation is the reverse of removal.

Inspection

1. Check the components for damage or deformation.
2. Compress and extend the piston and check that there is no abnormal resistance or unusual sound during operation.

Suspension System > Rear Suspension System > Rear Coil Spring > Components and Components Location

Components



1. Spring upper pad
2. Spring
3. Spring lower pad

Suspension System > Rear Suspension System > Rear Coil Spring > Repair procedures

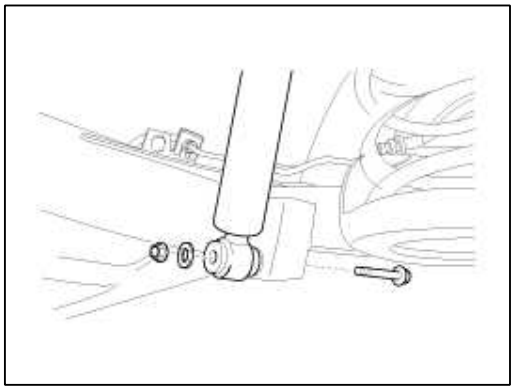
Replacement

1. Remove the rear wheel & tire.

Tightening torque :
90 ~ 110 N.m (9.0 ~ 11.0 kgf.m, 65 ~ 80 lb-ft)

2. Remove the rear shock absorber from the torsion beam axle by loosening the nut.

Tightening torque :
100 ~ 120 N.m (10.0 ~ 12.0 kgf.m, 72 ~ 87 lb-ft)



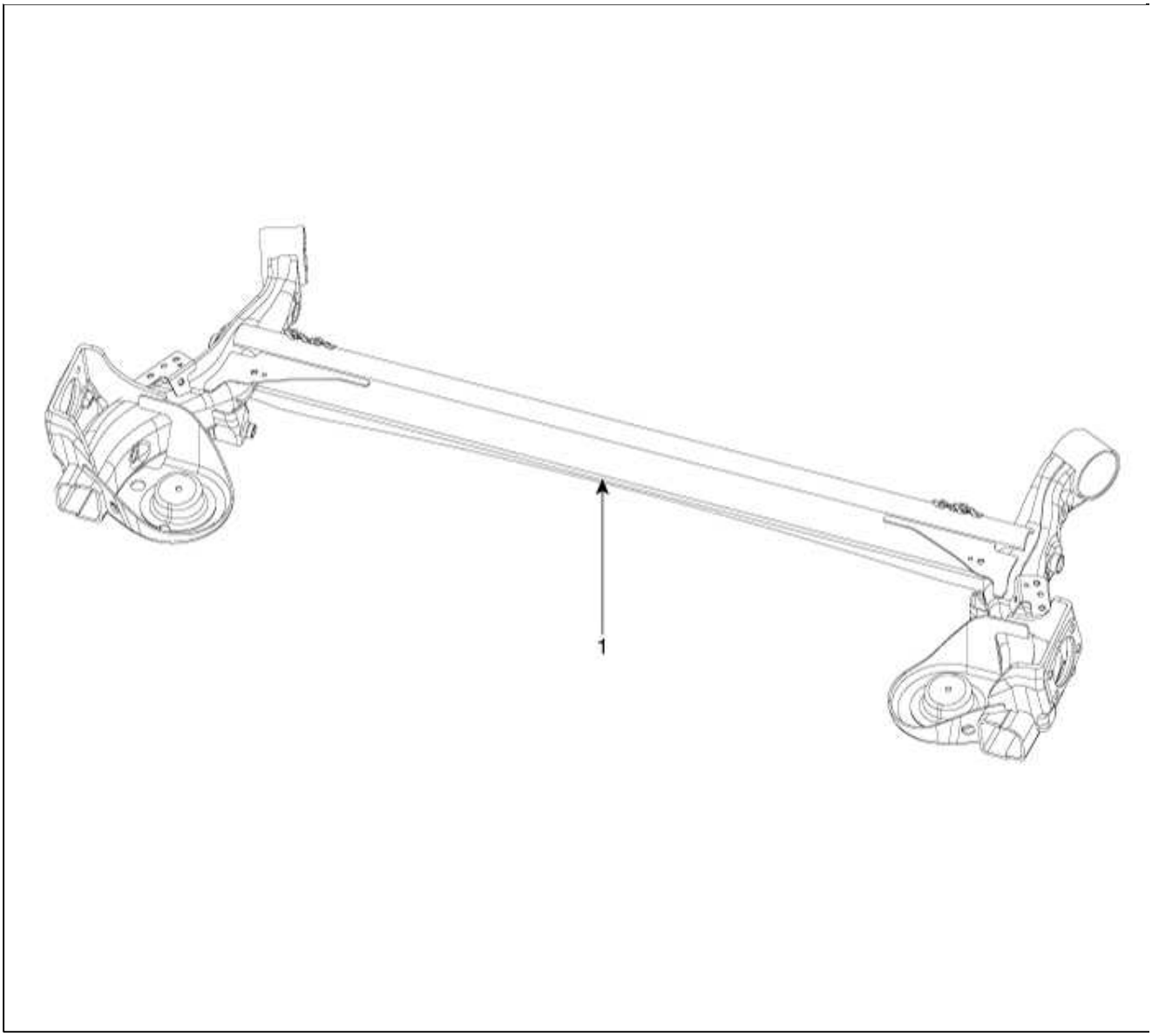
3. Installation is the reverse of removal.

Inspection

1. Check the coil spring for crack and deformation.
2. Check the coil spring pad for damage and deformation.

Suspension System > Rear Suspension System > Rear torsion beam axle > Components and Components Location

Components



1. Rear torsion beam axle

Suspension System > Rear Suspension System > Rear torsion beam axle > Repair procedures

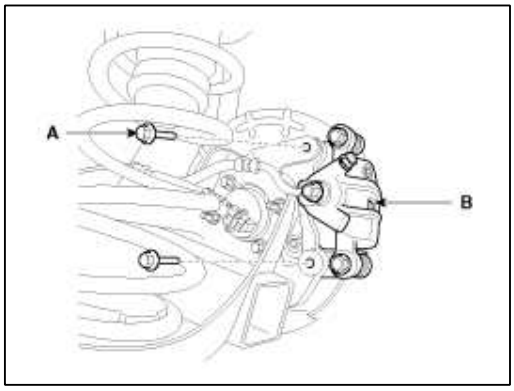
Replacement

1. Remove the rear wheel & tire.

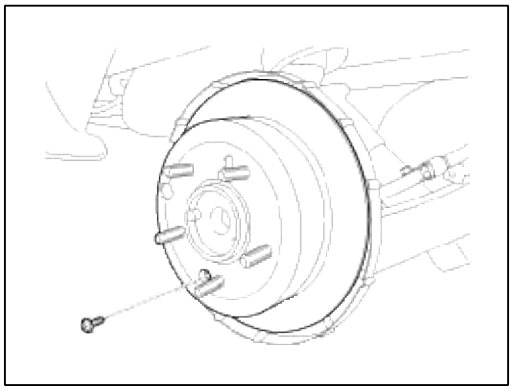
Tightening torque :
90 ~ 110 N.m (9.0 ~ 11.0 kgf.m, 65 ~ 80 lb-ft)

2. Remove the brake caliper assembly (B) from the torsion beam axle by loosening the bolts (A).

Tightening torque :
65 ~ 75 N.m (6.5 ~ 7.5 kgf.m, 47 ~ 54 lb-ft)

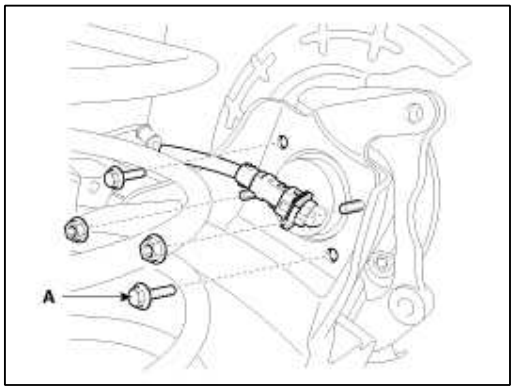


3. Loosen the screw (B).

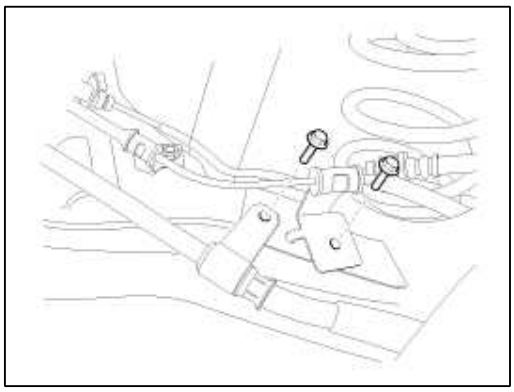


4. Remove the wheel speed sensor cable and the loosening the mounting bolts.

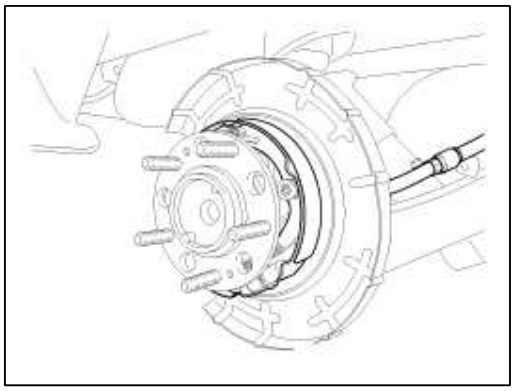
Tightening torque :
60 ~ 70 N.m (6.0 ~ 7.0 kgf.m, 43 ~ 50 lb-ft)



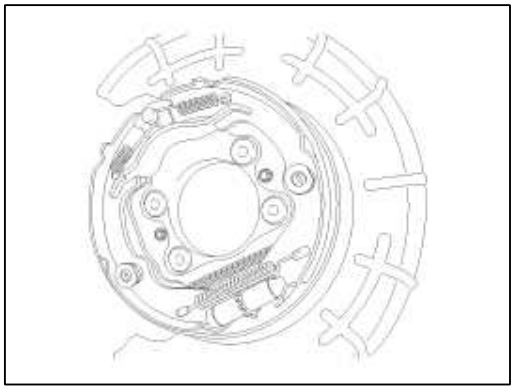
5. Remove the wheel speed sensor cable and parking break cable mounting bracket bolts.



6. Remove the rear hub unit bearing.

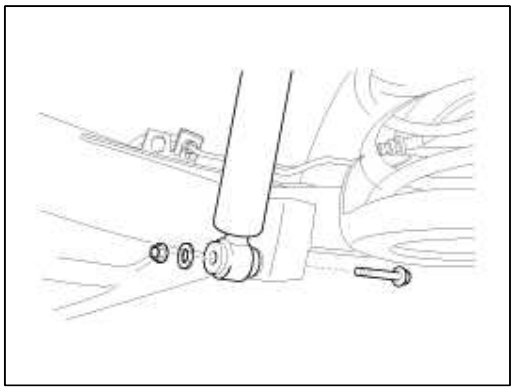


7. Remove the parking brake cable.

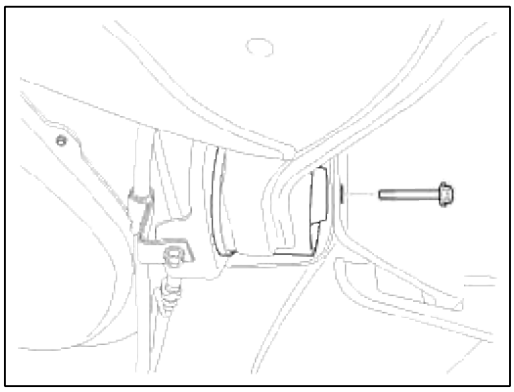


8. Remove the rear shock absorber from the torsion beam axle by loosening the nut.

Tightening torque :
100 ~ 120 N.m (10.0 ~ 12.0 kgf.m, 72 ~ 87 lb-ft)



9. Remove the torsion axle from the body loosening the bolts.



10. Installation is the reverse of removal.

Suspension System > Tires/Wheels > Tire > Repair procedures

Tire Wear

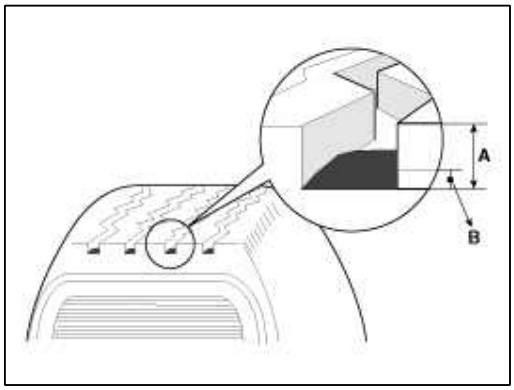
1. Measure the tread depth of the tires.

Tread depth [limit] : 1.6 mm (0.063 in)

2. If the remaining tread depth (A) is less than the limit, replace the tire.

NOTE

When the tread depth of the tires is less than 1.6 mm(0.063 in), the wear indicators (B) will appear.

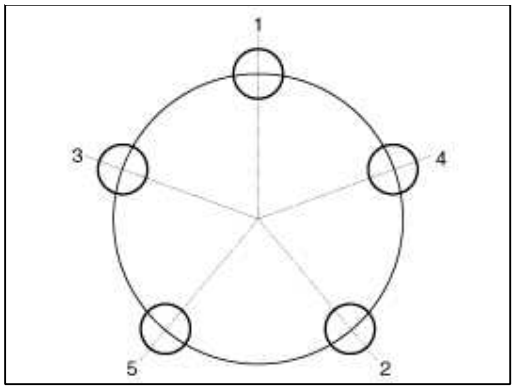


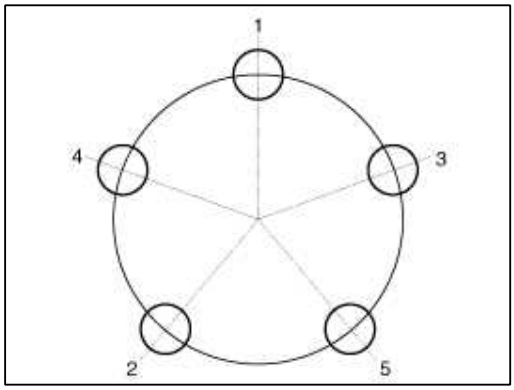
Suspension System > Tires/Wheels > Wheel > Repair procedures

Hub Nut Tightening Sequence

Tighten the hub nuts as follows.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)





CAUTION

When using an impact gun, final tightening torque should be checked using a torque wrench.

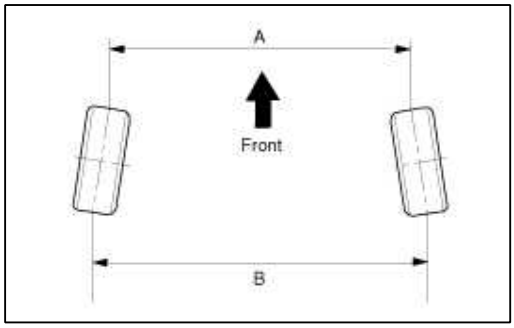
Suspension System > Tires/Wheels > Alignment > Repair procedures

Front Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the front wheel alignment, always position the vehicle on a level surface with the front wheels facing straight ahead.
Prior to inspection, make sure that the front suspension and steering system are in normal operating condition and that the tires are inflated to the specified pressure.

Toe

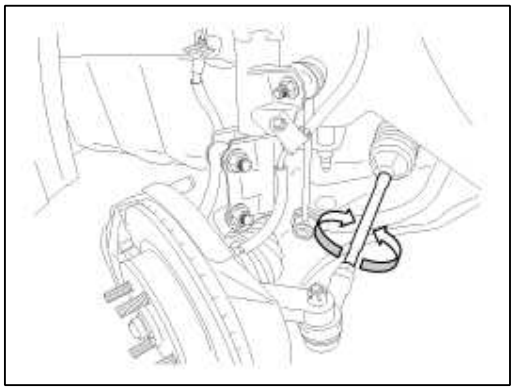


B - A > 0: Toe in (+)
B - A < 0: Toe out (-)

Toe Adjustment

1. Loosen the tie rod end lock nut.
2. Remove the bellows clip to prevent the bellows from being twisted.
3. Adjust the toe by screwing or unscrewing the tie rod. Toe adjustment should be made by turning the right and left tie rods by the same amount.

Toe-in
Total : -0.2°~0.2°
Individual : -0.1°~0.1°



4. When completing the toe adjustment, install the bellows clip and tighten the tie rod end lock nut to specified torque.

Tightening torque :
50 ~ 55N.m (5.0 ~ 5.5kgf.m, 36 ~ 40lb-ft)

Camber and Caster
Camber and Caster are pre-set at the factory, so they do not need to be adjusted. If the camber and caster are not within the standard value, replace or repair the damaged parts and then inspect again.

Camber : -0.5°±0.5°

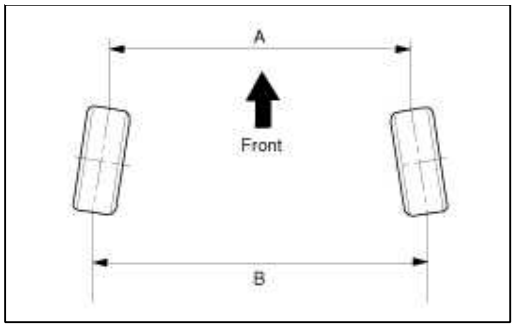
Caster : 3.45°±0.5°

Rear Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the rear wheel alignment, always position the vehicle on a level surface.
Prior to inspection, make sure that the rear suspension system is in normal operating condition and that the tires are inflated to the specified pressure.

Toe



B - A > 0: Toe in (+)
B - A < 0: Toe out (-)

Toe is pre-set at the factory, so it does not need to be adjusted. If the toe is not within the standard value, replace or repair the damaged parts and then inspect again.

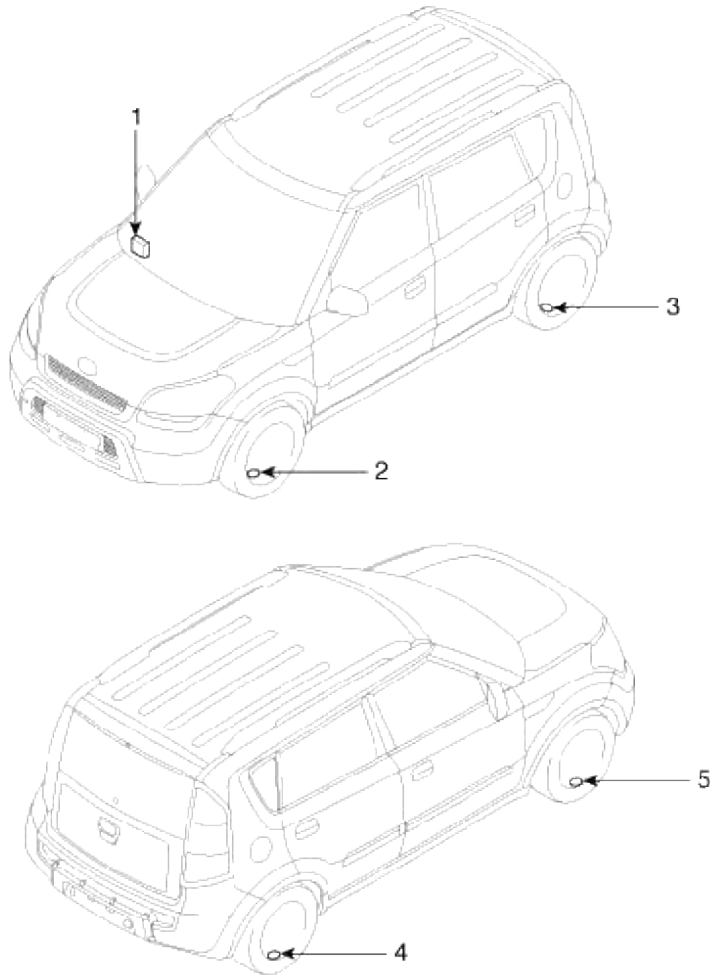
Toe-in
Total : 0.4°±0.2°
Individual : 0.2°± 0.1°

Camber
Camber is pre-set at the factory, so it does not need to be adjusted. If the camber is not within the standard value, replace or repair the damaged parts and then inspect again.

Camber : -1.5°± 0.5°

Suspension System > Tire Pressure Monitoring System > Components and Components Location

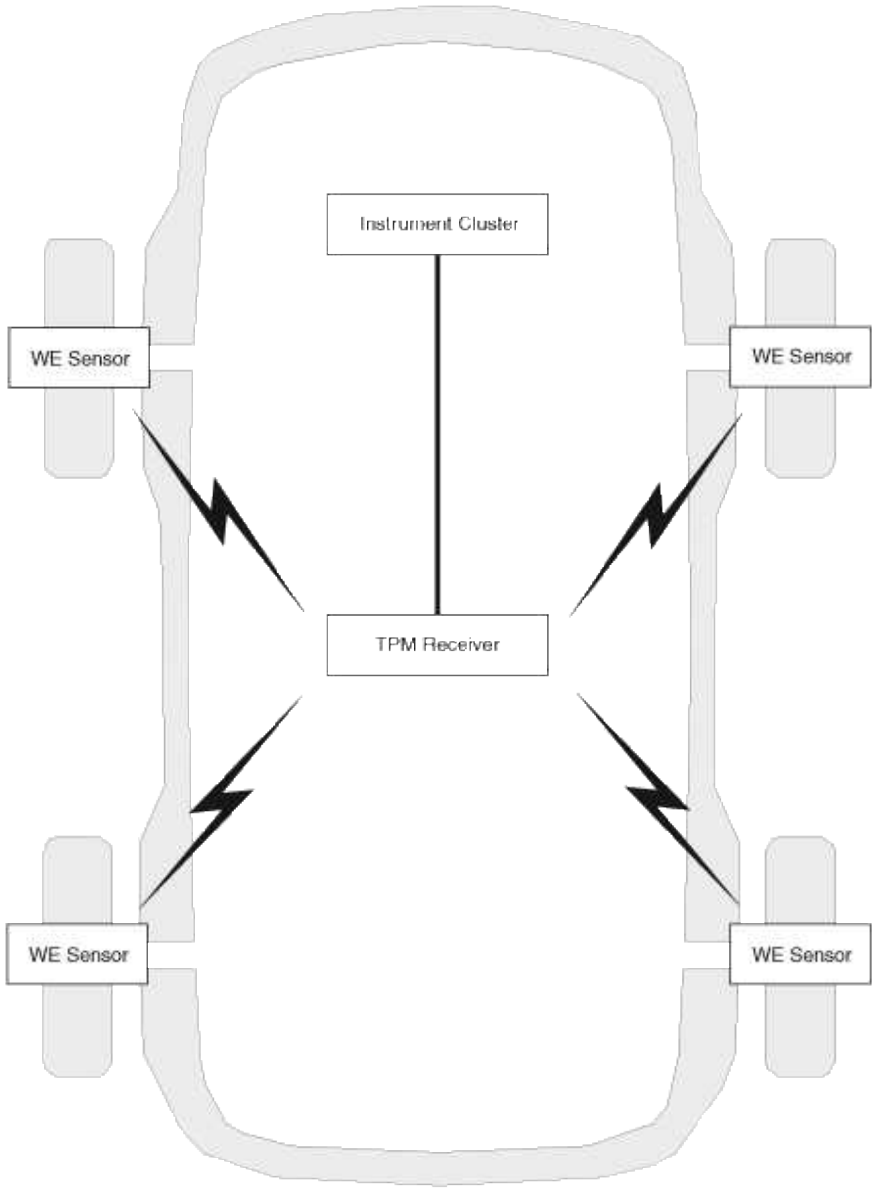
Components



1. TPMS Receiver 2. TPMS Sensor (FL) 3. TPMS Sensor (RL)	4. TPMS Sensor (FR) 5. TPMS Sensor (RR)

Suspension System > Tire Pressure Monitoring System > Schematic Diagrams

Schematic Diagram



Suspension System > Tire Pressure Monitoring System > Description and Operation

Description

1. System Description

NOTE

AL: Auto Learning
CAN: Controller Area Network
ECU: Electronic Control Unit
IC: Instrument Cluster
MIL: Malfunction Indicator LED
RF: Radio Frequency
WE: Wheel Electronic
WU: Wheel Unit

The TPMS monitors the pressure and temperature of a vehicles tire to alert on pressure variations that may impact the driving conditions. Messages deduced from processed data are displayed at the Instrument Cluster (IC) via 1 warning lamp. In parallel, the ECU executes error evaluation on input and output signals. Pressure monitoring during parking is provided.
The ECU processes data from the WE sensor, determines the state of the tires and communicates the required warning message via the CAN communication.
2. Functional Description
Warning Thresholds
Hard Warning
One non temperature compensated hard warning threshold applies to front and rear axle of vehicle. If the pressure reported by the WE sensor is below the tire-specific minimum pressure then the low pressure warning telltale of the under-inflated tire is illuminated immediately. A warning is reset when tire pressure is reported to be at 211kPa (30.6psi).

NOTE

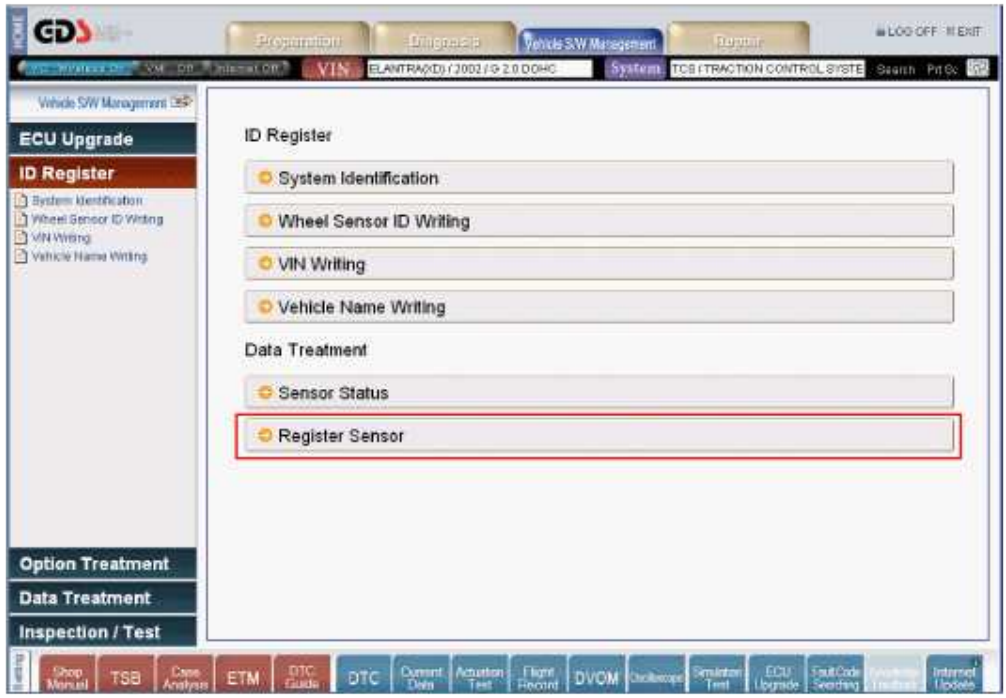
TPMS warning can be light on because the tire pressure declined by low temperature in the cold weather.

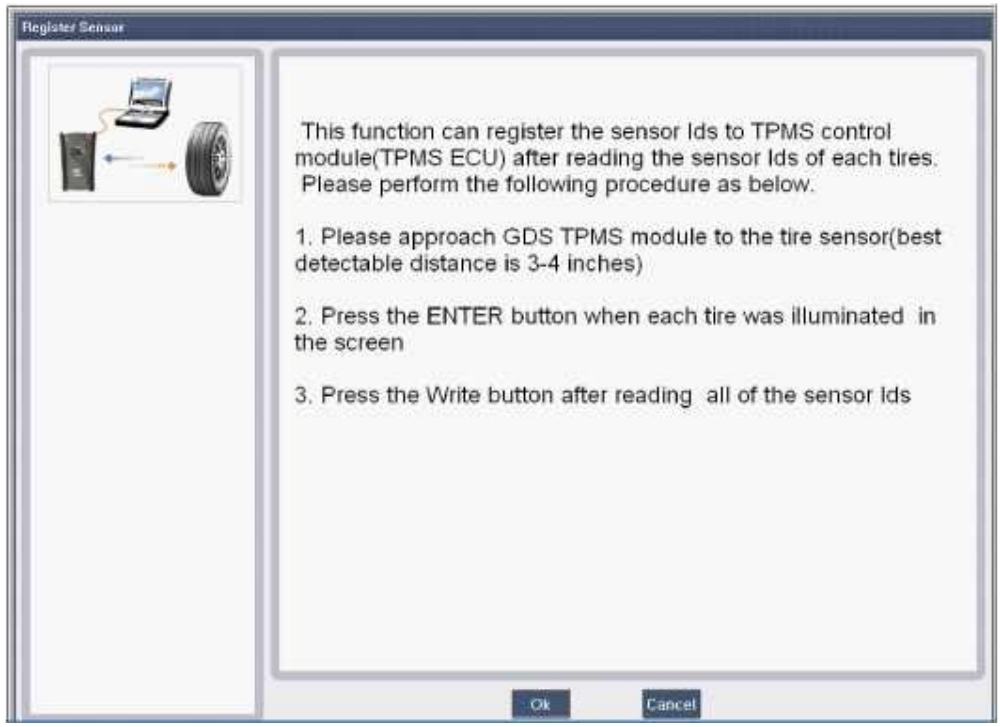
Fast Pressure Loss
Fast pressure loss function is deactivated during parking and only active while driving. So it is avoided that a warning is set when the driver manually deflates the tire to a level above hard warning threshold.
Upon a rapid pressure decrease the WE emits a delta-p telegram which triggers the fast pressure loss function to start. Including the first dp-telegram the function waits for a 2nd telegram of the same wheel electronic and calculates the pressure loss rate. If the pressure drops by more than 20kPa/min, a "fast pressure loss" warning is generated and displayed with a maximum of 60s delay while driving.
Initialization
The initialization function determines which WE sensor identifier belongs to the vehicle.
The corresponding set of identifiers is stored in the ECU memory and used to determine if a received RF telegram comes from a wheel unit, which belongs to the vehicle.
Only telegrams containing known (initialized) identifiers are being supervised in the warning algorithm.
The initialization function is implemented in two independent parts: as an auto learning function.
Initialization-auto Learning
AL starts every time, the vehicle was parked long enough to change or permute wheels (19min), and is traveling again at a speed that ensures that the WE sensors are transmitting.
AL is automatically considering all WE identifiers received and extracts, based on statistical evaluation, IDs belonging to the WEs mounted on the vehicle. If new (unknown) IDs are detected, their recurrence will be tracked by AL.
AI compares the acceleration reported by the wheel unit to the vehicle speed to rule out transmissions received from neighboring vehicles traveling with different speeds.
A WE sensor identifier is assigned to the vehicle when 8 RF telegrams have been received while driving above 25km/h.
Sensor Registraion

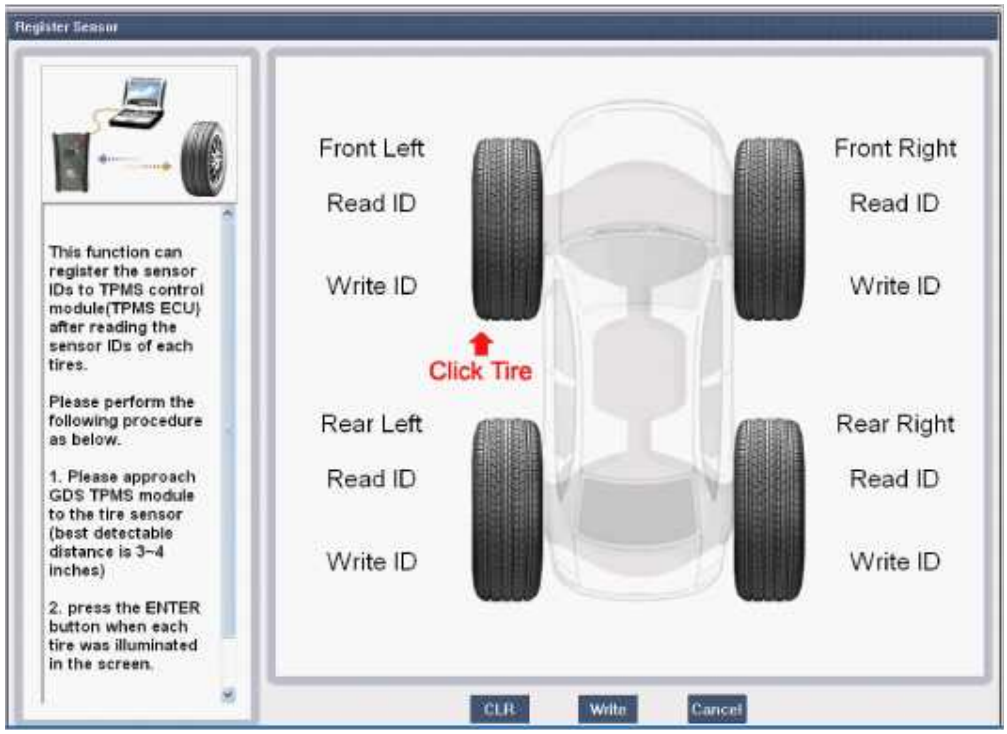
CAUTION

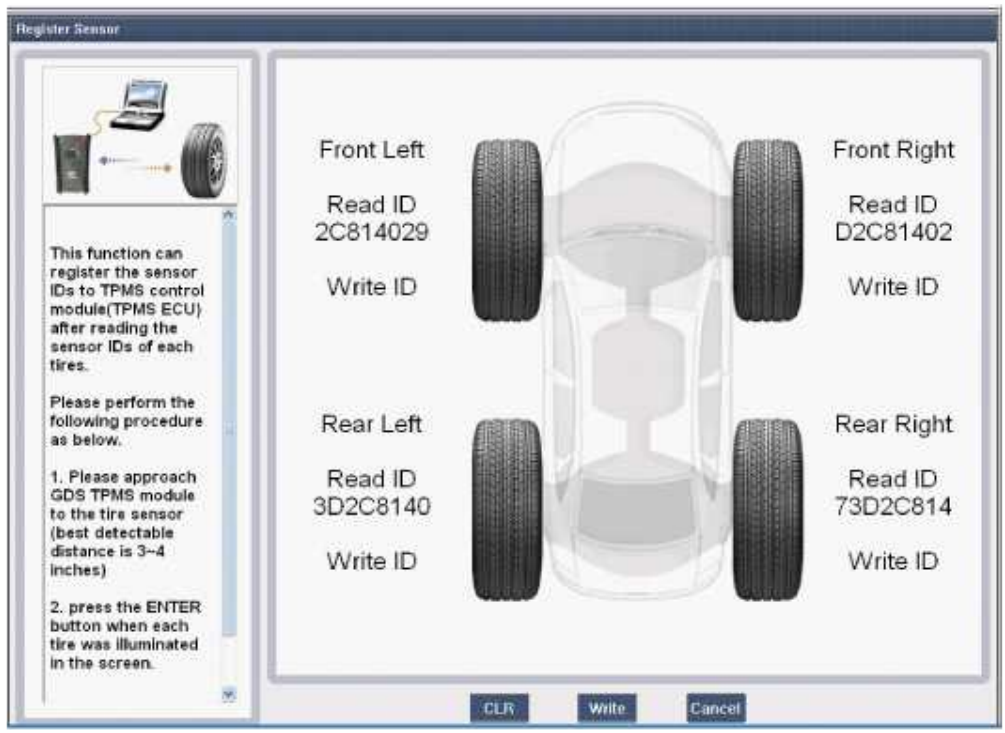
If the sensor registration procedure is not performed by GDS after replacing the TPM sensor or Receiver, TPMS is not operated.

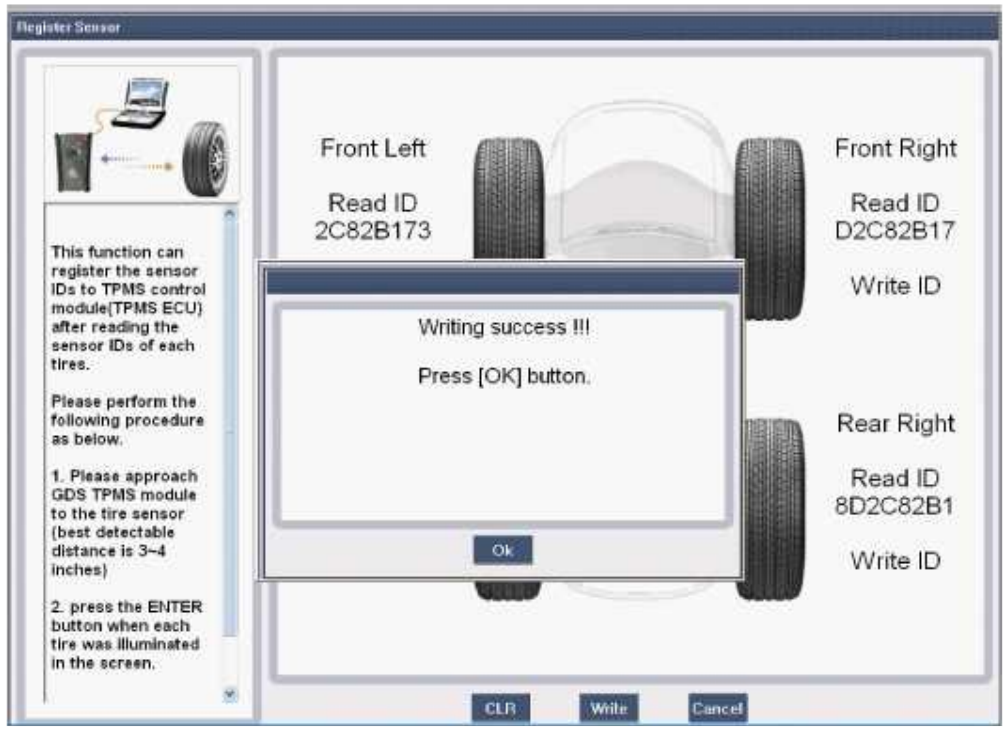
1. Install GDS (Global Diagnostic System) and GDS TPMS module to vehicle.
2. Select the model and perform the sensor registration procedure according to instruction of the GDS as follows.



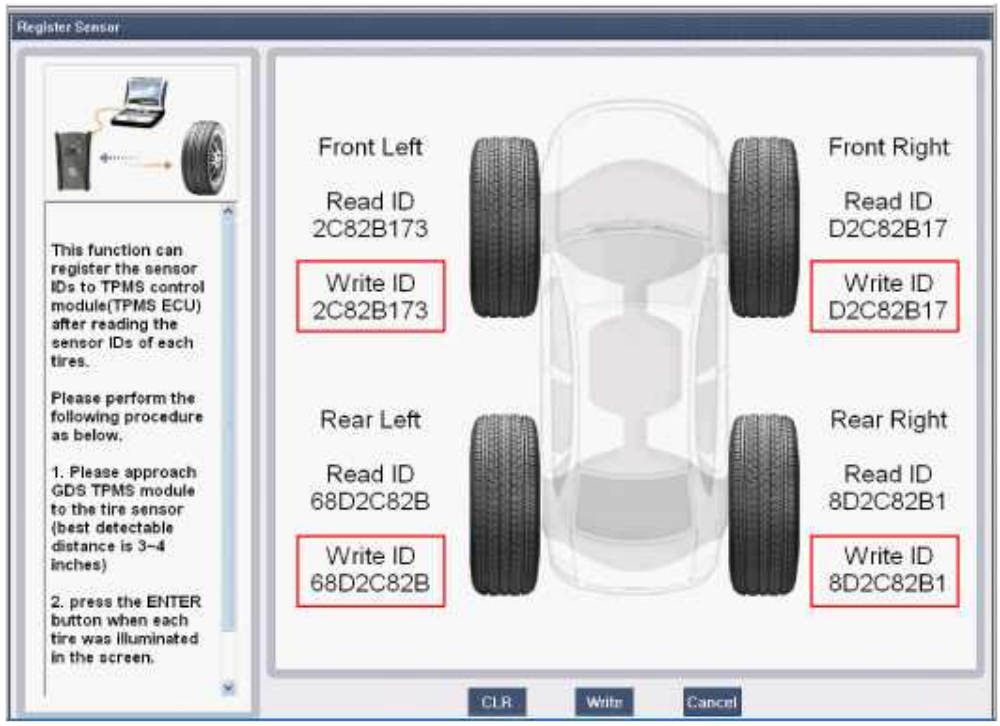



Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires.
Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor (best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen.
Front Left
Read ID
Write ID
Front Right
Read ID
Write ID
Click Tire
Rear Left
Read ID
Write ID
Rear Right
Read ID
Write ID
CLR
Write
Cancel


Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires.
Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor (best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen.
Front Left
Read ID
2C814029
Write ID
Front Right
Read ID
D2C81402
Write ID
Rear Left
Read ID
3D2C8140
Write ID
Rear Right
Read ID
73D2C814
Write ID
CLR
Write
Cancel


Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires.
Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor (best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen.
Front Left
Read ID
2C82B173
Front Right
Read ID
D2C82B17
Write ID
Writing success !!!
Press [OK] button.
Ok
Rear Right
Read ID
8D2C82B1
Write ID
CLR
Write
Cancel


Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires.
Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor (best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen.
Front Left
Read ID
2C814029
Front Right
Read ID
D2C81402
Write ID
GDS TPMS
Sensor Searching...
Cancel
Rear Right
Read ID
73D2C814
Write ID
Read ID
3D2C8140
Write ID
CLR
Write
Cancel

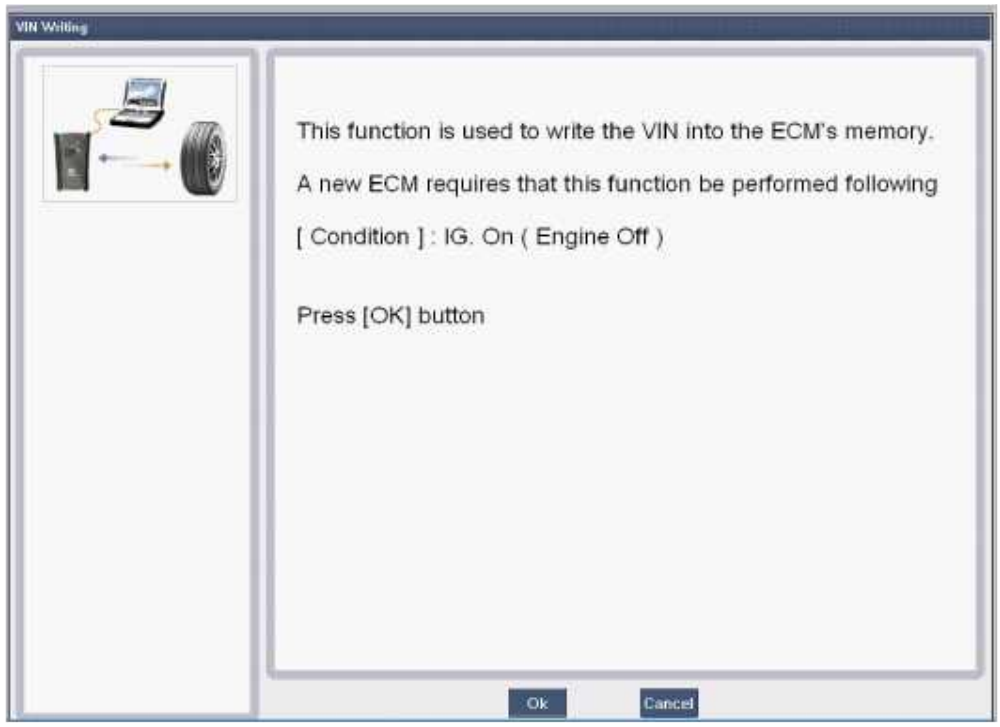


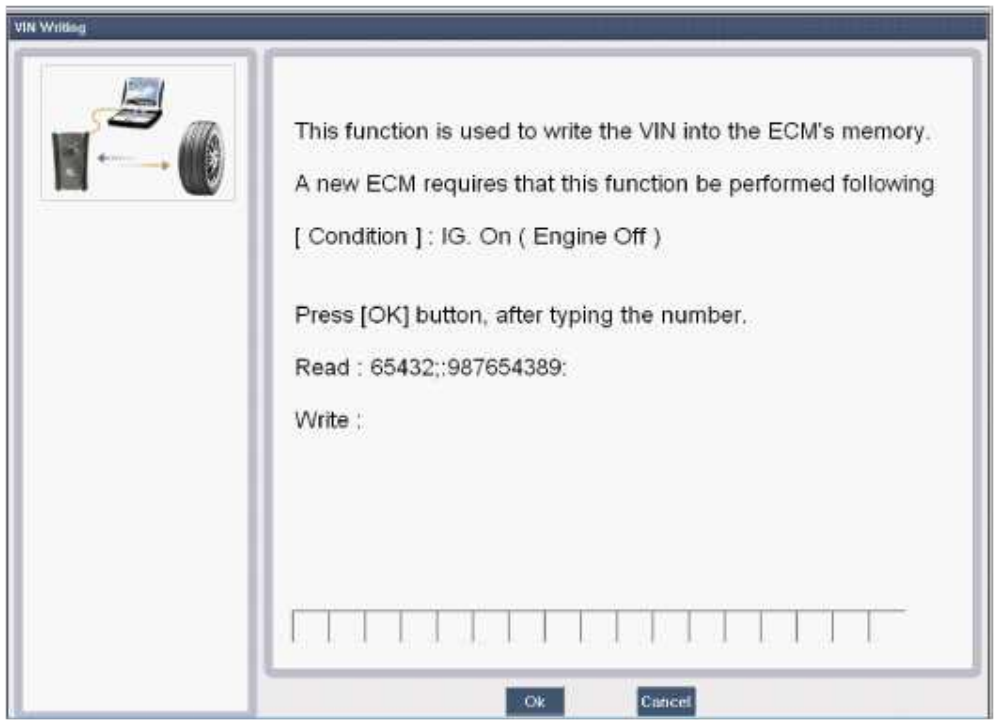
Vin And Vehicle Name Writing

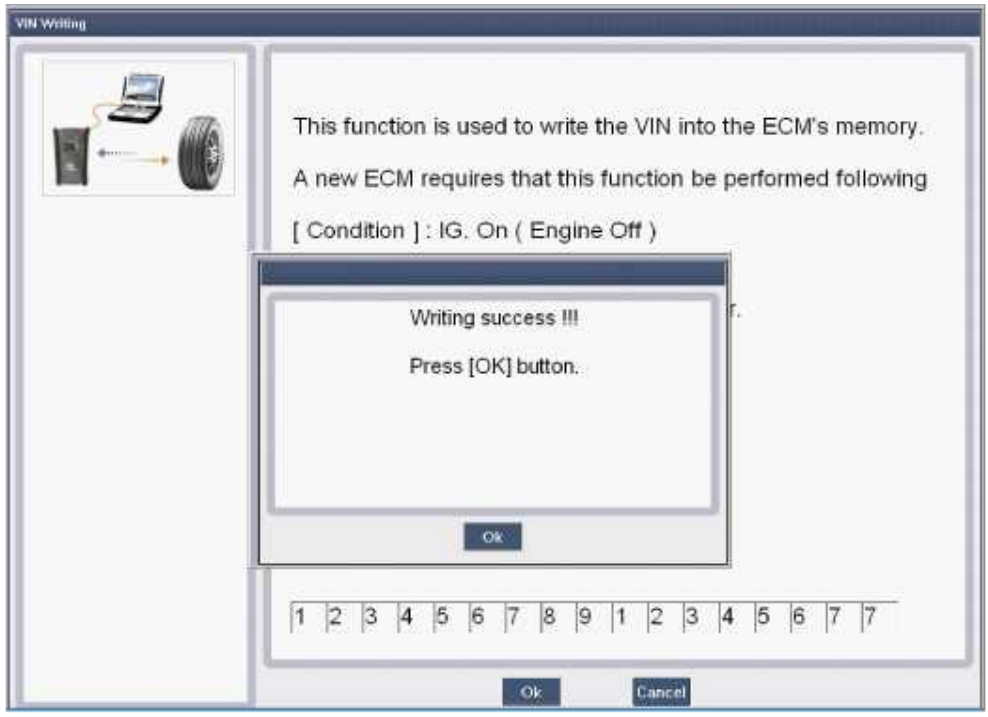
1. Install GDS (Global Diagnostic System) and GDS TPMS module to vehicle.
2. Select the model and perform the VIN and vehicle name writing procedure according to instruction of the GDS as follows.

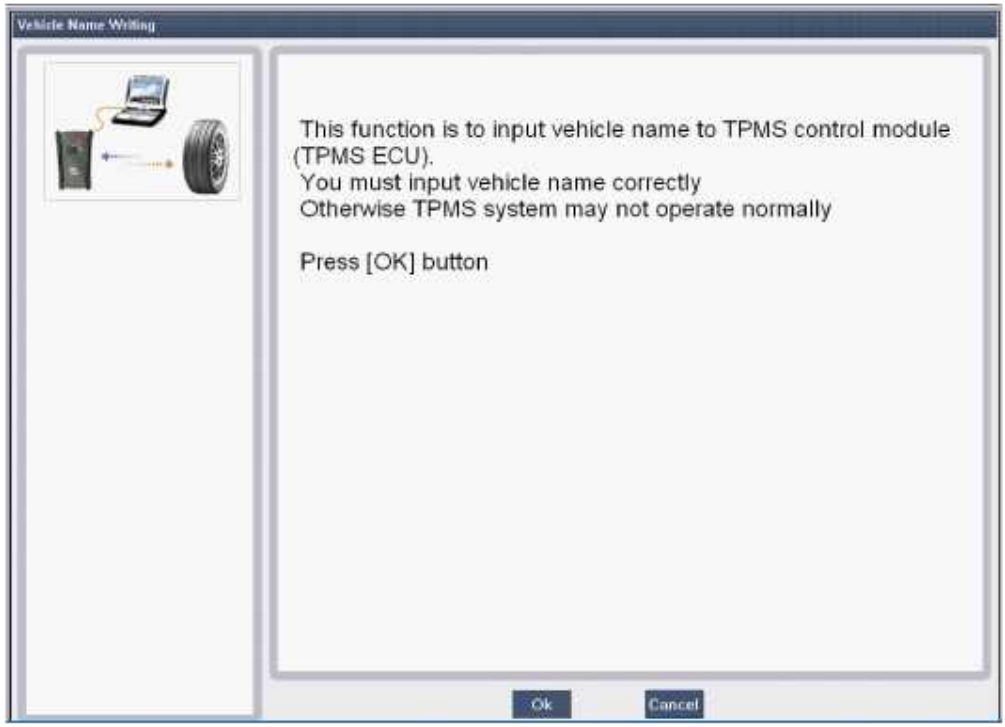
[VIN Writing]

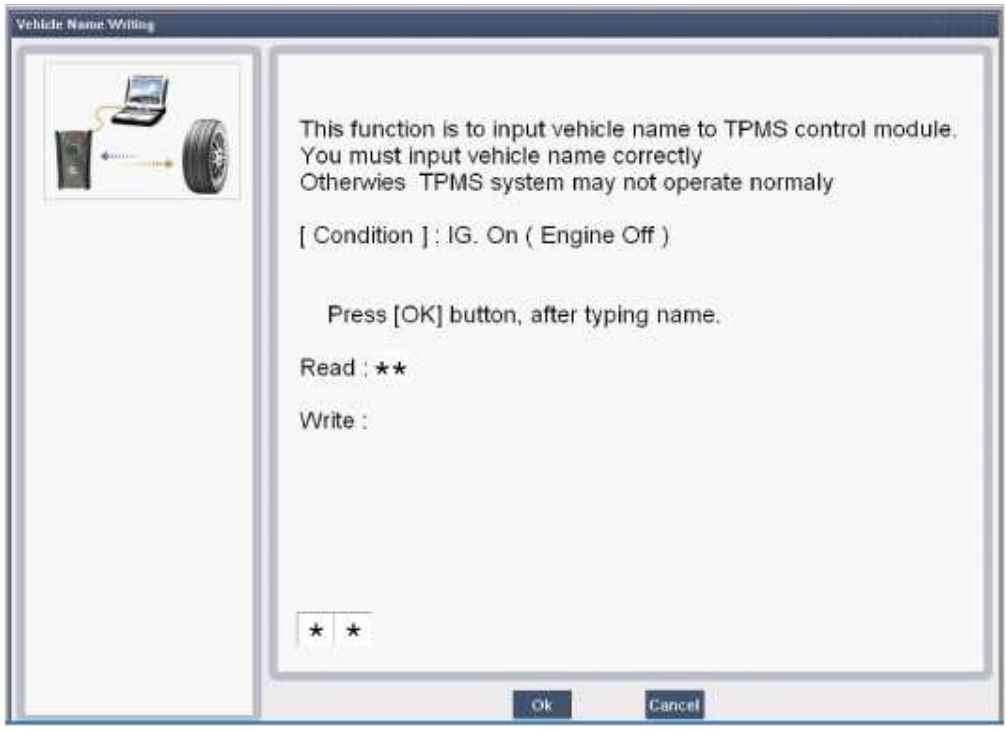


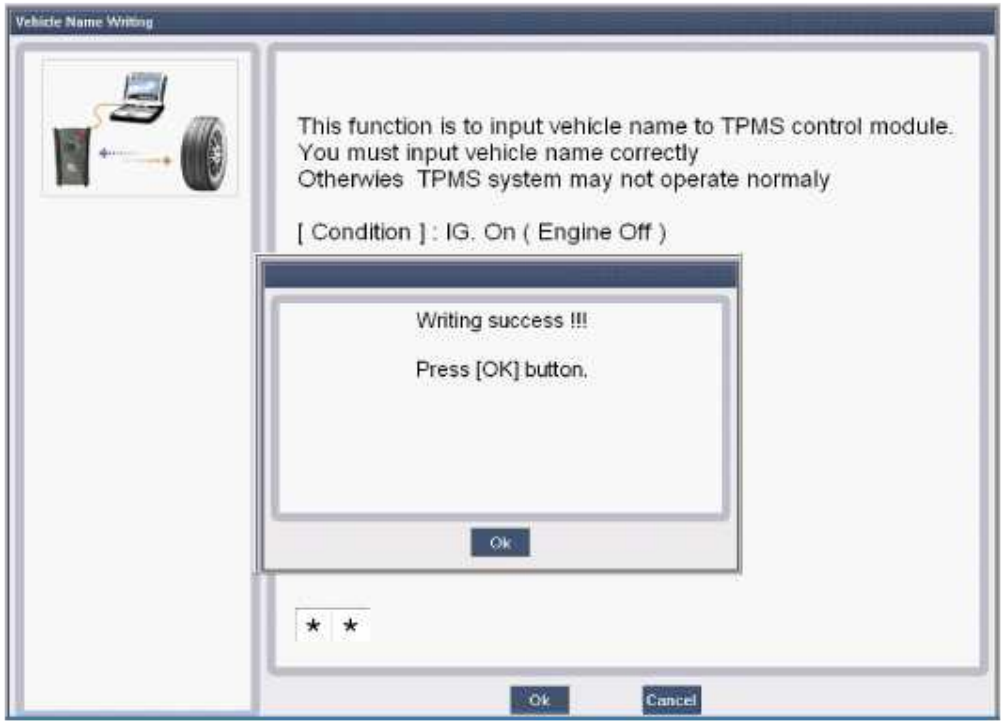

VIN Writing
This function is used to write the VIN into the ECM's memory.
A new ECM requires that this function be performed following
[Condition] : IG. On (Engine Off)
Press [OK] button
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
A new ECM requires that this function be performed following
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing the number.
Read : 65432;:987654389:
Write :
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
A new ECM requires that this function be performed following
[Condition] : IG. On (Engine Off)
Writing success !!!
Press [OK] button.
Ok
1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 7
Ok
Cancel


Vehicle Name Writing
This function is to input vehicle name to TPMS control module (TPMS ECU).
You must input vehicle name correctly
Otherwise TPMS system may not operate normally
Press [OK] button
Ok
Cancel





Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Repair procedures

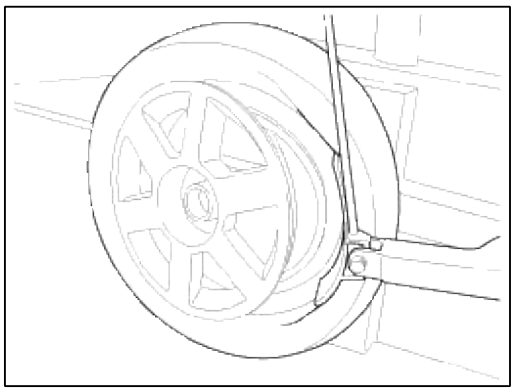
Removal

Removing The Tire From The Rim

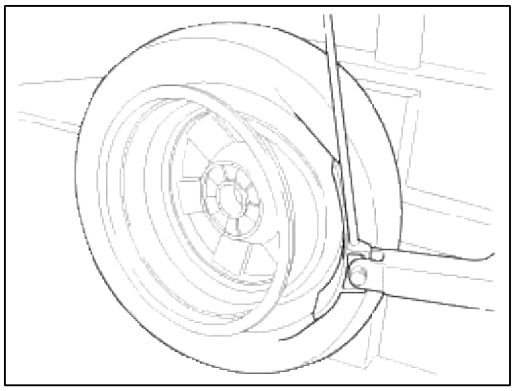
CAUTION

During all the operations on the tire, the sensor must be correctly maintained and thus it is FORBIDDEN to unscrew the nut and to force the sensor into the wheel. This could damage the sensor.

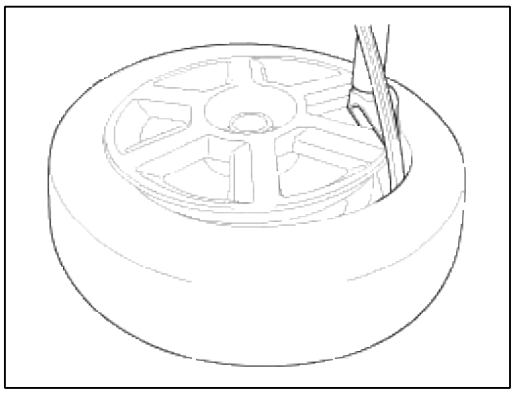
1. Take off the first side of the tire. The tool should not be used near the valve (no less than 30 cm).



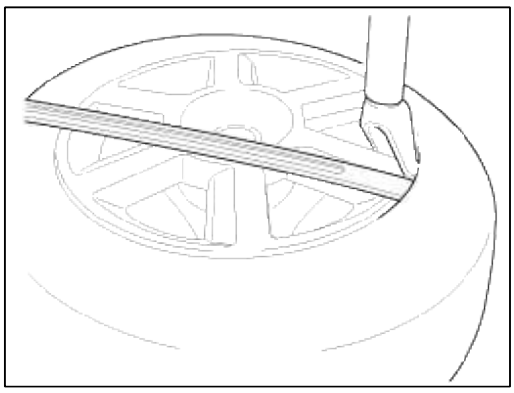
2. Take off the second side of the tire. The tool should not be used near the valve (No less than 30 cm).



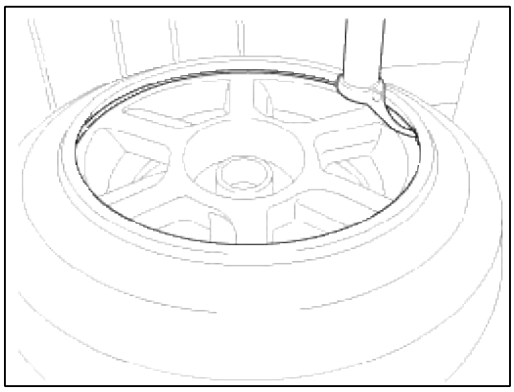
3. Dismount the first side of the tire: Place the shoe of the tool between 5 and 15 cm away from the sensor and use the tire lever as shown in the picture.



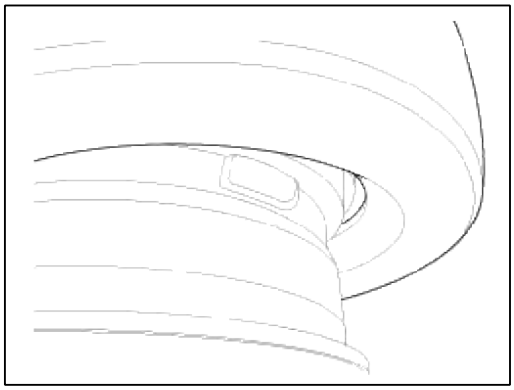
4. By using the tire lever, extract the external side wall of the tire and engage on the shoe of the machine. The lever and the tire must not come into contact with the sensor. Then remove the lever.



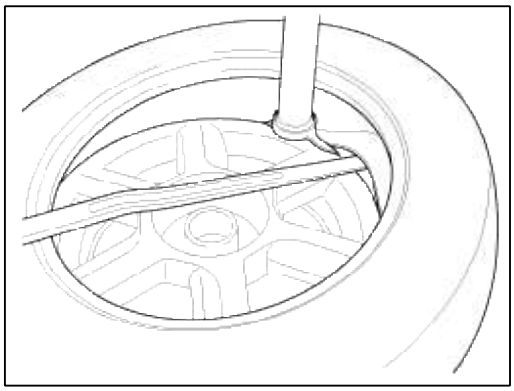
5. The wheel rotation allows the complete extraction of the first side of tire.



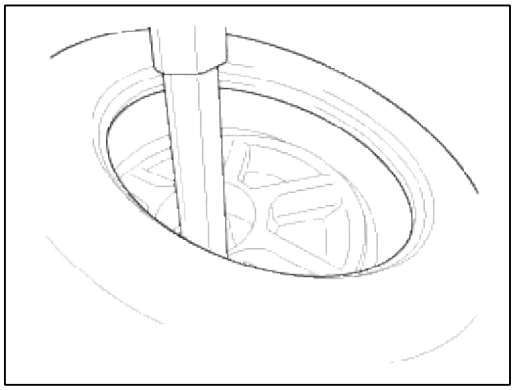
6. Raise the tire to prepare the introduction of the tire lever to aid extraction of the second side wall, the same recommendations as for the first side wall will apply.



7. By using the tire lever, extract the external side wall of the tire and engage the shoe of the machine. The lever and the tire must not come into contact with the sensor. Then remove the lever.

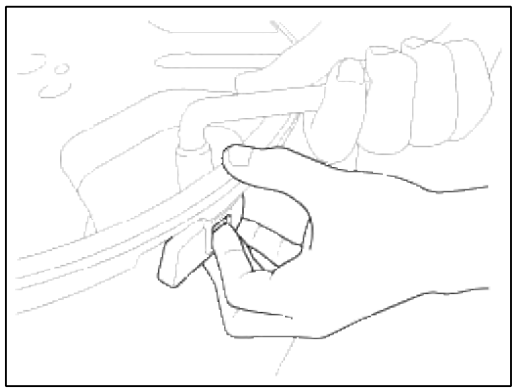


8. Extract entirely the second side wall of the tire.

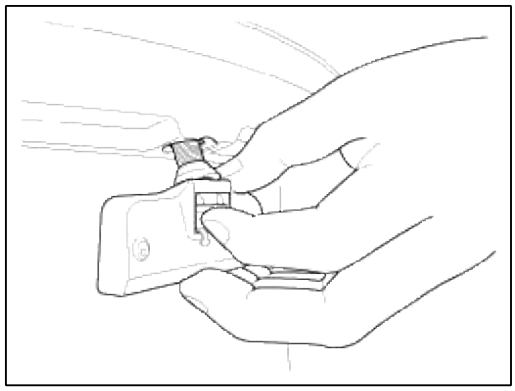


Pressure Sensor Removing

1. While supporting the sensor unit, unscrew the nut.



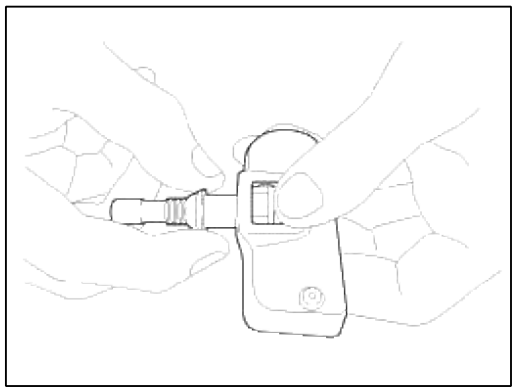
2. Remove the sensor.



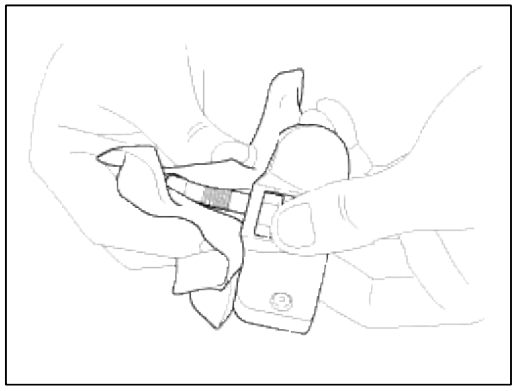
Installation

Sensor Reinstallation

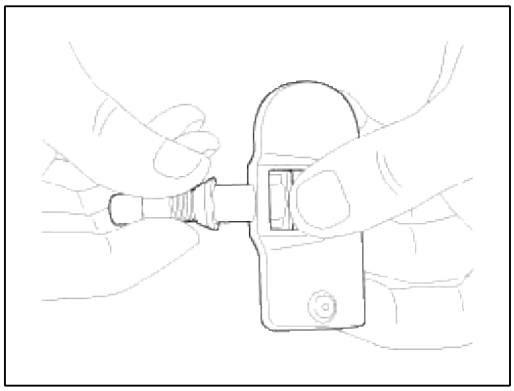
1. Hold the sensor and the seal washer, then extract it, this also extracts the seal. Take care to not damage the valve thread.



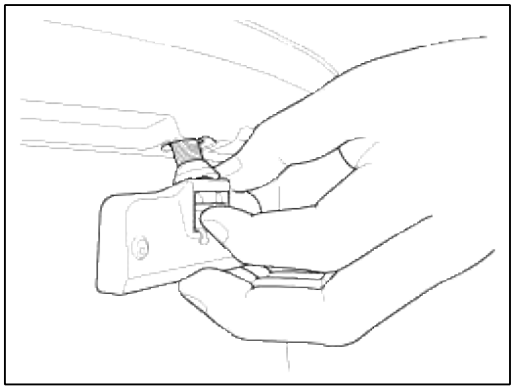
2. Clean the sensor and the valve stem holding the valve using a dry cloth as shown on the picture. Take care to support the rear of the valve with a thumb so that there is no movement of the stem.



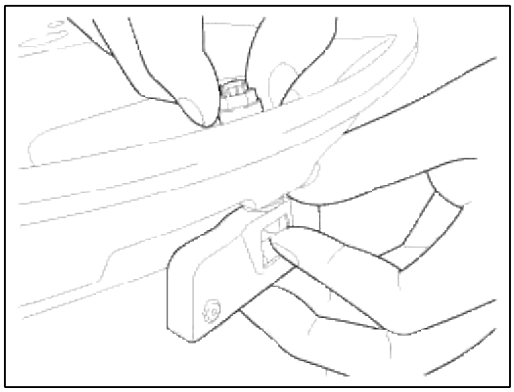
3. When removing the sensor, a new washer and seal must be used. Insert these up to the base of the sensor, making sure to secure the valve base with a thumb, as shown. Wipe the seal and threading.



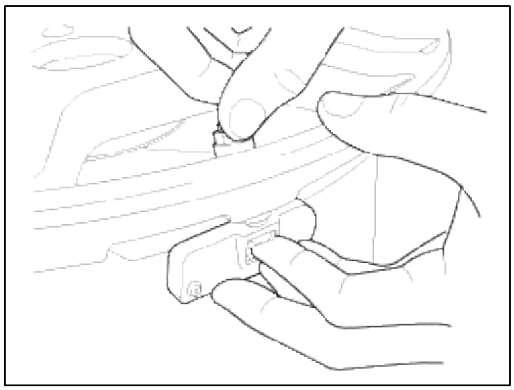
4. Insert the valve, in the valve hole, without modifying the angle of the stem (retain position of delivery). The laser marking should be visible to the operator.



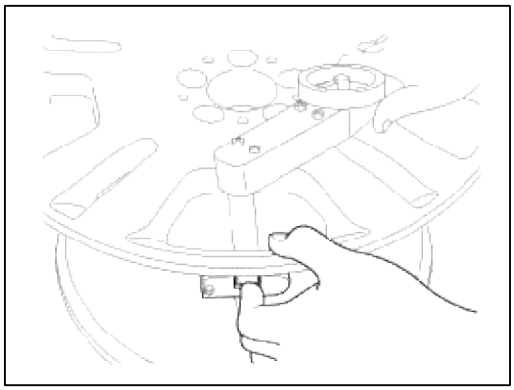
5. When the valve is completely inserted, maintain the sensor in contact with the rim (as shown on the picture), then screw manually the nut until it is in contact with the wheel (without force).



6. While maintaining the sensor contact with the rim by applying pressure to the back of the valve, slightly press on the cap towards the center of the wheel in order to adapt the angle of the valve/sensor to the profile of the rim. It is mandatory to guarantee the contact of the housing unit on the rim drop center.



7. While maintaining the sensor unit and valve in position, screw the nut with a torque wrench.
   Apply a torque of 7.5 ~ 8.5Nm (0.76 ~ 0.86kgf.m, 5.5 ~ 6.2lb-ft).
   Take care that the wrench socket is correctly inserted on the nut.



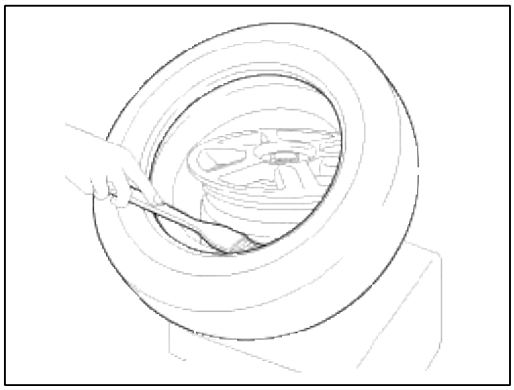
8. Check the followings.
   (1) It is normal that the seal washer becomes bent during the nut tightening.
   (2) Check that the visible part of the antenna is not damaged or broken.
   (3) The plastic bridge should neither be cracked nor broken. It is designed so that it will fracture due to an error in the assembly process (too high torque, bad positioning……). Any defect must mean the rejection of the sensor.

Mounting of Tire

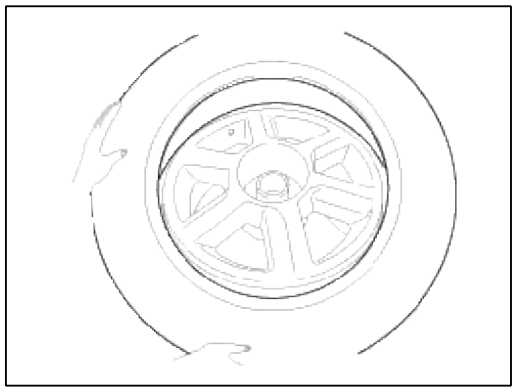
CAUTION

- Before any tire mounting operation, make sure that the sensor has been correctly mounted and tightened to the rim.
- No lubricant product or any other material may partially or completely cover the air pressure inlet hole of the sensor.
- The assembly tools have to never have a collision with the sensor.
- The tire cannot be in contact with the sensor only after it is engaged in the rim and after the exceeded peak of traction. Therefore, generally at the end of the assembly.

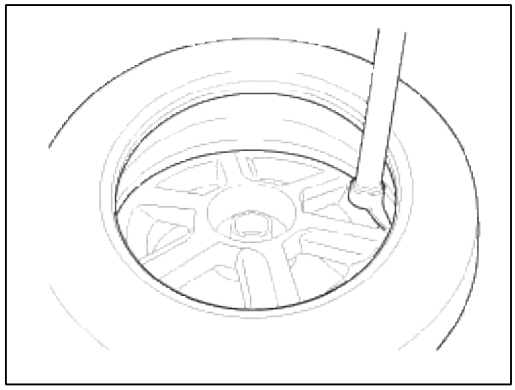
1. Prepare the tire and fix the rim as usual.



2. Put the tire on the rim, so that the cross point of the belt with the rim is between 15 and 20 cm away from the valve (see the picture).

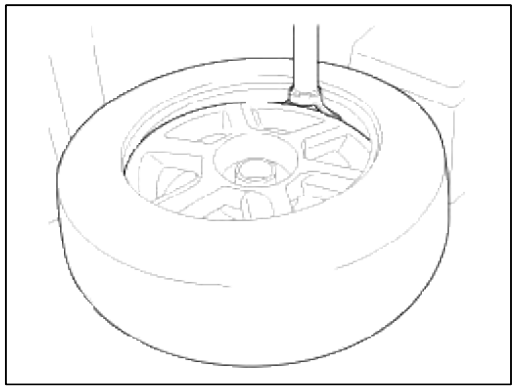


3. Engage the shoe and make sure that 20cm is maintained between the cross point and the valve. The arrow shows the direction of rotation of the wheel.

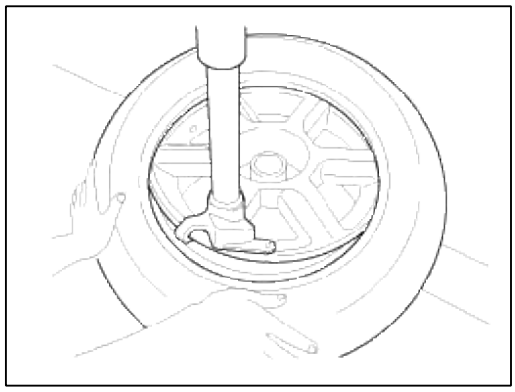


4. Turn the wheel in order to engage all the first side of the tire.

> NOTE
>
> The standard shoes can pass over the sensor without damaging it.



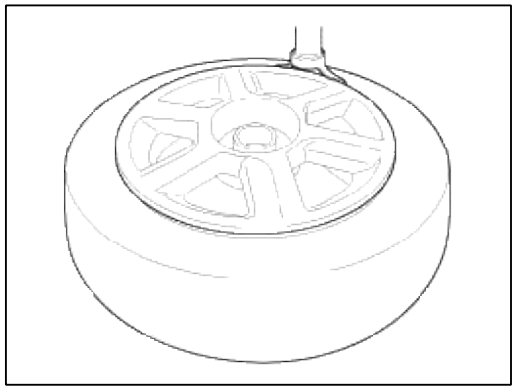
5. Put the second side of the tire in position, so that the cross point of the belt with the rim is approximately 20 cm away from the valve (see the picture). The curved arrow shows the direction of rotation of the wheel.



6. Turn the wheel in order to engage all of the second side of the tire.

NOTE

The standard shoes can pass over the sensor without damaging it.

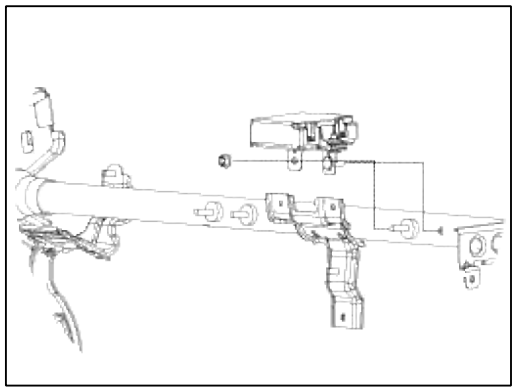


7. Perform the Register Sensor procedure. (Refer to Register Sensor.)

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Repair procedures

Replacement

1. Disconnect the battery negative cable from the battery.
2. Remove faulty part and fit bracket assembly to new part.



3. Secure new part to vehicle and fit connector.
4. Re-connect battery and turn ignition on.
5. Check that DTC flash rate matches virgin state indication.