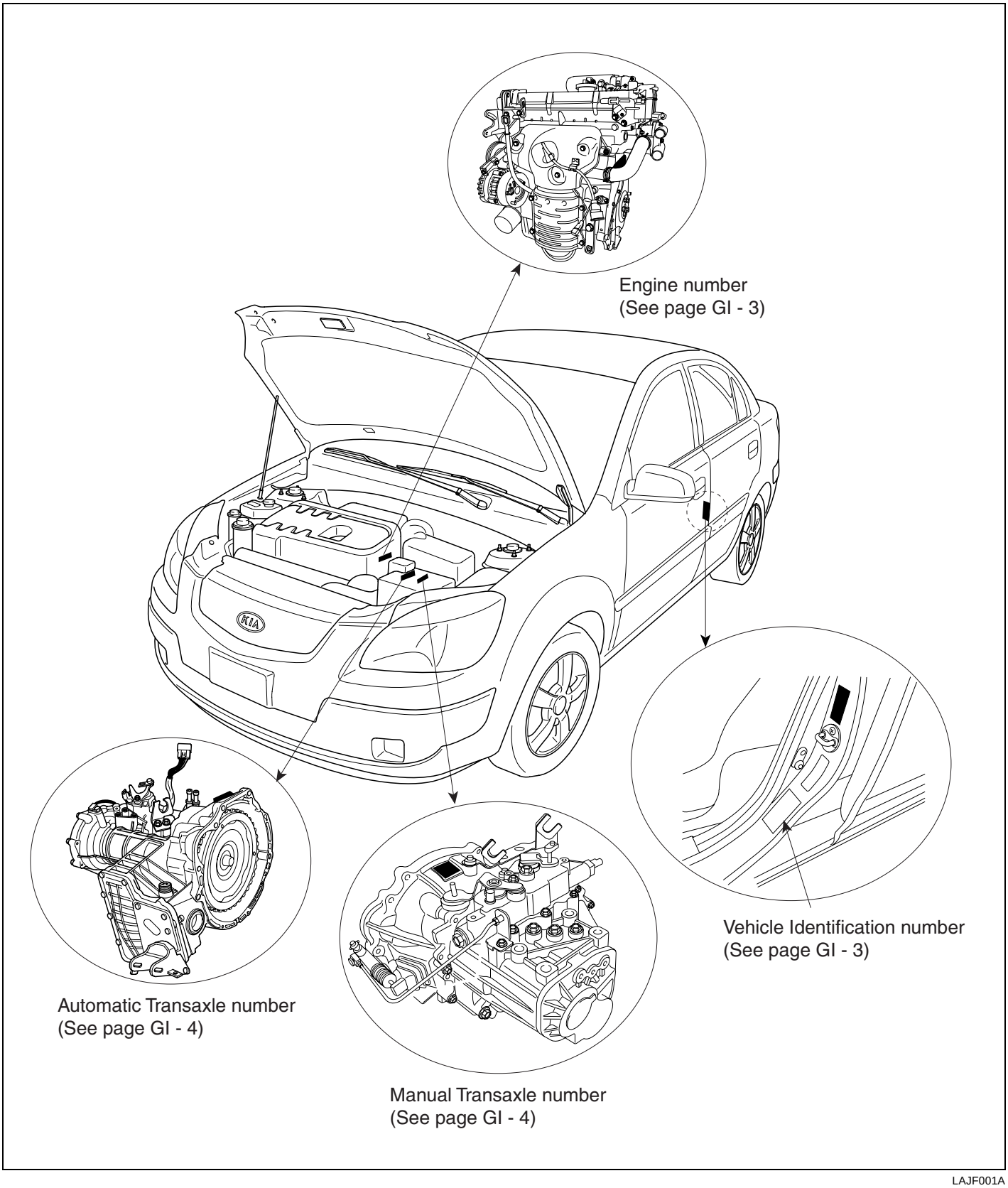
General Information

GENERAL

GENERAL

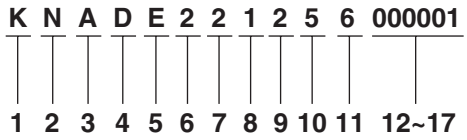
IDENTIFICATION NUMBER LOCATIONS EE840C2D



LAJF001A

IDENTIFICATION NUMBER DESCRIPTION

VEHICLE IDENTIFICATION NUMBER



LAJF002A

1 - 3 : Make / Vehicle type
- KNE, KNA = Kia Passenger Car

4 - 5 : Vehicle Line / Series
- DE = PRIDE

6 - 7: Body type
- 22 = 4 Door Sedan
- 24 = 5 Door Hatchback

8 : Engine type
- 1 = 1.4 Gasoline (G4EE)
- 2 = 1.6 Gasoline (G4ED)
- 4 = 1.5 Diesel (D4FA)

9 : Transaxle type
- Check digit
- 2 = 5 speed manual
- 3 = Automatic

10 : Model year
- 5 = 2005, 6 = 2006

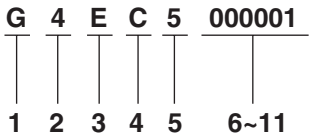
11 : Plant location
- 6 = Soha plant

12 : Sequential number
- 000001 ~ 999999

PAINT CODE

CODE	COLOR
UD	CLEAR WHITE
6C	CLEAR SILVER
J1	POLAR SILVER
J4	CASHMERE BEIGE
2D	SOFT GREEN
T5	SAPPHIRE
06	SUNSET ORANGE
08	TROPICAL RED
7V	OLIVE GRAY
9B	MIDNIGHT BLACK

ENGINE IDENTIFICATION NUMBER

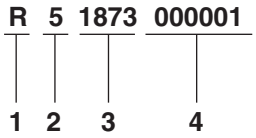


AAJF003A

1. Engine fuel
   - G = Gasoline
2. Engine range
   - 4 = 4 cycle 4 cylinder
3. Engine development order
   - E = ALPHA Engine
4. Engine capacity
   - D = 1,599cc
   - E = 1,399cc
5. Production year
   - 5 : 2005, 6 : 2006
6. Engine production sequence number
   - 000001 ~ 999999

TRANSMISSION IDENTIFICATION NUMBER

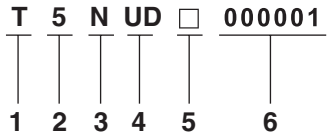
MANUAL



AAJF004A

1. Model
   - R = M5CF1
   - P = M5CF2
2. Production year
   - 5 : 2005, 6 : 2006
3. Gear ratio(Tooth number)
   < Differential drive gear tooth number / Output shaft gear tooth number >
   - 1873 = 73/18 = 4.056
4. Transaxle production sequence number
   - 000001 ~ 999999

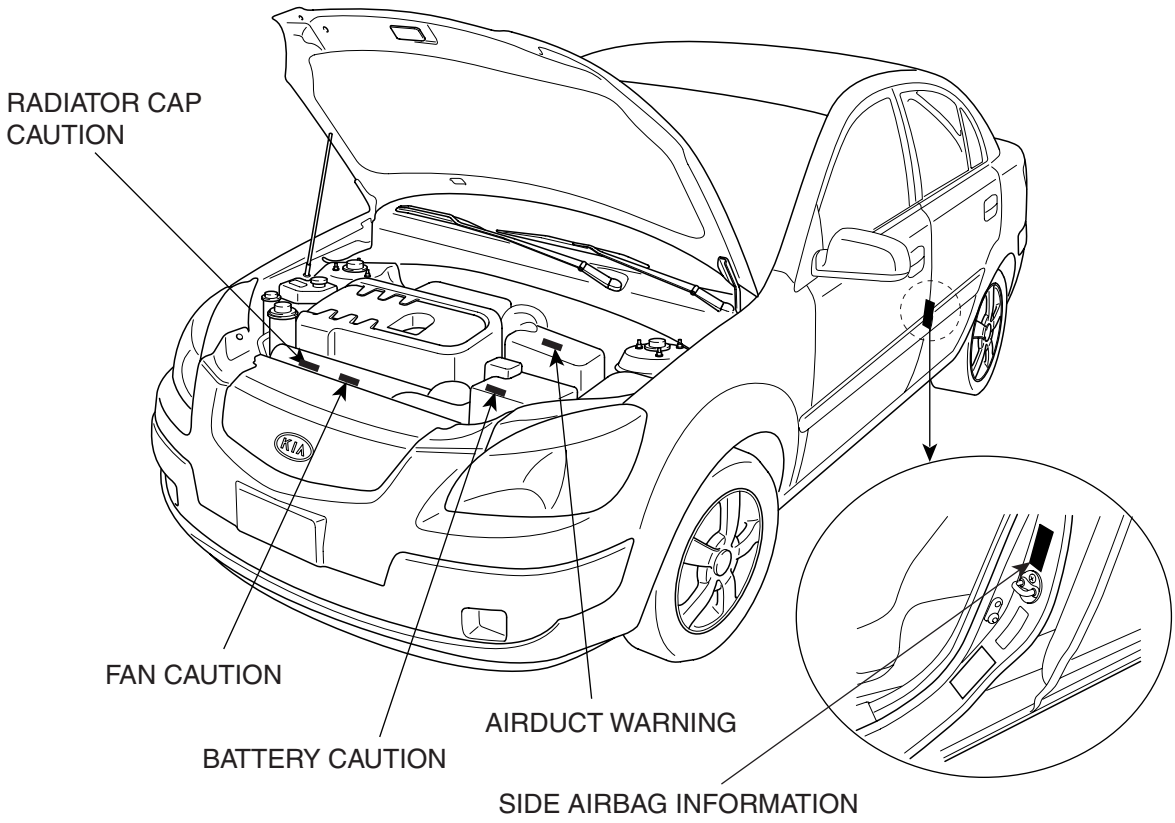
AUTOMATIC



AAJF005A

5. Modle
   - T = A4AF3
6. Production year
   - 5 : 2005, 6 : 2006
7. Gear ratio
   - N = 4.041
8. Detailed chassification
   - UD = 1.4 DOHC
   - WD = 1.6 CVVT
9. Spare
10. Transaxle production sequence number
    - 000001 ~ 999999

WARNING / CAUTION LABEL LOCATIONS

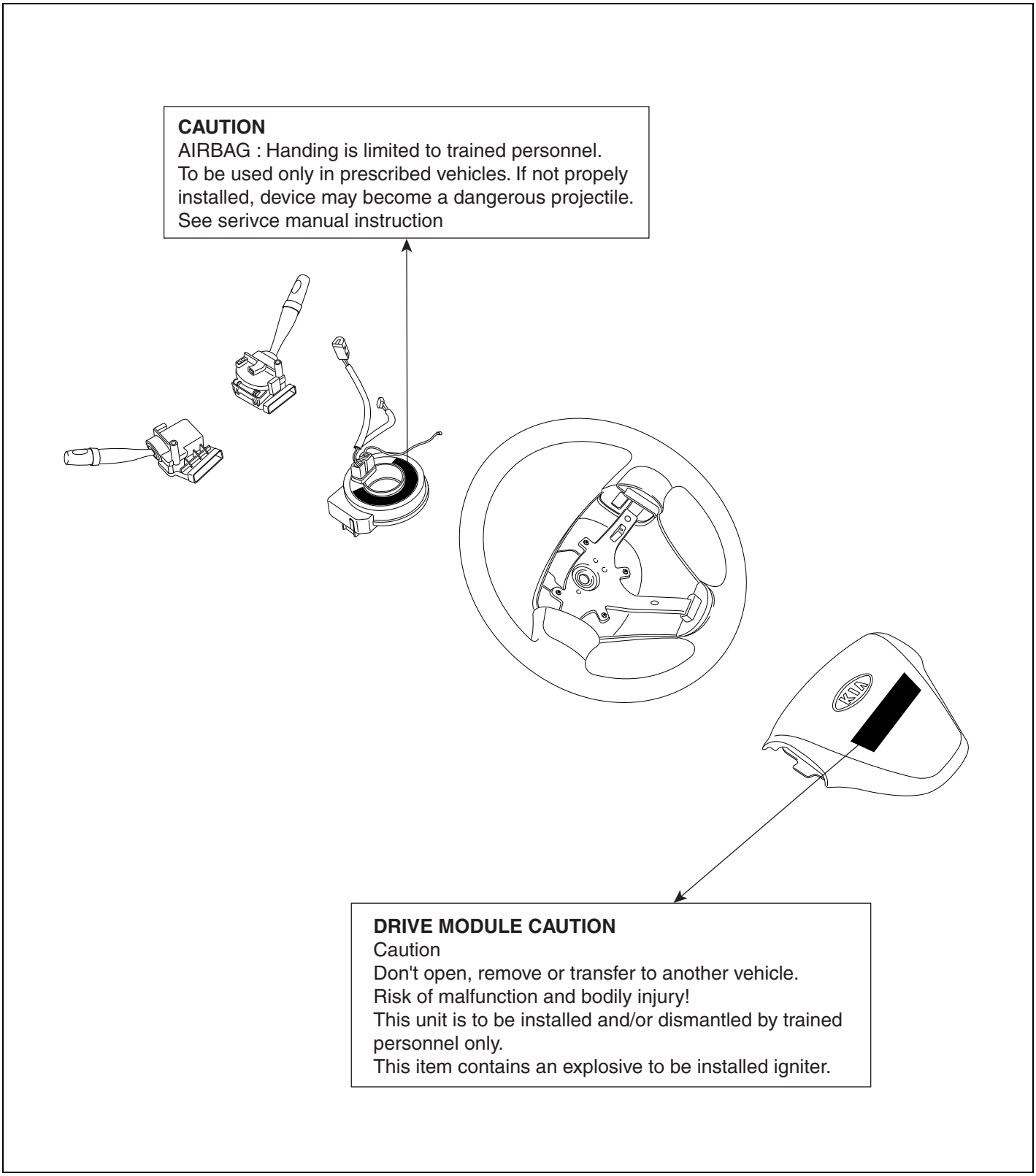


ATTENTION
SRS VEHICLE
THIS CAR IS EQUIPPED WITH A SUPPLEMENTAL RESTRAINT SYSTEM. TO PROVIDE CONTINED RELIABLITY, CERTAIN ELEMENTS OF THE SUPPLEMENTAL RESTRAINT SYSTEM SHALL BE SERVICED OR REPLACED BY AUTHORIZED DEALER TEN YEARS AFTER VEHICLE LABEL. FOR FURTHER INFORMATION.
SEE OWNER'S MANUAL.

SIDE AIR BAG
THIS CAR IS EQUIPPED WITH A SIDE AIRBAG SYSTEM.
TO PROVIDE CONTINUED RELIABILITY, CERTAIN ELEMENTS OF THE SIDE AIRBAG SYSTEM SHALL BE SERVICED OR VEHICLE MANUFACTURE DATE SHOWN ON CERTIFICATION LABEL.
FOR FURTHER INFORMATION
SEE OWNER'S MANUAL.

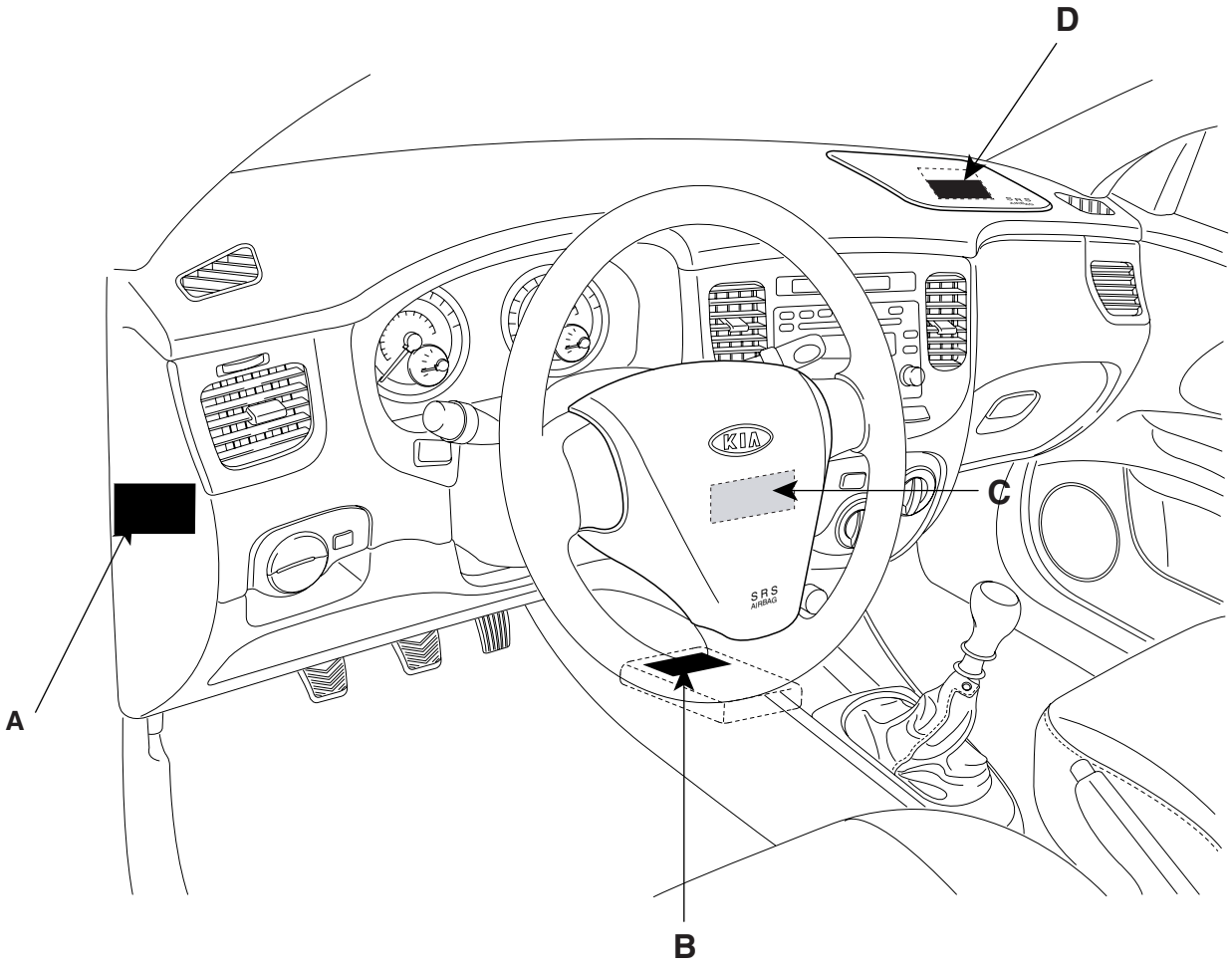
LAJF003A

AIR BAG WARNING / CAUTION LABEL



LAJF004A

AIR BAG WARNING / CAUTION LABEL (CONT'D)



AAJF008A

AIR BAG WARNING / CAUTION LABEL (CONT'D)

A : WARNING
SEE OWNER'S MANUAL.
This car is equipped a side airbag for each front seat.
- Do not use any accessory seat covers.
- Use of other seat covers could reduce the effect of the system.
- Do not install any accessories on the side or near the side airbag.
- Do not use excessive force on the side of the seal.
- For further information, see the owner's manual.

B : CAUTION
AIRBAG ESPE UNIT

Detach connector before unmounting. Assemble strictly according to manual instructions.

C : PASSENGER MODULE CAUTION

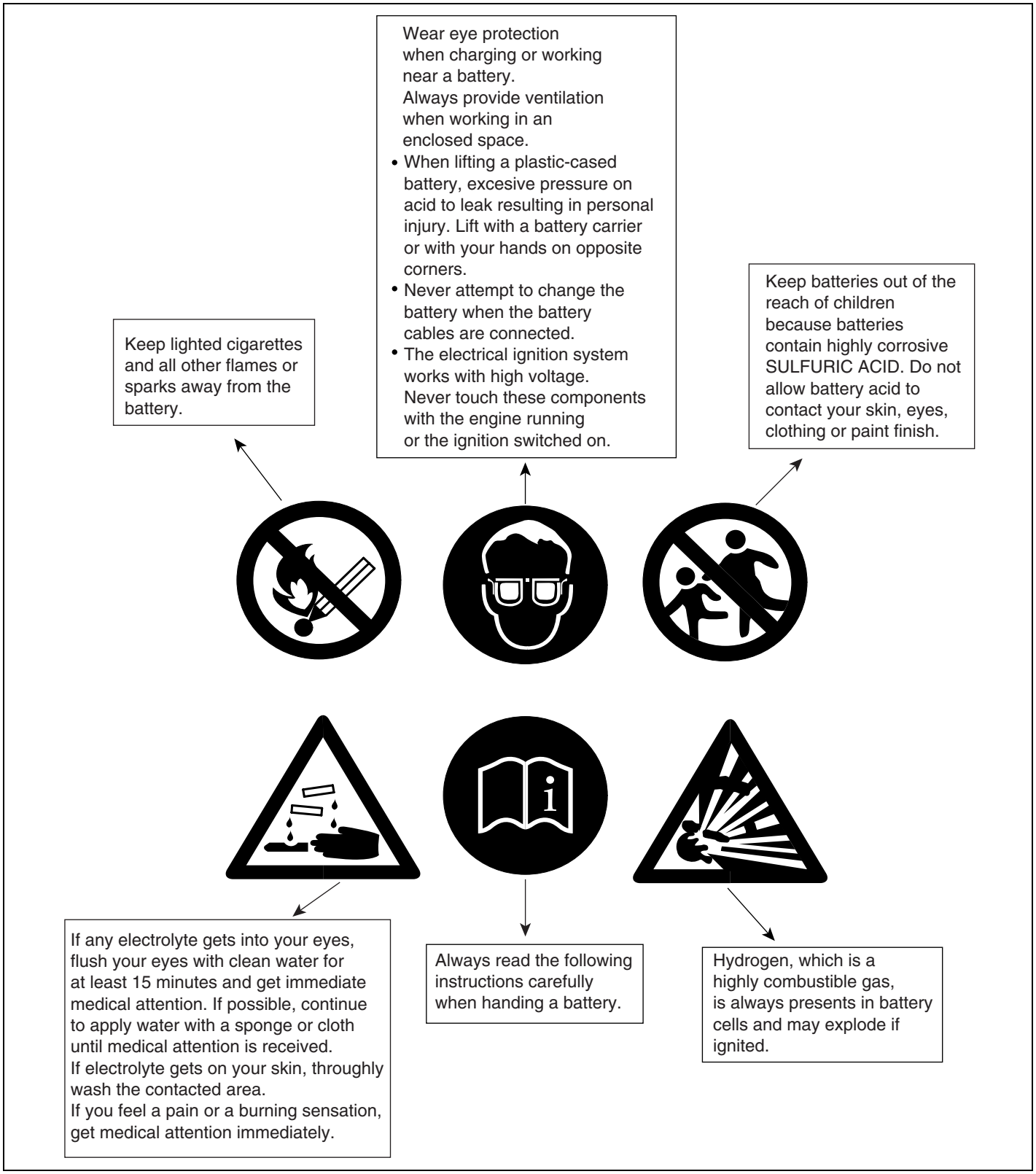
CAUTION
Don't open, remove or transfer to another vehicle.
Risk of malfunction and bodily injury!
This unit is to be installed and/or dismantled by trained personnel only. This item contains an explosive to be installed igniter.

D : SUPPLEMENTAL RESTRAINT SYSTEM (AIRBAG) INFORMATION
- The airbag is a Supplement Restraint System (SRS).
  You must always wear the seat belts.
- The airbag system condition is normal when the "SRS" lamp in the cluster flashes approximately 6 times after the ignition key is turned on and then goes off.
- If any of the following condition occur, the system must be serviced.
  - "SRS" lamp does not light up when the key is turned on.
  - "SRS" lamp stays lit or flashes continuously.
  - The airbag has inflated.

- The airbag system must be inspected by an authorized dealer ten years after the vehicle manufacture date shown on the certification label, located on left front door opening area.

WARNING
Failure to the above instructions may result in injury to you or other occupants in the vehicle
- See the "SRS" section in Owner's Manual for more information about airbags.

BATTERY CAUTION LABEL DESCRIBTION



EAKE007E

LIFT AND SUPPORT POINTS

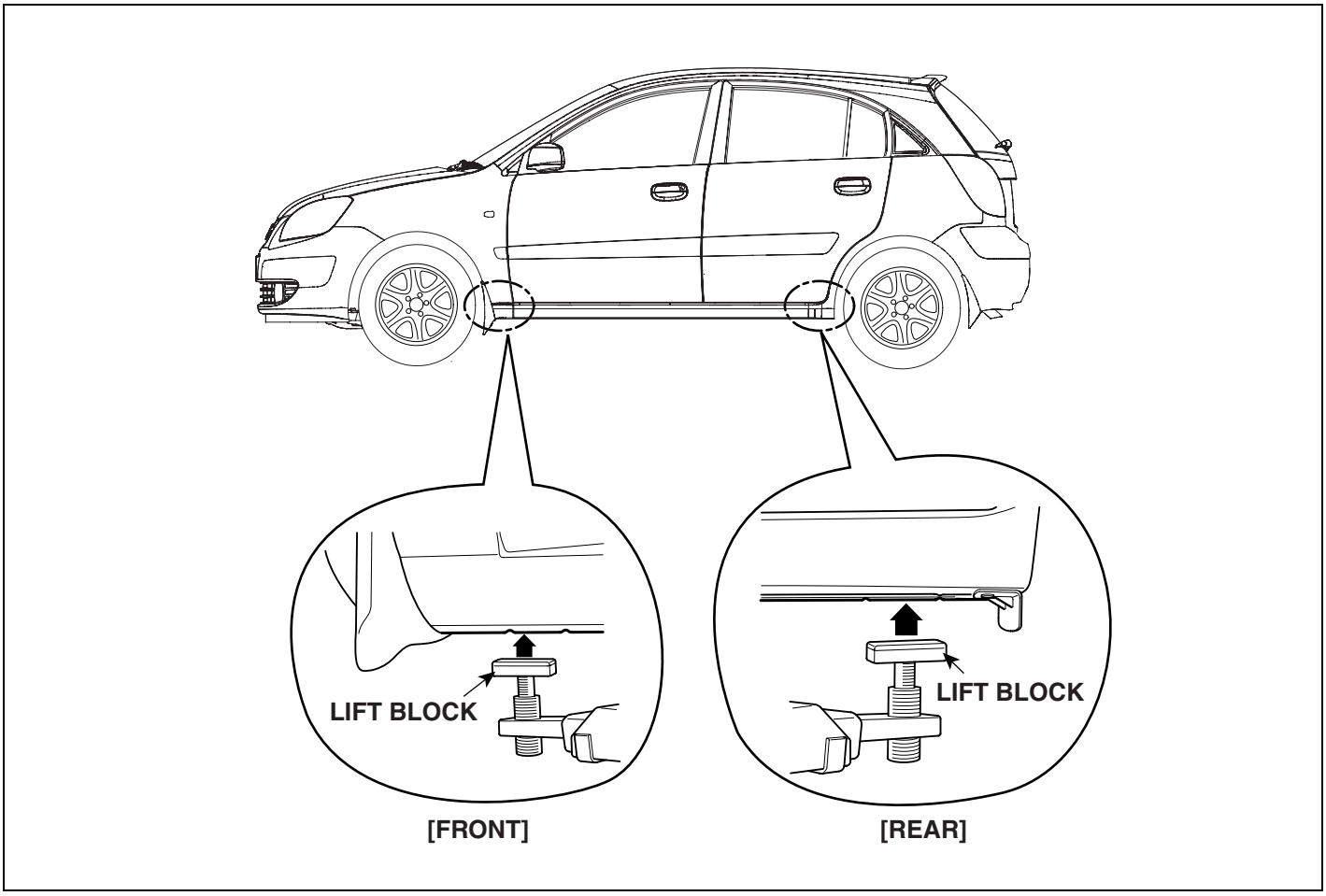
WARNING

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 substantial weight is removed from the rear of the vehicle, the center of gravity may change and cam 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.*

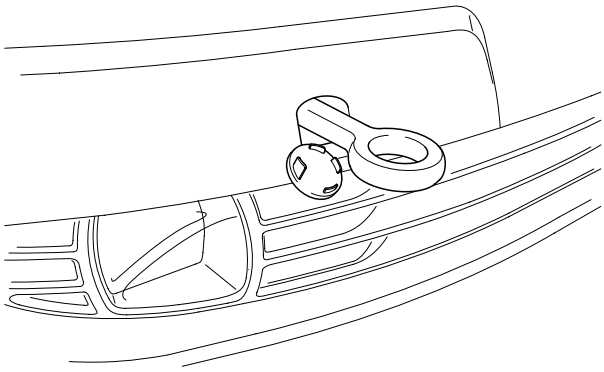
1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches (centimeters) and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height to inspect the lift points for secure support.



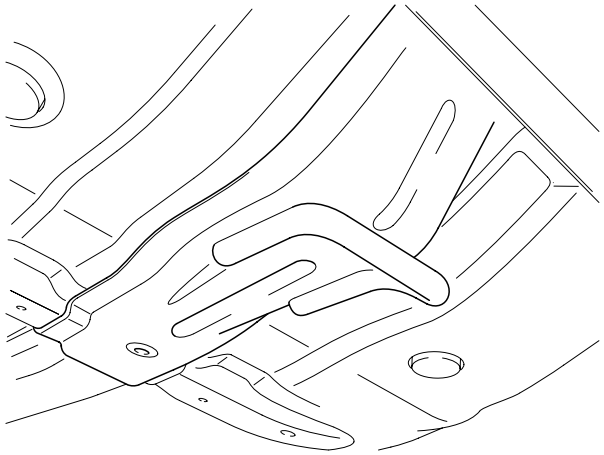
LAJF005A

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.



AAJF010A



AAJF011A

EMERGENCY TOWING

There are three propular methods of towing a vehicle :

Flat - bed Equipment - The operator loads the vehicle on the back of truck. This is best way of transporting the vehicle.

Wheel Lift Equipment - The tow truck uses two pivoting arms that go under the tires (front or rear) and lift them off the ground. The other two wheels remain on the ground.

Sling type Equipment - The tow truck 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, if should be towed with the front wheels off the ground. If due to damage, the vehicle must be toward with the front wheels on the ground, do not following :

Manual Transmission

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

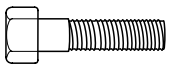
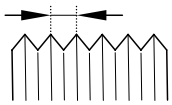
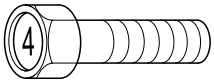
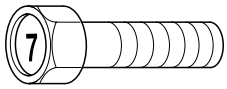
Automatic Transmission

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

CAUTION

- ***Improper towing preparation will damage the transmission. Follow the above procedure exactly. If you cannot shift the transmission or start the engine (automatic transmission), your vehicle must be transported on a flatbed.***
- ***It is the best to tow vehicle no farther than 19miles (30km), and keep the speed below 30mph (50km/h).***
- ***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 nominal diameter (mm)	Pitch (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7
 EAKE004E	 KASD100Y	 EAKE004F	 EAKE004G
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 ~ 60, 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. *If you reduce the torques in the table to the percentage indicated below, under the following conditions, if will be the standard value.*
   - *If spring washers are used : 85%*
   - *If threads and bearing sufaces are stained with oil : 85%*

LUBRICANTS

RECOMMENDED LUBRICANTS

Parts	OIL & GREASE STANDARD
Engine Oil	API SL(SJ) or ABOVE, ILSAC GF-3 and ABOVE
Manual transaxle	GENUINE PART MTF 75W90 (API GL - 4)
Automatic transaxle	DIAMOND ATF SP-III, SK ATF SP-III
Brake	DOT 3, DOT 4 or equivalent
Coolant	Ethlyene glycol base for aluminium radiator
Transaxle linkage, parking breake cable mechanism, hood, door latch, seat adjuster, tailgate latch, door hinges, tailgate hinge	Multipurpose grease NIGL grade #2
Power Steering	PSF -3

WARNING

Always use Genuine Hyundai parts and recommended fluid.
Using any other type of parts and fluid can cause serious damaged if the vehicle.

LUBRICANTS CAPACITIES

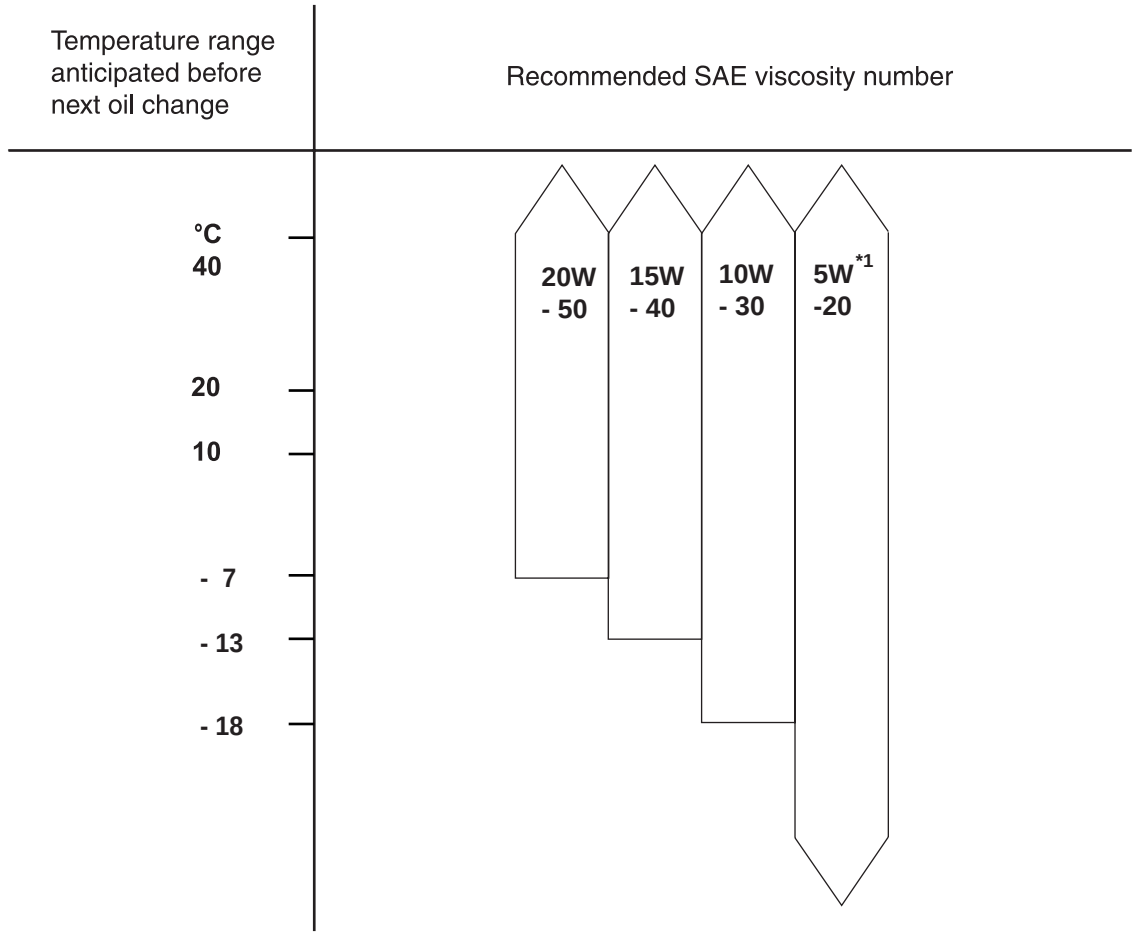
Description		Capacities
Engine oil	Oil pan	3.0 (3.17, 2.64)
	Oil filter	0.3 (0.32, 0.26)
	Total	3.3 (3.49, 2.90)
Cooling system		5.5~5.8 (5.81~6.13, 4.84~5.10)
Manual transaxle		2.0 (2.11, 1.76)
Automatic transaxle		6.1 (6.45, 5.37)
Power steering		0.75~0.8 (0.79~0.85, 0.66~0.70)

Capacities: [liter (U.S.qts, Imp.qts)]

SELECTION OF ENGINE OIL

RECOMMENDED ILSAC classification : GF-3 OR ABOVE
RECOMMENDED API classification : SL(SJ) OR ABOVE

RECOMMENDED SAE VISCOSITY GRADES :



*1 : Recommended regardless of environment.
If not available, refer to the recommended SAE viscosity numbers.

LC8F002A

NOTE

For best performance and maximum protection of all types of operation, select only those lubricants which :

1. *Satisfy the requirements of the API classification.*
2. *Have the proper SAE grade number for expected ambient temperature range.*

Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

GENERAL SERVICE INFORMATION

PROTECTION OF THE VEHICLE

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

CAUTION

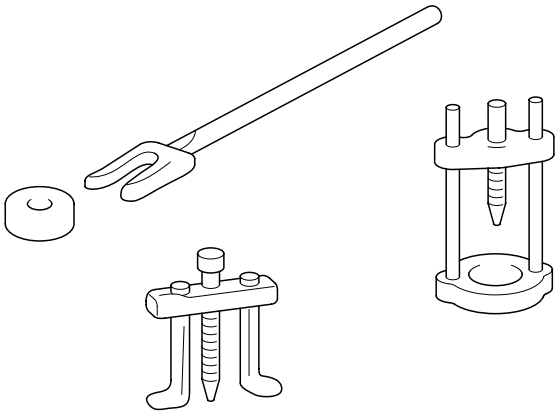
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched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

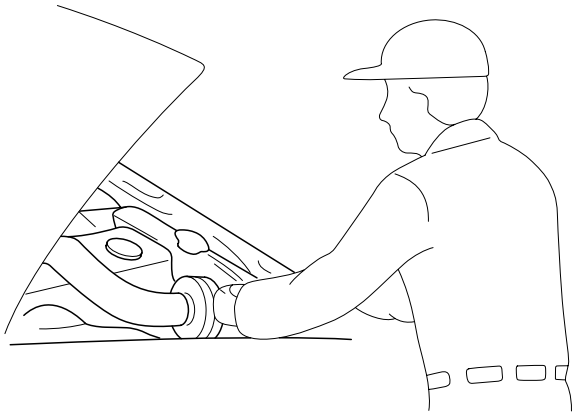
Use special tools when they are required.



EAKE005A

REMOVAL OF PARTS

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

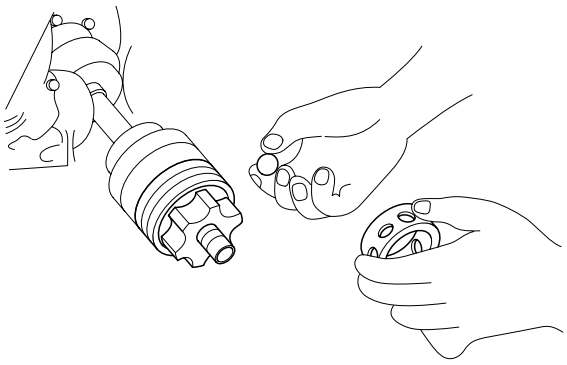


EAKE005B

DISASSEMBLY

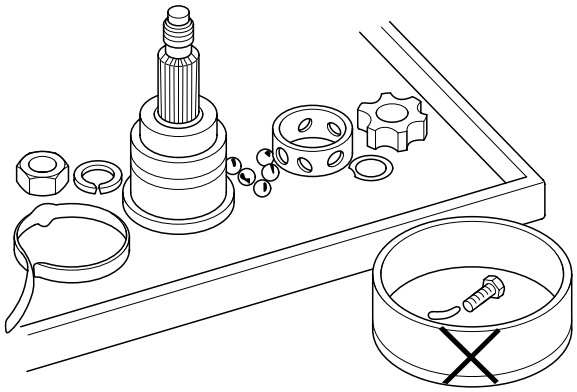
If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be disassembled in a way that will not affect their performance or external appearance.

1. **Inspection of parts**
   Each part, when removed, should be carefully inspected for malfunction, deformation, damage, and other problems.



EAKE005C

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.



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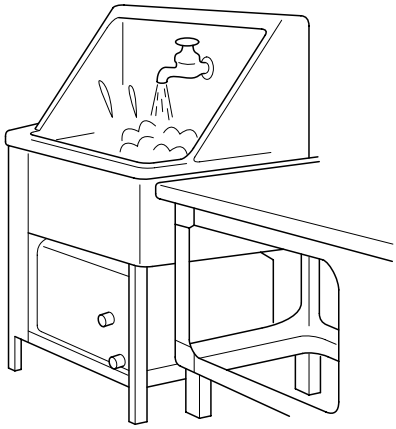
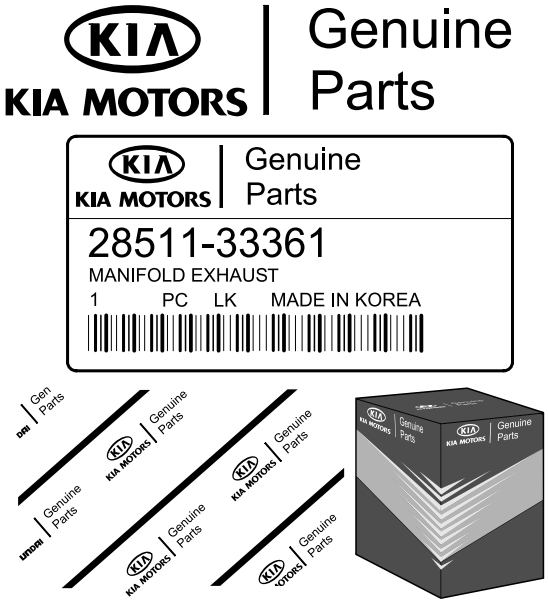
3. **Cleaning parts for reuse**
   All parts to be used again should be carefully and thoroughly cleaned by an appropriate method.



EAKE005E

PARTS

When replacing parts, use KIA MOTORS genuine parts.



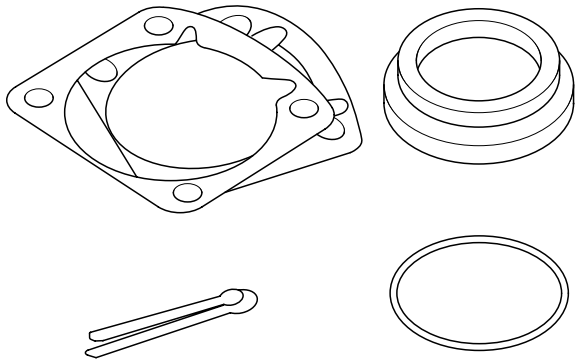
LAIF006A

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.

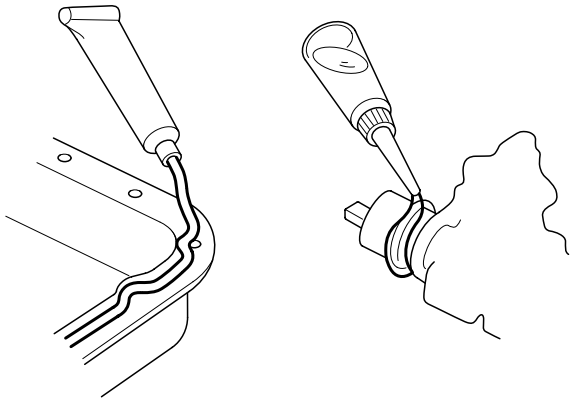
1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins (split pins)

6. Plastic nuts



EAKE005G

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.



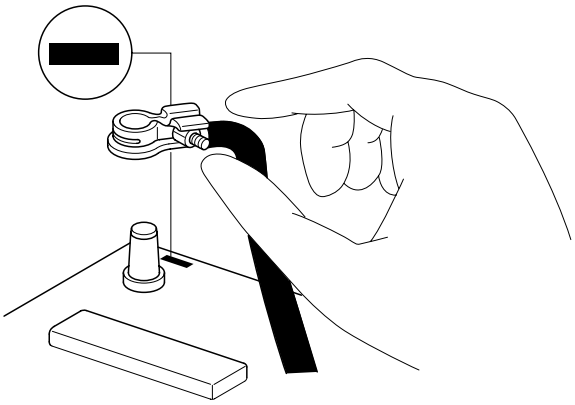
EAKE005H

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.



EAKE005I

RUBBER PARTS AND TUBES

Always prevent gasoline or from touching rubber parts or tubing.

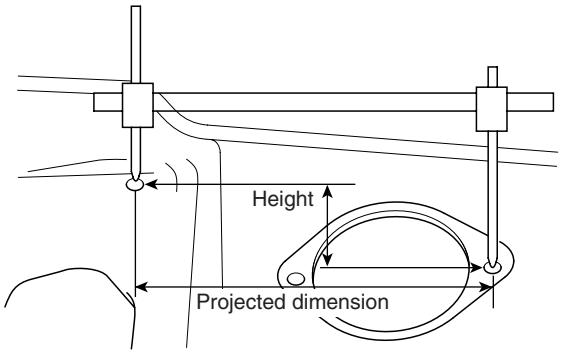
EAKE005J

MEASURING BODY DIMENSIONS

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 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.



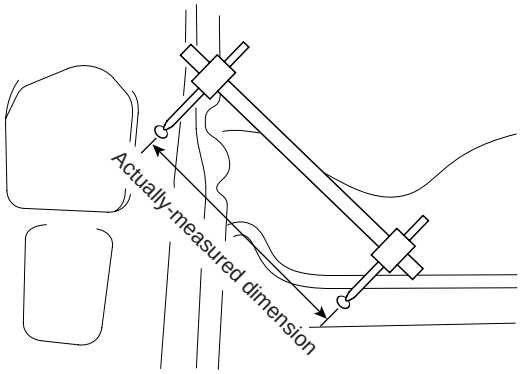
EAKE005K

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

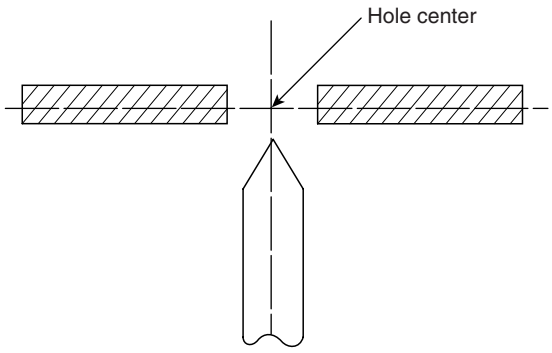
Check the probes and gauge itself to make sure there is no free play.



EAKE005L

MEASUREMENT POINT

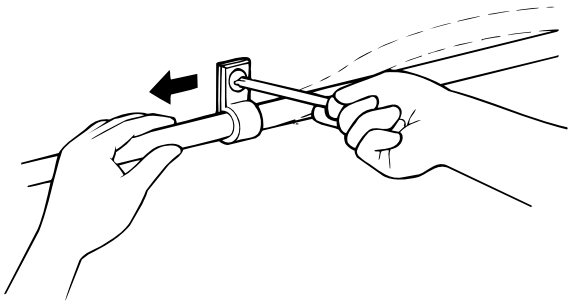
Measurements should be taken at the center fo the hole.



EAKE005M

CHECKING CABLES AND WIRES

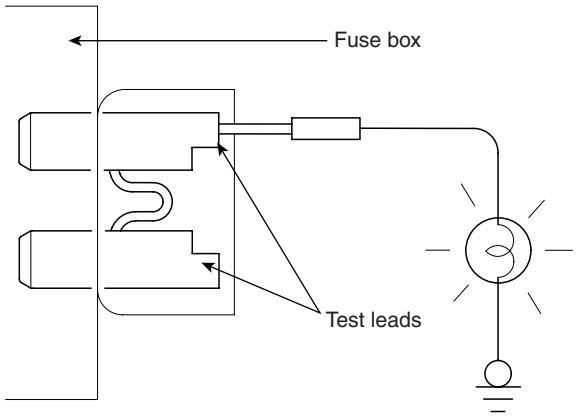
1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic 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.



EAKE005N

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)



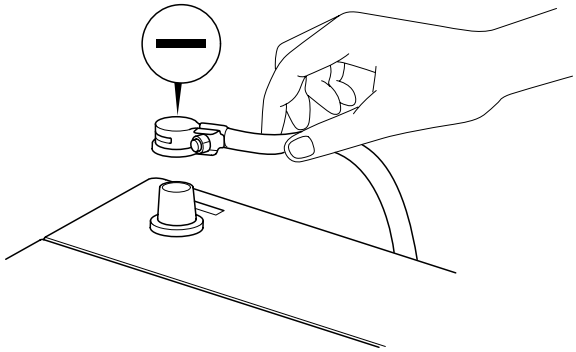
EAKE005O

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.

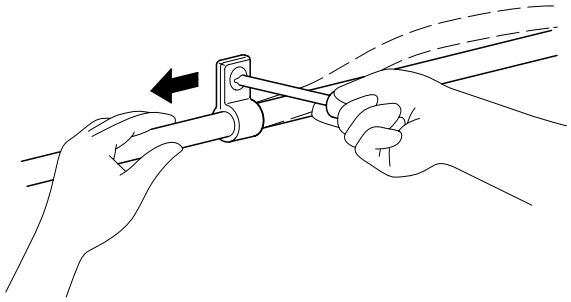
   NOTE

   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. Therefore, if necessary, read the diagnostic before removing the battery cable.



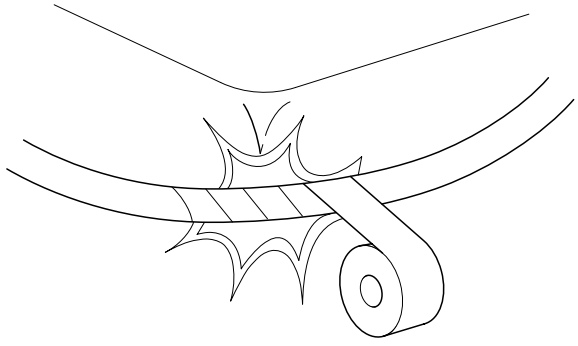
EAKE005P

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.



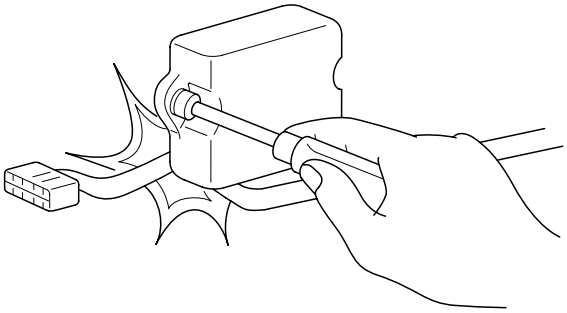
EAKE005R

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.



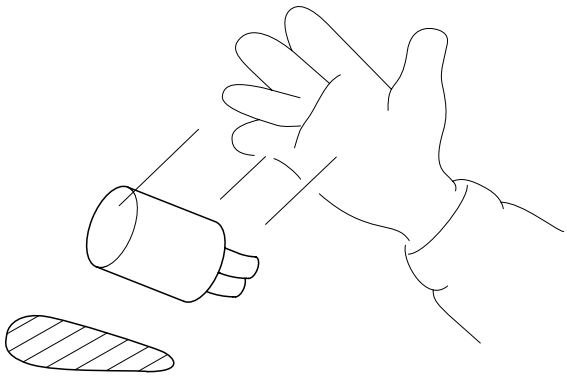
EAKE005S

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



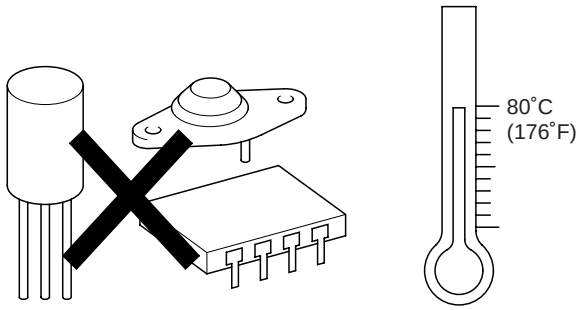
EAKE005T

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



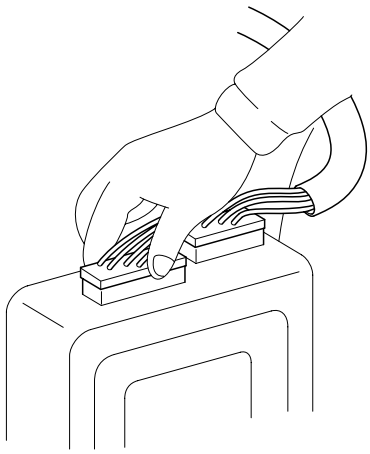
EAKE005U

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.



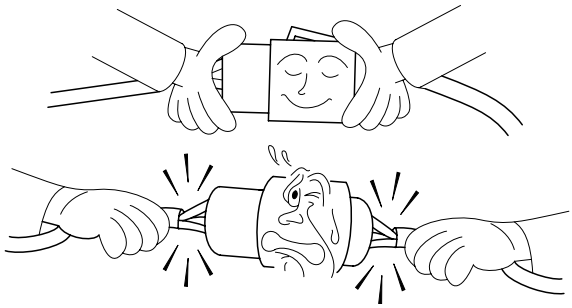
EAKE006A

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



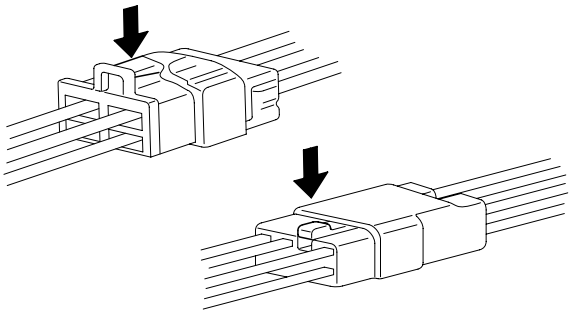
EAKE006B

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



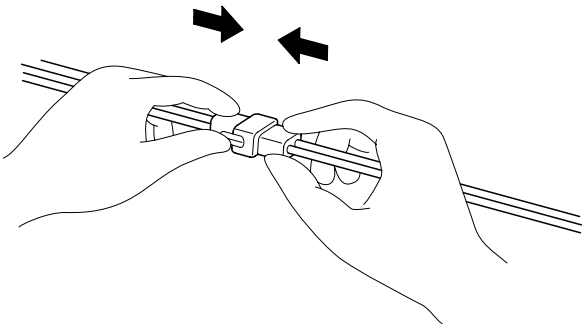
EAKE006C

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



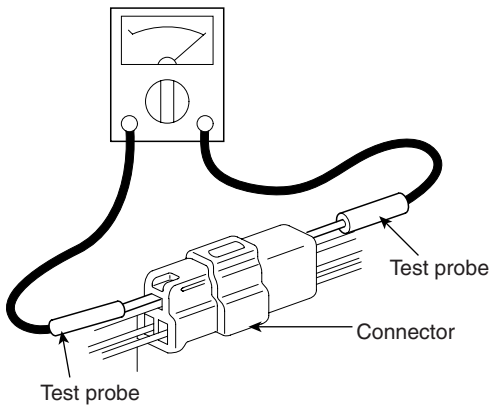
EAKE006D

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



EAKE006E

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.



EAKE006G

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

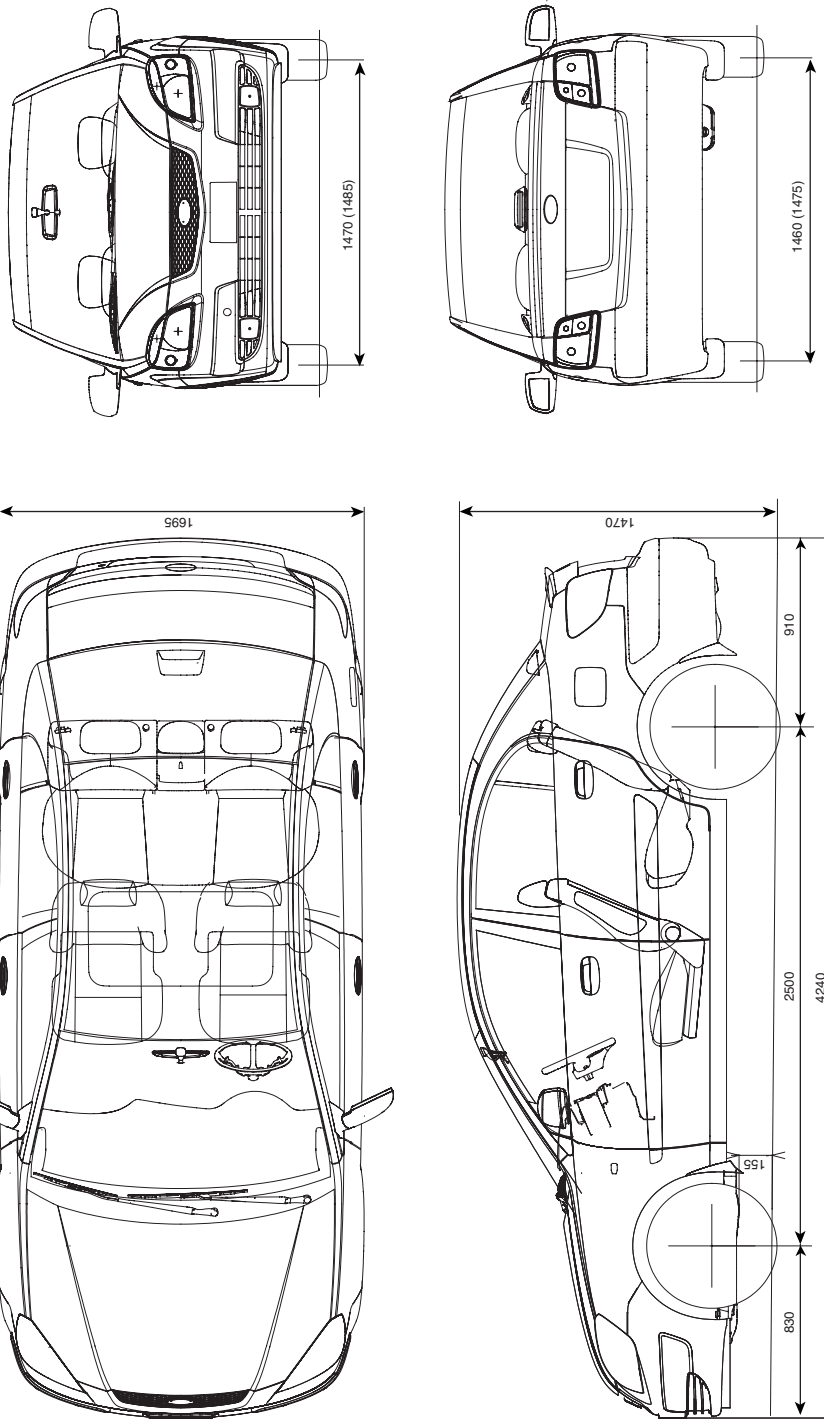
CAUTION

If a large amount of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this observe the following precautions 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. Avoid start-jump tests. Do start-jumps only when absolutely necessary. Perform this test as rapidly as possible and, while testing, never race the engine.
4. Do not measure engine compression for and extended time. Engine compression tests must be made as rapidly as possible.
5. Avoid coasting with the ignition turned and during prolonged braking.
6. Do not dispose of used catalytic converter together with parts contaminated with gasoline or oil.

BODY - DIMENSION

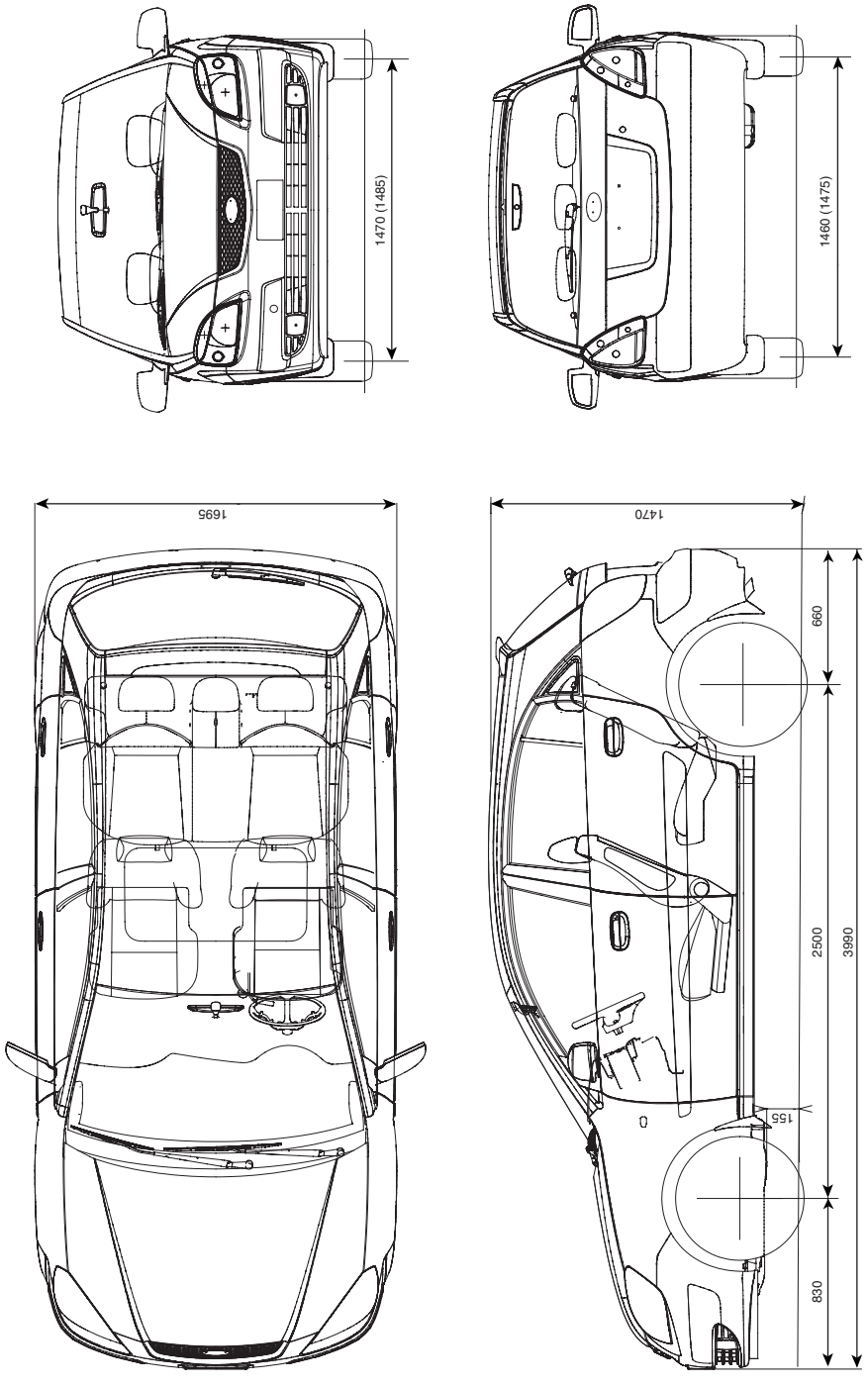
■ **4 DOOR**



Unit : mm

LAJF006A

■ **5 DOOR**



Unit : mm

LAJF007A

Engine (G4ED-GSL 1.6 / G4EE-GSL 1.4)

GENERAL

TIMING SYSTEM
- TIMMING BELT

CYLINDER HEAD ASSEMBLY

ENGINE AND TRANSAXLE ASSEMBLY

ENGINE BLOCK

COOLING SYSTEM

LUBRICATION SYSTEM

INTAKE AND EXHAUST SYSTEM
- INTAKE MANIFOLD
- EXHAUST MANIFOLD
- EXHAUST PIPE

GENERAL

GENERAL E13EACCE

SPECIFICATIONS

Description		Specifications		Limit
		1.4 DOHC	1.6 CVVT	
General				
Type		In-line, DOHC		
Number of cylinders		4		
Bore		75.5mm (2.9724in)	76.5mm (3.0118in)	
Stroke		78.1mm (3.0748in)	87mm (3.4252in)	
Total displacement		1,399 cc (85.37 cu.in)	1,599 cc (97.57 cu.in)	
Compression ratio		10.0 : 1		
Firing order		1-3-4-2		
Valve timing				
Intake valve	Opens (BTDC)	9°	-8°	
	Closes (ABDC)	31°	60°	
Exhaust valve	Opens (BBDC)	43°	46°	
	Closes (ATDC)	5°	10°	
Cylinder head				
Flatness of gasket surface		Less than 0.03mm (0.0012in)		0.1mm (0.0039in)
Flatness of manifold mounting surface	Intake	Less than 0.15mm (0.0059in)		0.2mm (0.0079in)
	Exhaust	Less than 0.15mm (0.0059in)		0.2mm (0.0079in)
Valve guide hole diameter (Intake, Exhaust)	STD	11.000 ~ 11.018mm (0.4331 ~ 0.4338in)		
	0.05 OS	11.050 ~ 11.068mm (0.4350 ~ 0.4357in)		
	0.25 OS	11.250 ~ 11.268mm (0.4429 ~ 0.4436in)		
	0.50 OS	11.500 ~ 11.518mm (0.4528 ~ 0.4535in)		
Intake valve seat ring hole diameter	STD	30.400 ~ 30.421mm (1.1968 ~ 1.1977in)		
	0.3 OS	30.700 ~ 30.721mm (1.2087 ~ 1.2095in)		
	0.6 OS	31.000 ~ 31.021mm (1.2205 ~ 1.2213in)		
Exhaust valve seat ring hole diameter	STD	27.000 ~ 27.021mm (1.0630 ~ 1.0638in)		
	0.3 OS	27.300 ~ 27.321mm (1.0748 ~ 1.0756in)		
	0.6 OS	27.600 ~ 27.621mm (1.0866 ~ 1.0874in)		
Camshaft				
Cam height	Intake	43.3484 ~ 43.5484mm (1.70663 ~ 1.71450in)	43.7492 ~ 43.9492mm (1.72241 ~ 1.73028in)	
	Exhaust	43.5486 ~ 43.7486mm (1.71451 ~ 1.72238in)	44.1494 ~ 44.3494mm (1.73816 ~ 1.74604in)	
Journal outer diameter (Intake, Exhaust)		26.964 ~ 26.980mm (1.0616 ~ 1.0622in)		

Description		Specifications		Limit
		1.4 DOHC	1.6 CVVT	
Camshaft cap oil clearance		0.02 ~ 0.061mm (0.0008 ~ 0.0024in)		0.1mm (0.0039in)
End play		0.10 ~ 0.20mm (0.0039 ~ 0.0079in)		
Valve				
Valve length	Intake	91.8mm (3.6142in)		
	Exhaust	92.4mm (3.6378in)		
Stem outer diameter	Intake	5.955 ~ 5.970mm (0.2344 ~ 0.2350in)		
	Exhaust	5.935 ~ 5.950mm (0.2337 ~ 0.2343in)		
Face angle		45°~ 45°30'		
Thickness of valve head (margin)	Intake	1.1mm (0.0433in)		0.8mm (0.0315in)
	Exhaust	1.3mm (0.0512in)		1.0mm (0.0394in)
Valve stem to valve guide clearance	Intake	0.03 ~ 0.06mm (0.0012 ~ 0.0024in)		0.10mm (0.0039in)
	Exhaust	0.05 ~ 0.08mm (0.0020 ~ 0.0031in)		0.15mm (0.0059in)
Valve guide				
Length	Intake	36.3 ~ 36.7mm (1.4291 ~ 1.4449in)		
	Exhaust	40.8 ~ 41.2mm (1.6063 ~ 1.6220in)		
Valve seat				
Width of seat contact	Intake	0.8 ~ 1.2mm (0.0315 ~ 0.0472in)		
	Exhaust	1.3 ~ 1.7mm (0.0512 ~ 0.0669in)		
Seat angle	Intake	45°~ 45°30'		
	Exhaust	45°~ 45°30'		
Valve spring				
Free length		44.0mm (1.7323in)		
Load		21.6±1.1kg/35mm(47.6±2.4 lb/1.3780in)		
		45.1±2.2kg/27.2mm(99.4±4.9 lb/1.0709in)		
Out of squareness		Less than 1.5°		3°
Cylinder block				
Cylinder bore		75.50 ~ 75.53mm (2.9724 ~ 2.9736in)	76.50 ~ 76.53mm (3.0118 ~ 3.0130in)	
Flatness of gasket surface		Less than 0.05mm (0.0020in)		
Piston				
Piston outer diameter		75.47 ~ 75.50mm (2.9713 ~ 2.9724in)	76.47 ~ 76.50mm (3.0106 ~ 3.0118in)	
Piston to cylinder clearance		0.020 ~ 0.040mm (0.0008 ~ 0.0016in)		
Ring groove width	No. 1 ring groove	1.230 ~ 1.255mm (0.0484 ~ 0.0494in)		
	No. 2 ring groove	1.230 ~ 1.255mm (0.0484 ~ 0.0494in)		
	Oil ring groove	2.030 ~ 2.055mm (0.0799 ~ 0.0809in)		
Piston ring				

Description		Specifications		Limit
		1.4 DOHC	1.6 CVVT	
Side clearance	No.1 ring	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)		0.1 mm (0.0039in)
	No.2 ring	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)		0.1 mm (0.0039in)
	Oil ring	0.08 ~ 0.175mm (0.0031 ~ 0.0069in)		
End gap	No. 1 ring	0.20 ~ 0.35mm (0.0079 ~ 0.0138in)	0.15 ~ 0.30mm (0.0059 ~ 0.0118in)	1.0mm (0.0394in)
	No. 2 ring	0.37 ~ 0.52mm (0.0146 ~ 0.0205in)	0.35 ~ 0.50mm (0.0138 ~ 0.0197in)	1.0mm (0.0394in)
	Oil ring	0.20 ~ 0.70mm (0.0079 ~ 0.0276in)	0.20 ~ 0.70mm (0.0079 ~ 0.0276in)	1.0mm (0.0394in)
Piston pin				
Piston pin outer diameter		18.001 ~ 18.007mm (0.7087 ~ 0.7089in)		
Piston pin hole inner diameter		18.016 ~ 18.021mm (0.7093 ~ 0.7095in)		
Piston pin hole clearance		0.011 ~ 0.018mm (0.0004 ~ 0.0007in)		
Connecting rod small end hole inner diameter		17.974 ~ 17.985mm (0.7076 ~ 0.7081in)		
Connecting rod small end hole clearance		-0.033 ~ -0.016mm (-0.0013 ~ -0.0006in)		
Piston pin press-in load		500~1,500 kg (1,102 ~ 3,306 lb)		
Connecting rod				
Connecting rod big end inner diameter		48.000 ~ 48.018mm (1.8898 ~ 1.8905in)		
Connecting rod bearing oil clearance		0.018 ~ 0.036mm (0.0007 ~ 0.0014in)		
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)		0.4mm (0.0157in)
Crankshaft				
Main journal outer diameter		49.950 ~ 49.968mm (1.9665 ~ 1.9672in)		
Pin journal outer diameter		44.954 ~ 44.972mm (1.7698 ~ 1.7705in)		
Main bearing oil clearance	No. 1, 2, 4, 5	0.022 ~ 0.040mm (0.0009 ~ 0.0016in)		0.1mm (0.0039in)
	No. 3	0.028 ~ 0.046mm (0.0011 ~ 0.0018in)		0.1mm (0.0039in)
End play		0.05 ~ 0.175mm (0.0020 ~ 0.0069in)		0.2mm (0.0079in)
Flywheel				
Runout		0.1mm (0.0039in)		0.13mm (0.0051in)
Oil pump				
Side clearance	Inner rotor	0.040 ~ 0.085mm (0.0016 ~ 0.0033in)		
	Outer rotor	0.040 ~ 0.090mm (0.0016 ~ 0.0035in)		
Body clearance		0.060 ~ 0.090mm (0.0024 ~ 0.0035in)		
Relief valve opening pressure		500±49.0kpa (5.1±0.5kg/cm², 72.5±7.1psi)		
Relief spring	Free length	46.6mm (1.8346in)		
	Load	6.1±0.4kg/40.1mm (13.4±0.9 lb/1.5787in)		
Engine oil				
Oil quantity (Total)		3.3 L (3.49 US qt, 2.90 lmp qt)		

Description		Specifications		Limit
		1.4 DOHC	1.6 CVVT	
Oil quantity (Oil pan)		3.0 L (3.17 US qt, 2.64 lmp qt)		
Oil quantity (Oil filter)		0.3 L (0.32 US qt, 0.26 lmp qt)		
Oil quality		Above SJ / SL		
Oil pressure (Idle)		78.4kpa (0.8kg/cm², 11.3psi)	107.8kpa (1.1kg/cm², 15.6psi)	
Cooling system				
Cooling method		Forced circulation with cooling fan		
Coolant quantity		5.5 ~ 5.8 L (5.81 ~6.13 US qt, 4.84 ~5.10 lmp qt)		
Thermostat	Type	Wax pellet type		
	Opening temperature	82±1.5°C (179.6±2.7°F)		
	Pull opening temperature	95°C (203°F)		
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi)		
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05kg/cm², 0.14 ~ 0.71 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 TORQUE

Item	Quan-tity	Tightening torque		
		N.m	kgf.m	lb-ft
Cylinder block				
Engine support bracket bolt	2	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Engine support bracket nut	1	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Engine support bracket stay bolt	2	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Rear plate bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Engine mounting				
Engine mounting bracket and body fixing bolt	3	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting insulator and engine mounting support bracket fixing nut	1	68.6 ~ 93.2	7.0 ~ 9.5	50.6 ~ 68.7
Engine mounting support bracket and engine support bracket fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting support bracket and engine support bracket fixing nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting bracket and body fixing bolt	3	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting insulator and transaxle support bracket fixing bolt	2	68.6 ~ 93.2	7.0 ~ 9.5	50.6 ~ 68.7
Front roll stopper bracket and sub frame fixing bolt	3	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Front roll stopper insulator and front roll stopper support bracket fixing bolt,nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Rear roll stopper bracket and sub frame fixing bolt	3	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Rear roll stopper insulator and rear roll stopper support bracket fixing bolt,nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Main moving system				
Connecting rod cap nut	8	31.4 ~ 34.3	3.2 ~ 3.5	23.1 ~ 25.3
Crankshaft main bearing cap bolt	10	53.9 ~ 58.8	5.5 ~ 6.0	39.8 ~ 43.4
Flywheel bolt (M/T)	5	117.7 ~ 127.5	12.0 ~ 13.0	86.8 ~ 94.0
Drive plate bolt (A/T)	5	117.7 ~ 127.5	12.0 ~ 13.0	86.8 ~ 94.0
Timing belt				
Timing belt front upper cover bolt	4	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Timing belt front lower cover bolt	5	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Timing belt rear lower LH cover bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing belt rear upper LH cover bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing belt rear upper RH cover bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft pulley bolt	1	137.3 ~ 147.1	14.0 ~ 15.0	101.3 ~ 108.5
Camshaft sprocket bolt	1	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Timing belt tensioner bolt	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing belt idler bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8

Item	Quan-tity	Tightening torque		
		N.m	kgf.m	lb-ft
Cylinder head				
Engine cover bolt	4	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Cylinder head cover bolt	12	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Camshaft bearing cap bolt	24	11.8 ~ 13.7	1.2 ~ 1.4	8.7 ~ 10.1
Intake camshaft and CMP sensor target wheel fixing bolt (1.6 CVVT)	1	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Exhaust camshaft and CVVT assembly fixing bolt(1.6 CVVT)	1	64.7 ~ 76.5	6.6 ~ 7.8	47.7 ~ 56.4
Timing chain auto tensioner bolt (1.6 CVVT)	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
OCV(oil control valve) bolt (1.6 CVVT)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
OCV(oil control valve) filter (1.6 CVVT)	1	40.2 ~ 50.0	4.1 ~ 5.1	29.7 ~ 36.9
Cylinder head bolt (1.4 DOHC)	10	34.3+90° → Release all bolts → 34.3+90°	3.5+90° → Release all bolts → 3.5+90°	25.3+90° → Release all bolts → 25.3+90°
Cylinder head bolt (1.6 CVVT)	10	29.4+90° → Release all bolts → 29.4+90°	3.0+90° → Release all bolts → 3.0+90°	21.7+90° → Release all bolts → 21.7+90°
Cooling system				
Water pump pulley bolt	4	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water pump bolt (8 X 28)	3	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Water pump and alternator brace fixing bolt (8 X 45)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Water pump and alternator brace fixing bolt (8 X 65)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Thermostat housing nut	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Water inlet and outlet fitting bolt (1.4 DOHC)	4	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Water outlet fitting nut (1.6 CVVT)	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Water inlet fitting bolt (1.6 CVVT)	3	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Water temperature sensor	1	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Water pipe fixing bolt	1	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.8
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Front case bolt (8 X 22)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Front case bolt (8 X 30)	3	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Front case bolt (8 X 45)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Front case bolt (8 X 60)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pan bolt	18	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	1	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Oil screen bolt	2	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Oil pressure switch	1	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9

Item	Quan-tity	Tightening torque		
		N.m	kgf.m	lb-ft
Rear oil seal case	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Intake and exhaust system				
Intake manifold and cylinder head fixing nut	6	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold and cylinder head fixing bolt(8X45)	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold and cylinder head fixing bolt(8X22)	1	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold stay bolt	4	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Exhaust manifold and cylinder head fixing nut	9	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
O2 sensor to exhaust manifold	1	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Exhaust manifold heat cover and exhaust manifold fixing bolt	3	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
Air cleaner lower cover fixing bolt	3	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Throttle body and surge tank fixing bolt and nut	4	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Exhaust manifold and front muffler fixing nut	2	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front muffler and center muffler fixing nut	2	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Center muffler and main muffler fixing nut	2	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9

COMPESSION PRESSURE INSPECTION EEF8AA76

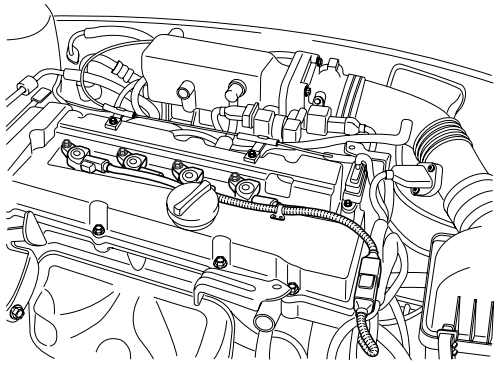
NOTE

If the there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. Warm up and stop engine.
   Allow the engine to warm up to normal operating temperature.

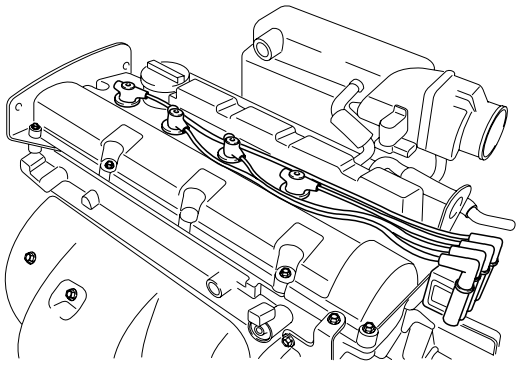
2. Disconnect the ignition coil connectors and the spark plug cables. (Refer to EE group - ignition system)

■ 1.6 CVVT



ACJF061A

■ 1.4 DOHC

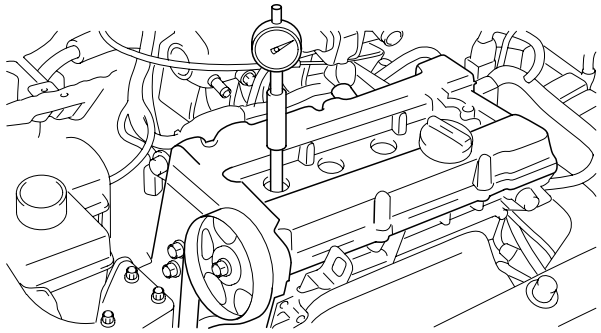


ACJF062A

3. Remove the spark plugs.
   Using a 16mm plug wrench, remove the 4 spark plugs.

4. Check the cylinder compression pressure.

   1) Insert a compression gauge into the spark plug hole.



KDPC001B

   2) Fully open the throttle.

   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 a time as possible.

Compression pressure (1.4 DOHC) Standard : 1,618kPa (16.5kg/cm², 235psi) (250~400 rpm) Minimum : 1,471kPa (15.0kg/cm², 213psi) Difference between each cylinder : 98kPa (1.0kg/cm², 14psi) or less
Compression pressure (1.6 CVVT) Standard : 1,422kPa (14.5kg/cm², 206psi) (250~400 rpm) Minimum : 1,275kPa (13.0kg/cm², 185psi) Difference between each cylinder : 98kPa (1.0kg/cm², 14psi) or less

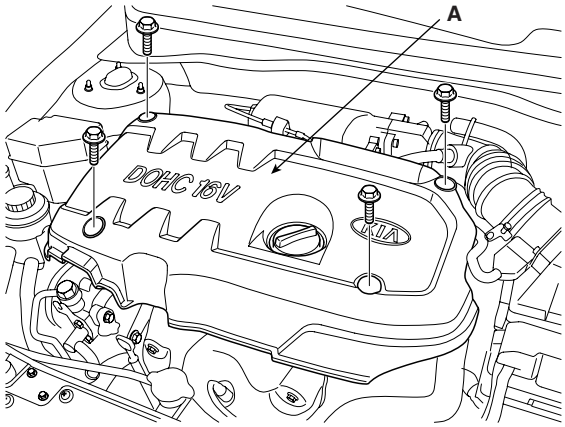
5) If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat step 1) through 3) for cylinders with low compression.
   - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
   - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. Reinstall the spark plugs.

6. Connect the ignition coil connectors and the spark plug cables. (Refer to EE group - ignition system)

TIMING BELT TENSION ADJUSTMENT

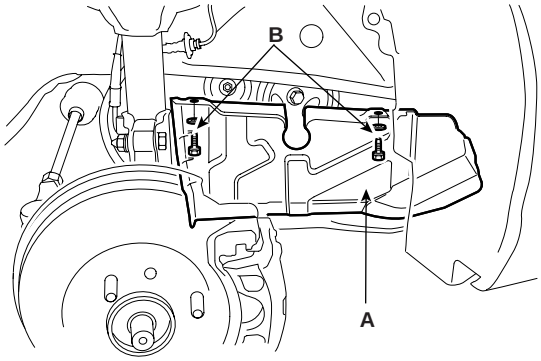
1. Remove the engine cover(A).



ACJF001A

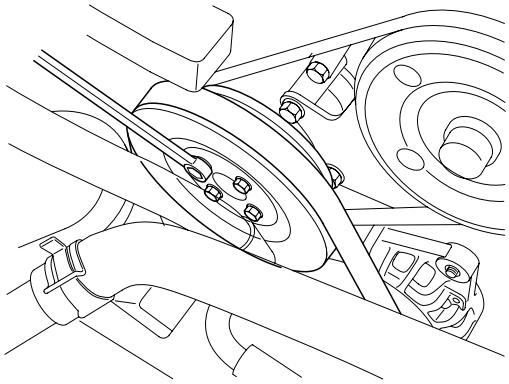
2. Remove the RH front wheel.

3. Remove the bolts(B) and RH side cover(A).



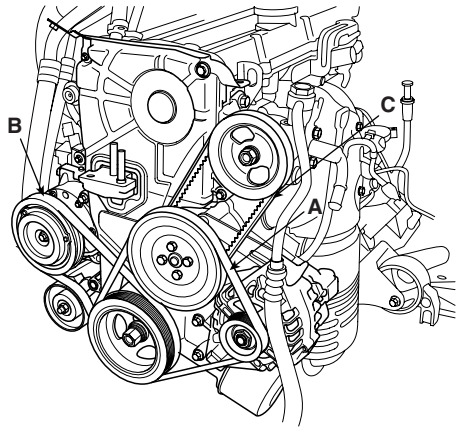
KXDSE16A

4. Loosen the water pump pulley bolts.



ECKD104B

5. Remove the alternator drive belt(A). (Refer to EE group - alternator)



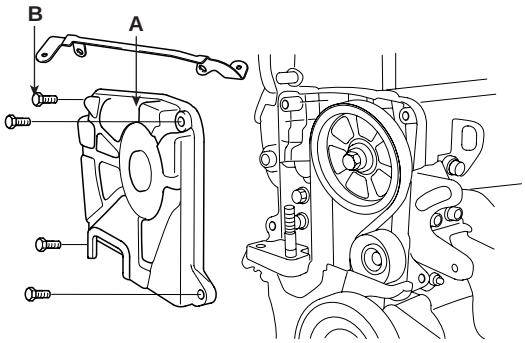
ACJF002A

6. Remove the air conditioner compressor drive belt(B). (Refer to HA group - air conditioner compressor)

7. Remove the power steering pump drive belt(C). (Refer to ST group - power steering pump)

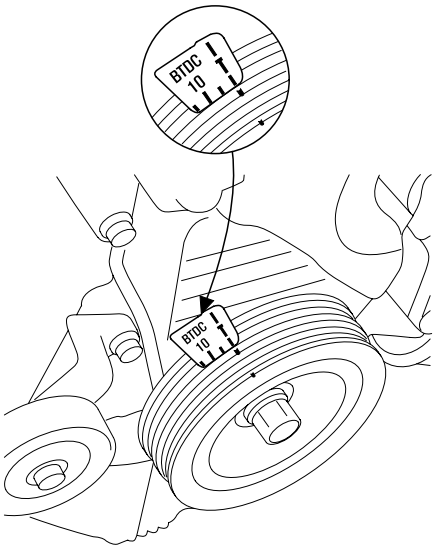
8. Remove the water pump pulley.

9. Remove the 4 bolts(B) and timing belt upper cover (A).

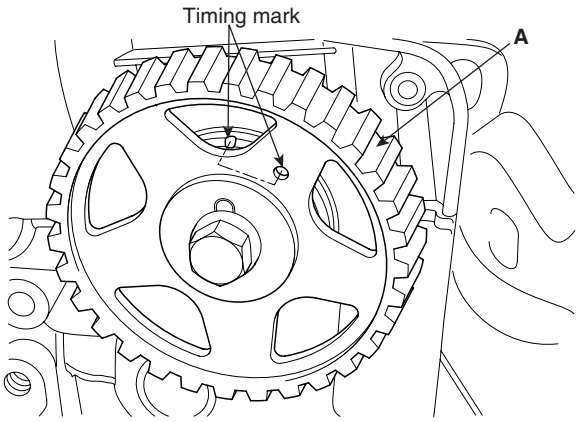


ADGE023A

10. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. Check that the timing mark of camshaft sprocket(A) is aligned with the timing mark of cylinder head cover. (No.1 cylinder compression TDC position)

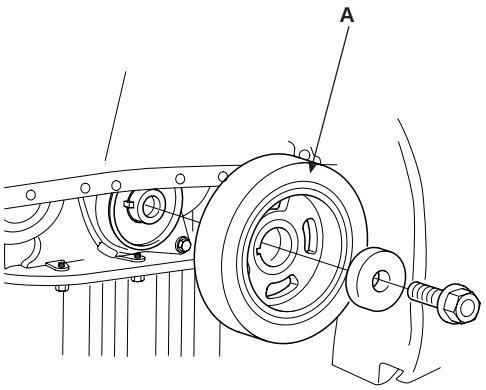


ECKD106A



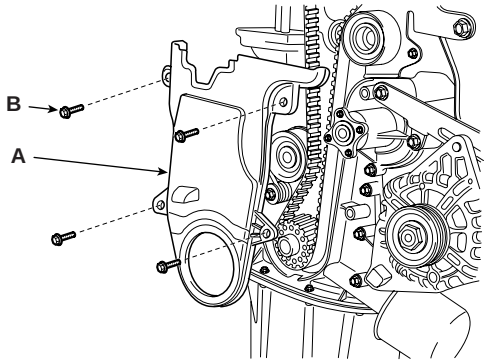
ECDD008F

11. Remove the crankshaft pulley(A).



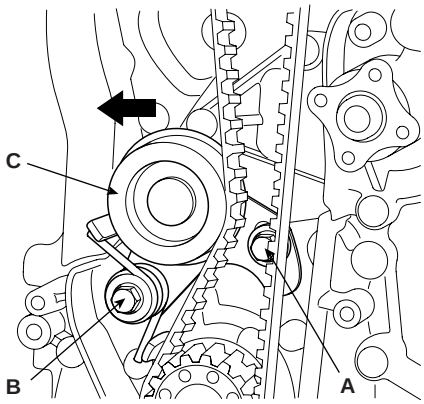
ADGE074A

12. Remove the 4 bolts(B) and timing belt lower cover(A).



ADGE024A

13. Move the tensioner pulley(C) to arrow direction after loosen the mounting bolt (A, B).
And temporarily tighten mouting bolt (A, B).

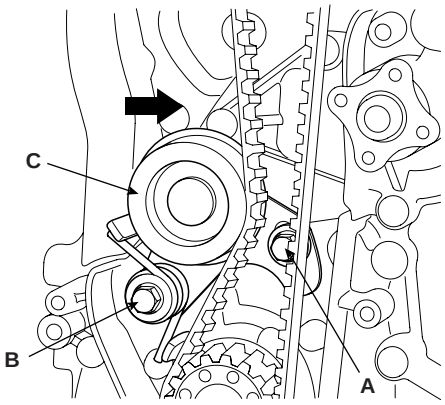


ADGE025A

14. Adjust the timing belt tension.

1) After inspecting the timing belt, replace it if necessary.

2) Give tension to timing belt using the tensioner's elasticity after loosening the mounting bolt (A,B).

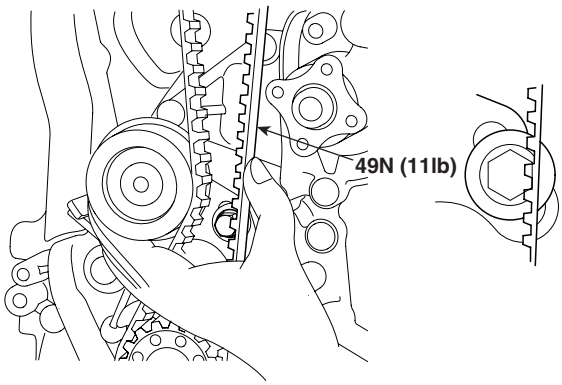


ADGE026A

3) After checking the alignment between each sprocket and each timing belt tooth, tighten the mounting bolt (A) and (B) one by one.

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

4) Then recheck the belt tension.
Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11lb)], the timing belt cog end is aprox. 1/2 of the tensioner mounting bolt head radius (across flats) away from the bolt head center.



EDKD108A

5) Timing belt tension measuring procedure (by a sonic tension guage)
Rotate crankshaft in clockwise direction to set 1st piston on top dead center (TDC) and rotate crankshaft in counterclockwise to 90˚ then measure the belt tension in the middle of tension side span (in arrow direction of above illustration) by free vibration method.

CAUTION

When rotating the crankshaft counter-clockwise, be sure to rotate the crankshaft at a time.

Conversion equation of frequency into tension :
$T = (4 / 9.8) \times S^2 \times M \times W \times f^2 / 100000000$

S: Measured belt span (mm)
M: Unit weight of belt (gf/cm^2)
W: Belt width (mm)
f: Transverse natural frequency of belt (Hz)

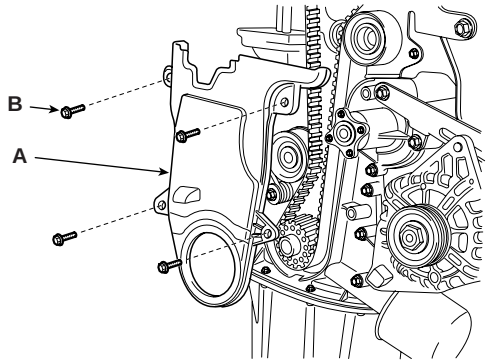
TIMING BELT SPECIFICATIONS

Item	Specifications
S (mm)	249.6
M (gf/cm^2)	0.4543
W (mm)	22
f (Hz)	70.4 ~ 87.9
T (kgf)	16 ± 3.5

15. Turn the crankshaft two turns in the operating direction (clockwise) and realign the crankshaft sprocket and camshaft sprocket timing mark.

16. Install the timing belt lower cover(A) with bolts(B).

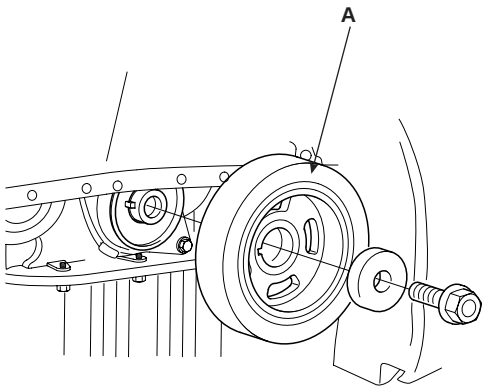
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



ADGE024A

17. Install the crankshaft pulley(A).

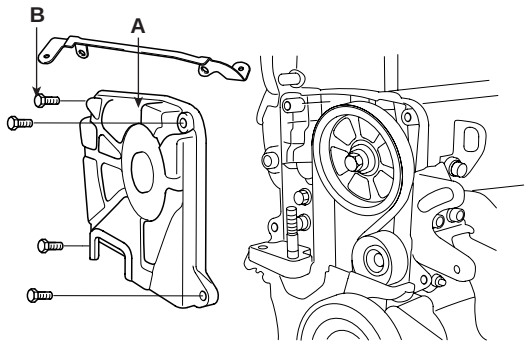
Tightening torque :
137.3 ~ 147.1N.m (14.0 ~ 15.0kgf.m, 101.3 ~ 108.5lb-ft)



ADGE074A

18. Install the timing belt upper cover(A) with bolts(B).

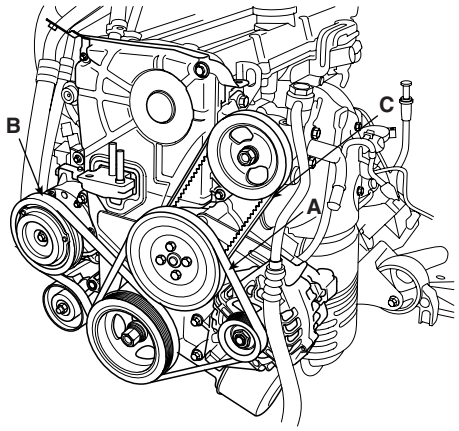
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



ADGE023A

19. Install the water pump pulley.

20. Install the power steering pump drive belt(C). (Refer to ST group - power steering pump)

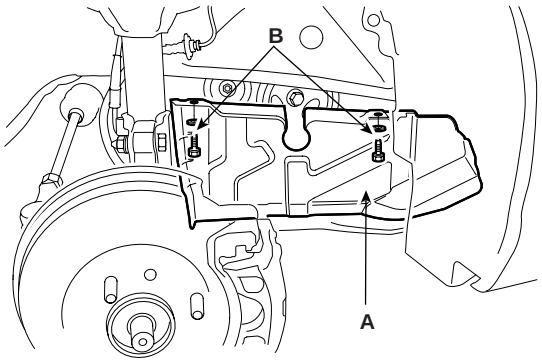


ACJF002A

21. Install the air conditioner compressor drive belt(B). (Refer to HA group - air conditioner compressor)

22. Install the alternator drive belt(A). (Refer to EE group - alternator)

23. Install the RH side cover(A) with bolts(B)



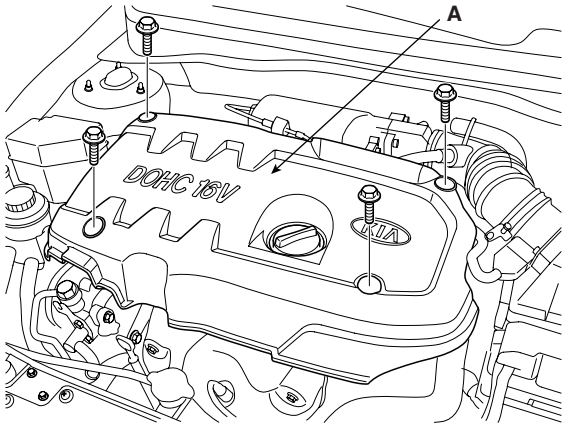
KXDSE16A

24. Install the RH front wheel.

Tightening torque :
88.3 ~ 107.9N.m (9 ~ 11kgf.m, 65.1 ~ 79.6lb-ft)

25. Install the engine cover(A) with bolts.

Tightening torque :
3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lb-ft)



ACJF001A

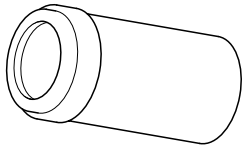
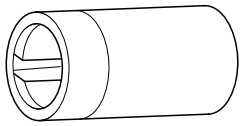
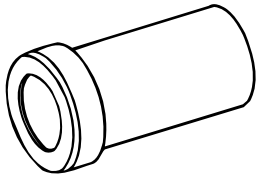
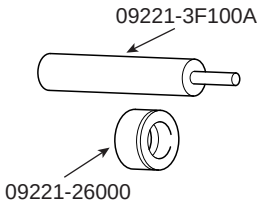
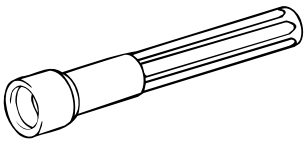
TROUBLESHOOTING ED5EEFF4

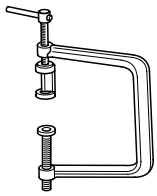
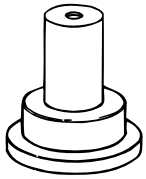
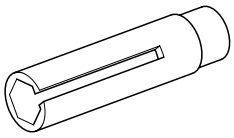
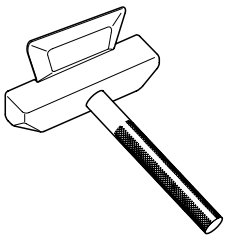
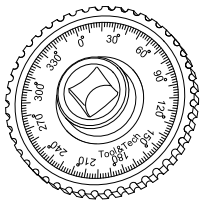
Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression . 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 valve lifers.
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.
	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.

Symptom	Suspect area	Remedy
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.

Symptom	Suspect area	Remedy
Engine will not crank. (crankshaft will not rotate)	Hydraulically locked cylinder. • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder.	Remove spark plugs and check for fluid. 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.

SPECIAL SERVICE TOOLS EDFD1F4A

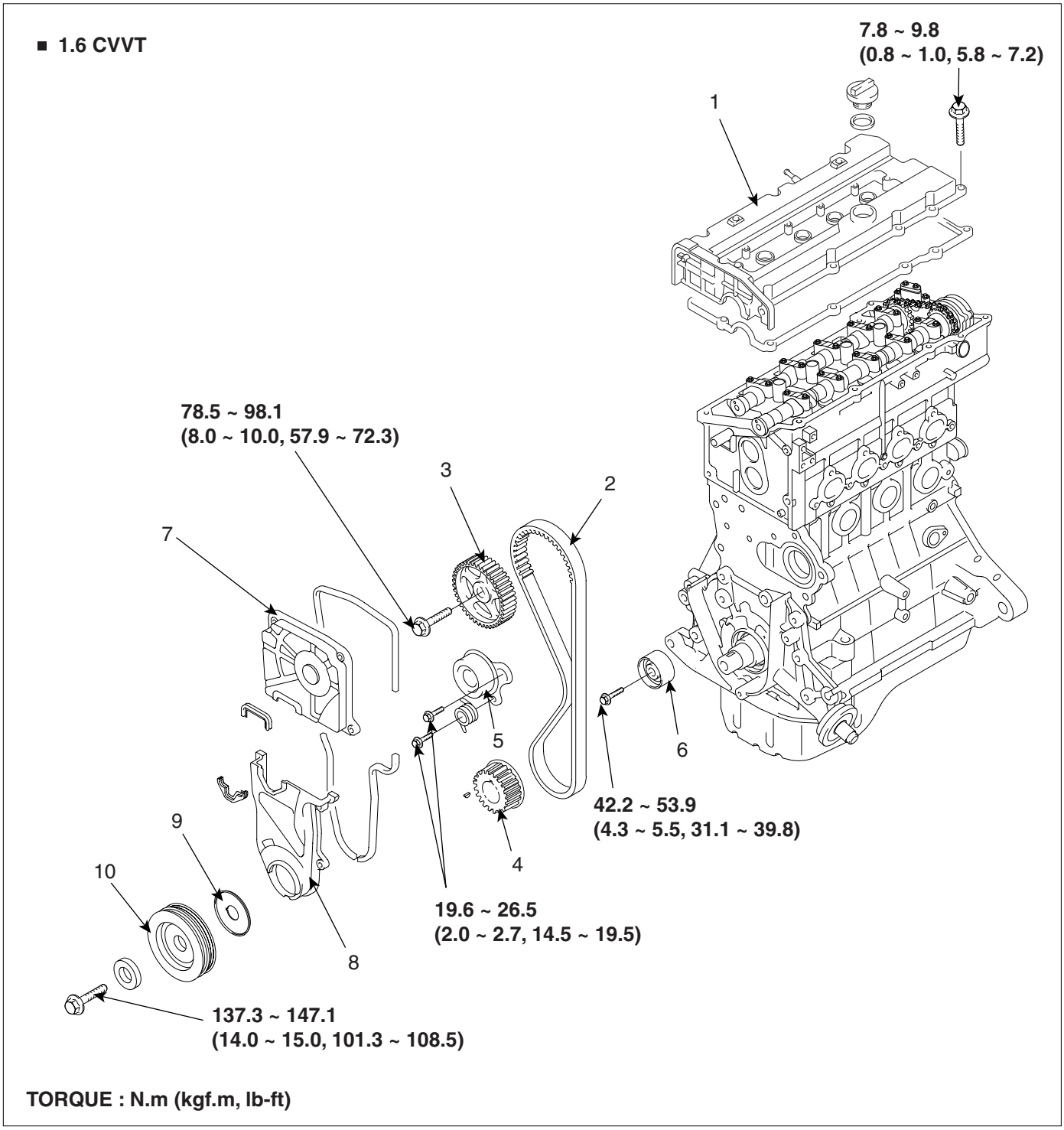
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-32000)	 EDKA010A	Installation of the front oil seal
Crankshaft front oil seal guide (09214-32100)	 EDKA010B	Installation of the front oil seal
Camshaft oil seal installer (09221-21000)	 EDDA005B	Installation of the camshaft oil seal
Valve guide remover (09209221-3F100 (A)) Valve guide installer (09221-26000)	 ADGE020B	Removal and installation of the valve guide
Valve stem oil seal installer (09222-22001)	 ECKA010A	Installation of the valve stem oil seal

Tool (Number and name)	Illustration	Use
Valve spring compressor (09222-28000) Valve spring compressor adaptor (09222-28100)	 EDDA005C	Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-21000)	 EDDA005F	Installation of the crankshaft rear oil seal
Water temperature sensor socket wrench (09221-25100)	 EDKD101B	Removal and installation of water temperature sensor
Oil pan remover (09215-3C000)	 ACJF125A	Removal of oil pan
Torque angle adapter (09221-4A000)	 LCAC030A	Installation of bolts & nuts needing an angular method

TIMING SYSTEM

TIMMING BELT

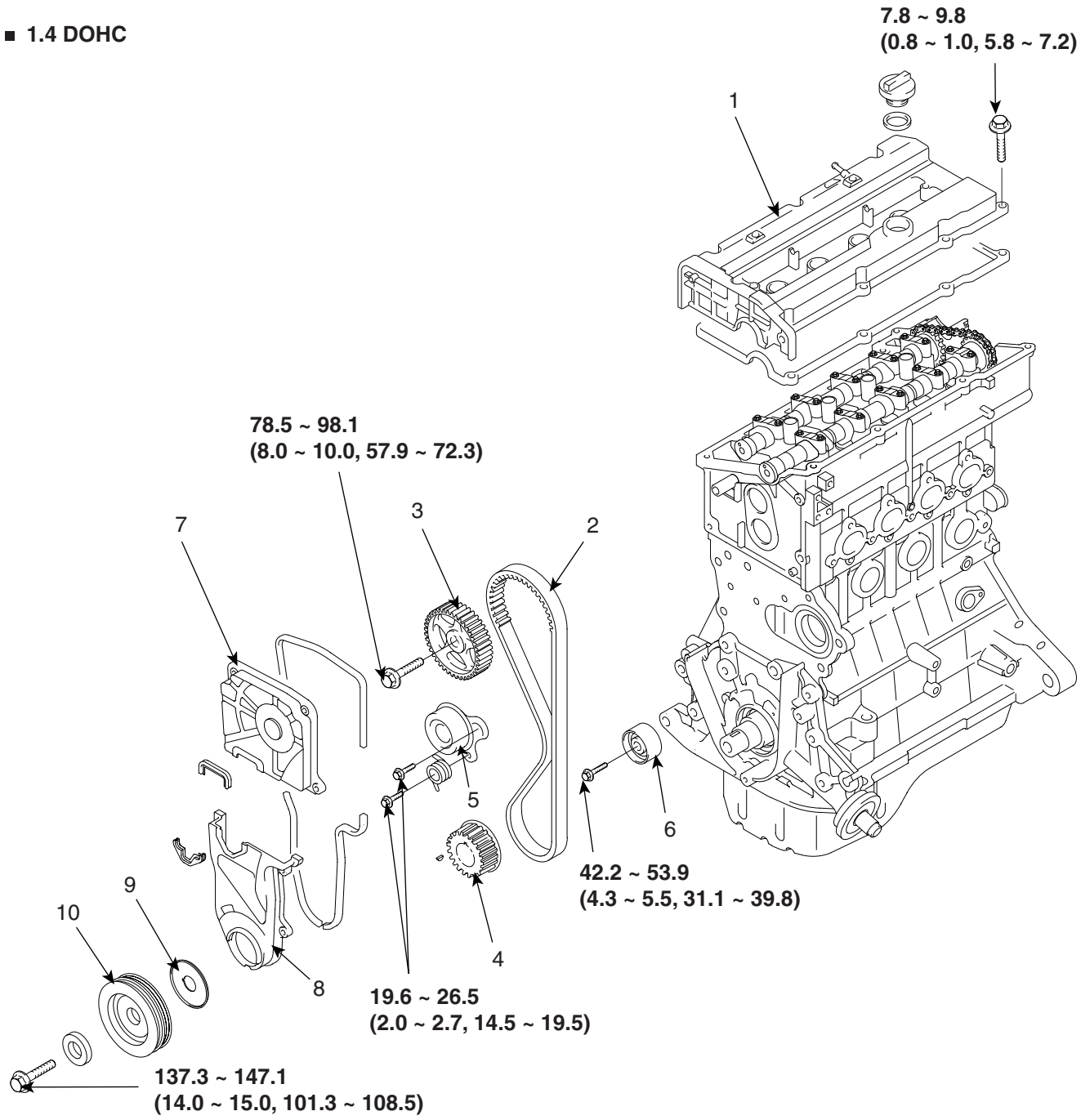
COMPONENT EFD40A4D



1. Cylinder head cover
2. Timing belt
3. Camshaft sprocket
4. Crankshaft sprocket
5. Tensioner
6. Idler
7. Timing belt upper cover
8. Timing belt lower cover
9. Flange
10. Crankshaft pulley

LCJF001A

■ 1.4 DOHC



TORQUE : N.m (kgf.m, lb-ft)

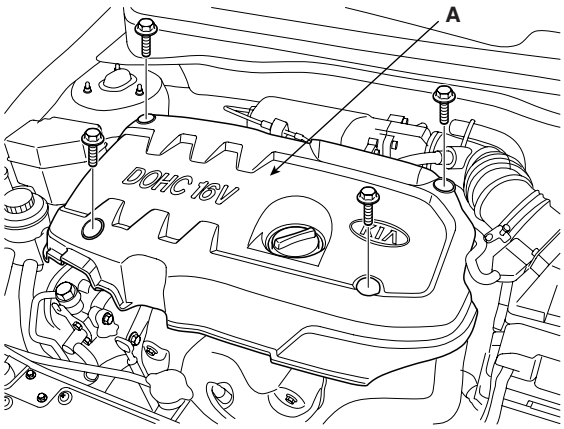
1. Cylinder head cover
2. Timing belt
3. Camshaft sprocket
4. Crankshaft sprocket
5. Tensioner
6. Idler
7. Timing belt upper cover
8. Timing belt lower cover
9. Flange
10. Crankshaft pulley

LCJF002A

REMOVAL EFB8E0EB

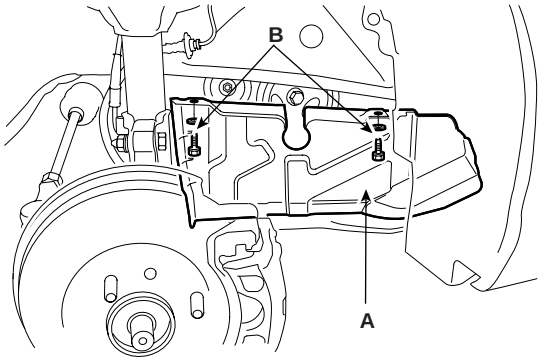
Engine removal is not required for this procedure.

1. Remove the engine cover(A).



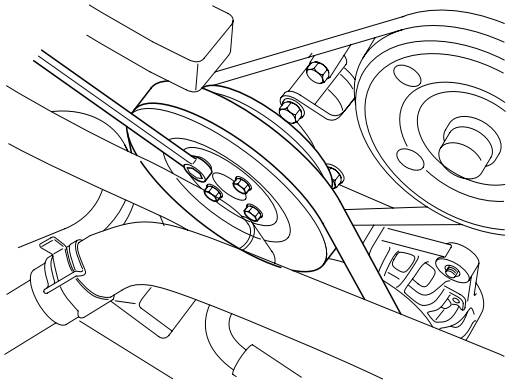
ACJF001A

2. Remove the RH front wheel.
3. Remove the 2 bolts(B) and RH side cover(A).



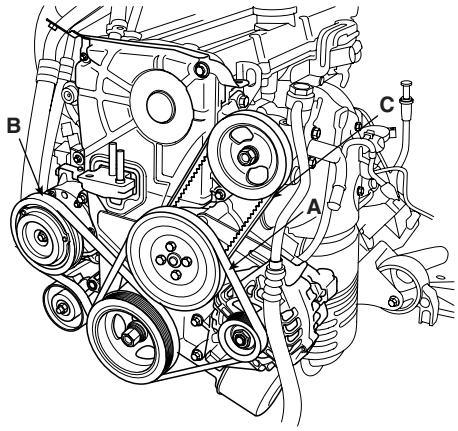
KXDSE16A

4. Temporarily loosen the water pump pulley bolts.



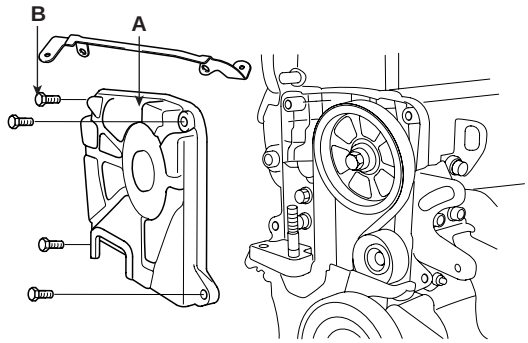
ECKD104B

5. Remove the alternator drive belt(A). (Refer to EE group - alternator)



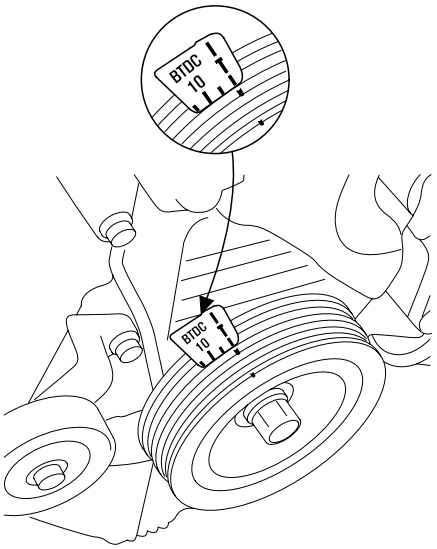
ACJF002A

6. Remove the air conditioner compressor drive belt(B). (Refer to HA group - air conditioner compressor)
7. Remove the power steering pump drive belt(C). (Refer to ST group - power steering pump)
8. Remove the 4 bolts and water pump pulley.
9. Remove the 4 bolts(B) and timing belt upper cover(A).

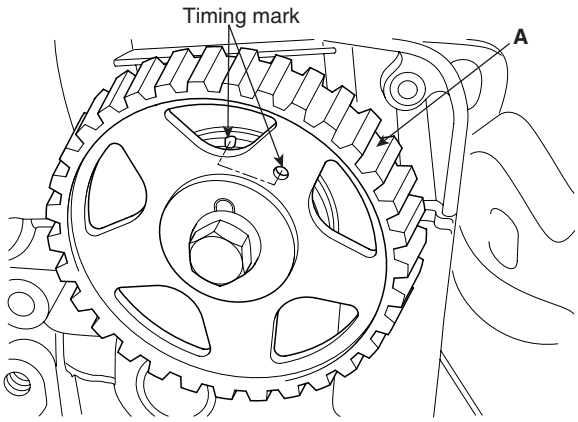


ADGE023A

10. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. Check that the timing mark of camshaft sprocket is aligned with the timing mark of cylinder head cover. (No.1 cylinder compression TDC position)

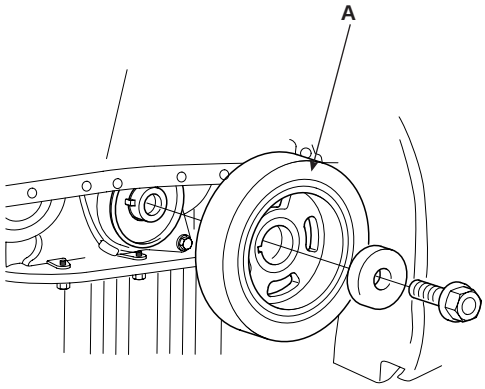


ECKD106A



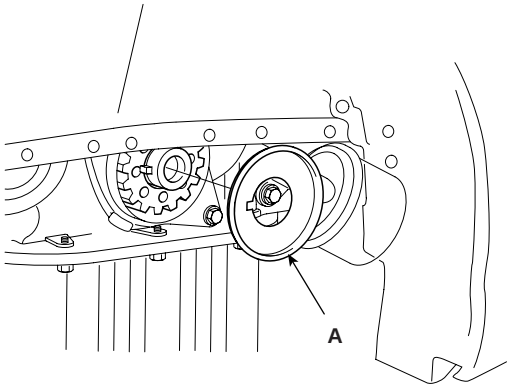
ECDD008F

11. Remove the crankshaft pulley bolt and crankshaft pulley(A).



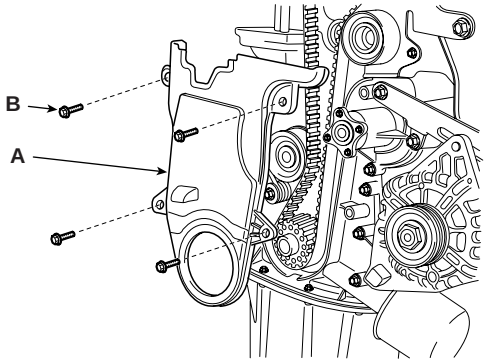
ADGE074A

12. Remove the crankshaft flange(A).



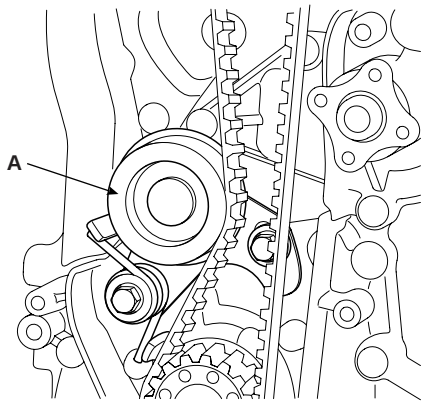
ECKD108A

13. Remove the 4 bolts(B) and timing belt lower cover(A).

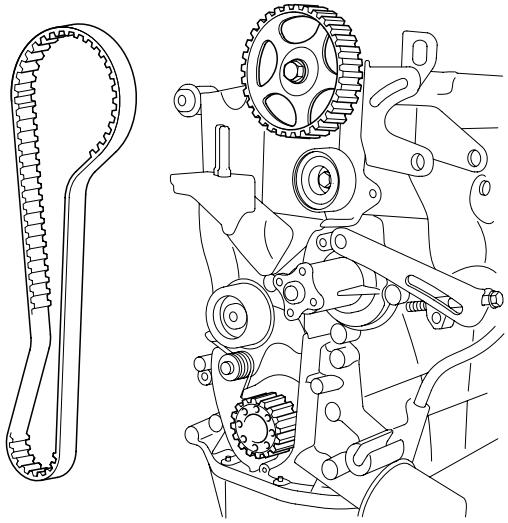


ADGE024A

14. Remove the timing belt tensioner(A) and timing belt.



EDKD102B

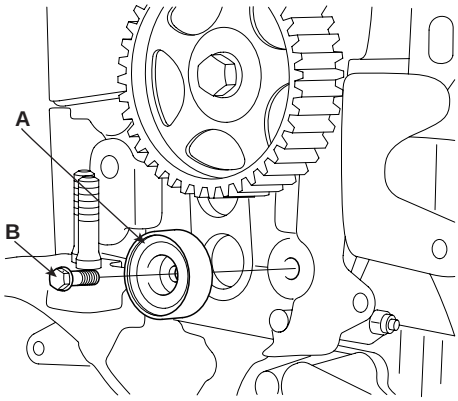


EDKD102A

NOTE

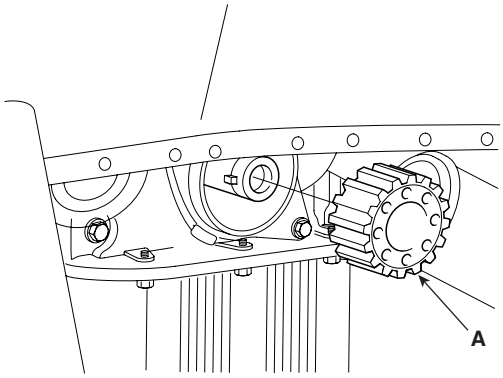
If the timing belt reused, make an arrow indicating the turning direction to make sure that the belt is reinstalled in the same direction as before.

15. Remove the bolt(B) and timing belt idler(A).



EDKD103A

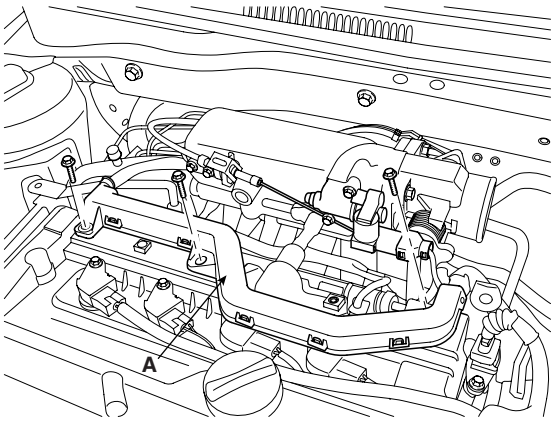
16. Remove the crankshaft sprocket(A).



ECKD110A

17. Remove the cylinder head cover.

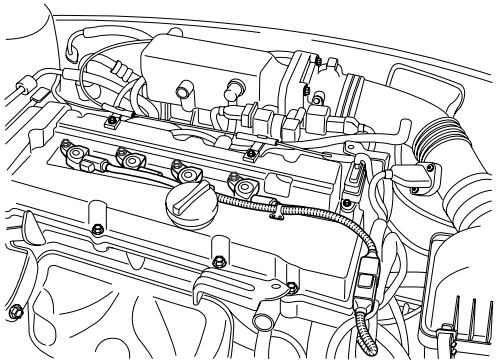
1) Remove the wire harness bracket(A).



ACJF120A

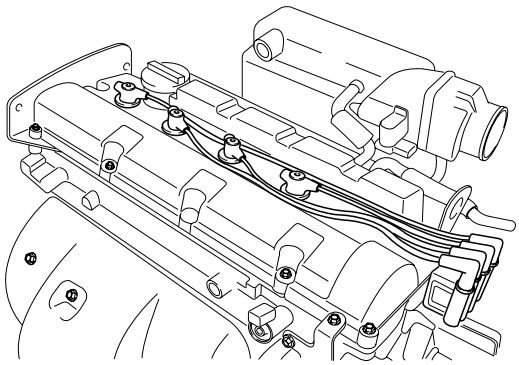
2) Remove the ignition coil.

■ **1.6 CVVT**



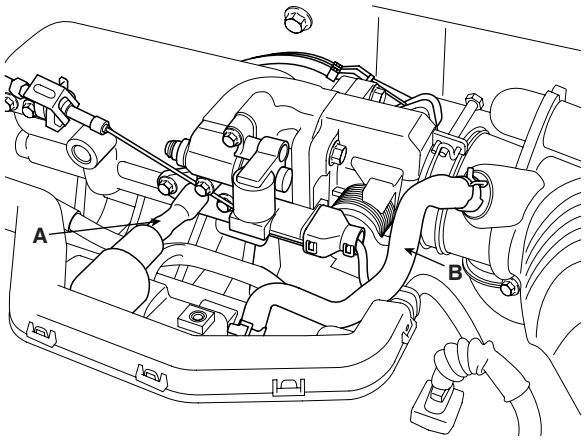
ACJF066A

■ **1.4 DOHC**



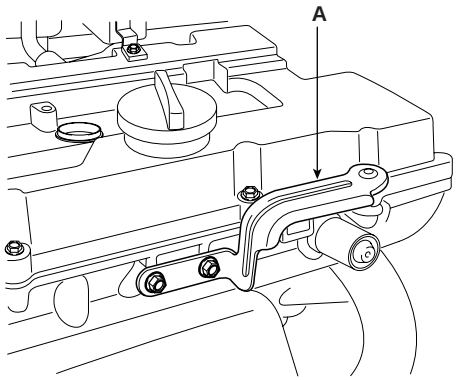
ACJF067A

3) Remove the PCV (Positive Crankcase Ventilation) hose(A) and the breather hose(B) from the cylinder head cover.



ACJF121A

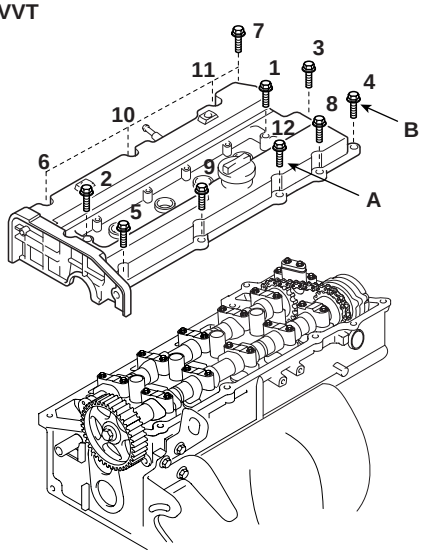
4) Remove the engine cover bracket(A). (1.6 CVVT)



ADGE031A

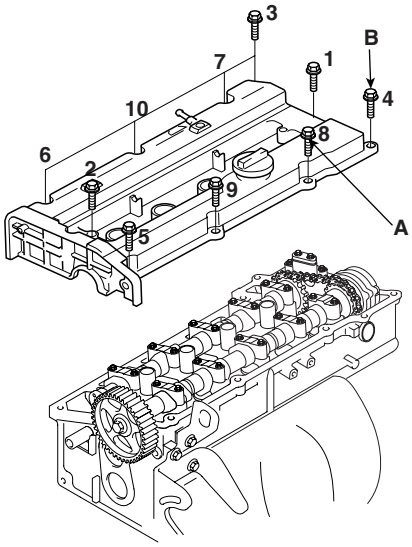
5) Loosen the cylinder head cover bolts(B) and then remove the cover(A) and gasket.

■ **1.6 CVVT**



ACJF068A

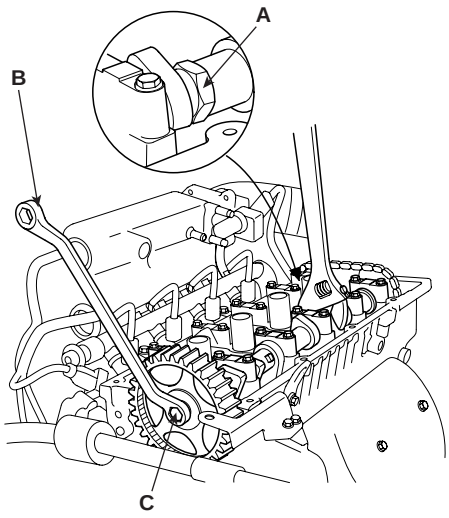
■ **1.4 DOHC**



ACJF069A

18. Remove the camshaft sprocket.

1) Hold the portion(A) of the camshaft with a hexagonal wrench, and remove the bolt(C) with a wrench(B) and remove the camshaft sprocket.



ADGE002A

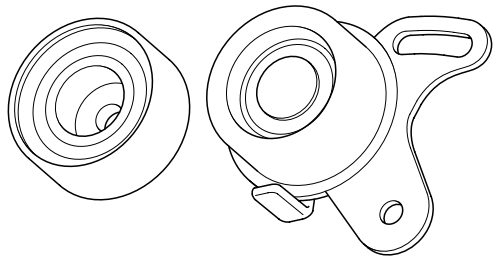
CAUTION

Be careful not to damage the cylinder head and valve lifter with the wrench.

INSPECTION EACEBBE7

SPROCKETS, TENSIONER, IDLER

1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth rotation and check for play or noise. Replace as necessary.



EDKD106A

3. Replace the pulley if there is a grease leak from its bearing.

TIMING BELT

1. Check the belt for oil or dust deposits.
   Replace, if necessary.
   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the carefully. If any of the following flaws are evident, replace the belt.

NOTE

- *Do not bend, twist or turn the timing belt inside out.*
- *Do not allow timing belt to come into contact with oil, water and steam.*

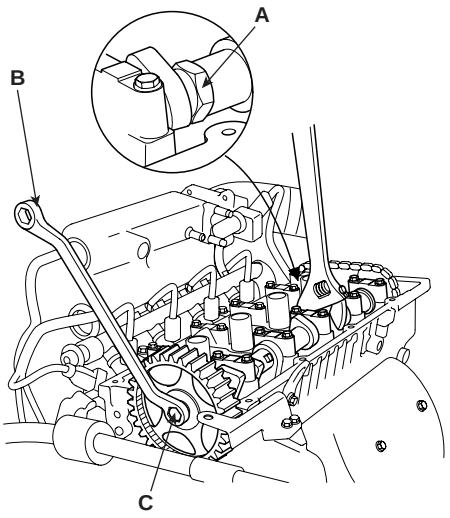
INSTALLATION E4BD34A8

1. Install the camshaft sprocket and tighten the bolt to the specified torque.

   1) Temporarily install the camshaft sprocket bolt(C).

   2) Hold the portion(A) of the camshaft with a hexagonal wrench, and tighten the bolt(C) with a wrench(B) .

Tightening torque :
78.5 ~ 98.1N.m (8.0 ~ 10.0kgf.m, 57.9 ~ 72.3lb-ft)



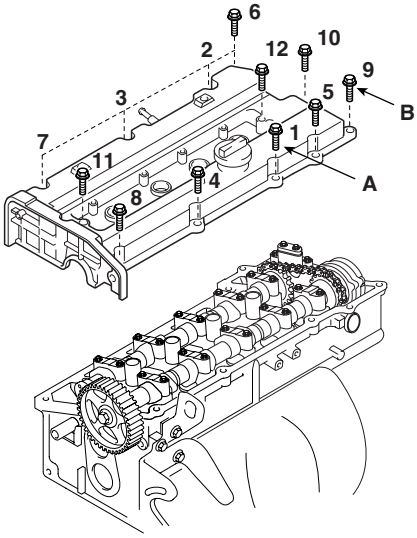
ADGE002A

2. Install the cylinder head cover.

   1) Install the cylinder head cover(A) and bolts(B).

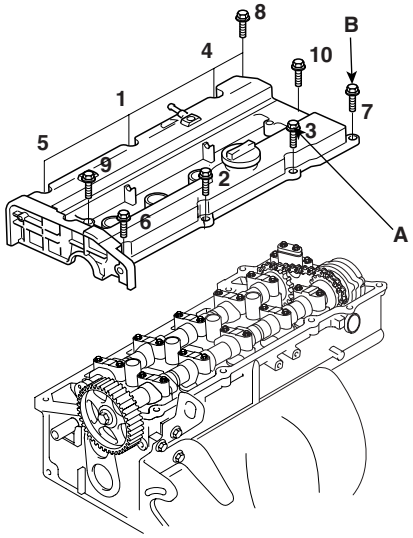
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

■ **1.6 CVVT**



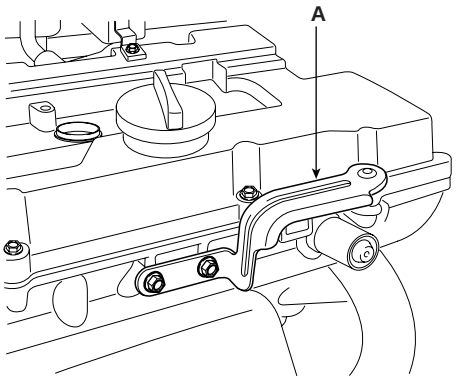
ACJF070A

■ **1.4 DOHC**



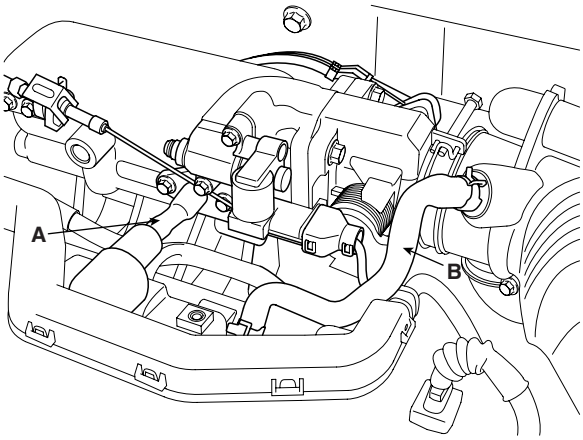
ACJF071A

2) Install the engine cover bracket(A). (1.6CVVT)



ADGE031A

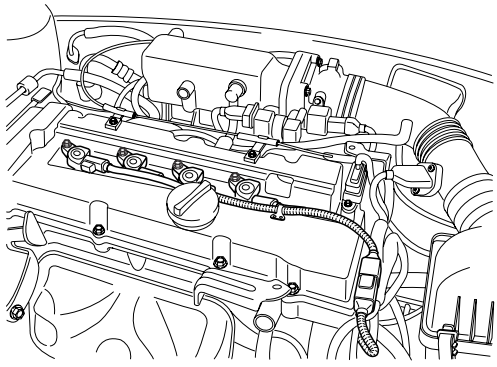
3) Install the PCV(Positive Crankcase Ventilation) hose(A) and breather hose(B) to the cylinder head cover.



ACJF121A

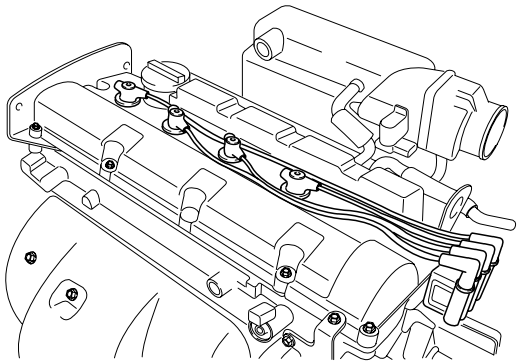
4) Install the ignition coil.

■ **1.6 CVVT**



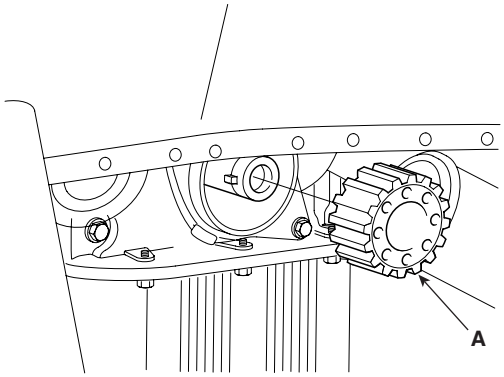
ACJF072A

■ **1.4 DOHC**



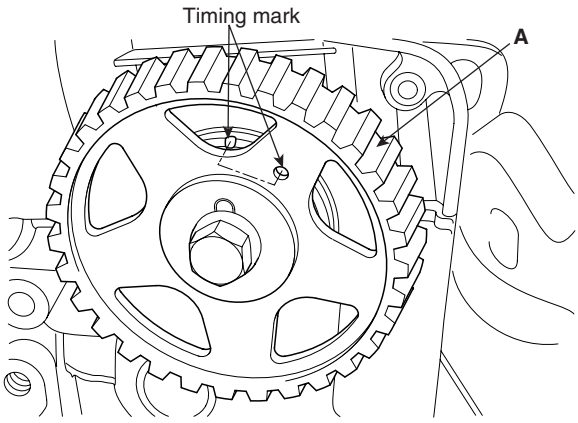
ACJF073A

3. Install the crankshaft sprocket(A).

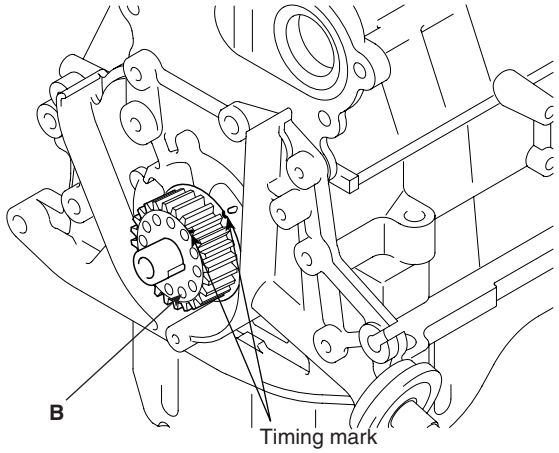


ECKD110A

4. Align the timing marks of the camshaft sprocket(A) and crankshaft sprocket(B) with the No.1 piston placed at top dead center and its compression stroke.



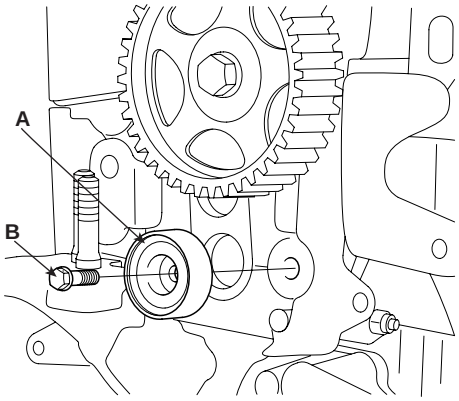
ECDD008F



EDKD107A

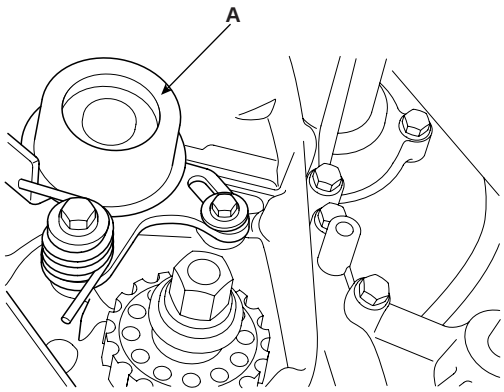
5. Install the idler pulley(A) and tighten the bolt(B) to the specified torque.

Tightening torque :
42.2 ~ 53.9N.m (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lb-ft)



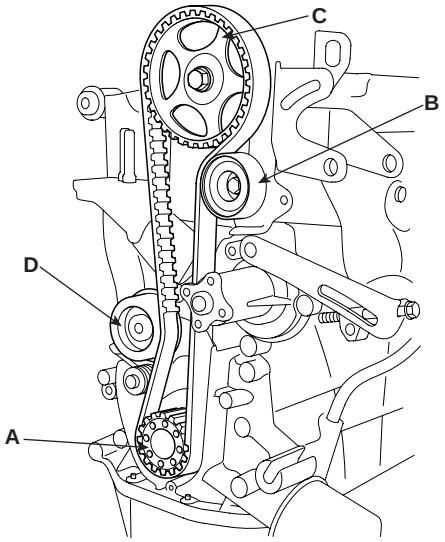
EDKD103A

6. Temporarily install the timing belt tensioner(A).



KDPC008E

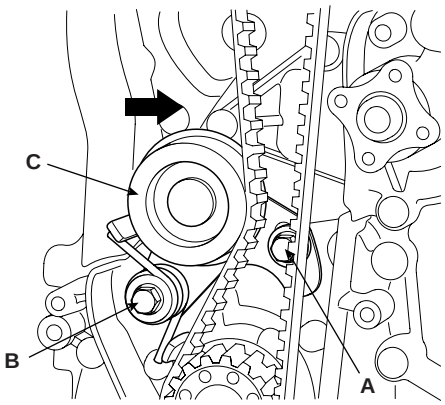
7. Install the belt so as not give slack at each center of shaft. Use the following order when installing timing belt.
Crankshaft sprocket(A) →idler pulley(B) →camshaft sprocket(C) →timing belt tensioner(D).



EDKD109A

8. Adjust the timing belt tension.

   1) Give tension to timing belt using the tensioner's elasticity after loosening the mounting bolt (A,B).

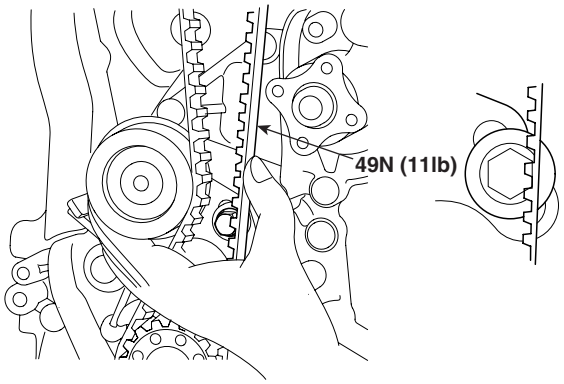


ADGE026A

   2) After checking the alignment between each sprocket and each timing belt tooth, tighten the mounting bolt (A) and (B) one by one.

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

   3) Then recheck the belt tension.
   Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11lb)], the timing belt cog end is aprox. 1/2 of the tensioner mounting bolt head radius (across flats) away from the bolt head center.



EDKD108A

   4) Timing belt tension measuring procedure
   (by a sonic tension guage)
   Rotate crankshaft in clockwise direction to set 1st piston on top dead center (TDC) and rotate crankshaft in counterclockwise to 90° then measure the belt tension in the middle of tension side span (in arrow direction of above illustration) by free vibration method.

CAUTION

When rotating the crankshaft counter-clockwise, be sure to rotate the crankshaft at a time.

Conversion equation of frequency into tension :
$T = (4 / 9.8) \times S^2 \times M \times W \times f^2 / 100000000$

S : Measured belt span (mm)
M : Unit weight of belt (gf/cm²)
W : Belt width (mm)
f : Transverse natural frequency of belt (Hz)

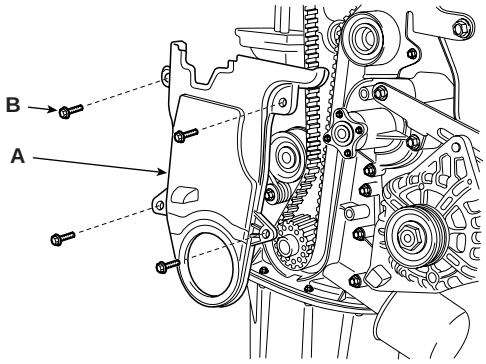
TIMING BELT SPECIFICATIONS

Item	Specifications
S (mm)	249.6
M (gf/cm²)	0.4543
W (mm)	22
f (Hz)	70.4 ~ 87.9
T (kgf)	16 ± 3.5

9. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.

10. Install the timing belt lower cover(A) with 5bolts(B).

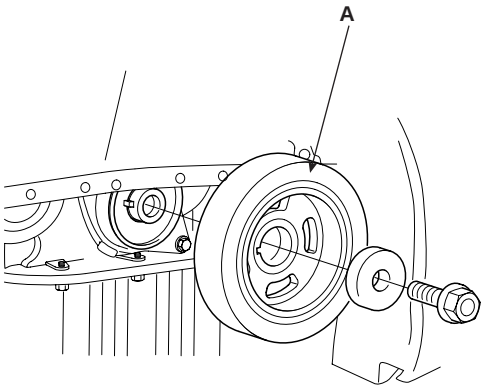
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



ADGE024A

11. Install the flange and crankshaft pulley(A), and then tighten crankshaft pulley bolt.
    Make sure that crankshaft sprocket pin fits the small hole in the pulley.

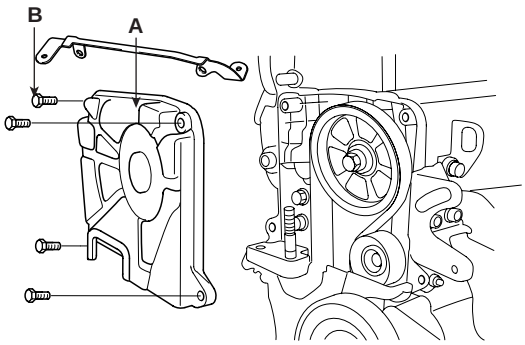
Tightening torque :
137.3 ~ 147.1N.m (14.0 ~ 15.0kgf.m, 101.3 ~ 108.5lb-ft)



ADGE074A

12. Install the timing belt upper cover(A) with 4 bolts(B).

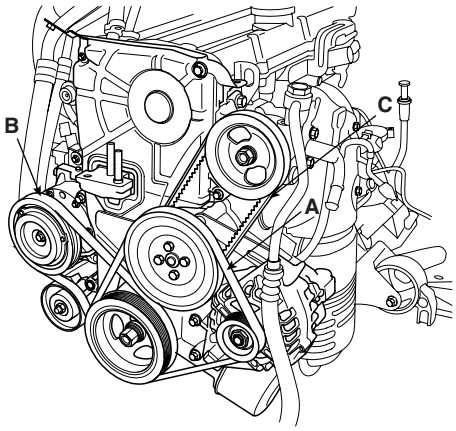
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



ADGE023A

13. Install the water pump pulley and 4 bolts.

14. Install the power steering pump drive belt(C). (Refer to ST group - power steering pump)

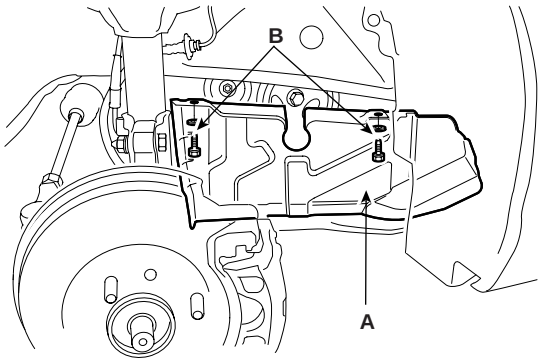


ACJF002A

15. Install the air conditioner compressor drive belt(B). (Refer to HA group - air conditioner compressor)

16. Install the alternator drive belt(A). (Refer to EE group - alternator)

17. Install the RH side cover(A) with 2 bolts(B).



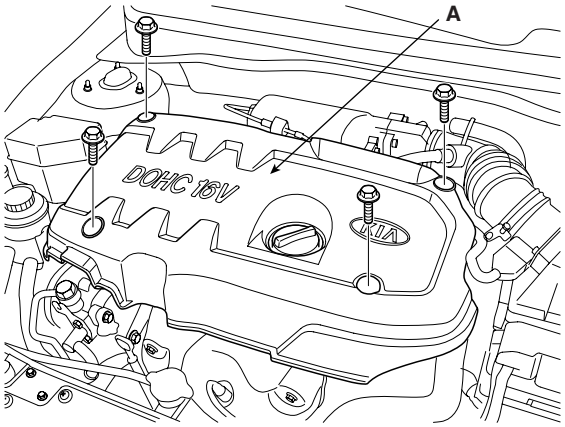
KXDSE16A

18. Install the RH front wheel.

Tightening torque :
88.3 ~ 98.1N.m (9.0 ~ 10.0kgf.m, 65.1 ~ 72.3lb-ft)

19. Install the engine cover with bolts.

Tightening torque :
3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lb-ft)

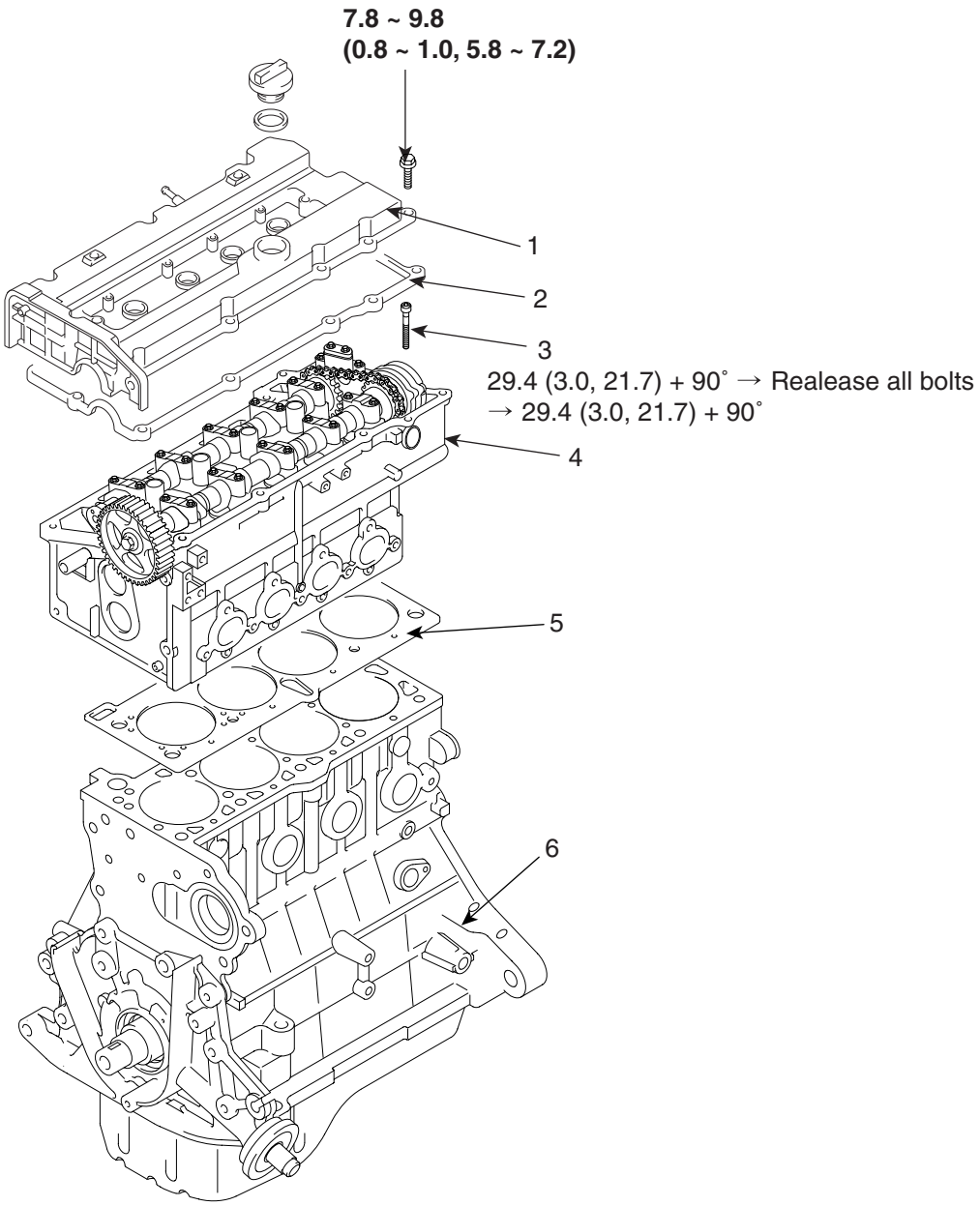


ACJF001A

CYLINDER HEAD ASSEMBLY

COMPONENT EDCA8C53

■ **1.6 CVVT**

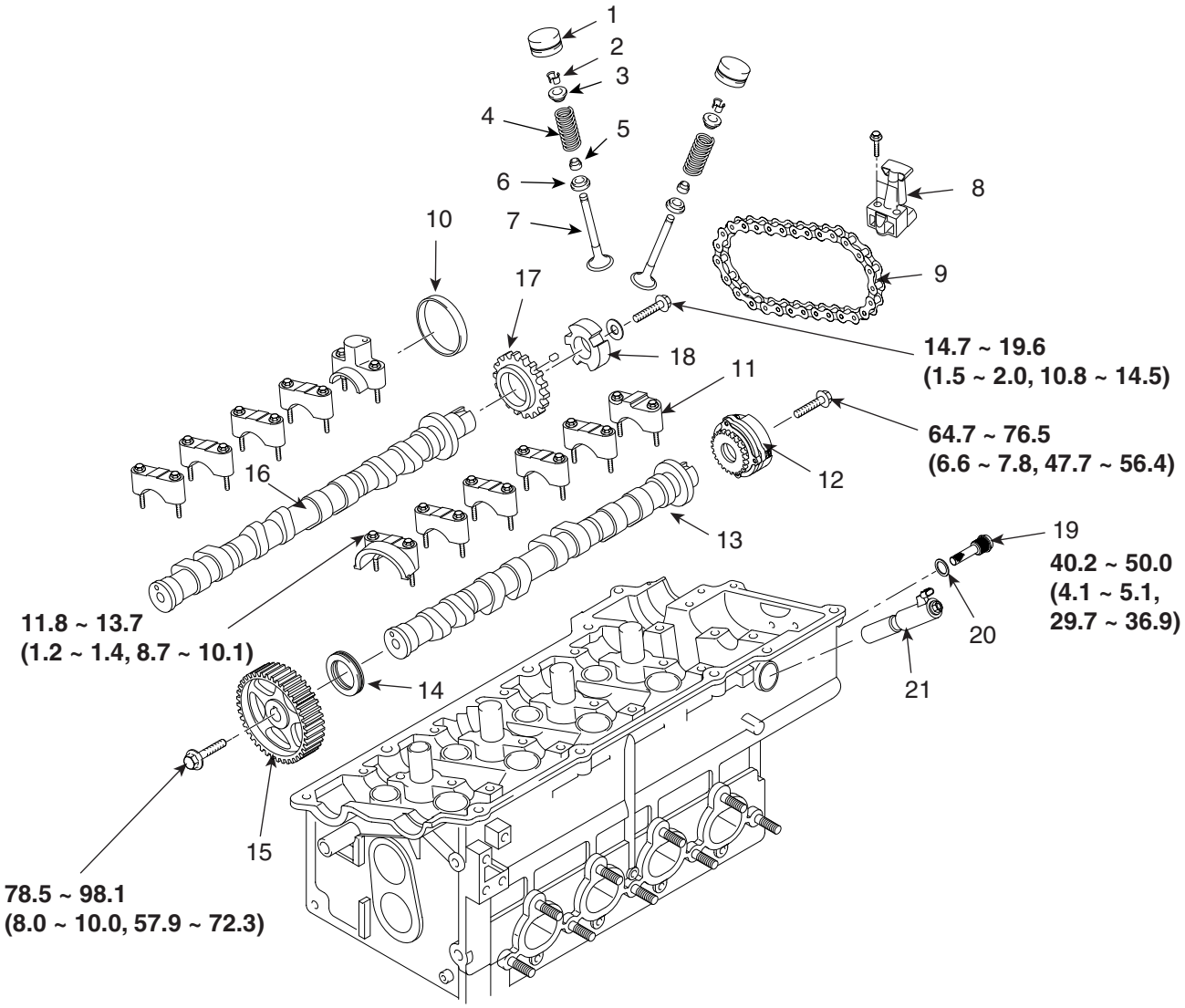


TORQUE : N.m (kgf.m, lb-ft)

1. Cylinder head cover
2. Gasket
3. Cylinder head bolt
4. Cylinder head
5. Cylinder head gasket
6. Cylinder block

LCJF003A

■ **1.6 CVVT**

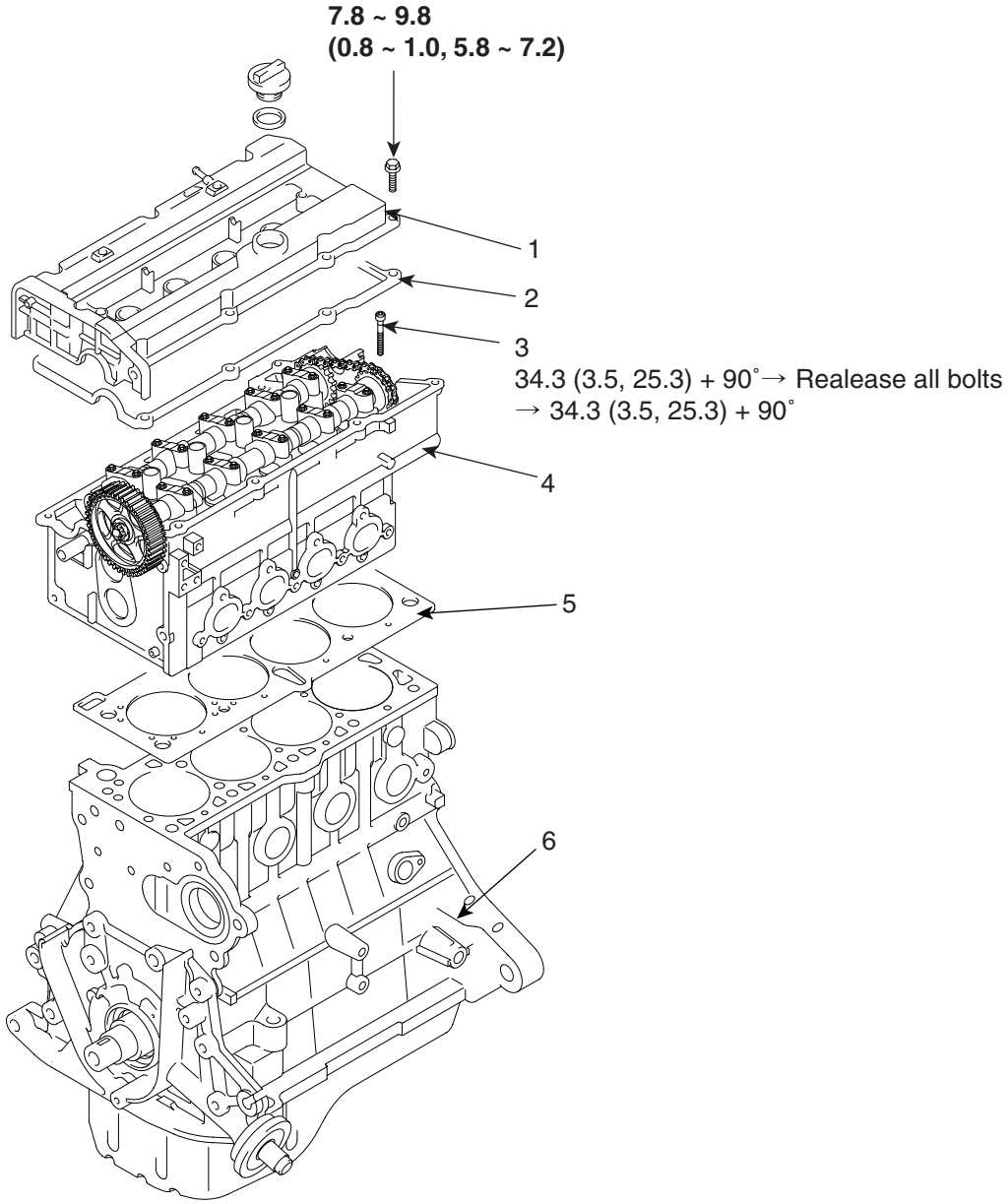


TORQUE : N.m (kgf.m, lb-ft)

1. HLA (Hydraulic Lash Adjuster)
2. Retainer lock
3. Retainer
4. Valve spring
5. Stem seal
6. Spring seat
7. Valve
8. Auto tensioner
9. Timing chain
10. Oil seal cap
11. Camshaft bearing cap
12. CVVT (Continuously Variable Valve Timing) assembly
13. Exhaust camshaft
14. Oil seal
15. Camshaft sprocket
16. Intake camshaft
17. Chain sprocket
18. Camshaft position sensor target wheel
19. OCV (Oil Control Valve) Filter
20. Washer
21. OCV (Oil Control Valve)

LCJF004A

■ **1.4 DOHC**

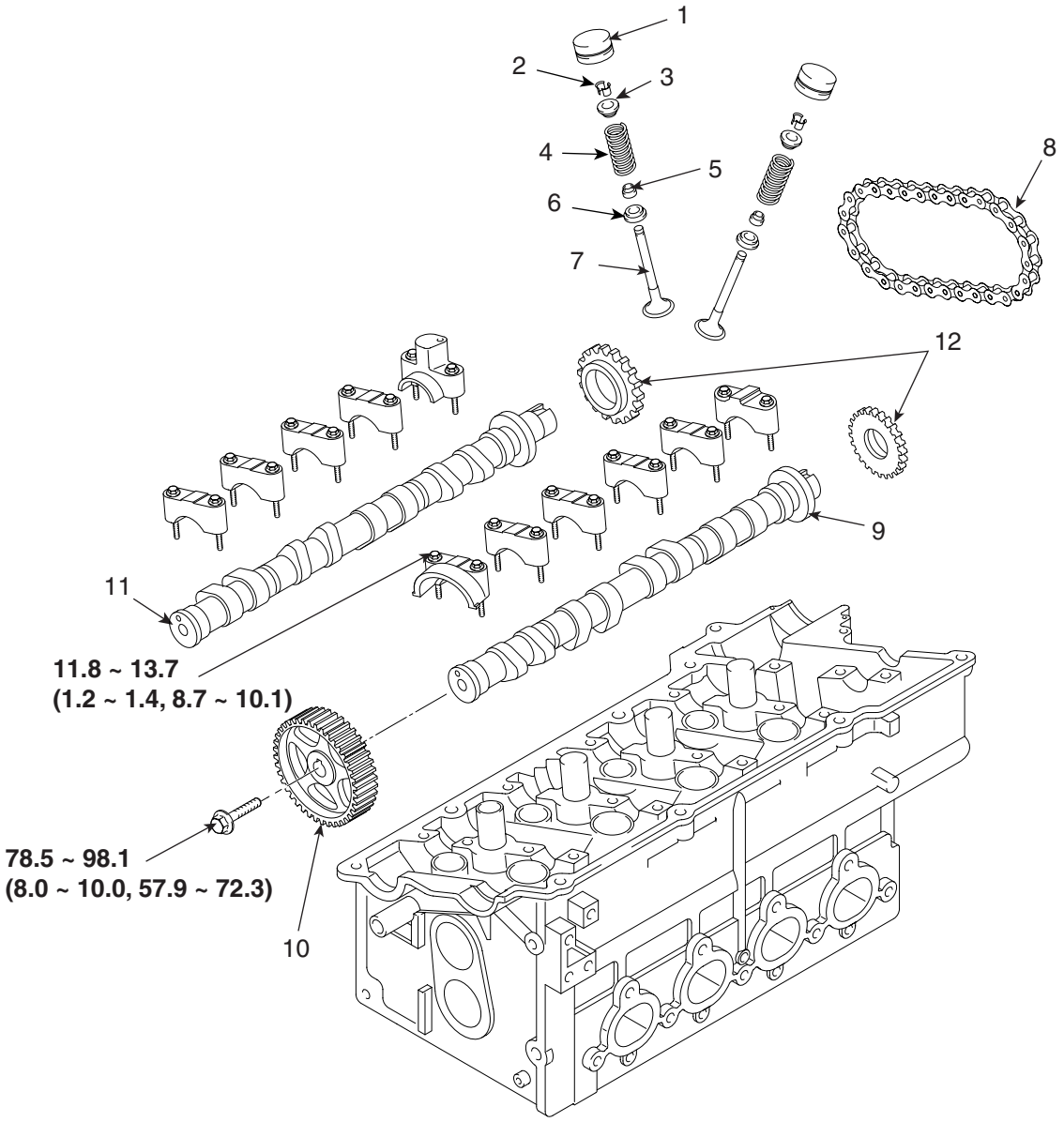


TORQUE : N.m (kgf.m, lb-ft)

1. Cylinder head cover
2. Gasket
3. Cylinder head bolt
4. Cylinder head
5. Cylinder head gasket
6. Cylinder block

LCJF005A

■ **1.4 DOHC**



TORQUE : N.m (kgf.m, lb-ft)

1. HLA (Hydraulic Lash Adjuster)
2. Retainer lock
3. Retainer
4. Valve spring
5. Stem seal
6. Spring seat
7. Valve
8. Timing chain
9. Exhaust camshaft
10. Camshaft sprocket
11. Intake camshaft
12. Chain sprocket

LCJF006A

REMOVAL ECC10CE5

Engine removal is not required for this procedure.

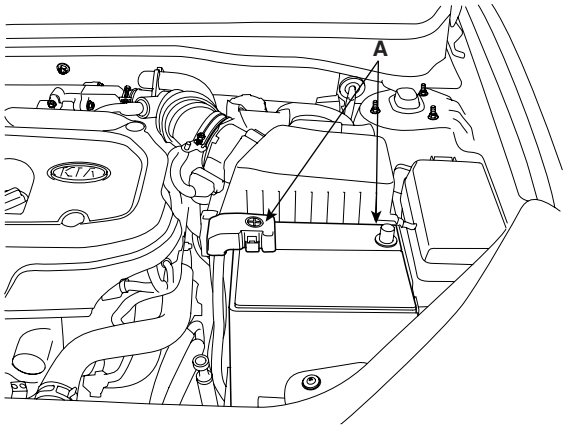
CAUTION

- ***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

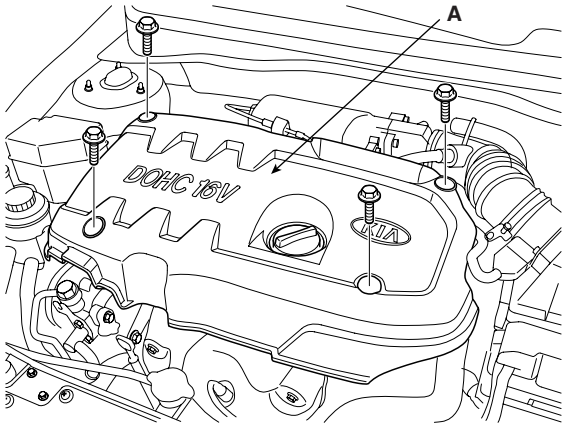
- *Mark all wiring and hoses to avoid misconnection.*
- *Inspect the timing belt before removing the cylinder head.*
- *Turn the crankshaft pulley so that the No. 1 piston is at top dead center. (Refer to EM - 23)*

1. Disconnect the terminals(A) from battery and remove the battery.



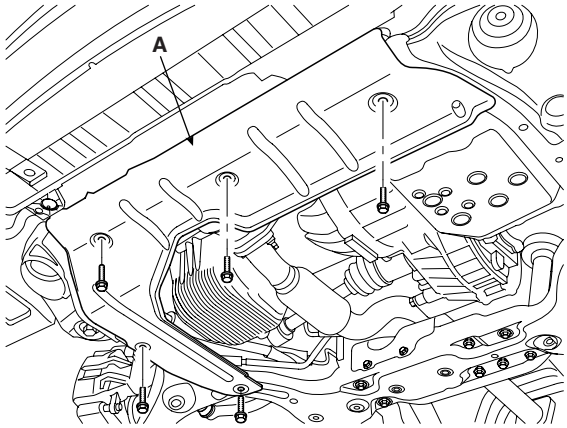
AJJF526A

2. Remove the engine cover(A).



ACJF001A

3. Remove the under cover(A).



ACJF006A

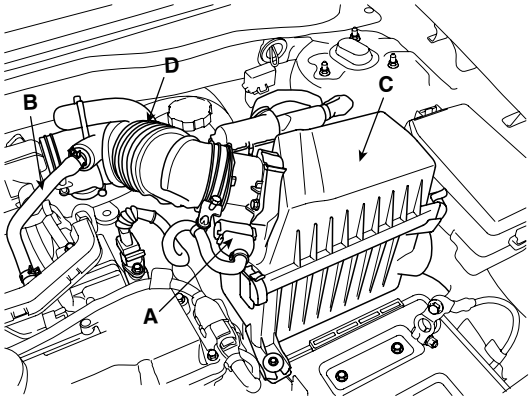
4. Drain the engine coolant. (Refer to EM - 94) Remove the radiator cap to speed draining.

5. Remove the intake air hose and air cleaner assembly.

   1) Disconnect the AFS(Air Flow Sensor) connector(A).
   (1.6CVVT)

   2) Disconnect the breather hose(B) from intake air hose(D).

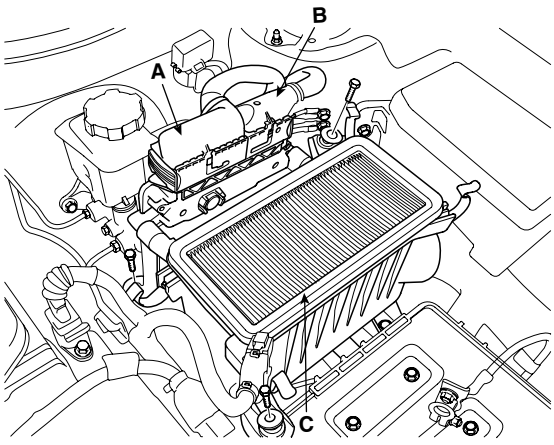
   3) Remove the intake air hose(D) and air cleaner upper cover(C).



ACJF007A

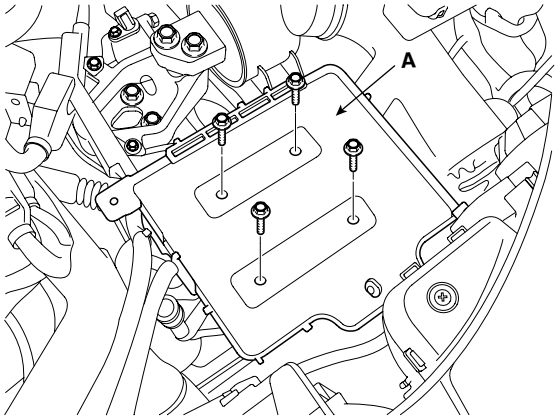
   4) Disconnect the ECM connector(A) and ECM connector(B) (A/T only).

   5) Remove the air cleaner element and air cleaner lower cover(C).



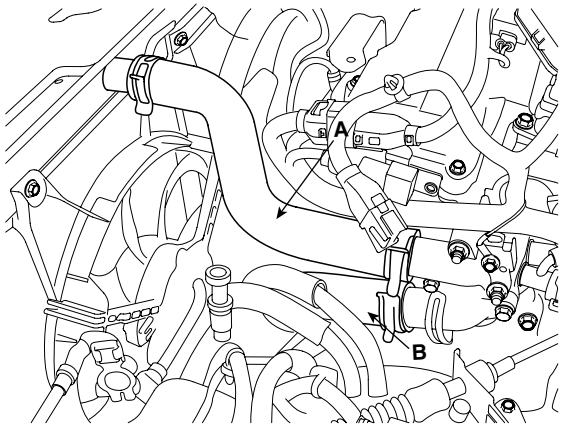
ACJF008A

6. Remove the battery tray(A).



ACJF009A

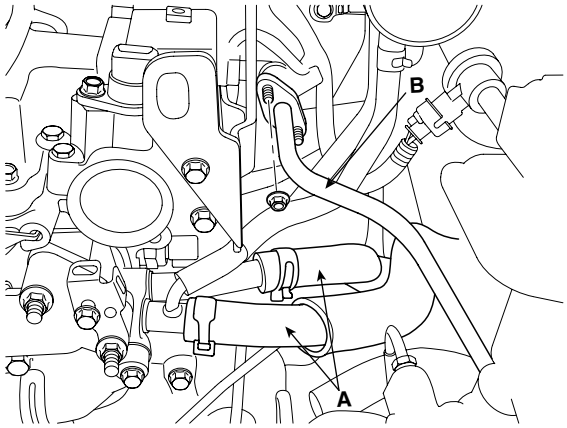
7. Remove the upper radiator hose(A) and lower radiator hose(B).



ACJF126A

8. Remove the heater hoses(A).

9. Remove the fuel hose(B).

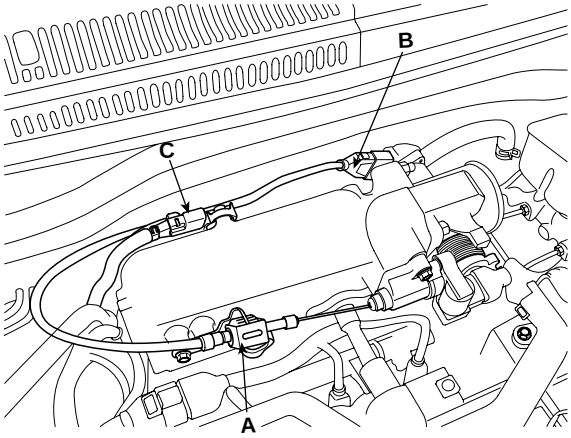


ACJF011A

10. Remove the accelerator cable(A) by loosening the lock-nut, then slip the cable end out of the throttle linkage.

11. Disconnect the TPS (Throttle Position Sensor) connector(B).

12. Disconnect the MAP sensor connector(C). (1.4 DOHC)



ACJF012A

13. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.

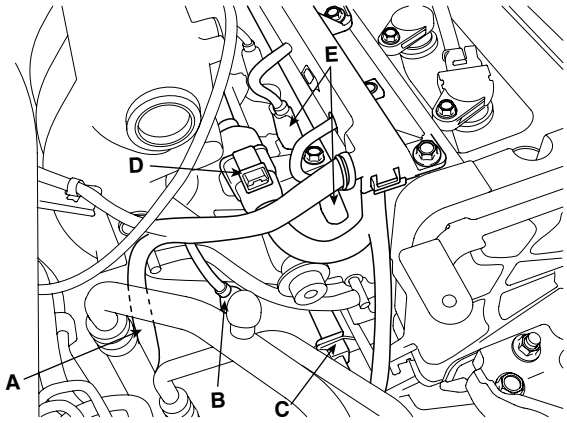
    1) Disconnect the rear oxygen sensor connector (A).

    2) Disconnect the air conditioner compressor switch connector (B).

    3) Disconnect the knock sensor connector (C).

    4) Disconnect the injector connectors(No.3,4) (D).

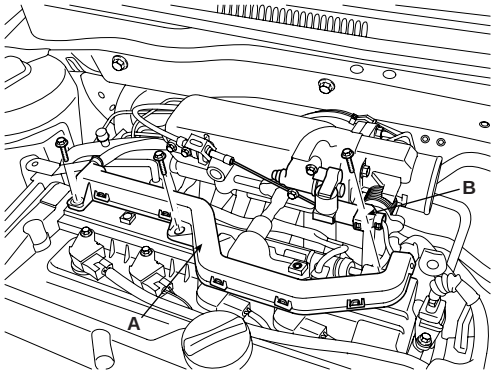
    5) Disconnect the injector connectors(No.1,2) (E)



ACJF013A

6) Remove the wire harness bracket(A).

7) Disconnect the ISA (Idle Speed Actuator) connector (B).

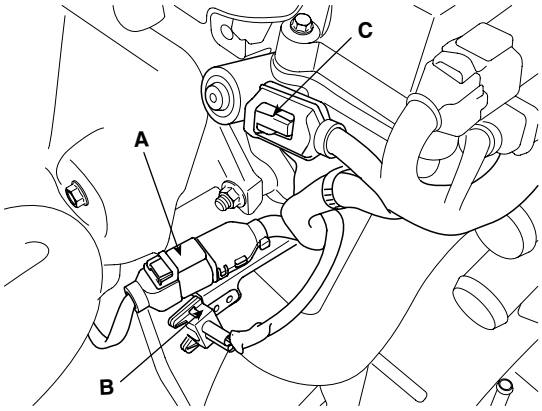


ACJF003A

8) Disconnect the front oxygen sensor connector(A).

9) Disconnect the CKP(Crankshaft Position Sensor) connector (B).

10) Disconnect the OCV(Oil Control Valve) connector (C). (1.6 CVVT)



ACJF014A

11) Disconnect the ignition coil connector(A).

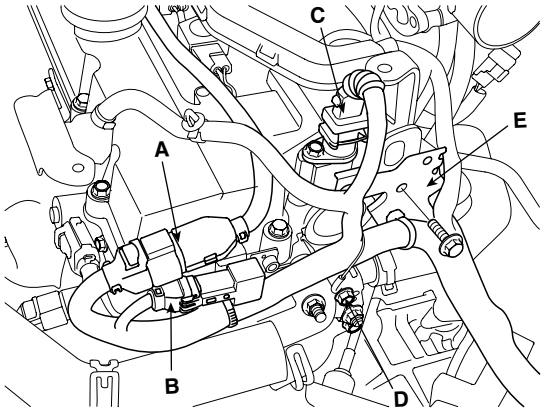
12) Disconnect the ignition coil condenser connector(B).

13) Disconnect the CMP(Camshaft Position Sensor) connector(C).

14) Disconnect the ground cable(D).

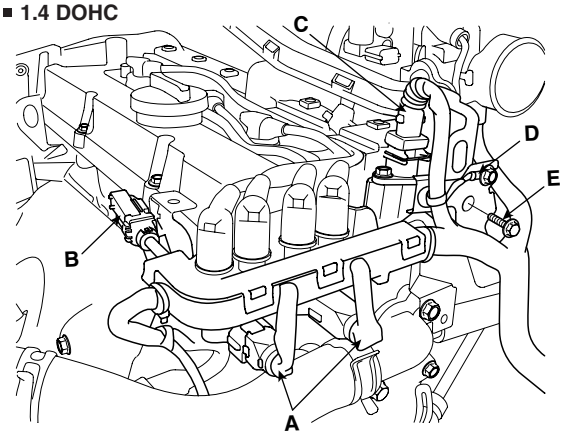
15) Remove the wire harness bracket(E).

■ 1.6 CVVT



ACJF015A

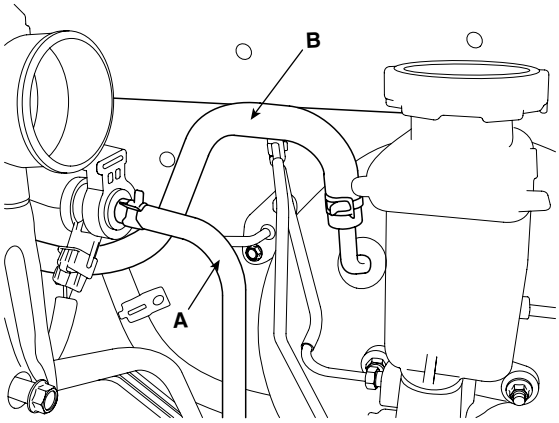
■ 1.4 DOHC



ACJF016A

14. Disconnect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.

15. Remove the brake booster vacuum hose(B).



ACJF018A

16. Remove the power steering pump and fix the pump to vehicle with a wire. (Refer to ST group - power steering pump)

17. Remove the ignition coil. (Refer to EE group - ignition system)

18. Remove the exhaust manifold. (Refer to EM - 120)

19. Remove the intake manifold. (Refer to EM - 117)

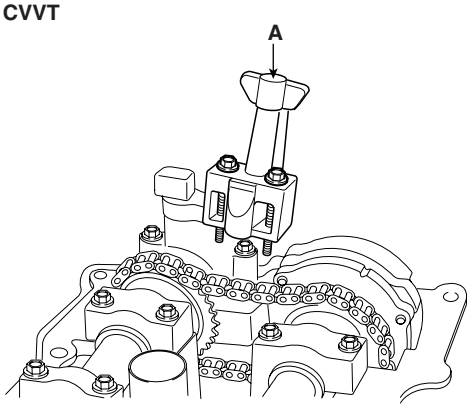
20. Remove the timing belt. (Refer to EM - 22)

21. Remove the cylinder head cover. (Refer to EM - 26)

22. Remove the camshaft sprocket. (Refer to EM - 26)

23. Remove the timing chain auto tensioner(A). (1.6 CVVT)

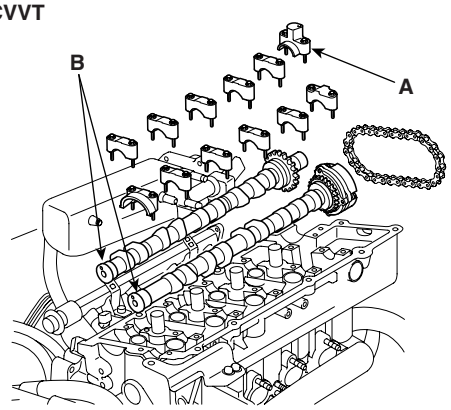
■ 1.6 CVVT



ACJF102A

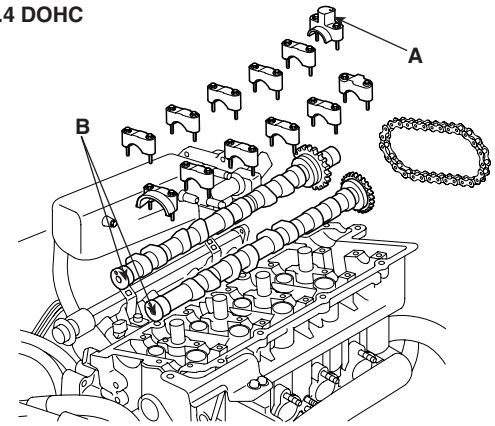
24. Remove the camshaft bearing caps(A) and camshafts (B).

■ **1.6 CVVT**



ACJF103A

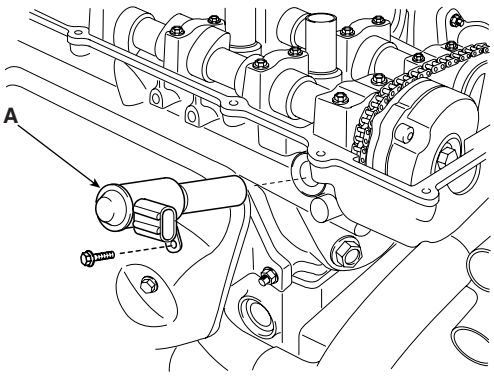
■ **1.4 DOHC**



ACJF104A

25. Remove the OCV(Oil Control Valve)(A). (1.6 CVVT)

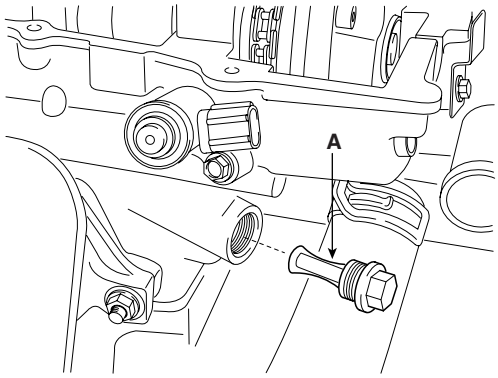
■ **1.6 CVVT**



ACJF105A

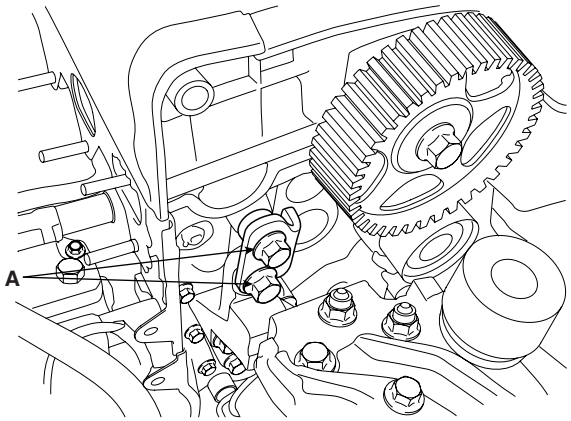
26. Remove the OCV(Oil Control Valve) filter(A). (1.6 CVVT)

■ **1.6 CVVT**



ACJF106A

27. Remove the engine mounting support bracket fixing bolts(A).

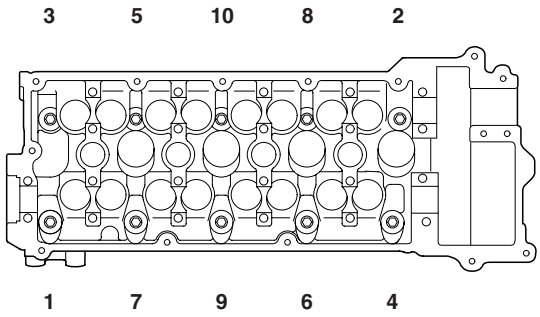


ACJF019A

28. Remove the cylinder head bolts, then remove the cylinder head.

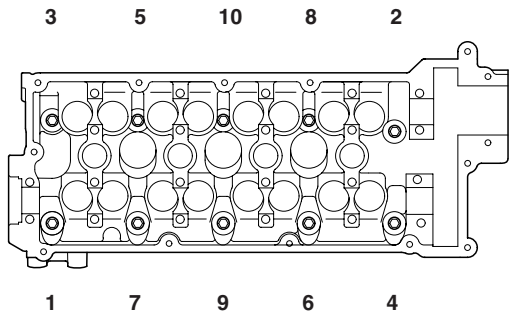
    1) Using 8mm hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.

■ **1.6 CVVT**



ACJF107A

■ **1.4 DOHC**



ACJF108A

CAUTION

Head warpage or cracking could result from removing bolts in an incorrect order.

    2) Lift the cylinder head from the dowels on the cylinder block and replace the cylinder head on wooden blocks on a bench.

CAUTION

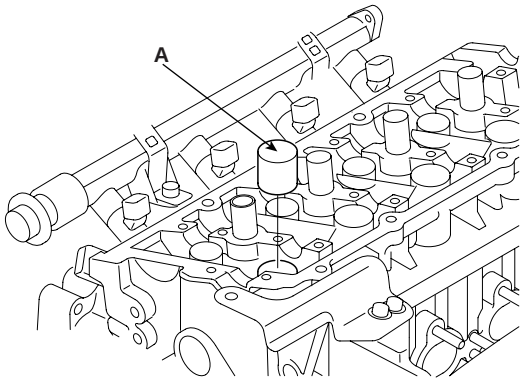
Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

DISASSEMBLY E6B1CB34

NOTE

Identify HLA(Hydraulic Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove the HLAs(A).

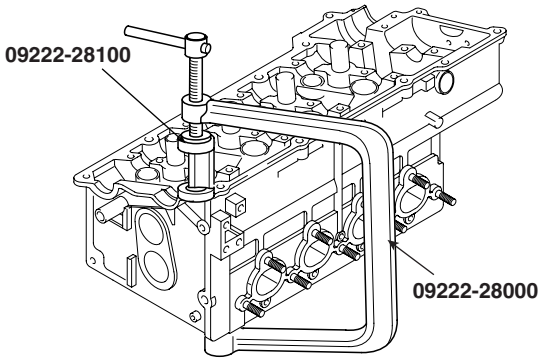


ECKD217A

2. Remove the valves.

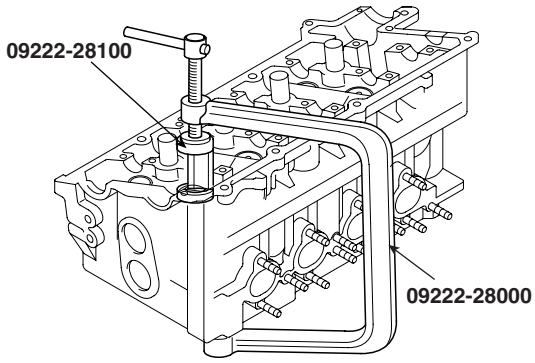
    1) Using the SST (09222 - 28000, 09222 - 28100), compress the valve spring and remove the retainer lock.

■ **1.6 CVVT**



ACJF078A

■ 1.4 DOHC



ACJF116A

2) Remove the spring retainer.

3) Remove the valve spring.

4) Remove the valve.

5) Using a needle-nose pliers, remove the oil seal.

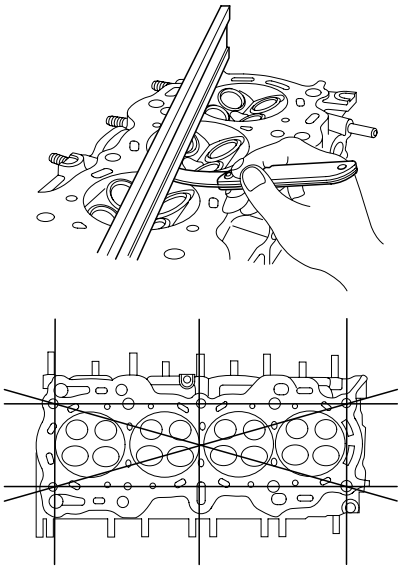
6) Using a magnetic finger, remove the spring seat.

INSPECTION E344D99E

CYLINDER HEAD

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 0.03mm (0.0012in)
Limit : 0.05mm (0.0020in)
Flatness of manifold mating surface
Standard : Less than 0.15mm (0.0059in)
Limit : 0.20mm (0.0079in)



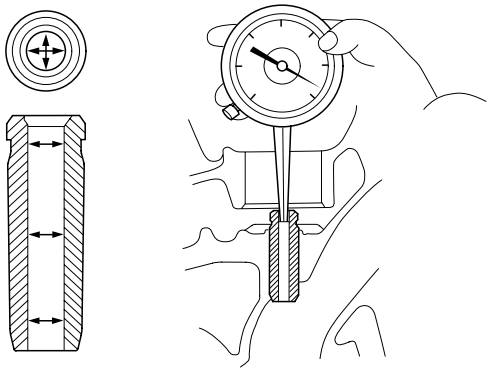
ECKD001H

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.

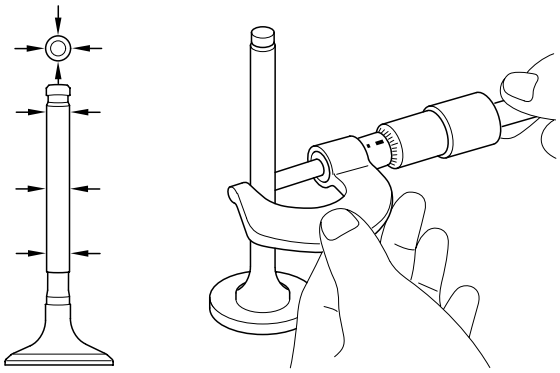
Valve guide inner diameter :
6.000 ~ 6.015mm (0.2362 ~ 0.2368in)



ECKD219A

   2) Using a micrometer, measure the outer diameter of valve stem.

Valve stem outer diameter
Intake : 5.955 ~ 5.970mm (0.2344 ~ 0.2350in)
Exhaust : 5.935 ~ 5.950mm (0.2337 ~ 0.2343in)



ECKD220A

3) Subtract the valve stem outer diameter measurement from the valve guide inner diameter measurement.

Valve stem- to-guide clearance
Standard
Intake : 0.03 ~ 0.06mm (0.0012 ~ 0.0024in)
Exhaust : 0.05 ~ 0.08mm (0.0020 ~ 0.0031in)
Limit
Intake : 0.10mm (0.0039in)
Exhaust : 0.15mm (0.0059in)

If the clearance is greater than maximum, replace the valve and valve guide.

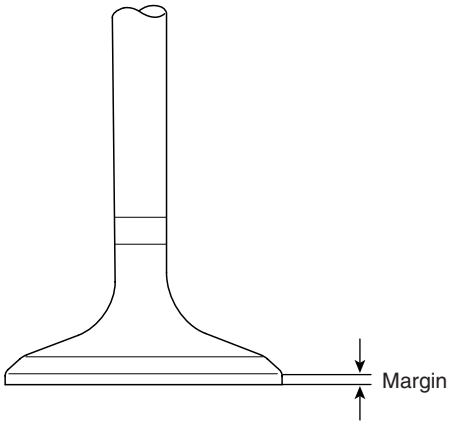
2. Inspect the valves.

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 : 1.3mm (0.0512in)
Limit
Intake : 0.8mm (0.0315in)
Exhaust : 1.0mm (0.0394in)



ECKD221A

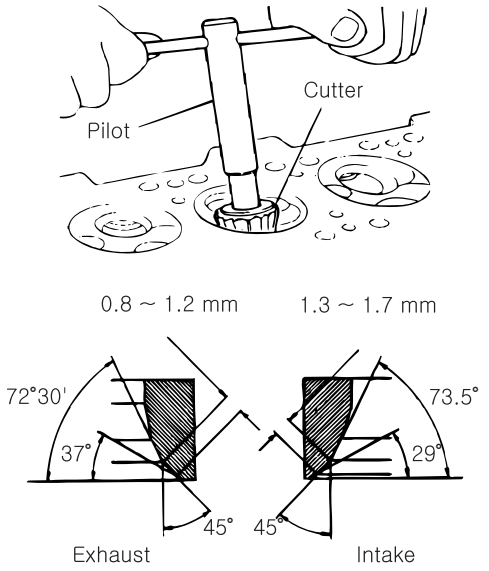
4) Check the surface of valve stem tip for wear.
If the valve stem tip is worn, replace the valve.

3. Inspect the valve seats.

1) Check the valve seat for evidence of overheating and improper contact with the valve face.
Replace the seat if necessary.

2) Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat.

3) Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.



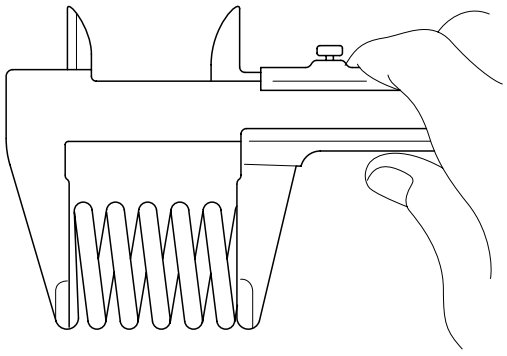
LCGE005A

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)
Load : 21.6±1.1kg/35.0mm (47.6±2.4lb/1.3780in)
45.1±2.2kg/27.2mm (99.4±4.9lb/1.0709in)
Out of square : Less than 1.5˚
Limit
Out of square : 3˚



ECKD222A

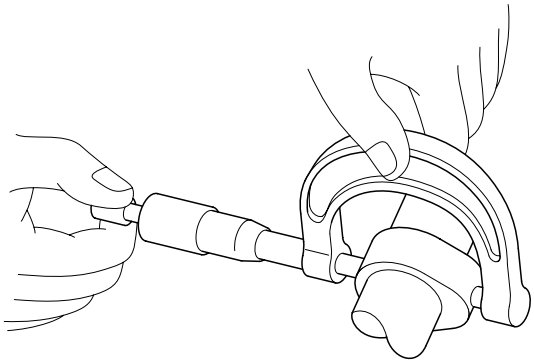
If the loads is not as specified, replace the valve spring.

CAMSHAFT

1. Inspect the cam lobes.
   Using a micrometer, measure the cam lobe height.

Cam height (1.6 CVVT)
Intake : 43.7492 ~ 43.9492mm (1.72241 ~ 1.73028in)
Exhaust : 44.1494 ~ 44.3494mm (1.73816 ~ 1.74604in)

Cam height (1.4 DOHC)
Intake : 43.3484 ~ 43.5484mm (1.70663 ~ 1.71450in)
Exhaust : 43.5486~ 43.7486mm (1.71451 ~ 1.72238in)



ECKD223A

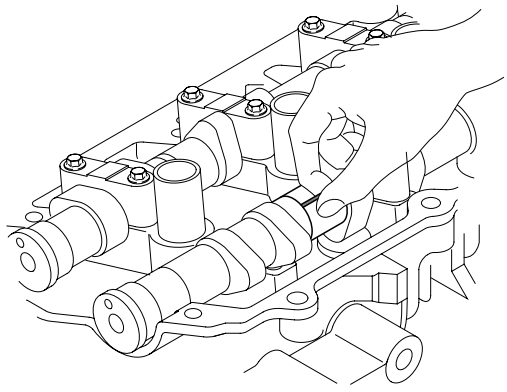
If the cam lobe height is less than specified, replace the camshaft.

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.



ECKD224A

4) Install the bearing caps and tighten the bolts with specified torque. (Refer to EM - 56)

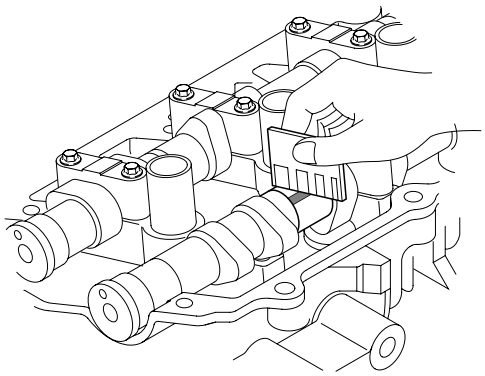
CAUTION

Do not turn the camshaft.

5) Remove the bearing caps.

6) Measure the plastigage at its widest point.

Bearing oil clearance
Standard : 0.020 ~ 0.061mm (0.0008 ~ 0.0024in)
Limit : 0.1mm (0.0039in)



ECKD225A

If the oil clearance is greater than specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

7) Completely remove the plastigage.

8) Remove the camshafts.

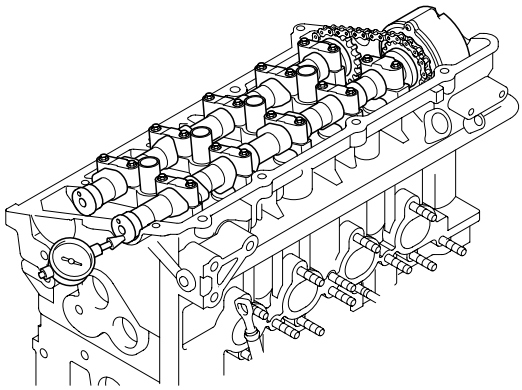
3. Inspect the camshaft end play.

1) Install the camshafts. (Refer to EM - 56)

2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

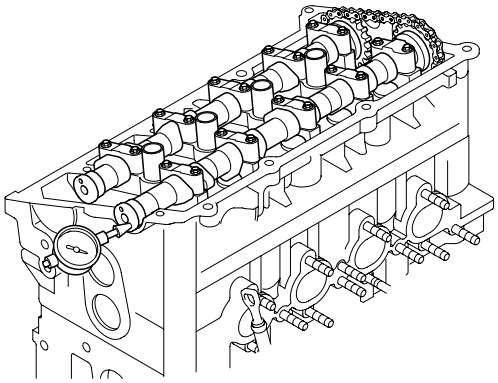
Camshaft end play
Standard : 0.1 ~ 0.2mm (0.0039 ~ 0.0079in)

■ **1.6 CVVT**



ACJF079A

■ **1.4 DOHC**



ACJF080A

If the end play is greater than specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

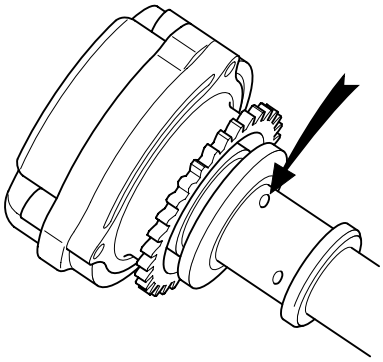
3) Remove the camshafts.

CVVT(CONTINUOUS VARIABLE VALVE TIMING) ASSEMBLY (1.6 CVVT)

1. Inspect the CVVT (Continuous Variable Valve Timing) assembly.

   1) Check that the CVVT (Continuous Variable Valve Timing) assembly will not turn.

   2) Apply vinyl tape to all the parts except the one indicated by the arrow in the illustration.



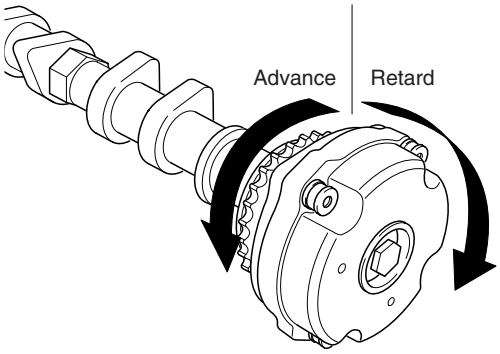
EDKD270B

   3) Wrap tape around the tip of the air gun and apply air of approx. 98kpa (1kg/cm², 14psi) to the port of the camshaft.
   Perform this order to release the lock pin for the maximum delay angle locking.)

NOTE

Wrap around it with a shop rag and the likes, because the oil splashes.

   4) Under the condition of 3), turn the CVVT assembly to the advance angle side with your hand.
      - Depending on the air pressure, the CVVT assembly will turn to the advance side.
      - 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.



BCGE010A

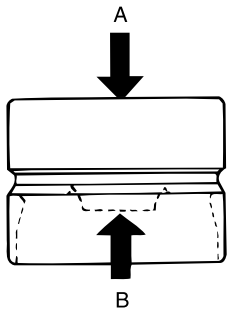
   5) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range about 20˚

   6) Turn the CVVT assembly with your hand and lock it at the maximum delay angle position.

HLA (HYDRAULIC LASH ADJUSTER)

With the HLA filled with engine oil, hold A and press B by hand. If B moves, replace the HLA.



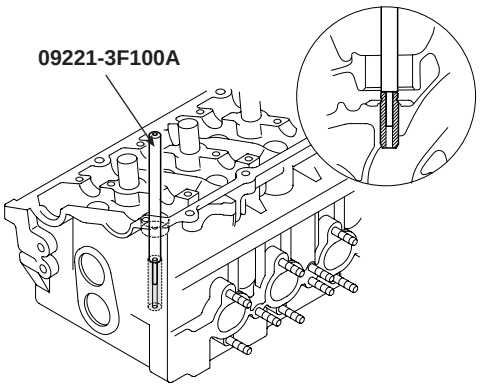
EDA9260B

No.	Problem	Possible cause	Action
1	Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
2	Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the HLA, allowing air to get in.	Noise will disappear within 15 minutes when engine runs at 2,000~3,000 rpm.If it doesn't disappear, refer to step 7 below. ***CAUTION*** ***Do not run engine at a speed higher than 3,000 rpm, as this may damage the HLA.***
3	Continuous noise when the engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
4	Continuous noise when the engine is started after excessively cranking the engine by the starter motor.	Oil leakage of the high-pressure chamber in the HLA, allowing air to get in. Insufficient oil in the HLA.	
5	Continuous noise when the engine is running after changing the HLA.		
6	Continuous noise during idle after high engine speed.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
		Excessive amount of air in the oil at high engine speed.	Check oil supply system
		Deteriorated oil.	Check oil quality. If deteriorated, replace with specified type.
7	Noise continues for more than 15 minutes.	Low oil pressure	Check oil pressure and oil supply system of each part of engine.
		Faulty HLA.	Remove the cylinder head cover and press HLA down by hand. If it moves, replace the HLA. **WARNING** **Be careful with the hot HLAs.**

REPLACEMENT E3058D88

VALVE GUIDE

1. Using the SST(09221 - 3F100A), withdraw the old valve guide toward the bottom of cylinder head.

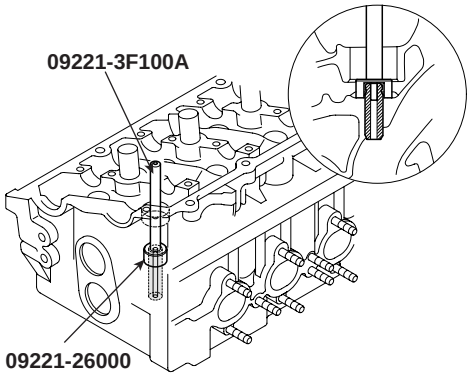


EDKD900A

2. Recondition the valve guide hole of cylinder head so that it can match the newly press-fitted oversize valve guide.

3. Using the SST (09221-3F100A, 09221-26000), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust valve guides are different in length.

Valve guide length
Intake : 36.3 ~ 36.7mm (1.4291 ~ 1.4449in)
Exhaust : 40.8 ~ 41.2mm (1.6063 ~ 1.6220in)



ADGE006A

4. After the valve guide is press-fitted, insert a new valve and check for proper stem-to-guide clearance.

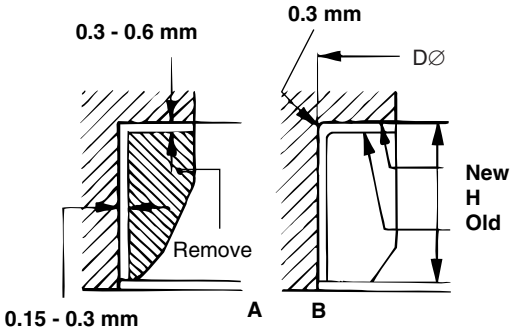
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

VALVE GUIDE OVERSIZE

Item	Oversize [mm (in)]	Size mark	Valve guide hole inner diameter [mm (in)]	Valve guide outer diameter [mm (in)]	Valve guide protrusion height [mm (in)]
Valve guide	STD	-	11.000 ~ 11.018 (0.4331 ~ 0.4338)	11.050 ~ 11.060 (0.4350 ~ 0.4354)	12.8 (0.5039)
	0.05 (0.002) OS	5	11.050 ~ 11.068 (0.4350 ~ 0.4357)	11.100 ~ 11.110 (0.4370 ~ 0.4374)	
	0.25 (0.010) OS	25	11.250 ~ 11.268 (0.4429 ~ 0.4436)	11.300 ~ 11.310 (0.4449 ~ 0.4453)	
	0.50 (0.020) OS	50	11.500 ~ 11.518 (0.4528 ~ 0.4535)	11.550 ~ 11.560 (0.4547 ~ 0.4551)	

VALVE SEAT RING

1. Cut away the inner face of the valve seat to reduce the wall thickness.



LCJF075A

2. Enlarge the seat ring hole of cylinder head so that matches the specified cylinder head hole inner diameter of new valve seat ring.
3. Heat the cylinder head to about 250℃(480˚F) and press-fit an oversize seat ring for the cylinder head hole size.
4. Using lapping compound, lap the valve to the new seat.

VALVE SEAT RING OVERSIZE

Item	Over size mm(in.)	Size mark	Seat ring hole inner diameter [mm(in)]	Seat ring outer diameter [mm(in)]	Seat ring height[mm(in)]
Intake valve seat ring	STD	-	30.400 ~30.421 (1.1968 ~ 1.1977)	30.490 ~30.505 (1.2004 ~ 1.2010)	4.800 ~5.000 (0.1890 ~ 0.1969)
	0.3(0.012)OS	30	30.700 ~ 30.721 (1.2087 ~ 1.2095)	30.790 ~ 30.805 (1.2122 ~ 1.2128)	5.100 ~ 5.300 (0.2008 ~ 0.2087)
	0.6(0.024)OS	60	31.000 ~ 31.021 (1.2205 ~ 1.2213)	31.090 ~ 31.105 (1.2240 ~ 1.2246)	5.400 ~ 5.600 (0.2126 ~ 0.2205)
Exhaust valve seat ring	STD	-	27.000 ~ 27.021 (1.0630 ~ 1.0638)	27.095 ~ 27.115 (1.0667 ~ 1.0675)	5.900 ~ 6.100 (0.2323 ~ 0.2402)
	0.3(0.012)	30	27.300 ~ 27.321 (1.0748 ~ 1.0756)	27.395 ~ 27.415 (1.0785 ~ 1.0793)	6.200 ~ 6.400 (0.2441 ~ 0.2520)
	0.6(0.024)	60	27.600 ~ 27.621 (1.0866 ~ 1.0874)	27.695 ~ 27.715 (1.0904 ~ 1.0911)	6.500 ~ 6.700 (0.2559 ~ 0.2638)

REASSEMBLY E62FA121

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.

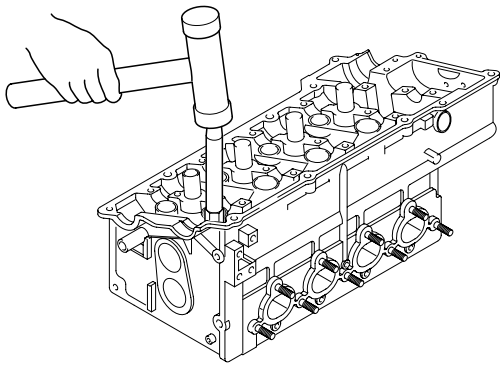
   1) Install the spring seats.

   2) Using the SST (09222 - 22001), push in a new oil seal.

NOTE

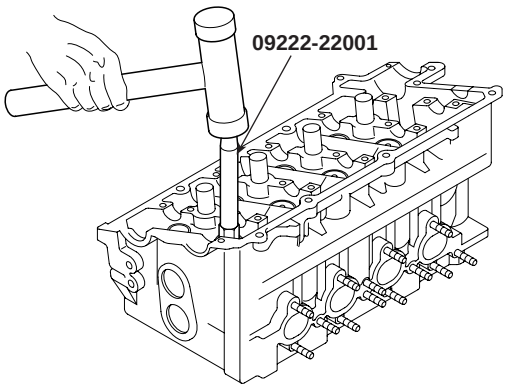
Do not reuse old valve stem oil seals.
Incorrect installation of the seal could result in oil leakage past the valve guides.

■ **1.6 CVVT**



ACJF081A

■ **1.4 DOHC**



ACJF082A

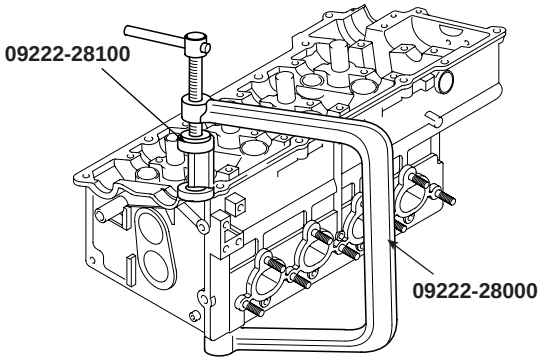
   3) Install the valve, valve spring and spring retainer.

NOTE

Place the valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

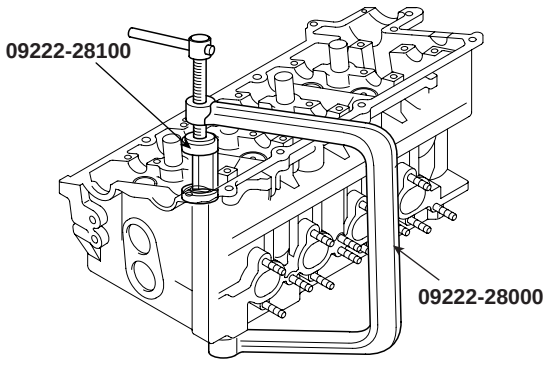
   4) Using the SST(09222 - 28000, 09222 - 28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.

■ **1.6 CVVT**



ACJF083A

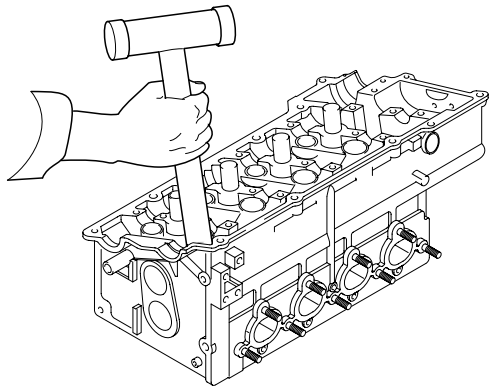
■ **1.4 DOHC**



ACJF084A

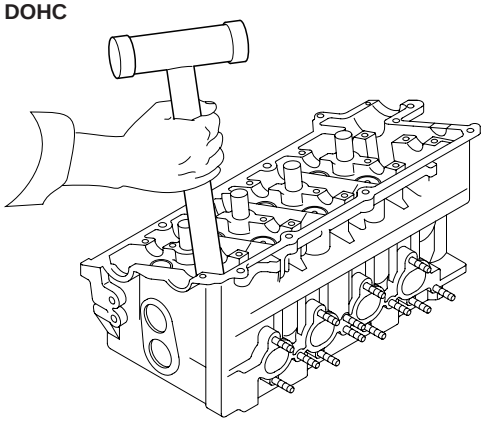
5) Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.

■ **1.6 CVVT**



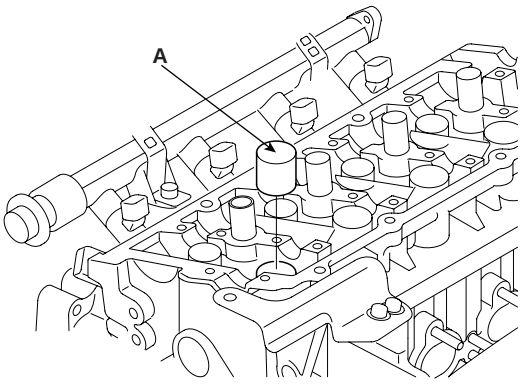
ACJF085A

■ **1.4 DOHC**



ACJF086A

2. Install the HLA(Hydraulic Lash Adjuster)s. Check that the HLA rotates smoothly by hand.



ECKD217A

INSTALLATION E2FFDB0B

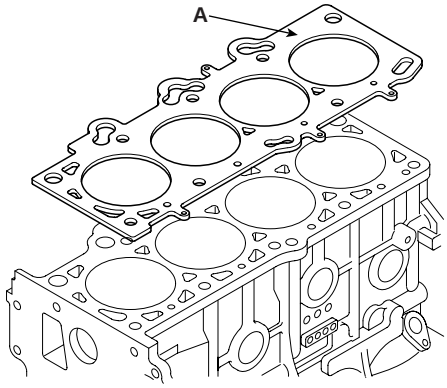
NOTE

- *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 gasket(A) on the cylinder block.

NOTE

Be careful of the installation direction.



ECKD231A

2. Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.

3. Install the cylinder head bolts.

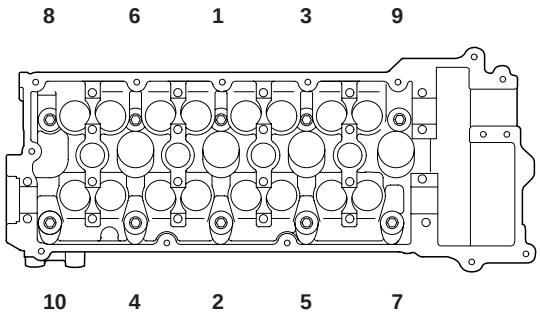
   1) Apply a light coat if engine oil on the threads and under the heads of the cylinder head bolts.

   2) Using 8mm and 10mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

Tightening torque (1.6 CVVT) :
29.4N.m (3.0kgf.m, 21.7lb-ft) + 90° → Release all bolts → 29.4N.m (3.0kgf.m, 21.7lb-ft) + 90°

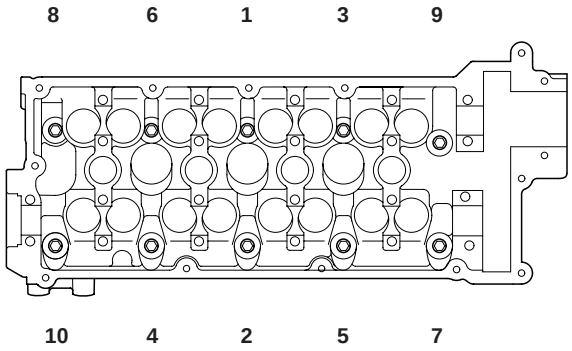
Tightening torque (1.4 DOHC) :
34.3N.m (3.5kgf.m, 25.3lb-ft) + 90° → Release all bolts → 34.3N.m (3.5kgf.m, 25.3lb-ft) + 90°

■ 1.6 CVVT



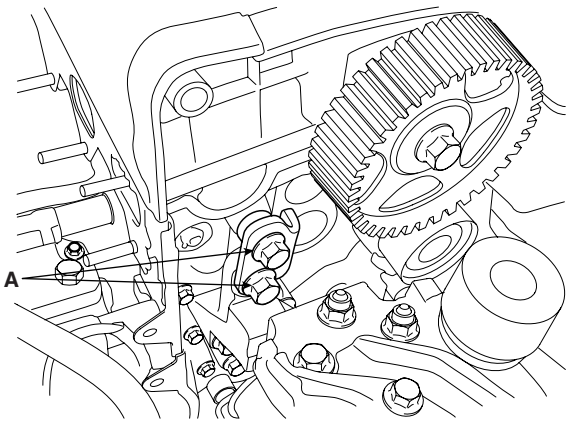
ACJF092A

■ 1.4 DOHC



ACJF093A

4. Install the engine mounting support bracket fixing bolts(A).

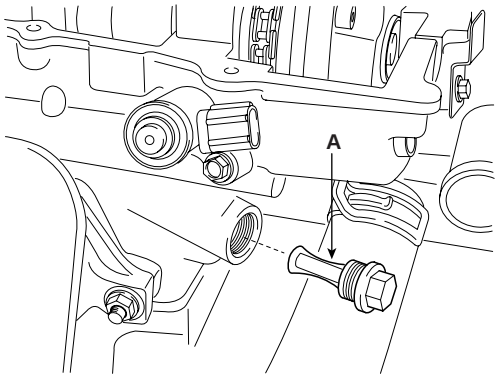


ACJF019A

5. Install the OCV(Oil Control Valve) filter(A). (1.6 CVVT)

Tightening torque :
40.2 ~ 50.0N.m (4.1 ~ 5.1kgf.m, 29.7 ~ 36.9lb-ft)

■ 1.6 CVVT



ACJF117A

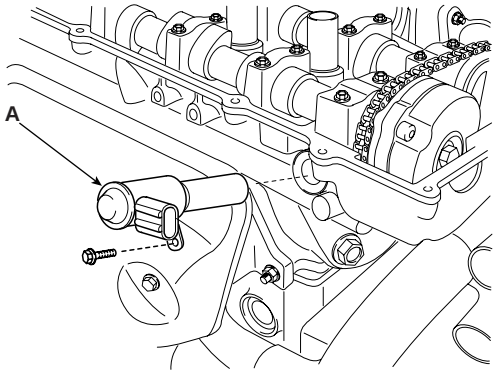
NOTE

- *Always use a new OCV(Oil Control Valve) filter gasket.*
- *Keep clean the OCV(Oil Control Valve) filter.*

6. Install the OCV(Oil Control Valve)(A). (1.6 CVVT)

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

■ 1.6 CVVT



ACJF118A

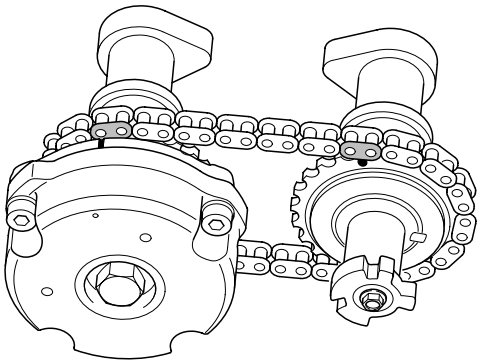
CAUTION

- ***Do not reuse the OCV(Oil Control Valve) when dropped.***
- ***Keep clean the OCV(Oil Control Valve).***
- ***Do not hold the OCV(Oil Control Valve) sleeve during servicing.***
- ***When the OCV(Oil Control Valve) is installed on the engine, do not move the engine with holding the OCV(Oil Control Valve) yoke.***

7. Install the camshafts.

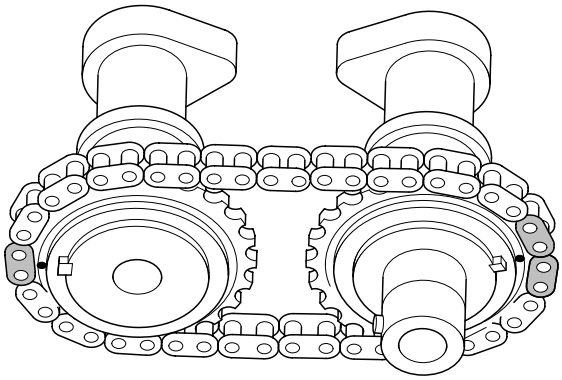
   1) Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.

■ **1.6 CVVT**



ACJF094A

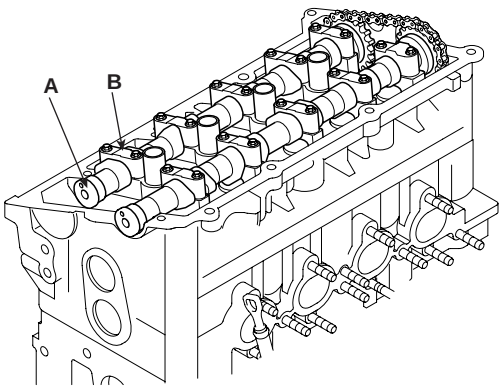
■ **1.4 DOHC**



ACJF095A

   2) Install the camshaft(A) and bearing caps(B).

Tightening torque :
11.8 ~ 13.7N.m (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)

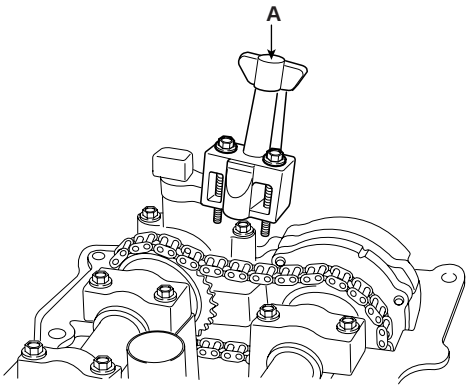


EDKD124A

   3) Install the timing chain auto tensioner(A). (1.6 CVVT)

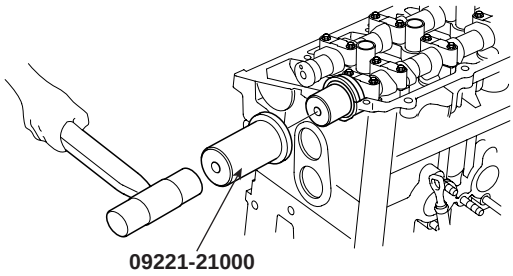
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

■ **1.6 CVVT**



ACJF119A

8. Using the SST (09221 - 21000), install the camshaft bearing oil seal.



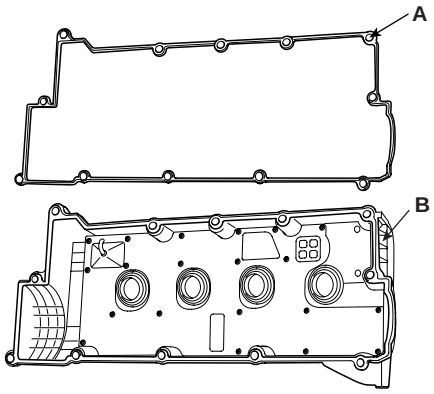
EDKD125A

9. Install the camshaft sprocket. (Refer to EM - 28)

10. Install the cylinder head cover.

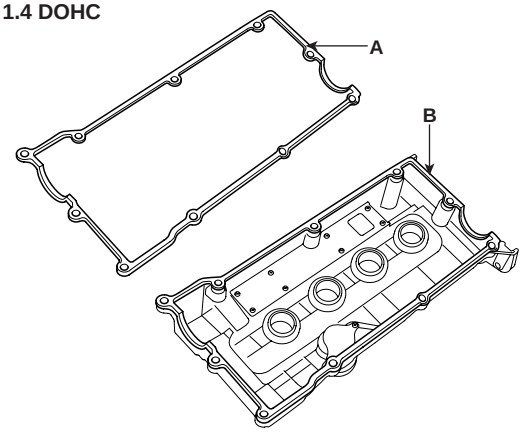
    1) Install the cylinder head cover gasket(A) in the groove of the cylinder head cover(B).

■ **1.6 CVVT**



ACJF096A

■ **1.4 DOHC**



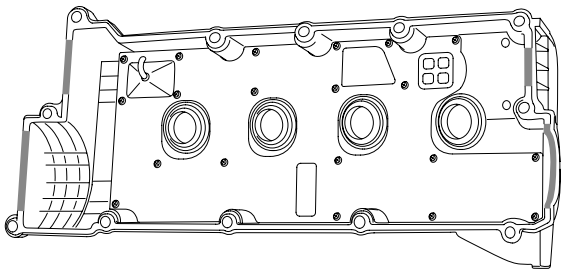
ACJF097A

NOTE

- *Before installing the cylinder head cover gasket, thoroughly clean the cylinder head cover and the groove.*
- *When installing, make sure the cylinder head cover gasket is seated securely in the corners of the recesses with no gap.*

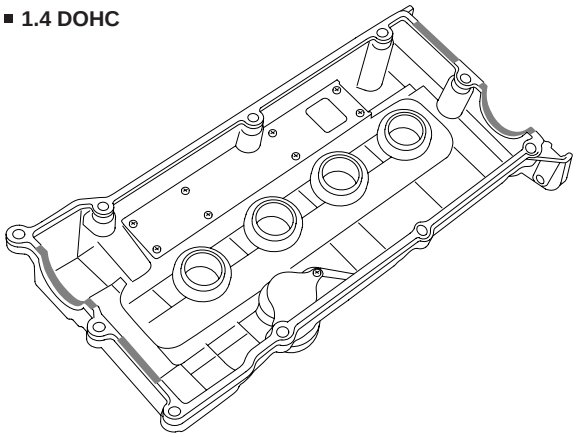
    2) Apply liquid gasket to the head cover gasket at the corners of the recess.

■ **1.6 CVVT**



ACJF098A

■ **1.4 DOHC**



ACJF099A

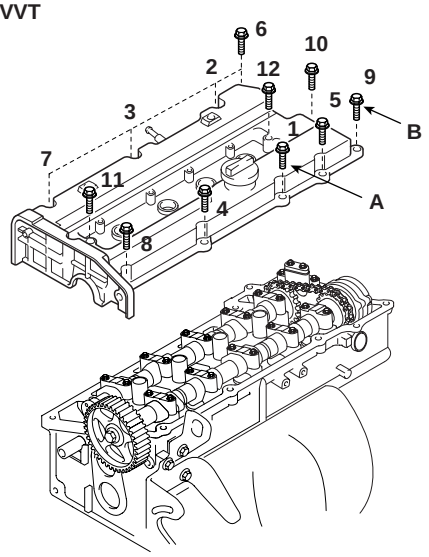
NOTE

- *Use liquid gasket, loctite No. 5999.*
- *Check that the mating surfaces are clean and dry before applying liquid gasket.*
- *After assembly, wait at least 30 minutes before filling the engine with oil.*

3) Install the cylinder head cover(A) with bolts(B). Uniformly tighten the bolts in several passes. Pre-tighten all bolts by 3.9~4.9N.m (0.4~0.5kgf.m, 2.9~3.6lb-ft) and then tighten by the specified torque.

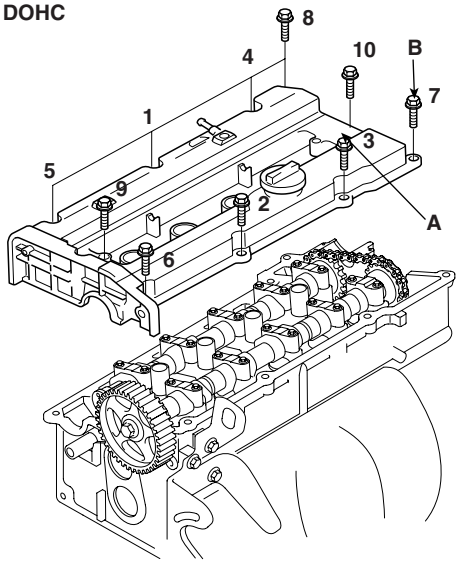
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

■ **1.6 CVVT**



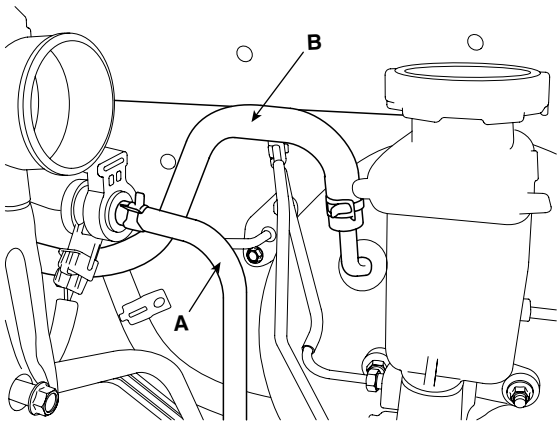
ACJF087A

■ **1.4 DOHC**



ACJF088A

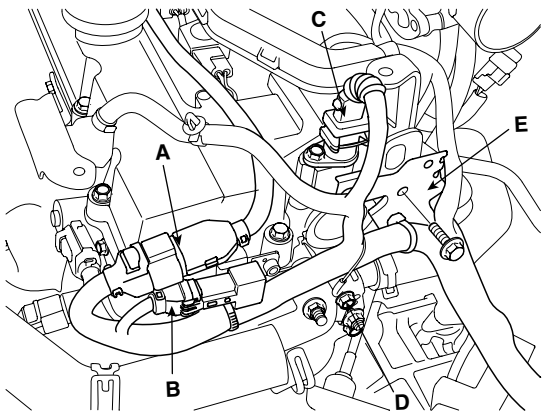
11. Install the timing belt. (Refer to EM - 28)
12. Install the intake manifold. (Refer to EM - 117)
13. Install the exhaust manifold. (Refer to EM - 120)
14. Install the ignition coil. (Refer to EE group - ignition system).
15. Install the power steering pump. (Refer to ST group - power steering pump)
16. Install the brake booster hose(B).
17. Connect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.



ACJF018A

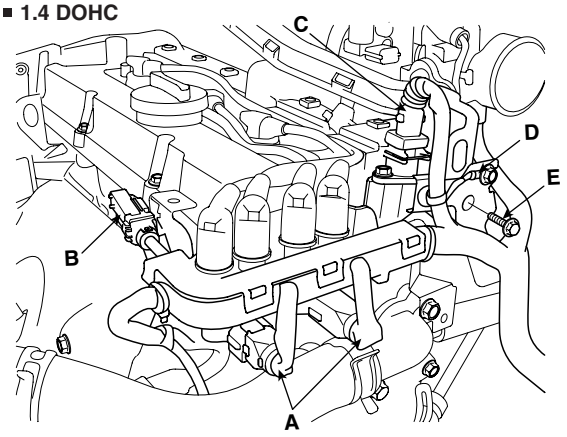
18. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
    1) Install the wire harness bracket(E).
    2) Connect the ground cable(D).
    3) Connect the CMP(Camshaft position sensor) connector(C).
    4) Connect the ignition coil condenser connector(B).
    5) Connect the ignition coil connector(A).

■ **1.6 CVVT**



ACJF015A

■ 1.4 DOHC

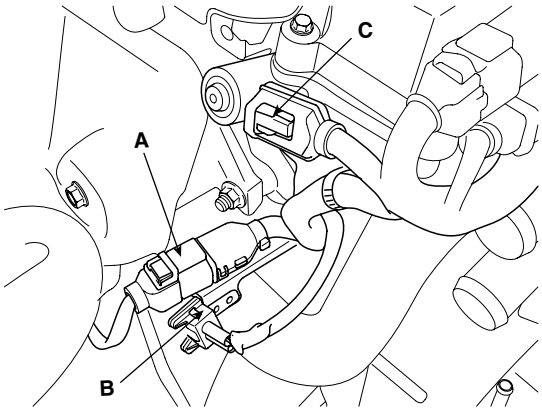


ACJF016A

6) Connect the OCV(Oil Control Valve) connector(C). (1.6 CVVT)

7) Connect the CKP(Crankshaft Position Sensor) connector(B).

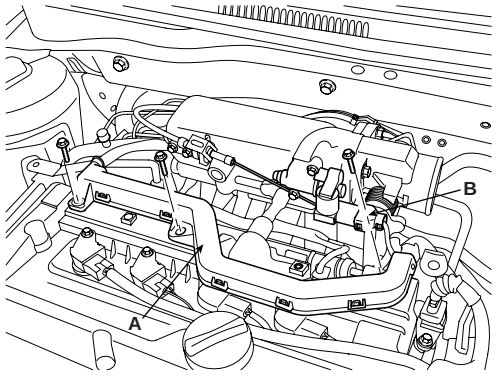
8) Connect the front oxygen sensor connector(A).



ACJF014A

9) Connect the ISA(Idle Speed Actuator) connector(B).

10) Install the wire harness bracket(A).



ACJF003A

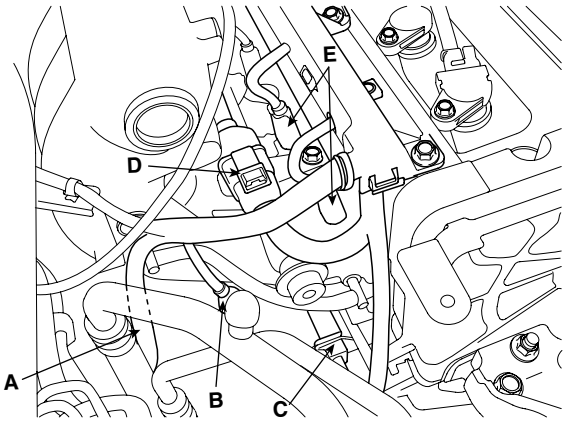
11) Connect the injector connectors (No.1,2) (E).

12) Connect the injector connectors (No.3,4) (D).

13) Connect the knock sensor connector(C).

14) Connect the air conditioner compressor switch connector(B).

15) Connect the rear oxygen sensor connector(A).

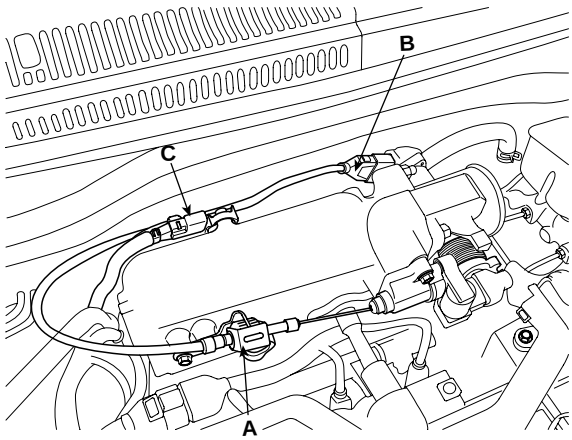


ACJF013A

19. Connect the MAP sensor connector(C). (1.4 DOHC)

20. Connect the TPS (Throttle Position Sensor) connector (B).

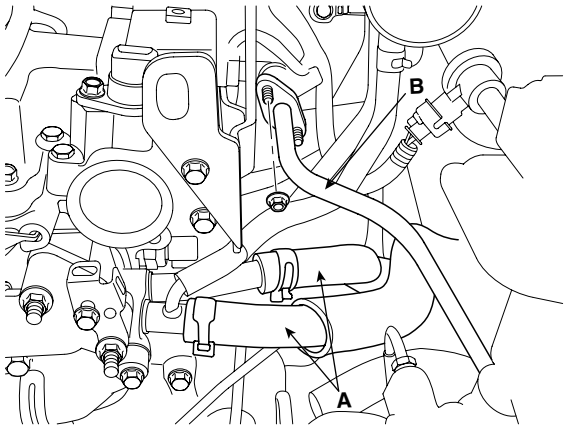
21. Install the accelerator cable(A).



ACJF012A

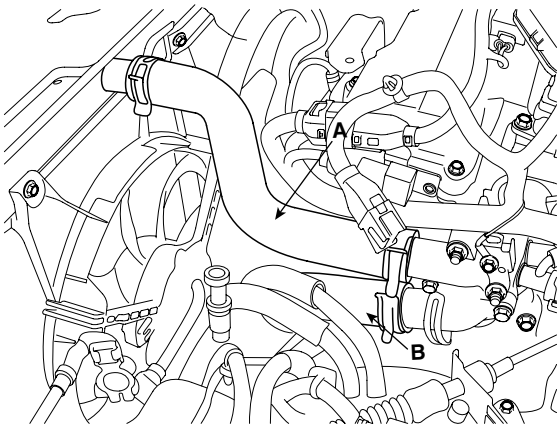
22. Install the fuel hose(B).

23. Install the heater hoses(A).



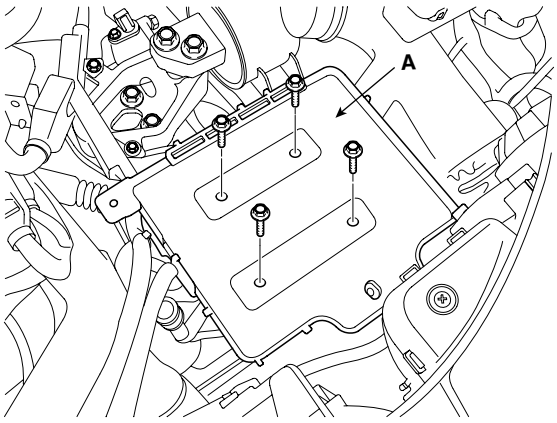
ACJF011A

24. Install the upper radiator hose(A) and lower radiator hose(B).



ACJF126A

25. Install the battery tray(A).



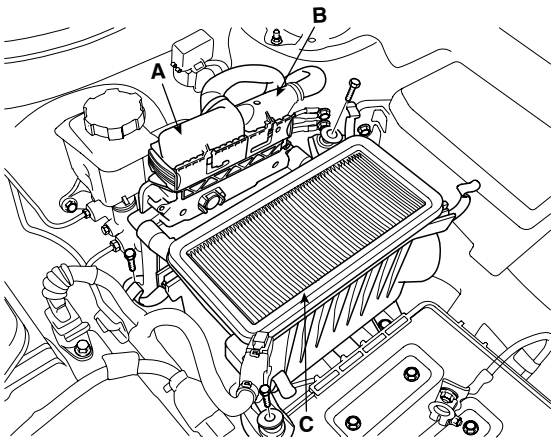
ACJF009A

26. Install the intake air hose and air cleaner assembly.

    1) Install the air cleaner element and air cleaner lower cover(C).

Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

    2) Connect the ECM connector(A) and ECM connector(B) (A/T only).

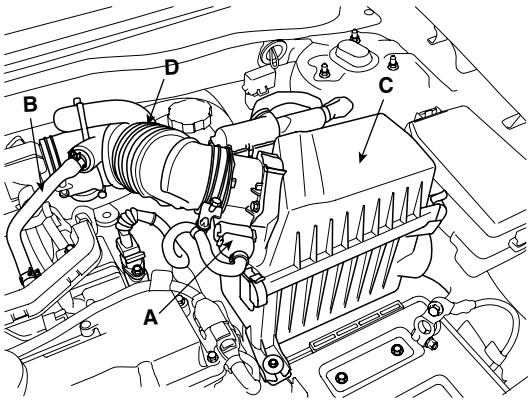


ACJF008A

    3) Install the intake air hose(D) and air cleaner upper cover(C).

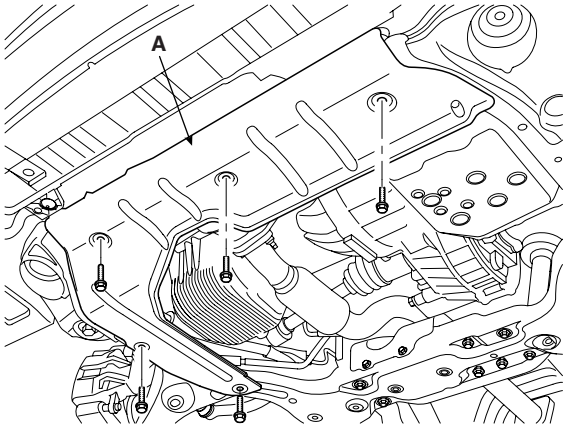
    4) Connect the breather hose(B) to intake air hose(D).

    5) Connect the AFS(Air Flow Sensor) connector(A). (1.6CVVT)



ACJF007A

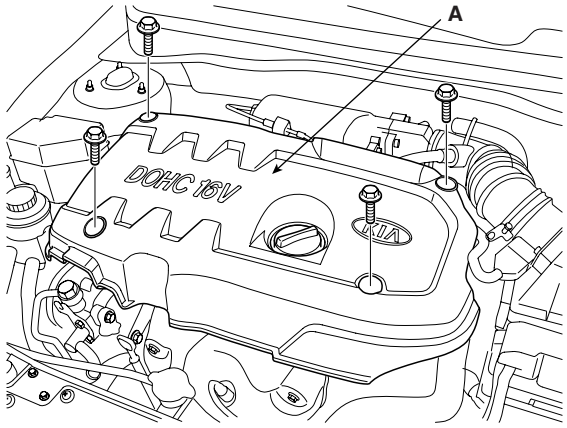
27. Install the under cover(A).



ACJF006A

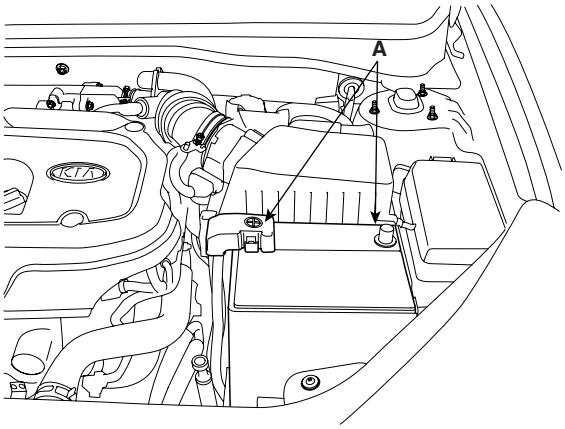
28. Install the engine cover(A).

Tightening torque :
3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lb-ft)



ACJF001A

29. Install the battery and connect the battery terminals(A).

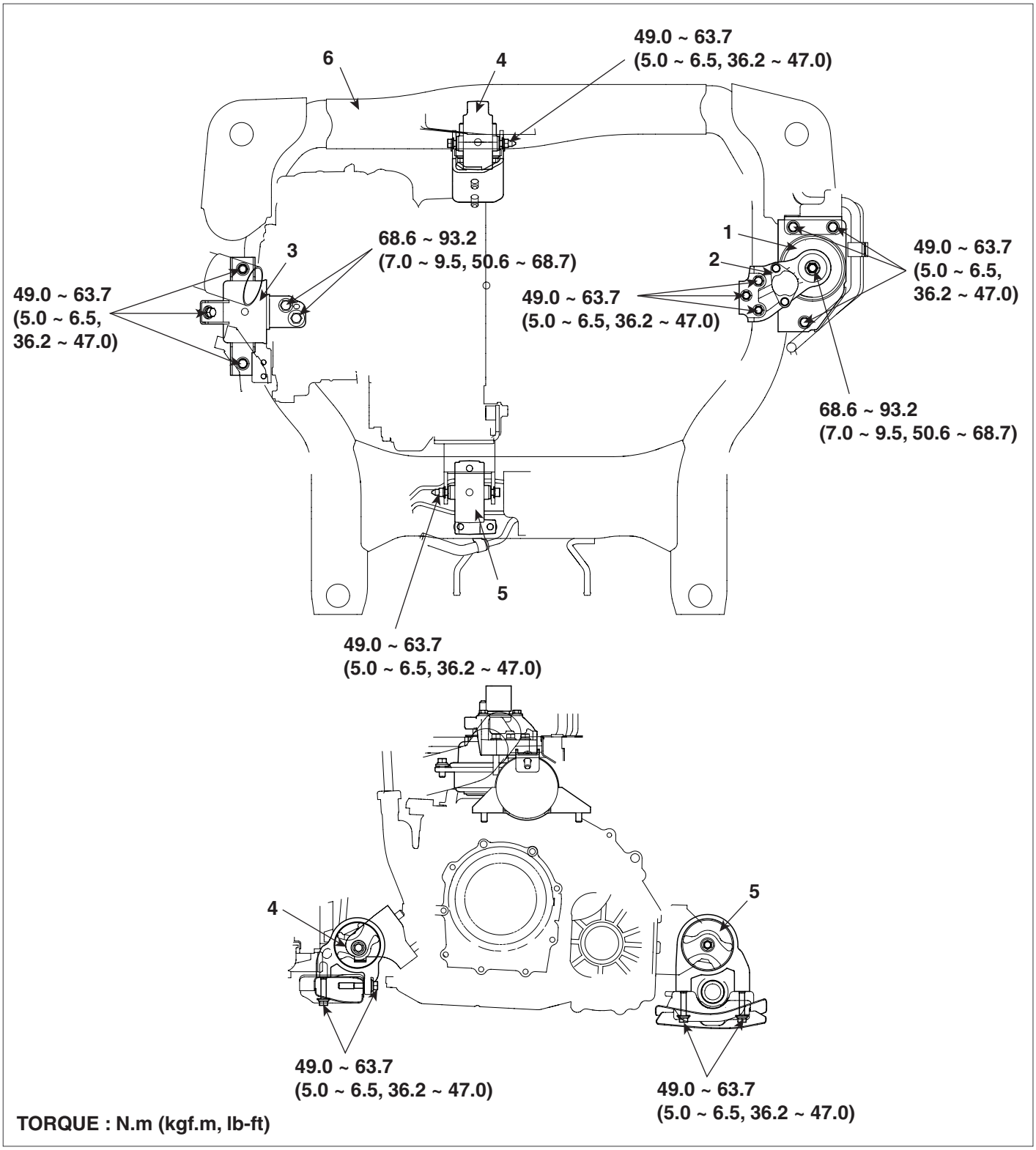


AJJF526A

30. Fill with engine coolant. (Refer to EM - 94)
31. Start the engine and check for leaks.
32. Recheck engine coolant level and oil level.

ENGINE AND TRANSAXLE ASSEMBLY

COMPONENT EB5DB67E



1. Engine mounting bracket
2. Engine mounting support bracket
3. Transaxle mounting bracket
4. Front roll stopper
5. Rear roll stopper
6. Sub-frame

LCJF007A

REMOVAL ECDEEDA2

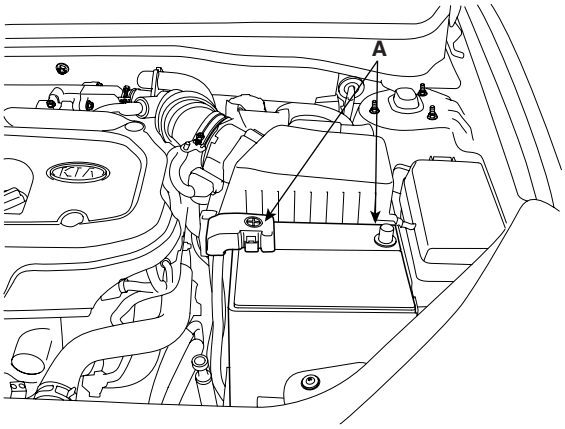
CAUTION

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

NOTE

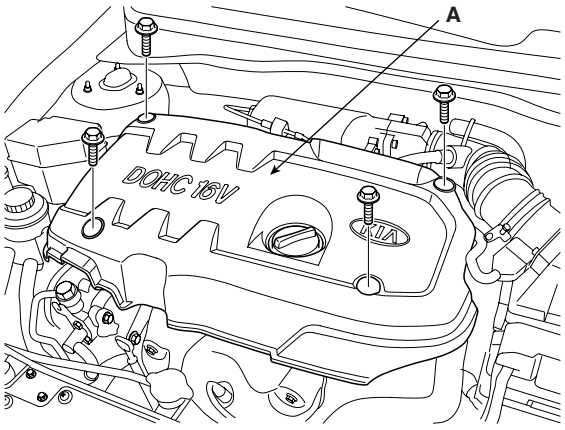
- *Mark all wiring and hoses to avoid misconnection.*

1. Disconnect the terminals(A) from battery and remove the battery.



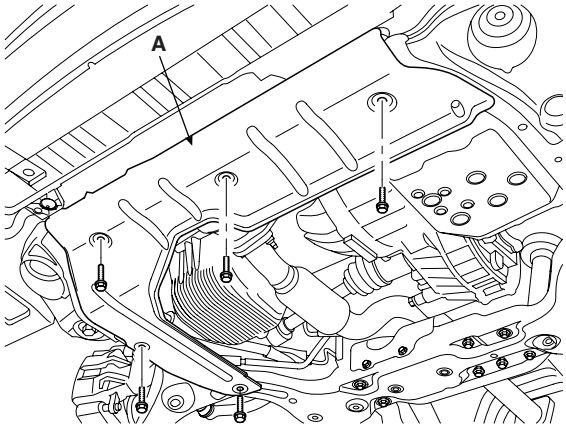
AJJF526A

2. Remove the engine cover(A).



ACJF001A

3. Remove the under cover(A).



ACJF006A

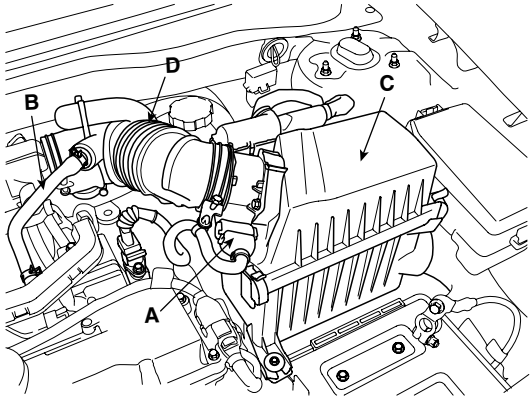
4. Drain the engine coolant. (Refer to EM - 94) Remove the radiator cap to speed draining.

5. Remove the intake air hose and air cleaner assembly.

   1) Disconnect the AFS(Air Flow Sensor) connector(A). (1.6CVVT)

   2) Disconnect the breather hose(B) from intake air hose(D).

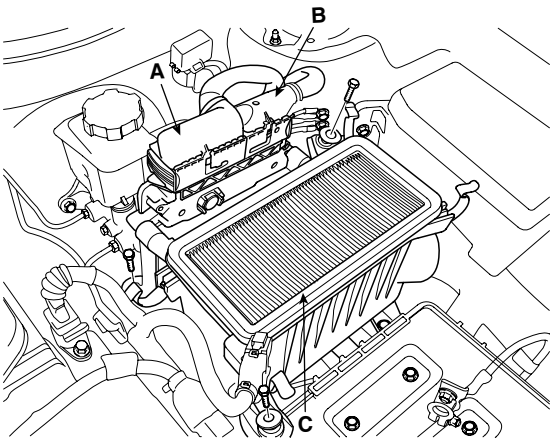
   3) Remove the intake air hose(D) and air cleaner upper cover(C).



ACJF007A

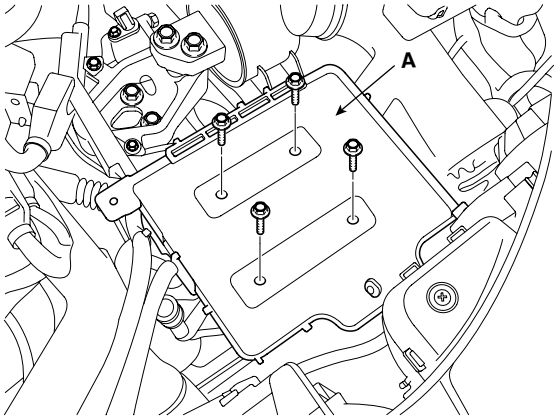
4) Disconnect the ECM connector(A) and ECM connector(B) (A/T only).

5) Remove the air cleaner element and air cleaner lower cover(C).



ACJF008A

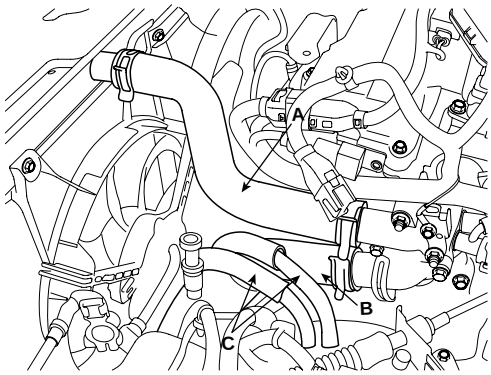
6. Remove the battery tray(A).



ACJF009A

7. Remove the upper radiator hose(A) and lower radiator hose(B).

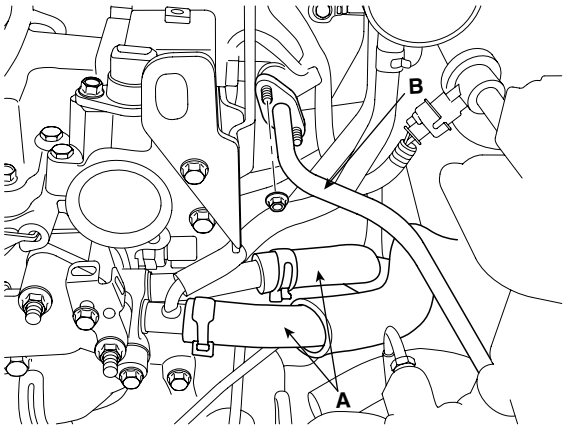
8. Remove the ATF oil cooler hoses(C).



ACJF010A

9. Remove the heater hoses(A).

10. Remove the fuel hose(B).

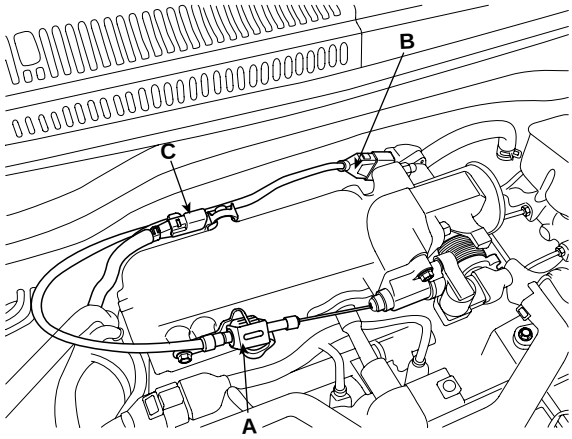


ACJF011A

11. Remove the accelerator cable(A) by loosening the lock-nut, then slip the cable end out of the throttle linkage.

12. Disconnect the TPS (Throttle Position Sensor) connector(B).

13. Disconnect the MAP sensor connector(C). (1.4 DOHC)



ACJF012A

14. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.

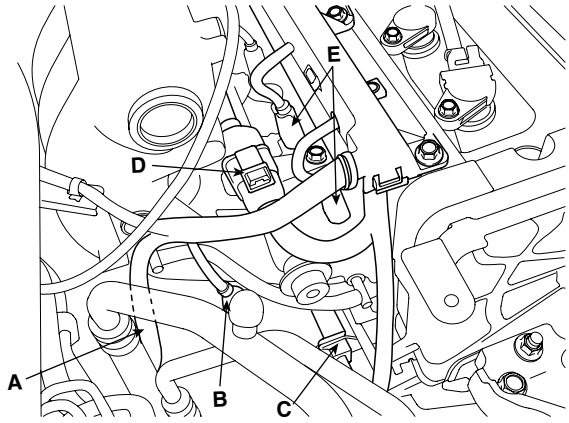
    1) Disconnect the rear oxygen sensor connector (A).

    2) Disconnect the air conditioner compressor switch connector (B).

    3) Disconnect the knock sensor connector (C).

    4) Disconnect the injector connectors(No.3,4) (D).

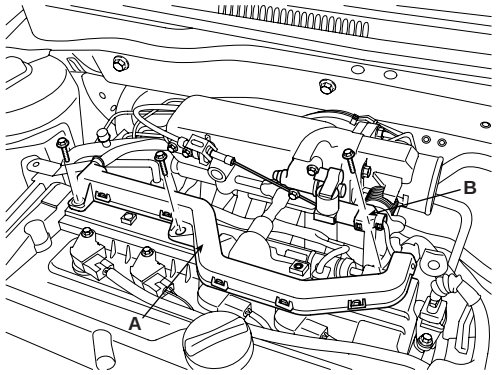
    5) Disconnect the injector connectors(No.1,2) (E)



ACJF013A

    6) Remove the wire harness bracket(A).

    7) Disconnect the ISA (Idle Speed Actuator) connector (B).

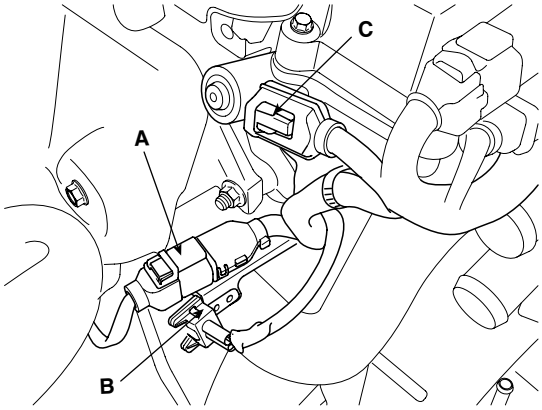


ACJF003A

    8) Disconnect the front oxygen sensor connector(A).

    9) Disconnect the CKP(Crankshaft Position Sensor) connector (B).

    10) Disconnect the OCV(Oil Control Valve) connector (C). (1.6 CVVT)



ACJF014A

    11) Disconnect the ignition coil connector(A).

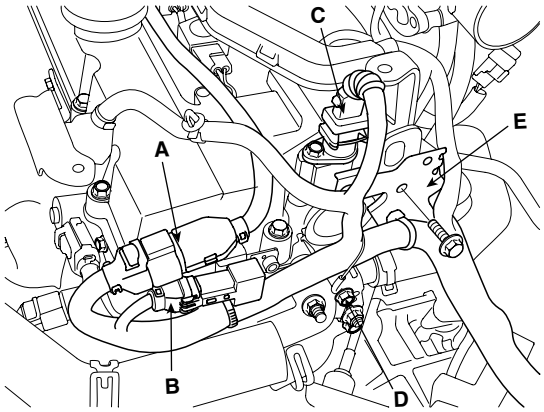
    12) Disconnect the ignition coil condenser connector(B).

    13) Disconnect the CMP(Camshaft Position Sensor) connector(C).

    14) Disconnect the ground cable(D).

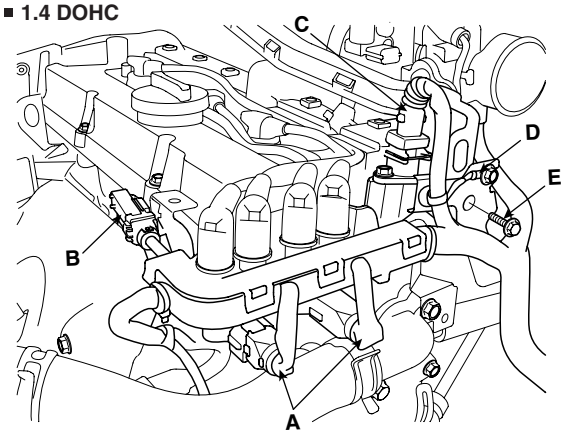
    15) Remove the wire harness bracket(E).

■ **1.6 CVVT**



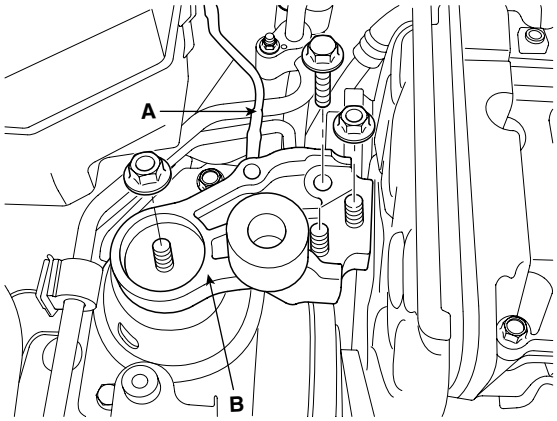
ACJF015A

■ 1.4 DOHC



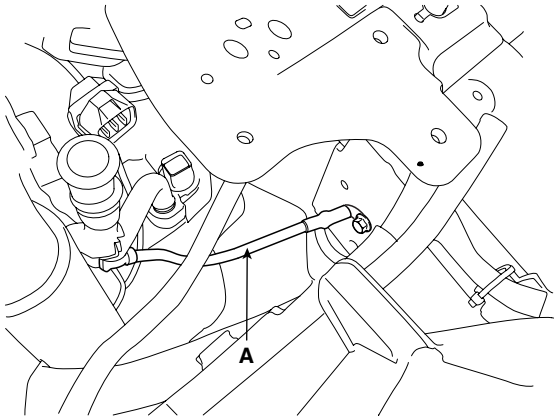
ACJF016A

16) Remove the ground cable(A) between engine mounting and vehicle body.



ACJF017A

17) Remove the ground cable(A) between transaxle housing and vehicle body.



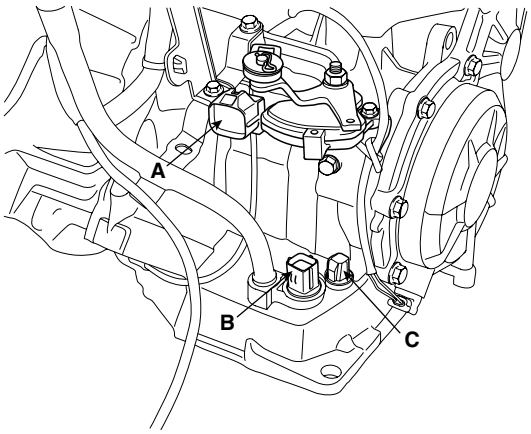
ACJF020A

15. Remove the transaxle wire harness connectors and control cable from transaxle (A/T).

1) Disconnect the transaxle range switch connector (A).

2) Disconnect the solenoid valve connector(B).

3) Disconnect the ATF oil temperature sensor connector (C).



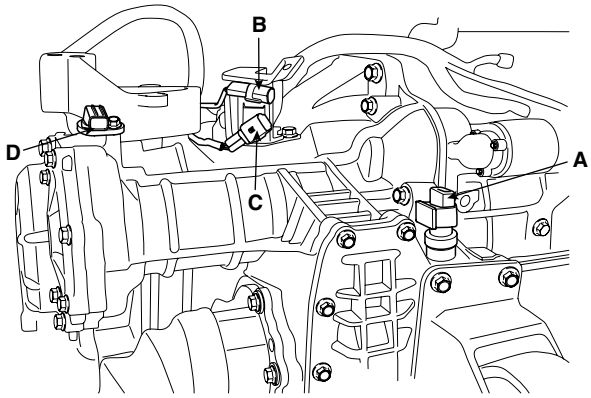
ACJF021A

4) Disconnect the vehicle speed sensor connector(A).

5) Disconnect the band server switch connector(B).

6) Disconnect the pulse generator(A) connector(C).

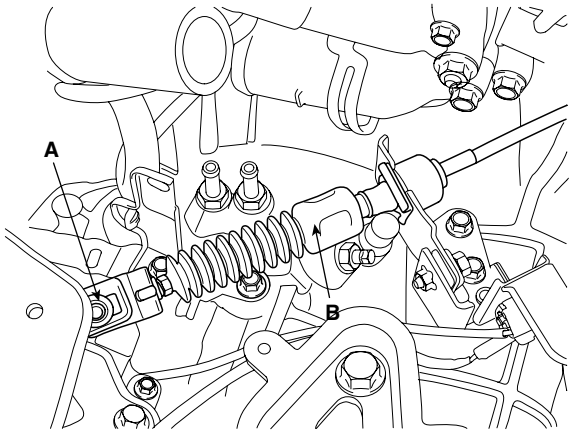
7) Disconnect the pulse generator(B) connector(D).



ACJF022A

8) Remove the control cable nut(A) from transaxle range switch.

9) Remove the control cable(B).



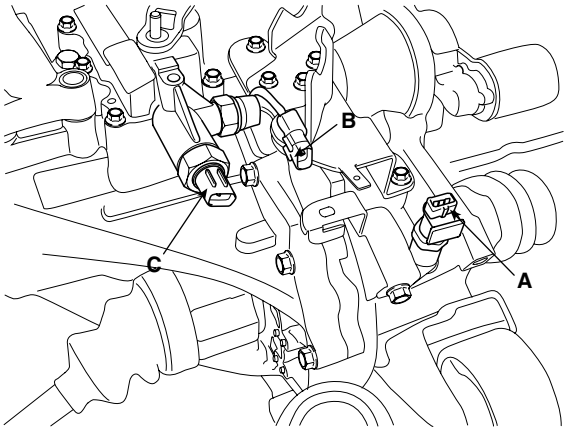
ACJF023A

16. Remove the transaxle wire harness connectors and control cable from transaxle (M/T).

1) Disconnect the vehicle speed sensor connector(A).

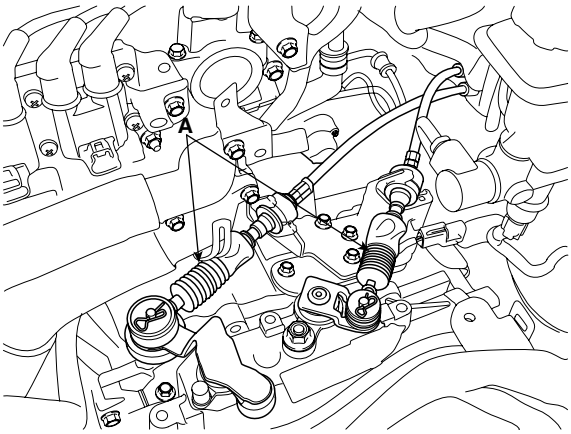
2) Disconnect the neutral switch connector(B).

3) Disconnect the back-up lamp switch connector(C).



ACJF024A

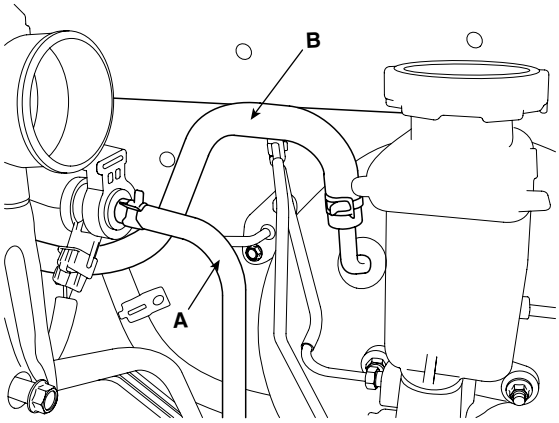
4) Remove the control cable(A).



ACJF025A

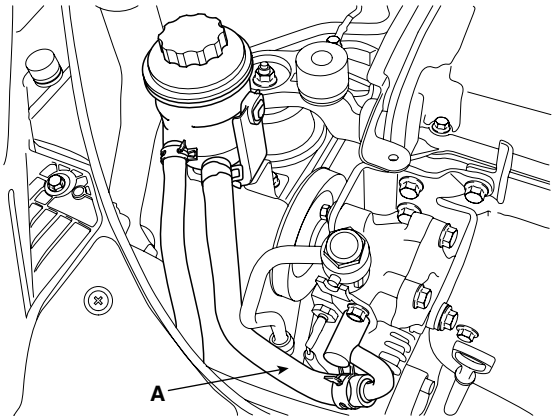
17. Disconnect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.

18. Remove the brake booster vacuum hose(B).



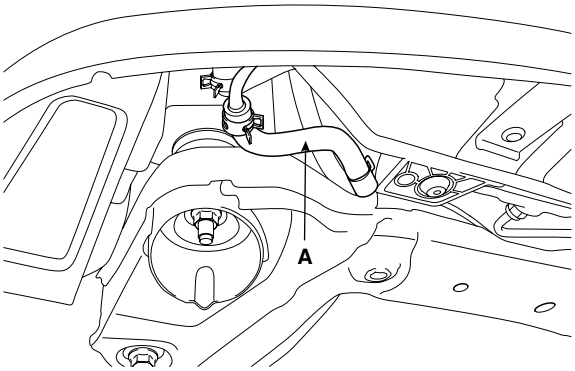
ACJF018A

19. Remove the power steering oil hose(A) and drain the power steering oil.



ACJF026A

20. Remove the power steering return hose(A).

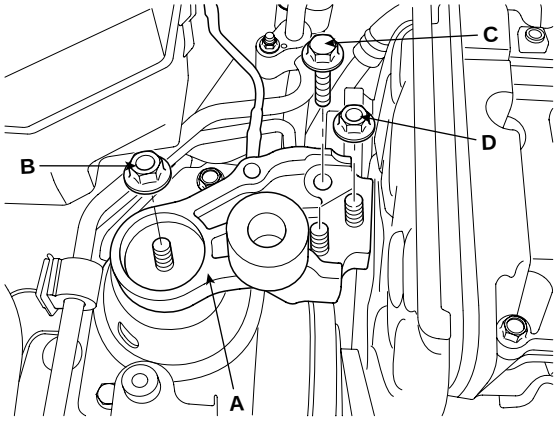


ACJF027A

21. Recovering refrigerant and remove the high & low pressure pipe. (Refer to HA group - air conditioner compressor)

22. Remove the nuts(B,D), bolt(C) and engine mounting support bracket(A).

Tightening torque :
Nut (B) : 68.6 ~ 93.2N.m (7.0~ 9.5kgf.m, 50.6 ~ 68.7lb-ft)
Bolt(C),Nut(D):49.0~63.7N.m(5.0~6.5kgf.m,36.2~47.0lb-ft)

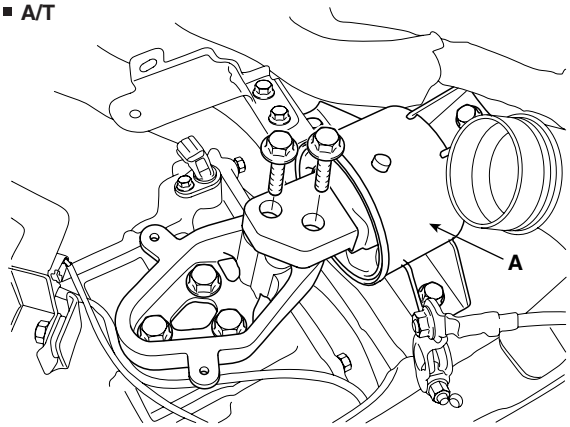


ACJF130A

23. Remove the transaxle mounting bracket(A).

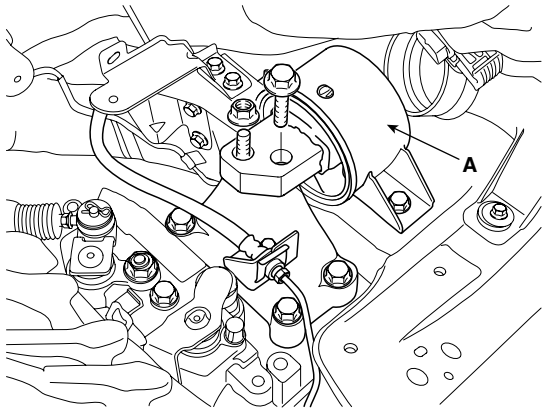
Tightening torque :
Bolt, Nut (B) :
68.6 ~ 93.2N.m (7.0~ 9.5kgf.m, 50.6 ~ 68.7lb-ft)

■ **A/T**



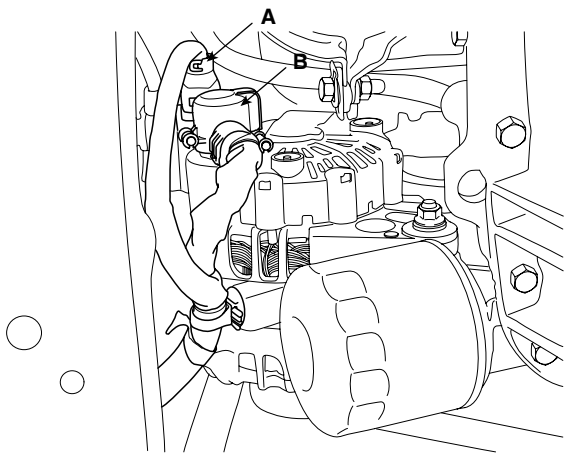
ACJF028A

■ **M/T**



ACJF029A

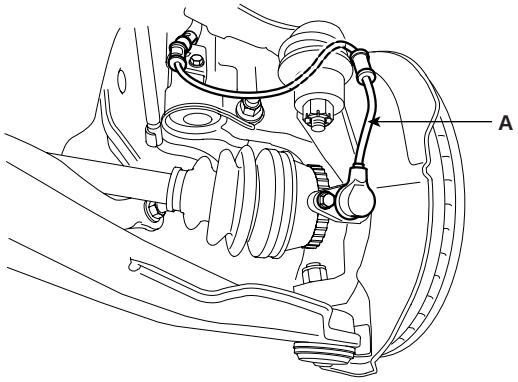
24. Disconnect the alternator connector(A) and "B" terminal (B).



ACJF030A

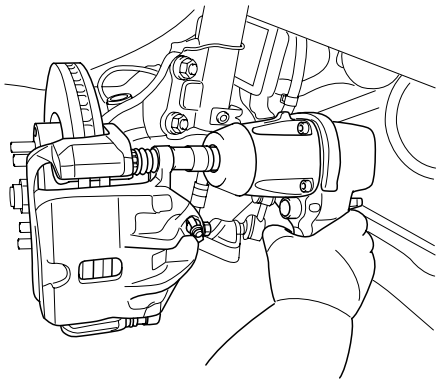
25. Remove the front tires.

26. Remove the ABS wheel speed sensor(A).

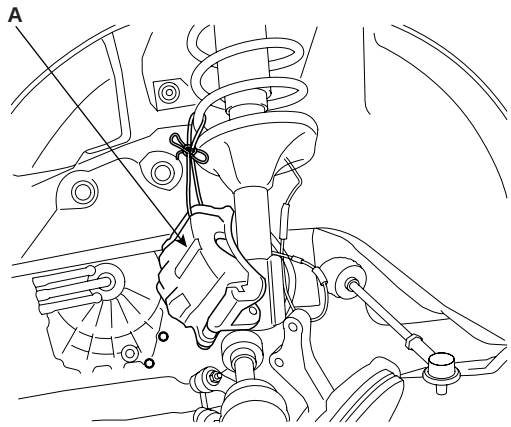


LCGF138A

27. Remove the caliper and hang assembly(A).

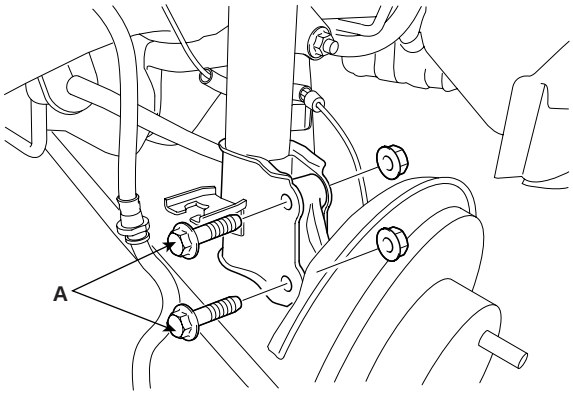


LCGF139A



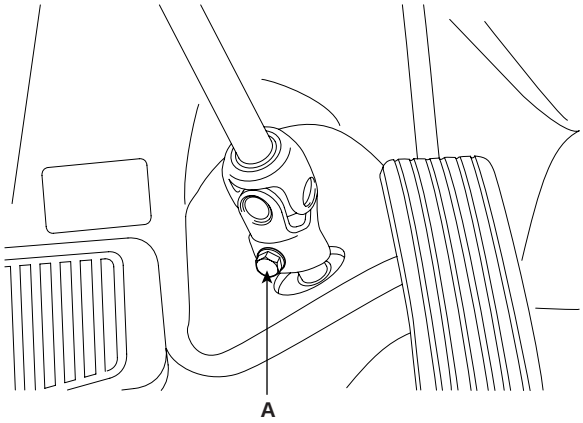
LCGF140A

28. Remove the knuckle mounting bolts(A).



LCGF141A

29. Remove the steering u-joint mounting bolt(A).

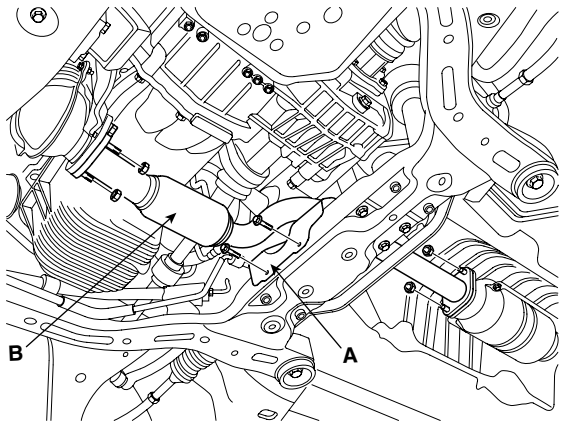


LCGF142A

30. Remove the front muffler heat protector(A).

31. Remove the front muffler(B).

Tightening torque :
29.4 ~ 39.2N.m(3.0 ~ 4.0kgf.m,21.7 ~ 28.9lb-ft)

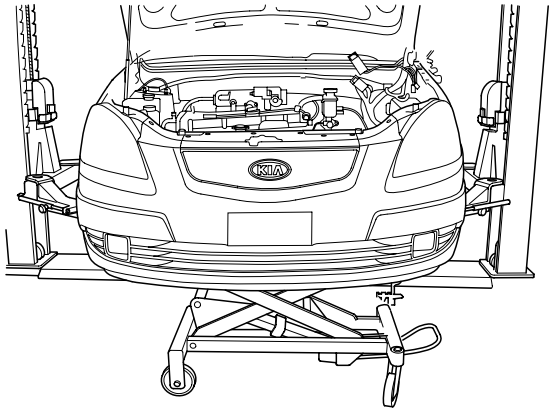


ACJF031A

32. Using a floor jack, support the engine and transaxle assembly.

NOTE

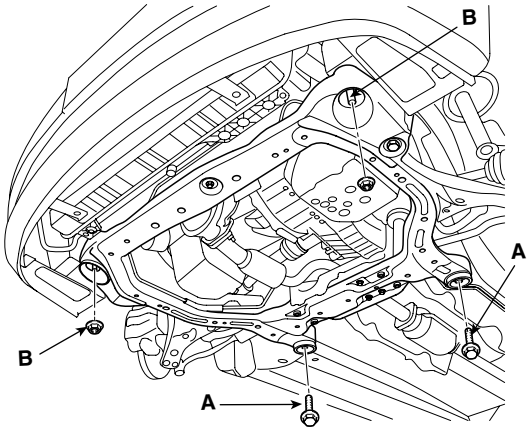
After removing the sub frame mounting bolt , the engine and transaxle assembly may fall downward, and so support them securely with floor jack.
Verify that the hoses and connectors are disconnected before removing the engine and transaxle assembly.



ACJF032A

33. Remove the sub frame bolts and nuts.

Tightening torque :
Bolt(A), Nut(B):
93.2 ~ 117.7N.m (9.5 ~ 12.0kgf.m, 68.7 ~ 86.8lbf.ft)



ACJF033A

34. Remove the engine and transaxle assembly by lifting vehicle.

NOTE

When remove the engine and transaxle assembly, be careful not to damage any surrounding parts or body components.

INSTALLATION EADDB127

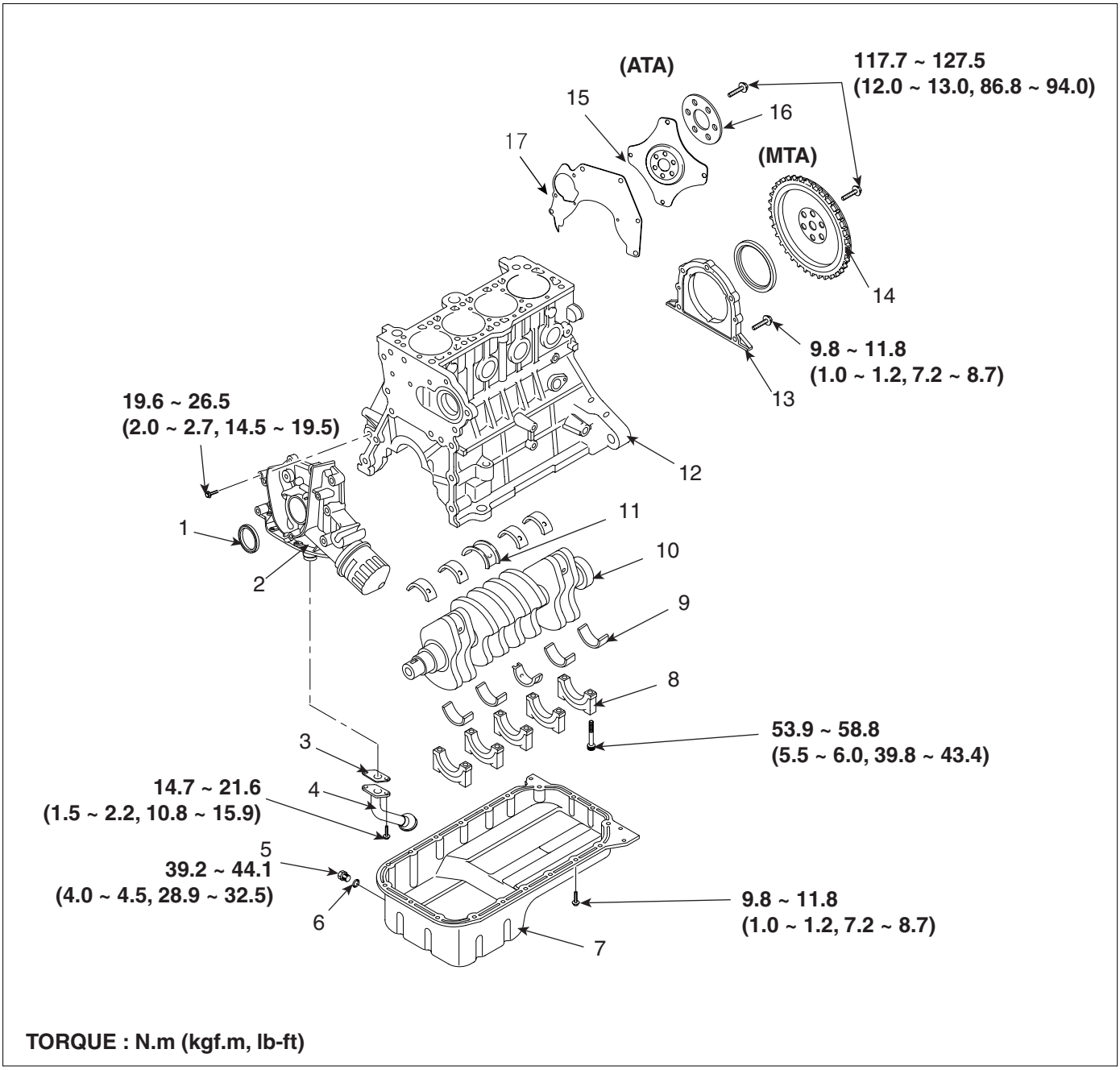
Installation is in the reverse order of removal.
Perform the following :

- 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.
- Place the heater control knob on "HOT" position.
- 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 the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
  - Put the radiator cap on tightly, then run the engine again and check for leaks.

- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
  - After assemble the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
  - Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

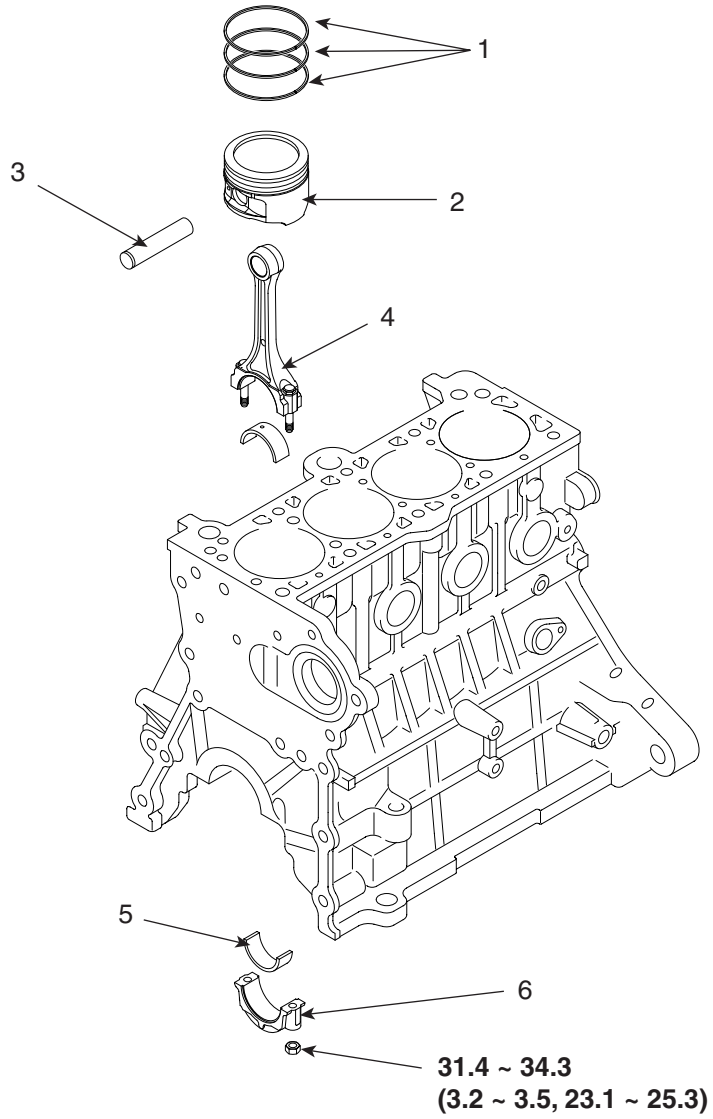
ENGINE BLOCK

COMPONENT ECFECE33



1. Oil seal
2. Front case
3. Gasket
4. Oil screen
5. Drain plug
6. Gasket
7. Oil pan
8. Main bearing cap
9. Main bearing
10. Crankshaft
11. Center bearing
12. Cylinder block
13. Rear oil seal case
14. Flywheel
15. Drive plate
16. Washer
17. Rear plate

LCJF008A



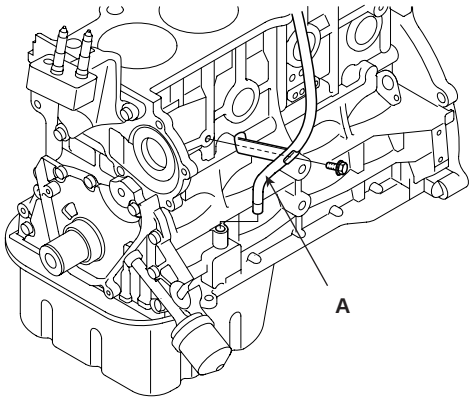
TORQUE : N.m (kgf.m, lb-ft)

1. Piston ring
2. Piston
3. Piston pin
4. Connecting rod
5. Connecting rod bearing
6. Connecting rod bearing cap

LCJF009A

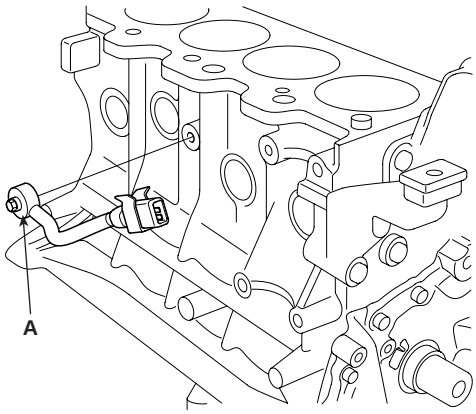
DISASSEMBLY EFDA87C3

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 belt. (Refer to EM - 22)
5. Remove the cylinder head. (Refer to EM - 38)
6. Remove the oil level gauge tube(A).



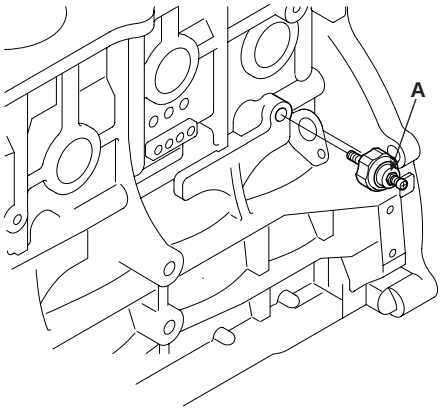
ECKD301A

7. Remove the knock sensor(A).



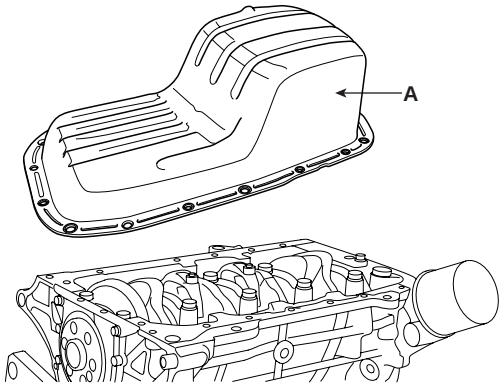
ECKD302A

8. Remove the oil pressure switch(A).



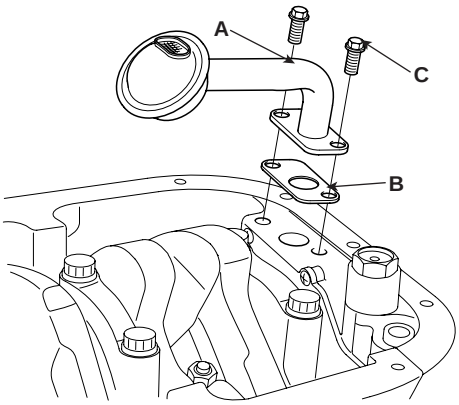
ECKD303A

9. Remove the water pump. (Refer to EM - 96)
10. Remove the oil pan(A).



ACJF131A

11. Remove the oil screen.
    Remove the 2bolts(C), oil screen(A) and gasket(B).



EDKD143A

12. Check the connecting rod end play. (Refer to EM - 75)

13. Remove the connecting rod caps and check oil clearance. (Refer to EM - 75)

14. Remove the piston and connecting rod assemblies.

    1) Using a ridge reamer, remove all the carbon from the top of the cylinder.

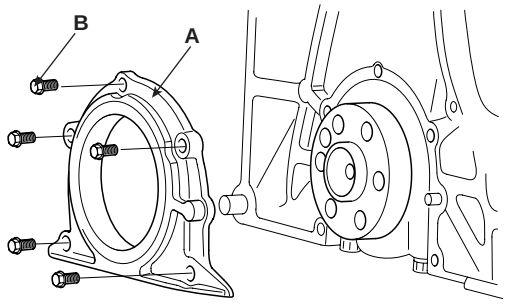
    2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

NOTE

- *Keep the bearings, connecting rod and cap together.*
- *Arrange the piston and connecting rod assemblies in the correct order.*

15. Remove the front case. (Refer to EM - 110)

16. Remove the rear oil seal case.
    Remove the 5bolts(B) and rear oil seal case(A).



EDKD144A

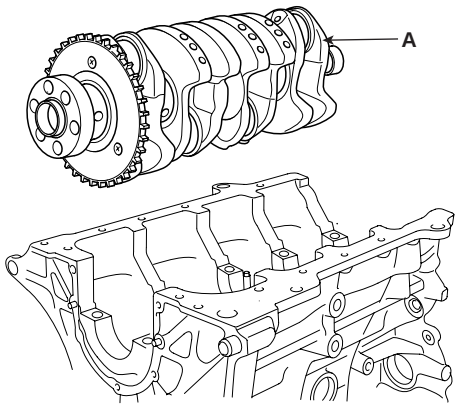
17. Remove the crankshaft bearing cap and check oil clearance. (Refer to EM - 77)

18. Check the crankshaft end play. (Refer to EM - 79)

19. 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.



ECKD307A

20. 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.

21. Remove the piston rings.

    1) Using a piston ring expender, 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.

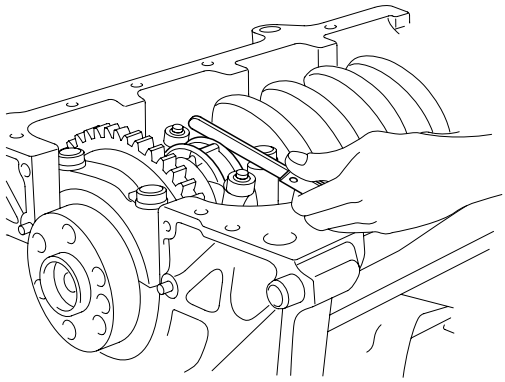
22. Remove the connecting rod from the piston.
    Using a press, remove the piston pin from piston.
    (Press-in load : 500 ~ 1,500kg(1,102 ~ 3,306lb))

INSPECTION E762AAE1

CONNECTING ROD AND CRANKSHAFT

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 : 0.4mm (0.0157in)



EDKD145A

- If out-of-tolerance, install a new connecting rod.
- 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 nuts.
   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 nuts.

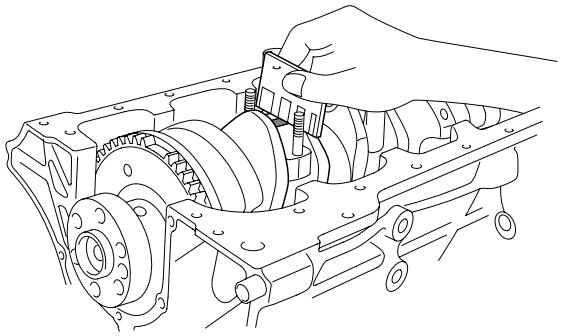
Tightening torque :
31.4 ~ 34.3N.m (3.2 ~ 3.5kgf.m, 23.1 ~ 25.3lb-ft)

NOTE

Do not turn the crankshaft.

   7) Remove the 2nuts, connecting rod cap and lower bearing .
   8) Measure the plastigage at its widest point.

Standard oil clearance
0.018 ~ 0.036mm (0.0007 ~ 0.0014in)



ECKD309A

   9) 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 EM - 77, connecting rod bearing selection table)
      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. (Refer to EM - 77, connecting rod bearing selection table)
       Recheck the oil clearance.

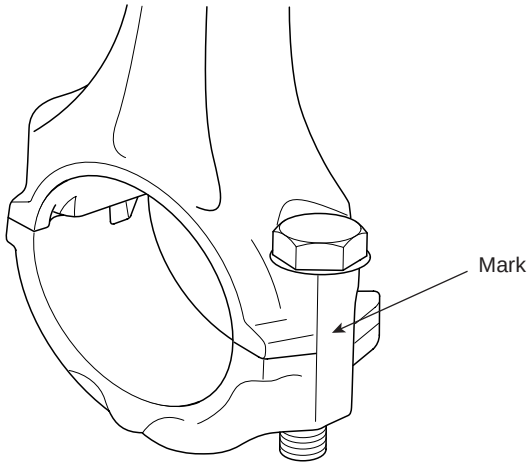
NOTE

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.

CONNECTING ROD MARK LOCATION

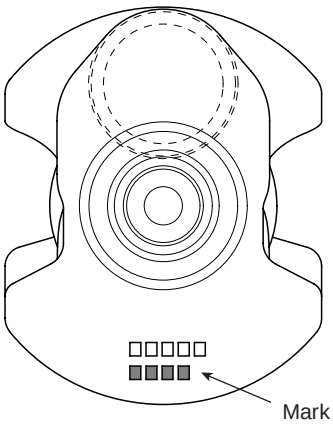


EDKD146A

DISCRIMINATION OF CONNECTING ROD

Mark	Connecting rod big-end inner diameter
^	48.000 ~ 48.006mm (1.8898 ~ 1.8900in)
b	48.006 ~ 48.012mm (1.8900 ~ 1.8902in)
c	48.012 ~ 48.018mm (1.8902 ~ 1.8905in)

CRANKSHAFT PIN JOURNAL MARK LOCATION

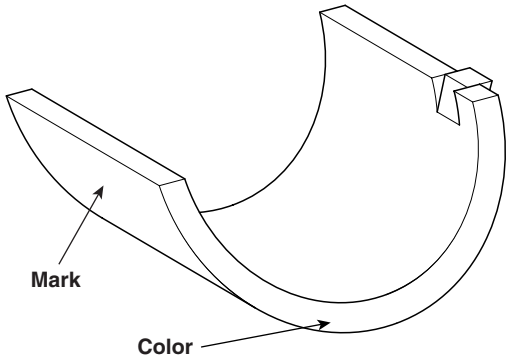


LCGE007A

DISCRIMINATION OF CRANKSHAFT PIN JOURNAL

Mark	Crankshaft pin journal outer diameter
^	44.966 ~ 44.972mm (1.7703 ~ 1.7705in)
b	44.960 ~ 44.966mm (1.7701 ~ 1.7703in)
c	44.954 ~ 44.960mm (1.7698 ~ 1.7701in)

CONNECTING ROD BEARING MARK LOCATION



ECKD313A

DISCRIMINATION OF CONNECTING ROD BEARING

Mark	Color	Connecting rod bearing thickness
AA	Blue	1.514 ~ 1.517mm (0.0596 ~ 0.0597in)
A	Black	1.511 ~ 1.514mm (0.0595 ~ 0.0596in)
B	None	1.508 ~ 1.511mm (0.0594 ~ 0.0595in)
C	Green	1.505 ~ 1.508mm (0.0593 ~ 0.0594in)
D	Yellow	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

11) Select the bearing by using selection table.

CONNECTING ROD BEARING SELECTION TABLE

		Connecting rod mark		
		^	b	c
Crank shaft pin journal mark	^	D (Yellow)	C (Green)	B (None)
	b	C (Green)	B (None)	A (Black)
	c	B (None)	A (Black)	AA (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

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.

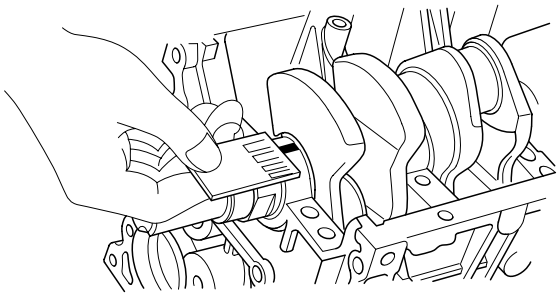
Tightening torque :
53.9 ~ 58.8N.m(5.5 ~ 6.0kgf.m, 39.8 ~ 43.4lb-ft)

NOTE

Do not turn the crankshaft.

5) Remove the cap and lower bearing again, and measure the widest part of the plastigage.

Standard oil clearance :
No.1, 2, 4, 5 : 0.022 ~ 0.040mm (0.0009 ~ 0.0016in)



ECKD001I

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 EM - 79, crankshaft main bearing selection table)
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 EM - 79, crankshaft main bearing selection table)
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.

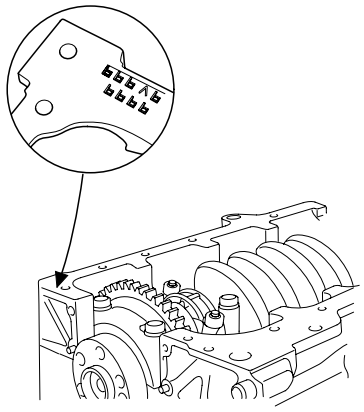
CAUTION

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 end 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.

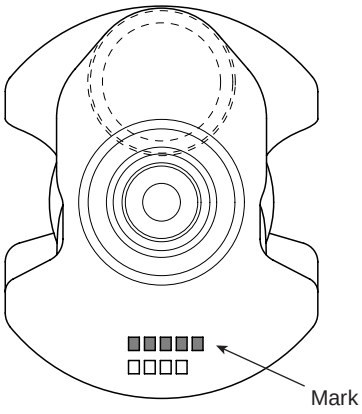


EDKD147A

DISCRIMINATION OF CYLINDER BLOCK CRANKSHAFT JOURNAL BORE

Mark	Cylinder block crankshaft journal bore inner diameter
^	54.000 ~ 54.006mm (2.1260 ~ 2.1262in)
b	54.006 ~ 54.012mm (2.1262 ~ 2.1265in)
c	54.012 ~ 54.018mm (2.1265 ~ 2.1267in)

CRANKSHAFT MAIN JOURNAL MARK LOCATION

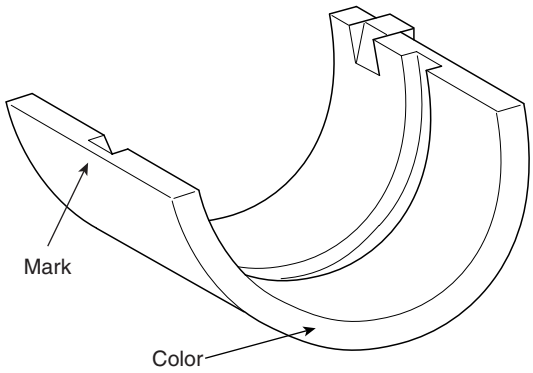


LCGE009A

DISCRIMINATION OF CRANKSHAFT MAIN JOURNAL

Mark	Crankshaft main journal outer diameter
^	49.962 ~ 49.968mm (1.9670 ~ 1.9672in)
b	49.956 ~ 49.962mm (1.9668 ~ 1.9670in)
c	49.950 ~ 49.956mm (1.9665 ~ 1.9668in)

CRANKSHAFT MAIN BEARING MARK LOCATION



ECKD316A

DISCRIMINATION OF CRANKSHAFT MAIN BEARING

Mark	Color	Crankshaft main bearing thickness	
		No.1, 2, 4, 5	No. 3
AA	Blue	2.014 ~ 2.017 (0.0793 ~ 0.0794)	2.011 ~ 2.014 (0.0792 ~ 0.0793)
A	Black	2.011 ~ 2.014 (0.0792 ~ 0.0793)	2.008 ~ 2.011 (0.0791 ~ 0.0792)
B	None	2.008 ~ 2.011 (0.0791 ~ 0.0792)	2.005 ~ 2.008 (0.0789 ~ 0.0791)
C	Green	2.005 ~ 2.008 (0.0789 ~ 0.0791)	2.002 ~ 2.005 (0.0788 ~ 0.0789)
D	Yel-low	2.002 ~ 2.005 (0.0788 ~ 0.0789)	1.999 ~ 2.002 (0.0787 ~ 0.0788)

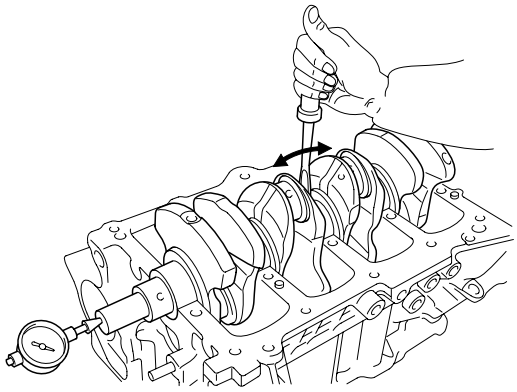
8) Select the bearing by using selection table.

CRANKSHAFT MAIN BEARING SELECTION TABLE

		Cylinder block crankshaft journal bore mark		
		^	b	c
Crank shaft main journal mark	^	D (Yellow)	C (Green)	B (None)
	b	C (Green)	B (None)	A (Black)
	c	B (None)	A (Black)	AA (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 ~ 0.175mm (0.0020 ~ 0.0069in)
Limit : 0.20mm (0.0079in)

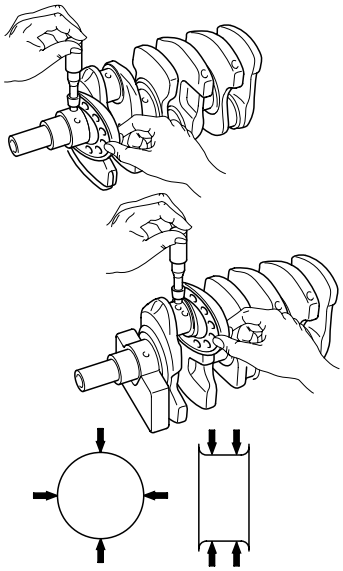


ECKD001B

If the end play is greater than maximum, replace the center bearing.

6. Inspect the crankshaft main journals and pin journals.
Using a micrometer, measure the diameter of each main journal and pin journal.

Main journal diameter :
49.950 ~ 49.968mm (1.9665 ~ 1.9672in)
Pin journal diameter :
44.954 ~ 44.972mm (1.7698 ~ 1.7705in)



ECKD001E

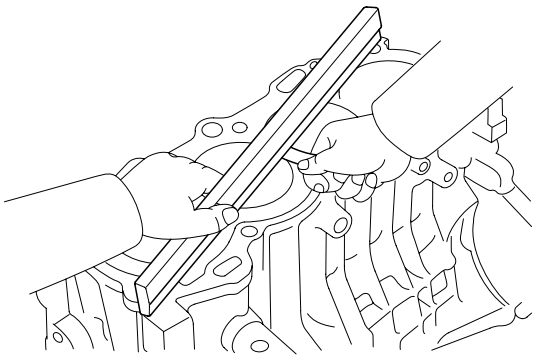
CYLINDER BLOCK

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)

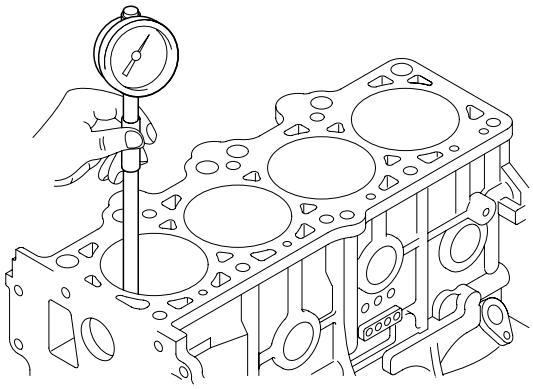


ECKD001L

4. Inspect the cylinder bore.
   Visually check the cylinder for vertical scratchs.
   If deep scratchs are present, replace the cylinder block.

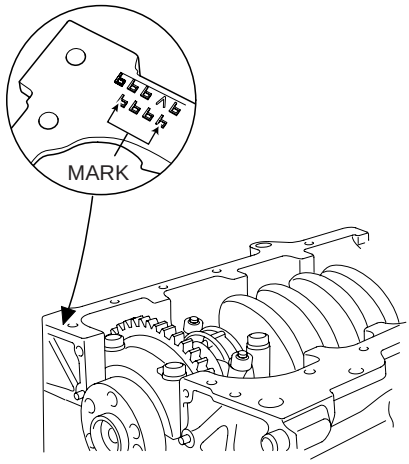
5. Inspect the cylinder bore diameter.
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial direction.

Standard diameter : 1.6 CVVT : 76.50 ~ 76.53mm (3.0118 ~ 3.0130in) 1.4 DOHC : 75.50 ~ 75.53mm (2.9724 ~ 2.9736in)



ECKD318A

6. Check the cylinder bore size code on the cylinder block bottom face.



LCGE010A

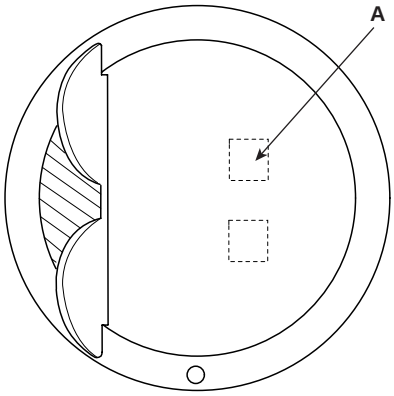
DISCRIMINATION OF CYLINDER BORE SIZE (1.6 CVVT)

Mark	Cylinder bore inner diameter
A	76.50 ~ 76.51mm (3.0118 ~ 3.0122in)
B	76.51 ~ 76.52mm (3.0122 ~ 3.0126in)
C	76.52 ~ 76.53mm (3.0126 ~ 3.0130in)

DISCRIMINATION OF CYLINDER BORE SIZE (1.4 DOHC)

Mark	Cylinder bore inner diameter
A	75.50 ~ 75.51mm (2.9724 ~ 2.9728in)
B	75.51 ~ 75.52mm (2.9728 ~ 2.9732in)
C	75.52 ~ 75.53mm (2.9732 ~ 2.9736in)

7. Check the piston size mark(A) on the piston top face.



ADGE079A

DISCRIMINATION OF PISTON OUTER DIAMETER (1.6 CVVT)

Mark	Piston outer diameter
A	76.47 ~ 76.48mm (3.0106 ~ 3.0110in)
B	76.48 ~ 76.49mm (3.0110 ~ 3.0114in)
C	76.49 ~ 76.50mm (3.0114 ~ 3.0118in)

DISCRIMINATION OF PISTON OUTER DIAMETER (1.4 DOHC)

Mark	Piston outer diameter
A	75.47 ~ 75.48mm (2.9713 ~ 2.9716in)
B	75.48 ~ 75.49mm (2.9716 ~ 2.9720in)
C	75.49 ~ 75.50mm (2.9720 ~ 2.9724in)

8. Select the piston related to cylinder bore class.

Piston -to-cylinder clearance :
0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

BORING CYLINDER

1. Oversize pistons should be selected according to the largest bore cylinder.

   NOTE

   The size of piston is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.

3. According to the measured O.D(Outer Diameter), calculate the new bore size.

New bore size = piston O.D + 0.02 to 0.04mm (0.0008 to 0.0016in) (clearance between piston and cylinder) - 0.01mm (0.0004in) (honing margin.)

4. Bore each of the cylinders to the calculated size.

   CAUTION

   To prevent distortion that may result from temperature rise during honing, bore the cylinder holes in the firing order.

5. Hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).

6. Check the clearance between the piston and cylinder.

Standard : 0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

   NOTE

   When boring the cylinders, finish all of the cylinders to the same oversize. Do not bore only one cylinder to the oversize.
   (1.4 DOHC :Useable over size - 0.25, 0.50 O/S
   1.6 CVVT : Don't use over size)

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.

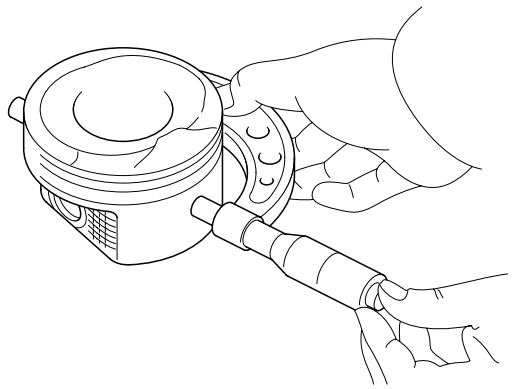
   3) Using solvent and a brush, thoroughly clean the piston.

   NOTE

   Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 39.87mm(1.5697in)(1.4 DOHC), 39.15mm(1.5413in)(1.6 CVVT) from top land of the piston.

Standard diameter :
1.6 CVVT : 76.47 ~ 76.50mm (3.0106 ~ 3.0118in)
1.4 DOHC : 75.47 ~ 75.50mm (2.9713 ~ 2.9724in)



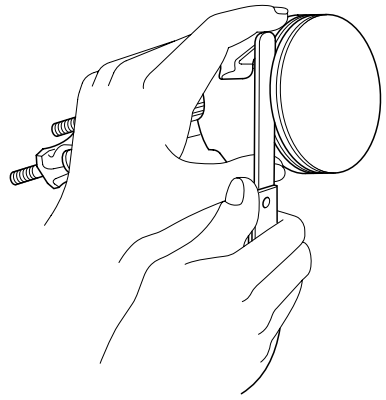
ECKD001D

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 : 0.04 ~ 0.085mm (0.0016 ~ 0.0033in)
No.2 ring : 0.04 ~ 0.085mm (0.0016 ~ 0.0033in)
Oil ring : 0.08 ~ 0.175mm (0.0031 ~ 0.0069in)
Limit
No.1 ring : 0.1mm (0.0039in)
No.2 ring : 0.1mm (0.0039in)



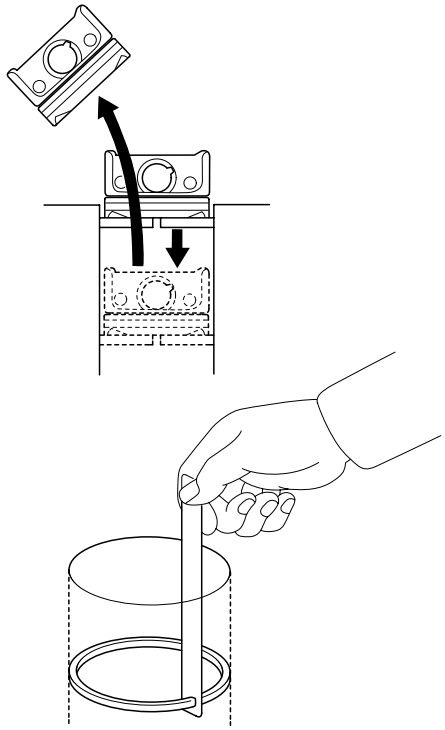
ECKD001G

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. (Refer to EM - 82)

Piston ring end gap (1.6 CVVT)
Standard
No.1 ring : 0.15 ~ 0.30mm (0.0059 ~ 0.0118in)
No.2 ring : 0.35 ~ 0.50mm (0.0138 ~ 0.0197in)
Oil ring : 0.20 ~ 0.70mm(0.0079 ~ 0.0276in)
Limit
No.1, 2, oil ring : 1.0mm(0.0394in)

Piston ring end gap (1.4 DOHC)
Standard
No.1 ring : 0.20 ~ 0.35mm (0.0079 ~ 0.0138in)
No.2 ring : 0.37 ~ 0.52mm (0.0146 ~ 0.0205in)
Oil ring : 0.20 ~ 0.70mm(0.0079 ~ 0.0276in)
Limit
No.1, 2, oil ring : 1.0mm(0.0394in)

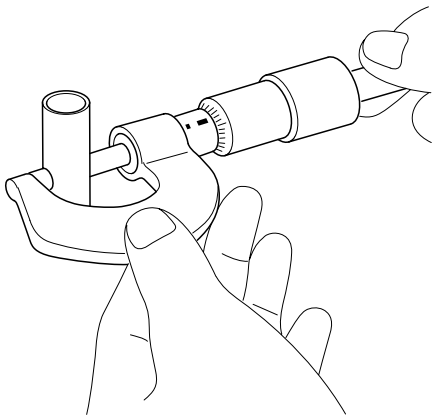


ACJF112A

PISTON PINS

1. Measure the outer diameter of piston pin

Piston pin diameter :
18.001 ~ 18.007mm (0.7087 ~ 0.7089in)



ECKD001Z

2. Measure the piston pin-to-piston clearance.

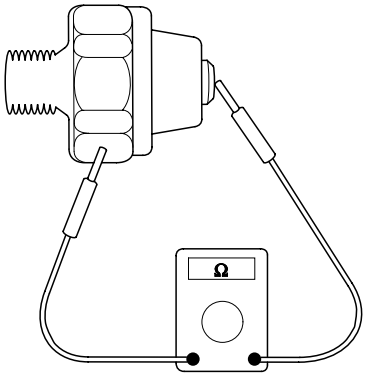
Piston pin-to-piston clearance :
0.011 ~ 0.018mm (0.0004 ~ 0.0007in)

3. Check the difference between the piston pin outer diameter and the connecting rod small end inner diameter.

Piston pin-to-connecting rod interference :
-0.033 ~ -0.016mm (-0.0013 ~ -0.0006in)

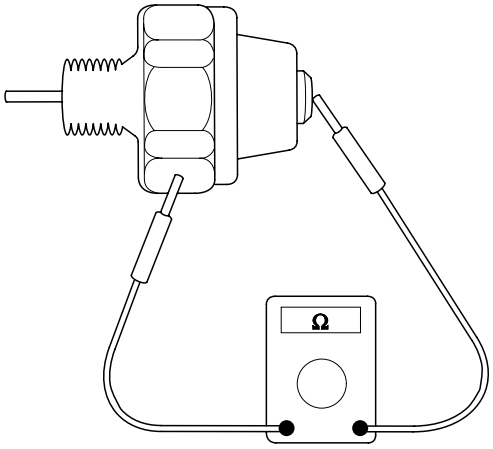
OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter. If there is no continuity, replace the oil pressure switch.



ECKD001W

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.



ECKD001Y

3. If there is no continuity when a 49.0kpa (0.5kg/cm², 7.1psi) vacuum 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 EB510CA0

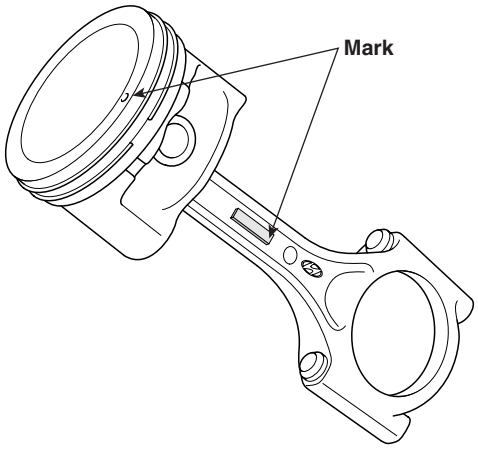
NOTE

- *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 belt side of the engine.



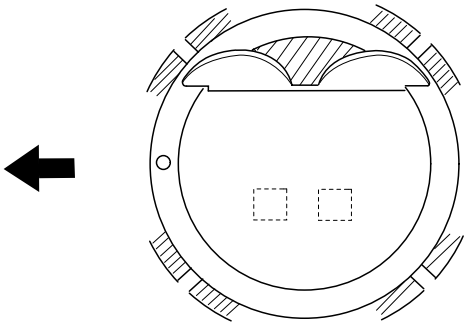
ECKD320A

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.

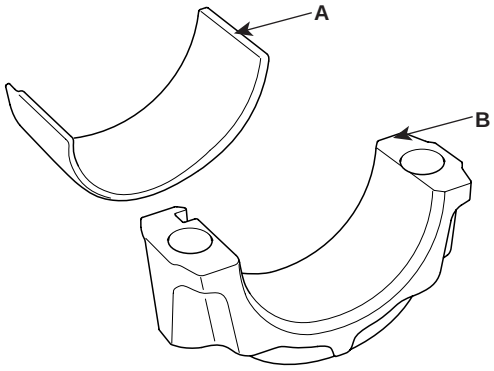


ADGE080A

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).



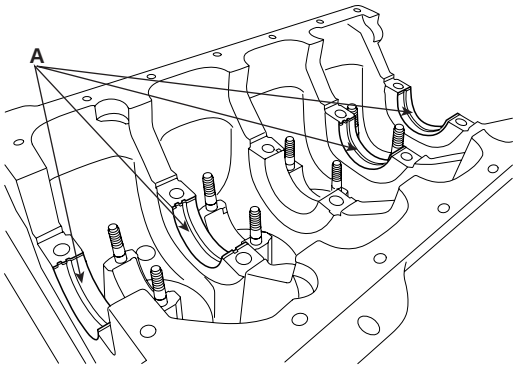
ECKD322A

4. Install the crankshaft main bearings.

NOTE

Upper bearings have an oil groove of oil holes ; Lower bearings do not.

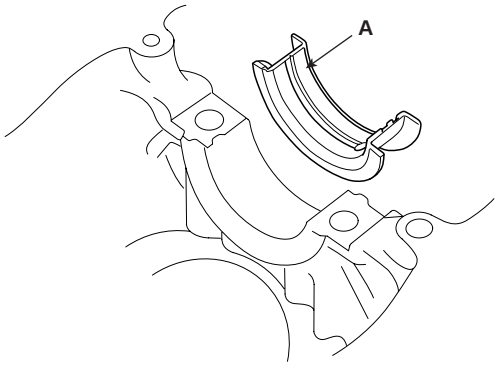
1) Align the bearing claw with the claw groove of the cylinder block, push in the 4 upper bearings(A).



EDKD149A

2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

5. Install the center bearing.
Install the center bearing(A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.



EDKD150A

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.

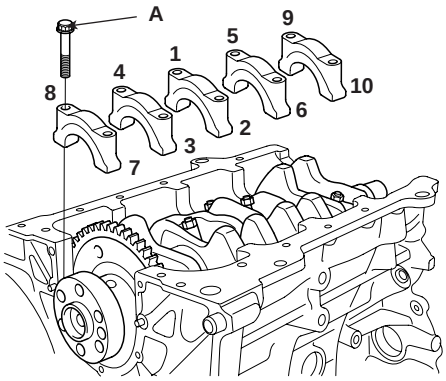
NOTE

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(A),in several passes, in the sequence shown.

Tightening torque :
53.9 ~ 58.8N.m (5.5 ~ 6.0kgf.m, 39.8 ~ 43.4lb-ft)



ADGE063A

3) Check that the crankshaft turns smoothly.

9. Check the crankshaft end play. (Refer to EM - 79)

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) Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts

2) 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.

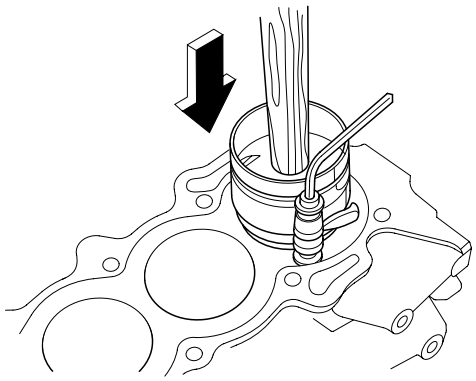
3) Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.

4) Apply engine oil to the bolt threads. install the rod caps with bearings, and tighten the nuts.

Tightening torque :
31.4 ~ 34.3N.m (3.2 ~ 3.5kgf.m, 23.1 ~ 25.3lb-ft)

NOTE

Maintain downward force on the ring compressor to prevent the rings from expending before entering the cylinder bore.



ECKD001F

11. Install the rear oil seal case.

1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

NOTE

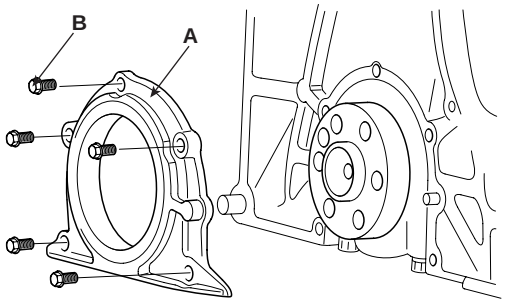
Check that the mating surfaces are clean and dry before applying liquid gasket.

2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.

Liquid gasket : MS 721-40A or equivalent

3) Install the rear oil seal case(A) with 5 bolts(B).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

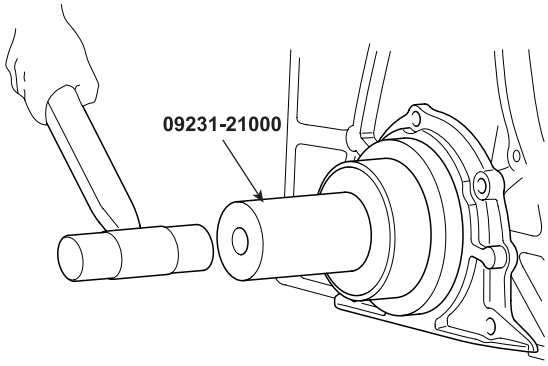


EDKD144A

12. Install the rear oil seal.

1) Apply engine oil to a new oil seal lip.

2) Using the SST(09231-21000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

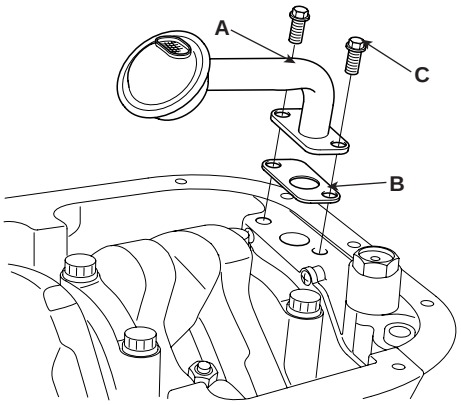


ACJF113A

13. Install the front case. (Refer to EM - 113)

14. Install the oil screen.
    Install a new gasket(B) and oil screen(A) with 2 bolts(C).

Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



EDKD143A

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 as an even bead, centered between the edges of the mating surface.

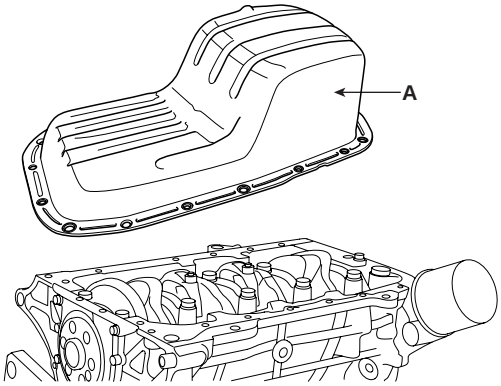
Liquid gasket : MS 721-40A or equivalent

NOTE

- *To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.*
- *D 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)



ACJF131A

16. Install the water pump. (Refer to EM - 101)

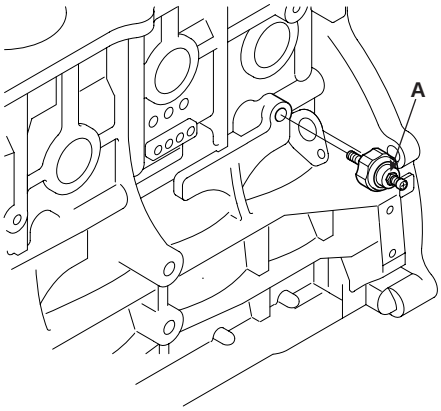
17. Install the oil pressure switch.

    1) Apply adhesive to 2 or 3 threads.

Adhesive : MS 721-39(B) or equivalent.

    2) Install the oil pressure switch(A).

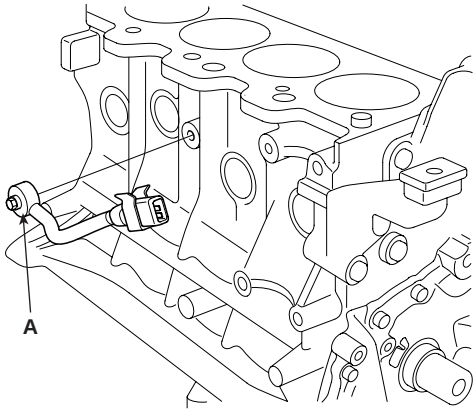
Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



ECKD303A

18. Install the knock sensor(A).

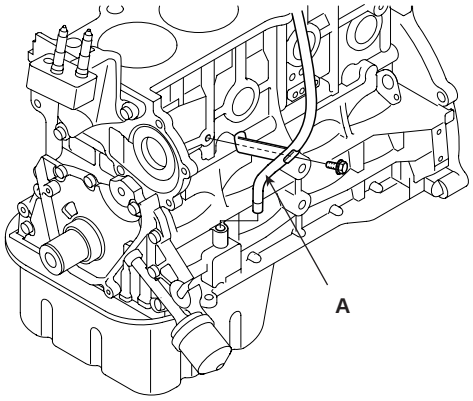
Tightening torque :
16.7 ~ 26.5N.m (1.7 ~ 2.7kgf.m, 12.3 ~ 19.5lb-ft)



ECKD302A

19. Install the oil level gauge tube(A).
    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(A) with the bolt.

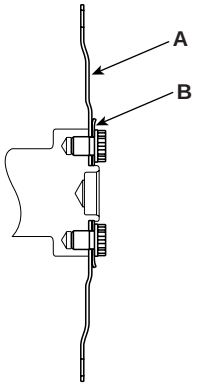
Tightening torque :
11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lb-ft)



ECKD301A

20. Install the cylinder head. (Refer to EM - 54)
21. Install the timing belt. (Refer to EM - 28)
22. Remove the engine stand.
23. A/T :install the drive plate.

Tightening torque :
117.7 ~ 127.5N.m (12.0 ~ 13.0kgf.m, 86.8 ~ 94.0lb-ft)



ACGE018A

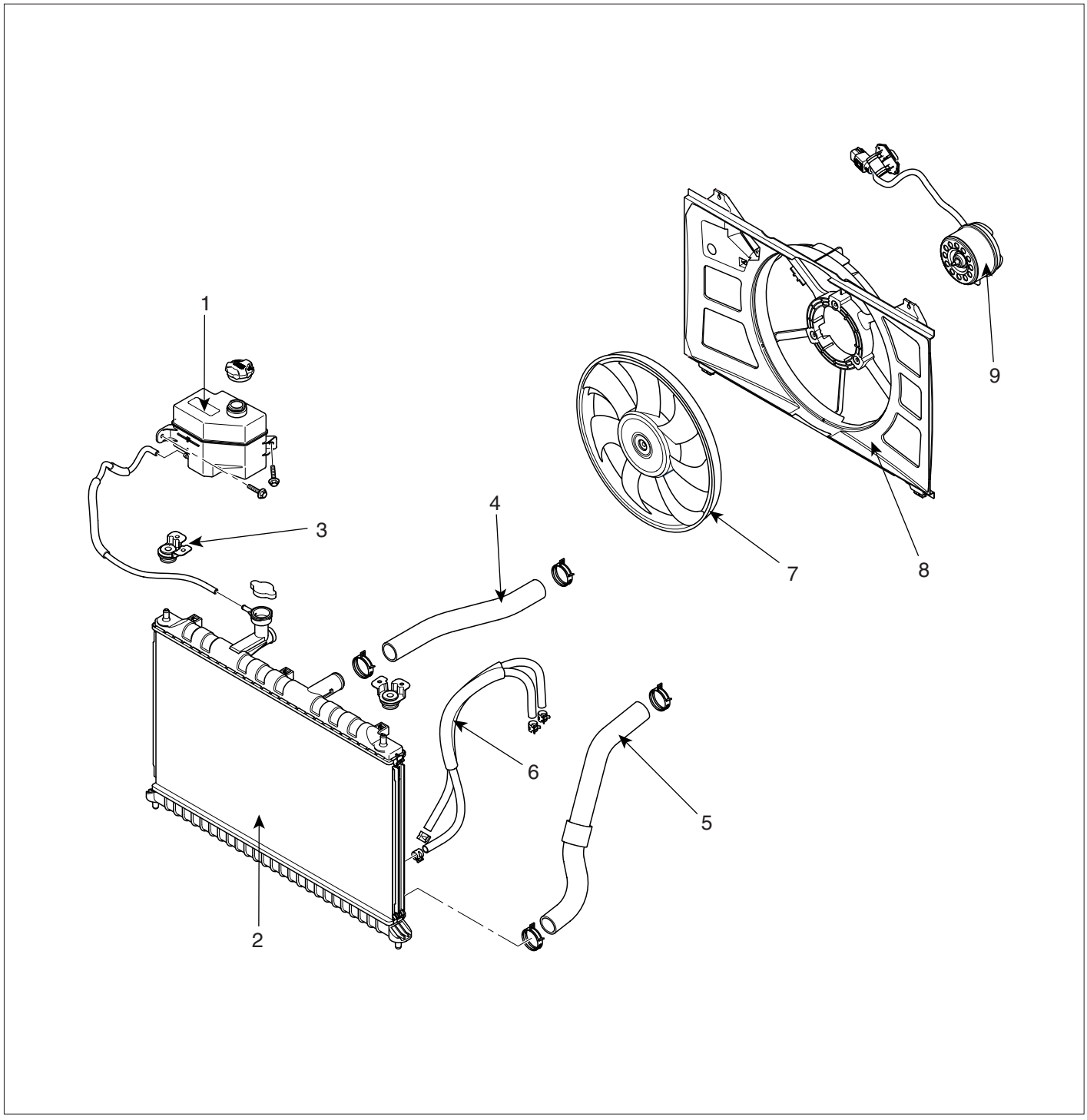
24. M/T :install the fly wheel.

Tightening torque :
117.7 ~ 127.5N.m (12.0 ~ 13.0kgf.m, 86.8 ~ 94.0lb-ft)

COOLING SYSTEM

COMPONENT EEB42400

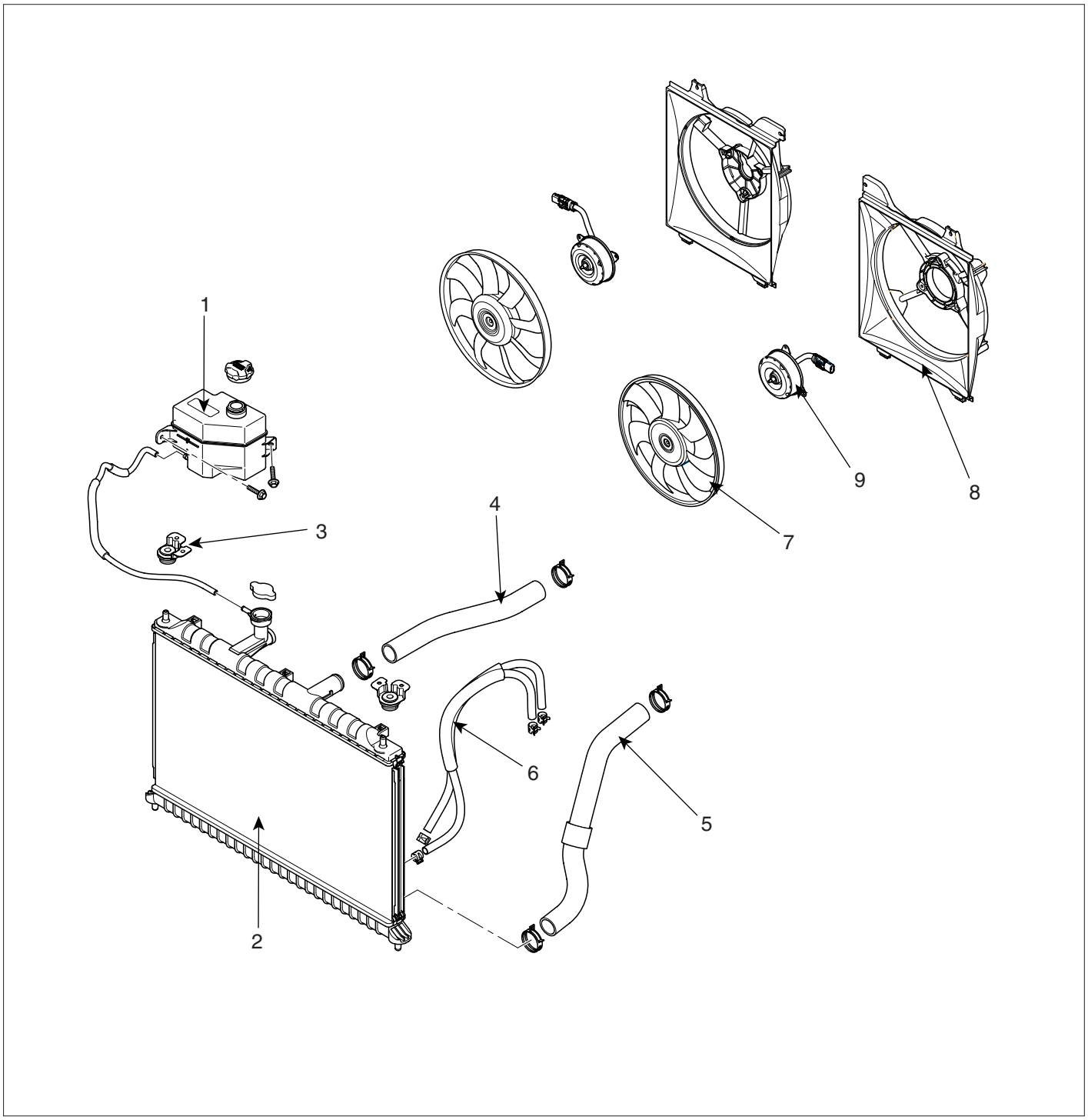
1 FAN TYPE



1. Coolant reservoir tank
2. Radiator
3. Radiator mounting bracket
4. Radiator upper hose
5. Radiator lower hose
6. ATF oil cooler hose
7. Cooling fan
8. Cooling fan shroud
9. Cooling fan motor

LCJF010A

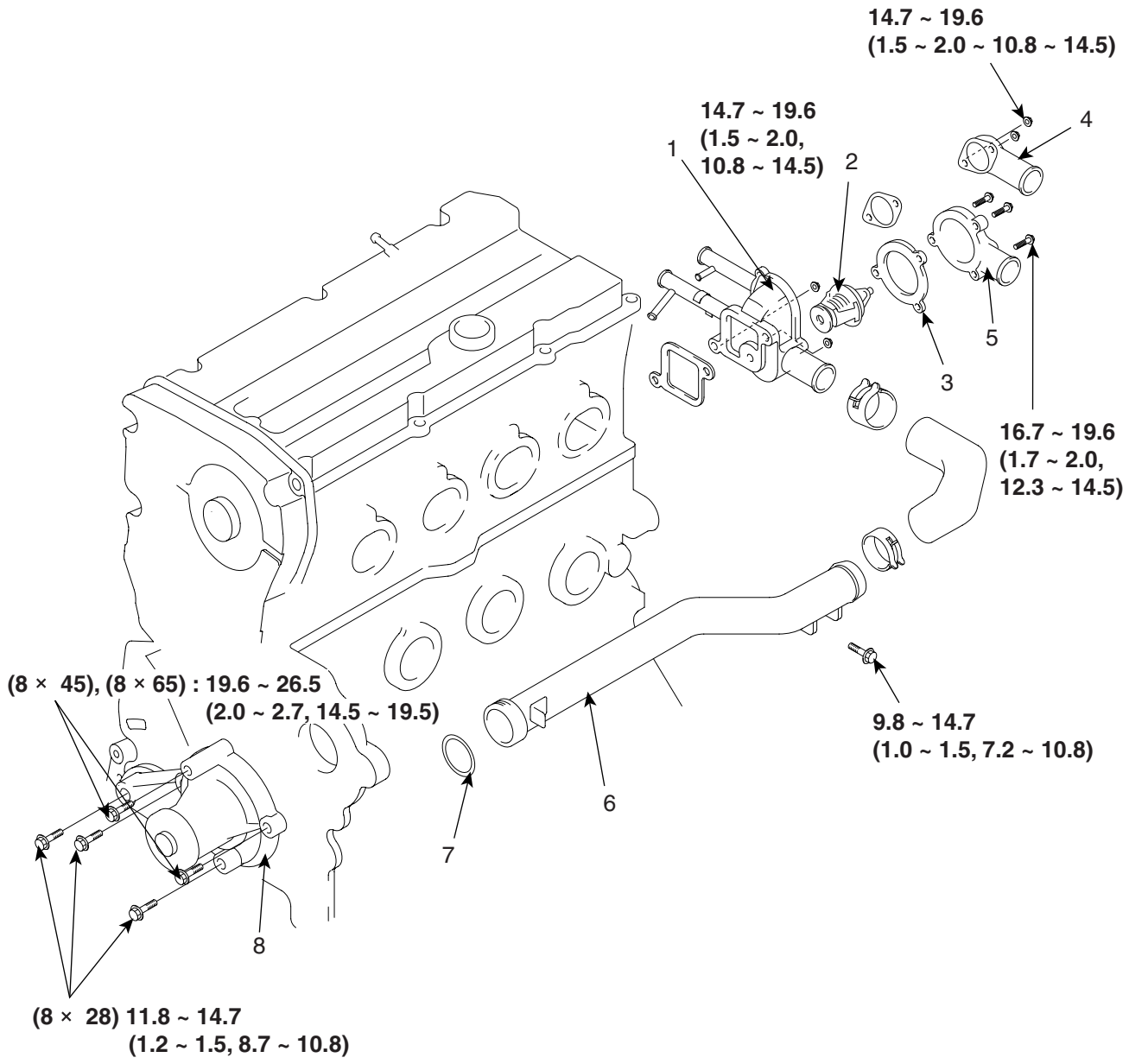
2 FAN TYPE



1. Coolant reservoir tank
2. Radiator
3. Radiator mounting bracket
4. Radiator upper hose
5. Radiator lower hose
6. ATF oil cooler hose
7. Cooling fan
8. Cooling fan shroud
9. Cooling fan motor

LCJF076A

▪ **1.6 CVVT**

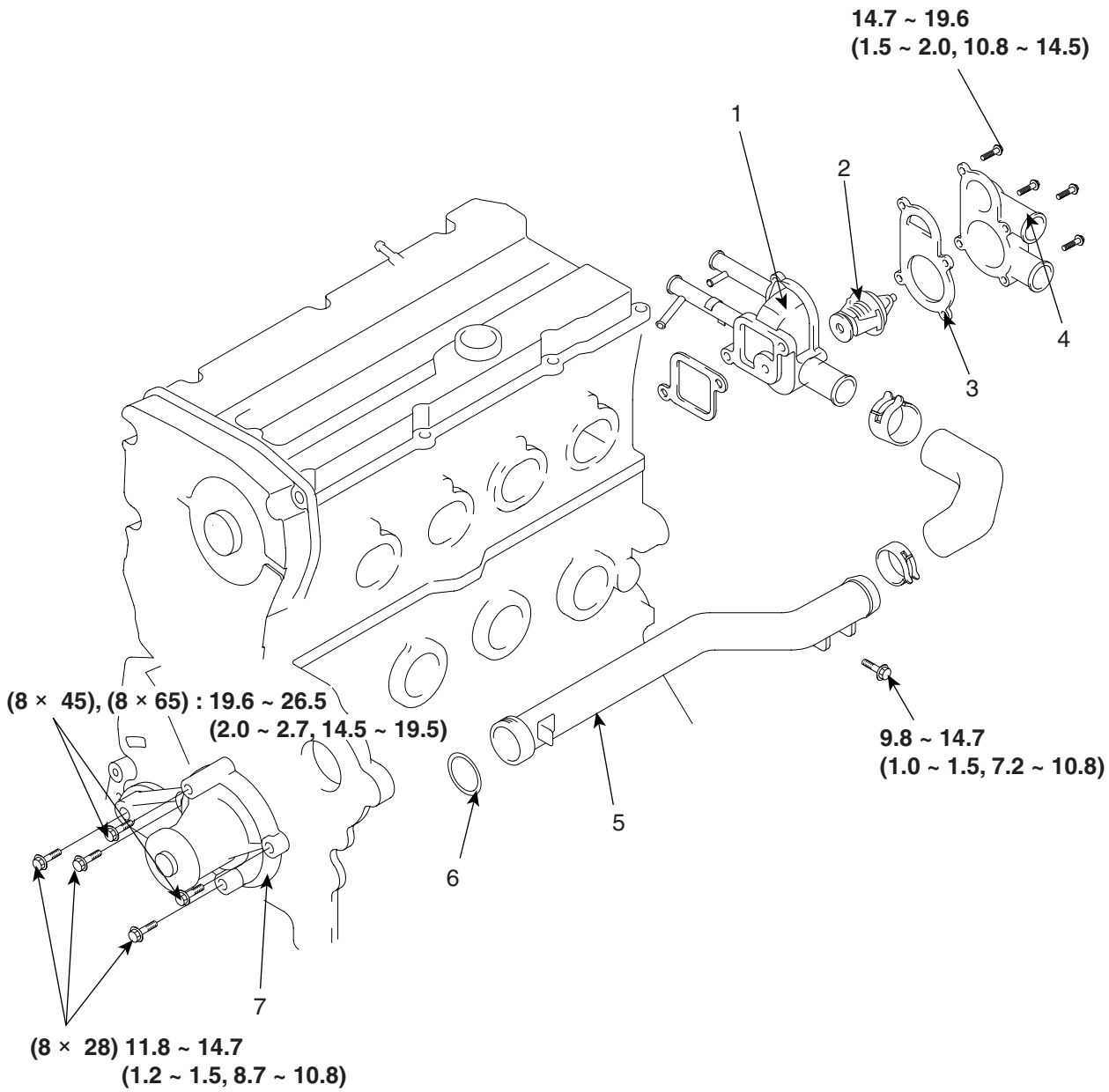


TORQUE : N.m (kgf.m, lb-ft)

1. Thermostat housing
2. Thermostat
3. Gasket
4. Water inlet fitting
5. Water outlet fitting
6. Water inlet pipe
7. O-ring
8. Water pump

LCJF011A

▪ **1.4 DOHC**



TORQUE : N.m (kgf.m, lb-ft)

1. Thermostat housing
2. Thermostat
3. Gasket
4. Water inlet fitting
5. Water inlet pipe
6. O-ring
7. Water pump

LCJF012A

ENGINE COOLANT REFILLING AND BLEEDING E8D464DF

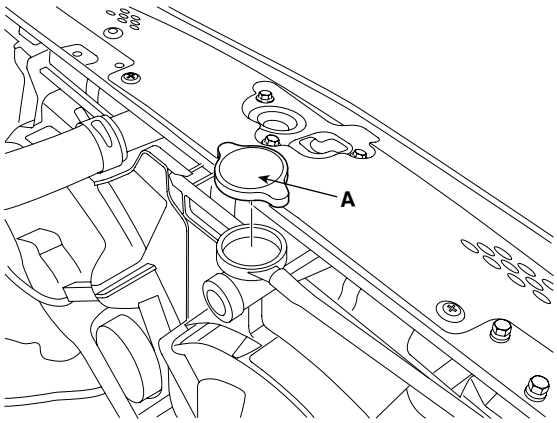
WARNING

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

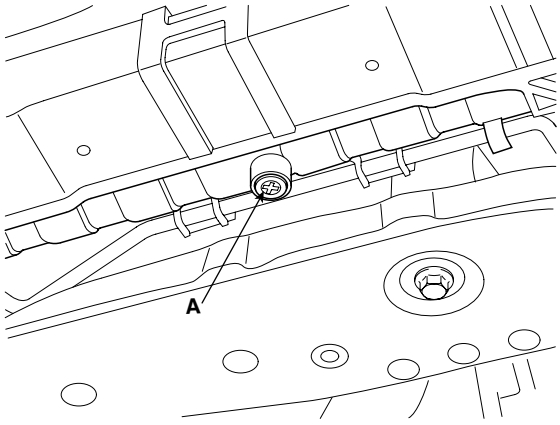
When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts of the paint. If any coolant spills, rinse it off immediately.

1. Slide the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove the radiator cap(A).



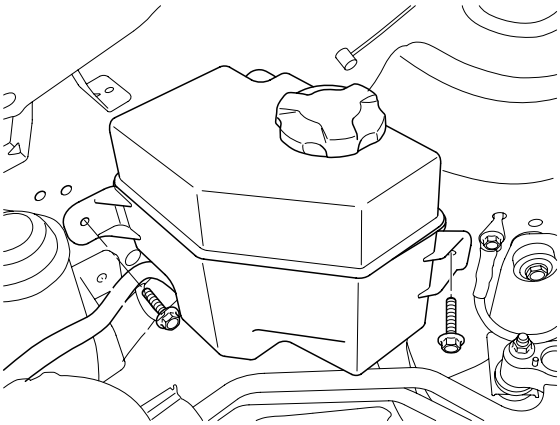
ACJF034A

3. Loosen the drain plug(A), and drain the coolant.



ACJF036A

4. Tighten the radiator drain plug(A) securely.
5. Remove the coolant reservoir tank. Drain the coolant and reinstall the coolant reservoir tank. Fill the coolant reservoir tank to the MAX mark with the coolant.



ACJF037A

6. Fill the coolant 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 concentrations 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.***

7. Start the engine and allow coolant to circulates. When the cooling fan operates and coolant circulates, refill coolant through the radiator filler neck.
8. Repeat 7 until the cooling fan 3~5 times and bleed air sufficiently out of the cooling system.
9. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
10. Run the vehicle under idle until the cooling fan operates 2~3 times.

11. Stop the engine and allow coolant to cool.
12. Repeat steps 6 to 11 until the coolant level stays constant and all air is bleed out of the cooling system.

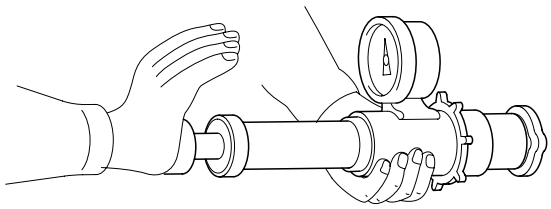
NOTE

Recheck the coolant level in the reservoir tank for 2~3 days after replacing coolant.

Coolant capacity :
5.5~5.8 liters(5.8~6.1 US qt, 4.8~5.1 lmp qt)

RADIATOR CAP TESTING

1. Remove the radiator cap, wet its seal with engine coolant, then install it no pressure tester.

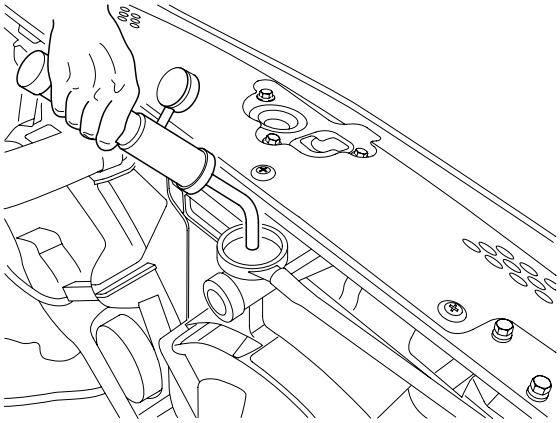


ECKD501X

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).



ACJF035A

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.

REMOVAL E144A6FF

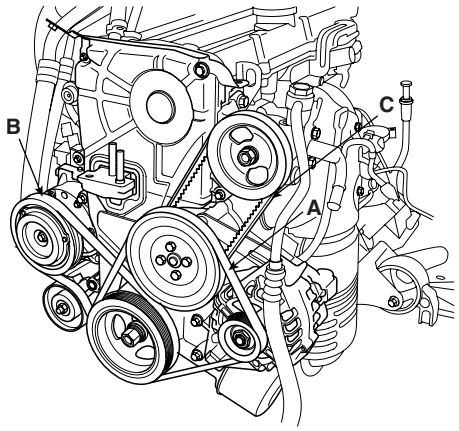
WATER PUMP

1. Drain the engine coolant.

   WARNING

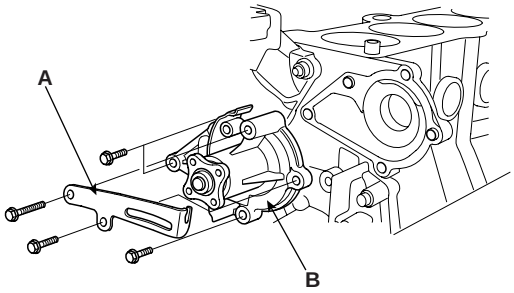
   System is under high pressure when the engine is hot.
   To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

2. Loosen the water pump pulley bolts.
3. Remove the drive belts.



ACJF002A

4. Remove the water pump pulley.
5. Remove the timing belt. (Refer to EM - 22)
6. Remove the timing belt idler.
7. Remove the water pump.
   1) Remove the 2 bolts and alternator brace(A).
   2) Remove the 3 bolts and remove the water pump(B) and gasket.



EDKD181A

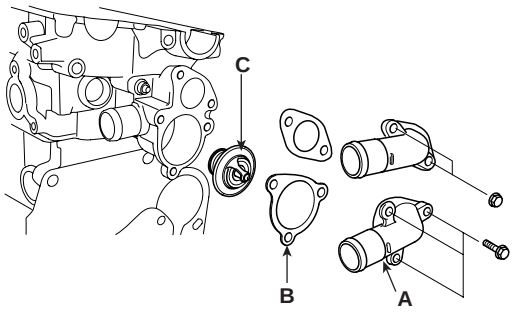
THRMOSTAT

NOTE

Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

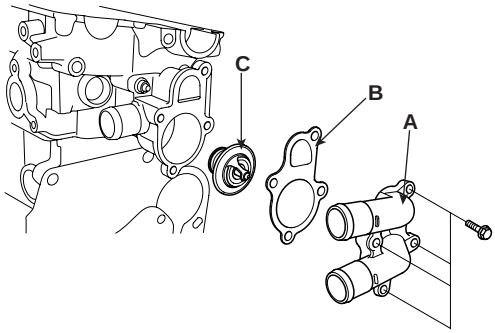
1. Drain the engine coolant so its level is below thermostat.
2. Remove the water inlet fitting(A), gasket(B) and thermostat(C).

■ **1.6 CVVT**



ACJF110A

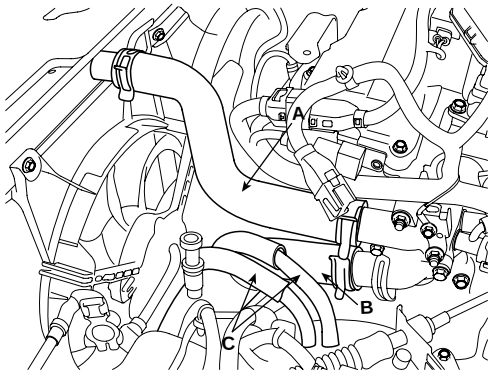
■ **1.4 DOHC**



ACJF111A

RADIATOR

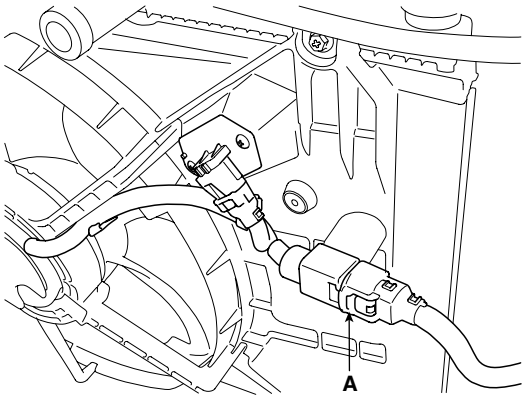
1. Drain the engine coolant.
   Remove the radiator cap to speed draining.
2. Remove the upper radiator hose(A) and lower radiator hose(B).
3. Remove the ATF(Automatic Transaxle Fluid) oil cooler hoses(C). (A/T)



ACJF010A

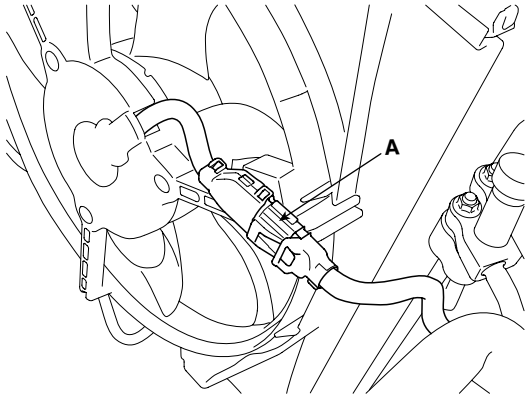
4. Disconnect the fan motor connector(A,B).

■ **1 Fan type**



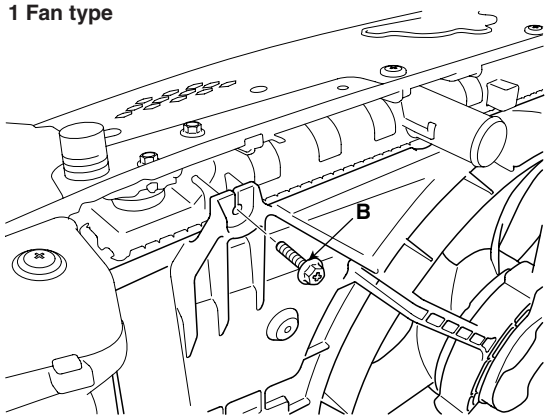
LCJF077A

■ 2 Fan type



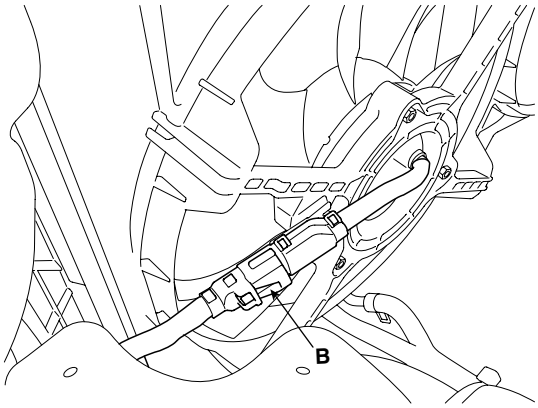
LCJF078A

■ 1 Fan type



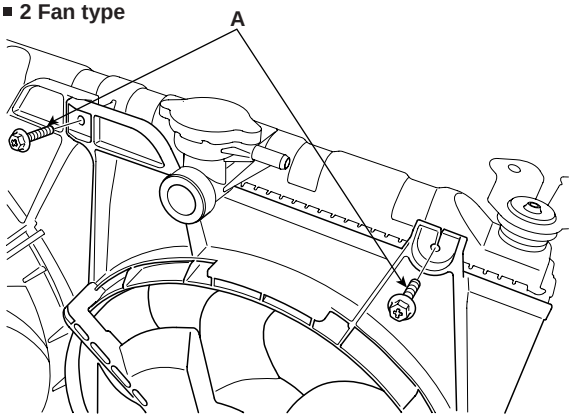
LCJF081A

■ 2 Fan type



LCJF079A

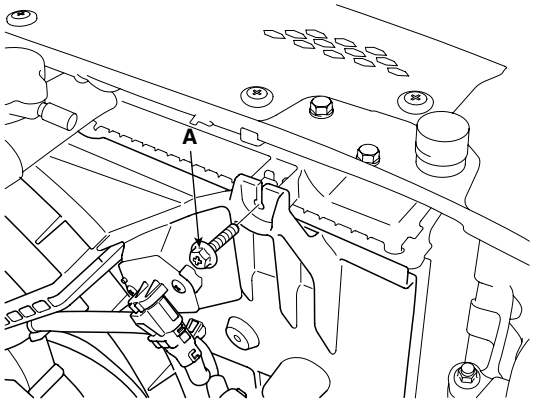
■ 2 Fan type



LCJF082A

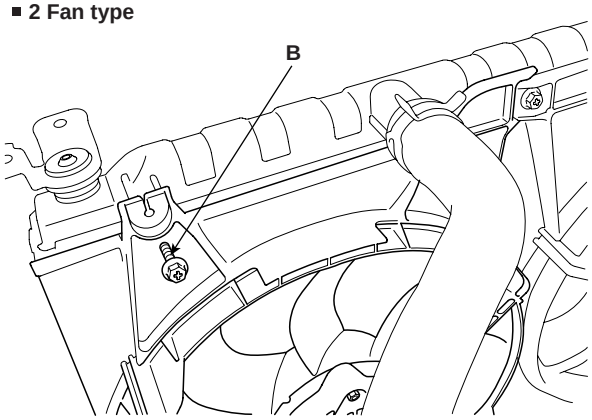
5. Remove the cooling fan mounting bolt(A,B) and remove cooling fan.

■ 1 Fan type



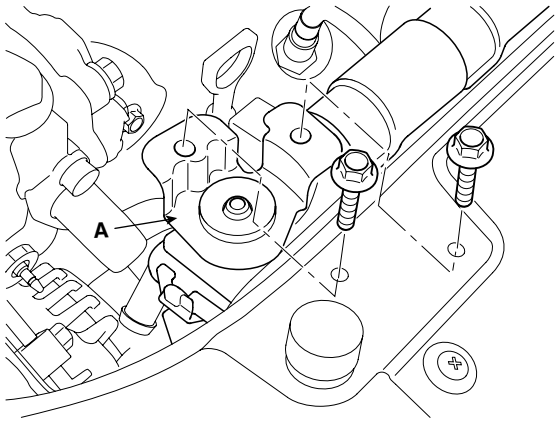
LCJF080A

■ 2 Fan type

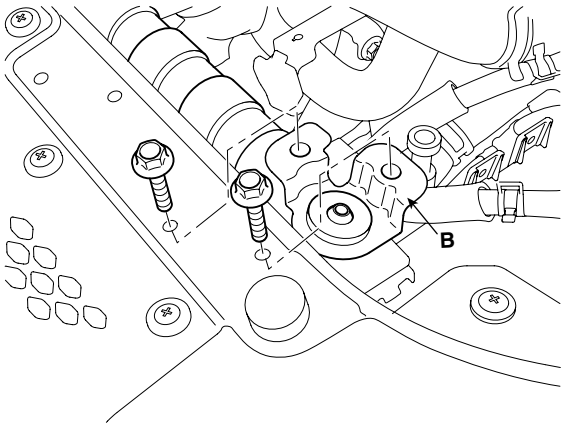


LCJF083A

6. Remove the radiator upper bracket(A,B), then pull up the radiator.



ACJF045A



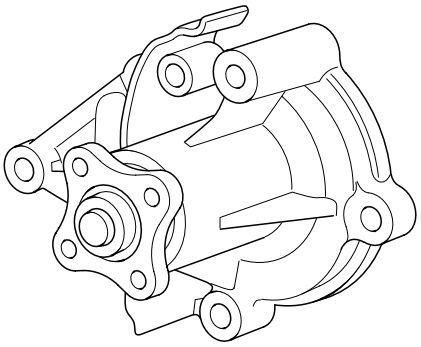
ACJF046A

INSPECTION EC8A266B

WATER PUMP

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.



EDKD183A

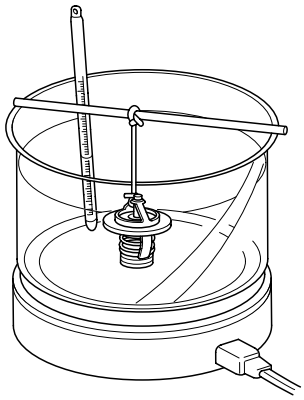
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

NOTE

A small amount of " weeping" from the bleed hole is normal.

THERMOSTAT

1. Immerse the thermostat in water and gradually heat the water.



ECKD503B

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.

3. Check the valve lift.

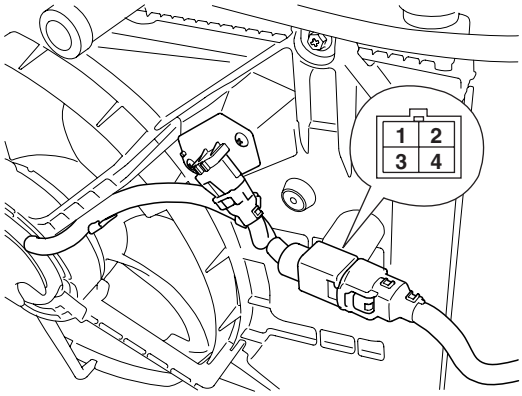
Valve lift : 8mm(0.3in) or more at 95°C (203°F)

If the valve lift is not as specified, replace the thermostat.

COOLING FAN (1 FAN TYPE)

1. Disconnect the cooling fan motor connector.

■ **1 Fan type**



LCJF084A

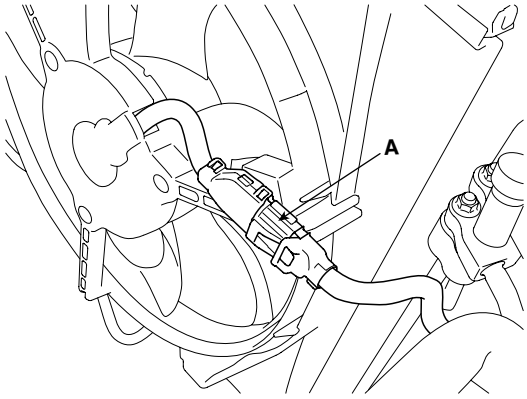
2. Check that the radiator fan rotates when battery voltage is applied between the terminals.

Cooing fan inspection		Cooling fan motor connector				Action
		1	2	3	4	
Battery	+	O				Low speed
	-			O		
Battery	+		O			High speed
	-			O		

COOLING FAN (2 FAN TYPE)

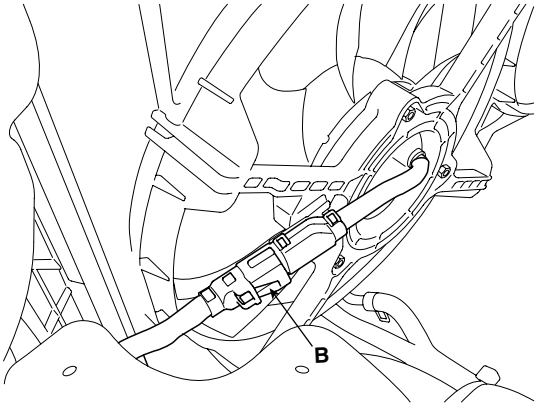
1. Disconnect the cooling fan motor connector.

■ 2 Fan type



LCJF078A

■ 2 Fan type



LCJF079A

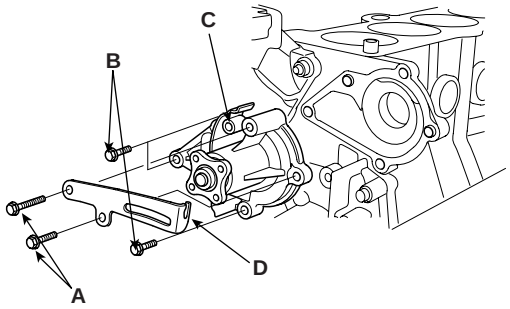
2. Check that the radiator fan rotates when battery voltage is applied between (+) and (-) terminals.

INSTALLATION EBC8DDC4

WATER PUMP

1. Install the water pump.
   1) Install the water pump(C) and a new gasket with the 3 bolts(B).

Tightening torque :
11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lb-ft)



EDKD181B

   2) Install the alternator brace(D) with the 2 bolts(A).

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

2. Install the timing belt idler.
3. Install the timing belt. (Refer to EM - 28)
4. Install the water pump pulley.
5. Install the drive belts.
6. Tighten the water pump pulley bolts.

Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

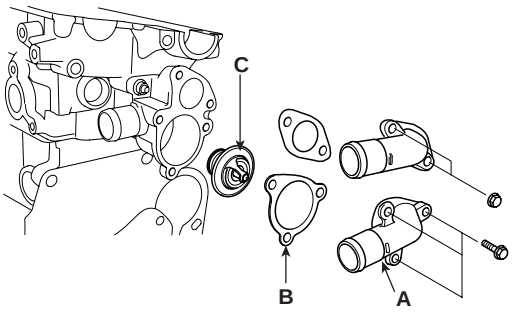
7. Fill with engine coolant.
8. Start engine and check for leaks.
9. Recheck engine coolant level.

THERMOSTAT

1. Place the thermostat in thermostat housing.
   1) Install the thermostat(B) with the jiggle valve upward.
   2) Install a new gasket(A) to the thermostat(B).
2. Install the water inlet fitting(A).

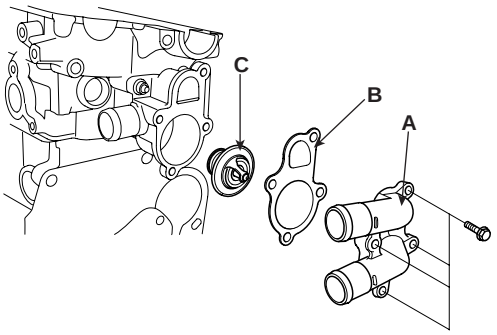
Tightening torque :
14.7 ~ 19.6N.m (1.5 ~ 2.0kgf.m, 10.8 ~ 14.5lb-ft)

■ **1.6 CVVT**



ACJF110A

■ **1.4 DOHC**



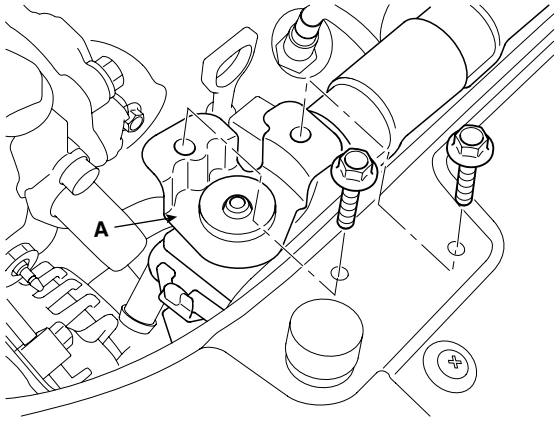
ACJF111A

3. Fill with engine coolant.
4. Start engine and check for leaks.

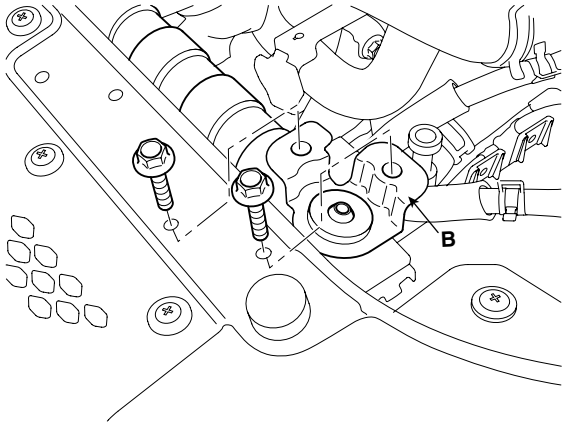
RADIATOR

1. Install the radiator.
2. Install the radiator upper bracket(A,B).

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



ACJF045A

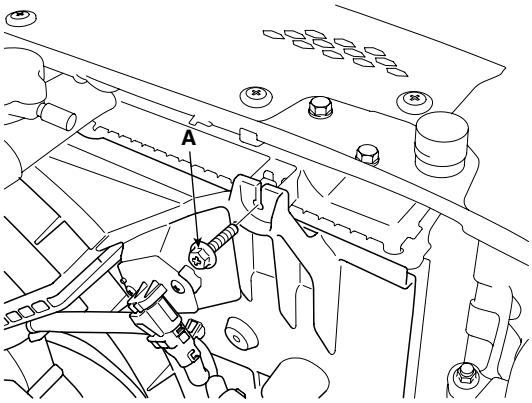


ACJF046A

3. Install the cooling fan mounting bolts(A,B).

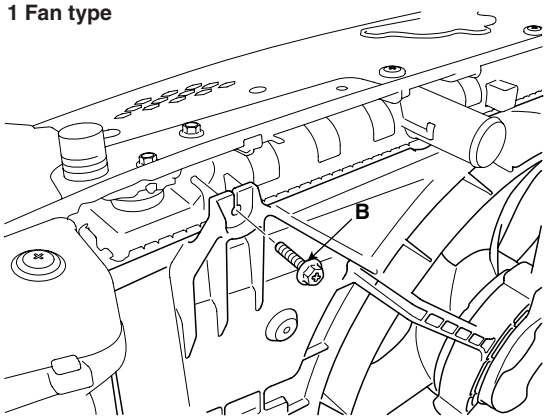
Tightening torque :
6.9 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 8.0lb-ft)

■ **1 Fan type**



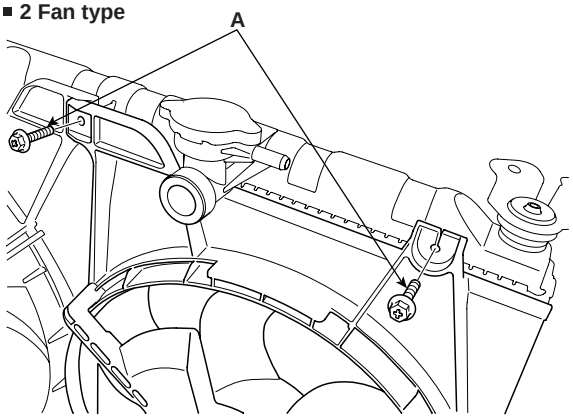
LCJF080A

■ **1 Fan type**



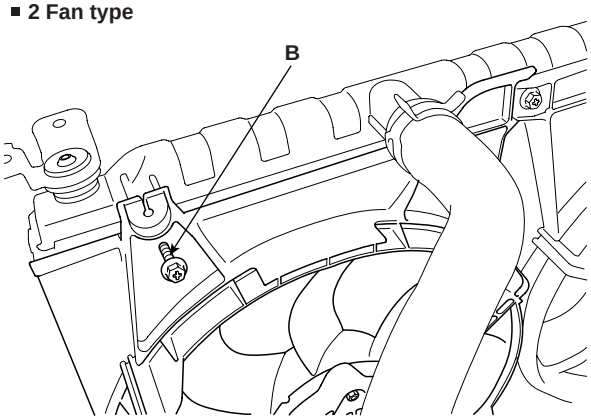
LCJF081A

■ **2 Fan type**



LCJF082A

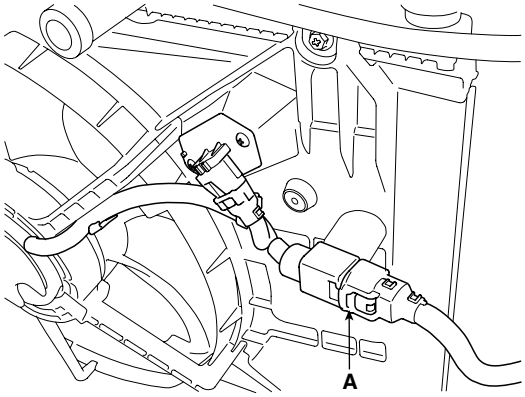
■ **2 Fan type**



LCJF083A

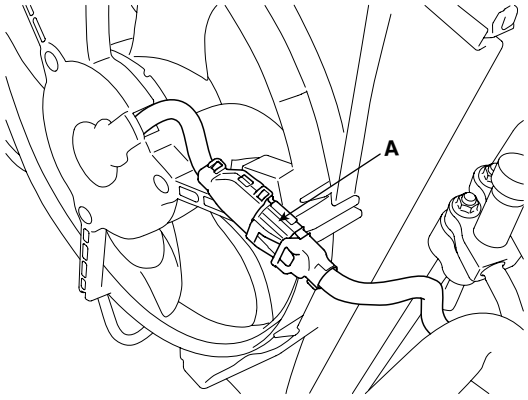
4. Connect the fan motor connector(A,B).

■ **1 Fan type**



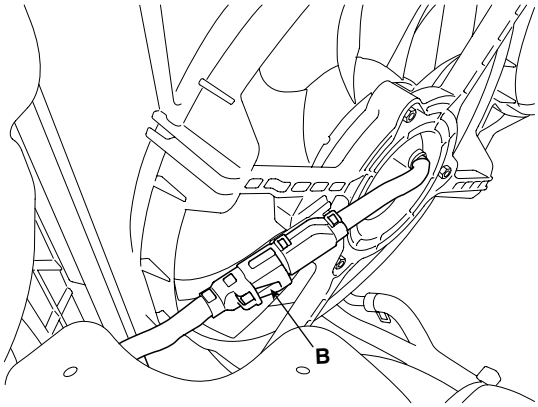
LCJF077A

■ **2 Fan type**



LCJF078A

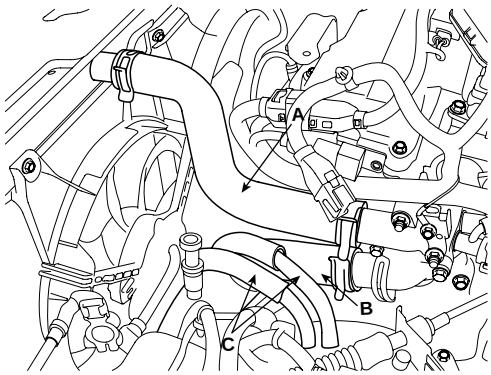
■ **2 Fan type**



LCJF079A

5. Install the upper radiator hose(A) and lower radiator hose(B).

6. Install the ATF(Automatic Transaxle Fluid) oil cooler hoses(C).



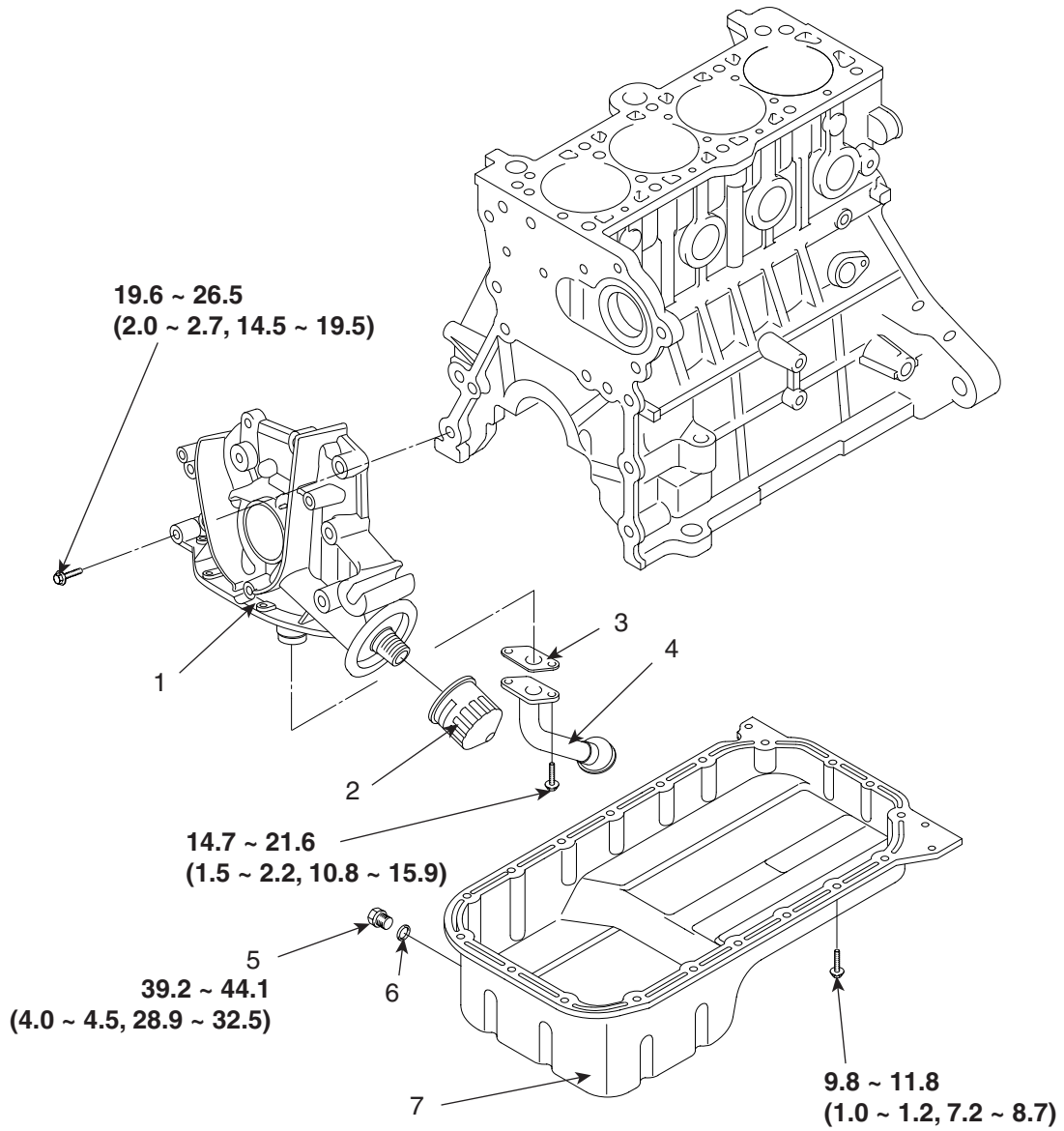
ACJF010A

7. Fill with engine coolant.

8. Start engine and check for leaks.

LUBRICATION SYSTEM

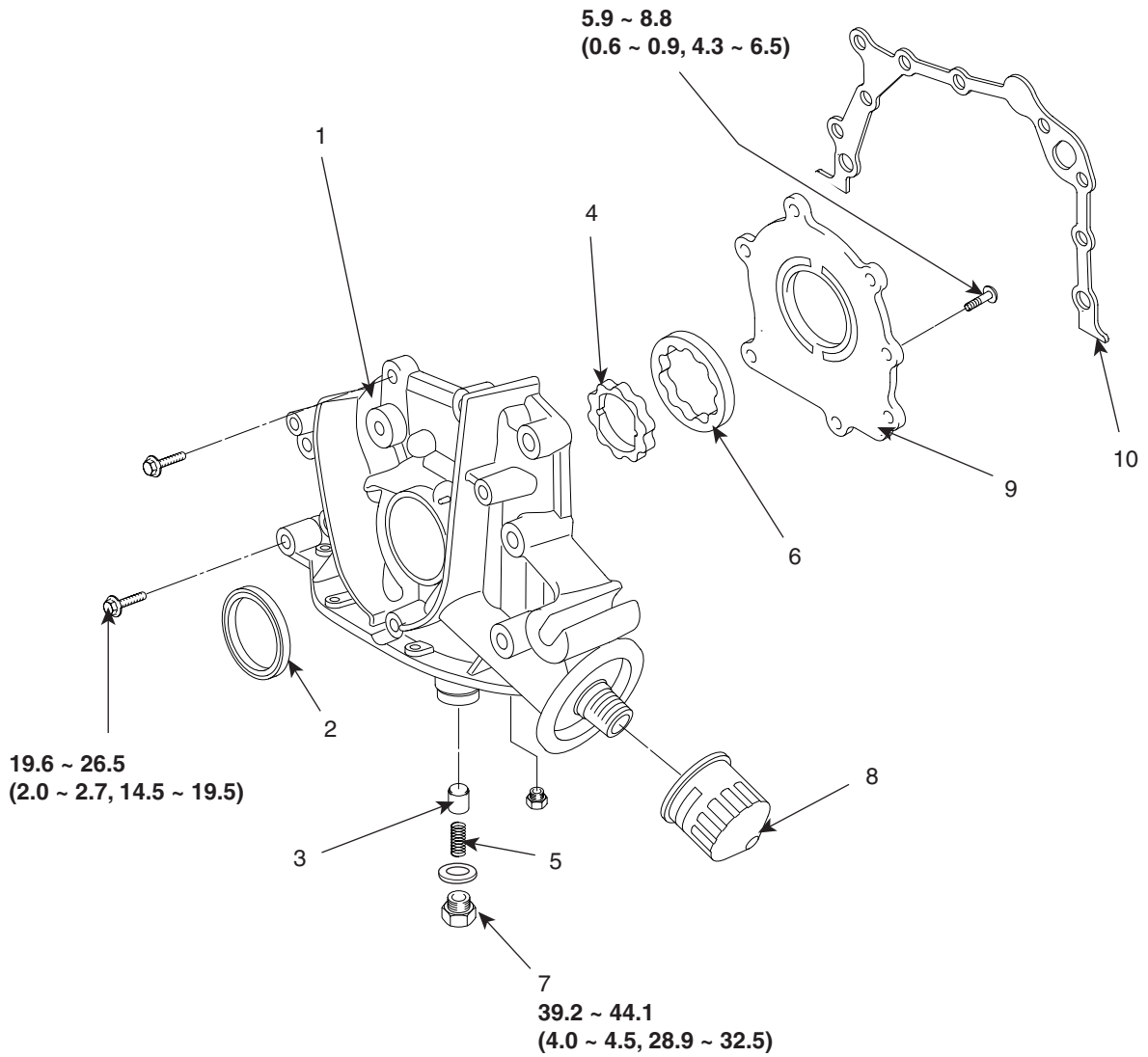
COMPONENT E41742E9



TORQUE : N.m (kgf.m, lb-ft)

1. Front case
2. Filter
3. Gasket
4. Oil screen
5. Drain plug
6. Gasket
7. Oil pan

LCJF013A



TORQUE : N.m (kgf.m, lb-ft)

1. Front case
2. Oil seal
3. Relief plunger
4. Inner rotor
5. Relief spring
6. Outer rotor
7. Plug
8. Oil filter
9. Pump cover
10. Gasket

LCJF014A

OIL AND FILTER REPLACEMENT EF6282B6

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 an additional 3/4 turn.
3. Refill with engine oil.
   1) Clean and install the oil drain plug with a new gasket.

Tightening torque :
39.2 ~ 44.1N.m (4.0 ~ 4.5kgf.m, 28.9 ~ 32.5lb-ft)

   2) Fill with fresh engine oil.

Oil Capacity
Total : 3.3 L (3.49 US qt, 2.90 lmp qt)
Oil pan : 3.0 L (3.17 US qt, 2.64 lmp qt)
Oil filter : 0.3 L (0.32 US qt, 0.26 lmp qt)

   3) Install the oil filler cap.
4. Start engine and check for oil leaks.
5. Recheck the engine oil level.

INSPECTION

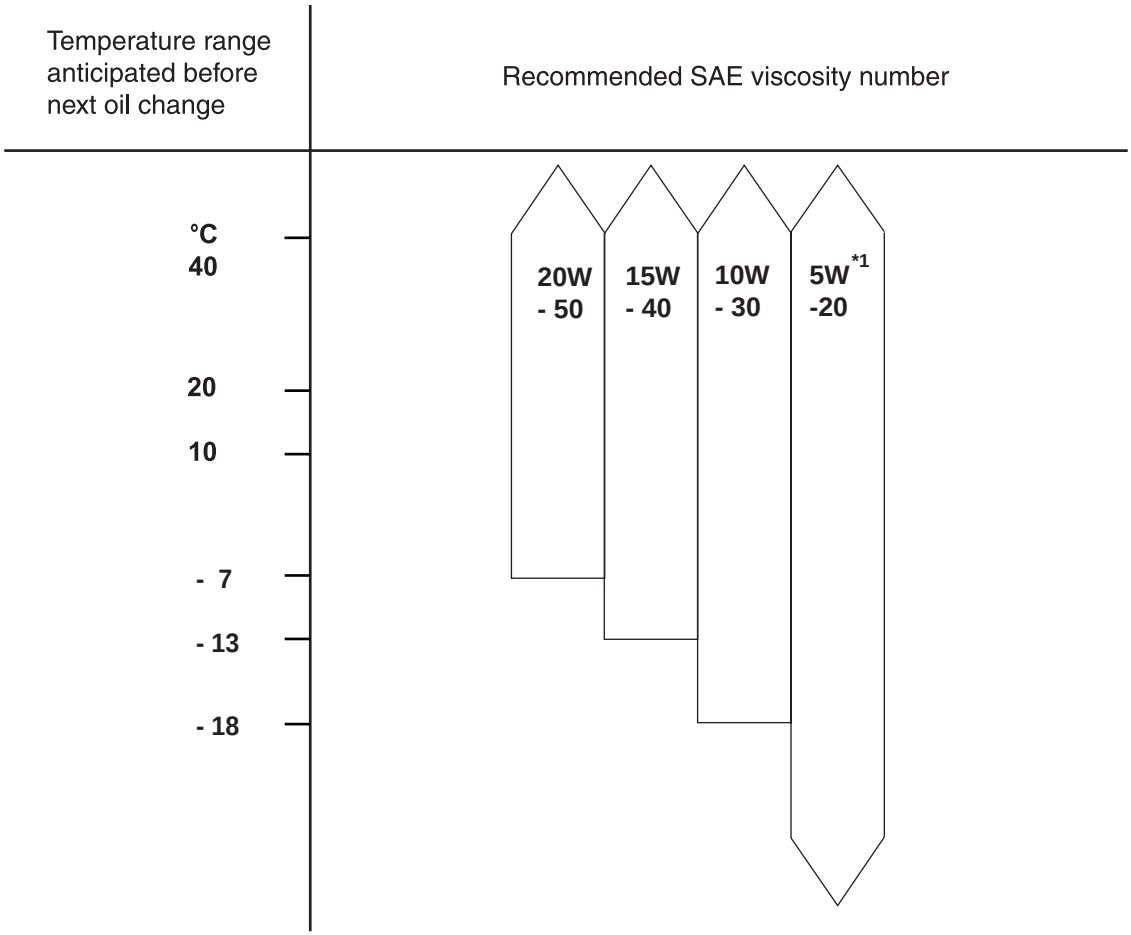
1. Check the engine oil quality.
   Check the oil deterioration, entry of water, discoloring of thinning.
   If the quality is visibly poor, replace the oil.
2. Check the engine oil level.
   After warning up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "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

Recommended ILSAC classification : GF3 OR ABOVE
Recommended API classification : SJ / SL OR ABOVE
Recommended SAE viscosity grades :



*1 : Recommended regardless of environment.
If not available, refer to the recommended SAE viscosity numbers.

LC8F002A

NOTE

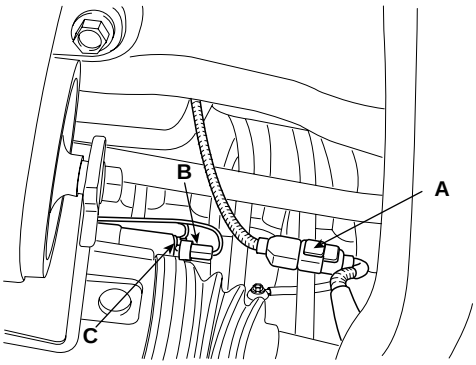
For best performance and maximum protection of all types of operation, select only those lubricants which :

1. *Satisfy the requirement of the API 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 service classification on the container should not be used.*

REMOVAL EB7E0652

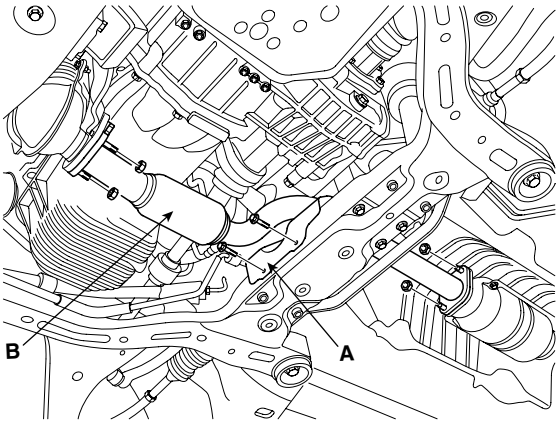
OIL PAN

1. Drain the engine oil.
2. Disconnect the rear oxygen sensor connector(A).



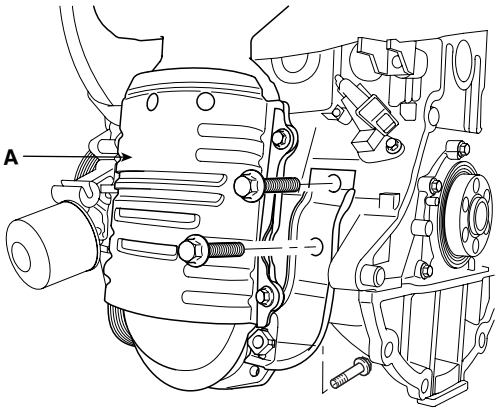
ACGE013A

3. Remove the front muffler heat protector(A)
4. Remove the front muffler(B).



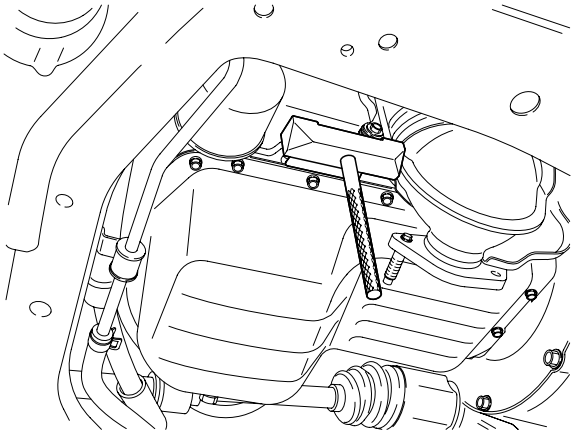
ACJF031A

5. Remove the exhaust manifold and catalytic converter assembly(A). (Refer to EM - 120)



ACJF005A

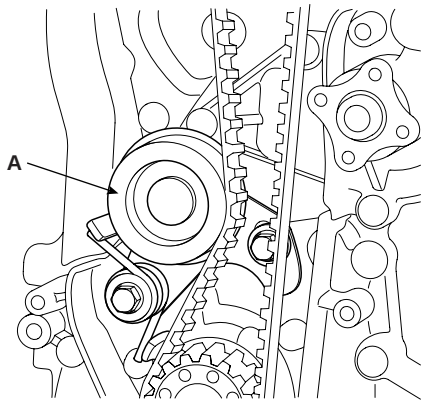
6. Using the SST(09215-3C000) and remove the oil pan.



ACJF127A

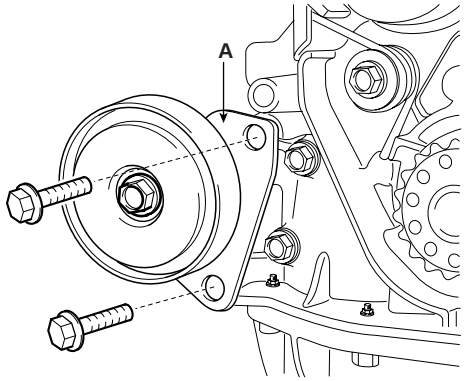
OIL PUMP

1. Drain the engine oil.
2. Remove the drive belts.
3. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.
4. Remove the timing belt. (Refer to EM - 22)
5. Remove the timing belt tensioner(A).



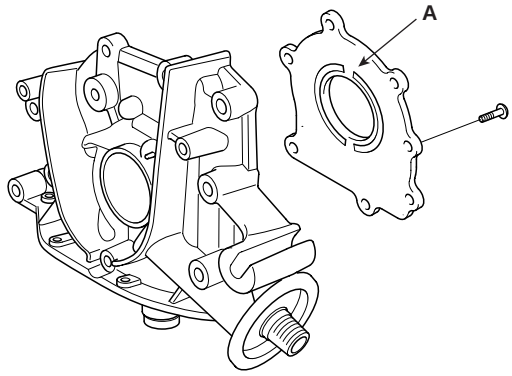
EDKD102B

6. Remove the oil pan and oil screen.
7. Remove the alternator. (Refer to EE group - alternator)
8. Remove the air conditioner compressor tensioner bracket(A).



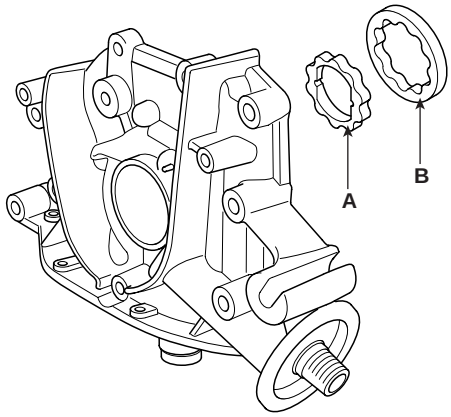
ADGE066A

9. Remove the front case.
   1) Remove the screw from the pump housing, then separate the housing and cover(A).



EDKD202A

   2) Remove the inner rotor(A) and outer rotor(B).

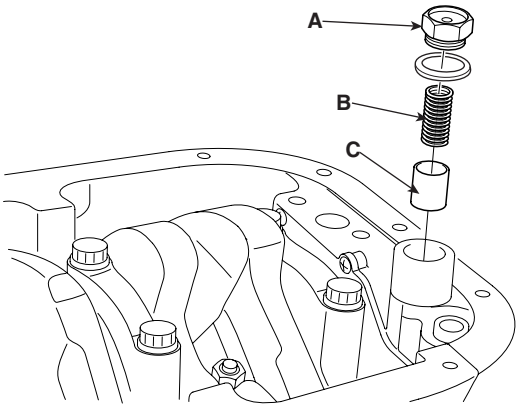


EDKD203A

DISASSEMBLY E5EBBBA4

RELIEF PLUNGER

1. Remove the relief plunger.
   Remove the plug(A), spring(B) and relief plunger(C).



ACJF128A

INSPECTION EC7F2A68

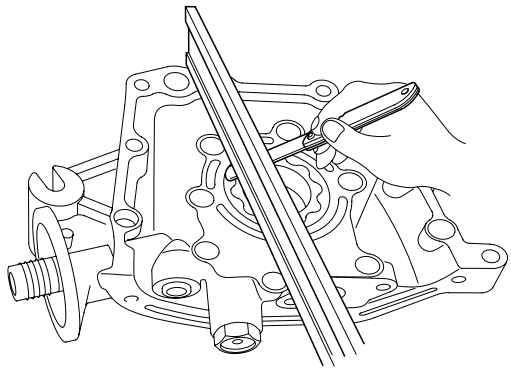
1. Inspect the relief plunger.
   Coat the plunger with engine oil and check that it falls smoothly into the plunger hole by its own weight.
   If it does not, replace the relief plunger. If necessary, replace the front case.

2. Inspect the relief valve spring.
   Inspect for distorted or broken relief valve spring.

Standard value
Free height : 46.6mm (1.8346in)
Load : 6.1±0.4kg/40.1mm (13.4±0.9 lb/1.5787in)

3. Inspect the rotor side clearance.
   Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

Side clearance	Inner rotor	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)
	Outer rotor	0.04 ~ 0.09mm (0.0016 ~ 0.0035in)

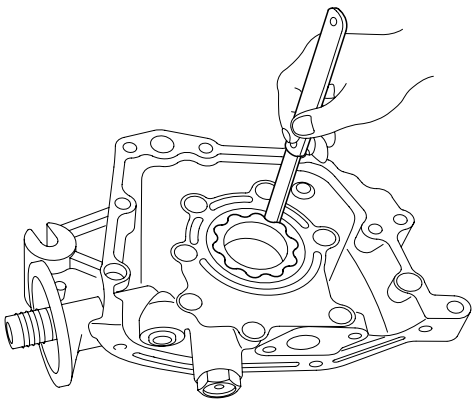


EDKD205A

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

4. Inspect the rotor tip clearance.
   Using a feeler gauge, measure the tip clearance between the inner and outer rotor tips.

Tip clearance
0.025 ~ 0.069mm (0.0010 ~ 0.0027in)

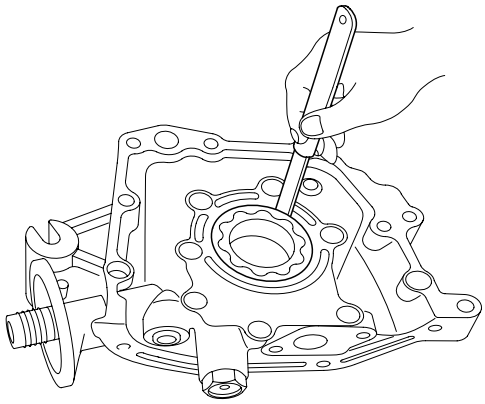


EDKD206A

If the tip clearance is greater than specified, replace the rotors as a set.

5. Inspect the rotor body clearance.
   Using a feeler gauge, measure the clearance between the outer rotor and body.

Body clearance
0.060 ~ 0.090mm (0.0024 ~ 0.0035in)



EDKD207A

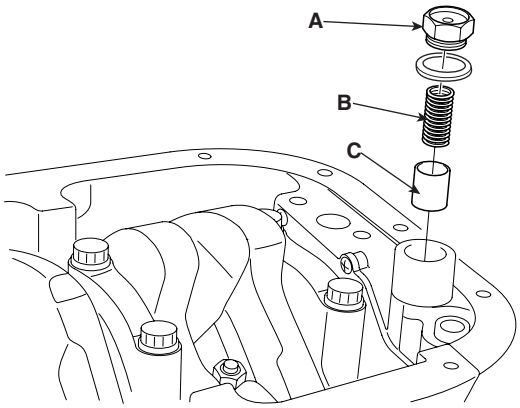
If the body clearance is greater than specified, replace the rotors as a set. If necessary, replace the front case.

REASSEMBLY ECBB88E3

RELIEF PLUNGER

1. Install the relief plunger.
   Install relief plunger(C) and spring(B) into the front case hole, and install the plug(A).

Tightening torque :
39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)



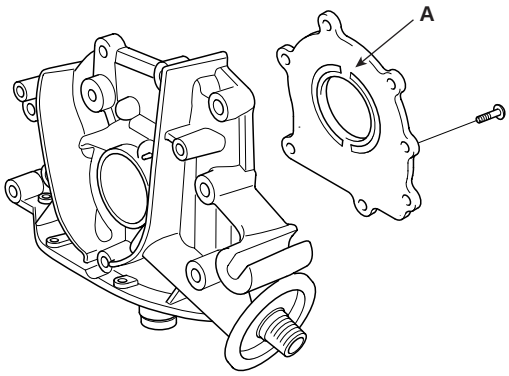
ACJF128A

INSTALLATION E2EFCA2F

OIL PUMP

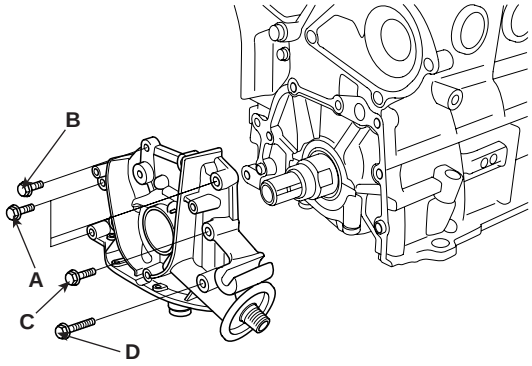
1. Install the oil pump.
   1) Place the inner and outer rotors into front case with the marks facing the oil pump cover side.
   2) Install the oil pump cover(A) to front case with the 7 screws.

Tightening torque :
5.9 ~ 6.9N.m (0.6 ~ 0.7kgf.m, 4.3 ~ 5.1lb-ft)



EDKD202A

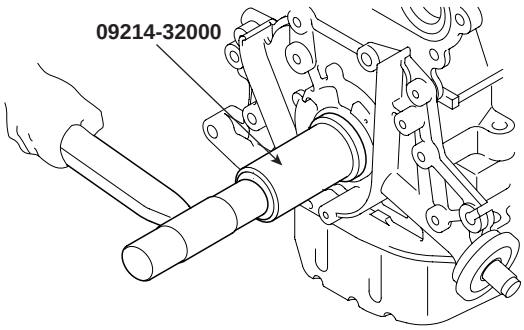
2. Check that the oil pump turns freely.
3. Install the oil pump on the cylinder block.
   1) Place a new front case gasket on the cylinder block.
   2) Apply engine oil to the lip of the oil pump seal. Then, install the oil pump onto the crankshaft.
   3) When the pump is in place, clean any excess grease off the crankshaft and check that the oil seal lip is not distorted.



EDKD208A

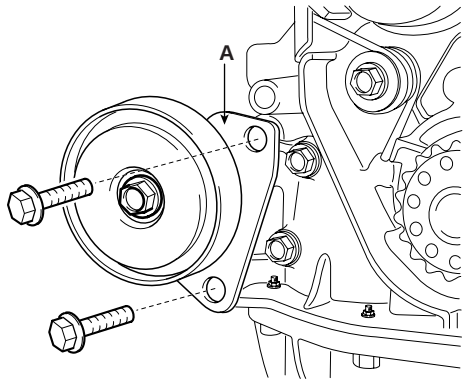
Bolt length
(A) : 30mm (1.181in), (B) : 22mm (0.866in),
(C) : 45mm (1.772in), (D) : 60mm (2.362in)
Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

4. Apply a light coat of oil to the front case oil seal lip.
5. Using the SST(09214-32000),install the front case oil seal.



EDKD209A

6. Install the air conditioner compressor tensioner bracket (A).



ADGE066A

7. Install the alternator. (Refer to EE group - alternator)

8. Install the oil screen.

Tightening torque : 14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)

9. Install the oil pan.

Tightening torque : 9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

NOTE

Clean the oil pan gasket mating surfaces.

10. Install the timing belt tensioner.

11. Install the timing belt (Refer to EM - 28)

12. Install the drive belts.

13. Fill with engine oil.

OIL PAN

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.

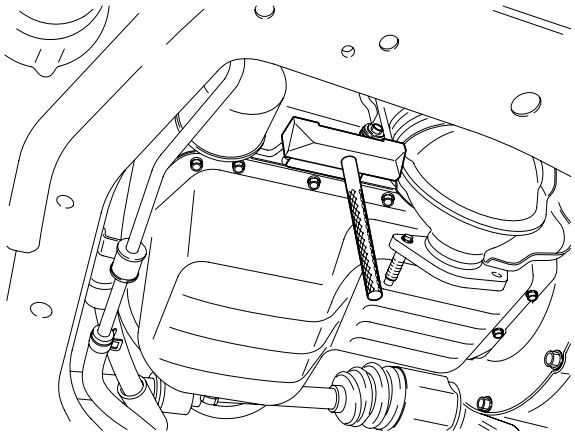
Liquid gasket : MS 721-40A or equivalent

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.*

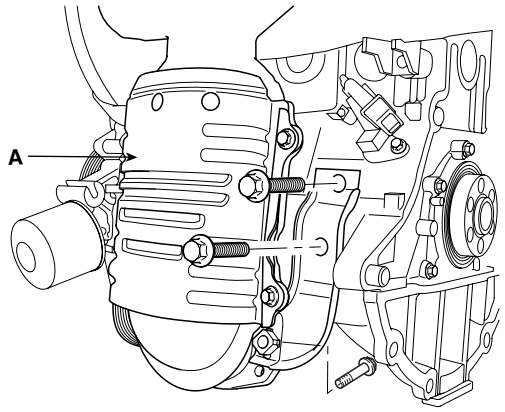
   3) Install the oil pan(A) with the bolts. Uniformly tighten the bolts in several passes.

Tightening torque : 9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



ACJF127A

2. Install the exhaust manifold and catalytic converter assembly(A). (Refer to EM - 120).

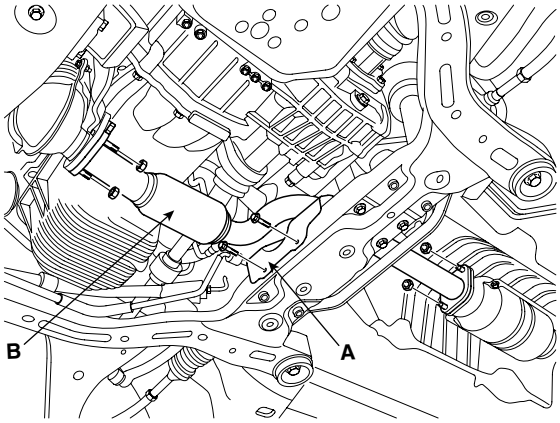


ACJF005A

3. Install the front muffler(B).

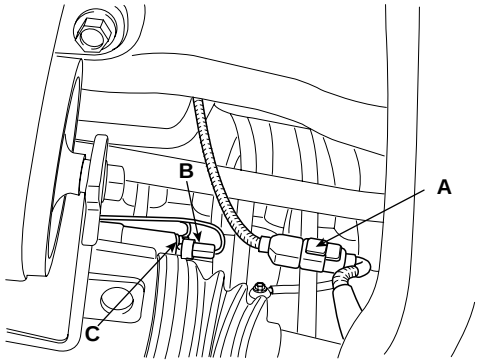
Tightening torque :
29.4 ~ 39.2N.m (3.0 ~ 4.0kgf.m, 21.7 ~ 28.9lb-ft)

4. Install the front muffler heat protector(A).



ACJF031A

5. Connect the rear oxygen sensor connector(A).



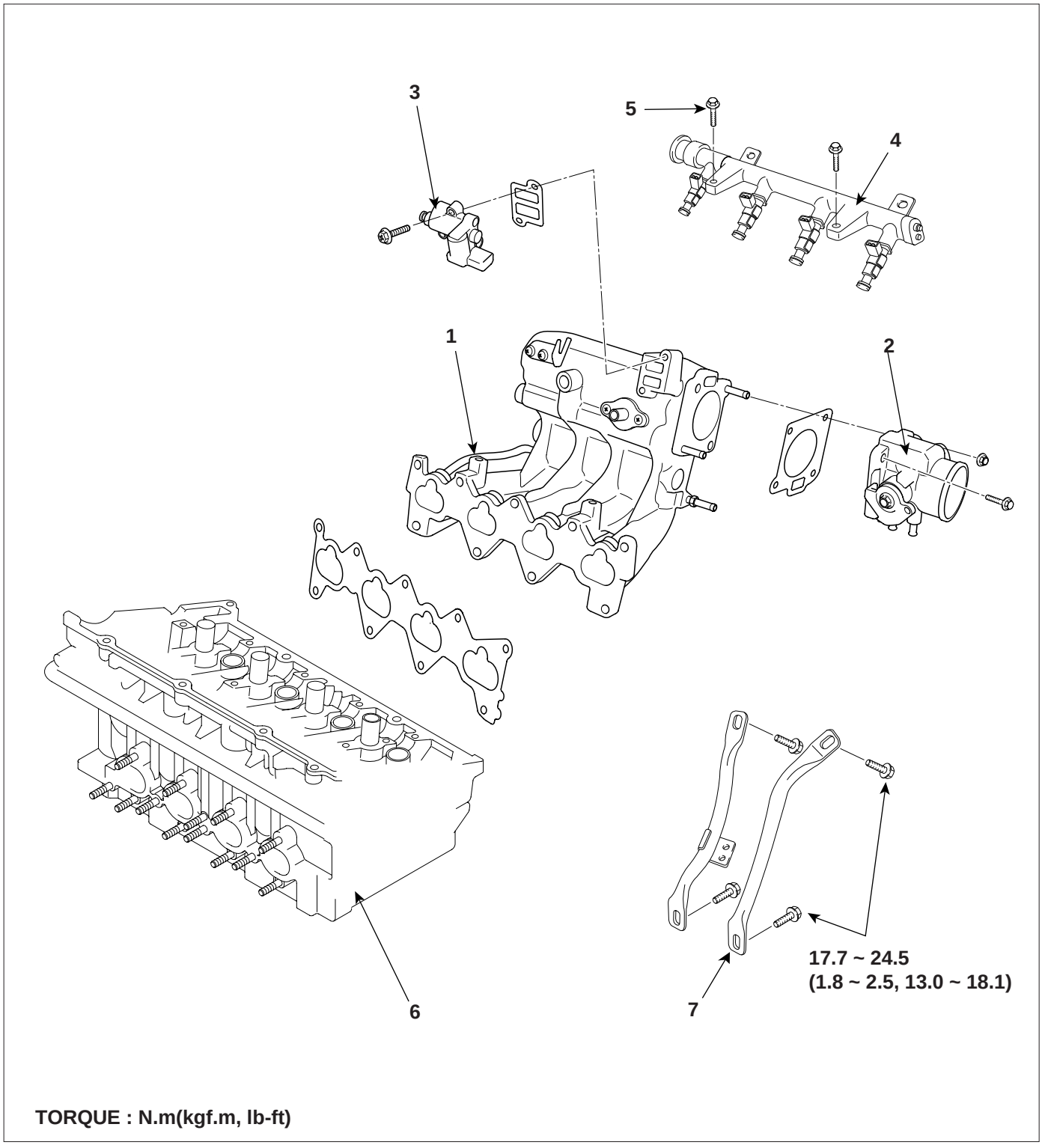
ACGE013A

6. Fill with engine oil

INTAKE AND EXHAUST SYSTEM

INTAKE MANIFOLD

COMPONENT EDDF9D5A

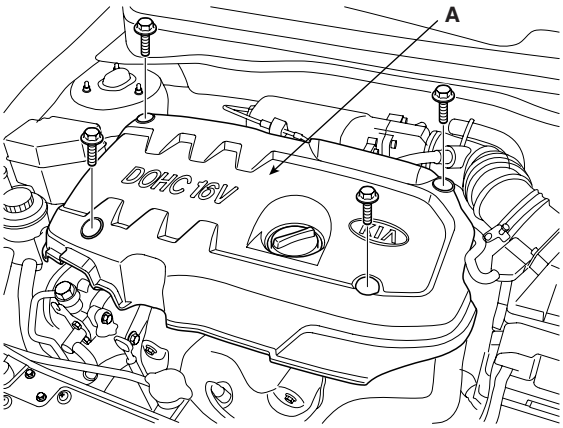


1. Intake manifold
2. Throttle body
3. ISA(Idle Speed Actuator)
4. Delivery pipe
5. Gasket
6. Cylinder head
7. Intake manifold stay

LCJF015A

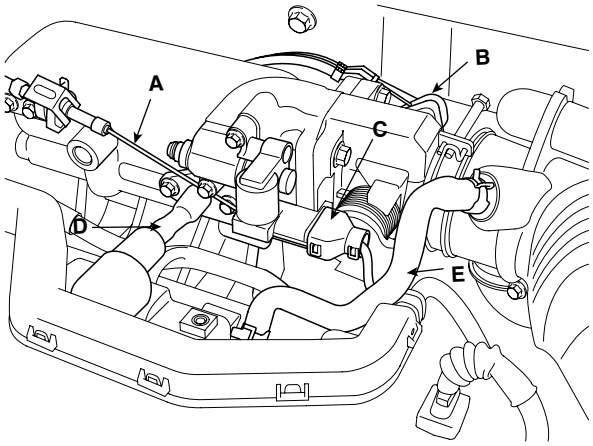
REMOVAL EAC85CFA

1. Remove the engine cover(A).



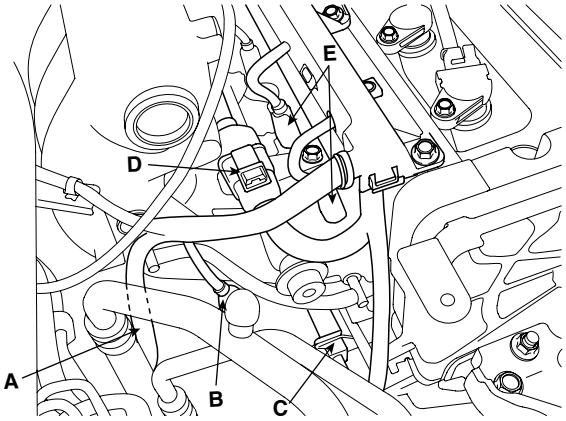
ACJF001A

2. Remove the accelerator cable(A).
3. Disconnect the TPS (Throttle Position Sensor) connector (B).
4. Disconnect the ISA(Idle Speed Actuator) connector(B).
5. Disconnect the PCV(Positive Crankcase Ventilation) hose(D) and breather hose(E).



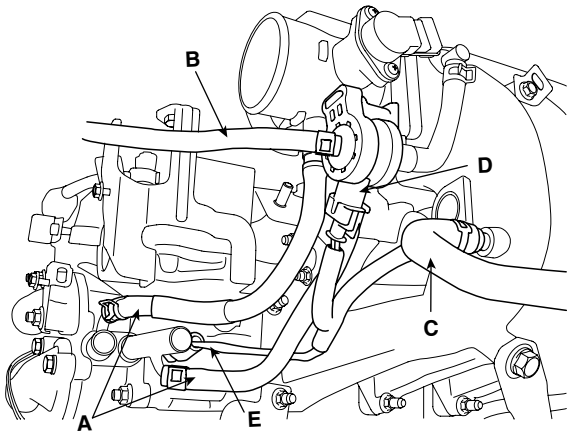
ACJF004A

6. Disconnect the injector connector (No. 3, 4) (A).
7. Disconnect the injector connector (No. 1, 2) (B).



ACJF013A

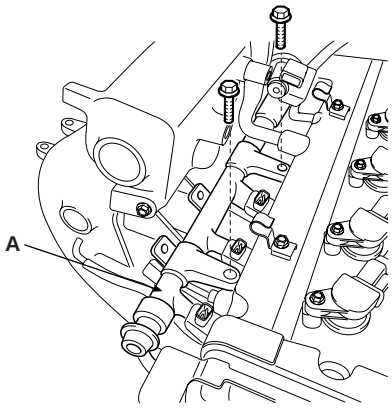
8. Remove the heater hose(A), PCSV(Purge Control Solenoid Valve)(B) and the brake vacuum hose(C) from throttle body and intake manifold.
9. Disconnect the PCSV(Purge Control Solenoid Valve) (D) and water temperature sensor connector(E).



ACJF047A

10. Remove the delivery pipe(A).

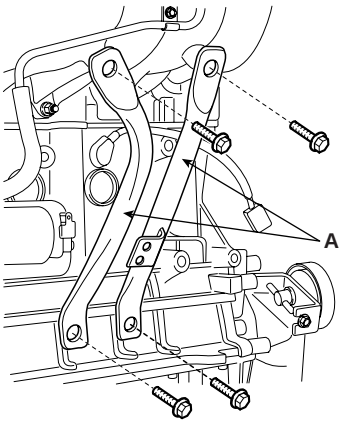
Tightening torque :
18.6 ~ 27.5N.m (1.9 ~ 2.8kgf.m, 13.7 ~ 20.3lb-ft)



ADGE067A

11. Remove the intake manifold stay(A).

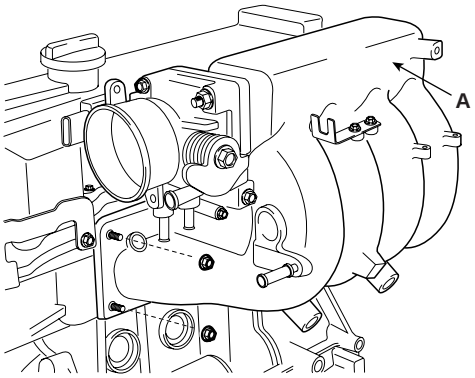
Tightening torque :
17.7 ~ 24.5N.m (1.8 ~ 2.5kgf.m, 13.0 ~ 18.1lb-ft)



ADGE070A

12. Remove the intake manifold.

Tightening torque :
14.7 ~ 19.6N.m (1.5 ~ 2.0kgf.m, 10.8 ~ 14.5lb-ft)

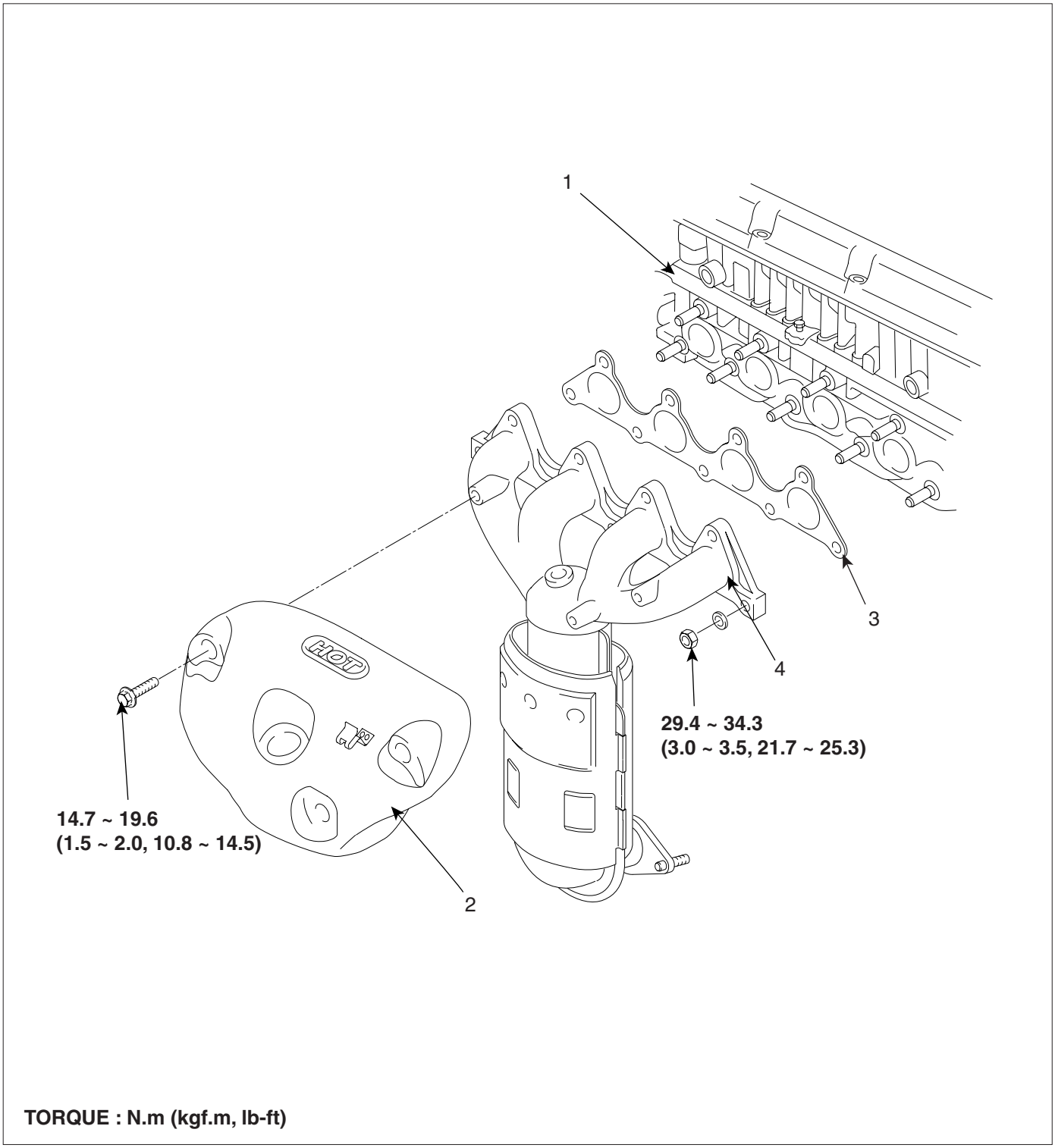


ADGE071A

13. Installation is in the reverse order of removal with new gasket.

EXHAUST MANIFOLD

COMPONENT E253A8D3



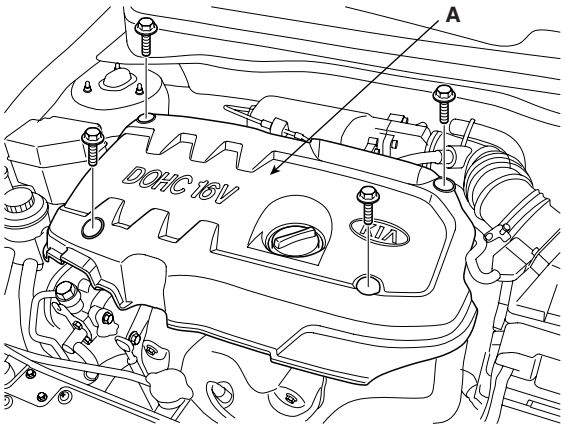
TORQUE : N.m (kgf.m, lb-ft)

1. Cylinder head
2. Heat protector
3. Gasket
4. Exhaust manifold

LCJF016A

REMOVAL ECFE4BC1

1. Remove the engine cover(A).



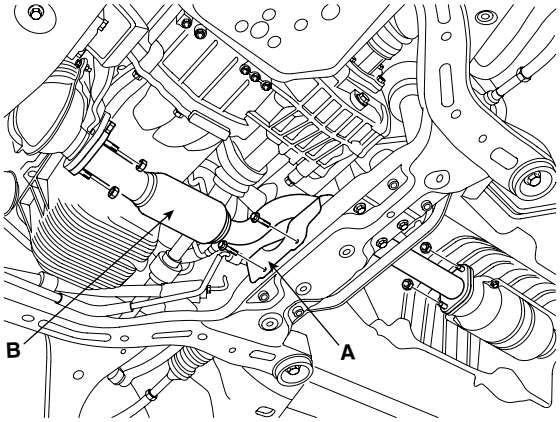
ACJF001A

2. Disconnect the front oxygen sensor connector.
3. Remove the front muffler heat protector(A).

Tightening torque :
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)

4. Remove the front muffler(B).

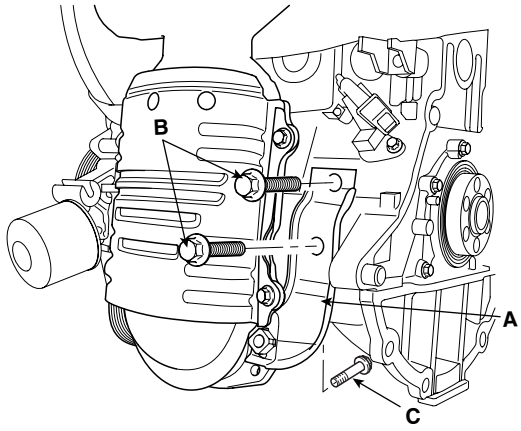
Tightening torque :
29.4 ~ 39.2N.m (3.0 ~ 4.0kgf.m, 21.7 ~ 28.9lb-ft)



ACJF031A

5. Remove the stay(A) of the exhaust manifold and catalytic converter assembly .

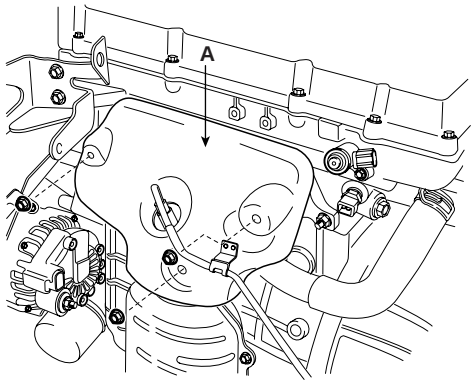
Tightening torque :
Bolts(B) : 34.3 ~ 39.2N.m (3.5 ~ 5.5kgf.m, 25.3 ~ 28.9lb-ft)
Bolts(C) : 29.4 ~ 39.2N.m (3.0 ~ 5.5kgf.m, 21.7 ~ 28.9lb-ft)



ACJF123A

6. Remove the heat protector(A).

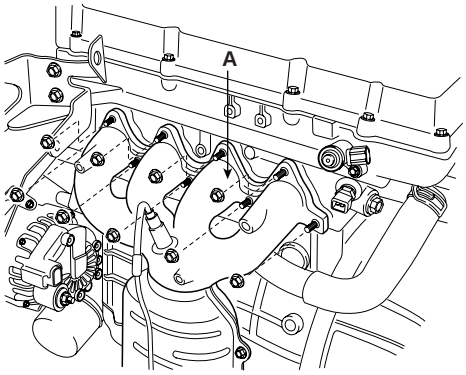
Tightening torque :
17.7 ~ 24.5N.m (1.8 ~ 2.5kgf.m, 13.0 ~ 18.1lb-ft)



ADGE072A

7. Remove the exhaust manifold and catalytic converter assembly(A).

Tightening torque :
17.7 ~ 24.5N.m (1.8 ~ 2.5kgf.m, 13.0 ~ 18.1lb-ft)

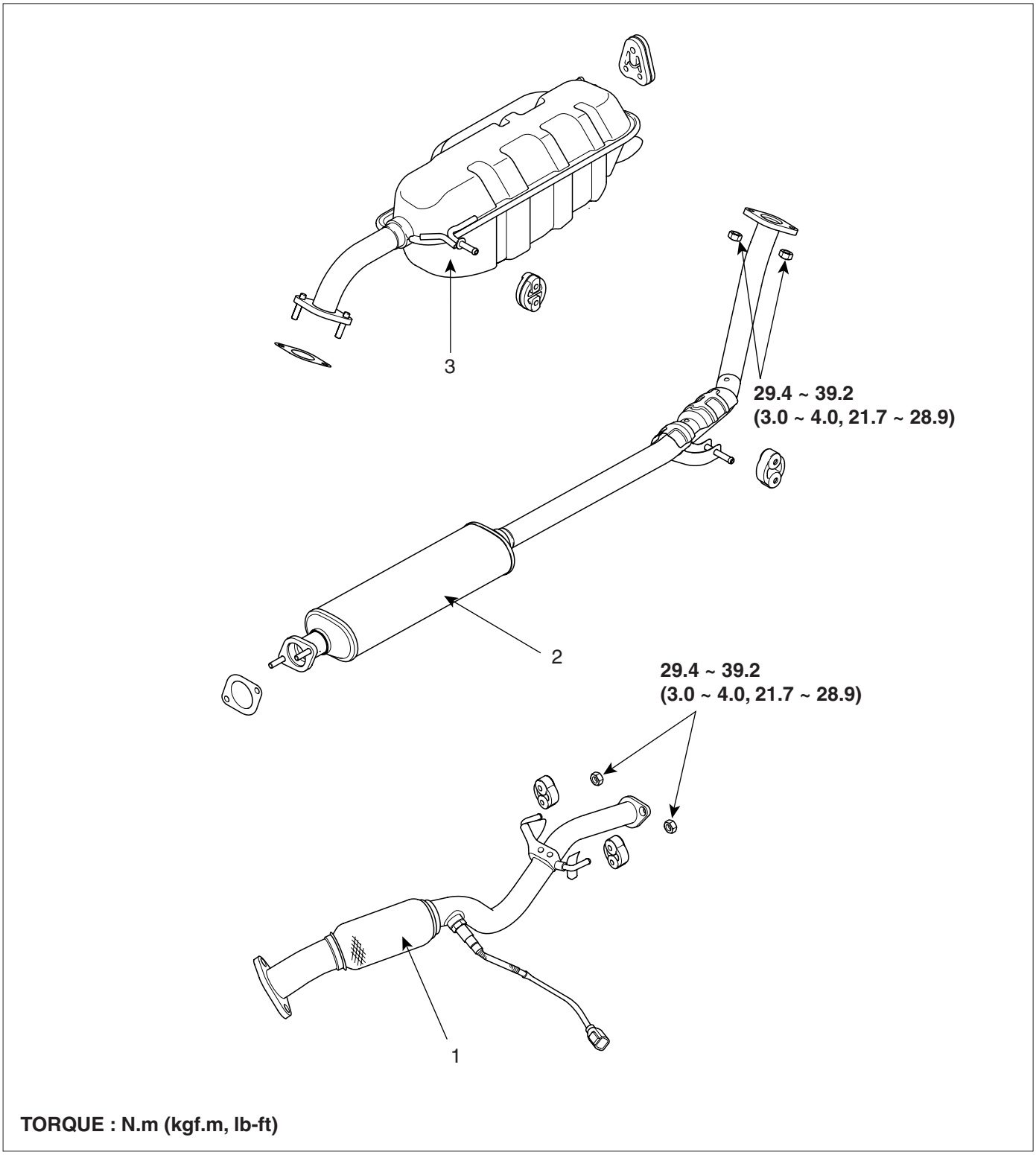


ADGE073A

8. Installation is in the reverse order of removal

EXHAUST PIPE

COMPONENT EA2DEA9D



1. Front muffler
2. Center muffler
3. Main muffler

LCJF017A

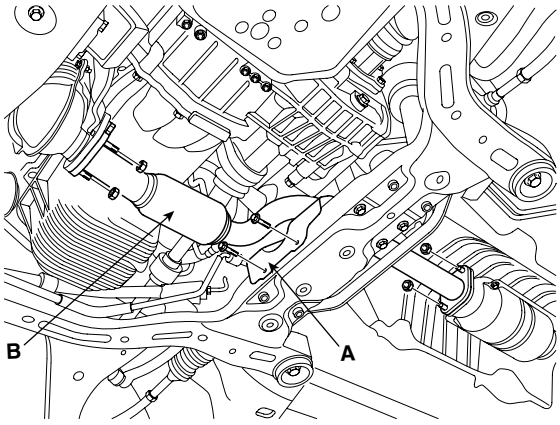
REMOVAL E2B40A80

1. Remove the front muffler heat protector(A).

Tightening torque :
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)

2. Remove the front muffler(B).

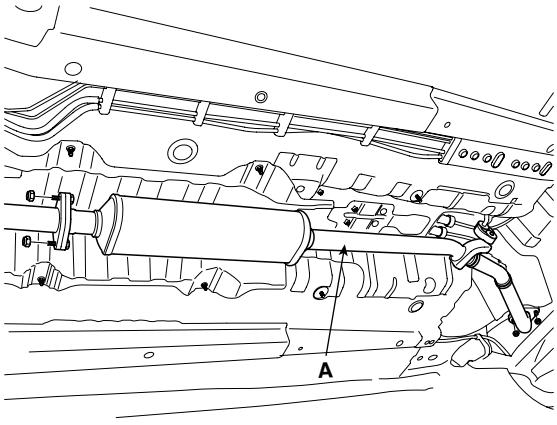
Tightening torque :
29.4 ~ 39.2N.m (3.0 ~ 4.0kgf.m, 21.7 ~ 28.9lb-ft)



ACJF031A

3. Remove the center muffler(A).

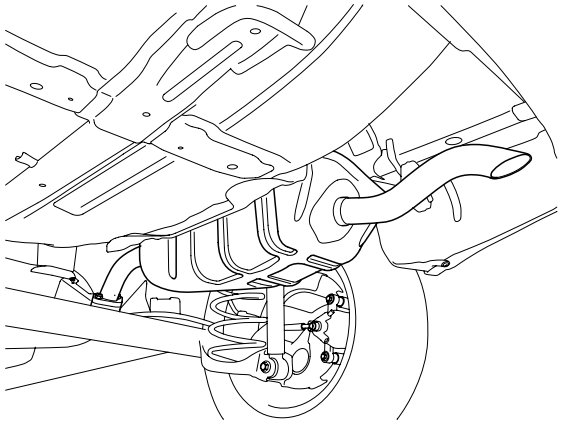
Tightening torque :
29.4 ~ 39.2N.m (3.0 ~ 4.0kgf.m, 21.7 ~ 28.9lb-ft)



ACJF050A

4. Remove the main muffler(A).

Tightening torque :
29.4 ~ 39.2N.m (3.0 ~ 4.0kgf.m, 21.7 ~ 28.9lb-ft)



ACJF054A

Engine Electrical System

GENERAL

IGNITION SYSTEM

CHARGING SYSTEM

ALTERNATOR
BATTERY

STARTING SYSTEM
STARTER
STARTER RELAY

GENERAL

GENERAL E12522AB

SPECIFICATION

IGNITION SYSTEM

Items		Specification	
		1.6 CVVT	1.4 DOHC
Ignition coil	Primary resistance	0.7 ± 15 % (Ω)	0.87 ± 10 % (Ω)
	Secondary resistance	-	13.0 ± 15 % (kΩ)
Spark plugs	NGK	BKR5ES-11	←
	CHAMPION	RC10YC4	←
	Gap	1.0 ~ 1.1 mm	

STARTING SYSTEM

Items			Specification	
			1.6 CVVT	1.4 DOHC
Starter	Rated voltage		12 V, 0.9 kW	
	No. of pinion teeth		8	
	No-load characteristics	Voltage	11.5 V	
		Ampere	35A, MAX	
		Speed	4,350 rpm, MIN	
	Commutator diameter	Standard	29.3 ~ 29.4 mm (1.1535 ~1.1575in.)	
	Under cut depth	Standard	0.4 ~ 1.0 mm (0.0157 ~ 0.0394in.)	
		Limit	0.2 mm (0.0079in.)	

CHARGING SYSTEM

Items		Specification	
		1.6 CVVT	1.4 DOHC
Alternator	Type	Battery voltage sensing	
	Rate voltage	13.5 V, 90A	
	Speed in use	1,000 ~ 18,000 rpm	
	Voltage regulator	Electronic built-in type	
	Regulator setting voltage	14.55 ± 0.2 V	
	Temperature compensation	-7 ± 3 mV / °C	
Battery	Type	MF 55AH	MF 45AH
	Cold cranking amperage [at -18°C(-0.4°F)]	500 A	410 A
	Reserve capacity	85 min	80 min
	Specific gravity [at 20°C(68°F)]	1.280 ± 0.01	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).***

TROUBLESHOOTING EF5DCBCE

IGNITION SYSTEM

Symptom	Suspect area	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch Ignition coil Spark plugs Ignition wiring disconnected or broken Spark plugs cable	Inspect ignition lock switch, or replace as required Inspect ignition coil, or replace as required Inspect spark plugs, or replace as required Repair wiring, or replace as required Inspect cable, or replace as required
Rough idle or stalls	Ignition wiring Ignition coil Spark plugs cable	Repair wiring, or replace as required Inspect ignition coil, or replace as required Inspect cable, or replace as required
Engine hesitates / poor acceleration	Spark plugs and spark plug cables Ignition wiring	Inspect spark plugs / cable, or replace as required Repair wiring, or replace as required
Poor mileage	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required

CHARGING SYSTEM

Symptom	Suspect area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off.	Fuse blown Light burned out Wiring connection loose Electronic voltage regulator	Check fuses Replace light Tighten loose connection Replace voltage regulator
Charging warning indicator does not go out with engine running. (Battery requires frequent recharging)	Drive belt loose or worn Battery cable loose, corroded or worn Electronic voltage regulator or alternator Wiring	Adjust belt tension or replace belt Inspect cable connection, repair or replace cable Replace voltage regulator or alternator Repair or replace wiring
Overcharge	Electronic voltage regulator Voltage sensing wire	Replace voltage regulator Repair or replace wiring
Discharge	Drive belt loose or worn Wiring connection loose or short circuit Electronic voltage regulator or alternator Poor grounding Worn battery	Adjust belt tension or replace belt Inspect wiring connection, repair or replace wiring Replace voltage regulator or alternator Inspect ground or repair Replace battery

STARTING SYSTEM

Symptom	Suspect area	Remedy
Engine will not crank	Battery charge low Battery cables loose, corroded or worn out Transaxle range switch (Vehicle with automatic transaxle only) Fuse blown Starter motor faulty Ignition switch faulty	Charge or replace battery Repair or replace cables Refer to TR group-automatic transaxle Replace fuse Replace Replace
Engine cranks slowly	Battery charge low Battery cables loose, corroded or worn out Starter motor faulty	Charge or replace battery Repair or replace cables Replace
Starter keeps running	Starter motor Ignition switch	Replace Replace
Starter spins but engine will not crank	Short in wiring Pinion gear teeth broken or starter motor Ring gear teeth broken	Repair wiring Replace Replace fly wheel or torque converter

IGNITION SYSTEM

DESCRITION E9724F12

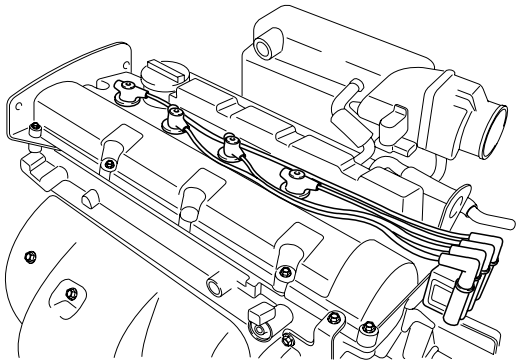
Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are pre-programmed in the memory of the ECM (Engine Control Module).

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.

ON-VEHICLE INSPECTION E4F36345

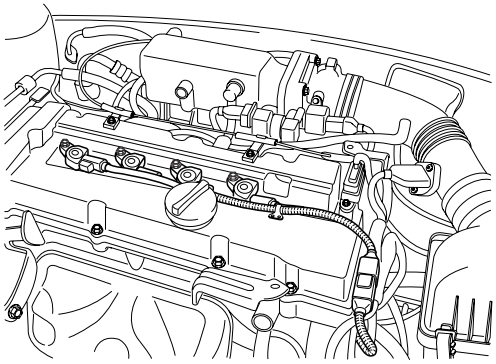
SPARK TEST

1. Remove the spark plug cable. (1.4 DOHC)



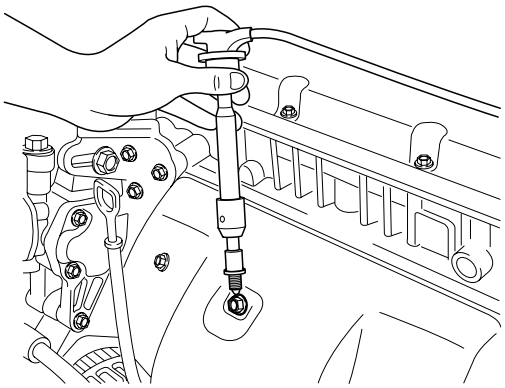
ACGE002A

2. Remove the ignition coil. (1.6 CVVT)



ADGE021A

3. Using a spark plug socket, remove the spark plug.
4. Install the spark plug to the spark plug cable. (1.4 DOHC)
5. Install the spark plug to the ignition coil. (1.6 CVVT)
6. Ground the spark plug to the engine.

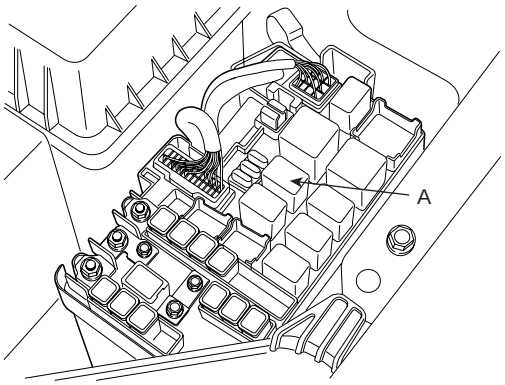


ABGE001A

7. Check is spark occurs while engine is being cranked.

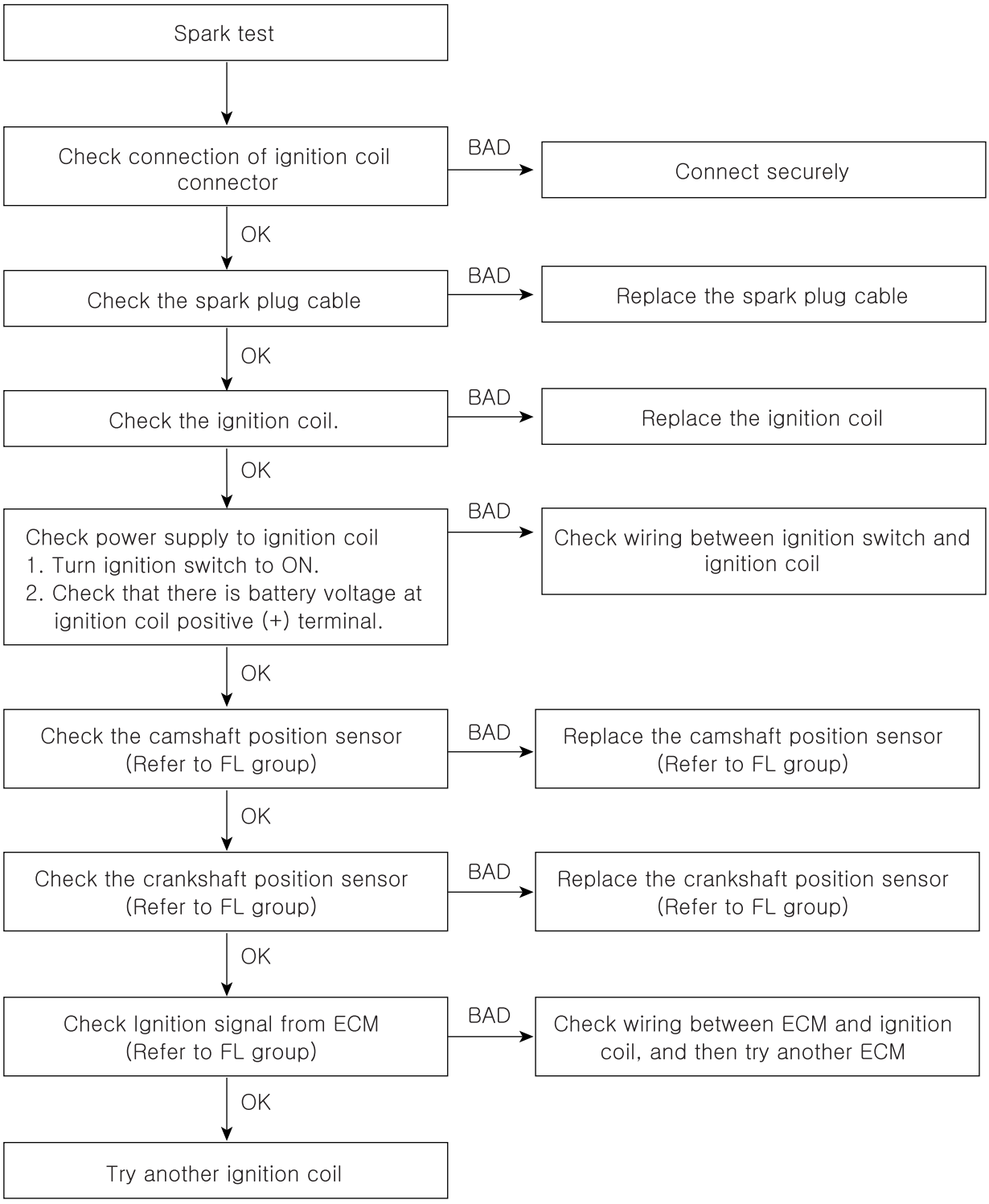
NOTE

To prevent fuel being injected from injectors while the engine is being cranked, remove the fuel pump(A) relay from the fuse box.
Crank the engine for no more than 5 ~ 10 seconds.



ABJF010A

8. Inspect all the spark plugs.
9. Using a spark plug socket, install the spark plug.
10. Install the spark plug cable. (1.4 DOHC)
11. Install the ignition coil. (1.6 CVVT)


Spark test
Check connection of ignition coil connector
BAD
Connect securely
OK
Check the spark plug cable
BAD
Replace the spark plug cable
OK
Check the ignition coil.
BAD
Replace the ignition coil
OK
Check power supply to ignition coil
1. Turn ignition switch to ON.
2. Check that there is battery voltage at ignition coil positive (+) terminal.
BAD
Check wiring between ignition switch and ignition coil
OK
Check the camshaft position sensor (Refer to FL group)
BAD
Replace the camshaft position sensor (Refer to FL group)
OK
Check the crankshaft position sensor (Refer to FL group)
BAD
Replace the crankshaft position sensor (Refer to FL group)
OK
Check Ignition signal from ECM (Refer to FL group)
BAD
Check wiring between ECM and ignition coil, and then try another ECM
OK
Try another ignition coil

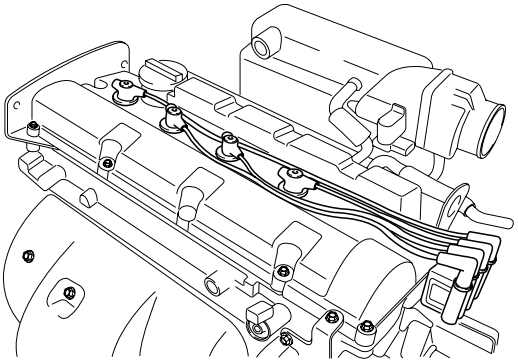
LBJF001A

INSPECT SPARK PLUG

1. Remove the spark plug cable. (1.4 DOHC)

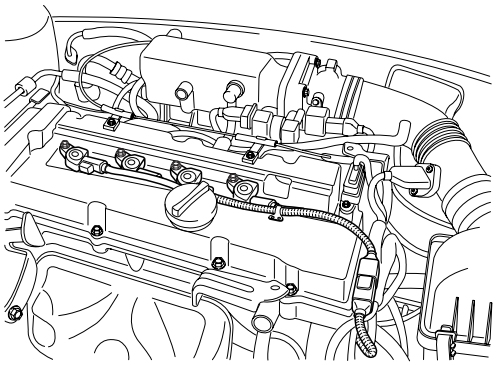
NOTE

When removing the spark plug cable, pull on the spark plug cable boot (not the cable), as it may be damaged.



ACGE002A

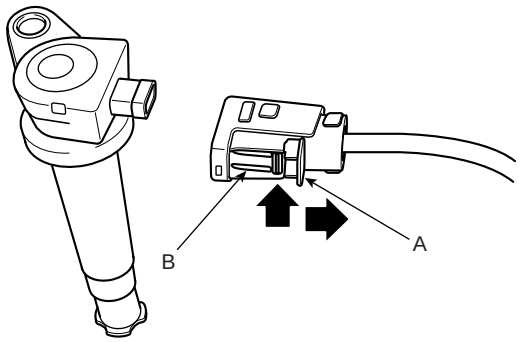
2. Remove the ignition coil with bolt. (1.6 CVVT)



ADGE021A

NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).



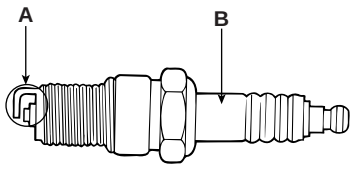
ABGE003A

3. Using a spark plug socket, remove the spark plug.

CAUTION

Be careful that no contaminates enter through the spark plug holes.

4. Inspect the electrodes (A) and ceramic insulator (B).



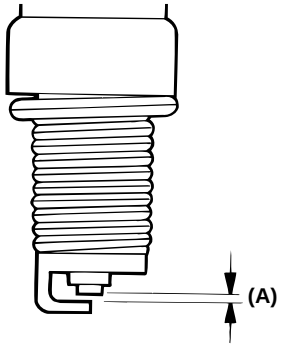
EBKD002K

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

5. Check the electrode gap (A).

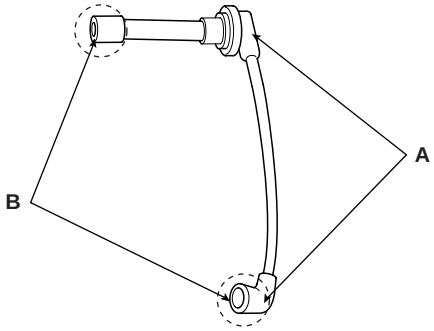
Standard : 1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)



EBKD002L

INSPECT SPARK PLUG CABLE (1.4 DOHC)

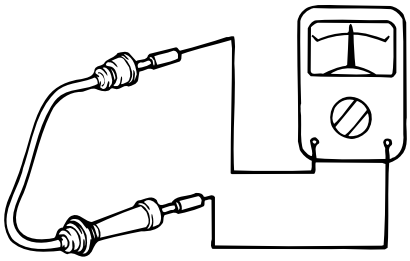
1. Carefully remove the spark plug cable by pulling on the rubber boots (A).
   Check the condition of the spark plug cable terminals (B), if any terminal is corroded, cleans it, and if it broken or distorted, replace the spark plug cable.



ABGE009A

2. Connect the ohmmeter probes and measure resistance.

RESISTANCE : 5.6kΩ /m ± 20%

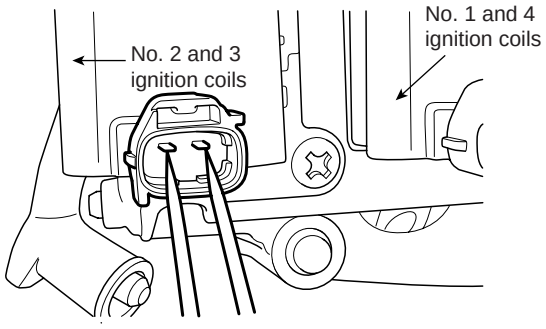


EBKD002P

3. Resistance should not be higher than 10kΩ /m.
   If resistance is higher, replace the cable.

INSPECT IGNITION COIL (1.4 DOHC)

1. Measure the primary coil resistance between terminals (+) and (-).



LBJF002A

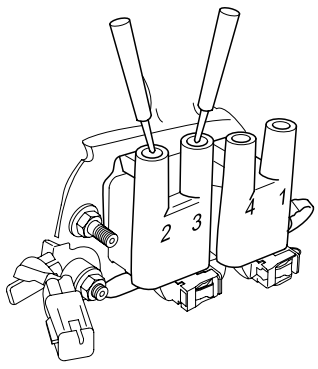
Standard value: 0.87Ω ± 10%

2. Measure the secondary coil resistance between the high-voltage terminals for the No.1 and No. 4 cylinders, and between the high voltage terminals for the No. 2 and No. 3 cylinders.

Standard value: 13.0kΩ ± 15%

CAUTION

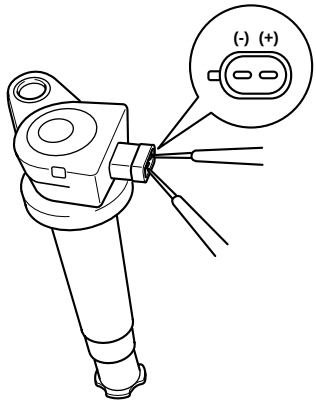
Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.



EBKD002C

INSPECT IGNITION COIL (1.6 CVVT)

1. Measure the primary coil resistance between terminals (+) and (-).



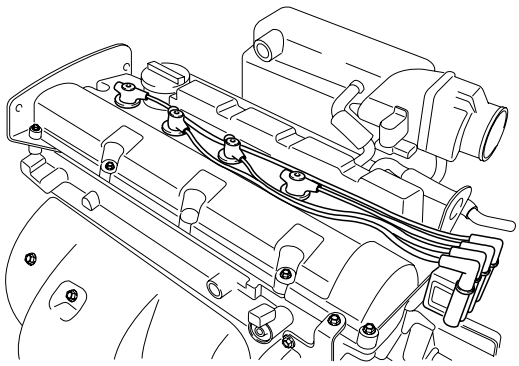
ABGE004A

Standard value: 0.7Ω ± 15%

REPLACEMENT E0AFE6B4

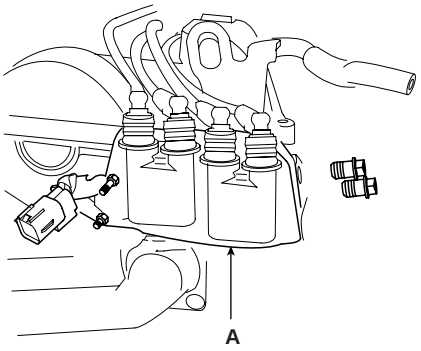
IGNITION COIL (1.4 DOHC)

1. Remove the engine cover.
2. Disconnect the spark plug cables and the ignition coil connector.



ACGE002A

3. Remove the ignition coil (A).

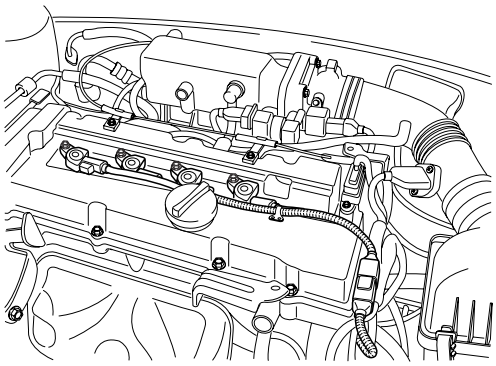


EBKD003A

4. Installation is the reverse of removal.

IGNITION COIL (1.6 CVVT)

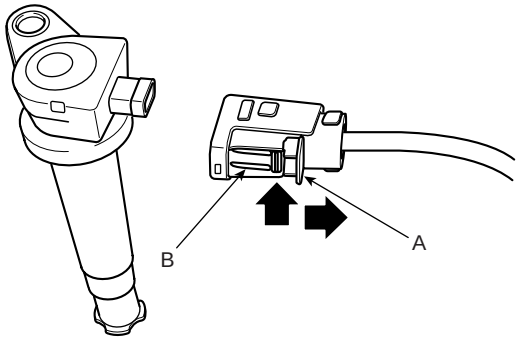
1. Remove the engine cover.
2. Remove the ignition coil with bolt.



ADGE021A

NOTE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).



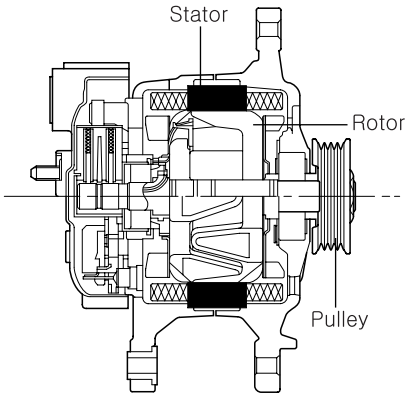
ABGE003A

3. Installation is the reverse of removal.

CHARGING SYSTEM

DESCRIPTION E024309A

The charging system included 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.



LBJF003A

ON-VEHICLE INPECTION E0EDEC50

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 BATTERY VOLTAGE

1. If 20 minutes have not passed since the engine was stopped, turn the ignition switch ON and turn on the electrical system (headlamp, blower motor, rear defogger etc.) for 60 seconds to remove the surface charge.

2. Turn the ignition switch OFF and turn off the electrical systems.

3. Measure the battery voltage between the negative (-) and positive (+) terminals of the battery.

Standard voltage : 12.5 ~ 12.9V at 20°C(68°F)

If the voltage is less than specification, charge the battery.

CHECK THE BATTERY TERMINALS AND FUSES

1. Check that the battery terminals are not loose or corroded.

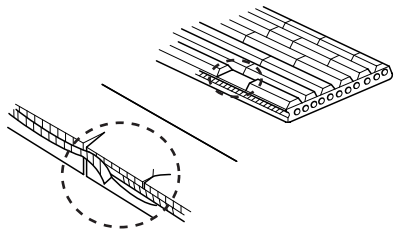
2. Check the fuses for continuity.

INSPECT DRIVE BELT

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.



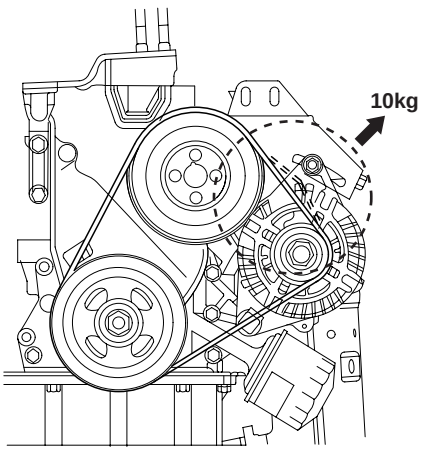
EBKD004B

2. Measure the drive belt tension and adjust it.
   Apply a force of 98N (10kg, 22lb), and measure the deflection between the alternator and the water pump pulley.

DEFLECTION

New belt	3.3 ~ 3.7mm (0.1299 ~ 0.1457in.)
Used belt	4.2 ~ 4.7mm (0.1654 ~ 0.1850in.)

If the belt tension is not as specified, adjust it.



ABJF002A

NOTE

- *"New belt" refers to a belt which has been used less than 5 minutes on a running engine.*
- *"Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.*
- *After installing a belt, check that it fits properly in the ribbed grooves.*
- *Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.*
- *After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.*

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.

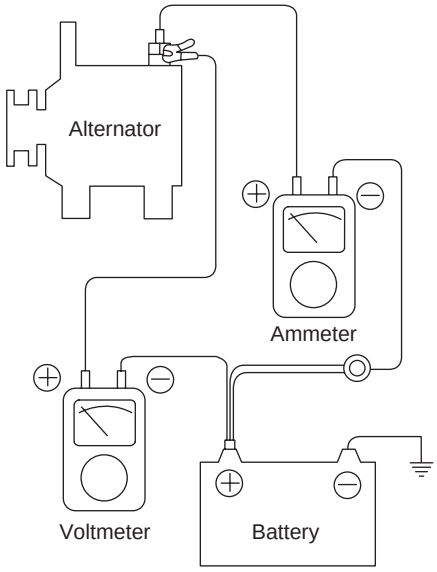
INSPECT CHARGING SYSTEM

VOLTAGE DROP TEST OF ALTERNATOR OUTPUT WIRE

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

PREPARATION

1. Turn the ignition switch to "OFF".
2. Disconnect the output wire from the alternator "B" terminal. Connect the (+) lead wire of ammeter to the "B" terminal of alternator and the (-) lead wire of ammeter to the output wire. Connect the (+) lead wire of voltmeter to the "B" terminal of alternator and the (-) lead wire of voltmeter to the (+) terminal of battery.



BBGE002A

TEST

1. Start the engine.
2. Turn on the headlamps and blower motor, and set the engine speed until the ammeter indicates 20A.
   And then, read the voltmeter at this time.

RESULT

1. The voltmeter may indicate the standard value.

Standard value: 0.2V max

2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the alternator "B" terminal to the battery (+) terminal. Check for loose connections, color change due to an over-heated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle.
   Turn off the headlamps, blower motor and the ignition switch.

OUTPUT CURRENT TEST

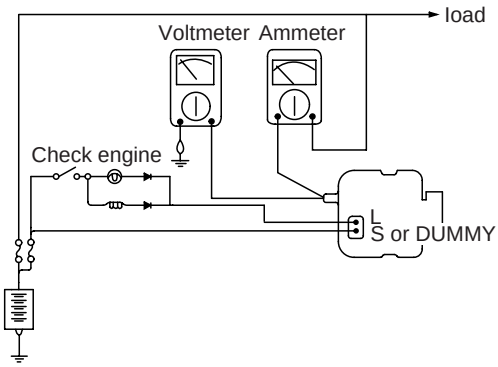
This test determines whether or not the alternator gives an output current that is equivalent to the normal output.

PREPARATION

1. Prior to the test, check the following items and correct as necessary.
   Check the battery installed in the vehicle to ensure that it is good condition. The battery checking method is described in the section "Battery".
   The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.
   Check the tension of the alternator drive belt. The belt tension check method is described in the section "Inspect drive belt".
2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

   NOTE

   Tighten each connection securely, as a heavy current will flow. Do not rely on clips.
6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



EBKD013H

TEST

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between alternator "B" terminal and battery (-) terminal or poor grounding is suspected.
2. Start the engine and turn on the headlamps.
3. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

   NOTE

   After the engine start up, the charging current quickly drops.
   Therefore, the above operation must be done quickly to read the maximum current value correctly.

RESULT

1. The ammeter reading must be higher than the limit value. If it is lower but the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

Limit value (90A alternator): 63A min.

NOTE

- *The nominal output current value is shown on the nameplate affixed to the alternator body.*
- *The output current value changes with the electrical load and the temperature of the alternator itself.*
  Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load.
  The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.
  In such a case, reduce the temperature before testing again.

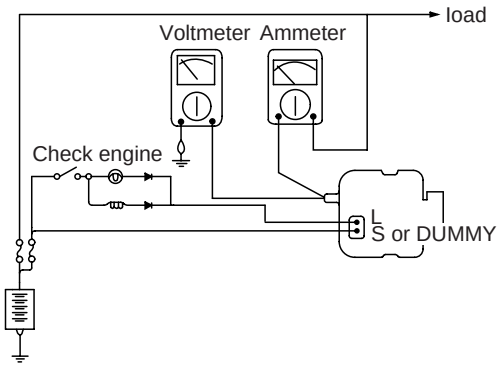
2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

REGULATED VOLTAGE TEST

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

PREPARATION

1. Prior to the test, check the following items and correct if necessary.
   Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".
   Check the alternator drive belt tension. The belt tension check method is described in the section "Inspect drive belt".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



EBKD013H

TEST

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

Voltage: Battery voltage

If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-) terminal.

2. Start the engine. Keep all lights and accessories off.
3. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less

RESULT

1. If the voltmeter reading agrees with the value listed in the regulating voltage table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.

REGULATING VOLTAGE TABLE

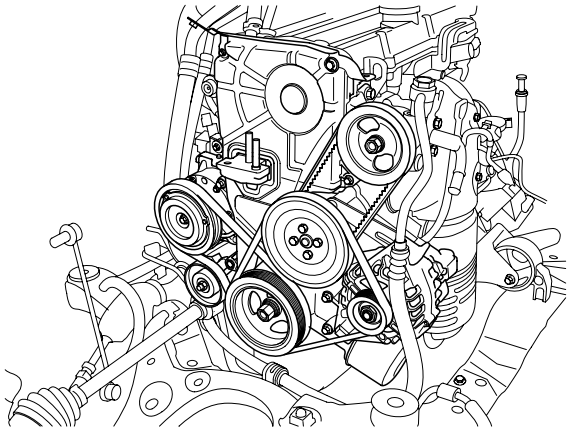
Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-20 (-4)	14.2 ~ 15.4
20 (68)	14.0 ~ 15.0
60 (140)	13.7 ~ 14.9
80 (176)	13.5 ~ 14.7

2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

ALTERNATOR

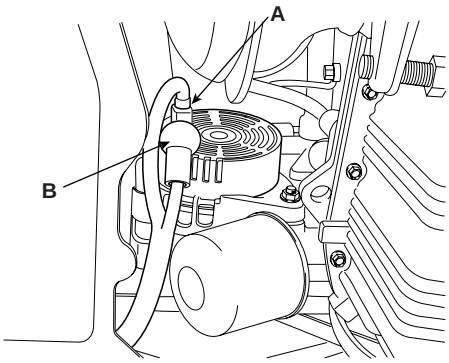
REPLACEMENT EAFC6680

1. Disconnect the battery negative terminal first, then the positive terminal.
2. Remove the drive belts.



ACJF002A

3. Disconnect the alternator connector (A), and remove the cable (B) from alternator "B" terminal.

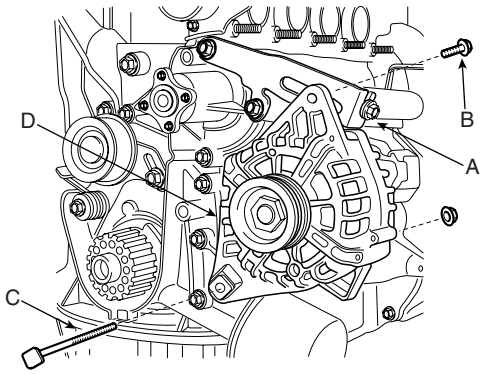


ACGE014A

4. Remove the power steering pump. (Refer to ST group - power steering pump)
5. Remove the power steering pump bracket.

6. Remove the adjusting bolt (A) and mounting bolt (B), then remove the alternator drive belt.

7. Pull out the through bolt (C) and then remove the alternator (D).



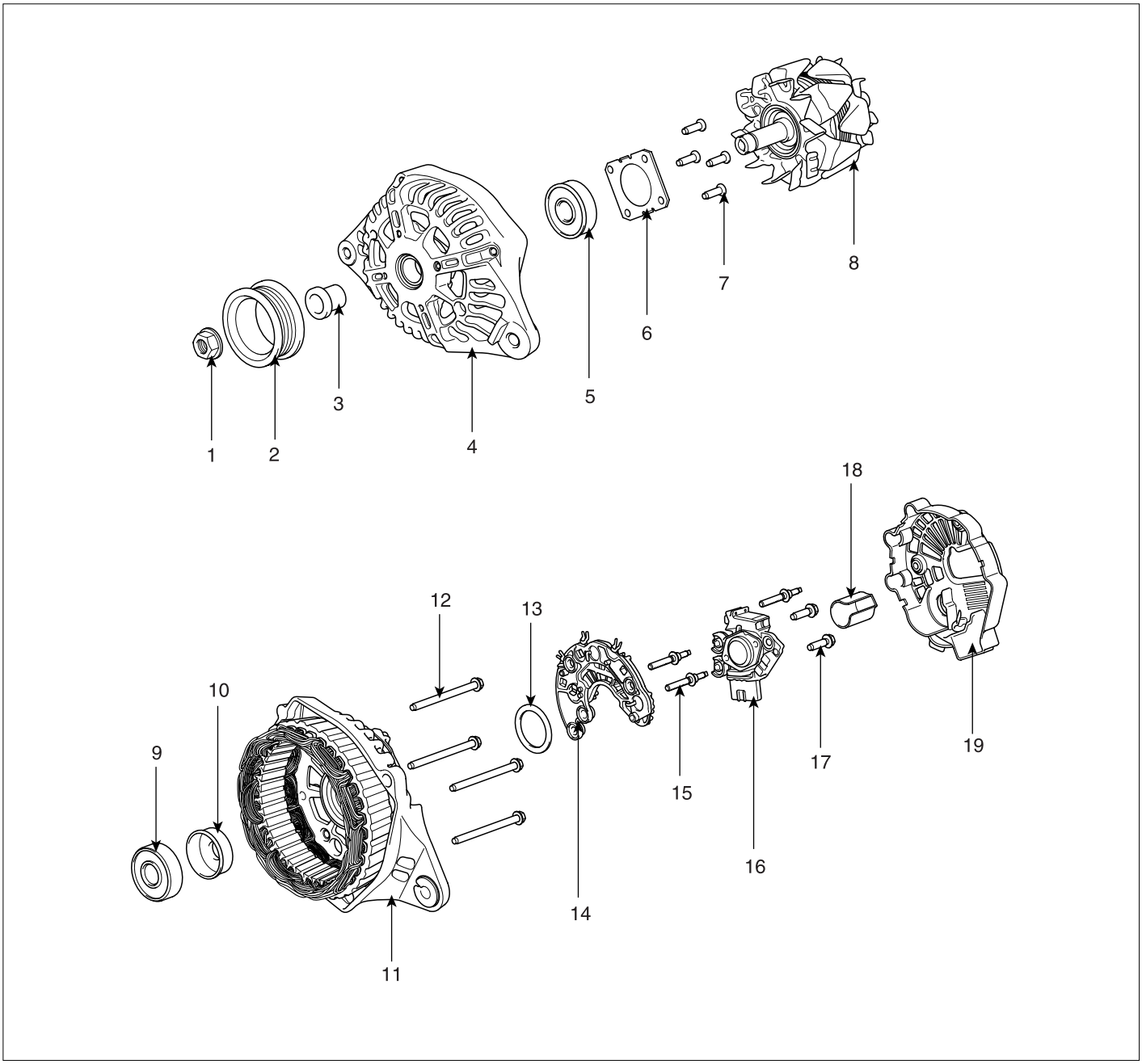
ABJF003A

8. Installation is the reverse order of removal.

9. Adjust the alternator belt tension after installation.

10. Install the power steering pump and adjust the power steering belt tension. (Refer to ST group - power steering pump)

COMPONENT E3F8E95F

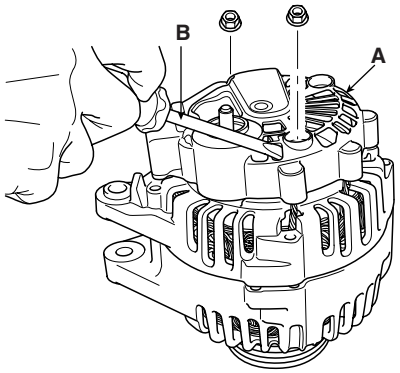


1. Nut
2. Pulley
3. Spacer
4. Front cover assembly
5. Front bearing
6. Bearing cover
7. Bearing cover bolts
8. Rotor coil
9. Rear bearing
10. Bearing cover
11. Rear cover
12. Bolts
13. Seal
14. Rectifier assembly
15. Stud bolts
16. Brush holder assembly
17. Brush holder bolts
18. Slip ring guide
19. Cover

LBGE008A

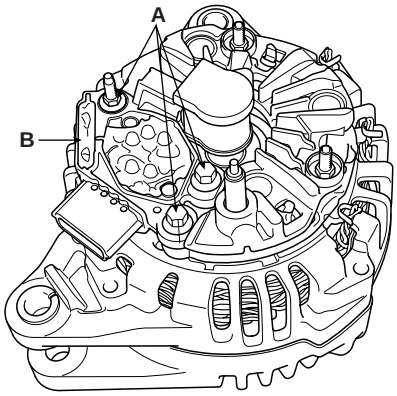
DISASSEMBLY E43E1C51

1. Remove the alternator cover(A) using a screw driver(B).



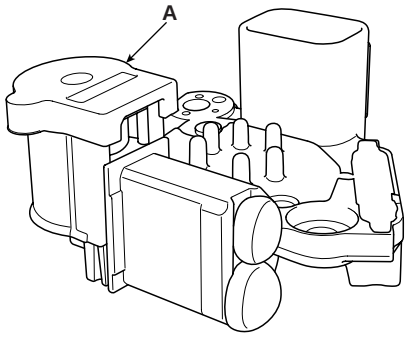
ABJF004A

2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



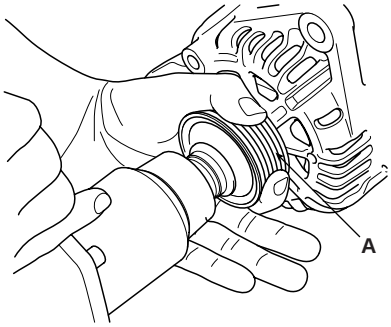
EBKD301B

3. Remove the slip ring guide(A).



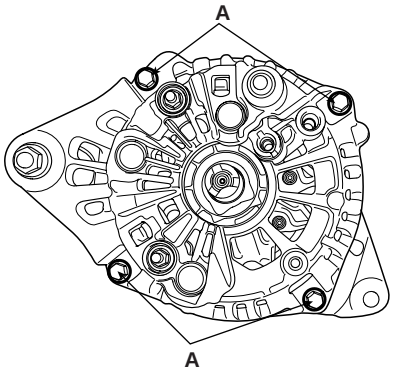
EBKD301C

4. Remove the nut, pulley(A) and spacer.



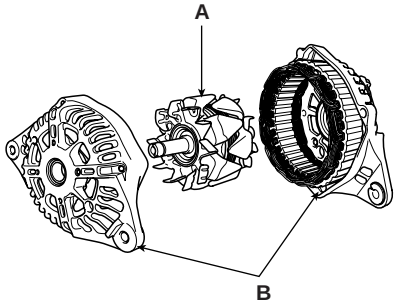
EBKD301D

5. Loosen the 4 through bolts(A).



EBKD301E

6. Disconnect the rotor(A) and cover(B).



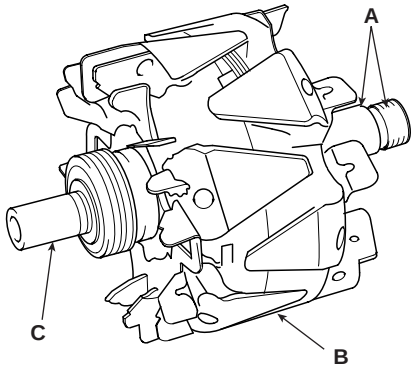
EBKD301G

7. Reassembly is the reverse of disassembly.

INSPECTION EECF033F

INSPECT ROTOR

1. Check that there is continuity between the slip rings (A).

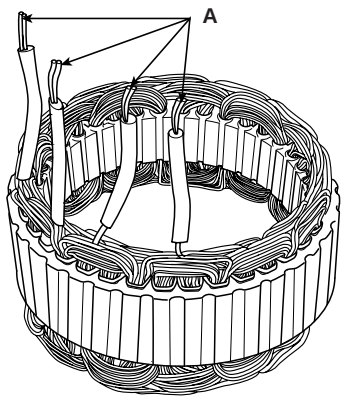


EBKD008A

2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (C).
3. If the rotor fails either continuity check, replace the alternator.

INSPECT STATOR

1. Check that there is continuity between each pair of leads (A).



EBKD008B

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.

ALTERNATOR BELT INSPECTION AND ADJUSTMENT

NOTE

When using a new belt, first adjust the deflection or tension to the values for the new belt, then readjust the deflection or tension to the value for the used belt after running engine for five minutes.

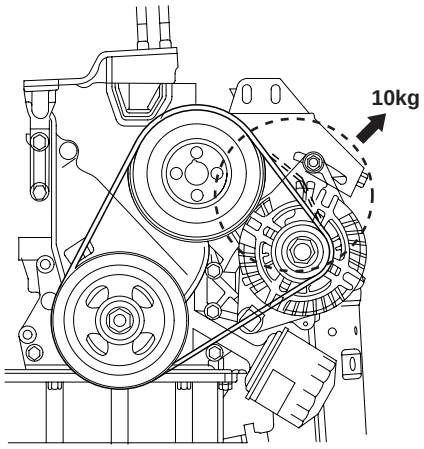
DEFLECTION METHOD:

Apply a force of 98N (10kg, 22lb), and measure the deflection between the alternator and the water pump pulley.

Deflection
Used belt: 4.2 ~ 4.7 mm (0.1654 ~ 0.1850 in)
New belt: 3.3 ~ 3.7 mm (0.1299 ~ 0.1457 in)

NOTE

If the belt is worn or damaged, replace it.



ABJF002A

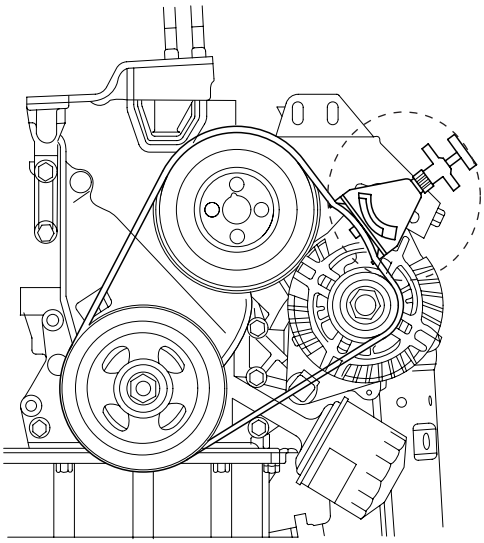
BELT TENSION GAUGE METHOD:

Attach the belt tension gauge to the belt and measure the tension. Follow the gauge manufacturer's instructions.

Tension
Used belt: 392.3 ~ 490.3N (40 ~ 50kg, 88.2 ~ 110.2lb)
New belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)

NOTE

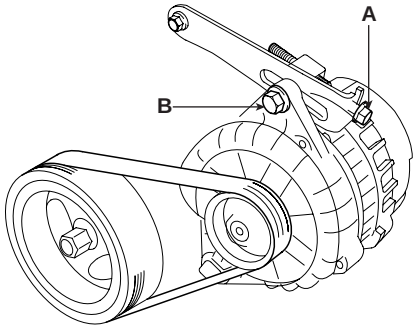
If the belt is worn or damaged, replace it.



EBKD008D

IF ADJUSTMENT IS NECESSARY:

1. Loosen adjusting bolt (A) and the lock bolt (B).
2. Move the alternator to obtain the proper belt tension, then retighten the nuts.



EBKD008E

3. Recheck the deflection or tension of the belt.

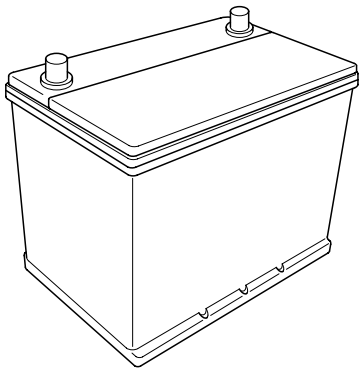
NOTE

For the power steering pump belt and A/C compressor belt adjustments, refer to ST group - power steering pump and HA group - air compressor.

BATTERY

DESCRIPTION EFAA5B7B

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.
3. The battery is completely sealed, except for small vent holes in the cover.

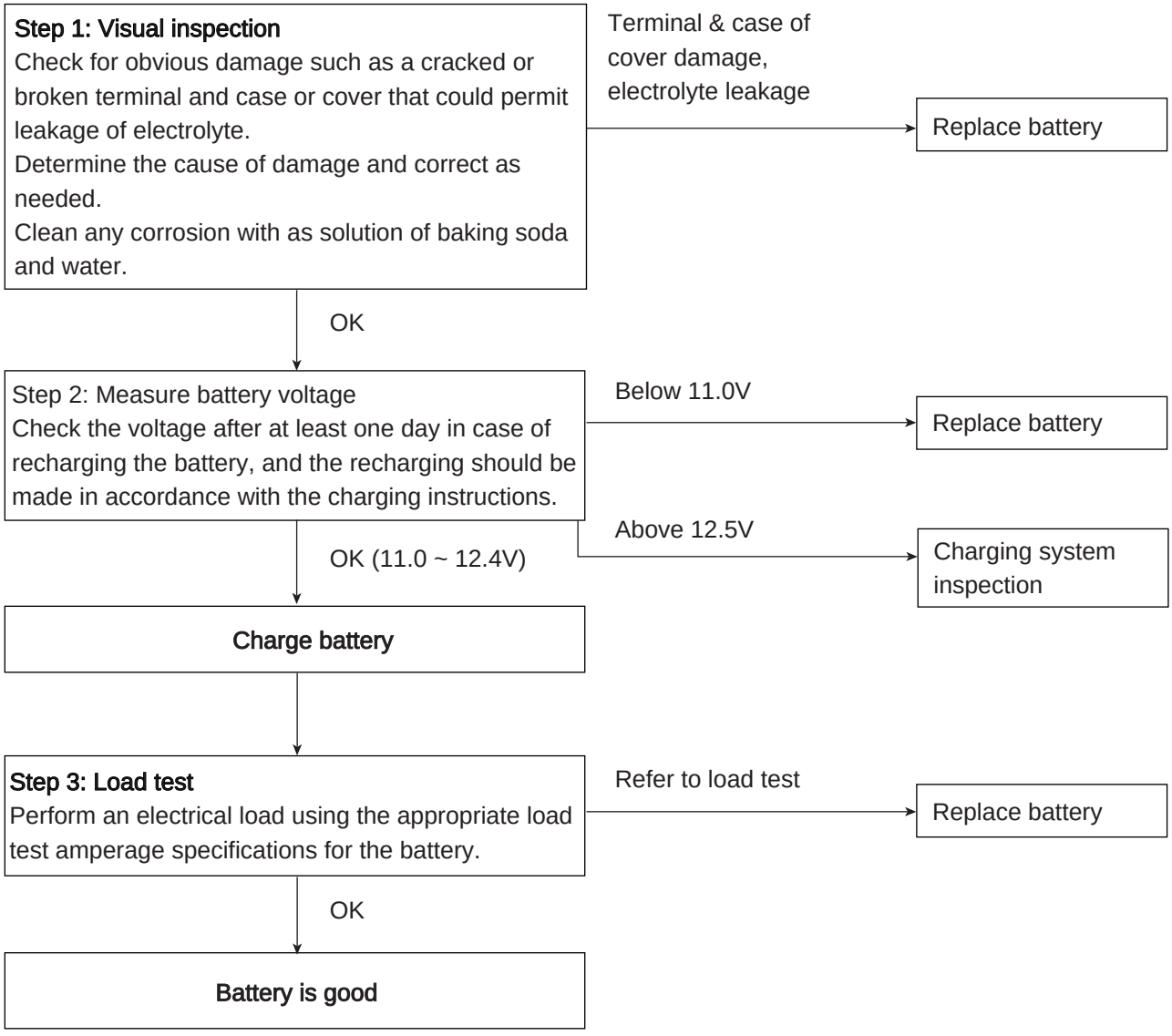


EBJD008A

INSPECTION EFCD68F1

BATTERY DIAGNOSTIC TEST (1)

CHECKING FLOW



BBGE007A

LOAD TEST

1. Perform the following steps to complete the load test procedure for maintenance free batteries.
2. Connect the load tester clamps to the terminals and proceed with the test as follow:
   1) If the battery has been on charge, remove the surface charge by connect a 300ampere load for 15 seconds.
   2) Connect the voltmeter and apply the specified load.
   3) Read the voltage after the load has been applied for 15 seconds.
   4) Disconnect the load.
   5) Compare the voltage reading with the minimum and replace the battery if battery test voltage is below that shown in the voltage table.

Voltage	Temperature
9.6V	20°C (68.0°F) and above
9.5V	16°C (60.8°F)
9.4V	10°C (50.0°F)
9.3V	4°C (39.2°F)
9.1V	-1°C (30.2°F)
8.9V	-7°C (19.4°F)
8.7V	-12°C (10.4°F)
8.5V	-18°C (-0.4°F)

NOTE

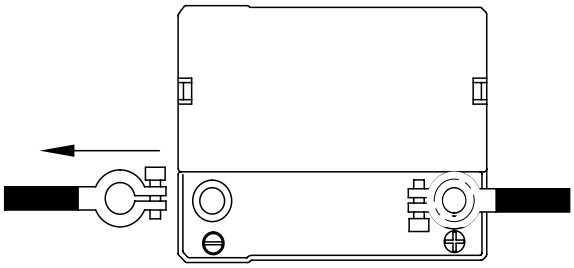
- *If the voltage is greater shown in the table, the battery is good.*
- *If the voltage is less than shown in the table, replace the battery.*

BATTERY DIAGNOSTIC TEST (2)

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.



EBJD008B

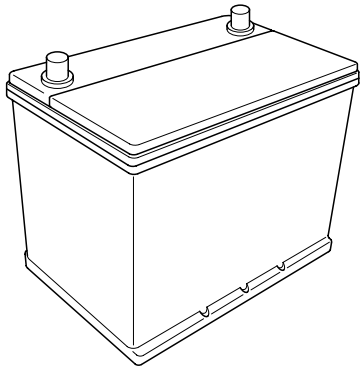
4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the 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.

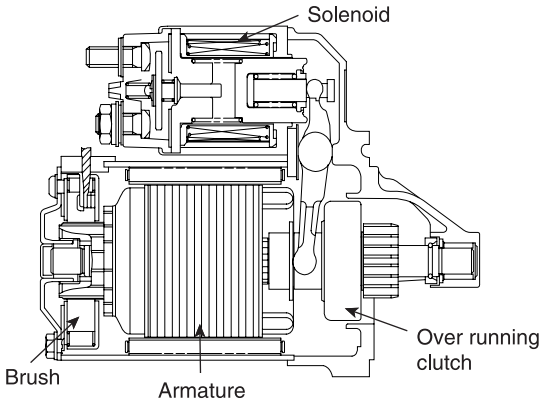


EBJD008A

STARTING SYSTEM

DESCRIPTION E16E5DEF

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.



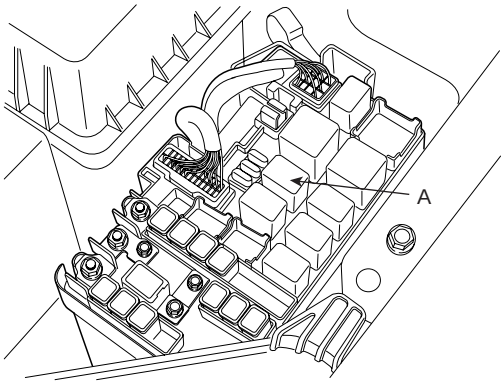
LBHE003A

STARTER CIRCUIT TROUBLESHOOTING E0F08581

NOTE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay from the fuse box.



ABJF010A

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.

   - Solenoid plunger and switch malfunction.
   - 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.

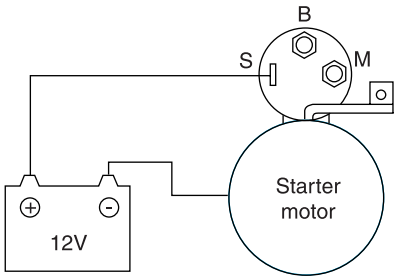
   If the starter cranks the engine, go to next step.
   If the starter still does not crank the engine, remove the starter, and repair or replace as necessary.

5. Check the following items in the order listed until you find the open circuit.

   - 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.
   - Check the ignition switch (Refer to BE group - ignition system)
   - Check the transaxle range switch connector or ignition lock switch connector.
   - Inspect the starter relay.

STATER SOLENOID TEST

1. Disconnect the field coil wire from the M-terminal of solenoid switch.
2. Connect a 12V battery between S-terminal and the starter body.



BBGE004A

3. Connect the field coil wire to the M-terminal.

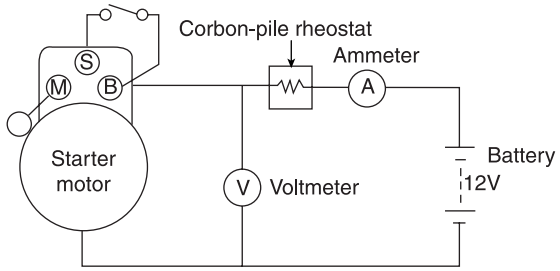
CAUTION

This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

4. If the pinion moves out, the pull-in coil of solenoid is working properly.
   If the pinion does not move, replace the solenoid.
5. Diconnect the field coil wire from the M-terminal.
6. If the pinion has moved out, the hold-in coil of the solenoid is working properly.
   If the pinion moves in, replace the solenoid.

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.



BBGE005A

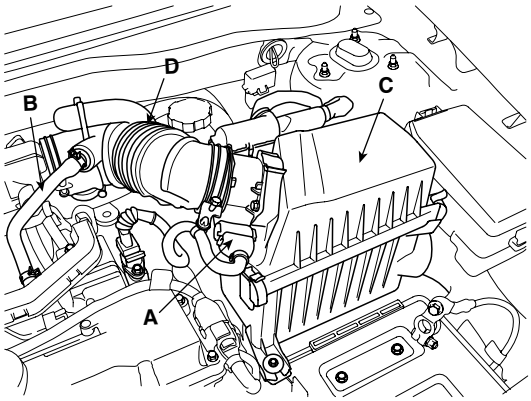
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery' s negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Current : 35A max
Speed : 4350 rpm

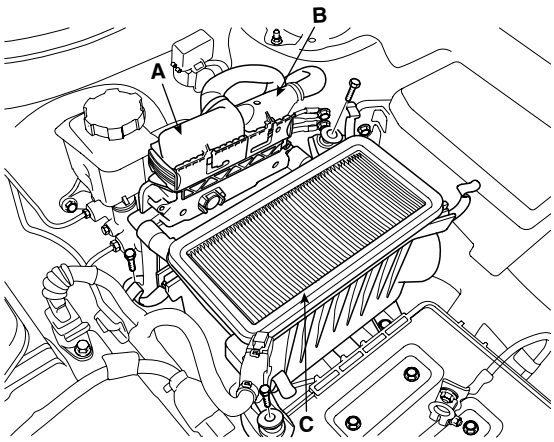
STARTER

REPLACEMENT E2F9D550

1. Disconnect the battery negative cable.
2. Remove the air cleaner assembly. (Refer to EM-)

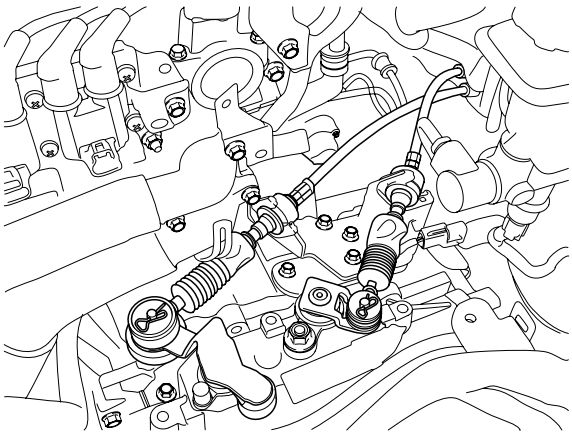


ACJF007A



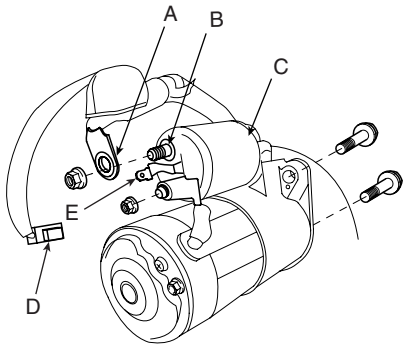
ACJF008A

3. Remove the shift cable and bracket. (M/T)



ACJF025A

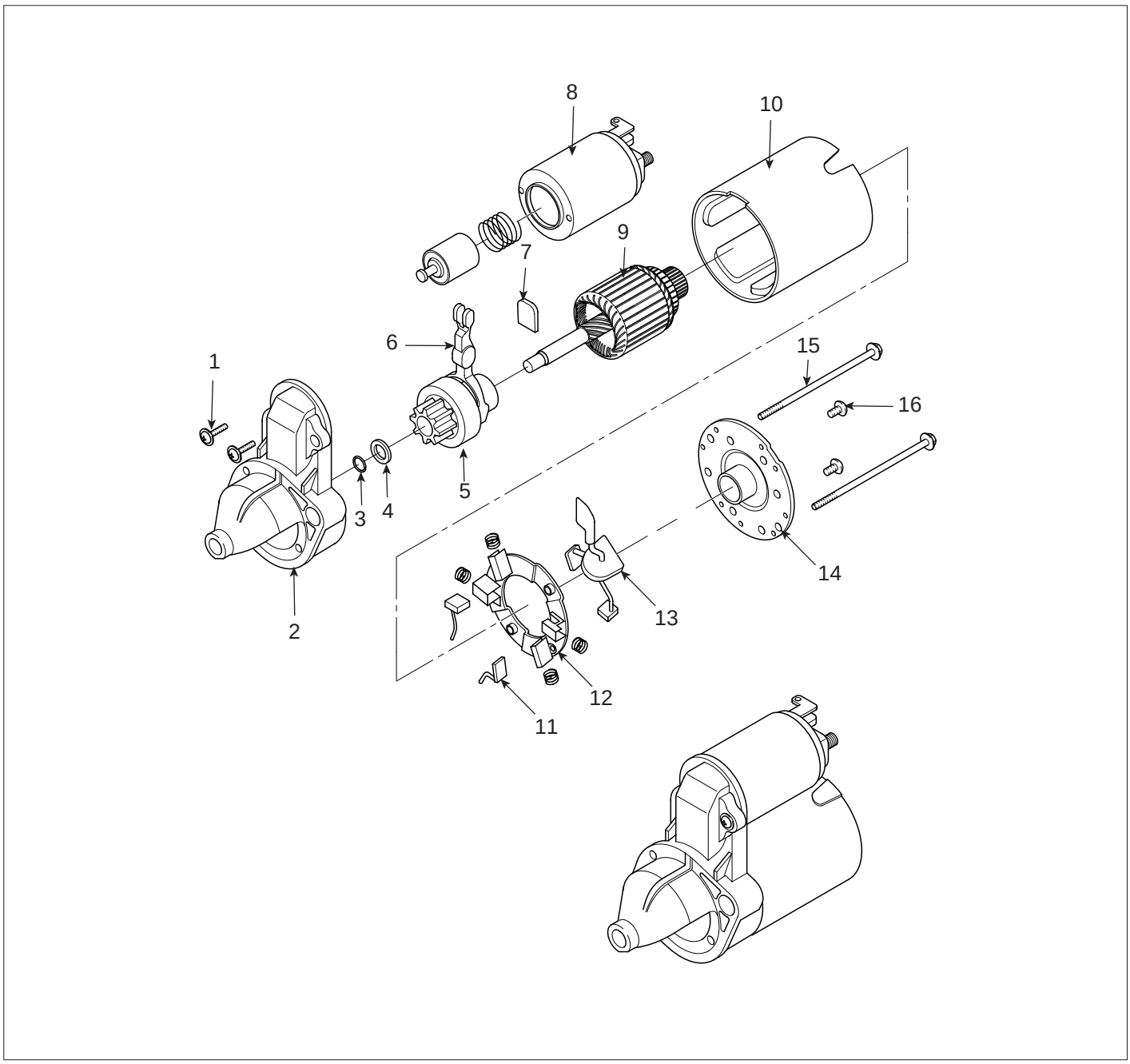
4. Disconnect the starter cable (A) from the B terminal (B) on the solenoid (C), then disconnect the connector (D) from the S terminal (E).



ABGE024A

5. Remove the 2 bolts holding the starter, then remove the starter.
6. Installation is the reverse of removal.
7. Connect the battery negative cable to the battery.

COMPONENT EB04E4D2

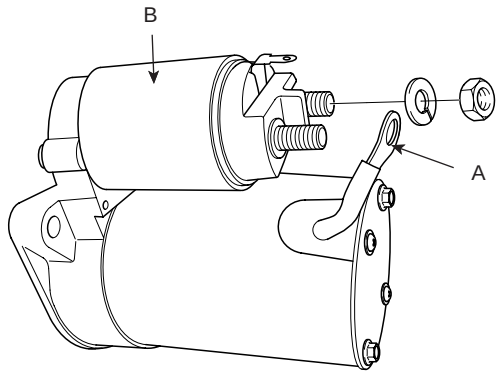


1. Screw
2. Front bracket assembly
3. Stop ring
4. Stopper
5. Overruning clutch assembly
6. Lever
7. Lever packing
8. Magnet switch assembly
9. Armature assembly
10. Yoke assembly
11. Brush (-)
12. Brush holder assembly
13. Brush (+)
14. Rear bracket
15. Through bolt
16. Screw

LBJF004A

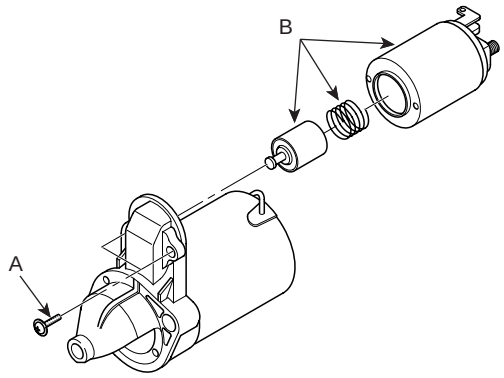
DISASSEMBLY EEA12C44

1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



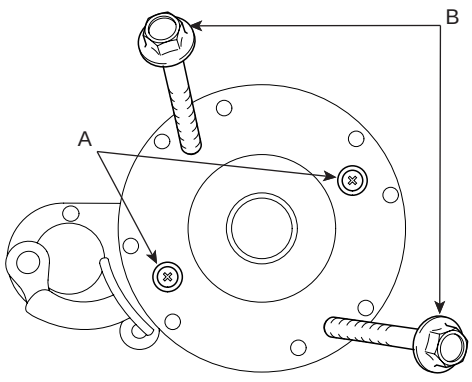
ABHE003A

2. After loosening the 2 screws (A), detach the magnet switch assembly (B).



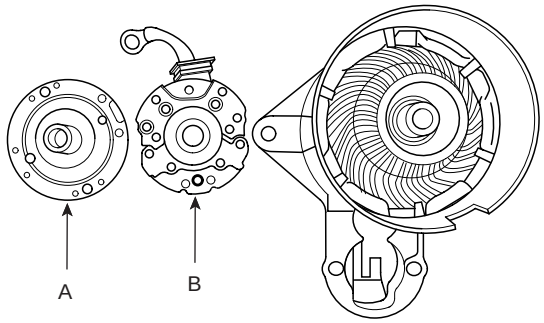
ABHE004A

3. Loosen the brush holder mounting screw (A) and through bolts (B).



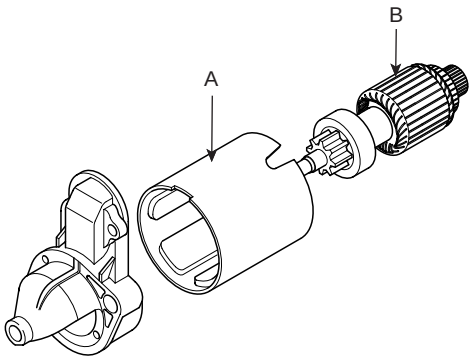
ABHE005A

4. Remove the rear bracket (A) and brush holder assembly (B).



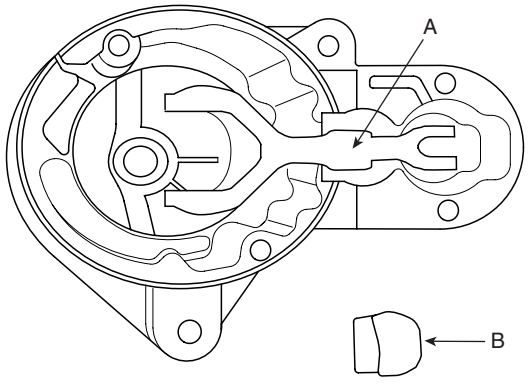
ABHE006A

5. Remove the yoke (A) and armature (B).



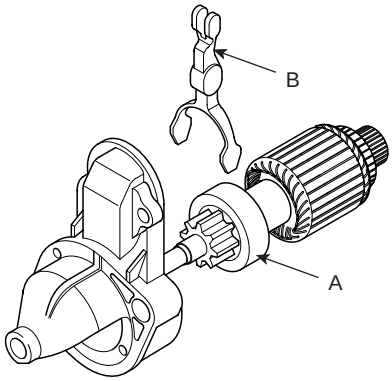
ABHE007A

6. Remove the, lever plate (A) and packing (B).



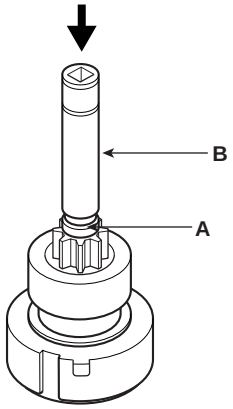
ABJF006A

7. Remove the overrunning clutch (A) and lever (B).



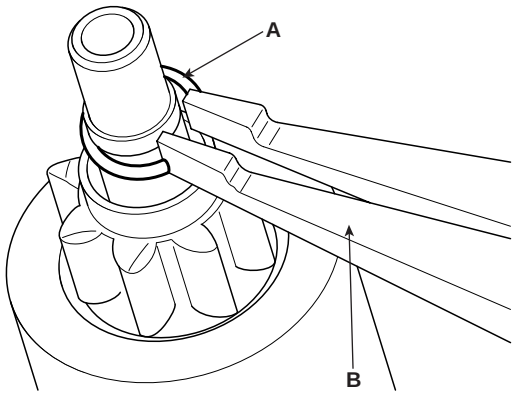
ABHE009A

8. Press the stop ring (A) using a socket (B).



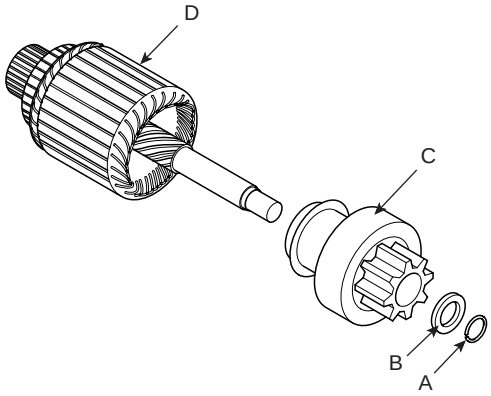
EBKD011K

9. After removing the stopper (A) using stopper pliers (B).



EBKD011L

10. Remove the stopper (A), stop ring (B), overrunning clutch (C) and armature (D).

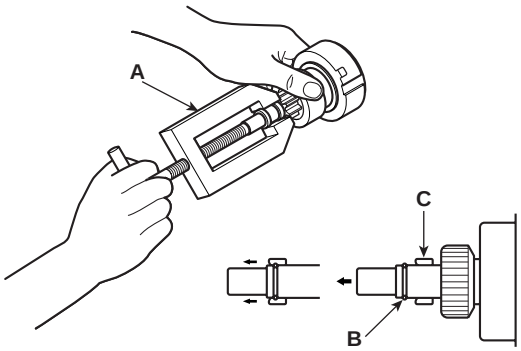


ABHE010A

11. Reassembly is the reverse of disassembly.

NOTE

Using a suitable pulling tool (A), pull the overrunning clutch stop ring (B) over the stopper (C).

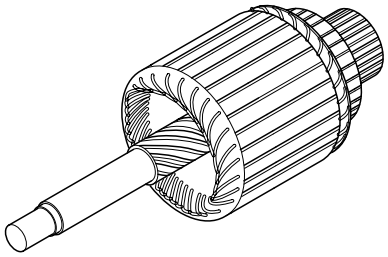


EBKD011O

INSPECTION E6B30AA7

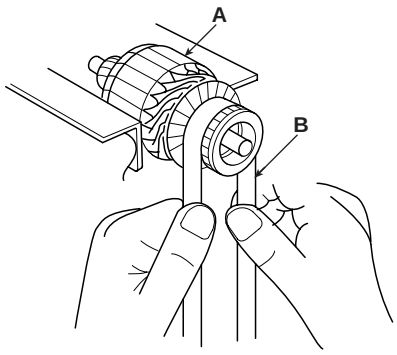
ARMATURE INSPECTION AND TEST

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.



ABHE011A

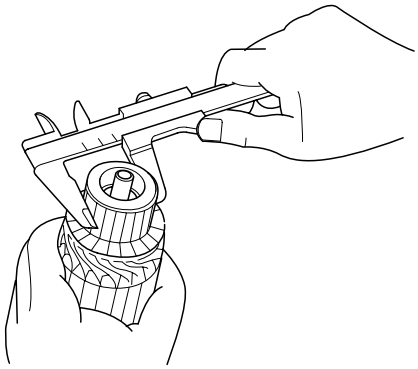
4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



EBKD012B

5. Check the commutator diameter. If the diameter is below the service limit, replace the armature.

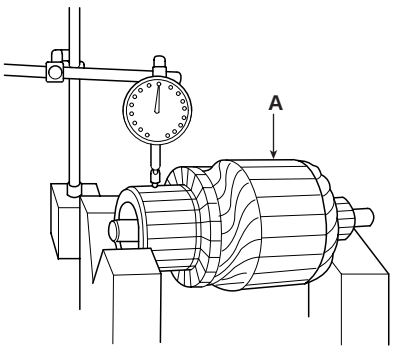
Commutator diameter
Standard (New) : 29.3 ~ 29.4 mm (1.1535 ~ 1.1575 in)



EBKD012C

6. Measure the commutator (A) runout.
   - If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   - If the commutator run out is not within the service limit, replace the armature.

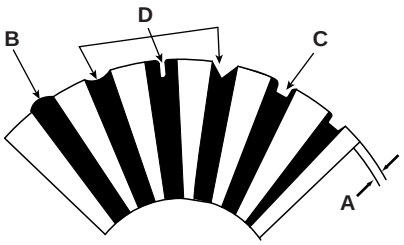
Commutator runout
Standard (New): 0.02mm (0.0008in.) max
Service limit: 0.05mm (0.0020in.)



EBKD012D

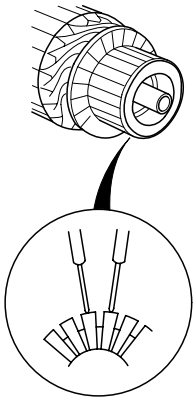
7. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

Commutator mica depth Standard (New) : 0.4 ~ 1.0 mm (0.0157 ~ 0.0394 in.) Limit : 0.2mm (0.0079 in.)



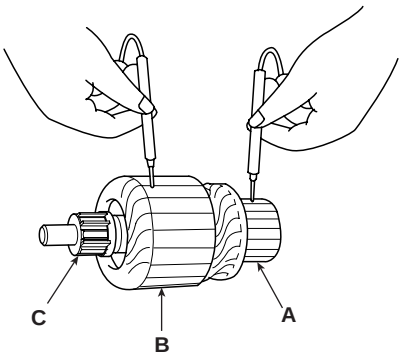
EBKD012E

8. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



EBKD012F

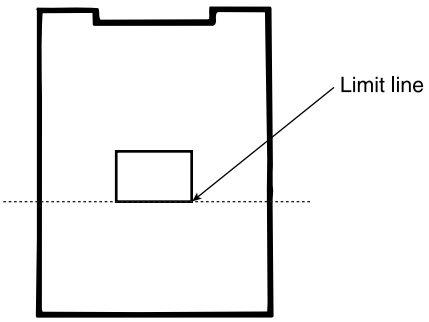
9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



EBKD012G

INSPECT STARTER BRUSH

Brushes that are worm out, or oil-soaked, should be replaced.



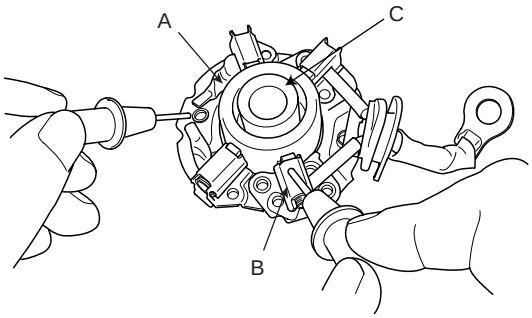
BBGE008A

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.

STARTER BRUSH HOLDER TEST

1. Check that there is no continuity between the (+) brush holder (A) and (-) brush holder (B). If there is no continuity, replace the brush holder assembly.



ABHE012A

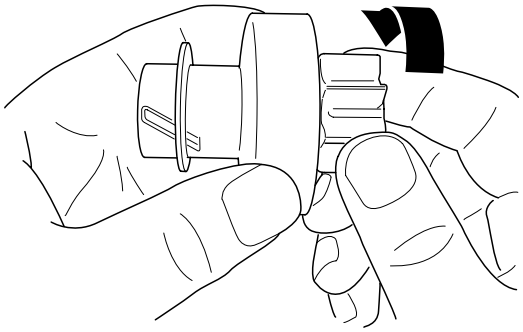
NOTE

Use a pipe (C) of suitable size for the brushes not to get removed from the brush holder.

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.



ABHE013A

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.

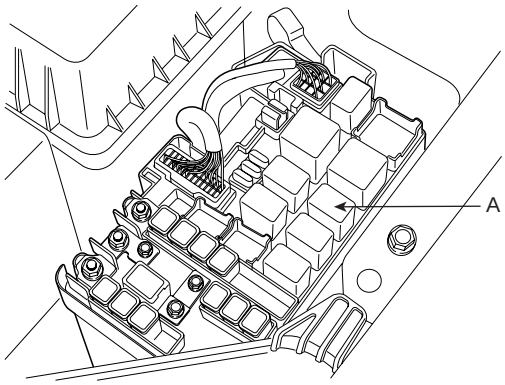
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.

3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

STARTER RELAY

INSPECTION E553B0B9

1. Remove the fuse box cover.
2. Remove the starter relay (A).

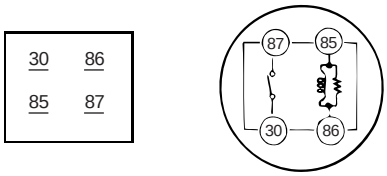


ABJF011A

3. Using an ohmmeter, check that there is continuity between each terminal.

Terminal	Continuity
30 - 87	NO
85 - 86	YES

4. Apply 12V to terminal 85 and ground to terminal 86. Check for continuity between terminals 30 and 87.



LDAD510B

5. If there is no continuity, replace the starter relay.
6. Install the starter relay.
7. Install the fuse box cover.

Emissions Control System

GENERAL

CRANKCASE EMISSION CONTROL SYSTEM
- POSITIVE CRANKCASE VENTILATION (PCV) VALVE

EVAPORATIVE EMISSION CONTROL SYSTEM
- EVAPORATIVE (EVAP) CANISTER
- EVAPORATIVE (EVAP) CANISTER PURGE SOLENOID VALVE
- FUEL FILLER CAP

EXHAUST EMISSION CONTROL SYSTEM
- CONTINUOUS VARIABLE VALVE TIMING

GENERAL

SPECIFICATIONS ECFA51BD

Item	Specification	
Purge Control Solenoid Valve (PCSV)	Type	Duty Control type
	Resistance (Ω)	16.0Ω at 20 °C (68 °F)

TIGHTENING TORQUES E2A839FA

Item	N·m	kgf·m	lbf·ft
Positive Crankcase Ventilation Valve	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7

TROUBLESHOOTING EDAB5E1F

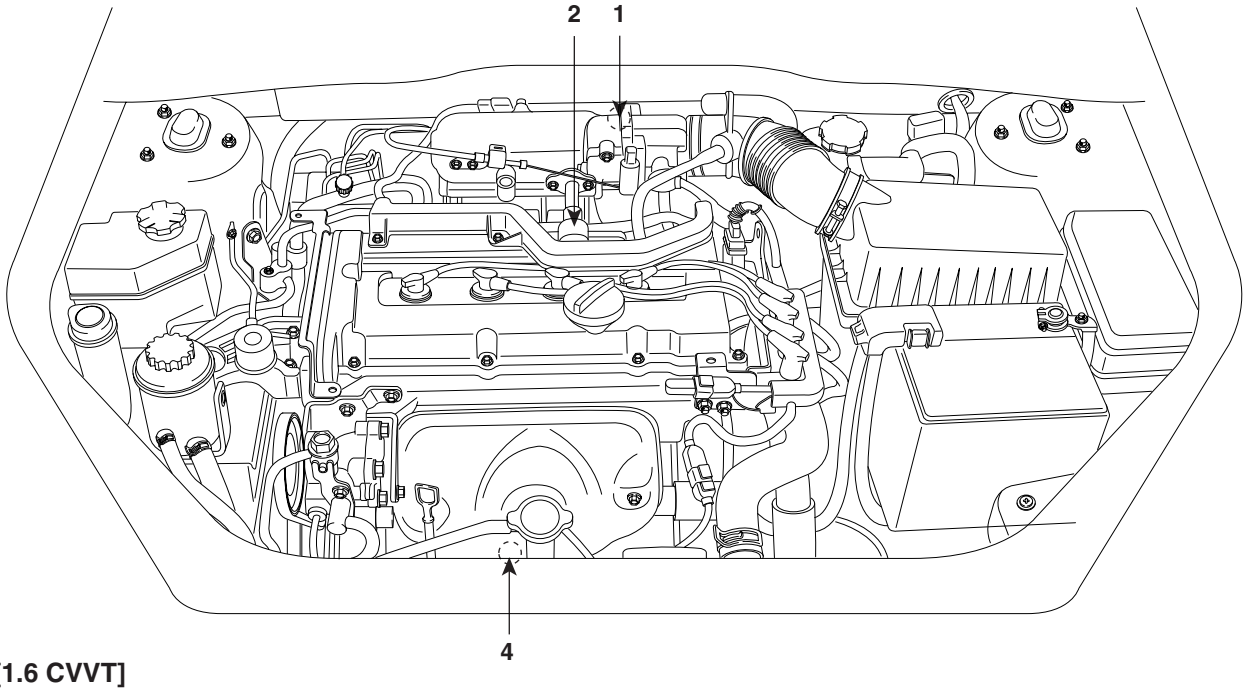
Symptom	Suspect area	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the EVAP. Canister Purge Solenoid Valve	Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the PCV valve	Replace
	Malfunction of the evaporative emission canister purge system	Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

COMPONENTS E4CA7D79

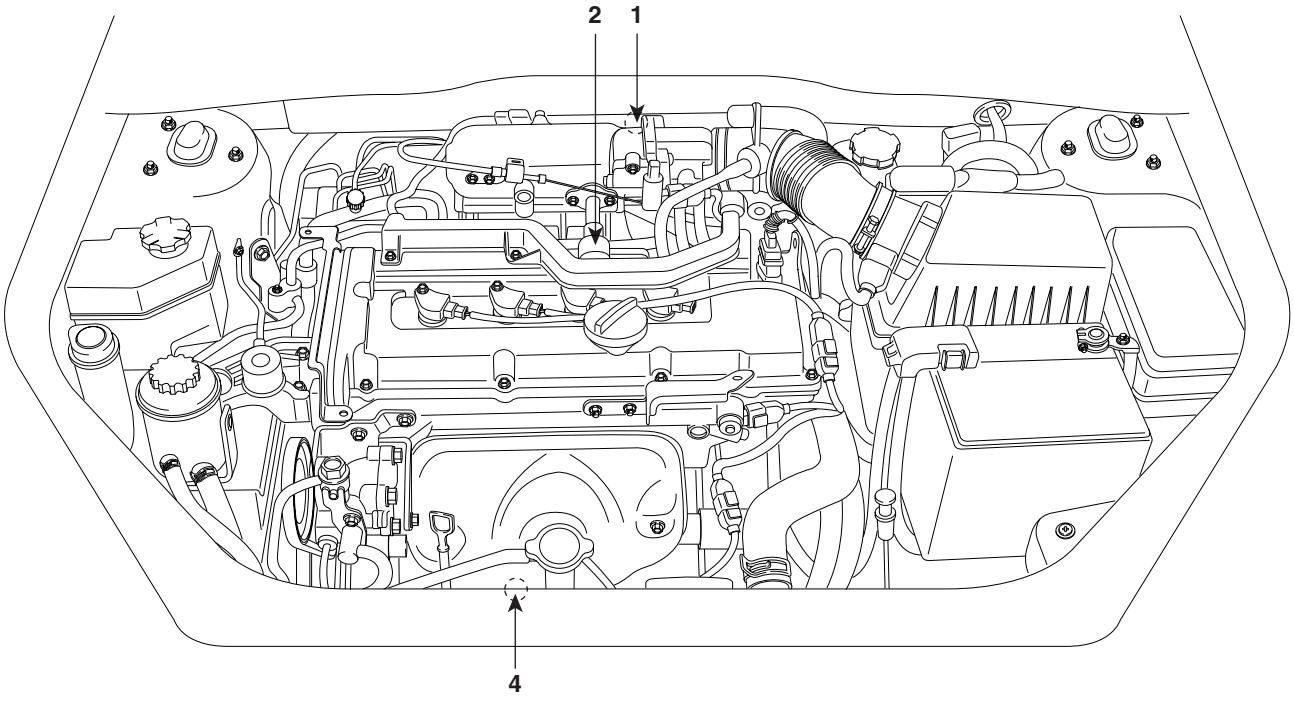
Components	Function	Remarks
Crankcase Emission System - Positive Crankcase Ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System - Evaporative emission canister - Purge Control Solenoid Valve (PCSV)	 HC reduction HC reduction	 Duty control solenoid valve
Exhaust Emission System - MFI system (air-fuel mixtrue control device) - Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor (feedback type) Monolithic type

COMPONENTS E0902E2C

[1.4 DOHC]



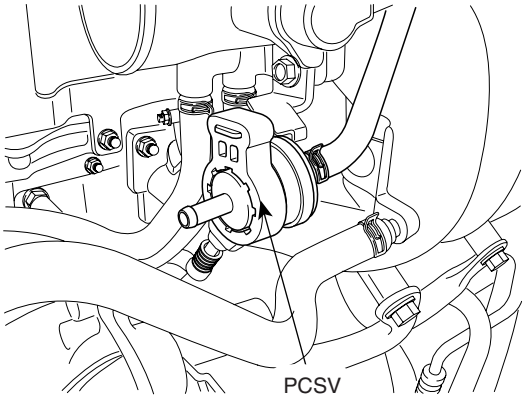
[1.6 CVVT]



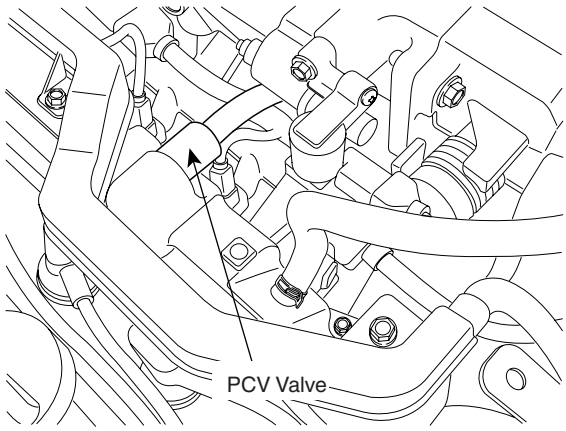
1. Purge Control Solenoid Valve (PCSV)
2. PCV Valve
3. Canister
4. Catalytic Converter

LEJF301A

1	Purge Control Solenoid Valve (PCSV)	2	Positive Crankcase Ventilation (PCV) Vave [1.4 DOHC]

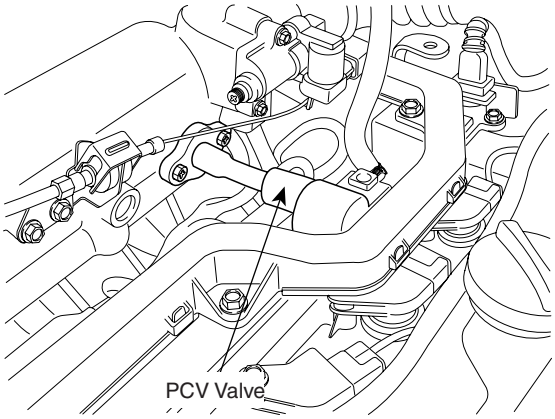


AEJF001A

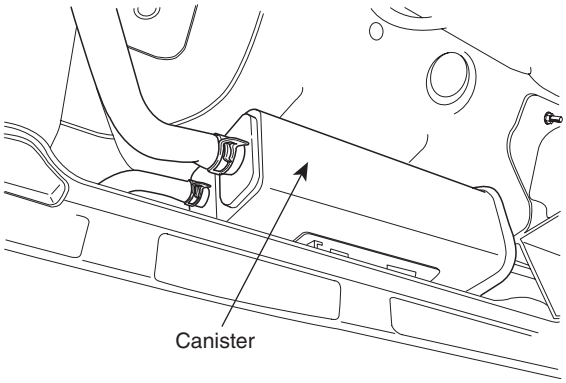


LEJF005A

2	Positive Crankcase Ventilation (PCV) Vave [1.6 CVVT]	3	Canister

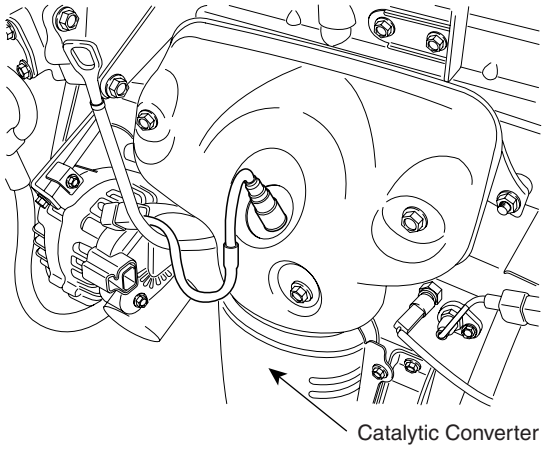


LEJF002A



LEJF003A

4	Catalytic Converter



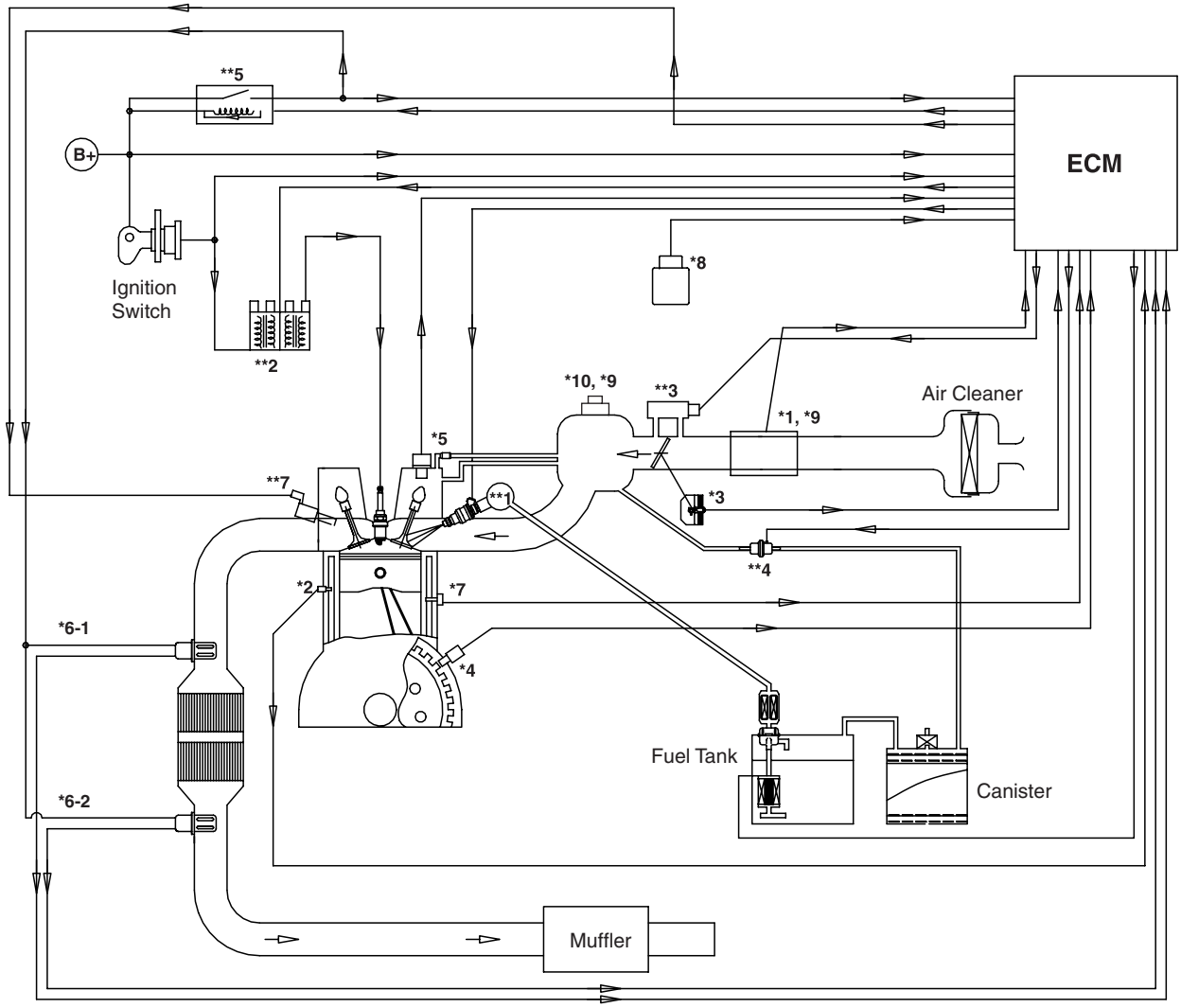
LEJF004A

SCHEMATIC DIAGRAM EE5CC58A

*1. Mass Air Flow Sensor (MAFS) [1.6 DOHC]
*2. Engine Coolant Temperature Sensor (ECTS)
*3. Throttle Position Sensor (TPS)
*4. Crankshaft Position Sensor (CKPS)
*5. Camshaft Position Sensor (CMPS)
*6-1. Heated Oxygen Sensor (HO2S, Sensor 1)
*6-2. Heated Oxygen Sensor (HO2S, Sensor 2)
*7. Knock Sensor
*8. Vehicle Speed Sensor (VSS)
*9. Intake Air Temperature Sensor (IATS)
*10. Manifold Absolute Pressure Sensor (MAPS) [1.4 DOHC]
· Switch Input Signals

INPUT → ECM → OUTPUT

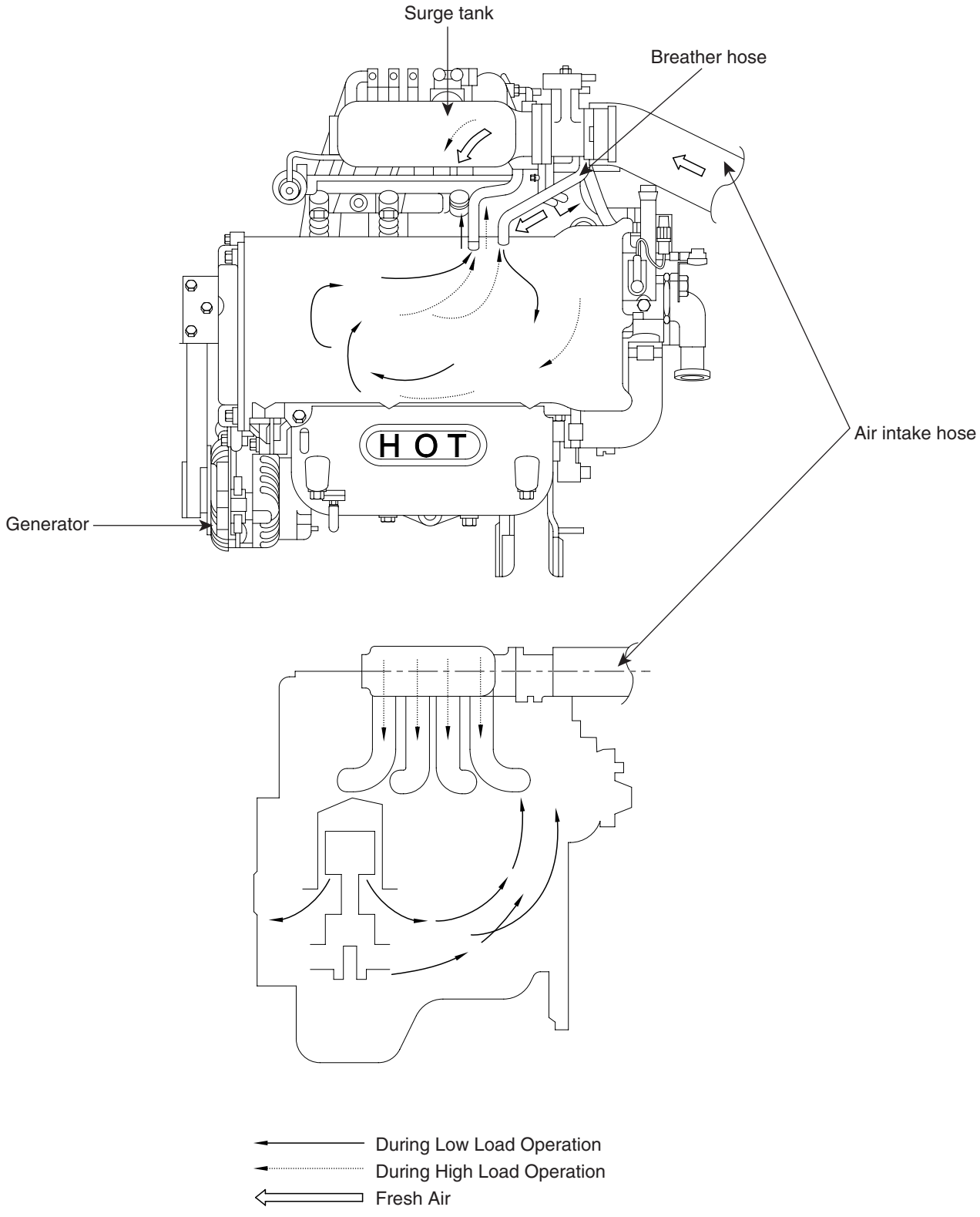
**1. Injector
**2. Ignition Coil
**3. Idle Speed Control Actuator (ISCA)
**4. Purge Control Solenoid Valve (PCSV)
**5. Main Relay
**6. Fuel Pump Relay
**7. CVVT Oil Control Valve (OCV) [1.6 DOHC]



LEJF010A

CRANKCASE EMISSION CONTROL SYSTEM

COMPONENT E48065C9



LEJF603I

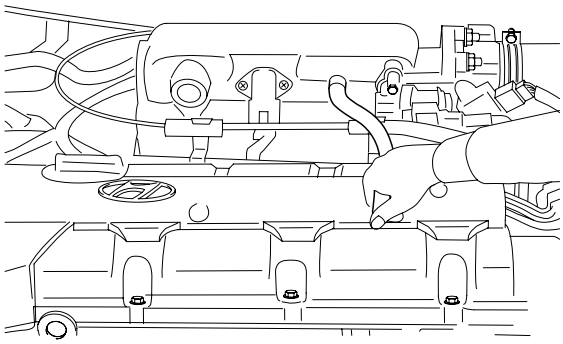
INSPECTION E6AFFAD9

1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.

2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum can be felt.

NOTE

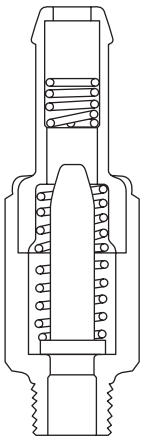
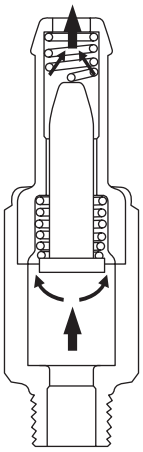
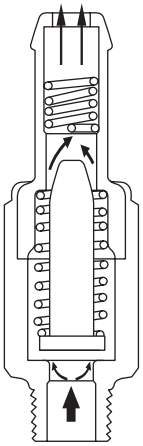
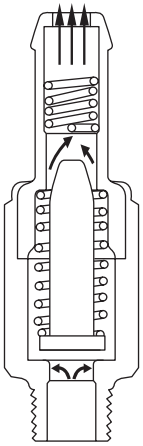
The plunger inside the PCV valve will move back and forth.



LEJF603E

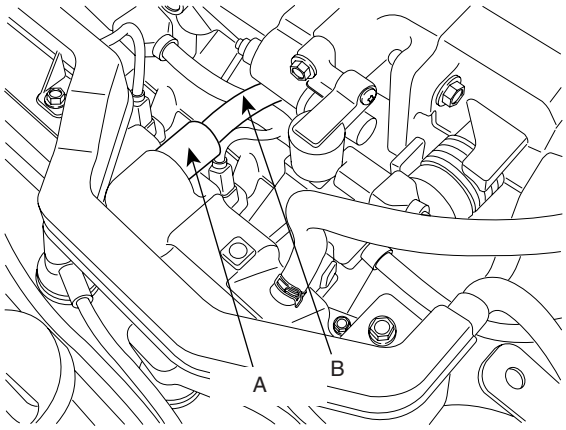
POSITIVE CRANKCASE VENTILATION (PCV) VALVE

OPERATION EE43A00F

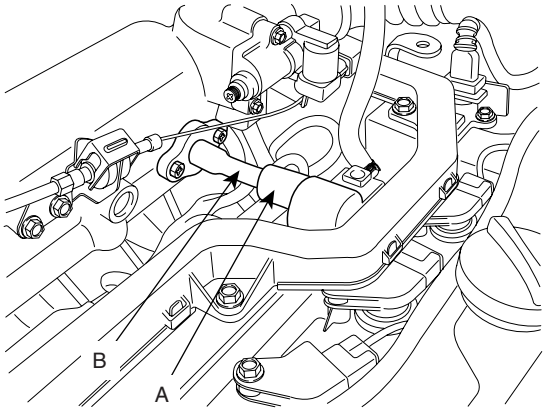
<table>
<tr>
<td colspan="2">Intake manifold side (No vacuum)
 
Rocker cover side
BEGE001S</td>
<td colspan="2">Intake manifold side (High vacuum)
 
Rocker cover side
BEGE001T</td>
</tr>
<tr><td>Engine condition</td><td>Not running</td><td>Engine condition</td><td>Idling or decelerating</td></tr>
<tr><td>PCV valve</td><td>Not operating</td><td>PCV valve</td><td>Fully operating</td></tr>
<tr><td>Vacuum passage</td><td>Restricted</td><td>Vacuum passage</td><td>Small</td></tr>
<tr>
<td colspan="2">Intake manifold side (Moderate vacuum)
 
Rocker cover side
BEGE001U</td>
<td colspan="2">Intake manifold side (Low vacuum)
 
Rocker cover side
BEGE001V</td>
</tr>
<tr><td>Engine condition</td><td>Normal operation</td><td>Engine condition</td><td>Accelerating and high load</td></tr>
<tr><td>PCV valve</td><td>Properly operating</td><td>PCV valve</td><td>Slightly operating</td></tr>
<tr><td>Vacuum passage</td><td>Large</td><td>Vacuum passage</td><td>Very large</td></tr>
</table>

REMOVAL EEF03EF7

1. Remove the valve pad (A) and disconnect the vacuum hose (B).



[1.4 DOHC]



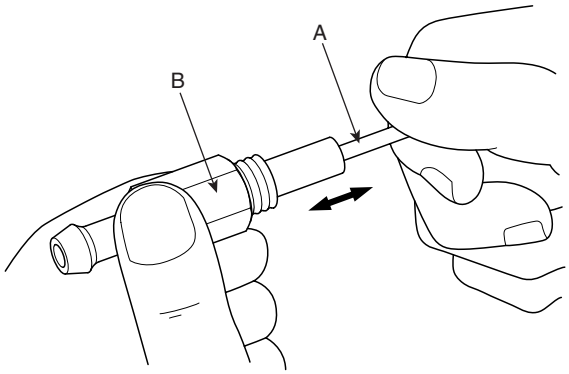
[1.6 CVVT]

LEJF011A

2. Remove the PCV Valve.

INSPECTION E0B8FC0C

1. Remove the PCV valve.
2. Insert a thin stick(A) into the PCV valve(B) from the threaded side to check that the plunger moves.
3. If the plunger does not move, the PCV valve is clogged. Clean it or replace.



LEIF603J

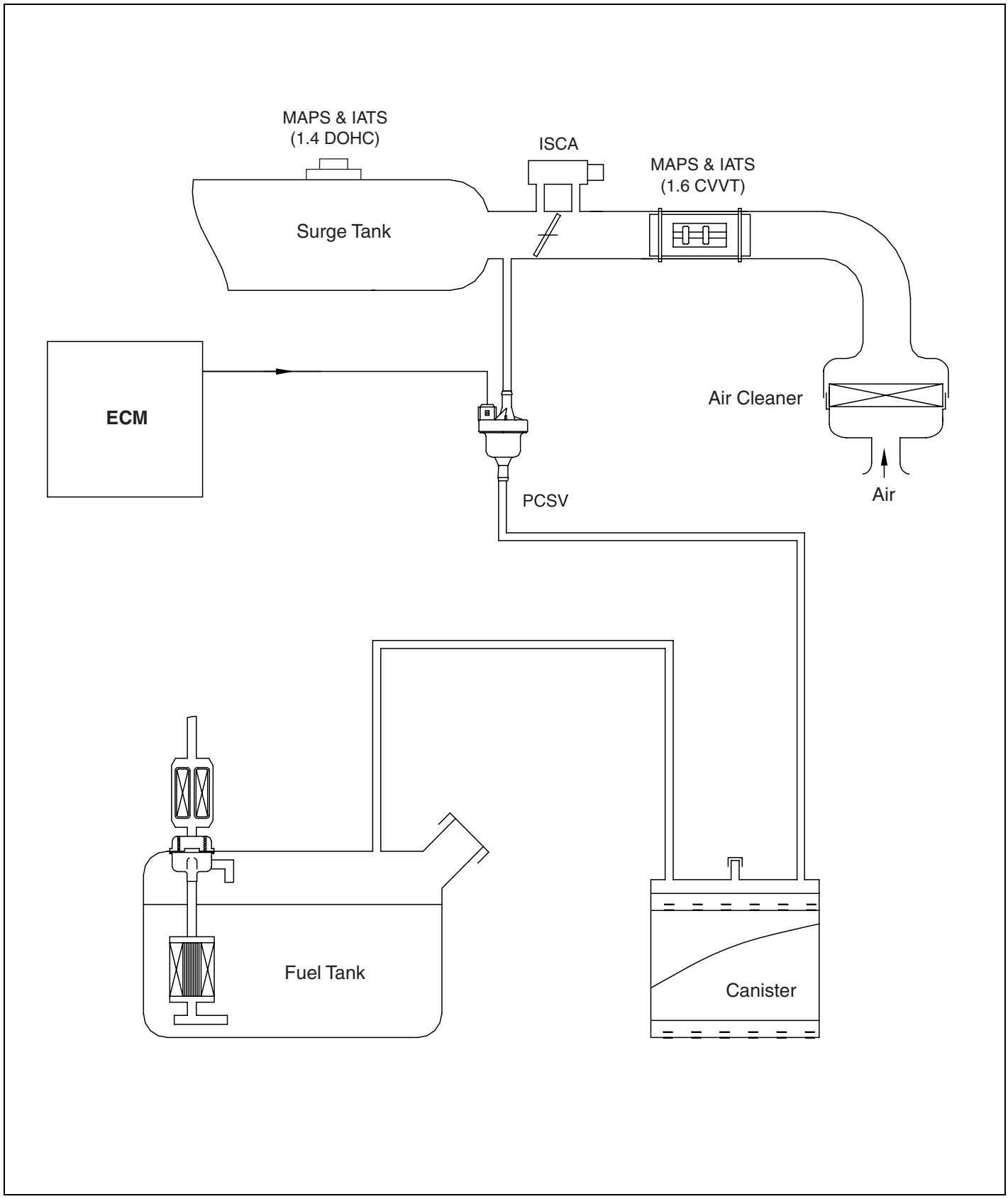
INSTALLATION EAC15E6D

1. Install the PCV valve according to the reverse order of the "REMOVAL" procedure.

PCV Valve Installation : 7.8 ~ 11.8 N·m (0.8 ~ 1.2 kgf·m, 5.8 ~ 8.7 lbf·ft)

EVAPORATIVE EMISSION CONTROL SYSTEM

COMPONENTS EEFDC6D5



LEJF012A

INSPECTION E54DDA8A

1. Disconnect the vacuum hose from the throttle body, and connect a vacuum pump to the vacuum hose.
2. Check the following points when the engine is cold [engine coolant temperature 60°C(140°F) or below] and when it is warm [engine coolant temperature 80°C(176°F) or higher].

WHEN ENGINE IS COLD

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
3,000 rpm		

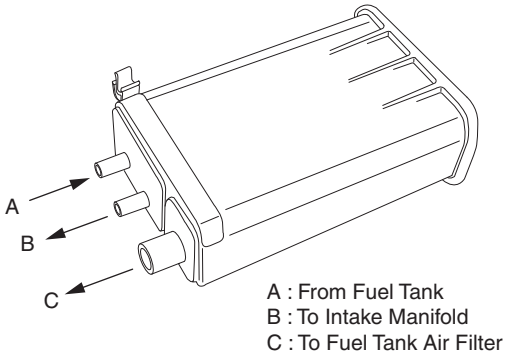
WHEN ENGINE IS WARM

Engine operating condition	Applied vacuum	Result
Idling	50 kPa (7.3 psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
After 3 minutes have passed after engine start at 3,000 rpm	50 kPa (7.3 psi)	Vacuum will be held momentarily, after which, it will be released

EVAPORATIVE (EVAP) CANISTER

INSPECTION EBC6C6F6

1. Look for loose connections, sharp bends or damage to the fuel vapor lines.
2. Look for distortion, cracks or fuel leakage.
3. After removing the EVAP. canister, inspect for cracks or damage.



LEJF013A

EVAPORATIVE (EVAP) CANISTER PURGE SOLENOID VALVE

INSPECTION E4A3E09A

NOTE

When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-striped vacuum hose was connected.
4. Apply vacuum and check when voltage is applied to the PCSV and when the voltage is discontinued.

Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained

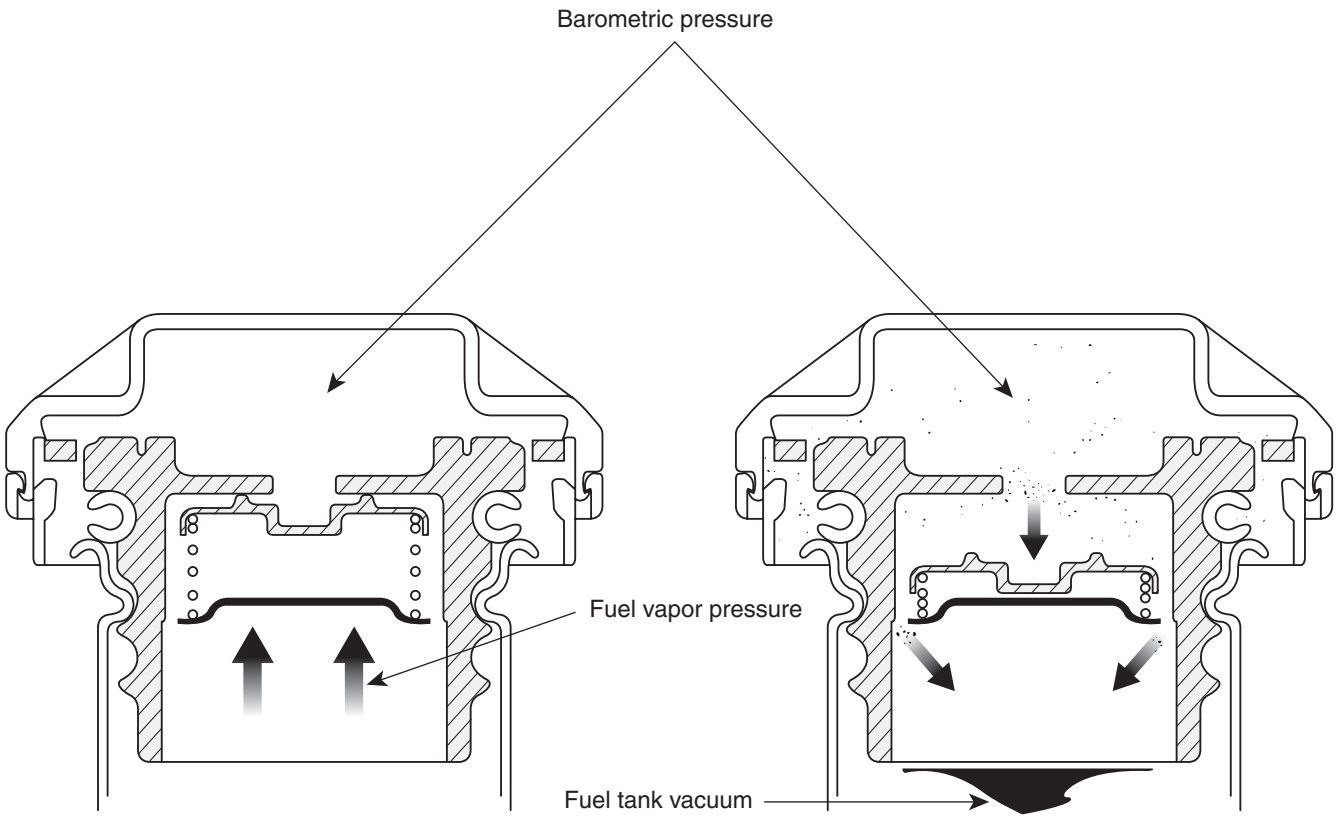
5. Measure the resistance between the terminals of the solenoid valve.

PCSV coil resistance (Ω) : 16.0 Ω at 20℃ (68°F)

FUEL FILLER CAP

DESCRIPTION EF5EB889

A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which would seal the fuel filler. After the gasket on the fuel filler cap and the filler neck flange contact each other, the retchet produces a loud clicking noise indicating the seal has been set.



When fuel tank is under pressure. **When fuel tank is under vacuum.**

LEGE015A

EXHAUST EMISSION CONTROL SYSTEM

DESCRIPTION E3575B09

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 driveability and fuel economy.

AIR/FUEL MIXTURE CONTROL SYSTEM [MULTIPORT FUEL INJECTION (MFI) SYSTEM]

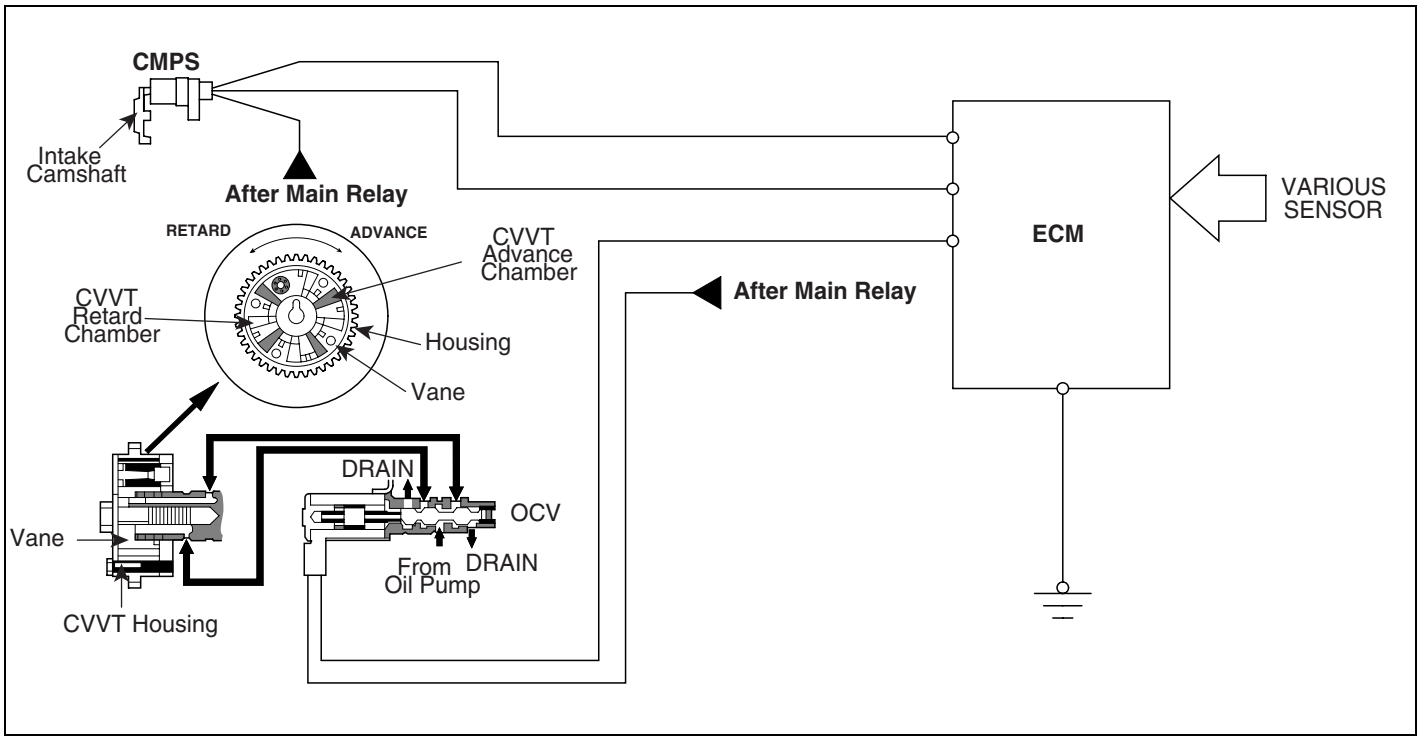
The MFI system is a system which uses the signals from the heated oxygen sensor to activate and control the injector installed in the manifold for each cylinder, thus precisely regulating the air/fuel mixture ratio and reducing emissions.

This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) 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.

CONTINUOUS VARIABLE VALVE TIMING

COMPONENTS E5B32B0E

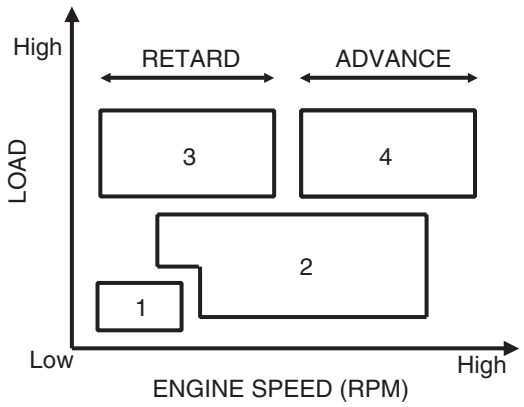


LEIF001P

DESCRIPTION EDB54DEF

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 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.

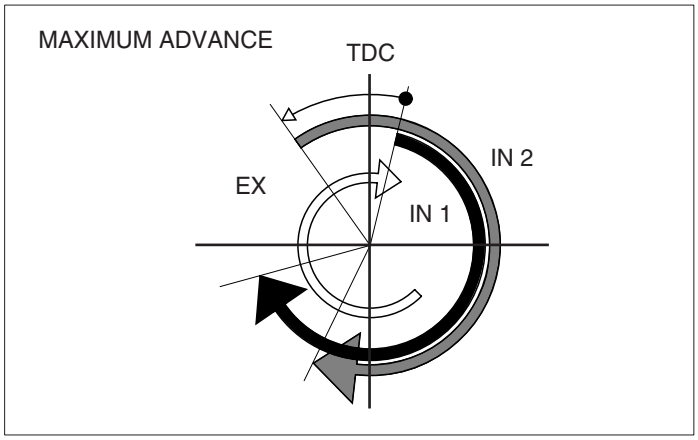


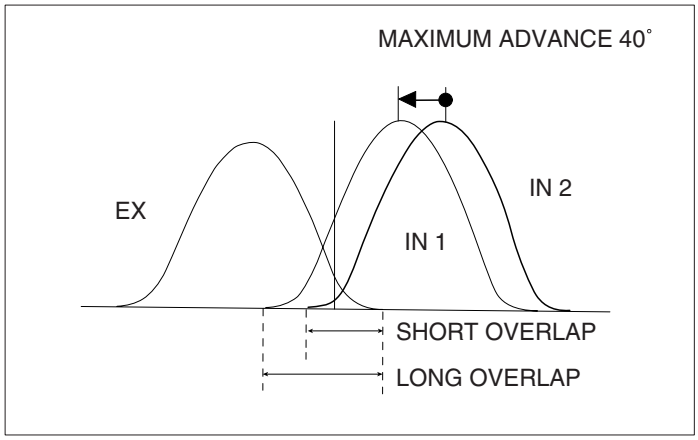
Driving Condition	Intake Valve Timing	Effect
Light load (1)	Retard	Stable combustion
Part load (2)	Advance	Enhanced fuel economy and exhaust emissions
High load& Low rpm (3)	Advance	Enhanced torque
High load& High rpm (4)	Retard	Enhanced Power

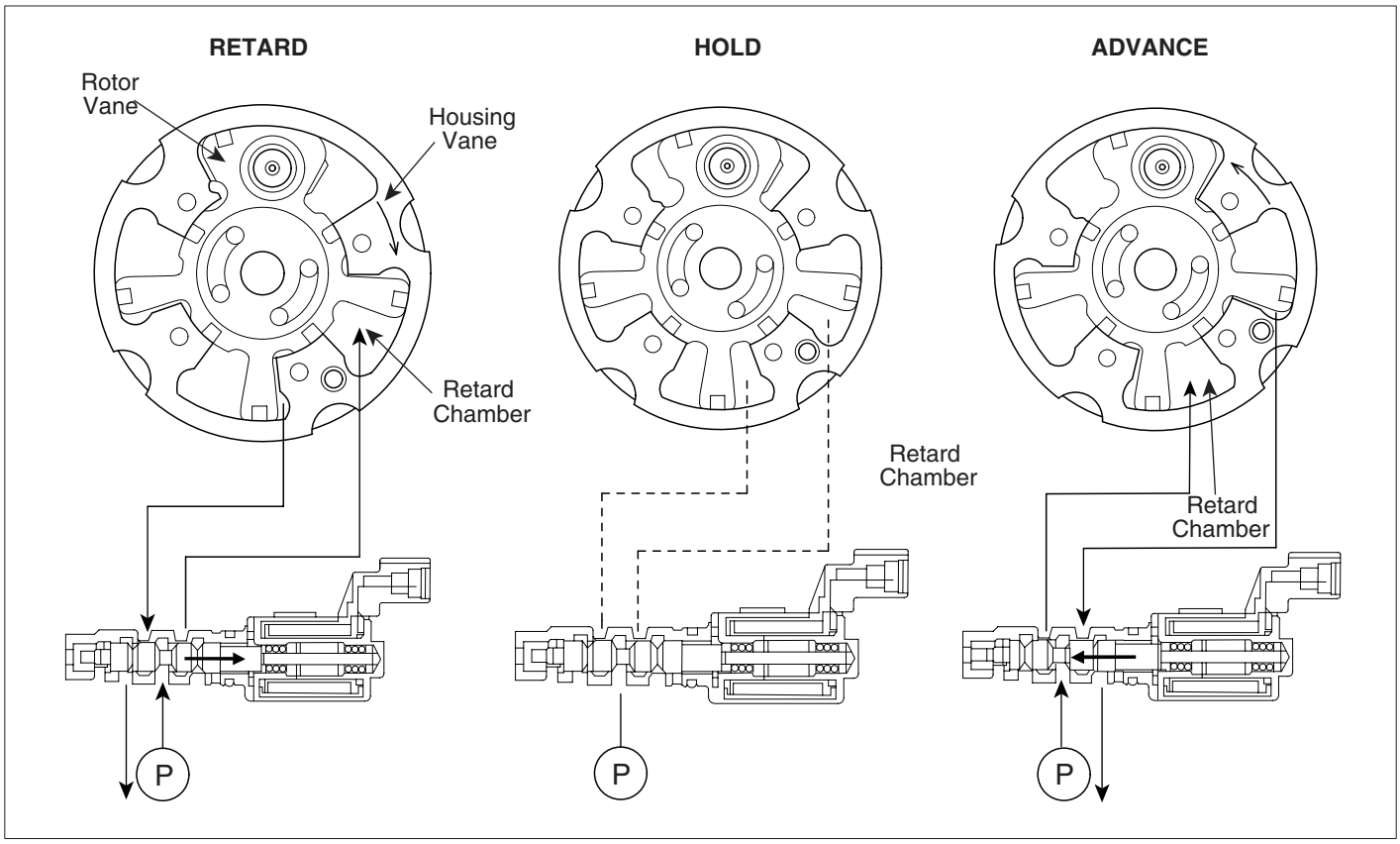
LEIF001Q

OPERATION EB49BA75

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.
Reduces the 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.







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1. The above figure shows the relative operation structures of the housing vane to the rotor vane.
2. If the CVVT is held a certain control angle, to hold this state, oil is replenished as much as oil leaks from the oil pump.

The OCV (Oil-flow 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).

Fuel System

GENERAL

GASOLINE ENGINE CONTROL SYSTEM

DTC TROUBLESHOOTING PROCEDURES

FUEL DELIVERY SYSTEM
- FUEL INJECTOR
- FUEL PUMP (FP)
- FUEL TANK

GENERAL

SPECIFICATION EBAC5B5D

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	45ℓ
Fuel Filter (built in Fuel Pump Assembly)	Type	High pressure type
Fuel Pressure Regulator (built in Fuel Pump Assembly)	Regulated Fuel Pressure	343 kpa (3.5 kg/cm2, 49.8 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor
Fuel Retrun System	Type	Returnless

INPUT SENSORS

MASS AIR FLOW SENSOR (MAFS) [1.6 CVVT]

▷ Type : Hot-Film Type
▷ Specification

Air Flow (kg/h)	Output Voltage (V)
4.9kg/h	0.7V
7.3kg/h	0.9V
12.2kg/h	1.18V
20.8kg/h	1.51V
28.3kg/h	1.73V
38.9kg/h	1.97V
64.7kg/h	2.4V
113.3kg/h	2.9V
185.3kg/h	3.35V
256.0kg/h	3.64V
404.6kg/h	4.07V
476.7kg/h	4.25V
603.3kg/h	4.56V

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS) [1.4 DOHC]

▷ Type : Piezo-resistive pressure sensor type
▷ Specification

Pressure (kPa)	Output Voltage (V)
20.0kPa	0.79V
46.66kPa	1.84V
101.32kPa	4.00V

INTAKE AIR TEMPERATURE SENSOR (IATS) [1.6 CVVT]

▷ Type : Thermister type
▷ Specification

Temperature (℃)	Resistnace (kΩ)
-40℃	41.26 ~ 47.49kΩ
-20℃	14.26 ~ 16.02kΩ
0℃	5.50 ~ 6.05kΩ
20℃	2.35 ~ 2.54kΩ
40℃	1.11 ~ 1.19kΩ
60℃	0.57 ~ 0.60kΩ
80℃	0.31 ~ 0.32kΩ

INTAKE AIR TEMPERATURE SENSOR (IATS) [1.4 DOHC]

▷ Type : Thermister type
▷ Specification

Temperature (℃)	Resistance (kΩ)
-40℃	38.88 ~ 50.77kΩ
-20℃	13.20 ~ 16.83kΩ
0℃	5.12 ~ 6.12kΩ
20℃	2.20 ~ 2.69kΩ
40℃	1.02 ~ 1.27kΩ
60℃	0.52 ~ 0.65kΩ
80℃	0.28 ~ 0.35kΩ

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)

▷ Type: Thermister type
▷ Specification

Temperature (℃)	Resistance (kΩ)
-40℃	48.14 kΩ
-20℃	14.13 ~ 16.83 kΩ
0℃	5.79 kΩ
20℃	2.31 ~ 2.59 kΩ
40℃	1.15 kΩ
60℃	0.59 kΩ
80℃	0.32 kΩ

THROTTLE POSITION SENSOR (TPS)

▷ Type: Variable resistor type
▷ Specification

Throttle Angle	Output Voltage (V)
C.T	0.2 ~ 0.9V
W.O.T	Min. 4.0V

Items	Specification
Sensor Resistance (kΩ)	1.6 ~ 2.4 kΩ

HEATED OXYGEN SENSOR (HO2S)

▷ Type: Zirconia (ZrO2) Type
▷ Specification

A/F Ratio	Output Voltage (V)
Rich	0.6 ~ 1.0V
Lean	0 ~ 0.4V

Items	Specification
Heater Resistance (Ω)	Approximately 9.0Ω (20℃)

CAMSHAFT POSITION SENSOR (CMPS)

▷ Type: Hall effect type

CRANKSHAFT POSITION SENSOR (CKPS)

▷ Type: Magnetic field sensitive Type

KNOCK SENSOR (KS)

▷ Type: Piezo-electricity type
▷ Specification

Items	Specification
Capacitance (pF)	950 ~ 1,350pF
Resistance (MΩ)	4.87 MΩ

OUTPUT ACTUATORS

INJECTOR

▷ Number: 4
▷ Specification

Items	Specification
Coil Resistance (Ω)	13.8 ~ 15.2Ω (20℃)

IDLE SPEED CONTROL ACTUATOR (ISCA)

▷ Type: Double coil type
▷ Specification

Items	Specification
Closing Coil Resistance (Ω)	14.6 ~ 16.2Ω (20℃)
Opening Coil Resistance (Ω)	11.1 ~ 12.7Ω (20℃)

Duty (%)	Air Flow Rate (㎥/h)
15.00%	1.0 ~ 2.0 ㎥/h
35.00%	7.0 ~ 12.2 ㎥/h
70.00%	38.0 ~ 50.0 ㎥/h
96.00%	55.0 ~ 65.0 ㎥/h

PURGE CONTROL SOLENOID VALVE (PCSV)

▷ Specification

Items	Specification
Coil Resistance (Ω)	16.0Ω (20℃)

CVVT OIL CONTROL VALVE (OCV)

▷ Specification

Items	Specification
Coil Resistance (Ω)	6.9 ~ 7.9Ω (20℃)

IGNITION COIL [1.6 CVVT]

▷ Type : Stick type
▷ Specification

Items	Resistance
Primary Coil	0.62Ω±10% (20℃)
Secondary Coil	-

IGNITION COIL [1.4 DOHC]

▷ Type: Double ended type
▷ Specification

Items	Resistance
Primary Coil	0.87Ω±10% (20℃)
Secondary Coil	13.0kΩ±15% (20℃)

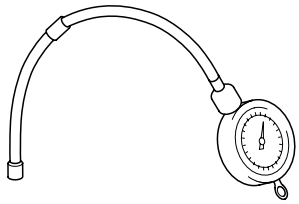
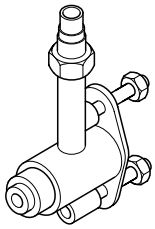
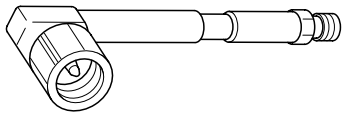
SERVICE STANDARD EC5CF43C

Ignition Timing (After warm up, at idle)		BTDC 5˚ ± 5˚
Basic Idle rpm(After warm up)	Neutral,N,P-range	720 ± 100 rpm
	D-range	660 ± 100 rpm

TIGHTENING TORQUES EBA4CDDB

Items		N·m	kg·m	lb·ft
ENGINE CONTROL SYSTEM	ECM installation bolts	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
	Heated oxygen sensor (Bank 1 / Sensor 1) installation	49.1 ~ 58.9	5.0 ~ 6.0	36.2 ~ 43.4
	Heated oxygen sensor (Bank 1 / Sensor 2) installation	49.1 ~ 58.9	5.0 ~ 6.0	36.2 ~ 43.4
	Engine Coolant Temperature Sensor installation	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
	Throttle Position Sensor installation bolt	1.5 ~ 2.5	0.15 ~ 0.25	1.1 ~ 1.8
	Manifold Absolute Pressure Sensor installation bolt	4.9	0.5	3.6
	Camshaft Position Sensor installation bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
	Crankshaft Position Sensor target wheel installation screw	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
	Crankshaft Position Sensor installation bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
	Knock sensor installation	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
	CVVT oil control valve installation bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
	CVVT oil filter installation	40.2 ~ 50.0	4.1 ~ 5.1	29.7 ~36.9
	Throttle body installation bolt/nut	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
	Oil pressure switch installation	14.7 ~ 21.6	1.5 ~ 2.2	10.9 ~ 15.9
FUEL DELIVERY SYSTEM	Fuel tank installation bolt/nut	39.2 ~ 54.0	4.0 ~ 5.5	28.9 ~ 39.8
	Delivery pipe installation bolt	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
	Fuel pump installation bolt	2.0 ~ 2.9	0.2 ~ 0.3	1.4 ~ 2.2

SPECIAL SERVICE TOOLS E16596C7

Tool (Number and name)	Illustration	Application
09353-24100 Fuel Pressure Gauge	 EFDA003A	Measuring the fuel line pressure
09353-38000 Fuel Pressure Gauge Adapter	 BF1A025D	Connection between the delivery pipe and fuel feed line
09353-24000 Fuel Pressure Gauge Connector	 EFDA003C	Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000)

BASIC TROUBLESHOOTING E447DA2D

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 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 malfunction 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 INFORMATION

(I) VIN:
(II) Production Date:
(III) Odometer Reading: (km)

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 ☐ Rough 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 ☐ DTC (_____) ☐ Freeze Frame Data

BASIC INSPECTION PROCEDURE

MEASURING CONDITION OF ELECTRONIC PARTS' RESISTANCE

The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20℃, 68˚F), unless there is any notice.

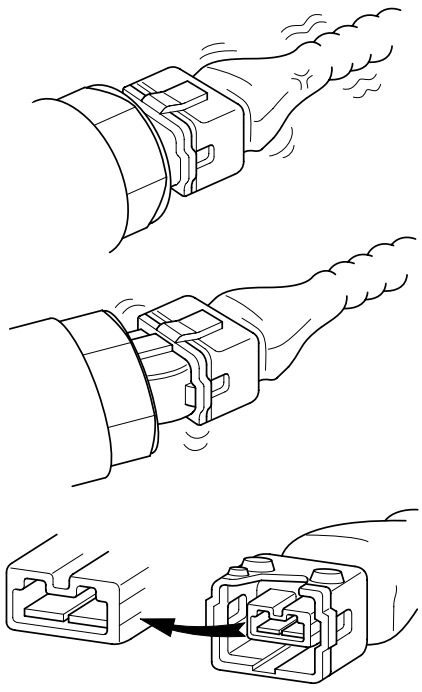
NOTE

The measured resistance in except for ambient temperature (20℃, 68˚F) is 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, 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.



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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.

● SIMULATING VIBRATION

a. Sensors and Actuators
: Slightly vibrate sensors, actuators or relays with finger.

WARNING

Strong vibration may break sensors, actuators or relays

b. Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

● SIMULATING HEAT

a. Heat components suspected of causing the malfunction with a hair dryer or other heat sourre.

WARNING

- **DO NOT heat components to the point where they may be damaged.**
- **DO NOT heat the ECM directly.**

● SIMULATING WATER SPRINKLING

a. Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

WARNING

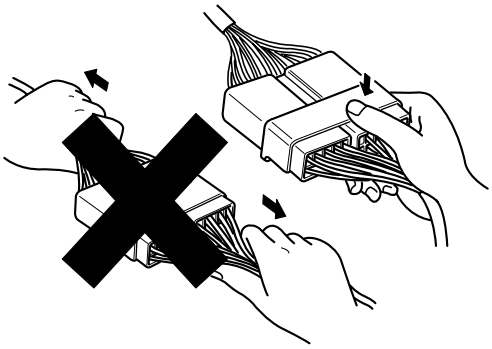
DO NOT sprinkle water directly into the engine compartment or electronic components.

● SIMULATING ELECTRICAL LOAD

a. Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, etc.).

CONNECTOR INSPECTION PROCEDURE

1. Handling of Connector
   a. Never pull on the wiring harness when disconnecting connectors.



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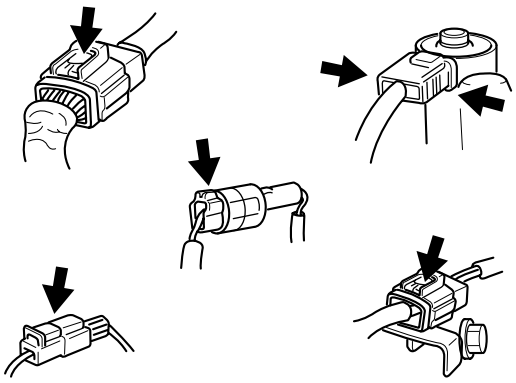
   b. When removing the connector with a lock, press or pull locking lever.



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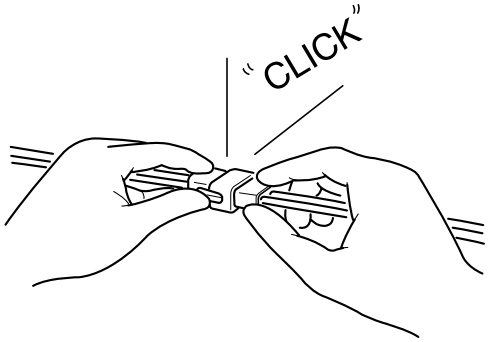
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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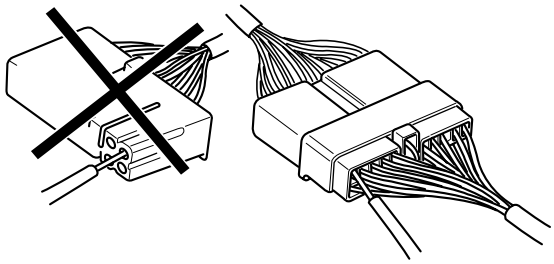
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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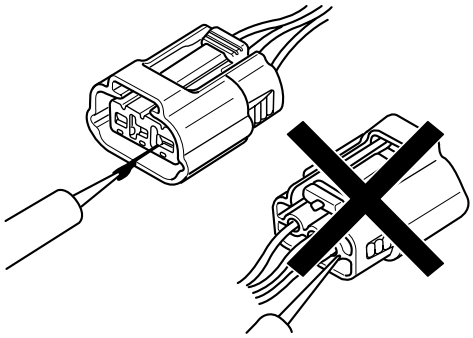
   e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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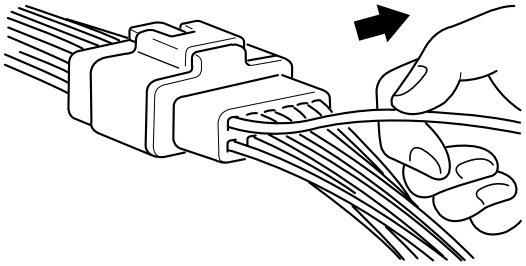
NOTE

- *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.



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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.

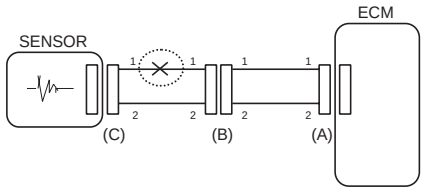
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● **CHECK OPEN CIRCUIT**

1. Procedures for Open Circuit
   - Continuity Check
   - 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



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2. Continuity Check Method

   NOTE

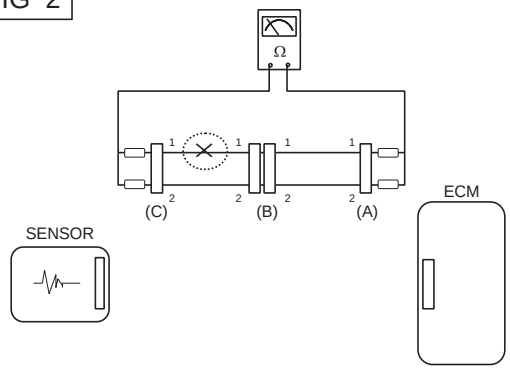
   When measuring for resistance, lightly shake the wire harness above and below or from side to side.

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



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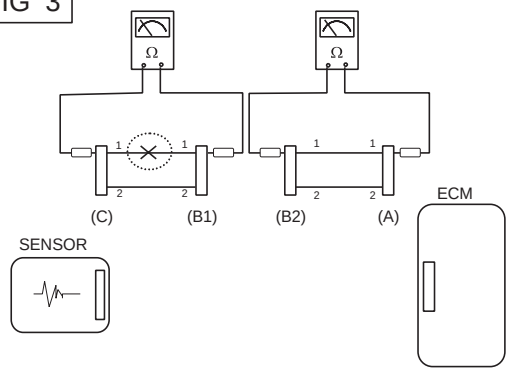
b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

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).

FIG 3



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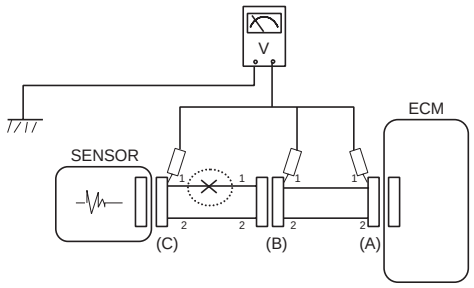
3. Voltage Check Method
   a. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

   The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

FIG 4



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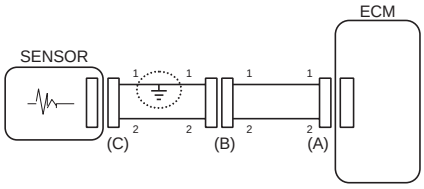
● **CHECK SHORT CIRCUIT**

4. Test Method for Short to Ground Circuit
   • Continuity Check with Chassis Ground

   If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing below Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5



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5. Continuity Check Method (with Chassis Ground)

NOTE

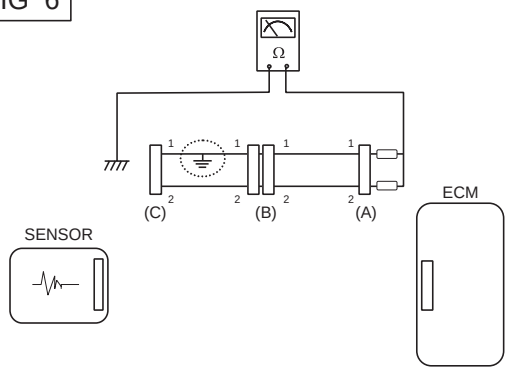
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

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 folowing step.

FIG 6

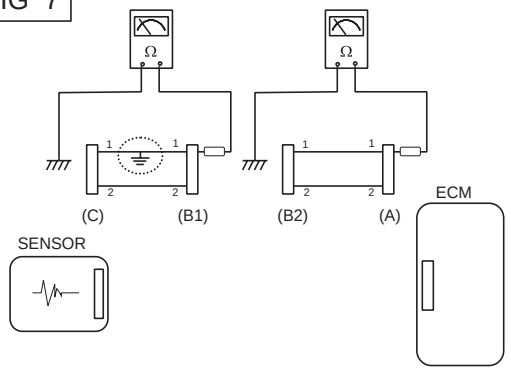


BFGE501F

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



BFGE501G

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 ON)	• 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 ISCA and ISCA 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 ISCA and ISCA 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 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)	• DTC • 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

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Poor fuel economy	1. Check customer's driving habits • Is 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 refueling (Overflow during refueling)	1. Inspect the fuel filler hose/pipe • Pinched, kinked or blocked? • Filler hose is torn 2. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 3. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

GASOLINE ENGINE CONTROL SYSTEM

DESCRIPTION EEA45E1A

If the Gasoline Engine Control system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for various engine operating conditions will result. The following situations may be encountered.

1. Engine is hard to start or does not start at all.
2. Unstable idle.
3. Poor driveability

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.). Then, inspect the Gasoline Engine Control system components with the HI-SCAN (Pro).

NOTE

- *Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.*
- *Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the ECM.*
- *The control harnesses between the ECM and heated oxygen sensor are shielded with the shielded ground wires to the body in order to prevent the influence of ignition noises and radio interference. When the shielded wire is faulty, the control harness must be replaced.*
- *When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.*
- *When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the ECM.*

MALFUNCTION INDICATOR LAMP (MIL)

[EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL.

- Catalyst
- Fuel system
- Mass Air Flow Sensor (MAFS)
- Intake Air Temperature Sensor (IATS)
- Engine Coolant Temperature Sensor (ECTS)
- Throttle Position Sensor (TPS)
- Upstream Oxygen Sensor
- Upstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Injector
- Misfire
- Crankshaft Position Sensor (CKPS)
- Camshaft Position Sensor (CMPS)
- Evaporative Emission Control System
- Vehicle Speed Sensor (VSS)
- Idle Speed Control Actuator (ISCA)
- Power Supply
- ECM
- MT/AT Encoding
- Acceleration Sensor
- MIL-on Request Signal
- Power Stage

NOTE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.

[NON-EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Heated oxygen sensor (HO2S)
- Mass Air Flow sensor (MAFS)
- Throttle position sensor (TPS)
- Engine coolant temperature sensor (ECTS)
- Idle speed control actuator (ISCA)
- Injectors
- ECM

NOTE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.

[INSPECTION]

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.

2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

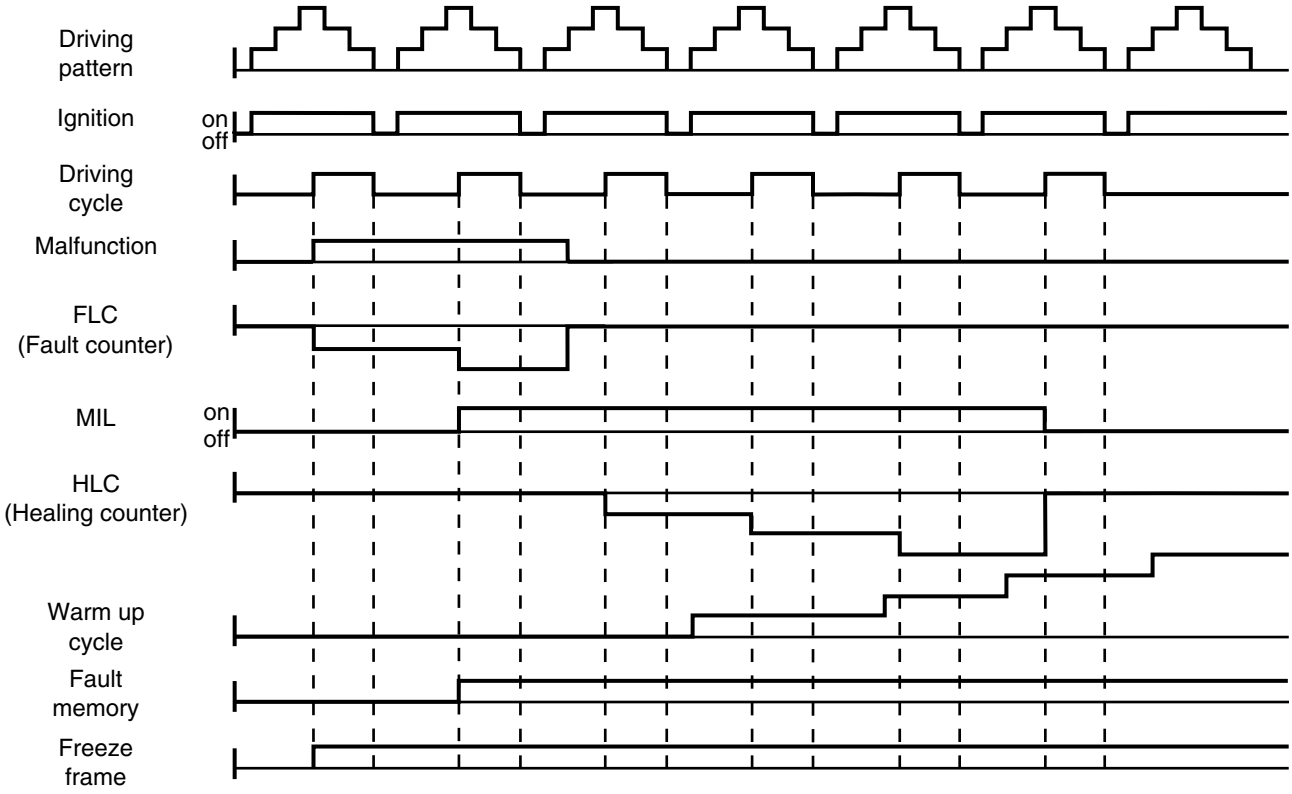
SELF-DIAGNOSIS

The ECM monitors the input/output signals (some signals at all times and the others under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN (Pro). Diagnostic Trouble Codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or ECM connector is disconnected, or by the HI-SCAN (Pro).

NOTE

If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.

THE RELATION BETWEEN DTC AND DRIVING PATTERN IN EOBD SYSTEM



LGIF601Q

1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.

2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.

3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.
   If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.

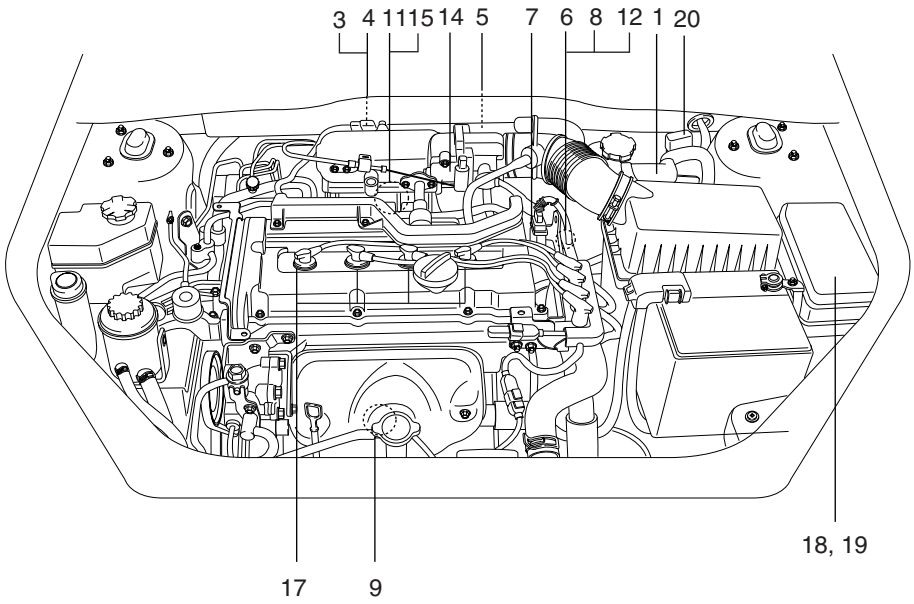
4. A Diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.

NOTE

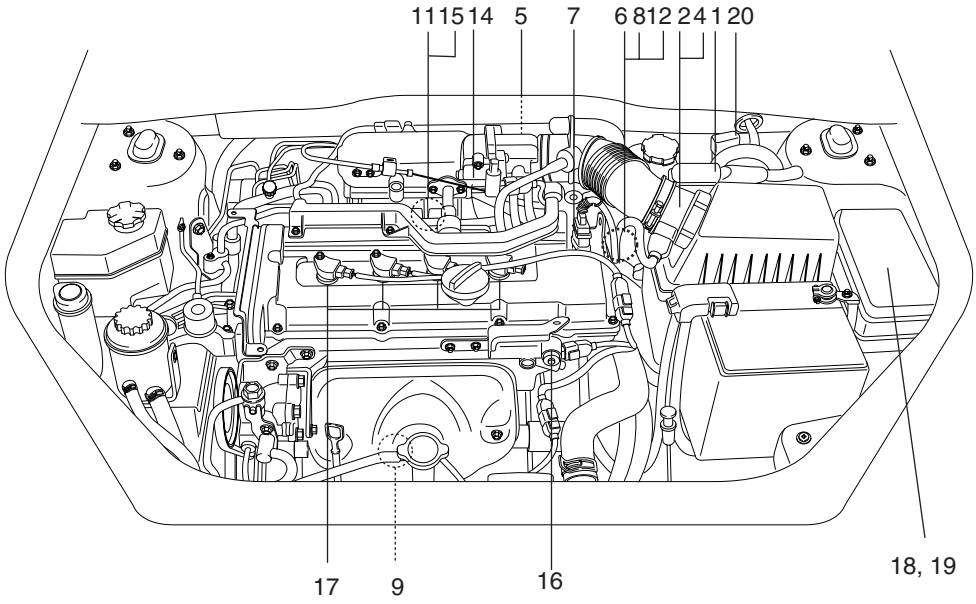
- *A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degress Fahrenheit.*
- *A "driving cycle" consists of engine startup, vehicle operation beyond the beginning of closed loop operation.*

COMPONENTS EFF5BE92

[1.4 DOHC]



[1.6 CVVT]



1. ECM (Engine Control Module)
2. Mass Air Flow Sensor (MAFS) [1.6 CVVT]
3. Manifold Absolute Pressure Sensor (MAPS) [1.4 DOHC]
4. Intake Air Temperature Sensor (IATS)
5. Throttle Position Sensor (TPS)
6. Engine Coolant Temperature Sensor (ECTS)
7. Camshaft Position Sensor (CMPS)
8. Crankshaft Position Sensor (CKPS)
9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
11. Knock Sensor (KS)
12. Vehicle Speed Sensor (VSS)
13. Injector
14. Idle Speed Control Actuator (ISCA)
15. Purge Control Solenoid Valve (PCSV)
16. CVVT Oil Control Valve (OCV) [1.6 CVVT]
17. Ignition Coil
18. Main Relay
19. Fuel Pump Realy
20. Multi Purpose Check Connector (20 pin)
21. Data Link Connector (DLC : 16 pin)

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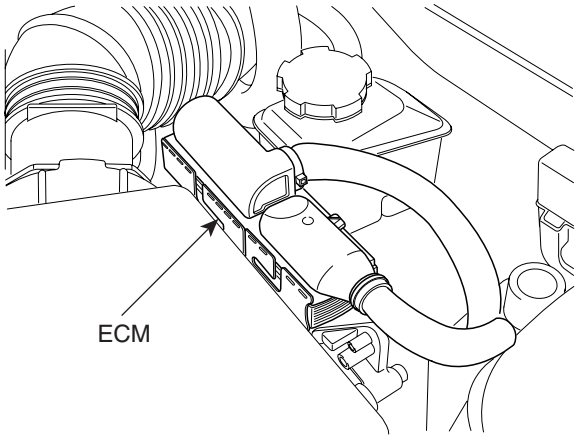
1. ECM (Engine Control Module)



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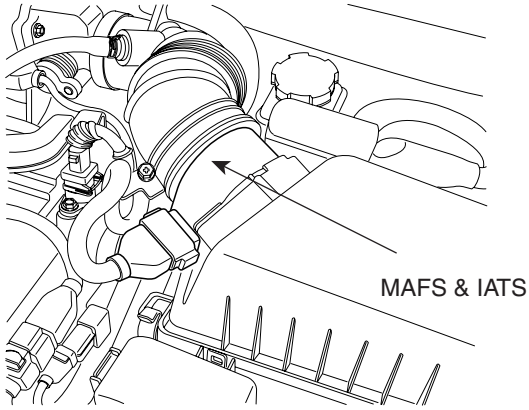
2. Mass Air Flow Sensor (MAFS) [1.6 CVVT]
4. Intake Air Temperature Sensor (IATS) [1.6 CVVT]



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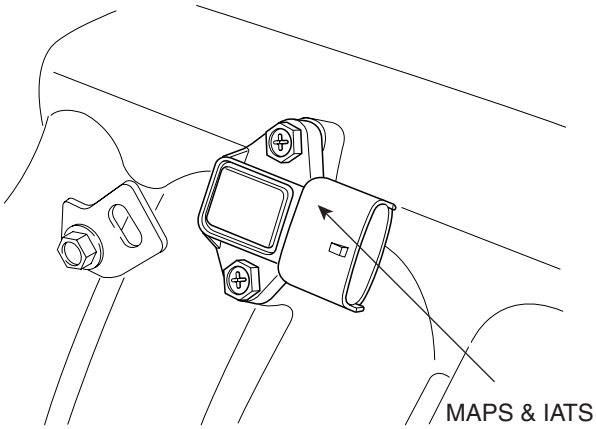
3. Manifold Absolute Pressure Sensor (MAPS) [1.4 DOHC]
4. Intake Air Temperature Sensor (IATS) [1.4 DOHC]



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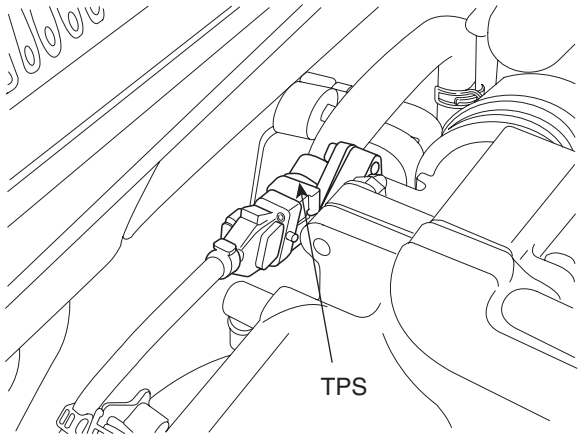
5. Throttle Position Sensor (TPS)



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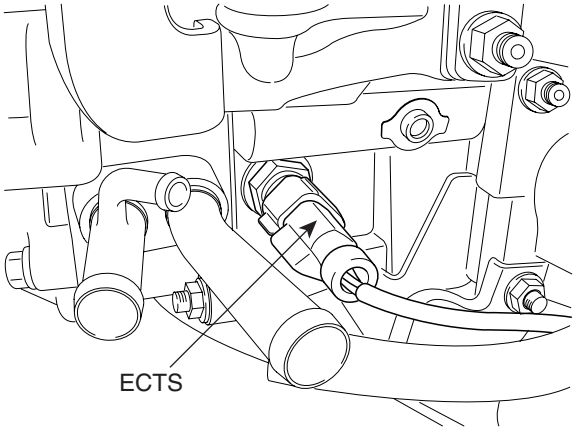
6. Engine Coolant Temperature Sensor (ECTS)



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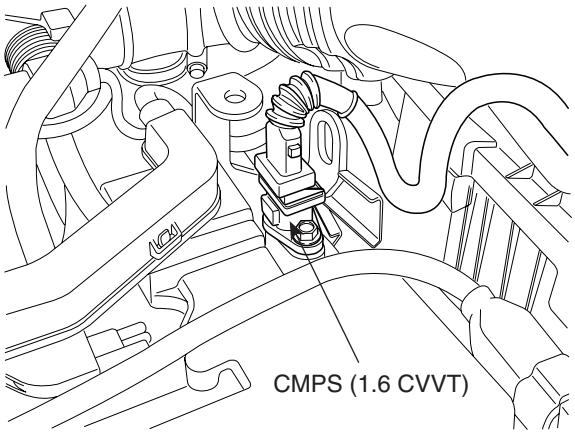
7. Camshaft Position Sensor (CMPS) [1.6 CVVT]



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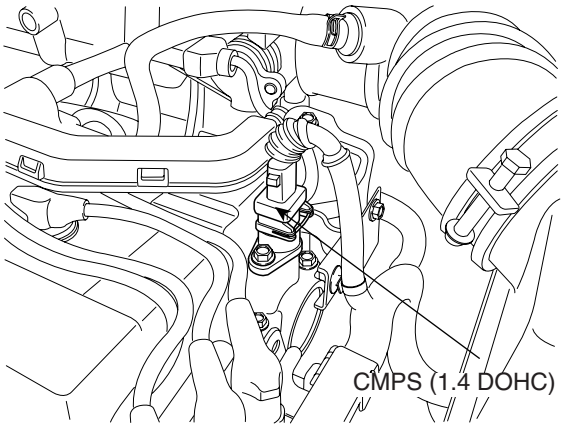
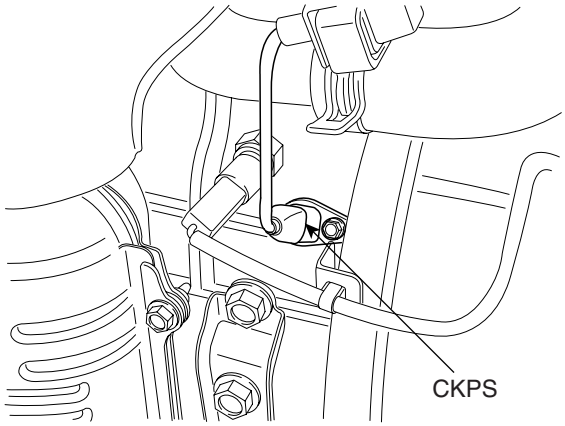
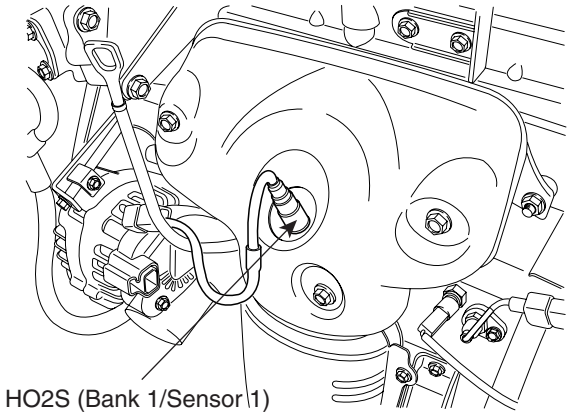
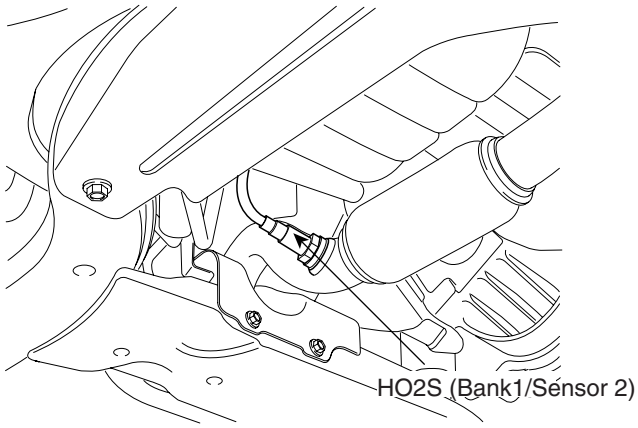
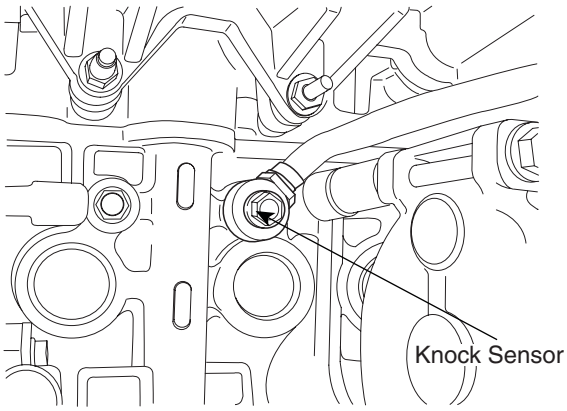
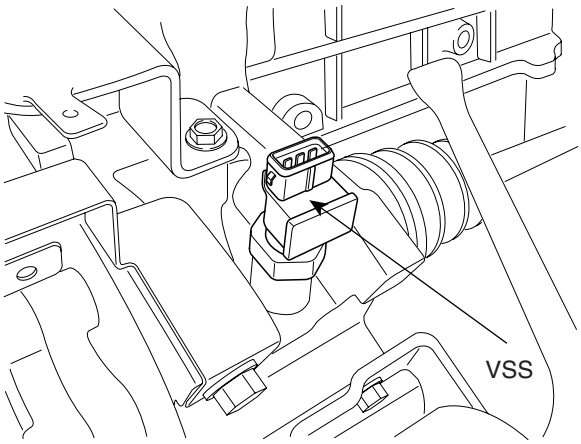
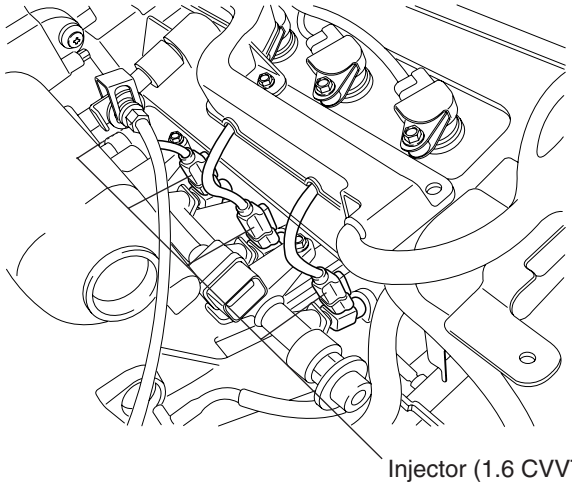
7. Camshaft Position Sensor (CMPS) [1.4 DOHC]	8. Crankshaft Position Sensor (CKPS)
 AFJF371AA	 AFJF378A
9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]	10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
 LFJF002A	 LFJF003A
11. Knock Sensor (KS)	12. Vehicle Speed Sensor (VSS)
 LFJF004A	 AFJF376A

13. Injector [1.6 CVVT]



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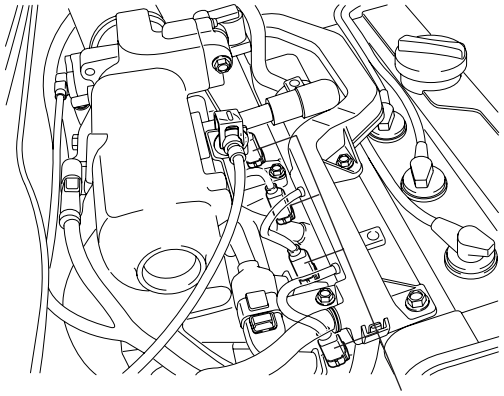
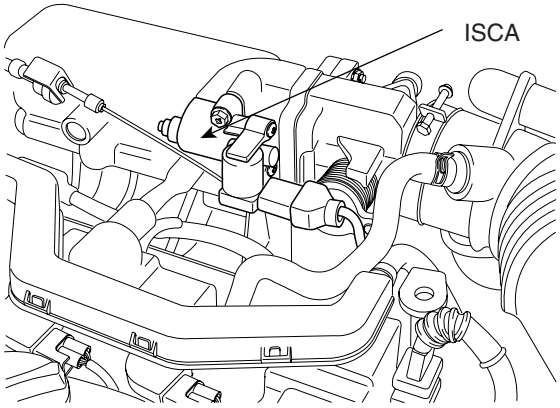
13. Injector [1.4 DOHC]



LFJF006A

14. Idle Speed Control Actuator (ISCA)



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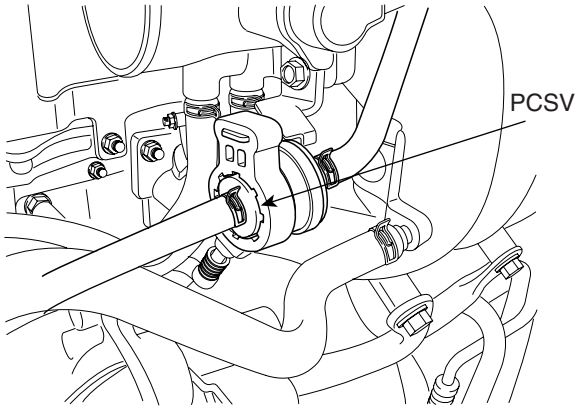
15. Purge Control Solenoid Valve (PCSV)



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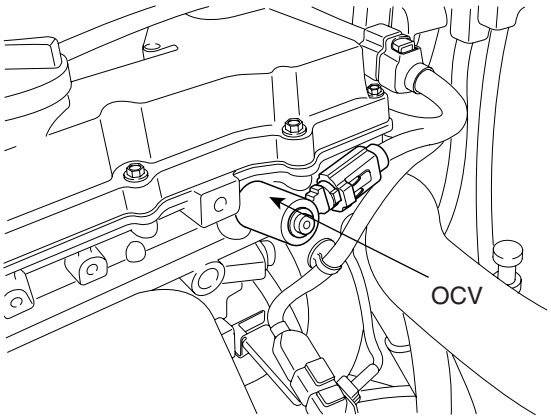
16. CVVT Oil Control Valve (OCV) [1.6 CVVT]



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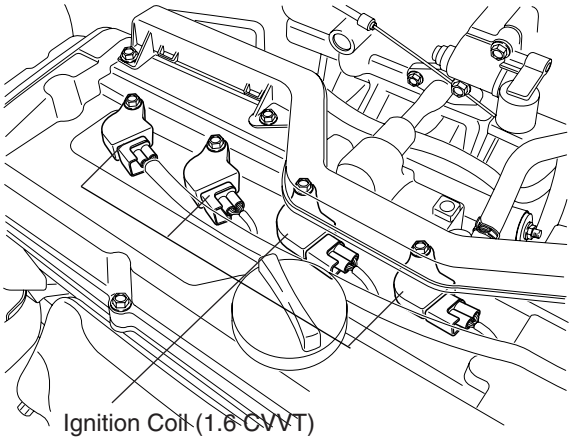
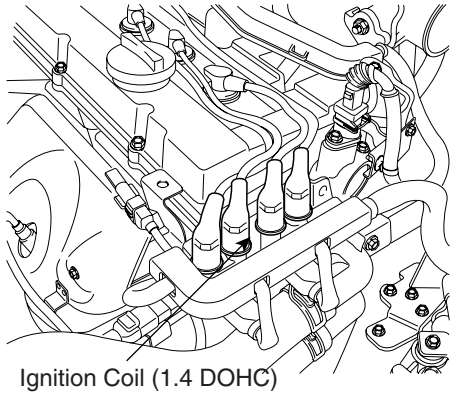
17. Ignition Coil [1.6 CVVT]



LFJF007A

17. Ignition Coil [1.4 DOHC]



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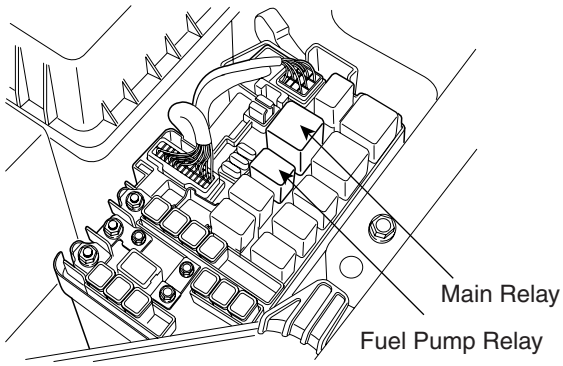
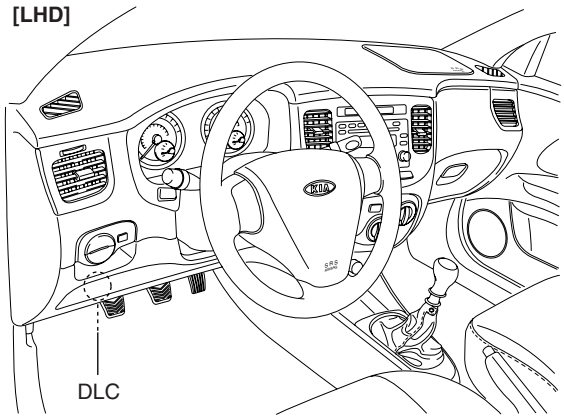
18. Main Relay
19. Fuel Pump Realy



LFJF009A

21. Data Link Connector (DLC : 16 pin)

[LHD]



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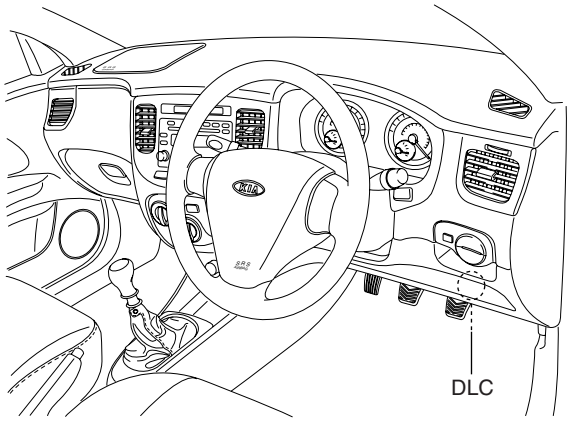
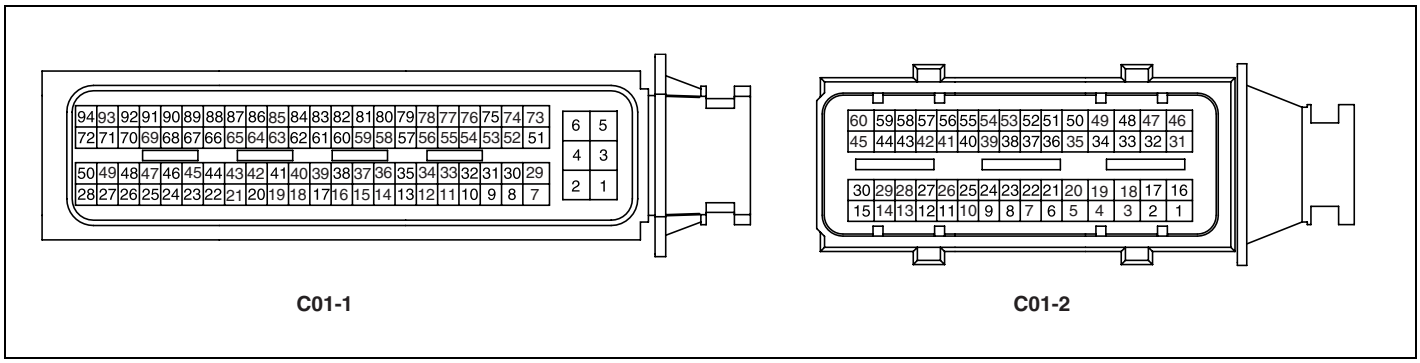
[RHD]



LFJF015A

ECM (ENGINE CONTROL MODULE) ECF3C0FF

1. ECM HARNESS CONNECTOR (A/T)



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2. ECM TERMINAL FUNCTION (A/T)

CONNECTOR [C01-1]

Pin	Description	Connected to	Remark
1	Ground	Chassis Ground	
2	Ground	Chassis Ground	
3	Ground	Chassis Ground	
4	For Autotransaxle Control		
5	For Autotransaxle Control		
6	Batter voltage supply after main relay	Main Relay	
7	-		
8	Sensor ground	MAFS & IATS	1.6 CVVT
		MAFS & IATS	1.4 DOHC
9	Sensor ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	Except for LEADED
10	Mass Air Flow Sensor (MAFS) signal input	Mass Air Flow Sensor (MAFS)	1.6 CVVT
	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)	1.4 DOHC
11	-		
12	-		
13	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	EURO-III/IV
14	-		
15	-		
16	-		
17	Load signal input (Defrost)	Defrost Relay	
18	-		
19	-		

Pin	Description	Connected to	Remark
20	Vehicle speed signal input	Vehicle Speed Sensor (VSS)	Except for EURO-III/IV
		ABS Control Module	EURO-III/IV with ABS
21	-		
22	Load signal input (Head Lamp)	Multi Function Switch	
23	A/C switch signal input	A/C Control Module	
24	Ground	Chassis Ground	
25	Ground	Chassis Ground	
26	For Autotransaxle Control		
27	For Autotransaxle Control		
28	-		
29	-		
30	Ground	A/C Pressure Transducer	
31	Sensor ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	Except for LEADED
32	Intake Air Temperature Sensor (IATS) signal input	Intake Air Temperature Sensor (IATS)	
33	-		
34	-		
35	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	Except for LEADED
36	-		
37	-		
38	Sensor ground	Camshaft Position Sensor (CMPS)	
39	-		
40	-		
41	Camshaft Position Sensor (CMPS) signal input	Camshaft Position Sensor (CMPS)	
42	-		
43	-		
44	Load signal input (Power Steering)	Power Steering Switch	
45	-		
46	A/C Pressure Switch signal input	A/C Control Module	
47	-		
48	For Autotransaxle Control		
49	-		
50	For Autotransaxle Control		
51	Sensor ground	Throttle Position Senosr (TPS)	
52	-		
53	-		
54	-		

Pin	Description	Connected to	Remark
55	-		
56	-		
57	For Autotransaxle Control		
58	-		
59	-		
60	For Autotransaxle Control		
61	For Autotransaxle Control		
62	For Autotransaxle Control		
63	For Autotransaxle Control		
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 Senosr (TPS) signal input	Throttle Position Senosr (TPS)	
76	-		
77	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)	
78	-		
79	A/C Pressure Transducer signal input	A/C Pressure Transducer	
80	For Autotransaxle Control		
81	For Autotransaxle Control		
82	For Autotransaxle Control		
83	For Autotransaxle Control		
84	For Autotransaxle Control		
85	-		
86	-		
87	For Autotransaxle Control		
88	For Autotransaxle Control		
89	For Autotransaxle Control		
90	For Autotransaxle Control		
91	For Autotransaxle Control		

Pin	Description	Connected to	Remark
92	For Autotransaxle Control		
93	-		
94	For Autotransaxle Control		

CONNECTOR [C01-2]

Pin	Description	Connected to	Remark
1	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)	1.6 CVVT
	Ignition Coil (Cylinder #2,3) control output	Ignition Coil (Cylinder #2,3)	1.4 DOHC
2	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)	1.6 CVVT
3	-		
4	-		
5	-		
6	Idle Speed Control Actuator (ISCA) [OPEN] control output	Idle Speed Control Actuator (ISCA)	
7	-		
8	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)	
9	Main Relay control output	Main Relay	
10	-		
11	Ignition switch signal input	Ignition switch	
12	CAN [High]	Data Link Connector (DLC)	
13	-		
14	-		
15	Knock Sensor [A] signal input	Knock Sensor	
16	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)	1.6 CVVT
17	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)	1.6 CVVT
	Ignition Coil (Cylinder #1,4) control output	Ignition Coil (Cylinder #1,4)	1.4 DOHC
18	-		
19	-		
20	-		
21	Cooling Fan [Low] control output	Radiator Fan Relay	
22	Idle Speed Control Actuator (ISCA) [CLOSE] control output	Idle Speed Control Actuator (ISCA)	
23	Cooling Fan [High] control output	Condensor Fan Relay	
24	Fuel consumption signal output	Trip computer	
25	Engine speed signal output	Tachometer (Cluster)	
26	-		
27	CAN [Low]	Data Link Connector (DLC)	
28	-		
29	-		
30	Knock Sensor [B] signal input	Knock Sensor	

Pin	Description	Connected to	Remark
31	-		
32	Immobilizer Lamp control output	Immobilizer Lamp (Cluster)	
33	HO2S [Bank 1 / Sensor 2] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	EURO-III/IV
34	HO2S [Bank 1 / Sensor 1] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	Except for LEADED
35	-		
36	Injector (Cylinder #3) control output	Injector (Cylinder #3)	
37	Fuel Pump Relay output	Fuel Pump Relay	
38	A/C Compressor Relay control output	A/C Compressor Relay	
39	-		
40	Crankshaft Position Sensor (CKPS) [A] signal input	Crankshaft Position Sensor (CKPS)	
41	-		
42	-		
43	Reference supply (+5V)	MAPS & IATS	1.4 DOHC
44	Immobilizer Communication Line	Immobilizer Control Module	
45	Wheel Speed Sensor (WSS) [+] signal input	Wheel Speed Sensor (WSS)	EURO-III/IV without ABS
46	-		
47	-		
48	Injector (Cylinder #4) control output	Injector (Cylinder #4)	
49	CVVT Oil Control Valve (OCV) control output	CVVT Oil Control Valve (OCV)	1.6 CVVT
50	Injector (Cylinder #1) control output	Injector (Cylinder #1)	
51	Malfunction Indicator Lamp (MIL) control output	Malfunction Indicator Lamp (Cluster)	
52	Injector (Cylinder #2) control output	Injector (Cylinder #2)	
53	-		
54	-		
55	Crankshaft Position Sensor (CKPS) [B] signal input	Crankshaft Position Sensor (CKPS)	
56	Battery power	Battery	
57	Reference supply (+5V)	A/C Pressure Transducer	
58	Reference supply (+5V)	Throttle Position Senosr (TPS)	
59	-		
60	Wheel Speed Sensor (WSS) [-] signal input	Wheel Speed Sensor (WSS)	EURO-III/IV without ABS

3. ECM TERMINAL IN/OUT SIGNAL (A/T)

CONNECTOR [C01-1]

Pin No.	Description	Condition	Type	Level	Test Result
1	Ground	Idle	DC	Max. 50mV	0.0V
2	Ground	Idle	DC	Max. 50mV	2.4mV
3	Ground	Idle	DC	Max. 50mV	1.8mV
4	For Autotransaxle Control				
5	For Autotransaxle Control				
6	Batter voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.81V
7	-				
8	Sensor ground	Idle	DC	Max. 50mV	13.2mV
9	Sensor ground	Idle	DC	Max. 50mV	8.9mV
10	[1.6 CVVT] Mass Air Flow Sensor (MAFS) signal input	Idle	Analog	0 ~ 2.0V	1.12V
		3000rpm		1.0 ~ 4.5V	1.96V
	[1.4 DOHC] Manifold Absolute Pressure Sensor (MAPS) signal input	IG ON	Analog	3.9 ~ 4.1V	4.05V
		Idle		0.8 ~ 1.6V	1.55V
11	-				
12	-				
13	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	872mV
				Lean: Max. 0.4V	155mV
14	-				
15	-				
16	-				
17	Load signal input (Defrost)	S/W OFF	DC	Max. 0.5V	0mV
		S/W ON		Battery Voltage	13.19V
18	-				
19	-				
20	Vehicle speed signal input	Vehicle Run	Pulse	HI : Min. 5.0V	12.4V
				LO : Min. 1.0V	17mV
					[1.6] 432Hz at 30kph [1.4] 31.2Hz at 30kph
21	-				
22	Load signal input (Head Lamp)	S/W OFF	DC	Battery Voltage	12.96V
		S/W ON		Max. 0.5V	274mV

Pin No.	Description	Condi-tion	Type	Level	Test Result
23	A/C switch signal input	S/W OFF	DC	Max. 1.0V	10.6mV
		S/W ON		Battery Voltage	11.78V
24	Ground	Idle	DC	Max. 50mV	2.1mV
25	Ground	Idle	DC	Max. 50mV	1.8MV
26	For Autotransaxle Control				
27	For Autotransaxle Control				
28	-				
29	-				
30	Ground	Idle	DC	Max. 50mV	8.7mV
31	Sensor ground	Idle	DC	Max. 50mV	7.2mV
32	Intake Air Temperature Sensor (IATS) signal input	Idle	Analog	0 ~ 5V	[1.6] 2.48V at 24℃ [1.4] 1.89V at 35℃
33	-				
34	-				
35	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] signal input	Racing	Analog	Rich : 0.6 ~ 1.0V Lean : Max. 0.4V	880mV
36	-				208mV
37	-				
38	Sensor ground	Idle	DC	Max. 50mV	3.7mV
39	-				
40	-				
41	Camshaft Position Sensor (CMPS) signal input	Idle	Pulse	HI : Battery Voltage	13.86V
				LO : Max. 0.5V	450mV
42	-				
43	-				
44	Load signal input (Power Steering)	S/W ON	DC	Battery Voltage	11.81V
		S/W OFF		Max. 0.5V	351mV
45	-				
46	A/C Pressure Switch signal input	S/W OFF	DC	Max. 1.0V	0.0mV
		S/W ON		Battery Voltage	12.77V
47	-				
48	For Autotransaxle Control				
49	-				
50	For Autotransaxle Control				
51	Sensor ground	Idle	DC	Max. 50mV	6.8mV
52	-				
53	-				

Pin No.	Description	Condi-tion	Type	Level	Test Result
54	-				
55	-				
56	-				
57	For Autotransaxle Control				
58	-				
59	-				
60	For Autotransaxle Control				
61	For Autotransaxle Control				
62	For Autotransaxle Control				
63	For Autotransaxle Control				
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	2.1mV
74	-				
75	Throttle Position Senosr (TPS) signal input	C.T	Analog	0.25 ~ 0.9V	0.31V
		W.O.T		Min. 4.0V	4.21V
76	-				
77	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.5 ~ 4.5V	[1.6] 0.85V at 95.1℃ [1.4] 0.98V at 95.5℃
78	-				
79	A/C Pressure Transducer signal input	A/C ON	Analog	Max. 4.8V	2.51V
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				

Pin No.	Description	Condi-tion	Type	Level	Test Result
89	For Autotransaxle Control				
90	For Autotransaxle Control				
91	For Autotransaxle Control				
92	For Autotransaxle Control				
93	-				
94	For Autotransaxle Control				

CONNECTOR [C01-2]

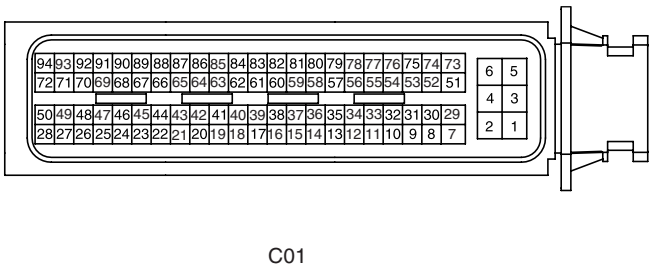
Pin No.	Description	Condi-tion	Type	Level	Test Result
1	[1.6 CVVT] Ignition Coil (Cylinder #2) control output	Idle	Pulse	1st Voltage: 300~400V	365V
				ON Voltage: Max. 2V	1.69V
					5.0Hz
	[1.4 DOHC] Ignition Coil (Cylinder #2,3) control output	Idle	Pulse	1st Voltage: 300~400V	373V
				ON Voltage: Max. 2V	1.74V
					10.9HZ
2	[1.6 CVVT] Ignition Coil (Cylinder #4) control output	Idle	Pulse	1st Voltage: 300~400V	362V
				ON Voltage: Max. 2V	1.69V
					5.0Hz
3	-				
4	-				
5	-				
6	Idle Speed Control Actuator (ISCA) [OPEN] control output	Idle	Pulse	HI: Battery Voltage	14.8V
				LO: Max. 1.0V	128mV
					[1.6] 250Hz at duty 32.5% [1.4] 250Hz at duty 27.5%
7	-				
8	Purge Control Solenoid Valve (PCSV) control output	Active Inactive	Pulse	HI: Battery Voltage	14.2V
				LO: Max. 1.0V	215mV
				Vpeak: Max. 70V	45.2V
					[1.6] 13.68Hz [1.4] 10.97Hz
9	Main Relay control output	Relay OFF	DC	Battery Voltage	12.97V
		Relay ON		Max. 1.0V	791mV
10	-				

Pin No.	Description	Condition	Type	Level	Test Result
11	Ignition switch signal input	IG OFF	DC	Max 0.5V	2.8mV
		IG ON		Battery Voltage	12.18V
12	CAN [High]	Recessive	Pulse	2.0 ~ 3.0V	2.36V
		Dominant		2.75 ~ 4.5V	3.44V
13	-				
14	-				
15	Knock Sensor [A] signal input	Knocking	Variable Frequency		
		Normal			
16	[1.6 CVVT] Ignition Coil (Cylinder #3) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	358V
				1st Voltage: 300 ~ 400V	1.68V
					5.0Hz
17	[1.6 CVVT] Ignition Coil (Cylinder #1) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	349V
				ON Voltage: Max. 2V	1.68V
					5.0Hz
	[1.4 DOHC] Ignition Coil (Cylinder #1,4) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	373V
				ON Voltage:: Max. 2V	1.74V
					10.9Hz
18	-				
19	-				
20	-				
21	Cooling Fan [Low] control output	Relay OFF	DC	Battery Voltage	14.05V
		Relay ON		Max. 1.0V	52.1mV
22	Idle Speed Control Actuator (ISCA) [CLOSE] control output	Idle	Pulse	HI : Battery Voltage	14.9V
				LO : Max. 1.0V	204mV
					[1.6] 250Hz at duty 67.5% [1.4] 250Hz at duty 72.5%
23	Cooling Fan [High] control output	Relay OFF	DC	Battery Voltage	14.12V
		Relay ON		Max. 1.0V	198mV
24	Fuel consumption signal output	Idle	Pulse	HI: Battery Voltage	13.9V
				LO: Max. 0.5V	16.1mV

Pin No.	Description	Condition	Type	Level	Test Result
25	Engine speed signal output	Idle	Pulse	HI: Battery Voltage	13.9V
				LO: Max. 0.5V	12.1mV
				20 ~ 26Hz	21.9Hz
26	-				
27	CAN [Low]	Recessive	Pulse	2.0 ~ 3.0V	2.36V
		Dominant		0.5 ~ 2.25V	1.44V
28	-				
29	-				
30	Knock Sensor [B] signal input	Knocking	Variable Frequency		
		Normal			
31	-				
32	Immobilizer Lamp control output	Lamp OFF	DC	Battery Voltage	11.98V
		Lamp ON		Max. 1.0V	27mV
33	HO2S [Bank 1 / Sensor 2] heater control output	Engine Run	Pulse (2Hz)	HI: Battery Voltage	14.1V
				LO: Max. 1.0V	304mV
34	HO2S [Bank 1 / Sensor 1] heater control output	Engine Run	Pulse (2Hz)	HI: Battery Voltage	14.1V
				LO: Max. 1.0V	326mV
35	-				
36	Injector (Cylinder #3) control output	Idle	Pulse (5.5Hz)	HI: Battery Voltage	14.2V
				LO: Max. 1.0V	330mV
				Vpeak: Max. 80V	69.6V
37	Fuel Pump Relay output	Relay OFF	DC	Battery Voltage	12.3V
		Relay ON		Max. 1.0V	30mV
38	A/C Compressor Relay control output	A/C OFF	DC	Battery Voltage	14.32V
		A/C ON		Max. 1.0V	114mV
39	-				
40	Crankshaft Position Sensor (CKPS) [A] signal input	Idle	Sine Wave	Vp_p : Min. 1.0V	8.44V
					[1.6] 718.4Hz [1.4] 661.6Hz
41	-				
42	-				
43	Reference supply (+5V)	IG OFF	DC	Max. 0.5V	
		IG ON		4.9 ~ 5.1V	

Pin No.	Description	Condition	Type	Level	Test Result
44	Immobilizer Communication Line	When communication after IG ON	Pulse	HI: Min. 8.5V	12.31V
				LO: Max. 3.5V	1.17V
45	Wheel Speed Sensor (WSS) [+] signal input	Vehicle Run	Sine Wave	Vp_p : Min. 0.2V	
46	-				
47	-				
48	Injector (Cylinder #4) control output	Idle	Pulse (5.5Hz)	HI: Battery Voltage	14.2V
				LO: Max. 1.0V	330mV
				Vpeak: Max. 80V	69.6V
49	CVVT Oil Control Valve (OCV) control output	Idle	Pulse	HI: Battery Voltage	14.9V
				LO: Max. 1.0V	36.2mV
				Vpeak: Max.70V	
					300.26Hz at duty 6.1%
50	Injector (Cylinder #1) control output	Idle	Pulse (5.5Hz)	HI: Battery Voltage	14.2V
				LO: Max. 1.0V	330mV
				Vpeak: Max. 80V	69.6V
51	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Battery Voltage	13.03V
		Lamp ON		Max.1.0V	716mV
52	Injector (Cylinder #2) control output	Idle	Pulse (5.5Hz)	HI: Battery Voltage	13.6V
				LO: Max. 1.0V	340mV
				Vpeak: Max. 80V	69.7V
53	-				
54	-				
55	Crankshaft Position Sensor (CKPS) [B] signal input	Idle	Sine Wave	Vp_p: Min.1.0V	8.44V
					[1.6] 718.4Hz [1.4] 661.6Hz
56	Battery power	Always	DC	Battery Voltage	
57	Reference supply (+5V)	IG OFF	DC	Max. 0.5V	4.2mV
		IG ON		4.9 ~ 5.1V	5.04V
58	Reference supply (+5V)	IG OFF	DC	Max. 0.5V	0.0mV
		IG ON		4.9 ~ 5.1V	5.04V
59	-				
60	Wheel Speed Sensor (WSS) [-] signal input	Vehicle Run	Sine Wave	Vp-p: Min. 0.2V	

1. ECM HARNESS CONNECTOR (M/T)



AFJF900B

2. ECM TERMINAL FUNCTION (M/T)

CONNECTOR [C01]

Pin	Description	Connected to	Remark
1	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)	1.6 CVVT
	Ignition Coil (Cylinder #1,4) control output	Ignition Coil (Cylinder #1,4)	1.4 DOHC
2	Ground	Chassis Ground	
3	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)	1.6 CVVT
	Ignition Coil (Cylinder #2,3) control output	Ignition Coil (Cylinder #2,3)	1.4 DOHC
4	-		
5	-		
6	Batter voltage supply after main relay	Main Relay	
7	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)	1.6 CVVT
8	A/C Pressure Switch signal input	A/C Control Module	
9	-		
10	Load signal input (Power Steering)	Power Steering Switch	
11	Knock Sensor [A] signal input	Knock Sensor	
12	Sensor ground	Throttle Position Senosr (TPS)	
13	-		
14	-		
15	Sensor ground	MAFS & IATS	1.6 CVVT
		MAFS & IATS	1.4 DOHC
16	Sensor ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	
17	Sensor ground	Camshaft Position Sensor (CMPS)	
18	Immobilizer Communication Line	Immobilizer Control Module	
19	Mass Air Flow Sensor (MAFS) signal input	Mass Air Flow Sensor (MAFS)	1.6 CVVT
	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)	1.4 DOHC
20	-		
21	-		

Pin	Description	Connected to	Remark
22	Main Relay control output	Main Relay	
23	Cooling Fan [High] control output	Condensor Fan Relay	
24	Injector (Cylinder #3) control output	Injector (Cylinder #3)	
25	Idle Speed Control Actuator (ISCA) [CLOSE] control output	Idle Speed Control Actuator (ISCA)	
26	-		
27	-		
28	Cooling Fan [Low] control output	Radiator Fan Relay	
29	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)	1.6 CVVT
30	A/C switch signal input	A/C Control Module	
31	Load signal input (Head Lamp)	Multi Function Switch	
32	Knock Sensor [B] signal input	Knock Sensor	
33	Ground	A/C Pressure Transducer	
34	-		
35	Sensor ground	Engine Coolant Temperature Sensor (ECTS)	
36	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	EURO-III/IV
37	-		
38	Sensor ground	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	
39	Throttle Position Senosr (TPS) signal input	Throttle Position Senosr (TPS)	Except for LEADED
40	A/C Pressure Transducer signal input	A/C Pressure Transducer	
41	-		
42	-		
43	Intake Air Temperature Sensor (IATS) signal input	Intake Air Temperature Sensor (IATS)	
44	-		
45	A/C Compressor Relay control output	A/C Relay	
46	Fuel Pump Relay output	Fuel Pump Relay	
47	Injector (Cylinder #2) control output	Injector (Cylinder #2)	
48	Immobilizer Lamp control output	Immobilizer Lamp (Cluster)	
49	-		
50	-		
51	Ground	Chassis Ground	
52	-		
53	-		
54	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	Except for LEADED
55	-		
56	-		

Pin	Description	Connected to	Remark
57	-		
58	Wheel Speed Sensor (WSS) [+] signal input	Wheel Speed Sensor (WSS)	EURO-III/IV without ABS
59	Reference supply (+5V)	A/C Pressure Transducer	
60	Reference supply (+5V)	Throttle Position Senosr (TPS)	
61	-		
62	CAN [Low]	Data Link Connector (DLC)	
63	Camshaft Position Sensor (CMPS) signal input	Camshaft Position Sensor (CMPS)	
64	Vehicle speed signal input	Vehicle Speed Sensor (VSS)	Except for EURO-III/IV
		ABS Control Module	EURO-III/IV with ABS
65	-		
66	Load signal input (Defrost)	Defrost Relay	
67	Engine speed signal output	Tachometer (Cluster)	
68	Injector (Cylinder #4) control output	Injector (Cylinder #4)	
69	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)	
70	Malfunction Indicator Lamp (MIL) control output	Malfunction Indicator Lamp (Cluster)	
71	HO2S [Bank 1 / Sensor 2] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	EURO-III/IV
72	HO2S [Bank 1 / Sensor 1] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	Except for LEADED
73	Ground	Chassis Ground	
74	-		
75	-		
76	-		
77	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)	
78	-		
79	Wheel Speed Sensor (WSS) [-] signal input	Wheel Speed Sensor (WSS)	EURO-III/IV without ABS
80	-		
81	Reference supply (+5V)	MAPS & IATS	1.4 DOHC
82	Battery power	Battery	
83	Ignition switch signal input	Ignition switch	
84	CAN [High]	Data Link Connector (DLC)	
85	-		
86	Crankshaft Position Sensor (CKPS) [B] signal input	Crankshaft Position Sensor (CKPS)	
87	Crankshaft Position Sensor (CKPS) [A] signal input	Crankshaft Position Sensor (CKPS)	
88	Fuel consumption signal output	Trip computer	
89	-		

Pin	Description	Connected to	Remark
90	Idle Speed Control Actuator (ISCA) [OPEN] control output	Idle Speed Control Actuator (ISCA)	
91	Injector (Cylinder #1) control output	Injector (Cylinder #1)	
92	CVVT Oil Control Valve (OCV) control output	CVVT Oil Control Valve (OCV)	1.6 CVVT
93	-		
94	-		

3. ECM TERMINAL IN/OUT SIGNAL (M/T)

CONNECTOR [C01]

Pin	Description	Condi-tion	Type	Level	Test Result
1	[1.6 CVVT] Ignition Coil (Cylinder #1) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	349V
				ON Voltage: Max. 2V	1.68V
					5.0Hz
	[1.4 DOHC] Ignition Coil (Cylinder #1,4) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	373V
				ON Voltage: Max. 2V	1.74V
					10.9Hz
2	Ground	Idle	DC	Max. 50mV	0.0V
3	[1.6 CVVT] Ignition Coil (Cylinder #3) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	358V
				ON Voltage: Max. 2V	1.68V
					5.0Hz
	[1.4 DOHC] Ignition Coil (Cylinder #2,3) control output	Idle	Pulse	1st Voltage: 300 ~ 400V	373V
				ON Voltage: Max. 2V	1.74V
					10.9Hz
4	-				
5	-				
6	Batter voltage supply after main relay	IG OFF	DC	Max. 1.0V	0V
		IG ON		Battery Voltage	12.81V
7	[1.6 CVVT] Ignition Coil (Cylinder #4) control output	Idle	Pulse	1st Voltage: 300~400V	362V
				ON Voltage: Max. 2V	1.69V
					5.0Hz
8	A/C Pressure Switch signal input	S/W OFF	DC	Max. 1.0V	0.0mV
		S/W ON		Battery Voltage	12.77V
9	-				
10	Load signal input (Power Steering)	S/W ON	DC	Battery Voltage	11.81V
		S/W OFF		Max. 0.5V	351mV

Pin	Description	Condition	Type	Level	Test Result
11	Knock Sensor [A] signal input	Knocking	Variable Frequency		
		Normal			
12	Sensor ground	Idle	DC	Max. 50mV	13.2V
13	-				
14	-				
15	Sensor ground	Idle	DC	Max. 50mV	8.9mV
16	Sensor ground	Idle	DC	Max. 50mV	7.2mV
17	Sensor ground	Idle	DC	Max. 50mV	6.8mV
18	Immobilizer Communication Line	When communication after IG ON	Pulse	HI: Min. 8.5V	12.31V
				LO: Max. 3.5V	1.17V
19	[1.6 CVVT] Mass Air Flow Sensor (MAFS) signal input	Idle	Analog	0 ~ 2.0V	1.12V
		3000rpm		1.0 ~ 4.5V	1.96V
	[1.4 DOHC] Manifold Absolute Pressure Sensor (MAPS) signal input	IG ON	Analog	3.9 ~ 4.1V	4.05V
		Idle		0.8 ~ 1.6V	1.55V
20	-				
21	-				
22	Main Relay control output	Relay OFF	DC	Battery Voltage	12.97V
		Relay ON		Max. 1.0V	791mV
23	Cooling Fan [High] control output	Relay OFF	DC	Battery Voltage	14.12V
		Relay ON		Max. 1.0V	198mV
24	Injector (Cylinder #3) control output	Idle	Pulse (5.5 Hz)	HI: Battery Voltage	14.2V
				LO: Max. 1.0V	330mV
				Vpeak: Max.80V	69.6V
25	Idle Speed Control Actuator (ISCA) [CLOSE] control output	Idle	Pulse	HI: Battery Voltage	14.9V
				LO: Max. 1.0V	204mV
				Vpeak: Max.80V	[1.6] 250Hz at duty 67.5% [1.4] 250Hz at duty 72.5%
26	-				
27	-				

Pin	Description	Condi-tion	Type	Level	Test Result
28	Cooling Fan [Low] control output	Relay OFF	DC	Battery Voltage	14.05V
		Relay ON		Max. 1.0V	52.1mV
29	[1.6 CVVT] Ignition Coil (Cylinder #2) control output	Idle	Pulse	1st Voltage: 300~400V	365V
				ON Voltage: Max. 2V	1.69V
					5.0Hz
30	A/C switch signal input	S/W OFF	DC	Max. 1.0V	10.6mV
		S/W ON		Battery Voltage	11.78V
31	Load signal input (Head Lamp)	S/W OFF	DC	Battery Voltage	12.96V
		S/W ON		Max. 0.5V	274mV
32	Knock Sensor [B] signal input	Knock-ing	Vari-ableFre-quency		
		Normal			
33	Ground	Idle	DC	Max. 50mV	2.4mV
34	-				
35	Sensor ground	Idle	DC	Max. 50mV	3.7mV
36	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	872mV
				Lean: Max. 0.4V	155mV
37	-				
38	Sensor ground	Idle	DC	Max. 50mV	2.1mV
39	Throttle Position Senosr (TPS) signal input	C.T	Analog	0.25 ~ 0.9V	0.31V
		W.O.T		Min. 4.0V	4.21V
40	A/C Pressure Transducer signal input	A/C ON	Analog	Max. 4.8V	2.51V
41	-				
42	-				
43	Intake Air Temperature Sensor (IATS) signal input	Idle	Analog	0 ~ 5V	[1.6] 2.48V at 24℃ [1.4] 1.89V at 35℃
44	-				
45	A/C Compressor Relay control output	A/C OFF	DC	Battery Voltage	14.32V
		A/C ON		Max. 1.0V	114mV
46	Fuel Pump Relay output	Relay OFF	DC	Battery Voltage	12.3V
		Relay ON		Max. 1.0V	30mV

Pin	Description	Condi-tion	Type	Level	Test Result
47	Injector (Cylinder #2) control output	Idle	Pulse (5.5Hz)	HI: Battery Voltage	13.6V
				LO: Max. 1.0V	340mV
				Vpeak: Max. 80V	69.7V
48	Immobilizer Lamp control output	Lamp OFF	DC	Battery Voltage	11.98V
		Lamp ON		Max. 1.0V	27mV
49	-				
50	-				
51	Ground	Idle	DC	Max. 50mV	1.8mV
52	-				
53	-				
54	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	880mV
				Lean: Max. 0.4V	208mV
55	-				
56	-				
57	-				
58	Wheel Speed Sensor (WSS) [+] signal input	Vehicle Run	Sine Wave	Vp-p: Min. 0.2V	
59	Reference supply (+5V)	IG OFF	DC	Max. 0.5V	4.2mV
		IG ON		4.9 ~ 5.1V	5.04V
60	Reference supply (+5V)	IG OFF	DC	Max. 0.5V	0.0mV
		IG ON		4.9 ~ 5.1V	5.04V
61	-				
62	CAN [Low]	Reces-sive	Pulse	2.0 ~ 3.0 V	2.36V
		Domi-nant		0.5 ~ 2.25 V	1.44V
63	Camshaft Position Sensor (CMPS) signal input	Idle	Pulse	HI: Battery Voltage	13.86V
				LO: Max . 0.5V	450mV
64	Vehicle speed signal input	Vehicle Run	Pulse	HI: Min. 5.0V	12.4V
				LO: Max. 1.0V	17mV
					[1.6] 432Hz at 30kph [1.4] 31.2Hz at 30kph
65	-				
66	Load signal input (Defrost)	S/W OFF	DC	Max. 0.5V	0mV
		S/W ON		Battery Voltage	13.19V

Pin	Description	Condi-tion	Type	Level	Test Result
67	Engine speed signal output	Idle	Pulse	HI: Battery Voltage	13.9V
				LO: Max. 0.5V	12.1mV
				20 ~ 26Hz	21.9Hz
68	Injector (Cylinder #4) control output	Idle	Pulse (5.5Hz)	HI: Battery Voltage	14.2V
				LO: Max. 1.0V	330mV
				Vpeak: Max. 80V	69.6V
69	Purge Control Solenoid Valve (PCSV) control output	Active Inactive	Pulse	HI: Battery Voltage	14.2V
				LO: Max. 1.0V	215mV
				Vpeak: Max. 70V	45.2V
					[1.6] 13.68Hz [1.4] 10.97Hz
70	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Battery Voltage	13.03V
		Lamp ON		Max. 1.0V	716mV
71	HO2S [Bank 1 / Sensor 2] heater control output	Engine Run	Pulse (2Hz)	HI: Battery Voltage	14.1V
				LO: Max. 1.0V	304mV
72	HO2S [Bank 1 / Sensor 1] heater control output	Engine Run	Pulse (2Hz)	HI: Battery Voltage	14.1V
				LO: Max. 1.0V	326mV
73	Ground	Idle	DC	Max. 50mV	2.1mV
74	-				
75	-				
76	-				
77	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.5 ~ 4.5V	[1.6] 0.85V at 95.1℃ [1.4] 0.98V at 91.5℃
78	-				
79	Wheel Speed Sensor (WSS) [-] signal input	Vehicle Run	Sine Wave	Vp-p: Min.0.2V	
80	-				
81	Reference supply (+5V)	IG OFF	DC	Max. 0.5V	
		IG ON		4.9 ~ 5.1V	
82	Battery power	Always	DC	Battery Voltage	
83	Ignition switch signal input	IG OFF	DC	Max. 0.5V	2.8mV
		IG ON		Battery Voltage	12.18V
84	CAN [High]	Reces-sive	Rulse	2.0 ~ 3.0V	2.36V
		Domi-nant		2.75 ~ 4.5V	3.44V
85	-				

Pin	Description	Condi-tion	Type	Level	Test Result
86	Crankshaft Position Sensor (CKPS) [B] signal input	Idle	Sine Wave	Vp_p: Min.1.0V	8.44V
					[1.6] 718.4Hz [1.4] 661.6Hz
87	Crankshaft Position Sensor (CKPS) [A] signal input	Idle	Sine Wave	Vp_p: Min. 1.0V	8.44V
					[1.6] 718.4Hz [1.4] 661.6Hz
88	Fuel consumption signal output	Idle	Pulse	HI: Battery Voltage	13.9V
				LO: Max. 0.5V	16.1mV
89	-				
90	Idle Speed Control Actuator (ISCA) [OPEN] control output	Idle	Pulse	HI: Battery Voltage	14.8V
				LO: Max. 1.0V	128mV
					[1.6] 250㎐ at duty 32.5% [1.4] 250㎐ at duty 27.5%
91	Injector (Cylinder #1) control output	Idle	Pulse (5.5Hz)	HI: Battery Voltage	14.2V
				LO: Max. 1.0V	330mV
				Vpeak: Max. 80V	69.6V
92	CVVT Oil Control Valve (OCV) control output	Idle	Pulse	HI: Battery Voltage	14.9V
				LO: Max. 1.0V	36.2mV
				Vpeak: Max. 70V	
					300.26Hz at duty 6.1%
93	-				
94	-				

ECM PROBLEM INSPECTION PROCEDURE ECBAA46E

1. TEST ECM GROUND CIRCUIT: Measure resistance between ECM and chassis ground using the backside of ECM harness connector as ECM side check point. If the problem is found, repair it.

Specification (Resistance): 1Ω or less

2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminal on ECM side and harness side for bent pins or poor contact 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 agaon. 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 dose not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

DTC TROUBLESHOOTING PROCEDURES

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC) E0E83BC5

DTC	Description	MIL			Page
		EURO-III/IV	UNLEADED	LEADED	
P0011	"A" Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)	●	▲	▲	
P0012	"A" Camshaft Position-Timing Over-Retarded (Bank 1)	●	▲	▲	
P0016	Crankshaft Position-Camshaft Position Correlation (Bank 1 Sensor A)	▲	▲	▲	
P0031	HO2S Heater Circuit low (Bank 1 / Sensor 1)	●	▲		
P0032	HO2S Heater Circuit high (Bank 1 / Sensor 1)	●	▲		
P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)	●			
P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	●			
P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	●			
P0068	MAFS/MAPS-TPS Correlation	▲			
P0075	Intake Valve Control Solenoid Circuit (Bank1)	●	▲	▲	
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	●	▲	▲	
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	●	▲	▲	
P0100	Mass or Volume Air Flow Circuit Malfunction	●	●	●	
P0101	Mass or Volume Air Flow Circuit Range/Performance	●	●	●	
P0102	Mass or Volume Air Flow Circuit Low Input	●	●	●	
P0103	Mass or Volume Air Flow Circuit high Input	●	●	●	
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	●			
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●	●	●	
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●	●	●	
P0112	Intake Air Temperature Sensor1 Circuit Low Input	●	▲	▲	
P0113	Intake Air Temperature Sensor1 Circuit High Input	●	▲	▲	
P0117	Engine Coolant Temperature Circuit Low Input	●	●	●	
P0118	Engine Coolant Temperature Circuit High Input	●	●	●	
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	▲			
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	●	●	

DTC	Description	MIL			Page
		EURO-III/IV	UNLEADED	LEADED	
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	●	●	
P0130	HO2S Circuit (Bank 1/ Sensor 1)	●	▲		
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	▲		
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	▲		
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●	▲		
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	●	▲		
P0135	HO2S Heater Circuit (Bank 1 / Sensor 1)	●	▲		
P0136	HO2S Circuit (Bank 1/ Sensor 2)	●			
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●			
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●			
P0139	HO2S Circuit Slow Response (Bank 1 / Sensor 2)	●			
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	●			
P0141	HO2S Heater Circuit (Bank 1 / Sensor 2)	●			
P0171	System Too Lean (Bank 1)	●	▲	▲	
P0172	System Too Rich (Bank 1)	●	▲	▲	
P0201	Injector Circuit/Open-Cylinder 1	●	●	●	
P0202	Injector Circuit/Open-Cylinder 2	●	●	●	
P0203	Injector Circuit/Open-Cylinder 3	●	●	●	
P0204	Injector Circuit/Open-Cylinder 4	●	●	●	
P0230	Fuel Pump Primary Circuit	▲	▲	▲	
P0231	Fuel Pump Relay-Open or Short Circuit	▲	▲	▲	
P0232	Fuel Pump Relay-Short Circuit	▲	▲	▲	
P0261	Cylinder 1-Injector Circuit Low	●	●	●	
P0262	Cylinder 1-Injector Circuit High	●	●	●	
P0264	Cylinder 2-Injector Circuit Low	●	●	●	
P0265	Cylinder 2-Injector Circuit High	●	●	●	
P0267	Cylinder 3-Injector Circuit Low	●	●	●	
P0268	Cylinder 3-Injector Circuit High	●	●	●	
P0270	Cylinder 4-Injector Circuit Low	●	●	●	
P0271	Cylinder 4-Injector Circuit High	●	●	●	
P0300	Random/Multiple Cylinder Misfire Detected	●			
P0301	Cylinder 1-Misfire detected	●			

DTC	Description	MIL			Page
		EURO-III/IV	UNLEADED	LEADED	
P0302	Cylinder 2-Misfire detected	●			
P0303	Cylinder 3-Misfire detected	●			
P0304	Cylinder 4-Misfire detected	●			
P0326	Knock Sensor 1 Circuit Range/Performance (Bank 1)	▲	▲		
P0327	Knock Sensor 1 Circuit Low Input	▲	▲		
P0328	Knock Sensor 1 Circuit High Input	▲	▲		
P0335	Crankshaft Position Sensor A Circuit	●	▲	▲	
P0336	Crankshaft Position Sensor A Circuit Range/Performance	●	▲	▲	
P0337	Crankshaft Position Sensor A Circuit Low Input	●	▲	▲	
P0338	Crankshaft Position Sensor A Circuit High Input	●	▲	▲	
P0339	Crankshaft Position Sensor A Circuit	●	▲	▲	
P0340	Camshaft Position Sensor A Circuit Malfunction (Bank 1 or Single Sensor)	●	▲	▲	
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	●	▲	▲	
P0342	Camshaft Position Sensor A Circuit Low Input	●	▲	▲	
P0343	Camshaft Position Sensor A Circuit High Input	●	▲	▲	
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●			
P0444	Evap. Emission System-Purge Control. Valve Circuit Open	●	▲		
P0458	Evap. Emission System-Purge Control Valve Circuit Low	●	▲		
P0459	Evap. Emission System-Purge Control Valve Circuit High	●	▲		
P0496	Evap. Emission System-High Purge Flow	●	▲		
P0497	Evap. Emission System-Low Purge Flow	●	▲		
P0501	Vehicle Speed Sensor A Range/Performance	●	▲	▲	
P0506	Idle Air Control System-RPM lower than expected	●	▲	▲	
P0507	Idle Air Control System-RPM higher than expected	●	▲	▲	
P0561	System Voltage Unstable	●	▲	▲	
P0562	System Voltage Low	●	▲	▲	
P0563	System Voltage High	●	▲	▲	
P0600	CAN Communication BUS	●	▲	▲	
P0630	VIN not Programmed or Incompactible-ECM/PCM	●			
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲	▲	▲	
P1505	Idle Charge Actuator Signal Low of Coil #1	●	●	●	

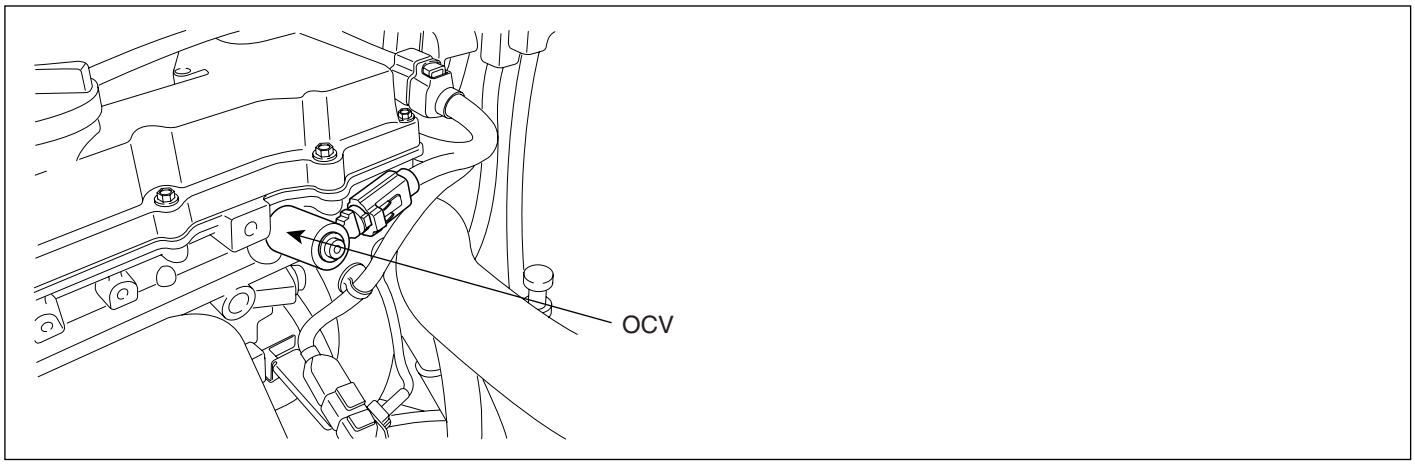
DTC	Description	MIL			Page
		EURO-III/IV	UNLEADED	LEADED	
P1506	Idle Charge Actuator Signal High of Coil #1	●	●	●	
P1507	Idle Charge Actuator Signal Low of Coil #2	●	●	●	
P1508	Idle Charge Actuator Signal High of Coil #2	●	●	●	
P1550	Knock sensor evaluation IC	▲	▲		
P1560	Knock control SPI (Serial Port Interface) check	▲	▲		
P1602	CAN Communication BUS with TCM (Timeout)	●	▲	▲	
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	●			
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	●			
P2232	HO2S Signal Circuit Shorted to Heater Circuit (Bank 1 / Sensor 2)	●			

NOTE

● *: MIL ON & MEMORY*
▲ *: MIL OFF & MEMORY*

DTC P0011 "A" CAMSHAFT POSITION-TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

COMPONENT LOCATION EBAB259A



AFJF389B

GENERAL DESCRIPTION E8FB47EE

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION E6DD3E79

This diagnostic monitors the phasing response rate and determineswhether the response rate is fast enough. A state machine is used to capture the response rate. Themeasured results are then compared to an allowable threshold.
If "Counter of △ (original target ? actual angle) < 3 Deg" is over 10 times under enable conditions, ECM sets DTC P0011.

DTC DETECTING CONDITION EE8E7D64

Item	Detecting Condition	Possible Cause
DTC Strategy	• Slow response check	• Poor connection • Contamination of Oil / Clog of Oil path • OCV • CVVT • ECM
Enable Conditions	• Difference of target and actual angle > 10 Deg(2 sec and above) • Adaptation of alignment between camshaft and crankshaft finished • Time after engine start > 10~60s • Coolant temperature 60~110℃ • Engine oil temperature (model) 60~110℃ • Engine speed 1000~5000rpm	
Threshold Value	• l Counter of △ (original target - actual angle) 〈 3 Deg l 〉 10 times	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

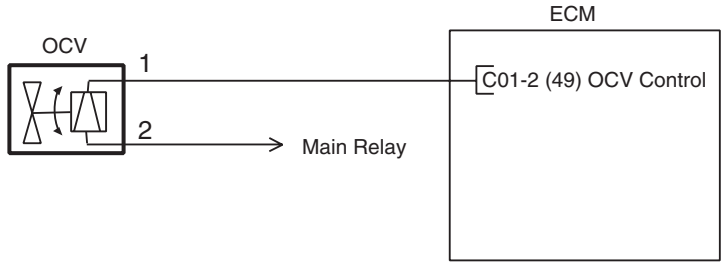
SPECIFICATION EC26958C

ITEM	SPECIFICATION
Coil Resistance (Ω)	7.4 ± 0.5Ω (20℃)

SCHEMATIC DIAGRAM EBBEF874

(A/T)

[CIRCUIT DIAGRAM]

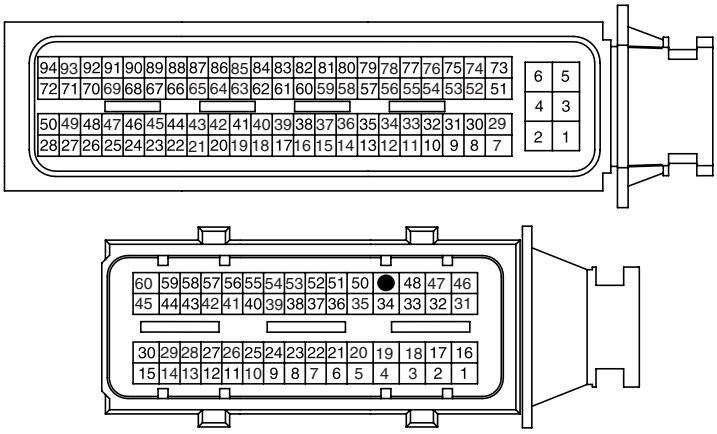


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-2 (49)	OCV Control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]

OCV (C08)

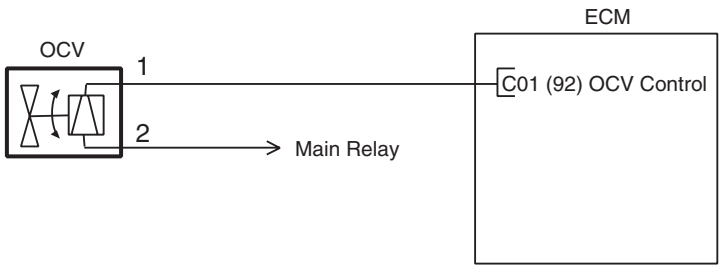


ECM

LFJF301A

(M/T)

[CIRCUIT DIAGRAM]

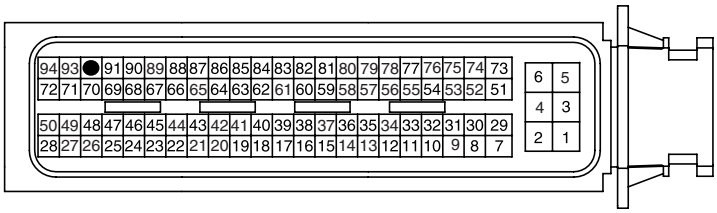


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (92)	OCV Control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]

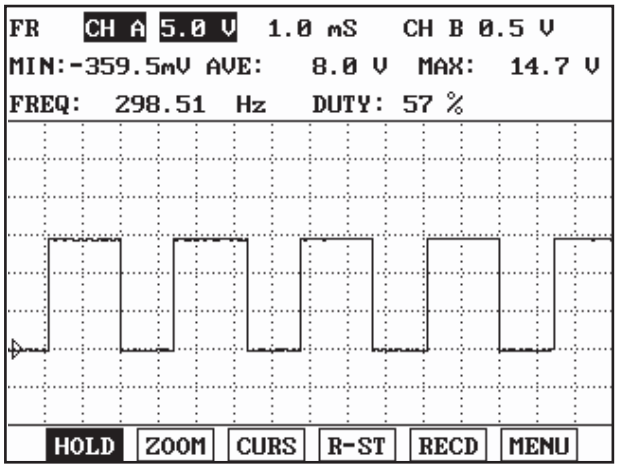
OCV (C08)



ECM (C01)

LFJF301B

SIGNAL WAVEFORM & DATA EC89B3AB

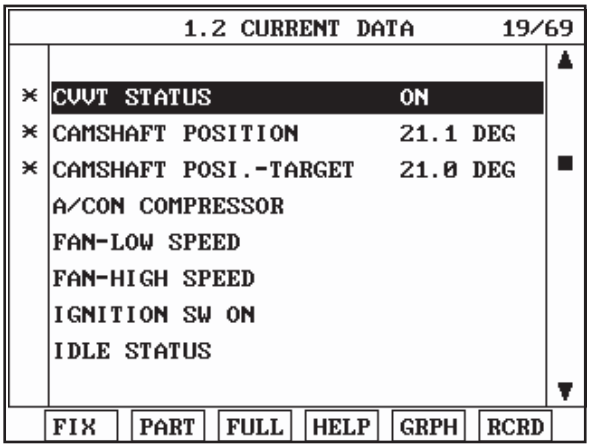


The ECM controls OCV by duty value.

LFJF302A

MONITOR SCANTOOL DATA ED2F2DB0

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "OCV" parameters on the scantool.



LFJF303A

4. Are the parameters displayed correctly ?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E6753DA5

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

YES

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

NO

▶ Go to "System inspection" procedure.

SYSTEM INSPECTION EB36BE45

1. Visual check.
   1) Check engine oil gauge.
   2) Check contamination of engine oil.
   3) Check contamination of OCV filter.
   4) Check clog of oil path.

5) Is there any problem?

YES

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

NO

▶ Go to "Component inspection" procedure.

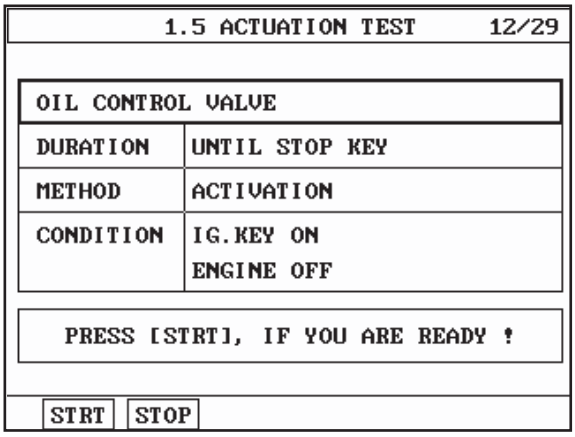
COMPONENT INSPECTION E1D22AC5

1. Check OCV

   1) Connect scantool to Data Link Connector(DLC).

   2) Key "ON".

   3) Perform "Actuation Test" for OCV.



LFJF304A

   4) Does the OCV work normally?

YES

▶ Substitute with a known-good CVVT and check for proper operation. If the problem is corrected, replace CVVT and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good OCV and check for proper operation. If the problem is corrected, replace OCV and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EAC9A7D7

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

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.

3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0012 "A" CAMSHAFT POSITION-TIMING OVER-RETARDED (BANK 1)

COMPONENT LOCATION E89B9849

Refer to DTC P0011.

GENERAL DESCRIPTION E43B63AD

Refer to DTC P0011.

DTC DESCRIPTION E87A47E6

If "Counter of △ (original target - actual angle) > 3 Deg" is over 10 times under enable conditions, ECM sets DTC P0012.

DTC DETECTING CONDITION E528A4F1

Item	Detecting Condition	Possible Cause
DTC Strategy	• Target error check	• Poor connection • Contamination of Oil / Clog of Oil path • OCV • CVVT • ECM
Enable Conditions	• Difference of target and actual angle > 10 Deg (2 sec and above) • Adaptation of alignment between camshaft and crankshaft finished • Time after engine start > 10~60s • Coolant temperature 60~110℃ • Engine oil temperature (model) 60~110℃ • Engine speed 1000~5000rpm	
Threshold Value	• l Counter of △ (original target - actual angle) > 3 Deg l > 10 times	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E0F0D09B

Refer to DTC P0011.

SCHEMATIC DIAGRAM E0182A0E

Refer to DTC P0011.

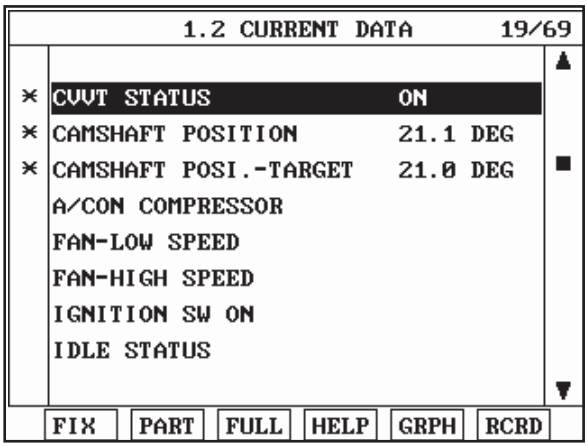
SIGNAL WAVEFORM & DATA E3895CB2

Refer to DTC P0011.

MONITOR SCANTOOL DATA E278A205

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.

3. Monitor the "OCV" parameters on the scantool.



LFJF306A

4. Are the parameters displayed correctly ?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E0305D79

Refer to DTC P0011.

SYSTEM INSPECTION ED014847

1. Visual check.

   1) Check engine oil gauge.

   2) Check contamination of engine oil.

   3) Check contamination of OCV filter.

   4) Check clog of oil path.

   5) Is there any problem?

   YES

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

   NO

   ▶ Go to "Component inspection" procedure.

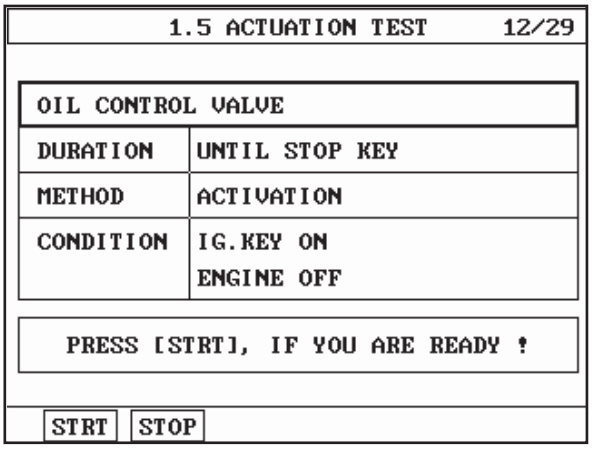
COMPONENT INSPECTION EA700CE8

1. Check OCV

   1) Connect scantool to Data Link Connector(DLC).

   2) Key "ON".

   3) Perform "Actuation Test" for OCV.



LFJF307A

   4) Does the OCV work normally?

YES

▶ Substitute with a known-good CVVT and check for proper operation. If the problem is corrected, replace CVVT and then go to "Verification of Vehicle Repair" procedure.

NO

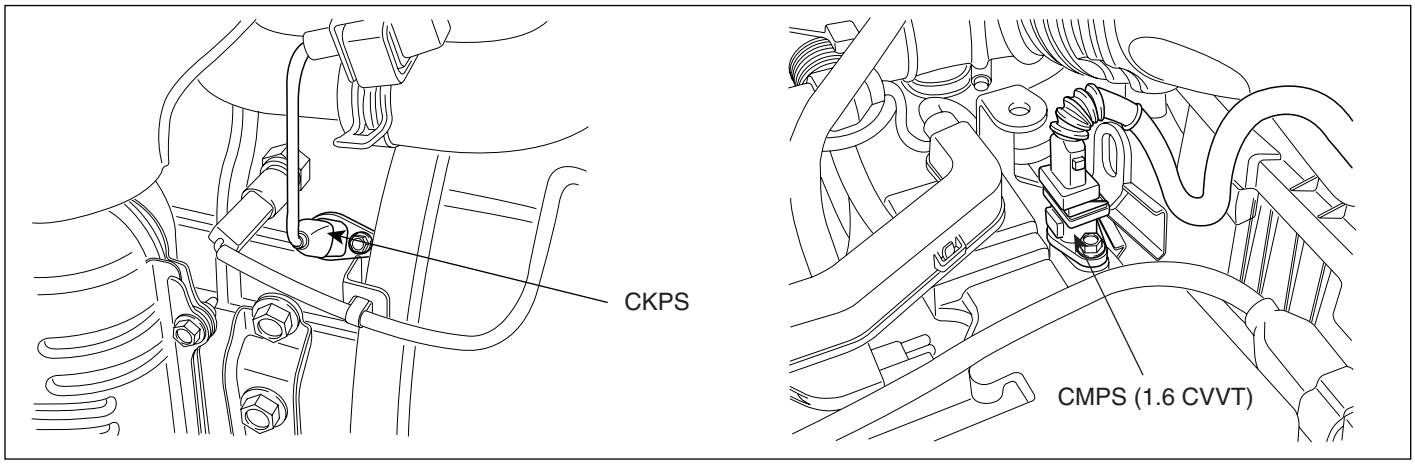
▶ Substitute with a known-good OCV and check for proper operation. If the problem is corrected, replace OCV and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA556036

Refer to DTC P0011.

DTC P0016 CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION (BANK 1 SENSOR A)

COMPONENT LOCATION E3EF5EBB



AFJF378C

GENERAL DESCRIPTION EE35C578

A Crankshaft Position Sensor (CKPS) is a magnetic type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft. The PCM calculates engine RPM by using the sensor' s signal and controls the injection duration and the ignition timing.
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 the each cylinder which the CKPS can' t detect. This CMPS signal is sent to the ECM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

DTC DESCRIPTION E6E43B58

If the deviation between CKPS and CMPS is bigger than the threshold value, ECM sets DTC P0016.

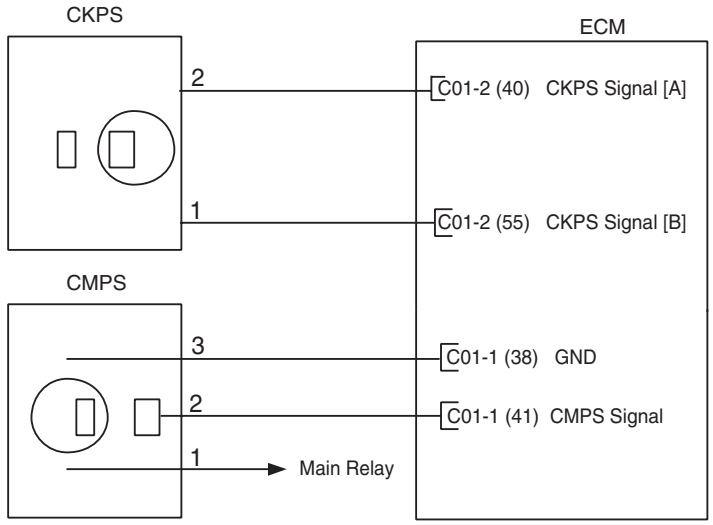
DTC DETECTING CONDITION E288EBA0

Item		Detecting Condition	Possible Cause
DTC Strategy		• Camshaft and crankshaft alignment check	• Poor connection • Contamination of Oil / Clog of Oil path • CKPS, CMPS • OCV • CVVT • ECM
Case1	Enable Conditions	• Adaptation of alignment between camshaft and crankshaft finished	
	Threshold Value	• Deviation of the camshaft position from the set point > 13 Deg	
	Diagnostic Time	• 2 sec	
Case2	Enable Conditions	• Difference of the adapted and actual value > 9 Deg	
	Threshold Value	• 2.6 sec	
MIL ON Condition		• 2 driving cycle	

SCHEMATIC DIAGRAM E885F737

(A/T)

[CIRCUIT DIAGRAM]

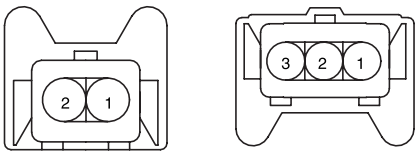


[CONNECTION INFORMATION]

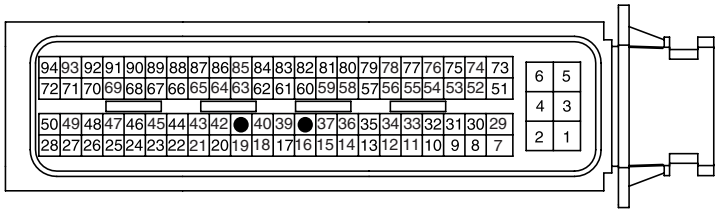
Terminal	Connected to	Function
1	ECM C01-2 (55)	CKPS Signal [B]
2	ECM C01-2 (40)	CKPS Signal [A]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (41)	CMPS Signal
3	ECM C01-1 (38)	Sensor Ground

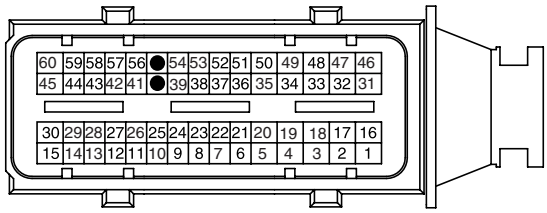
[HARNESS CONNECTOR]



CKPS (C06) CMPS (C05)



C01-1



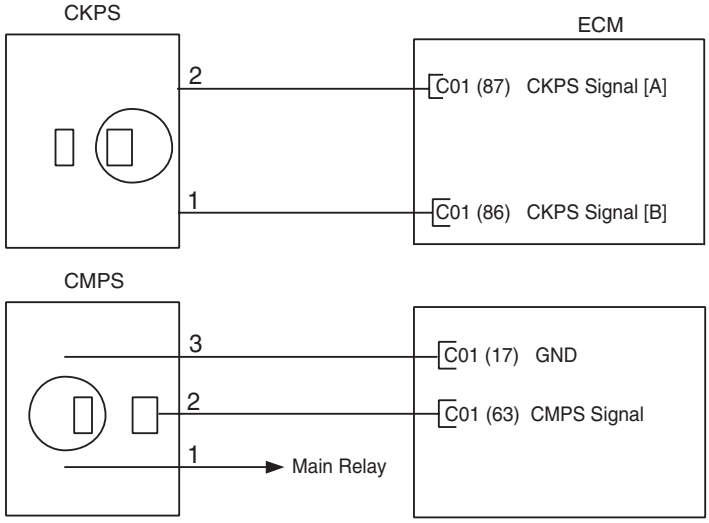
C01-2

ECM

LFJF309A

(M/T)

[CIRCUIT DIAGRAM]

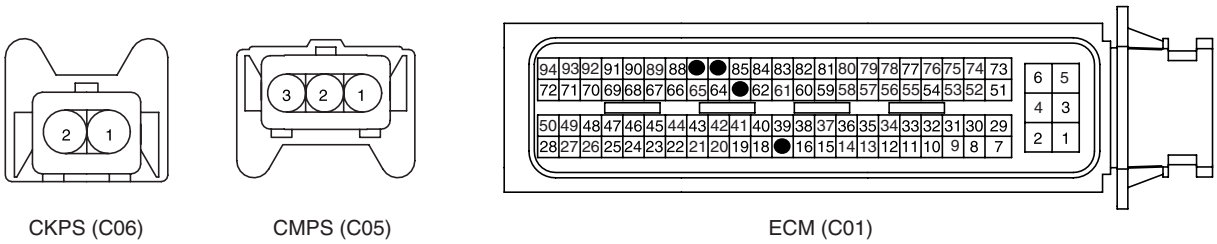


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (86)	CKPS Signal [B]
2	ECM C01 (87)	CKPS Signal [A]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (63)	CMPS Signal
3	ECM C01 (17)	Sensor Ground

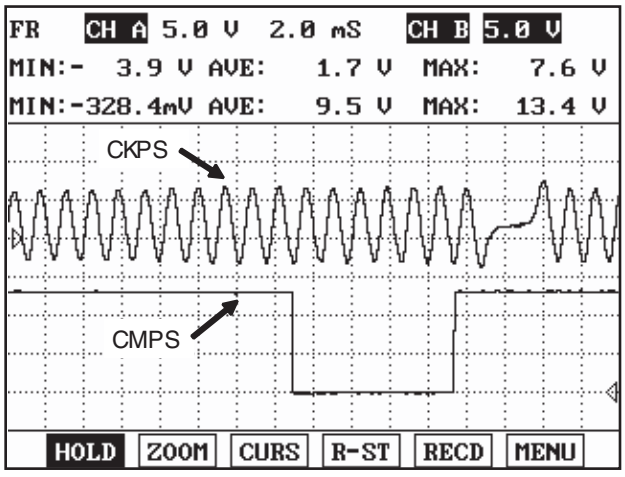
[HARNESS CONNECTOR]



CKPS (C06) CMPS (C05) ECM (C01)

LFJF309B

SIGNAL WAVEFORM & DATA E5C02DD0

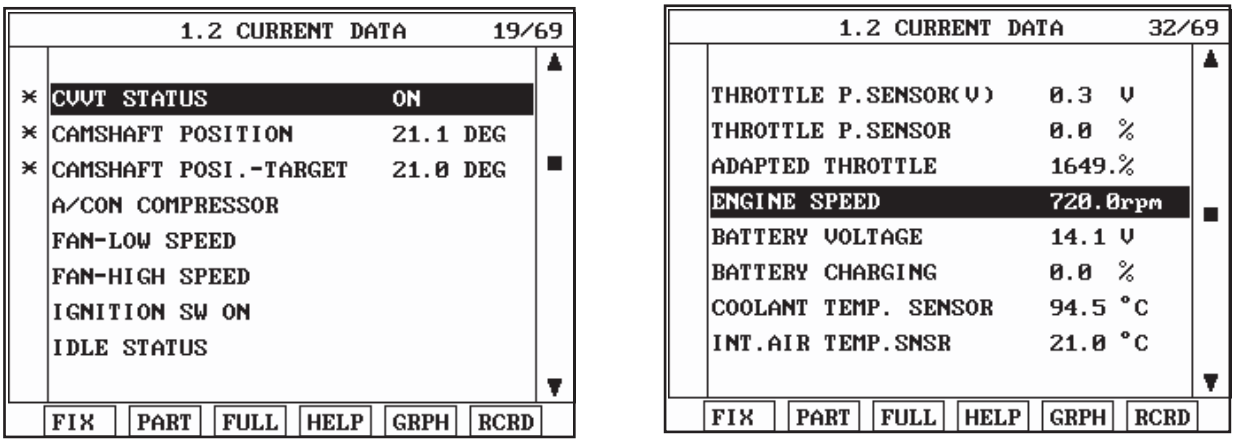


This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM co ntrols the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

LFJF310A

MONITOR SCANTOOL DATA E7F98DED

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "OCV and RPM" parameters on the scantool.



LFJF311A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E3C1AAB4

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

YES

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

NO

▶ Go to "CMPS circuit inspection" procedure.

CMPS CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect the CMPS connector.

3. Key "ON".

4. Measure the voltage between terminal 1, 2, 3 of CMPS harness connector and chassis ground.

Specification :
Terminal 1 B+
Terminal 2 Approx. 12V
Terminal 3 Approx. 0V

5. Is the measured voltage within specifications?

YES

▶ Go to "CKPS circuit inspection" procedure.

NO

▶ Repair Open or Short in CMPS circuit, and go to " Verification of Vehicle Repair" procedure.

CKPS CIRCUIT INSPECTION

1. Key "OFF".

2. Disconnect CKPS connector.

3. Key "ON".

4. Measure the voltage Between terminal 1, 2 of CKPS harness connector and chassis ground.

Specification : Approx. 2.5 V

5. Is the measured voltage within specifications?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Repair Open in CKPS circuit, and go to " Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION EBCE914A

1. Visual check.

   1) Check engine oil gauge.

   2) Check contamination of engine oil.

   3) Check contamination of OCV filter.

   4) Check clog of oil path.

   5) Is there any problem?

YES

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

NO

▶ Go to "Component inspection" procedure.

COMPONENT INSPECTION EB9186F3

1. Check CMPS, CKPS.

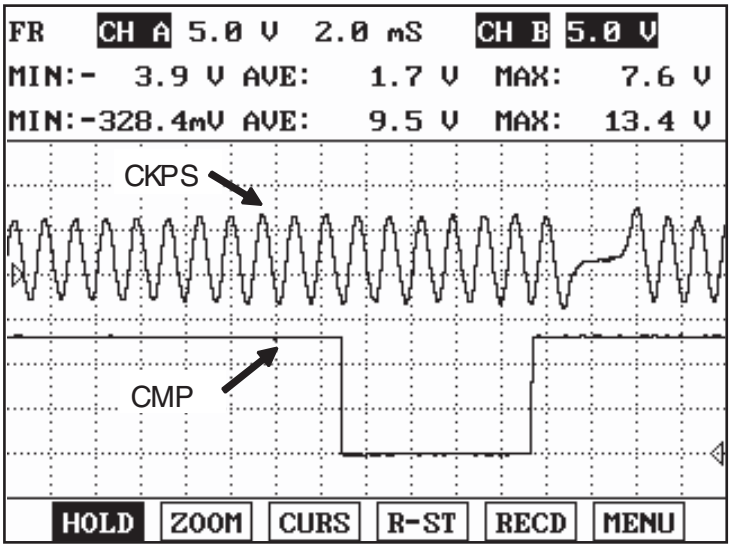
   1) Key "OFF". (Don't disconnect sensors.)

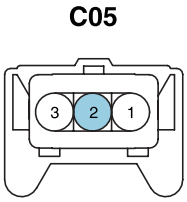
   2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 2 of CKPS harness connector.

   3) Connect Channel B of scantool with terminal 1 or 2 of CMPS harness connector.

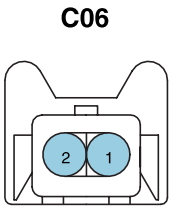
   4) Engine start. And check the signal waveforms.

SPECIFICATION :





1. Sensor power
2. **CMPS signal**
3. Sensor ground



1. CKPS signal
2. CKPS signal

LFJF314A

   5) Is the measured signal waveforms of CKPS/CMPS normal?

YES

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

NO

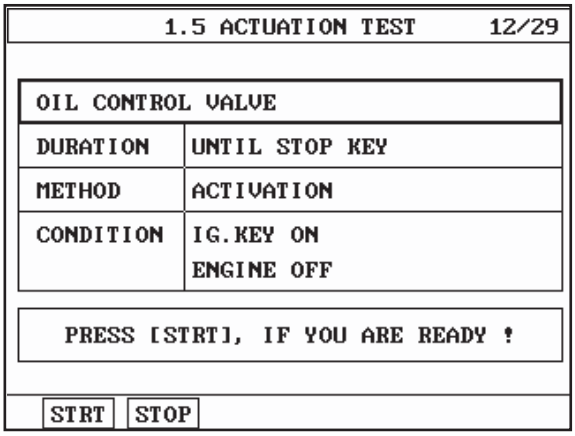
▶ Go to "OCV" procedure.

2. Check OCV.

   1) Connect scantool to Data Link Connector(DLC).

   2) Key "ON".

   3) Perform "Actuation Test" for OCV.



LFJF304A

4) Does the OCV work normally?

YES

▶ Go to "Check timing mark" procedure.

NO

▶ Substitute with a known-good OCV and check for proper operation. If the problem is corrected, replace OCV and then go to "Verification of Vehicle Repair" procedure.

3. Check timing mark.

1) Key "OFF".

2) Check timing mark.

NOTE

Refer to " TIMING SYSTEM" in " EM" group.

3) Is timing mark normal?

YES

▶ Substitute with a known-good CVVT and check for proper operation. If the problem is corrected, replace CVVT and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Reset timing mark, and go to " Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA43EA57

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

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

YES

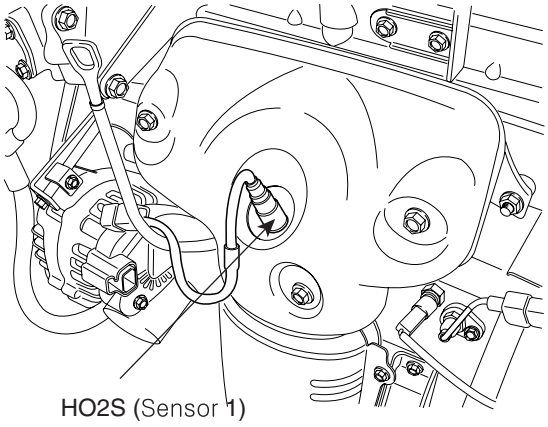
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0031 HO2S HEATER CIRCUIT LOW (BANK 1 / SENSOR 1)

COMPONENT LOCATION ECA4EB92



LFJF800A

GENERAL DESCRIPTION EE120217

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

DTC DESCRIPTION E20BBB87

When ECM detects open or short to ground in the heater control circuit(B1S1), ECM sets DTC P0031.

DTC DETECTING CONDITION E205281F

Item	Detecting Condition	Possible Cause
DTC Strategy	• Heater check low	• Poor connection • Open or short to ground in power circuit • Open or short to ground in control circuit • B1S1 • ECM
Enable Conditions		
Threshold Value	• Open or short to ground	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

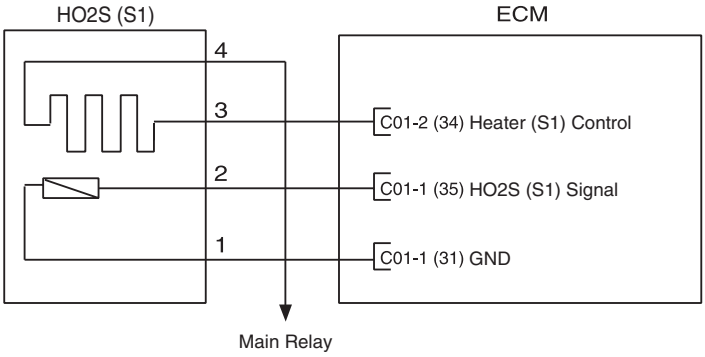
SPECIFICATION E632222B

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

SCHEMATIC DIAGRAM E9FA40A4

(A/T)

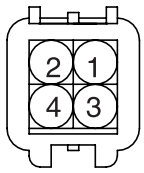
[CIRCUIT DIAGRAM]



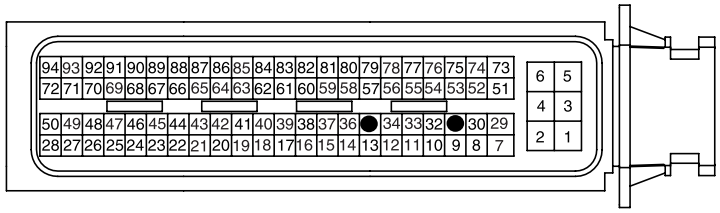
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-2 (31)	Sensor Ground
2	ECM C01-1 (35)	HO2S (S1) Signal
3	ECM C01-2 (34)	Heater (S1) Control
4	Main Relay	Battery Voltage (B+)

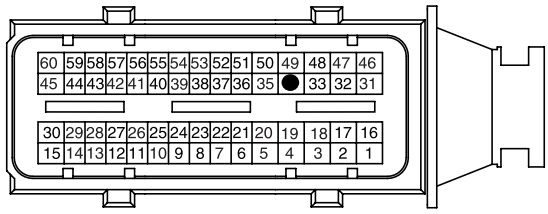
[HARNESS CONNECTOR]



HO2S [S1] (C18)



C01-1



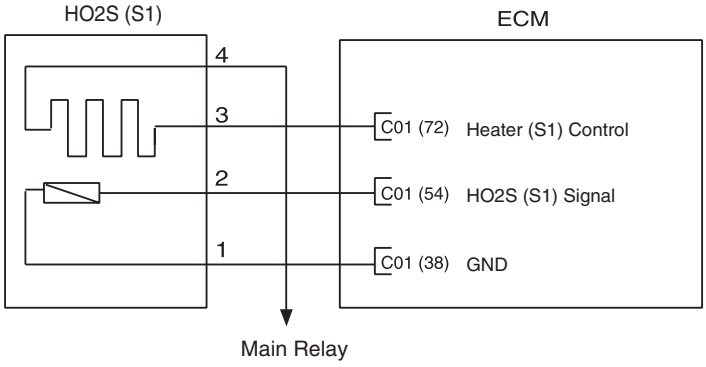
C01-2

ECM

LFJF317A

(M/T)

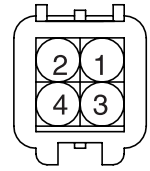
[CIRCUIT DIAGRAM]



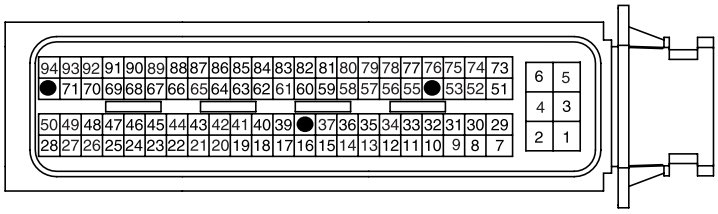
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (38)	Sensor Ground
2	ECM C01 (54)	HO2S (S1) Signal
3	ECM C01 (72)	Heater (S1) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



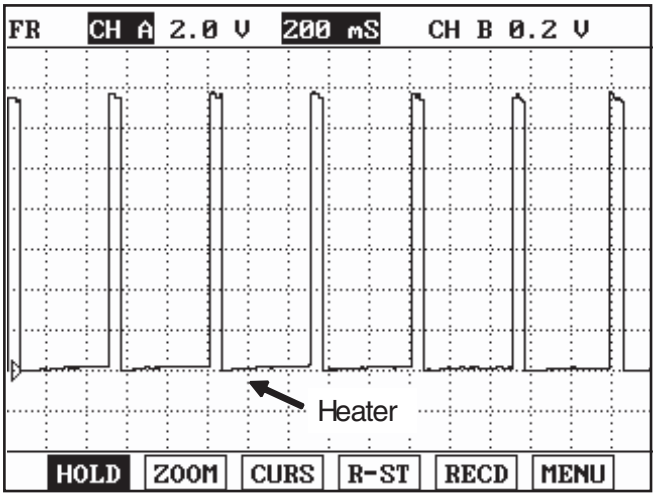
HO2S [S1] (C18)

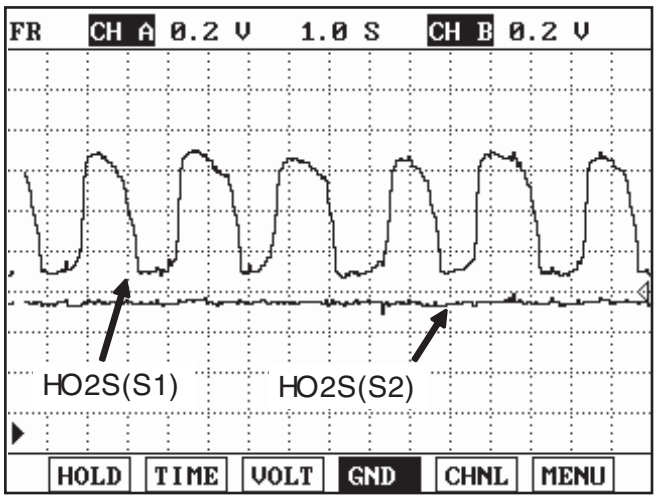


ECM (C01)

LFJF317B

SIGNAL WAVEFORM & DATA E43EDF76



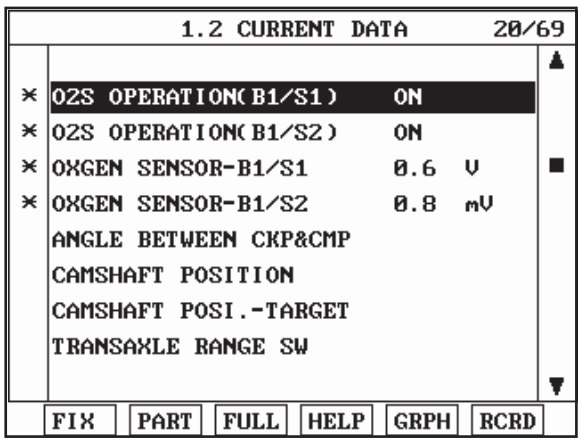


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

LFJF318A

MONITOR SCANTOOL DATA E9063275

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S1)" parameter on scantool.



LFJF319A

4. Is the "HO2S(B1S1)" parameter operating correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or ECM’s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EBDBBD75

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

YES

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

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E0238F60

1. IG "OFF".

2. Disconnect HO2S(S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S1) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION E9B92322

1. IG "OFF".
2. Disconnect HO2S(S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S1) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION EB537DFF

1. Check resistance.
   1) IG "OFF".
   2) Disconnect HO2S(S1) connector.
   3) Measure resistance between terminal 3 and 4 of HO2S(S1)(Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

   4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good HO2S(S1) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E480DC93

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

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

YES

- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P0032 HO2S HEATER CIRCUIT HIGH (BANK 1 / SENSOR 1)

COMPONENT LOCATION ED706B86

Refer to DTC P0031.

GENERAL DESCRIPTION E8DD7AEF

Refer to DTC P0031.

DTC DESCRIPTION E4DD0F8E

When ECM detects short to power in the heater control circuit(B1S1), ECM sets DTC P0032.

DTC DETECTING CONDITION E1683926

Item	Detecting Condition	Possible Cause
DTC Strategy	• Heater check high	• Poor connection • Short to battery in control circuit • B1S1 • ECM
Enable Conditions		
Threshold Value	• Short to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E81376A6

Refer to DTC P0031.

SCHEMATIC DIAGRAM E97AF2A8

Refer to DTC P0031.

SIGNAL WAVEFORM & DATA E44ED5E1

Refer to DTC P0031.

MONITOR SCANTOOL DATA EE4FAD7B

Refer to DTC P0031.

TERMINAL AND CONNECTOR INSPECTION E71D8B1F

Refer to DTC P0031.

POWER CIRCUIT INSPECTION ECA21F45

1. IG "OFF".
2. Disconnect HO2S(S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S1) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION E4F30608

1. IG "OFF".
2. Disconnect HO2S(S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S1) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E78331A2

1. Check resistance.
   1) IG "OFF".
   2) Disconnect HO2S(S1) connector.
   3) Measure resistance between terminal 3 and 4 of HO2S(S1)(Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

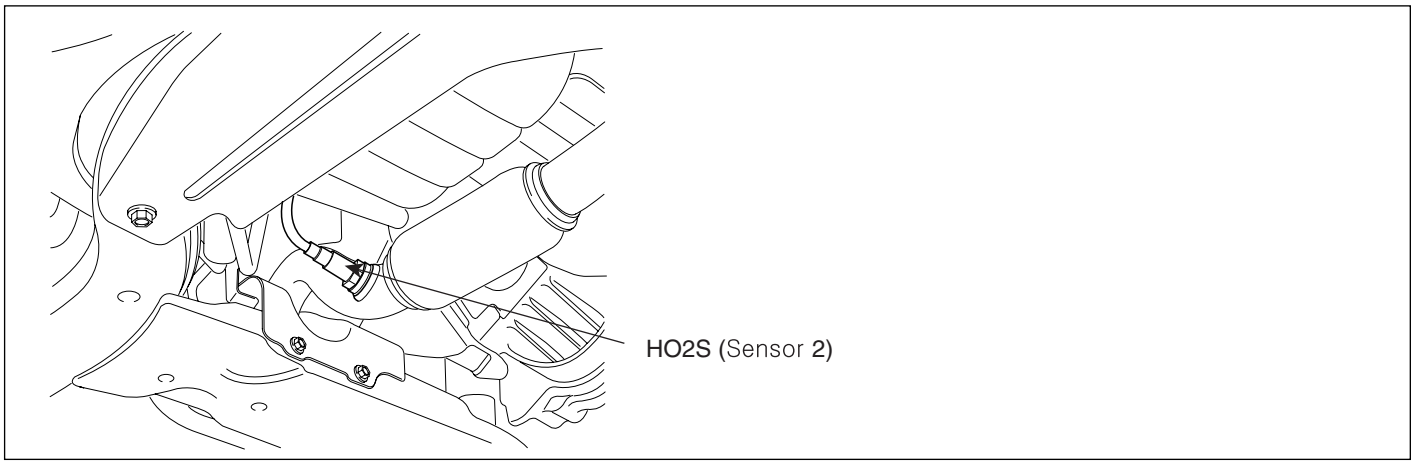
- ▶ Substitute with a known - good HO2S(S1) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4A6963B

Refer to DTC P0031.

DTC P0036 HO2S HEATER CONTROL CIRCUIT (BANK 1 / SENSOR 2)

COMPONENT LOCATION EE4DB3F4



LFJF800B

GENERAL DESCRIPTION E10BF41F

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

DTC DESCRIPTION E97769B7

When ECM detects the open in the heater control circuit(B1S2), ECM sets DTC P0036.

DTC DETECTING CONDITION E330CA94

Item	Detecting Condition	Possible Cause
DTC Strategy	• Heater check open	• Poor connection • Open in control circuit • H1S2 • ECM
Enable Conditions		
Threshold Value	• Open in control circuit	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

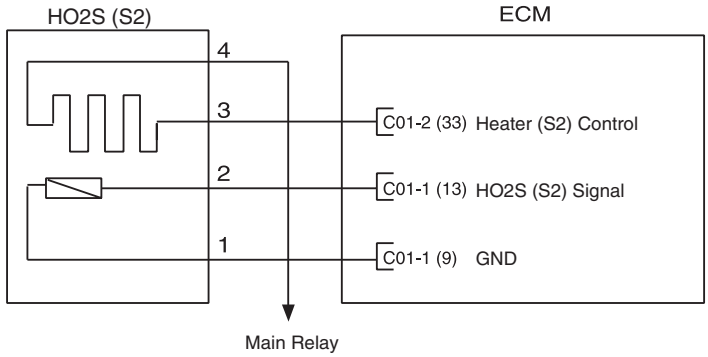
SPECIFICATION EA45D22F

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

SCHEMATIC DIAGRAM EF837609

(A/T)

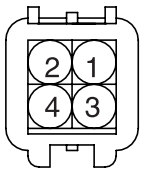
[CIRCUIT DIAGRAM]



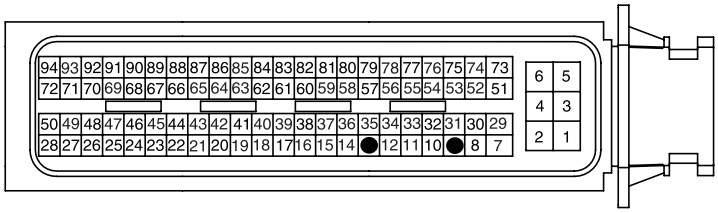
[CONNECTION INFORMATION]

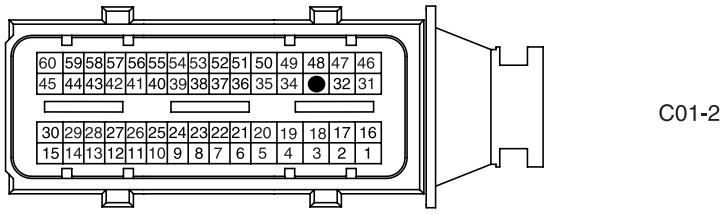
Terminal	Connected to	Function
1	ECM C01-1 (9)	Sensor Ground
2	ECM C01-1 (13)	HO2S (S2) Signal
3	ECM C01-2 (33)	Heater (S2) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



HO2S [S2] (C17)



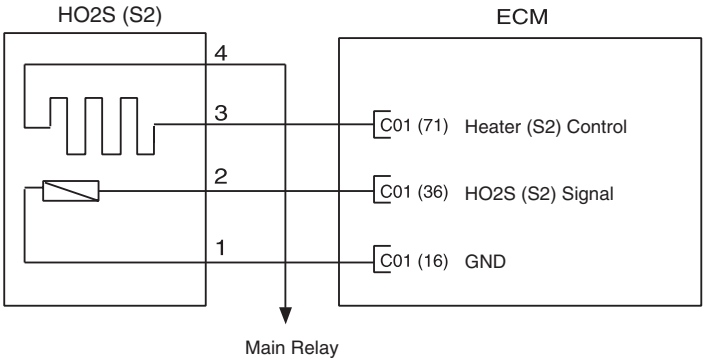


ECM

LFJF324A

(M/T)

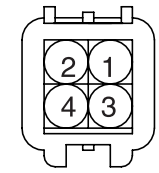
[CIRCUIT DIAGRAM]



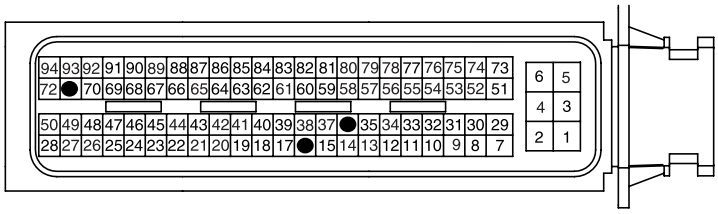
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (16)	Sensor Ground
2	ECM C01 (36)	HO2S (S2) Signal
3	ECM C01 (71)	Heater (S2) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



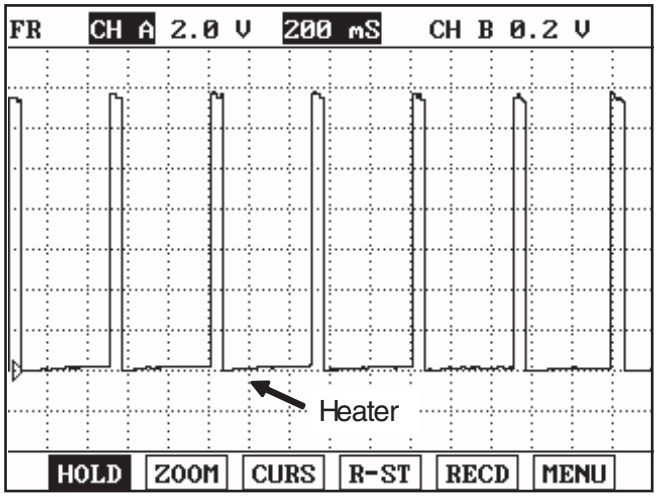
HO2S [S2] (C17)

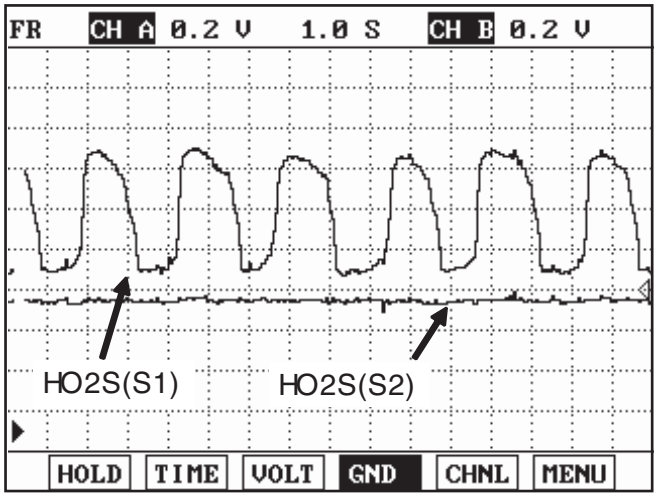


ECM (C01)

LFJF324B

SIGNAL WAVEFORM & DATA E73AE826



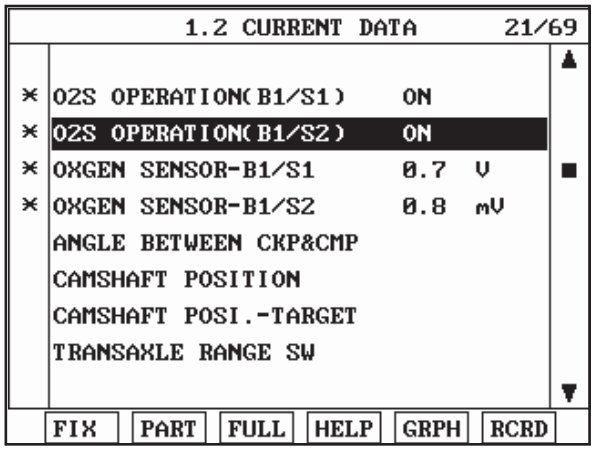


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

LFJF318A

MONITOR SCANTOOL DATA EAE23F4B

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S2)" parameter on scantool.



LFJF319B

4. Is the "HO2S Heater(B1/S2)" data displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E15123F6

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

YES

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

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EF4A0FB0

1. IG "OFF".

2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S2) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION E3E921DB

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S2) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E3DF0499

1. Check resistance.
   1) IG "OFF".
   2) Disconnect HO2S(S2) connector.
   3) Measure resistance between terminal 3 and 4 of HO2S(S2) (Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

   4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good HO2S(S2) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC7151F9

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

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

YES

- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P0037 HO2S HEATER CIRCUIT LOW (BANK 1 / SENSOR 2)

COMPONENT LOCATION E5C1F1D0

Refer to DTC P0036.

GENERAL DESCRIPTION EA1C1EAD

Refer to DTC P0036.

DTC DESCRIPTION E71148DE

When ECM detects short to ground in the heater control circuit(B1S2), ECM sets DTC P0037.

DTC DETECTING CONDITION E8B7BBED

Item	Detecting Condition	Possible Cause
DTC Strategy	• Heater check low	• Poor connection • Open or short to ground in power circuit • Short to ground in control circuit • B1S2 • ECM
Enable Conditions		
Threshold Value	• Short to ground	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E8B7A016

Refer to DTC P0036.

SCHEMATIC DIAGRAM E8D3960B

Refer to DTC P0036.

SIGNAL WAVEFORM & DATA EE665692

Refer to DTC P0036.

MONITOR SCANTOOL DATA EA5B4C36

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E84D291B

Refer to DTC P0036.

POWER CIRCUIT INSPECTION EA764D4D

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S2) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION E2B7D752

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S2) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E8E73A91

1. Check resistance (S2).
   1) IG "OFF".
   2) Disconnect HO2S(S2) connector.
   3) Measure resistance between terminal 3 and 4 of HO2S(S2) (Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good HO2S(S2) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED49BE4E

Refer to DTC P0036.

DTC P0038 HO2S HEATER CIRCUIT HIGH (BANK 1 / SENSOR 2)

COMPONENT LOCATION E6BAE525

Refer to DTC P0036.

GENERAL DESCRIPTION EAE3EF4E

Refer to DTC P0036.

DTC DESCRIPTION E5C53BA5

When ECM detects short to power in the heater control circuit, ECM sets DTC P0038.

DTC DETECTING CONDITION E7A3E92F

Item	Detecting Condition	Possible Cause
DTC Strategy	• Heater check high	• Poor connection • Short to power in control circuit • B1S2 • ECM
Enable Conditions		
Threshold Value	• Short to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E7ED9677

Refer to DTC P0036.

SCHEMATIC DIAGRAM E2969A8C

Refer to DTC P0036.

SIGNAL WAVEFORM & DATA E8B67A97

Refer to DTC P0036.

MONITOR SCANTOOL DATA ECF104ED

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E74AED97

Refer to DTC P0036.

POWER CIRCUIT INSPECTION E6324B37

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S2) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION E49F58FC

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S2) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E771FAAF

1. Check resistance (S2).
   1) IG "OFF".
   2) Disconnect HO2S(S2) connector.
   3) Measure resistance between terminal 3 and 4 of HO2S(S2) (Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

4) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

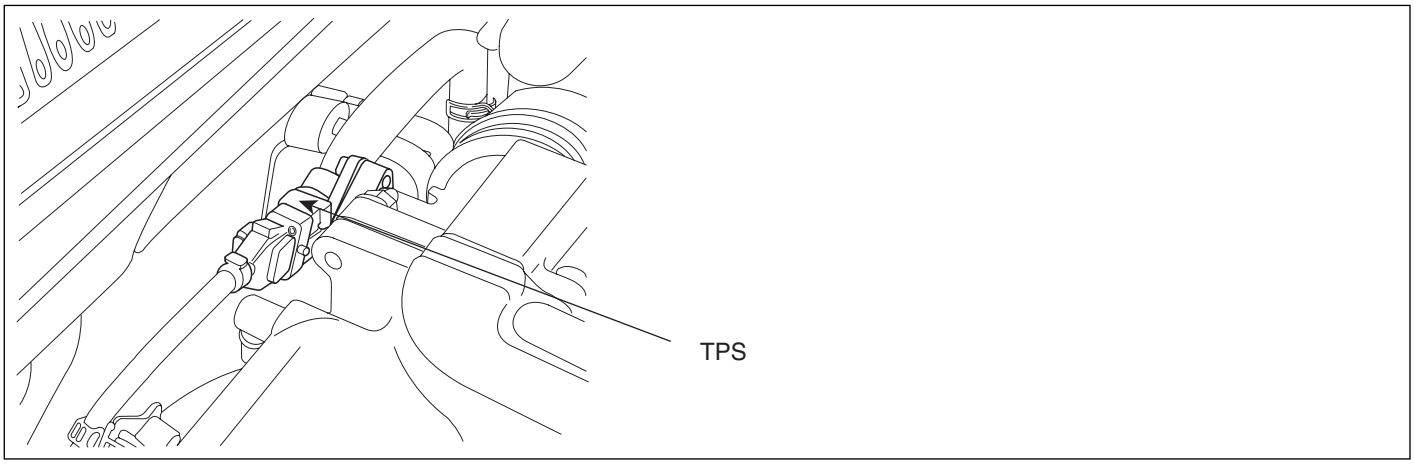
▶ Substitute with a known - good HO2S(S2) and check for proper operation.
▶ If the problem is corrected, replace HO2S(S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E44C9059

Refer to DTC P0036.

DTC P0068 MAFS/MAPS-TPS CORRELATION

COMPONENT LOCATION E373BF5C



AFJF375B

GENERAL DESCRIPTION ED578B1D

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) whose characteristic is the resistance changing 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 ECM supplies a reference 5V to the TPS and the output voltage increases directly with the opening of the throttle valve. The TPS output voltage will vary from 0.2~0.8V at closed throttle to 4.3~4.8V at wide-open throttle.
The ECM determines operating conditions such as idle (closed throttle), part load, acceleration/deceleration, and wide-open throttle from the TPS. Also The ECM uses the Mass Air Flow Sensor (MAFS) or Manifold Absolute Pressure Sensor (MAPS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC DESCRIPTION EEE9C7B5

If the sensor input value of TPS is lower or higher than the threshold value which is depending on MAF(MAP) more 300sec, PCM sets DTC P0068.

DTC DETECTING CONDITION E806A8E1

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check (Correlation of actual and secondary load)	• Poor connection • TPS • MAFS(MAPS) • ECM
Enable Conditions	• Correction factor for secondary load 〉 1.2 or Correction factor for secondary load 〈 0.8	
Threshold Value	• Time for secondary load adaptation 〉 300s	
Diagnostic Time	• 1sec	
MIL ON Condition	• 2 driving cycle	

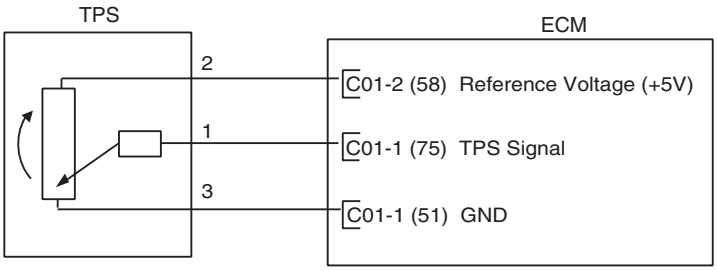
SPECIFICATION E706795A

ITEM	Specification
TPS Resistance(kΩ)	2kΩ ± 20% (20℃)

SCHEMATIC DIAGRAM E4DEAB27

(A/T)

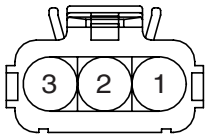
[CIRCUIT DIAGRAM]



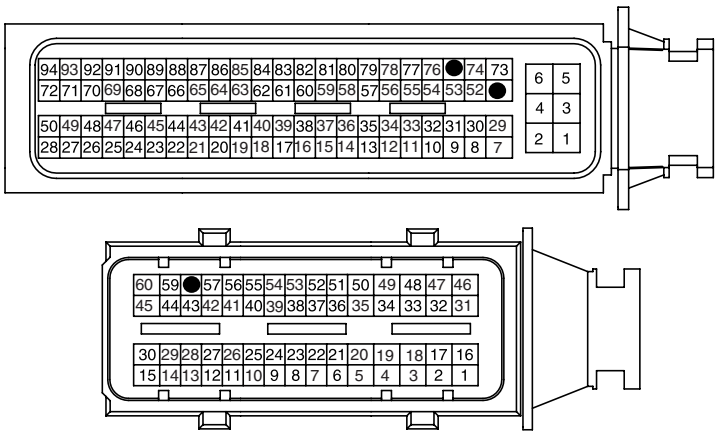
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (75)	TPS Signal
2	ECM C01-2 (58)	Reference Voltage (+5V)
3	ECM C01-1 (51)	Sensor Ground

[HARNESS CONNECTORS]



TPS (C23)

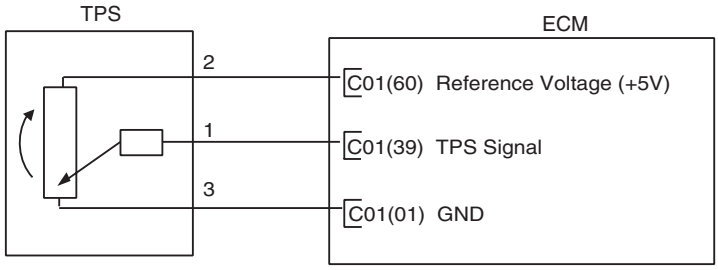


ECM

LFJF397A

(M/T)

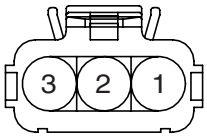
[CIRCUIT DIAGRAM]



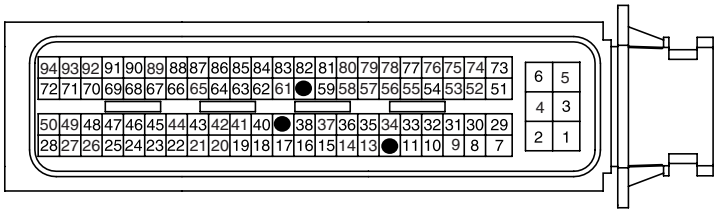
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (39)	TPS Signal
2	ECM C01 (60)	Reference Voltage (+5V)
3	ECM C01 (12)	Sensor Ground

[HARNESS CONNECTORS]



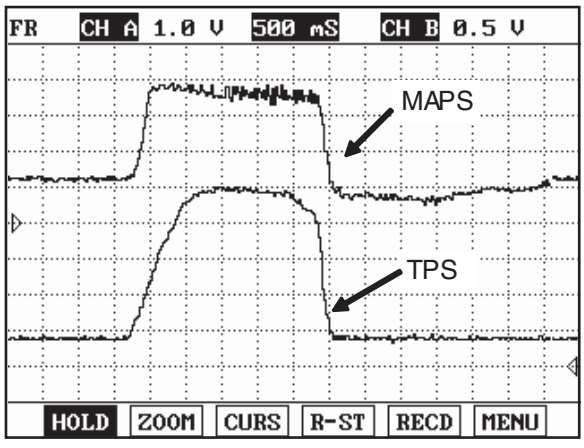
TPS (C23)

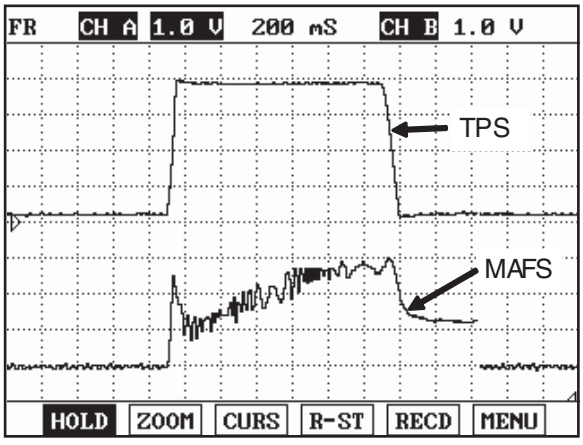


ECM (C01)

LFJF331B

SIGNAL WAVEFORM & DATA ECDC7DDD

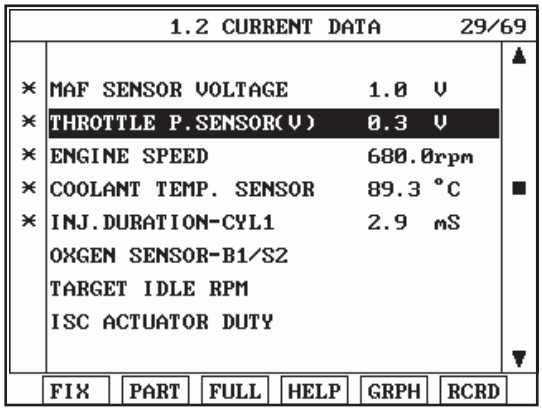


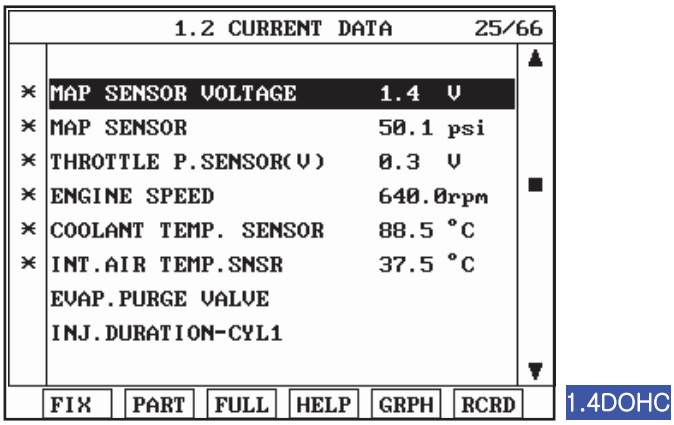


LFJF332A

MONITOR SCANTOOL DATA E61634F8

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "TPS and MAFS(MAPS)" parameters on the scantool.





LFJF333A

4. Is parameter displayed within specifications?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EFCB80C6

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

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

NO

▶ Go to "Component inspection" procedure.

COMPONENT INSPECTION E2DD3CBE

1. Check TPS.

   1) Ignition "OFF".

   2) Disconnect TPS connector.

   3) Measure resistance terminal 2 and 3 of TP sensor connector(Component side).

SPECIFICATION :

ITEM	Specification
TPS Resistance(kΩ)	2kΩ ± 20% (20℃)

4) Is the measured resistance within specifications?

YES

▶ Go to "Check ECM" as below.

NO

▶ Check TPS for contamination, deterioration, or damage. Substitute with a known-good TPS and check for proper operation. If the problem is corrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

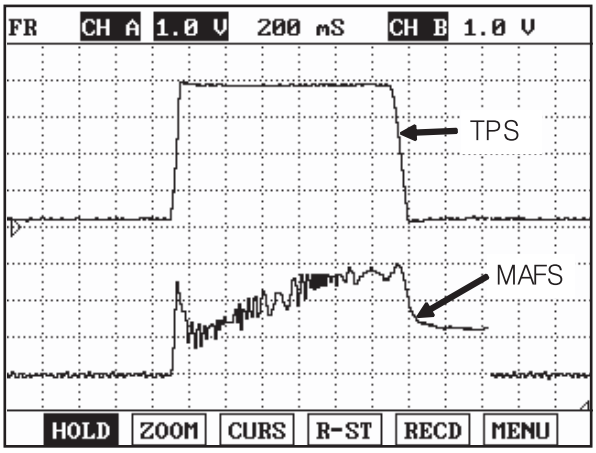
2. Check ECM.

1) Key "OFF". (Don't disconnect sensors.)

2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 1 of TPS harness connector.

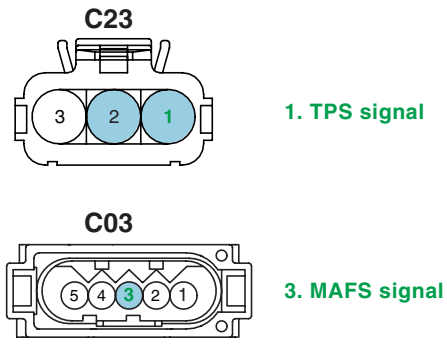
3) Connect channel B of scantool with terminal 3(1) of MAFS(MAPS) harness connector.

4) Engine start. And check the signal waveforms with stepping on accelerator pedal.

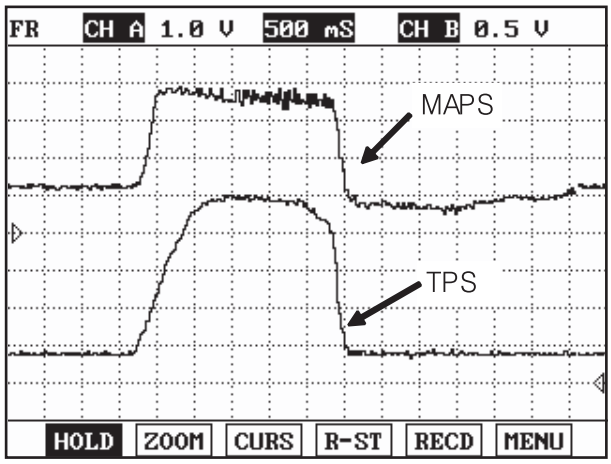


1.6CVVT

<B-15>

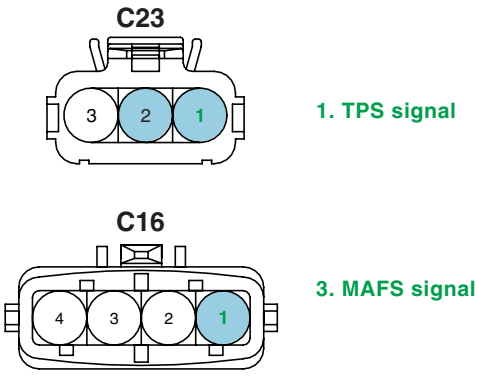


LFJF335A



1.4DOHC

<B-15>



1. TPS signal

3. MAFS signal

LFJF336A

5) Is the signal waveform within specifications?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute the sensor which outputs abnormal waveform with a known-good sensor and check for proper operation. If the problem is corrected, replace the sensor and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EEFABCA6

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

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

YES

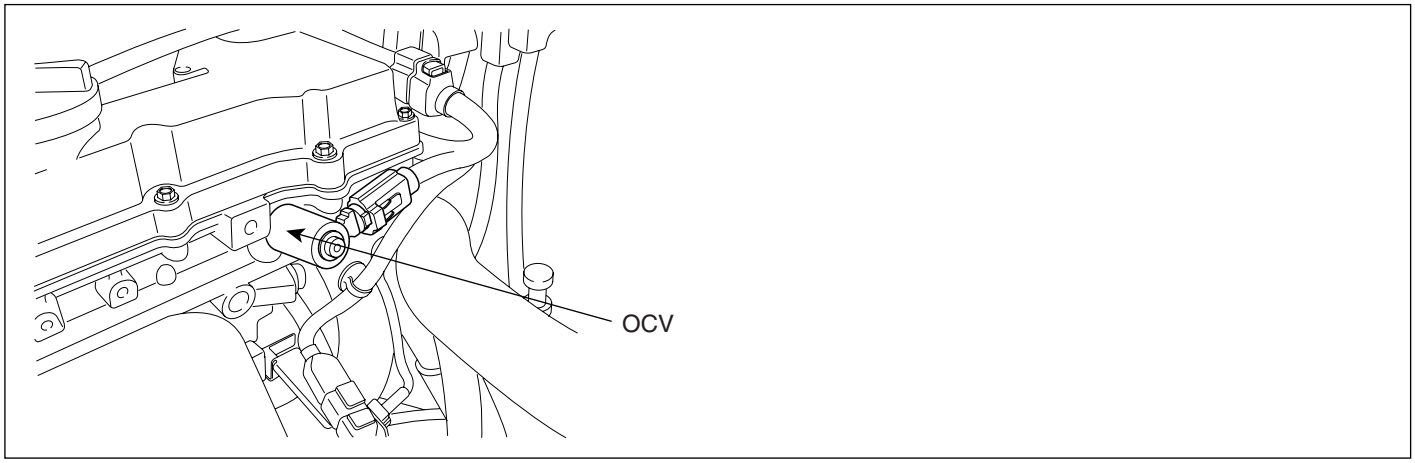
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0075 INTAKE VALVE CONTROL SOLENOID CIRCUIT (BANK1)

COMPONENT LOCATION E7A89FDB



AFJF389B

GENERAL DESCRIPTION EE81D3DC

Different from the existing fixed cam phase angle type, CVVT(Continuously Variable Valve Timing) is the device which varies cam phase angle continuously to be optimum. And with engine oil pressure, it operates. CVVT consists of OCV(Oil Control Valve) and cam phaser. OCV, mounted on cylinder head, controlls the amount and direction of oil delivered to cam phaser by oil valve which is connected to a solenoid. Cam phaser, rotating cam phaser rotor with pressure and amount of oil produced by OCV, rotates cam shaft forcefully for or against the rotating direction and finally, cam shaft phase changes. With the appliance of CVVT, engine power,fuel efficiency and the quality of exhause gas are improved.

DTC DESCRIPTION E56A3BAD

When ECM detects open in the OCV control circuit, ECM sets DTC P0075.

DTC DETECTING CONDITION EA973AD5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, open	• Poor connection • Open in power circuit • Open in control circuit • OCV • ECM
Enable Conditions		
Threshold Value	• Disconnected	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

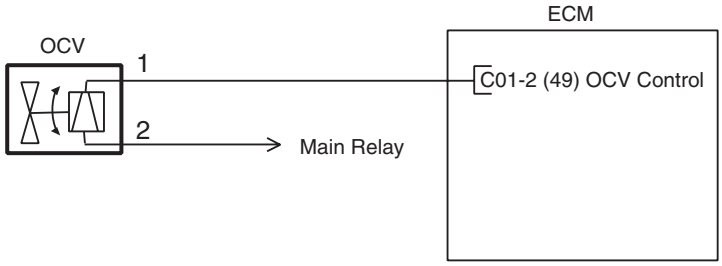
SPECIFICATION ED20C00F

Temp.	Coil Resistance
20℃	7.4 ± 0.5Ω

SCHEMATIC DIAGRAM E6F99F05

(A/T)

[CIRCUIT DIAGRAM]

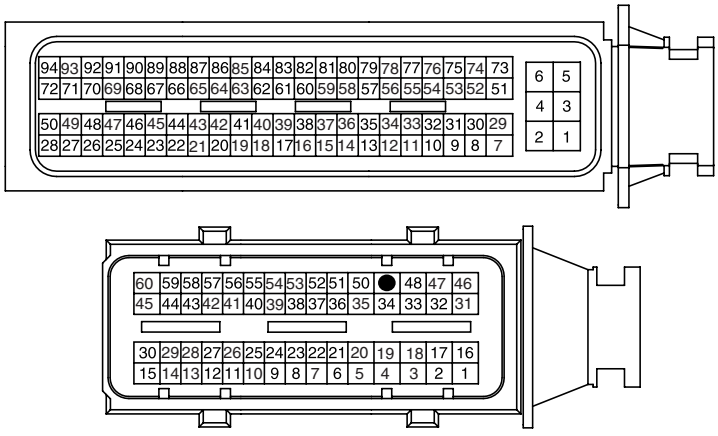


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-2 (49)	OCV Control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]

OCV (C08)

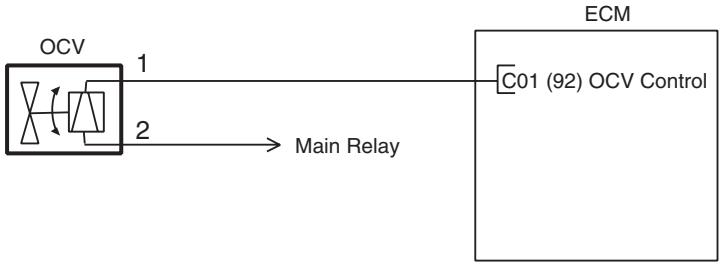


ECM

LFJF301A

(M/T)

[CIRCUIT DIAGRAM]

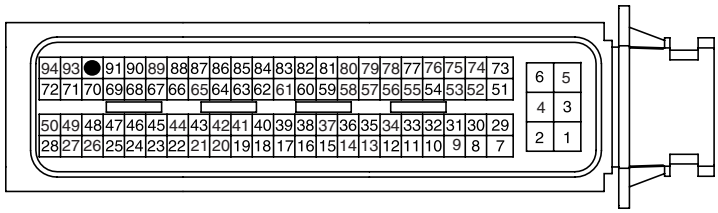


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (92)	OCV Control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]

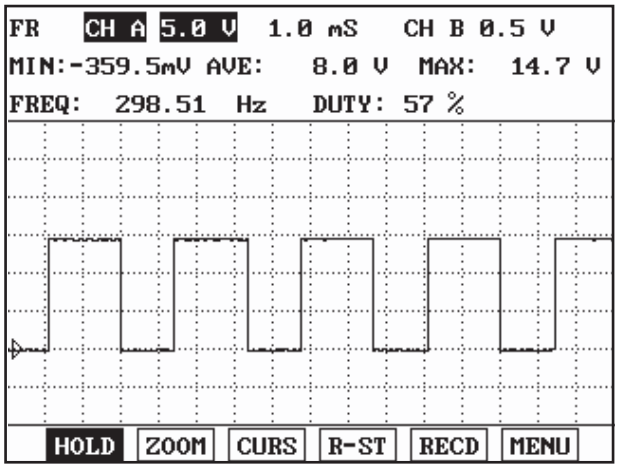
OCV (C08)



ECM (C01)

LFJF301B

SIGNAL WAVEFORM & DATA E8C086BF

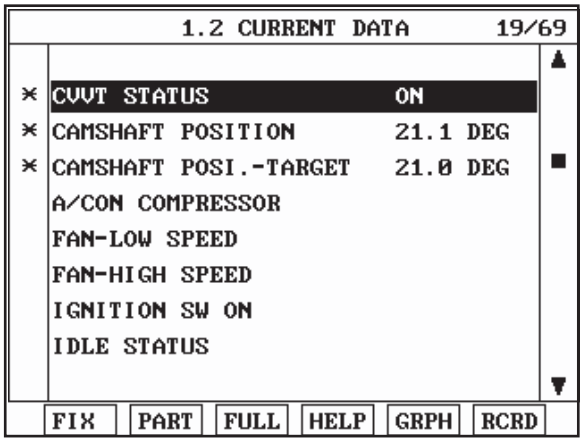


The ECM controls OCV by duty value.

LFJF302A

MONITOR SCANTOOL DATA E0BD2071

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "OCV" parameter on scantool.



LFJF337A

4. Is the "OCV" data displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E8B727F5

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

YES

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

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E0F17352

1. IG "OFF".
2. Disconnect OCV connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of OCV harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E5518BDD

1. IG "OFF".
2. Disconnect OCV connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 1 of OCV harness connector and chassis ground.

Specification : Approx. 3.2V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE38C5AB

1. Check OCV.
   1) IG "OFF"
   2) Disconnect OCV connector.
   3) Measure resitance between terminal 1 and 2 of OCV connector.(Component Side)

SPECIFICATION :

Temp.	Coil Resistance
20℃	7.4 ± 0.5Ω

   4) Is the measured resistance within specification ?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good OCV and check for proper operation.
▶ If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3D6A0D2

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

COMPONENT LOCATION EB23F1D5

Refer to DTC P0075.

GENERAL DESCRIPTION E96F4F1E

Refer to DTC P0075.

DTC DESCRIPTION E5502BD1

When PCM detects short to ground in OCV control circuit, ECM sets DTC P0076.

DTC DETECTING CONDITION EEC3CEB5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low	• Poor connection • Short to ground in control circuit • Short to ground in power circuit • OCV • ECM
Enable Conditions		
Threshold Value	• Short circuit to ground	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E306FB3C

Refer to DTC P0075.

SCHEMATIC DIAGRAM E781C974

Refer to DTC P0075.

SIGNAL WAVEFORM & DATA EA57807C

Refer to DTC P0075.

MONITOR SCANTOOL DATA EE25AC73

Refer to DTC P0075.

TERMINAL AND CONNECTOR INSPECTION E823BDEC

Refer to DTC P0075.

POWER CIRCUIT INSPECTION ED72309B

1. IG "OFF".

2. Disconnect OCV connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of OCV harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E922DD40

1. IG "OFF".
2. Disconnect OCV connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of OCV harness connector and chassis ground.

Specification : Approx. 3.2V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2BABA37

1. Check OCV.
   1) IG "OFF"
   2) Disconnect OCV connector.
   3) Measure resitance between terminal 1 and 2 of OCV connector.(Component Side)

SPECIFICATION :

Temp.	Coil Resistance
20℃	7.4 ± 0.5Ω

   4) Is the measured resistance within specification ?

YES

- Substitute with a known - good ECM and check for proper operation.
- If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good OCV and check for proper operation.
- If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E074B723

Refer to DTC P0075.

DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

COMPONENT LOCATION E4F8E3DA

Refer to DTC P0075.

GENERAL DESCRIPTION EB8E086D

Refer to DTC P0075.

DTC DESCRIPTION ED11101A

When ECM detects short to power in OCV control circuit, ECM sets DTC P0077.

DTC DETECTING CONDITION EBA3259B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high	• Poor connection • Short to battery in control circuit • OCV • ECM
Enable Conditions		
Threshold Value	• Short circuit to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION EA660DA8

Refer to DTC P0075.

SCHEMATIC DIAGRAM E8802FF7

Refer to DTC P0075.

SIGNAL WAVEFORM & DATA E5173708

Refer to DTC P0075.

MONITOR SCANTOOL DATA E7AC7EE2

Refer to DTC P0075.

TERMINAL AND CONNECTOR INSPECTION E038E6F8

Refer to DTC P0075.

CONTROL CIRCUIT INSPECTION EF777CE5

1. Check short to ground.

1) IG "OFF".

2) Disconnect OCV connector.

3) IG "ON" & ENG "OFF".

4) Measure voltage between terminal 1 of OCV harness connector and chassis ground.

Specification : Approx. 3.2V

5) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to 'Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E14C089F

1. Check OCV.

1) IG "OFF"

2) Disconnect OCV connector.

3) Measure resistance between terminal 1 and 2 of OCV harness connector.(Component Side)

SPECIFICATION :

Temp.	Coil Resistance
20℃	7.4 ± 0.5Ω

4) Is the measured resistance within specification ?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

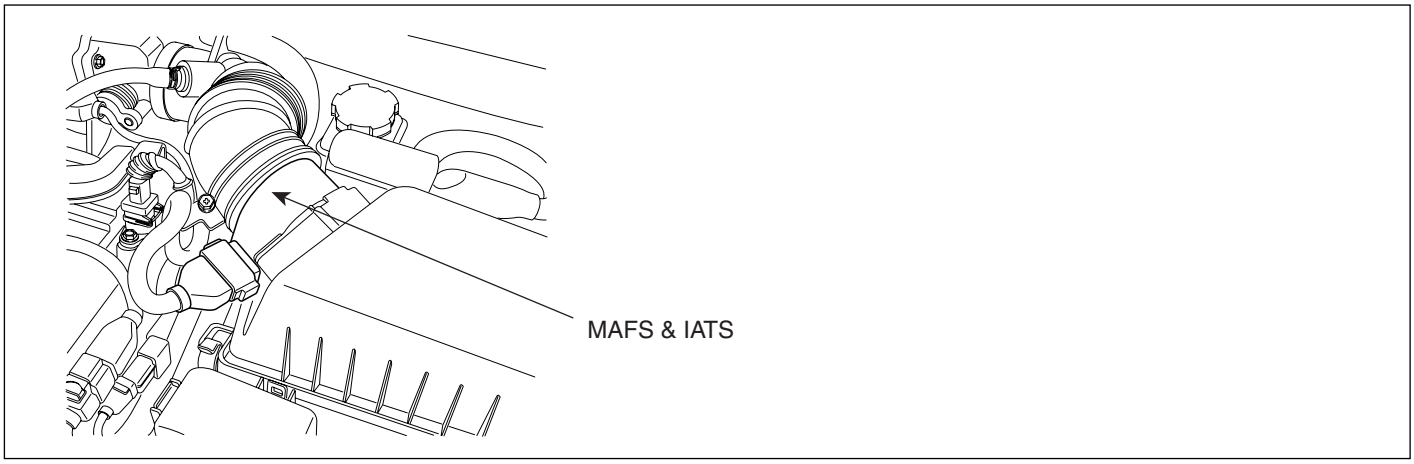
▶ Substitute with a known - good OCV and check for proper operation.
▶ If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECE384CF

Refer to DTC P0075.

DTC P0100 MASS OR VOLUME AIR FLOW CIRCUIT MALFUNCTION

COMPONENT LOCATION E681ABAA



AFJF388B

GENERAL DESCRIPTION EA78F55B

MAF Sensor is an air mass flowmeter, which operates on the principle of hot film anemometry. A heated element is placed within the air stream, and maintained at a constant temperature above the air temperature. The amount of electrical power required to maintain the heated element at the proper temperature is a direct function of the flow rate of the air mass past the element. ECM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION E2A6FB82

If intake air mass is less than the minimum threshold value according to RPM and TPS during 3 sec under normal TPS signal input condition, ECM sets P0100.

DTC DETECTING CONDITION E6BAB735

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • Open or short to ground in control circuit • Open or short to ground in power circuit • Open in ground circuit • leak or clog in intake air system • MAFS • ECM
Enable Conditions	• No TPS error detected • Crankshaft revolution 〉 150	
Threshold Value	• Air mass 〈 Minimum Threshold f (Eng. speed, TPS)	
Diagnostic Time	• 3 sec	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E062D5C4

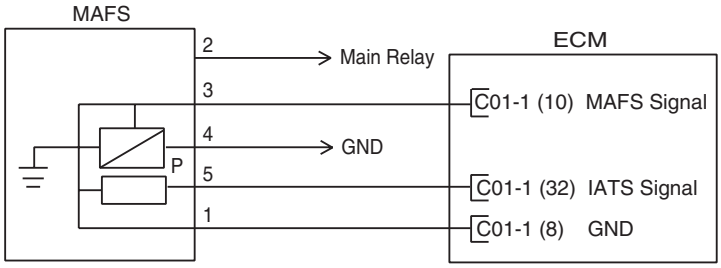
Q[kg/h]	HFM+(V)
4.935	0.703
7.328	0.895
12.221	1.175

Q[kg/h]	HFM+(V)
20.802	1.512
28.256	1.732
38.852	1.972
64.689	2.395
113.264	2.896
185.308	3.346
256.019	3.643
404.596	4.073
476.747	4.253
603.25	4.555

SCHEMATIC DIAGRAM EDBB183F

(A/T)

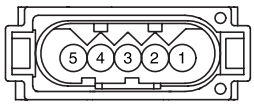
[CIRCUIT DIAGRAM]



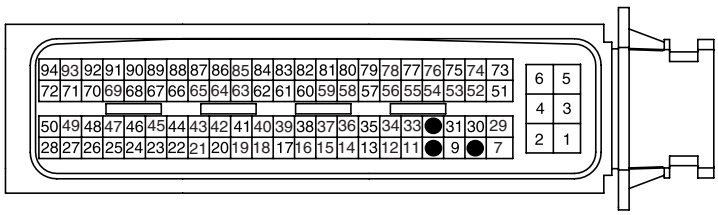
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C 01-1 (8)	Sensor Ground
2	Main Relay	Battery Voltage (B+)
3	ECM C01-1 (10)	MAFS Signal
4	Chassis Ground	Ground
5	ECM C01-1 (32)	IATS Signal

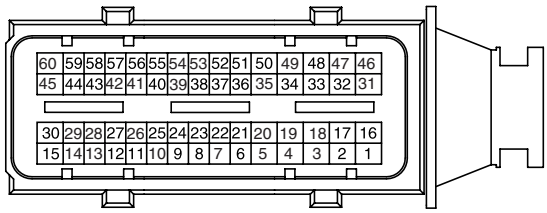
[HARNESS CONNECTOR]



MAFS & IATS (C03)



C01-1



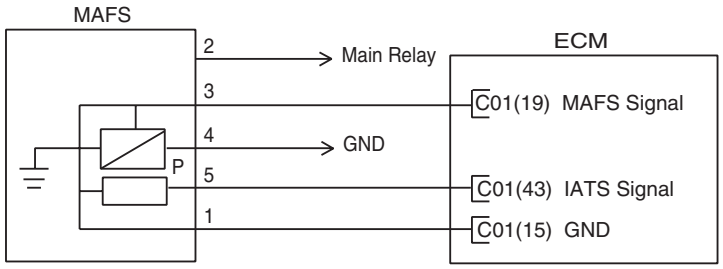
C01-2

ECM

LFJF342A

(M/T)

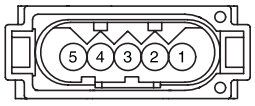
[CIRCUIT DIAGRAM]



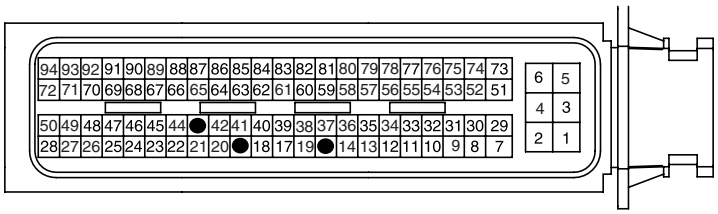
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01(15)	Sensor Ground
2	Main Relay	Battery Voltage (B+)
3	ECM C01(19)	MAFS Signal
4	Chassis Ground	Ground
5	ECM C01(43)	IATS Signal

[HARNESS CONNECTOR]



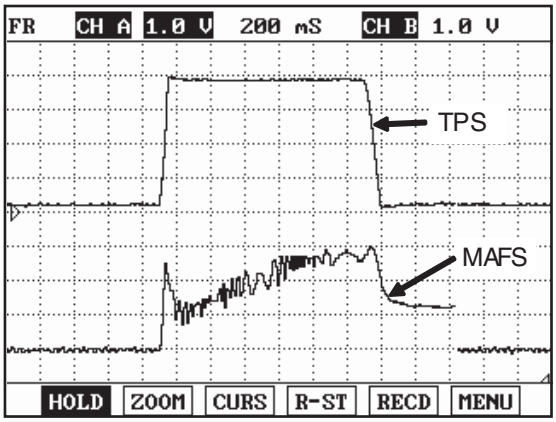
MAFS & IATS (C03)



ECM (C01)

LFJF342B

SIGNAL WAVEFORM & DATA E9C30DCF

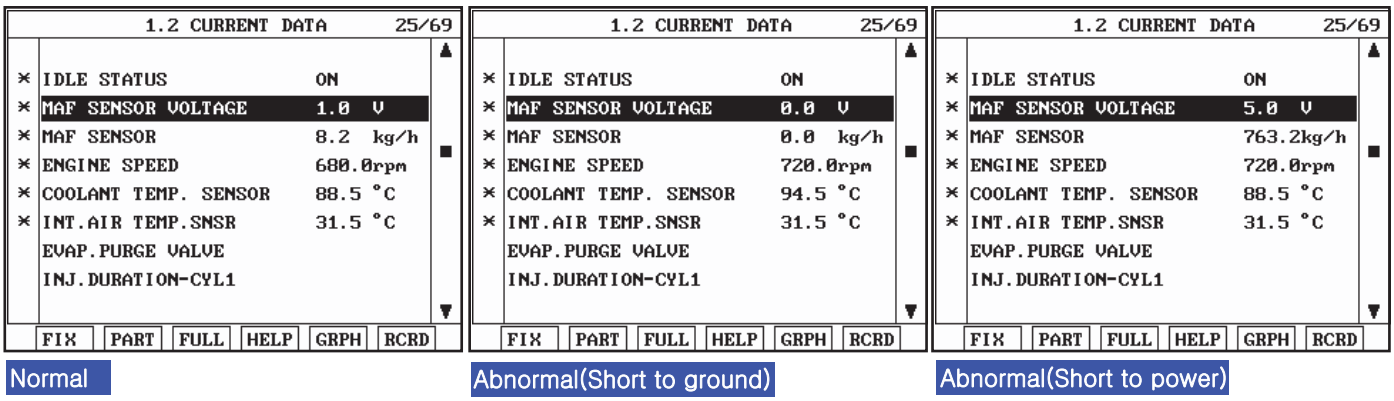


As often as possible, the MAFS signal should be compared with the TPS signal. Check whether the MAFS and TPS signals increase at the same time when accelerating. During acceleration, the MAFS output voltage increases; during deceleration, the MAFS output voltage decreases.

LFJF343A

MONITOR SCANTOOL DATA E8BED13F

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "MAFS" parameter on scantool.



LFJF344A

4. Is the "MAFS" parameter displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E3D0CF88

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

YES

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

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EEA5C45F

1. IG "OFF".
2. Disconnect MAFS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of MAFS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION EC454777

1. Check open in ground harness.
   1) IG "OFF".
   2) Disconnect MAFS connector.
   3) IG "ON" & ENG "OFF"
   4) Measure voltage between terminal 2 of MAFS harness connector and chassis ground.(A)
   5) Measure voltage between terminal 2 and 4 of MAFS harness connector.(B)

Specification : "A" - "B" = Approx. below 200mV

   6) Is the measured voltage within specification?

YES

▶ Go to "Check open in sensor ground" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in sensor ground harness.
   1) IG "OFF".
   2) Disconnect MAFS connector.
   3) IG "ON" & ENG "OFF"
   4) Measure voltage between terminal 2 of MAFS harness connector and chassis ground.(A)
   5) Measure voltage between terminal 1 and 2 of MAFS harness connector.(B)

Specification : A - B = Approx. below 200mV

   6) Is the measured voltage within specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EA2C5388

1. Check open in harness.
   1) IG "OFF".
   2) Disconnect MAFS and ECM connector.
   3) Measure resistance between terminal 3 of MAFS harness connector and terminal 19/C01(M/T) or 10/C01-1(A/T) of ECM harness connector.

Specification : Below 1Ω

   4) Is the measured resistance within specification?

YES

▶ Go to "Check short to battery in harness" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Short to battery in harness.
   1) IG "OFF"
   2) Disconnect MAFS and ECM connector.
   3) Measure resistance between terminal 2 and 3 of MAFS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Repair or repalce as necessary and then, go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION E09FFA76

1. Check air cleaner.
   1) Check that air cleaner is contaminated or clogged by foreign materials.
   2) Is the air cleaner normal?

YES

▶ Go to "Check air leakage" as follows.

NO

▶ Repair or replace air cleaner and then, go to "Verification of Vehicle Repair" procedure.

2. Check air leakage.

1) Check as follows.
▶ Check any damage or installation of throttle body gasket.
▶ Check any damage or installation between intake manifold and MAFS
▶ ISCA stuck

2) Has a problem been found?

YES

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION ED229C06

1. Check MAFS performance.

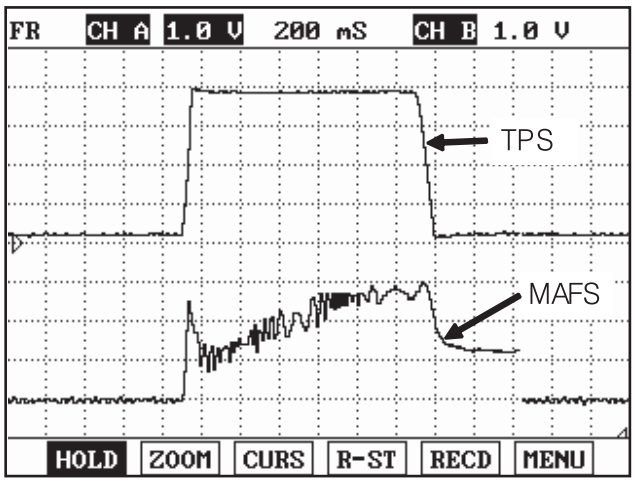
1) IG "OFF".

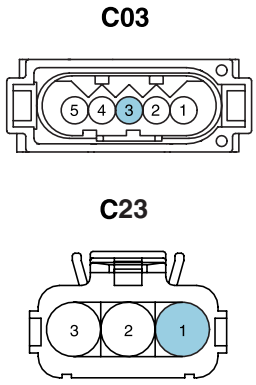
2) Connnect CHA probe to terminal 3 of MAFS and CHB probe to terminal 1 of TPS connector.

3) Warm up the engine to normal operating temperature.

4) Measure signal waveform of MAFS and TPS together by stepping on and off the accellerator padel.

SPECIFICATION :





3. MAFS Signal

1. TPS Signal

LFJF350A

5) Is the measured signal waveform(Comparison response of TPS with MAFS) O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good MAFS and check for proper operation.
▶ If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

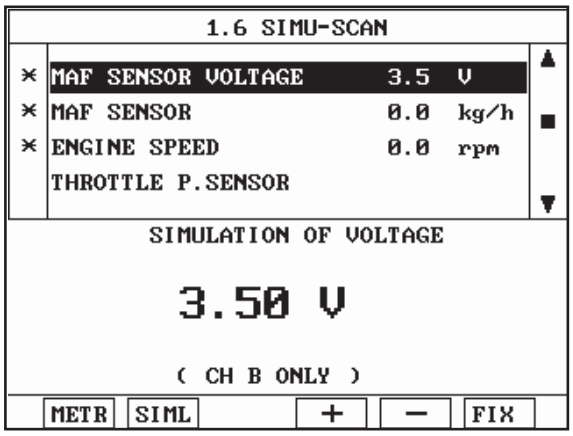
2. Check ECM.

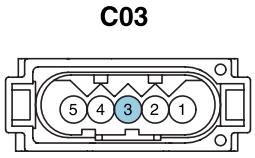
1) IG "OFF" and disconnect MAFS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 3 of MAFS signal connector.





1. Sensor Ground
2. Sensor Power
3. MAFS Signal
4. Ground
5. IATS Signal

LFJF351A

5) Does the signal value of MAFS change according to simulation voltage?

YES

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

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5713F36

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

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.

3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION ECD3FE56

Refer to DTC P0100.

GENERAL DESCRIPTION E5DCA7FC

Refer to DTC P0100.

DTC DESCRIPTION EDA25482

If intake air mass is more than the maximum threshold value according to RPM and TPS during 3 sec under normal TPS signal input condition, ECM sets P0101.

DTC DETECTING CONDITION E2FB4343

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • Short to power in control circuit • Air leakage • MAFS • ECM
Enable Conditions	• No TPS error detected • Crankshaft revolution 〉 150	
Threshold Value	• Air mass 〈 Minimum Threshold f (Eng. speed, TPS)	
Diagnostic Time	• 3 sec	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E65D985D

Refer to DTC P0100.

SCHEMATIC DIAGRAM E6063C7E

Refer to DTC P0100.

SIGNAL WAVEFORM & DATA E748C452

Refer to DTC P0100.

MONITOR SCANTOOL DATA E8567A78

Refer to DTC P0100.

TERMINAL AND CONNECTOR INSPECTION EF2BC5C3

Refer to DTC P0100.

POWER CIRCUIT INSPECTION E5B5707C

1. IG "OFF".
2. Disconnect MAFS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of MAFS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION E90221C2

1. Check open in ground harness.
   1) IG "OFF".
   2) Disconnect MAFS connector.
   3) IG "ON" & ENG "OFF"
   4) Measure voltage between terminal 2 of MAFS harness connector and chassis ground.(A)
   5) Measure voltage between terminal 2 and 4 of MAFS harness connector.(B)

Specification : "A" - "B" = Approx. below 200mV

   6) Is the measured voltage within specification?

YES

▶ Go to "Check open in sensor ground" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in sensor ground harness.
   1) IG "OFF".
   2) Disconnect MAFS connector.
   3) IG "ON" & ENG "OFF"
   4) Measure voltage between terminal 2 of MAFS harness connector and chassis ground.(A)
   5) Measure voltage between terminal 1 and 2 of MAFS harness connector.(B)

Specification : A - B = Approx. below 200mV

6) Is the measured voltage within specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E56DBE07

1. Check short to battery in harness.

1) IG "OFF".

2) Disconnect MAFS and ECM connector.

3) Measure resistance between terminal 2 and 3 of MAFS harness connector.

Specification : Infinite

4) Is the measured resistance within specification?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Repair or repalce as necessary and then, go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION E13932C2

1. Check air cleaner.

1) Check that air cleaner is contaminated or clogged by foreign materials.

2) Is the air cleaner normal?

YES

▶ Go to "Check air leakage" as follows.

NO

▶ Repair or replace air cleaner and then, go to "Verification of Vehicle Repair" procedure.

2. Check air leakage.

1) Check as follows.
▶ Check any damage or installation of throttle body gasket.
▶ Check any damage or installation between intake manifold and MAFS
▶ ISCA stuck

2) Has a problem been found?

YES

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E6D00DD8

1. Check MAFS performance.

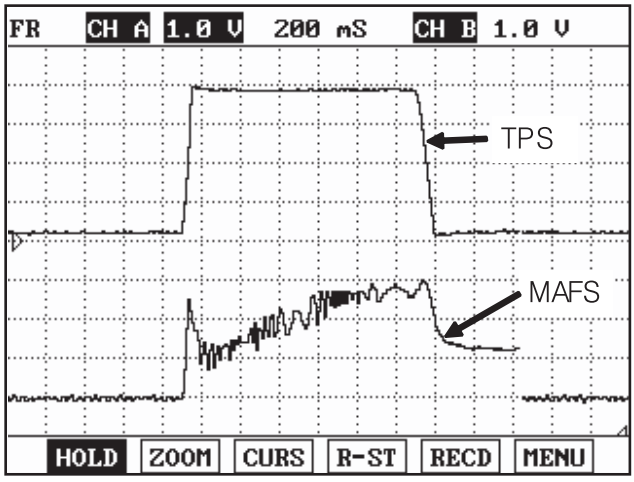
1) IG "OFF".

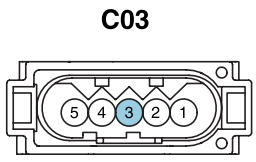
2) Connnect CHA probe to terminal 3 of MAFS and CHB probe to terminal 1 of TPS connector.

3) Warm up the engine to normal operating temperature.

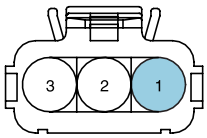
4) Measure signal waveform of MAFS and TPS together by stepping on and off the accellerator padel.

SPECIFICATION :





3. MAFS Signal



1. TPS Signal

LFJF350A

5) Is the measured signal waveform(Comparison response of TPS with MAFS) O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good MAFS and check for proper operation.
▶ If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

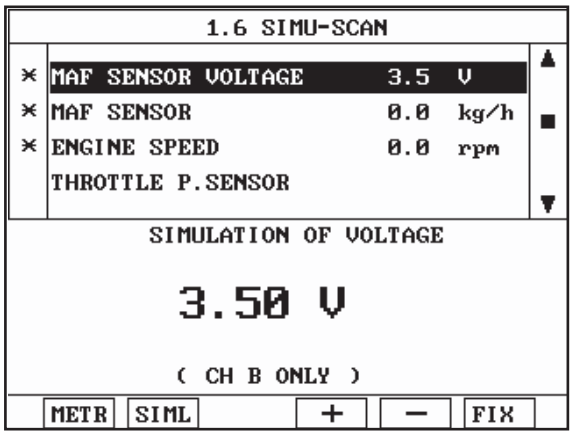
2. Check ECM.

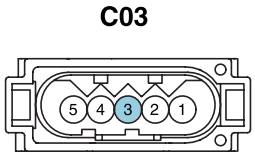
1) IG "OFF" and disconnect MAFS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 3 of MAFS signal connector.





1. Sensor Ground
2. Sensor Power
3. MAFS Signal
4. Ground
5. IATS Signal

LFJF351A

5) Does the signal value of MAFS change according to simulation voltage?

YES

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

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E35EF00A

Refer to DTC P0100.

DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

COMPONENT LOCATION EABEDE0B

Refer to DTC P0100.

GENERAL DESCRIPTION ECA3E837

Refer to DTC P0100.

DTC DESCRIPTION EF824D65

If signal output voltage or intake air mass is less than the minimum threshold value under specified conditions, ECM sets P0102.

DTC DETECTING CONDITION E0681E05

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, low	• Poor connection • Open or short to ground in signal circuit • Open in power circuit • MAFS • ECM
Case1	Enable Conditions	• Engine speed 〈 2000rpm • Throttle angle 〈 10%	
	Threshold Value	• Sensor voltage 〈 0.2V	
Case2	Enable Conditions	• Engine speed 〉 2000rpm • Throttle angle 〉 10%	
	Threshold Value	• Air mass 〈 1.0kg/h	
Diagnostic Time		• 2 sec	
MIL ON Condition		• 2 driving cycle	

SPECIFICATION E545B17C

Refer to DTC P0100.

SCHEMATIC DIAGRAM E6A6EC6A

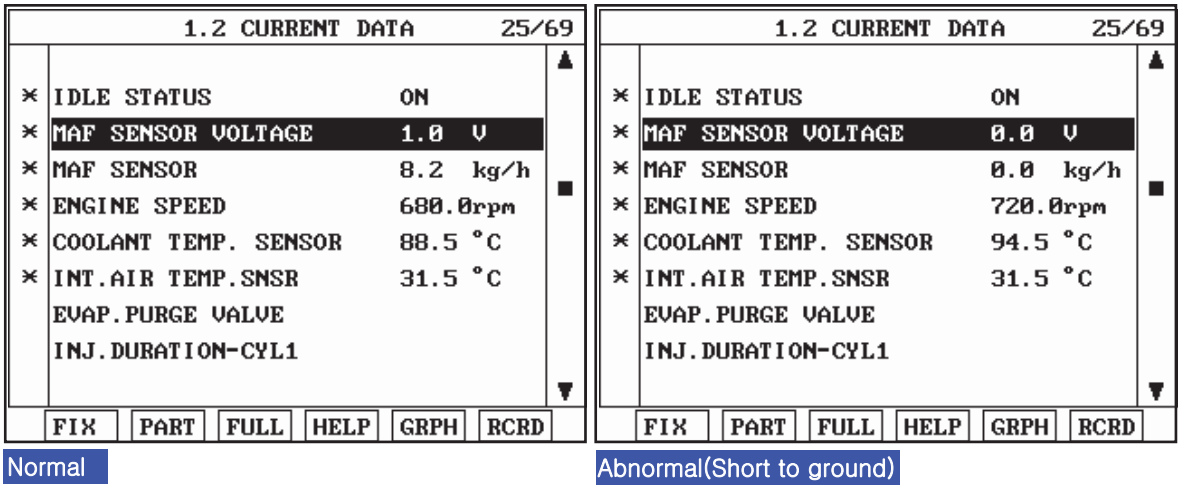
Refer to DTC P0100.

SIGNAL WAVEFORM & DATA E1847DA7

Refer to DTC P0100.

MONITOR SCANTOOL DATA EB8BFA52

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "MAFS" parameter on scantool.



LFJF352A

4. Is the "MAFS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E8B37906

Refer to DTC P0100.

POWER CIRCUIT INSPECTION EA904EEE

1. IG "OFF".
2. Disconnect MAFS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of MAFS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

SIGNAL CIRCUIT INSPECTION EF86D75E

1. Check open in harness.

   1) IG "OFF".

   2) Disconnect MAFS and ECM connector.

   3) Measure resistance between terminal 3 of MAFS harness connector and terminal 19/C01(M/T) or 10/C01-1(A/T) of ECM harness connector.

Specification : Below 1Ω

   4) Is the measured resistance within specification?

YES

▶ Go to "Check short to ground in harness" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness.

   1) IG "OFF".

   2) Disconnect MAFS and ECM connector.

   3) Measure resistance between terminal 3 and 4 of MAFS harness connector.

Specification : Infinite

   4) Is the measred resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1F67BCA

1. Check MAFS performance.

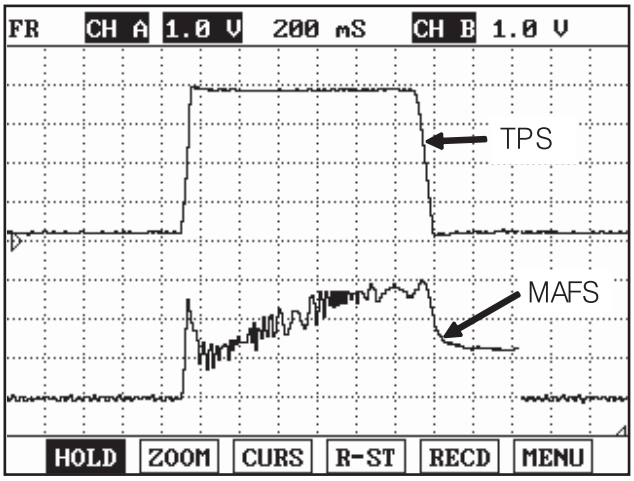
   1) IG "OFF".

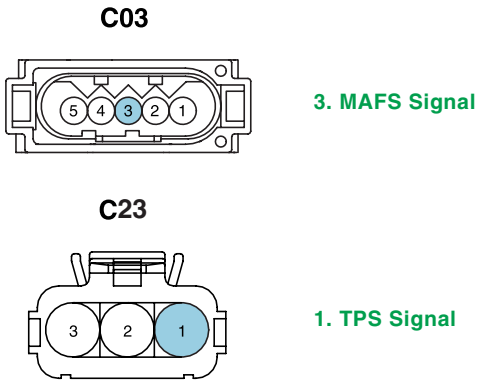
   2) Connnect CHA probe to terminal 3 of MAFS and CHB probe to terminal 1 of TPS connector.

   3) Warm up the engine to normal operating temperature.

   4) Measure signal waveform of MAFS and TPS together by stepping on and off the accellerator padel.

SPECIFICATION :





LFJF350A

5) Is the measured signal waveform(Comparison response of TPS with MAFS) O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good MAFS and check for proper operation.
▶ If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

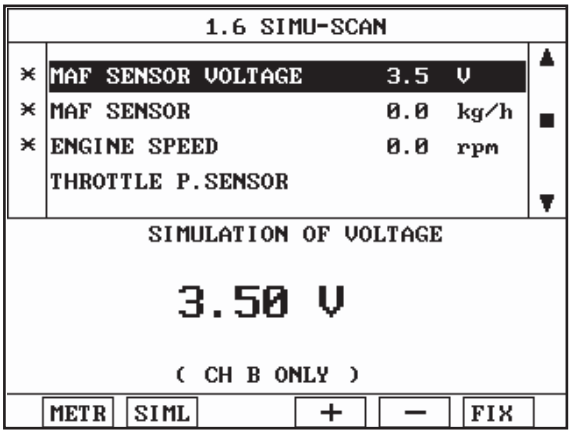
2. Check ECM.

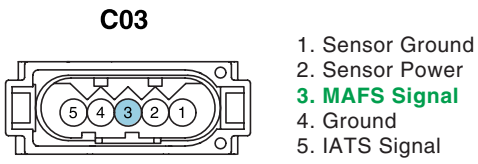
1) IG "OFF" and disconnect MAFS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 3 of MAFS signal connector.





LFJF351A

5) Does the signal value of MAFS change according to simulation voltage?

YES

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

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E886DB03

Refer to DTC P0100.

DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

COMPONENT LOCATION E6C58AB4

Refer to DTC P0100.

GENERAL DESCRIPTION EE890F7D

Refer to DTC P0100.

DTC DESCRIPTION E9E15506

If signal output voltage or intake air mass is more than the maximum threshold value under specified conditions, ECM sets P0103.

DTC DETECTING CONDITION EEBE3AF6

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, high	• Poor connection • Short to power in signal circuit • Open in ground circuit • MAFS • ECM
Case1	Enable Conditions	• Engine speed 〈 2000rpm • Throttle angle 〈 10%	
	Threshold Value	• Sensor voltage 〈 0.2V	
Case2	Enable Conditions	• Engine speed 〉 2000rpm • Throttle angle 〉 10%	
	Threshold Value	• Air mass 〈 706 kg/h	
Diagnostic Time		• 2 sec	
MIL ON Condition		• 2 driving cycle	

SPECIFICATION E72B90AC

Refer to DTC P0100.

SCHEMATIC DIAGRAM EE1A70EC

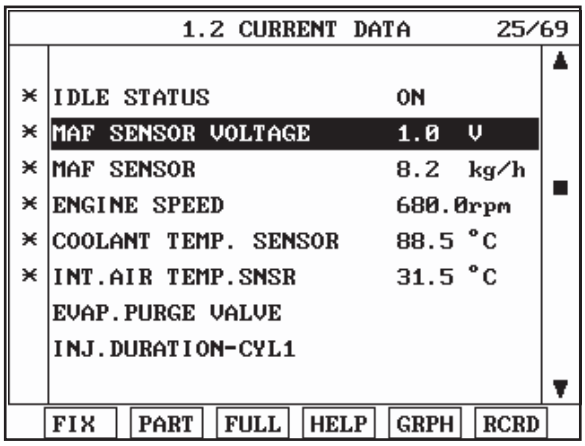
Refer to DTC P0100.

SIGNAL WAVEFORM & DATA E84088ED

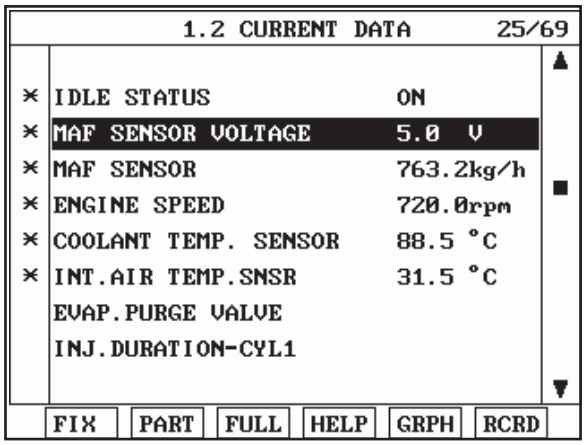
Refer to DTC P0100.

MONITOR SCANTOOL DATA EBD9EB93

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "MAFS" parameter on scantool.



Normal



Abnormal(Short to ground)

LFJF357A

4. Is the "MAFS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or ECM’s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E5F2DED3

Refer to DTC P0100.

POWER CIRCUIT INSPECTION E196634F

1. IG "OFF".
2. Disconnect MAFS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of MAFS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION EAADCD6D

1. Check open in ground harness.
   1) IG "OFF".
   2) Disconnect MAFS connector.
   3) IG "ON" & ENG "OFF"
   4) Measure voltage between terminal 2 of MAFS harness connector and chassis ground.(A)
   5) Measure voltage between terminal 2 and 4 of MAFS harness connector.(B)

Specification : "A" - "B" = Approx. below 200mV

   6) Is the measured voltage within specification?

YES

▶ Go to "Check open in sensor ground" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in sensor ground harness.
   1) IG "OFF".
   2) Disconnect MAFS connector.
   3) IG "ON" & ENG "OFF"
   4) Measure voltage between terminal 2 of MAFS harness connector and chassis ground.(A)
   5) Measure voltage between terminal 1 and 2 of MAFS harness connector.(B)

Specification : A - B = Approx. below 200mV

   6) Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EF2E9A94

1. Check short to battery in harness.
   1) IG "OFF".
   2) Disconnect MAFS and ECM connector.
   3) Measure resistance between terminal 2 and 3 of MAFS harness connector.

Specification : Infinite

4) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or repalce as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5CD21AA

1. Check MAFS performance.

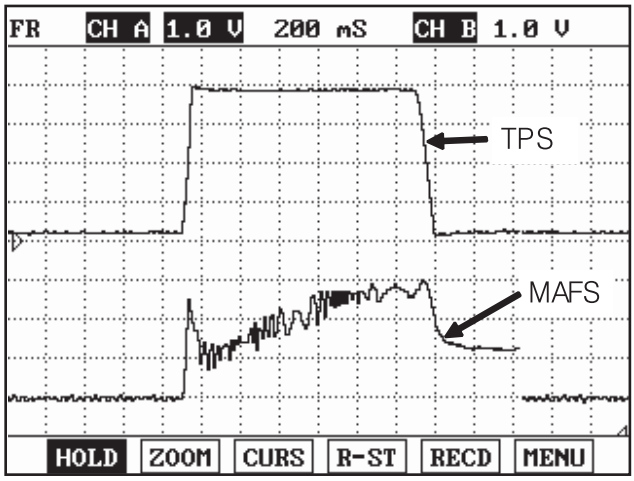
1) IG "OFF".

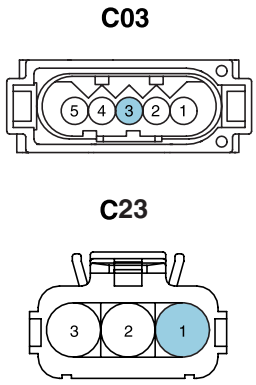
2) Connnect CHA probe to terminal 3 of MAFS and CHB probe to terminal 1 of TPS connector.

3) Warm up the engine to normal operating temperature.

4) Measure signal waveform of MAFS and TPS together by stepping on and off the accellerator padel.

SPECIFICATION :





3. MAFS Signal

1. TPS Signal

LFJF350A

5) Is the measured signal waveform(Comparison response of TPS with MAFS) O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good MAFS and check for proper operation.
▶ If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

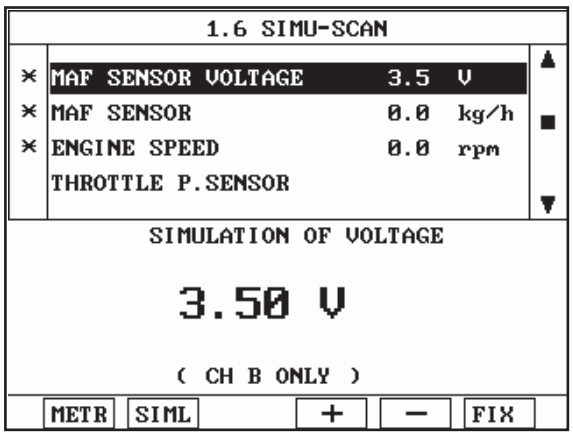
2. Check ECM.

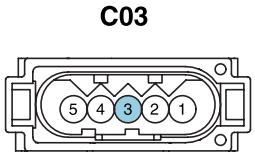
1) IG "OFF" and disconnect MAFS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 3 of MAFS signal connector.





1. Sensor Ground
2. Sensor Power
3. **MAFS Signal**
4. Ground
5. IATS Signal

LFJF351A

5) Does the signal value of MAFS change according to simulation voltage?

YES

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

NO

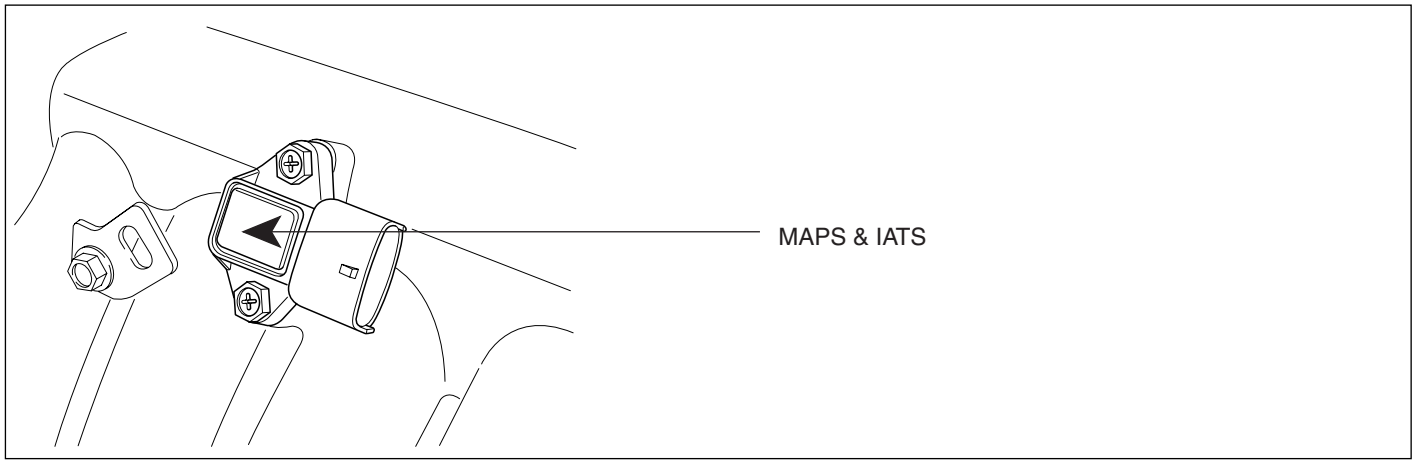
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECD908A0

Refer to DTC P0100.

DTC P0106 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EFFDBDCC



AFJF374B

GENERAL DESCRIPTION E6A028F8

The amount of intake air flow must be inputted to ECM in order to determine the fuel injection quantity. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.
MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, ECM calculates the amount of intake air flow.
MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION EF3CFC43

If intake manifold pressure is lower than the minimum threshold value or higher than the maximum threshold value according to RPM and TPS under normal TPS signal input condition, ECM sets DTC P0106.

DTC DETECTING CONDITION E75B33F5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • MAPS • ECM
Enable Conditions	• No TPS error detected	
Threshold Value	• Intake manifold pressure 〉 max. Threshold f(Eng. Speed, TPS) • Intake manifold pressure 〈 min. Threshold f(Eng. Speed, TPS)	
Diagnostic Time		
MIL ON Condition		

SPECIFICATION E249E3A8

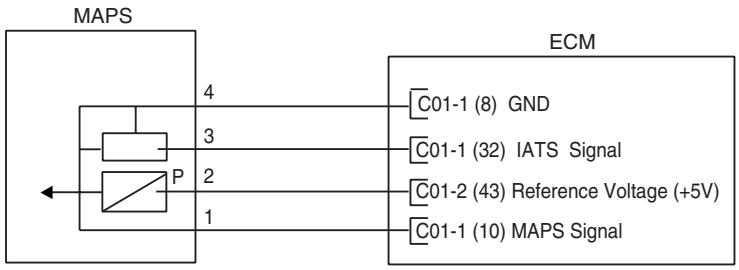
Pressure [Pa]	20	35	60	95	107
Voltag [V]	0.789 ± 0.045	1.382 ± 0.045	2.369 ± 0.045	3.75 ± 0.045	4.224 ± 0.045

Acceptable temperature range : (23 ±5) ℃

SCHEMATIC DIAGRAM E139197A

(A/T)

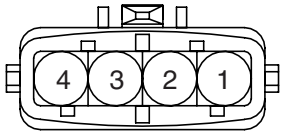
[CIRCUIT DIAGRAM]



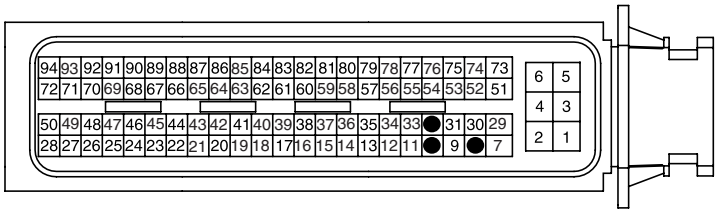
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (10)	MAPS Signal
2	ECM C01-2 (43)	Reference Voltage (+5V)
3	ECM C01-1 (32)	IATS Signal
4	ECM C01-1 (8)	Sensor Ground

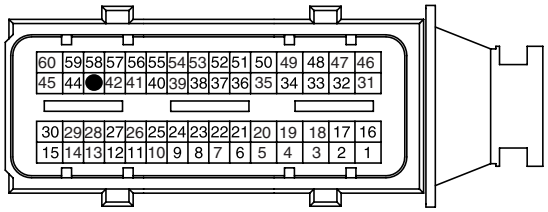
[HARNESS CONNECTORS]



MAPS & IATS (C16)



C01-1



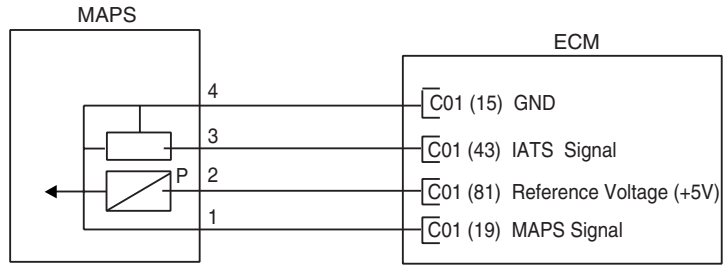
C01-2

ECM

LFJF359A

(M/T)

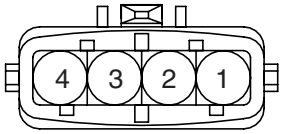
[CIRCUIT DIAGRAM]



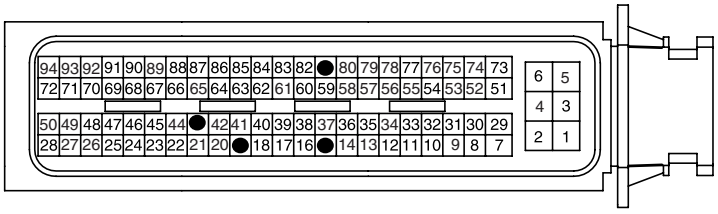
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (19)	MAPS Signal
2	ECM C01 (81)	Reference Voltage (+5V)
3	ECM C01 (43)	IATS Signal
4	ECM C01 (15)	Sensor Ground

[HARNESS CONNECTORS]



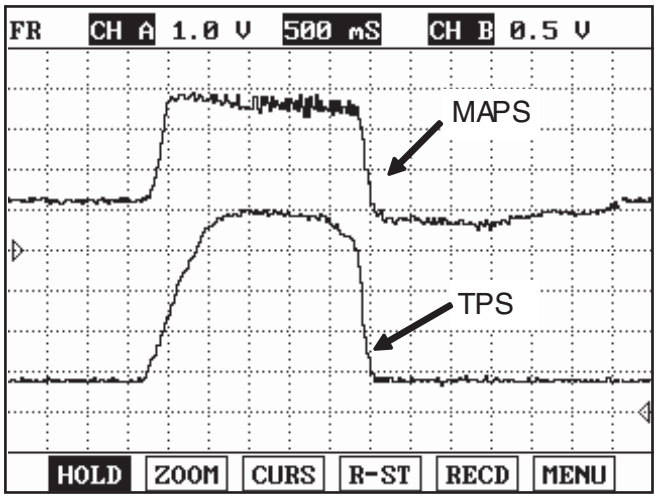
MAPS & IATS (C16)



ECM (C01)

LFJF359B

SIGNAL WAVEFORM & DATA E1336FED



As often as possible, the MAPS signal should be compared with the TPS signal. Check whether the MAPS and TPS signals increase at the same time when accelerating. During acceleration, the MAPS output voltage increases; during deceleration, the MAPS output voltage decreases.

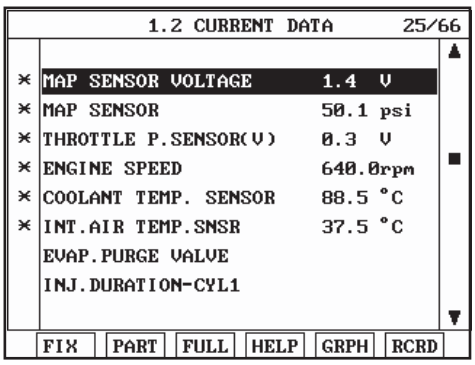
LFJF360A

MONITOR SCANTOOL DATA E9CA5380

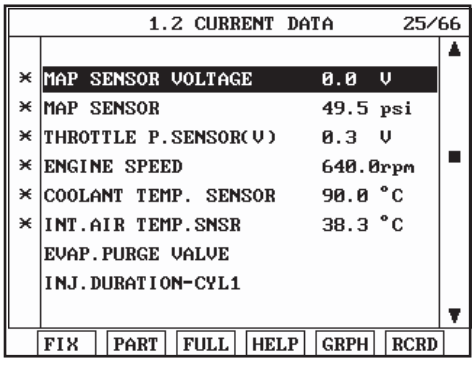
1. Connect scantool to DLC(Data Link Cable).

2. Warm up the engine to normal operating temperature.

3. Monitor "MAPS" parameter on scantool.



Normal



Abnormal(Short to ground)

LFJF361A

4. Is the "MAPS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or ECM’s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E04CA697

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

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

NO

▶ Go to " Voltage Inspection " procedure.

VOLTAGE INSPECTION EA9EA2F7

1. IG "OFF".

2. Disconnect MAPS connector.

3. IG "ON" & ENG "OFF".

4. Measure voltage between terminal 1, 2,4 of MAPS harness connector and chassis ground.

Specification :
Terminal 1 : Approx. 5V
Terminal 2 : Approx. 5V
Terminal 4 : Below 0V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection " procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E926E861

1. Check MAPS performance.

1) IG "OFF".

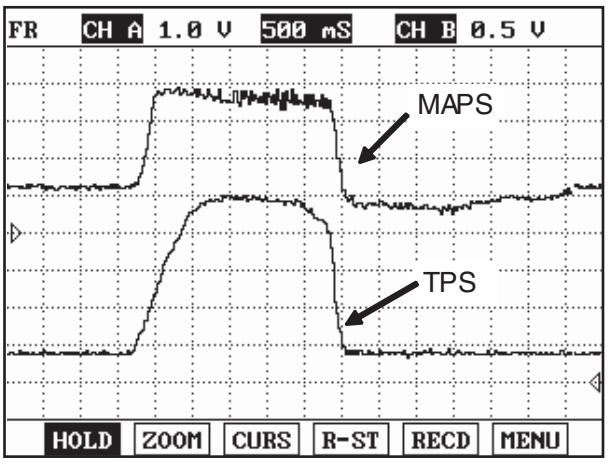
2) Connnect CH A probe to terminal 1 of MAPS and CH B probe to terminal 1 of TPS connector.

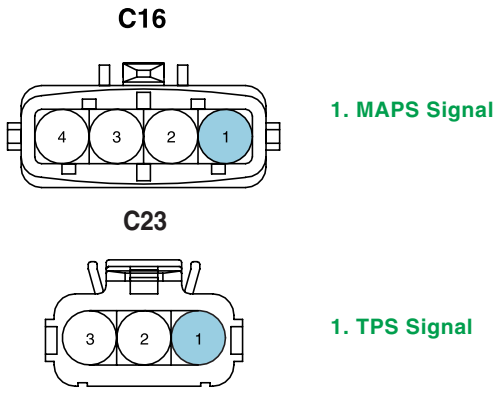
3) Warm up the engine to normal operating temperature.

4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator padel.

Specification : Accepatable temperature range : (23 ±5)℃

Pressure [Pa]	20	35	60	95	107
Voltag [V]	0.789 ± 0.045	1.382 ± 0.045	2.369 ± 0.045	3.75 ± 0.045	4.224 ± 0.045





LFJF363A

5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good MAPS and check for proper operation.
▶ If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

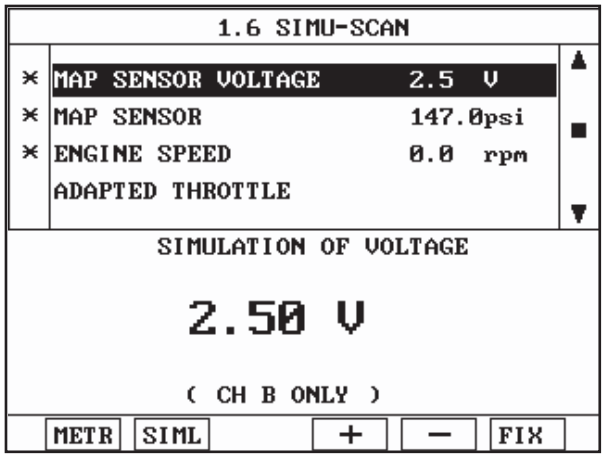
2. Check ECM.

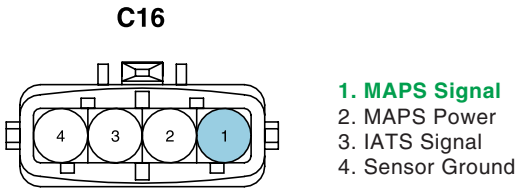
1) IG "OFF" and disconnect MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of MAPS signal connector.





LFJF364A

5) Does the signal value of MAPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3E4393D

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

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.

3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

COMPONENT LOCATION ECBDB4DE

Refer to DTC P0106.

GENERAL DESCRIPTION E742399D

Refer to DTC P0106.

DTC DESCRIPTION E7139E0D

If sensor signal input is lower than 0.25V during 5 sec, ECM sets DTC P0107.

DTC DETECTING CONDITION E431346A

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Open or short to ground in power circuit • Short to ground in signal circuit • MAPS • ECM
Enable Conditions	• 5sec after engine start	
Threshold Value	• Sensor voltage 〈 0.25 V	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E1322998

Refer to DTC P0106.

SCHEMATIC DIAGRAM E2C93D22

Refer to DTC P0106.

SIGNAL WAVEFORM & DATA EC20BC8C

Refer to DTC P0106.

MONITOR SCANTOOL DATA E4C26E02

Refer to DTC P0106.

TERMINAL AND CONNECTOR INSPECTION E958C3BD

Refer to DTC P0106.

POWER SUPPLY CIRCUIT INSPECTION ED1B6522

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of MAPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E30F48E5

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage terminal 1 of MAPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

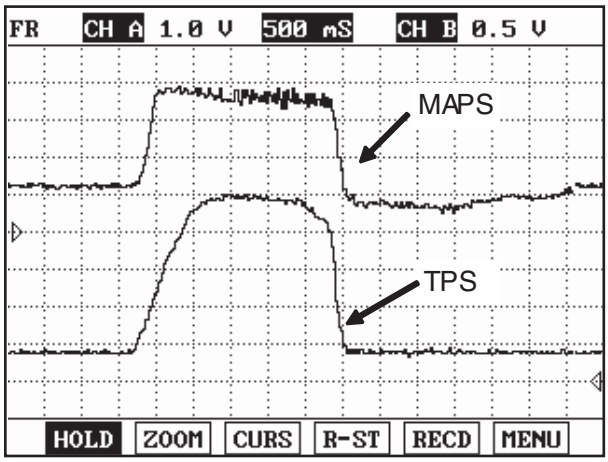
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

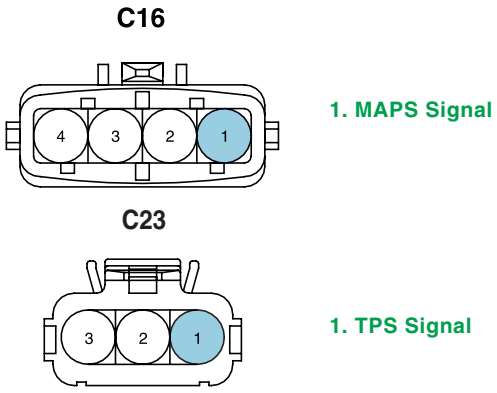
COMPONENT INSPECTION ECBDD31C

1. Check MAPS performance.
   1) IG "OFF".
   2) Connnect CH A probe to terminal 1 of MAPS and CH B probe to terminal 1 of TPS connector.
   3) Warm up the engine to normal operating temperature.
   4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator padel.

Specification : Accepatable temperature range : (23 ±5)℃

Pressure [Pa]	20	35	60	95	107
Voltag [V]	0.789 ± 0.045	1.382 ± 0.045	2.369 ± 0.045	3.75 ± 0.045	4.224 ± 0.045





LFJF363A

5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K?

YES

▶ Go to "Check ECM" as follows

NO

▶ Substitute with a known - good MAPS and check for proper operation.
▶ If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure..

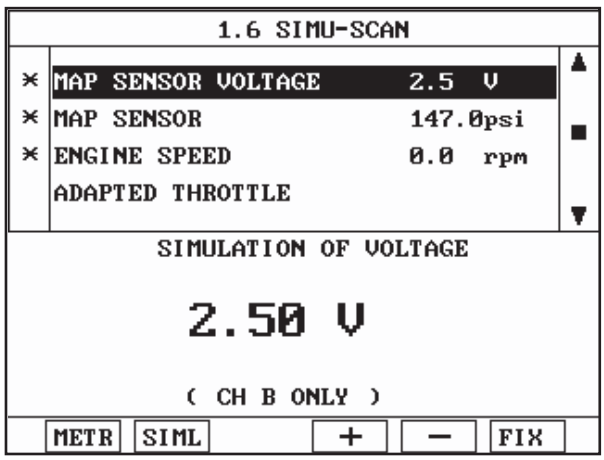
2. Check ECM.

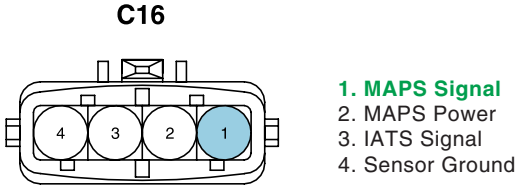
1) IG "OFF" and disconnect MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of MAPS signal connector.





LFJF364A

5) Does the signal value of MAPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0A0799D

Refer to DTC P0106.

DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E00CDCEB

Refer to DTC P0106.

GENERAL DESCRIPTION ECA9D1CC

Refer to DTC P0106.

DTC DESCRIPTION E0E627B8

If sensor signal input is higher than 0.25V during 5 sec, ECM sets DTC P0108.

DTC DETECTING CONDITION EBB5ACD4

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • MAPS • ECM
Enable Conditions	• 5sec after engine start	
Threshold Value	• Sensor voltage 〉 4.88V	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E4CA5C6E

Refer to DTC P0106.

SCHEMATIC DIAGRAM E32D3C38

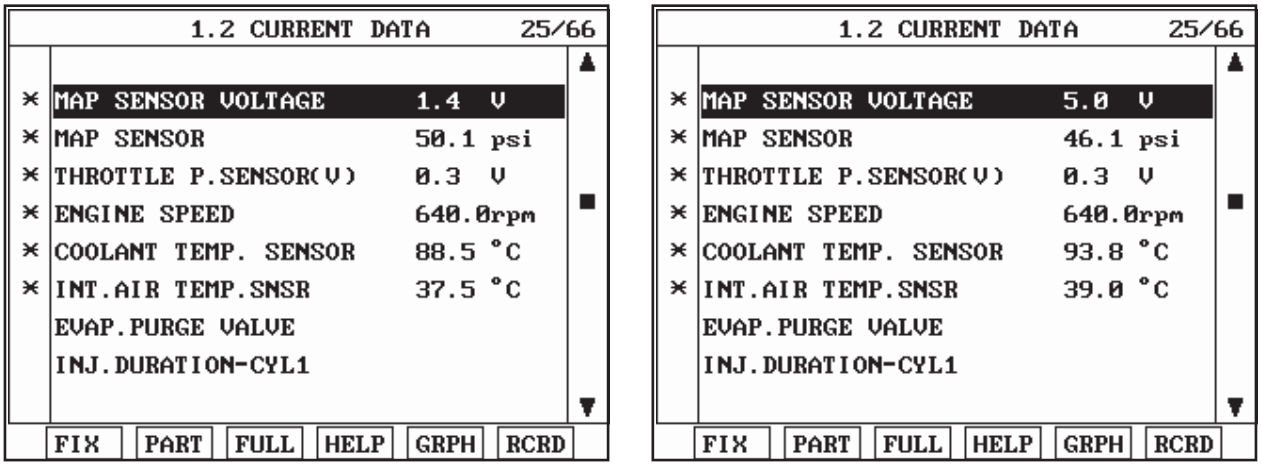
Refer to DTC P0106.

SIGNAL WAVEFORM & DATA EC02ADE3

Refer to DTC P0106.

MONITOR SCANTOOL DATA E7FA3A23

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "MAPS" parameter on scantool.



LFJF369A

4. Is the "MAPS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E5C056C9

Refer to DTC P0106.

SIGNAL CIRCUIT INSPECTION E577B218

1. Check open in harness.
   1) IG "OFF".
   2) Disconnect MAPS connector.
   3) IG "ON" & ENG "OFF"
   4) Measure voltage between terminal 1 of MAPS harness connector and chassis ground.

Specification : Approx. 5V

   5) Is the measured voltage within specification?

YES

▶ Go to "Check short to battery in harness" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check short to battery in harness.
   1) IG "OFF".
   2) Disconnect MAPS and ECM connector.
   3) Measure resistance between terminal 1 and 2 MAPS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EED9E815

1. IG "OFF".
2. Disconnect MAPS connector.
3. Measure resistance between terminal 4 of MAPS harness connector and chassis ground.

Specification : Below 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

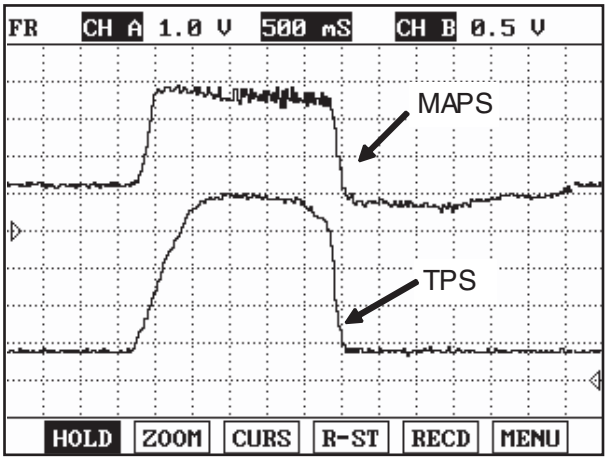
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

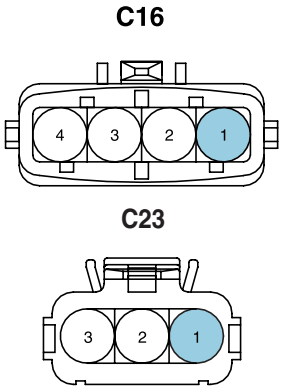
COMPONENT INSPECTION E702B178

1. Check MAPS performance.
   1) IG "OFF".
   2) Connnect CH A probe to terminal 1 of MAPS and CH B probe to terminal 1 of TPS connector.
   3) Warm up the engine to normal operating temperature.
   4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator padel.

Specification : Accepatable temperature range : (23 ±5)℃

Pressure [Pa]	20	35	60	95	107
Voltag [V]	0.789 ± 0.045	1.382 ± 0.045	2.369 ± 0.045	3.75 ± 0.045	4.224 ± 0.045





LFJF363A

5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good MAPS and check for proper operation.
▶ If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

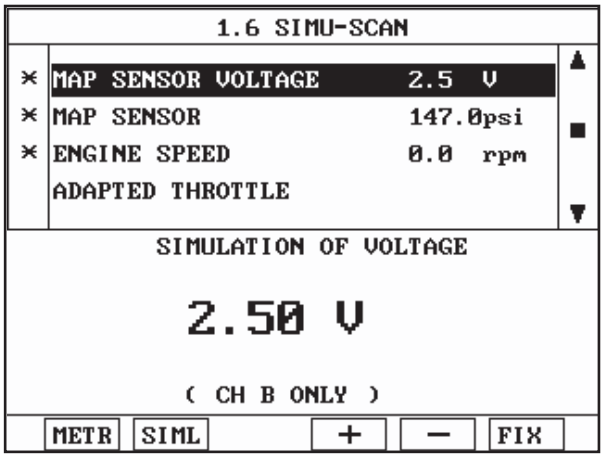
2. Check ECM.

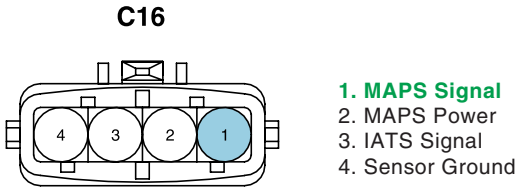
1) IG "OFF" and disconnect MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of MAPS signal connector.





LFJF364A

5) Does the signal value of MAPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

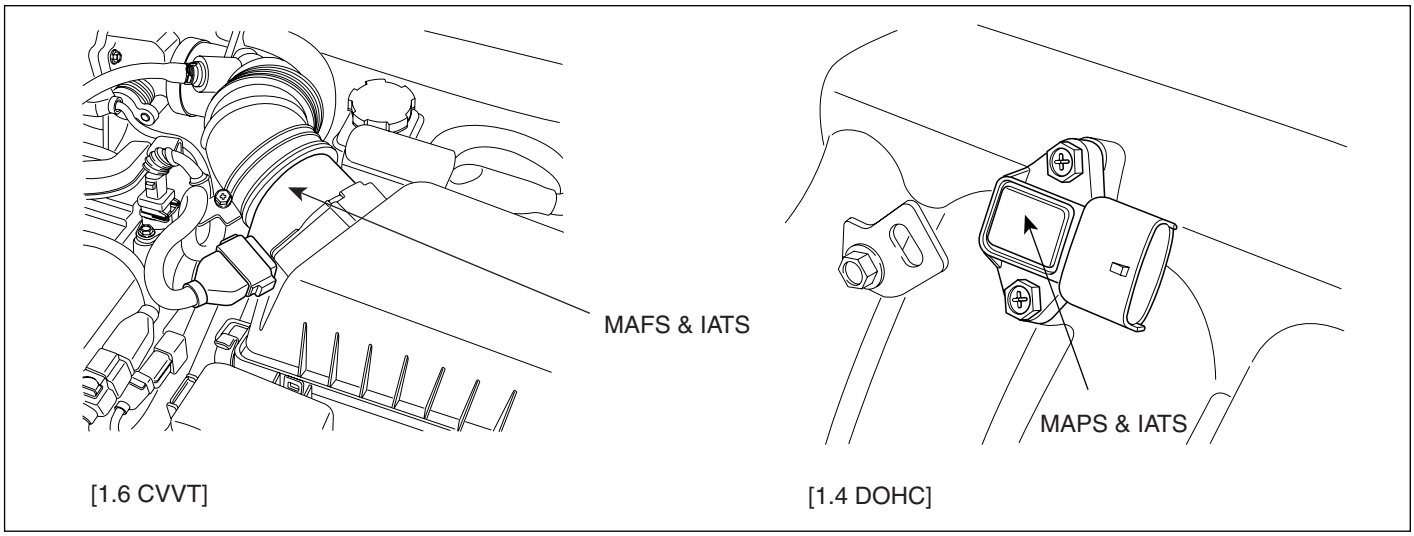
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7379E13

Refer to DTC P0106.

DTC P0112 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT LOW INPUT

COMPONENT LOCATION E70B5C5A



AFJF388C

GENERAL DESCRIPTION E4687408

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the ECM. The ECM applies 5V to the IAT sensor. The ECM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the ECM will receive a high voltage input, and when the air temperature is warm the ECM will receive a low voltage input. The signal from IAT sensor is used for injection duration correction, ignition timing correction and idle speed correction(Air-density correction).

DTC DESCRIPTION E3B4DFA7

If measured temperature is higher than the maximum threshold value during 2sec, ECM sets DTC P0112.
(In this case, the input signal voltage is the minimum threshold vaue.)

DTC DETECTING CONDITION E00FC6CE

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Short to ground in signal circuit • IATS • ECM
Enable Conditions		
Threshold Value	• Measured temperature 〉 128.3 ℃	
Diagnostic Time	• 2 sec	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION EE7B3BBD

[1.6 CVVT]

Temperature [℃]	Resistance [kΩ]	Temperature[℃]	Resistance [kΩ]
-40℃	41.26 ~ 47.49kΩ	40℃	1.11 ~ 1.19kΩ
-20℃	14.26 ~ 16.02kΩ	60℃	0.57 ~ 0.6kΩ
0℃	5.50 ~ 6.05kΩ	80℃	0.31 ~ 0.32kΩ
20℃	2.35 ~ 2.54kΩ		

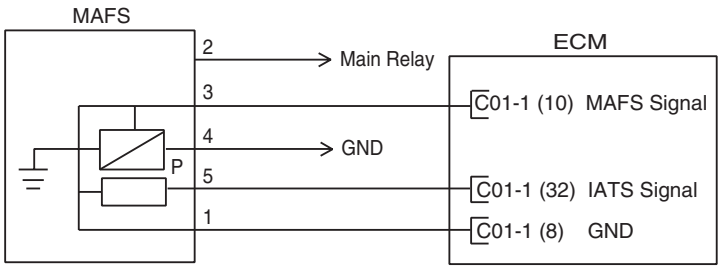
[1.4 DOHC]

Temperature [℃]	Resistance [kΩ]	Temperature[℃]	Resistance [kΩ]
-40℃	38.88 ~ 50.77kΩ	40℃	1.02 ~ 1.27kΩ
-20℃	13.20 ~ 16.83kΩ	60℃	0.52 ~ 0.65kΩ
0℃	5.12 ~ 6.12kΩ	80℃	0.28 ~ 0.35kΩ
20℃	2.20 ~ 2.69kΩ		

SCHEMATIC DIAGRAM EE0903D7

[1.6 CVVT (A/T)]

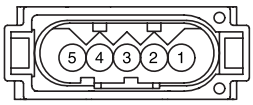
[CIRCUIT DIAGRAM]



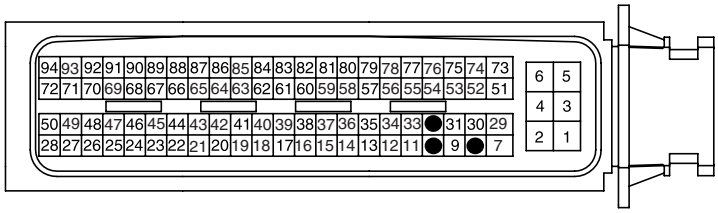
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C 01-1 (8)	Sensor Ground
2	Main Relay	Battery Voltage (B+)
3	ECM C01-1 (10)	MAFS Signal
4	Chassis Ground	Ground
5	ECM C01-1 (32)	IATS Signal

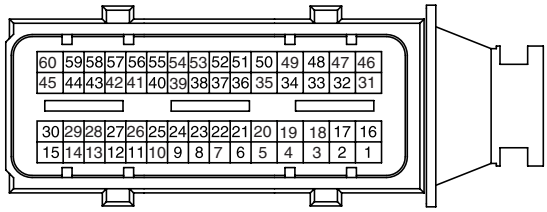
[HARNESS CONNECTOR]



MAFS & IATS (C03)



C01-1



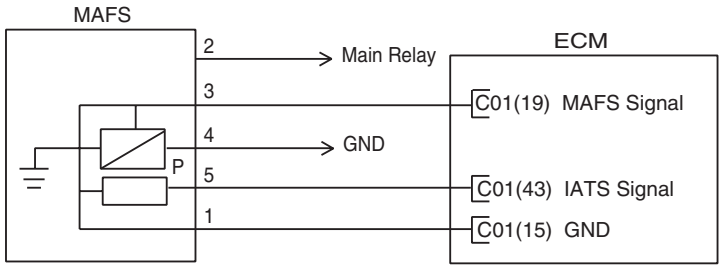
C01-2

ECM

LFJF342A

[1.6 CVVT (M/T)]

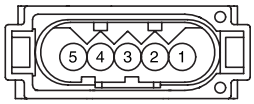
[CIRCUIT DIAGRAM]



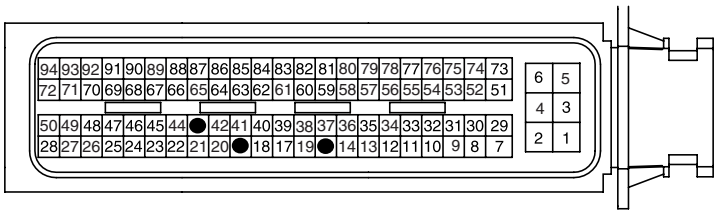
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01(15)	Sensor Ground
2	Main Relay	Battery Voltage (B+)
3	ECM C01(19)	MAFS Signal
4	Chassis Ground	Ground
5	ECM C01(43)	IATS Signal

[HARNESS CONNECTOR]



MAFS & IATS (C03)

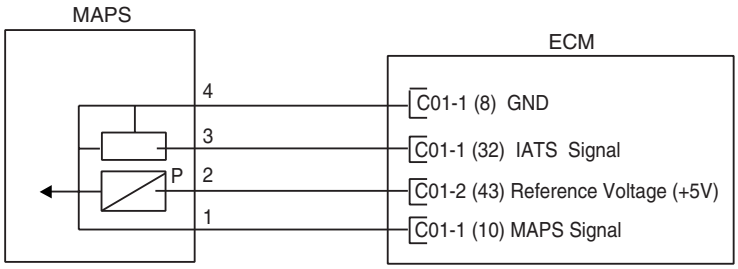


ECM (C01)

LFJF342B

[1.4 DOHC (A/T)]

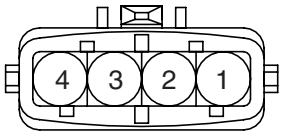
[CIRCUIT DIAGRAM]



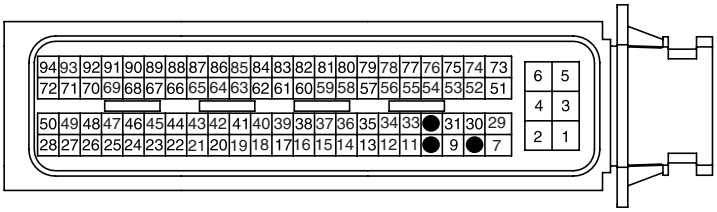
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (10)	MAPS Signal
2	ECM C01-2 (43)	Reference Voltage (+5V)
3	ECM C01-1 (32)	IATS Signal
4	ECM C01-1 (8)	Sensor Ground

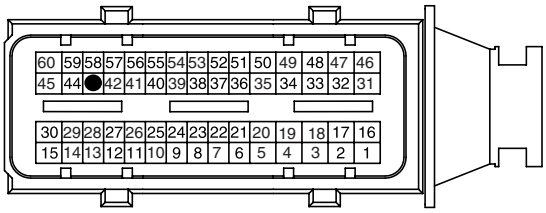
[HARNESS CONNECTORS]



MAPS & IATS (C16)



C01-1



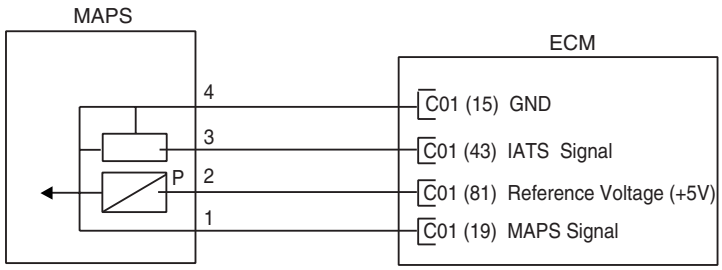
C01-2

ECM

LFJF359A

[1.4 DOHC (M/T)]

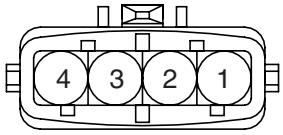
[CIRCUIT DIAGRAM]



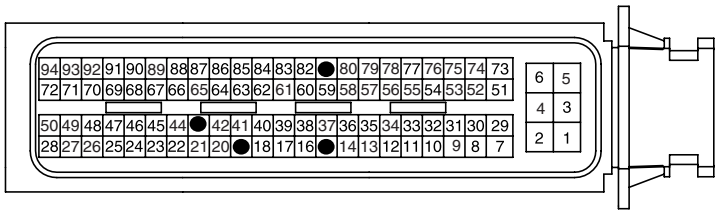
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (19)	MAPS Signal
2	ECM C01 (81)	Reference Voltage (+5V)
3	ECM C01 (43)	IATS Signal
4	ECM C01 (15)	Sensor Ground

[HARNESS CONNECTORS]



MAPS & IATS (C16)

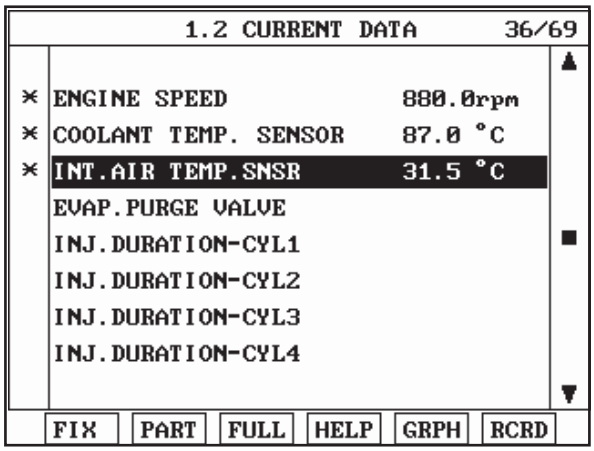


ECM (C01)

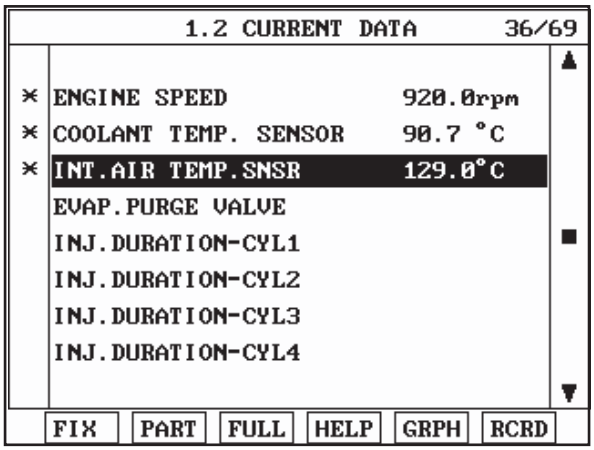
LFJF359B

MONITOR SCANTOOL DATA E480B12F

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "IATS" parameter on scantool.



Normal



Abnormal(Short to ground)

LFJF375A

4. Is the "IATS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’ s and/or ECM’ s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EB7583A1

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

YES

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

NO

▶ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION E1AF54AC

1. IG "OFF".
2. Disconnect IATS connector.
3. IG "ON" & ENG "OFF".
4. (1.6CVVT) Measure voltage between terminal 5 of IATS harness connector and chassis ground.
   (1.4DOHC) Measure voltage between terminal 3 of IATS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E4449946

1. Check IATS resistance.
   1) IG "OFF".

2) Disconnect IATS connector.

3) (1.6CVVT) Measure resistance between terminal 1 and 5 of IATS connector.(Component Side)
(1.4DOHC) Measure resistance between terminal 3 and 4 of IATS connector(Component Side)

4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator padel.

Specification :

[1.6 CVVT]

Temperature [℃]	Resistance [kΩ]	Temperature[℃]	Resistance [kΩ]
-40℃	41.26 ~ 47.49kΩ	40℃	1.11 ~ 1.19kΩ
-20℃	14.26 ~ 16.02kΩ	60℃	0.57 ~ 0.6kΩ
0℃	5.50 ~ 6.05kΩ	80℃	0.31 ~ 0.32kΩ
20℃	2.35 ~ 2.54kΩ		

[1.4 DOHC]

Temperature [℃]	Resistance [kΩ]	Temperature[℃]	Resistance [kΩ]
-40℃	38.88 ~ 50.77kΩ	40℃	1.02 ~ 1.27kΩ
-20℃	13.20 ~ 16.83kΩ	60℃	0.52 ~ 0.65kΩ
0℃	5.12 ~ 6.12kΩ	80℃	0.28 ~ 0.35kΩ
20℃	2.20 ~ 2.69kΩ		

5) Is the measured resistance within specification ?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good IATS and check for proper operation.
▶ If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

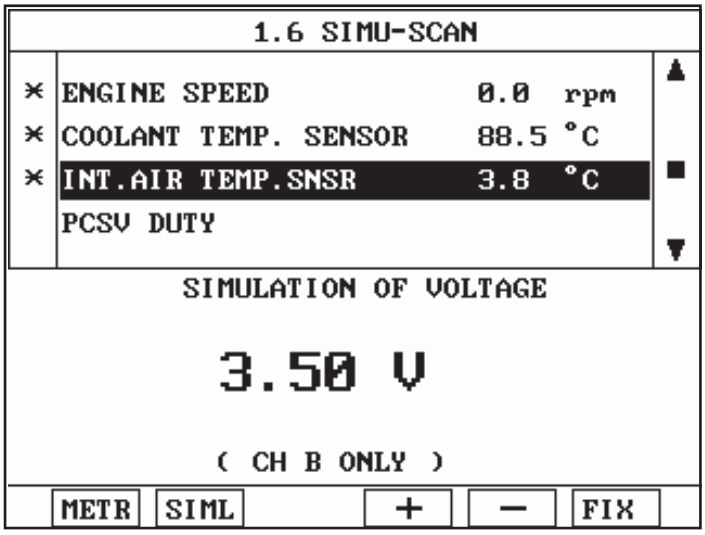
2. Check ECM.

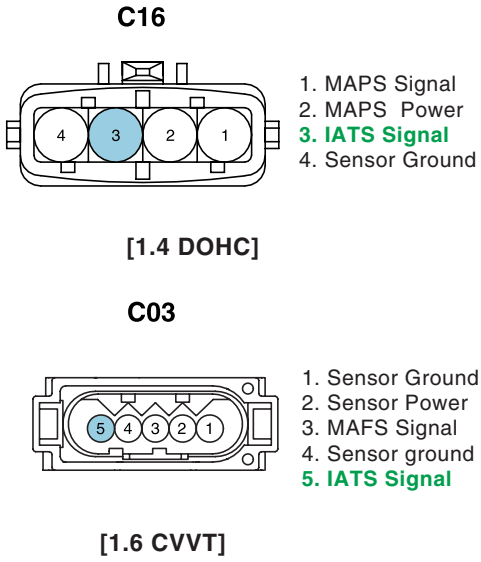
1) IG "OFF" and disconnect MAFS/MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 5(1.6 CVVT)or 3(1.4DOHC) of IATS signal connector.





LFJF378A

5) Does the signal value of IATS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E68388D9

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0113 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT HIGH INPUT

COMPONENT LOCATION E89F5D5A

Refer to DTC P0112.

GENERAL DESCRIPTION E99ED6C8

Refer to DTC P0112.

DTC DESCRIPTION EB7ED0E2

If measured temperature is lower than the minimum threshold value during 2sec, ECM sets DTC P0113.
(In this case, the input signal voltage is the maximum threshold vaue.)

DTC DETECTING CONDITION EF2D21D9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • IATS • ECM
Enable Conditions	• Idle and no fuel cut-off • Time after engine start 〉 28s • Integrated air mass 〉 1.0kg • Increase of measured temp. after start 〈 3.0℃	
Threshold Value	• Measured temperature 〈 -39.0℃	
Diagnostic Time	• 2 sec	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E6C12FB6

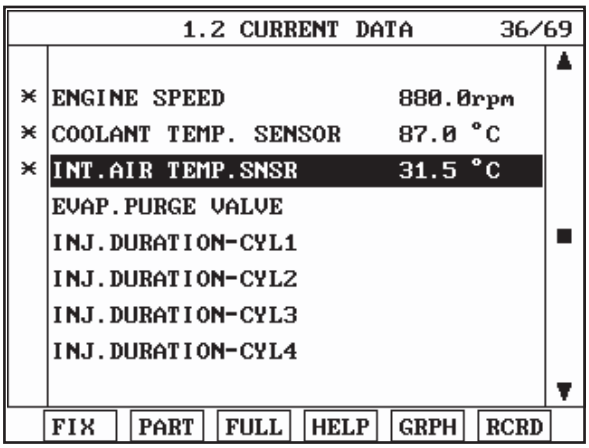
Refer to DTC P0112.

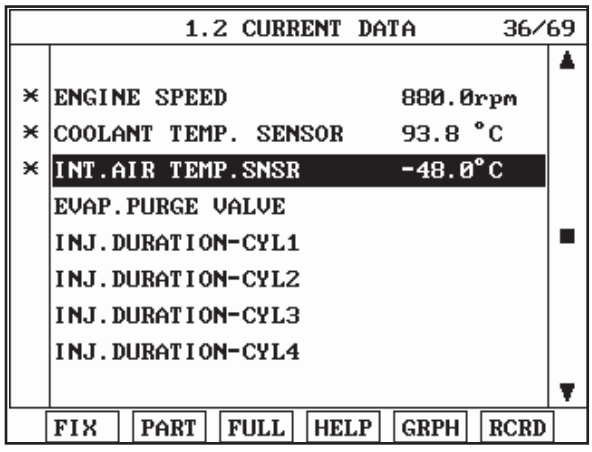
SCHEMATIC DIAGRAM EB15F7D7

Refer to DTC P0112.

MONITOR SCANTOOL DATA EEE3E3D5

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "IATS" parameter on scantool.





LFJF379A

4. Is the "IATS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION ED7DC299

Refer to DTC P0112.

SIGNAL CIRCUIT INSPECTION E1FBB209

1. Check open in harness.

   1) IG "OFF".

   2) Disconnect IATS connector.

   3) IG "ON" & ENG "OFF"

   4) (1.6CVVT) Measure voltage between terminal 5 of IATS harness connector and chassis ground.
   (1.4DOHC) Measure voltage between terminal 3 of IATS harness connector and chassis ground.

Specification : Approx. 5V

   5) Is the measured voltage within specification?

   YES

   ▶ Go to "Check short to ground in harness" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness.

   1) IG "OFF".

   2) Disconnect IATS and ECM connector.

   3) (1.6CVVT) Measure resistance between terminal 1 and 5 of IATS harness connector.
   (1.4DOHC) Measure resistance between terminal 3 and 4 of IATS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EE92CB6A

1. IG "OFF".
2. Disconnect IATS connector.
3. IG "ON" & ENG "OFF"
4. (1.6CVVT) Measure voltage between terminal 5 of IATS harness connector and chassis ground.(A)
   (1.4DOHC) Measure voltage between terminal 3 of IATS harness connector and chassis ground(A)
5. (1.6CVVT) Measure voltage between terminal 1 and 5 of IATS harness connector.(B)
   (1.4DOHC) Measure voltage between terminal 3 and 4 of IATS harness connector. (B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5353352

1. Check IATS resistance.

   1) IG "OFF".

2) Disconnect IATS connector.

3) (1.6CVVT) Measure resistance between terminal 1 and 5 of IATS connector.(Component Side)
(1.4DOHC) Measure resistance between terminal 3 and 4 of IATS connector(Component Side)

Specification :

[1.6 CVVT]

Temperature [℃]	Resistance [kΩ]	Temperature[℃]	Resistance [kΩ]
-40℃	41.26 ~ 47.49kΩ	40℃	1.11 ~ 1.19kΩ
-20℃	14.26 ~ 16.02kΩ	60℃	0.57 ~ 0.6kΩ
0℃	5.50 ~ 6.05kΩ	80℃	0.31 ~ 0.32kΩ
20℃	2.35 ~ 2.54kΩ		

[1.4 DOHC]

Temperature [℃]	Resistance [kΩ]	Temperature[℃]	Resistance [kΩ]
-40℃	38.88 ~ 50.77kΩ	40℃	1.02 ~ 1.27kΩ
-20℃	13.20 ~ 16.83kΩ	60℃	0.52 ~ 0.65kΩ
0℃	5.12 ~ 6.12kΩ	80℃	0.28 ~ 0.35kΩ
20℃	2.20 ~ 2.69kΩ		

4) Is the measured resistance within specification ?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good IATS and check for proper operation.
▶ If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

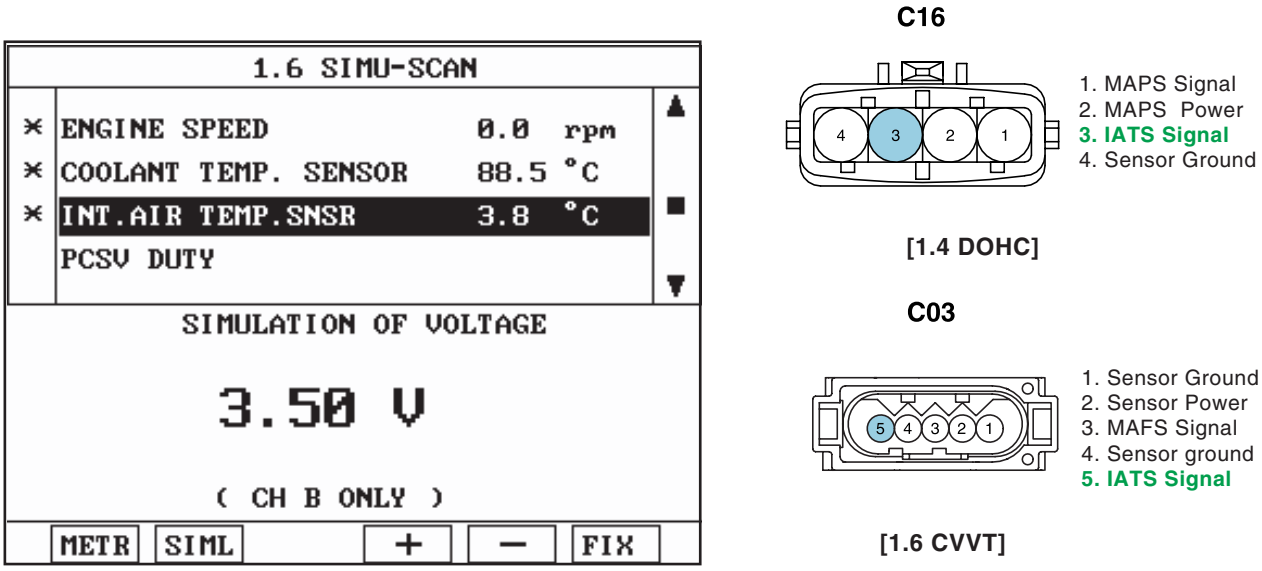
2. Check ECM.

1) IG "OFF" and disconnect MAFS/MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 5(1.6 CVVT)or 3(1.4DOHC) of IATS signal connector.



LFJF378A

5) Does the signal value of IATS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

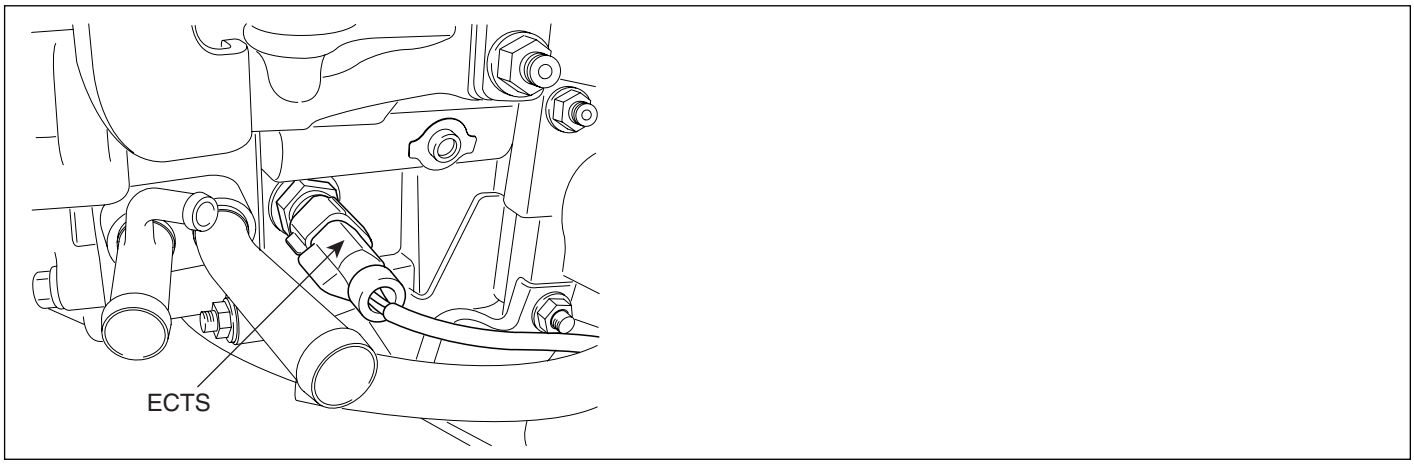
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6AA9E4F

Refer to DTC P0112.

DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

COMPONENT LOCATION E6EFBF9D



AFJF381B

GENERAL DESCRIPTION E4E34802

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (ECM). The ECM applies 5 volts to the ECT sensor. The ECM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the ECM will receive a high voltage input, and when the engine is warm the ECM will receive a low voltage input. The signal from ECT sensor is used for Injection control, ignition timing, idle speed and cooling fan control.

DTC DESCRIPTION E2460BD0

If measured temperature is higher than the maximum threshold value, ECM sets DTC P0117.
(In this case, the input signal voltage is the minimum threshold vaue.)

DTC DETECTING CONDITION E030B4C7

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Short to ground in signal circuit • ECTS • ECM
Enable Conditions		
Threshold Value	• Measured temperature 〉 138.8 ℃	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

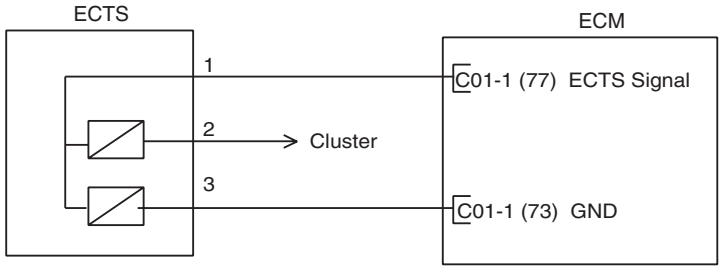
SPECIFICATION E3AEC4F5

Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)
-40℃	48.14kΩ	40℃	1.15kΩ
-20℃	14.13 ~ 16.83kΩ	60℃	0.59kΩ
0℃	5.79kΩ	80℃	0.32kΩ
20℃	2.31 ~ 2.59kΩ		

SCHEMATIC DIAGRAM E671262E

[AT]

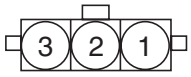
[CIRCUIT DIAGRAM]



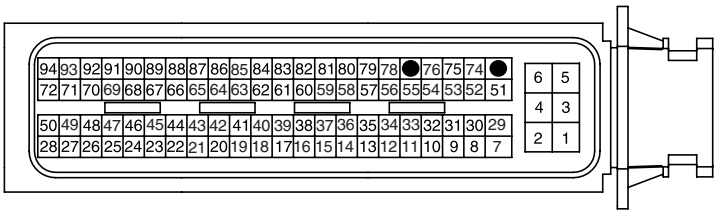
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (77)	ECTS Signal
2	Cluster	-
3	ECM C01-1 (73)	Sensor Ground

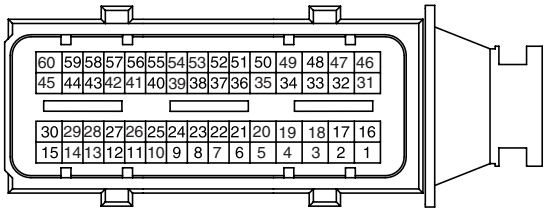
[HARNESS CONNECTORS]



ECTS (C27)



C01-1



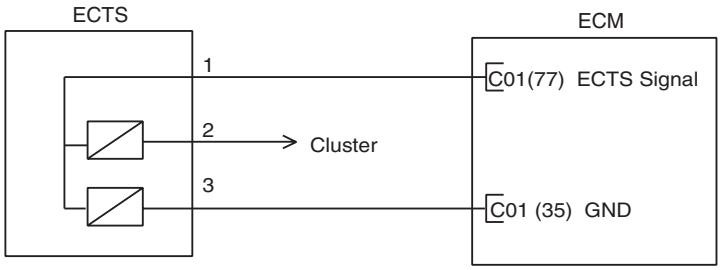
C01-2

ECM

LFJF386A

[MT]

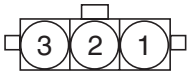
[CIRCUIT DIAGRAM]



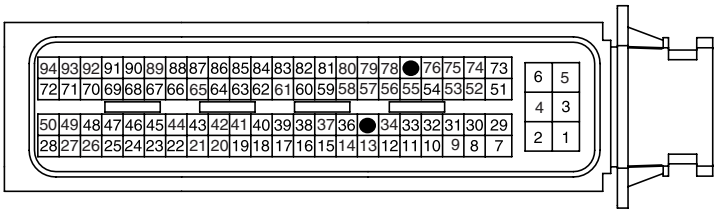
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (77)	ECTS Signal
2	Cluster	-
3	ECM C01 (35)	Sensor Ground

[HARNESS CONNECTORS]



ECTS (C27)

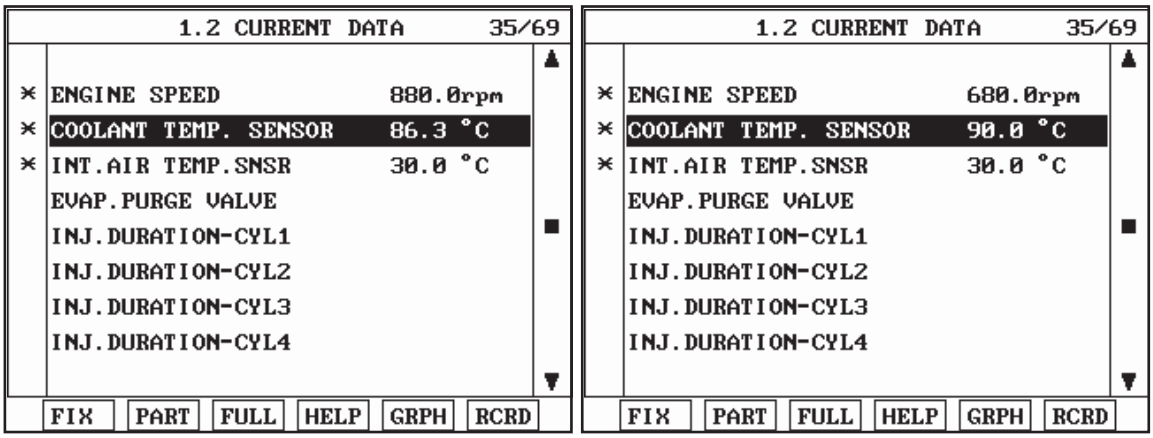


ECM (C01)

LFJF386B

MONITOR SCANTOOL DATA E989F13C

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "ECTS" parameter on scantool.



Normal state

Fail Safe Mode

LFJF387A

4. Is the "ECTS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E943D202

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

YES

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

NO

▶ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION E0D4BEDB

1. IG "OFF".
2. Disconnect ECTS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 1 of ECTS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E44F0DFE

1. Check ECTS resistance.
   1) IG "OFF".
   2) Disconnect ECTS connector.

3) Measure resistance between terminal 1 and 3 of ECTS harness connector.(Component Side)

SPECIFICATION :

Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)
-40℃	48.14kΩ	40℃	1.15kΩ
-20℃	14.13 ~ 16.83kΩ	60℃	0.59kΩ
0℃	5.79kΩ	80℃	0.32kΩ
20℃	2.31 ~ 2.59kΩ		

4) Is the measured resistance within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good ECTS and check for proper operation.
▶ If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

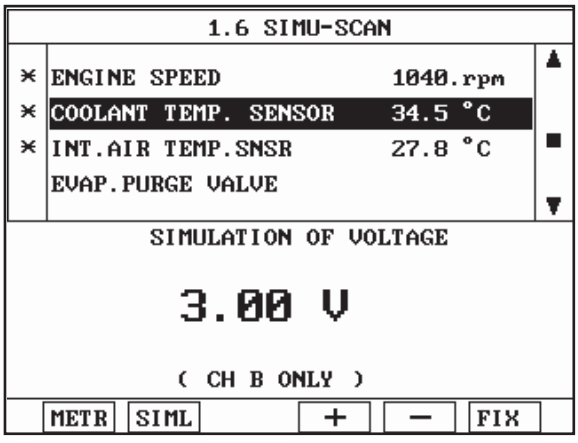
2. Check ECM.

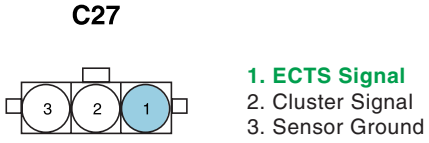
1) IG "OFF" and disconnect ECTS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of ECTS signal connector.





LFJF390A

5) Does the signal value of ECTS change according to simulation voltage?

YES

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

NO

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EADFBD94

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

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

YES

- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION EF0C40D5

Refer to DTC P0117.

GENERAL DESCRIPTION EE70D860

Refer to DTC P0117.

DTC DESCRIPTION E1268618

If measured temperature is lower than the minimum threshold value, ECM sets DTC P0118.
(In this case, the input signal voltage is the maximum threshold vaue.)

DTC DETECTING CONDITION E49DB276

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • ECTS • ECM
Enable Conditions	• (Time after Integrated air mass 〉 0.18kg) 〉 2.0s • Increase of measured temp. after start 〈 3.0℃	
Threshold Value	• Measured temperature 〈 -38.3 ℃	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

SPECIFICATION EE1F2D19

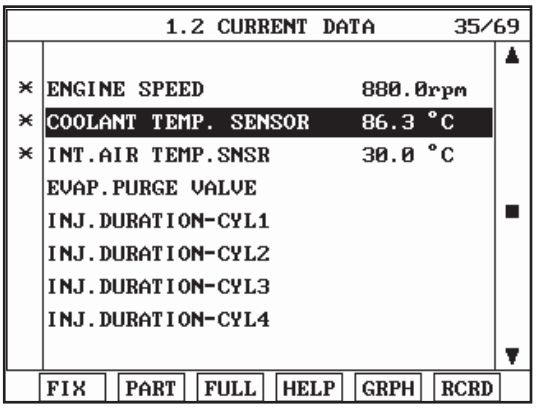
Refer to DTC P0117.

SCHEMATIC DIAGRAM E2D26E64

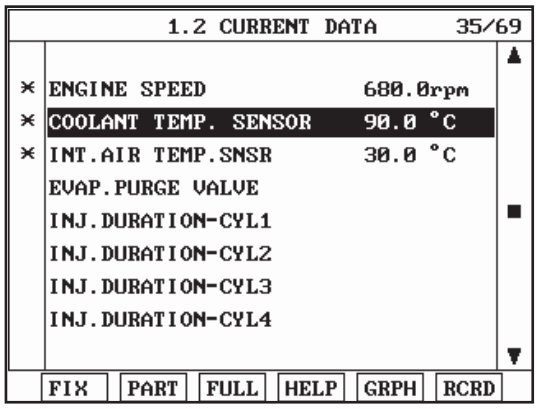
Refer to DTC P0117.

MONITOR SCANTOOL DATA EE510E41

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "ECTS" parameter on scantool.



Normal state



Fail Safe Mode

LFJF390C

4. Is the "ECTS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E8A71E6D

Refer to DTC P0117.

SIGNAL CIRCUIT INSPECTION EFA99336

1. IG "OFF".
2. Disconnect ECTS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 1 of ECTS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E3B6A7CF

1. IG "OFF".
2. Disconnect ECTS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 1 of ECTS harness connector and chassis ground.(A)
5. Measure voltage between terminal 1 and 3 of ECTS harness connector.(B)

Specification : "A" - "B" = Below 200mV‘

6. Is the measured voltage within specification?

YES

▶ Go to "Component Insepction" procedure.

NO

▶ Repair or replace as necessary and then, go to ’Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2519BAB

1. Check ECTS resistance.
   1) IG "OFF".
   2) Disconnect ECTS connector.
   3) Measure resistance between terminal 1 and 3 of ECTS harness connector.(Component Side)

SPECIFICATION :

Temperature (℃)	Resistance (kΩ)	Temperature (℃)	Resistance (kΩ)
-40℃	48.14kΩ	40℃	1.15kΩ
-20℃	14.13 ~ 16.83kΩ	60℃	0.59kΩ
0℃	5.79kΩ	80℃	0.32kΩ
20℃	2.31 ~ 2.59kΩ		

   4) Is the measured resistance within specification?

YES

▶ Go to "Check ECM" as follows.

NO

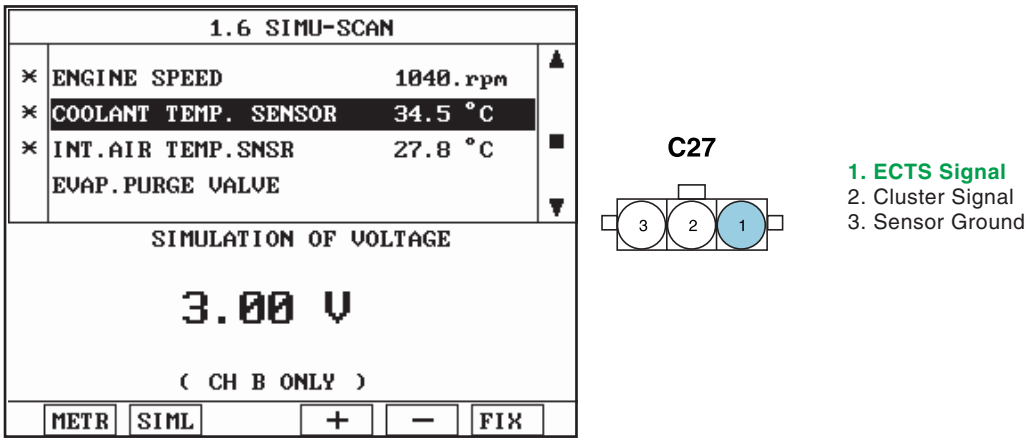
▶ Substitute with a known - good ECTS and check for proper operation.
▶ If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) IG "OFF" and disconnect ECTS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of ECTS signal connector.



LFJF395A

5) Does the signal value of ECTS change according to simulation voltage?

YES

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

NO

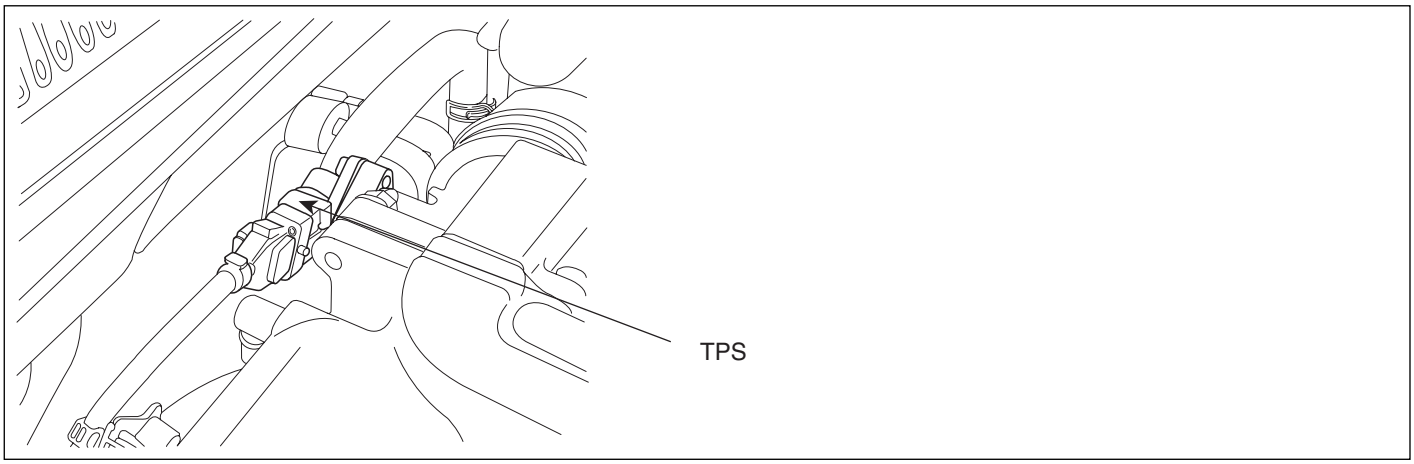
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E22E7233

Refer to DTC P0117.

DTC P0121 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E1A5A88E



AFJF375B

GENERAL DESCRIPTION E6FBB1A6

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) whose characteristic is the resistance changing 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 ECM supplies a reference 5V to the TPS and the output voltage increases directly with the opening of the throttle valve. The TPS output voltage will vary from 0.2~0.8V at closed throttle to 4.3~4.8V at wide-open throttle.The ECM determines operating conditions such as idle (closed throttle), part load, acceleration/deceleration, and wide-open throttle from the TPS. Also The ECM uses the Mass Air Flow Sensor (MAFS) or Manifold Absolute Pressure Sensor (MAPS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC DESCRIPTION E6FA69FA

If the number that throttle angle input signal chages rapidly (above 30%) is 3 times or more, PCM sets DTC P0121.

DTC DETECTING CONDITION E052867D

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check (Jittering)	• Poor connection • TPS • ECM
Enable Conditions	• Engine speed 〉 600 rpm	
Threshold Value	• Counter of ∣△ throttle angle 〉 30%∣≥ 3 times	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

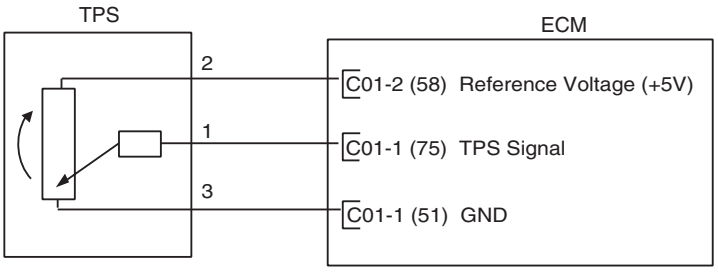
SPECIFICATION E5031DBF

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)

SCHEMATIC DIAGRAM EC679AD7

[AT]

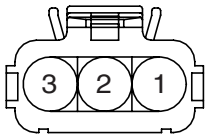
[CIRCUIT DIAGRAM]



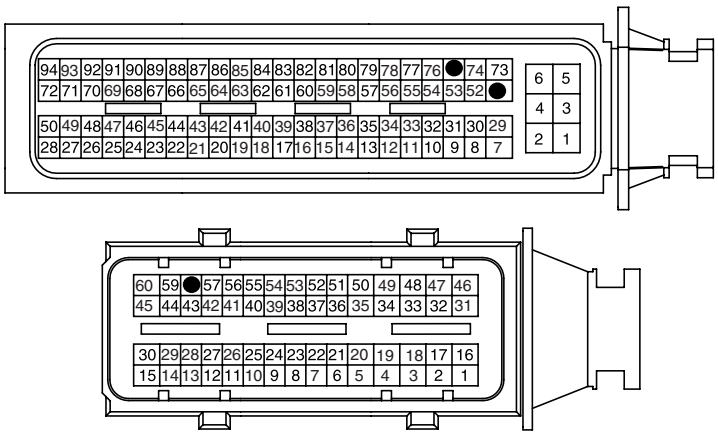
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (75)	TPS Signal
2	ECM C01-2 (58)	Reference Voltage (+5V)
3	ECM C01-1 (51)	Sensor Ground

[HARNESS CONNECTORS]



TPS (C23)

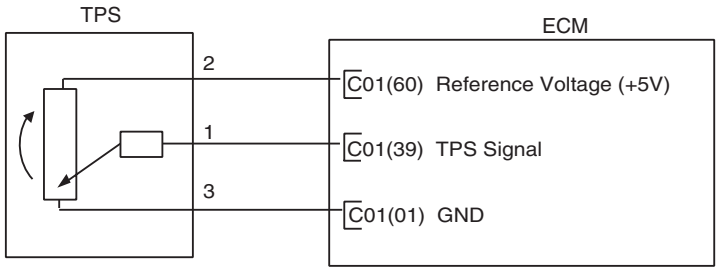


ECM

LFJF397A

[MT]

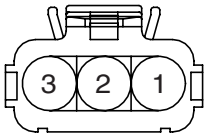
[CIRCUIT DIAGRAM]



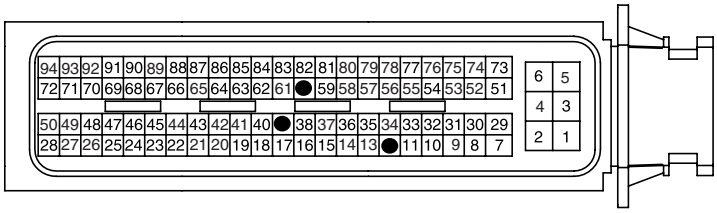
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (39)	TPS Signal
2	ECM C01 (60)	Reference Voltage (+5V)
3	ECM C01 (12)	Sensor Ground

[HARNESS CONNECTORS]



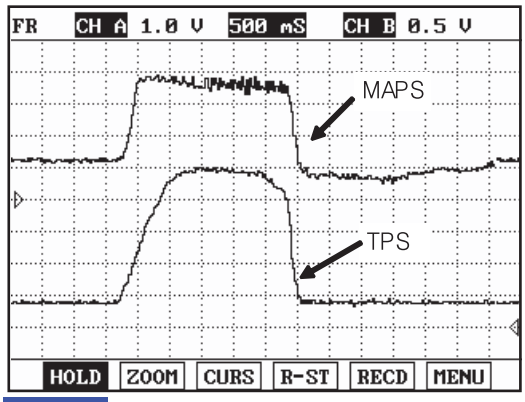
TPS (C23)



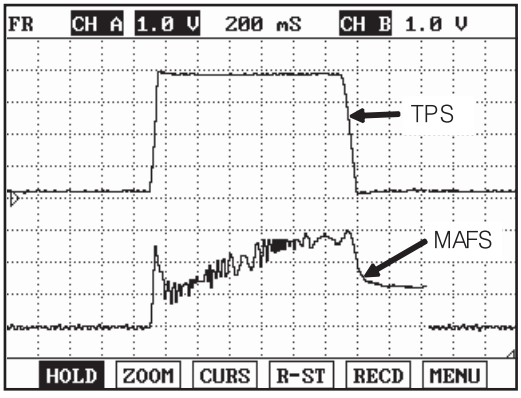
ECM (C01)

LFJF331B

SIGNAL WAVEFORM & DATA E254AC25



1.6CVVT

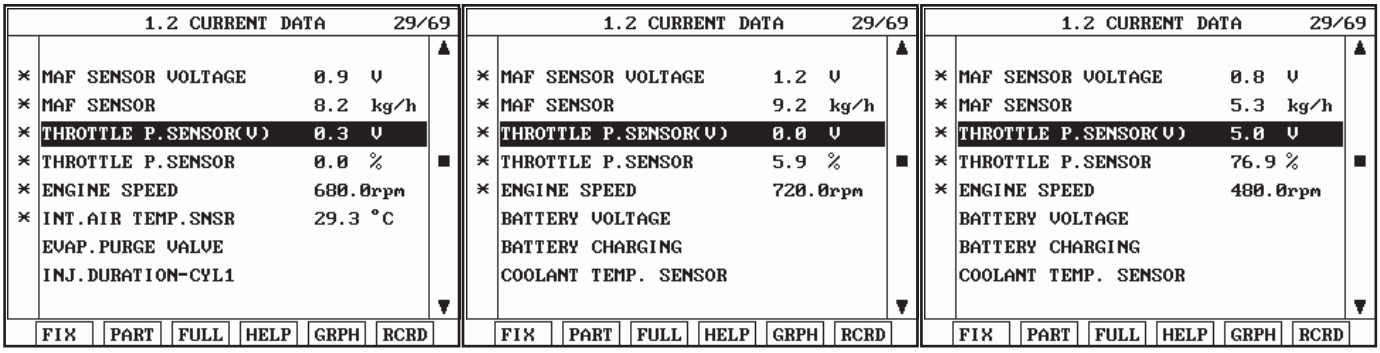


1.4DOHC

LFJF398A

MONITOR SCANTOOL DATA ECBEF17A

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "TPS" parameters on the scantool.



LFJF399A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EAA07569

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

YES

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

NO

▶ Go to "TPS circuit inspection" procedure.

TPS CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON".
4. Measure the voltage between terminal 1, 2, 3 of TPS harness connector and chassis ground.

Specification :
Terminal 1 : Approx. 5V
Terminal 2 : Approx. 5V
Terminal 3 : Approx. 0V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check for Open or Short in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFCADE26

1. Check TPS resistance.

   1) Key "OFF".

   2) Disconnect TPS connector.

   3) Measure the resistance between terminal 2 and 3 of TPS component side.

SPECIFICATION :

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)

   4) Is the measured resistance within specifications?

YES

▶ Go to "Check ECM" procedure.

NO

▶ Substitute with a known-good TPS and check for proper operation. If the problem iscorrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

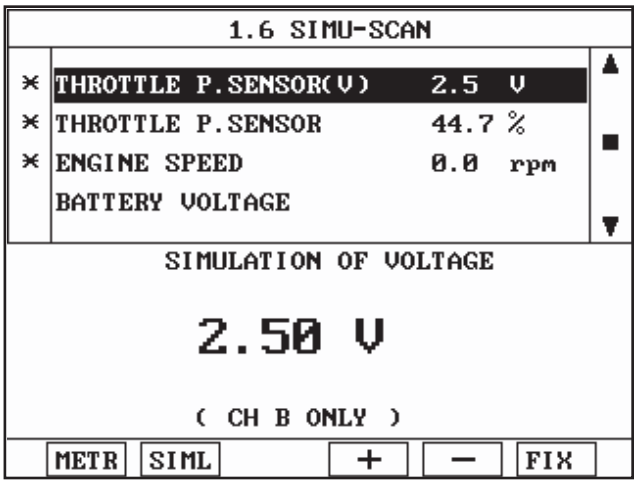
2. Check ECM.

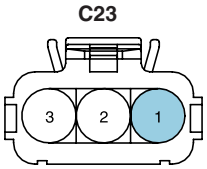
   1) Key "OFF".

   2) Connect the scantool and select "Simulation SCAN" in the menu.

   3) Connect channel A of scantool with terminal 1 of TPS harness connector, and key "ON".

   4) Simulate voltage at signal line.





1. Sensor signal
2. Sensor power
3. Sensor ground

LFJF402A

5) Does the signal output of TPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2982321

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT

COMPONENT LOCATION ED10FE7B

Refer to DTC P0121.

GENERAL DESCRIPTION E9AB7AB7

Refer to DTC P0121.

DTC DESCRIPTION EC2A755E

If the sensor input voltage is lower than the minimum threshold value during 0.08 sec under normal driving condition, ECM sets DTC P0122.

DTC DETECTING CONDITION E7202D72

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Open or short to ground in power circuit • Short to ground in signal circuit • TPS • ECM
Enable Conditions	• Engine speed 〉 600 rpm	
Threshold Value	• Calculated signal from sensor voltage 〈 3.1%	
Diagnostic Time	• 0.08 sec	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION EA5B0662

Refer to DTC P0121.

SCHEMATIC DIAGRAM E7B21EEE

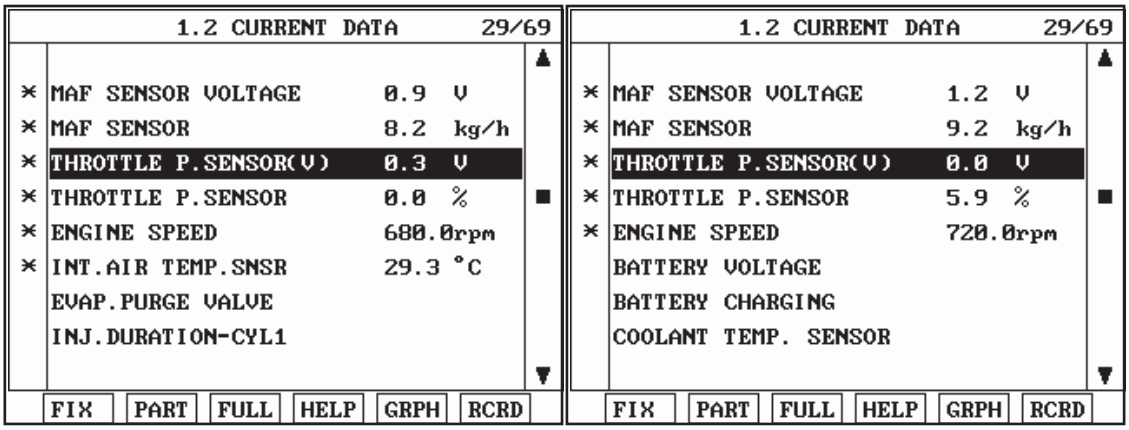
Refer to DTC P0121.

SIGNAL WAVEFORM & DATA EDF53CAB

Refer to DTC P0121.

MONITOR SCANTOOL DATA EC66BFA8

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "TPS" parameters on the scantool.



LFJF403A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E06E5CF0

Refer to DTC P0121.

POWER CIRCUIT INSPECTION E6D52B88

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of TPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Check for Open or Short to ground in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E22F0BC6

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON".
4. Measure the voltage between terminal 1 of TPS harness connecto and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDBD33EC

1. Check TPS resistance.
   1) Key "OFF".
   2) Disconnect TPS connector.
   3) Measure the resistance between terminal 2 and 3 of TPS component side.

SPECIFICATION :

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)

   4) Is the measured resistance within specifications?

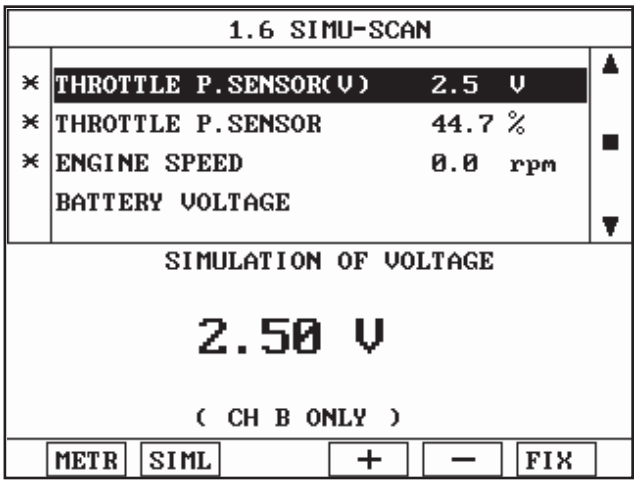
YES

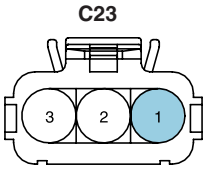
▶ Go to "Check ECM" procedure.

NO

▶ Substitute with a known-good TPS and check for proper operation. If the problem iscorrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) Key "OFF".
   2) Connect the scantool and select "Simulation SCAN" in the menu.
   3) Connect channel A of scantool with terminal 1 of TPS harness connector, and key "ON".
   4) Simulate voltage at signal line.





1. Sensor signal
2. Sensor power
3. Sensor ground

LFJF402A

5) Does the signal output of TPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7F5BACD

Refer to DTC P0121.

DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT

COMPONENT LOCATION EEED19D2

Refer to DTC P0121.

GENERAL DESCRIPTION E6CABF95

Refer to DTC P0121.

DTC DESCRIPTION E7B454B7

If the sensor input voltage is higher than the maximum threshold value during 0.08 sec under normal driving condition, PCM sets DTC P0123.

DTC DETECTING CONDITION E0BB947A

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • TPS • ECM
Enable Conditions	• Engine speed 〉 600 rpm	
Threshold Value	• Calculated signal from sensor voltage 〉 95.7%	
Diagnostic Time	• 0.08 sec	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E6DA36DF

Refer to DTC P0121.

SCHEMATIC DIAGRAM E78B5ECB

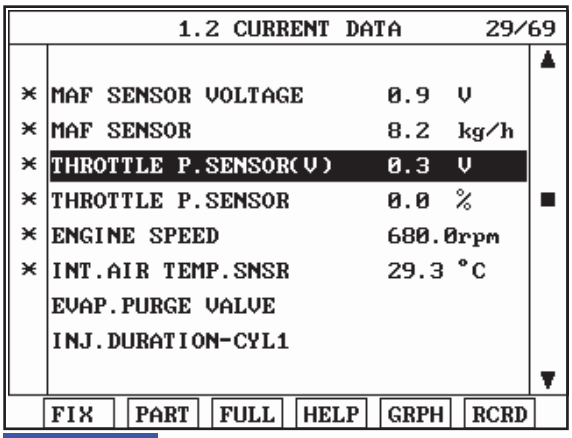
Refer to DTC P0121.

SIGNAL WAVEFORM & DATA E6EA0CA5

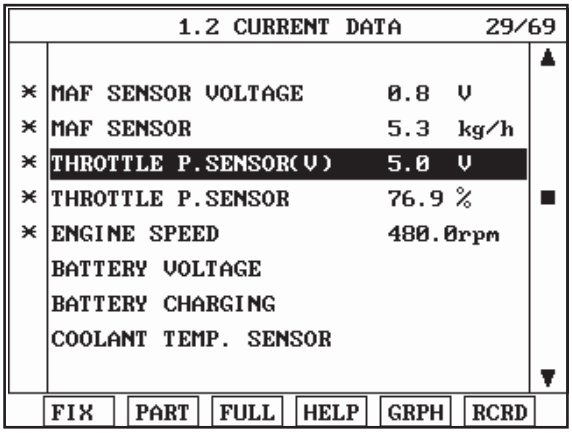
Refer to DTC P0121.

MONITOR SCANTOOL DATA EADBD6CC

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "TPS" parameters on the scantool.



Normal state



Abnormal(Open or Short to power)

LFJF408A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EEC15890

Refer to DTC P0121.

POWER CIRCUIT INSPECTION E44B910F

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of TPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Check for Open or Short to ground in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EECFC4CF

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of TPS harness connector and chassis ground.(A)
5. Measure the voltage between terminal 2 and 3 of TPS harness connector.(B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Check for Open in ground circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EB2083F9

1. Check for open in signal circuit.
   1) Key "OFF".
   2) Disconnect TPS connector.
   3) Key "ON".
   4) Measure the voltage between terminal 1 of TPS harness connector and chassis ground.

Specification : Approx. 5V

   5) Is the measured voltage within specification?

YES

▶ Go to "Check for Short in signal circuit" procedure.

NO

▶ Repair Open or Short to power in signal circuit and go to "Verification of Vehicle Repair" procedure.

2. Check for short in signal circuit.
   1) Key "OFF".
   2) Disconnect TPS connector and ECM connector.
   3) Measure the resistance between terminal 1 and 2 of TPS harness connector.

Specification : Infinite

4) Is the measured resistance within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E05BC0E1

1. Check TPS resistance.

1) Key "OFF".

2) Disconnect TPS harness connector.

3) Measure the resistance between terminal 2 and 3 of TPS component side connector.

SPECIFICATION :

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)

4) Is the measured resistance within specifications?

YES

▶ Go to "Check ECM" procedure.

NO

▶ Substitute with a known-good TPS and check for proper operation. If the problem iscorrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

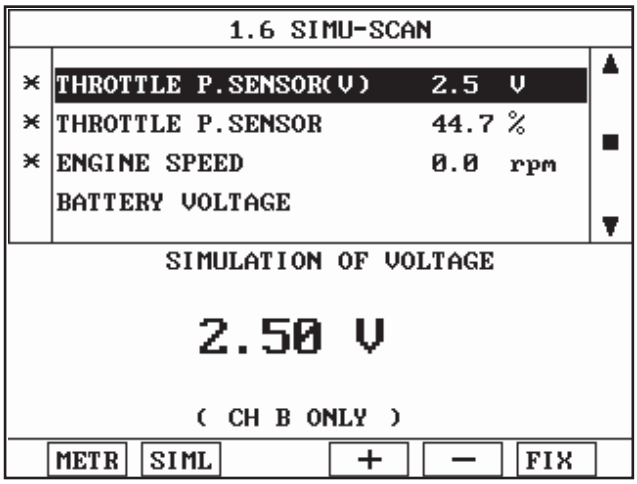
2. Check ECM.

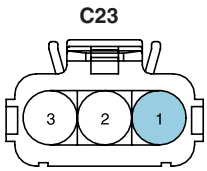
1) Key "OFF".

2) Connect the scantool and select "Simulation SCAN" in the menu.

3) Connect channel A of scantool with terminal 1 of TPS harness connector, and key "ON".

4) Simulate voltage at signal line.





1. **Sensor signal**
2. Sensor power
3. Sensor ground

LFJF402A

5) Does the signal output of TPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED6BD017

Refer to DTC P0121.

DTC P0124 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT INTERMITTANT

COMPONENT LOCATION EDF4C782

Refer to DTC P0121.

GENERAL DESCRIPTION EFEE05DF

Refer to DTC P0121.

DTC DESCRIPTION EFACED33

If the difference between modeled relative load and measured relative load is over the threshold value according to throttle position under enable conditions, ECM sets DTC P0124.

DTC DETECTING CONDITION E8A7A6A7

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • TPS • ECM
Enable Conditions	• Rate of change of throttle angle 〈 0.1221% • Engine speed 〉 600rpm • Coolant temperature 〉 75℃ • Rate of change of predicted eng. load 〈 15% • Altitude 〉 0m • Time in idling 〉 30s	
Threshold Value	• Difference between modeled relative load and measured relative load 〉 threshold f(throttle position)	
Diagnostic Time	• 2.5sec	
MIL ON Condition	• DTC only	

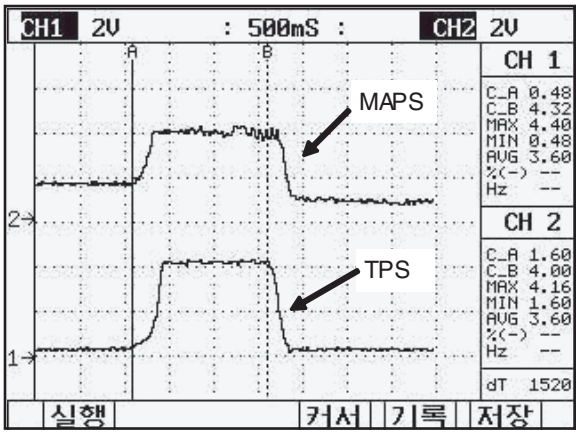
SPECIFICATION EB0595D1

Refer to DTC P0121.

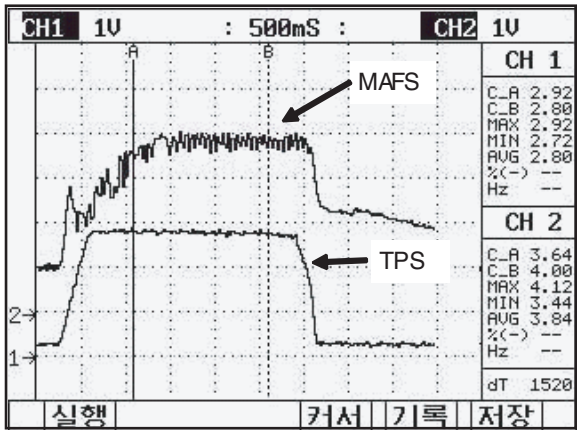
SCHEMATIC DIAGRAM E4D7839C

Refer to DTC P0121.

SIGNAL WAVEFORM & DATA E16571DD



1.4 DOHC

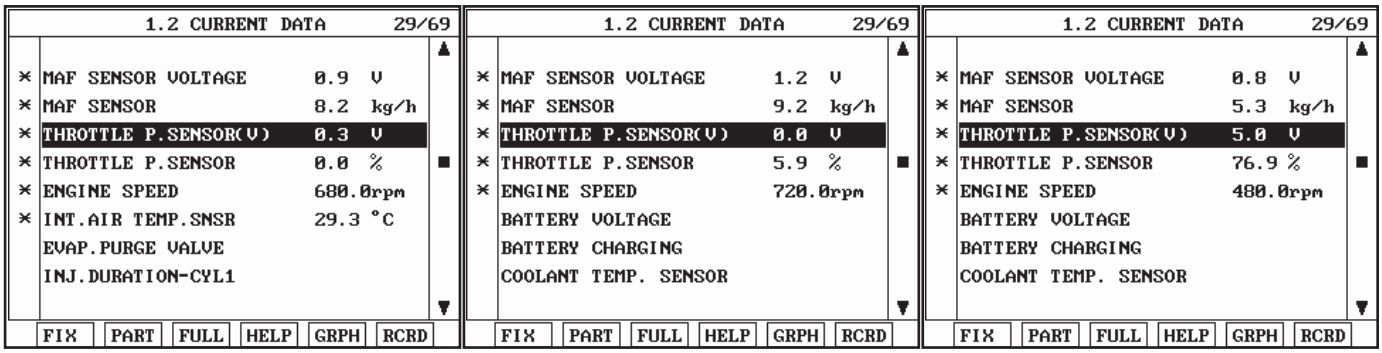


1.6 CVVT

LFJF414A

MONITOR SCANTOOL DATA E27A3E77

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "TPS" parameters on the scantool.



Normal state | Abnormal(Short to ground) | Abnormal(Open or Short to power)

LFJF415A

4. Is parameter displayed within specifications?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EA7A9103

Refer to DTC P0121.

TPS CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect TPS connector.
3. Ignition "ON"
4. Measure voltage between terminal "1","2" and "3" of sensor harness connector and chassis ground

Specification :
Terminal 1 : Approx. 5V
Terminal 2 : Approx. 5V
Terminal 3 : Approx. 0V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check for Open or Short in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE9754D4

1. Check TPS.
   1) Ignition "OFF"
   2) Disconnect TPS connector
   3) Measure resistance terminal 2 and 3 of TPS Component side connector.

SPECIFICATION :

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)

   4) Is the measured resistance within specifications?

YES

▶ Go to "Check ECM" procedure.

NO

▶ Check TPS for contamination, deterioration, or damage. Substitute with a known-good TPS andcheck for proper operation. If the problem is corrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

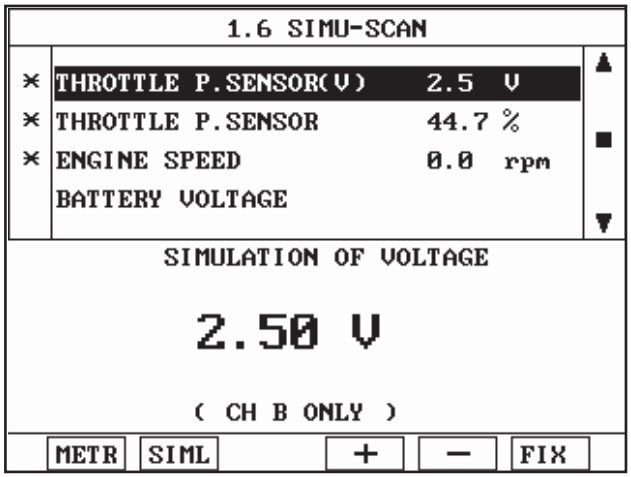
2. Check ECM.

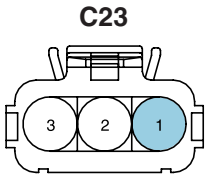
1) Ignition "OFF"

2) Connect scantool and select "Simulation SCAN" in the menu.

3) Connect channel A of scantool with terminal 1 of TPS harness connector, and key "ON".

4) Simulate voltage at signal line.





1. Sensor signal
2. Sensor power
3. Sensor ground

LFJF419A

5) Is TPS signal value changed according to simulation voltage?

YES

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

NO

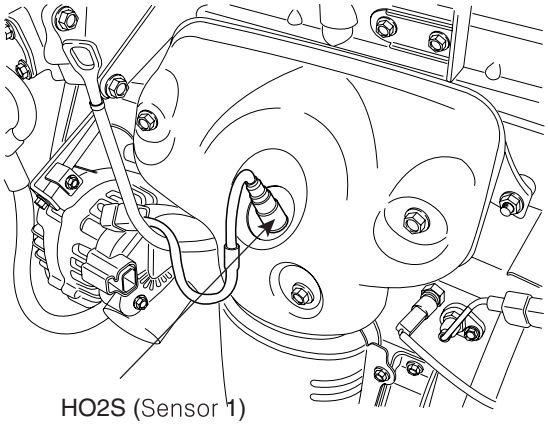
▶ Substitute with a known-good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4C48938

Refer to DTC P0121.

DTC P0130 HO2S CIRCUIT (BANK 1/ SENSOR 1)

COMPONENT LOCATION E4434C7B



LFJF800A

GENERAL DESCRIPTION E4A9CC4D

The heated oxygen sensors are mounted on the front side and the rear sied of Catalytic Converter (warm-up catalytic converter), which detects the oxygen concentration in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The heated oxygen snesor (HO2S) produces a voltage that varies between 0V and 1V. When the air/fuel ratio is lean, the oxygen concentration in the exhaust gas increases and the front HO2S outputs a low voltage (approximately 0 ~ 0.1 V).When the air/fuel ratio is rich, the oxygen concentration in the exhaust gas decreases and the front HO2S output a high voltage (approximately 0.8 ~ 1 V). The ECM constantly monitors the HO2S and increases or decreases the fuel injection duration by using the HO2S signal, which is called closed-loop fuel control operation.

DTC DESCRIPTION EB711736

If ECM detects that the output signal satisfies the threshold values under enable conditions, ECM sets DTC P0130.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E3D42EA0

Item		Detecting Condition	Possible Cause
DTC Strategy		• Rationality check	• Poor connection • Open or short power/ground in signal circuit • B1S1 • ECM
General Enable Conditions		• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled	
Case1	Enable Conditions	• B1S2 sensor voltage 〉 0.5V	
	Threshold Value	• B1S1 sensor voltage : 0.06 ~ 0.4V	
	Diagnostic Time	• 25 sec	
Case2	Enable Conditions	• B1S2 sensor voltage 〈 0.1V	
	Threshold Value	• B1S1 sensor voltage : 0.6 ~ 1.08V	
	Diagnostic Time	• 10 sec	
Case3	Enable Conditions	• Time after dew point end detected 〉 10s	
	Threshold Value	• Counter of l △usvk 〉 2V during 0.04 secafter heater on→off l 〉 5 times	
MIL ONCondition		• 2 driving cycle	

※△usvk : Sum of the signal voltage change value (B1S1)
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

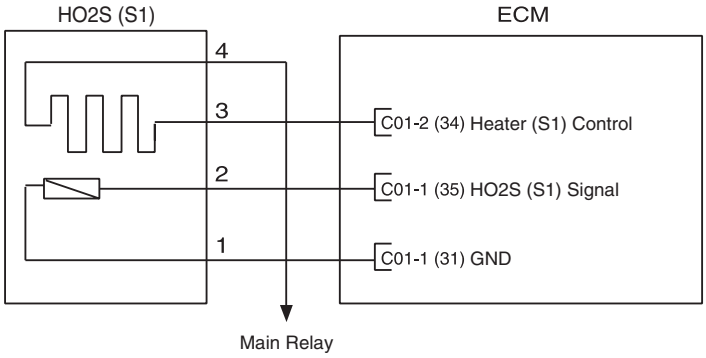
SPECIFICATION E73A2DF2

Specification	0.1 ~ 0.9V

SCHEMATIC DIAGRAM E474C9DD

(A/T)

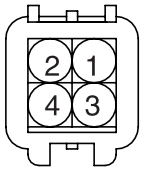
[CIRCUIT DIAGRAM]



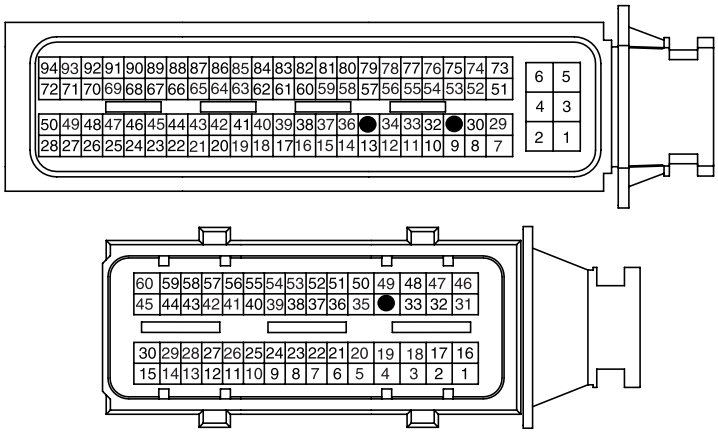
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-2 (31)	Sensor Ground
2	ECM C01-1 (35)	HO2S (S1) Signal
3	ECM C01-2 (34)	Heater (S1) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



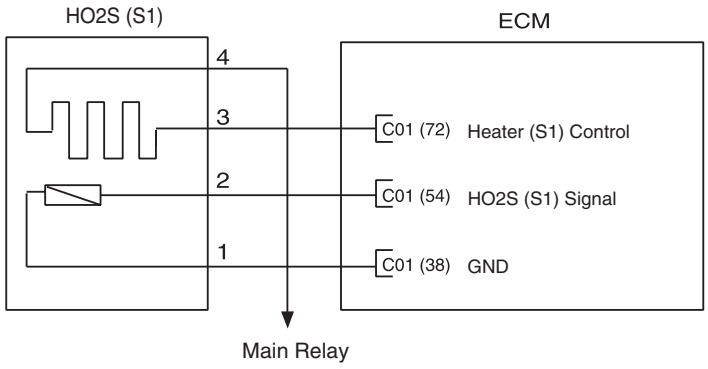
HO2S [S1] (C18)



LFJF317A

(M/T)

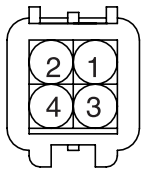
[CIRCUIT DIAGRAM]



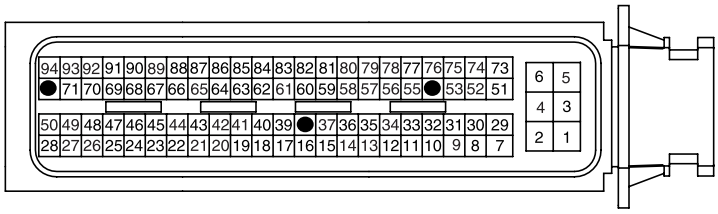
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (38)	Sensor Ground
2	ECM C01 (54)	HO2S (S1) Signal
3	ECM C01 (72)	Heater (S1) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



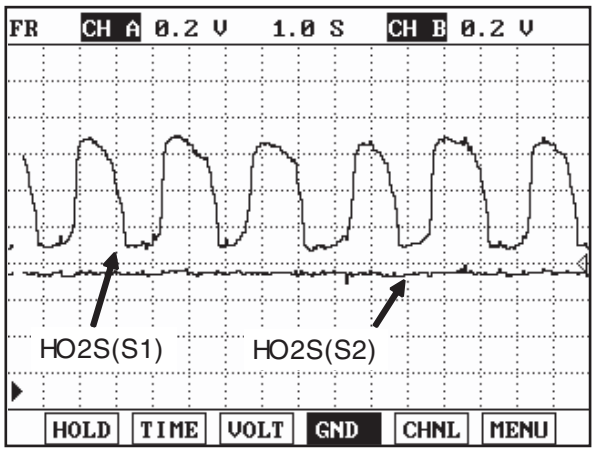
HO2S [S1] (C18)



ECM (C01)

LFJF317B

SIGNAL WAVEFORM & DATA EAC074C0



If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O2 sensor service data in the Hi-Scan (Pro) will display values 200mV or lower.
When you suddenly press on the accelerator pedal down, the voltage will reach 0.6 ~ 1.0 V.
When you let the engine idle again, the voltage will fluctuate between 200 mV or lower and 0.6 ~ 1.0 V.
In this case, the O2sensor can be determined as good.

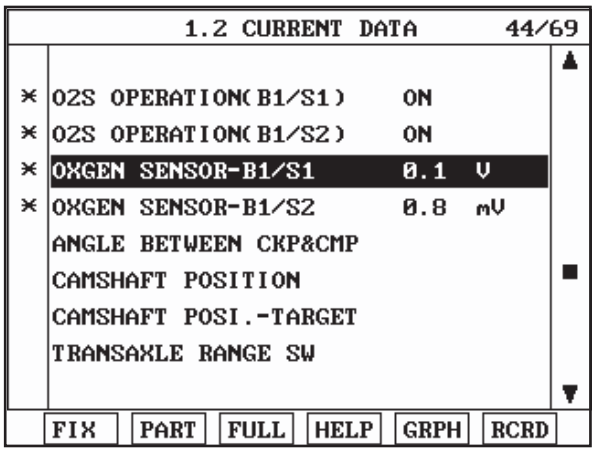
LFJF421A

MONITOR SCANTOOL DATA E0674FEE

1. Connect scantool to DLC (Data Link Cable).

2. Warm up the engine to normal operating temperature.

3. Monitor "HO2S(B1S1)" parameter on scantool.



LFJF422A

4. Is the "HO2S(B1S1)" parameter operating correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or ECM’s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

NOTE

This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.

TERMINAL AND CONNECTOR INSPECTION EEA1B2E3

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

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

NO

▶ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION E4A8AC2E

1. IG "OFF".

2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S1) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Groud Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION EA820780

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. Measure resistance between terminal 1 of HO2S(B1/S1) and chassis ground.

Specification : Approx. below 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E372D16B

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S1) connector.
   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

YES

▶ Go to "Check HO2S(B1/S1) performance" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.

▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

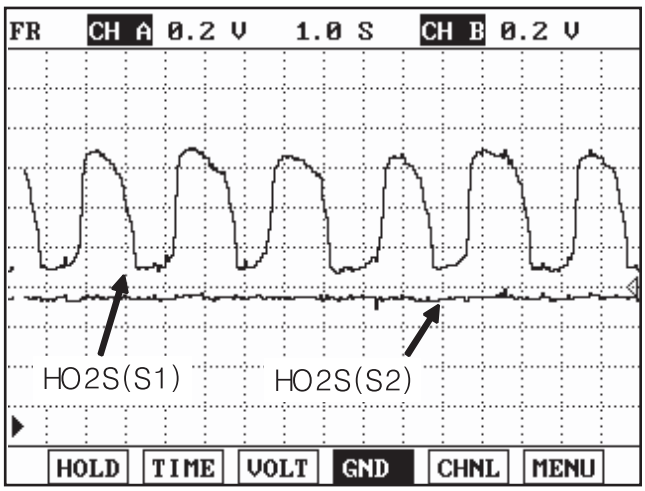
2. Check HO2S(B1/S1) performance.

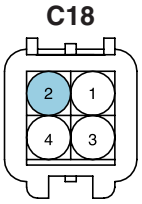
1) IG "OFF".

2) Connect probe to terminal 2 of HO2S(B1/S1) connector and select oscilloscope function with scantool.

3) Warm up the engine to normal operating temperature.

4) Measure signal waveform of HO2S(B1/S1) with scantool.





1. Sensor Ground
2. **Sensor(B1S1) Signal**
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

LFJF425A

5) Is the measured signal waveform within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

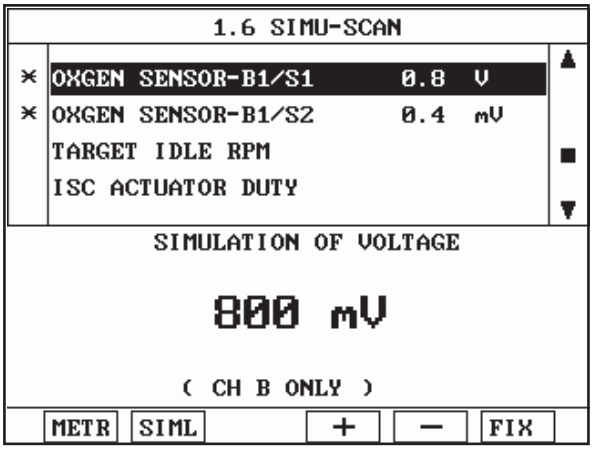
3. Check ECM.

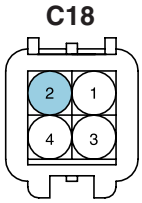
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1/S1) signal connector.





1. Sensor Ground
2. **Sensor(B1S1) Signal**
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

LFJF426A

5) Does the signal value of HO2S(B1/S1) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7668EEB

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0131 HO2S CIRCUIT LOW VOLTAGE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E27BFA0D

Refer to DTC P0130.

GENERAL DESCRIPTION E3A29FD9

Refer to DTC P0130.

DTC DESCRIPTION E99D3962

If the sensor output is below 0.06 V under enable conditions, ECM sets DTC P0131.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E90F2F52

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, low	• Poor connection • Short to ground in signal circuit • B1S1 • ECM
General Enable Conditions		• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled	
Case1	Enable Conditions	• B1S2 sensor voltage 〉 0.5V	
	Diagnostic Time	• Counter of | △ throttle angle 〉 30% | ≥ 3 times	
Case2	Enable Conditions	• Sensor in cold condition	
	Diagnostic Time	• 0.1 sec	
Case3	Threshold Value	• Sensor voltage 〈 0.06V	
MIL ONCondition		• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E392110E

Specification	0.1 ~ 0.9V

SCHEMATIC DIAGRAM E08793DC

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA E8200A4C

Refer to DTC P0130.

MONITOR SCANTOOL DATA E829B2B9

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION E4FA44D6

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION EA9D2FB3

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S1) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E8CDB694

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S1) connector.
   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

      YES

      ▶ Go to "Check HO2S(B1/S1) performance" as follows.

      NO

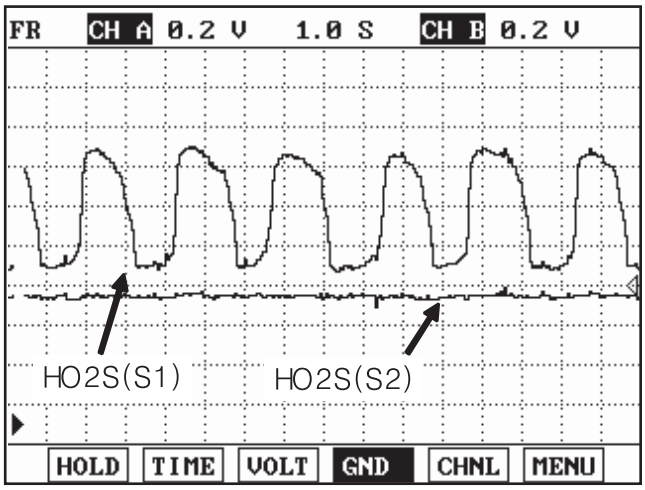
      ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
      ▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.
2. Check HO2S(B1/S1) performance.

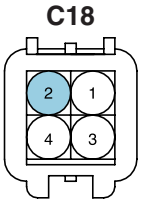
1) IG "OFF".

2) Connect probe to terminal 2 of HO2S(B1/S1) connector and select oscilloscope function with scantool.

3) Warm up the engine to normal operating temperature.

4) Measure signal waveform of HO2S(B1/S1) with scantool.





1. Sensor Ground
2. **Sensor(B1S1) Signal**
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

LFJF425A

5) Is the measured signal waveform within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

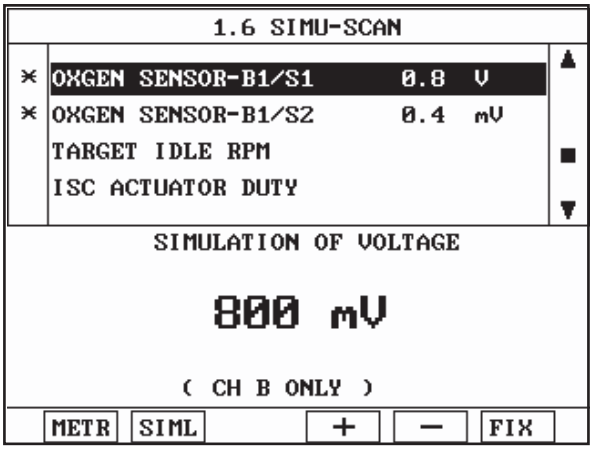
3. Check ECM.

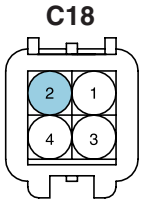
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1/S1) signal connector.





1. Sensor Ground
2. **Sensor(B1S1) Signal**
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

LFJF426A

5) Does the signal value of HO2S(B1/S1) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5B6BAB1

Refer to DTC P0130.

DTC P0132 HO2S CIRCUIT HIGH VOLTAGE (BANK 1 / SENSOR 1)

COMPONENT LOCATION EBBC8C8A

Refer to DTC P0130.

GENERAL DESCRIPTION E1D8BBDC

Refer to DTC P0130.

DTC DESCRIPTION E29D11C4

If the sensor output is over 1.08 V under enable conditions, ECM sets P0132.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E15F8FD9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Short to battery in signal circuit • B1S1 • ECM
Enable Conditions	• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled	
Threshold Value	• B1S1 sensor voltage 〉 1.08V	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E5093F23

Refer to DTC P0130.

SCHEMATIC DIAGRAM E8235F6D

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA E3D4532C

Refer to DTC P0130.

MONITOR SCANTOOL DATA E8F6E90A

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION E6E53830

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION EC799324

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S1) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E084D031

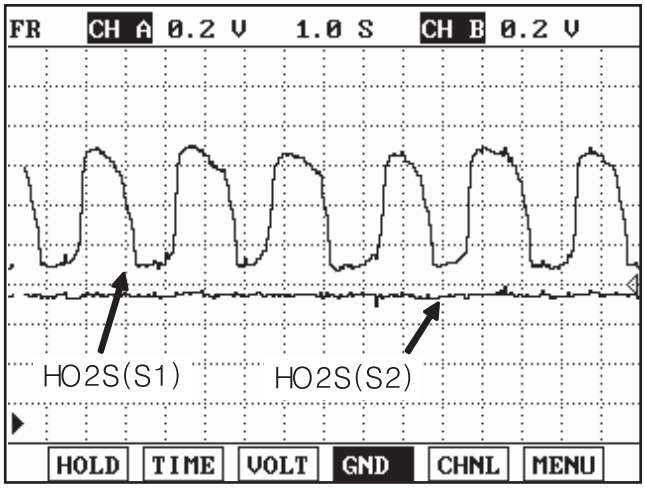
1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S1) connector.
   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

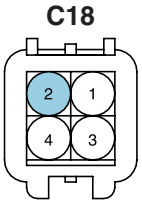
      YES

      ▶ Go to "Check HO2S(B1/S1) performance" as follows.

      NO

      ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
      ▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.
2. Check HO2S(B1/S1) performance.
   1) IG "OFF".
   2) Connect probe to terminal 2 of HO2S(B1/S1) connector and select oscilloscope function with scantool.
   3) Warm up the engine to normal operating temperature.
   4) Measure signal waveform of HO2S(B1/S1) with scantool.





1. Sensor Ground
2. **Sensor(B1S1) Signal**
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

LFJF425A

5) Is the measured signal waveform within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

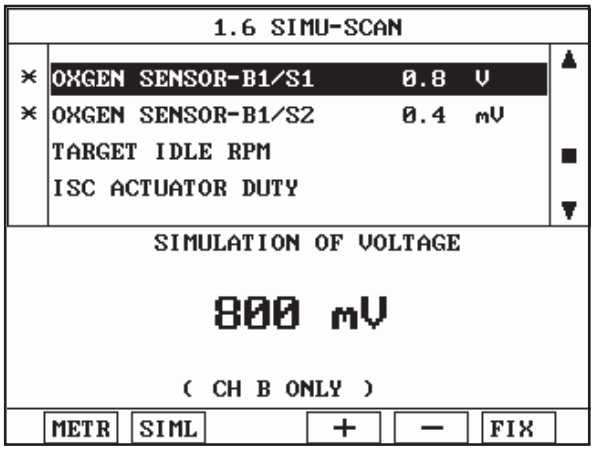
3. Check ECM.

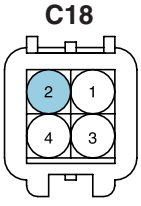
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1/S1) signal connector.





1. Sensor Ground
2. **Sensor(B1S1) Signal**
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

LFJF426A

5) Does the signal value of HO2S(B1/S1) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E032C26D

Refer to DTC P0130.

DTC P0133 HO2S CIRCUIT SLOW RESPONSE (BANK 1 / SENSOR 1)

COMPONENT LOCATION EFE63C4A

Refer to DTC P0130.

GENERAL DESCRIPTION E266EE6A

Refer to DTC P0130.

DTC DESCRIPTION E4447450

If there is abnormal response rate of HO2S under enable conditions, ECM sets DTC P0133.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E394F4C4

Item	Detecting Condition	Possible Cause
DTC Strategy	• Response rate	• Poor connection • leak or clog in intake air system • Injector • Fuel pressure • B1S1 • ECM
Enable Conditions	• Engine speed 1800～2800rpm • Engine load 30～65% • Exhaust gas temperature (model) 〉 450℃	
Threshold Value	• Cycle period of B1S1 signal 〉 3 sec	
Diagnostic Time	• 12 cycle	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION EF21619F

Refer to DTC P0130.

SCHEMATIC DIAGRAM ECB2810E

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA E7249F40

Refer to DTC P0130.

MONITOR SCANTOOL DATA E9897E88

Refer to DTC P0130.

SYSTEM INSPECTION EF4DEBF2

1. Check leakage or clog of air.

1) Check contamination, clog and installation of gasket
   - ▶ Any damage or installation of throttle body gasket.
   - ▶ Any damage or installation of gasket between intake manifold and surge tank.
   - ▶ Clog or contamination of intake manifold and injector by foreign materials
   - ▶ Contamination and open stuck between surge tank and PCSV by foreign materials
   - ▶ Any damage or contamination of HO2S(B1/S1) by foreign materials.

2) Has a problem been found?

YES

▶ Go to " Check Fuel Line" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check Fuel Line.

1) Check Clog, contamination and installation of Fuel Line as follows.
   - ▶ Connection for each connectors in Fuel Line.
   - ▶ Damage, interference and installation of vaccum hose connected to Fuel Line.
   - ▶ Bend, Leakage and squeeze of pipe in Fuel Line.

2) Has a problem been found?

YES

▶ Go to "Check Fuel Pressure" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

3. Check Fuel Pressure.

1) IG "OFF".

2) Disconnect fuel pump relay from junction box in passenger compartment.

3) Start engine and await until engine is off and then, IG "OFF".

4) Connect fuel pump relay again.

5) Connect fuel pressure gauge on the fuel filter with fuel pressure gauge adaptor.

6) Start engine again and measure fuel pressure.

NOTE

Refer to "FUEL PRESSURE TEST" in FUEL DELIVERY SYSTEM.

Specification : Approx. 3.5 kg/cm²

7) Is the fuel pressue normal?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check any damage of fuel return hose or pipe.
▶ Check any stuck of the valve in the fuel pressure regulator.
▶ Repair or replace as necessary and then, go to 'Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EF6BC5ED

1. Check PCV.

   1) IG "OFF"

   2) Disconnect PCV.

   3) Check that PCV is properly operating.

   4) Is the PCV O.K?

      YES

      ▶ Go to "Check PCSV" as follows.

      NO

      ▶ Substitute with a known - good PCV and check for proper operation.
      ▶ If the problem is corrected, replace PCV and go to "Verification of Vehicle Repair" procedure.

2. Check the PCSV.

   1) Ignition "OFF".

   2) Disconnect PCSV and Vacuum Hose.

   3) Apply vacuum on PCSV with Hand Vacuum Gauge.

   4) Is the PCSV keeping the Vacuum?

      YES

      ▶Go to "Check Injector" as below.

      NO

      ▶Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check Injector.

   1) Ignition "OFF"

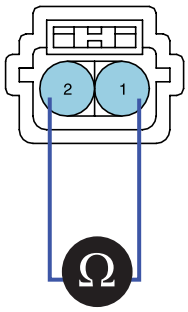
   2) Remove Injector.

   3) Check Leakage and clog on Injector.

   4) Measure resistance terminal 1 and 2 of Injector connector(Component side).

SPECIFICATION :

Temperature [℃]	Resistance [Ω]
20	14.5 ± 0.7 Ω



1. Injector Power
2. Injector control

LFJF438A

5) Is the measured resistance within specifications?

YES

▶ Go to "Check sensors related to Fuel Trim " as below.

NO

▶ Substitute with a known-good Injector and check for proper operation. If the problem is corrected, replace Injector and then go to "Verification of Vehicle Repair" procedure.

4. Check Sensors related to Fuel Trim.

1) Check the Input Voltage of Sensors related to Fuel Trim(MAPS, TPS, ECTS, PCSV, Injector, and etc) - Refer to Trouble Shooting Guide -

2) Are the sensors related to Fuel Trim O.K?

YES

▶ Go to "Check ECM" as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

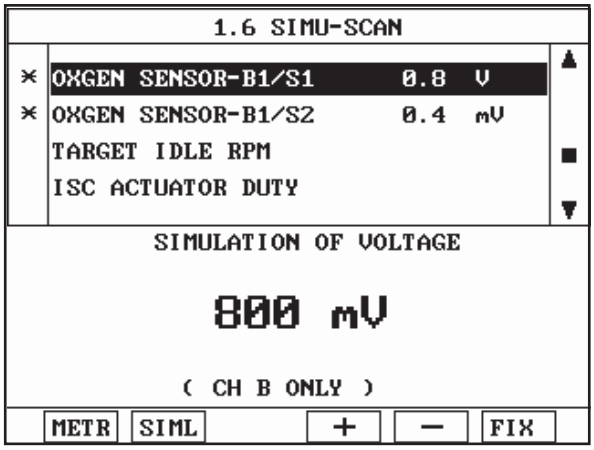
5. Check ECM.

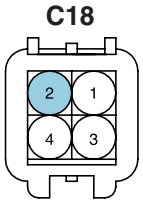
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1S1) sensor signal connector.





1. Sensor Ground
2. **Sensor(B1S1) Signal**
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

LFJF426A

5) Is the HO2S(B1/S1) signal value changed according to simulation voltage ?

YES

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

NO

▶ Substitute with a known-good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED16E896

Refer to DTC P0130.

DTC P0134 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 1 / SENSOR 1)

COMPONENT LOCATION E26AC77D

Refer to DTC P0130.

GENERAL DESCRIPTION E38D531E

The heated oxygen sensors are mounted on the front side and the rear sied of Catalytic Converter (warm-up catalytic converter), which detects the oxygen concentration in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The heated oxygen snesor (HO2S) produces a voltage that varies between 0V and 1V. When the air/fuel ratio is lean, the oxygen concentration in the exhaust gas increases and the front HO2S outputs a low voltage (approximately 0 ~ 0.1 V).When the air/fuel ratio is rich, the oxygen concentration in the exhaust gas decreases and the front HO2S output a high voltage (approximately 0.8 ~ 1 V). The ECM constantly monitors the HO2S and increases or decreases the fuel injection duration by using the HO2S signal, which is called closed-loop fuel control operation.

DTC DESCRIPTION EA0C8F78

If the signal output satisfies the threshold value under enable conditions, ECM sets DTC P0134.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION EA93F64E

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, wiring interruption	• Poor connection • Open or short in signal circuit • B1S1 • ECM
General Enable Conditions		• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled	
Case1	Enable Conditions	• Time after fuel cut-off 〉 3.0s • B1S2 sensor voltage 〉 0.2V	
	Diagnostic Time	• 0.1 sec	
	Threshold Value	• Counter of ∣△ throttle angle 〉 30%∣≥ 3 times	
Case2	Threshold Value	• Sensor voltage : 0.4~0.6V	
	Diagnostic Time	• 5 sec	
Case3	Enable Conditions	• Exhaust gas temperature (model) 〉 600℃	
	Threshold Value	• Internal resistance 〉 20 kΩ	
MIL ONCondition		• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E2062AA7

Refer to DTC P0130.

SCHEMATIC DIAGRAM EFCF781A

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA EAC3B81F

Refer to DTC P0130.

MONITOR SCANTOOL DATA EAB41E95

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION EC0D8DDC

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION E5F28AE9

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S1) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Groud Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION E0F71B45

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. Measure resistance between terminal 1 of HO2S(B1/S1) and chassis ground.

Specification : Approx. below 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EB8FCA49

1. Visual Inspection.

   1) IG "OFF"

   2) Disconnect HO2S(B1/S1) connector.

   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.

   4) Has a problem been found?

   YES

   ▶ Go to "Check HO2S(B1/S1) performance" as follows.

   NO

   ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
   ▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

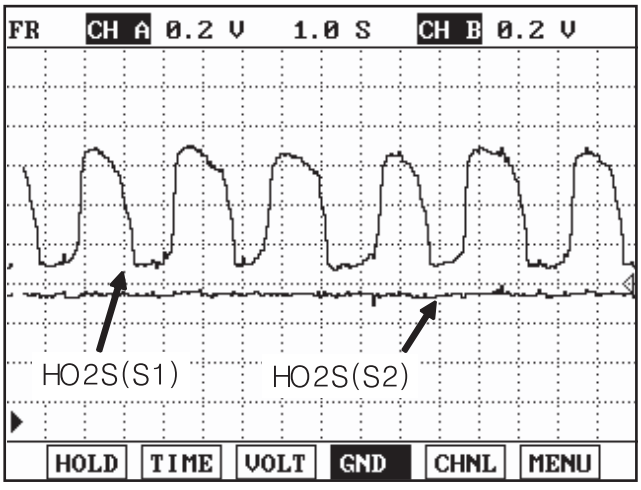
2. Check HO2S(B1/S1) performance.

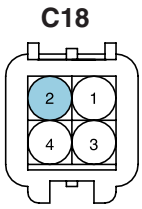
   1) IG "OFF".

   2) Connect probe to terminal 2 of HO2S(B1/S1) connector and select oscilloscope function with scantool.

   3) Warm up the engine to normal operating temperature.

   4) Measure signal waveform of HO2S(B1/S1) with scantool.





1. Sensor Ground
2. HO2S(B1S1) Signal
3. HO2S(B1S1) Heater control
4. HO2S(B1S1) Heater Power

LFJF443A

   5) Is the measured signal waveform within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

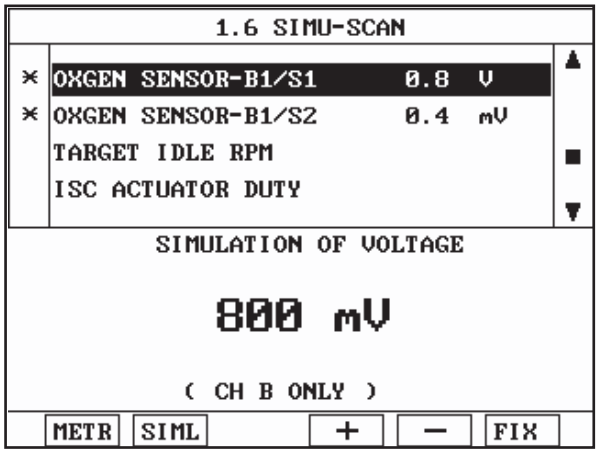
3. Check ECM.

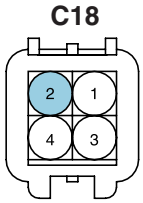
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1/S1) signal connector.





1. Sensor Ground
2. HO2S(B1S1) Signal
3. HO2S(B1S1) Heater control
4. HO2S(B1S1) Heater Power

LFJF444A

5) Does the signal value of HO2S(B1/S1) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E86A05B1

Refer to DTC P0130.

DTC P0135 HO2S HEATER CIRCUIT (BANK 1 / SENSOR 1)

COMPONENT LOCATION EF0DB8FF

Refer to DTC P0130.

GENERAL DESCRIPTION E4B02E04

Refer to DTC P0130.

DTC DESCRIPTION EA909848

If ECM detects that the internal resistance of heater is out of threshold value, ECM sets DTC P0135.

DTC DETECTING CONDITION E0C89DA5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Heater current check	• Poor connection • Open or short to ground in control circuit • B1S1 • ECM
Enable Conditions	• Exhaust gas temperature (model) 200～550 ℃ • Intake air temperature 〉 -7 ℃ • Battery voltage 10.7～16.1 V	
Threshold Value	• Internal resistance 〉 threshold f(exh. temp., heater power)	
Diagnostic Time	• Above 15 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

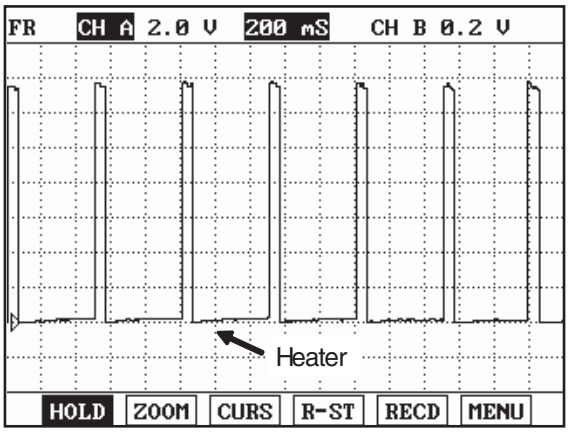
SPECIFICATION EF374E01

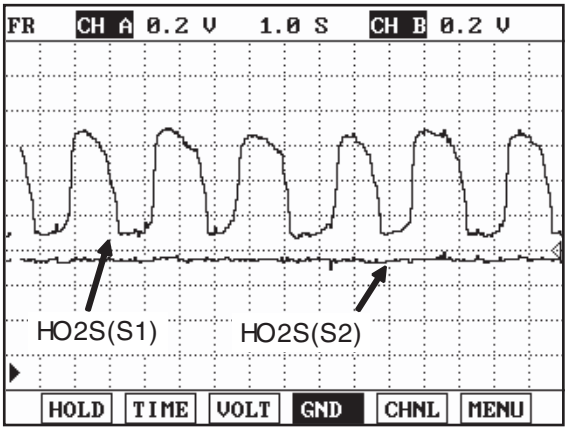
ITEM	Specification
Heater Resistance	Approx. 9.0Ω

SCHEMATIC DIAGRAM EE18C6DE

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA EF06160B



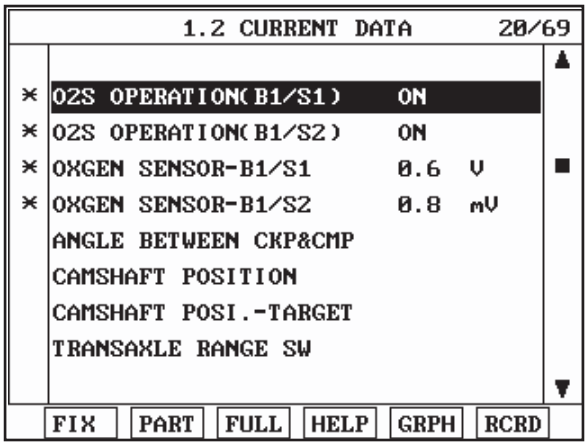


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

LFJF445A

MONITOR SCANTOOL DATA EB48DE1F

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S1)" parameter on scantool.



LFJF446A

4. Is the "HO2S(B1S1)" parameter displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EEB9B21A

Refer to DTC P0130.

POWER CIRCUIT INSPECTION EBBA8CE4

1. IG "OFF".
2. Disconnect HO2S(B1S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 4 of HO2S (B1S1) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E258A37A

1. IG "OFF".
2. Disconnect HO2S(B1S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(B1S1) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3FB9CAE

1. Check Heater resistance.
   1) IG "OFF".
   2) Disconnect HO2S(B1S1) connector.
   3) Measure resistance bwteen terminal 3 and 4 of HO2S(B1S1) connector.(Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance	Approx. 9.0Ω

4) Is the measured resistance within specification ?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

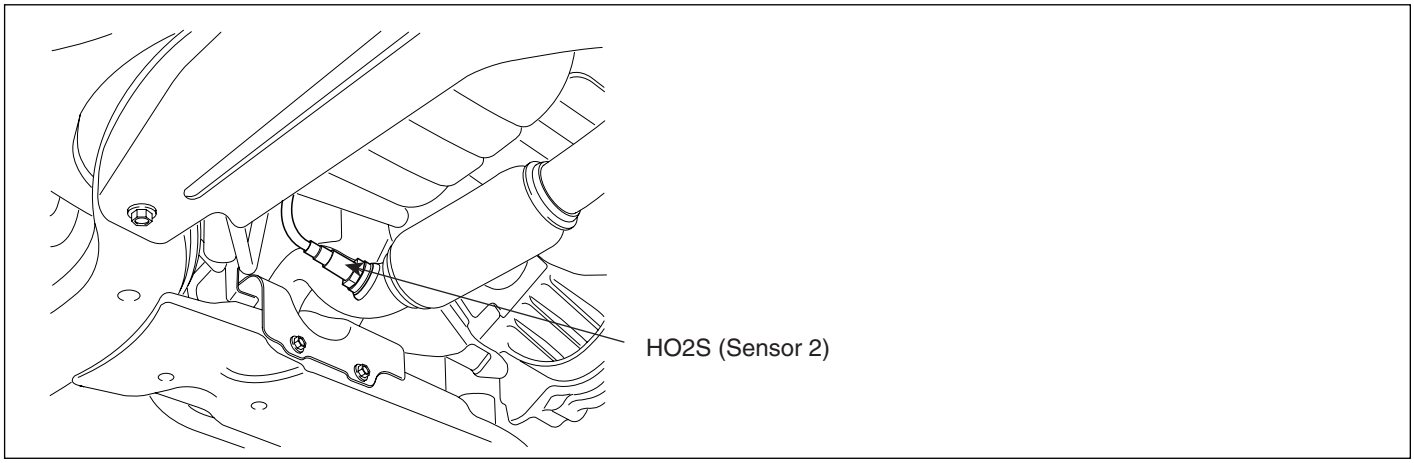
- ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E631F502

Refer to DTC P0130.

DTC P0136 HO2S CIRCUIT (BANK 1/ SENSOR 2)

COMPONENT LOCATION E3AA82BC



LFJF800E

GENERAL DESCRIPTION E43AF86A

HO2S(B1/S2) is in the rear side of Catalytic Converter to check the proper operation of catalyst. Oxygen density after the catalytic converter has to be within specific range (around 0.5V when there is no acceclation and deceleration.)If the oxygen density changes in accordance with HO2S(B1/S1), it means the poor performance of catalytic converter.

DTC DESCRIPTION EA14778C

In case the sensor output is 0.4~0.52 V during 600sec or the internal resistance is over 40 kΩ under enable conditions, ECM sets DTC P0136.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E31128AF

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, wiring interruption	• Poor connection • Open or short in signal circuit • B1S2 • ECM
General Enable Conditions		• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃	
Case1	Threshold Value	• Sensor voltage : 0.4~0.52 V	
	Diagnostic Time	• 600 sec	
Case2	Enable Conditions	• Catalyst temperature (model) 〉 600 ℃	
	Threshold Value	• Internal resistance 〉 40 kΩ	
MIL ONCondition		• 2 driving cycle	

※ B1S2 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

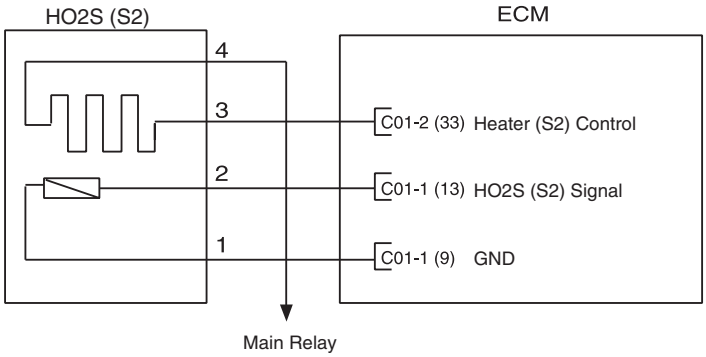
SPECIFICATION EF305400

Specification	0.1 ~ 0.9V

SCHEMATIC DIAGRAM EC07E94D

(A/T)

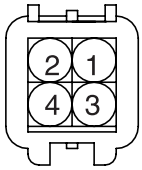
[CIRCUIT DIAGRAM]



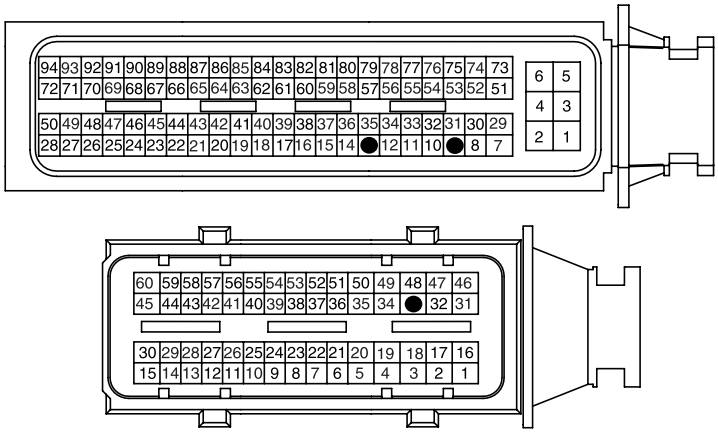
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (9)	Sensor Ground
2	ECM C01-1 (13)	HO2S (S2) Signal
3	ECM C01-2 (33)	Heater (S2) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



HO2S [S2] (C17)

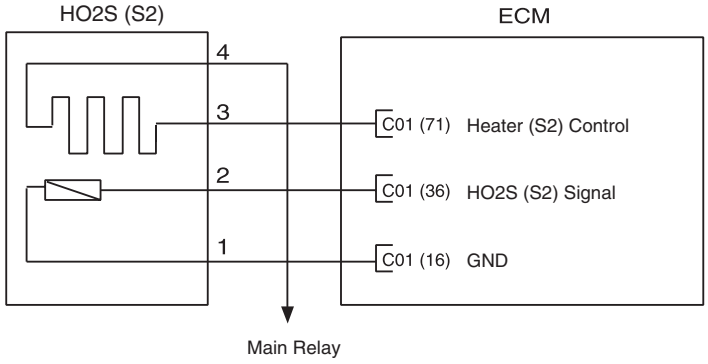


ECM

LFJF324A

(M/T)

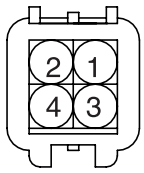
[CIRCUIT DIAGRAM]



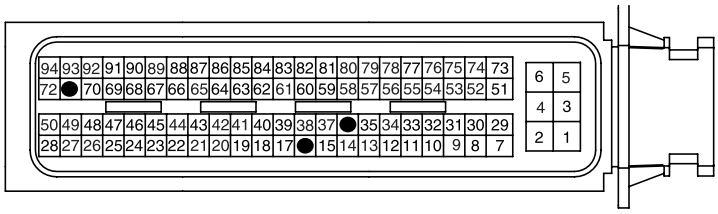
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (16)	Sensor Ground
2	ECM C01 (36)	HO2S (S2) Signal
3	ECM C01 (71)	Heater (S2) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



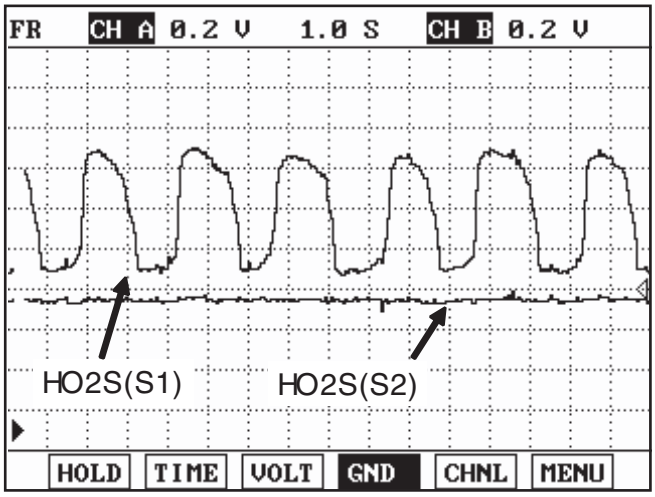
HO2S [S2] (C17)



ECM (C01)

LFJF324B

SIGNAL WAVEFORM & DATA E9439D0D



The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter.
This is the normal signal waveform of the rear HO2S at idle.

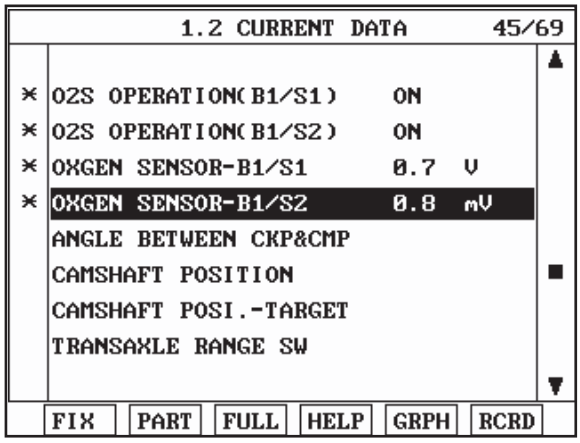
LFJF451A

MONITOR SCANTOOL DATA E4220B1D

1. Connect scantool to DLC (Data Link Cable).

2. Warm up the engine to normal operating temperature.

3. Monitor "HO2S(B1S2)" parameter on scantool.



LFJF452A

4. Is the "HO2S(B1S2)" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or ECM’s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

NOTE

This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.

TERMINAL AND CONNECTOR INSPECTION E5C81D6D

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

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

NO

▶ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION E88C90C1

1. IG "OFF".

2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Groud Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION E547CA76

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. Measure resistance between terminal 1 of HO2S(B1/S2) and chassis ground.

Specification : Approx. below 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2647D14

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S2) connector.
   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.

▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

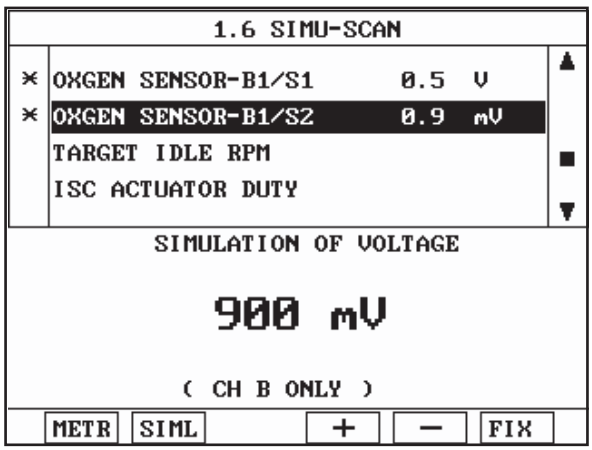
2. Check ECM.

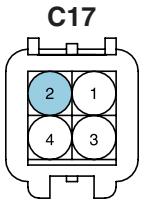
   1) IG "OFF" and disconnect B1S2 connector.

   2) Connect scantool and Key "ON".

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal 2 of HO2S(B1/S2) signal connector.





1. Sensor Ground
2. Sensor(B1S2) Signal
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

LFJF455A

   5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

   YES

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known - good ECM and check for proper operation.
   ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EB1D8552

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

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.

3. Are any DTCs present ?

   YES

   ▶ Go to the applicable troubleshooting procedure.

   NO

   ▶ System is performing to specification at this time.

DTC P0137 HO2S CIRCUIT LOW VOLTAGE (BANK 1 / SENSOR 2)

COMPONENT LOCATION EAC63AAA

Refer to DTC P0136.

GENERAL DESCRIPTION EB154174

Refer to DTC P0136.

DTC DESCRIPTION E37ECB8A

If the sensor output is below 0.06V under enable conditions, ECM sets DTC P0137.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION EDB8C486

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, low	• Poor connection • Short to ground in signal circuit • B1S2 • ECM
General Enable Conditions		• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃	
Case1	Enable Conditions	• Engine speed : 1000 ~ 3800 rpm • Engine load : 18 ~ 60%	
	Threshold Value	• B1S2 sensor voltage 〈 0.06 V	
	Diagnostic Time	• 25 sec	
Case2	Enable Conditions	• Sensor in cold condition	
	Threshold Value	• B1S2 sensor voltage 〈 0.06 V	
	Diagnostic Time	• 0.1 sec	
MIL ONCondition		• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION EA2BF360

Refer to DTC P0136.

SCHEMATIC DIAGRAM E33B7643

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA EB62C793

Refer to DTC P0136.

MONITOR SCANTOOL DATA E8BABF95

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION E280AA8B

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E58AD3AB

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E50D0C22

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S2) connector.
   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

YES

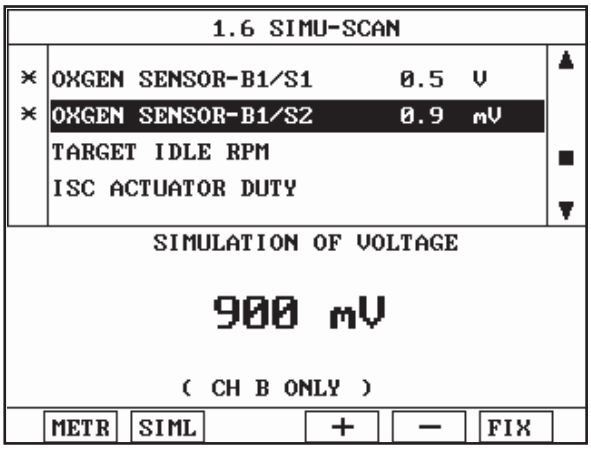
▶ Go to "Check ECM" as follows.

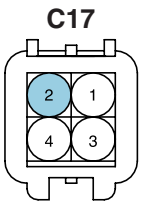
NO

▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) IG "OFF" and disconnect B1S2 connector.
   2) Connect scantool and Key "ON".
   3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1/S2) signal connector.





1. Sensor Ground
2. Sensor(B1S2) Signal
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

LFJF455A

5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFC62BE1

Refer to DTC P0136.

DTC P0138 HO2S CIRCUIT HIGH VOLTAGE (BANK 1 / SENSOR 2)

COMPONENT LOCATION EDD93FAF

Refer to DTC P0136.

GENERAL DESCRIPTION E4724E41

Refer to DTC P0136.

DTC DESCRIPTION E5CA6E97

If the sensor output is over 1.08V under enable conditions, ECM sets DTC P0138.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E1DCAC22

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Short to power in signal circuit • B1S2 • ECM
Enable Conditions	• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃	
Threshold Value	• B1S2 sensor voltage 〉 1.08 V	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION EBB0E931

Refer to DTC P0136.

SCHEMATIC DIAGRAM E0324502

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA E5C13C0C

Refer to DTC P0136.

MONITOR SCANTOOL DATA EAE6989C

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION E46F98C8

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E9EE53E4

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E542FA8B

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S2) connector.
   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

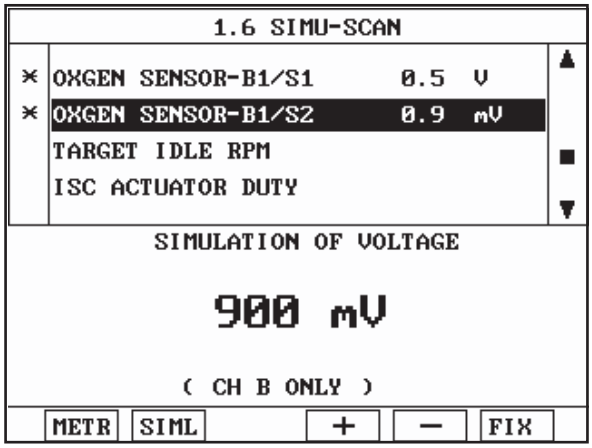
YES

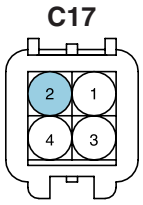
▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) IG "OFF" and disconnect B1S2 connector.
   2) Connect scantool and Key "ON".
   3) Select simulation function on scantool.
   4) Simulate voltage at terminal 2 of HO2S(B1/S2) signal connector.





1. Sensor Ground
2. Sensor(B1S2) Signal
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

LFJF455A

5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E75457F4

Refer to DTC P0136.

DTC P0139 HO2S CIRCUIT SLOW RESPONSE (BANK 1 / SENSOR 2)

COMPONENT LOCATION E33342CA

Refer to DTC P0136.

GENERAL DESCRIPTION EC250E7A

Refer to DTC P0136.

DTC DESCRIPTION EAED158B

If the sensor output is over 0.15 V under enable conditions, ECM sets DTC P0139.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION EF9470E6

Item	Detecting Condition	Possible Cause
DTC Strategy	• Response rate	• Poor connection • leak or clog in intake air system • Injector • Fuel pressure • B1S2 • ECM
Enable Conditions	• Time after fuel cut-off 〉 5 s • Integrated air mass after fuel cut-off 〉 15 g • Time after dew point end detected 〉 30 s	
Threshold Value	• B1S2 sensor voltage 〉 0.15 V	
Diagnostic Time	• 0.2 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E285EC61

Refer to DTC P0136.

SCHEMATIC DIAGRAM E1B13848

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA E09DC262

Refer to DTC P0136.

MONITOR SCANTOOL DATA E1FB7F7E

Refer to DTC P0136.

SYSTEM INSPECTION EBB4E060

1. Check leakage or clog of air.

1) Check contamination, clog and installation of gasket
   - ▶ Any damage or installation of throttle body gasket.
   - ▶ Any damage or installation of gasket between intake manifold and surge tank.
   - ▶ Clog or contamination of intake manifold and injector by foreign materials
   - ▶ Contamination and open stuck between surge tank and PCSV by foreign materials
   - ▶ Any damage or contamination of HO2S(B1/S2) by foreign materials.

2) Has a problem been found?

YES

▶ Go to " Check Fuel Line" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check Fuel Line.

1) Check Clog, contamination and installation of Fuel Line as follows.
   - ▶ Connection for each connectors in Fuel Line.
   - ▶ Damage, interference and installation of vaccum hose connected to Fuel Line.
   - ▶ Bend, Leakage and squeeze of pipe in Fuel Line.

2) Has a problem been found?

YES

▶ Go to "Check Fuel Pressure" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

3. Check Fuel Pressure.

1) IG "OFF".

2) Disconnect fuel pump relay from junction box in passenger compartment.

3) Start engine and await until engine is off and then, IG "OFF".

4) Connect fuel pump relay again.

5) Connect fuel pressure gauge on the fuel filter with fuel pressure gauge adaptor.

6) Start engine again and measure fuel pressure.

Specification : Approx. 3.5 ㎏/㎠

NOTE

Refer to "FUEL PRESSURE TEST" in FUEL DELIVERY SYSTEM.

7) Is the fuel pressue normal?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check any damage of fuel return hose or pipe.
▶ Check any stuck of the valve in the fuel pressure regulator.
▶ Repair or replace as necessary and then, go to 'Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDB281F6

1. Check PCV.

   1) IG "OFF"

   2) Disconnect PCV.

   3) Check that PCV is properly operating.

   4) Is the PCV O.K?

   YES

   ▶ Go to "Check PCSV" as follows.

   NO

   ▶ Substitute with a known - good PCV and check for proper operation.
   ▶ If the problem is corrected, replace PCV and go to "Verification of Vehicle Repair" procedure.

2. Check the PCSV.

   1) Ignition "OFF".

   2) Disconnect PCSV and Vacuum Hose.

   3) Apply vacuum on PCSV with Hand Vacuum Gauge.

   4) Is the PCSV keeping the Vacuum?

   YES

   ▶Go to "Check Injector" as below.

   NO

   ▶Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check Injector.

   1) Ignition "OFF"

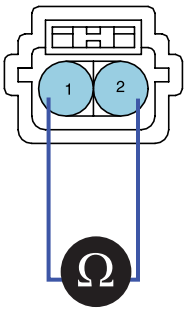
   2) Remove Injector.

   3) Check Leakage and clog on Injector.

   4) Measure resistance terminal 1 and 2 of Injector connector(Component side).

SPECIFICATION :

Temperature [℃]	Resistance [Ω]
20	14.5 ± 0.7 Ω



1. Sensor Power
2. Injector Control

LFJF463A

5) Is the measured resistance within specifications?

YES

▶ Go to "Check sensors related to Fuel Trim " as below.

NO

▶ Substitute with a known-good Injector and check for proper operation. If the problem is corrected, replace Injector and then go to "Verification of Vehicle Repair" procedure.

4. Check Sensors related to Fuel Trim.

1) Check the Input Voltage of Sensors related to Fuel Trim(MAPS, TPS, ECTS, PCSV, Injector, and etc) - Refer to Trouble Shooting Guide -

2) Are the sensors related to Fuel Trim O.K?

YES

▶ Go to "Check ECM" as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

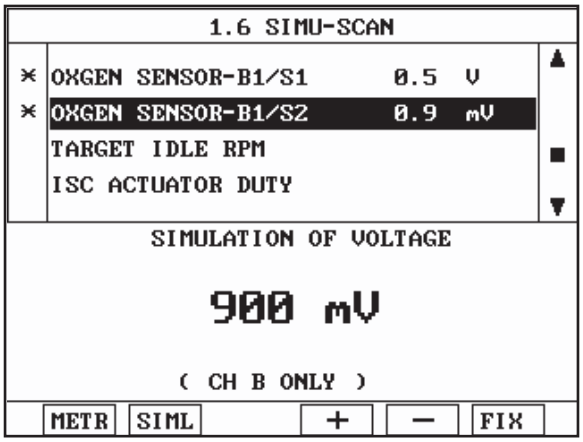
5. Check ECM.

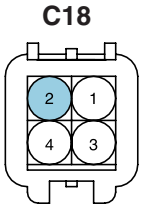
1) IG "OFF" and disconnect B1S2 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1S2) sensor signal connector.





1. Sensor Ground
2. **Sensor(B1S2) Signal**
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

LFJF464A

5) Is the HO2S(B1/S2) signal value changed according to simulation voltage ?

YES

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

NO

▶ Substitute with a known-good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5A2F863

Refer to DTC P0136.

DTC P0140 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 1 / SENSOR 2)

COMPONENT LOCATION E1FC70A8

Refer to DTC P0136.

GENERAL DESCRIPTION E9DF7506

Refer to DTC P0136.

DTC DESCRIPTION ED946A52

If there is not any signal activity, ECM sets DTC P0140.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E09F2BD3

Item	Detecting Condition	Possible Cause
DTC Strategy	• No signal activity	• Poor connection • Open or short in signal circuit • B1S2 • ECM
Enable Conditions	• After oscillation check finished	
Threshold Value	• No signal activity	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E9391F29

Refer to DTC P0136.

SCHEMATIC DIAGRAM E21E9D8F

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA E947ED45

Refer to DTC P0136.

MONITOR SCANTOOL DATA E1ABF224

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION E7673467

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E1D26276

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E0F2185F

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S2) connector.
   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

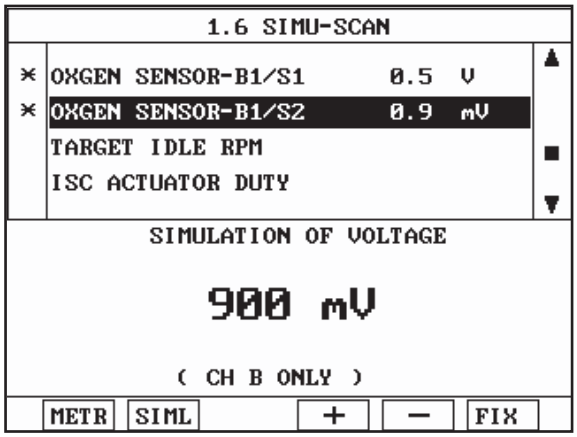
YES

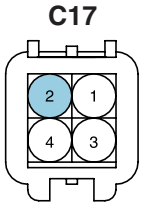
▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) IG "OFF" and disconnect B1S2 connector.
   2) Connect scantool and Key "ON".
   3) Select simulation function on scantool.
   4) Simulate voltage at terminal 2 of HO2S(B1/S2) signal connector.





1. Sensor Ground
2. **Sensor(B1S2) Signal**
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

LFJF467A

5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EAA0149B

Refer to DTC P0136.

DTC P0141 HO2S HEATER CIRCUIT (BANK 1 / SENSOR 2)

COMPONENT LOCATION E2E199B3

Refer to DTC P0136.

GENERAL DESCRIPTION E101CBE4

Refer to DTC P0136.

DTC DESCRIPTION E08C2491

If the internal resistance of heater is over the threshold value under enable conditins, PCM sets DTC P0141.

DTC DETECTING CONDITION E0607A79

Item	Detecting Condition	Possible Cause
DTC Strategy	• Heater current check	• Poor connection • Open or short to ground in signal circuit • B1S2 • ECM
Enable Conditions	• Catalyst temperature (model) 200～550℃ • Intake air temperature 〉 -7℃ • Battery voltage 10.7～16.1V	
Threshold Value	• Internal resistance 〉 threshold f (cat. temp., heater power)	
Diagnostic Time	• Above 6 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S2 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E150A43B

ITEM	Specification
Heater Resistance	Approx. 9.0 (20℃)

SCHEMATIC DIAGRAM E44839A2

Refer to DTC P0136.

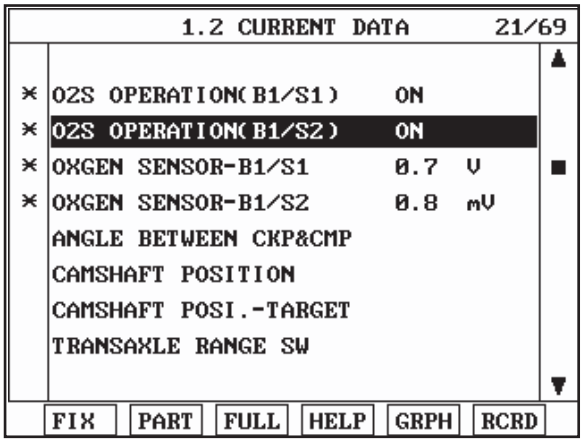
SIGNAL WAVEFORM & DATA E1AB30BA

Refer to DTC P0136.

MONITOR SCANTOOL DATA E4D62337

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.

3. Monitor "HO2S(B1S2)" parameter on scantool.



LFJF468A

4. Is the "HO2S(B1S2)" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EAAE5E46

Refer to DTC P0136.

POWER CIRCUIT INSPECTION E366B759

1. IG "OFF".
2. Disconnect HO2S(B1S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 4 of HO2S (B1S2) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E3DAF491

1. IG "OFF".
2. Disconnect HO2S(B1S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(B1S2) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E47F0848

1. Check Heater resistance.
   1) IG "OFF".
   2) Disconnect HO2S(B1S2) connector.
   3) Measure resistance bwteen terminal 3 and 4 of HO2S(B1S2) connector.(Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance	Approx. 9.0 (20℃)

   4) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good HO2S and check for proper operation.
▶ If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0E1FC1E

Refer to DTC P0136.

DTC P0171 SYSTEM TOO LEAN (BANK 1)

GENERAL DESCRIPTION EF72C196

The catalyst's efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2 O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION E13B5EFE

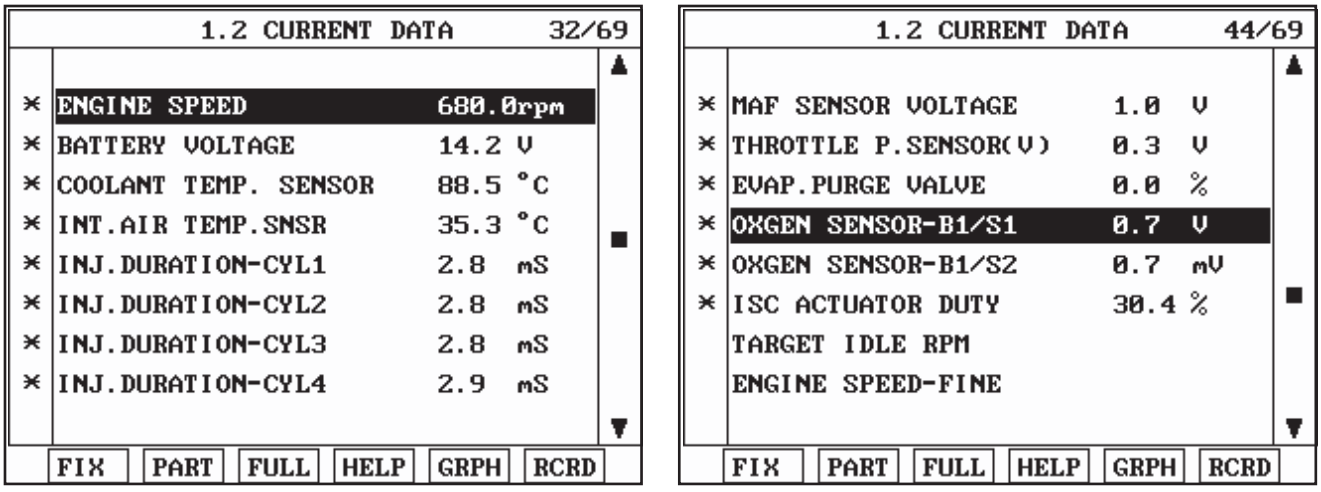
If the correction value of air-fuel ratio is higher than the threshold value, ECM sets DTC P0171.

DTC DETECTING CONDITION E1740329

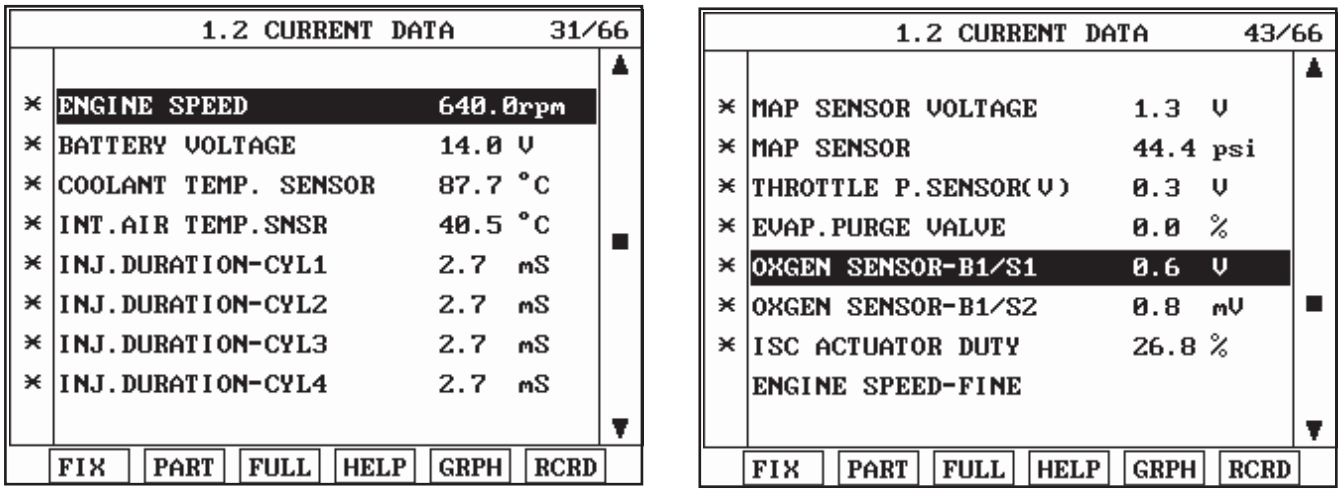
Item		Detecting Condition	Possible Cause
DTC Strategy		• Long-term fuel trim limit	• Poor connection • Related sensor • Intake air system • Fuel pressure • ECM
General Enable Conditions		• Coolant temperature 〉 70℃ • Intake air temperature 〈 80℃ • Throttle angle 〈 60% • Closed loop control enabled • No transient control phase • No canister purge phase	
Case1	Enable Conditions	• Engine load : 30~75 % • Air mass : 40~200 kg/h	
	Threshold Value	• Multiplicative 〉 1.23	
	Diagnostic Time	• 30 sec	
Case2	Enable Conditions	• Engine speed ≤ 920 rpm • Air mass ≤ 24 kg/h	
	Threshold Value	• Additive value > 8.5 %	
	Diagnostic Time	• 20 sec	
MIL ONCondition		• 2 driving cycle	

MONITOR SCANTOOL DATA E080F4B7

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Parameters related to air/fuel ratio(HO2S, MAF, MAP, TPS, ECTS, PCSV, Injector, etc)" on the scantool.



1.6CVVT



1.4DOHC

LFJF473A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION E9DC7769

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

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

NO

▶ Go to "System inspection" procedure.

SYSTEM INSPECTION E125C363

1. Air leakage check.

   1) Check "Air intake system"
      ▶ Check looseness, deterioration or contamination on throttle body and gasket.
      ▶ Check contamination, damage or crack on intake manifold, ISCA and injectors.

   2) Is there any leakage?

      YES

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

      NO

      ▶ Go to "Fuel line check" procedure.

2. Fuel line check.

   1) Check "Fuel line system"
      ▶ Check looseness of connectors on fuel line.
      ▶ Check looseness, damage, or interference of vacuum hose on fuel line.
      ▶ Check damage, leakage or bending on fuel line pipe.

   2) Is fuel line normal?

      YES

      ▶ Go to "Fuel line pressure check" procedure.

      NO

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

3. Fuel line pressure check.

   1) Key "OFF".

   2) Disconnect a fuel pump relay.

   3) Engine start and wait until engine stop. and then key "OFF".

   4) Connect a fuel pump relay.

   5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

   6) Engine start and measure a fuel pressure.

NOTE

Refer to "FUEL PRESSURE TEST" in FUEL DELIVERY SYSTEM.

Specification : Approx. 3.5kgf/cm²

7) Is the fuel pressure normal?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check clogging on the fuel filter.
▶ Check the valve in a fuel pressure regulator.
(If it has a problem, fuel happen to be leaked to a return line.)
▶ Check the supply pressure of fuel pump.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E714BE02

1. PCV(Positive Crankcase Ventilation) valve check.

1) Key "OFF".

2) Disconnect PCV valve.

3) Check the movement of plunger by putting in and out a thin stick.

4) Is the movement of plunger normal?

YES

▶ Go to "PCSV check" procedure.

NO

▶ Substitute with a known - good PCV valve and check for proper operation.
▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

2. PCSV check.

1) Key "OFF".

2) Disconnect PCSV and vacuum hose.

3) Apply a vacuum by a hand vacuum gauge on PCSV.

4) Does PCSV keep the vacuum condition normally?

YES

▶ Go to "Injector check" procedure.

NO

▶ Substitute with a known - good PCSV and check for proper operation.
▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

3. Injector check.

   1) Key "OFF".

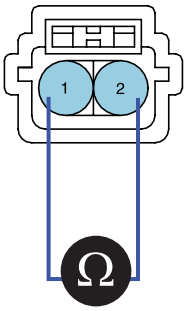
   2) Disconnect injectors.

   3) Check clog on injectors.

   4) Measure the resistance between terminal 1 and 2 of injectors(Component side).

SPECIFICATION :

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω



1. Injector Power
2. Injector control

LFJF474A

   5) Is the measured resistance within specifications?

YES

▶ Go to "Sensors related to air/fuel ratio check" procedure.

NO

▶ Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

4. Sensors related to air/fuel ratio check.

   1) Check the output data of sensors related to air/fuel ratio (HO2S, MAPS, TPS, ECTS, PCSV, Injectors, etc) on scantool. (Refer to each DTC guide procedure.)

   2) Are those sensors normal?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E1D7EC3B

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0172 SYSTEM TOO RICH (BANK 1)

GENERAL DESCRIPTION E85EEEF6

Refer to DTC P0171.

DTC DESCRIPTION E3B938C3

If the correction value of air-fuel ratio is lower than the threshold value, ECM sets DTC P0172.

DTC DETECTING CONDITION E2C1F0D1

Item		Detecting Condition	Possible Cause
DTC Strategy		• Long-term fuel trim limit	• Poor connection • Related sensor • Intake air system • Fuel pressure • ECM
General Enable Conditions		• Coolant temperature 〉 70℃ • Intake air temperature 〈 80℃ • Throttle angle 〈 60% • Closed loop control enabled • No transient control phase • No canister purge phase	
Case1	Enable Conditions	• Engine load : 30~75 % • Air mass : 40~200 kg/h	
	Threshold Value	• multiplicative value 〈 0.77	
	Diagnostic Time	• 30 sec	
Case2	Enable Conditions	• Engine speed ≤ 920 rpm • Air mass ≤ 24 kg/h	
	Threshold Value	• additive value 〈 -8.5%	
	Diagnostic Time	• 20 sec	
MIL ON Condition		• 2 driving cycle	

MONITOR SCANTOOL DATA EF8744A0

Refer to DTC P0171.

TERMINAL AND CONNECTOR INSPECTION EEEA5AF9

Refer to DTC P0171.

SYSTEM INSPECTION E6E80361

1. Air clog check

   1) Check "Air intake system"
      ▶ Check clog of air-cleaner.
      ▶ Check deterioration or contamination on throttle body and gasket.
      ▶ Check contamination, damage, stuck or clog on intake manifold, PCSV, ISCA and injectors.

2) Is there any problem?

YES

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

NO

▶ Go to "Fuel pressure check" procedure

2. Fuel pressure check.

1) Key "OFF".

2) Disconnect a fuel pump relay.

3) Engine start and wait until engine stop. and then key "OFF".

4) Connect a fuel pump relay.

5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

6) Engine start and measure a fuel pressure.

NOTE

Refer to "FUEL PRESSURE TEST" in FUEL DELIVERY SYSTEM.

Specification : Approx. 3.5kgf/cm²

7) Is the fuel pressure normal?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check the valve in a fuel pressure regulator.
(If it has a problem, fuel happen to be leaked to a return line.)
▶ Check the supply pressure of fuel pump.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EEF46149

1. PCV(Positive Crankcase Ventilation) valve check.

1) Key "OFF".

2) Disconnect PCV valve.

3) Check the movement of plunger by putting in and out a thin stick.

4) Is the movement of plunger normal?

YES

▶ Go to "PCSV check" procedure.

NO

▶ Substitute with a known - good PCV valve and check for proper operation.
▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

2. PCSV check.

1) Key "OFF".

2) Disconnect PCSV and vacuum hose.

3) Apply a vacuum by a hand vacuum gauge on PCSV.

4) Does PCSV keep the vacuum condition normally?

YES

▶ Go to "Injector check" procedure.

NO

▶ Substitute with a known - good PCSV and check for proper operation.
▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

3. Injector check.

1) Key "OFF".

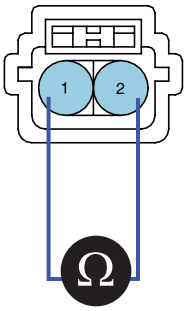
2) Disconnect injectors.

3) Check clog on injectors.

4) Measure the resistance between terminal 1 and 2 of injectors(Component side).

SPECIFICATION :

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω



1. Injector Power
2. Injector control

LFJF474A

5) Is the measured resistance within specifications?

YES

▶ Go to "Sensors related to air/fuel ratio check" procedure.

NO

▶ Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

4. Sensors related to air/fuel ratio check.

   1) Check the output data of sensors related to air/fuel ratio (HO2S, MAPS, TPS, ECTS, PCSV, Injectors, etc) on scantool. (Refer to each DTC guide procedure.)

   2) Are those sensors normal?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

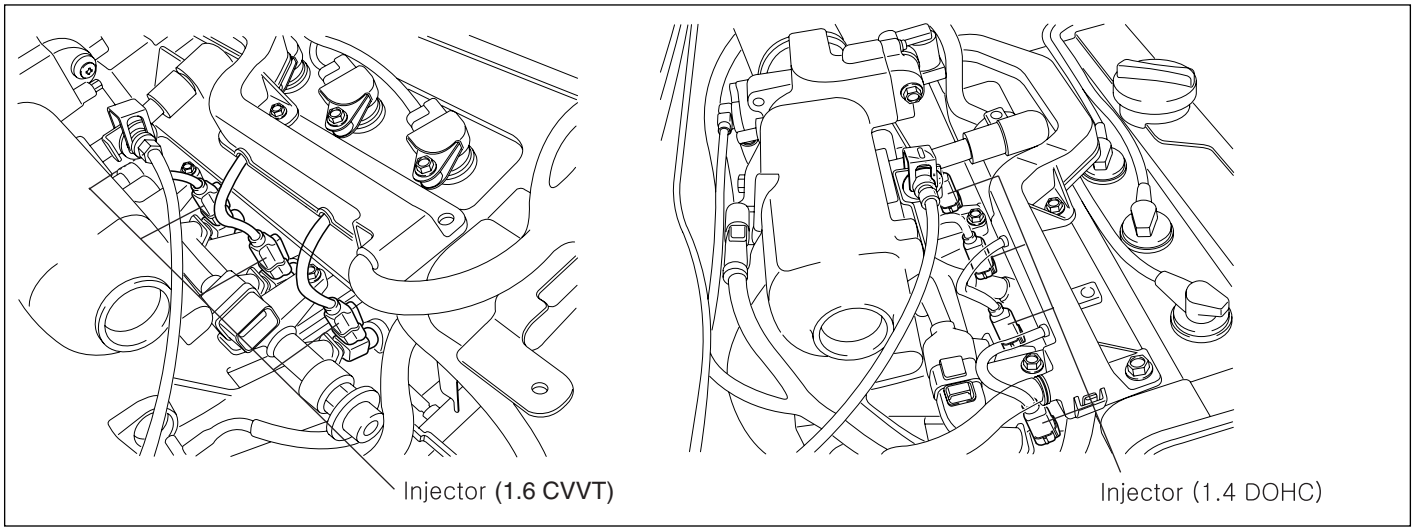
Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5005A08

Refer to DTC P0171.

DTC P0201 INJECTOR CIRCUIT/OPEN-CYLINDER 1
DTC P0202 INJECTOR CIRCUIT/OPEN-CYLINDER 2
DTC P0203 INJECTOR CIRCUIT/OPEN-CYLINDER 3
DTC P0204 INJECTOR CIRCUIT/OPEN-CYLINDER 4

COMPONENT LOCATION E51DF52D



LFJF800D

GENERAL DESCRIPTION ECC19502

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meet air-fuel ratio required in system, ECM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

DTC DESCRIPTION E1638025

If there is Open in injector #1 circuit, PCM sets DTC P0201/P0202/P0203/P0204.

DTC DETECTING CONDITION EF1C0456

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, open	• Poor connection • Open or short to ground in power circuit • Open in control circuit • Injector • ECM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

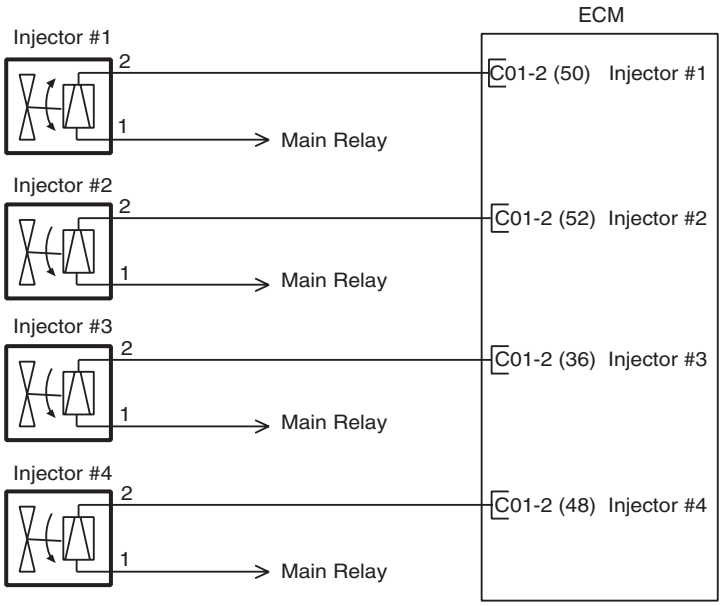
SPECIFICATION E93EBEAF

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω

SCHEMATIC DIAGRAM EA35D117

(A/T)

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-2 (50)	Injector #1 Control

Injector #2

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-2 (52)	Injector #2 Control

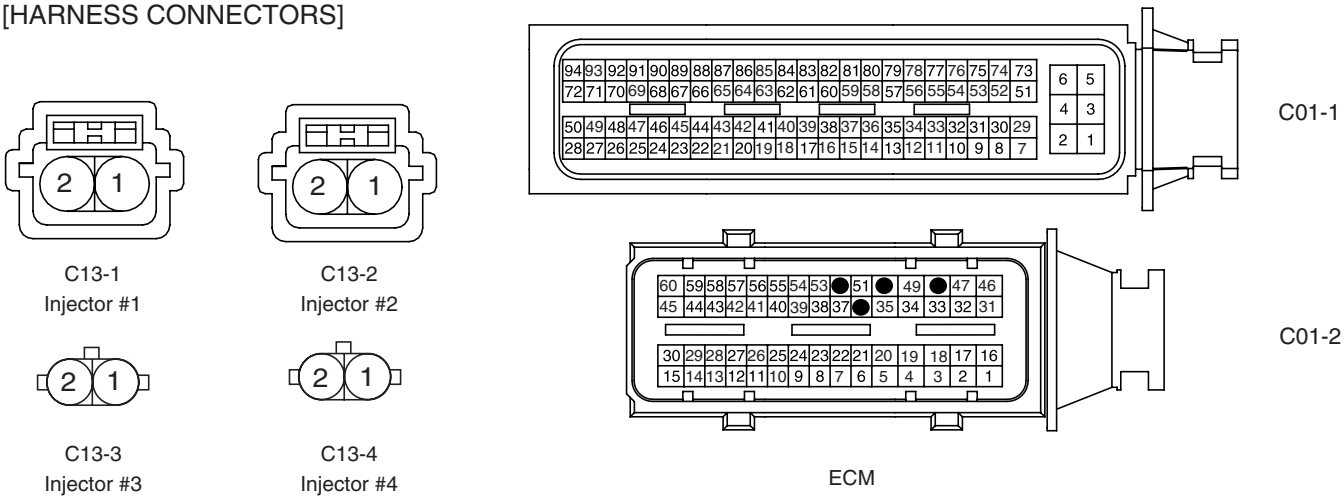
Injector #3

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-2 (36)	Injector #3 Control

Injector #4

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-2 (48)	Injector #4 Control

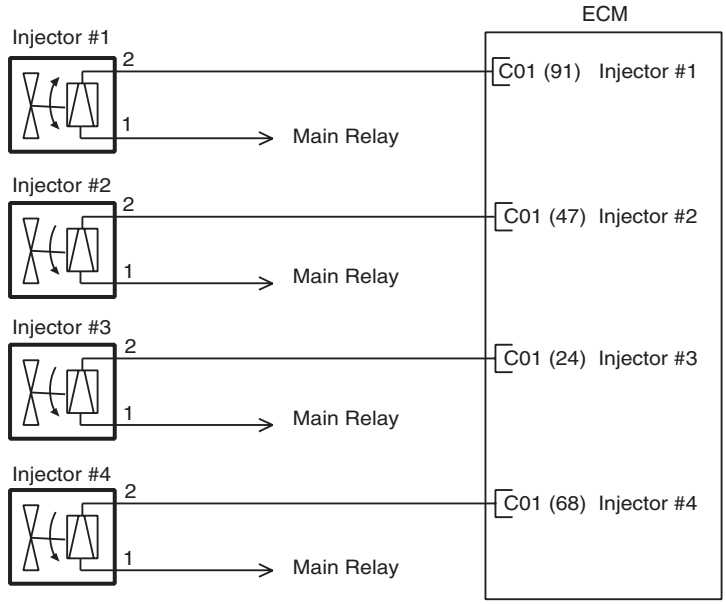
[HARNESS CONNECTORS]



LFJF478A

(M/T)

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (91)	INjector #1 Control

Injector #2

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (47)	INjector #2 Control

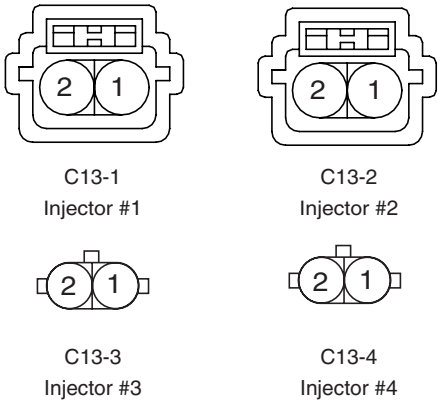
Injector #3

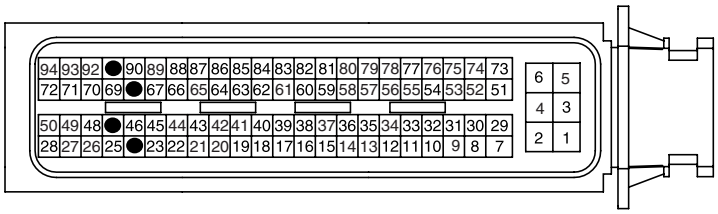
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (24)	INjector #3 Control

Injector #4

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (68)	INjector #4 Control

[HARNESS CONNECTORS]

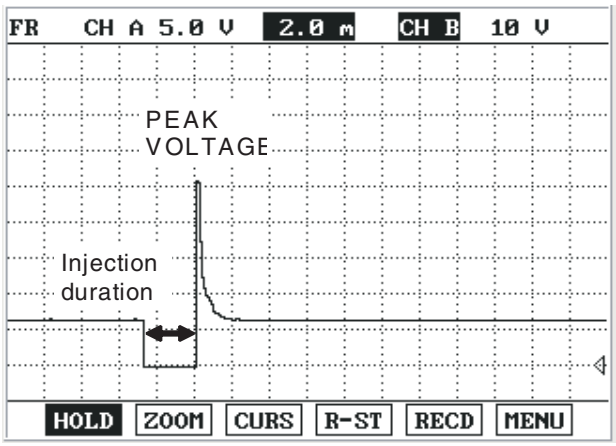




ECM (C01)

LFJF478B

SIGNAL WAVEFORM & DATA EE55B0BC

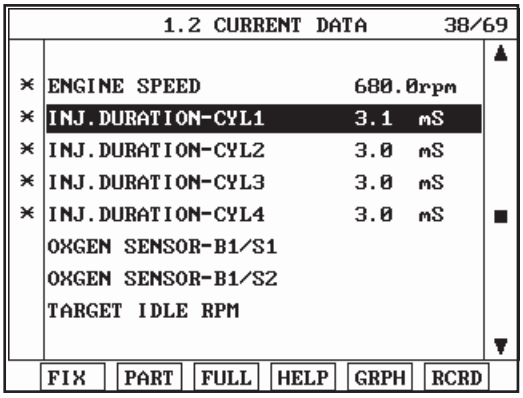


When the ECM energizes the injector by grounding the control circuit, the circuit voltage should below (theoretically 0V) and the fuel is iniected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak for a moment.

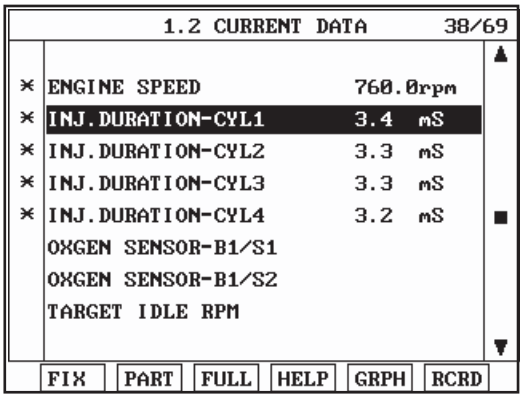
LFJF479A

MONITOR SCANTOOL DATA E539E4AE

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "injector" parameter on scantool.



Normal State



Abnormal State

LFJF512A

4. Is the "Injector" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or ECM’s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EF310E33

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

YES

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

NO

▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION ED1F215A

1. IG "OFF".
2. Disconnect injector connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E4ADDB40

1. IG "OFF".
2. Disconnect injector connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0E0AB22

1. Check injecotor resistance.

   1) IG "OFF".

   2) Disconnect injector connector.

   3) Measure resistance between terminal 1 and 2 of injector connector.(Component Side)

SPECIFICATION :

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω

   4) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good injector and check for proper operation.
▶ If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EDC25DE5

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

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

YES

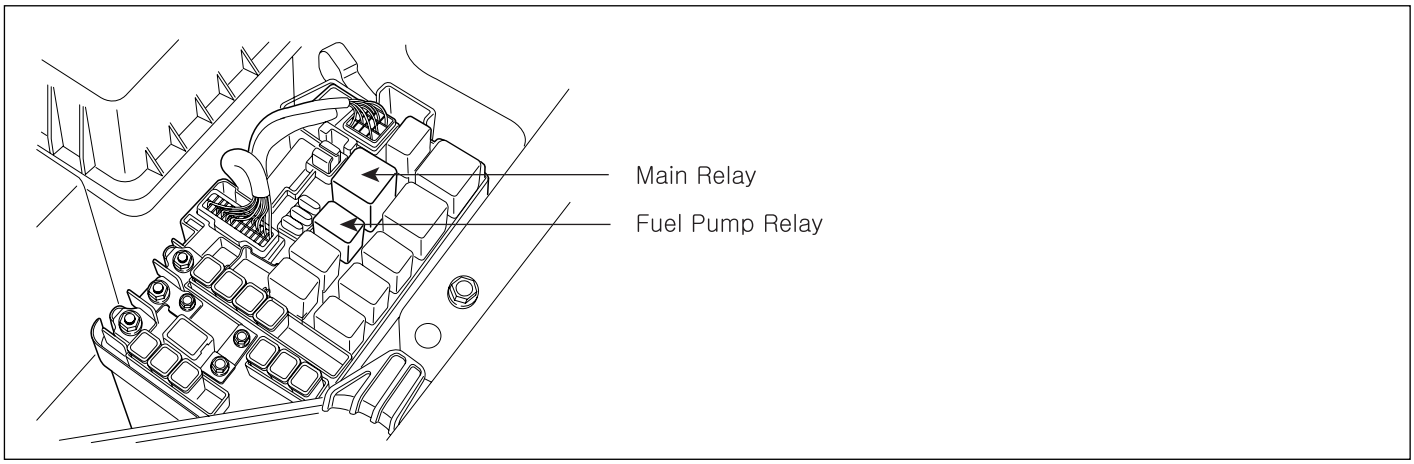
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0230 FUEL PUMP PRIMARY CIRCUIT

COMPONENT LOCATION EFC9E237



LFJF800C

GENERAL DESCRIPTION E7C72171

The PCM provides ground to one side of the coil in the fuel pump relay to control the fuel pump relay. The other side of the fuel pump relay coil is connected to fuel pump relay, which activates when the ignition switch is ON. The PCM monitors the control circuit between the fuel pump relay and the ECM. When the ignition switch is turned ON, the PCM energizes the fuel pump relay, which sends power to the fuel pump.

DTC DESCRIPTION E435327C

If there is Open in fuel pump circuit, PCM sets DTC P0230.

DTC DETECTING CONDITION E5046C39

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, open	• Poor connection • Open or short to ground in power circuit • Open in control circuit • Fuel pump relay • PCM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Disconnected	
MIL ON Condition	• Continuous	

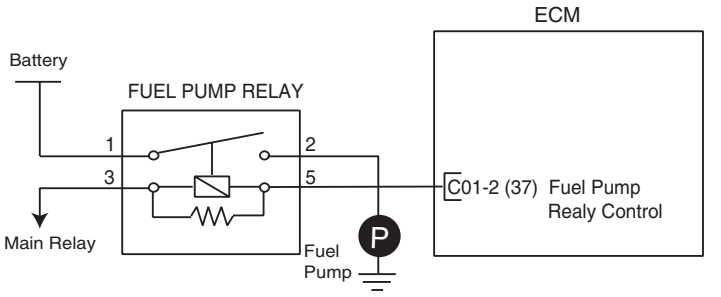
SPECIFICATION ED3115FD

Coil
70Ω ~ 120Ω

SCHEMATIC DIAGRAM EAF7A6F6

(A/T)

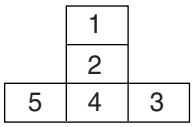
[CIRCUIT DIAGRAM]



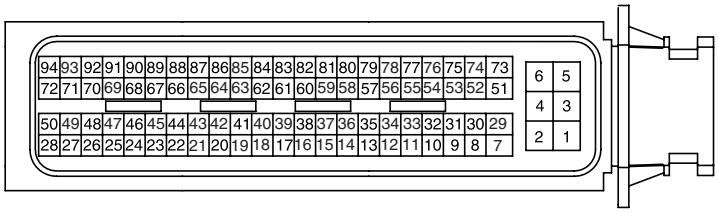
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Battery	Battery Voltage (B+)
2	Fuel Pump	Fuel Pump Power supply
3	Main Relay	Battery Voltage (B+)
4	-	-
5	ECM C01-2 (37)	Fuel Pump Realy Control

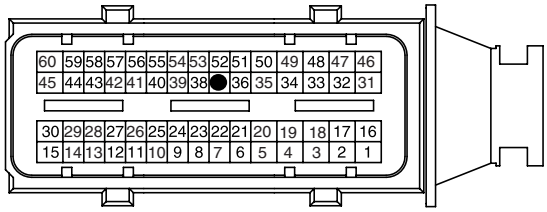
[HARNESS CONNECTORS]



FUEL PUMP RELAY (E67)



C01-1



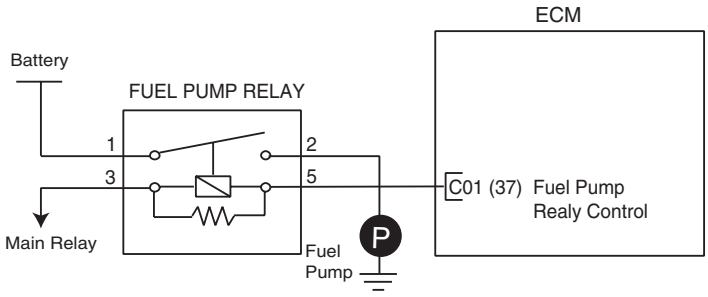
C01-2

ECM

LFJF498A

(M/T)

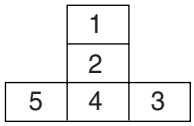
[CIRCUIT DIAGRAM]



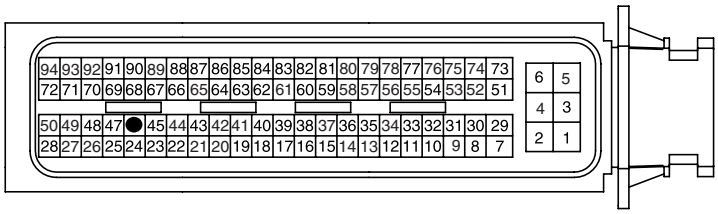
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Battery	Battery Voltage (B+)
2	Fuel Pump	Fuel Pump Power supply
3	Main Relay	Battery Voltage (B+)
4	-	-
5	ECM C01 (46)	Fuel Pump Realy Control

[HARNESS CONNECTORS]



FUEL PUMP RELAY (E67)

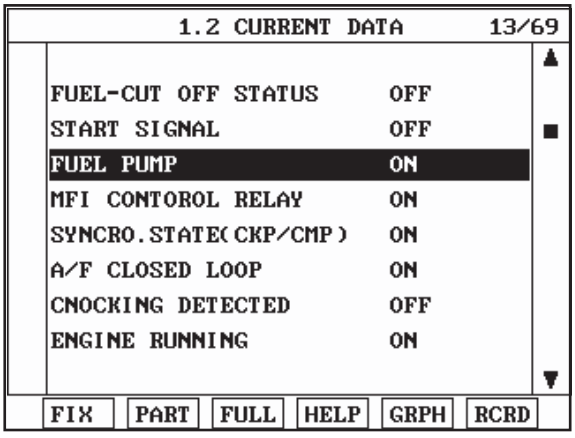


ECM (C01)

LFJF498C

MONITOR SCANTOOL DATA ECB0199E

1. Connect scantool to Data Link Connector(DLC).
2. Engine start.
3. Monitor the "Fuel pump relay" parameters on the scantool.



LFJF499A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E4BB5842

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

YES

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

NO

▶ Go to "Fuel pump relay circuit inspection" procedure.

POWER CIRCUIT INSPECTION E60F20B4

1. Key "OFF".
2. Disconnect fuel pump relay.
3. Key "ON".
4. Measure the voltage between terminal 1 and 3 of fuel pump relay harness connector.

Specification : B+

5. Is the measured voltage within specifications?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Check "INJ15A" fuse between fuel pump relay and main relay.
▶ Check "ECU A 30A" fuse between fuel pump relay and battery.
▶ Repair Open or Short in power circuit, and go to "Verification of vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EC1811AF

1. Key "OFF".
2. Disconnect fuel pump relay.

3. Key "ON".

4. Measure the voltage between terminal 5 of fuel pump relay harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open in control circuit, and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EE26ABE1

1. Fuel pump relay check.

   1) Key "OFF".

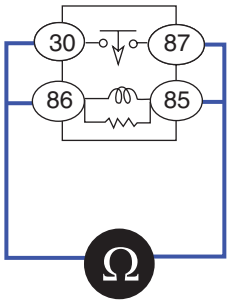
   2) Disconnect fuel pump relay.

   3) Measure the resistance between terminal 30 and 87 of fuel pump relay component side.

   4) Measure the resistance between terminal 85 and 86 of fuel pump relay component side.

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (70Ω ~ 120Ω)



LFJF505A

   5) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good Fuel pump relay and check for proper operation.
▶ If the problem is corrected, replace Fuel pump relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E63D0207

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0231 ELECTRIC FUEL PUMP RELAY-OPEN OR SHORT CIRCUIT

COMPONENT LOCATION EAAA17FC

Refer to DTC P0230.

GENERAL DESCRIPTION E120A682

Refer to DTC P0230.

DTC DESCRIPTION ECA1F1B5

If there is Open in fuel pump circuit, PCM sets DTC P0230.

DTC DETECTING CONDITION ECEE976D

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low	• Poor connection • Short to ground in control circuit • Fuel pump relay • PCM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Short circuit to Ground	
MIL ON Condition	• Continuous	

SPECIFICATION EF65AD65

Refer to DTC P0230.

SCHEMATIC DIAGRAM EAFF1FAA

Refer to DTC P0230.

MONITOR SCANTOOL DATA EB6183B8

Refer to DTC P0230.

TERMINAL AND CONNECTOR INSPECTION EA016D93

Refer to DTC P0230.

FUEL PUMP RELAY CIRCUIT INSPECTION E99910A8

1. Key "OFF".
2. Disconnect fuel pump relay.
3. Key "ON".

4. Measure the voltage between terminal 5 of fuel pump relay harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open in control circuit, and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E0D413DC

1. Fuel pump relay check.

   1) Key "OFF".

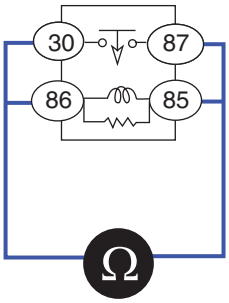
   2) Disconnect fuel pump relay.

   3) Measure the resistance between terminal 30 and 87 of fuel pump relay component side.

   4) Measure the resistance between terminal 85 and 86 of fuel pump relay component side.

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (70Ω ~ 120Ω)



LFJF505A

   5) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good Fuel pump relay and check for proper operation.
- ▶ If the problem is corrected, replace Fuel pump relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E217FADC

Refer to DTC P0230.

DTC P0232 ELECTRIC FUEL PUMP RELAY-SHORT CIRCUIT

COMPONENT LOCATION EF68EB6C

Refer to DTC P0230.

GENERAL DESCRIPTION EC49D3A4

Refer to DTC P0230.

DTC DESCRIPTION EDCCA679

If there is Short to battery in fuel pump circuit, PCM sets DTC P0232.

DTC DETECTING CONDITION EEF9FA80

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high	• Poor connection • Short to power in control circuit • Fuel pump relay • PCM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Short circuit to battery	
MIL ON Condition	• Continuous	

SPECIFICATION E27AE103

Refer to DTC P0230.

SCHEMATIC DIAGRAM E6796581

Refer to DTC P0230.

MONITOR SCANTOOL DATA E8109EB2

Refer to DTC P0230.

TERMINAL AND CONNECTOR INSPECTION EFA66153

Refer to DTC P0230.

FUEL PUMP RELAY CIRCUIT INSPECTION EB72E346

1. Key "OFF".
2. Disconnect fuel pump relay.
3. Key "ON".

4. Measure the voltage between terminal 5 of fuel pump relay harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

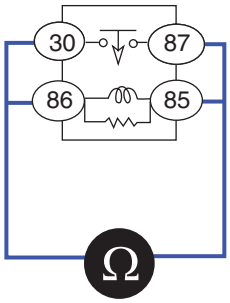
▶ Repair Open in control circuit, and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EB428FBF

1. Fuel pump relay check.
   1) Key "OFF".
   2) Disconnect fuel pump relay.
   3) Measure the resistance between terminal 30 and 87 of fuel pump relay component side.
   4) Measure the resistance between terminal 85 and 86 of fuel pump relay component side.

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (70Ω ~ 120Ω)



LFJF505A

   5) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

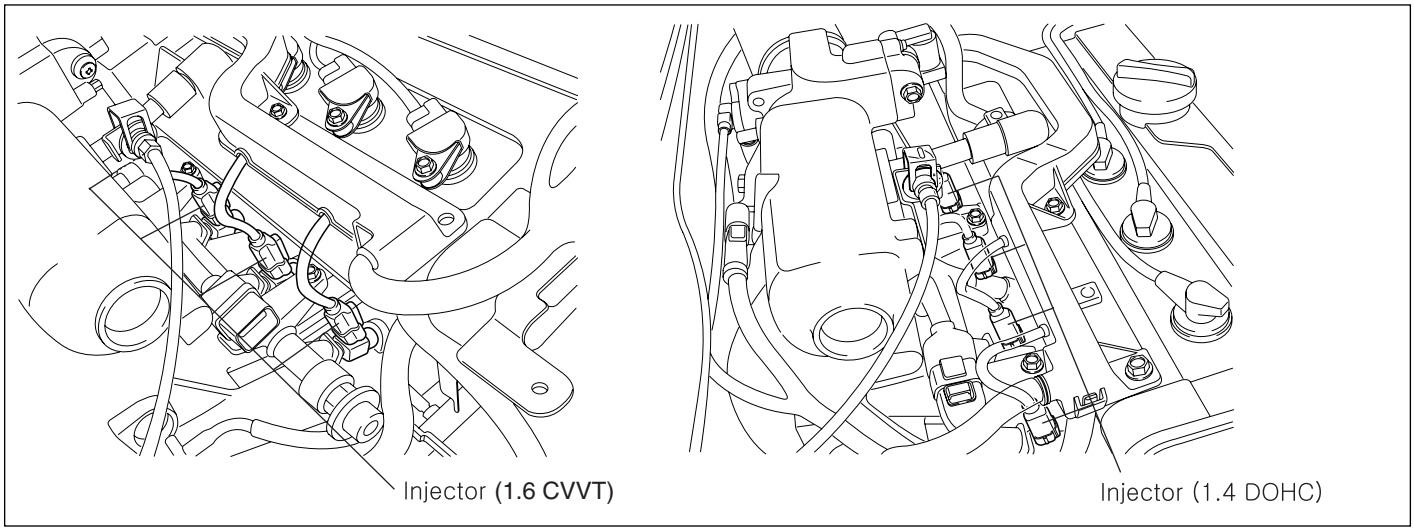
- ▶ Substitute with a known - good Fuel pump relay and check for proper operation.
- ▶ If the problem is corrected, replace Fuel pump relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E55734AA

Refer to DTC P0230.

DTC P0261 CYLINDER 1-INJECTOR CIRCUIT LOW
DTC P0264 CYLINDER 2-INJECTOR CIRCUIT LOW
DTC P0267 CYLINDER 3-INJECTOR CIRCUIT LOW
DTC P0270 CYLINDER 4-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EBFF42EC



LFJF800D

GENERAL DESCRIPTION EF7E3B43

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meet air-fuel ratio required in system, ECM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

DTC DESCRIPTION E5920C1A

If there is Short to ground in injector #1 circuit, PCM sets DTC P0261/P0264/P0267/P0270.

DTC DETECTING CONDITION E01A5612

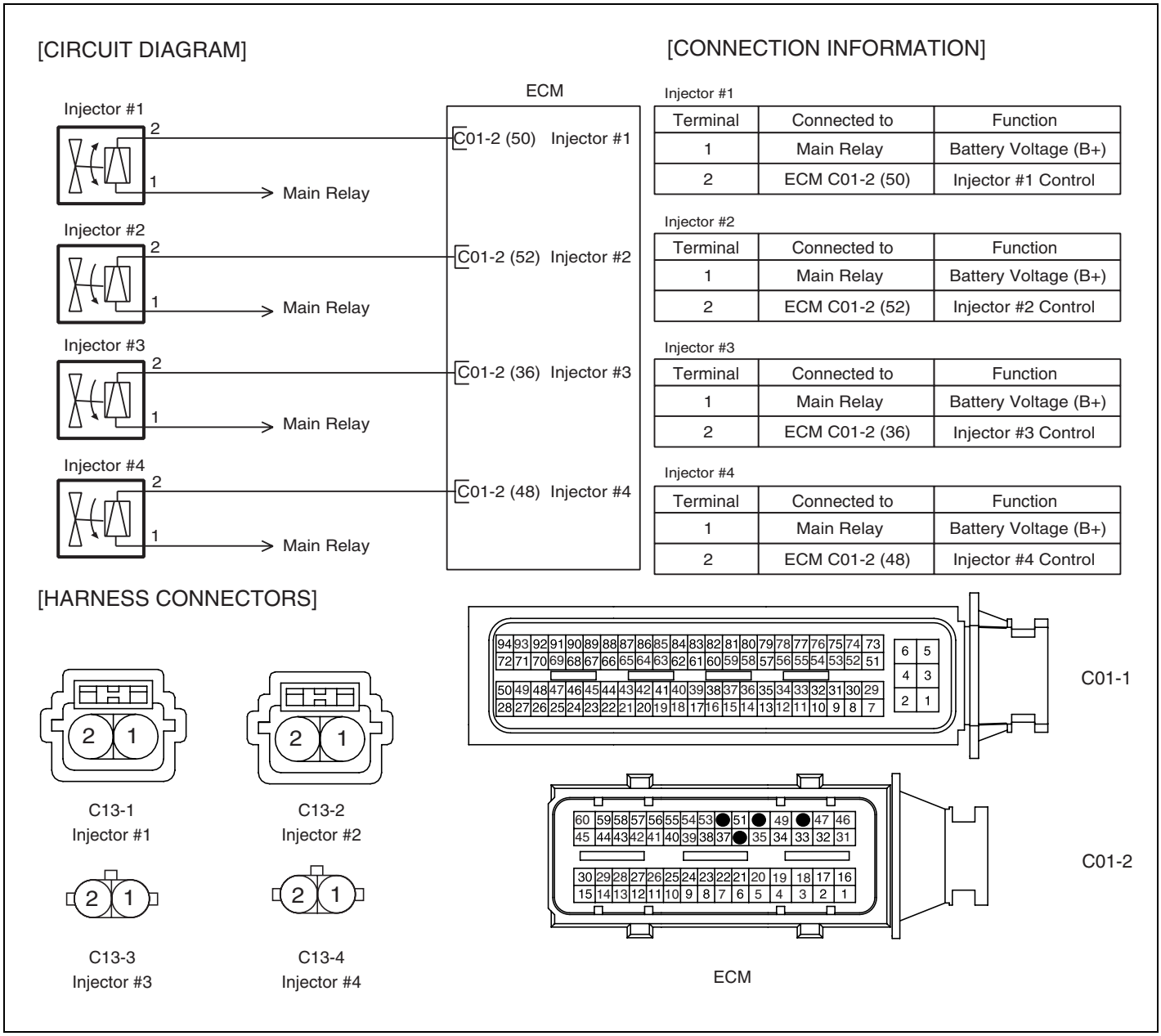
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low	• Poor connection • Short to ground in control circuit • Injector • ECM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Continuous	
MIL ON Condition	• 5 sec	

SPECIFICATION E2EB3497

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω

SCHEMATIC DIAGRAM E41D41CD

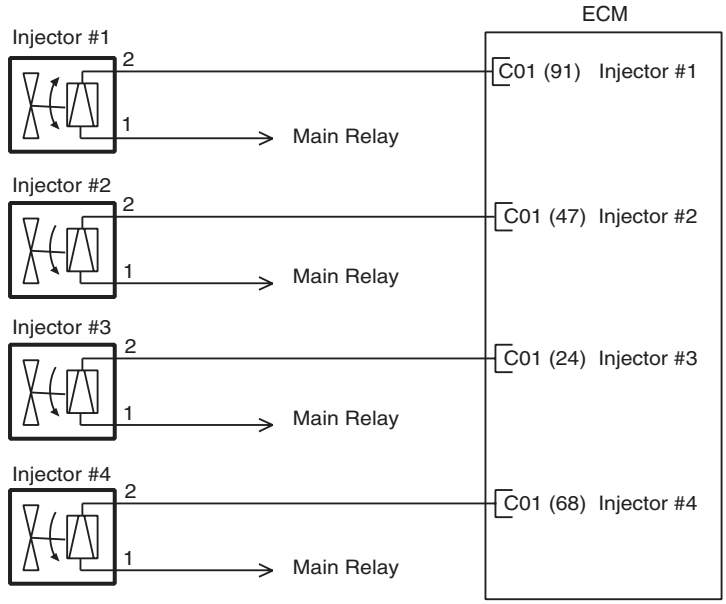
(A/T)



LFJF478A

(M/T)

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (91)	INjector #1 Control

Injector #2

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (47)	INjector #2 Control

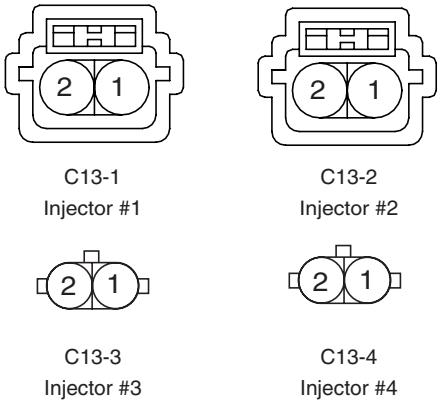
Injector #3

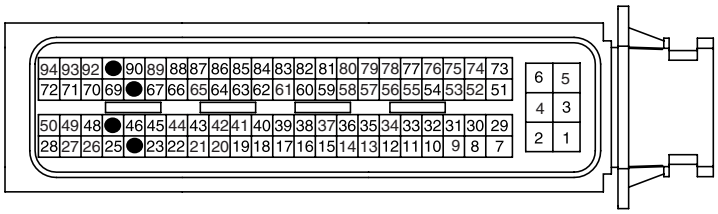
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (24)	INjector #3 Control

Injector #4

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (68)	INjector #4 Control

[HARNESS CONNECTORS]

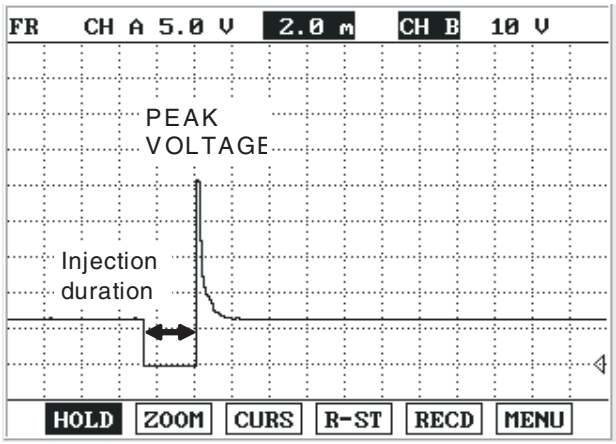




ECM (C01)

LFJF478B

SIGNAL WAVEFORM & DATA ED3A9548

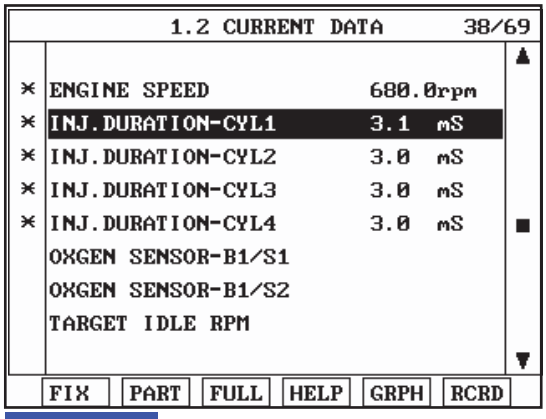


When the ECM energizes the injector by grounding the control circuit, the circuit voltage should below (theoretically 0V) and the fuel is iniected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak for a moment.

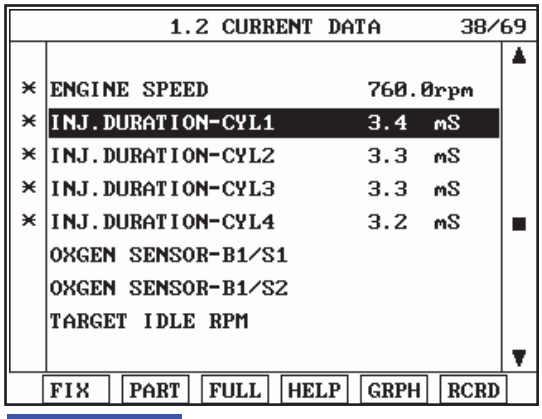
LFJF479A

MONITOR SCANTOOL DATA EDBCBB20

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "injector" parameter on scantool.



Normal State



Abnormal State

LFJF509A

4. Is the "Injector" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor’s and/or ECM’s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EA344330

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

YES

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

NO

▶ Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION E6EFA3B2

1. IG "OFF".
2. Disconnect injector connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EB8CE6B5

1. Check injecotor resistance.
   1) IG "OFF".
   2) Disconnect injector connector.
   3) Measure resistance between terminal 1 and 2 of injector connector.(Component Side)

SPECIFICATION :

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω

   4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good injector and check for proper operation.
- ▶ If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E8420ACA

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

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

YES

- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P0262 CYLINDER 1-INJECTOR CIRCUIT HIGH
DTC P0265 CYLINDER 2-INJECTOR CIRCUIT HIGH
DTC P0268 CYLINDER 3-INJECTOR CIRCUIT HIGH
DTC P0271 CYLINDER 4-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION EEBCD756

Refer to DTC P0261.

GENERAL DESCRIPTION E4A62EB9

Refer to DTC P0261.

DTC DESCRIPTION E3D8AF74

If there is Short to battery in injector #1 circuit, PCM sets DTC P0262/P0265/P0268/P0271.

DTC DETECTING CONDITION EDED8CFD

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high	• Poor connection • Short to power in control circuit • Injector • ECM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Continuouss	
MIL ON Condition	• 5 sec	

SPECIFICATION EE0C7F7D

Refer to DTC P0261.

SCHEMATIC DIAGRAM EA4C32BC

Refer to DTC P0261.

SIGNAL WAVEFORM & DATA EE06ADC1

Refer to DTC P0261.

MONITOR SCANTOOL DATA E148B1BB

Refer to DTC P0261.

TERMINAL AND CONNECTOR INSPECTION EFB721F6

Refer to DTC P0261.

CONTROL CIRCUIT INSPECTION EE8E449D

1. IG "OFF".
2. Disconnect injector connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EF8C866F

1. Check injecotor resistance.
   1) IG "OFF".
   2) Disconnect injector connector.
   3) Measure resistance between terminal 1 and 2 of injector connector.(Component Side)

SPECIFICATION :

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω

   4) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

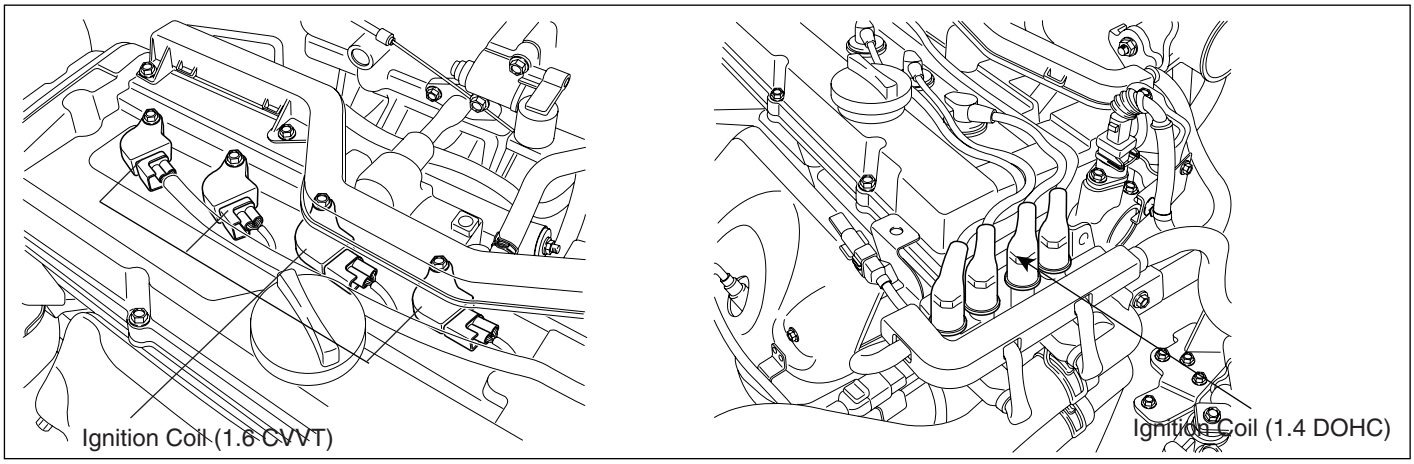
▶ Substitute with a known - good injector and check for proper operation.
▶ If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E67A312B

Refer to DTC P0261.

DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED
DTC P0301 CYLINDER 1 - MISFIRE DETECTED
DTC P0302 CYLINDER 2 - MISFIRE DETECTED
DTC P0303 CYLINDER 3 - MISFIRE DETECTED
DTC P0304 CYLINDER 4 - MISFIRE DETECTED

COMPONENT LOCATION E32FC22B



LFJF800G

GENERAL DESCRIPTION E23A6BCA

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION E6B376CB

If there happen misfires over the threshold value at 1 or more than 2 cylinders, PCM sets DTC P0300/P0301/P0302/P0303/P0304.

DTC DETECTING CONDITION E177316F

Item		Detecting Condition	Possible Cause
DTC Strategy		• Engine roughness through crankshaft speed fluctuation	• Poor connection • Ignition system • Fuel system • Intake/exhaust air system • Ignition timing • Injector • ECM
Enable Conditions		• Engine speed 510 ~ 6480rpm • Engine load 〉 Zero torq. • Eng. load change 〈 Max. • Eng. speed change 〈 Max. • Calculated wheel acceleration 〈 20~38 • Time after engine start 〉 0 • Intake air temperature 〉 -30℃	
Case1	Threshold Value	• Misfire rate for FTP(Federal Test Procedure) emission thresh 〉 5%	
	Diagnostic Time	• 1000 revs	
	MIL ON Condition	• 2 driving cycle	
Case2	Threshold Value	• 16% 〈 Misfire rate for catalyst damage 〈 90%	
	Diagnostic Time	• 200 revs	
	MIL ON Condition	• Immediately (Blink)	

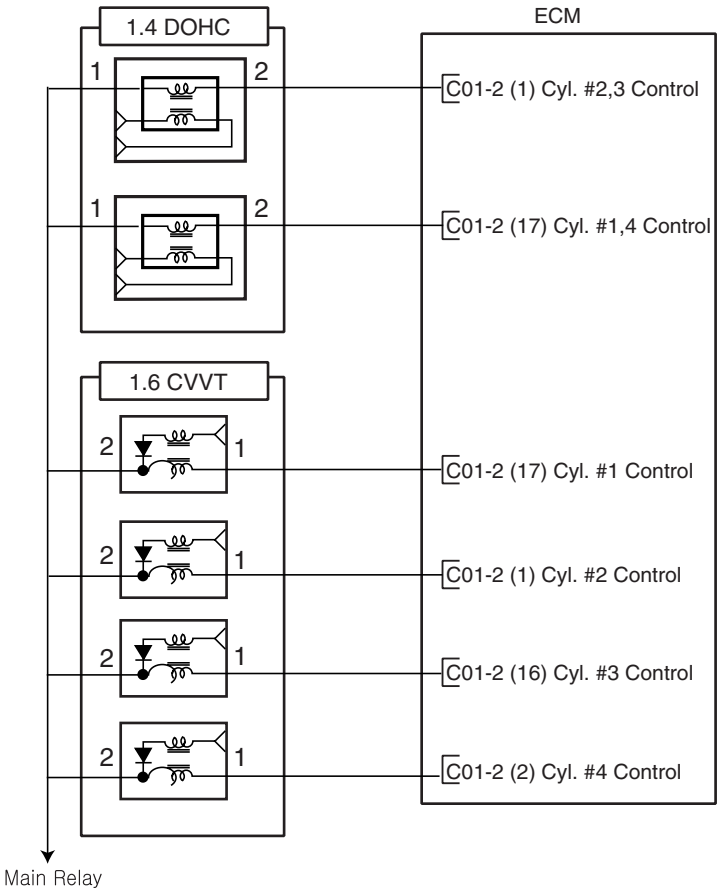
SPECIFICATION EB921F9C

Ignitioncoil resistance	
Primary coil	Secondary coil
0.5 ± 0.05 Ω	12.1 ± 1.8 kΩ

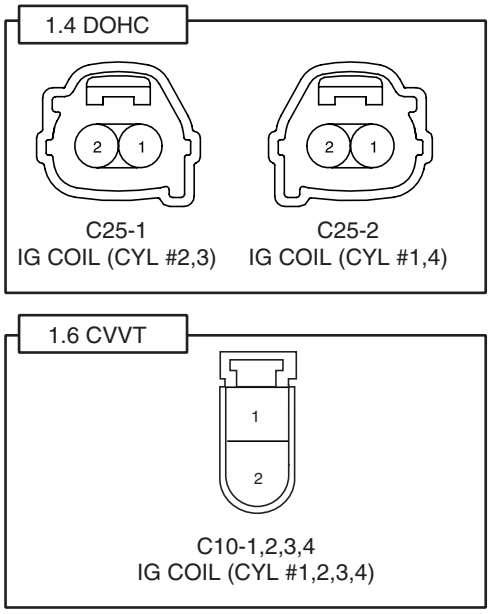
SCHEMATIC DIAGRAM E81018AE

(A/T)

[CIRCUIT DIAGRAM]



[HARNESS CONNECTORS]



[CONNECTION INFORMATION]

IG COIL (CYL. #2,3)

Terminal	Connected to	Function
1	IG ON	Battery Voltage (B+)
2	ECM C01-2 (1)	IG Coil (Cyl. #2,3) Control

IG COIL (CYL. #1,4)

Terminal	Connected to	Function
1	IG ON	Battery Voltage (B+)
2	ECM C01-2 (17)	IG Coil (Cyl. #1,4) Control

IG COIL (CYL. #1)

Terminal	Connected to	Function
1	ECM C01-2 (17)	IG Coil (Cyl. #1) Control
2	IG ON	Battery Voltage (B+)

IG COIL (CYL. #2)

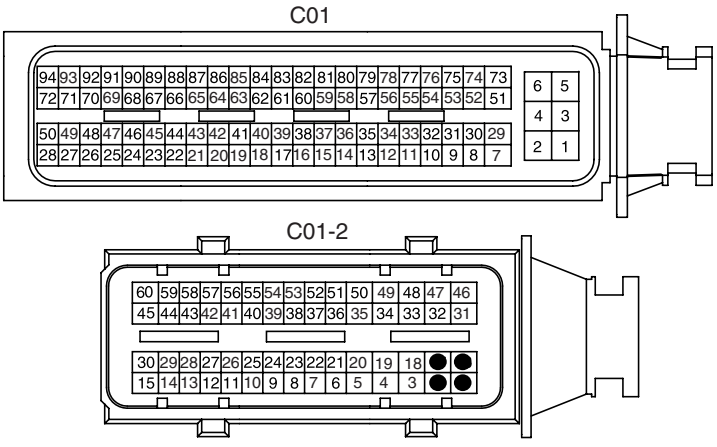
Terminal	Connected to	Function
1	ECM C01-2 (1)	IG Coil (Cyl. #2) Control
2	IG ON	Battery Voltage (B+)

IG COIL (CYL. #3)

Terminal	Connected to	Function
1	ECM C01-2 (16)	IG Coil (Cyl. #3) Control
2	IG ON	Battery Voltage (B+)

IG COIL (CYL. #4)

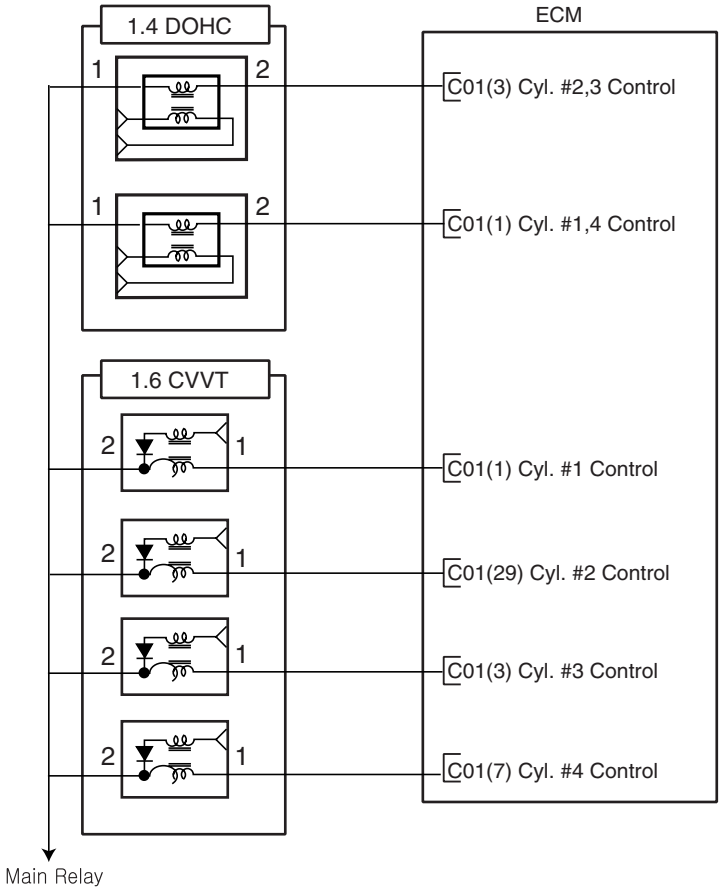
Terminal	Connected to	Function
1	ECM C01-2 (2)	IG Coil (Cyl. #4) Control
2	IG ON	Battery Voltage (B+)



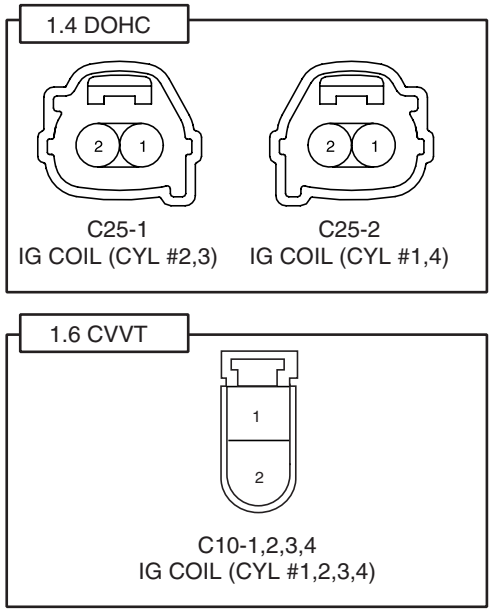
LFJF536S

(M/T)

[CIRCUIT DIAGRAM]



[HARNESS CONNECTORS]



[CONNECTION INFORMATION]

IG COIL (CYL. #2,3)

Terminal	Connected to	Function
1	IG ON	Battery Voltage (B+)
2	ECM C01 (3)	IG Coil (Cyl. #2,3) Control

IG COIL (CYL. #1,4)

Terminal	Connected to	Function
1	IG ON	Battery Voltage (B+)
2	ECM C01 (1)	IG Coil (Cyl. #1,4) Control

IG COIL (CYL. #1)

Terminal	Connected to	Function
1	ECM C01 (1)	IG Coil (Cyl. #1) Control
2	IG ON	Battery Voltage (B+)

IG COIL (CYL. #2)

Terminal	Connected to	Function
1	ECM C01(29)	IG Coil (Cyl. #2) Control
2	IG ON	Battery Voltage (B+)

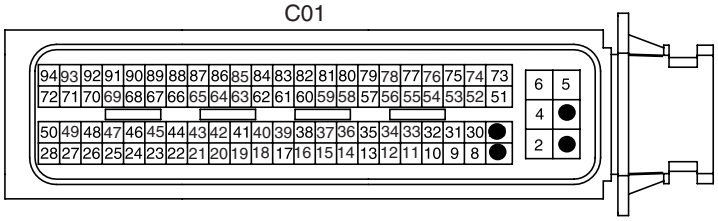
IG COIL (CYL. #3)

Terminal	Connected to	Function
1	ECM C01(3)	IG Coil (Cyl. #3) Control
2	IG ON	Battery Voltage (B+)

IG COIL (CYL. #4)

Terminal	Connected to	Function
1	ECM C01-2 (7)	IG Coil (Cyl. #4) Control
2	IG ON	Battery Voltage (B+)

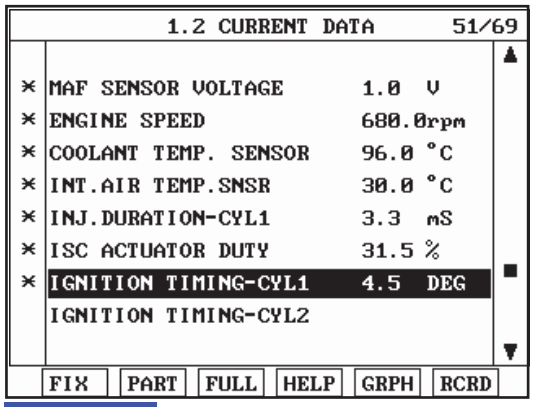
C01



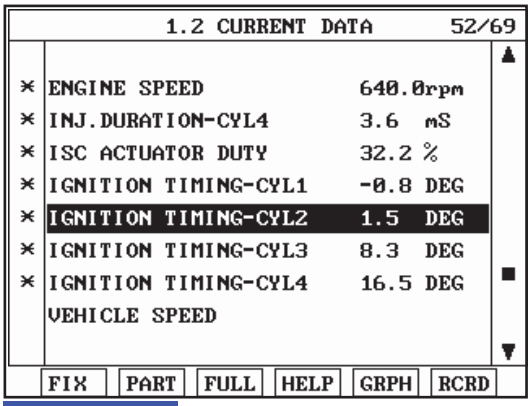
LFJF536Y

MONITOR SCANTOOL DATA E9B8A8EF

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Parameters related to Ignition and Misfire" on the scantool.



Normal State



Abnormal State

LFJF534A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION EC98B8F5

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

YES

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

NO

▶ Go to "System inspection" procedure.

SYSTEM INSPECTION E2AF1A47

1. Spark cable check (Only 1.4 DOHC available)

   1) Do visual inspect
      ▶ Check contamination or damage on spark cable.

   2) Measure the resistance of spark cable.

Specification : 5.6kΩ m ± 20%

   3) Is the measured resistance within specifications?

      YES

      ▶ Go to "Check Spark Plug" as below.

      NO

      ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Spark plug check.

   1) Remove cylinder's spark plugs.

   2) Visually/physically inspect the following items:
      - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
      - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
      - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

   3) Has a problem been found in any of the above areas?

      YES

      ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

      NO

      ▶ Go to "Compression pressure check" procedure.

3. Compression pressure check.

   1) Warm up the engine to normal operating temperature.

   2) Disconnect the spark plug cables. And remove the spark plugs and fuel pump relay.

   3) Crank the engine to remove any foreign material in the cylinders.

   4) Put compression pressure gauge into spark pulg hole.

   5) Check compression pressure at each cylinder.

Specification : Approx. 15 kgf/cm²

   6) Is compression pressure for each cylinder displayed within specifications?

      YES

      ▶ Go to "Ignition system check" procedure.

NO

▶ Add a small amount of oil through the spark plug hole, and repeat above steps.
▶ If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.
▶ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

4. Ignition system check

1) Key "OFF".

2) Disconnect Ignition coil connector.

3) Do visual inspection.
▶ Check contamination or damege on ignition coil.

4) Key "ON".

5) Measure the voltage between terminal 1 of ignition coil harness connector and chassis ground. [1.4 DOHC]
Measure the voltage between terminal 2 of ignition coil harness connector and chassis ground. [1.6 CVVT]

Specification : Approx. B+

6) Is the measured voltage within specifications?

YES

▶ Go to "Ignition coil check" procedure.

NO

▶ Repair Open or Short to ground in power circuit, and go to "Verification of Vehicle Repair" procedure.

5. Ignition coil check (Only 1.4 DOHC available)

1) Measure the resistance between terminal 1 and 2 of ingnition coil connector.
(Component side / Primary coil)

2) [P0300/P0301/P0304] Measure the resistance between terminal for cylinder #1 and terminal for cylinder #4.
(Component side / Secondary coil)
[P0300/P0302/P0303] Measure the resistance between terminal for cylinder #2 and terminal for cylinder #3.
(Component side / Secondary coil)

SPECIFICATION

Ignitioncoil resistance	
Primary coil	Secondary coil
0.5 ± 0.05 Ω	12.1 ± 1.8 kΩ

3) Is the measured resistance within specifications?

YES

▶ Go to "Timing mark check" procedure.

NO

▶ Substitute with a known - good ignition coil and check for proper operation.
▶ If the problem is corrected, replace ignition coil and go to "Verification of Vehicle Repair" procedure.

6. Timing mark check.

   1) Key "OFF".

   2) Check the timing mark.

   3) Is the timing mark normal?

   YES

   ▶ Go to "Air leakage check" procedure.

   NO

   ▶ Repair and go to "Verification of Vehicle Repair" procedure.

7. Air leakage check.

   1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
      - Vacuum hoses for splits, kinks and improper connections.
      - Throttle body gasket
      - Gasket between intake manifold and cylinder head
      - Seals between intake manifold and fuel injectors
      - Exhaust system between HO2S and Three way catalyst for air leakage.

   2) Has a problem been found in any of the above areas?

   YES

   ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Go to "PCV(Positive Crankcase Ventilation) valve check" procedure.

8. PCV(Positive Crankcase Ventilation) valve check.

   1) Key "OFF".

   2) Disconnect PCV valve.

   3) Check the movement of plunger by putting in and out a thin stick.

   4) Is the movement of plunger normal?

   YES

   ▶ Go to "Injector check" procedure.

   NO

   ▶ Substitute with a known - good PCV valve and check for proper operation.
   ▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

9. Injector check.

   1) Key "OFF".

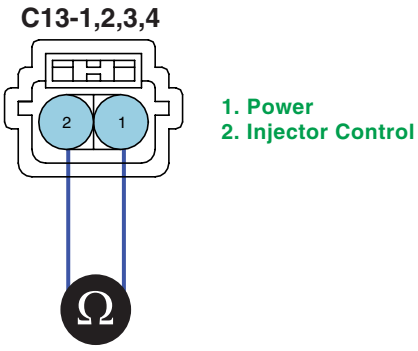
2) Remove injectors.

3) Check leakage or clog on injectors.

4) Measure the resistance between terminal 1 and 2. (Component side)

SPECIFICATION :

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω



LFJF540A

5) Is the measured resistance within specification?

YES

▶ Go to "Fuel line check" procedure.

NO

▶ Substitute with a known - good injector and check for proper operation.
▶ If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

10. Fuel line check.

1) Check clog, contamination and damage on fuel line.
- Splits, kinks and improper connections of fuel line pipe.
- Interference, damage and improper connections of vacuum hose on fuel line.
- Improper connection of connectors on fuel line.

2) Is the fuel line normal?

YES

▶ Go to "Fuel pressure check" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

11. Fuel pressure check.

1) Key "OFF".

2) Disconnect a fuel pump relay.

3) Engine start and wait until engine stop. and then key "OFF".

4) Connect a fuel pump relay.

5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

6) Engine start and measure a fuel pressure.

Specification : Approx. 3.5 kg/cm²

7) Is the fuel pressure normal?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check clogging on the fuel filter.
▶ Check the valve in a fuel pressure regulator.
(If it has a problem, fuel happen to be leaked to a return line.)
▶ Check the fuel supply and return line.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9EAB62E

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

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

YES

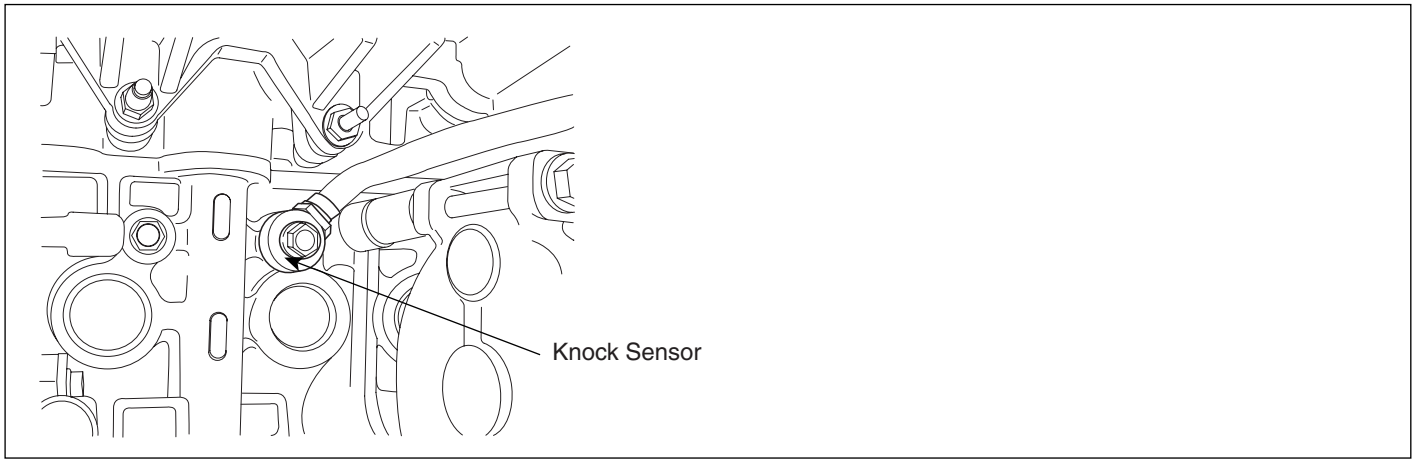
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0326 KNOCK SENSOR 1 CIRCUIT RANGE/PERFORMANCE (BANK 1)

COMPONENT LOCATION E3A43042



LFJF800F

GENERAL DESCRIPTION EAC66752

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION E12194E9

If the number of knock sensor error is over 25 times, PCM sets P0326.

DTC DETECTING CONDITION E6CEAB40

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • Open or short in signal circuit • Knock sensor • PCM
Enable Conditions		
Threshold Value	• Number of knock sensor errors 〉 25	
Diagnostic Time	• Continuous	

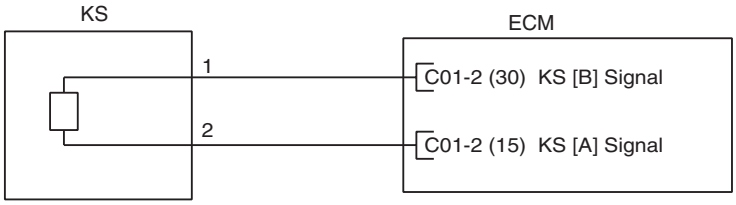
SPECIFICATION E486C047

Item	Specification
Capacitance	950 ~ 1,350pF

SCHEMATIC DIAGRAM EB76E989

(A/T)

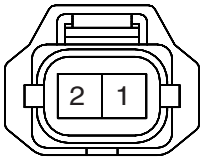
[CIRCUIT DIAGRAM]



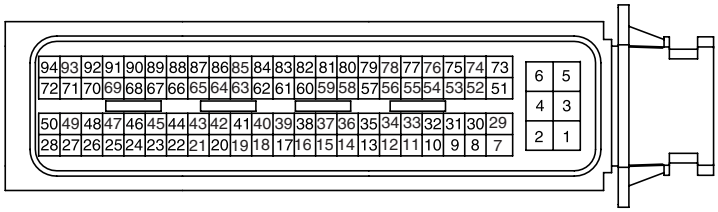
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-2 (30)	KS [A] Signal
2	ECM C01-2 (15)	KS [B] Signal

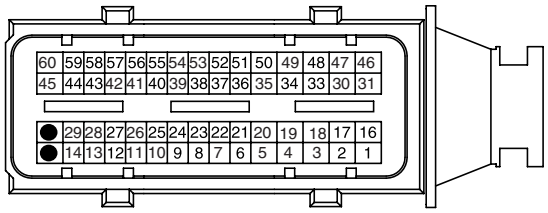
[HARNESS CONNECTORS]



KS (C14)



C01-1



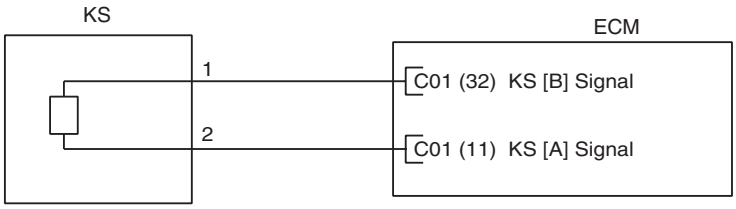
C01-2

ECM

LFJF563A

(M/T)

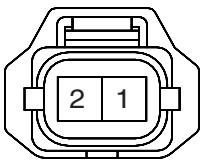
[CIRCUIT DIAGRAM]



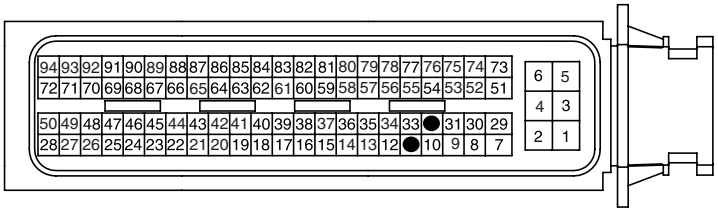
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (32)	KS [A] Signal
2	ECM C01 (11)	KS [B] Signal

[HARNESS CONNECTORS]



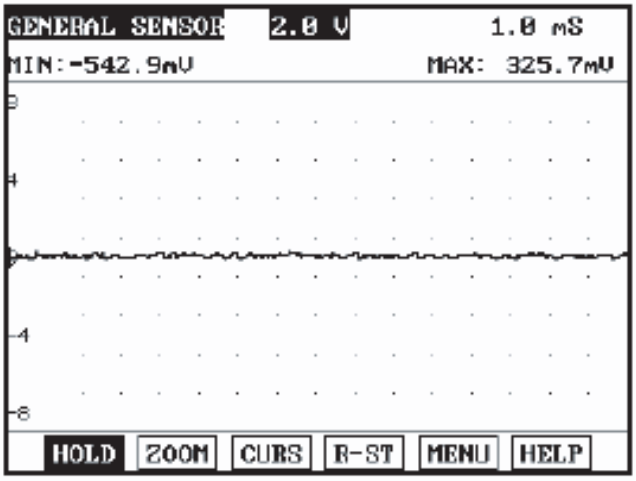
KS (C14)



ECM (C01)

LFJF563B

SIGNAL WAVEFORM & DATA E4796718

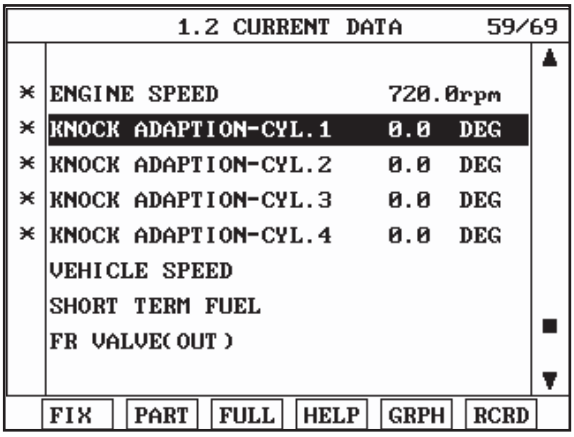


This is a normal signal waveform of knock sensor. Generally, there would be much more noise on knock sensor signal than the others.

LFJF564A

MONITOR SCANTOOL DATA E15781E5

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Knock sensor" parameters on the scantool.



LFJF565A

4. Are the parameters displayed correctly ?

YES

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

NO

▶ Go to "Terminal and Connector Inspection"procedure.

TERMINAL AND CONNECTOR INSPECTION E155B932

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

YES

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

NO

▶ Go to "Knock sensor circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION EC343448

1. Check voltage.
   1) Key "OFF".
   2) Disconnect Knock sensor connector.
   3) Key "ON".
   4) Measure the voltage between terminal 1 of knock sensor harness connector and chassis ground.
   5) Measure the voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx 2.4V

   6) Is the measured voltage within specification?

YES

▶ Go to "Check Short in signal circuit" procedure.

NO

▶ Repair Oepn or Short in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Shrot in signal circuit.
   1) Key "OFF".
   2) Disconnect Knock sensor connector and ECM connector.
   3) Measure the resistance between terminal 1 and 2 of knock sensor harness connector.

Specification : Infinite

   4) Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EB83CBD3

1. Check Knock sensor.
   1) Substitute with a known - good Knock sensor and check for proper operation.
   2) Is the signal normal?

YES

▶ Replace Knock sensor and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EEE25B61

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW INPUT

COMPONENT LOCATION ECF53B40

Refer to DTC P0326.

GENERAL DESCRIPTION EB19EB39

Refer to DTC P0326.

DTC DESCRIPTION EC84E7CD

If normalized reference signal is lower than the bottom limit according to rpm, PCM sets P0327.

DTC DETECTING CONDITION EC81FE62

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Poor connection • Open or short to ground in signal circuit • Knock sensor • PCM
Enable Conditions	• Engine speed 〉 2600rpm	
Threshold Value	• Normalized reference level 〈 lower limit, f(rpm)	
Diagnostic Time	• Continuous	

SPECIFICATION E03D2B96

Refer to DTC P0326.

SCHEMATIC DIAGRAM EBED2365

Refer to DTC P0326.

SIGNAL WAVEFORM & DATA EA62E510

Refer to DTC P0326.

MONITOR SCANTOOL DATA EC0E1939

Refer to DTC P0326.

TERMINAL AND CONNECTOR INSPECTION EA57E855

Refer to DTC P0326.

SIGNAL CIRCUIT INSPECTION EB299636

1. Check voltage.
    1) Key "OFF".

2) Disconnect Knock sensor connector.

3) Key "ON".

4) Measure the voltage between terminal 1 of knock sensor harness connector and chassis ground.

5) Measure the voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx 2.4V

6) Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Go to "Check resistance" procedure.

2. Check resistance.

1) Key "OFF".

2) Disconnect Knock sensor connector and ECM connector.

3) Measure the resistance between terminal 1 of knock sensor harness connector and 39(32) of PCM(ECM) harness connector.

4) Measure the resistance between terminal 2 of knock sensor harness connector and 15(11) of PCM(ECM) harness connector.

Specification : Below approx. 1Ω

5) Is the measured resistance within specifications?

YES

▶ Repair Short to ground in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EACFD760

1. Check Knock sensor.

1) Substitute with a known - good Knock sensor and check for proper operation.

2) Is the signal normal?

YES

▶ Replace Knock sensor and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE486495

Refer to DTC P0326.

DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH INPUT

COMPONENT LOCATION E472E8FF

Refer to DTC P0326.

GENERAL DESCRIPTION EF60EA0D

Refer to DTC P0326.

DTC DESCRIPTION EF8C1E90

If normalized reference signal is higher than the upper limit according to rpm, PCM sets P0328.

DTC DETECTING CONDITION EAC73470

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Poor connection • Short to power in signal circuit • Knock sensor • PCM
Enable Conditions	• Coolant temperature 〉 40 ℃	
Threshold Value	• Normalized reference level 〉 upper limit, f(rpm)	
Diagnostic Time	• Continuous	

SPECIFICATION E3A6B82D

Refer to DTC P0326.

SCHEMATIC DIAGRAM E6F226BC

Refer to DTC P0326.

SIGNAL WAVEFORM & DATA ED19D86D

Refer to DTC P0326.

MONITOR SCANTOOL DATA E668D21F

Refer to DTC P0326.

TERMINAL AND CONNECTOR INSPECTION E6B2CCCF

Refer to DTC P0326.

SIGNAL CIRCUIT INSPECTION ED2678A6

1. Check voltage.
   1) Key "OFF".

2) Disconnect Knock sensor connector.

3) Key "ON".

4) Measure the voltage between terminal 1 of knock sensor harness connector and chassis ground.

5) Measure the voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx 2.4V

6) Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EC08968D

1. Check Knock sensor.

1) Substitute with a known - good Knock sensor and check for proper operation.

2) Is the signal normal?

YES

▶ Replace Knock sensor and go to "Verification of Vehicle Repair" procedure.

NO

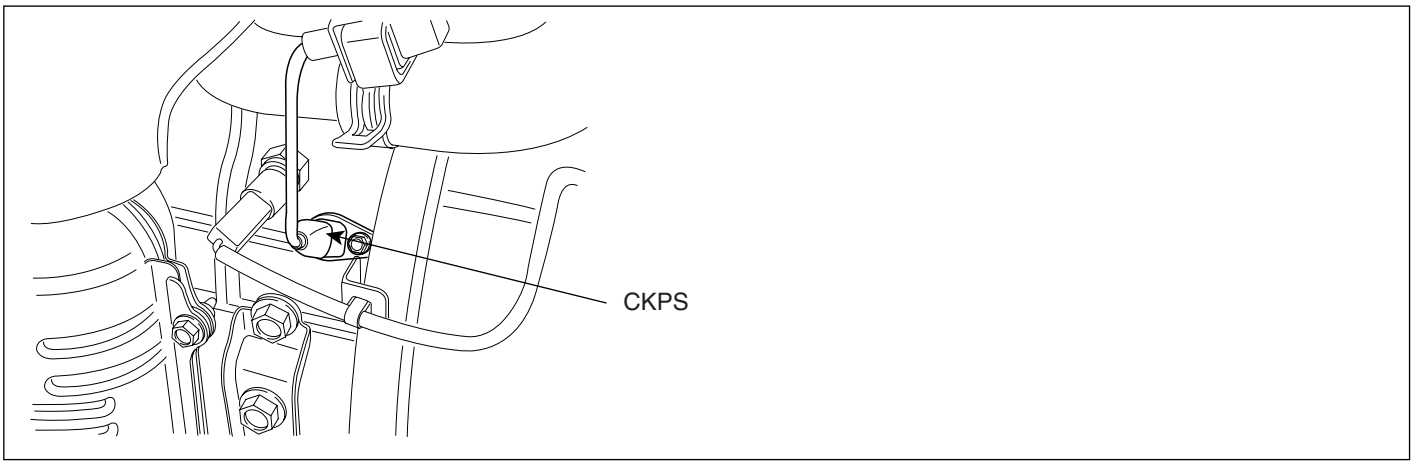
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EADD50E7

Refer to DTC P0326.

DTC P0335 CRANKSHAFT POSITION SENSOR A CIRCUIT

COMPONENT LOCATION EF916BB7



AFJF378B

GENERAL DESCRIPTION E44BBAE1

A Crankshaft Position Sensor (CKPS) is a magnetic type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft; there are 58 slots in the target wheel where one is longer than the others. When the slot in the wheel aligns with the sensor, the sensor voltage outputs low. When the metal (tooth) in the wheel aligns with the sensor, the sensor voltage outputs high. During one crankshaft rotation there are 58 rectangular signals and one longer signal. The PCM calculates engine RPM by using the sensor' s signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the PCM identifies which cylinder is at top dead center.

DTC DESCRIPTION ECD38902

If CKPS cannot find reference mark during 6 times or more, PCM sets DTC P0335.

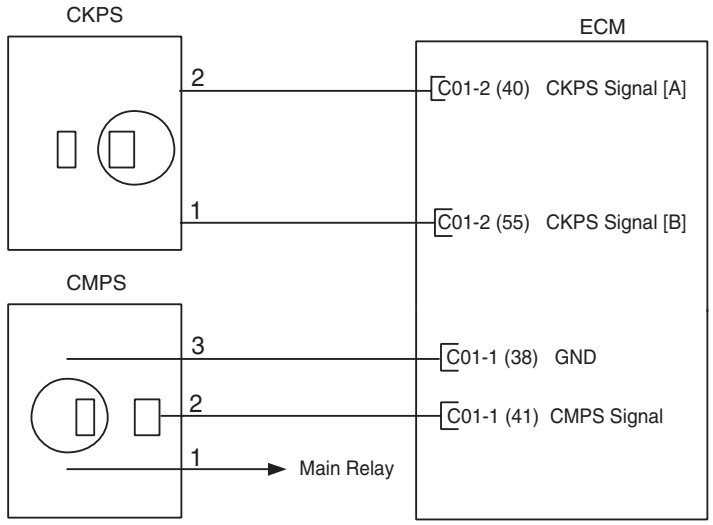
DTC DETECTING CONDITION EF575DDE

Item	Detecting Condition	Possible Cause
DTC Strategy	• Reference mark check	• Poor connection • Open or short in signal circuit • CKPS • PCM
Enable Conditions		
Threshold Value	• No reference mark 〉 6 times	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E0F678C9

(A/T)

[CIRCUIT DIAGRAM]

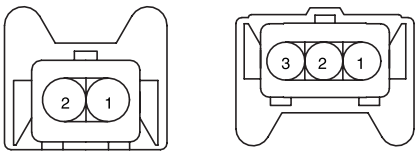


[CONNECTION INFORMATION]

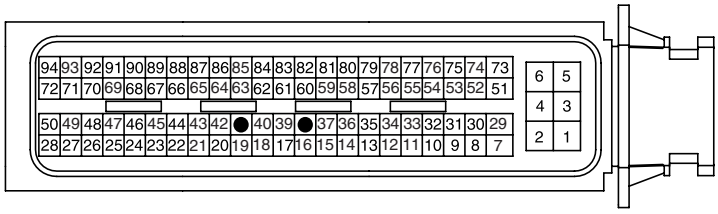
Terminal	Connected to	Function
1	ECM C01-2 (55)	CKPS Signal [B]
2	ECM C01-2 (40)	CKPS Signal [A]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (41)	CMPS Signal
3	ECM C01-1 (38)	Sensor Ground

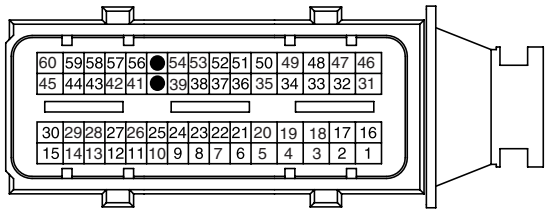
[HARNESS CONNECTOR]



CKPS (C06) CMPS (C05)



C01-1



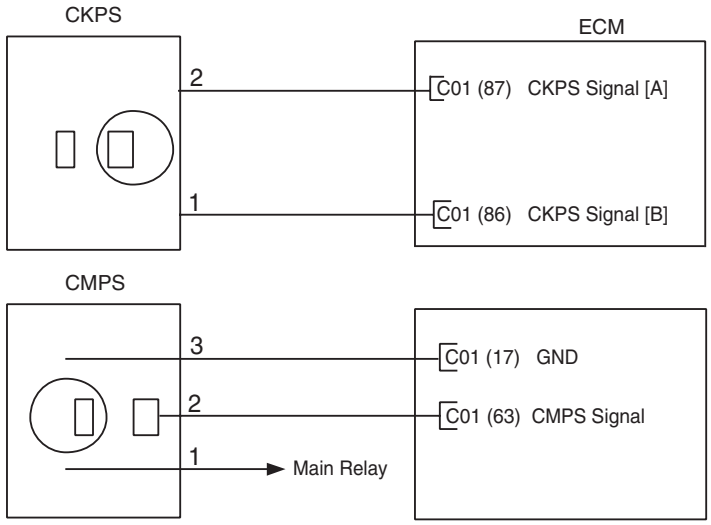
C01-2

ECM

LFJF309A

(M/T)

[CIRCUIT DIAGRAM]

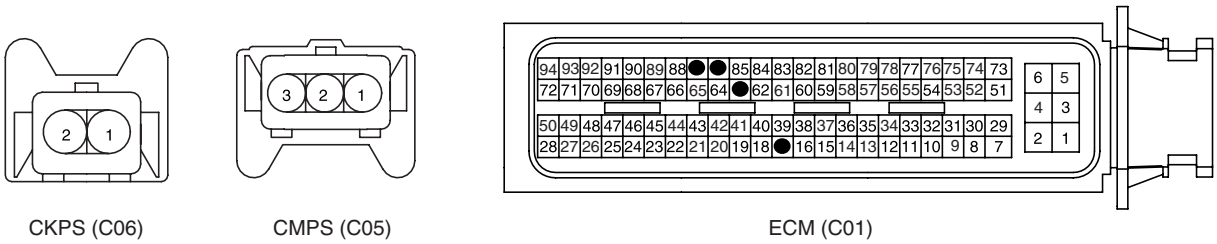


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (86)	CKPS Signal [B]
2	ECM C01 (87)	CKPS Signal [A]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (63)	CMPS Signal
3	ECM C01 (17)	Sensor Ground

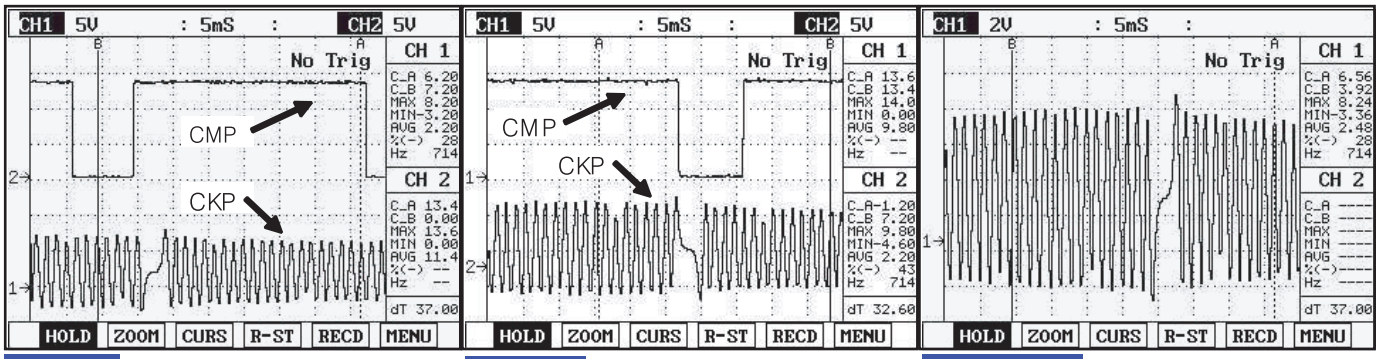
[HARNESS CONNECTOR]



CKPS (C06) CMPS (C05) ECM (C01)

LFJF309B

SIGNAL WAVEFORM & DATA E045DEEC



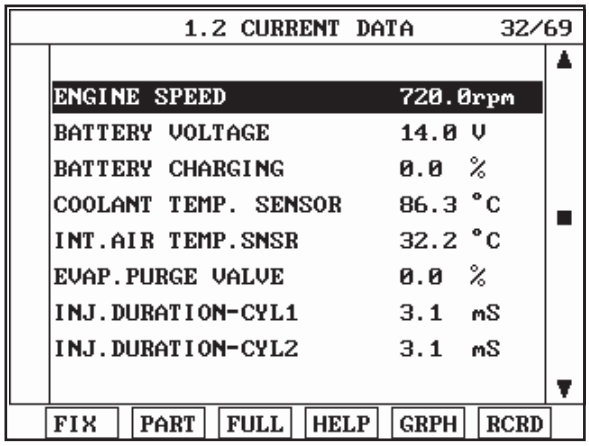
1.6 CVVT 1.4 DOHC Commonness

This example shows a typical Crankshaft Position Sensor(CkPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CkPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

LFJF576A

MONITOR SCANTOOL DATA ED8D8595

1. Connect scantool to DLC(Data Link Cable).
2. Start the engine.
3. Monitor the "CKP" parameters on the scantool.



LFJF577A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E0F762BE

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

YES

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

NO

▶ Go to "CKPS circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION E527C677

1. Check Oepn in signal circuit.

1) Key "OFF".
2) Disconnect CKPS connector.
3) Key "ON".
4) Measure the voltage between terminal 1 / 2 of CKPS harness connector and chassis ground.

Specification : Approx 2.5V

5) Is the measured voltage within specification?

YES

▶ Go to "Check Short in signal circuit" procedure.

NO

▶ Go to "Check Short to ground in signal circuit" procedure.

2. Check Short to ground in signal circuit.

1) Key "OFF".
2) Disconnect CKPS connector and ECM connector.
3) Measure the resistance between 1 / 2 of CKPS harness connector and chassis ground.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair Short to ground in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

3. Check Short in signal circuit.

1) Key "OFF".
2) Disconnect CKPS connector and ECM connector.
3) Measure the resistance between 1 and 2 of CKPS harness connector.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2FA6309

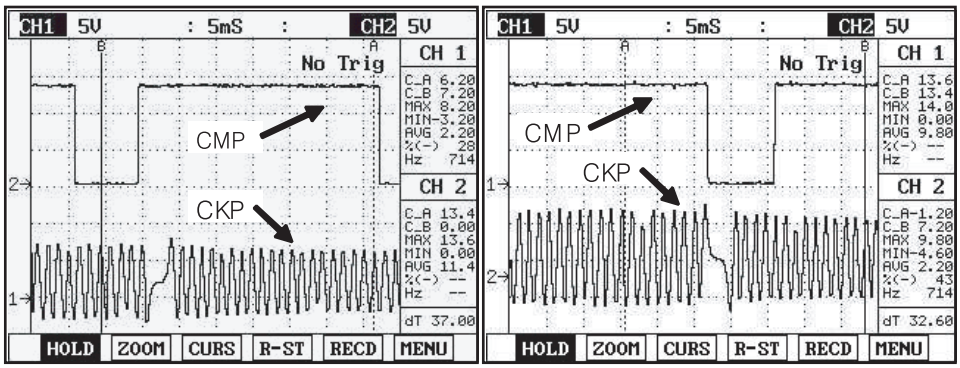
1. Check CKPS.

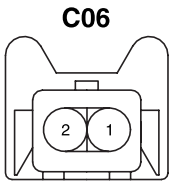
   1) Key "ON". (Don't disconnect sensors.)

   2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 1 of CKPS harness connector.

   3) Engine start. And check the signal waveforms.

SPECIFICATION :





1. CKPS signal B
2. CKPS signal A

LFJF581A

   4) Is the measured signal waveform O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good CKPS and check for proper operation.
▶ If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

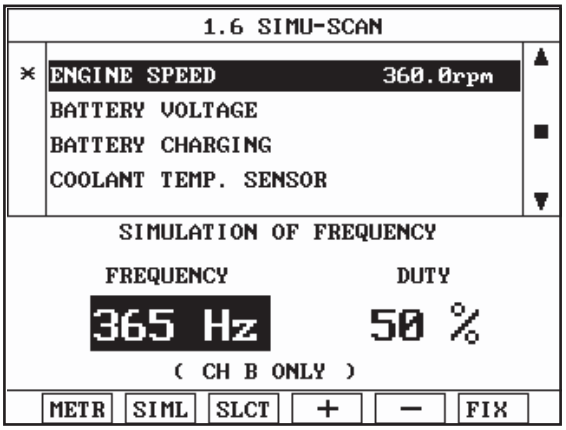
2. Check ECM.

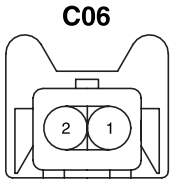
   1) IG "OFF".

   2) Connect scantool and Engine "ON".

   3) Select simulation function on scantool.

   4) Simulate frequency(Hz) at terminal 1 of CKPS signal connector.





1. CKPS signal B
2. CKPS signal A

LFJF582A

5) Does the signal value of CKPS change according to simulation frequency?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7CD6ACB

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0336 CRANKSHAFT POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E7AFDB09

Refer to DTC P0335.

GENERAL DESCRIPTION ECF16A55

Refer to DTC P0335.

DTC DESCRIPTION E6FF7A74

If frequency counter of the lost reference gap is over 2000, PCM sets DTC P0336.

DTC DETECTING CONDITION E94BA943

Item	Detecting Condition	Possible Cause
DTC Strategy	• Reference mark check	• Poor connection • Open or short in signal circuit • CKPS • PCM
Enable Conditions	• No back turn of engine detected	
Threshold Value	• Frequency counter of the lost reference gap 〉 2000	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E984BE60

Refer to DTC P0335.

SIGNAL WAVEFORM & DATA E2342E20

Refer to DTC P0335.

MONITOR SCANTOOL DATA E53C9639

Refer to DTC P0335.

TERMINAL AND CONNECTOR INSPECTION E3517F06

Refer to DTC P0335.

SIGNAL CIRCUIT INSPECTION E57515C6

1. Key "OFF".
2. Disconnect CKPS connector.
3. Key "ON".

4. Measure the voltage between terminal 1 / 2 of CKPS harness connector and chassis ground.

Specification : Approx 2.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open or Short in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EF0F3AC0

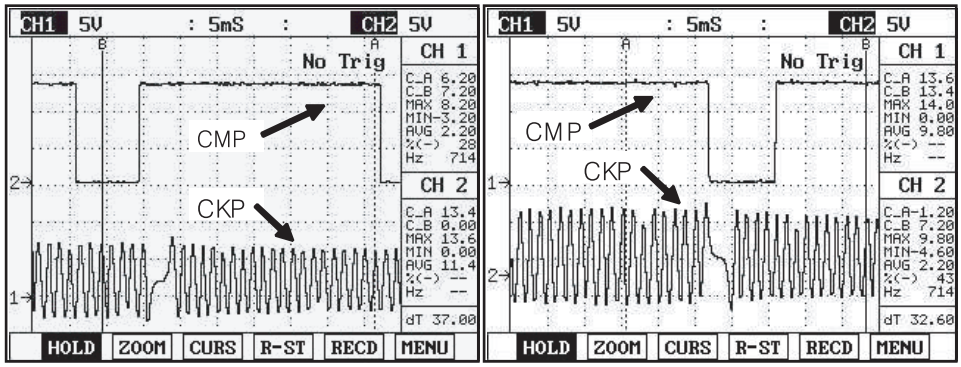
1. Check CKPS.

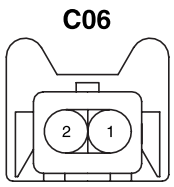
   1) Key "ON". (Don't disconnect sensors.)

   2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 1 of CKPS harness connector.

   3) Engine start. And check the signal waveforms.

SPECIFICATION :





1. CKPS signal B
2. CKPS signal A

LFJF581A

   4) Is the measured signal waveform O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good CKPS and check for proper operation.
▶ If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

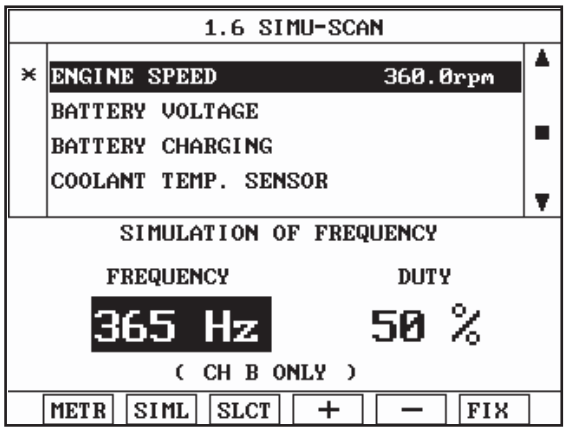
2. Check ECM.

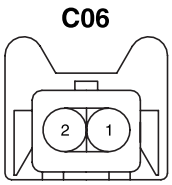
   1) IG "OFF".

   2) Connect scantool and Engine "ON".

3) Select simulation function on scantool.

4) Simulate frequency(Hz) at terminal 1 of CKPS signal connector.





1. CKPS signal B
2. CKPS signal A

LFJF582A

5) Does the signal value of CKPS change according to simulation frequency?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2144CE5

Refer to DTC P0335.

DTC P0337 CRANKSHAFT POSITION SENSOR A CIRCUIT LOW INPUT

COMPONENT LOCATION E8271159

Refer to DTC P0335.

GENERAL DESCRIPTION EDE5A0E7

Refer to DTC P0335.

DTC DESCRIPTION E32D798F

If frequency counter of the gap correction is retarded over 265, PCM sets DTC P0337.

DTC DETECTING CONDITION ECEDF2A9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Reference mark check	• Poor connection • Open or short in signal circuit • CKPS • PCM
Enable Conditions	• Idle engine speed 〉 target speed - 50rpm	
Threshold Value	• Frequency counter of the gap correction (Minus side)〉 265	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E2E2F108

Refer to DTC P0335.

SIGNAL WAVEFORM & DATA E397336C

Refer to DTC P0335.

MONITOR SCANTOOL DATA E5BFDDE4

Refer to DTC P0335.

TERMINAL AND CONNECTOR INSPECTION E909F968

Refer to DTC P0335.

SIGNAL CIRCUIT INSPECTION E1EF576A

1. Check Oepn in signal circuit.
   1) Key "OFF".
   2) Disconnect CKPS connector.

3) Key "ON".

4) Measure the voltage between terminal 1 / 2 of CKPS harness connector and chassis ground.

Specification : Approx 2.5V

5) Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Go to "Check Short to ground in signal circuit" procedure.

2. Check Short to ground in signal circuit.

1) Key "OFF".

2) Disconnect CKPS connector and ECM connector.

3) Measure the resistance between 1 / 2 of CKPS harness connector and chassis ground.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair Short to ground in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE4AE353

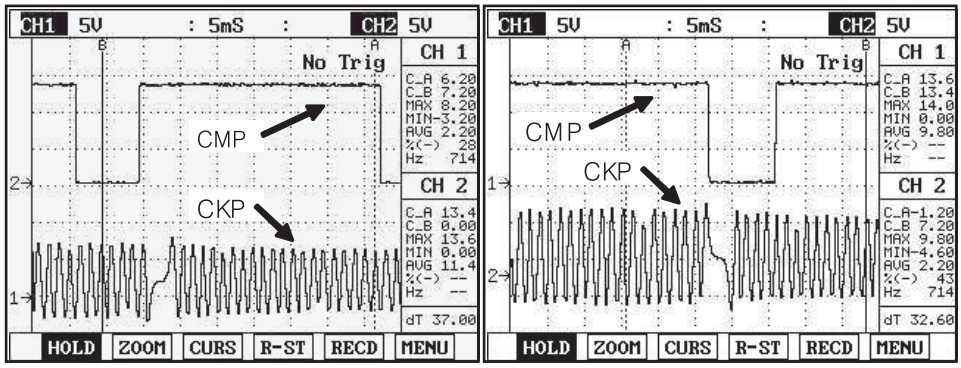
1. Check CKPS.

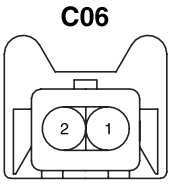
1) Key "ON". (Don't disconnect sensors.)

2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 1 of CKPS harness connector.

3) Engine start. And check the signal waveforms.

SPECIFICATION :





1. CKPS signal B
2. CKPS signal A

LFJF581A

4) Is the measured signal waveform O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good CKPS and check for proper operation.
▶ If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

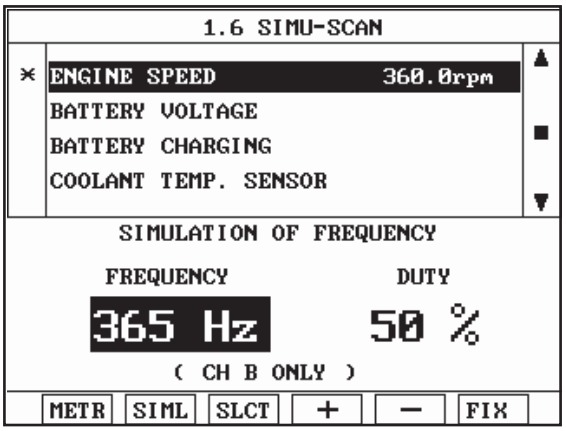
2. Check ECM.

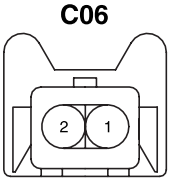
1) IG "OFF".

2) Connect scantool and Engine "ON".

3) Select simulation function on scantool.

4) Simulate frequency(Hz) at terminal 1 of CKPS signal connector.





1. CKPS signal B
2. CKPS signal A

LFJF582A

5) Does the signal value of CKPS change according to simulation frequency?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E27B3CFC

Refer to DTC P0335.

DTC P0338 CRANKSHAFT POSITION SENSOR A CIRCUIT HIGH INPUT

COMPONENT LOCATION E69EBA9C

Refer to DTC P0335.

GENERAL DESCRIPTION ED6512BE

Refer to DTC P0335.

DTC DESCRIPTION EAD35253

If frequency counter of the gap correction is advanced over 265, PCM sets DTC P0338.

DTC DETECTING CONDITION E6616358

Item	Detecting Condition	Possible Cause
DTC Strategy	• Reference mark check	• Poor connection • Open or short in signal circuit • CKPS • PCM
Enable Conditions	• Vehicle speed 〈 1kph or 〉 25kph	
Threshold Value	• Frequency counter of the gap correction (Plus side)〉 265	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E973DCFE

Refer to DTC P0335.

SIGNAL WAVEFORM & DATA E130963E

Refer to DTC P0335.

MONITOR SCANTOOL DATA E9C2EB31

Refer to DTC P0335.

TERMINAL AND CONNECTOR INSPECTION ECC53402

Refer to DTC P0335.

SIGNAL CIRCUIT INSPECTION EA46336A

1. Check Oepn in signal circuit.
   1) Key "OFF".
   2) Disconnect CKPS connector.

3) Key "ON".

4) Measure the voltage between terminal 1 / 2 of CKPS harness connector and chassis ground.

Specification : Approx 2.5V

5) Is the measured voltage within specification?

YES

▶ Go to "Check Short in signal circuit" procedure.

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short in signal circuit.

1) Key "OFF".

2) Disconnect CKPS connector and ECM connector.

3) Measure the resistance between 1 and 2 of CKPS harness connector.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2C7DC47

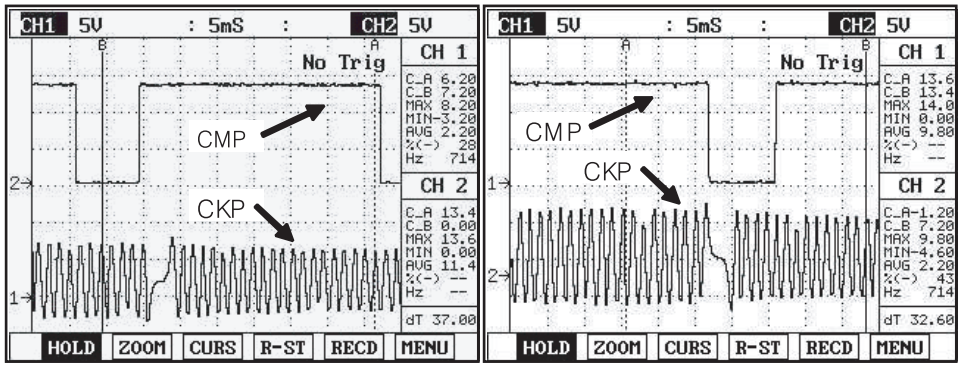
1. Check CKPS.

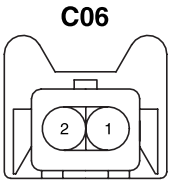
1) Key "ON". (Don't disconnect sensors.)

2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 1 of CKPS harness connector.

3) Engine start. And check the signal waveforms.

SPECIFICATION :





1. CKPS signal B
2. CKPS signal A

LFJF581A

4) Is the measured signal waveform O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good CKPS and check for proper operation.
▶ If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

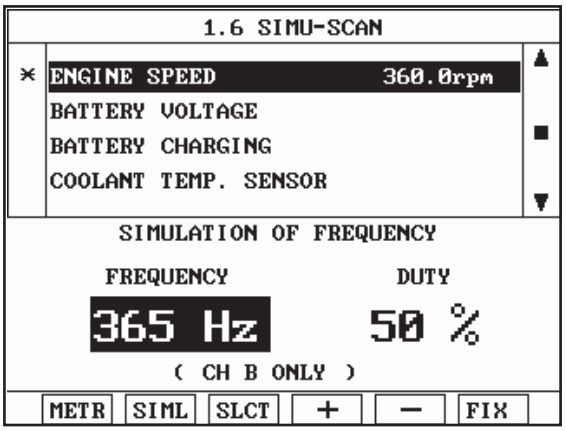
2. Check ECM.

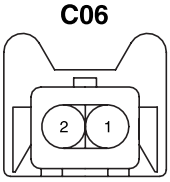
1) IG "OFF".

2) Connect scantool and Engine "ON".

3) Select simulation function on scantool.

4) Simulate frequency(Hz) at terminal 1 of CKPS signal connector.





1. CKPS signal B
2. CKPS signal A

LFJF582A

5) Does the signal value of CKPS change according to simulation frequency?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E34EB428

Refer to DTC P0335.

DTC P0339 CRANKSHAFT POSITION SENSOR A CIRCUIT

COMPONENT LOCATION EA48D3FF

Refer to DTC P0335.

GENERAL DESCRIPTION E4140A6A

Refer to DTC P0335.

DTC DESCRIPTION E89E1BC5

If there is no signal from CKPS while there is CKPS signal, PCM sets DTC P0339.

DTC DETECTING CONDITION E73C864F

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Poor connection • Open or short in signal circuit • CKPS • PCM
Enable Conditions	• Edge counter of camshaft position sensor 〉 8	
Threshold Value	• No signal	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM EFEE7AA2

Refer to DTC P0335.

SIGNAL WAVEFORM & DATA EDAE509A

Refer to DTC P0335.

MONITOR SCANTOOL DATA E64EE914

Refer to DTC P0335.

TERMINAL AND CONNECTOR INSPECTION EBD384F5

Refer to DTC P0335.

SIGNAL CIRCUIT INSPECTION E6A11665

1. Check Oepn in signal circuit.
   1) Key "OFF".
   2) Disconnect CKPS connector.

3) Key "ON".

4) Measure the voltage between terminal 1 / 2 of CKPS harness connector and chassis ground.

Specification : Approx 2.5V

5) Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Go to "Check Short to ground in signal circuit" procedure.

2. Check Short to ground in signal circuit.

1) Key "OFF".

2) Disconnect CKPS connector and ECM connector.

3) Measure the resistance between 1 / 2 of CKPS harness connector and chassis ground.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair Short to ground in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E51384F3

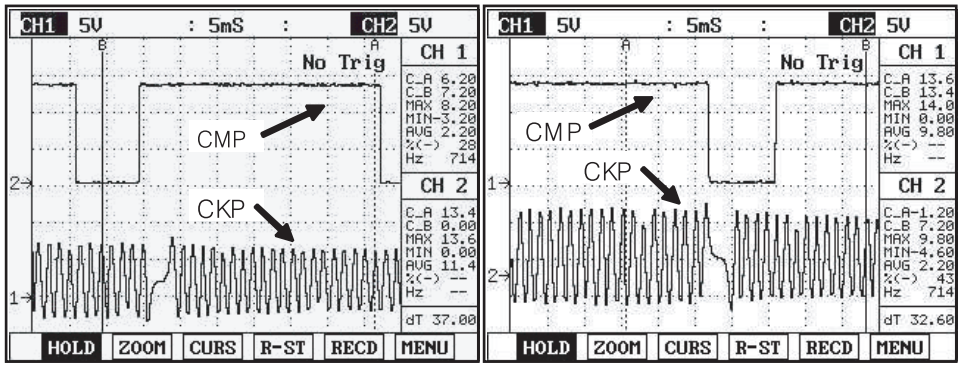
1. Check CKPS.

1) Key "ON". (Don't disconnect sensors.)

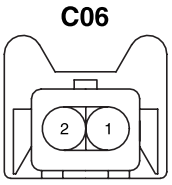
2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 1 of CKPS harness connector.

3) Engine start. And check the signal waveforms.

SPECIFICATION :



1.6 CVVT 1.4 DOHC



1. CKPS signal B
2. CKPS signal A

LFJF581A

4) Is the measured signal waveform O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good CKPS and check for proper operation.
▶ If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

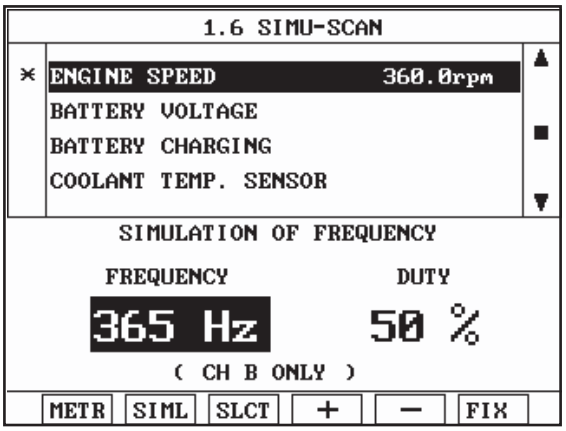
2. Check ECM.

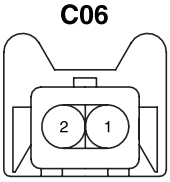
1) IG "OFF".

2) Connect scantool and Engine "ON".

3) Select simulation function on scantool.

4) Simulate frequency(Hz) at terminal 1 of CKPS signal connector.





1. CKPS signal B
2. CKPS signal A

LFJF582A

5) Does the signal value of CKPS change according to simulation frequency?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

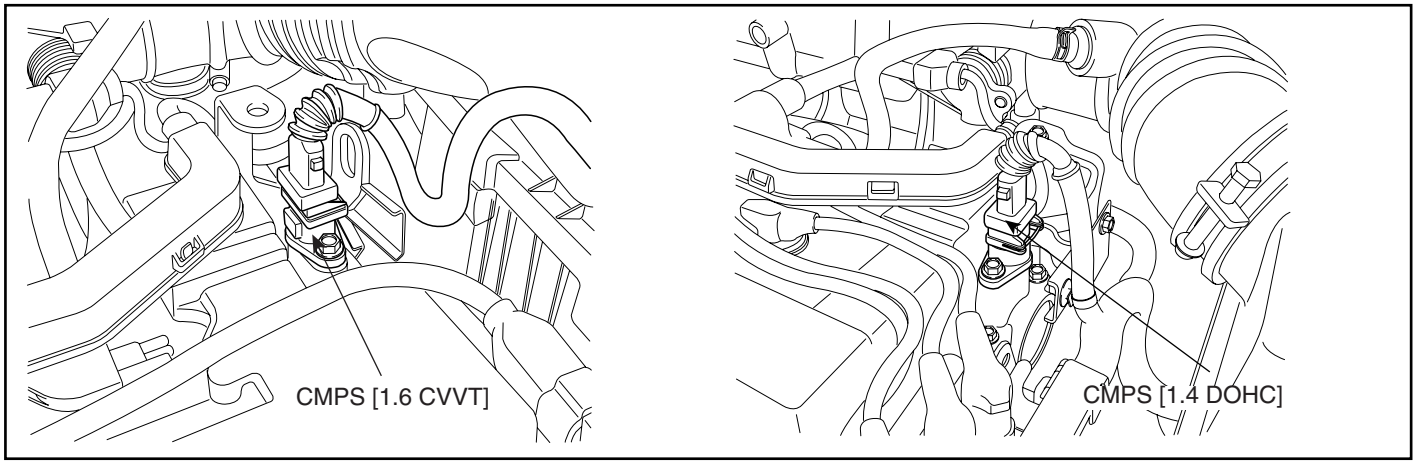
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA345A48

Refer to DTC P0335.

DTC P0340 CAMSHAFT POSITION SENSOR A CIRCUIT MALFUNCTION (BANK 1 OR SINGLE SENSOR)

COMPONENT LOCATION EF8344E9



LFJF800Z

GENERAL DESCRIPTION EE5A2723

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 the each cylinder which the CKPS can't detect. The CMPS are installed on engine head cover and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. When teeth on the target wheel trigger the sensor, output voltage is 12V. If not, it is 0V. These CMPS signal is sent to the PCM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

DTC DESCRIPTION E4CAEDD4

If signal input phase is abnormal over 12 times by faulty assembling, PCM sets DTC P0340.

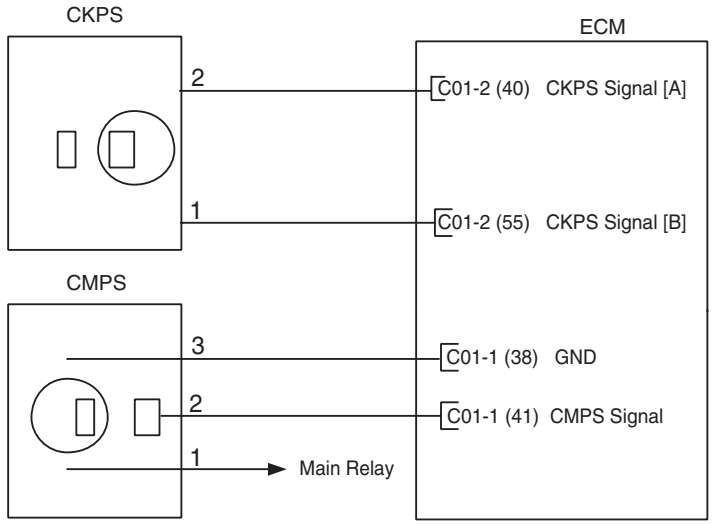
DTC DETECTING CONDITION E5DF33CC

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check (check the assembling state)	• Poor connection • abnormal assembling state • CMPS • PCM
Enable Conditions	• Sensor signal requested	
Threshold Value	• Abnormal phase edges 〉 12 times	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E3984FEE

(A/T)

[CIRCUIT DIAGRAM]

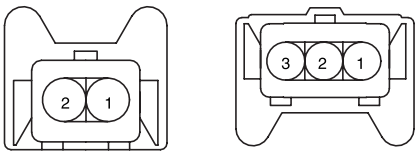


[CONNECTION INFORMATION]

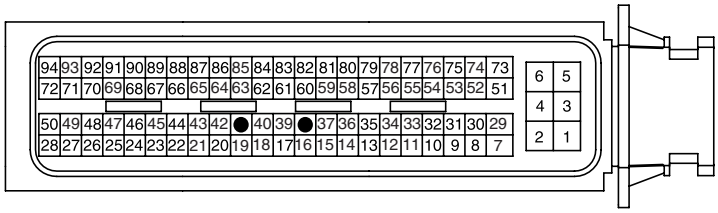
Terminal	Connected to	Function
1	ECM C01-2 (55)	CKPS Signal [B]
2	ECM C01-2 (40)	CKPS Signal [A]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (41)	CMPS Signal
3	ECM C01-1 (38)	Sensor Ground

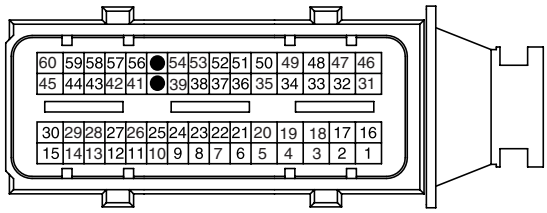
[HARNESS CONNECTOR]



CKPS (C06) CMPS (C05)



C01-1



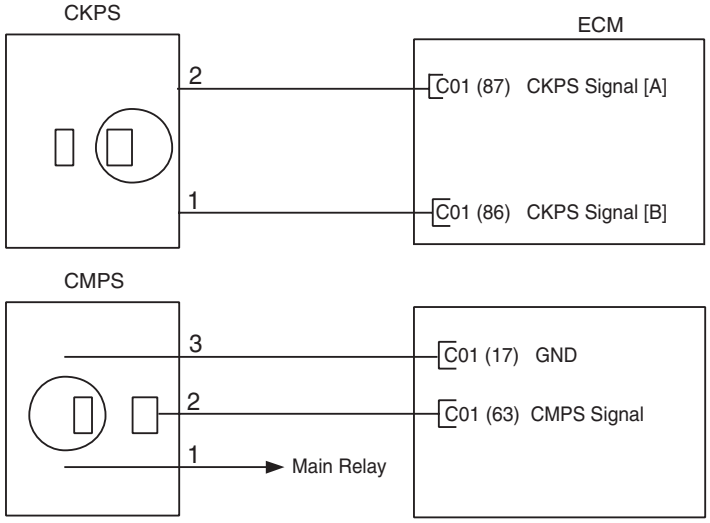
C01-2

ECM

LFJF309A

(M/T)

[CIRCUIT DIAGRAM]

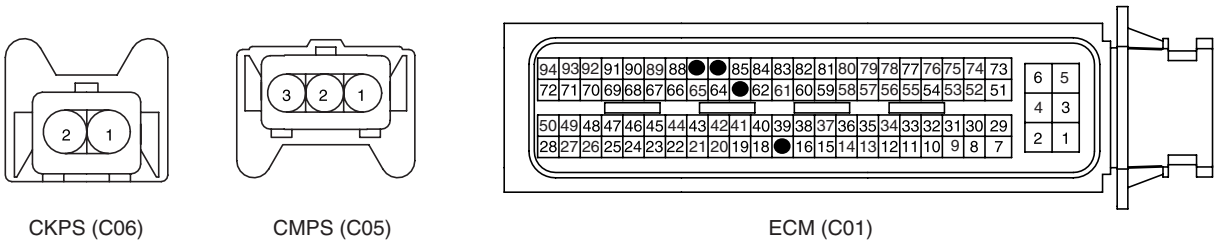


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (86)	CKPS Signal [B]
2	ECM C01 (87)	CKPS Signal [A]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (63)	CMPS Signal
3	ECM C01 (17)	Sensor Ground

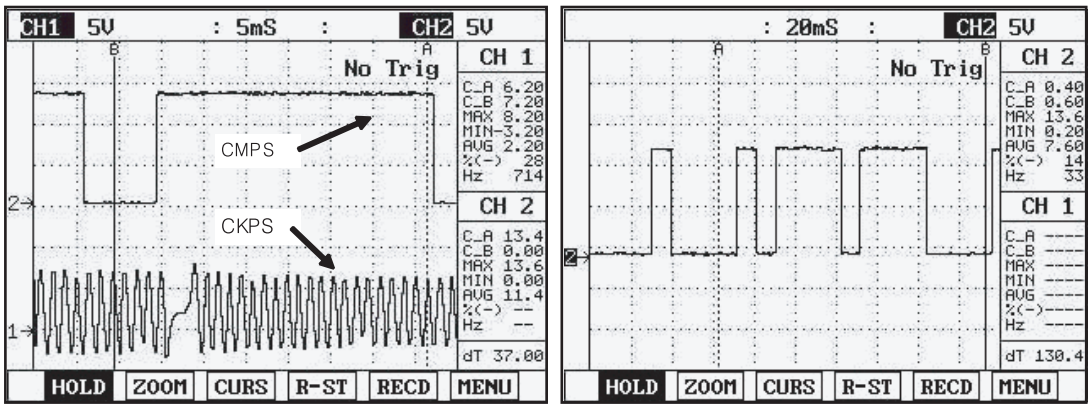
[HARNESS CONNECTOR]



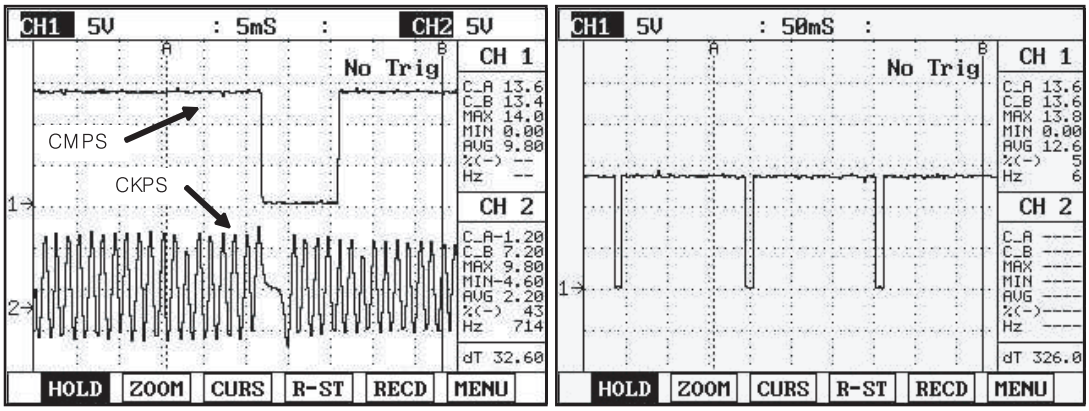
CKPS (C06) CMPS (C05) ECM (C01)

LFJF309B

SIGNAL WAVEFORM & DATA EB620FED



1.6CVVT



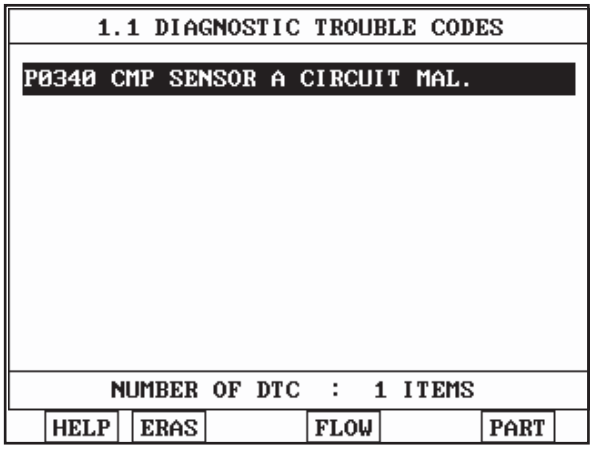
1.4DOHC

This example shows a typical Crankshaft Position Sensor(CkPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CkPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

LFJF584A

MONITOR SCANTOOL DATA E4A19BD7

1. Connect scantool to Data Link Connector(DLC) and erase the DTC.
2. Warm up the engine to normal operating temperature.
3. Monitor DTC(Diagnostics Trouble Code) on the scantool.



LFJF585A

4. Is the same DTC displayed again?

YES

▶ Go to "Terminal and connector inspection" procedure

NO

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

TERMINAL AND CONNECTOR INSPECTION E5098424

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

YES

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

NO

▶ Go to "CMPS Power circuit inspection" procedure.

POWER CIRCUIT INSPECTION EE852B4B

1. Key "OFF".
2. Disconnect CMPS connector.
3. key "ON".
4. Measure the voltage between terminal 1 of CMPS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair Open or Short circuit and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EEF33E1B

1. Check Oepn in signal circuit.
   1) Key "OFF".
   2) Disconnect CMPS connector.
   3) Key "ON".
   4) Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.

Specification : Approx 12V

   5) Is the measured voltage within specification?

YES

▶ Go to "Short to power circuit inspection" procedure

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short to power in signal circuit.
   1) Key "OFF".
   2) Disconnect CMPS connector and PCM connector.
   3) Measure the resistance between terminal 1 and 2 of CMPS harness connector.

Specification : Infinite

   4) Is the measured resistance within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Repair Short to power in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0CBD019

1. Key "OFF".

2. Disconnect CMPS connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.(A)
5. Measure the voltage between terminal 2 and 3 of CMPS harness connector.(B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0266651

1. CMPS visual check.
   1) Key "OFF".
   2) Check damage and assembling state of CMPS.
   3) Check the projection of cam-shaft visually after remove the CMPS.
   4) Is everything O.K?

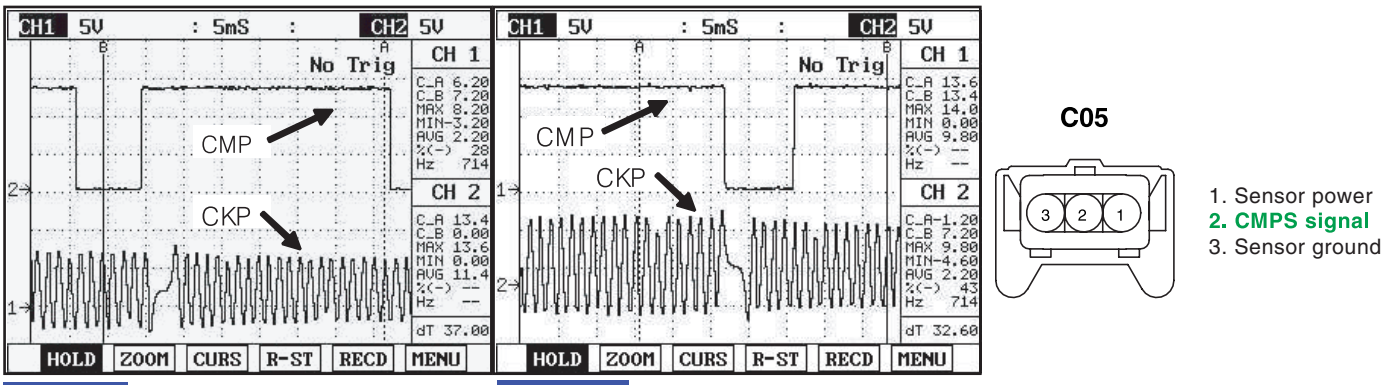
   YES

   ▶ Go to "CMPS check" procedure.

   NO

   ▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.
2. CMPS check.
   1) Key "ON". (Don’t disconnect sensors.)
   2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 2 of CMPS harness connector.
   3) Engine start. And check the signal waveforms.

SPECIFICATION :



LFJF590A

4) Is the signal waveform within specifications?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6E50FE5

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0341 CAMSHAFT POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

COMPONENT LOCATION ECE69FFB

Refer to DTC P0340.

GENERAL DESCRIPTION EFDAD6E7

Refer to DTC P0340.

DTC DESCRIPTION E8FAB76F

If signal input phase is abnormal over 12 times by faulty wiring, PCM sets DTC P0341.

DTC DETECTING CONDITION E81DD092

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check (check the wiring state)	• Poor connection • Open or short in power/ground/ signal circuit • CMPS • PCM
Enable Conditions	• Sensor signal requested	
Threshold Value	• Abnormal phase edges 〉 12 times	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E51E0D72

Refer to DTC P0340.

SIGNAL WAVEFORM & DATA EE54CA84

Refer to DTC P0340.

MONITOR SCANTOOL DATA E78142B1

Refer to DTC P0340.

TERMINAL AND CONNECTOR INSPECTION E0DC7E7F

Refer to DTC P0340.

POWER CIRCUIT INSPECTION E33DE8A2

1. Key "OFF".
2. Disconnect CMPS connector.

3. key "ON".
4. Measure the voltage between terminal 1 of CMPS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair Open or Short circuit and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E941D519

1. Check Oepn in signal circuit.
   1) Key "OFF".
   2) Disconnect CMPS connector.
   3) Key "ON".
   4) Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.

Specification : Approx 12V

   5) Is the measured voltage within specification?

YES

▶ Go to "Short to power circuit inspection" procedure

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short to power in signal circuit.
   1) Key "OFF".
   2) Disconnect CMPS connector and PCM connector.
   3) Measure the resistance between terminal 1 and 2 of CMPS harness connector.

Specification : Infinite

   4) Is the measured resistance within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Repair Short to power in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E3F1BDA3

1. Key "OFF".
2. Disconnect CMPS connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.(A)
5. Measure the voltage between terminal 2 and 3 of CMPS harness connector.(B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

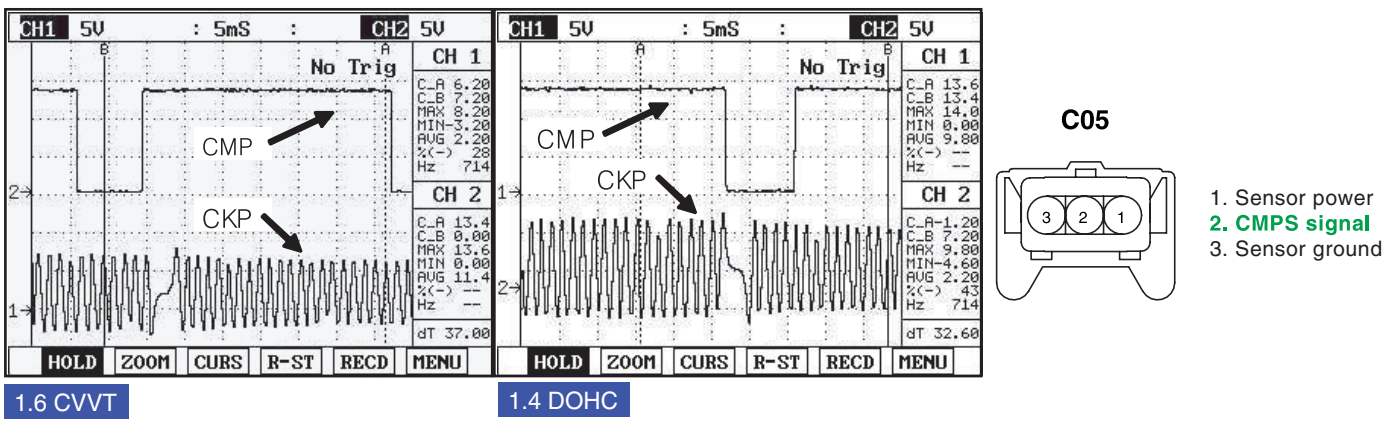
NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6AD2E86

1. CMPS check.
   1) Key "ON". (Don't disconnect sensors.)
   2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 2 of CMPS harness connector.
   3) Engine start. And check the signal waveforms.

SPECIFICATION :



LFJF590A

4) Is the signal waveform within specifications?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA9585F6

Refer to DTC P0340.

DTC P0342 CAMSHAFT POSITION SENSOR A CIRCUIT LOW INPUT

COMPONENT LOCATION E2FD43B2

Refer to DTC P0340.

GENERAL DESCRIPTION E30570EA

Refer to DTC P0340.

DTC DESCRIPTION EC815384

If there are low signal input and no phase edge over 12 times, PCM sets DTC P0342.

DTC DETECTING CONDITION EF7C8665

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Poor connection • Short to ground in signal circuit • CMPS • PCM
Enable Conditions	• Sensor signal requested	
Threshold Value	• Signal low and no phase edge 〉 12 times	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM EED0D7D0

Refer to DTC P0340.

SIGNAL WAVEFORM & DATA EB7F4E6E

Refer to DTC P0340.

MONITOR SCANTOOL DATA E37F0FAE

Refer to DTC P0340.

TERMINAL AND CONNECTOR INSPECTION EAAA47D6

Refer to DTC P0340.

POWER CIRCUIT INSPECTION EC6D1FBB

1. Key "OFF".
2. Disconnect CMPS connector.
3. Key "ON".

4. Measure the voltage between terminal 1 of CMPS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair Open or Short circuit and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E785BEF2

1. Check Short in signal circuit.
   1) Key "OFF".
   2) Disconnect CMPS connector.
   3) Key "ON".
   4) Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.

Specification : Approx 12V

   5) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

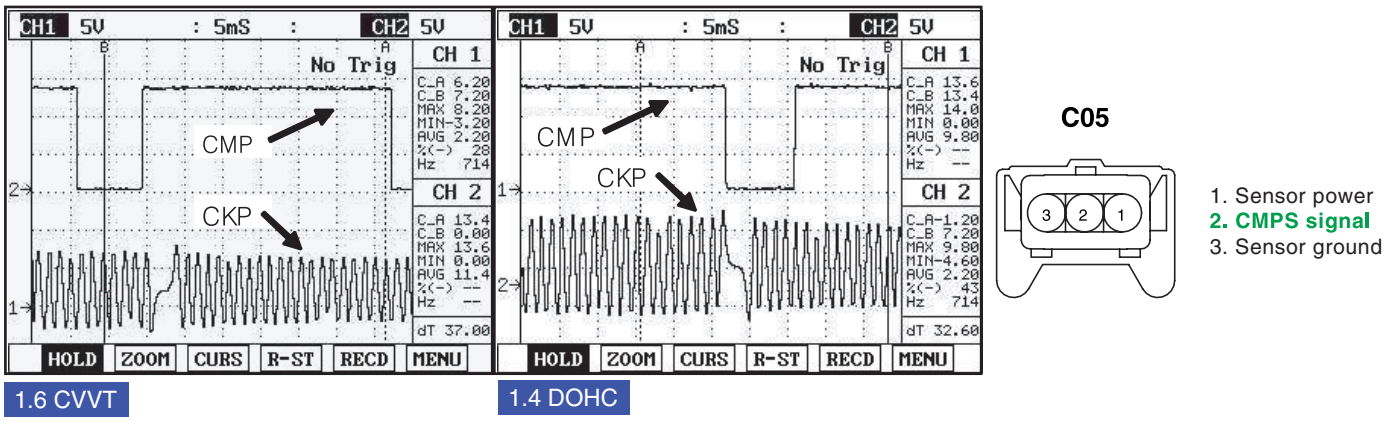
NO

▶ Repair Short to ground in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E8CEC208

1. CMPS check.
   1) Key "ON". (Don't disconnect sensors.)
   2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 2 of CMPS harness connector.
   3) Engine start. And check the signal waveforms.

SPECIFICATION :



LFJF590A

4) Is the signal waveform within specifications?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBA91B4F

Refer to DTC P0340.

DTC P0343 CAMSHAFT POSITION SENSOR A CIRCUIT HIGH INPUT

COMPONENT LOCATION EAD6F8E0

Refer to DTC P0340.

GENERAL DESCRIPTION E5AC4773

Refer to DTC P0340.

DTC DESCRIPTION ED2372FB

If there are high signal input and no phase edge over 12 times, PCM sets DTC P0343.

DTC DETECTING CONDITION E61822F6

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Poor connection • Open in signal/ground circuit • Short to power in signal circuit • CMPS • PCM
Enable Conditions	• Sensor signal requested	
Threshold Value	• Signal high and no phase edge 〉 12 times	
Diagnostic Time		
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E5C58CDE

Refer to DTC P0340.

SIGNAL WAVEFORM & DATA EEAE9BAA

Refer to DTC P0340.

MONITOR SCANTOOL DATA EDDC5590

Refer to DTC P0340.

TERMINAL AND CONNECTOR INSPECTION EE72412F

Refer to DTC P0340.

POWER CIRCUIT INSPECTION E4389DD4

1. Key "OFF".
2. Disconnect CMPS connector.
3. Key "ON".

4. Measure the voltage between terminal 1 of CMPS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Repair Open or Short circuit and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION ECF8E065

1. Key "OFF".
2. Disconnect CMPS connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.(A)
5. Measure the voltage between terminal 2 and 3 of CMPS harness connector.(B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specification?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E1A6468C

1. Check Open in signal circuit.
   1) Key "OFF".
   2) Disconnect CMPS connector.
   3) Key "ON".
   4) Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.

Specification : Approx 12V

   5) Is the measured voltage within specification?

YES

▶ Go to "Short to power circuit inspection" procedure.

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short to power in signal circuit.

1) Key "OFF".

2) Disconnect CMPS connector and PCM connector.

3) Measure the resistance between terminal 1 and 2 of CMPS harness connector.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E78A806E

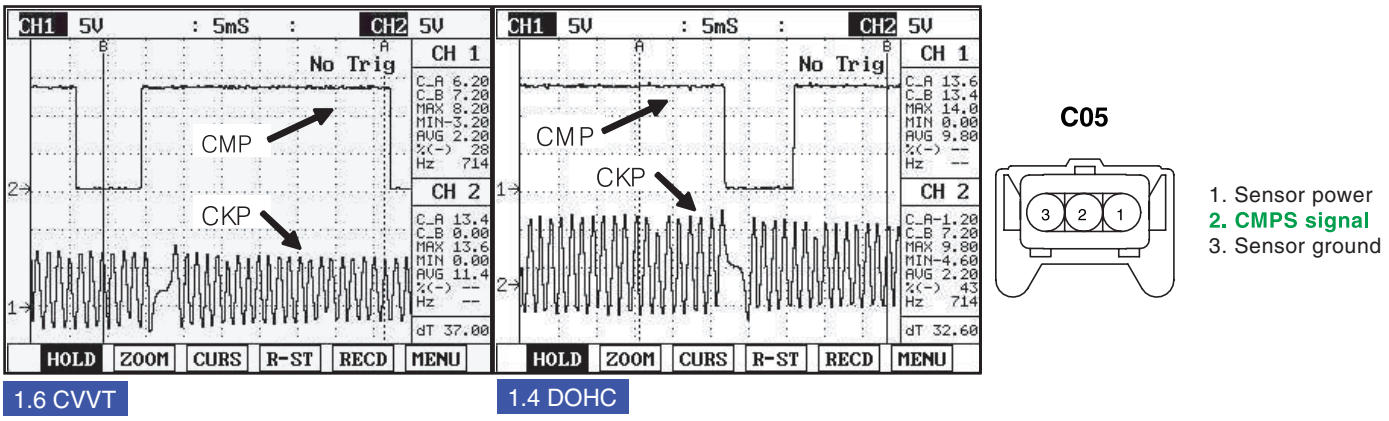
1. CMPS check.

1) Key "ON". (Don't disconnect sensors.)

2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 2 of CMPS harness connector.

3) Engine start. And check the signal waveforms.

SPECIFICATION :



LFJF590A

4) Is the signal waveform within specifications?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6075793

Refer to DTC P0340.

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

GENERAL DESCRIPTION E8605F42

The catalyst's efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2 O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION E4094016

If amplitude of B1S2 is over 0.5 voltage during 60 sec under enable conditions, PCM sets DTC P0420.

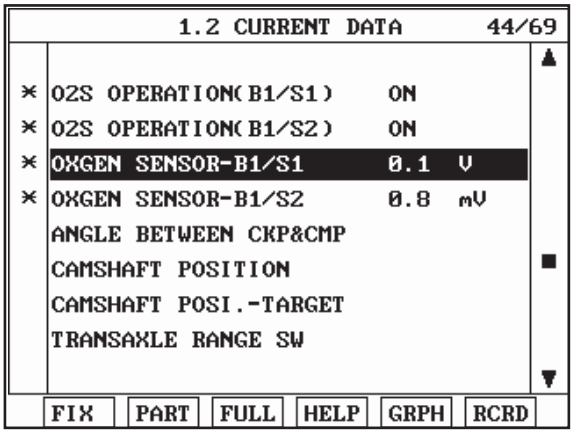
DTC DETECTING CONDITION E7D779E7

Item	Detecting Condition	Possible Cause
DTC Strategy	• Oxygen storage capacity	• Exhaust system • B1S2 • Catalyst converter • ECM
Enable Conditions	• Engine speed 1200～3000rpm • Engine load 15～50% • Catalyst temp.(model) 470～700℃ • Purge factor (high load canister) 〈 12 • Closed loop control	
Threshold Value	• Amplitude of downstream O2 sensor signal 〉 0.5	
Diagnostic Time	• 60 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

MONITOR SCANTOOL DATA EB66C031

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "B1S1 and B1S2" parameters on the scantool.



LFJF597A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "System Inspection" procedure.

SYSTEM INSPECTION E2B3EF62

1. Exhaust gas system check.

   1) Visual check.
      - Check air leakage at junction of HO2S or Catalyst converter.
      - Check looseness, poor connection, or damage.

   2) Is there something wrong?

      YES

      ▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

      NO

      ▶ Go to "Component inspection" procedure.

COMPONENT INSPECTION E3CACAD0

1. Rear HO2S(B1S2) check.

   1) B1S2 visual check
      - Check assembling state of B1S2. (Check the interference between sensor wiring and exhaust pipe.)
      - Check corrosion, contamination, or damage on sensor terminal and connector.

   2) Is there something wrong?

YES

▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Catalyst converter check" procedure.

2. Catalyst converter check.

   1) Catalyst converter visual check.
      - Check discoloration by over-heating.
      - Check deflection or crack(hole).
      - Check noise.

   2) Check whether the catalyst converter is genuine.

   3) Is there something wrong?

YES

▶ Substitute with a known-good Catalyst Converter and check for proper operation. If the problem iscorrected, replace Catalyst Converter and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC970CC9

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

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

YES

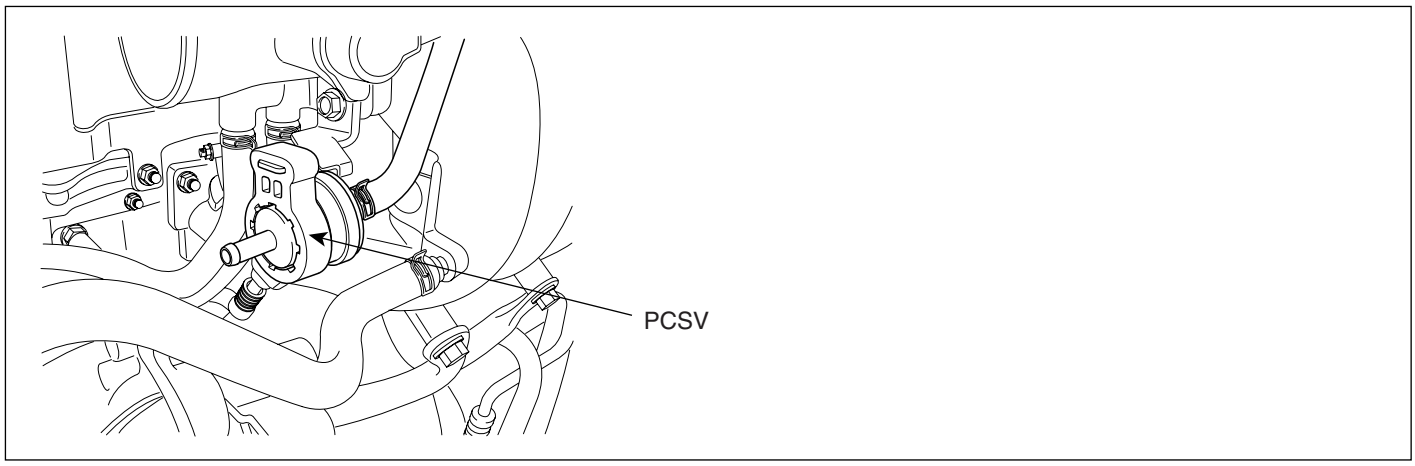
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0444 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT OPEN

COMPONENT LOCATION EBBFB431



AFJF390B

GENERAL DESCRIPTION EEA0D31A

The purge solenoid is a pneumatic device that meters the air and fuel (purge) vapor flow to the purge port. In a sense, the purge solenoid is comparable to a fuel injector, because the metered purge flow follows the same slope and offset characteristics. However, the purge solenoid normally runs with a duty cycle at a fixed frequency because the opening response is significantly slower than a fuel injector. It would not practical to run the solenoid synchronously with engine events except perhaps at very low RPM. The normal frequencies for the purge solenoid are between 8 and 20 Hz.

DTC DESCRIPTION EB220C02

If there is Open in PCSV circuit, PCM sets DTC P0444.

DTC DETECTING CONDITION E567FD1E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, open	• Poor connection • Open in power circuit • Open in control circuit • PCSV • PCM
Enable Conditions		
Threshold Value	• Disconnected	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

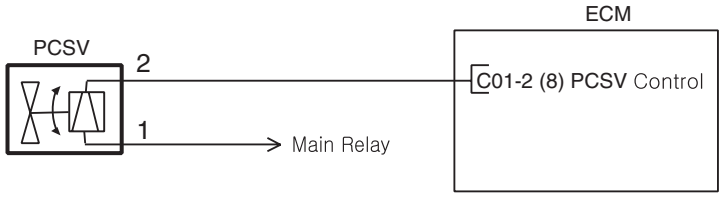
SPECIFICATION EAC8EFB8

Temperature	Coil Resistance
20℃	16Ω

SCHEMATIC DIAGRAM EF4C0E85

(A/T)

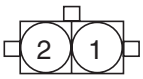
[CIRCUIT DIAGRAM]



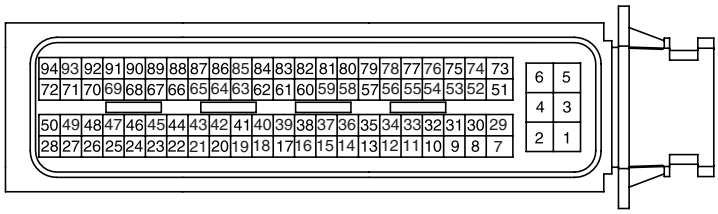
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-2 (8)	PCSV Control

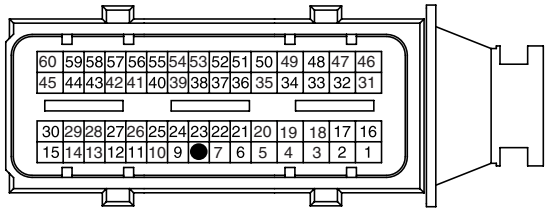
[HARNESS CONNECTORS]



PCSV (C26)



C01-1



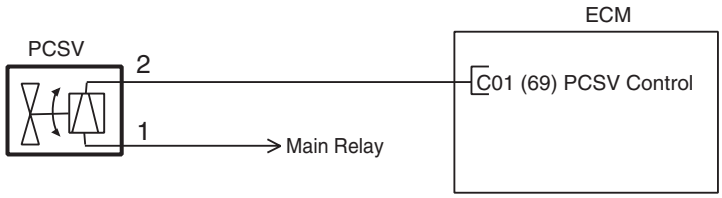
C01-2

ECM

LFJF599A

(M/T)

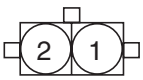
[CIRCUIT DIAGRAM]



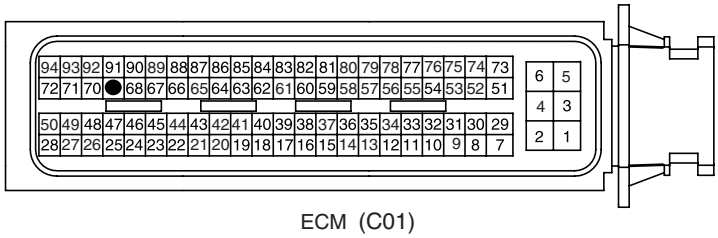
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01 (69)	PCSV Control

[HARNESS CONNECTORS]



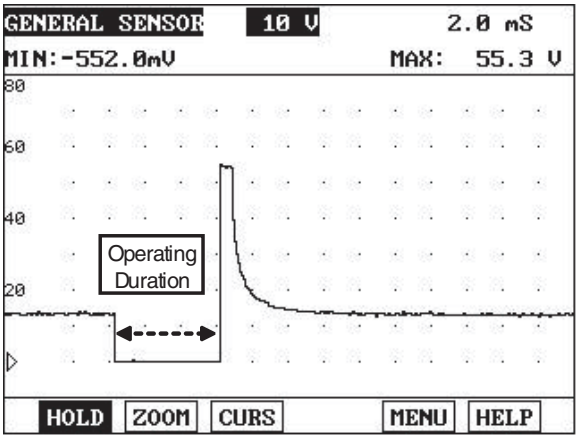
PCSV (C26)



ECM (C01)

LFJF599B

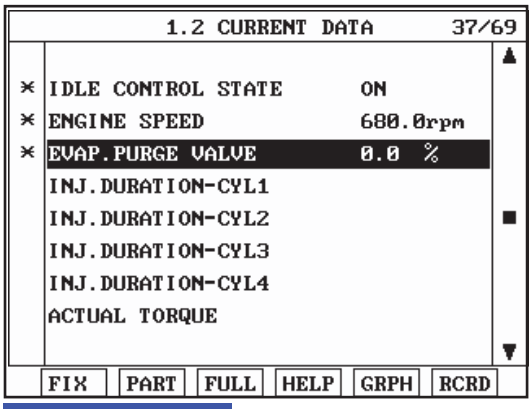
SIGNAL WAVEFORM & DATA EACA764F



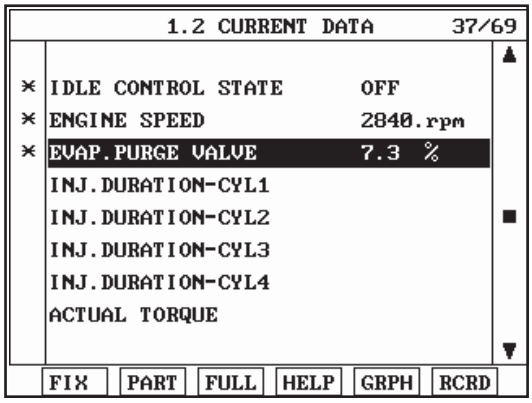
LFJF600A

MONITOR SCANTOOL DATA E7392501

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "PCSV" parameters on the scantool.



Normal state at idle



Normal state at accelerating

LFJF601A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EE3D1138

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

YES

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

NO

▶ Go to "PCSV circuit inspection" procedure.

POWER CIRCUIT INSPECTION E74F20CE

1. Key "OFF".
2. Disconnect PCSV connector.
3. key "ON".
4. Measure the voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EE01A6FD

1. Key "OFF".
2. Disconnect PCSV connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx 3.5V

5. Is the measured voltage within specification?
6. ▶ Go to "Component inspection" procedure.

NO

▶ Repair Open or Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E369396B

1. PCSV check.

   1) Key "OFF".

   2) Disconnect PCSV harness connector.

   3) Measure the resistance between terminal 1 and 2 of PCSV harness connector.(Component side)

SPECIFICATION :

Temperature	Coil Resistance
20℃	16Ω

   4) Is the measured resistance within specification?

   YES

   ▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E1CA9391

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0458 EVAP. EMISSION SYSTEM-PURGE CONTROL VALVE CIRCUIT LOW

COMPONENT LOCATION E3828E5F

Refer to DTC P0444.

GENERAL DESCRIPTION E752F246

Refer to DTC P0444.

DTC DESCRIPTION EE6178D3

If there is Short to ground in PCSV circuit, PCM sets DTC P0458.

DTC DETECTING CONDITION E34A5118

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low	• Poor connection • Short to ground in power circuit • Short to ground in control circuit • PCSV • PCM
Enable Conditions		
Threshold Value	• Short circuit to ground	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION ED4588A4

Refer to DTC P0444.

SCHEMATIC DIAGRAM E4C35C6B

Refer to DTC P0444.

SIGNAL WAVEFORM & DATA E9F6F54C

Refer to DTC P0444.

MONITOR SCANTOOL DATA EE8DF223

Refer to DTC P0444.

TERMINAL AND CONNECTOR INSPECTION E1A9E769

Refer to DTC P0444.

POWER CIRCUIT INSPECTION E84AE4DB

1. Key "OFF".
2. Disconnect PCSV connector.
3. Key "ON".
4. Measure the voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EBBE5BD1

1. Key "OFF".
2. Disconnect PCSV connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx 3.5V

5. Is the measured voltage within specification?
6. ▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E08ABE65

1. PCSV check.
   1) Key "OFF".
   2) Disconnect PCSV harness connector.
   3) Measure the resistance between terminal 1 and 2 of PCSV harness connector.(Component side)

SPECIFICATION :

Temperature	Coil Resistance
20℃	16Ω

4) Is the measured resistance within specification?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E8958A41

Refer to DTC P0444.

DTC P0459 EVAP. EMISSION SYSTEM-PURGE CONTROL VALVE CIRCUIT HIGH

COMPONENT LOCATION E70BD9EF

Refer to DTC P0444.

GENERAL DESCRIPTION EB651136

Refer to DTC P0444.

DTC DESCRIPTION E3381B2B

If there is Short to power in PCSV circuit, PCM sets DTC P0459.

DTC DETECTING CONDITION E509CA4D

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high	• Poor connection • Short to power in control circuit • PCSV • PCM
Enable Conditions		
Threshold Value	• Short circuit to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E143A8E5

Refer to DTC P0444.

SCHEMATIC DIAGRAM EA2BBC4D

Refer to DTC P0444.

SIGNAL WAVEFORM & DATA E1C890BE

Refer to DTC P0444.

MONITOR SCANTOOL DATA EA58483B

Refer to DTC P0444.

TERMINAL AND CONNECTOR INSPECTION E8B06777

Refer to DTC P0444.

POWER CIRCUIT INSPECTION E69F9295

1. Key "OFF".
2. Disconnect PCSV connector.
3. Key "ON".
4. Measure the voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EF0C4C7B

1. Key "OFF".
2. Disconnect PCSV connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx 3.5V

5. Is the measured voltage within specification?
6. ▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6F5C5CA

1. PCSV check.
   1) Key "OFF".
   2) Disconnect PCSV harness connector.
   3) Measure the resistance between terminal 1 and 2 of PCSV harness connector.(Component side)

SPECIFICATION :

Temperature	Coil Resistance
20℃	16Ω

4) Is the measured resistance within specification?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

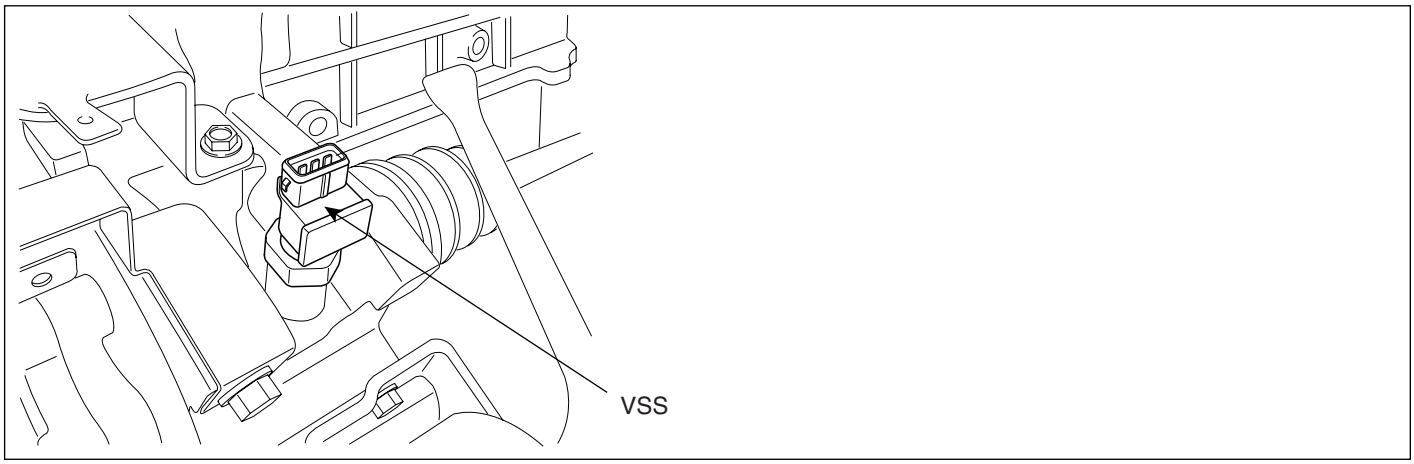
▶ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR EED02223

Refer to DTC P0444.

DTC P0501 VEHICLE SPEED SENSOR A RANGE/PERFORMANCE

COMPONENT LOCATION E2DB3EF8



AFJF376B

GENERAL DESCRIPTION E5744382

The wheel speed sensor is the essential component taht the PCM uses to calculate vehicle speed. This wheel speed sensor is the active hall-sensor type and good at temperature and noise charariteristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and PCM gets vehicle speed through ABS/ESP control unit or the wheel speed sensor(In case of non-ABS/ESP vehicle).

DTC DESCRIPTION ECA68AD2

If the vehicle speed signal is below 1.0 Km/h during 2 sec under enable conditions, PCM sets P0501.

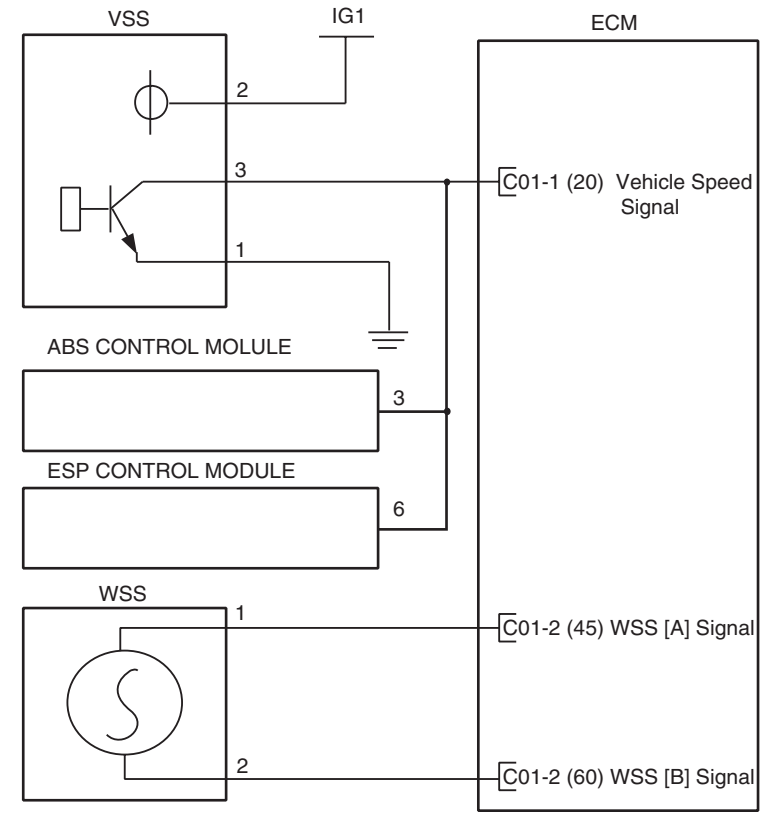
DTC DETECTING CONDITION E1CE81C0

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Poor connection • Open or short to ground in power circuit • Short to ground in signal circuit • VSS • PCM
Enable Conditions	• (M/T or A/T) Engine speed during fuel cut-off 1520~3520rpm • (only A/T at D or R position) Engine speed 〉 3000rpm, Engine load 〉 49.5% Coolant temperature 〉 65℃	
Threshold Value	• Vehicle speed signal 〈 1.0 Km/h	
Diagnostic Time	• 2 sec	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM ECE0EE95

(A/T)

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

[VSS]

Terminal	Connected to	Function
1	Chassis Ground	Sensor Ground
2	IG 1	Battery Voltage (B+)
3	ECM C01-1 (20)	VSS Signal

[ABS CONTROL MODULE]

Terminal	Connected to	Function
1	ECM C01-1 (20)	Vehicle Speed Signal

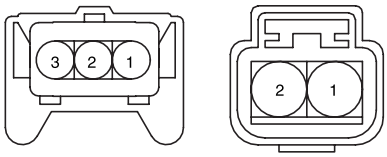
[ESP CONTROL MODULE]

Terminal	Connected to	Function
1	ECM C01-1 (20)	Vehicle Speed Signal

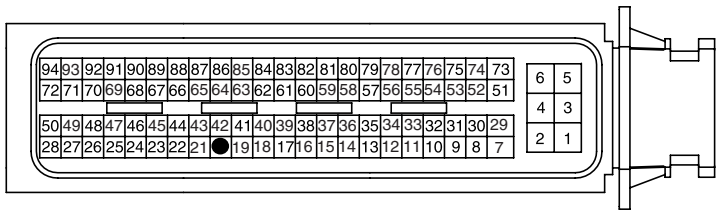
[WSS]

Terminal	Connected to	Function
1	ECM C01-2 (45)	WSS [A] Signal
2	ECM C01-2 (60)	WSS [B] Signal

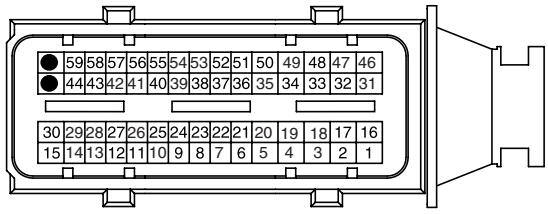
[HARNESS CONNECTORS]



VSS (C22) WSS (E50)

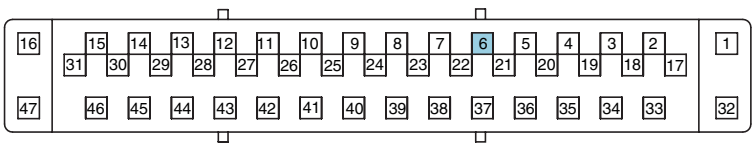


C01-1

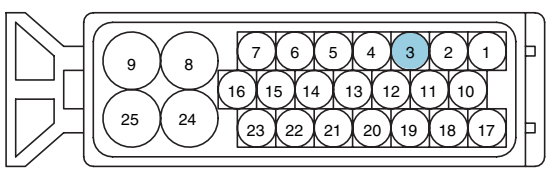


C01-2

ECM



ESP CONTROL MODULE (E17)

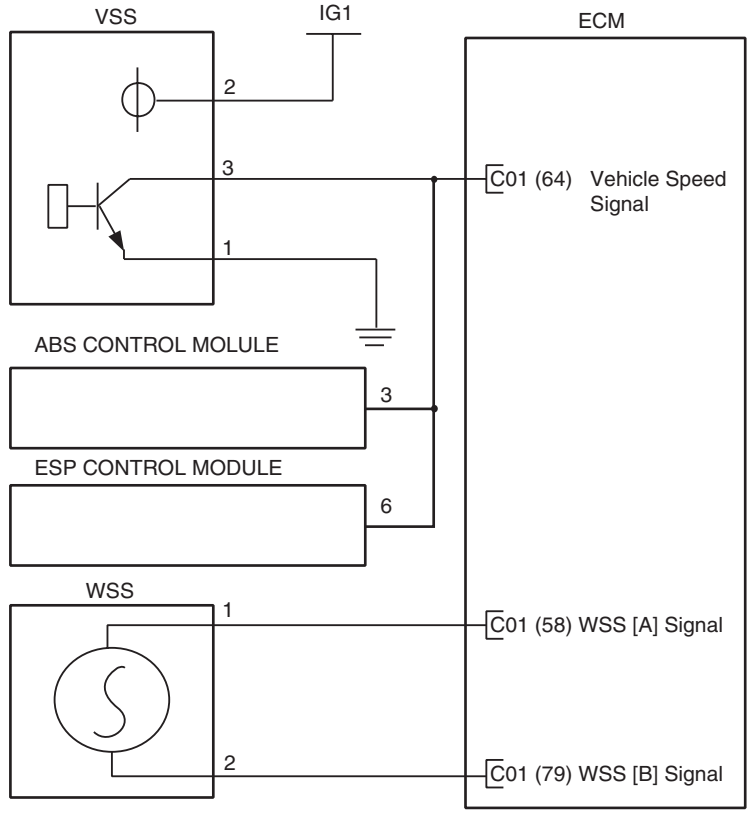


ABS CONTROL MODULE (E51)

LFJF606A

(M/T)

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

[VSS]

Terminal	Connected to	Function
1	Chassis Ground	Sensor Ground
2	IG 1	Battery Voltage (B+)
3	ECM C01 (64)	VSS Signal

[ABS CONTROL MODULE]

Terminal	Connected to	Function
1	ECM C01 (64)	Vehicle Speed Signal

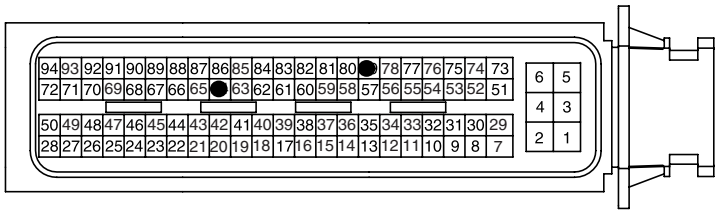
[ESP CONTROL MODULE]

Terminal	Connected to	Function
1	ECM C01 (64)	Vehicle Speed Signal

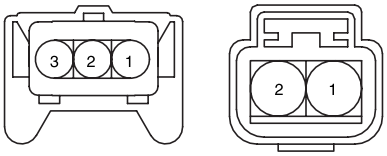
[WSS]

Terminal	Connected to	Function
1	ECM C01 (58)	WSS [A] Signal
2	ECM C01 (79)	WSS [B] Signal

[HARNESS CONNECTORS]

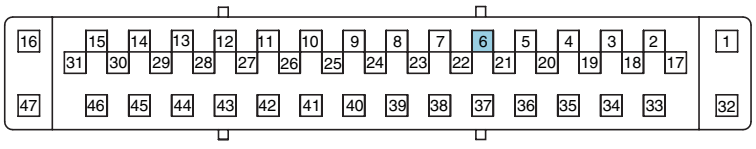


C01

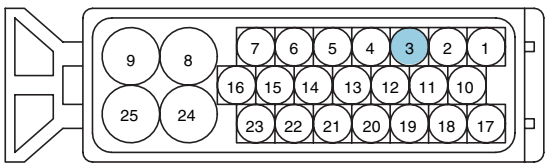


VSS (C22) WSS (E50)

ECM



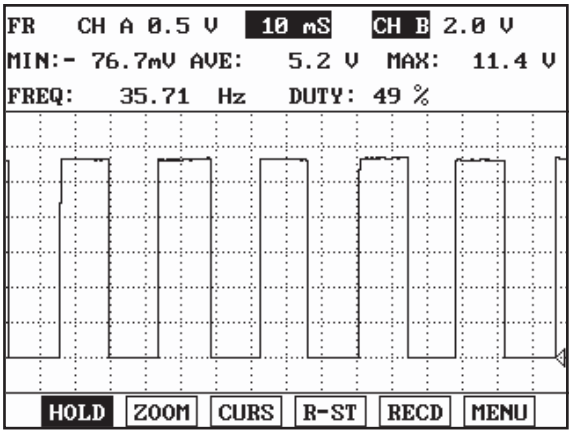
ESP CONTROL MODULE (E17)



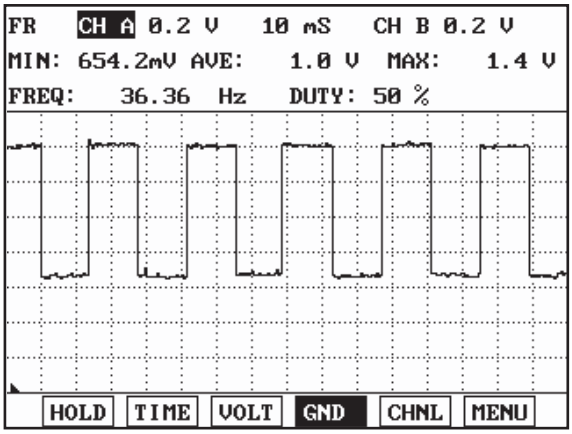
ABS CONTROL MODULE (E51)

LFJF606B

SIGNAL WAVEFORM & DATA EA04589D



Signal from ABS/ESP Module to ECM



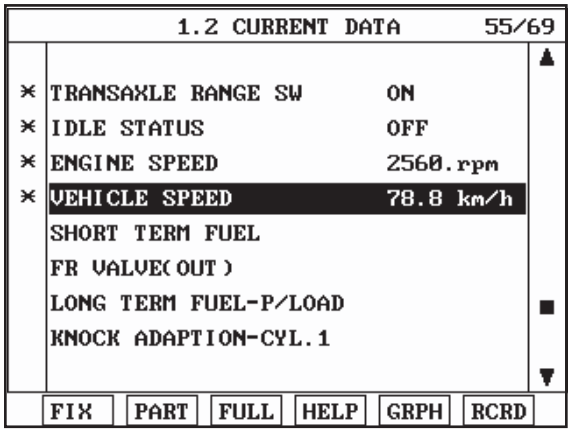
Signal from WSS to ECM

LFJF607A

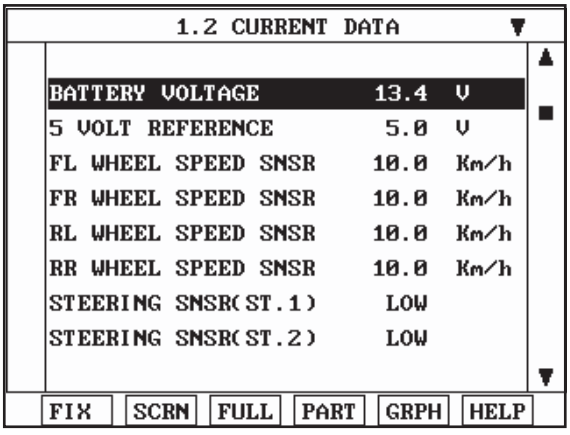
MONITOR SCANTOOL DATA E700DB81

ABS/ESP VEHICLE

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "VSS" parameters on the scantool.(ENG. Control)
4. Monitor the "WHEEL SPEED SENSOR-FR" parameter on the Scantool. (ABS Control or ESP Control)



ENG. Control



ABS Control or ESP Control

LFJF608A

5. Are the parameters displayed correctly?

YES

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

NO

▶ If both vehicle speed signal from ECM and Wheel Speed Signal from ABS(ESP) on current data are not displayed correctly refer to DTC C1203 Wheel speed sensor front -RH open/short" in ABS(ESP) troubleshooting guide.
▶ If the Wheel Speed Signal from ABS(EPS) is O.K but Vehicle Speed Signal from ECM on current data is not properly displayed, go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E9E4EBAD

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E0A7EAF3

1. Check short to ground in harness.

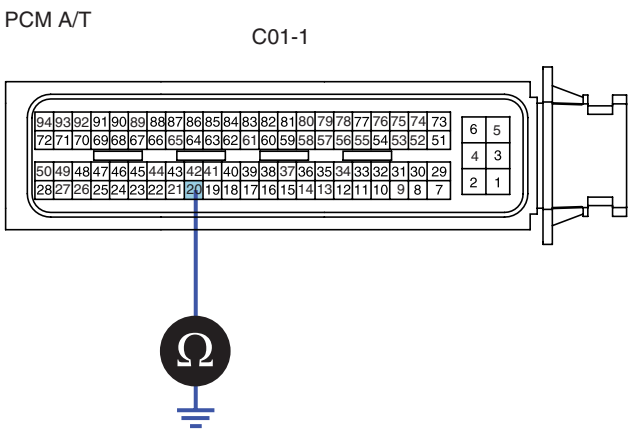
   1) Key "OFF".

   2) Disconnect PCM connector.

   3) Disconnect ABS control unit(or ESP control unit connector).

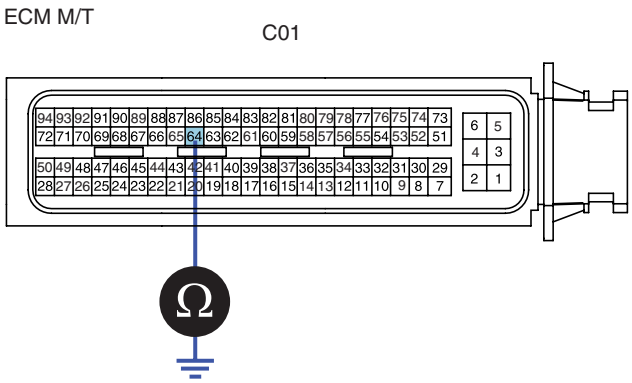
   4) Measure resistance between terminal 20/C01-1(64/C01) of PCM (ECM) harness connector and chassis ground.

Specification : Infinite



20. Speed Signal

LFJF609A



5) Is the measured resistance within specification?

YES

▶ Go to "Check open in harness" as follows.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness.

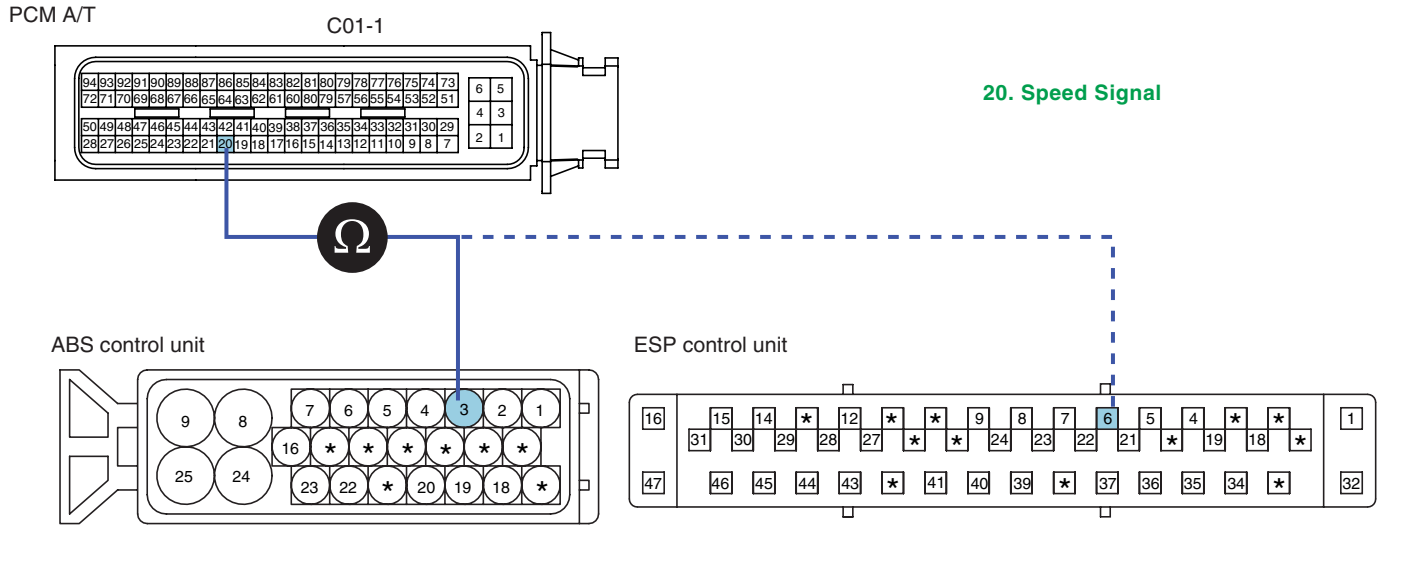
1) Key "OFF".

2) Disconnect PCM connector.

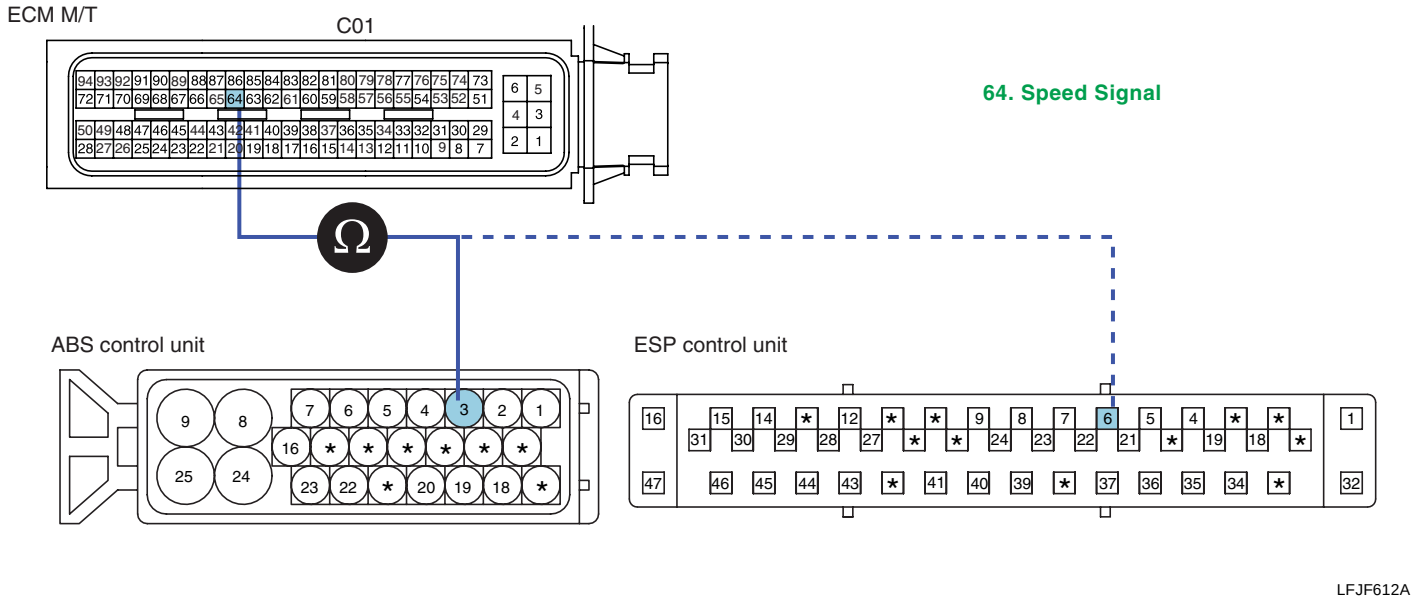
3) Disconnect ABS control unit(or ESP control unit connector).

4) Measure resistance between terminal 20/C01-1 of PCM harness connector and terminal 3/E51(6/E17) of ABS(ESP) control module harness connector.(A/T)
Measure resistance between terminal 64/C01 of ECM harness connector and terminal 3/E51(6/E17) of ABS(ESP) control module harness connector.(M/T)

Specification : Approx. below 1Ω



LFJF611A



LFJF612A

5) Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

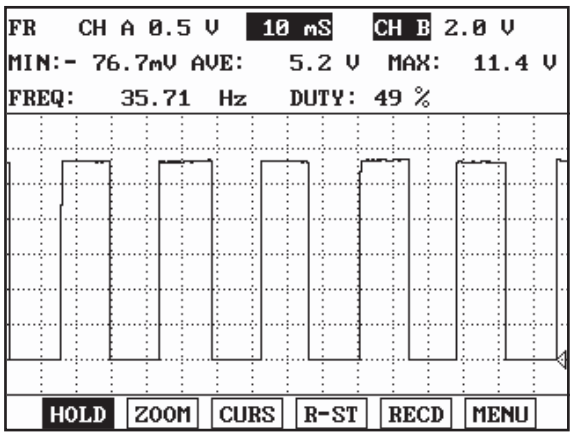
NO

▶ Repair Open circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5CB7E2F

1. ENG "ON".
2. Measure signal waveform of Vehicle Speed from ABSCM to ECM while driving.

SPECIFICATION :



Signal from ABS/ESP Module to ECM

LFJF800Y

3. Is the signal waveform normal?

YES

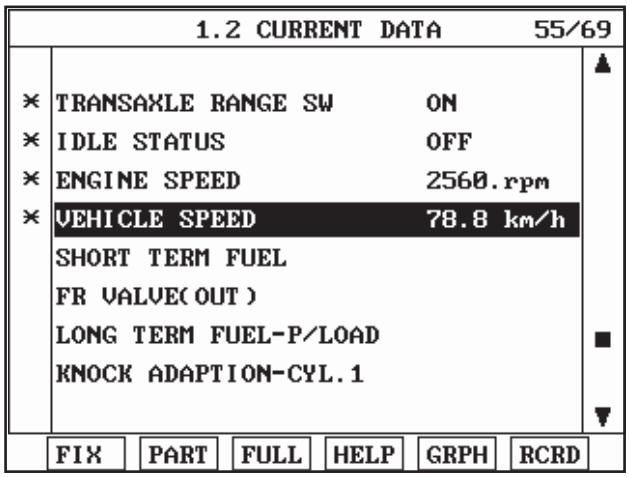
▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ABS or ESP control unit and check for proper operation. If the problem is corrected, replace ABS or ESP control unit and go to "Verification of Vehicle Repair" procedure.

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "VSS" parameters on the scantool.



LFJF613B

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

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

YES

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

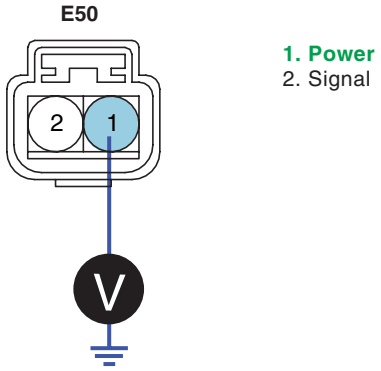
NO

▶ Go to "Power Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Key "ON".
2. Measure voltage between terminal 1/E50 of the wheel speed sensor harness connector and chassis ground. (Connect wheel speed sensor connector)

Specification : Approx. B+



LFJF613C

3. Is the measured voltage within specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check short to ground in harness.

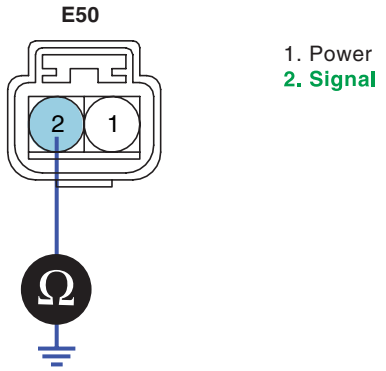
   1) Key "OFF".

   2) Disconnect PCM connector.

   3) Disconnect wheel speed sensor connector.

   4) Measure resistance between terminal 2/E50 of wheel speed sensor harness connector and chassis ground.

Specification : Infinite



1. Power
2. Signal

LFJF613D

   5) Is the measured resistance within specifications?

YES

▶ Go to "Check open in harness" as follows.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness.

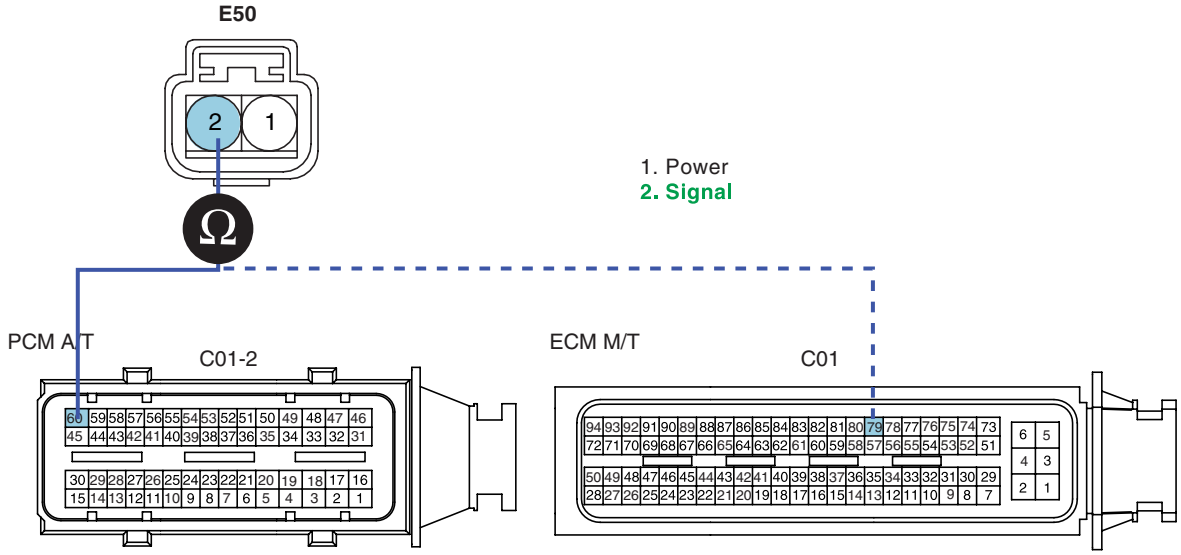
   1) Key "OFF".

   2) Disconnect PCM connector.

   3) Disconnect wheel speed sensor connector.

   4) Measure resistance between terminal 60/C01-2(79/C01) of PCM(ECM) harness connector and terminal 2/E50 harness cnnector.

Specification : Approx. below 1Ω



LFJF613E

5) Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

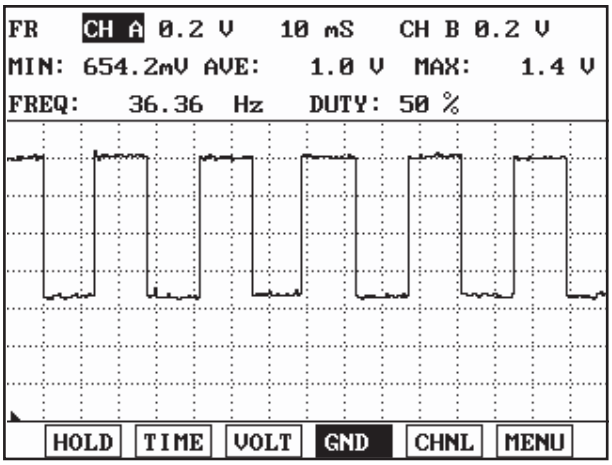
NO

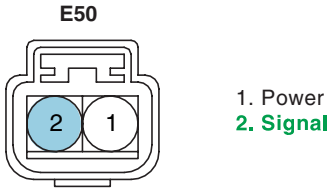
▶ Repair Open circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Engine "ON".
2. Measure signal waveform of wheel speed sensor while driving.

SPECIFICATION :





LFJF613F

3. Is the signal waveform normal?

YES

▶ Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good wheel speed sensor and check for proper operation. If the problem is corrected, replace wheel speed sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

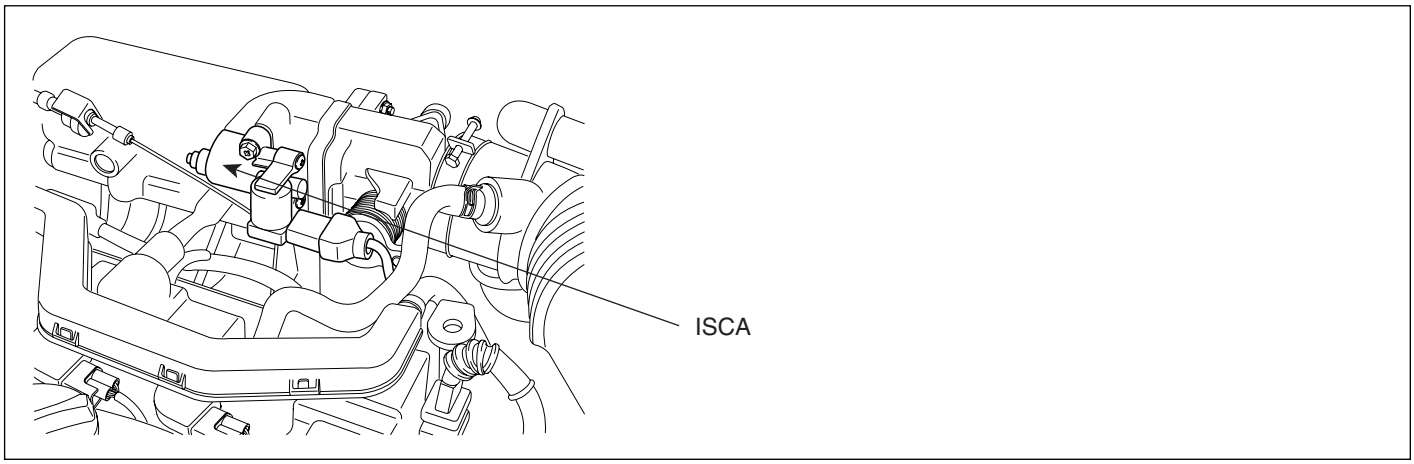
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0506 IDLE AIR CONTROL SYSTEM-RPM LOWER THAN EXPECTED

COMPONENT LOCATION ED2CA798



AFJF386B

GENERAL DESCRIPTION EBD5FA8D

The ISCA (Idle Speed Control Actuator) is designed to maintain a steady desired idle speed. Idle airflow is adjustedthrough the idle air actuator in order to maintain the desired idle speed under various load conditions. Load conditions vary due to numerous factors, such as engine temperature, air conditioning, electrical load and power steering load.

DTC DESCRIPTION E6862618

If the real engine speed is lower than the desired engine speed over 100 rpm under enable conditions, ECM sets P0506.

DTC DETECTING CONDITION E8C95F85

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check, low	• Poor connection • Clog in intake air system • Carbon pile • ISCA • ECM
Enable Conditions	• Vehicle speed = 0 • Coolant temperature 〉 70℃ • Intake air temperature 〉 -7.5℃ • Altitude 〈 3000m • Idle status • Idle controller I part = 15.0% • Engine load 〈 35%	
Threshold Value	• Desired engine speed ? Engine speed 〉 100rpm	
Diagnostic Time	• 8 sec	
MIL ON Condition	• 2 driving cycle	

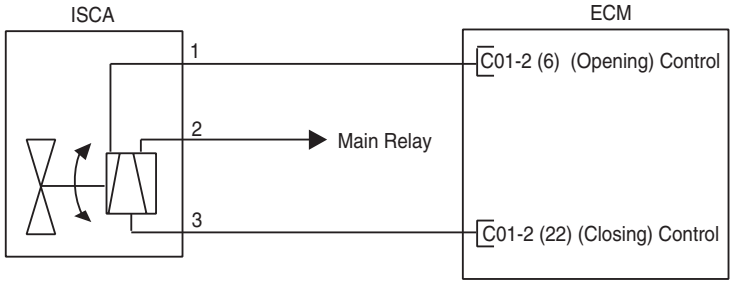
SPECIFICATION E52C3750

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35	15.4±0.8	11.9±0.8

SCHEMATIC DIAGRAM E7845080

(A/T)

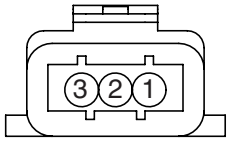
[CIRCUIT DIAGRAM]



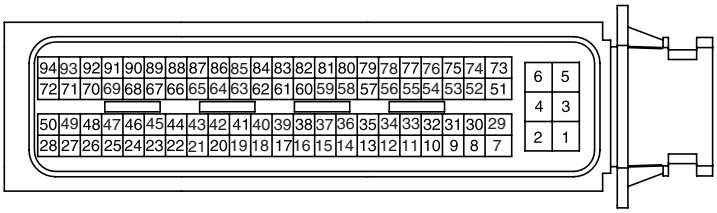
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-2 (6)	Opening Control
2	Main Relay	Battery Voltage (B+)
3	ECM C01-2 (22)	Closing Control

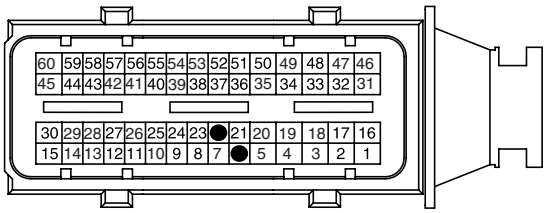
[HARNESS CONNECTORS]



ISCA (C09)



C01-1



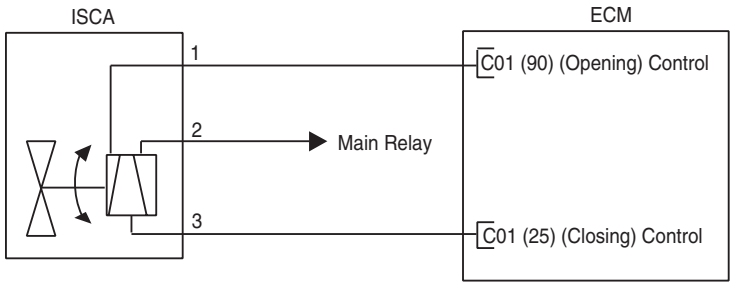
C01-2

ECM

LFJF615A

(M/T)

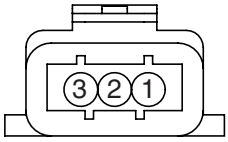
[CIRCUIT DIAGRAM]



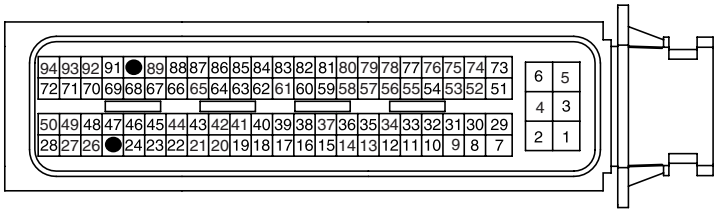
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (90)	Opening Control
2	Main Relay	Battery Voltage (B+)
3	ECM C01 (25)	Closing Control

[HARNESS CONNECTORS]



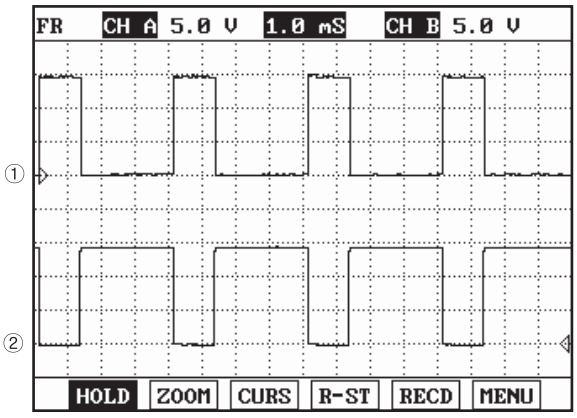
ISCA (C09)



ECM (C01)

LFJF615B

SIGNAL WAVEFORM & DATA ED9D9C07

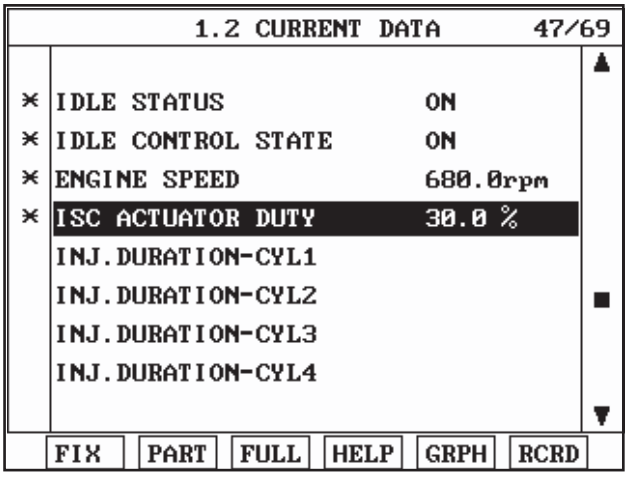


① Closing control duty signal at idle
② Opening control duty signal at idle

LFJF616A

MONITOR SCANTOOL DATA EEA2CF34

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "ISCA" parameters on the scantool.



LFJF617A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E68E4DF5

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

YES

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

NO

▶ Go to "System inspection" procedure.

SYSTEM INSPECTION E95C5D98

1. Visual Inspection.
   1) Check "Air intake/exhaust system."
      ▶ Check looseness, deterioration or contamination on air cleaner, throttle body and gasket.
      ▶ Check contamination, damage or clog on exhaust gas system.
   2) Is the air intake/exhaust system O.K?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E454D2AD

1. ISCA visual check.

   1) Key "OFF".

   2) Disassemble ISCA.

   3) Check contamination, damage or stuck on ISCA.

   4) Check the operating sound when key turns "OFF" to "ON".

   5) Is ISCA O.K?

YES

▶ Go to "ISCA check" procedure.

NO

▶ Substitute with a known - good ISCA and check for proper operation.
▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.

   1) Key "OFF".

   2) Disassemble ISCA.

   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)

   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35	15.4±0.8	11.9±0.8

   5) Is the measured resistance within specifications?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ISCA and check for proper operation.
▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE3461D8

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0507 IDLE AIR CONTROL SYSTEM-RPM HIGHER THAN EXPECTED

COMPONENT LOCATION E37423B2

Refer to DTC P0506.

GENERAL DESCRIPTION E64A4C81

Refer to DTC P0506.

DTC DESCRIPTION EFDB5A6F

If the real engine speed is higher than the desired engine speed over 200 rpm under enable conditions, PCM sets P0507.

DTC DETECTING CONDITION EDDE799D

Item		Detecting Condition	Possible Cause
DTC Strategy		• Rationality check, high	• Poor connection • Leak in intake air system • Carbon pile • ISCA • ECM
General Enable Conditions		• Vehicle speed = 0 • Coolant temperature 〉 70℃ • Intake air temperature 〉 -7.5℃ • Altitude 〈 3000m • Idle status	
Case 1	Enable Conditions	• Idle controller I part = -15%	
	Threshold Value	• Desired engine speed - Engine speed 〈 -200rpm	
Case 2	Threshold Value	• Fuel cut-off ≥ 3times	
Diagnostic Time		• 15 sec	
MIL ON Condition		• 2 driving cycle	

SPECIFICATION EF87864F

Refer to DTC P0506.

SCHEMATIC DIAGRAM ED95D225

Refer to DTC P0506.

SIGNAL WAVEFORM & DATA EA86E779

Refer to DTC P0506.

MONITOR SCANTOOL DATA EE4F2E45

Refer to DTC P0506.

TERMINAL AND CONNECTOR INSPECTION E8A13F87

Refer to DTC P0506.

POWER CIRCUIT INSPECTION EDE56AD3

1. Key "OFF".
2. Disconnect ISCA connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of ISCA harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short in power circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E81BFA40

1. Key "OFF".
2. Disconnect ISCA connector and Key "ON".
3. Measure the voltage between terminal 1 of ISCA harness connector and chassis ground.
4. Measure the voltage between terminal 3 of ISCA harness connector and chassis ground.

Specification : Approx 1.3V (at terminal 1), Approx 2V (at terminal 3)

5. Is the measured voltage within specification?

YES

▶ Go to "System inspection" procedure.

NO

▶ Repair Open or Short in control circuit and then, go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION E6647C28

1. Visual inspection.
   1) Key "OFF".
   2) Check intake air system
      ▶ Check assembling state and damage on throttle body gasket.
      ▶ Check assembling/sealing state and damage on MAFS and PCV valve.

3) Is everything O.K?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E086F270

1. ISCA visual check.

   1) Key "OFF".

   2) Disassemble ISCA.

   3) Check contamination, damage or stuck on ISCA.

   4) Check the operating sound when key turns "OFF" to "ON".

   5) Is ISCA O.K?

   YES

   ▶ Go to "ISCA check" procedure.

   NO

   ▶ Substitute with a known - good ISCA and check for proper operation.
   ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.

   1) Key "OFF".

   2) Disassemble ISCA.

   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)

   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35	15.4±0.8	11.9±0.8

   5) Is the measured resistance within specifications?

   YES

   ▶ Substitute with a known - good ECM and check for proper operation.
   ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

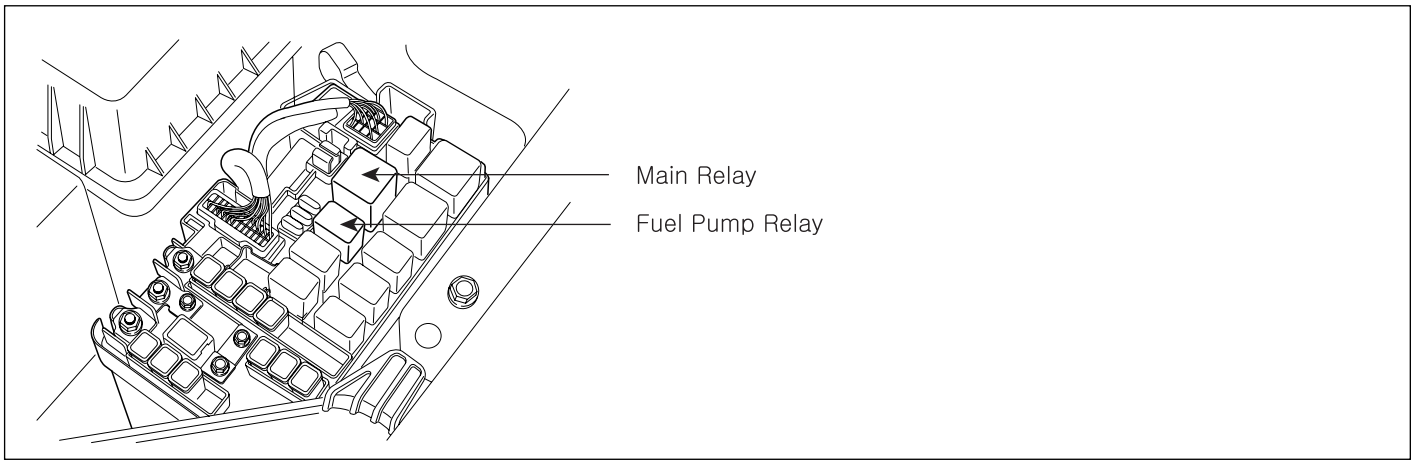
- ▶ Substitute with a known - good ISCA and check for proper operation.
- ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA3C1F1C

Refer to DTC P0506.

DTC P0560 SYSTEM VOLTAGE

COMPONENT LOCATION E2ABFFA0



LFJF800C

GENERAL DESCRIPTION E36418D7

The purpose of the System Voltage is to detect an excessively low or high system voltage that may be caused by a malfunctioning charging system.
System Voltage is the ignition voltage potential at the Powertrain Control Module (PCM)PCM measures and compares voltage from ignition key and each relay. With this mechanism, PCM knows if the main relay switch turns on after IG on or if turns OFF after IG off.

DTC DESCRIPTION EBD9456B

If ECM detects malfunction in power supply system, ECM sets DTC P0560.

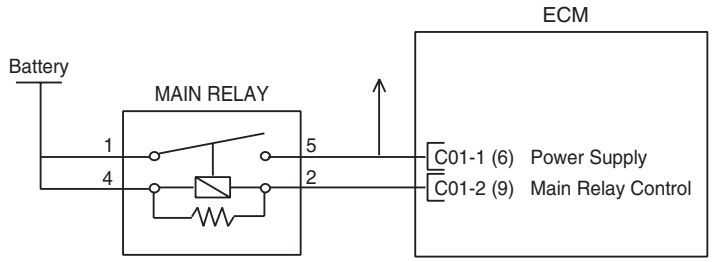
DTC DETECTING CONDITION E96331BA

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • Open / Short • Main relay • ECM
Enable Conditions		
Threshold Value		
Diagnostic Time		
MIL ON Condition	• DTC only	

SCHEMATIC DIAGRAM E9F8DACC

(A/T)

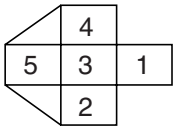
[CIRCUIT DIAGRAM]



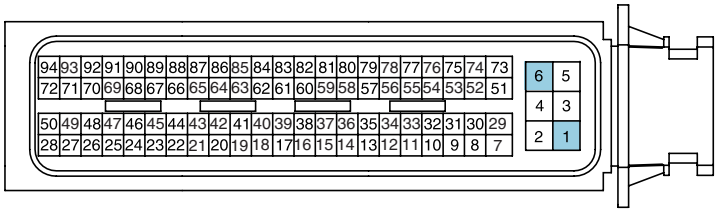
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Battery	Battery Voltage (B+)
2	ECM C01-2 (9)	Relay Control
3	-	-
4	Battery	Battery Voltage (B+)
5	ECM C01-1 (6)	Power Supply

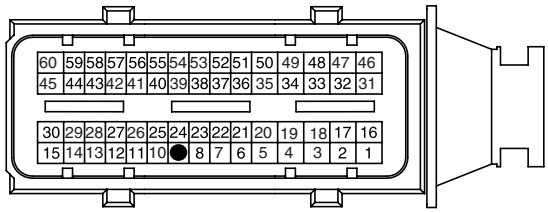
[HARNESS CONNECTORS]



Main Relay (E63)



C01-1



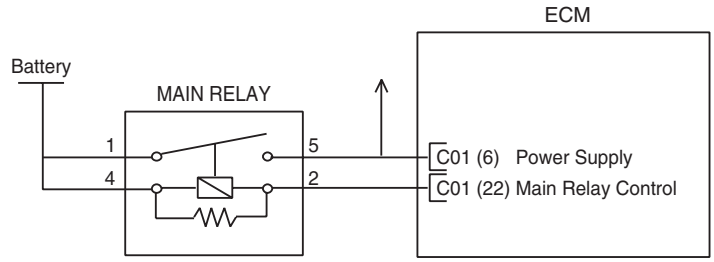
C01-2

ECM

LFJF624A

(M/T)

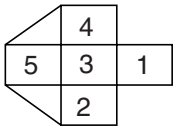
[CIRCUIT DIAGRAM]



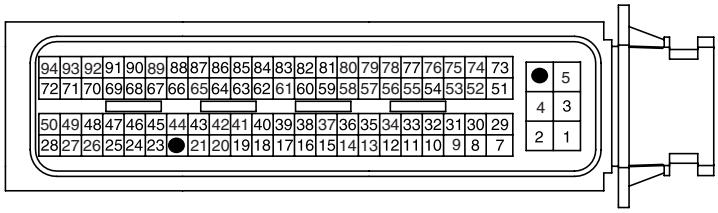
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Battery	Battery Voltage (B+)
2	ECM C01-2 (22)	Relay Control
3	-	-
4	Battery	Battery Voltage (B+)
5	ECM C01 (6)	Power Supply

[HARNESS CONNECTORS]



Main Relay (E63)

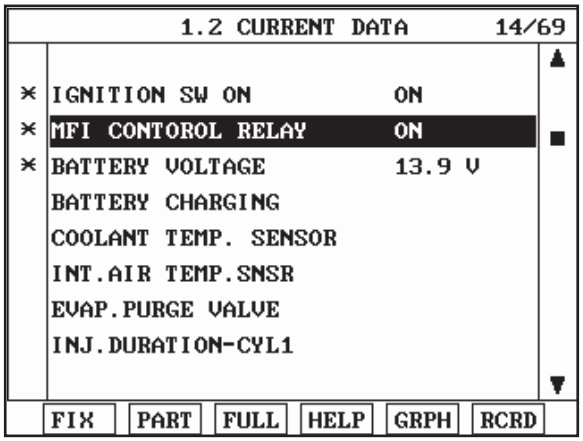


ECM (C01)

LFJF624B

MONITOR SCANTOOL DATA E9D97B7C

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Main relay" parameters on the scantool.



LFJF625A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EACD9C65

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

YES

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

NO

▶ Go to "Main relay circuit inspection" procedure.

POWER CIRCUIT INSPECTION E076260B

1. Key "OFF".
2. Disconnect Main relay and Key "ON".
3. Measure the voltage between terminal 30 of main relay harness connector and chassis ground.
4. Measure the voltage between terminal 86 of main relay harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Check the fuse(ECU A 30A) between battery and main relay.
▶ Repair Open in power circuit and then go to "Verification of vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E36D837D

1. Key "OFF".
2. Disconnect main relay and ECM connector.
3. Measure the resistance between terminal 85 of main relay harness connectorand terminal 9/C01-2 of PCM harness connector. (AT)
4. Measure the resistance between terminal 85 of main relay harness connectorand terminal 22/C01 of ECM harness connector. (MT)

Specification : Approx 1Ω

5. Is the measured resistance within specification?

YES

▶ Go to "Power supply circuit inspection" procedure.

NO

▶ Repair Open in control circuit and then go to "Verification of vehicle Repair" procedure.

POWER SUPPLY CIRCUIT INSPECTION EBAFCE3F

1. Key "OFF".
2. Disconnect main relay and ECM connector.
3. Measure the resistance between terminal 87 of main relay harness connector and terminal 6/C01-1 of PCM harness connector. (AT)
   Measure the resistance between terminal 87 of main relay harness connector and terminal 6/C01 of ECM harness connector.(MT)

Specification : Approx 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open in power supply circuit and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION ECAAC523

1. Key "OFF".
2. Disconnect main relay.
3. Measure the resistance between terminal 30 and 87 of main relay. (Component side)
4. Measure the resistance between terminal 85 and 86 of main relay. (Component side)

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (Approx. 70Ω ~ 120Ω)

5. Is the measured resistance within specifications?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good Main relay and check for proper operation.
- ▶ If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E47E5528

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

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

YES

- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P0561 SYSTEM VOLTAGE UNSTABLE

COMPONENT LOCATION E96EFBFD

Refer to DTC P0560.

GENERAL DESCRIPTION E0366B84

Refer to DTC P0560.

DTC DESCRIPTION E77CAAEC

If the system voltage is below 2.54V during 0.2 sec, PCM sets DTC P0561.

DTC DETECTING CONDITION E200A8E7

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • Open/short to ground in control circuit • Charging system • Main relay • ECM
Enable Conditions		
Threshold Value	• Voltage 〈 2.54 V	
Diagnostic Time	• 0.2 sec	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E05A0CD9

Refer to DTC P0560.

MONITOR SCANTOOL DATA E6ABB310

Refer to DTC P0560.

TERMINAL AND CONNECTOR INSPECTION E3B3B5A3

Refer to DTC P0560.

POWER CIRCUIT INSPECTION E8027290

1. Key "OFF".
2. Disconnect Main relay and Key "ON".
3. Measure the voltage between terminal 30 of main relay harness connector and chassis ground.
4. Measure the voltage between terminal 86 of main relay harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Check the fuse(ECU A 30A) between battery and main relay.
▶ Repair Open in power circuit and then go to "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION EF3F3EB2

1. Alternator circuit check.

1) Key "OFF".

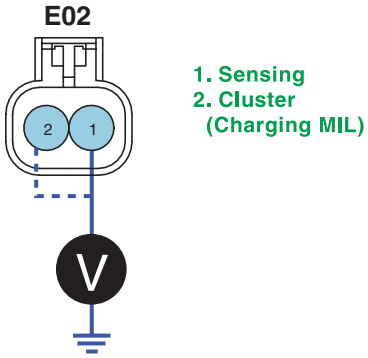
2) Disconnect alternator connector.

3) Key "ON".

4) Measure the voltage between terminal 1 of alternator harness connector and chassis ground.

5) Measure the voltage between terminal 2 of alternator harness connector and chassis ground.

Specification : B+



LFJF633A

6) Is the measured voltage within specification?

YES

7) ▶ Go to "Component inspection" procedure.

NO

▶ In case there is no voltage detected at terminal 1, check Open circuit, Battery and Fuse(MAIN 120 A)between battery and alternator. And then go to "Verification of vehicle Repair" procedure.
▶ In case there is no voltage detected at terminal 2, check Open circuit, MIL circuit and MIL resistor. And then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E912216C

1. Main relay check.

   1) Key "OFF".

   2) Disconnect Main relay.

   3) Measure the resistance between terminal 30 and 87 of main relay. (Component side)

   4) Measure the resistance between terminal 85 and 86 of main relay. (Component side)

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (Approx. 70Ω ~ 120Ω)

   5) Is the measured resistance within specifications?

YES

▶ Go to "Alternator check" procedure.

NO

▶ Substitute with a known - good Main relay and check for proper operation.
▶ If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

2. Alternator check.

   1) Key "OFF".

   2) Check the tension of alternator belt.

   3) Check corrosion, damage or looseness of Battery terminal and Alternator terminal.

   4) Engine start.

   5) Operate electrical parts(Head lamp, Defoger, etc).

   6) Measure the voltage at 2000rpm.

Specification : Approx 12.5V ~ 14.5V

   7) Is the measured voltage within specifications?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good Alternator and check for proper operation.
▶ If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9CE9638

Refer to DTC P0560.

DTC P0562 SYSTEM VOLTAGE LOW

COMPONENT LOCATION E0734341

Refer to DTC P0560.

GENERAL DESCRIPTION E7D235EB

Refer to DTC P0560.

DTC DESCRIPTION EC5861E1

If the system voltage is 2.54~10 V during 0.2 sec, PCM sets DTC P0562.

DTC DETECTING CONDITION E67A725E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Short to ground in control circuit • Charging system • Main relay • ECM
Enable Conditions	• Time after engine start 〉 120 sec	
Threshold Value	• Voltage : 2.54 ~ 10 V	
Diagnostic Time	• 0.2 sec	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM EC45B7C4

Refer to DTC P0560.

MONITOR SCANTOOL DATA EC49DBE8

Refer to DTC P0560.

TERMINAL AND CONNECTOR INSPECTION EF663C85

Refer to DTC P0560.

POWER CIRCUIT INSPECTION E64E0129

1. Key "OFF".
2. Disconnect Main relay and Key "ON".
3. Measure the voltage between terminal 30 of main relay harness connector and chassis ground.
4. Measure the voltage between terminal 86 of main relay harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "System inspection" procedure.

NO

▶ Check the fuse(ECU A 30A) between battery and main relay.
▶ Repair Open or short to ground in power circuit and then go to "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION E5CD1F86

1. Alternator circuit check.

1) Key "OFF".

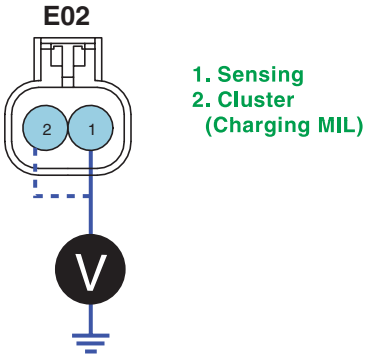
2) Disconnect alternator connector.

3) Key "ON".

4) Measure the voltage between terminal 1 of alternator harness connector and chassis ground.

5) Measure the voltage between terminal 2 of alternator harness connector and chassis ground.

Specification : B+



LFJF633A

6) Is the measured voltage within specification?

YES

7) ▶ Go to "Component inspection" procedure.

NO

▶ In case there is no voltage detected at terminal 1, check Open circuit, Battery and Fuse(MAIN 120 A)between battery and alternator. And then go to "Verification of vehicle Repair" procedure.
▶ In case there is no voltage detected at terminal 2, check Open circuit, MIL circuit and MIL resistor. And then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E13150CB

1. Main relay check.

   1) Key "OFF".

   2) Disconnect Main relay.

   3) Measure the resistance between terminal 30 and 87 of main relay. (Component side)

   4) Measure the resistance between terminal 85 and 86 of main relay. (Component side)

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (Approx. 70Ω ~ 120Ω)

   5) Is the measured resistance within specifications?

YES

▶ Go to "Alternator check" procedure.

NO

▶ Substitute with a known - good Main relay and check for proper operation.
▶ If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

2. Alternator check.

   1) Key "OFF".

   2) Check the tension of alternator belt.

   3) Check corrosion, damage or looseness of Battery terminal and Alternator terminal.

   4) Engine start.

   5) Operate electrical parts(Head lamp, Defoger, etc).

   6) Measure the voltage at 2000rpm.

Specification : Approx 12.5V ~ 14.5V

   7) Is the measured voltage within specifications?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good Alternator and check for proper operation.
▶ If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E103CC69

Refer to DTC P0560.

DTC P0563 SYSTEM VOLTAGE HIGH

COMPONENT LOCATION EE73628A

Refer to DTC P0560.

GENERAL DESCRIPTION E2DE1F0D

Refer to DTC P0560.

DTC DESCRIPTION E09186F6

If the system voltage is over 17 V during 0.2 sec, PCM sets DTC P0563.

DTC DETECTING CONDITION E421007B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Charging system • Main relay • ECM
Enable Conditions	• Time after engine start 〉 120 sec • Vehicle speed 〉 25 kph	
Threshold Value	• Voltage 〉 17 V	
Diagnostic Time	• 0.2 sec	
MIL ON Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM E7C9F195

Refer to DTC P0560.

MONITOR SCANTOOL DATA E0E2B44D

Refer to DTC P0560.

TERMINAL AND CONNECTOR INSPECTION EDA3189E

Refer to DTC P0560.

POWER CIRCUIT INSPECTION E704D8F1

1. Key "OFF".
2. Disconnect Main relay and Key "ON".
3. Measure the voltage between terminal 30 of main relay harness connector and chassis ground.
4. Measure the voltage between terminal 86 of main relay harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "System inspection" procedure.

NO

▶ Check the fuse(ECU A 30A) between battery and main relay.
▶ Repair short in power circuit and then go to "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION E94CF4F4

1. Alternator circuit check.

   1) Key "OFF".

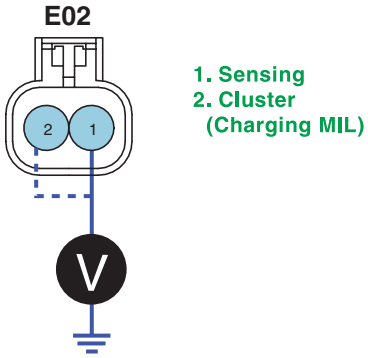
   2) Disconnect alternator connector.

   3) Key "ON".

   4) Measure the voltage between terminal 1 of alternator harness connector and chassis ground.

   5) Measure the voltage between terminal 2 of alternator harness connector and chassis ground.

Specification : B+



LFJF633A

   6) Is the measured voltage within specification?

YES

   7) ▶ Go to "Component inspection" procedure.

NO

▶ In case there is no voltage detected at terminal 1, check Open circuit, Battery and Fuse(MAIN 120 A)between battery and alternator. And then go to "Verification of vehicle Repair" procedure.
▶ In case there is no voltage detected at terminal 2, check Open circuit, MIL circuit and MIL resistor. And then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E4B9B73C

1. Main relay check.

   1) Key "OFF".

   2) Disconnect Main relay.

   3) Measure the resistance between terminal 30 and 87 of main relay. (Component side)

   4) Measure the resistance between terminal 85 and 86 of main relay. (Component side)

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (Approx. 70Ω ~ 120Ω)

   5) Is the measured resistance within specifications?

YES

▶ Go to "Alternator check" procedure.

NO

▶ Substitute with a known - good Main relay and check for proper operation.
▶ If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

2. Alternator check.

   1) Key "OFF".

   2) Check the tension of alternator belt.

   3) Check corrosion, damage or looseness of Battery terminal and Alternator terminal.

   4) Engine start.

   5) Operate electrical parts(Head lamp, Defoger, etc).

   6) Measure the voltage at 2000rpm.

Specification : Approx 12.5V ~ 14.5V

   7) Is the measured voltage within specifications?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good Alternator and check for proper operation.
▶ If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3CA4F75

Refer to DTC P0560.

DTC P0600 CAN COMMUNICATION BUS

GENERAL DESCRIPTION E5EC735B

As vehicles electronically controlled, various control unit is applied to vehicle and several units are controlled based on the signals from the sensors. Therefore sharing signals of sensors and information is required. To meet this requirement, CAN communication type, which is insensible to external noises and whose communication speed is fast, is applied to power train control.
Sharing signals from RPM, APS, gear shifting, torque reduction in ESP, ABS and various modules, addtive control is performed.

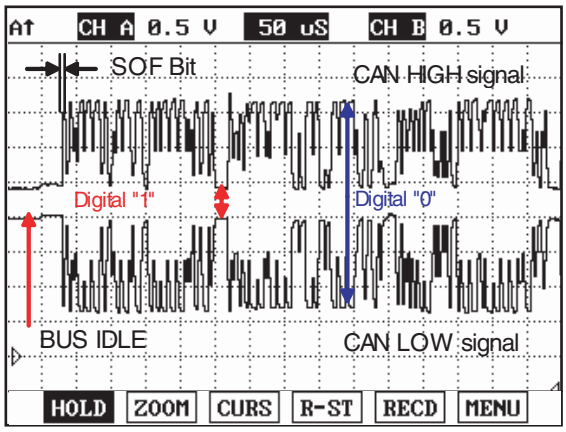
DTC DESCRIPTION E24FA222

If it is impossible to communicate through internal or external CAN line over 500ms, PCM sets DTC P600.

DTC DETECTING CONDITION E773724B

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN communication status check	• Poor connection • PCM
Enable Conditions	• Battery voltage 〉 10.7V • Ignition on, no start phase	
Threshold Value	• Bus-Off time on external CAN 〉 500ms • Bus-Off time on internal CAN 〉 500ms	
Diagnostic Time	• Continuous	
MIL ON Condition	• 5 sec	

SIGNAL WAVEFORM & DATA E50BAC1C



Monitoring CAN HIGH and LOW simultaneously is important in monitoring CAN communication waveform.
When CAN HIGH signal rise to 3.5V and LOW signal drops to 1.5V - voltage difference between HIGH and LOW signal is 2V - at BUS IDLE state(DIGITAL "1") whose reference voltage is 2.5V, "0" is recognized. Besides, comparing HIGH and LOW signal if opposite waveform is detected with the reference voltage of 2.5V, Check if current CAM signal is transfers correctly.
Continuous "0"signal above 6BIT means the occurence of error in CAN communication. 1BIT is easily distinguished as calculating the time when "SOF"(START OF FRAME) which notifies the start of frame occurs. Check if "0"signal above 6BIT is detected continuously when monitoring CAN communication waveform.

LFJF636A

MONITOR SCANTOOL DATA EA1CE629

1. Connect scantool to Data Link Connector(DLC).

2. Warm up the engine to normal operating temperature.

3. Monitor the "CAN" parameters on the scantool.
   - Check the value of current data displayed normally.
   - Check "Transaxle Range Switch" and "Torque Reqired from TCU" parameters among ECU's current data. (AT vehicle only)
   - Check "TPS", "RPM", and "Idle Status" parameters among TCU's current data. (AT vehicle only)
   - Check "RPM" and "TPS" parameters among ABS's current data. (ABS or ESP vehicle only)

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E17E2EEB

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

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

NO

▶ Go to "CAN communication circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION EACC0849

1. Check CAN BUS Short to Ground.

   1) Key "OFF".

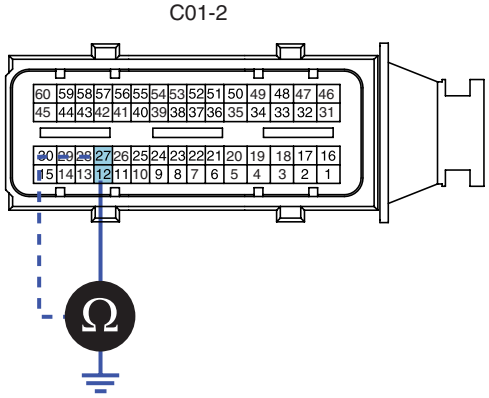
   2) Disconnect PCM connector.

   3) Measure the resistance between terminal 12(84) of PCM(ECM) harness connectorand chassis ground.

   4) Measure the resistance between terminal 27(62) of PCM(ECM) harness connectorand chassis ground.

Specification : Infinite

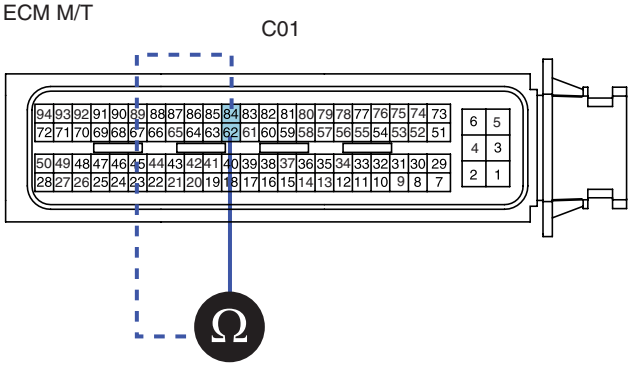
PCM A/T



12. CAN High
27. CAN Low

LFJF637A

ECM M/T



84. CAN High
62. CAN Low

LFJF637B

5) Is the measured resistance within specification?

YES

▶ Go to "CAN BUS Terminus Resistance Check(Harness side)" procedure.

NO

▶ Repair Short in signal circuit and then go to "Verification of vehicle Repair" procedure.

2. CAN BUS Terminus Resistance Check(Harness side)

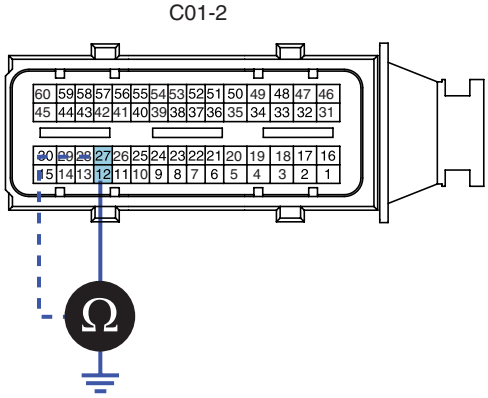
1) Key "OFF".

2) Disconnect PCM connector.

3) Measure the resistance between terminal 12(84) and 27(62) of PCM(ECM) harness connnector.

Specification : 120Ω ± 10Ω

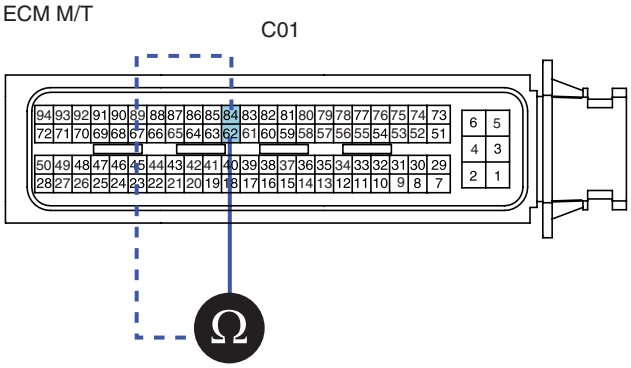
PCM A/T



12. CAN High
27. CAN Low

LFJF637A

ECM M/T



84. CAN High
62. CAN Low

LFJF637B

4) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ In case the measured resistance is around 1.0Ω : Repair Short in signal circuit and then go to "Verification of vehicle Repair" procedure.
▶ In case the measured resistance is Infinite : Repair Open in signal circuit and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E9E16DAD

1. CAN BUS Terminus Resistance Check (Component side)

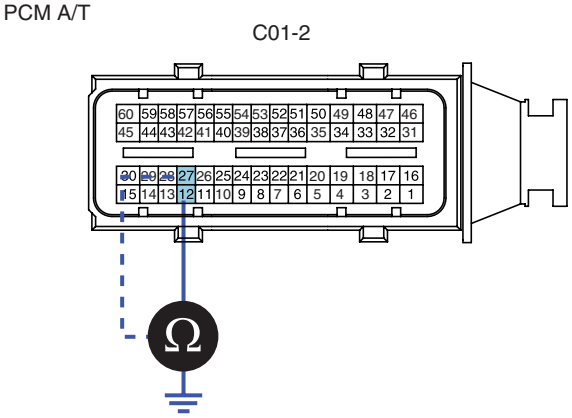
1) Key "OFF".

2) Disconnect PCM connector.

3) Measure the resistance between terminal 12(84) and 27(62) of PCM(ECM) connector. (Component side)

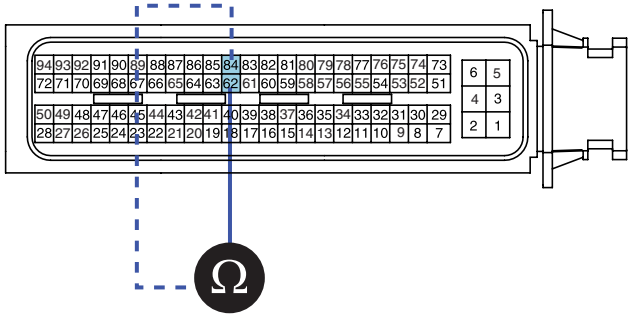
Specification : 120Ω ± 10Ω

PCM A/T



LFJF637A

ECM M/T



LFJF637B

4) Is the measured resistance within specification?

YES

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

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0281F94

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

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

YES

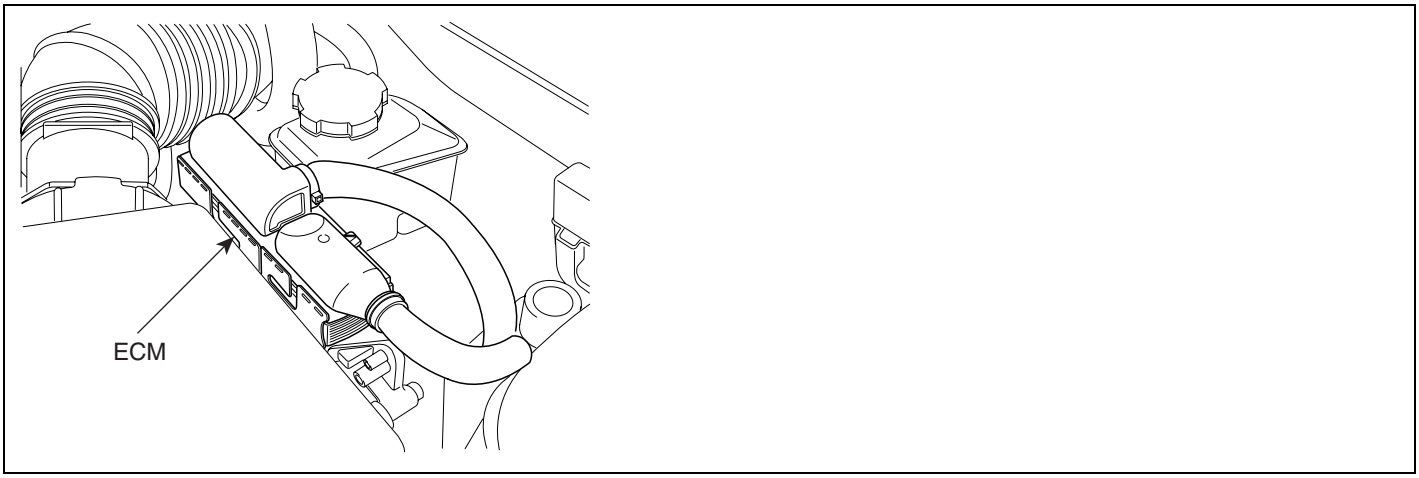
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY(ROM) ERROR

COMPONENT LOCATION EAF8E30F



LFJF800I

GENERAL DESCRIPTION E9CC74E5

PCM monitors errors through checksum. Every information consists of the combination of 0 and 1, checksum means summing up all values in a row. Thus, errors are recognized comparing checksum value and the memory value at PCM.

DTC DESCRIPTION E4C5B8B7

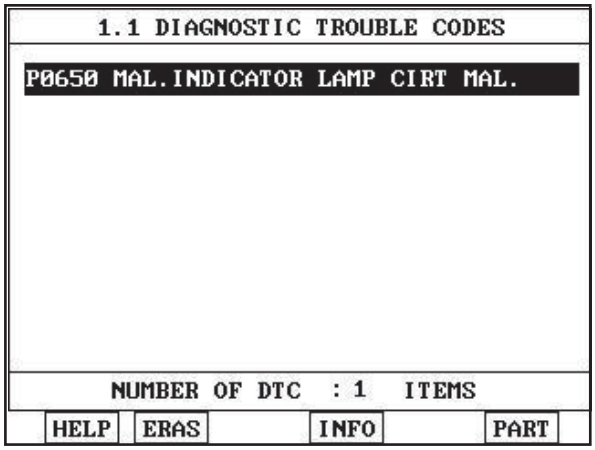
ECM detects the signal exchages between micro-processor and sensor/actuator. By the way, if there is error, ECM sets DTC P0605.

DTC DETECTING CONDITION ED4367B5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection ECM
Enable Conditions		
Threshold Value	• Each check sum of several blocks (Actual check sum ≠ check sum data)	
Diagnostic Time		
MIL ON Condition		

MONITOR SCANTOOL DATA EFC850CC

1. Connect scantool to Data Link Connector(DLC).
2. Key "ON".
3. Monitor DTC(Diagnostics Trouble Code) on the scantool.



LFJF643A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EE010428

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

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

NO

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5445950

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

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.

3. Are any DTCs present ?

YES

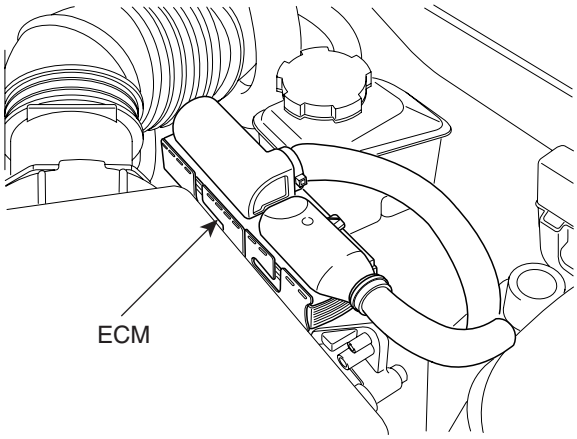
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0650 MALFUNCTION INDICATOR LAMP(MIL) CONTROL CIRCUIT

COMPONENT LOCATION E3AC1727



LFJF800I

GENERAL DESCRIPTION E4969F13

As monitoring the errors of several sensors and actuators circuit,if any problem occurs, PCM turns engine check lamp ON at cluster to notify driver occurence of a problem.
Generally, engine check lamp turns ON at Ignition ON and turns OFF within couple of seconds after turning engine ON.
If engine check lamp turns on during driving, perform diagnosis of engine system and auto-transaxle system.

DTC DESCRIPTION EFAA83C1

If there is Open, Short to ground or Short to power in MIL circuit, PCM sets DTC P0650.

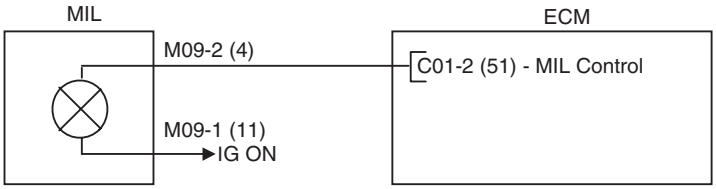
DTC DETECTING CONDITION E4A81C39

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high, low, or open	• Poor connection • Open or short in power/control circuit • Instrument cluster • ECM
Enable Conditions		
Threshold Value	• Short circuit to battery, ground, or disconnected	
Diagnostic Time	• Continuous	

SCHEMATIC DIAGRAM E7402F52

(A/T)

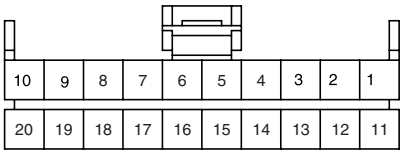
[CIRCUIT DIAGRAM]



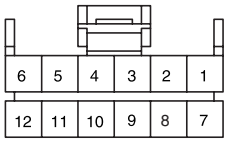
[CONNECTION INFORMATION]

Terminal	Connected to	Function
M09-2 (4)	ECM C01-2 (51)	MIL Control
M09-1 (11)	IG ON	Battery Voltage (B+)

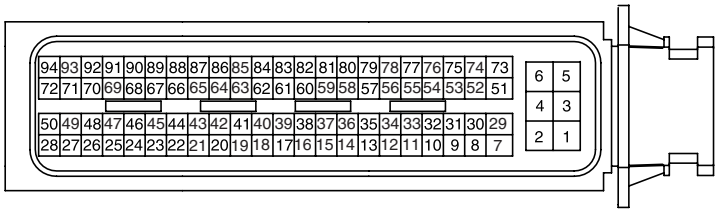
[HARNESS CONNECTORS]



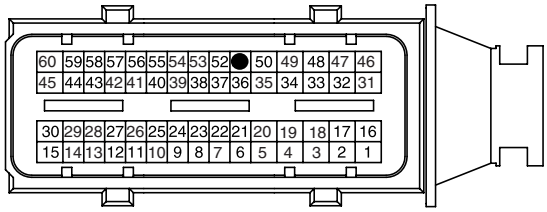
Cluster (M09-1)



Cluster (M09-2)



C01-1



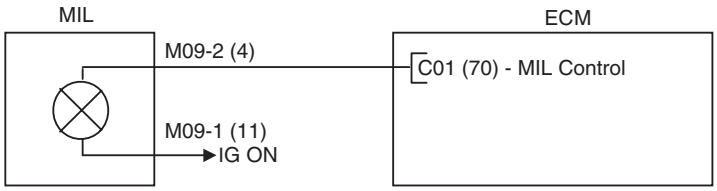
C01-2

ECM

LFJF901D

(M/T)

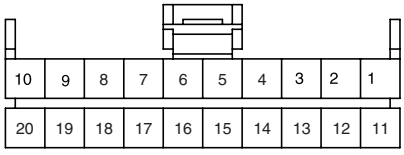
[CIRCUIT DIAGRAM]



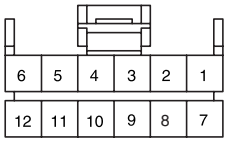
[CONNECTION INFORMATION]

Terminal	Connected to	Function
M09-2 (4)	ECM C01 (70)	MIL Control
M09-1 (11)	IG ON	Battery Voltage (B+)

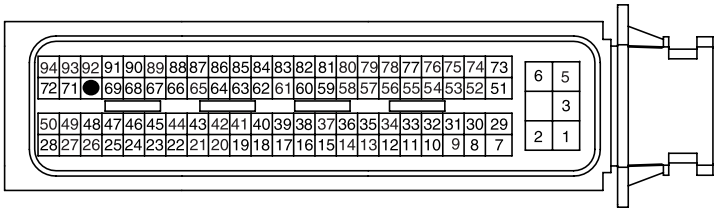
[HARNESS CONNECTORS]



Cluster (M09-1)



Cluster (M09-2)

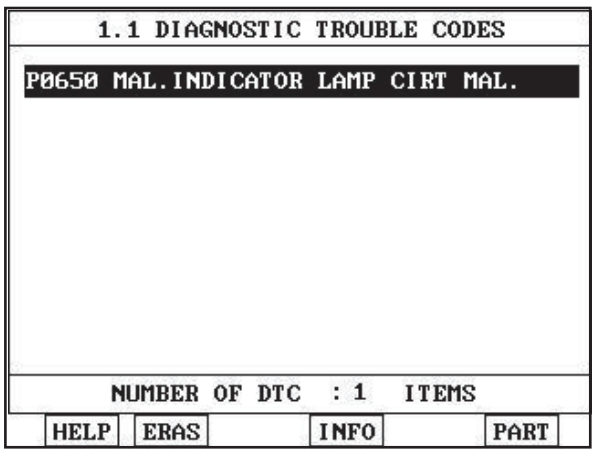


ECM (C01)

LFJF901E

MONITOR SCANTOOL DATA E91187B5

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor DTC(Diagnostics Trouble Code) on the scantool.



LFJF643A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EEC6C9CD

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

YES

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

NO

▶ Go to "MIL circuit inspection" procedure.

POWER CIRCUIT INSPECTION E261C446

1. Key "OFF".
2. Disconnect Cluster connector(M09-1).
3. Measure the voltage between terminal 11 of Cluster harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

▶ Go to "Control ciruit inspection" procedure.

NO

▶ Check the fuse(CLUSTER 10A) between Battery and Engine MIL.
▶ Repair Open or Short in power circuit, and then go to "Verification of vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EA647B5F

1. Key "OFF".
2. Disconnect PCM connector.
3. Key "ON".

4. Measure the voltage between terminal 51/C01-2(70/C01) of PCM(ECM) harness connectorand chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check the filament of Engine MIL lamp.
▶ Repair Open or Short in control circuit, and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E9CAD06C

1. Key "OFF".
2. Disconnect ECM connector.
3. Short terminal 51(70) of PCM(ECM) harness connector to Ground.

Specification : Lighting Engine MIL lamp on cluster.

4. Is the Engine MIL lamp lighting normally?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good Cluster and check for proper operation. If the problem is corrected, replace Cluster and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECD8038B

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

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

YES

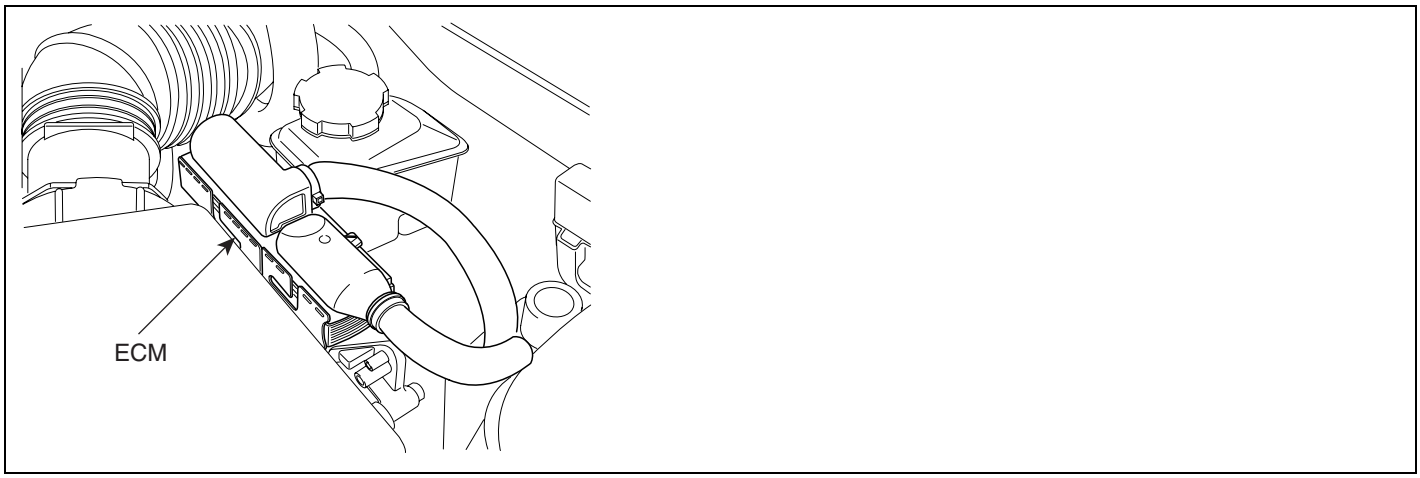
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0700 TCU REQUEST FOR MIL ON

COMPONENT LOCATION EBC04AC0



LFJF800I

DTC DESCRIPTION E2ECBCF2

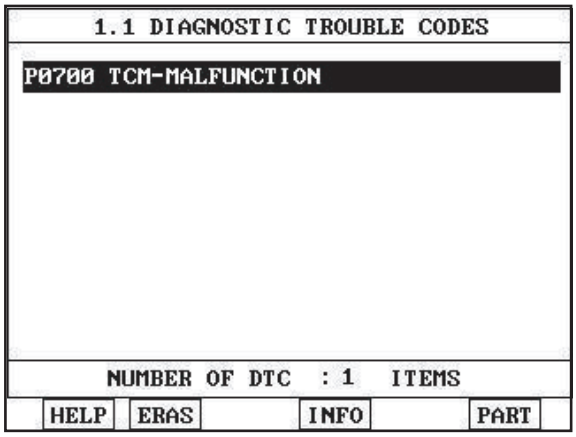
If there is(are) DTC(s) of auto-transmission, PCM sets DTC P0700. In this case, check DTC(s) of auto-transmission and repair it.

DTC DETECTING CONDITION E521ECE6

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal interference	• Poor connection • TCM • ECM
Enable Conditions		
Threshold Value	• When TCM demands	
Diagnostic Time		

MONITOR SCANTOOL DATA ECB2C9F9

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor A/T DTC(Diagnostics Trouble Code) on the scantool. And go to "Verification of vehicle Repair" procedure.



LFJF648A

VERIFICATION OF VEHICLE REPAIR EA1C5D63

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

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

YES

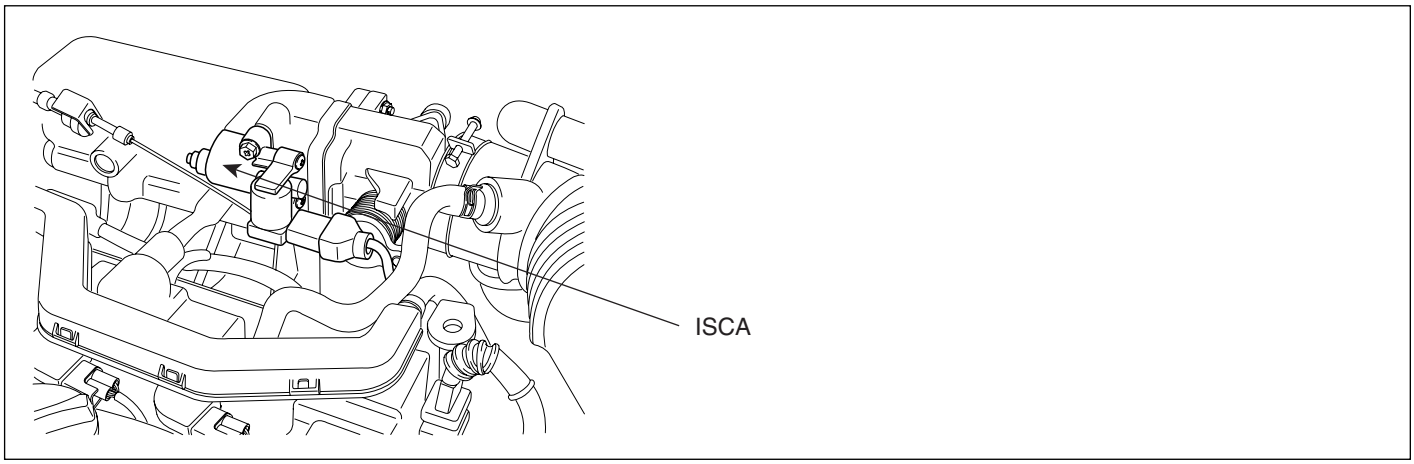
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1505 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #1

COMPONENT LOCATION E8EFF563



AFJF386B

GENERAL DESCRIPTION E0F2EA81

The ISCA (Idle Speed Control Actuator) is designed to maintain a steady desired idle speed. Idle airflow is adjustedthrough the idle air actuator in order to maintain the desired idle speed under various load conditions. Load conditions vary due to numerous factors, such as engine temperature, air conditioning, electrical load and power steering load.

DTC DESCRIPTION EE6F4F89

If there is Open or Short to ground in ISCA(opening coil) circuit, ECM sets DTC P1505.

DTC DETECTING CONDITION E0A514DD

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low (opening coil)	• Poor connection • Open or short to ground in control circuit • ISCA • ECM
Enable Conditions		
Threshold Value	• Shorted to ground or disconnected	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

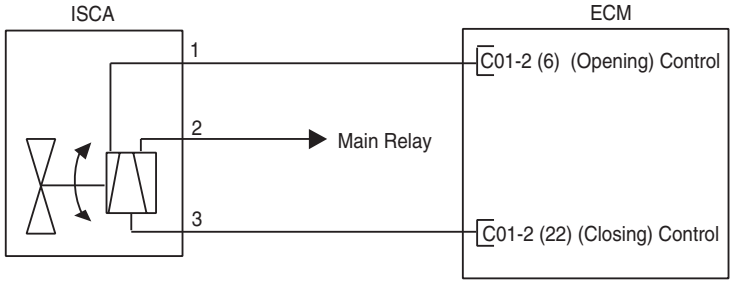
SPECIFICATION EE12D098

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35	15.4±0.8	11.9±0.8

SCHEMATIC DIAGRAM EFFE8ED3

(A/T)

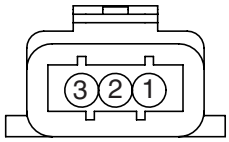
[CIRCUIT DIAGRAM]



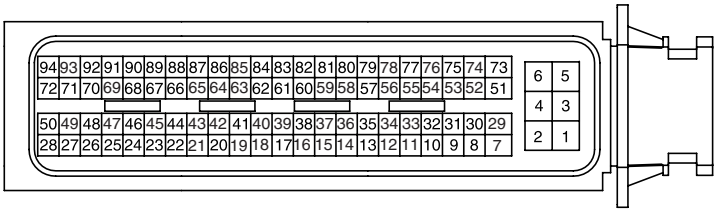
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-2 (6)	Opening Control
2	Main Relay	Battery Voltage (B+)
3	ECM C01-2 (22)	Closing Control

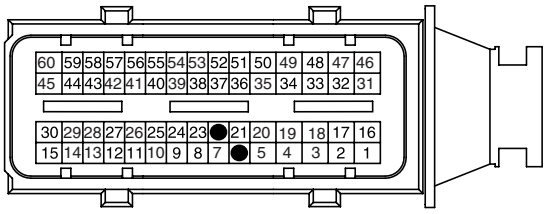
[HARNESS CONNECTORS]



ISCA (C09)



C01-1



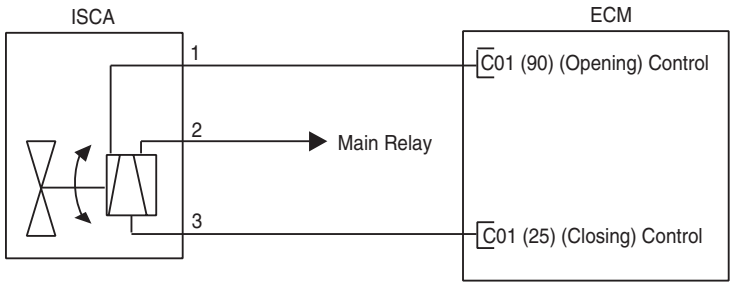
C01-2

ECM

LFJF615A

(M/T)

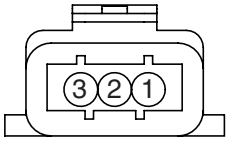
[CIRCUIT DIAGRAM]



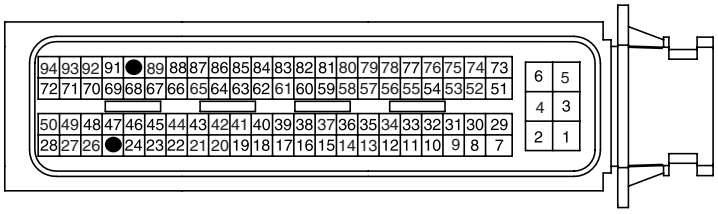
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (90)	Opening Control
2	Main Relay	Battery Voltage (B+)
3	ECM C01 (25)	Closing Control

[HARNESS CONNECTORS]



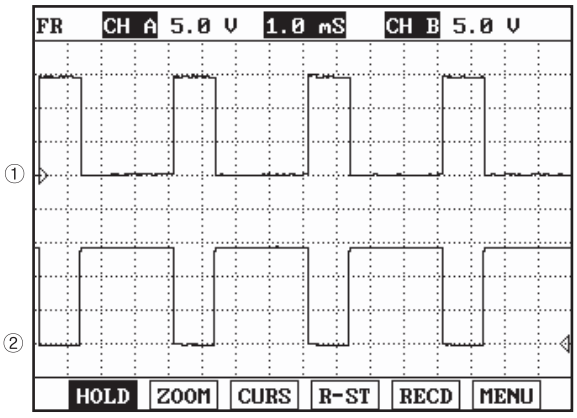
ISCA (C09)



ECM (C01)

LFJF615B

SIGNAL WAVEFORM & DATA E538154C

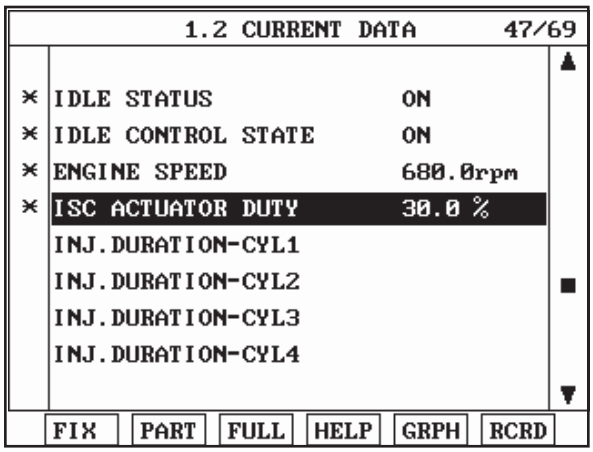


① Closing control duty signal at idle
② Opening control duty signal at idle

LFJF616A

MONITOR SCANTOOL DATA E44DC0CD

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "ISCA" parameters on the scantool.



LFJF649A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E81655C0

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

YES

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

NO

▶ Go to "Power circuit inspection" procedure.

POWER CIRCUIT INSPECTION E3BF34CB

1. Key "OFF".
2. Disconnect ISCA connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of ISCA harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short in power circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E03CE3DA

1. Check Open in control circuit.
   1) Key "OFF".
   2) Disconnect ISCA connector and ECM connector.
   3) Measure the resistance between terminal 1 of ISCA harness connector and terminal 6/C01-2(90/C01) of PCM(ECM) harness connector.

Specification : Approx 1Ω below

   4) Is the measured resistance within specification?

YES

▶ Go to "Check Short in Control circuit" procedure.

NO

▶ Repair Open in control circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short in control circuit.
   1) Key "OFF".
   2) Disconnect ISCA connector and ECM connector.
   3) Measure the resistance between terminal 1 of ISCA harness connector and chassis ground.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to ground in control circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0F0A3B7

1. ISCA visual check.

1) Key "OFF".

2) Disassemble ISCA.

3) Check contamination, damage or stuck on ISCA.

4) Check the operating sound when key turns "OFF" to "ON".

5) Is ISCA O.K?

YES

▶ Go to "ISCA check" procedure.

NO

▶ Substitute with a known - good ISCA and check for proper operation.
▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.

1) Key "OFF".

2) Disassemble ISCA.

3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)

4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35	15.4±0.8	11.9±0.8

5) Is the measured resistance within specifications?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ISCA and check for proper operation.
▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA3B9B34

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

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.

3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1506 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #1

COMPONENT LOCATION E3FBA4DF

Refer to DTC P1505.

GENERAL DESCRIPTION E562FBD9

Refer to DTC P1505.

DTC DESCRIPTION E8379FED

If there is Short to power in ISCA(opening coil) circuit, PCM sets DTC P1506.

DTC DETECTING CONDITION E7D490C6

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high (opening coil)	• Poor connection • Short to power in control circuit • ISCA • ECM
Enable Conditions		
Threshold Value	• Shorted to battery voltage	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION E789A1A7

Refer to DTC P1505.

SCHEMATIC DIAGRAM E2D58EA4

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA E6E0D89A

Refer to DTC P1505.

MONITOR SCANTOOL DATA E3B32F40

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION EA4071F2

Refer to DTC P1505.

CONTROL CIRCUIT INSPECTION E938AC8D

1. Key "OFF".

2. Disconnect ISCA connector.
3. Key "ON".
4. Measure the voltage between terminal 1 of ISCA harness connector and chassis ground.

Specification : Approx 1.3V

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power in control circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED2EEDB1

1. ISCA visual check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Check contamination, damage or stuck on ISCA.
   4) Check the operating sound when key turns "OFF" to "ON".
   5) Is ISCA O.K?

   YES

   ▶ Go to "ISCA check" procedure.

   NO

   ▶ Substitute with a known - good ISCA and check for proper operation.
   ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.
2. ISCA check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)
   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35	15.4±0.8	11.9±0.8

   5) Is the measured resistance within specifications?

YES

- Substitute with a known - good ECM and check for proper operation.
- If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good ISCA and check for proper operation.
- If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECF5FC82

Refer to DTC P1505.

DTC P1507 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #2

COMPONENT LOCATION EFFF369D

Refer to DTC P1505.

GENERAL DESCRIPTION E55A0797

Refer to DTC P1505.

DTC DESCRIPTION E8C5A5EE

If there is Open or Short to ground in ISCA(closing coil) circuit, PCM sets DTC P1507.

DTC DETECTING CONDITION E2CCD71B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low (Closing coil)	• Poor connection • Open or short to ground in control circuit • ISCA • PCM
Enable Conditions		
Threshold Value	• Shorted to ground or disconnected	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION EF15AA6B

Refer to DTC P1505.

SCHEMATIC DIAGRAM E24959AC

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA EFC3FA2A

Refer to DTC P1505.

MONITOR SCANTOOL DATA E39DB28E

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION EC27316F

Refer to DTC P1505.

POWER CIRCUIT INSPECTION E2547CEA

1. Key "OFF".

2. Disconnect ISCA connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of ISCA harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short in power circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION ECEFAC2B

1. Check Open in control circuit.
   1) Key "OFF".
   2) Disconnect ISCA connector and ECM connector.
   3) Measure the resistance between terminal 3 of ISCA harness connector and terminal 22/C01-2(25/C01) of PCM(ECM) harness connector.

Specification : Approx 1Ω below

   4) Is the measured resistance within specification?

YES

▶ Go to "Check Short in Control circuit" procedure.

NO

▶ Repair Open in control circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short in control circuit.
   1) Key "OFF".
   2) Disconnect ISCA connector and ECM connector.
   3) Measure the resistance between terminal 3 of ISCA harness connector and chassis ground.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to ground in control circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1B00384

1. ISCA visual check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Check contamination, damage or stuck on ISCA.
   4) Check the operating sound when key turns "OFF" to "ON".
   5) Is ISCA O.K?

YES

▶ Go to "ISCA check" procedure.

NO

▶ Substitute with a known - good ISCA and check for proper operation.
▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)
   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35	15.4±0.8	11.9±0.8

   5) Is the measured resistance within specifications?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ISCA and check for proper operation.
▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E312246B

Refer to DTC P1505.

DTC P1508 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #2

COMPONENT LOCATION E5F08CEF

Refer to DTC P1505.

GENERAL DESCRIPTION EC3686E6

Refer to DTC P1505.

DTC DESCRIPTION EC94270A

If there is Short to power in ISCA(closing coil) circuit, PCM sets DTC P1508.

DTC DETECTING CONDITION EB32BB66

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high (closing coil)	• Poor connection • Short to power in control circuit • ISCA • PCM
Enable Conditions		
Threshold Value	• Shorted to battery voltage	
Diagnostic Time	• Continuous	
MIL ON Condition	• 2 driving cycle	

SPECIFICATION EAC1EEFF

Refer to DTC P1505.

SCHEMATIC DIAGRAM E20E9BC5

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA ED68968A

Refer to DTC P1505.

MONITOR SCANTOOL DATA EBFA387D

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION E48E5A22

Refer to DTC P1505.

CONTROL CIRCUIT INSPECTION EB3C1828

1. Key "OFF".

2. Disconnect ISCA connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of ISCA harness connector and chassis ground.

Specification : Approx 2V

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power in control circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EB7E7409

1. ISCA visual check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Check contamination, damage or stuck on ISCA.
   4) Check the operating sound when key turns "OFF" to "ON".
   5) Is ISCA O.K?

      YES

      ▶ Go to "ISCA check" procedure.

      NO

      ▶ Substitute with a known - good ISCA and check for proper operation.
      ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)
   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35	15.4±0.8	11.9±0.8

   5) Is the measured resistance within specifications?

      YES

      ▶ Substitute with a known - good ECM and check for proper operation.
      ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

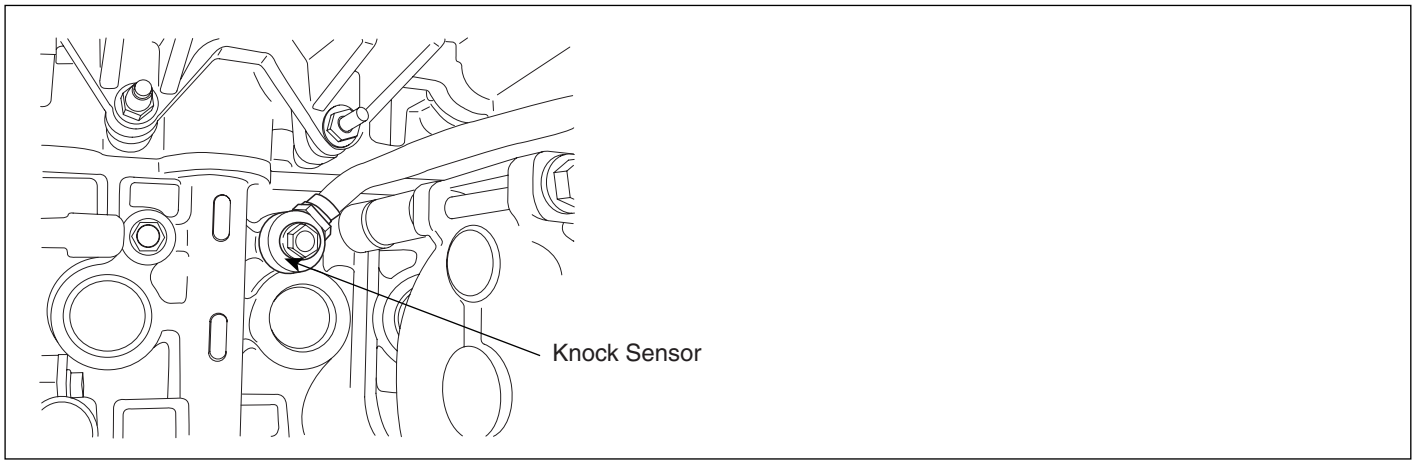
- ▶ Substitute with a known - good ISCA and check for proper operation.
- ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2524A14

Refer to DTC P1505.

DTC P1550 KNOCK SENSOR EVALUATION IC

COMPONENT LOCATION EF1B2F53



LFJF800F

GENERAL DESCRIPTION EB4070CB

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The PCM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION E8288FA0

Through monitoring the scope of analog input signal from knock sensor, PCM detect Open, Short or faulty component.If the input signal is out of threshold value, PCM sets P1550.

DTC DETECTING CONDITION E0FC313E

Item		Detecting Condition	Possible Cause
CASE 1	DTC Strategy	• Circuit continuity check, pulse test	• Poor connection • Open or short in control circuit • Knock sensor • PCM
	Threshold Value	• Integrator value difference (End value - Start value) 〈 4V	
CASE 2	DTC Strategy	• Circuit continuity check, zero test	
	Threshold Value	• Integrator gradient 〉 200 V/sec	
CASE 3	DTC Strategy	• Parity check	
	Threshold Value	• Number of parity errors 〉 5	
Diagnostic Time		• Continuous	

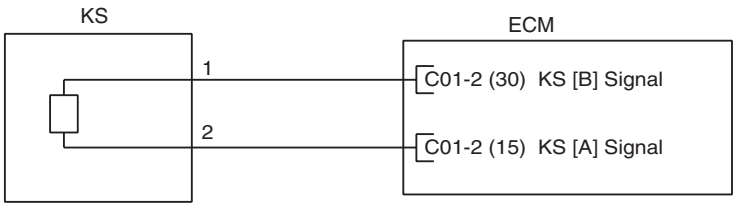
SPECIFICATION E3228BED

Item	Specification
Capacitance	950 ~ 1,350pF

SCHEMATIC DIAGRAM EEE7368A

(A/T)

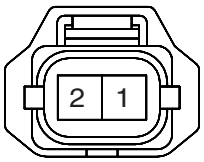
[CIRCUIT DIAGRAM]



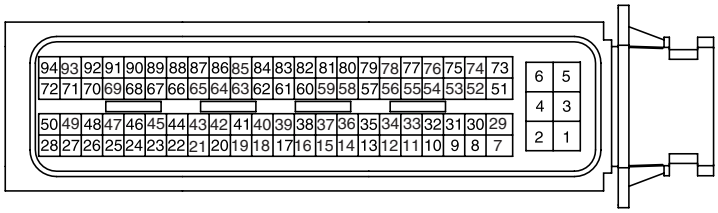
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-2 (30)	KS [A] Signal
2	ECM C01-2 (15)	KS [B] Signal

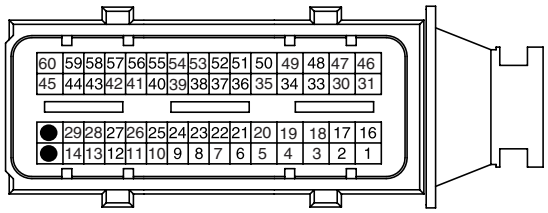
[HARNESS CONNECTORS]



KS (C14)



C01-1



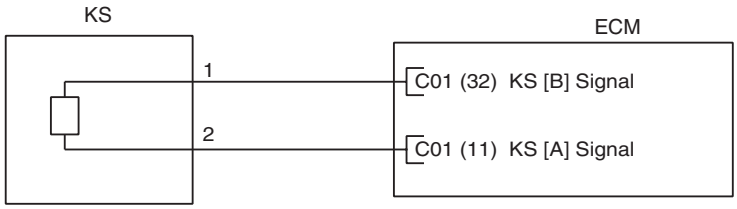
C01-2

ECM

LFJF563A

(M/T)

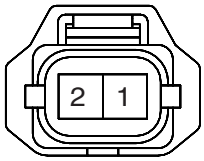
[CIRCUIT DIAGRAM]



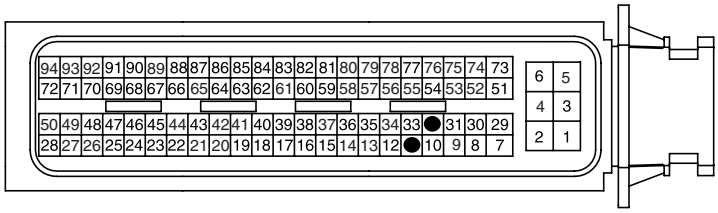
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01 (32)	KS [A] Signal
2	ECM C01 (11)	KS [B] Signal

[HARNESS CONNECTORS]



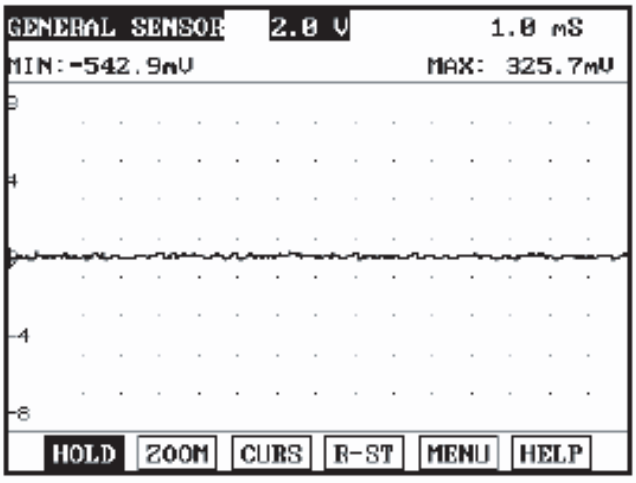
KS (C14)



ECM (C01)

LFJF563B

SIGNAL WAVEFORM & DATA E601833B

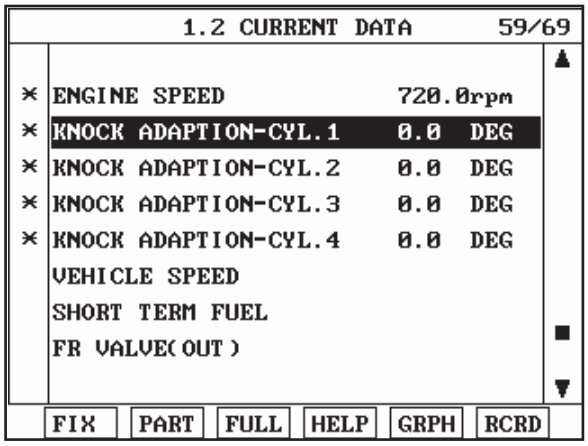


This is a normal signal waveform of knock sensor. Generally, there would be much more noise on knock sensor signal than the others.

LFJF564A

MONITOR SCANTOOL DATA EECA055E

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Knock sensor" parameters on the scantool.



LFJF661A

4. Are the parameters displayed correctly ?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EFF722A4

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

YES

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

NO

▶ Go to "Knock sensor circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION E1EE620B

1. Key "OFF".
2. Disconnect Knock sensor connector.
3. Key "ON".
4. Measure the voltage between terminal 1 of knock sensor harness connector and chassis ground.
5. Measure the voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx 2.4V

6. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open or Short in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E25CE574

1. Check Knock sensor.
   1) Substitute with a known - good Knock sensor and check for proper operation.
   2) Is the signal normal?

YES

▶ Replace Knock sensor and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E668BC6A

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1560 KNOCK CONTROL SPI (SERIAL PORT INTERFACE) CHECK

COMPONENT LOCATION ED4DE506

Refer to DTC P1550.

GENERAL DESCRIPTION E0008B69

Refer to DTC P1550.

DTC DESCRIPTION E94E0580

Knock sensor signal is inputted to CPU through SPI(Serial Port Interface). By the way, if there is malfunction between SPI and CPU, PCM sets DTC P1560.

DTC DETECTING CONDITION EAF7013D

Item	Detecting Condition	Possible Cause
DTC Strategy	• SPI communication check	• Poor connection • PCM
Enable Conditions		
Threshold Value	• Number of SPI errors 〉 1	
Diagnostic Time	• Continuous	

SPECIFICATION E59039A6

Refer to DTC P1550.

SCHEMATIC DIAGRAM E1F891C1

Refer to DTC P1550.

SIGNAL WAVEFORM & DATA EA7A1B45

Refer to DTC P1550.

MONITOR SCANTOOL DATA E79B8D4C

Refer to DTC P1550.

TERMINAL AND CONNECTOR INSPECTION E821C3BE

Refer to DTC P1550.

VERIFICATION OF VEHICLE REPAIR EF0E88FE

Refer to DTC P1550.

DTC P1602 CAN COMMUNICATION BUS WITH TCU (TIMEOUT)

GENERAL DESCRIPTION E4A6DBD6

As vehicles electronically controlled, various control unit is applied to vehicle and several units are controlled based on the signals from the sensors. Therefore sharing signals of sensors and information is required. To meet this requirement, CAN communication type, which is insensible to external noises and whose communication speed is fast, is applied to power train control.
Sharing signals from RPM, APS, gear shifting, torque reduction in ESP, ABS and various modules, addtive control is performed.

DTC DESCRIPTION E4116D81

If there is no message from TCM to ECM through external CAN line over 500 ms, PCU sets DTC P1602.

DTC DETECTING CONDITION EA0360B0

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN communication status check	• Poor connection • TCM • ECM
Enable Conditions	• TCM is not coming via internal CAN	
Threshold Value	• No message time from TCM via external CAN 〉 500ms	
Diagnostic Time	• Continuous	
MIL ON Condition	• 5 sec	

MONITOR SCANTOOL DATA EB75E68C

1. Connect scantool to Data Link Connector(DLC).

2. Warm up the engine to normal operating temperature.

3. Monitor the "CAN" parameters on the scantool.
   - Check "Transaxle type, Torque control request, etc" at the ECU service data mode.
   - Check "TPS, RPM, IDLE STATE, etc" at the TCU service data mode.

4. Are the parameters displayed correctly?

YES

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

NO

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED14ACBF

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

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

YES

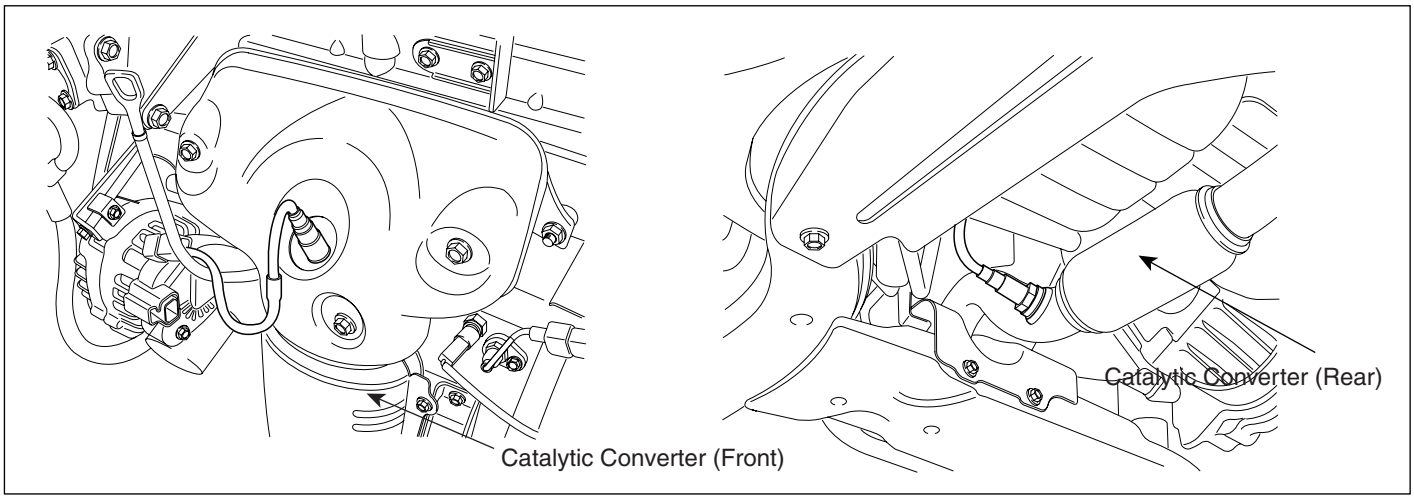
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

COMPONENT LOCATION E770AE61



LFJF800H

GENERAL DESCRIPTION E4EA775B

The catalyst's efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor's signal trace begins to match the front oxygen sensor's signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2 O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION E04345F3

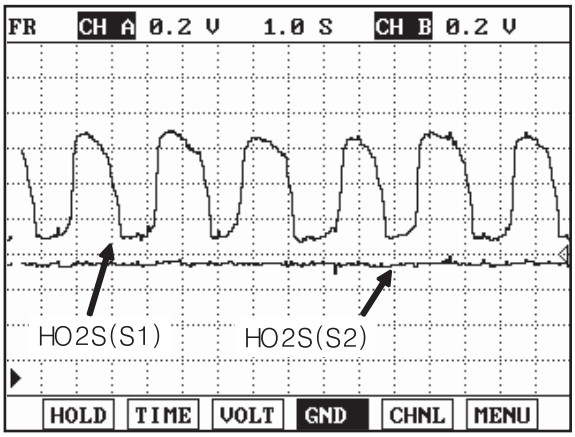
ECM controls Air/Fuel ratio by B1S1 monitoring and B1S2 monitoring. By the way, if there is the advanced B1S1 signal line shift compared with the value of B1S2 controller, PCM sets DTC P2096.

DTC DETECTING CONDITION E78D7C30

Item	Detecting Condition	Possible Cause
DTC Strategy	• O2 sensor characteristic line shift	• Catalyst converter • B1S1 • ECM
Enable Conditions	• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled • 1000rpm 〈 Engine speed 〈 3800rpm • Engine load : 18 ~ 60 %	
Threshold Value	• The second controller by B1S2 〉 1sec	
Diagnostic Time	• 50 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

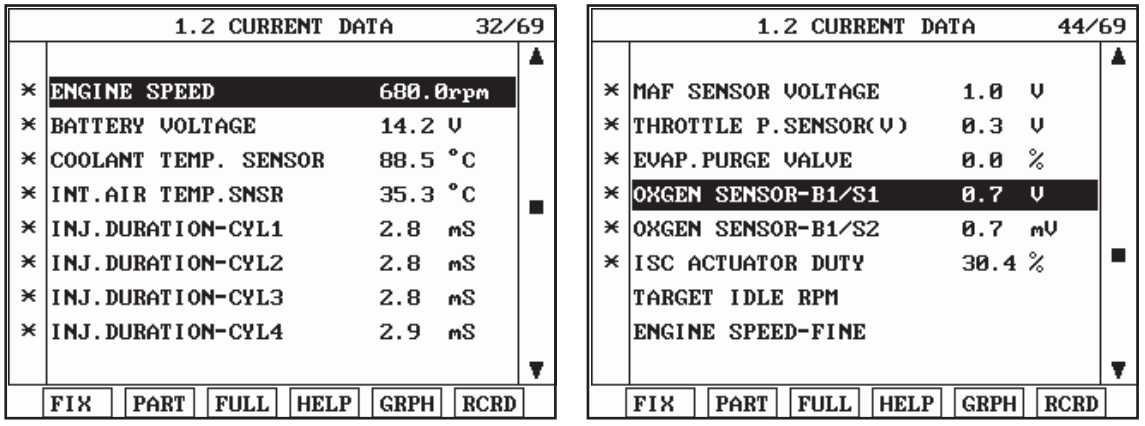
SIGNAL WAVEFORM & DATA E9F08274



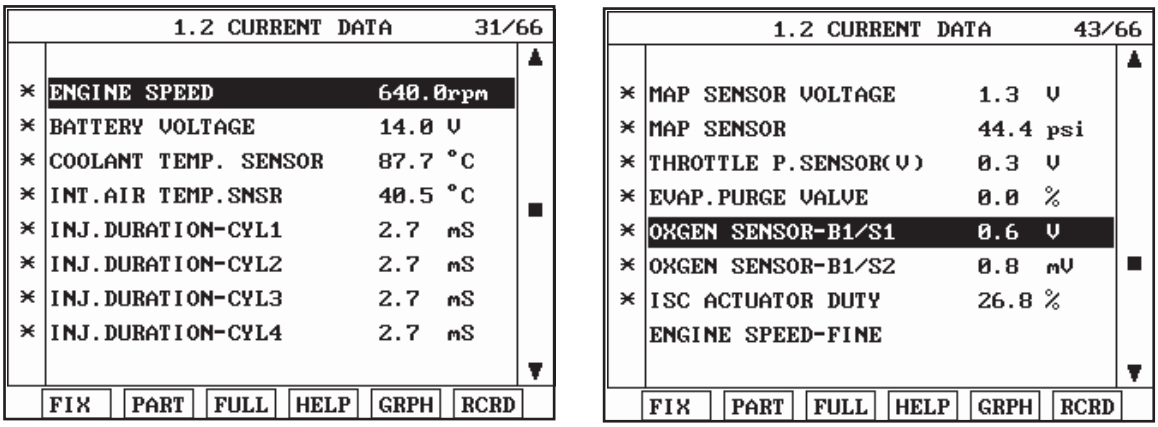
LFJF669A

MONITOR SCANTOOL DATA EA70BBE3

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Parameters related to air/fuel ratio(HO2S, MAF, MAP, TPS, ECTS, PCSV, Injector, etc)" on the scantool.



1.6CVVT



1.4DOHC

LFJF670A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "System Inspection" procedure

SYSTEM INSPECTION E320311E

1. Check clog on Exhaust gas system

   1) Key "OFF".

   2) Check clog on muffler or catalyst converter.

   3) Is Exhaust gas system O.K?

      YES

      ▶ Go to "Intake air system check" procedure.

NO

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

2. Intake air system check.

   1) Check leakage on Intake air system
      ▶ Check looseness, deterioration or contamination on throttle body and gasket.
      ▶ Check contamination, damage or crack on intake manifold, ISCA and injectors.
      ▶ Check contamination or stuck on ISCA and EGR valve.

   2) Is there any leakage?

      YES

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

      NO

      ▶ Go to "Fuel line check" procedure.

3. Fuel line check.

   1) Check "Fuel line system"
      ▶ Check looseness of connectors on fuel line.
      ▶ Check looseness, damage, or interference of vacuum hose on fuel line.
      ▶ Check damage, leakage or bending on fuel line pipe.

   2) Is fuel line normal?

      YES

      ▶ Go to "Fuel line pressure check" procedure.

      NO

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

4. Fuel line pressure check.

   1) Key "OFF".

   2) Disconnect a fuel pump relay.

   3) Engine start and wait until engine stop. and then key "OFF".

   4) Connect a fuel pump relay.

   5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

   6) Engine start and measure a fuel pressure.

   NOTE

   Refer to "FUEL PRESSURE TEST" in FUEL DELIVERY SYSTEM.

Specification : Approx. 3.5 kg/cm²

   7) Is the fuel pressure normal?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check clogging on the fuel filter.
▶ Check the valve in a fuel pressure regulator.
(If it has a problem, fuel happen to be leaked to a return line.)
▶ Check the supply pressure of fuel pump.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E6D871F9

1. PCV(Positive Crankcase Ventilation) valve check.

   1) Key "OFF".

   2) Disconnect PCV valve.

   3) Check the movement of plunger by putting in and out a thin stick.

   4) Is the movement of plunger normal?

   YES

   ▶ Go to "injectors check" procedure.

   NO

   ▶ Substitute with a known - good PCV valve and check for proper operation.
   ▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

2. Injector check

   1) Key "OFF".

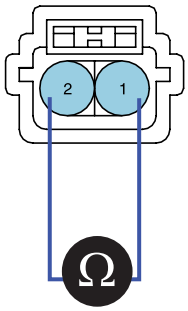
   2) Disconnect injectors.

   3) Check clog on injectors.

   4) Measure the resistance between terminal 1 and 2 of injectors(Component side).

SPECIFICATION :

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω



1. Injector Power
2. Injector control

LFJF483A

5) Is the measured resistance within specifications ?

YES

▶ Go to "Sensors related to air/fuel ratio check" procedure.

NO

▶ Substitute with a known - good Injector and check for proper operation.
▶ If the problem is corrected, replace Injector and go to "Verification of Vehicle Repair" procedure.

3. Sensors related to air/fuel ratio check.

1) Check the output data of sensors related to air/fuel ratio (HO2S, MAPS, TPS, ECTS, PCSV, Injectors, etc) on scantool. (Refer to each DTC guide procedure.)

2) Are those sensors normal?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E1796EA5

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

COMPONENT LOCATION E614A578

Refer to DTC P2096.

GENERAL DESCRIPTION EBA2CD6F

Refer to DTC P2096.

DTC DESCRIPTION E7E1FC18

ECM controls Air/Fuel ratio by B1S1 monitoring and B1S2 monitoring. By the way, if there is the retarded B1S1 signal line shift compared with the value of B1S2 controller, PCM sets DTC P2097.

DTC DETECTING CONDITION EE58BA99

Item	Detecting Condition	Possible Cause
DTC Strategy	• O2 sensor characteristic line shift	• Catalyst converter • B1S1 • ECM
Enable Conditions	• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled • 1000rpm 〈 Engine speed 〈 3800rpm • Engine load : 18 ~ 60 %	
Threshold Value	• The second controller by B1S2 〉 -1sec	
Diagnostic Time	• 50 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SIGNAL WAVEFORM & DATA EF58659A

Refer to DTC P2096.

MONITOR SCANTOOL DATA E0C764FC

Refer to DTC P2096.

SYSTEM INSPECTION E8C8AD8F

1. Check clog on Exhaust gas system
   1) Key "OFF".
   2) Check clog on muffler or catalyst converter.

3) Is Exhaust gas system O.K?

YES

▶ Go to "Intake air system check" procedure.

NO

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

2. Intake air system check.

1) Check clog on Intake air system"
▶ Check clog of air-cleaner.
▶ Check deterioration or contamination on throttle body and gasket.
▶ Check contamination, damage, stuck or clog on intake manifold, hoses, PCSV, ISCA and injectors.

2) Is there any problem?

YES

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

NO

▶ Go to "Fuel line pressure check" procedure.

3. Fuel line pressure check.

1) Key "OFF".

2) Disconnect a fuel pump relay.

3) Engine start and wait until engine stop. and then key "OFF".

4) Connect a fuel pump relay.

5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

6) Engine start and measure a fuel pressure.

NOTE

Refer to "FUEL PRESSURE TEST" in FUEL DELIVERY SYSTEM.

Specification : Approx. 3.5 kgf/cm²

7) Is the fuel pressure normal?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check clog or stuck of the valve in a fuel pressure regulator.
▶ Check the supply pressure of fuel pump.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E3C8B7A3

1. PCV(Positive Crankcase Ventilation) valve check.

   1) Key "OFF".

   2) Disconnect PCV valve.

   3) Check the movement of plunger by putting in and out a thin stick.

   4) Is the movement of plunger normal?

   YES

   ▶ Go to "PCSV check" procedure.

   NO

   ▶ Substitute with a known - good PCV valve and check for proper operation.
   ▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

2. PCSV check.

   1) Key "OFF".

   2) Disconnect PCSV and vacuum hose.

   3) Apply a vacuum by a hand vacuum gauge on PCSV.

   4) Does PCSV keep the vacuum condition normally?

   YES

   ▶ Go to "Injector check" procedure.

   NO

   ▶ Substitute with a known - good PCSV and check for proper operation.
   ▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

3. Injector check

   1) Key "OFF".

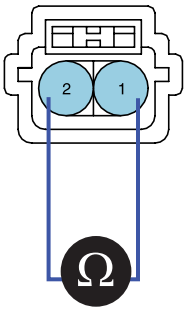
   2) Disconnect injectors.

   3) Check clog on injectors.

   4) Measure the resistance between terminal 1 and 2 of injectors(Component side).

SPECIFICATION :

Temperature (℃)	Resistance (Ω)
20	14.5 ± 0.7Ω



1. Injector Power
2. Injector control

LFJF483A

5) Is the measured resistance within specifications ?

YES

▶ Go to "Sensors related to air/fuel ratio check" procedure.

NO

▶ Substitute with a known - good Injector and check for proper operation.
▶ If the problem is corrected, replace Injector and go to "Verification of Vehicle Repair" procedure.

4. Sensors related to air/fuel ratio check.

1) Check the output data of sensors related to air/fuel ratio (HO2S, MAPS, TPS, ECTS, PCSV, Injectors, etc) on scantool. (Refer to each DTC guide procedure.)

2) Are those sensors normal?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

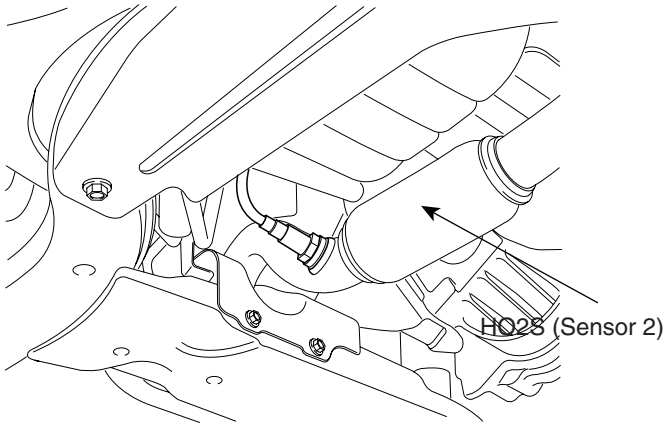
Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7E15397

Refer to DTC P2096.

DTC P2232 O2 SENSOR SIGNAL CIRCUIT SHORTED TO HEATER CIRCUIT (SENSOR 2)

COMPONENT LOCATION ECC4DC76



LFJF800X

GENERAL DESCRIPTION EE71F79C

HO2S(B1/S2) is in the rear side of Catalytic Converter to check the proper operation of catalyst. Oxygen density after the catalytic converter has to be within specific range (around 0.5V when there is no acceclation and deceleration.)If the oxygen density changes in accordance with HO2S(B1/S1), it means the poor performance of catalytic converter.

DTC DESCRIPTION EA63DFB9

If the counter that the signal voltage changes rapidly is over 5 times, PCM sets DTC P2232.

DTC DETECTING CONDITION E2290348

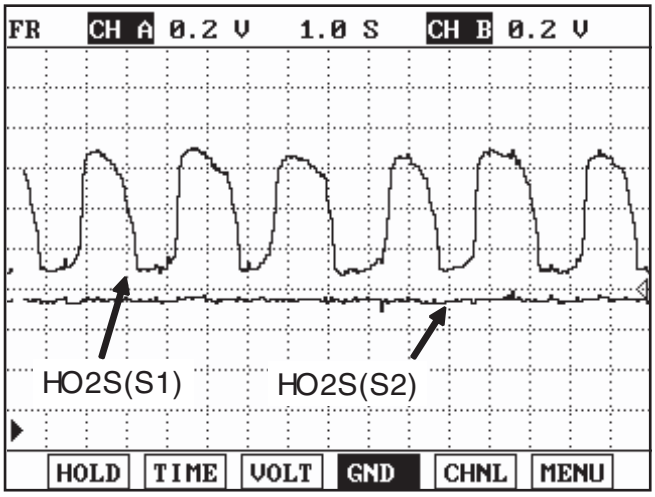
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • Short to power in signal circuit • B1S2 • ECM
Enable Conditions	• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃ • Time after dew point end detected 〉 10 sec	
Threshold Value	• Counter of [△ushk > 2V during 0.04 sec after heater on→off] > 5 times	
Diagnostic Time	• 2 driving cycle	

△ushk : Sum of the signal voltage change value (B1S2)
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION EBFA08A4

Specification	0.1 ~ 0.9V

SIGNAL WAVEFORM & DATA E28772C0

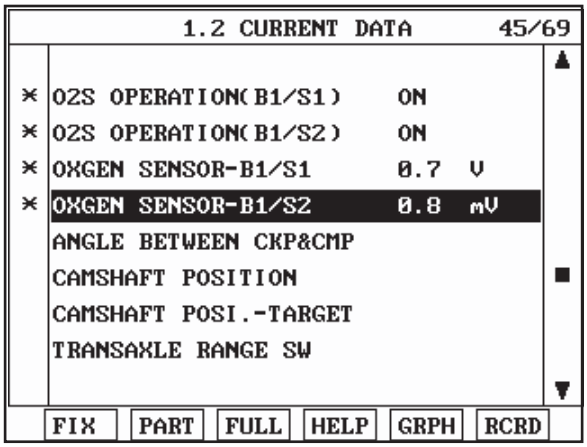


The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter.
This is the normal signal waveform of the rear HO2S at idle.

LFJF451A

MONITOR SCANTOOL DATA EA9A90EC

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "B1S2" parameters on the scantool.



LFJF672A

4. Are the parameters displayed correctly?

YES

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

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E702B917

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

YES

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

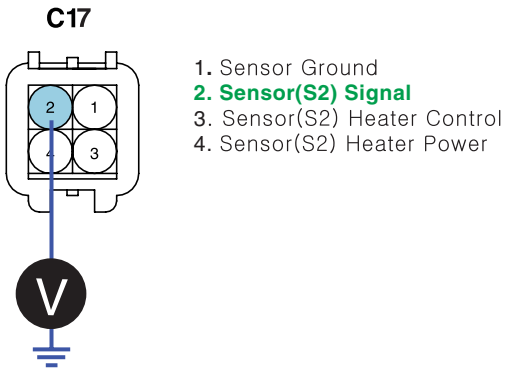
NO

▶ Go to "B1S2 circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION ED77FC34

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V



LFJF673A

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to power in signal circuit and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION EE5FF73A

1. Visual Inspection.

   1) IG "OFF"

   2) Disconnect HO2S(B1/S2) connector.

   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.

   4) Has a problem been found?

   YES

   ▶ Go to "Check ECM" as follows.

   NO

   ▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
   ▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.

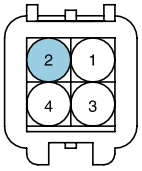
   1) IG "OFF".

   2) Connect scantool and Engine "ON".

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal 2 of HO2S(B1/S2) signal connector.

C17



1. Sensor Ground
2. **Sensor(S2) Signal**
3. Sensor(S2) Heater Control
4. Sensor(S2) Heater Power

LFJF674A

   5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

   YES

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known - good ECM and check for proper operation.
   ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED2E86AA

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

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

YES

▶ Go to the applicable troubleshooting procedure.

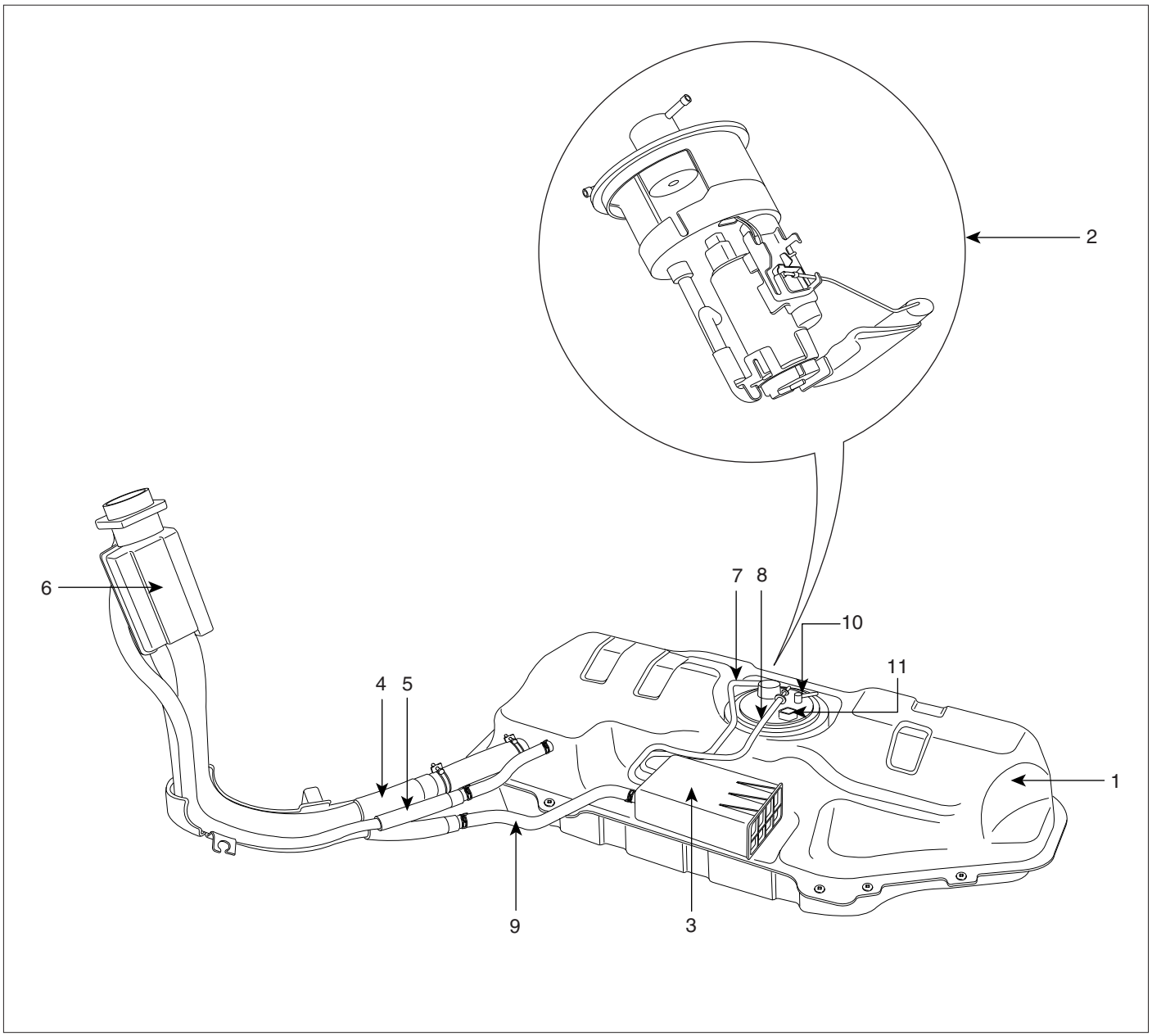
NO

▶ System is performing to specification at this time.

FUEL DELIVERY SYSTEM

FUEL DELIVERY SYSTEM E37B7203

COMPONENTS



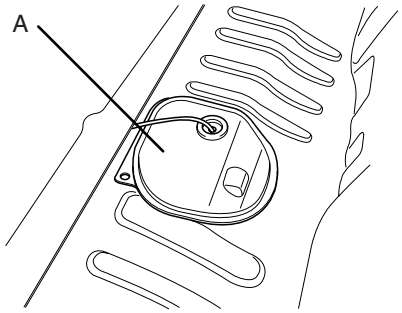
1. Fuel Tank
2. Fuel Pump Assembly
   (including Fuel Filter & Fuel Pressure Regulator)
3. Canister
4. Fuel Filler Hose
5. Leveling Hose
6. Fuel Tank Air Filter
7. Hose (Canister ↔ Fuel Tank)
8. Hose (Canister ↔ Intake Manifold)
9. Hose (Canister ↔ Fuel Tank Air Filter)
10. Nipple-Fuel Feed Line
11. Fuel Pump Connector

LFJF010A

FUEL PRESSURE TEST E6F8CA1A

1. PREPARING

1. Remove the rear seat cushion (Refer to "BD" group in this WORKSHOP MANUAL).
2. Open the service cover (A).

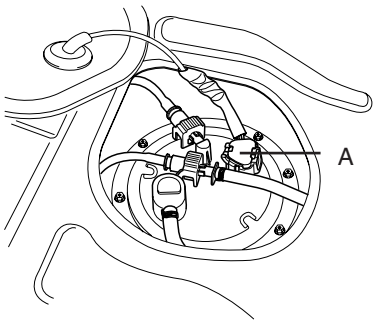


2. RELEASE THE INTERNAL PRESSURE

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 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.



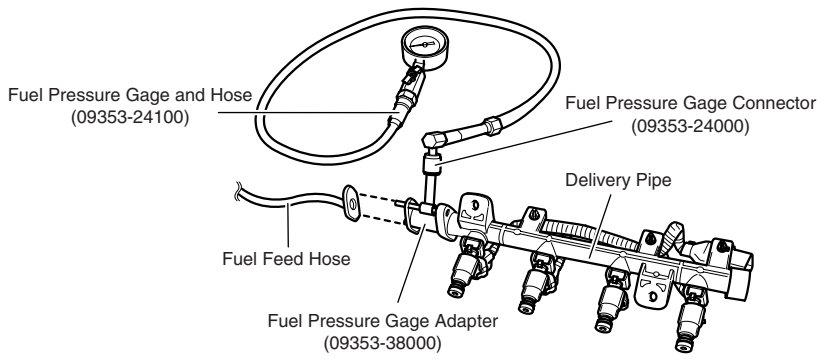
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

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).



LFJF011A

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 PRESURE 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: 343 kpa (3.5 kgf/㎠, 49.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Supected 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 seating 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

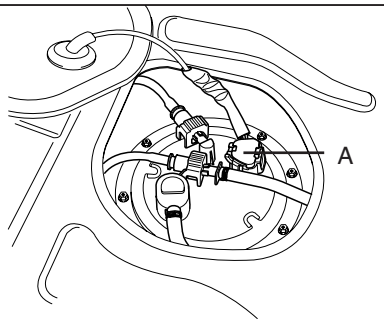
LGIF009J

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

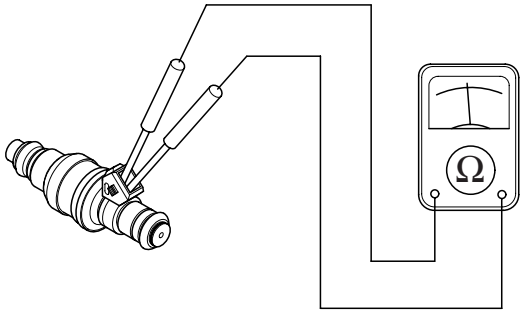
1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

FUEL INJECTOR

INSPECTION E66D79E6

1. Measure resistance between the terminal 1 and 2 of the injector.

Injector Resistance: 13.8 ~ 15.2 Ω at 20℃ (68°F)



LGIF602P

2. If the resistance is not within specification, replace the injector.

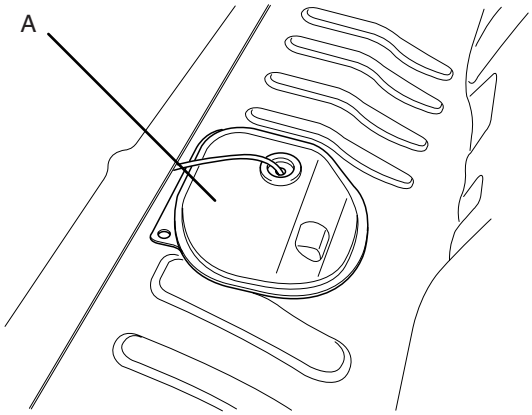
FUEL PUMP (FP)

REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) EBD6A45B

1. Preparation

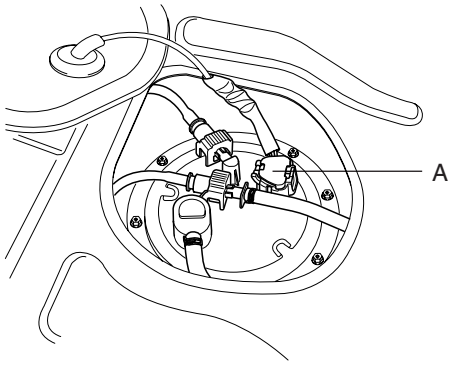
   1) Remove the rear seat cushion (Refer to"BD" group in this WORKSHOP MANUAL).

   2) Remove the service cover (A).



AFJF901C

   3) Disconnect the fuel pump connector (A).

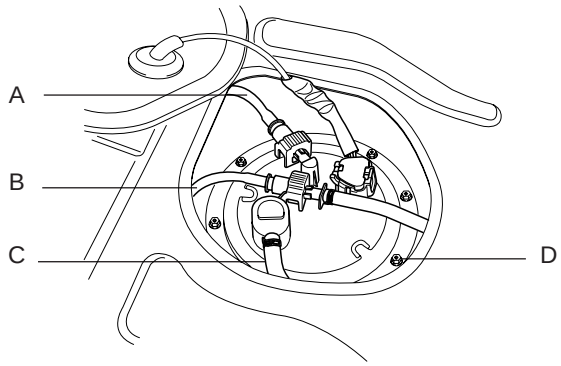


AFJF901B

   4) Start the engine and wait until fuel in fuel line is exhausted.

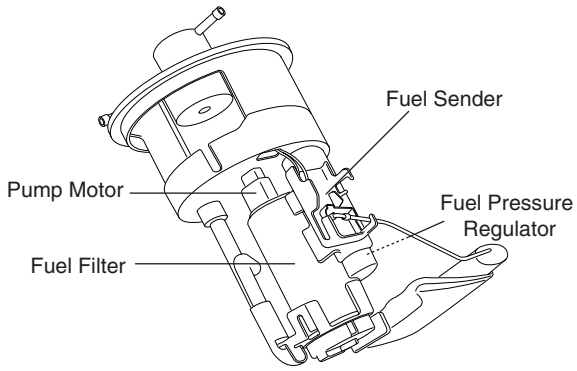
   5) After engine stalls, turn the ignition switch to OFF position.

2. Disconnect the fuel feed line (A) and canister hoses (B,C).



AFJF397A

3. Unscrew the fuel pump mounting bolts (D) and remove the fuel pump assembly.



LFJF013A

INSTALLATION EB998E6A

Install the Fuel Pump according to the reverse order of REMOVAL procedure.

Tightening Torques
Fuel pump installation bolts/nuts: 2.0 ~ 2.9N·m (0.2 ~ 0.3kg·m, 1.4 ~ 2.2lb·ft)

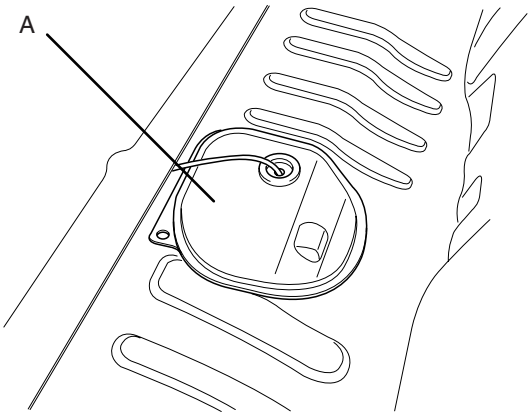
FUEL TANK

REMOVAL EA0DC853

1. Preparation

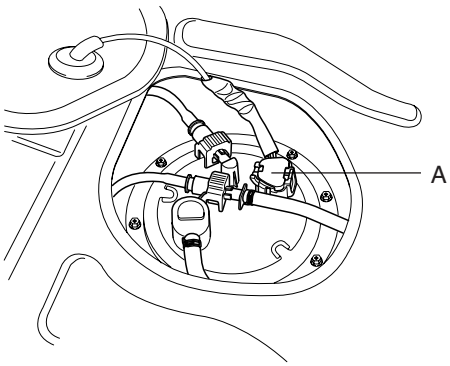
   1) Remove the rear seat cushion (Refer to"BD" group in this WORKSHOP MANUAL).

   2) Remove the service cover (A).



AFJF901C

   3) Disconnect the fuel pump connector (A).

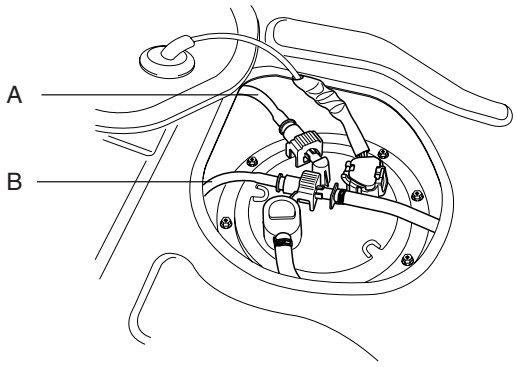


AFJF901B

   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 line (A) and canister hose (B).



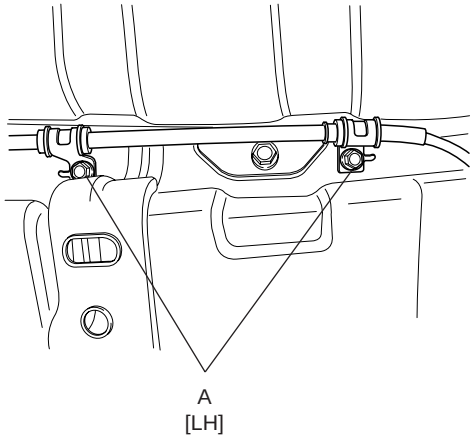
AFJF397B

3. Life the vehicle.

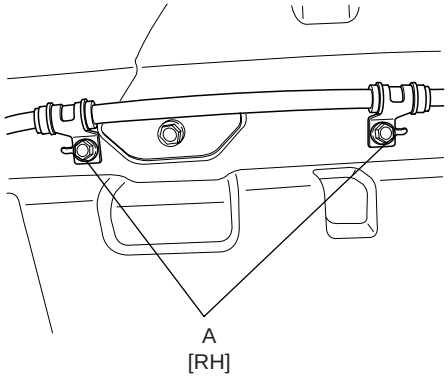
4. Remove the center muffler (Refer to"EM" group in this WORKSHOP MANUAL).

5. Support the fuel tank with a jack.

6. Unscrew the brake hose mounting bolts (A).

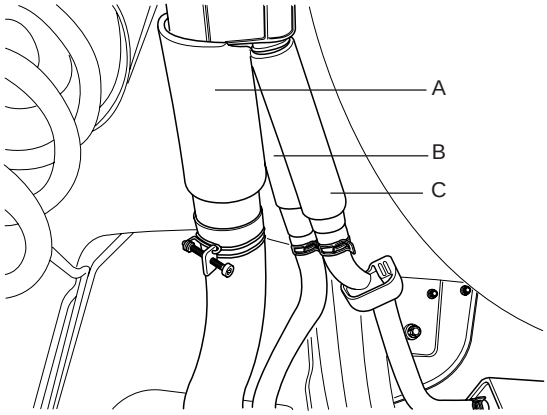


AFJF392A



AFJF393A

7. Disconnect the fuel feed hose (A), the leveling hose (B) and canister hose (C).



AFJF396A

8. Unscrew the fuel tank mounting bolts (2) and nuts (2), and then remove the fuel tank.

INSTALLATION E80B010D

Install the Fuel Tank according to the reverse order of REMOVAL procedure.

Tightening Torques
Fuel tank installation bolts: 39.2 ~ 54.0 N·m (4.0 ~ 5.5 kg·m, 28.9 ~ 39.8 lb·ft)

Clutch System

GENERAL

CLUTCH SYSTEM
CLUTCH COVER AND DISC
CLUTCH MASTER CYLINDER
CLUTCH PEDAL
CLUTCH RELEASE CYLINDER

GENERAL

SPECIFICATIONS EC53B64D

Engine type	G4EE(1.4)/G4ED(1.6)
Clutch operation method Clutch disc Type	Hydraulic type Single dry with diaphragm
Facing diameter (outside x inside)mm (in.)	215 x 145 (8.5 x 5.7)
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

Standard value Clutch disc thickness [When free] Clutch pedal height[without carpet] Clutch pedal free play Clutch pedal stroke	 8.2 ~ 8.8 mm (0.322 ~ 0.346 in.) LHD : 163.9 mm (6.45 in.) RHD : 174.5 mm (6.87 in.) LHD/ RHD : 6 ~ 13 mm (0.24 ~ 0.51 in.) LHD/ RHD : 145 mm (5.7 in.)
Limit Clutch disc rivet sink Diaphragm spring end height difference Clutch replease cylinder clearance to piston Clutch master cylinder clearance to piston	 1.1 mm (0.043 in.) 0.5 mm (0.02 in.) 0.15 mm (0.006 in.) 0.15 mm (0.006 in.)

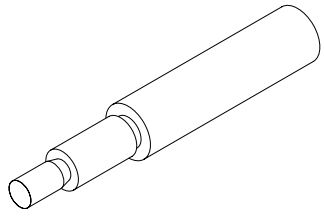
TIGHTENING TORQUE

Item	Nm	kgf.cm	lb-ft
Clutch pedal to pedal support member (Clutch pedal bracket)	25 ~ 35	250 ~ 350	18 ~ 25
Clutch pedal support member to master cylinder	19 ~ 20	190 ~ 200	13 ~ 14
Clutch tube flare nut	13 ~ 17	130 ~ 170	10 ~ 13
Clutch tube bracket	15 ~ 22	150 ~ 220	11 ~ 16
Clutch release cylinder	15 ~ 22	150 ~ 220	11 ~ 16
Clutch release cylinder union bolt	25 ~ 40	250 ~ 400	18 ~ 29
Clutch cover assembly	12 ~ 22	120 ~ 220	9 ~ 16
Ignition lock switch nut	8 ~ 10	80 ~ 100	6 ~ 7
Clutch release lever fulcrum	55 ~ 60	550 ~ 600	40 ~ 43
Master cylinder cap screw	2 ~ 3	20 ~ 30	1.4 ~ 2.2
Master cylinder push rod nut	9 ~ 14	90 ~ 140	6.5 ~ 10
Master cylinder nut	9 ~ 14	90 ~ 140	6.5 ~ 10

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

SPECIAL TOOLS E13BAED1

Tool (Number and name)	Illustration	Use
09411-25000 Clutch disc guide	 EOKD001A	Installation of the clutch disc.

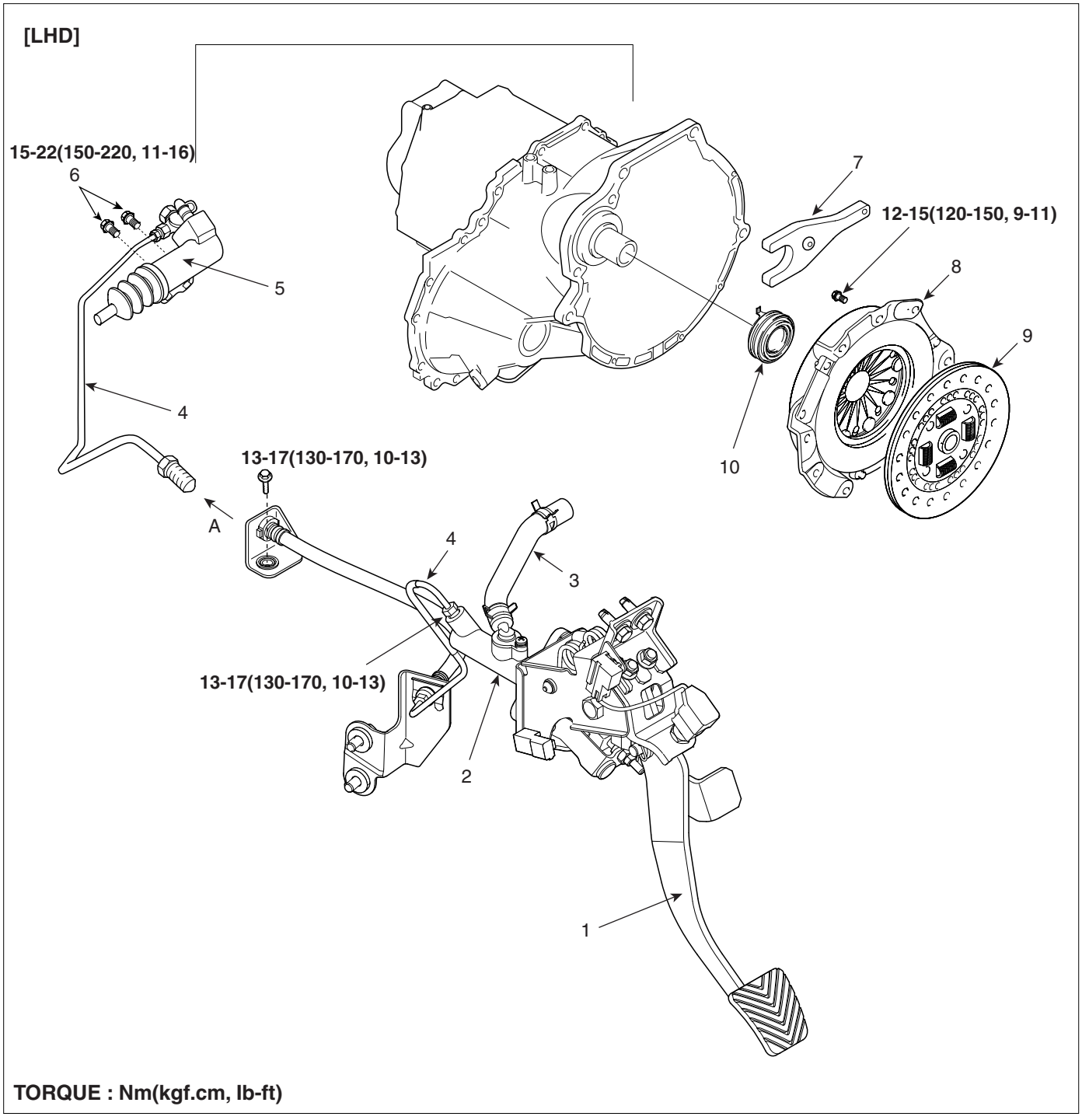
TROUBLESHOOTING EDFF450F

Trouble symptom		Suspect area	Remedy (See page)
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	Adjust
		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
	A noise is heard when the car suddenly rolled up with the clutch partially engaged	Damaged pilot bushing	Replace
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	Repair
		Insufficient lubrication of the front bearing retainer	Repair
Hard to shift or will not shift		Excessive clutch pedal free play	Adjust the pedal free play
		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

Trouble symptom	Suspect area	Remedy (See page)
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
	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 replease bearing
	Sticking release fork or linkage	Repair as necessary

CLUTCH SYSTEM

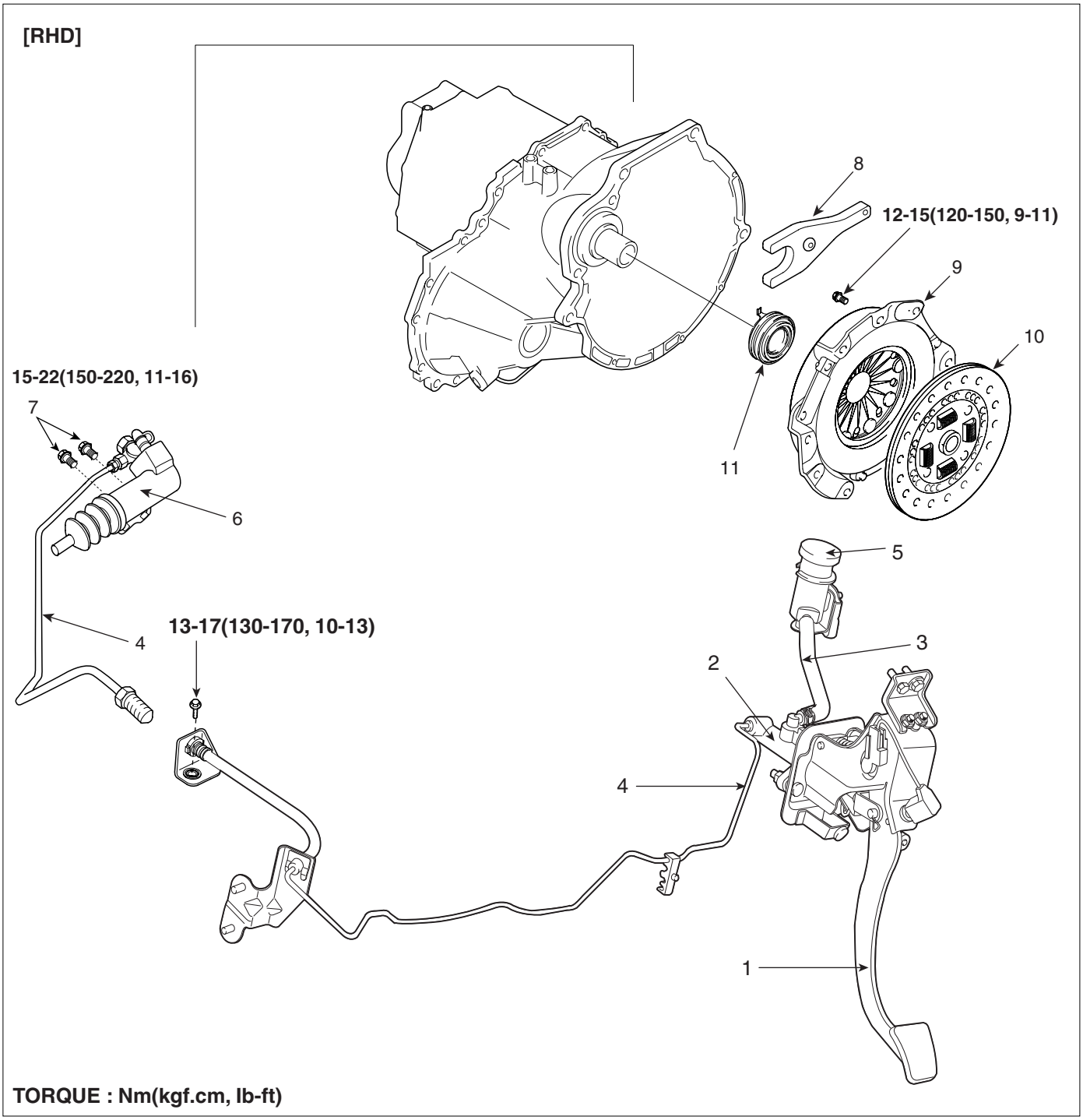
COMPONENTS (1) EF192322



1. Clutch pedal
2. Master cylinder
3. Reserve hose
4. Clutch tube
5. Clutch release cylinder
6. Bolt
7. Clutch release fork
8. Clutch cover
9. Clutch disc
10. Clutch release bearing

LOJF001C

COMPONENTS (2)



1. Clutch pedal
2. Master cylinder
3. Reserve hose
4. Clutch tube
5. Reservior tank
6. Clutch release cylinder
7. Bolt
8. Clutch release fork
9. Clutch cover
10. Clutch disc
11. Clutch release bearing

LOJF015A

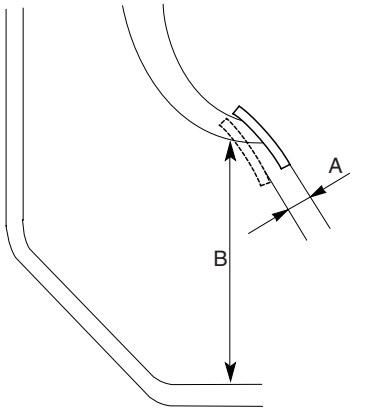
SERVICE ADJUSTMENT PROCEDURE E54C0944

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) LHD/ RHD : 1 ~ 3 mm (0.04~0.11 in.)
(B) LHD : 163.9 mm (6.45 in.)
RHD : 174.9 mm (6.87 in.)

Clutch pedal clevis pin and pedal height



LOJF001A

2. If the clutch pedal clevis pin 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.

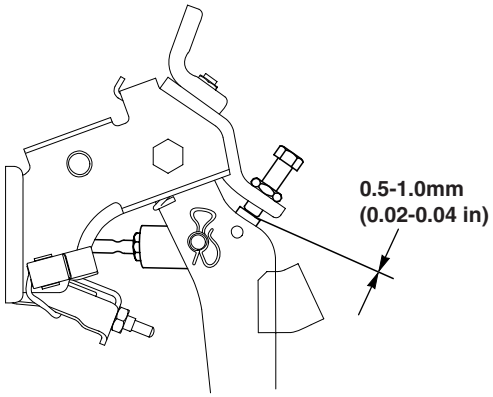
NOTE

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 clevis pin play, be careful not to push the push rod toward the master cylinder.

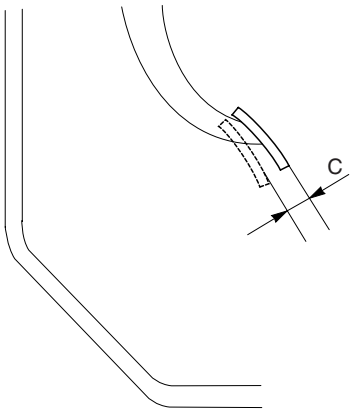


LOJF003A

3. After completing the adjustments, check that the clutch pedal free play (measured at the face of the pedal pad) is within the standard value ranges.

Standard value
LHD/RHD : (C) 6~13 mm (0.24~0.51 in.)

Clutch pedal



LOJF012B

4. If the clutch pedal free play and the distance between the clutch pedal and the floor board when the clutch is disengaged, do not meet with the standard values, it may be the result of either air in the hydraulic system or a faulty the clutch master cylinder. Bleed the air or disassemble and inspect the master cylinder or clutch.

BLEEDING

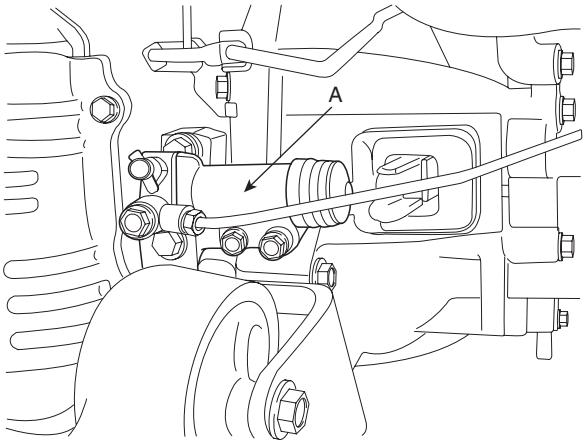
Whenever the clutch tube, the clutch hose, and/or the clutch master cylinder have been removed, or if the clutch pedal is spongy, bleed the system.

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(B) at the clutch release cylinder(A).

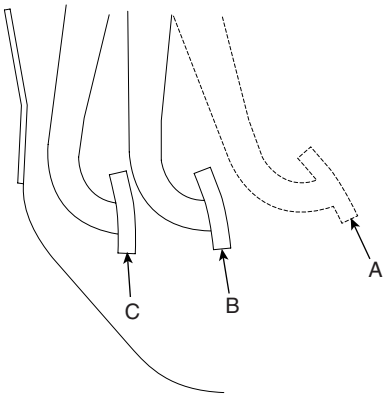


LOJF004B

2. Pump 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

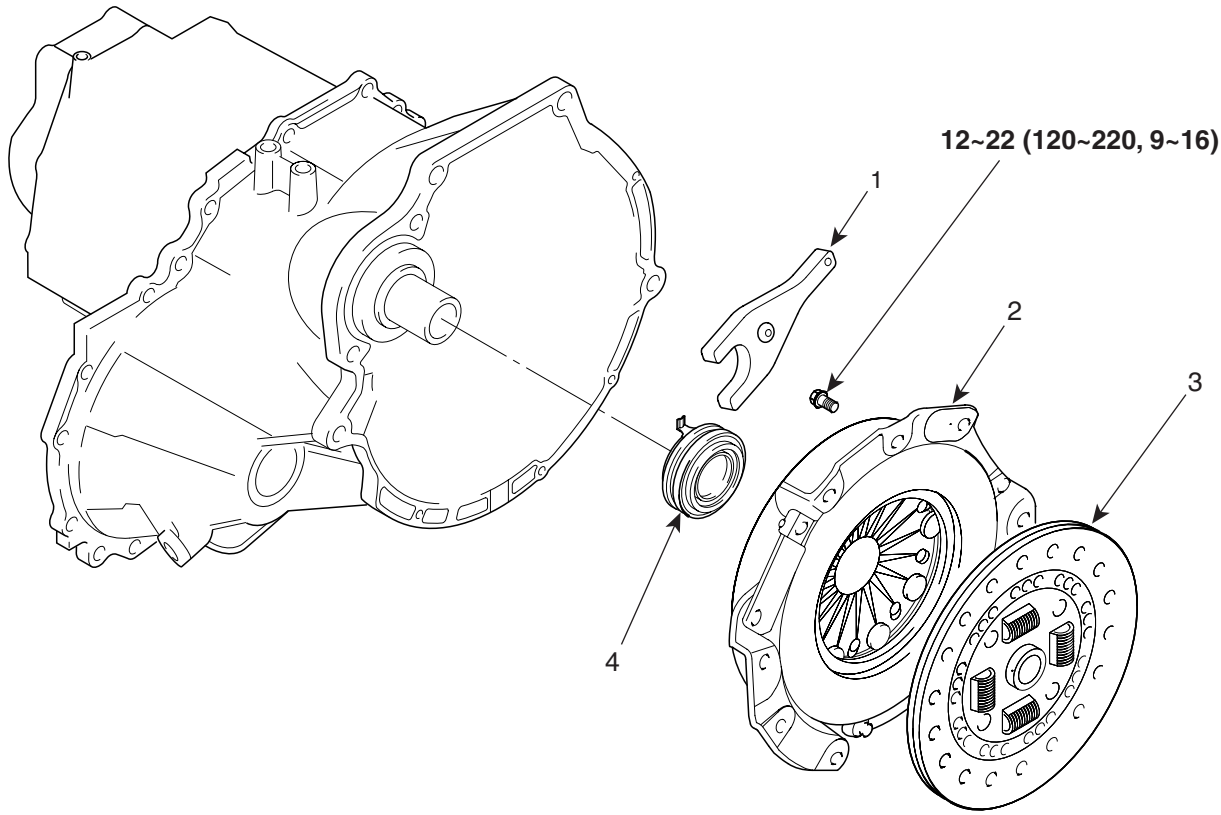
The rapidly-repeated operation of the clutch pedal in B-C range may disrupt the release cylinder's position. During the bleeding operation, press the clutch pedal to the floor after it returns to the "A" point.



EOKD006A

CLUTCH COVER AND DISC

COMPONENTS EB4E6FEE



TORQUE: Nm (kgf.cm, lb-ft)

1. Clutch release fork
2. Clutch disc cover
3. Clutch disc
4. Clutch release bearing

LOJF005A

REMOVAL ED7846C5

1. To remove the transaxle assembly, first drain the clutch fluid and transaxle gear oil, then remove the air cleaner joint and the mounting bracket etc.

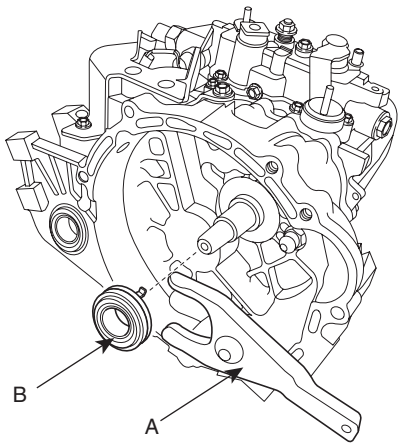
2. Remove the transaxle assembly, after removing each bolt which connects the transaxle assembly and engine.

3. Loosen the bolts attached to the release cylinder and remove the release cylinder.

4. Remove the clutch release fork(A) and bearing(B).

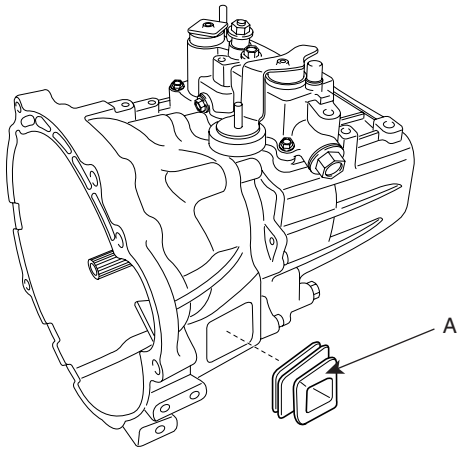
NOTE

- *It is impossible to remove the transaxle assembly without performing this step because the clutch cover assembly, release bearing and release fork are held together.*
- *To reduce rattling noise from the gear, a new dual mass flywheel has been used. Due to the application of the dual mass flywheel, the clutch assembly has also been changed. When replacing the flywheel with the dual mass flywheel, the clutch disc and cover should be replaced with the new parts at the same time.*



LOGF003B

5. Remove the shift fork boot(A).



LOGF003C

6. Insert the special tool (09411-25000) in the clutch disc to prevent the disc from shifting.

7. Loosen the bolts 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 EEA83F69

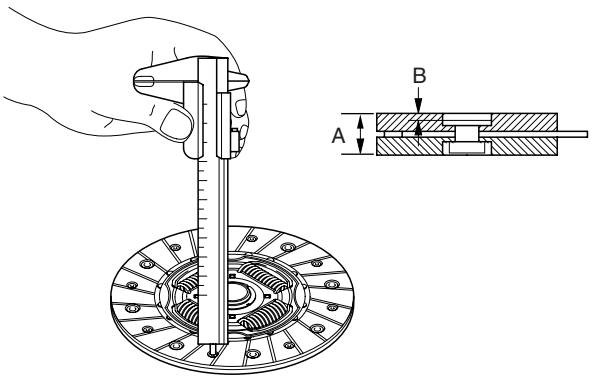
CLUTCH COVER ASSEMBLY

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] : 8.5 ± 0.3mm[0.33 ±0.012in.] Limit Clutch disc rivet depth(B) : 0.3mm[0.012 in.]



EOKD010A

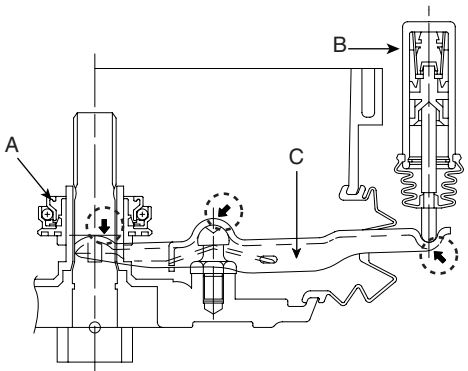
3. Check for the torsion spring play and damage and if defective, replace the clutch disc.
4. Clean the splines on the input shaft and install the clutch disc.
   If the disc does not slide smoothly or if play is excessive, replace the clutch disc and/or the input shaft.

CLUTCH RELEASE BEARING

CAUTION

The release bearing is packed with grease. Do not use cleaning solvent or oil.

Standard grease : CASMOLY L9508



A: Clutch release bearing
B: Clutch release cylinder
C: Clutch release fork

LOJF007A

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.

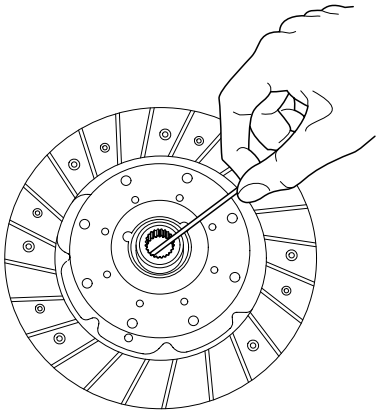
INSTALLATION EFC615DC

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).

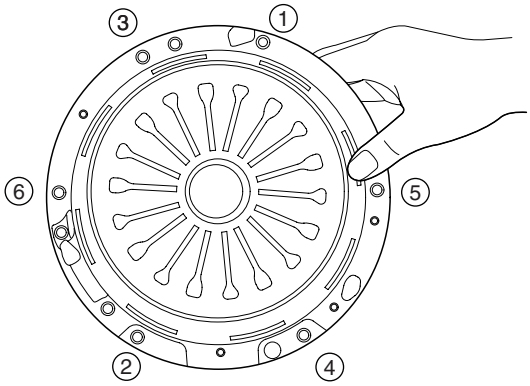


EOKD011A

2. Install the clutch disc assembly to the flywheel using the special tool (09411-25000).

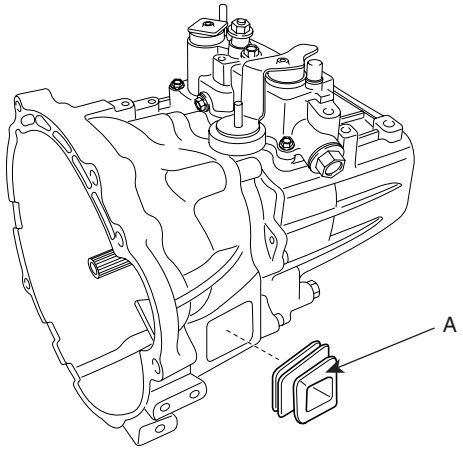
3. Install the clutch cover assembly to the flywheel and temporarily tighten the bolts one or two steps at a time in a star pattern.

TORQUE
Clutch cover bolt :
12 ~ 22 Nm (120 ~ 220 kgf.cm, 9 ~ 16 lb-ft)



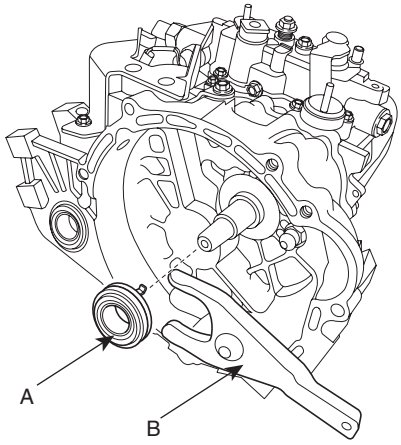
LOJF008A

4. Install the clutch release fork boot(A).



LOGF003E

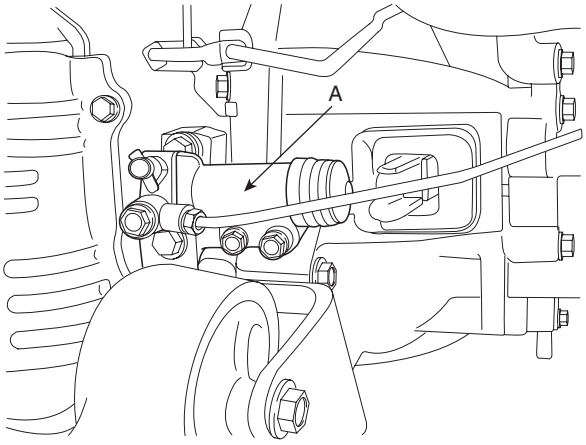
5. Install the release bearing(A) and shift fork(B).



LOGF003F

6. Install the release cylinder(A) to the transaxle

TORQUE
Release cylinder bolt :
15 ~ 22 Nm (150 ~ 220 kgf.cm, 11 ~ 16 lb-ft)

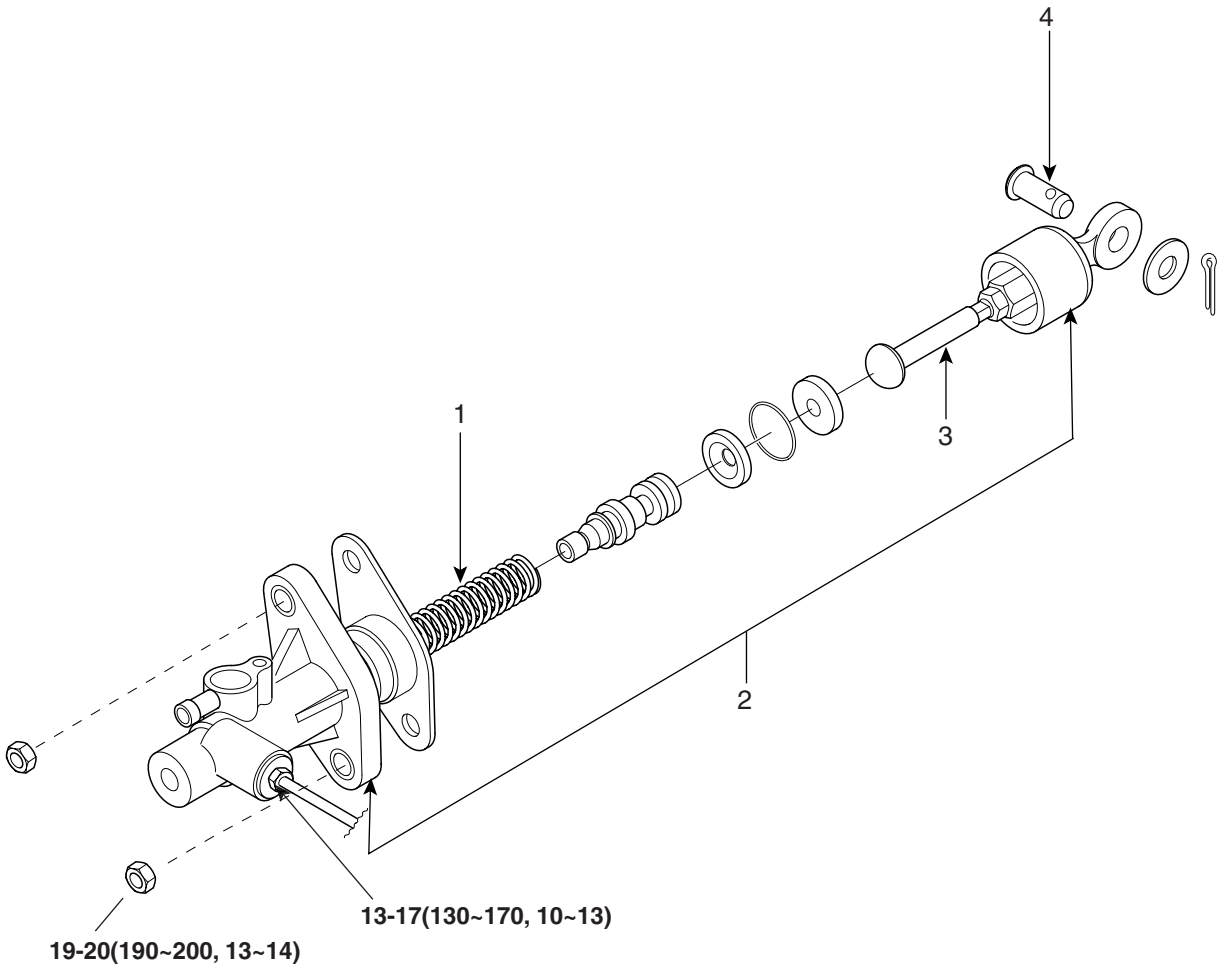


LOJF004B

7. Install the transaxle assembly to the engine.

CLUTCH MASTER CYLINDER

COMPONENTS ECAC355B



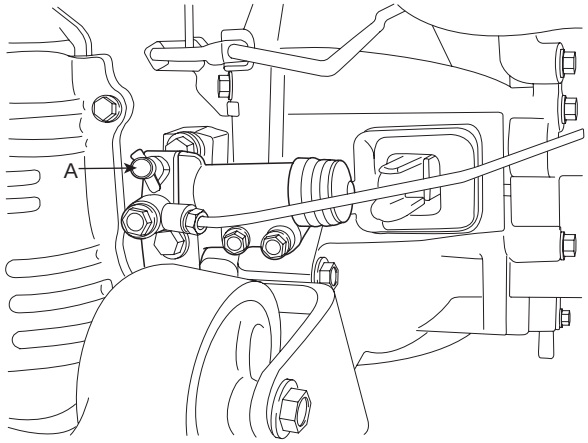
TORQUE: Nm (kgf.cm, lb-ft)

1. Return spring
2. Clutch master cylinder
3. Damper & Push rod
4. Clevis pin

LOJF009A

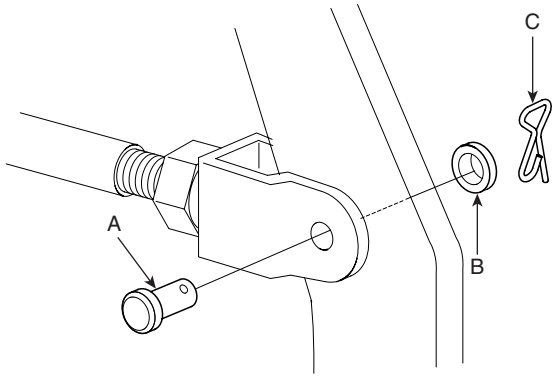
REMOVAL E56B05FD

1. Drain the clutch fluid through the bleed plug (A).



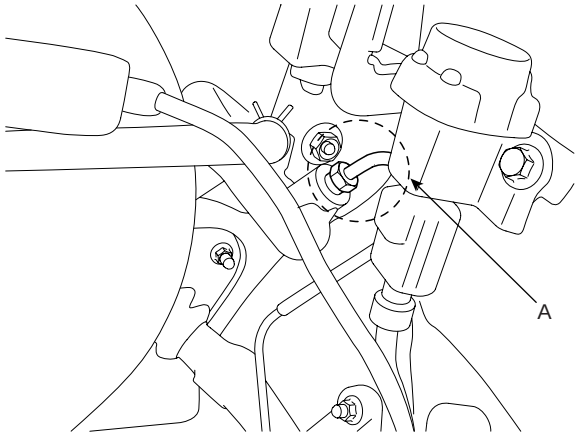
LOJF004A

2. Remove clevis pin (A), split pin (cotter pin) (C) and washer (B).



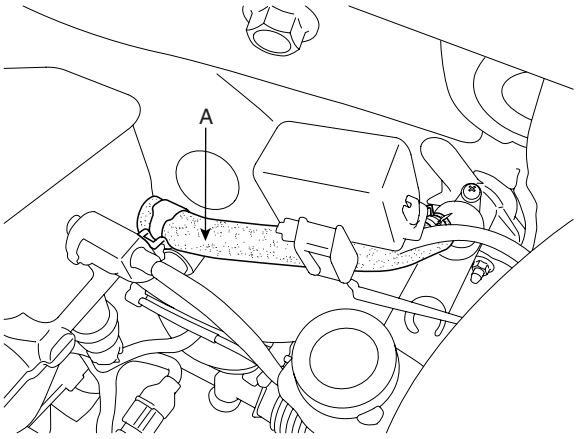
LOJF010A

3. Disconnect the clutch tube (A) (master cylinder side).



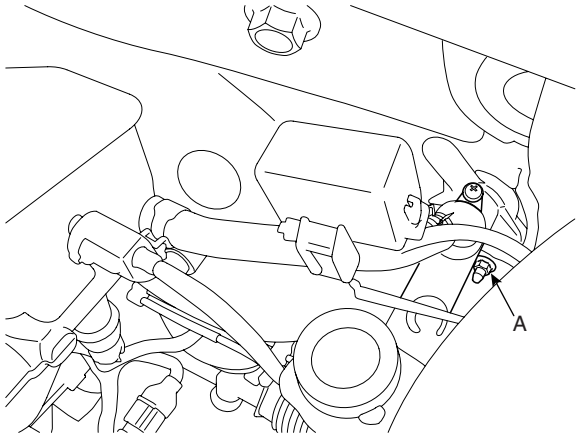
AOJF200A

4. Remove the flexible hose connected to brake reserve tank.



LOJF011A

5. Remove the master cylinder mounting nut (A).



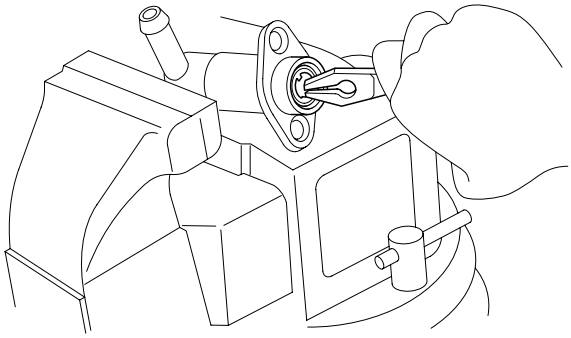
AOJF301A

DISASSEMBLY EBDCBD55

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

1. Use care not to damage the master cylinder body and piston assembly.
2. Do not disassemble the piston assembly.



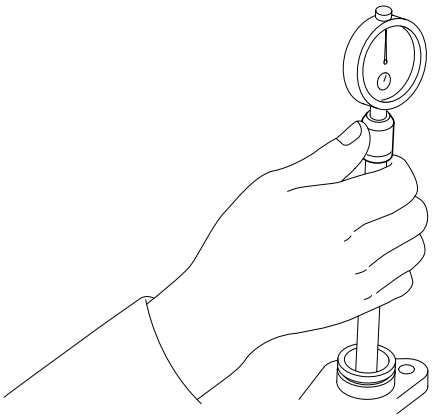
EOKD019A

INSPECTION E54BC349

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.



EOKD100A

6. If the master cylinder-to-piston clearance exceeds the limit, replace the master cylinder and/or piston assembly.

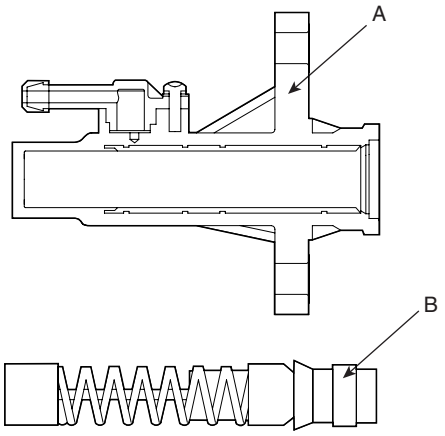
Limit : 0.15 mm (0.006 in.)

REASSEMBLY E6E9E4B3

1. Apply the specified fluid to the inner surface of the master cylinder body (A) and to the entire periphery of the piston assembly (B).

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.

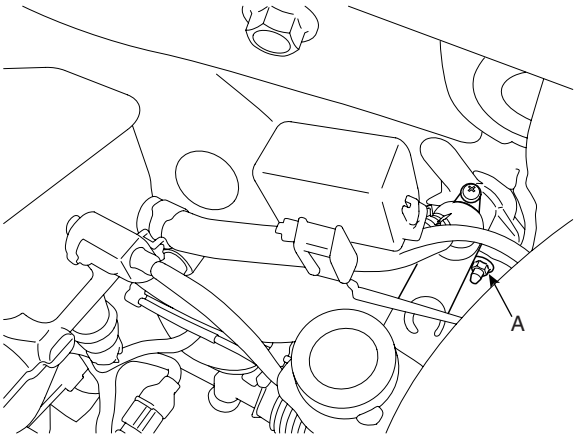


LOGF004D

INSTALLATION EB167F18

1. Install the master cylinder(A).

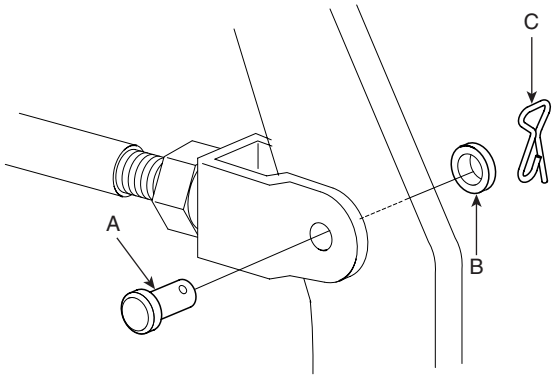
TORQUE : 9~14Nm(90-140 kgf.cm, 6.5-10 lb-ft)



AOJF301A

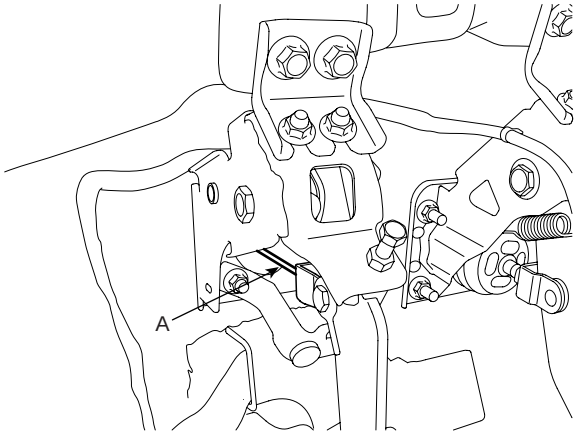
2. Apply specified grease to the clevis pin(A) and washer(B).

Grease : SAE J310 NLGI NO.2



LOJF010A

3. Connect the push rod(A) to the clutch pedal.



AOJF202A

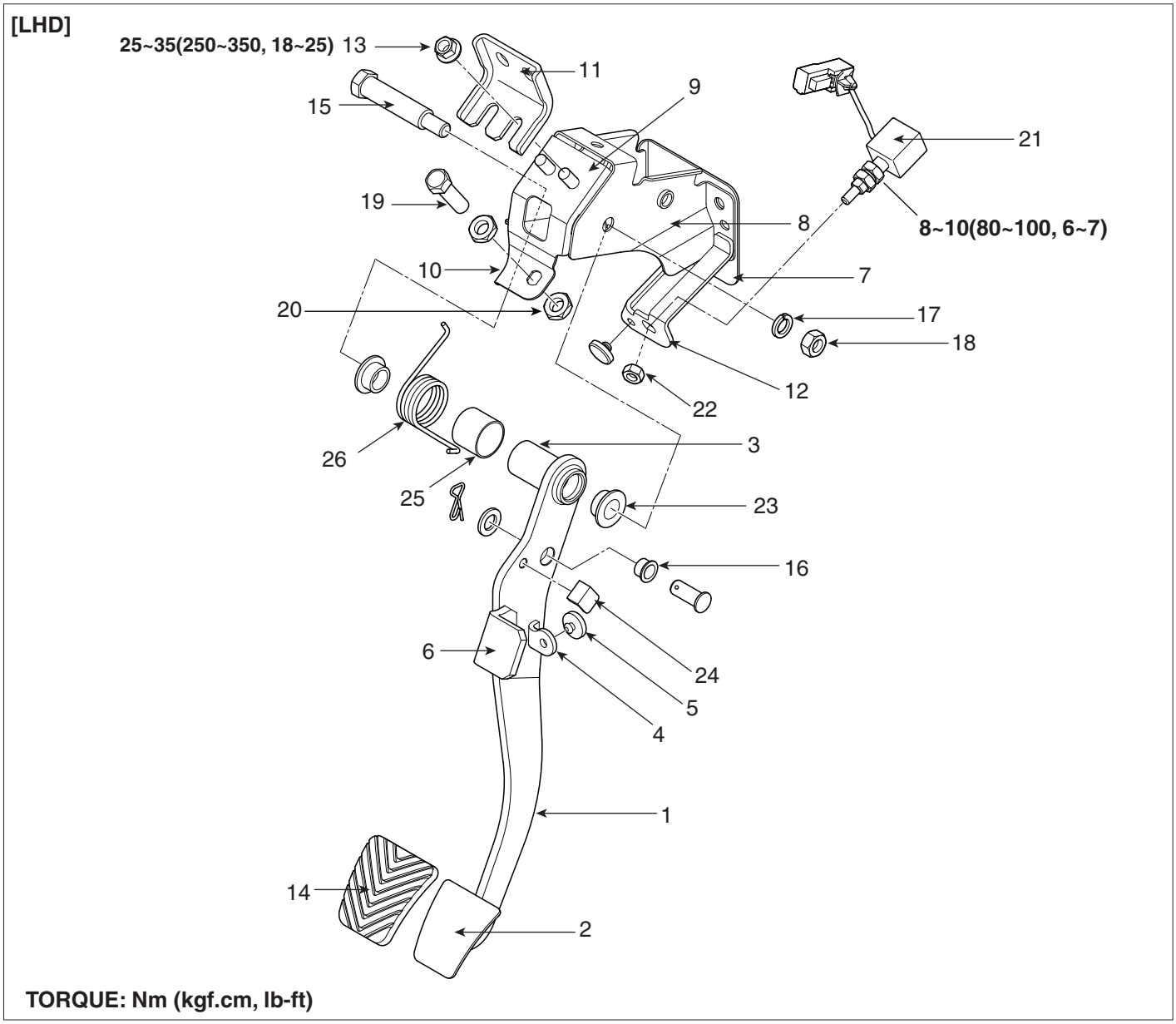
4. Connect the flexible hose of the brake reserve tank to the master cylinder.
5. Pour the brake fluid.
6. Connect the clutch tube to the master cylinder.

TORQUE : 13~17Nm(130-170 kgf.cm, 10-13 lb-ft)

7. Bleed the clutch system.

CLUTCH PEDAL

COMPONENTS (1) EB0F1E60

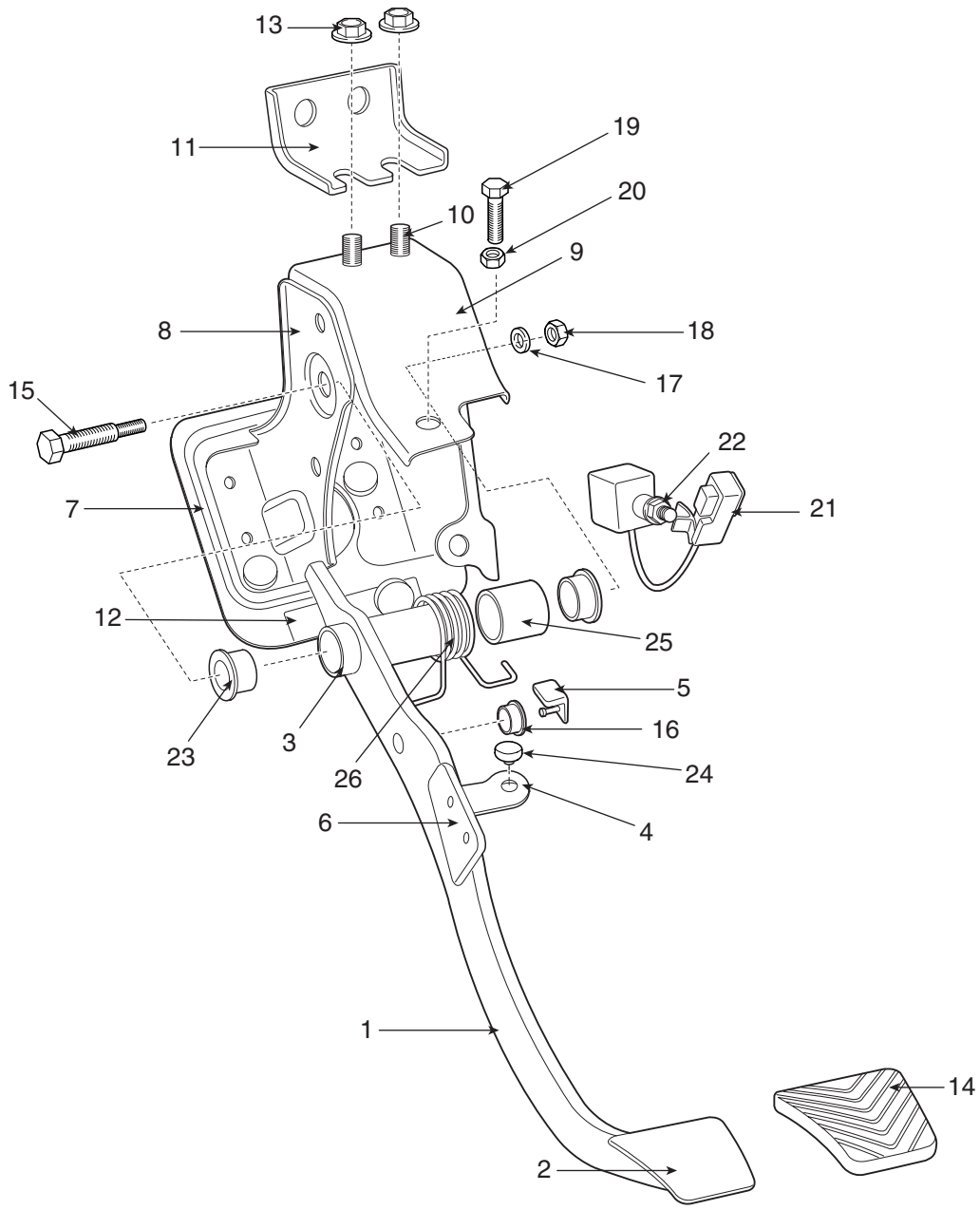


1. Clutch arm
2. Pedal plate
3. Pipe
4. Bracket
5. Pedal stopper
6. Arm bracket
7. Plate
8. Clutch member
9. Switch bracket
10. Bolt
11. Cowl bracket
12. Stopper bracket
13. Nut
14. Pedal pad
15. Bolt
16. Bush
17. Spring washeer
18. Nut
19. Bolt
20. Nut
21. Ignition lock switch
22. Switch nut
23. Bush
24. Brake pedal stopper
25. Bush
26. Return spring

LOJF001B

COMPONENTS (2)

[RHD]



1. Clutch arm
2. Pedal plate
3. Pipe
4. Bracket
5. Pedal stopper
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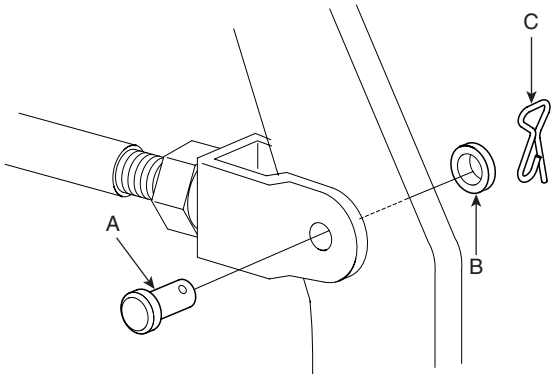
9. Switch bracket
10. Bolt
11. Cowl bracket
12. Stopper bracket
13. Nut
14. Pedal pad
15. Bolt
16. Bush
17. Spring washeer
18. Nut
19. Bolt
20. Nut
21. Ignition lock switch
22. Switch nut
23. Bush
24. Brake pedal stopper
25. Bush
26. Return spring

LOJF016A

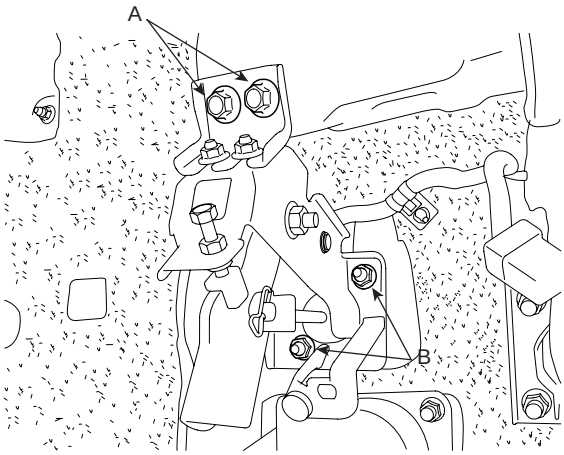
REMOVAL E9794D18

1. Remove the cotter pin (A), washer (B), and clevis pin (C).



LOJF010A

2. Remove the clutch pedal mounting bolts(A) and nuts(B).



AOJF220A

INSPECTION E40DC8B5

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.

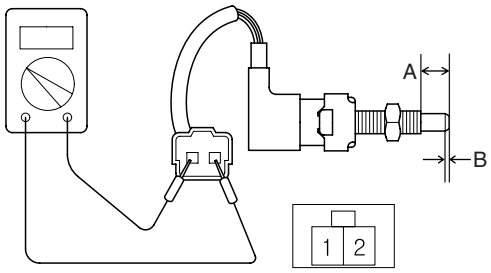
IGNITION LOCK SWITCH INSPECTION

Remove the ignition lock switch and check for continuity between the terminals. If the continuity is not as specified, replace the switch.

Terminal / Condition	1	2
Pushed(ON)	○———	———○
Free(OFF)		

LOJF012A

Standard value
Full stroke(A) : 12.0 ± 0.3mm (0.472 ± 0.012 in.)
ON-OFF point (B) : 2.0 ± 0.3mm (0.078 ± 0.012 in.)

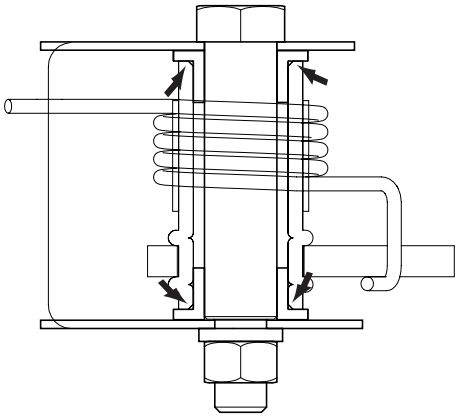


LOJF002B

INSTALLATION EF31349B

1. Apply the specified grease to the clutch pedal and bushings.

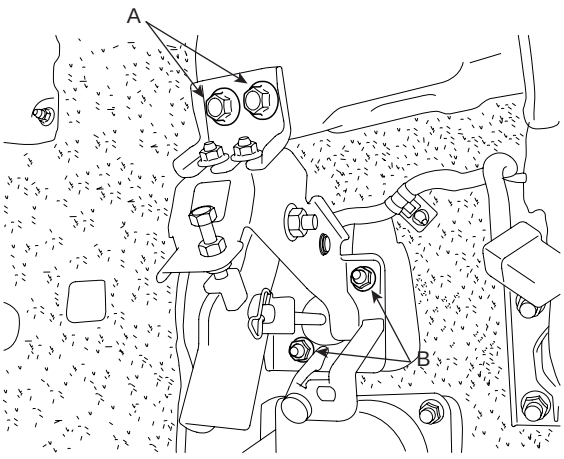
Chassis grease: SAE J310a, NLGI No.1



AOJF221A

2. Install the clutch pedal mounting bolts(A) and nuts(B).

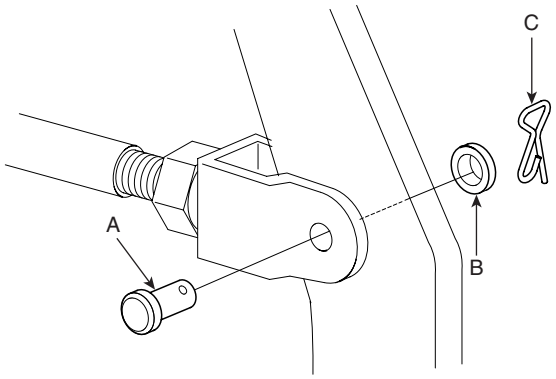
TORQUE :
25~35 Nm(250~350 kgf.cm, 18~25 lb-ft)



AOJF220A

3. Apply the specified grease to the clevis pin and washer.

Wheel bearing grease: SAE J310, NLGI No.2



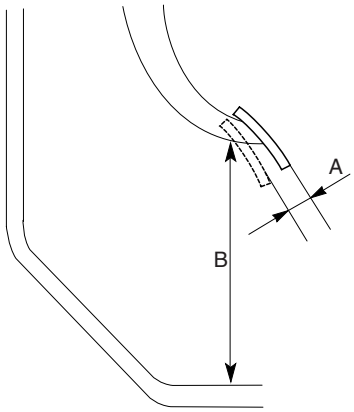
LOJF010A

4. Install the push rod to the clutch pedal.

5. Adjust the clutch pedal within the standard value, then secure by tightening the lock nut.

Standard value
Free play (A)
LHD/RHD : 6~13mm (0.24~0.51 in.)
Height (B)
LHD : 163.9 mm (6.45 in.)
RHD : 174.5 mm (6.87 in.)

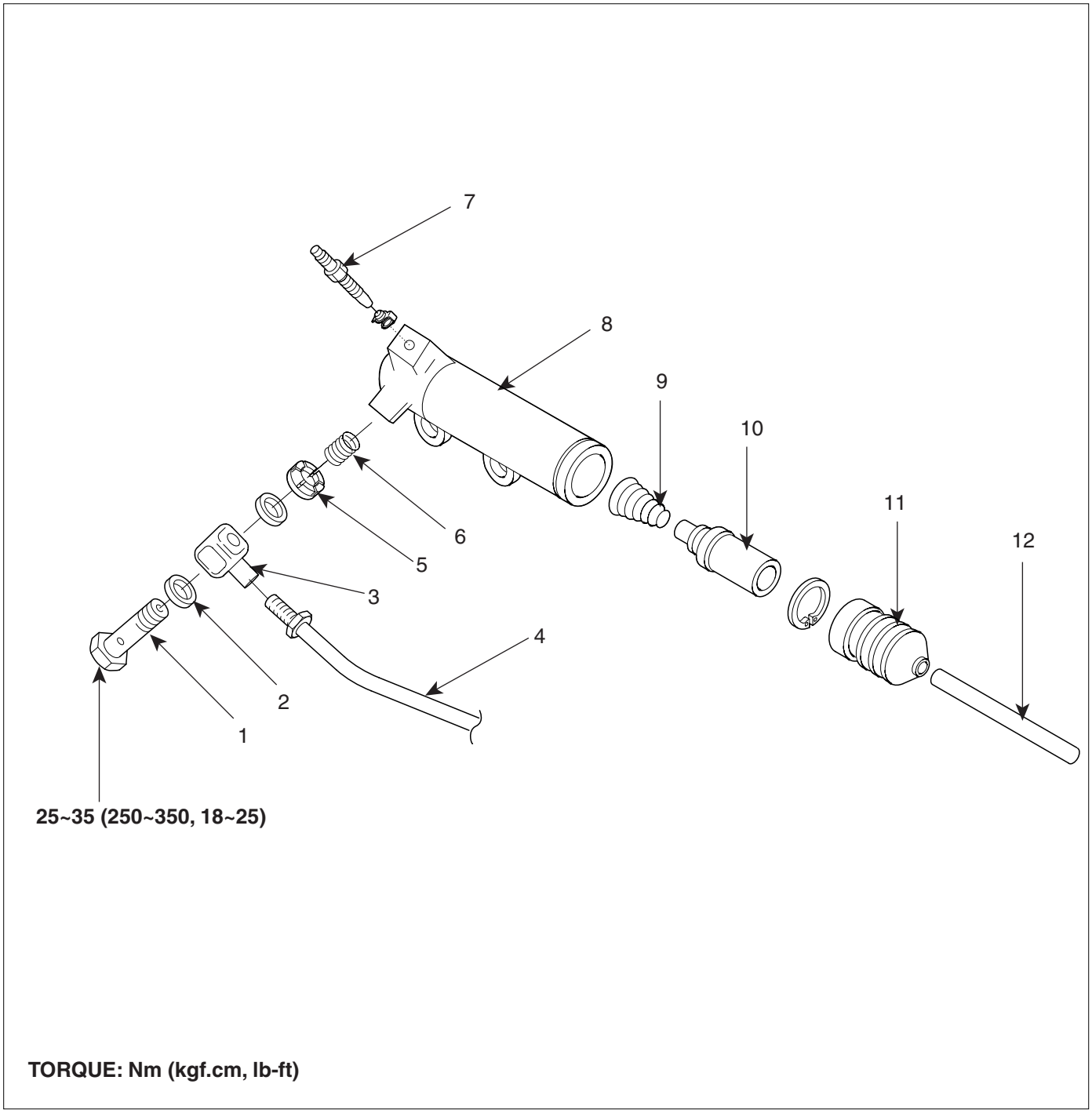
Clutch pedal clevis pin and pedal height



LOJF001A

CLUTCH RELEASE CYLINDER

COMPONENTS EFF04CCC

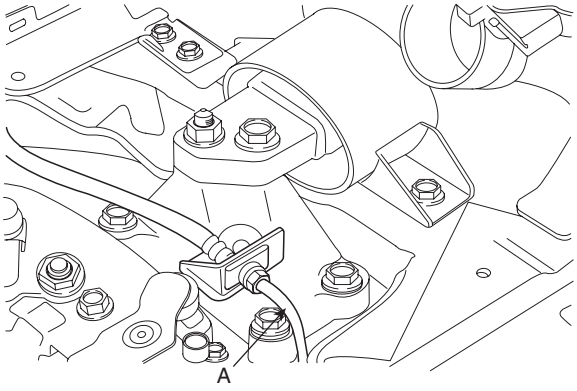


1. Union bolt
2. Gasket
3. Tube joint
4. Clutch tube
5. Valve plate
6. Valve spring
7. Bleeder screw
8. Release cylinder
9. Return spring
10. Piston
11. Boot
12. Push rod

LOGF006A

REMOVAL E8901260

1. Disconnect the clutch tube(A).



LOJF013A

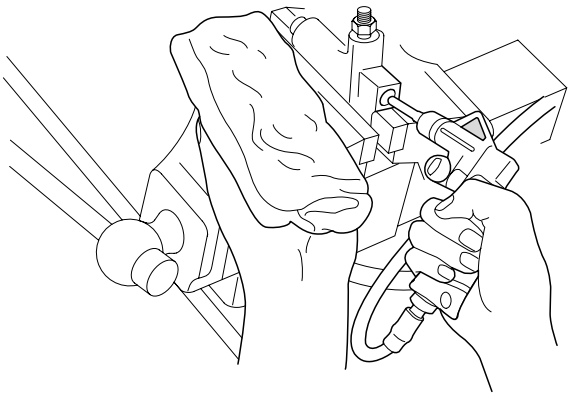
2. Remove the clutch release cylinder mounting bolt.

DISASSEMBLY EB5C6C24

1. Remove the clutch hose, valve plate, spring, push rod, and boot.
2. Remove any dirt from the piston bore opening of the release cylinder.
3. Remove the piston from the release cylinder using compressed air.

CAUTION

- ***Use rags to prevent the piston from popping out and causing injury.***
- ***Apply compressed air slowly. Keep the fluid from splashing in your eyes or on your skin.***

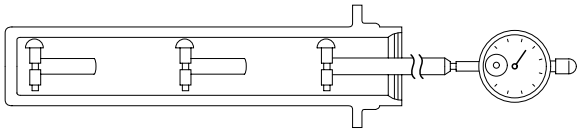


EOKD024A

INSPECTION EB3A79B4

1. Check the release cylinder bore for rust and damage.
2. Measure the release cylinder bore at three locations (bottom, middle, and top) with a cylinder gauge and replace the release cylinder assembly if the bore-to-piston clearance exceeds the limit.

Limit clearance to piston: 0.15 mm (0.006 in.)



EOKD025A

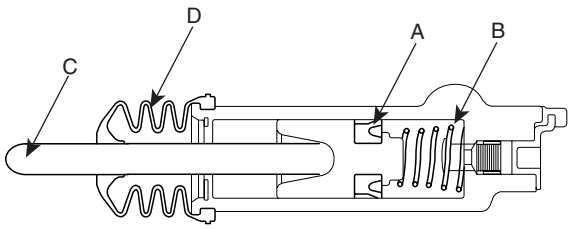
3. Check the clutch release cylinder for fluid leakage.
4. Check the clutch release cylinder boots for damage.

REASSEMBLY EA0325E8

1. Apply specified brake fluid to the release cylinder bore and the outer surface of the piston and piston cup, and push the piston cup assembly into the cylinder.

Specified fluid: Brake fluid DOT 3 or DOT 4

2. Install the valve plate(A), Spring(B), push rod(C) and boot(D).

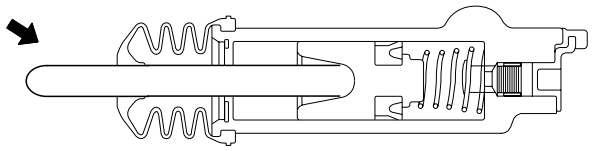


LOJF003B

INSTALLATION E281A68D

1. Coat the clevis push rod specified grease.

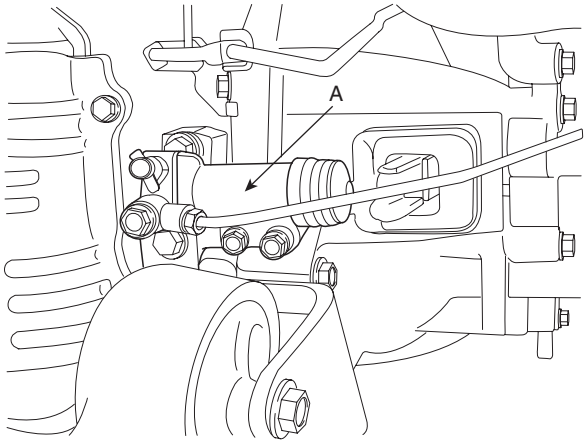
Specified grease: CASMOLY L9508



LOGF006B

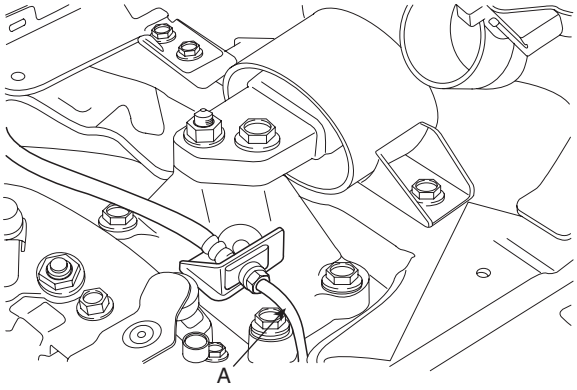
2. Install the release cylinder(A) to the transaxle.

TORQUE : 15 ~ 22Nm(150 ~ 220kgf.cm, 11~16 Ib-ft)



LOJF004B

3. Install the clutch tube(A).



LOJF013A

Manual Transaxle (M5CF1)

GENERAL

MANUAL TRANSAXLE SYSTEM
- MANUAL TRANSAXLE
- INPUT SHAFT
- OUTPUT SHAFT
- SHIFT FORK
- DIFFERENTIAL
- SPEEDOMETER DRIVEN GEAR ASSEMBLY

GENERAL

SPECIFICATIONS EFEAC1DF

Transaxle type		M5CF1
Gear ratio	1st	3.615
	2nd	2.053
	3rd	1.370
	4th	1.031
	5th	0.837
	Reverse	3.583
Final gear ratio		4.056

SERVICE STANDARD

Items	Standard value [in(mm)]
Input shaft rear bearing end play	0.00-0.0019L(0.00-0.05L)
Output shaft bearing end play (At 70kgf load)	0.0019T-0.0039T(0.05T-0.10T)
Input shaft front bearing end play (At 70kgf load)	0.00-0.0019L(0.00-0.05L)
Differential bearing end play	0.0059T-0.0078T(0.15T-0.20T)
Differential pinion backlash	0.001L-0.0039L(0.025L-0.10L)

T: Indicate tightening of -(minus) direction of end play
L: Indicate loosening of +(plus) direction of end play

SNAP RING AND SPACER FOR ADJUSTMENT

Part name	Thickness [in(mm)]	Part number
Spacer (For adjustment of differential bearing end play)	0.028 (0.71)	43331-23071
	0.029 (0.74)	43331-23074
	0.030 (0.77)	43331-23077
	0.031 (0.8)	43331-23080
	0.033 (0.83)	43331-23083
	0.034 (0.86)	43331-23086
	0.035 (0.89)	43331-23089
	0.036 (0.93)	43331-23092
	0.037 (0.95)	43331-23095
	0.039 (0.98)	43331-23098
	0.040 (1.01)	43331-23101
	0.041 (1.04)	43331-23104
	0.042 (1.07)	43331-23107
	0.043 (1.1)	43331-23110
	0.044 (1.13)	43331-23113
	0.046 (1.16)	43331-23116
	0.047 (1.19)	43331-23119
	0.048 (1.22)	43331-23122
	0.049 (1.25)	43331-23125
	0.050 (1.28)	43331-23128
Spacer (For adjustment of differential pinion backlash)	0.0295-0.0323 (0.75-0.82)	45835-22782
	0.0327-0.0362 (0.83-0.92)	45835-22792
	0.0366-0.0425 (0.93-1.00)	45835-22700
	0.0398-0.0425 (1.01-1.08)	45835-22708
	0.0429-0.0457 (1.09-1.16)	45835-22716

Part name	Thickness [in(mm)]	Part number
Spacer (For adjustment of output shaft bearing end play)	0.056 (1.43)	43227-28430
	0.057 (1.46)	43227-28460
	0.059 (1.49)	43227-28490
	0.060 (1.52)	43227-28520
	0.061 (1.55)	43227-28550
	0.062 (1.58)	43227-28580
	0.063 (1.61)	43227-28610
	0.065 (1.64)	43227-28640
	0.066 (1.67)	43227-28670
	0.067 (1.70)	43227-28700
	0.068 (1.73)	43227-28730
	0.069 (1.76)	43227-28760
	0.070 (1.79)	43227-28790
	0.072 (1.82)	43227-28820
	0.073 (1.85)	43227-28850
	0.074 (1.88)	43227-28880
	0.075 (1.91)	43227-28910
Snap ring (For adjustment of input shaft rear bearing end play)	0.078 (1.98)	43278-23198
	0.080 (2.02)	43278-23202
	0.081 (2.06)	43278-23206
	0.083 (2.10)	43278-23210
	0.084 (2.14)	43278-23214
	0.086 (2.18)	43278-23218
Snap ring (For adjustment of input shaft 5th gear end play)	0.098 (2.50)	43239-23050
	0.100 (2.54)	43239-23054
	0.102 (2.58)	43239-23058
	0.103 (2.62)	43239-23062
	0.105 (2.66)	43239-23066
Snap ring (For adjustment of input shaft front bearing end play)	0.088 (2.24)	43224-21240
	0.091 (2.31)	43224-21310
	0.094 (2.38)	43224-21380
	0.096 (2.45)	43224-23450

TIGHTENING TORQUE

Standard value	Nm	kgf.cm	lb-ft
Clutch tube flare nut	13-17	130-170	9-12
Release cylinder bolt	15-22	150-220	10-16
Control shift complete bolt	20-27	200-270	15-20
Oil drain plug	60-80	600-800	43-58
Oil filler plug	60-80	600-800	43-58
Poppet ball	30-35	300-350	21-25
Clutch housing to transmission case	43-55	430-550	32-40
Speedometer driven gear	3-5	30-50	2-4
Reverse idler bolt	43-55	430-550	32-40
Reverse shift lever assembly bolt	15-22	150-220	10-16
Input shaft bearing retainer	15-22	150-220	10-16
Shift control cable bracket on transaxle side	20-27	200-270	15-20
Rear roll support bracket bolt	60-80	600-800	43-58
Rear roll stopper insulator bolt and nut	50-65	500-650	36-47
Front roll stopper insulator bolt and nut	50-65	500-650	36-47
Front roll support bracket bolt	60-80	600-800	43-58
Transaxle support bracket bolts	60-80	600-800	43-58
Transaxle mounting bracket bolts	70-95	700-950	50-69
Differential drive gear seal bolt	130-140	1300-1400	94-101
Clutch release lever fulcrum bolt	55-60	550-600	40-43
Shift lever mounting bolts	9-14	90-140	6-9.5

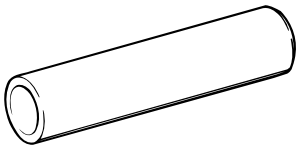
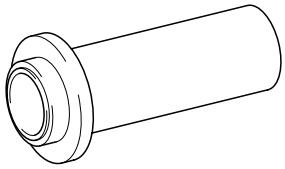
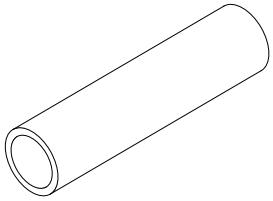
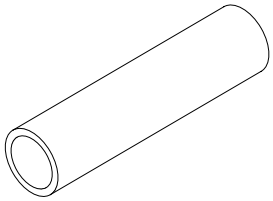
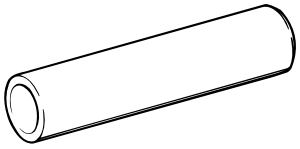
WARNING

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.

LUBRICATIONS

Items	Recommnend lubricant	Quantity
Transaxle gear oil	SAE 75W/85 API GL-4 TGO-7(MS517-14) ZIC G-F TOP 75W/85 HD GEAR OIL XLS 75W/85	1.9L(2.0US qt, 1.67lmp qt)
Air bleeder	MS721-38	As requried
Transaxle housing	MS721-40 or MS721-38	As requried
Surface of release fork and bearing	Grease (CASMOLY L9508)	As requried

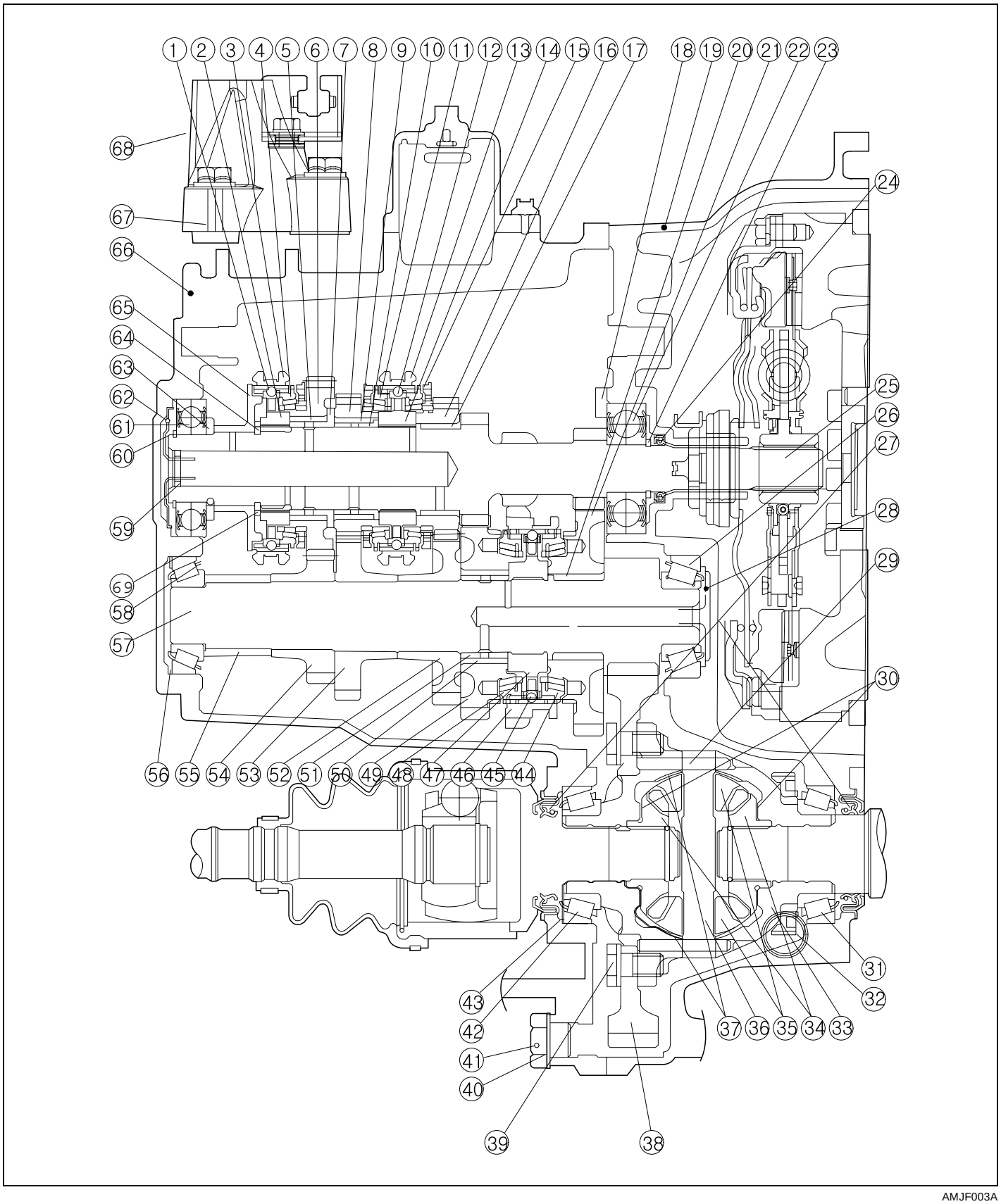
SPECIAL TOOL E6B9B1F4

TOOL (Number and Name)	Illustration	Use
09455-21100 Bearing installer	 LKGF001E	Installation of differential taper roller bearing
09452-21200 Oil seal installer	 Y45006B	Installation of differential oil seal
09432-33300 Bearing installer	 LKGF001F	Installer of ball bearing and taper roller bearing
09432-22000 Output shaft Bearing installer	 LKGF001F	Installer of output shaft taper roller bearing
09432-21500 Bearing installer	 LKGF001E	Installatoin of output shaft gears and sleeve

MANUAL TRANSAXLE SYSTEM

MANUAL TRANSAXLE

COMPONENTS (1) EE8CE91E

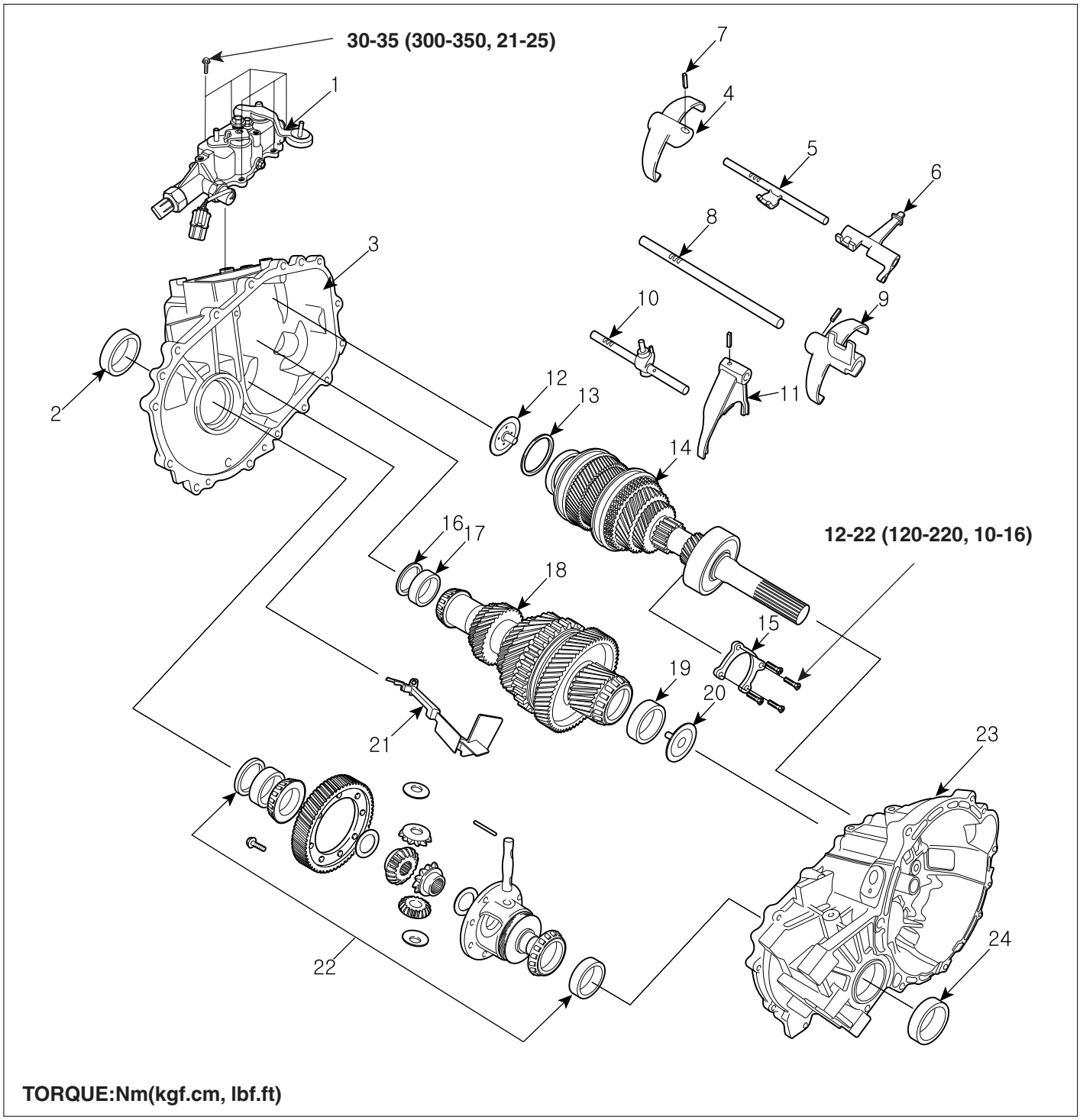


AMJF003A

1. 5th synchronizer key assembly
2. 5th synchronizer hub
3. 5th synchronizer sleeve
4. 5th synchronizer ring
5. Needle roller bearing
6. 5th speed gear
7. 5th speed gear sleeve
8. 4th speed gear
9. Needle roller bearing
10. 4th speed gear sleeve
11. 4th synchronizer ring
12. 4th synchronizer key assembly
13. 3rd & 4th synchronizer sleeve
14. 3rd & 4th synchronizer hub
15. 3rd double cone assembly
16. 3rd speed gear
17. Needle roller bearing
18. Input shaft bearing retainer
19. Clutch housing
20. Needle roller bearing
21. 1st speed gear
22. Input shaft front ball bearing
23. Input shaft front snap ring
24. Input shaft front oil seal
25. Input shaft
26. Output shaft front taper roller bearing
27. Differential oil seal
28. Output shaft oil guide
29. Lock pin
30. Differential spacer
31. Differential taper roller bearing
32. Speedometer drive gear
33. Differential side gear
34. Differential side gear
35. Differential pinion gear
36. Pinion shaft
37. Washer
38. Differential drive gear
39. Differential gear seal bolt
40. Gasket
41. Drain plug
42. Differential taper roller bearing
43. Spacer
44. 1st tripple cone assembly
45. 1st synchronizer key
46. 1st & 2nd synchronizer sleeve
47. 1st & 2nd synchronizer hub
48. 2nd tripple cone assembly
49. 2nd speed gear
50. Needle roller bearing
51. 2nd speed gear sleeve
52. 3rd speed output gear
53. 4th speed output gear
54. 5th speed output gear
55. Spacer
56. Output bearing spacer
57. Output shaft
58. Output shaft rear taper roller bearing
59. Oil guide ring
60. Input shaft rear snap ring
61. Input shaft rear ball bearing
62. Input shaft oil guide
63. Thrust washer
64. Input shaft 5th spacer
65. Spacer
66. Transaxle case
67. Transaxle support bracket bolt
68. Transaxle support bracket
69. Ring

LMJF003A

COMPONENTS (2)

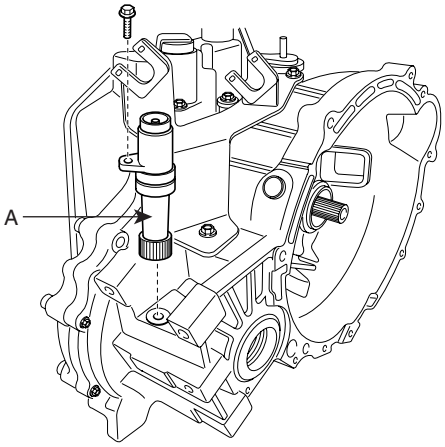


1. Control shift complete
2. Oil seal
3. Transaxle case
4. 5th shift fork
5. 5th shift rail
6. Reverse shift lug
7. Pin
8. 3rd & 4th shift rail
9. 3rd & 4th shift lug and fork
10. 1st & 2nd shift rail
11. 1st & 2nd shift fork
12. Input shaft oil guide
13. Snap ring
14. Input shaft assembly
15. Input shaft bearing retainer
16. Spacer
17. Output shaft rear outer racer
18. Output shaft assembly
19. Output shaft front outer racer
20. Output shaft oil guide
21. Oil guide
22. Differential assembly
23. Oil seal
24. Clutch housing

LKGF003C

DISASSEMBLY E8CAFE82

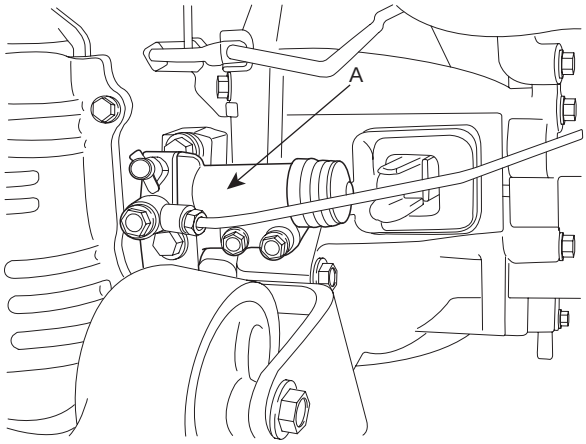
1. Remove the vehicle speed sensor(A). (Bolt: 1EA)



LKGF004A

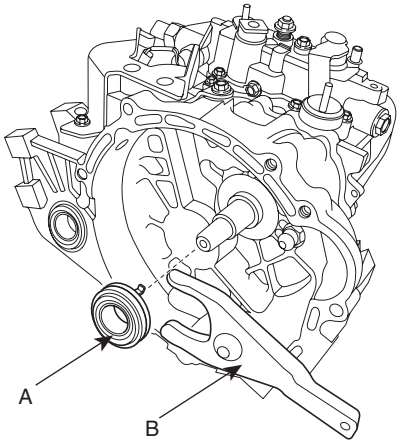
2. Remove the release cylinder(A) tube from the release cylinder.

3. Remove the release cylinder from the transaxle. (Bolt: 2EA)



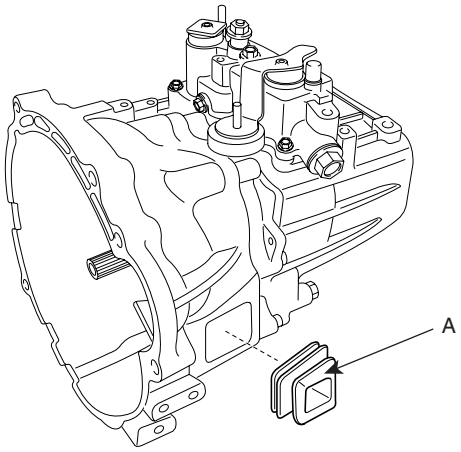
LMJF019I

4. Remove the release bearing(A) and clutch fork(B).



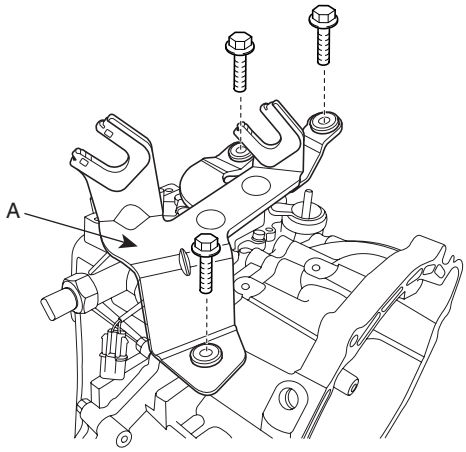
LKGF004D

5. Remove the clutch fork boot(A).



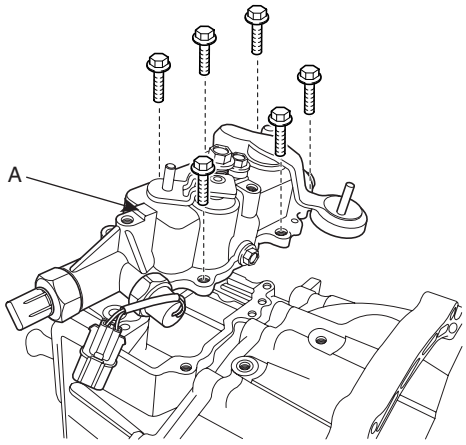
LKGF004E

6. Remove the shift cable bracket(A). (Bolt:2EA)



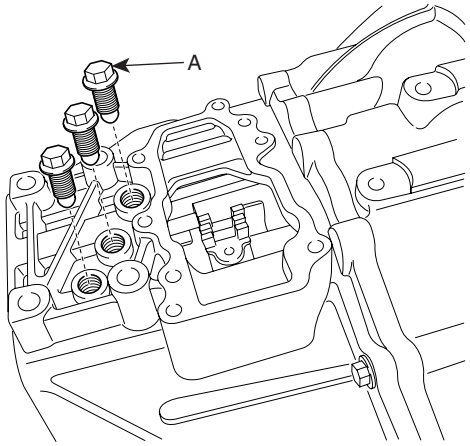
LKGF004F

7. Remove the control shift complete(A) from the transaxle case. (Bolt:6EA)



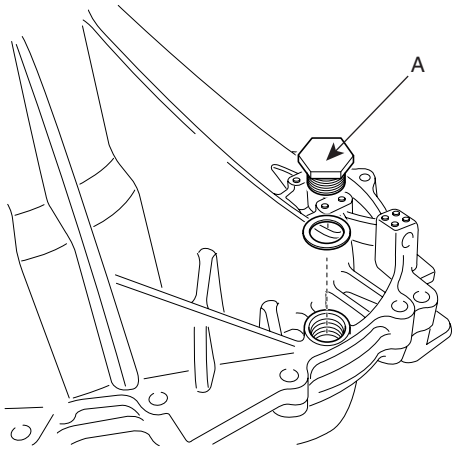
LKGF004G

8. Remove the shift rail poppet bolt(A) (3EA).



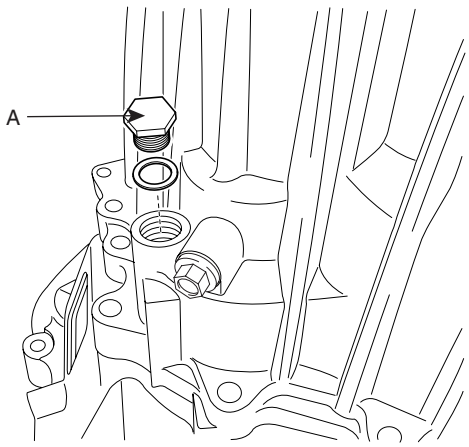
LKGF004H

9. Remove the drain plug(A).



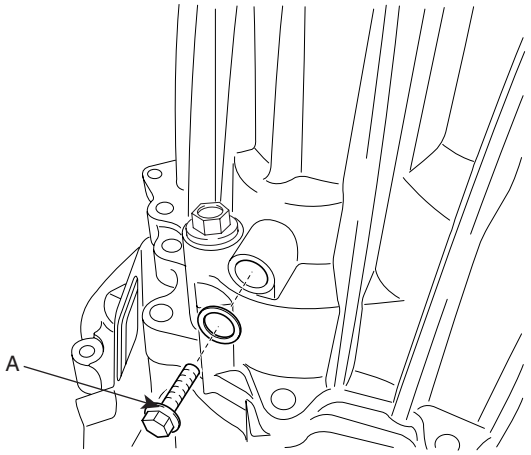
LKGF004I

10. Remove the filler plug(A).



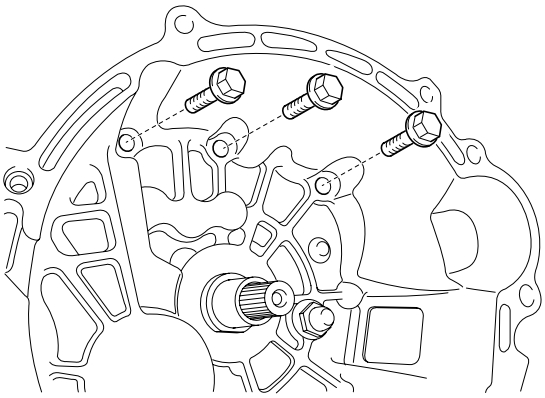
LKGF004J

11. Remove the reverse idle bolt(A) from the transaxle case.



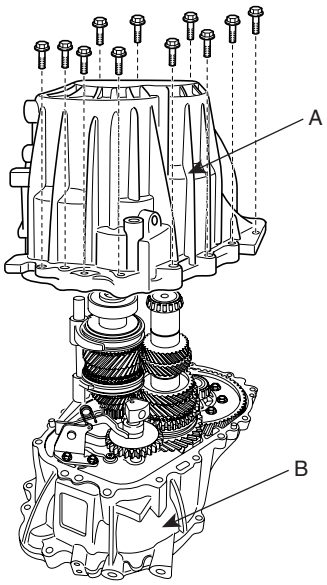
LKGF004K

12. Remove the housing bolt(3EA) from the clutch housing inside.



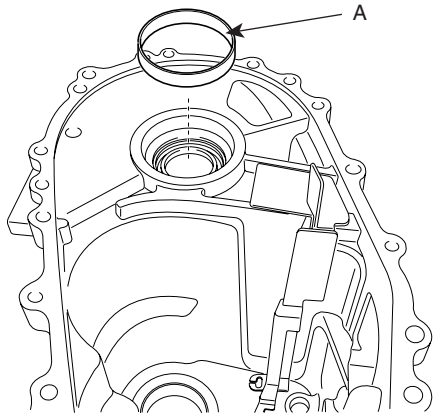
LKGF004L

13. Remove the transaxle case(A) from the housing(B). (Bolt: 11EA)



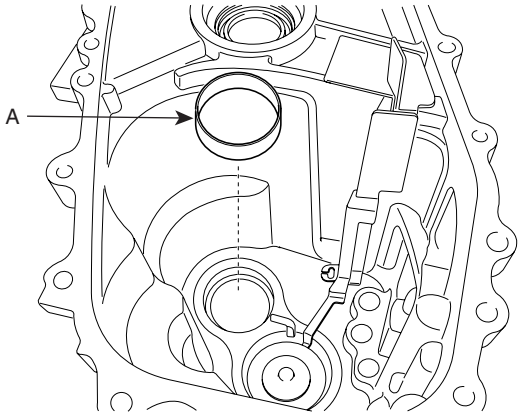
LKGF004M

14. Remove the differential outer race(A).



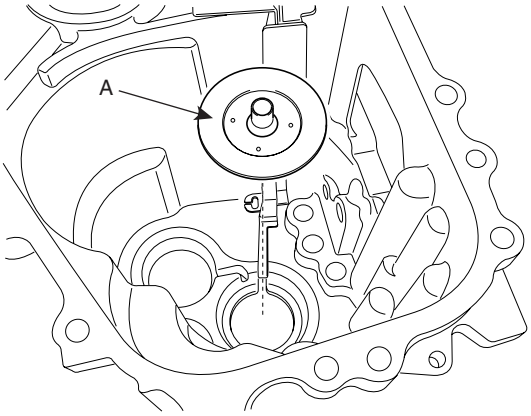
LKGF004N

15. Remove the output outer race(A).



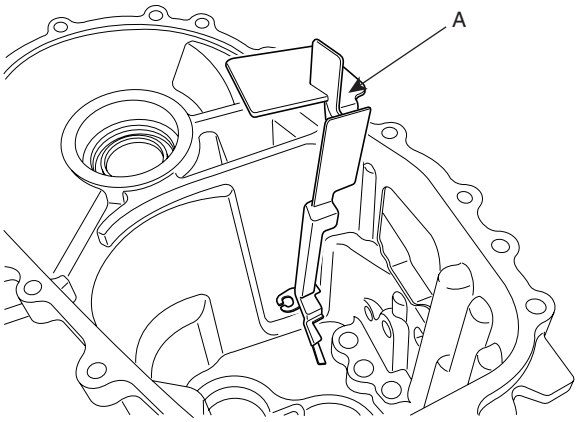
LKGF004O

16. Remove the input shaft oil guide(A) in the transalxe case.



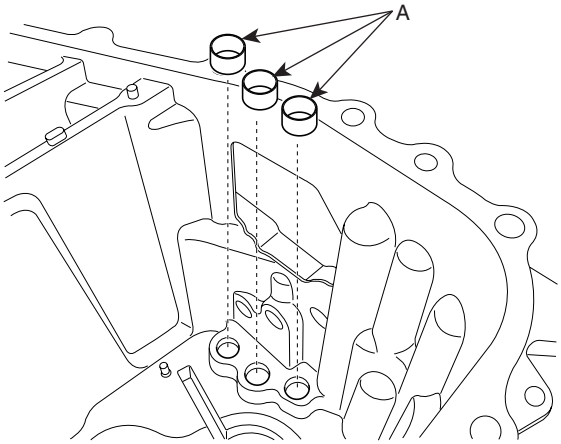
LKGF004P

17. Remove the oil guide(A).



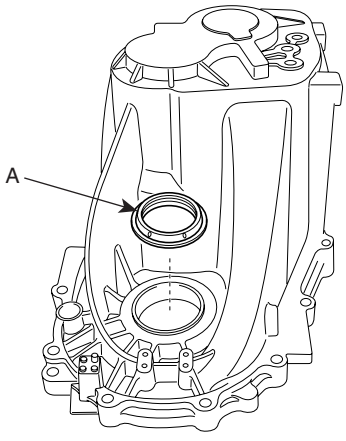
LKGF004Q

18. Remove the bushing(A) (3EA).



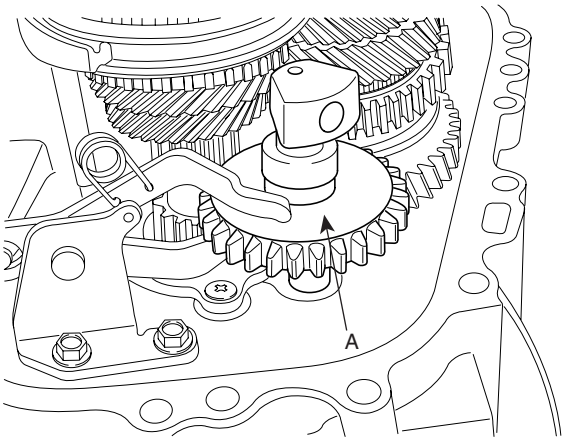
LKGF004R

19. Remove the drive shaft oil seal(A).



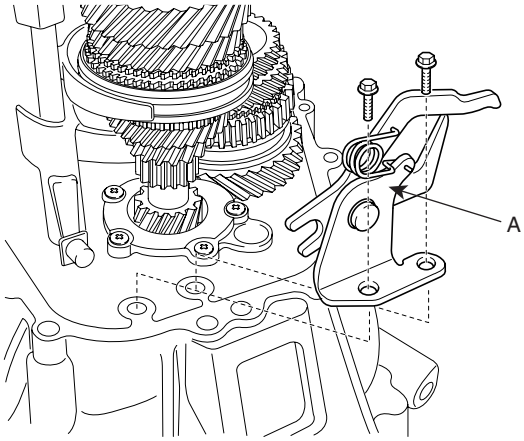
LKGF004S

20. Remove the reverse idle gear assembly(A).



LKGF004T

21. Remove the reverse shaft lever assembly(A). (Bolt: 2EA)

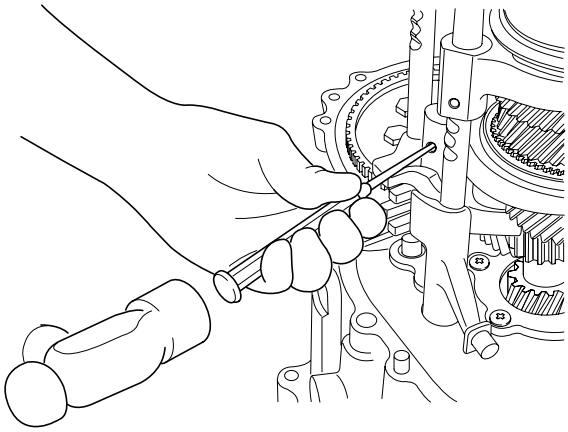


LKGF004U

22. Remove the spring pin.

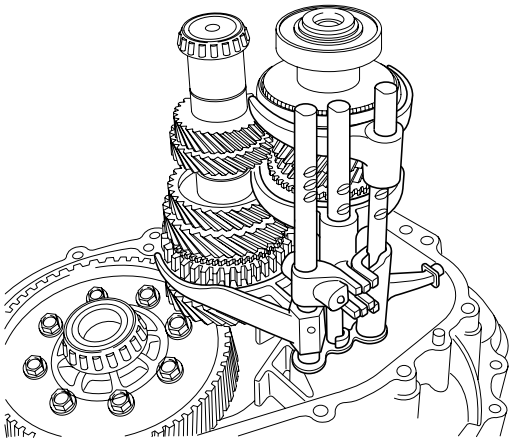
NOTE

Be careful not to damage it when removing spring pin.



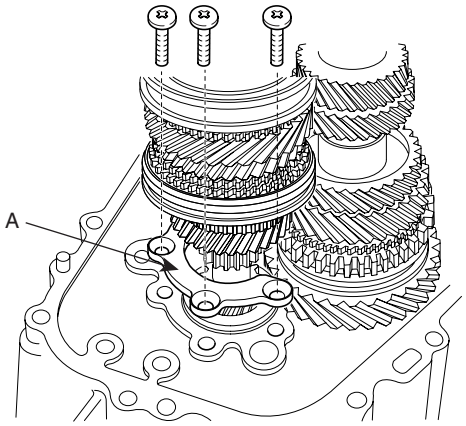
LKGF004V

23. Remove the shift rail and fork assembly.



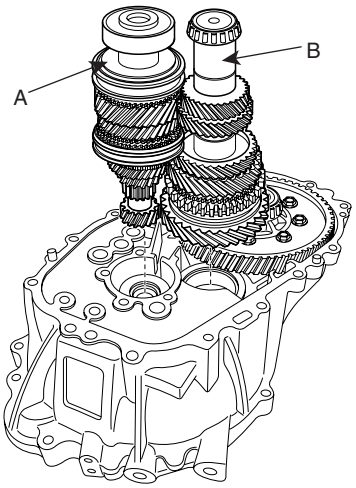
LKGF004W

24. Remove the bearing retainer(A). (Bolt: 4EA)



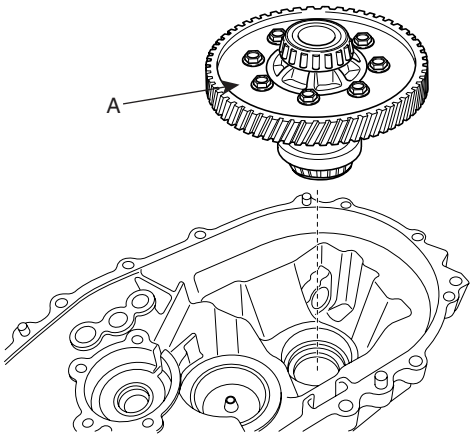
LKGF004X

25. Remove the input shaft(A) and output shaft(B) assembly together from the clutch housing.



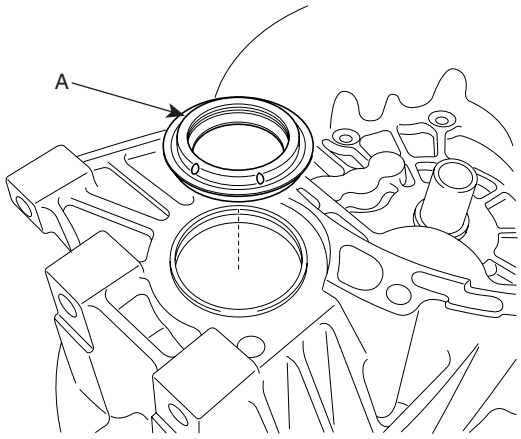
LKGF004Y

26. Remove the differential assembly(A).



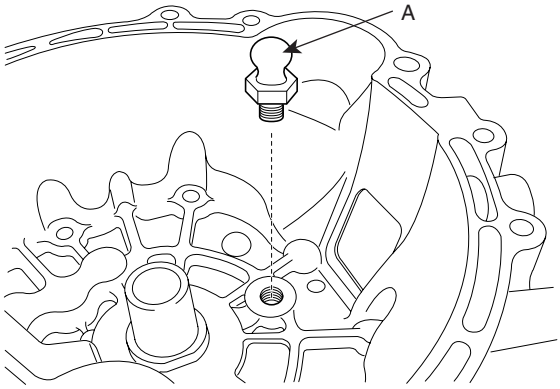
LKGF004Z

27. Remove the differential oil seal(A).



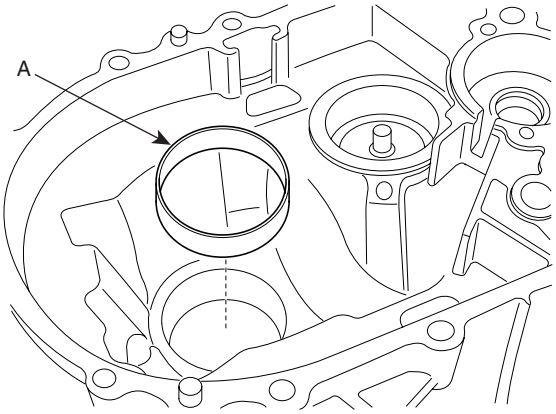
LKGF005A

28. Remove the clutch release lever fulcrum bolt(A).



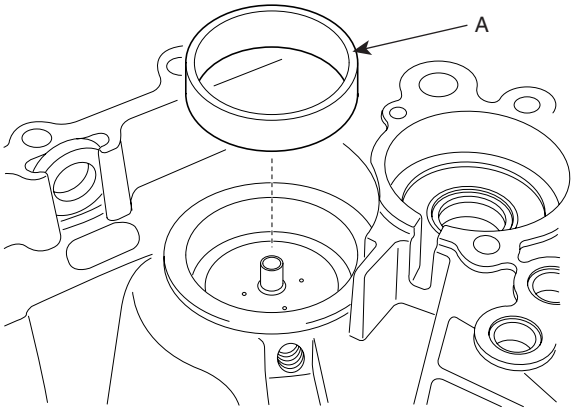
LKGF005B

29. Remove the differential outer race(A).



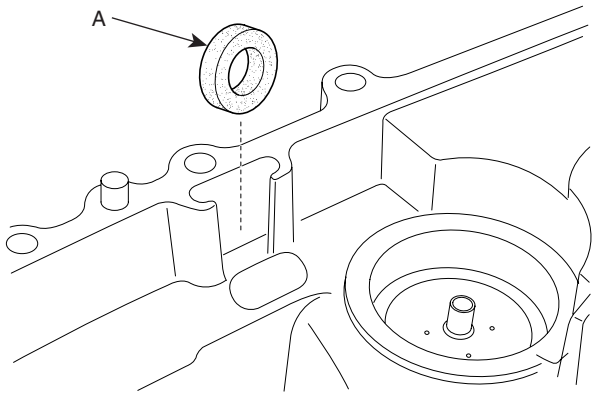
LKGF005C

30. Remove the output shaft outer race(A).



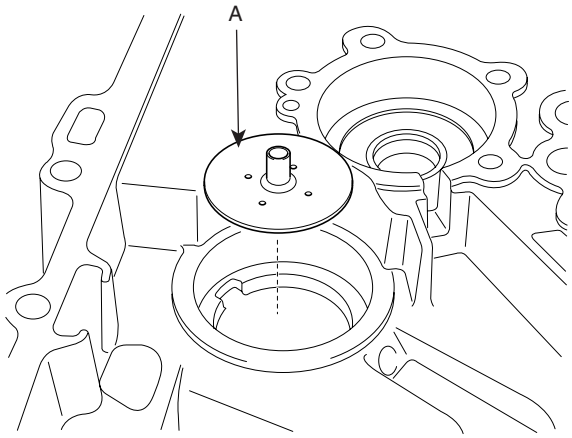
LKGF005D

31. Remove the magnetic(A).



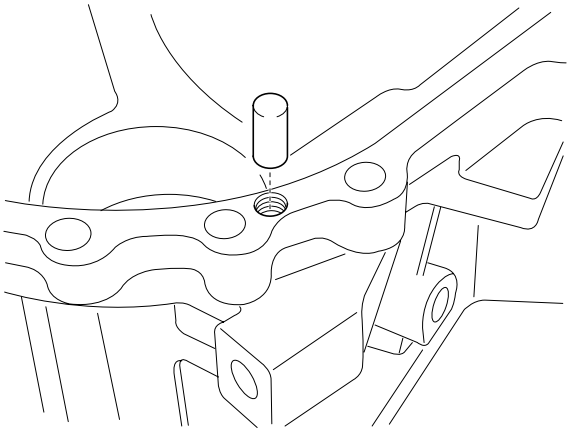
LKGF005E

32. Remove the output shaft oil guide(A).



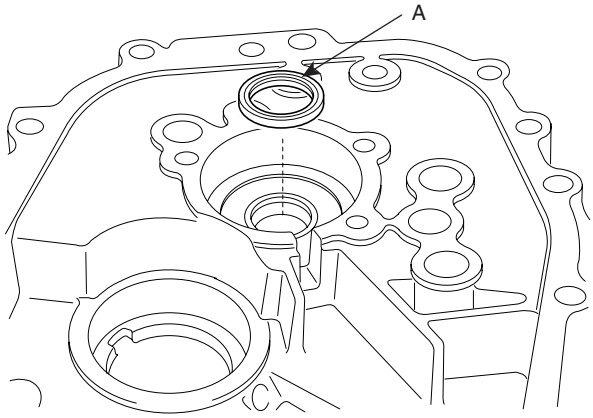
LKGF005F

33. Remove the dowel pin(3EA).



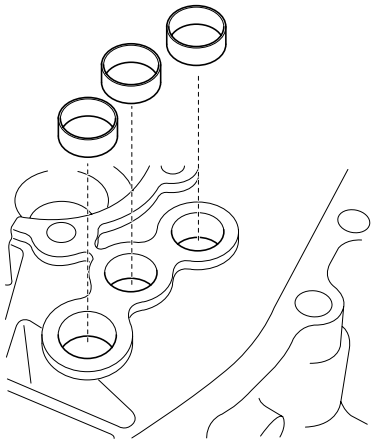
LKGF005G

34. Remove the input shaft front oil seal(A).



LKGF005H

35. Remove the bushing(3EA) from the clutch housing.



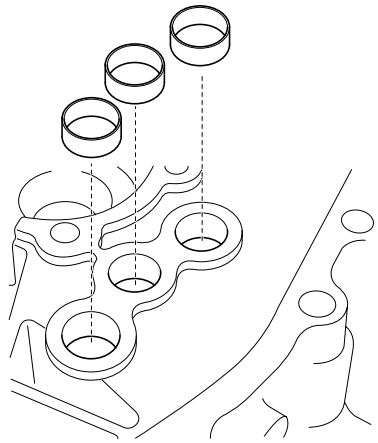
LKGF005I

REASSEMBLY E70B65AD

NOTE

Before reassembling, clean all parts in slovent, dry them, and apply lubicant to any contact surfaces.

1. Install the bushing(3EA) in the housing using the special tool.

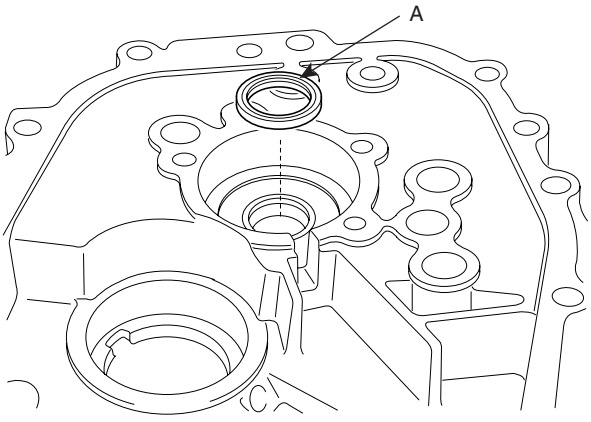


LKGF005I

2. Install the input shaft front oil seal(A).

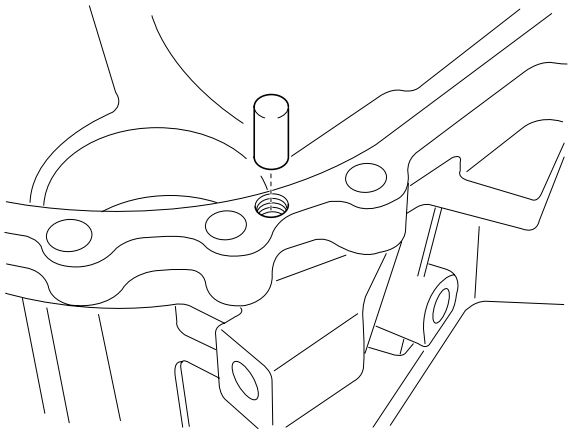
NOTE

Do not reuse the old oil seal.



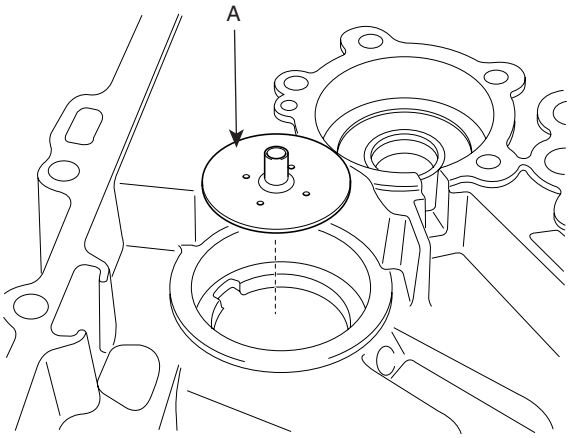
LKGF005H

3. Install the dowel pin(3EA) into the groove of the housing surface.



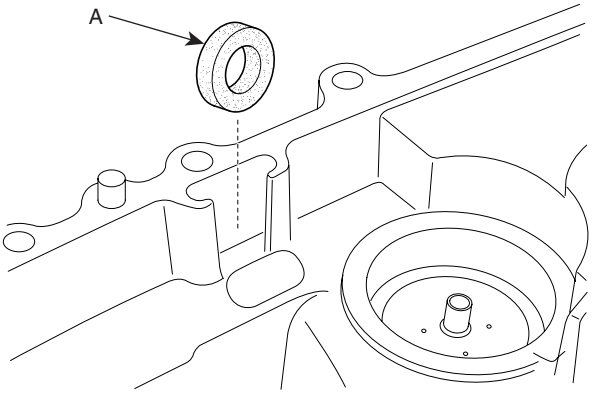
LKGF005G

4. Install the output shaft front oil guide(A).



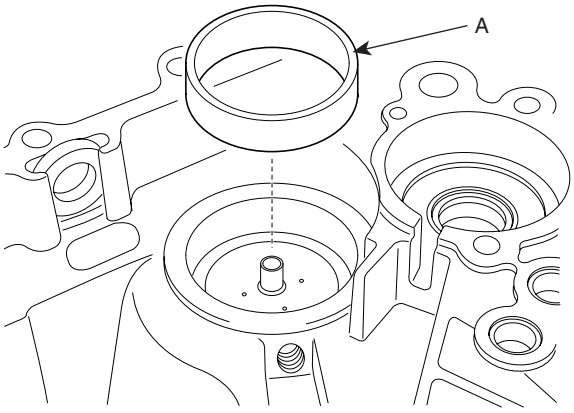
LKGF005F

5. Install the magnetic(A).



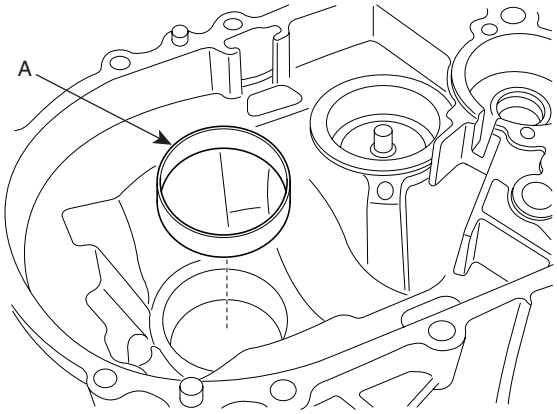
LKGF005E

6. Install the output outer race(A).



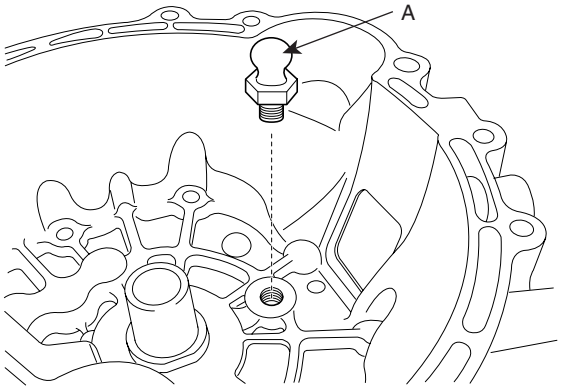
LKGF005D

7. Install the differential outer race(A).



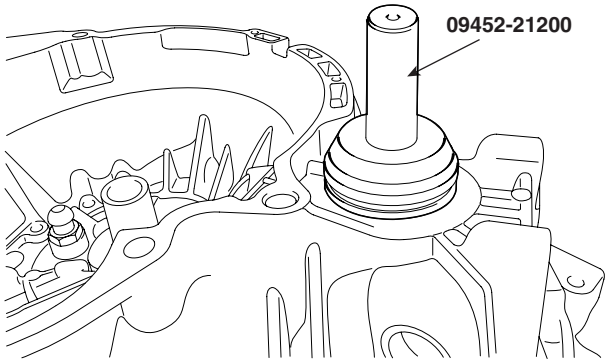
LKGF005C

8. Install the clutch release lever fulcrum bolt(A).

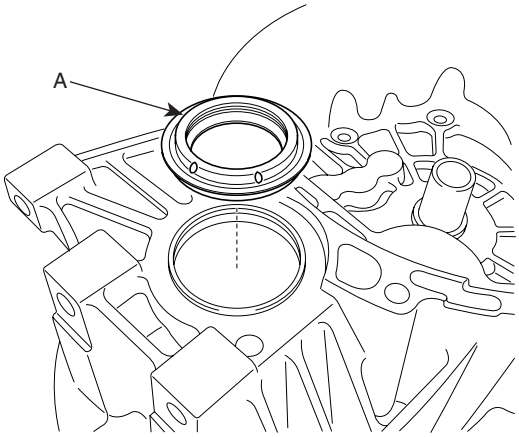


LKGF005B

9. Install the differential oil seal(A) in the transaxle case using the special tool(09452-21200).

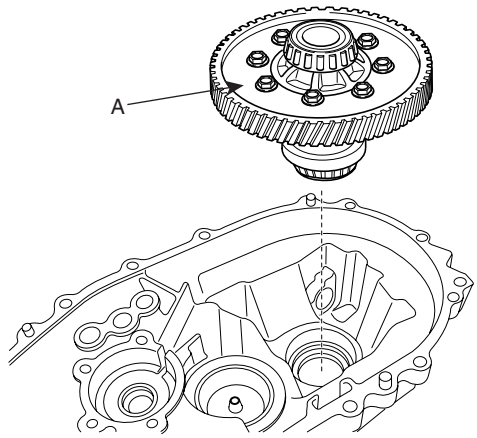


LMJF002A



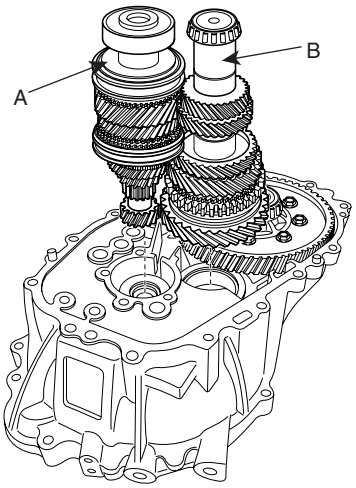
LKGF005A

10. Install the differential gear assembly(A).



LKGF004Z

11. Install the input shaft(A) and output shaft(B) in the clutch housing.



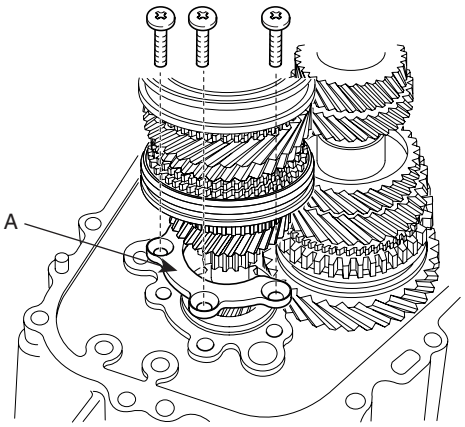
LKGF004Y

12. Install the bearing retainer.(Bolt: 4EA)

NOTE

Apply three bond 1303 equivalent around the hex bolt(4EA) before installing the bearing retainer(A).

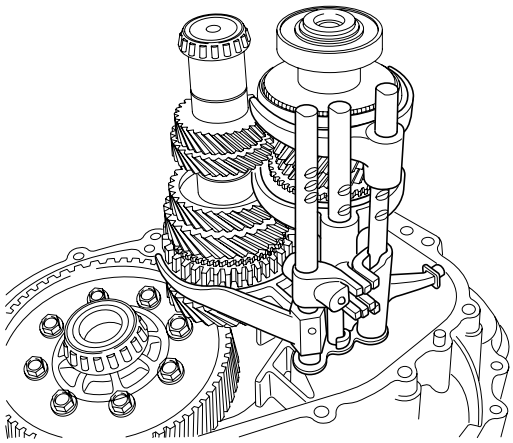
TORQUE :
15-22 Nm(150-220 kgf.cm, 10-16 lbf.ft)



LKGF004X

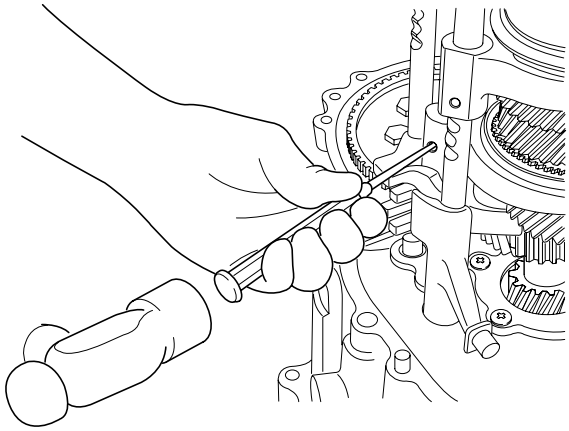
13. Install the 1 & 2 shift rail and fork assembly.

14. Install the 3 & 4, 5th shift rail and fork assembly.



LKGF004W

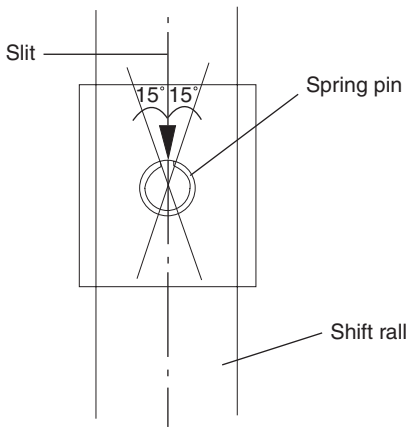
15. Install the spring pin.



LKGF004V

NOTE

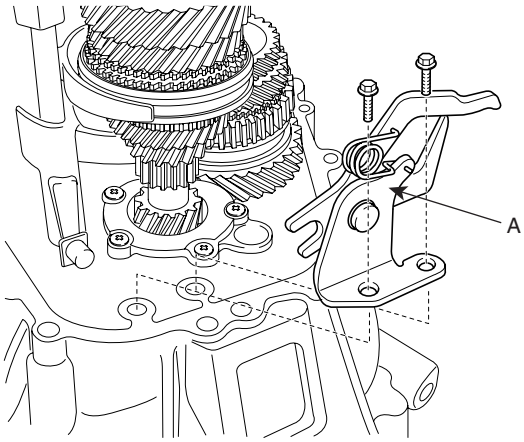
When installing, make sure that the slit of the spring pin is aligned within 15° of the center line of the shift rail.



LKGF006B

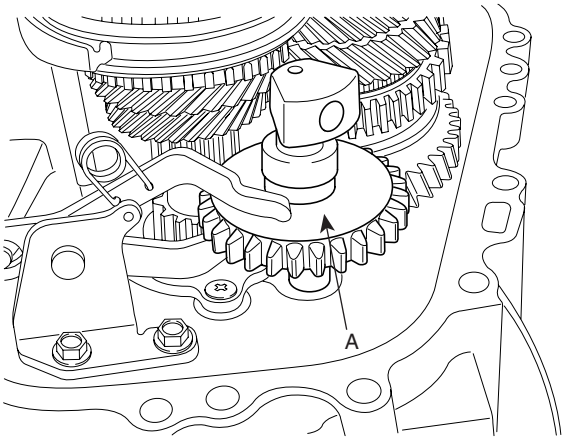
16. Install the reverse shift lever(A). (Bolt:2EA)

TORQUE :
15-22 Nm(150-220 kgf.cm, 10-16 lbf.ft)



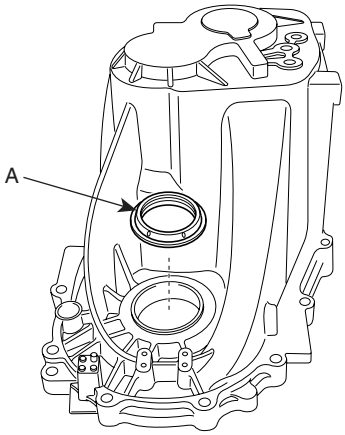
LKGF004U

17. Install the reverse idle gear assembly(A).

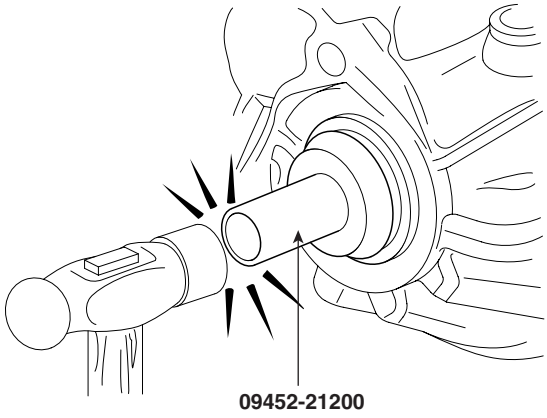


LKGF004T

18. Install the drive shaft oil seal(A) in the transaxle case using the special tool(09452-21200).

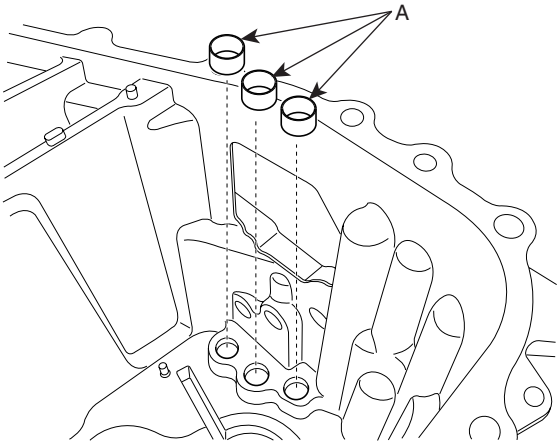


LKGF004S



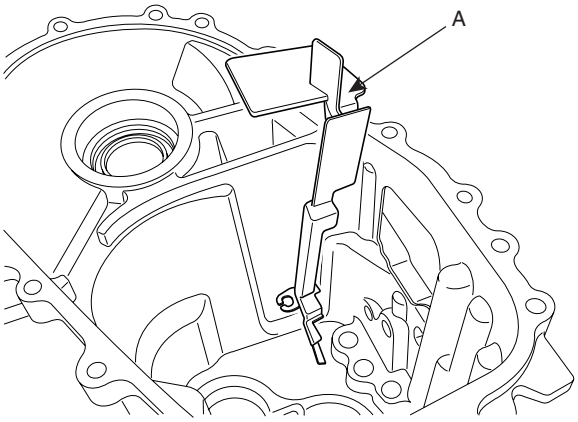
LMJF004A

19. Install the bushing(A) (3EA) in the transaxle case.



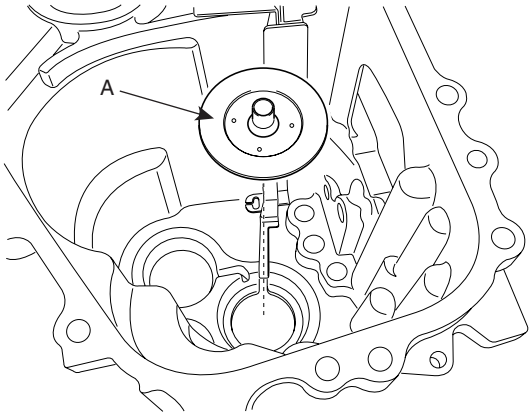
LKGF004R

20. Install the oil guide(A) in the transaxle case.



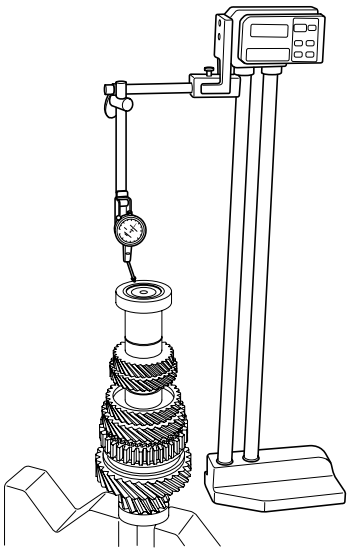
LKGF004Q

21. Install the input shaft oil guide(A).



LKGF004P

22. Measure and choose the proper space as followed.



LKGF006D

End play [in(mm)]: 0.0019T-0.0039T in(0.05T-0.10T mm)
Thickness of space [in(mm)] = (Height of housing [in(mm)] + Height of transaxle case [in(mm)]) - lengh of output [in(mm)] + end play [0.0003in(0.075mm)] + tolerance [0.0018in(0.045mm)]

NOTE

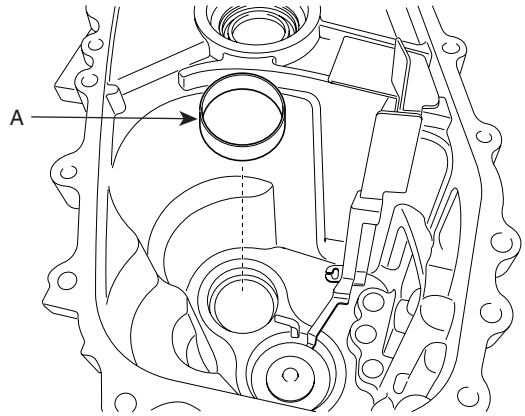
Measure the lengh of output shaft with both sides of bearing.
For keeping accuracy, measure at least 3 places and calculate the average value.

23. Install the output shaft space.

INPUT SIDE BEARING ADJUSTING SPACE

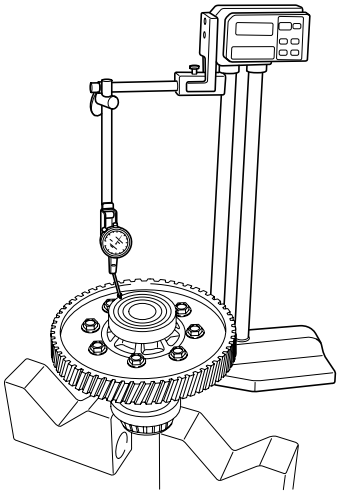
Parts Number	Thickness [in(mm)]
43227-28430	0.056 (1.43)
43227-28460	0.057 (1.46)
43227-28490	0.059 (1.49)
43227-28520	0.060 (1.52)
43227-28550	0.061 (1.55)
43227-28580	0.062 (1.58)
43227-28610	0.063 (1.61)
43227-28640	0.065 (1.64)
43227-28670	0.066 (1.67)
43227-28700	0.067 (1.70)
43227-28730	0.068 (1.73)
43227-28760	0.069 (1.76)
43227-28790	0.070 (1.79)
43227-28820	0.072 (1.82)
43227-28850	0.073 (1.85)
43227-28880	0.074 (1.88)
43227-28910	0.075 (1.91)

24. Install the output shaft rear outer race(A).



LKGF004O

25. Select the space of the differential assembly to minimize end play.



LKGF006E

End paly [in(mm)]: 0.0059T-0.0078T in(0.15T-0.20T mm)
Thickness of space [in(mm)] = (height of housing [in(mm)] + transaxle case [in(mm)]) - the length of differential [in(mm)] + end play [0.0007in(0.175mm)] + tolerance [0.0022in(0.055mm)]

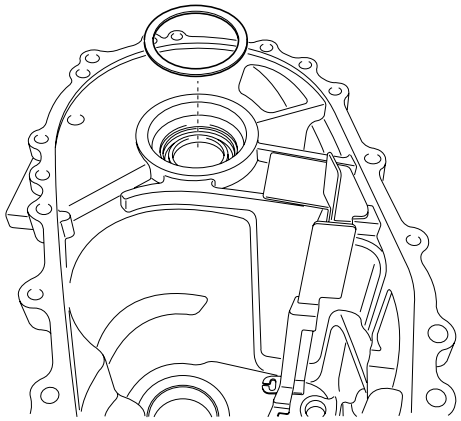
NOTE

Measure the lengh of differential assembly with both sides of bearing.
For keeping accuracy, measure at least 3 places and the calculate average value.

26. Install the space of the differential assembly.

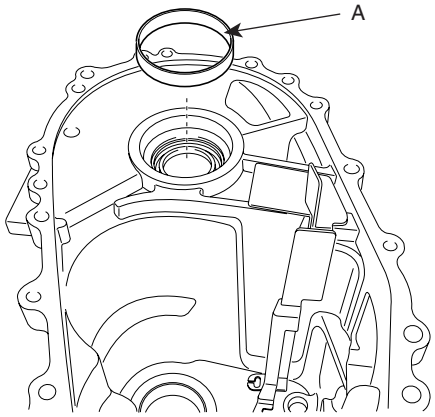
INPUT SIDE BEARING ADJUSTING SPACE

Parts Number	Thickness [in(mm)]
45835-22782	0.0295-0.0323(0.75-0.82)
45835-22792	0.0327-0.0362 (0.83-0.92)
45835-22700	0.0366-0.0425 (0.93-1.00)
45835-22708	0.0398-0.0425 (1.01-1.08)
45835-22716	0.0429-0.0457 (1.09-1.16)



LKGF006F

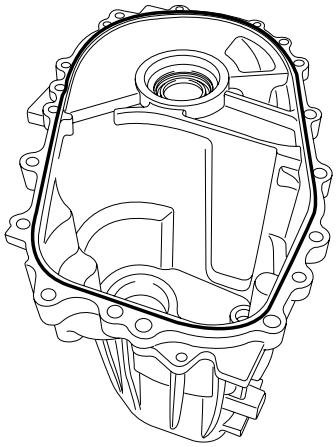
27. Install the differential outer race(A).



LKGF004N

28. Apply the specified sealant on the surface of the transaxle housing.

Specified sealant: MS 721-40



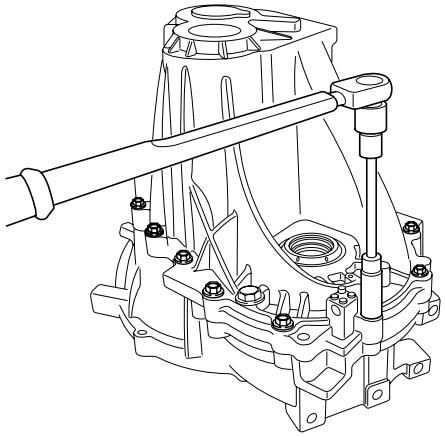
LKGF006G

29. Install transaxle case onto the transaxle housing. (Bolt:11EA)

NOTE

Use torque lench when tightening bolt.

TORQUE :
43-55 Nm(430-550 kgf.cm, 32-40 lbf.ft)



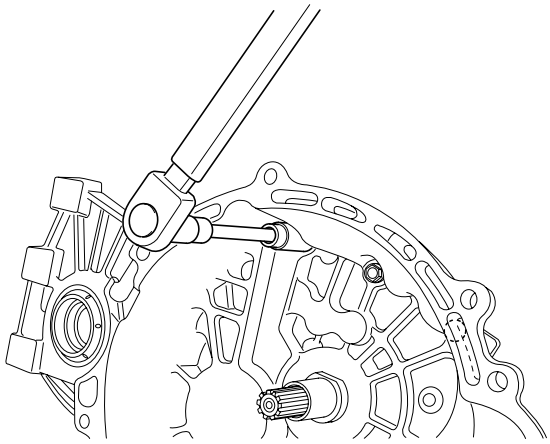
LKGF006H

30. Install bolt insides of the transaxle housing.(Bolt:3EA)

NOTE

Use torque lench when tightening bolt.

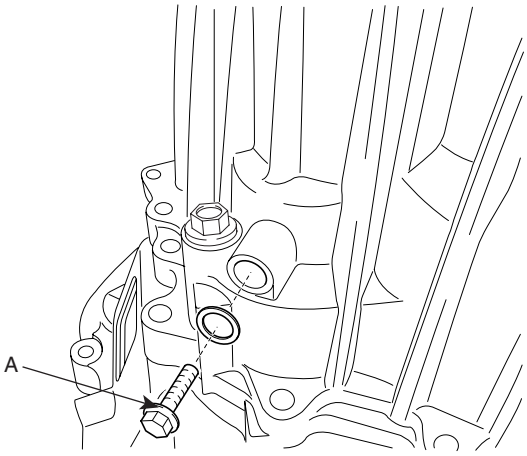
TORQUE :
43-55 Nm(430-550 kgf.cm, 32-40 lbf.ft)



LKGF006I

31. Install the reverse idle bolt(A) to housing side.

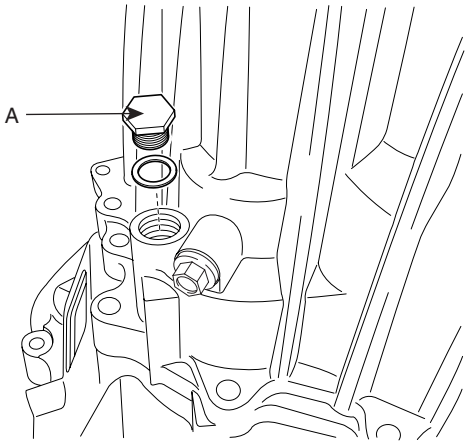
TORQUE :
43-55 Nm(430-550 kgf.cm, 32-40 lbf.ft)



LKGF004K

32. Install filler plug(A).

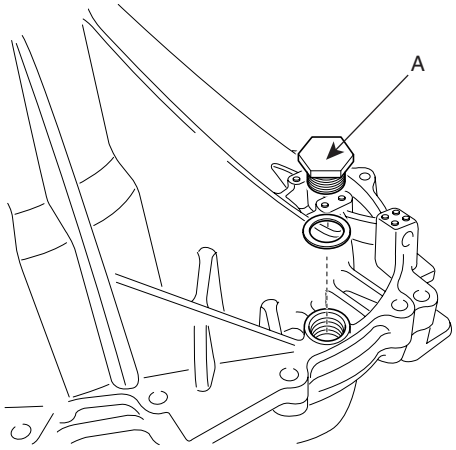
TORQUE :
60-80 Nm(600-800 kgf.cm, 43-58 lbf.ft)



LKGF004J

33. Install drain plug(A).

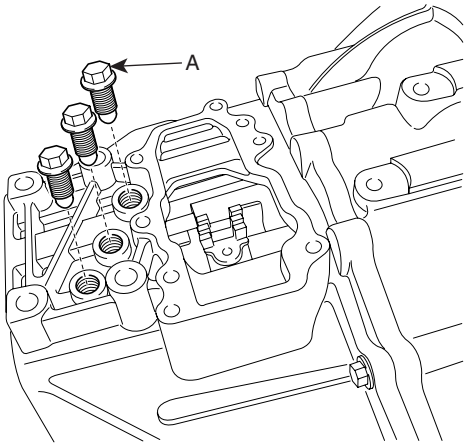
TORQUE :
60-80 Nm(600-800 kgf.cm, 43-58 lbf.ft)



LKGF004I

34. Install 1 & 2, 3 & 4, 5th shift rail poppet bolt(A).

TORQUE :
30-35 Nm(300-350 kg·cm, 21-25 lb·ft)



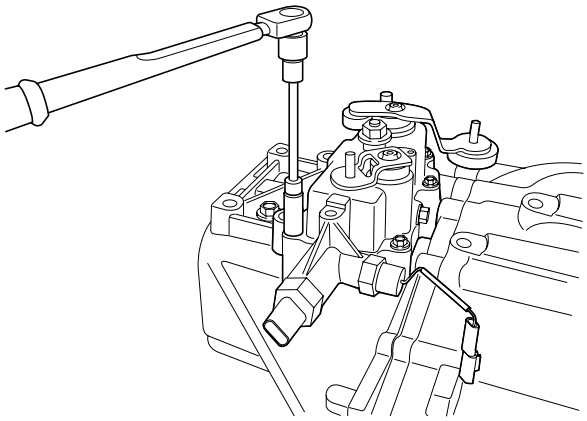
LKGF004H

35. Install the control shift complete onto the transaxle case. (Bolt:6EA)

TORQUE :
30-35 Nm(300-350 kg·cm, 21-25 lb·ft)

NOTE

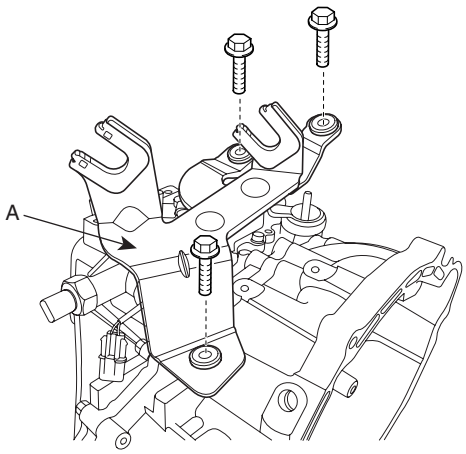
Use torque lench when tightening bolt.



LKGF006J

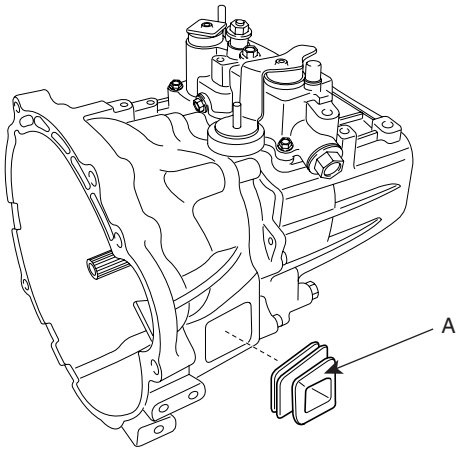
36. Install the shift cable bracket(A). (Bolt:2EA)

TORQUE :
20-27 Nm(200-270 kgf.cm, 15-20 lbf.ft)

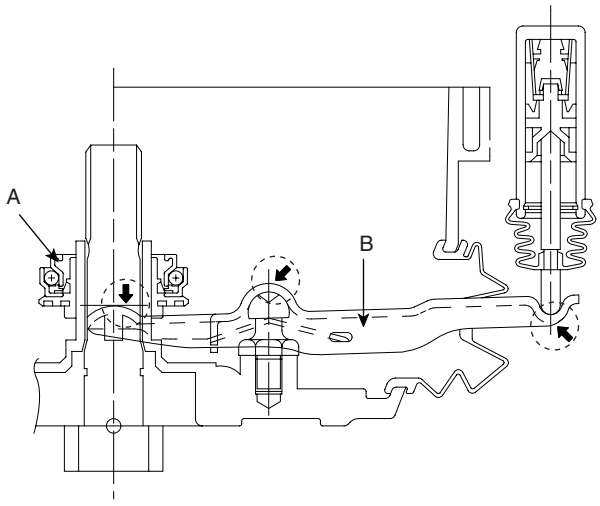


LKGF004F

37. Install the clutch fork boot(A).

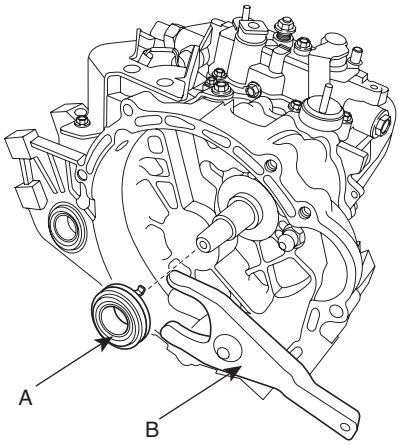


LKGF004E



LKGF006K

38. Install the release bearing(A) and clutch fork(B).



LKGF004D

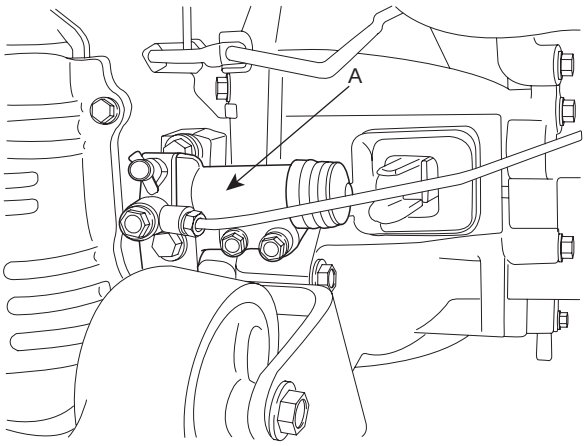
NOTE

Spread bearing sliding surface and holes of release fork with Grease.

Standard grease : CASMOLY L9508

39. Install the release cylinder(A). (Bolt:2EA)

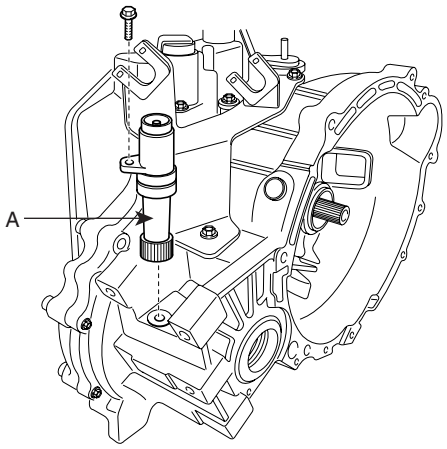
TORQUE : 15-22 Nm(150-220 kgf.cm, 10-16 lbf.ft)



LMJF019I

40. Install the vehicle speed sensor(A). (Bolt 1EA)

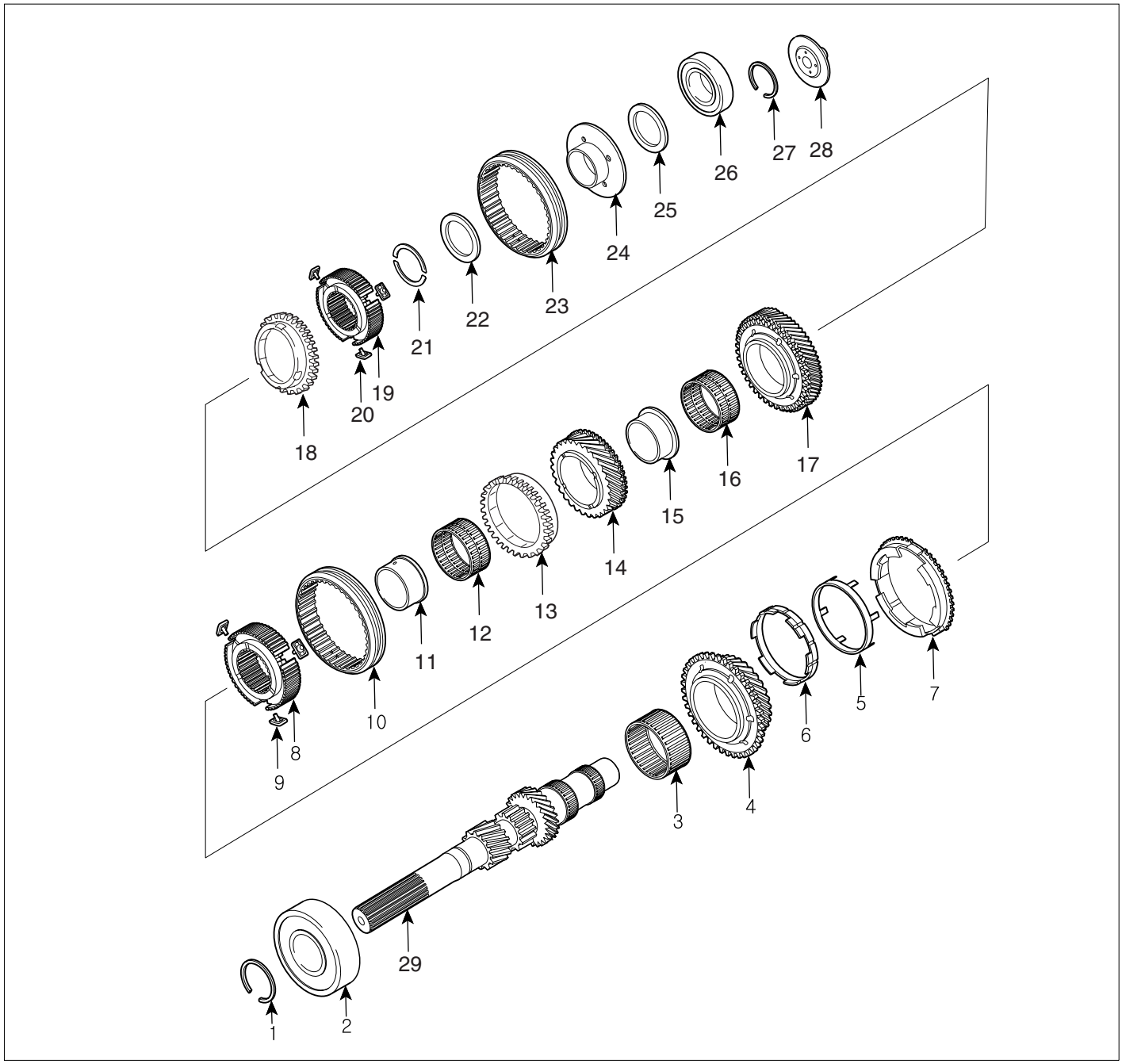
TORQUE :
3-5 Nm(30-50 kg·cm, 2-4 lb·ft)



LKGF004A

INPUT SHAFT

COMPONENTS E46DF4DF

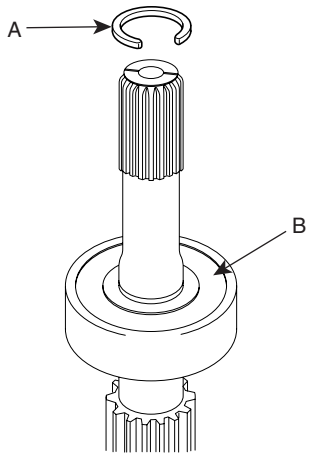


1. Snap ring
2. Front ball bearing
3. Needle bearing
4. 3rd speed gear
5. 3rd inner synchronizer ring
6. 3rd synchronizer cone
7. 3rd outer synchronizer ring
8. 3rd &4th synchronizer hub
9. Synchronizer key
10. 3rd &4th synchronizer sleeve
11. 4th gear sleeve
12. Needle bearing
13. 4th synchronizer ring
14. 4th speed gear
15. 5th gear sleeve
16. Needle bearing
17. 5th speed gear
18. 5th synchronizer ring
19. 5th synchronizer hub
20. Synchronizer key
21. Spacer
22. ring
23. 5th synchronizer sleeve
24. Spacer
25. Thrust washer
26. Rear ball bearing
27. Snap ring
28. Oil guide
29. Input shaft

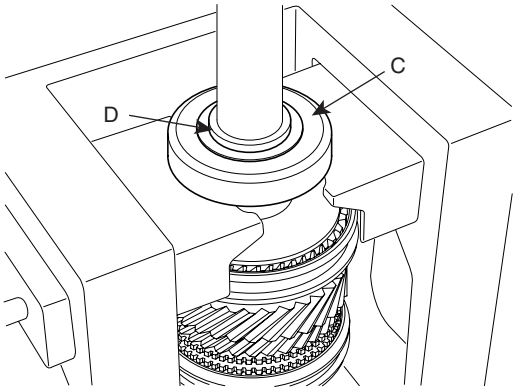
LMJF005A

DISASSEMBLY E26BB9DF

1. Remove the snap ring(A) and washer(D) and remove the front ball bearing(B) and the rear ball bearing(C) using press.

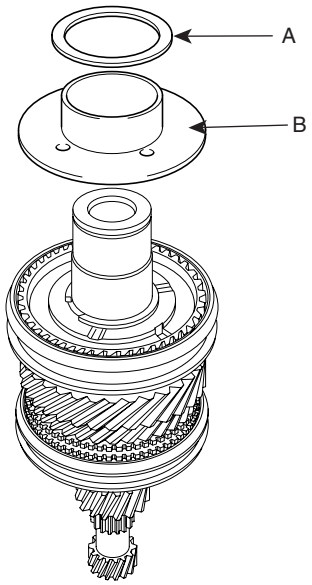


LKGF009A



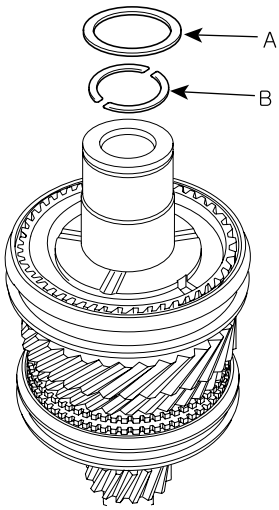
LKGF009B

2. Remove the thrust washer(A) and spacer(B).



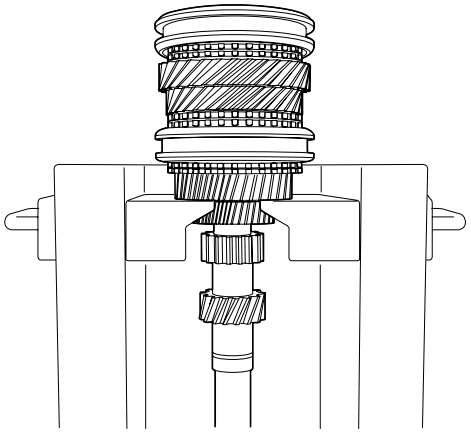
LKGF009C

3. Remove the ring(A) and specer(B).



LMJF019B

4. Remove the 5th sleeve, 5th gear, 4th gear, 3 & 4th sleeve and 3rd gear all together using press.

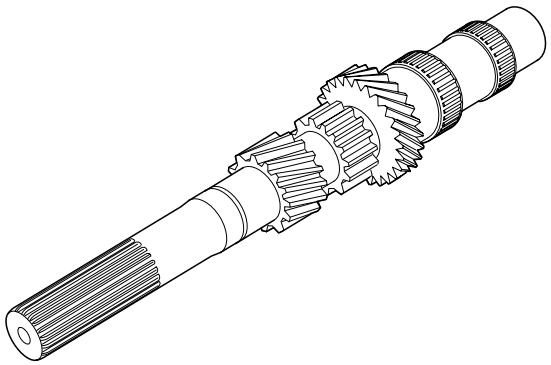


LKGF009E

INSPECTION E2E5B004

INPUT SHAFT

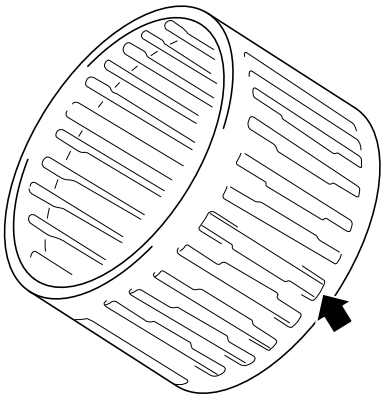
1. Check the outer surface of the input shaft where the needle bearing is mounting for damage or abnormal wear.
2. Check the input shaft gear teeth for damage.



LKGF009F

NEEDLE ROLLER BEARING

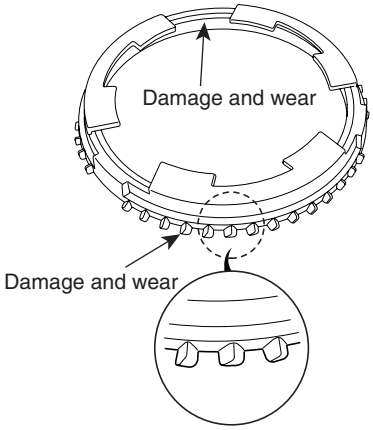
1. Install the needle bearing on the shaft with the bearing sleeve and gear.
   Check that it rotates smoothly without abnormal noise or play.
2. Check the needle bearing cage for distortion.



LKGF009G

SYNCHRONIZER RING

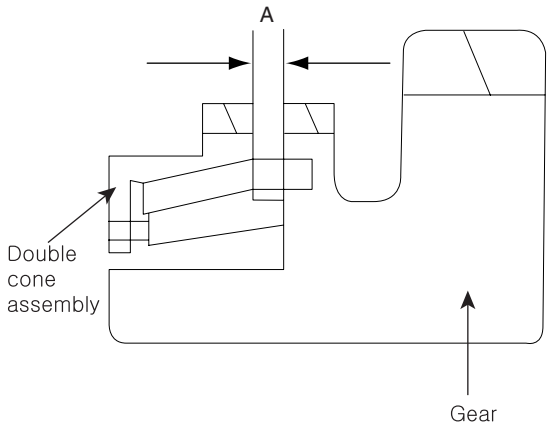
1. Check the clutch gear teeth for damage.
2. Check the internal surface for damage, wear or broken grooves.



LKGF009H

3. Push the synchronizer ring toward the clutch gear and check clearance "A".
   Replace if it is not within specifications.

Limit"A" : 0.02in (0.5mm)



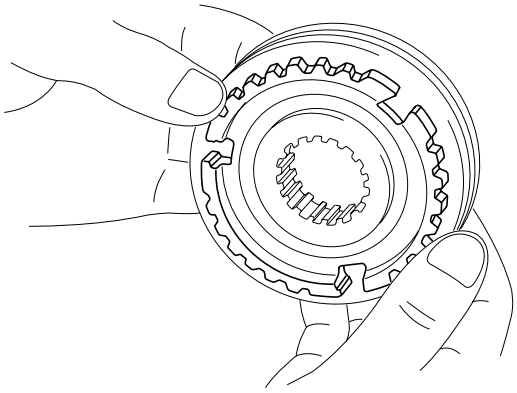
LKGF009I

SYNCHRONIZER SLEEVE AND HUB

1. Install the synchronizer sleeve on the hub and check that it slides smoothly.
2. Check that the sleeve is free from damage.
3. Check for wear of the hub end surfaces (in contact with each gear).

CAUTION

Replace the synchronizer hub and sleeve as a set.



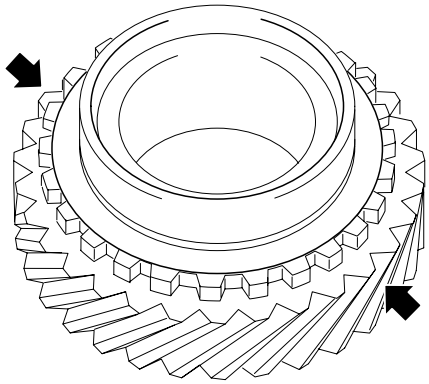
LKGF009J

SYNCHRONIZER KEY

1. Check for wear of the synchronizer key center protrusion.
2. Replace the synchronizer key assembly.

GEARS

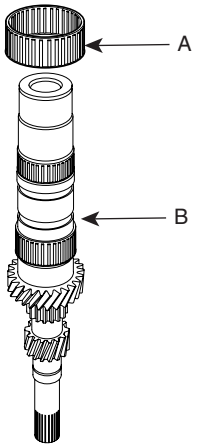
1. Check the bevel gear and clutch gear teeth for danage or wear.
2. Check the gear bore for damage or wear.



LKGF009L

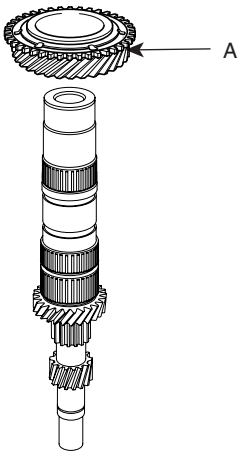
REASSEMBLY EAD7E2AA

1. Install the 3rd needle bearing(A) on the input shaft(B).



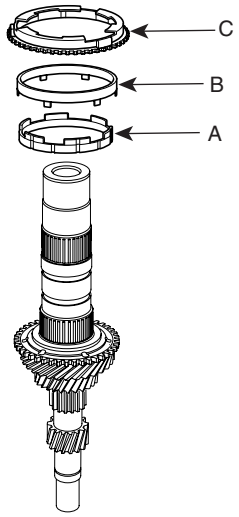
LKGF010A

2. Apply transaxle oil to the needle bearing.
3. Install the 3rd gear(A).



LKGF010B

4. Install the 3rd inner synchronizer ring(A). (Double cone type)

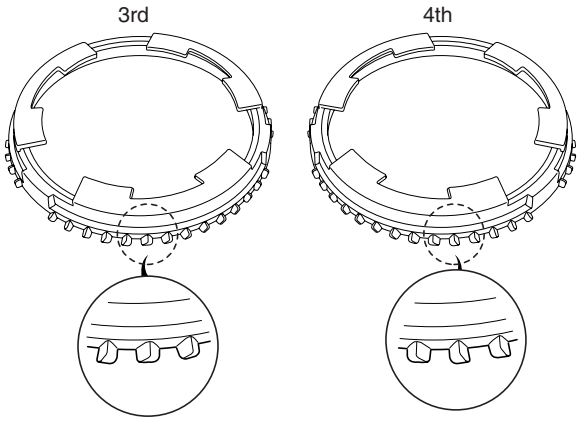


AMJF557A

5. Install the 3rd synchronizer cone(B).
6. Install the 3rd outer synchronizer ring(C).

NOTE

Pay attention the direction of protrusion of a synchronizer ring.

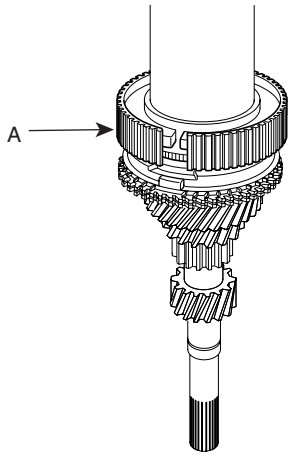


LMJF006A

7. Assemble the 3rd & 4th synchronizer hub(A) using press.

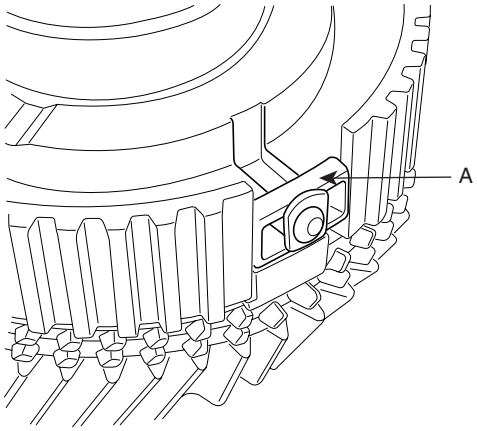
NOTE

- *When installing the synchronizer hub, make sure that the fingers of synchronizer ring are seated correctly in its groove on the synchronizer hub.*
- *After installation of the synchronizer hub, check that sychronizer hub rotates smoothly.*



LMJF007A

8. Install the synchronizer keys(A).

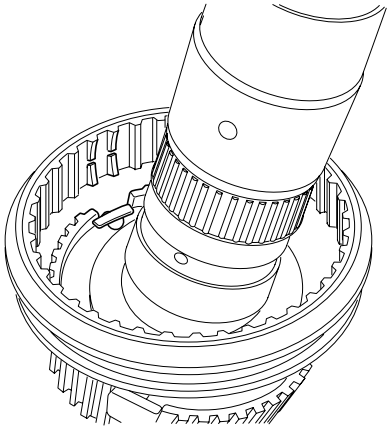


LKGF010F

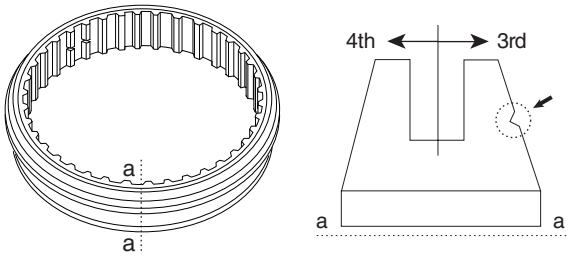
9. Install the 3rd & 4th synchronizer sleeve.

NOTE

- *Put down the 3rd slope face of sleeve with the identification mark.*
- *Make sure that the groove of sleeve inside is seated correctly in the groove of synchronizer hub.*



LKGF010G

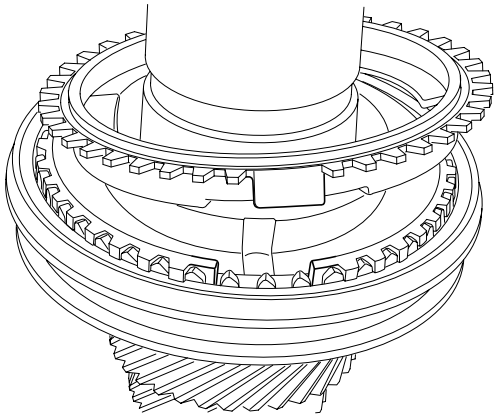


LMJF008A

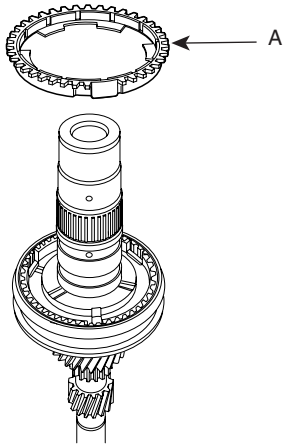
10. Install the 4th outer synchronizer ring(A).

NOTE

When installing the synchronizer ring, make sure that the fingers of synchronizer ring are seated correctly in the grooves of the 3rd & 4th synchronizer hub.

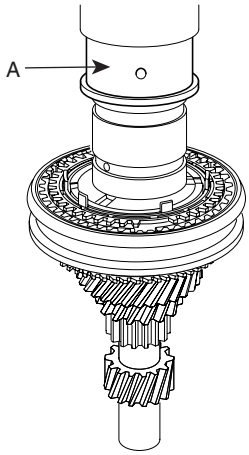


LKGF010I



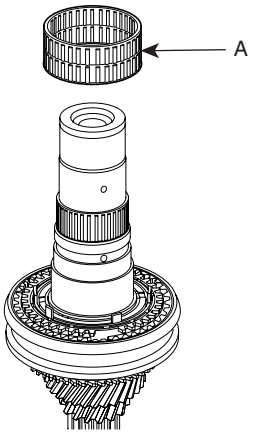
LMJF009A

11. Install the 4th gear sleeve(A) using press.



LMJF010A

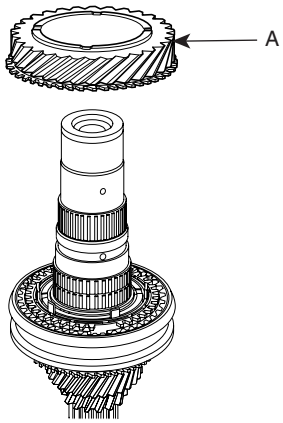
12. Install the 4th needle bearing(A).



LKGF010M

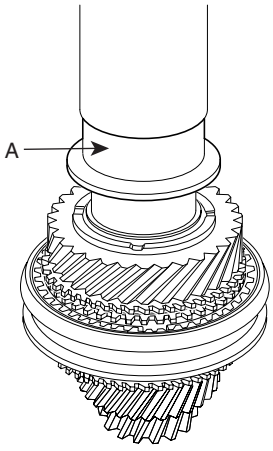
13. Apply transaxle oil to the needle bearing.

14. Install the 4th gear(A).



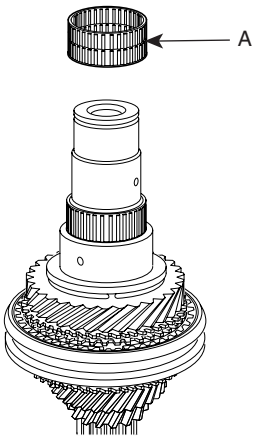
LKGF010N

15. Install the 5th sleeve(A) using press.



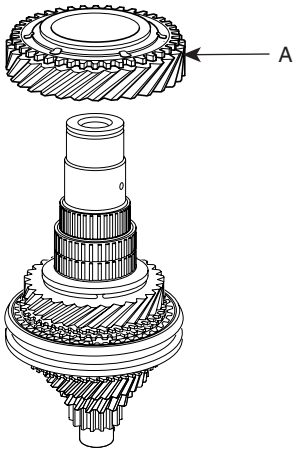
LMJF011A

16. Install the 5th needle bearing(A).



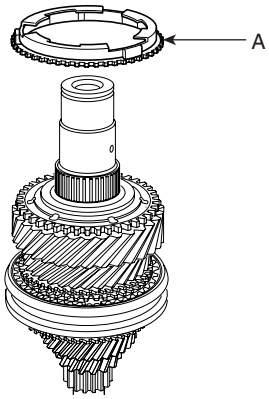
LKGF010P

17. Install the 5th gear(A).



LKGF010Q

18. Install the 5th synchronizer ring(A).

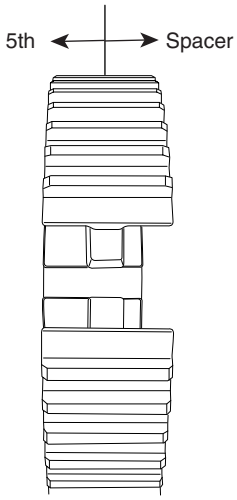


LMJF012A

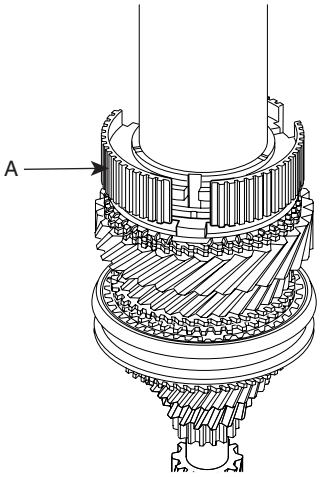
19. Install the 5th synchronizer hub(A) using the press.

NOTE

- *When installling hub, make sure the direction as shown in the picture.*
- *When pressing the hub, make sure that the fingers of the 5th synchronizer ring(double cone) are seated correctly in the grooves of the hub.*

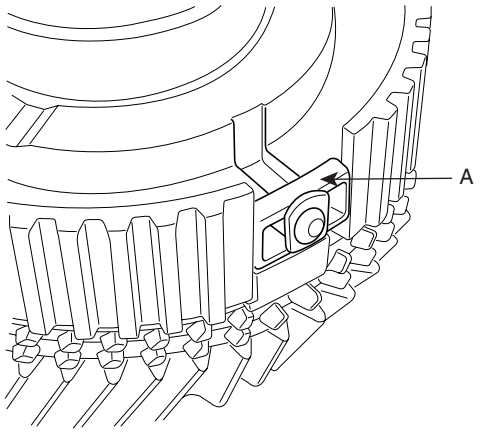


LKGF010S



LMJF013A

20. Install the synchronizer key(A).

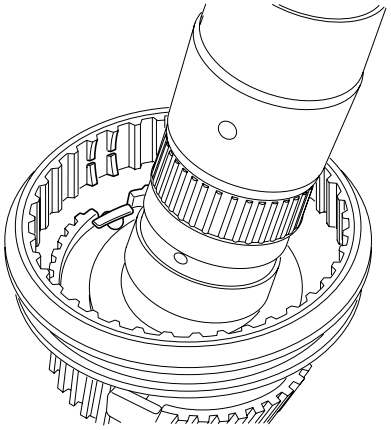


LKGF010F

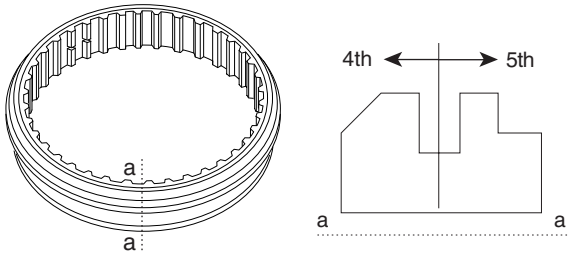
21. Install the 5th synchronizer sleeve.

NOTE

- *Put down the 5th slope face of sleeve with the identification mark.*
- *Make sure that the groove of sleeve inside is seated correctly in the groove of synchronizer hub.*

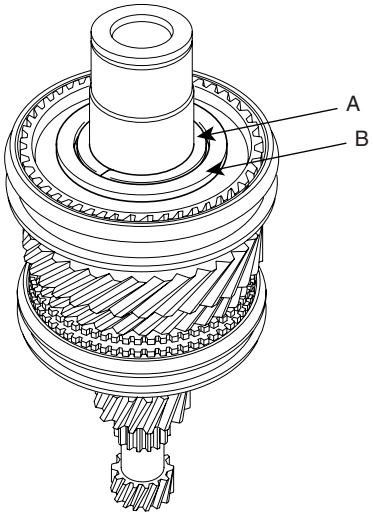


LKGF010G



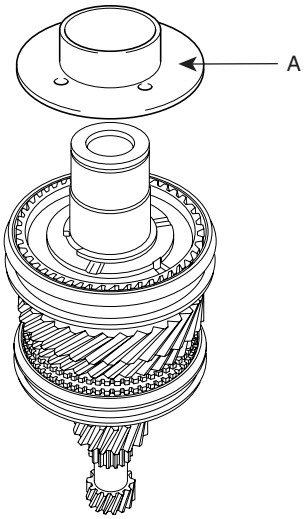
LKGF010Z

22. Install the spacer(A) and ring(B).



LMJF019F

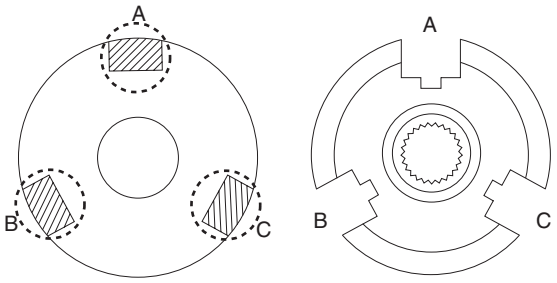
23. Install the spacer(A).



LKGF010U

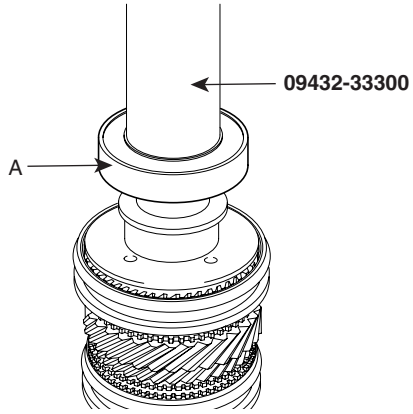
NOTE

When installing the spacer, make sure that three fingers of spacer are seated correctly in three grooves of 5th synchronizer hub.



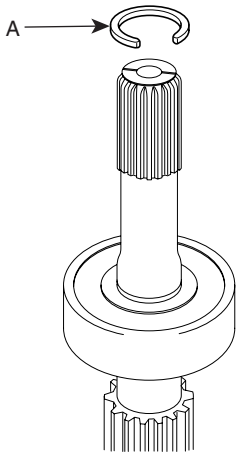
LKGF009K

24. Install the thrust washer.
25. Install the ball bearing(A) by press and special tool(09432-33300).



LMJF019D

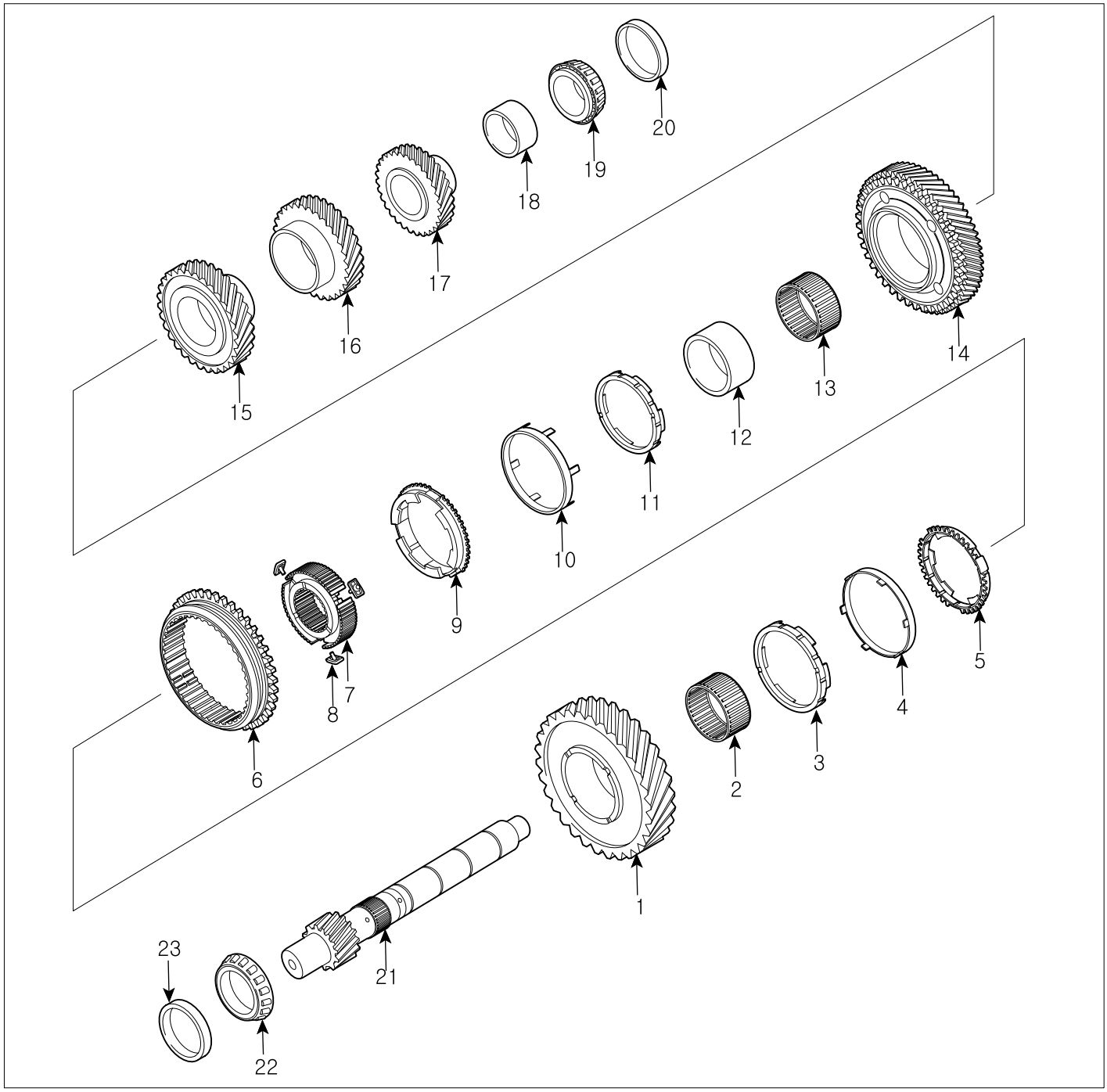
26. Install the snap ring.
27. Install the front input shaft ball bearing by press and special tool(09432-33300).
28. Install the snap ring(A).



LKGF010Y

OUTPUT SHAFT

COMPONENTS E30AFAD9



1. 1st speed gear
2. Needle bearing
3. 1st inner synchronizer ring
4. 1st synchronizer cone
5. 1st outer synchronizer ring
6. 1st & 2nd speed sleeve
7. 1st &2nd synchronizer hub
8. Synchronizer key
9. 2nd outer synchronizer ring
10. 2nd synchronizer cone
11. 2nd inner synchronizer ring
12. 2nd sleeve
13. Needle bearing
14. 2nd speed gear
15. 3rd speed gear
16. 4th speed gear
17. 5th speed gear
18. Sleeve
19. Rear taper roller bearing
20. Outer race
21. Output shaft
22. Front taper roller bearing
23. Outer race

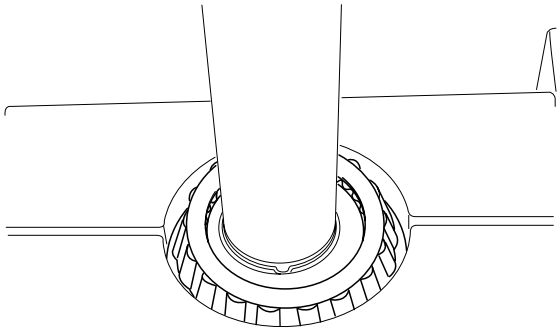
LKGF012A

DISASSEMBLY E8DFDF9F

1. Remove the taper ball bearing.

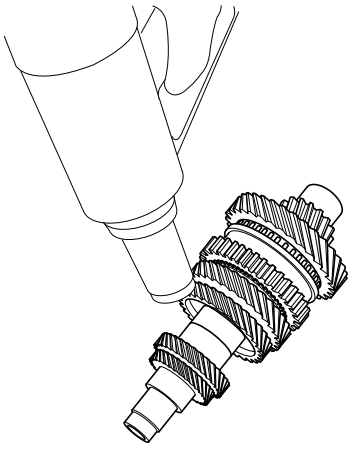
NOTE

Do not reuse the removed bearing.



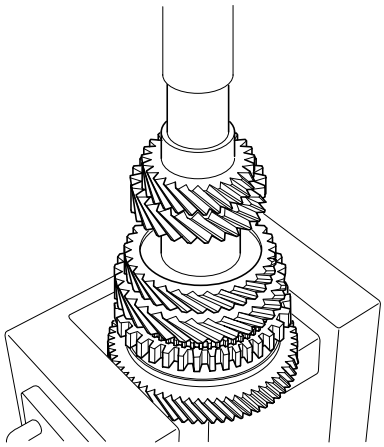
LKGF013A

2. Heat the 3rd, 4th and 5th gear with electrical heater as shown picture below.



LKGF013B

3. Remove the 1st & 2nd synchronizer hub, 2nd sleeve, 3rd gear, 4th gear and 5th gear all together using press.

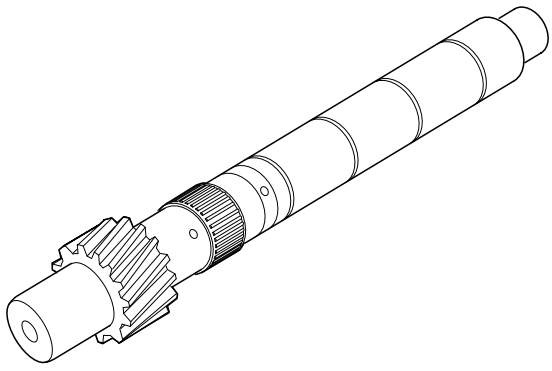


LKGF013C

INSPECTION E2CCC11D

OUTPUT SHAFT

1. Check the outer surface of where the needle bearing is mounted for damage or abnormal wear.
2. Check the splines for damage or wear.

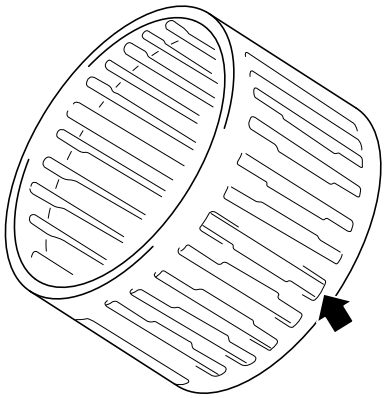


LKGF013D

NEEDLE BEARING

1. Install the needle bearing on the shaft with the bearing sleeve and gear.
   Check that it rotates smoothly without abnormal noise or play.

2. Check the needle bearing cage for distortion.

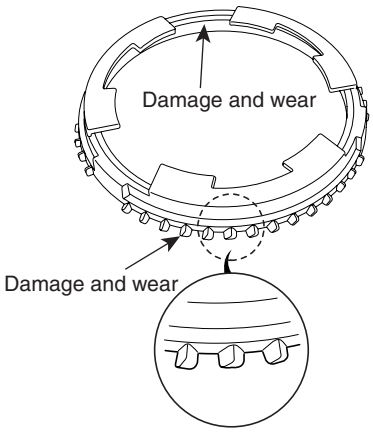


LKGF009G

SYNCHRONIZER RING

1. Check the clutch gear teeth for damage.

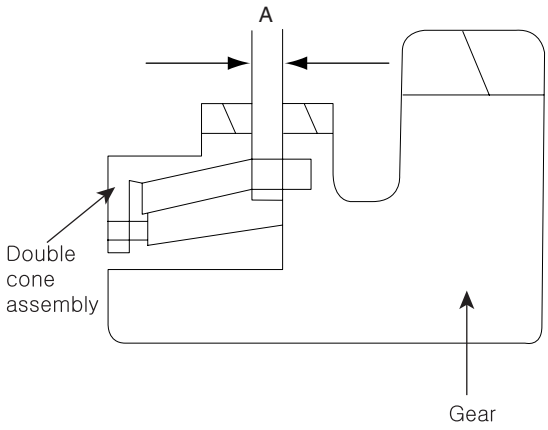
2. Check internal surface for damage, wear or broken grooves.



LKGF009H

3. Push the synchronizer ring toward the clutch gear and check clearance "A".
   Replace if it is not within specifications.

Limit : 0.02 in(0.5 mm)



LKGF009I

SYNCHRONIZER SLEEVE AND HUB

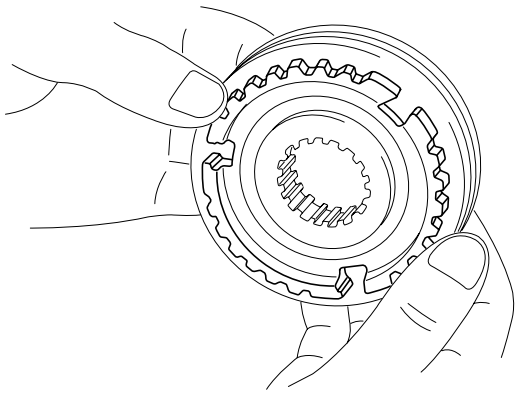
1. Install the synchronizer sleeve on the hub and check that it slides smoothly.

2. Check that the sleeve is free from damage.

3. Check for wear of the hub end surfaces (in contact with each gear).

NOTE

Replace the synchronizer hub and sleeve as a set.



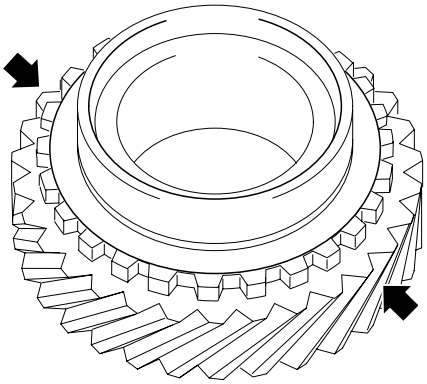
LKGF009J

SYNCHRONIZER KEY

1. Check for wear of the synchronizer key center protrusion.
2. Replace the synchronizer key assembly.

GEARS

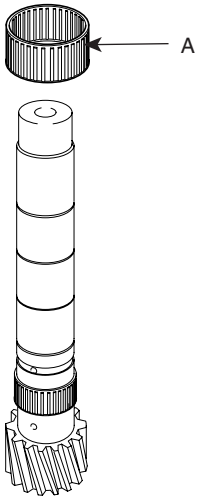
1. Check the bevel gear and clutch gear teeth for damage or wear.
2. Check the gear bore for damage or wear.



LKGF009L

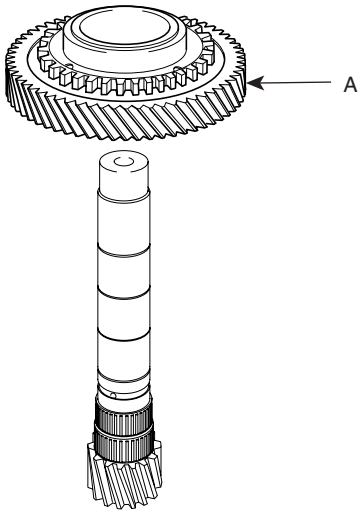
REASSEMBLY E1A25AEF

1. Install the needle bearing(A).



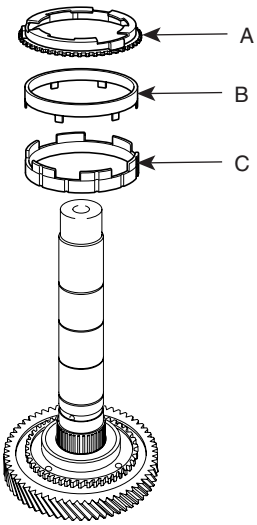
LKGF014A

2. Apply the MT oil to the needle bearing.
3. Install the 1st gear(A).



LKGF014B

4. Install the 1st inner synchronizer ring(A).

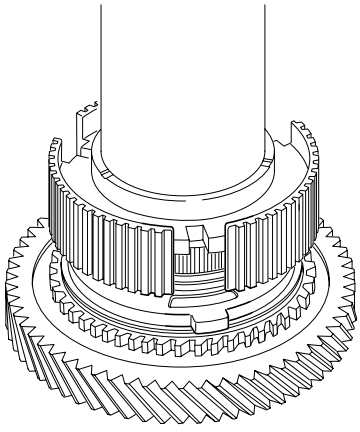


LKGF014C

5. Install the 1st synchronizer cone(B).
6. Install the 1st outer synchronizer ring(C).
7. Install the 1st & 2nd synchronizer hub using press.

NOTE

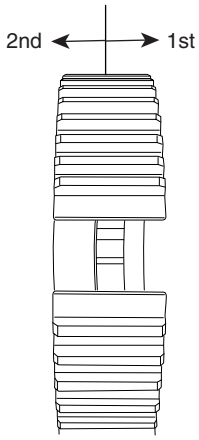
When installing hub, make sure that the the fingers of 1st synchronizer ring are seated correctly in the grooves of synchronizer hub.



LMJF014A

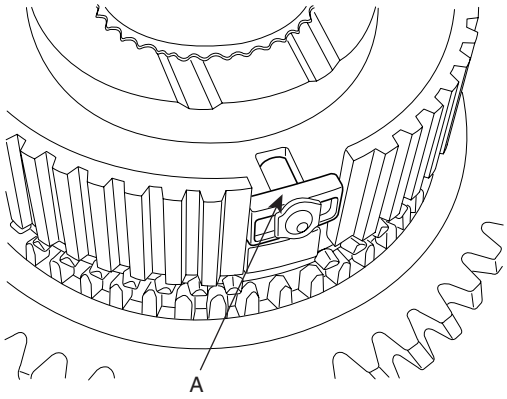
NOTE

When installling hub, make sure the direction as shown in the picture.



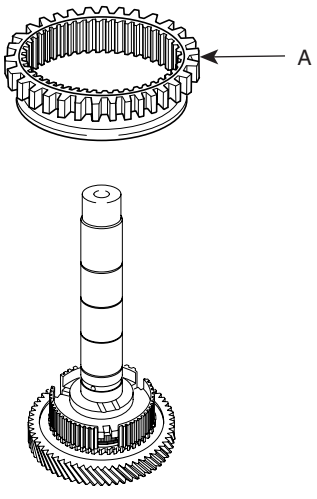
LKGF014E

8. Install the synchronizer key(A).



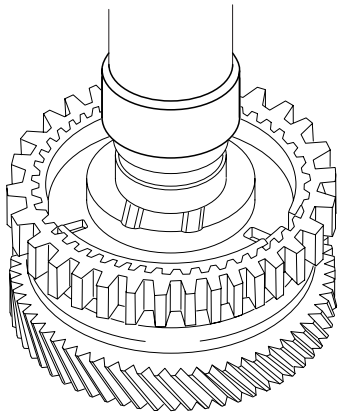
LKGF014F

9. Install the 1st & 2nd sleeve(A).



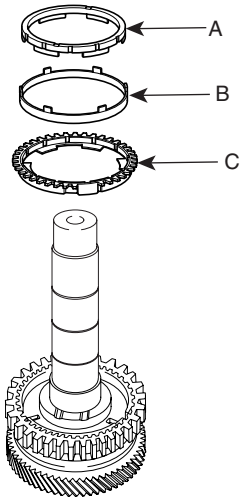
LKGF014G

10. Install the 2nd sleeve using press.



LMJF015A

11. Install the 2nd outer synchronizer ring(A). (Trifle cone)

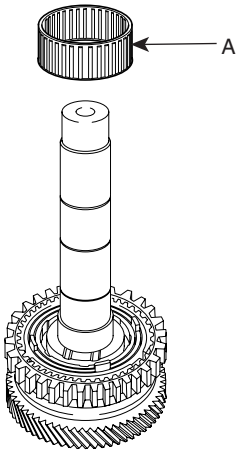


LKGF014I

12. Install the 2nd synchronizer cone(B).

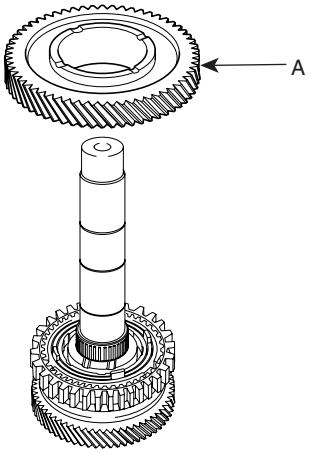
13. Install the 2nd inner synchronizer rin(C).

14. Install the 2nd needle bearing(A).



LKGF014J

15. Install the 2nd gear(A).

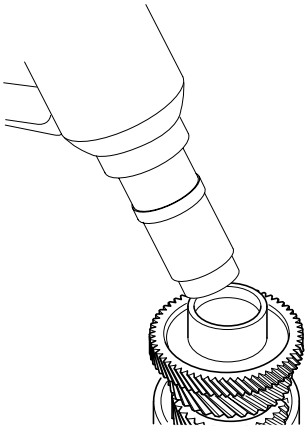


LKGF014K

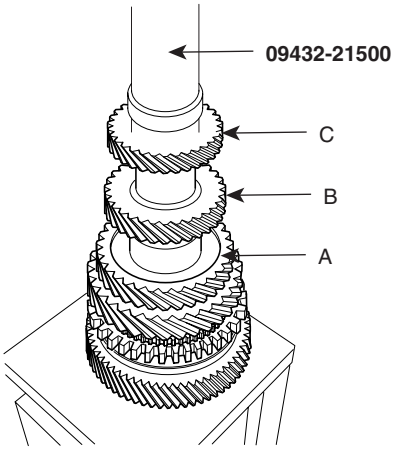
16. Install the 3rd(A), 4th(B) and 5th(C) gear using press.(09432-21500)

NOTE

Heat the 3rd gear with electrical heater before using press.



LKGF014L



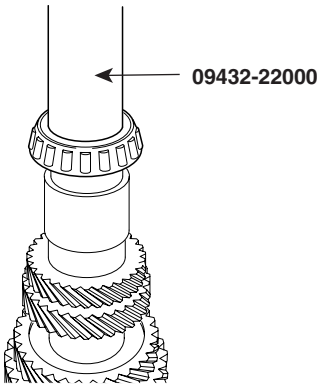
LMJF019G

17. Install the spacer using press and special tool(09455-21100).

18. Install the rear taper roller bearing using press and special tool(09432-22000).

NOTE

Do not reuse the removed bearing.

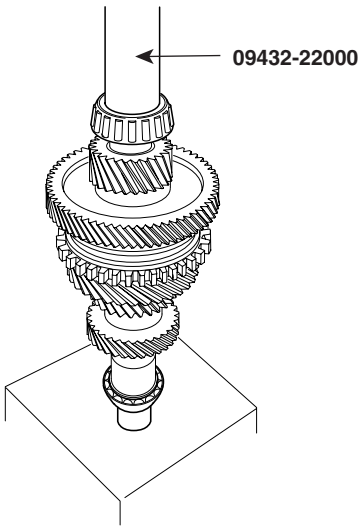


LMJF001B

19. Install the opposite side taper roller bearing using press and special tool(09432-22000).

NOTE

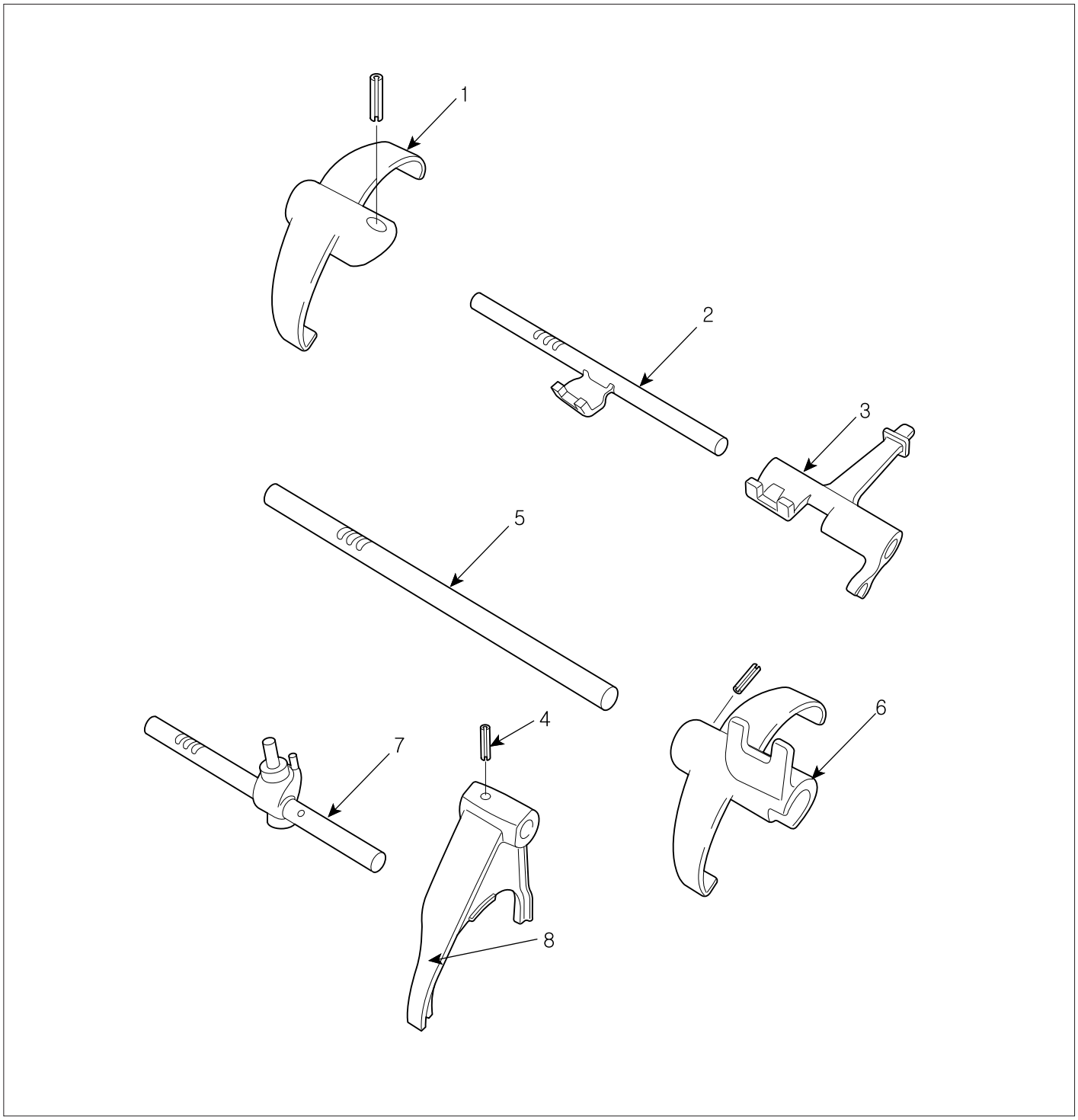
Do not reuse the removed bearing.



LMJF002B

SHIFT FORK

COMPONENTS ED5FA5BA

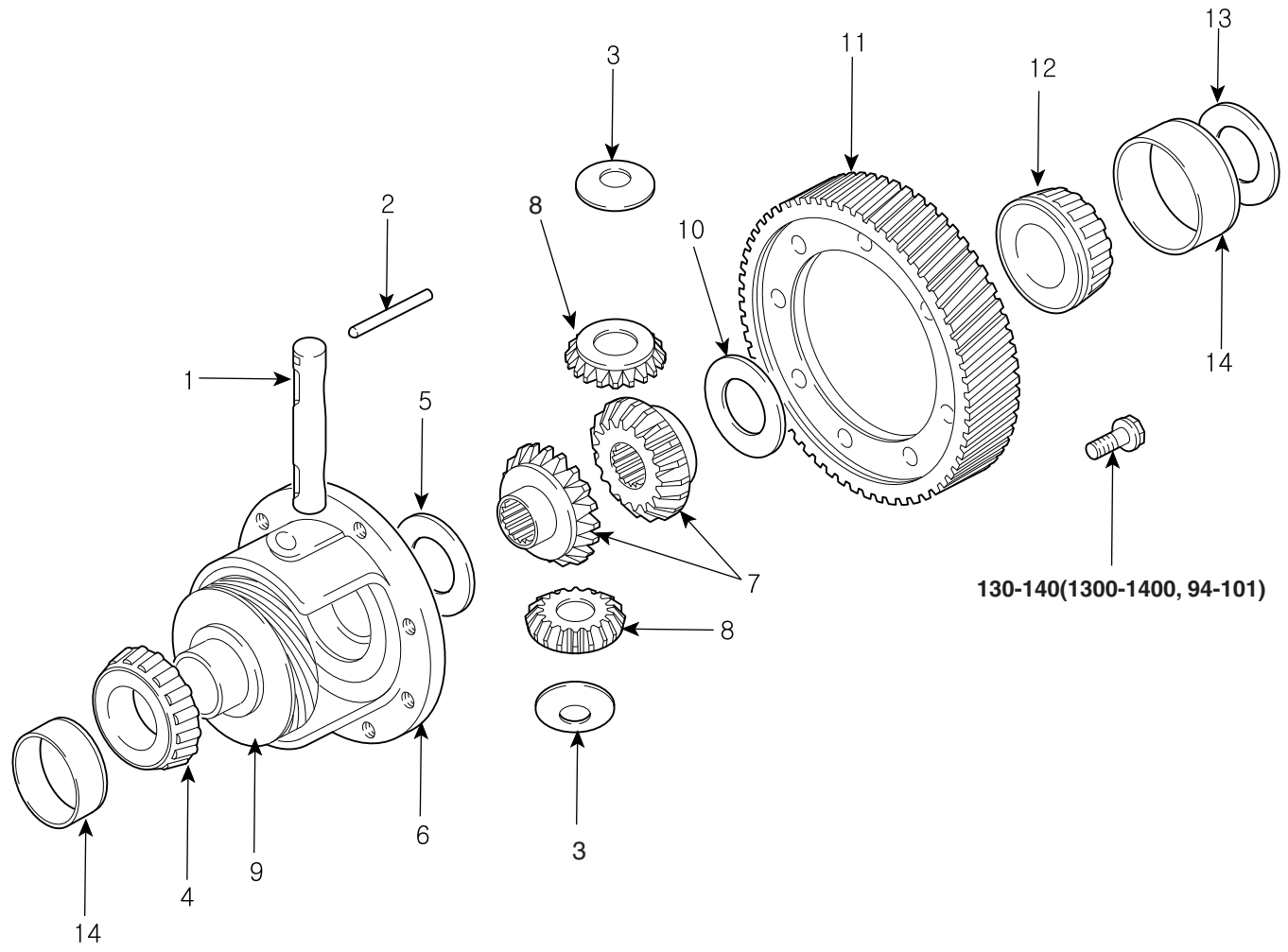


1. 5th shift fork
2. 5th shift rail
3. Reverse shift lug
4. Pin
5. 3rd & 4th shift rail
6. 3rd & 4th shift lug and fork
7. 1st & 2nd shift rail
8. 1st & 2nd shift fork

LKGF015A

DIFFERENTIAL

COMPONENTS EADF7D60



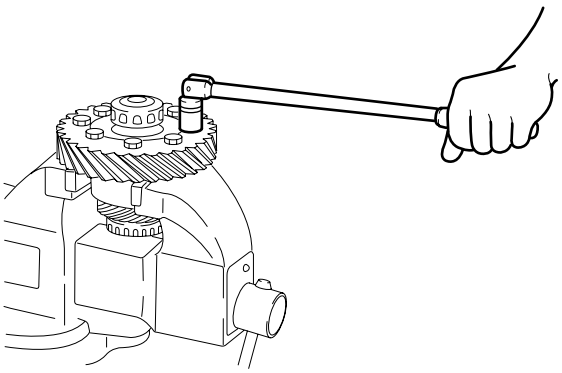
TORQUE : Nm (kg·cm, lb·ft)

1. Pinion shaft
2. Lock pin
3. Washer
4. Taper roller bearing
5. Spacer
6. Differential case
7. Side gear
8. Pinion gear
9. Washer
10. Spacer
11. Differential drive gear
12. Taper roller bearing
13. Spacer
14. Outer race

LKGF016A

DISASSEMBLY EE6CFA41

1. Clamp the differential case in a vise.
2. Remove the differential drive gear retaining bolts and remove the differential drive gear from the case.

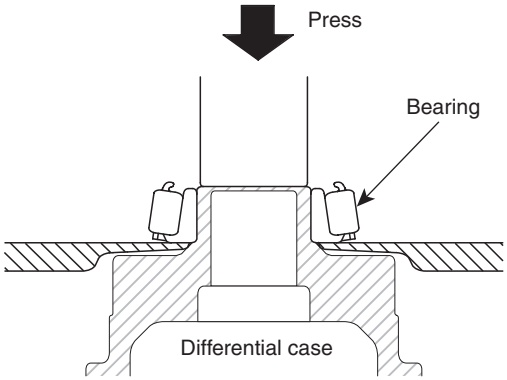


LKGF016B

3. Remove the taper roller bearing using press.

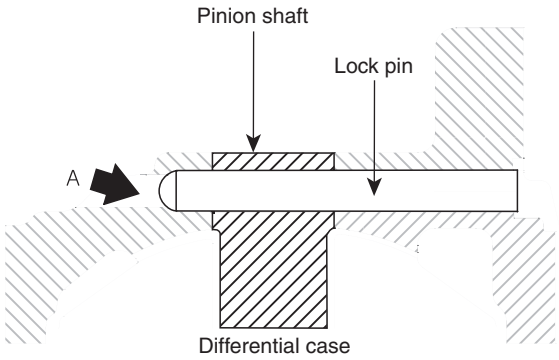
CAUTION

Do not reuse the bearing removed from the shaft.



LMJF016A

4. Drive out the lock pin from the hole A using a punch.
5. Drive out the pinion shaft.
6. Remove the pinion gears, washers, side gears and spacers.



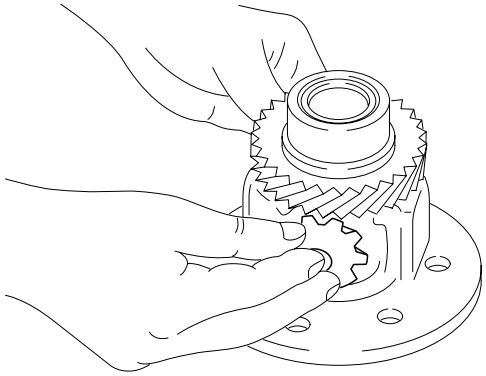
LMJF017A

REASSEMBLY E4921CE7

1. Install the spacer on the back of the side gear and then install the gear in the differential case.

CAUTION

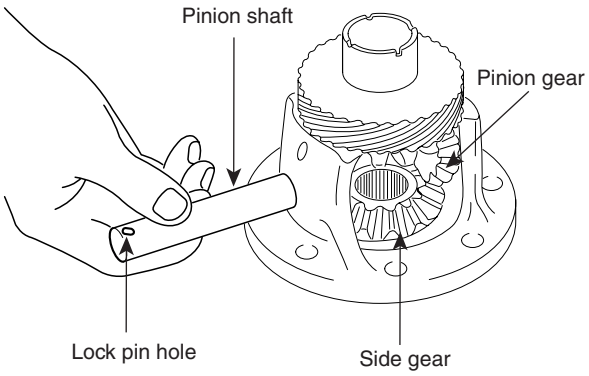
When installing a new side gear, use a spacer of medium thickness [0.0366~0.0394 in(0.93~1.00 mm)].



LKGF016E

2. Set the washer on the back of each pinion and insert the two pinions to specified position while engaging them with the side gears by turning them.

3. Insert the pinion shaft.



LKGF016F

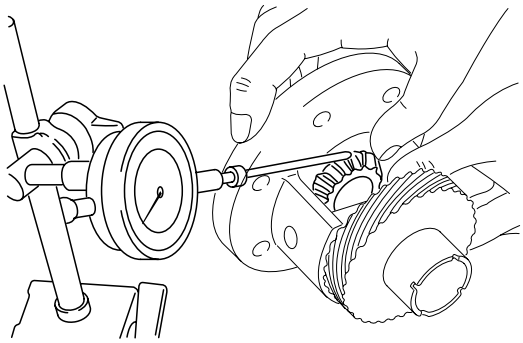
4. Measure the backlash between the side gears and pinions.

Standard value :
0.001~0.006in (0.025~0.150mm)

5. If the backlash is out of specification, disassemble and install the correct spacer, reassemble and remeasure.

CAUTION

Adjust the backlash of both side gears to the same specification.

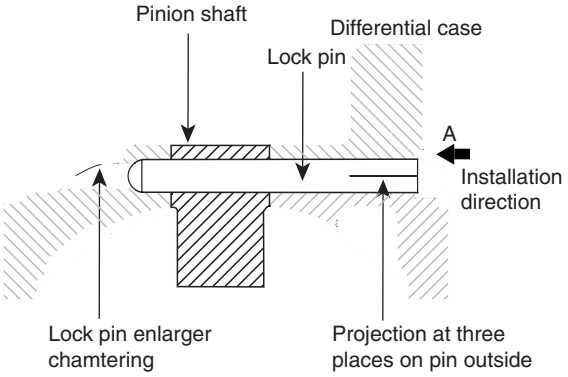


LKGF016G

6. Align the pinion shaft lock pin hole with the case lock pin hole and insert the lock pin.

CAUTION

- ***Do not reuse the lock pin.***
- ***The lock pin head must be sunk below the flange surface of the differential case.***

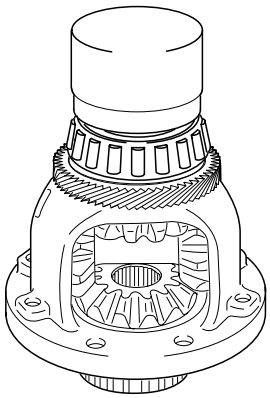


LKGF016H

7. Install the taper roller bearings on both sides of the differential case.

CAUTION

When press-fitting the bearing, press on the inner race only.



AMJF016I

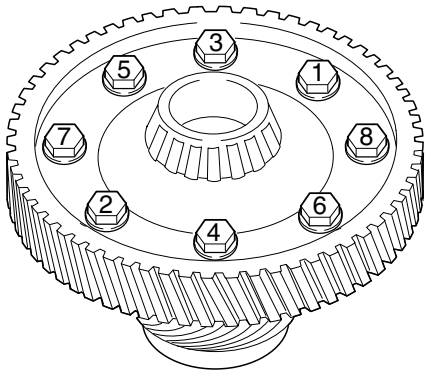
8. Apply specified sealant to the entire threads of the bolts. Tighten to specifications using the sequence shown in the illustration.

Specified sealant : BM Stud Locking No. 2471.

TORQE
Differential drive gear bolt:
130~140Nm (1300~1400kg·cm, 94~101lb·ft)

CAUTION

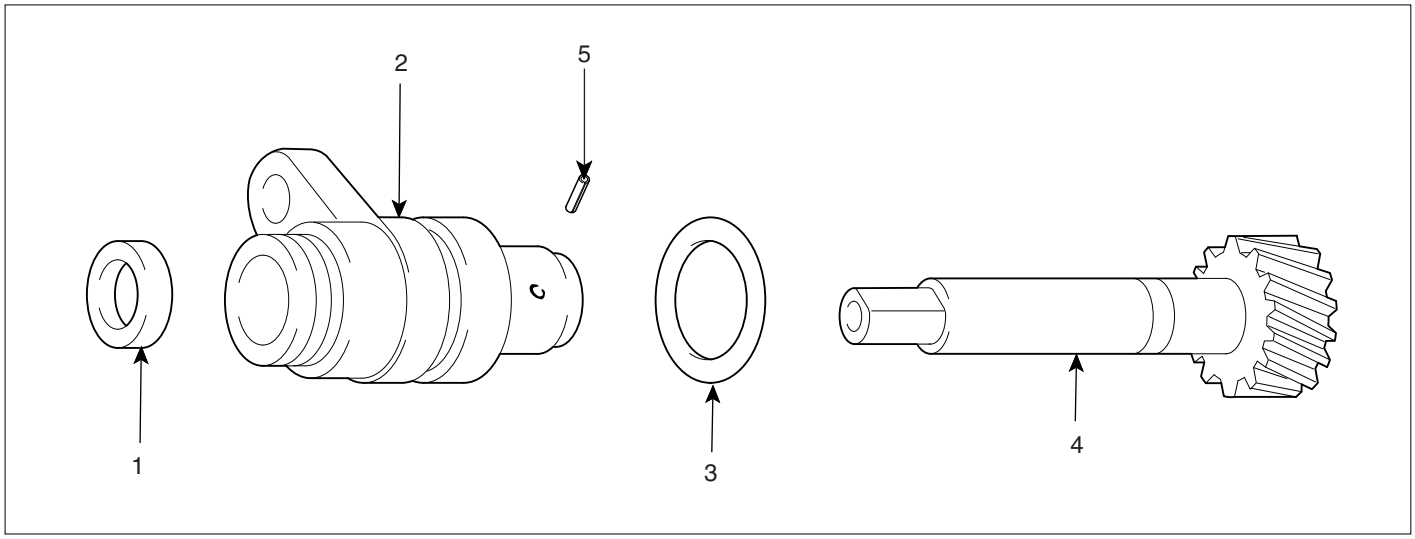
If a bolt is reused, remove the old sealant from the threads.



AMJF016J

SPEEDOMETER DRIVEN GEAR ASSEMBLY

COMPONENTS E5C04DA3

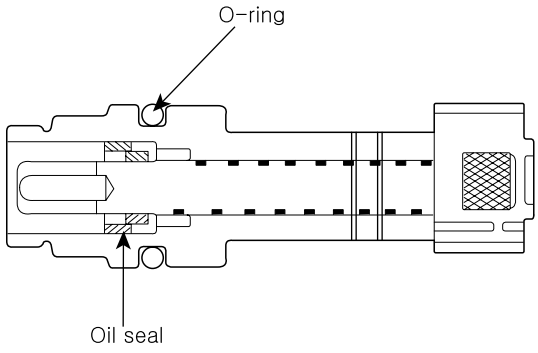


1. Oil seal
2. Sleeve
3. O-ring
4. Speedometer driven gear
5. Spring pin

LMJF018B

REASSEMBLY E4CDE2EC

Apply gear oil sparingly to the speedometer driven gear shaft and insert the shaft.



AMJF017B

Automatic Transaxle (A4AF3)

GENERAL

AUTOMATIC TRANSAXLE SYSTEM
AUTOMATIC TRANSAXLE

AUTOMATIC TRANSAXLE CONTROL SYSTEM
KICK DOWN SWITCH
PRESSURE CONTROL SOLENOID VALVE (PCSV)
PULSE GENERATOR
TRANSAXLE OIL TEMPERATURE SENSOR
TRANSAXLE RANGE (TR) SWITCH
SHIFT LEVER

GENERAL

SPECIFICATION E1CAAE4F

ITEM		CONTENTS
Engine displacement		G4EE(1.4)/ G4ED(1.6)
Torque converter	Type	3 elements, 2 phases, 1 stage
	Engine stall speed(rpm)	2400~2800
	Stall torque ratio	1.9
Transaxle	Type	Electronically controlled automatic transaxle with four-speed
Gear ratio	1st	2.846
	2nd	1.581
	3rd	1.000
	4th	0.685
	Reverse	2.176
Final gear ratio		4.381(G4EE)/ 4.041(G4ED)
Speedometer gear ratio		Drive 36/ Driven 31
Friction elements		3C2B1F (3Clutches 2Brakes 1OWC): 1-band, 4-multiple disc type 3 Clutches: Front clutch, Rear clutch, End clutch 2 Brakes: Low & reverse brake, Kick-down brake (Band type)
Planetary gear		1 Ravinoux type planetary gear set with long and short pinion
Solenoid valve		6 Solenoid valves (3-PWM, 3-ON/OFF) 2-Pressure control solenoid valves (PWM) 1-Damper clutch control solenoid valve (PWM) 3-Shift control solenoid valve (ON/OFF)

TIGHTENING TORQUE

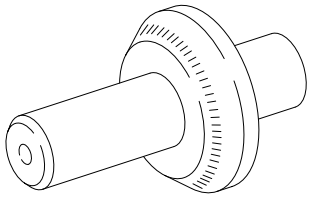
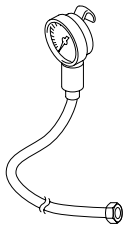
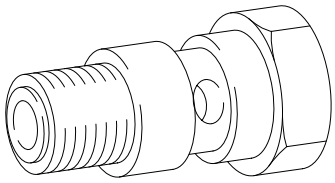
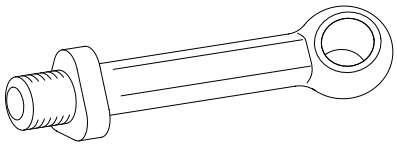
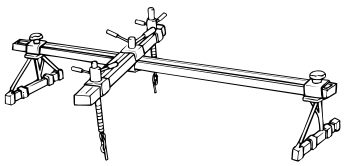
Items	Nm	kgf.cm	lb-ft
Oil pan bolt	10-12	100-120	7-8
Select lever assembly mounting bolt	9-14	90-140	6.5-10
Starter motor mounting bolt	27-34	270-340	19-24
Oil cooler hose connector	15-22	150-220	11-16
Hose bracket	3-5	30-50	2-4
Bell housing cover to engine	8-10	80-100	6-7
Transaxle mounting bolt(dia.10mm)	43-55	430-550	32-41
Transaxle mounting bolt(dia.12mm)	60-80	600-800	43-58
Control cable to body	8-11	80-110	6-7.5
Lever assembly to bracket assembly	14-22	140-220	10-16
Oil drain plug	35-45	350-450	25-32
Pressure check plug	8-10	80-100	6-7
Pulse generator	10-12	100-120	7-8
Bearing retainer	17-22	170-220	13-16

Items	Nm	kgf.cm	lb-ft
Transfer drive gear	16-21	160-210	12-15
One-way clutch inner race	35-45	350-450	25-32
Differential drive gear	130-140	1300-1400	94-101
Manual control lever	17-21	170-210	13-15
Manual control shaft lock screw	8-10	80-100	6-7
Inhibitor switch	10-12	100-120	7-8
Sprag rod support bolt	20-27	200-270	14-19
Pump housing to reaction shaft support bolt	10-12	100-120	7-8
Oil pump assembly mounting bolt	19-23	190-230	14-17
Valve body cover	10-12	100-120	7-8
Valve body assembly mounting bolt	10-12	100-120	7-8
Oil filter	5-7	50-70	4-5
Speedometer driven gear sleeve	3-5	30-50	2-4
End clutch cover	4-6	40-60	3-4
Kickdown adjusting screw	15-22	150-220	11-15
Rear cover bolt	19-23	190-230	14-17
Differential cover	20-27	200-270	14-19
Differential bearing cap	60-80	600-800	43-58
Differential bearing retainer	43-55	430-550	32-41
Locking nut(M38)-Input	180-210	1800-2100	130-152
Locking nut-Output	200-230	2000-2300	146-166
Shift cable bracket bolt	19-23	190-230	14-17

LUBRICANT

Items	**Specified lubricant**	**Quantity**
Transaxle fluid liter (U.S. lmp.qts.)	GENUINE DIAMOND ATF SP-III or SK ATF SP-III	6.1L
Drive shaft and oil seal lip bushing sliding parts	GENUINE DIAMOND ATF SP-III CHASSIS GREASE SAE J310, NLGINO.0	As required
Select lever sliding parts	SAE J310, NLGINo.2	

SPECIAL SERVICE TOOLS EBFB2F30

Tool (Number and name)	Illustration	Use
09431-21200 Oil seal installer	 Y45005C	Installation of the differential oil seal.
09452-21500 Oil pressure gauge	 EKAA006C	Measurement of the oil pressure. (Use with 09452-21001 and 09452-21002)
09452-21002 Oil pressure gauge adapter	 EKAA006B	Measurement of the oil pressure. (Use with 09452-21500 and 09452-21001)
09452-21001 Oil pressure gauge adapter	 EKAA006A	Measurement of the oil pressure. (Use with 09452-21500 and 09452-21002)
09200-38001 Engine support fixture	 D0038001	Removal and installation of the transaxle.

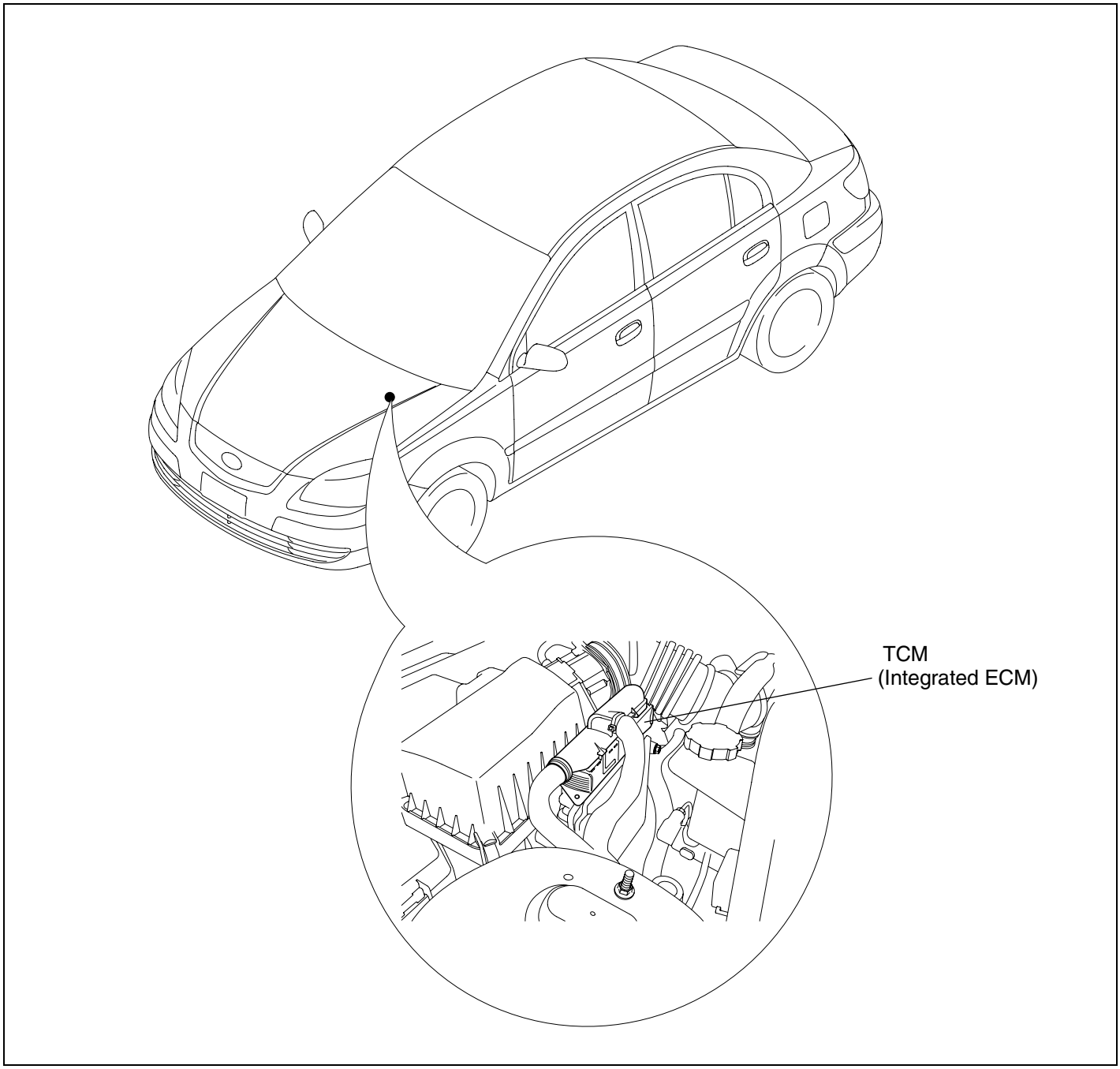
AUTOMATIC TRANSAXLE SYSTEM

DESCRIPTION EA641954

The advanced alpha automatic transaxle is for a 1.4/1.6 DOHC engine. The advanced alpha AT which is developed by HMC is popularly used among small sized vehicles.

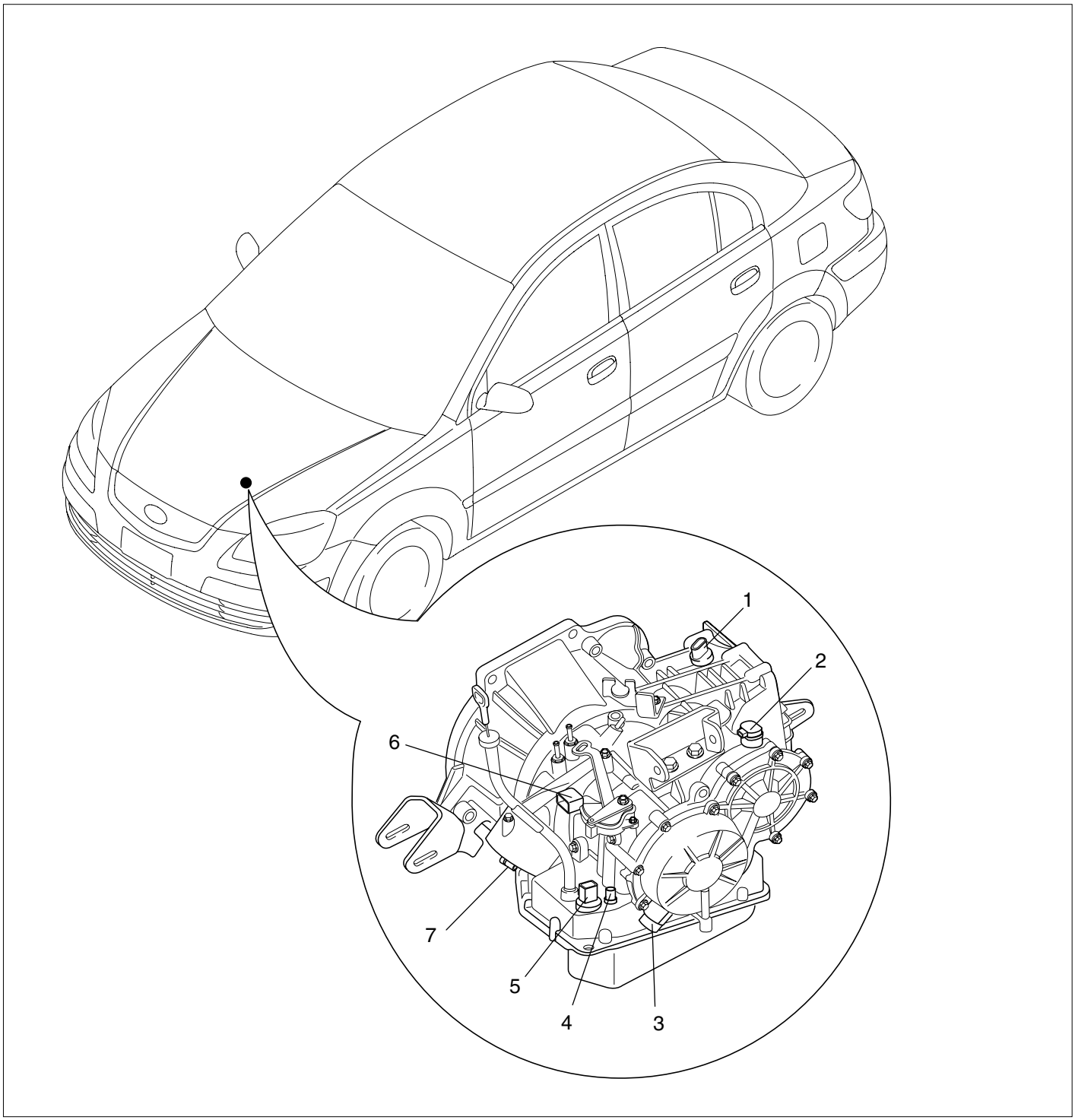
Nowadays PCM(power-train control module), which ECU and TCU are integrated inside, is new trend of the power-train system.
The merge of two system guarantees stable quality of the AT as well as better shift feeling and faster response to ECU information.

COMPONENTS(1)



LKJF001A

COMPONENTS(2)

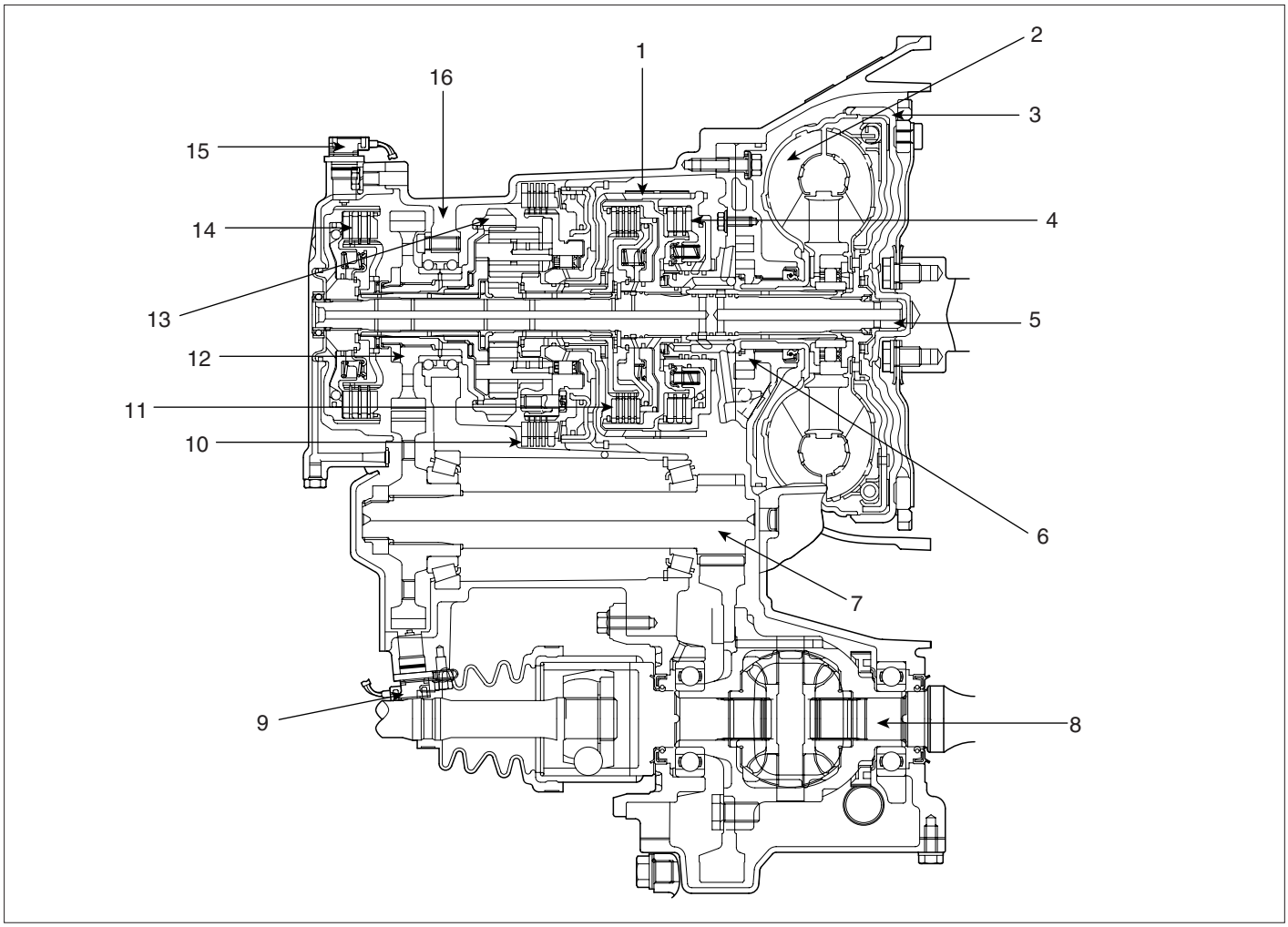


1. Vehicle speed sensor
2. Output shaft speed sensor
3. Input shaft speed sensor
4. Fluid temperature sensor
5. Solenoid valve
6. Inhibitor switch
7. Kickdown servo switch

LKJF001B

MECHANICAL SYSTEM

COMPONENTS



1. Kickdown band
2. Torque converter
3. Damper clutch
4. Front clutch
5. Input shaft
6. Oil pump
7. Transfer drive gear
8. Transfer driven gear
9. Pulse generator B
10. Low&Reverse brake
11. Rear clutch
12. Output shaft
13. Planetary gear set
14. End clutch
15. Pulse generator A
16. Transaxle case

LKJF002A

FUNCTION

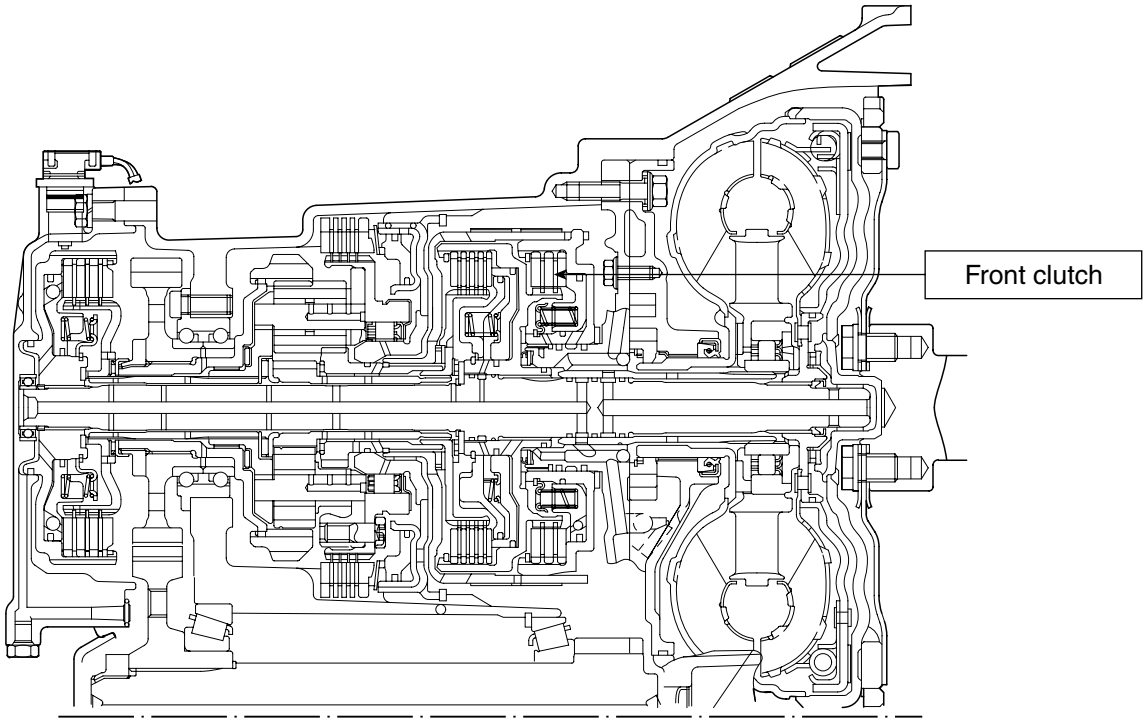
Component	Symbol	Function
Front clutch	F/C	Connect input shaft and reverse sun gear
Rear clutch	R/C	Connect input shaft and forward sun gear
End clutch	E/C	Connect input shaft and planetary carrier
Kick down brake	K/D	Hold reverse sun gear
Low & Reverse clutch	L/R	Hold planetary carrier
One way clutch	OWC	Restrict planetary carrier turning direction

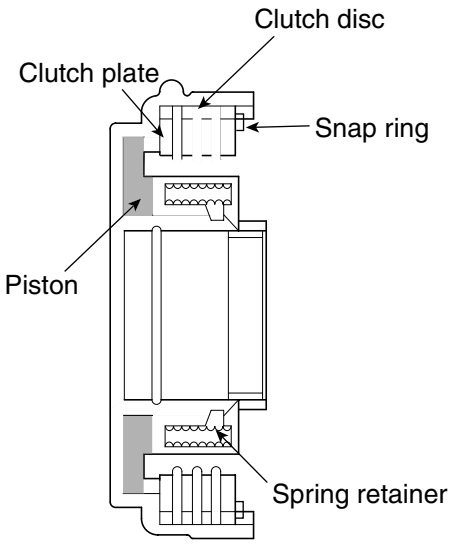
FRONT CLUTCH

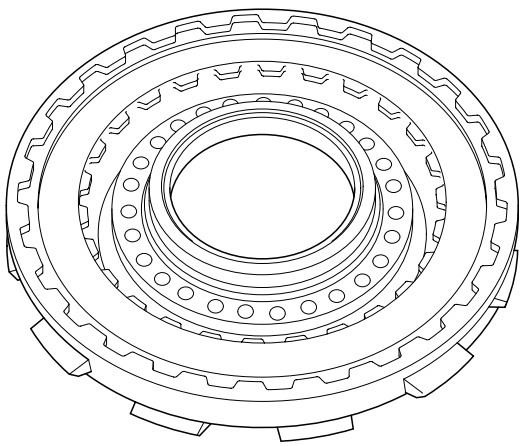
Front clutch is engaged at 3rd gear of D range and R range. When it is engaged, reverse sun gear of the planetary gear rotates.

Power flow:

Input shaft→ Rear clutch retainer→ Front clutch→ Kick-down drum→ Reverse sun gear→ Long pinion→ Ring gear→ Transfer driven gear







Front clutch

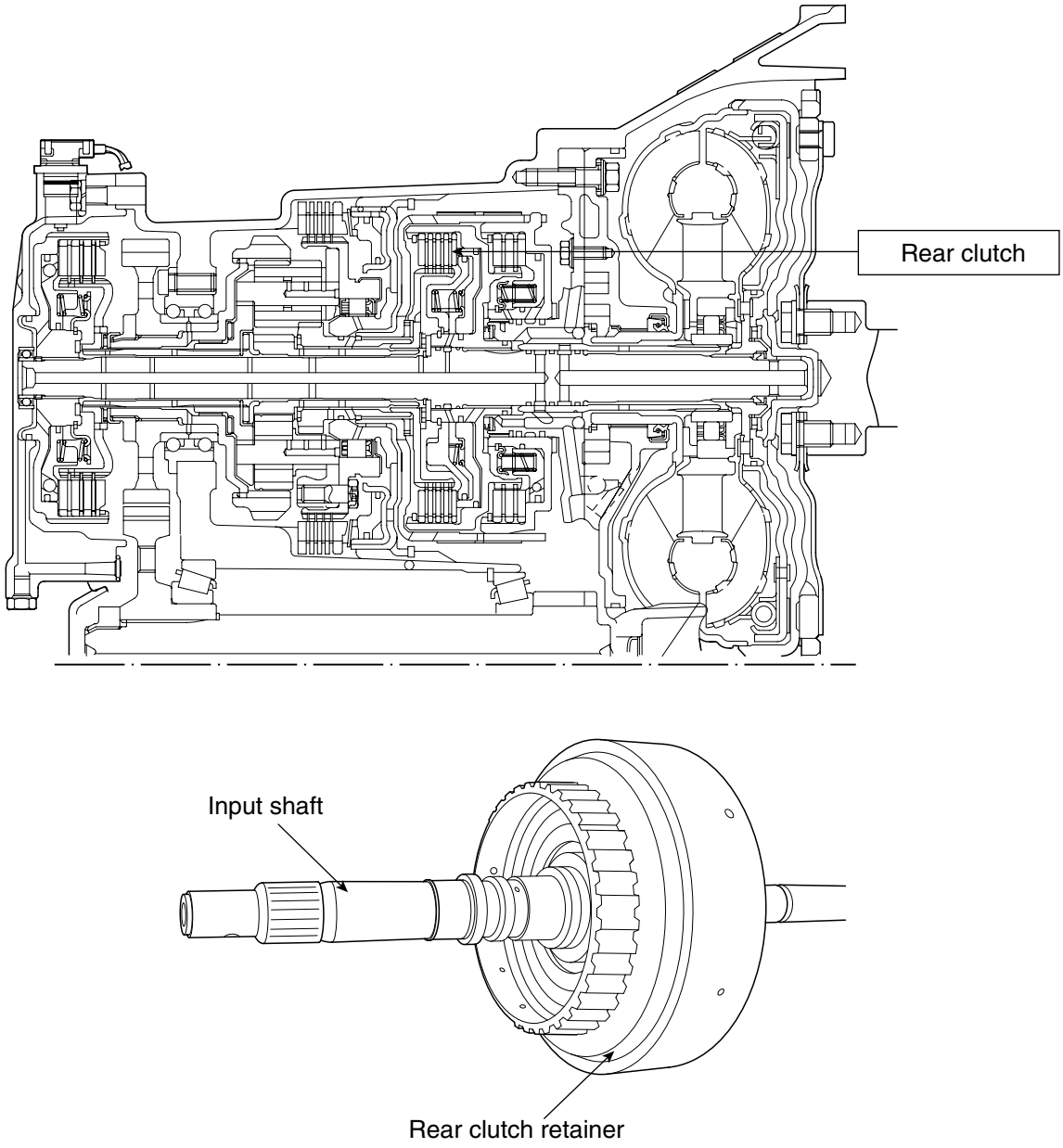
LKJF002B

REAR CLUTCH

Rear clutch is engaged at 1st~3rd gear of D/2/L range. When it is engaged, forward sun gear of the planetary gear rotates.

Power flow:

Input shaft→ Rear clutch retainer→ Rear clutch→ Rear clutch hub→ Forward sun gear→ Short pinion



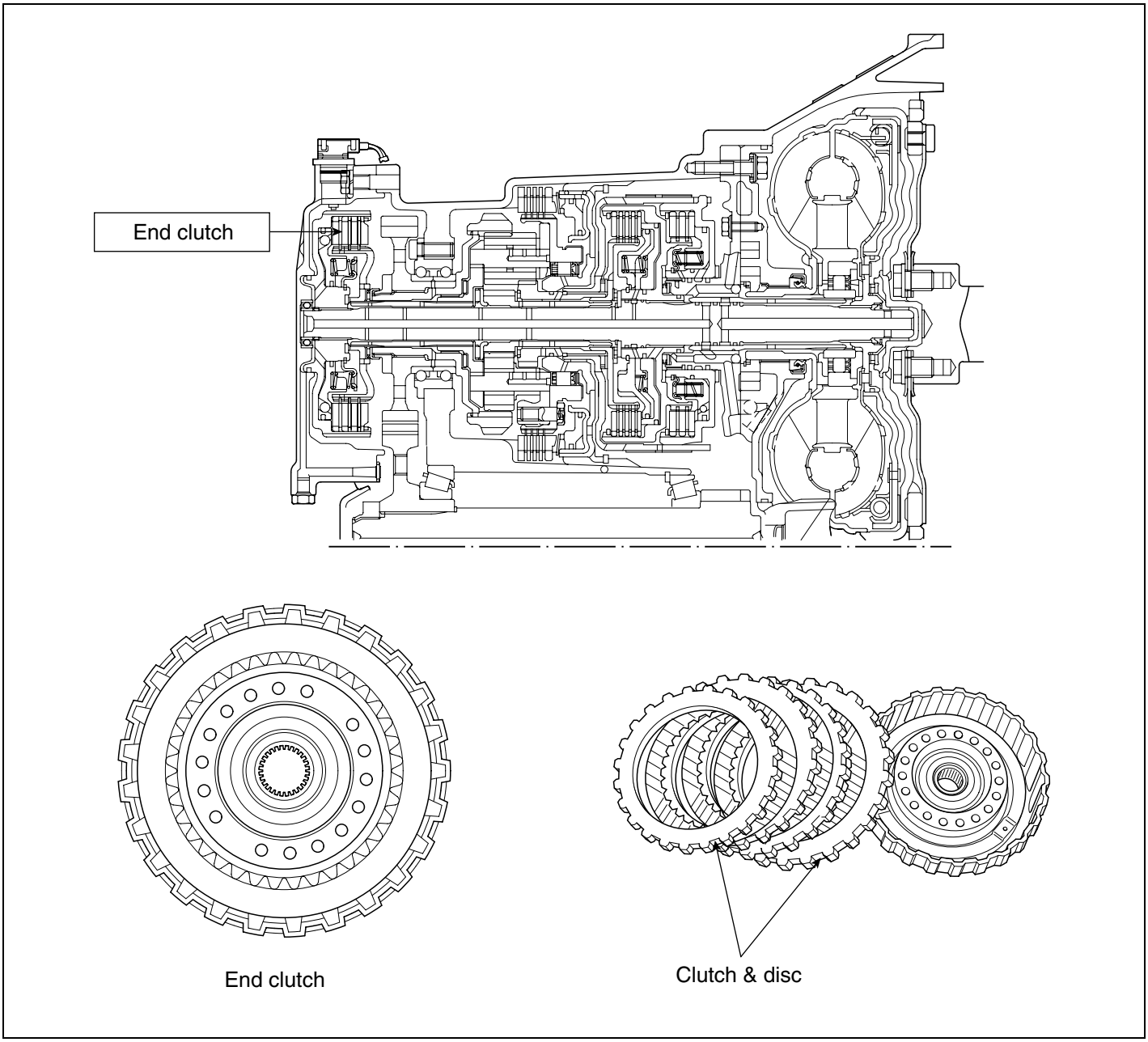
LKJF002C

END CLUTCH

End clutch is engaged at 4th gear (Actually, end clutch is being engaged from 3rd gear.
This is only for smooth shifting to 4th gear).
When it operates, planetary carrier rotates.

Power flow:

Input shaft→ End clutch retainer→ End clutch→ End clutch hub→ End clutch shaft→ Planetary carrier → Ring gear→ Transfer driven gear



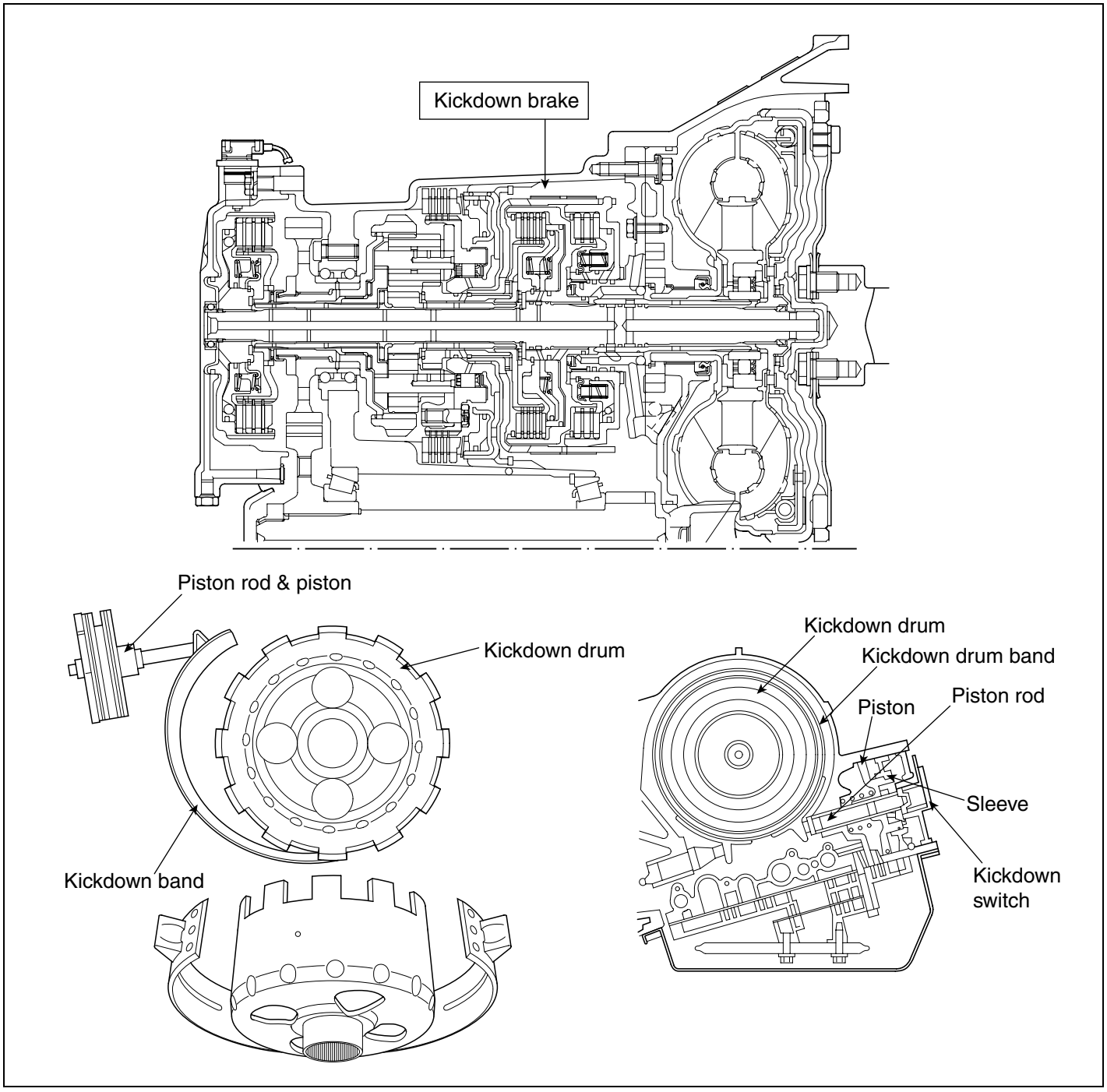
LKJF002D

KICK DOWN BRAKE

End clutch is composed of a kick down brake band, drum, servo piston and servo switch. It is engaged at 2nd & 4th gear. When it operates, reverse sun gear of the planetary gear is hold.

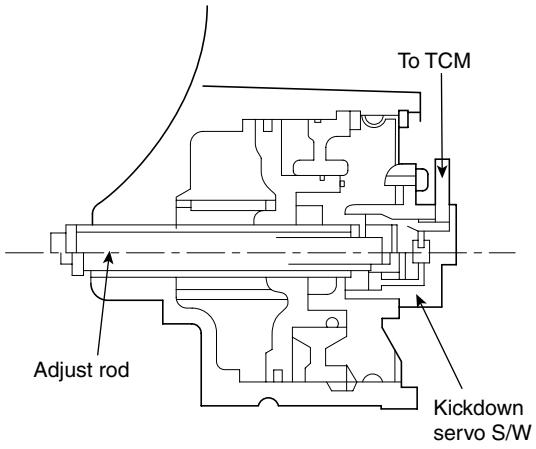
Power flow:

Kick down brake→ Kick down drum hold→ Reverse sun gear hold



LKJF002E

The kickdown brake is a band type brake; it is composed of a kickdown band, drum, kickdown servo, switch and anchor. When the 2nd pressure is admitted to the apply side chamber of kickdown servo cylinder, the kickdown piston and rod moves toward the left, tightening the brake band to hold the kickdown drum. As a result, the reverse sun gear (interlocked with the kickdown drum) is held. This brake functions during 2nd gear and during overdrive. The kickdown servo switch detects the position of the kickdown piston just before the brake is applied, and sends the signal to the transaxle control module. Using this signal, the transaxle control module controls the 2nd pressure both before, and during application of the brake. In the initial control stage or until just before the kickdown brake is applied, a higher 2nd pressure is supplied to the kickdown servo so that the kickdown piston con move quickly for faster response to the kickdown condition that has been initiated. In the second control stage or while the brake is being applied, the 2nd pressure is regulated at an optimum level so that the band is tightened on the drum the proper amount for good kickdown "feeling".



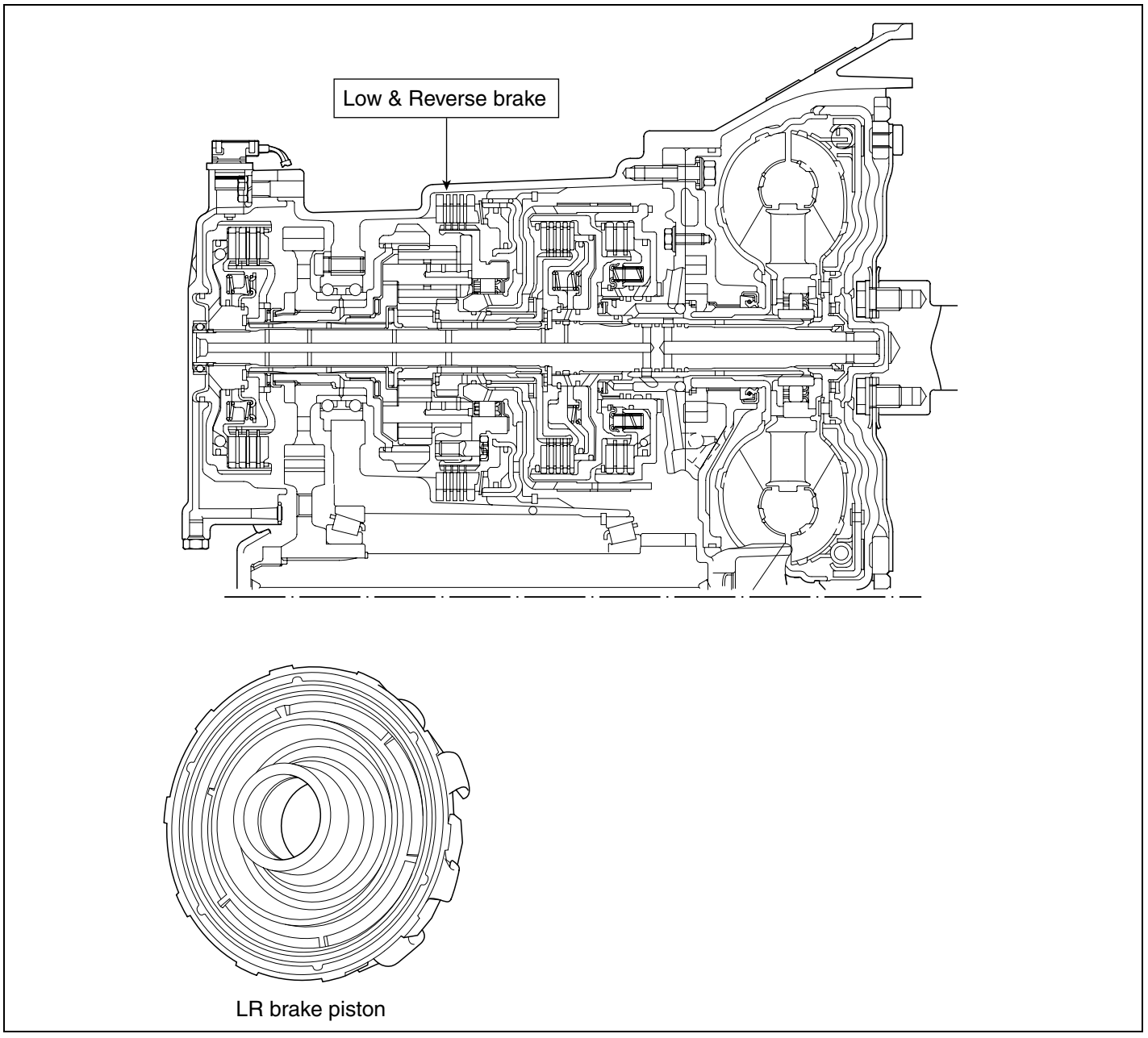
LKJF002F

LOW & REVERSE BRAKE

Low & Reverse brake is engaged at 1st gear of L range and R range. When it operates, the planetary carrier is hold.

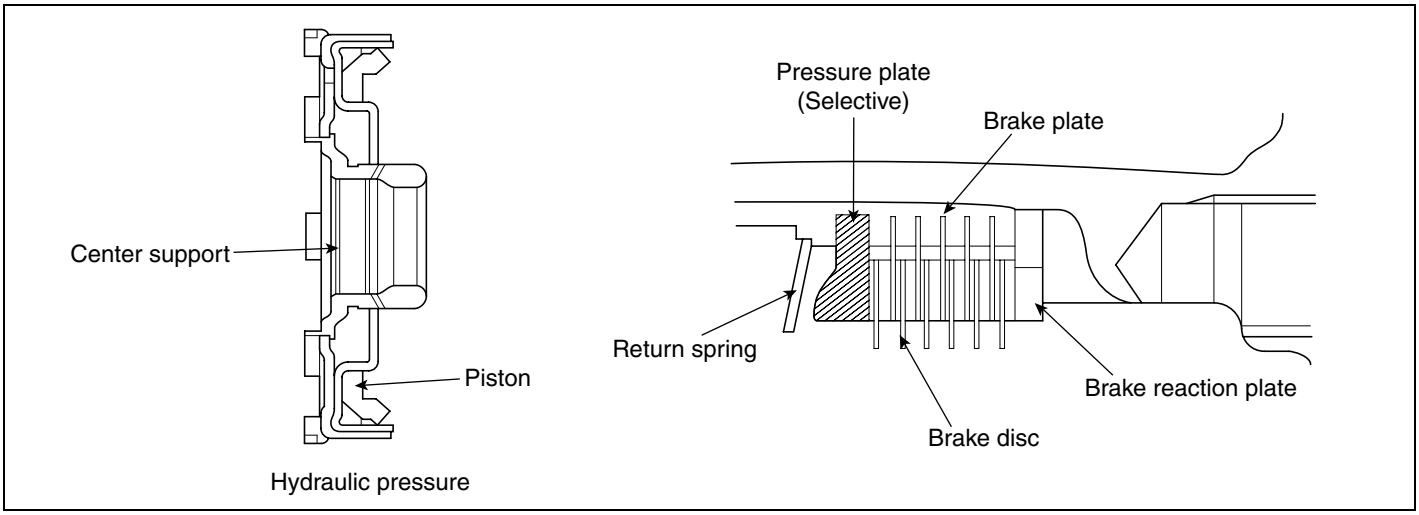
Power flow:

Low & Reverse brake→ Planetary carrier hold



LKJF002G

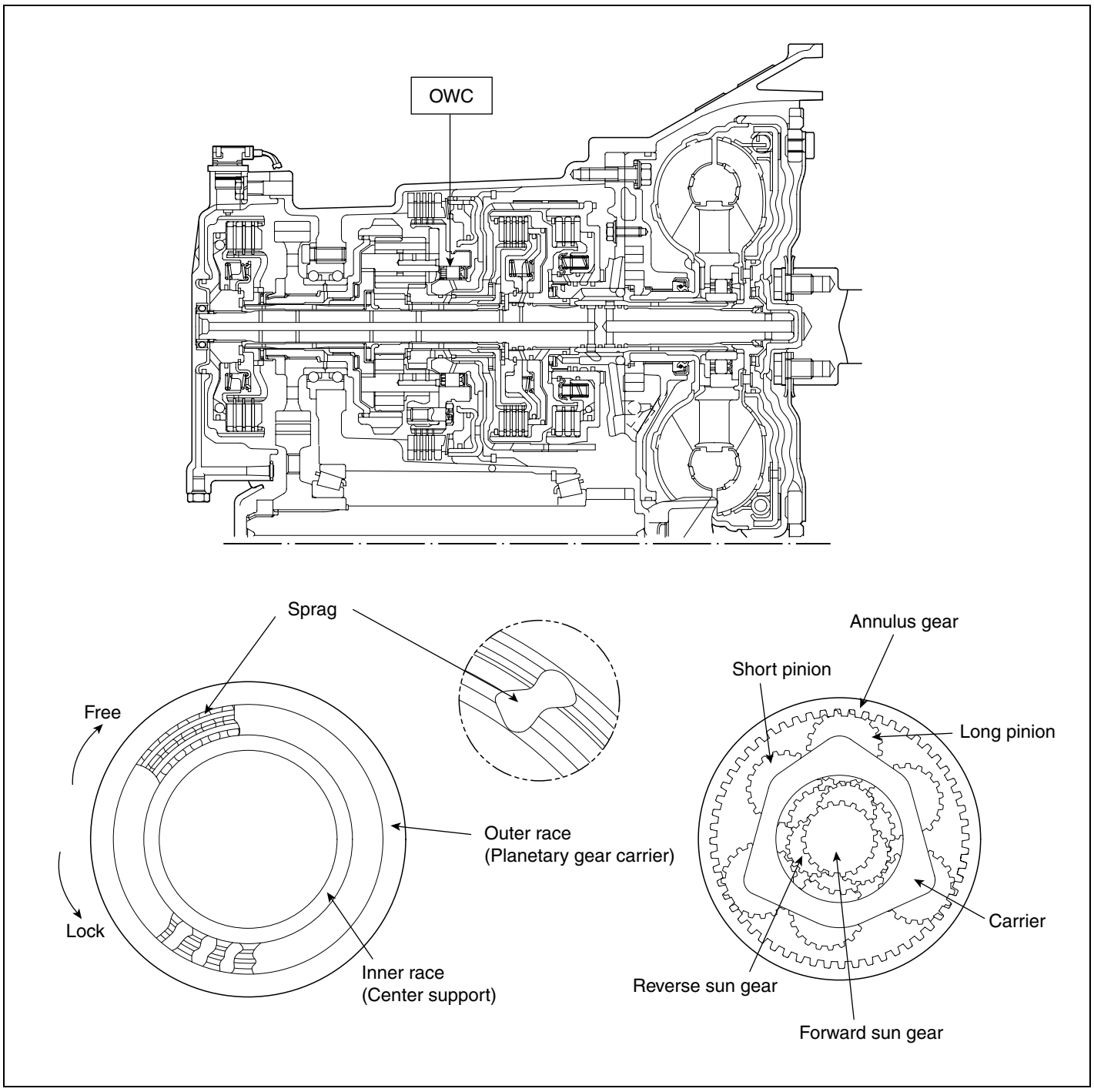
Low & reverse brake is of the multiple disc type and is composed of a center support, disc plates and a piston. The brake operates when the shift is in 1st gear in the "L" range or back gear. It fastens the carrier in the planetary gearing set. That is, the shafts of the long and short pinions are fastened.



LKJF002H

ONE WAY CLUTCH (O.W.C)

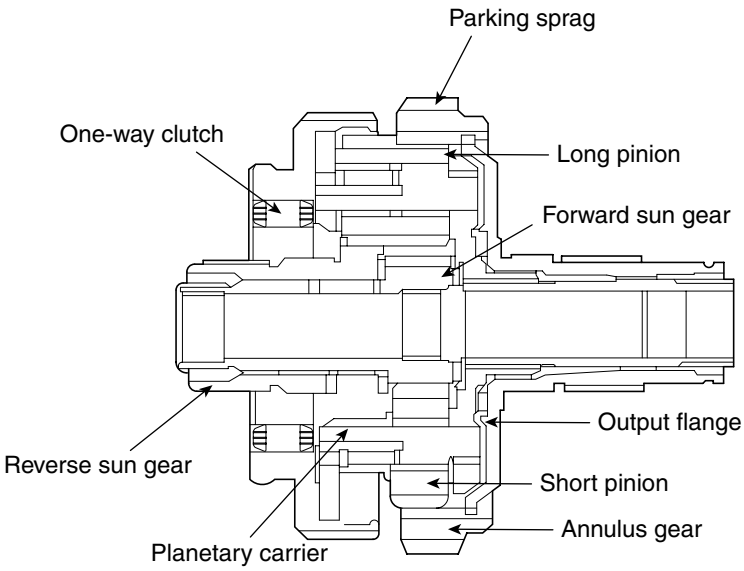
One-way clutch is of the sprag type and is incorporated between the pinion carrier and the center support.
In 1st gear (D or 2 range), the long pinion rotates clockwise. This reduces a force which has the tendency to cause the carrier is blocked from rotating in that direction by the one-way clutch. As a result, the long pinion transmits its force to the annulus gear. The carrier, which is coupled with the one-way clutch outer race, is free to turn in clockwise direction.
In an engine braking condition under which the annulus gear is turned first, the carrier turns clockwise freely and, therefore, the engine braking effect is not obtained.



LKJF002I

PLANETARY GEAR

The planetary gear set incorporated in this transaxle consists of a forward sun gear, a reverse sun gear, a short pinion, a carrier to support both pinions, and an annulus gear.
The reverse sun gear is connected to the front clutch retainer via the kickdown drum, while the forward sun gear is connected to the rear clutch hub.
The carrier is built in one unit with the low reverse brake's hub and the outer race of the one-way clutch. The carrier is connected to the end clutch via the end clutch shaft.
The annulus gear, to which the output flange is connected, conveys driving force to the transfer drive gear installed on the output flange. And the parking sprag is provided on the outer circumference of the annulus gear.
The Ravigneaux type plnetary gear set consists of two sun gears, each meshing with one of two sets of planetary pinion gears in a single carrier, and a single annulus gear that meshes with one of the sets of pinions. The two sun gears are called the forward and the reverse sun gears, for the gear conditions they operate in. Power input is to either of these two sun gears. Power output is through the annulus gear, which has the parking sprag on the outer circumstance. Various holding elements are built into gear set components.- Ravigneaux type planetary gear ratio.

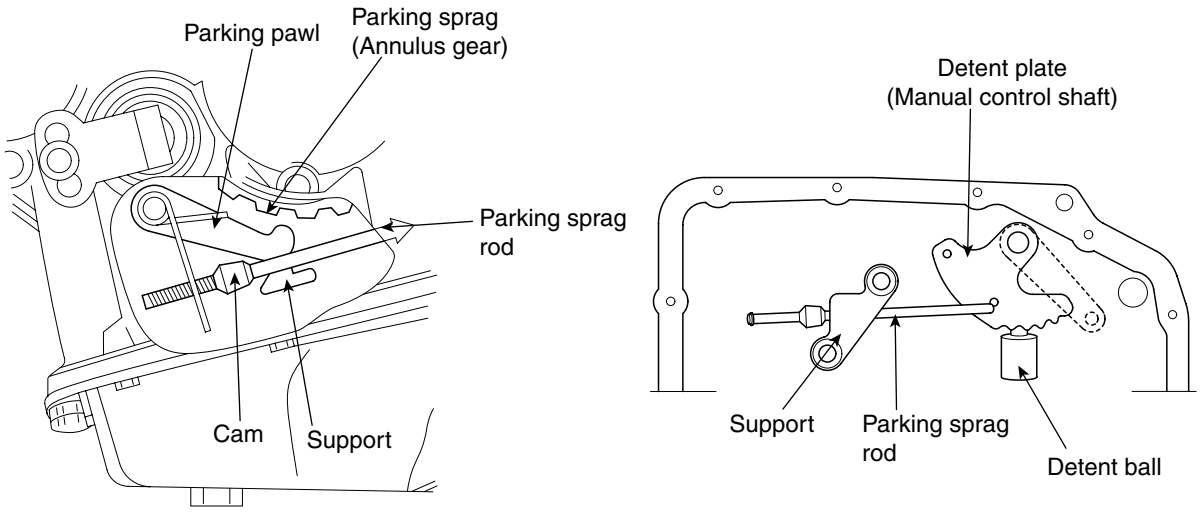


LKJF002J

PARKING MECHANISM

When the shaft is in the "P" range, the parking pawl engages with the parking sprag provided on outer circumference of the annulus gear to fasten the output shaft, to prevent the wheels from rotating. In other words, when the select lever is set to the "P" range, the detent plate and the parking sprag rod move in the direction of arrow, causing the cam on the parking sprag rod to push up the parking pawl to engage with the sprag.
In case the parking pawl collides against a crest of the sprag, only the rod moves because the parking pawl cannot be moved upward, and the cam, while pressing the spring, collides with the parking pawl and the support, and is withheld in this condition. If the car is moved even slightly in this condition, the turning of wheels causes the annulus gear to turn as well. Since the cam is pressed in the direction of arrow, the parking pawl is pushed up as a bottom of the sprag aligns with the parking sprag to engage with the sprag.
In this way, the parking mechanism eliminates any chances of the vehicle from being idly moved.

No.	Cause	Symptom	Analysis	Remedy	Remarks
1	Calking due to cam broken	Forward and/ or reverse drive impossible intermmittently	Parking sprag locks the annulus gear due to drifted cam	Replace parking sprag rod	
2	Detent ball separated	Looseness of manual lever	Detent plate not fixed properly	Install detent ball	



LKJF002K

POWER FLOW

Selector lever position			Gear position	Clutches			Brakes			Re-marks
				F/C	R/C	E/C	K/D	L & R	OWC	
P			Parking							☆ □
R			Reverse	○				○		
N			Neutral							☆
D	O/D S/W ON	O/D S/W OFF	1st		○				○	
			2nd		○		○			
			3rd	○	○	△				
			4th			○	○			
2			1st		○				○	
			2nd		○		○			
L			1st		○			○		

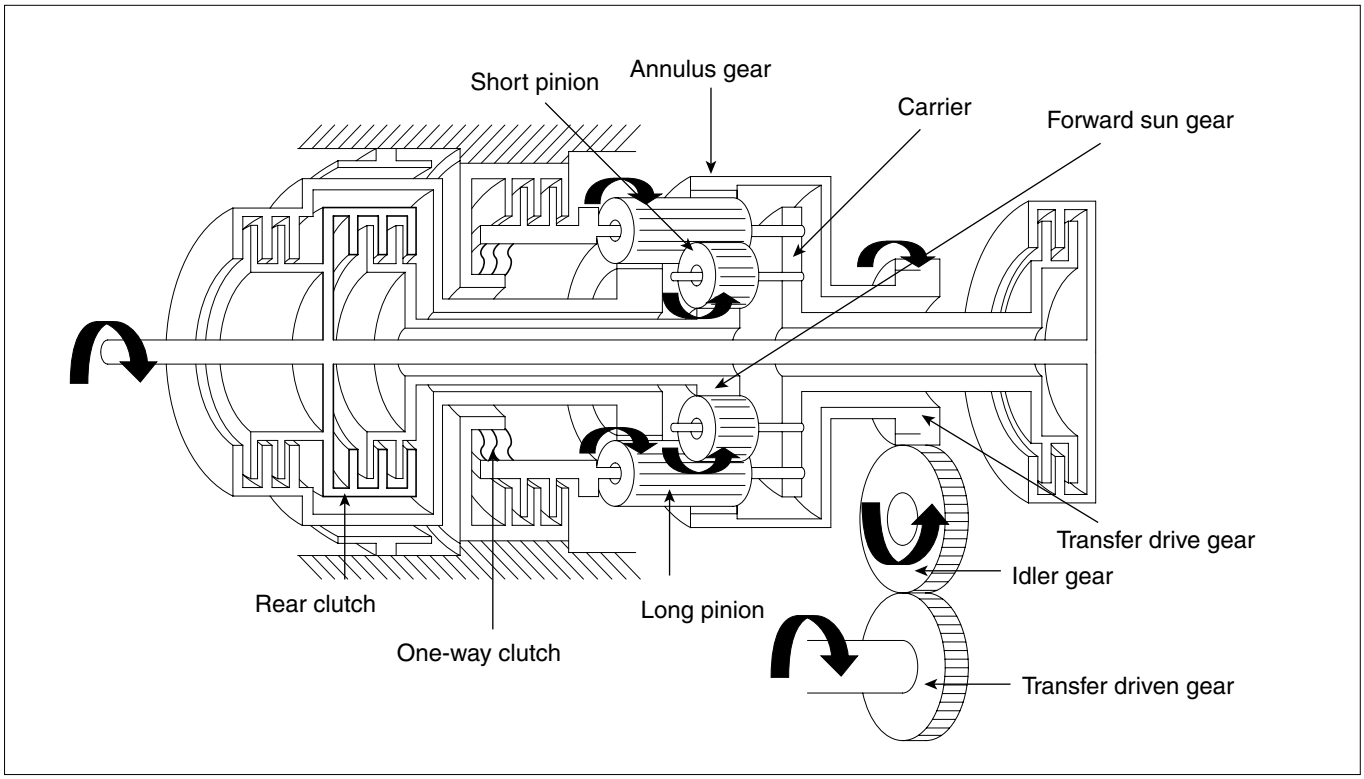
☆ - Engine start possible
□ - Parking mechanism
○ - Element engaged in each gear position
△ - Pre-engaged element

- F/C : Front Clutch
- R/C : Rear Clutch
- E/C : End Clutch
- OWC : One Way Clutch
- K/D : Kickdown brake
- L & R : Low & Reverse brake

For each shift condition, certain holding units in the transaxle are used. Knowing which holding element is used and how they are connected in the transaxle, we can trace the power flow through the transaxle for each shift condition. One set of pinions, the short pinions, meshes with the reverse sun gear.
The other set, the long pinions, meshes with both the forward sun gear and with the annulus gear. The two sets of pinions also mesh with each other in pairs. The pinion carrier is built as a unit with the low reverse brake hub and the outer race of the one-way clutch. Power input is to either of the two sun gears.
The reverse sun gear is connected to the front clutch retainer through the kick-down drum. The forward sun gear is connected to the rear clutch hub. So by engaging either the front or the rear clutch, power is directed to either the reverse or the forward sun gear. When both front and rear clutches are engaged, the gear set is locked, and power passes directly through the transaxle. Power output is through the annulus gear, which has the parking sprag on the outer circumference and is connected to the output flange.

1ST GEAR ("D" AND "2" RANGE)

→ Operating elements: Rear Clutch, One-Way Clutch



The rear clutch and one-way clutch are engaged.

↓

Operation of rear clutch rotates the forward sun gear clockwise.

↓

Rotation of forward sun gear moves the ring gear (annulus gear) via pinion gears.

↓

At the moment, the planetary carrier tries to move counterclockwise because of long pinion.
However the one-way clutch holds the carrier rotation to count-clockwise, all power is delivered to the ring gear (annulus gear).

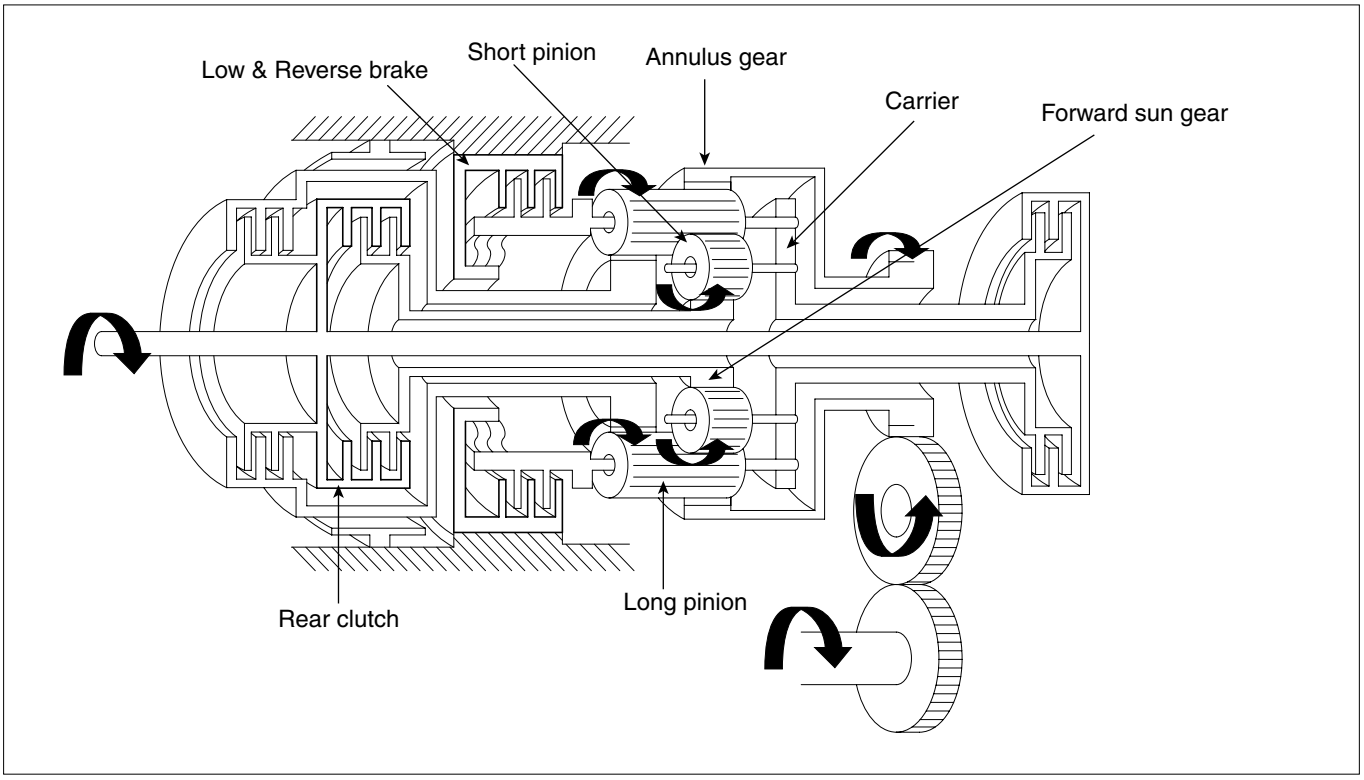
↓

On the contrary, power from the ring gear (annulus gear) is delivered back to the planetary carrier.
At the moment the carrier rotates clockwise loosing the power. Engine brake does not work.

LKJF002L

1ST GEAR ("L" RANGE)

→ Operating elements: Rear Clutch, Low & Reverse Brake



At "L" range 1st gear, the rear clutch and low & reverse brake are engaged.

Planetary carrier is fixed.

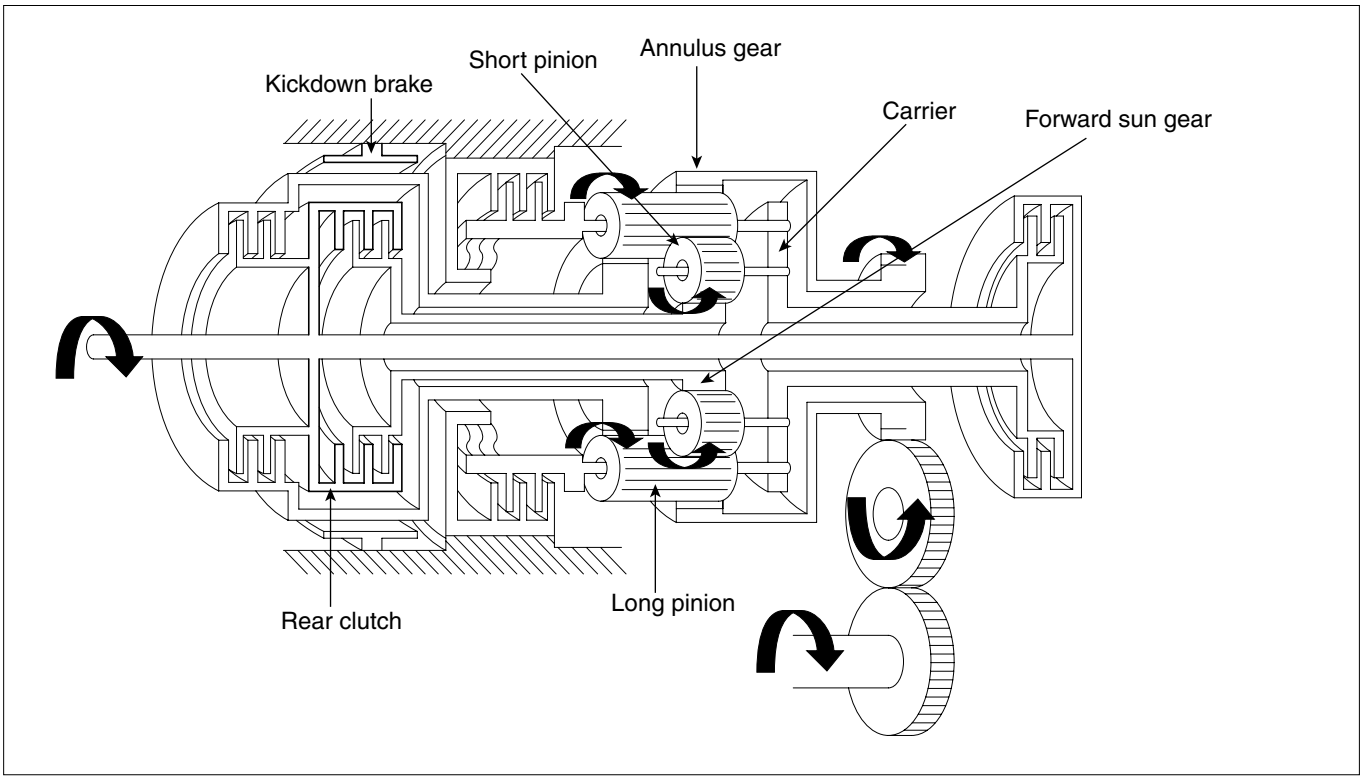
All power is delivered to the ring gear (annulus gear) via pinion gears.

In the case that power is delivered from the ring gear back to the planetary carrier.
The carrier cannot be rotated with any direction, and the engine brake does work.

LKJF002M

2ND GEAR ("D" AND "2" RANGE)

→ Operating elements: Rear Clutch, Kick Down Brake



At 2nd gear the rear clutch and kick down brake are engaged.

↓

Operation of rear clutch rotates the forward sun gear clockwise.

↓

Rotation of forward sun gear moves the ring gear via pinion gears.

↓

At the moment, the reverse sun gear is fixed by the kick down brake.

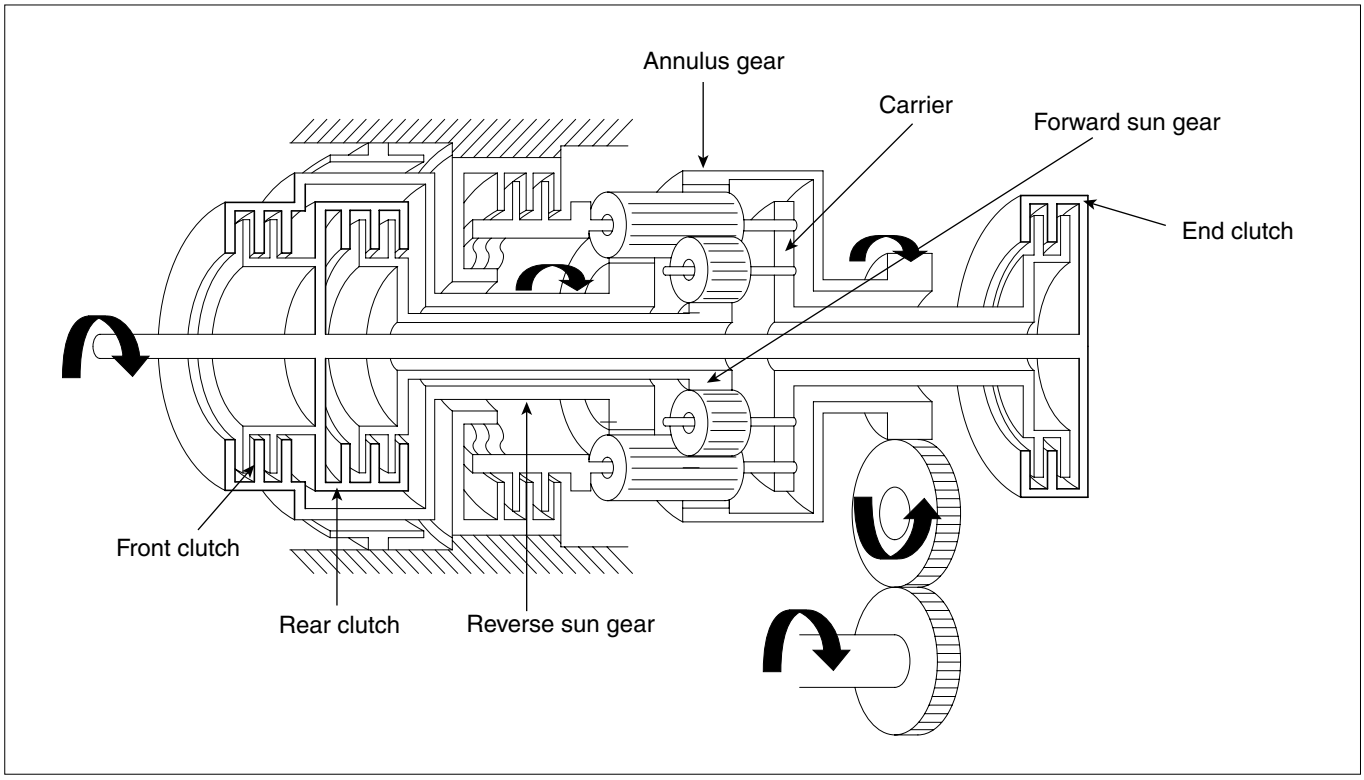
↓

Long pinion gears are rotating around the sun gear. The speed of the ring gear (annulus gear) is faster than 1st gear.

LKJF002N

3RD GEAR ("D" RANGE)

→ Operating elements: Front Clutch, Rear Clutch, End Clutch



At 3rd gear the front clutch and the rear clutch are engaged.
End clutch is engaged only to prepare the 4th gear for the purpose of reducing the 3-4 shifting shock.
However end clutch does not deliver the power at 3rd gear.

↓

Power is delivered to the forward sun gear and the reverse sun gear.

↓

The forward sun gear and the reverse sun gear rotate same direction.
At the moment the short pinion gears and the long pinion gears are fixed, the planetary gear set rotates as one unit.

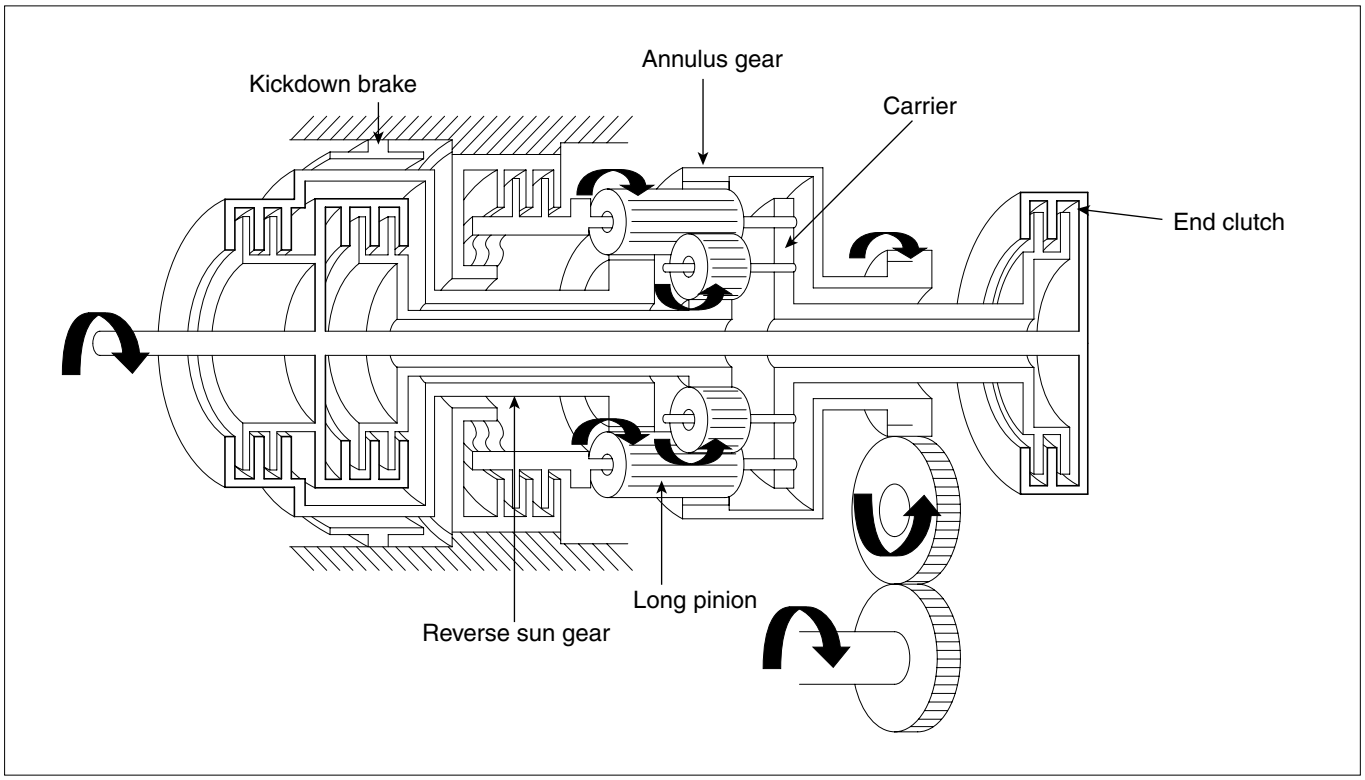
↓

Input speed is directly delivered to the ring gear (annulus gear).

LKJF002O

4TH GEAR ("D" RANGE)

→ Operating elements: Front Clutch, Rear Clutch, End Clutch



At 4th gear, the end clutch and the kick down brake are engaged.

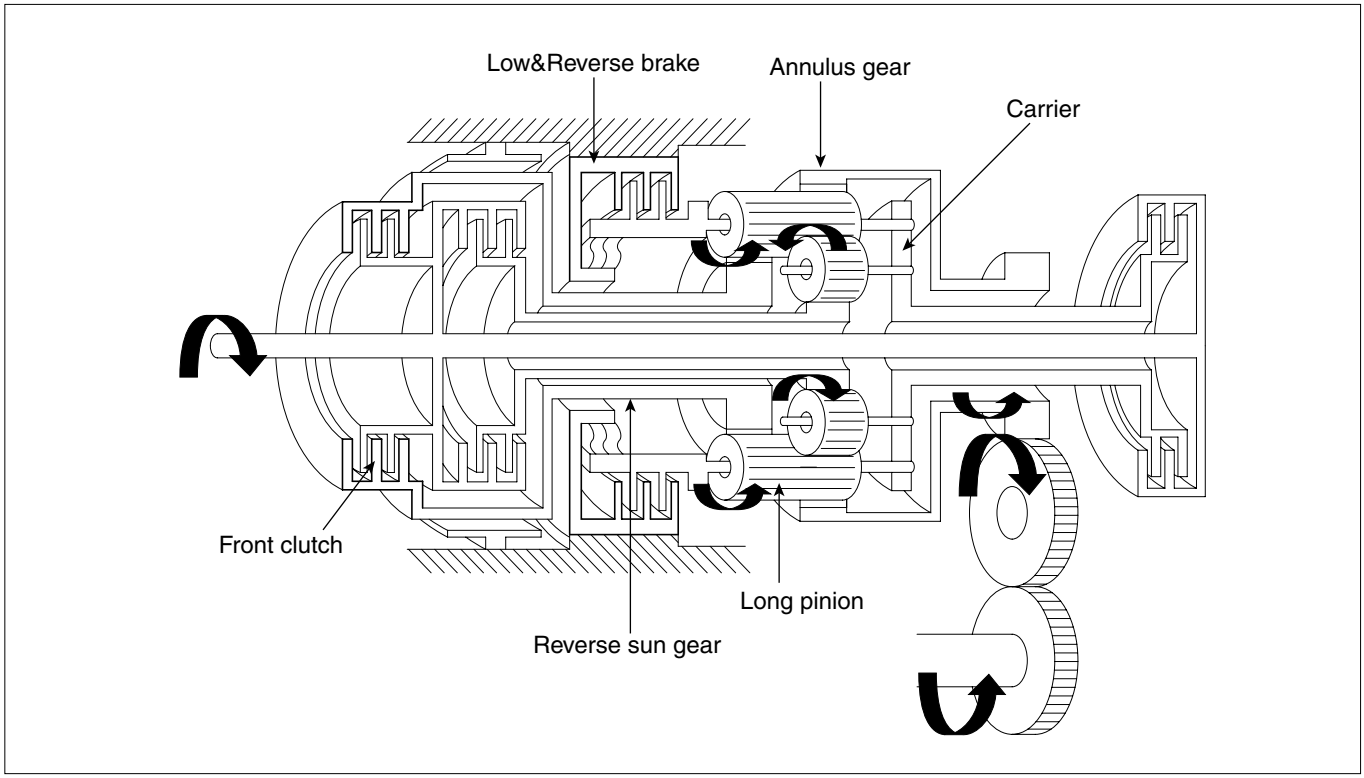
Power is delivered to the planetary carrier by the end clutch.

At the moment, the reverse sun gear is fixed by the kick down brake and the long pinion gears are rotating around the reverse sun gear.
The ring gear (annulus gear) speed is faster as much as the reverse sung gear circumference than the 3rd gear speed.

LKJF002P

"R" RANGE

→ Operating elements: Front Clutch, Low & Reverse Brake



The front clutch and the low & reverse brake are engaged.

↓

Power is delivered to the reverse sun gear and it rotates clockwise.

↓

The planetary carrier is fixed by the low & reverse brake.
The rotation of the reverse sun gear turns the long pinion gears counterclockwise.
And the ring gear (annulus gear) which is contacting the long pinion gears rotates counterclockwise.

↓

In the case that power is delivered from the ring gear back to the planetary carrier.
The carrier cannot rotate any direction, engine brake does work.

LKJF002Q

HYDRAULIC CONTROL SYSTEM E7DBDAD0

1. The hydraulic pressure during gear shifting engages the clutches and applies the brakes. It is regulated by the pressure control valve. The hydraulic pressure that works on the pressure control valve is further regulated by the pressure control solenoid valve which functions under the control of the transaxle control module. The transaxle control module controls the solenoid valve through the duty control, thus providing appropriate regulation of the hydraulic pressure.

2. The transaxle control module decides the timing of the gear-shifting period (during which it performs hydraulic pressure control for gear shifting) according to the change in the kickdown drum rotating speed that it detects. The module identifies the time just before the kickdown brake is applied and uses that as the timing for initiating control of the hydraulic pressure that is to be applied to the kickdown brake.

3. TCM detects torque change ratio (turbine speed change ratio in torque converter). If input torque is larger than the pre-set torque in TCM, TCM controls the duty of PCSV and changes oil pressure. Shift shock will be alleviated due to torque control. Torque change ratio is applied differently according to each pattern.

4. When the transaxle is cold, the fluid viscosity is high, causing slower oil pressure response. In such conditions, the transaxle control module provides a correction for the oil pressure by changing the control duty of the pressure control solenoid valve. This control is performed when the fluid temperature as indicated by the oil temperature sensor is lower than 60°C(140°F).

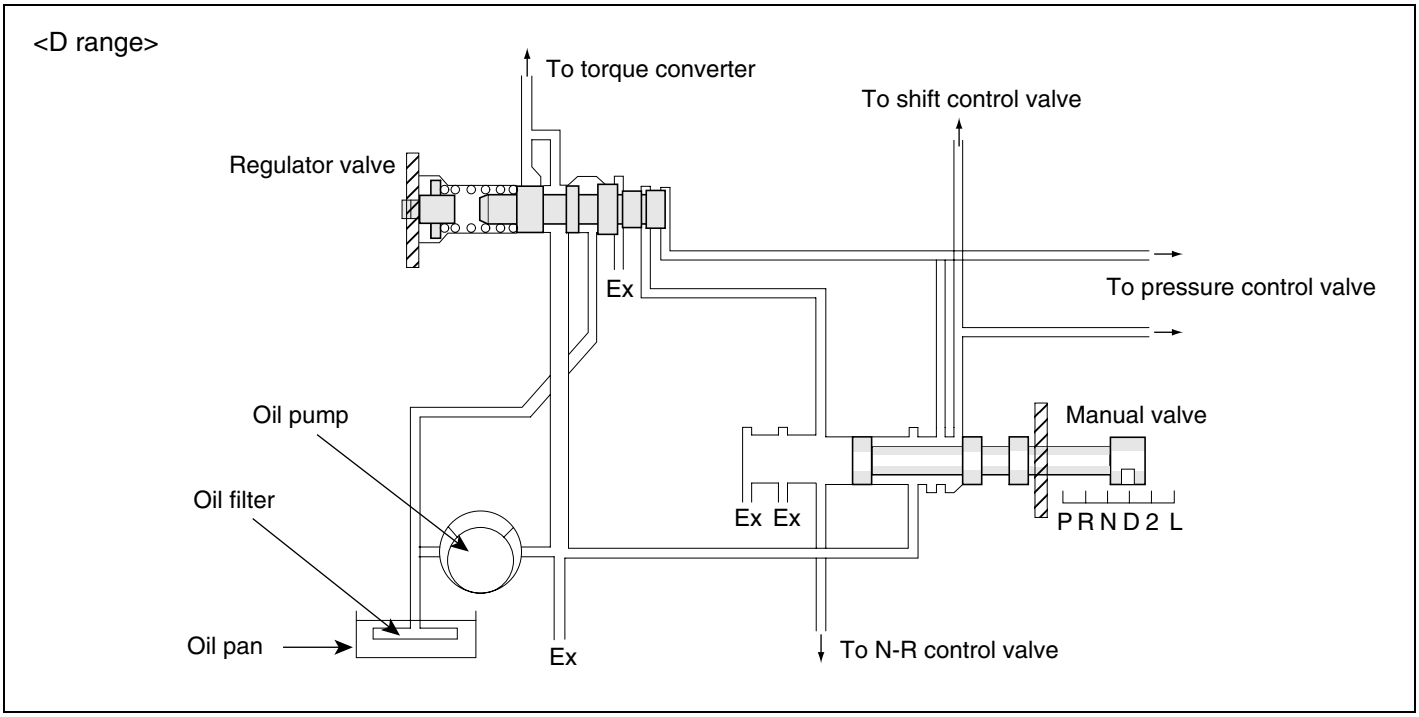
5. After the engine has been started and the vehicle is in motion, the transaxle control module continues to refine its performance for smoothest possible gear shifting.
   The hydraulic control system consists of an oil pump that generates hydraulic pressure for A/T. It also has valves and solenoid valves that control the hydraulic pressure or switch the oil passage. The valves and solenoid valves are all built into the valve body.
   For better and smoother shift quality, the rear clutch pressure is controlled independently, 4th→2nd gear skip shift is available and the line pressure at 3rd/4th gear is reduced.
   There are 6 solenoid valves are incorporated on the valve body. 2 of those are duty-controlled type and the rest are ON/OFF type.
   - Duty control type: Pressure control solenoid valve A/B, Damper clutch control solenoid valve
   - ON/OFF type: Shift control solenoid valve A/B/C

   If the mechanical malfunction such as valve stick is occurred, the fail-safe valve has been adopted to prevent interlock. The line pressure is regulated at the 4th speed to improve the efficiency of power transmission. This function is performed by High-low pressure valve and regulator valve.

OIL PUMP

Oil pump generates pressure for supplying oil to the torque converter, for lubricating frictional parts of the planetary gearing set and the overrunning clutch, etc.., and for activating the hydraulic control system.
The pump is one of the inner-teeth engaging trochoid type. It always generates the oil pressure when the engine is running since the drive gear is driven by 2 pawls of the pump drive hub welded at the center of the torque converter shell.

MANUAL VALVE



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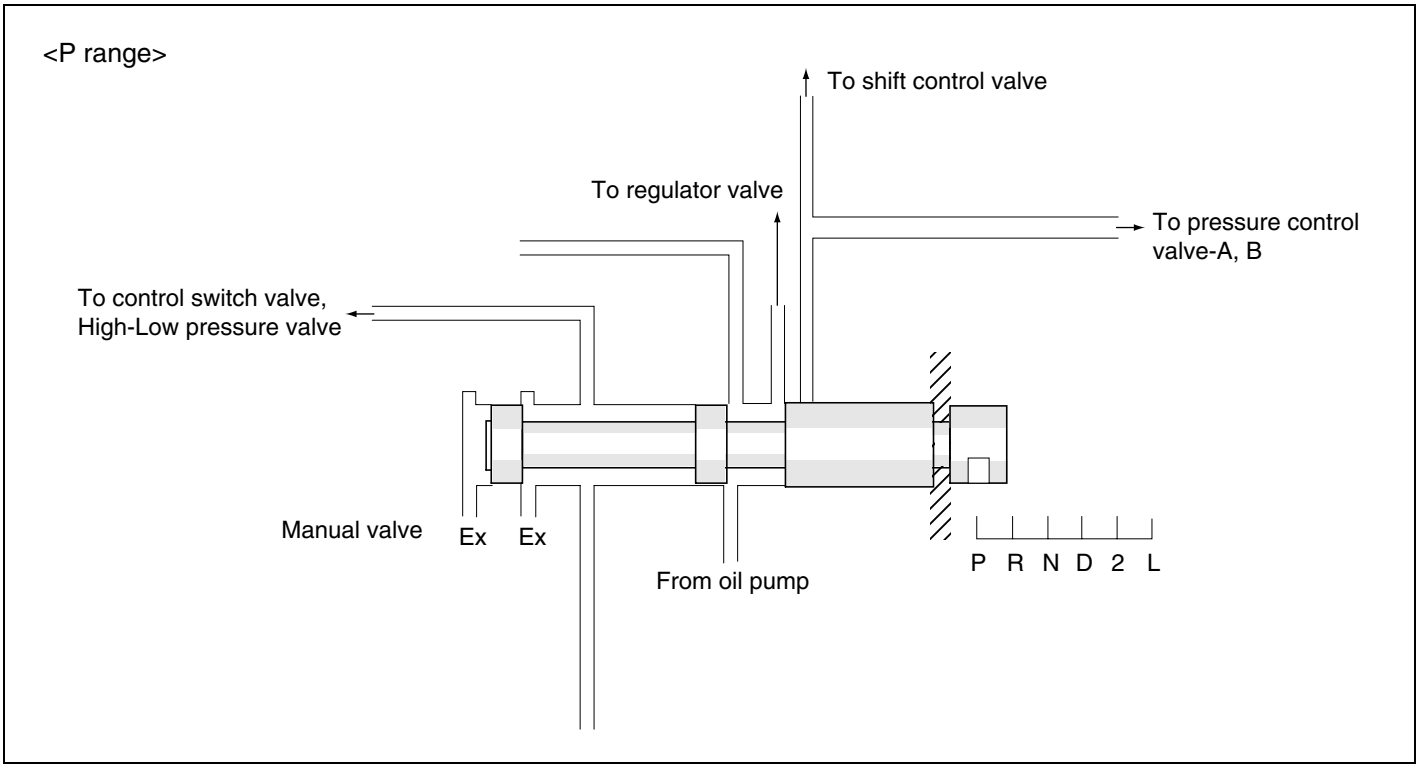

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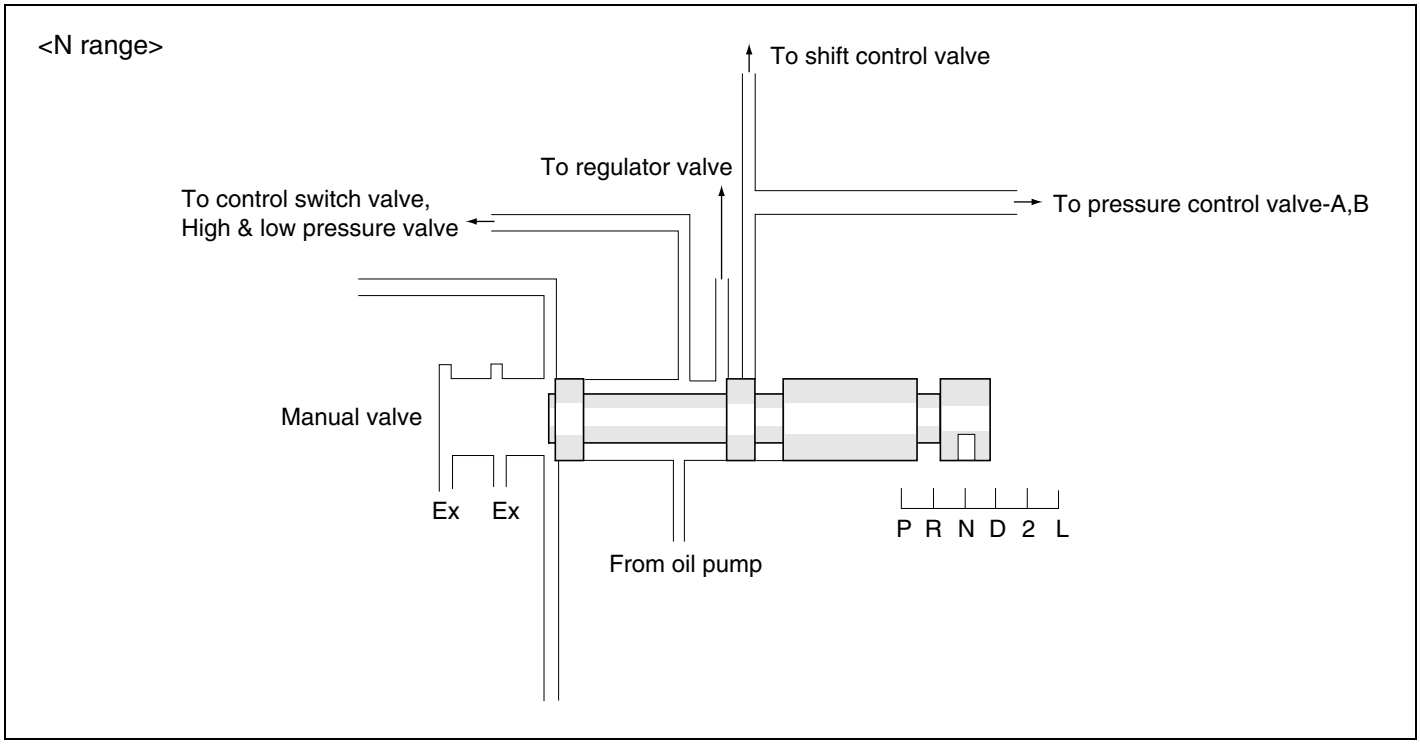
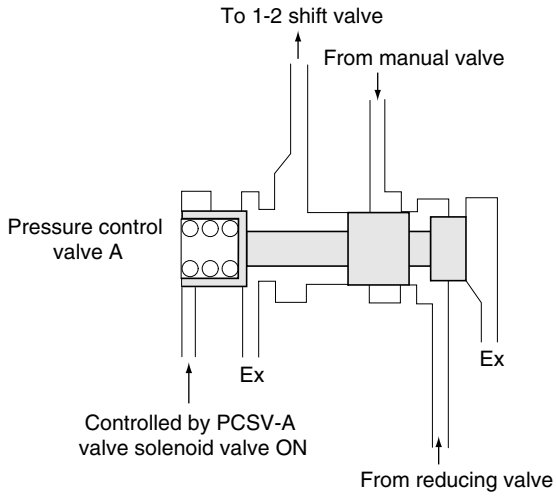


LKJF003C

PRESSURE CONTROL VALVE-A, B

Pressure control valve A, B regulate the pressure supplied to each clutch under the control of the pressure control solenoid valve A, B to eliminate shock at the time of shifting.

1. Pressure control valve A - Not operated



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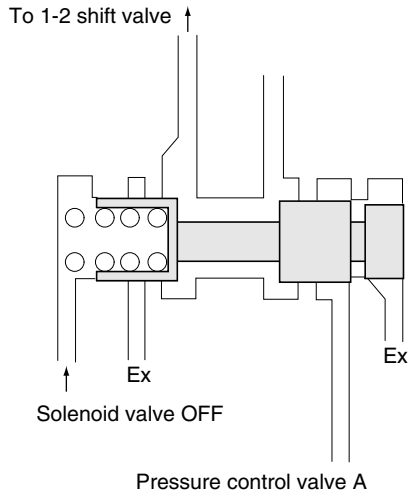
PRESSURE CONTROL VALVE-A, B

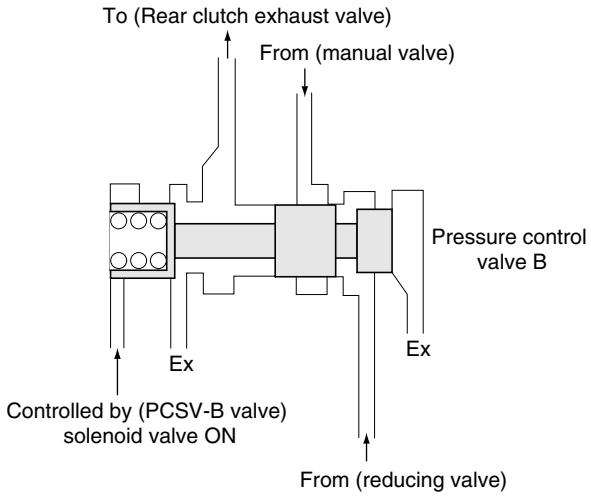
1. Pressure control valve A - Operation



LKJF003E

PRESSURE CONTROL VALVE-A, B

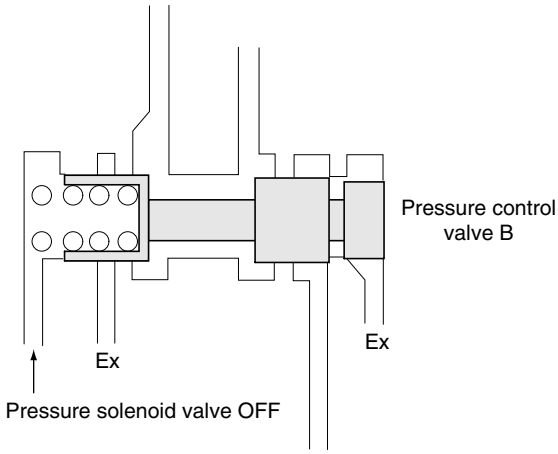
1. Pressure control valve B - Not Operated



LKJF003F

PRESSURE CONTROL VALVE-A, B

1. Pressure control valve B - Operation
   The main function of this valve controls the rear clutch independently.



LKJF003G

SHIFT CONTROL VALVE(SCV) AND SOLENOID VALVE-A, B, C (SCSV-A,B,C)

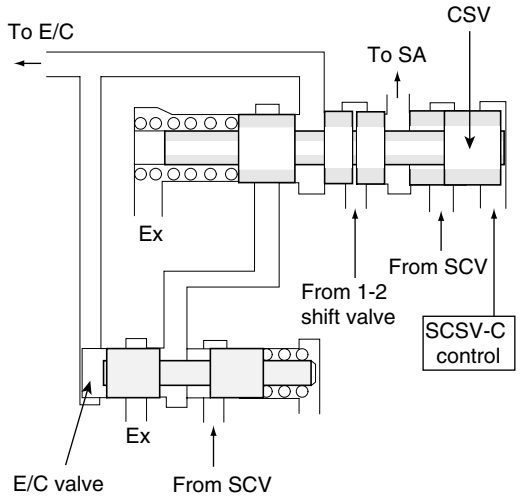
The line pressure acting upon the shift control valve is controlled by the two shift control solenoid valves(which are switch ON and OFF according to the shifting gear by the transaxle control module command), and the shift control valve isactivated according to the shifting gear, thus switching the oil passages.

The relationship of the shifting gear and the ON-OFF switch of shift control solenoid valve "A", "B" and "C" are shown in the table below.

Operation	Shift control solenoid valve		
Position	**A**	**B**	**C**
1st gear	ON	ON	OFF
2nd gear	OFF	ON	OFF
3rd gear	OFF	OFF	ON
4th gear	ON	OFF	ON

CONTROL SWITCH VALVE(CSV) & END CLUTCH(E/C) VALVE

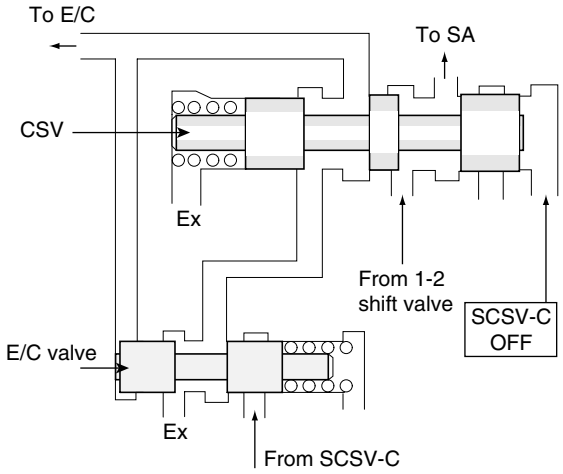
- Function
Switching the pressure of E/C and SA



LKJF003H

CONTROL SWITCH VALVE(CSV) & E/C VALVE

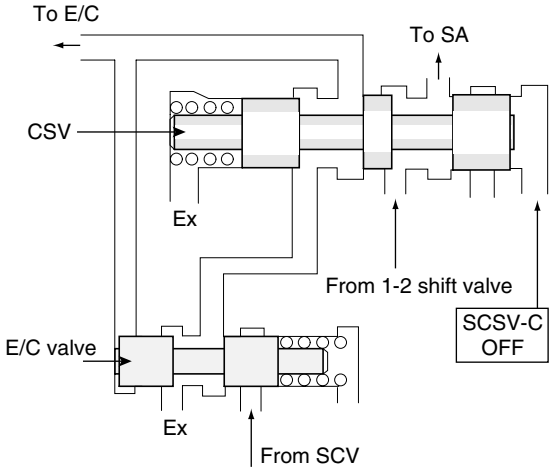
- 2nd Gear
  - 2nd pressure is supplied from SA through the CSV.
  - SCSV-C maintains OFF as well as 2nd gear.



LKJF003I

CONTROL SWITCH VALVE(CSV) & E/C VALVE

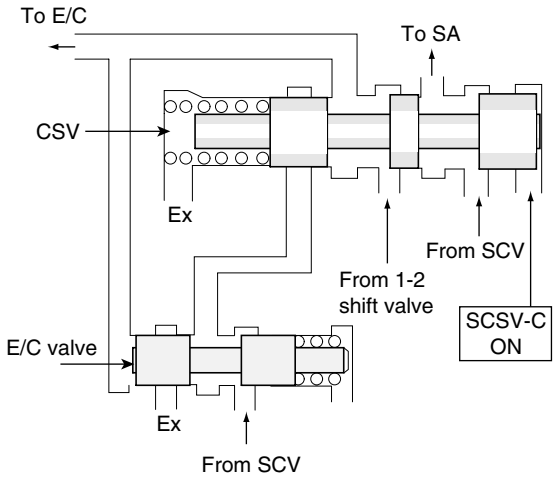
- 2nd → 3rd gear
  - SCSV-C maintains OFF as well as 2nd gear.
  - The E/C pressure from shift control valve is intercepted at the E/C valve during up-shifting from 2nd to 3rd gear.
  - SA pressure is supplied from 1-2 shift valve, but the front clutch and SR pressure is also supplied from the 2-3/4-3 shift valve, so the both SR and SA pressure will be set off..



LKJF003J

CONTROL SWITCH VALVE(CSV) & E/C VALVE

- 3rd gear
  - SCSV-C is changed from OFF to ON.
  - The E/C pressure is supplied from 1-2 shift valve at the CSV after finishing the up-shifting from 2nd to 3rd gear.
  - SA pressure is supplied from shift control valve, but the front clutch and SR pressure is also supplied from the 2-3/4-3shift valve, so the both SR and SA pressure will be set off.



LKJF003K

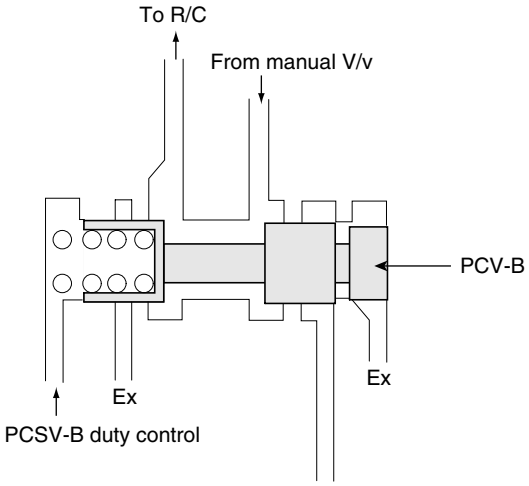
4 → 2 SKIP SHIFT

1. Operating elements

Speed	R/C	E/C	K/D
4th	-	O	O
2nd	O	-	O

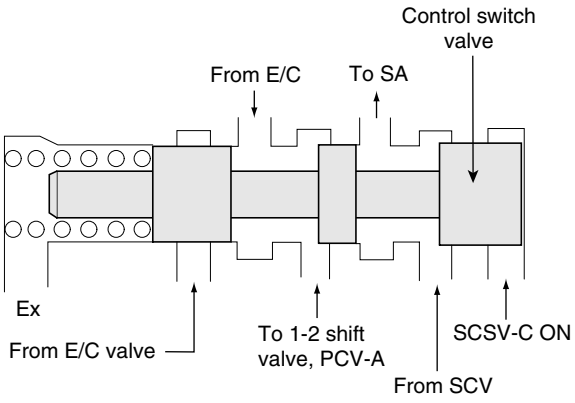
2. Controls
   a. R/C engaging duty control
   b. E/C releasing duty control
   c. Continuous switching to SA

3. Description
   a. R/C engaging duty control



LKJF003L

   b. E/C releasing duty control
   4 → 2 Skip shift only (SCSV-C ON)
   When releasing the E/C clutch pressure, it is controlled by duty of PCSV-A only in case of 4 → 2 skip shift.



LKJF003M

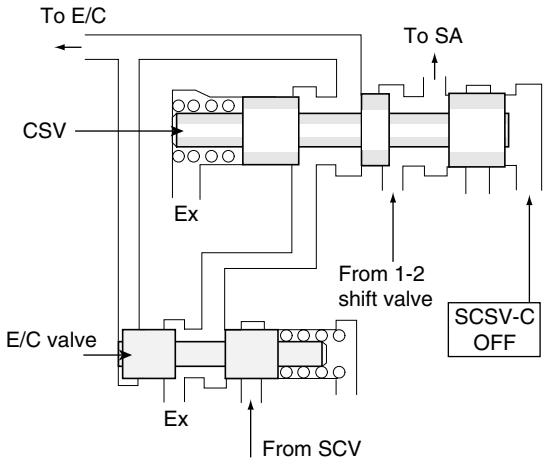
   c. Continuous switching to SA
   From (SCV) to SA through (CSV)

FAIL SAFE FUNCTION

1. TCM fail when drive with 1st or 2nd speed.
   CUTTING OFF THE E/C PRESSURE BY E/C VALVE

Speed	F/C	R/C	E/C	K/D
1st		O		
2nd		O		O
Fail	O	O		

- F/C, SR : from 2-3/4-3 shift valve
- R/C : from PCV-B
- SA : from 1-2 shift valve

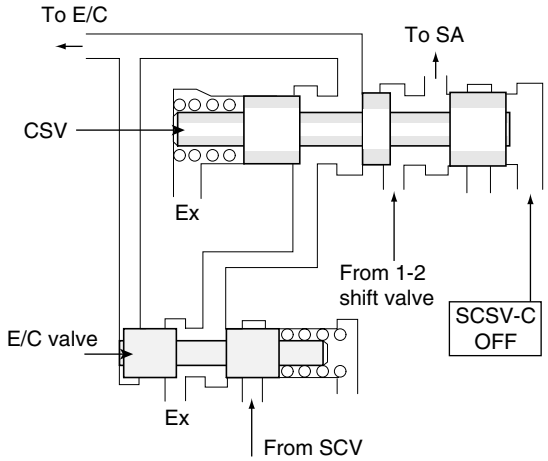


LKJF003N

2. TCM fail when drive with 1st or 2nd speed.
   If the hydraulic pressure is supplied to E/C and the F/C, SR pressure is delayed?

Speed	F/C	R/C	E/C	K/D
1st		O		
2nd		O		O
Fail		O		O

- R/C, E/C, S/A : interlock



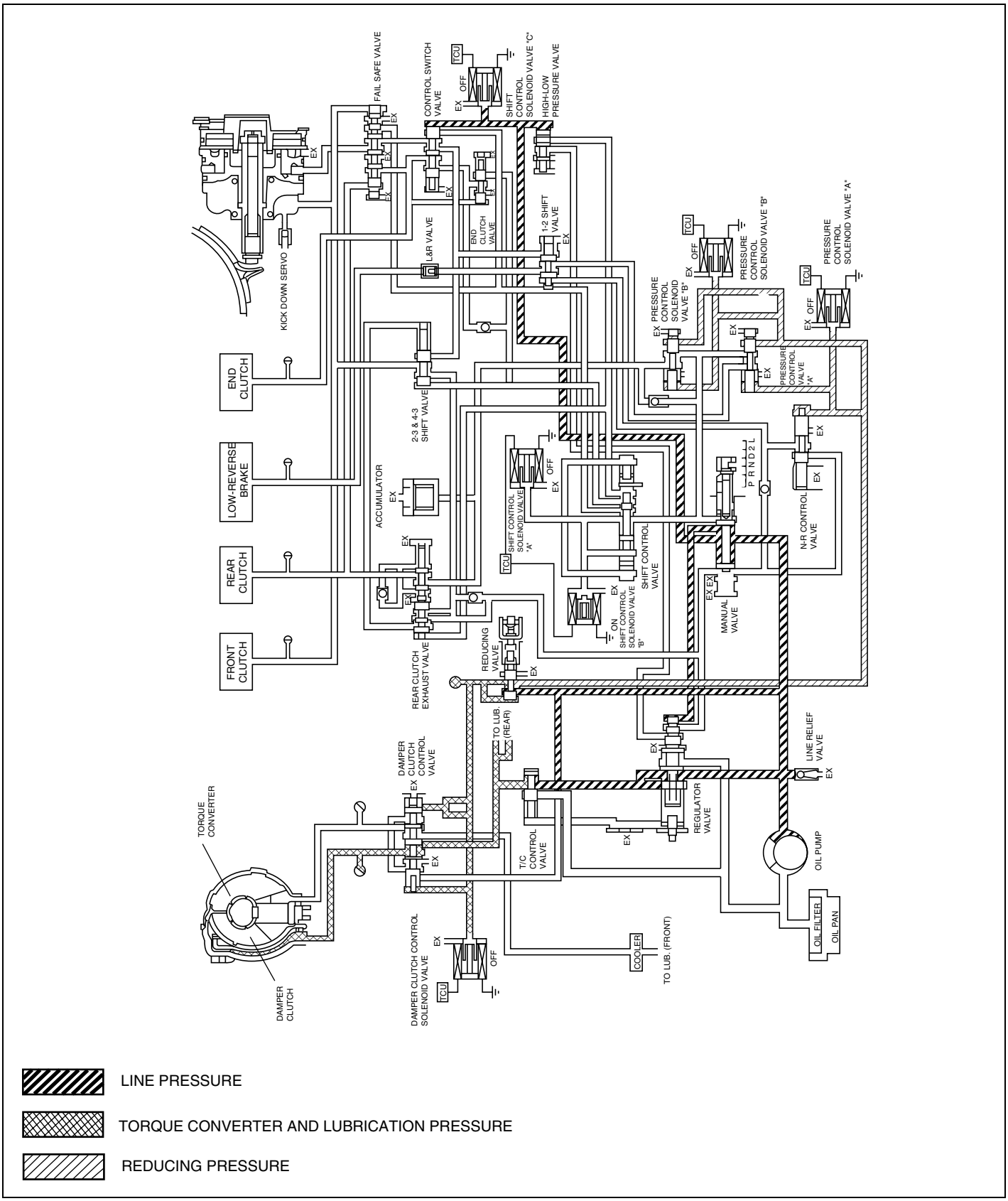
LKJF003N

NOTE

- *SA : Servo Apply pressure*
- *F/C : Front Clutch pressure*
- *R/C : Rear Clutch pressure*
- *K/D : Kick Down*
- *SCV : Shift Control Valve*
- *CSV : Control Switch Valve*
- *PCSV : Pressure Control Solenoid Valve*
- *SCSV : Shift Control Solenoid Valve*
- *PCV : Pressure Control Valve*
- *RCEV : Rear Clutch Exhaust Valve*

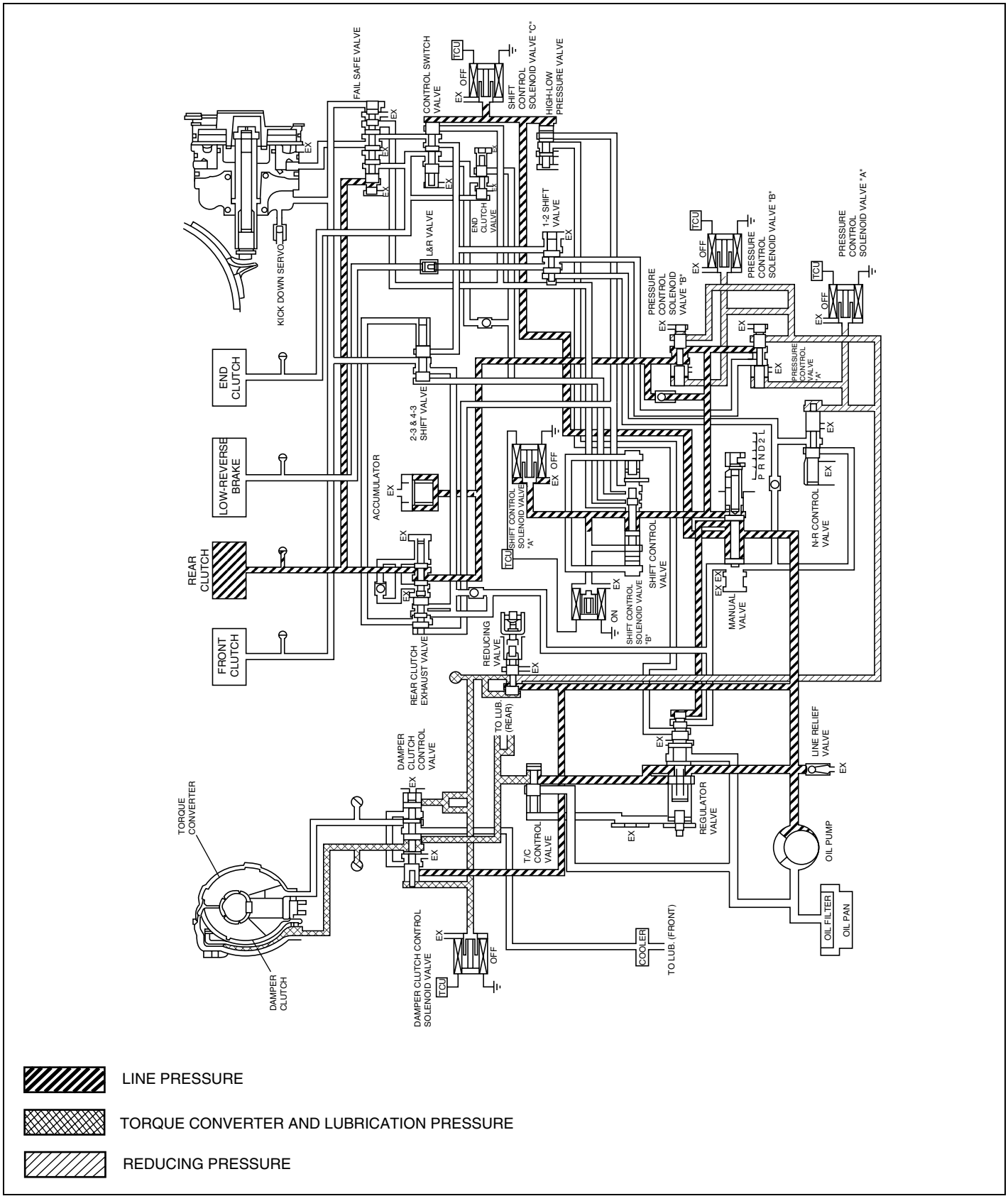
AUTOMATIC TRANSAXLE HYDRAULIC CIRCUIT

PARKING AND NEUTRAL



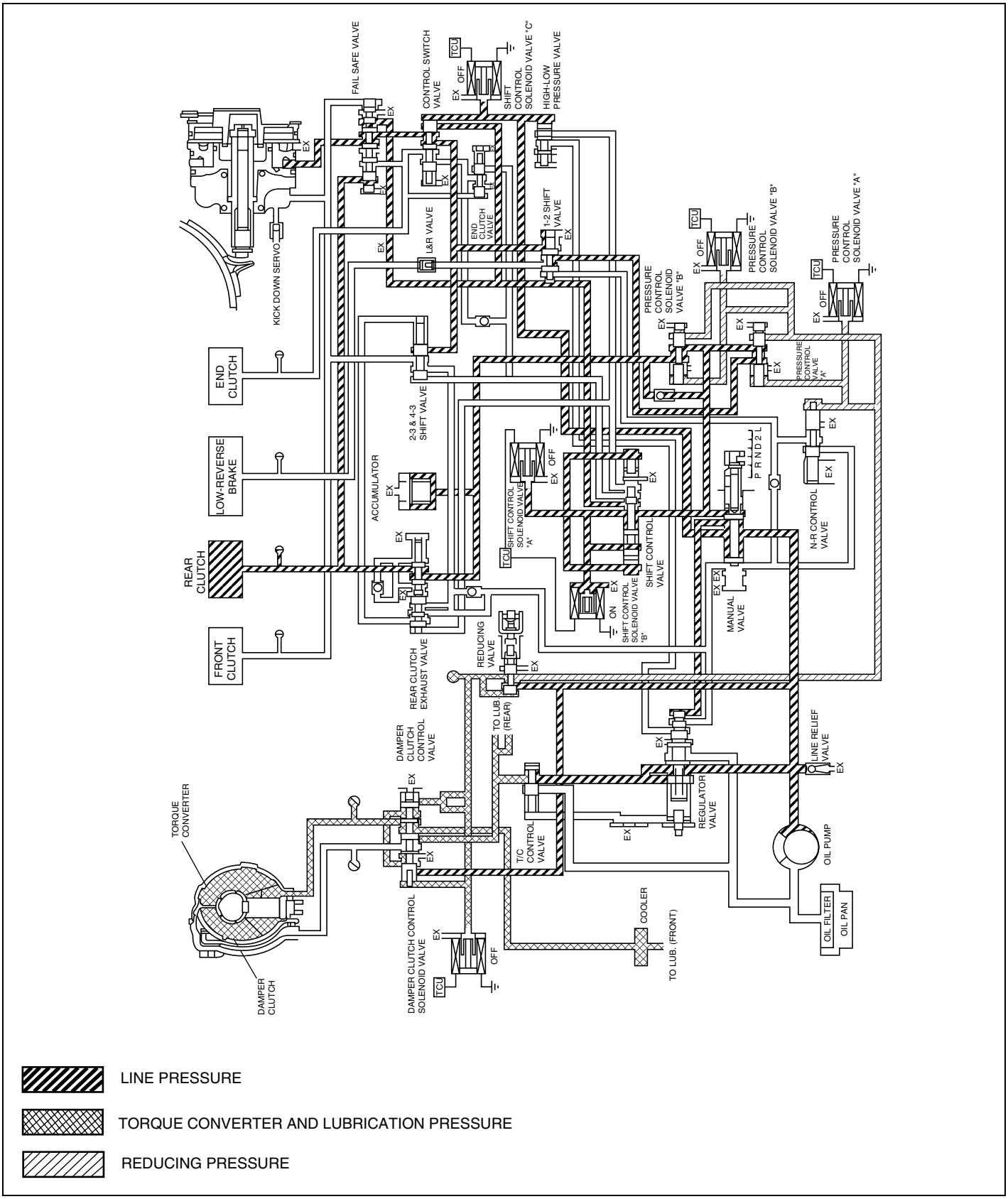
LKJF004A

D RANGE(1ST)



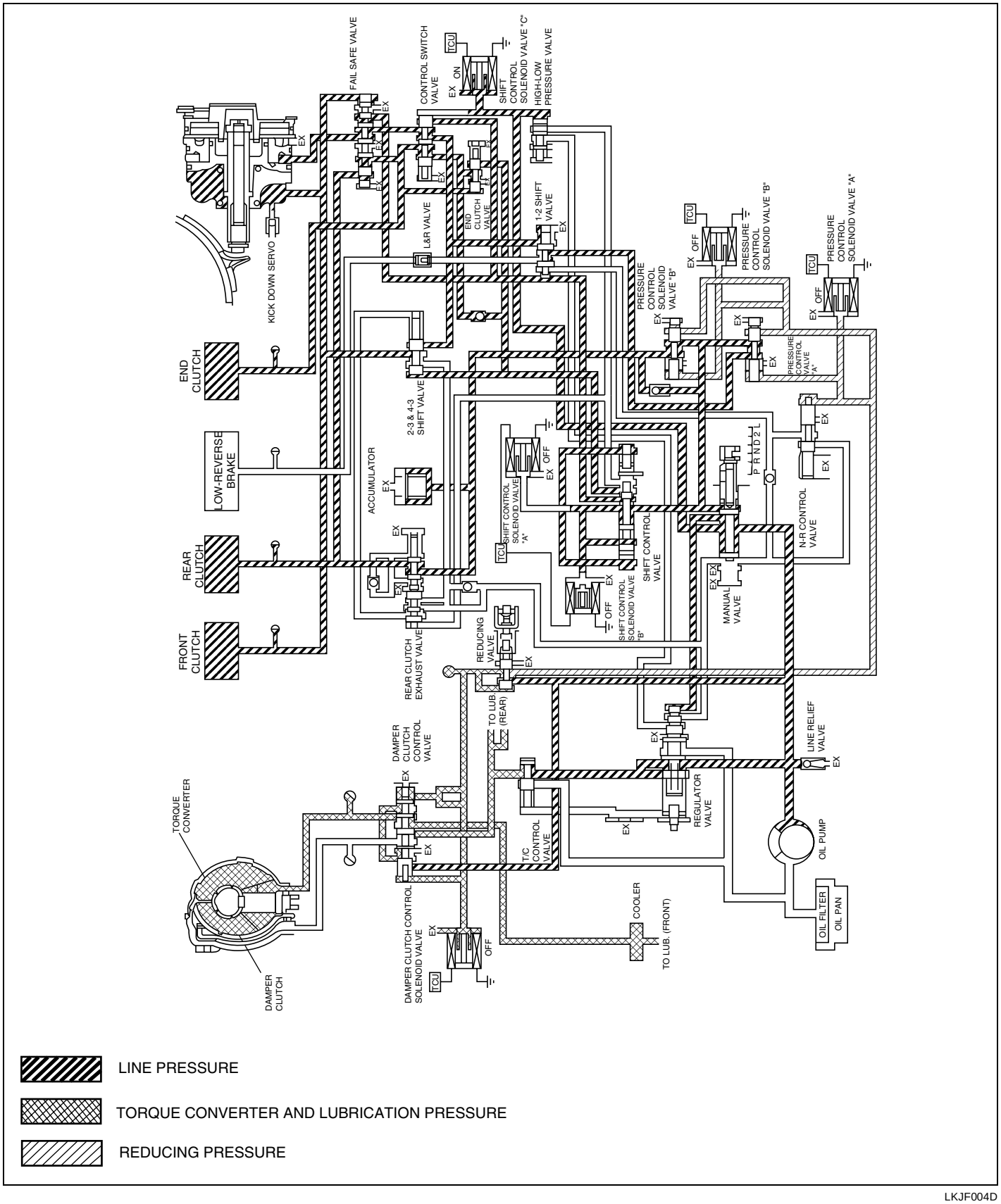
LKJF004B

D RANGE(2ND)



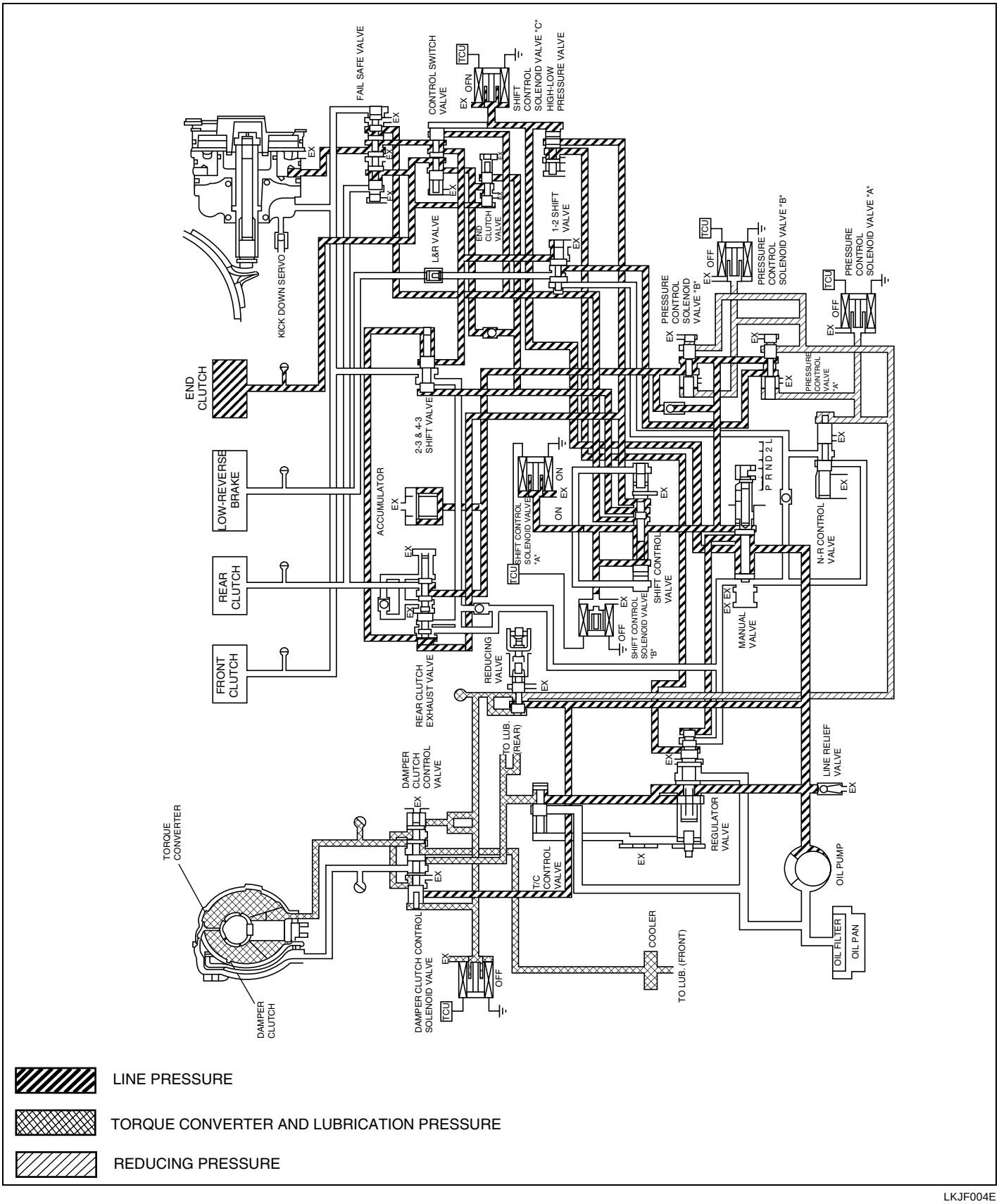
LKJF004C

D RANGE(3RD)



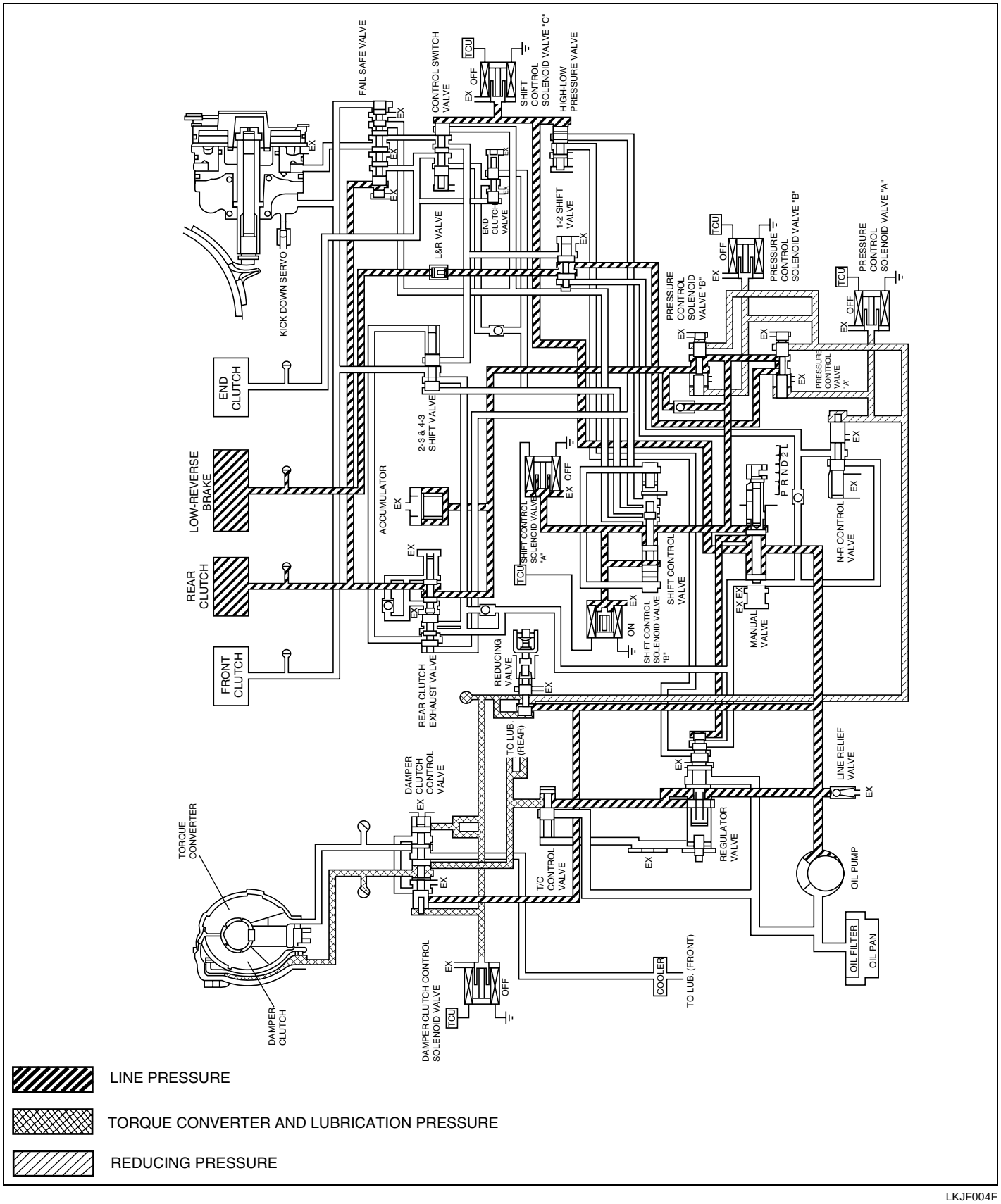
LKJF004D

D RANGE(4TH)



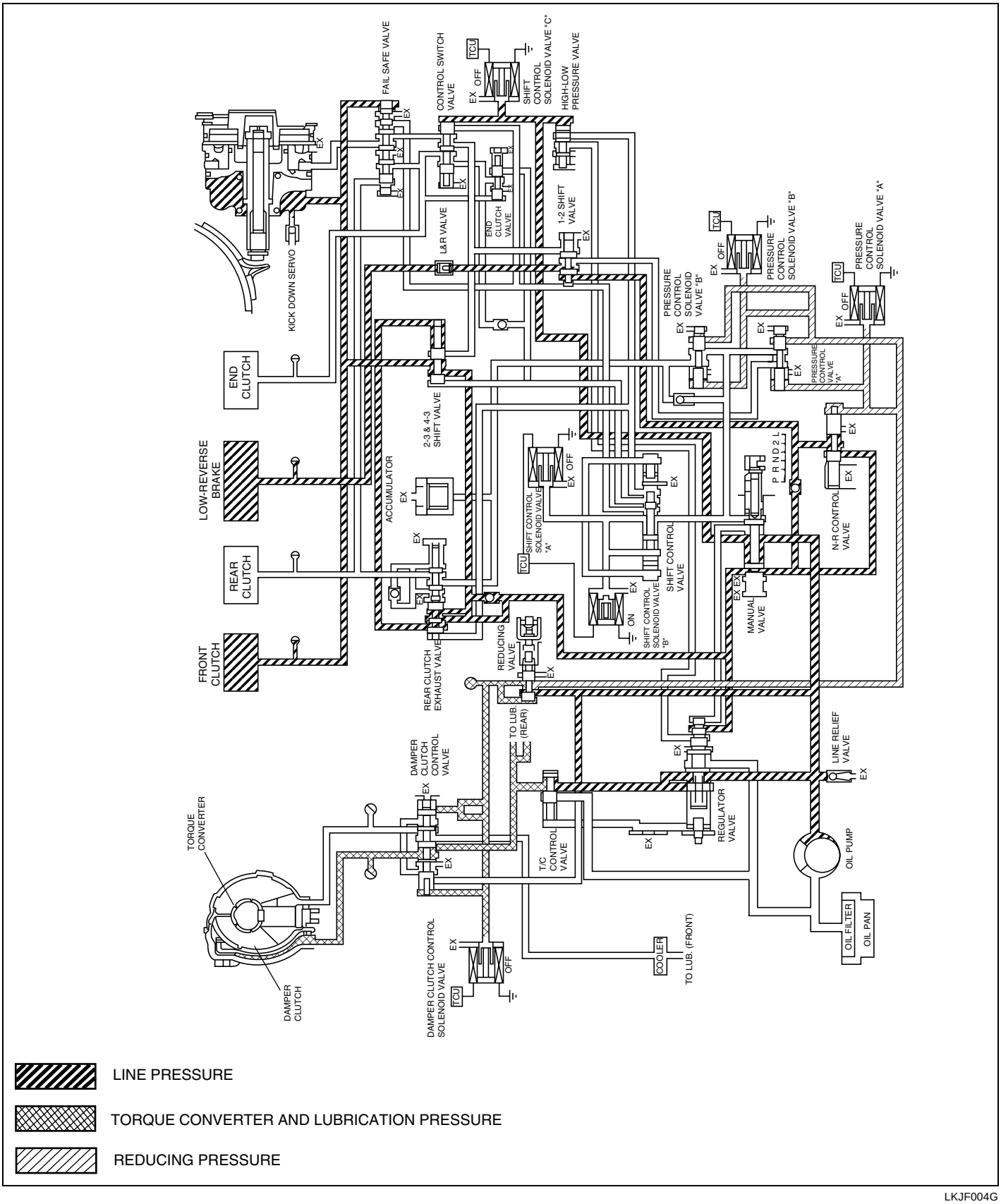
LKJF004E

LOCK



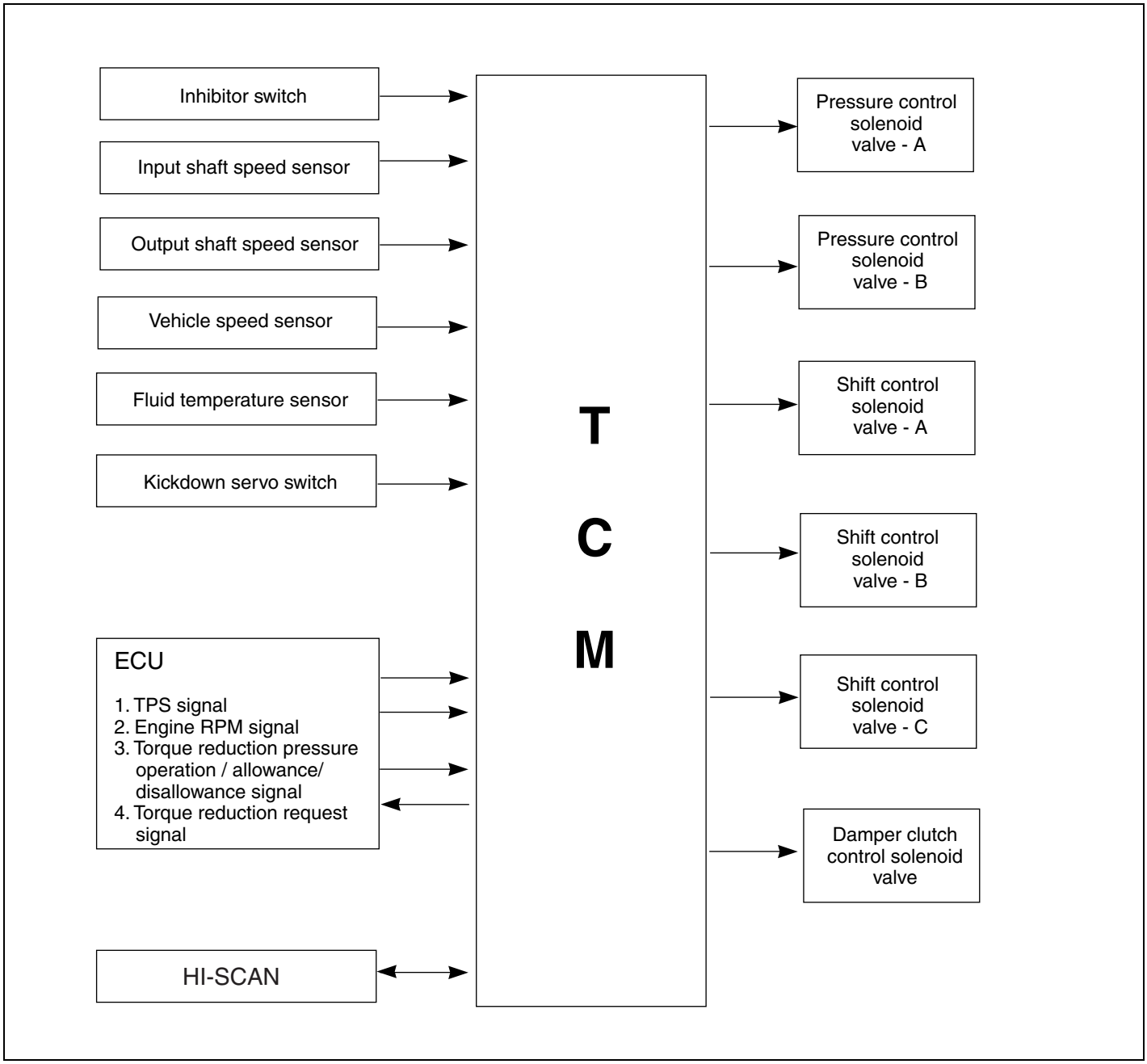
LKJF004F

REVERSE



LKJF004G

ELECTRONIC CONTROL SYSTEM



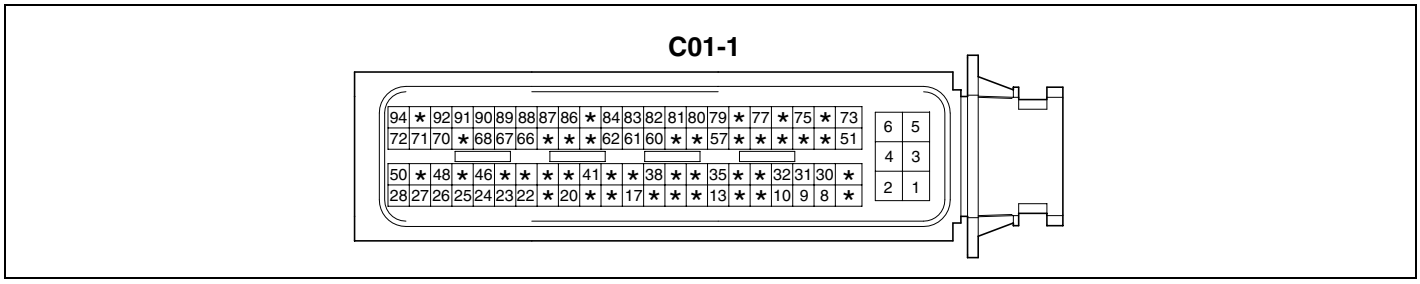
LKJF001C

SENSOR AND ACTUATOR FUNCTION

Item	Functions
Input shaft speed sensor	Detect the turbine RPM at the E/C retainer
Output shaft speed sensor	Detect the T/F drive gear RPM at the transfer drive gear
Engine RPM signal	Receive the engine RPM via communication with ECU
Vehicle speed sensor	Detect the vehicle speed at the speedometer gear
Kickdown servo switch	Detect the operation starting of kickdown brake
Inhibitor switch	Detect the position of select lever through the contact switch
Overdrive switch	Detect the position of overdrive(4th gear)
TPS	Detect the throttle open angle through the potentiometer
Fluid temperature sensor	Detect the temperature of ATF through the thermistor
Torque reduction request signal	Transmit the torque reduction request signal to the engine ECU
Torque reduction operation/allowance/dis-allowance signal	Receive the signal of engine reduction pressure operation / allowance/disallowance from the ECU
Pressure control solenoid valve-A	Control the hydraulic pressure to the pressure control valve for shift control
Pressure control solenoid valve-B	Control the hydraulic pressure to the pressure control valve for shift control
Shifting control solenoid valve-A	Make the hydraulic passage for shift control
Shifting control solenoid valve-B	Make the hydraulic passage for shift control
Shifting control solenoid valve-C	Make the hydraulic passage for shift control
Damper clutch control solenoid valve	Control the hydraulic pressure for the damper clutch control

* E/C : End Clutch
  T/F : Transfer

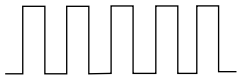
INTEGRATED TCM SIDE CONNECTOR



LKJF005A

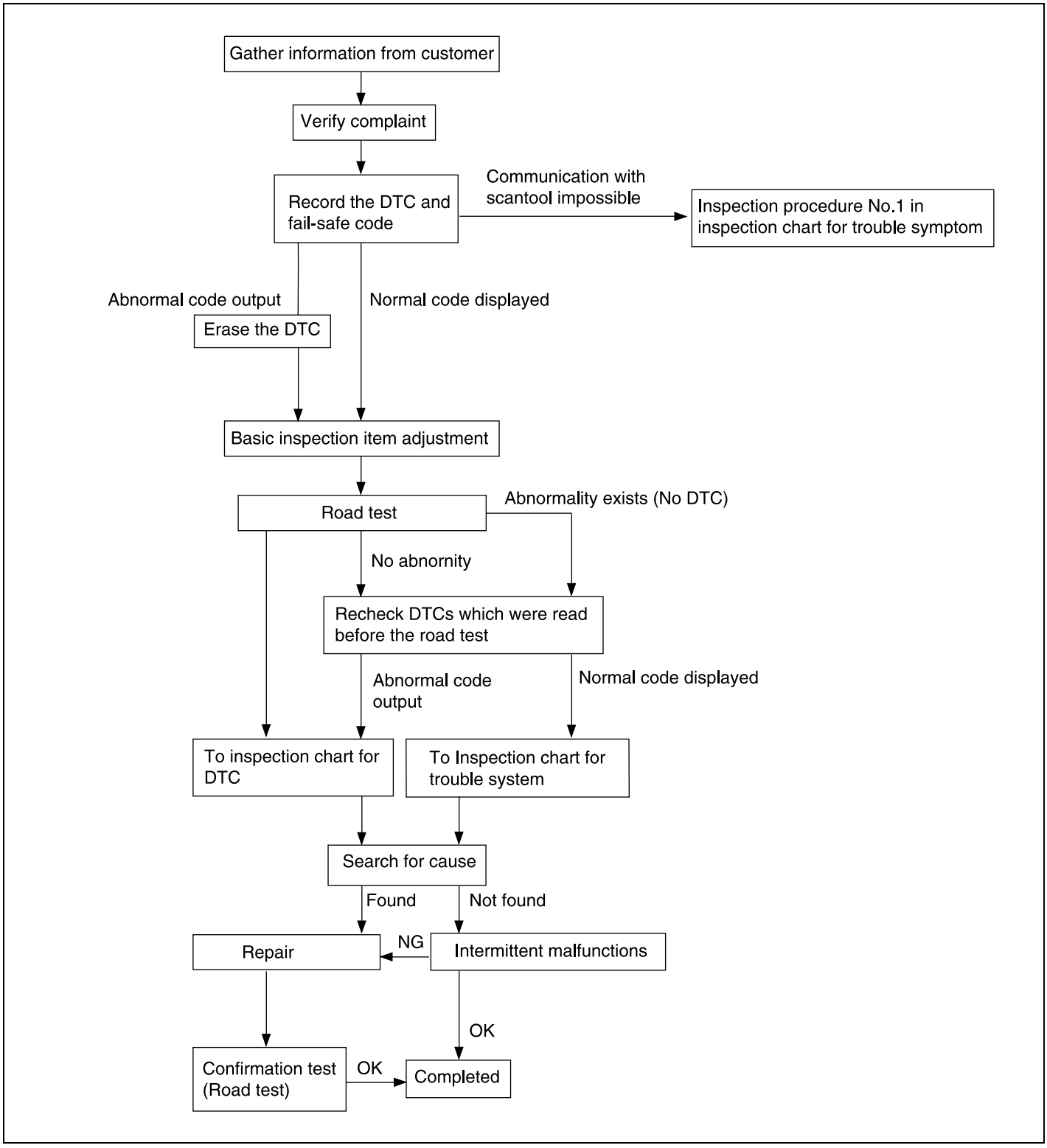
INTEGRATED TCM INPUT/OUTPUT TERMINAL VOLTAGE

PIN No.	Signal	Condition	Input/output value		Test result	Remark
			Type	Level		
4 5	Battery voltage (Main relay)	IG ON	DC Voltage	VBR	VBR	
26	Shift control solenoid valve-B	Shifting	Pulse	Vlow : VBR-47V Vhigh : VBR-1.6V (Clamping)	Vlow : 0.0V Vhigh:13.3V	OFF_surge clamping voltage : VBR-47V Maximum current : 4A
27	Shift control solenoid valve-A	Shifting				
48	Drive position PWM signal	P R N D OD OFF 2 L		Vlow : Max.1.0V Vhigh : VB	Prange : 12.5% Rrange : 25.0% Nrange : 37.5% Drange : 50% OD Off (3 speed) : 50% 2range : 75.0% Lrange : 87.5%	Period : 20msec Duty : The high section
50	Shift control solenoid valve-C	Shifting		Vlow : VBR-47V Vhigh : VBR-1.6V (Clamping)	Vlow : 0.0V Vhigh:13.3V	OFF_surge clamping voltage : VBR-47V Maximum current : 4A
60 61	PG-A(NTU)	Idling		Vhigh : VB-1.5V Vlow : -0.3V		Differential input between pin 102 and pin109 Level Limit: -0.3V ~ VB-1.5V
66	Inhibitor SW "D"	"D" range Other	DC Voltage	Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	12.7V 0.0 V	
67	Inhibitor SW "P"	"P" range Other		Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	12.7V 0.0 V	
68	Inhibitor SW "L"	"L" range Other		Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	12.7V 0.0 V	

PIN No.	Signal	Condition	Input/output value		Test result	Remark
			Type	Level		
71	Pressure control solenoid valve-A	Shifting	Pulse	Vlow : VBR-47V Vhigh : VBR-1.6V (Clamping)		The period of pulse : 2kHz OFF_surge clamping voltage : VBR-47V Maximum current : 4 AKGE003C
72	Pressure control solenoid valve-B	Shifting				
80	Fluid temperature sensor	Idling	Analog	0.2V ~ 4.9V	2.5V (58°C (136°F))	
81 82	PG-B(NAB)	Driving	Pulse	Vhigh : VB-1.5V Vlow : -0.3V		Differential input between pin 101 and pin110 Level Limit: -0.3V ~ VB-1.5V
86	Brake SW	ON OFF	DC Voltage	Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	11.7V 0V	 AKGE003B
87	Kickdown(K/D) servo	K/D ON K/D OFF		Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	55.8mV 11.7V	
88	Inhibitor SW "R"	"R" range Other		Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	12.7V 0.0 V	
89	Inhibitor SW "2"	"2" range Other		Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	12.7V 0.0 V	
90	O/D OFF SW	OD ON OD OFF		Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	12.7V 0.0 V	
91	Inhibitor SW "N"	"N" range Other		Vlow : (Vcc*0.8)-0.2V Vhigh : 2.0V	12.7V 0.0 V	
94	Damper clutch solenoid valve	Lock Up ON OFF	Pulse	Vlow : VBR-47V Vhigh : VBR-1.6V (Clamping)		The period of pulse : 2kHz OFF_surge clamping voltage : VBR-47V Maximum current : 4 AKGE003C

- VB : Battery
- VBR : Converted battery voltage via main relay
- VBB : Permanence battery voltage
- VCC : 5V

TROUBLESHOOTING EF38FC05



LKJF005B

DIAGNOSITC TORUBLE CODES (INSPECTION PROCEDURE)

CHECK THE DIAGNOSTIC TROUBLE CODES

1. Turn the ignition switch to OFF.
2. Connect the Hi-scan tool 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 remedy procedures according to the "DIAGNOSTIC TROUBLE CODE DESCRIPTION" on the following pages.

NOTE

- *A maximum of 10 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 10, 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.

CAUTION

- ***After reading the diagnostic trouble code, disconnect the battery (-)terminal.***
- ***If the sensor connector is disconnected, the diagnostic trouble code is stored when the ignition switch is ON. If the battery (-)terminal is disconnected more than 15seconds, the diagnostic trouble code is erased.***

NOTE

Use the Hi-scan tool for deleting the diagnostic trouble code as possible.

HOW TO USE THE HI-SCAN TOOL

1. Insert ROM pack in the Hi-scan tool and then connect self-diagnostic connector to the cigar-lighter socket.
2. Wait 3-4seconds and select the vehicle model.
3. Upon selecting vehicle, press "YES" button.
4. Screen will display MENU and then choose diagnostic trouble code or maintenance data item to output.

DIAGNOSTIC TROUBLE CODE TABLE

No.	Code	Item	Remark
1	P0703	STOP LAMP SWITCH(BRAKE SW) - SHORT(+B)	AT-53
2	P0707	TRANSAXLE RANGE SWITCH CIRCUIT LOW INPUT	AT-59
3	P0708	TRANSAXLE RANGE SWITCH CIRCUIT HIGH INPUT	AT-65
4	P0711	TRANSAXLE FLUID TEMPERATURE SENSOR RATIONALITY	AT-68
5	P0712	TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT LOW INPUT	AT-75
6	P0713	TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT HIGH INPUT	AT-77
7	P0716	A/T INPUT SPEED SENSOR(PG-A)-TOO MAX	AT-79
8	P0717	A/T INPUT SPEED SENSOR(PG-A) CIRCUIT - OPEN or SHORT(GND)	AT-86
9	P0722	A/T OUTPUT SPEED SENSOR(PG-B) CIRCUIT - OPEN or SHORT(GND)	AT-88
10	P0731	GEAR 1 INCORRECT RATIO	AT-94
11	P0732	GEAR 2 INCORRECT RATIO	AT-102
12	P0733	GEAR 3 INCORRECT RATIO	AT-109
13	P0734	GEAR 4 INCORRECT RATIO	AT-116
14	P0736	GEAR R INCORRECT RATIO	AT-121
15	P0741	TORQUE CONVERTER CLUTCH STUCK OFF	AT-126
16	P0742	TORQUE CONVERTER CLUTCH STUCK ON	AT-131
17	P0743	TCC CONTROL SOLENOID VALVE CIRCUIT - OPEN or SHORT(GND)	AT-134
18	P0745	PRESSURE CONTROL SOLENOID VALVE-A CIRCUIT - OPEN or SHORT(GND)	AT-139
19	P0750	SHIFT CONTROL SOLENOID VALVE-A CIRCUIT - OPEN or SHORT(GND)	AT-144
20	P0755	SHIFT CONTROL SOLENOID VALVE-B CIRCUIT - OPEN or SHORT(GND)	AT-148
21	P0760	SHIFT CONTROL SOLENOID VALVE-C CIRCUIT - OPEN or SHORT(GND)	AT-152
22	P0775	PRESSURE CONTROL SOLENOID VALVE-B CIRCUIT - OPEN or SHORT(GND)	AT-156
23	P1709	KICKDOWN SERVO SWITCH CIRCUIT - OPEN or SHORT	AT-161
24	U0001	CAN BUS OFF	AT-168
25	U0100	CAN TIME OUT	AT-169

NOTE

- *D/C : Damper clutch*
- *PG-A : Input shaft rotation speed sensor*
- *PG-B : Output shaft rotation speed sensor*
- *PCSV : Pressure control solenoid valve*
- *SCSV : Shift solenoid valve*

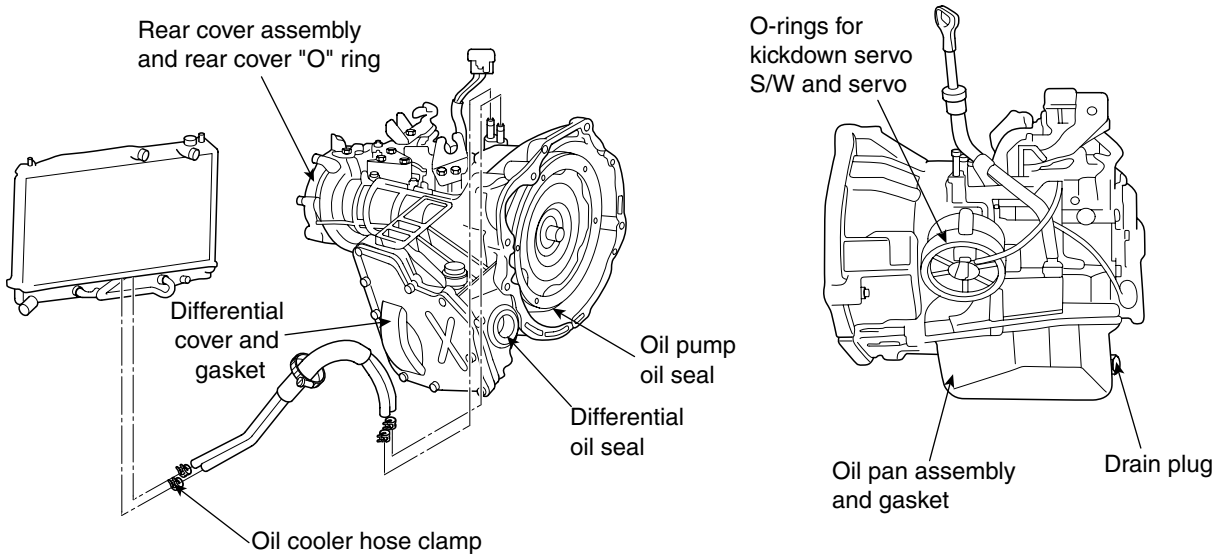
CHECK THE CONTROL SYSTEM (USING THE HI-SCAN TOOL)

Diagnosis items	Checking procedures		Probable cause
	Check conditions	Normal value	
Fluid temperature sensor	Engine doesn't operate before starting	Equivalent to outside air temperature	- Malfunction of the fluid temperature sensor or the circuit harness
	While warming up engine	Gradual increase	
	After warming up engine	80~110°C (176~230°F)	
Kickdown servo switch	"L"range : Idling	ON	- Malfunction of the kickdown servo adjustment - Malfunction of the kickdown servo switch or the circuit harness - Malfunction of the kickdown servo system
	"D"range :1st or 3rd gear	ON	
	"D"range :2nd or 4th gear	OFF	
Ignition signal • Engine rpm	"N"range: Idling	650-900rpm	- Malfunction of the ignition system - Malfunction of the ignition signal pick-up circuit
	"N"range, 2500rpm (Tachometer)	2400-2600rpm	
Idling switch	Accelerator pedal fully released	ON	- Malfunction of the TPS adjustment - Malfunction of the TPS or the circuit harness
	Press accelerator pedal slightly	OFF	
Air conditioning relay signal	"D"range: Air conditioning ON	ON	- Malfunction of the air conditioning power relay circuit harness
	"D"range: Air conditioning OFF	OFF	
Transaxle range switch	"D"range: Idling	C(creep)	- Malfunction of the TCM - Malfunction of the idling switch system - Malfunction of the inhibitor switch system - Malfunction of the TPS system
	"L"range: Idling	1st gear	
	"2"range: 2nd gear	2nd gear	
	"D"range: Overdrive switch is turned OFF, 3rd gear	3rd gear	
	"D"range: Overdrive switch is turned ON, 4th gear	4th gear	
Pulse generator-A • Turbine rpm	"D"range: Engine stopped	0rpm	- Malfunction of the pulse generator-A or the circuit harness - Incoming noise from outside
	"D"range:Driving at 50km/h(31mph) in 3rd gear	1600~2000rpm	
	"D"range:Driving at 50km/h(31mph) in 4th gear	1100~1400rpm	
Pulse generator-B • Output shaft RPM sensor	"D"range: Engine stopped	0rpm	- Malfunction of the pulse generator-B or the circuit harness - Incoming noise from outside
	"D"range:Driving at 50km/h(31mph) in 3rd gear	1600~2000rpm	
	"D"range:Driving at 50km/h(31mph) in 4th gear	1600~2000rpm	
Overdrive switch	Overdrive switch is turned ON	OD:ON	- Malfunction of the overdrive switch or the circuit harness
	Overdrive switch is turned OFF	OD:OFF	

Diagnosis items	Checking procedures		Probable cause
	Check conditions	Normal value	
Inhibitor switch	Shift select lever to "P"range	P	- Malfunction of the inhibitor switch adjustment - Malfunction of the inhibitor switch or the circuit harness - Malfunction of the manual control cable
	Shift select lever to "R"range	R	
	Shift select lever to "N"range	N	
	Shift select lever to "D"range	D	
	Shift select lever to "2"range	2	
	Shift select lever to "L"range	L	
Vehicle speed sensor	Keep vehicle stopped	0km/h	- Malfunction of the vehicle speed sensor if high speed signal is delivered while vehicle is stopping - In other cases, malfunction of the vehicle speed sensor or circuit harness
	Driving at 30km/h(19mph)	30km/h(19mph)	
	Driving at 50km/h(31mph)	50km/h(31mph)	
Pressure control solenoid valve duty(PCSV duty)	"D"range : Idling	60~80%	- When accelerator pedal is slightly pressed while idling in "D"range, duty should become100% - Malfunction of the TCM - Malfunction of the TPS system - Malfunction of the idling switch system
	"D"range: 1st gear	100%	
	"D"range: During shift	Varies with condition	
Damper clutch slip rpm • Turbine rpm	"D"range: 3rd gear, 1500rpm (Tachometer)	200~300rpm	- Malfunction of the damper clutch - Malfunction of the ignition signal wire or pulse generator-B system - Abnormality transaxle fluid pressure - Malfunction of the damper clutch solenoid valve
	"D"range: 3rd gear, 3500rpm (Tachometer)	0rpm	
DCCSV duty	"D"range: 3rd gear, 1500rpm (Tachometer)	0%	- Malfunction of the TCM - Malfunction of the TPS system - Malfunction of the pulse generator-B system
	"D"range: 3rd gear, 2500rpm (Tachometer)	Varies with load	

FLUID LEAKS INSPECTION

Check for leaks from the transmission. If there are leaks, it is necessary to repair or replace O-ring, seal packings, oil seals, plugs or other parts.

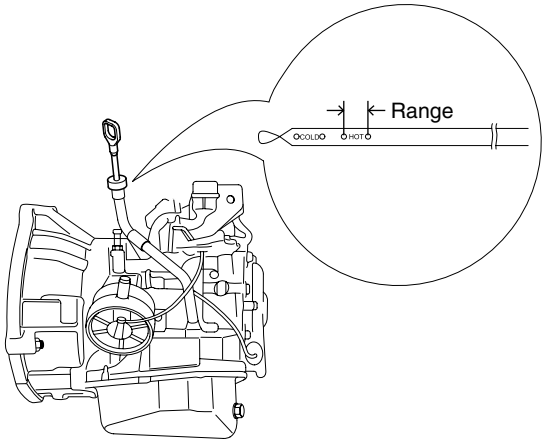


LKJF005C

TRANSAXLE FLUID LEVEL INSPECTION

1. Park the vehicle at even straight surface.
2. Before removing the oil level gauge, wipe all contaminants from around the oil level gauge.
3. Set the select lever to the "P"position and engage the parking brake and then start the engine.
4. Drive the vehicle until the fluid reaches normal.(80~90°C(176~194°F))
5. Move the select lever through all positions. This will fill the torque converter with transaxle fluid. Set the select lever to the "N"(Neutral) position.
6. Check that the fluid level is the "HOT"mark on the oil level gauge. If fluid level is low, add automatic transaxle fluiduntil the level reaches the "HOT" mark. Low fluid level can cause a variety of abnormal conditions because it allows thepump 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.
   Also check the condition of the transaxle fluid. If the fluid smells as if it is burning, it means that the fluid has been ontaminated by fine particles from the bushes and friction material, a transaxle overhaul may be necessary.

Inspect the condition of fluid on the oil level gauge. For the detail check, drain some of the oil fluid out of the pump and then inspect the condition of the oil fluid.
After checking, insert the oil level gauge into the oil filler tube securely.



LKJF005D

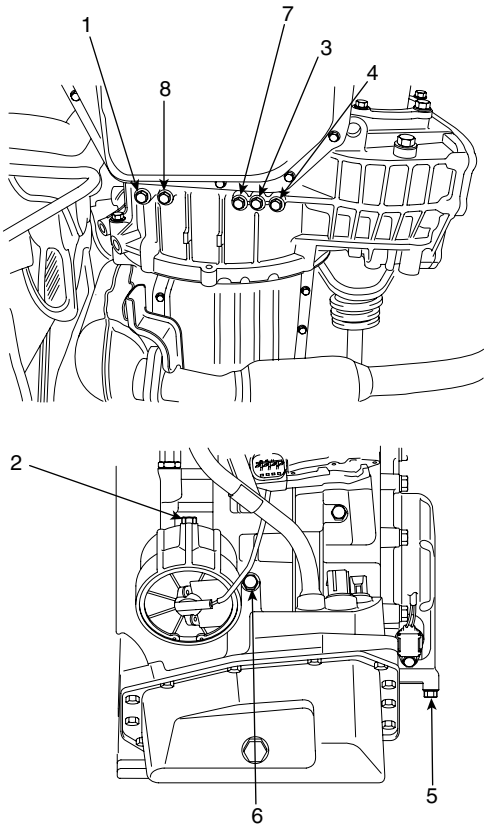
NOTE

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

- *If there is a "burning"door.*
- *If the fluid the color has become noticeably blacker.*
- *If there is a noticeably excessive amount of metal particle in the fluid.*

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 engine tachometer.
4. Connect the oil pressure gauge(09452-21500) and the oil pressure gauge adapter(09452-21002, 09452-21001) to each pressure discharge port. But use the gauge(30kg/cm²) when measuring the reverse pressure, front clutch pressure and low & reverse brake pressure.



1. Reduction pressure
2. Kickdown servo pressure
3. Rear clutch pressure
4. Front clutch pressure
5. End clutch pressure
6. Low & reverse brake pressure
7. Damper clutch apply pressure
8. Damper clutch prelease pressure

LKJF005E

5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.

STANDARD HYDRAULIC PRESSURE TEST

No.	Measurement Condition			Standard hydraulic pressure kpa(kg/cm^2 , psi)							
				1	2	3	4	5	6	7	8
	Select lever position	Engine speed (rpm)	Shift position	Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure	Damper clutch pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)	235~275 (2.4~2.8, 34~40) (When the D/C non-operating)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)	265~343 (2.7~3.5, 38~50) (When the D/C non-operating)

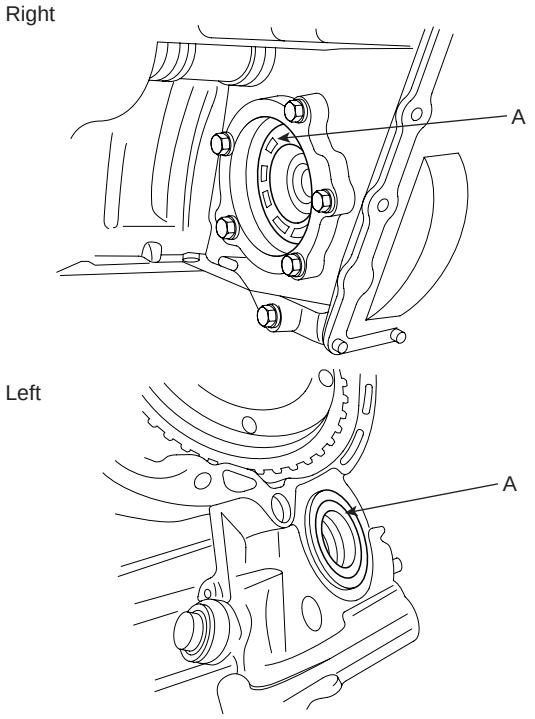
LKJF207F

NOTE

- *"-" is 0.2(0.3)kg/cm² or less and "( )" is the reverse.*
- *SW-ON : Turn the overdrive control switch ON.*
- *SW-OFF : Turn the overdrive control switch OFF.*
- *The hydraulic pressure may be more than standard value at the ambient temperature.*

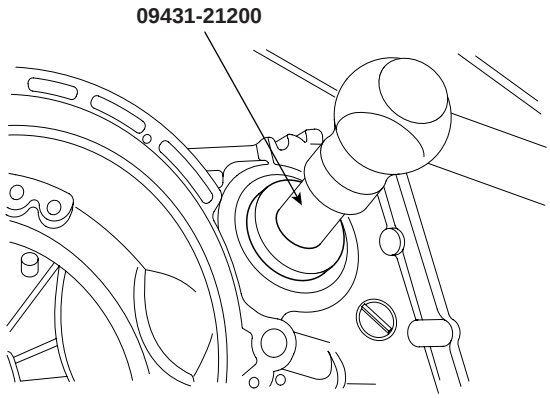
DRIVE SHAFT OIL SEALS REPLACEMENT

1. Disconnect the drive shaft from the transaxle.
2. Using a flat-tip (-) screwdriver, remove the oil seal(A).



LKGE004D

3. Apply a coating of the transaxle fluid to the lip of the oil seal.
4. Using the special tool (09431-21200), tap the drive shaft oil seal into the transaxle.



EKKD016A

TORQUE CONVERTER STALL TEST

This test measures the maximum engine speed when the select lever is at the "D" or "R" position and the throttle is fully opened to test the operation of the torque converter overrunning clutch and the holding ability of clutch and brake inthe transaxle.

NOTE

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

1. Check the automatic transaxle fluid level and temperature and the engine coolant temperature.
   - Fluid level : At the HOT mark on the oil level gauge
   - Fluid temperature : 80~90°C (176~194°F)
   - Engine coolant temperature : 80~90°C (176~194°F)
2. Apply chocks to both rear wheels.
3. Connect the engine tachometer.
4. Pull the parking brake lever on, with the brake pedal fully depressed.
5. Start the engine.
6. 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 : 2,400~2,800 RPM

7. Moe the select lever to the "R" position carry out the same test again.

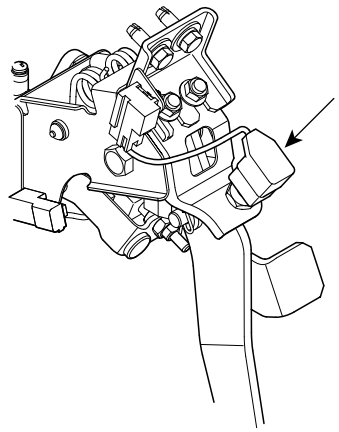
   1) "Stall speed above specification in "D"
      If stall speed is higher than specification, the rear clutch or overrunning clutch of the transaxle is slipping. In thiscase, perform a hydraulic test to locate the cause of slippage.

   2) Stall speed above specification in "R"
      If the stall speed is higher than specification, the front clutch of the transaxle or low & reverse brake is slipping. In this case, perform a hydraulic test to locate the cause of slippage.

   3) Stall speed above specification in "D" and "R"
      If the stall speed is lower than specification, insufficient engine output or a faulty torque converter is suspected.

DTC P0703 BRAKE S/W MALFUNCTION

COMPONENT LOCATION E0CFAEA9



LKJF200A

GENERAL DESCRIPTION EFB1DFF5

The new alpha automatic transmission's function, of intelligence control, is based on the fuzzy control system. The fuzzy control system determines optimal gear positions as related to driver's intention and current driving conditions. The brake switch provides important information by deciding whether the vehicle is decelerating by the depression of the brake pedal, or if the speed is decreasing because the vehicle is running uphill.

DTC DESCRIPTION EF28AAA9

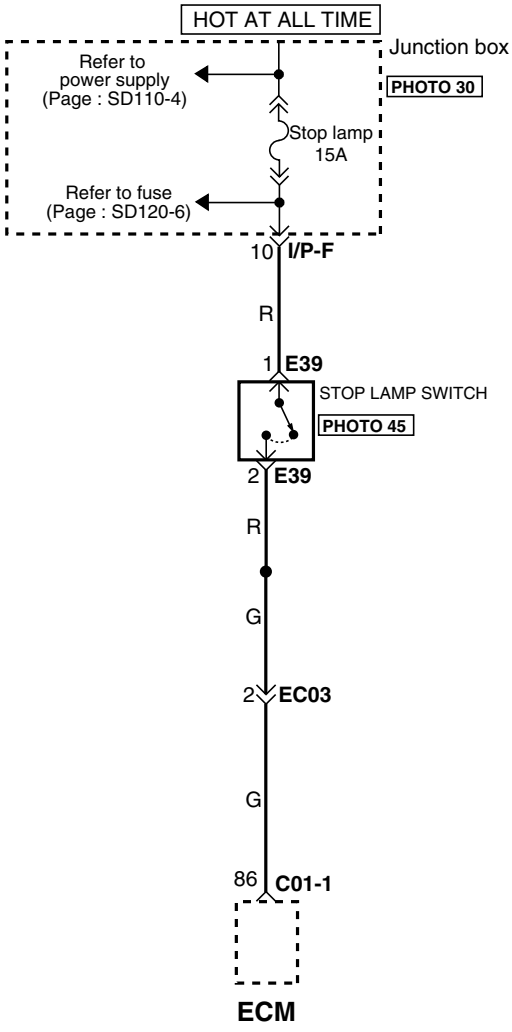
The TCM sets this code if a brake switch signal is input continuously, for an extended period of time, when the vehicle is supposed to be running (moving).

DTC DETECTING CONDITION E27ADACB

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check signal for B+ Short	• Short to battery in circuit • Faulty brake switch adjustment • Faulty brake switch • Faulty TCM(PCM)
Enable Conditions	• No(Output Speed Sensor) ≥ 600rpm • Brake switch "ON" • TPS > 9.8%	
Threshold value	• +B Short	
Diagnostic Time	• More than 1 sec	
Fail Safe	• Intelligent-shift is inhibited	

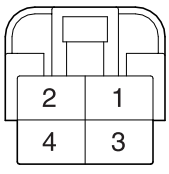
SCHEMATIC DIAGRAM ECB94DBD

[Circuit Diagram]

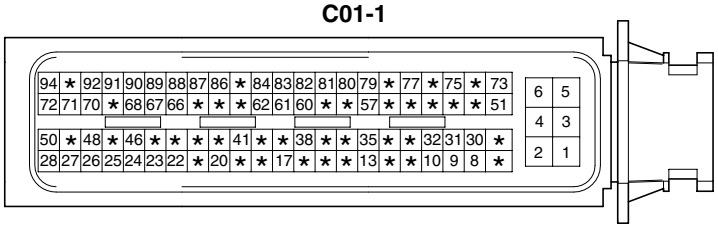


[Harness Connector]

E39



C01-1



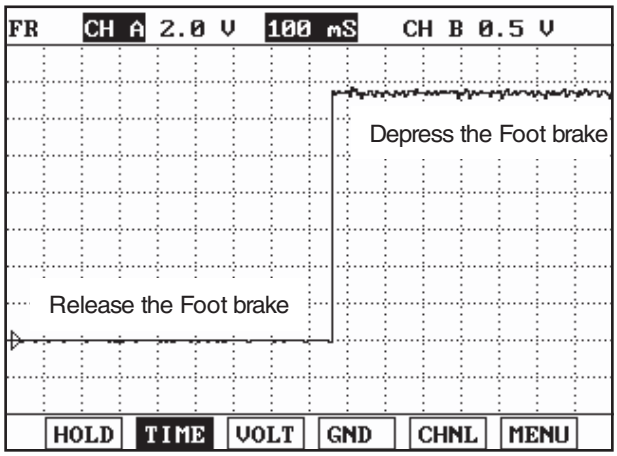
[Connection Information]

Terminal	Connection	Function
E39-1	Hot at all times	-
E39-2	ECM/TCM (C01-1 No. 86)	ECM

LKJF200B

MONITOR SCANTOOL DATA E858D11E

1. Connect scantool to data link connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Connect the scope meter with "STOP LAMP SWITCH" .
4. Depress and release Foot Brake.



LKJF200C

5. Does "STOP LAMP SWITCH" follow the reference data?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E6CDE8E4

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

YES

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

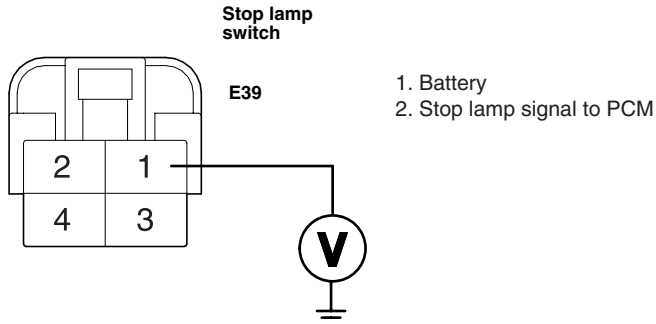
NO

▶ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION EE1C8528

1. Ignition "ON" & Engine "OFF".
2. Disconnect "STOP LAMP SWITCH" connector.
3. Measure voltage between teminal "1" of the sensor harness connector and chassis ground.

Specification : 11.5V ~ 12.5V



LKJF200D

4. Is voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

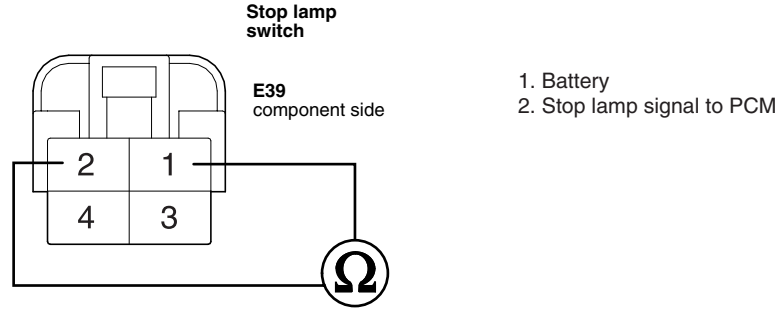
NO

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

COMPONENT INSPECTION E1D3B62D

1. Check "STOP LAMP SWITCH".
   1) Ignition "OFF".
   2) Disconnect "STOP LAMP SWITCH" connector and Remove "STOP LAMP SWITCH".
   3) Measure resistance between terminal "1" and "2" of the STOP LAMP SWITCH when plunger of the STOP LAMP SWITCH is pushed in.

Specification : Infinite



LKJF200E

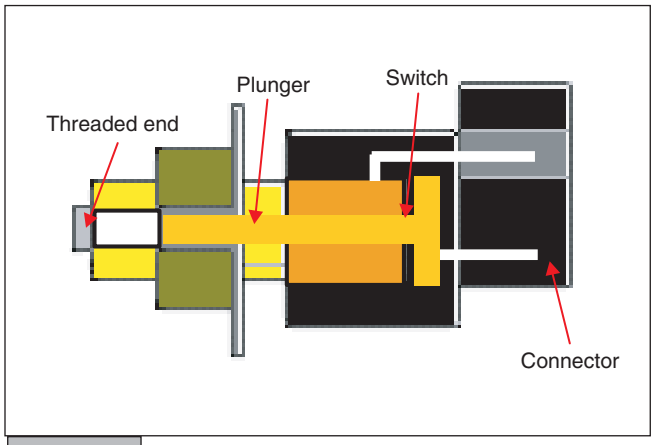


FIG.1)

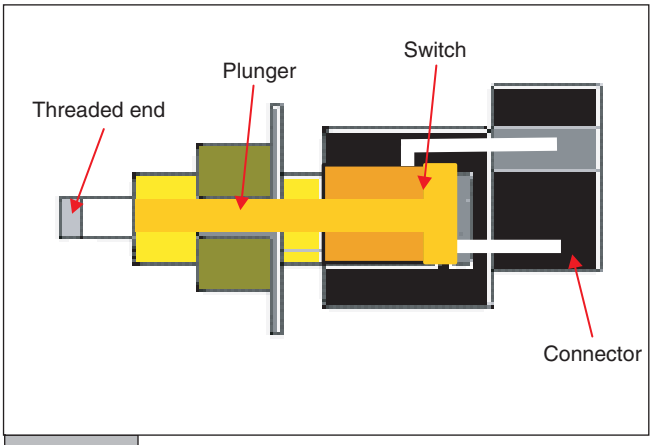


FIG.2)

FIG.1) Brake pedal is released-∞Ω
FIG.2) Brake pedal is depressed-0Ω

LKJF200F

4) Is resistance within specifications?

YES

▶ Go to "Adjust STOP LAMP SWITCH" as below.

NO

▶ Replace "STOP LAMP SWITCH" as necessary and go to "Verification vehicle repair" procedure.

2. Adjust "STOP LAMP SWITCH" clearance.

1) Ignition "OFF".

2) Reinstall "STOP LAMP SWITCH".

3) Adjust "STOP LAMP SWITCH" Clearance as below.

Specification : 0.5~1.0mm (0.02~0.04in)

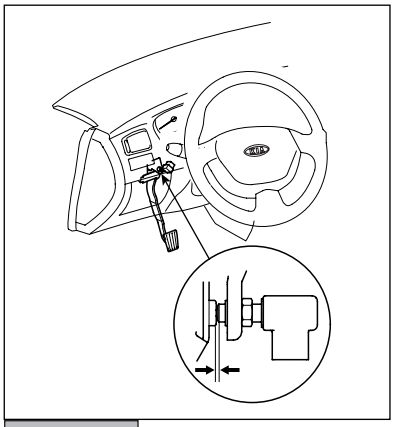


FIG.1)

FIG 1)method of adjust : Screw in the "STOP LAMP SWITCH" until its plunger is fully de-pressed(threaded end (A) touching the pad (B) on the pedal arm). Then back off the switch 3/4 turn to make 0.5-1.0mm(0.02-0.04in) of clearance between the threaded end and pad Tighten the locknut firmly. Connect the "STOP LAMP SWITCH" connector. Make sure that the stop lamp go off when the pedal is released.

LKJF200G

4) After Adjusting, has problem been solved?

YES

▶ Go to "Verification vehicle repair" procedure.

NO

▶ Substitute with a known-good TCM(PCM) and check for proper operation. If the problem is corrected, replace TCM/PCM as necessary and go to "Verification Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC48FBDE

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

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

YES

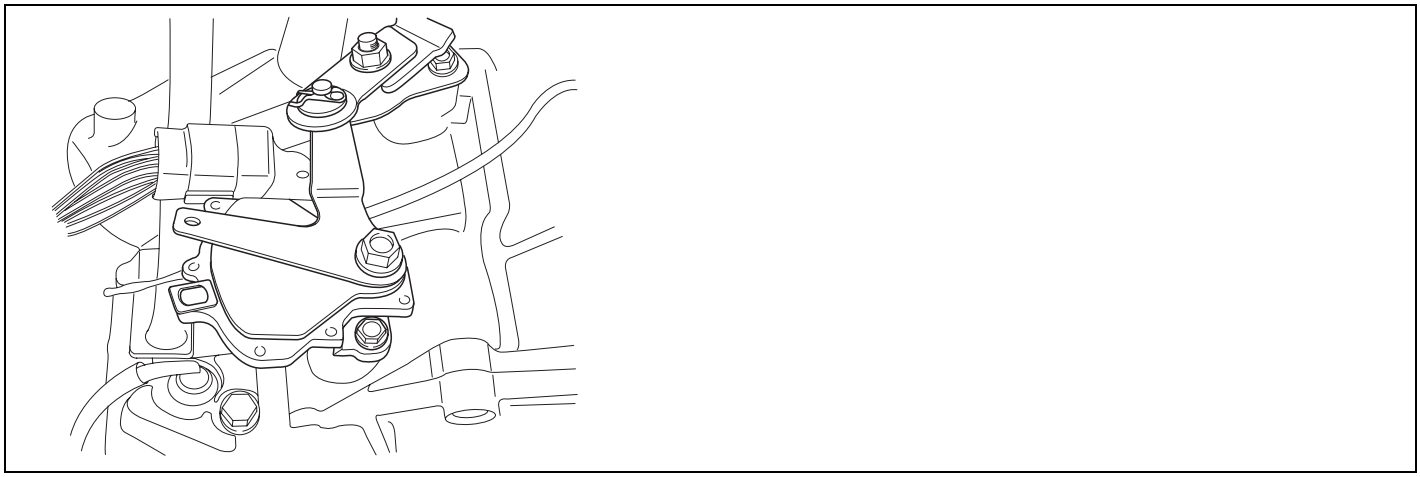
▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC P0707 TRANSAXLE RANGE SWITCH - LOW INPUT

COMPONENT LOCATION E366A8F5



LKJF201A

GENERAL DESCRIPTION E3EBCAD9

The Transaxle range switch sends the shift lever position information to the TCM(PCM) using a 12V (battery voltage) signal. When the shift lever is in the D (Drive) position the output signal of transaxle range switch is 12V and in all other positions the voltage is 0V. The TCM(PCM) judges the shift lever position by reading all signals, for the transaxle range switch, simultaneously.

DTC DESCRIPTION EFEF2D9D

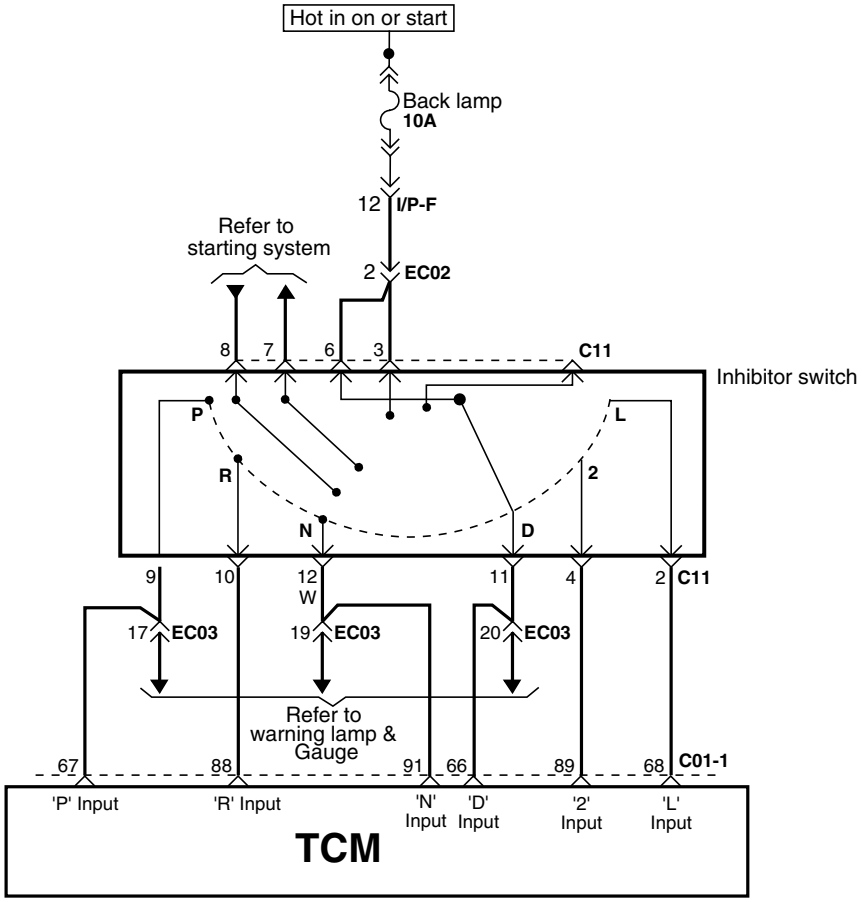
The TCM(PCM) sets this code when the transaxle range switch has no output signal for an extended period of time.

DTC DETECTING CONDITION E846B5FD

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for No signal	• Open or short in circuit • Faulty TRANSAXLE RANGE SWITCH • Faulty TCM(PCM)
Enable Conditions	• Engine speed ≥ 500rpm • OUTPUT SPEED(PG-B) ≥ 0rpm	
Threshold value	• No signal detected	
Diagnostic Time	• More than 30sec	
Fail Safe	• Recognition as previous signal - When P-D or R-D or D-R SHIFT is detected, it is regarded as N-D or N-R though "N" signal is not detected.	

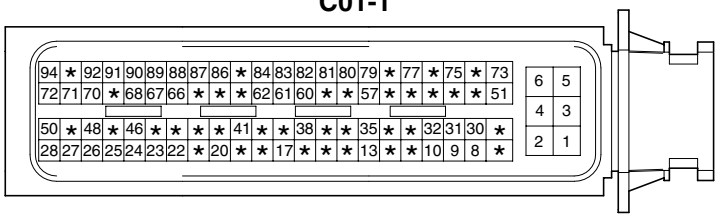
SCHEMATIC DIAGRAM E1EB3C52

[Circuit Diagram]



[Harness Connector]

C01-1



C11

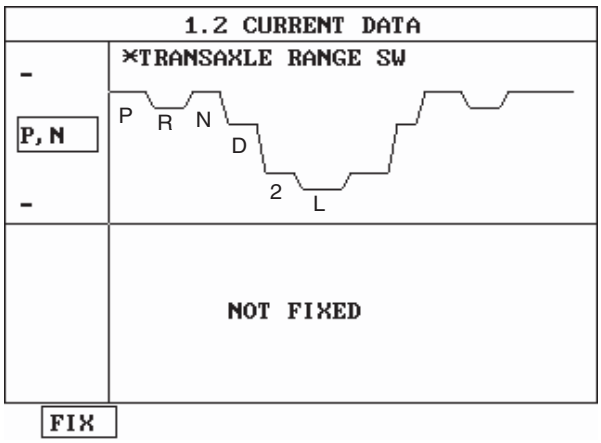
[Connection Information]

Terminal No. / Shift Lever	P	R	N	D	2	L	Connection
2						●	TCM(C01-1 No.68)
4					●		TCM(C01-1 No.89)
6	●	●	●	●	●	●	Ignition SW (IG1)
7	●		●				Starting motor
8	●		●				Ignition SW (Start)
9	●						TCM(C01-1 No.67)
10		●					TCM(C01-1 No.88)
11				●			TCM(C01-1 No.66)
12			●				TCM(C01-1 No.91)

LKJF201B

MONITOR SCANTOOL DATA E9E1CBCB

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



LKJF201C

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

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E7EE09D3

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

YES

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

NO

▶ Go to "Power supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION E13351E3

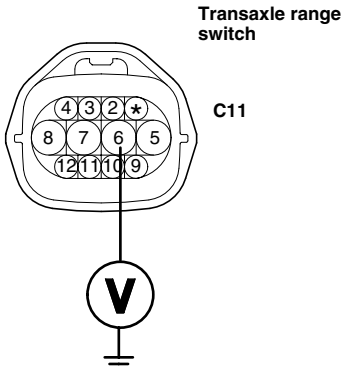
1. CHECK POWER TO RANGE SWITCH

   1) Disconnect "TRANSAXLE RANGE SWITCH" connector.

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

   3) Measure voltage between teminal "6" of the sensor harness connector and chassis ground.

Specification : approx. B+



2. RANGE L
3. Power supply
4. RANGE 2
5. BACK-UP LAMPS
6. Power supply
9. RANGE P
10. RANGE R
11. RANGE D
12. RANGE N

LKJF201D

   4) Is voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Check that Fuse 5-10A is installed or not blown.
▶ Check for open in harness. Repair as necessary and go to "Verification vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION E5CB7F8A

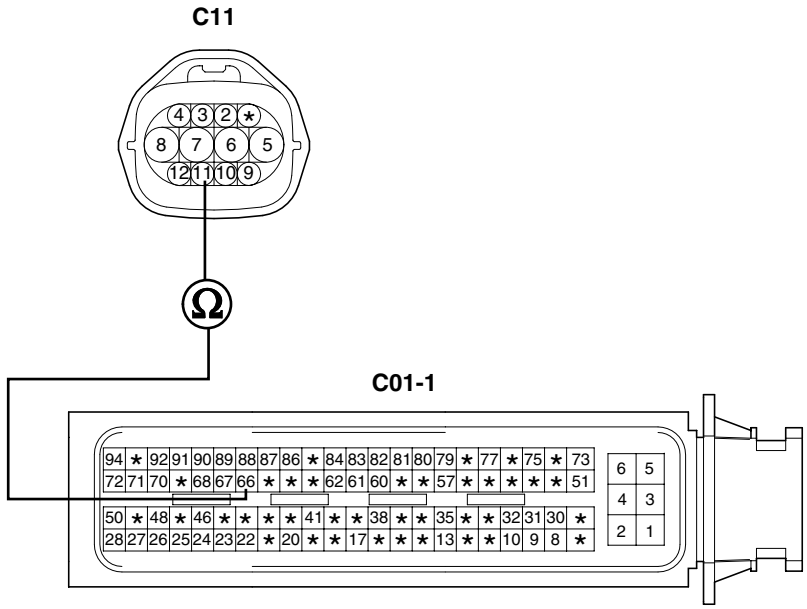
1. Ignition "OFF".

2. Disconnect "TRANSAXLE RANGE SWITCH" and "TCM(PCM)" connector.

3. Measure resistance between each teminal of the sensor harness connector and TCM(PCM) harness connector as below.

Specification : Shown below

RANGE	L	2	P	R	D	N
Pin No of "TRANSAXLE RANGE SWITCH	C11 No.2	C11 No.4	C11 No.9	C11 No.10	C11 No.11	C11 No.12
Pin No of "TCM(PCM)" harness	C01-1 No.68	C01-1 No.89	C01-1 No.67	C01-1 No.88	C01-1 No.66	C01-1 No.91
Specification	0Ω	0Ω	0Ω	0Ω	0Ω	0Ω



2. RANGE L
3. Power supply
4. RANGE 2
5. BACK-UP LAMPS
6. Power supply
9. RANGE P
10. RANGE R
11. RANGE D
12. RANGE N

66. Range D input signal
88. Range R input signal
91. Range N input signal
68. Range L input signal
67. Range P input signal
89. Range 2 input signal

LKJF201E

4. Is resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

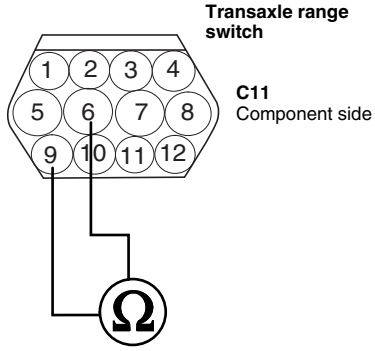
NO

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

COMPONENT INSPECTION EE828EEF

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

Specification : approx. 0 Ω



2. RANGE L
3. Power supply
4. RANGE 2
5. BACK-UP LAMPS
6. Power supply
9. RANGE P
10. RANGE R
11. RANGE D
12. RANGE N

LKJF201F

Terminal No. / Shift Lever	P	R	N	D	2	L
2						●
4					●	
6	●	●	●	●	●	●
7	●		●			
8	●		●			
9	●					
10		●				
11				●		
12			●			

[RANGE SWITCH continuity check table]

LKJF201G

4. Is resistance within specifications?

YES

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

NO

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

VERIFICATION OF VEHICLE REPAIR EB3BF892

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC P0708 TRANSAXLE RANGE SWITCH - HIGH INPUT

COMPONENT LOCATION ED5EF2CE

Refer to DTC P0707.

GENERAL DESCRIPTION EA5FCB5F

Refer to DTC P0707.

DTC DESCRIPTION E6180DA8

Refer to DTC P0707.

DTC DETECTING CONDITION E6EB6BBC

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for multiple signals	• Open or short in TRANSAXLE RANGE SWITCH • Faulty TRANSAXLE RANGE SWITCH • Faulty TCM(PCM)
Enable Conditions	• Engine speed ≥ 500rpm • OUTPUT SPEED(PG-B) ≥ 0rpm	
Threshold value	• Multiple signal	
Diagnostic Time	• More than 30sec	
Fail Safe	• Recognition as previous signal - When signal is input "D" and "N" at the same time, TCM(PCM) regards it as "N" RANGE. - After TCM(PCM) reset, if the if the TCM(PCM) detects multiple signal or no signal, then it holds the 3rd gear position.	

SCHEMATIC DIAGRAM E3F911BF

Refer to DTC P0707.

MONITOR SCANTOOL DATA E2AA43D4

Refer to DTC P0707.

TERMINAL & CONNECTOR INSPECTION E4D13C3B

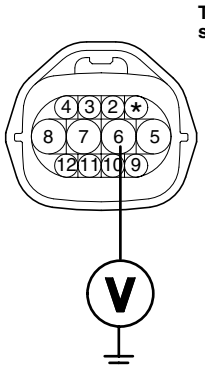
Refer to DTC P0707.

POWER SUPPLY CIRCUIT INSPECTION E9229162

1. Disconnect "TRANSAXLE RANGE SWITCH" connector.
2. Ignition "ON" & Engine "OFF".
3. Measure voltage between each teminal of the sensor harness connector and chassis ground.

Specification : Shown below

TERMINAL (C11)	2	3	4	5	6	7	8	9	10	11	12
SPECIFI-CATION	0V	12V	0V	0V	12V	0V	0V	0V	0V	0V	0V



2. RANGE L
3. Power supply
4. RANGE 2
5. BACK-UP LAMPS
6. Power supply
9. RANGE P
10. RANGE R
11. RANGE D
12. RANGE N

LKJF201D

4. Is voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

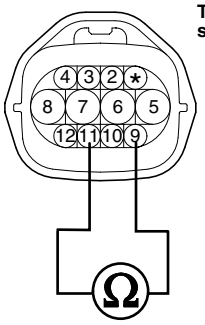
NO

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

SIGNAL CIRCUIT INSPECTION E7CF1804

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "TCM(PCM)" connector.
3. Measure resistance between each teminals of the sensor harness to check for Short.

Specification : Infinite



Transaxle range switch

C11

2. RANGE L
3. Power supply
4. RANGE 2
5. BACK-UP LAMPS
6. Power supply
9. RANGE P
10. RANGE R
11. RANGE D
12. RANGE N

LKJF202A

4. Is resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E5BF6699

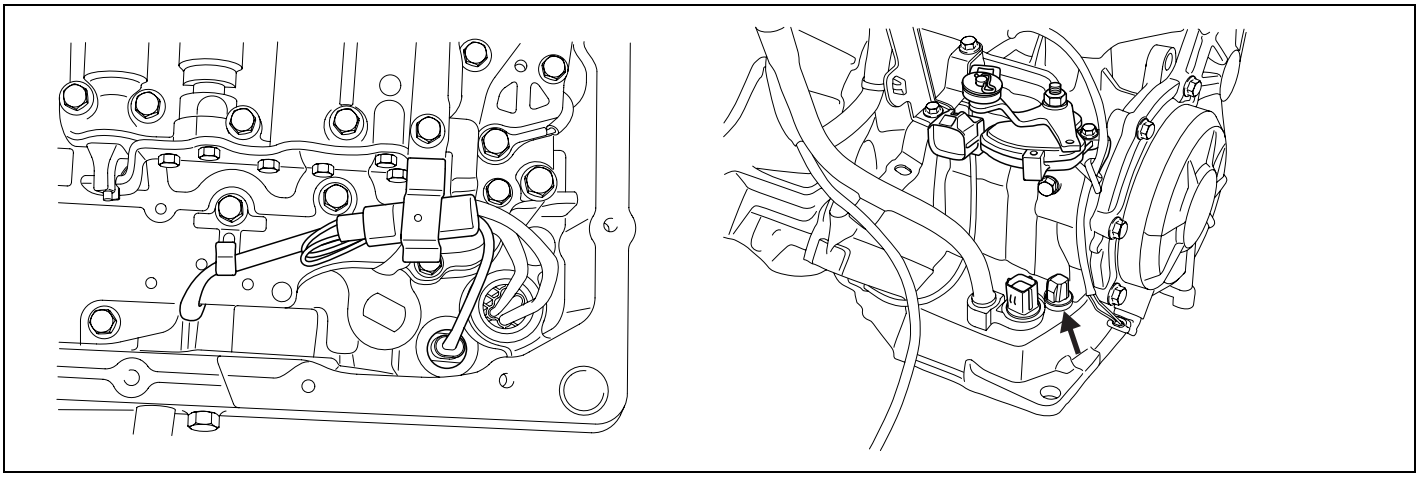
Refer to DTC P0707.

VERIFICATION OF VEHICLE REPAIR E1BF031A

Refer to DTC P0707.

DTC P0711 TRANSAXLE FLUID TEMPERATURE SENSOR RATIONALITY

COMPONENT LOCATION E0DA047D



LKJF203A

GENERAL DESCRIPTION EA2EA74A

The automatic transmission fluid(ATF) temperature sensor is installed in the valve body. This sensor uses a thermistor whose resistance changes according to the temperature changes. The TCM(PCM) supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic transmission fluid(ATF) temperature provides very important data for the TCM(PCM)'s control of the torque converter clutch, and is also used for many other purposes.

DTC DESCRIPTION E5CF26BB

This DTC code is set when the ATF temperature output voltage is lower than the value generated by thermistor resistance, in a normal operating range, for approximately 1 second or longer. The TCM(PCM) regards the ATF temperature as fixed at a value of 80°C(176°F), if this DTC is detected.

DTC DETECTING CONDITION EA1C5BC0

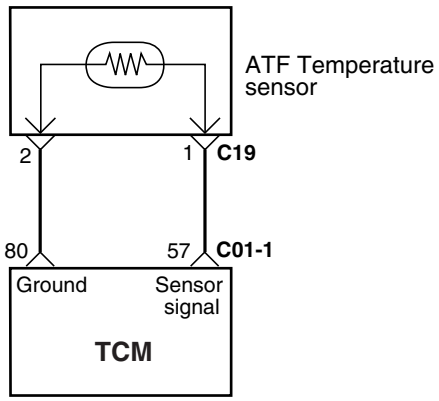
Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		• Check for ground short	• Sensor signal circuit is short to ground • Faulty sensor • Faulty TCM(PCM)
Enable Conditions	**Case 1**	• 4.547V > Voltage > 0.1V	
	Case 2	• Engine speed > 1000rpm • Output speed > 500rpm • ATF temperature > 50°C(122°F) • Timer of ATF stuck monitoring > 600sec.	
	Case 3	• ATF Temp. at IG ON > 45°C(113°F) • (ATF Temp. at IG OFF - Coolant Temp. at IG ON) > 30°C(86°F) • The variation of coolant temp. > 5°C(41°F) • Coolant temp. at IG ON > -20°C(-4°F)	
Threshold value	**Case 1**	• Change of voltage at 0.5sec > 10.11V	
	Case 2	• (Present ATF Temp. - ATF Temp. when timer starts) < 5°C(41°F)	
	Case 3	• (ATF Temp. at IG ON - Coolant Temp. at IG ON) > 10°C(50°F)	
Diagnostic Time		• More than 1sec	
Fail Safe		• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C(176°F)	

SPECIFICATION E29232E6

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

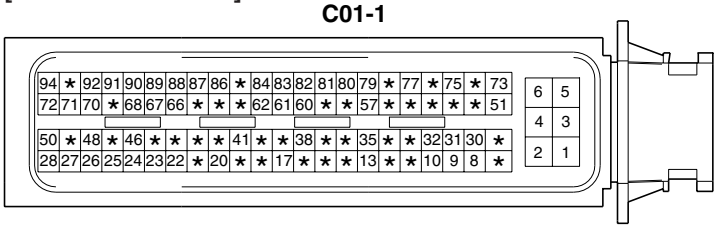
SCHEMATIC DIAGRAM EF6EE990

[Circuit Diagram]

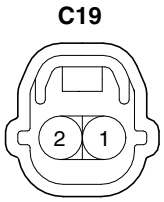


[Harness Connector]

C01-1



C19



[Connection Information]

Terminal	Connection	Function
1	TCM(C01-1 No.57)	Sensor signal
2	TCM(C01-1 No.80)	Sensor ground

LKJF203B

MONITOR SCANTOOL DATA E6CD4856

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

Specification : Increasing Gradually

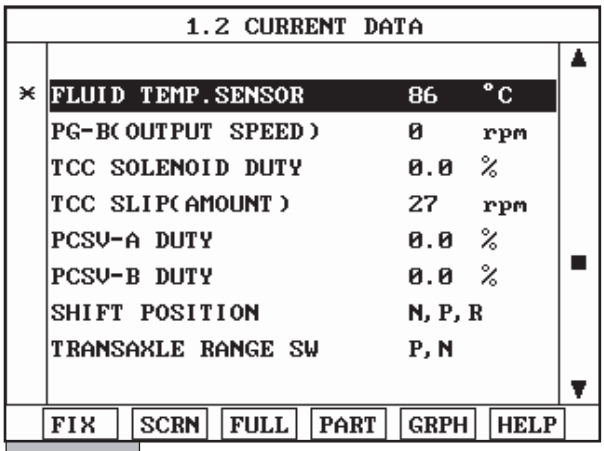


FIG.1)

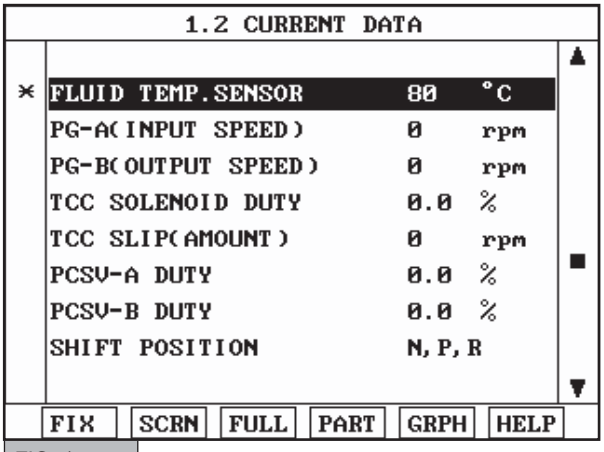


FIG.2)

FIG.1) Normal.
FIG.2) Signal harness short.

LKJF203C

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

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EADAC775

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

YES

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

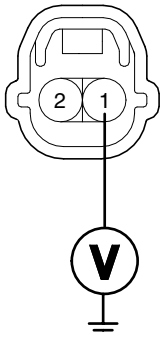
NO

▶ Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION EC37F2F2

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

Specification : Approx. 5 V



1.TRANSAXLE FLUID TEMPERATURE SENSOR signal
2.Sensor ground

LKJF203D

4. Is voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION ECDF85B2

1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"

   1) Ignition "OFF".

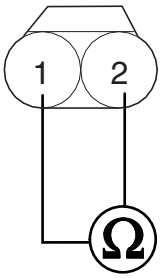
   2) Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.

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

Specification : Refer to "Reference data"

[REFERENCE DATA]

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



C19
Component side

1.TRANSAXLE FLUID TEMPERATURE SENSOR signal
2.Sensor ground

LKJF203E

   4) Is resistance within specifications?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

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

2. CHECK TCM(PCM)

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

   2) Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.

   3) Install scantool and select a SIMU-SCAN.

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

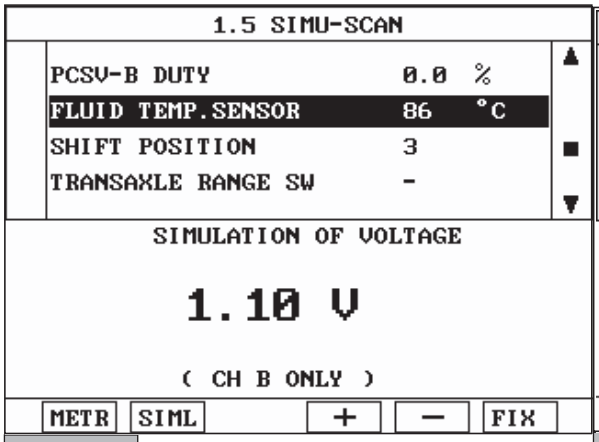


FIG.1)

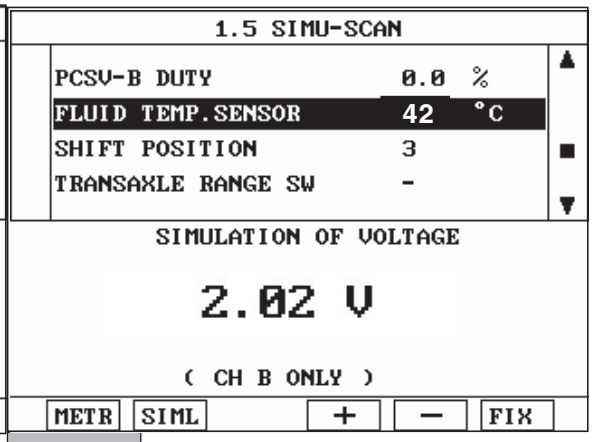


FIG.2)

FIG.1) INPUT 1.02V → 86˚C
FIG.2) INPUT 2.02V → 42˚C

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

LKJF203F

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

YES

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

NO

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

VERIFICATION OF VEHICLE REPAIR E187A1C5

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC P0712 FLUID(OIL) TEMPERATURE SENSOR CIRCUIT - LOW

COMPONENT LOCATION EE5B5D00

Refer to DTC P0711.

GENERAL DESCRIPTION E1358502

Refer to DTC P0711.

DTC DESCRIPTION E40CB0EF

Refer to DTC P0711.

DTC DETECTING CONDITION EB2674EE

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for ground short	• Sensor signal circuit is short to ground • Faulty sensor • Faulty TCM(PCM)
Enable Conditions	• Battery voltage > 9V	
Threshold value	• Voltage < 0.1V	
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C(176°F)	

SPECIFICATION EC115319

Refer to DTC P0711.

SCHEMATIC DIAGRAM E89083E4

Refer to DTC P0711.

MONITOR SCANTOOL DATA E76F6758

Refer to DTC P0711.

TERMINAL & CONNECTOR INSPECTION E52F4B83

Refer to DTC P0711.

SIGNAL CIRCUIT INSPECTION EBA0DD62

Refer to DTC P0711.

COMPONENT INSPECTION EFF59C82

Refer to DTC P0711.

VERIFICATION OF VEHICLE REPAIR E3E7518B

Refer to DTC P0711.

DTC P0713 FLUID(OIL) TEMPERATURE SENSOR CIRCUIT - HIGH

COMPONENT LOCATION E8999B06

Refer to DTC P0711.

GENERAL DESCRIPTION E6ECD9BD

Refer to DTC P0711.

DTC DESCRIPTION E216D5EC

Refer to DTC P0711.

DTC DETECTING CONDITION EB2FB2B9

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open in circuit • Faulty sensor • Faulty TCM(PCM)
Enable Conditions	• Engine speed > 1000rpm • Output speed > 500rpm • Accumulated time in above condition : 160sec	
Threshold value	• Voltage > 4.547V	
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C(176°F)	

SPECIFICATION E58BF514

Refer to DTC P0711.

SCHEMATIC DIAGRAM E425A013

Refer to DTC P0711.

MONITOR SCANTOOL DATA E99DDB8B

Refer to DTC P0711.

TERMINAL & CONNECTOR INSPECTION E77E06BF

Refer to DTC P0711.

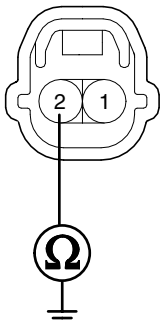
SIGNAL CIRCUIT INSPECTION ED52D11A

Refer to DTC P0711.

GROUND CIRCUIT INSPECTION E28D556E

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

Specification : Approx. 0 Ω



1.TRANSAXLE FLUID TEMPERATURE SENSOR signal
2.Sensor ground

LKJF204A

4. Is resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION EAB7BD34

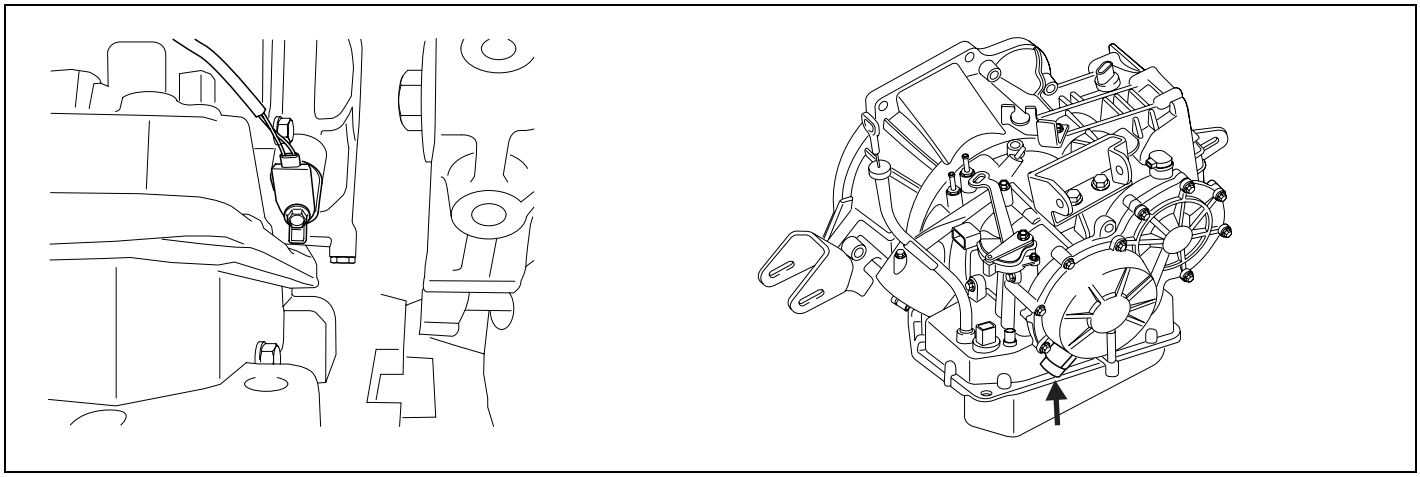
Refer to DTC P0711.

VERIFICATION OF VEHICLE REPAIR E901C676

Refer to DTC P0711.

DTC P0716 INPUT SPEED SENSOR RANGE/PERFORMANCE

COMPONENT LOCATION ECB3FBBD



LKJF205A

GENERAL DESCRIPTION EE1CBBEF

The input(turbine) speed sensor outputs waveform signals according to the revolutions of the input shaft ,installed in front of end clutch retainer, of the transmission. The TCM(PCM) determines the input shaft speed by calculating the frequency of the pulses. This value is mainly used to control the optimum fluid pressure during shifting.

DTC DESCRIPTION EB75D31B

The TCM(PCM) sets this code if an output pulse-signal is not detected, from the INPUT SPEED SENSOR(PG-A), when the vehicle is running faster than 30 km/h(19 mile/h). The Fail-Safe function will be set by the TCM(PCM) if this code is detected.

DTC DETECTING CONDITION E1E18873

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty INPUT SPEED SENSOR • Faulty TCM(PCM)
Enable Conditions	• Battery voltage > 9V	
Threshold value	• Input speed > 8000rpm	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd or 2nd gear • Manual shifting is possibe (2nd → 3rd, 3rd → 2nd)	

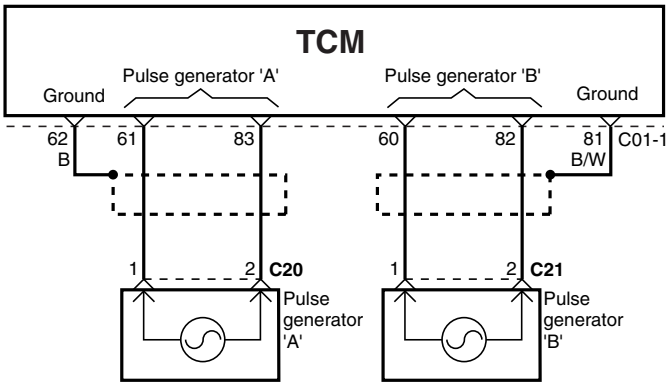
SPECIFICATION E0BFE7D9

Input shaft & Output shaft speed sensor

● Type : Magnetic Inductive Type
● Sensor body and sensor connector have been unified as one.

SCHEMATIC DIAGRAM E8A2B05D

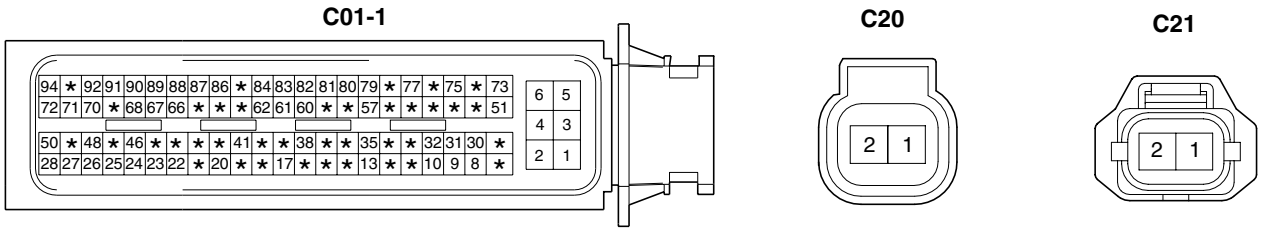
[Circuit Diagram]



[Connection Information]

Terminal	Connection	Function
C20-1	TCM (C01-1 No.61)	Pulse generator A +
C20-2	TCM (C01-1 No.83)	Pulse generator A -
C21-1	TCM (C01-1 No.60)	Pulse generator B +
C21-2	TCM (C01-1 No.82)	Pulse generator B -

[Harness Connector]



LKJF205B

SIGNAL WAVEFORM E76B4E99

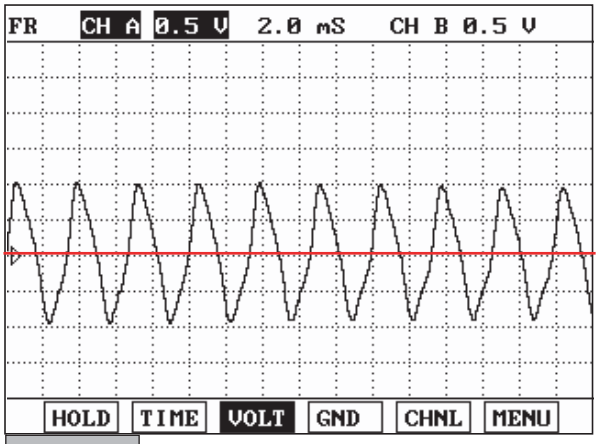


FIG.1)

FIG.1) Connect RED lead wire to PULSE GENERATOR A SIGNAL(+),Black lead wire to PULSE GENERATOR A SIGNAL(-), and measure.

LKJF205C

MONITOR SCANTOOL DATA EFD805B3

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

Specification : Increasing Gradually

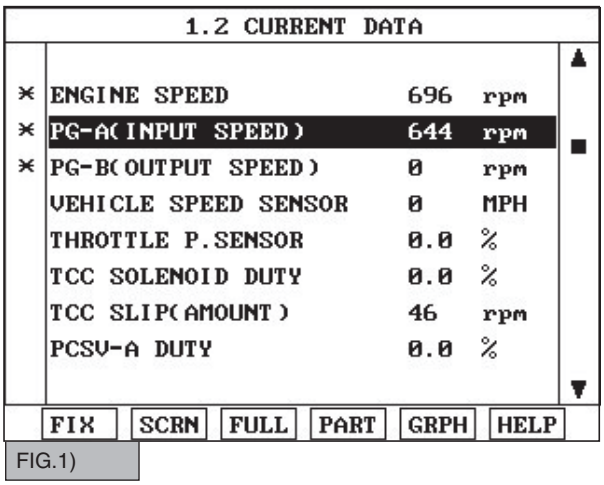


FIG.1)

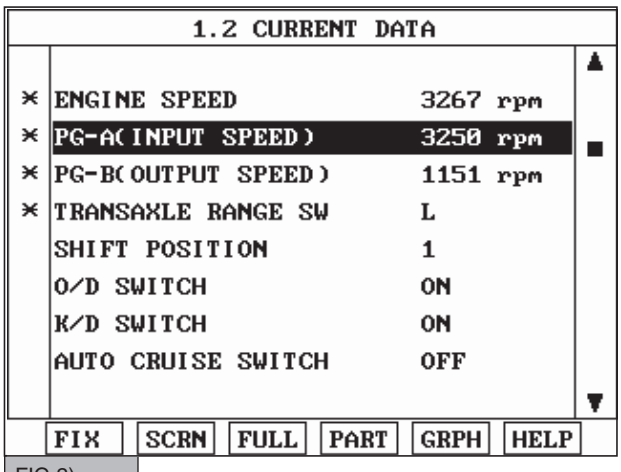


FIG.2)

FIG.1) Idling
FIG.2) Accelerating

LKJF205D

5. Does "INPUT SPEED SENSOR(PG-A) " follow the referance data?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E4DBEC56

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

YES

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

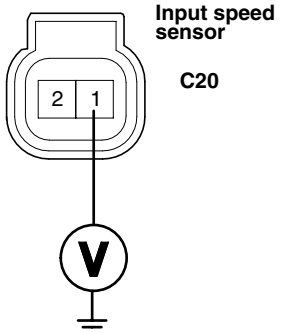
NO

▶ Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION EFEEE00F

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

Specification : approx. 1.45V



1.Pulse generator A +
2.Pulse generator A -

LKJF205E

4. Is voltage within specifications?

YES

▶ Go to "Ground circuit inspection" procedure .

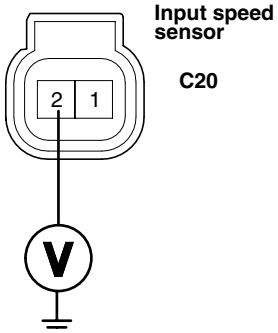
NO

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

GROUND CIRCUIT INSPECTION E2DA9C4D

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

Specification : approx. 1.7V



1.Pulse generator A +
2.Pulse generator A -

LKJF205F

4. Is voltage within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION EA8F24F1

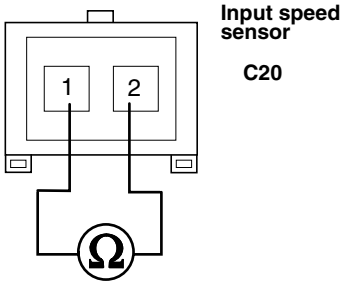
1. Check "INPUT SPEED SENSOR(PG-A)"

   1) Ignition "OFF".

   2) Disconnect the "INPUT SPEED SENSOR" connector.

   3) Measure resistance between terminal "1" and "2" of the "INPUT SPEED SENSOR" connector.

Specification : 245 ± 30 Ω /20°C(68°F)



LKJF205G

   4) Is resistance within specifications?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

▶ Replace "INPUT SPEED SENSOR" as necessary and Go to "Verification vehicle repair" procedure.

2. CHECK TCM(PCM)

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

   2) Connect "INPUT SPEED SENSOR" connector.

   3) Install scantool and select a SIMU-SCAN.

4) Simulate frequency to INPUT SPEED SENSOR signal circuit.

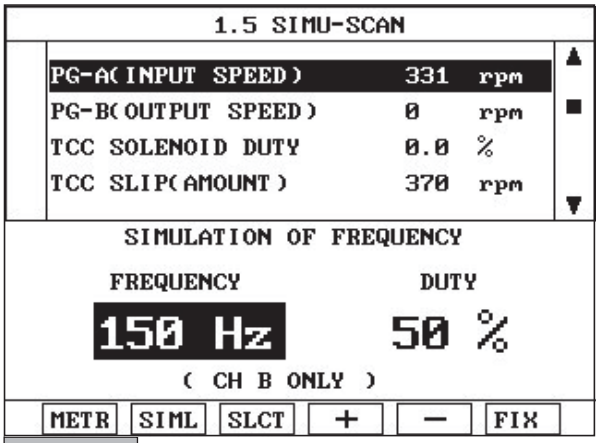


FIG.1)

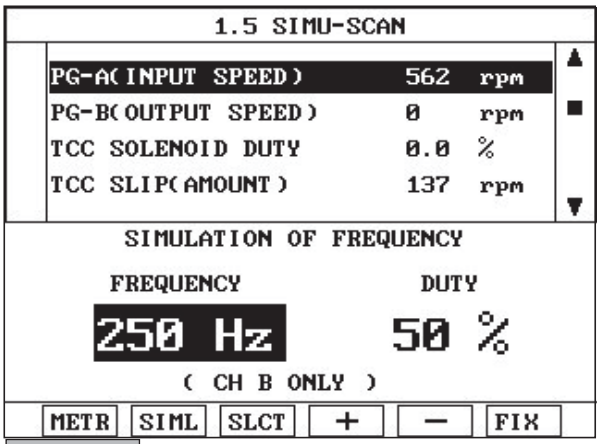


FIG.2)

FIG.1) INPUT 150Hz → 331rpm
FIG.2) INPUT 250Hz → 562rpm

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

LKJF205H

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

YES

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

NO

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

VERIFICATION OF VEHICLE REPAIR EDE5508C

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC P0717 INPUT SPEED SENSOR CIRCUIT - NO SIGNAL

COMPONENT LOCATION EC16DDC8

Refer to DTC P0716.

GENERAL DESCRIPTION E109ACC4

Refer to DTC P0716.

DTC DESCRIPTION E1263A1C

Refer to DTC P0716.

DTC DETECTING CONDITION EFFA1B21

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty INPUT SPEED SENSOR • Faulty TCM(PCM)
Enable Conditions	• Vehicle speed is over 19 Mile/h(30 Km/h) in D,2,L(A/T range swhitch) • Battery voltage > 9V • Output speed sensor > 1000rpm • Engine speed(Only 1st gear) > 3000rpm	
Threshold value	• No signal	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd or 2nd gear • Manual shifting is possibe (2 nd → 3 rd, 3 rd → 2 nd)	

SPECIFICATION E36E4F0C

Refer to DTC P0716.

SCHEMATIC DIAGRAM E64056D8

Refer to DTC P0716.

SIGNAL WAVEFORM ECFF58BE

Refer to DTC P0716.

MONITOR SCANTOOL DATA E056B47F

Refer to DTC P0716.

TERMINAL & CONNECTOR INSPECTION E45046C2

Refer to DTC P0716.

SIGNAL CIRCUIT INSPECTION E1D26D96

Refer to DTC P0716.

GROUND CIRCUIT INSPECTION E2BAA065

Refer to DTC P0716.

COMPONENT INSPECTION E66AD10A

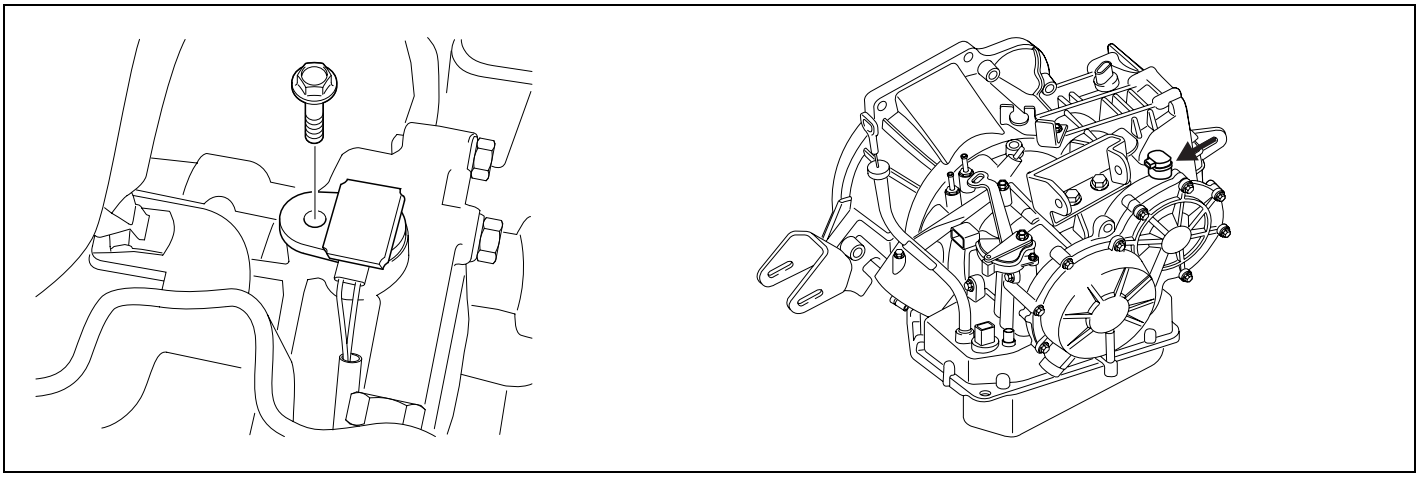
Refer to DTC P0716.

VERIFICATION OF VEHICLE REPAIR E73A9D8B

Refer to DTC P0716.

DTC P0722 OUTPUT SPEED SENSOR CIRCUIT - NO SIGNAL

COMPONENT LOCATION ED2AC252



LKJF206A

GENERAL DESCRIPTION E876DDC2

The OUTPUT SPEED SENSOR(PG-B) outputs waveform signals according to the revolutions of the output shaft of the transmission. The OUTPUT SPEED SENSOR(PG-B) is installed in front of the Transfer Drive Gear and determine the Transfer Drive Gear rpms by calculating the frequency of the pulses. This value, together with the throttle position data, is mainly used to decide the optimum gear position.

DTC DESCRIPTION E7EAAF98

The TCM(PCM) sets this code if the calculated value of the pulse-signal is noticeably different from the value calculated, using the Vehicle Speed Sensor output, when the vehicle is running faster than 30 km/h. The TCM(PCM) will initiate the fail safe function if this code is detected.

DTC DETECTING CONDITION E55AC8F0

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		• Speed rationality check	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty OUTPUT SPEED SENSOR • Faulty TCM(PCM)
Enable Conditions	**Case 1**	• Vehicle speed is over 19 Mile/h(30 Km/h) in D, 2, L(A/T range swhitch) • Throttle opening > 14.9% • Engine speed > 3000 rpm	
	Case 2	• Vehicle speed is over 19 Mile/h(30 Km/h) in D, 2(A/T range swhitch) • Input speed > 1500 rpm • Engine speed > 3000 rpm	
Threshold value		• Output speed = 0 rpm	
Diagnostic Time		• More than 1sec	
Fail Safe		• Locked into 3rd or 2nd gear • Manual shifting is possibe (2 nd → 3 rd, 3 rd → 2 nd)	

SPECIFICATION EA6AC0C5

Refer to DTC P0716.

SCHEMATIC DIAGRAM E75DB6AC

Refer to DTC P0716.

SIGNAL WAVEFORM EADF5F22

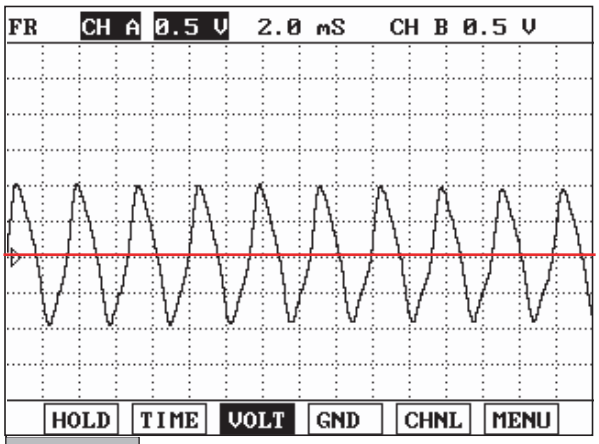


FIG.1)

FIG.1) Connect RED lead wire to PULSE GENERATOR B SIGNAL(+),Black lead wire to PULSE GENERATOR B SIGNAL(-), and measure.

LKJF206G

MONITOR SCANTOOL DATA EDC863FD

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

Specification : Increasing Gradually

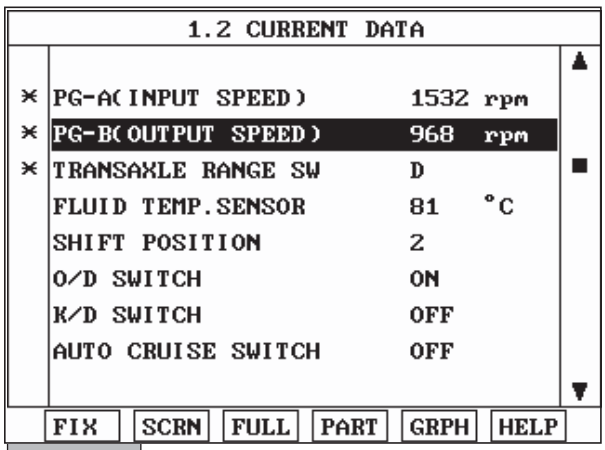


FIG.1)

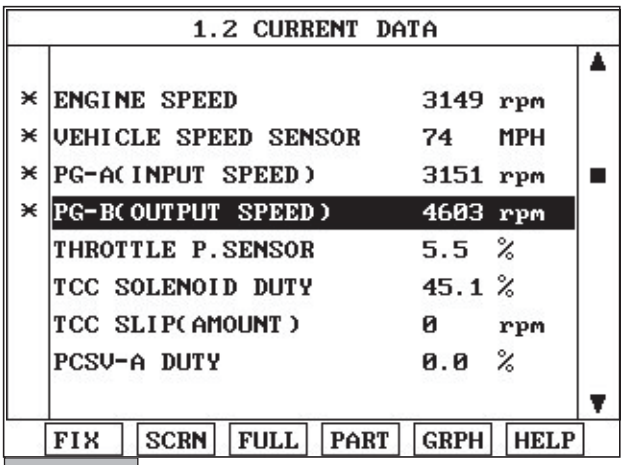


FIG.2)

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

LKJF206B

5. Does "OUTPUT SPEED SENSOR(PG-B)" follow the referance data?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

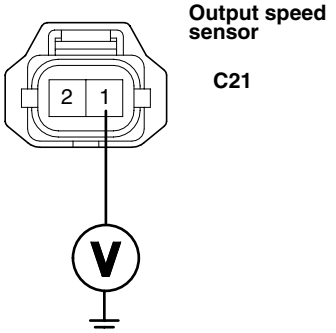
TERMINAL & CONNECTOR INSPECTION EE9AF749

Refer to DTC P0716.

SIGNAL CIRCUIT INSPECTION EEBEDE7B

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

Specification : approx. 1.45V



LKJF206C

4. Is voltage within specification?

YES

▶ Go to "Ground circuit inspection" procedure.

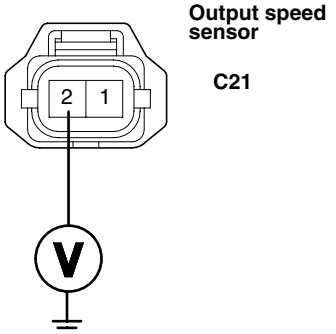
NO

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

GROUND CIRCUIT INSPECTION EBD6AE95

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

Specification : approx. 1.17V



LKJF206D

4. Is voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E82CBDC8

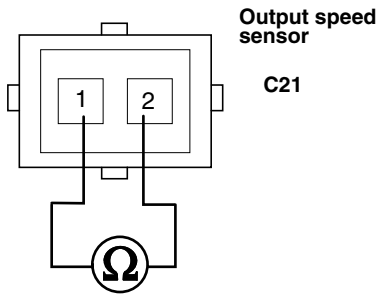
1. Check "OUTPUT SPEED SENSOR(PG-B)"

   1) Ignition "OFF".

   2) Disconnect the "OUTPUT SPEED SENSOR" connector.

   3) Measure resistance between terminal "1","2" of the "OUTPUT SPEED SENSOR" connector.

Specification : 245±30 Ω /20°C(68°F)



1.Pulse generator B +
2.Pulse generator B -

LKJF206E

   4) Is resistance within specifications?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

▶ Replace "OUTPUT SPEED SENSOR(PG-B)" as necessary and go to "Verification vehicle repair" procedure.

2. CHECK TCM(PCM)

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

2) Connect "OUTPUT SPEED SENSOR" connector.

3) Install scantool and select a SIMU-SCAN.

4) Simulate frequency to "OUTPUT SPEED SENSOR(PG-B)" signal circuit.

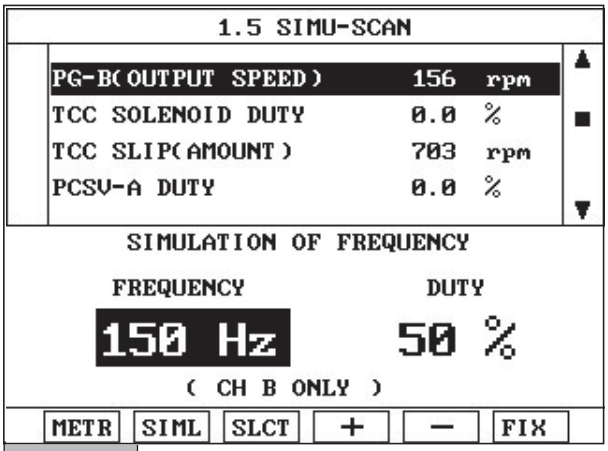


FIG.1)

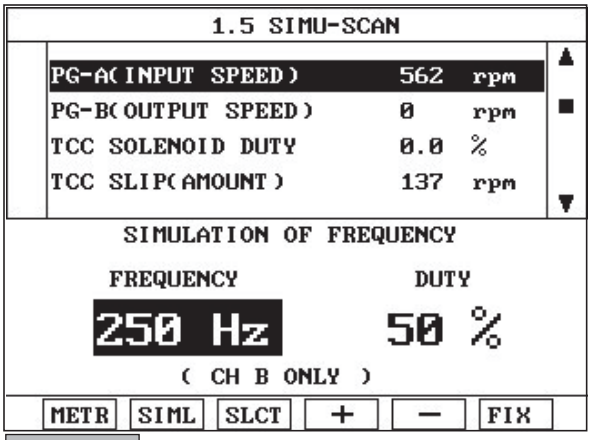


FIG.2)

FIG.1) OUTPUT 150Hz → 156rpm
FIG.2) OUTPUT 250Hz → 562rpm

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

LKJF206F

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

YES

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

NO

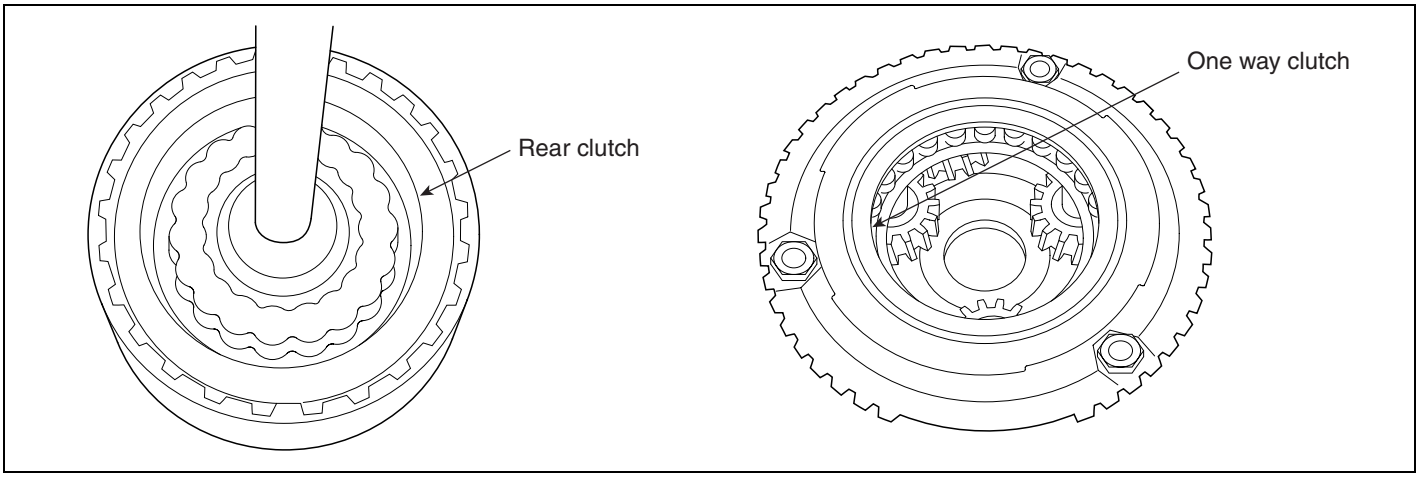
▶ Substitute with a known-good TCM(PCM) and check for proper operation. If the problem is corrected, replace TCM(PCM) as necessary and then go to "Verification of vehicle repair" procedure.

VERIFICATION OF VEHICLE REPAIR E328BB9B

Refer to DTC P0716.

DTC P0731 GEAR 1 INCORRECT RATIO

COMPONENT LOCATION EDE749EA



LKJF207A

GENERAL DESCRIPTION E1A884BC

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 1st gear ratio, while the transaxle is engaged in the 1st gear. For example, if the input speed is 1000 rpm and the 2nd gear ratio is 2.846, then the output speed is about 2846 rpm.

DTC DESCRIPTION EBD4D7EF

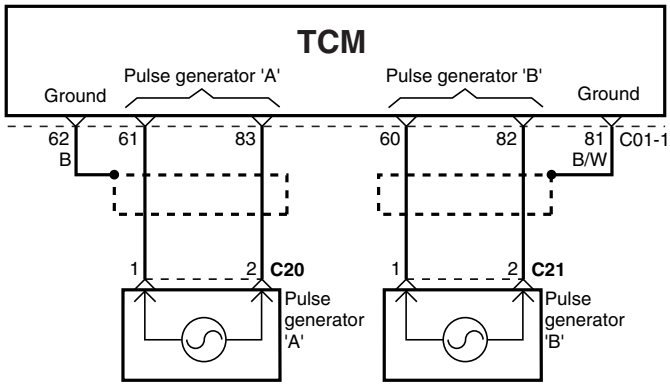
This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 1st gear ratio, while the transaxle is engaged in 1st gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfuctioning rather than an electrical issue.

DTC DETECTING CONDITION EAE081DE

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 1st gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty R/C or OWC F/C-Front Clutch R/C - Rear Clutch E/C - End Clutch OWC - One Way Clutch K/B - Kicdown brake L/R - Low & Reverse brake
Enable Conditions	• Engine speed > 400rpm • Output speed(PG-B) > 300rpm • Shift stage 1st gear • Input speed(PG-A) > 300rpm • A/T fluid temp sensor voltage > 10V • TRANSAXLE RANGE SWITCH is normal • Solenoid is normal	
Threshold value	• Input speed(Nt) > (1st gear ratio×Output speed +200)	
Diagnostic Time	• More than 2secs	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0731 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM E12627FF

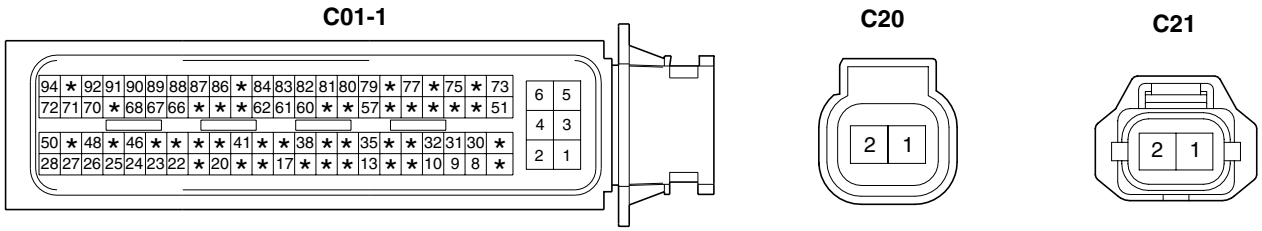
[Circuit Diagram]



[Connection Information]

Terminal	Connection	Function
C20-1	TCM (C01-1 No.61)	Pulse generator A +
C20-2	TCM (C01-1 No.83)	Pulse generator A -
C21-1	TCM (C01-1 No.60)	Pulse generator B +
C21-2	TCM (C01-1 No.82)	Pulse generator B -

[Harness Connector]



LKJF205B

SIGNAL WAVEFORM E9A4AAAE

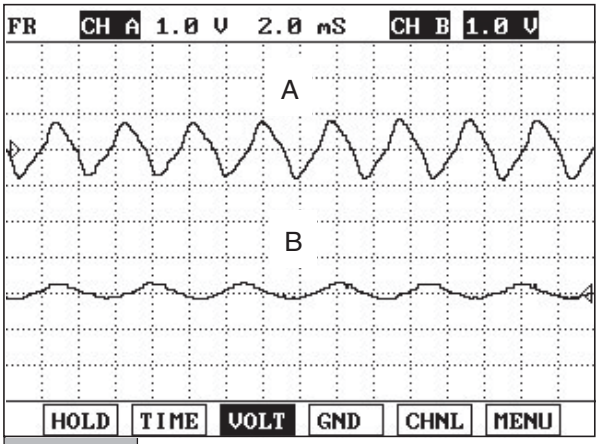


FIG.1)

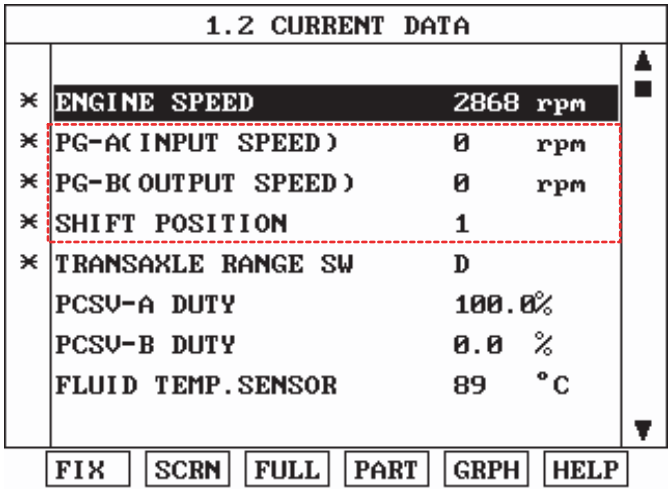
A : INPUT SPEED SENSOR(PG-A)
B : OUTPUT SPEED SENSOR(PG-B)

LKJF207B

MONITOR SCANTOOL DATA E8AC54C7

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

Specification : 2400~2800 engine rpm



LKJF207C

OPERATING ELEMENT OF EACH SHIFTING RANGE

Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	O						
R	-	Reverse			O					
N	-	Neutral	Possible							O
D	ON	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
		4th					O		O	
D	OFF	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
2	-	1st				O		O		
		2nd				O			O	
L	-	1st				O				O

C1 : Front clutch
C2 : Rear clutch
C3 : End clutch
OWC : One way clutch
B1 : Kickdown brake
B2 : Low & reverse brake

Stall test procedure in D1 and reason

Procedure

1. Warm up the engine
2. After positioning the select lever in "D" , depress the foot brake pedal fully. After that, depress the accelerator pedal to the maximum

   * The slippage of 1st gear operating parts can be detected by stall test in D1.

Reason for stall test

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

5. Is "STALL TEST " within specification?

YES

▶ Go to "W/Harness inspection" procedure.

NO

▶ Go to "Component inspection" procedure.

CAUTION

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

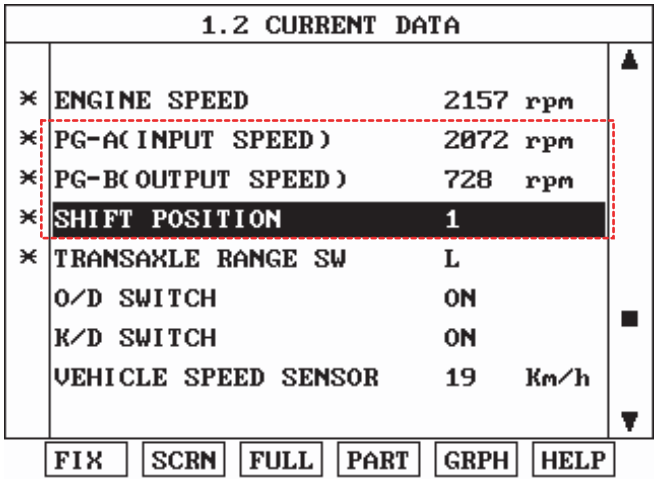
- ***Chock both rear wheel(left and right).***
- ***Pull the parking brake lever on with the brake pedal fully depressed.***
- ***The throttle should not be left fully open for more than eight second.***
- ***If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.***

※ Perform stall test on "L" range If the result of stall test on "D" range is out of specifications.
"One Way Clutch" is fauly If the result of stall test on "L" range is within specifications.

SIGNAL CIRCUIT INSPECTION EEFAAFC4

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

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



LKJF207D

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

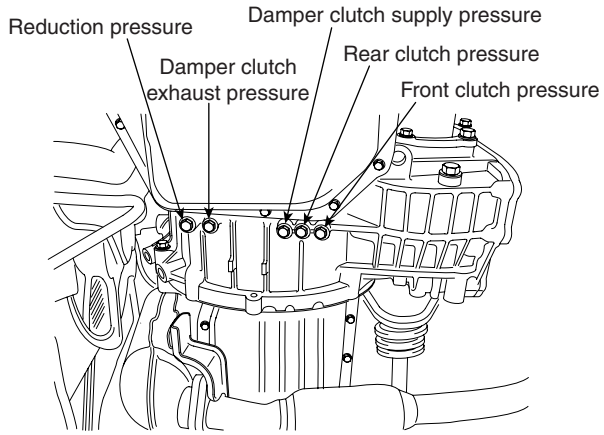
YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION EDC32C3D



LKJF207E

1. Connect oil pressure gauge to "R/C(rear clutch)" port.
2. Engine "ON".
3. Drive a car with gear position 1 in "D RANGE".
4. Compare it with referance data as below.

Specification : Shown below

No.	Measurement Condition			Standard hydraulic pressure kpa(kg/cm^2 , psi)							
				1	2	3	4	5	6	7	8
	Select lever position	Engine speed (rpm)	Shift position	Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure	Damper clutch pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)	235~275 (2.4~2.8, 34~40) (When the D/C non-operating)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)	265~343 (2.7~3.5, 38~50) (When the D/C non-operating)

LKJF207F

NOTE

- *"-" is 0.2(0.3)kg/cm² or less and "( )" is the reverse.*
- *SW-ON : Turn the overdrive control switch ON.*
- *SW-OFF : Turn the overdrive control switch OFF.*
- *The hydraulic pressure may be more than standard value at the ambient temperature.*

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

5. Is oil pressure value within specification?

YES

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

NO

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

VERIFICATION OF VEHICLE REPAIR EE8E3818

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

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

YES

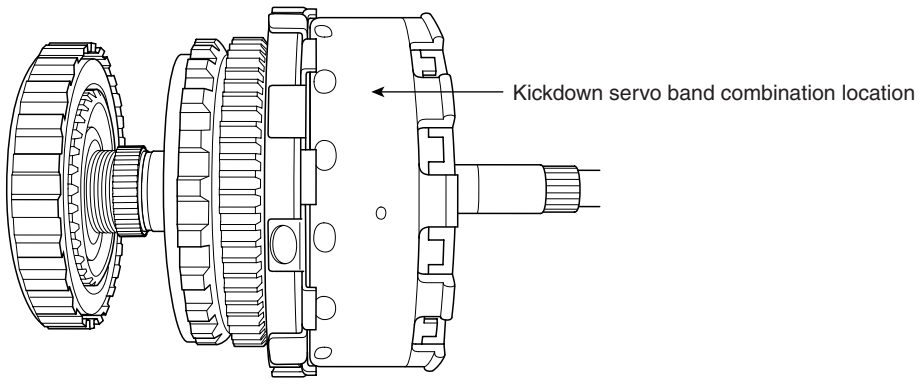
▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC P0732 GEAR 2 INCORRECT RATIO

COMPONENT LOCATION E9B4CFC3



LKJF208A

GENERAL DESCRIPTION E6C0361D

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 2nd gear ratio, while the transaxle is engaged in the 2nd gear. For example, if the input speed is 1000 rpm and the 2nd gear ratio is 1.581, then the output speed is 1581 rpm.

DTC DESCRIPTION ED8F2638

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 2nd gear ratio, while the transaxle is engaged in 2nd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfuctioning rather than an electrical issue.

DTC DETECTING CONDITION E2EF7D88

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 2nd gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty R/C or K/D F/C-Front Clutch R/C - Rear Clutch E/C - End Clutch OWC - One Way Clutch K/B - Kicdown brake L/R - Low & Reverse brake
Enable Conditions	• Engine speed > 400rpm • Output speed(PG-B) > 600rpm • Shift stage 2nd gear • Input speed(PG-A) > 300rpm • A/T fluid temp sensor voltage > 10V • TRANSAXLE RANGE SWITCH is normal • Solenoid is normal	
Threshold value	• | Input speed/2nd gear ratio - output speed | ≥ 200rpm /2nd gear ratio	
Diagnostic Time	• More than 2 secs	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0732 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM EBE6DD2E

Refer to DTC P0731.

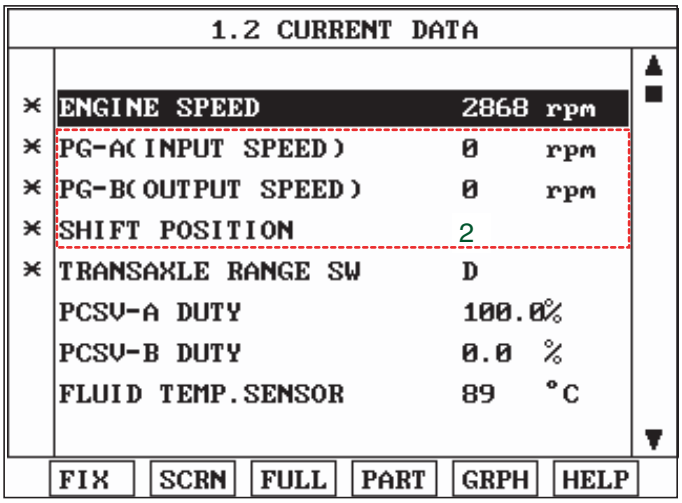
SIGNAL WAVEFORM EBD5552E

Refer to DTC P0731.

MONITOR SCANTOOL DATA EA4B81AA

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

Specification : 2400~2800 engine rpm



LKJF208C

* This test is possible only for "HOLD S/W" or "SPORTS MODE" applied vehicles.

OPERATING ELEMENT OF EACH SHIFTING RANGE

Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	O						
R	-	Reverse			O					
N	-	Neutral	Possible							O
D	ON	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
		4th					O		O	
D	OFF	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
2	-	1st				O		O		
		2nd				O			O	
L	-	1st				O				O

C1 : Front clutch
C2 : Rear clutch
C3 : End clutch
OWC : One way clutch
B1 : Kickdown brake
B2 : Low & reverse brake

Stall test procedure in D2 and reason

Procedure

1. Warm up the engine
2. After positioning the select lever in "D" and "ON" of the HOLD SW.
3. Depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum.

   * The slippage of 2nd gear operating parts can be detected by stall test in D2.

Reason for stall test

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

5. Is "STALL TEST " within specification?

YES

▶ Go to "W/Harness inspection" procedure.

NO

▶ Go to "Component inspection" procedure.

CAUTION

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

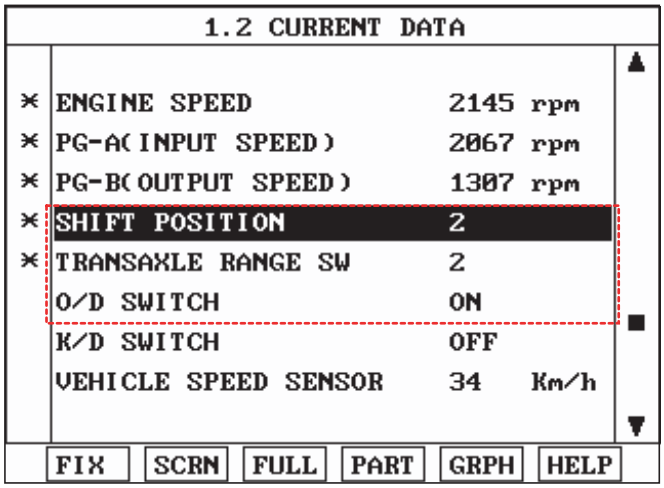
- ***Chock both rear wheel(left and right).***
- ***Pull the parking brake lever on with the brake pedal fully depressed.***
- ***The throttle should not be left fully open for more than eight second.***
- ***If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.***

※ Perform stall test on "L" range If the result of stall test on "D" range is out of specifications.
"One Way Clutch" is fauly If the result of stall test on "L" range is within specifications.

SIGNAL CIRCUIT INSPECTION EBCBAA45

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

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



LKJF208D

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

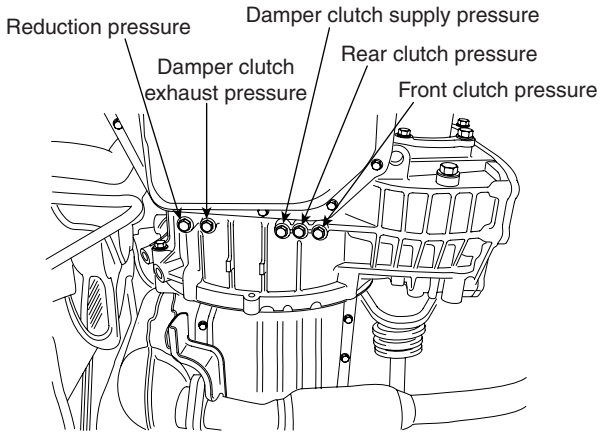
YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION ECD6FFB9



LKJF207E

1. Connect oil pressure gauge to "R/C" and "K/D" port.
2. Engine "ON".
3. Drive a car with gear position 2 in "D RANGE".
4. Compare it with referance data as below.

Specification : Shown below

No.	Measurement Condition			Standard hydraulic pressure kpa(kg/cm^2 , psi)							
				1	2	3	4	5	6	7	8
	Select lever position	Engine speed (rpm)	Shift position	Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure	Damper clutch pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)	235~275 (2.4~2.8, 34~40) (When the D/C non-operating)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)	265~343 (2.7~3.5, 38~50) (When the D/C non-operating)

LKJF207F

NOTE

- *"-" is 0.2(0.3)kg/cm² or less and "( )" is the reverse.*
- *SW-ON : Turn the overdrive control switch ON.*
- *SW-OFF : Turn the overdrive control switch OFF.*
- *The hydraulic pressure may be more than standard value at the ambient temperature.*

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

5. Is oil pressure value within specification?

YES

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

NO

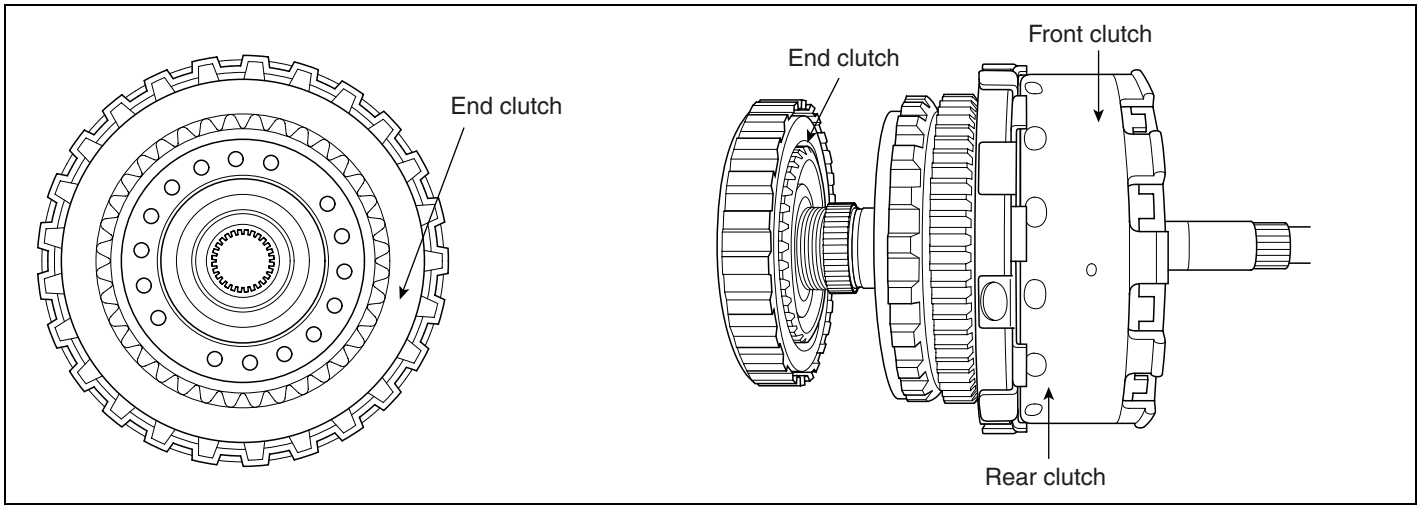
▶ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR EF813BDD

Refer to DTC P0731.

DTC P0733 GEAR 3 INCORRECT RATIO

COMPONENT LOCATION E8D543EE



LKJF209A

GENERAL DESCRIPTION EDFEFC70

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 3rd gear ratio, while the transaxle is engaged in the 3rd gear. For example, if the input speed is 1000 rpm and the 3rd gear ratio is 1.000, then the output speed is approx. 1000 rpm.

DTC DESCRIPTION E8BAC7EF

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 3rd gear ratio, while the transaxle is engaged in 3rd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfuctioning rather than an electrical issue.

DTC DETECTING CONDITION E3A9C13B

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 3rd gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty R/D or F/C or E/C F/C-Front Clutch R/C - Rear Clutch E/C - End Clutch OWC - One Way Clutch K/B - Kicdown brake L/R - Low & Reverse brake
Enable Conditions	• Engine speed > 400rpm • Output speed(PG-B) > 600rpm • Shift stage 3rd gear • Input speed(PG-A) > 300rpm • A/T fluid temp sensor voltage > 10V • TRANSAXLE RANGE SWITCH is normal • Solenoid is normal	
Threshold value	• | Input speed/3rd gear ratio - output speed | ≥ 200rpm /3rd gear ratio	
Diagnostic Time	• More than 2secs	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0733 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM E32315AB

Refer to DTC P0731.

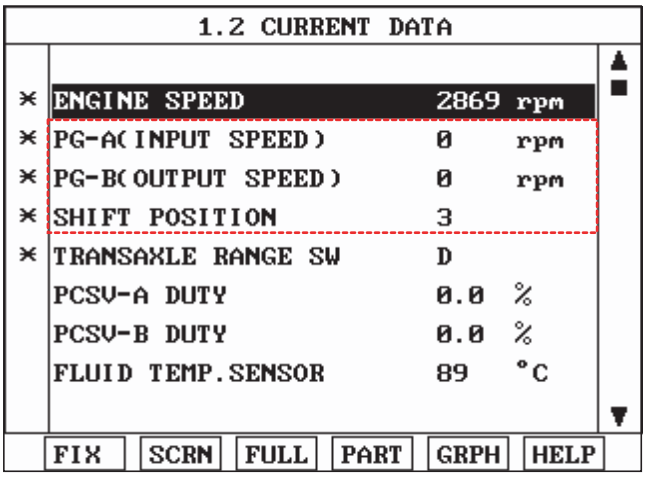
SIGNAL WAVEFORM EA8FBD5E

Refer to DTC P0731.

MONITOR SCANTOOL DATA E0271CEC

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

Specification : 2400~2800 engine rpm



LKJF209C

OPERATING ELEMENT OF EACH SHIFTING RANGE

Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	O						
R	-	Reverse			O					
N	-	Neutral	Possible							O
D	ON	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
		4th					O		O	
D	OFF	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
2	-	1st				O		O		
		2nd				O			O	
L	-	1st				O				O

C1 : Front clutch
C2 : Rear clutch
C3 : End clutch
OWC : One way clutch
B1 : Kickdown brake
B2 : Low & reverse brake

Stall test procedure in D3 and reason

Procedure

1. Warm up the engine
2. After positioning the select lever in "D" , depress the foot brake pedal fully. After that, depress the accelerator pedal to the maximum

   * The slippage of 3rd gear operating parts can be detected by stall test in D3.

Reason for stall test

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

5. Is "STALL TEST " within specification?

YES

▶ Go to "W/Harness inspection" procedure.

NO

▶ Go to "Component inspection" procedure.

CAUTION

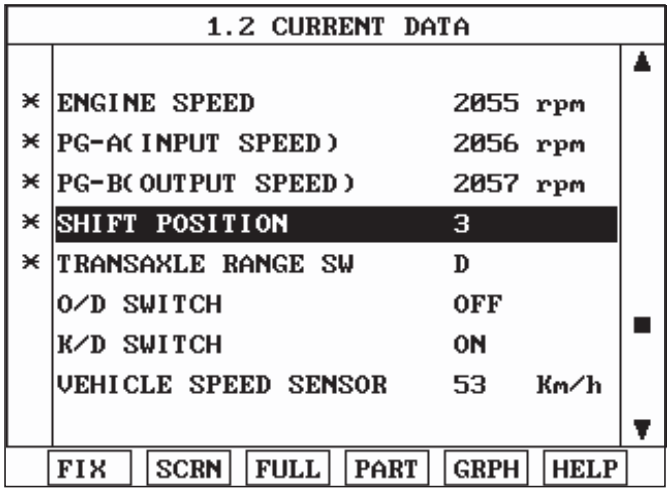
- ***Do not let anybody stand in front of or behind the vehicle while this test is being carried out.***
- ***Check the A/T fluid level and temperature and the engine coolant temperature.***
  - ***Fluid level : At the hot mark on the oil level gauge.***
  - ***Fluid temperature : 176 °F~ 212 °F (80~100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

- ***Chock both rear wheel(left and right).***
- ***Pull the parking brake lever on with the brake pedal fully depressed.***
- ***The throttle should not be left fully open for more than eight second.***
- ***If carrying out the stall test two or more time, move the select lever to the "N" position and run the engine at 1,000 rpm to let the A/T fluid cool down before carrying out subsequent.***

SIGNAL CIRCUIT INSPECTION E06145DC

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

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



LKJF209D

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

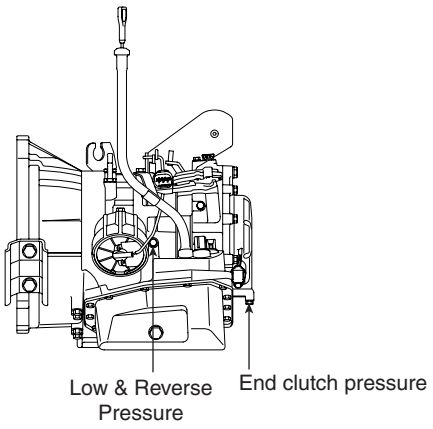
YES

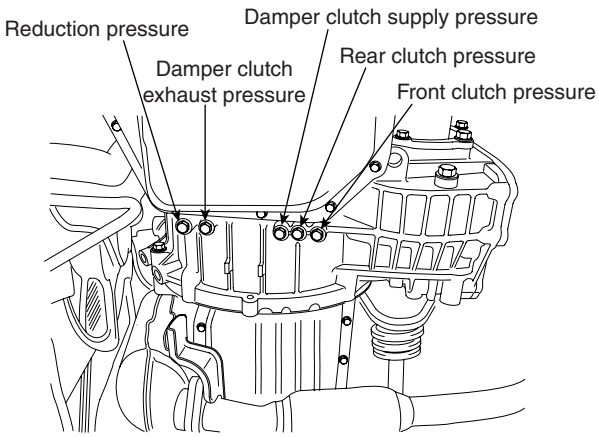
▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E01B570F





LKJF209E

1. Connect oil pressure gauge to "E/C" and "R/C" and "F/C"port.
2. Engine "ON".
3. Disconnect the solenoide valve connector.
4. Drive a car with gear position 3 in "D RANGE".
5. Compare it with referance data as below.

Specification : Shown below

No.	Measurement Condition			Standard hydraulic pressure kpa(kg/cm^2 , psi)							
				1	2	3	4	5	6	7	8
	Select lever position	Engine speed (rpm)	Shift position	Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure	Damper clutch pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)	235~275 (2.4~2.8, 34~40) (When the D/C non-operating)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)	265~343 (2.7~3.5, 38~50) (When the D/C non-operating)

LKJF207F

NOTE

- *"-" is 0.2(0.3)kg/cm² or less and "( )" is the reverse.*
- *SW-ON : Turn the overdrive control switch ON.*
- *SW-OFF : Turn the overdrive control switch OFF.*
- *The hydraulic pressure may be more than standard value at the ambient temperature.*

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

6. Is oil pressure value within specifications?

YES

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

NO

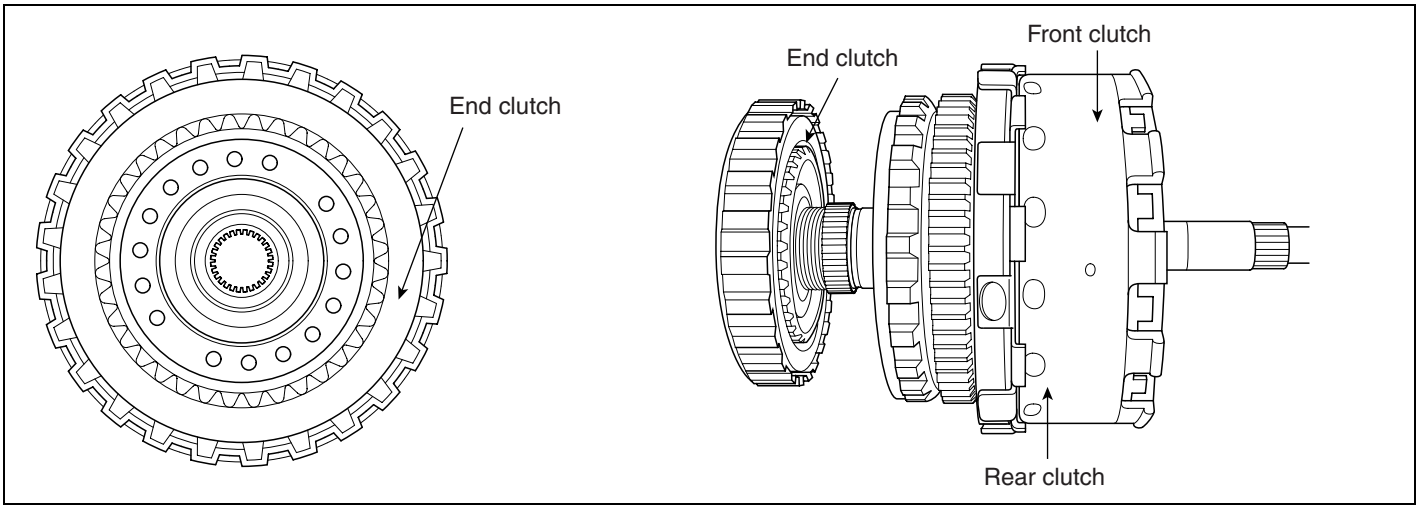
▶ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR E16D5B07

Refer to DTC P0731.

DTC P0734 GEAR 4 INCORRECT RATIO

COMPONENT LOCATION E0248061



LKJF209A

GENERAL DESCRIPTION E88555CE

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 4th gear ratio, while the transaxle is engaged in the 4th gear. For example, if the input speed is 1000 rpm and the 4th gear ratio is 0.685, then the output speed is 685 rpm.

DTC DESCRIPTION E80C81A7

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 4th gear ratio, while the transaxle is engaged in 4th gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfuctioning rather than an electrical issue.

DTC DETECTING CONDITION EFA937BE

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 4th gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty E/C or K/D F/C-Front Clutch R/C - Rear Clutch E/C - End Clutch OWC - One Way Clutch K/B - Kicdown brake L/R - Low & Reverse brake
Enable Conditions	• Engine speed > 400rpm • Output speed(PG-B) > 900rpm • Shift stage 4th gear • Input speed(PG-A) > 300rpm • A/T fluid temp sensor voltage > 10V • TRANSAXLE RANGE SWITCH is normal • Solenoid is normal	
Threshold value	• | Input speed/4th gear ratio - output speed | ≥ 200rpm /4th gear ratio	
Diagnostic Time	• More than 2secs	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0734 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM E73D2FFF

Refer to DTC P0731.

SIGNAL WAVEFORM EC5C0E8B

Refer to DTC P0731.

MONITOR SCANTOOL DATA EAECB8F9

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

OPERATING ELEMENT OF EACH SHIFTING RANGE

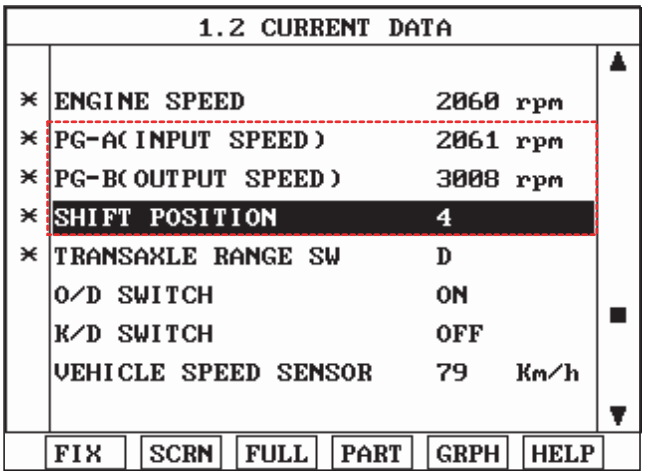
Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	O						
R	-	Reverse			O					
N	-	Neutral	Possible							O
D	ON	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
		4th					O		O	
D	OFF	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
2	-	1st				O		O		
		2nd				O			O	
L	-	1st				O				O

C1 : Front clutch
C2 : Rear clutch
C3 : End clutch
OWC : One way clutch
B1 : Kickdown brake
B2 : Low & reverse brake

SIGNAL CIRCUIT INSPECTION EAE91005

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

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



LKJF210B

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

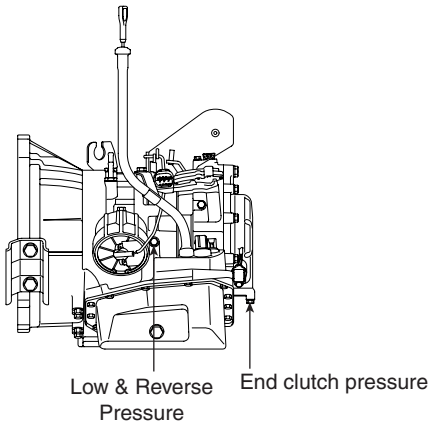
YES

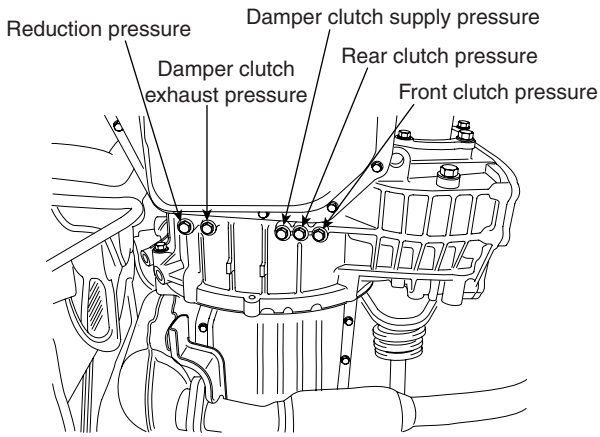
▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E361CAD6





LKJF209E

1. Connect oil pressure gauge to "E/C" and "K/D" port.
2. Engine "ON".
3. Drive a car with gear position "4" in "D RANGE".
4. Compare it with referance data as below.

Specification : Shown below

No.	Measurement Condition			Standard hydraulic pressure kpa(kg/cm^2 , psi)							
				1	2	3	4	5	6	7	8
	Select lever position	Engine speed (rpm)	Shift position	Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure	Damper clutch pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)	235~275 (2.4~2.8, 34~40) (When the D/C non-operating)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)	265~343 (2.7~3.5, 38~50) (When the D/C non-operating)

LKJF207F

NOTE

- *"-" is 0.2(0.3)kg/cm² or less and "( )" is the reverse.*
- *SW-ON : Turn the overdrive control switch ON.*
- *SW-OFF : Turn the overdrive control switch OFF.*
- *The hydraulic pressure may be more than standard value at the ambient temperature.*

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

5. Is oil pressure value within specifications?

YES

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

NO

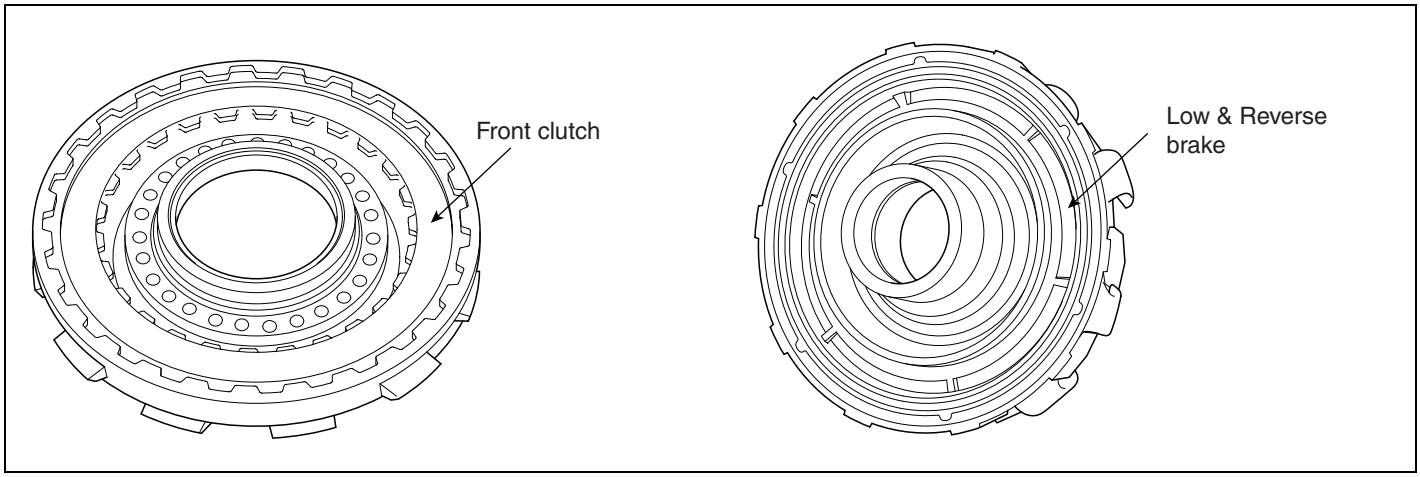
▶ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR EEDE40A9

Refer to DTC P0731.

DTC P0736 REVERSE GEAR INCORRECT RATIO

COMPONENT LOCATION E719EECC



LKJF211A

GENERAL DESCRIPTION E3412C90

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the reverse gear ratio, while the transaxle is engaged in the reverse gear. For example, if the input speed is 1000 rpm and the reverse gear ratio is 2.176, then the output speed is 2176 rpm.

DTC DESCRIPTION EE8F75EE

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the reverse gear ratio, while the transaxle is engaged in reverse gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfuctioning rather than an electrical issue.

DTC DETECTING CONDITION EFB015E9

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Reverse gear incorrect ratio	• Faulty input speed sensor • Faulty output speed sensor • Faulty F/C or L/R F/C-Front Clutch R/C - Rear Clutch E/C - End Clutch OWC - One Way Clutch K/B - Kicdown brake L/R - Low & Reverse brake
Enable Conditions	• Engine speed > 400rpm • Output speed(PG-B) > 100rpm • Shift stage reverse gear • Input speed(PG-A) > 300rpm • A/T fluid temp sensor voltage > 10V • TRANSAXLE RANGE SWITCH is normal • Solenoid is normal	
Threshold value	• | Input speed/reverse gear ratio - output speed | ≥ 200rpm /reverse gear ratio	
Diagnostic Time	• More than 2secs	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0736 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM EBAB1DE2

Refer to DTC P0731.

SIGNAL WAVEFORM EB1811DB

Refer to DTC P0731.

MONITOR SCANTOOL DATA EAB6AFAA

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

OPERATING ELEMENT OF EACH SHIFTING RANGE

Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	O						
R	-	Reverse			O					
N	-	Neutral	Possible							O
D	ON	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
		4th					O		O	
D	OFF	1st				O		O		
		2nd				O			O	
		3rd			O	O	O			
2	-	1st				O		O		
		2nd				O			O	
L	-	1st				O				O

C1 : Front clutch
C2 : Rear clutch
C3 : End clutch
OWC : One way clutch
B1 : Kickdown brake
B2 : Low & reverse brake

SIGNAL CIRCUIT INSPECTION E27FCBD1

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

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

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

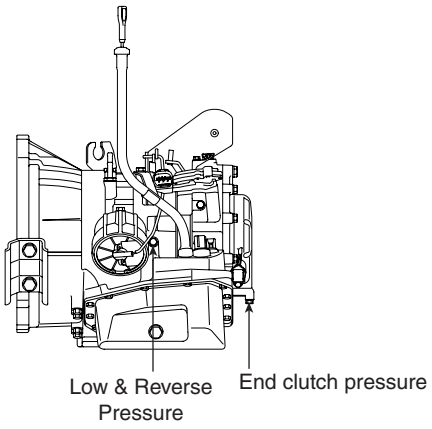
YES

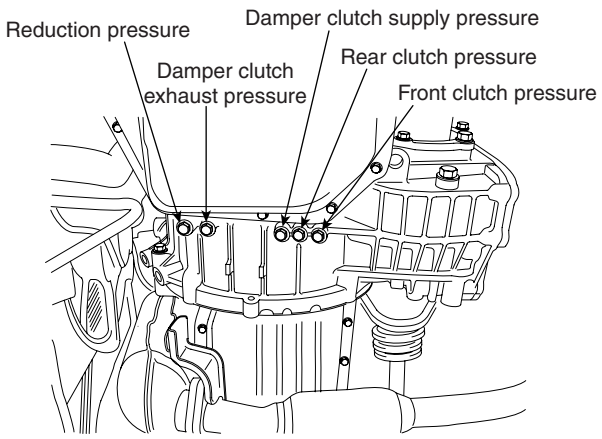
▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION EF3148E7





LKJF209E

1. Connect oil pressure gauge to "F/C" and "L/R" port.
2. Engine "ON".
3. Drive a car with gear position "Reverse" in "D RANGE".
4. Compare it with referance data as below.

Specification : Shown below

No.	Measurement Condition			Standard hydraulic pressure kpa(kg/cm^2 , psi)							
				1	2	3	4	5	6	7	8
	Select lever position	Engine speed (rpm)	Shift position	Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure	Damper clutch pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-	628~687 (6.4~7.0, 91~96) (When the D/C operation)
5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)	235~275 (2.4~2.8, 34~40) (When the D/C non-operating)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)	265~343 (2.7~3.5, 38~50) (When the D/C non-operating)

LKJF207F

NOTE

- *"-" is 0.2(0.3)kg/cm² or less and "( )" is the reverse.*
- *SW-ON : Turn the overdrive control switch ON.*
- *SW-OFF : Turn the overdrive control switch OFF.*
- *The hydraulic pressure may be more than standard value at the ambient temperature.*

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

5. Is oil pressure value within specifications?

YES

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

NO

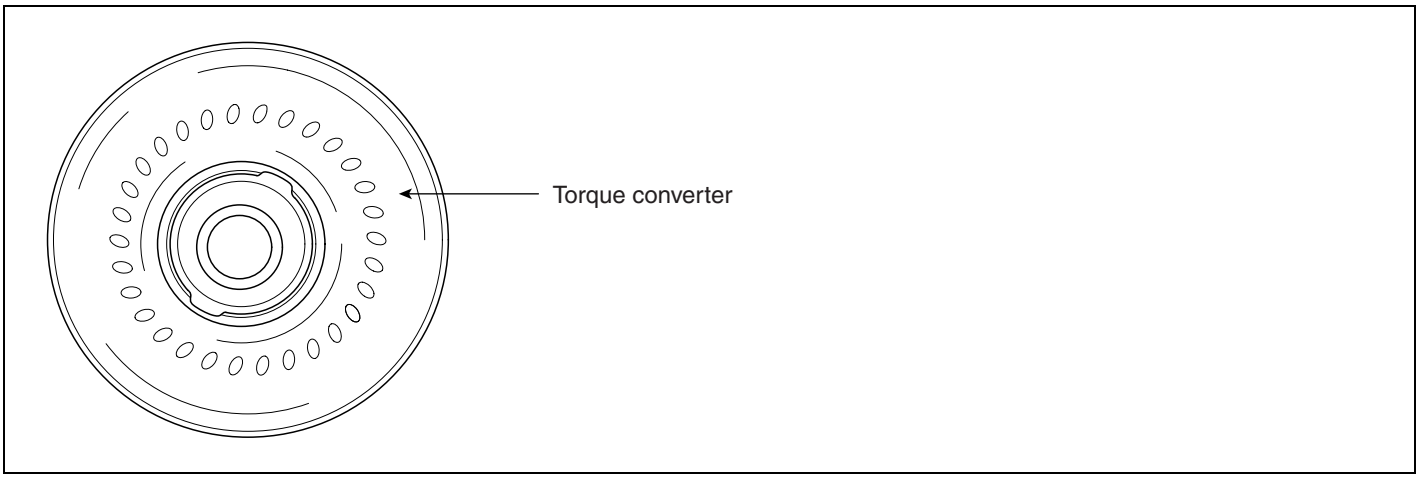
▶ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR EE1556BF

Refer to DTC P0731.

DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT - STUCK OFF

COMPONENT LOCATION E57E8B35



LKJF212A

GENERAL DESCRIPTION E448FB2C

The TCM(PCM) controls the locking and unlocking of the Torque Converter Clutch (or Damper Clutch), to the input shaft of the transmission, by appling hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The TCM(PCM) outputs duty pulses to control the Damper Clutch Control Solenoid Valve(DCCSV) and hydraulic pressure is applied to the DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control duty ratio value is from 30%(unlocked) to 85%(locked).

DTC DESCRIPTION E0E7132A

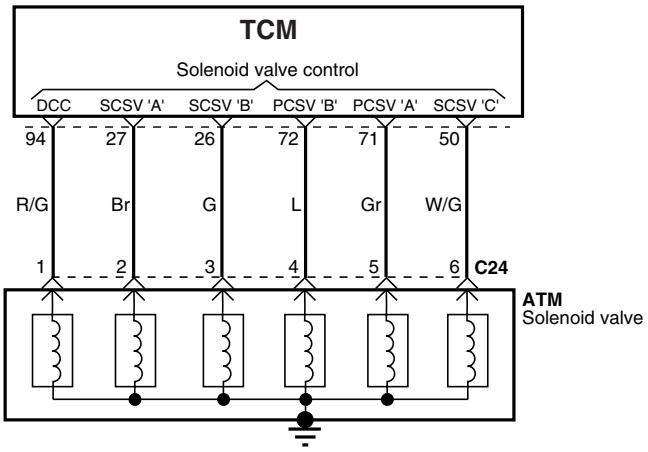
The TCM(PCM) increases the duty ratio to engage the Damper Clutch by monitoring slip rpms (difference vlaue beteween engine speed and turbine speed). To decrease the slip of the Damper Clutch, the TCM(PCM) increases the duty ratio by appling more hyraulic pressure. When slip rpm does not drop under specification with 100% duty ratio, the TCM(PCM) determines that the Torque Converter Clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION EC115BFE

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "OFF"	※ TORQUE CONVERTER(DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty TCM(PCM)
Enable Conditions	• A/T range switch D,2,L • Solenoid valve status is 100% duty • Input speed(PG-A) ≠ 0	
Threshold value	• Calculated slip (engine speed-input speed) > 100rpm(need to verify threshold value)	
Diagnostic Time	• More than 10secs	
Fail Safe	• Damper clutch abnormal system (If diagnosis code P0741 is output four times, TORQUE CONVERTER(DAMPER) CLUTCH is not controlled by TCM(PCM))	

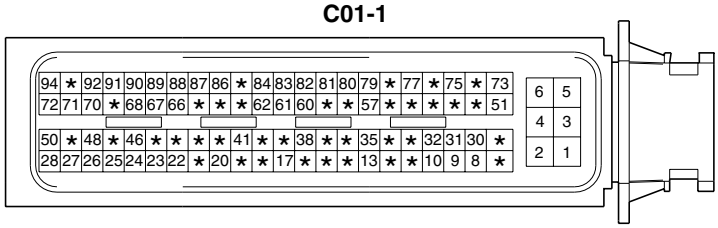
SCHEMATIC DIAGRAM EAA4CDA0

[Circuit Diagram]

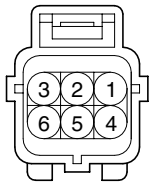


[Harness Connector]

C01-1



C24



[Connection Information]

Terminal	Connection	Function
1	TCM (C01-1 No.94)	Damper clutch(TCC) control solenoid valve
2	TCM (C01-1 No.27)	Shift control solenoid valve A
3	TCM (C01-1 No.26)	Shift control solenoid valve B
4	TCM (C01-1 No.72)	Pressure control solenoid valve B
5	TCM (C01-1 No.71)	Pressure control solenoid valve A
6	TCM (C01-1 No.50)	Shift control solenoid valve C

LKJF212B

MONITOR SCANTOOL DATA ECFBFCE6

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

Specification : TCC SLIP < 100RPM(In condition that TCC SOL. DUTY = 100%)

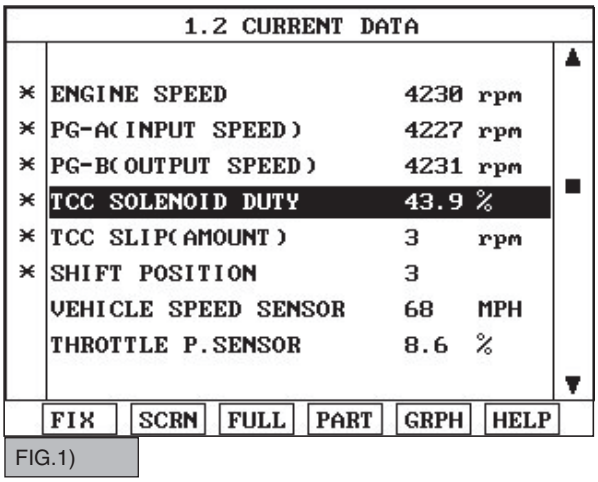


FIG.1 : Normal status.

LKJF212C

5. Is "TCC SLIP" within specifications?

YES

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

NO

▶ Go to "Component inspection" procedure.

COMPONENT INSPECTION E3997283

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE

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

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

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

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

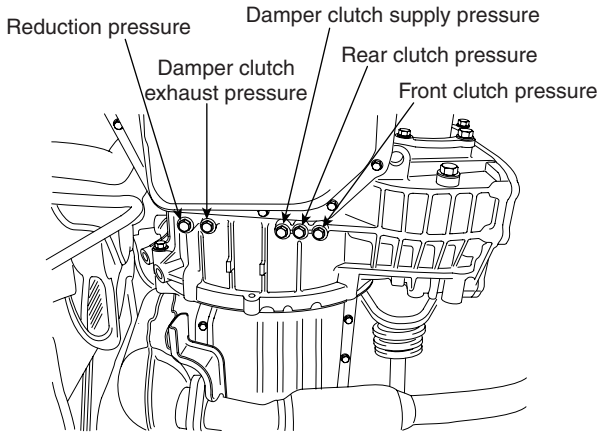
   YES

   ▶ Go to "CHECK OIL PRESSURE" as below.

   NO

   ▶ Repair or replace as necessary and then go to "TCC SOLENOID VALVE" and go to "Verification vehicle repair" procedure.

2. CHECK OIL PRESSURE



LKJF212D

   1) Connect oil pressure gauge to "DA" port.

   2) Engine "ON".

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

   4) Operate vehicle with 3rd or 4th gear and operate the "TCC SOLENIOD VALVE DUTY" more than 40%.

   5) Measure oil pressure.

Specification : approx. 637~686Kpa(6.4~7.0kg/cm²) - (In condition that TCC SOL. DUTY > 40%)

6) Is oil pressure value within specification?

YES

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

NO

▶ Replace A/T ass'y (possible to BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR EAF2FCCA

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC P0742 TORQUE CONVERTER CLUTCH CIRCUIT - STUCK ON

COMPONENT LOCATION E88DDE95

Refer to DTC P0741.

GENERAL DESCRIPTION EBEC9139

Refer to DTC P0741.

DTC DESCRIPTION E2DCBA44

The TCM(PCM) increases duty ratio, to engage the Damper Clutch, by monitoring slip rpms. (difference in value between engine speed and turbine speed). However, If a very small amount of slip rpm is maintained, the TCM(PCM) applies 0% duty ratio value, then the TCM(PCM) judges that the Torque Converter Clutch is stuck ON and sets this code.

DTC DETECTING CONDITION E53B8B78

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "ON"	※ TORQUE CONVERTER(DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty TCM(PCM)
Enable Conditions	• Solenoid valve status is 0% duty • Throttle position > 14.9% • Engine speed > 0 rpm • Output speed(PG-B) > 1000rpm • A/T range switch D,2,L • -10°C(14°F) < A/T fluid temperature > 130°C(266°F)	
Threshold value	• Calculated slip: | engine speed-input speed | < 5rpm	
Diagnostic Time	• More than 7 secs	
Fail Safe	• Damper clutch abnormal system (If diagnosis code P0742 is output four times, TORQUE CONVERTER(DAMPER) CLUTCH is not controlled by TCM(PCM))	

SCHEMATIC DIAGRAM E2BBE2AA

Refer to DTC P0741.

MONITOR SCANTOOL DATA EABAFB3D

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

Specification : TCC SLIP > 5RPM ≥ (In condition that TCC SOL. DUTY = 0%)

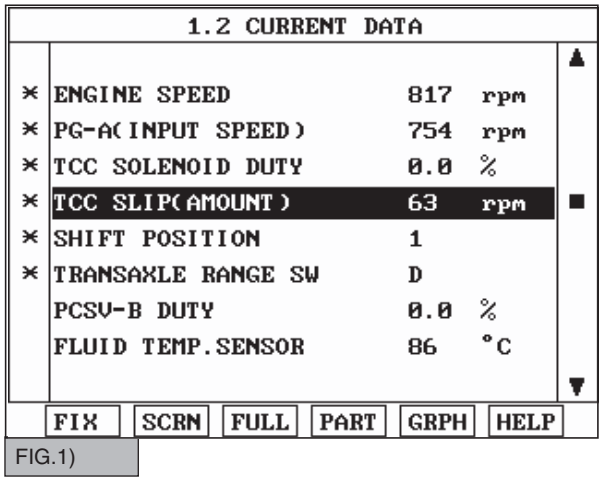


FIG.1)

FIG.1 : Normal status.

LKJF213A

5. Is "TCC SLIP" within specifications?

YES

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

NO

▶ Go to "Component inspection" procedure.

COMPONENT INSPECTION EDCC7F23

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE

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

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

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

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

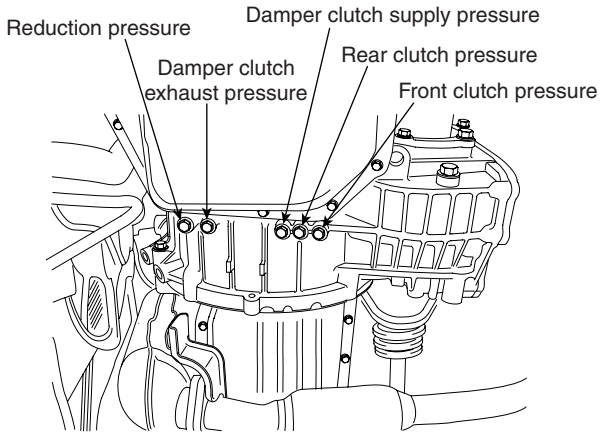
   YES

   ▶ Go to "CHECK OIL PRESSURE" as below.

   NO

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

2. CHECK OIL PRESSURE



LKJF212D

1) Connect oil pressure gauge to "DR" port.

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

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

4) Select 1st gear and accelerate engine speed to 2500 rpm.

5) Measure oil pressure.

Specification : approx. 235~274Kpa(2.4~2.8kg/cm²) ≥ (In condition that TCC SOL. DUTY = 0%)

6) Is oil pressure value within specification?

YES

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

NO

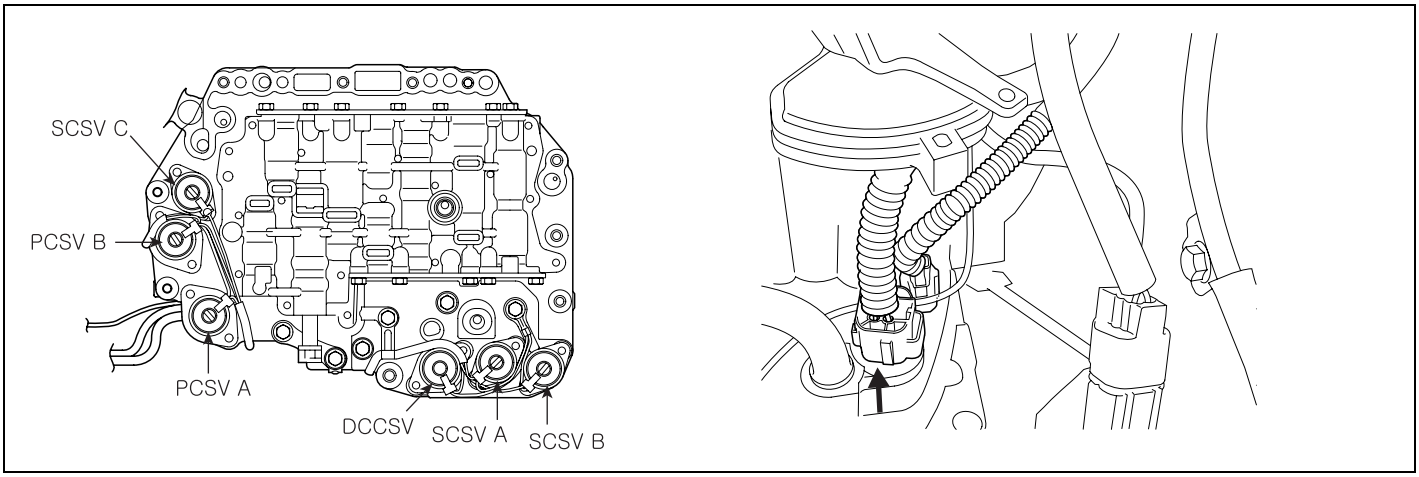
▶ Replace A/T ass'y (possible to BODY CONTROL VALVE faulty) as necessary and go to "Verification vehicle repair " procedure.

VERIFICATION OF VEHICLE REPAIR E4570AC7

Refer to DTC P0741.

DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT - ELECTRICAL

COMPONENT LOCATION EEC45DDA



LKJF214A

GENERAL DESCRIPTION E4A0A4D6

Refer to DTC P0741.

DTC DESCRIPTION EBDDEBB7

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

DTC DETECTING CONDITION EBA0321B

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	※ TORQUE CONVERTER(DAMPER) CLUTCH : TCC ※ PWM : Pulse Width Modulation • Open or short in circuit • Faulty TCC SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• 25% < PWM duty < 100% • 8V < Battery voltage < 16V	
Threshold value	• The circuit is short in condition of the Max. of the feedback voltage > 3.999V • The circuit is open in condition of the Max. of the feedback voltage < 0.0977V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Lock-up control is prohibited	

SCHEMATIC DIAGRAM EE0B0F29

Refer to DTC P0741.

SIGNAL WAVEFORM E5D151A0

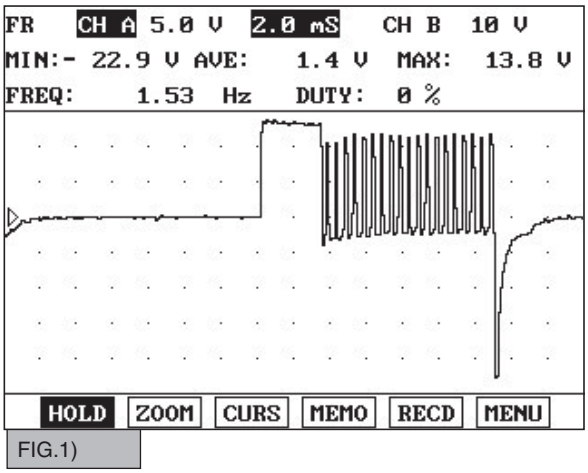


FIG.1)

FIG.1) Operating for the TCCSV

LKJF214B

MONITOR SCANTOOL DATA E0DFAAFE

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "TCC SOL. VALVE" parameter on the scantool.
4. Select "D RANGE" and operate the vehicle.
5. Check "TCC SOL. VALVE" parameter value changes while driving.

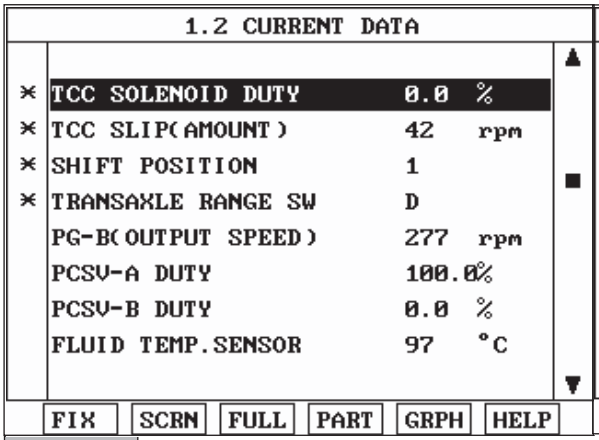


FIG.1)

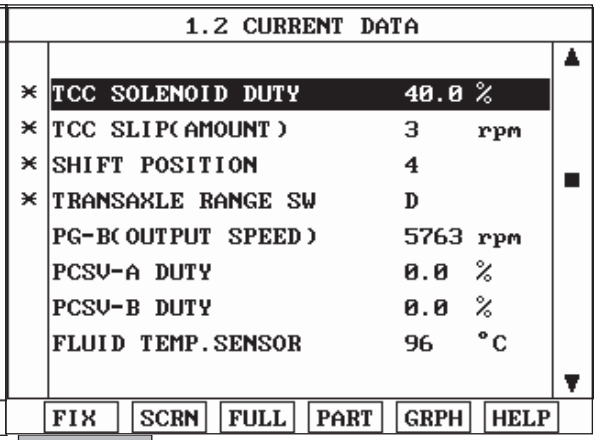


FIG.2)

FIG.1) Not engagement status of TCC
FIG.2) Engagement status of TCC

LKJF214C

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

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EAC3C5B1

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

YES

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

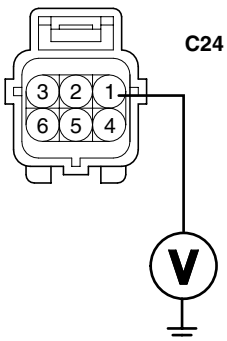
NO

▶ Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION EAC08FFD

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between teminal "1" of the sensor harness connector and chassis ground.

Specification: approx. 6V



1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF214D

4. Is resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E703FBD5

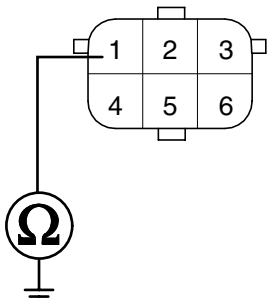
1. CHECK SOLENOID VELVE

1) Ignition "OFF".

2) Disconnect "A/T SOLENOID VALVE" connector.

3) Measure resistance between terminal "1" and chassis ground.

Specification: Approximately 2.7~3.4 Ω [20°C(68°F)]



C24
Component side

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF214E

4) Is resistance within specification?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

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

2. CHECK TCM(PCM)

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

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

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

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

   YES

   ▶ Go to "Verification vehicle repair" procedure.

   NO

   ▶ Replace TCM(PCM) as necessary and Go to "Verification vehicle repair" procedure

   ACTUATOR TEST CONDITION
   1. IG SWITCH ON
   2. TRANSAXLE RANGE SWITCH is normal
   3. P RANGE
   4. Vehicle speed 0km/h
   5. Throttle position sensor < 1V
   6. IDLE SWITCH ON
   7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR EBB07C82

Refer to DTC P0741.

DTC P0745 PRESSURE CONTROL SOLENOID VALVE A

COMPONENT LOCATION E3D07EAF

Refer to DTC P0743.

GENERAL DESCRIPTION EBFCEA37

The Pressure Control Solenoid Valve A (PCSV A) converts the electric signals, which are controlled by the TCM(PCM), into hyraulic pressure. The PCSV A controls the hydraulic pressure, which is applied to the Clutches and Brakes, to reduce the shift shock during shifting.

DTC DESCRIPTION E84CEA8B

The TCM(PCM) checks the Pressure Control Solenoid Valve signals by monitoring the feedback signals from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the TCM(PCM) judges that the PCSV A drive circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION EBC12EDB

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	※ PWM : Pulse Width Modulation • Open or short in circuit • Faulty PCSV-A • Faulty TCM(PCM)
Enable Conditions	• 25% < PWM duty < 100% • 8V < Battery voltage < 16V	
Threshold value	• The circuit is open in condition of the Max. of feedback voltage > 3.999V • The circuit is short in condition of the Max. of feedback voltage < 0.097V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Locked in 3rd gear	

SCHEMATIC DIAGRAM ECC38BCA

Refer to DTC P0741.

SIGNAL WAVEFORM EB738BDB

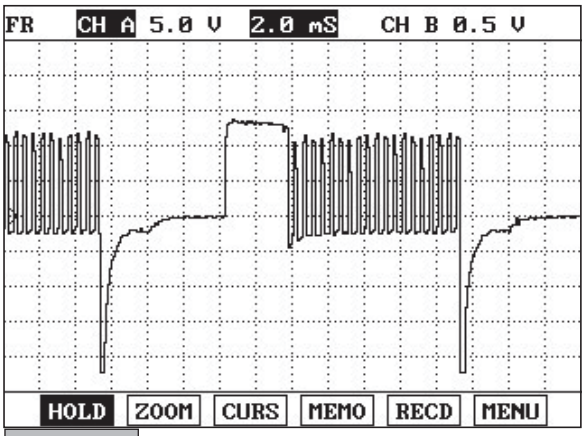


FIG.1)

FIG.1) Operating for the PCSV-A

LKJF215A

MONITOR SCANTOOL DATA EC842FB5

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "PCSV-A" parameter on the scantool.
4. Select "N → D RANGE".
5. Check "PCSV-A " parameter value changes while driving.

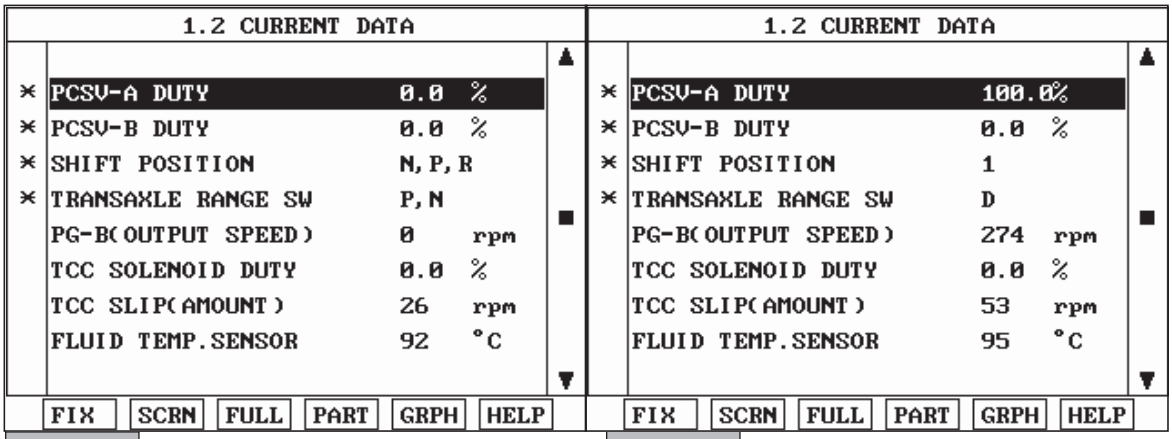


FIG.1) FIG.2)

FIG.1) "N" Range
FIG.2) "D" Range

※ PCSV-A is gradually changed from 0% to 100% while you are selecting D RANGE from N RANGE and then return to 0%.

LKJF215B

6. Does "PCSV-A DUTY " follow the referance data?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

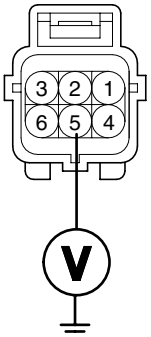
TERMINAL & CONNECTOR INSPECTION E6BA91D9

Refer to DTC P0743.

SIGNAL CIRCUIT INSPECTION EA6BE4CF

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between teminal "5" of the sensor harness connector and chassis ground.

Specification: approx. 6V



1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF215C

4. Is voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E5D1E6CA

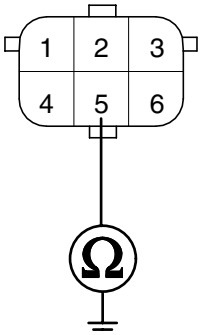
1. CHECK SOLENOID VELVE

   1) Ignition "OFF".

   2) Disconnect "A/T SOLENOID VALVE" connector.

   3) Measure resistance between terminal "5" and chassis ground.

Specification: Approximately 2.7~3.4 Ω [20°C(68°F)]



C24
Component side

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF215D

   4) Is resistance within specification?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

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

2. CHECK TCM(PCM)

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

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

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

   4) Can you hear operating sound for "TCC SOLENOID VALVE" actuator testing function?

   YES

   ▶ Go to "Verification vehicle repair" procedure.

   NO

   ▶ Replace TCM(PCM) as necessary and Go to "Verification vehicle repair" procedure

   ACTUATOR TEST CONDITION
   1. IG SWITCH ON
   2. TRANSAXLE RANGE SWITCH is normal
   3. P RANGE
   4. Vehicle speed 0km/h
   5. Throttle position sensor < 1V
   6. IDLE SWITCH ON
   7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR EB9EE6F8

Refer to DTC P0741.

DTC P0750 SHIFT CONTROL SOLENOID VALVE A CIRCUIT MALFUNCTION

COMPONENT LOCATION E631A4BE

Refer to DTC P0743.

GENERAL DESCRIPTION EEFD5DEE

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The New Alpha Automatic Transmission consists of a: LR (Low and Reverse Brake), KD (Kick Down Brake), FC (Front Clutch), RC (Rear Clutch), and EC (End Clutch). The gear position is determined by the combination of 3 kinds of Shift Control Solenoid Valves. (SCSV A , SCSV B, SCSV C).

DTC DESCRIPTION E7A7569C

The TCM(PCM) checks the Shift Control Solenoin Valve A control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the TCM(PCM) judges that SCSV A control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION EC9AABD8

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty SCSV-A • Faulty TCM(PCM)
Enable Conditions	• Solenoid is turned ON and circuit is short • Solenoid is turned OFF and circuit is open • Voltage of battery > 9V	
Threshold value	• The circuit is open in condition of the feedback voltage > 1.01V • The circuit is short in condition of the feedback voltage < 1.001V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Locked in 3rd gear	

SCHEMATIC DIAGRAM EDCB03D5

Refer to DTC P0741.

MONITOR SCANTOOL DATA EEEBB1C6

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Measure valtage between teminal "2" of the sensor harness connector and chassis ground.
4. Select "N → D RANGE".

Specification: "N" Range - 0V, "D 1" Range - 12V.

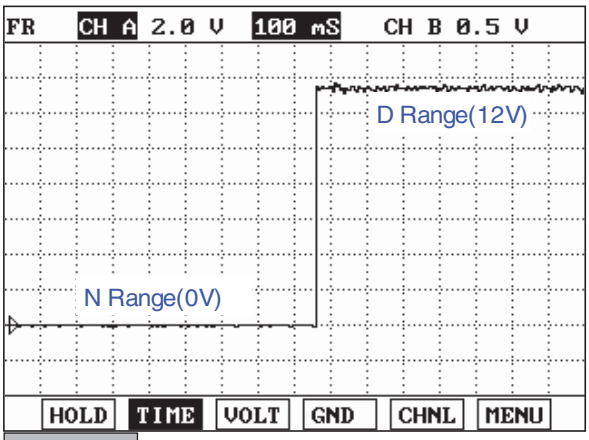


FIG.1)

FIG.1) Shifting "N" → "D"

LKJF216A

5. Is "SCSV-A" within the specifications?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

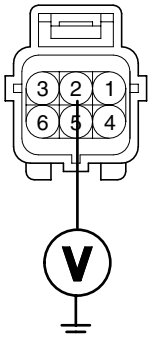
TERMINAL & CONNECTOR INSPECTION E6A683BB

Refer to DTC P0743.

SIGNAL CIRCUIT INSPECTION E4EAB3CB

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between teminal "2" of the sensor harness connector and chassis ground.

Specification: approx. 12V



C24

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF216B

4. Is voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

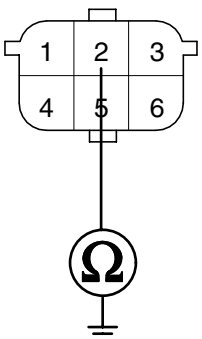
NO

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

COMPONENT INSPECTION EC4FFD27

1. CHECK SOLENOID VELVE
   1) Ignition "OFF".
   2) Disconnect "A/T SOLENOID VALVE" connector.
   3) Measure resistance between terminal "2" and chassis ground.

Specification: Approximately 22.3±1.5 Ω [20°C(68°F)]



C24
Component side

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF216C

4) Is resistance within specification?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

▶ Replace SHIFT CONTROL SOLENOID VALVE-A as necessary and go to "Verification vehicle repair" procedure.

2. CHECK TCM(PCM)

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

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

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

4) Can you hear operating sound for "TCC SOLENOID VALVE" actuator testing function?

YES

▶ Go to "Verification vehicle repair" procedure.

NO

▶ Replace TCM(PCM) as necessary and Go to "Verification vehicle repair" procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle speed 0km/h
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR EDC4D509

Refer to DTC P0741.

DTC P0755 SHIFT CONTROL SOLENOID VALVE B CIRCUIT MALFUNCTION

COMPONENT LOCATION EA11DA69

Refer to DTC P0743.

GENERAL DESCRIPTION E6FA7A7C

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The New Alpha Automatic Transmission consists of a: LR (Low and Reverse Brake), KD (Kick Down Brake), FC (Front Clutch), RC (Rear Clutch), and EC (End Clutch). The gear position is determined by the combination of 3 kinds of Shift Control Solenoid Valves. (SCSV A , SCSV B, SCSV C).

DTC DESCRIPTION EB9CA560

The TCM(PCM) checks the Shift Control Solenoin Valve B control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the TCM(PCM) judges that SCSV B control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION EBF5FF63

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty SCSV-B • Faulty TCM(PCM)
Enable Conditions	• Solenoid is turned ON and circuit is short • Solenoid is turned OFF and circuit is open • Voltage of battery > 9V	
Threshold value	• The circuit is open in condition of the feedback voltage > 1.01V • The circuit is short in condition of the feedback voltage < 1.001V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Locked in 3rd gear	

SCHEMATIC DIAGRAM E6CFED35

Refer to DTC P0741.

MONITOR SCANTOOL DATA E22CDDAE

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Measure valtage between teminal "3" of the sensor harness connector and chassis ground.
4. Shift 2nd → 3rd.

Specification: "2nd" gear - 12V, "3rd" gear - 0V.

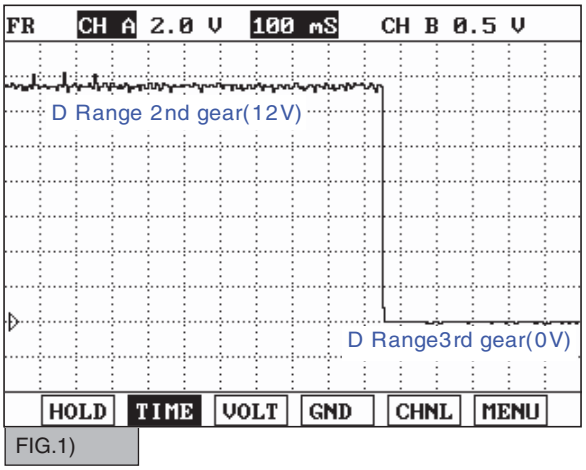


FIG.1) Shifting "2nd" → "3rd"

LKJF217A

5. Is "SCSV-B" within the specifications?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

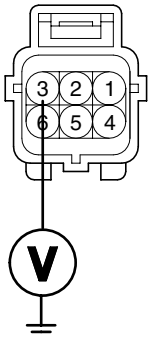
TERMINAL & CONNECTOR INSPECTION E5E97F31

Refer to DTC P0743.

SIGNAL CIRCUIT INSPECTION E5A8DBD7

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between teminal "3" of the sensor harness connector and chassis ground.

Specification: approx. 12V



C24

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF217B

4. Is voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

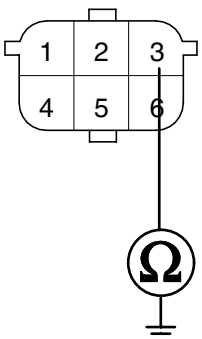
NO

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

COMPONENT INSPECTION E2F53E20

1. CHECK SOLENOID VELVE
   1) Ignition "OFF".
   2) Disconnect "A/T SOLENOID VALVE" connector.
   3) Measure resistance between terminal "3" and chassis ground.

Specification: Approximately 22.3±1.5 Ω [20°C(68°F)]



C24
Component side

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF217C

4) Is resistance within specification?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

▶ Replace SHIFT CONTROL SOLENOID VALVE-B as necessary and go to "Verification vehicle repair" procedure.

2. CHECK TCM(PCM)

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

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

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

4) Can you hear operating sound for "TCC SOLENOID VALVE" actuator testing function?

YES

▶ Go to "Verification vehicle repair" procedure.

NO

▶ Replace TCM(PCM) as necessary and Go to "Verification vehicle repair" procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle speed 0km/h
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR EF26C1E1

Refer to DTC P0741.

DTC P0760 SHIFT CONTROL SOLENOID VALVE C CIRCUIT MALFUNCTION

COMPONENT LOCATION E35375A1

Refer to DTC P0743.

GENERAL DESCRIPTION ED492B59

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The New Alpha Automatic Transmission consists of a: LR (Low and Reverse Brake), KD (Kick Down Brake), FC (Front Clutch), RC (Rear Clutch), and EC (End Clutch). The gear position is determined by the combination of 3 kinds of Shift Control Solenoid Valves. (SCSV A , SCSV B, SCSV C).

DTC DESCRIPTION EE8AE244

The TCM(PCM) checks the Shift Control Solenoin Valve C control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the TCM(PCM) judges that SCSV C control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION E079BF0C

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty SCSV-C • Faulty TCM(PCM)
Enable Conditions	• Solenoid is turned ON and circuit is short • Solenoid is turned OFF and circuit is open • Voltage of battery > 9V	
Threshold value	• The circuit is open in condition of the feedback voltage > 1.01V • The circuit is short in condition of the feedback voltage < 1.001V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Locked in 3rd gear	

SCHEMATIC DIAGRAM E71FB62B

Refer to DTC P0741.

MONITOR SCANTOOL DATA E28FB9BE

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Measure valtage between teminal "6" of the sensor harness connector and chassis ground.
4. Select "N → D".

Specification: "D" Range 2nd gear- 0V, "D " Range 3rd gear- 12V.

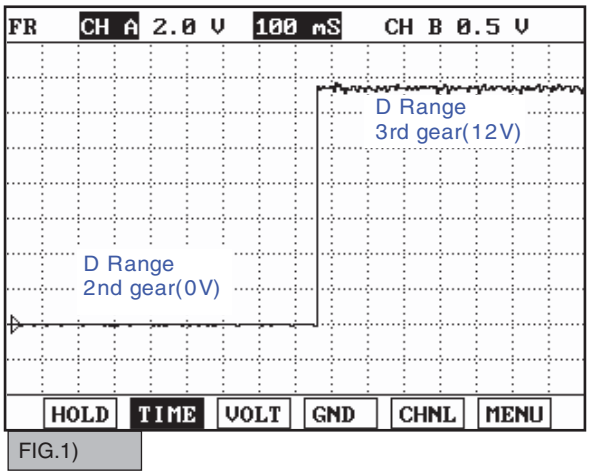


FIG.1) Shifting "2nd" → "3rd"

LKJF218A

5. Is "SCSV-C" within the specifications?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

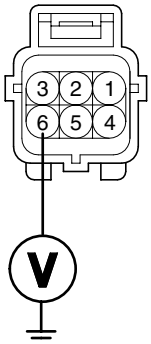
TERMINAL & CONNECTOR INSPECTION EC1CBBA3

Refer to DTC P0743.

SIGNAL CIRCUIT INSPECTION EEA5AEEB

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between teminal "6" of the sensor harness connector and chassis ground.

Specification: approx. 12V



C24

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF218B

4. Is voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

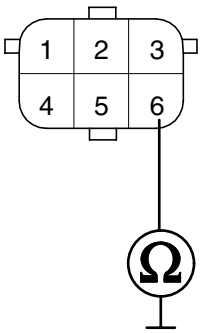
NO

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

COMPONENT INSPECTION EFDCBAD7

1. CHECK SOLENOID VELVE
   1) Ignition "OFF".
   2) Disconnect "A/T SOLENOID VALVE" connector.
   3) Measure resistance between terminal "6" and chassis ground.

Specification: Approximately 22.3±1.5 Ω [20°C(68°F)]



C24
Component side

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF218C

4) Is resistance within specification?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

▶ Replace SHIFT CONTROL SOLENOID VALVE-C as necessary and go to "Verification vehicle repair" procedure.

2. CHECK TCM(PCM)

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

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

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

4) Can you hear operating sound for "TCC SOLENOID VALVE" actuator testing function?

YES

▶ Go to "Verification vehicle repair" procedure.

NO

▶ Replace TCM(PCM) as necessary and Go to "Verification vehicle repair" procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle speed 0km/h
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR E75E0FEE

Refer to DTC P0741.

DTC P0775 PRESSURE CONTROL SOLENOID VALVE B (PCSV-B)

COMPONENT LOCATION EFDD29C4

Refer to DTC P0743.

GENERAL DESCRIPTION E048BBED

The Pressure Control Solenoid Valve B (PCSV B) converts the electric signals, which are controlled by the TCM(PCM), into hyraulic pressure. The PCSV B is designed to control the Rear Clutch and related skip shift from 4th to 2nd or from 2nd to 4th.

DTC DESCRIPTION EB0F0A8F

The TCM(PCM) checks the Pressure Control Solenoid Valve signals by monitoring the feedback signals from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected or low voltage is detected when high voltage is expected) the TCM(PCM) judges that the PCSV B drive circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION E9D9DADB

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	※ PWM : Pulse Width Modulation • Open or short in circuit • Faulty PCSV-B • Faulty TCM(PCM)
Enable Conditions	• 25% < PWM duty < 100% • 8V < Battery voltage < 16V	
Threshold value	• The circuit is open in condition of the Max. of the feedback voltage > 3.999V • The circuit is short in condition of the Max. of the feedback voltage < 0.097V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Locked in 3rd gear	

SCHEMATIC DIAGRAM E6B2D4A3

Refer to DTC P0741.

SIGNAL WAVEFORM EF3E8A4C

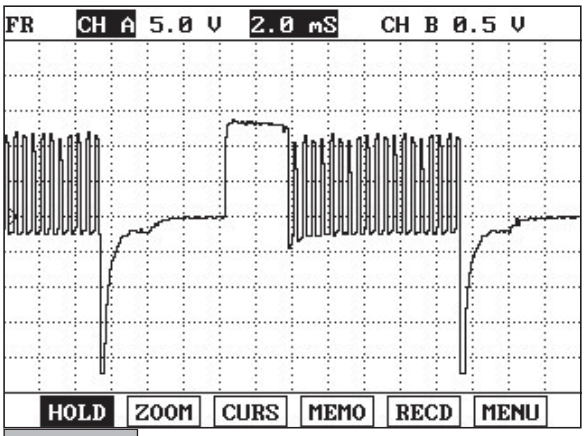


FIG.1)

FIG.1) Operating for the PCSV-B

LKJF219A

MONITOR SCANTOOL DATA EB3EB4C1

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "PCSV-B" parameter on the scantool.
4. Select "D → N RANGE".
5. Check "PCSV-B" parameter value changes while driving.

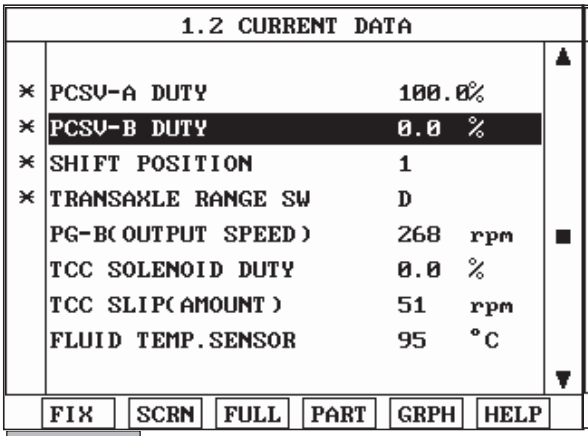


FIG.1)

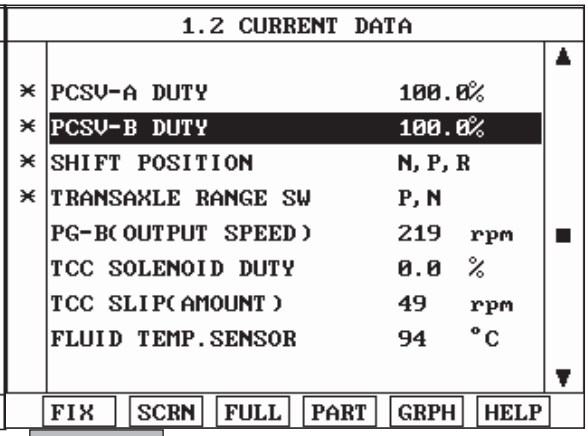


FIG.2)

FIG.1) "N" Range
FIG.2) "D" Range

※ PCSV-B is gradually changed from 0% to 100% while you are selecting N RANGE from D RANGE and then return to 0%.

LKJF219B

6. Does "PCSV-B DUTY" follow the referance data?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

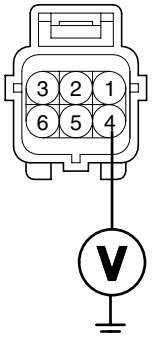
TERMINAL & CONNECTOR INSPECTION E1986BC1

Refer to DTC P0743.

SIGNAL CIRCUIT INSPECTION E93DDF5A

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between teminal "4" of the sensor harness connector and chassis ground.

Specification: approx. 6V



1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF219C

4. Is resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E39C7957

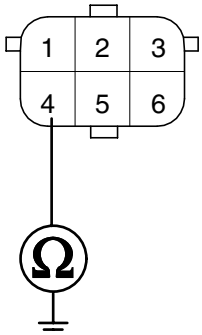
1. CHECK SOLENOID VELVE

   1) Ignition "OFF".

   2) Disconnect "A/T SOLENOID VALVE" connector.

   3) Measure resistance between terminal "4" and chassis ground.

Specification: Approximately 2.7~3.4 Ω [20°C(68°F)]



C24
Component side

1.TCC SOLENOID VALVE
2.SHIFT CONTROL SOLENOID VELVE A
3.SHIFT CONTROL SOLENOID VELVE B
4.PRESSURE CONTROL SOLENOID VELVE B
5.PRESSURE CONTROL SOLENOID VELVE A
6.SHIFT CONTROL SOLENOID VELVE C

LKJF219D

   4) Is resistance within specification?

YES

▶ Go to "CHECK TCM(PCM)" as below.

NO

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

2. CHECK TCM(PCM)

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

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

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

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

   YES

   ▶ Go to "Verification vehicle repair" procedure.

   NO

   ▶ Replace TCM(PCM) as necessary and Go to "Verification vehicle repair" procedure

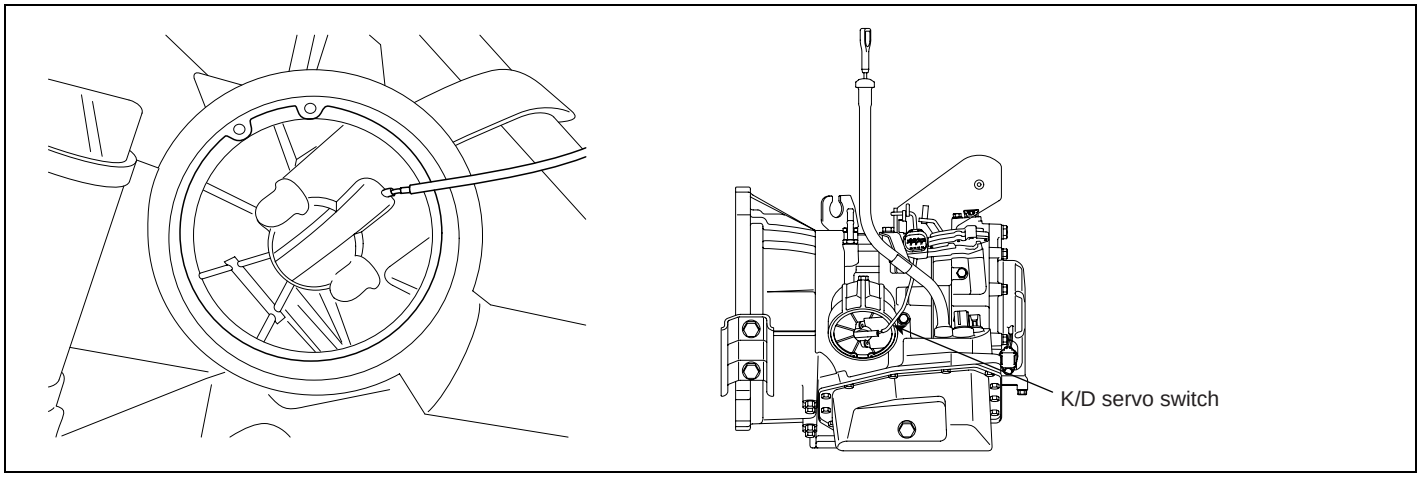
   ACTUATOR TEST CONDITION
   1. IG SWITCH ON
   2. TRANSAXLE RANGE SWITCH is normal
   3. P RANGE
   4. Vehicle speed 0km/h
   5. Throttle position sensor < 1V
   6. IDLE SWITCH ON
   7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR E2E52D87

Refer to DTC P0741.

DTC P1709 KICK DOWN SWITCH

COMPONENT LOCATION EE5337DD



LKJF220A

GENERAL DESCRIPTION EC4654BD

The KICK DOWN BRAKE is one of the New Alpha automatic transmission's members, which is engaged in the 2nd or 4th gear position, and is released in the 1st or 3rd gear position. The Kick Down Servo switch is installed inside the Kick down brake to provide the optimum hydraulic pressure control by checking the position of the kickdown brake. The Kick Down Servor switch is OFF when the gear is in the 2nd or 4th position, and the switch is ON when the gear is 1st or 3rd position.

DTC DESCRIPTION E9ABFF50

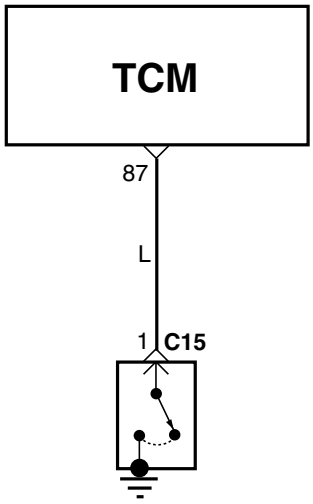
The TCM sets this code if the Kick Down Servo switch is ON when the gear is in the 2nd or 4th position, or the switch is OFF when the gear is in the 1st or 3rd position.

DTC DETECTING CONDITION E23A63A2

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		• Check voltage range	• Open or short in circuit • Faulty KICK DOWN SERVO SWITCH • Faulty TCM(PCM)
Enable Conditaions		• PG-B > 900 & oil temp. > 60°C(140°F) • Inhibitor swich D,2,L • Engine speed > 400rpm • Output speed > 900rpm	
Threshold value	**Case 1**	• After holding gear position 1 or 3 and continuing 5 sec, SW OFF state	
	Case 2	• After holding gear position 2 or 4 and continuing 5 sec, SW ON state	
Diagnostic Time	**Case 1**	• 1 sec.	
	Case 2	• 2 sec.	
Fail Safe		• None	

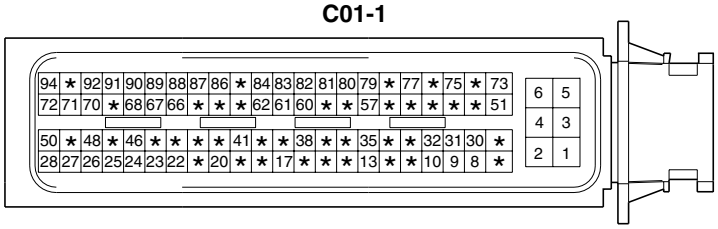
SCHEMATIC DIAGRAM E1EEE25A

[Circuit Diagram]



[Harness Connector]

C01-1



C15

[Connection Information]

Terminal	Connection	Function
C15-1	TCM(Co1-1 No.87)	Kick down servo switch

LKJF220B

SIGNAL WAVEFORM EEDD2510

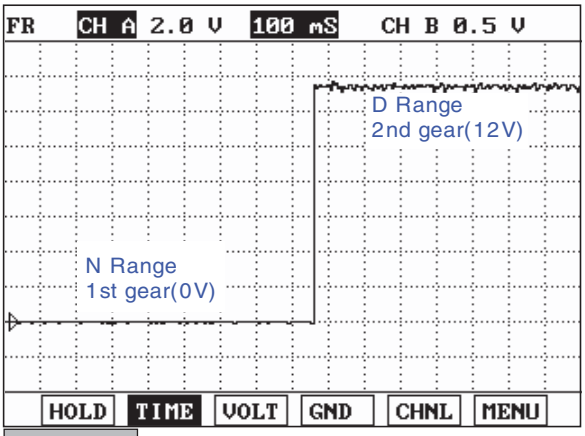


FIG.1)

FIG.1) Shifting "1st" → "2nd"

LKJF220C

MONITOR SCANTOOL DATA EB06FAE3

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "K/D SWITCH" parameter on the scantool.
4. Operate the vehicle from "1st" gear to "4th" gear.

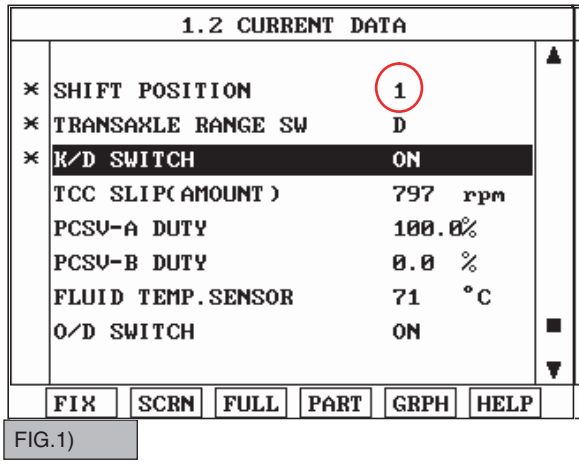


FIG.1)

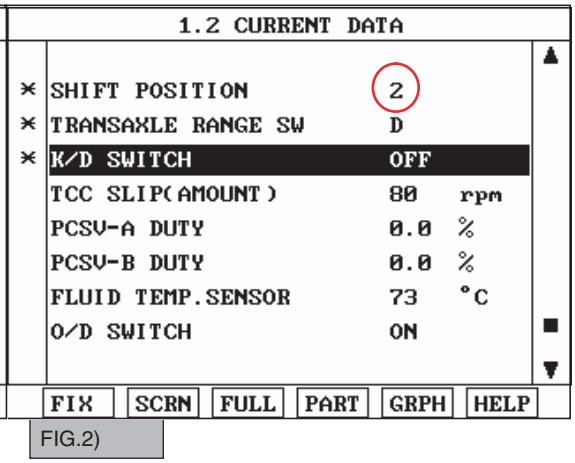


FIG.2)

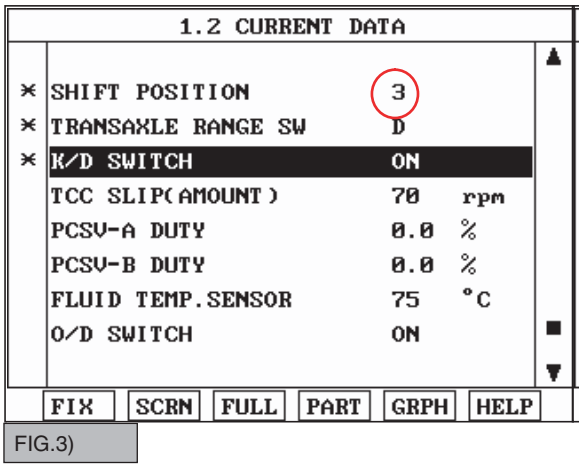


FIG.3)

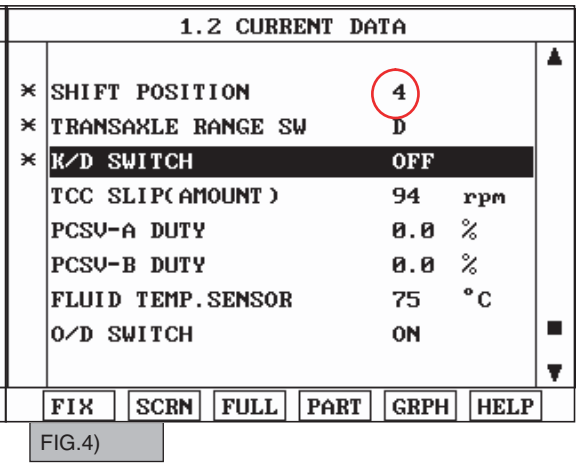


FIG.4)

FIG.1) & FIG.3) : K/D SWITCH → "ON"
FIG.2) & FIG.4) : K/D SWITCH → "OFF"

LKJF220D

5. Does "K/D SWITCH" follow the referance data?

YES

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

NO

▶ Go to "Terminal & connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E9105A29

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

YES

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

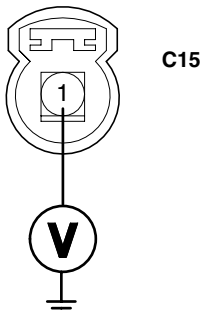
NO

▶ Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION EE7B91BA

1. Disconnect "K/D SWITCH" connector.
2. IGNITION "ON", ENGINE "OFF"
3. Measure voltage between teminal "1" of the sensor harness connector and chassis ground.

Specification : Approx. 12 V



1. KICK DOWN SWITCH

LKJF220E

4. Is voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION EEBFF92E

1. CHECK K/D SWITCH

Specification: Connecting the point of contact → 0Ω , Disonnecting the point of contact → ∞Ω

1) Is resistance within specifications?

YES

▶ Go to "2. KICK DOWN SERVO ADJUSTMENT" as below.

NO

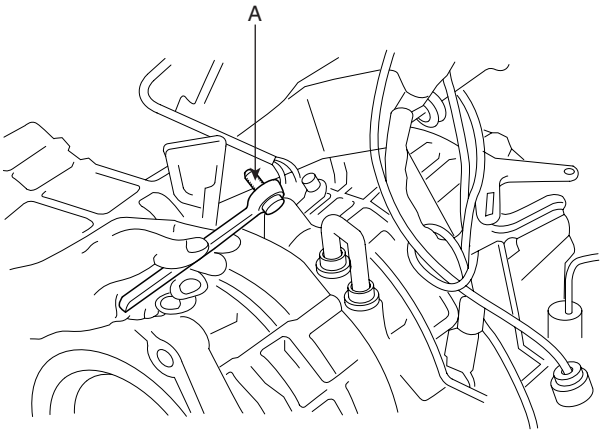
▶ Replace "K/D SWITCH" as necessary and go to "Verification vehicle repair" procedure.

2. KICK DOWN SERVO ADJUSTMENT

1) Completely remove all dirt and other contaminating materials adhered around the kickdown adjust screw.

2) Loosen the lock nut.

3) Loosen and tighten the adjust screw(A) two times by torque of 5Nm(3.6lb·ft).



LKJF220F

4) Tighten adjust screw by torque of 5 Nm and then loosen the adjust screw 3 to 3.1/3 turns.

5) Tighten the lock nut to the specified torque.

6) After adjusting, has problem been solved?

YES

▶ Go to "Verification vehicle repair" procedure.

NO

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

VERIFICATION OF VEHICLE REPAIR ED281346

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

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

YES

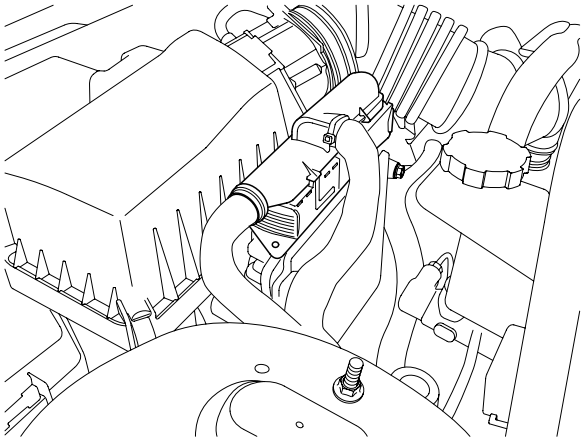
▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC U0001 CAN COMMUNICATION MALFUNCTION

COMPONENT LOCATION E5BD1ED1



LKJF221A

GENERAL DESCRIPTION EFD4FECD

The TCM can either receive data from the Engine Control Module or ABS control module, or it can send data to the ECM and ABSCM by using CAN communication. The CAN communicaton is one of the vehicle communication methods, which is now widely used to transfer the vehicle data.

DTC DESCRIPTION E4F22BE7

When the TCM cannot read the data from the ECM through the CAN-BUS line, the TCM sets this code.
CAN-BUS circuit malfunctioning or ECM can be a posssible cause of this DTC.

DTC DETECTING CONDITION E3CA644E

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check communication	• Open or short in CAN communication harness • Faulty ECM • Faulty TCM
Enable Conditions	• Input speed > 300rpm • Battery voltage > 10V	
Threshold value	• CAN message transfer error	
Diagnostic Time	• 1 sec	
Fail Safe	• INTELLIGENT SHIFT is inhibited • Learning for oil pressure control is inhibited • Torque Retard requirement is inhibited • Direct connection control of TCC is inhibited	

DTC U0100 CAN-TIME OUT ECU

COMPONENT LOCATION EAA00274

Refer to DTC U0001.

GENERAL DESCRIPTION E7238B8D

Refer to DTC U0001.

DTC DESCRIPTION E85037A7

Refer to DTC U0001.

DTC DETECTING CONDITION EDBCBE9E

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check communication	• Open or short in CAN communication harness • Faulty ECM • Faulty TCM
Enable Conditions	• Battery voltage > 10V • Timer of ECM CAN monitoring > 25msec	
Threshold value	• No message from ems.	
Diagnostic Time	• 1 sec	
Fail Safe	• INTELLIGENT SHIFT is inhibited • Learning for oil pressure control is inhibited • Torque Retard requirement is inhibited • Direct connection control of TCC is inhibited	

MONITOR SCANTOOL DATA EB0AF984

1. Connect scantool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, VEHICLE SPEED SENSOR, THROTTLE P. SENSOR)" parameters on the scantool.
4. Does "CAN BUS LINE DATA " follow the reference data?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or TCM's connector or was repaired and TCM memory was not cleared. And go to verification of vehicle repair procedure.

NO

▶ Go to "Terminal & connector inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EC41E8A1

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

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or TCM's connector or was repaired and TCM memory was not cleared.And go to verification of vehicle repair procedure.

NO

▶ Go to "Signal circuit inspection" procedure.

VERIFICATION OF VEHICLE REPAIR EACFAD44

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

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

YES

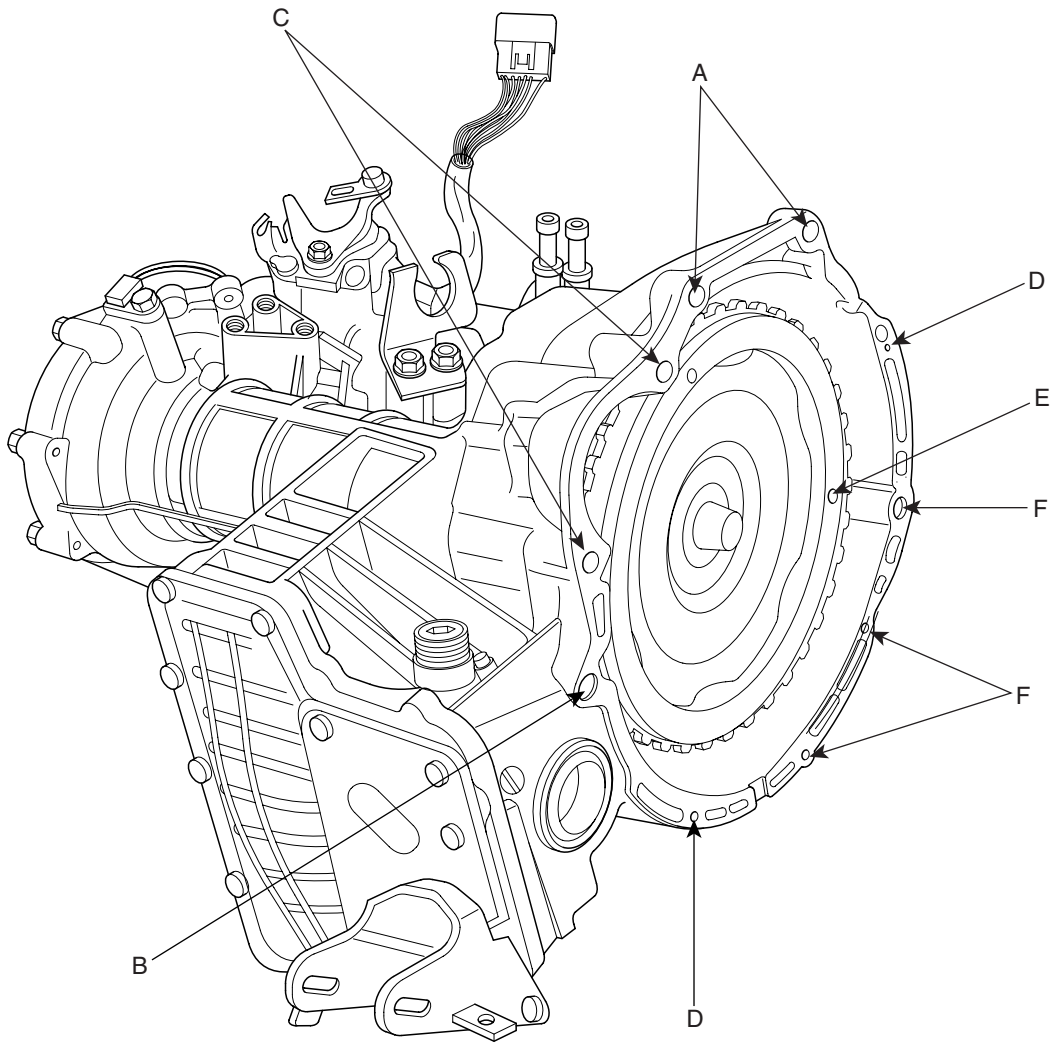
▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

AUTOMATIC TRANSAXLE

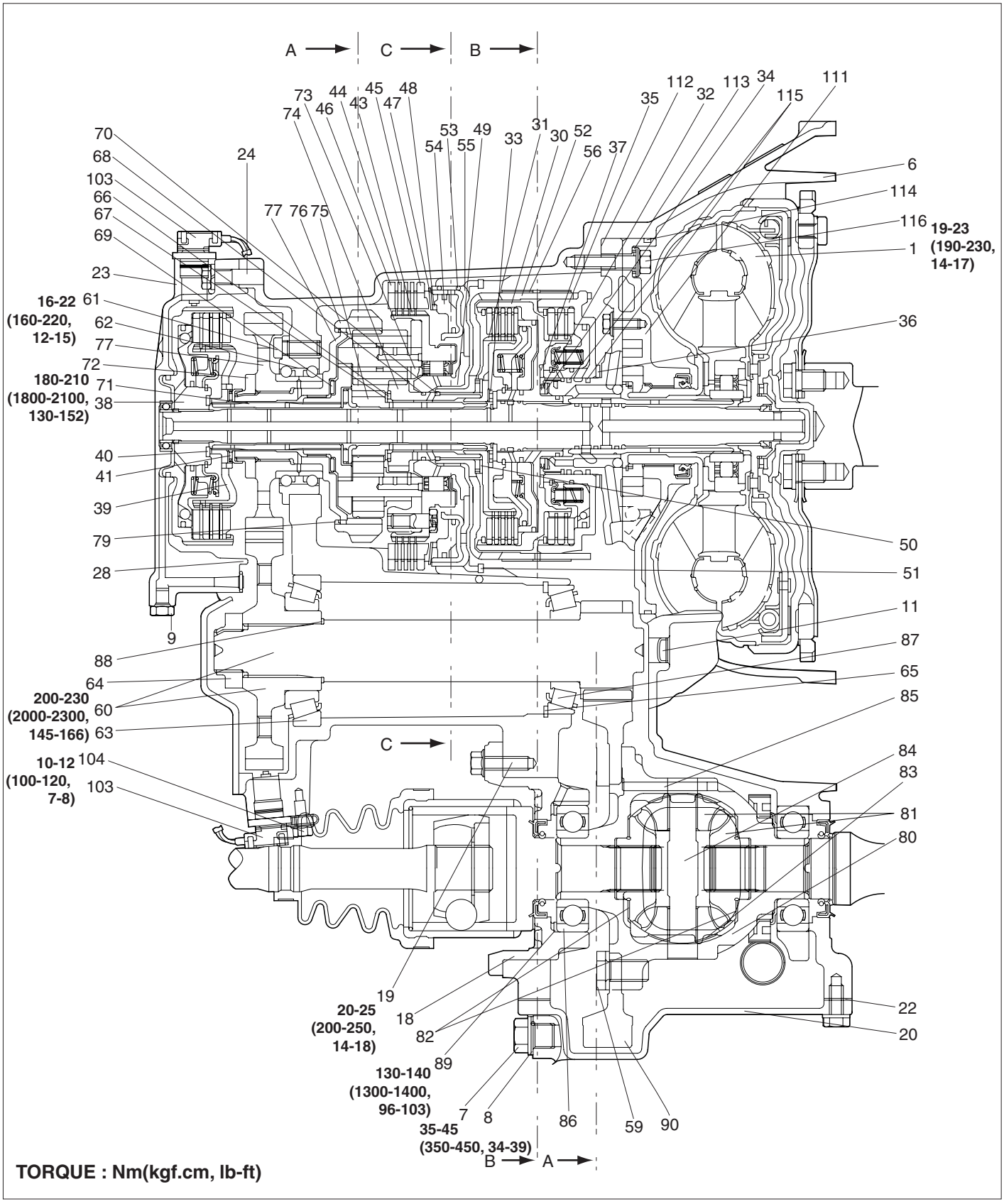
COMPONENT(1) ECEF36B7



	Tightening torque (Nm(kgf.cm, lb−ft))	O.D × Length [mm(in.)]	Identification Mark
A	60~80(600~800, 43~58)	7 12×40(0.47×1.57)	7 A×B
B	43~55(430~550, 32~41)	7 10×70(0.39×2.761)	
C	27~34(270~340, 19~24)	7 10×55(0.39×2.17)	
D	8~10(80~100, 6~7)	7 6×10(0.24×0.39)	
E	46~53(460~530, 34~39)	7 10×11(0.39×0.43)	

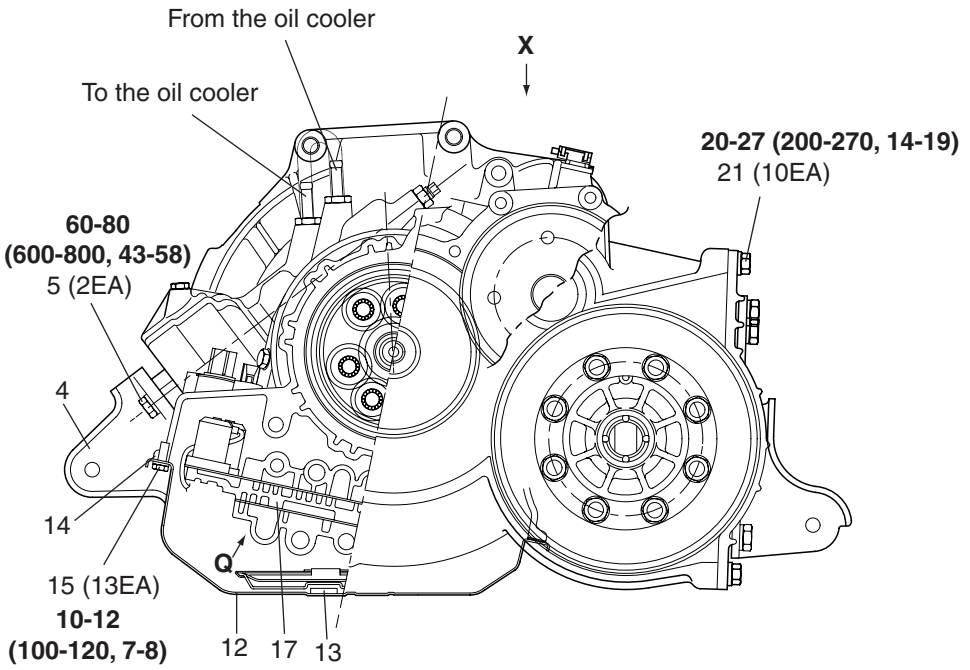
LKGE005C

COMPONENT(2)

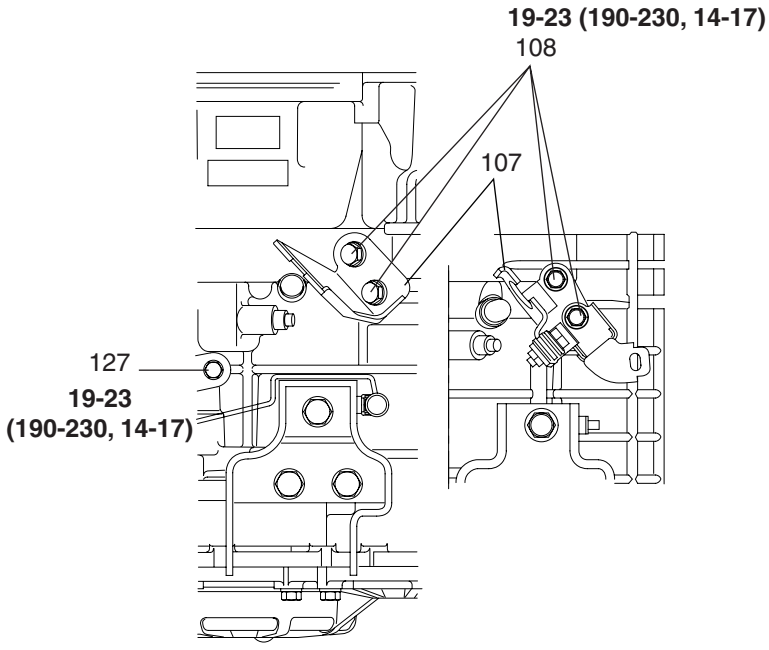


LKGE005D

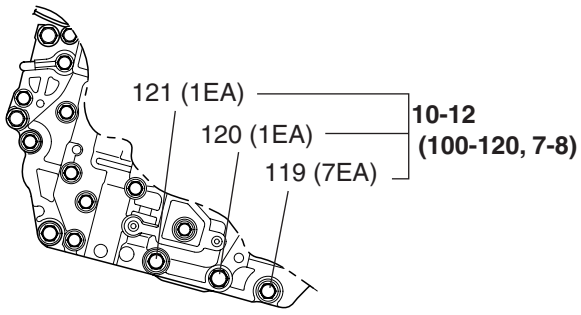
COMPONENT(3)



<A-A side view>



<Side view ("X" axis)>

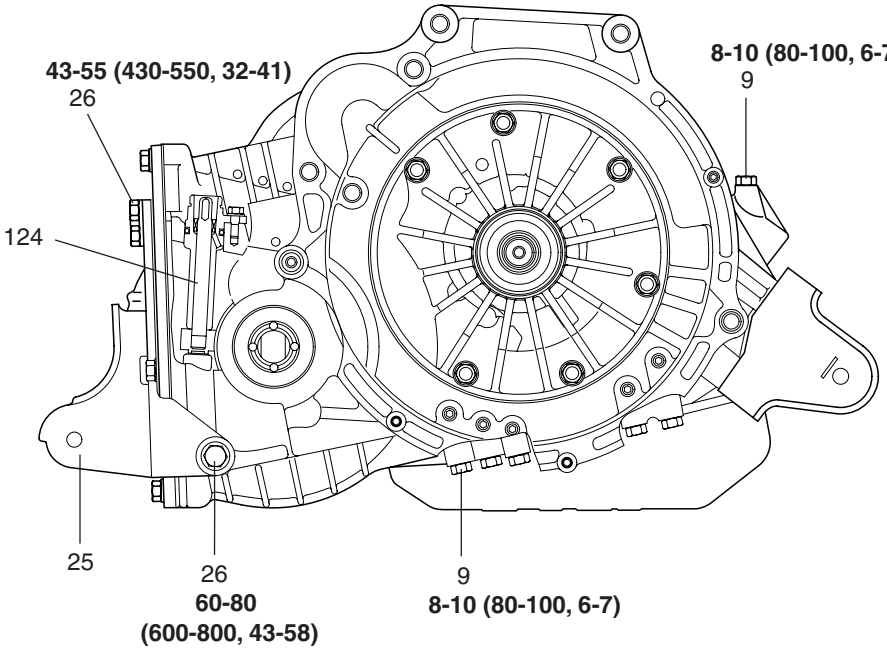


<Side view ("Q" axis)>

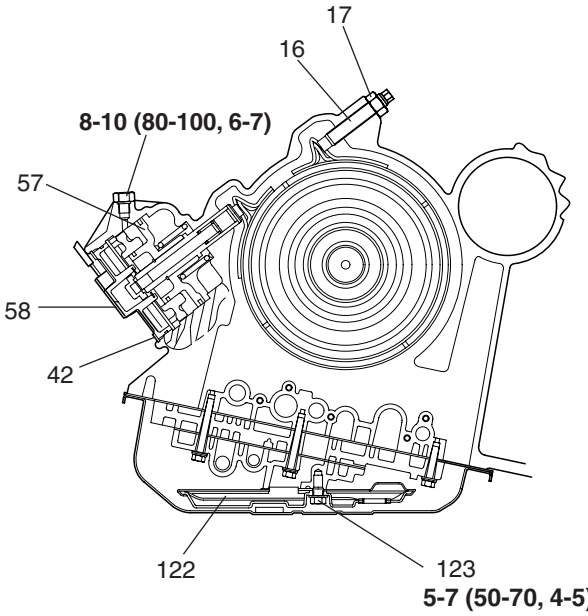
TORQUE : Nm(kgf.cm, lb-ft)

LKGE005E

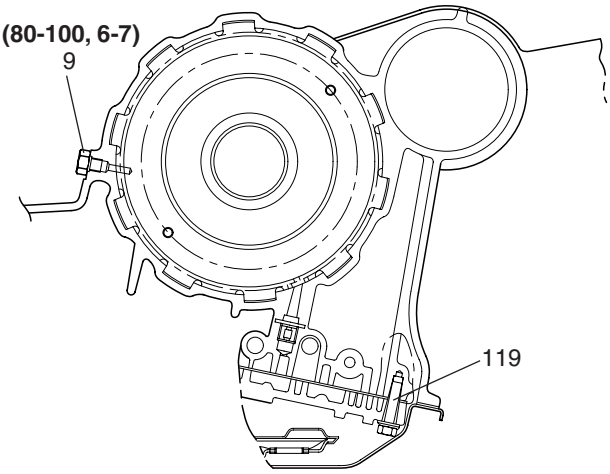
COMPONENT(4)



<Transaxle side view>



<Section B-B>

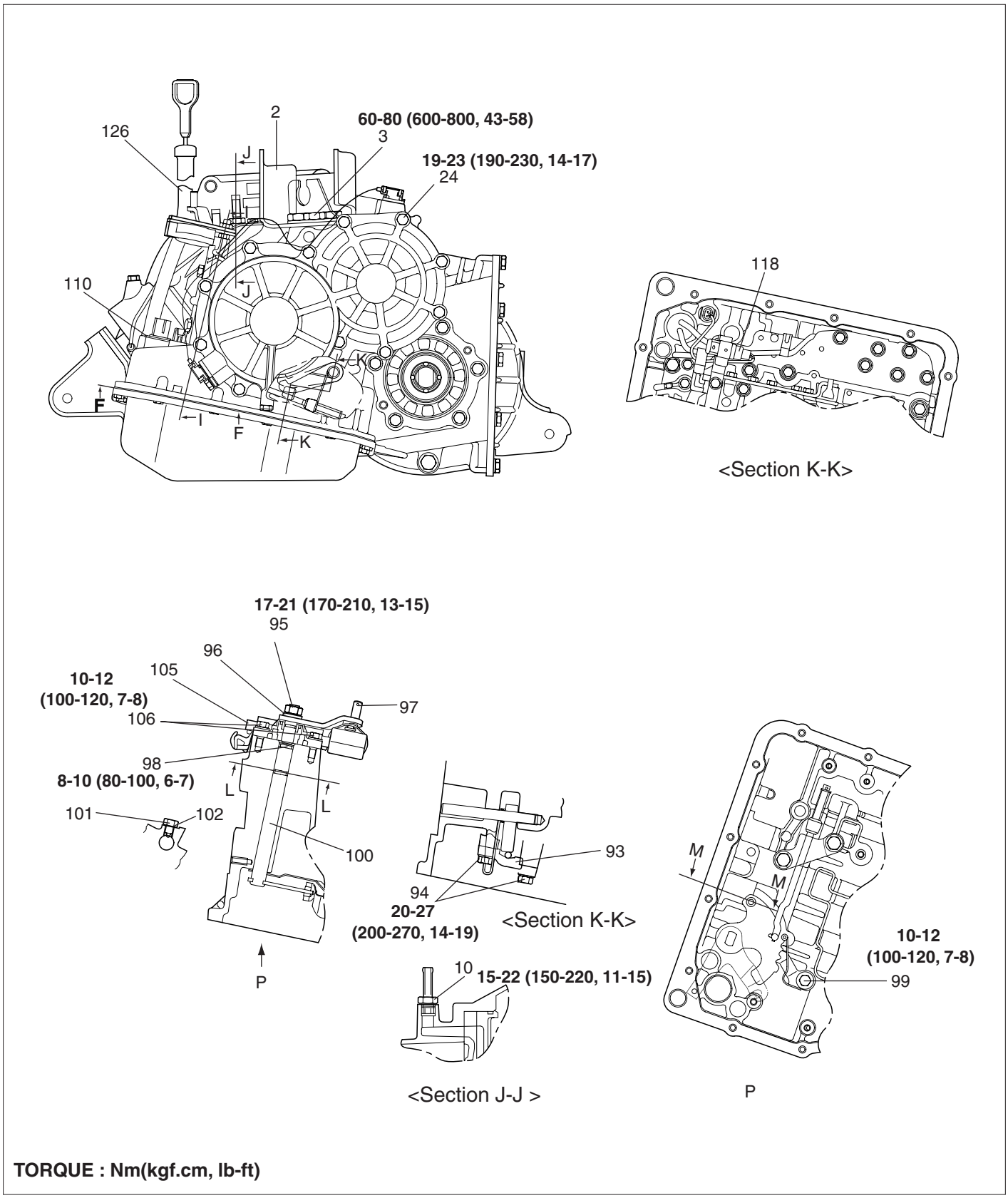


<Section C-C>

TORQUE : Nm(kgf.cm, lb-ft)

LKGE005F

COMPONENT(5)



TORQUE : Nm(kgf.cm, lb-ft)

LKGE005G

COMPONENT(6)

1. Torque converter
2. Transaxle support bracket
3. Bolt washer
4. Front roll support bracket
5. Bolt washer
6. Transaxle case
7. Drain plug
8. Gasket
9. Pressure check plug
10. Oil cooler connector
11. Seal ring cap
12. Oil pan
13. Magnet
14. Oil pan gasket
15. Bolt
16. Adjusting screw
17. Nut
18. Differential bearing retainer
19. Flange bolt(8×25)
20. Differential cover
21. Bolt washer
22. Differential cover gasket
23. End cover
24. Flange bolt
25. Rear roll support bracket
26. Seal bolt
27. Bolt(10×20)
28. O-ring
29. Air breather cap
30. Rear clutch
31. Rear clutch hub
32. Thrust bearing
33. Thrust bearing
34. Thrust race
35. Front clutch
36. Thrust washer
37. Thrust washer
38. End clutch
39. End clutch hub
40. Thrust washer
41. Thrust bearing
42. Snap ring
43. Brake disc
44. Brake plate
45. Brake pressure plate
46. Brake reaction plate
47. Return spring
48. Wave spring
49. Thrust bearing
50. Thrust race
51. Snap ring
52. Kickdown drum
53. Packing
54. Low & reverse brake piston
55. Center support
56. Kickdown band
57. Kickdown servo and spring piston
58. Kickdown servo switch
59. Fly wheel bolt
60. Transfer driven gear set
61. Bolt
62. Double angular ball bearing
63. Taper roller bearing
64. Locking nut
65. Snap ring
66. Thrust bearing
67. Thrust race
68. Seal ring
69. Thrust bearing
70. Snap ring
71. End clutch shaft
72. Locking nut(M38)
73. Planetary carrier
74. Reverse sun gear
75. Forward sun gear
76. Annulus gear
77. Transfer drive gear
78. Output flange
79. Snap ring
80. Differential case
81. Differential gear
82. Differential gear spacer
83. Washer
84. Pinion shaft
85. Lock pin
86. Ball bearing
87. Side bearing
88. Spacer
89. Spacer
90. Differential drive gear
91. Speedometer driven gear
92. Stopper plate
93. Sprag rod support
94. Flange bolt(8×25)
95. Nut
96. Spring washer
97. Manual control lever
98. O-ring
99. Bolt
100. Manual control
101. Screw
102. Seal ring washer
103. Pulse generator
104. Flange bolt(6×14)
105. Inhibitor switch
106. Flange bolt
107. Shift cable bracket
108. Flange bolt
109. Clamp
110. Snap ring
111. Oil pump
112. Oil pump gasket
113. Seal washer
114. O-ring
115. Seal ring
116. Seal bolt
117. Valve body
118. Oil temperature sensor
119. Bolt(6×26)
120. Bolt(6×36)
121. Bolt(6×41)
122. Oil filter
123. Flange bolt(6×12)
124. Speedometer driven gear sleeve
125. Flange bolt(6×14)
126. Oil level gauge and filler tube
127. Flange bolt(8×16)
128. Oil level gauge

LKGE005H

REMOVAL EF12E68F

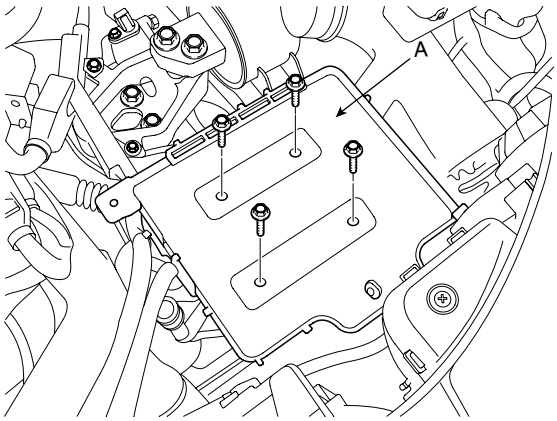
CAUTION

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

NOTE

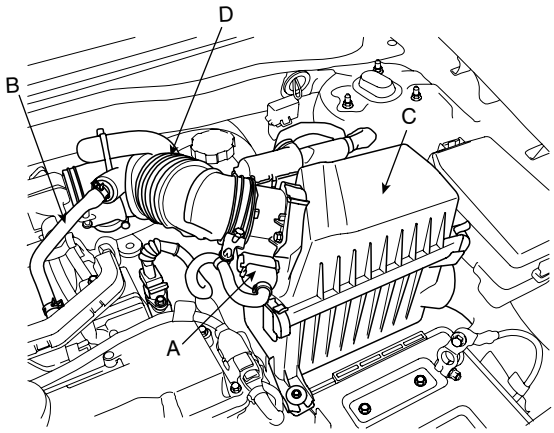
- *Mark all wiring and hoses to avoid misconnection.*

1. Disconnect the battery terminals and then remove battery.
2. Remove the battery and battery tray(A).



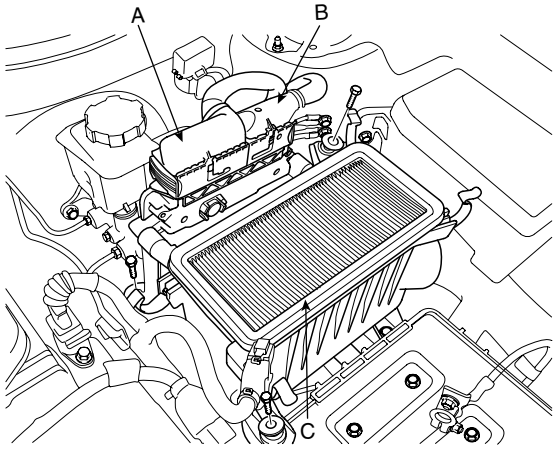
AKJF902A

3. Remove the intake air hose and air cleaner assembly.
   1) Disconnect the AFS(Air Flow Sensor) connector(A).
   2) Disconnect the breather hose(B) from intake air hose(D).
   3) Remove the intake air hose(D) and air cleaner upper cover(C).



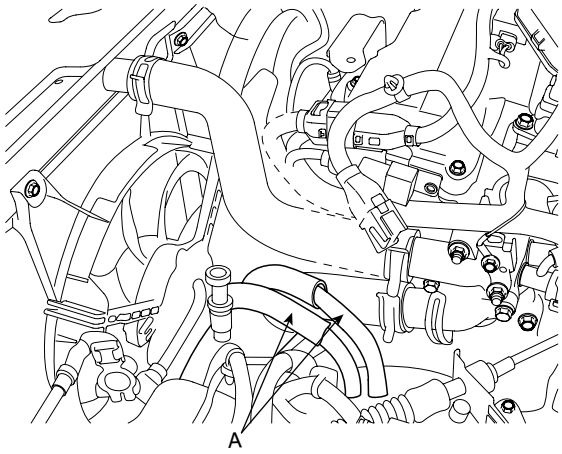
AKJF900A

   4) Disconnect the ECM connector(A, B).
   5) Remove the air cleaner element and lower cover(C).



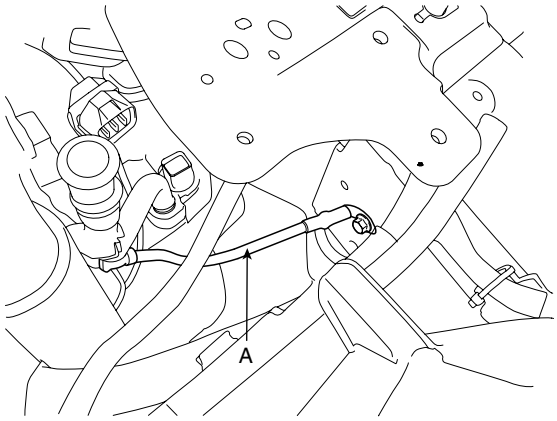
AKJF901A

4. Remove the ATF(Automatic transaxle fluid) cooler hose(A).



AKJF911A

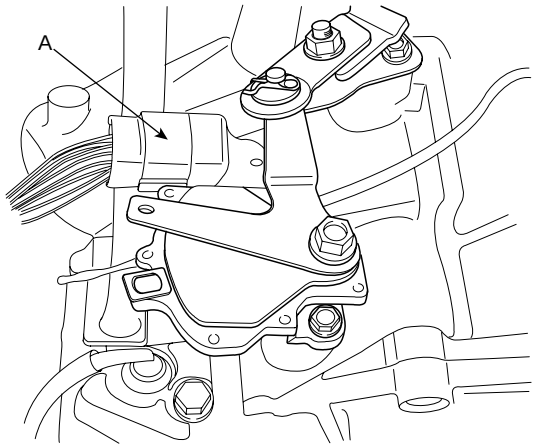
5. Remove the transaxle ground cable(A).



AKJF903A

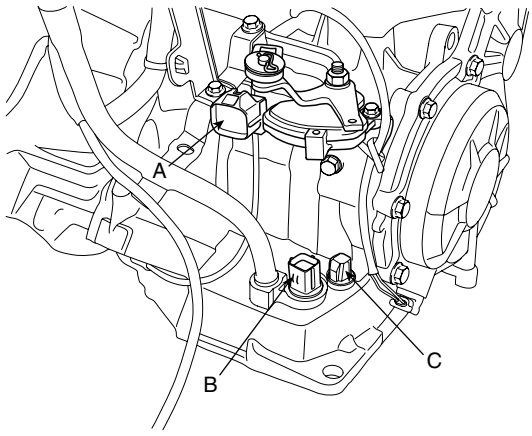
6. Remove the transaxle wire harness connectors and control cable from transaxle.

   1) Disconnect the transaxle range switch connector(A).



LKJF009A

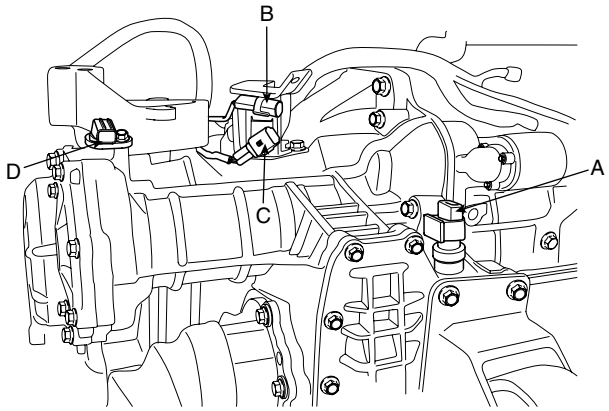
   2) Disconnect the solenoid valve connector(B).



AKJF905A

   3) Disconnect the fluid temperature sensor connector(C).

   4) Disconnect the vehicle speed sensor connector(A).



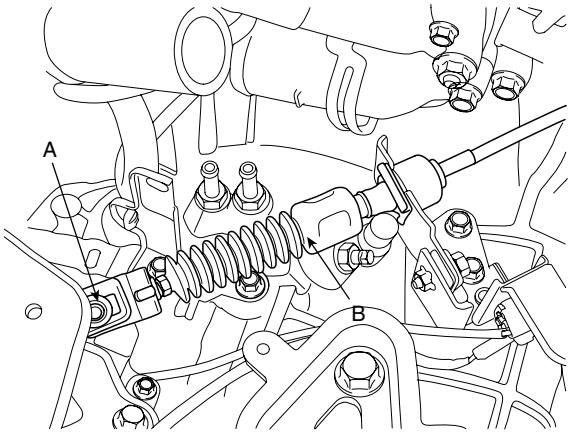
AKJF907A

   5) Disconnect the band servo switch connector(B).

   6) Disconnect the pulse generator A connector(C).

   7) Disconnect the pulse generator B connector(D).

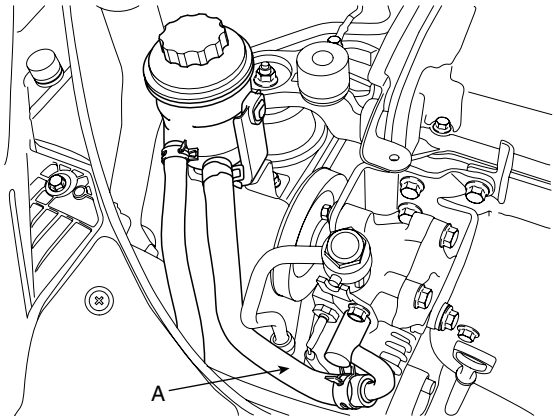
   8) Remove the control cable nut(A) from transaxle range switch.



AKJF909A

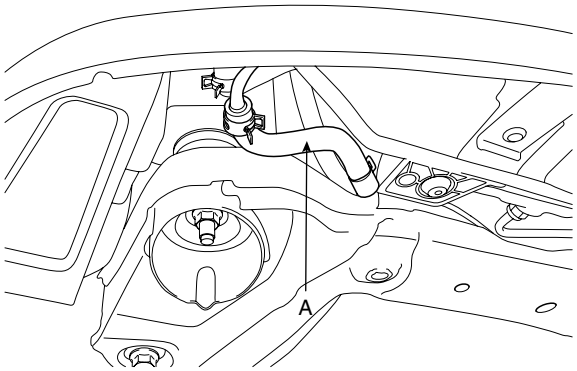
   9) Remove the control cable(B).

7. Remove the power steering oil hose(A) and drain the power steering oil.



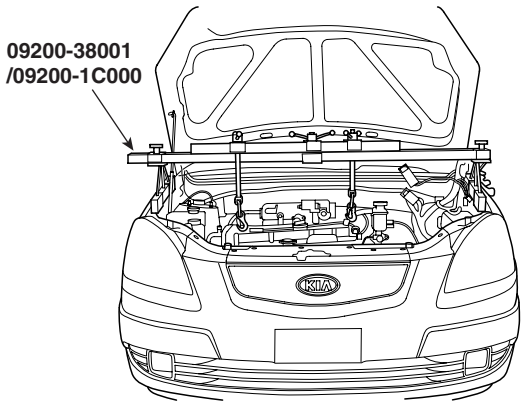
AKJF910A

8. Remove the power steering return hose(A).



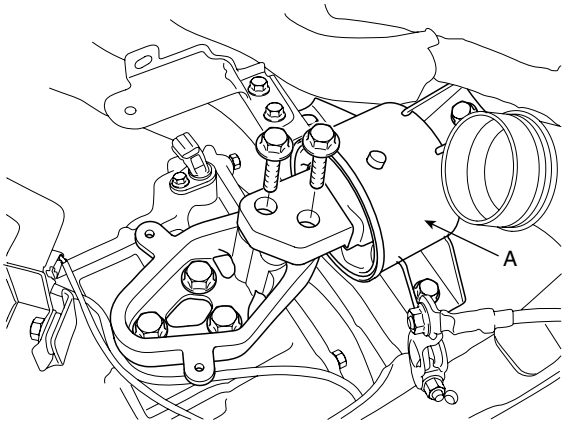
AKJF900B

9. Install the special tools(09200-38001/ 09200-1C000), the engine support fixture and the adapter, on the engine assembly.



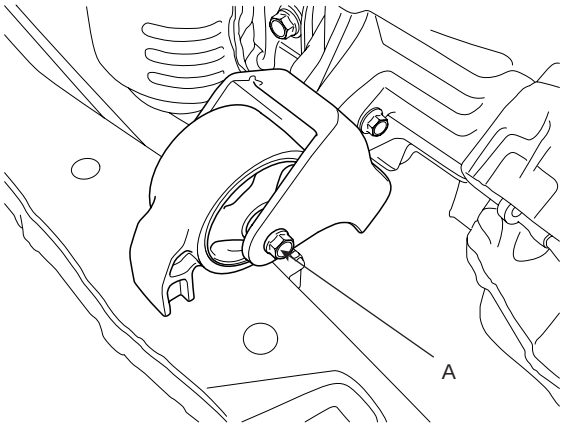
AKJF031A

10. Remove the transaxle mounting support bracket(A).



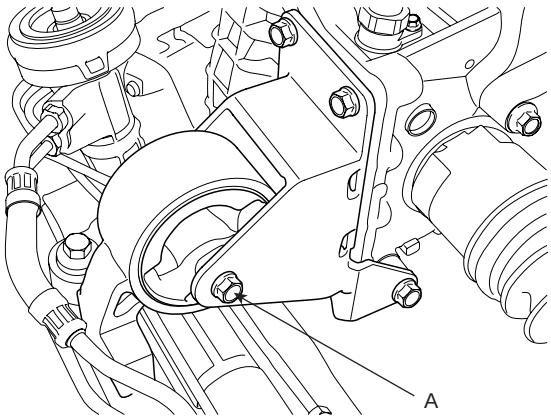
AKJF901B

11. Remove the front roll stopper mounting bolt(A).



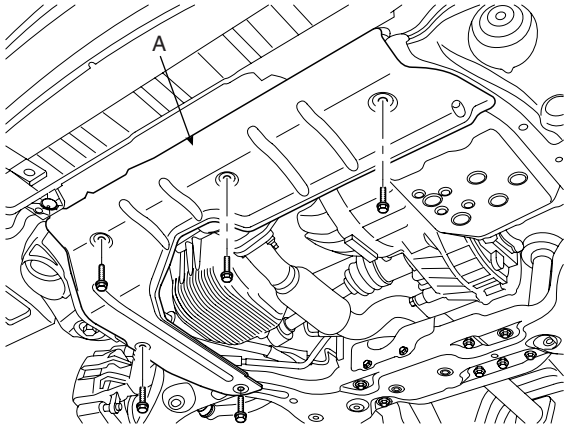
AKJF032A

12. Remove the rear roll stopper mounting bolt(A).



AKJF033A

13. Remove the under cover(A).

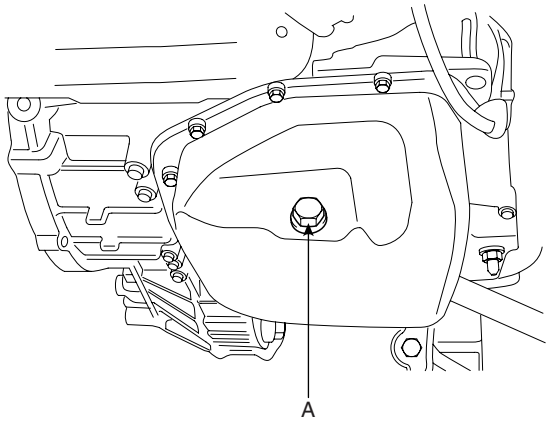


AKJF902B

14. Remove the side cover.

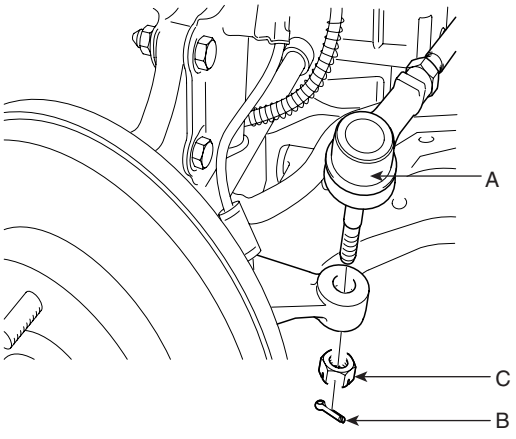
15. Remove the front wheel.

16. Remove the drain plug(A) and drain the automatic transaxle fluid.



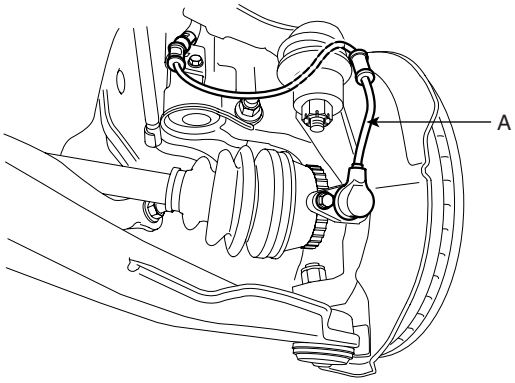
AKJF903B

17. Separate the tie rod end(A) from the pin(B) and nut(C).



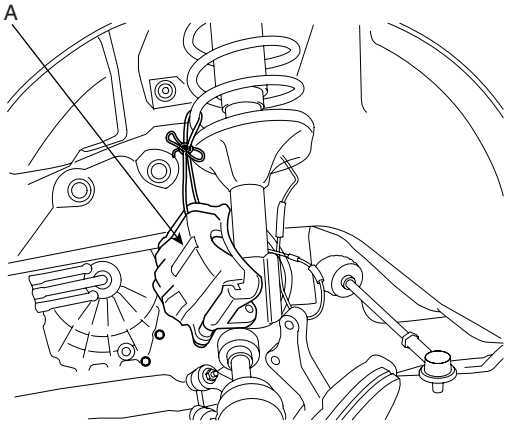
AKJF904B

18. Remove the ABS wheel speed sensor(A).



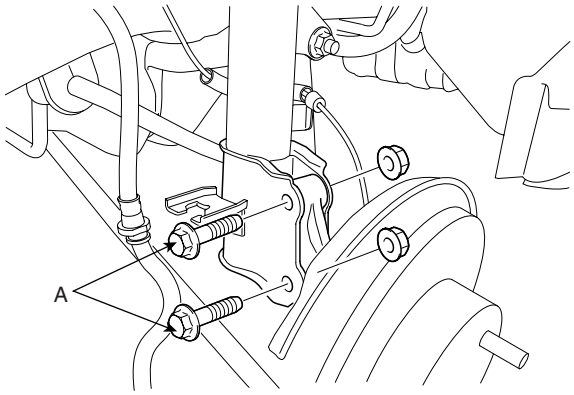
AKJF905B

19. Remove the front caliper(A) and use a wire to secure the caliper to the vehicle so that it is out of the way.



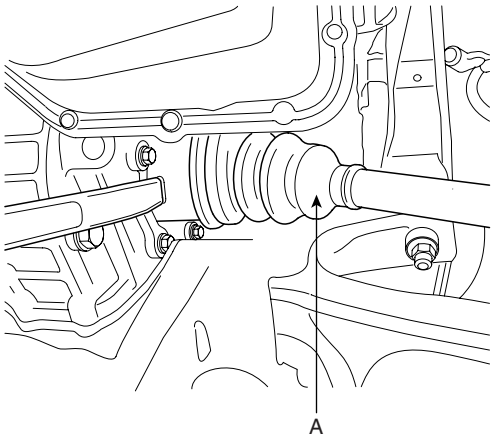
AKJF906B

20. Remove the knuckle mounting bolts(A).



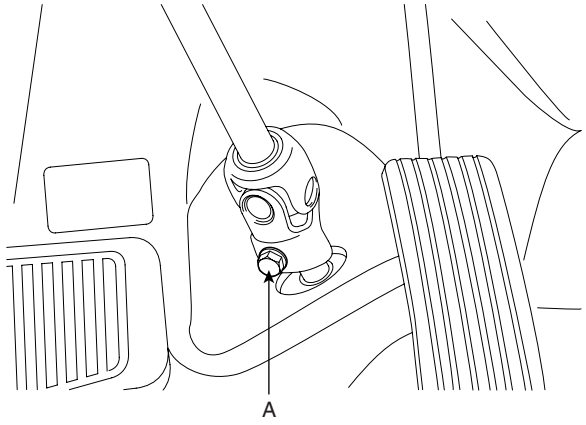
AKJF907B

21. Remove the drive shaft(A) from the transaxle.



AKJF301O

22. Remove the steering U-joint mounting bolt(A).

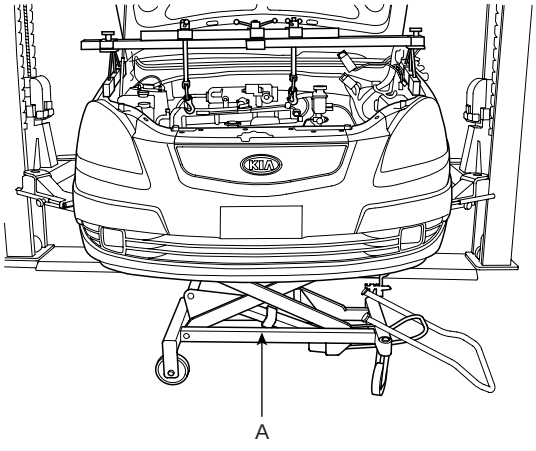


AKJF908B

23. Install the jack(A) for supporting transaxle.

NOTE

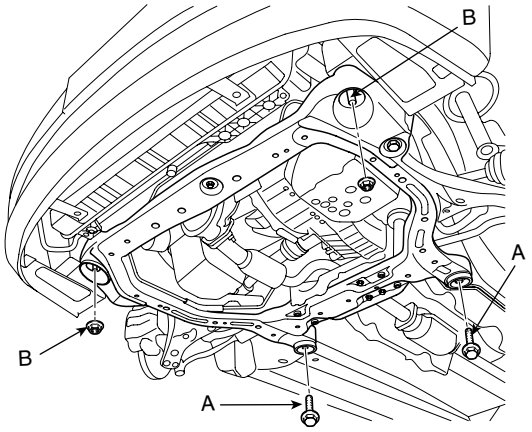
When supporting the transaxle assembly, make sure that the weight is applied to a wide area of the jack surface.



LKJF009B

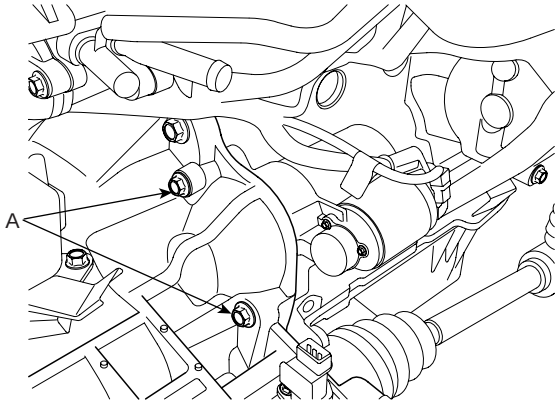
24. Remove the sub-frame bolt(A) and nut(B).

TORQUE :
Bolts(A): 40~50Nm(400~550Kgf.cm, 29-40lb-ft)
Nuts(B): 160~180Nm(1600~1800Kgf.cm, 110-126lb-ft)



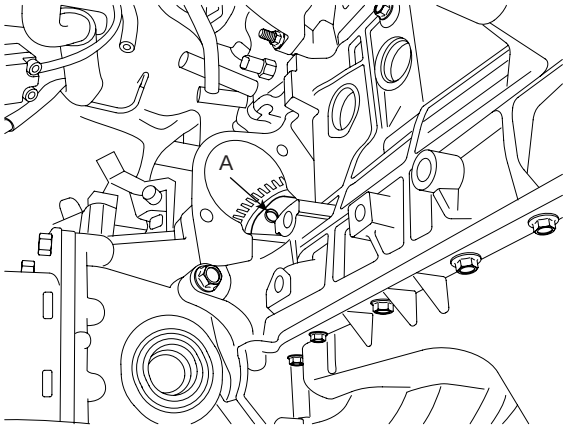
AKJF911B

25. Remove the start motor mounting bolt(A).



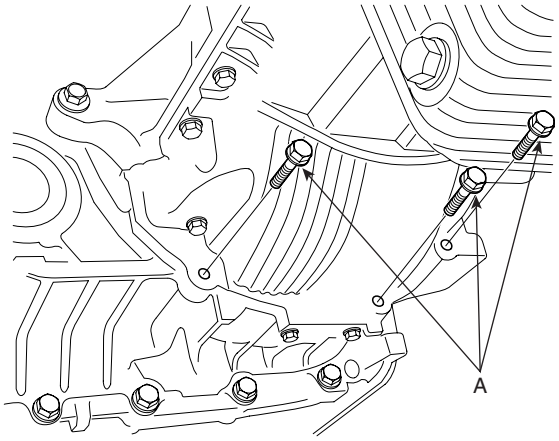
AKJF034A

26. Remove the engine to the torque converter mounting bolts(A). (4EA).



AKJF035A

27. Remove the engine to automatic transaxle mounting bolts(A).

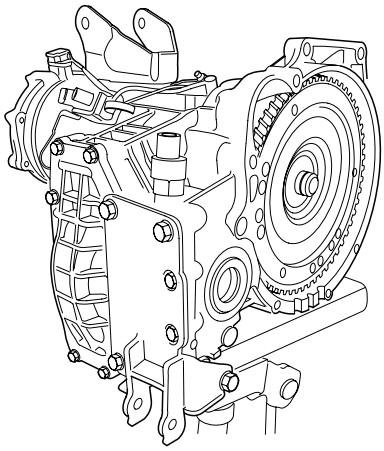


AKJF912B

28. Remove the transaxle assembly.

⚠ ***CAUTION***

Be careful not damage the other parts during removal.



AKJF913B

INSTALLATION ED8A1E6D

1. Attach the torque converter on the transaxle side and mount the transaxle assembly onto the engine.

⚠ ***CAUTION***

If the torque converter is mounted first on the engine, the oil seal on the transaxle may be damaged.
Therefore, be sure to first assemble the torque converter to the transaxle.

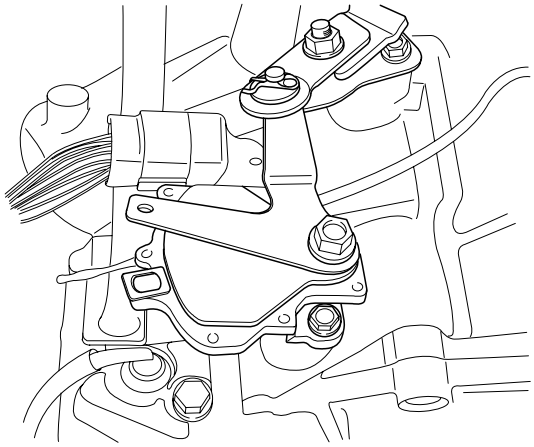
2. Install the transaxle control cable and adjust as follows.

   1) Move the shift lever and the transaxle range switch to the "N" position, and install the control cable.

   2) When connecting the control cable to the transaxle mounting bracket, install the clip until it contacts the control cable.

   3) Remove any free-play in the control cable by adjusting nut and then check to see that the selector lever moves smoothly.

4) Check to see that the control cable has been adjusted correctly.



LKJF009C

3. Installation is the reverse of removal.

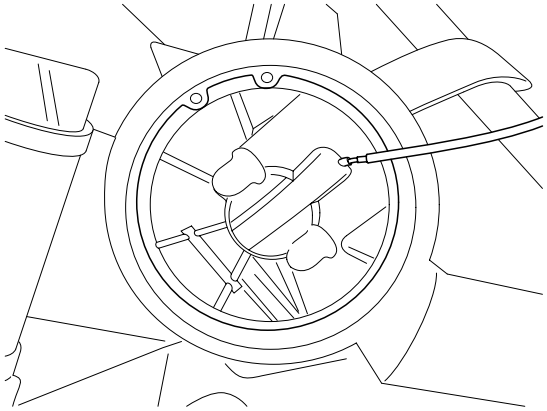
AUTOMATIC TRANSAXLE CONTROL SYSTEM

KICK DOWN SWITCH

DESCRIPTION E48032EE

The adjust sleeve and the retainer constitute the contacts of the kick-down servo switch. The switch detects the position of the kickdown piston just before the kick-down brake is applied, and sends the signal to the transaxle control module.
When the kickdown servo is not in operation, the switch contacts are kept closed. When the hydraulic pressure is applied to the kick-down servo, the piston operates, and the adjust sleeve separates from the retainer, thus turning off the switch.

* Switch ON/OFF condition
→ ON: 1st gear, 3rd gear
→ OFF : 2nd gear, 4th gear



AKJF025A

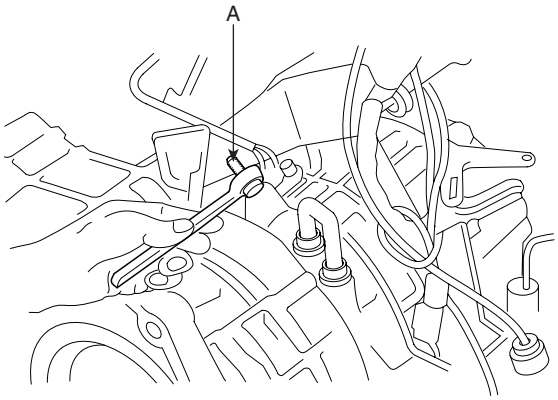
ADJUSTMENT E3CFDA42

1. Completely remove all dirt and other contaminating materials adhered around the kickdown adjust screw.
2. Loosen the lock nut.
3. Loosen and tighten the adjust screw(A) two times by torque of 5 Nm (50 kg·cm, 4 lb·ft).
4. Tighten adjust screw by torque of 5 Nm and then, loosen the adjust screw 3 to 3-1/3 turns.
5. Tighten the lock nut to the specified torque.

Lock nut :
15~22 Nm (150~220 kgf.cm, 11~15 lb-ft)

NOTE

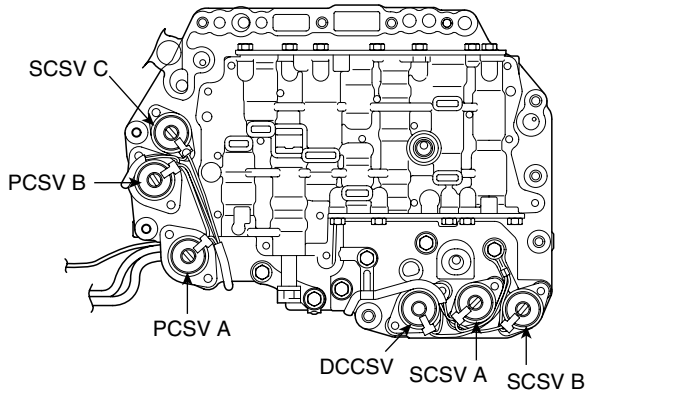
Before assembling, apply sealant (DC780) to the center portion of the adjust screw.



EKDA028F

PRESSURE CONTROL SOLENOID VALVE (PCSV)

DESCRIPTION EEB863A6



LKJF006A

NOTE

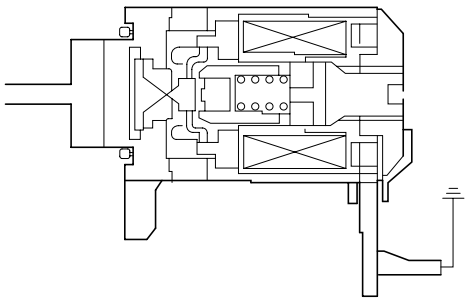
- *SCSV-A/B/C (ON/OFF)*
- *PCSV-A/B (Duty)*
- *DCCSV (ON/OFF)*

FUNCTION

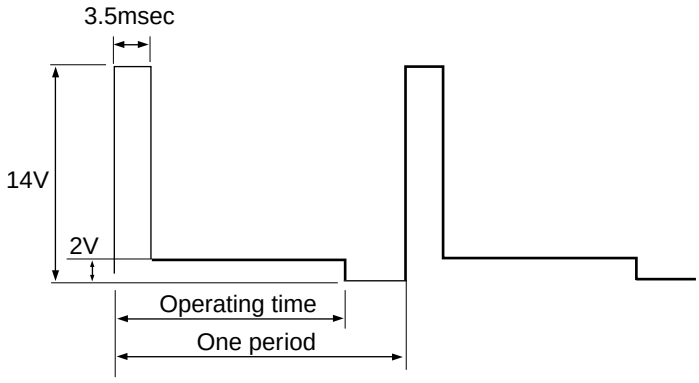
- Damper Clutch Control Solenoid Valve(DCCSV)
  : Controlled by the PCM. A damper clutch operates by the DCCSV.
- Shift Control Solenoid Valve-A (SCSV-A)
  : Controlled by the PCM. It operates at 1st / 4th gear.
- Shift Control Solenoid Valve-B (SCSV-B)
  : Controlled by the PCM. It operates at 1st / 2nd gear.
- Shift Control Solenoid Valve-C (SCSV-C)
  : Controlled by the PCM. It operates at 3rd / 4th gear and reduces line pressure.
  It controls the end clutch.
- Pressure Control Solenoid Valve-A (PCSV-A)
  : Controlled by the PCM. It controls the engaged pressure of the front clutch, end clutch, kick down brake and low & reverse brake.
- Pressure Control Solenoid Valve-B (PCSV-B)
  : Controlled by the PCM. It controls the engaged pressure of the rear clutch.

Item	Function
DC control solenoid valve	Makes the oil passage for damper clutch
Pressure control solenoid valve A	Makes the oil passage for K/D, E/C
Pressure control solenoid valve B	Makes the oil passage for R/C
Shift control solenoid valve A	Makes the oil passage at each gear
Shift control solenoid valve B	Makes the oil passage at each gear
Shift control solenoid valve C	Makes the oil passage for E/C
Torque reduction request sig.	Send torque reduction request signal to ECM

FEATURES

<table>
<tr><td>Duty ratio
(Frequency)</td><td>- PCVSV-A : 35Hz
- PCVSV-B : 50Hz</td></tr>
<tr><td>Surge voltage</td><td>
<table>
<tr><td>Solenoid</td><td>Valve resistance : Above 2.6Ω</td></tr>
<tr><td>Surge voltage</td><td>56V</td></tr>
</table>
LKJF006B
</td></tr>
<tr><td>Structure</td><td> 
LKJF006C</td></tr>
<tr><td>Pressure by duty ratio</td><td>
<table>
<tr><td rowspan="2">PCSV-B</td><td colspan="5">Duty(%)</td></tr>
<tr><td>0</td><td>25</td><td>50</td><td>75</td><td>100</td></tr>
<tr><td>Rear clutch pressure(kg/cm²)</td><td>8.7±0.3</td><td>6.3±0.5</td><td>2.8±0.4</td><td>0.9±0.3</td><td>Max. 0.2</td></tr>
<tr><td>Reducing pressure(kg/cm²)</td><td>4.3±0.2</td><td>←</td><td>←</td><td>←</td><td>←</td></tr>
</table>
※ The pressure is under normal temperature. [85˚C(185˚F)]
LKJF006D
</td></tr>
</table>

CHARACTERISTICS

<table>
<tr><td colspan="2">Pin voltage</td><td>Output waveform</td></tr>
<tr><td>Solenoid valve resistance</td><td>Above 2.6Ω</td><td rowspan="3"> 

LKJF006E</td></tr>
<tr><td>Surge voltage</td><td>56V</td></tr>
<tr><td>IG "ON"</td><td>12~14V
(TCM Pin)</td></tr>
</table>

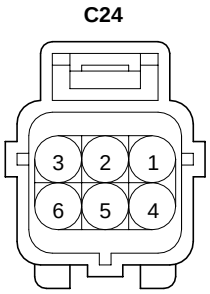
SOLENOID OPERATION

Shift	SCSV-A	SCSV-B	SCSV-C	PCSV-A	PCSV-B	Remarks
1	ON	ON	OFF	ON	OFF	
1→2A	OFF	ON	OFF	DUTY	OFF	
2A	OFF	ON	OFF	OFF	OFF	
2→3	OFF	OFF	OFF	DUTY	OFF	
3	OFF	OFF	ON	OFF	OFF	
3→4	ON	OFF	OFF	DUTY	OFF	
4	ON	OFF	ON	OFF	OFF	
4→3	OFF	OFF	OFF	DUTY	DUTY	
4→2B	OFF	ON	ON	DUTY	DUTY	
2B	OFF	ON	ON	ON	OFF	
3→2A	OFF	ON	OFF	DUTY	OFF	
2→1	ON	ON	OFF	ON	OFF	
N→D2	OFF	ON	OFF	DUTY	DUTY	
Fail safe	OFF	OFF	OFF	OFF	OFF	

INSPECTION EEEF2CCD

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the side cover. (Bolt : 2EA)
4. Disconnect the solenoid valve connector.
5. Measure the resistance between terminals of the solenoid valve connector on the transaxle case.

Pin no.	Name	Resistance
1	Damper clutch solenoid valve	2.7 ~ 3.4Ω (20°C(68°F))
2	Shift control solenoid valve A	22.3 ± 1.5Ω (20°C(68°F))
3	Shift control solenoid vlave B	
4	Pressure control solenoid valve B	2.7 ~ 3.4Ω (20°C(68°F))
5	Pressure control solenoid valve A	
6	Shift control solenoid valve C	22.3 ± 1.5Ω (20°C(68°F))

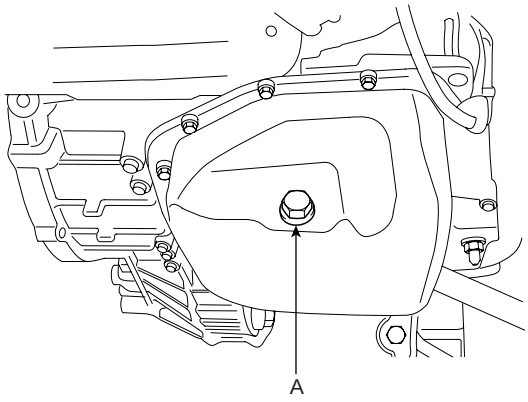


LKJF008D

6. If the result isn't within the standard value, remove the valve body cover.
7. Measure the resistance after removing the solenoid valve connector.
8. If the result isn't within the standard value, replace the solenoid valve.

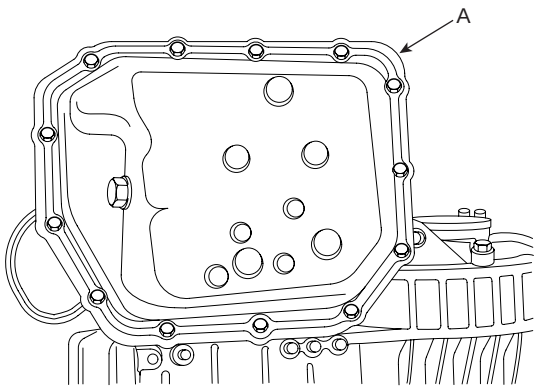
ADJUSTMENT E4A1ECAD

1. Remove the drain plug(A) and drain the automatic transaxle fluid.



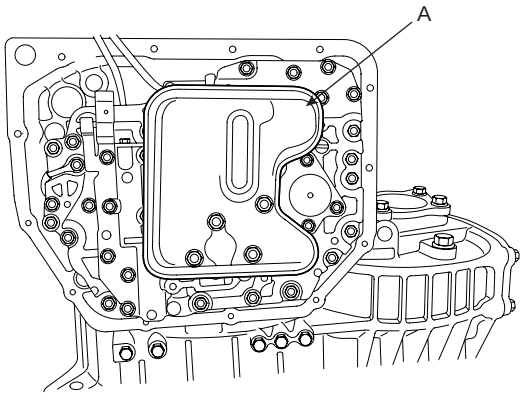
EKKD006A

2. Remove the oil pan(A).



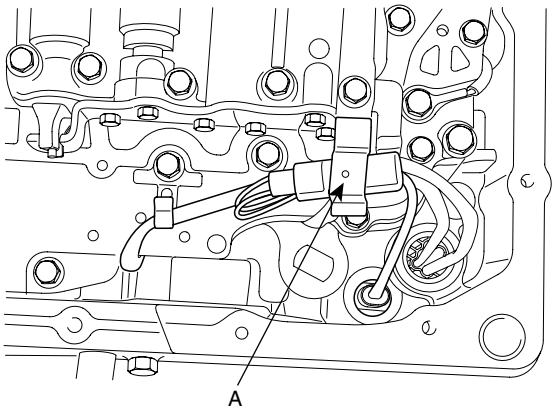
EKKD007A

3. Remove the oil filter(A).



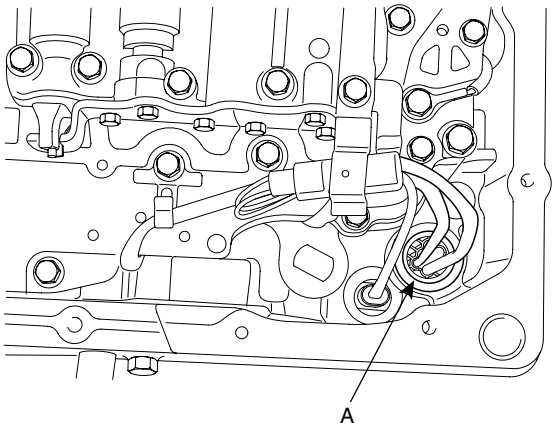
EKKD008A

4. Remove the fluid temperature sensor(A).



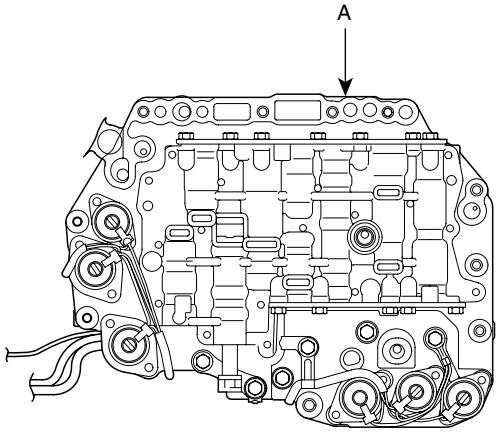
LKJF007A

5. Press the tab of the solenoid valve harness grommet tab(A) and push in.



LKJF007B

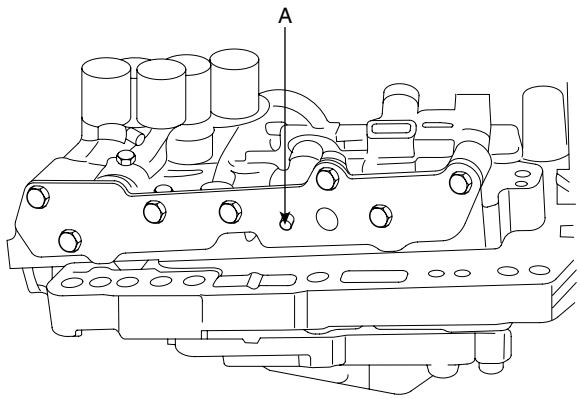
6. Remove the valve body assembly(A). The manual valve can come out, so be careful not to drop it.



LKJF007C

7. Turn the adjustment screw(A) of the regulator valve and adjust so that the line pressure (kickdown brake pressure) reaches the standard value. When the adjustment screw is turned clockwise, the line pressure becomes lower; when it is turnedcounter-clockwise, it becomes higher.

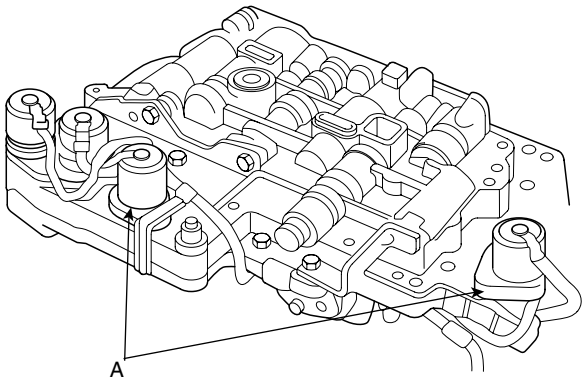
Standard value:
860~900 kPa (122~129 psi, 8.77~9.18 kg/cm²)
Oil pressure change for each turn of adjustment screw :
38 kPa (5.4 psi, 0.39 kg/cm²)



LKJF007D

8. Check to be sure that the O-ring is installed on the upper surface of the valve body at the place.

9. Replace the O-ring(A) of the solenoid valve connector with a new one.



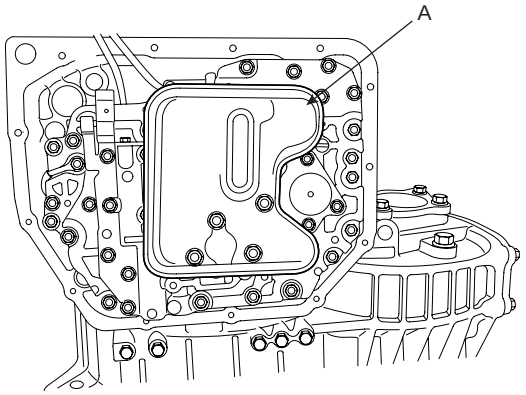
LKJF007E

10. Install the valve body assembly to the case and then insert the solenoid valve connector into the case.
Be sure, at this time, that the notched part of the connector faces. Also be careful that the lead wiring isn't caught.

11. Tighten the valve body assembly mounting bolts to 10-12 Nm (100-120 kgf.cm, 7-8 lb-ft).

Bolts	Length [in(mm)]
A	0.98 (25)
B	1.38 (35)
C	1.57 (40)

12. Install a new oil pan gasket with the oil pan.



EKKD008A

13. Pour in the specified amount of automatic transaxle fluid.

14. Perform the oil pressure test. Readjust if necessary.

REDUCING PRESSURE ADJUSTMENT

1. If the Hi-scan tool is not available

    1) Remove parts up to the oil filter in the same way as for adjustment of the line pressure. The valve body need not be removed.

    2) Turn the adjusting screw of the lower valve body and adjust so that the reduction pressure is the standard value.
    When the adjusting screw is turned clockwise, the reduction pressure becomes lower; when it is turned counter clockwise, it becomes higher.

    NOTE

    When adjusting the reducing pressure, aim for the center value (425 kPa, 60 psi) of the standard value allowance.

Standard value: 420 kPa (60 psi, 4.2 ± 0.2 kg·cm²) Oil pressure change for each turn of the adjustment screw: 420 kPa (60 psi, 4.2 ± 0.2 kg·cm²)

    3) Install the oil filter and oil pan in the same way as for adjustment of the line pressure.

    4) Perform the oil pressure test. Readjust if necessary.

2. If the Hi-scan tool is used

    1) Adjust the pressure control solenoid so that the kickdown brake pressure is the standard value when activated to 50% duty by the Scan Tool.

Standard value: 320±30 kPa (39 ± 1 psi, 3.2 ± 0.3 kg·cm²) Oil pressure change for each turn of the adjustment screw: 30 kPa (3 psi, 0.3 kg·cm²)

    CAUTION

    This adjustment should be made with an oil temperature of 80~90°C (176~194°F). If the adjustment is made at a temperature that is too high, the line pressure will drop during idling, with the result that it might not be possible to make thecorrect adjustment.

PULSE GENERATOR

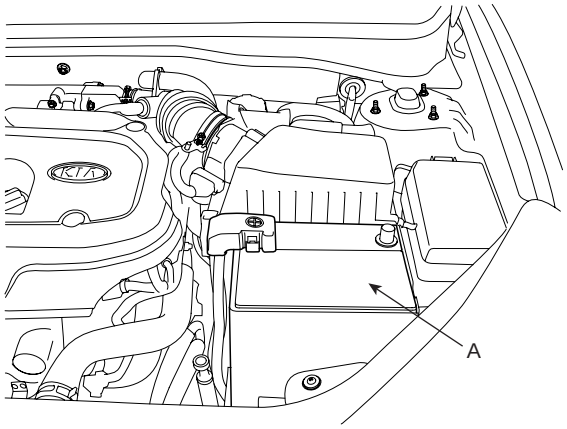
DESCRIPTION E3AB85E7

The pulse generator "A" detects the speed of the end clutch retainer. The speed signal is used for damper clutch control, hydraulic pressure control and incorrect gear detection by PCM.
The pulse generator "B" detects the speed of the transfer driven gear. The speed signal is used for shift timing, hydraulic pressure control and incorrect gear detection by PCM.

Pulse generator A,B	Inspection item	Standard value
Senaor resistance	A: 1 terminal ~ 2 terminal	215 ~ 275 Ω
	B: 1 terminal ~ 2 terminal	215 ~ 275 Ω
Output voltage (A,B)	1 terminal ~ ground	1.45 V
	2 terminal ~ ground	1.7 V

REPLACEMENT EC28AF0A

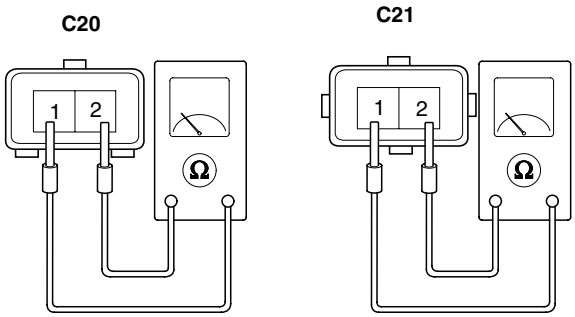
1. Remove the battery terminal(A).



AKJF306A

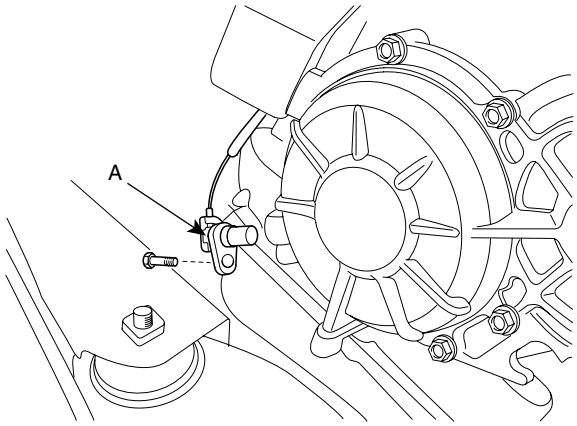
2. Remove the intake air hose and air clean assembly. (Refer to the automatic transaxle - Removal/ installation procedure)
3. Disconnect the sensor wire from the control cable mounting bracket.
4. Remove the pulse generator A, B.
   1) Disconnect the connector from the sensor.
   2) Measure the pulse generator A, B resistance.

Standard value:
Pulse generator A: 245±30Ω / 20°C(68°F)
Pulse generator B: 245±30Ω / 20°C(68°F)

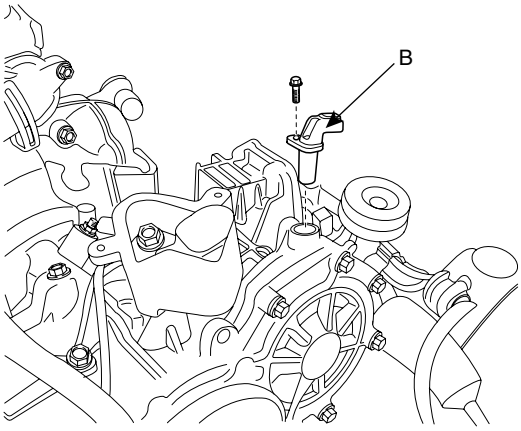


LKJF008A

3) If the result isn't within the standard value, replace the pulse generator A, B.



LKJF008B



LKJF008C

5. Apply the ATF oil around the oil seal before installing the oil seal.

6. Install the pulse generator A, B.

TORQUE :
10~12Nm (100~120Kgf.cm, 7~8lb-ft)

7. Connect the sensor wire to the control cable mounting bracket.

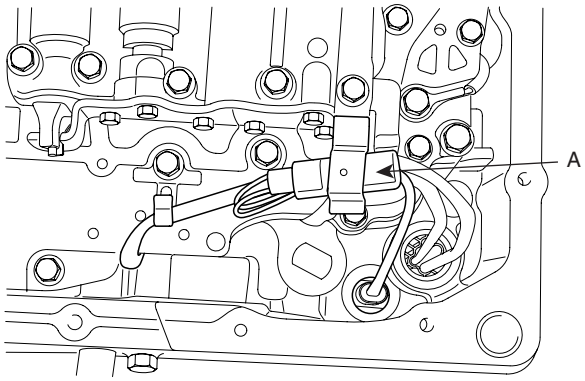
8. Connect the pulse generator connector.

9. Installation is the reverse of removal.

TRANSAXLE OIL TEMPERATURE SENSOR

DESCRIPTION EF8CFCD7

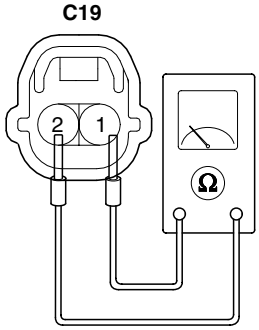
The oil temperature sensor(A) detects the automatic transaxle fluid temperature. The oil temperature sensor is a negative thermal coefficient type. The resistance of the sensor increases when the oil temperature goes down and the resistance goes up when the oil temperature decreases.
Using the signal from this sensor, PCM corrects the solenoid drive duty when the fluid is cold (lower than 60°C) and hot (higher than 125°C). PCM restricts the shift pattern to the economy mode when the fluid is cold.- Service point



AKJF400A

INSPECTION E60EE9FB

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remeve the side cover. (bolt : 2EA)
4. Disconnect the fluid temperature sensor connector.
5. Measure the resistance between terminals "1" and "2" of the fluid temperature sensor connector on the transaxle case.

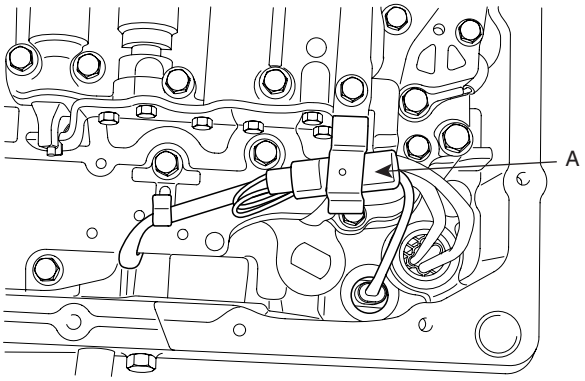


LKJF008E

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

6. If the result isn't within the standard value, remove the valve body cover.

7. Replace the fluid temperature sensor(A).



AKJF400A

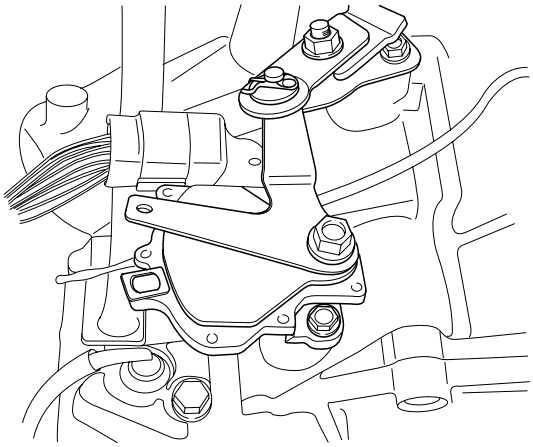
TRANSAXLE RANGE (TR) SWITCH

DESCRIPTION E86AD4D8

The start safety mechanism ensures the safety during the engine starting operation. When the selector lever is in the position other than "P" or "N", the electrical circuit for starting the engine is kept in the OFF state by the inhibitor switch. Therefore, the engine does not start even if the ignition switch is turned to the "START" position. Inhibitor switch is installed on the transaxle case located at the upper end of the manual control shaft and is interlocked with the manual control lever.

By shifting the selector to the "P" or "N" range, the electrical circuit inside the inhibitor switch is connected to form the ignition circuit with which the engine can be started. When the shift is in the "R" range, the backup lamp lights up as backup lamp circuit is energized.

The inhibitor switch, in addition to the start safety device, also includes a circuit for detection of the selector lever position, for sending signals to the transaxle control module.



LKJF005F

Type	- Type : rotary type - Use available temperature : -40°C~145°C - TORQUE : 1.0~1.2 kg/m
Function	- Detect shift lever position - It makes starting possible in "P" & "N".
Terminal	

C11

2. RANGE L
3. Power supply
4. RANGE 2
5. BACK-UP LAMPS
6. Power supply
9. RANGE P
10. RANGE R
11. RANGE D
12. RANGE N

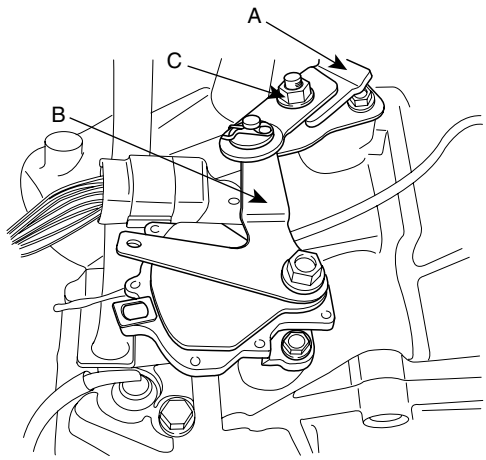
Terminal No. / Shift Lever	P	R	N	D	2	L
2						●
4					●	
6	●	●	●	●	●	●
7	●		●			
8	●		●			
9	●					
10		●				
11				●		
12			●			

[RANGE SWITCH continuity check table]

LKJF005G

ADJUSTMENT E485DFAA

1. Set the select lever to the "N" position.
2. Loosen the control cable(A) to manual control lever flange nut(C) to free the cable and lever(B).



LKJF005H

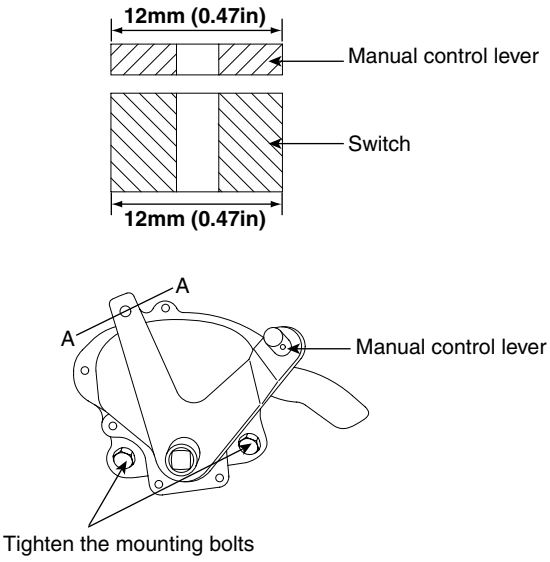
3. Set the manual control lever to the "N" position.
4. Loosen the transaxle range switch body mounting bolts and then turn the transaxle range switch body so the hole in the end of the manual control lever and the hole (cross section A-A in the figure) in the flange of the transaxle range switch body flange are aligned.
5. Insert the special tool to fix the manual control lever and switch body.
6. Tighten the transaxle range switch body mounting bolts to the specified torque.

TORQUE :
10~12Nm (100~120kgf.cm, 7~8lb-ft)

NOTE

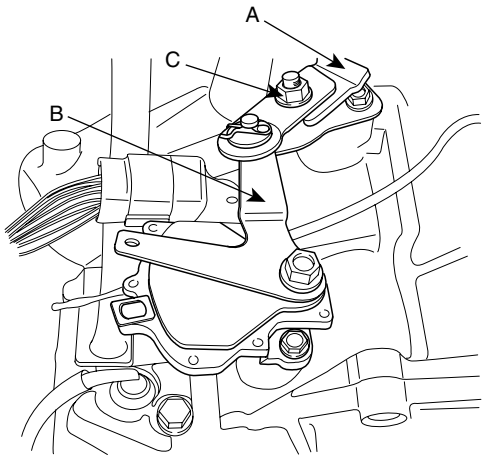
- *When setting up the switch body, be careful that the O-ring does not drop from the switch.*
- *Tighten the mounting bolts carefully so that the position of the switch body does not move.*

Section A-A



LKJF005I

7. Check that the select lever is in the "N" position.
8. Adjust the adjusting nut(C) so that there is no slack in the control cable(A) and make sure that the select lever(B) operates smoothly.

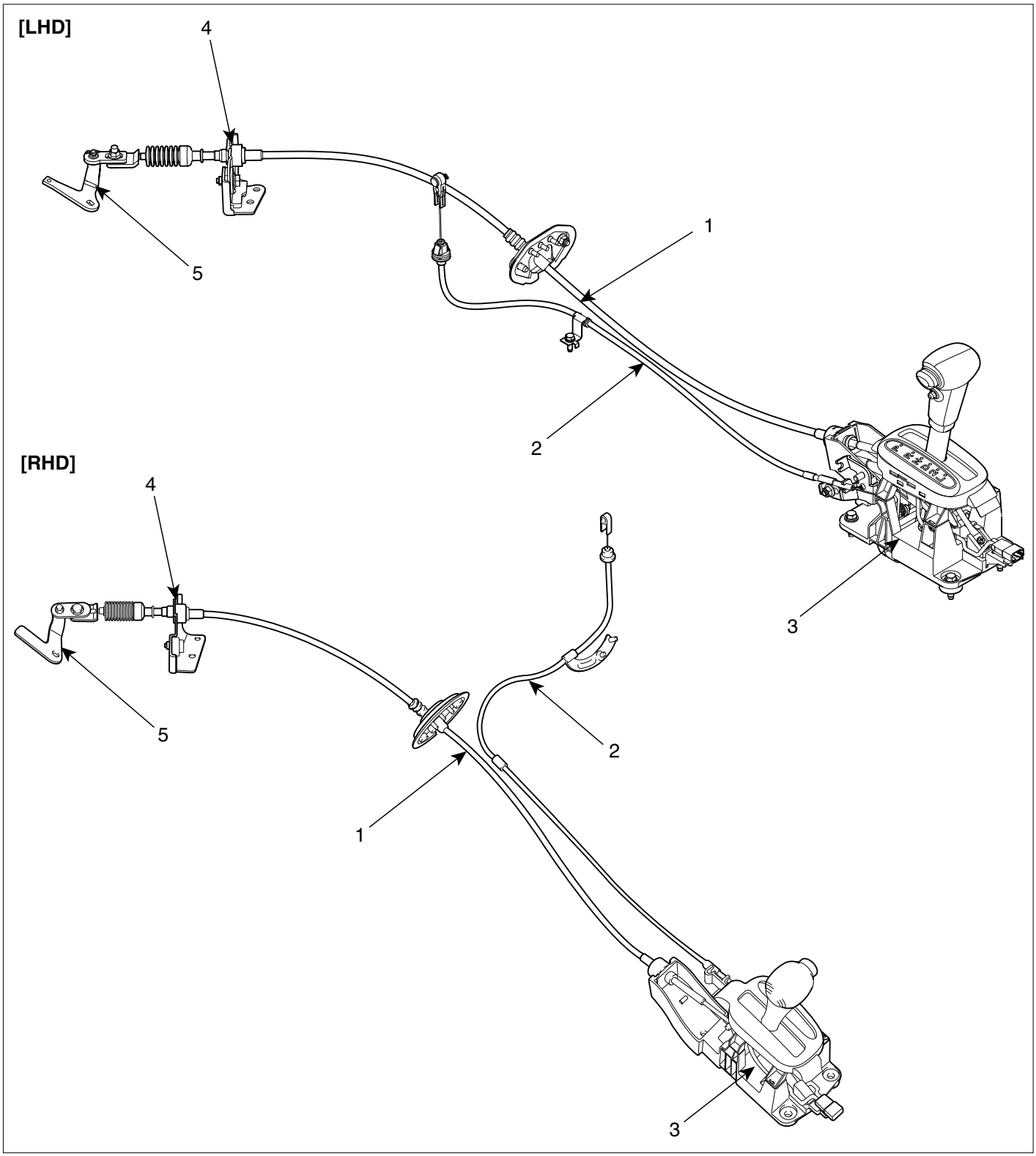


LKJF005H

9. Run the vehicle and confirm that the transaxle is set in each range when the select lever is shifted to each position.

SHIFT LEVER

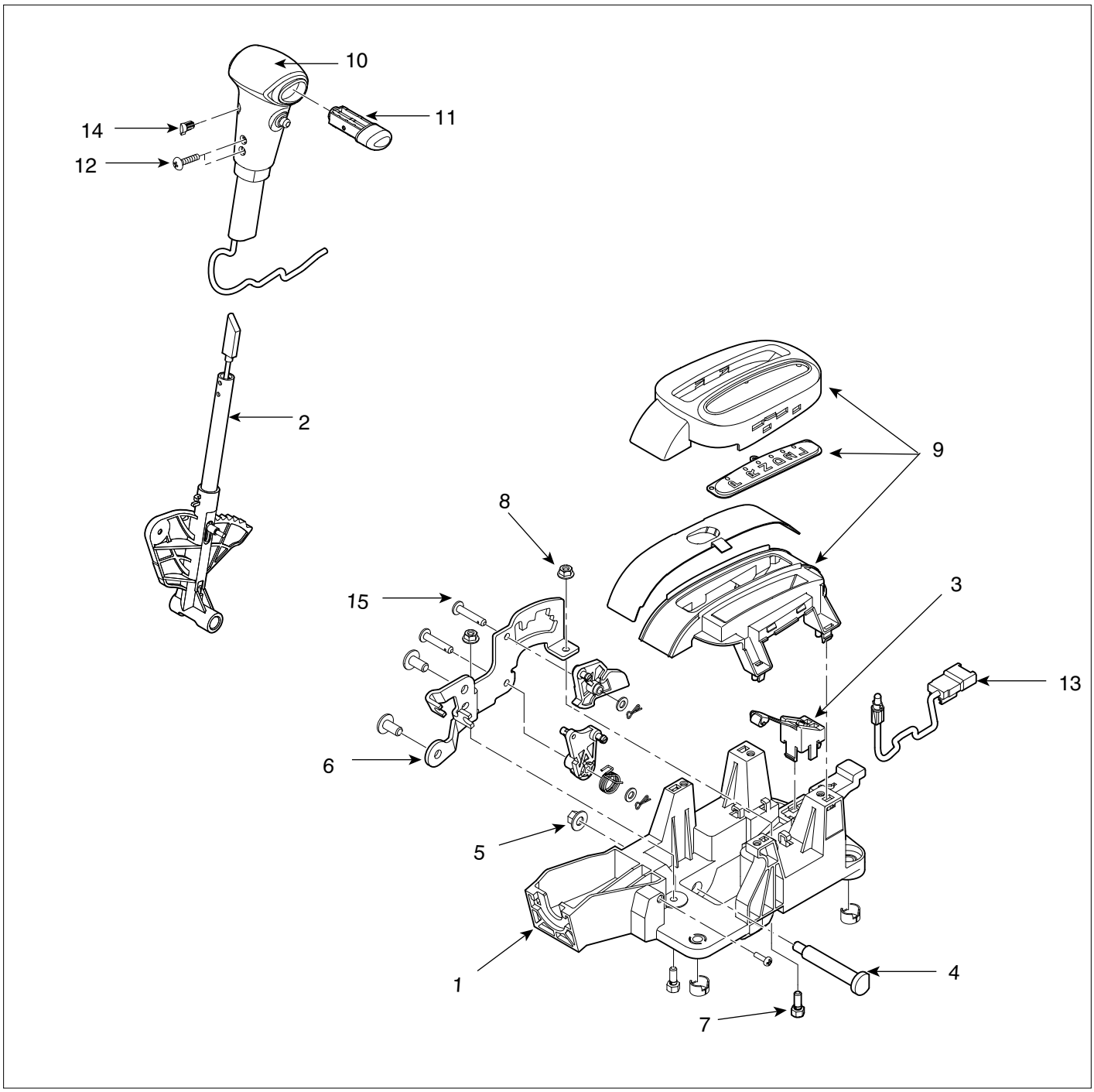
COMPONENTS (1) EFFA7191



1. A/T control cable
2. Shift lock cable
3. Shift lever assembly
4. Cable pin
5. Shift lever(TM side)

LKJF010A

COMPONENTS (2)

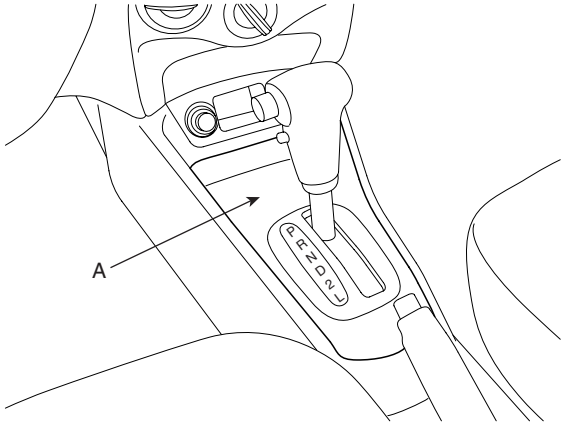


1. Shift lever bracket assembly
2. Lever sub assembly
3. Detent spring
4. Hinge shaft
5. Plain washer
6. Cable bracket sub assembly
7. Tapping screw
8. Flange nut
9. Indicator assembly
10. Knob sub assembly
11. Push button
12. Knob screw
13. Illumination wiring assembly
14. Knob cap
15. Pin stopper

LKJF010B

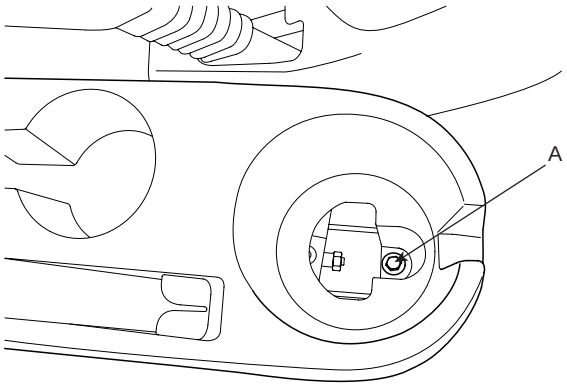
REMOVAL EE4FFF8C

1. Remove the center console cover(A).



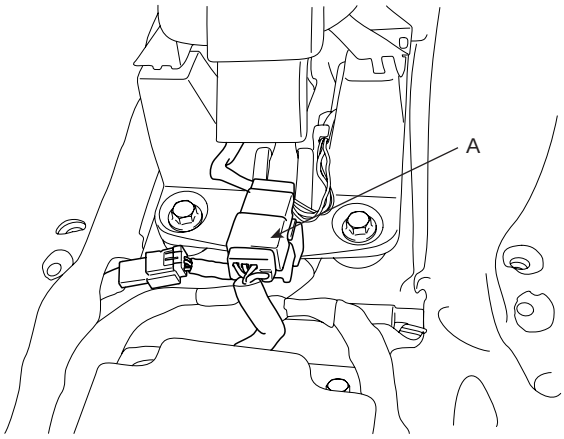
AKJF700B

2. Remove the center console mounting bolt(A) and screw(4EA) and remove the center console.(Refer to BD Group)



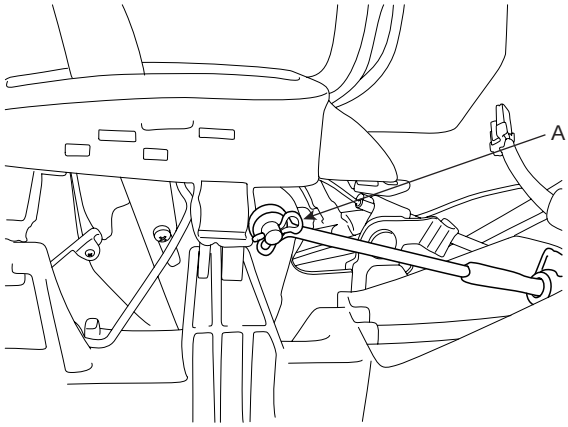
AKJF720A

3. Disconnect lever assembly electrical connector(A).



AKJF700C

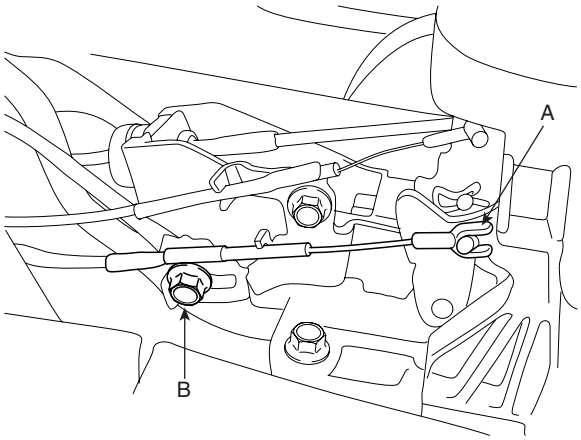
4. Remove the control cable cotter pin(A).



AKJF700D

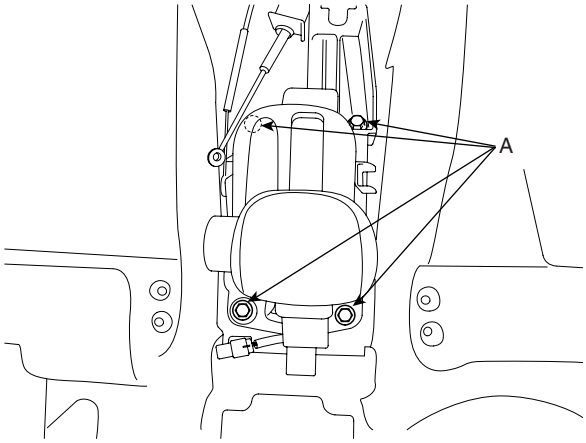
5. Remove control cable hold (lever side).
6. Remove the shift lock cable P-LOCK cam(A).

7. Remove the shift lock cable mounting nut(B). (Nut: 1EA)



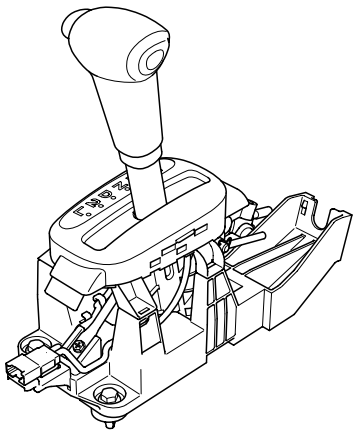
AKJF721A

8. Remove the shift lever bolt(A). (Bolt: 4EA)



AKJF005Z

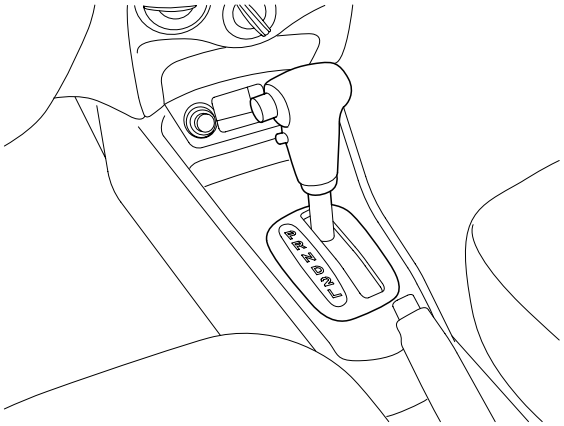
9. Remove the shift lever assembly.



AKJF012Z

INSTALLATION E2AE3AF9

1. Installation is the reverse of removal.
2. After assembling, check the followings.
   1) When shifting with each position, lever must be operated securely without friction and free from looseness, noise and so on.
   2) When lever shifting, it shall not be stopped easily between each positions.
   3) When lever should be stopped between "P" and "R" position intentionally. It should not be shifted to "R" position by vibration added for lever assembly.



LKJF010C

   4) Free from noise when being shifted from "R" to "N", push button being released.
   5) Slider must be operated smoothly between each position.
   6) Slider must be operated smoothly without looseness, stick and noise.

Driveshaft and Axle

GENERAL

DRIVESHAFT
- FRONT DRIVESHAFT ASSEMBLY
- FRONT DRIVESHAFT

FRONT AXLE
- FRONT HUB / KNUCKLE

REAR AXLE
- REAR HUB / CARRIER

GENERAL

SPECIFICATIONS E00FD85C

Item				Inner	Outer
Front drive shaft	Joint type	1.4/1.6 GSL	LH	UTJ-II22	BJ22
			RH	TJ22	BJ22
	Maximum permissible	1.4/1.6 GSL		23°	45°
Hub end play mm (in)	0.008 (0.0003) or less				
Wheel bearing starting torque	1.8 Nm (18 kg·cm, 1.3 lb·ft) or less				

- BJ : Birfield Joint
- TJ : Tripot Joint
- UTJ-II : U TYPE-II Tripot Joint

TIGHTENING TORQUE EF299A3B

Items	Nm	kgf·m	lb-ft
Drive shaft lock nut	200 ~ 260	20 ~ 26	145 ~ 188
Knuckle to strut assembly bolt	100 ~ 120	10 ~ 12	72 ~ 86
Lower arm ball joint to knuckle bolt	100 ~ 120	10 ~ 12	72 ~ 86
Tie rod end to knuckle bolt	16 ~ 34	1.6 ~ 3.4	12 ~ 25
Brake caliper to knuckle bolt	65 ~ 75	6.5 ~ 7.5	47 ~ 54
Wheel nut	90 ~ 110	9 ~ 11	65 ~ 80
Rear hub bearing flange nut	200 ~ 260	20 ~ 26	145 ~ 188
Rear brake to rear torsion beam axle mounting bolt	65 ~ 75	6.5 ~ 7.5	47 ~ 54
Rear strut to rear torsion beam axle nut	110 ~ 120	11 ~ 12	80 ~ 86
Rear torsion beam axle to rear hub bearing mounting nut	50 ~ 60	5 ~ 6	36 ~ 43

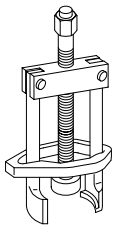
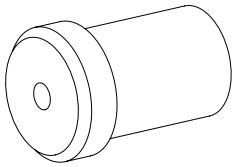
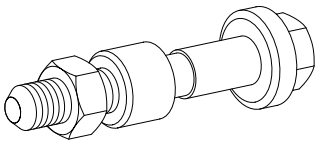
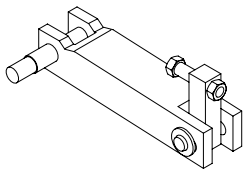
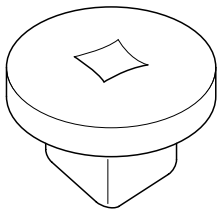
CAUTION

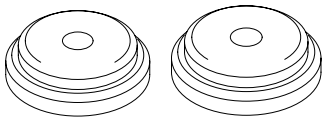
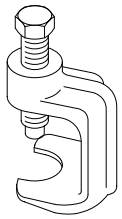
Replace self-locking nuts with new ones after removal.

LUBRICANT

Items	Recommended	Quantity
TJ22(UTJ-II22) - BJ22 type drive shaft (1.4/1.6 GSL MT)		
TJ22(UTJ-II22) boot grease	SK CHEMICAL RTA-R	110g + 10g
BJ22 boot grease	SK CHEMICAL RBA	100g + 10g
TJ22(UTJ-II22) - BJ22 type drive shaft (1.4/1.6 GSL AT)		
TJ22(UTJ-II22) boot grease	SK CHEMICAL RTA-R	130g + 10g
BJ22 boot grease	SK CHEMICAL RBA	100g + 10g

SPECIAL TOOLS E01491CD

Tool (Number and Name)	Illustration	Use
09495-33000 Puller	 EIRF001B	Removal of wheel bearing inner race from a hub.
09495-33100 Center bearing remover and installer	 AIJF002B	1. Removal of a wheel bearing from a knuckle. (use with 09517-29000) 2. Installation of a hub to a knuckle.
09517-21500 Front hub remover and installer	 EIRF001A	1. Removal of a front hub from a knuckle. (use with 09517-29000) 2. Measurement of a front wheel bearing pre-load. (use with 09532-11600)
09517-29000 Knuckle arm bridge	 AIJF002D	1. Removal of a front hub from a knuckle. (use with 09517-21500) 2. Removal of a wheel bearing outer race from a knuckle. (use with 09495-33100)
09532-11600 Preload socket	 EIRF001C	Measurement of a front wheel bearing pre-load. (use with 09517-21500)

Tool (Number and Name)	Illustration	Use
09532-11500 Bearing outer race installer	 AIJF002E	Installation of a wheel bearing to knuckle.
09568-4A000 Ball joint puller	 KPRE103I	Separation of a lower arm and a tie rod end ball joint.

TROUBLESHOOTING ECEB54EA

GENERAL DIAGNOSTICS AND TESTS

To assist the service adviser and the technician, check the drive shaft condition with the questions listed below by filling them.

It serves as a place to record information reported as well as data from the testing to be carried out.
To begin a successful diagnosis, fill out the questions.

DRIVE SHAFT CONDITION : Noise ☐ Vibration ☐

Balance Weights Missing/Other Visual Defects? **Yes / No**

Maximum Allowable Runout : _____

Actual Runout : Front _____ Middle _____ Rear _____

Two-Piece Drive shaft Runout : Front _____ Rear _____

Middle Support Bearing : Loose ☐ Damaged ☐ Worn ☐ Others _____

Suspect Drive shaft Balanced ? **Yes / No**

Pinion Angle : Engine Height : Specification _____ Actual _____

Pinion Angle : Specification _____ Actual _____

Drive shaft Angle - Truck : Specification _____ Actual _____

LIJF002A

Once the concern is narrowed down to a symptom/condition, proceed to condition and Symptom Categories below.
Condition and Symptom Categories.
Operation Condition Vehicle is moving.
Depends more one how the vehicle is operated.

1. Speed related
   - Related to vehicle speed
   a. Noise occurs at specific vehicle speed. A high pitch noise (whine).
      Go to troubleshooting.
   b. Loudness proportional to vehicle speed. Low frequency noise at high speeds, noise and loudness increase with speed. Go to Troubleshooting.

2. Acceleration

- Light/moderate acceleration
a. Driveline shudder. Go to Troubleshooting.

3. Cruising speeds
-Driveline vibration. Go to Troubleshooting.

Symptom	Cause	Remedy
Hub howling or whine - Hub or transfer case	Axle lubricant low	Check the lubricant level. Fill the axle to specification
	Damaged or worn wheel bearings or axle bearings	Check for abnormal wheel bearing play or roughness. Refer to wheel Bearing Check in this section. Adjust or Install new wheel bearings as necessary.
Driveline clunk - loud clunk when shifting from reverse to drive	Excessive backlash in the axle or transmission	Carry out a total backlash check
	Loosen suspension components	Inspect the suspension for damage or wear.Repair or Install new components as necessary.
	Broken powertrain mounts	Inspect the powertrain mounts. Install new mounts as necessary.
	Idle speed too high	Check for the correct idle speed
Driveline clunk-occurs as the vehicle starts to move forward following a stop	Worn drive shaft joints with excessive play	Inspect the joints for a worn condition. Install a new driveshaft as necessary.
Driveline clunk-occurs during acceleration or from cruise to coast/deceleration	Damaged or worn tripod joints	Inspect the joint and boot. Repair or Install a new joint as necessary.
Quirer-noise from the rear hub, occurs when driving on rugged roads	Cap seperation from the hub bearing	Remove the rear hub check the hub bearing cap. Install a new cap if necessary.
Clicking, popping or grinding-occurs while vehicle is turning	Inadequate or contaminated lubrication in the joints	Check the joint boots and joints for wear or damage. Repair or Install new components as necessary.
	Another component contacting the drive shaft	Check the drive shafts and around the drive shafts. Repair as necessary.
	Brake components	Inspect the front brakes for wear or damage. Repair as necessary.
	Suspension components	Inspect the lower arm ball joints for wear or damage. Repair as necessary.
	Damaged or worn wheel bearings	Check for abnormal wheel bearing play or roughness. Refer to wheel bearing check in this section. Adjust or Install new wheel bearings as necessary.
Clicking or snapping-occurs when accelerating around a corner	Damaged or worn birfield joints	Inspect the Birfield joints and boots. Repair or Install a new joint as necessary.

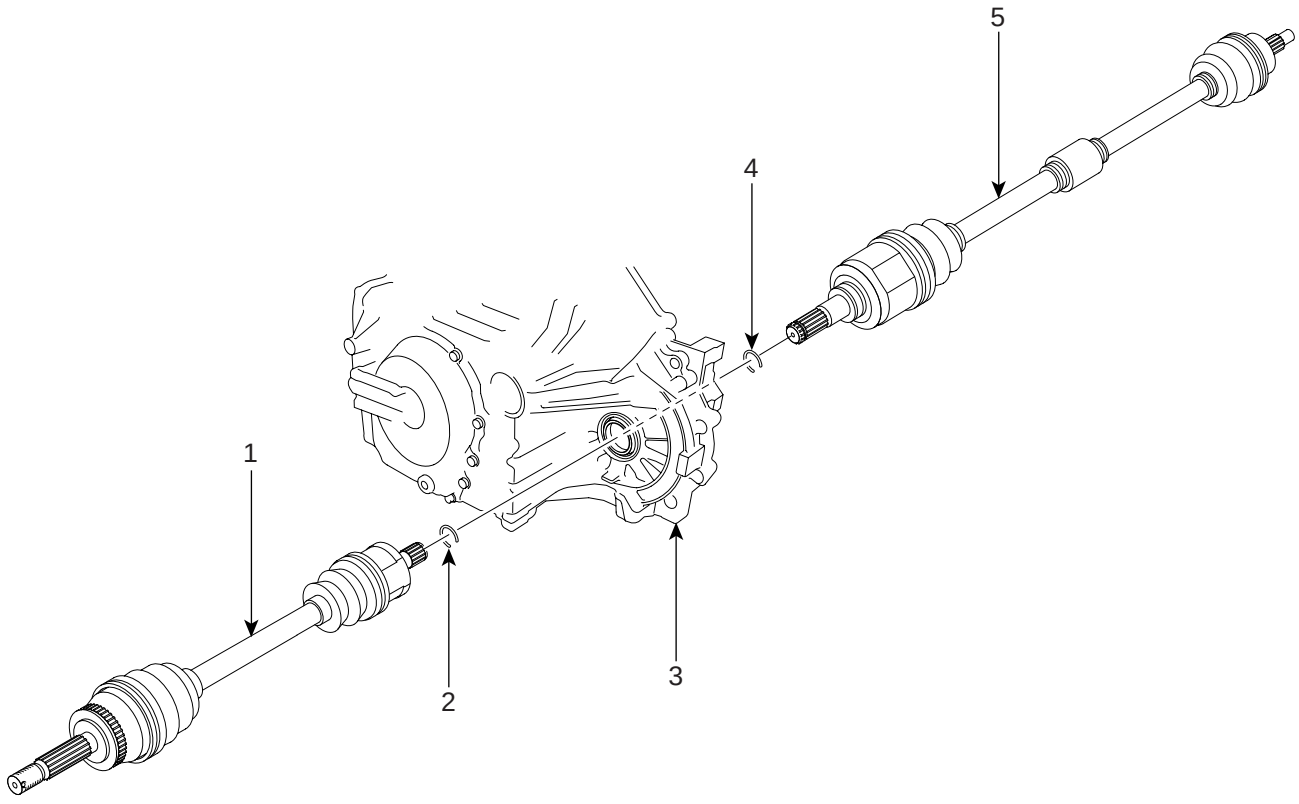
Symptom	Cause	Remedy
Buzz-buzzing noise is the same at cruise or coast/deceleration	Damaged or worn tires	Check for abnormal tire wear or damage. Install a new tire as necessary.
Driveline shudder-occurs during acceleration from a slow speed or stop	Rear axle assembly mispositioned	Check the axle mounts and the rear suspension for damage or wear. Repair as necessary.
	Loose rear axle bolts	Inspect the bolts. Tighten the bolt nuts to specification.
	Damaged or worn front suspension components	Check for a loose stabilizerbar, damagedor loose strut/strut bushings or looseor worn ball joints. Inspect the steering linkage for wear or damage. Repair or Install new components as necessary.
	Binding the drive shaft joint	Inspect the drive shaft shaft joint for worn, or damaged condition. Install a new drive shaft assembly as necessary. Repair as necessary.
	Loose rear axle bolts	Inspect the bolts. Tighten the bolts to specification.
Driveline vibration-occurs at cruising speeds	Binding or damaged drive shaft joint	Inspect the drive shaft joint for wear or damage. Install a new drive shaft assembly as necessary.
	Incorrect lateral and radial tire/wheel runout	Inspect the tire and wheels. Measure tire runouts. Repair or Install new components as necessary.
	Incorrectly seated joint in the front wheel hub	Check the Birfield joint for correct seating into the hub. Repair as necessary.

DRIVESHAFT

FRONT DRIVESHAFT ASSEMBLY

COMPONENTS E7EF4871

NOTE : This illustration is shown the LHD type.
RHD type is symmetrical.

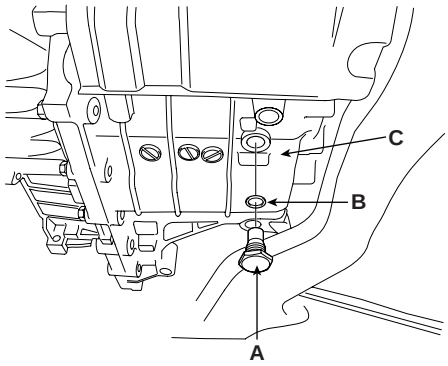


1. Driveshaft (LH)
2. Clip
3. Transaxle
4. Clip
5. Driveshaft (RH)

LIJF010A

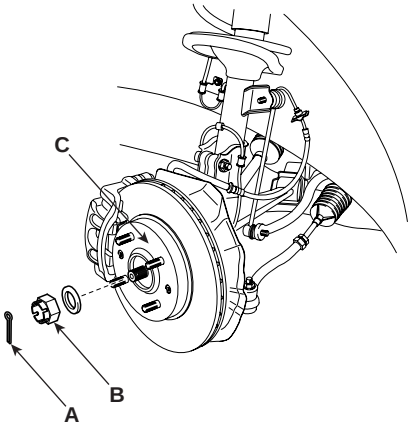
REMOVAL E5E7A80A

1. Loosen the wheel nuts slightly.
2. Raise the front of the vehicle and support it with safety stands in a proper location.
3. Remove the front wheel and tire.
4. Remove the drain plug(A). Drain the transaxle oil.
   a. Lay a bottle keeping the gear oil under transaxle.
   b. Remove drain plug(A) and washer(B) in the lower part of transaxle(C).



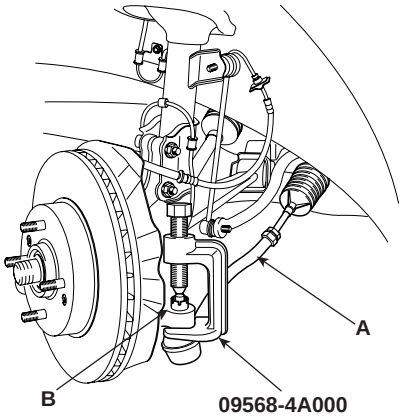
BIGE001A

5. Remove the split pin(A), the lock nut(B) and the washer(C) from the front hub(D) under applying the brake.



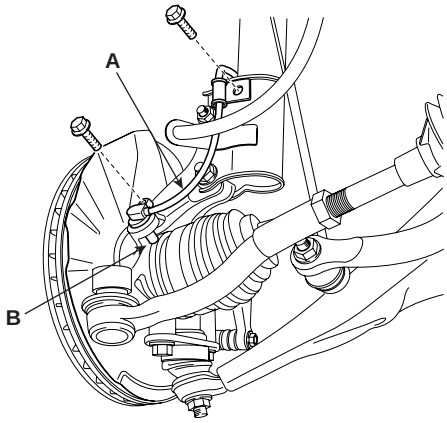
AIJF001A

6. Disconnect the tie rod end ball joint(A) from the knuckle(B) using the Special Tool (09568-4A000) after removing the split pin and lock nut.



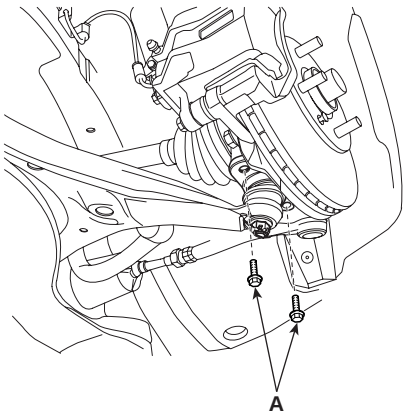
AIJF001B

7. Remove the wheel speed sensor(A) from the knuckle(B).



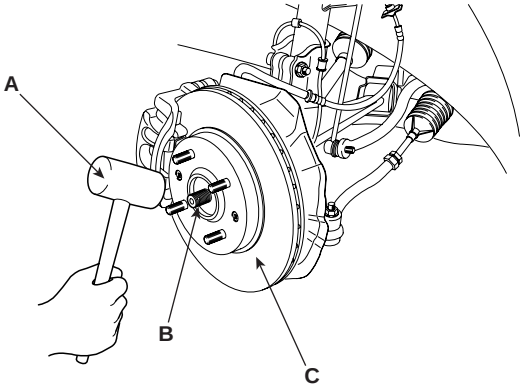
AIJF107A

8. Remove the lower arm mounting bolts(A) from the knuckle.



AHJF021A

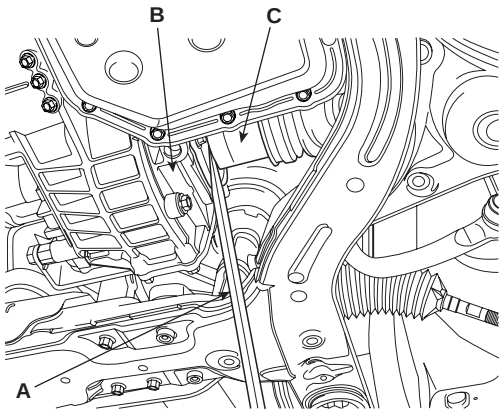
9. Using a plastic hammer(A), disconnect the drive shaft(B) from the axle hub(C).



AIJF004A

10. Push the axle hub(C) outward and separate the drive shaft(B) from the axle hub(C).

11. Insert a pry bar(A) between the transaxle case(B) and joint case(C), and separate the drive shaft from the transaxle case(B).



AIJF001C

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. [max. depth : 7mm (0.28 in.)]***
- ***Do not pull the drive shaft by excessive force it may cause components inside the BJ or TJ joint(C) kit to dislodge resulting in a torn boot(E) or a damaged bearing.***

12. Pull out the drive shaft(F) from the transaxle case(B).

CAUTION

- ***Plug the hole of the transaxle case with the oil seal cap to prevent contamination.***
- ***Support the drive shaft properly.***
- ***Replace the retainer ring whenever the drive shaft is removed from the transaxle case.***

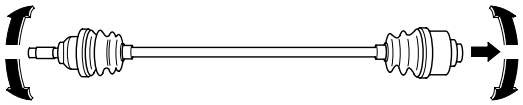
INSPECTION EE5F2CBB

1. Check the drive shaft boots for damage and deterioration.

2. Check the ball joints for wear and damage.

3. Check the splines for wear and damage.

4. Check the dynamic damper for cracks and wear.

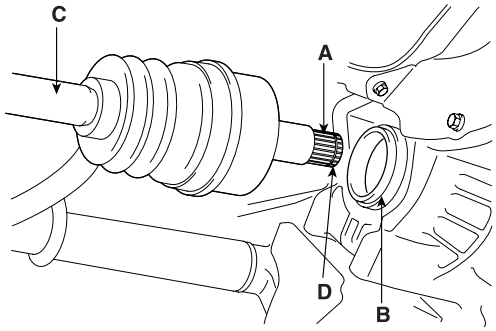


BIGE002A

INSTALLATION EAFDCB5B

1. Applygear oil on the drive shaft splines(A) and the contacting surface of differential case oil seal(B).

2. Before installing the drive shaft(C), set the opening side of the clip(D) facing downward.



BIGE003A

3. After installation, check that the drive shaft cannot be removed by hand.

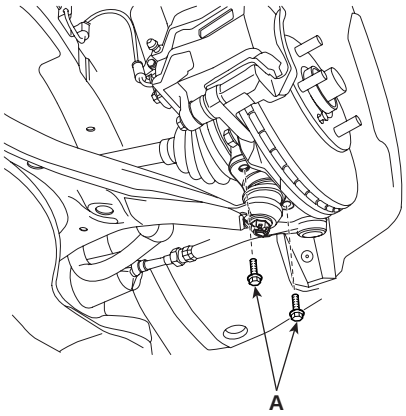
4. Install the drive shaft into the knuckle.

CAUTION

Be careful not to damage the boot.

5. Install the lower arm assembly bolts(A) to the knuckle.

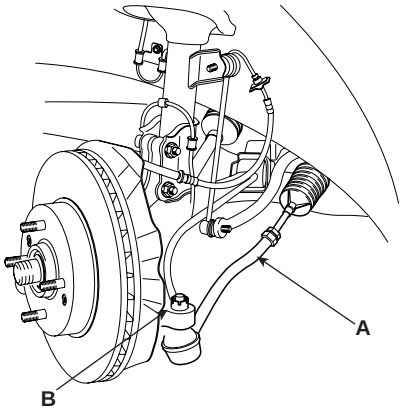
Tightening torque Nm(kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72 ~ 86)



AHJF021A

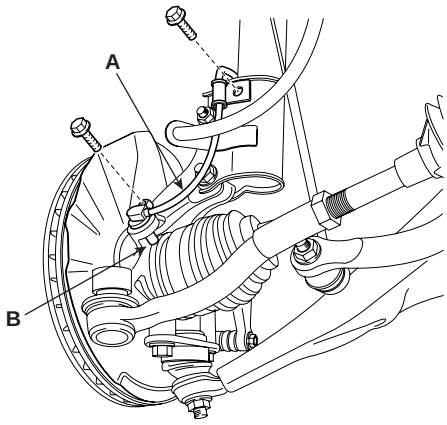
6. Install the tie rod end(A) to the knuckle(B).

Tightening torque Nm(kgf·m, lb-ft) :
16 ~ 34 (1.6 ~ 3.4, 12 ~ 25)



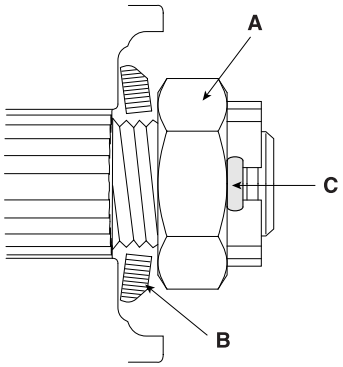
LIJF001B

7. Install the wheel speed sensor(A) to the knuckle(B).



AIJF107A

8. After installing the washer(B) with convex surface outward, install the lock nut(A) and the split pin(C).

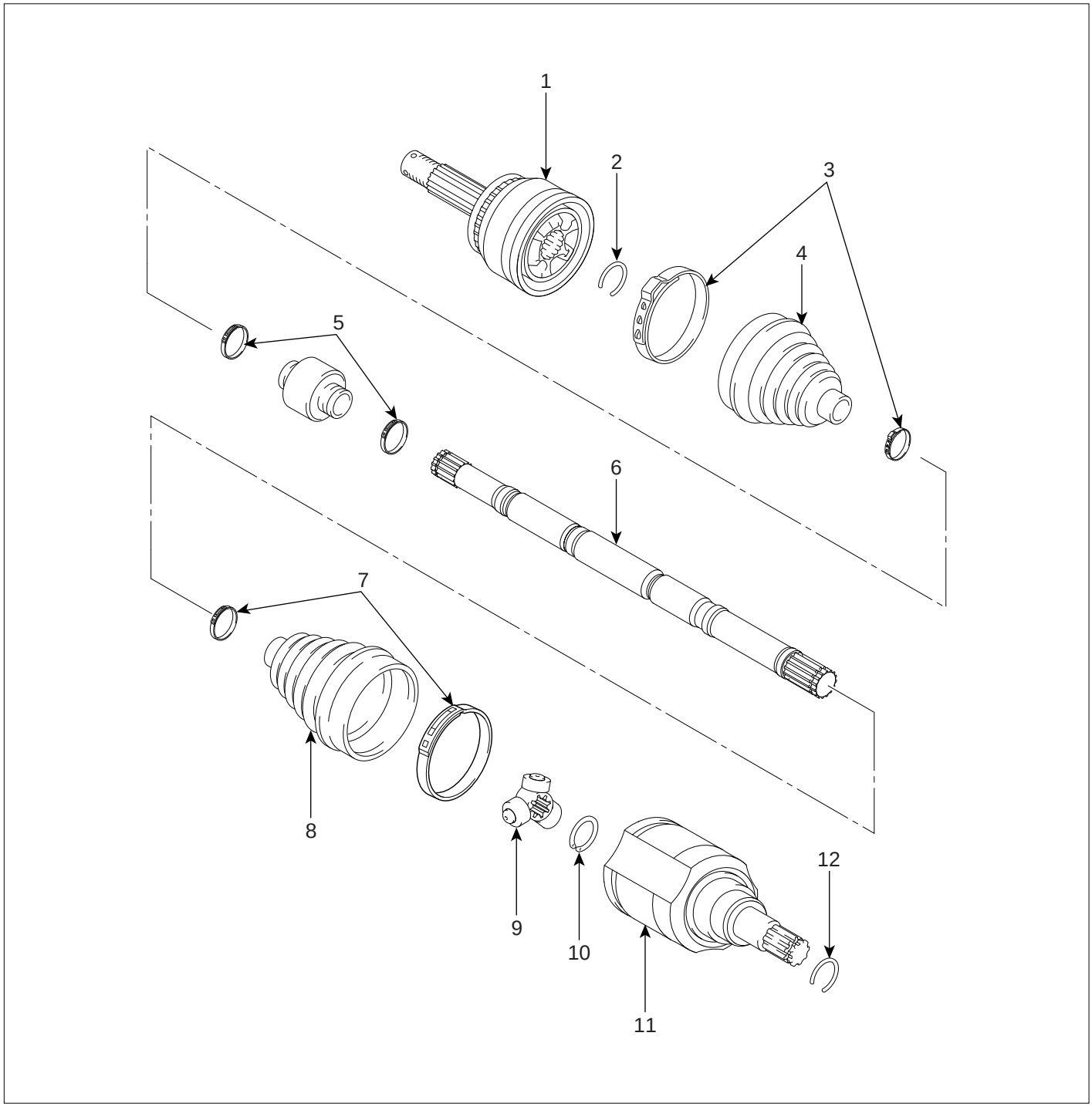


BIGE003B

9. Install the wheel and tire.

FRONT DRIVESHAFT

COMPONENTS EAF46D5E



1. BJ assembly
2. Clip
3. BJ boot bands
4. BJ boot
5. Dynamic damper bands
6. Shaft
7. UTJ boot bands
8. UTJ boot
9. Spider assembly
10. Clip
11. UTJ case
12. Clip

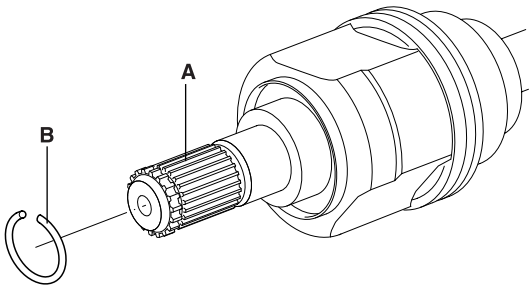
LIJF003A

DISASSEMBLY EBBB1CF2

NOTE

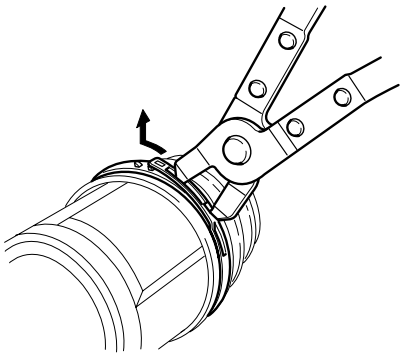
- *Do not disassemble the BJ assembly.*
- *Special grease must be applied to the drive shaft joint. Do not substitute with another type of grease.*
- *The boot band should be replaced with a new one.*

1. Remove the clip(B) from drive shaft splines(A) of the transaxle side.



KXDDE07A

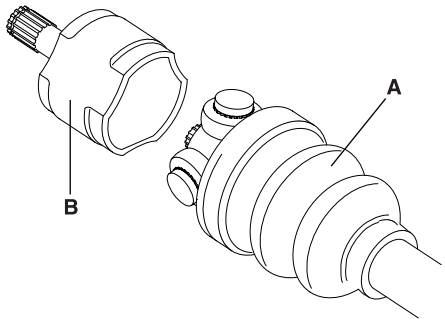
2. Remove both boot bands from the transaxle side UTJ case.



AIGE004A

3. Pull out the boot from the transaxle side joint(UTJ).

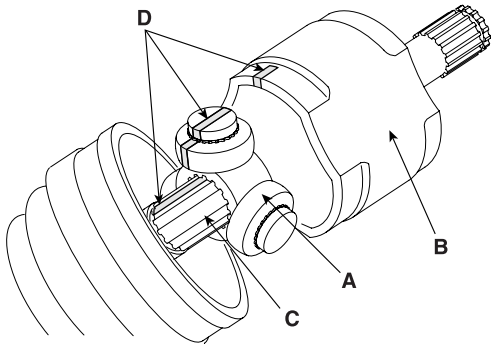
4. When separating the joint and boot(A), remove the grease from the UTJ case(B).



AIGE004B

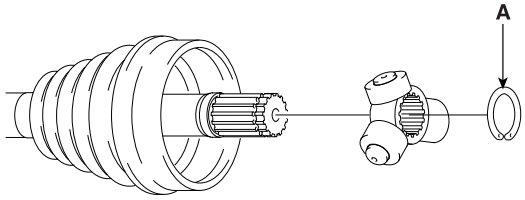
CAUTION

- ***Be careful not to damage the boot.***
- ***Make alignment marks on spider roller assembly(A), UTJ case(B), and shaft splines(C) to aid reassembly.***



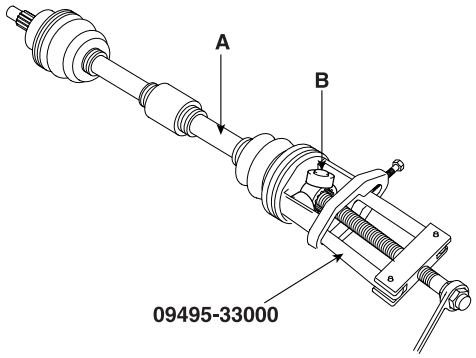
BIGE005D

5. Using a plier or flat-tipped (-) screwdriver, remove the snap ring(A).



BIGE005E

6. Remove the spider assembly(B) from drive shaft(A) by using the Special Tool(09495-33000).



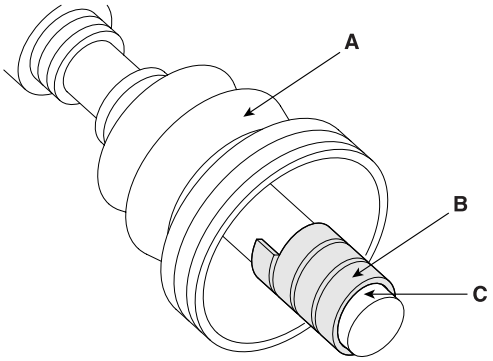
BIGE005F

7. Clean the spider assembly.

8. Remove the boot(A), of the transaxle side joint(UTJ).

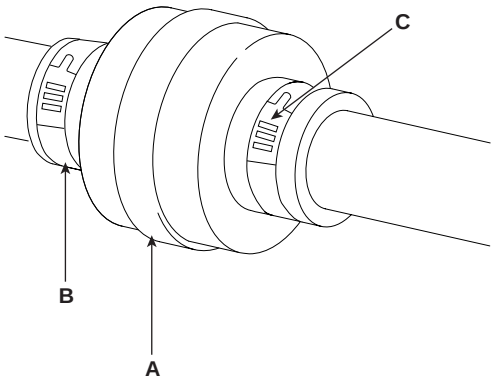
CAUTION

Wrap tape(B) around the driveshaft splines(C) to protect the boot(A).



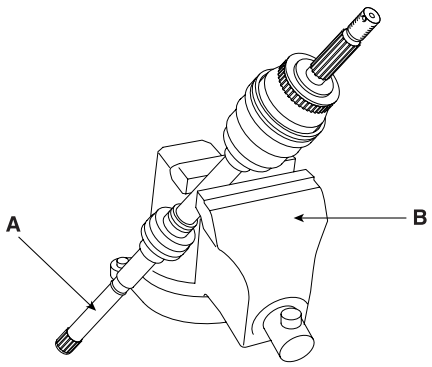
BIGE005G

9. Remove both side of bands(B,C) of the dynamic damper(A).



LIJF004C

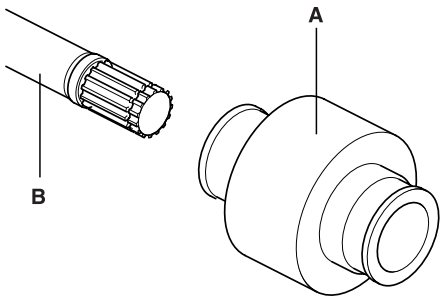
10. Fix the drive shaft(A) with a vice(B) as illustrated.



BIGE005I

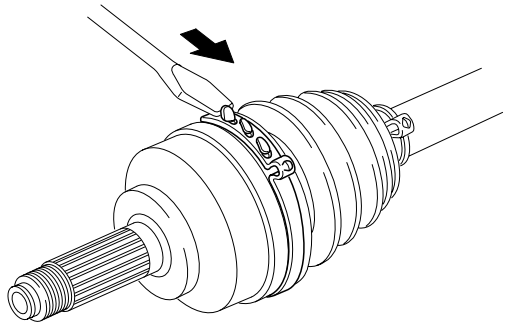
11. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.

12. Separate dynamic damper(A) from the shaft(B) carefully.



AIGE004D

13. Remove both bands on the side of wheel.



EIRF003H

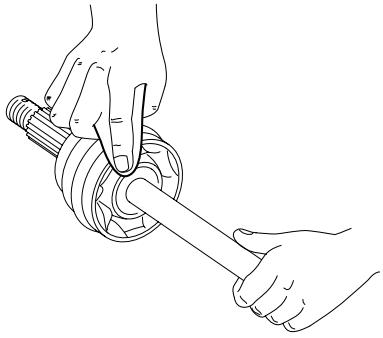
14. Pull out the joint(BJ) boot on the side of wheel into the transaxle direction.

CAUTION

Be carefull not to damage the boot.

INSPECTION E139BBAD

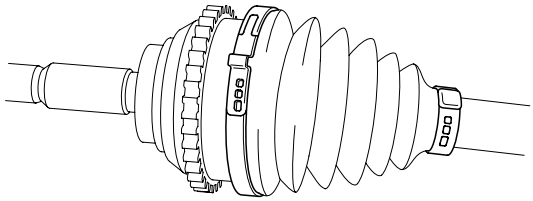
1. Check the drive shaft spline for wear or damage.
2. Check that there is no water or foreign material in the BJ.
3. Check the spider assembly for roller rotation, wear or corrosion.
4. Check the groove inside the UTJ case for wear or corrosion.
5. Check the dynamic damper for damage or cracks.



EIKD025B

REASSEMBLY E00CBBCC

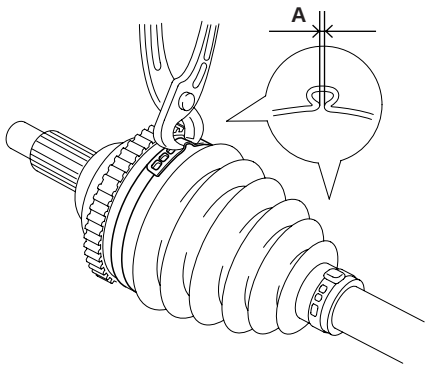
1. Wrap tape around the drive shaft splines (UTJ side) to prevent damage to the boots.
2. Apply grease to the joint(BJ) boot on the side of wheel and install the boots.
3. Install the bands to both boots.



EIRF003I

4. Using clamp, secure the boot bands.

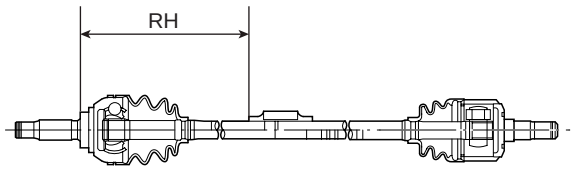
Clearance(A) : 2.0 mm (0.079 in.) or less



EIRF003J

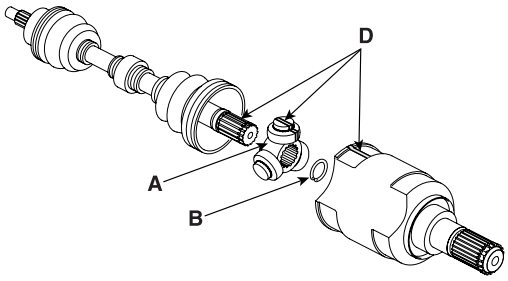
5. To install the dynamic damper, keep the BJ shaft in a straight line and secure the dynamic damper with the dynamic damper bands.

Standardvalue mm(in) : 1.4/1.6 GSL 405.0 ± 3 (15.94 ± 0.118)

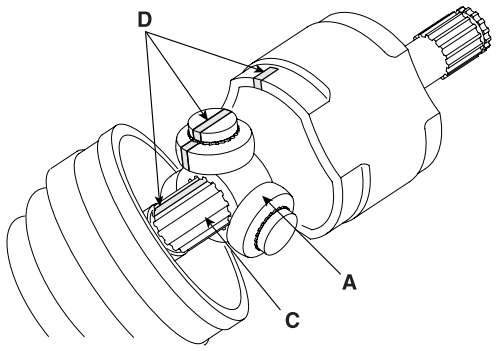


AIJF005C

6. Install the UTJ boot bands and UTJ boot.
7. 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).



BIGE007D

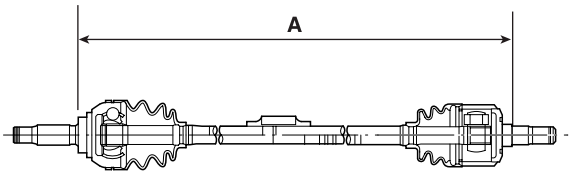


BIGE007E

8. Add the specified grease to the joint(UTJ) boot as mush as wiped away at inspection.
9. Install the boots.
10. To control the air in the UTJ boot, keep the specified distance between the boot bands when they are tightened.

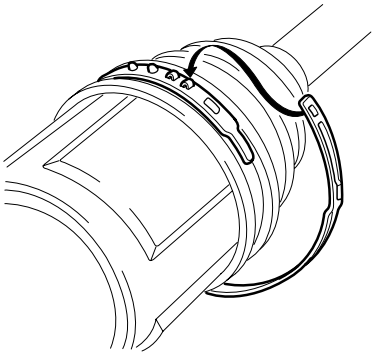
STANDARD VALUE [A]

Items	Standard(A) mm(in)	
	LH	RH
1.4/1.6 GSL	504.1 ± 2 (19.84 ± 0.078)	792.0 ± 2 (31.18 ± 0.078)

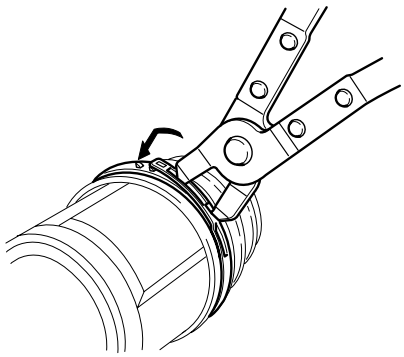


AIJF022A

11. Install both sides of the boot bands.



AIGE005D

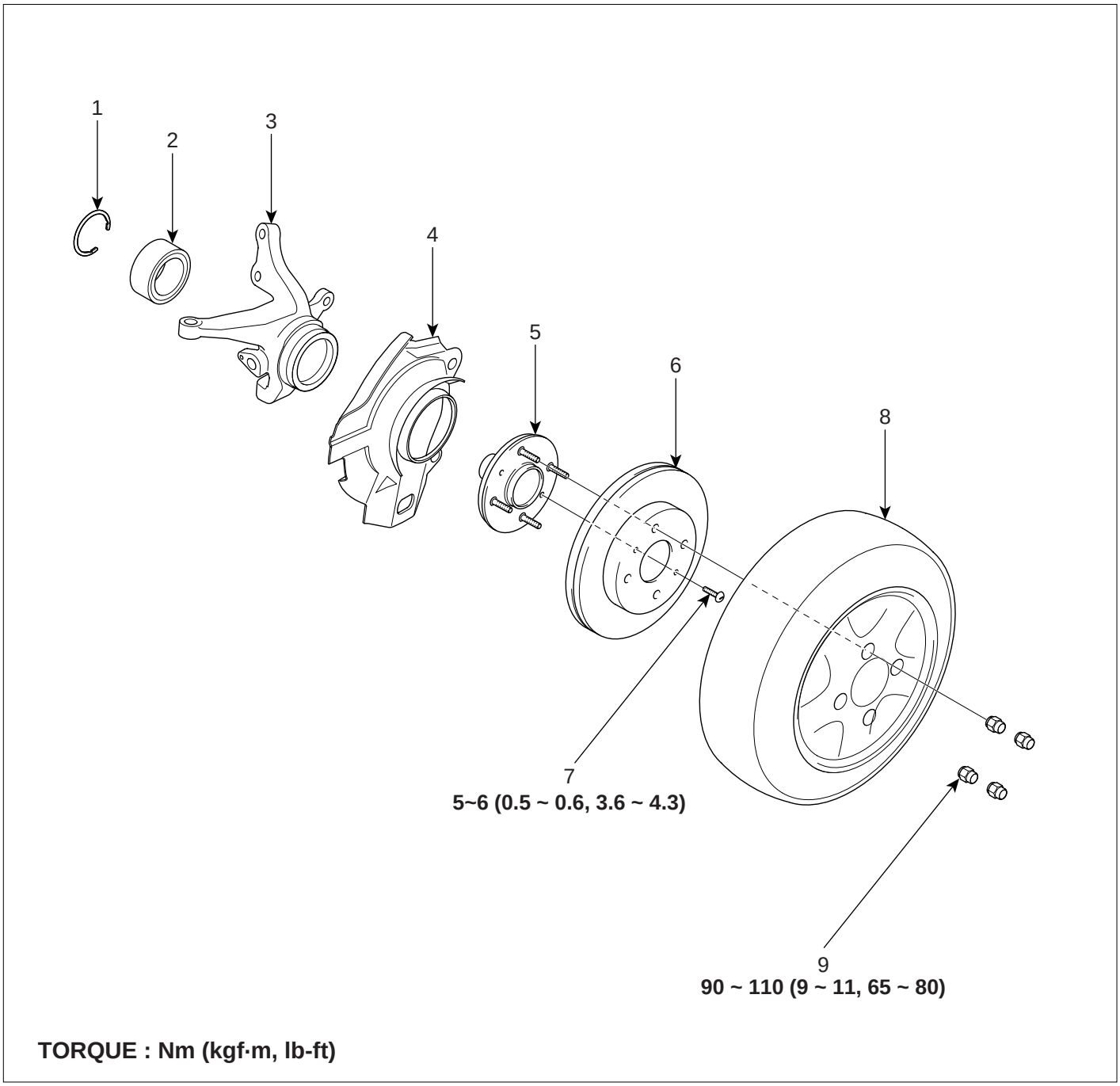


AIGE005E

FRONT AXLE

FRONT HUB / KNUCKLE

COMPONENTS E5FF58CB

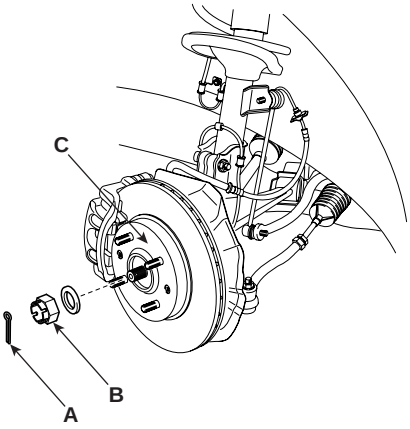


1. Snap ring
2. Front wheel hub bearing
3. Front axle assembly
4. Front brake disc dust cover
5. Front wheel hub assembly
6. Front wheel brake disc
7. Front brake disc fixing screw
8. Front wheel/tire
9. Front wheel nut

LIJF008A

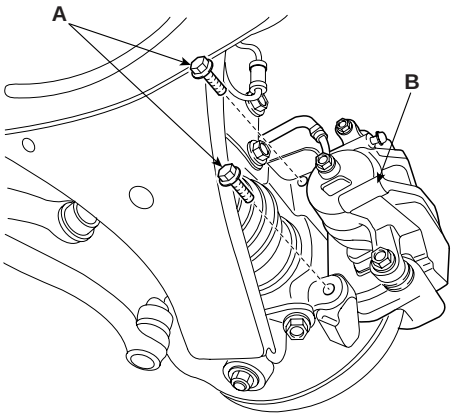
REMOVAL EAFC5834

1. Remove the front wheel and tire.
2. While applying the brakes, remove the split pin(A), then remove the locknut(B) and washer from the front hub(C).

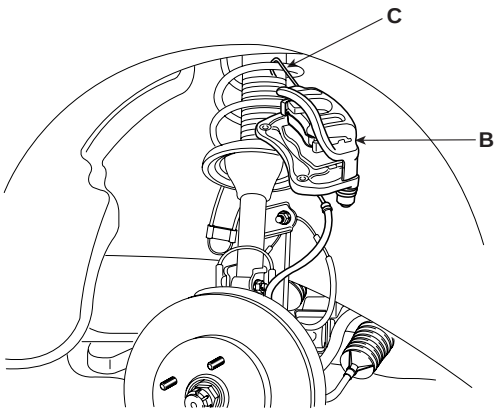


AIJF001A

3. Remove the caliper(A) from the knuckle(B) and hang the caliper(A) on the front damper(C) with wire(D).

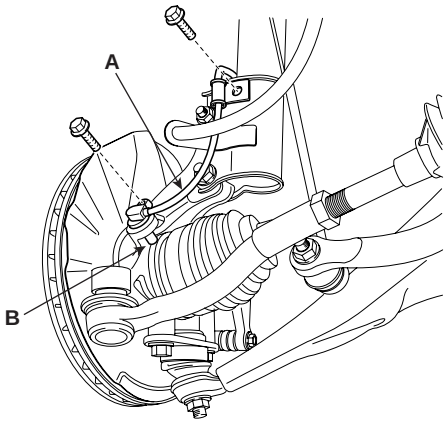


AIJF006A



AIJF006B

4. Remove the wheel speed sensor(A) from the knuckle(B).



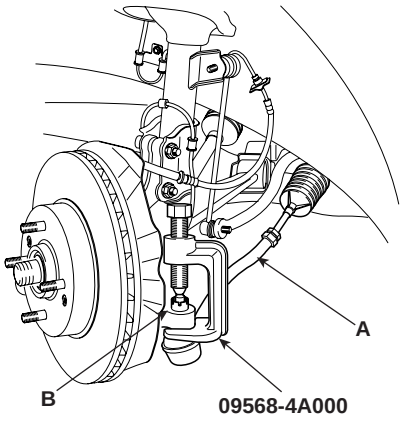
AIJF107A

5. Disconnect the tie rod end ball joint(A) from the knuckle(D) using the special tool(09568-34000).

NOTE

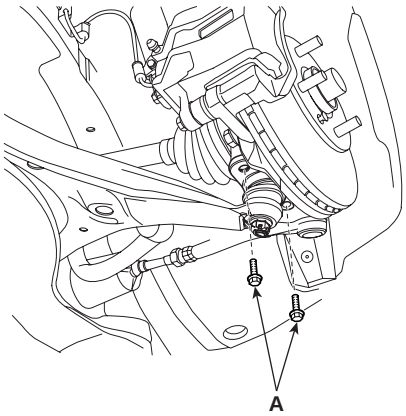
Be sure to secure the ball joint, remove tool to the vehicle so that it doesn't fall when the ball joint is removed.

a. Remove the split pin(C).
b. Remove the lock nut (D).
c. Disconnect the ball joint(A) from knuckle(B) using the special tool (09568-34000).



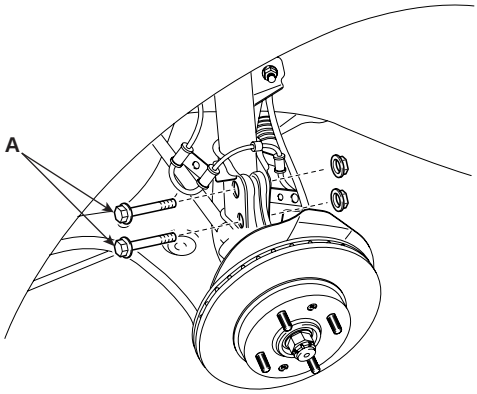
AIJF001B

6. Removet the lower arm mounting bolts(A) from the knuckle.



AHJF021A

7. Disconnect the strut assembly mountinf bolts(A) from the knuckle.



AIJF106A

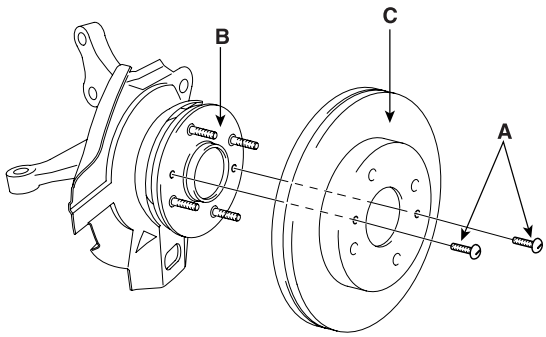
8. Remove the hub and knuckle as an assembly.

CAUTION

Be careful not to damage the boot and tone wheel.

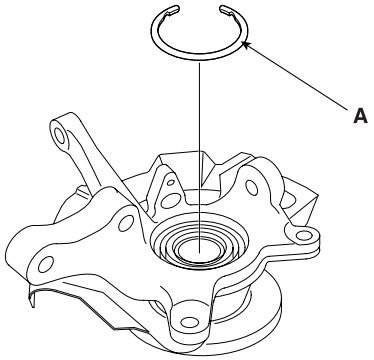
DISASSEMBLY E9FE4FCE

1. After removing the fixed screws(A) mounting the brake disc(C), remove the brake disc(C) from the hub(B).



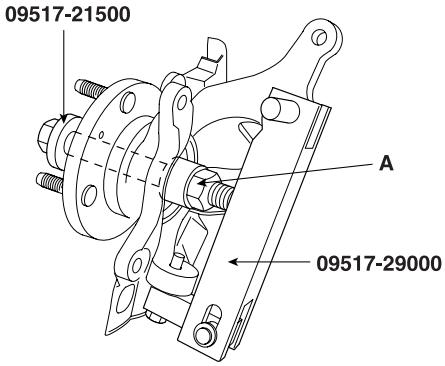
BIGE010A

2. Remove the snap ring(A).



BIGE010B

3. Install the special tools(09517-29000, 09517-21500) as shown in illustration below.

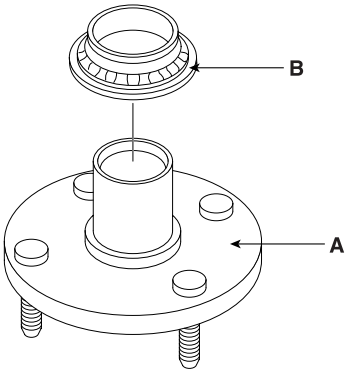


BIGE010C

4. Separate the hub from the knuckle by turning nut(A) of the special tool(09517-21500).

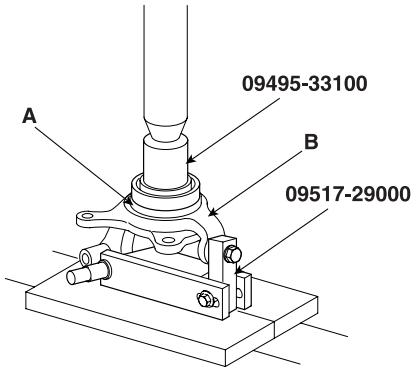
5. Using a plastic hammer, remove the dust cover from the knuckle.

6. Remove the bearing inner race(B) from the hub(A) using the special tool (09495-33000).



BIGE010D

7. Using the special tools (09495-33100, 09517-29000), remove the wheel bearing outer race(A)from the knuckle(B).



BIGE010E

INSPECTION E71FED26

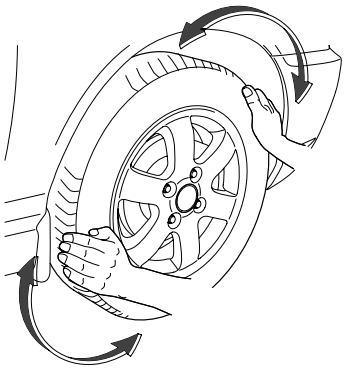
Wheel Bearing Check

1. Raise the vehicle unitl the front tires are off the floor.
   - Make sure the wheels are in a straight forward position.

   NOTE

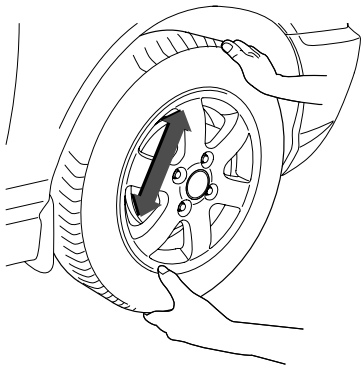
   Make sure the wheel rotates freely and that the brake pads are retraced sufficiently to allow free movement of the tire and wheel assembly.

   Spin the tire by hand to check the wheel bearings for roughness.



BIGE011A

2. Grip each front tire at the top and bottom and move the wheel inward and outward while lifting the weight of the tire off the front wheel bearings.



BIGE011B

3. If the tire and wheel (hub) is loose on the spindle, does not rotate freely, or has a rough feeling when spun, carry out one of the following.
   On vehicles with inner and outer bearings, inspect the bearings and races for wear or damage. Adjust or install new bearing and races as necessary.

4. Check the hub for cracks and the splines for wear.

5. Check the brake disc for scoring and damage.

6. Check the knuckle for cracks.

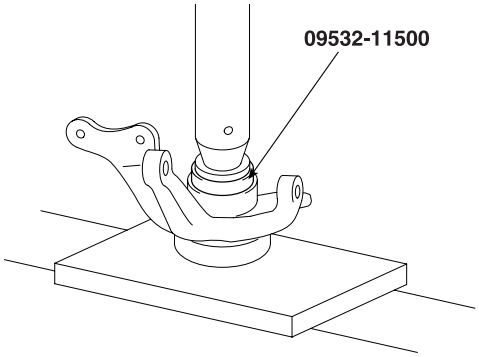
7. Check the bearing for cracks or damage.

REASSEMBLY EF771608

1. Apply multi-purpose grease to the contacting surface of the knuckle hub and bearing thinly.
2. Using the Special Tool (09532-11500), press-in the bearing to the knuckle.
   a. Install the snap ring.

NOTE

- *Press-in the outer race of the wheel bearing to prevent damage to the bearing assembly.*
- *When installing a bearing assembly, always use a new one.*
- *The right and the left bearings must be replaced as a matched set.*



BIGE012A

3. Using a plastic hammer, install the dust cover.
4. Press-in the hub to the knuckle.

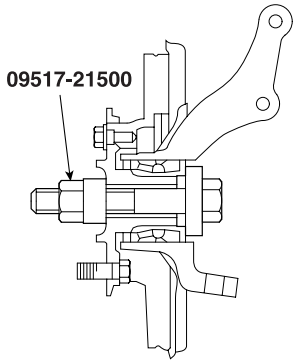
Press fit lodad : 20 ~ 25 KN (2000 ~ 25000 kgf)

NOTE

Press-in the inner race of the wheel bearing to prevent damage to the bearing assembly.

5. Tighten the hub and the knuckle to the specified torque using the Special Tool (09517-21500).

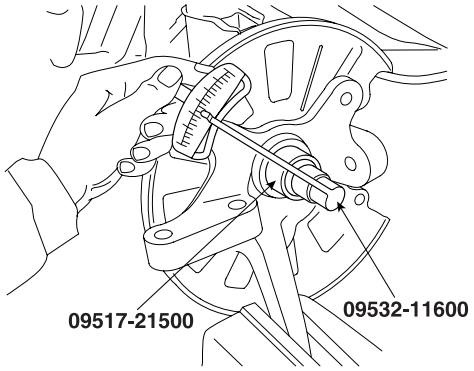
Specified torque Nm (kgf·m, lb-ft) : 200 ~ 260 (20 ~ 26, 144 ~ 188)



BIGE012B

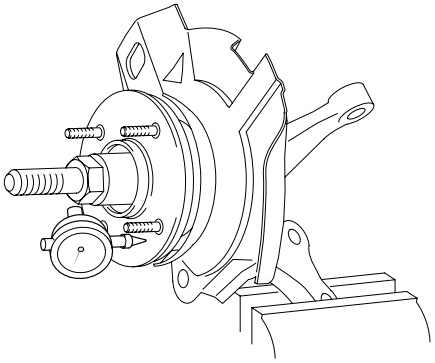
6. Measure the hub bearing starting torque.

Hub bearing starting torque [Limit] 1.3 Nm (13 kgf·m, 0.94 lb-ft) or less



BIGE012C

7. If the starting torque is 0 Nm (0 kg·cm, 0 lb·ft), measure the hub bearing axial play.



BIGE012E

8. If the hub axial play exceeds the limit while the nut is tightened to 200 ~ 260 Nm (20 ~ 26 kgf·m, 145 ~ 188 lb-ft), the bearing, hub and knuckle are not installed correctly. Repate the disassembly and assemblyprocedure.

Hub bearing axial play [Limit]
0.008 mm (0.0003 in) or less

9. Remove the Special Tool.

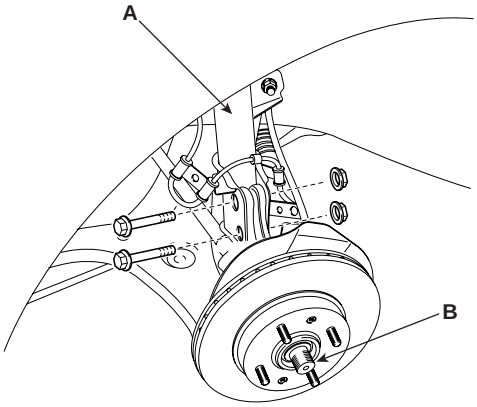
10. Fix the brake disc with the mounting screws.

INSTALLATION E6BD0FBB

1. Installation is reverse of the removal.

2. Install the strut assembly(A) and the drive shaft(B) in the knuckle.

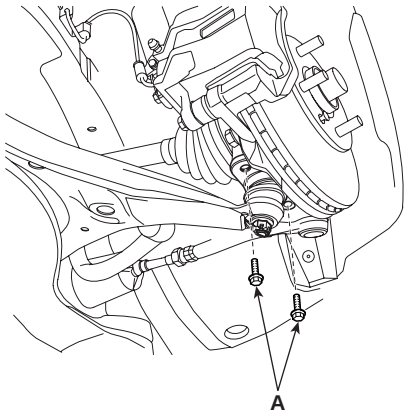
Tightening torque Nm(kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72 ~ 86)



LIJF106A

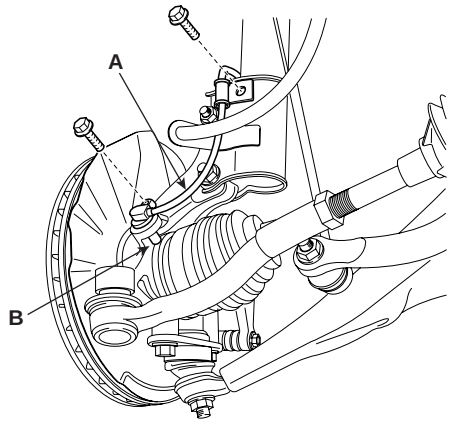
3. Install the lower arm assembly mounting bolts(A) to the knuckle.

Tightening torque Nm(kgf·m, lb-ft) :
100 ~ 120 (10 ~ 12, 72 ~ 86)



AHJF021A

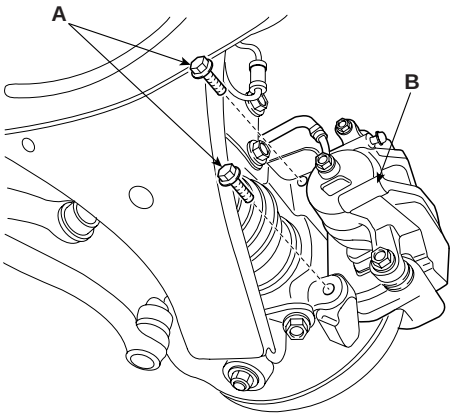
4. Install the wheel speed sensor(A) to the knuckle(B).



AIJF107A

5. Install the brake caliper assembly(A) to the knuckle(B).

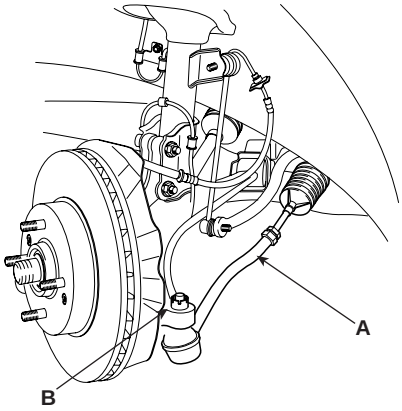
Tightening torque Nm(kgf·m, lb-ft) :
65 ~ 75 (6.5 ~ 7.5, 47 ~ 54)



AIJF006A

6. Install the tie rod end ball joint nut(A) and insert the split pin.

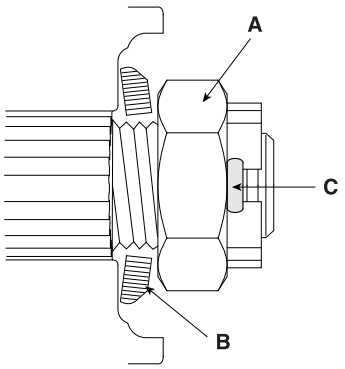
Tightening torque Nm(kgf·m, lb-ft) :
16 ~ 34 (1.6 ~ 3.4, 12 ~ 25)



LIJF001B

7. Insert the washer(B) and tighten the locking nut(A).

8. Insert the split pin(C).



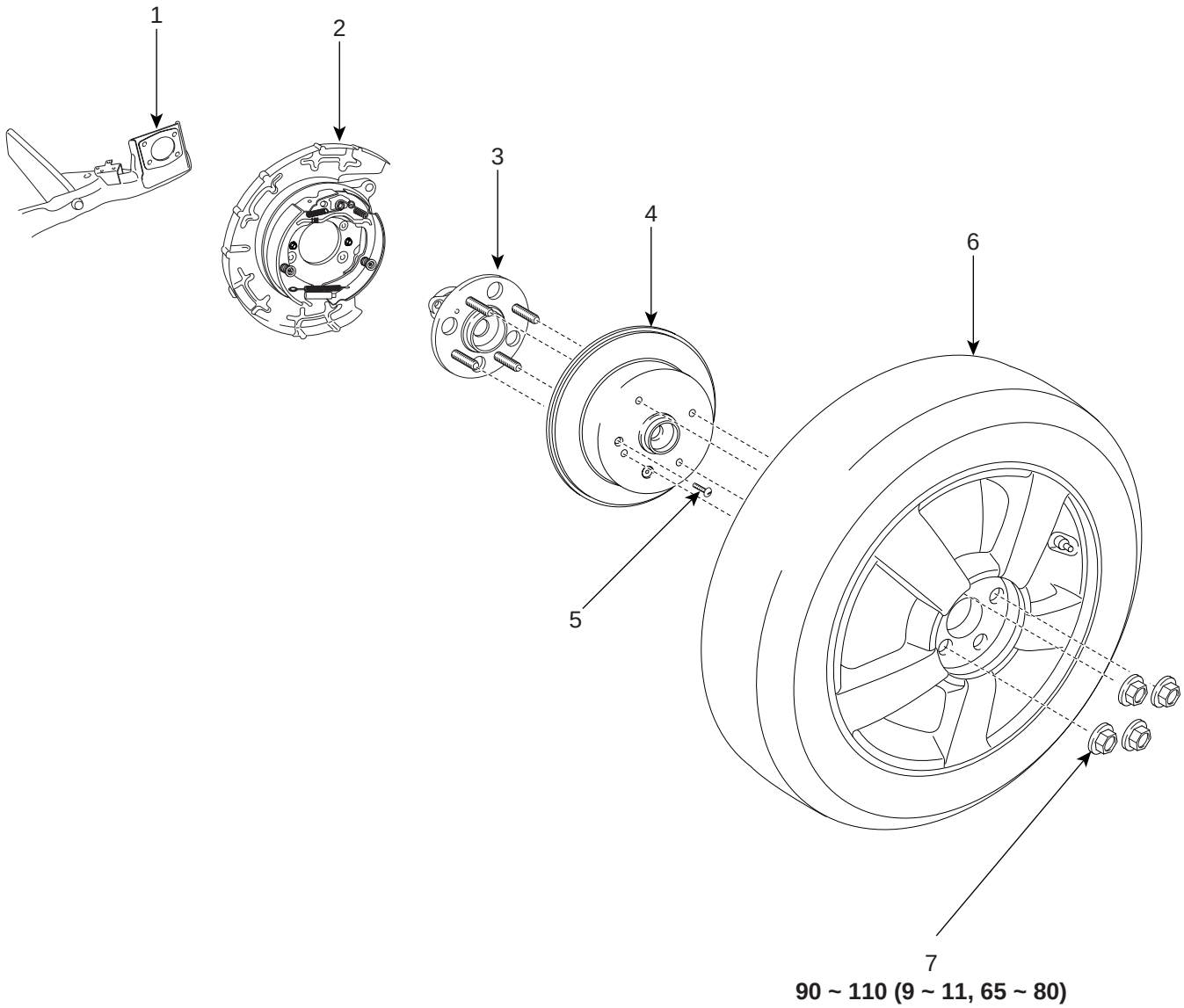
BIGE003B

9. Install the wheel and tire and tighten the wheel nuts.

REAR AXLE

REAR HUB / CARRIER

COMPONENTS EC4A810C



CAUTION
The right and the left bearing must be made in the same company.

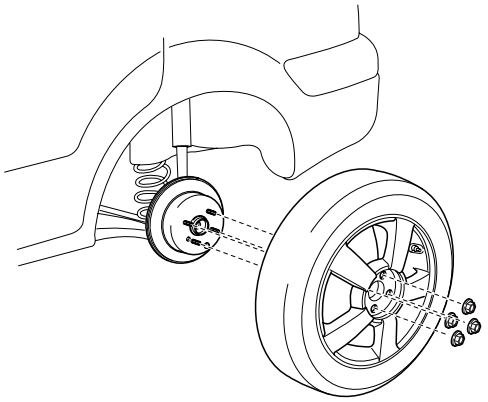
TORQUE : Nm (kgf·m, lb-ft)

1. Rear torsion beam axle assembly
2. Rear drum brake assembly
3. Rear wheel hub assembly
4. Rear brake disk
5. Rear brake disk mounting screw
6. Rear wheel/tire
7. Rear wheel nut

LIJF007A

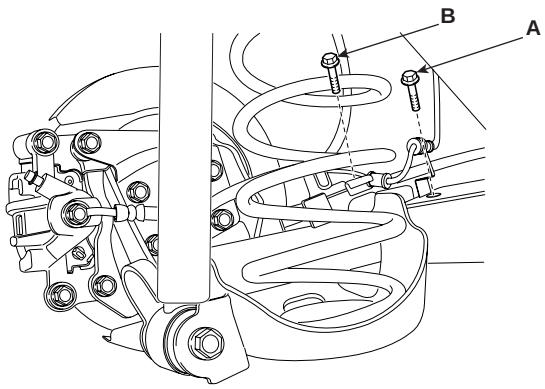
REPLACEMENT EAED1F74

1. Loosen the wheel nuts slightly.
2. Raise the rear of the vehicle and support it with safety stand in a proper location.
3. Remove the rear wheel and tire.



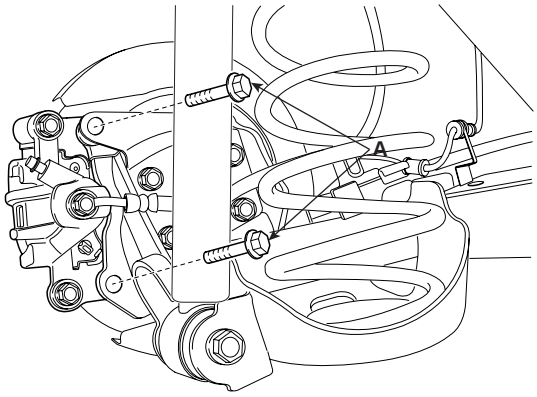
AHJF061A

4. Remove the wheel speed sensor wire bracket bolt(A) and the parking brake wire bracket bolt(B).



AHJF041A

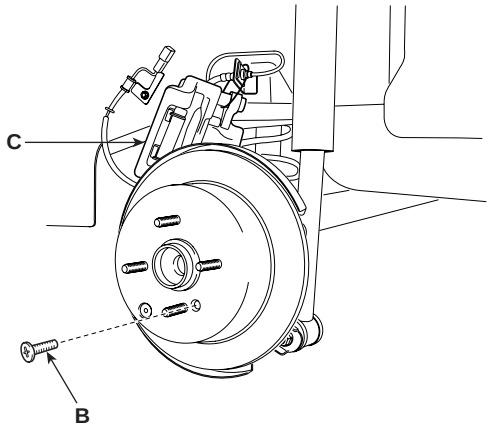
5. Remove the brake caliper assembly bolt(A) and the brake disk mounting screw(B).



AHJF041J

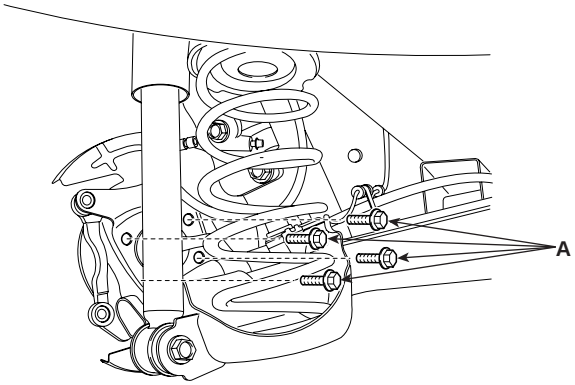
NOTE

Hang the brake caliper assembly(C) tightly on a proper place with wire.



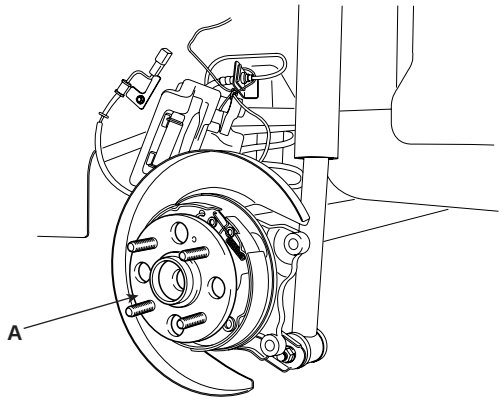
LIJF041B

6. Remove the rear hub bearing assembly bolts(A).



AHJF041C

7. Remove the rear hub bearing assembly(A).



AHJF041D

8. The installation is reverse of the removal.

Tightening torque Nm (kgf·m,lb-ft) :
Hub bearing assembly ; 50 ~ 60 (5 ~ 6, 36 ~ 43)

Suspension System

GENERAL

FRONT SUSPENSION SYSTEM
- FRONT STRUT ASSEMBLY
- FRONT LOWER ARM
- FRONT STABILIZER BAR

REAR SUSPENSION SYSTEM
- REAR TORSION AXLE BEAM
- SHOCK ABSORBER
- REAR COIL SPRING

TIRES / WHEELS
- WHEEL
- TIRE

GENERAL

SPCIFICATIONS E91D51BC

FRONT SUSPENSION SYSTEM

Items			Specifications
Type			Macpherson strut type
Shock absorber	Type		Gas
	Stroke mm(in)		162.5 (6.39)
	Expansion mm(in)		497 ± 3 (19.56 ± 0.11)
	Compression mm(in)		335 + 3, -free (13.18 + 0.11, -free)
	Damping force (0.3m/s)	Expansion N(kfg)	52 ± 9
		Compression N(kfg)	22 ± 5
Spring	1.4 GSL MT	Free height mm(in)	316.5 (12.4)
		Compression N(kgf)	ORANGE - WHITE
	1.4 GSL AT 1.6 GSL MT	Free height mm(in)	322.5 (12.7)
		Compression N(kgf)	ORANGE - YELLOW
	1.6 GSL AT	Free height mm(in)	357.5 (14)
		Compression N(kgf)	GREEN - GREEN

REAR SUSPENSION SYSTEM

Items			Specifications
Type			Torsion beam axle
Shock absorber	Type		Gas
	Stroke mm(in)		213 (8.38)
	Expansion mm(in)		606 ± 3 (23.85 ± 0.11)
	Compression mm(in)		393 + 3, -free (15.47 + 0.11, -free)
	Damping force (0.3m/s)	Expansion N(kfg)	44 ± 8
		Compression N(kfg)	18 ± 5
Spring	Free height mm(in)		320.0 (12.6)
	Compression N(kgf)		RED - RED

WHEELS AND TIRES

Items		Specifications
Tire size		P195/55 R15
		P185/65 R14
		P175/70 R14
Wheel size	Steel	5.5J X 14 offset = 46
		5J X 14 offset = 39
	Aluminium	5.5J X 15 offset = 46
		5.5J X 14 offset = 46
	PCD (mm)	100
Tire pressure kPa(kg/㎠, PSI)	Gasoline	206 (2.1, 30)

WHEEL ALIGNMENT

Items		Front	Rear
Camber		0° ± 30′	-1° ± 30′
Caster	to ground	4° 00′ ± 30′	-
	to body	4° 30′	-
Toe-in mm(in)		-2 ~ 2 (-0.078 ~ 0.078)	2 ~ 6 (0.078 ~ 0.236)
King pin angle		13° ± 30′	-
Tread mm(in)	185, 195 Tire	1470 (57.87)	1460 (57.48)
	175 Tire	1484 (58.42)	1474 (58.03)

TIGHTENING TORQUE E13CC4B8

Items	Nm	Kgf·m	lb-ft
Wheel nut	90 ~ 110	9 ~ 11	65 ~ 79
Driveshaft nut	200 ~ 260	20 ~ 26	144 ~ 188
Front strut upper mounting nut	20 ~ 30	2 ~ 3	14.4 ~ 21.6
Front strut lower mounting nut	100 ~ 120	10 ~ 12	72 ~ 86
Front strut mounting self-locking nut	50 ~ 70	5 ~ 7	36 ~ 50
Subframe mounting bolt	95 ~ 120	9.5 ~ 12	68 ~ 86
Wheel speed sensor mouning bolt	13 ~ 17	1.3 ~ 1.7	9.4 ~ 12
Front lower arm ball joint mounting bolt	100 ~ 120	10 ~ 12	72 ~ 86
Front lower arm bush(A) mounting bolt	100 ~ 120	10 ~ 12	72 ~ 86
Front lower arm bush(G) mounting bolt	100 ~ 140	10 ~ 14	72 ~ 101
Engine mounting bolt	50 ~ 65	5 ~ 6.5	36 ~ 47
Stabilizer bracket mounting bolt	45 ~ 55	4.5 ~ 5.5	32 ~ 39
Tie rod end ball joint self-locking nut	16 ~ 34	1.6 ~ 3.4	11 ~ 24
Tie rod toe adjustment nut	16 ~ 34	1.6 ~ 3.4	11 ~ 24
Stabilizer bar link mounting nut	35 ~ 45	3.5 ~ 4.5	25 ~ 32
Rear shock absorber upper mounting nut	40 ~ 60	4 ~ 6	28 ~ 43
Rear shock absorber lower mounting nut	100 ~ 120	10 ~ 12	72 ~ 86
Rear torsion alxe beam mounting bolt	100 ~ 120	10 ~ 12	72 ~ 86
Rear shock absorber self-locking nut	22 ~ 32	2.2 ~ 3.2	15 ~ 23
Rear brake caliper to knuckle bolt	65 ~ 75	6.5 ~ 7.5	47 ~ 54
Rear hub unit bearing	50 ~ 60	5 ~ 6	36 ~ 43
Brake hose mounting bolt	9 ~ 14	0.9 ~ 1.4	6 ~ 10
Wheel speed sensor wire mounting bolt	7 ~ 11	0.7 ~ 1.1	5 ~ 7

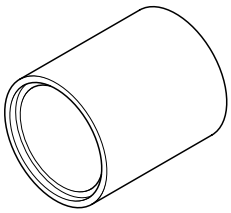
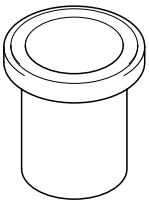
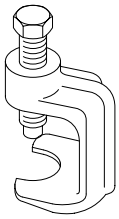
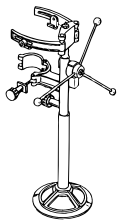
CAUTION

Replace the self-locking nuts with new ones after removal.

LUBRICANTS

Item	The recommended	Quantity
Lower arm ball joint	Ball : CGMS01 (CMS-H006)	0.5g ~ 1g
	Dust cober : CGMS03 (CMS-H006)	4g ~ 5g
Strut insulator bearing	GLE	3.9g ± 1g
Stabilizer bar link ball joint	Ball : LUBCHEM	0.2g ~ 1.7g
	Dust cover : LUBCHEM	1.2g ~ 1.7g

SPECIAL TOOLS EF8D6C9A

Tool(Number and Name)	Illustration	Use
09216-21100 Mount bushing remover and installer	 AHIE001A	Removal & installation of lower arm bushing(G)
09214-32000 Mount bushing remover and installer	 AHIE001B	Removal & installation of lower arm bushing(G)
09568-4A000 Ball joint remover	 KPRE103I	Removal of the front lower arm and tie rod end ball joint
09546-26000 Strut spring compressor	 AHIE001D	Compression of the coil spring

TROUBLESHOOTING EED4CEFE

VEHICLE INSPECTION

To assist the service advisor and the technician, check the suspension and wheel/tire condition with the questions listed below by filling them. It serves as a place to record information as well as data from the test to be carried out. To begin a successful diagnosis, fill out the questions.

WHEEL/TIRE/CHECK :

Balance Check **Yes / No**

Maximum Runout Allowed :

Wheel : Radial _____ Lateral _____

Tire : Radial _____ Lateral _____

Measured Runout :

Tire/Wheel Radial : LF _____ LR _____ RF _____ RR _____

Lateral : LF _____ LR _____ RF _____ RR _____

Wheel Only Radial : LF _____ LR _____ RF _____ RR _____

Lateral : LF _____ LR _____ RF _____ RR _____

SUSPENSION INSPECTION :

Can Cause Shimmy ☐ Clunk ☐ Squeak ☐ Harshness ☐

Suspension Bushing : Loose ☐ Worn ☐ Missing ☐ OK ☐

Front stabilizer ☐ Rear stabilizer (sway bar) ☐ Rear trailing arm ☐

Front lower arm ☐ Rear suspension front ☐ Rear suspension rear arm ☐

Other _____

Suspension/Components : Loose Worm Missing OK

Ball Joint ☐ Shock absorbers F/R ☐ Springs F/R ☐ The rod ends/sleeve ☐

EHKE002A

SYMPTOM CHART

Symptom	Suspect Area	Remedy (See page)
Squeak or grunt-noise from the front suspension, occurs more in cold ambient temperatures-more noticeable over rough roads or when turning	Front stabilizer bar	Under these conditions, the noise is acceptable.
Clunk-noise from the front suspension, occurs in and out of turns	Loose front struts or shocks	Inspect for loose nuts or bolts. Tighten to specifications. See page SS-25.
Clunk-noise from the rear suspension, occurs when shifting from reverse to drive	Loose rear suspension components	Inspect for loose or damaged rear suspension components. Repair or install new components as necessary. See page SS-42.

Symptom	Suspect Area	Remedy (See page)
Click or pop-noise from the front suspension-more noticeable over rough roads or over bumps	Worn or damaged ball joints	Install new lower arm as necessary. See page SS-33.
Click or pop-noise occurs when vehicle is turning	Worn or damaged ball joints	Install new lower arm as necessary. See page SS-33.
Click or snap-occurs when accelerating around a corner	Damaged or worn Birfield joint	Repair or install a new Birfied joint as necessary. See DS group - driveshaft.
Front suspension noise-a squeak, creak or rattle noise-occurs mostly over bumps or rough roads	Steering components Loose or bent front struts or shock absorbers Damaged spring or spring mounts Damaged or worn arm bushings Worn or damaged stabilizer bar bushing or links	Go to detailed test A. See page SS-10.
Groaning or grinding-noise from the front strut, occurs when driving on bumpy roads or turning the vehicle	Uneven seating surface between the insulator and panel by the burrs around the strut insulator mounting bolts and the insulator boltes mounting holes	Repair or install a new parts as necessary. See page SS-29.
Rear suspension noise - a squeak, creak or rattle noise - occurs mostly over bumps or rough roads	Loose or bent rear shock absorbers Damaged spring or spring mounts Damaged or worn control arm bushings	Go to detailed test B. See page SS-11.
Shudder-occurs during acceleration from a slow speed or stop	Rear axle assembly mispositioned Damaged or worn front suspension components	Check the axle mounts and Rear suspension the rear suspension for damage or wear. Repair as necessary. Check for a loose stabilizer bar, damaged or loose strut/strut bushings or loose or worn ball joints. Inspect the steering linkage for wear or damage. Repair or Install new components as necessary.
Shimmy-most noticeable on coast/deceleration-also hard steering condition	Excessive positive caster	Check the caster alignment angle. Correct as necessary. See page SS-51.
Tire noise-hum/moan at constant speeds	Abnormal wear patterns	Spin the tire and Check for tire wear. Install a new tire as necessary. Inspect for damaged/worn suspension components. Carry out wheel alignment. See page SS-50, SS-51.
Tire noise-noise tone lowers as the vehicle speed is lowered	Out-of-balance tire	Balance the tire and road test. Install a new tire as necessary. See page SS-51.
Tire noise - ticking noise, change with speed	Nail puncture or stone in tire tread	Inspect the tire. Repair as necessary. See page SS-51.

Symptom	Suspect Area	Remedy (See page)
Wheel and tire-vibration and noise concern is directly related to vehicle speed and is not affected by acceleration, coasting or decelerating	Damaged or worn tire	Go to detailed test C. See page SS-12.
Tire wobble or shudder - occurs at lower speeds	Damaged wheel bearings	Spin the tire and check for abnormal wheel bearing play or roughness. Adjust or Install new wheel bearings as necessary. See DS group - front/rear axle.
	Damaged wheel	Inspect the wheel for damage. Install a new wheel as necessary. See page SS-53.
	Damaged or worn suspension components	Inspect the suspension components for wear or damage. Repair as necessary. See page SS-46.
	Loose wheel nuts	Check the wheel nuts. Tighten to specification. See page SS-53.
	Damaged or uneven tire wear	Spin the tire and Check for abnormal tire wear or damage. Install a new tire as necessary. See page SS-51.
Tire shimmy or shake - occurs at lower speeds	Wheel/tire out of balance	See page SS-50.
	Uneven tire wear	Check for abnormal tire wear. Install a new tire as necessary. See page SS-51.
	Excessive radial runout of wheel or tire	Carry out a radial runout test of the wheel and tire. Install a new tire as necessary. See page SS-53.
	Worn or damaged wheel studs or elongate stud holes	Inspect the wheel studs and wheels. Install new components as necessary. See page SS-53.
	Excessive lateral runout of the wheel or tire	Carry out a lateral runout test of the wheel and tire. Check the wheel, tire and hub. Repair or Install new components as necessary. See page SS-53.
	Foreign materal between the brake disc and hub.	Clean the mounting surfaces of the brake disc and hub. See DS group - front/rear axle.
High speed shake or shimmy-occurs at high speeds	Excessive wheel hub runout Damaged or worn tires Damaged or worn wheel bearings Worn or damaged suspension or steering linkage Brake disc or drum imbalance	Go to detailed test D. See page SS-15.

Symptom	Suspect Area	Remedy (See page)
Drift left or right	Tires Steering linkage Alignment Base brake system	Go to detailed test E. See page SS-17.
Steering wheel	Alignment Steering linkage Front lower arm ball joint	Go to detailed test F. See page SS-18.
Tracks incorrectly	Rear suspension Caster	Go to detailed test G. See page SS-19.
Rough ride	Front strut and spring assembly Rear shock absor and spring assembly	Go to detailed test H. See page SS-20.
Excessive noise	Front or rear stabilizer bar components Springs Suspension components Shock absorbers	Go to detailed test I. See page SS-20.
Incorrect tire wear	Tire or unbalanced wheels Tire inflation Strut Alignment	Go to detailed test J. See page SS-21.
Vibration	Wheel/tire Front wheel drivshaft(s) Steering system Strut and spring assembly Spring and strut mounting Front lower arm ball joint Front lower arm mounting bolt bushing Stabilizer bar bushings Wheel hubs and bearing Rear suspension arms and bushings	Go to detailed test K. See page SS-22.
Vehicle leans	Tire/wheel Vehicle load Suspension components Incorrect ride height	Inflate tires to specification. See page SS-51. Redistribute the load as necessary Visually inspect the suspention system Correct the ride height as necessary
Poor returnability	High knuckle rotating torque Alignment	Go to detailed test E. See page SS-17.

DETAILED TEST A : FRONT SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 ROAD TEST THE VEHICLE	
	1. Test drive the vehicle. 2. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? ⇒ **YES** Go to **A2**. ⇒ **NO** The suspension system is OK. Conduct a diagnosis on other suspect systems.
A2 INSPECT THE STEERING SYSTEM	
	1. Check the steering system for wear or damage. Carry out a steering linkage test. 2. Inspect the tire wear pattern. See page SS-24. ● Are the steering components worn or damaged ? ⇒ **YES** Repair the steering system. Install new components as necessary. Test the system for normal operation ⇒ **NO** Go to **A3**.
A3 FRONT SHOCK ABSORBER/STRUT CHECK	
	1. Check the front shock absorbers/strut mounts for loose bolts or nuts. 2. Check the front shock absorbers/struts for damage. Carry out a shock absorber check. ● Are the front shock absorbers/struts loose or damaged ? ⇒ **YES** Tighten to specifications if loose. Install new front shock absorbers/struts if damaged. Test the system for normal operation. ⇒ **NO** Go to **A4.**
A4 CHECK THE FRONT SPRINGS	
	Check the front spring and front spring mounts/brackets for wear or damage ● Are the front springs or spring mounts/brackets worn or damaged ? ⇒ **YES** Repair or Install new components as necessary. Test the system for normal operation. ⇒ **NO** Go to **A5.**

CONDITIONS	DETAILS/RESULTS/ACTIONS
A5 CHECK THE STABILIZER BAR	
	1. Check the stabilizer bar bushing and links for damage or wear. 2. Check the stabilizer bar for damage. 3. Check for loose or damaged stabilizer brackets. ● Are the stabilizer bar/track bar components loose, worn or damaged ? ⇒ **YES** Repair or Install new components as necessary. Test the system for normal operation. ⇒ **NO** Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST B : REAR SUSPENSION NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 ROAD TEST THE VEHICLE	
	1. Test drive the vehicle. 2. During the road test, drive the vehicle over a rough road. Determine from which area/component the noise is originating. ● Is there a squeak, creak or rattle noise ? ⇒ **YES** Go to **B2.** ⇒ **NO** The suspension system is OK. Conduct a diagnosis on other suspect systems.
B2 REAR SHOCK ABSORBER/STRUT CHECK	
	1. Raise and support the vehicle. See GI group - lift support point. 2. Check the rear shock absorber/strut mounts for loose bolts or nuts. 3. Check the rear shock absorbers/strut for damage. Carry out a shock absorber check. ● Are the rear shock absorbers/struts loose or damaged ? ⇒ **YES** Tighten to specifications if loose. Install new rear shock absorbers/struts if damaged. Test the system for normal operation. ⇒ **NO** Go to **B3.**

CONDITIONS	DETAILS/RESULTS/ACTIONS
B3 CHECK THE REAR SPRINGS	
	Check the rear springs and rear spring mounts/brackets for wear or damage. ● Are the rear springs or spring mounts/brackets worn or damaged ? ⇒ **YES** Repair or Install new components as necessary. Test the system for normal operation. ⇒ **NO** Go to **B4.**
B4 CHECK THE TRAILING ARMS	
	1. Inspect the trailing arm bushings for wear or damage. Check for loose trailing arm bolts. 2. Inspect for twisted or bent trailing arms. ● Are the trailing arms loose, damaged or worn ? ⇒ **YES** Repair or Install new components as necessary. Test the system for normal operation. ⇒ **NO** Suspension system is OK. Conduct diagnosis on other suspect systems.

DETAILED TEST C : WHEEL AND TIRE

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 ROAD TEST THE VEHICLE	
	NOTE *Wheel or tire vibrations felt in the steering wheel are most likely related to the front wheel or tire. Vibration felt through the seat are most likely related to the rear wheel or tire. This may not always be true, but it can help to isolate the problem to the front or rear of the vehicle.* *Test drive the vehicle at different speed ranges.* During the road test, if the vibration can be eliminated by placing the vehicle in neutral or is affected by the speed of the engine, the cause is not the wheels or tires. ● Is there a vibration and noise ? ⇒ **YES** Go to **C2.** ⇒ **NO** The wheel and tires are OK. Conduct a diagnosis on other suspect systems.

CONDITIONS	DETAILS/RESULTS/ACTIONS
C2 CHECK THE FRONT WHEEL BEARINGS	
	Check the front wheel bearings. Refer to Wheel Bearing Check (See DS group - front axle). ● Are the wheel bearing OK ? ⇒ **YES** Go to **C3.** ⇒ **NO** Inspect the wheel bearings. Adjust or Repair as necessary. Test the system for normal operation.
C3 INSPECT THE TIRES	
	1. Check the tires for missing weights. 2. Check the wheels for damage. 3. Inspect the tire wear pattern. See page SS-24. ● Do the tires have an abnormal wear pattern ? ⇒ **YES** Correct the condition that caused the abnormal wear. Install new tire(s). Test the system for normal operation. ⇒ **NO** Go to **C4.**
C4 TIRE ROTATION DIAGNOSIS	
	1. Spin the tires slowly and watch for signs of lateral runout. 2. Spin the tires slowly and watch for signs of radial runout.. ● Are there signs of visual runout ? ⇒ **YES** Go to **C5.** ⇒ **NO** Check the wheel and tire balance. Correct as necessary. Test the system for normal operation.
C5 RADIAL RUNOUT CHECK ON THE TIRE	
	Measure the radial runout of the wheel and tire assembly. A typical specification for total radial runout is 1.15mm (0.059 inch). ● Is the radial runout within specifications ? ⇒ **YES** Go to **C8.** ⇒ **NO** Go to **C6.**

CONDITIONS	DETAILS/RESULTS/ACTIONS
C6 RADIAL RUNOUT CHECK ON THE WHEEL	
	Measure the radial runout of the wheel. A typical specification for total radial runout is 1.14mm (0.045 inch.). ● Is the radial runout within specifications ? ⇒ **YES** Install a new tire. Test the system for normal operation. ⇒ **NO** Go to **C7.**
C7 CHECK THE HUB/BRAKE DISC OR DRUM PILOT RUNOUT OR BOLT CIRCLE RUNOUT	
	Measure the pilot or bolt circle runout. A typical specification for radial runout is : ● pilot runout - less than 0.15mm (0.006 inch.) ● bolt circle runout - less than 0.38 mm (0.015 inch.) ● Is the radial runout within specification ? ⇒ **YES** Install a new wheel. Test the system for normal operation. ⇒ **NO** Repair or Install new components as necessary. See page SS-28 for the front suspension or SS-42 for the rear suspension.
C8 LATERAL RUNOUT CHECK ON THE TIRE	
	Measure the lateral runout of the wheel and tire assembly. A typical specification for total lateral runout is 2.5mm (0.098 inch). ● Is the lateral runout within specifications ? ⇒ **YES** Wheel and tires are OK. Conduct diagnosis on other suspect systems. ⇒ **NO** Go to **C9.**
C9 LATERAL RUNOUT CHECK ON THE WHEEL	
	Measure the lateral runout of the wheel. A typical specification for total radial runout is 1.2mm (0.047 inch.) ● Is the lateral runout within specifications ? ⇒ **YES** Install a new tire. Test the system for normal operation. ⇒ **NO** Go to **C10.**

CONDITIONS	DETAILS/RESULTS/ACTIONS
C10 CHECK THE FLANGE FACE LATERAL RUNOUT	
	Measure the flange face lateral runout. A typical specification for lateral runout is : ● hub/brake disc - less than 0.13mm (0.005 inch) ● Is the lateral runout within specifications ? ⇒ **YES** Install a new wheel. Test the system for normal operation. ⇒ **NO** Repair or Install new components as necessary. See page SS-27 for the front suspension or SS-42 for the rear suspension.

DETAILED TEST D : HIGH SPEED SHAKE OR SHIMMY

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK FOR FRONT WHEEL BEARING ROUGHNESS	
	1. Raise and support the front end of the vehicle so that the front wheel and tire assemblies can spin. See GI group - lift support point. 2. Spin the front tires by hand. ● Do the wheel bearings feel rough ? ⇒ **YES** Inspect the wheel bearings. Repair as necessary. Test the system for normal operation. ⇒ **NO** Go to **D2.**
D2 CHECK THE END PLAY OF THE FRONT WHEEL BEARINGS	
	Check the end play of the front wheel bearings. ● Is the end play OK ? ⇒ **YES** Go to **D3.** ⇒ **NO** Adjust or Repair as necessary. Test the system for normal operation.

CONDITIONS	DETAILS/RESULTS/ACTIONS
D3 MEASURE THE LATERAL RUNOUT AND THE RADIAL RUNOUT OF THE FRONT WHEELS ON THE VEHICLE	
	Measure the lateral runout and the radial runout of the front wheels on the vehicle. Go to detailed test C. ● Are the measurements within specifications ? ⇒ **YES** Go to **D4.** ⇒ **NO** Install new wheels as necessary and Balance the assembly. Test the system for normal operation.
D4 MEASURE THE LATERAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	Measure the lateral runout of the front tires on the vehicle. Go to detailed test C. ● Is the runout within specifications ? ⇒ **YES** Go to **D5.** ⇒ **NO** Install new tires as necessary and Balance the assembly. Test the system for normal operation.
D5 MEASURE THE RADIAL RUNOUT OF THE FRONT TIRES ON THE VEHICLE	
	Measure the radial runout of the front tires on the vehicle. Go to detailed test C. ● Is the runout within specifications ? ⇒ **YES** Balance the front wheel and tire assemblies. If any tire cannot be balanced, Install a new tire. Test the system for normal operation. ⇒ **NO** Go to **D6.**
D6 MATCH MOUNT THE TIRE AND WHEEL ASSEMBLY	
	Mark the high runout location on the tire and also on the wheel. Break the assembly down and rotate the tire 180 degrees (halfway around) on the wheel. Inflate the tire and measure the radial runout. ● Is the runout within specifications ? ⇒ **YES** Balance the assembly. Test the system for normal operation. ⇒ **NO** If the high spot is not within 101.6mm (4 inches) of the first high spot on the tire, Go to **D7**

CONDITIONS	DETAILS/RESULTS/ACTIONS
D7 MEASURE THE WHEEL FLANGE RUNOUT	
	Dismount the tire and mount the wheel on a wheel balancer. Measure the runout on both wheel flanges. Go to detailed test C ● Is the runout within specifications ? ⇒ **YES** Locate and Mark the low spot on the wheel. Install the tire, matching the high spot on the tire with the low spot on the wheel. Balance the assembly. Test the system for normal operation. If the condition persists, Go to **D8**. ⇒ **NO** Install a new wheel. Check the runout on the new wheel. If the new wheel is within limits, locate and Mark the low spot. Install the tire, matching the high spot on the tire with the low spot on the wheel. Balance the assembly. Test the system for normal operation. If the condition persists, Go to **D8**.
D8 CHECK FOR VIBRATION FROM THE FRONT OF THE VEHICLE	
	Spin the front wheel and tire assemblies with a wheel balancer while the vehicle is raised on a hoist. Feel for vibration in the front fender or while seated in the vehicle. ● Is the vibration persent ? ⇒ **YES** Substitute known good wheel and tire assemblies as necessary. Test the system for normal operation. ⇒ **NO** Check the driveline components. Test the system for normal operation.

DETAILED TEST E : DRIFT LEFT OR RIGHT

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK THE TIRES	
	Inspect the tires for excessive wear or damage. ● Are the tires excessively worn or damaged ? ⇒ **YES** Install new tires. ⇒ **NO** Go to **E2.**

CONDITIONS	DETAILS/RESULTS/ACTIONS
E2 CHECK THE STEERING LINKAGE	
	1. Raise and support the vehicle. 2. Check the steering components for indications of excessive wear or damage. See ST group - specification. ● Is there an indication of excessive wear or damage ? ⇒ **YES** Repair or Install new components as necessary. ⇒ **NO** Go to **E3.**
E3 CHECK THE VEHICLE ALIGNMENT	
	1. Place the vehicle on an alignment rack. Check the vehicle alignment. ● Is the alignment within specification ? ⇒ **YES** Go to **E4.** ⇒ **NO** Adjust the alignment as necessary. See page SS-50 (wheel alignment).
E4 BRAKE DRAG DIAGNOSIS	
	Apply the brakes while driving. ● Does drift or pull occur when the brakes are applied ? ⇒ **YES** See BR group - specification. ⇒ **NO** If the steering wheel is in the center, the vehicle is OK. If the steering wheel is off-center, Go to Detailed Test **F**.

DETAILED TEST F : STEERING WHEEL OFF-CENTER

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK THE CLEAR VISION	
	Place the vehicle on an alignment rack. ● Is the clear vision within specification ? ⇒ **YES** Go to **F2**. ⇒ **NO** Adjust the clear vision to specification.

CONDITIONS	DETAILS/RESULTS/ACTIONS
F2 INSPECT THE STEERING COMPONENTS	
	1. Raise and support the vehicle. 2. Inspect the steering components for excessive wear or damage. See ST group - specification. ● Are the steering components excessively worn or damaged ? ⇒ **YES** Repair or Install new components as necessary. ⇒ **NO** If it tracks corectly, vehicle is OK. If it tracks incorrectly, Go to Detailed Test **G**.

DETAILED TEST G : TRACKS INCORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 CHECK THE CASTER	
	Place the vehicle on an alignment rack. ● Are the caster within specification ? ⇒ **YES** Go to **G2.** ⇒ **NO** Replace bent or damaged parts.
G2 CHECK THE REAR SUSPENSION	
	1. Measure the vehicle wheel base for LH and RH. 2. Compare the measurements. ● Are the measurements the same ? ⇒ **YES** If the ride is smooth, vehicle is OK. If the ride is rough, Go to Detailed Test **H**. ⇒ **NO** Inspect the rear suspension components for wear or damage. Repair or Install new components as necessary. See page SS-42 (rear suspension).

DETAILED TEST H : ROUGH RIDE

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 CHECK THE FRONT SHOCK ABSORBER	
	1. Raise support the vehicle. 2. Inspect the front shock absorber for oil leaks or damage. ● Are the tires excessively worn or damaged ? ⇒ **YES** Install new front shock absorbers. See page SS-29 (front strut assembly). ⇒ **NO** Go to **H2**.
H2 CHECK THE REAR SHOCK ABSORBERS	
	Inspect the rear shock absorbers for oil leaks or damage. ● Are the rear shock absorbers leaking ? ⇒ **YES** Install new rear shock absorbers. See page SS-43 (rear strut assembly). ⇒ **NO** The vehicle is OK. Go to **TROUBLESHOOTING**.

DETAILED TEST I : EXCESSIVE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
I1 INSPECT THE SUSPENSION	
	1. Raise and support the vehicle. 2. Inspect the shock absorber mounting bolts. ● Are the mounting bolts loose or broken ? ⇒ **YES** Tighten or Install new shock absorber mounting bolts. See page SS-29 and SS-46 (front/rear suspension). ⇒ **NO** Go to **I2.**
I2 INSPECT THE SPRING AND TORSION BARS	
	Inspect the springs and stabilizer bars for damage. ● Are the spring or stabilizer bars damaged ? ⇒ **YES** Install new spring and/or stabilizer bars. See page SS-36 (front stabilizer bars). ⇒ **NO** Go to **I3**.

CONDITIONS	DETAILS/RESULTS/ACTIONS
I3 INSPECT THE FRONT SUSPENSION	
	Inspect the front suspension components for excessive wear or damage. ● Are the front suspension components worn or damaged ? ⇒ **YES** Install new front suspension components. See page SS-25 (front suspension). ⇒ **NO** The vehicle is OK. Go to **TROUBLESHOOTING**.

DETAILED TEST J : INCORRECT TIRE WEAR

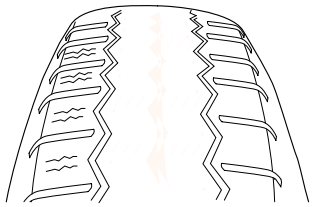
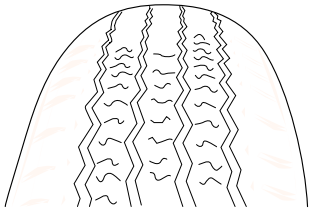
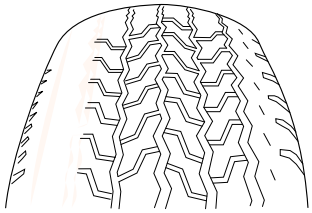
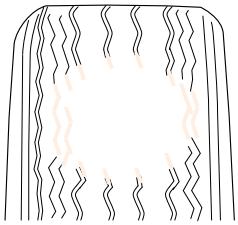
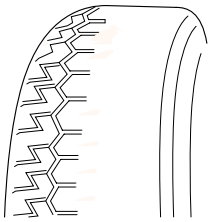
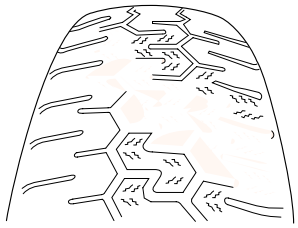
CONDITIONS	DETAILS/RESULTS/ACTIONS
J1 INSPECT THE TIRES	
	1. Raise and support the vehicle. 2. Inspect the tires for uneven wear on the inner or outer shoulder. ● Is there uneven tire wear ? ⇒ **YES** Align the vehicle. Install new tires if badly worn. ⇒ **NO** Go to **J2.**
J2 UNEVEN TIRE WEAR	
	Inspect the tires for a feathering pattern. ● Do the tires have a feahering pattern ? ⇒ **YES** Align the vehicle. Install new tires if badly worn. ⇒ **NO** Go to **J3**.
J3 CHECK FOR CUPPED TIRE	
	Inspect the tires for cupping or dishing. ● Are the tires cupped or dished ? ⇒ **YES** Balance and Rotate the tires. ⇒ **NO** The vehicle is OK. Go to **TROUBLESHOOTING**.

DETAILED TEST K : VIBRATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
K1 ROAD TEST	
	Accelerate the vehicle to the speed at which the customer indicated the vibration occured. ● Is the vibration present ? ⇒ **YES** Go to **K2**. ⇒ **NO** The vehicle is OK. Go to **TROUBLESHOOTING.**
K2 INSPECT THE TIRES	
	1. Raise and support the vehicle with a frame contact hoist. 2. Inspect the tires for extreme wear or damage, cupping, or flat spots. ● Are the tires OK ? ⇒ **YES** Go to **K3**. ⇒ **NO** Check the suspension components for misalignment, abnormal wear, or damage that may have contributed to the tire wear. Correct the suspension concerns and Install new tires.
K3 INSPECT THE WHEEL BEARINGS	
	Spin the tires by hand to check for wheel bearing rougness. ● Is the front wheel bearing OK ? ⇒ **YES** Go to **K4**. ⇒ **NO** Install new front wheel bearings as necessary. See DS group - front axle.
K4 TIRE/WHEEL BALANCE	
	Check the tire/wheel balance. ● Are the tires balanced ? ⇒ **YES** Go to **K5.** ⇒ **NO** Balance the tires and wheels as necessary.

CONDITIONS	DETAILS/RESULTS/ACTIONS
K5 MEASURE THE RUNOUTS	
	For each wheel position measure, locate and mark the following items. See page SS-53 (wheel/tire). - High point of the tire/wheel assembly total radial runout - High point of the wheel radial runout - High point of the wheel lateral runout ● Are the runouts as specified ? ⇒ **YES** Go to **K7.** ⇒ **NO** Go to **K6.**
K6 SUBSTITUTE THE WHEELS AND TIRE	
	1. Substitute a known good set of wheels and tires. 2. Carry out a road test. 3. If the vehicle still exhibits a shake or vibration, note the vehicle speed and/or engine rpm which it occurs. ● Is the vibration felt ? ⇒ **YES** Engine/transmission imbalance. See the specification of TR group, EM group, FL group and EC group. ⇒ **NO** Install the original tire/wheel assemblies one by one, Road testing at each step until the damaged tire(s)/wheel(s) as necessary. Test the system for normal operation.

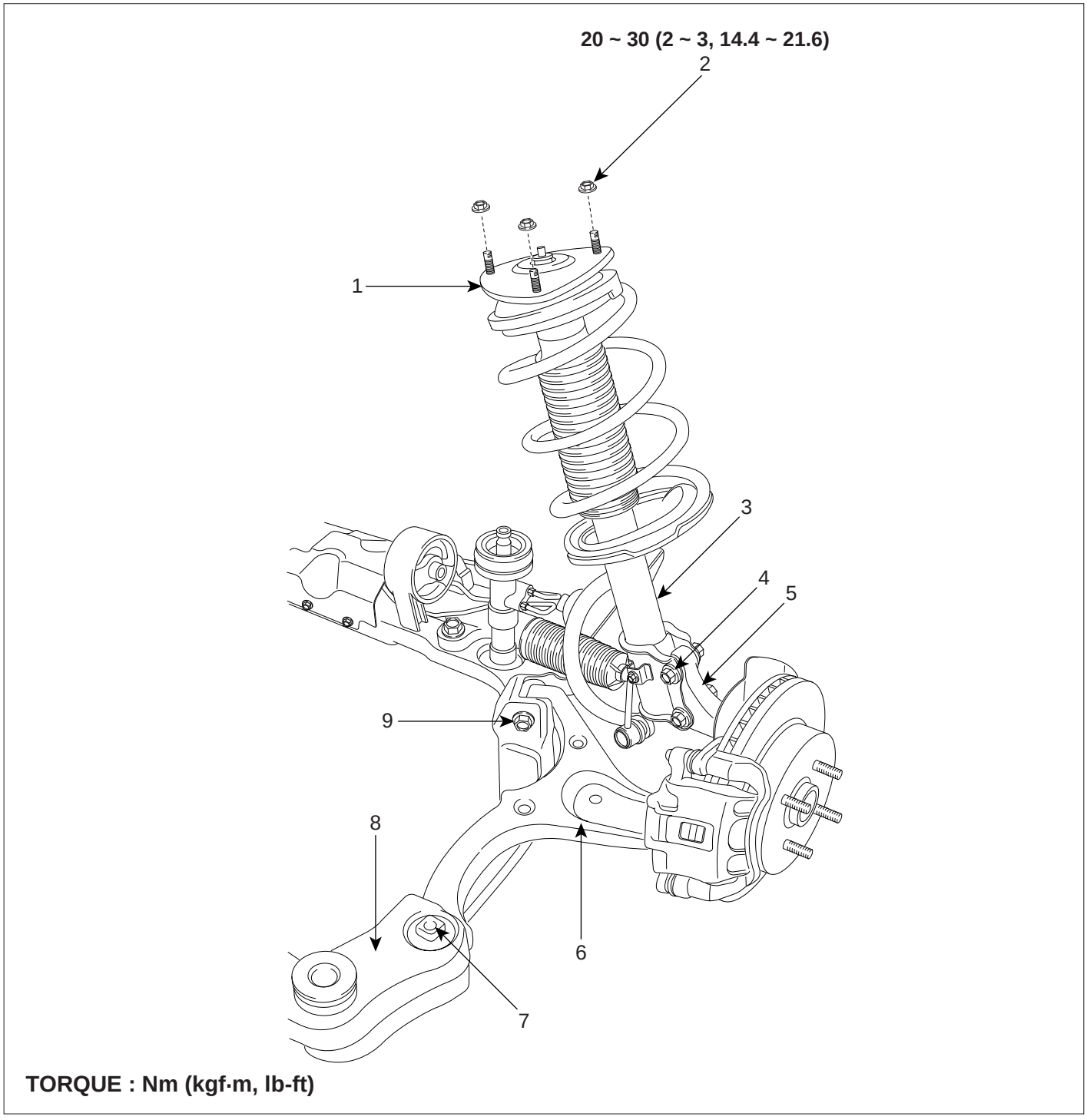
Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated 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. Carry out 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
 AHIE002A	 AHIE002B	 AHIE002C
• 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
 AHIE002D	 AHIE002F	 AHIE002G
• 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

FRONT SUSPENSION SYSTEM

FRONT STRUT ASSEMBLY

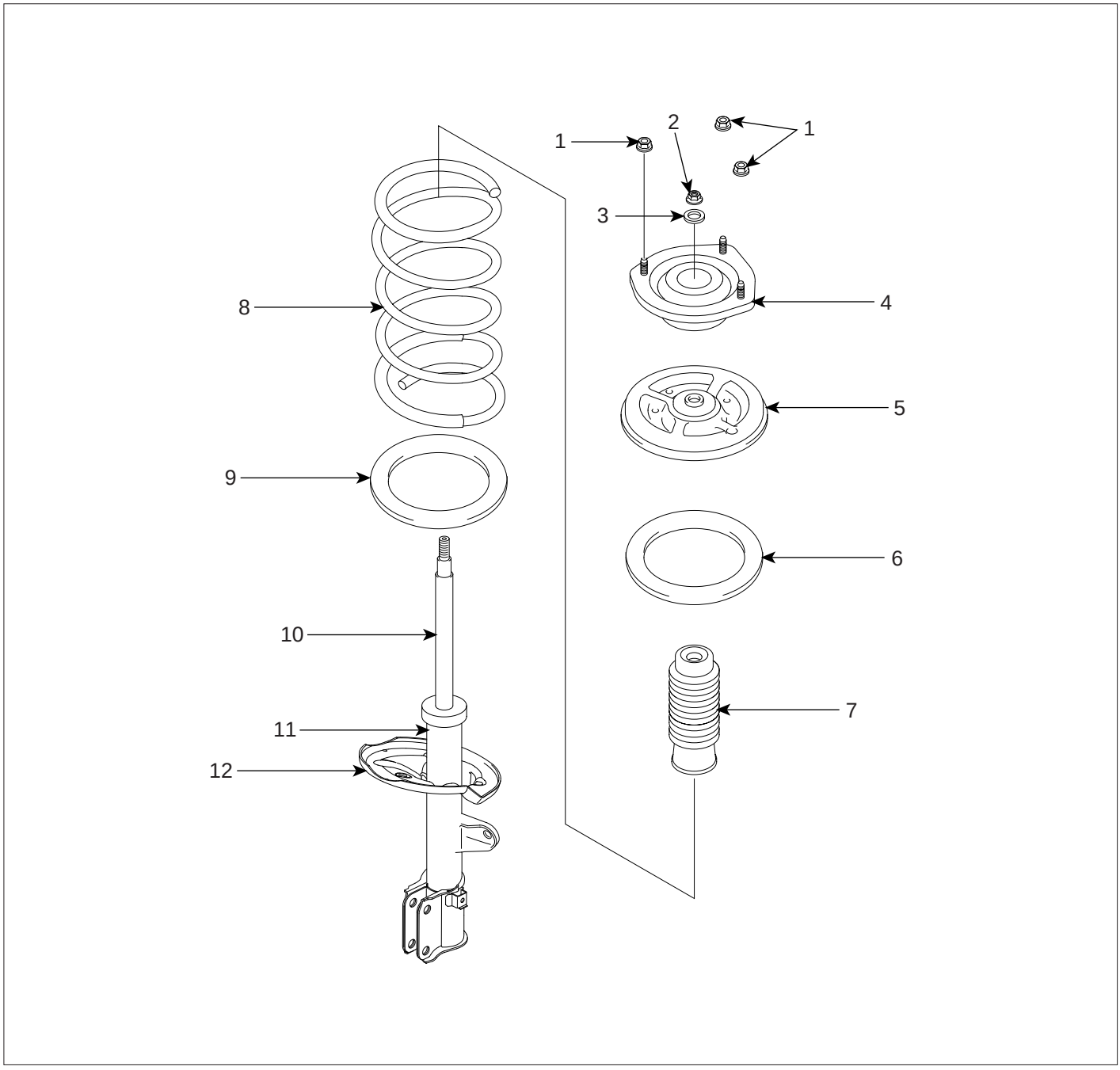
COMPONENTS E9E55372



1. Strut insulator
2. Upper mounting nut
3. Front strut assembly
4. Front strut lower mounting bolt
5. Knuckle assembly
6. Lower arm
7. Lower arm bush(G) mounting bolt
8. Subframe
9. Lower arm bush(A) mounting bolt

LHJF010A

COMPONENTS



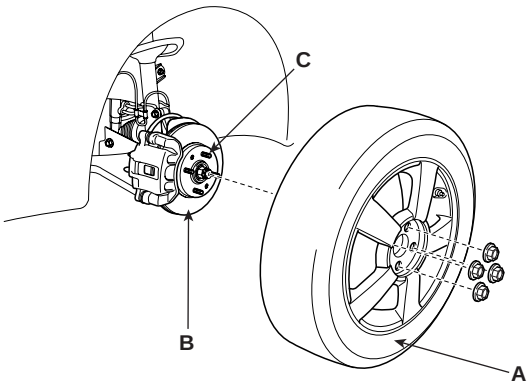
1. Upper mounting nuts
2. Self-locking nut
3. Spacer
4. Insulator
5. Spring upper seat
6. Spring upper pad
7. Strut dust cover & bumper rubber
8. Coil spring
9. Spring lower pad
10. Piston rod
11. Strut assembly
12. Spring lower seat

LHJF010B

REMOVAL EECBD55F

1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.

2. Remove the front wheel and tire(A) from front hub(B).

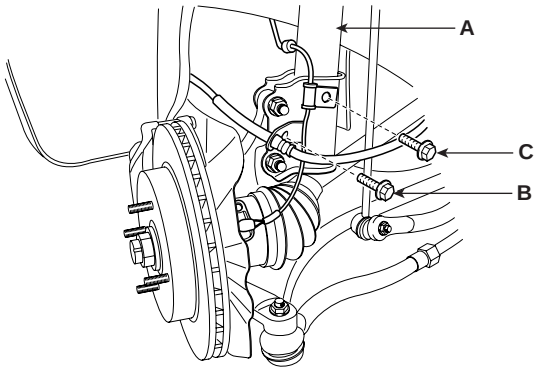


AHJF011A

CAUTION

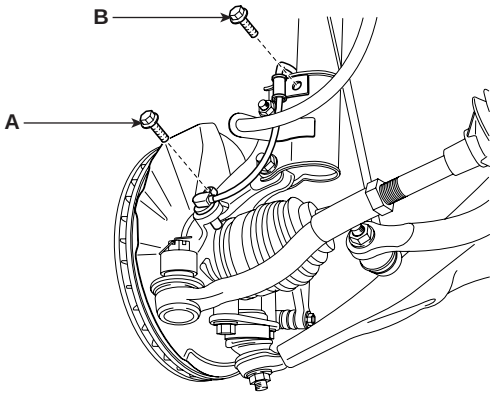
Be careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

3. Remove the brake hose bracket(B) and speed sensor wire mounting bolt(C) from the strut assembly(A).



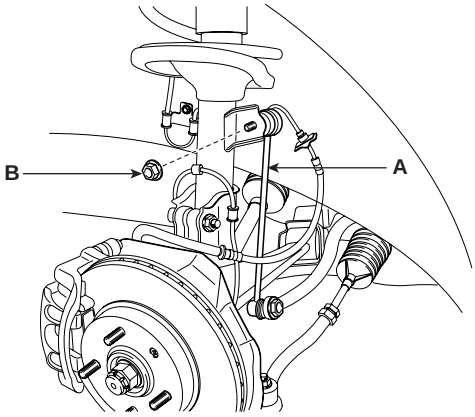
AHJF011B

4. Remove the speed sensor wire mounting bolt(B) and speed sensor(A).



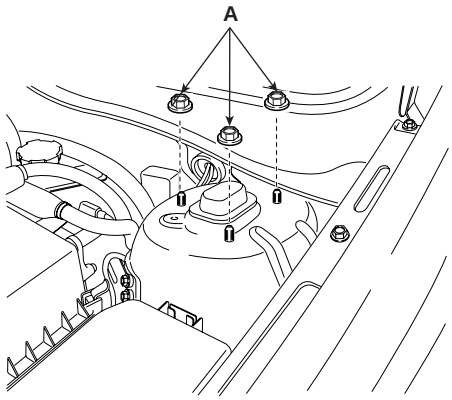
AHJF011C

5. Remove the nut(B) from the stabilizer bar link(A).



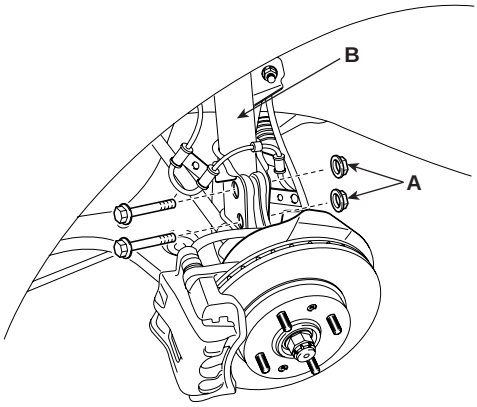
AHJF011D

6. Remove the strut upper mounting nuts(A).



AHJF011E

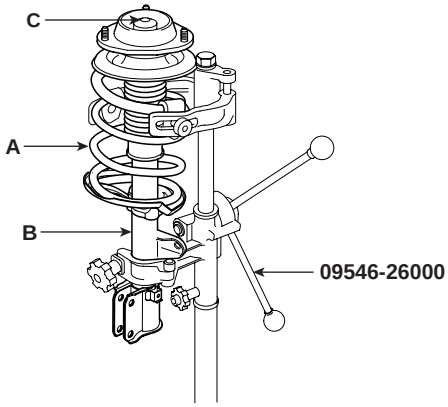
7. Remove the strut lower mounting bolts(A) and then remove the strut assembly(B).



AHJF011F

DISASSEMBLY E5CA0CA5

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.

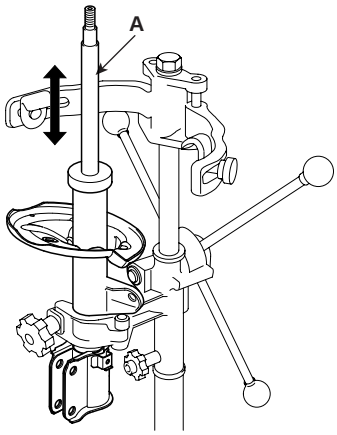


AHJF101J

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 E97F6F7C

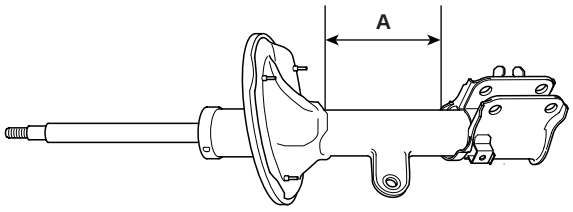
1. Check the strut insulator bearing for wear or damage.
2. Check rubber parts for damage or deterioration.
3. Compress and extend the piston rod(A) and check that there is no abnormal resistance or unusual sound during operation.



AHJF101L

DISPOSAL EB69F3FC

1. Fully extend the piston rod.
2. Drill a hole on the A section to remove gas from the cylinder.



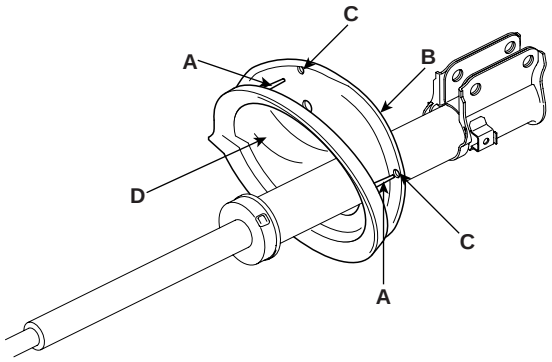
AHIE101K

CAUTION

The gas coming out is harmless, but be careful of chips that may fly when drilling.

REASSEMBLY E49C66AA

1. Install the spring lower pad(D) so that the protrusions(A) fit in the holes(C) in the spring lower seat(B).



AHIE101S

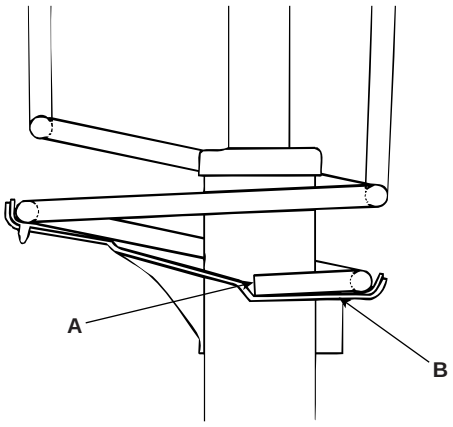
2. Compress coil spring using special tool (09546-26000).
   Install compressed coil spring into shock absorber.

   NOTE

   a. 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.
   b. 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.



AHIE101T

5. Remove the special tool(09546-26000).

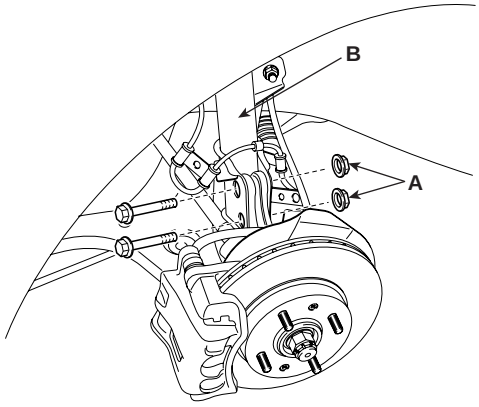
6. Tighten the self-locking nut to the specified torque.

Tightening torque :
50 ~ 70 Nm (5 ~7 kgf·m, 36 ~ 50 lb-ft)

INSTALLATION E8558E4D

1. Install the strut assembly(B) and then install the strut lower mounting bolts(A).

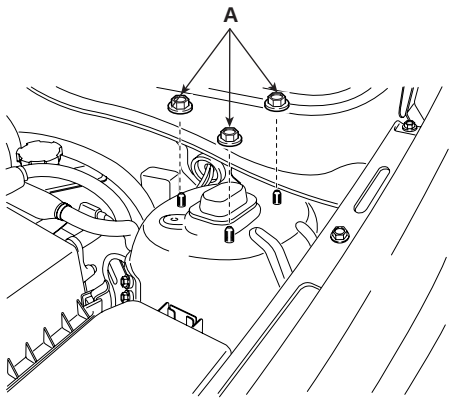
Tightening torque :
100 ~ 120 Nm (10 ~ 12 Kgf·m, 72 ~ 86 lb-ft)



AHJF011F

2. Install the strut upper mounting nuts(A).

Tightening torque :
20 ~ 30 Nm (2 ~ 3 Kgf·m, 14.4 ~ 21.6 lb-ft)

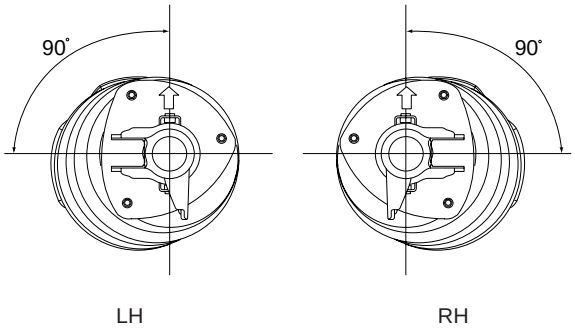


AHJF011E

NOTE

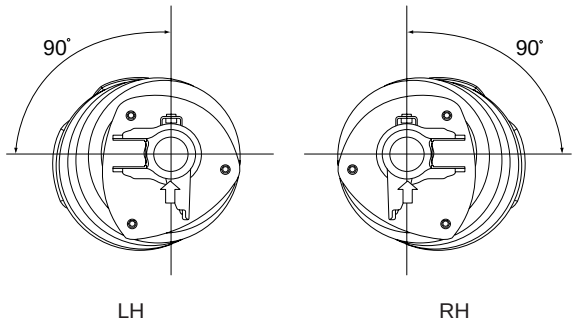
When installing the strut assembly mounting nuts, check if the self-locking nut is in the right direction as shown in the illustration.

POWER STEERING

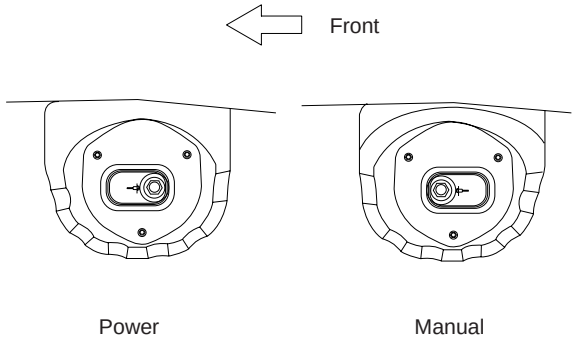


LHJF011G

MANUAL STEERING



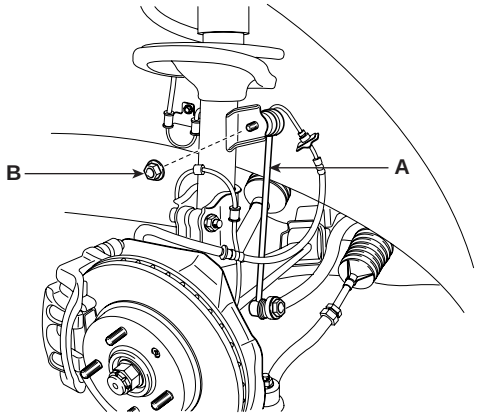
LHJF011I



LHJF011H

3. Install the nut(B) on the stabilizer bar link(A).

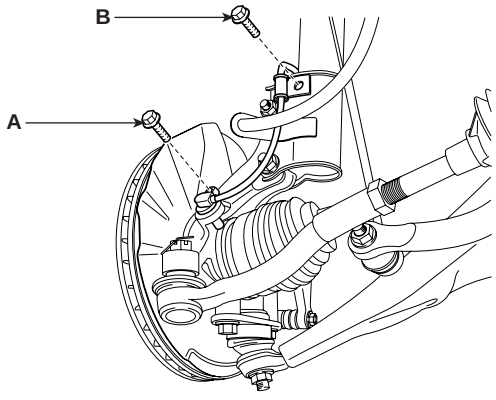
Tightening torque :
35 ~ 45 Nm (3.5 ~4.5 Kgf·m, 25 ~ 32 lb-ft)



AHJF011D

4. Install the speed sensor wire mounting bolt(B) and speed sensor(A).

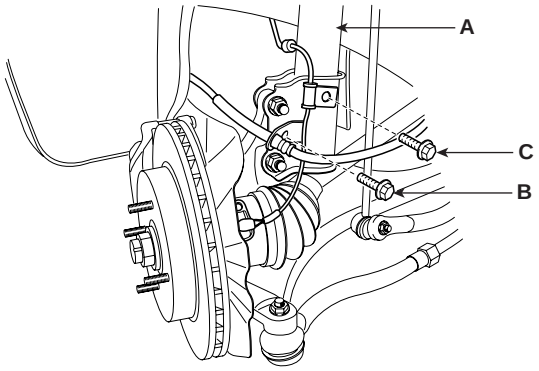
Tightening torque :
A : 13 ~ 17 Nm (1.3 ~ 1.7 Kgf·m, 9.4 ~ 12 lb-ft)
B : 7 ~ 11 Nm (0.7 ~ 1.1 Kgf·m, 5 ~ 7 lb-ft)



AHJF011C

5. Install the brake hose bracket(B) and speed sensor wire mounting bolt(C) on the strut assembly(A).

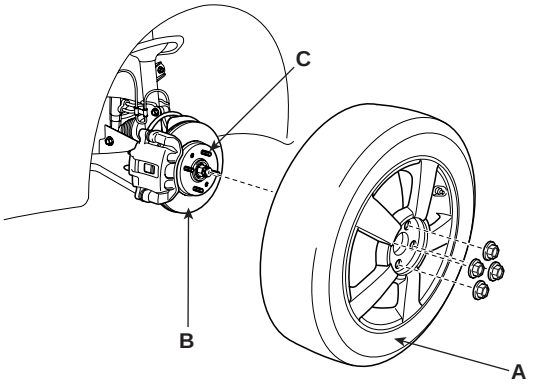
Tightening torque :
Brake hose mounting bolt ;
9 ~14 Nm (0.9 ~ 1.4 Kgf·m, 6 ~ 10 lb-ft)



AHJF011B

6. Install the front wheel and tire(A) on the front hub(B).

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



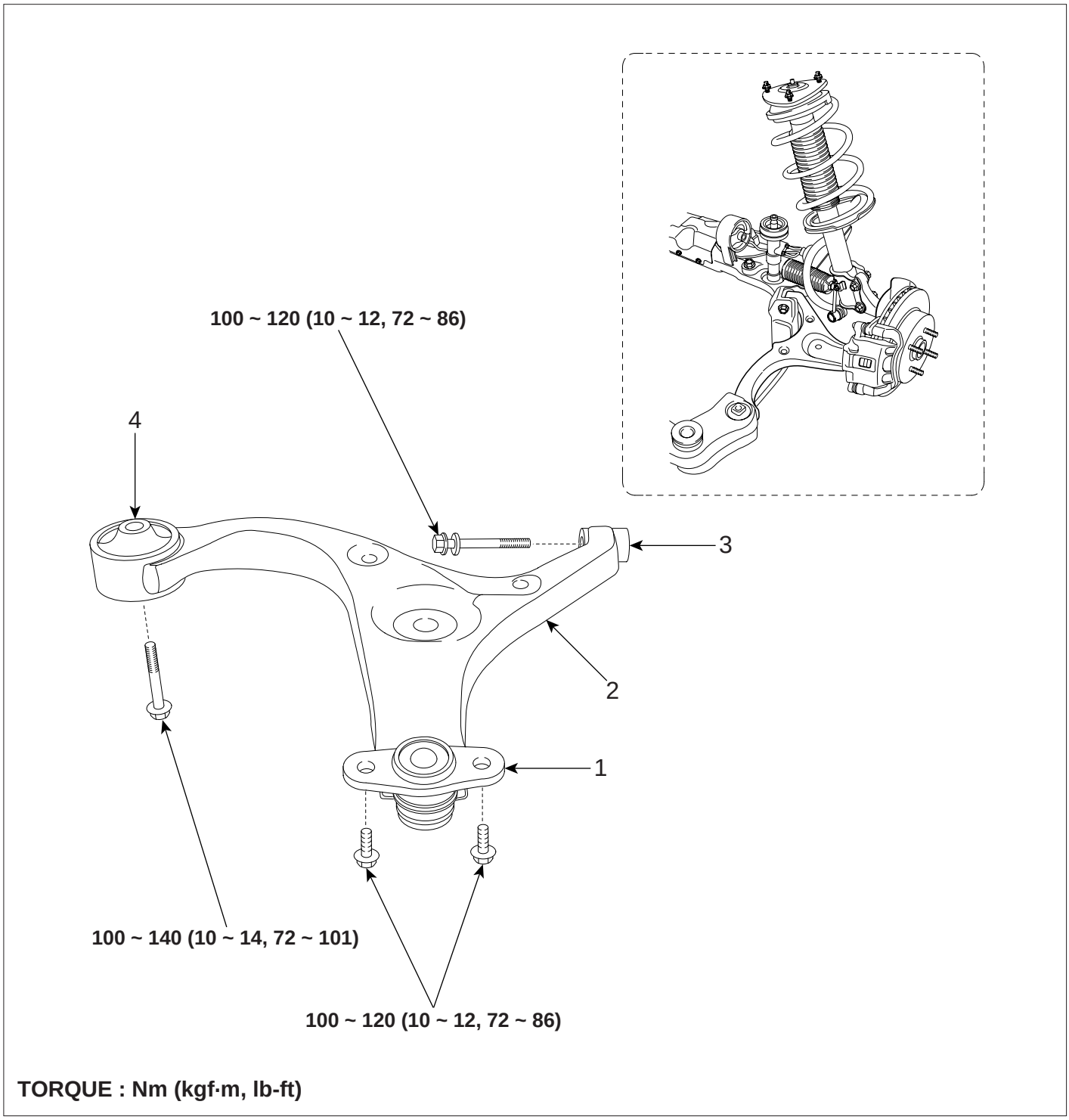
AHJF011A

CAUTION

Be careful not to damage the hub bolts(C) then install the front wheel and tire(A).

FRONT LOWER ARM

COMPONENTS EE0585D7



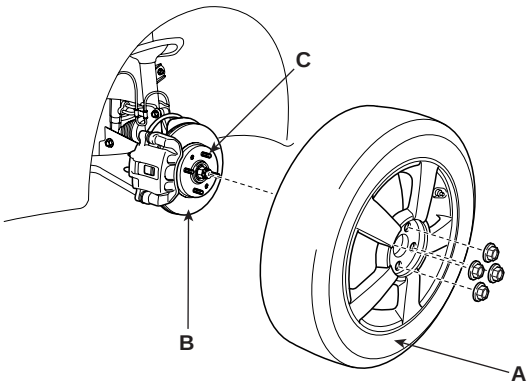
1. Front lower arm ball joint
2. Lower arm
3. A bushing
4. G bushing

LHJF020A

REMOVAL EA65CF2B

1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.

2. Remove the front wheel and tire(A) from front hub(B).

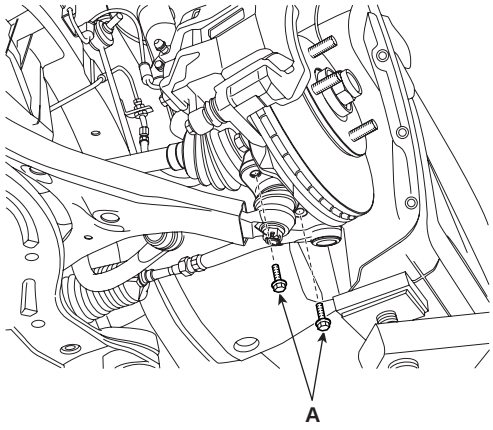


AHJF011A

CAUTION

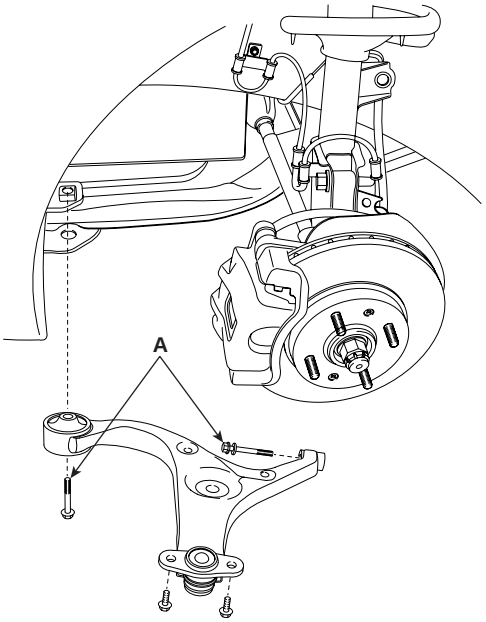
Be careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

3. Remove the lower arm ball joint mounting bolts(A).



AHJF021A

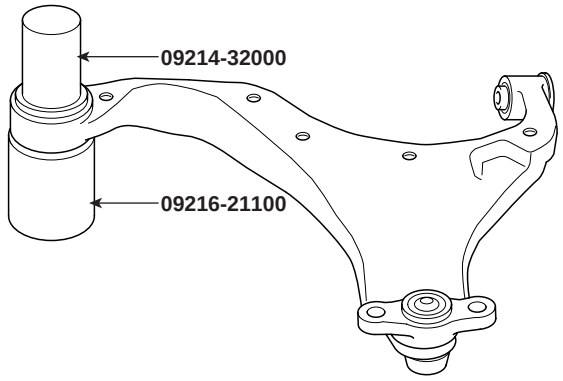
4. Remove the lower arm mounting bolts(A).



AHJF021B

REPLACEMENT E3F4E2ED

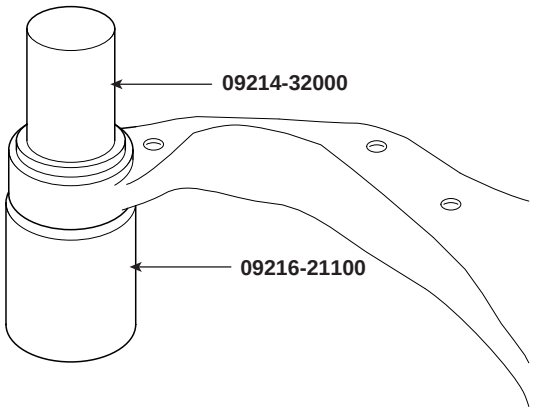
1. Using the special tools(09214-32000 & 09216-211000), remove the bushing from the lower arm.



AHJF021C

2. Apply soap solution to the following parts.
   - Outer surface of the bushing.
   - Inner surface of the lower bushing mounting part.

3. Using the special tools(09214-32000 & 09216-21100), install the busing on the lower arm.

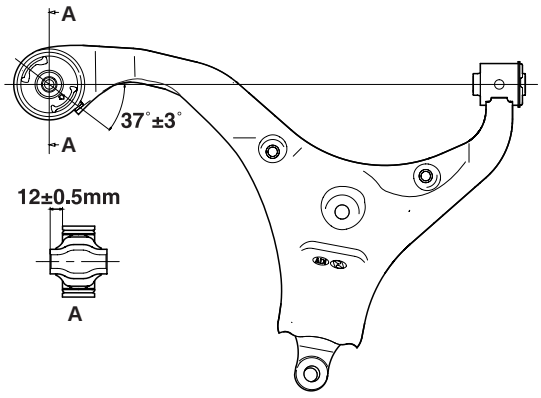


AHJF021D

CAUTION

Insert bush as to arrow direct toward this dir shown.

Separation force is over 800Kg

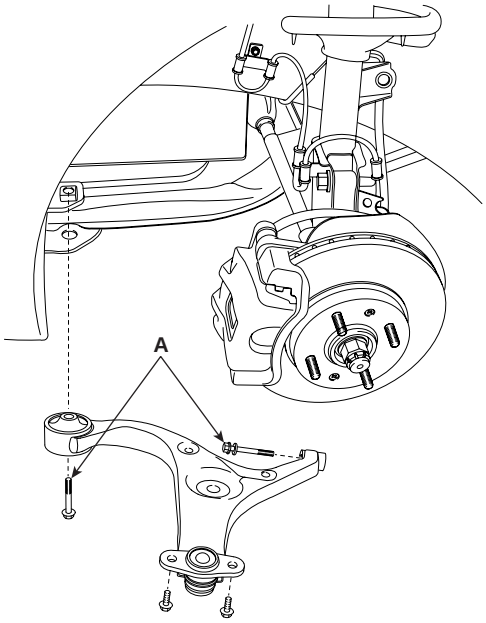


AHJF021E

INSTALLATION EBBAF5EB

1. Install the lower arm mounting bolts(A).

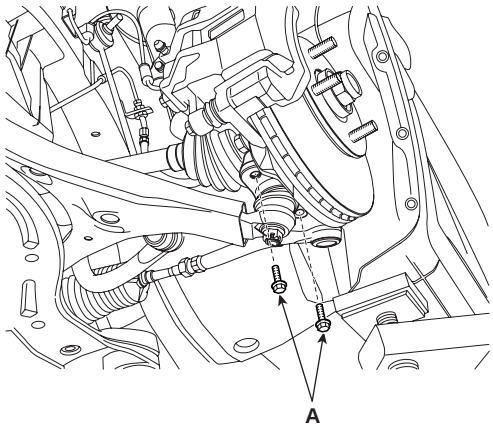
Tightening torque :
A bushing :
100 ~ 120 Nm (10 ~ 12 Kgf·m, 72 ~ 86 lb-ft)
G bushing :
100~140 Nm (10 ~ 14 Kgf·m, 72 ~ 101 lb-ft)



AHJF021B

2. Install the lower arm ball joint mounting bolts(A).

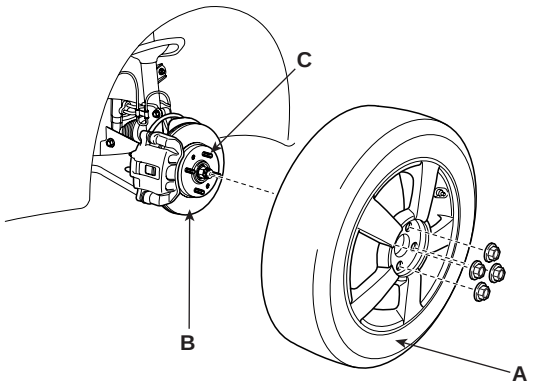
Tightening torque :
100 ~ 120 Nm (10 ~ 12 Kgf·m, 72 ~ 86 lb-ft)



AHJF021A

3. Install the front wheel and tire(A) on the front hub(B).

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



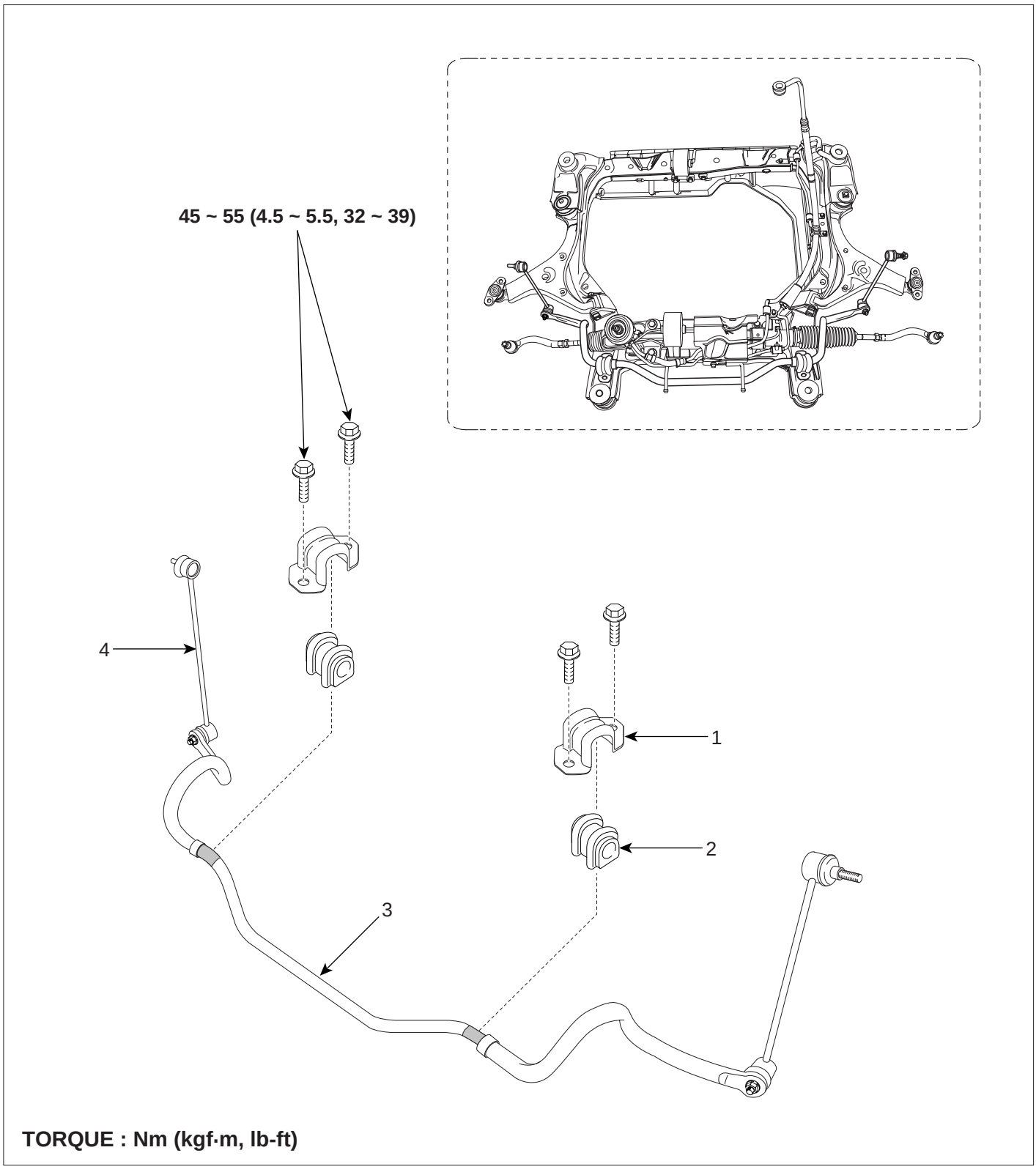
AHJF011A

CAUTION

Be careful not to damage the hub bolts(C) then install the front wheel and tire(A).

FRONT STABILIZER BAR

COMPONENTS E671EECE



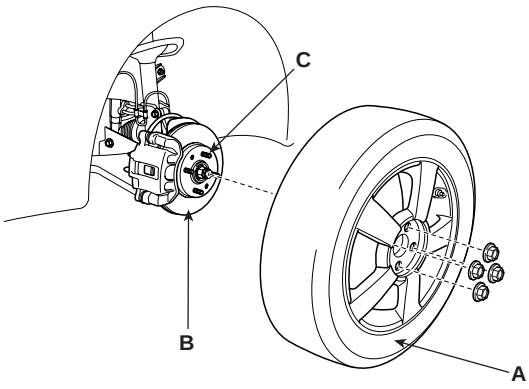
1. Stabilizer bracket
2. Stabilizer bushing
3. Stabilizer bar
4. Stabilizer bar link

LHJF030A

REMOVAL E0C7C0D4

1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.

2. Remove the front wheel and tire(A) from front hub(B).

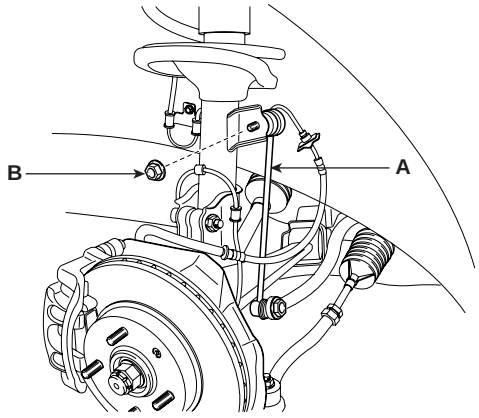


AHJF011A

CAUTION

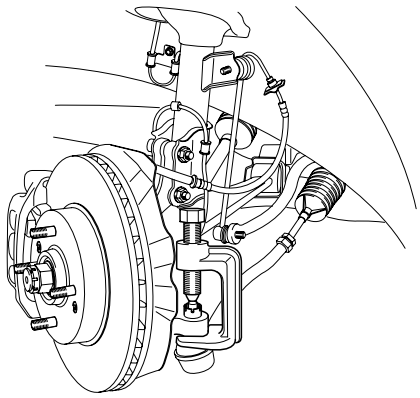
Be careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

3. Remove the stabilizer bar link(B) from the strut assmembly(A).



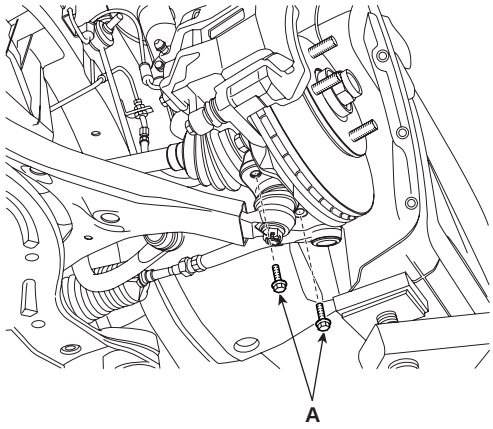
AHJF011D

4. Remove the tie rod end(A) from the knuckle by using the special tool(09568-4A000).



APJF005C

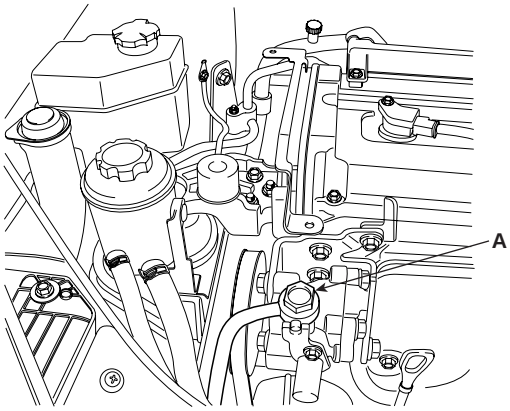
5. Remove the two bolts(A) for lower arm ball joint.



AHJF021A

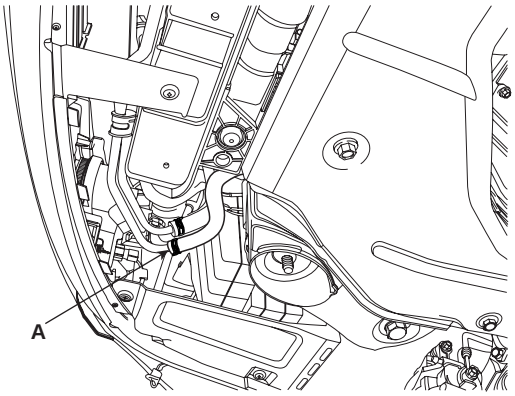
6. Drain power steering oil.

7. Remove the pressure pipe mounting bolt(A).



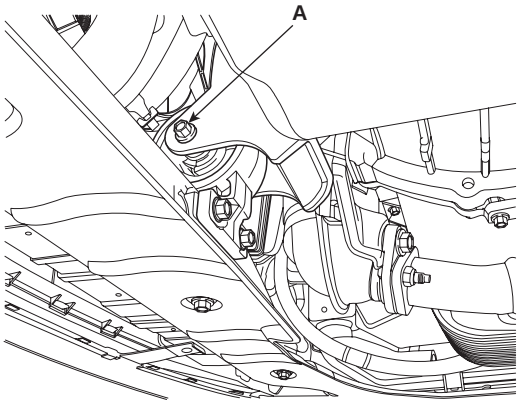
AHJF031A

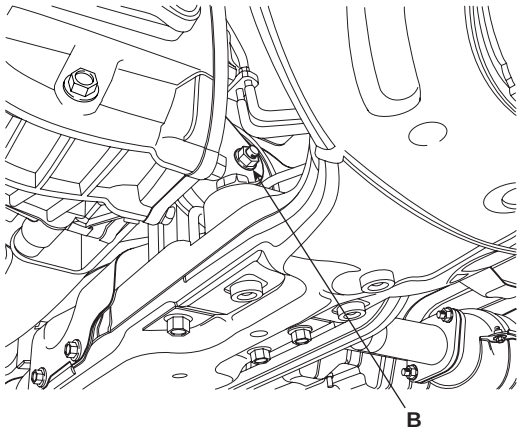
8. Disconnect between the return hose and tube(A).



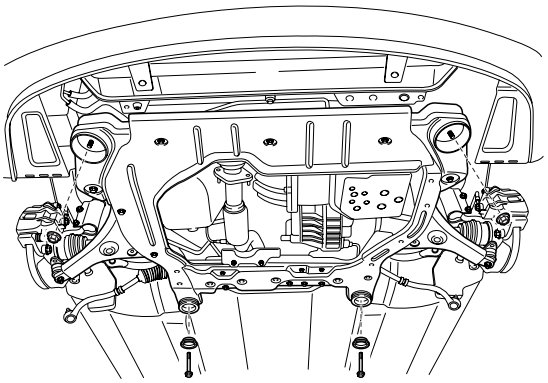
AHJF031B

9. Remove two engline mounting bolts(A,B) and six sub-frame mounting bolts in order to remove the subframe.



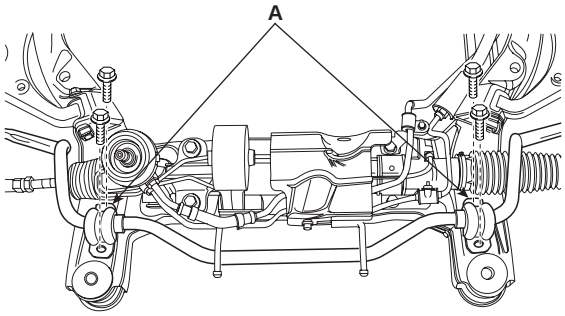


APJF005J



AHJF031C

10. Remove both two stabilizer brackets(A) and two bushes respcetively.



AHJF031D

11. Remove the stabilizer bar.

CAUTION

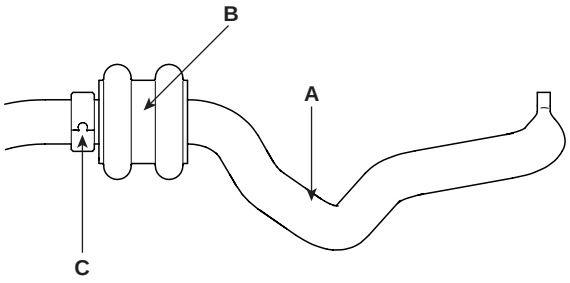
Be careful not to do damage to pressure tubes.

INSPECTION ECEF8562

1. Check the stabilizer bar for deterioration and damage.
2. Check all bolts for damage and deformation.
3. Check the stabilizer link dust cover for cracks or damage.

INSTALLATION ED152F2F

1. Install the bushing(B) on the stabilizer bar(A).



AHIE106I

NOTE

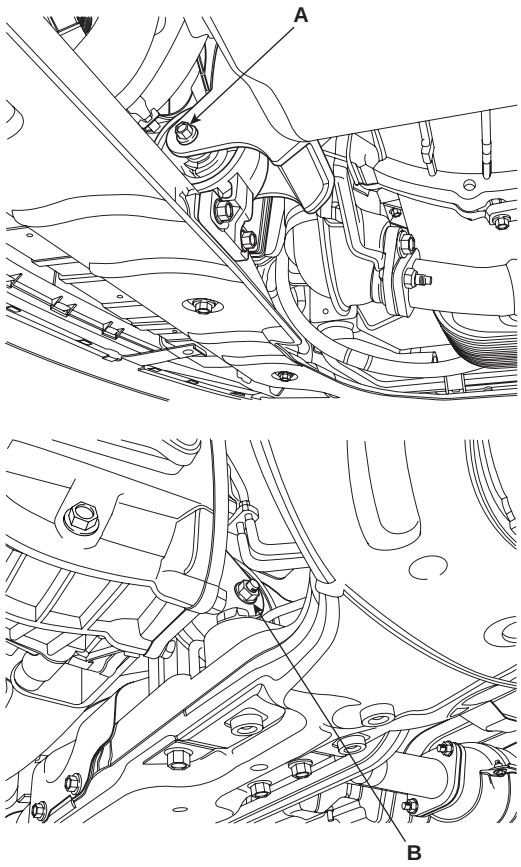
Bring clamp(C) of stabilizer bar(A) into contact with bushing(B).

2. Install the bracket on the bushing(B).
3. After tightening the bolts of the bushing bracket temporarily, install the bushing bracket on the opposite side.

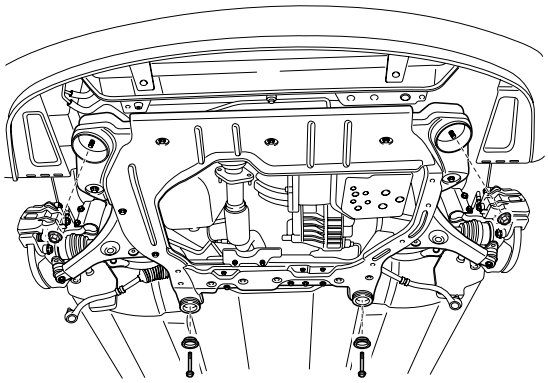
Tightening torque :
45 ~ 55 Nm (4.5 ~ 5.5 Kgf·m, 32 ~ 39 lb-ft)

4. Install the six subframe mounting bolts, then the two engine mounting bolts(A,B).

Tightening torque :
Engine mounting ;
50 ~ 65 Nm (5 ~ 6.5 Kgf·m, 36 ~ 47 lb-ft)
Subframe mounting ;
95 ~ 120 Nm (9.5 ~ 12 Kgf·m, 68 ~ 86 lb-ft)



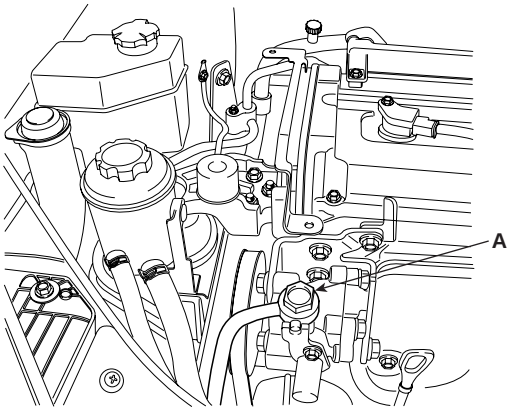
APJF005J



AHJF031C

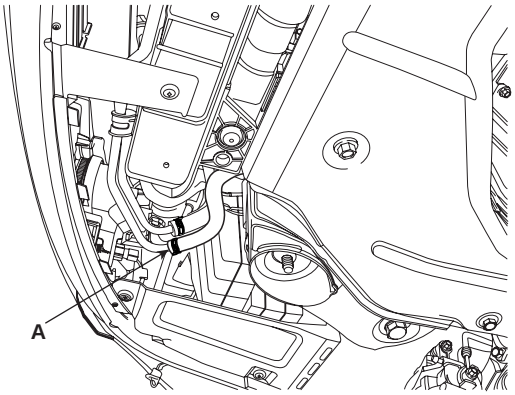
5. Install the pressure pipe mounting bolt(A).

Tightening torque :
55 ~ 65 Nm (5.5 ~ 6.5 Kgf·m, 39 ~ 47 lb-ft)



AHJF031A

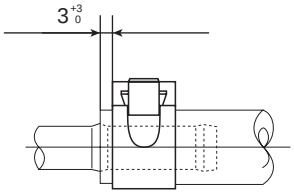
6. Connect between the return tube and hose(A).



AHJF031B

CAUTION

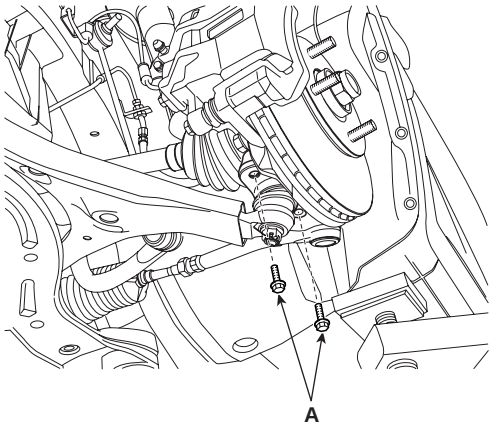
Be sure to connect between a tube and a hose as shown in the illustration.



APJF009A

7. Install the two bolts(A) for the lower arm ball joint.

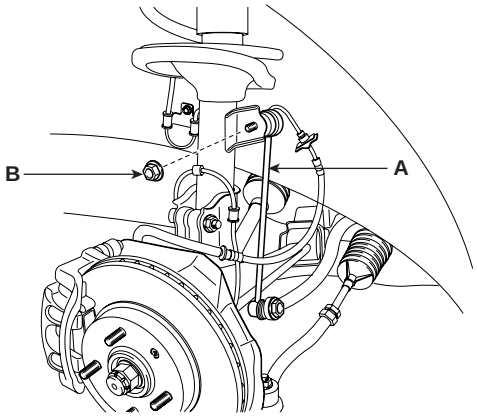
Tightening torque :
100 ~ 120 Nm (10 ~ 12 Kgf·m, 72 ~ 86 lb-ft)



AHJF021A

8. Install the nut(B) on the stabilizer bar link(A).

Tightening torque :
35 ~ 45 Nm (3.5 ~ 4.5 Kgf·m, 25 ~ 32 lb-ft)

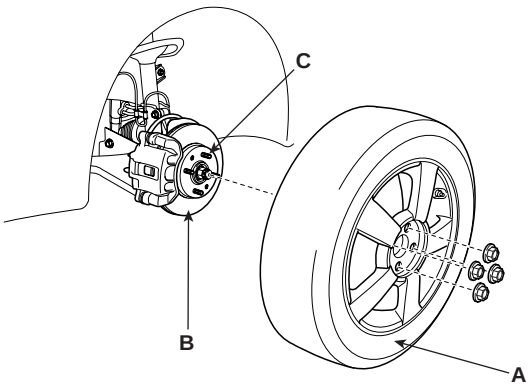


AHJF011D

9. Install the tie rod end on the knuckle.

10. Install the front wheel and tire(A) on thr front hub(B).

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



AHJF011A

CAUTION

Be careful not to do damage the hub bolts(C) then install the front wheel and tire(A).

11. Refill the power steering fluid(PSF-3).

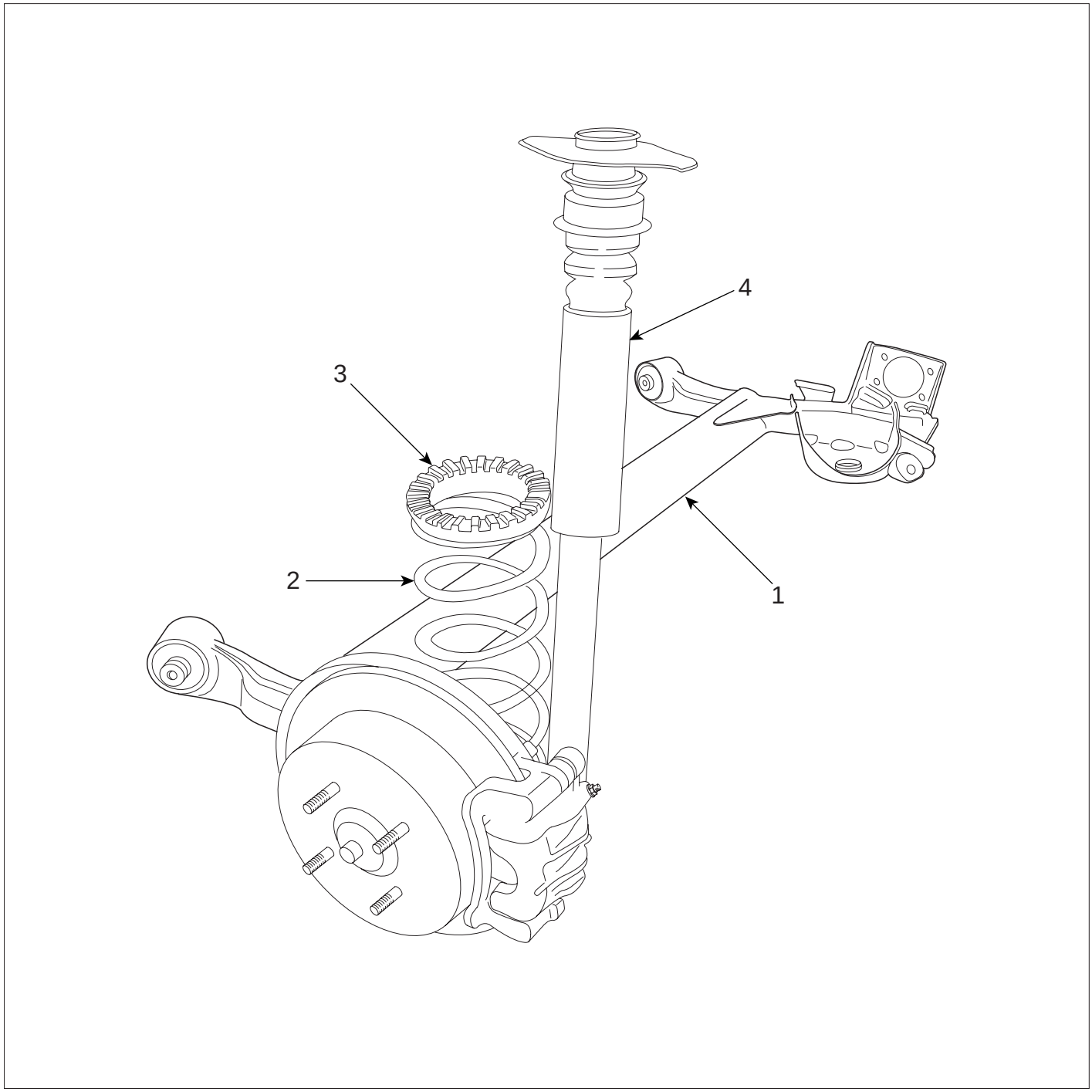
CAUTION

After installation, bleed the air in the power steering system. (refer to ST-10)

REAR SUSPENSION SYSTEM

REAR TORSION AXLE BEAM

COMPONENTS E0F4CEFB

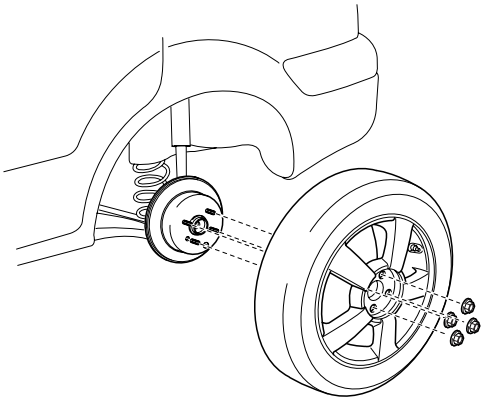


1. Rear torsion beam axle
2. Rear coil spring
3. Uppper pad
4. Rear shock absorber

LHJF040A

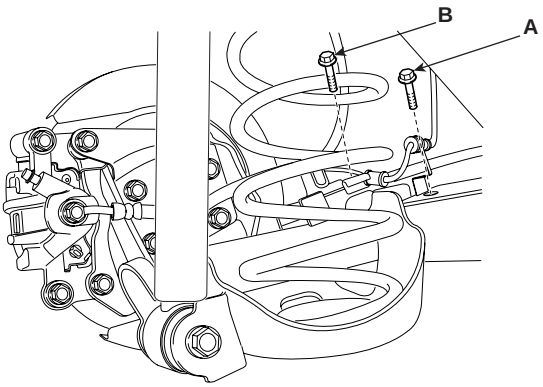
REMOVAL E1446DEB

1. Remove the rear tire and wheel.



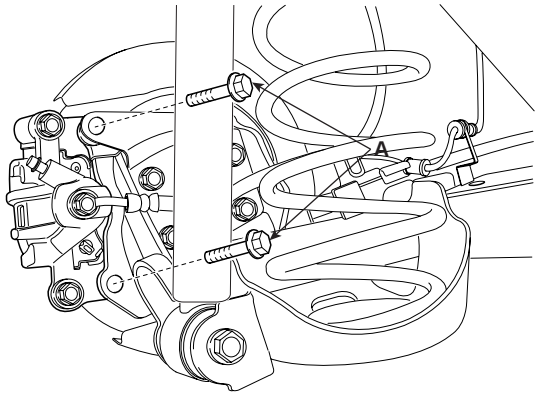
AHJF061A

2. Remove the wheel speed sensor wire bracket bolt(A) and the brake pressure hose bracket bolt(B).



AHJF041A

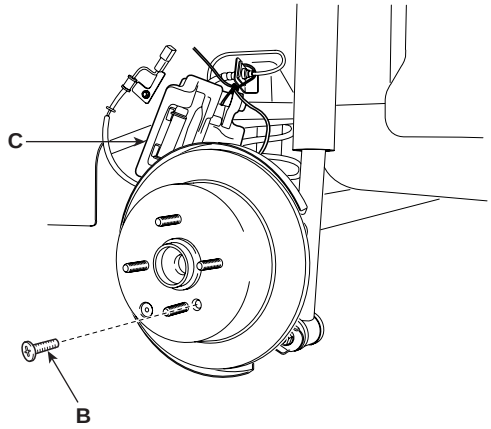
3. Remove the brake caliper assembly bolt(A) and the brake disk mounting screw(B).



AHJF041J

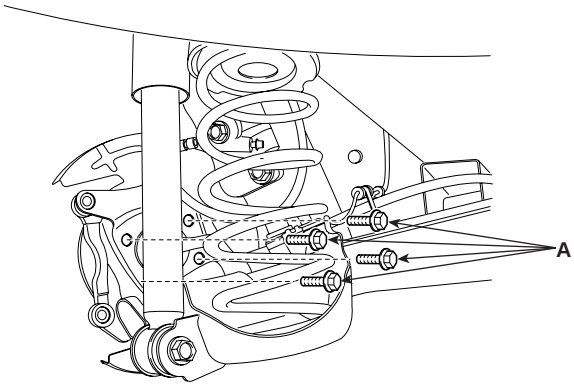
NOTE

Hang the brake caliper assembly(C) tightly on a proper place with wire.



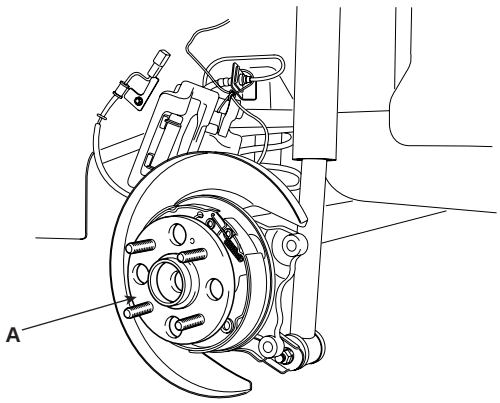
AHJF041B

4. Remove the rear hub bearing assembly bolts(A).



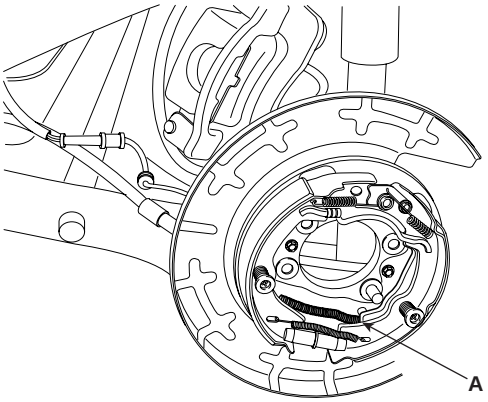
AHJF041C

5. Remove the rear hub bearing assembly(A).



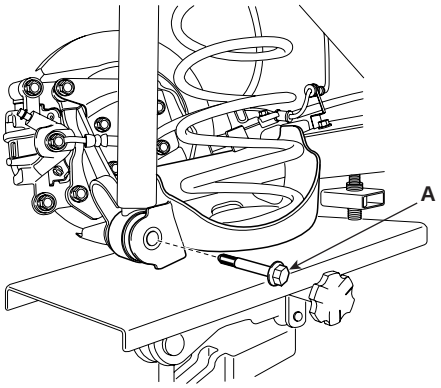
AHJF041D

6. Remove the parking brake wire(A).



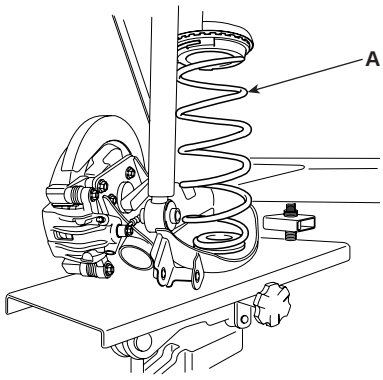
AHJF041E

7. Remove the rear shock absorber mounting bolt(A) from the rear torsion axle beam which is supported by a jack.



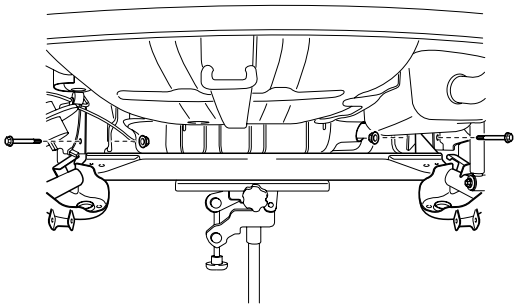
AHJF041F

8. Release the rear coil spring tension by lowering the jack and remove the rear coil spring.



AHJF041G

9. Remove the rear torsion axle beam mounting bolts.



AHJF041H

INSTALLATION E1ECA377

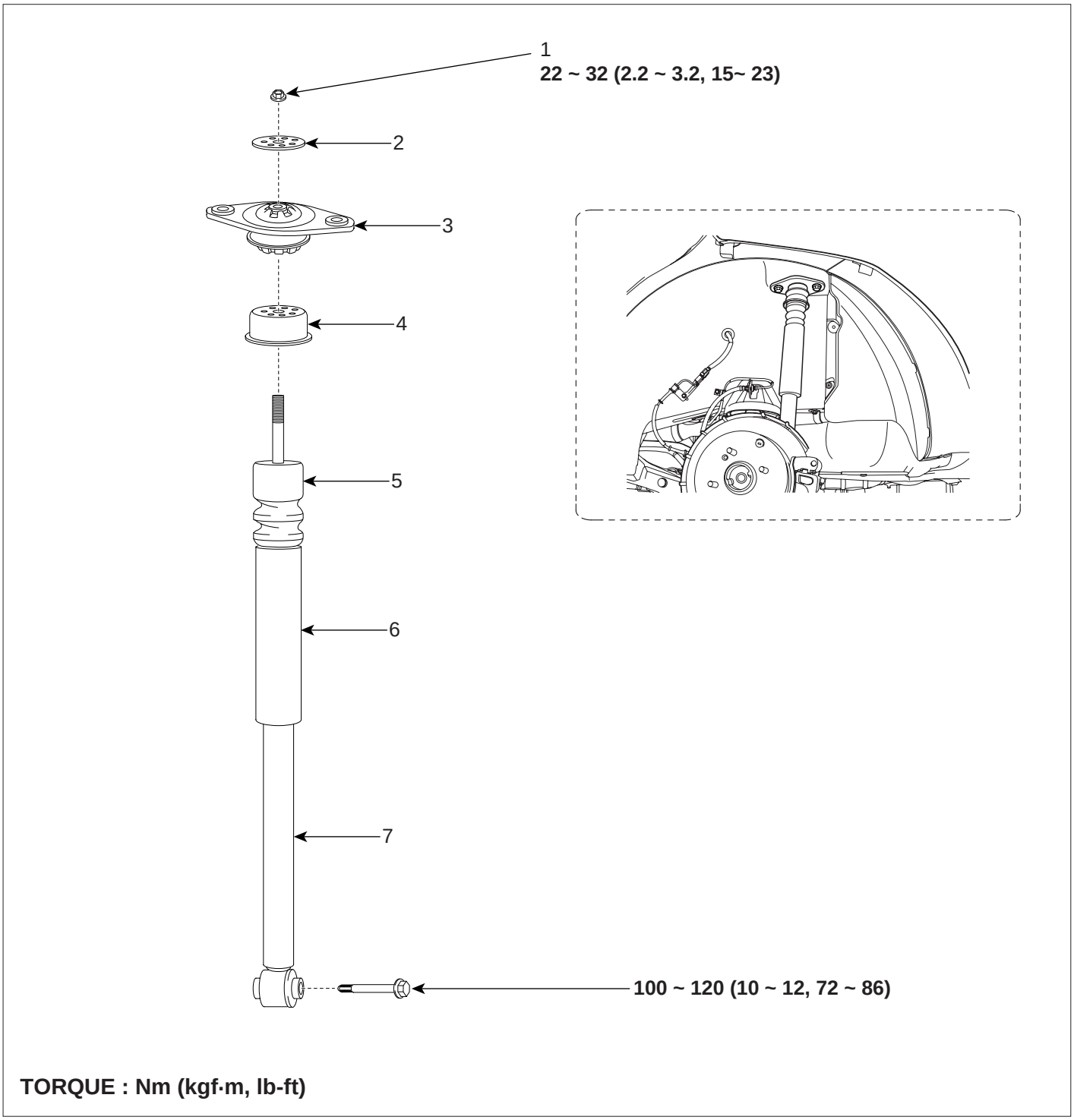
1. Installation is reverse of removal.

2. Install the following parts with the specified torque.

Items	Tightening Torque Nm(kgf·m,lb-ft)
Rear hub unit bearing mounting bolt	50 ~ 60 (5 ~ 6, 36 ~ 43)
Rear shock absober lower mounting	100 ~ 120 (10 ~ 12, 72 ~ 86)
Rear torsion axle beam mounting bolt	100 ~ 120 (10 ~ 12, 72 ~ 86)

SHOCK ABSORBER

COMPONENTS E2933DE0

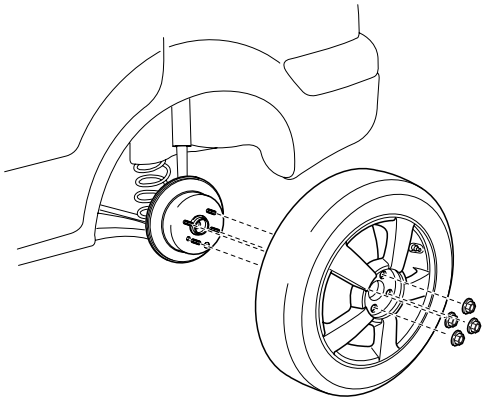


1. Self locking nut
2. Retainer
3. Insulater
4. Upper cup
5. Bumper stopper
6. Dust cover
7. Rear shock absober assembly

LHJF050A

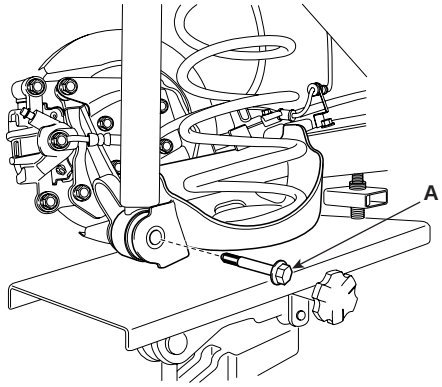
REMOVAL E1ABC700

1. Remove the wheel and tire.



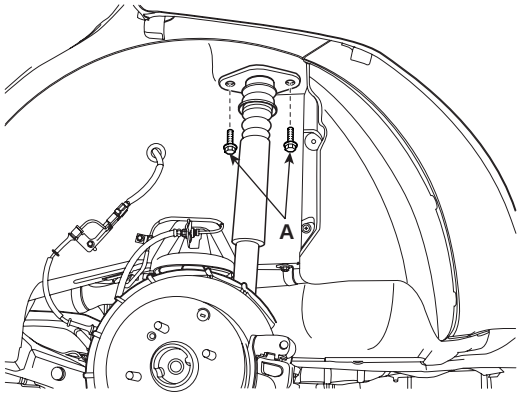
AHJF061A

2. After supporting the rear torsion axle beam with a jack, remove the rear shock absorber lower mounting bolt. Remove the rear shock absorber.



AHJF041F

3. Remove the rear shock absorber mounting bolts(A).

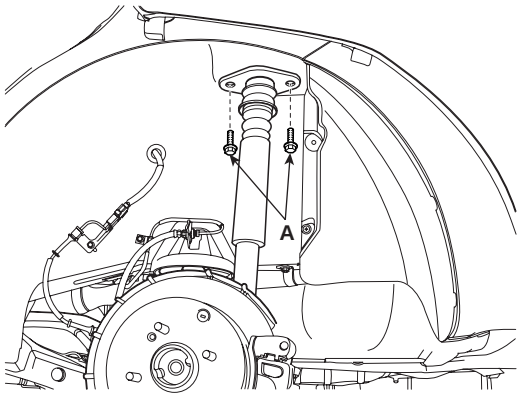


AHJF051B

INSTALLATION EBDFB173

1. Tighten the rear shock absorber upper mounting bolt to the specified torque as follows.

Specified torque :
40 ~ 60 Nm (4 ~6 kgf·m, 28 ~ 43 lb-ft)



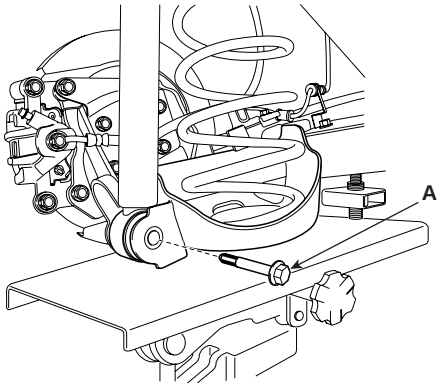
AHJF051B

2. After placing a jack at the bottom of the rear torsion axle beam and jacking up the vehicle to the proper location, tighten the rear shock absorber lower mounting bolt(A).

Specified torque :
100 ~ 120 Nm (10 ~ 12 kgf·m, 72 ~ 86 lb-ft)

CAUTION

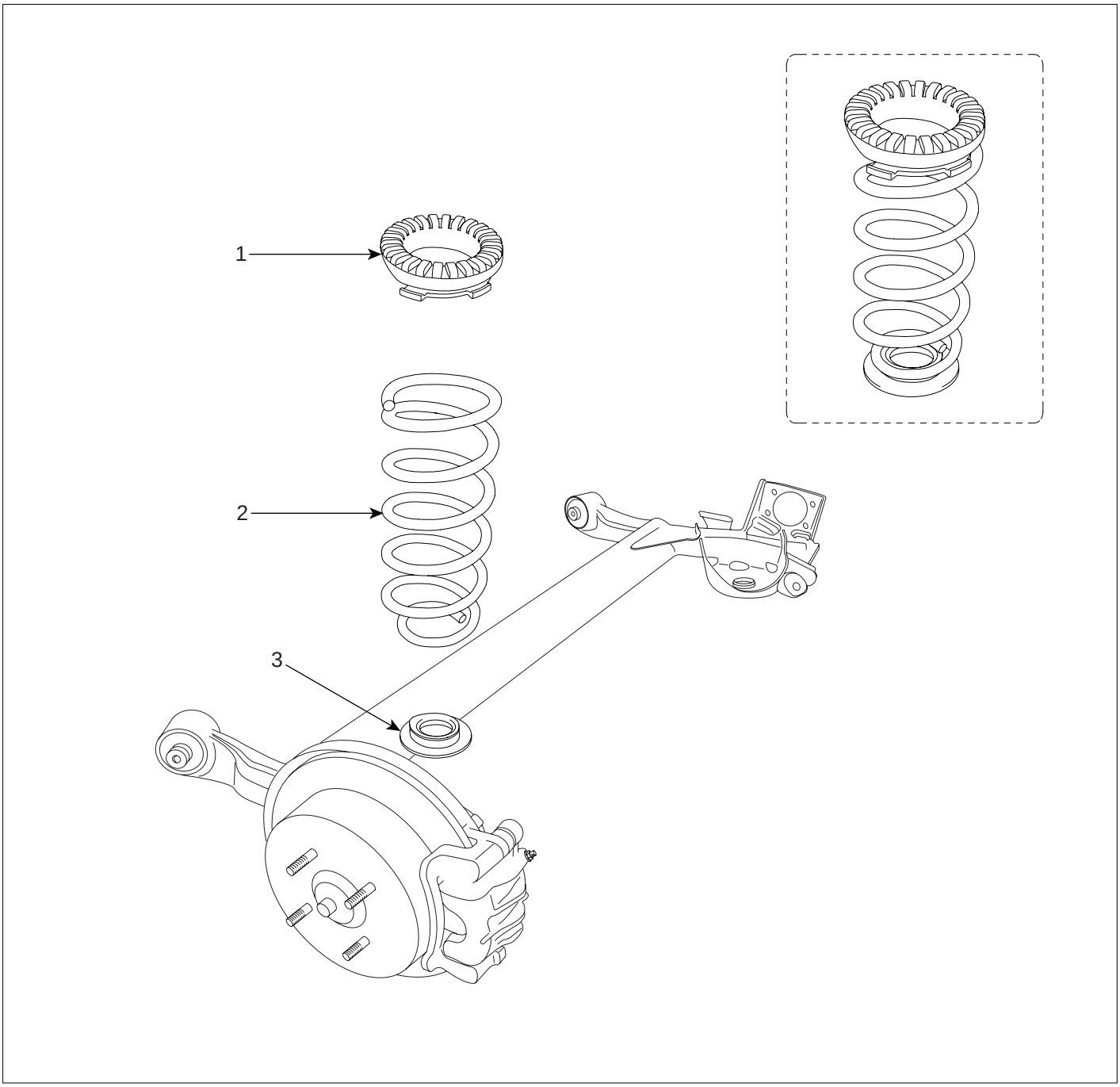
Check that the rear coil spring is located in the proper position.



AHJF041F

REAR COIL SPRING

COMPONENTS EB7ADF51

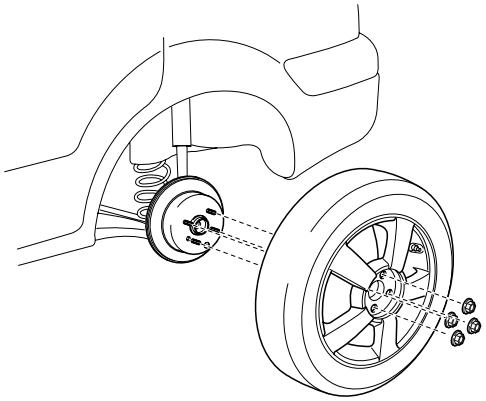


1. Spring upper pad
2. Spring
3. Spring lower pad

LHJF060A

REMOVAL E981C7B3

1. Remove the wheel and tire.

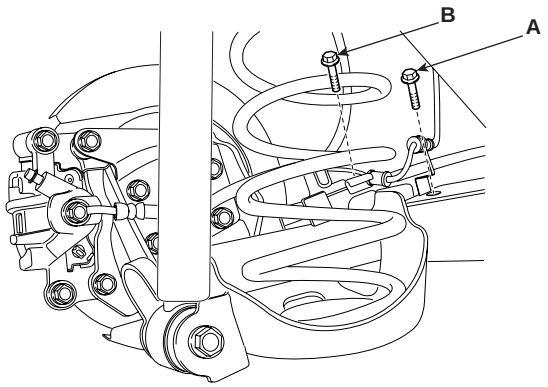


AHJF061A

2. Remove the brake hose bracket(B) and the wheel speed sensor wire bracket(A).

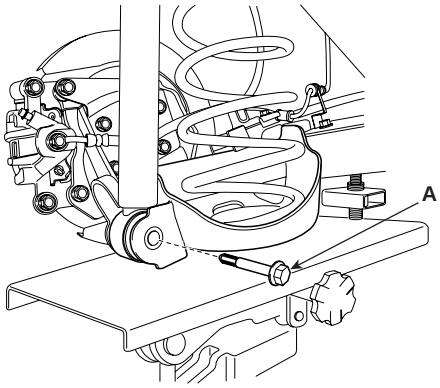
CAUTION

The brake hose should not expand when the rear torsion axle beam is hanged down from the body.



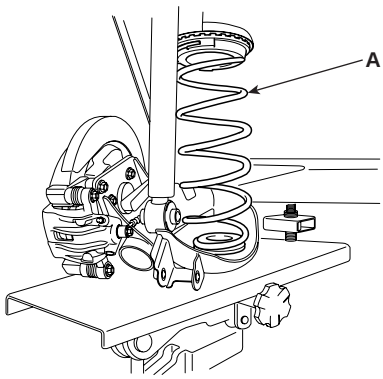
AHJF041A

3. After placing a jack at the bottom of the rear torsion axle beam, remove the rear shock absorber lower mounting bolt(A).



AHJF041F

4. Remove the rear coil spring(A).



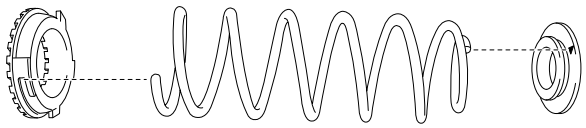
AHJF041G

INSPECTION EEFFBF91

1. Check the coil spring for crack and deformation.
2. Check the coil spring pad for damage and deformation.

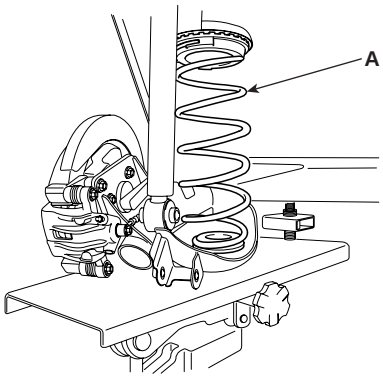
INSTALLATION E22093A7

1. Install the upper and lower pads on the coil spring by aligning the grooves on the pads.



AHJF061C

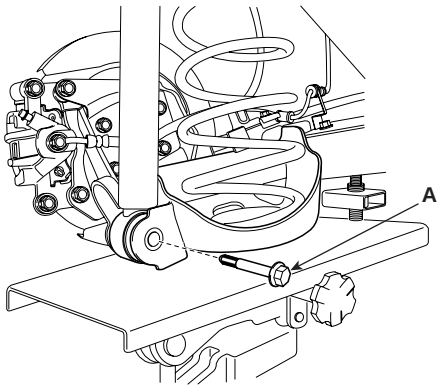
2. Place the coil spring(A) with the pads on the torsion axle beam and support it with a jack.



AHJF041G

3. Install the rear shock absorber mounting bolt(A) by lifting the rear torsion axle beam.

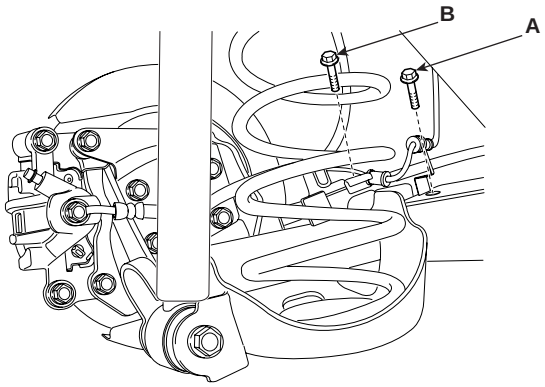
Tightening torque Nm(kgf·m,lb-ft) :
100 ~ 120 Nm (10 ~12 kgf·m, 72 ~ 86 lb-ft)



AHJF041F

4. Install the wheel speed sensor wire bracket bolt(A) and the brake pressure hose bracket bolt(B).

Tightening torque Nm(kgf·m,lb-ft) :
Brake pressure hose bracket ;
9 ~ 14 Nm (0.9 ~1.4 kgf·m, 6 ~ 10 lb-ft)
Speed sensor wire bracket ;
7 ~ 11 Nm (0.7 ~1.1 kgf·m, 5 ~ 7 lb-ft)



AHJF041A

TIRES / WHEELS

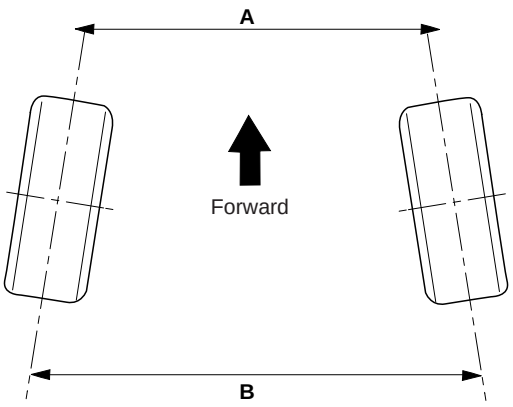
WHEEL

FRONT WHEEL ALIGNMENT EE4BC10F

When using a commercially-available computerized four wheel alignment equipment (caster, camber, toe) to inspect the front wheel alignment, always position the car 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 wheels and tires facestraight ahead and the tires are inflated to the specified pressure.

TOE

Toe is a measurement of how much the front of the wheels are turned in or out from the straight-ahead position.



LHIE107A

ITEM	Description
A-B < 0	Positive (+) toe (toe in)
A-B > 0	Negative (-) toe (toe out)

When the wheels aree turned in toward the front of the vehicle, toe is positive (+) (toe in). When the wheels are turned out toward the front of the vehicle, toe is negative (-) (toe out). Toe is measured in degrees, from side to side, and totaled.

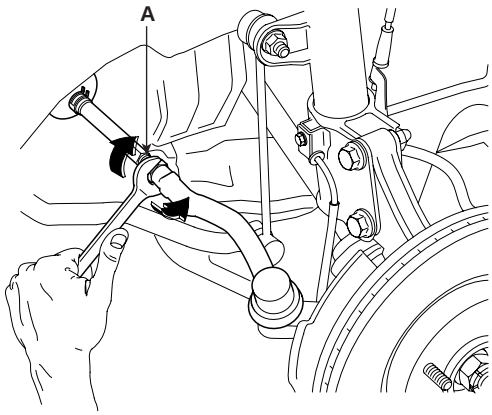
Toe-in(B-A or angle a+b) is adjusted by turning the tie rod turnbuckles. Toe-in on the left front wheel can be reduced by turning the tie rod toward the rear of the car. Toe- in change is adjusted by turning the tie rods for the right and left wheelss simultaneously at the same amount as follows.

Standard value
Toe-in (B-A) mm (in) : -2 ~ 2 mm (-0.078 ~ 0.078 in)

NOTE

- *Toe-in adjustment should be made by turning the right and left tie rods at the same amount.*
- *When adjusting toe-in, loosen the outer bellows clip to prevent twisting the bellows.*
- *After the adjustment, tighten the tie rod end lock nuts firmly and reinstall the bellows clip.*
- *Adjust each toe-in to be the range of ±1mm.*

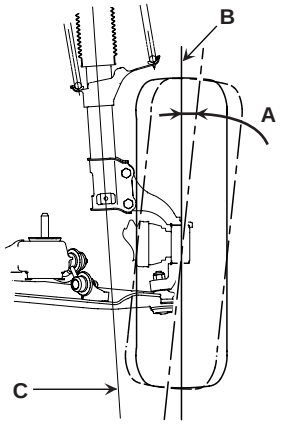
Tie rod end lock nuts(A) tightening torque :
16 ~ 34 Nm (1.6 ~ 3.4 Kgf·m, 11 ~ 24 lb-ft)



AHIE107B

CAMBER

Camber is the inward or outward tilting of the wheels at the top.



AHIE107C

ITEM	Description
A	Positive camber angle
B	True vertical
C	Strut centerline

When the wheel tilts out at the top, then the camber is positive (+).

When the wheel tilts in at the top, then the camber is negative (-).
The stering knuckle which is installed with the strut assembly is pre-set to the specified camber at the factory and doesn't need to be adjusted.

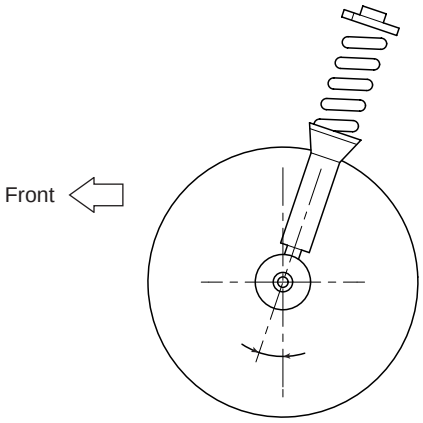
Camber : 0°±30´

CASTER

Caster is the tilting of the strut axis either forward or backward from vertical. A backward tilt is positive (+) and a forward tilt is negative (-).

Caster is pre-set at the factory and doesn't need to be adjusted. If the caster is not within the standard value, replace the bent or damaged parts.

Caster : to ground ; 4°00´ ± 30´ to body ; 4°30´



LHJF071A

NOTE

- *The worn loose or damaged parts of the front suspension assembly must be replaced prior to measuring front wheel alignment.*
- *Camber and caster are pre-set to the specified value at the factory and don't need to be adjusted.*
- *If the camber and caster are not within specifications, replace bent or damaged parts.*
- *The difference of left and right wheels about the camber and the caster must be within the range of 0° ± 30´.*

REAR WHEEL ALIGNMENT E2CADFD8

TOE-IN

Standard value Toe-in mm(in) : 2 ~ 6 (0.078 ~ 0.236)

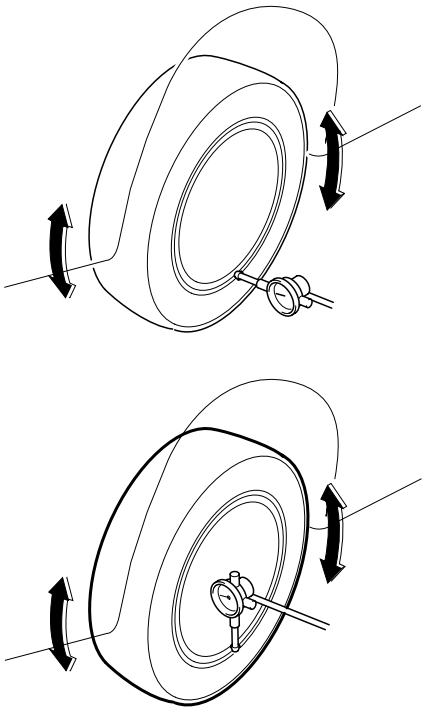
CAMBER

Standard value -1° ± 30´

WHEEL RUNOUT ED8F2FA1

1. Jack up the vehicle and support it with jack stands.
2. Measure the wheel runout with a dial indicator as illustrated.
3. Replace the wheel if the wheel runout exceeds the limit.

Limit		Radial	Axial
Runout mm(in)	Aluminium	0.3(0.012)	0.3(0.012)
	Steel	0.9(0.035)	1.4(0.055)



KHRE402A

WHEEL NUT TIGHTENING EFBEFF17

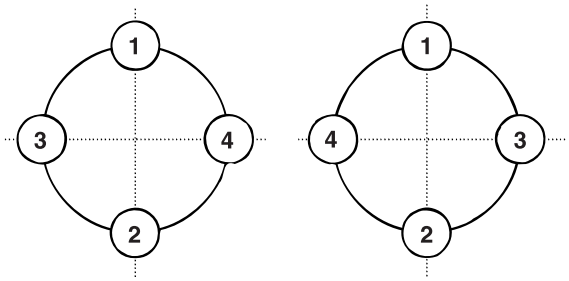
1. Tightening torque.

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

CAUTION

When using an impact gun, final tightening torque should be checked using a torque wrench.

2. Tightening order.
   Check the torque again after tightening the wheel nuts diagonally.



KXDSS51A

TIRE

TIRE WEAR EF60107E

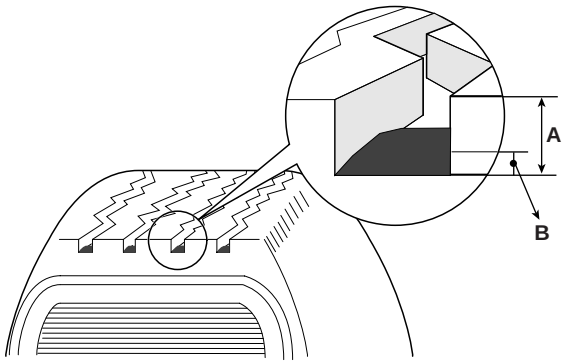
1. Measure the tread depth of the tires.

Tread depth of tire [Limit] : 1.6 mm (0.06 in)

2. If the remaining tread(A) depth is less than the limit, replace the tire.

NOTE

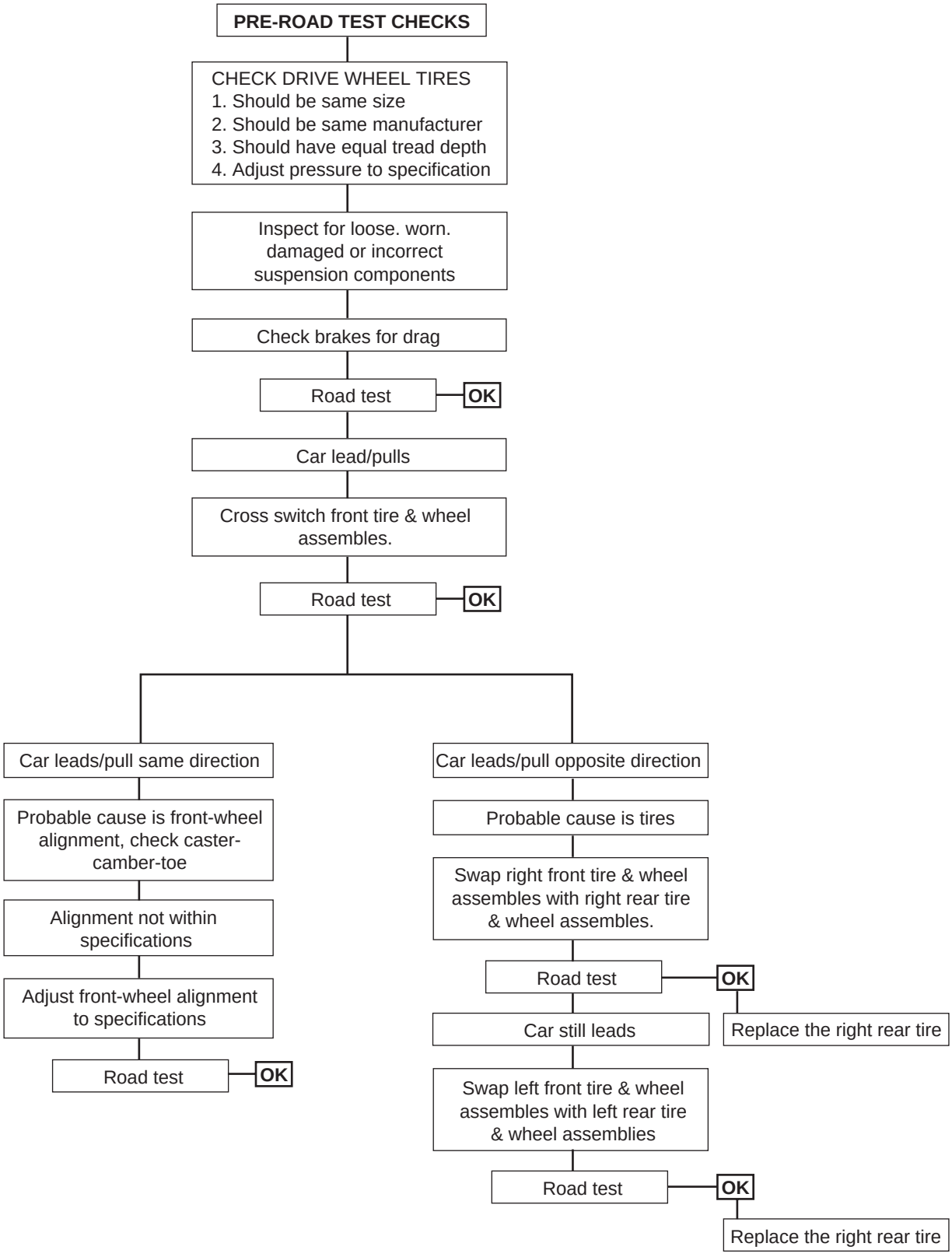
When the tread depth of the tires is less than 1.6 mm (0.06 in.), the wear indicators(B) will appear.



AHIE107I

TIRE ROTATION E8FA6729

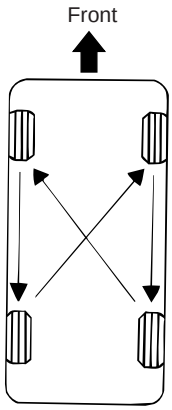
LEAD/PULL CORRECTION CHART



EHKE323A

ROTATION

Rotate the tires in the pattern illustrated.



LHIE107J

Steering System

GENERAL

STEERING COLUMN AND SHAFT
STEERING COLUMN / SHAFT

MECHANICAL POWER STEERING SYSTEM
POWER STEERING GEAR BOX
POWER STEERING HOSES
POWER STEERING OIL PUMP

GENERAL

SPECIFICATIONS ED68DD32

Items	Specifications
Steering gear type	Rack and pinion
Rack stroke	Manual : 144 ± 1 mm Power : 142 ± 1 mm (175 tire), 138 ± 1 mm (others)
Power steering pump type	Vane type
Oil pump displacement	9.6 cm^3/rev. MAX. (0.59 in^3/rev. MAX.)

SERVICE STANDARD

Items	Specifications	
Steering wheel free play	0 ~ 30 mm (0 ~ 1.1 in)	
Steering angle Inner wheel Outer wheel	Manual	Power
	38° 58′ ± 1° 30′ 32° 38′	39° 57′ (38° 17′) ± 1° 30′ 32° 54′ (31° 57′)
Stationary steering effort	34N (3.5 kg, 7.7 lb) or less	
Belt deflection [under 100N (10kg, 22lb) force]	7 ~ 10 mm (0.27 ~ 0.39 in)	
Oil pump relief pressure MPa (kg/㎠, psi)	6.6 ~ 7.3 (68 ~ 75, 967 ~ 1066)	
Tie rod swing resistance Nm (kgf·m, lb-ft)	2 ~ 5 (0.2 ~ 0.5, 1.4 ~ 3.6)	
Tie rod end ball joint starting torque Nm (kgf·m, lb-ft)	0.5 ~ 2.5 (0.05 ~ 0.25, 0.36 ~ 1.81)	

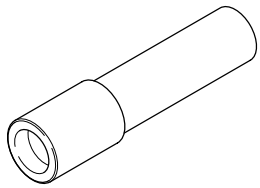
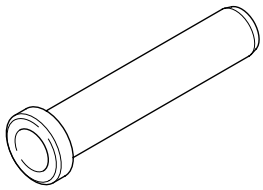
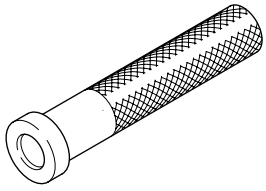
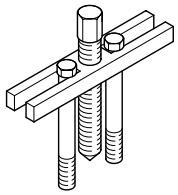
TIGHTENING TORQUE EF26BCDC

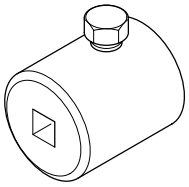
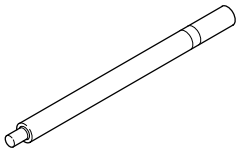
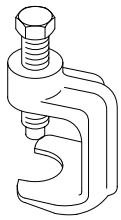
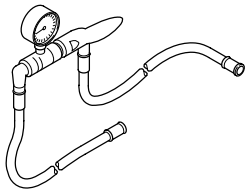
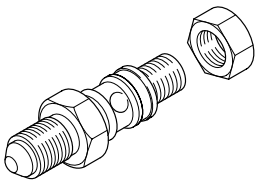
Items	Nm	kgf·m	lb-ft
Steering wheel and shaft (with Airbag)	35 ~ 45	3.5 ~ 4.5	26 ~ 33
Steering column and shaft assembly mounting bracket	13 ~ 18	1.3 ~ 1.8	9 ~ 13
Steering shaft and joint	15 ~ 20	1.5 ~ 2.0	11 ~ 14
Joint to gear box	13 ~ 18	1.3 ~ 1.8	9 ~ 13
Gear box mounting bolt	90 ~ 110	9 ~ 11	65 ~ 79
Tie rod end lock nut	50 ~ 55	5 ~ 5.5	36 ~ 40
Tie rod end ball joint slotted nut	16 ~ 34	1.6 ~ 3.4	12 ~ 25
Yoke plug lock nut	50 ~ 60	5 ~ 6	36 ~ 51
Pressure and return tube to gear box	12 ~ 18	1.2 ~ 1.8	9 ~ 13
Feed tube	12 ~ 18	1.2 ~ 1.8	9 ~ 13
Oil pump to mounting bracket	20 ~ 27	2.0 ~ 2.7	14 ~ 19
Oil pump bracket to engine	20 ~ 27	2.0 ~ 2.7	14 ~ 19
Pressure hose to oil pump	55 ~ 65	5.5 ~ 6.5	40 ~ 47

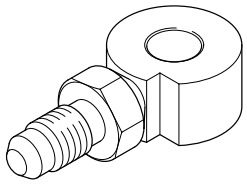
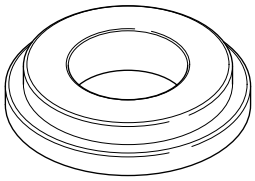
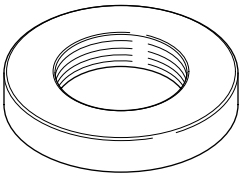
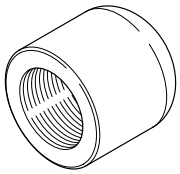
LUBRICANTS

Items	Recommended lubricant	Quantity
Ball joint of tie rod end	SHOWA SUNLIGHT MB-2 OR equivalent	4g
Contact area of gear box bellows & tie rod	SILICON GREASE	As required
Power steering fluid	PSF-III	0.8 liter (0.84 qts.)

SPECIAL TOOLS E92D8AA8

Tool (Number and name)	Illustration	Use
09222-32100 Valve stem oil seal installer	 APJF001L	Installing the pinion gear bearing
09432-21600 Bearing installer	 APJF001K	Installing the pinion gear bearing
09434-14200 Counter shaft bearing installer	 APJF001M	Installing the gear box oil seal.
09561-11002 Steering wheel puller	 APJF001F	Removing the steering wheel.

Tool (Number and name)	Illustration	Use
09565-11100 Preload socket	 APJF001A	Measuring the pinion shaft preload.
09555-21000 Bar	 APJF001H	Removing & installing the oil seal of the rack housing.
09568-34000 Ball joint puller	 KPRE103I	Separating the tie rod end ball joint.
09572-21000 Oil pressure gauge	 APJF001C	Measuring the power steering oil pressure (use with 09572-21200, 09572-22100)
09572-21200 Oil pressure gauge adapter	 APJF001E	Measuring the power steering oil pressure (use with 09572-21000, 09572-22100)

Tool (Number and name)	Illustration	Use
09572-22100 Oil pressure gauge adapter	 APJF001D	Measuring the power steering oil pressure (use with 09572-21000, 09572-21200)
09573-21000 Oil seal installer gauge	 APJF001I	Installing the oil seal of the rack housing
09573-21100 Oil seal installer	 APJF001J	Installing the oil seal of the rack housing
09573-21200 Oil seal guide	 APJF001G	Removing & installing the oil seal of the rack housing

TROUBLESHOOTING EE6B7A1A

Symptom	Probable cause	Remedy
Excessive play in steering	Loose yoke plug	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie rod end	Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	V-belt slippage	Readjust
	Damaged V-belt	Replace
	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Twisted or damaged hoses	Correct the routing or replace
	Insufficient oil pump pressure	Repair or replace the oil pump
	Sticky flow control valve	Replace
	Excessive internal oil pump leakage	Replace the damaged parts
	Excessive oil leaks from rack and pinion in gear box	Replace the damaged parts
	Distorted or damaged gear box or valve body seals	Replace
Steering wheel does not return properly	Excessive turning resistance of tierod end	Replace
	Yoke plug excessively tight	Adjust
	Tie rod and/or ball joint cannot turn smoothly	Replace
	Loose mounting of gear box mounting bracket	Retighten
	Worn steering shaft joint and/or body grommet	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace
	Twisted or damaged hoses	Reposition or replace
	Damaged oil pressure control valve	Replace
	Damaged oil pump input shaft bearing	Replace
Noise	**Hissing Noise in Steering Gear** There is some noise with all power steering systems. One of the most common is a hissing sound when the steering wheel is turned and the car is not moving. This noise will be most evident when turning the wheel while the brakes are being applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and is not always a solution for the condition.	
Rattling or chucking noise in the rack and pinion	Interference with hoses from vehicle body	Reposition
	Loose gear box bracket	Retighten
	Loose tie rod end and/or ball joint	Retighten
	Worn tie rod and/or ball joint	Replace
Noise in the oil pump	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Loose pump mounting bolts	Retighten

NOTE

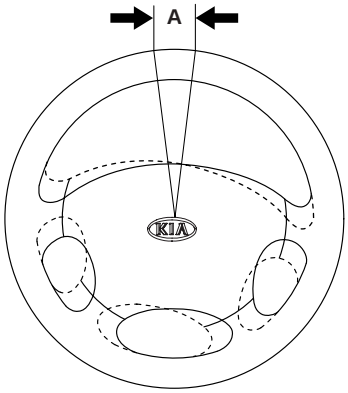
A slight "grinding noise" may be heard immediately after the engine is started in extremely cold weather conditions (below - 20°C). This is due to power steering fluid characteristics in extreme cold conditions and is not an indication of a malfunction.

SERVICE ADJUSTMENT PROCEDURE E276C4FC

CHECKING STEERING WHEEL FREE PLAY

1. Start the engine with the steering wheel in the straight ahead position, apply a force of 5 N (1.1 lb) to the steering wheel in the peripheral direction.
2. Measure the play at the circumference of the steering wheel.

Standard value [A]
Steering wheel free play : 0 ~ 30 mm (0 ~ 1.1 in)



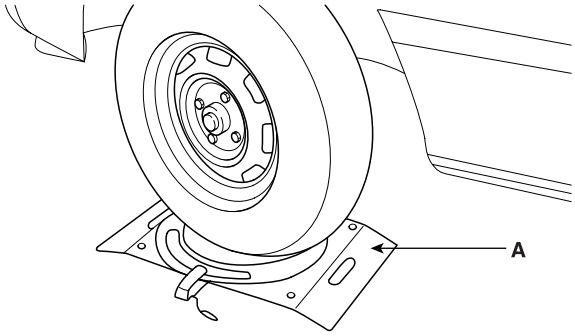
LPJF001A

3. If the play exceeds the standard value, inspect the connection between the steering shaft and tie rod ends.

CHECKING STEERING ANGLE

1. Place the front wheel on a turning radius gauge and measure the steering angle.

Standard value
Steering angle : See page ST-2

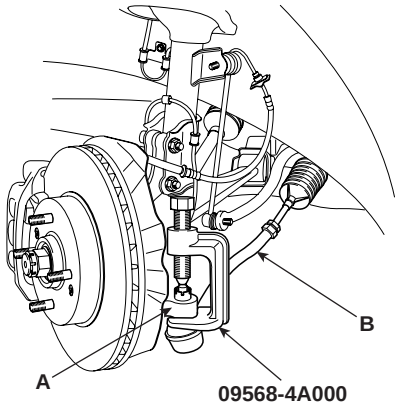


EPKE001A

2. If the measured value is not within the standard value, adjust the linkage.

CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE

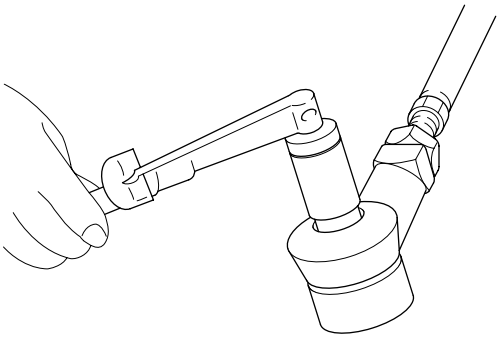
1. Disconnect the tie rod(A) and knuckle(B) by using the special tool (09568-4A000).



LPJF005C

2. Shake the ball joint stud several times to check for looseness.
3. Mount the nuts on the ball joint, and then measure the ball joint starting torque.

Standard value
0.5 ~ 2.5 Nm (0.05 ~ 0.25 kgf·m, 0.36 ~ 1.80 lb-ft)



EPA9003A

4. If the starting torque exceeds the upper limit of the standard value, replace the tie rod end.

5. Even if the starting torque is below the lower limit of the standard value, check the play of the ball joint and replace if necessary.

CHECKING STATIONARY STEERING EFFORT

1. Place the vehicle on a level surface and place the steering wheel in the straight ahead position.

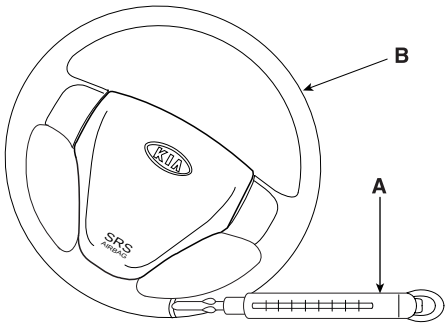
2. Increase the engine speed to 1000 ± 100 rpm.

   NOTE

   After checking, reset the engine speed to the standard value (idling speed).

3. Measure the turning force with a spring scale(A) by turning the steering wheel(B) clockwise and counter-clockwise one and a quarter turns.

Standard value
Stationary steering effort :
34 N (3.5 kg, 7.7 lbs) or less



APJF001B

4. Check that there is no sudden change of force while turning the steering wheel.

5. If the stationary steering effort is excessive, check and adjust the following points.

   1) Damage or cracks on the dust cover of the lower arm ball joint and tie rod end.

   2) Pinion preload of the steering gear box and starting torque of the tie rod end ball joint.

   3) Starting torque of the ball joint.

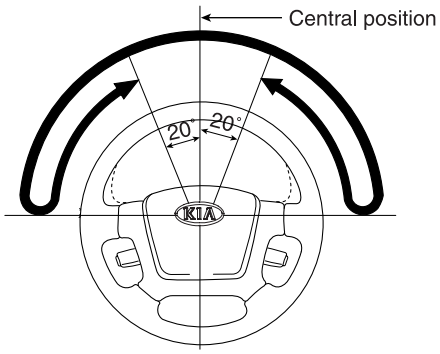
CHECKING STEERING WHEEL RETURN

1. The force required to turn and return the steering wheel should be the same for both left and right in case of moderate or sharp turns.

2. When the steering wheel is turned 90° and held for a couple of seconds while the vehicle is being driven at 35kph, the steering wheel should return to within 20° from the neutral position when it is released.

   NOTE

   If the steering wheel is turned very quickly, steering may be momentarily difficult. This is not a malfunction because the oil pump output will be somewhat decreased.

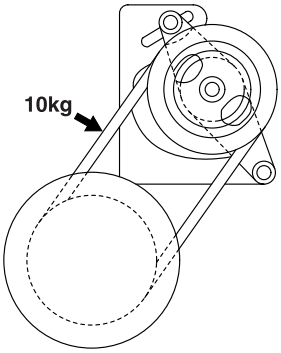


BPGE001A

CHECKING POWER STEERING BELT TENSION

1. Press the V belt, applying a pressure of 98N (10kg, 22lb) at the specified point and measure the deflection to confirm that it is within the standard value.

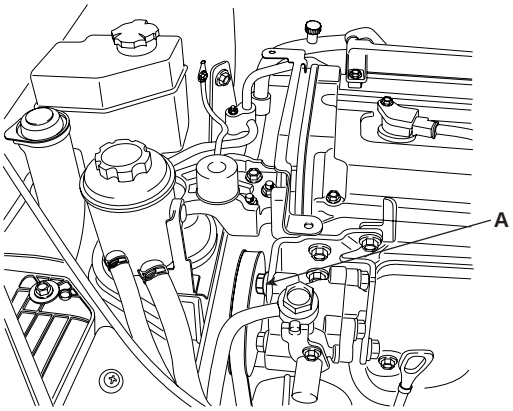
Standard value
V belt deflection : 7 ~ 10 mm (0.27 ~ 0.39 in)



EPKE085A

2. If the belt deflection is beyond the standard value, adjust the belt tension as follows.

   1) Loosen the bolt(A) adjusting the power steering V belt tension.



APJF012A

   2) Put a bar or equivalent, between the bracket and the oil pump and adjust the tension so that the belt deflection is within the standard value.

   3) Tighten the bolt adjusting the power steering V belt tension.

   4) Check the belt deflection and adjust it again if necessary.

CAUTION

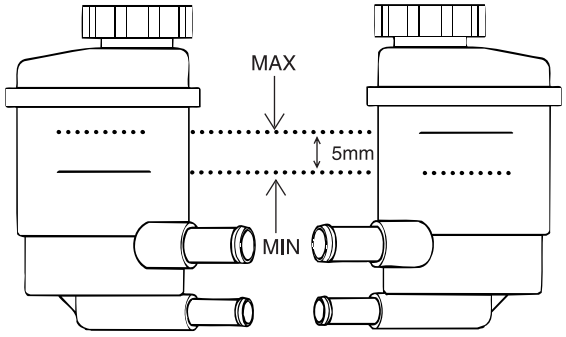
After turning the V belt in the normal rotation direction more than once, recheck the belt deflection.

CHECKING POWER STEERING FLUID LEVEL

1. Position the vehicle on a surface level.
2. Start the engine. With the vehicle kept stationary, turn the steering wheel several times continuously to raise the fluid temperature to 50 - 60°C(122 to 140°F).
3. With the engine at idle, turn the steering wheel fully clockwise and counterclockwise several times.
4. Make sure there is no foaming or cloudiness in the reservoir fluid.
5. Stop the engine to check for any difference in fluid level between a stationary and a running engine.

NOTE

1. If the fluid level varies 5 mm (0.2 in) or more, bleed the system again.
2. If the fluid level suddenly rises after stopping the engine, further bleeding is required.
3. Incomplete bleeding will produce a chattering sound in the pump and noise in the flow control valve, and lead to decreased durability of the pump.



KPKA008A

REPLACING POWER STEERING FLUID

1. Jack up the front wheels of the car and support them with jackstands.
2. Disconnect the return hose from the oil reservoir and plug the oil reservoir.
3. Connect a hose to the disconnected return hose, and drain the oil into a container.
4. Disconnect the high tension cables and ignition coils.While operating the starter motor intermittently, turn the steering wheel all the way to the left and then to the right several times to drain the fluid.
5. Connect the return hose and fix it with a clip.
6. Fill the power steering fluid reservoir with the specified fluid.

PSF-III : 0.8 lit. (0.84 gts.)

7. Start the engine.
   Check for fluid leaks from the hose, then stop the engine.
8. Pour the fluid into the bottom of the oil filter in the power steering fluid reservoir.
9. Bleed the air.

AIR BLEEDING

1. Fill the power steering fluid reservoir up to the "MAX" position with specified fluid.
2. Jack up the front wheels.
3. Disconnect the ignition coil high tension cable, and then, while operating the starter motor intermittently (for 15 to 20 seconds), turn the steering wheel all the way to the left and then to the right five or six times.

   NOTE

   1. *When bleeding fluid, replenish with the fluid so that the level does not fall below the bottom of the filter.*
   2. *If air bleeding is done while the vehicle is idling, the air will be broken up and absorbed into the fluid. Be sure to do the bleeding only while cranking.*

4. Connect the high tension cable, and then start the engine (idling).
5. Turn the steering wheel to the left and then to the right, until there are no air bubbles in the oil reservoir.

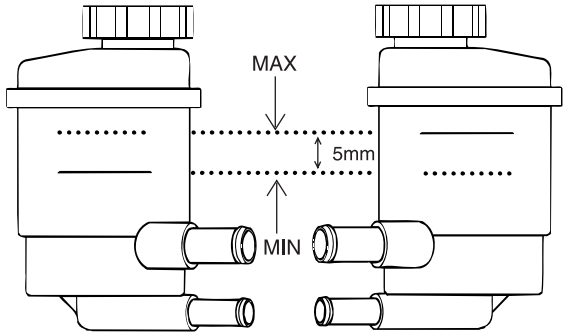
   NOTE

   Do not hold the steering wheel turned all the way to either side for more than ten seconds.

6. Confirm that the fluid is not milky and that the level is between "MAX" and "MIN" mark on the reservoir.
7. Check that there is a little change in the fluid level when the steering wheel is turned left and right.

   NOTE

   1. *If the fluid level varies 5mm (0.2 in.) or more, bleed the air in the system again.*
   2. *If the fluid level suddenly rises after stopping the engine, further bleeding is required.*
   3. *Incomplete bleeding will produce a chattering sound in the pump and noise in the flow control valve, and lead to decreased durability of the pump.*



KPKA008A

OIL PUMP PRESSURE TEST

1. Disconnect the pressure hose from the pump. Connect the special tool between the pump and the pressure hose as illustrated.

2. Bleed the air, and then start the engine and turn the steering wheel several times, measure the fluid temperature by Temperature gauge so that the fluid temperature can rise to approximately 50°C (122°F).

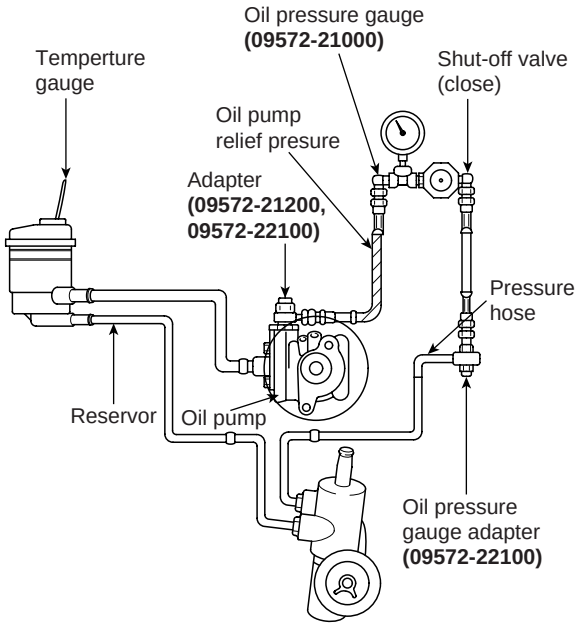
3. Increase the engine speed to 1,000 rpm.

4. Close the shut-off valve of the special tool and measure the fluid pressure to confirm that it is within the standard value range.

Standard value
Oil pump pressure
Relief pressure :
8.3 ~ 8.8 MPa (85 ~ 90 kg·cm², 1209 ~ 1280 psi)

CAUTION

Do not keep the shut-off valve on the pressure gauge closed for more than ten seconds.



EPRF002B

5. Remove the special tools, and tighten the pressure hose against the oil pump using the specified torque.

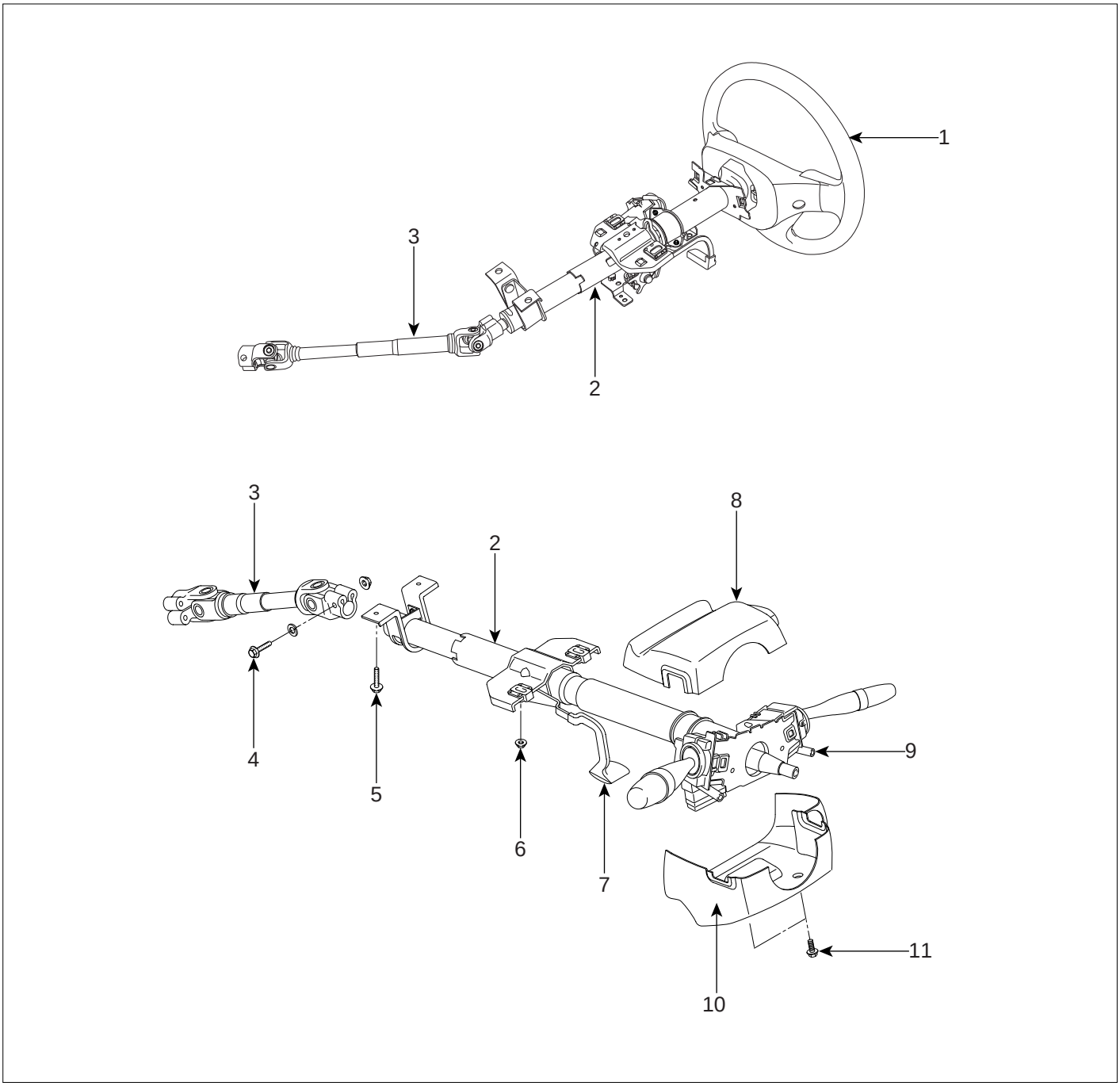
Tightening torque
55 ~ 65 Nm (5.5 ~ 6.5 kgf·m, 40 ~ 47 lb-ft)

6. Bleed the air in the system.

STEERING COLUMN AND SHAFT

STEERING COLUMN / SHAFT

COMPONENTS E5BB3EDA

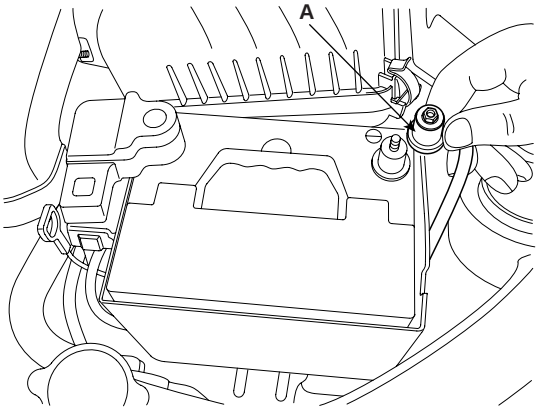


1. Steering wheel
2. Steering column
3. Universal joint assembly
4. Universal joint mounting bolt
5. Steering column shaft mounting bolt
6. Steering column shaft mounting nut
7. Tilt lever
8. Steering column upper shroud
9. Multifunction switch
10. Steering column lower shroud
11. Steering column lower shroud mounting bolt

LPJF002A

REMOVAL EA75A205

1. Disconnect the negative (-) terminal(A) from the battery.

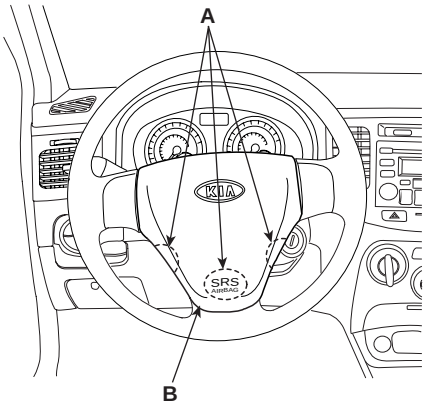


APIE102B

2. Remove the bolts (A) in the illustration, and then remove the driver's airbag module(B).

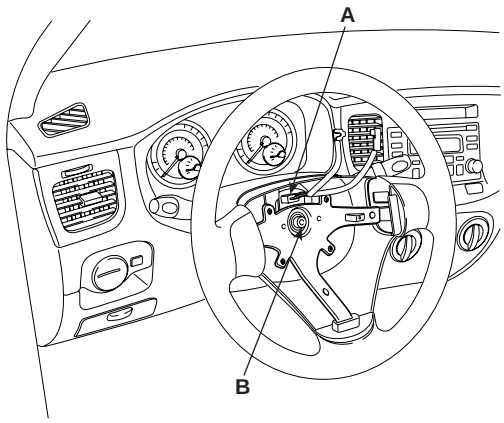
NOTE

For the vehicles not equipped with SRS airbag, remove the horn cover assembly.



APJF003A

3. Remove the connector(A) and steering wheel lock nut(B).

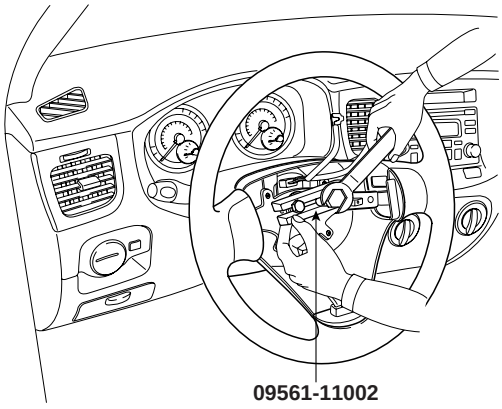


APJF003B

4. After aligning the marks on the steering shaft and wheel, remove the steering wheel using the special tool (09561-11002).

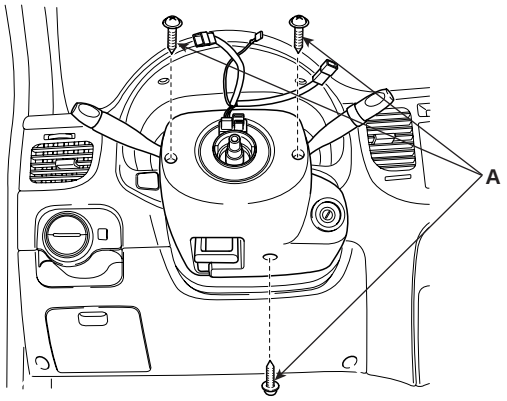
NOTE

Do not hammer on the steering wheel to remove it: it may damage the steering column.



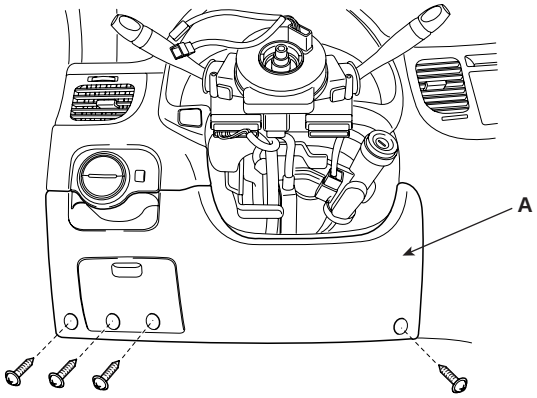
APJF014A

5. Remove the steering column upper and lower shrouds after remaining the three bolts(A).



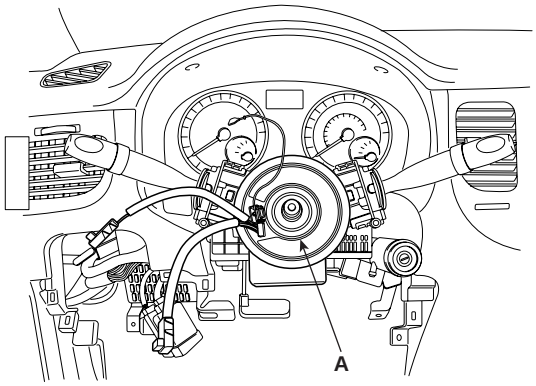
APJF003C

6. Remove the lower crash pad(A) after loosening the four bolts in the illustration.



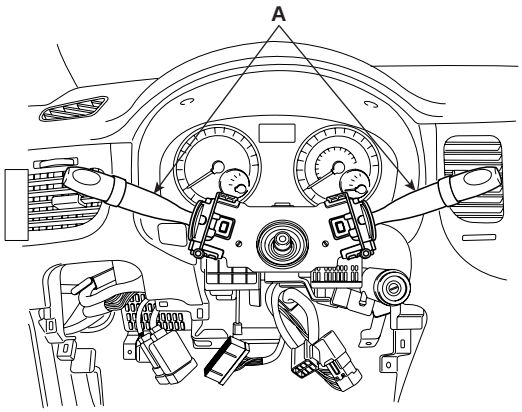
APJF018A

7. Remove the connectors of the multifunction switch(A).



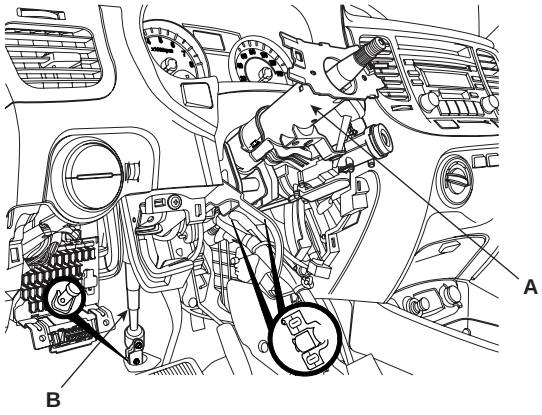
APJF003D

8. Remove the multifunction switch assembly(A).



APJF150A

9. Remove the five bolts connecting the steering column shaft(A) and the universal joint(B) as shown in the illustration.



APJF003E

INSPECTION EF95B5CD

1. Check the steering column shaft for damage and deformation.
2. Check connections for play, damage and smooth operation.
3. Check the ball joint bearing for wear and damage.

INSTALLATION ECD7205A

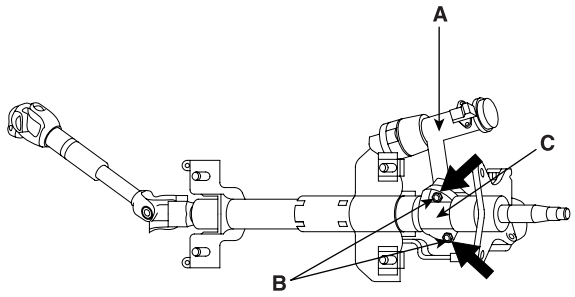
1. Installation is reverse of removal.

Tightening torque Nm(kgf·m, lb-ft) :
Steering wheel locking nut : 35 ~ 45 (3.5 ~ 4.5, 25 ~ 32)
Mountinf bolts and nuts : 13 ~ 18 (1.3 ~ 1.8, 9.4 ~ 13)

DISASSEMBLY AND REASSEMBLY EF67B4E5

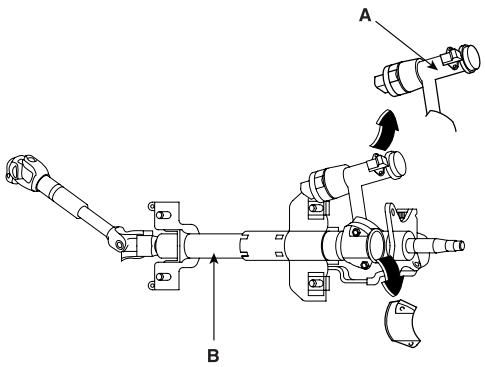
KEY LOCK ASSEMBLY

1. If it is necessary to remove the key lock assembly(A), use a punch to make a groove on the head of the special bolt(B), and then use a screwdriver to remove the key lock assembly mounting bracket(C).



EPKE021A

2. Disassemble the key lock assembly(A) from the steering column and shaft assembly(B).

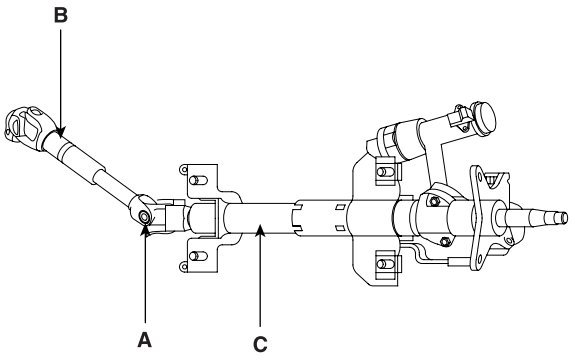


EPKE022A

3. Reassembly is reverse of disassembly.

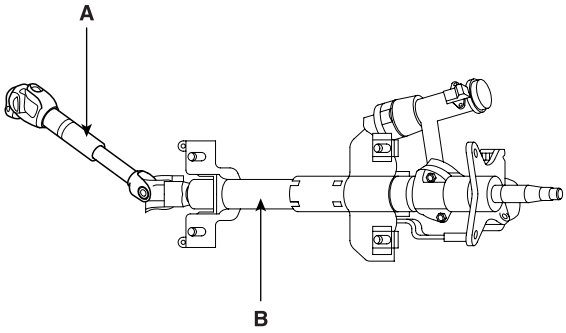
UNIVERSAL JOINT ASSEMBLY

1. Remove the bolt(A) connecting the universal joint assembly(B) and the steering column and shaft assembly(C).



EPKE023A

2. Remove the universal joint assembly(A) from the steering column and shaft assembly(B).



EPKE024A

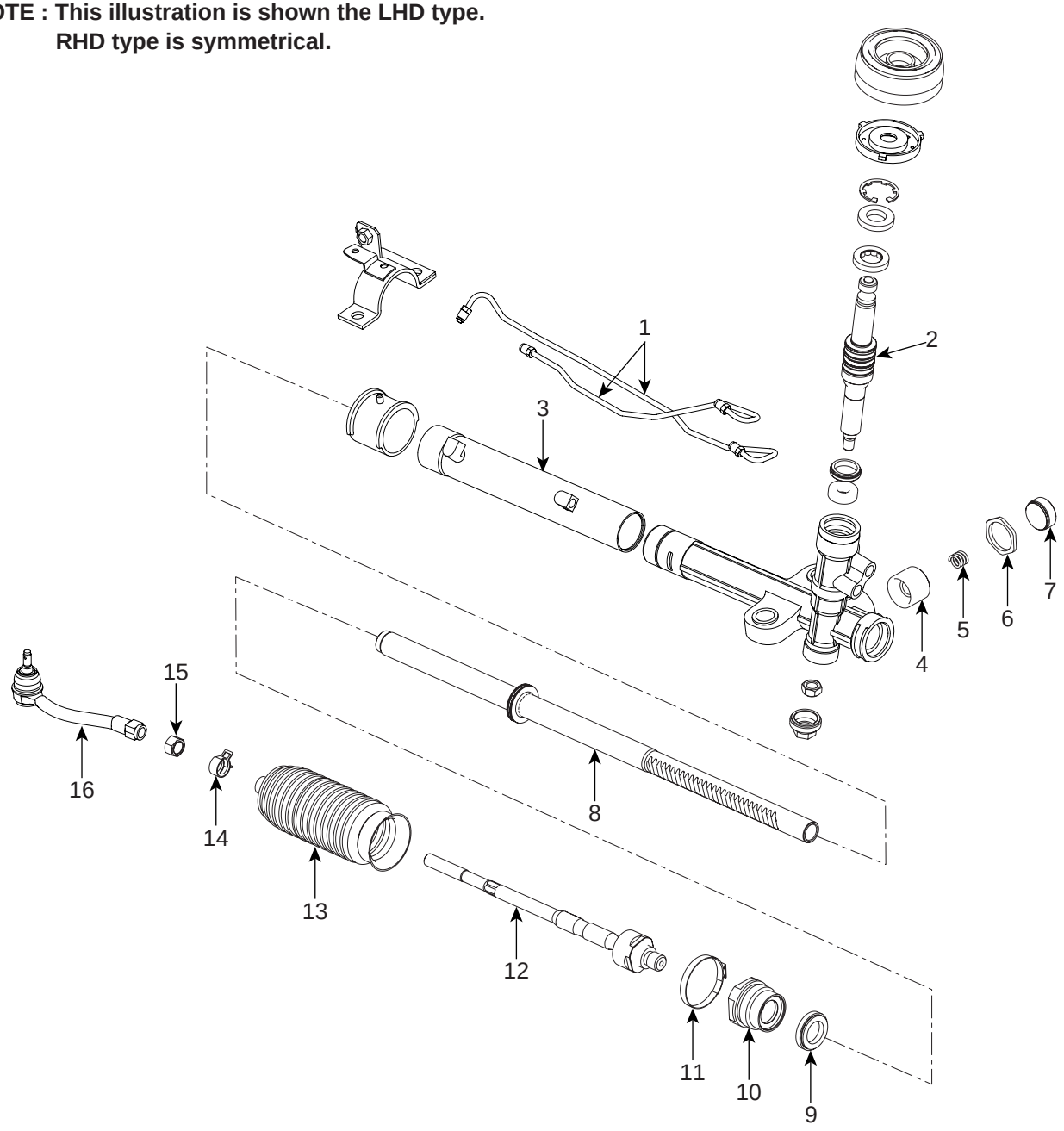
3. Reassembly is reverse of disassembly.

MECHANICAL POWER STEERING SYSTEM

POWER STEERING GEAR BOX

COMPONENTS E054EDDB

NOTE : This illustration is shown the LHD type.
RHD type is symmetrical.

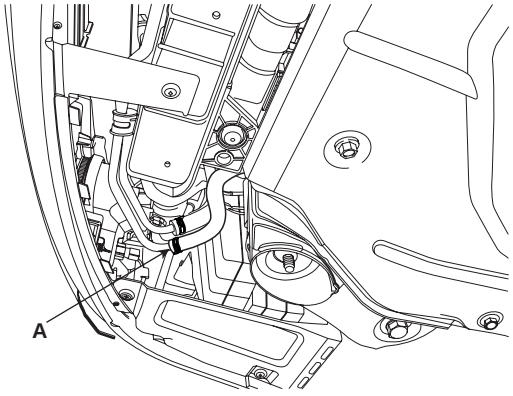


1. Feed tube
2. Pinion valve assembly
3. Rack housing
4. Rack support yoke
5. Rack support spring
6. Lock nut
7. Yoke plug
8. Rack
9. Oil seal
10. Rack stopper
11. Bellows band
12. Tie rod
13. Bellows
14. Bellows clip
15. Lock nut
16. Tie rod end

LPJF004B

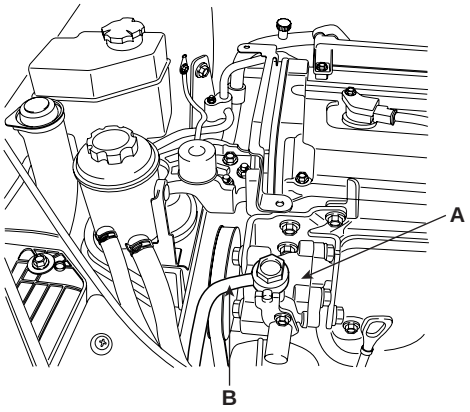
REMOVAL EF5328E9

1. Drain the power steering fluid by disconnecting the return hose(A).



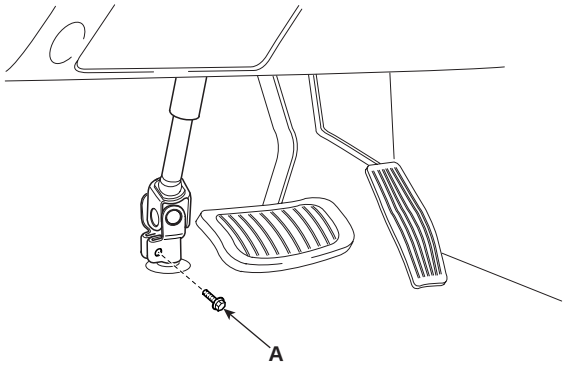
LPJF031B

2. Remove the pressure pipe(B) from the power steering oil pump(A).



APJF005A

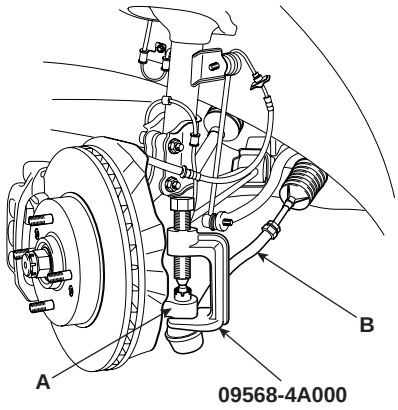
3. Remove the universal joint assembly mounting bolt(A).



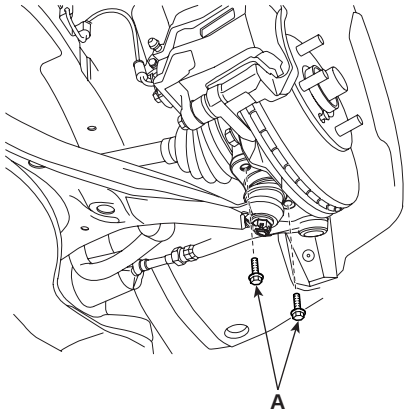
LPJF005B

4. Remove the both sides of the front tires, while lifting the vehicle.

5. Remove the lower arm mounting bolts(A) and the tie rod end(B) from the knuckle.

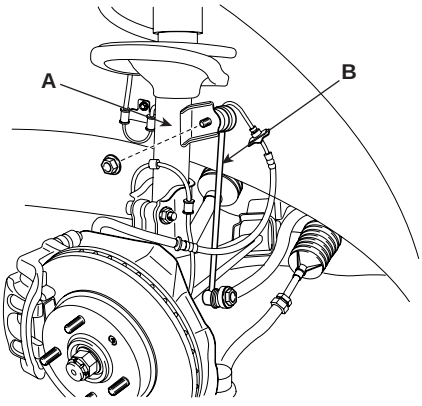


LPJF005C



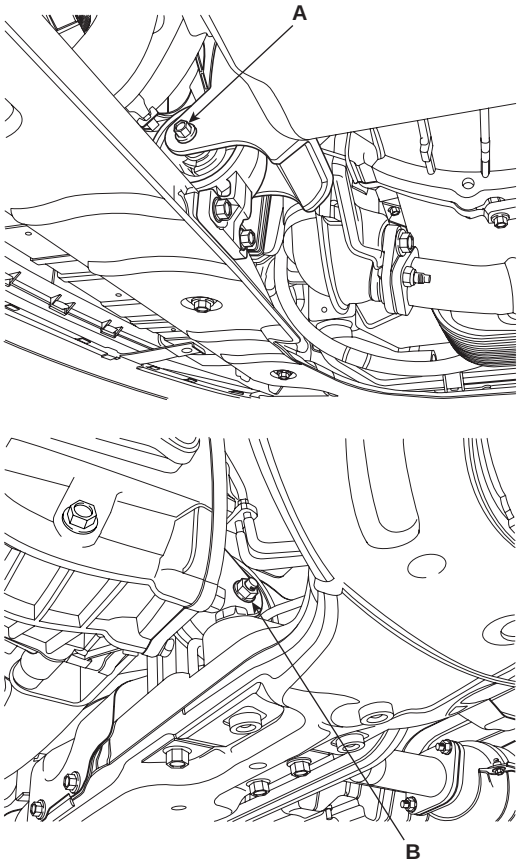
AHJF021A

6. Remove the stabilizer link(B) from the strut assembly(A).



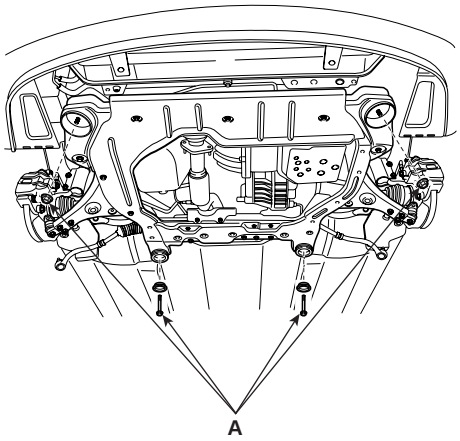
LPJF005E

7. Repeat the procedure of 4, 5 on the other side.
8. Remove the engine mounting bolts(A,B).



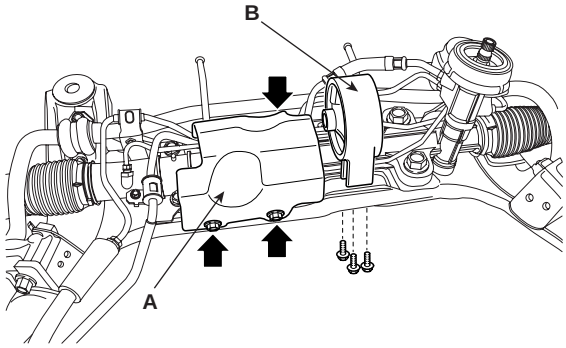
APJF005J

9. Remove the front subframe by removing the four mounting bolts and nuts (A).



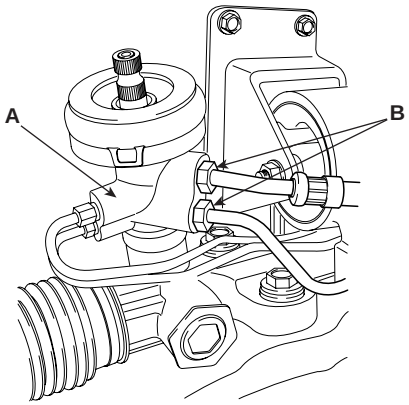
APJF005F

10. Remove the heat cover(A) and the engine mounting bracket(B).



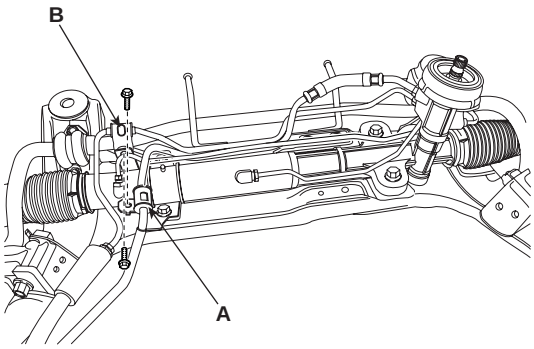
APJF005G

11. Remove the both pressure and return tubes from the valve body housing(A).



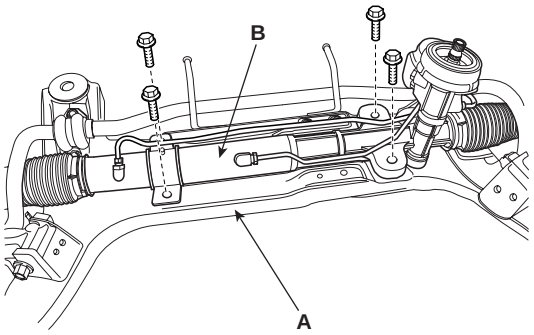
APJF005H

12. Remove the both pressure and return tubes brackets(A,B).



APJF005K

13. Remove the power steering gear box from the front subframe(A).



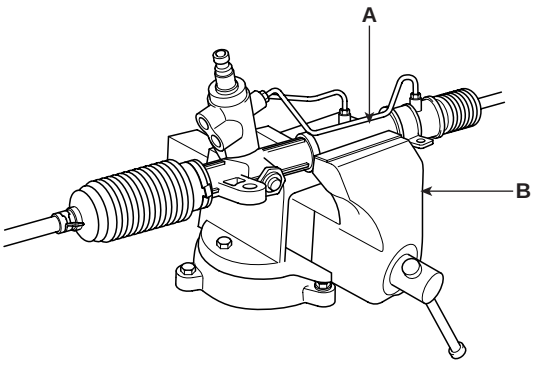
APJF005I

INSPECTION AND ADJUSTMENT BEFORE DISASSEMBLY E1E468BD

Fix a brass plate or aluminum plate for protection to the jaws of a vise and mount the gear box(A) in a vise(B).

CAUTION

When mounting the gear box in a vise, let the installation section of it be fixed to the jaws. If other section is fixed the gear box may be damaged.



LPJF006A

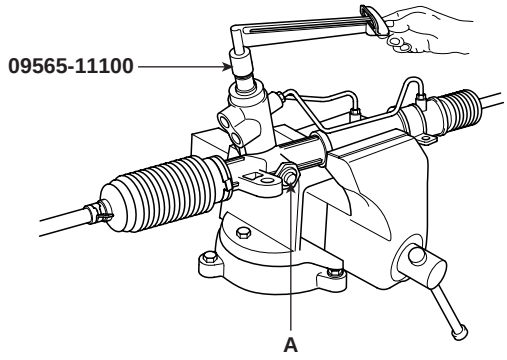
TOTAL PINION PRELOAD

1. Rotate the pinion gear for approximately 4 to 6 seconds for one rotation to measure the total pinion preload.

Standard value
Total pinion preload :
0.6 ~ 1.3 N·m (0.06 ~ 0.13 kgf·m, 0.4 ~ 1.0 lb-ft)

NOTE

Measure the pinion preload through the entire stroke of the rack.



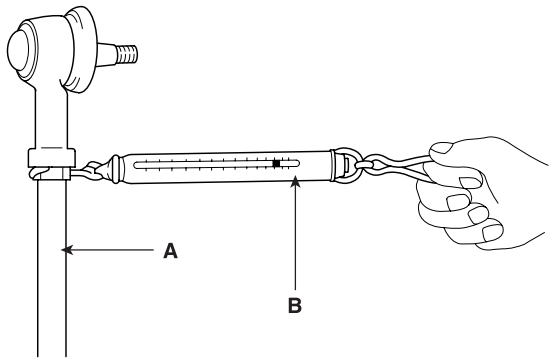
LPJF006B

2. If the measured value is out of specifications, first adjust the yoke plug(A), then recheck the total pinion preload.
3. If you adjust the yoke plug but do not obtain the total pinion preload, check or replace the yoke plug components.

TIE ROD SWING RESISTANCE

1. Rotate the tie rod severely ten times.
2. Measure the tie rod(A) swing resistance with a spring scale(B).

Standard value
Total rod swing resistance :
2 ~ 5 N·m (0.2 ~ 0.5 kgf·m, 1.4 ~ 3.6 lb-ft)



EPKE200A

3. If the measured value exceeds the standard value, replace the tie rod assembly.

CAUTION

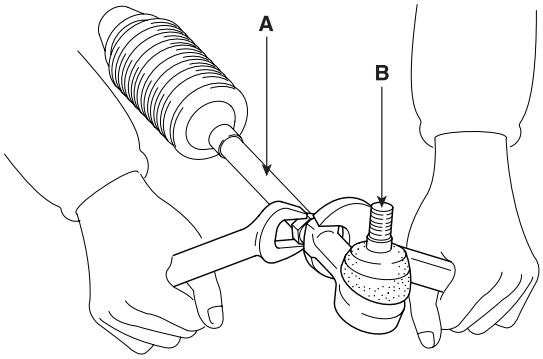
Even if the measured value is below the standard value, the tie rod that swings smoothly without excessive play may be used. If the measured value is below 0.044 Nm (0.44kg·cm, 0.03 lb·ft) replace the tie rod.

BELLOWS INSPECTION

1. Inspect the bellows for damage or deterioration.
2. Make sure the bellows are secured in the correct position.
3. If the bellows are defective, replace them with new ones.

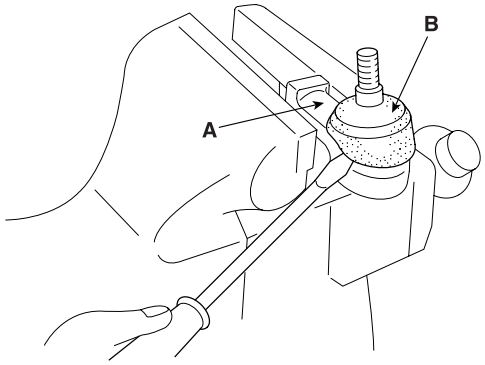
DISASSEMBLY ED9BB2EA

1. Remove the tie rod end(B) from the tie rod(A).



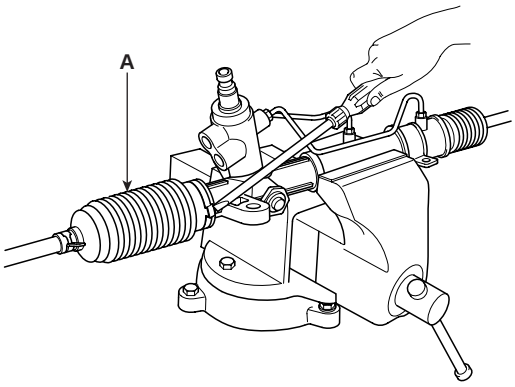
EPKE013F

2. After mounting the tie rod end(A) in a vise, remove the dust cover(B) from the ball joint.



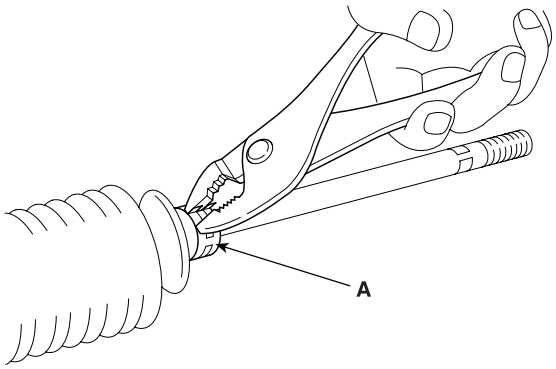
EPKE013G

3. Remove the bellows band(A).



LPJF006F

4. Remove the bellows clip(A).



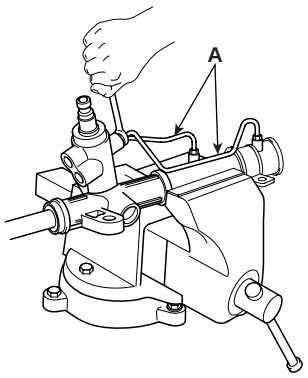
EPKE013I

5. Pull the bellows out toward the tie rod.

NOTE

Check for rust on the rack when the bellows are replaced.

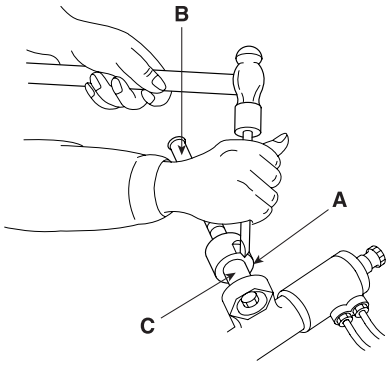
6. Remove the feed tube(A) from the rack housing.



LPJF006H

7. While moving the rack slowly, drain the fluid from the rack housing.

8. Unstake the tab washer(A) which fixes the tie rod(B) and rack(C) with a chisel.

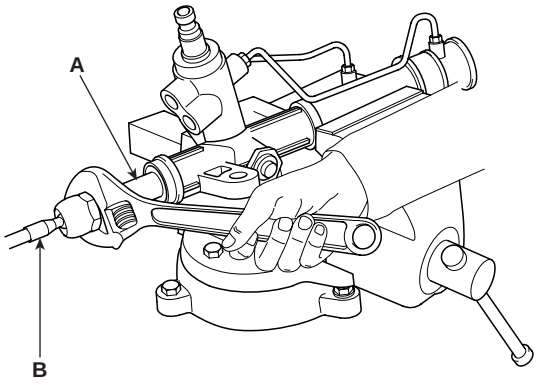


EPKE037A

9. Remove the tie rod(B) from the rack(A).

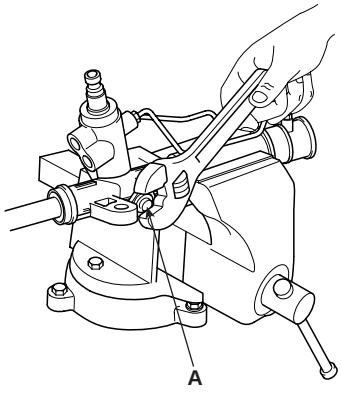
CAUTION

Remove the tie rod(B) from the rack(A), taking care not to twist the rack.



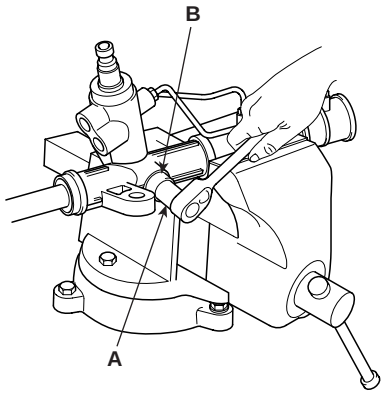
LPJF006J

10. Remove the yoke plug locking nut(A).



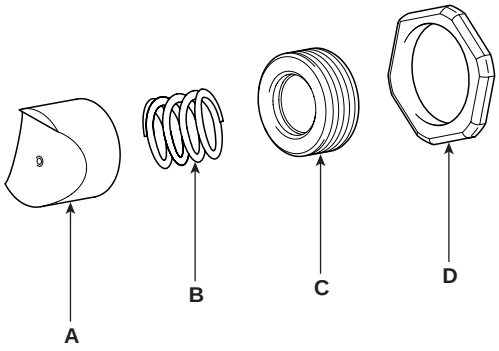
LPJF006K

11. Remove the yoke plug(B) with a 14mm socket(A).



LPJF006L

12. Remove the lock nut(D), yoke plug(C), rack support spring(B)and rack support yoke(A) from the gear box.

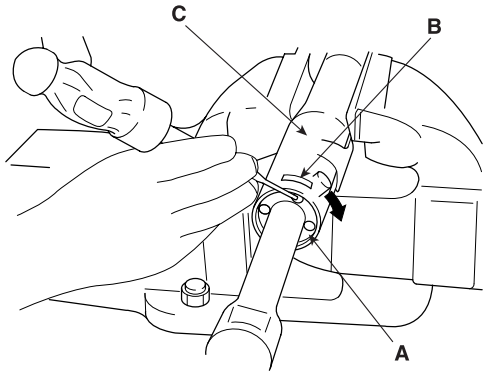


LPJF007H

13. 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

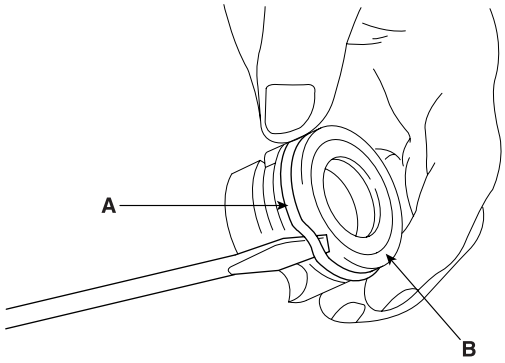
Be careful not to damage the rack.



EPKE013Q

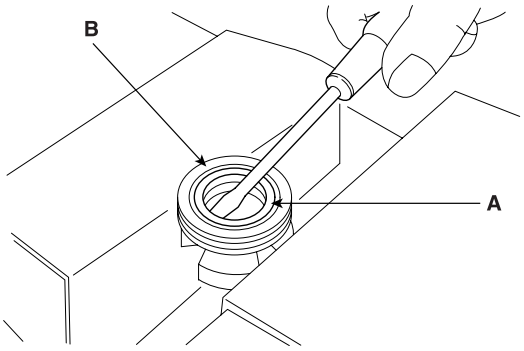
14. Remove the rack bushing and rack from the rack housing.

15. Remove the O-ring(A) from the rack bushing(B).



EPKE013T

16. Remove the oil seal(B) from the rack bushing(A).



EPKE013U

17. Remove the valve body from the valve body housing with a soft hammer.

18. Using the special tool, remove the oil seal and ball bearing from the valve body housing.

19. Remove the oil seal and O-ring from the rack housing.

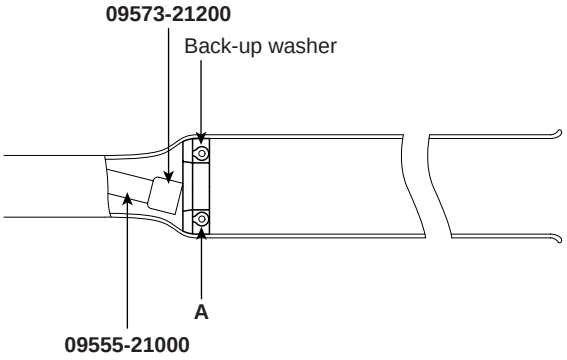
CAUTION

Be careful not to damage the pinion valve cylinder inside of the rack housing.

20. Using the special tool(09573-21200, 09555-21000), remove the oil seal(A) from the rack housing.

CAUTION

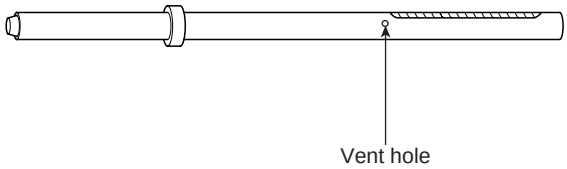
Be careful not to damage the rack cylinder inside of the rack housing.



LPJF210B

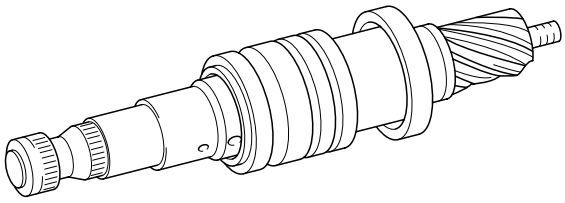
INSPECTION E94ACAA8

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



LPJF006C

2. 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



APJF013Z

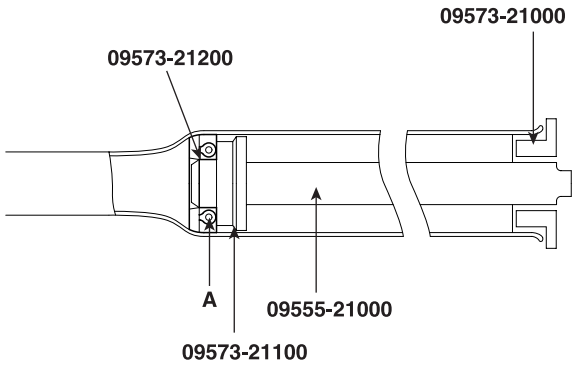
3. Bearing
   1) Check for seizure or abnormal noise during a bearing rotation
   2) Check for excessive play
   3) Check for missing needle bearing rollers
4. Others
   1) Check for damage of the rack housing cylinder bore
   2) Check for boot damage, cracking or aging

REASSEMBLY EE20E052

1. Apply the specified fluid to the entire surface of the rack oil seal.

Recommended fluid : PSF-III

2. Install the backup washer and oil seal(A) to the specified position in the rack housing.

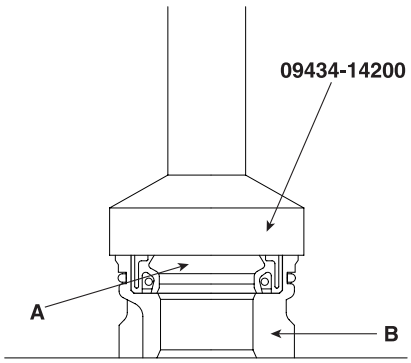


APGE007F

3. Apply the specified fluid to the entire surface of the rack bushing oil seal.

Recommended fluid : PSF-III

4. Install the oil seal(A) in the rack bushing(B).



APHE007B

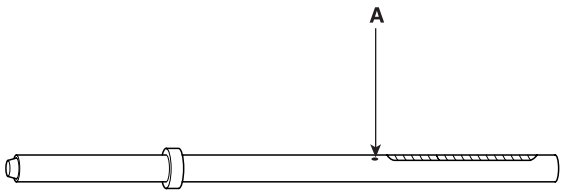
5. Apply the specified fluid to the entire surface of the O-ring and install it in the rack bushing.

6. Apply the specified grease to the rack teeth.

Recommended grease
Multipurpose grease SAE J310a NLGI No.2

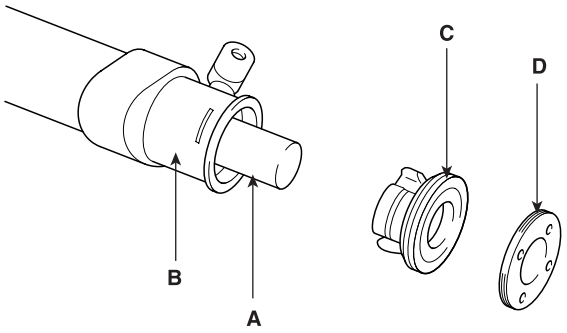
NOTE

Do not plug the vent hole(A) in the rack with grease.



APJF014E

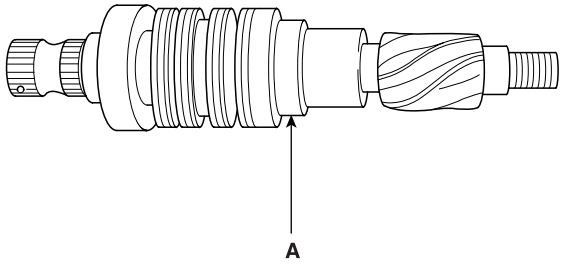
7. Insert the rack(A) into the rack housing(B) and install the rack bushing(C).



EPKE230I

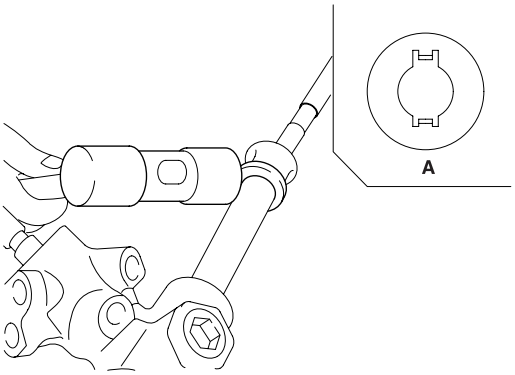
8. Using a special tool, install the oil seal and the ball bearing in the valve body housing.

9. After applying the specified fluid and grease to the pinion valve assembly(A), install it in the rack housing assembly.



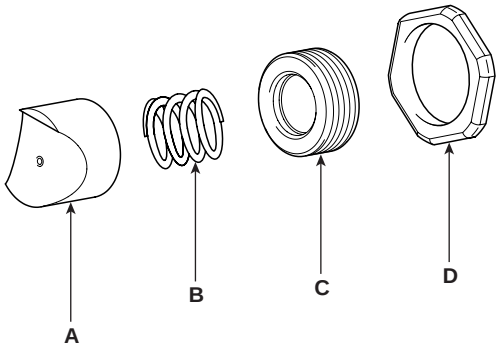
EPKE230E

10. Install the tie rod and punch on a point over the tie rod with a chisel.



EPKE230F

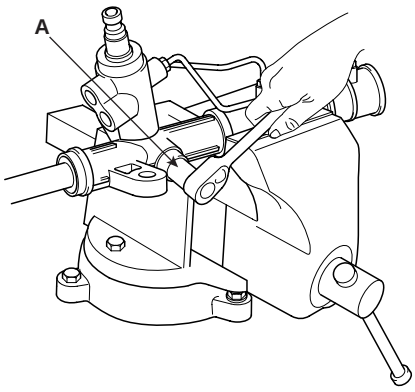
11. Install the rack support yoke(A), rack support spring(B), yoke plug(C) and lock nut(D) in the order shown in the illustration. Apply semi-drying sealant to the threaded section of the yoke plug before installation.



LPJF007H

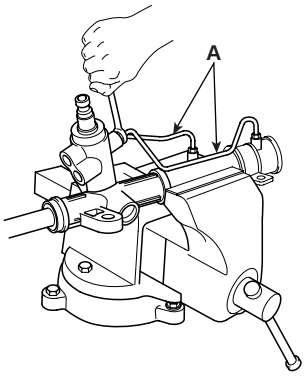
12. With the rack placed in the center position, attach the yoke plug to the rack housing. Tighten the yoke plug to 12 Nm (120 kg·cm, 8.9 lb·ft), with a 14mm socket(A). Loosen the yoke plug approximately from 30° to 60° and tighten the yoke nut to the specified torque.

Tightening torque
50 ~ 70 N·m (5 ~ 7 kgf·m, 37 ~ 52 lb-ft)



LPJF007I

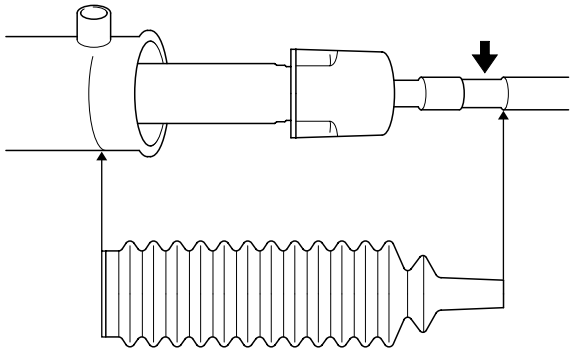
13. Tighten the feed tube(A) to the specified torque and install the mounting rubber using adhesive.



LPJF006H

14. Apply the specified grease to the bellows mounting position (fitting groove) of the tie rod.

Recommended grease : Silicone grease



APGE008C

15. Install the new attaching band to the bellows.

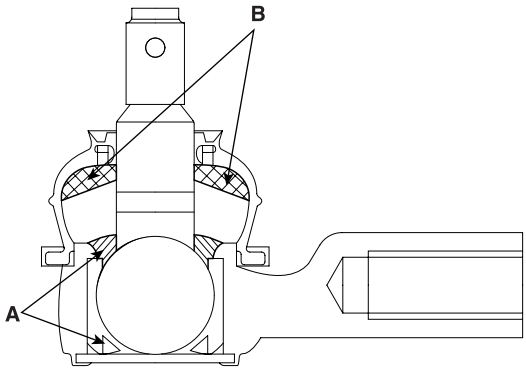
NOTE

When the bellows are installed, a new band must be used.

16. Install the bellows in position, taking care not to twist it.

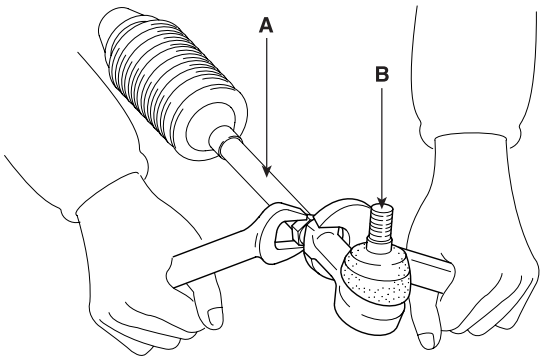
17. Fill the dust cover inner side and lip with the specified grease, and fix the dust cover in position with the clip ring attached in the groove of the tie rod end.

Recommended grease A : POLY LUB GLY 801K or equivalent B : SHOWA SUNLIGHT MB2 or equivalent Dust cover inner side and lip : THREE BOND



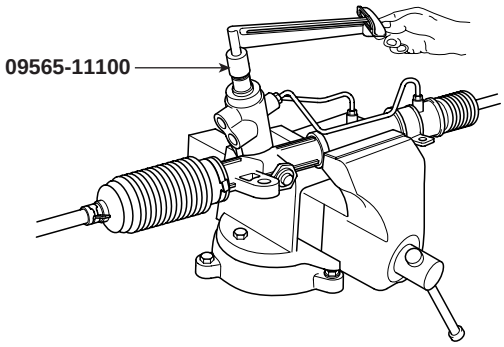
EPKE043A

18. Install the tie rod(A) to the tie rod end(B).



EPKE013F

19. Check for total pinion preload.

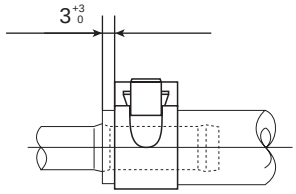


LPJF007O

INSTALLATION ECF6136F

NOTE

Be sure to connect between a tube and a hose as shown in the illustration.



APJF009A

1. Installation is reverse of removal.

Tightening torque :

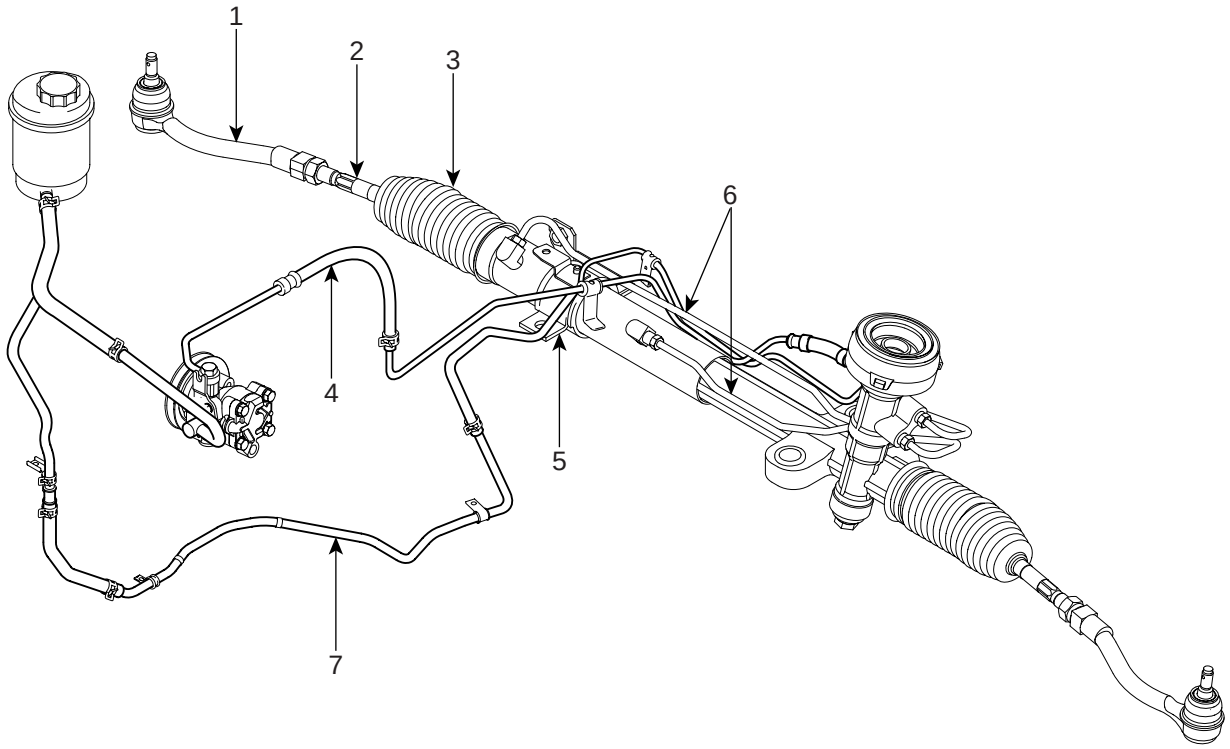
Items	Nm(kgf·m, lb-ft)
Engine mounting bracket to subframe	50~65(5~6.5, 36~47)
Heat cover mounting	8~12(0.8~1.2, 5.8~8.6)
Gear box mounting	90~110(9~11, 65~79)
Subframe mounting	95~120(9.5~12, 69~86)
Engine mounting	50~65(5~6.5, 36~47)
Pressure pipe to oil pump	55~65(5.5~6.5, 40~47)

2. After installation, bleed the air in the power steering system. (see page ST-10)

POWER STEERING HOSES

COMPONENTS EB5AB6AF

NOTE : This illustration is shown the LHD type.
RHD type is symmetrical.



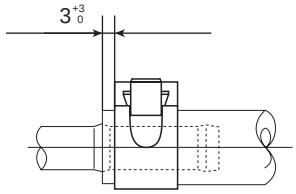
1. Tie rod end
2. Tie rod
3. Bellows
4. Pressure hose and tube assembly
5. Power steering gear box mounting clamp
6. Feed tube
7. Return hose and tube assembly

LPJF004A

REPLACEMENT EFFE802D

NOTE

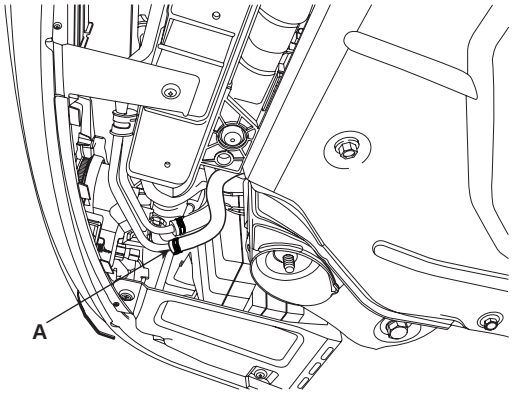
Be sure to connect between a tube and a hose as shown in the illustration.



APJF009A

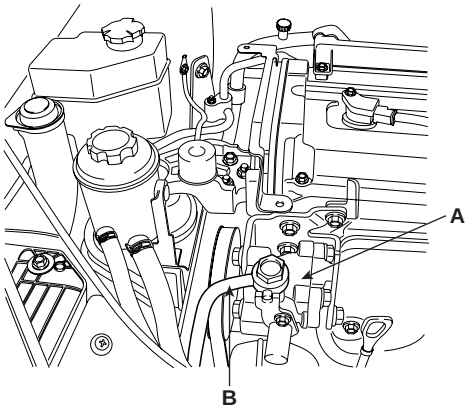
PRESSURE HOSE AND TUBE

1. Drain the power steering fluid by disconnecting the return hose(A).



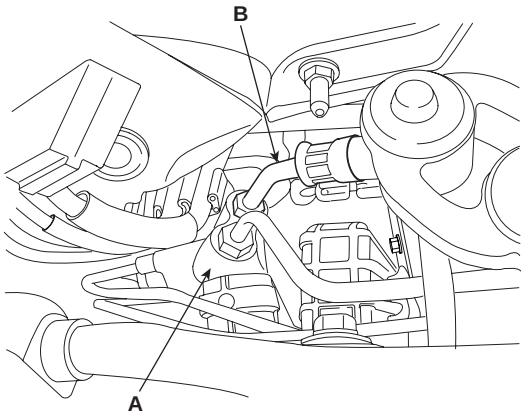
LPJF031B

2. Remove the pressure pipe(B) from the power steering oil pump(A).



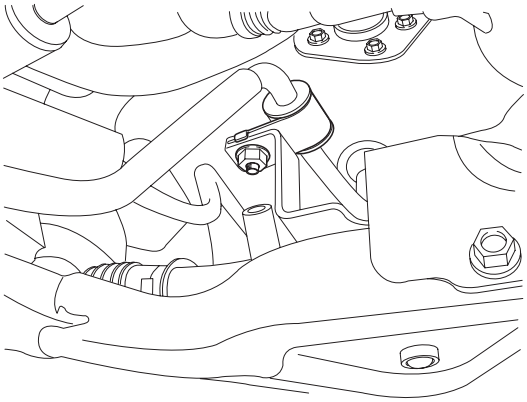
APJF005A

3. Remove the pressure tube(B) from the valve body housing(A).



APJF009B

4. Remove the two brackets of the pressure tube and hose from the front subframe.



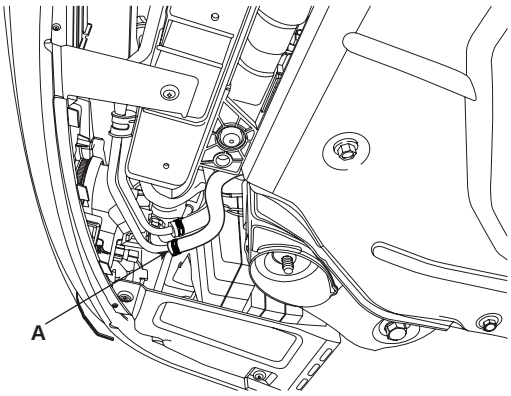
APJF009C

5. Installation is reverse of the removal.

Tightening torque Nm (kgf·m, lb-ft) :
Pressure tube to gear box ; 12 ~ 18 (1.2 ~ 1.8, 9 ~ 13)
Pressure pipe to oil pump ; 55 ~ 65 (5.5 ~ 6.5, 40 ~ 47)

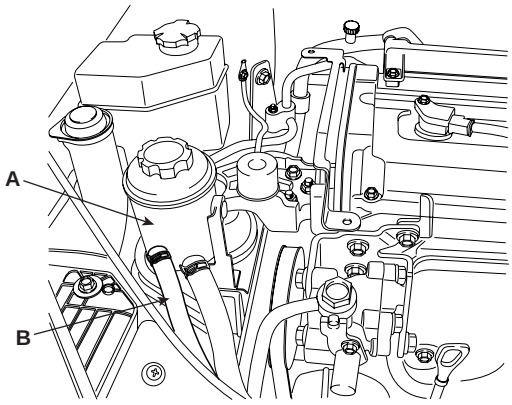
RETURN HOSE AND TUBE

1. Drain the power steering fluid by disconnecting the return hose(A).



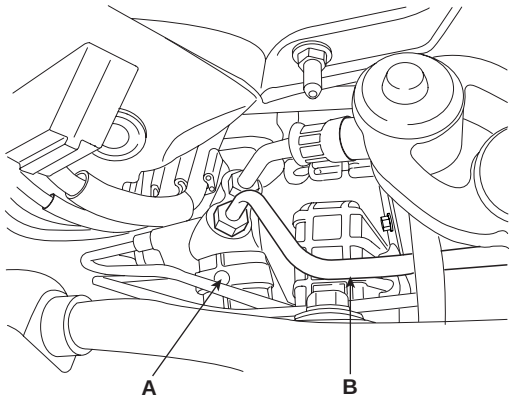
LPJF031B

2. Remove the return hose(B) from the power steering reservoir tank(A).



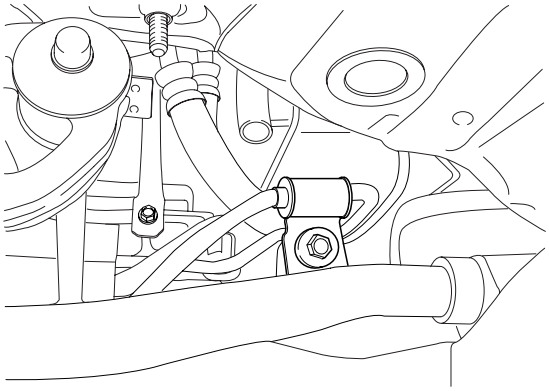
APJF009D

3. Remove the return tube(B) from the valve body housing(A).



APJF009E

4. Remove the three brackets of the return tube and hose from the front subframe.



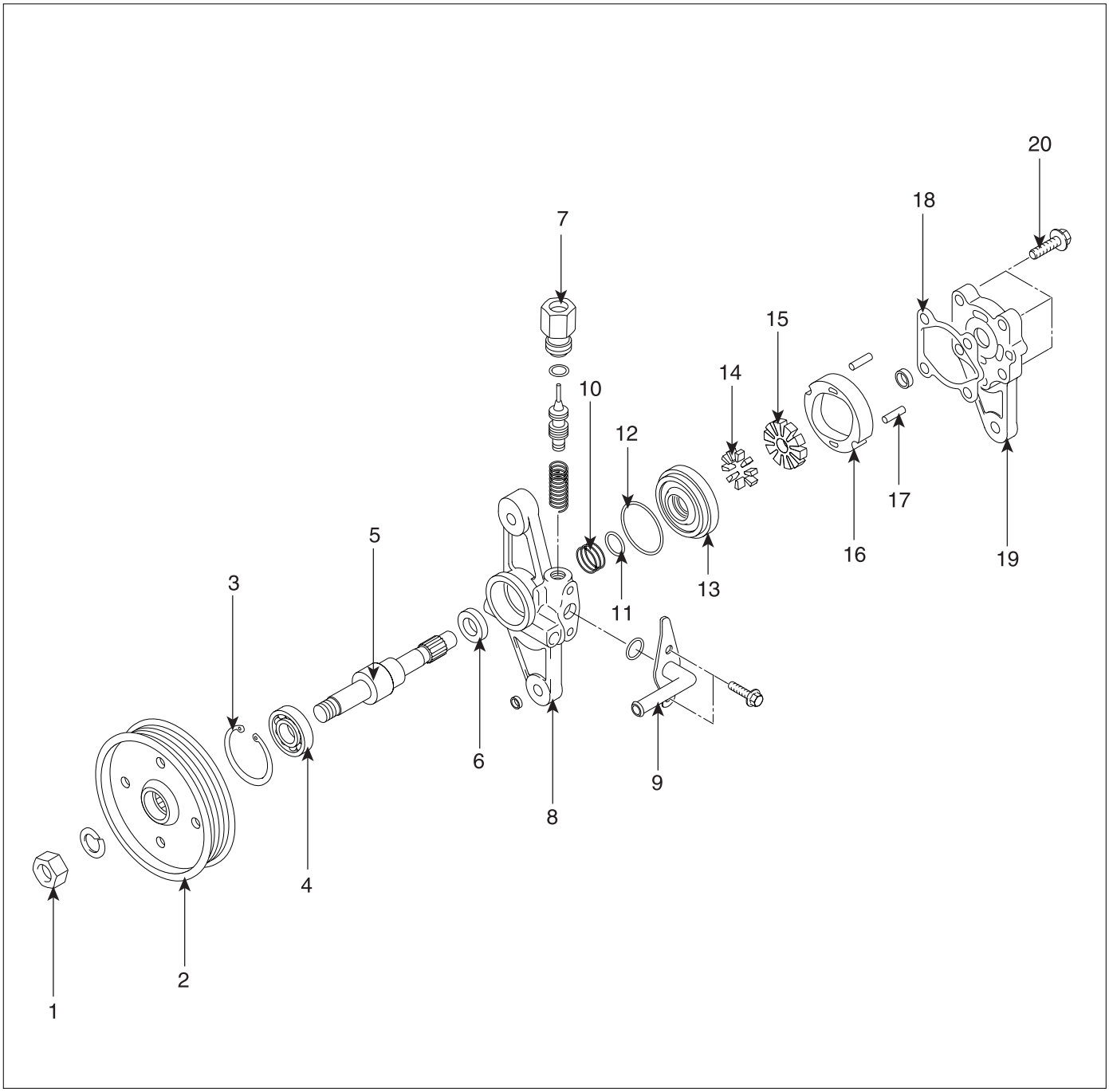
APJF009F

5. Installation is reverse of the removal.

Tightening torque Nm (kgf·m, lb-ft) :
Return tube to gear box ; 12 ~ 18 (1.2 ~ 1.8, 9 ~ 13)

POWER STEERING OIL PUMP

COMPONENTS EACB78AD

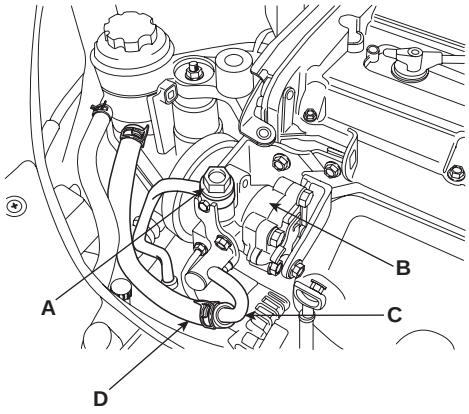


1. Pulley nut
2. Pulley
3. Snap ring
4. Bearing
5. Driver shaft
6. Oil seal
7. Connector
8. Front housing
9. Suction pipe
10. Slide plate spring
11. O-ring (Inner)
12. O-ring (Outer)
13. Oil pump side plate
14. Vane
15. Rotor
16. Cam ring
17. Lock pin
18. Gasket
19. Oil pump cover assembly
20. Mounting bolt

BPGE007A

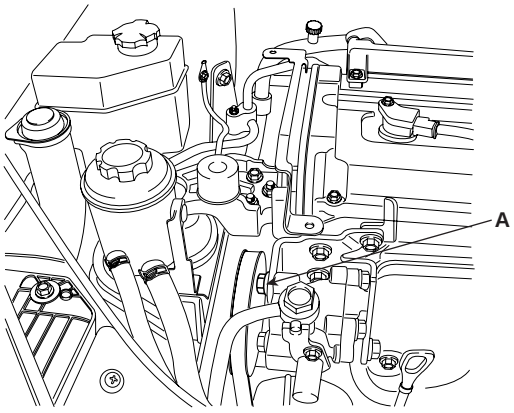
REMOVAL E9CEAD6E

1. Remove the pressure hose(A) from the oil pump(B).
2. Disconnect the suction hose(C) from the suction connector(D) and drain the fluid into a container.



APJF044B

3. Loosen the oil pump mounting bolts to remove the V belt.
4. Loosen the tension adjusting bolt(A).



APJF012A

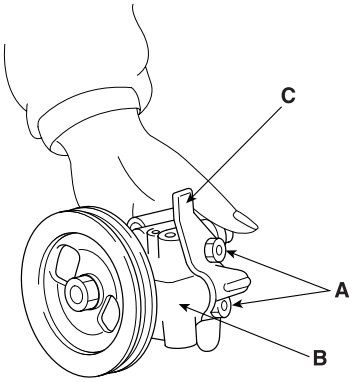
5. Remove the power steering drive belt from the power steering oil pump pulley.
6. Remove the power steering oil pump mounting bolt and the tension adjusting bolt.
7. Remove the power steering oil pump assembly.

NOTE

Be careful not to drip fluid from the power steering oil pump.

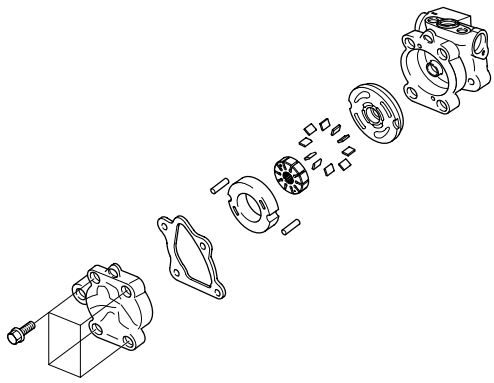
DISASSEMBLY E3987A6F

1. Remove two bolts(A) from the oil pump body(B), and then remove the suction pipe(C) and O-ring.



APJF050A

2. Loosen the four bolts and remove the oil pump cover assembly.
3. Remove the cam ring.
4. Remove the rotor and vanes.
5. Remove the oil pump side plate.

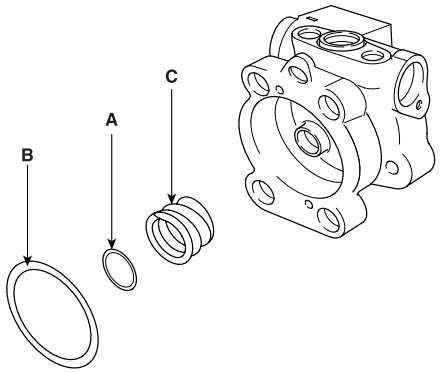


KPKA046A

6. Remove the inner(A) and outer O-ring(B).
7. Remove the side plate spring(C).

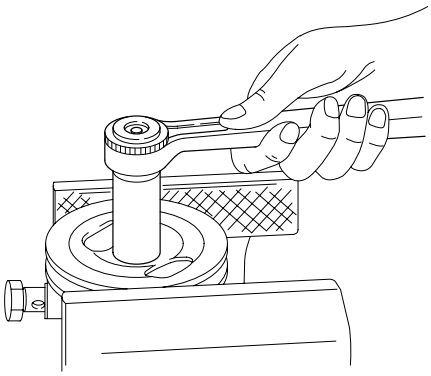
NOTE

When assembling, use a new gasket and O-ring.



EPKE055A

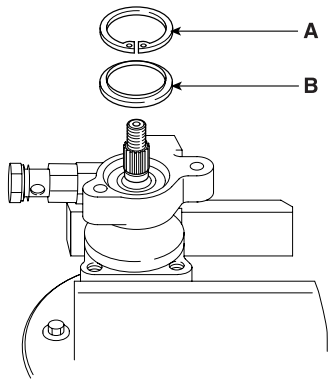
8. Mount the pulley in a vise and remove the pulley nut and the spring washer.



KPKA056A

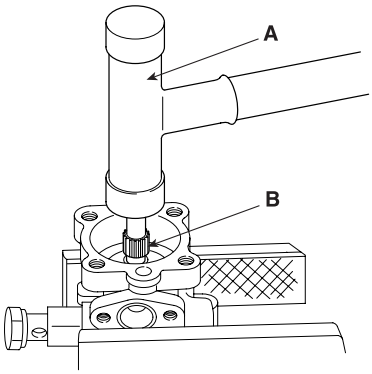
9. Pull the pulley out.

10. After removing the snap ring(A) of the shaft with snap ring pliers, remove the dust spacer(B).



EPKE057A

11. Tap the rotor side of the shaft slightly with a plastic hammer(A) to remove the shaft(B).

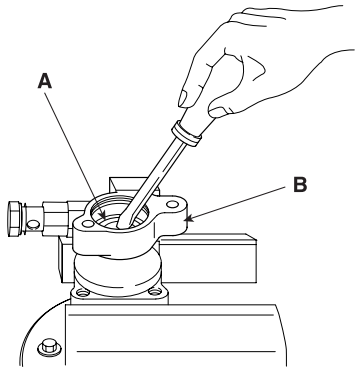


EPKE058A

12. Remove the oil seal(A) from the oil pump body(B).

NOTE

When assembling, use a new oil seal.



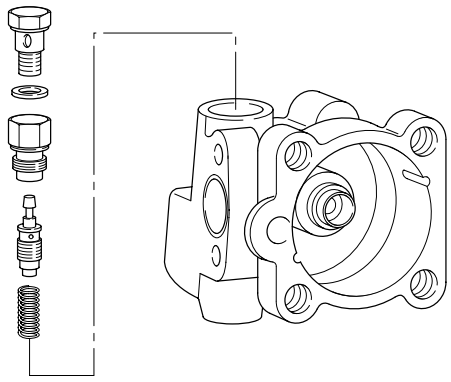
EPKE059A

13. Remove the connector from the oil pump body, and take out the flow control valve and the flow control spring.

14. Remove the O-ring from the connector.

CAUTION

Do not disassemble the flow control valve.

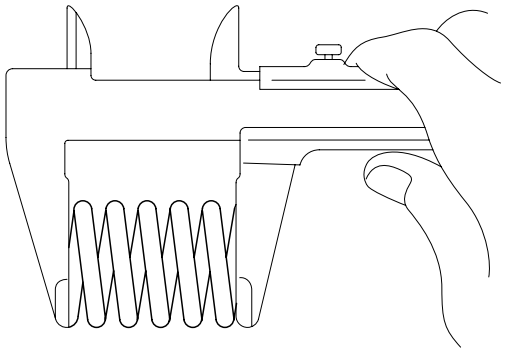


KPKA060A

INSPECTION EFC7445B

1. Check the free length of the flow control spring.

Free length of the flow control spring : 36.5 mm (1.4in)

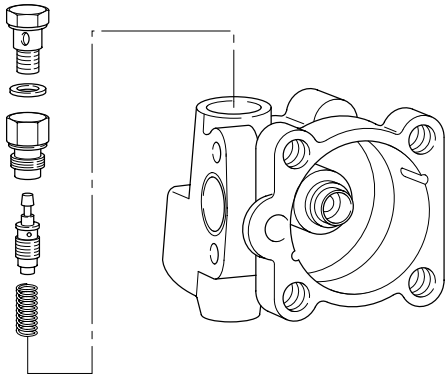


KPKA068A

2. Check that the flow control valve is not bent.
3. Check the shaft for wear and damage.
4. Check the V belt for wear and deterioration.
5. Check the grooves of the rotor and vanes for stratified abrasion.
6. Check the contact surface of the cam ring and vanes for stratified abrasion.
7. Check vanes for damage.
8. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

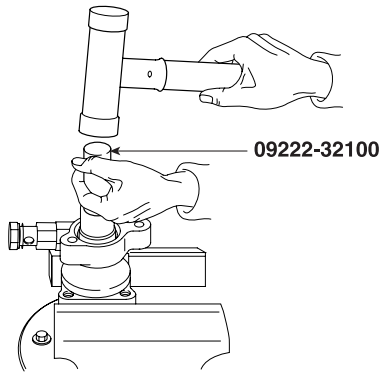
REASSEMBLY EBAC2BA5

1. Install the flow control spring, the flow control valve and the connector into the pump body.



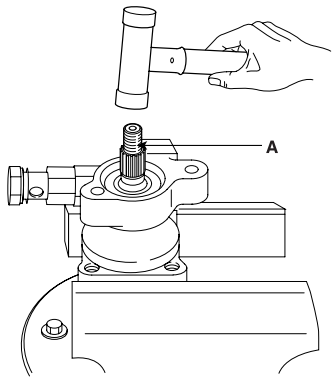
KPKA060A

2. Install the oil seal in the pump body by using the special tool(09222-32100).

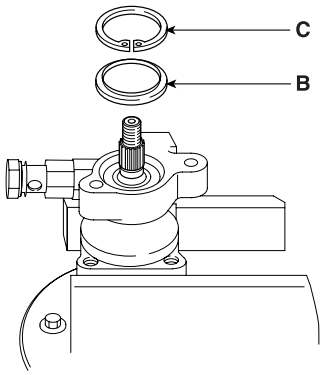


EPKE061A

3. After inserting the shaft assembly(A) into the pump body, install the dust spacer(B) and snap ring(C).

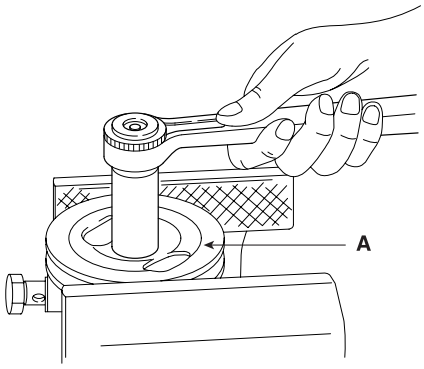


KPKA062A



EPKE057B

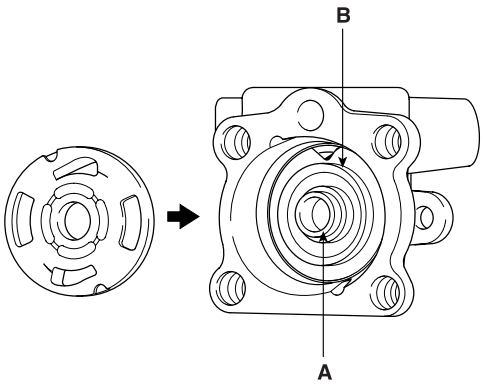
4. Install the pump pulley(A).



EPKE056A

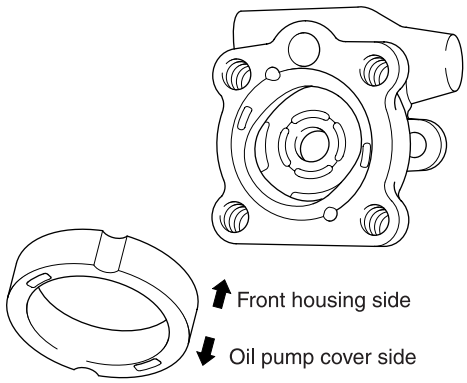
5. Install the spring(A) and inner O-ring(B).

6. Insert the outer O-ring in the oil pump side plate and then install it in the pump body.



EPKE300A

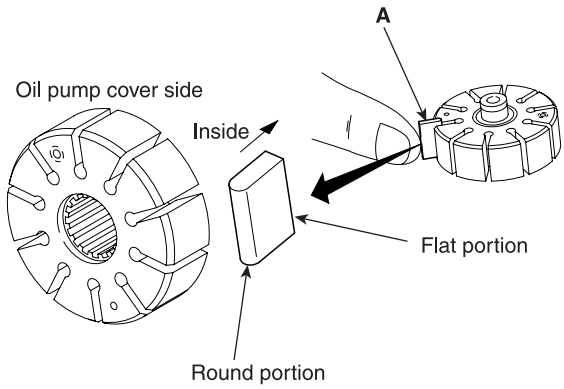
7. After inserting the lock pin into the groove of the front housing, install the cam ring attending to the direction.



EPKB300B

8. Install the rotor.

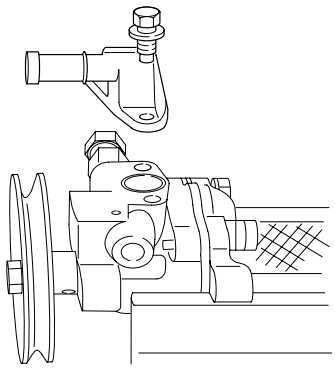
9. Install vanes(A) so that the rounded edges face outward.



EPKE300C

10. Install the gasket and oil pump cover assembly.

11. Install the suction pipe and O-ring.

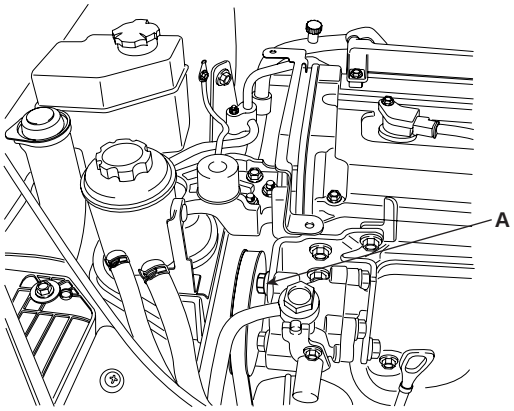


KPKA063A

INSTALLATION ED22EE7A

1. After installing the oil pump to the oil pump bracket, install the V belt and tighten the bolt(A) adjusting tension to the specified torque.

Oil pump adjusting bolt : 25 ~ 33 Nm (2.5 ~ 3.3 kgf·m, 18 ~ 24 lb-ft)



APJF012A

2. Install the suction hose.

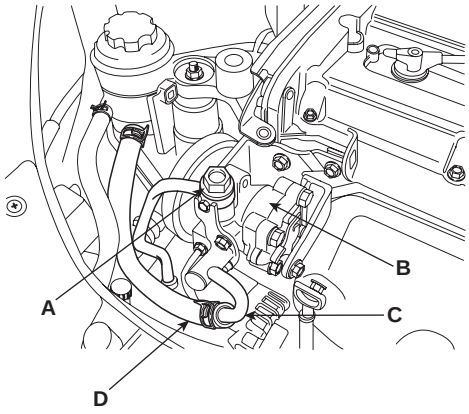
CAUTION

Install the pressure hose to the oil pump.

3. Install the pressure hose(A) to the oil pump(B).

NOTE

Install the pressure hose carefully that it does not twist and come in contact with other components.



APJF044B

4. Add power steering fluid (PSF-III).
5. Bleed the air in the system.
6. Check the oil pump pressure.

Brake System

GENERAL

BRAKE SYSTEM
- BRAKE BOOSTER
- BRAKE LINE
- BRAKE PEDAL
- FRONT DISC BRAKE
- MASTER CYLINDER
- PROPORTIONING VALVE
- REAR DISC BRAKE
- REAR DRUM BRAKE

PARKING BRAKE SYSTEM
- PARKING BRAKE
- PARKING BRAKE SWITCH

ABS (ANTI-LOCK BRAKE SYSTEM)
- ANTI-LOCK BRAKING SYSTEM CONTROL MODULE
- FRONT WHEEL SPEED SENSOR
- REAR WHEEL SPEED SENSOR

EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION)

ESP(ELECTRONIC STABILITY PROGRAM) SYSTEM
- YAW-RATE SENSOR AND G-SENSOR
- MASTER CYLINDER PRESSURE SENSOR
- ESP SWITCH
- STEERING WHEEL ANGLE SPEED SENSOR

GENERAL

SPECIFICATIONS EB7F495C

Item	Specification
Master cylinder Type I.D. Piston stroke Fluid level warning sensor	 Tandem type 22.22 mm (0.875 in) 29 ~ 31 mm Provided
Proportioning valve(CBS) Cut-in pressure(Split point) Decompression ratio	 35 kg/㎠ (3.43 MPa, 497.8 psi) 0.27 : 1
Brake booster Type Effective diameter Boosting ratio	 Vacuum 254 mm(10 in) 7 : 1
Front brake(Disc) Type Disc O.D. Disc thickness Pad thickness Cylinder type Cylinder I.D.	 Floating type with ventilated disc 256 mm(10 in) 22 mm(0.87 in) 11 mm(0.43 in) Single piston Ø54 mm(2.12 in)
Rear brake(Disc) Type Disc O.D. Disc thickness Pad thickness Cylinder type Cylinder I.D.	 Floating type with solid disc 262 mm (10.3 in) 10 mm (0.39 in) 10 mm (0.39 in) Single piston 31 mm (1.22 in)
Rear brake(Drum) Type Drum I.D Brake lining thickness Clearance adjustment	 Leading trailing 203.2 mm (8 in) 4.3 mm(0.17 in) Automatic
Parking brake Actuation Type Drum I.D.	 Mechanical brake acting on rear wheels Lever 168 mm(6.61 in)

NOTE

ABS : Anti-lock Brake System
CBS : Conventional Brake System

SPECIFICATION(ABS) EDA60E0F

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	
	Type	ABS + EBD	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-40 ~ 110 ℃	
	Motor power	180 W	
Warning lamp	Min. Operating Voltage	1.2 V	
	Max. Current consumption	120 mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 20 V	
	Operating Temperature	-40 ~ 150 ℃	
	Output current low	5.9 ~ 8.4 mA	Typ. 7 mA
	Output current high	11.8 ~ 16.8 mA	Typ. 14 mA
	Output range	1 ~ 2500 Hz	
	Tone wheel	48 teeth	
	Air gap	0.4 ~ 1.5 mm	
	Output duty	30 ~ 70 %	

SPECIFICATION(ESP)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	Total control (ABS, EBD, TCS, ESP)
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-40 ~ 110 ℃	
	Motor power	180 W	
Warning lamp	Min. Operating Voltage	1.2 V	
	Max. Current consumption	120 mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 20 V	
	Operating Temperature	-40 ~ 150 ℃	
	Output current low	5.9 ~ 8.4 mA	Typ. 7 mA
	Output current high	11.8 ~ 16.8 mA	Typ. 14 mA
	Output range	1 ~ 2500 Hz	
	Tone wheel	48 teeth	
	Air gap	0.4 ~ 1.5 mm	
	Output duty	30 ~ 70 %	
Steering Wheel Angle Sensor	Operating Voltage	9 ~ 16 V	
	Operating Temperature	-30 ~ 75 ℃	
	Current Consumption	Max. 100 mA	
	Output Current	Max. 10 mA	
	Operating Angular velocity	Max. 1500 °/sec	
Yaw rate & Lateral G sensor	Operating Voltage	4.75 ~ 5.25 V	
	Current Consumption	Max. 65 mA	
	Output voltage	0.5 ~ 4.5 V	
	Operating Temperature	-40 ~ 85 ℃	
	Yaw rate sensor measurement range	± 75 °/sec	
	Lateral G sensor measurement range	± 1.5 g	

SERVICE STANDARD EFE66F10

Item	Standard value
Standard value	
Brake pedal height	164.8 mm (6.49 in)
Brake pedal stroke	125 mm (4.92 in)
Stop lamp switch outer case to pedal stopper clearance	0.5~1.0 mm (0.02~0.04 in)
Brake pedal free play	3~8 mm (0.11~0.31 in)
Booster push rod to master cylinder piston clearance	0 (at 500 mmHg vacuum)
Parking brake lever stroke when lever assembly is pulled with 196N (20Kg, 44lb force)	6~ 8 clicks
Front disc brake pad thickness	11 mm (0.43 in)
Front disc thickness	22 mm (0.87 in)
Rear drum brake lining thickness	4.3 mm (0.17 in)
Rear drum brake drum I.D.	203.2 mm (8 in)
Rear disc brake pad thickness	10 mm (0.4 in)
Rear disc brake disc thickness	10 mm (0.4 in)

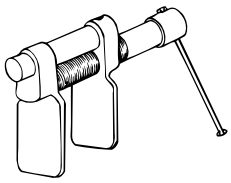
TIGHTENING TORQUE

Item	Nm	kgf.m	lb-ft
Master cylinder to booster mounting nut	7.9 ~ 11.8	0.8 ~ 1.2	5.79 ~ 8.68
Brake booster mounting nut	12.74 ~ 15.68	1.3 ~ 1.6	9.4 ~ 11.57
Bleeder screw	5.88 ~ 9.8	0.6 ~ 1.0	4.34 ~ 7.23
Brake tube nut, brake hose	12.74 ~ 16.64	1.3 ~ 1.7	9.4 ~ 12.3
Caliper guide rod bolt	21.56 ~ 31.36	2.2 ~ 3.2	15.91 ~ 23.14
Caliper mounting bolt	83.36 ~ 93.16	8.5 ~ 9.5	61.48 ~ 68.71
Brake pedal member assembly bracket mounting bolt	7.9 ~ 11.8	0.8 ~ 1.2	5.79 ~ 8.68
Brake pedal mounting nut	24.51 ~ 34.32	2.5 ~ 3.5	18.08 ~ 25.31
Stop lamp switch mounting nut	7.9 ~ 9.8	0.8 ~ 1.0	5.79 ~ 7.23
Rear drum brake bleeder screw	5.88 ~ 8.82	0.6 ~ 0.9	4.34 ~ 6.51
Wheel speed sensor mounting bolt	8.04 ~ 9.51	0.82 ~ 0.97	5.93 ~ 7.02
HECU mounting bracket bolt	7.9 ~ 9.8	0.8 ~ 1.0	5.79 ~ 7.23
HECU union screw	11.76 ~ 15.68	1.2 ~ 1.6	8.68 ~ 11.57
Rear drum backing plate mounting bolt	9.8 ~ 12.74	1 ~ 1.3	7.23 ~ 9.4
Proportioning valve to master cylinder	34.3 ~ 44.1	3.5 ~ 4.5	25.31~32.55
Yaw rate & Lateral G sensor mounting nut	7.9 ~ 10.79	0.8 ~ 1.1	5.79 ~ 7.95
Master cylinder pressure sensor	22.56 ~ 26.48	2.3 ~ 2.7	16.64 ~ 19.53

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
Caliper guide rod bolt and boot	AI -11(P) grease	1.0 ~ 1.8 g
Parking brake shoe and backing plate contact surfaces	Bearing grease	As required

SPECIAL TOOLS EBE980DB

Tool (Number and Name)	Illustration	Use
09581 - 11000 Piston expander	 ARJE504I	Pushing back of the front disc and rear disc brake piston

TROUBLESHOOTING EEA006CA

PROBLEM SYMPTOMS TABLE

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the like 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 Adjust
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 Repair 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 (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks)	Repair Air bleeding Replace Replace Replace Adjust Replace Replace Repair
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Pad retainers (Loosen) 5. Sliding pin (Worn) 6. Pad or lining (Dirty) 7. Pad or lining (Glazed) 8. Return spring (Faulty) 9. Brake pad shim (Damage) 10. Shoe hold-down spring (Damage)	Replace Retighten Replace Retighten Replace Clean Replace Replace Replace Replace
Brake fades	1. Master cylinder	Replace

Symptom	Suspect Area	Remedy
Brake vibration, pulsation	1. Brake booster 2. Pedal free play 3. Master cylinder 4. Caliper 5. Master cylinder cap seal 6. Damaged brake lines	Replace Adjust 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.	

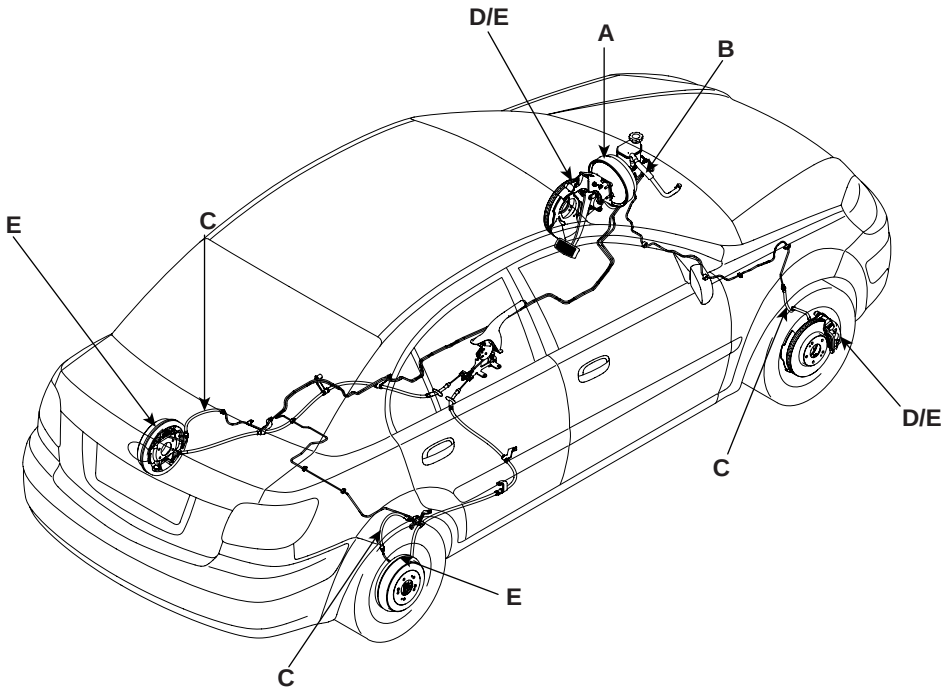
BRAKE SYSTEM

OPERATION AND LEAKAGE CHECK E8ADB1AE

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. 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.
Wheel cylinder piston cup and dust cover (E)	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, replace the wheel cylinder.

This illustration is shown the LHD type.
RHD type is symmetrical.

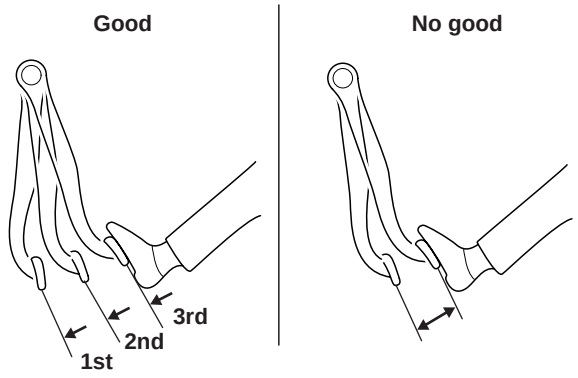


LJJF503W

BRAKE BOOSTER OPERATING TEST

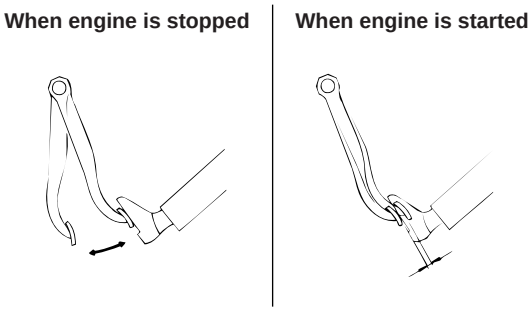
For simple checking of the brake booster operation, carry out the following tests :

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 defective.



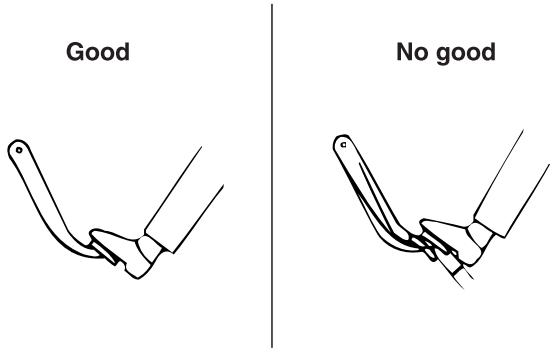
EJRF500B

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 defective.



EGGB700B

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 defective. 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 defect.



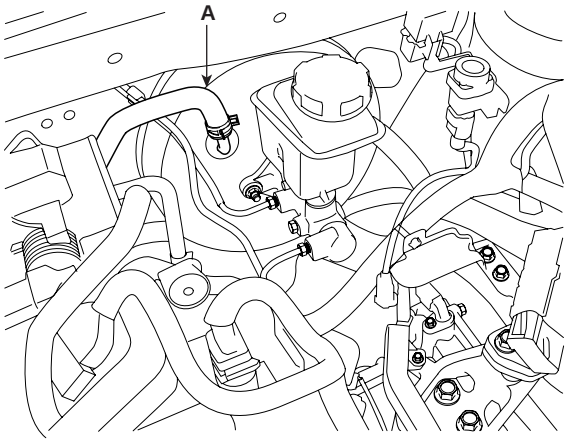
EGGE700C

VACUUM HOSE (CHECK VALVE)

INSPECTION

1. Disconnect the brake booster vacuum hose (check valve built in) (A) at the booster .

2. Start the engine and let it idle. There should be vacuum available. If no vacuum is available, the check valve is not working properly. Replace the brake booster vacuum hose and check valve and retest.



AJJF501A

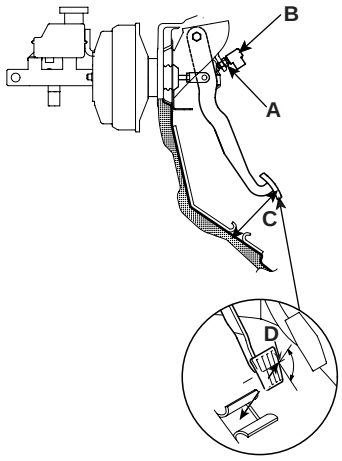
BRAKE PEDAL BRAKE SWITCH ADJUSTMENT

PEDAL HEIGHT

1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and brake off the brake switch (B) until it is no longer touching the brake pedal.

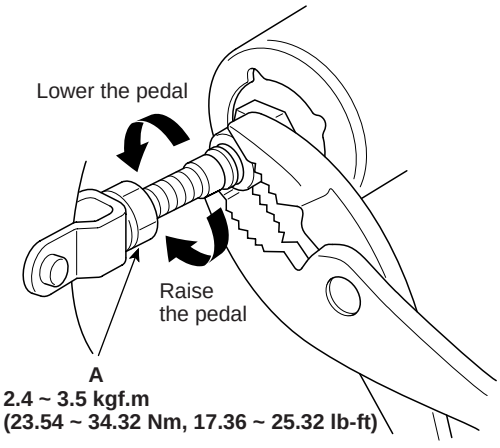
2. Lift up the carpet. At the insulator cutout, measure the pedal height (C) from the middle of the left-side center of the pedal pad (D).

Standard pedal height (with carpet removed) :
164.8 mm (6.49 in)



EJKE001A

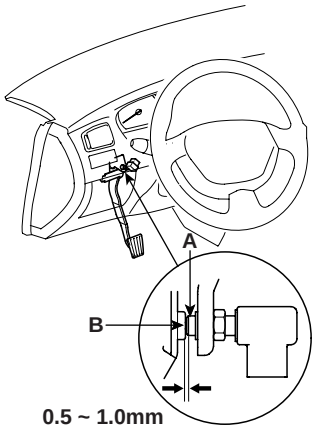
3. Loosen the pushrod locknut (A), and screw the pushrod in or out with pliers until the standard pedal height from the floor is reached. After adjustment, tighten the locknut firmly. Do not adjust the pedal height with the pushrod depressed.



LJJF500A

BRAKE SWITCH CLEARANCE

Screw in the brake switch until its plunger is fully depressed (threded end (A) touching the pad (B) on the pedal arm) then brake off the switch 3/4 turn to make 0.5~1.0 mm(0.0197~0.0394 in.) of clearance between the brake switch connector. Make sure that the brake lights go off when the pedal is released.

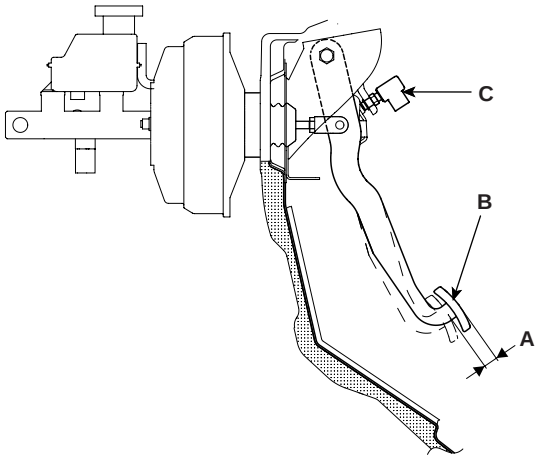


AJJF600J

PEDAL FREE PLAY

1. With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal(B) down by hand, and confirm that the amount of movement(A) before resistance is met (the free play) is within the standard value.

Standard value : 3 ~ 8 mm (0.117 - 0.312 in.)



EJKE001D

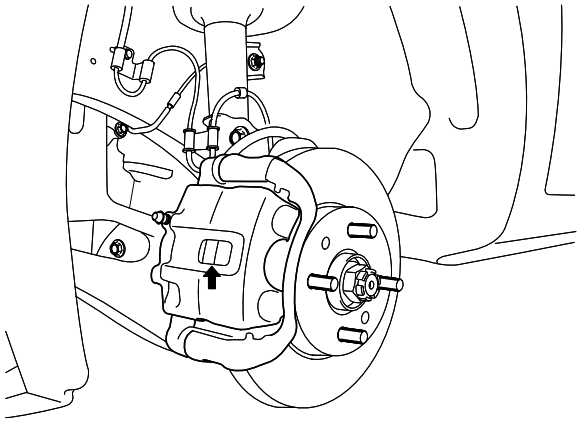
2. If free play does not reach the standard value, check that clearance between the outer case of stop light switch(C) and brake pedal is within the standard value. If free play exceeds the standard value, it is probably due to excessive clearance between the clevis pin and brake pedal arm. Check for excessive clearance and replace faulty parts as required.

3. Start the engine, depress the brake pedal with approximately 120kg(1176.8N, 264.5 lb) of force, and check for oil leakage in the master cylinder, brake line and each connecting part. Repair the faulty parts as required.

INSPECTION OF FRONT DISC BRAKE PAD

1. Check the brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 11.0 mm (0.43 in.)
Service limit : 2.0 mm (0.0787 in.)



AJJF502A

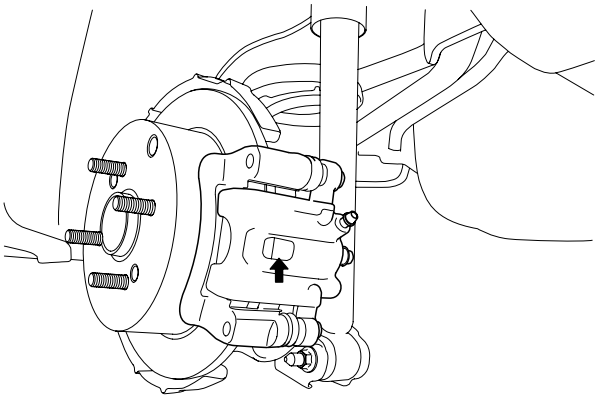
CAUTION

- ***If the pad lining thickness is out of specification, left and right pads must be replaced as a complete set.***
- ***When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.***

INSPECTION OF REAR DISC BRAKE PAD

1. Check the brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 10.0 mm (0.39 in.)
Service limit : 2.0 mm (0.0787 in.)



AJJF503A

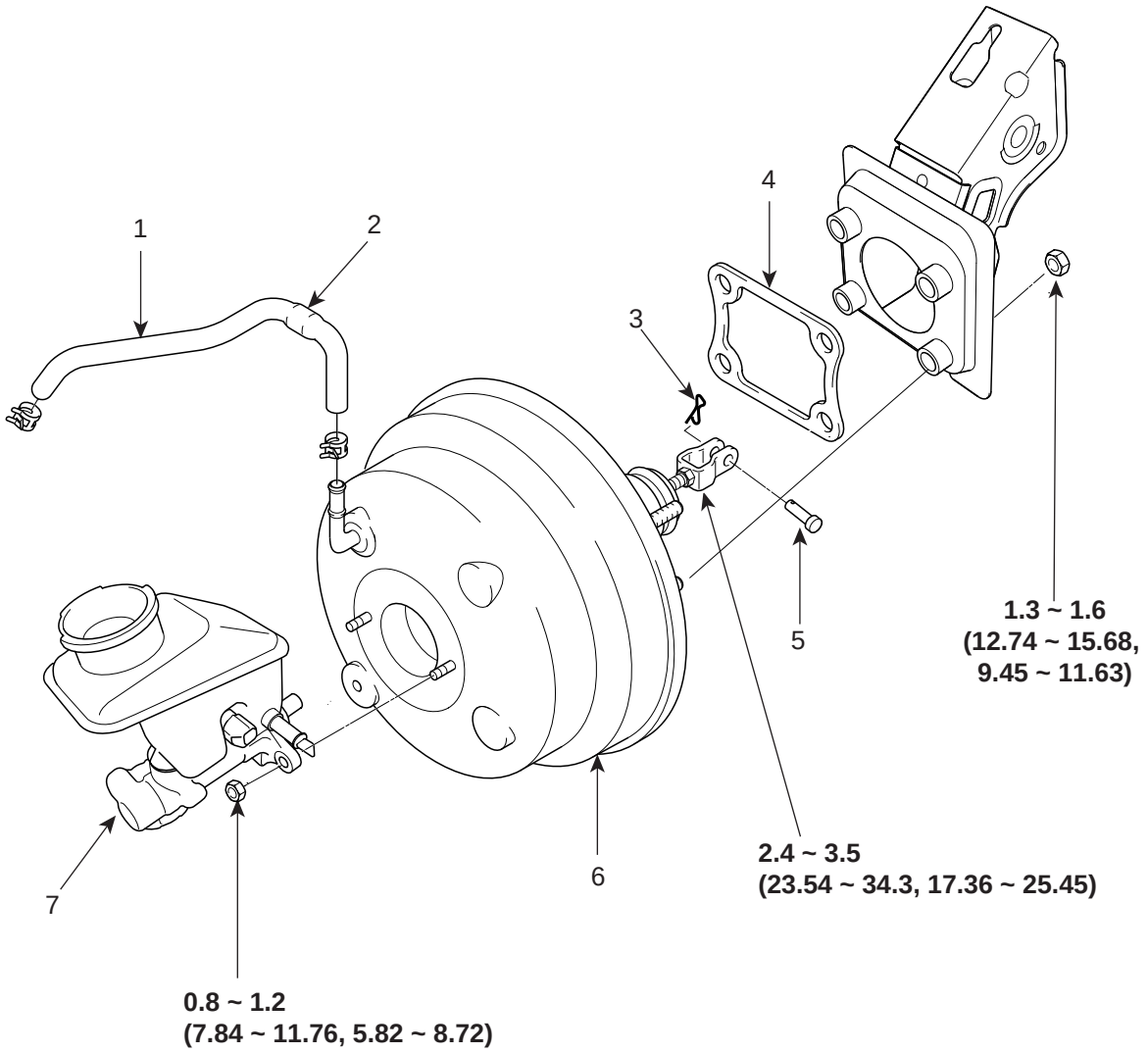
CAUTION

- ***If the pad thickness is out of specification, left and right pads must be replaced as a complete set.***
- ***When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.***

BRAKE BOOSTER

COMPONENTS(1) E3FEFE85

This illustration is shown the LHD type.
RHD type is similar.

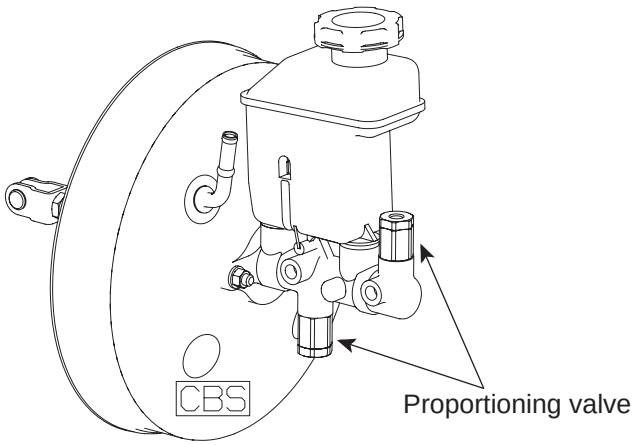


TORQUE : kgf.m (Nm, lb-ft)

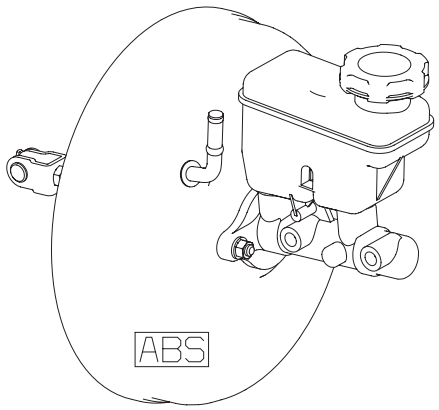
1. Vacuum hose
2. Check valve
3. Snap pin
4. Seal
5. Clevis pin
6. Brake booster
7. Mater cylinder
8. Washer

LJJF500B

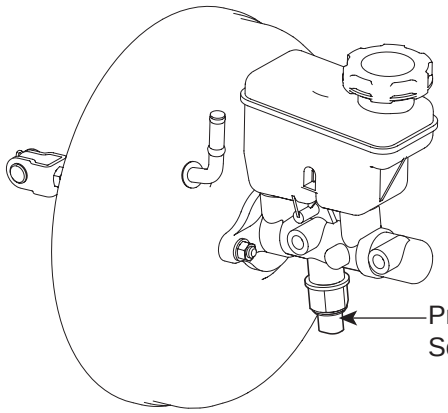
COMPONENTS(2)



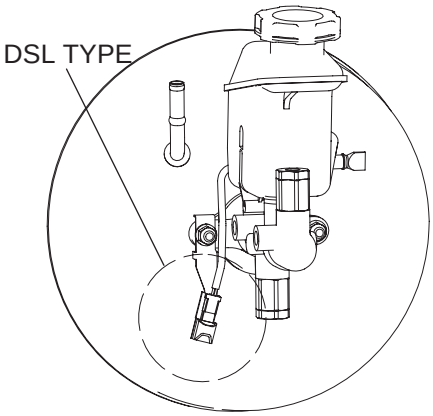
<CBS Type>



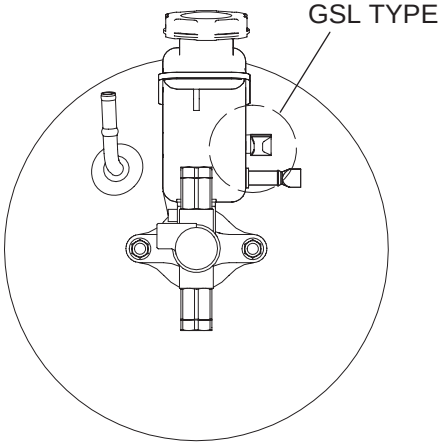
<ABS Type>



<ESP Type>



<Diesel engine Type>

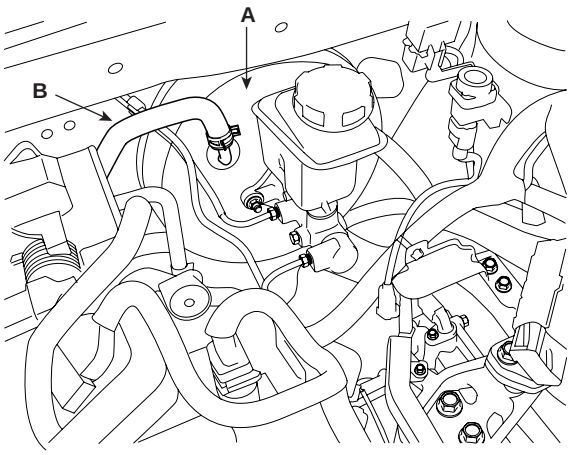


<Gasoline engine Type>

LJJF500C

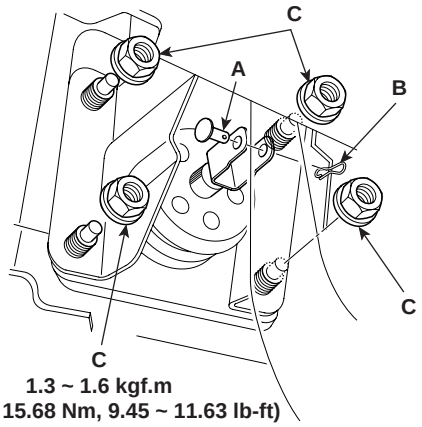
REMOVAL ECEC42CE

1. Remove the master cylinder.(Refer to BR-32)
2. Disconnect the vacuum hose (B) from the brake booster (A).



AJJF600M

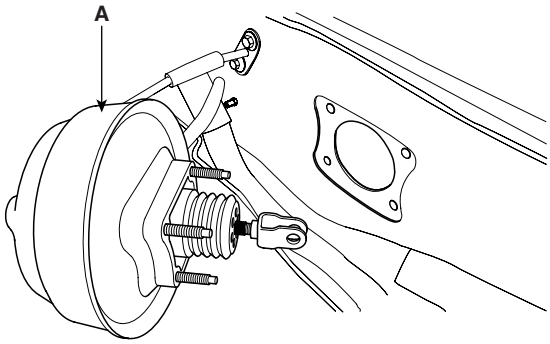
3. Remove the clevis pin(A) and snap pin (B).



1.3 ~ 1.6 kgf.m
(12.74 ~ 15.68 Nm, 9.45 ~ 11.63 lb-ft)

LJJF501W

4. Remove the four booster mounting nuts (C).
5. Remove the brake booster (A) from the engine compartment.

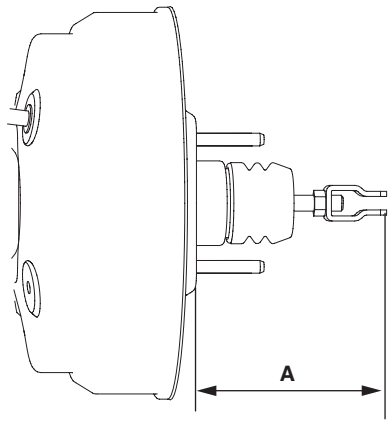


ARJE500H

INSTALLATION E4A72DD8

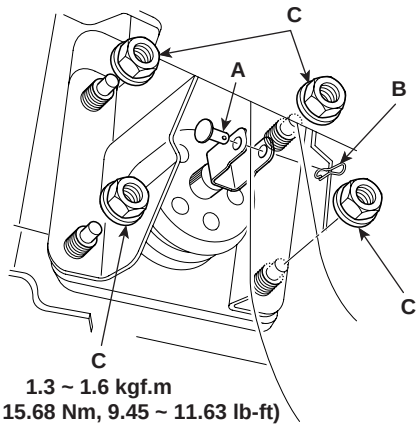
1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length(A) : 116.3 ± 0.5 mm (4.58 ± 0.019 in)



ARJE500I

2. Insert the booster and tighten the nuts (C).



LJJF501X

3. Connect the booster push rod and brake pedal with a clevis pin (A) and install a snap pin (B) to the clevis pin (A).

CAUTION

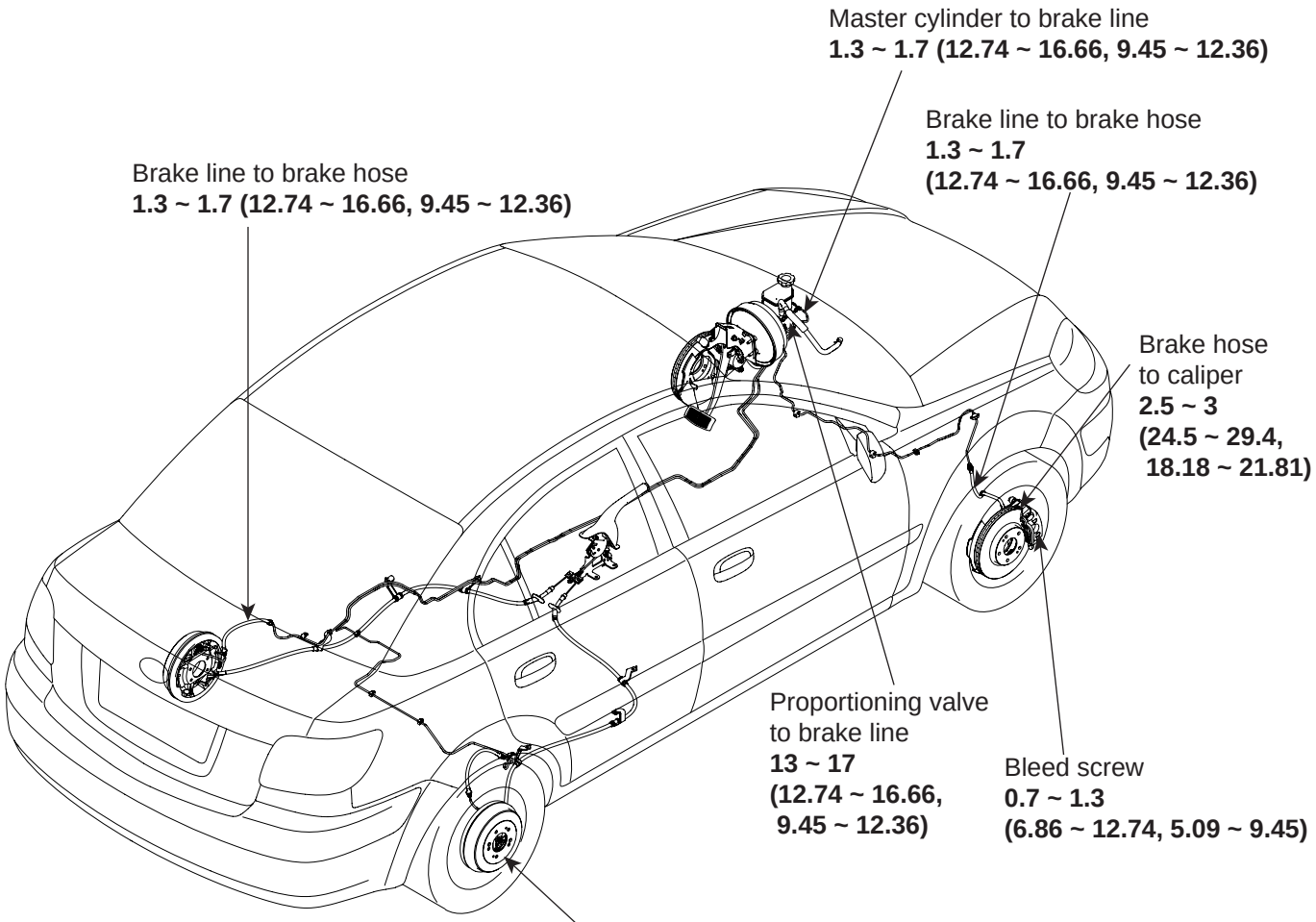
Grease the pin before installing the snap pin.
Always use a new snap pin.

4. Install the master cylinder, then install the brake tubes to the master cylinder.
5. Connect the vacuum hose to the brake booster.
6. After filling the brake reservoir with brake fluid, bleed the system.
7. Check for fluid leakage.
8. Check and adjust the brake pedal for proper operation.

BRAKE LINE

COMPONENTS EBBA9697

This illustration is shown the LHD type.
RHD type is symmetrical.



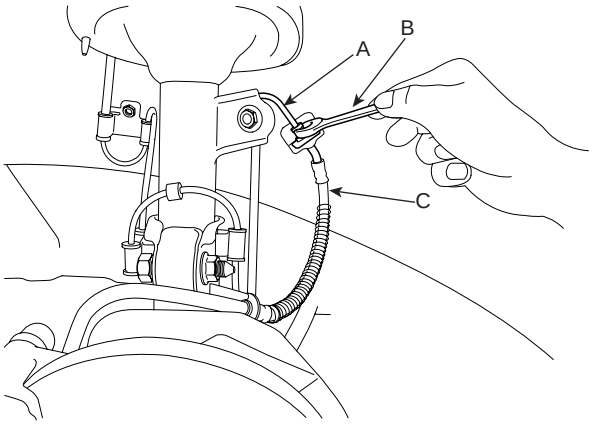
Disc brake:
Brake hose to caliper **2.5 ~ 3 (24.5 ~ 29.4, 18.18 ~ 21.81)**
Bleed screw **0.7 ~ 1.3 (6.86 ~12.74, 5.09 ~ 9.45)**
Drum brake:
Brake line to wheel cylinder **1.3 ~ 1.7 (12.74 ~16.66, 9.45 ~ 12.36)**
Bleed screw **0.7~1.3 (6.86 ~12.74, 5.09 ~ 9.45)**

TORQUE : kgf.m (Nm, lb-ft)

LJJF500D

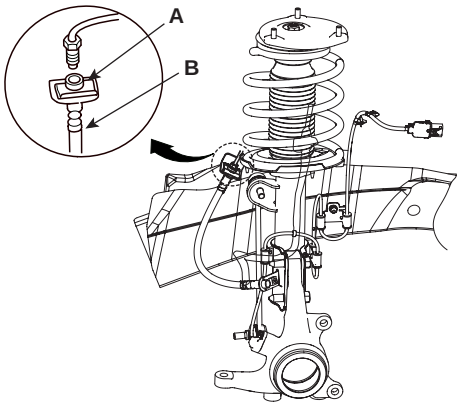
REMOVAL EFDD23DE

1. Disconnect the brake hose(C) from the brake line(A) using a flare-nut wrench(B).



AJJF505A

2. Remove the brake hose clip(A), and then remove the brake hose(B).

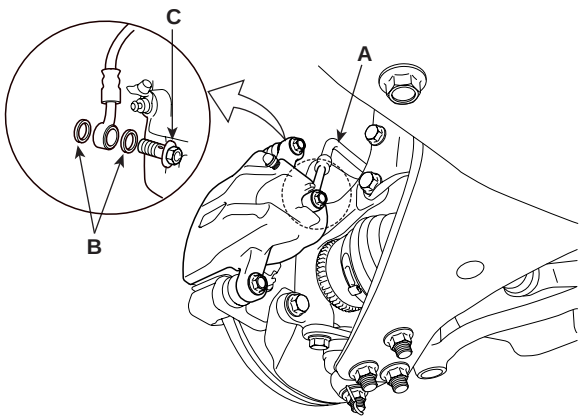


AJJF600P

3. Remove the connector bolt from the caliper, and disconnect the brake hose from the caliper.

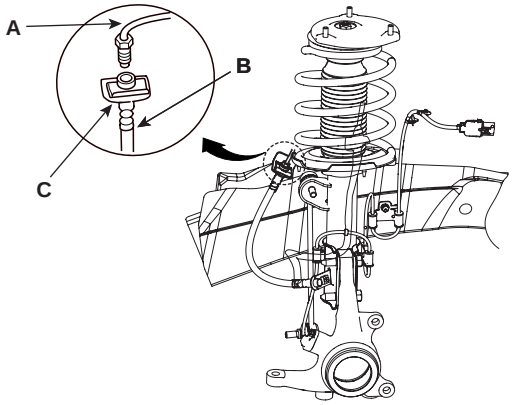
INSTALLATION E626ADF9

1. Install a brake hose(A) on the caliper with tightening brake hose bolt(C) and washer(B).



AJJF600Q

2. Install the brake hose clip(C) to the brake hose bracket(B), then install the brake hose(A).



AJJF600R

3. Connect the brake hose to the brake line.
4. After installing the brake hose, bleed the brake system.

CAUTION

- ***Check the brake hoses for interference and twisting.***
- ***Check the brake hose and line joint for leaks, and tighten if necessary.***

INSPECTION E3FF54EC

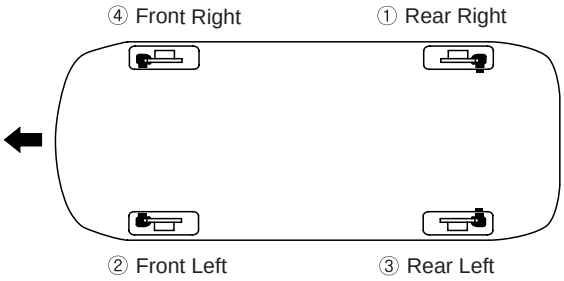
1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damaged and oil leakage.
3. Check the brake tube flare nuts for damage and oil leakage.

BRAKE SYSTEM BLEEDING EB2B9B45

NOTE

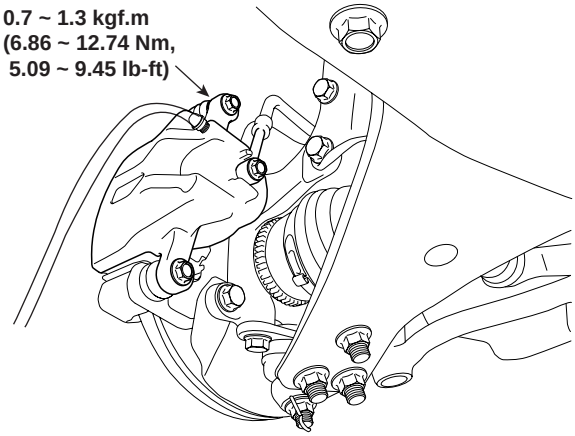
- *Do not reuse the drained fluid.*
- *Always use Genuine DOT 3 or DOT 4 Brake Fluid. Using a non-Genuine DOT3 or DOT 4 brake fluid can cause corrosion and decrease the life of the system.*
- *Make sure no dirt of other foreign matter is allowed to contaminate the brake fluid.*
- *Do not spill brake 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 level in the reservoir is at the MAX (upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply steady pressure.
3. Loosen the right-rear brake bleed screw to allow air to escape from the system. Then tighten the bleed screw securely.
4. Repeat the procedure for each wheel in the sequence shown below until air bubbles no longer appear in the fluid.
5. Refill the master cylinder reservoir to the MAX (upper) level line.



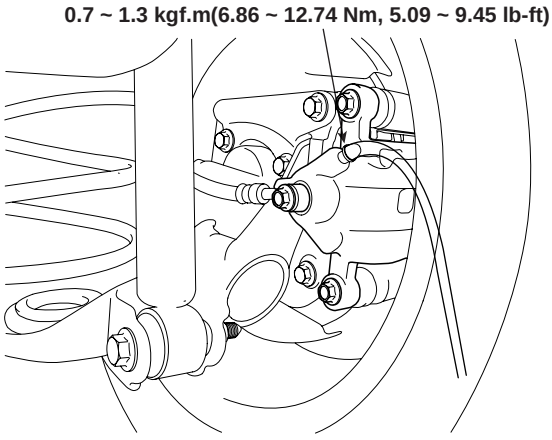
EJKE003B

FRONT DISC BRAKE :



LJJF500E

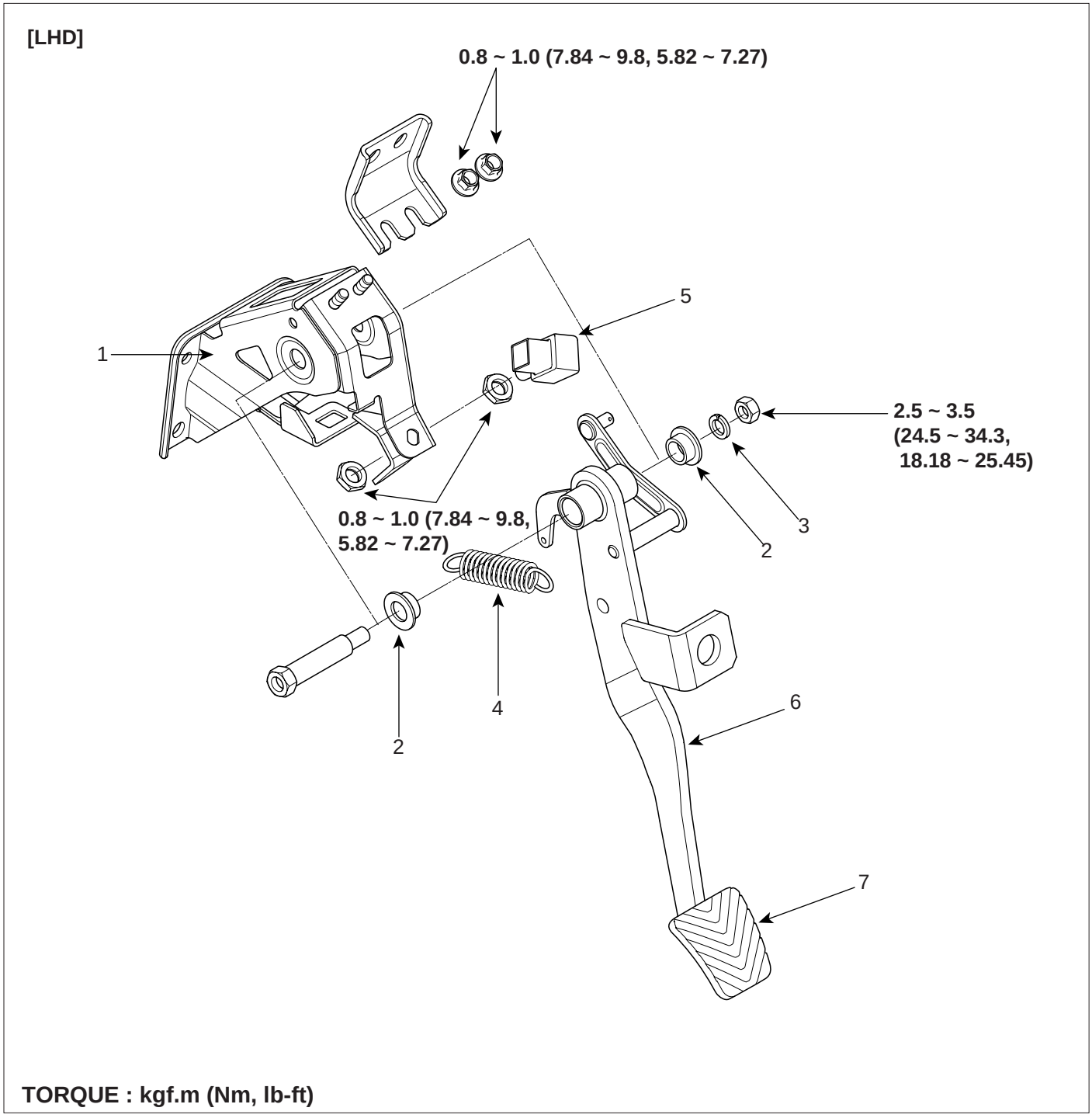
REAR DISC BRAKE :



LJJF500F

BRAKE PEDAL

COMPONENTS(1) EA5956F8

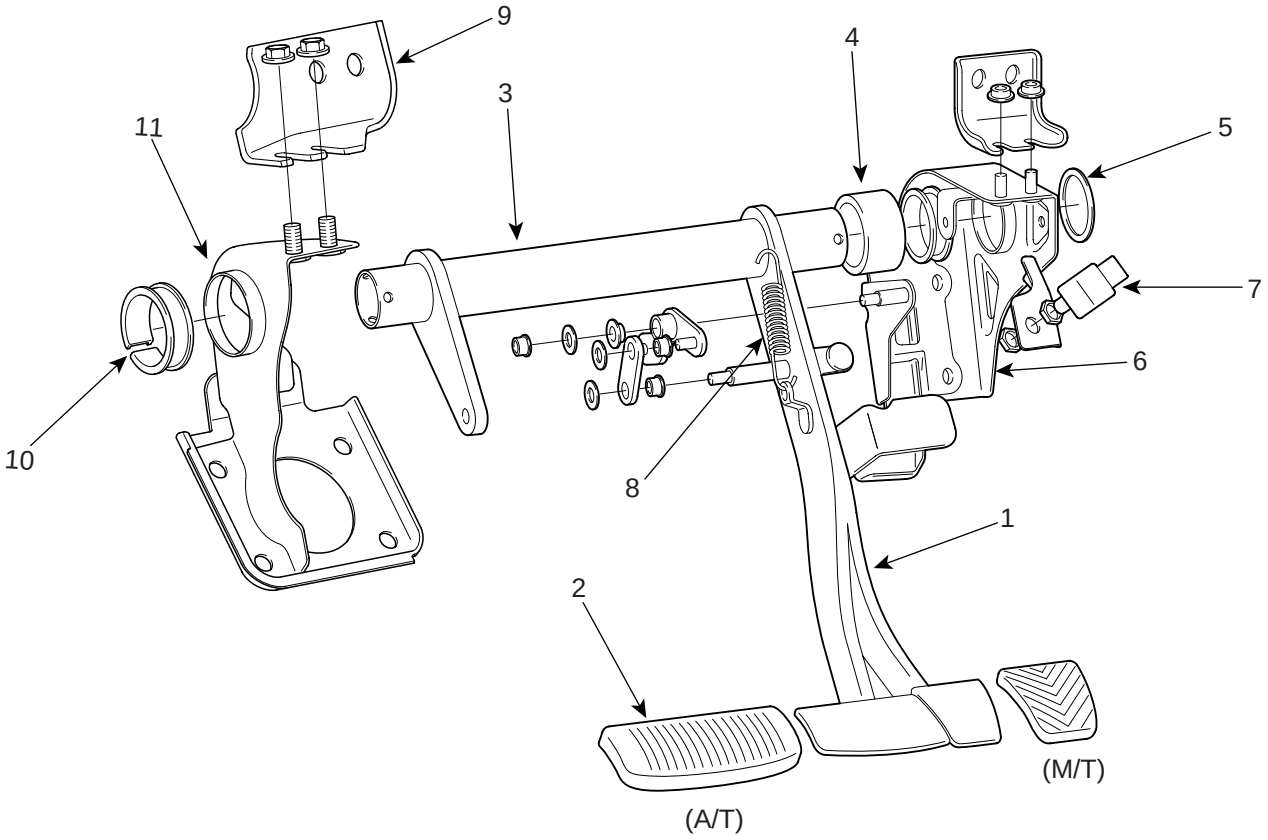


1. Member assembly bracket
2. Pedal bushing
3. Spring washer
4. Return spring
5. Stop lamp switch
6. Brake pedal
7. Pedal pad

LJJF500G

COMPONENTS(2)

[RHD]

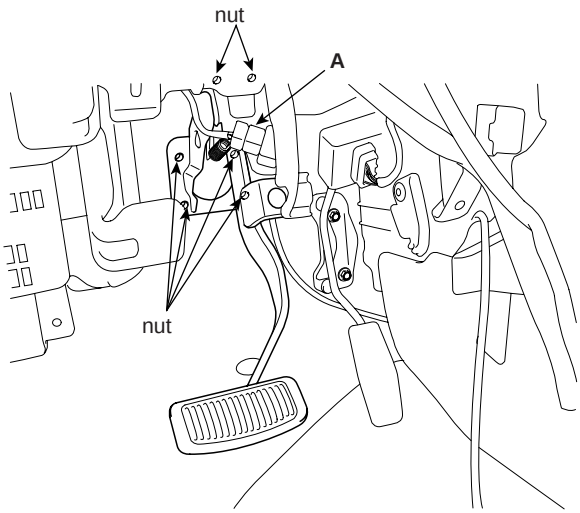


1. Brake pedal arm
2. Pedal pedal
3. Pipe
4. Bush
5. Washer
6. Pedal support bracket
7. Stop lamp switch
8. Return spring
9. Mounting bracket
10. Bushing
11. Support bracket

LJJF503X

REMOVAL E1A2ACB9

1. Remove the lower crash pad.(Refer to BD-“ crash pad”)
2. Loosen the brake member assembly bracket two upper nuts and 4 lower nuts.
3. Remove the stop lamp switch connector (A).

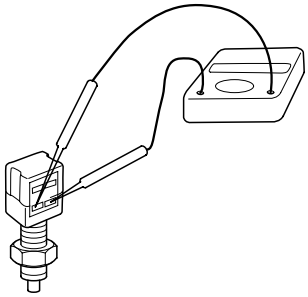


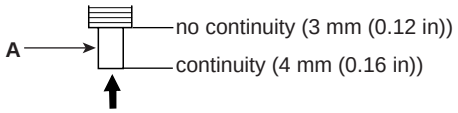
LJJF500H

4. Remove the shift lock cable (A/T).
5. Remove the clevis pin and snap pin.
6. Remove the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

INSPECTION E391CCB2

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting
3. Check all parts for crack and wear.
4. Check the stop lamp switch.
   1) Connect a circuit tester to the connector (1-2 terminals) 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 the plunger is pushed.





EJRF500O

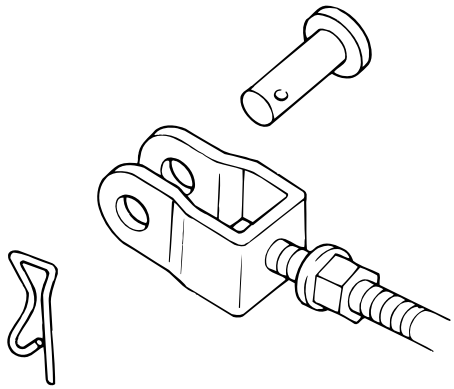
INSTALLATION E0F0CE0B

1. Installation is the reverse of removal.

CAUTION

Coat the inner surface of the bushings with the specified grease.

2. Before inserting the pin, apply the specified grease to the joint pin.



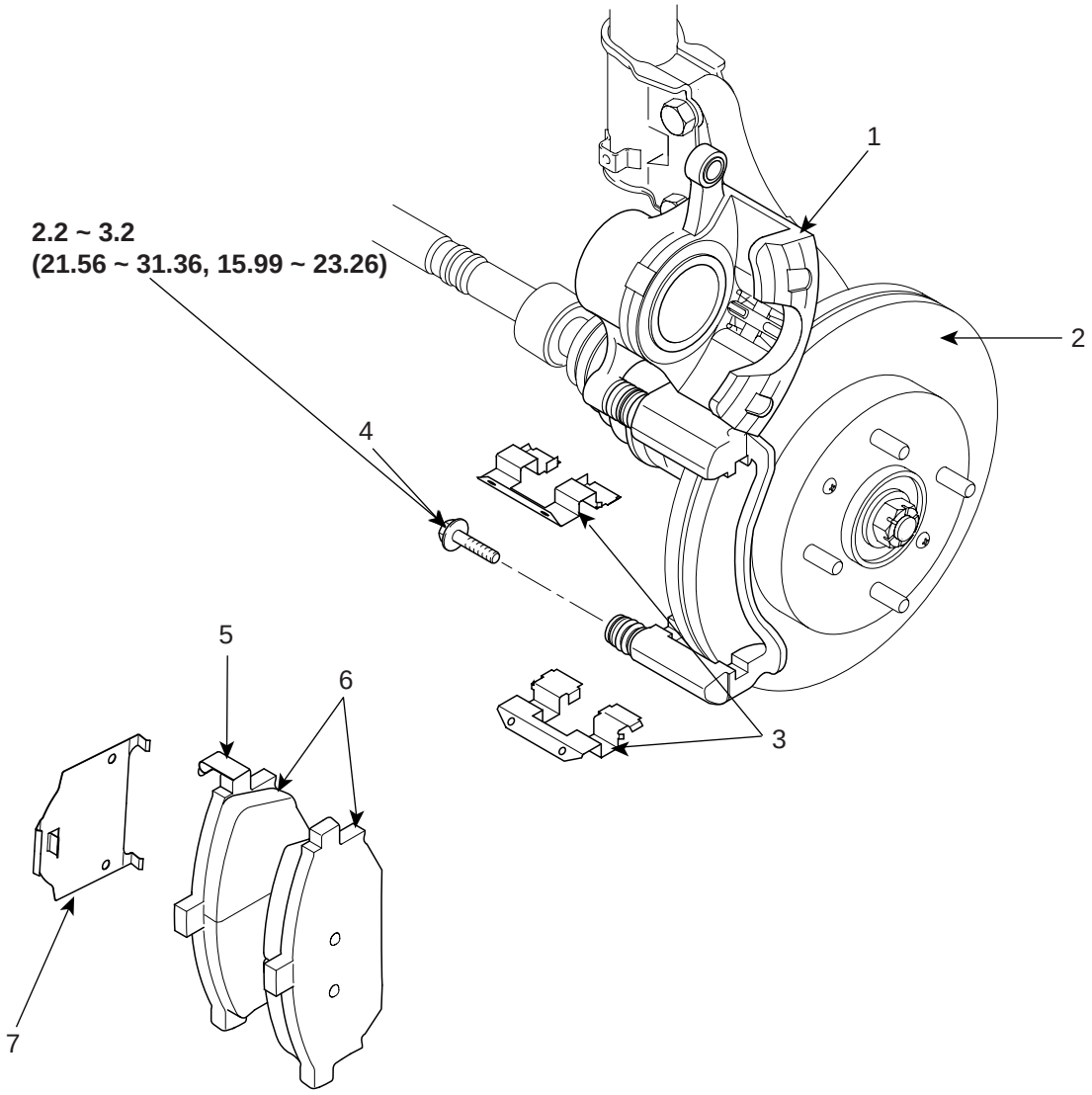
ARJE500U

3. Adjust the brake pedal height and free play.(See page BR-13)

4. Install the stop lamp switch.

FRONT DISC BRAKE

COMPONENTS(1) E2CE9A2B

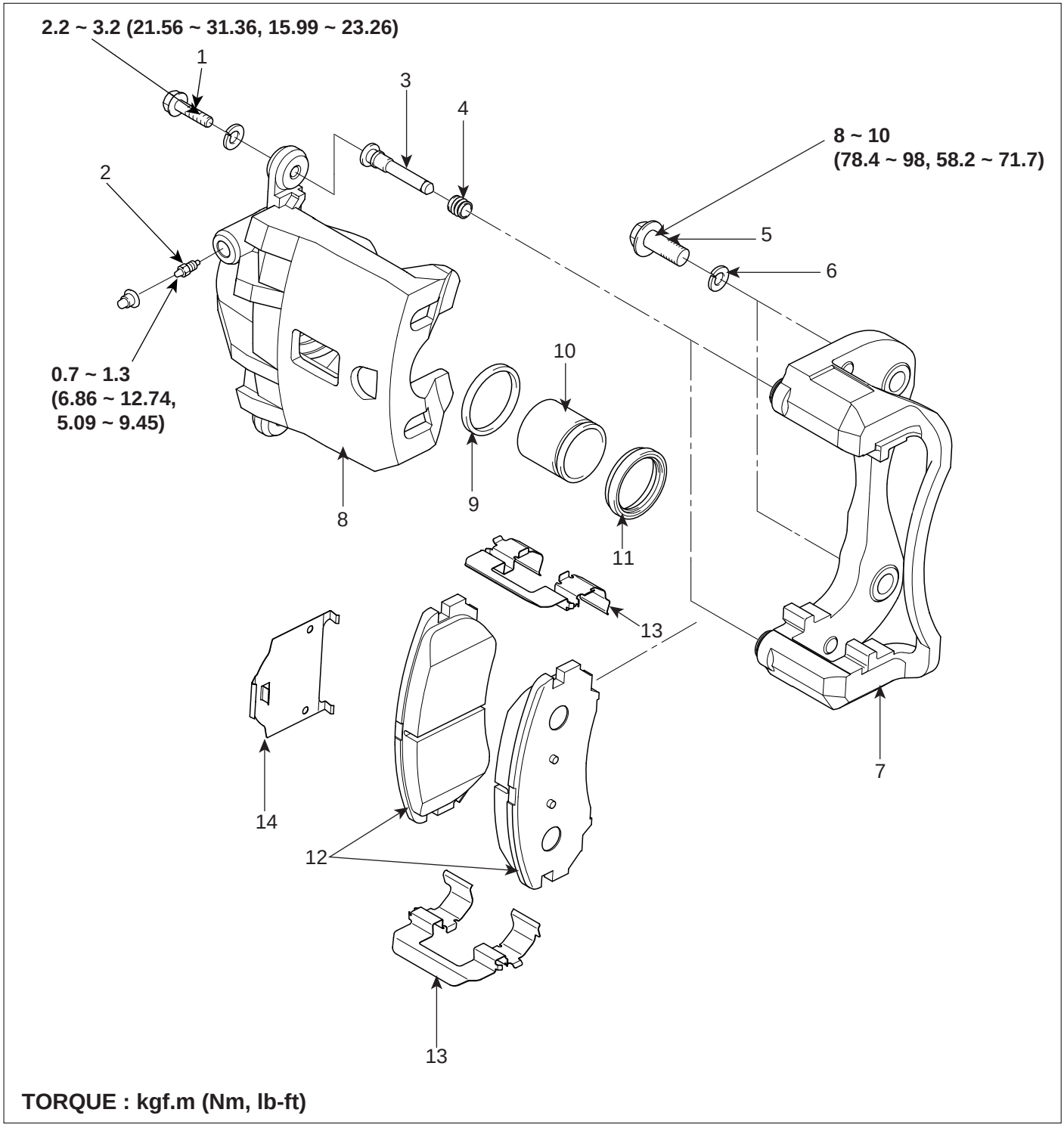


TORQUE : kgf.m (Nm, lb-ft)

1. Brake caliper
2. Brake disc
3. Pad retainer
4. Guide rod bolt
5. Indicator
6. Brake pad
7. Brake pad shim

LJJF500I

COMPONENTS(2)



1. Guide rod bolt
2. Bleeder screw
3. Guide rod
4. Boot
5. Caliper mounting bolt
6. Washer
7. Caliper bracket
8. Caliper body
9. Piston seal
10. Piston
11. Piston boot
12. Brake pad
13. Pad retainer
14. Shim

LJJF500J

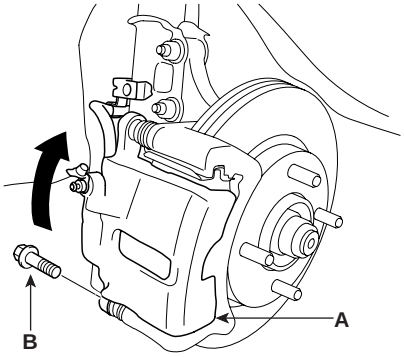
REMOVAL EDFFC96C

CAUTION

Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.

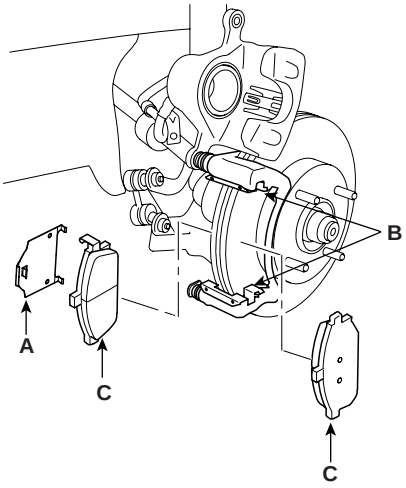
- ***Avoid breathing dust particles.***
- ***Never use on air hose or brush to clean brake assemblies.***

1. Remove guide rod bolt(B) and raise the caliper (A).Check the hoses and pin boots for damage and deterioration.



LJJF500K

2. Remove the pad shims (A), pad retainers (B) and pads (C).



LJJF503V

INSPECTION EB6A90F5

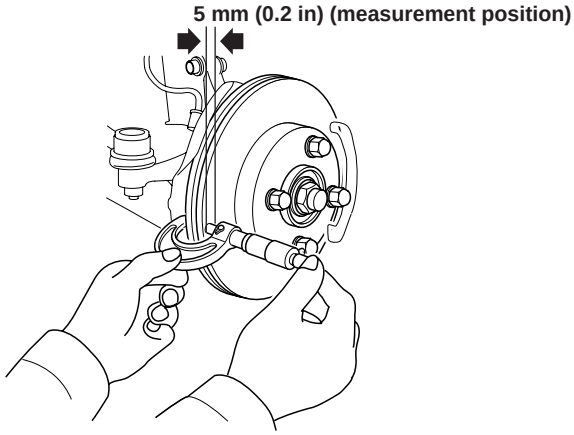
FRONT BRAKE DISC THICKNESS CHECK

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 4 positions at least.

Front brake disc thickness Standard value : 22.0 mm (0.87 in) Limit : 20.0 mm (0.79 in)

2. Thickness variation should not exceed 0.005 mm(0.0002 in) (circumference) and 0.05 mm(0.0020 in) (radius) at any directions.

3. If wear exceeds the limit, replace the discs and pad assemblies for left and right of the vehicle.

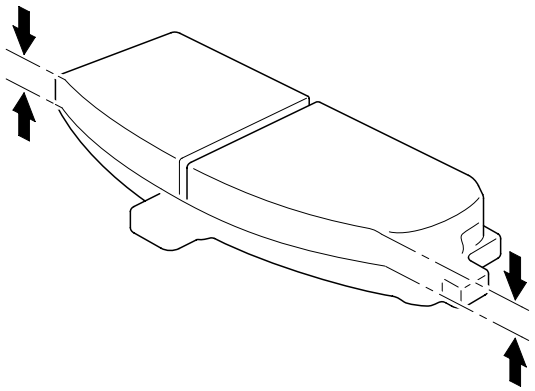


LJJF500L

FRONT BRAKE PAD CHECK

1. Check the pad wear. Measure the pad thickness. replace it if it is less than the specified value.

Pad thickness Standard value : 11.0 mm (0.43 in) Service limit : 2.0 mm (0.0787 in)



ARJE501R

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

FRONT BRAKE DISC RUN OUT CHECK

1. Place a dial gauge about 5mm (0.2 in) from the outer circumference of the brake disc, and measure the run out of the disc.

Brake disc run out Limit : 0.03mm (0.0012 in) or less

2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.

3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.

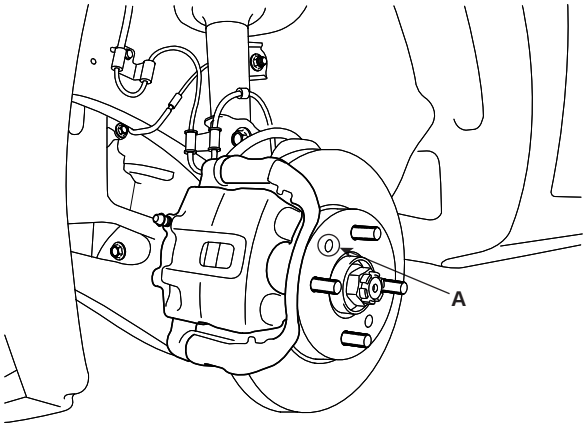
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

SEIZE OF FRONT BRAKE DISC

1. Remove the brake disc from hub using M8 screw(A) if the brake disc has been seized with the hub due to corrosion or overheat.

NOTE

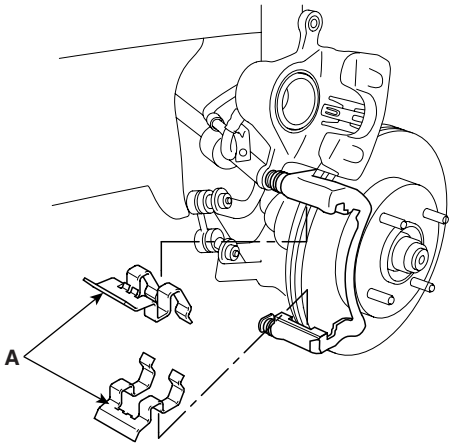
Be careful not to use the hammer. The disc can be damaged if you remove the disc from the hub by hammer.



AJJF600W

INSTALLATION E33C4CCA

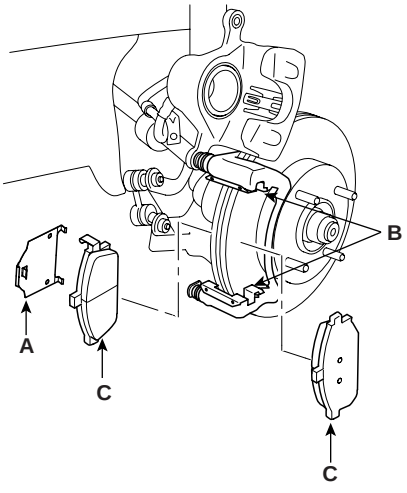
1. Install the pad retainers (A) to the caliper.



ARJE501M

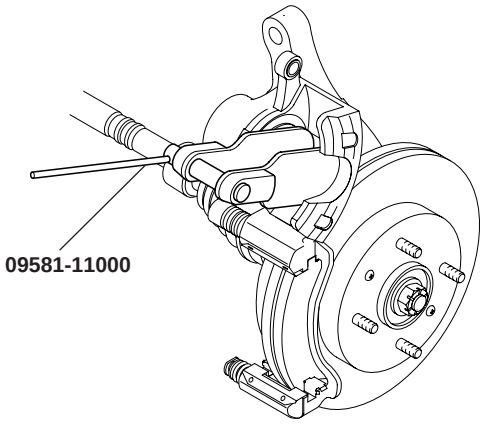
2. Check the foreign material at the pad shims (D) and the back of the pads (B).
   Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.

3. Install the brake pads (B) and pad shims (D) on the pad retainer correctly. Install the pad with the wear indicator (C) on the inside. If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.



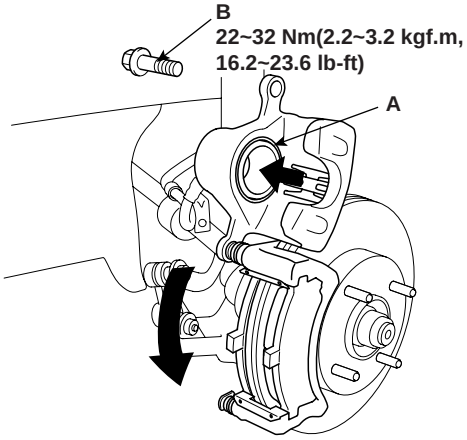
LJJF503Y

4. Push in the piston (A) using the SST(09581-11000) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.



AJJF600Y

5. Pivot the caliper down into position. Being careful not to damage the pin boot(A) , install the guide rod bolt (B) and tighten it to the specified torque.



LJJF503S

6. If caliper assembly was removed, install the brake hose to the caliper.

7. Refill the master cylinder reservoir to the MAX line.

8. Bleed the brake system.

9. Depress the brake pedal several times to make sure the brakes work, then test-drive.

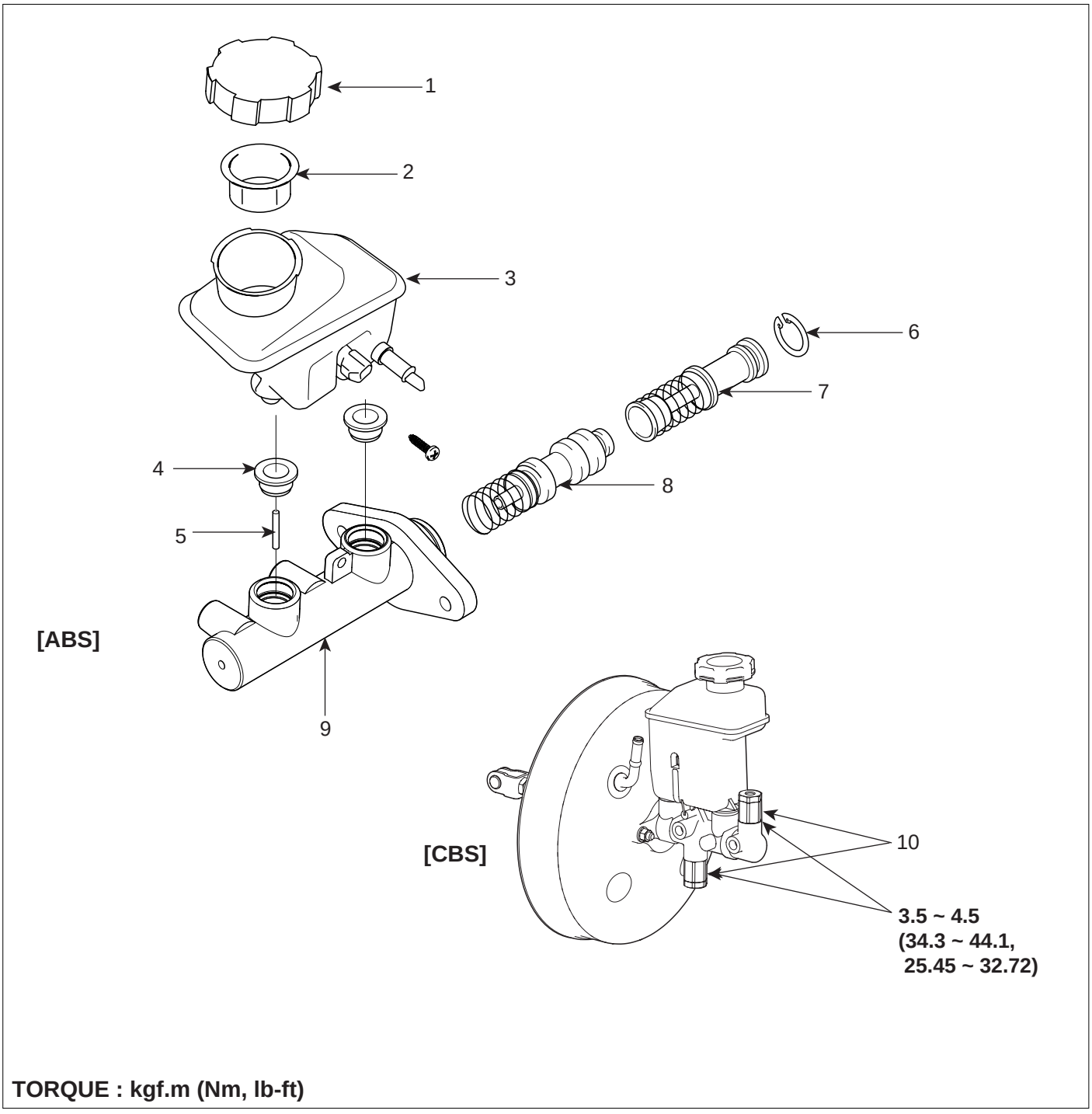
   NOTE

   Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set. Several applications of the brake will restore the normal pedal stroke.

10. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

MASTER CYLINDER

COMPONENTS EF483DAD



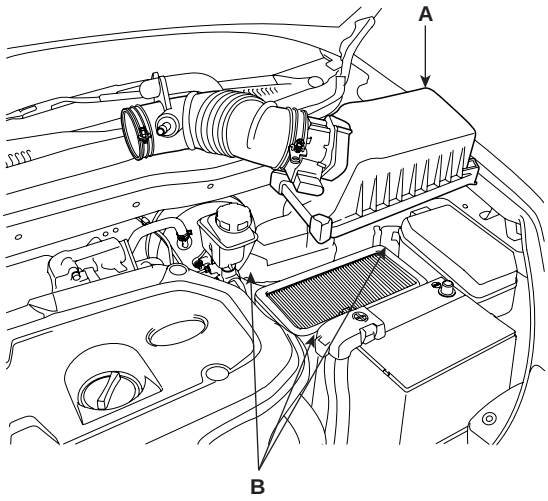
1. Reservoir cap
2. Brake fluid filter
3. Reservoir
4. Grommet
5. Cylinder pin
6. Retainer
7. Primary piston assembly
8. Secondary piston assembly
9. Master cylinder body
10. Proportioning valve

LJJF500M

REMOVAL EFB687E0

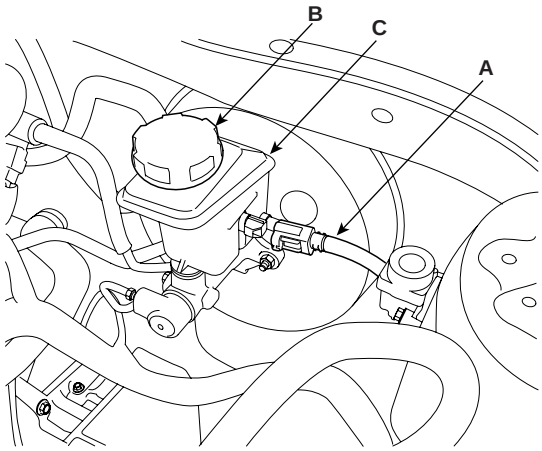
> ***NOTE***
>
> *Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.*

1. Remove air cleaner mounting bolts (B) from the air cleaner mounting bracket and air cleaner body (A).



AJJF509A

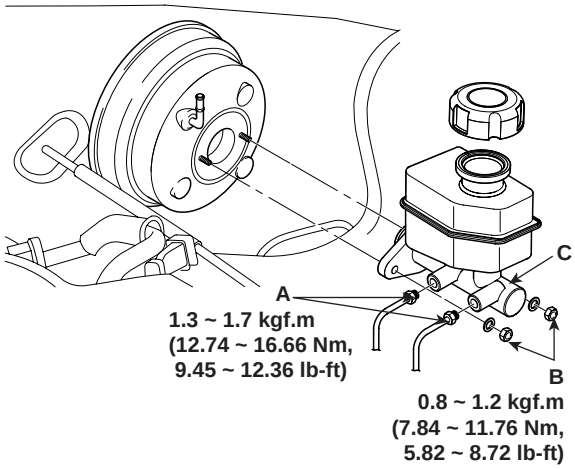
2. Disconnect the brake fluid level switch connector (A), and remove the reservoir cap (B).



AJJF510A

3. Remove the brake fluid from the master cylinder reservoir (C) with a syringe.

4. Disconnect the brake lines (A) from the master cylinder. To prevent spills, cover the hose joints with rags or shop towels.



LJJF500N

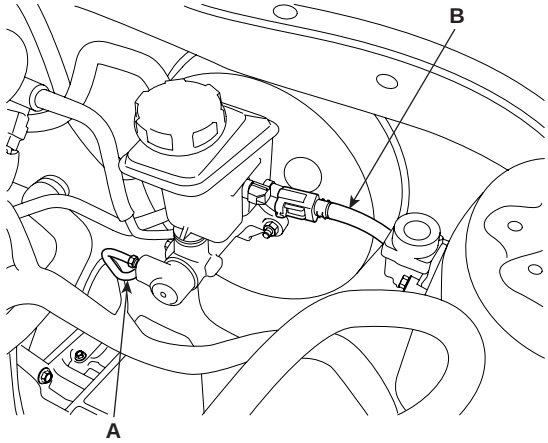
5. Remove the master cylinder mounting nuts (B) and washers.

6. Remove the master cylinder(C) from the brake booster . Be careful not to bend or damage the brake lines when removing the master cylinder.

INSTALLTION E11FF80D

1. Install the master cylinder to the brake booster.

2. Connect the brake tubes(A) and brake level switch connector(B) to the master cylinder.

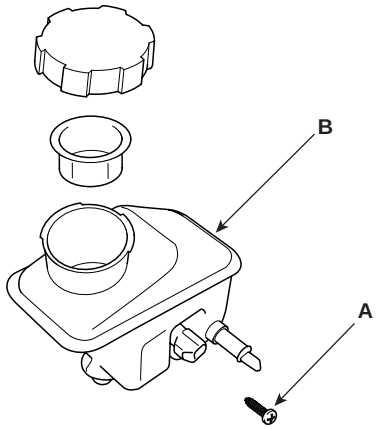


AJJF602P

3. After refill the master cylinder reservoir to the Max line , bleed the brake system.

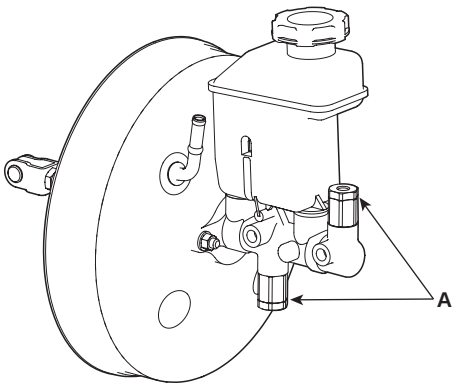
DISASSEMBLY E6BECAD4

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the fluid level sensor.
3. Remove the reservoir(B) from the master cylinder after remove the mounting screw (A).



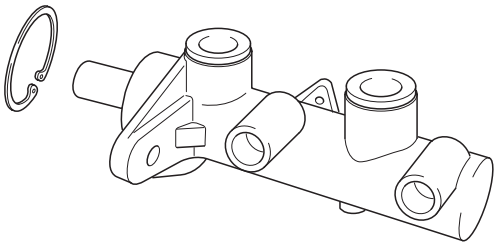
AJJF511A

4. Remove the proportioning valves .(Conventional brake system)



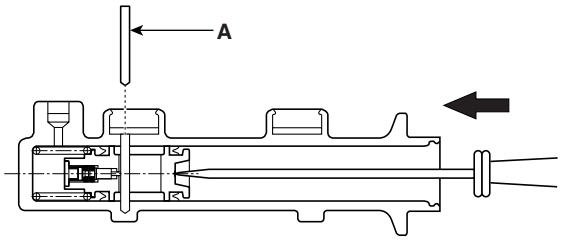
AJJF601C

5. Remove the retainer ring by using the snap ring pliers.



LJJF503Z

6. Remove the pin with the primary piston pushed completely using a screwdriver. Remove the primary piston assembly.
7. Remove the pin(A) with the secondary piston pushed completely using a screwdriver. Remove the secondary piston assembly.



ARJE501C

NOTE

Do not disassemble the primary and secondary piston assembly.

INSPECTION EE7BC2AE

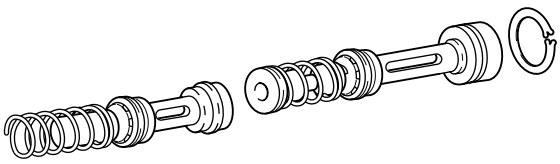
1. Check the master cylinder bore for rust or scratch.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

CAUTION

- ***If the cylinder bore is damaged, replace the master cylinder assembly.***
- ***Wash the contaminated parts in alcohol.***

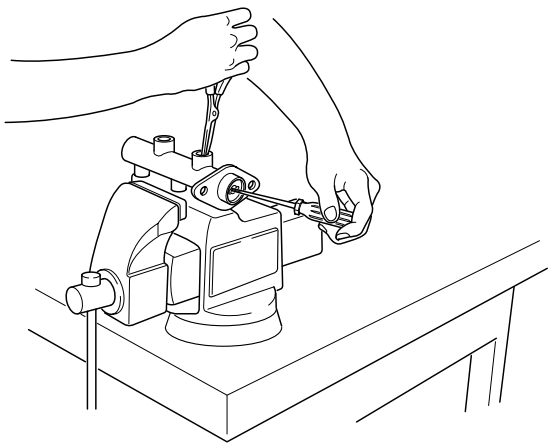
REASSEMBLY EFCF70D2

1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.
2. Carefully insert the springs and pistons in the proper direction.



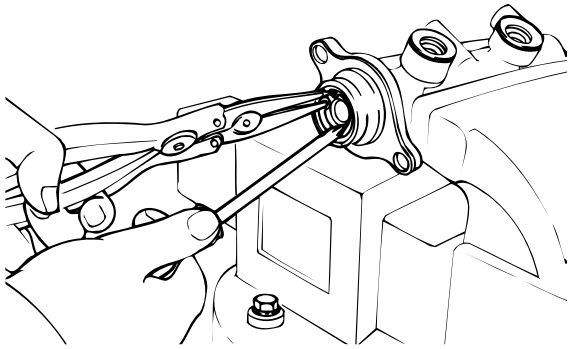
ARJE501D

3. Press the piston with a screwdriver and install the cylinder pin.



ARJE501E

4. Press the piston with a screwdriver and install the retainer ring.



ARJE501F

5. Install the proportioning valves.(In case of CBS)
6. Mount two grommets.
7. Install the reservoir on the cylinder.

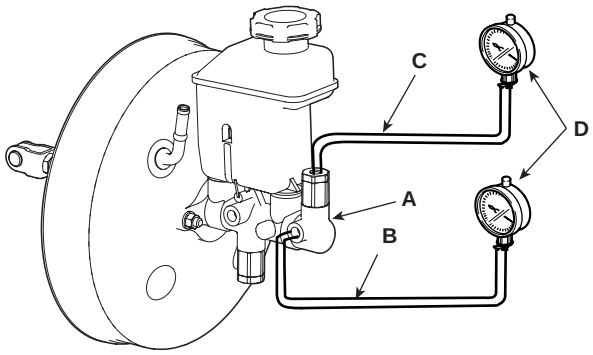
PROPORTIONING VALVE

DESCRIPTION EFADC65E

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.

INSPECTION E6EC99E9

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.



AJJF601D

NOTE

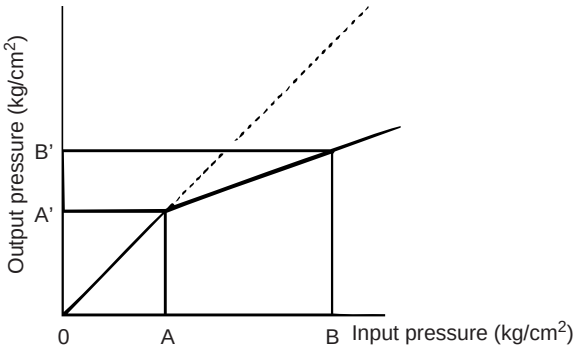
Be sure to bleed the system after connecting the pressure gauges.

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.

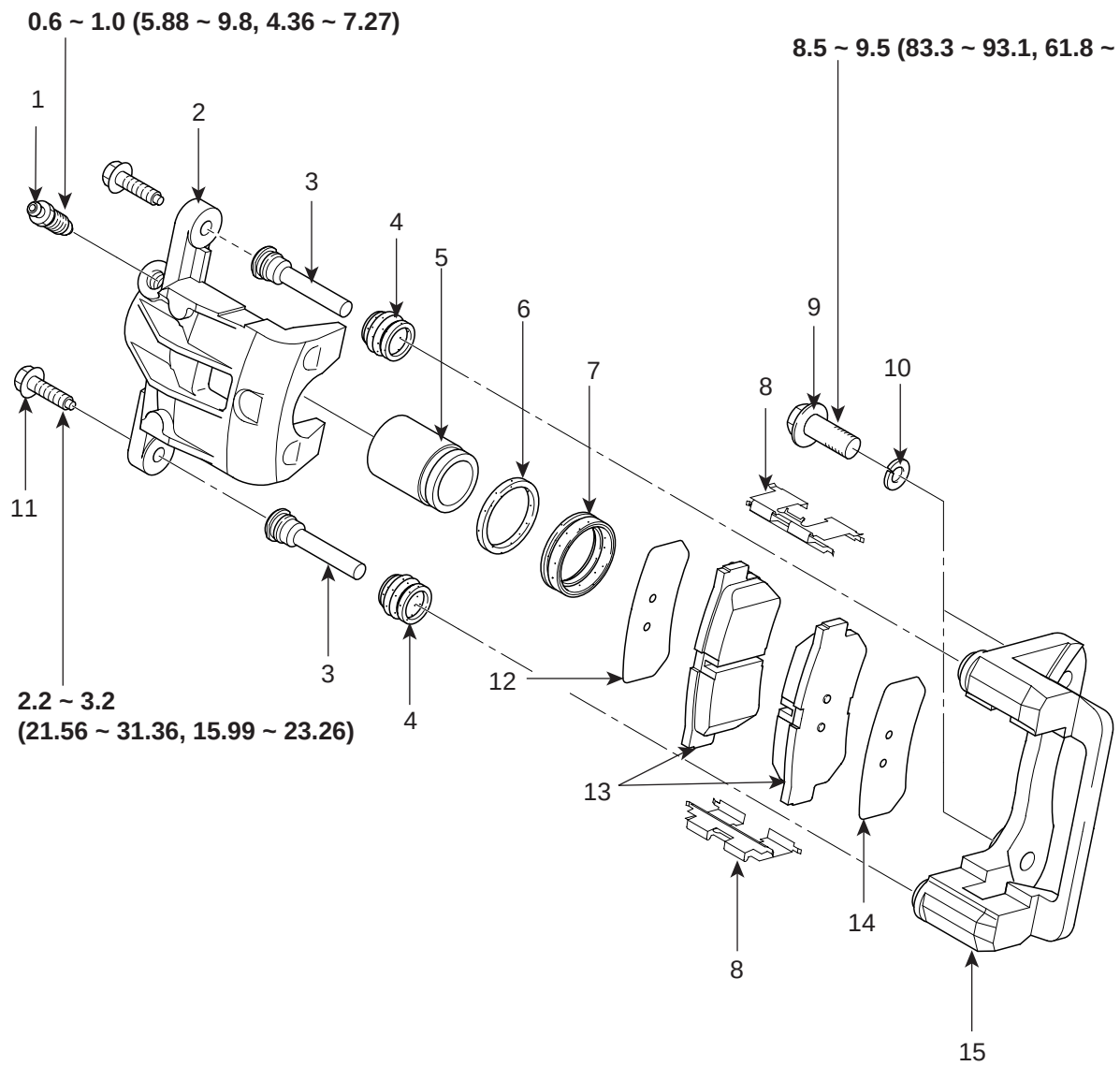
Front (Output of master cylinder)	Rear (Output of proportioning valve)
A : 35 kg/㎠ (3.43 MPa, 497 psi)	A' : 35 kg/㎠ (3.43 MPa, 497 psi)
B : 70 kg/㎠ (6.86 MPa, 996 psi)	B' : 44.5 ± 3.5 kg/㎠ (4.36 ± 0.34 MPa, 633 ± 50 psi)



LJJF500O

REAR DISC BRAKE

COMPONENTS E2BA80EE



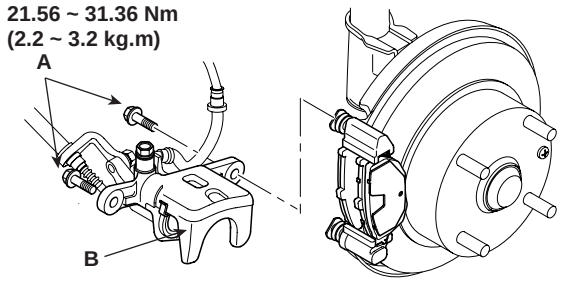
TORQUE : kgf.m (Nm, lb-ft)

1. Bleeder screw
2. Caliper body
3. Guide rod
4. Boot
5. Piston
6. Piston seal
7. Piston boot
8. Pad retainer
9. Caliper mounting bolt
10. Washer
11. Guide rod bolt
12. Inner shim
13. Brake Pad
14. Outer shim
15. Caliper bracket

LJJF500P

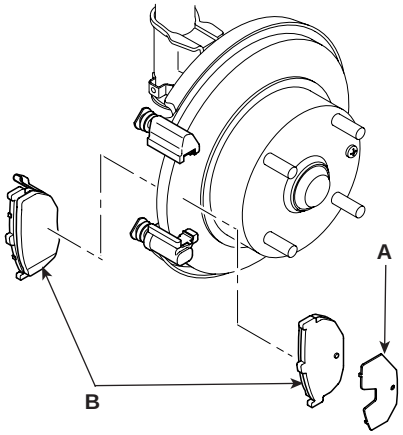
REMOVAL E09D14D6

1. Raise the rear of the vehicle and make sure it is securely supported. Remove the rear wheel.
2. Release the parking brake.
3. Remove the guide rod bolt(A). After raise the caliper assembly(B) , support it with a wire.



AJJF601E

4. Remove the pad shim(A) and pad assembly(B) .



EJKE600B

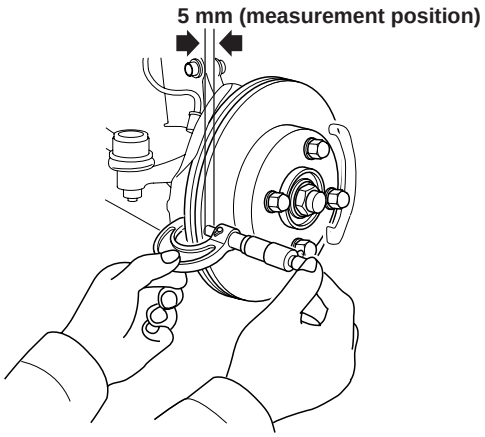
INSPECTION E85CF784

REAR BRAKE DISC THICKNESS CHECK

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 positions at least.

Rear brake disc thickness
Standard value : 10.0 mm (0.39 in)
Limit : 8.0 mm (0.315 in)

2. Thickness variation should not exceed 0.005mm(0.0002 in) (circumference) and 0.01mm(0.0004 in) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly for left and right of the vehicle.

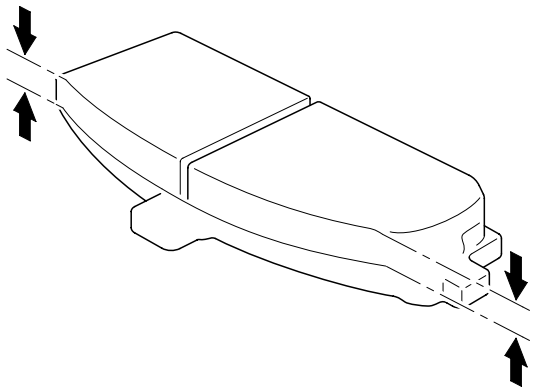


LJJF500Q

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 : 10.0 mm (0.39 in)
Service limit : 2.0 mm (0.0787 in)



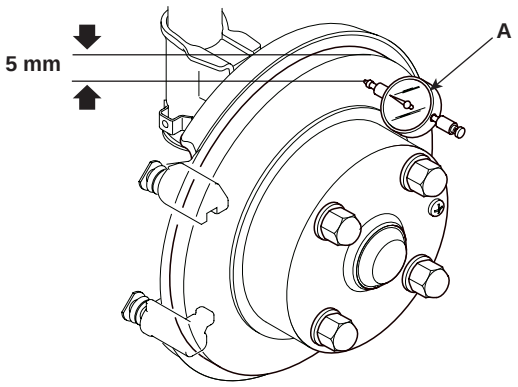
ARJE501R

2. Check that grease is applied, and the pad and backing metal for damage.

REAR BRAKE DISC RUN OUT CHECK

1. Place a dial gauge(A) about 5mm (0.2 in) from the outer circumference of the brake disc, and measure the run out of the disc.

Brake disc run out
Limit : 0.03mm (0.0012 in) or less



AJJF602R

2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.

3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.

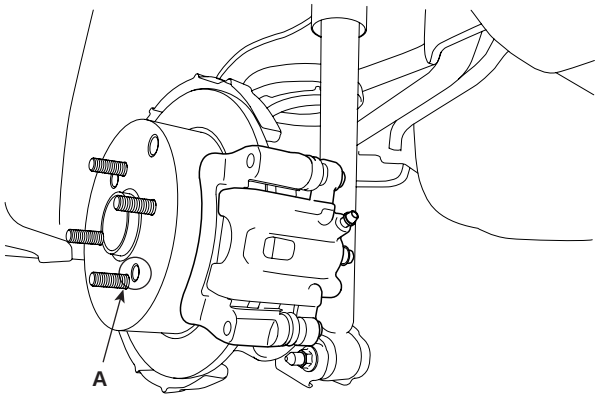
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

SEIZE OF REAR BRAKE DISC

1. Remove the brake disc from hub using M8 screw(A) if the brake disc has been seized with the hub due to corrosion or overheat.

NOTE

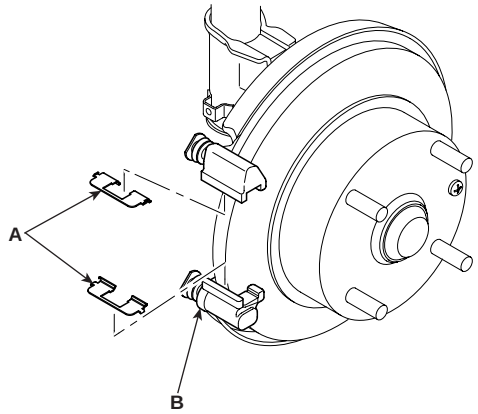
Be careful not to use the hammer. The disc can be damaged if you remove the disc from the hub by hammer.



AJJF601F

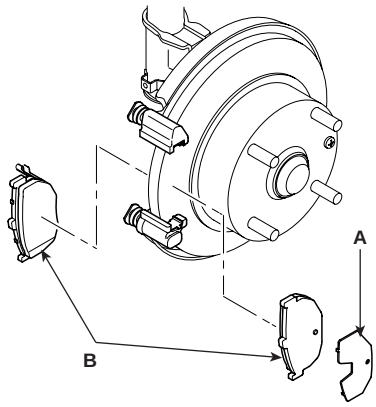
INSTALLATION E03660C4

1. Install the pad retainers(A) to the caliper (B).



EJKE600D

2. Check the foreign material at the pad shim (A) and the back of the pads (B).



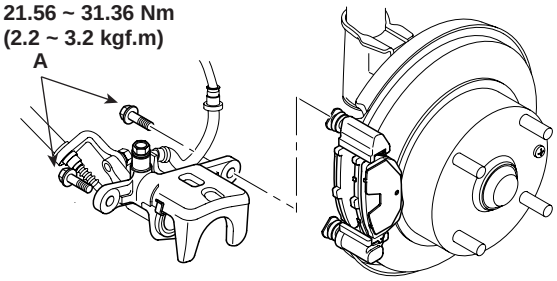
AJGE019D

3. Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.

4. Install the brake pads (B) and pad shim (A) on the caliper bracket.

5. If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency. Push in the piston using SST(09581-11000) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.

6. Pivot caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (A) and tighten it to the specified torque.



AJJF602S

7. Install the brake caliper .

8. After installation, check for leaks at hose and line joints and connections, and retighten if necessary.

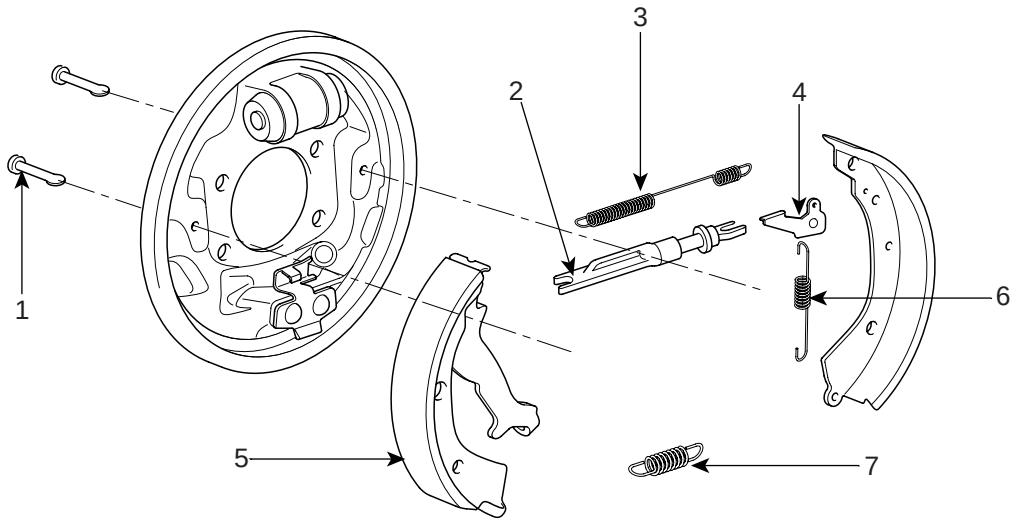
9. Depress the brake pedal several times to make sure the brakes work, then test-drive.

NOTE

Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set. Several applications of the brake pedal will restore the normal pedal stroke.

REAR DRUM BRAKE

COMPONENTS EDCBECAA



1. Shoe hold down pin
2. shoe adjuster
3. Upper return spring
4. Adjusting lever
5. Shoe
6. Adjusting spring
7. Lower return spring

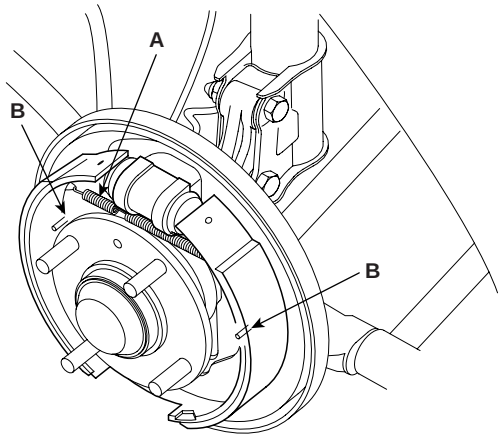
LJJF500R

REMOVAL EA43F67D

CAUTION

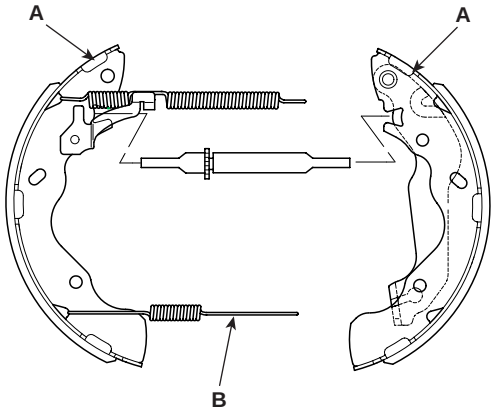
- ***Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.***
- ***Avoid breathing dust particles***
- ***Never use an air hose or brush to clean brake assemblies.***

1. Remove the shoe hold spring and shoe hold pin (B).
2. Remove the upper return spring (A).



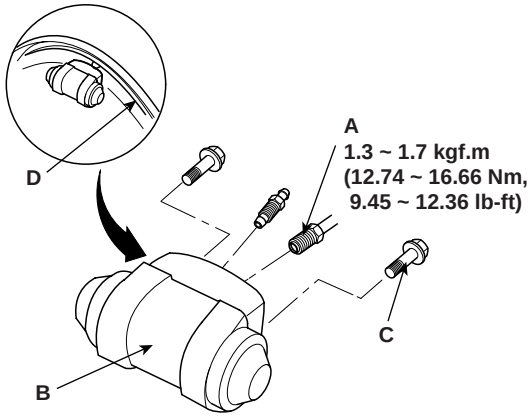
AJJF603K

3. 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.



AJJF601G

4. Disconnect the parking brake cable from the parking brake lever.
5. Remove the brake shoe assembly.
6. Disconnect brake tubes(A) from the wheel cylinder(B).
7. Remove the bolt (C) and the wheel cylinder(B) from the backing plate(D).



LJJF501Y

INSPECTION EC8DF780

CAUTION

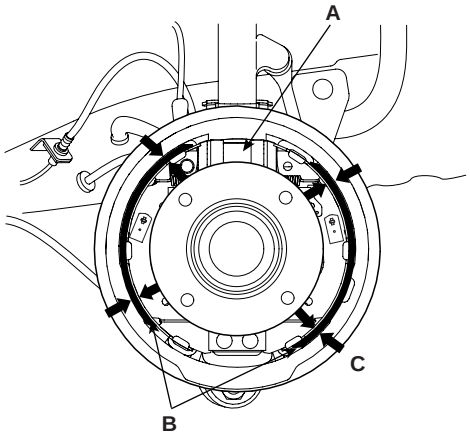
Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.

- ***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.



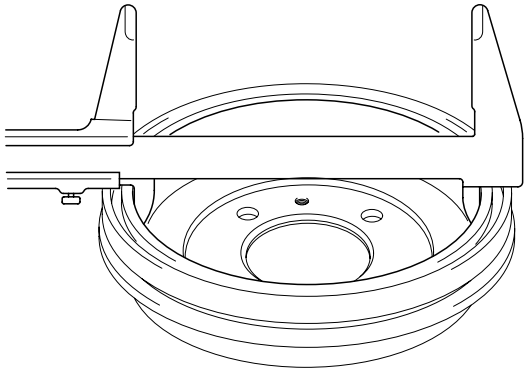
AJJF603N

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 : 3.9 ~ 4.5 mm (0.15 ~ 0.177 in.)
Service limit : 1.0 mm (0.039 in.)

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 : 203.2 mm (8.0 in)
Drum roundness
Service limit : 0.06 mm(0.00236 in)



EJKE800B

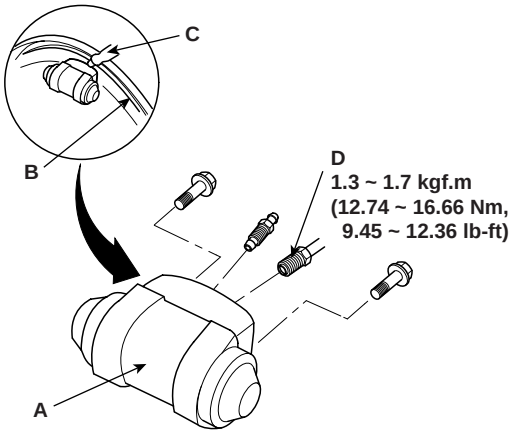
9. If the inside diameter of the brake drum is more than the service limit, replace the brake drum.
10. Check the brake drum for scoring, grooves, and cracks.
11. Inspect the brake lining and drum for proper contact.
12. Inspect the wheel cylinder outside for excessive wear and damage.
13. Inspect the backing plate for wear or damage.

INSTALLATION E287DD5D

NOTE

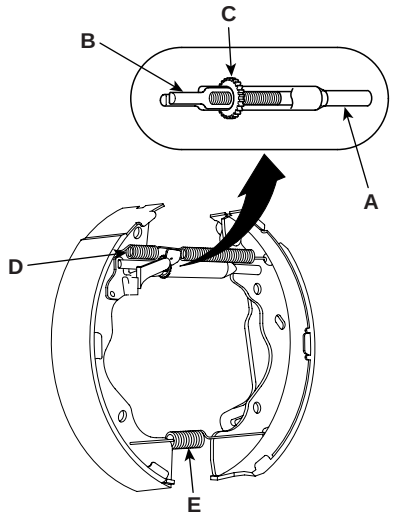
- *Do not spill brake fluid on the vehicle: it may damage the paint; if brake fluid does contact the paint. Wash it off immediately with water.*
- *To prevent spills, cover the hose joints with rags or shop towels.*
- *Use only a genuine wheel cylinder special bolt.*

1. Apply sealant (C) between the wheel cylinder (A) and backing plate (B), and install the wheel cylinder.



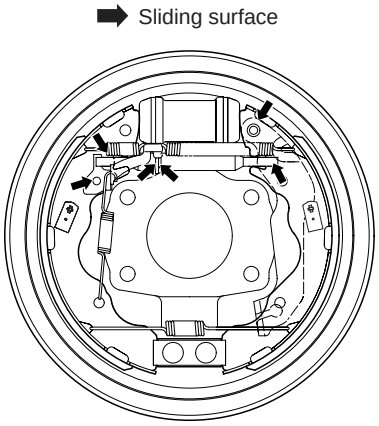
LJJF500S

2. Connect the brake tubes (D) to the wheel cylinder.
3. Connect the parking brake cable to the parking brake lever.
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).



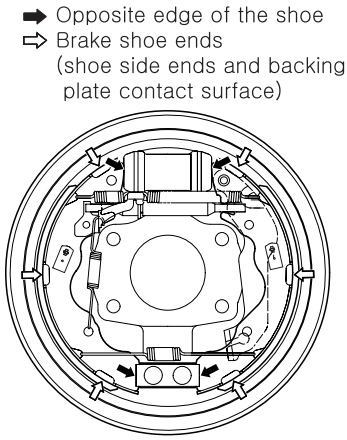
AJJF603E

5. Hook the shoe adjuster lever, then install it to the brake shoe.
6. Install the adjuster assembly and upper return spring (D) as right direction. Be careful not to damage the wheel cylinder dust covers.
7. Install the lower return spring (E).
8. Apply brake cylinder grease or equivalent rubber grease to the sliding surfaces shown. Don't get grease on the brake linings.



LJJF501Z

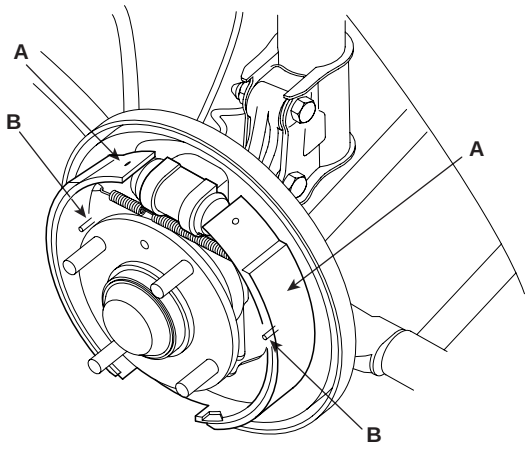
9. Apply brake cylinder grease or equivalent rubber grease to the brake shoe ends and opposite edges of the shoes shown. Don't get grease on the brake linings.



LJJF502A

10. Install the brake shoes (A) onto the backing plate. Be careful not to damage the wheel cylinder dust covers.

11. Install the shoe hole down pins (B) and the shoe hole down springs.



AJJF602V

12. Install the brake drum.

13. If the wheel cylinder has been removed, bleed the brake system.

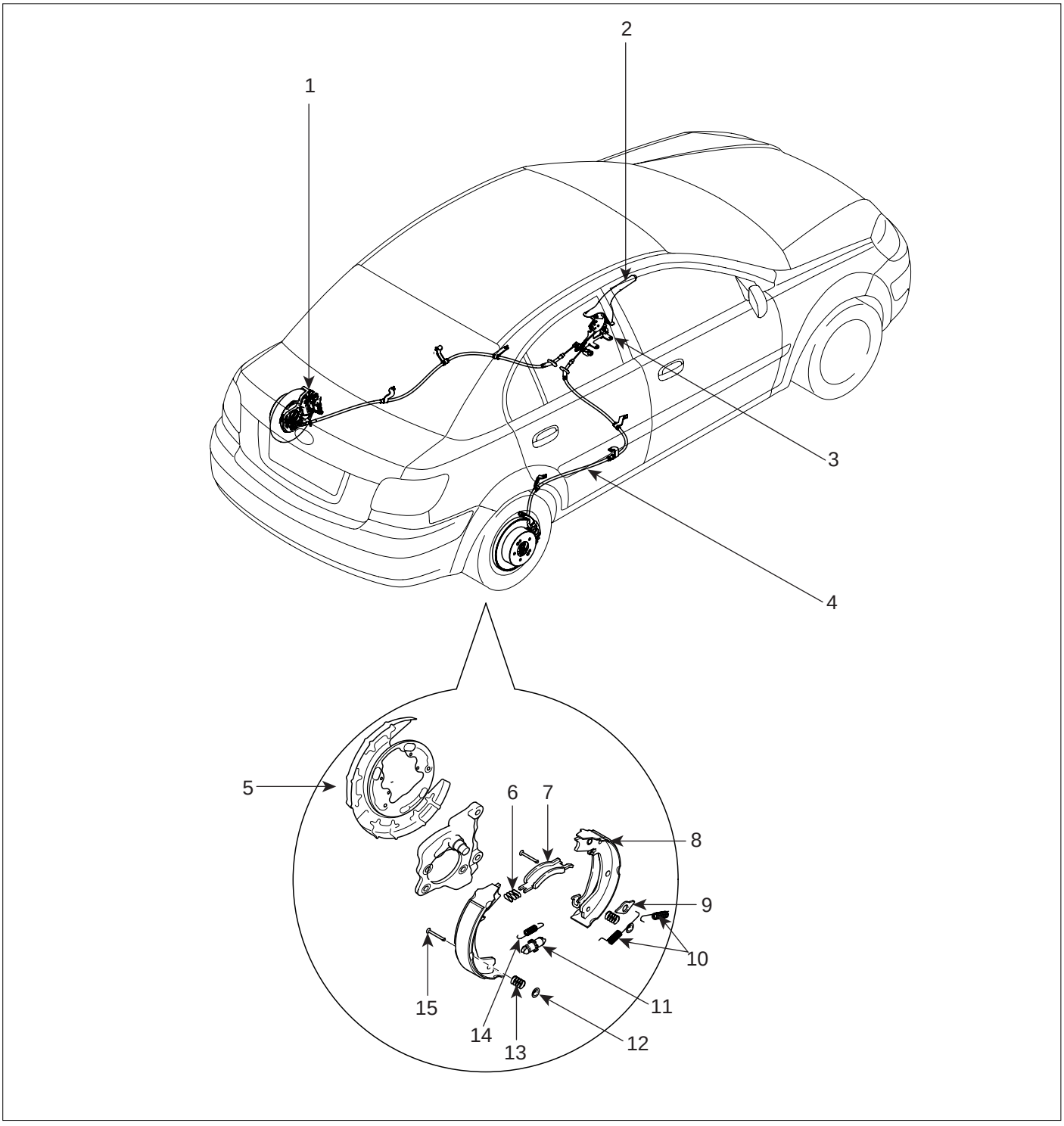
14. Depress the brake pedal several times to set the self-adjusting brake.

15. Adjust the parking brake.

PARKING BRAKE SYSTEM

PARKING BRAKE

COMPONENTS EC7B78AA



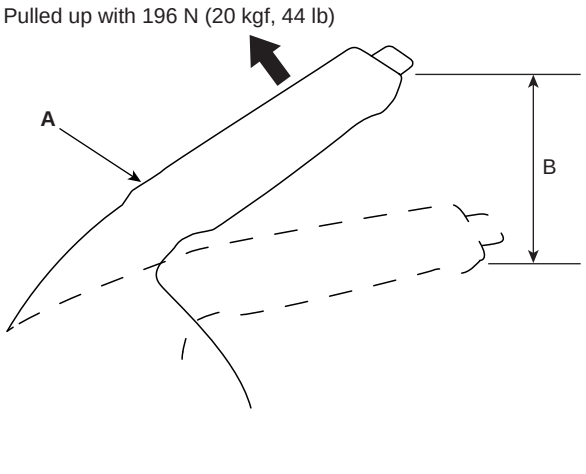
1. Rear brake caliper
2. Parking brake lever
3. Parking brake switch
4. Parking brake cable
5. Backing plate
6. Strut spring
7. Strut
8. Shoe & lining
9. Shoe guide
10. Return spring
11. Adjuster
12 .Cup washer
13. Shoe hold down spring
14. Return spring
15. Shoe hold down pin

LJJF500T

INSPECTION E0C21CF5

1. Pull the parking brake lever (A) with 196 N (20 kg, 44lbf) force to fully apply the parking brake. The parking brake lever should be locked within the specified number of clicks (B).

Lever locked clicks: 8~9 clicks



LJJF503U

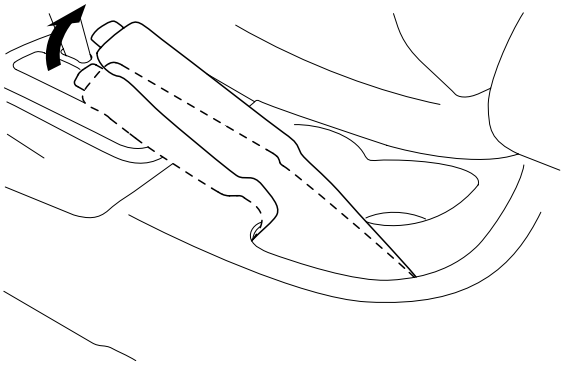
2. Adjust the parking brake if the lever clicks are out of specification.

ADJUSTMENT E037206C

NOTE

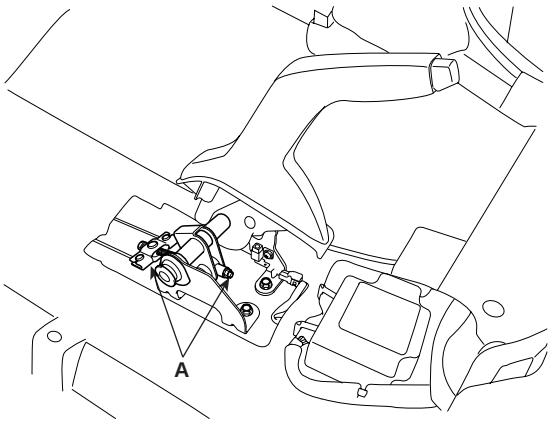
After rear brake caliper servicing, loosen the parking brake adjusting nut, start the engine and depress the brake pedal several times to set the self-adjusting brake before adjusting the parking brake.

1. Block the front wheels, then raise the rear of the vehicle and make sure it is securely supported.
2. Pull the parking brake lever up one click.



ARJE502R

3. Remove the console.(Refer to the body group -console)
4. Tighten the adjusting nuts (A) until the parking brakes drag slightly when the rear wheels are turned.



AJJF513A

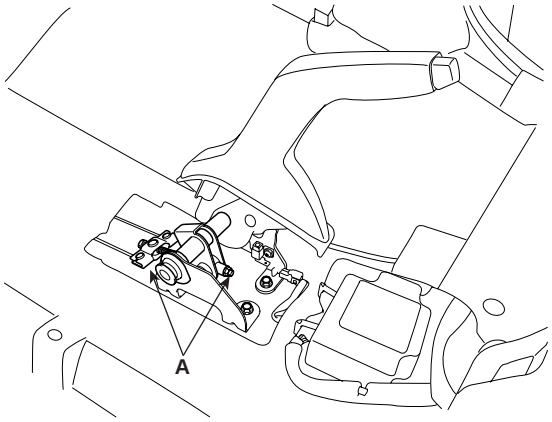
5. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
6. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
7. Reinstall the console.

REMOVAL EBF83E8B

NOTE

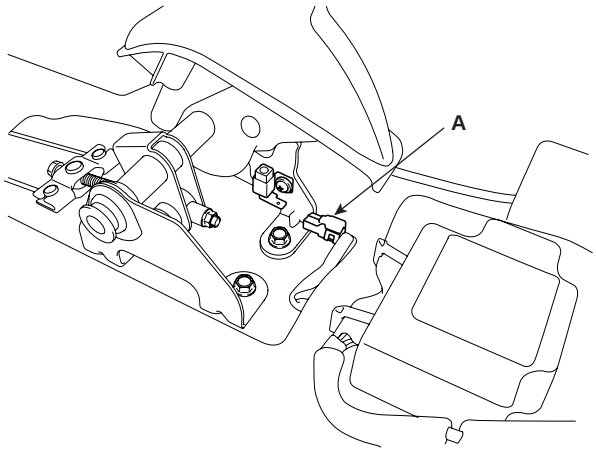
The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

1. Remove the console.(refer to body group-console)
2. Loosen the adjusting nut (A) and the parking brake cables.



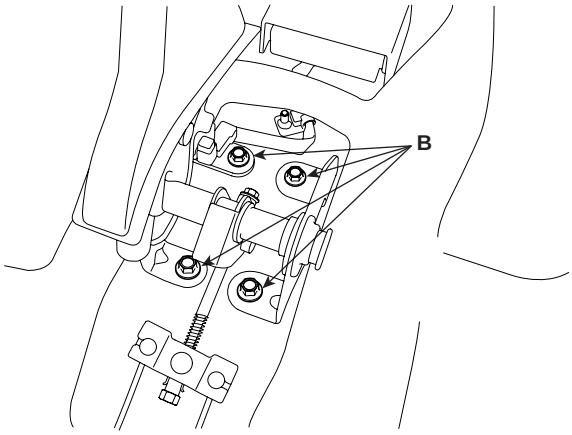
AJJF601I

3. Disconnect the connector(A) of parking brake switch.



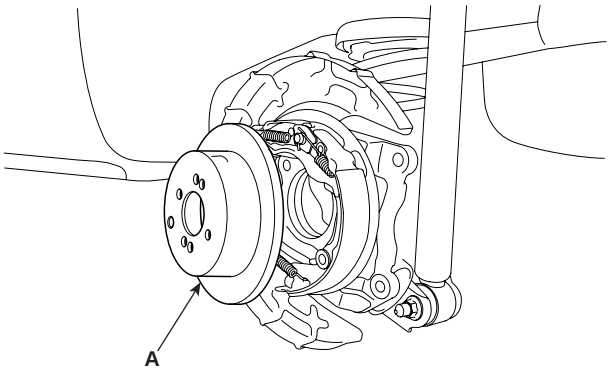
AJJF514A

4. Remove the parking brake lever assembly(A) with loosening the bolts(B).



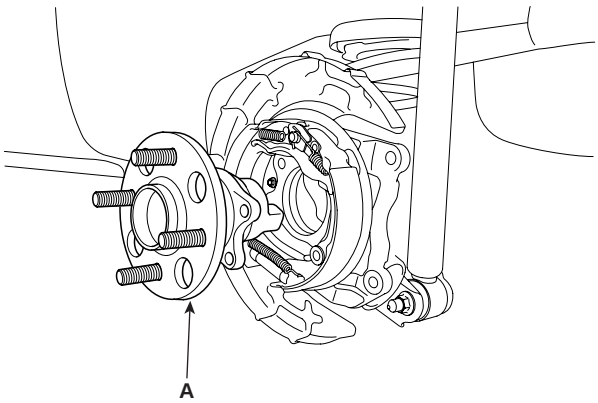
AJJF515A

5. Remove the wheel and tire.
6. Remove the brake disc(A).



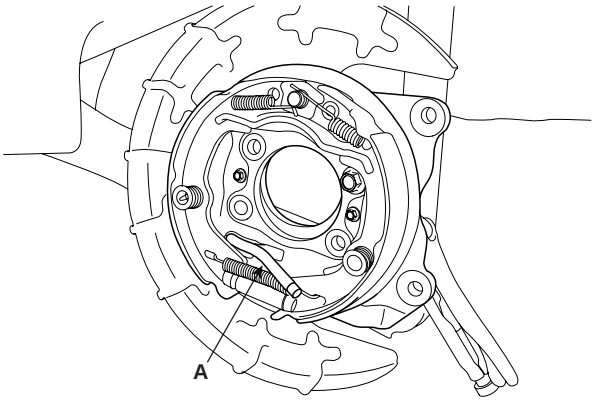
AJJF516A

7. Remove the rear hub unit bearing(A).



AJJF517A

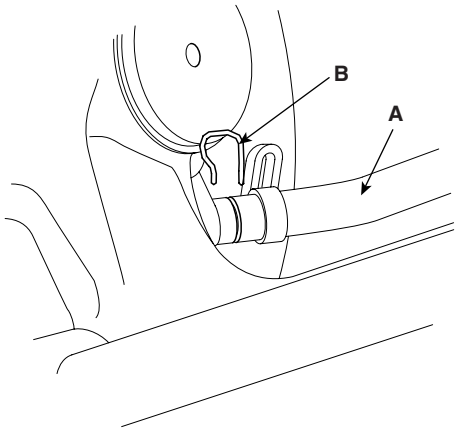
8. Remove the parking brake cable(A) from the brake shoe.



AJJF518A

9. Remove the brake shoe.

10. Remove the parking brake cable retaining ring(B) from the parking brake cable (A).



ARJE502W

11. Loosen the parking brake cable clamp , then remove the parking brake cable assembly.

INSTALLATION E4FB9A84

1. Check the parking brake cables for an identification mark paint and install as appropriate on the left and right sides.

Identification color **Rear drum brake** Left side : Red Right side : Yellow **Rear disc brake** Left side : Green Right side : White

2. Install the removed parts in the reverse order of removal.

3. Apply a coating of the specified grease to each sliding parts of the ratchet plate or the ratchet pawl.

Specified grease : Multi purpose grease SAE J310, NLGI No.2

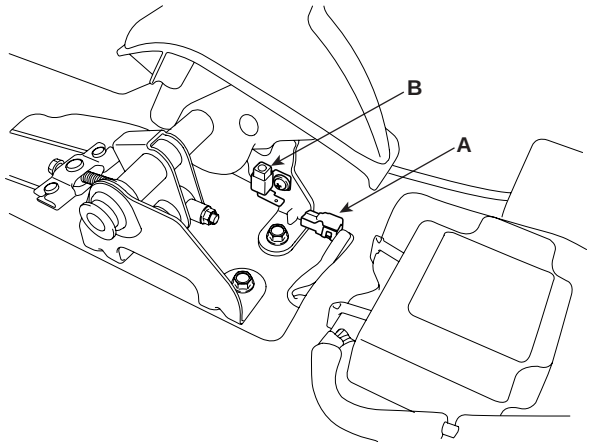
4. After installing the cable adjuster, adjust the parking brake lever stroke (see page BR-46).

PARKING BRAKE SWITCH

INSPECTION EFDC90BA

1. Remove the floor console .(refer to body group-console)

2. Remove the connector(B) from the switch(A).



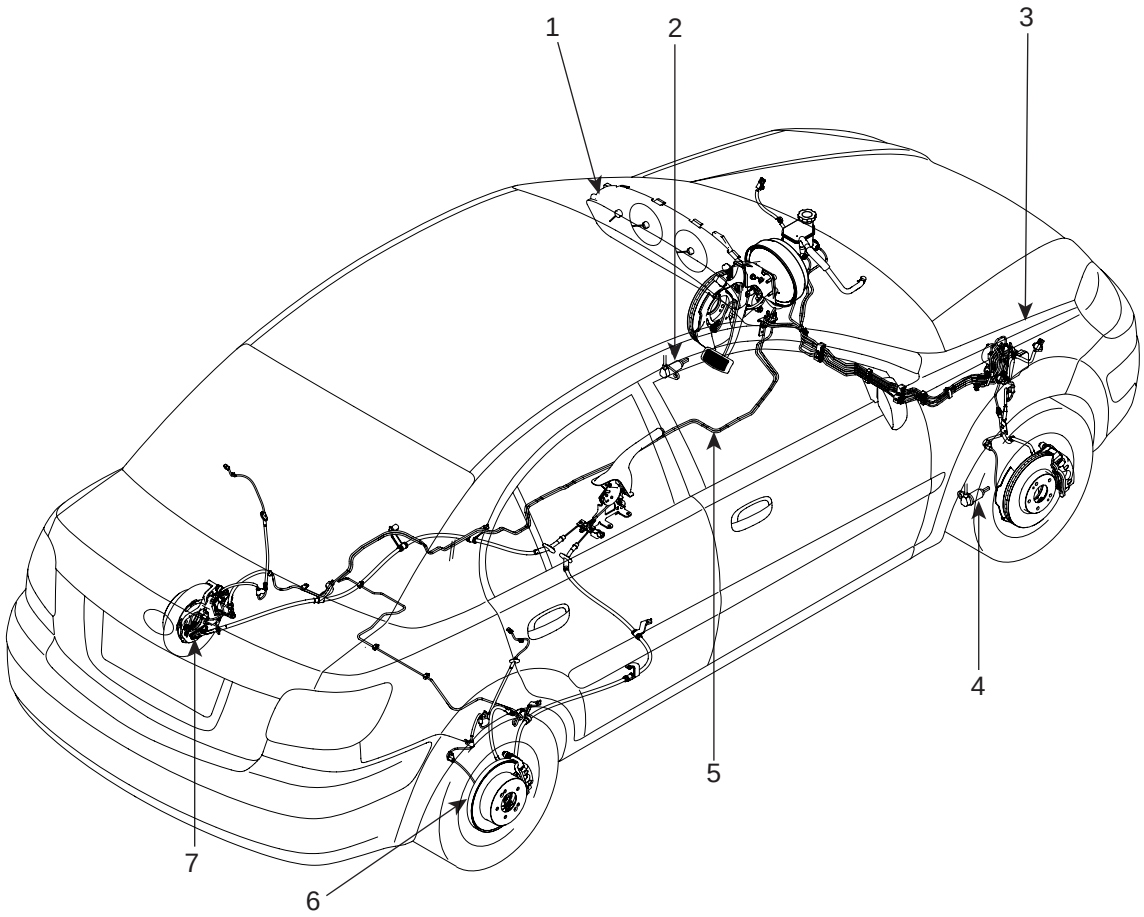
AJJF601J

3. Inspect the continuity between (-) terminal and the ground.
   - When the brake lever is pulled, there should be the continuity between them.
   - When the brake lever is released, there should be no continuity between them.

ABS (ANTI-LOCK BRAKE SYSTEM)

COMPONENTS EB2E466E

This illustration is shown the LHD type.
RHD type is symmetrical.



1. Cluster (ABS/EBD warning lamp)
2. Front left wheel speed sensor
3. ABS control module (HECU)
4. Front right wheel speed sensor
5. Hydrauric line
6. Rear right wheel speed sensor
7. Rear left wheel speed sensor

LJJF500U

DESCRIPTION E5846EFE

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/ESP 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 MCU.

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.

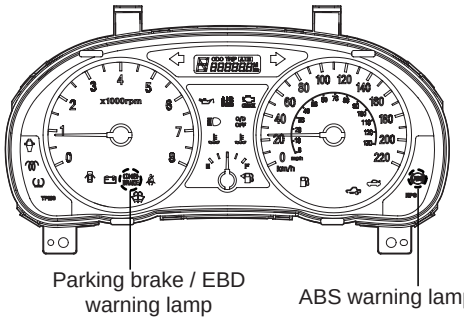
PUMP MOTOR CHECKING

The ECU performs a pump motor test at a speed of 12k m/h(7 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 MODULE



LJJF500V

1. ABS Warning Lamp module
   The active ABS warning lamp module 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.

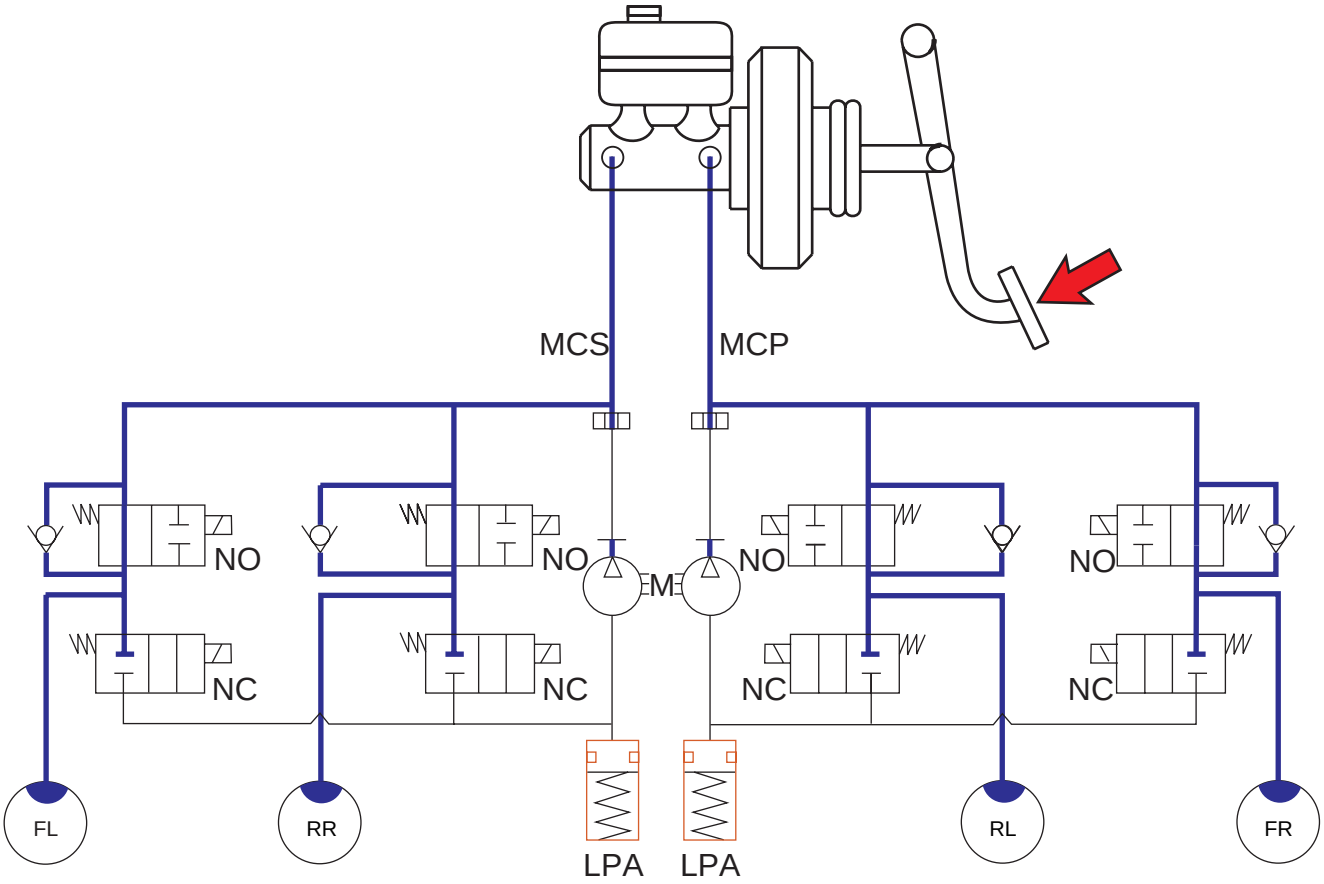
2. PARKING/EBD warning lamp module
   The active EBD warning lamp module indicates the self-test and failure status of the EBD.
   However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.
   The EBD warning lamp shall be on:
   - During 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.

ABS CONTROL EFC9BCEA

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 is 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	

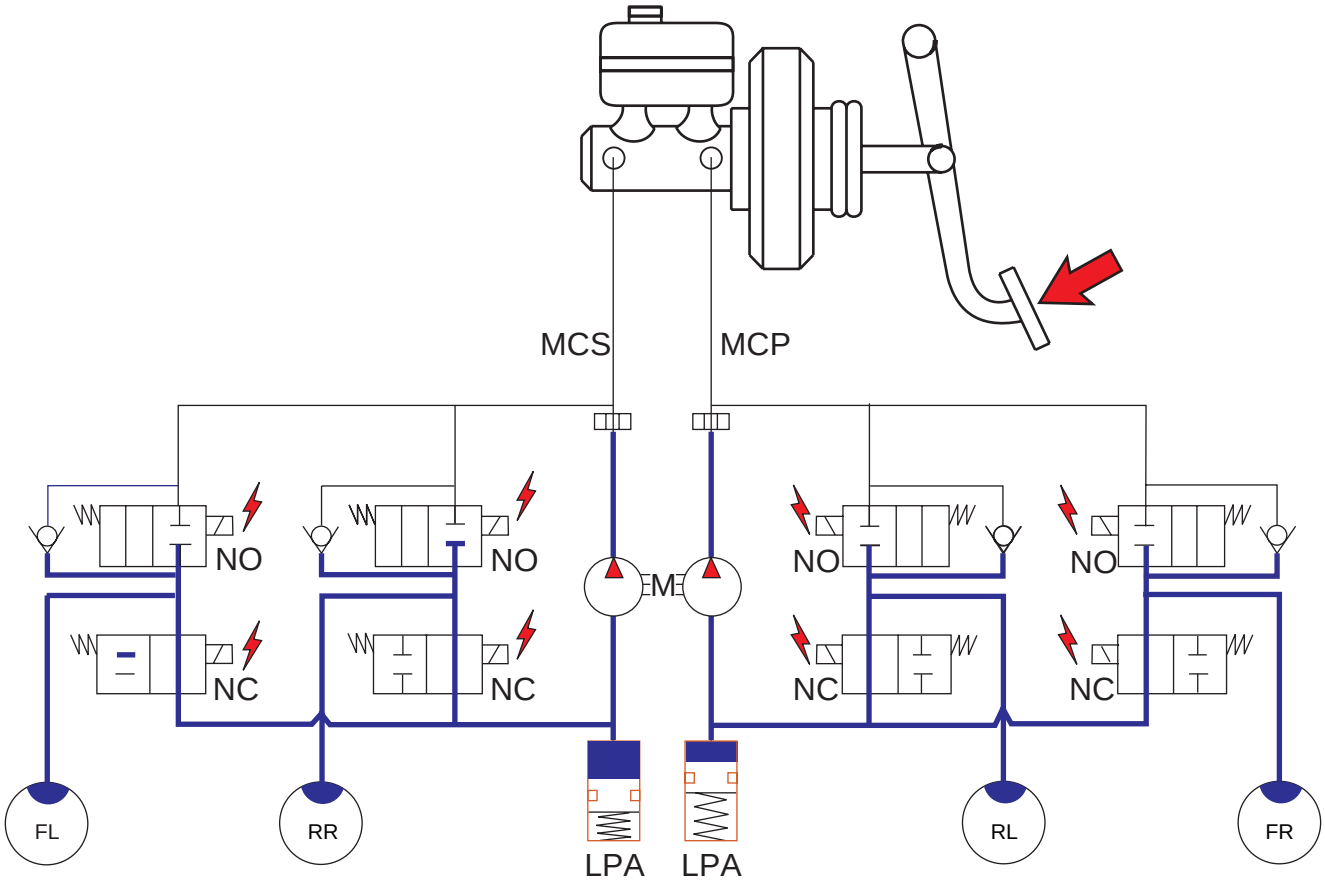


LJJF500W

2. DUMP MODE

Under the emergency braking, if the wheels start to lock up, HECU sends a signal to the solenoid valve to decrease the brake fluid, then voltage is supplied to each solenoid. At this time inlet valve is closed and brake fluid is blocked 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	

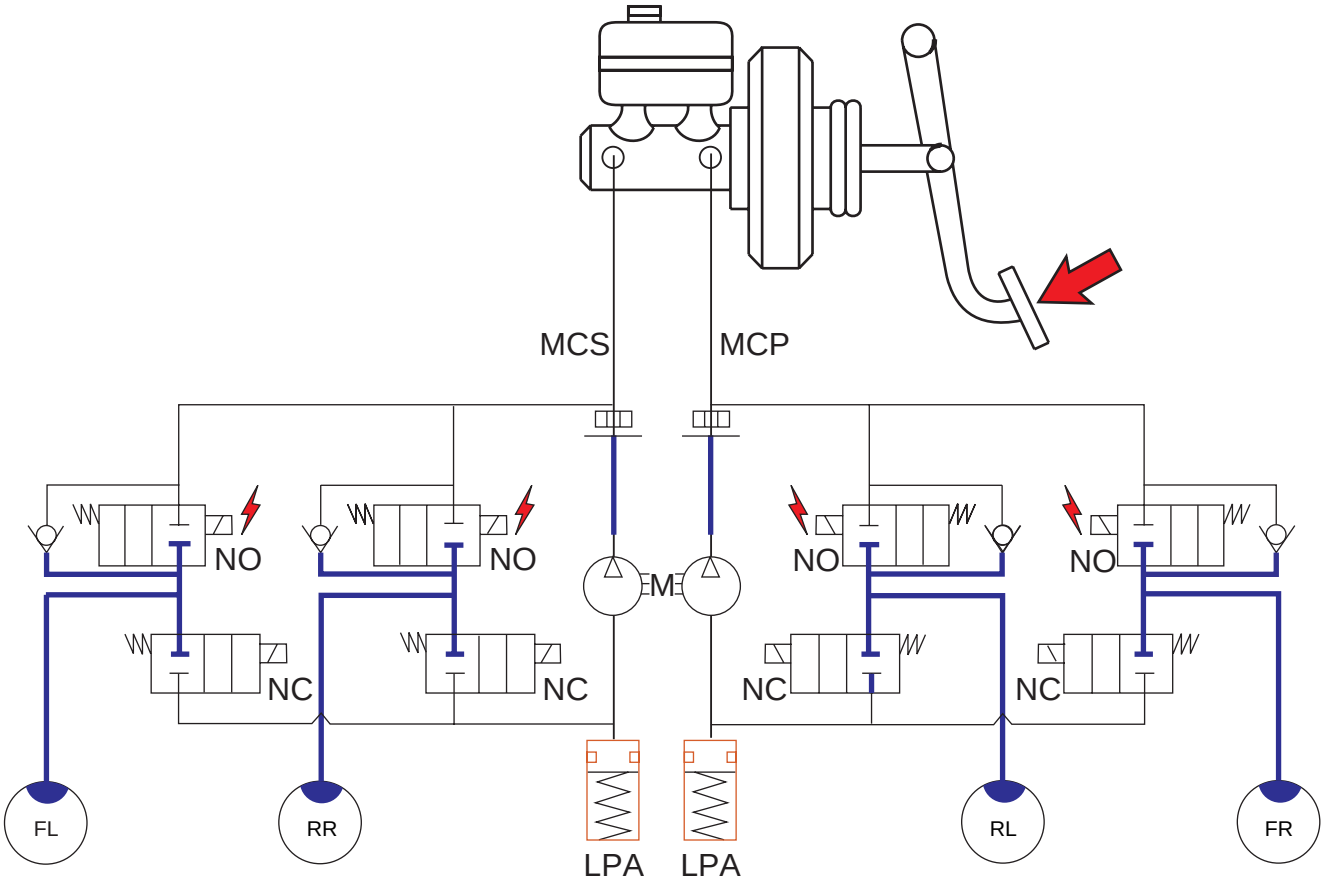


LJJF500X

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	

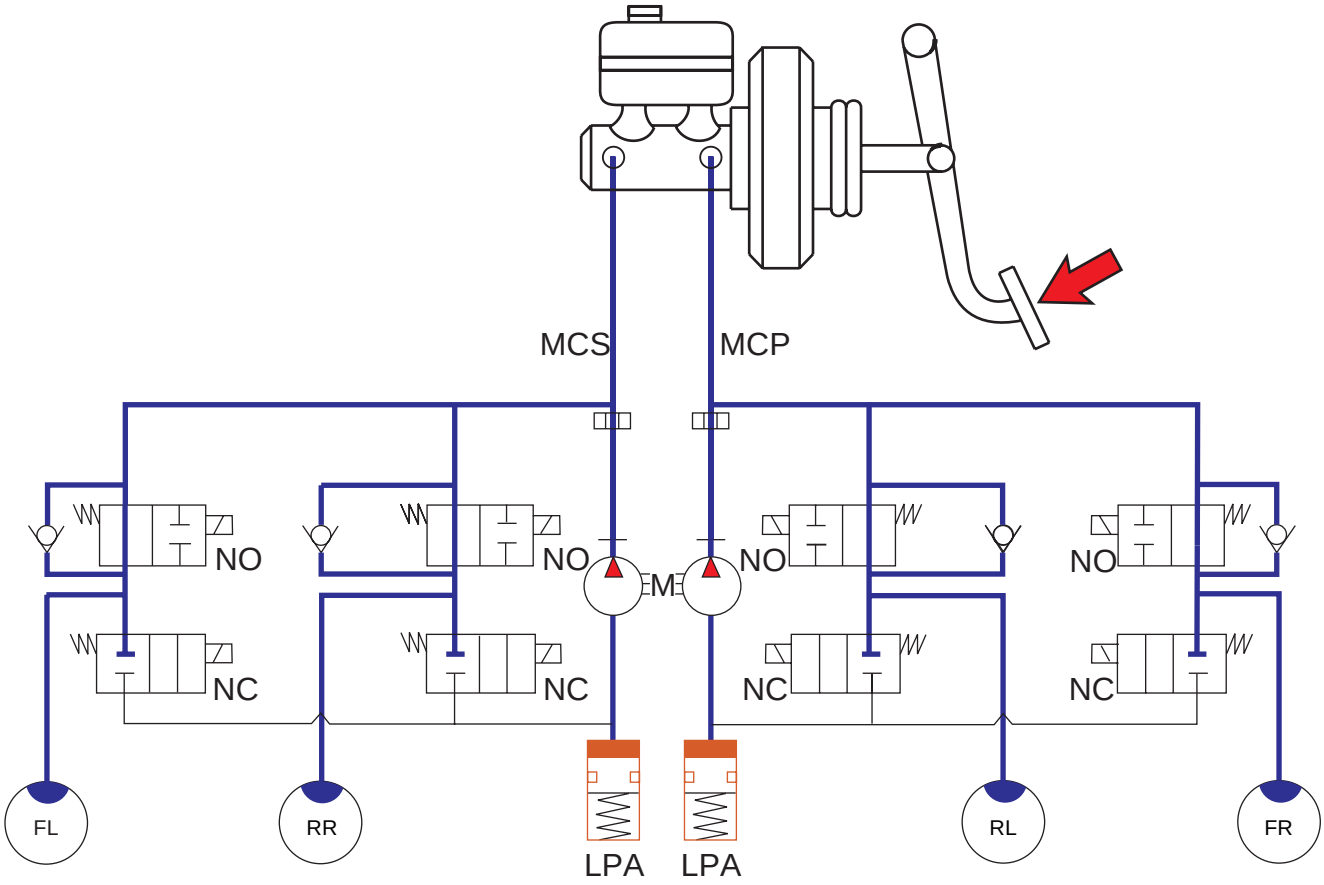


LJJF500Y

4. INCREASE MODE

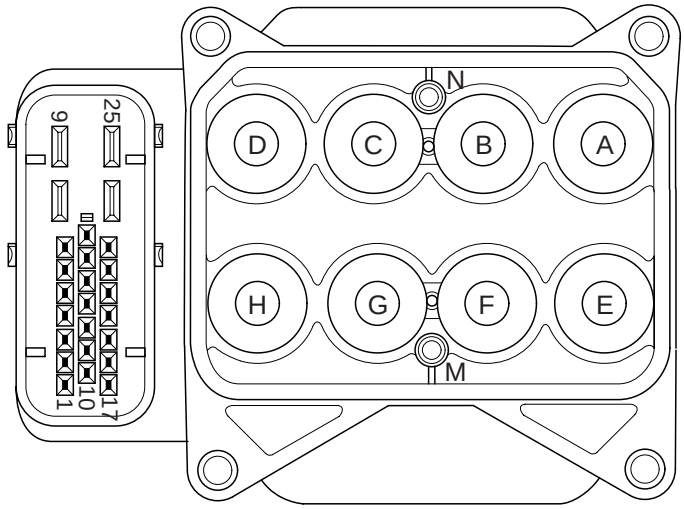
If HECU determines there's no lock-up in the wheel, HECU cuts voltage to solenoid valve. So voltage is not supplied to each solenoid valve, brake fluid passes through the inlet valve to wheel cylinder, resulting in pressure increase.

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	Open	Master cylinder ⇔ Wheel cylinder	ON
Outlet valve (NC)	OFF	Close	Wheel cylinder ⇔ Reservoir	



LJJF500Z

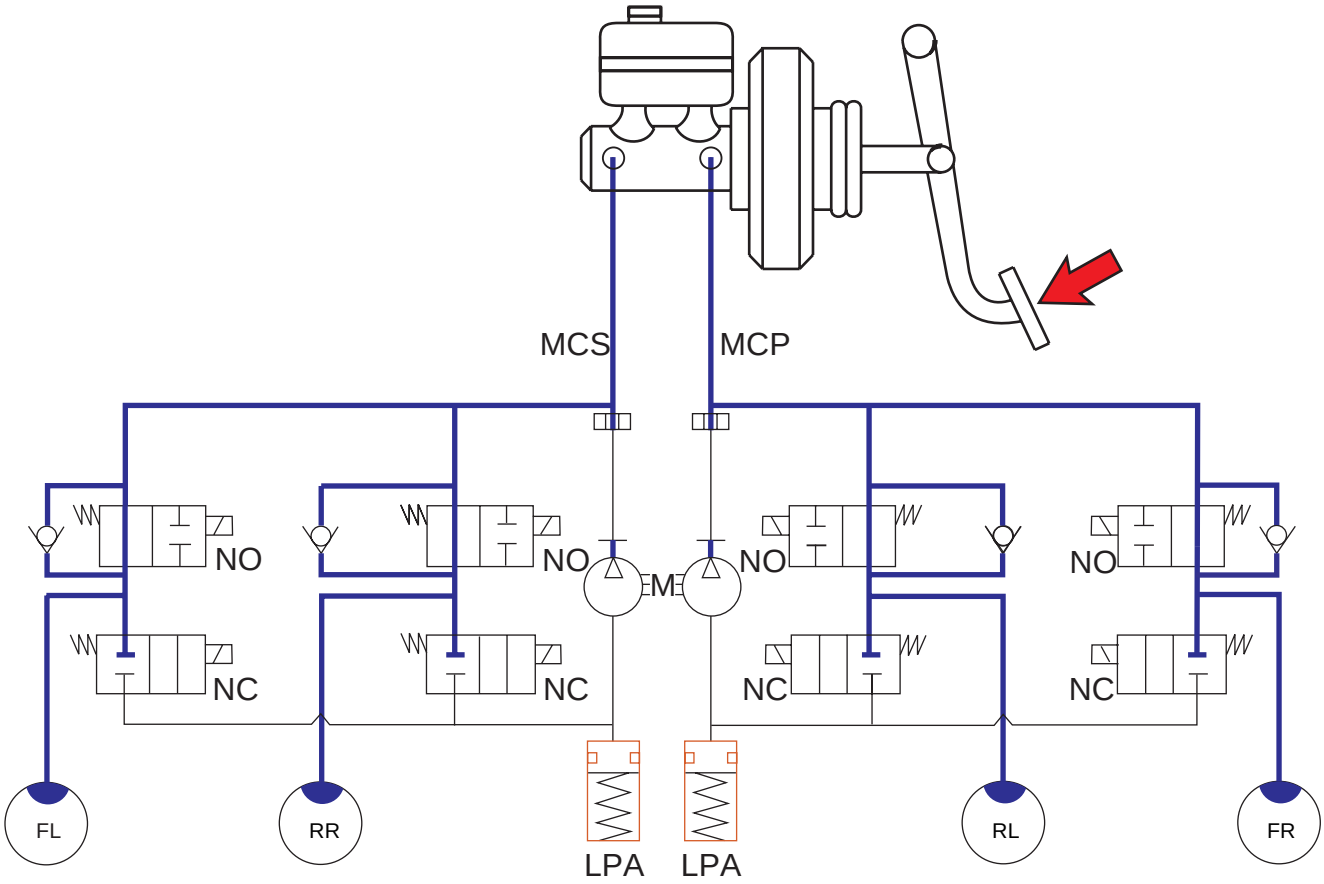
ABS HECU EXTERNAL DIAGRAM



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(+)
N : Motor(Ground)

LJJF501A

HYDRAULIC SYSTEM DIAGRAM

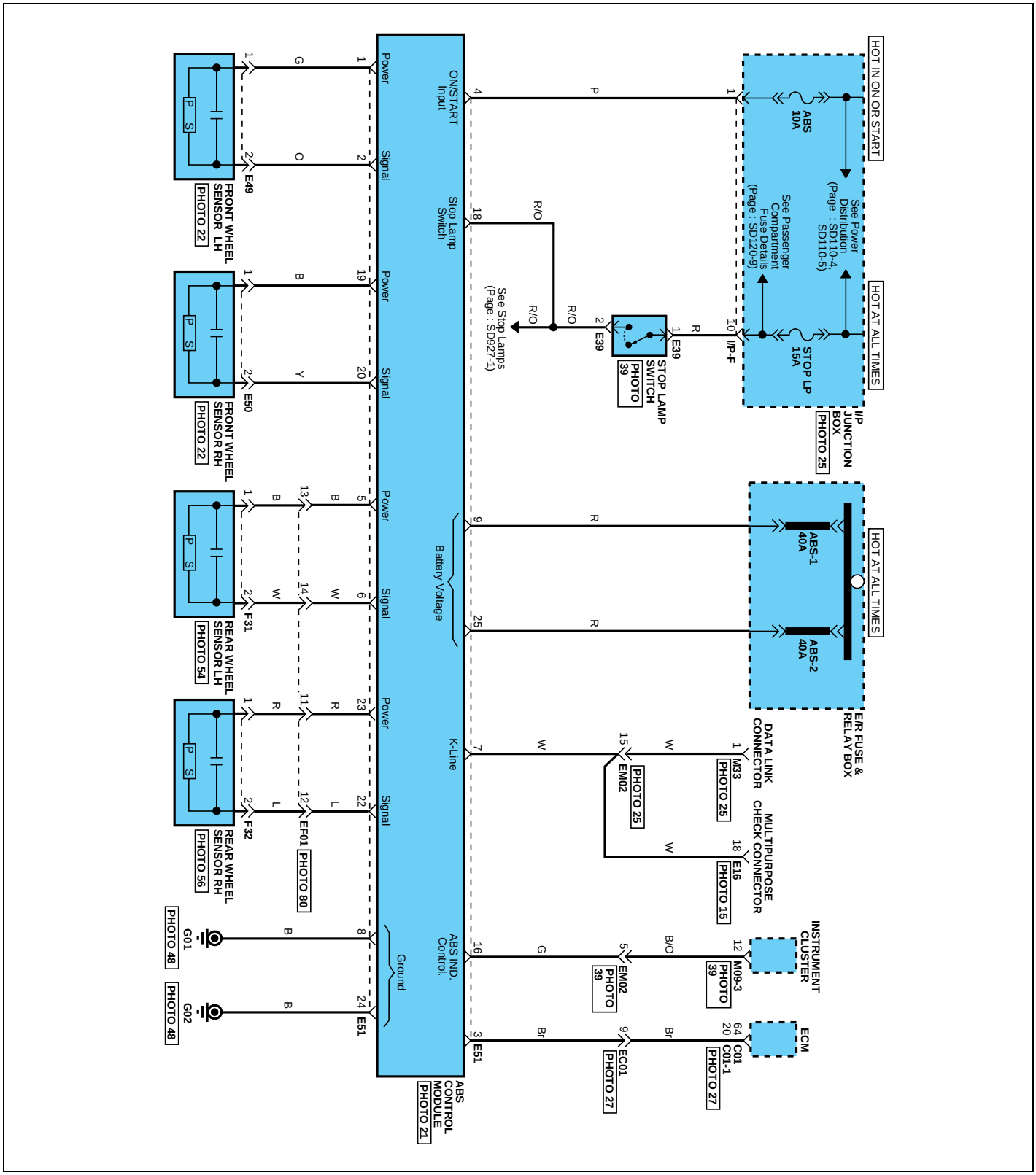


MCP : Primary master cylinder
MCS : Secondary master cylinder
LPA : Low pressure accumulator

M : Motor pump
NO : Normal open valve
NC : Normal close valve

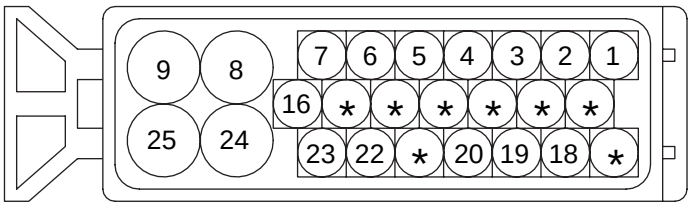
LJJF501B

ABS CIRCUIT DIAGRAM EAA338FD



LJJF501C

ABS CONNECTOR INPUT/OUTPUT



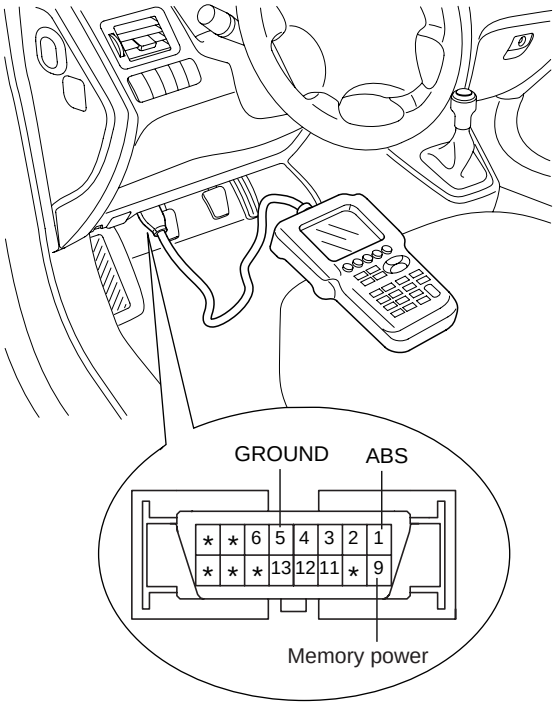
LJJF504A

Connector Terminal		Specification	Remark
No	Description		
4	IGNITION1(+)	Over voltage range: 16.5 ± 0.5 V < V Operating voltage range: 9.5 ± 0.5 V < V < 16.5 ± 0.5 V Low voltage range: 7.0 ± 0.5 V < V < 9.5 ± 0.5 V Max. current: I < 300 mA	
25	POS. BATTERY.(SOLENOID)	Max leakage current : I < 0.8 mA Operating voltage range: 9.5 ± 0.5 V < V < 16.5 ± 0.5 V Max current : I < 30 A	
9	POS, BATTERY.(MOTOR)	Operating voltage range: 9.5 ± 0.5 V < V < 16.5 ± 0.5 V Rush current : I < 100 A Max current : I < 30 A (lower 250 W motor) I < 40 A (higher 250 W motor) Max leakage current : I < 0.2 mA	
8	GROUND	Rated current : I < 300 mA Max. current: I < 30 A	
24	PUMP MOTOR GROUND	Rush current : I < 100 A Max current : I < 30 A	
18	BRAKE LIGHT SWITCH	Input voltage low: 0 V ≤ V ≤ 3.0 V Input voltage High: 7.0 V ≤ V ≤ 16.0 V	
16	ABS/EBD W/LAMP DRIVE	Max. current: I < 200 mA Max. output low voltage : V < 1.2 V	
1	SENSOR FRONT LEFT POWER	- Output voltage : IGN[V] ± 1V - Output current : Max 30mA	
19	SENSOR FRONT RIGHT POWER		
5	SENSOR REAR LEFT POWER		
23	SENSOR REAR RIGHT POWER		
2	SENSOR FRONT LEFT SIGNAL	- Input current LOW : 5.9 ~8.4 ㎃ - Input current HIGH : 11.8 ~ 16.8 ㎃ - Frequency range : 1 ~ 2000 Hz - Input duty : 50 ± 20 %	
20	SENSOR FRONT RIGHT SIGNAL		
6	SENSOR REAR LEFT SIGNAL		
22	SENSOR REAR RIGHT SIGNAL		

Connector Terminal		Specification	Remark
No	Description		
7	DIAGNOSIS INPUT/OUTPUT	Input voltage : VI_L < 0.3 IGN[V] VI_H > 0.7 IGN[V] Output voltage : VO_L < 0.2 IGN[V] VO_H > 0.8 IGN[V]	
3	SENSOR FRONT RIGHT OUTPUT	Maxcurrent : I < 2 mA External pull up resister : 10KΩ < R Output duty : 50 ± 20 %	

HI-SCAN (PRO) CHECK EBB7BD2A

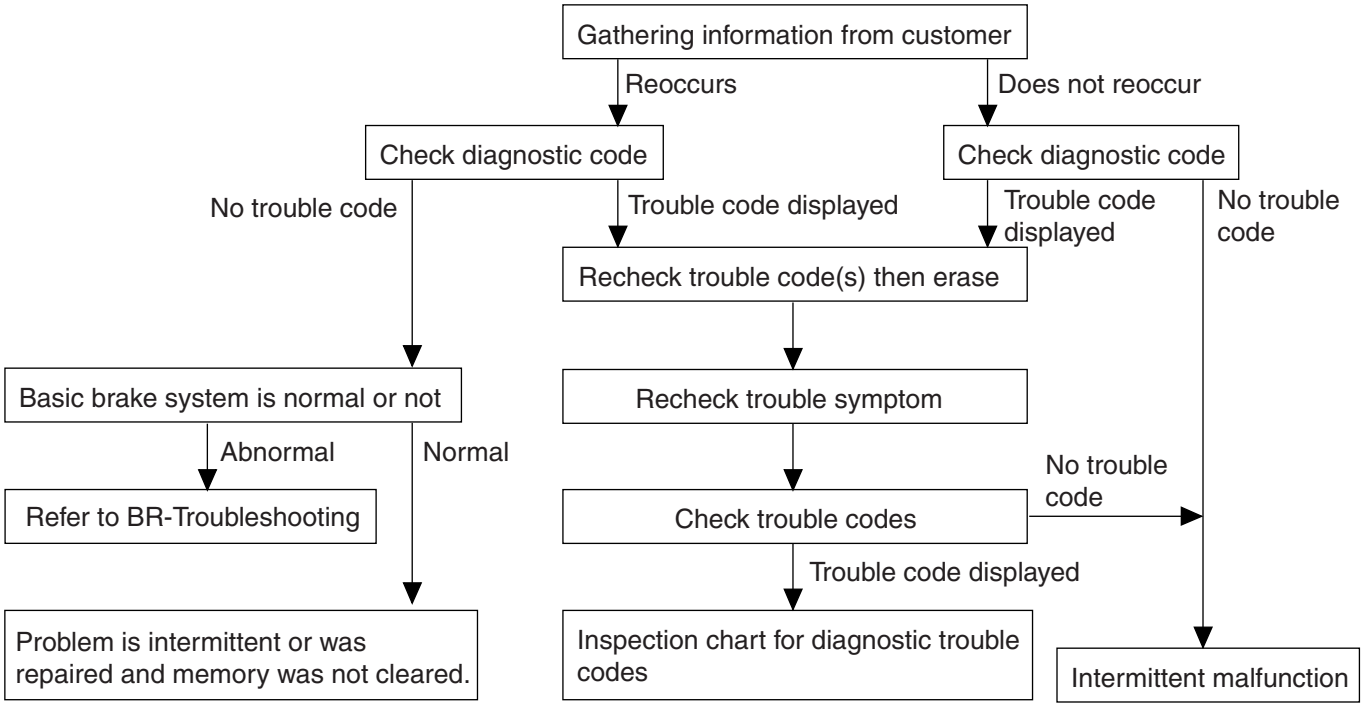
1. Turn the ignition switch OFF.
2. Connector the Hi-scan(pro) to the 16P data link connector located the driver'd side kick panel.



LJJF501D

3. Turn the ignition switch ON.
4. Check for diagnostic trouble using the Hi-scan(pro)
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes the clear key on the Hi-scan(pro).
6. Disconnect the Hi-scan(pro) from the 16P data link connector.

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



*** Using the customer problem analysis check sheet for reference, ask the customer as much detail as possible about the problem.**

EJKB055A

NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

Phenomenon	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		**Registration No.**	
		Registration 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)

EJDA017A

PROBLEM SYMPTOMS TABLE

If a normal code is displayed during the DTC check but the problem still occurs, check the circuits for each problem symptom in the order given in the table below and proceed to the relevant troubleshooting page.

Symptom	Suspect Area	See page
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.	BR - 66
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.	BR - 68
Communication with Hi-scan (pro) is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line	BR - 69
Communication with Hi-scan (pro) is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU	BR - 70
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU	BR - 72
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU	BR - 73

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 normal 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 Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
   Is the normal code output?

NO

▶ Check the power source circuit.

YES

▶ Erase the DTC and recheck using Hi-Scan (pro).

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 4 of the ABS control module harness side connector and body ground.

Specification : approximately B+

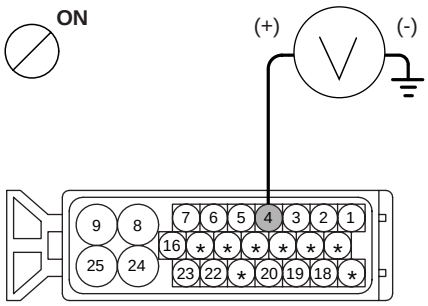
Is the voltage within specification?

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.



LJJF501E

CHECK THE GROUND CIRCUIT.

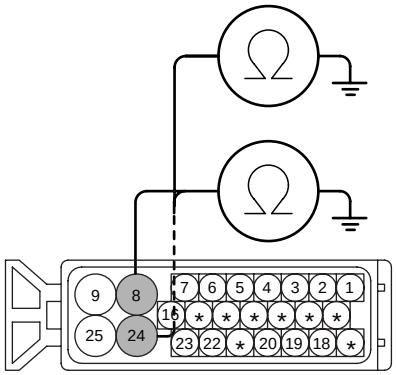
1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 8, 24 of the ABS control module harness side connector and ground point.
   Is there continuity?

YES

▶ Check the wheel speed sensor circuit.

NO

▶ Repair an open in the wire and ground point.



LJJF501F

CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.(See page BR-78)
Is it normal?

YES

▶ Check the hydraulic circuit for leakage.

NO

▶ Repair or replace the wheel speed sensor.

CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
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 normal 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 Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
   Is the normal code output?

NO

▶ Check the wheel speed sensor circuit.

YES

▶ Erase the DTC and recheck using Hi-Scan (pro).

CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.(See page BR-78)
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 18 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification : approximately B+

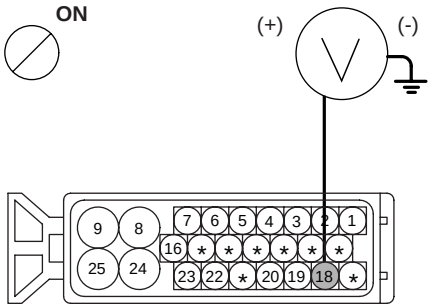
Is the voltage within specification?

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.



LJJF501G

CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
Is it normal?

YES

▶ The problem is still occurring, replace the ABS control module.

NO

▶ Repair the hydraulic lines for leakage.

Communication With Hi-Scan (pro) 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

Measure the voltage between terminal 9 of the data link connector and body ground.

Specification : approximately B+

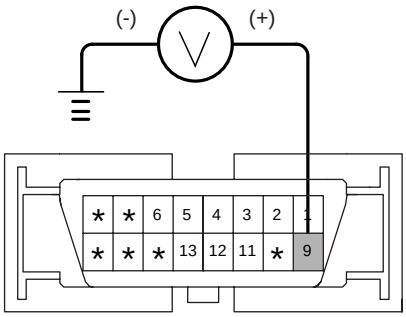
Is voltage within specification?

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.



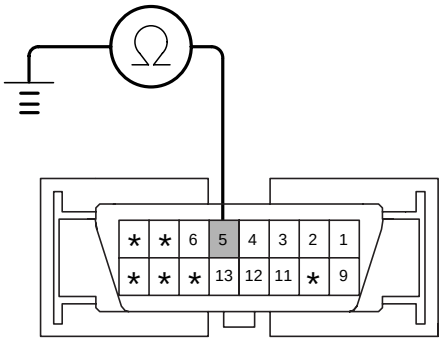
LJJF501H

CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

Check for continuity between terminal 5 of the data link connector and body ground.
Is there continuity?

NO

▶ Repair an open in the wire between terminal 5 of the data link connector and ground point.



LJJF501I

Communication With Hi-Scan (pro) Is Not Possible.
(Communication With ABS Only Is Not Possible)

DETECTING CONDITION

Trouble Symptoms	Possible Cause
When communication with Hi-Scan (pro) 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.
   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 4 of the ABS control module harness side connector and body ground.

Specification : approximately B+

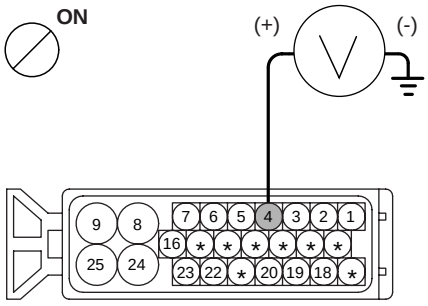
Is voltage within specification?

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.



LJJF501E

CHECK FOR POOR GROUND

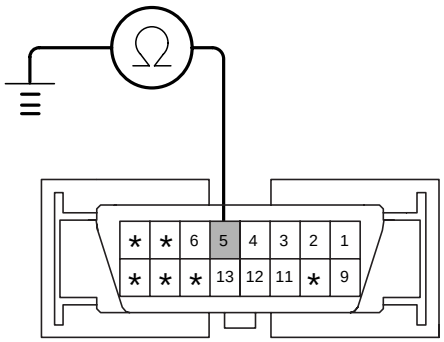
Check for continuity between terminal 5 of the data link connector and ground point.

YES

▶ Replace the ABS control module and recheck.

NO

▶ Repair an open in the wire or poor ground.



LJJF501I

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

INSPECTION PROCEDURES

PROBLEM VERIFICATION

Disconnect the connector from the ABS control module and turn the ignition switch ON.
Does the ABS warning lamp light up?

YES

▶ It is normal. Recheck the ABS control module.

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 and turn the ignition switch ON.
2. Measure the voltage between terminal 12 of the cluster harness side connector and body ground.

Specification : approximately B+

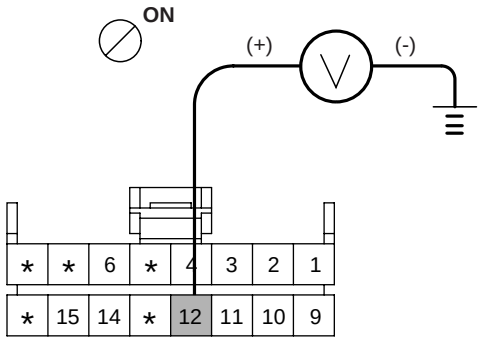
Is voltage within specification?

YES

▶ Repair bulb or instrument cluster assembly.

NO

▶ Check for blown fuse.



LJJF501J

CHECK FOR BLOWN FUSE

Check continuity of fuse (10A) from the engine compartment junction block.
Is there continuity?

YES

▶ Repair an open in the wire between ABS fuse and 12 of cluster connector.

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 Hi-Scan (pro) to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using Hi-Scan (pro).
   Is DTC output?

NO

▶ Repair circuit indicated by code output.

YES

▶ Check instrument cluster.

CHECK INSTRUMENT CLUSTER

Disconnect the cluster connector and turn the ignition switch ON.
Does the ABS warning lamp remains ON?

YES

▶ Replace the instrument cluster.

NO

▶ Check for open the wire.

CHECK FOR OPEN IN THE WIRE

Check for continuity in the wire between cluster and ABS control module.
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.

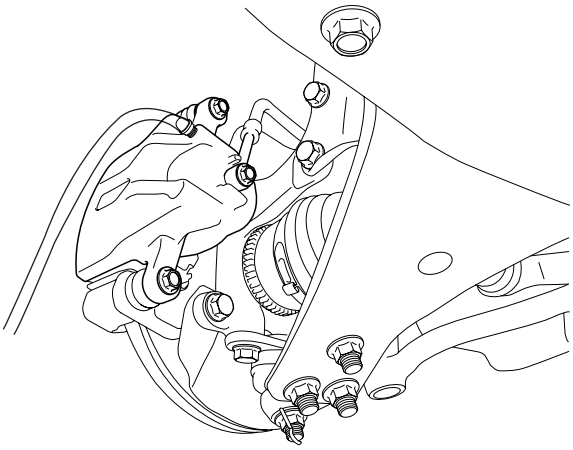
   CAUTION

   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

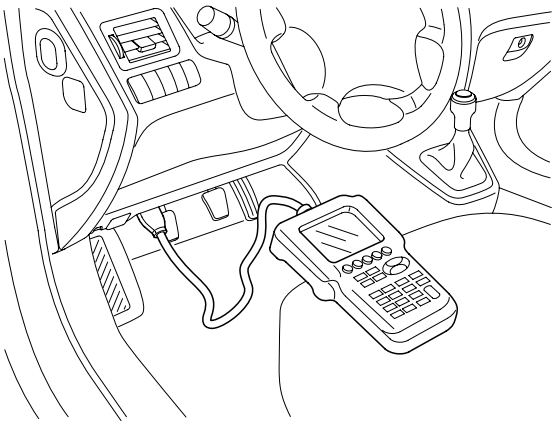
2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.



AJJF508A

3. Bleed the brake system(See page BR-21)

4. Connect the hi-scan (pro) to the data link connector located underneath the dash panel.



ARJE503N

5. Select and operate according to the instructions on the hi-scan (Pro) screen.

   CAUTION

   You must obey the maximum operating time of the ABS motor with the hi-scan (Pro) to prevent the motor pump from burning.

   1) Select KIA vehicle diagnosis.
   2) Select vehicle name.
   3) Select Anti-Lock Brake system.
   4) Select air bleeding mode.
   5) Press "YES" to operate motor pump and solenoid valve.

1.6 AIR BLEEDING MODE	
ABS AIR BLEEDING STATUS	
01. SOLENOID VALVE STATUS	CLOSE
02. MOTOR PUMP STATUS	OFF
DO YOU WANT TO START ?	
(PRESS [YES] KEY)	

EJDA014F

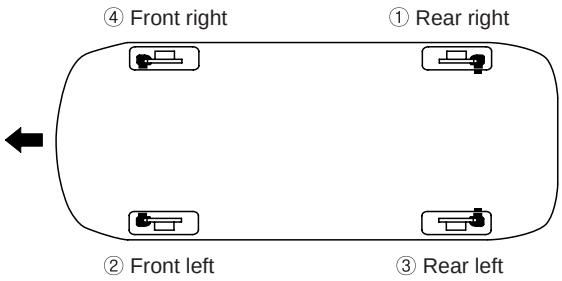
   6) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)

1.6 AIR BLEEDING MODE	
ABS AIR BLEEDING STATUS	
01. SOLENOID VALVE STATUS	OPEN
02. MOTOR PUMP STATUS	ON
TIME : AUTOMATIC COUNT (1-60 SEC.)	

EJDA014G

6. 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.

7. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



KJKE003B

8. Tighten the bleeder screw.

Bleed screw tightening torque:
6.86~12.74 Nm (0.7 ~1.3 kgf·m, 5.09 ~ 9.45 lb-ft)

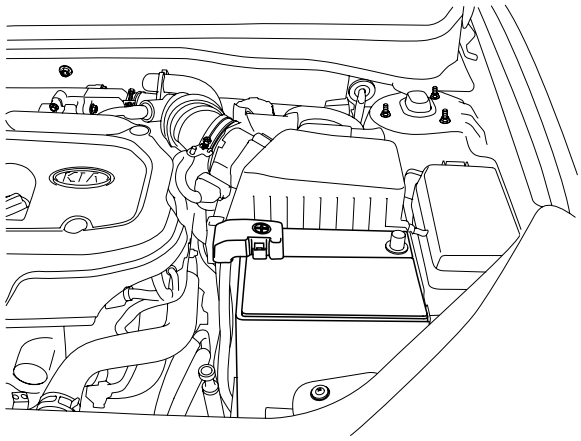
DIGNOSTIC TROUBLE CODE CHART(DTC)

DTC	Trouble description	Warning lamp			Remarks	See page
		EBD	ABS	ESP		
C1101	Battery voltage high	○	○	○		BR - 78
C1102	Battery voltage low	X/○	○	○		BR - 82
C1112	Sensor power voltage	X	X	○	ESP	BR - 84
C1200	Wheel speed sensor front-LH open/short	X/○	○	○		BR - 87
C1201	Wheel speed sensor front-LH range / performance / intermittent	X/○	○	○		BR - 92
C1202	Wheel speed sensor front-LH invalid/no signal	X/○	○	○		BR - 96
C1203	Wheel speed sensor front-RH open/short	X/○	○	○		BR - 87
C1204	Wheel speed sensor front-RH range / performance / intermittent	X/○	○	○		BR - 92
C1205	Wheel speed sensor front-RH invalid/no signal	X/○	○	○		BR - 96
C1206	Wheel speed sensor rear-LH open/short	X/○	○	○		BR - 87
C1207	Wheel speed sensor rear-LH range / performance / intermittent	X/○	○	○		BR - 92
C1208	Wheel speed sensor rear-LH invalid/no signal	X/○	○	○		BR - 96
C1209	Wheel speed sensor rear-RH open/short	X/○	○	○		BR - 87
C1210	Wheel speed sensor rear-RH range / performance / intermittent	X/○	○	○		BR - 92
C1211	Wheel speed sensor rear-RH invalid/no signal	X/○	○	○		BR - 96
C1235	Primary pressure sensor - electrical	X	X	○	ESP	BR - 99
C1237	Primary pressure sensor - signal	X	X	○	ESP	BR - 103
C1259	Steering sensor - electrical	X	X	○	ESP	BR - 105
C1260	Steering sensor circuit - signal	X	X	○	ESP	BR - 110
C1282	Yaw rate & lateral G sensor - electrical	X	X	○	ESP	BR - 113
C1283	Yaw rate & lateral G sensor - signal	X	X	○	ESP	BR - 118
C1503	ESP switch error	X	X	○	ESP	BR - 121
C1513	Brake switch error	X	X	○	ESP	BR - 124
C1604	ECU hardware error	○	○	○		BR - 127
C1605	CAN hardware error	X	X	○	ESP	BR - 129
C1611	CAN time-out EMS	X	X	○	ESP	BR - 131
C1612	CAN time-out TCU	X	X	○	ESP	BR - 132
C1613	CAN wrong message	X	X	○	ESP	BR - 133
C1616	CAN bus off	X	X	○	ESP	BR - 135
C2112	Valve relay error	○	○	○		BR - 137

DTC	Trouble description	Warning lamp			Remarks	See page
		EBD	ABS	ESP		
C2227	Excessive temperature of brake disc	X	X	○	ESP	BR - 141
C2380	ABS/TCS/ESP valve error	○	○	○		BR - 143
C2402	Motor electrical	X	○	○		BR - 145

DTC C1101 BATTERY VOLTAGE HIGH

COMPONENT LOCATION E86F046F



AJJF601M

GENERAL DESCRIPTION E64B6E20

The ABS ECU(Electronic Control Unit) checks the battery voltage to determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

DTC DESCRIPTION E0A0EAF2

The ABS ECU monitors battery voltage by reading the value of voltage. When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/TCS/ESP functions are prohibited. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operation as well.

DTC DETECTING CONDITION EADC4DFA

Item	Detecting Condition	Possible cause
DTC Strategy	• Battery Voltage Monitoring	• Poor connection in power supply circuit (IGN+) • Faulty Alternator • Faulty HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• When V_IGN > 17 ± 0.5 V is continued for 500msec. • If V_IGN is recovered to normal operating voltage, the controller is reset.	
Fail Safe	• System down. The ABS/EBD/TCS/ESP functions are inhibited. - The valve relay and all solenoids are prevented from being switched on. • The ABS/EBD/ESP warning lamps are activated.	

TERMINAL AND CONNECTOR INSPECTION E9C0ABDC

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

YES

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

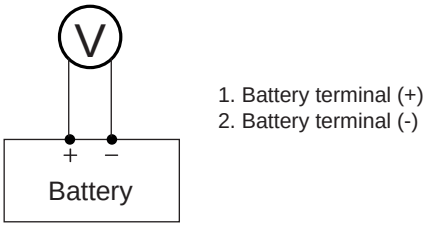
NO

▶ Go to next step.

ALTERNATOR OUTPUT VOLTAGE INSPECTION E5BEA0DA

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and the battery terminal(-).

Specification : 10 < V < 16 V



1. Battery terminal (+)
2. Battery terminal (-)

LJJF502E

3. Is the measured voltage within specifications?

YES

▶ Go to "Power Circuit Inspection" procedure.

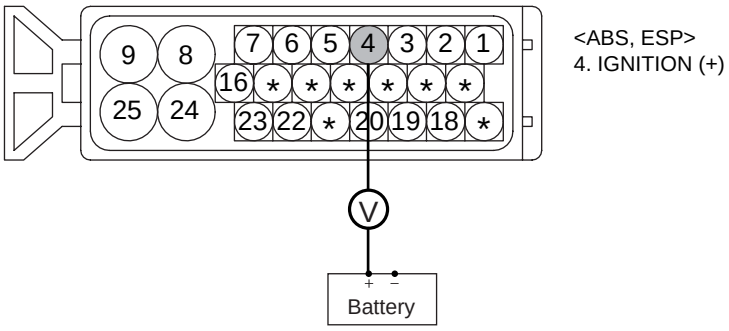
NO

▶ Check for damaged harness and poor connection between alternator and battery. If OK repair or replace alternator and then go to "Verification of vehicle Repair" procedure.

POWER CIRCUIT INSPECTION E6CC30A0

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and terminal "4" of the HECU harness connector.

Specification : Approx. below 0.2 V



<ABS, ESP>
4. IGNITION (+)

LJJF502F

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

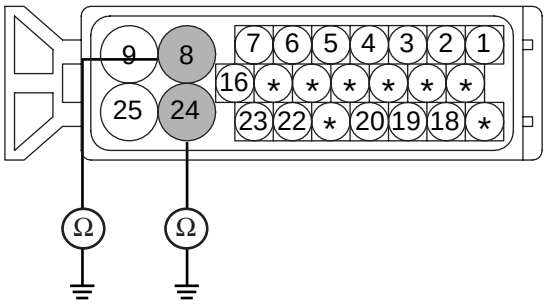
NO

▶ Check for damaged harness and poor connection between the battery terminal(+) and terminal "4" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E5E30846

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "8, 24(ESP : 16, 47)" of the HECU harness connector and chassis ground.

Specification : Approx. below 1Ω



<ABS>
8. GROUND
24. GROUND

<ESP>
16. GROUND
47. GROUND

LJJF502G

4. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between terminal " 8, 24(ESP : 16, 47)" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EDDCDB1D

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by poor connection in power harness (IGN+), faulty Alternator and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E63D688F

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

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

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC C1102 BATTERY VOLTAGE LOW

COMPONENT LOCATION E629A9A7

Refer to DTC C1101.

GENERAL DESCRIPTION EABCC08E

The ABS ECU(Electronic Control Unit) checks the battery voltage to determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as instended.

DTC DESCRIPTION E91CADBA

The ABS ECU monitors the battery voltage by reading the value of voltage. When the voltage is lower than the expected normal value, this code is set. The ABS/TCS/ESP functions are prohibited and the EBD function is allowed on LOW VOLTAGE CONDITION, the ABS/EBD/TCS/ESP functions are prohibited on UNDER VOLTAGE CONDITION. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operations as well.

DTC DETECTING CONDITION E0986C0F

Item		Detecting Condition	Possible cause
DTC Strategy		• Battery Voltage Monitoring	• Poor connection in power supply circuit (IGN+) • Faulty HECU
Detect Mode		• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Case1 (Low voltage)	Enable Conditions	• When Vign < 9.5 V ± 0.5 V is continued for 500 msec during Vref > = 7 Km/h. • When Vign < 8.5 V ± 0.5 V is continued for 500msec during Vref < 7 Km/h or ABS/TCS/ESP control. - If IGN voltage is recovered to normal operating voltage, the system recovers to normal state.	
	Fail Safe	• Outside the ABS control cycle : inhibit the ABS/TCS/ESP control of front wheels and allow the ABS/TCS/ESP control of rear wheels, deactivating the motor and the ABS/ESP warning lamps are directly switched on. When the voltage recovers the normal operating range, enable ABS/ESP functions and warning lamps are switched off and erase the error code. • Inside the ABS control cycle : inhibit the ABS/TCS/ESP control of front wheels and allow the ABS/TCS/ESP control of rear wheels, deactivating the motor. The ABS/ESP warning lamps are directly switched on and the state keeps continuously. The error code is always stored.	
Case2 (Under voltage)	Enable Conditions	• When Vign < 7.2 V ± 0.5 V is continued for 56 msec. - If IGN voltage is recovered to normal operating voltage, the system recovers to normal state.	
	Fail Safe	• System down. The ABS/EBD/TCS/ESP functions are inhibited. - The valve relay and all solenoids are prevented from being switched on. • The ABS/EBD/ESP warning lamps are activated.	

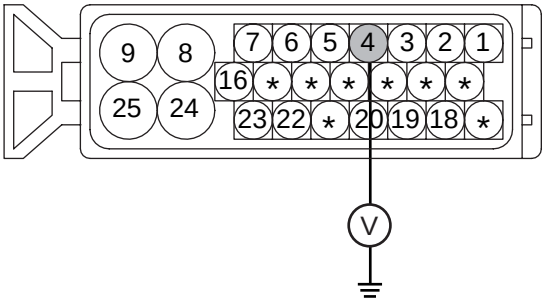
TERMINAL AND CONNECTOR INSPECTION E42A2729

Refer to DTC C1101.

POWER CIRCUIT INSPECTION EC6A8DF8

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. B+



<ABS, ESP>
4. IGNITION (+)

LJJF502H

5. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between the battery terminal(+) and terminal "4" of the HECU harness connector. Check for open or blown 10A ABS fuse. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EBB7C44C

Refer to DTC C1101.

COMPONENT INSPECTION E8DECCCC

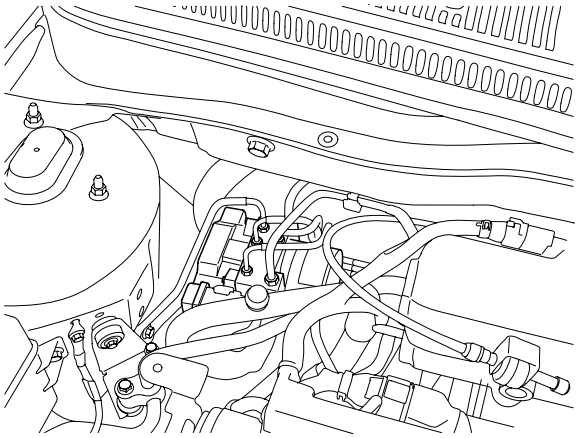
Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR E5AC65FB

Refer to DTC C1101.

DTC C1112 SENSOR POWER VOLTAGE

COMPONENT LOCATION E4206C1B



AJJF530A

GENERAL DESCRIPTION E3A5B345

The HECU supplies operating voltage with pressure sensor in master cylinder & lateral G sensor . The HECU monitors supply voltage of each sensor for normal ESP control. If supply voltage is out of specified range ESP warning lamps are turned on and TCS/ESP controls are inhibited.

DTC DESCRIPTION E3963D6D

A failure is detected if the external sensor supply voltage is out of the specified range for more than the specified min. fault duration.

DTC DETECTING CONDITION EC67A8EB

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage monitoring	• Faulty HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• During sensor power ON, If the voltage of sensor power is out of the range of 5 ± 0.5 V for 500 ms. • During sensor power OFF, If the voltage of sensor power is out of the range of 0.5 ± 0.1 V for 500 ms. • If the YAW or lateral sensor signal pin has a short circuit to a battery.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

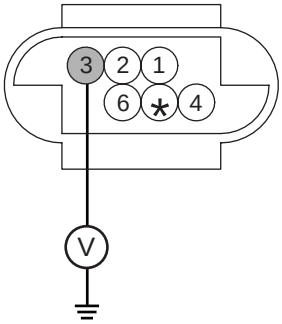
TERMINAL AND CONNECTOR INSPECTION EEF3C7E7

Refer to DTC C1101.

POWER CIRCUIT INSPECTION E44CA8B3

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 5 V



1. YAW sensor signal
2. Lateral G sensor signal
3. Power Supply (B+)
4. Ground
6. Self Test

LJJF502J

3. Is the measured voltage within specifications?

YES

▶ Go to number 4 (Power Circuit Inspection procedure of pressure sensor).

NO

▶ Check for short to GND or short to B+ in the Yaw Rate & Lateral G sensor harness between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and terminal "36" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure. If OK, go to "Component Inspection" procedure.

4. Measure voltage between terminal "2" of the pressure sensor harness connector and chassis ground.

Specification : Approx. 5 V

COMPONENT INSPECTION E7ACA997

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

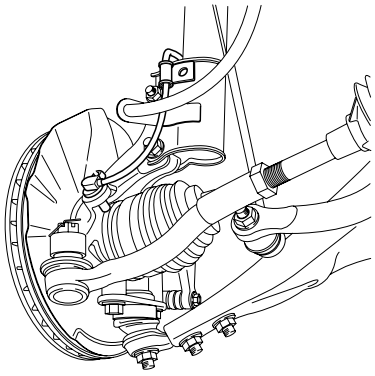
▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR EA01D7B1

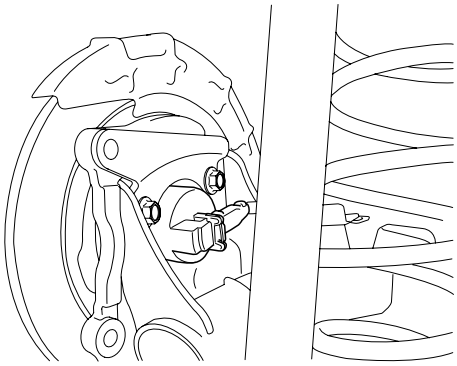
Refer to DTC C1101.

DTC C1200 WHEEL SPEED SENSOR FRONT-LH OPEN/SHORT
DTC C1203 WHEEL SPEED SENSOR FRONT-RH OPEN/SHORT
DTC C1206 WHEEL SPEED SENSOR REAR-LH OPEN/SHORT
DTC C1209 WHEEL SPEED SENSOR REAR-RH OPEN/SHORT

COMPONENT LOCATION E7E508E9



Front wheel sensor



Rear wheel sensor

LJJF502L

GENERAL DESCRIPTION E11BBCFA

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise tolerance. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION EAB8EAE6

The ABS ECU monitors the wheel speed sensor circuit continuously. If the sensor signal current is continuously out of the specified range for 140 msec, then the HECU determines that the circuit is open/short, and sets this code. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h.

DTC DETECTING CONDITION E9F91CAF

Item	Detecting Condition	Possible cause
DTC Strategy	• Current Monitoring	• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• When the sensor signal current is continuously out of the specified range of 4 mA ± 10% ~ 22 mA ± 10% for 140msec.	
Fail Safe	• Sensor failure outside of the ABS control cycle 1) Only one wheel failure : Only the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 2) More than two wheels failure : System down. The ABS/EBD/TCS/ESP functions are inhibited. The valve relay and all solenoids are prevented from being switched on. The ABS/EBD/ESP warning lamps are activated. • Sensor failure inside the ABS control cycle 1) One front wheel failure : Inhibit the ABS/TCS/ESP control of the failed-wheel and maintain the ABS/TCS/ESP control of normal wheel. After the ABS/TCS/ESP control, the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 2) Failure at one rear wheel : ABS/TCS/ESP control of both front wheels are inhibited and the pressure of both rear wheels are decreased. After the controller completes the ABS/TCS/ESP control, the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 3) More than 2 wheels failure : System down. The ABS/EBD/TCS/ESP functions are inhibited. The valve relay and all solenoids are prevented from being switched on. The ABS/EBD/ESP warning lamps are activated.	

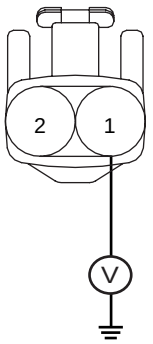
TERMINAL AND CONNECTOR INSPECTION E592AA81

Refer to DTC C1101.

POWER CIRCUIT INSPECTION EDCC40EE

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "1" of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



1. Wheel speed sensor(power)
2. Wheel speed sensor(signal)

LJJF502M

3. Is the measured voltage within specifications?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for open or short to GND in wheel speed sensor harness between terminal 1 of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, go to "Component Inspection" procedure.

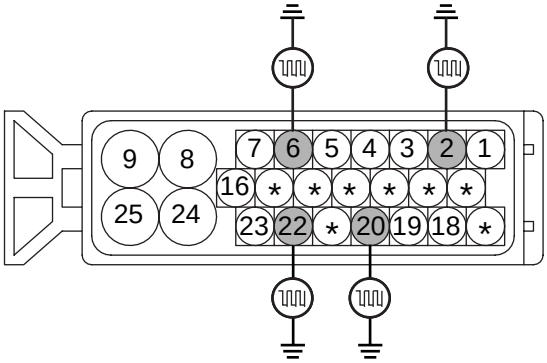
DTC	HECU connector harness terminal
DTC C1200	1(ESP : 46) - FL
DTC C1203	19(ESP : 45) - FR
DTC C1206	5(ESP : 44) - RL
DTC C1209	23(ESP : 43) - RR

SIGNAL CIRCUIT INSPECTION E82017AE

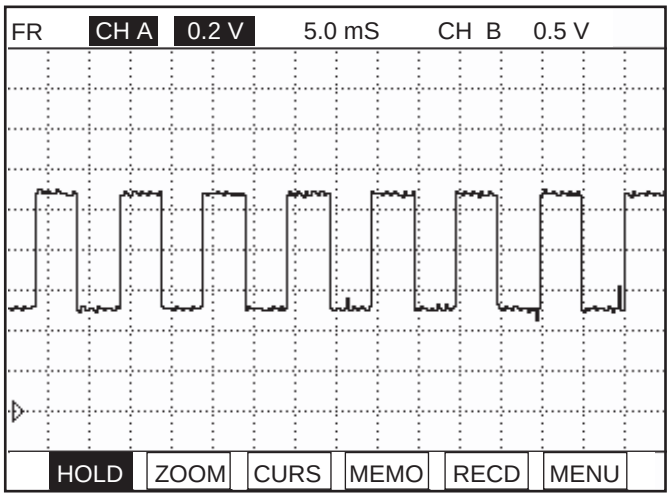
1. Ignition "ON" & Engine "OFF".
2. Turn the wheel slowly with hand.
3. Measure voltage between terminal "2, 20, 6, 22(ESP : 15, 30, 14, 29)" of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.18 ~ 1.68 V , Low : 0.59 ~ 0.84 V

DTC	HECU connector harness terminal
DTC C1200	2(ESP : 15) - FL
DTC C1203	20(ESP : 30) - FR
DTC C1206	6(ESP : 14) - RL
DTC C1209	22(ESP : 29) - RR



<ABS>



LJJF502N

4. Is the measured voltage within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short to GND in wheel speed sensor harness between terminal "2" of the wheel speed sensor harness connector and terminal "2, 20, 6, 22(ESP : 15, 30, 14, 29)" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E14FF72B

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more).
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E33D2EB4

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

1. Connect Scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a Scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more(6mph or more))
4. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC C1201 WHEEL SPEED SENSOR FRONT-LH RANGE / PERFORMANCE / INTERMITTENT
DTC C1204 WHEEL SPEED SENSOR FRONT-RH RANGE / PERFORMANCE / INTERMITTENT
DTC C1207 WHEEL SPEED SENSOR REAR-LH RANGE / PERFORMANCE / INTERMITTENT
DTC C1210 WHEEL SPEED SENSOR REAR-RH RANGE / PERFORMANCE / INTERMITTENT

COMPONENT LOCATION EA110FAD

Refer to DTC C1200.

GENERAL DESCRIPTION EFFFA124

Refer to DTC C1200.

DTC DESCRIPTION E4D74D24

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set if an abnormal speed change ratio is detected while the vehicle speed is more than 2Km/h . Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h.

DTC DETECTING CONDITION E9A7DDC6

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
Detect Mode		• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	Case1 (Wrong Exciter)	• Max. wheel velocity exceeds 20km/h and the wheel velocity is 40% of max. wheel velocity. if this condition is lasted for 2 minutes. • Max. wheel velocity exceeds 40km/h and the wheel velocity is 60% of max. wheel velocity. if this condition is lasted for 2 minutes.	
	Case2 (Speed Jump)	• Controller counts the number of the wheel acceleration of 100 g[(25 km/h) for 7 ms]. When the numbers at one wheel exceed 56 times, or When the numbers at more two wheels exceed 5 times, controller recognize the failure. • Controller counts the number of the wheel acceleration of 40 g[(17.5 km/h) for 7 ms]. When the numbers at one wheel exceed 126 times, or When the numbers at more two wheels exceed 20 times, controller recognize the failure. • Controller counts the number of the wheel deceleration of -100 g[(-25 km/h) for 7 ms]. When the numbers at each wheel exceed 56 times, controller recognize the failure. • The wheel deceleration of -100 g[(-25 km/h) for 7 ms] causes the controller to start monitoring this failure and to compare the wheel velocity with the vehicle velocity from next cycle. When its difference of -100 g is continued for more than 140 msec, controller recognize the failure. • n case that any sensor failure at other wheel was already detected, When the numbers of 100 g at each wheel exceed 5 times, or When the numbers of 40 g at each wheel exceed 20 times, controller recognize the failure. - The counter of speed jump is cleared every 30 min.	
Fail Safe		• Sensor failure outside of the ABS control cycle 1) Only one wheel failure : Only the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated 2) More than two wheels failure : System down. The ABS/EBD/TCS/ESP functions are inhibited. The valve relay and all solenoids are prevented from being switched on. The ABS/EBD/ESP warning lamps are activated. • Sensor failure inside the ABS control cycle 1) One front wheel failure : Inhibit the ABS/TCS/ESP control of the failed-wheel and maintain the ABS/TCS/ESP control of normal wheel. After the ABS/TCS/ESP control, the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 2) Failure at one rear wheel : ABS/TCS/ESP control of both front wheels are inhibited and the pressure of both rear wheels are decreased. After the controller completes the ABS/TCS/ESP control, the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 3) More than 2 wheels failure : System down. The ABS/EBD/TCS/ESP functions are inhibited. The valve relay and all solenoids are prevented from being switched on. The ABS/EBD/ESP warning lamps are activated.	

MONITOR SCANTOOL DATA E7E642DB

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 40 km/h or more(24 mph or more)

5. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.
▶ If OK, Go to "Component Inspection" procedure.

COMPONENT INSPECTION EC5CC323

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more).
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E71B34F7

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more))
4. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC C1202 WHEEL SPEED SENSOR FRONT-LH INVALID/NO SIGNAL
DTC C1205 WHEEL SPEED SENSOR FRONT-RH INVALID/NO SIGNAL
DTC C1208 WHEEL SPEED SENSOR REAR-LH INVALID/NO SIGNAL
DTC C1211 WHEEL SPEED SENSOR REAR-RH INVALID/NO SIGNAL

COMPONENT LOCATION EACCCDF0

Refer to DTC C1200.

GENERAL DESCRIPTION E28ED6F1

Refer to DTC C1200.

DTC DESCRIPTION E0EBBEF9

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when the sensor air gap is out of specified range or when the ABS control cycle is continued abnormally. The HECU checks for air gap malfunctioning by monitoring the sensor signal at speeds between 2 Km/h to 10 Km/h. Warning lamp is turned OFF if the detected fault is not more than when the IG KEY is turned to ON again, and wheel speeds are more than 10 Km/h.

DTC DETECTING CONDITION E92AEAE2

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
Case1 (Large Air-gap)	Detect Mode	• Outside the ABS control cycle • Diagnosis mode • Failure mode	
	Enable Conditions	• When the minimum wheel velocity is 2 km/h and the velocity of other wheels exceed 10 km/h with the acceleration of < 0.4g , the controller start comparing the velocity of other wheels except the min. wheel. if their difference below 4 km/h is continued for 140 msec, Otherwise, if their difference beyond 4 km/h or > 0.4 g is continued for 2 minutes. • In < 0.4 g, when the velocity of more two wheels is 2 km/h and the max. wheel velocity exceeds 10 km/h, the condition is continued for 20 sec. Otherwise, In > 0.4 g, the condition is 2 minutes. • After velocity of 4 wheel exceeds 10km/h, when velocity of 1 wheel or 2 wheel is 2 km/h and difference of other 2 wheel velocity is less than 4 km/h under that those velocity is more than 10 km/h, if that conditions are continued for 12 seconds. - This monitoring is performed for the period that the minimum velocity rises from 2 km/h to 10 km/h.	
Case2 (long term ABS mode)	Detect Mode	• Inside the ABS control cycle	
	Enable Conditions	• During the ABS control cycle, if the wheel velocity of 2 km/h is lasted for more than 12 sec. • If the ABS control cycle is continued for more than 36 sec.	
Fail Safe		• Sensor failure outside of the ABS control cycle 1) Only one wheel failure : Only the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated 2) More than two wheels failure : System down. The ABS/EBD/TCS/ESP functions are inhibited. The valve relay and all solenoids are prevented from being switched on. The ABS/EBD/ESP warning lamps are activated. • Sensor failure inside the ABS control cycle 1) One front wheel failure : Inhibit the ABS/TCS/ESP control of the failed-wheel and maintain the ABS/TCS/ESP control of normal wheel. After the ABS/TCS/ESP control, the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 2) Failure at one rear wheel : ABS/TCS/ESP control of both front wheels are inhibited and the pressure of both rear wheels are decreased. After the controller completes the ABS/TCS/ESP control, the ABS/TCS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 3) More than 2 wheels failure : System down. The ABS/EBD/TCS/ESP functions are inhibited. The valve relay and all solenoids are prevented from being switched on. The ABS/EBD/ESP warning lamps are activated.	

MONITOR SCANTOOL DATA E8AEBAB8

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6mph or more)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 10km/h or more(6mph or more)

5. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by faulty wheel speed sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Component Inspection" procedure.

NO

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.
▶ If OK, Go to "Component Inspection" procedure.

COMPONENT INSPECTION EBD79849

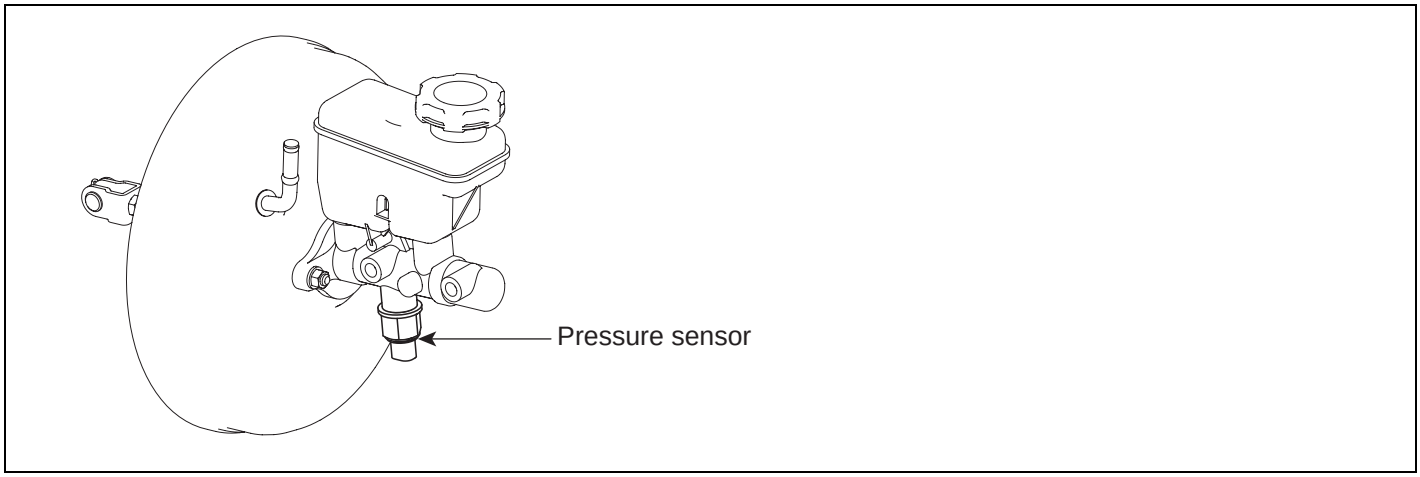
Refer to DTC C1200.

VERIFICATION OF VEHICLE REPAIR E1D06A23

Refer to DTC C1200.

DTC C1235 PRESSURE SENSOR(PRIMARY) - ELECTRICAL

COMPONENT LOCATION ED5B2E14



LJJF502O

GENERAL DESCRIPTION ED74D4A0

The one pressure sensor ,installed in the master cylinder, sense the brake oil pressure to judge driver's brake intention when ESP is operating. If pressure of master cylinder is applied to pressure sensor, the strain of the piezo element is changed and then the resistance of bridge circuit is changed according to changed strain. Therefore this changed resistance changes output voltage of bridge circuit and output voltage changes linearly. The sensor output is a analog signal in proportion to supply voltage, and the HECU recognizes a pressure value according to signal ratio about supply voltage.

DTC DESCRIPTION E11BE39E

Each unfiltered input signal voltage is monitored to be in the range of 0.2V ± 0.1V < input signal voltage < 4.8V ± 0.1V. A failure is detected if the output signal value is out of specified range for more than 1s or pressure sensor self test form is against to specification during self test.

DTC DETECTING CONDITION EB39369F

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage Monitoring	• Open or short of pressure sensor circuit • Faulty pressure sensor • Faulty HECU
Case1	Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
	Enable Conditions	• Vmcp > 4.8 ± 0.1 V or Vmcp < 0.2 ± 0.1 V continue 1 sec. - The monitoring starts 1sec after power up.	
Case2	Detect Mode	• Initial Check	
	Enable Conditions	• When sensor self test form is against to sensor specification. - The monitoring starts 1sec after power up.	
Case3	Detect Mode	• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
	Enable Conditions	• While the vehicle is stopped affter driving over 40kph for 3 times, If predefined value of pressure signal is not detected, ECU detect the failure after sensor self test. - The monitoring starts 1sec after power up.	
Fail Safe		• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

TERMINAL AND CONNECTOR INSPECTION EECFDFE9

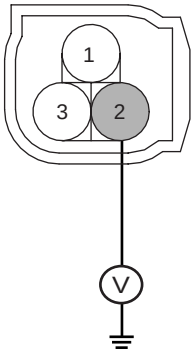
Refer to DTC C1101.

POWER CIRCUIT INSPECTION EED704C0

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

2. Measure voltage between terminal "2" of the pressure sensor harness connector and chassis ground.

Specification : Approx. 5 V



1. Pressure Sensor Signal
2. Pressure Sensor Power Supply
3. Pressure Sensor Ground

LJJF502P

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

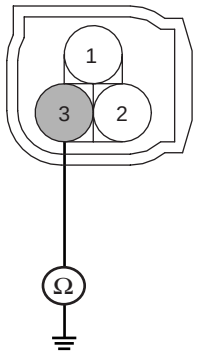
NO

▶ Check for open or short to GND in pressure sensor harness between terminal "2" of the pressure sensor harness connector and terminal "37" of the ESP HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure. If OK, go to "Component Inspection" precedure.

GROUND CIRCUIT INSPECTION EF116A70

1. Ignition "OFF".
2. Disconnect pressure sensor connector.
3. Measure resistance between terminal "3" of the pressure sensor harness connector and chassis ground.

Specification : Approx. below 1Ω



1. Pressure Sensor Signal
2. Pressure Sensor Power Supply
3. Pressure Sensor Ground

LJJF502Q

4. Is the measured resistance within specifications?

YES

▶ Go to "Signal Circuit Inspection" procedure.

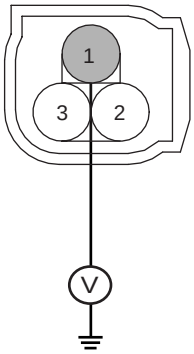
NO

▶ Check for open or short in pressure sensor harness between terminal "3" of the pressure sensor harness connector and terminal "28" of the ESP HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION ECFE7C32

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "1" of the pressure sensor harness connector and chassis ground.

Specification : 0.2 ± 0.1 V ~ 4.8 ± 0.1 V



1. Pressure Sensor Signal
2. Pressure Sensor Power Supply
3. Pressure Sensor Ground

LJJF502R

3. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short in pressure sensor harness between terminal "1" of the pressure sensor harness connector and terminal "12" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, substitute with a known-good pressure sensor and check for proper operation. If problem is corrected, replace pressure sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDDEACF8

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 40 km/h or more(24 mph or more) and then put on the brake three times.
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by open or short of pressure sensor harness, faulty pressure sensor and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E3519CEC

Refer to DTC C1201.

DTC C1237 PRESSURE SENSOR - OTHER

COMPONENT LOCATION EBA1CAB9

Refer to DTC C1235.

GENERAL DESCRIPTION EFB4F1DC

Refer to DTC C1235.

DTC DESCRIPTION EA0B5882

The failure is detected if the pressure sensor signal noise is out of normal range, or the pressure sensor signal is changed abnormally, or In spite of no brake switch signal, master cyclinder pressure exceeds 20 bar when brake switch is normal.

DTC DETECTING CONDITION E49E374A

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage Monitoring	• Open or short of pressure sensor circuit • Faulty pressure sensor • Faulty HECU
Detect Mode	• Outside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• If input signal is noisy, Which the gradient of the sensor signal is larger than 15 bar over 25 times in 2 sec, ECU detect the failure. • Outside an ABS/TCS/ESP control,And after normal operation of BLS, If the pressure sensor signal is higher than 20 bar and BLS is low for 3 sec, ECU detects the failure.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

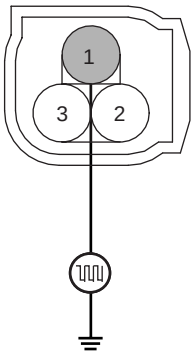
TERMINAL AND CONNECTOR INSPECTION E7F748EE

Refer to DTC C1101.

SIGNAL CIRCUIT INSPECTION E8D3D17A

1. Ignition "ON" & Engine "OFF".
2. Press the brake pedal.
3. Measure voltage between terminal "1" of the pressure sensor harness connector and chassis ground by using the oscilloscope.

Specification : 0.2 ± 0.1 V ~ 4.8 ± 0.1 V



1. Pressure Sensor Signal
2. Pressure Sensor Power Supply
3. Pressure Sensor Ground

LJJF502S

4. Is the measured voltage within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for damaged harness and poor connection in pressure sensor harness between terminal "1" of the pressure sensor harness connector and terminal "12" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, substitute with a known-good pressure sensor and check for proper operation. If problem is corrected, replace pressure sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EABDECFA

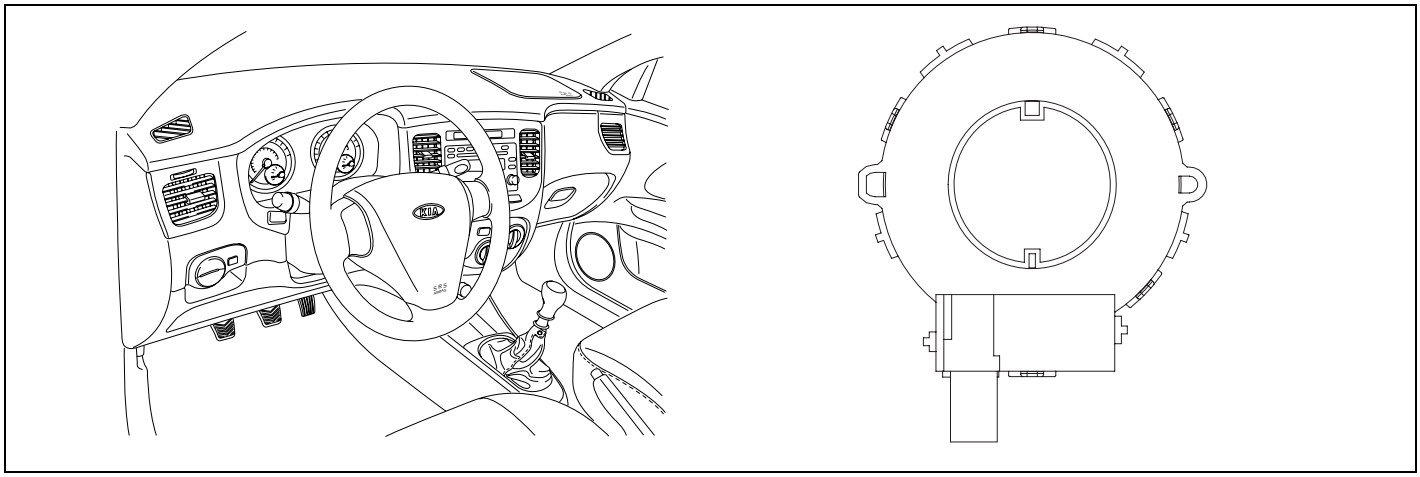
Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR EFF7010E

Refer to DTC C1101.

DTC C1259 STEERING ANGLE SENSOR - ELECTRICAL

COMPONENT LOCATION EFDEAE17



LJJF502T

GENERAL DESCRIPTION ECCC1E98

The Steering wheel angle sensor uses two sensors (A-sensor and B-sensor) to determine the direction of the rotation. The main components of each sensor are LED, photo transistor and slit plate.The slit plate, which has 45 holes, is installed between LED and photo transistor, and generates signals if slit plate rotates according to the steering wheel rotation.The sensor signals are generated by photo transistor which is driven whenever the light passes through the holes. The HECU detects operating speed and direction of the steering wheel by this input signal, and the signal is used to input signal for anti-roll control.

DTC DESCRIPTION EF9B02E6

If some signal voltage stays in abnormal voltage range, the time is counted separately. And if the monitored time exceeds the specified min. fault duration, failure is detected. The monitoring starts 1sec after Power Up.

DTC DETECTING CONDITION E98AEFE9

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage Monitoring	• Open or short of steering wheel sensor circuit • Faulty steering wheel sensor • Faulty HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• When Vsas > 4.2 ± 0.1 V or Vsas < 1.2 ± 0.1 V or 2.1 ± 0.1 V < Vsas < 2.9 ± 0.1 V continue 1 sec. - The monitoring starts 1 sec after Power Up.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamps are activated.	

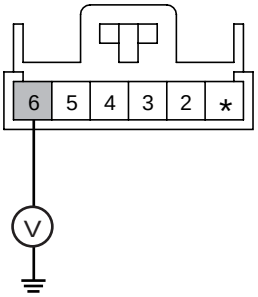
TERMINAL AND CONNECTOR INSPECTION E343554D

Refer to DTC C1101.

POWER CIRCUIT INSPECTION EF6A40C1

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "6" of the steering wheel angle sensor harness connector and chassis ground.

Specification : Approx. B+



2. Ground
3. ST1 Signal
4. ST2 Signal
5. STN Signal
6. Power Supply (IG1)

LJJF502U

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

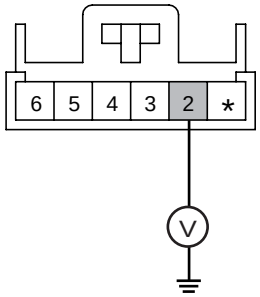
NO

▶ Check for open or blown 10 A fuse. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, check for open or short to GND in steering wheel angle sensor harness between the battery terminal(+) and terminal "2" of the steering wheel angle sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E2587253

1. Ignition "OFF".
2. Disconnect steering wheel angle sensor connector.
3. Measure resistance between terminal "2" of the steering wheel angle sensor harness connector and chassis ground.

Specification : Approx. below 1 Ω



2. Ground
3. ST1 Signal
4. ST2 Signal
5. STN Signal
6. Power Supply (IG1)

LJJF502V

4. Is the measured resistance within specifications?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for open or short in steering wheel angle sensor harness between terminal "2" of the steering wheel angle sensor harness connector and terminal "31" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EBAF5FE2

1. Ignition "ON" & Engine "ON".
2. Turn the steering wheel to the left or right.
3. Measure signal waveform between terminal "3, 4, 5" of the steering wheel angle sensor harness connector and chassis ground.

Specification :
HIGH : 2.9 ± 0.1 V ~ 4.4 ± 0.1 V
LOW : 1.2 ± 0.1 V ~ 2.1 ± 0.1 V

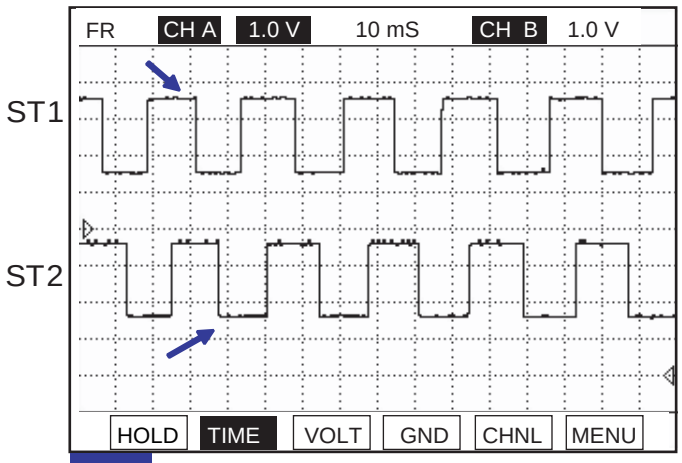


Fig1

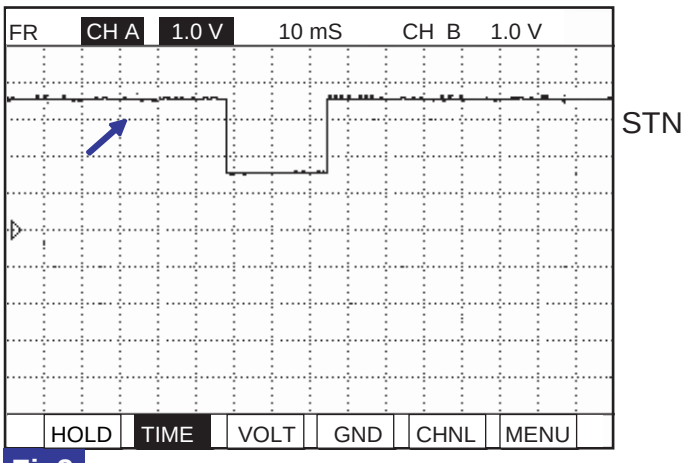
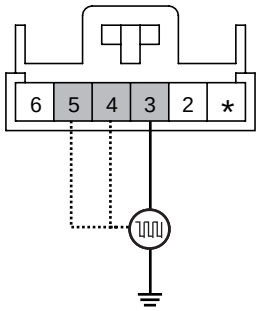


Fig2

Fig 1) Test Condition : Ignition "ON" & Engine "ON".
Normal data (Approx. High : 3.5 V , Low : 1.5 V)
Fig 2) Test Condition : Ignition "ON" & Engine "ON".
Normal data (Approx. High : 3.5 V , Low : 1.5 V)

LJJF502W



2. Ground
3. ST1 Signal
4. ST2 Signal
5. STN Signal
6. Power Supply (IG1)

LJJF502X

4. Is the measured signal waveform within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short in steering wheel angle sensor harness between terminal "3, 4, 5" of the steering wheel angle sensorr harness connector and terminal "8, 40, 39" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, substitute with a known-good steering wheel angle sensor and check for proper operation. If problem is corrected, replace steering wheel angle sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDD8EF37

Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR E8ECAAEC

Refer to DTC C1101.

DTC C1260 STEERING ANGLE SENSOR - SIGNAL

COMPONENT LOCATION EF20506F

Refer to DTC C1259.

GENERAL DESCRIPTION E00D4B37

Refer to DTC C1259.

DTC DESCRIPTION E0B1F5B8

This monitoring function monitors the changing point of N-signal with measured steering angle from ST1 and ST2. If N-signal changing point differs more than predefined degree, the failure is detected. If there is no variation of the steering wheel angle for predefined time ECU detect the failure.

DTC DETECTING CONDITION E54AE65B

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal Monitoring	• Faulty steering wheel sensor • Faulty HECU
Detect Mode	• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode	
Enable Conditions	• The STN is low more than ± 20 degrees for 70 msec. • When the steering wheel is turned more than 370 ± 5 degrees, if center is not detected, ECU detects the failure. • When the steering wheel angle is higher than 700 degrees ECU detects the failure. • During straight driving, if the steering wheel angle is larger than 55 ± 5 degree ECU detects the failure. • When the curve is detected after driving straight, if there is no variation of the steering wheel angle for 3 sec, ECU detect the failure. • While the vehicle drive 60 ± 5 degree ↔ -60 ± 5 degree, if STN is not detected low, ECU detect the failure. • While steering angle sensor wheel through center, of steering angle sensor is against specification three times, ECU detect the failure. • When the curve is detected after driving straight, if estimated valve and measured value of the sensor indicate in the opposite direction for 2 times.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamps are activated.	

TERMINAL AND CONNECTOR INSPECTION E2D107FC

Refer to DTC C1101.

SIGNAL CIRCUIT INSPECTION EEBE1731

1. Ignition "ON" & Engine "ON".
2. Turn the steering wheel to the left or right.
3. Measure signal waveform between terminal "1, 4, 5" of the steering wheel angle sensor harness connector and chassis ground.

Specification :
HIGH : 2.9 ± 0.1 V ~ 4.4 ± 0.1 V
LOW : 1.2 ± 0.1 V ~ 2.1 ± 0.1 V

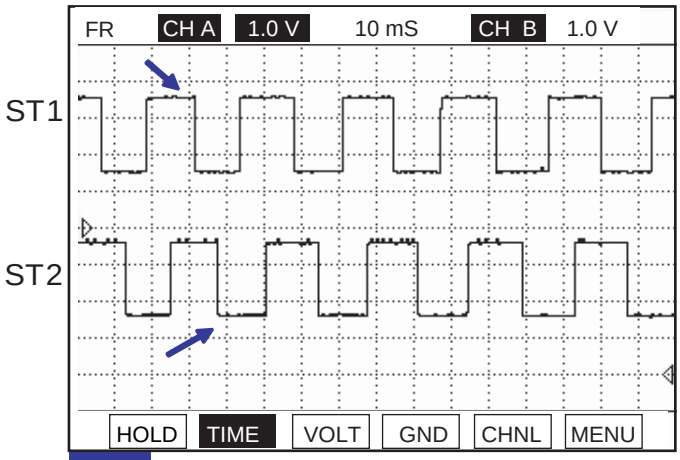


Fig1

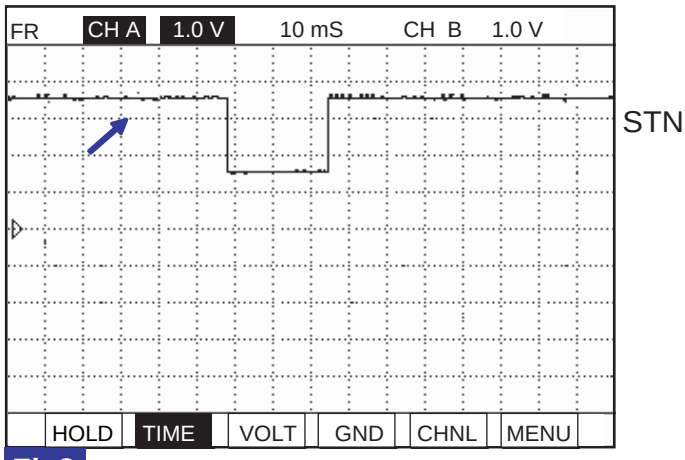
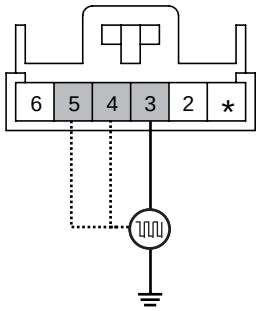


Fig2

Fig 1) Test Condition : Ignition "ON" & Engine "ON".
Normal data (Approx. High : 3.5 V , Low : 1.5 V)
Fig 2) Test Condition : Ignition "ON" & Engine "ON".
Normal data (Approx. High : 3.5 V , Low : 1.5 V)

LJJF502Y



2. Ground
3. ST1 Signal
4. ST2 Signal
5. STN Signal
6. Power Supply (IG1)

LJJF502Z

4. Is the measured signal waveform within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short in steering wheel angle sensor harness between terminal "1, 4, 5" of the steering wheel angle sensorr harness connector and terminal "39, 40, 8" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If STN signal is LOW when the steering wheel is in center position, Check for improper installation of steering angle sensor. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, substitute with a known-good steering wheel angle sensor and check for proper operation. If problem is corrected, replace steering wheel angle sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6DFD15D

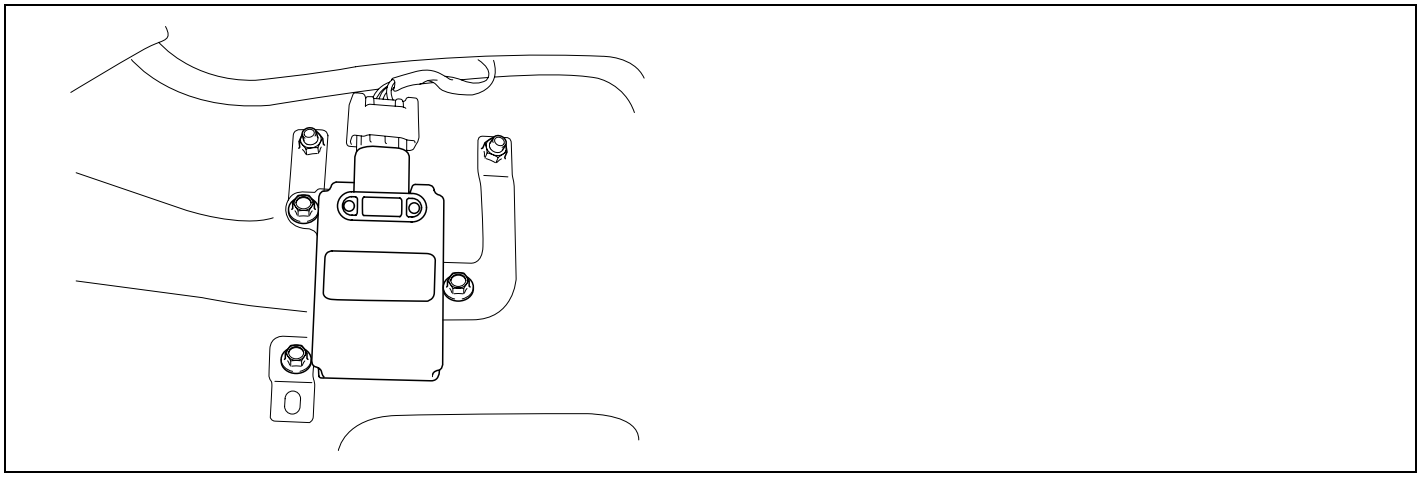
Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR E1A8ECD4

Refer to DTC C1101.

DTC C1282 YAW RATE AND LATERAL G SENSOR - ELECTRICAL

COMPONENT LOCATION E69AFBD4



LJJF503A

GENERAL DESCRIPTION E783901F

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 ESP control is reactivated. The lateral G sensor senses vehicle's lateral G. A small element inside the sensor is attached to a deflectable leverarm by lateral G. Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G. The output voltage of the lateral G sensor is 2.5V when the vehicle is at a standstill. Only with lateral G sensor, the ESP can not be reactivated.

DTC DESCRIPTION EDE32EB7

A failure is detected if the lateral acceleration sensor or yaw rate sensor signal stays in the fault range longer than the specified failure detection time. The Monitoring starts 1sec after Power Up.

DTC DETECTING CONDITION EADB0C9F

Item		Detecting Condition	Possible cause
Case1	DTC Strategy	• Lateral G sensor monitoring	• Faulty Yaw Rate & Lateral G sensor • Open or short of Yaw Rate & Lateral G sensor • Faulty HECU
	Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
	Enable Conditions	• When V_LG > 4.90 ± 0.05 V or V_LG < 0.10 ± 0.05 V continue 1 sec, - The monitoring starts 1 sec after power up.	
Case2	DTC Strategy	• YAW rate Sensor monitoring	
	Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
	Enable Conditions	• When V_YAW > 4.90 ± 0.05 V or V_YAW < 0.10 ± 0.05 V continue 1sec, - The monitoring starts 1sec after power up.	
Case3	DTC Strategy	• CBIT(Commended built in test) monitoring	
	Detect Mode	• Initial Check	
	Enable Conditions	• When CBIT is high (> 3.6 V), YAW signal voltage don't increase 0.1 ~ 1.2 V than case of low state of CBIT pin . • Lateral G signal voltage is smaller than 4.1 ± 0.1 V when CBIT is high(> 3.6 V). • When GND of yaw rate sensor and lateral G sensor are open.	
Fail Safe		• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

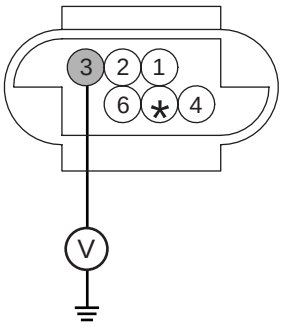
TERMINAL AND CONNECTOR INSPECTION E9BA7B5D

Refer to DTC C1101.

POWER CIRCUIT INSPECTION E550ADAB

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 5 V



1. YAW sensor signal
2. Lateral G sensor signal
3. Power Supply (B+)
4. Ground
6. Self Test

LJJF503B

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

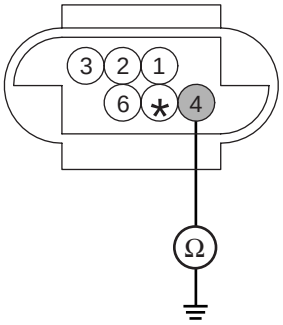
NO

▶ Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and terminal "36" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure. If OK, go to "Component Inspection" procedure.

GROUND CIRCUIT INSPECTION EB2A763D

1. Ignition "OFF".
2. Disconnect Yaw Rate & Lateral G sensor connector.
3. Measure resistance between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. below 1Ω



1. YAW sensor signal
2. Lateral G sensor signal
3. Power Supply (B+)
4. Ground
6. Self Test

LJJF503C

4. Is the measured resistance within specifications?

YES

▶ Go to next procedure.

NO

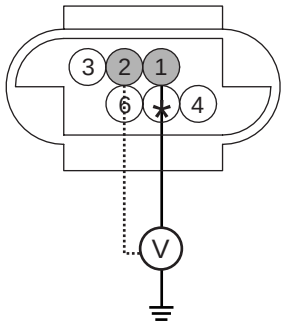
▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and terminal "23" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EA556B67

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

2. Measure voltage between terminal "1, 2" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5 V



1. YAW sensor signal
2. Lateral G sensor signal
3. Power Supply (B+)
4. Ground
6. Self Test

LJJF503D

3. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "1, 2" of the Yaw Rate & Lateral G sensor harness connector and terminal "41, 9" of the HECU harness connector. Repair as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, go to "Component Inspection" procedure.
▶ If OK, Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBA4A1AF

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by open or short of Yaw Rate & Lateral G sensor harness and/or faulty Yaw Rate & Lateral G sensor or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR EAAD4BFF

Refer to DTC C1101.

DTC C1283 YAW RATE AND LATERAL G SENSOR - SIGNAL

COMPONENT LOCATION E98ACA48

Refer to DTC C1282.

GENERAL DESCRIPTION E9FF780E

Refer to DTC C1282.

DTC DESCRIPTION E65AF5BC

A lateral acceleration reference signal is calculated from the wheel speeds, the steering angle and the yaw rate signals to observe the lateral acceleration sensor signal. The difference between the reference signal and the sensor signal is evaluated for failure detection. A yaw rate reference signal is calculated from the wheel speeds, the steering angle and the lateral acceleration signals to observe the yaw rate sensor signal. The difference between the reference signal and the sensor signal, and the gradient of the measured sensor signal is evaluated for the failure detection. If the difference between estimated value and measured value of the sensor is larger than predefined value for predefined time, the failure is recognized.

DTC DETECTING CONDITION E56FE750

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	• Faulty Yaw Rate & Lateral G sensor • Open or short of Yaw Rate & Lateral G sensor • Faulty HECU
Case1	Detect Mode	• Initial Check	
	Enable Conditions	• During standstill if lateral G value is larger than 7 g, and continue 2 sec. • During standstill if yaw rate value is larger than 7 deg/s, and continue 2 sec.	
Case2	Detect Mode	• Initial Check • Outside the ABS control cycle • Diagnosis mode	
	Enable Conditions	• If noise of input signal is happened 429 times in 5 sec , Which the amplitude of the sensor signal is larger than predefined value(standstill : 0.3 g , driving:0.5 g~ 1.0 g). • If noise of input signal is happened 429 times in 5 sec , Which the amplitude of the sensor signal is larger than predefined value(standstill : 8 deg/s , driving:15 deg/s~ 30 deg/s).	
Case3	Detect Mode	• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode	
	Enable Conditions	• When the difference between estimated value and measured value of the sensor is lager than 0.3 g, the difference value add and subtract. When sum Total value is larger than predefined value. • When the difference between estimated value and measured value of the sensor is lager than 7 deg/s, the difference value add and subtract. When sum Total value is larger than predefined value	
Case4	Detect Mode	• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
	Enable Conditions	• When GND of yaw rate sensor and lateral G sensor are open.	
Fail Safe		• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

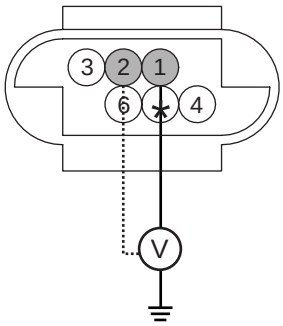
TERMINAL AND CONNECTOR INSPECTION EEC56762

Refer to DTC C1101.

POWER CIRCUIT INSPECTION E9BCBBD5

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "1, 2" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5 V



1. YAW sensor signal
2. Lateral G sensor signal
3. Power Supply (B+)
4. Ground
6. Self Test

LJJF503E

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "1, 2" of the Yaw Rate & Lateral G sensor harness connector and terminal "41, 9" of the HECU harness connector. Repair as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, go to "Component Inspection" procedure.
▶ If OK, Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E53EE55F

Refer to DTC C1282.

COMPONENT INSPECTION EBFCB6EA

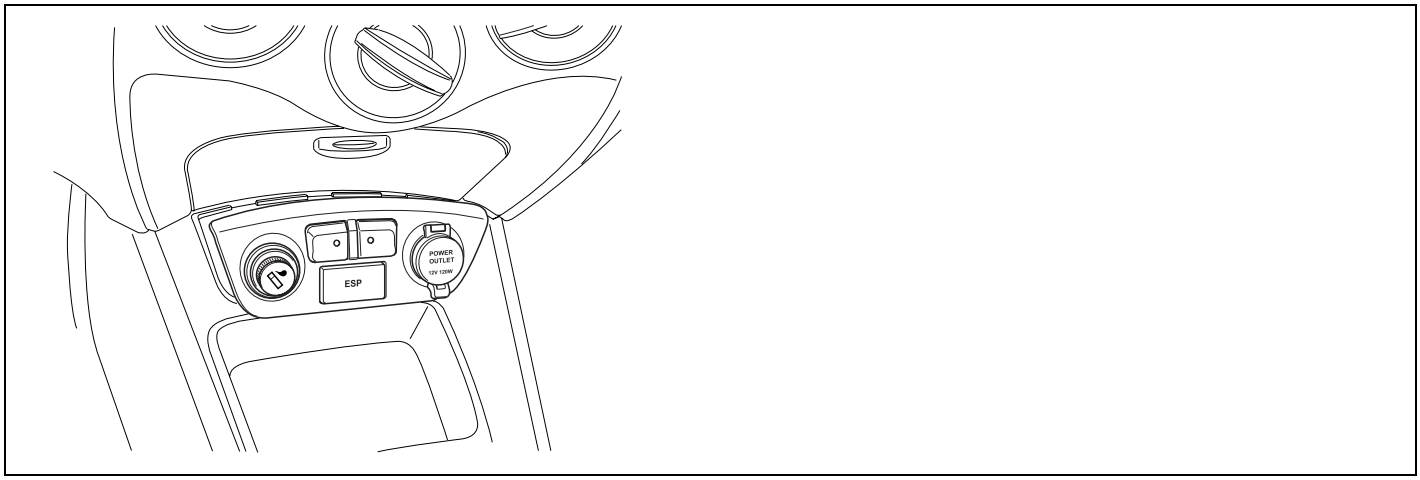
Refer to DTC C1282.

VERIFICATION OF VEHICLE REPAIR E83A58ED

Refer to DTC C1201.

DTC C1503 ESP SWITCH ERROR

COMPONENT LOCATION E3CD9CDF



LJJF503G

GENERAL DESCRIPTION E21B45BD

Driver can inhibit the ESP control by ESP switch. When switch signal send into HECU, ESP warning lamp goes ON and ESP control is stopped and if next switch signal is inputted again, ESP control is ready. This function is used for sporty driving or vehicle inspection.

DTC DESCRIPTION E9A1CA8C

Trouble code is set when the condition that the level of ESP switch is high is continued for 60sec. When the ESP switch failure is set there is no signal in the warning lamp and HECU inhibits the ESP control and allows the ABS/EBD control.

DTC DETECTING CONDITION EF68EA70

Item	Detecting Condition	Possible cause
DTC Strategy	• Short circuit monitoring	• Open or short ESP switch
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• When the ESP switch is ON for 60 sec.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamps are activated.	

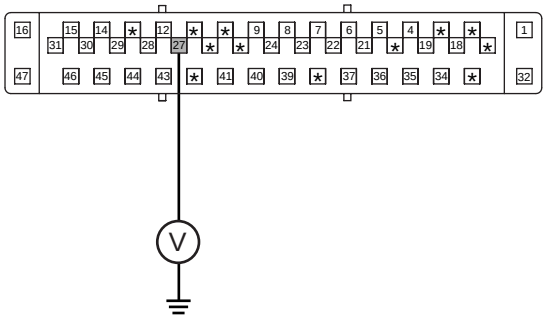
TERMINAL AND CONNECTOR INSPECTION E011BF8D

Refer to DTC C1101.

SIGNAL CIRCUIT INSPECTION EDD7CCBC

1. Ignition "ON" & Engine "OFF" & ESP Switch "ON".
2. Measure voltage between terminal "27" of the HECU harness connector and chassis ground.

Specification : Approx B+



<ESP>
27. ESP switch

LJJF503H

3. Is the measured signal waveform within specifications?

YES

▶ Fault is intermittent caused by open or short in ESP switch line, faulty ESP switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

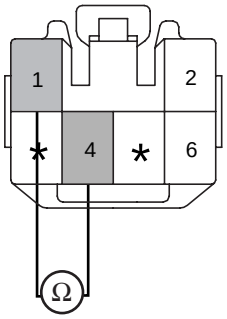
NO

▶ Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "27" of the HECU harness connector . Check for open or blown 10 A fuse referring to "Circuit Diagram" . Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, go to "Component Inspection" procedure.

COMPONENT INSPECTION E984E174

1. Ignition "OFF".
2. Disconnect ESP switch connector.
3. Press the ESP switch.
4. Measure resistance between terminal "1" of the ESP switch harness connector and terminal "4" of the ESP switch harness connector

Specification : Approx. below 1 Ω



1. POWER SUPPLY
4. SIGNAL

LJJF503I

5. Is the measured resistance within specifications?

YES

▶ Fault is intermittent caused by faulty ESP switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

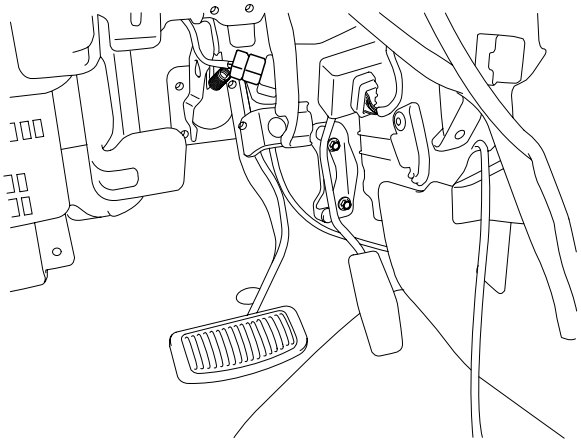
▶ Substitute with a known-good ESP switch and check for proper operation. If problem is corrected, replace ESP switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA9AF6A6

Refer to DTC C1101.

DTC C1513 BRAKE SWITCH ERROR

COMPONENT LOCATION EEAAFA2B



LJJF503J

GENERAL DESCRIPTION E70CC3A5

The brake light switch indicates brake pedal status to the ABS control unit. The switch is turned on when brake is depressed. The brake light switch is a normally-open contact which runs to battery voltage when active (brake depressed). When passive (brake not depressed), the cable is grounded via the break light bulbs.

DTC DESCRIPTION E3F3BA54

The brake light signal is a reference to judge driver's will for braking. ABS ECU monitor open circuit of brake light switch for normal ABS control. HECU set the warning lamp if either BLS or BS is fault.

DTC DETECTING CONDITION EA7C1E54

Item	Detecting Condition	Possible cause
DTC Strategy	• Open circuit monitoring	• Open circuit in brake switch line • Faulty brake light switch • Faulty input stage in HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• If both BLS and BS have a same state for predetermined time, The failure is recognized. • Outside an ABS/TCS/ESP control, And after normal operation of MCP, If the pressure sensor. • The signal is higher than 20 bar and BLS is low for 3 sec, ECU detect the failureIf the BLS/BS changed more than 40 times for 5 sec, ECU detect the failure. • While Vref > 10 KPH, TPS > 5 %, MCP < 7 bar, if BLS is high over 1 minute, ECU detect the failure.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamps are activated.	

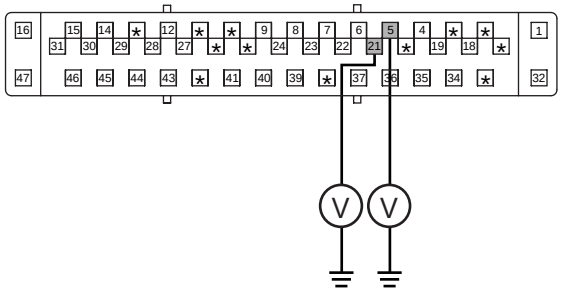
TERMINAL AND CONNECTOR INSPECTION EBC51CC1

Refer to DTC C1101.

SIGNAL CIRCUIT INSPECTION EDBE8C0F

1. Ignition "ON" & Engine "OFF".
2. Press the brake pedal.
3. Measure voltage between the terminal "5, 21" of the HECU harness connector and chassis ground.

Specification :
Brake Light Switch - Approx. B+
Brake Switch - Approx. 0 V



<ESP>
5. Brake Light Switch
21. Brake Switch

LJJF503K

4. Is the measured signal waveform within specifications?

YES

▶ Fault is intermittent caused by open harness in brake light switch and brake switch line, faulty brake light switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▶ Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "5, 21" of the HECU harness connector . Check for open or blown 15 A stop fuse. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, Go to "Component Inspection" procedure.

COMPONENT INSPECTION E1F47329

1. Connect a ohmmeter to the connector of brake light switch, and check whether or not there is continuity when the plunger of the brake light switch is pushed in and when it is released.
   The switch is in good condition if there is no continuity when the plunger is pushed.

2. Is there no continuity when the plunger is pushed?

YES

▶ Fault is intermittent caused by open harness in brake light switch line, faulty brake light switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▶ Substitute with a known-good brake light switch and check for proper operation. If problem is corrected, replace brake light switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE8BF7AF

Refer to DTC C1101.

DTC C1604 ECU HARDWARE ERROR

COMPONENT LOCATION EB2E9D41

Refer to DTC C1112.

GENERAL DESCRIPTION ECCC0525

The HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit) , so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.

DTC DESCRIPTION E7ED66CB

The HECU monitors the operation of the IC components such as memory, register, A/D converter and so on. The HECU sets this code when the EEPROM data read by the master processor is different from prior data written, or when the master/slave processor detects abnormal operation in RAM, Status Register, Interrupt, Timer, A/D converter or cycle time.

DTC DETECTING CONDITION E66CC98E

Item	Detecting Condition	Possible cause
DTC Strategy	• Internal monitoring	• Faulty HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• When the MCU can’ t erase or write a data of the EEPROM. • When the master/slave processor detects abnormal operation in RAM, ROM, INTERRUPT, TIMER, A/D CONVERTER, CYCLE TIME.	
Fail Safe	• System down. The ABS/EBD/TCS/ESP functions are inhibited. - The valve relay and all solenoids are prevented from being switched on. • The ABS/EBD/ESP warning lamps are activated.	

COMPONENT INSPECTION EA811336

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E0467F6A

Refer to DTC C1101.

DTC C1605 CAN HARDWARE ERROR

COMPONENT LOCATION E5FDEFE7

Refer to DTC C1112.

GENERAL DESCRIPTION E97AF3F3

CAN communication is applied just for ESP(Electronic Stability Program) installed in the vehicle for sending requirement data, such as torque reduction, the number of fuel cut cylinders, and TCS control requests, to the Engine ECM & TCU. The Engine ECM performs fuel cut functions according to requests from the ABS ECU and retards ignition timing by torque reduction requests. The TCU maintains current gear positions during TCS/ESP control time, by not increasing power which causes a kickdown shift.

DTC DESCRIPTION E72D0C86

The HECU checks the CAN RAM for normal TCS/ESP control, and sets this code if a CAN RAM malfunction is detected.

DTC DETECTING CONDITION EF086471

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN RAM monitoring	• Faulty HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• CAN Hardware failure.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

COMPONENT INSPECTION EE3CEEA0

1. Ignition "OFF".
2. Ignition "ON"
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by short harness in CAN line and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E5BEAD44

Refer to DTC C1101.

DTC C1611 CAN TIME-OUT EMS

COMPONENT LOCATION EFE0FD95

Refer to DTC C1112.

GENERAL DESCRIPTION E10CCCB2

Refer to DTC C1605.

DTC DESCRIPTION EB9B196A

The HECU checks the CAN communication lines for normal TCS/ESP control, and sets this code if an ECM message is not received within 500ms. The HECU does not detect this code until 2 seconds after the IG KEY is turned to ON.

DTC DETECTING CONDITION ECA8BF44

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN message monitoring	• Faulty ECM • Faulty HECU
Detect Mode	• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• In case that EMS1 or EMS2 message was not received for more than 500ms within normal voltage condition. - The Monitoring starts 2s after power up.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

COMPONENT INSPECTION E6539CBF

1. Ignition "OFF".
2. Ignition "ON"
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good ECM and check for proper operation. If problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty ECM and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E4CF0C2B

Refer to DTC C1101.

DTC C1612 CAN TIME-OUT TCU

COMPONENT LOCATION EB6F117B

Refer to DTC C1112.

GENERAL DESCRIPTION EE0A8696

Refer to DTC C1605.

DTC DESCRIPTION EB0FFE43

The HECU checks the CAN communication lines for normal TCS/ESP control, and sets this code if an TCU message is not received within 500ms. The HECU does not detect this code until 3 seconds after the IG KEY is turned to ON.

DTC DETECTING CONDITION EAF7F0D3

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN message monitoring	• Faulty TCU • Faulty HECU
Detect Mode	• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• In case that TCU message was not received for more than 500ms within normal voltage condition. - The Monitoring starts 2s after power up.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

COMPONENT INSPECTION EBF665A2

1. Ignition "OFF".
2. Ignition "ON"
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good TCU and check for proper operation. If problem is corrected, replace TCU and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty TCU and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E750A40A

Refer to DTC C1101.

DTC C1613 CAN WRONG MESSAGE

COMPONENT LOCATION E4ED0EAF

Refer to DTC C1112.

GENERAL DESCRIPTION E036BE9D

Refer to DTC C1605.

DTC DESCRIPTION E5ADA5BB

The HECU checks the CAN communication lines for normal TCS/ESP control, and sets this code if the data received between the EMS2 and TCU is not the same. The HECU will not detect this code until 2 seconds after the IG KEY is turned ON.

DTC DETECTING CONDITION E325EEA0

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN message monitoring	• Faulty ECM • Faulty HECU
Detect Mode	• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• In case that TCU message was not received for more than 500ms within normal voltage condition. - The Monitoring starts 2s after power up.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

COMPONENT INSPECTION EF552E8B

1. Ignition "OFF".
2. Ignition "ON"
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good ECM and check for proper operation. If problem is corrected, replace TCU and then go to "Verification of Vehicle Repair" procedure. If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty ECM and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR EF4F3C6B

Refer to DTC C1101.

DTC C1616 CAN BUS OFF

COMPONENT LOCATION E1EC7CB1

Refer to DTC C1112.

GENERAL DESCRIPTION E7BC00A6

Refer to DTC C1605.

DTC DESCRIPTION EE354B34

The HECU checks the CAN communication lines for normal TCS/ESP control, and sets this code if CAN BUS OFF status is detected for more than 100 ms.

DTC DETECTING CONDITION E6FA986F

Item	Detecting Condition	Possible cause
DTC Strategy	• Open or short circuit monitoring	• Open or short circuit in CAN line
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode • Failure mode	
Enable Conditions	• In case CAN BUS off state continued for more than 100 ms.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

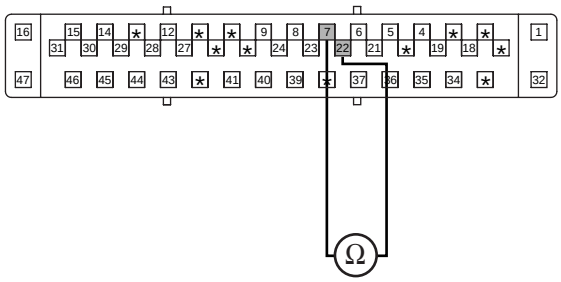
TERMINAL AND CONNECTOR INSPECTION EBDC7C4E

Refer to DTC C1101.

SIGNAL CIRCUIT INSPECTION E08FE0DF

1. Ignition "OFF".
2. Measure resistance between terminal "22" of the HECU harness connector and terminal "7" of the HECU harness connector.

Specification : Approx. 60 Ω



<ESP>
7. CAN (HIGH)
22. CAN (LOW)

LJJF503L

3. Is the measured resistance within specifications?

YES

▶ Fault is intermittent caused by open or short in CAN signal harnessor was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▶ Check for open or short in CAN signal harness between terminal "22" of the HECU harness connector and terminal "7" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E84AFAEF

Refer to DTC C1101.

DTC C2112 VALVE RELAY ERROR

COMPONENT LOCATION EBFE3A37

Refer to DTC C1112.

GENERAL DESCRIPTION EF6ACBFF

The ABS ECU supplies battery power to all solonid valves by way of a valve relay which is controlled by the Electronic Control UNIT(ECU). The valve relay and all solenoid valves are installed inside the HECU (Hydraulic and Electronic Control Unit).

DTC DESCRIPTION E7AF19B1

ABS ECU monitors voltage of the valve relay to check if ABS ECU can perform ABS control normally. When the valve relay is switched to ON, the HECU will set this code if the solenoid drive voltage is below permissible voltage ranges for a period of time. When the valve relay is switched to OFF, the HECU sets this code if the solenoid drive voltage is over the permissible voltage range for a period of time.

DTC DETECTING CONDITION E70C37ED

Item		Detecting Condition	Possible cause
DTC Strategy		• Battery Voltage Monitoring	• Open or short of power supply circuit (ABS1) • Faulty HECU
Case1 (Open)	Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode	
	Enable Conditions	• If the valve relay is switched on and the reference voltage of valve relay $<$ 5 ± 0.5 V continuously for 56 ms, the failure is detected.	
Case2 (Short or Leakage)	Detect Mode	• Initial Check • Failure mode	
	Enable Conditions	• If the valve relay is switched off and Vvr $>$ 6 ± 0.5 V or Vvr $<$ 2.5 ± 0.5 V continuously for 56 ms, the failure is detected.	
Fail Safe		• System down. The ABS/EBD/TCS/ESP functions are inhibited. - The valve relay and all solenoids are prevented from being switched on. • The ABS/EBD/ESP warning lamps are activated.	

MONITOR ACTUATION TEST E90AEF84

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of all valves with Actuation Test.

Specification : It's normal if operating sound is heard.

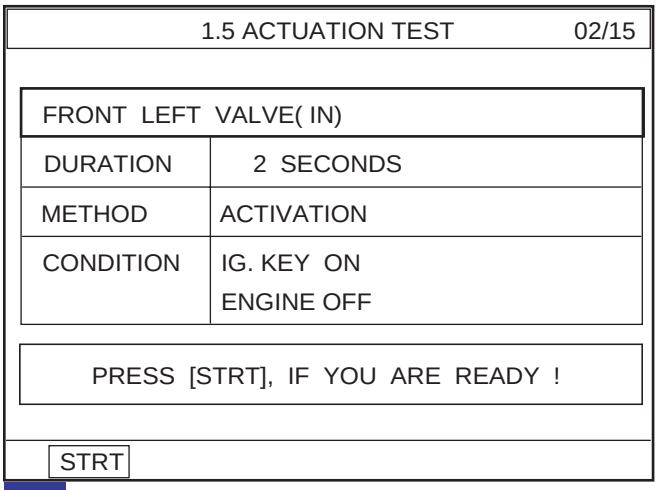


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Front left valve(in)

LJJF503M

5. Do all valves operate normally?

YES

▶ Fault is intermittent caused by poor connection in power harness (ABS1) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next step.

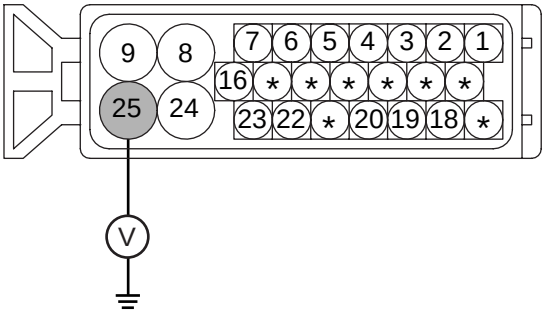
TERMINAL AND CONNECTOR INSPECTION E75919CA

Refer to DTC C1101.

POWER CIRCUIT INSPECTION E61B7B57

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "25(ESP : 32)" of the HECU harness connector and chassis ground.

Specification : Approx. B+



<ABS>
25. Battery (ABS1)

<ESP>
32. Battery (ABS1)

LJJF503N

5. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

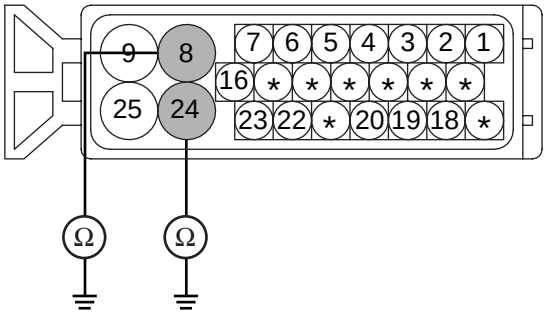
NO

▶ Check for open or short in power harness between battery terminal(+) and terminal "25(ESP : 32) " of the HECU harness connector. Check for open or blown 40 A ABS1 fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E6CACDD8

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "8, 24(ESP : 16, 47) " of the HECU harness connector and chassis ground.

Specification : Approx. below 1Ω



<ABS>
8. Ground
24. Ground

<ESP>
16. Ground
47. Ground

LJJF503O

4. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between terminal "8, 24(ESP : 16, 47)" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EDBA6B9D

Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR EB5ADFCD

Refer to DTC C1101.

DTC C2227 EXCESSIVE TEMPERATURE OF BRAKE DISC

COMPONENT LOCATION ED0AC921

Refer to DTC C1101.

GENERAL DESCRIPTION E9FB6CF4

BTCS (Brake Traction Control System) is operated when the value (Wheel acceleration value + speed difference value) exceeds the specified value when vehicle speed is lower than the 50 Km/h. The BTCS intalled HECU calculates the disc temperature logically, which is an assumed value, by using the value of Wheel speed, vehicle speed change, CONTROL MODE and BLS SIGNAL. Assumed disc temperature is used to protect DISC overheating, caused by long-time operation, which may cause a decrease in brake efficiency.

DTC DESCRIPTION EAEBCECB

If the HECU decides that the disc is over-heated (above 500 ℃), then it turns the ESP lamp ON and inhibits BTCS operation to protect overheating of the disc. If the calculated temperature becomes lower than specified value (aprrox. 250 ℃), then the HECU turns the ESP lamp OFF and operates the BTCS again.

DTC DETECTING CONDITION ECBB59D5

Item	Detecting Condition	Possible cause
DTC Strategy	• Internal monitoring	• Faulty HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle	
Enable Conditions	• When the calculated temperature of disc is higher than 500 ℃. • If the calculated temperature drops below 300 ℃, the controller recovers to normal state. • When IGN switched OFF, ECU calculate temperature of disc until calculated temperature drops below 80 ℃ by BATT1 power.	
Fail Safe	• Inhibit the TCS/ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the TCS/ESP control. • The ESP warning lamp is activated.	

COMPONENT INSPECTION E098927E

1. Ignition "OFF".
2. Ignition "ON"
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is caused by Faulty HECU or was repaired and HECU memory was not cleared.
▶ The DTC code can be set by excessive TCS/ESP control in normal system status. Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E215391C

Refer to DTC C1101.

DTC C2380 ABS/TCS/ESP VALVE ERROR

COMPONENT LOCATION E6BDFBCE

Refer to DTC C1112.

GENERAL DESCRIPTION E3774D8A

The ABS HECU is composed of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydrualic pressure supplied to a wheel cylinder.

DTC DESCRIPTION EED5BE4F

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if an unexpected high drive voltage is detected when the valve relay is switched to OFF. (or unexpected low voltage is detected when the solenoid valve drive TR is switched to ON).

DTC DETECTING CONDITION E30DDC3D

Item	Detecting Condition	Possible cause
DTC Strategy	• Internal monitoring	• Faulty HECU
Detect Mode	• Initial Check • Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode	
Enable Conditions	• If the valve relay is switched ON and corresponding solenoid driver OFF and the voltage of solenoid $< 3.5 \pm 0.5$ V continuously for 56 ms, the failure is detected. • If the valve relay is switched ON and corresponding solenoid driver ON and the voltage of solenoid $> 1.5 \pm 0.5$ V continuously for 56 ms, the failure is detected.	
Fail Safe	• System down. The ABS/EBD/TCS/ESP functions are inhibited. - The valve relay and all solenoids are prevented from being switched on. • The ABS/EBD/ESP warning lamps are activated.	

COMPONENT INSPECTION ED7A83D3

1. Ignition "OFF".
2. Ignition "ON"
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more)
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR EFBFE90D

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
4. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

DTC C2402 MOTOR - ELECTRICAL

COMPONENT LOCATION EEAF69C1

Refer to DTC C1112.

GENERAL DESCRIPTION E0F8B2D5

The ABS ECU supplies battery power to the electric motor by way of a motor relay which is controlled by the Electronic Control Unit(ECU). The electric motor pump supplies hydraulic pressure to all wheel brake calipers by operating the piston inside the pump.

DTC DESCRIPTION EFBA030A

The ABS ECU monitors the pump motor relay or fuse open, open or short in motor or motor lock and then sets this code if a malfunction is detected.

DTC DETECTING CONDITION E17D2E59

Item		Detecting Condition	Possible cause
DTC Strategy		• Battery Voltage Monitoring	• Open or short of power supply circuit (ABS2) • Faulty HECU
Case1 (Motor Relay Open orMotor Short to GND)	Detect Mode	• Outside the ABS control cycle • Inside the ABS control cycle • Diagnosis mode	
	Enable Conditions	• If the motor relay is switched ON and motor voltage < (IGN voltage - 4 ± 0.5 V) continued for 56 msec, the failure is detected.	
Case2 (Motor Open, Motor Short to BATT)	Detect Mode	• Initial Check • Outside the ABS control cycle • Diagnosis mode • Failure mode	
	Enable Conditions	• After 1.8 sec from the time that motor relay is switched OFF, the motor voltage > 4 ± 0.5 V continued for 1.8 sec, the failure is detected.	
Case3 (Motor Lock)	Detect Mode	• Outside the ABS control cycle	
	Enable Conditions	• After motor relay is switched OFF, motor voltage is measured. If the time which motor voltage > 1 ± 0.1 V is less than evaluation time, recheck is performed again for a maximum of three times. When the motor voltage is not normal even on the third recheck, the controller recognizes it as failure.	
Case4 (Motor Fuse Open)	Detect Mode	• Initial Check • Outside the ABS control cycle • Diagnosis mode • Failure mode	
	Enable Conditions	• If the motor relay is switched OFF and motor power supply voltage < 4 ± 0.5 V continued for 1 sec, the failure is detected.	
Fail Safe		• The ABS/TCS/ESP functions are inhibited. • The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. • Motor failure during the ABS control cycle (Case 1, 4) :Inhibit the ABS/TCS/ESP control of front wheels, allow the ABS/TCS/ESP control of rear wheels, and ABS/ESP warning lamps are switched on at the end of ABS control.	

MONITOR ACTUATION TEST E878E3EB

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of all valves with Actuation Test.

Specification : It's normal if operating sound is heard.

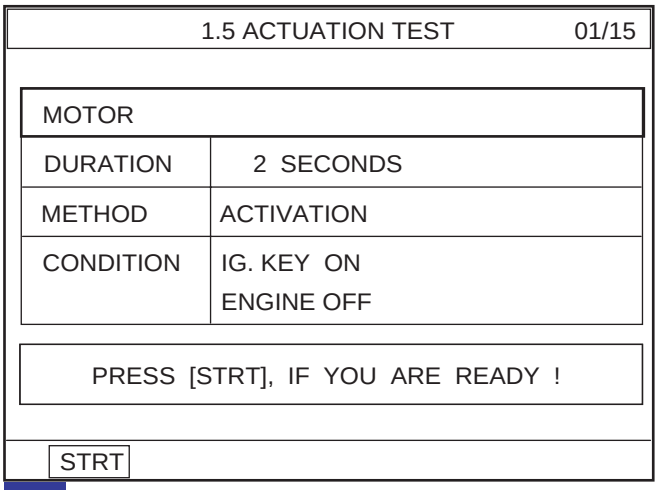


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Motor

LJJF503P

5. Does the motor operate normally?

YES

▶ Fault is intermittent caused by poor connection in power harness (ABS1) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

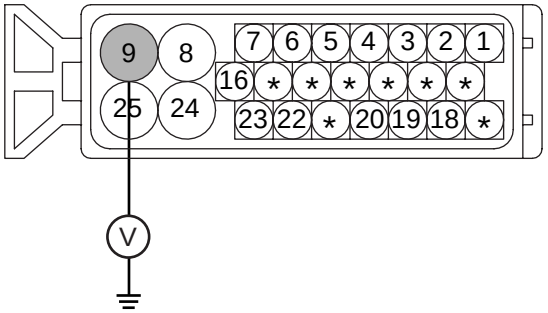
TERMINAL AND CONNECTOR INSPECTION E7F49312

Refer to DTC C1101.

POWER CIRCUIT INSPECTION E4702A3D

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "9(ESP : 1)" of the HECU harness connector and chassis ground.

Specification : Approx. B+



<ABS>
9. Battery Voltage (ABS2)

<ESP>
1. Battery Voltage (ABS2)

LJJF503Q

5. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

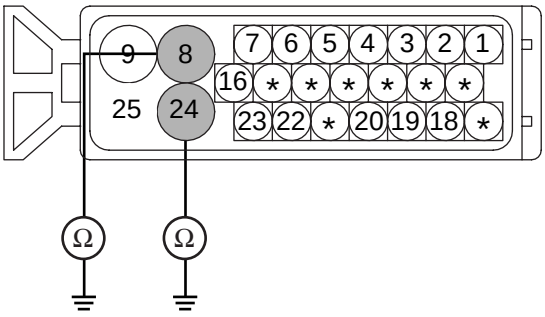
NO

▶ Check for open or short in power harness between battery terminal(+) and terminal "9(ESP : 1)" of the HECU harness connector. Check for open or blown 40 A ABS2 fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure

GROUND CIRCUIT INSPECTION E1A49E88

1. Ignition "OFF".
2. Check for open or short in power harness between battery terminal(+) and terminal "9(ESP :1)" of the HECU harness connector. Check for open or blown 40A ABS2 fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure.

Specification : Approx. below 1Ω



<ABS>
8. Ground
24. Ground

<ESP>
16. Ground
47. Ground

LJJF503R

3. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between terminal "8, 24(ESP : 16, 47)" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EACFBADB

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more)
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

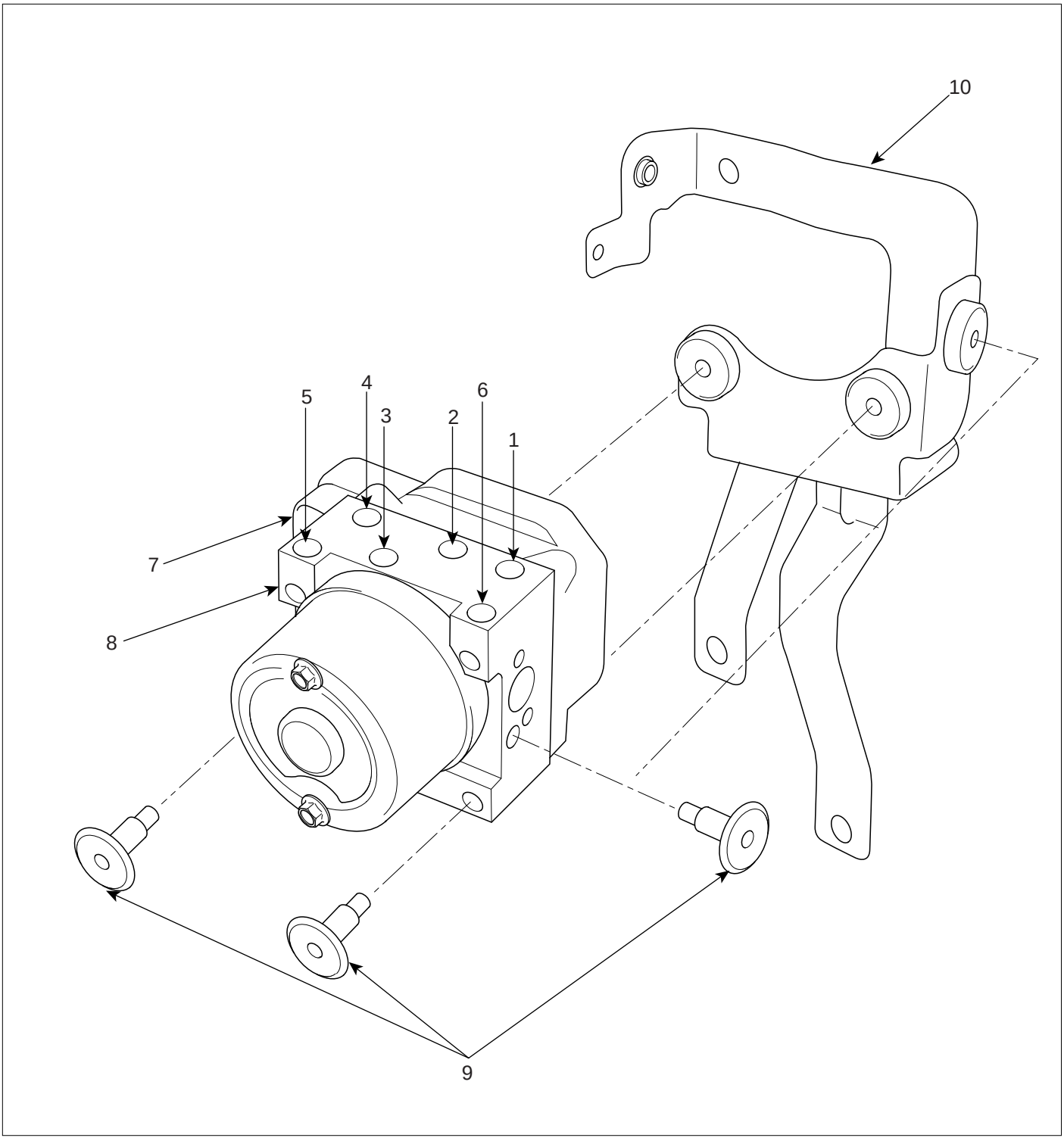
▶ Fault is intermittent caused by open or short of power harness (ABS2) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR EDBE8E7B

Refer to DTC C1200.

ANTI-LOCK BRAKING SYSTEM CONTROL MODULE

COMPONENTS EEB9DF59

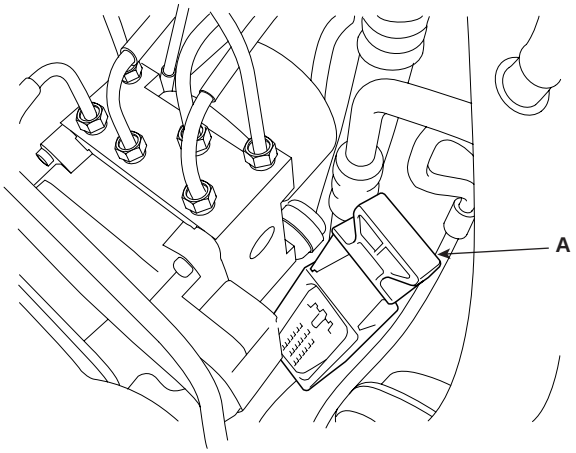


1. Front-right tube
2. Rear-left tube
3. Rear-right tube
4. Front-left tube
5. MC2
6. MC1
7. ABS control module connector (25P)
8. ABS control module(HECU)
9. Damper screw
10. Bracket

LJJF501K

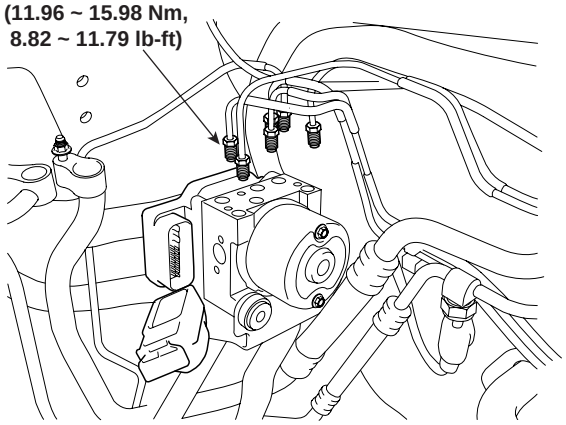
REMOVAL EED88E12

1. Turn the ignition switch OFF.
2. Pull up the lock(A) of the ABS control unit 25P connector , then disconnect the connector.



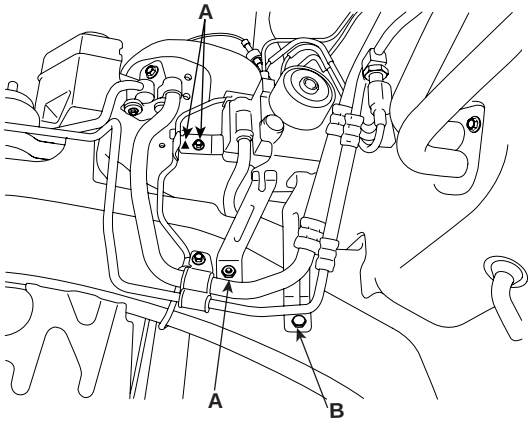
AJJF519A

3. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.



LJJF502B

4. Loosen the 3 ABS HECU bracket bolts (A) and 1 nut(B) , then remove HECU and bracket.



AJJF529A

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 damper screws and washer , then remove the bracket.

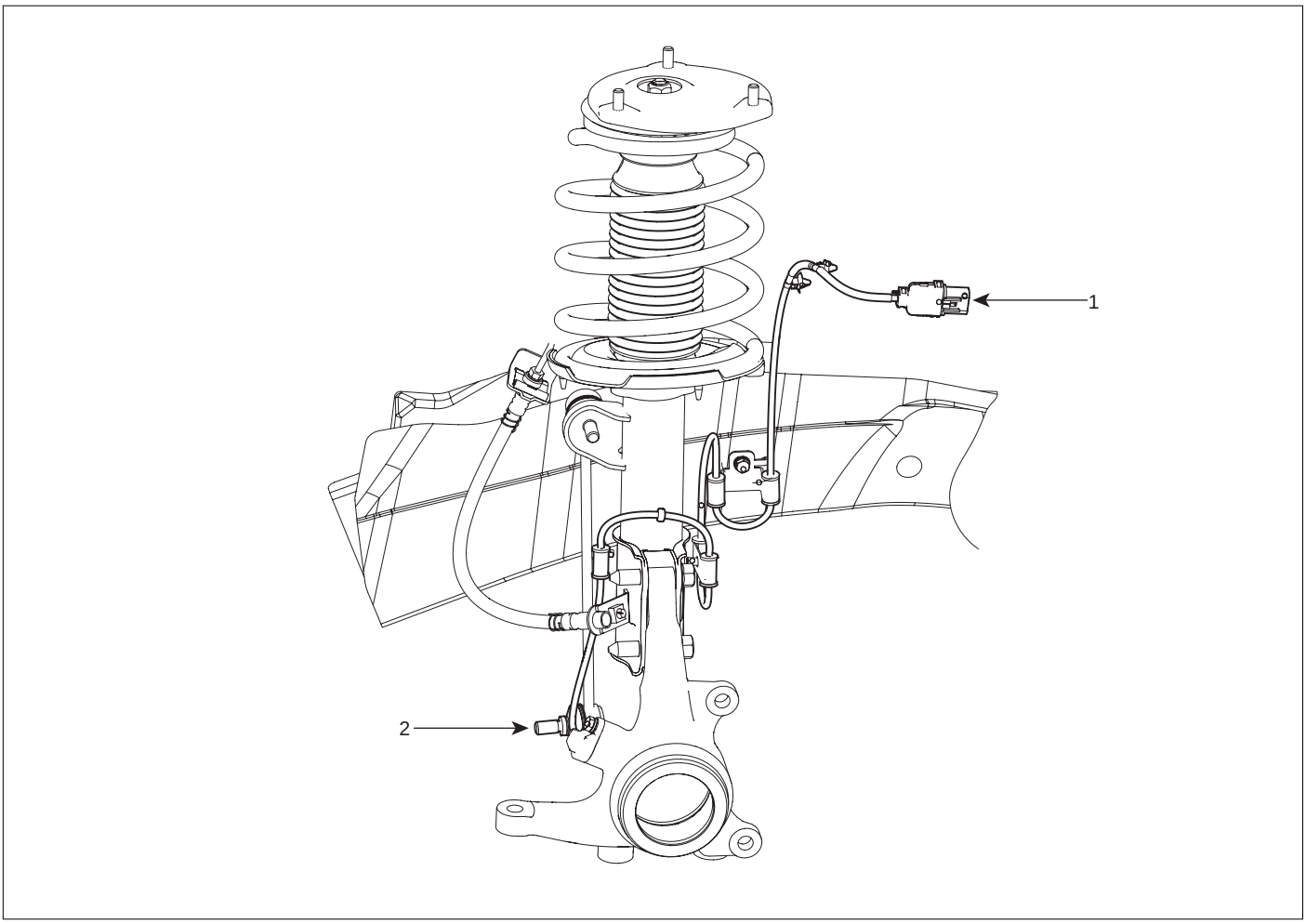
INSTALLATION E195F15A

1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and brake tube nuts to the specified torque.

Tightening torque
HECU damper screw :
10.98 ~ 14.02 Nm (1.12 ~ 1.43 kgf.m, 8.1 ~ 10.34 lb-ft)
HECU bracket mounting bolt, nut :
7.85 ~ 9.8 Nm (0.8 ~ 1.0 kgf.m, 5.79 ~ 7.23 lb-ft)

FRONT WHEEL SPEED SENSOR

COMPONENTS E7C754E6

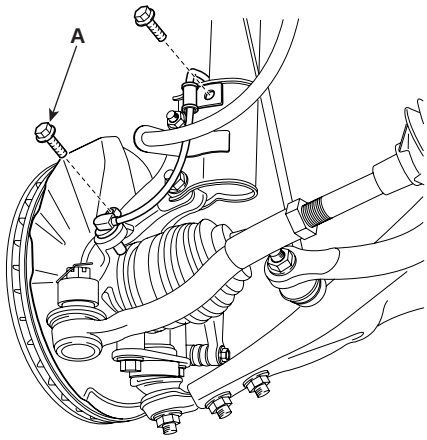


1. Front wheel speed sensor connector
2. Front wheel speed sensor

LJJF501L

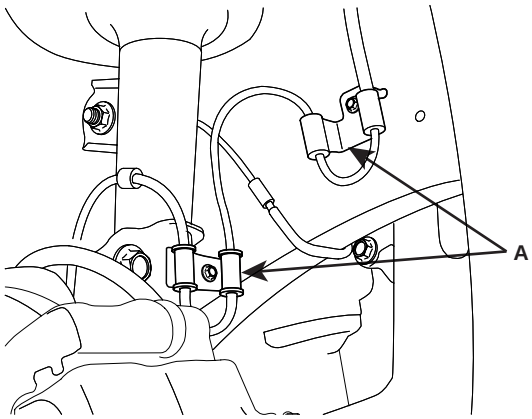
REMOVAL E26A6E4D

1. Remove the front wheel speed sensor mounting bolt(A).



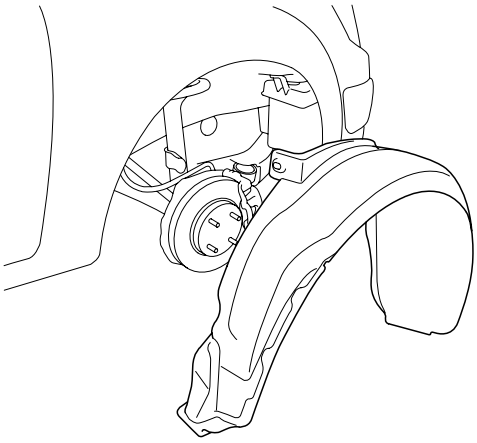
AJJF532A

2. Remove the front wheel speed sensor bracket(A).



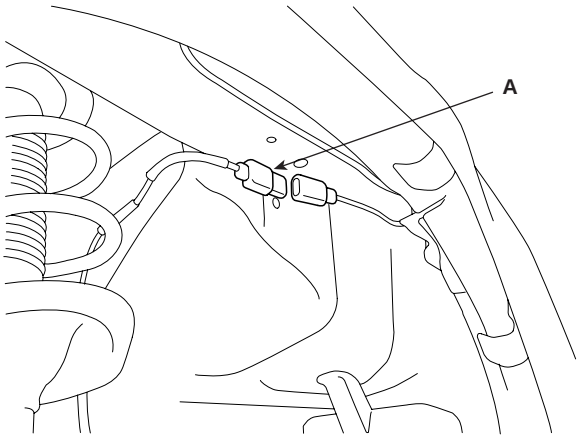
AJJF521A

3. Remove the front wheel guard .



AJJF522A

4. Disconnect the front wheel speed sensor connector (A) , then remove the front wheel speed sensor.



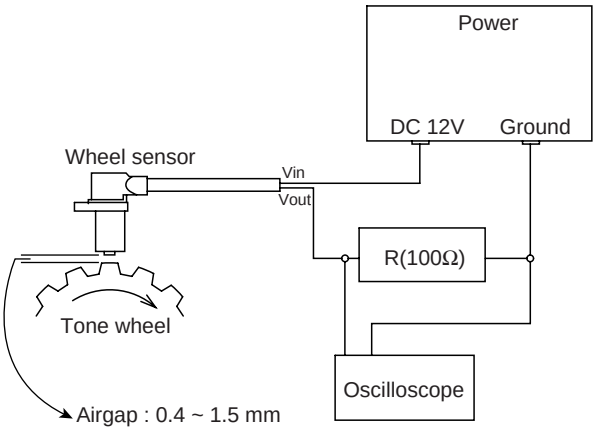
AJJF523A

INSPECTION EB1D3836

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

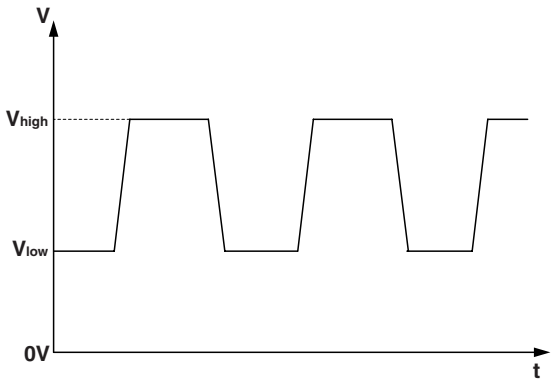
CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resister must be used as shown.



LJJF501M

2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

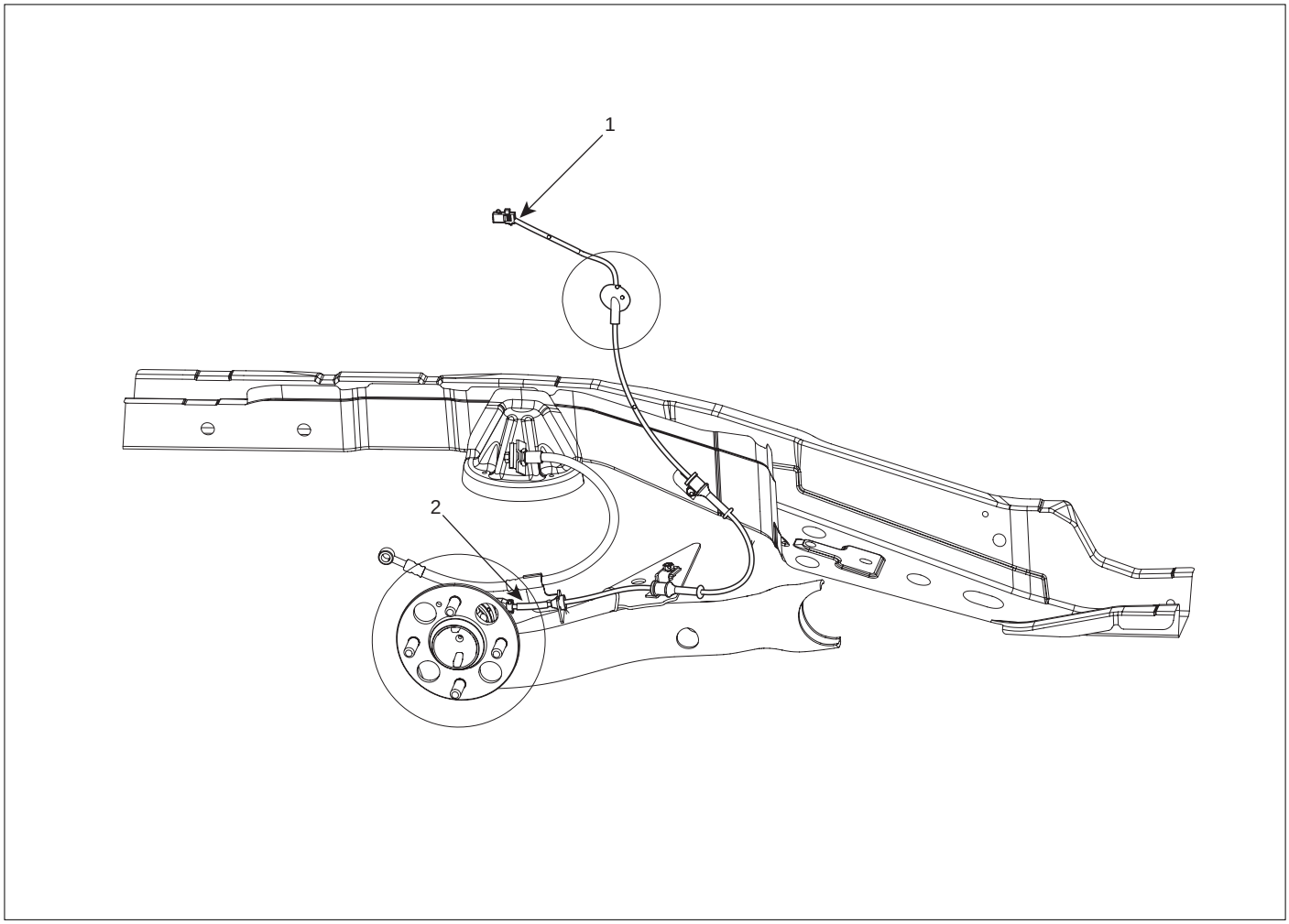


ARJE503Z

V_low : 0.59 V ~ 0.84 V
V_high : 1.18 V ~ 1.68 V
Frequency range : 1 ~ 2,500 Hz

REAR WHEEL SPEED SENSOR

COMPONENTS EA4ECF1C

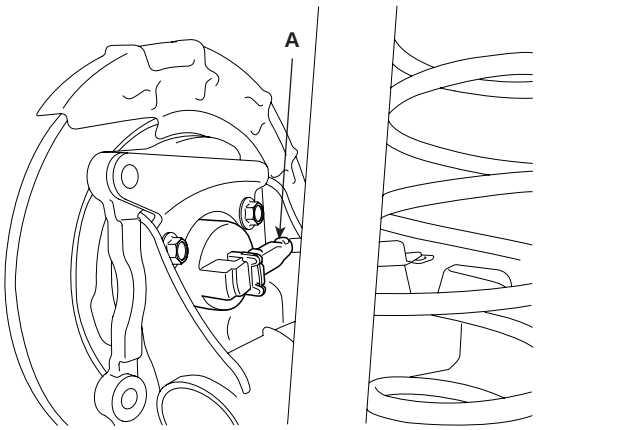


1. Rear wheel speed sensor connector
2. Rear wheel speed sensor

LJJF501N

REMOVAL E44D6BB4

1. Remove the rear wheel speed sensor connector (A).



AJJF524A

2. Remove the rear seat assembly.(Refer to BD-"rear seat")

3. Remove the rear wheel speed house trim and rear pillar trim.Disconnect the rear wheel speed sensor connector.

EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION)

EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION) OPERATION E1D47EAC

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization 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.

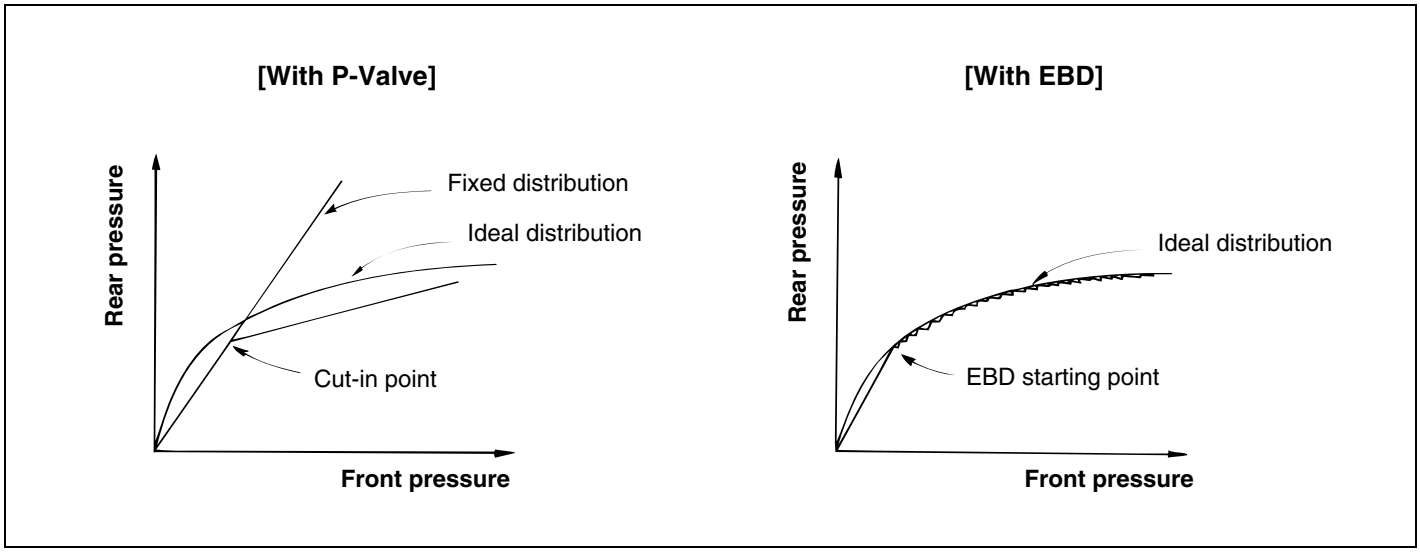
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

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



EJA0032A

ESP(ELECTRONIC STABILITY PROGRAM) SYSTEM

DESCRIPTION OF ESP E4383D92

Optimum driving safety now has a name : ESP, the Electronic Stability Program.

ESP is based on the MGH 25 ABS Hydraulic System. ESP 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.

ESP 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.

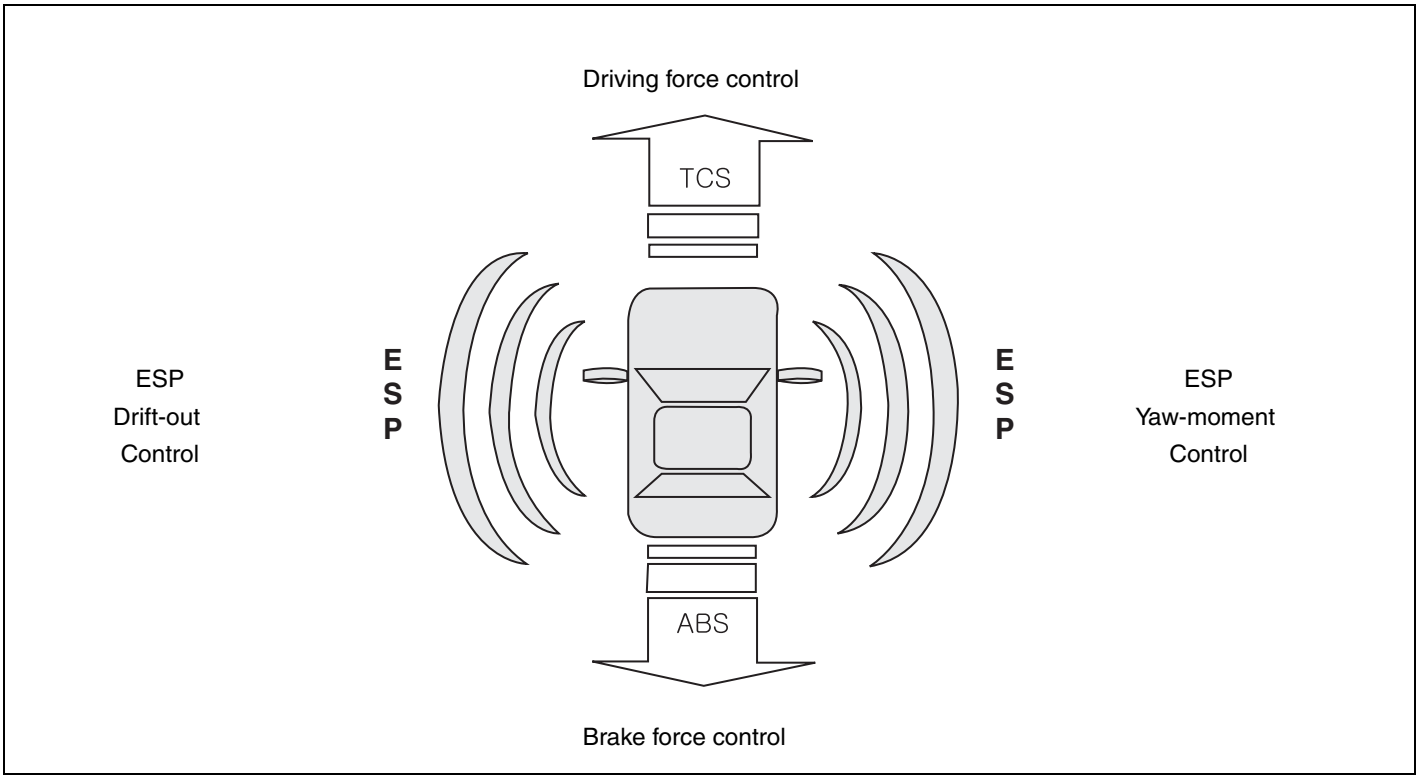
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.

ESP 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 25 system, but has been substantially expanded in terms of capacity and monitoring concept in order to permit the additional sensor signals and arithmetic operations 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 ESP 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.



LJCD201A

DESCRIPTION OF ESP CONTROL

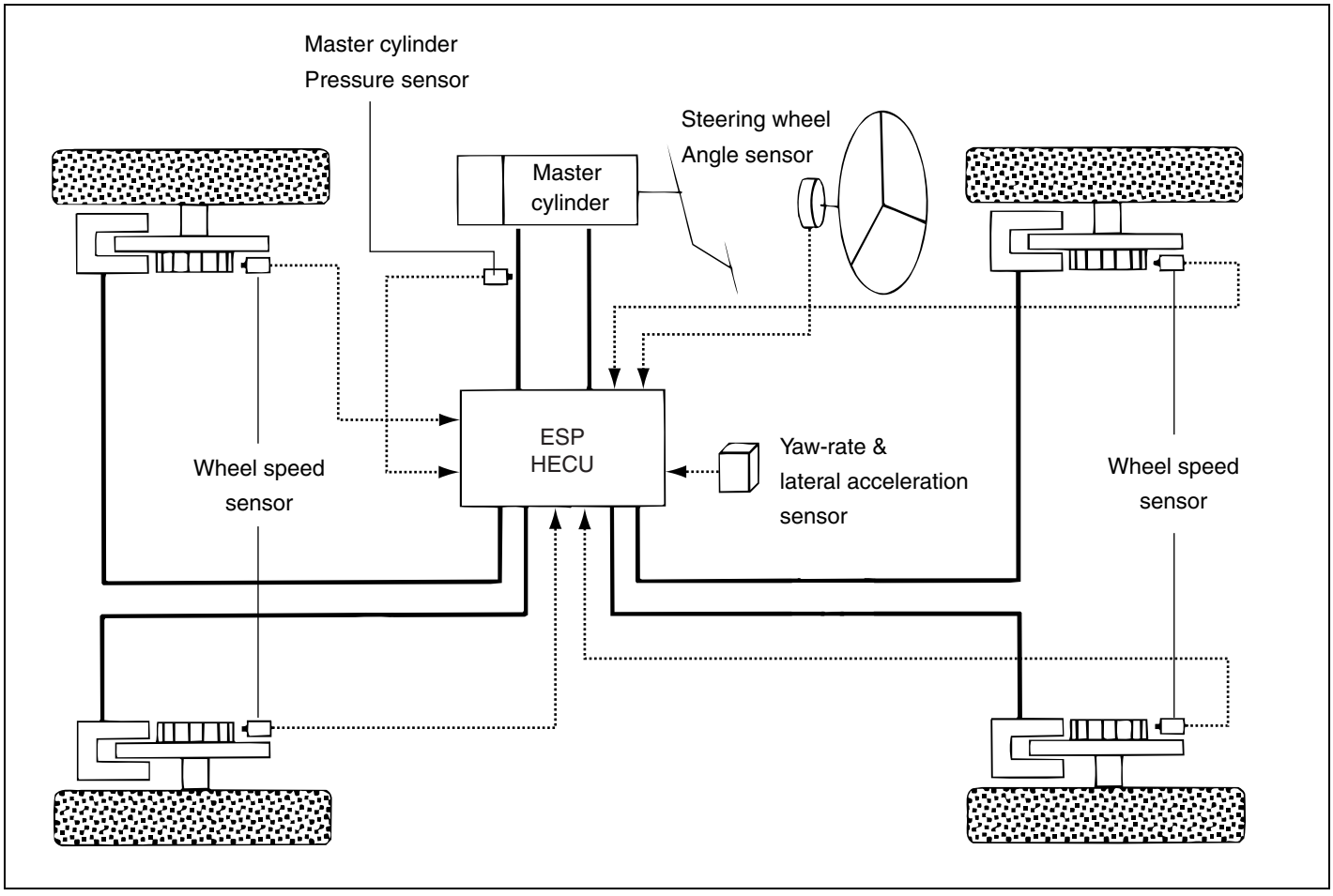
ESP system includes ABS/EBD, TCS and AYC function.

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 CANcommunication.TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.

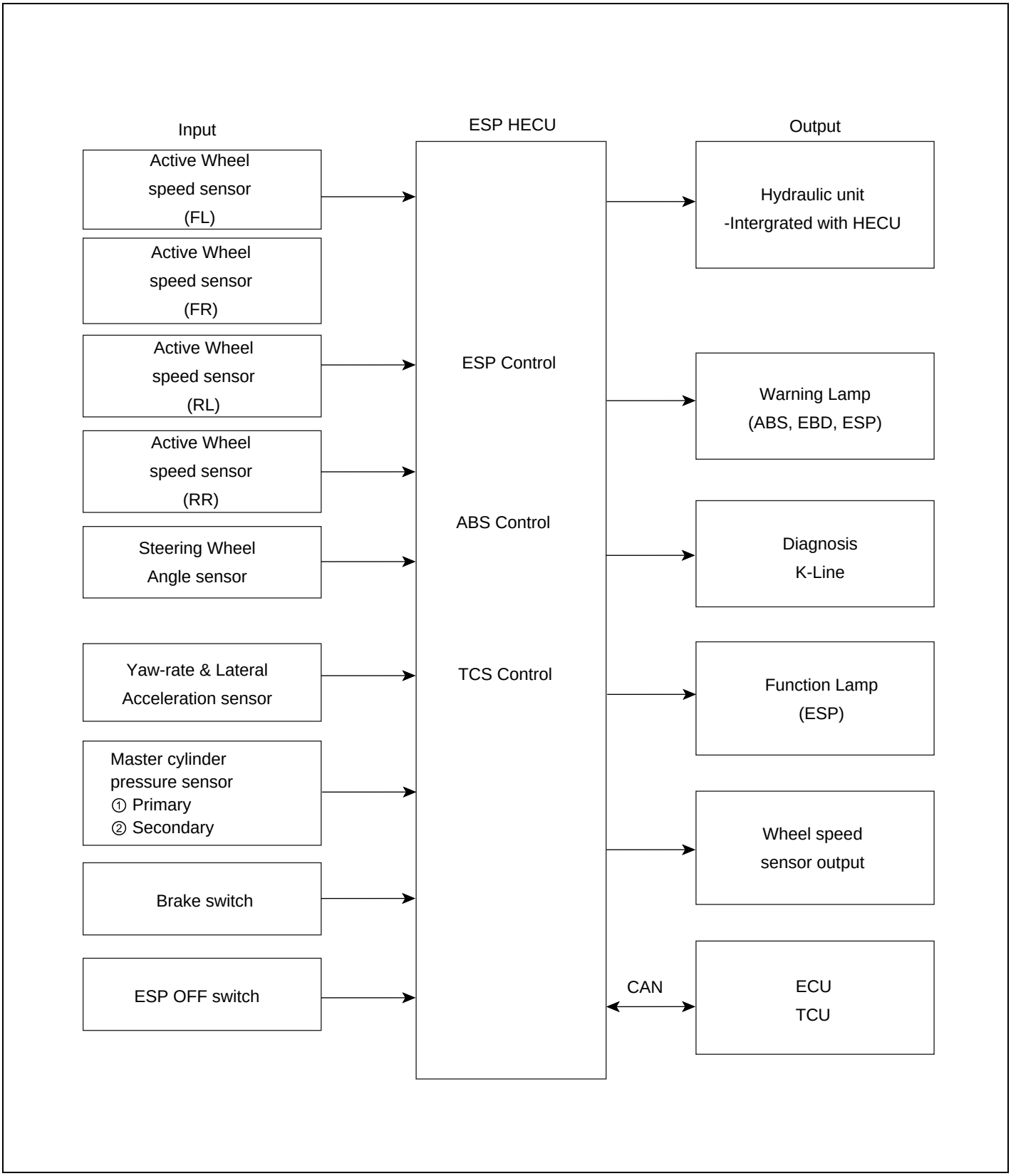
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake 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/ESP warning lamp. (fail-safe warning)



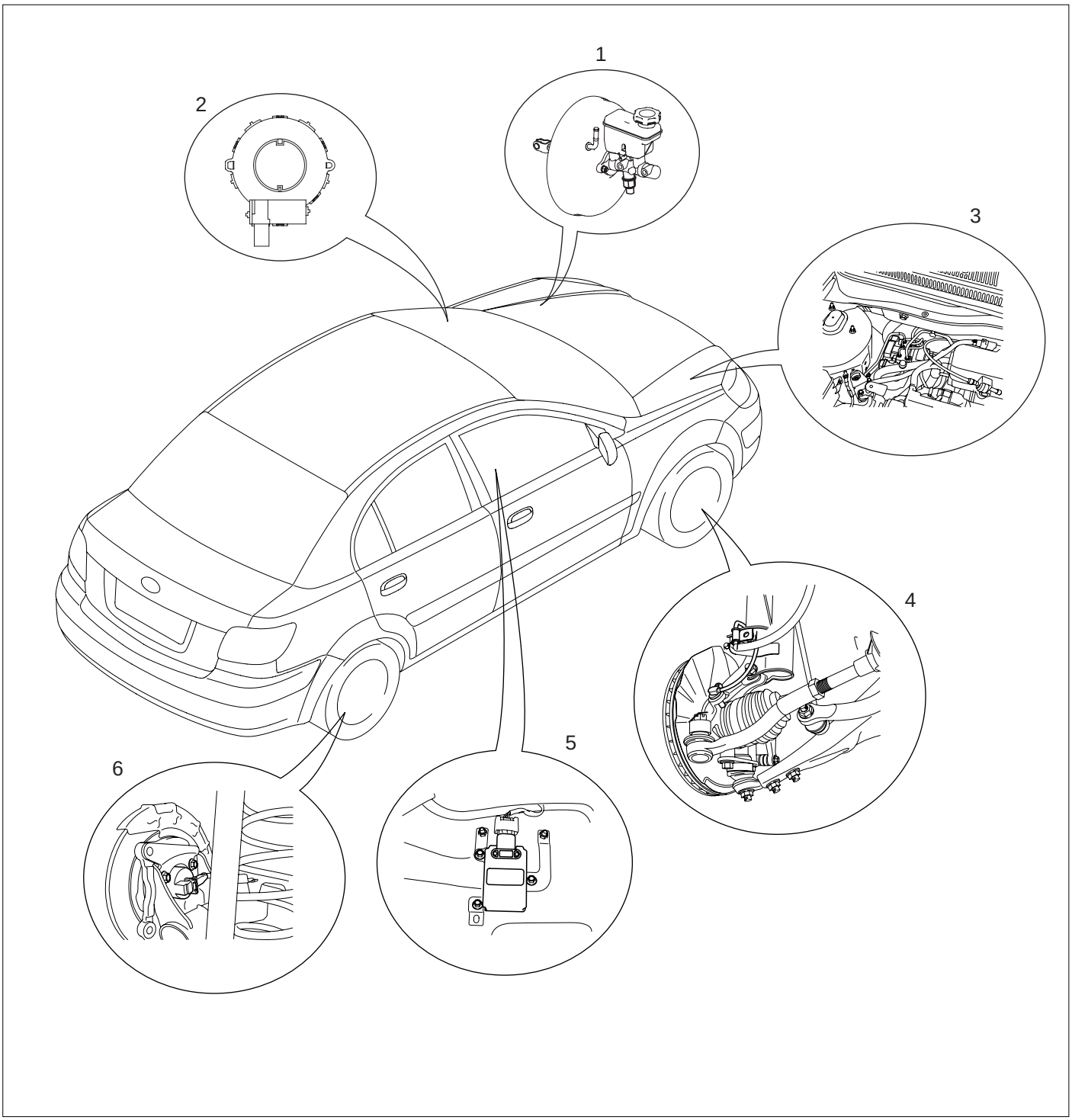
EJQE005M

INPUT AND OUTPUT DIAGRAM



LJJF501O

COMPONENTS EEC776A9

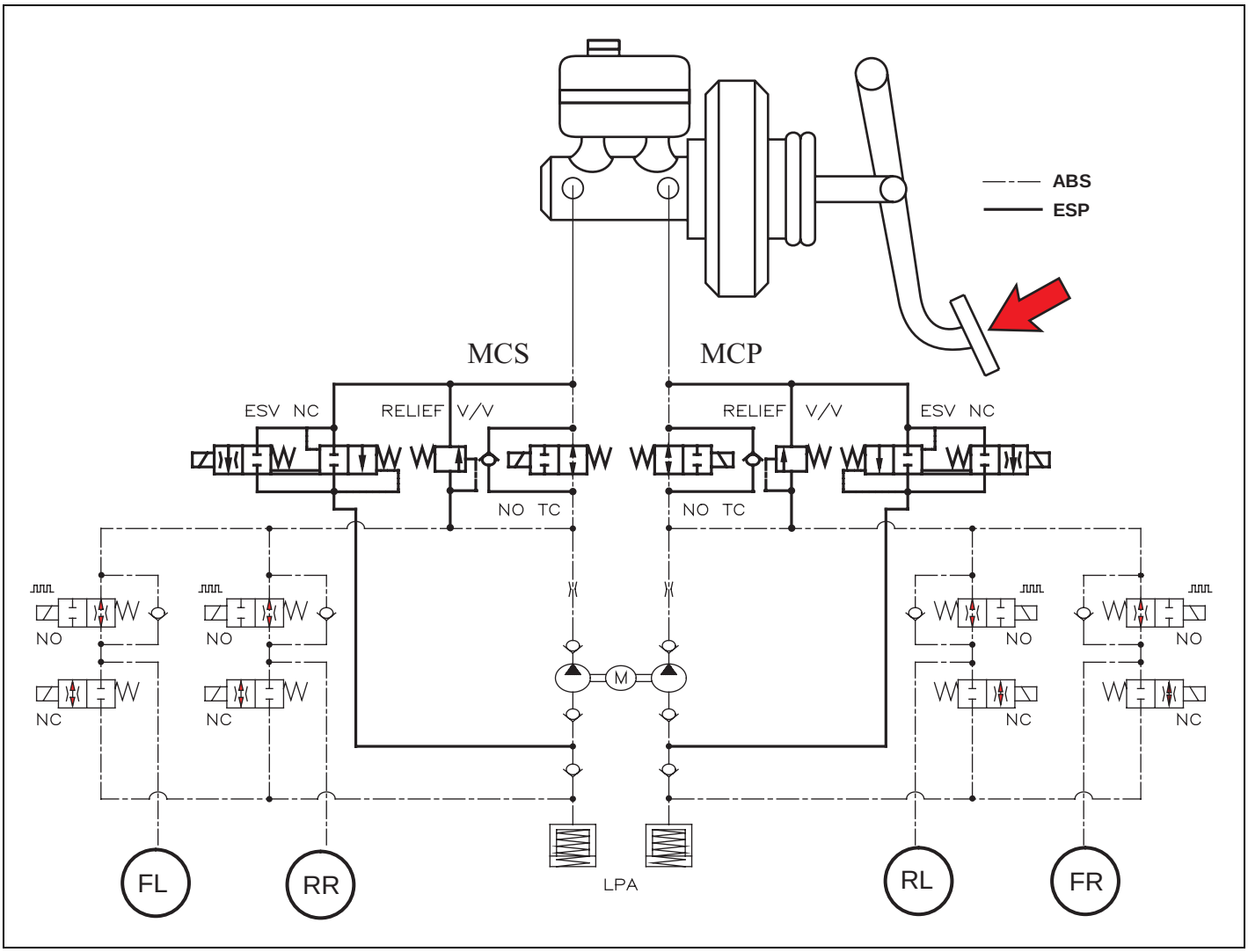


1. Pressure Sensor
2. Steering angle sensor
3. HECU module
4. Front wheel speed sensor
5. Yaw rate & Lateral G sensor
6. Rear Wheel Speed Sensor

LJJF502C

ESP OPERATION MODE E4255DB9

ESP HYDRAULIC SYSTEM DIAGRAM



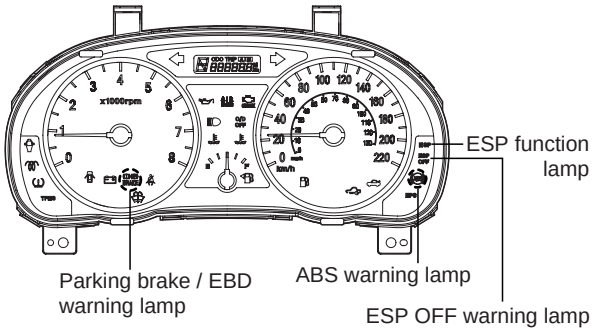
LJJF501P

1. ESP Non-operation : Normal braking.

Solenoid valve	Continuity	Valve	Motor pump	TC Valve
IN (NO)	OFF	OPEN	OFF	OFF
OUT (NC)	OFF	CLOSE		

2. ESP 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		



LJJF501Q

ABS WARNING LAMP MODULE

The active ABS warning lamp module 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 MODULE

The active EBD warning lamp module 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 shallbe 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.

ESP WARNING LAMP (ESP SYSTEM)

The ESP warning lamp indicates the self-test and failure status of the ESP.
The ESP 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 ESP functions by failure.
- When driver trun off the ESP function by on/off switch.
- During diagnostic mode.

ESP FUNCTION LAMP (ESP SYSTEM)

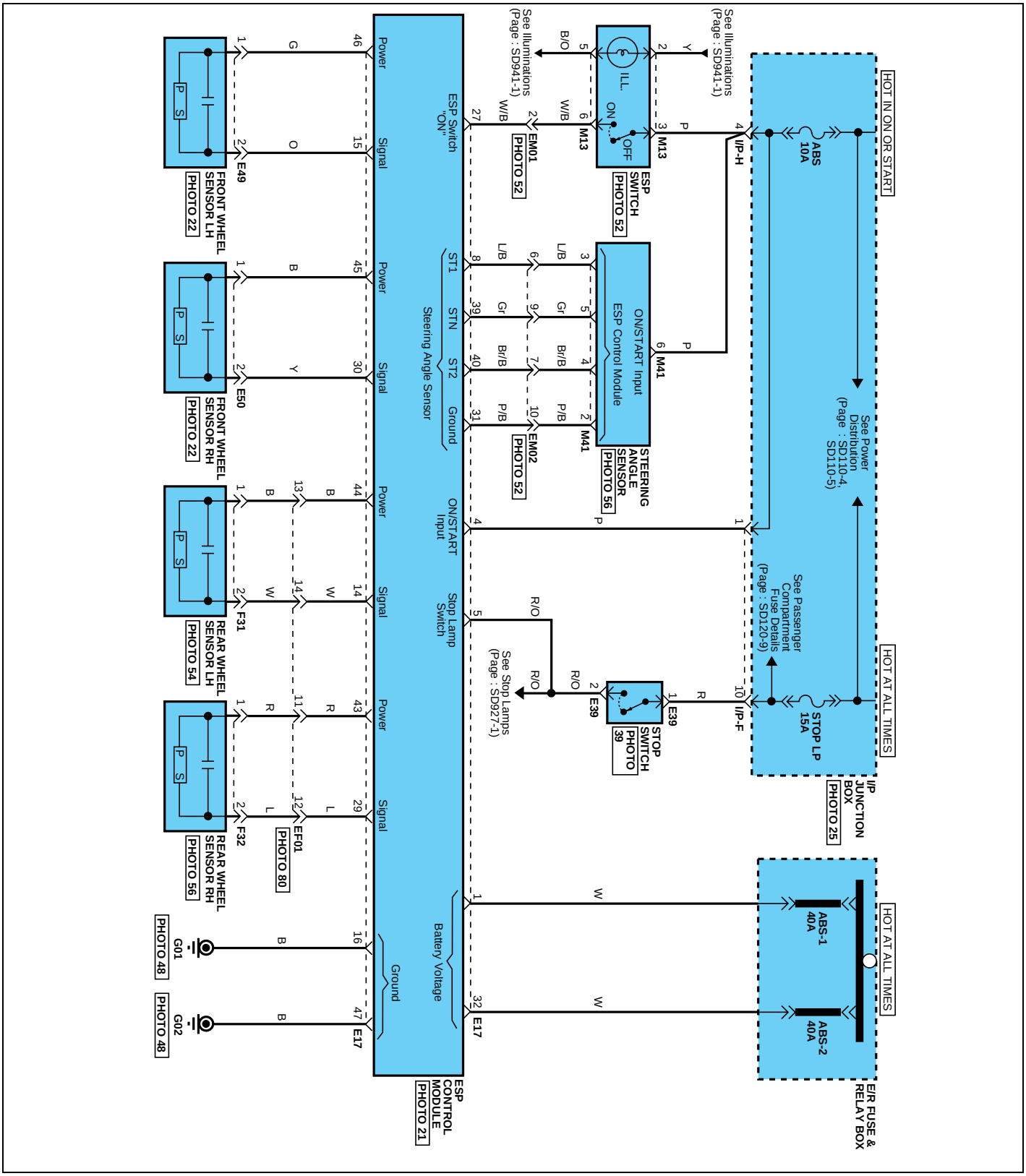
The ESP function lamp indicates the self-test and operating status of the ESP.
The ESP Function lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESP control is operating. (Blinking - 2Hz)

ESP ON/OFF SWITCH (ESP SYSTEM)

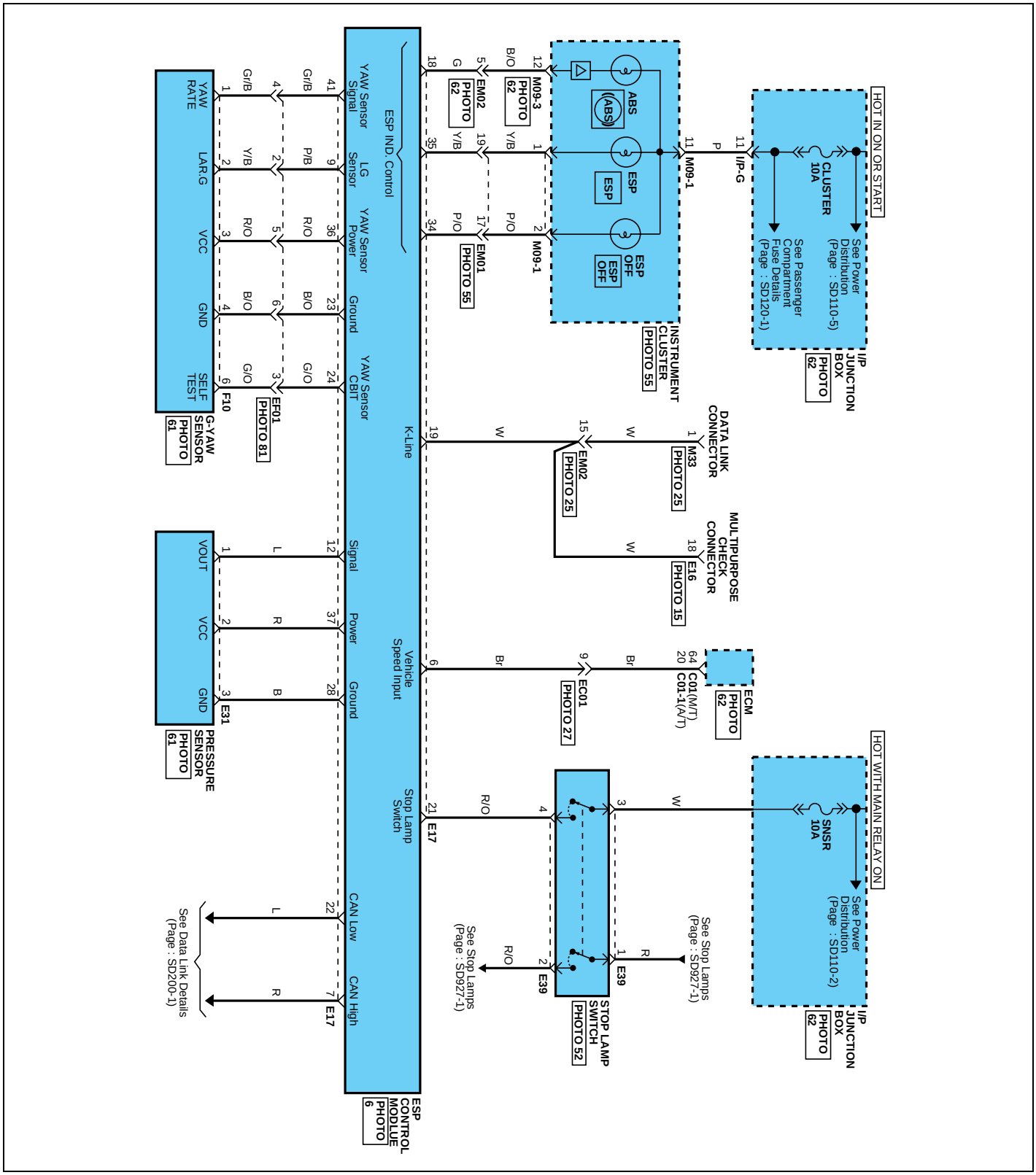
The ESP On/Off Switch shall be used to toggle the ESP function between On/Off states based upon driver input.
The On/Off switch shall be a normally open, momentary contact switch.Closed contacts switch the circuit to ignition.
Initial status of the ESP function is on and switch toggle the state.

CIRCUIT DIAGRAM - ESP(1) EC8B231B



LJJF501R

CIRCUIT DIAGRAM - ESP(2)



LJJF501S

ESP CONNECTOR INPUT/OUTPUT E7E349BA

Connector Terminal		Specification	Remark
No	Description		
4	IGNITION1(+)		
32	POS.BATTERY.(SOLENOID)	Max leakage current : I < 0.8 mA	
1	POS.BATTERY.(MOTOR)	Operating voltage range: 9.5 ± 0.5 V < V < 16.5 ± 0.5 V Rush current : I < 100 A Max current : I < 30 A Max leakage current : I < 0.2 mA	
16	GROUND	Rated current : I < 300 mA Max. current: I < 30 A	
47	PUMP MOTOR GROUND	Rush current : I < 100 A Max current : I < 30 A	
23	YAW & LATERAL G SENSOR GROUND	Rated current : I < 65 mA	
28	MASTER PRESSURE SENSOR GROUND	Rated current : I < 10 mA	
31	STEERING ANGLE SENSOR GROUND	Rated current : I < 100 mA	
37	MASTER PRESSURE SENSOR POWER	Max Output current : I < 10 mA Max Output voltage : 4.9 V ≤ V ≤ 5.1 V	
36	YAW SENSOR POWER	Max Output current : I < 65mA Max Output voltage : 4.9V ≤ V ≤ 5.1V	
5	BRAKE LIGHT SWITCH	Input voltage low: 0 V ≤ V ≤ 3.0 V Input voltage High: 7.0 V ≤ V ≤ 16.0 V	
21	BRAKE SWITCH		
6	SENSOR FRONT RIGHT OUTPUT	Max current : I < 2 mA External pull up resistance :10 KΩ < R Output duty :50 ± 20 %	
18	ABS/EBD W/LAMP DRIVE	Max. current: I < 200 mA Max. output low voltage: V < 1.2 V	
34	ESP W/LAMP DRIVE		
35	ESP F/LAMP DRIVE		
27	ESP ON/OFF SWITCH	Input voltage low:0 V ≤ V ≤ 3.0 V Input voltage High: 7.0 V ≤ V ≤ 16.0 V Max input current:I < 10 mA	
22	CAN BUS LINE(LOW)	Max. current : I < 10 mA	
7	CAN BUS LINE(HIGH)		
46	SENSOR FRONT LEFT POWER	Output voltage : IGN (V) ± 1 V Output current : Max 30 mA	
45	SENSOR FRONT RIGHT POWER		
44	SENSOR REAR LEFT POWER		
43	SENSOR REAR RIGHT POWER		

Connector Terminal		Specification	Remark
No	Description		
15	SENSOR FRONT LEFT SIGNAL	Input current LOW : 5.9 ~ 8.4 ㎃ Input current HIGH :11.8 ~ 16.8 ㎃ Frequency range :1 ~ 2000 Hz Input duty : 50 ± 20 %	
30	SENSOR FRONT RIGHT SIGNAL		
14	SENSOR REAR LEFT SIGNAL		
29	SENSOR REAR RIGHT SIGNAL		
8	STEERING ANGLE SENSOR PHASE 1	Input duty (ST1, ST2): 50 ± 10 Phase difference (ST1, ST2): 2 ± 0.6 deg High voltage: 3.0 V < V < 4.1 V Low voltage: 1.3 V < V < 2.0 V	
40	STEERING ANGLE SENSOR PHASE 2		
39	STEERING ANGLE SENSOR PHASE N		
12	MASTER PRESSURE SENSOR SIGNAL	Sensor Input Voltage : 0 V ≤ V ≤ 5.0 V Zero offset Voltage : 0.5 V ± 0.15 V Input current :Max 2 mA	
9	LATERAL G SENSOR SIGNAL	Sensor Input Voltage :0 V ≤ V ≤ 5.0 V Zero offset Voltage : 2.5 ± 0.1 V	
41	YAW SENSOR SIGNAL	Sensor Input Voltage :0 V ≤ V ≤ 5.0 V Zero offset Voltage : 2.5 ±0.1 V	
19	DIAGNOSIS INPUT/OUTPUT	Input voltage IL(V) < 0.3 IGN (V) IH(V) > 0.7 IGN (V) Output voltage OL(V) < 0.2 IGN (V) OH(V) > 0.8 IGN (V)	

FAILURE DIAGNOSIS EC4A44FB

1. In principle, ESP and TCS controls are prohibited in case of ABS failure.
2. When ESP or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESP failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESP 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.
4. Initial checkup is made in the following cases.
   1) When the failure is not detected now
   2) When ABS and ESP are not in control.
   3) Initial checkup is not made after ECU power on.
   4) If the vehicle speed is over 5 mph(8 km/h) when the brake lamp switch is off.
   5) When the vehicle speed is over 24.8 mph(40 km/h).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESP control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
   1) When the power is normal.
   2) From the point in which the vehicle speed reaches 4.9 mph(8 km/h) after HECU power 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

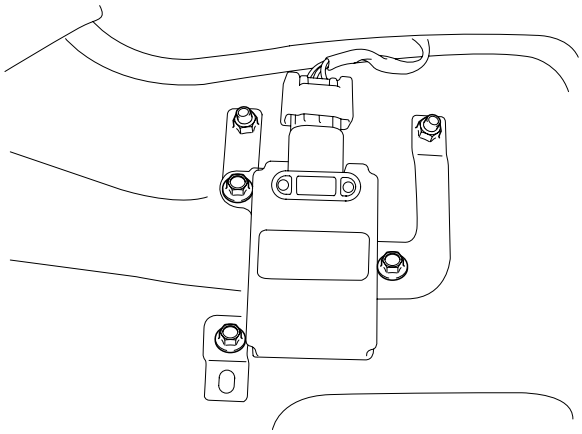
1. ABS warning lamp turns on when ABS is fail.
2. ESP operation lamp turns on and ESP OFF warning lamp blinks when ESP is fail.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

YAW-RATE SENSOR AND G-SENSOR

DESCRIPTION E73B8D8C

1. The yaw-rate & lateral G sensor is applied for the ESP system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the front passenger seat lower floor on vehicle.

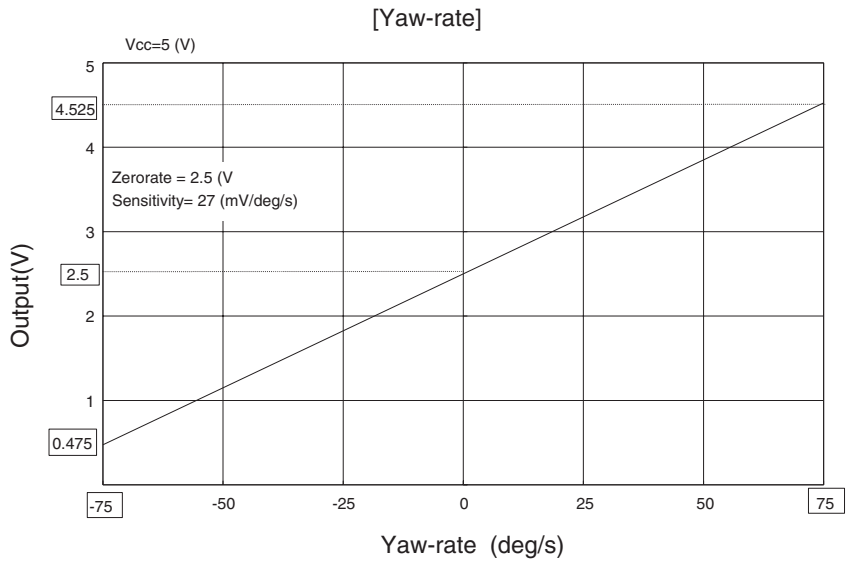


AJJF520A

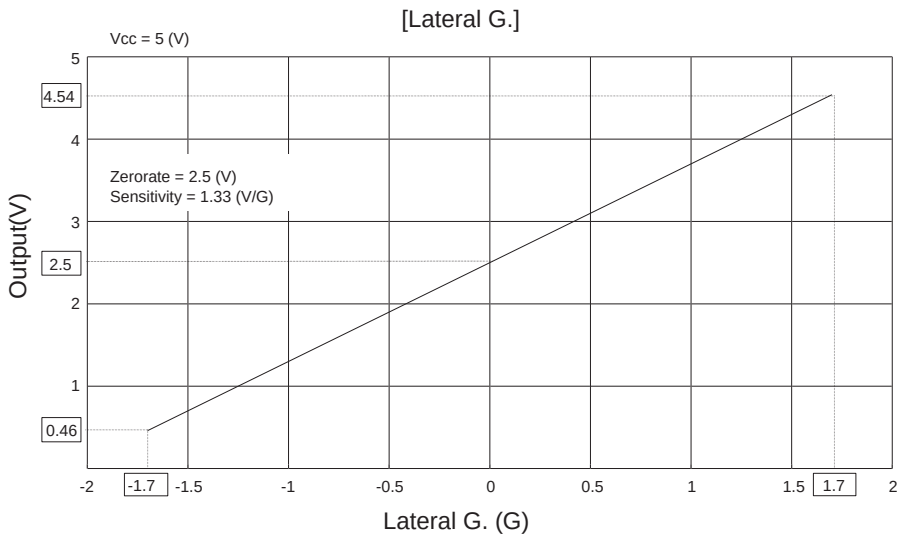
SPECIFICATIONS

Description		Specification	Remarks
Operating voltage		4.75 ~ 5.25 V	
Current consumption		Max. 65 mA	
Output voltage range		0.5 ~ 4.5 V	
Operating temperature		-40 ~ 85 °C	
Yaw-rate sensor	Measurement range	-75 ~ 75 °/sec	
	Output voltage range	0.5 ~ 4.5 V	
	Sensitivity	26.67 mV (°/sec.)	
	Zero rate output	2.5 V	
	Frequency response	10 Hz	
Lateral G sensor	Measurement range	-1.5 ~ 1.5 g	
	Output voltage range	0.5 ~ 4.5 V	
	Sensitivity	1.33 V/g	
	Zero rate output	2.5 V	
	Frequency response	50 Hz	

OUTPUT CHARACTERISTIC

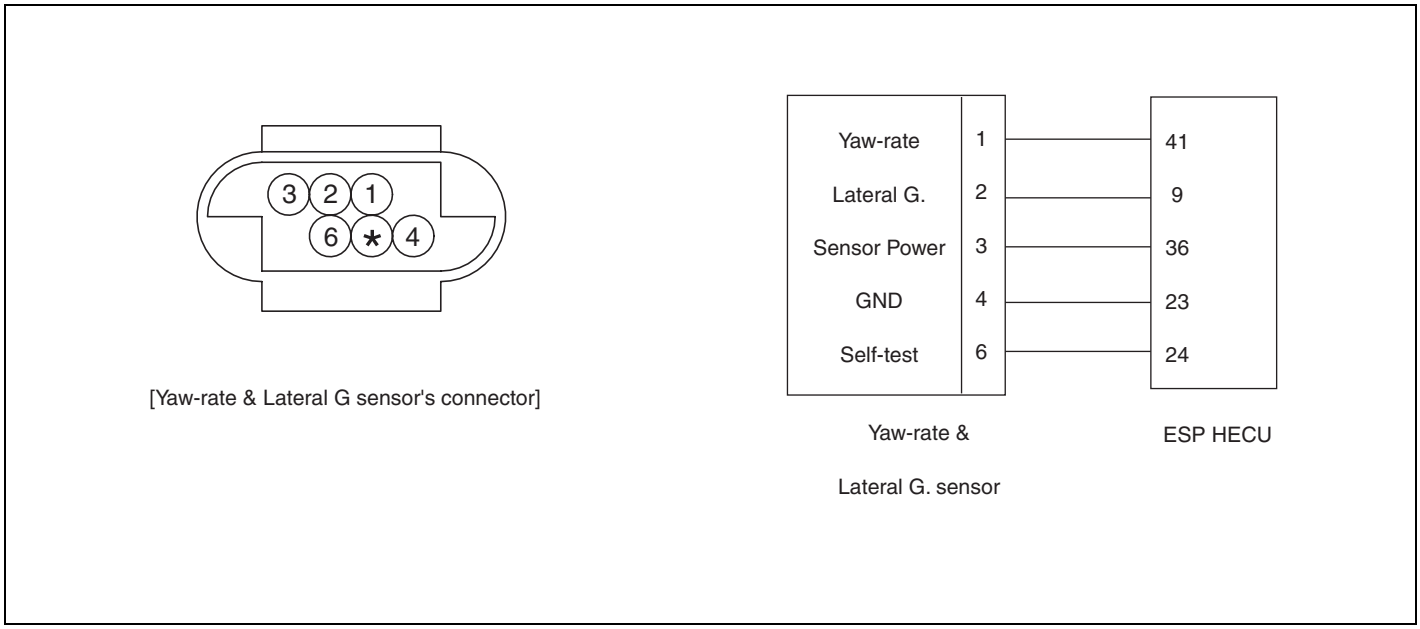


EJQE206A



LJJF502D

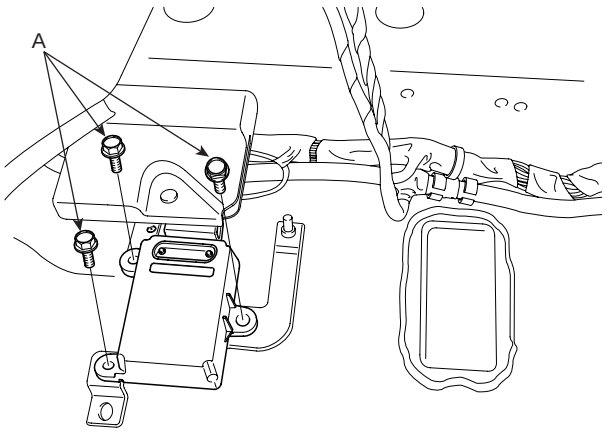
EXTERNAL DIAGRAM



LJIF502C

REPLACEMENT E73B8D9C

1. Remove the passenger seat. (refer to BD- "seat")
2. Remove the floor console. (refer to BD- "console")
3. Remove the center pillar upper trim.(refer to BD-"interior trim")
4. Remove the front , rear lower scuff trim(refer to BD-"interior trim")
5. Clerar away the floor mat.
6. Disconnect the yaw rate & lateral G sensor connector.
7. Remove the mounting bolts(A).

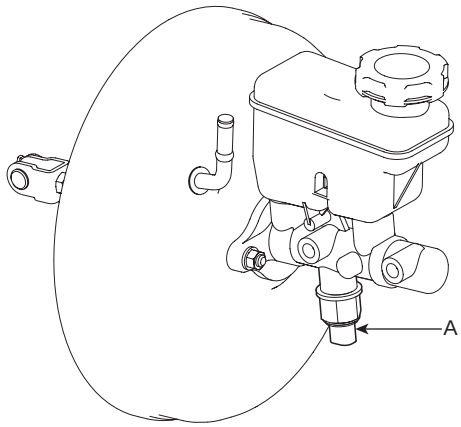


LJJF538K

MASTER CYLINDER PRESSURE SENSOR

DESCRIPTION EE2AC6B4

The pressure sensor(A) is connected to the master cylinder, when ESP is on operation, detecting the brake pressure in order to sense the user's will to brake a vehicle.The pressure sensor(A) consists of two ceramic discs, one is fixed and the other movable, so that changes the distance of the two discs.(Max. measurable pressure is 200bar.)

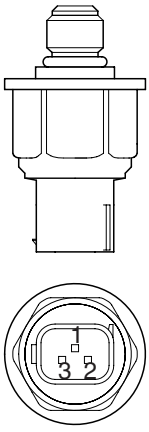


LJJF501T

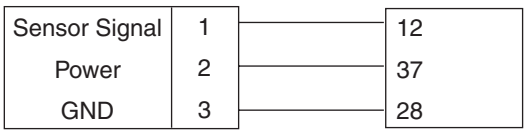
SPECIFICATIONS

Item	Specification	Remark
Supply voltage	4.75 V ~ 5.25 V	
Supply current	less than 15 mA	
Operating temperature	-40 °C ~ 125 °C	
Measurement pressure range	0 ~ 200 bar	
Max. pressure limit	350 bar	
Zero rate output	0.5 V	
Output range	0.5 ~ 4.4 V	

CIRCUIT DIAGRAM



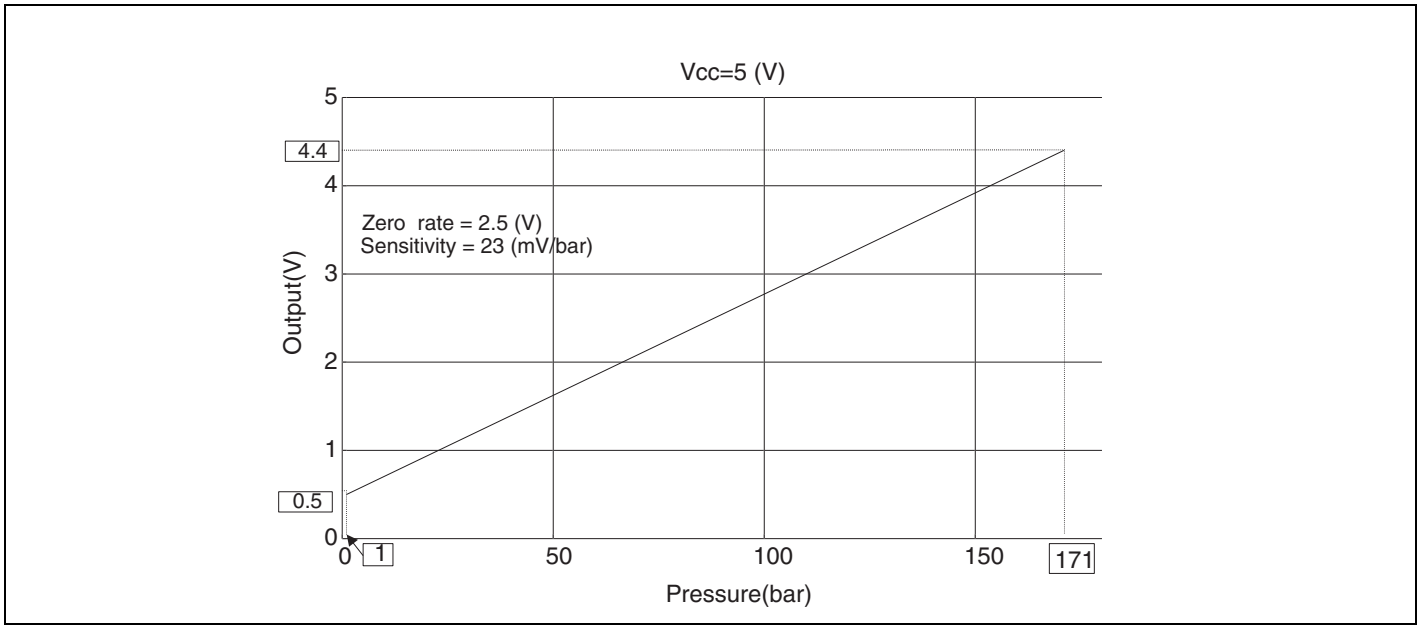
[Pressure sensor's connector]



[Pressure sensor] [ESP HECU]

LJIF502D

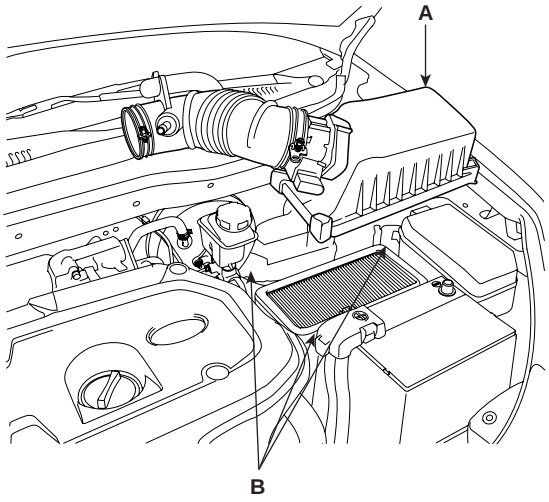
OUTPUT CHARACTERISTIC



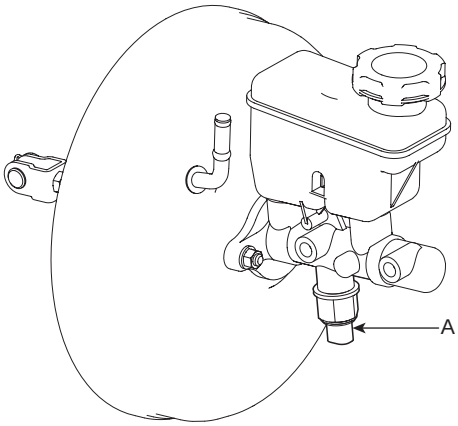
EJQE206C

REPLACEMENT E74B8D8C

1. Remove air cleaner mounting bolts (B) from the air cleaner mounting bracket and air cleaner body(A).



AJJF509A



LJJF501T

2. Disconnect the pressure sensor(A).

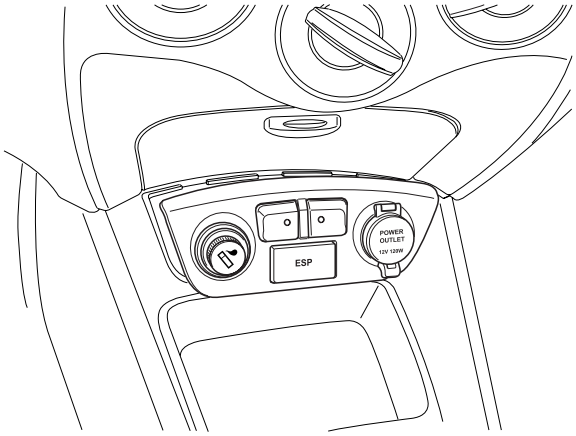
ESP SWITCH

DESCRIPTION E3CFAAC7

1. The ESP OFF switch is for the user to turn off the ESP system.
2. The ESP OFF lamp is on when ESP OFF switch is engaged.

INSPECTION E9929FC0

1. Remove the ESP OFF switch from the switch panel on the center cover of the floor console assembly.



LJJF501U

2. Check the continuity between the switch terminals as the ESP OFF switch is engaged.

Terminal / Function	2	5	6	3
ON	○	○	○	○
OFF				

LJJF504B

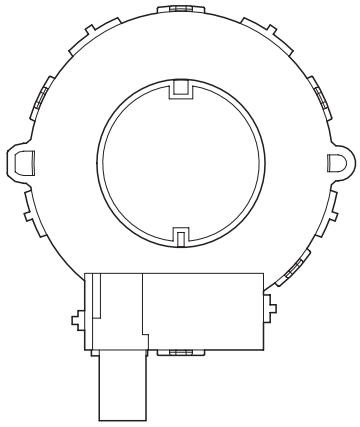
STEERING WHEEL ANGLE SPEED SENSOR

DESCRIPTION E7AAC47B

The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.The sensor is detached on the MPS(Mutil-Function Switch) under the steering wheel.

MEASUREING PRINCIPLE

The split of the steering angle sensor detects a steering angle of the steering wheel by a ON/OFF pulse caused by whether or not the LED lights go through the hole of the split, rotating as the steering wheel revolves. There are three LEDs, two(ST1, ST2) for detecting a steering direction, and the other for the neutral position.The HECU calculates the steering angle by the pulse from the steering angle sensor.

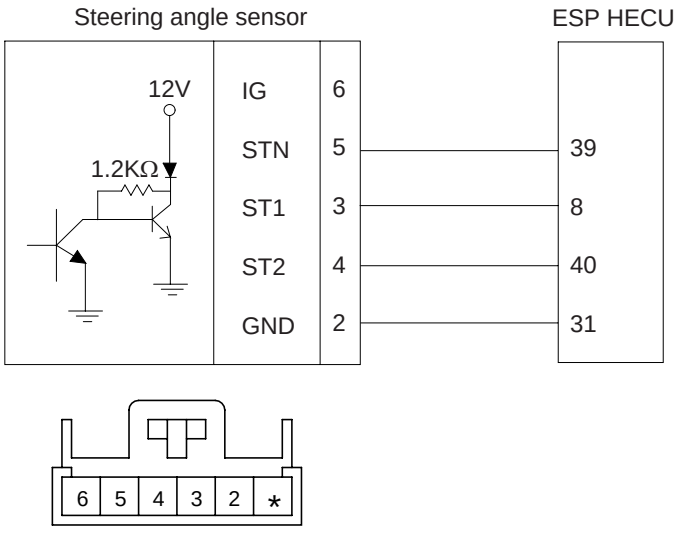


LJJF501V

SPECIFICATION

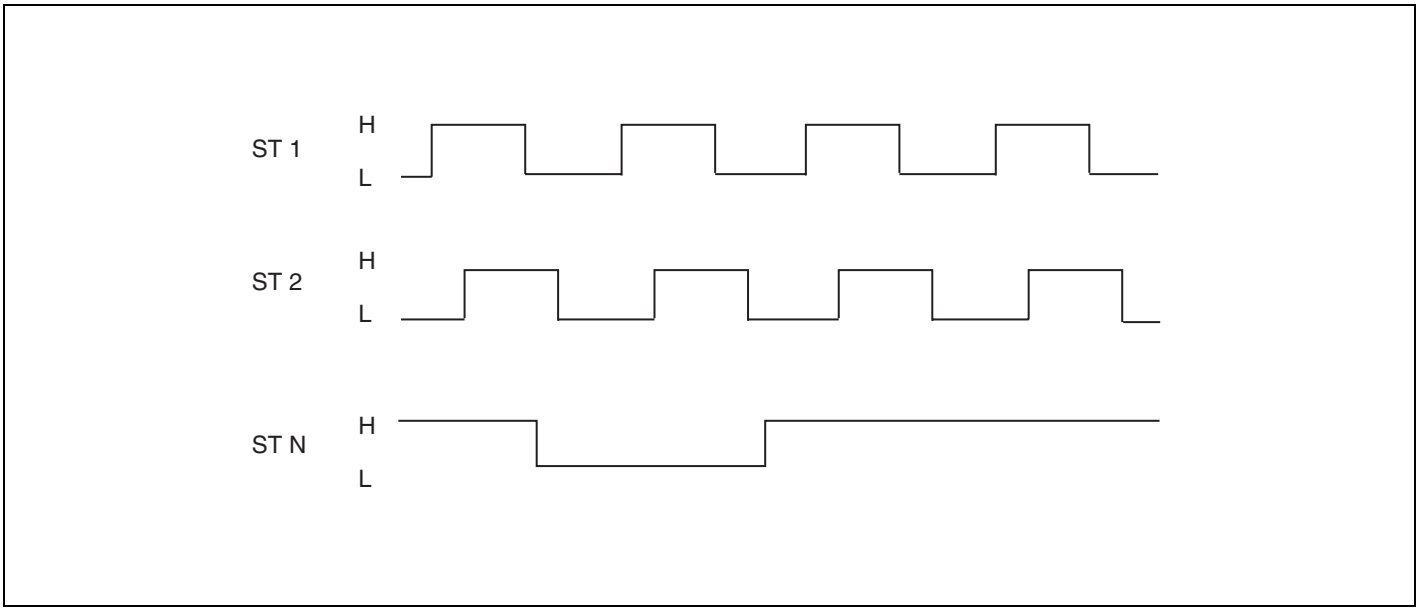
Description	Specification
Operating voltage	9 ~ 16 V
Operating temperature	-30 ~ 75 ℃
Current consumption	Max.100 mA
Steering angle velocity	Max. ± 1500 °/sec
Voltage(high)	3.0 V ~ 4.1 V
Voltage(low)	1.3 V ~ 2.0 V
Pulse duty	40 ~ 60 %

CIRCUIT DIAGRAM(STEERING WHEEL SPEED ANGLE SENSOR)



LJJF504C

OUTPUT CHARACTERISTIC

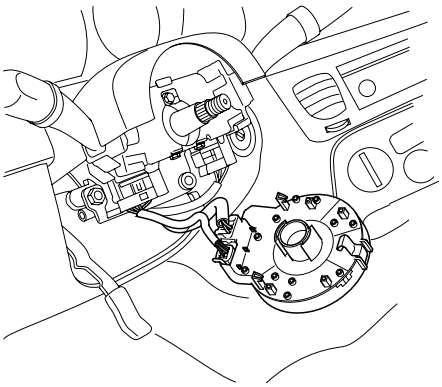


ARCD204A

No.	INPUT		OUTPUT	Steering direction	Remark
1	ST1	L	L	Right	
	ST2	L	H		
	ST1	L	H	Left	
	ST2	L	L		
2	ST1	L	L	Left	
	ST1	H	L		
	ST1	L	H	Right	
	ST2	H	H		
3	ST1	H	H	Left	
	ST2	L	H		
	ST1	H	L	Right	
	ST2	L	L		
4	ST1	H	H	Right	
	ST2	H	L		
	ST1	H	L	Left	
	ST2	H	H		

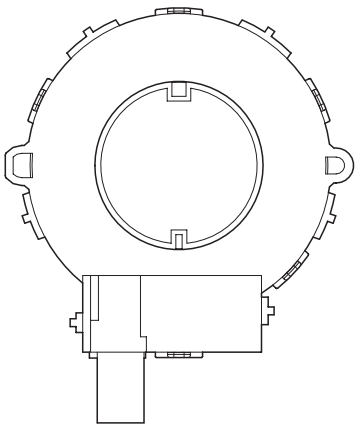
REPLACEMENT E75B8D8C

1. Remove the driver airbag.(Refer to RT group)
2. Remove the steering wheel and steering wheel column cover(Refer to ST group).
3. Disconnect the clock spring and horn connector, then remove the clock spring.



ARJF102F

4. Remove the steering angle sensor from the clock spring.



LJJF501V

Body (Interior and Exterior)

GENERAL

EXTERIOR
- FENDER
- HOOD
- TRUNK LID
- FRONT DOOR
- REAR DOOR
- BODY SIDE MOLDINGS
- SUN ROOF
- MIRROR

INTERIOR
- CONSOLE
- CRASH PAD
- INTERIOR TRIM
- WINDSHIELD GLASS

BUMPER
- FRONT BUMPER
- REAR BUMPER

SEAT
- FRONT SEAT
- REAR SEAT
- SEAT BELT

GENERAL

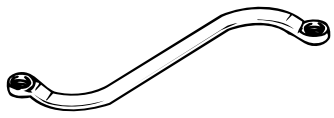
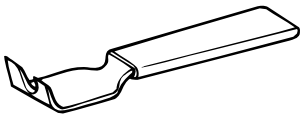
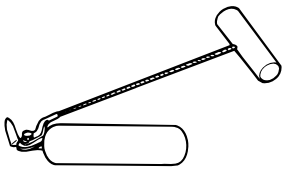
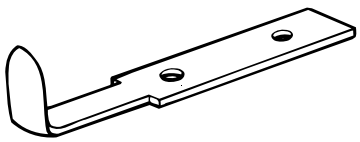
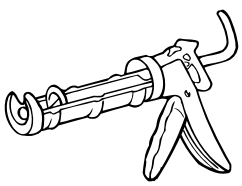
SPECIFICATIONS EE6B329A

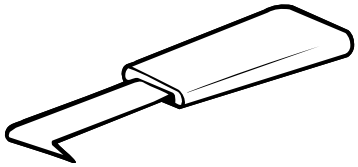
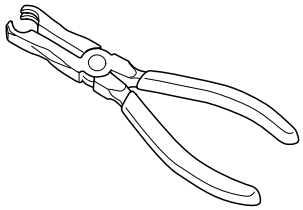
HOOD • Type	 Rear hinged, gas lifter type
FRONT DOOR • Construction • Regulator system • Locking system	 Front hinged, full door construction Wire drum type Pin-fork system
REAR DOOR • Construction • Regulator system • Locking system	 Front hinged, full door construction Wire drum type Pin-fork system
TRUNK LID • Type	 Inner hinged, gas lifter type
GLASS THICKNESS • Windshield glass • Front door glass • Rear door glass • Rear window glass	Laminated clear, tinted 5mm 3.2mm 3.2mm 3.2mm
SEAT BELTS • Front • Rear	 3 point type with Emergency Locking Retractor (E.L.R) 3 point type with Emergency Locking Retractor (E.L.R) 2 point type

TIGHTENING TORQUE ED3ECE77

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

SPECIAL TOOLS EF65AFAB

Tool (Number and name)	Illustration	Use
09793-2100 Door hinge adjusting wrench	 KSRE010A	Adjustment, removal and installationOf the door hinge
09800-21000 Ornament remover	 KSRE010B	Trim removal
09853-31000 Headliner clip remover	 KSRE010C	Removal of the headliner clips
09861-31100 Sealant cut-out tool	 KSRE010D	Cutting the sealant of the windshield (Use with 09861-31200)
09861-31200 Sealant cutting blade	 KSRE010E	Cutting the sealant of the windshield (Use with 09861-31100)
09861-31300 Sealant gun	 KSRE010F	Application of the sealant to the windshield

09681-31400 Glass holder	 KSRE010G	Removal and installation of the windshield
09681-31000 Windshield moulding remover	 KSRE010H	Removal of the windshield moulding
09880-4F000 Hogring clip installer	 KSRE010I	Installation of the hogring clip

TROUBLESHOOTING EC5DCCD6

Symptom	Suspect Area	Remedy
Water leaks from sunroof	Dirt accumulated in drain tube	Clear dirt inside of drain
	Clogged drain tube	Blow air into drain to remove dirt
	Broken or dislocated drain tube, defectiveOr 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
Sunroof lid makes a noise when move	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	Check drive cable and guide Rails for foreign particles
	Incorrect engagement of motor pinion With drive cable	Check for loose motor installation And damaged pinion
	Decrease in motor‘s clutch slipping force	Adjust
	Increased sunroof sliding resistance Or interference of sunroof with drive Cables, weatherstrip, etc. due to Maladjustment of sunroof	Adjust or replace
Noise in motor clutch slipping Noise from motor when sunroof Is 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

EXTERIOR

FENDER

REPLACEMENT E3CC637F

NOTE

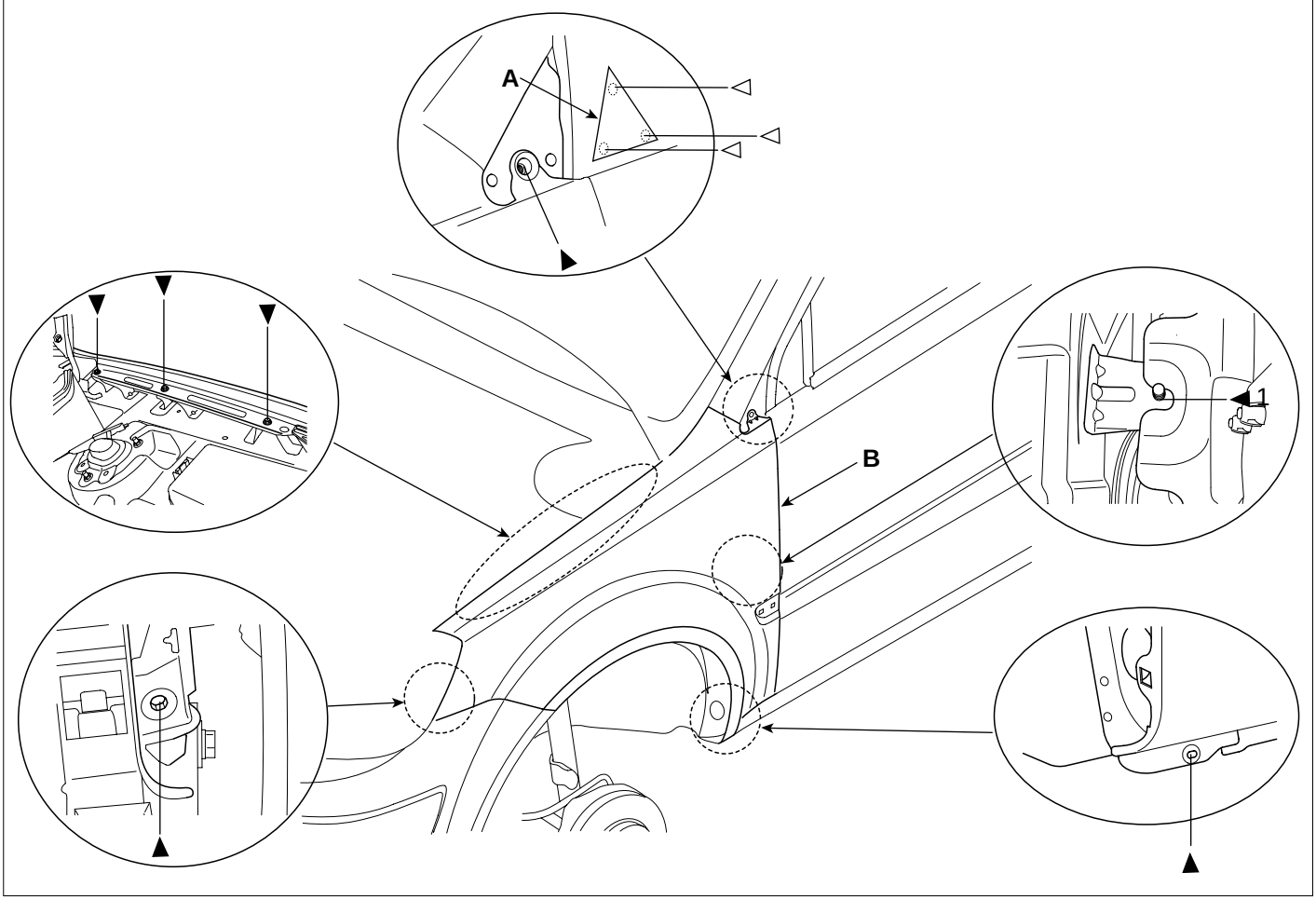
- *When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.*
- *Put on gloves to protect your hands.*
- *Take care not to scratch the body surface.*
- *Put on gloves to protect your hands.*
- *Take care not to scratch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

1. Remove the wheel guard and mud guard(See page BD- 38).
2. Remove the headlamp assemble.
3. Remove the quadrant inner cover(A).
4. After loose the mounting bolts, remove the fander(B).
5. Installation is the reverse of removal.

Fastener Locations

[LHD type is shown, RHD type is similar]

► : Bolt, 5 | ▷ : Clip, 3 | 1► : Nut, 1



BSJE040A

HOOD

REPLACEMENT EBBD4740

HOOD ASSEMBLY REPLACEMENT

NOTE

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

1. Disconnect the windshield washer nozzle connecting tube.
2. After loose the hood hinge (A) mounting bolts, remove the hood (B).
3. Installation is the reverse of removal.

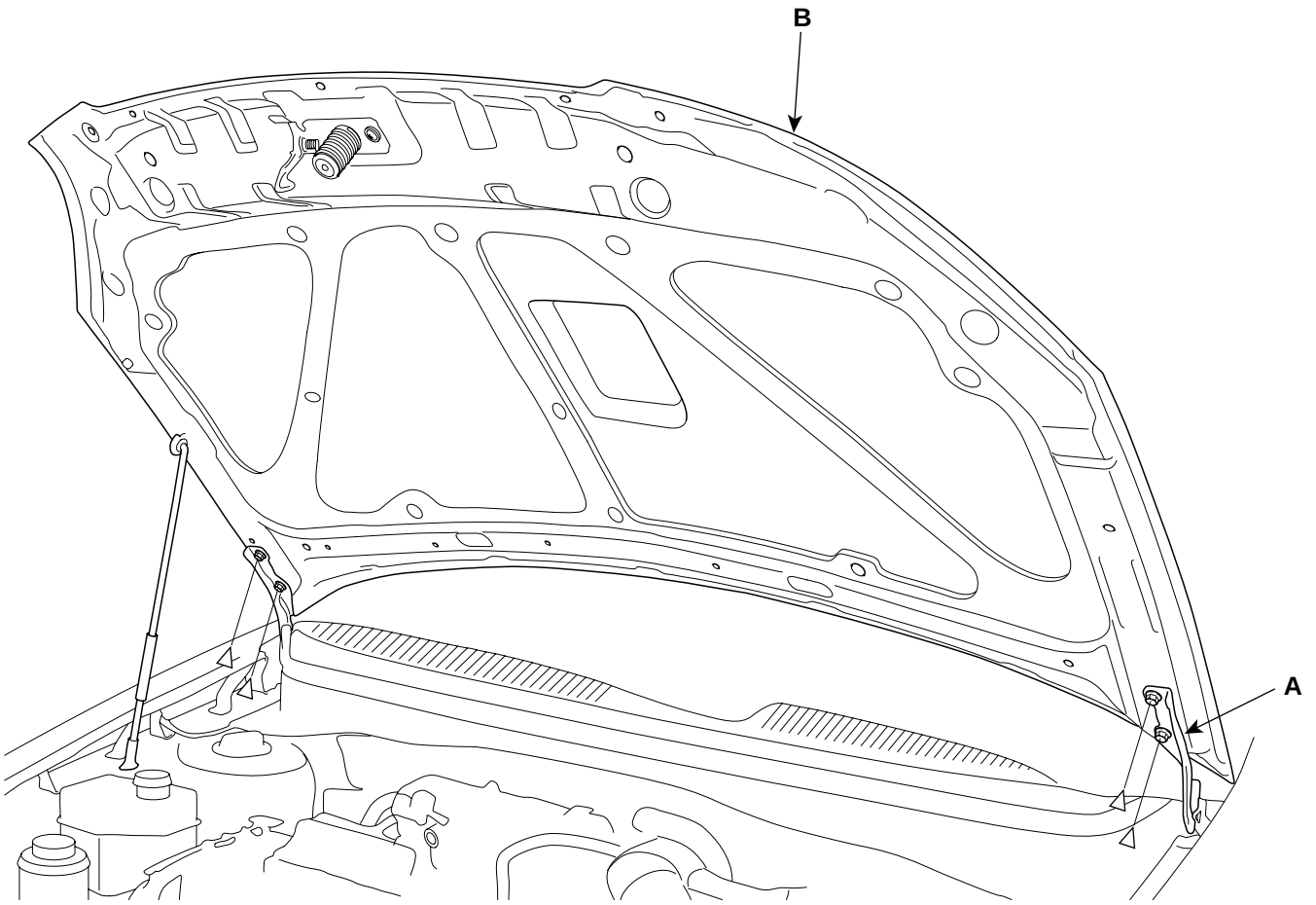
NOTE

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

▷ : Bolt Locations, 4

2.2~2.7 kgf·m

[LHD type is shown, RHD type is similar]



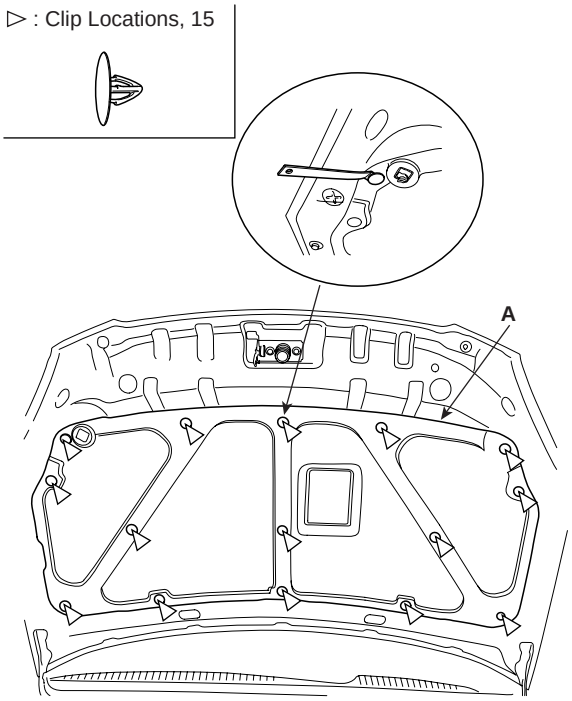
BSJE050A

HOOD INSULATOR REPLACEMENT

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

NOTE

- *Take care not to scratch the hood panel.*



BSJE050B

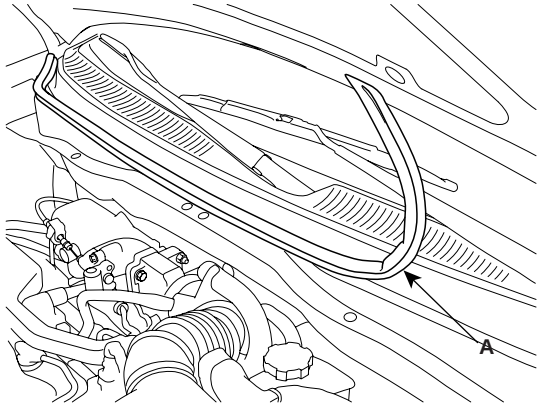
2. Installation is the reverse of removal.

NOTE

- *Replace any damaged clips.*

HOOD SEAL WEATHERSTRIP REPLACEMENT

1. Remove the hood weatherstrip(A).



BSJE050C

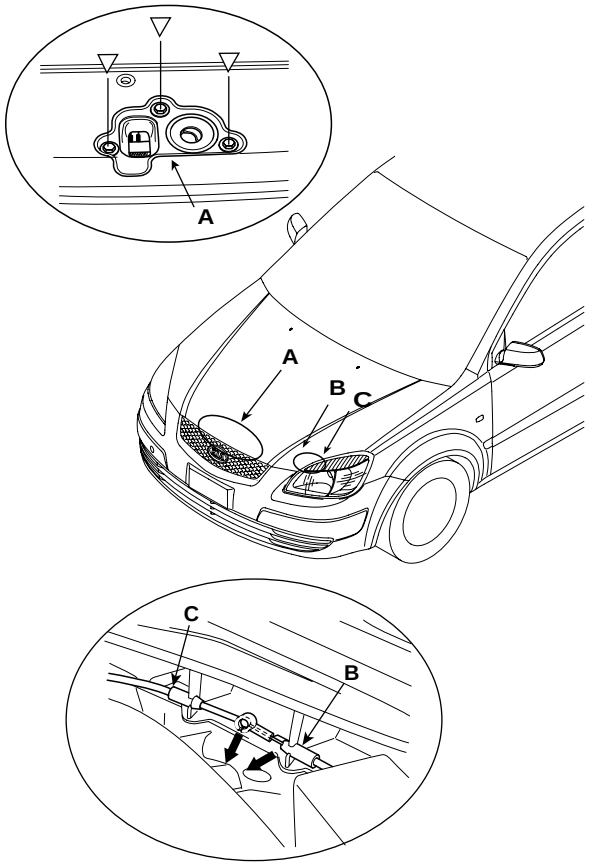
2. Installation is the reverse of removal.

HOOD LATCH REPLACEMENT

1. Loosen the latch (A) mounting bolt then disconect the latch cable(B) and release cable(C).

▷ : Bolt Locations, 3

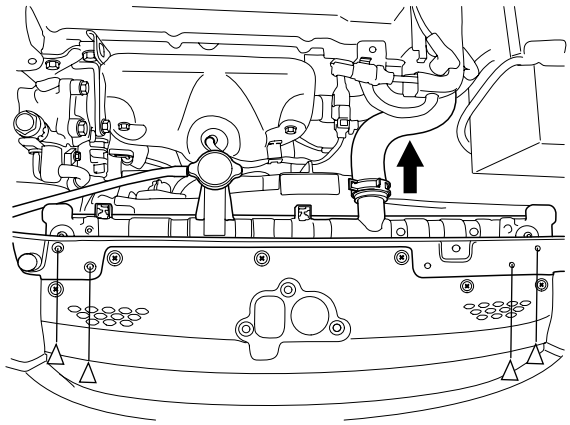
0.7~1.1 kgf·m



BSJE050D

2. Pull tn the arrow direction after loosen the radiator mounting bolts then remove the hood latch.

▷ : Bolt Locations, 4



BSJE050E

3. Installation is the reverse of removal.

NOTE

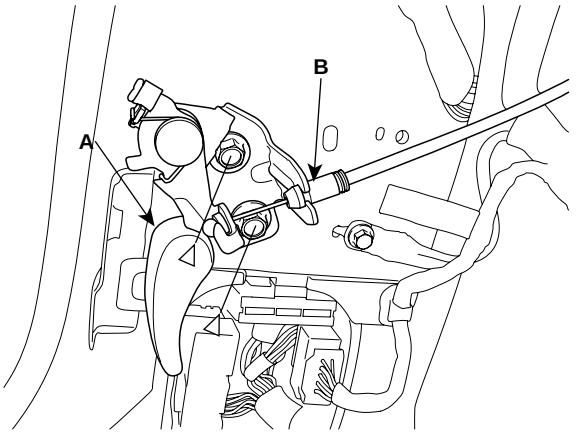
- *Make sure the hood latch cable is connected properly.*
- *Make sure the hood locks securely.*

HOOD RELEASE HANDLE REPLACEMENT

1. Remove the cowl side trim.
2. Remove the mounting bolt, then remove the hood release handle (A).

▷ : Bolt Locations, 2

0.7~1.1 kgf · m



BSJE050J

3. Disconnect the hood latch cable (B) from the hood release handle.
4. Installation is the reverse of removal.

NOTE

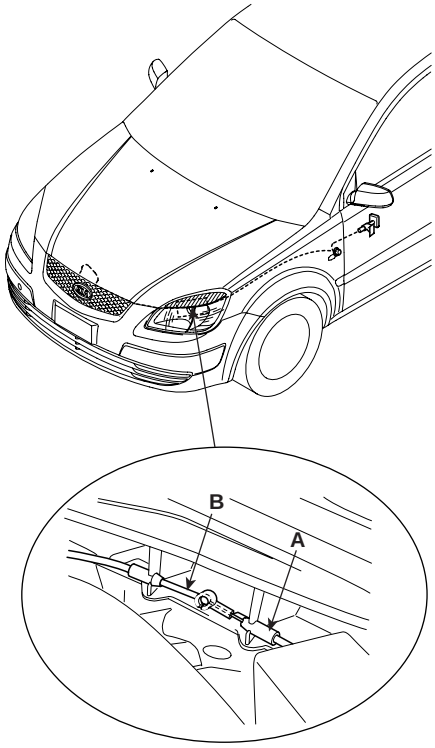
- *Make sure the hood latch cable is connected properly.*
- *Make sure the hood locks securely.*

HOOD LATCH RELEASE CABLE REPLACEMENT

1. Remove the following items.
   - Hood latch(See page BD- 10).
   - Hood latch release handle(See page BD- 11).
   - Weel gurad(See page BD- 38).
2. Remove the clip, latch cable(A) and then remove the realese cable(B).

NOTE

- *Make sure the hood latch cable is connected.*



BSJE050H

3. Installation is the reverse of removal.

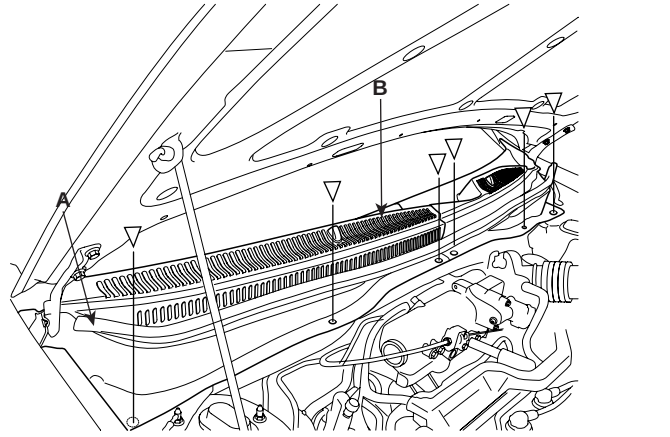
NOTE

- *Make sure the hood latch cable is connected proterly.*
- *Replace any damaged clips.*

COWL TOP COVER REPLACEMENT

1. Remove the wiperarm(See page- BE).
2. Disconnecting the hood weatherstrip(A), remove the cowl top cover(B).

▷ : Clip Locations, 6

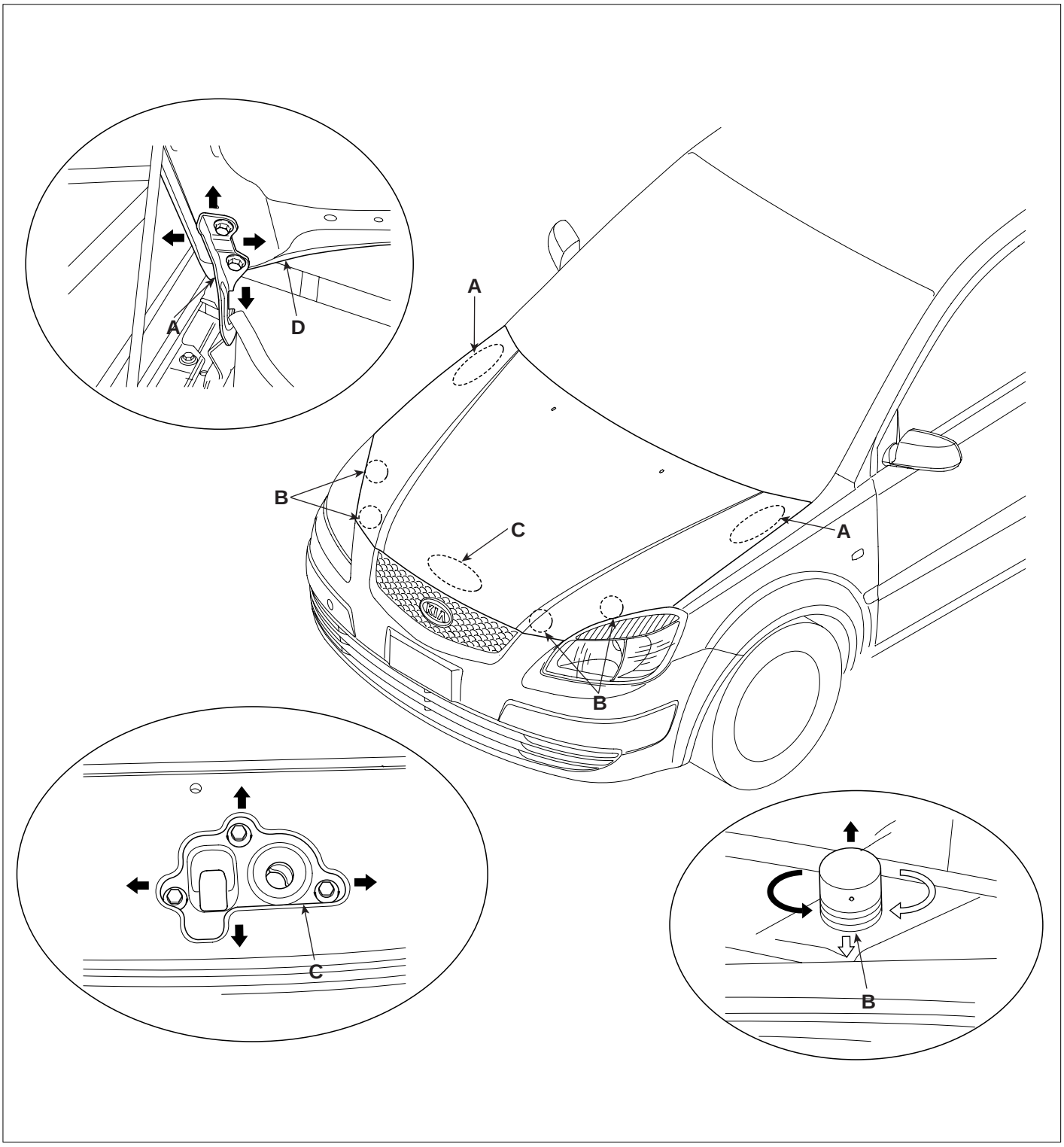


BSJE050I

ADJUSTMENT EBC4C6FC

ADJUST HOOD

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



BSJE050G

TRUNK LID

REPLACEMENT EFACDEC3

NOTE

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

1. Disconnect the key holder connector (A) license plate lamp connector(B) then remove tne wire ring harness from trunk lid.
2. Loosen the trunt lid mounting bolt, then remove the trunk lid(C).
3. Installation is the reverse of removal.

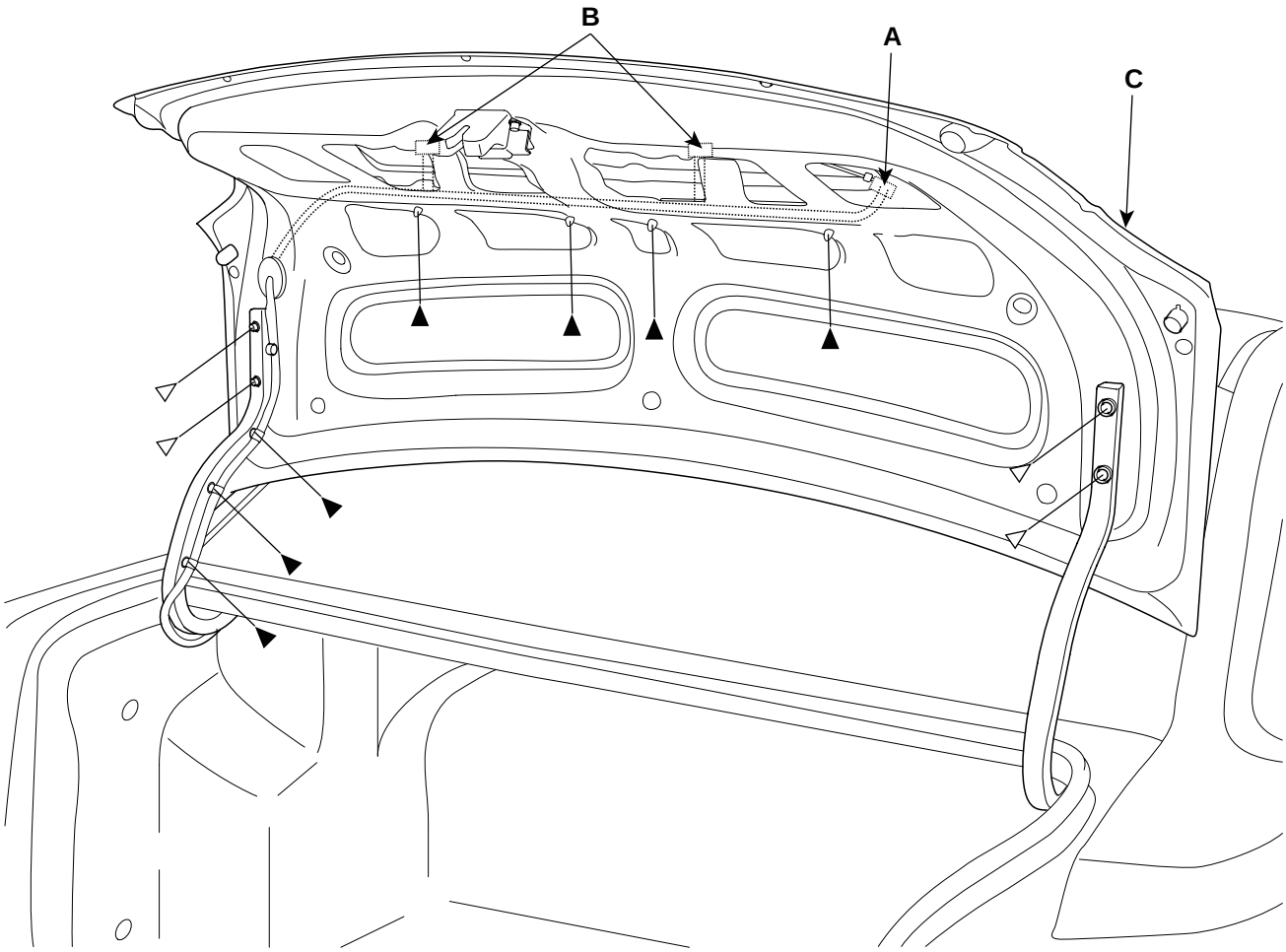
Fastener Locations

▷ : Bolt, 4

0.7~1.1 kgf·m

► : Clip, 7

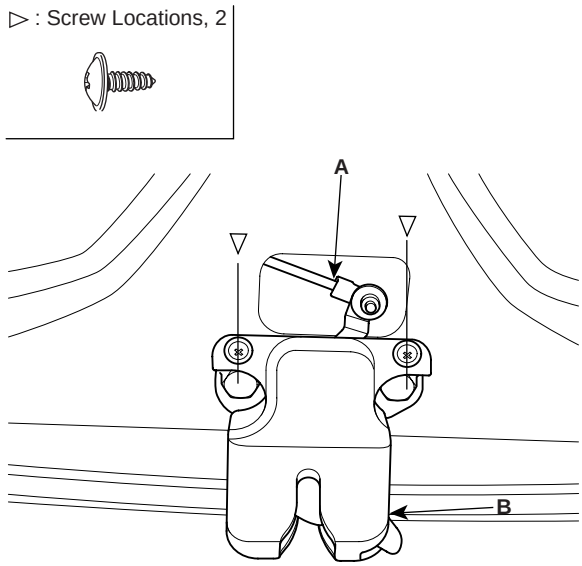
[LHD type is shown, RHD type is similar]



BSJE060A

TRUNK LID LATCH REPLACEMENT

1. Losening the tunk lid latch mounting bolts.
2. Disconnect the tunk lid latch rod(A).

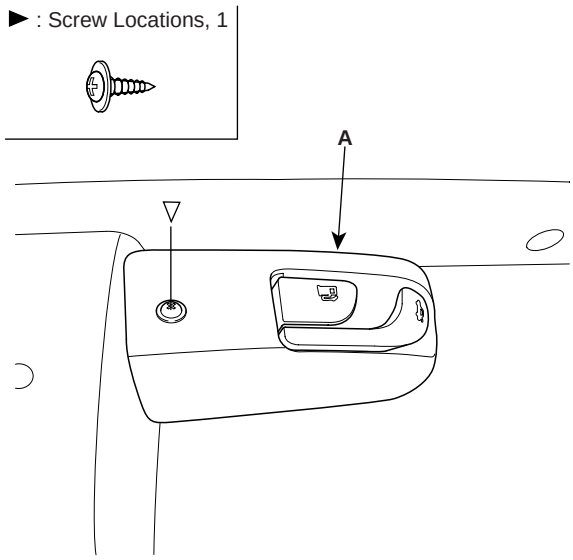


BSJE060B

3. Remove the tunk lid latch(B).
4. Installation is the reverse of removal.

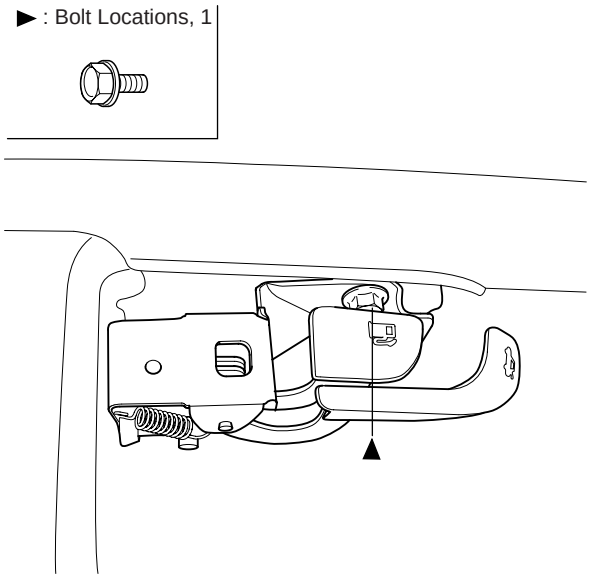
TRUNK LID RELEASE HANDLE REPLACEMENT

1. Remove the handle cover(A).



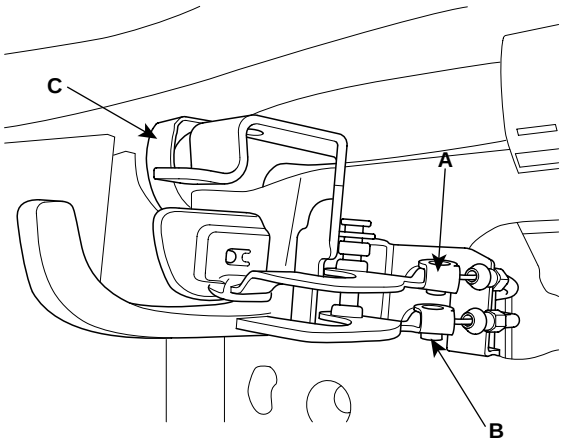
BSJE150B

2. After loossning the mounting bolts.



BSJE150C

3. Disconnet the release handle cable (A) and fuel fill door release handle cable (B) then remove the release handle(C).



BSJE150D

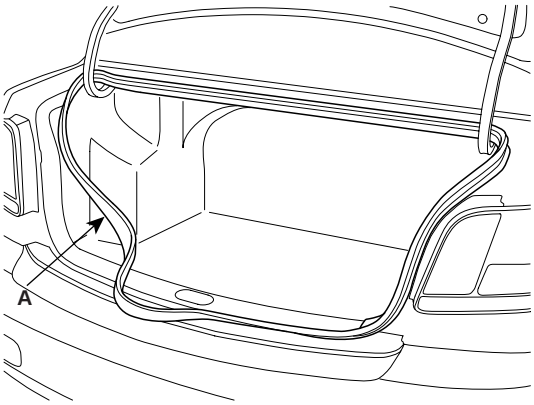
4. Installation is the reverse of removal.

NOTE

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

TRUNK LID WEATHERSTRIP REPLACEMENT

1. Remove the trunk lid weatherstrip(A).



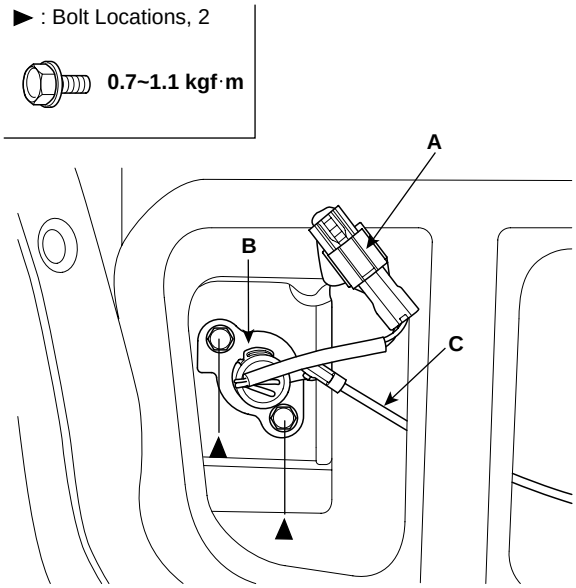
BSJE060C

2. Installation is the reverse of removal.

KEY HOLDER REPLACEMENT

1. Loosening the mounting bolts, disconnect the connector (A), rod(C).

2. Remove the key holder(B).

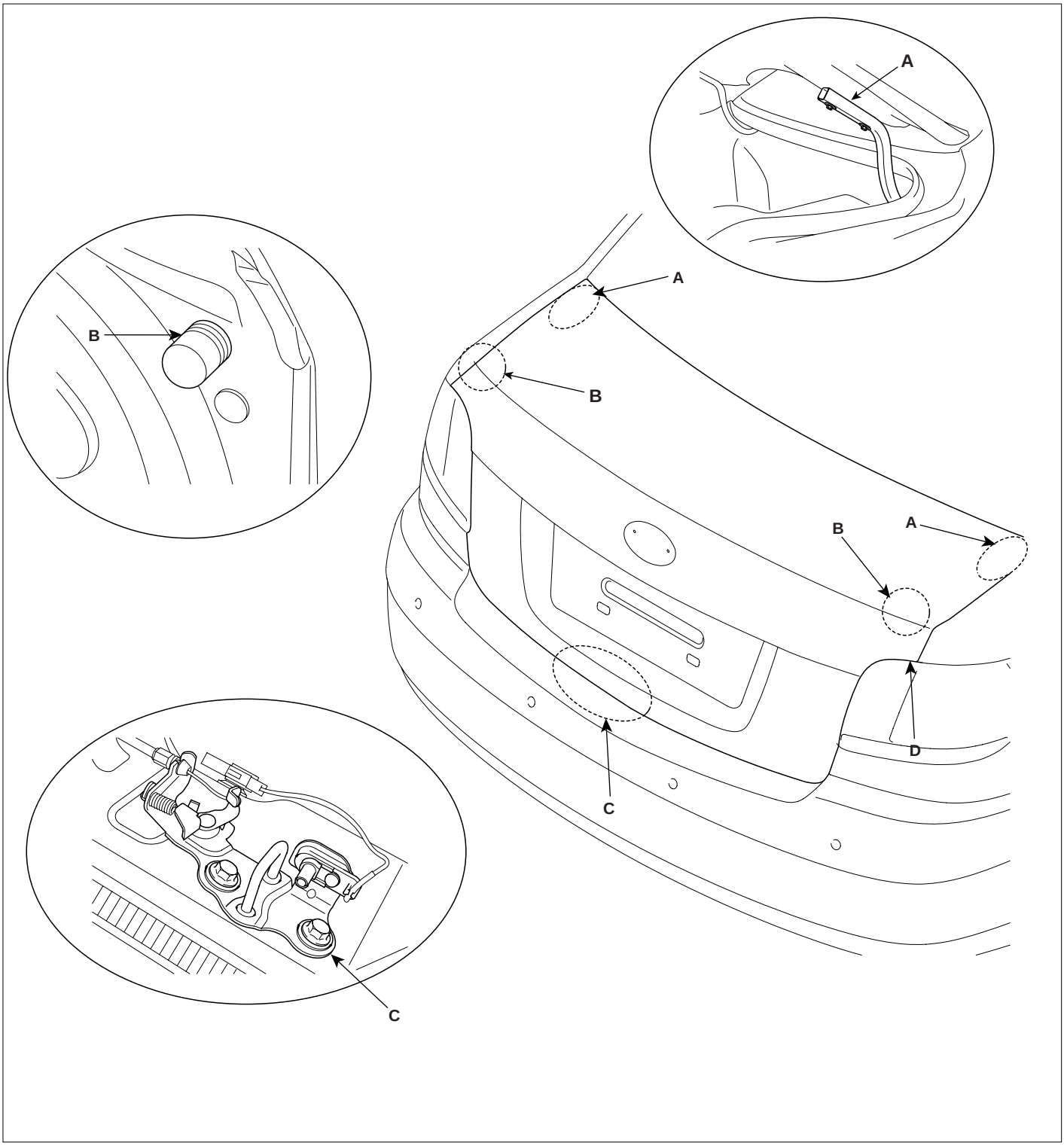


BSJE060D

3. Installation is the reverse of removal.

ADJUSTMENT E737872D

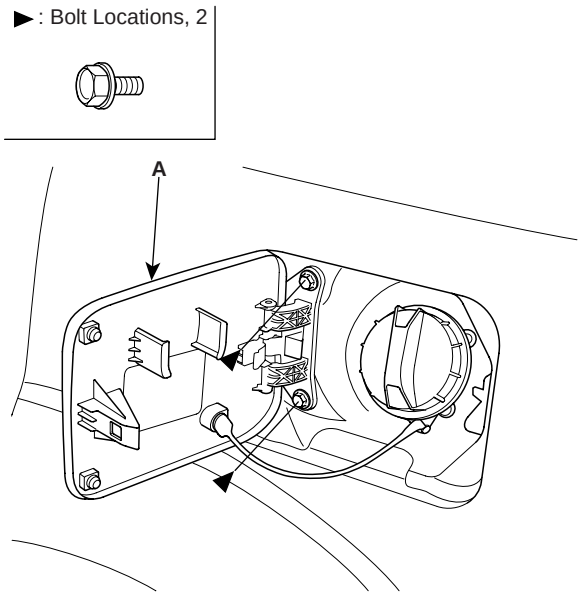
1. After loosening the trunk lid hinge (A) mounting bolt, adjust the hood by moving it up or down, or right or left.
2. Adjust the trunk lid height by turning the trunk lid over-slam bumpers (B).
3. After loosening the trunk lid latch (C) mounting bolts, adjust the trunk lid latch by moving it up or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



BSJE060E

FUEL FILL DOOR REPLACEMENT

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



BSJE150A

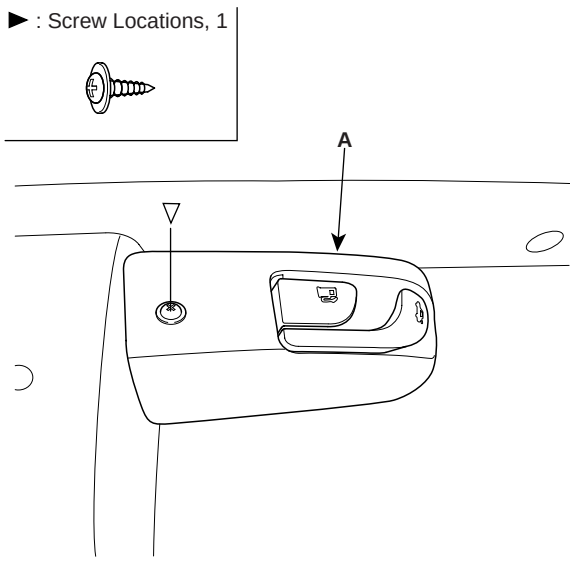
2. Installation is the reverse of removal.

NOTE

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

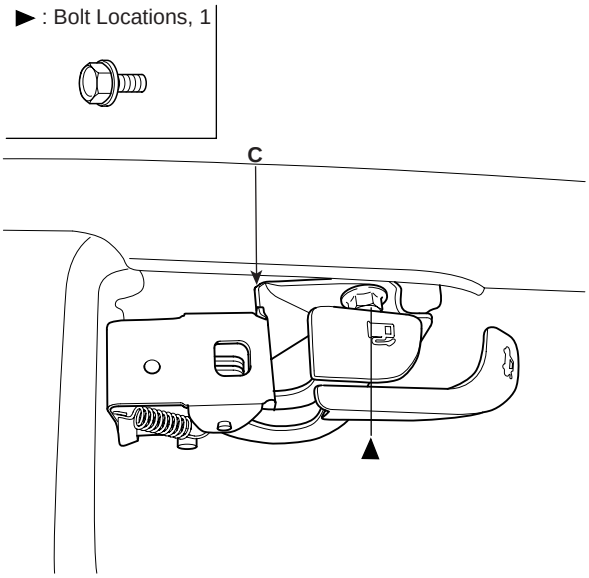
FEUL FILL DOOR RELEAS HANDLE REPLACEMENT

1. Remove the handle cover(A).



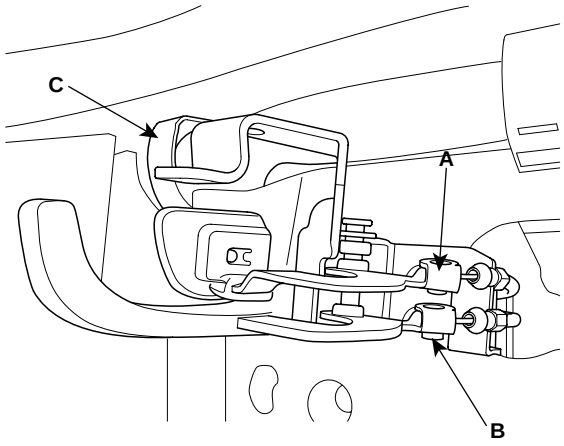
BSJE150B

2. After loosening the mouning bolt, remove the releas handle assemble(C).



BSJE560E

3. After disconnecting the trunk releas handle cable(A), feul fill door releas handle cable(B), remove the releas handle(C).



BSJE150D

4. Installation is the reverse of removal.

NOTE

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

TRUNK LID, FEUL FILL DOOR RELEAS CABLE REPLACEMENT

1. Remove the following items.
   - Front seat(See page BD- 72).
   - Rear seat(See page BD- 80).
   - Front, rear door scuff trim(See page BD- 60).
   - Center lower pillar trim(See page BD- 60).
   - Luggage side trim(See page BD- 60).
   - Fuel fill door releas handle(See page BD- 18).

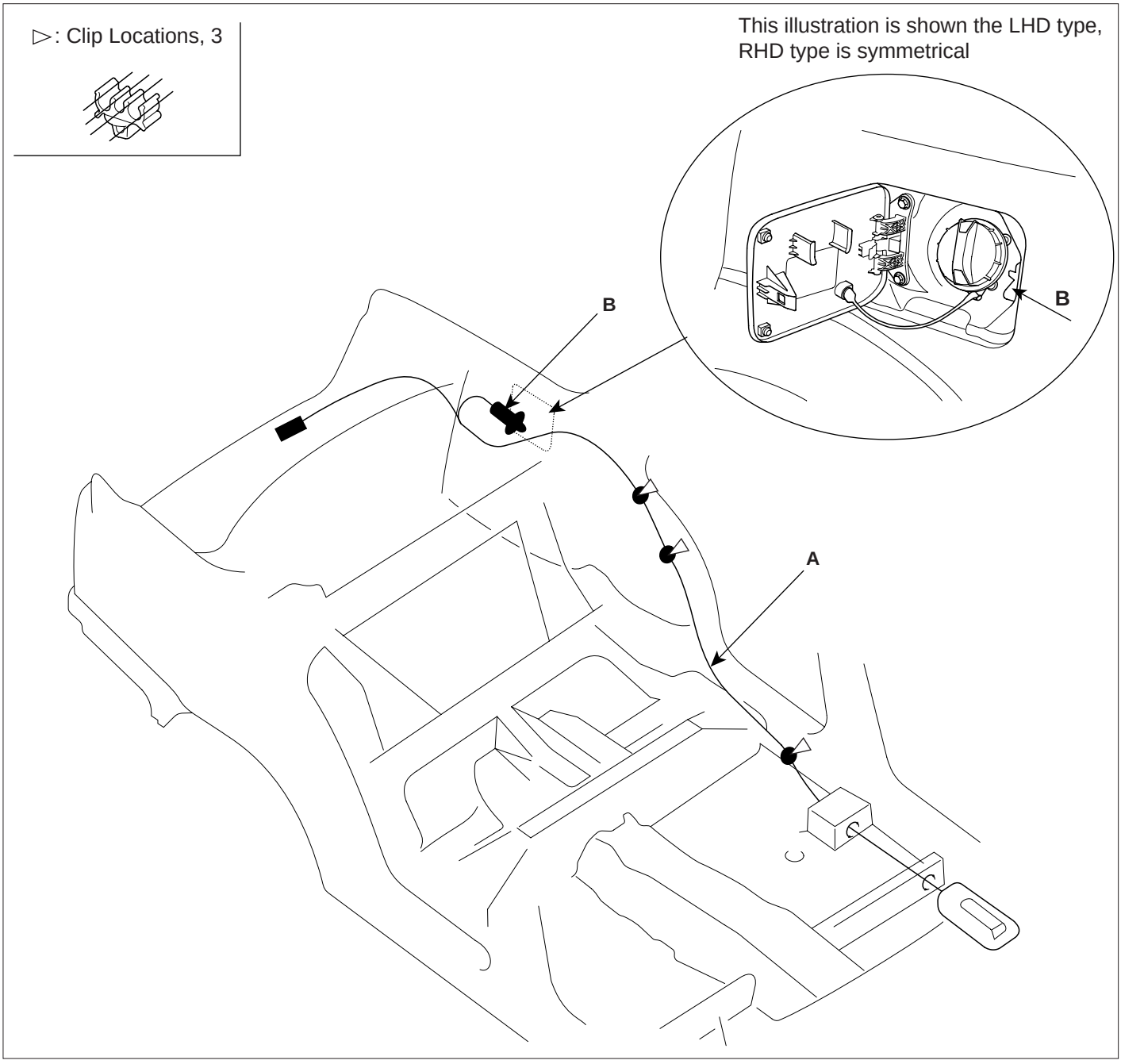
2. Disconnect the fuel filler door release cable from the release handle.

3. Remove the release cable(A) from the clip, and dis connect the fuel filler door catch(B), then remove the fuel filler door cable from the vehicle.

4. Installation is the reverse of removal.

NOTE

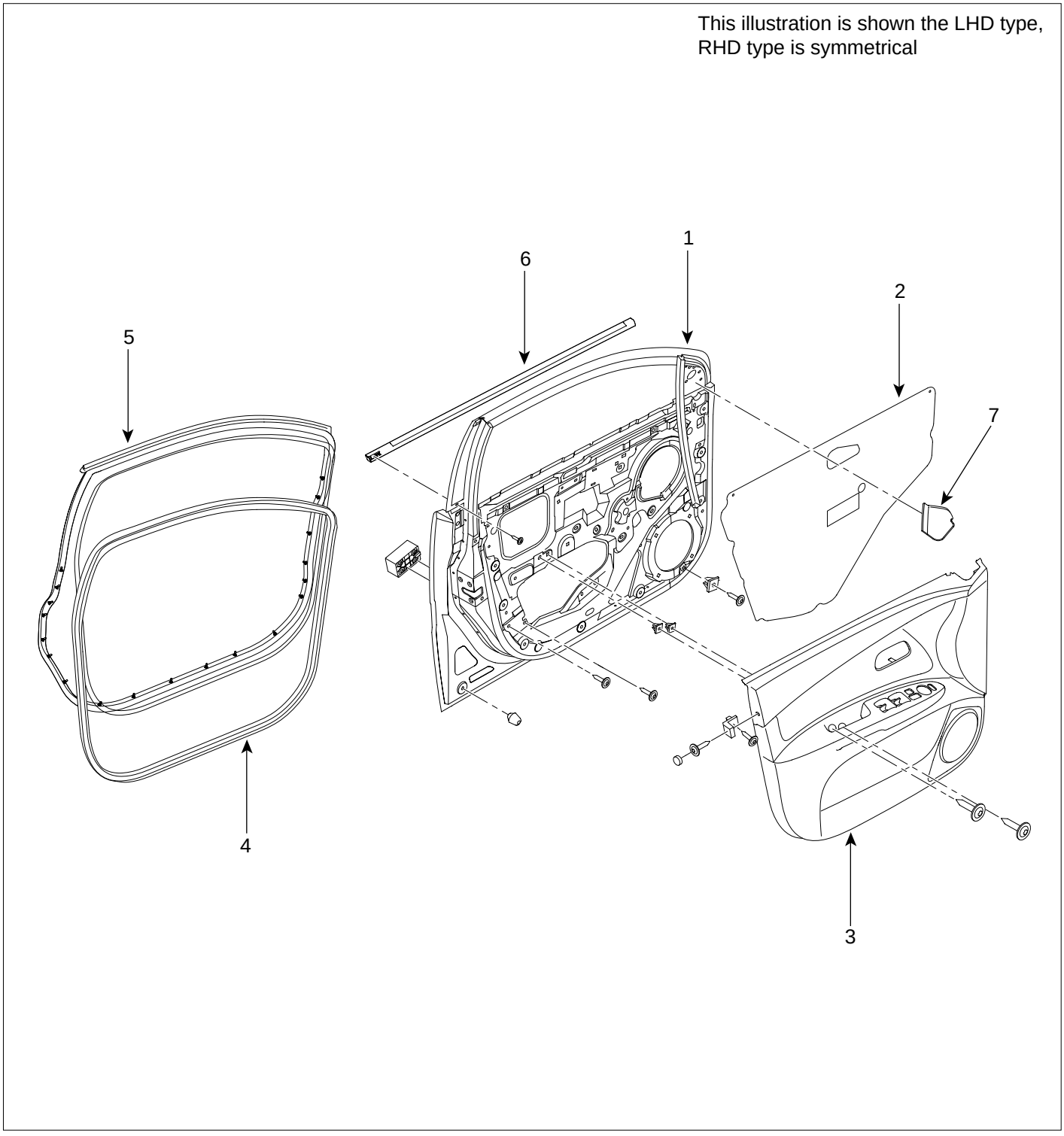
- *Make sure the fuel fill door opens properly and locks securely.*



BSJE060J

FRONT DOOR

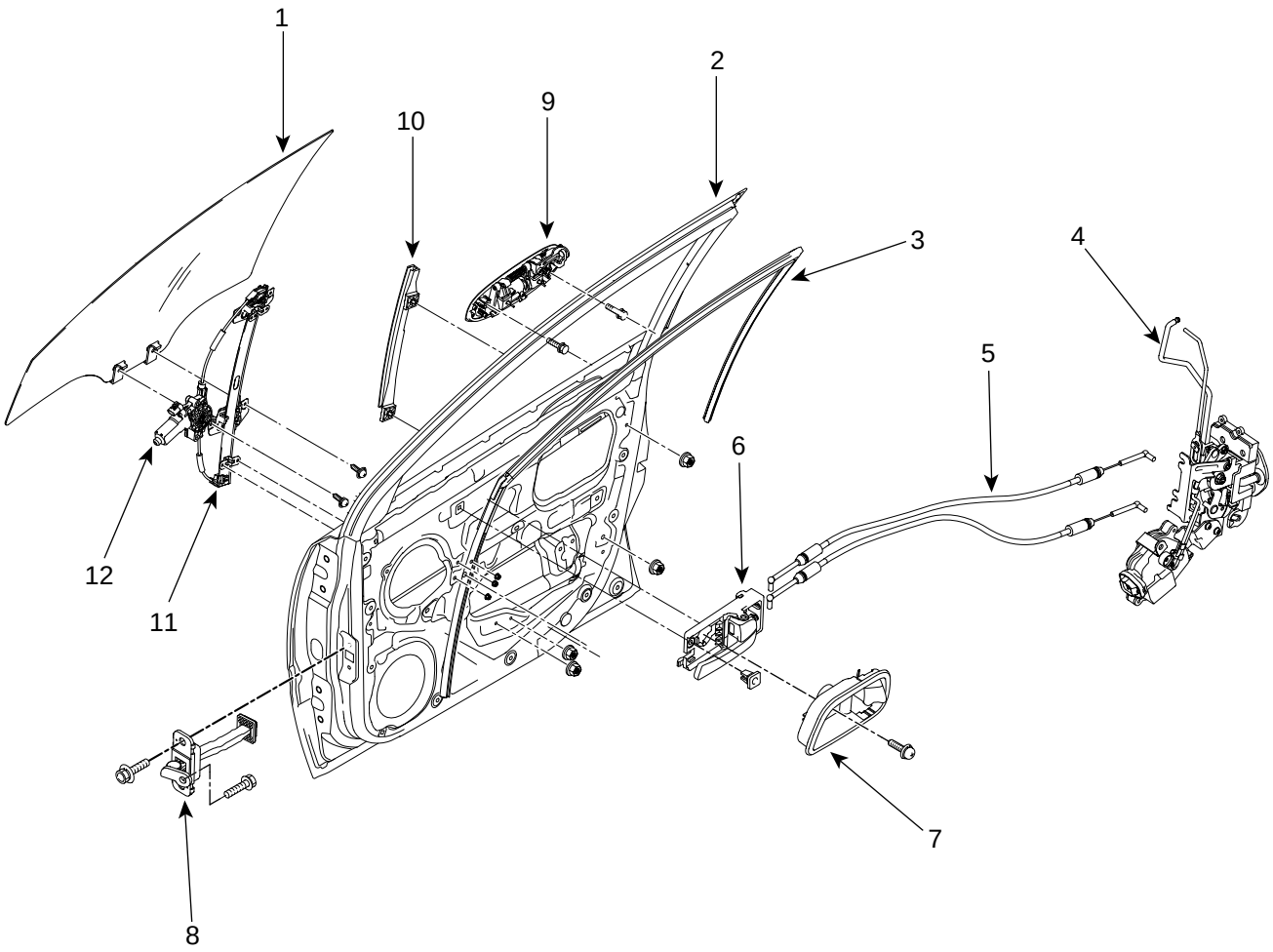
COMPONENTS E42EB2DE



1. Door panel
2. Door trim seal
3. Door trim
4. Door body side weatherstrip
5. Door side weatherstrip
6. Door belt weatherstrip
7. Quadrant cover

BSJE080A

[LHD type is shown, RHD type is symmetrical]



1. Glass
2. Door panel
3. Glass molding
4. Latch
5. Inside handle cable
6. Inside handle
7. Inside handle housing
8. Door checker
9. Outside handle
10. Chanel
11. Module
12. Power window motor

BSJE081A

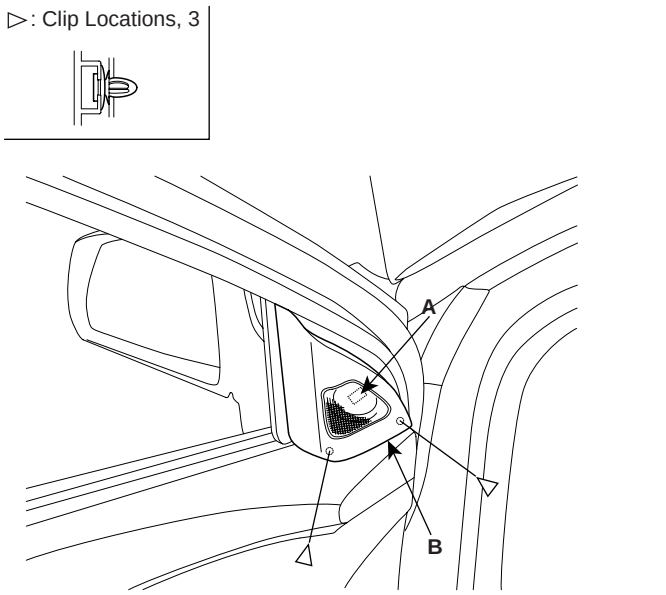
REPLACEMENT ECD11F51

DOOR TRIM REPLACEMENT

NOTE

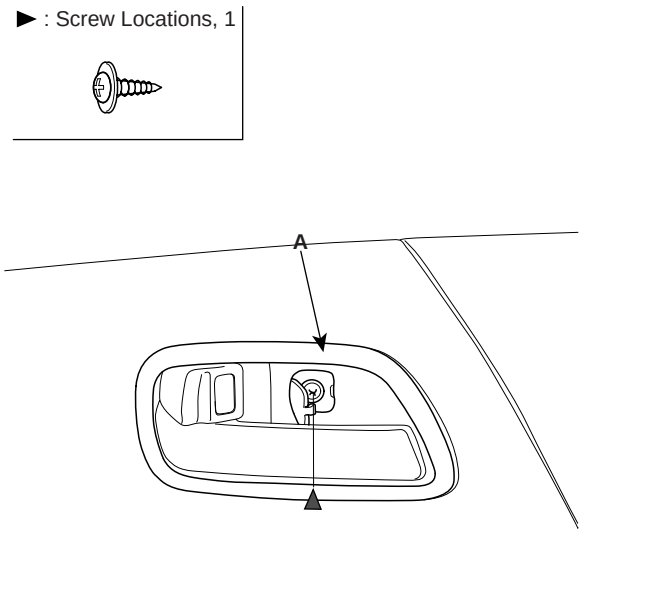
- *Take care not to scratch the door trim and other parts.*
- *Put on gloves to protect your hands.*

1. After disconncting the connector(A), remove the quadrant inner cover(B).



BSJE090A

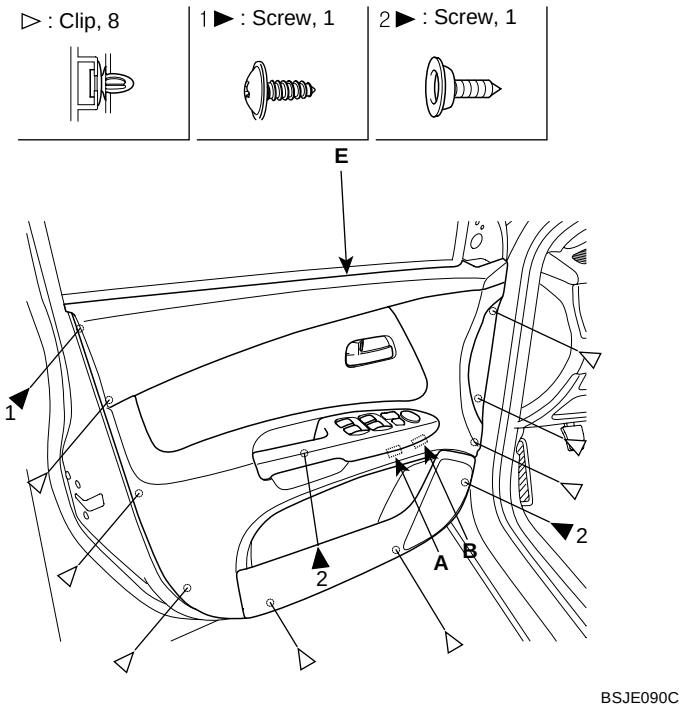
2. After loosen the inside handle cover mounting screw, remove the inside handle cover(A).



BSJE090B

3. Loosen the door trim mounting screws. Disconnect the power window switch connector(A), power mirror connector(B). Remove the door trim(E).

Fastener Locations



BSJE090C

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.*

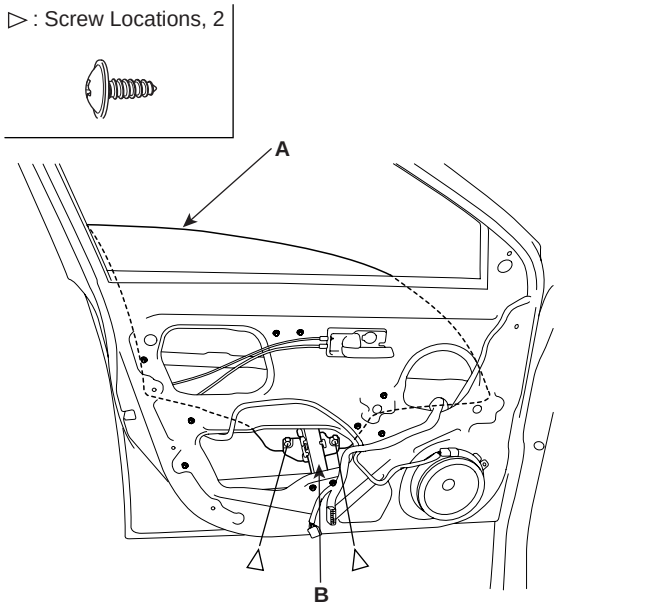
GLASS REPLACEMENT

1. Remove the front door trim(See page BD- 22).

NOTE

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

2. 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 (B).



BSJE090D

CAUTION

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

3. Installation is the reverse of removal.

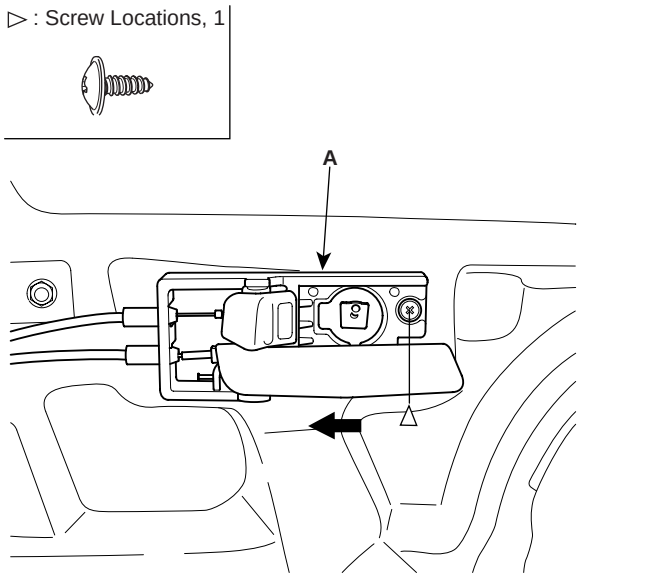
NOTE

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

INSIDE HANDLE REPLACEMENT

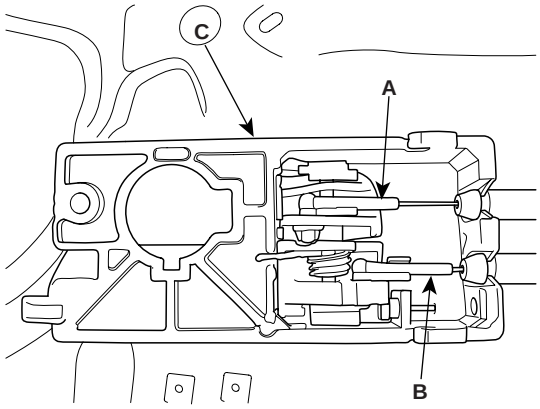
1. Remove the front door trim(See page BD- 22).

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



BSJE090E

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



BSJE090F

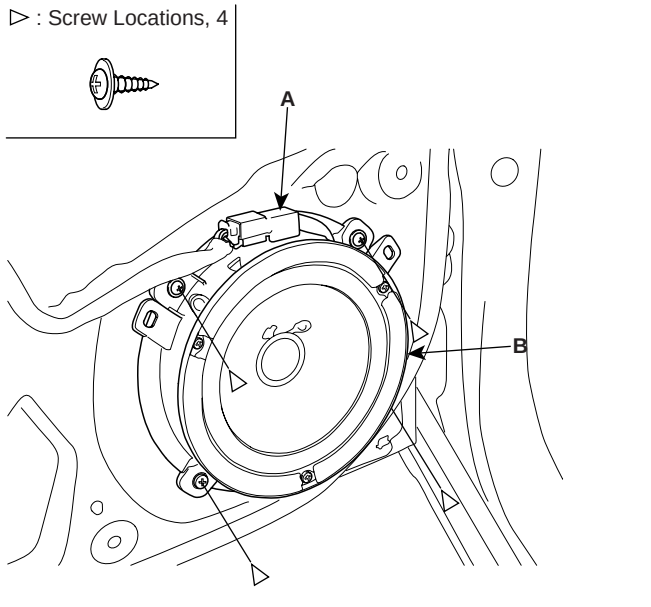
4. Installation is the reverse of removal.

NOTE

- *Make sure the door lock and open properly.*

SPEAKER REPLACEMENT

1. Remove the front door trim(See page BD- 22).
2. After disconnect the speaker mounting screw and connector(A), remove the speaker(B).

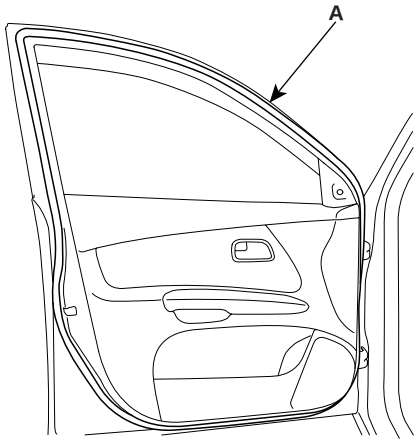


BSJE090G

3. Installation is the reverse of removal.

DOOR WEATHERSTRIP REPLACEMENT

1. Remove the door weatherstrip(A).

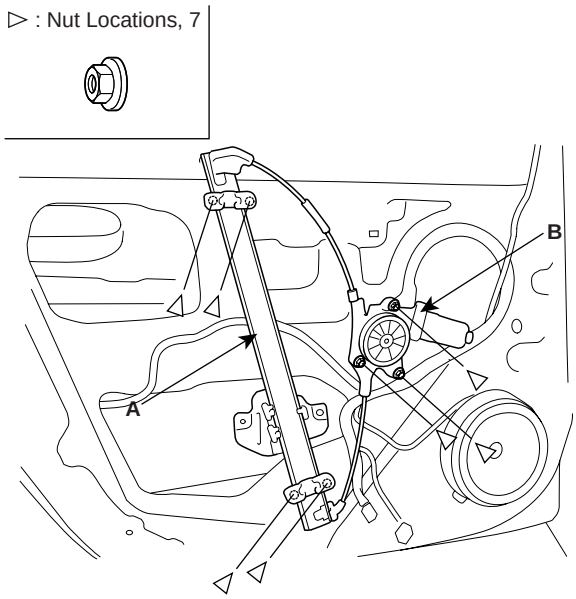


BSJE090N

2. Installation is the reverse of removal.

DOOR REGULATOR REPLACEMENT

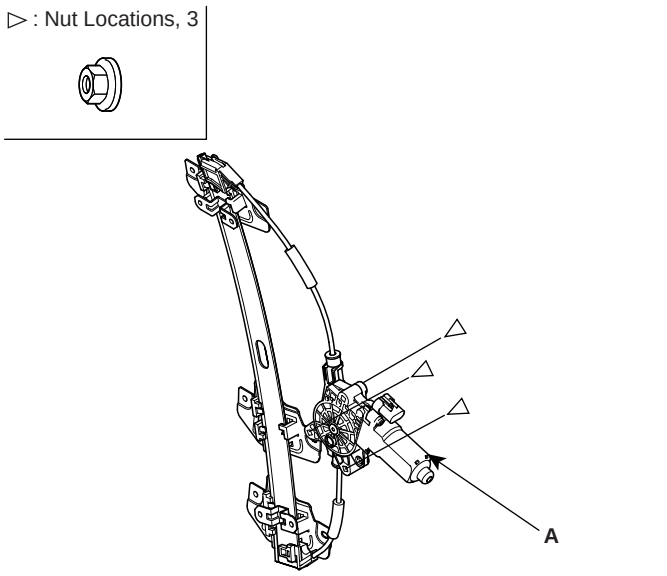
1. Remove the door trim(See page BD- 22).
2. Remove the door trim seal.
3. Remove the window glass.
4. After loosen the door regulator mounting nuts and window motor(B) mounting nuts, remove the door regulator(A).



BSJE090H

POWER WINDOW MOTOR REPLACEMENT

1. Remove the front door trim(See page BD- 22).
2. Remove the door regulator(See page BD- 24).
3. Remove the window motor(A).



BSJE090I

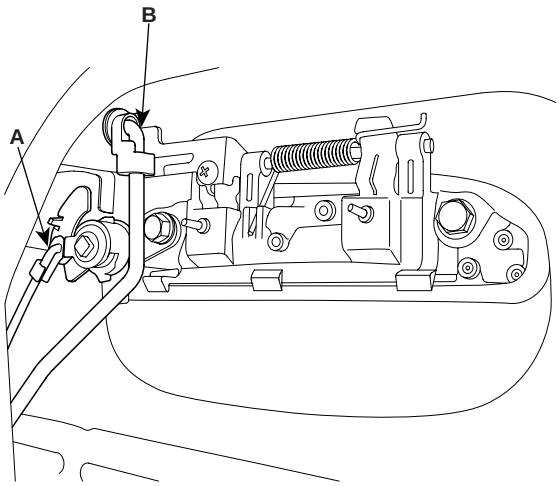
4. Installation is the reverse of removal.

NOTE

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

FRONT DOOR LATCH REPLACEMENT

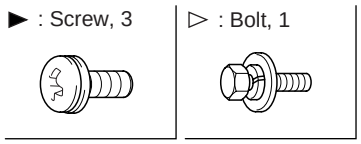
1. Remove the door trim(See page BD- 22).
2. Remove the inside handle(See page BD- 23).
3. Remove the chennel(See page BD- 26).
4. Disconnect the lock cable(A), out side handle cable(B).

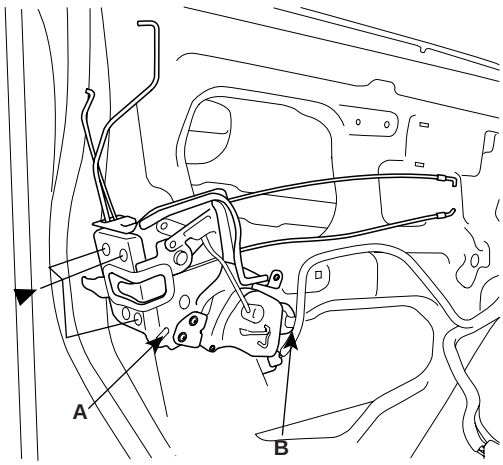


BSJE090J

5. After disconnect the connector(B), loosen the mounting bolts. Remove the latch assemble(A).

Fastener Locations





BSJE090K

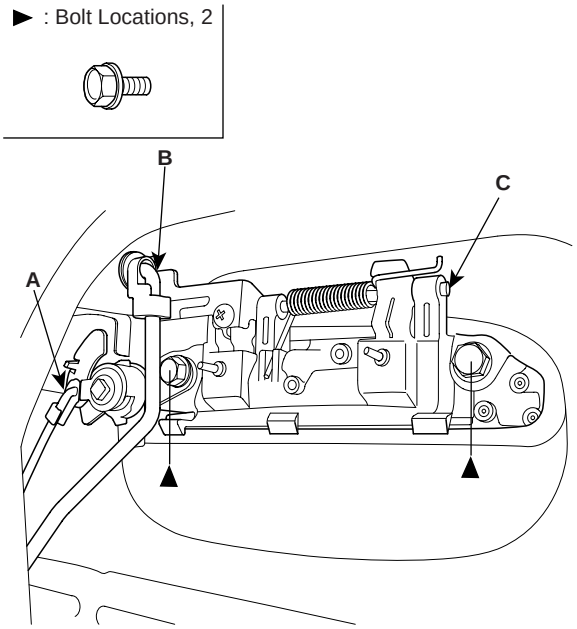
6. Installation is the reverse of removal.

NOTE

- *Roll the glass up down to see if it move freely without binding.*
- *Make sure the door lock and opens properly.*

OUTSIDE HANDLE REPLACEMENT

1. Remove front door trim(See page BD- 22).
2. Remove the door trim seal.
3. Disconnect the lock cable(A), out side handle cable(B).
4. Loosen the outsidr handle mounting bolts.
5. Remove the outside handle(C).



BSJE090S

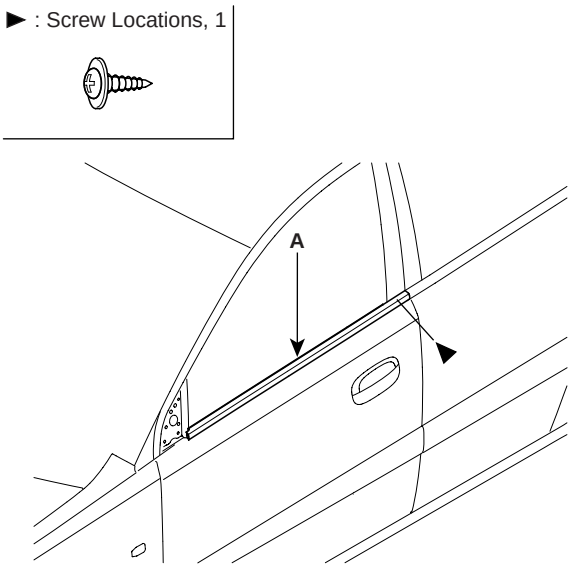
6. Installation is the reverse of removal.

NOTE

- *Make sure the door lock and opens properly.*

DOOR BELT WEATHERSRIP REPLACEMENT

1. Remove front door trim.
2. Remove the door belt weatherstrip(A), after straightening hook of weatherstrip.

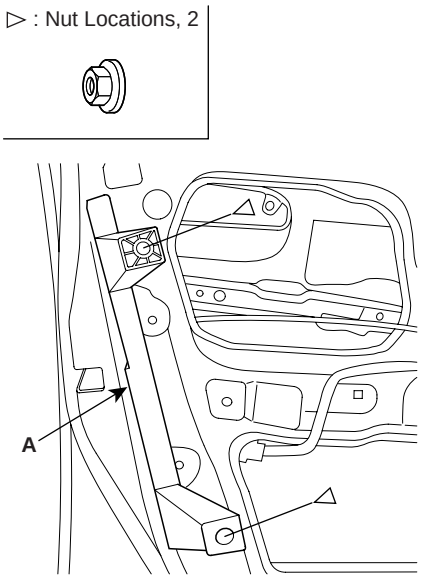


BSJE090L

3. Installation is the reverse of removal.

REAR CHENNEL REPLACEMENT

1. Remove front door trim.
2. Remove the rear chennel(A).



BSJE090M

3. Installation is the reverse of removal.

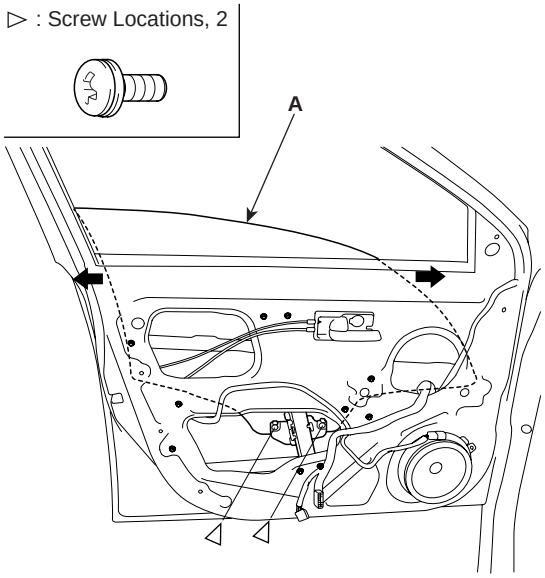
ADJUSTMENT EDAED746

GLASS ADJUSTMENT

NOTE

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

1. Remove the front door trim(See page BD- 22).
2. Carefully move the glass (A) until you can see the glass mounting bolts, then loosen them.



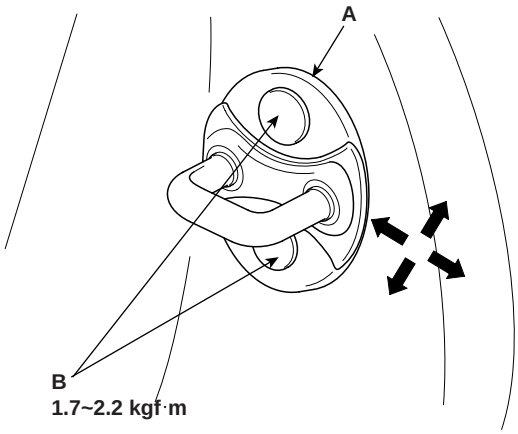
BSJE090O

3. Check that the glass moves smoothly.

DOOR STRIKER ADJUSTMENT

Make sure the door latches securely without slamming It. If necessary, adjust the striker (A): The strike nuts Are fixed. The strike 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(A).



BSJE090P

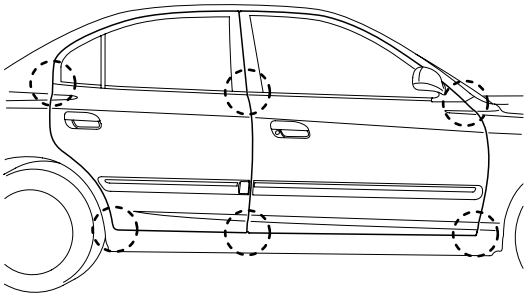
2. Lightly tighten the screws.
3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
   Do not tap the striker too hard.
4. Loosen the screws and remove the shop towel.
5. Lightly tighten the screws.
6. Hold the outer handle out, and push the door against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

DOOR POSITION ADJUSTMENT

NOTE

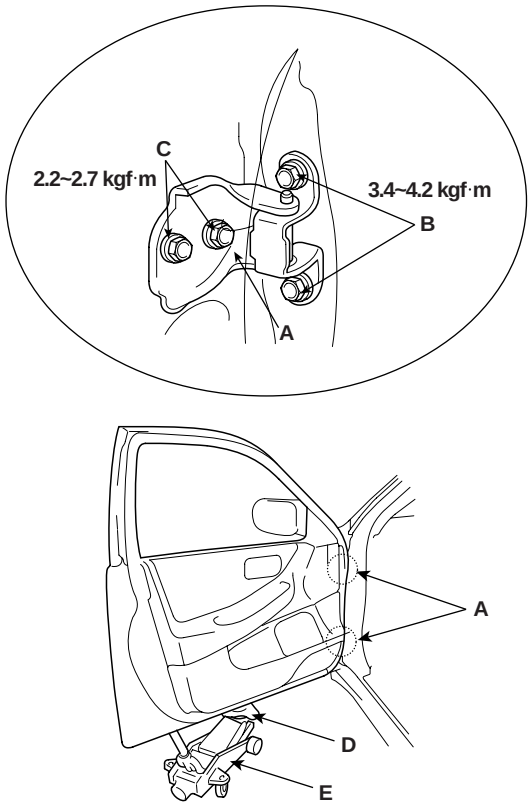
- *After installing the door, check for a flush fit with the Body, then check for equal gaps between the front, Rear, and bottom, door edges and the body. CheckThat the door and body edges are parallel. Before Adjusting, replace the mounting bolts.*

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



BSJE090Q

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



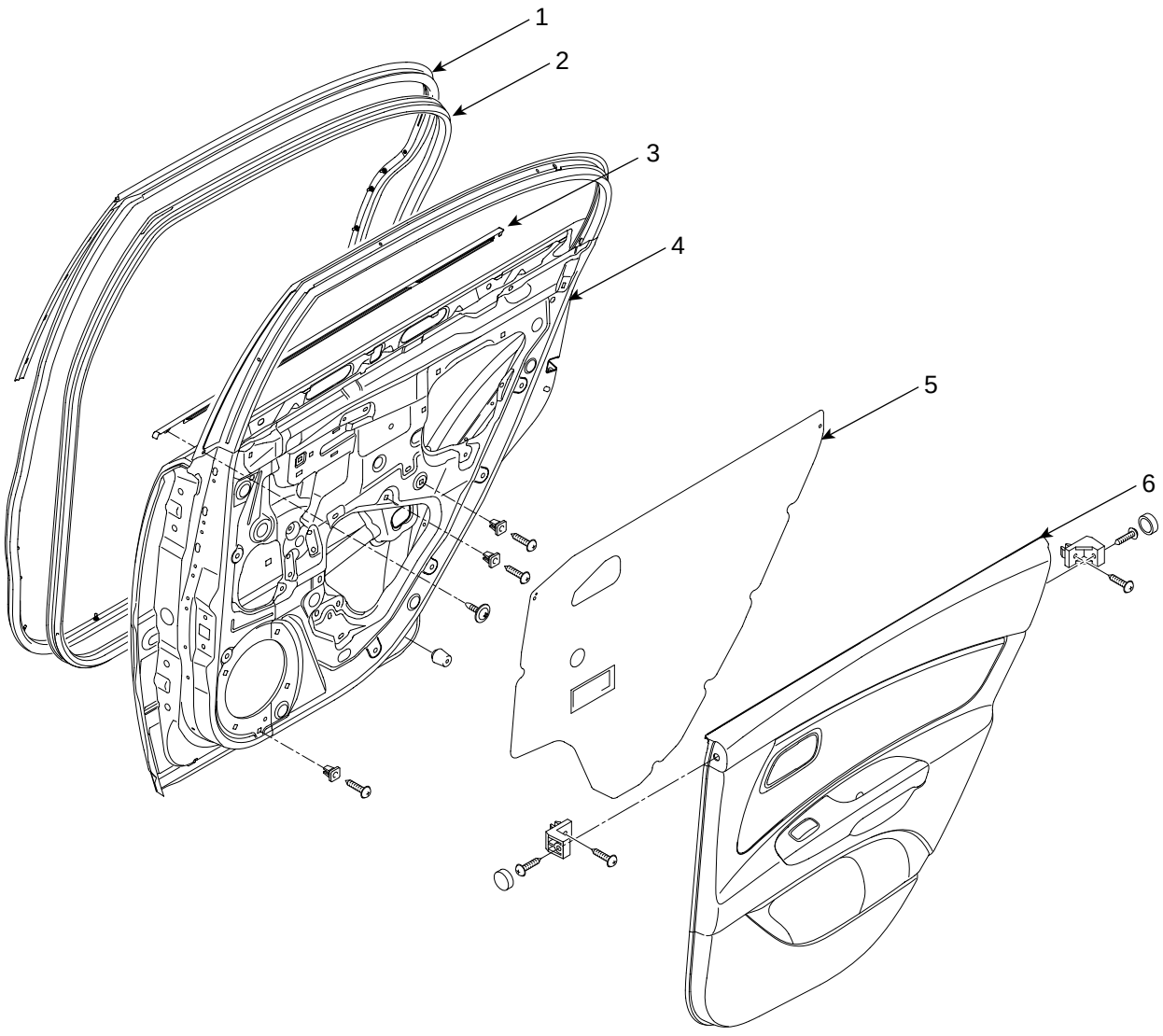
BSJE090R

3. Check that the door and body edges are parallel.
4. Grease the pivot portions of the hinges indicated by the arrows.
5. Check for water leaks.

REAR DOOR

COMPONENTS E37DD53D

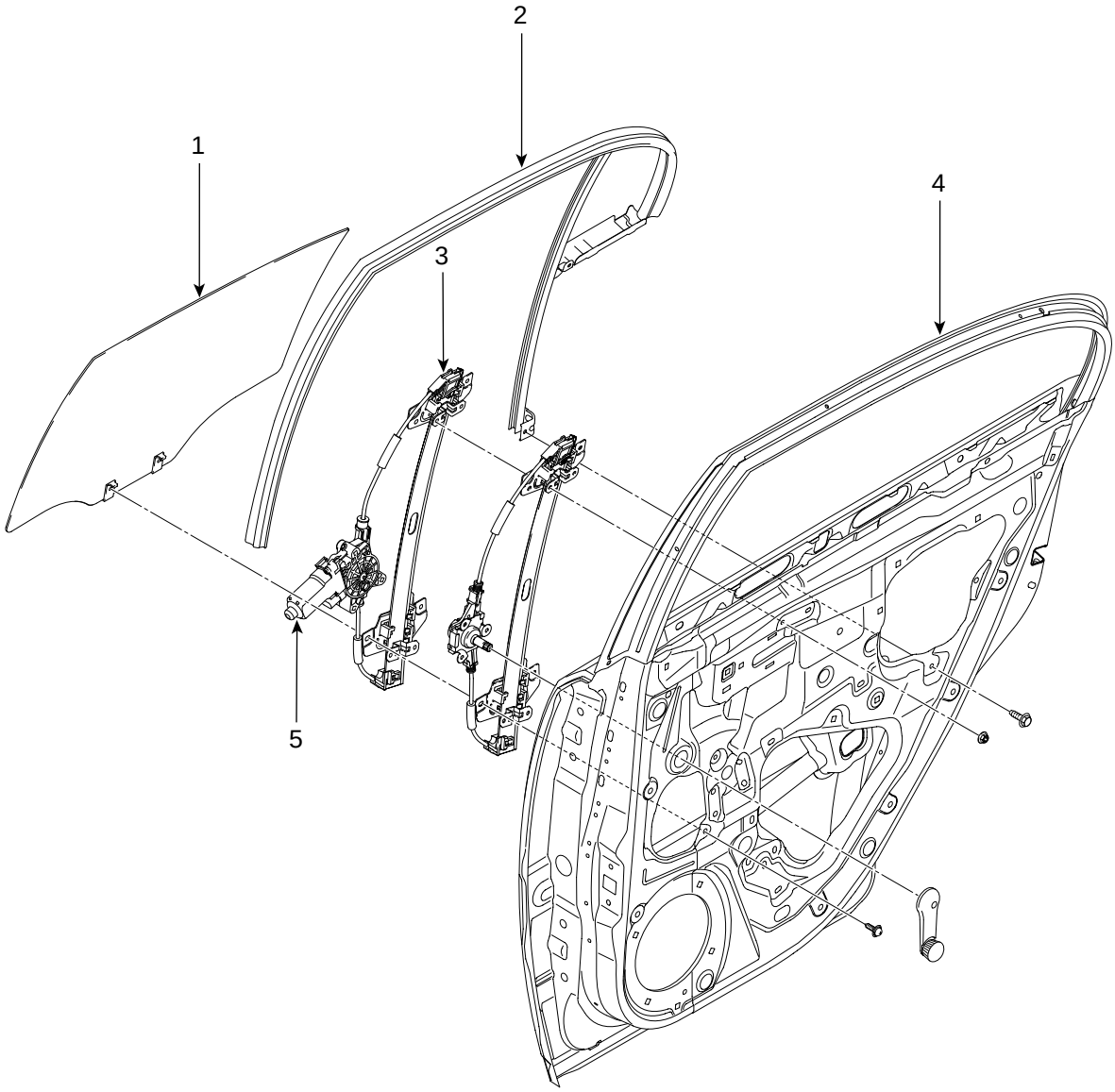
This illustration is shown the LHD type,
RHD type is symmetrical



1. Door side weatherstrip
2. Door body side weatherstrip
3. Door belt weatherstrip
4. Door panel
5. Door trim seal
6. Door trim

BSJE101Z

[LHD type is shown, RHD type is similar]



1. Glass
2. Glass molding
3. Module
4. Door panel
5. Window motor

BSJE101A

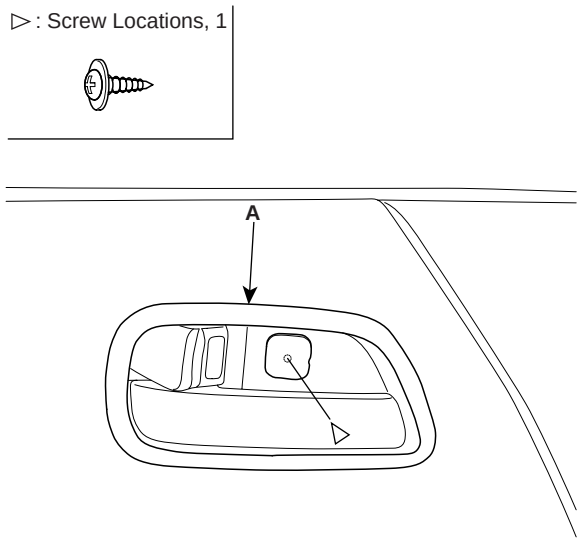
REPLACEMENT EFF1C5CF

REAR DOOR TRIM REPLACEMENT

NOTE

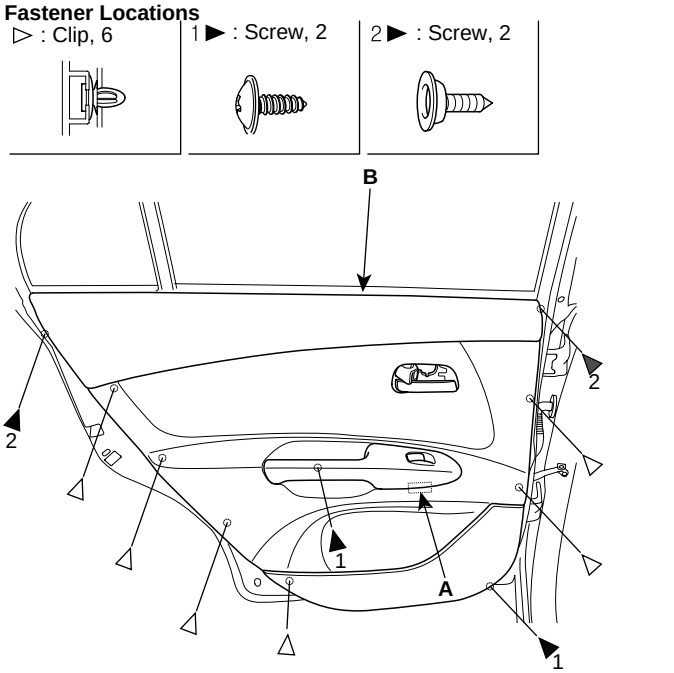
- *Take care not to scratch the door trim and other parts.*
- *Put on gloves to protect your hands.*

1. After loosen the inside handle cover mounting screw, remove the inside handle cover(A).



BSJE100A

2. Loosen the door trim mounting screws. Disconnect the power window switch connector(A), power mirror connector. Remove the door trim(B).



BSJE100B

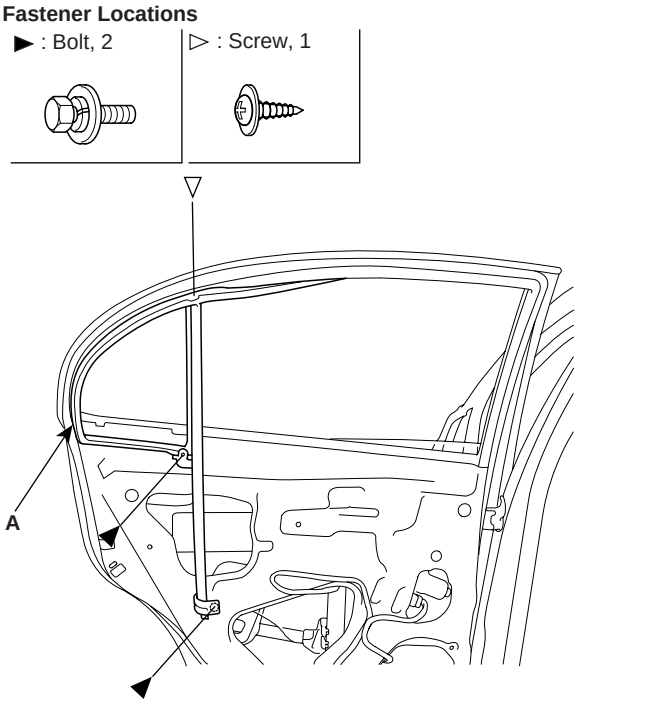
3. Installation is the reverse of removal.

NOTE

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

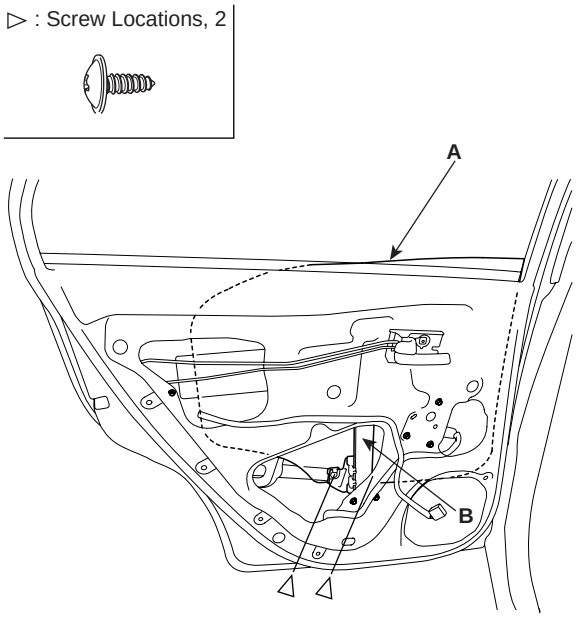
GLASS REPLACEMENT

1. Remove the rear door trim(See page BD- 31).
2. After loosening the fixed glass mounting screw and bolts, remove the glass(A).



BSJE100C

3. 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 (B).



BSJE100D

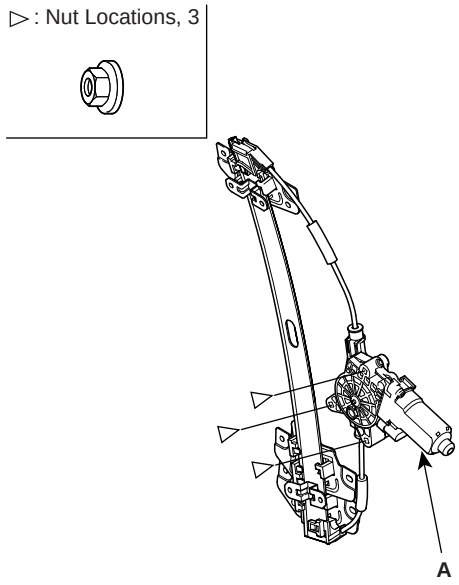
4. Installation is the reverse of removal.

CAUTION

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

POWER WINDOW MOTOR REPLACEMENT

1. Remove the rear door trim(See page BD- 31).
2. Remove the rear door regulator(See page BD- 34).
3. After loosening the power window motor mounting nuts, remove the power window motor(A).



BSJE100E

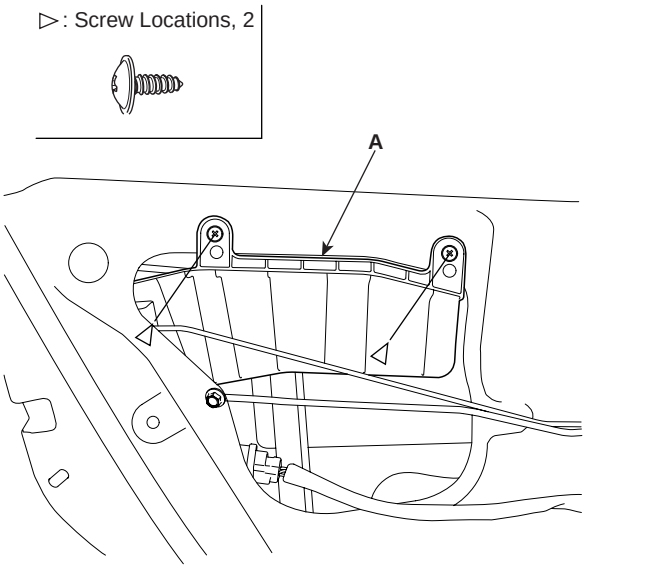
4. Installation is the reverse of removal.

NOTE

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

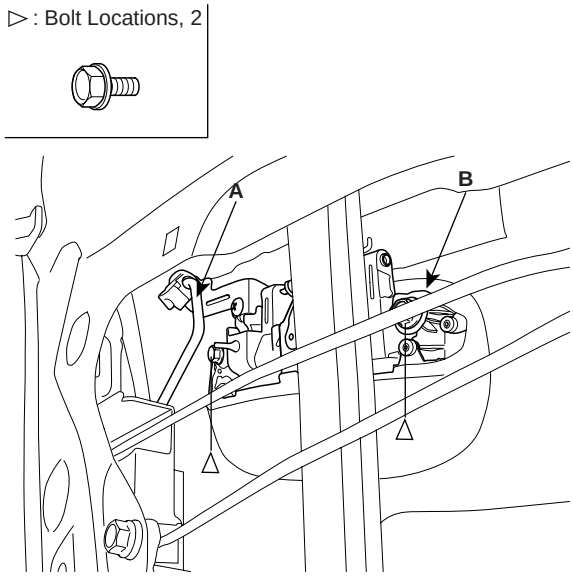
OUT SIDE HANDLE REPLACEMENT

1. Remove the rear door trim(See page BD- 31).
2. Remove the rear door trim seal.
3. Remove the road cover(A).



BSJE100F

4. After disconnect the out side handle rod(A), Loosen the outsidr handle mounting bolts.
5. Remove the out side handle(B).



BSJE100G

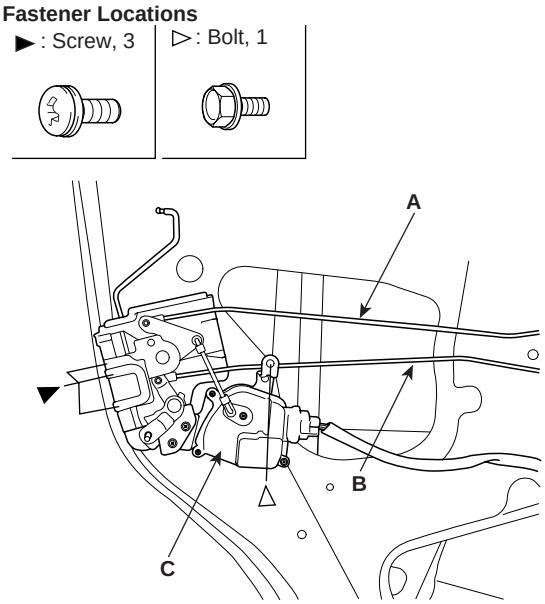
6. Installation is the reverse of removal.

CAUTION

- ***Roll the galss UP DOWN to see if it move freely without binding.***
- ***Make sure door lock and opens properlt.***

REAR DOOR LATCH REPLACEMENT

1. Remove the rear door trim.
2. Remove the door trim seal.
3. Remove the inside handle.
4. Disconnect the lock cable(A), out side handle cable(B).
5. After loosen the latch mounting bolts, remove the latch assmble(C).



BSJE100H

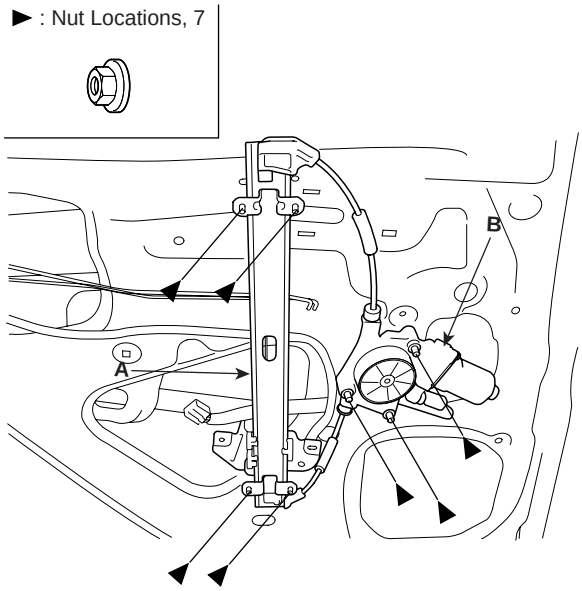
6. Installation is the reverse of removal.

NOTE

- *Make sure the door lock and opens properly.*

DOOR REGULATOR REPLACEMENT

1. Remove the door trim(See page BD- 31).
2. Remove the door trim seal.
3. Remove the window glass(See page BD- 32).
4. After disconnecting window motor connector(B), loosen the door regulator mounting nuts and window mounting nuts.Remove the door regulator(A).



BSJE100I

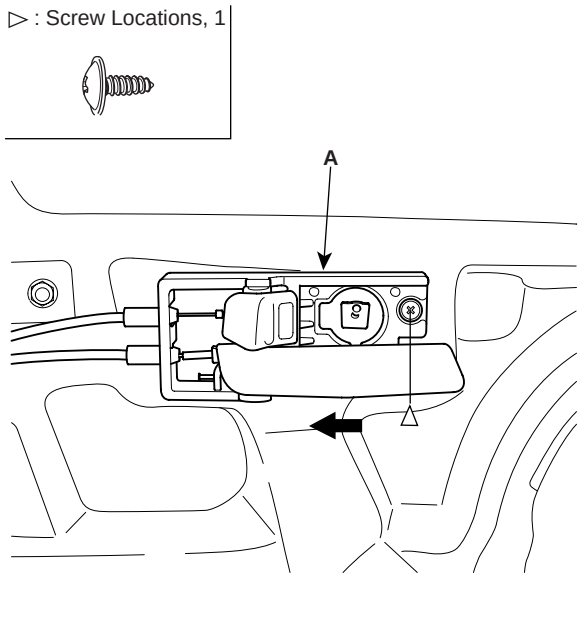
5. Installation is the reverse of removal.

CAUTION

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

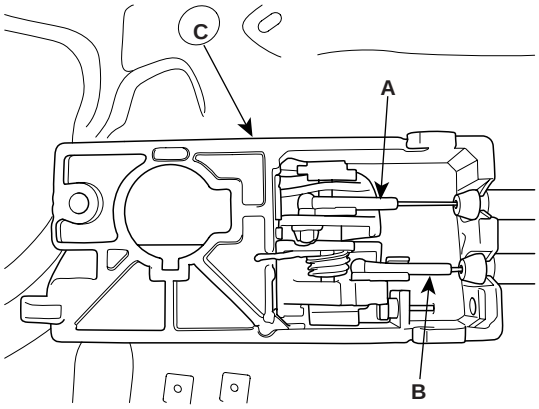
INSIDE HANDLE REPLACEMENT

1. Remove the rear door trim(See page BD- 31).
2. Loose the inside handle (A) mounting screw.
   Push the inside handle rearward to disconnect from the door module.



BSJE090E

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



BSJE090F

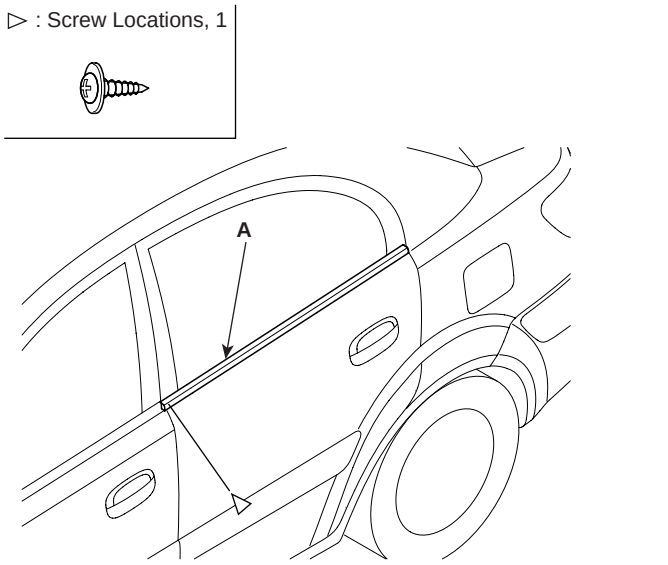
4. Installation is the reverse of removal.

NOTE

- *Make sure the door lock and open properly.*

DOOR BELT WEATHERSTRIP REPLACEMENT

1. Remove the rear door trim(See page BD- 31).
2. Remove the door belt weatherstrip(A) after straightening hook of weatherstrip.

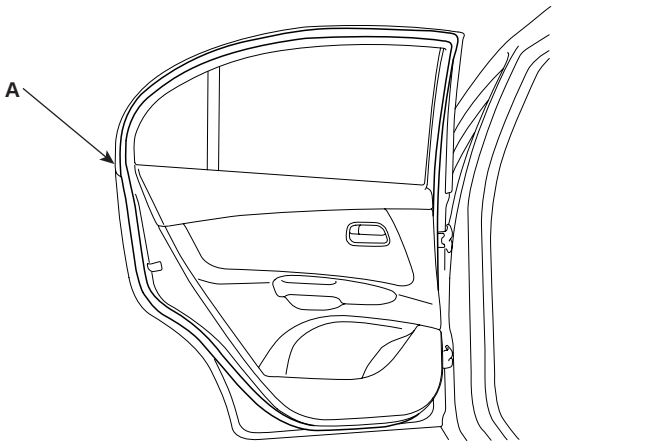


BSJE100K

3. Installation is the reverse of removal.

DOOR WEATHERSTRIP REPLACEMENT

1. Remove the door weatherstrip(A).



BSJE100L

2. Installation is the reverse of removal.

ADJUSTMENT EFEEC512

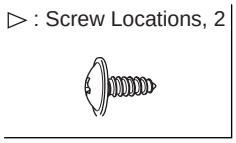
GLASS ADJUSTMENT

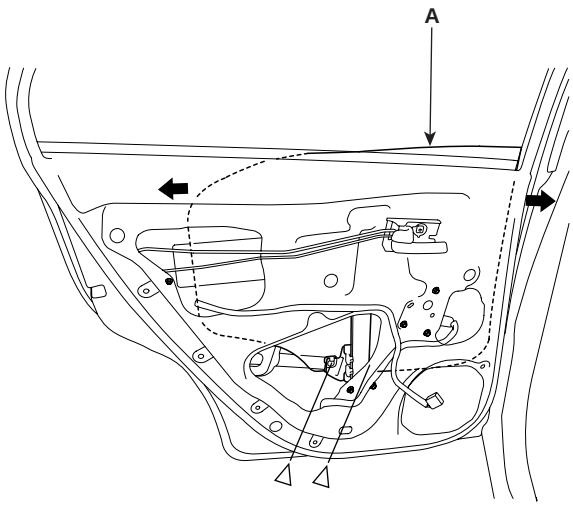
NOTE

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

1. Remove the following parts.
   - Door trim.

2. Carefully move the glass (A) until you can see the glass mounting bolts, then loosen them.





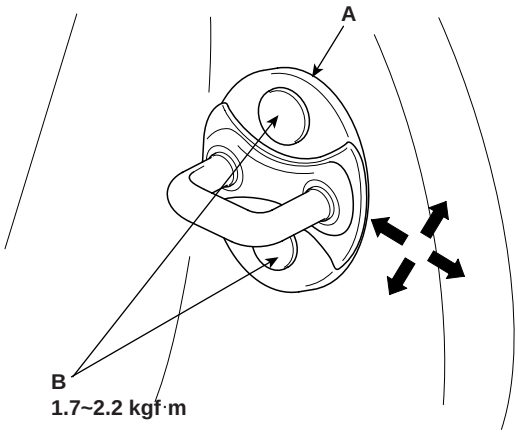
BSJE100M

3. Check that the glass moves smoothly.

DOOR STRIKER ADJUSTMENT

Make sure the door latches securely without slamming it. If necessary, adjust the striker (A) : The strike nuts Are fixed. The strike 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(A).



BSJE090P

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.

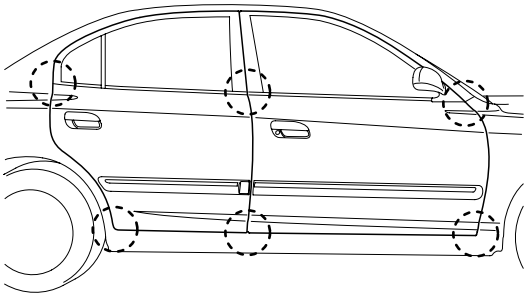
6. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit. If the door latches properly, tighten the screws and recheck.

DOOR POSITION ADJUSTMENT

NOTE

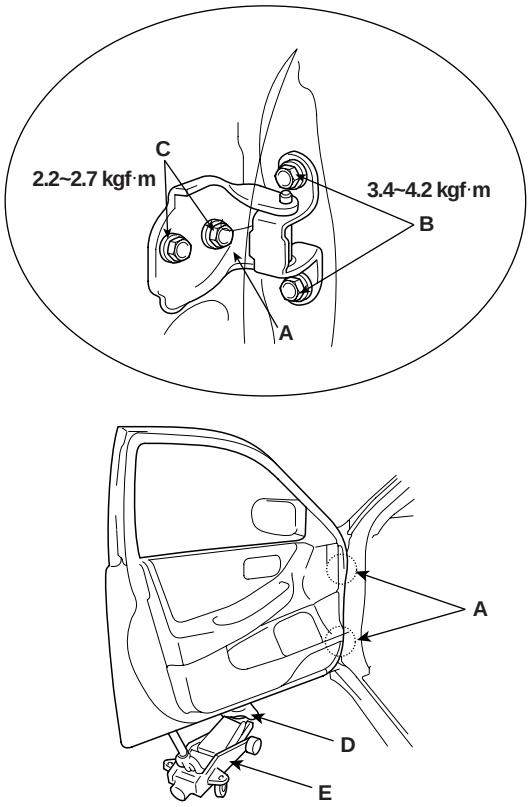
- *After installing the door, check for a flush fit with the Body, then check for equal gaps between the front, Rear, and bottom, door edges and the body. CheckThat the door and body edges are parallel. Before Adjusting, replace the mounting bolts.*

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



BSJE090Q

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



BSJE090R

3. Check that the door and body edges are parallel.
4. Grease the pivot portions of the hinges indicated by the arrows.
5. Check for water leaks.

BODY SIDE MOLDINGS

REPLACEMENT E0C703BD

FRONT MUD GUARD AND WHEEL GUARD

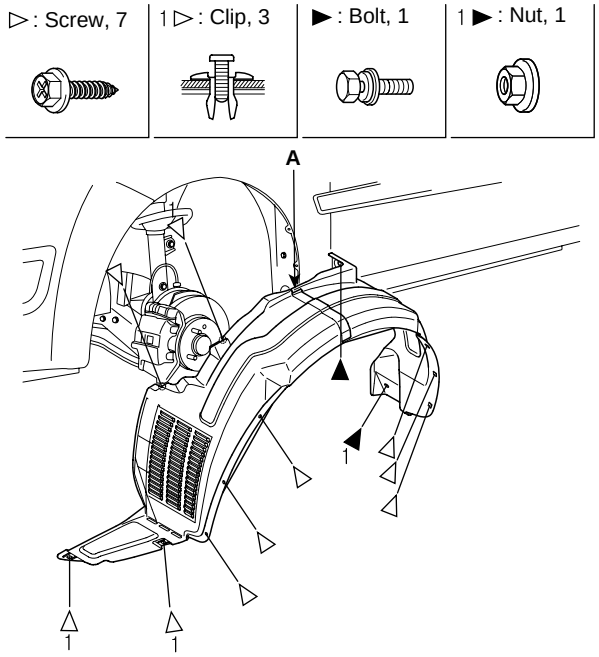
NOTE

- *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.*
- *Take care not to scratch the body surface.*

1. Remove the wheel guard, mud guard(A).

Fastener Locations

▷: Screw, 7 | 1▷: Clip, 3 | ▶: Bolt, 1 | 1▶: Nut, 1



BSJE110A

2. Installation is the reverse of removal.

REAR MUD GUARD AND WHEEL GUARD

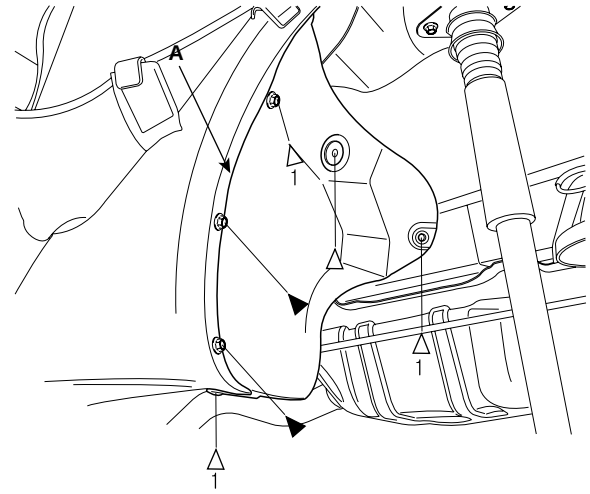
NOTE

- *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.*
- *Take care not to scratch the body surface.*

1. Remove the wheel guard(A).

Fastener Locations

▶: Screw, 2 | ▷: Nut, 1 | 1▷: Clip, 3



BSJE110B

2. Installation is the reverse of removal.

SIDE GARNISH AND SIDE SILL REPLACEMENT

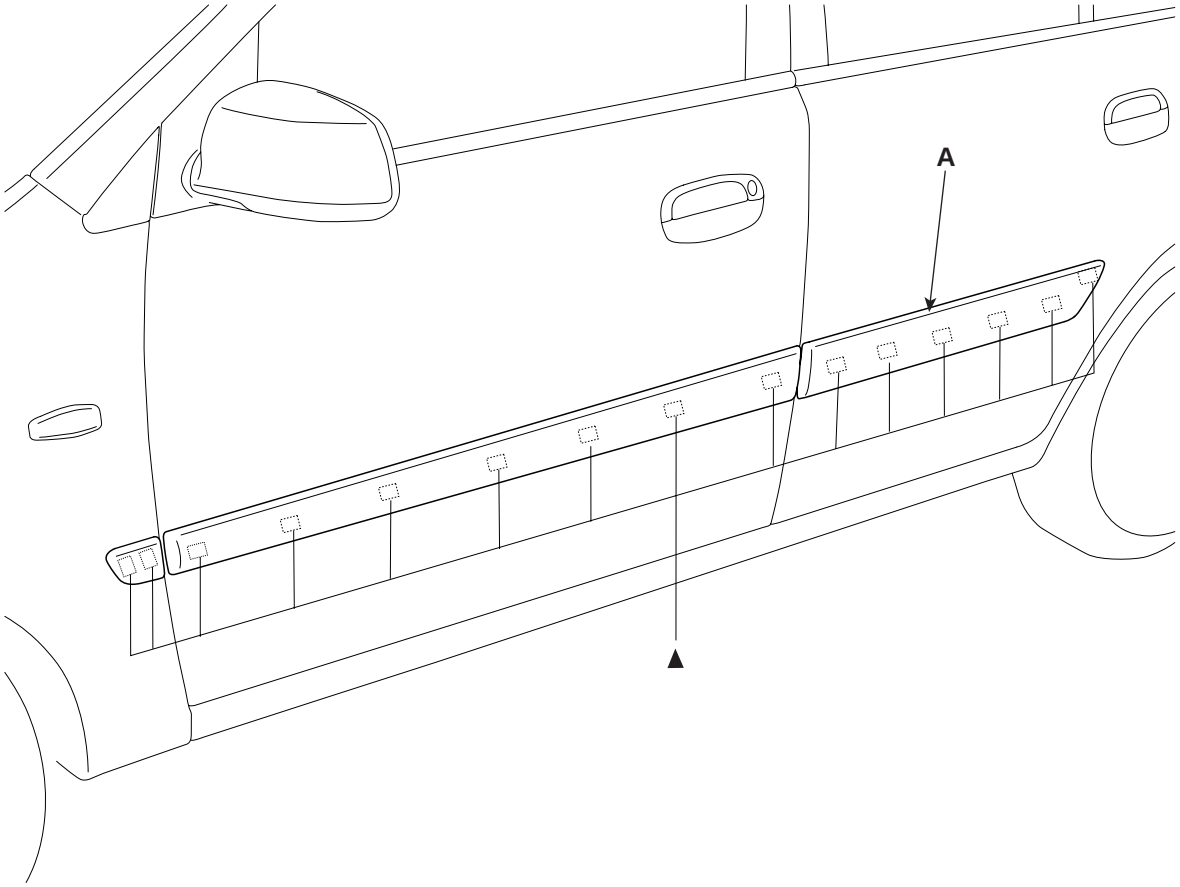
NOTE

- *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.*
- *Take care not to scratch the body surface.*

1. Remove the side garnish(A).
2. Installation is the reverse of removal.

► : Clip Location, 15

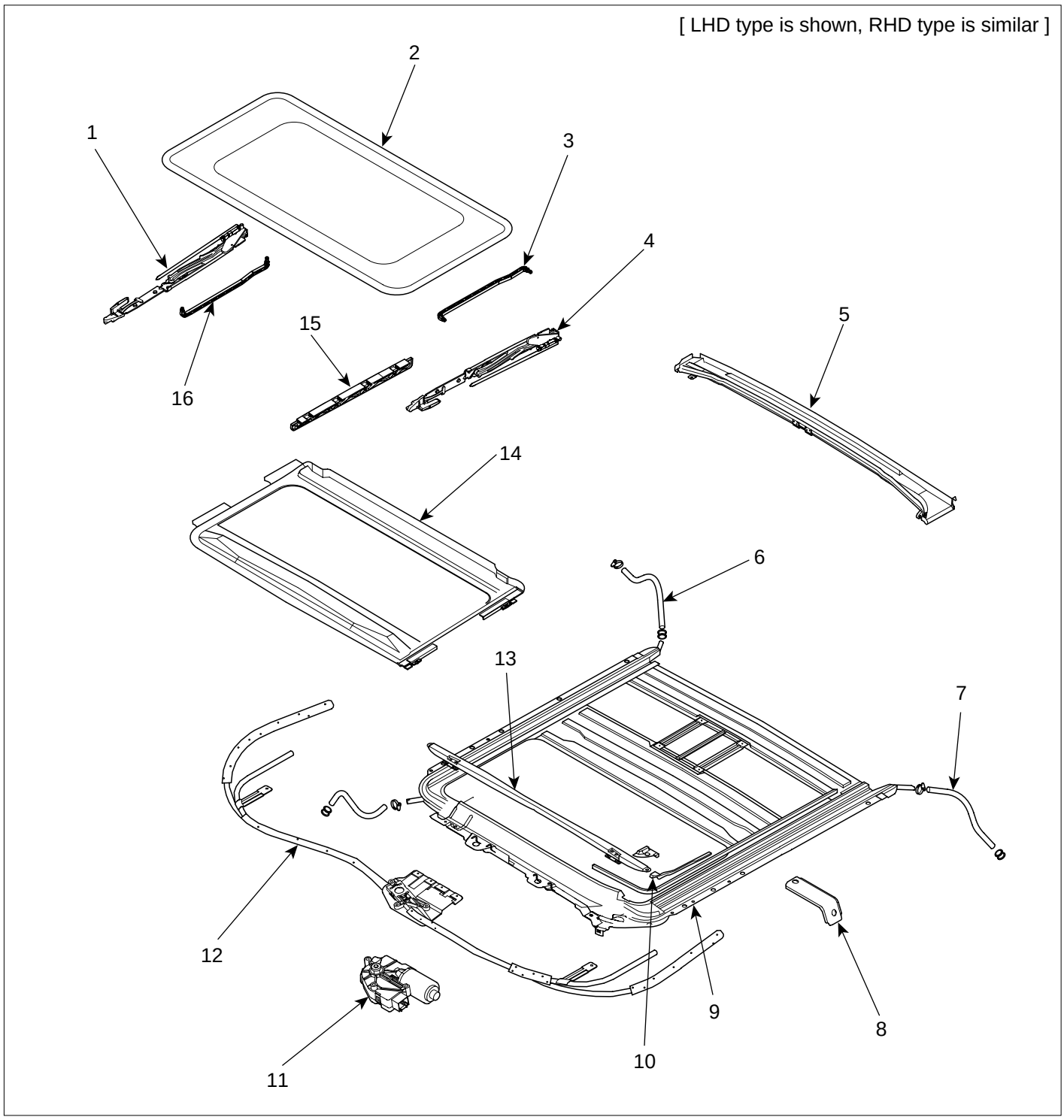
This illustration is shown the LHD type, RHD type is symmetrical



BSJE110C

SUN ROOF

COMPONENTS EE197002



1. Guide assemble
2. Glass
3. Drip link
4. Guide assemble
5. Drip rail
6. Drain hose
7. Drain hose
8. Set bracket
9. Frame
10. Defector link
11. Motor
12. Drive unit
13. Defector
14. Sunshade
15. Decoration cover

BSJE170A

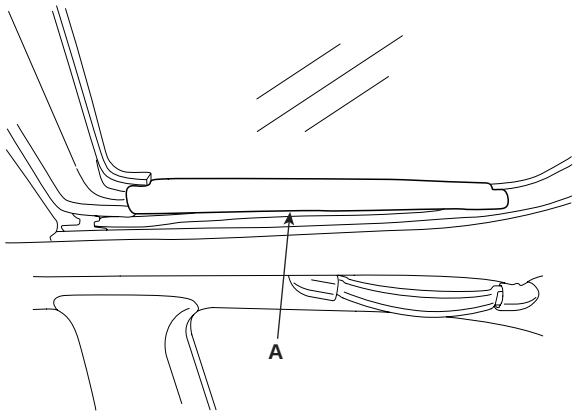
REPLACEMENT EBD0CE0A

GLASS REPLACEMENT

NOTE

- *Put on glove to protect your hands.*

1. Remove both decoration cover (A).

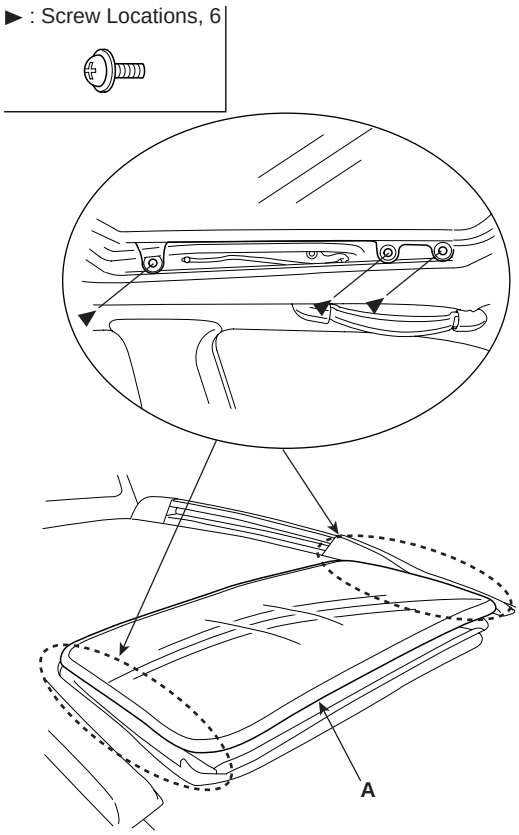


BSJE170E

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

NOTE

- *Do not damage the roof panel.*



BSJE170D

3. Installation is the reverse of removal.

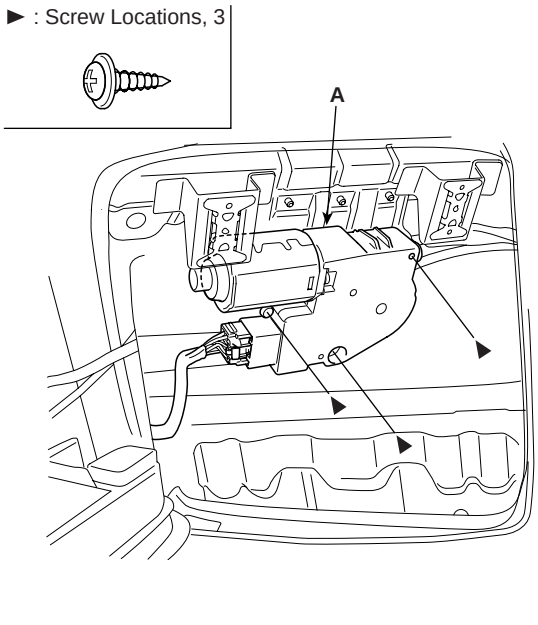
MOTOR REPLACEMENT

1. Remove the over head console(See page BD- 62).

   NOTE

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

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



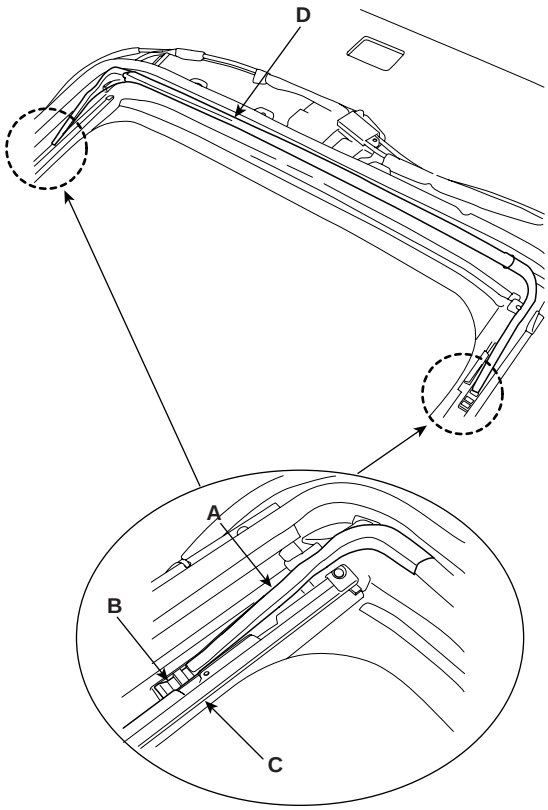
BSJE170J

3. Installation is the reverse of removal.

DEFLECTOR REPLACEMENT

1. Open the glass fully.

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



BSJE170M

3. Installation is the reverse of removal.

SUNROOF ASSEMBLY REPLACEMENT

1. Remove the follows parts.
   - Front and door scuff trim(See page BD- 60).
   - Front, center and rear pillar trim (See page BD- 60).
   - headlining(See page BD- 62).
   - Sunroof glass(See page BD- 41).

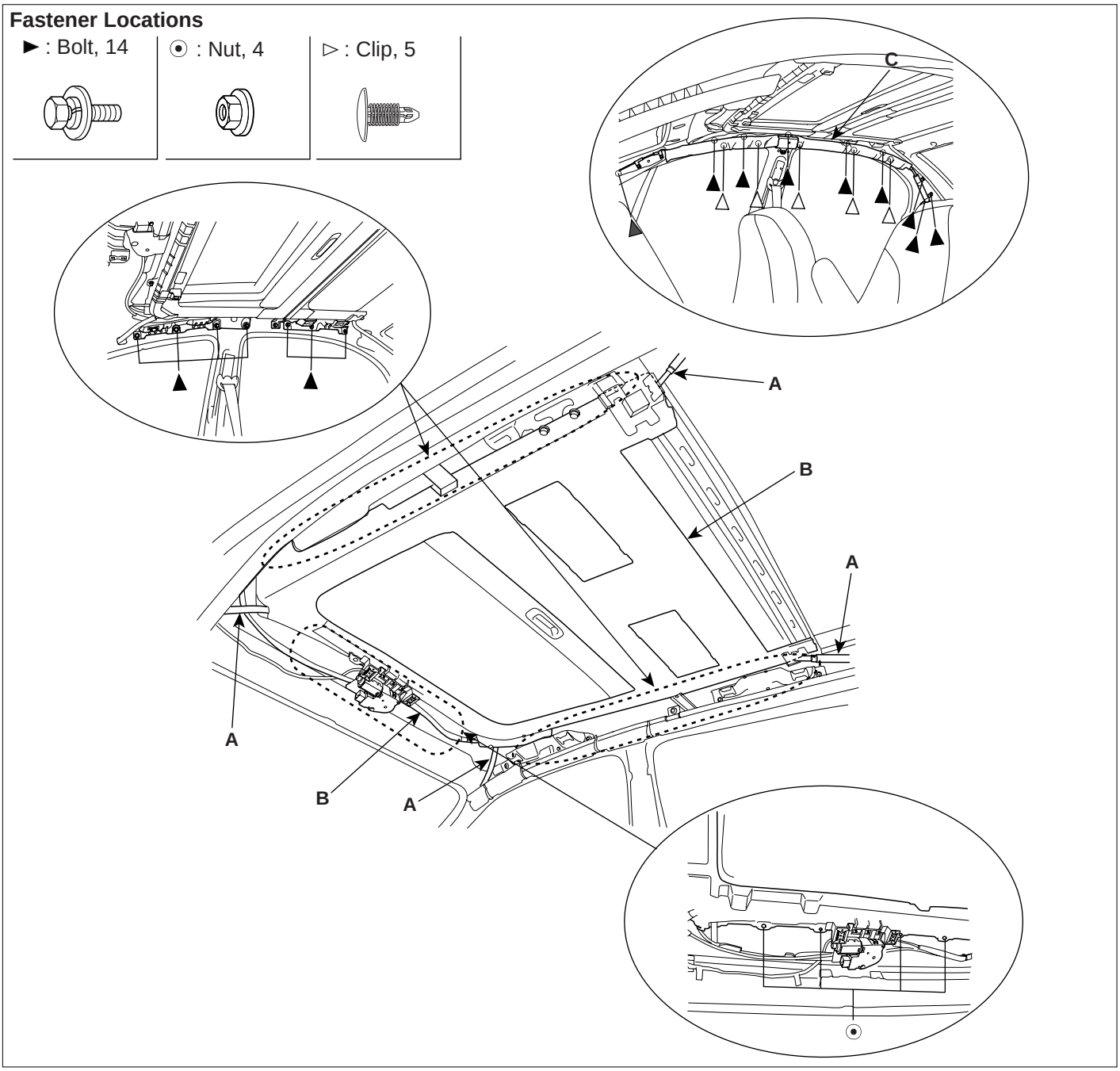
2. Disconnect the drain tubes (A).

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.*

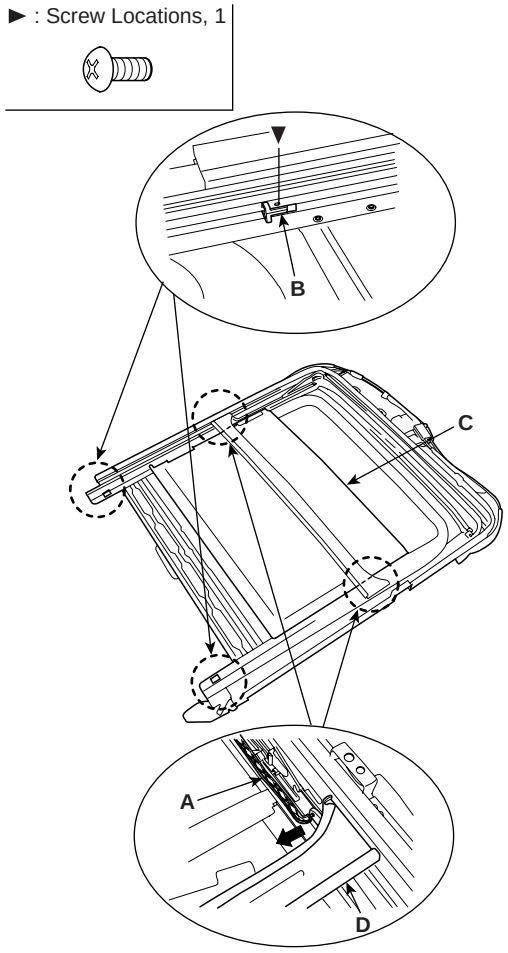
4. Installation is the reverse of removal.



BSJE170I

SUNSHADE AND DRIP RAIL REPLACEMENT

1. Remove the sunroof assembly(See page BD- 43).
2. Remove the drip link (A) and sunshade stopper (B).
3. Remove the sunshade (C) and drip rail (D).

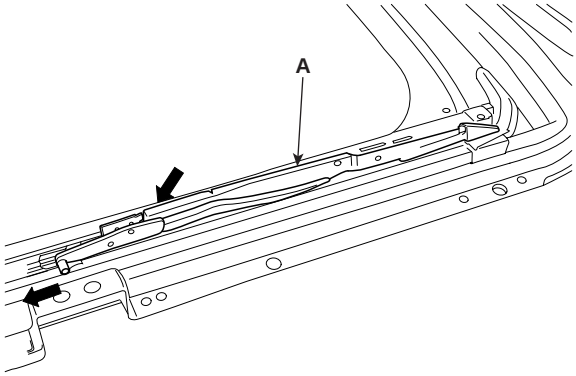


BSJE171D

4. Installation is the reverse of removal.

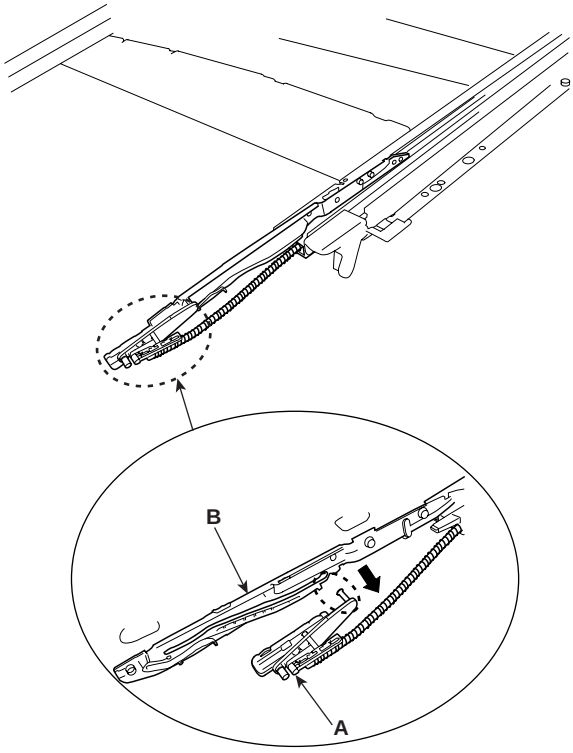
GUIDE ASSEMBLY REPLACEMENT

1. Remove the sunroof assembly(See page BD- 43).
2. Remove a guide assembly (A) after lowering a guide thoroughly by pushing a slide to rear.



BSJE171E

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

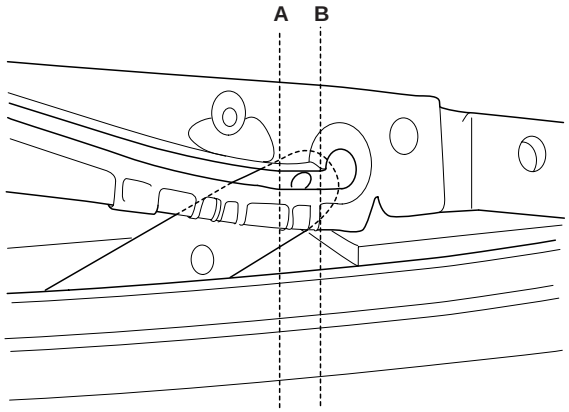


BSJE171H

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.*



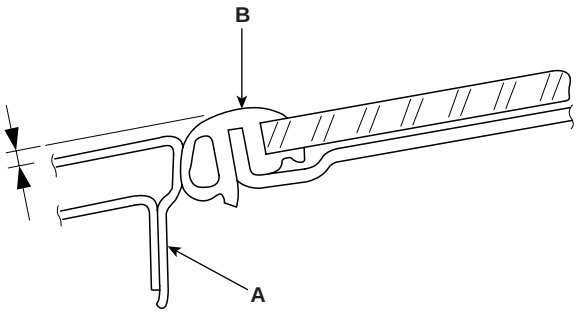
BSJE171I

ADJUSTMENT E0953ECF

HOW TO INITIALIZE

1. Check that the glass has been installed.
   - Finished height adjustment.

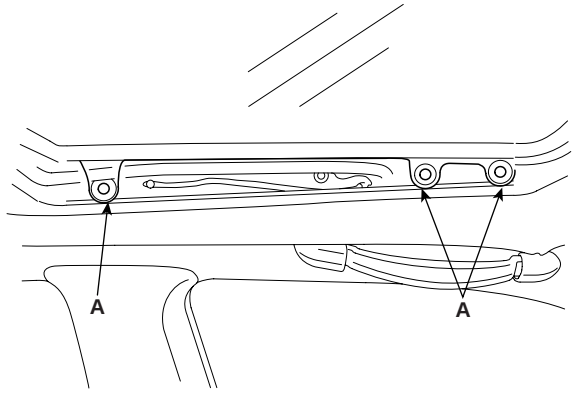
Front : 0 ~ 1.4mm Rear : 1.0 ~ 1.4mm



BSJE171P

2. Push the up switch. (Keep on pushing the switch)
   - The slide moved 5mm forward after 15 seconds.

Tightening Torque : 0.2 ~ 0.4 kgf·m



BSJE170C

3. After moving the slide 5mm forward, turn OFF the switch and push the UP switch (Keeping on pushing the switch with continuous operation)
   - If the operation above is normal condition, the sunroof once and closes.

4. When the sunroof is closed completely, turn OFF the UP switch initialize the motor completely.

WHEN TO INITIALIZE THE MOTOR

1. First operation the vehicle after manufacture it.

2. Initial value is erased or damaged because of short power electric discharge during operation.

3. After using the manual handle.

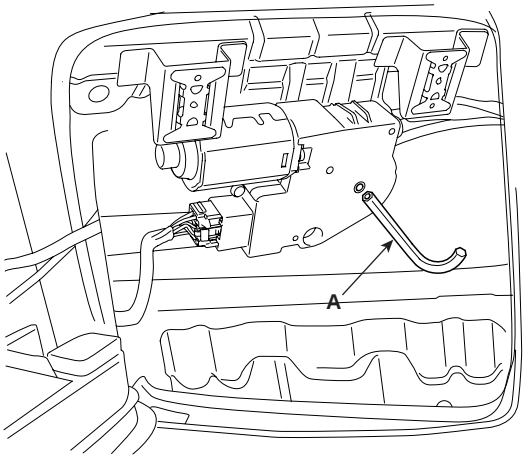
OPERATING THE SUNROOF EMERGENCY HANDLE

1. Use the sunroof emergency handle to close and open the sunroof manually for the following case only.
   - To close the sunroof before driving a vehicle in a rainy day or on the highway if the sunroof cannot be closed due to failure of the sunroof motor or controller.

2. Operating method.
   - Remove the overhead console.
   - 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.
   - Carefully turn the emergency handle clockwise to close the sunroof.
   - After closing the sunroof, wiggle the handle back and forth as you remove the tool from the motor, to ensure the motor clutch reengages.
   - 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.



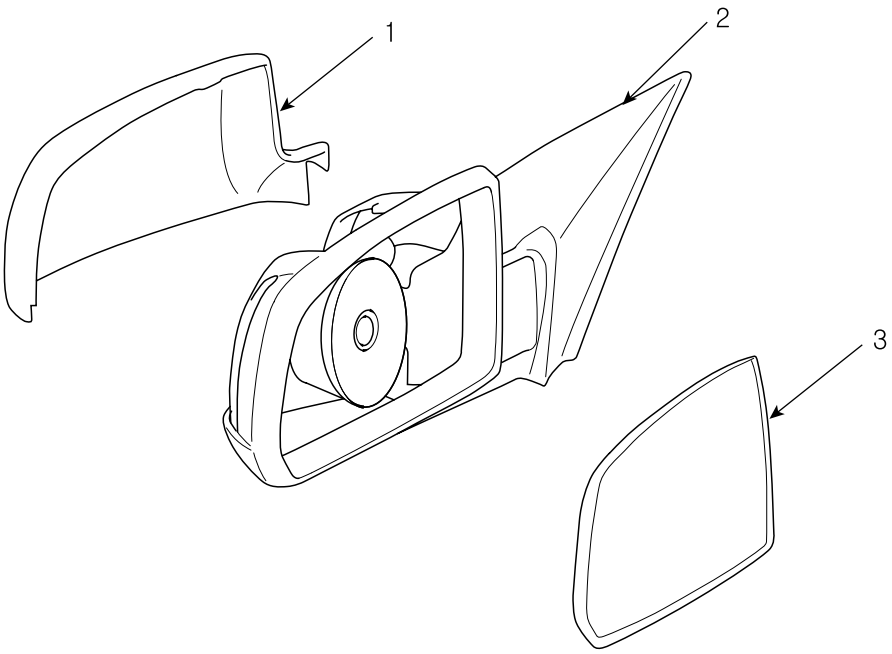
BSJE171N

MIRROR

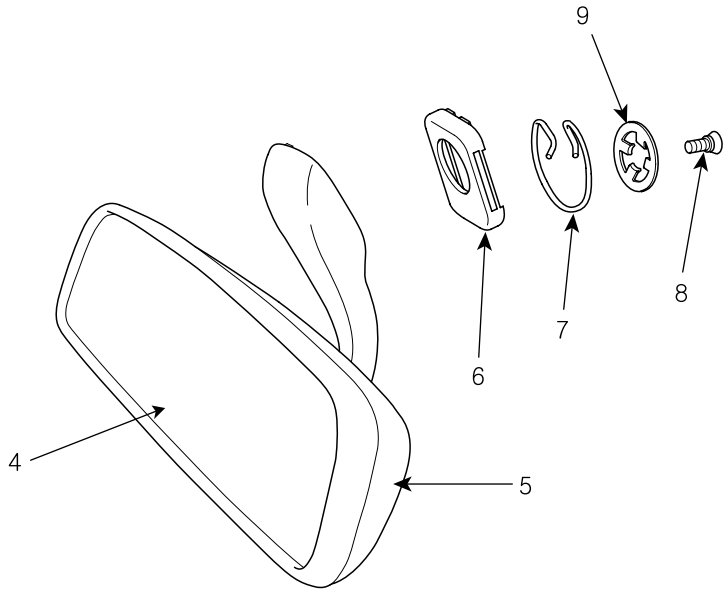
COMPONENETS EAAA14A5

[Outside Rear View Mirror]

This illustration is shown the LHD type, RHD type is symmetrical



[Inside Rear View Mirror]



1. Housing cover
2. Housing
3. Glass
4. Mirror
5. Housing
6. Base
7. Spring
8. Screw
9. Retainer

BSJE130D

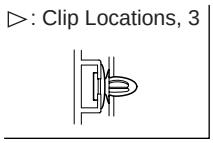
REPLACEMENT ECCADB0C

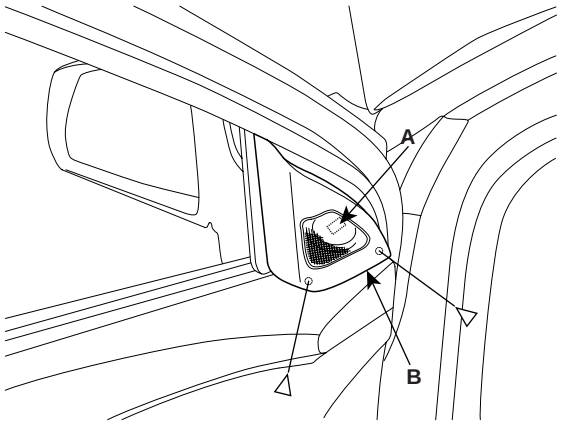
OUTSIDE REAR VIEW MIRROR RELPLACEMENT

NOTE

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

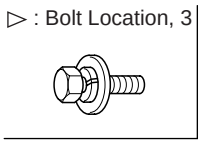
1. Remove the quadrant inner cover (A), then disconnect the connector (B).

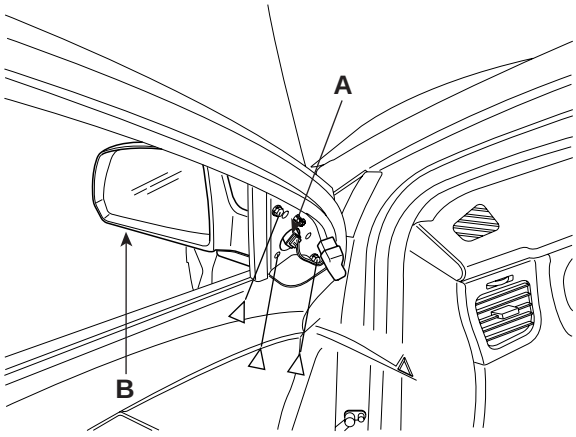




BSJE090A

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





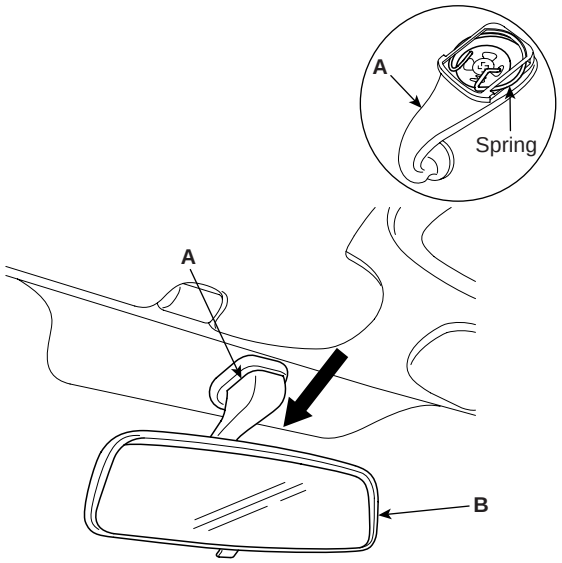
BSJE130A

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.

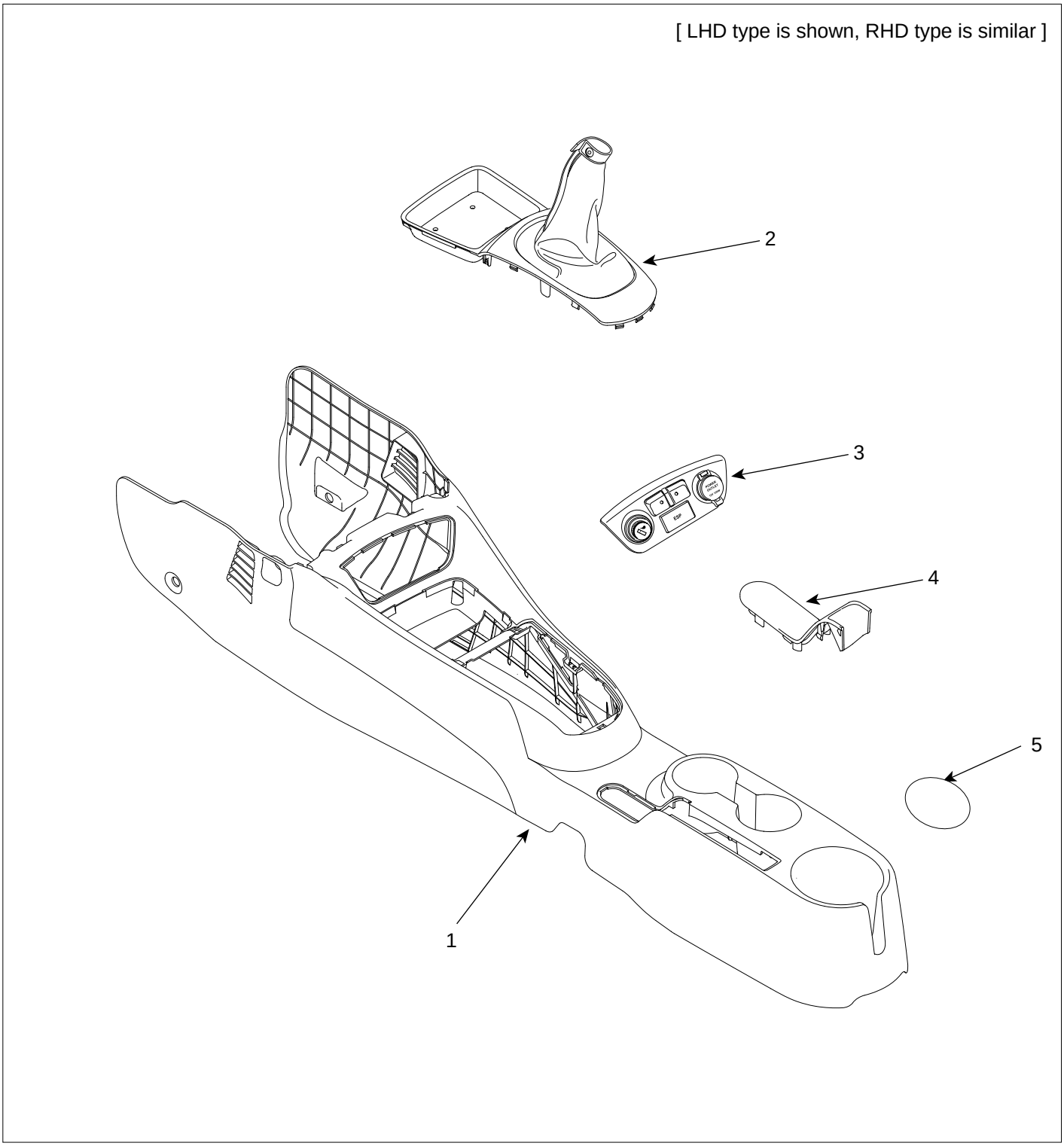


BSJE130B

INTERIOR

CONSOLE

COMPONENTS E4AB5265



1. Floor console
2. Console upper cover
3. Console swich
4. Parking brake cover
5. Cup holder ma

BSJE160A

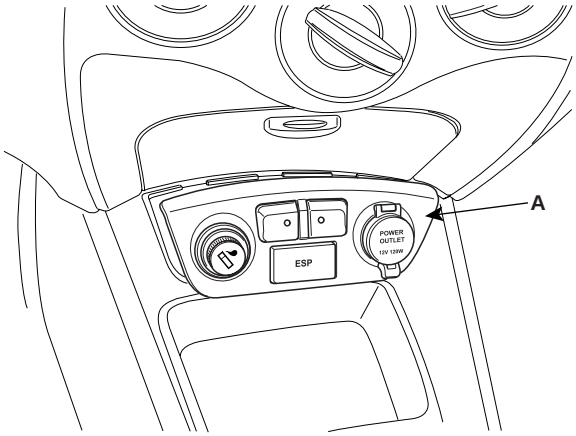
REPLACEMENT ED5B1FE6

FLOOR CONSOLE REPLACEMENT

NOTE

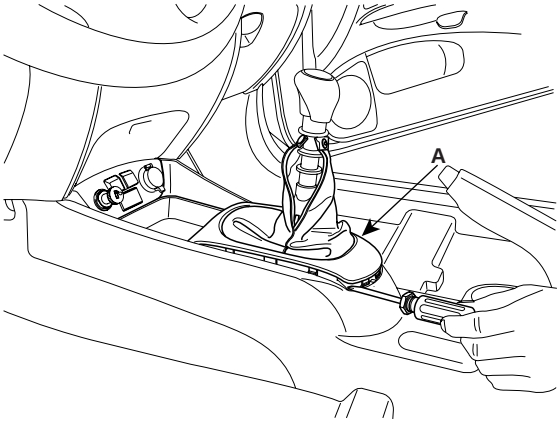
- *When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.*
- *Put on gloves to protect your hands.*

1. Remove the front seet(See page BD- 72).
2. After disconnecting the center cover(A), remove the connector.



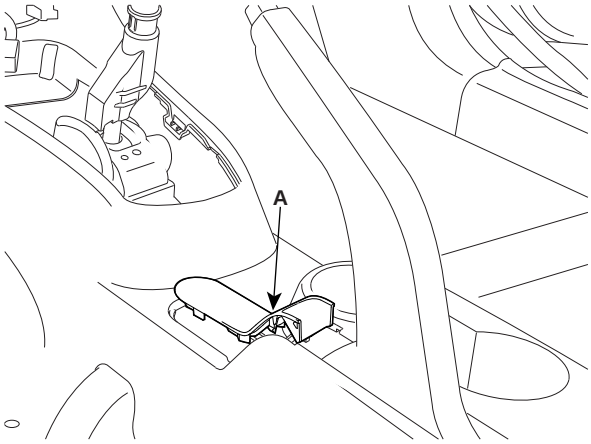
BSJE160C

3. Remove the console upper cover(B).



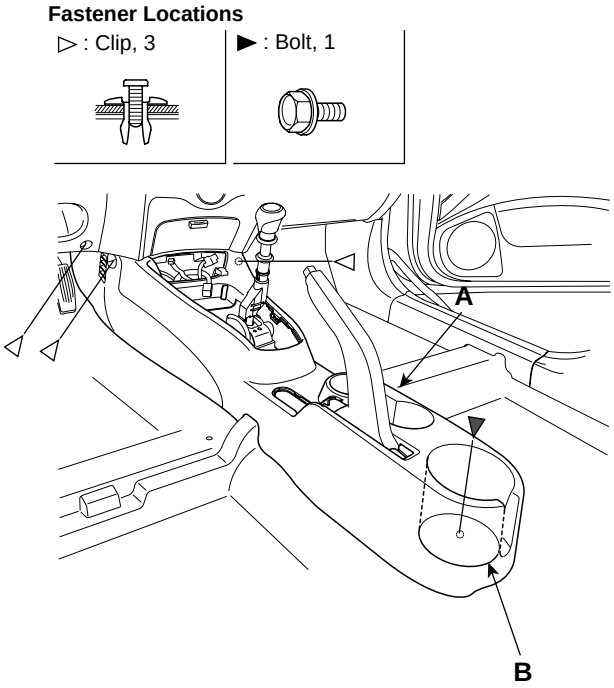
BSJE160B

4. Remove the parking brake cover(A).



BSJE160D

5. Loosning the console mounting screw and clip, remove the console assembly(A).

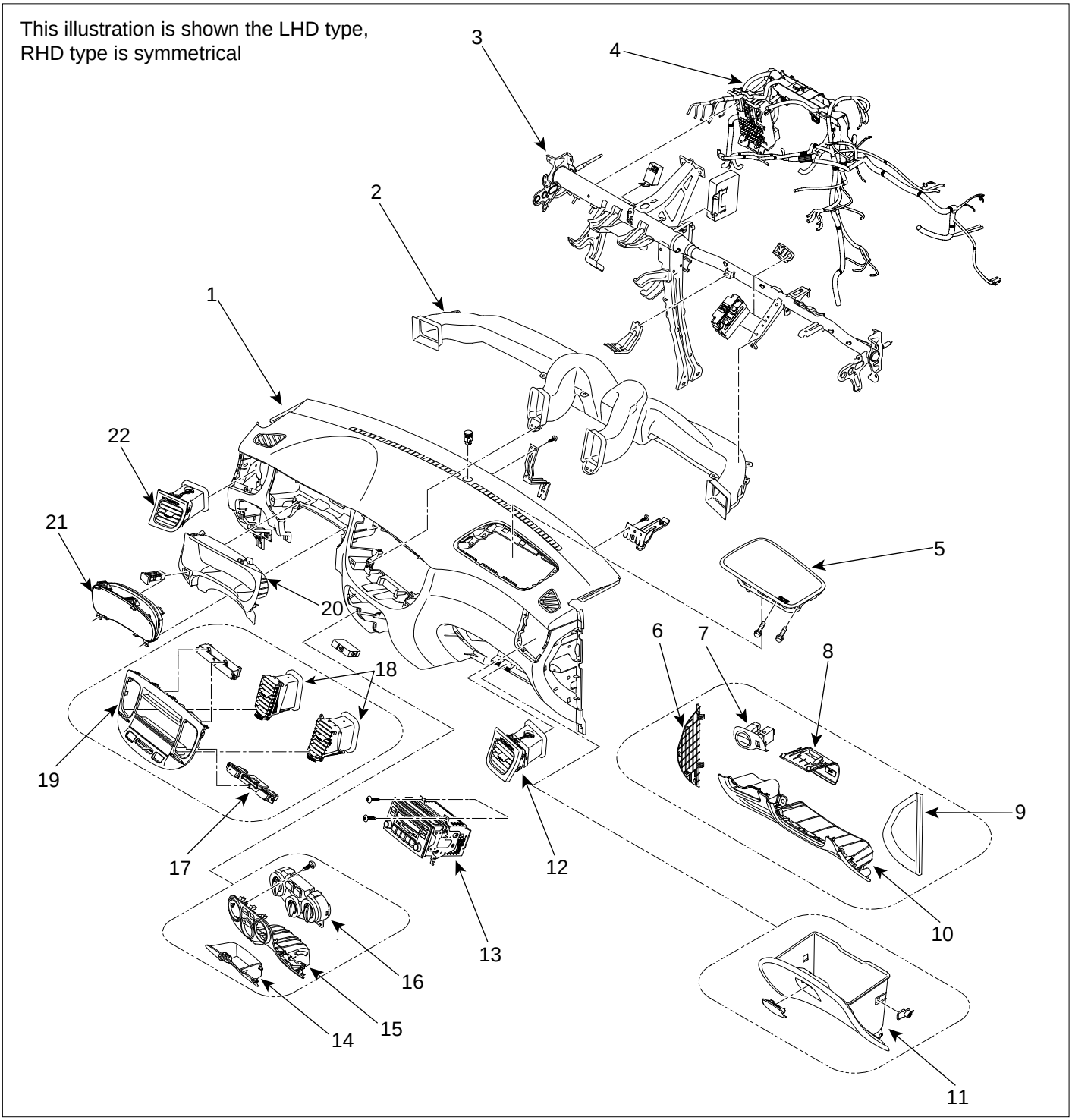


BSJE160E

6. Installation is the reverse of removal.

CRASH PAD

CONPONENTS EB997AE4



1. Crash pad main
2. Air vent
3. Cowl cross bar
4. Main wire harness
5. Air bag moduel
6. Crash pad side panel(Left)
7. Lower crash pad switch
8. Fuse box cover
9. Crash pad side panel(Right)
10. Crash pad lower panel
11. Glove box
12. Side air vent(Right)
13. Audio
14. Center facia lower tray
15. Center facia lower panel
16. Heater control switch
17. Center facia switch
18. Center air vent
19. Center facia upper panel
20. Cluster facia panel
21. Cluster gauge
22. side air vent(Left)

BSJE120A

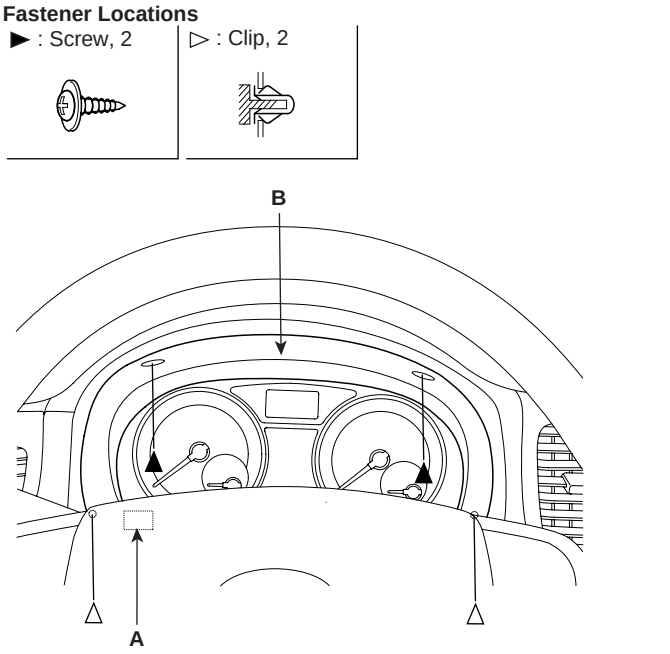
REPLACEMENT EF65FAD1

CLUSTER FACIA PANEL REPLACEMENT

NOTE

- *When prying with a flat-up 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. Disconnet the trip sencor connector(A) then remove the cluster facia panel(B).



BSJE120B

3. Installation is the reverse of removal.

NOTE

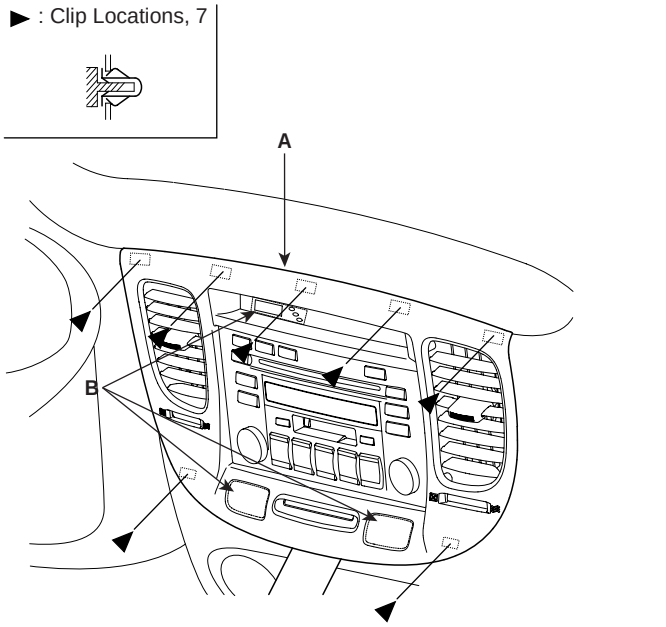
- *Make sure the connector is plugged in properly.*

CENTER FACIA PANEL REPLACEMENT

1. After disconnecting the connector (A), remove the center facia panel (B).

NOTE

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



BSJE120C

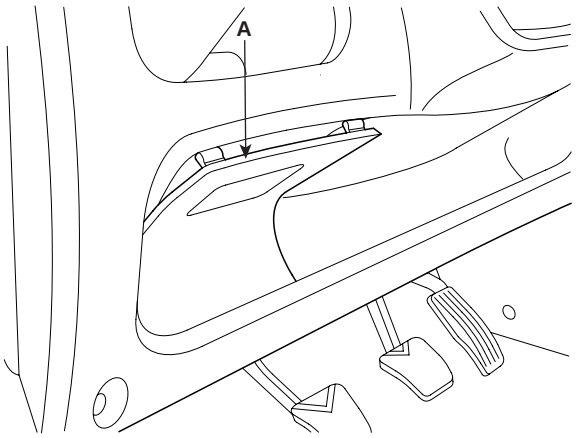
2. Installation is the reverse of removal.

NOTE

- *Make sure the connector is plugged in properly.*

LOWER CRASH PAD PANEL REPLACEMENT

1. Remove the fuse box cover(A).

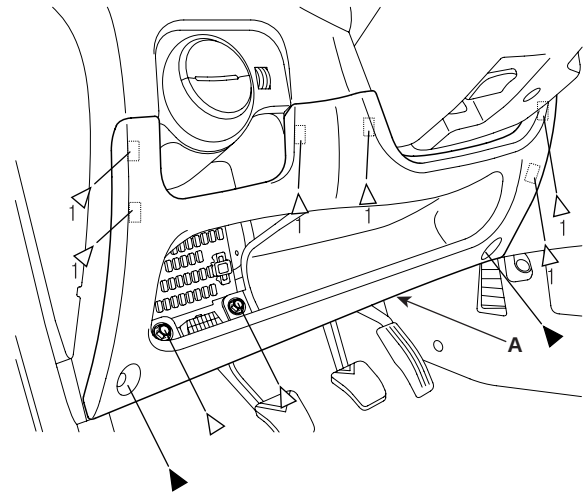


BSJE120D

2. Loosening the crash pad lower panel mounting screw. Remove the lower crash pad panel(A).

Fastener Locations

▷ : Bolt, 2 ▶ : Screw, 2 1 ▷ : Clip, 6

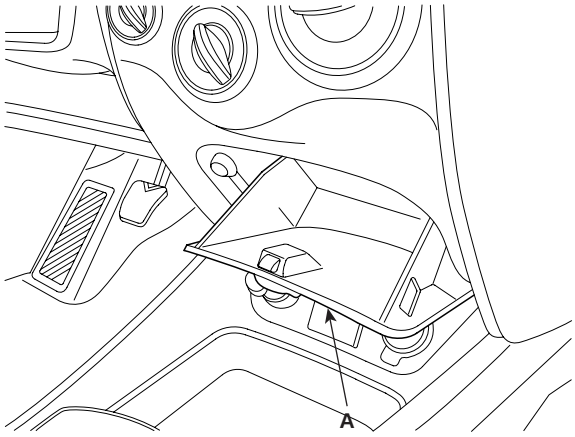


BSJE120E

3. Installation is the reverse of removal.

HEATER CONTROL UNIT REPLACEMENT

1. Remove the center lower tray(A).

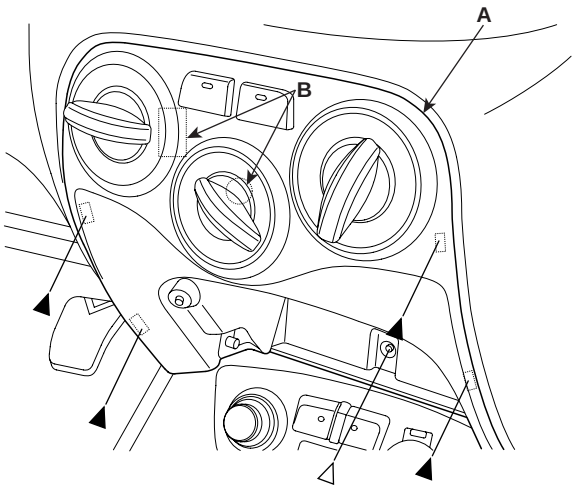


BSJE120F

2. After loosen the center facia lower panel mounting screw, remove the center facia lower panel(A). Disconnect the heater control unit connector(B).

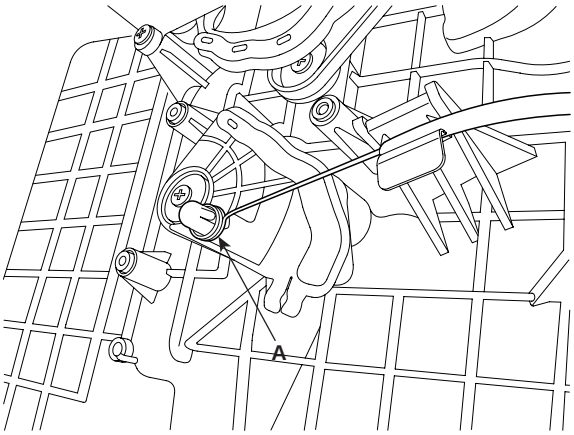
Fastener Locations

▷ : Screw, 1 ▶ : Clip, 4



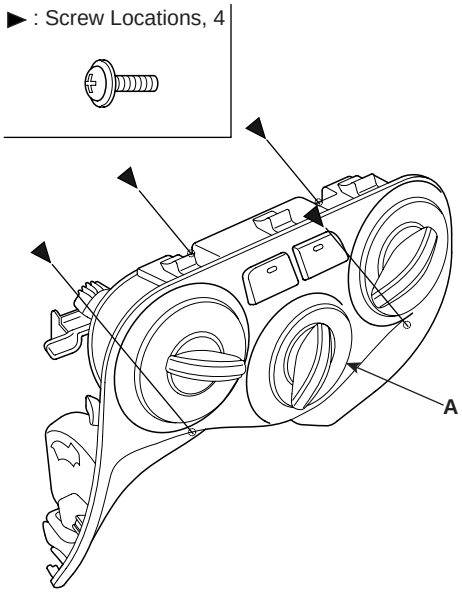
BSJE120G

3. Disconnect the heater control cable(A).



BSJE120H

4. Lossen the heater control unit mounting screw. Remove the heater control unit(A).



BSJE120I

5. Installation is the reverse of removal.

NOTE

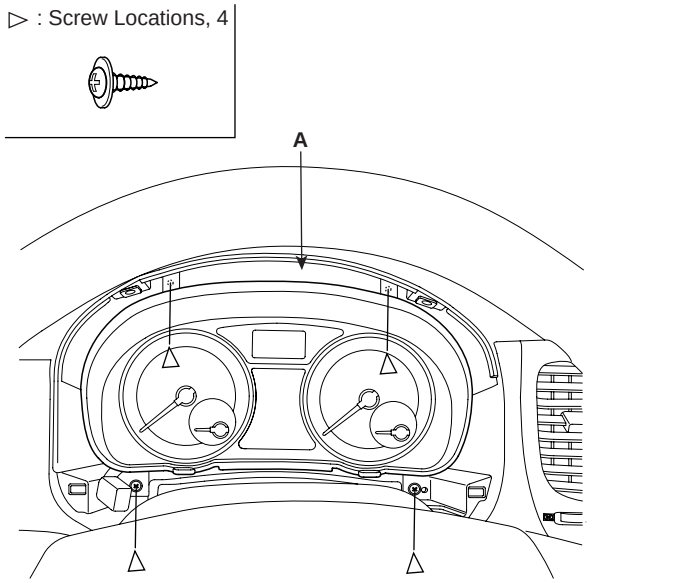
- *Make sure the connector is plugged in properly.*

CLUSTER REPLACEMENT

1. Remove the cluster facia panel(See page BD- 52).
2. Loosen the mounthing screws.

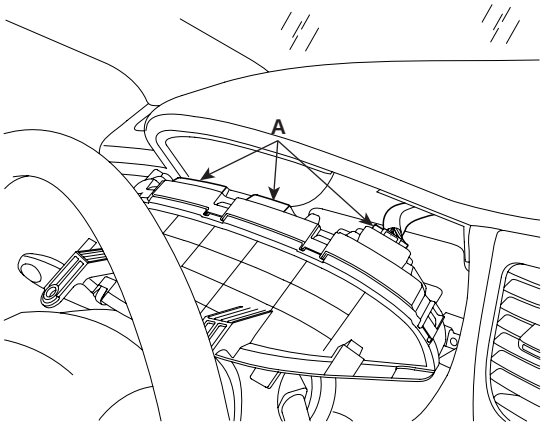
CAUTION

- ***Take care not to drop the galss scratch the glass surface.***



BSJE120J

3. Disconnect the cluster connector (A), then remove the cluster.



BSJE120K

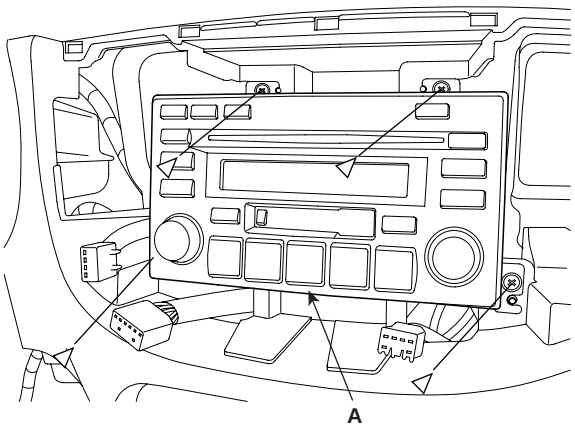
NOTE

- *Make sure the connector is plugged in properly.*

AUDIO ASSEMBLE REPLACEMENT

1. Remove the center facia panel.
2. Loosen the screws.
3. Disconnect the audio connector and antenna cable, then remove the audio assembly (A).

▷ : Screw Locations, 4



BSJE120L

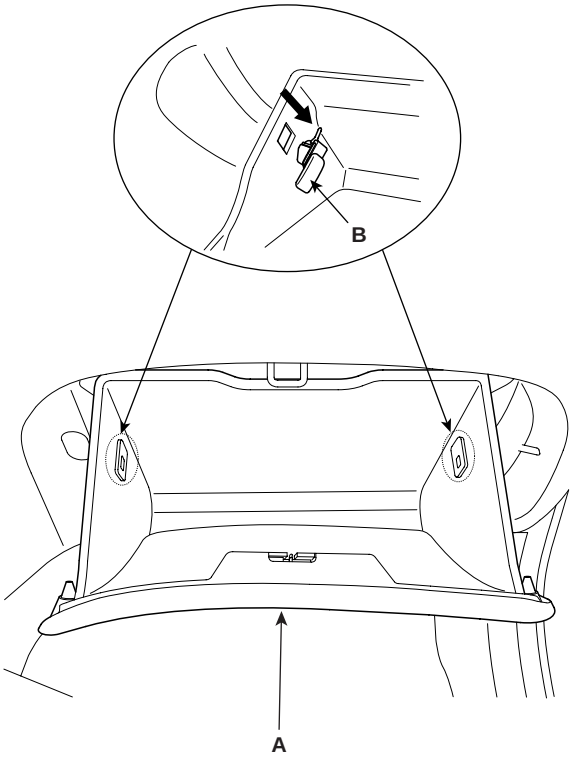
4. Installation is the reverse of removal.

NOTE

- *Make sure the connector is plugged in properly.*

GLOVE BOX REPLACEMENT

1. Disconnect the damper (B) from the glove box (A).



BSJE120M

2. Remove the glove box(A).
3. Installation is the reverse of removal.

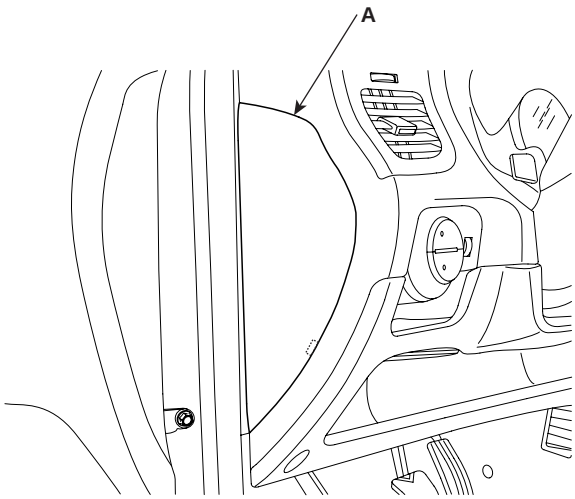
COVER REPLACEMENT

NOTE

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

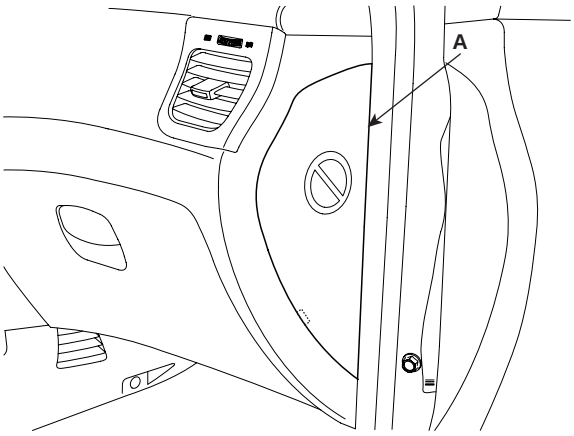
1. Remove the crash pad side cover(A).

DRIVE' S



BSJE120N

PASSENGER' S



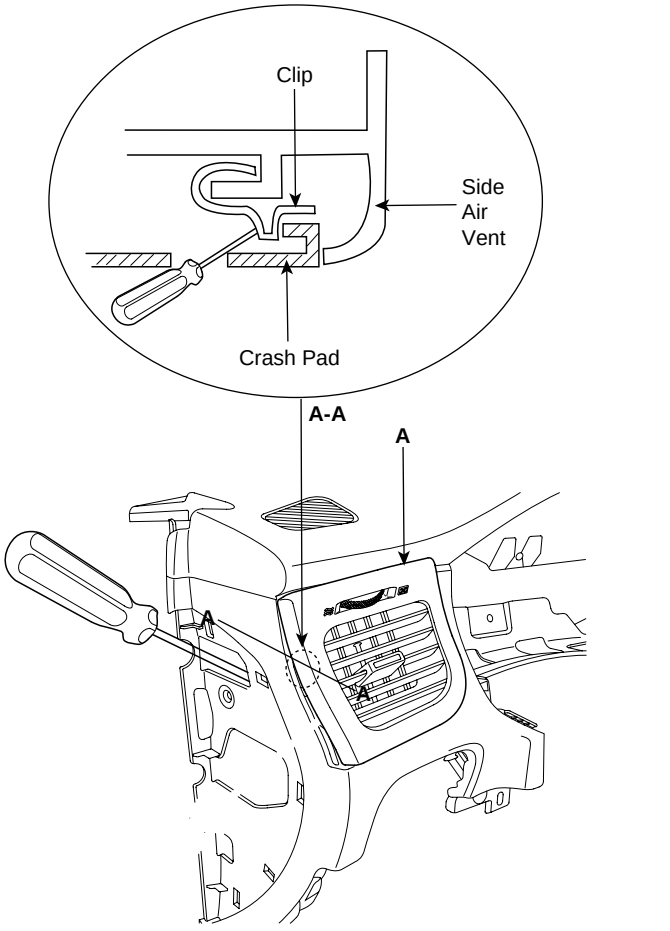
BSJE120O

AIR VENT REPLACEMENT

NOTE

- *When prying with a flat-up 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 crashpad side cover.
2. Using a screw driver remove the air vent(A).

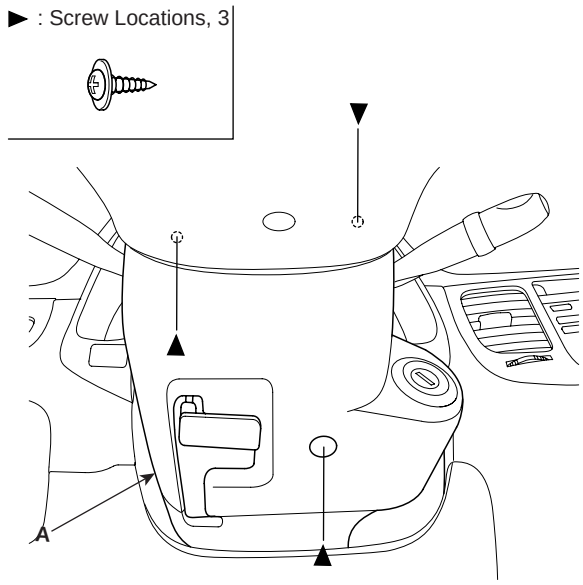


BSJE120P

3. Installation is the reverse of removal.

STEERING COLUMN SHROVND REPLACEMENT

1. After loosening shround mounting screw, remove the shround(A).



BSJE120T

2. Installation is the rever of removal.

CRASH PAD MAIN REPLACEMENT

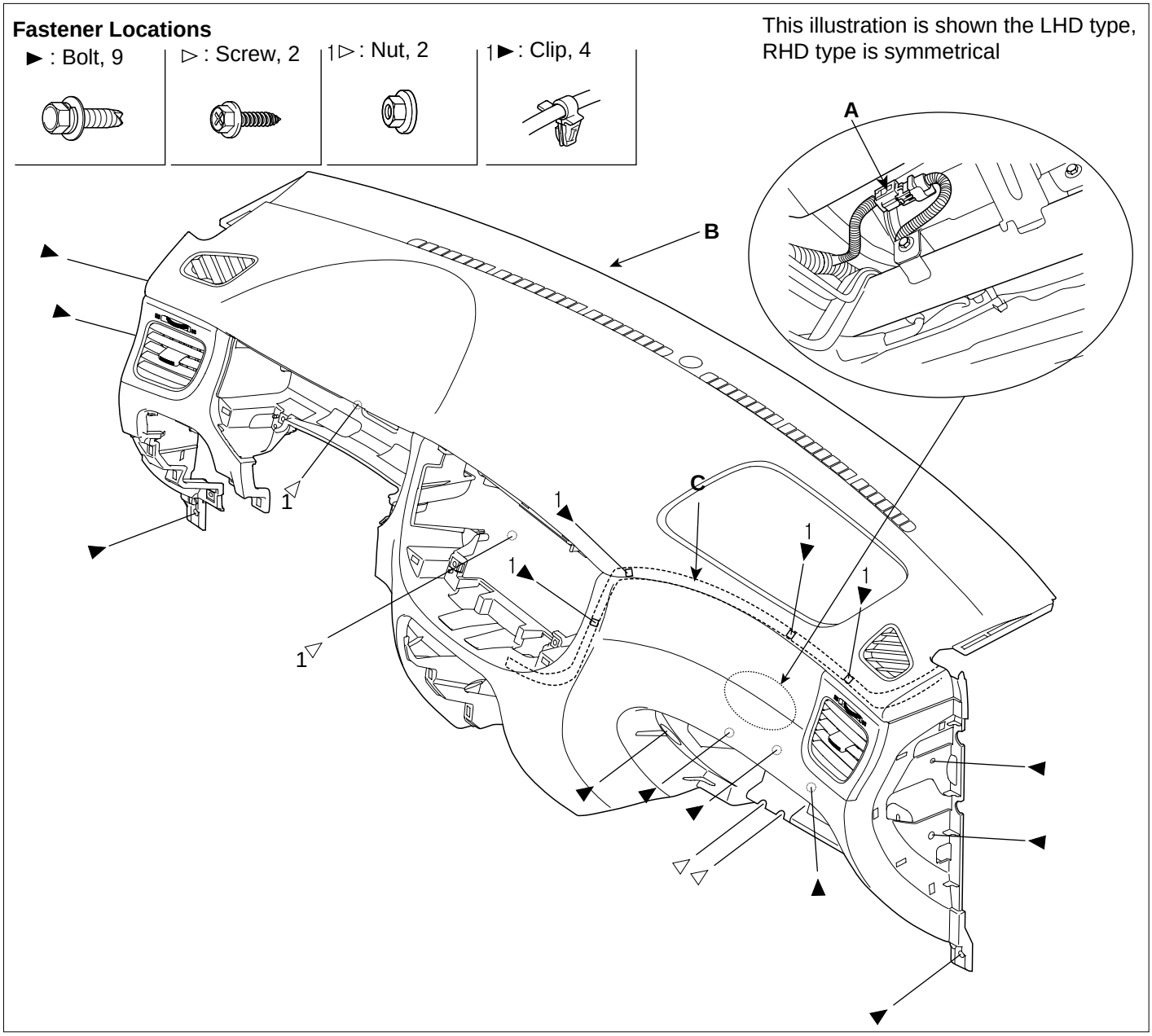
NOTE

- *When prying with a flat-up 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.
   - Front seat assemble(See page BD- 72).
   - Cluster facia panel, cluster (See page BD- 52, 54).
   - Lower crash pad(See page BD- 55).
   - Glove box(See page BD- 55).
   - Side cover(See page BD- 56).
   - Front pillar trim(See page BD- 60).
   - Center facia upper, lower cover.
   - Cowl side trim(See page BD- 60).
2. Disconnect the passenger's air bag connector(A).
3. Losen the bolt's and nuts then remove the main carash pad assemble(B).
4. Installation is the reverse of removal.

NOTE

- *Make sure the crash pad fits on to the guide pins correctly.*
- *Before tihgtening 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.*



BSJE120Q

COWL CROSS BAR ASSEMBLE REPLACE MENT

NOTE

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

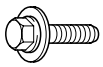
1. Remove the crash pad(See page BD- 58).
2. Disconnect the connectors, after loosening the mounthing bolts and nuts remove the cowl crossbar(A).
3. Installation is the reverse of removal.

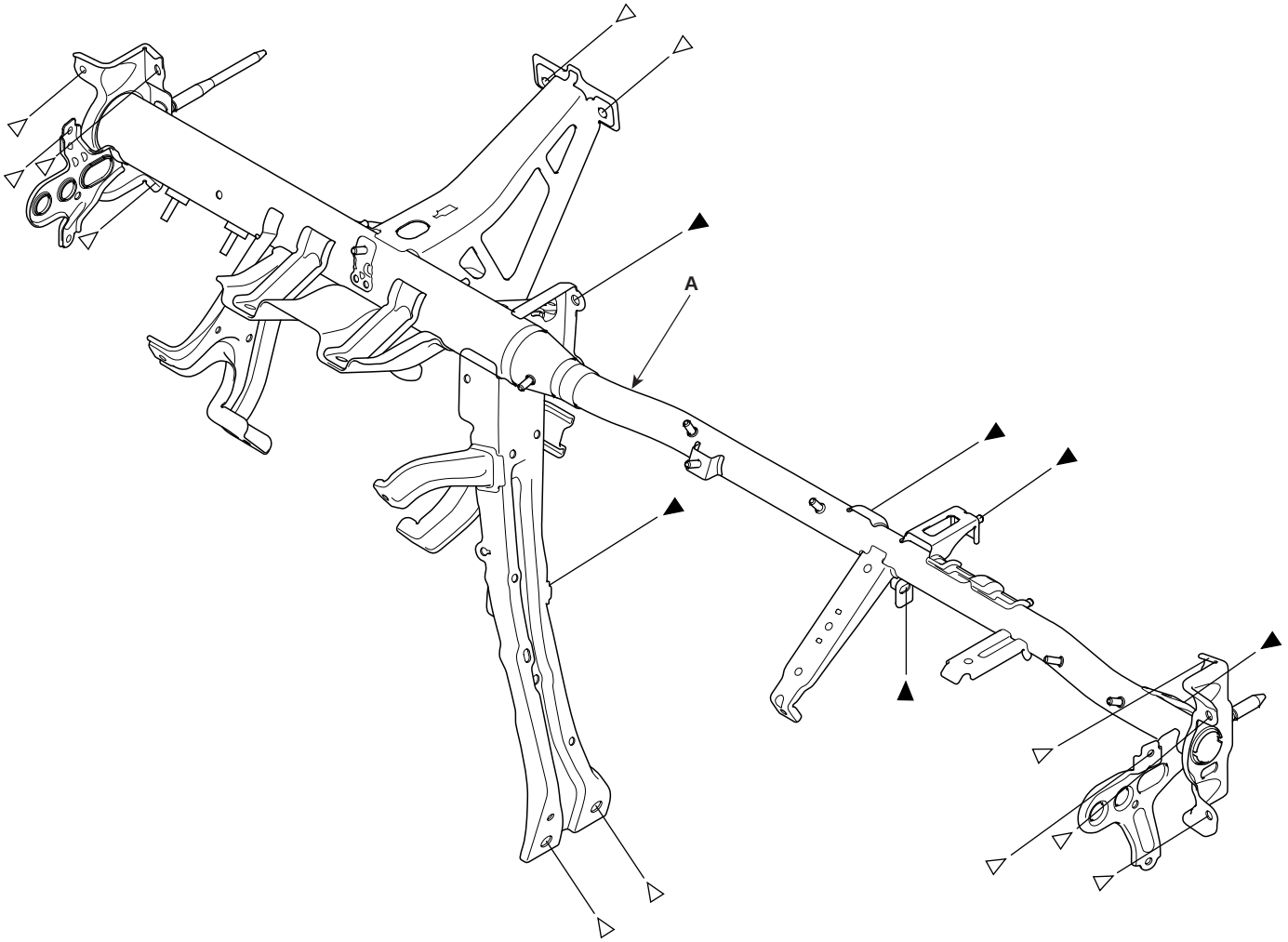
Fastener Locations

[LHD type is shown, RHD type is symmetrical]

► : Nut, 3

▷ : Bolt, 12





BSJE120R

INTERIOR TRIM

REPLACEMENT EFCCAA43

FLOOR AND SIDE TRIM

1. Remove the trim.

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.*

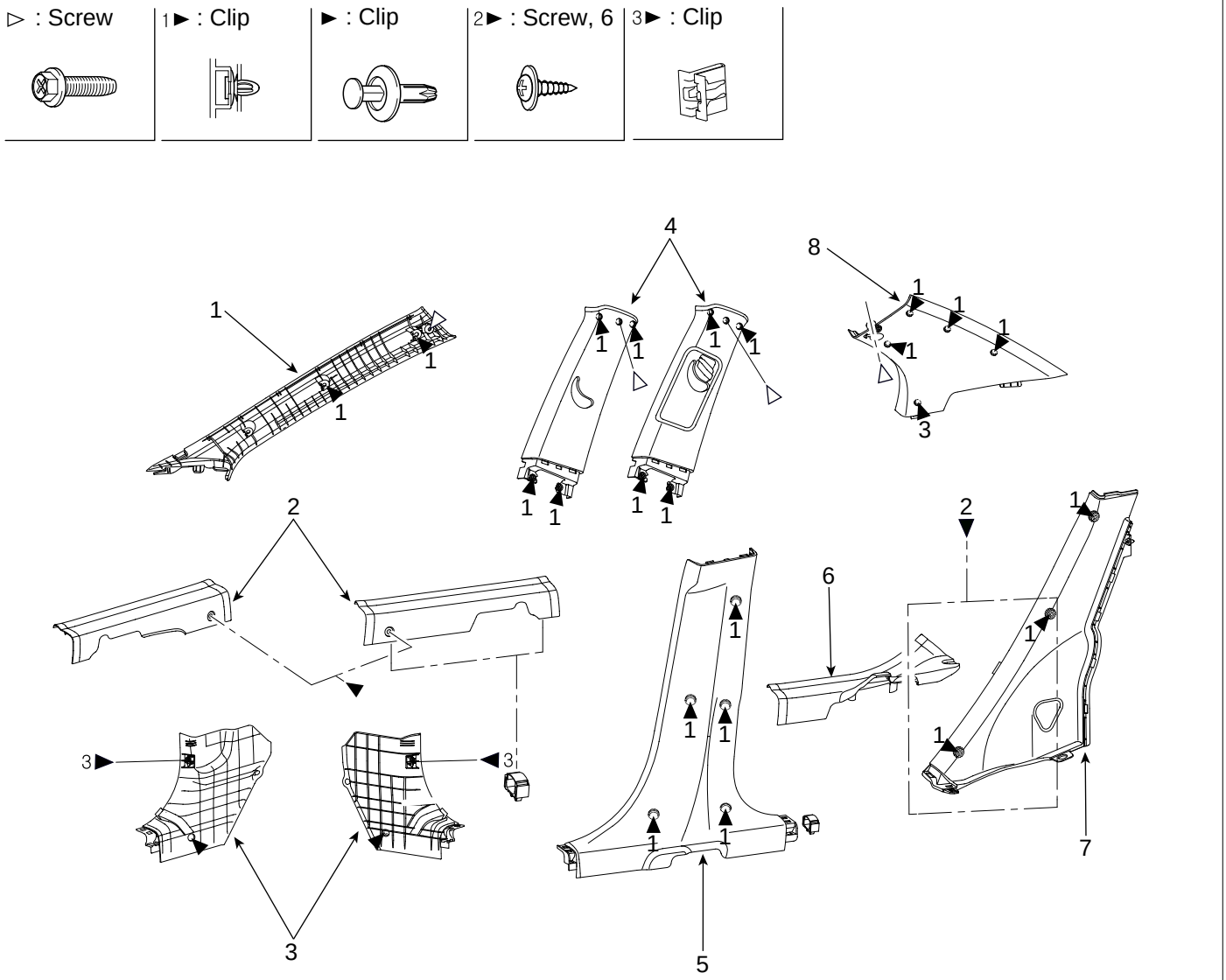
2. Installation is the reverse of removal.

NOTE

- *Replace any damage clips.*

Fastener Locations

▷ : Screw | 1► : Clip | ► : Clip | 2► : Screw, 6 | 3► : Clip



This illustration is shown the LHD type, RHD type is symmetrical

1. Front pillar trim
2. Frint door scuff trim
3. Cowl side trim
4. Center piller trim
5. Center piller lower trim
6. Rear door scuff trim
7. Rear wheel house trim
8. Rear piller trim

BSJE210A

TRUNK TRIM

1. Remove the trunk trim.

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.*

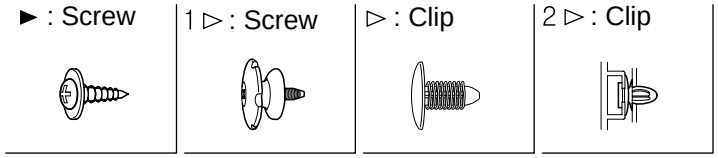
2. Installation is the reverse of removal.

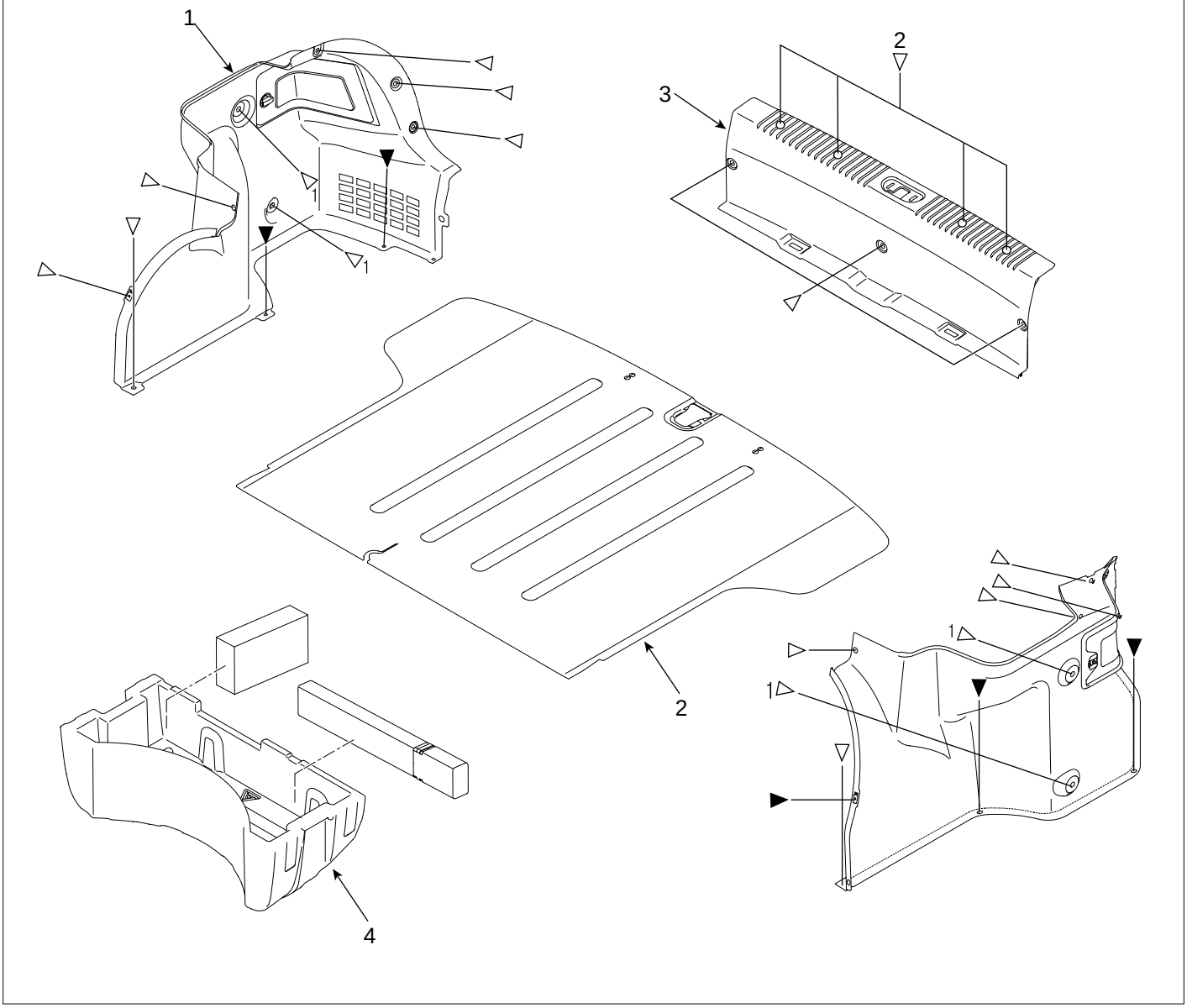
NOTE

- *Replace any damage clips*

Fastener Locations

[LHD type is shown, RHD type is similar]





1. Luggage side trim
2. Luggage flower
3. Rear tranverse trim
4. Luggage tray

BSJE200A

ROOF TRIM

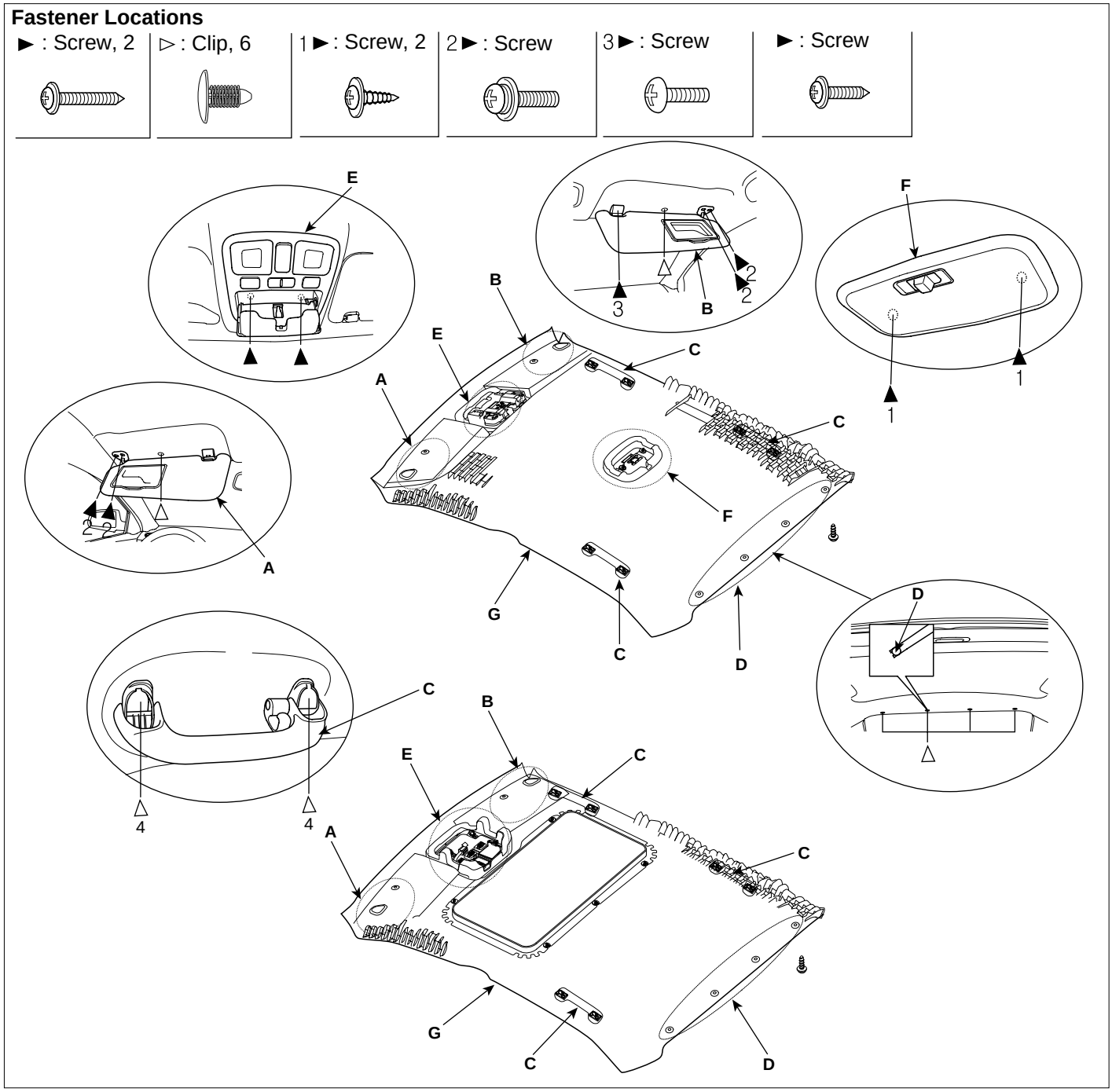
1. Remove the following items.
   - Sunvisor(A),(B).
   - Over head console(E).
   - Room lamp(F).
   - Assist handle(C).

2. Remove the roof trim.

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

3. Installation is the reverse of removal.

   NOTE
   - *Replace any damage clips.*



BSJE180A

PACKAGE TRAY

1. Remove the package trim.

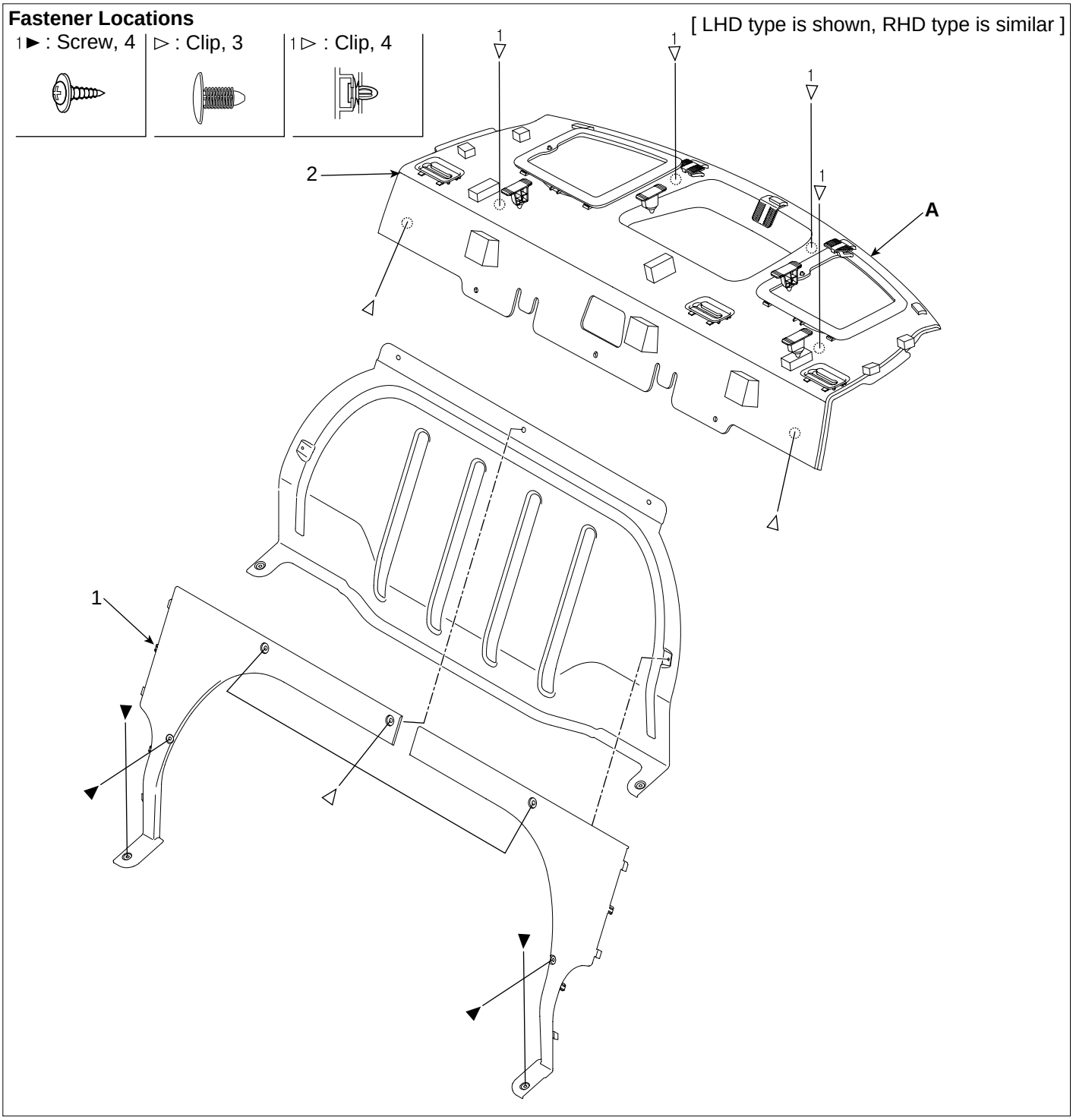
NOTE

- *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.*

2. Installation is the reverse of removal.

NOTE

- *Replace any damage clips.*



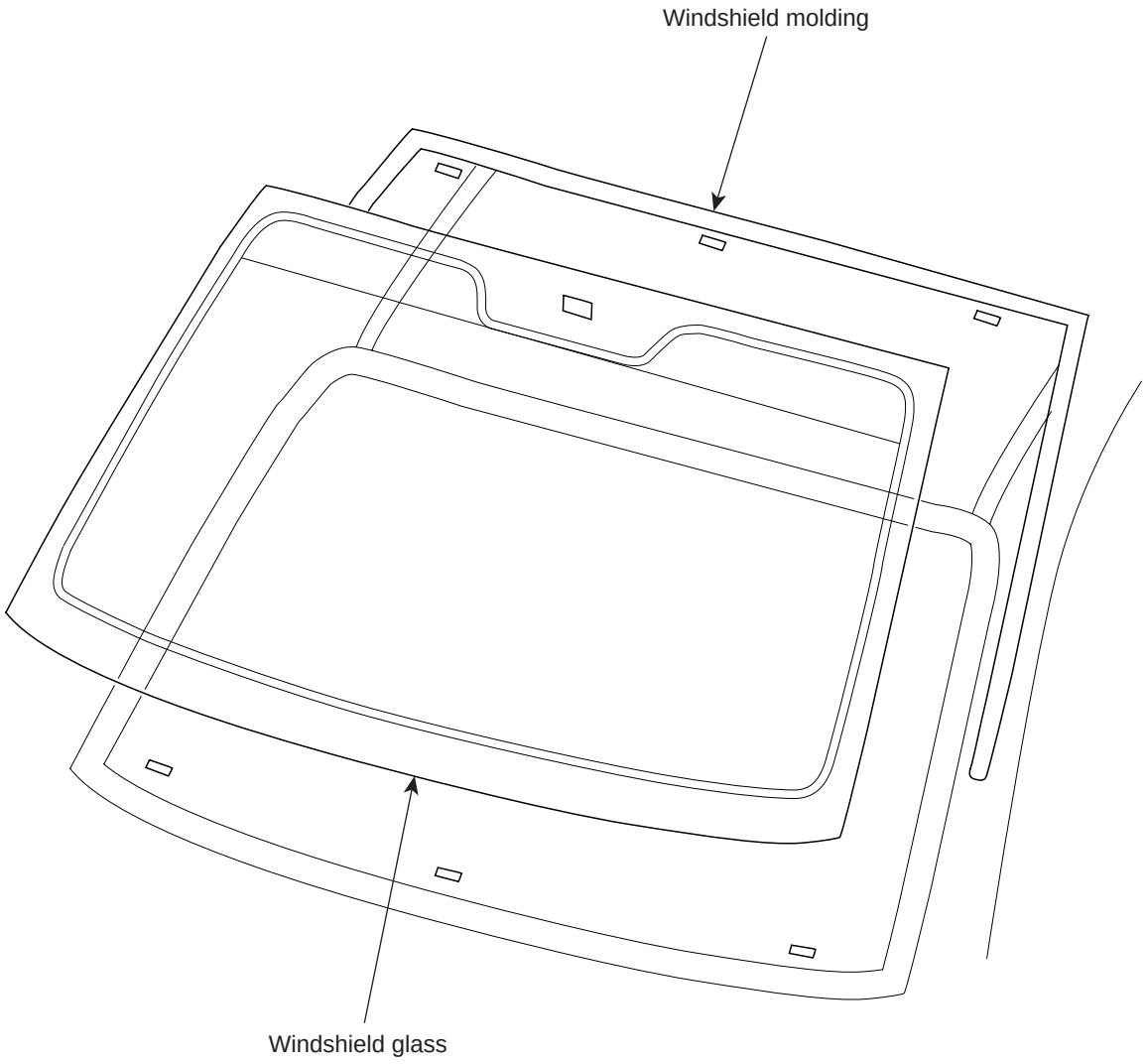
1. Rear package board
2. Rear package tray

BSJE180B

WINDSHIELD GLASS

COMPONENTS EEFC9EFD

[LHD type is shown, RHD type is similar]



BSJE220A

REPLACEMENT E3EF05B3

REMOVAL

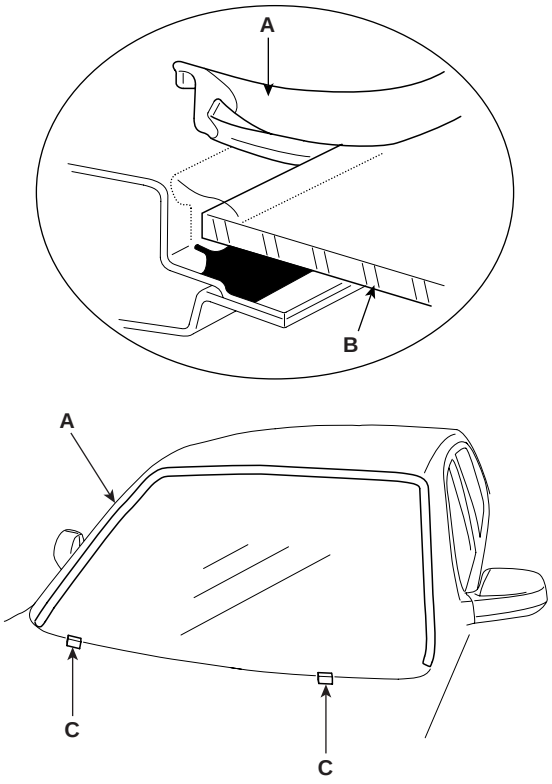
NOTE

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

1. Remove the following items.
   - Front piller trim.
   - Inside rear view mirror.
   - Windshield wiper arms.
   - Cowl top cover.
   - Windshield glass heater connector.

2. Remove the molding (A) from the edge of the windshield (B). If necessary, cut the molding with a utility knife.

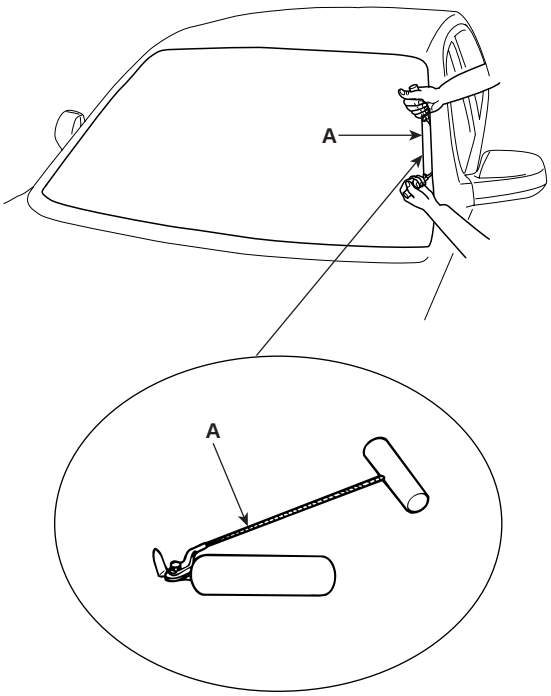
3. Remove the spacer (C).



BSJE220B

4. Pull down the front portion of the headliner. Take care not to bend the headliner excessively, or you may crease or break it.

5. Cut out the sealant using the sealant cutting tool [A(09861-31100)].



BSJE220C

6. Remove the windshield (A) carefully using the glass holder (B)(09861-31100).

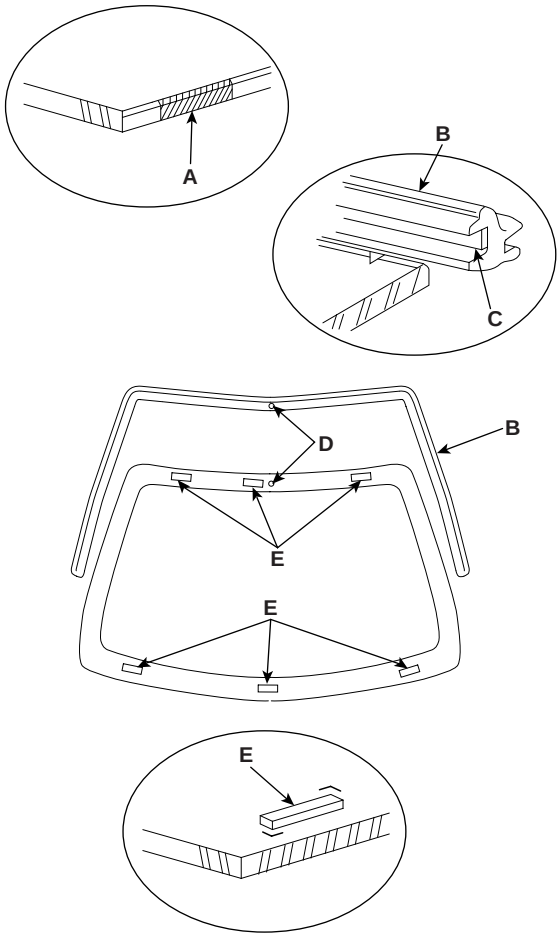
INSTALLTION

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

2. Clean the body bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.

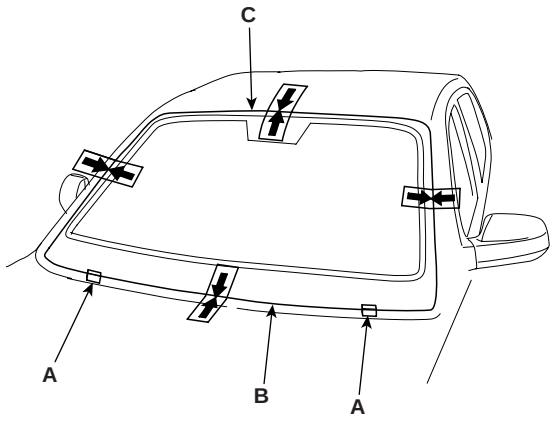
3. Apply the glass primer (A) to the side of the windshield glass edge and stick the bothsided adhesive tape (B) on the inside of molding (C).

4. When attaching the molding, make it in line (D) with the windshield glass and attach the windshield glass pad (E)to the designated place.



BSJE220E

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



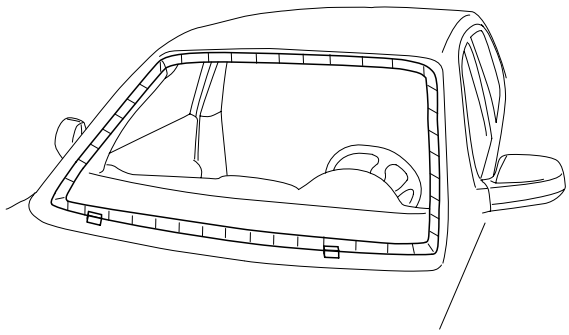
BSJE220F

6. 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.*

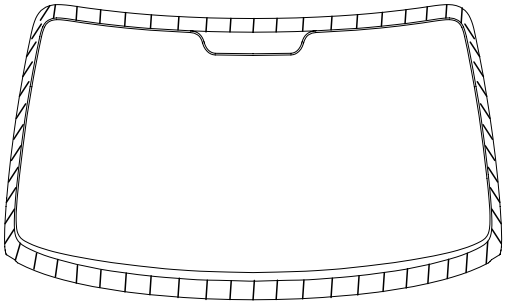
////////// : 프라이머



BSJE220G

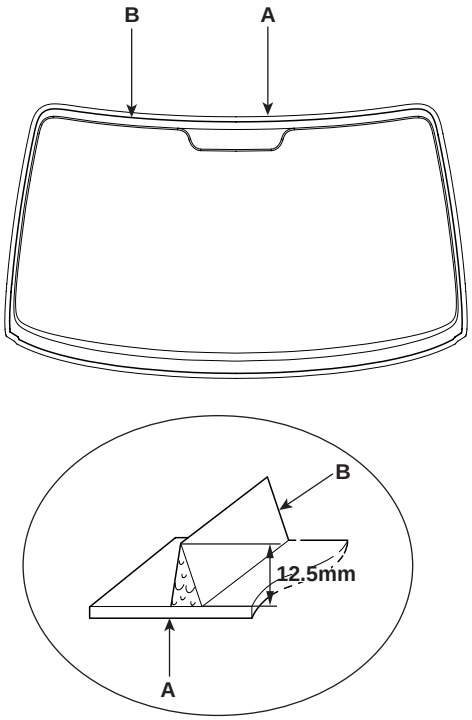
7. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes:
   - Do not apply glass primer to the body, and be careful not to mixup glass and body primer sponges.
   - Never touch the primed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

////////// : 프라이머



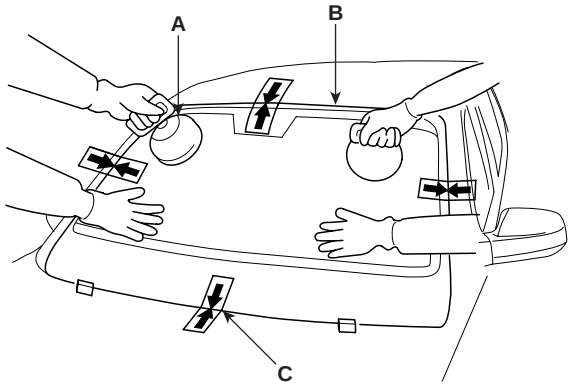
BSJE220H

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 sealant (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.



BSJE220I

9. Use glass holder (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.



BSJE220J

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:
    - 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.
    - 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;
    - Slam the door with all the windows rolled up.
    - Twist the body excessively (such as when going in and out of driveways at an angle or driving over rough, uneven roads).

BUMPER

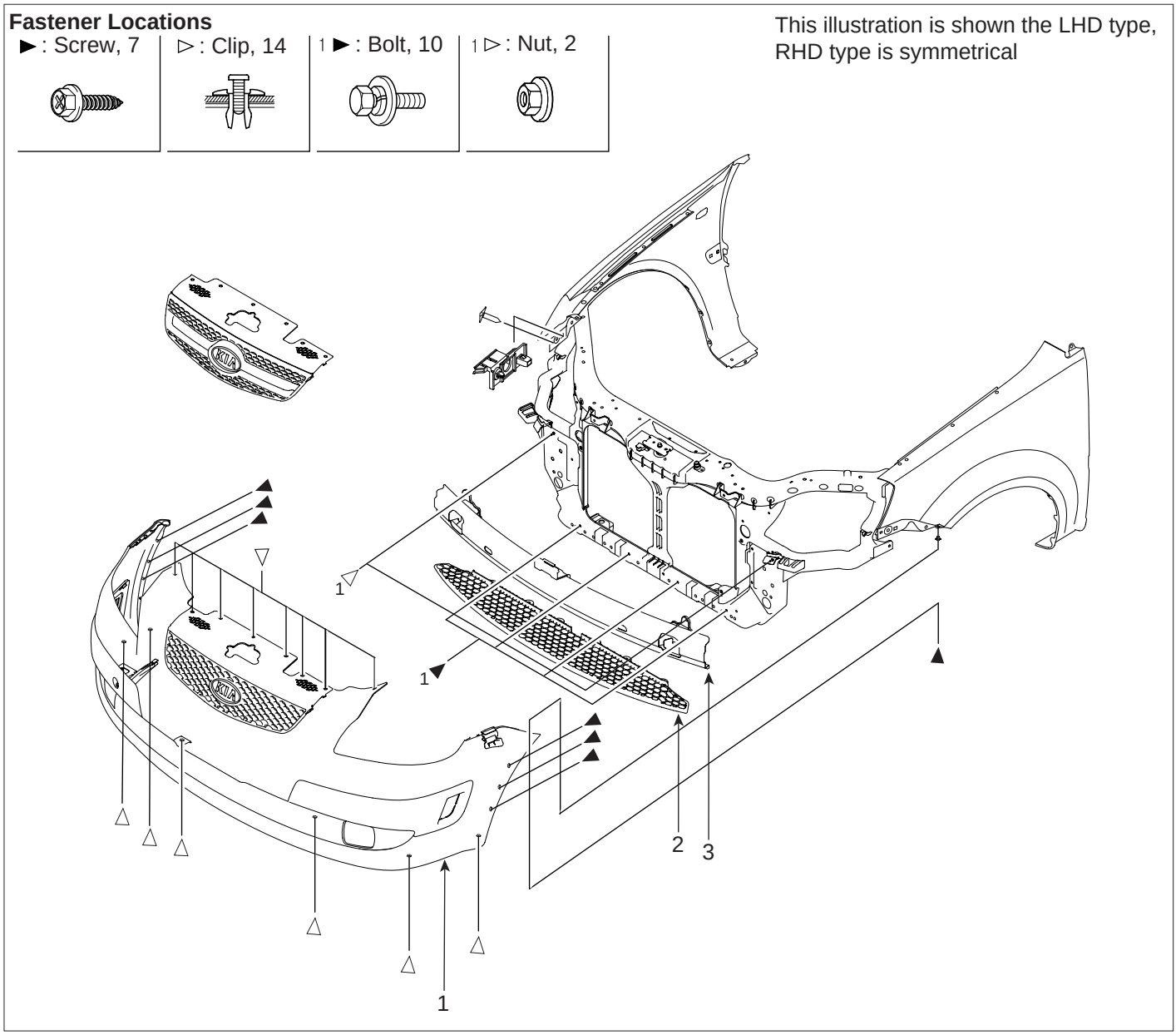
FRONT BUMPER

REPLACEMENT EB9E52A3

- *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.*

NOTE

- *Put on gloves to protect your hands.*



1. Front bumper cover
2. Front bumper lower stiffner
3. Front bumper rail

BSJE290A

REAR BUMPER

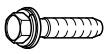
REPLACEMENT EFE61BB2

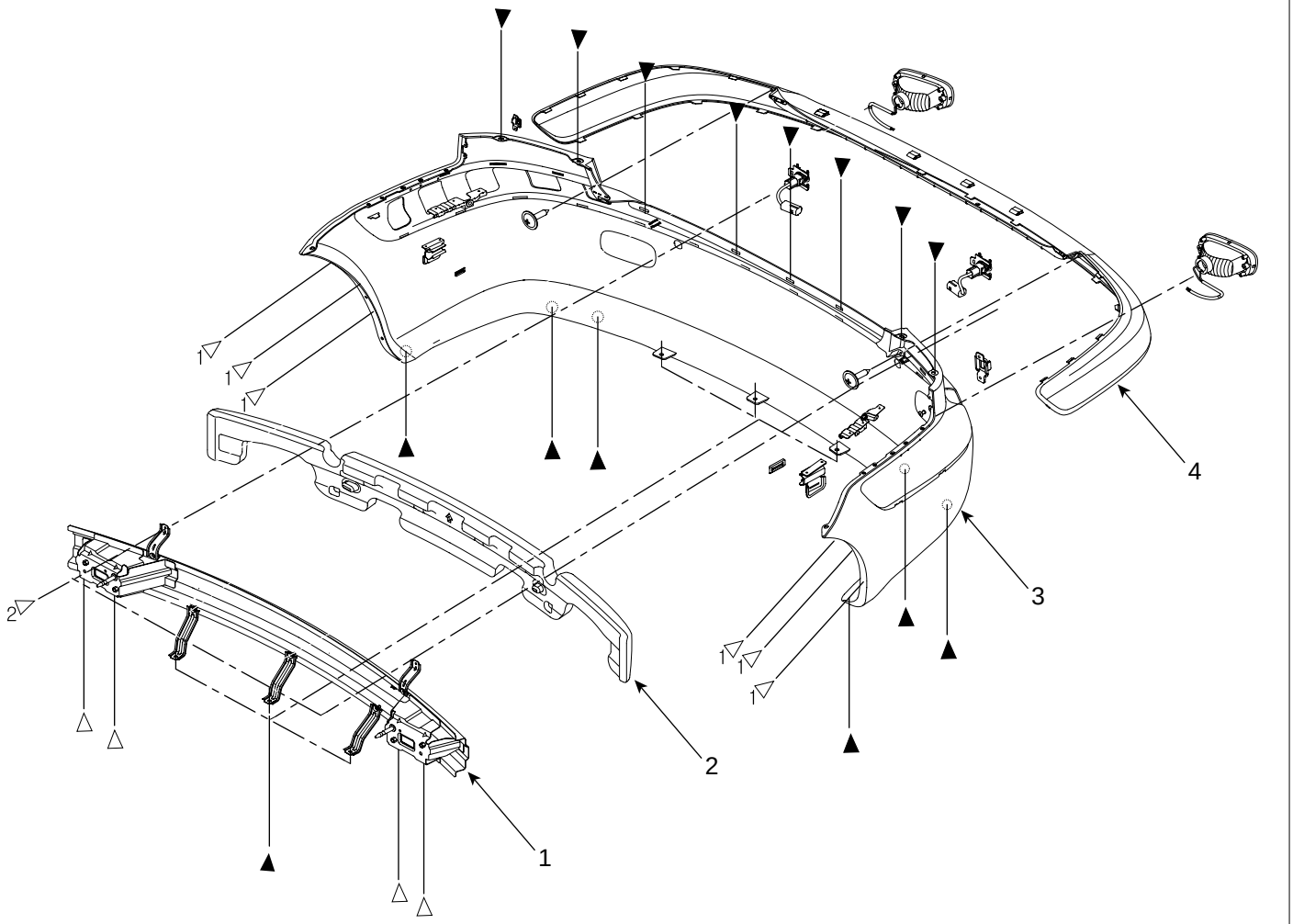
NOTE

- *After remove the rear combinati0n lamp.*
- *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.*
- *Replace any damage clips.*

Fastener Locations

[LHD type is shown, RHD type is symmetrical]

►: Clip, 17	▷: Bolt, 4	1▷: Screw, 6	2▷: Screw, 2
			



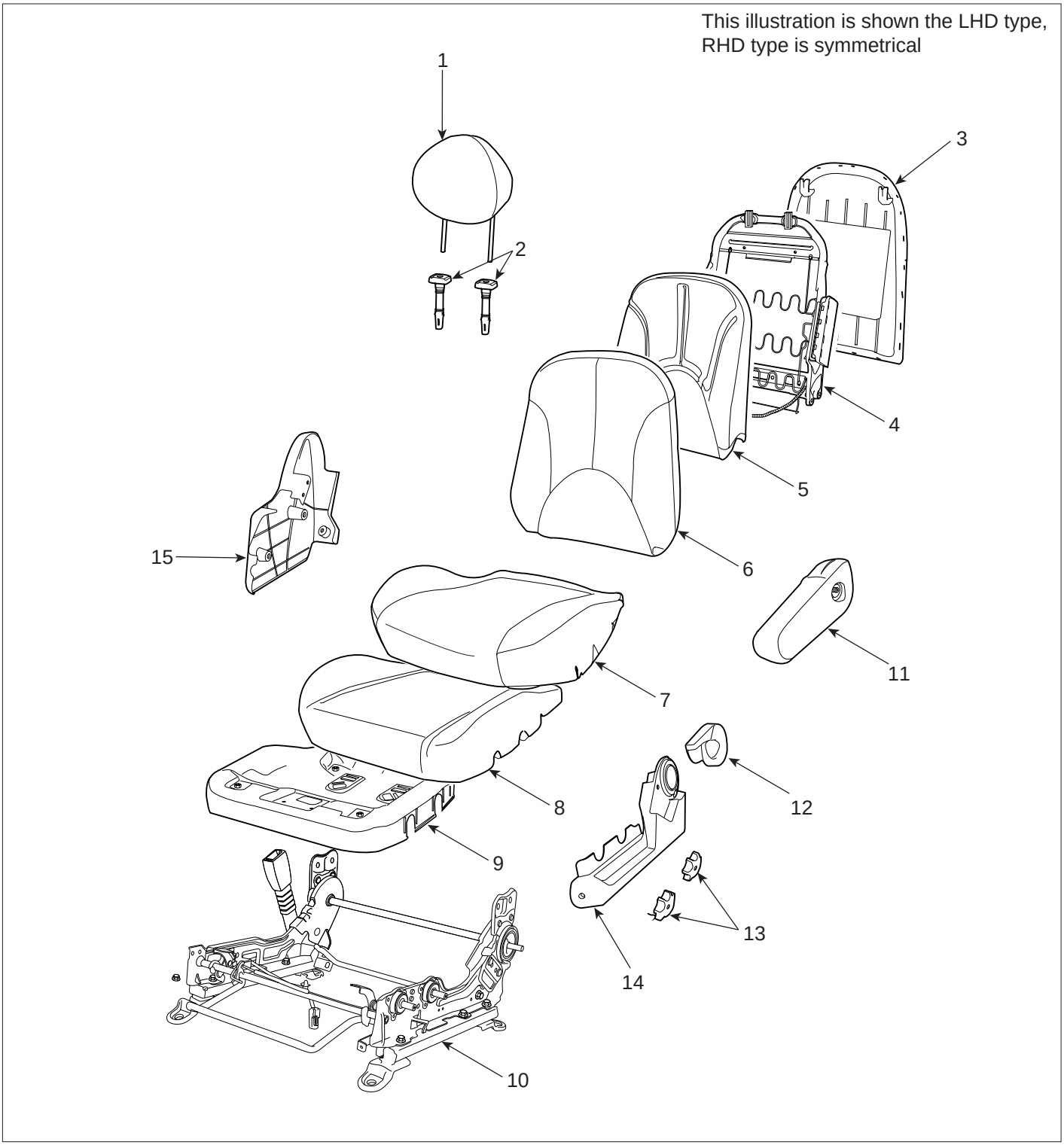
1. Rear bumper rail
2. Rear energy absorber
3. Rear bumper cover
4. Rear bumper protecter molding

BSJE300A

SEAT

FRONT SEAT

COMPONENTS E5B9BA9F



1. Head rest
2. Head rest guide
3. Back panel
4. Back frame
5. Seat back pad
6. Seat back cover
7. Seat cusion cover
8. Seat cusion pad
9. Seat cusion frame
10. Seat track assemble
11. Arm rest
12. Recliner lever
13. Height adjuster knob
14. Recliner cover
15. Recliber cover

BSJE009Z

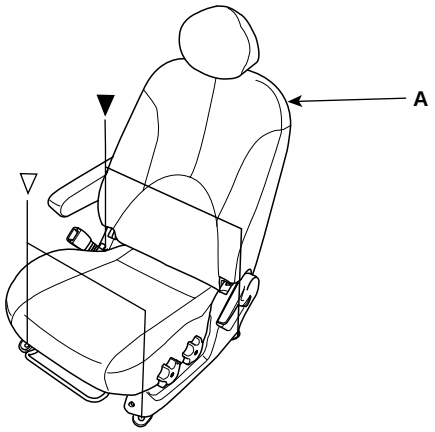
REPLACCEMENT ECF39C95

SEAT ASSEMBLY REPLACEMENT

1. Remove the seat assembly mounting cover.
2. After loosening the seat assembly mounting bolt and nut, remove the seat assembly (A).

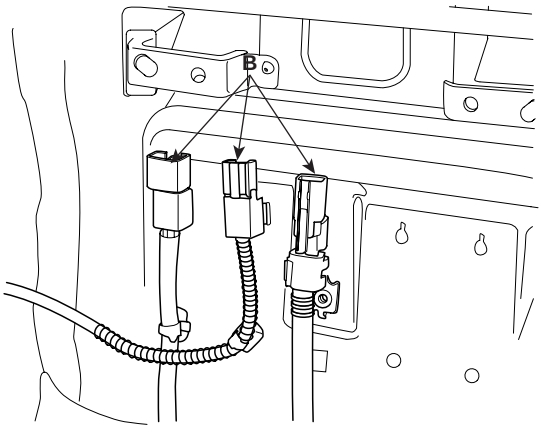
Fastener Locations

► : Bolt, 2	▷ : Nut, 2
3.5~5.5kgf·m	3.9~5.5kgf·m



BSJE320B

3. Disconnect the connector (B), and remove the seat assembly.



BSJE320C

4. Installation is the reverse of removal.

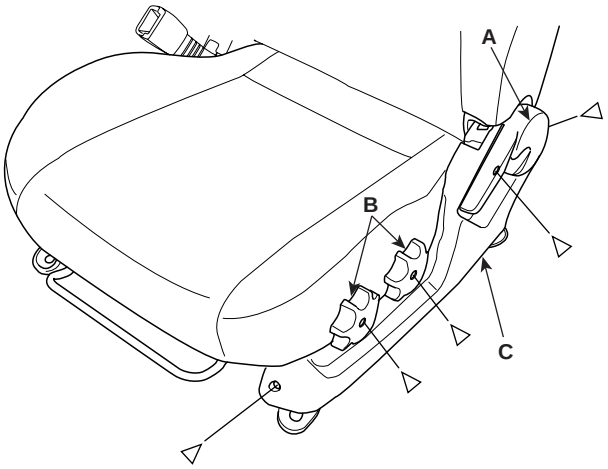
CAUTION

- ***Set the into the most rearward position. Check then 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. Check the front mounting bolt completely.***
- ***Check that the seat operates to and fro smoothy and the locking portion locks properly.***

RECLINER COVER, KNOB AND HEIGHT KNOB REPLACEMENT

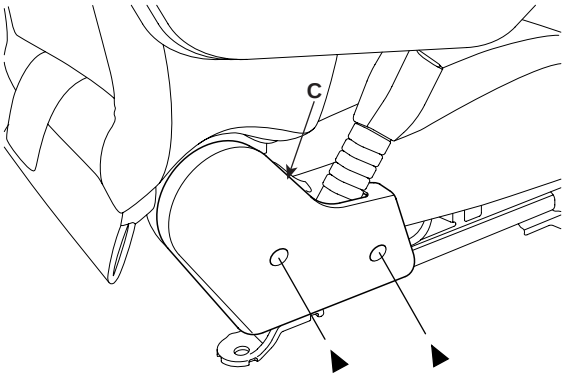
1. Remove the height adjuster knob (A) and recliner knob(B).
2. Loosen the recliner mounting screw and clip, then remove the recliner cover(C).

▷: Screw Locations, 4



BSJE320D

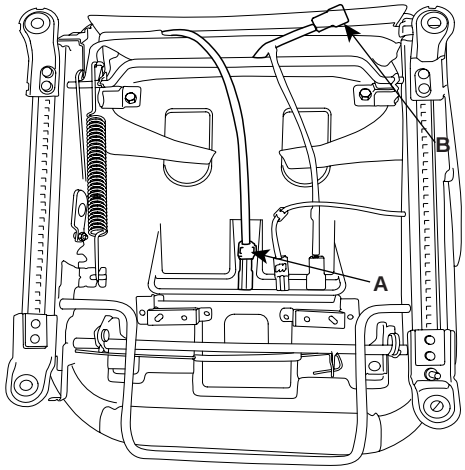
► : Screw Locations, 6



BSJE380G

SEAT BACK COVER REPLACEMENT

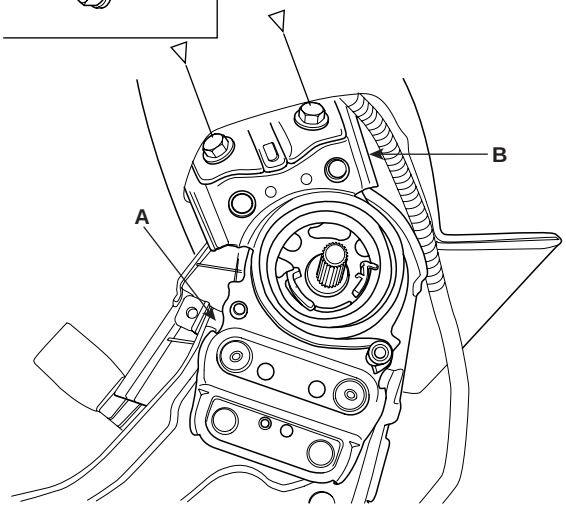
1. Remove the recliner cover, knob and height knob (See page BD- 73).
2. Disconnect the airbag connect(A), heater connect(B).



BSJE320R

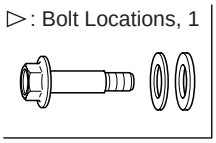
3. Disconnect the seat back frame(B), from seat track assemble(A).

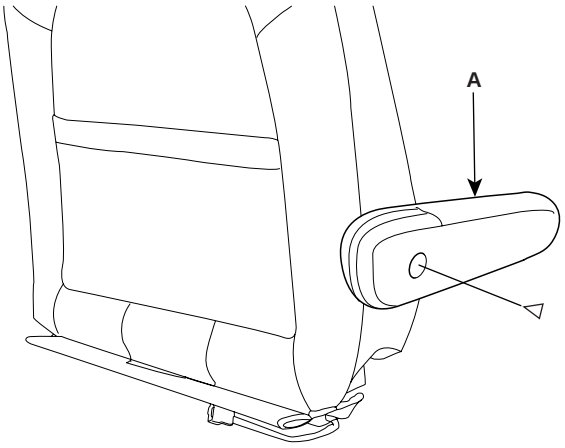
► : Bolt Locations, 2



BSJE320E

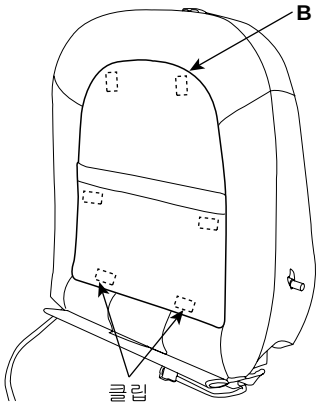
4. After loosening the mounthing screw, remove the front seat armrest(A).





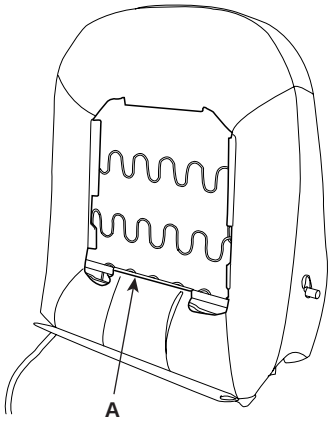
BSJE320Z

5. Using a screw driver, remove the seat back panel(B).



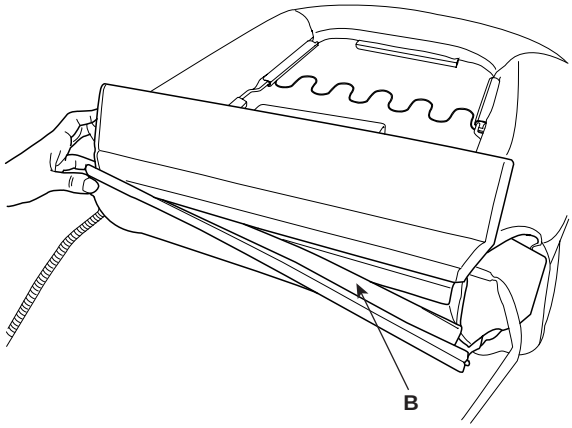
BSJE320F

6. Disconnect the protector(A) from seat back frame.



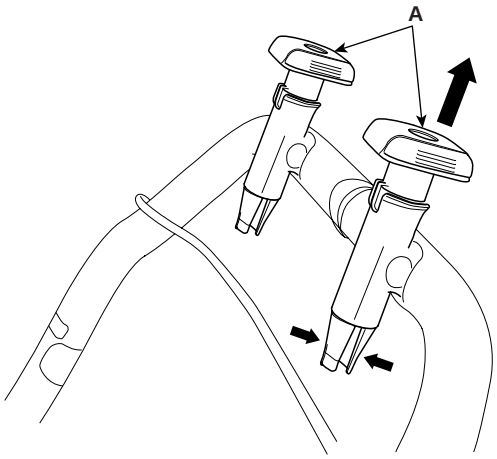
BSJE320G

7. Disconnect the band(B).



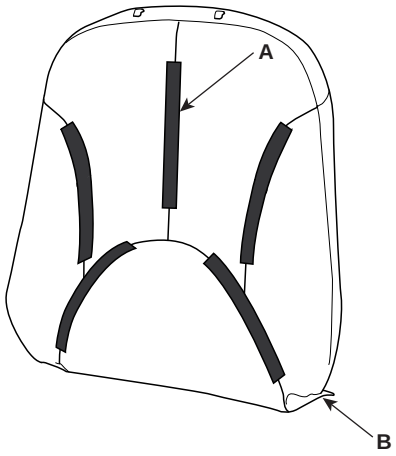
BSJE320H

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



BSJE722L

9. Arter removing the apilx(A) on the front of seat cover and remove the seat cover(B).



BSJE320I

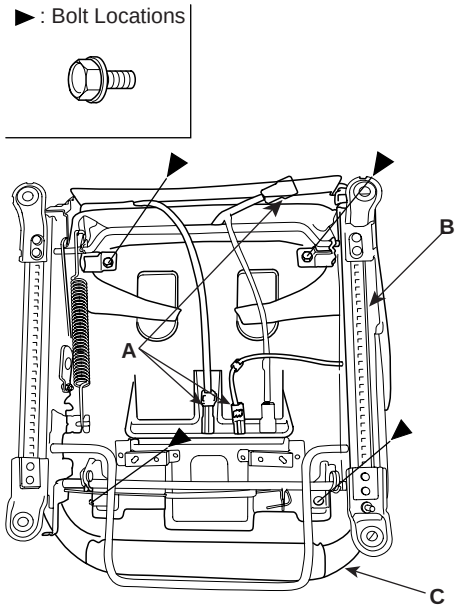
10. Installation is the reverse of removal.

NOTE

- *To prevent wrinkles, make sure the material is stretched evenly over the over (A) before securing the hogring clips (B).*
- *Replace the hogring clips with new ones using special tool (C).*

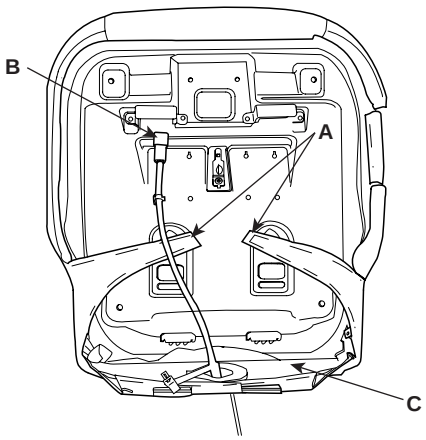
SEAT CUSION COVER REPLACEMENT

1. Remove the front seat assemble(See page BD- 72).
2. Disconnect the connector(A) then remove the track assemble(B) from cusion frame(C).



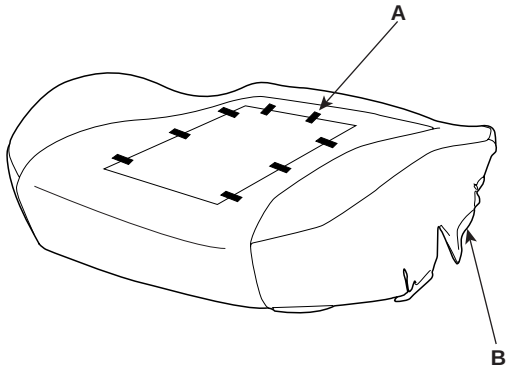
BSJE320J

3. Remove the scuff band(A).
4. Remove the connector(B) then disconnect the protector from cusion frame(C).



BSJE320K

5. After removing the hogring clips(A) on the front of seat cusion and remove the seat cusion(B).

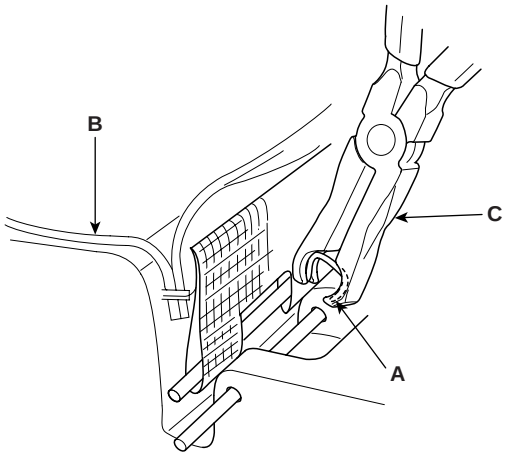


BSJE320L

6. Installation is the reverse of removal.

NOTE

- *To prevent wrinkles, make sure the material is stretched evenly over the over (A) before securing the hogring clips (B).*
- *Replace the hogring clips with new ones using special tool (C).*

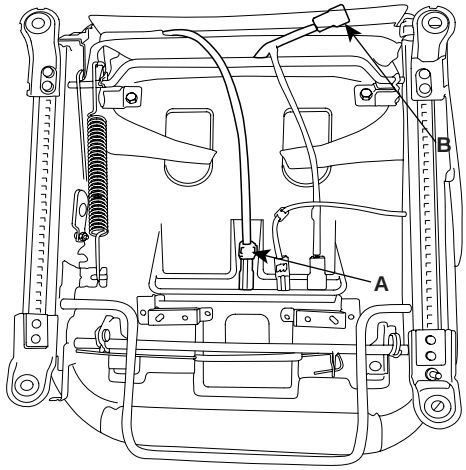


BSJE502F

SEAT BACK FRAME REPLACEMENT

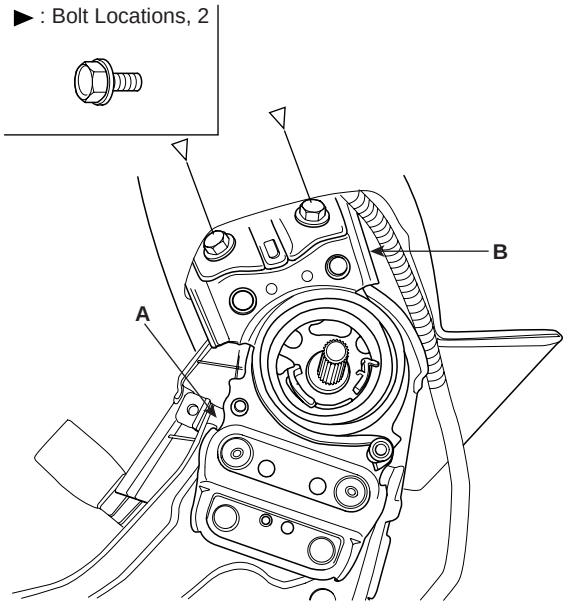
1. Remove the recliner cover, knob and height knob (See page BD- 73).

2. Disconnect the airbag connect(A), heater connect(B).



BSJE320R

3. Disconnect the seat back frame(B) from seat track assemble(A).



BSJE320E

4. Remove the seat back cover(See page BD- 73).

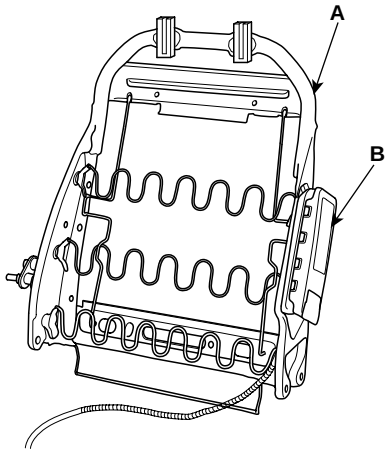
5. Remove the head rest and head rest guide (See page BD- 75).

6. Remove the seat back cover and sponge, from frame (See page BD- 73).

7. After loosening seat back frame mouting bolts, remove the seat back frame(A).

NOTE

- *Remove the side air bag for replacing side air bag installation seat.*
- *Be fore service, be fully aware of precaution and service procedure relevant to air bag.*

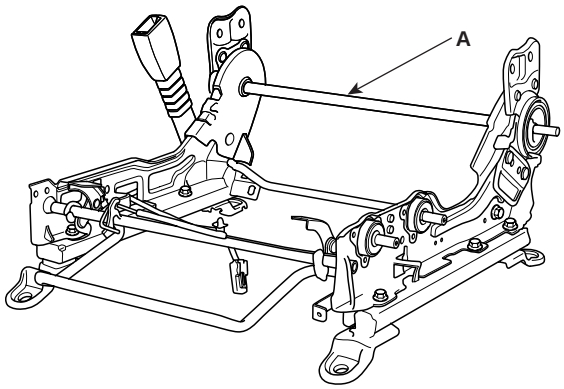


BSJE320N

8. Installation is the reverse of removal.

SEAT TRACK REPLACEMENT

1. Remove the seat back pannel(See page BD- 74).
2. Remove the recliner cover, knob and height knob (See page BD - 73).
3. Remove the seat back assemble(See page BD- 73).
4. Remove the seat cusion(See page BD- 75).
5. Remove the seat assembly (A).



BSJE320O

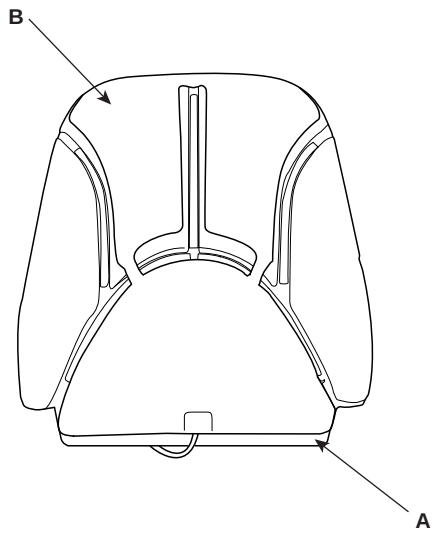
6. Installation is the reverse of removal.

SEAT BACK HEATER REPLACEMENT

1. Remove the seat back cover(See page BD- 73).
2. Cut the heater (A)attached to the pad (B), as shown in the picture.
3. Take off the paper from the backside of the heater assembly.

CAUTION

- ***Be sure to match the heater with main apperance.***



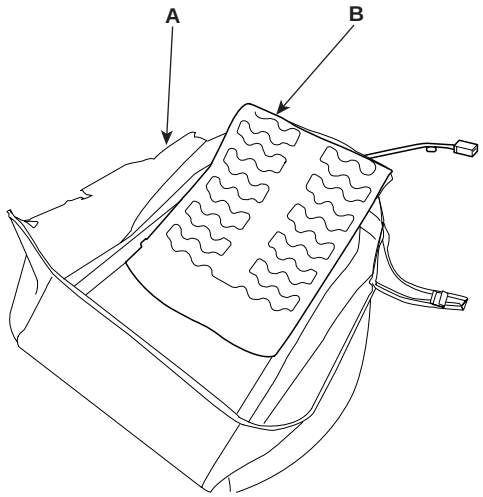
BSJE320P

SEAT CUSION HEATER REPLACEMENT

1. Remove the seat back cover(See page BD- 73).
2. Cut the heater(B) attached to the pad(A).
3. Take off the paper from the backside of the heater assembly.

CAUTION

- ***Be sure to match the heater with main apperance.***



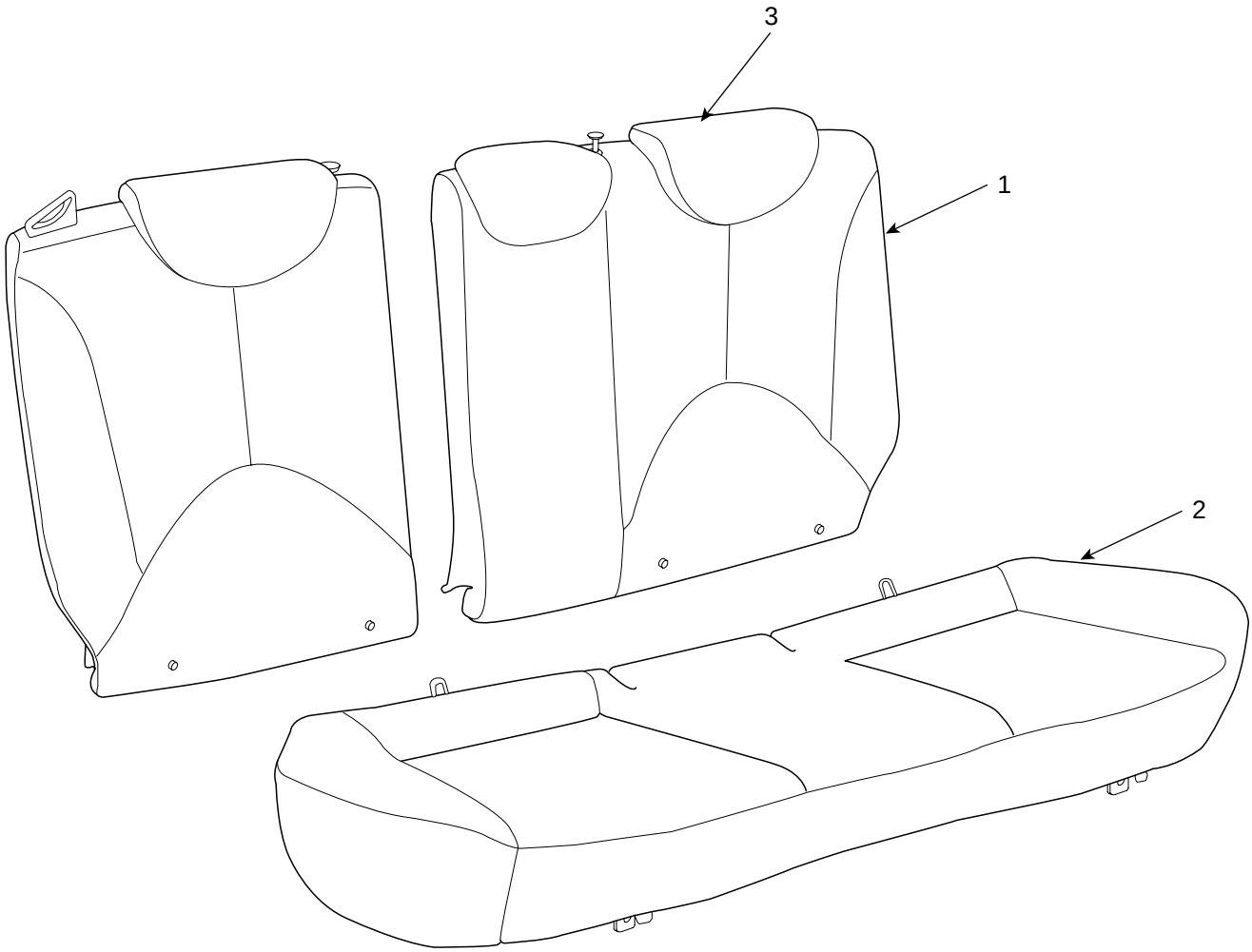
BSJE320Q

4. Installation is the reverse of removal.

REAR SEAT

COMPONENTS E73199FC

[LHD type is shown, RHD type is symmetrical]



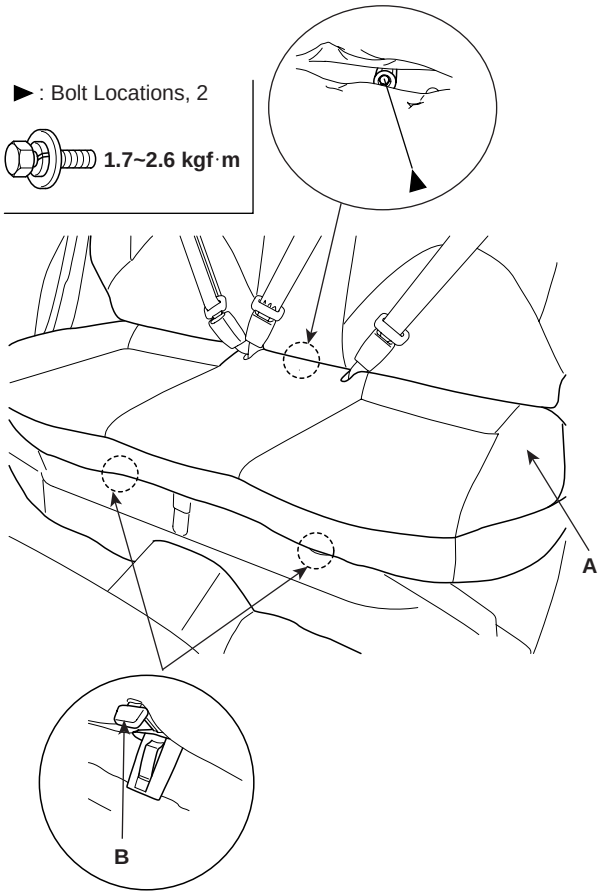
1. Seat back cusion
2. Seat cusion
3. Head rest

BSJE330A

REPLACEMENT EECBEABD

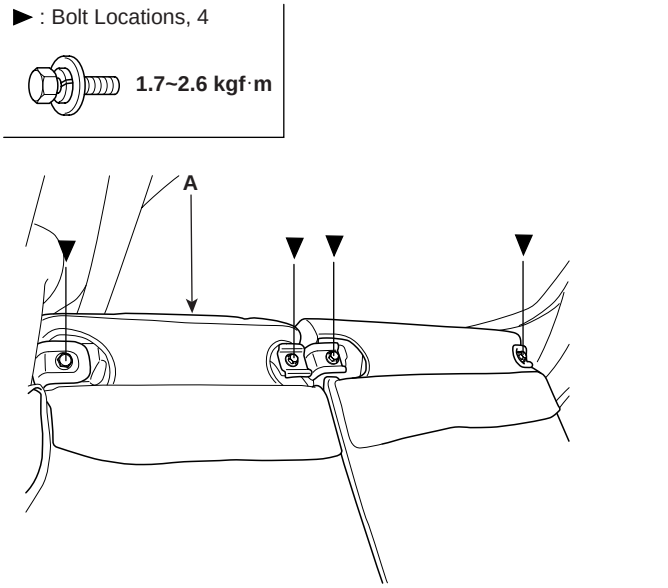
SEAT ASSEMBLY REPLACEMENT

1. Loosen the rear seat cusion mounting bolts, then remove the rear seat cusion(A) after pull the stopper(B).



BSJE330B

2. Loosenig the seat belt mounting bolt, remove the seat back(A).



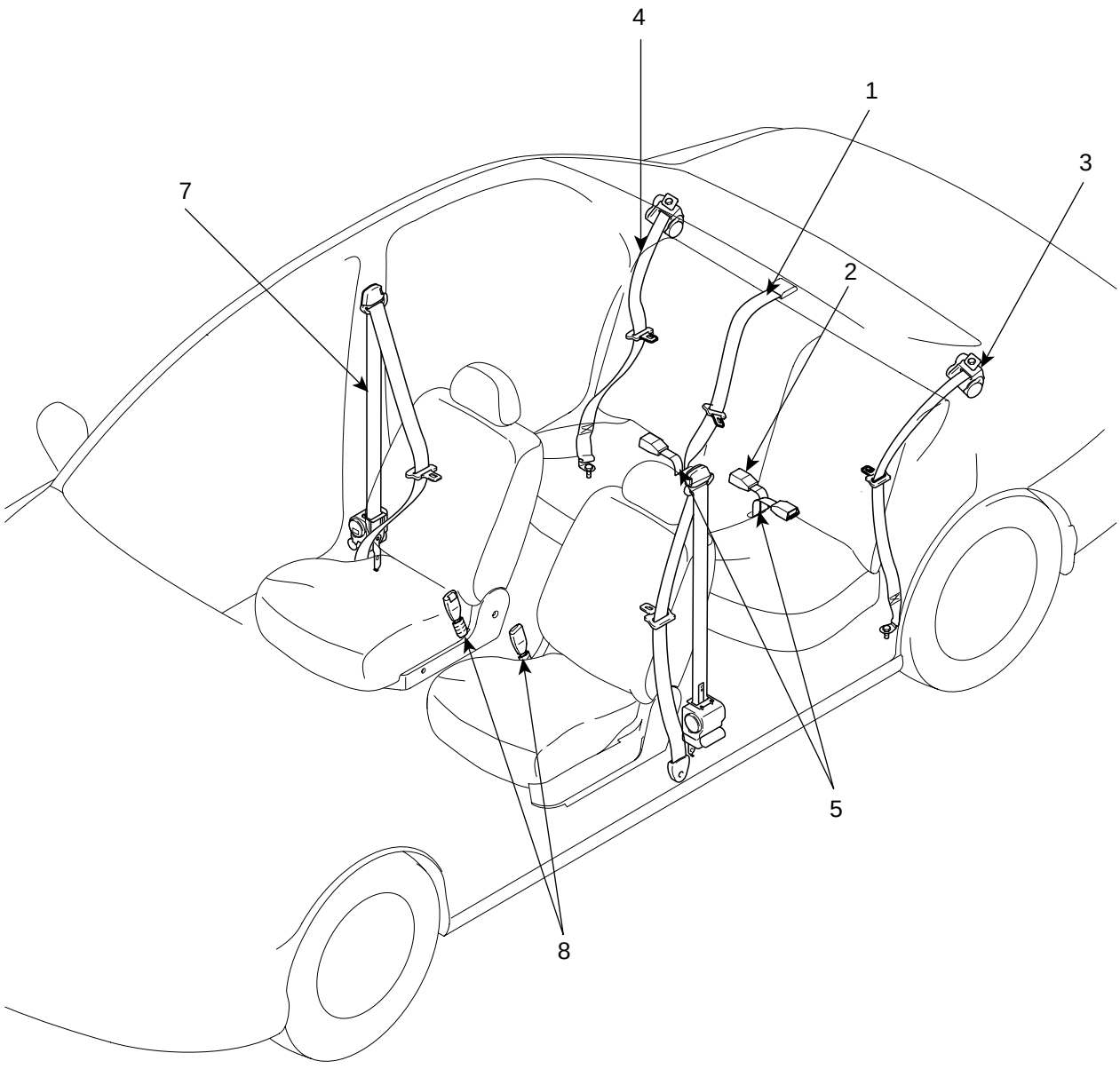
BSJE330C

3. Installation is the reverse of removal.

SEAT BELT

COMPONENTS E23FC092

[LHD type is shown, RHD type is similar]



1. Rear center seat belt
2. Rear center seat buckle
3. Rear seat belt retractor
4. Rear seat belt
5. Rear seat belt buckle
6. Front seat belt retractor
7. Front seat belt
8. Front seat buckle

BSJE560A

REPLACEMENT E5537336

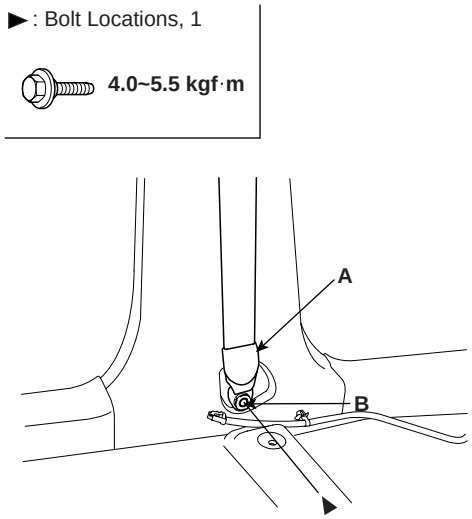
FRONT SEAT BELT REPLACEMENT

CAUTION

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

1. Remove the following items first.
   - Front seat assembly(See page BD- 72).
   - Front and rear door scuff trim(See page BD- 60).

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



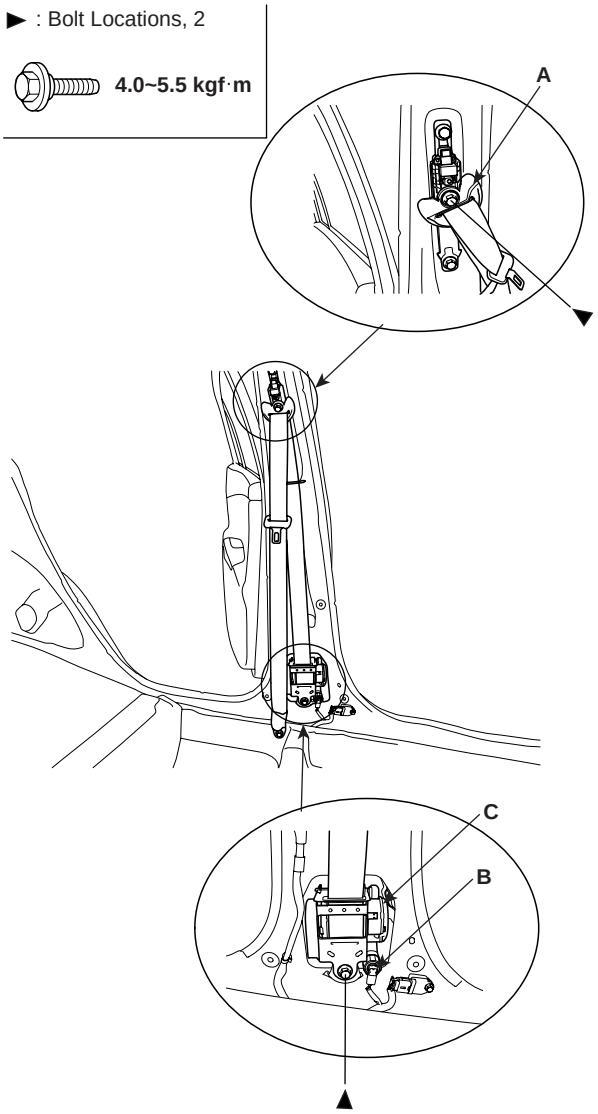
BSJE560D

3. Remove the center pillar lower trim(See page BD- 60).

4. Remove the center pillar upper trim (See page BD- 60).

5. Remove the upper anchor (A).

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



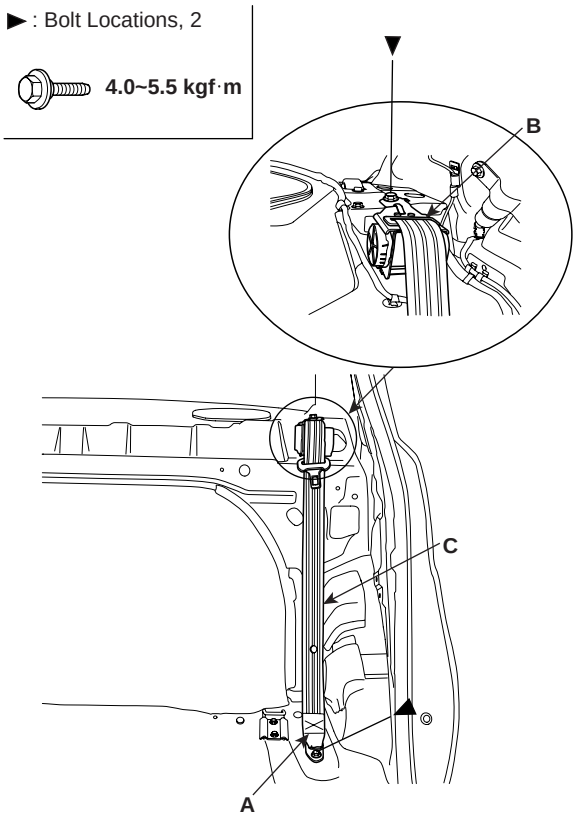
BSJE380A

REAR SEAT BELT RELACEMENT

CAUTION

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

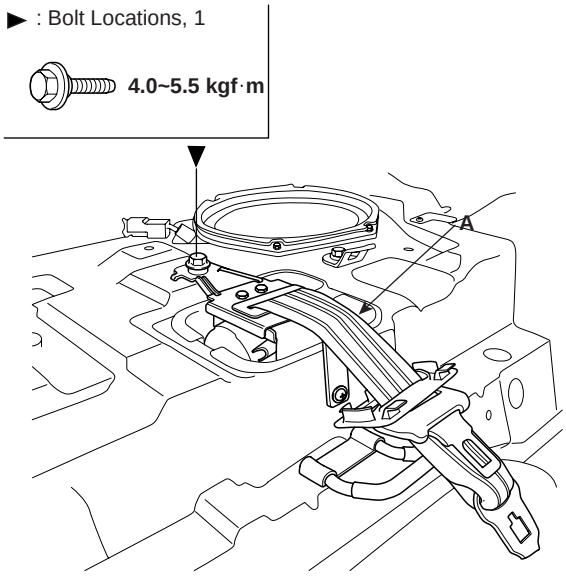
1. Remove the following items first.
   - Rear seat assembly(See page BD- 80).
   - Front and rear door scuff trim(See page BD- 60).
   - Rear piller trim(See page BD- 60).
2. Remove the lower anchor (A).
3. Remove the package tray trim(See page BD- 63).
4. After loosening the retractor (B) mounting bolt, remove the rear seat belt (C).



BSJE380E

REAR CENTER SEAT BELT REPLACEMENT

1. Remove the following items first.
   - Rear seat assemble(See page BD- 80).
   - Rear wheel guard and rear door scuff trim (See page BD- 60).
   - Rear piller trim(See page BD- 60).
   - Package tray(See page BD- 63).
2. Remove the rear center seat belt(A).



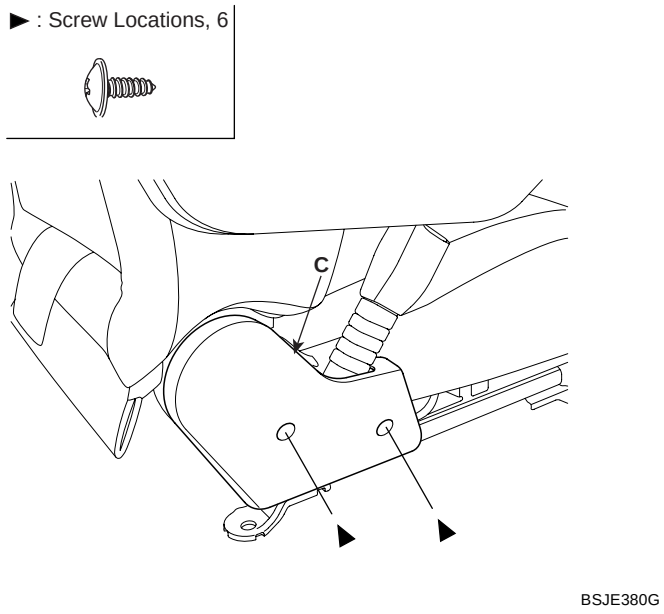
BSJE380F

3. Installation is the reverse of removal.

FRONT SEAT BELT BUCKLE REPLACEMENT

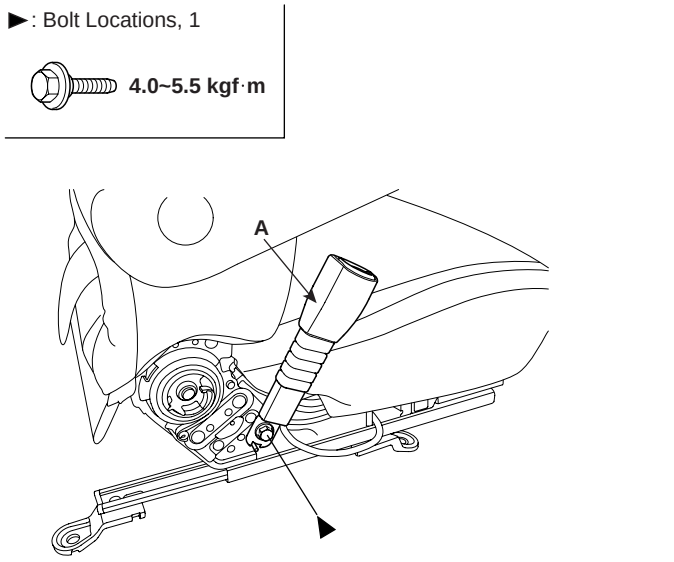
1. Remove the following items first.
   - Front seat assembly(See page BD- 72).

2. Remove the recliner cover(C).



BSJE380G

3. Remove the seat belt buckle(A).



BSJE380H

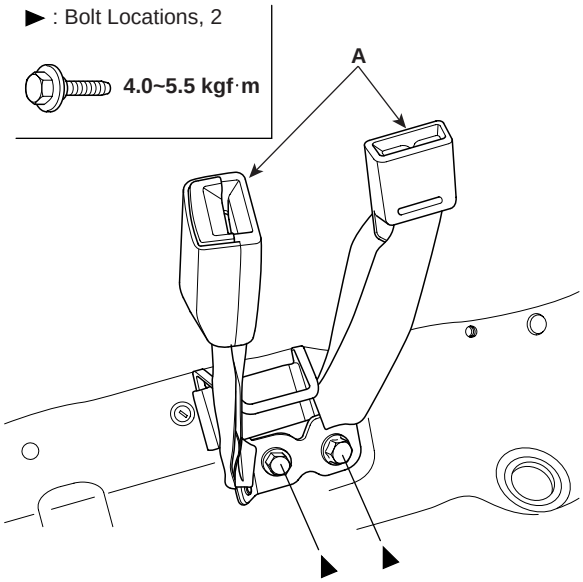
4. Installation is the reverse of removal.

REAR SEAT BELT BUCKLE REPLACEMENT

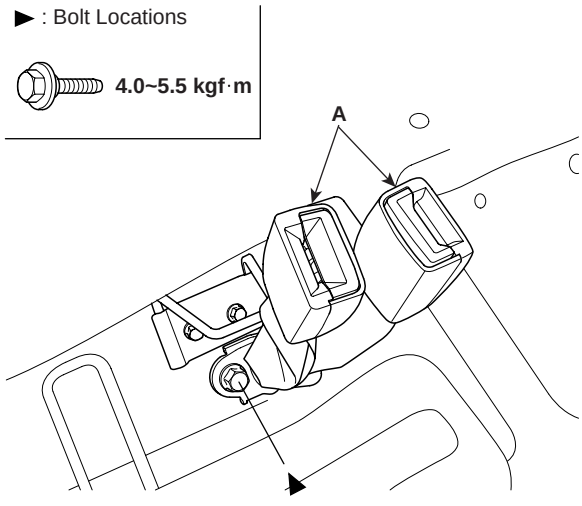
1. After cushion frame hinge mounting bolt, fold the cushion.

2. Remove the seat belt buckle (A).

3. Installation is the reverse of removal.



BSJE380I

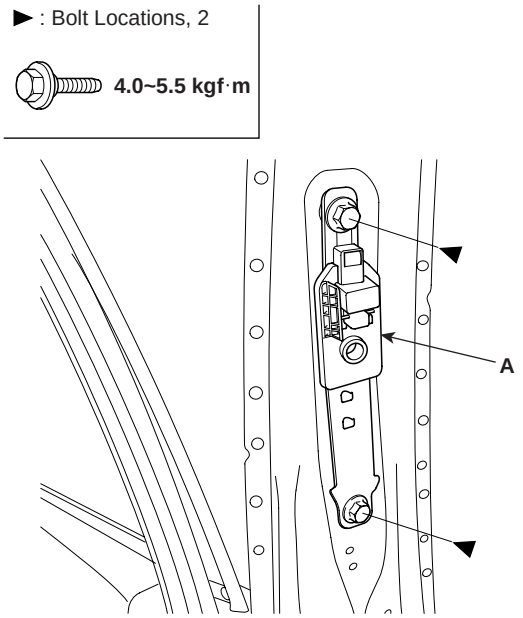


BSJE380J

HIGHT ADJUSTER REPLACEMENT

1. Remove the following items first.
   - Front assembly(See page BD- 72).
   - Front and rear door scuff trim(See page BD- 60).
   - Front seat belt upper and lower anchor (See page BD- 82).
   - Center pillar lower and upper trim (See page BD- 60).

2. Loosen the mounting bolt, then remove the height adjuster (A).



BSJE380K

3. Installation is the reverse of removal.

Body Electrical System

GENERAL

GENERAL TROUBLESHOOTING INFORMATION ECFD0CDC

BEFORE TROUBLESHOOTING

1. Check applicable fuses in the appropriate fuse/relay box.
2. Check the battery for damage, state of charge, and clean and tight connections.

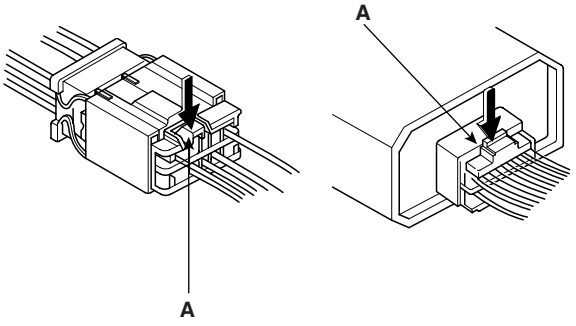
NOTE

- *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.

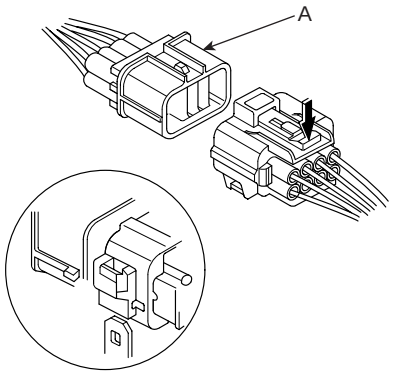
HANDLING CONNECTORS

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).



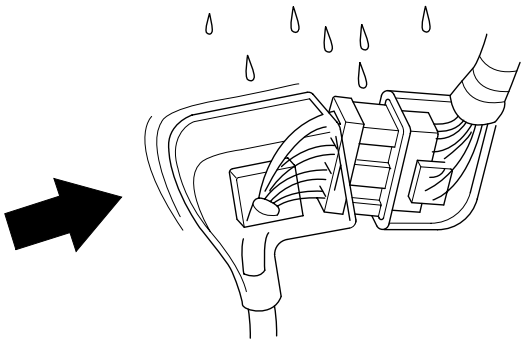
ETKD150A

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).



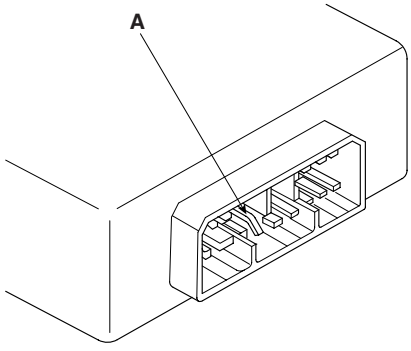
ETKD150B

6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



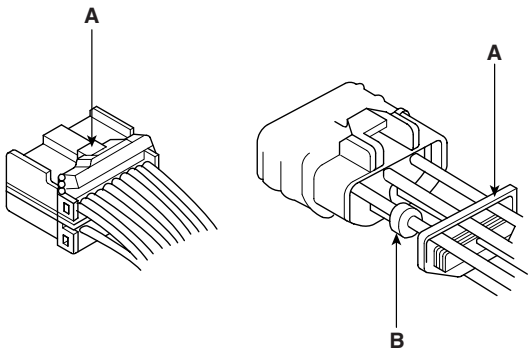
ETKD150C

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



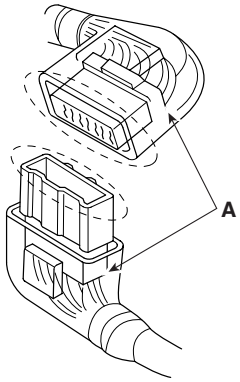
ETKD150D

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



ETKD150E

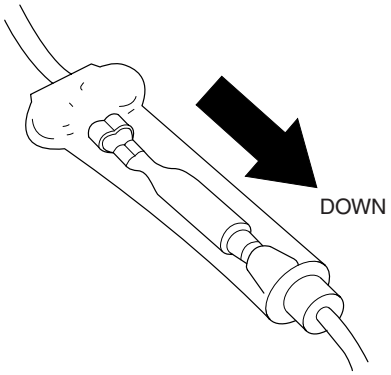
10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.



ETKD150F

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.

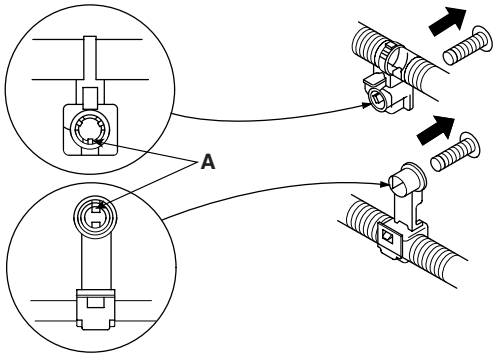


ETKD150G

HANDLING WIRES AND HARNESSES

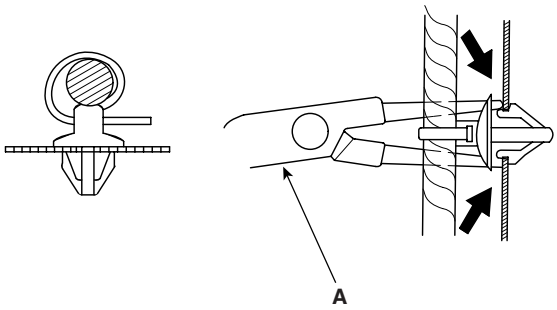
1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.

2. Remove clips carefully; don't damage their locks (A).



ETKD150H

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.

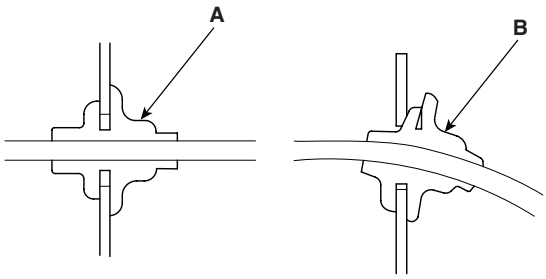


ETKD150I

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.

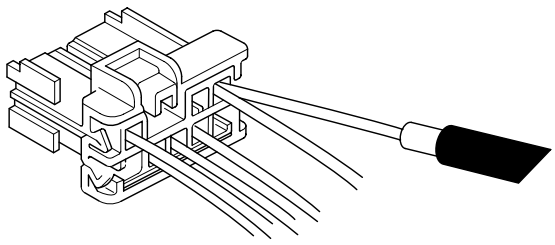
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).



ETKD150J

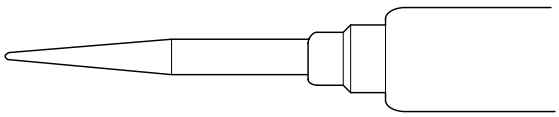
TESTING AND REPAIRS

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 probe of the tester from the wire side (except waterproof connector).



ETKD150K

5. Use a probe with a tapered tip.



ETKD150L

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.

AUDIO SYSTEM

SPECIFICATION E7EFD063

AUDIO

Item		Specification			
Model		AM/FM/Cas-sette (M420)	AM/FM/CD (M445)	AM/FM/Cas-sette/MP3 (M455)	AM/FM/Cas-sette/6CDC (M465)
Power supply		DC 14.4V			
Rated output		Max 43W x 4			Maw 55W x 4
Speaker impedance		4Ω x 4			10kΩ x 4
Antenna		80PF 75Ω			
Tuning type		PLL synthesized type			
Frequency range / Channel space	FM	87.5~108 MHz/ 100KHz (General), 50KHz(Europe)			
	AM	531~1602 KHz/ 9KHz (General)			
	MW	522~1620 KHz/ 9KHz (Europe)			
	LW	153~279 KHz/ 1KHz (Europe)			

SPEAKER

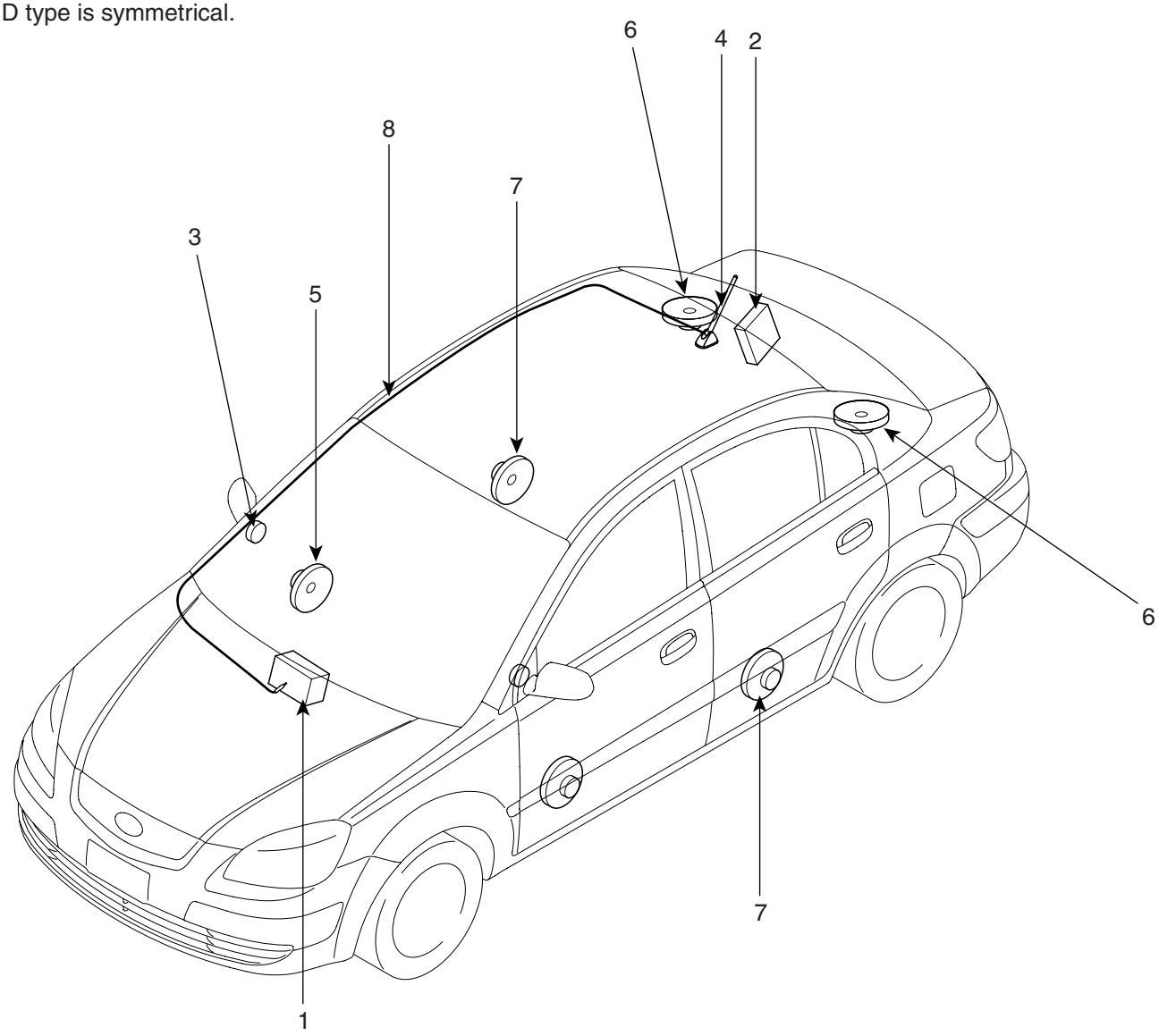
Item	Specification				
Model	Front	Rear	Tweeter	Front (External amplifier)	Rear (External amplifier)
Input power	Max 40W	Max 40W	Max 40W	Max 45W	Max 45W
Impedance	4±0.6Ω	4±0.6Ω	4±0.6Ω	2±0.6Ω	2±0.6Ω

EXTERNAL AMPLIFIER

Item	Specification
Power supply	DC 14.4V
Output power	Max 310W (55W*4Channel+45W*2 Channel)
Speaker impedance	2Ω x 4

COMPONENT LOCATION ED938BF4

This illustration is shown the LHD type.
RHD type is symmetrical.



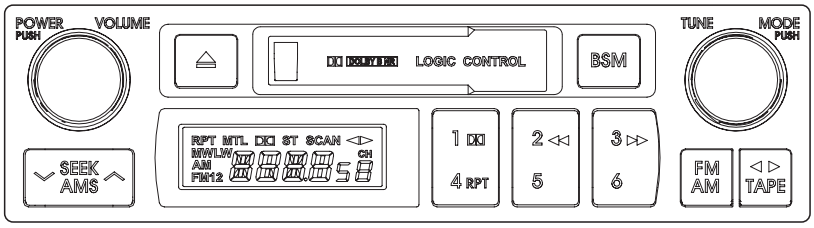
1. Audio unit
2. External amplifier
3. Tweeter speaker
4. Roof antenna
5. Front door speaker
6. Rear package tray speaker (4 doors)
7. Rear door speaker (5 doors)
8. Antenna feeder cable

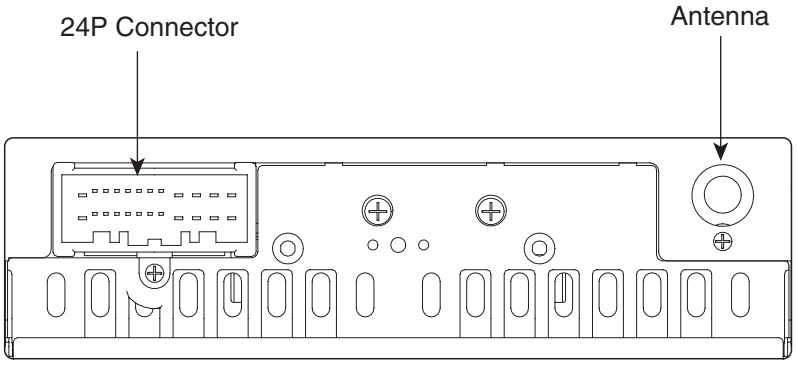
LTJF020A

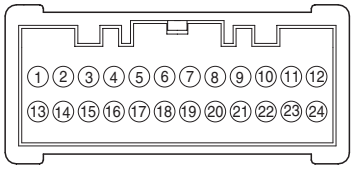
AUDIO UNIT

COMPONENT E635C97C

AM/FM/CASSETTE (M420)

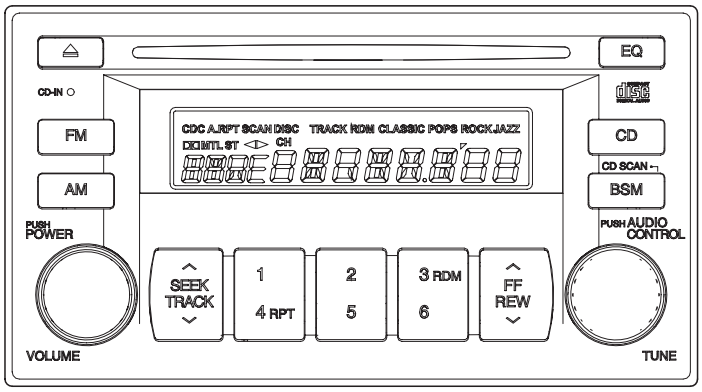


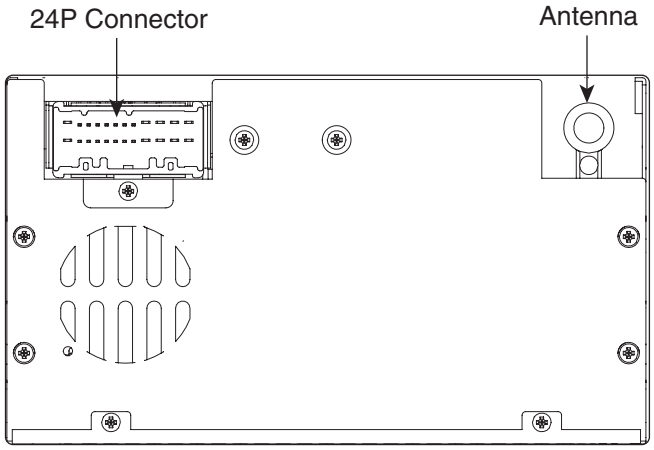


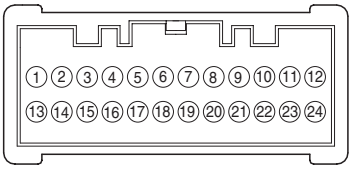
Audio connector	Terminal	Description	Terminal	Description
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	-	18	-
	7	-	19	TEL MUTE
	8	-	20	Ground
	9	-	21	-
	10	-	22	-
	11	ACC	23	Antenna B+
	12	Battery	24	Ground

LTJF021B

AM/FM/CD (M445)

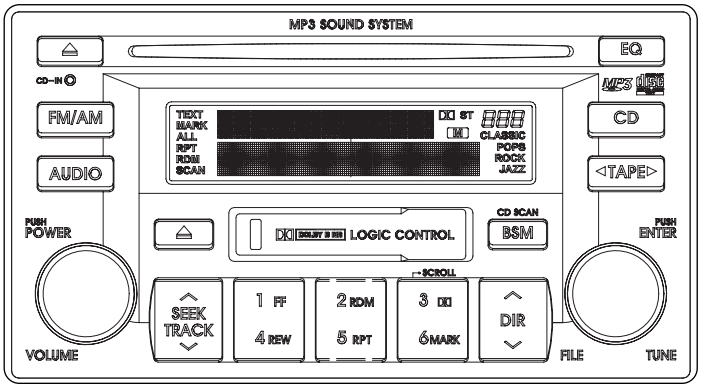


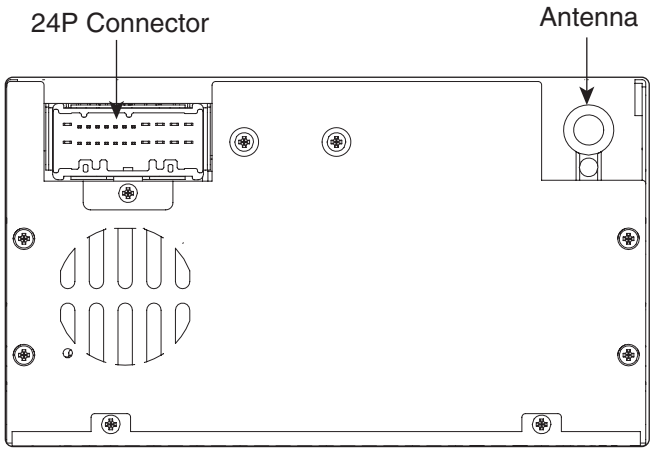


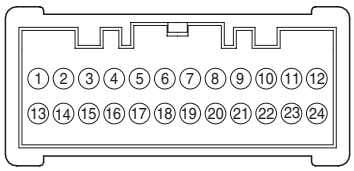
Audio connector	Terminal	Description	Terminal	Description
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	Steering remote control	18	-
	7	-	19	TEL MUTE
	8	-	20	Ground
	9	-	21	-
	10	-	22	-
	11	ACC	23	Antenna B+
	12	Battery	24	Ground

LTJF021C

AM/FM/CASSETTE/MP3 (M455)

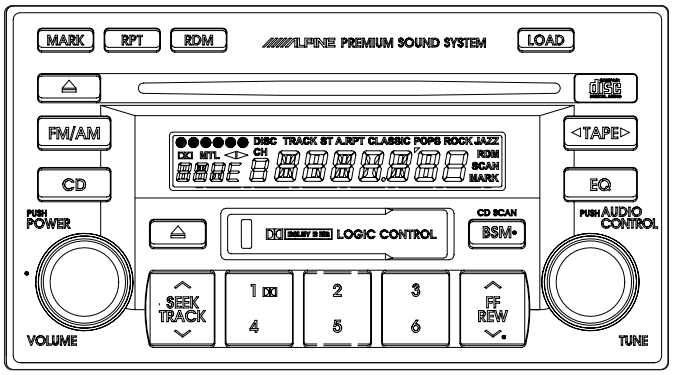


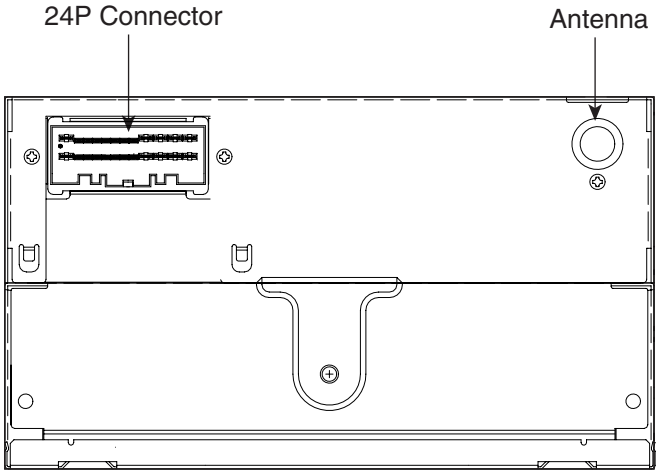


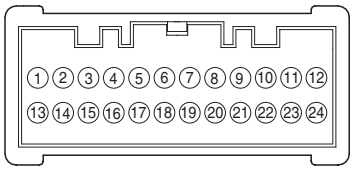
Audio connector	Terminal	Description	Terminal	Description
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	Steering remote control	18	-
	7	-	19	TEL MUTE
	8	-	20	Ground
	9	-	21	-
	10	-	22	-
	11	ACC	23	Antenna B+
	12	Battery	24	Ground

LTJF021D

AM/FM/CASSETTE/6CDC (M465)



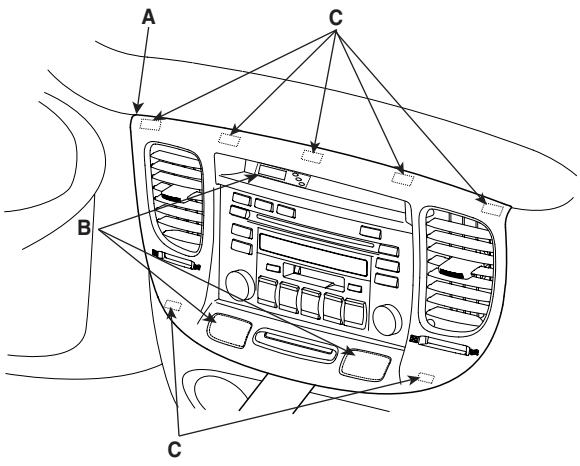


Audio connector	Terminal	Description	Terminal	Description
	1	Front left speaker (+)	13	Front left speaker (-)
	2	Front right speaker (+)	14	Front right speaker (-)
	3	Rear right speaker (+)	15	Rear right speaker (-)
	4	Rear left speaker (+)	16	Rear left speaker (-)
	5	Illumination (+)	17	Illumination (-)
	6	Steering remote control	18	Remote control ground
	7	Rear-arm remote control	19	TEL MUTE
	8	Twiter ground	20	Ground
	9	Tweeter in (L)	21	Tweeter in (R)
	10	-	22	-
	11	ACC	23	Antenna B+
	12	Battery	24	Ground

LTJF021E

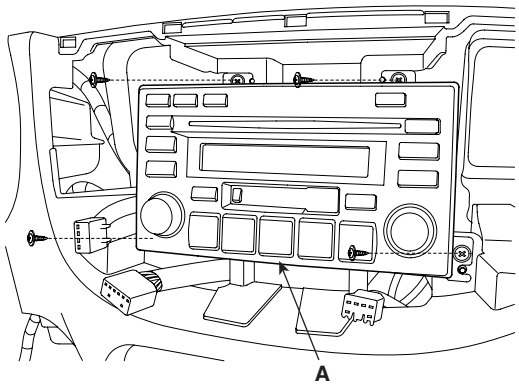
REPLACEMENT E2B3323A

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia upper panel (A). Take care of fixing clips (C).



LTJF021F

3. Remove the connectors of digital clock and hazard switch (B).
4. Remove the mounting screws then remove the audio unit (A).



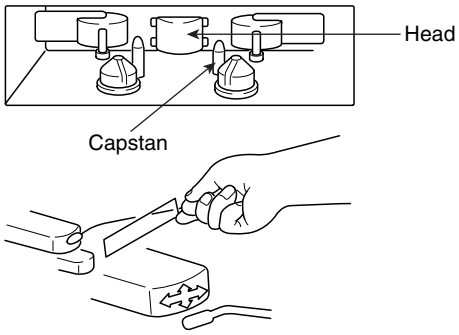
LTJF021G

5. Installation is the reverse of removal.

INSPECTION EDB6E9D8

TAPE HEAD AND CAPSTAN CLEANING

1. To obtain optimum performance, clean the head, and capstan as often as necessary, depending on frequency of use and tape cleanness.
2. To clean the tape head and capstan, use a cotton swab dipped in ordinary rubbing an alcohol. Wipe the head and capstan.



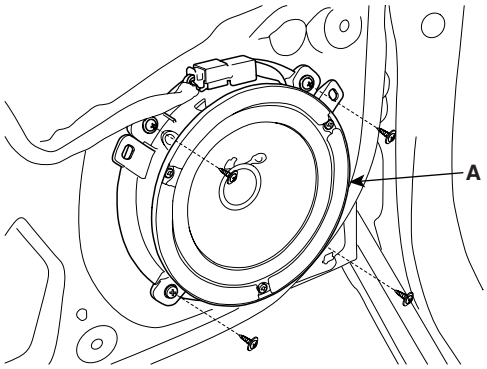
LTAC005A

SPEAKERS

REPLACEMENT EF52D27B

FRONT SPEAKER

1. Remove the front door trim panel (Refer to the Body group - front door).
2. Remove the front speaker (A) after removing 4 screws.

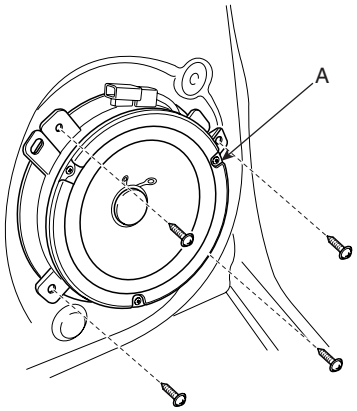


LTJF022B

3. Installation is the reverse of removal.

REAR SPEAKER (4 DOORS)

1. Remove the rear door trim panel (Refer to the Body group - rear door).
2. Remove the rear speaker (A) after removing 4 screws.

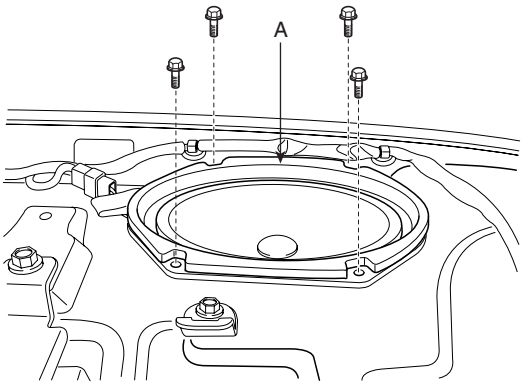


ATJF022C

3. Installation is the reverse of removal.

REAR SPEAKER (5 DOORS)

1. Remove the rear seat (Refer to the Body group - rear seat).
2. Remove the rear package tray (Refer to the Body group - rear seat).
3. Remove the rear speaker (A) after removing 4 bolts.

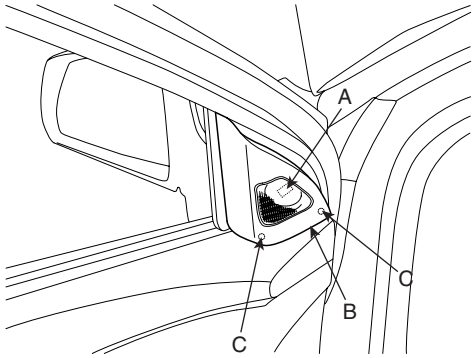


ATJF022E

4. Installation is the reverse of removal.

TWEETER SPEAKER

1. Remove the front door quadrant inner cover (B) (Refer to the Body group - front door).
2. Remove the tweeter speaker after disconnecting the connector(A). Take care of fixing clips (C).

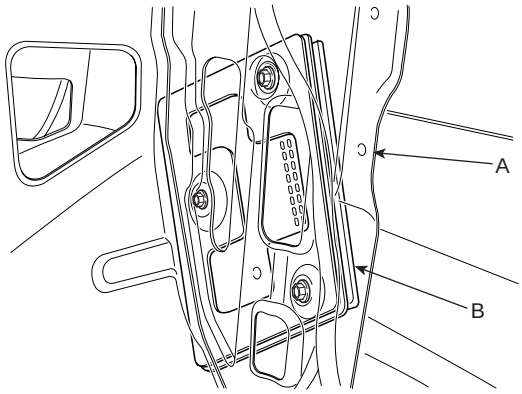


LTJF022D

3. Installation is the reverse of removal.

EXTERNAL AMPLIFIER (4 DOORS)

1. Remove the right luggage side trim.
2. Remove the external amplifier (B) from the quarter inner panel (A) after removing 3 nuts.

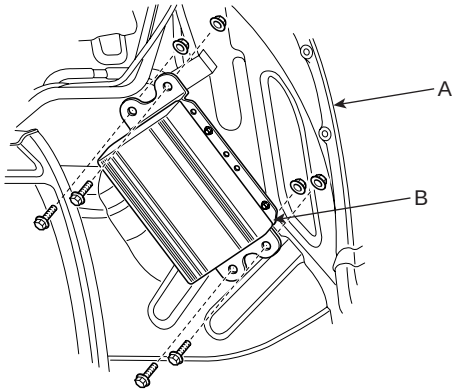


ATJF022F

3. Installation is the reverse of removal.

EXTERNAL AMPLIFIER (5 DOORS)

1. Remove the right luggage side trim.
2. Remove the external amplifier (B) from the quarter inner panel (A) after removing 4 bolts.



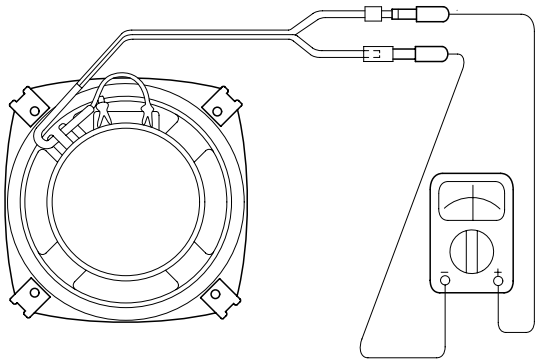
ATJF022G

3. Installation is the reverse of removal.

INSPECTION EFDFAE44

1. Check the speaker with an ohmmeter. If an ohmmeter indicates the correct impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is ok.

Specified impedance : 2 ~ 4Ω

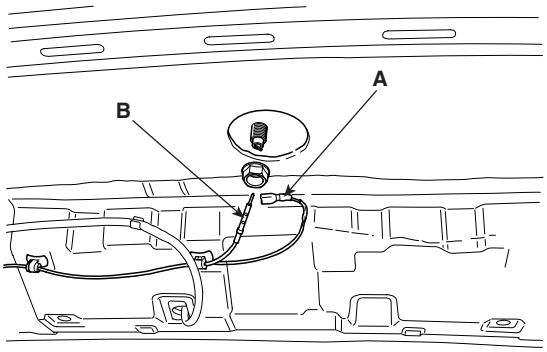


KTMB060A

ANTENNA

REPLACEMENT E7EFE2C8

1. Remove the rear roof trim (Refer to Body group-roof trim).
2. Disconnect the 1P connector (A) and antenna jack (B) from the roof antenna.
3. Remove the roof antenna after removing a nut.



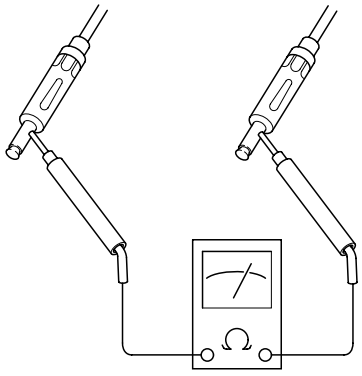
LTJF023A

4. Installation is the reverse of removal.

INSPECTION E4DAAF52

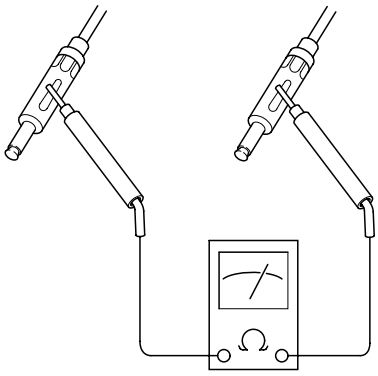
ANTENNA CABLE

1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



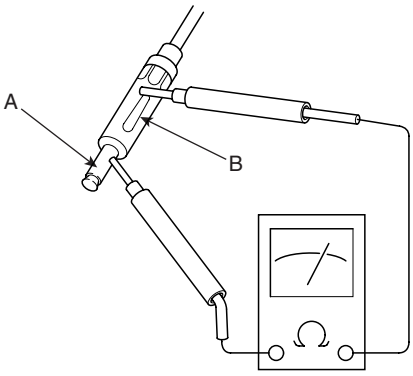
ATJF023C

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



ATJF023D

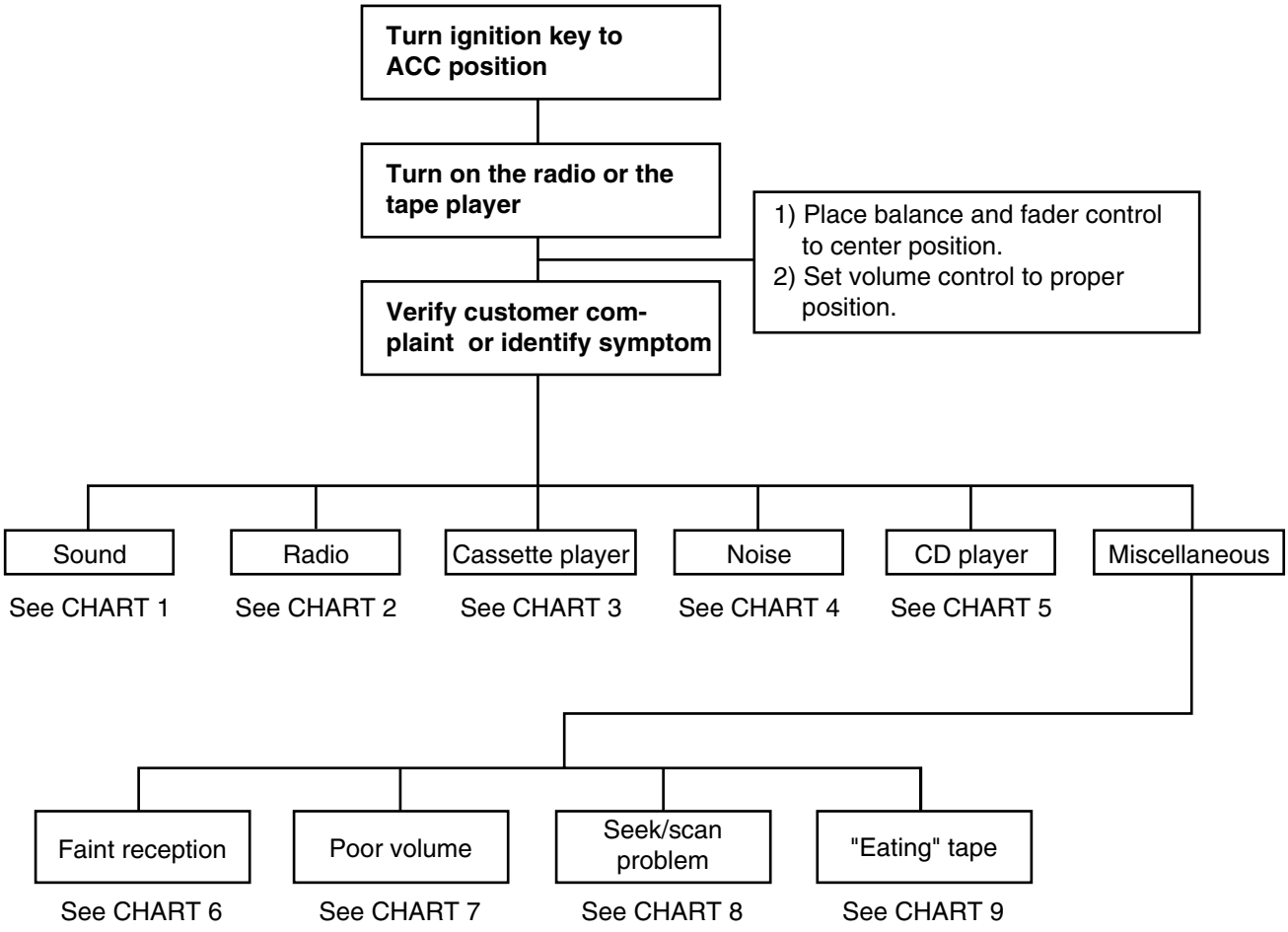
4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.
6. If there is continuity, replace the antenna cable.



ATJF023F

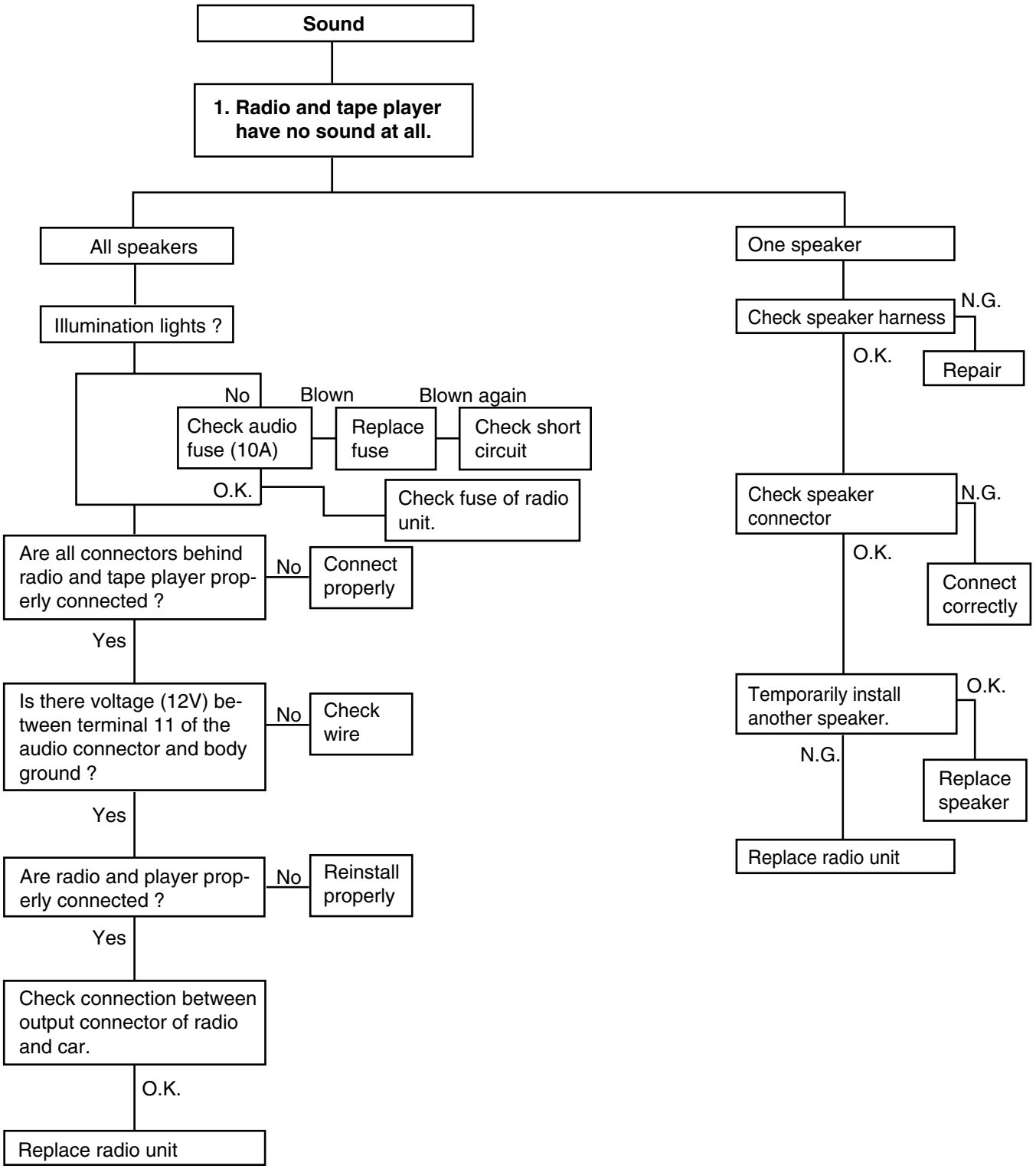
TROUBLESHOOTING EBCA9F5A

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

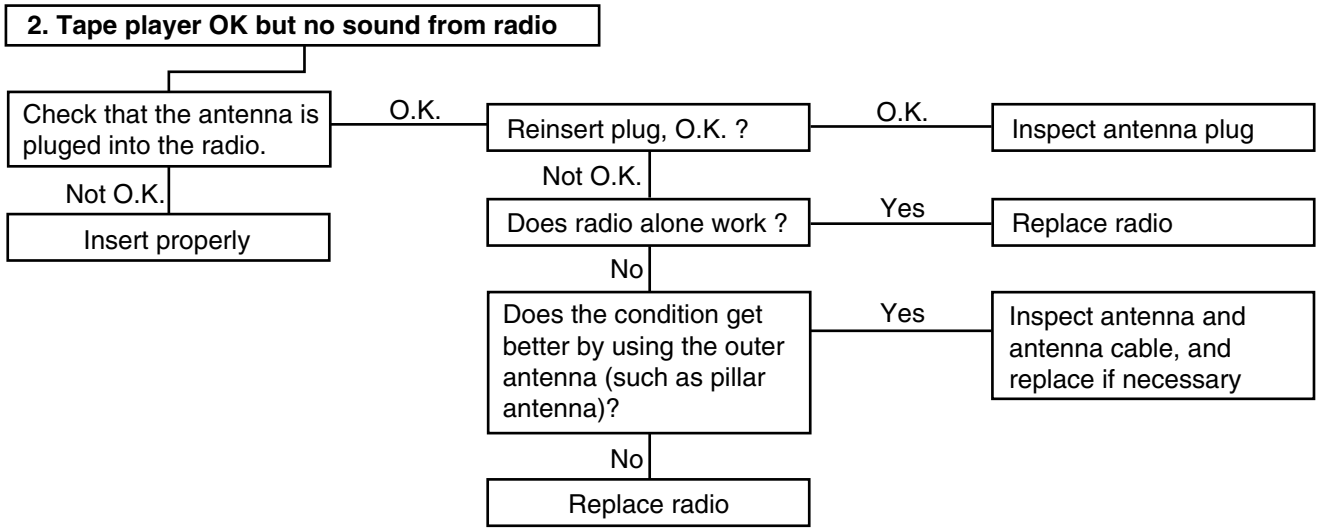


LTIF001A

CHART 1

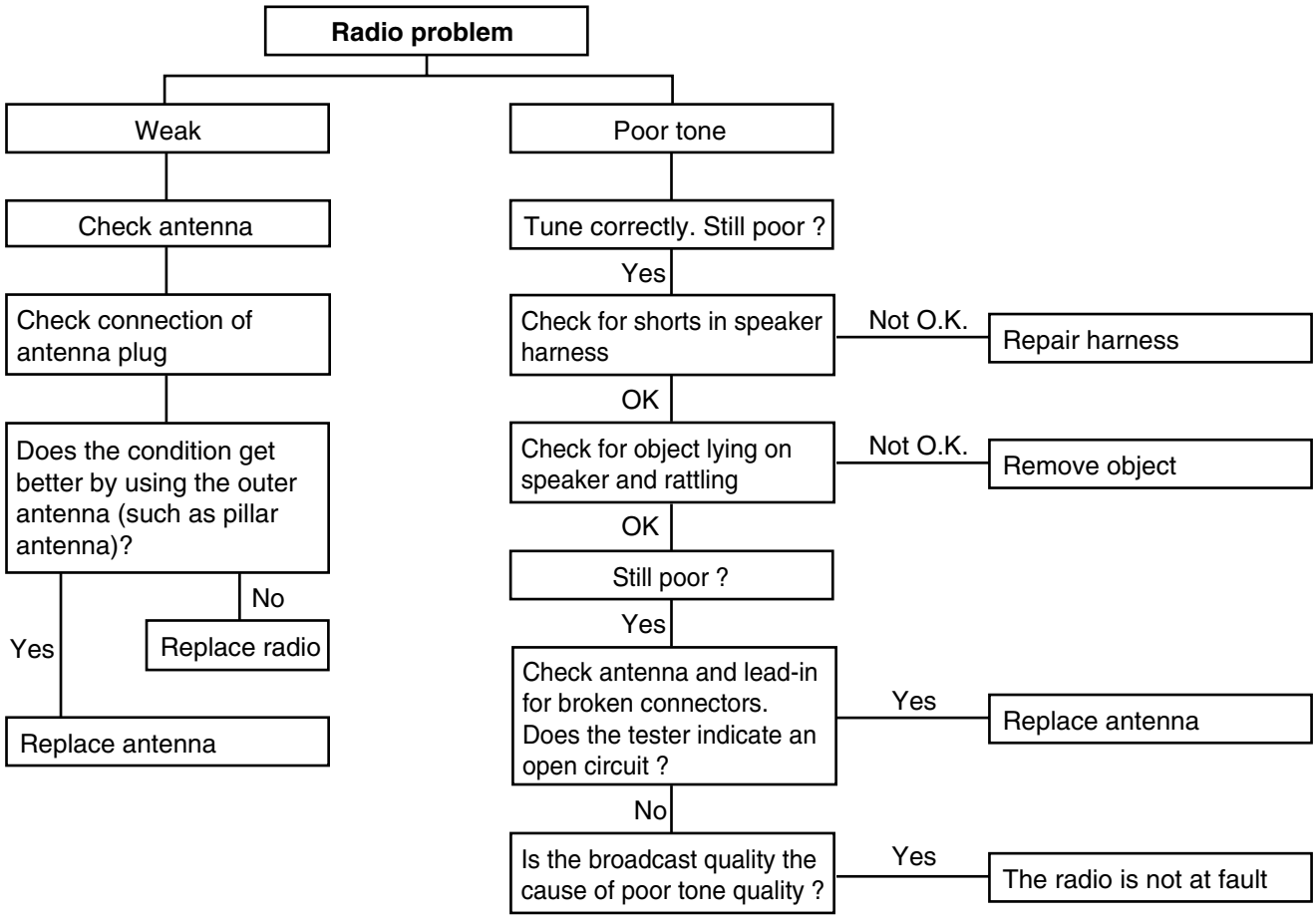


LTJF001B



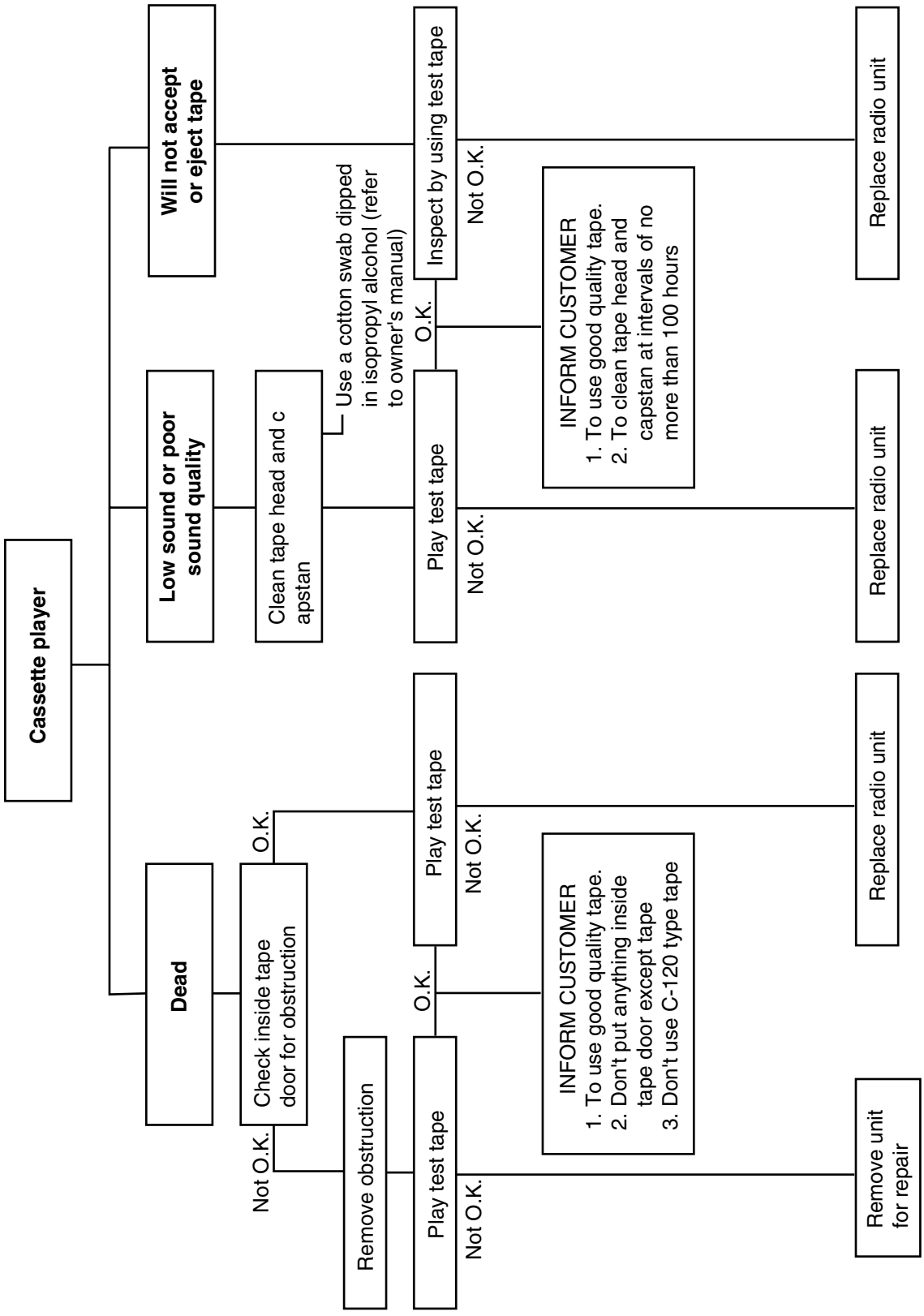
LTIF001C

CHART 2



BTIF001D

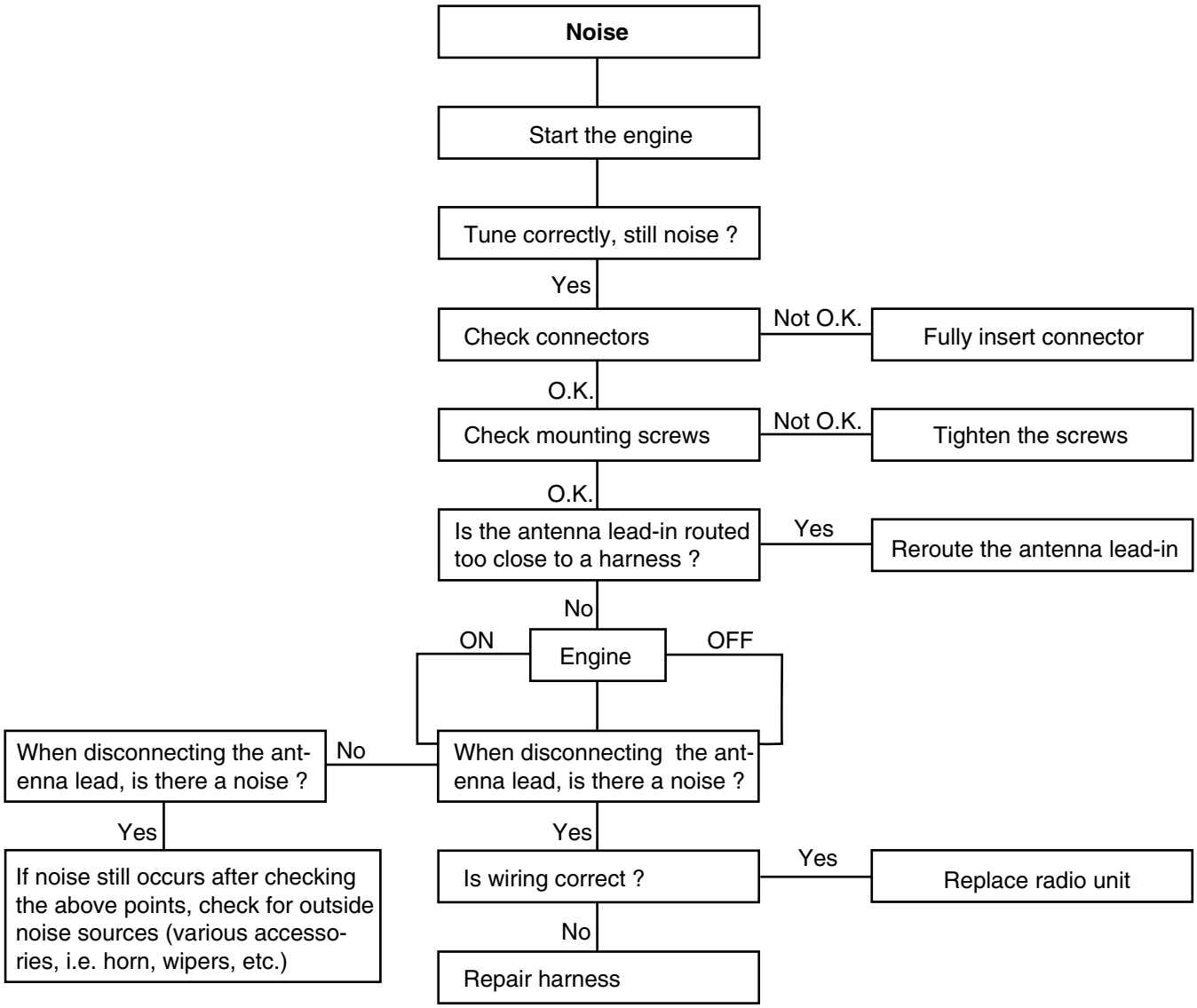
CHART 3



LTJF001E

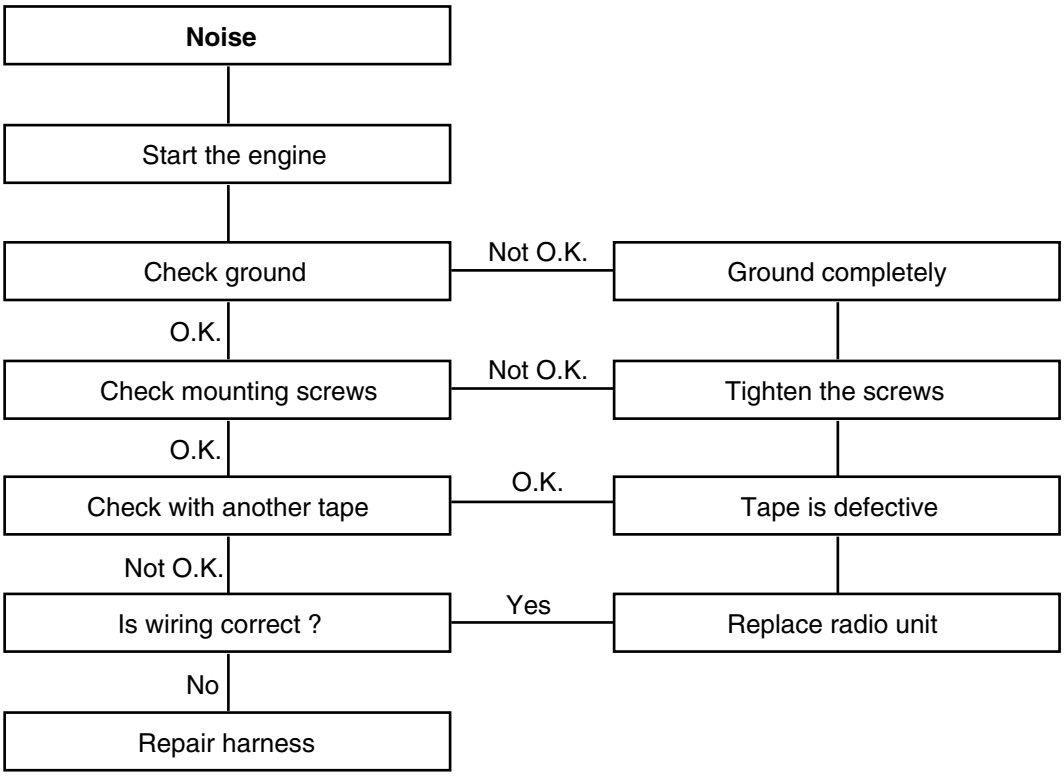
CHART 4

1. RADIO



LTIF001F

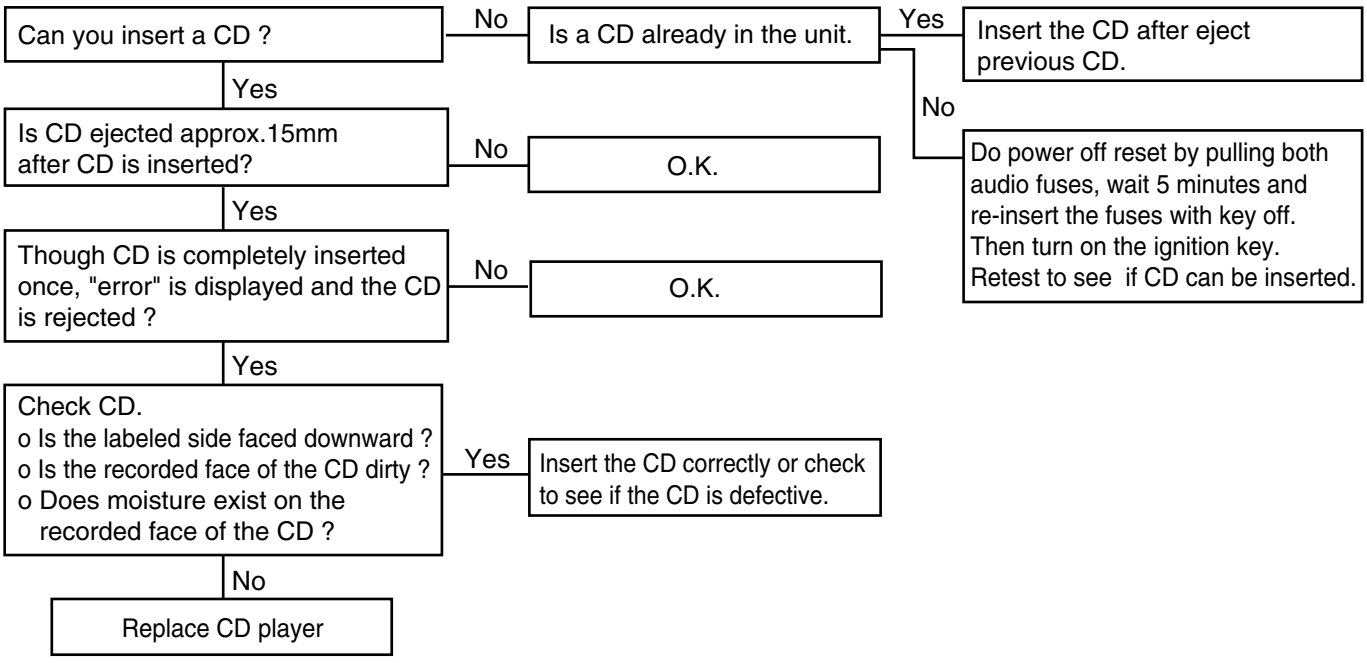
2. TAPE



LTIF001G

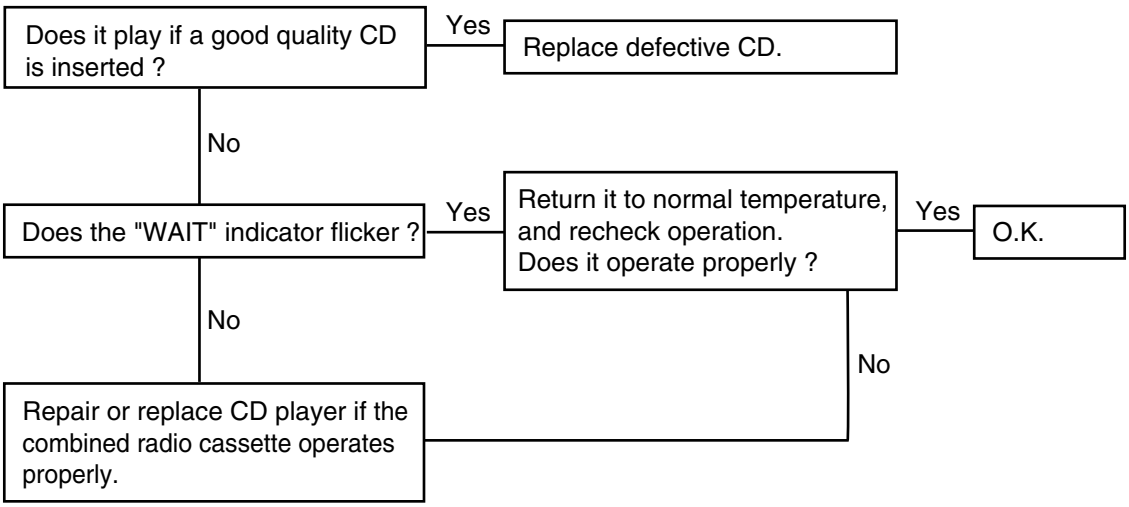
CHART 5

1. CD WILL NOT BE ACCEPTED



BTIF001H

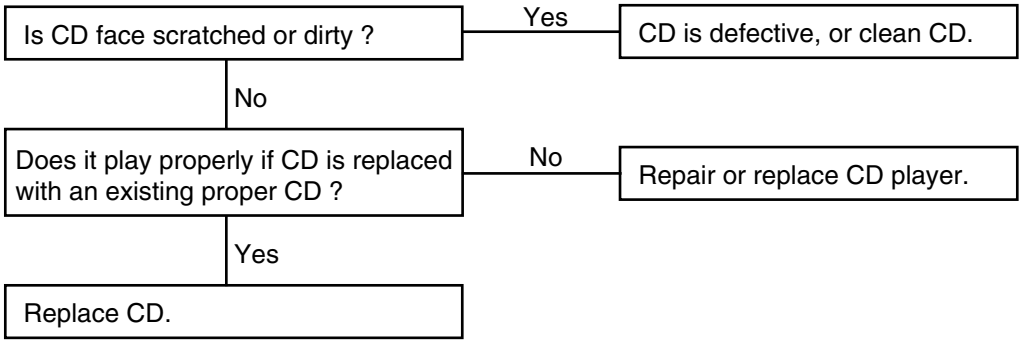
2. NO SOUND



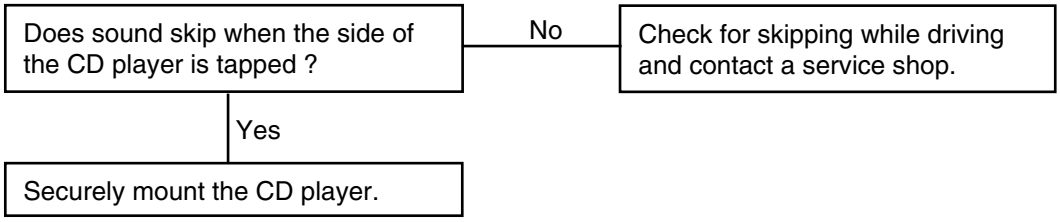
LTIF001I

3. CD SOUND SKIPS

1) Sound sometimes skips when parking.

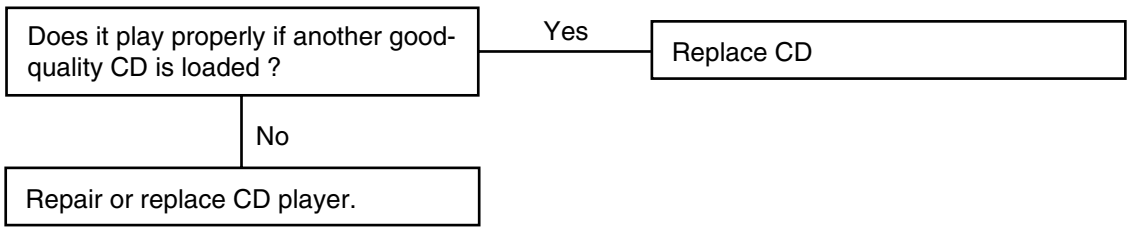


2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)

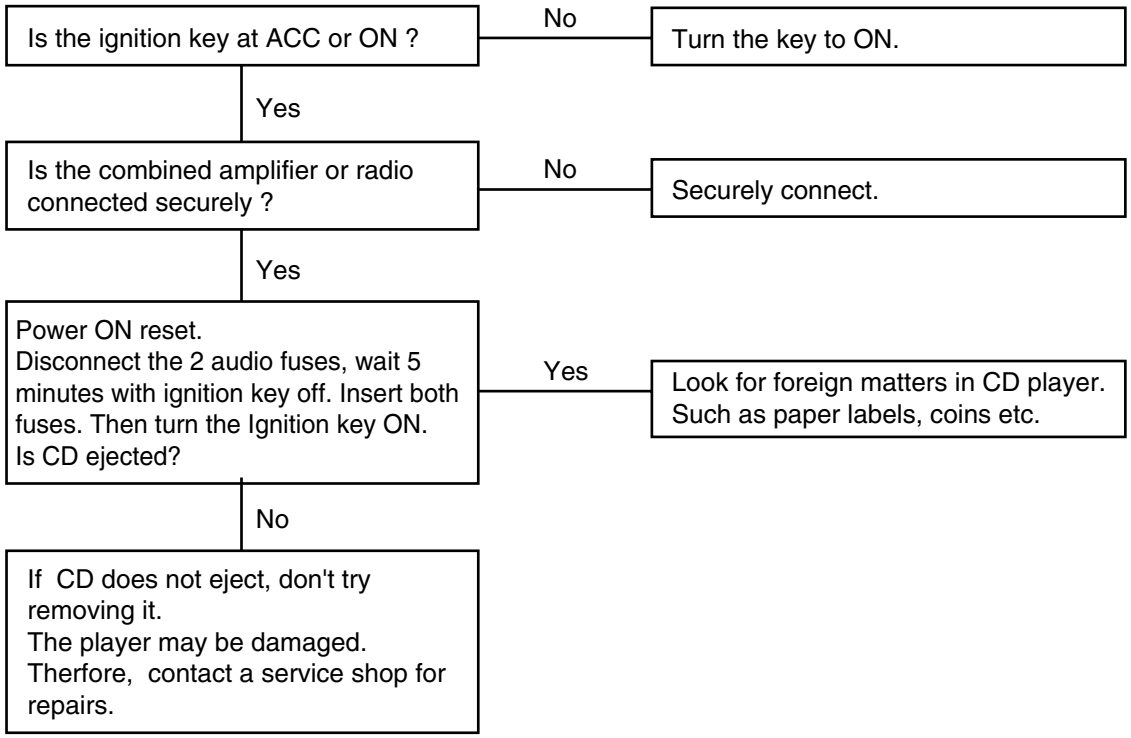


LTIF001J

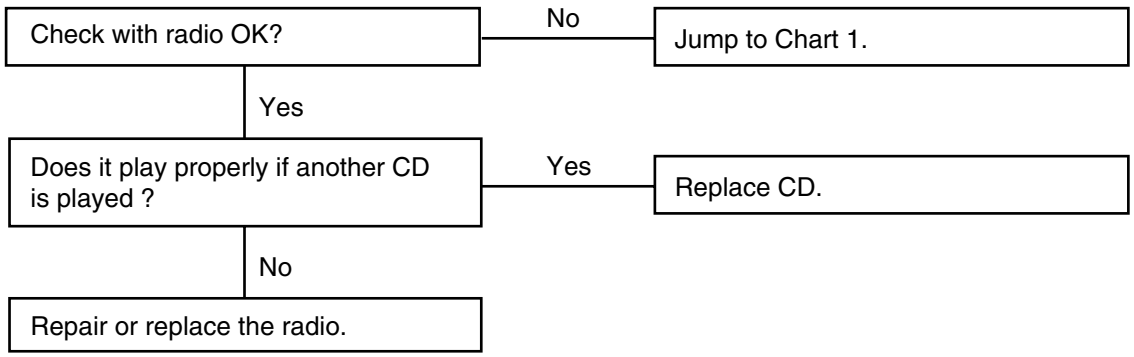
4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT

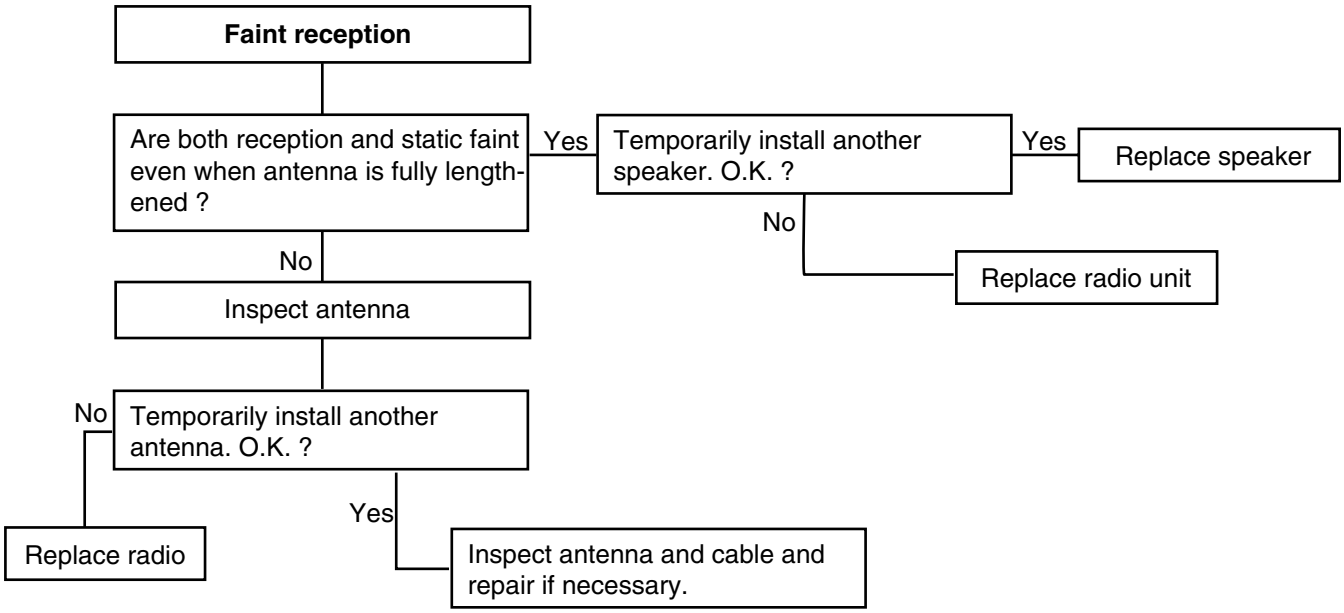


6. NO SOUND FROM ONE SPEAKER



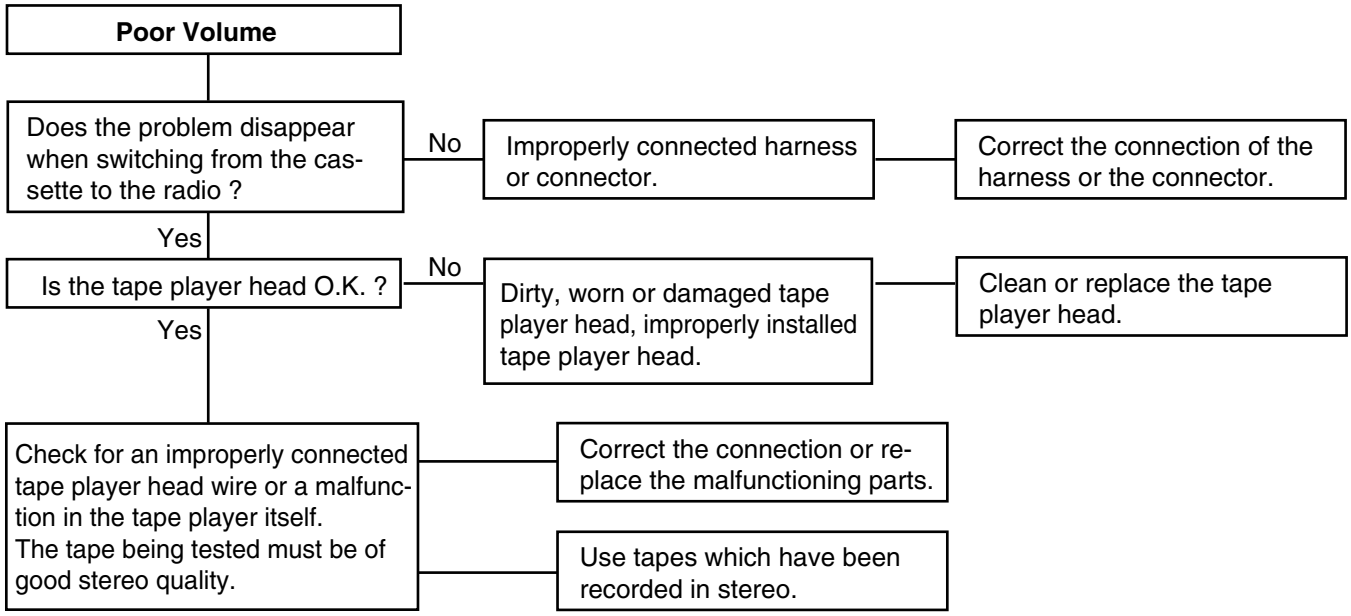
LTIF001K

CHART 6



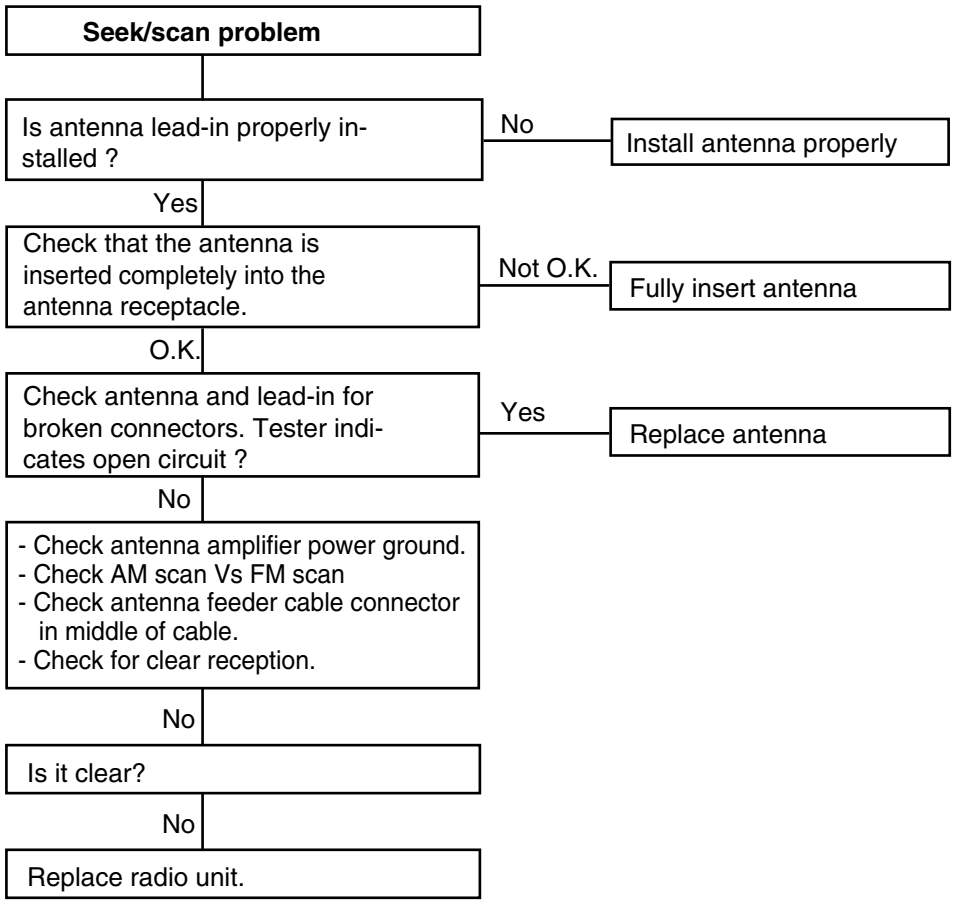
LTIF001L

CHART 7



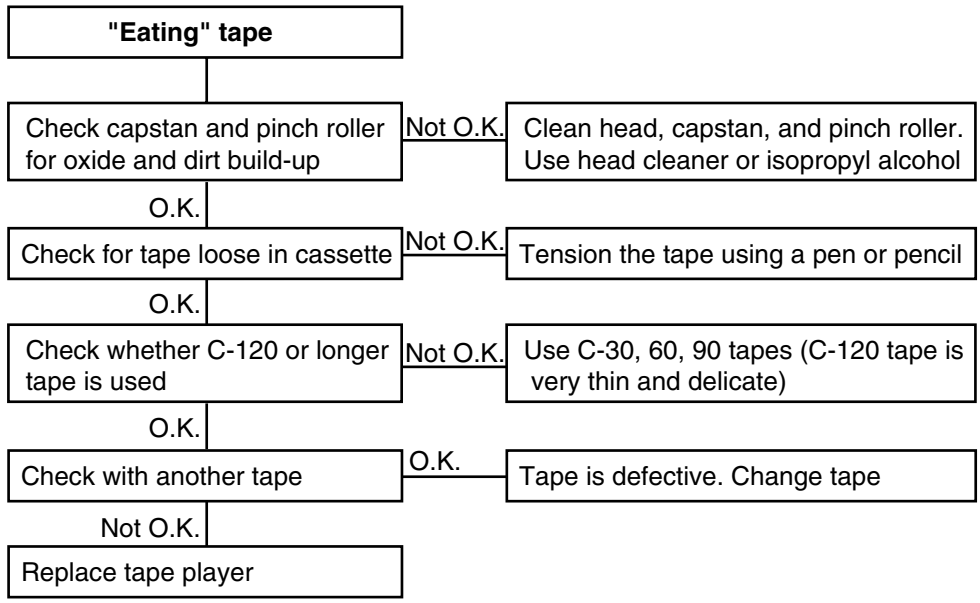
LTIF001M

CHART 8



LTIF001N

CHART 9



LTIF001O

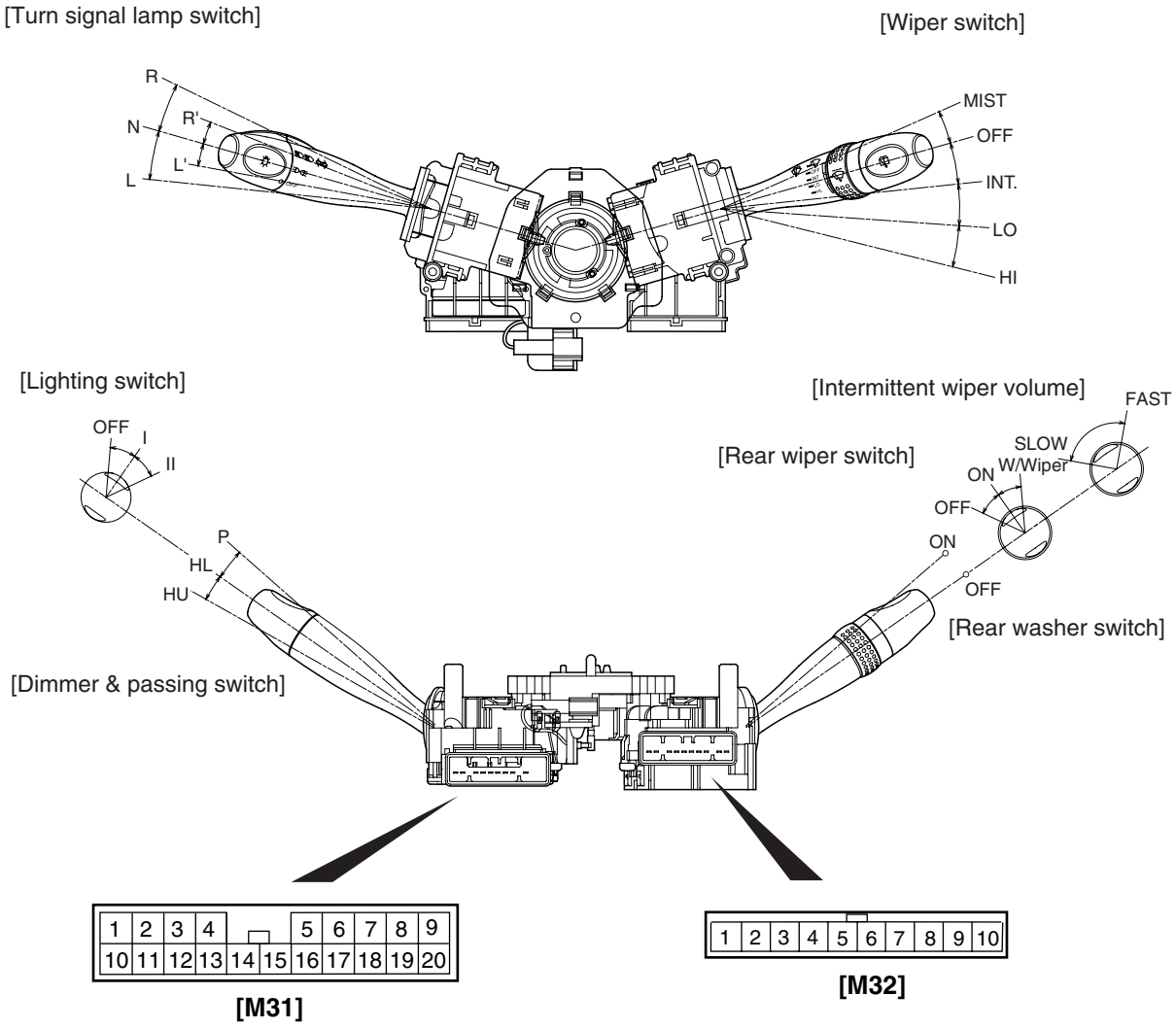
MULTI FUNCTION SWITCH

SPECIFICATION E4CFE3FF

Items	Specifications
Rated voltage	DC 12 V
Operating temperature range	-30°C ~ +80°C (-22 ~ +176°F)
Rated load	
Dimmer & passing switch	High : 120W (Lamp load) Low : 110W (Lamp load) Passing : 120W (Lamp load)
Lighting switch	Lighting : 21W (Lamp load)
Turn signal & lane change switch	69W (Lamp load)
Wiper & mist switch	Low, High : 5.0A (Motor load) Intermittent : 0.07±0.05A (Relay load) Lock : Max. 25A (Motor load) Mist: 5A (Motor load)
Washer switch	4.0A (Motor load)
Rear wiper & washer switch (5doors)	Rear wiper : 3.5A (Motor load) Rear washer : 5A (Motor load)

COMPONENT E4C024D5

This illustration is shown the LHD type.
RHD type is symmetrical.



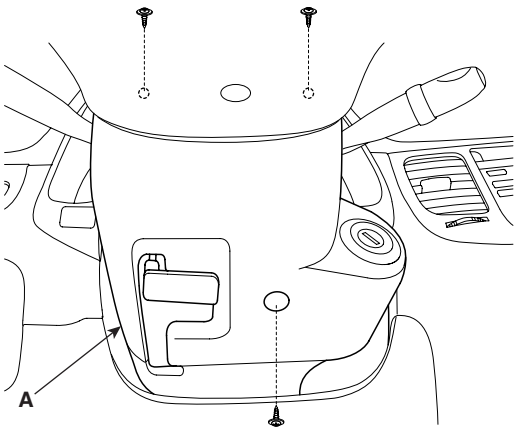
Circuit connection

Connector No.	Terminal No.	Description	Connector No.	Terminal No.	Description
M31	10	Head lamp switch power	M32	1	Wiper ground
	11	Rear fog switch		2	Wiper high speed
	12	Head lamp switch ground		3	Wiper & washer power
	13	Tail lamp switch		4	Wiper low speed
	14	Head lamp high beam power		5	Wiper parking
	15	Head lamp low beam power		6	Rear wiper & washer power
	16	Turn signal lamp (RH)		7	Front washer switch
	17	Flasher unit power		8	Rear wiper parking
	18	Turn signal lamp (LH)		9	Rear washer
				10	Rear wiper

LTJF031A

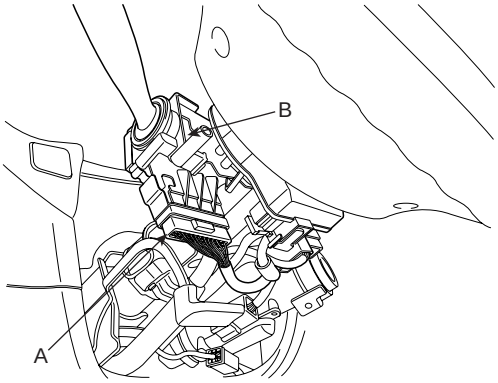
REPLACEMENT E8CDCFAD

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws.



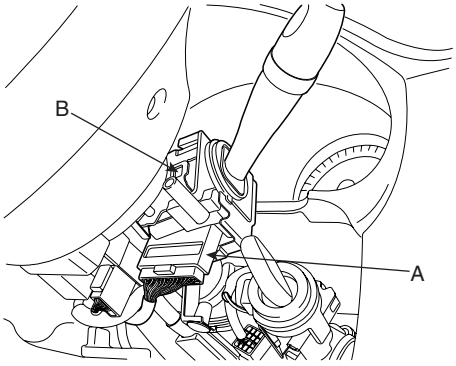
LTJF031B

3. Remove the light switch by pushing the lock pin (B) after disconnecting the connector (A).



ATJF031C

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



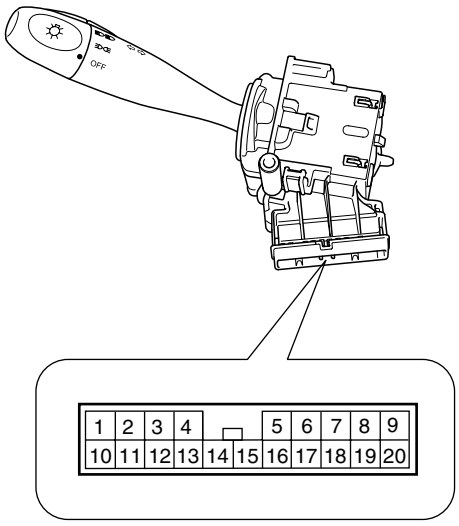
ATJF031D

5. Installation is the reverse of removal.

INSPECTION E9F01C74

LIGHTING SWITCH INSPECTION

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.



ATHE031B

( ) : RHD

Terminal / Position	10(20)	13(17)	11(19)	12(18)
OFF				
I	○——	——○		
II	○——	——○	○——	——○

LTJF031C

( ) : RHD

Terminal / Position	12(18)	14(16)	15(15)
HU	○——	——○	
HL	○——		——○
P	○——	——○	

HU : Head lamp high beam

HL : Head lamp low beam

P : Head lamp passing switch

LTJF031D

TURN SIGNAL SWITCH

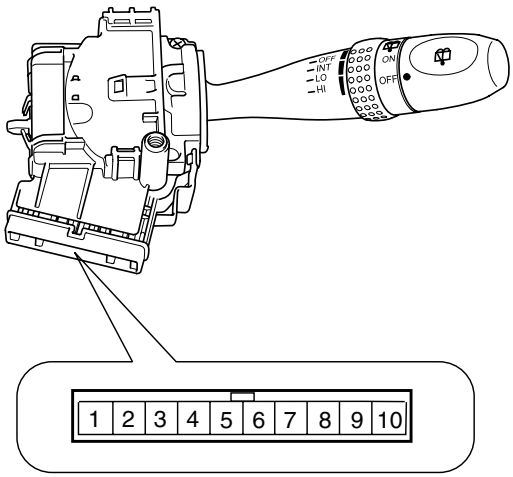
( ) : RHD

Hazard switch	Terminal / Trun signal switch	16(12)	17(13)	18(14)
OFF	L		○——	——○
	N			
	R	○——	——○	

LTJF031G

WIPER AND WASHER SWITCH INSPECTION

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.



ATBE031F

( ) : RHD

Terminal / Position	2(9)	3(8)	4(7)	5(6)
MIST		○——	——○	
OFF			○——	——○
INT			○——	——○
LOW		○——	——○	
HI	○——	——○		

LTJF031H

( ) : RHD

Terminal / Position	3(8)	7(4)
OFF		
ON	○——	——○

LTJF031I

REAR WIPER & WASHER SWITCH (5DOORS)

( ) : RHD

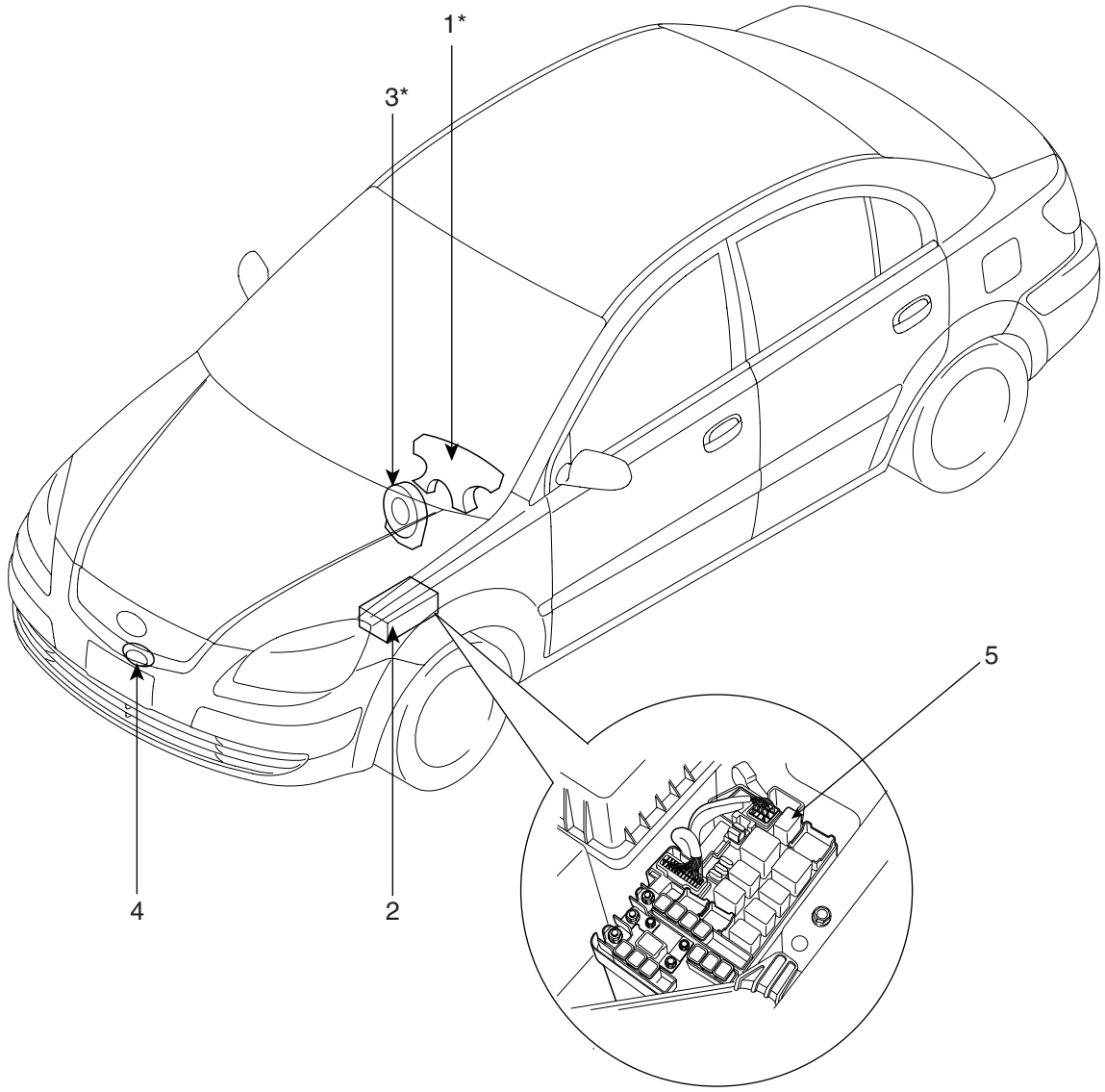
Terminal / Position	6(5)	8(3)	9(2)	10(1)
OFF		○——		——○
ON	○——			——○
Rear washer	○——		○——	——○

LTJF031J

HORNS

COMPONENT LOCATION EDDF5FC3

The parts with asterisk(*) :
This illustration is shown the LHD type.
RHD type is symmetrical.

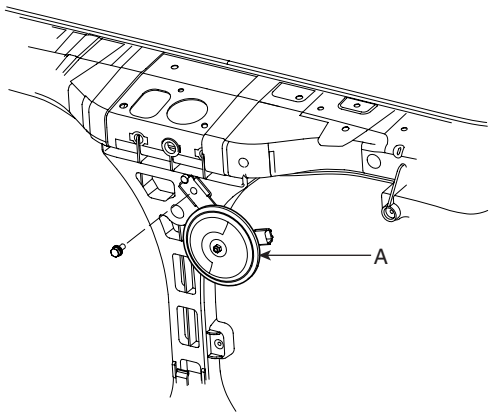


1. Horn switch
2. Relay box (Engine room compartment)
3. Clock spring
4. Horn (High pitch)
5. Horn relay

LTJF051A

REPLACEMENT EC29F94B

1. Remove the radiator grill.
2. Remove the bolt and disconnect the horn connector, then remove the high pitch horn (A).



LTJF051B

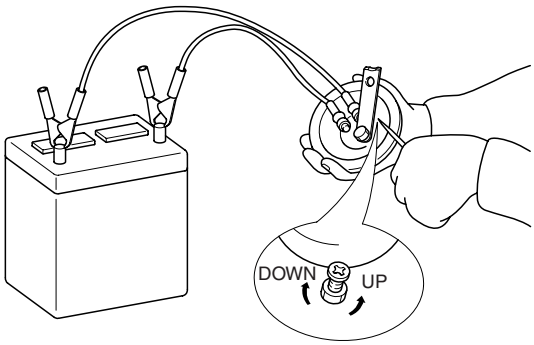
3. Installation is the reverse of removal.

ADJUSTMENT EE1DF87A

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.



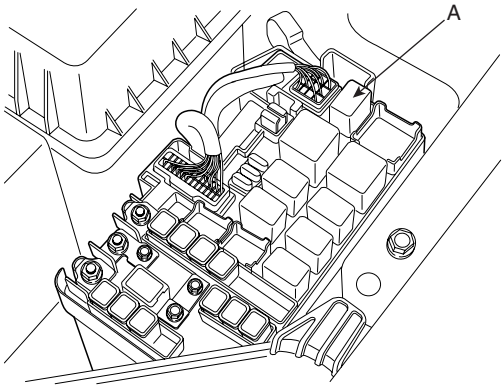
ETDA050A

INSPECTION EBBA23B5

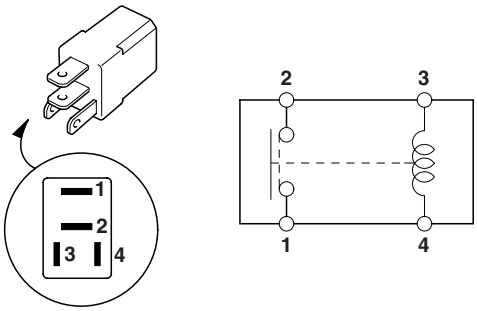
Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The horn should make a sound. If the horn fails to make a sound, replace it.

HORN RELAY INSPECTION

1. Remove the horn relay (A) from the engine room relay box.
2. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
3. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.



ATJF051C



ATJF051D

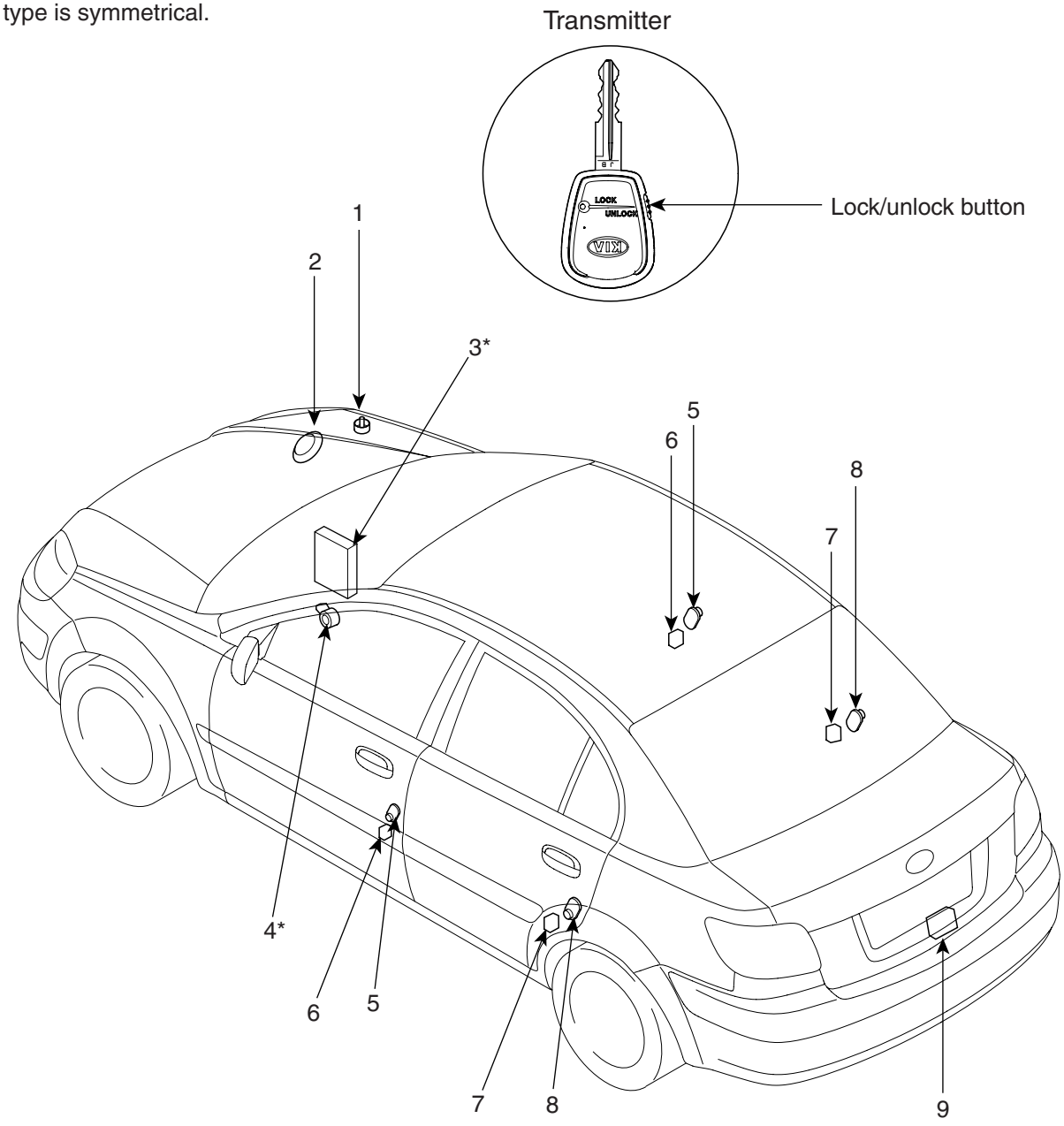
Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

ETKE215E

KEYLESS ENTRY AND BURGLAR ALARM

COMPONENT LOCATION EF86D423

The parts with asterisk(*) :
This illustration is shown the LHD type.
RHD type is symmetrical.



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

LTJF120A

DESCRIPTION EB1FE4D7

BURGLAR ALARM SYSTEM

The burglar alarm system is armed automatically after the doors, hood, and trunk lid (tailgate) are closed and locked.

The system is set off when any of these things occur :
- A door is forced open.
- A door is unlocked without using the transmitter.
- The trunk lid (tailgate) is opened without using the key.
- The hood is opened.
- The engine starter circuit and battery circuit are bypassed by breaking the ignition switch.

When the system is set off, the alarm (horn) sounds and the hazard lamp flash for about two minutes or until the system is disarmed by unlocking the transmitter.

For the system to arm, the ignition switch must be off and the key removed. Then, the body control module must receive signals that the doors, hood, and trunk lid (tailgate) are closed and locked. When everything is closed and locked, none of the control unit inputs are grounded.

The door switches, hood switch and trunk lid (tailgate) switch are all close and lock the doors with the remote transmitter and then the system arms immediately.

If anything is opened or improperly unlocked after the system is armed, the body control module gets a ground signal from that switch, and the system is set off.

If one of the switches is misadjusted or there is a short in the system, the system will not arm. As long as the body control module continues to get a ground signal, it thinks the vehicle is not closed and locked and will not arm.The receiver is integrated in the body control module.

KEYLESS ENTRY SYSTEM

The burglar alarm system is integrated with the keyless entry system. The keyless entry system allows you to lock and unlock the vehicle with the remote transmitter. When you push the LOCK/UNLOCK button, all doors lock. When you push the LOCK/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 twice when they unlock.

FUNCTIONS EC247515

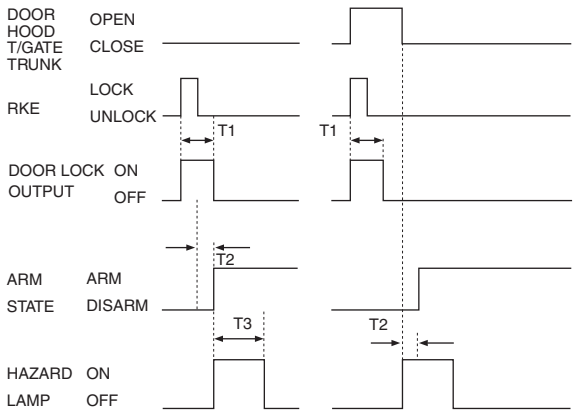
1. ARM Function

   1) When using LOCK on the RKE (Remote Keyless Entry) the doors will lock, the hazard lamp will blink once within 1 second and the Anti-Theft System will ARM, if the following conditions have been met.
      - The ignition key is removed from the ignition switch.
      - All entry points are closed (doors, trunk, tail gate and hood)

   2) If either the door or trunk or hood is open when activating LOCK using the RKE, the doors will lock, however the hazard lamp will not flash and the Anti-Theft System will not arm.

   3) In Step 2) if the opened entry points are subsequently closed. the door will lock, the hazard lamp will blink once and the Anti-Theft System will ARM.

   4) The ARM mode of the Anti-Theft System can only be set using the LOCK feature of the RKE. The door key will not arm the Anti-theft System.



LTJF121A

T1 : 0.5 ± 0.1 sec,
T2 : within 2.0 sec,
T3 : 1.0 ± 0.2 sec.

2. DISARM Function

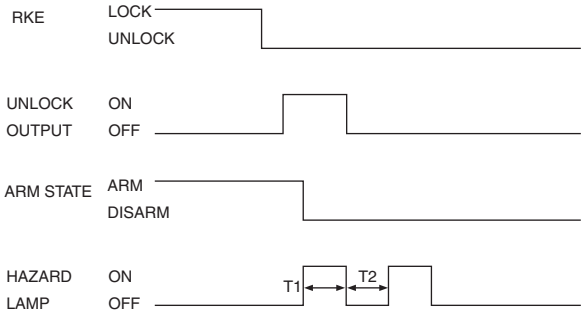
1) When UNLOCK is pressed on the RKE (Remote Keyless Entry control) the ANTI-Theft System will DISARM, the hazard lamps blink 2 times and the doors unlock.
(Whether entry points are open or Closed is irrelevant)

2) Once the ignition key is IN (inserted into the ignition switch) and the ignition is turned to the ON position the Anti-Theft system will immediately DISARM.

3) If the UNLOCK signal is sent by the RKE, and either the ignition key is not inserted or entry (door, trunk, tail gate, hood) to the vehicle is not made within 30 seconds, the LOCK mode will be automatically reset, the hazard lamps will blink, and the Anti-Theft System will rearm. (Key IN = Key Insertion)
(Provided that there is no automatic lock function at a period of 30 seconds, when the UNLOCK is done by the RKE with an entry being open).

4) In steps 3), when UNLOCK is activated within the initial 30 seconds, another period of 30 seconds occurs.

5) The DISARM mode of the Anti-Theft System can only be set using the UNLOCK feature of the RKE. The door key will not disarm the Anti-theft System.

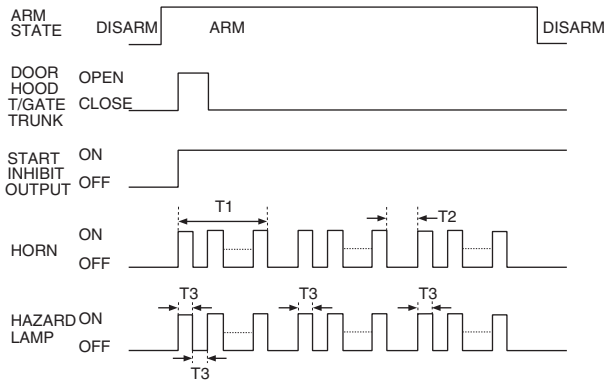


LTJF121B

T1, T2 : 0.5 ± 0.1 sec.

3. ALARM Function

1) GENERAL AREA
a. When a point of entry is opened while the Anti-Theft System is in the ARM mode, the hazard lamp and horn alarm will activate (ON/OFF 3 times each) for a period of 27 seconds.
b. Output intervals for the horn alarm and hazard lamps are identical.
c. The alarm sequence, when activated will continue for the duration of the alarm period even when the entry point is closed. (The alarm will reactivate if entry port is reopened after the initial alarm sequence completes.)

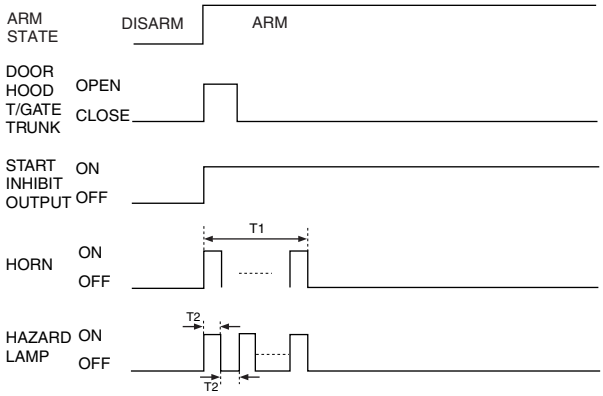


LTJF121C

T1: 27 ± 2 sec,
T2: 10 ± 1 sec,
T3: 0.4 ~ 0.5 sec.

2) EUROPE, AUSTRALIA AREA
a. When a point of entry is opened while the Anti-Theft System is in the ARM mode, the hazard lamp and horn alarm will activate (ON/OFF 1 time each) for a period of 27 seconds.
b. Output intervals for the horn alarm and hazard lamps are identical.

c. The alarm sequence, when activated will continue for the duration of the alarm period even when the entry point is closed. (The alarm will reactivate if entry port is reopened after the initial alarm sequence completes.)

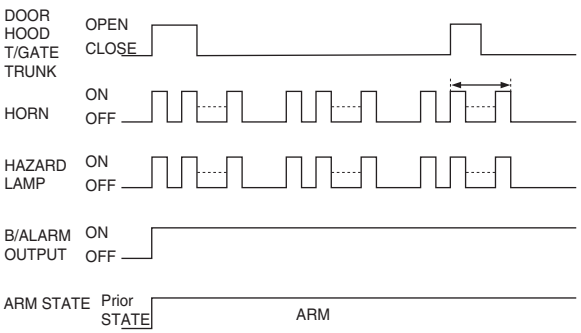


LTJF121D

T1: 27 ± 2 sec,
T2: 0.4 ~ 0.5 sec,

4. New condition occurring during alarming

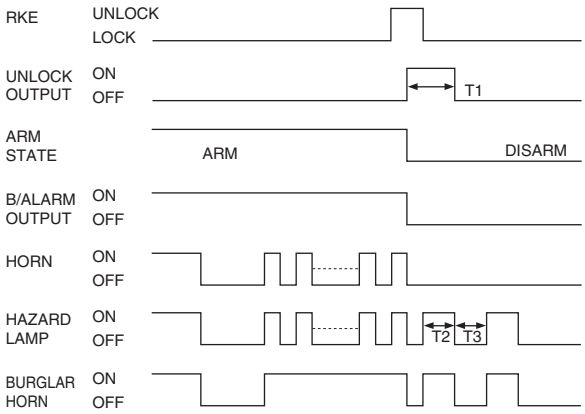
1) When a new alarming condition is occurred during alarming, the B/Alarm shall be maintained ON state and the horn alarm output and hazard Lamp output shall be output only for the remained time period.



LTJF121E

5. Transmitter controlled unlock during the alarm sequence

1) ARM state is released (DISARM state) and the horn, the hazard output and the B/Alarm output shall be OFF, and the unlock output shall be ON for T1, and hazard lamp output shall be ON twice with cycle of T2.

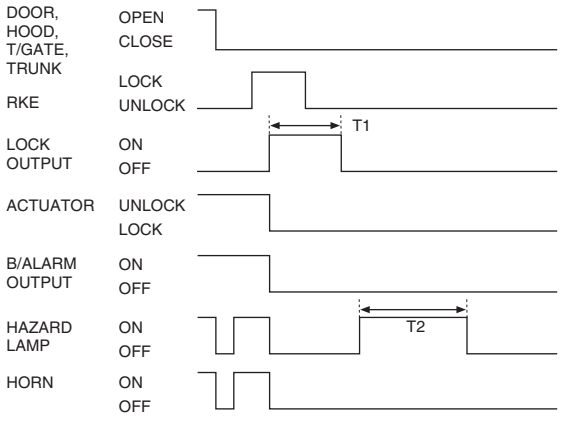


LTJF121F

T1, T2, T3 : 0.5 ± 0.1 sec.

6. Transmitter controlled lock during the alarm sequence

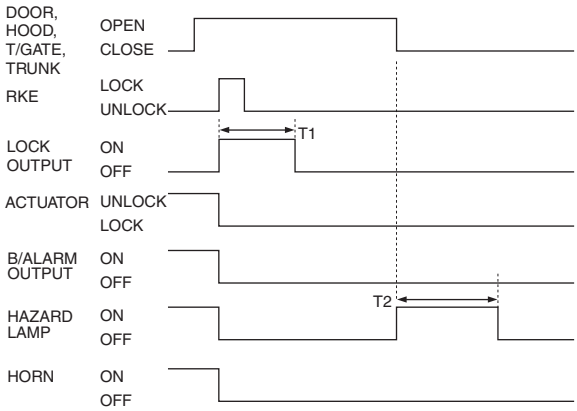
1) During alarming, if the opened door is closed and the Lock signal is received from RKE :The horn alarm output, the hazard lamp output and the B/Alarm output shall be OFF and the Lock output shall be ON for T1 and then, actuator lock shall be checked, the hazard lamp output shall be ON once and, it shall be in the ARM state.



LTJF121G

T1 : 0.5 ± 0.1 sec,
T2 : 1.0 ± 0.2 sec.

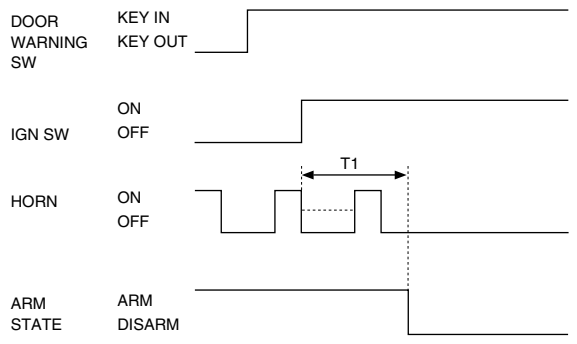
2) During alarming, if the opened door is open and the Lock signal is received from RKE: The horn alarm output, the hazard lamp output and the B/Alarm output shall be OFF and, the Lock output shall be ON for T1 and then, if the opened door is closed actuator lock shall be checked, the hazard lamp output shall be ON once and, it shall be in the ARM state.



LTJF121H

T1 : 0.5 ± 0.1 sec,
T2 : 1.0 ± 0.2 sec.

7. Alarm clearance
If the ignition key is turned to ON for 30 seconds during alarm activation the alarm will be cleared and the start inhibitor reset.

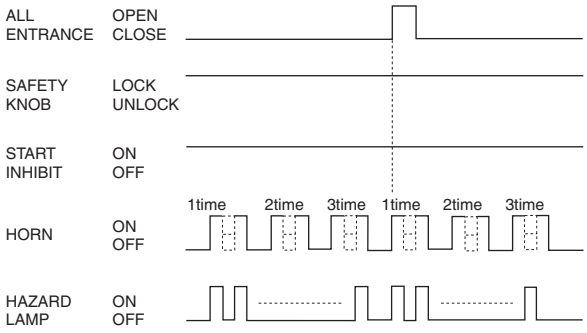


LTJF121I

T1 : 30 ± 3 sec.

8. REALARM Function

1) Output again horn alarm 3 times when outlet OPEN again, again B/ALARM horn hold "ON", without safety knob lock at outlet close condition after completing 3 times alarm(120sec.)
※ EC/Australia : The horn alarm shall be On at once.

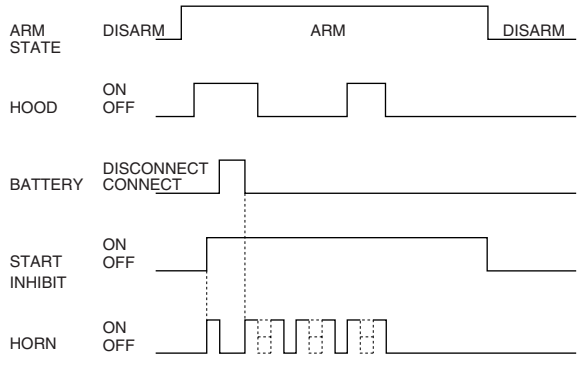


LTJF121J

9. Battery Separation

1) Case detaching battery during alarm.
- Starr inhibit is ON and horn alarm output 3 times again after detaching battery regardless of hood switch and installing.(output hazard lamp, horn equally.) where, do not regard horn alarm regard horn alarm as continuous alarm.
※ EC/Australia : The horn alarm shall be On at once.
(Alarm when re-installing after detaching battery for alarming)

2) Case detaching battery at ARM condition.
- Hold ARM condition when installing after detaching battery at ARM condition.
- Disalarm ARM condition immediately if door warning switch ON & IGN1 SW ON & IGN2 SW is ON at ARM condition.
- Defer alarm when trunk open with key at ARM condition.
- Hold ARM condition only that close condition is holding over 2 sec. for trunk close.

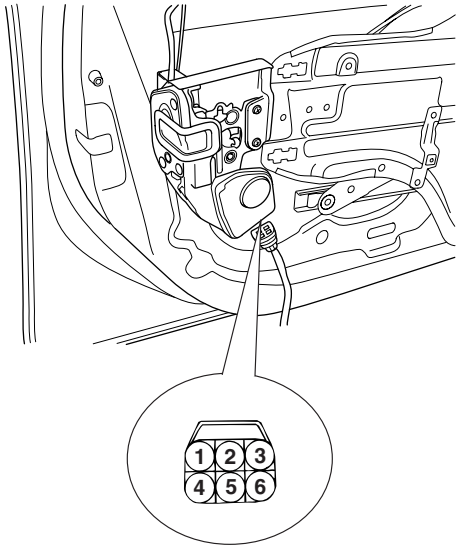


LTJF121N

INSPECTION EBCFAE7D

FRONT DOOR LOCK ACTUATOR

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 6P connector from the actuator.



KTKD047A

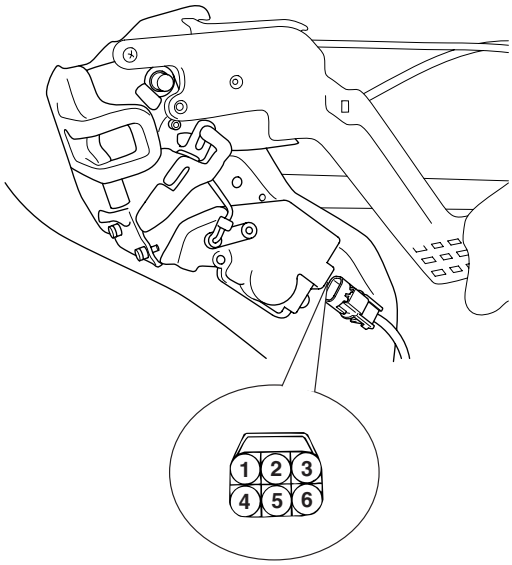
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		4	6
Right	Lock	⊖	⊕
	Unlock	⊕	⊖
Left	Lock	⊕	⊖
	Unlock	⊖	⊕

LTJF122B

REAR DOOR LOCK ACTUATOR

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.



KTKD048A

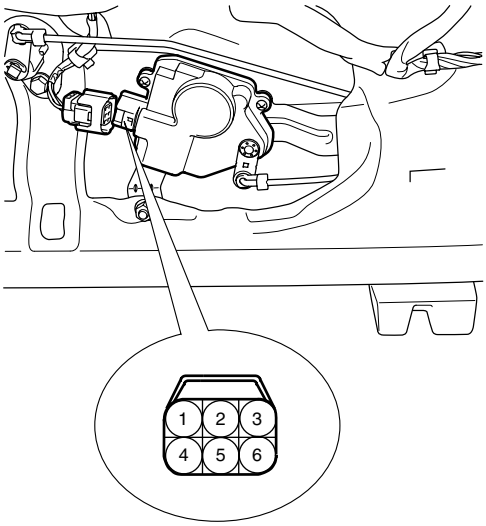
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		4	6
Right	Lock	⊖	⊕
	Unlock	⊕	⊖
Left	Lock	⊕	⊖
	Unlock	⊖	⊕

LTJF122D

TAILGATE LOCK ACTUATOR (5DOORS)

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.



KTPC165A

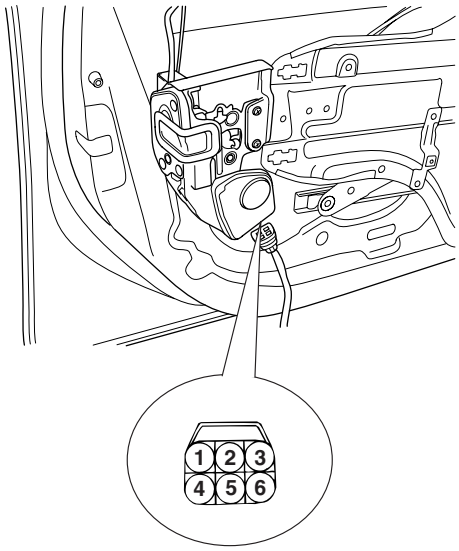
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	1	2
LOCK	⊕	⊖
UNLOCK	⊖	⊕

LTJF122F

FRONT DOOR LOCK SWITCH

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 6P connector from the actuator.



KTKD047A

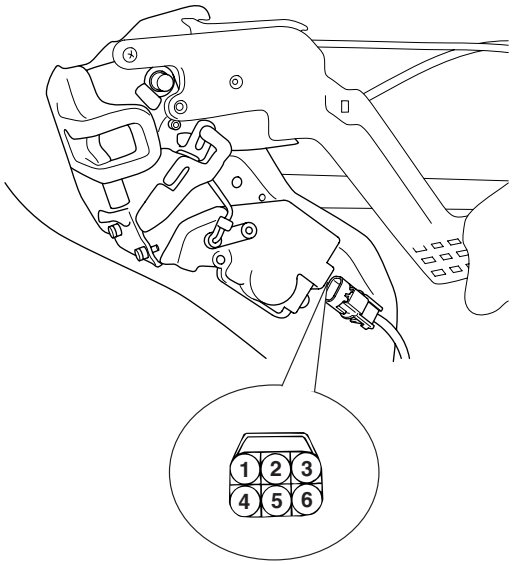
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	2	3
Right	Lock	○		○
	Unlock	○	○	
Left	Lock	○		○
	Unlock		○	○

LTJF122G

REAR DOOR LOCK SWITCH

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.



KTKD048A

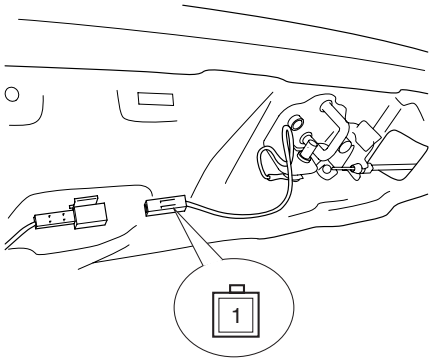
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	2	3
Right	Lock	○		○
	Unlock	○	○	
Left	Lock	○		○
	Unlock		○	○

LTJF122H

TRUNK LID SWITCH (4DOORS)

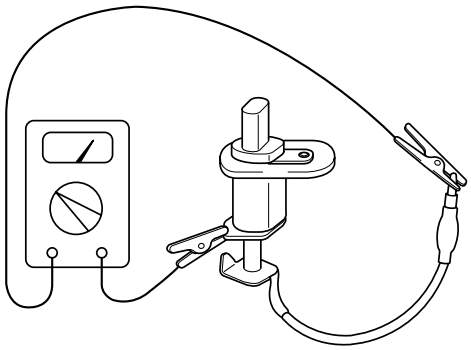
1. Disconnect the negative battery terminal.
2. Remove the rear trunk lid trim, and then remove the trunk lid switch from the trunk lid striker.



KTKD005M

3. Disconnect the 1P connector from the rear harness.
4. Check for continuity between the terminal and body while pushing the rod.

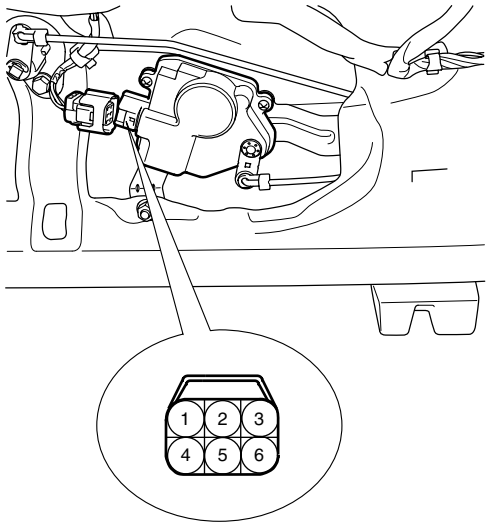
Switch rod condition	Continuity
Push (OFF)	Non-conductive (∞Ω)
Released (ON)	Conductive (0Ω)



KTBC455E

TAILGATE LOCK SWITCH (5DOORS)

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.



KTPC165A

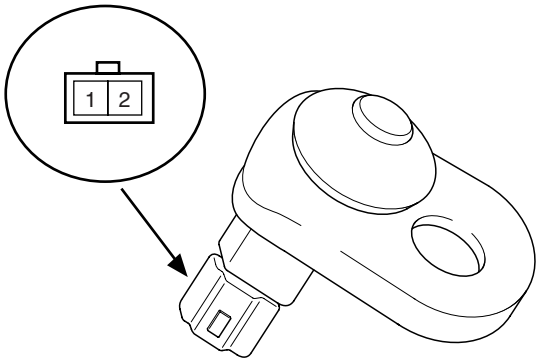
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	4	5	6
Unlock		○	○
Lock	○		○

LTJF122I

DOOR SWITCH

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



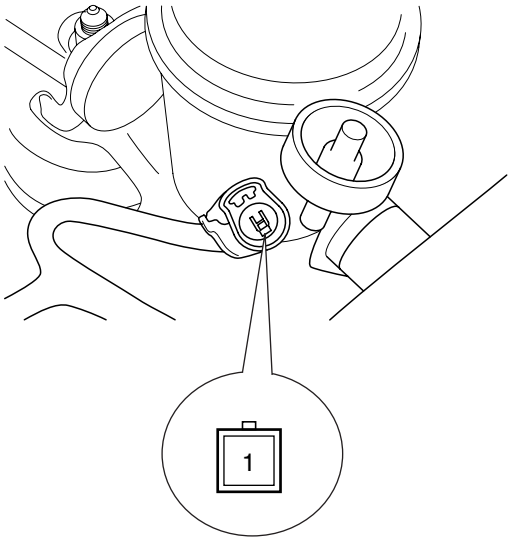
ATIE121Q

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

ETQF180D

HOOD SWITCH

1. Disconnect the 1P connector from the hood switch.



KTKD026A

2. Check for continuity between the terminals and ground according to the table.

Terminal / Position	Ground (Body)	1
Hood open (Free)	○	○
Hood close (Push)		

ETPD180B

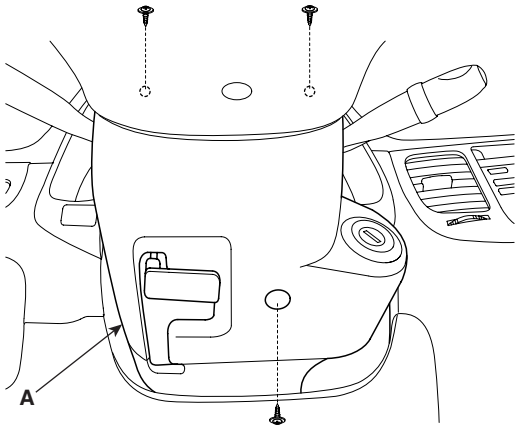
3. Check for continuity between the terminals in each position according to the table.

Terminal / Key position	5	6
Insert	○	○
Removal		

ETQF180F

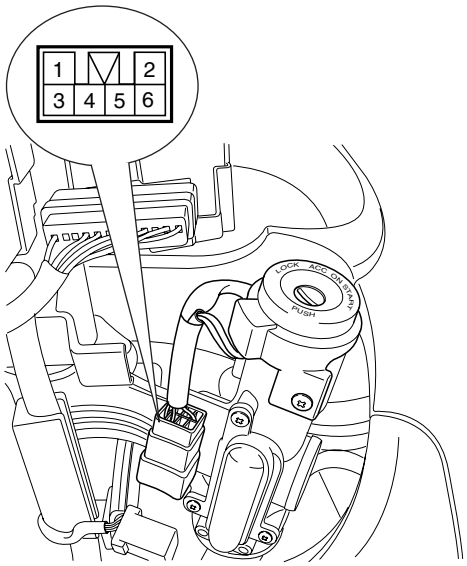
DOOR WARNING SWITCH

1. Remove the steering column upper & lower shrouds (A) after loosening 3 screws.



LTJF031B

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

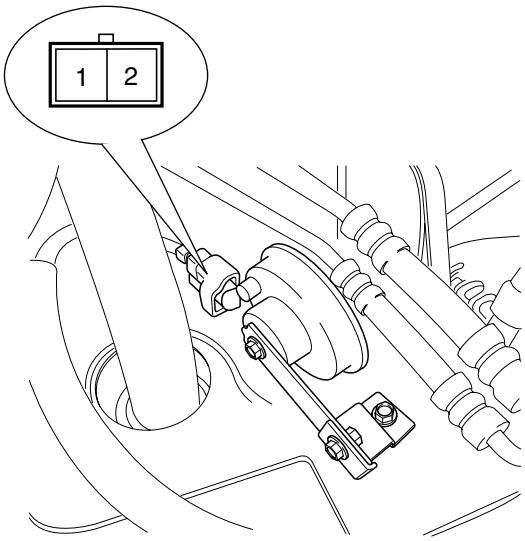


ATJF122J

BURGLAR HORN

1. Remove the burglar horn after removing 2 bolts and disconnect the 2P connector from the burglar horn.

2. Test the burglar horn by connecting battery power to the terminal 1 and ground the terminal 2.



ATJF122K

3. The burglar horn should make a sound. If the burglar horn fails to make a sound replace it.

TRANSMITTER

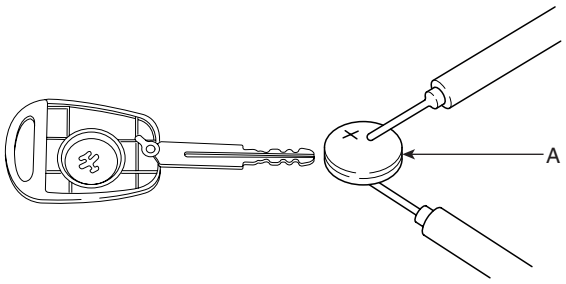
SPECIFICATION EBEA0ECC

Items	Specifications
Keyless entry transmitter Power source	Lithium 3V battery (1EA)
Transmissible distance	10m or more
Life of battery	2 years or more (at 20 times per day)
Button	Door lock/unlock
Transmission frequency	433.92 MHz (EURORE, AUSTRAILIA, MIDDLE EAST) 315.00 MHz (GENERAL)

INSPECTION E2BCA6AC

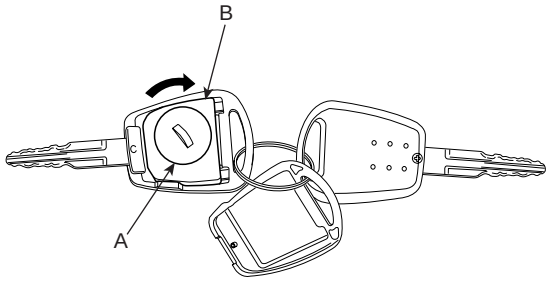
1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V



ATJF122O

3. Replace the battery after removing the battery cover(A) by rotating it about 15° with a clockwise direction.

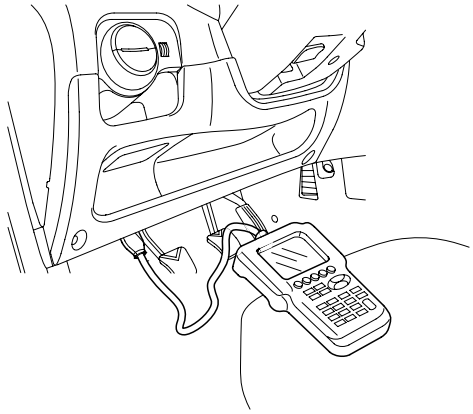


ATJF122L

4. 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.
5. 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.
6. If the transmitter is failure, replace only the transmitter (B).

TRANSMITTER CODE REGISTRATION E82112F5

1. Connect the DLC cable of hi-scan to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on hi-scan.



ATJF122M

2. Select the vehicle model and then do "CODE SAVING".

1. KIA VEHICLE DIAGNOSIS	
MODEL :	ALL
02. ENGINE	
03. AUTOMATIC TRANSAXLE	
04. ANTI-LOCK BRAKE SYSTEM	
:	
:	
:	
07. CODE SAVING	

LTJF700A

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

TRANSMITTER CODE SAVE
REMOVE THE IG. KEY FROM THE KEY CYLINDER. CONNECT THE DLC CABLE AND 16 PIN CONNECTOR OF THE VEHICLE.
PRESS [ENTER], IF YOU ARE READY!

ETRF065M

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

TRANSMITTER CODE SAVE
1ST. TRANSMITTER SAVE PRESS THE TRANSMITTER [LOCK] BUTTON OR [UNLOCK] BUTTON FOR 1 SECOND.
* NO. OF CODED KEY : 0 EA

ETRF065N

TRANSMITTER CODE SAVE
1ST. TRANSMITTER SAVE PRESS THE TRANSMITTER [LOCK] BUTTON OR [UNLOCK] BUTTON FOR 1 SECOND.
1ST. TRANSMITTER SAVE SUCCESS! IF YOU WANT TO SAVE THE 2ND KEY PRESS [YES], OR NOT PRESS [NO]
* NO. OF CODED KEY : 1 EA

ETRF065O

TRANSMITTER CODE SAVE

2ND. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.

* NO. OF CODED KEY : 1 EA

ETRF065P

TRANSMITTER CODE SAVE

2ND. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.

2ND. TRANSMITTER SAVE SUCCESS!

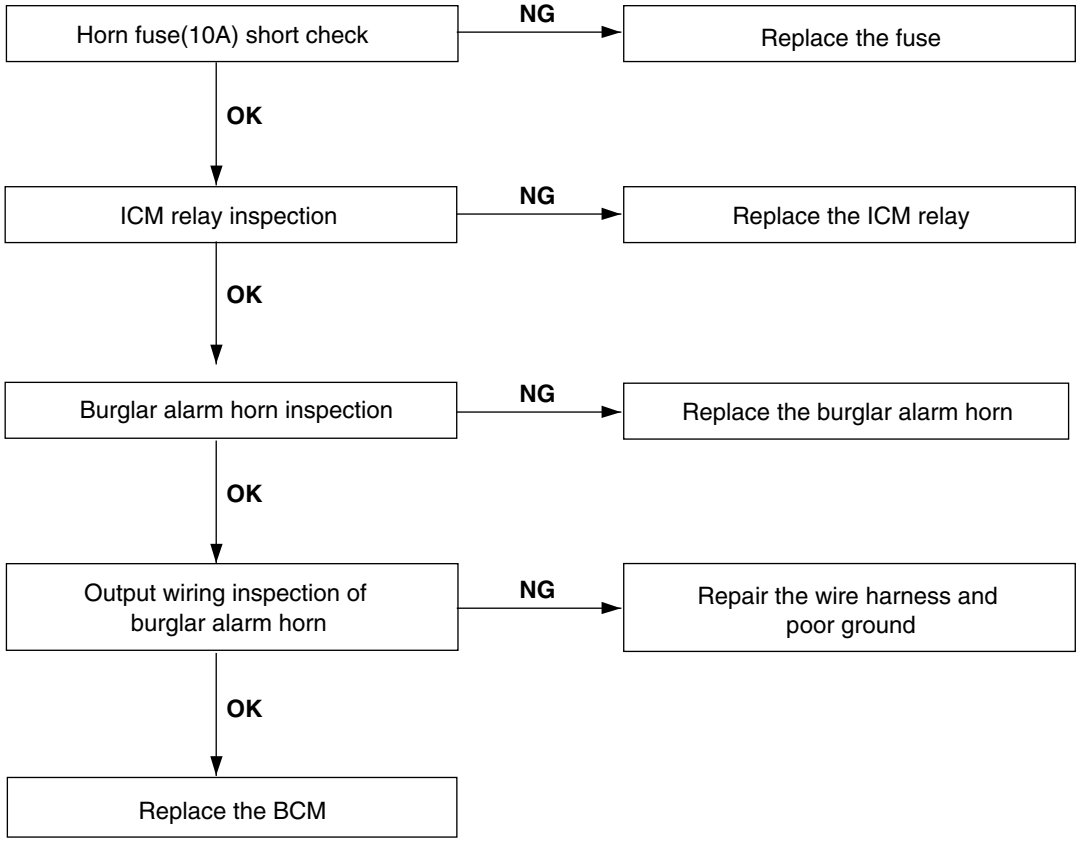
CODE SAVING IS COMPLETED!
IF YOU STOP, PRESS [ESC] KEY!!!

* NO. OF CODED KEY : 2 EA

ETRF065Q

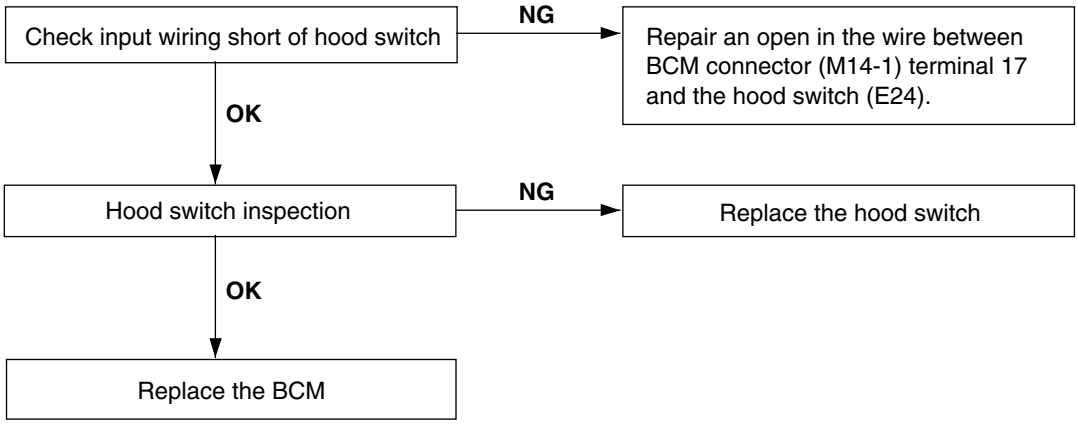
TROUBLESHOOTING EF8EFA92

1. Alarm does not work. (Hazard lamps work)



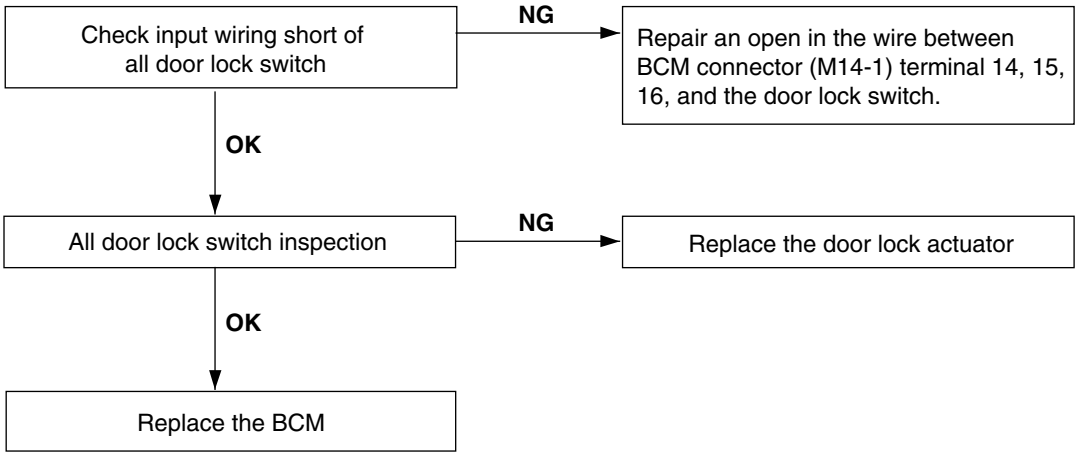
LTJF900I

2. When hood is opened in ARM mode, burglar horn does not work.



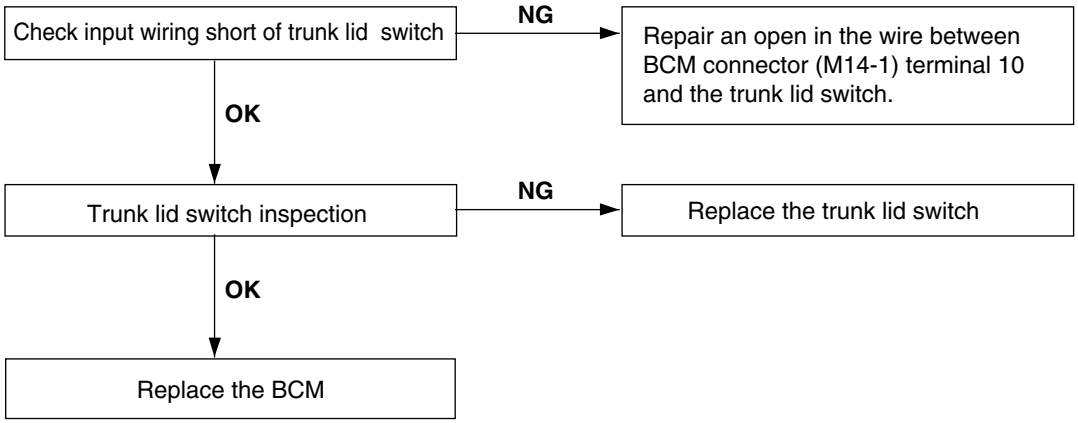
LTJF900J

3. When door is opened in ARM mode, burglar horn does not work (If tailgate and hood is opened, alarm works)



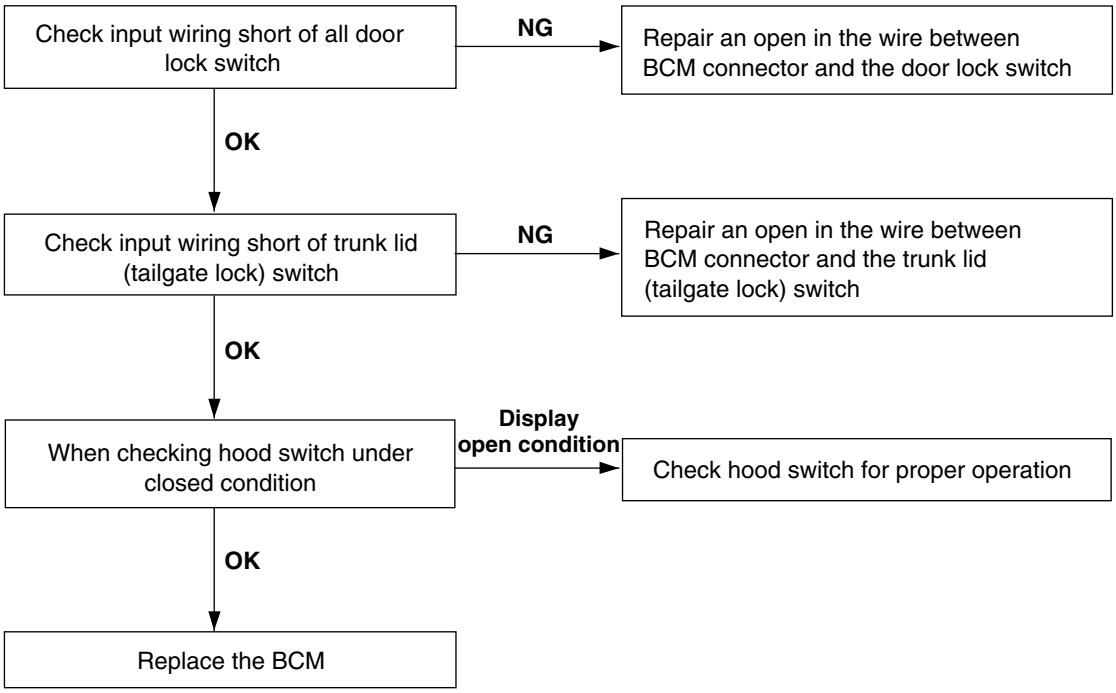
LTJF900K

4. When tailgate is opened in ARM mode, burglar horn does not work.



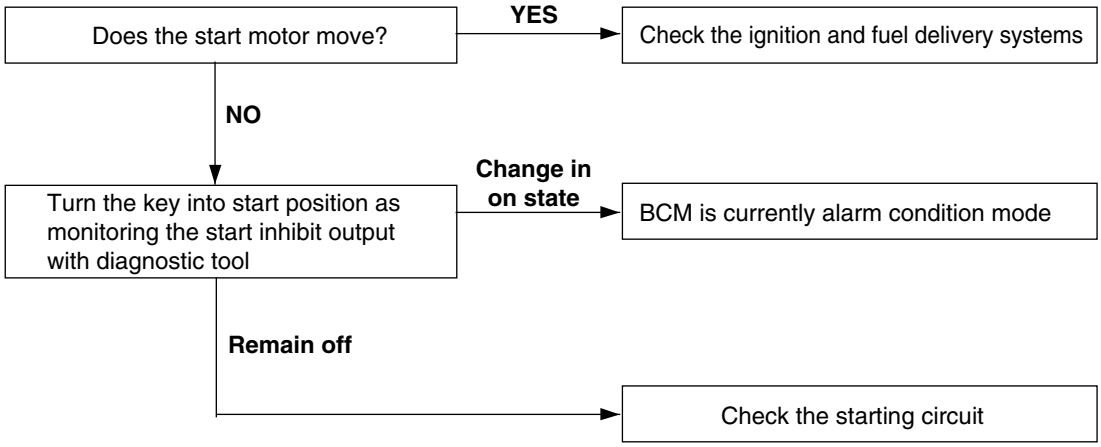
LTJF900L

5. When the vehicle is locked by the transmitter, central door lock function works but hazard lamp doesn't blink.



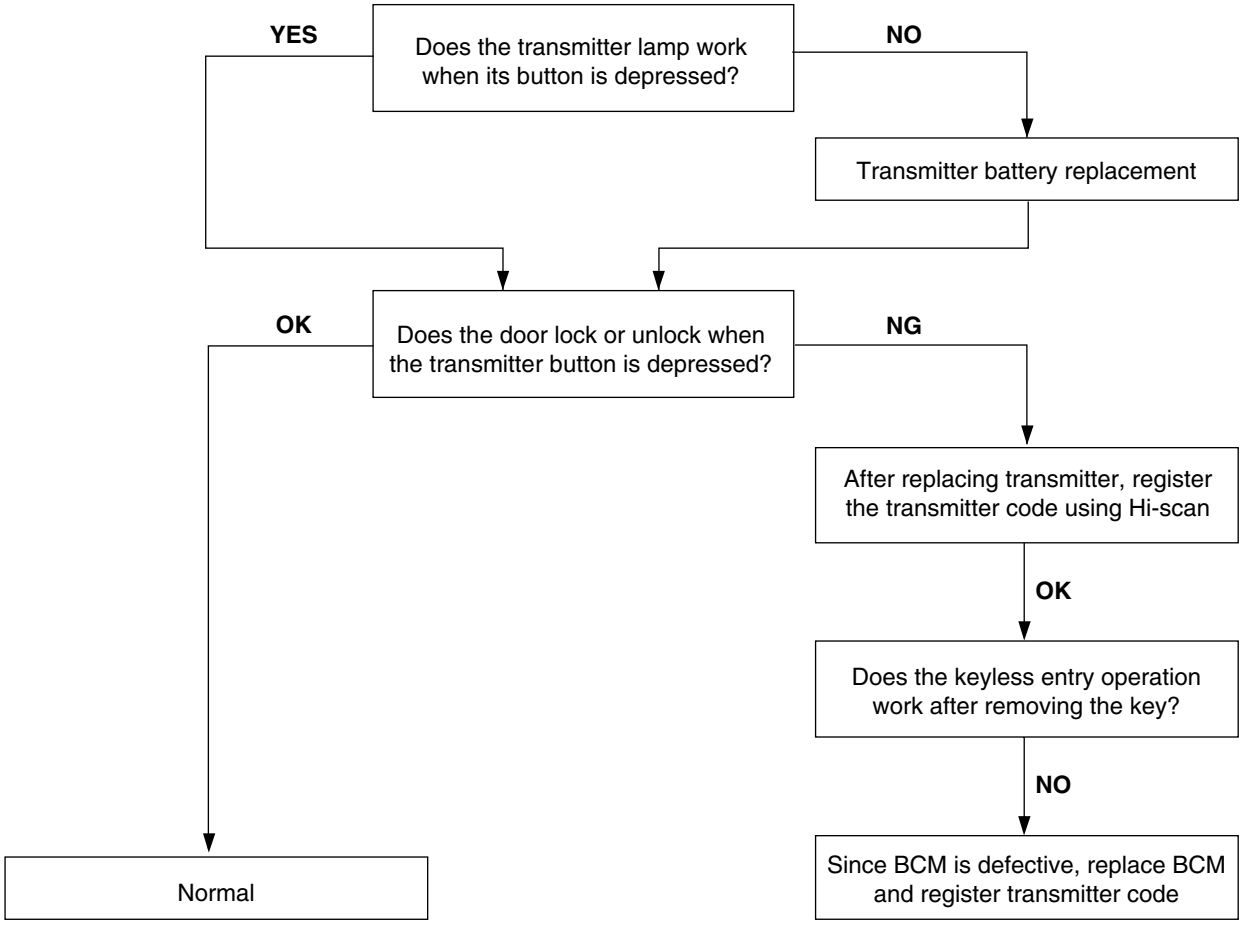
LTJF900M

6. Engine does not start, even when the alarm is disarmed.



LTJF900N

7. Central door lock function works, but keyless entry system does not work.

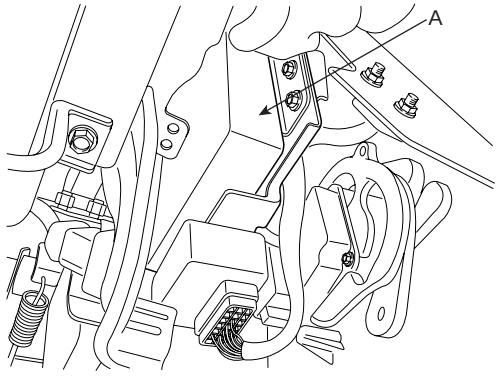


LTJF900O

BODY CONTROL MODULE

DESCRIPTION EF785A4F

Body control module (A) receives various input switch signals controlling time and alarm functions for the rear defogger timer, seat belts warning, delayed out room lamp, central door lock, ignition key reminder, power window timer, door warning, tail lamp auto cut, crash door unlock, ignition key hole illumination, rear fog lamp control and keyless entry & burglar alarm.



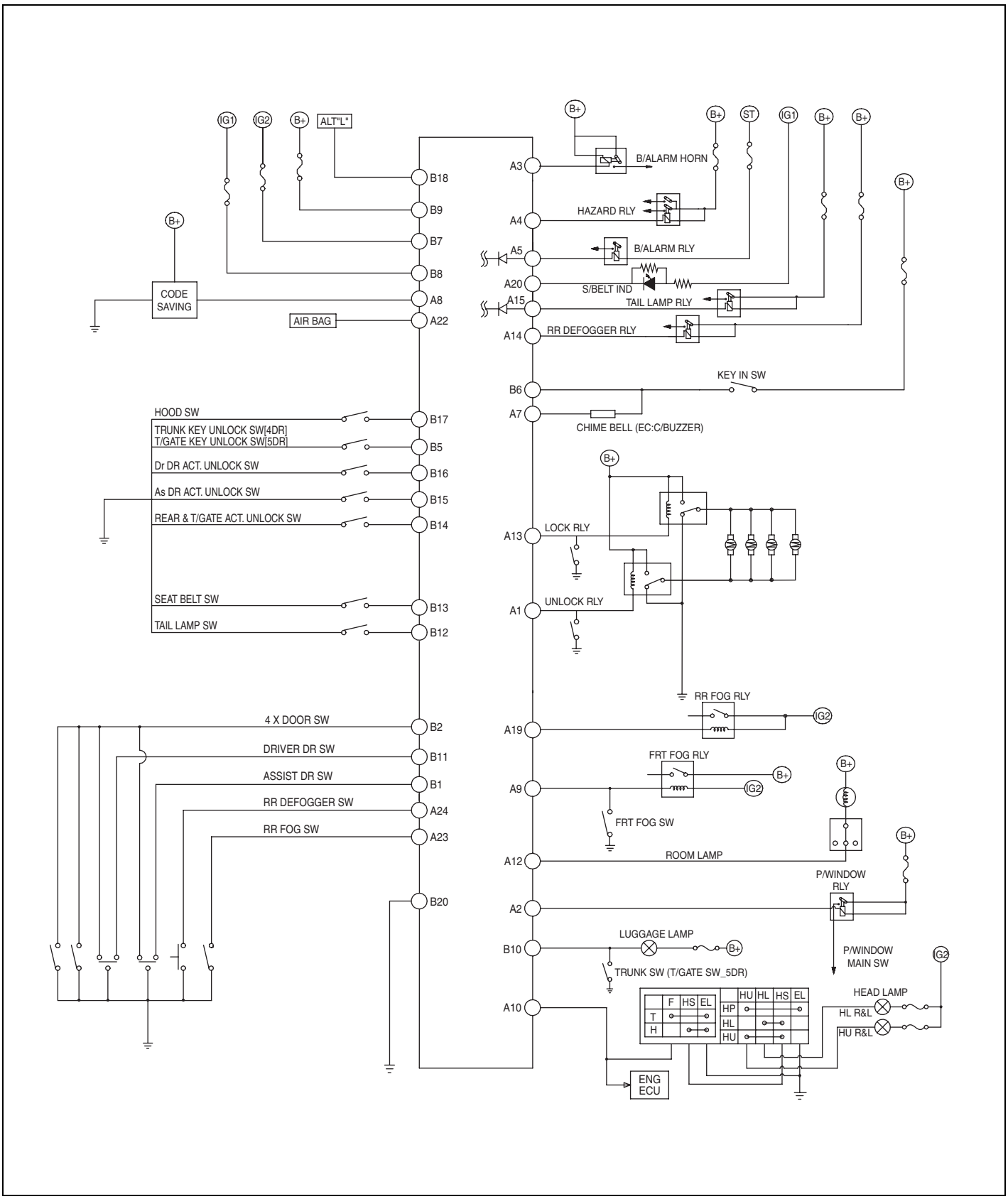
ATJF140A

SPECIFICATION E9D6BAFF

Items	Specifications
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-22°F~176°F(-30°C ~ 80°C)
Insulation resistance	100MΩ or more
Dark current	Less than 4mA (12.8 V) - BCM & Receiver Less than 3mA (12.8V) - BCM
Rated load	
Burglar horn	DC 12V, 200mA (Inductance load)
Burglar relay	DC 12V, 200mA (Inductance load)
Tail lamp relay	DC 12V, 200mA (Inductance load)
Rear defogger relay	DC 12V, 200mA (Inductance load)
Power window timer relay	DC 12V, 200mA (Inductance load)
Seat belt warning indicator	DC 12V, 40~60mW (LED load)
Room lamp	DC 12V, 30W (Lamp load)
Door lock relay	DC 12V, 200mA (Inductance load)
Door unlock relay	DC 12V, 200mA (Inductance load)
Hazard lamp relay	DC 12V, 200mA (Inductance load)
Driver door actuator	DC 12V, 10W (Motor load)
Rear fog lamp relay	DC 12V, 200mA (Inductance load)

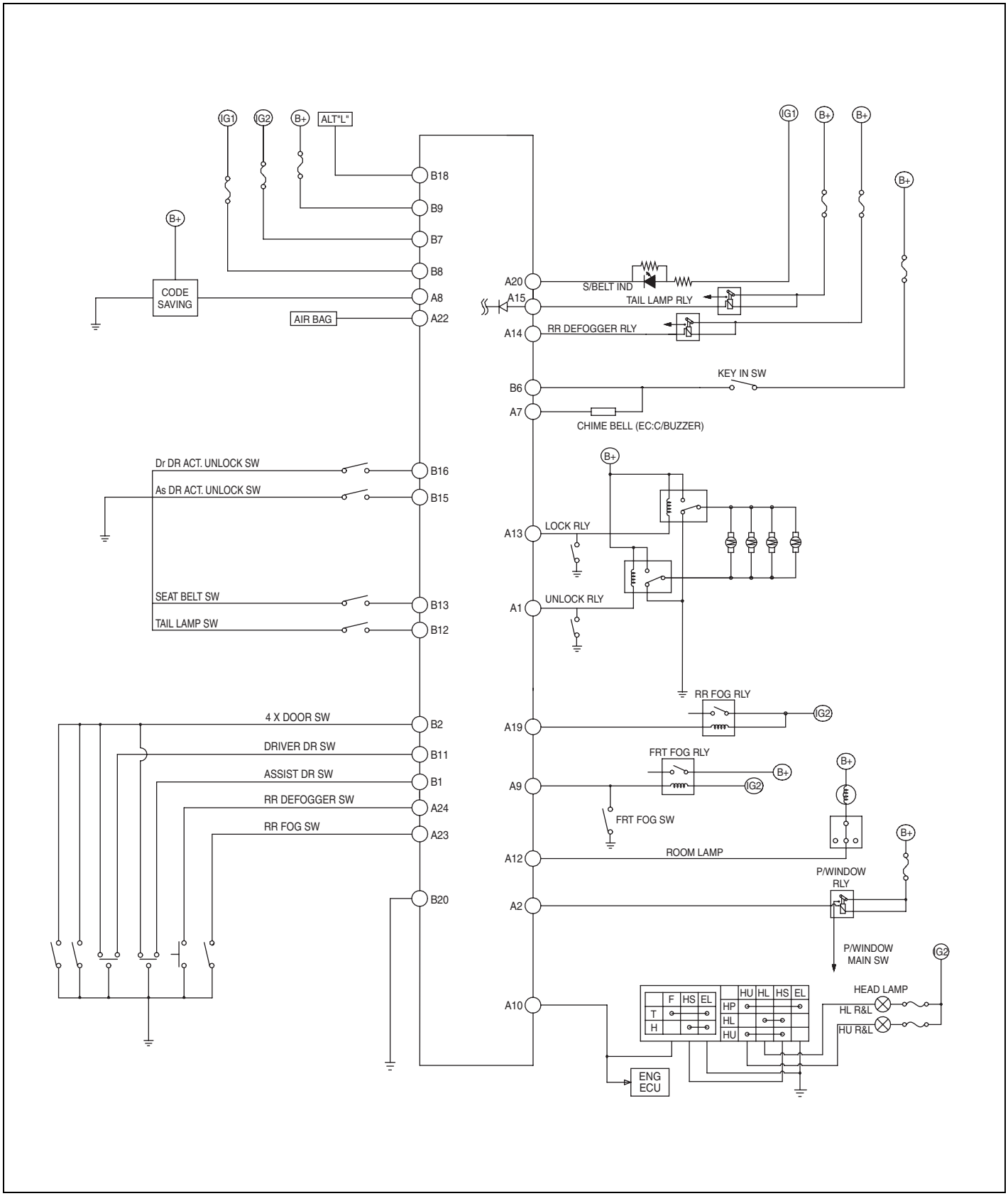
CIRCUIT DIAGRAM E82DD704

BCM & RECEIVER



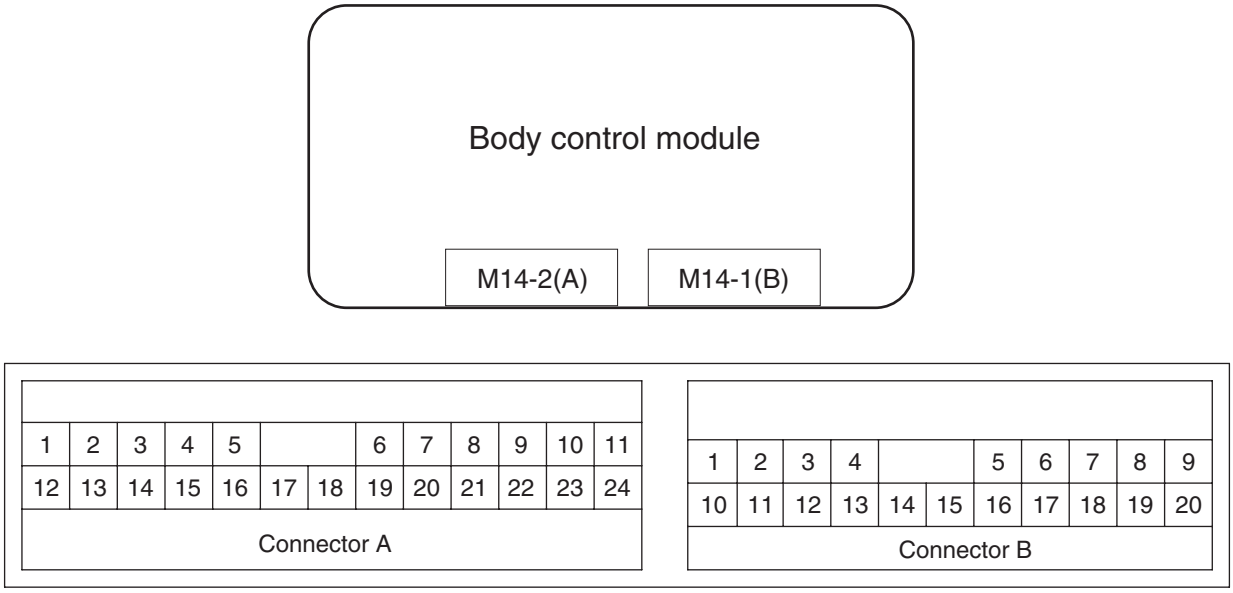
LTJF140B

BCM



LTJF140E

BCM CONNECTOR TERMINALS



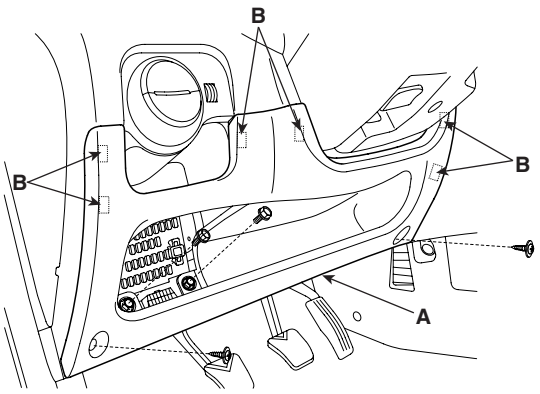
LTJF140C

Terminal No.	Connector A	Connector B
1	Door unlock relay	Assist door switch
2	Power window relay	4 door switch
3	Burglar alarm horn relay	-
4	Hazard lamp relay	-
5	Burglar alarm relay	Trunk key unlock switch (4Doors), Tail gate key unlock switch (5Doors)
6	-	Door warning switch
7	Chime bell or chime buzzer	IG2
8	Code saving	IG1
9	Front fog lamp switch (EC, Australia)	B+
10	Head lamp switch (EC, Australia)	Trunk switch (4Doors), Tail gate switch (5Doors)
11	Seat belt switch	Driver door switch
12	Room lamp switch	Tail lamp switch
13	Door lock relay	-
14	Rear defogger relay	Rear door actuator unlock switch (4Doors), Rear door & tail gate actuator unlock switch (5Doors)
15	Tail lamp relay	Assist door actuator unlock switch
16	-	Driver door actuator unlock switch
17	-	Hood switch
18	-	Alternator (L)
19	Rear fog lamp relay (EC, Australia)	-

Terminal No.	Connector A	Connector B
20	Seat belt indicator	
21	-	-
22	Air bag signal(Crash signal)	-
23	Rear fog lamp switch (EC, Australia)	-
24	Rear defogger switch	-

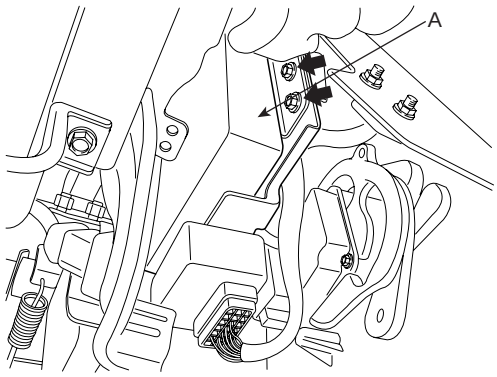
REPLACEMENT E42E944C

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A) (Refer to the Body group - crash pad). Take care of fixing clips(B).



LTJF141A

3. Remove the body control module (A) after loosening 2 nuts.



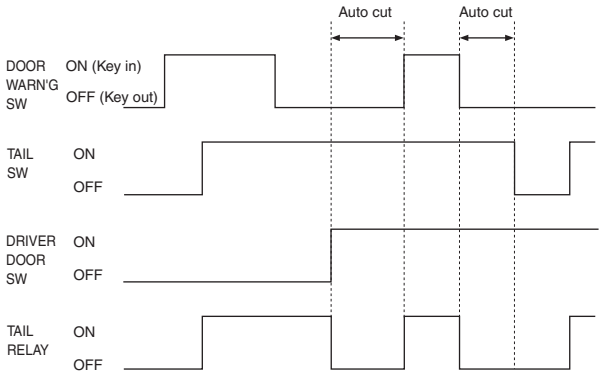
LTJF140F

4. Installation is the reverse of removal.

INSPECTION EFCC7261

Verify each components operation using related timing charts.

1. TAIL LAMP AUTO CUT
   1) With the tail lamp switched ON, if the ignition Is switched OFF and the Driver door opened, the tail lamp should be automatically turned OFF.
   2) With the ignition switch ON, if the Driver door is opened and the ignition is switched to OFF, the tail lamp should be automatically turned OFF.
   3) When the tail lamp is cut automatically and the tail lamp switch is turned OFF and ON, the tail lamp illuminates and auto cut function is cancelled.
   4) When the tail lamp is cut automatically and the ignition key is inserted, the tail lamp illuminates and auto cut function is canceled.



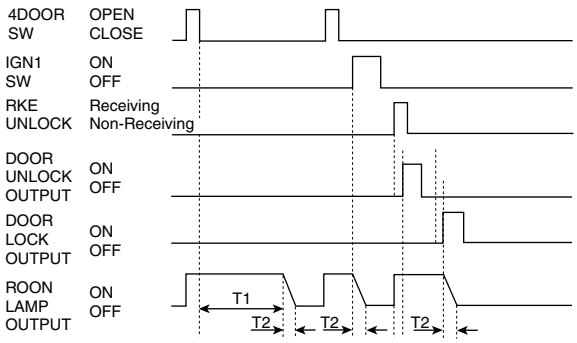
LTGE141A

2. DELAYED ROOM LAMP
   1) When the first door (driver, or assist or 4doors) is opened, room lamp is turned on.
   2) When the door is closed, the room lamp is fade out for 2 seconds after there is on for 30 seconds.

3) Regardless of ignition ON/OFF in door open state, room lamp output is ON.

4) When remote control unlock is received, room lamp is turned on for 30 seconds.

5) While room lamp is on due to Remote control unlock, if another remote control unlock is received, then room lamp is again on for 30 sec.



LTJF141C

T1 : 30 ± 3 sec.,
T2 : 2 ± 0.2 sec.

3. CENTRAL DOOR LOCK/UNLOCK

1) Central door lock/unlock

Function \ Option		Centeral door Lock	Transmitter (RKE)
Door key UNLOCK	Driver	All unlock	All unlock
	Assist	All unlock	All unlock
Door key LOCK	Driver	All lock	All lock
	Assist	All lock	All lock
Transmitter (RKE)	Lock	–	All lock
	Unlock	–	All unlock
Driver knob	Lock	All lock	All lock
	Unlock	All unlock	All unlock
Assist knob	Lock	All lock	All lock
	Unlock	All unlock	All unlock
Door Lock switch	Lock	All lock	All lock
	Unlock	All unlock	All unlock

LTJF141U

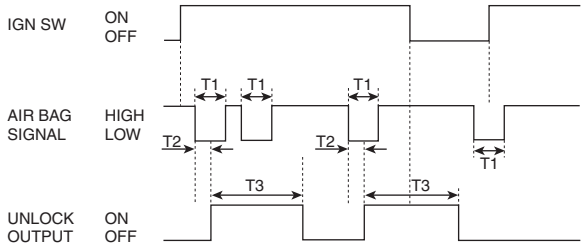
4. CRASH DOOR UNLOCK

1) Whenever the air bag (below A/BAG) signal is inputted in the IG SW ON state, the unlock output shall be ON for T3.

2) During unlock output, although IG SW is turned to OFF from ON, the unlock output shall maintain for the remained time period.

3) If IG SW is turned to ON from OFF after A/BAG signal first is inputted, the Unlock output shall not be performed.

4) If drive or assist door lock switch is turned to lock from unlock after unlock output, the unlock output shall be On for T3.



LTJF141F

T1 : 0.2 sec,
T2 : 0.04 sec,
T3 : 5 ± 0.5 sec.

5. IGNITION KEY REMINDER

1) In the state that the door warning switch is ON, the driver/assist door is opened, and the driver/assist Safety Knob(below S/KNOB) is locked, all door unlock shall be output within T1 for T2.
※ If the door is locked, the unlock shall be output at one time for T2, at three times for T3 only when the switch has not been changed within actuator.

2) During the 3-time outputting, if the actuator is unlocked, then the next output shall be stopped.

3) During the 3-time outputting, if the door is closed or the key is out from the cylinder, then the next output shall be stopped.

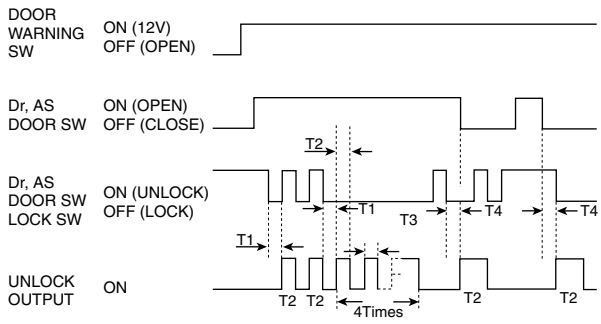
4) After the 3-time output, if the actuator is locked, then the current state shall be maintained.

5) If any of the door warning switch, the driver/assist door switch, and the driver/assist door actuator. UNLOCK switch is changed, then the reset operation shall be performed.

6) If the door is closed within T4 after the actuator is locked, all the door unlock shall be output for T2.

7) If the lock switch is ON within T4 sec. when the door is turn to the closed state from the state, then all the door unlock signal shall be output for T2.

8) If door warning switch is Off and IGN switch is On, then the IG key reminder function shall not be operated.



LTJF141G

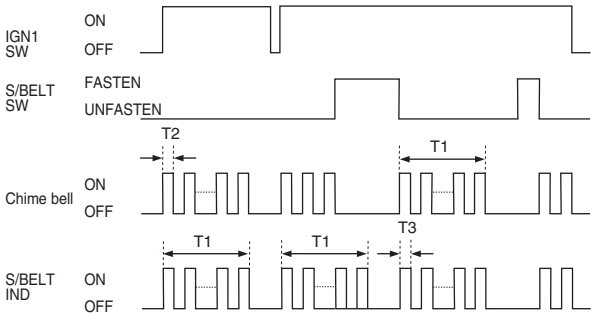
T1 : MAX 0.5 sec,
T2 : 1 ± 0.2sec,
T3 : 0.5 ± 0.1 sec,
T4 : MAX 0.5 sec.

6. SEAT BELT WARNING TIMER

1) When the ignition is switched ON, the seat belt warning indicator will illuminate (period: 0.6 sec., duty rate: 50%) and the chime bell will sound (period: 0.9 sec., duty rate: 50%) for total of 6 seconds.

2) If the ignition is switched off while the seat belt warning indicator and chime bell are active (Step 1) the indicator and chime bell will be switched OFF. If the seat belt is sensed as fastened during indicator and chime bell output, the chime bell will switch OFF however the seat belt warning indicator will stay illuminated for the remaining seconds.

3) If the seat belt is removed, with the ignition switched ON, the seat belt warning indicator and chime bell will activate for 6 seconds.



LTJF141H

T1 : 6±1 sec,
T2 : 0.5 ± 0.1 sec,
T3 : 0.3 ± 0.1 sec.

7. SEAT BELT REMINDER FUNCTION (EC, AUSTRALIA)

1) Regardless of seat belt being inserted/withdrawn if ignition switch is ON the warning lamp shall be illuminated.

2) When ignition switch is On, seat belt is withdrawn, the initial warning lamp will operate for 6 sec, and then if seat belt is inserted the reminder signal shall be output for 6 sec. After the initial warning lamp operates for 6 sec, if seat belt is inserted the warning lamp shall be stopped immediately.

3) While the warning lamp and alarm is operating if ignition switch is Off and seat belt is inserted, the warning lamp and alarm shall be stopped immediately.

4) With seat belt being withdrawn, if ignition switch is On the warning lamp be illuminated and if the speed maintains more than 9KPH and above 1 sec, the warning lamp be flickered. With seat belt being withdrawn, although it is changed below 9KPH the warning lamp continuously flicker.

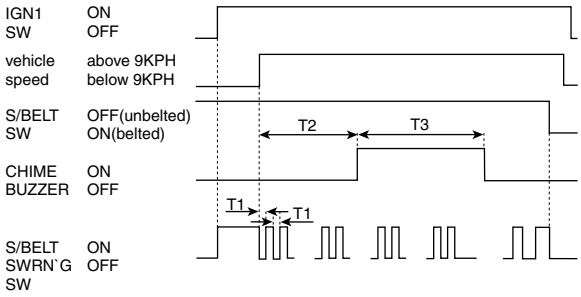
5) After the warning lamp flickers in item (4), if it elapses T2 the warning sound operate (during T3 continuously) and warning lamp continuously flicker.

6) After the Warning Sound completes (after T3) in item (5) the warning lamp continuously keeps flickering .

7) With ignition switch On after seat belt is inserted if the unfastening time is less than 9 sec, the warning lamp and warning sound don't operate.

8) With ignition switch On after seat belt is inserted if the unfastening time is more than 9 sec. With the belt withdrawn if the speed maintains less than 9KPH for above 1 sec, it start from the flickering. With the belt withdrawn if the speed maintains more than 9KPH for above 1 sec, it start from the flickering and alarm operation.

9) After ignition switch is On, when ignition switch is OFF Under alarm. After ignition switch is OFF, if ignition switch is On within 55 seconds, and then if seat belt is withdrawn, it start from the flickering. After ignition switch is OFF, if ignition switch is On after 55 sec, and then if Seat belt is withdrawn, it start from the illumination.



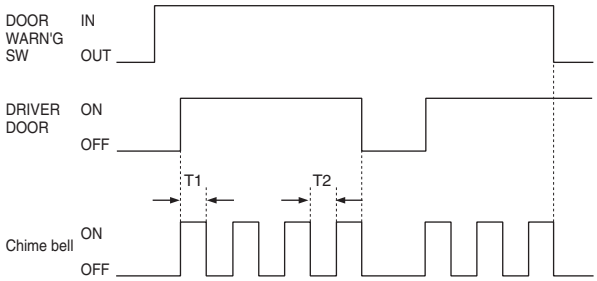
LTJF141Z

T1 : 0.3 ± 0.1 sec,
T2 : 55 ± 3 sec,
T3 : 100 ± 3 sec.

8. KEY OPERATED WARNING

1) If the key is in the key cylinder and the Driver door is opened, the chime bell is sounded (period: 0.9 sec., duty rate: 50%).

2) If the ignition key is removed, or the door is closed, the chime bell is switched OFF immediately.



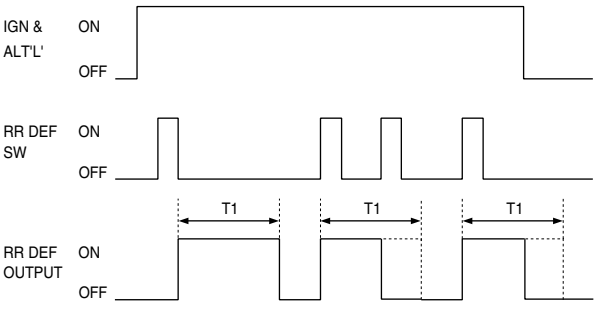
LTJF141I

T1, T2 : 0.45 ± 0.1sec.

9. DEFOGGER TIMER (INCLUDING OUTSIDE MIRROR HEATER)

1) Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.

2) If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.



LTJF141J

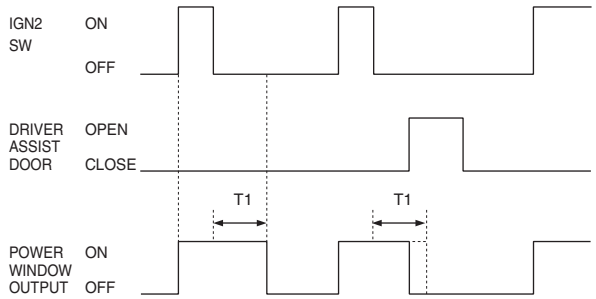
T1 : 20 ± 1 min.

10. POWER WINDOW TIMER

1) When the ignition is switched OFF, power window output remains ON for 30 seconds and then turns OFF.

2) Related to Step 1), if the driver door or assist door is opened, window power output is turned OFF immediately.

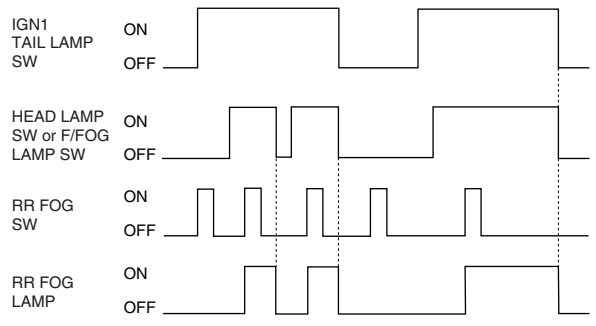
3) When the driver door or assist door is opened, the power window relay output is turned OFF immediately.



LTGE141K

T1: 30 ± 3 sec.

11. Rear fog lamp control (EC, AUSTRALIA)
In case of (Ignition & tail output) and [(head lamp low output) or (front fog lamp output) is turned ON], if rear fog switch is pushed, rear fog lamp is turned ON.



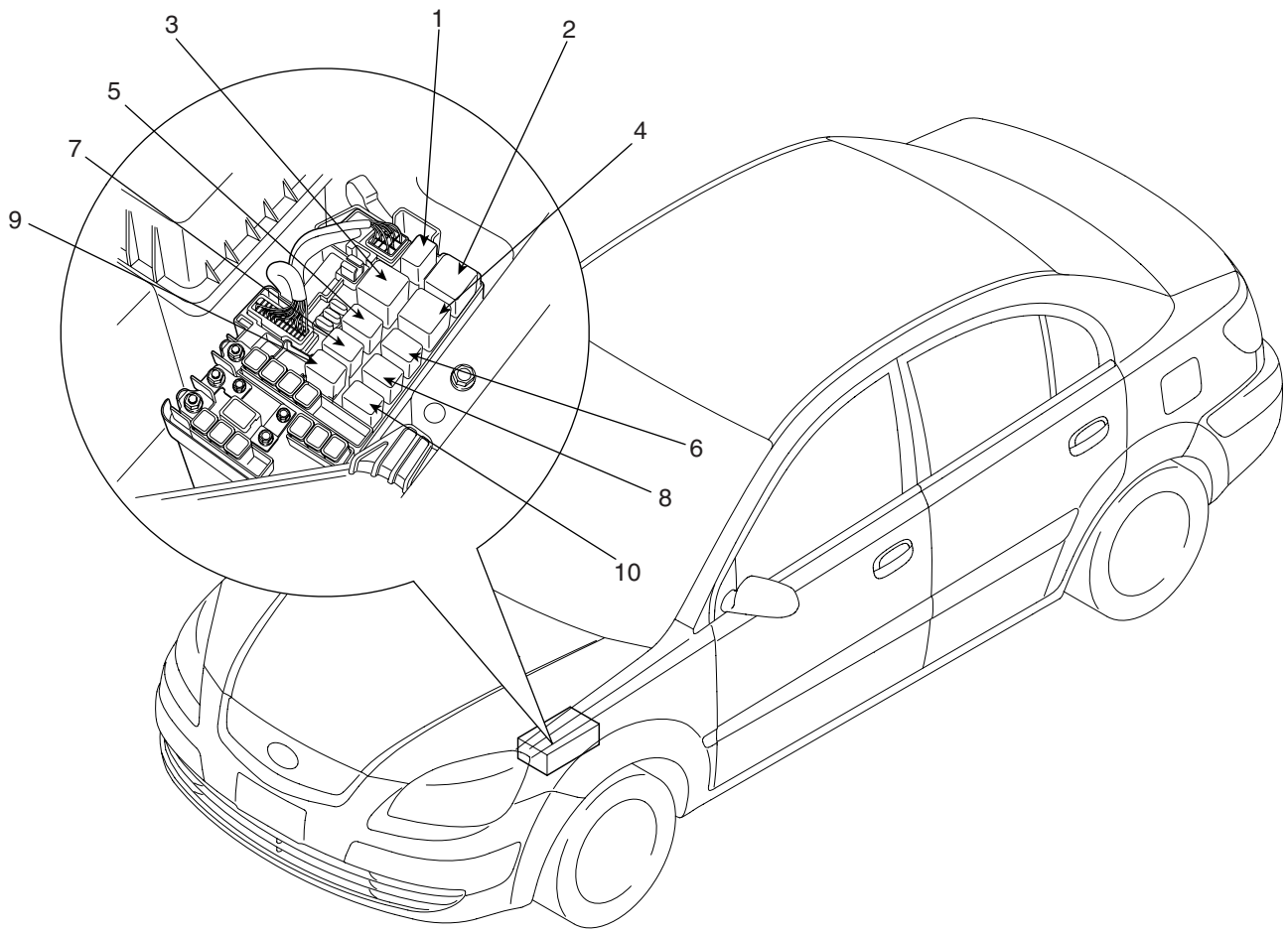
LTJF141S

FUSES AND RELAYS

COMPONENT LOCATION ED928DF7

[Engine room relay box]

This illustration is shown the LHD type.
RHD type is similar.

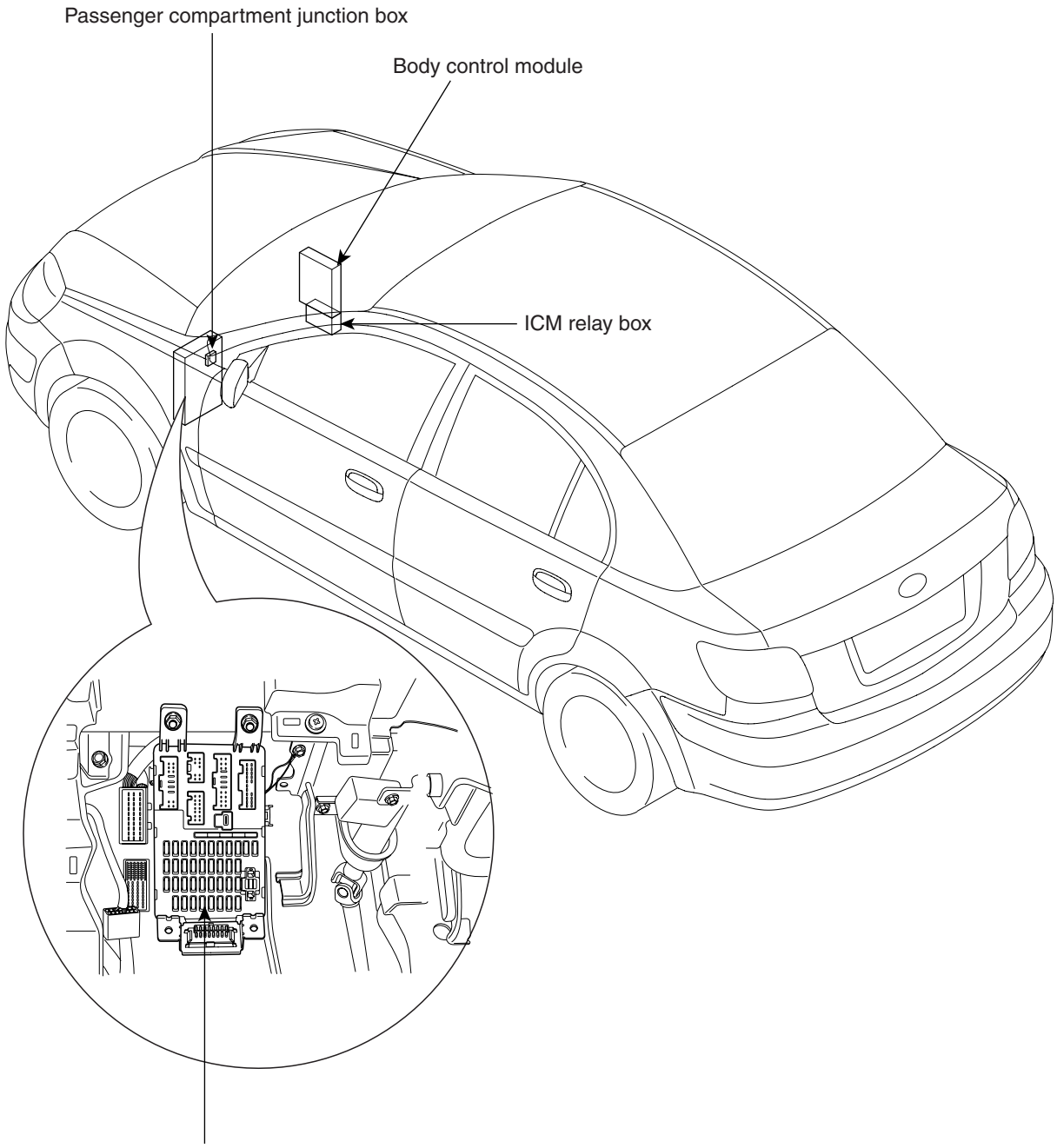


1. Horn relay
2. Fuel heater relay
3. Main relay
4. Blower relay
5. Fuel pump relay
6. Start relay
7. Radiator fan relay
8. Condenser fan relay 1
9. Condenser fan relay 2
10. Air conditioning relay

LTJF220A

[Passenger compartment relay box]

This illustration is shown the LHD type.
RHD type is symmetrical.

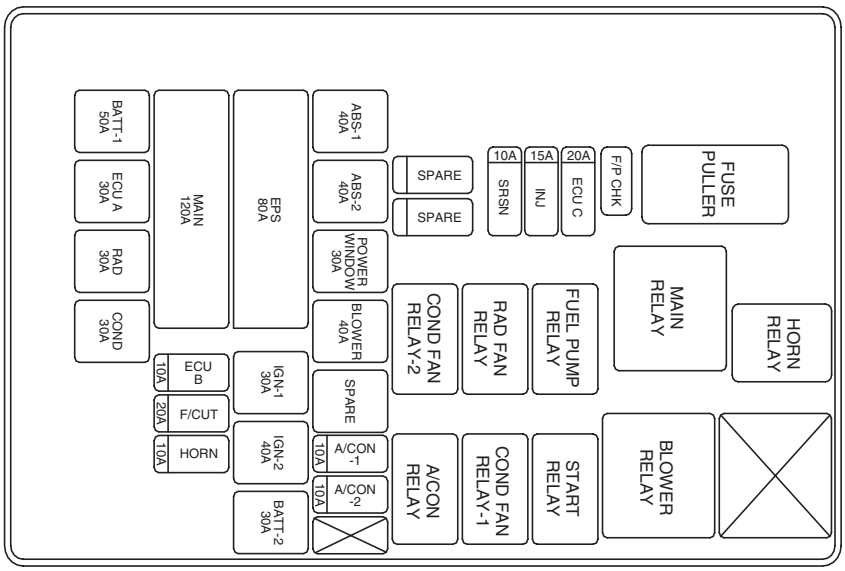


Power window relay, front fog lamp relay, Rear fog lamp relay, door lock relay,
door unlock relay, rear defogger relay (Built-in junction box),
tail lamp relay (Built-in junction box), flasher unit

LTJF220B

RELAY BOX (ENGINE COMPARTMENT)

COMPONENTS EC0A2449



CIRCUIT

FUSE	(A)	Circuit Protected
MAIN	120A	Alternator
BATT-1	50A	I/P Junction Box
BLOWER	40A	Blower Relay
ABS-1	40A	ABS Control Module, ESP Control Module
ABS-2	40A	ABS Control Module, ESP Control Module
IGN-2	40A	Start Relay, Ignition Switch
IGN-1	30A	Ignition Switch, Horn Relay, ICM Relay Box
BATT-2	30A	I/P Junction Box
P/WDW	30A	I/P Junction Box
RAD	30A	Cond Fan Relay-1, RAD Fan Relay
ECU A	30A	Main Relay
ECU C	20A	ECM
FUEL CUT	20A	Fuel Pump Relay
INJ	15A	Injector-1, -2, -3, -4, CVVT Oil Control Valve, Idle Speed Control Actuator, Canister Purge Control Valre, Immobilizer Control Module
A/CON-1	10A	A/Con Relay
A/CON-2	10A	A/Con Control Module, Blower Motor
ECU B	10A	ECM
HORN	10A	Horn Relay, Siren Relay
SNSR	10A	A/Con Relay, RAD Fan Relay, Cond Fan Relay-1, -2

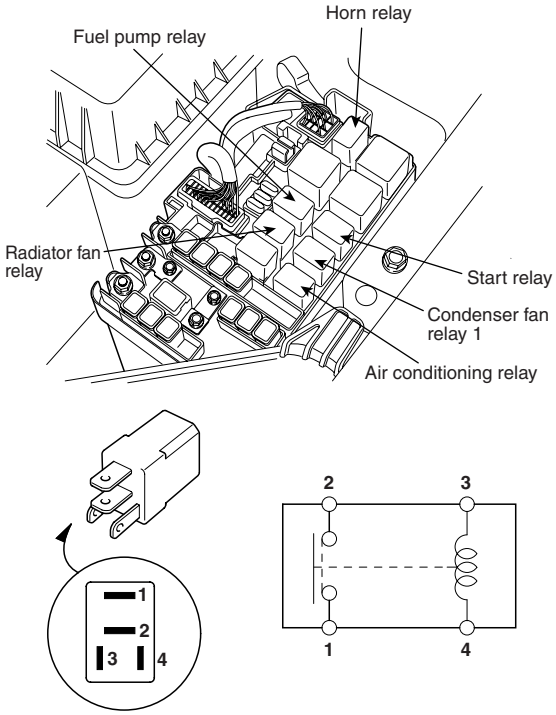
※ USE THE DESIGNATED FUSE ONLY

INSPECTION EE7E7EDB

POWER RELAY (TYPE A)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
2. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.



LTJF201A

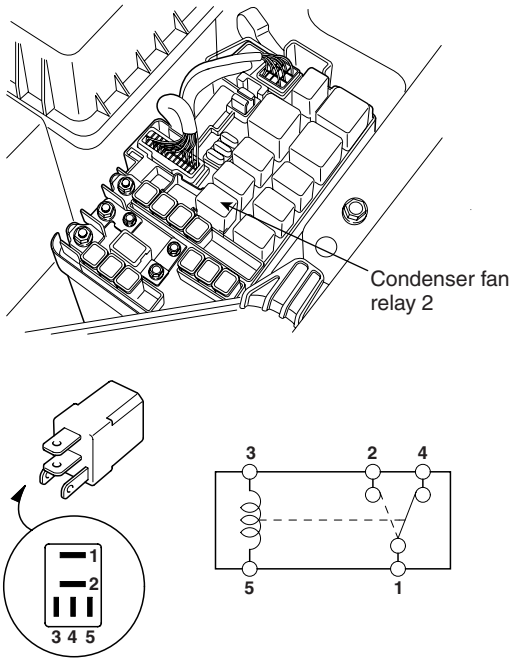
Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

ETKE903A

POWER RELAY (TYPE B)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.5 terminals.
2. There should be continuity between the No.1 and No.4 terminals when power is disconnected.



LTJF201B

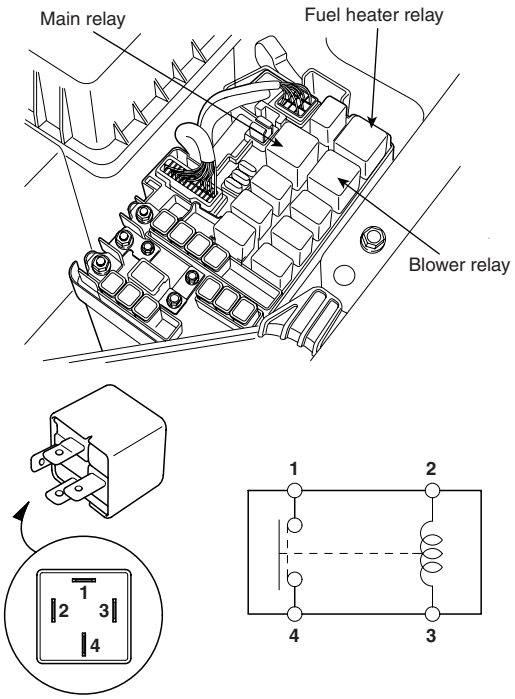
Terminal / Power (No.3-No.5)	3	5	1	2	4
Disconnected			○		○
Connected	⊖	⊕	○	○	

ETKE215H

POWER RELAY (TYPE C)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
2. There should be no continuity between the No.1 and No.4 terminals when power is disconnected.



LTJF201C

Terminal / Power (No.2-No.3)	2	3	1	4
Disconnected	○	○		
Connected	⊖	⊕	○	○

ETKE215B

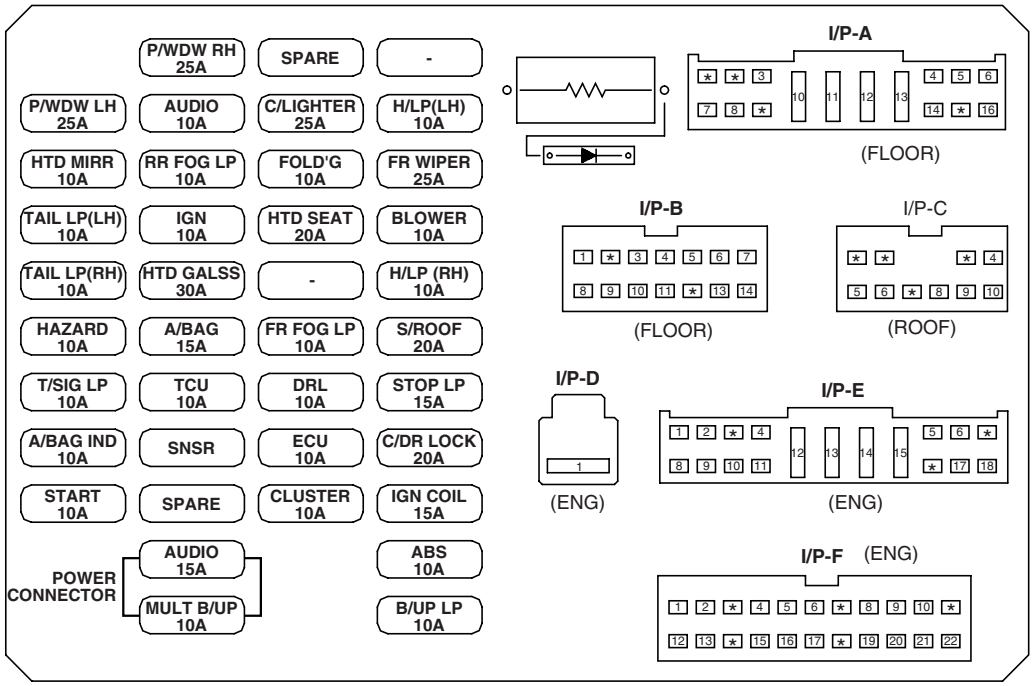
FUSE

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.

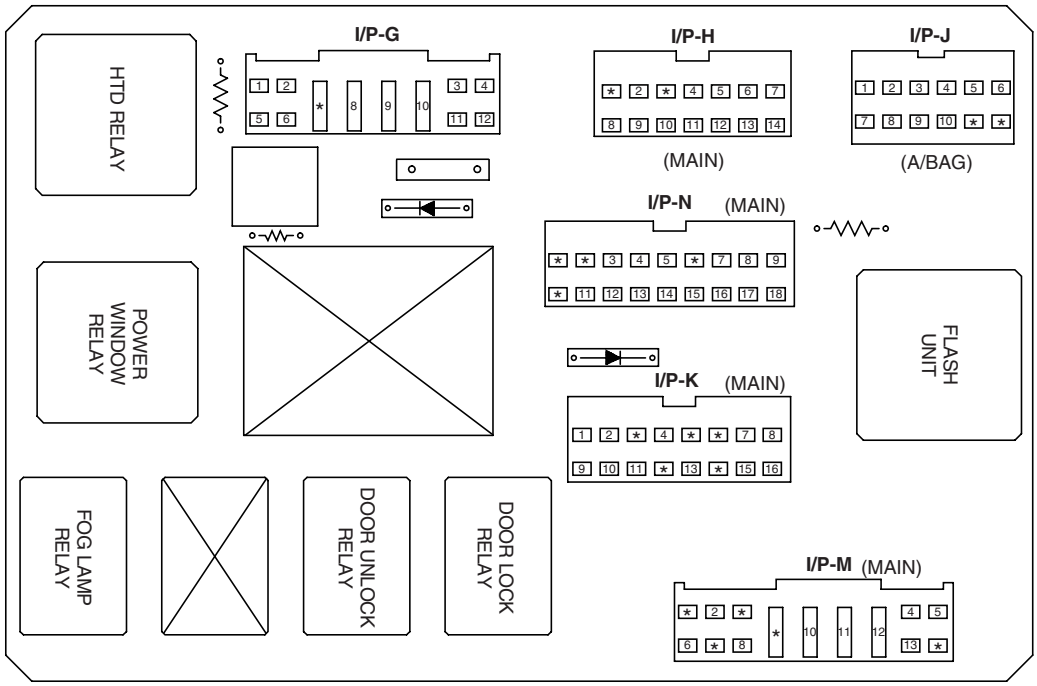
RELAY BOX (PASSENGER COMPARTMENT)

COMPONENTS EDCAF5BA

< FRONT>



<REAR>



※ USE THE DESIGNATED FUSE ONLY

CIRCUIT

FUSE	(A)	Circuit Protected
P/WDW RH	25A	Front Power Window Switch, Rear Power Window Switch RH,Front power window Switch RH Rear Power Window Switch LH,
P/WDW LH	25A	Front Power Window Switch LH
AUDIO	10A	Power Outside Mirror & Mirror Folding Switch, Audio, Digital Clock
C/LIGHTER		Cigarette Lighter, Power Outlet
H/LP (LH)	10A	Head Lamp LH
HTD MIRR	10A	ECM, Power Outside Mirror & Mirror Folding Motor LH, Power Outside Mirror & Mirror Folding Motor RH, Rear Defogger Switch
FOLD'G	10A	Power Outside Mirror & Mirror Floding Switch
FR WIPER	25A	Multifunction Switch, Front Wiper Motor
TAIL LP (LH)	10A	Rear Combi Lamp LH, License Lamp LH, Head Lamp LH
IGN	10A	Head Lamp Leveling Switch, Defogger Timer, Head Lamp LH, Head Lamp RH
HTD SEAT	20A	Seat Warmer Switch LH, Seat Warmer Switch RH
BLOWER	10A	BCM, A/C Control Module, AQS Sensor, Sunroof Motor, E/R Fuse & Relay Box
TAIL LP (RH)	10A	Rear Combi Lamp RH, License Lamp RH, Head Lamp RH
HTD GLASS	30A	Defogger Timer, BCM, Rear Defogger Switch
AMP	25A	Audio
H/LP (RH)	10A	Head Lamp RH, Instrument Cluster, DRL Control Module
HAZARD	10A	ICM Relay Box, Hazard Switch, BCM, Multifunction Switch, Front Fog Lamp Switch
A/BAG	15A	SRS control Module
FR FOG LP	10A	Front Fog Lamp LH, Front Fog Lamp RH, BCM, Front Fog Lamp Switch
S/ROOF	20A	Sunroof Motor, AMP
T/SIG LP	10A	Hazard Switch
TCU	10A	Vehicle Speed Sensor, Over Driver Switch
STOP LP	15A	Multipur Pose Check Connector, Stop Lamp Switch, Data Link Connector
A/BAG IND	10A	Instrument Cluster
ECU	10A	ECM
C/DR LOCK	20A	Front Door Lock Actuator LH, Front Door Lock Actuator RH, Rear Door Lock Actuator LH, Rear Door Lock Actuator RH, Front Door Lock Switch, BCM
START	10A	Start Relay
CLUSTER	10A	BCM, Instrument Cluster, Defogger Timer, Alternator
ING COIL	15A	Ignition Coil-1, -2, -3, -4, Condensor
AUDIO	15A	Audio
MULT B/UP	10A	Luggage Lamp, Center Room Lamp, Driver Sunvisor Lamp, Overhead Consol Lamp, Front Room Lamp, Digital Clock, BCM, A/C Control Module, Door Warning, Instrument Cluster, Piezo Buzzer, Power Outside Mirror & Mirror Folding Switch
ABS	10A	ESP Switch, ABS Control Module, ESP Control Module,Steering Angle Sensor
B/UP LP	10A	Back-up Lamp Switch, Transaxle Range Switch
RR FOG LP	10A	DRL Control
SNSR	10A	Rear Combi Lamp LH, Rear Fog Lamp Switch, BCM
DRL	10A	PAD Switch

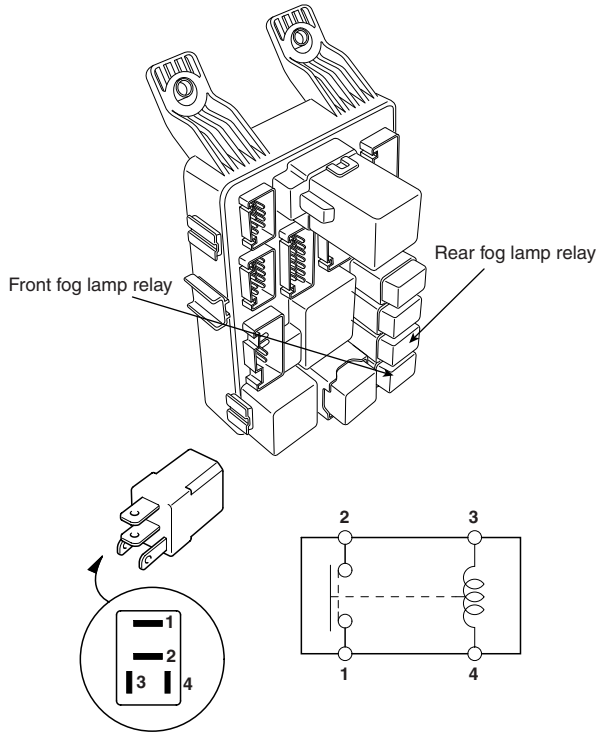
※ USE THE DESIGNATED FUSE ONLY

INSPECTION E8DEBD34

POWER RELAY (TYPE A)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
2. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.



LTJF220F

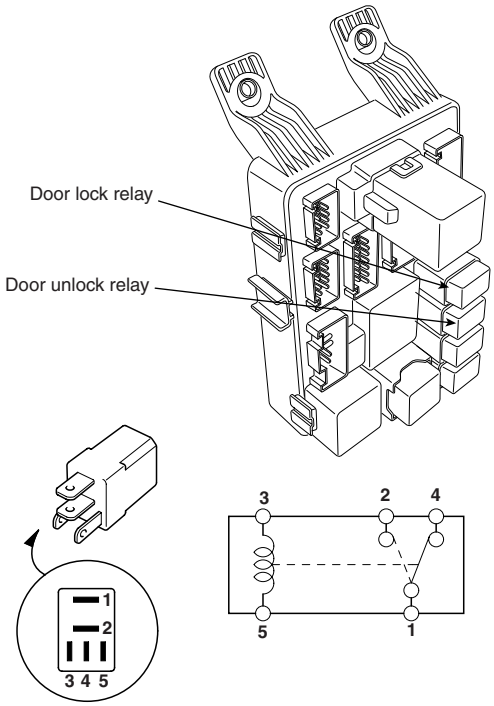
Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

ETKE903A

POWER RELAY (TYPE B)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.5 terminals.
2. There should be continuity between the No.1 and No.4 terminals when power is disconnected.



LTJF220G

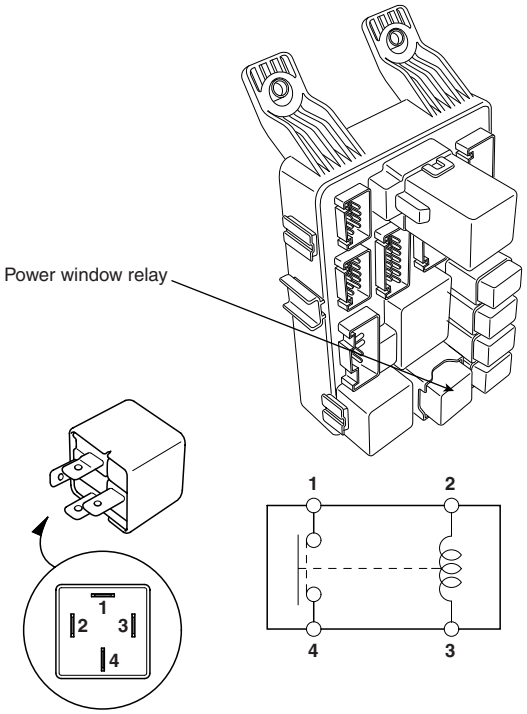
Terminal / Power (No.3-No.5)	3	5	1	2	4
Disconnected			○		○
Connected	⊖	⊕	○	○	

ETKE215H

POWER RELAY (TYPE C)

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
2. There should be no continuity between the No.1 and No.4 terminals when power is disconnected.



LTJF220H

Terminal / Power (No.2-No.3)	2	3	1	4
Disconnected	○	○		
Connected	⊖	⊕	○	○

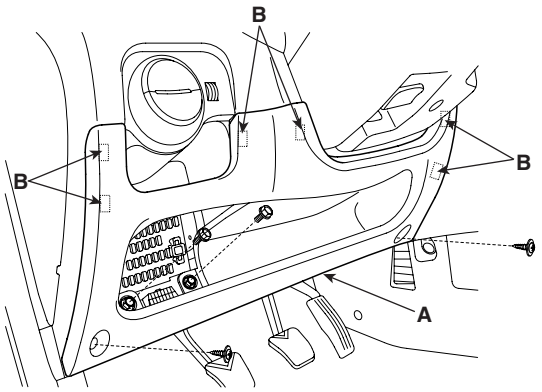
ETKE215B

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.

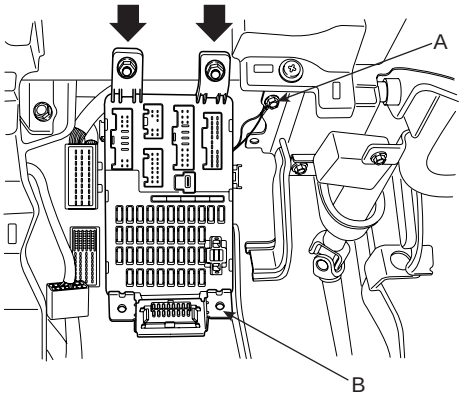
REPLACEMENT EBA5249B

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A) (Refer to the Body group - crash pad). Take care of fixing clips (B).



LTJF141A

3. Disconnect the connectors of junction box and loosen the ground cable (A).



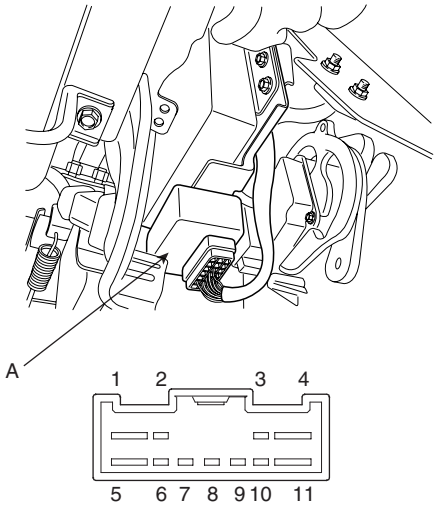
ATJF220I

4. Remove the junction box (B) after loosening the mounting nuts (2EA).
5. Installation is the reverse of removal procedures.

ICM (INTEGRATED CIRCUIT MODULE) RELAY BOX

DESCRIPTION EB950B62

The ICM is united with many kinds of relays and installed below the body control module.



[M21]

ATJF220J

INSPECTION EAB1CA89

HAZARD LAMP RELAY

Check for continuity between the terminals.

1. There should be continuity between the No.8 and No.6 terminals when power and ground are connected to the No.8 and No.9 terminals.
2. There should be no continuity between the No.8 and No.6 terminals when power is disconnected.

BURGLAR ALARM HORN

Check for continuity between the terminals.

1. There should be continuity between the No.11 and No.4 terminals when power and ground are connected to the No.11 and No.3 terminals.
2. There should be no continuity between the No.11 and No.4 terminals when power is disconnected.

BURGLAR ALARM

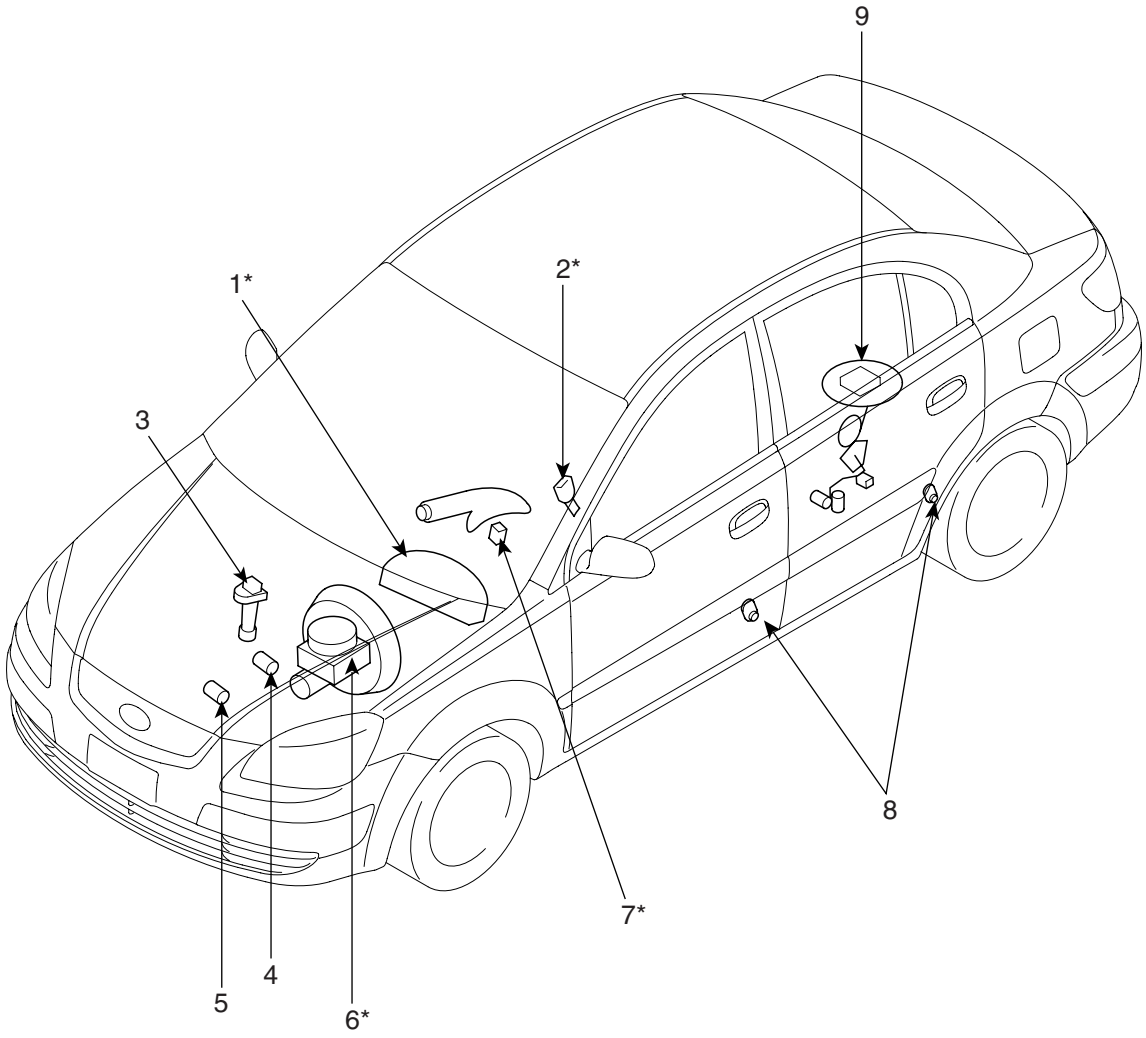
Check for continuity between the terminals.

1. There should be no continuity between the No.1 and No.5 terminals when power and ground are connected to the No.1 and No.2 terminals.
2. There should be continuity between the No.1 and No.5 terminals when power is disconnected.

INDICATORS AND GAUGES

COMPONENT LOCATION EFCA40D5

The parts with asterisk(*) :
This illustration is shown the LHD type.
RHD type is symmetrical.

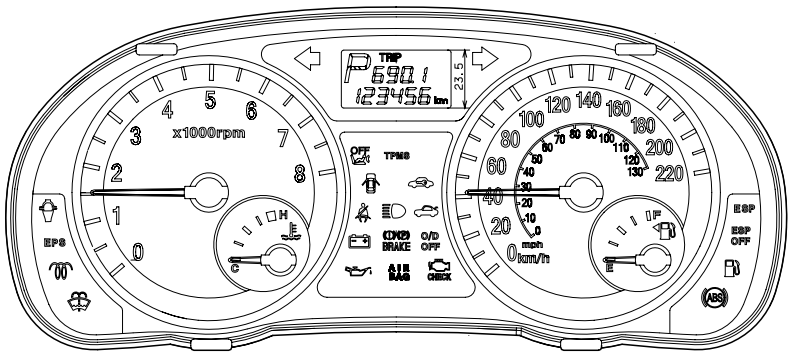


1. Cluster assembly
2. Seat belt switch
3. Vehicle speed sensor
4. Engine coolant temperature sender
5. Oil pressure switch
6. Brake fluid level warning switch
7. Parking brake switch
8. Door switch
9. Fuel gauge sender

LTJF260A

INSTRUMENT CLUSTER

COMPONENTS EC611E28



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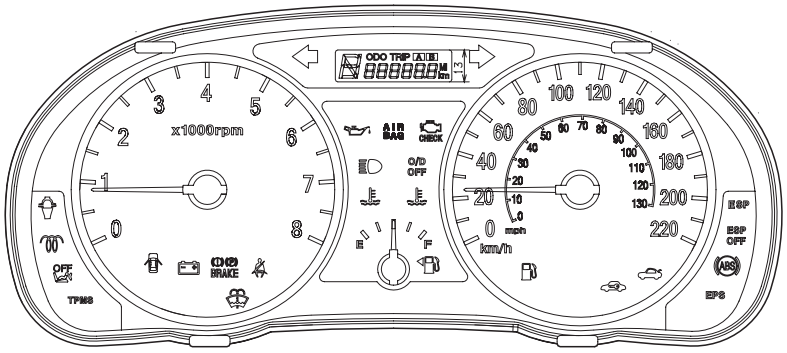

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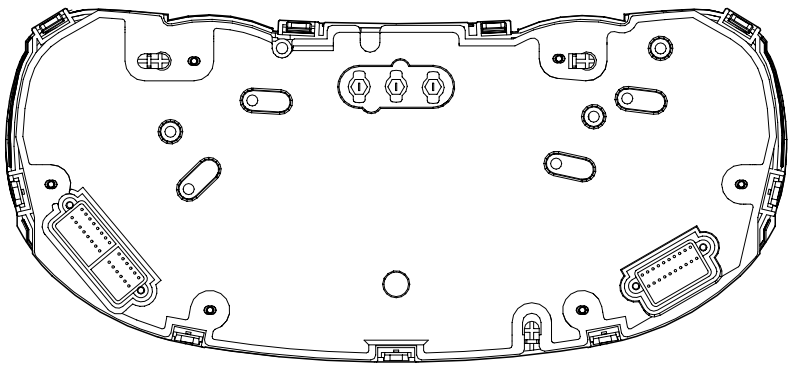
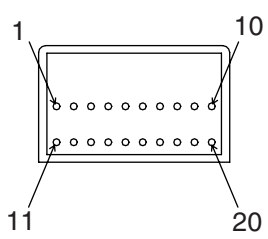
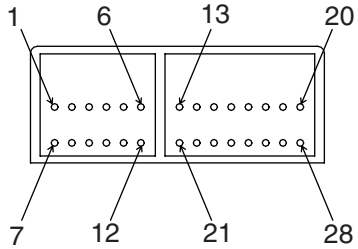




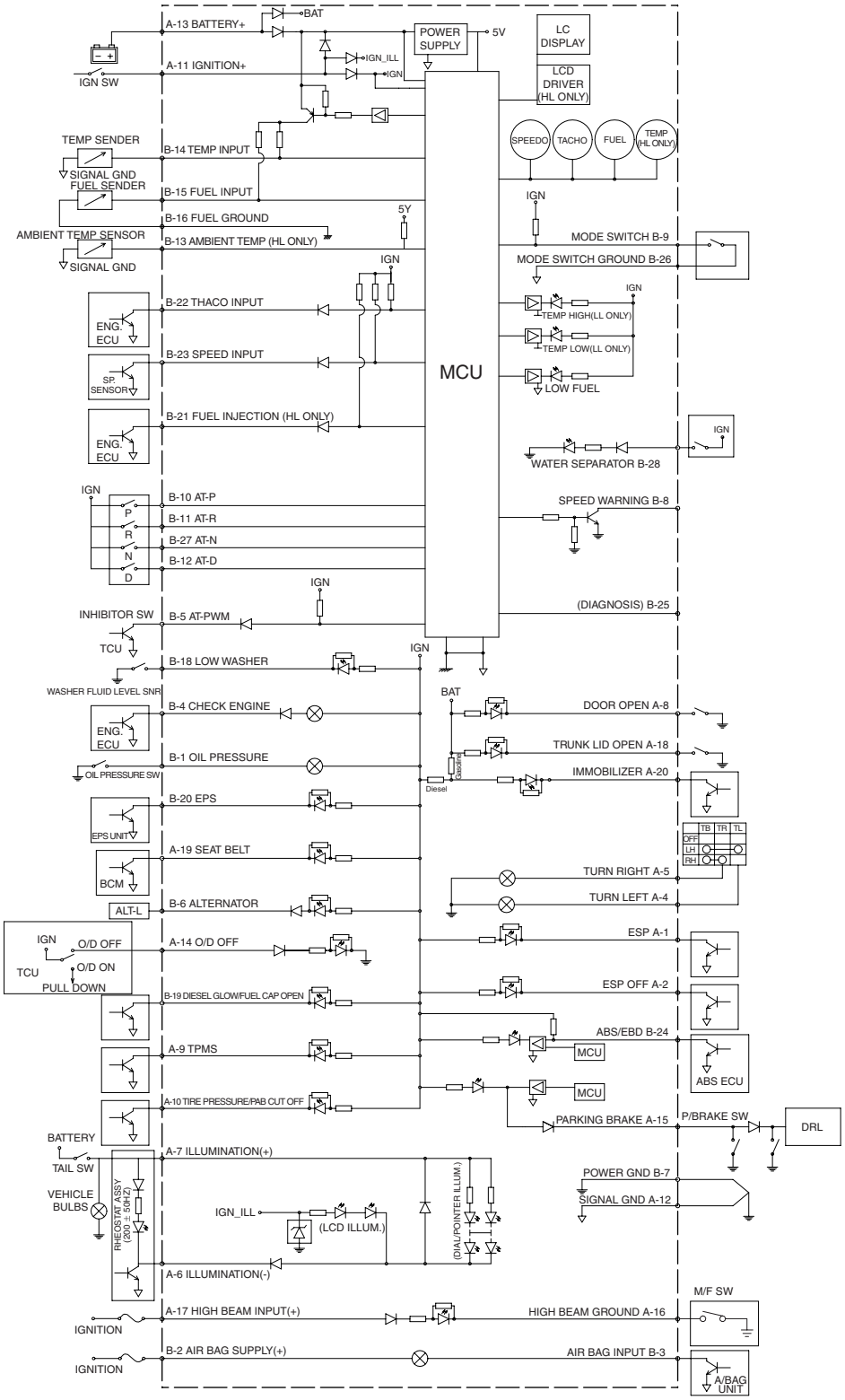
M09-1(A)



M09-2(B) M09-3(B)

LTJF260B

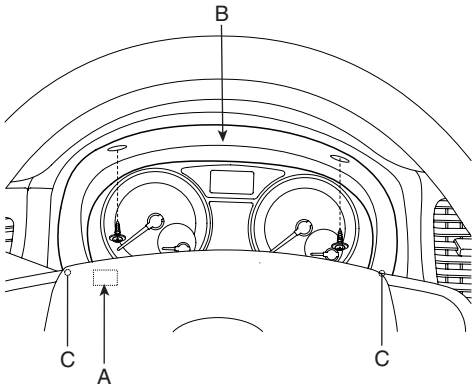
CIRCUIT DIAGRAM E71126C0



LTJF260C

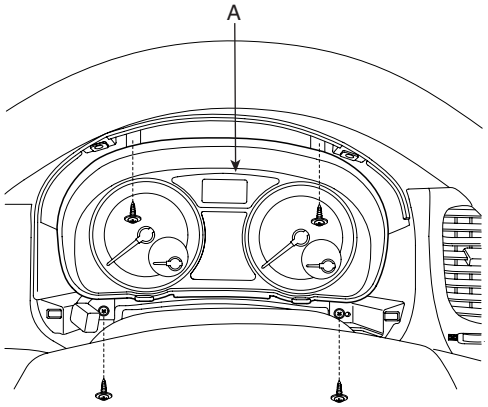
REPLACEMENT EEE1B01A

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel (B) after disconnecting the connector of trip switch (A) and loosening the 2 screws take care of fixing clips(C).



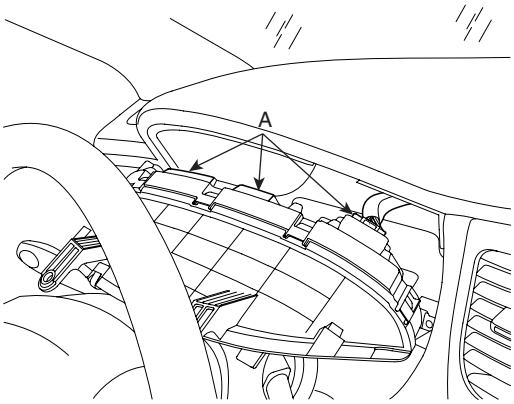
LTJF261B

3. Pull out the cluster (A) from the housing after removing 4 screws.



LTJF261C

4. Disconnect the cluster connecter (A) and then remove the cluster.



ATJF261D

5. Installation is the reverse of removal.

INSPECTION EFCCB056

SPEEDOMETER

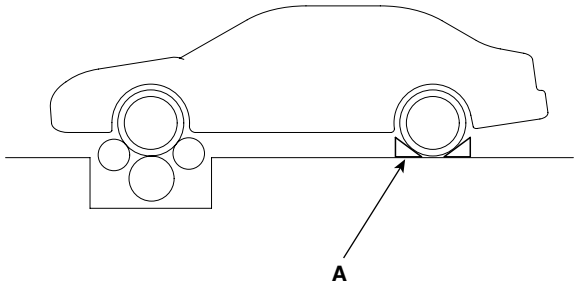
1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks as appropriate.
3. Check if the speedometer indicator range is within the standard values.

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.



ETKE100E

[EXCEPT AUSTRALIA - KM/H]

Velocity (km/h)	20	40	60	80	100
Tolerance (km/h)	+5.5 +1.6	+7.2 +3.2	+8.2 +4.0	+9.7 +5.3	+11.1 +6.5
Velocity (km/h)	120	140	160	180	200
Tolerance (km/h)	+12.4 +7.8	+13.8 +9.0	+15.2 +10.2	+16.5 +11.5	+17.8 +12.8

[AUSTRALIA- KM/H]

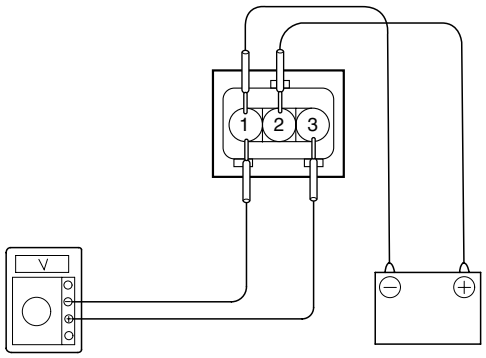
Velocity (km/h)	20	40	60	80	100
Tolerance (km/h)	+4.1 +0.7	+4.2 +1.3	+6.1 +1.9	+7.0 +2.6	+7.8 +3.2
Velocity (km/h)	120	140	160	180	200
Tolerance (km/h)	+8.5 +3.9	+9.3 +4.5	+10.2 +5.2	+10.8 +5.8	+11.4 +6.4

[MPH]

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	+3.1 +0.6	+3.9 +1.4	+5.1 +2.4	+6.7 +3.7
Velocity (MPH)	80	100	120	-
Tolerance (MPH)	+8.0 +5.1	+9.3 +6.2	+10.5 +7.3	-

VEHICLE SPEED SENSOR

1. Connect the positive (+) lead from battery to terminal 2 and negative (-) lead to terminal 1.
2. Connect the positive (+) lead from tester to terminal 3 and the negative (-) lead to terminal 1.
3. Rotate the shaft.
4. Check that there is voltage change from approx. 0V to 11V or more between terminals 3 and 1.
5. The voltage change should be 4 times for every revolution of the speed sensor shaft.
   If operation is not as specified, replace the sensor.



LTJF261E

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

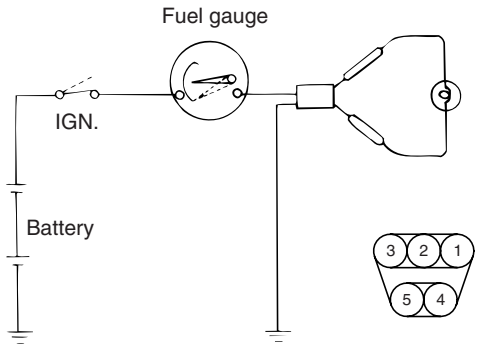
a. Reversing the connections of the tachometer will damage the transistor and diodes inside.

b. 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
Tolerance(rpm)	±100	±125	±150
Revolution(rpm)	4,000	5,000	6,000
Tolerance(rpm)	±170	±200	±240

FUEL GAUGE

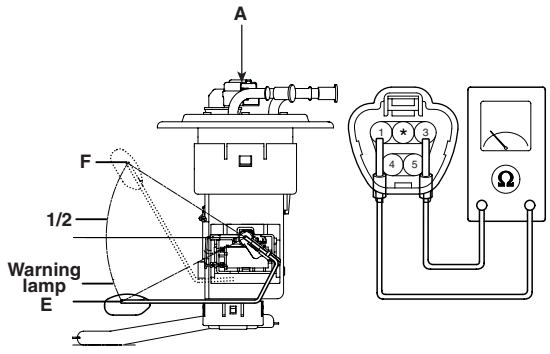
1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 wattages, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



LTJF262A

FUEL GAUGE SENDER

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



LTJF262B

2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

Position	Resistance(Ω)
Sender (E)	184 ± 2
Warning lamp	170 ± 2
1/2	66 ± 2
Sender (F)	15 ± 2

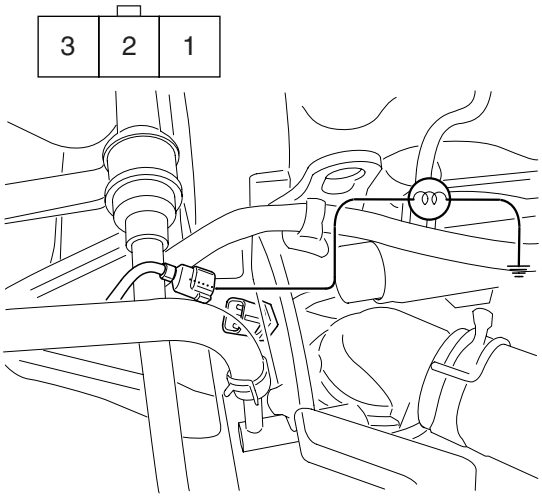
3. If the height resistance is unsatisfied, replace the fuel sender as an assembly.

CAUTION

After completing this test, wipe the sender dry and reinstall it in the fuel tank.

ENGINE COOLANT TEMPERATURE GAUGE (HI MODEL)

1. Disconnect the wiring connector (A) from the engine coolant temperature sender in the engine compartment.
2. Turn the ignition switch ON. Check that the gauge needle indicates cool. Turn the ignition switch OFF.
3. Connect a 12V, 3.4 wattages test bulb between the harness side connector and ground.
4. Turn the ignition switch ON.
5. Verify that the test bulb flashes and that the indicator moves to HOT position.
   If operation is not as specified, replace the cluster. Then recheck the system.



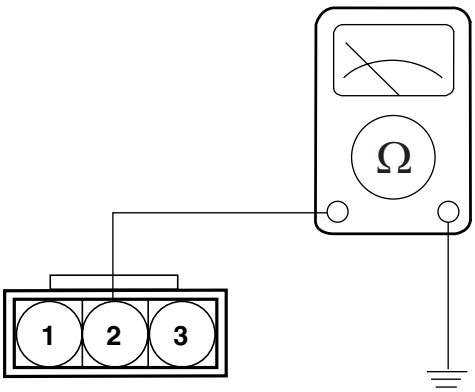
ETRF262C

ENGINE COOLANT TEMPERATURE GAUGE (LOW MODEL)

1. Turn the ignition switch ON.
2. Check that the high temperature lamp (Red) is ON for 3 seconds and then the low temperature lamp (Blue) is ON.
3. If operation is not as specified, replace the cluster. Then recheck the system.

ENGINE COOLANT TEMPERATURE SENDER

1. Using an ohmmeter, measure the resistance between the terminal 2 and ground.



ETKE110I

2. If the resistance value is not as shown in the table, replace the temperature sender.

HI MODEL

Temperature [°F(°C)]	140 (60)	185 (85)	230 (110)	257 (125)	E/G
Resistance (Ω)	142	62	26	17.5	Gasoline

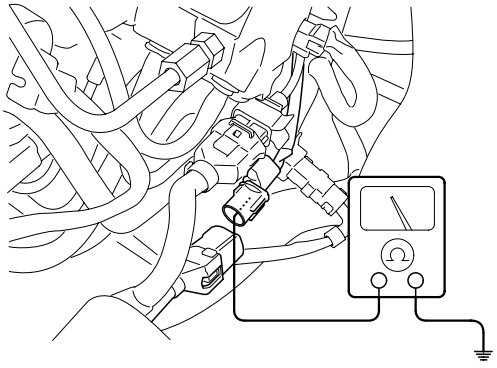
Temperature [°F(°C)]	120.2 (49)	159.8 (71)	230 (110)	257 (125)	E/G
Resistance (Ω)	215	98	21.5	16.5	Diesel

LOW MODEL

Temperature [°F(°C)]	Resistance (Ω)		Tolerance	Lamp
	Diesel	Gasoline		
131 (55)	160	160	± 3°C	Low temperature lamp (ON)
140 (60)	133	133	± 3°C	Low temperature lamp (OFF)
248 (120)	18.5	19	± 3°C	High temperature lamp (OFF)
257 (125)	16.5	17.5	± 3°C	High temperature lamp (ON)

OIL PRESSURE SWITCH

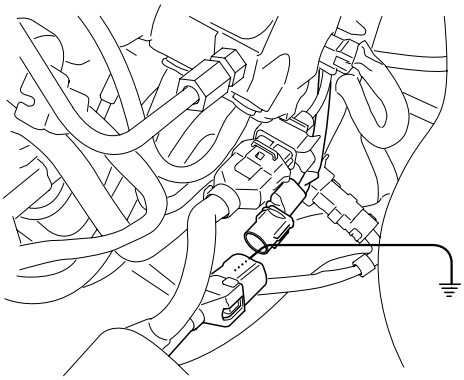
1. Check that there is continuity between the oil press switch terminal and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



KTQE530A

OIL PRESSURE WARNING LAMP

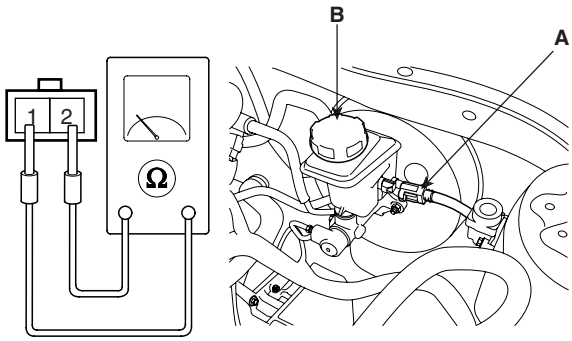
1. Disconnect the connector from the warning switch and ground the terminal on the wire harness side connector.
2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect the wire harness.



KTQE530B

BRAKE FLUID LEVEL WARNING SWITCH.

1. Remove the connector (A) from the switch located at the brake fluid reservoir (B).
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



ATJF260D

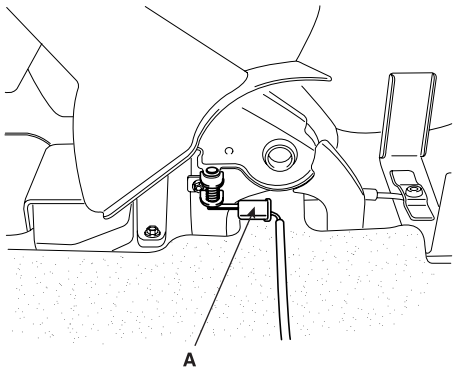
BRAKE FLUID LEVEL WARNING LAMP

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 (A) is a pulling type. It is located under the parking brake lever. To adjust, move the switch mount up and down with the parking brake lever released all the way.

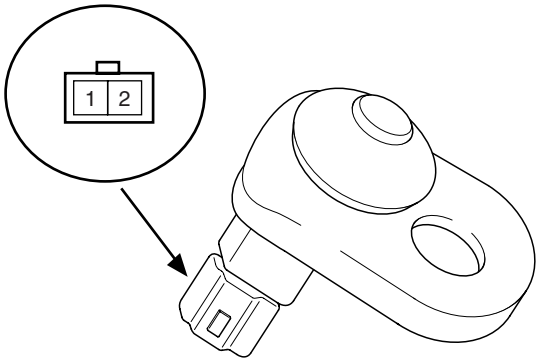
1. Check that there is continuity between the terminal and switch body with the switch ON (Lever is pulled).
2. Check that there is no continuity between the terminal and switch body with the switch OFF (Lever is released).
   If continuity is not as specified, replace the switch or inspect its ground connection.



AJGE038B

DOOR SWITCH

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



ATIE121Q

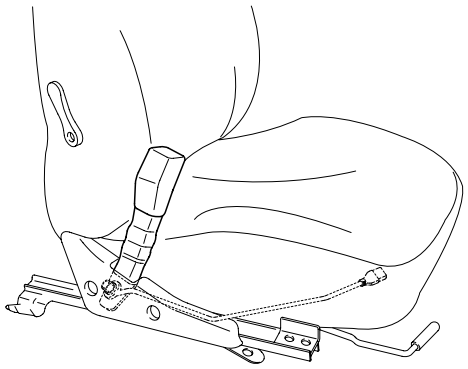
Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

ETQF180D

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)



V5BE060Q

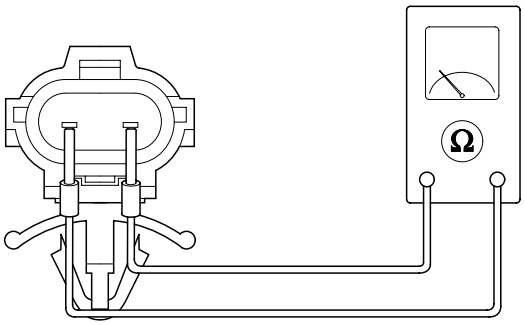
SEAT BELT WARNING LAMP

With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

AMBIENT TEMPERATURE SENSOR

1. The ambient temperature sensor is located at the behind the right fog lamp.
2. Ignition "OFF".
3. Disconnect ambient temperature sensor.
4. Check the resistance of ambient temperature sensor between terminals 1 and 2 whether it is changed by changing temperature of the ambient temperature sensor.



AQIE204B

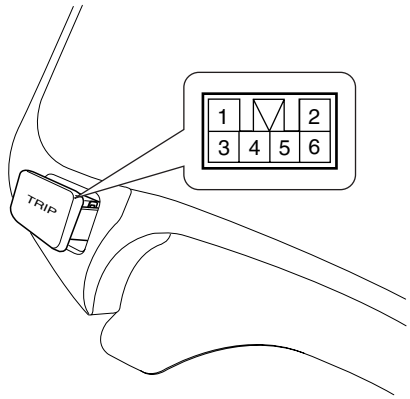
SPECIFICATION

Ambient temperature [°C(°F)]	Resistance between terminals 1 and 2 (KΩ ±3%)
-20 (-4) 0 (32) 20 (68) 40 (104)	284.5 97.5 37.5 16.0

5. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.
6. If the problem is corrected, replace the ambient temperature sensor.

TRIP SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the trip switch (A) from the cluster facia panel (B).



ATJF261F

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

Terminal / Position	3	6	4	5
ON	○	○ (Illumination)	○	○
OFF				

LTJF261G

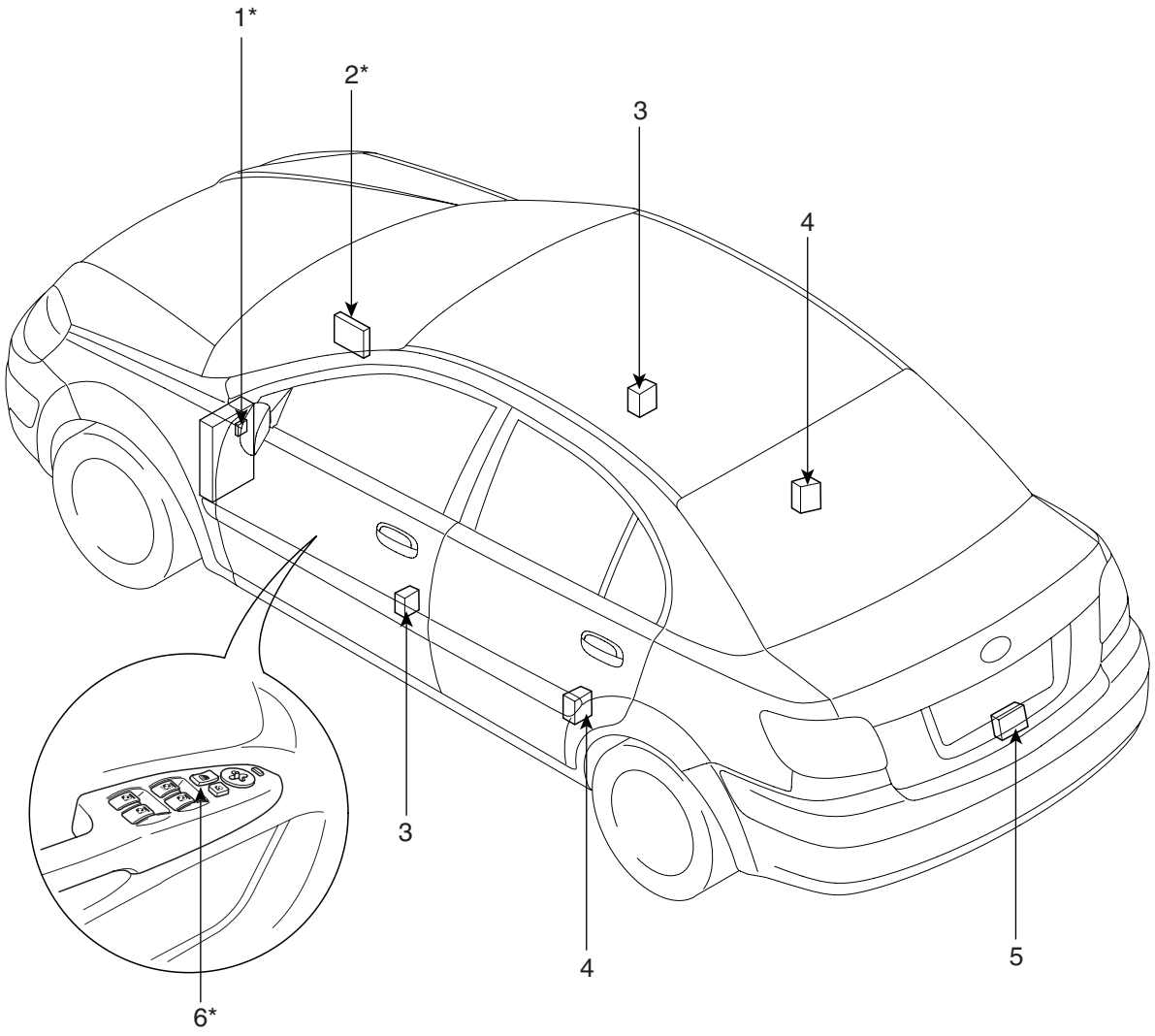
TROUBLESHOOTING E61C6F9E

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 trunk lid warning lamp do not light up	Multi backup 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

POWER DOOR LOCKS

COMPONENT LOCATION E4F7FD6C

The parts with asterisk(*) :
This illustration is shown the LHD type.
RHD type is symmetrical.



1. Junction box (Door lock/unlock relay)
2. Body control module
3. Front door lock actuator & switch
4. Rear door lock actuator & switch
5. Tail gate lock actuator (5 Doors)
6. Door lock switch

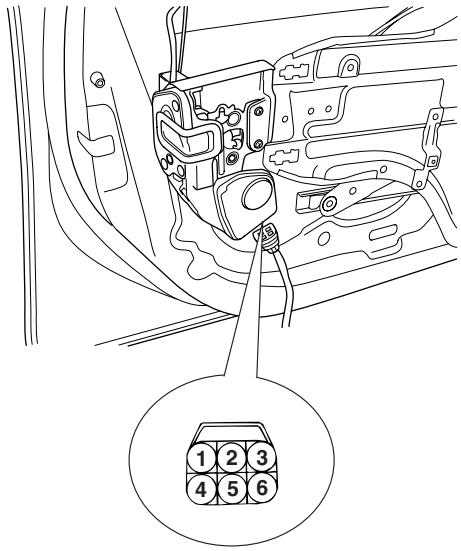
LTJF280A

POWER DOOR LOCK ACTUATORS

INSPECTION E4A1DADE

FRONT DOOR LOCK ACTUATOR

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 6P connector from the actuator.



KTKD047A

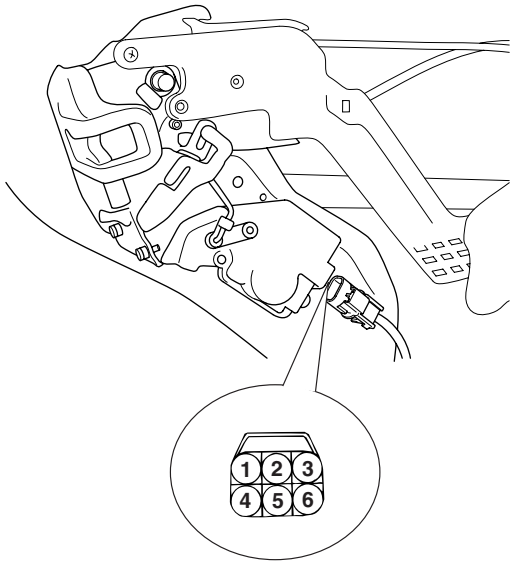
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		4	6
Right	Lock	⊖	⊕
	Unlock	⊕	⊖
Left	Lock	⊕	⊖
	Unlock	⊖	⊕

LTJF122B

REAR DOOR LOCK ACTUATOR

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.



KTKD048A

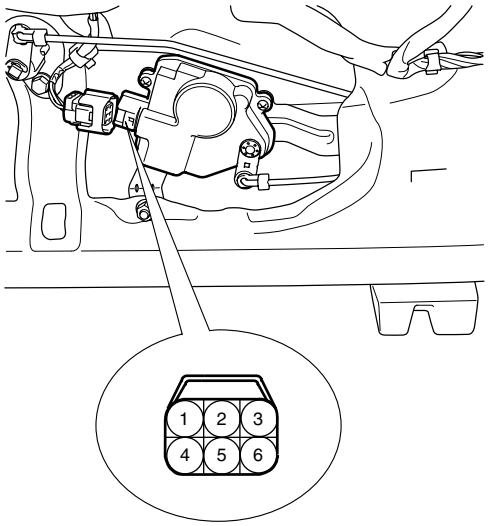
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		4	6
Right	Lock	⊖	⊕
	Unlock	⊕	⊖
Left	Lock	⊕	⊖
	Unlock	⊖	⊕

LTJF122D

TAILGATE LOCK ACTUATOR (5DOORS)

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.



KTPC165A

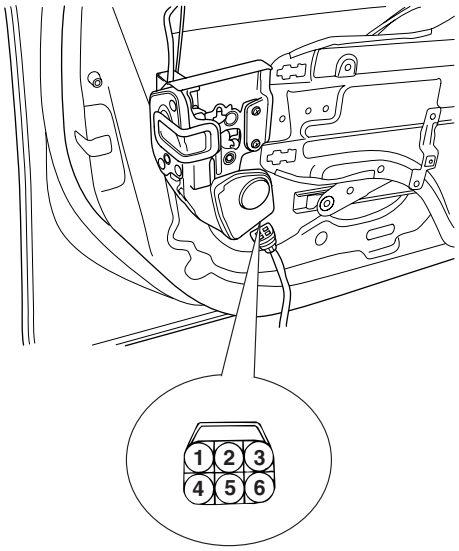
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	1	2
LOCK	⊕	⊖
UNLOCK	⊖	⊕

LTJF122F

FRONT DOOR LOCK SWITCH

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 6P connector from the actuator.



KTKD047A

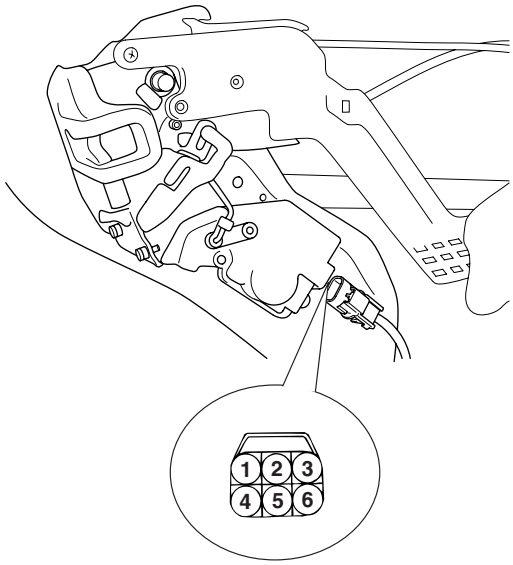
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	2	3
Right	Lock	○		○
	Unlock	○	○	
Left	Lock	○		○
	Unlock		○	○

LTJF122G

REAR DOOR LOCK SWITCH

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.



KTKD048A

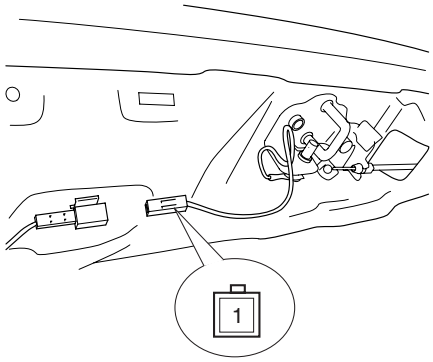
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	2	3
Right	Lock	○		○
	Unlock	○	○	
Left	Lock	○		○
	Unlock		○	○

LTJF122H

TRUNK LID SWITCH (4DOORS)

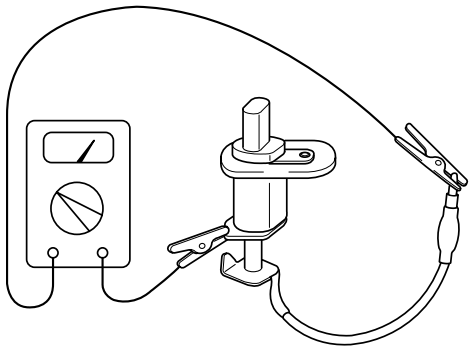
1. Disconnect the negative battery terminal.
2. Remove the rear trunk lid trim, and then remove the trunk lid switch from the trunk lid striker.



KTKD005M

3. Disconnect the 1P connector from the rear harness.
4. Check for continuity between the terminal and body while pushing the rod.

Switch rod condition	Continuity
Push (OFF)	Non-conductive (∞Ω)
Released (ON)	Conductive (0Ω)

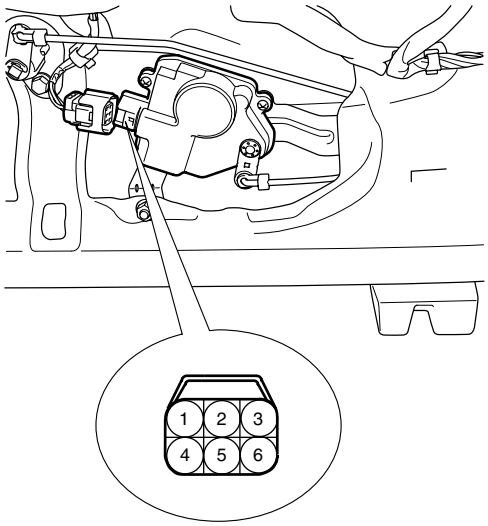


KTBC455E

TAILGATE LOCK SWITCH (5DOORS)

1. Remove the tailgate trim panel. (Refer to the Body group - tailgate)

2. Disconnect the 6P connector from the actuator.



KTPC165A

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

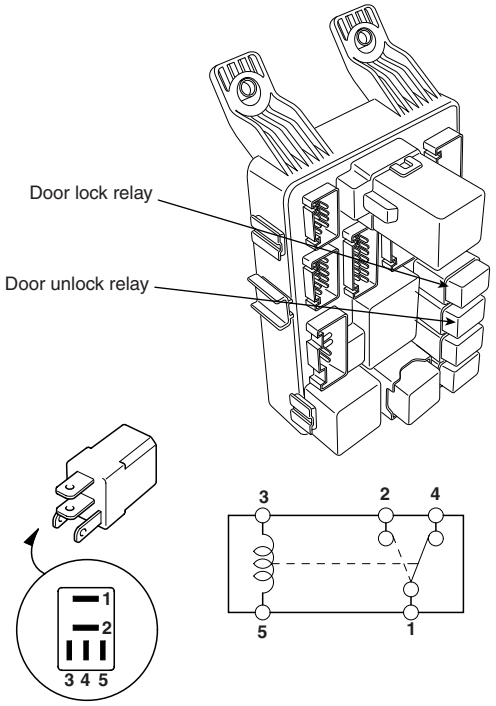
Terminal / Position	4	5	6
Unlock		○	○
Lock	○		○

LTJF122I

POWER DOOR LOCK RELAY

INSPECTION EB8F1780

1. Remove the door lock/unlock relay from the junction box.
2. Check for continuity between the terminals.
3. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.5 terminals.
4. There should be continuity between the No.1 and No.4 terminals when power is disconnected.



LTJF220G

Terminal / Power (No.3-No.5)	3	5	1	2	4
Disconnected			○		○
Connected	⊖	⊕	○	○	

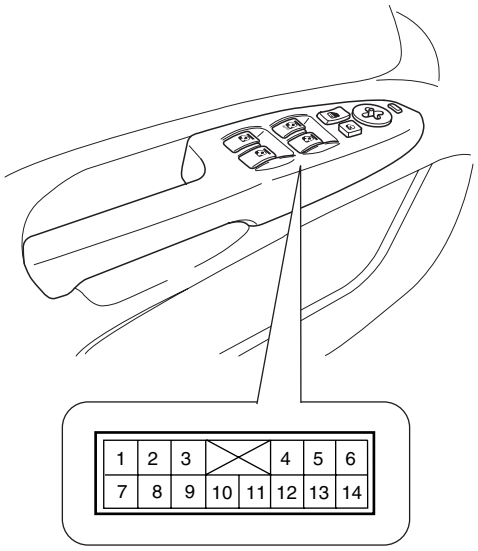
ETKE215H

POWER DOOR LOCK SWITCH

INSPECTION EB4F516D

DRIVER DOOR LOCK SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 14P connector from the switch.



ATJF284A

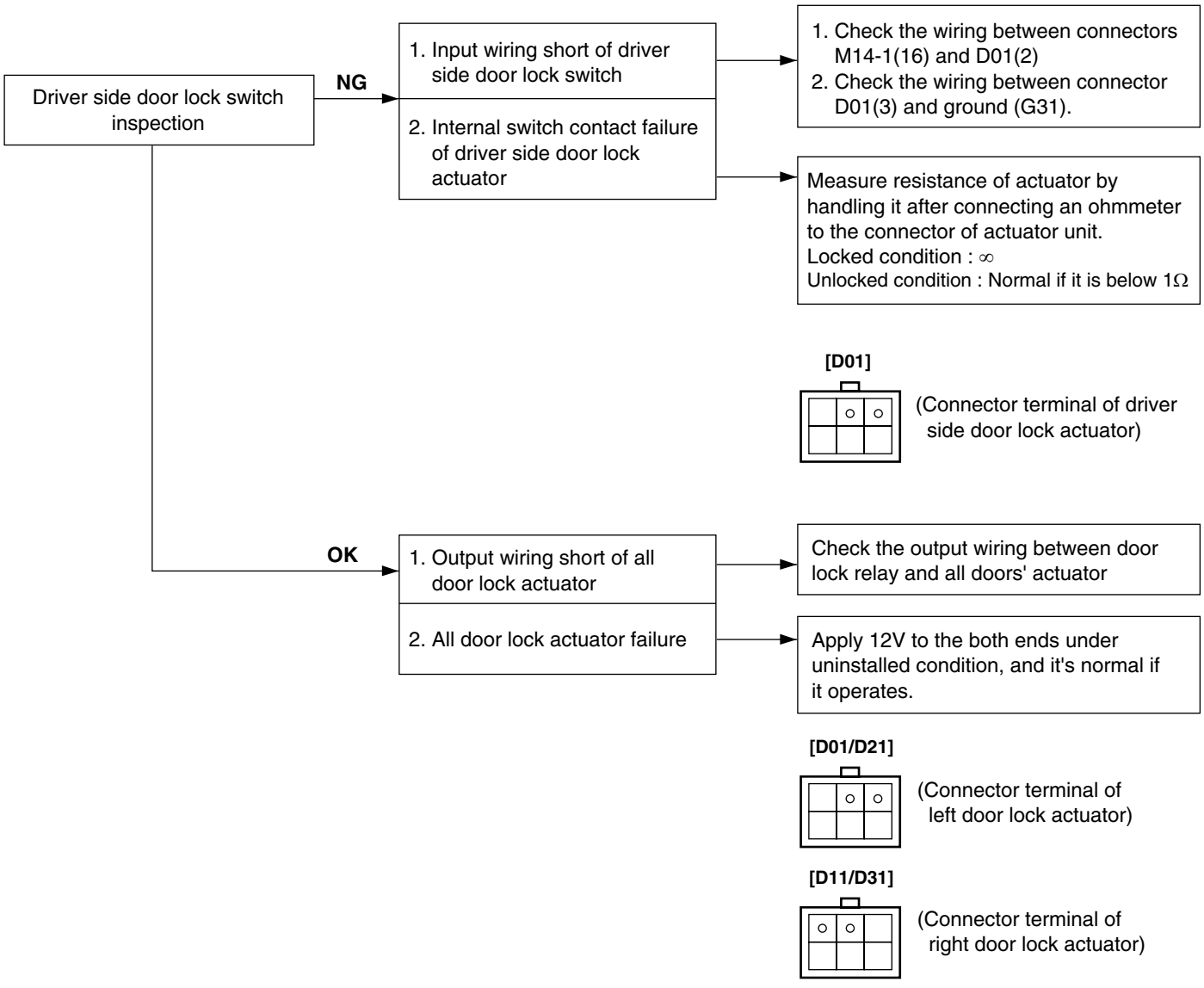
4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	13	2	14
Lock		○——	——○
Unlock	○——	——○	

LTJF284C

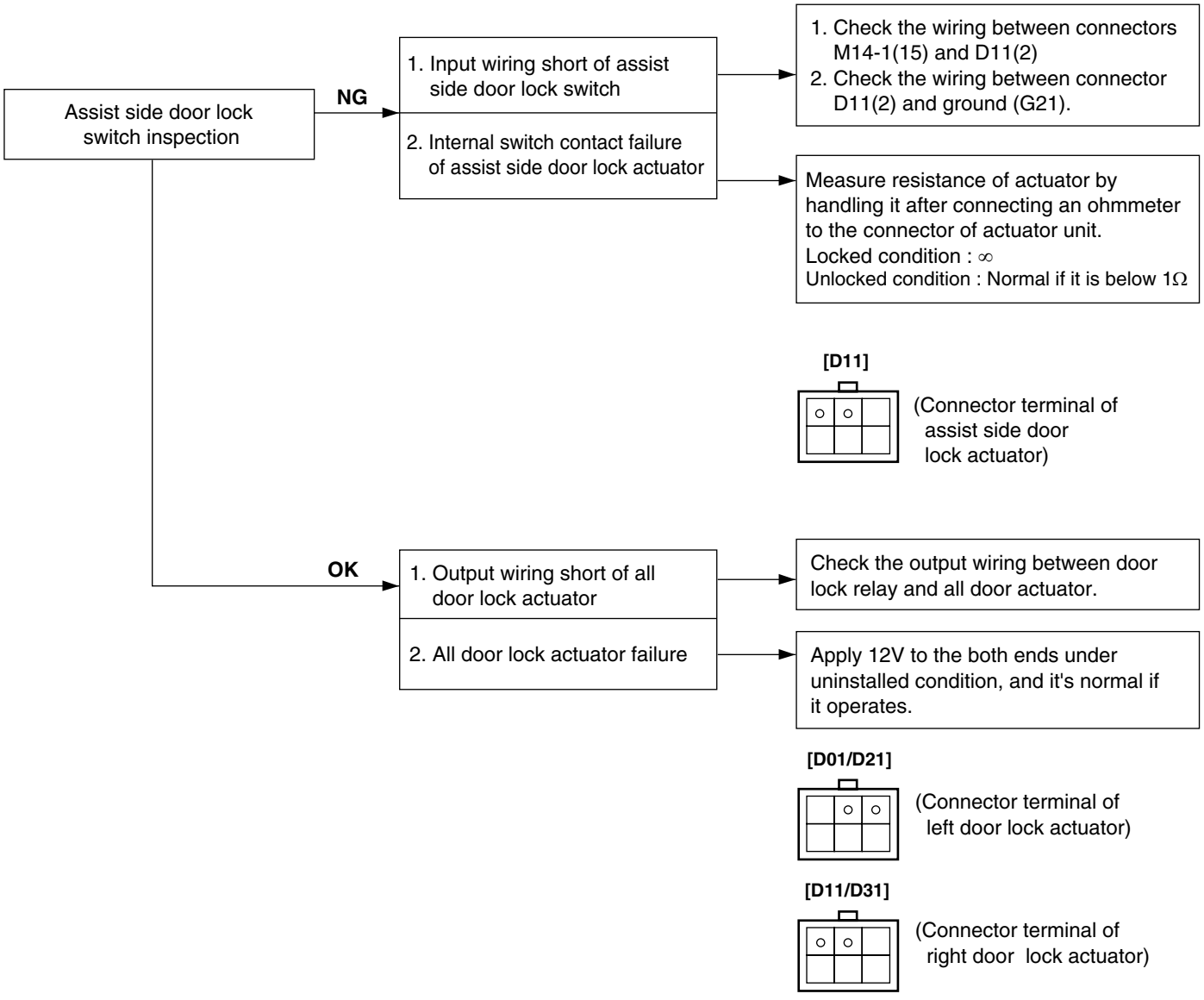
TROUBLESHOOTING EFC8BAEA

1. Lock function works but unlock function does not work. → Since door unlock relay is malfunction, replace the door unlock relay.
2. Unlock function works but lock function does not work. → Since door lock relay is malfunction, replace the door lock relay.
3. When Assist side knob is controlled, all doors locks, but when driver side knob is controlled, all doors do not lock.



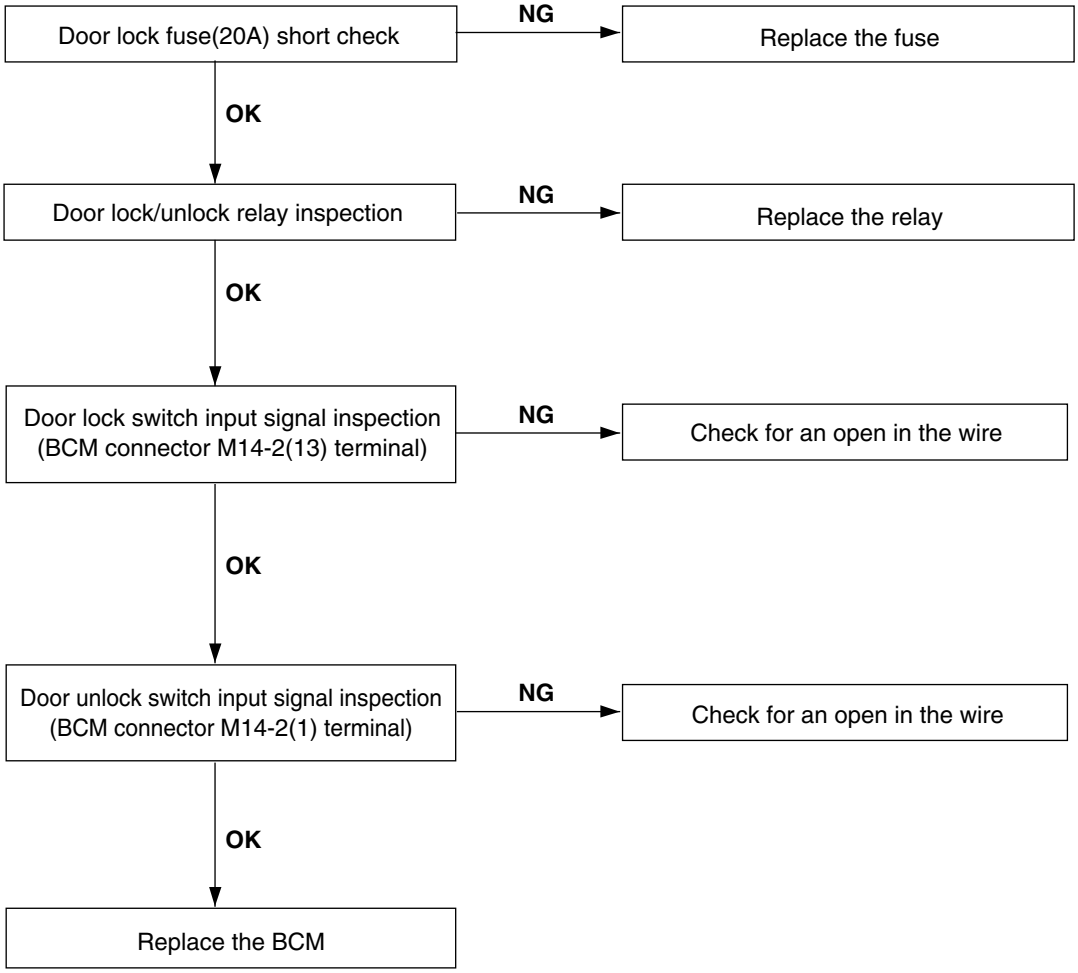
LTJF900F

4. When driver side knob is controlled. All doors lock. But when the Assist side knob is controlled, all doors do not lock.



LTJF900G

5. Both sides do not lock either.

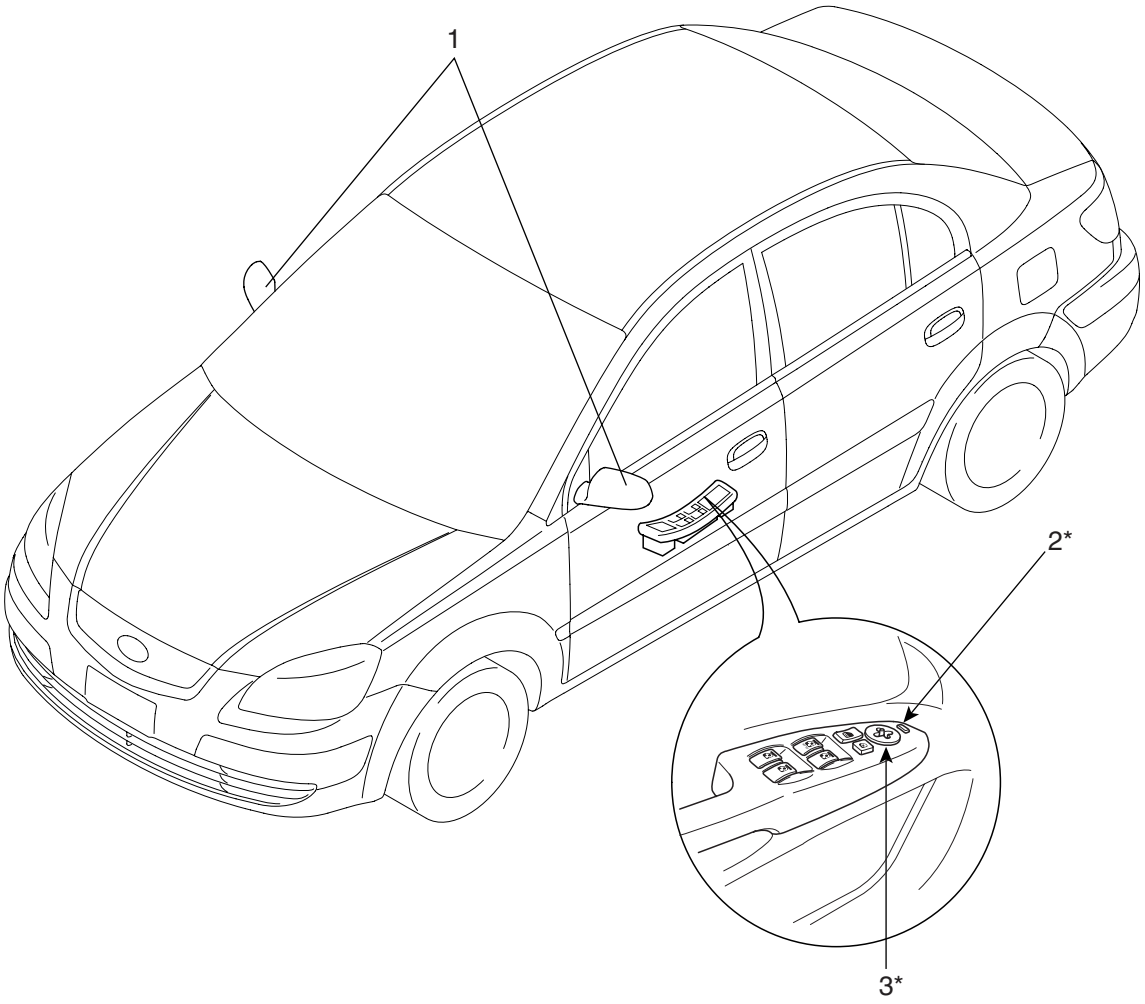


LTJF900H

POWER DOOR MIRRORS

COMPONENT LOCATION EC3FA10D

The parts with asterisk(*) :
This illustration is shown the LHD type.
RHD type is symmetrical.

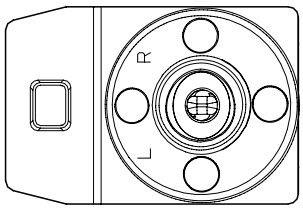


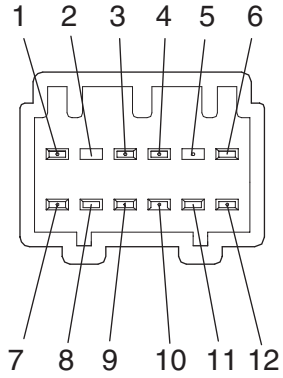
1. Power door mirror
2. Mirror folding switch
3. Power door mirror switch

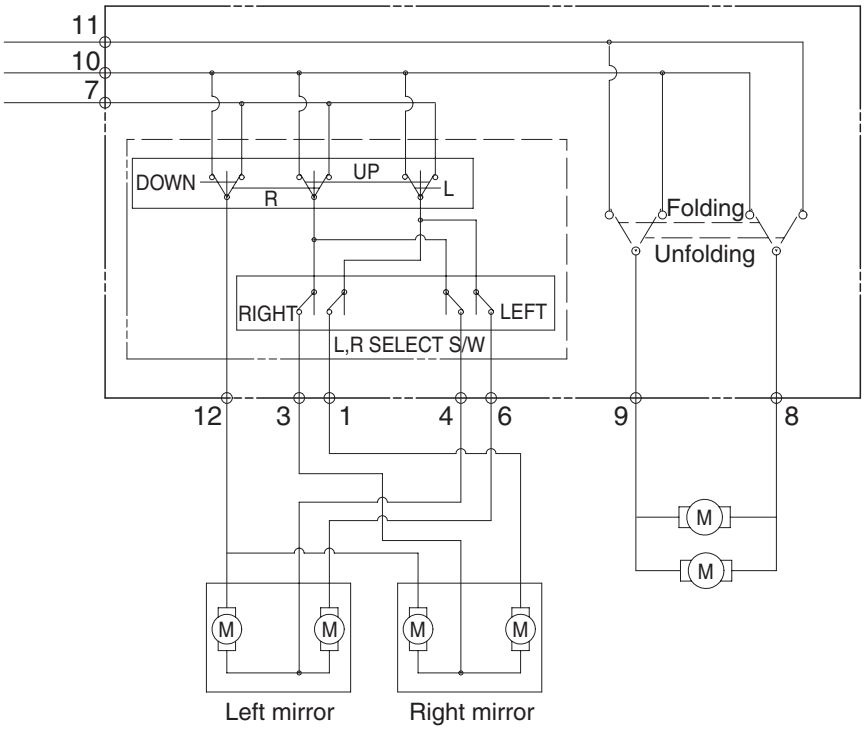
LTJF300A

POWER DOOR MIRROR SWITCH

CIRCUIT DIAGRAM EC184CDE



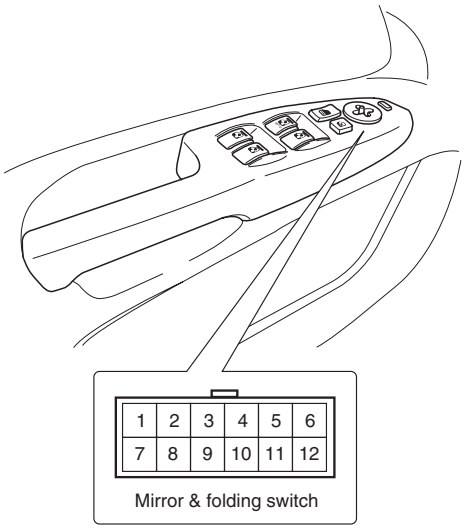




LTJF300B

INSPECTION E37424B9

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group-front door)
3. Disconnect the 12P connector from the switch.



LTJF301A

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

Class	Terminal / Direction	4	6	3	1	12	7	10	11	9	8
Left	UP	○	○			○	○	○			
	DOWN	○	○			○	○	○			
	OFF	○	○			○		○			
	LEFT	○				○	○	○			
	RIGHT		○			○	○	○			
Right	UP			○	○	○	○				
	DOWN			○	○		○	○			
	OFF			○	○	○		○			
	LEFT			○		○	○	○			
	RIGHT				○		○	○			
Folding	Folding							○	○	○	○
	Unfolding							○	○	○	○

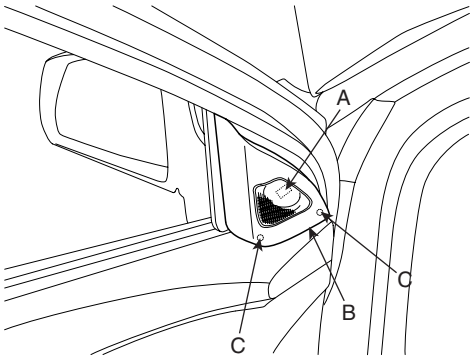
<Mirror & folding switch>

LTJF301B

POWER DOOR MIRROR ACTUATOR

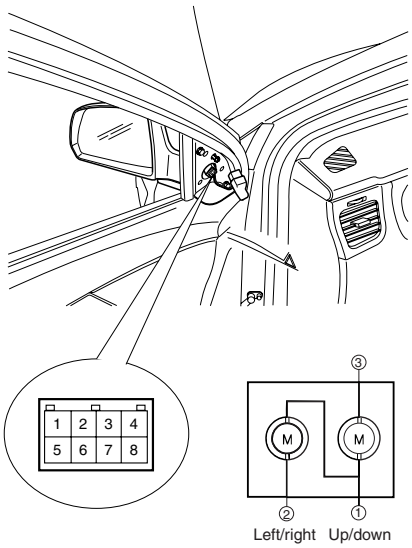
INSPECTION EAFDAA88

1. Remove the front door quadrant inner cover (B) (Refer to the Body group - front door)
2. Remove the tweeter speaker after disconnecting the connector(A). Take care of fixing clips (C).



LTJF022D

3. Disconnect the power door mirror connector from the harness.
4. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



LTJF302B

Position \ Terminal	1	2	3
UP	⊕	⊕	⊖
DOWN	⊖	⊖	⊕
OFF	⊕	⊕	⊖
LEFT	⊕	⊖	⊕
RIGHT	⊖	⊕	⊖

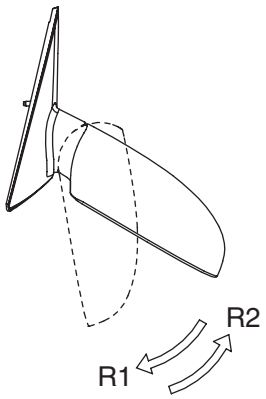
LTJF302C

MIRROR HEATER

Position \ Terminal	7	8
Heater	○	○

LTJF302D

MIRROR FOLDING



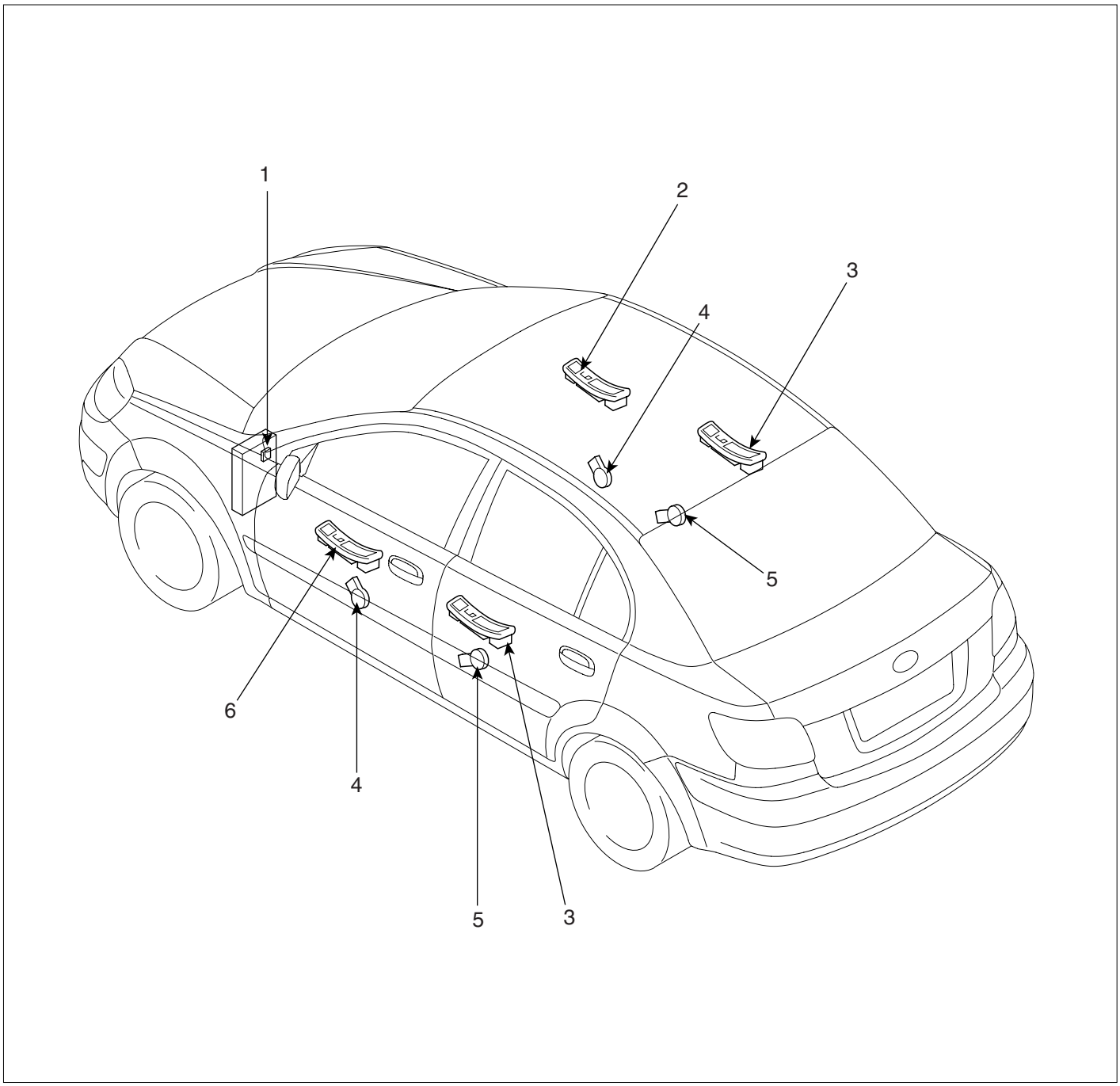
ETJA055B

Direction \ Terminal	5	6
R1	⊕ — M — ⊖	
R2	⊖ — M — ⊕	

LTJF302E

POWER WINDOWS

COMPONENT LOCATION EDAECD1C



1. Junction box (Power window relay)
2. Assist window switch
3. Rear window switch
4. Front window motor
5. Rear window motor
6. Driver window main switch

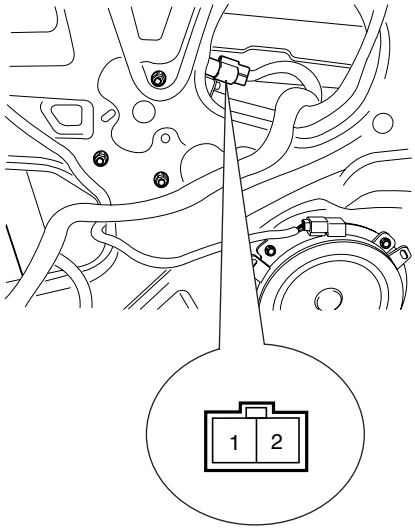
LTJF320A

POWER WINDOW MOTOR

INSPECTION E6DEC1FC

FRONT POWER WINDOW MOTOR

1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Disconnect the connector from the motor.



ATJF321A

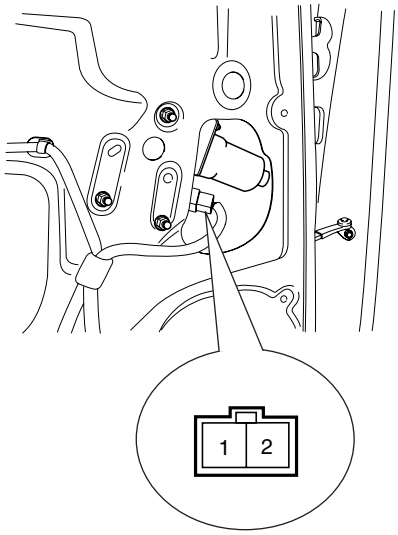
3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Position \ Terminal		1	2
Left	Clockwise	⊕	⊖
	Counter-clockwise	⊖	⊕
Right	Clockwise	⊖	⊕
	Counter-clockwise	⊕	⊖

LTJF321B

REAR POWER WINDOW MOTOR

1. Remove the rear door trim panel. (Refer to the Body group-rear door)
2. Disconnect the 2P connector from the motor.



ATJF321C

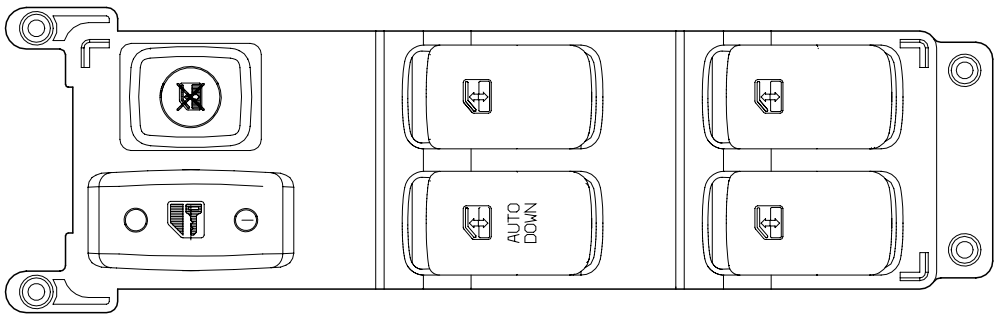
3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

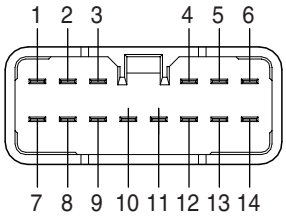
Position \ Terminal		1	2
Left	Clockwise	⊖	⊕
	Counter-clockwise	⊕	⊖
Right	Clockwise	⊕	⊖
	Counter-clockwise	⊖	⊕

LTJF321D

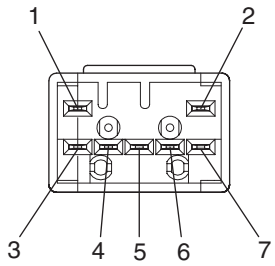
POWER WINDOW SWITCH

CIRCUIT DIAGRAM ED2F952E

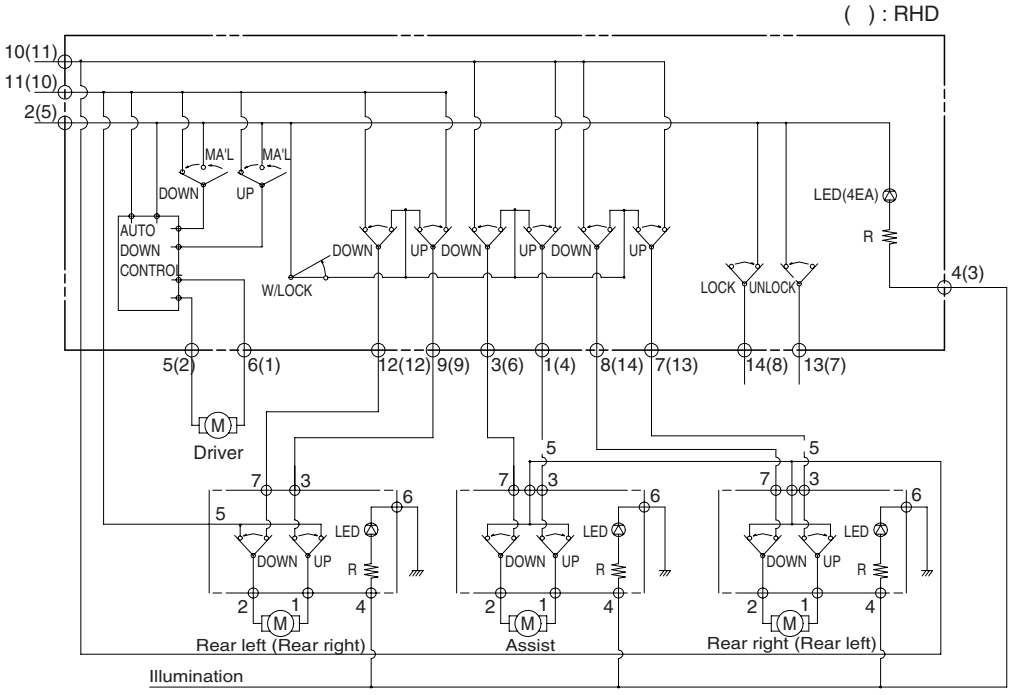




<Power window main switch>



<Assist/rear power window switch>

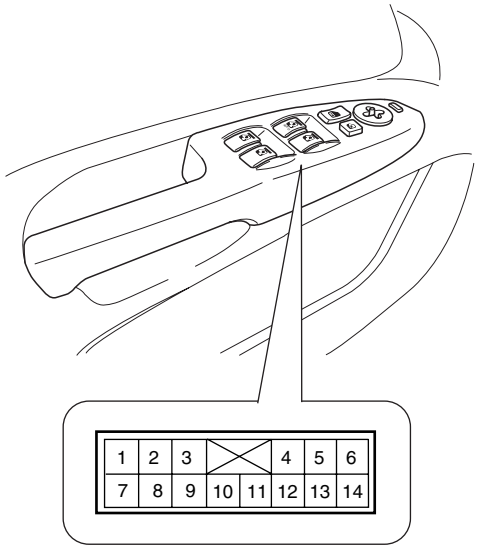


LTJF322A

INSPECTION E8B1CE00

POWER WINDOW MAIN SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - front door)
3. Disconnect the 14P connector from the switch.



ATJF284A

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.

( ) : RHD

Position \ Terminal	DRIVER				ASSIST			
	11 (10)	6 (1)	5 (2)	2 (5)	3 (6)	10 (11)	1 (4)	2 (5)
UP	○—○		○—○		○—○		○—○	
OFF		○—○	○—○		○——	——○	○—○	
DOWN	○——	——○		○—○	○——	——○	——○	
Position \ Terminal	**Rear left**				**Rear right**			
	9 (13)	11 (10)	12 (14)	2 (5)	7 (9)	10 (11)	8 (12)	2 (5)
UP	○—○		○—○		○—○		○—○	
OFF	○——	——○	○—○		○——	——○	○—○	
DOWN	○——	——○	——○		○——	——○	——○	

LTJF322F

POWER WINDOW LOCK SWITCH

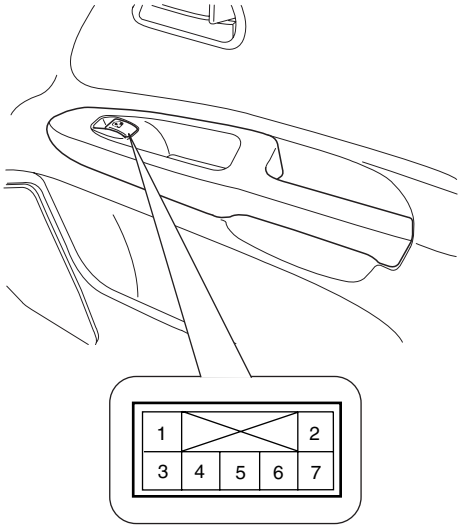
( ) : RHD

Position \ Terminal	2(5)	9 or 12
NORMAL	○——	——○
LOCK		

LTJF322E

ASSIST/REAR POWER WINDOW SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the door trim panel. (Refer to the Body group - door)
3. Disconnect the 7P connector from the switch.



ATJF322H

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.

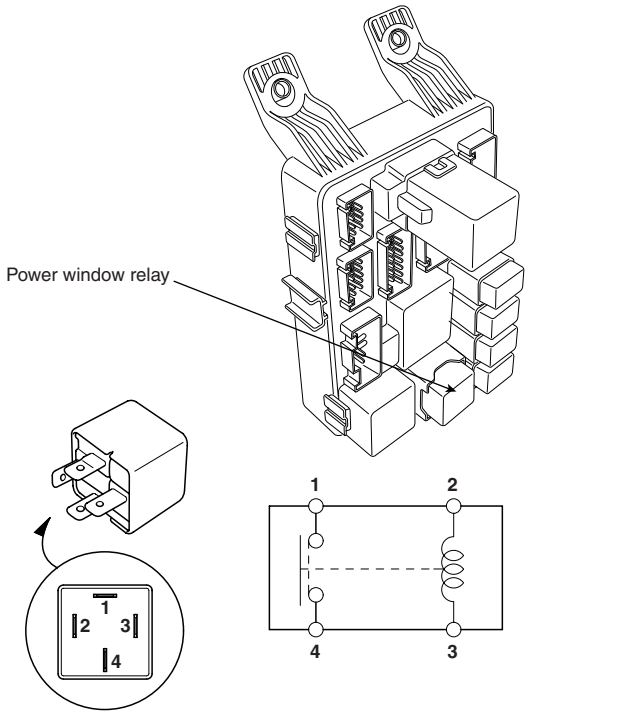
Position \ Terminal	1	2	3	5	7
UP	○——	○——	——○	——○	——○
OFF	○——	——○	○——	——○	——○
DOWN	○——	——○	○——	——○	——○

LTJF322I

POWER WINDOW RELAY

INSPECTION E3EBD6C9

1. Disconnect the negative (-) battery terminal.
2. Remove the power window relay from the junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 and No.4 terminals when power and ground are connected to the No.2 and No.3 terminals.
5. There should be no continuity between the No.1 and No.4 terminals when power is disconnected.



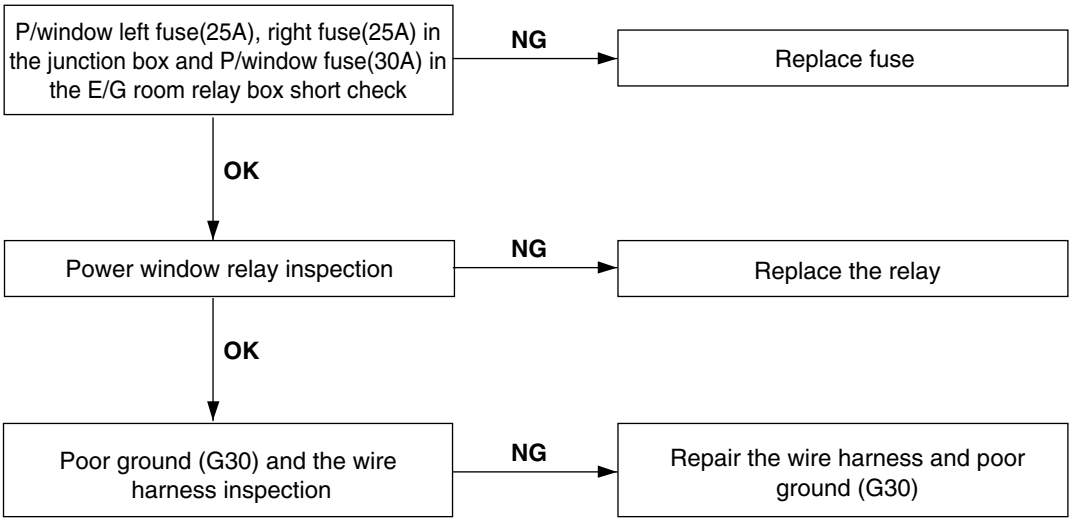
LTJF220H

Terminal / Power (No.2-No.3)	2	3	1	4
Disconnected	○	○		
Connected	⊖	⊕	○	○

ETKE215B

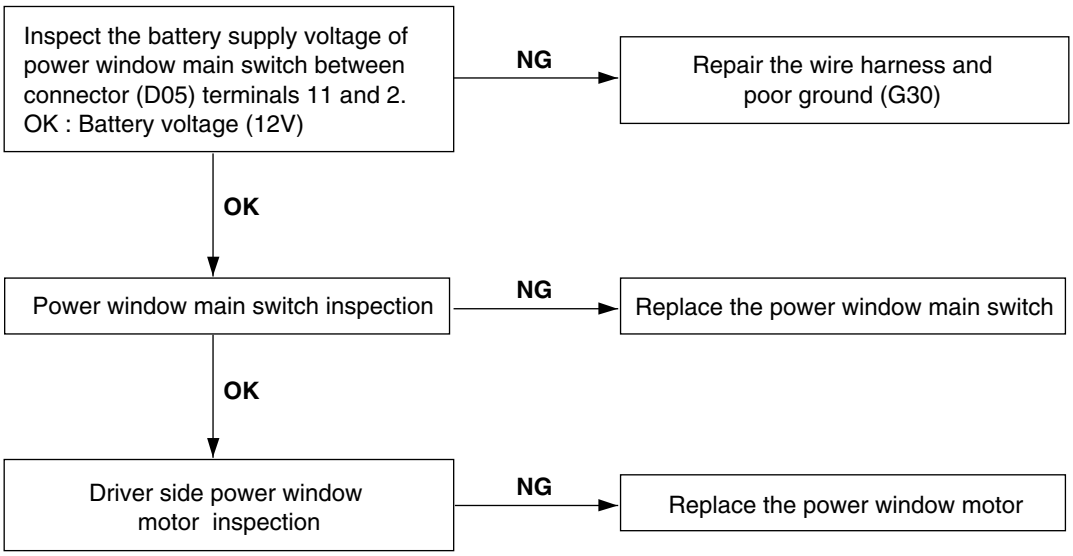
TROUBLESHOOTING EB2CF2FD

1. No windows operate from the main switch on the driver door.



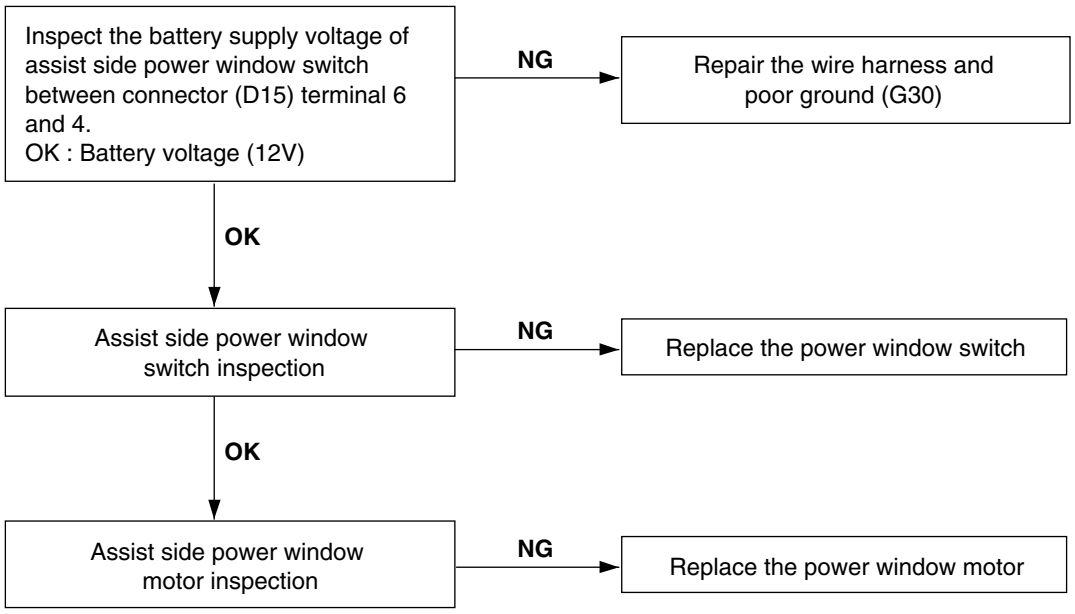
LTJF900C

2. Driver side window does not operate.



LTJF900D

3. Assist side window does not operate.

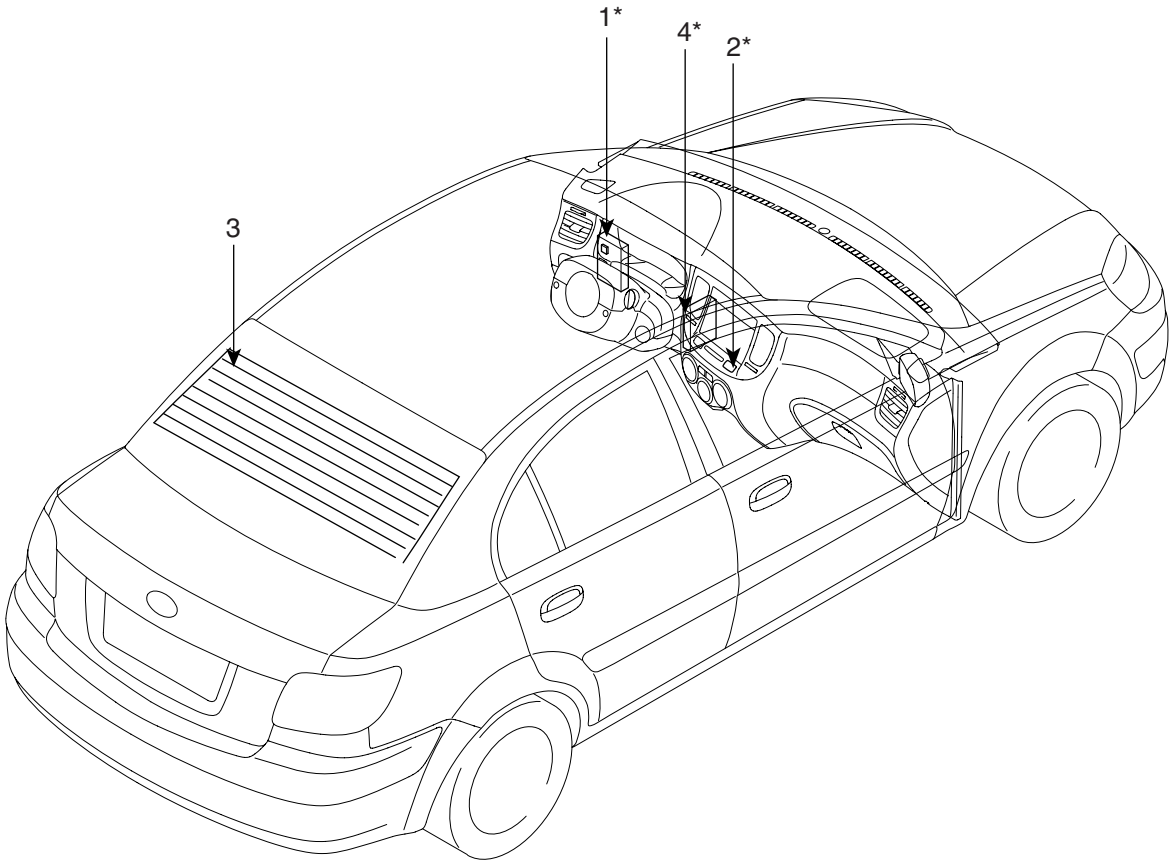


LTJF900E

REAR WINDOW DEFOGGER

COMPONENT LOCATION E46B3638

The parts with asterisk(*) :
This illustration is shown the LHD type.
RHD type is symmetrical.



1. Junction box (Rear window defogger)
2. Rear window defogger switch
3. Rear window defogger
4. Body control module

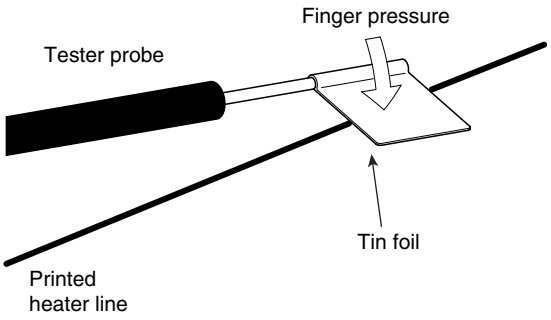
LTJF340A

REAR WINDOW DEFOGGER PRINTED HEATER

INSPECTION EC2ACBF9

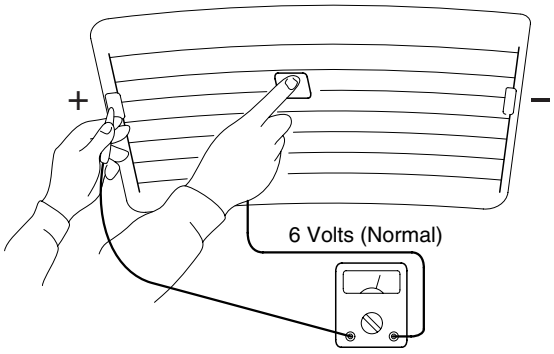
CAUTION

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.



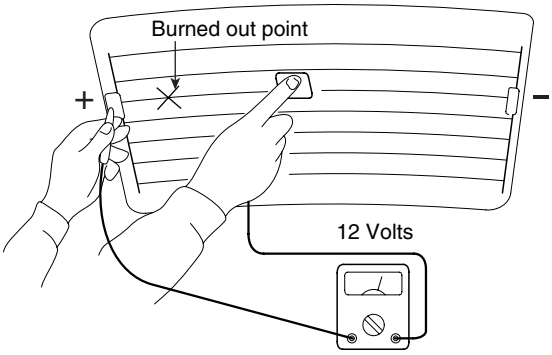
ETA9165A

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.



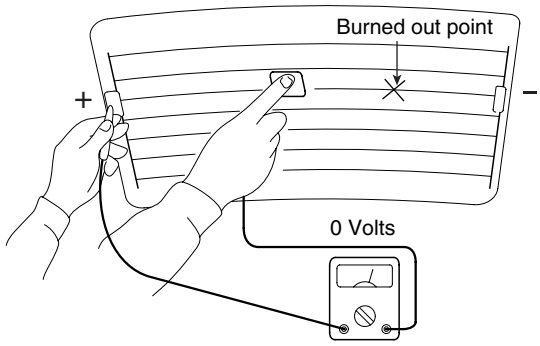
ETA9165B

2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



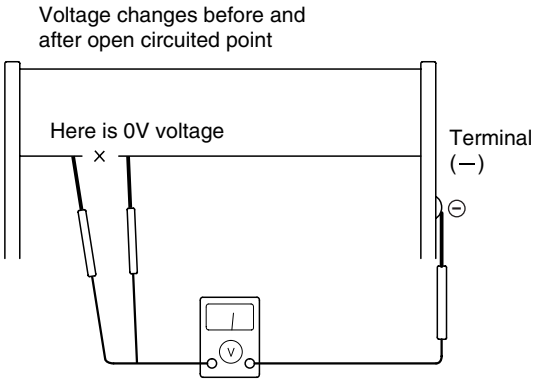
ETA9165C

3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



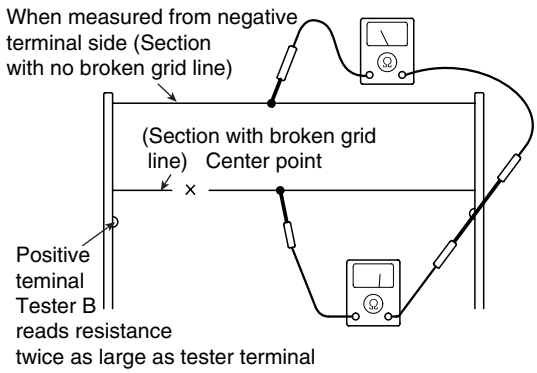
ETA9165D

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.



ETA9165E

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.

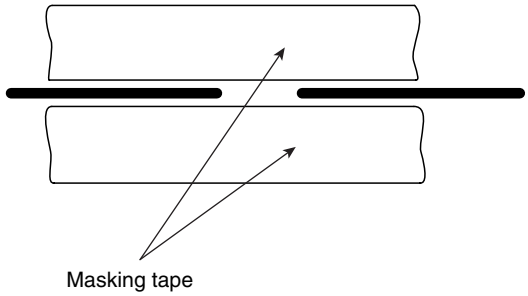


ETA9165F

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).

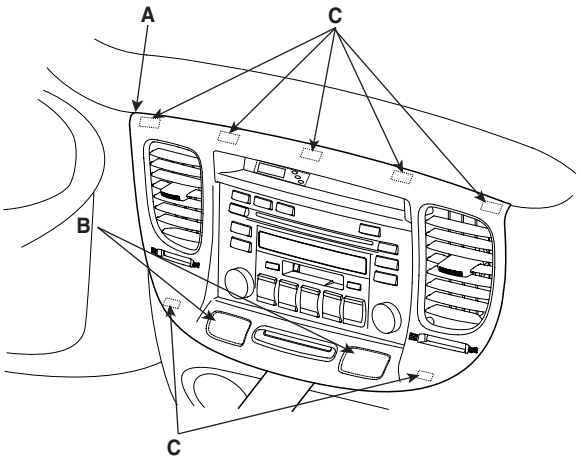


ETA9165G

REAR WINDOW DEFOGGER SWITCH

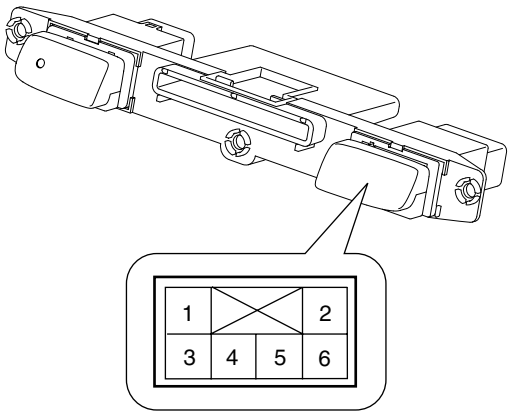
INSPECTION EE047BED

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia upper panel (A). Take care of fixing clips (C).



LTJF342A

3. Remove the connectors of rear window defogger switch and hazard switch (B).
4. Using an ohmmeter, inspection the continuity between the terminals after removing to the switch connector.



ATJF332A

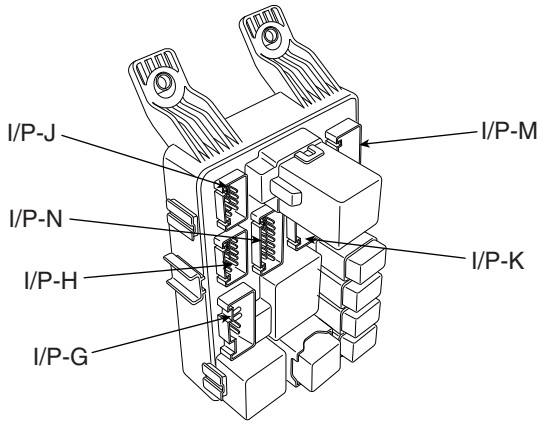
Terminal / Position	2	5	3	6	4	1
ON		Illumination				
OFF						

LTJF332C

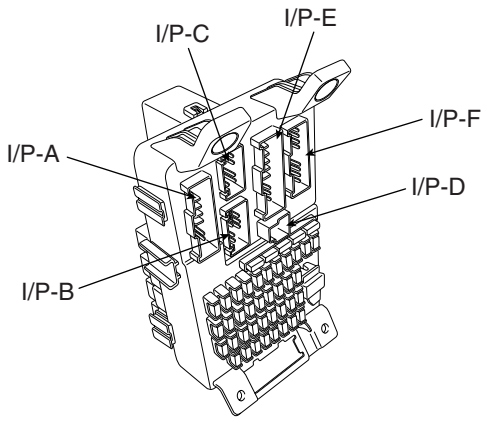
REAR WINDOW DEFOGGER RELAY

INSPECTION E5FD919E

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.1 in the I/P-D and No.6 terminal in the I/P-M when power and ground are connected to the No.10 terminal in the I/P-M and No.6 terminal in the I/P-G.
5. There should be no continuity between the No.1 terminal in the I/P-D and No.6 terminal in the I/P-M when power is disconnected.



ATJF343A



ATJF343B

Terminal / Power	I/P-D (1)	I/P-M (6)	I/P-G (6)	I/P-M (10)
Disconnected			○	○
Connected	○	○	⊖	⊕

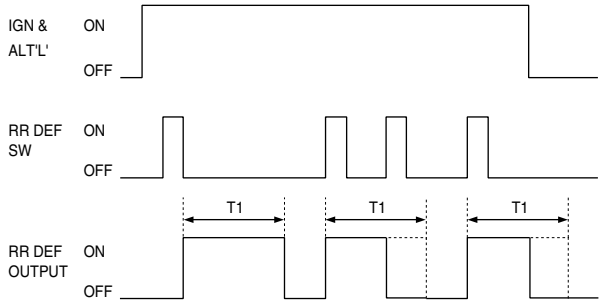
LTJF343A

REAR WINDOW DEFOGGER TIMER

INSPECTION E64EB21C

While operating the components, check whether the operations are normal as shown in the timing chart.
(Including outside mirror heater)

1. Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.



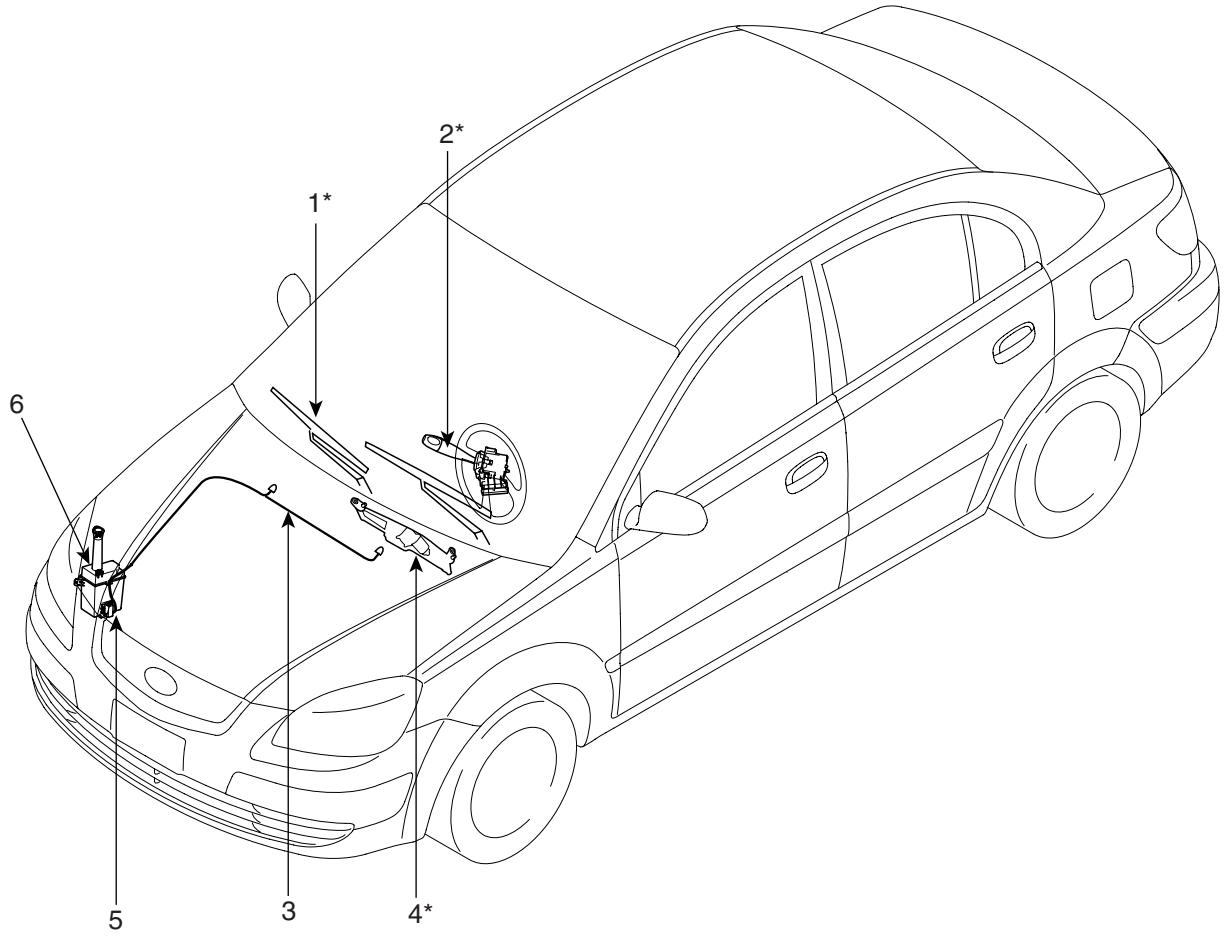
LTJF141J

T1 : 20 ± 1 min.

WINDSHIELD WIPER / WASHER

COMPONENT LOCATION E50BF412

The parts with asterisk(*) :
This illustration is shown the LHD type.
RHD type is symmetrical.



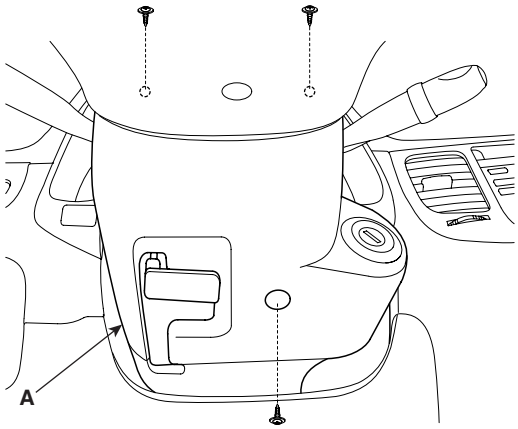
1. Windshield wiper arm & blade
2. Wiper & washer switch
3. Windshield washer hose
4. Windshield wiper motor & linkage
5. Washer motor
6. Washer reservoir

LTJF360A

WINDSHIELD WIPER / WASHER SWITCH

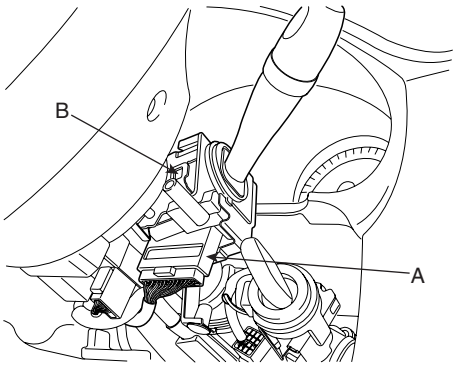
REPLACEMENT E2F957F6

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



LTJF031B

2. Remove the wiper switch (A) by pushing the lock pin (B) after disconnecting the connector.

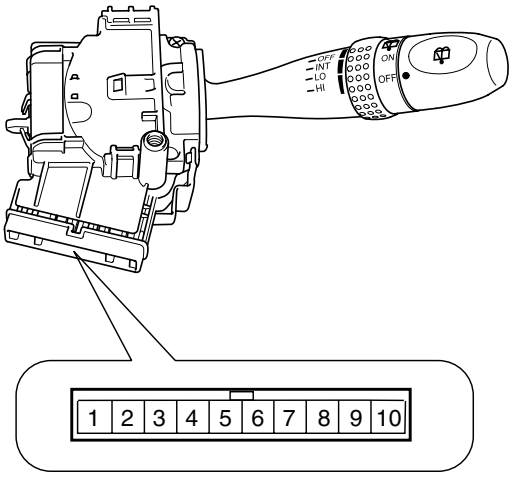


ATJF031D

3. Installation is the reverse of removal.

INSPECTION ED2CCC95

Check for continuity between the terminals while operating the wiper and washer switch. If it is not normal condition, replace wiper and wiper switch.



ATBE031F

WIPER SWITCH

( ) : RHD

Terminal / Position	2(9)	3(8)	4(7)	5(6)
MIST		○	○	
OFF			○	○
INT			○	○
LOW		○	○	
HI	○	○		

LTJF031H

WASHER SWITCH

( ) : RHD

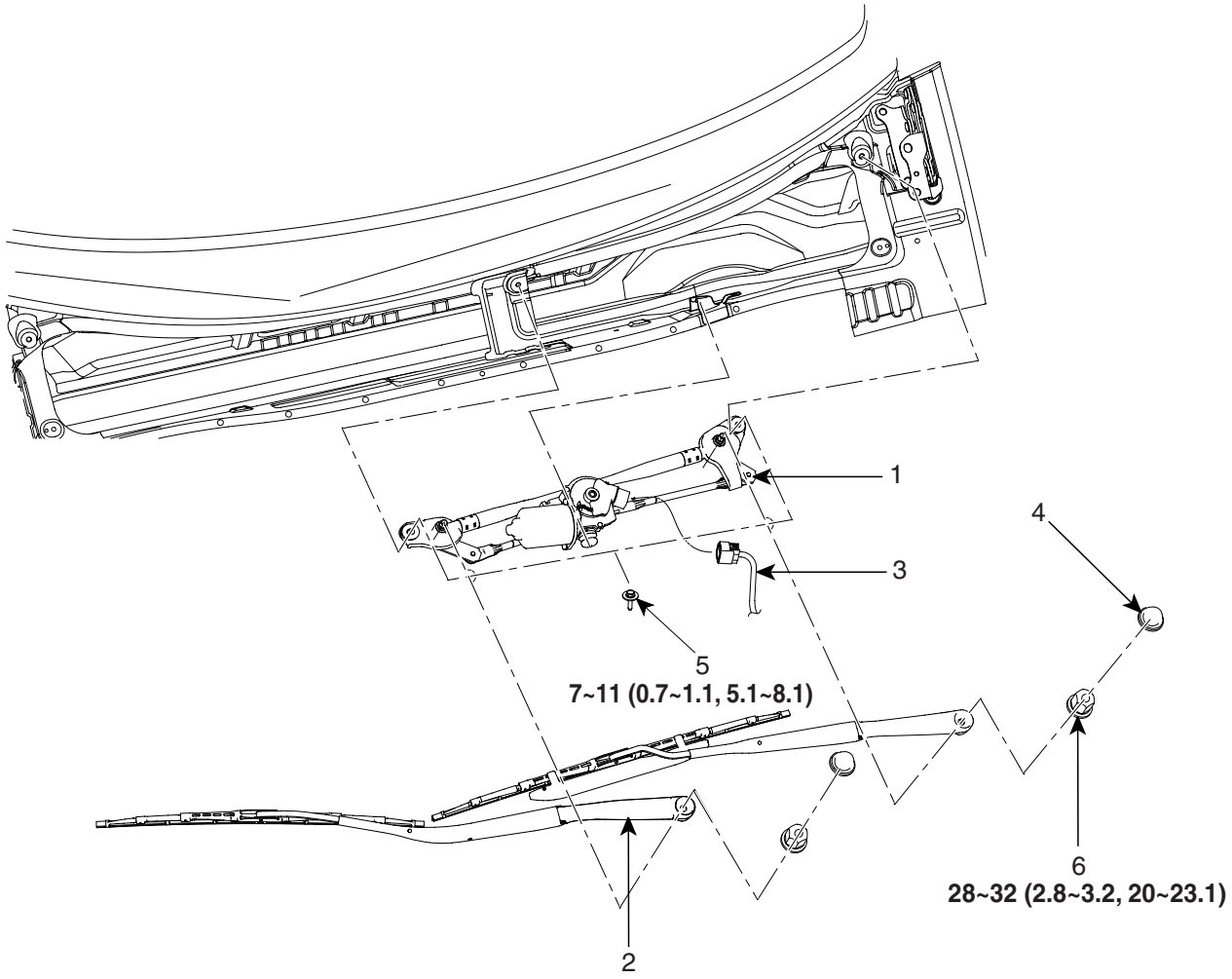
Terminal / Position	3(8)	7(4)
OFF		
ON	○	○

LTJF031I

FRONT WIPER MOTOR

COMPONENT LOCATION EDC3368F

This illustration is shown the LHD type.
RHD type is symmetrical.



TORQUE : Nm(kgf.m, lbf.ft)

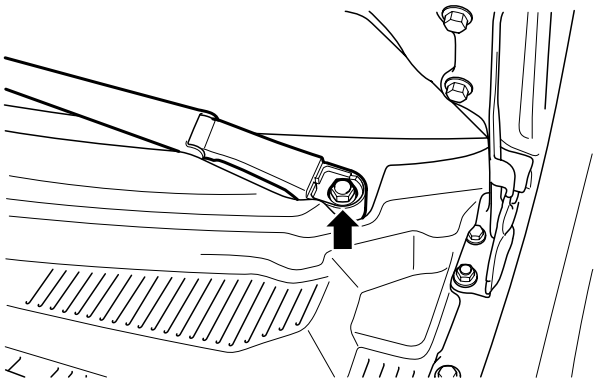
1. Wiper motor & linkage assembly
2. Wiper arm & blade
3. Wiper motor connector
4. Cap
5. Bolt
6. Nut

LTJF362A

REMOVAL EADD82CA

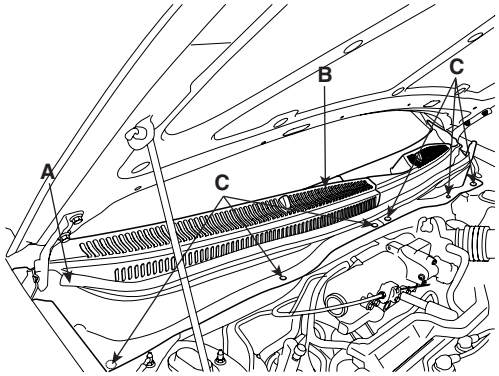
1. Remove the windshield wiper arm and blade after removing a nut.

TORQUE : 28~32 Nm (2.8~3.2 kgf.m, 20~23.1 lbf.ft)



KTPC365A

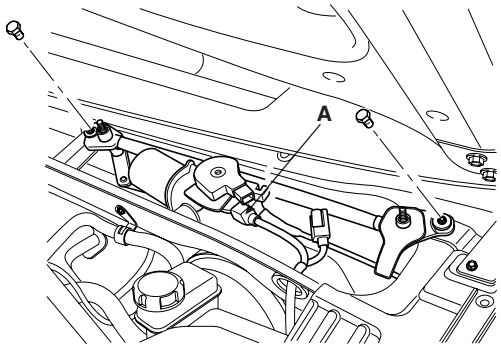
2. Remove the weather strip (A) then remove the cowl top cover (B) after removing 6 clips (C).



LTJF362B

3. Remove the windshield wiper motor and linkage assembly after removing 2 bolts. Disconnect the wiper motor connector (A) from the wiper motor & linkage assembly.

TORQUE : 7-11Nm (0.7-1.1, kgf.m, 5.1-8.1 lbf.ft)



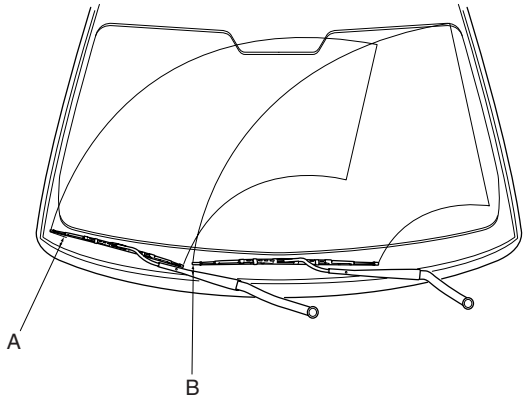
ATJF362C

4. Installation is the reverse of removal.

INSTALLATION EAC508AC

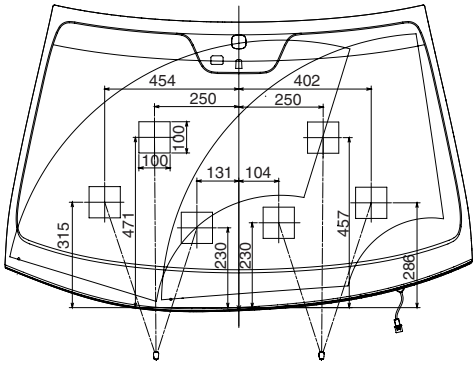
1. Install the wiper arm and blade to the specified position.

Specified position	A	B
Distance [in (mm)]	1.38+0.2/0 (35+5/0)	1.26+0.2/0 (32+5/0)



ATGE362C

2. Set the washer nozzle on the specified spray position.



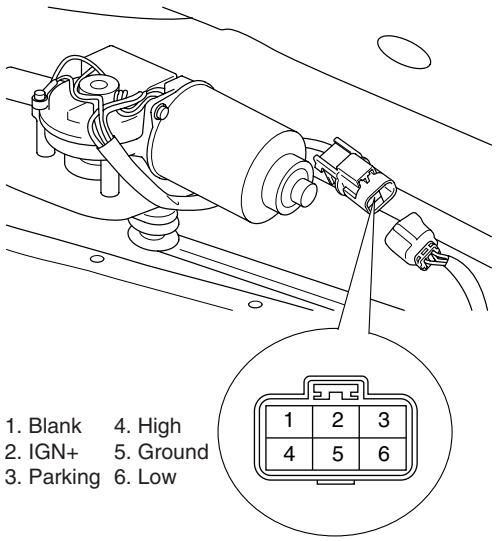
Unit : mm

LTJF362E

INSPECTION E1BEF08E

SPEED OPERATION CHECK

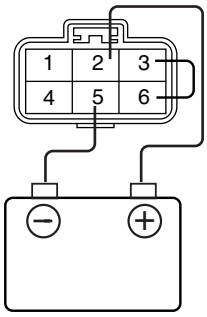
1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminal 6 and the negative (-) lead to terminal 5.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 5.
5. Check that the motor operates at high speed.



ETRF310B

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 6.
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.

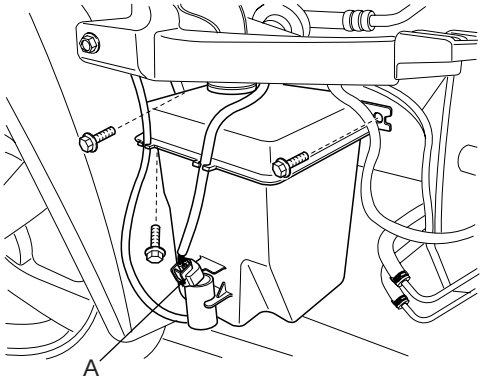


KTRE362D

FRONT WASHER MOTOR

REPLACEMENT EE4D2CED

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 after removing 3 bolts.

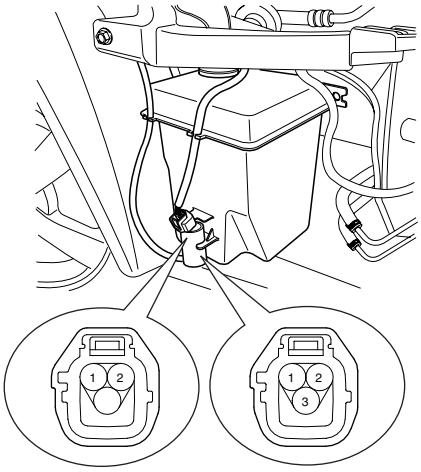


ATJF363A

5. Installation is the reverse of removal.

INSPECTION E3A72236

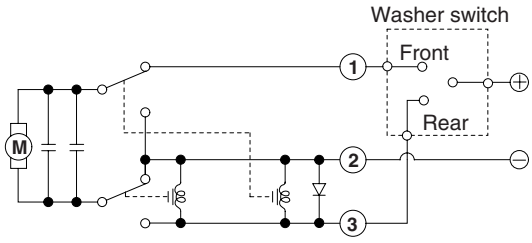
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive (+) battery cables to terminal 2 and negative (-) battery cables to terminal 1 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor.



[Windshield washer]
1. Ground
2. Windshield washer(+)

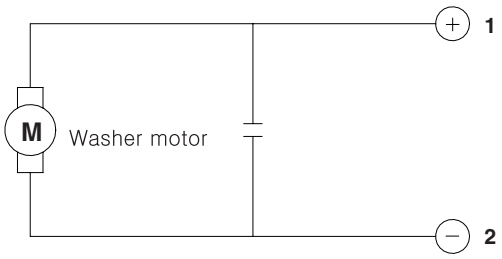
[Windshield & rear washer]
1. Ground
2. Windshield washer(+)
3. Rear washer(+)

LTJF363D



<Windshield & rear washer motor(5Doors)>

LTJF363B



<Windshield washer motor(4Doors)>

LTJF363C

WASHER FLUID LEVEL SWITCH

1. Remove the washer fluid level switch from the washer reservoir.

   NOTE

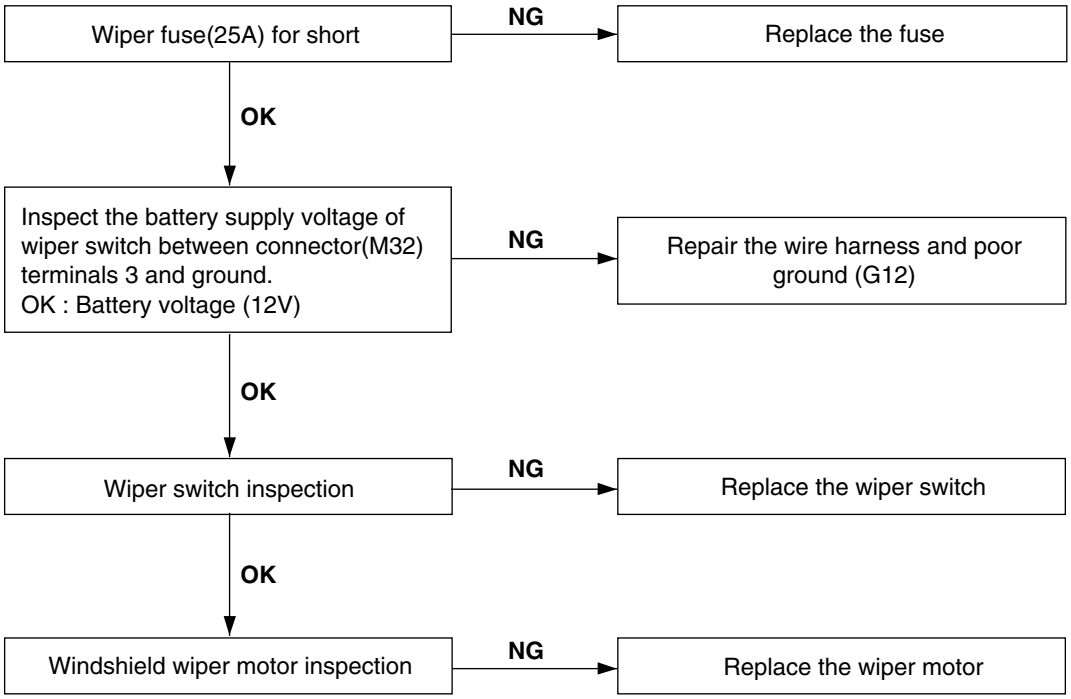
   Fluid may flow out of the opening

2. Check for continuity between the No. 1and No. 2 terminals in each float position.
   There should be continuity when the float is down.
   There should be no continuity when the float is up.

3. If the continuity is not as specified, replace the washer fluid level switch.

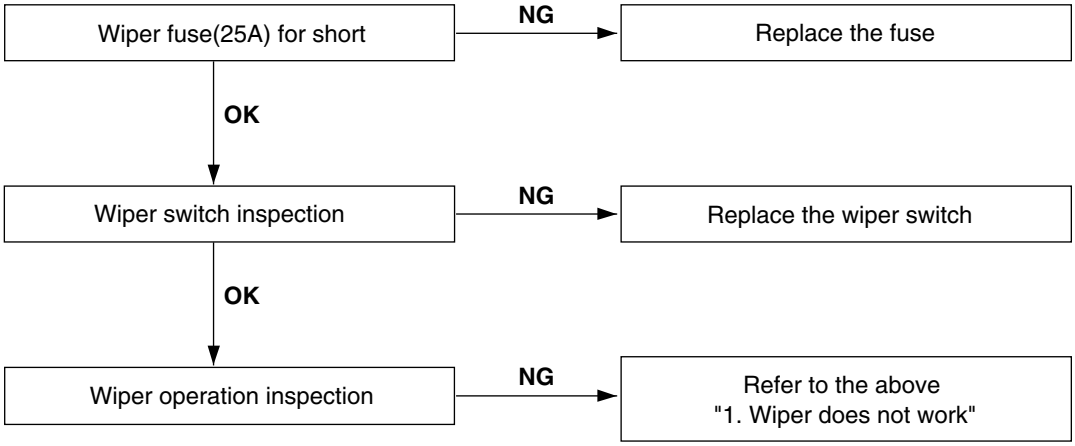
TROUBLESHOOTING EA810E7E

1. Wiper low and wiper high do not work.



LTJF900A

2. When washer switch is on, wiper does not work.

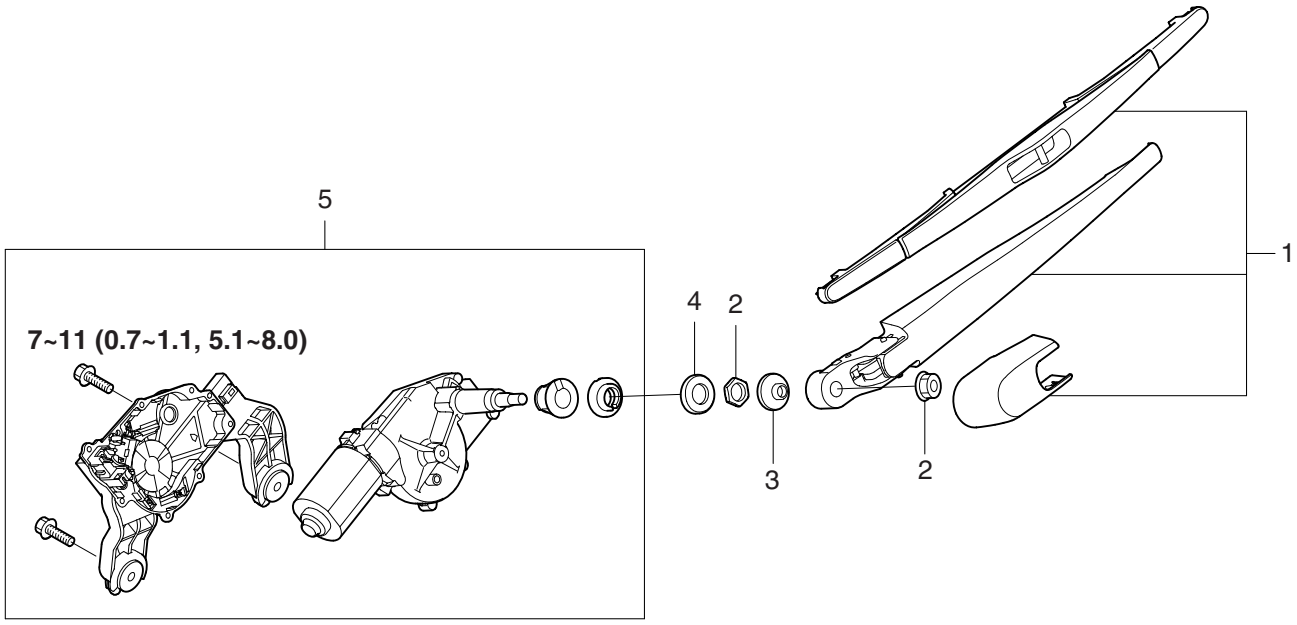


LTJF900B

REAR WIPER / WASHER

COMPONENT LOCATION E0FC7152

This illustration is shown the LHD type.
RHD type is similar.



TORQUE : Nm (kgf.m, lbf.ft)

1. Rear wiper arm & blade
2. Nut
3. Rear wiper motor cover
4. Rear wiper cap & pad
5. Rear wiper motor

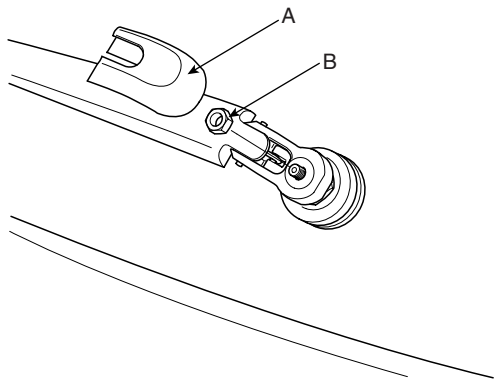
LTJF380A

REAR WIPER MOTOR

REMOVAL EFB7ADD1

1. Remove the tail gate trim.
2. Detach the wiper cap (A), and then remove the rear wiper arm after removing a nut (B).

Tightening torque Nut(B) :
10~13 Nm (1.0~1.3 kgf·m, 7.2~9.4 lbf·ft)



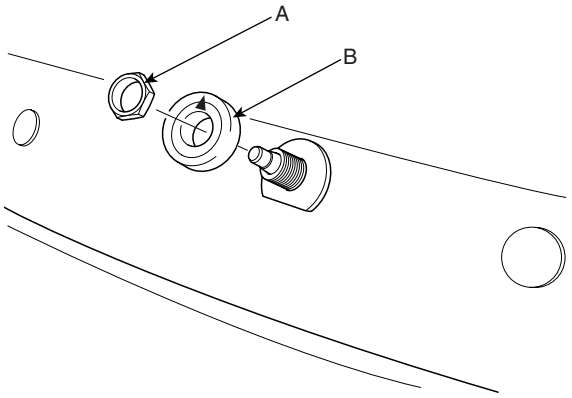
ATJF381A

3. Detach the wiper motor cover, and then remove the rear wiper cap & pad (B) after removing a nut (A).

NOTE

When installing the rear wiper cap & pad, in order for the arrow mark toward an upper direction.

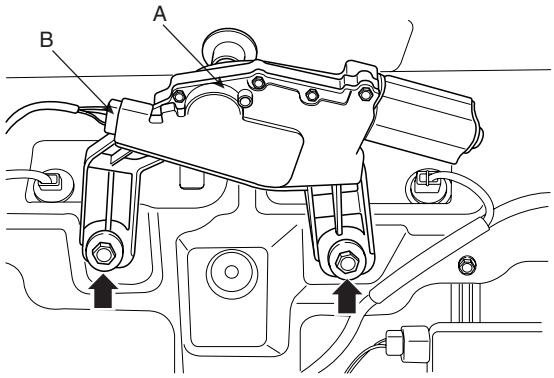
Tightening torque Nut(A) :
10~13 Nm (1.0~1.3 kgf·m, 7.2~9.4 lbf·ft)



ATJF381B

4. Disconnect the rear wiper motor connector (B) then remove the rear wiper motor (A) after removing 2 bolts.

Tightening torque Nut :
7~11 Nm (0.7~1.1 kgf·m, 5.1~8.0 lbf·ft)



ATJF381D

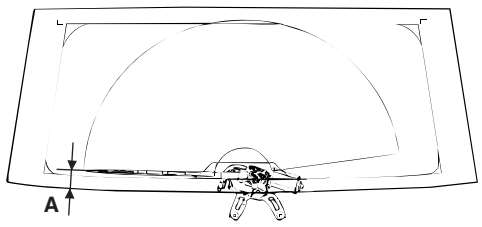
5. Installation is the reverse of removal.

INSTALLATION E6F487DE

1. Install the rear wiper arm and blade to the specified position.

Specified position	A
Distance [in (mm)]	1.38+0.2/0 (35+5/0)

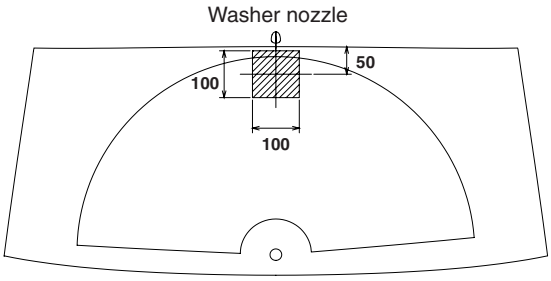
※ Specified position: The first defogger line from bottom of the rear window.



ATJF381H

2. Set the rear washer nozzle on the specified spray position.

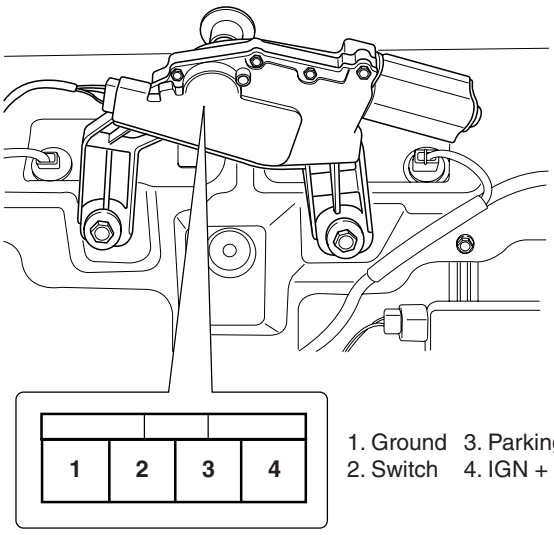
Unit : mm



LTJF381F

INSPECTION E23785E7

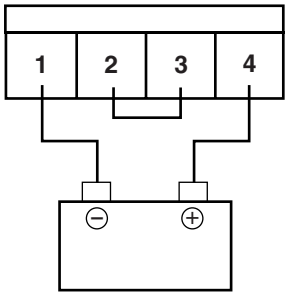
1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 2 and 1 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.



LTJF381E

AUTOMATIC STOP OPERATION

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 1 and the negative (-) lead to terminal 4.
5. Check that the motor stops running at the off position.

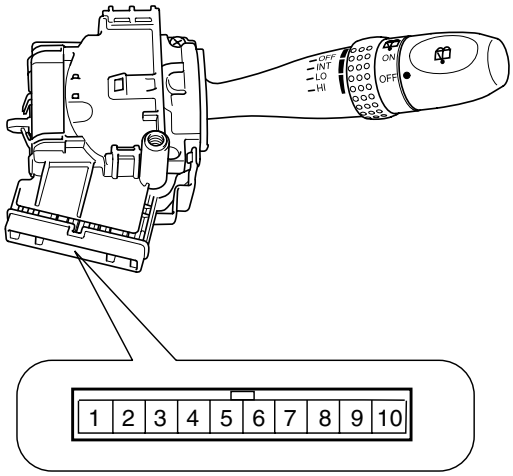


ATHE381G

REAR WASHER SWITCH

INSPECTION EACC6FC1

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.



ATBE031F

REAR WIPER & WASHER SWITCH

( ) : RHD

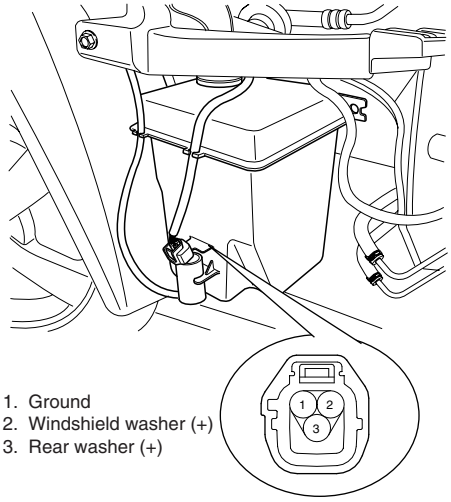
Terminal / Position	6(5)	8(3)	9(2)	10(1)
OFF		○		○
ON	○			○
Rear washer	○		○	○

LTJF031J

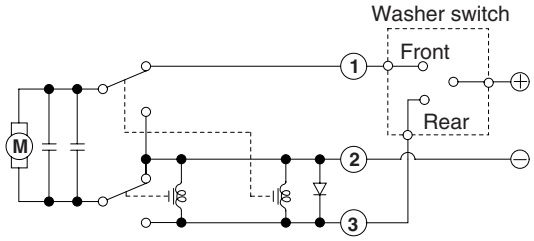
REAR WASHER MOTOR

INSPECTION E52AA74D

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Remove the front bumper. (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.



LTJF383A



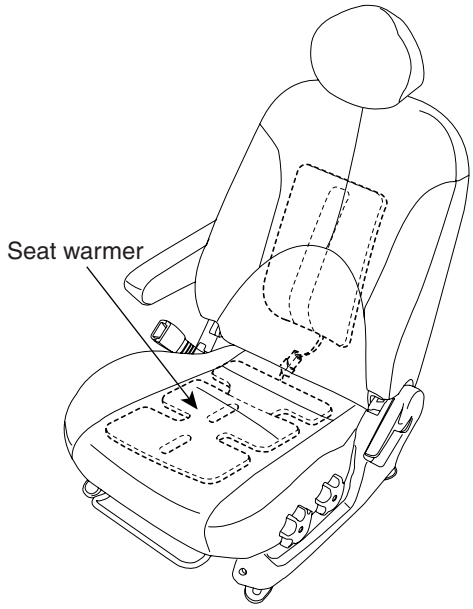
<Windshield & rear washer motor(5Doors)>

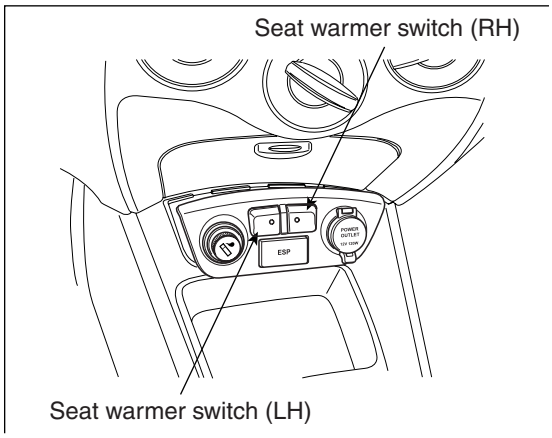
LTJF363B

SEAT WARMER

COMPONENT LOCATION E7BCB336

This illustration is shown the LHD type.
RHD type is similar.



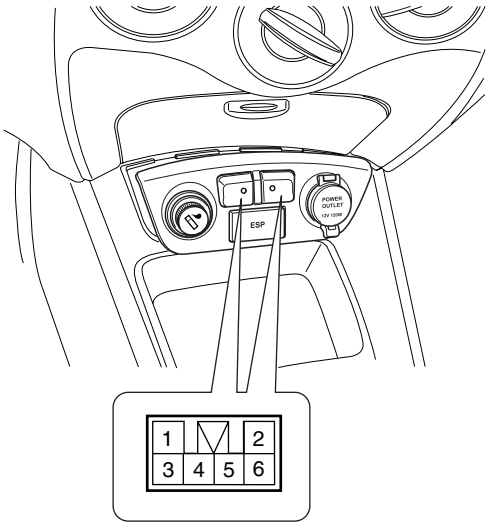


LTJF440A

SEAT WARMER SWITCH

INSPECTION E9DA75BC

1. Disconnect the negative (-) battery terminal.
2. Remove the seat warmer switch from the floor console with scraper.



ATJF441A

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

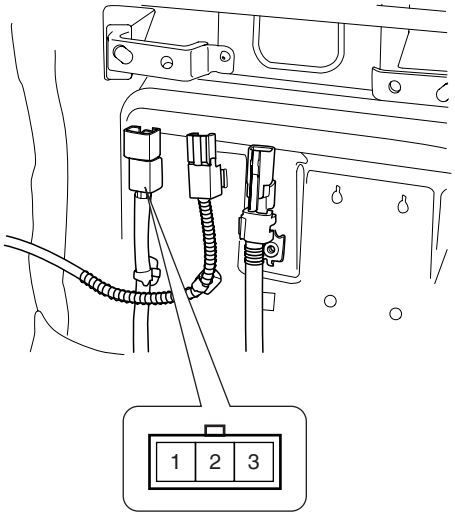
Terminal / Position	2	6	1	4	5	3
ON						
OFF		Illumination				

LTJF441B

SEAT WARMER

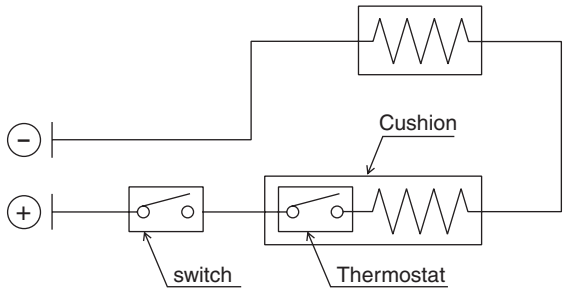
INSPECTION EDCFBE84

1. Check for continuity and measure the resistance between No.1 and NO.3 terminals.



ATJF441D

Standard value: 2.45Ω ± 10%
(Cushion: 1.2Ω ± 10%, Back: 1.2Ω ± 10%)



LTJF441C

2. Operate the seat warmer after connecting the 3P connector, and then check the thermostat by measuring the temperature of seat surface.

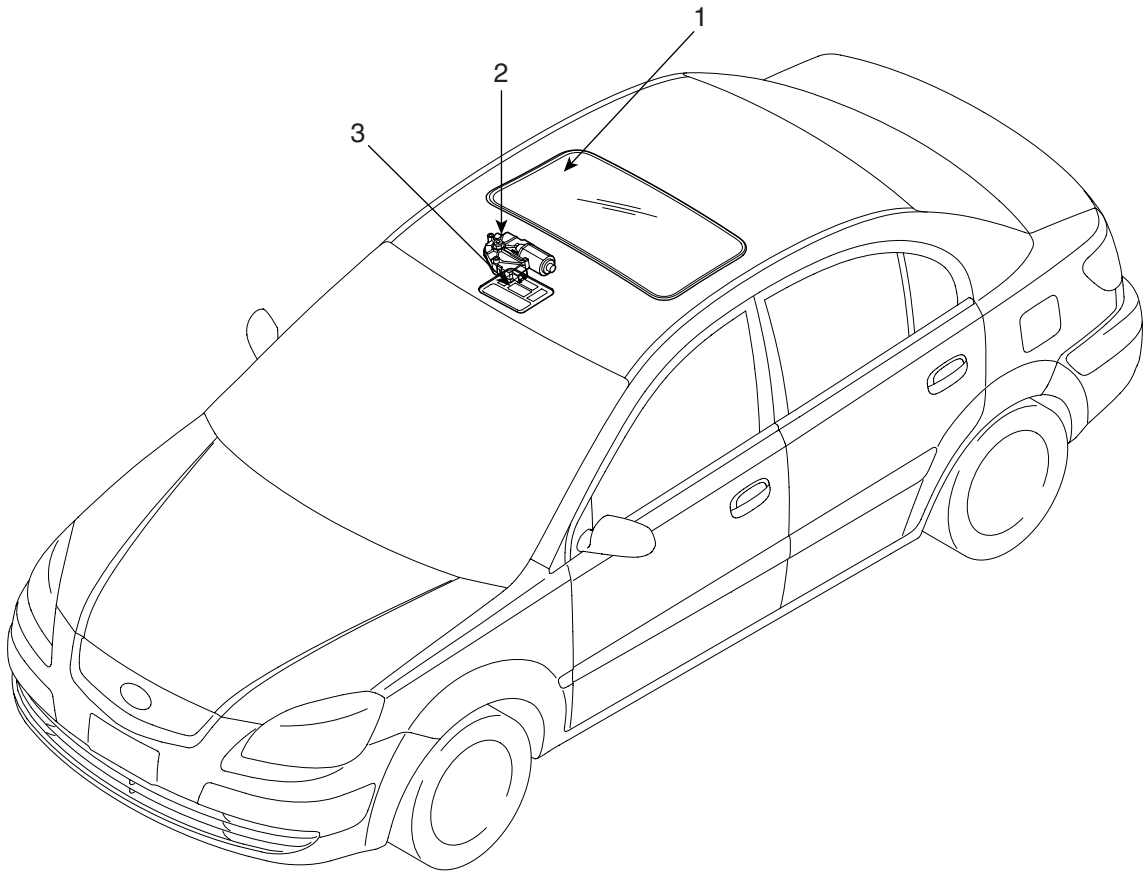
3. Check for continuity between the terminals after disconnecting the 3P connector.

Standard value :
28 ±3.5°C(Continuity), 37 ±3.0°C(Short)

SUNROOF

COMPONENT LOCATION E65B4F6A

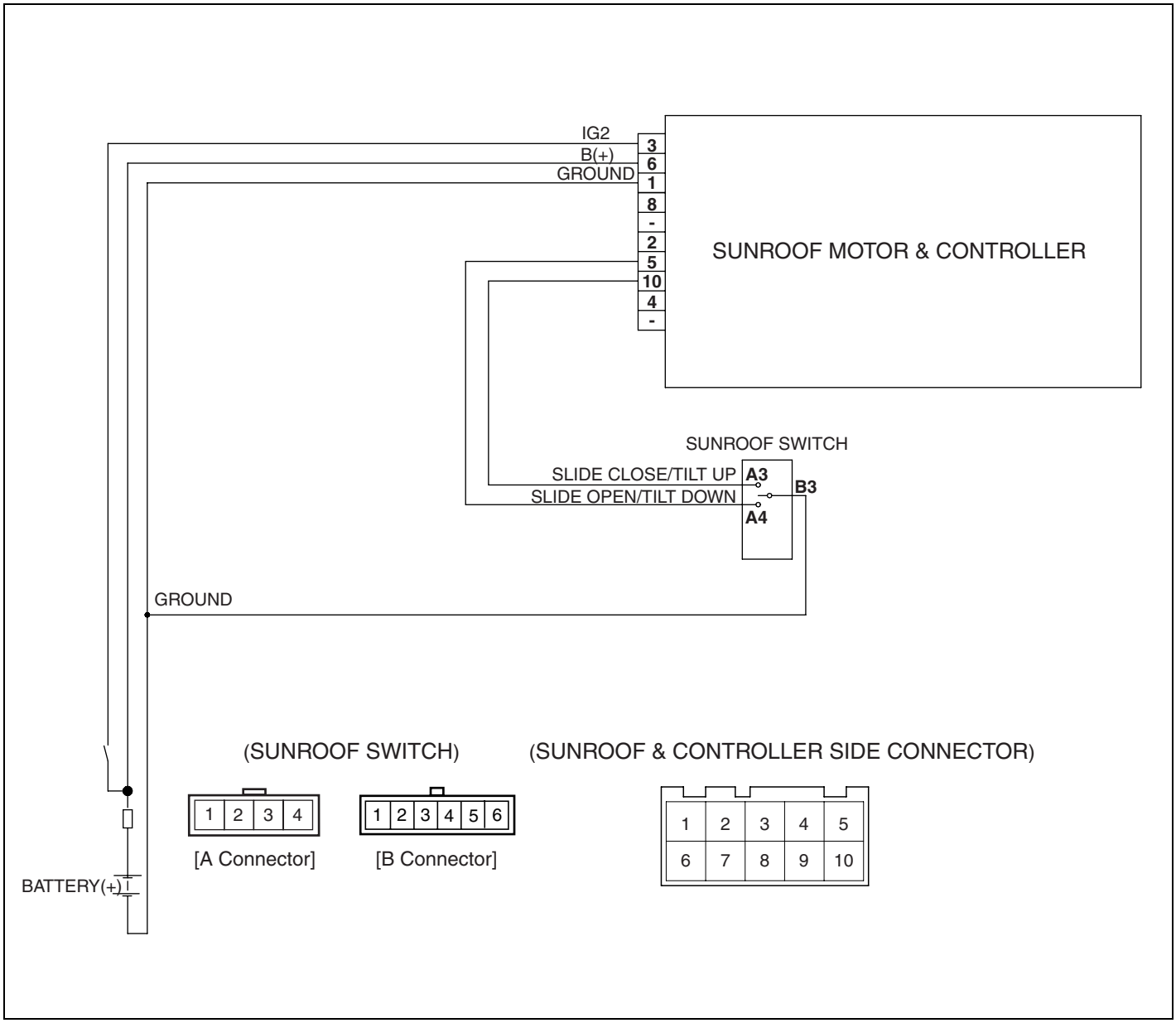
[LHD type is shown, RHD type is similar]



1. Sunroof
2. Sunroof motor & controller
3. Sunroof switch

LTJF480A

CIRCUIT DIAGRAM E6FD0DC0

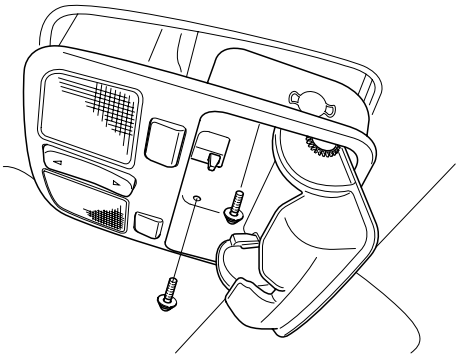


LTJF480B

SUNROOF SWITCH

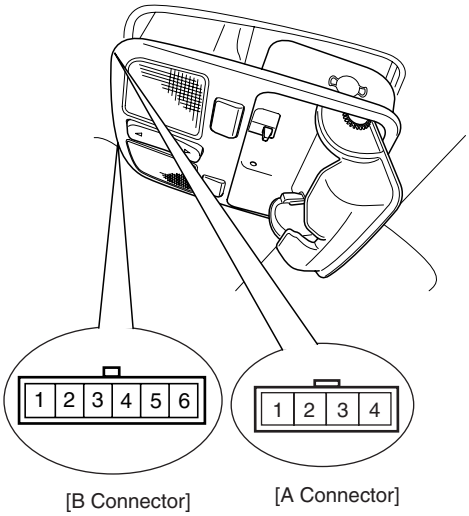
INSPECTION ED1C7F03

1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console.



KTRE481A

3. Disconnect the connector then remove the overhead console lamp assembly from the headliner. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.



LTJF481B

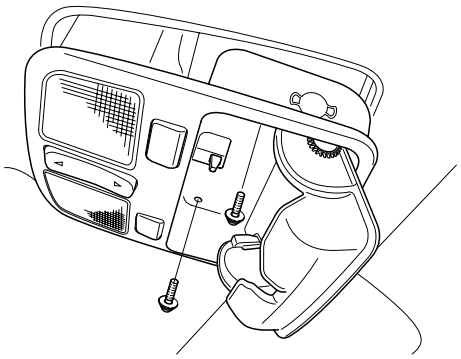
Terminal / position	B3	A3	A4
Slide open	○		○
Tilt down	○		○
Tilt up	○	○	

LTJF481C

SUNROOF MOTOR

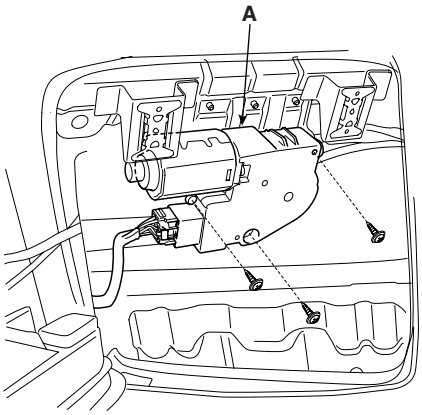
REPLACEMENT E5A48C42

1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console. Disconnect the connector then remove the overhead console lamp assembly from the headliner.



KTRE481A

3. Remove the sunroof motor (A) after removing 3 screws and disconnect.

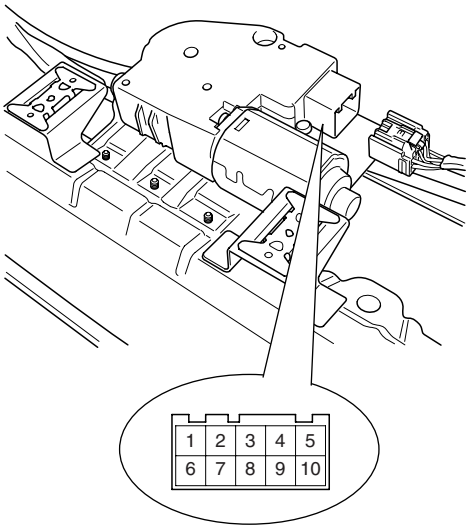


LTJF483A

4. Installation is the reverse of removal.

INSPECTION ED1EEEFE

1. Disconnect the negative (-) battery terminal.
2. Apply the battery voltage to terminal 3, 6 and ground the terminal 1.



KTQE460A

3. Ground the terminals as below table, and check that the sunroof unit operates as below table.

Position \ Terminal	3	4	5	10
Slide close/Tilt up	⊕			⊖
Slide open/Tilt down	⊕		⊖	

ETRF483A

4. 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 E47DD2DB

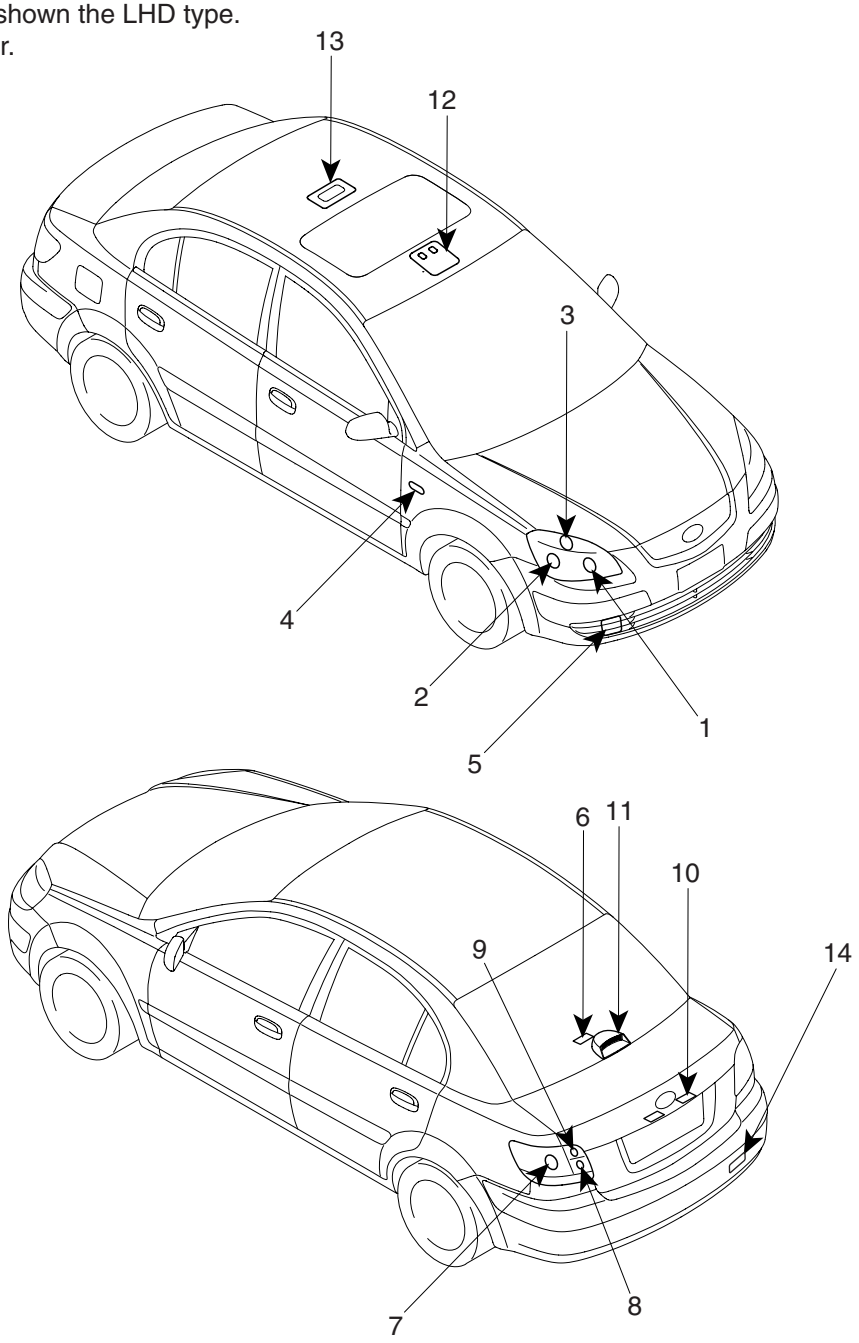
Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows:

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 UP 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 UP button until the sunroof has tilted upward completely.
3. Release the TILT UP button.
4. Press and hold the TILT UP button once again until the sunroof has returned to the original position of TILT UP after it is raised a little higher than the maximum TILT UP position.
    When this is complete, the sunroof system is reset.

LIGHTING SYSTEM

COMPONENT LOCATION EA7EAFA5

This illustration is shown the LHD type.
RHD type is similar.



1. Head lamp (High/Low)
2. Front turn signal lamp
3. Position lamp
4. Side repeater
5. Front fog lamp
6. Luggage lamp
7. Tail/stop lamp
8. Rear turn signal lamp
9. Back up lamp
10. License plate lamp
11. High mounted stop lamp
12. Overhead console lamp (Map lamp)
13. Room lamp
14. Rear fog lamp (Europe)

LTJF490A

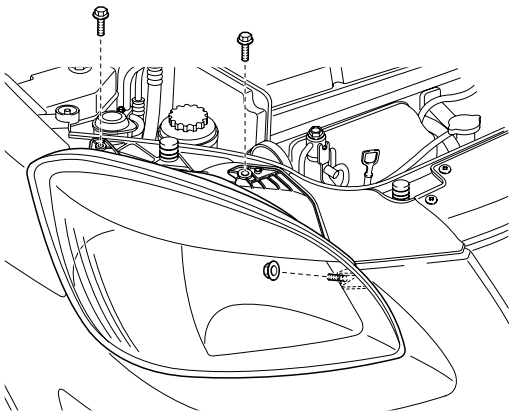
SPECIFICATION E6C062B2

Items	Bulb Wattage (W)
Head lamp (High/Low)	60/55
Front turn signal lamp	21
Front position lamp	5
Front fog lamp	27
Rear tail/stop lamp	21/5
Back up lamp	16
Rear turn signal lamp	21
Rear fog lamp - Europe	21
License plate lamp	5
Side repeater	5
Room lamp	10
Overhead console lamp	10 x 2
High mounted stop lamp	16
Luggage lamp	5

HEAD LAMPS

REPLACEMENT EB8972CD

1. Disconnect the negative (-) battery terminal.
2. Loose the mounting bolts (2EA) and nut of head lamp.

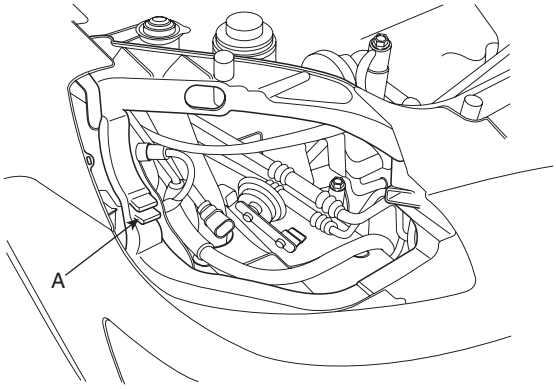


ATJF491A

3. Remove the head lamp assembly after disconnecting the lamp connectors.

NOTE

Take care that holding clip (A) is not to be damaged.



ATJF491C

4. Installation is the reverse of removal.

HEAD LAMP AIMING INSTRUCTIONS ECDB0851

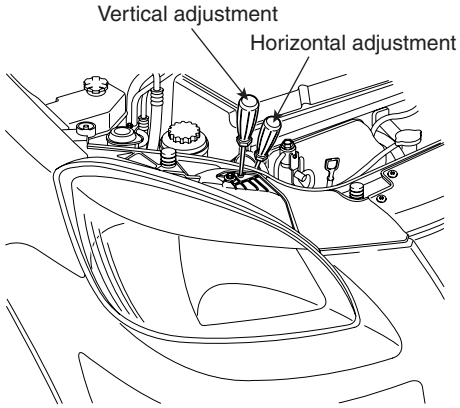
The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

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 and horizontal adjustments to the lower beam using the adjusting wheel.

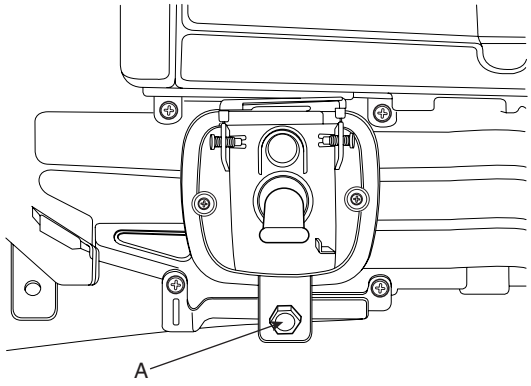


LTJF491D

FRONT FOG LAMP AIMING

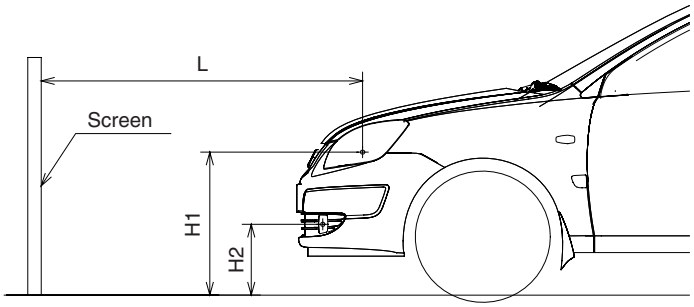
The front fog lamps should be aimed as the same manner of the head lamps aiming.

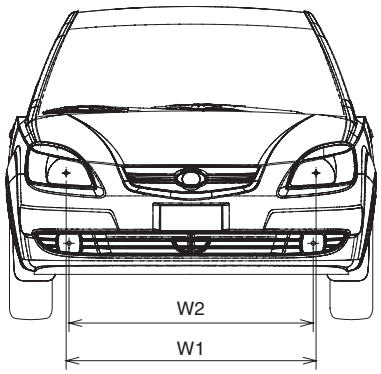
With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear.



ATJF491E

HEAD LAMP AND FOG LAMP AIMING POINT





H1 : Height between the head lamp bulb center and ground (High/Low beam)
H2 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulb centers (High/Low beam)
W2 : Distance between the two fog lamp bulb centers
L : Distance between the head lamp bulb center and screen

LTJF491F

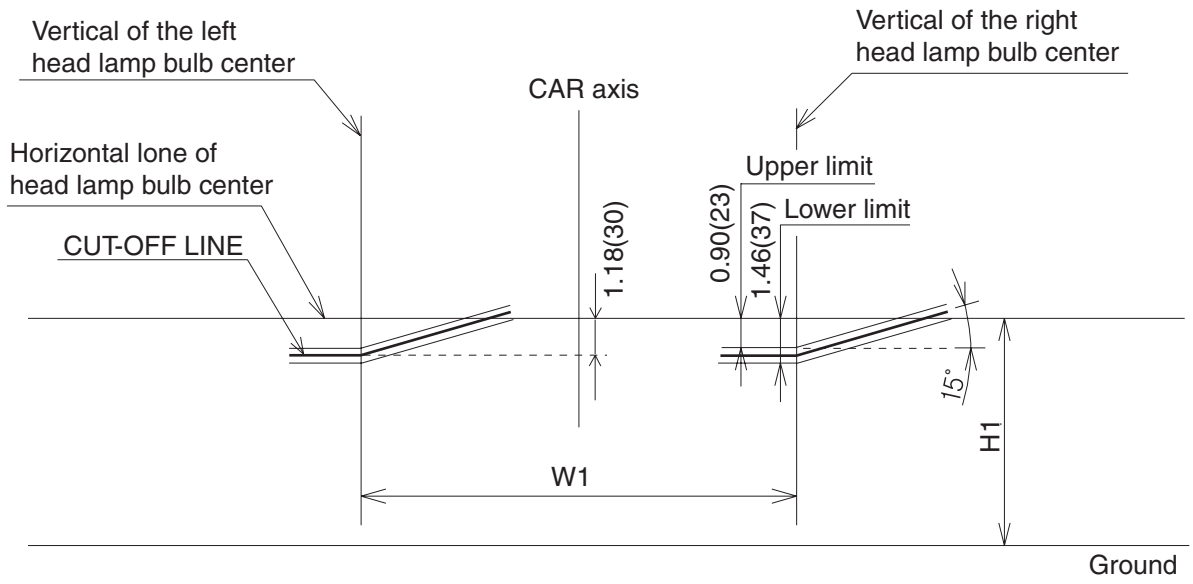
Unit : in(mm)

Vehicle condition	H1	H2	0	W2	L
Without driver	26.3(669)	13.3(337)	45.1(1,146)	44.1(1,120)	118.1(3,000)
With driver	26.1(664)	13.0(332)			

LTJF491G

1. Turn the low beam on without driver aboard.
   The cut-off line should be projected in the allowable range (shaded region).

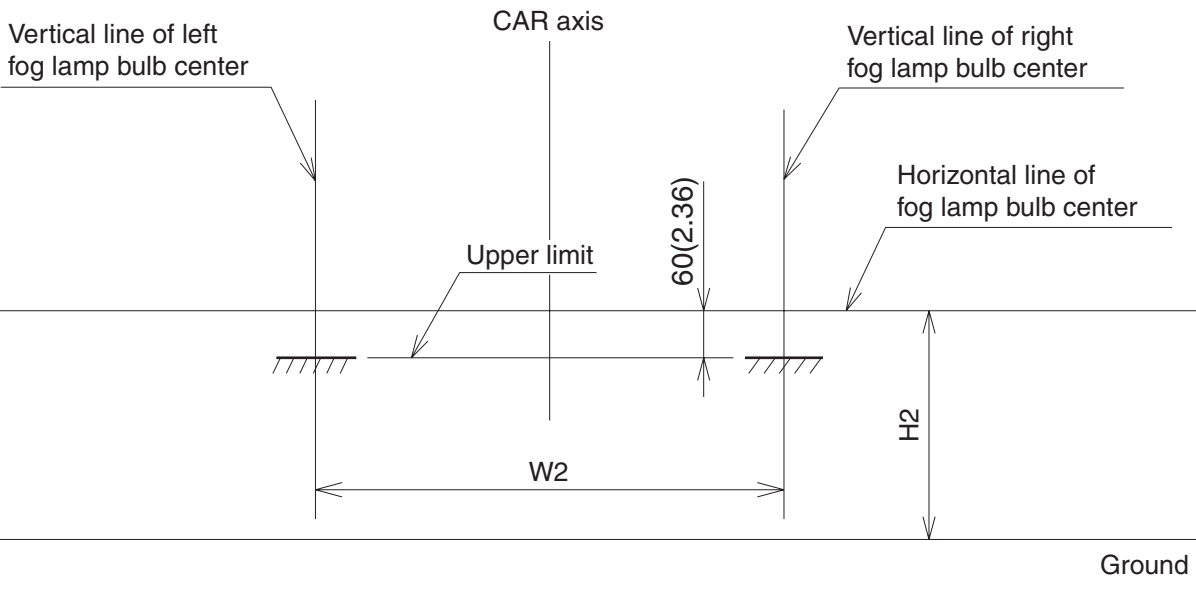
   If head lamp leveling device is equipped, adjust the head lamp leveling device switch with 0 positions.



Unit : in.(mm)

LTJF491H

2. Turn the front fog lamp on without the driver aboard.
   The cut-off line should be projected in the allowable range (shaded region).



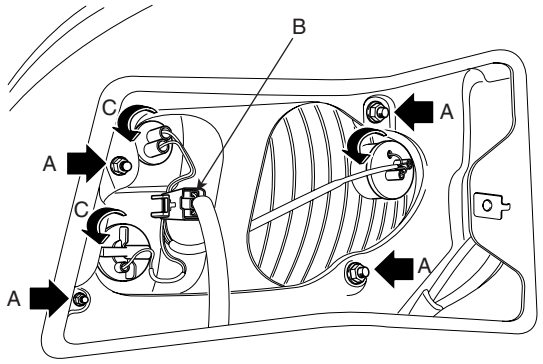
Unit : in.(mm)

LTJF491J

TURN SIGNAL LAMP

REPLACEMENT E3F7A6B3

1. Disconnect the negative (-) battery terminal.
2. Loose the nuts holding the rear combination lamp then disconnect the 6P connector then remove the rear combination lamp.



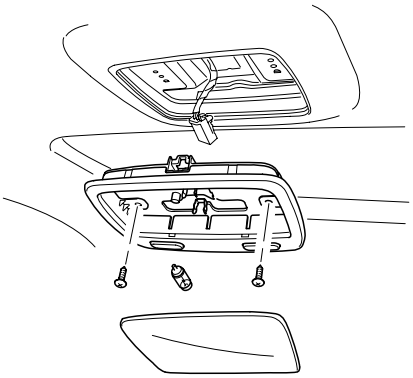
ATJF491L

3. Installation is the reverse of removal.

ROOM LAMP

REPLACEMENT EC6AA87A

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens from the room lamp with a flat-tip screwdriver then replace the bulb.

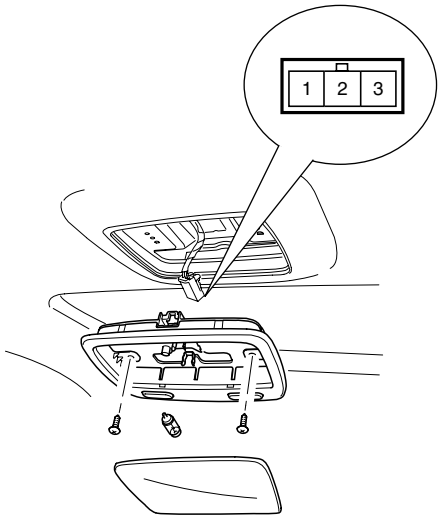


ATIE491K

3. Remove the room lamp assembly after removing 2 screws and disconnecting the 3P connector.
4. Installation is the reverse of removal.

INSPECTION EF92EEE4

Remove the room lamp assembly then check for continuity between terminals.



KTQE210F

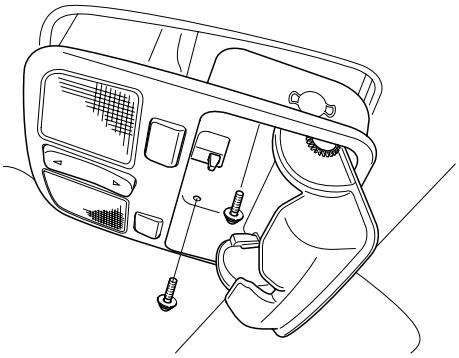
Terminal / Position	1	2	3
DOOR		○	○
ON	○	○	○
OFF			

LTJF491O

OVERHEAD CONSOLE LAMP

REPLACEMENT E1D4BA46

1. Disconnect the negative (-) battery terminal.
2. Replace the bulb after the lens.
3. Open the sunglass case cover then remove the 2 screws holding the overhead console.

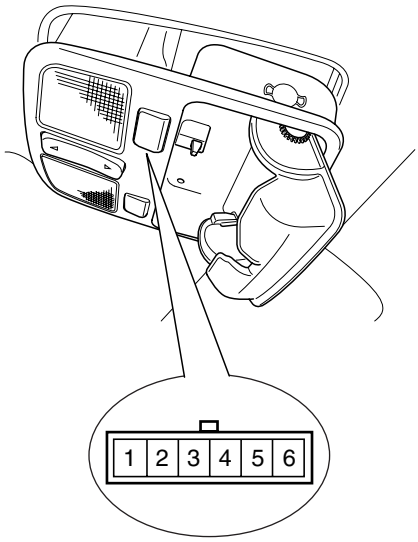


KTRE481A

4. Disconnect the connector (4P) of sunroof switch and the connector (6P) of map lamp then remove the overhead console lamp assembly from the headliner.
5. Installation is the reverse of removal.

INSPECTION E8597A35

Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.



LTJF491M

Terminal / Position	2	3	4
ROOM	○	○	○
DOOR	○	○	

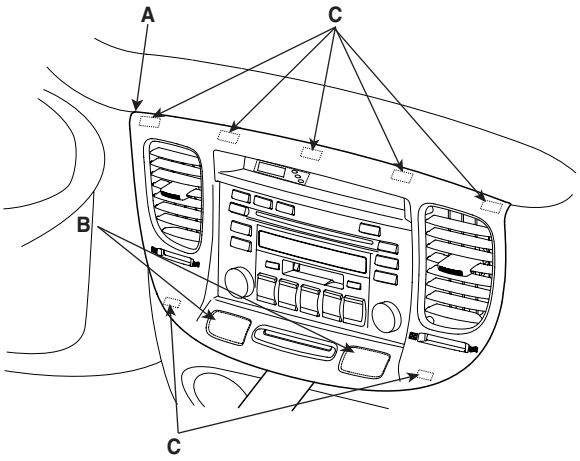
LTJF491N

TURN / HAZARD LAMPS

INSPECTION E553C2ED

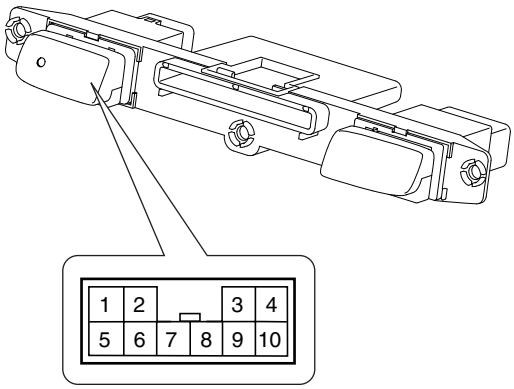
HAZARD LAMP SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia upper panel (A) after pulling it by using regular screw driver (-). Take care of fixing clips (C).



LTJF342A

3. Disconnect the connectors of rear defogger switch and hazard switch (B).
4. Remove the hazard lamp switch from the center facia upper panel.



ATJF495A

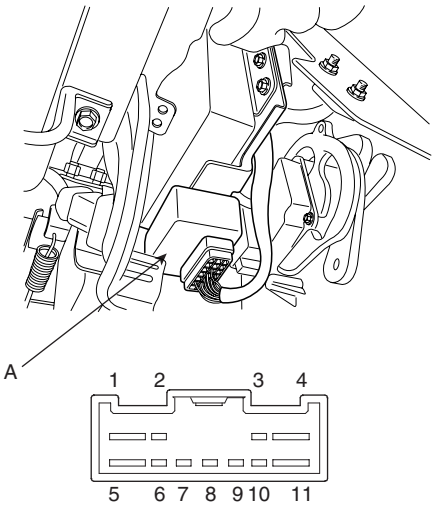
5. Operate the switch and check for continuity between terminals with an ohmmeter.

Position \ Terminal	2	3	6	9	10	5	7	8
OFF						○		○
ON	Illumination		○	○	○		○	○

LTIF491M

HAZARD LAMP RELAY

1. Remove the negative (-) battery terminal.
2. Remove the ICM relay box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.8 and No.6 terminals when power and ground are connected to the No.8 and No.9 terminals.
5. There should be no continuity between the No.8 and No.6 terminals when power is disconnected.



[M21]

ATJF220J

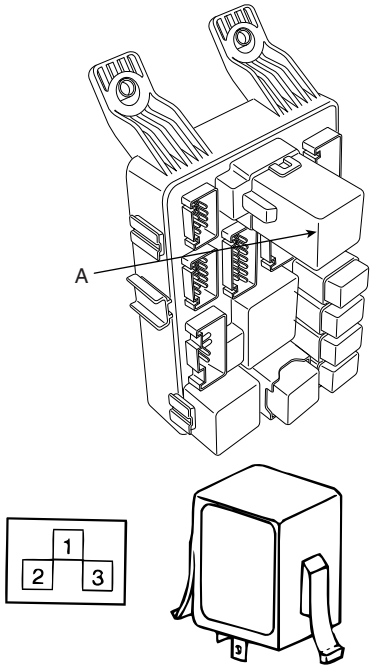
Power \ Terminal	9	8	8	7	6
Disconnected					
Connected	⊖	⊕	○	○	○

LTJF495C

FLASHER UNIT

INSPECTION E38D1E55

1. Disconnect the negative (-) battery terminal.
2. Remove the junction box. (Refer to the Fuses and relays)
3. Remove the flasher unit (A) from the junction.



ATJF495D

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.

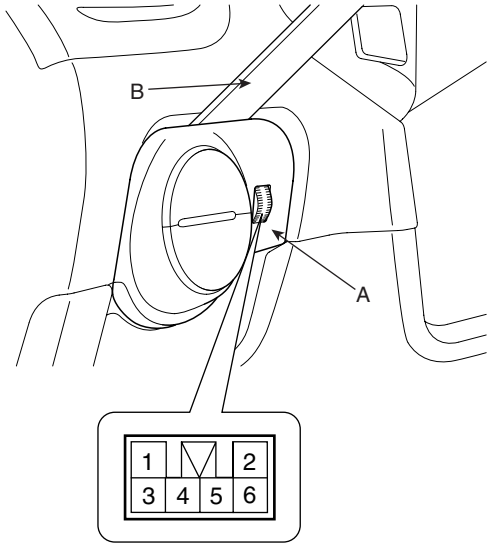
NOTE

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 flasher unit.

RHEOSTAT

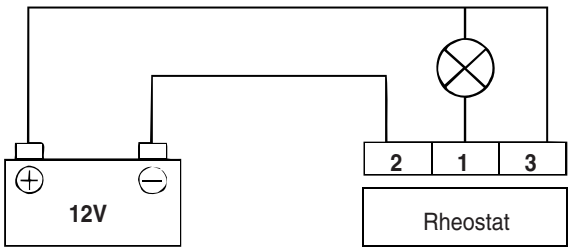
INSPECTION E3BFF960

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash pad switch (A) by using the scraper (B) and then disconnect the connectors. Take care of fixing clips.



LTJF495F

3. Check for intensity. 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.

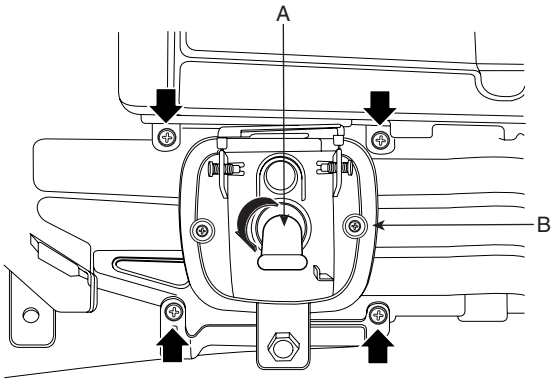


ETRF495G

FRONT FOG LAMPS

REPLACEMENT E19E36BD

1. Disconnect the negative (-) battery terminal.
2. Replace the bulb by rotating the bulb holder (A) to the clockwise direction after disconnecting the fog lamp connector.
3. Remove the front fog lamp (B) after loosening the screws and disconnecting the fog lamp connector.



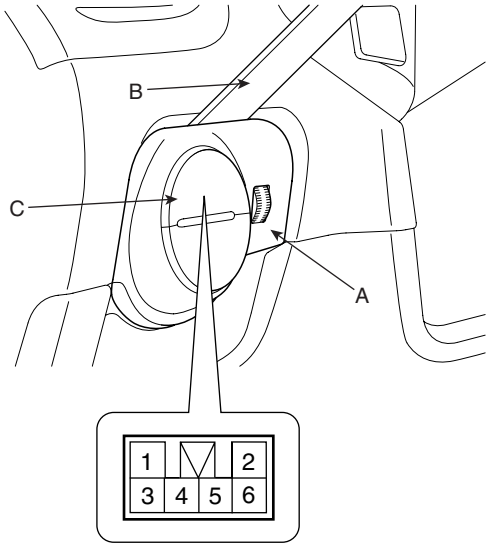
ATJF496A

4. Installation is the reverse of removal.

INSPECTION E9F8D5F8

FRONT FOG LAMP SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side switch (A) by using the scraper (B) and then disconnect the connectors. Take care of fixing clips.



LTJF496B

3. Remove the front fog lamp switch (C) from crash pad side switch.
4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	2	6	1	4	5	3
ON	Illumination					
OFF						

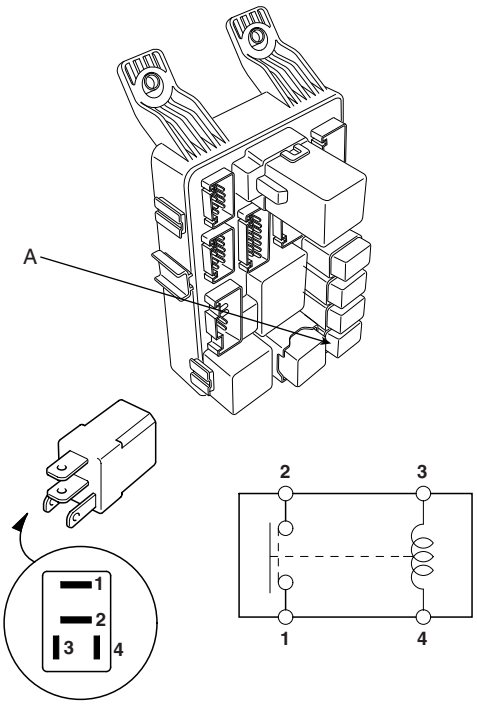
LTJF496C

FRONT FOG LAMP RELAY

1. Pull out the front fog lamp (A) relay from the junction box.

2. Check for continuity between terminals. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.

3. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.



LTJF496E

Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

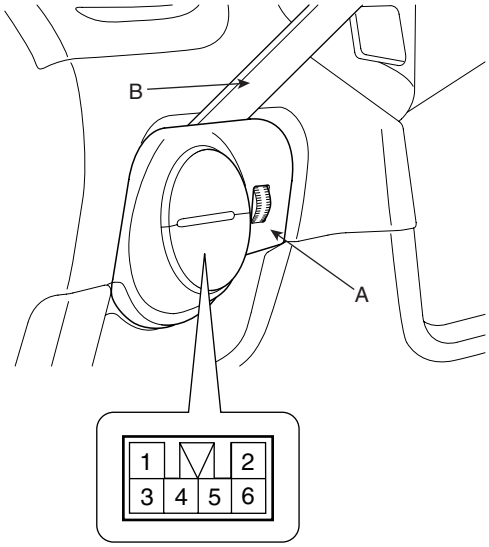
ETKE903A

REAR FOG LAMPS

INSPECTION E91E3F7C

REAR FOG LAMP SWITCH

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash pad switch (A) by using the scraper (B) and then disconnect the connectors. Take care of fixing clips.



LTJF497A

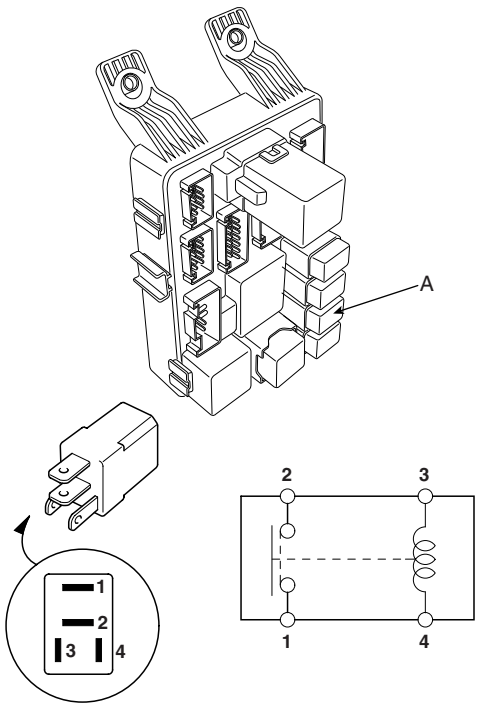
3. Remove the rear fog lamp switch (C) from lower crash pad side switch.
4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position	2	6	1	4	5	3
ON	○	○	○	○	○	○
OFF	Illumination					

LTJF496C

REAR FOG LAMP RELAY

1. Remove the negative (-) battery terminal.
2. Pull out the front fog lamp (A) relay from the junction box.
3. Check for continuity between terminals. There should be continuity between the No.1 and No.2 terminals when power and ground are connected to the No.3 and No.4 terminals.
4. There should be no continuity between the No.1 and No.2 terminals when power is disconnected.



LTJF497C

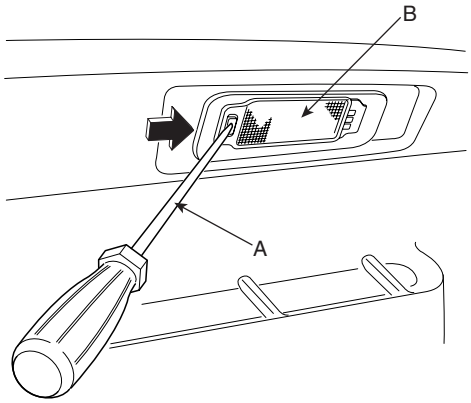
Terminal / Power (No.3-No.4)	1	2	3	4
Disconnected			○	○
Connected	○	○	⊖	⊕

ETKE903A

LICENSE LAMPS

REPLACEMENT E01EB0CC

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (B) from the room lamp with a flat-tip screwdriver (A).



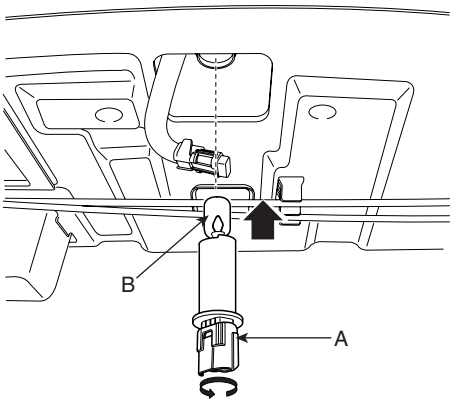
ATJF498A

3. Replace the bulb.
4. Installation is the reverse of removal.

STOP LAMPS

REPLACEMENT E8B7DF7C

1. Disconnect the negative (-) battery terminal.
2. Open the trunk lid (Tail gate) and then disconnect the connector of high mounted stop lamp.
3. Replace the bulb (B) by rotating the bulb holder (A) to the clockwise direction.



ATJF499A

TROUBLESHOOTING EEEF2CCD

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 (10A) blown	Check for short and replace fuse
	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
	Position 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

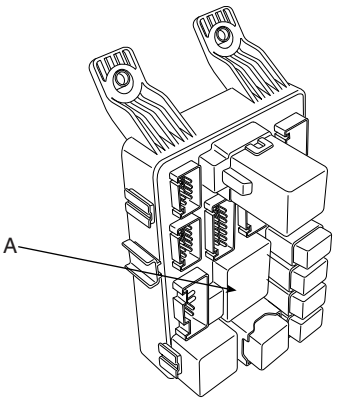
Symptom	Possible cause	Remedy
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check Flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too 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
	Multi back up fuse (10A) 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 (10A) 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 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
Map lamp does not light	Bulb burned out	Replace bulb
	Multi back up fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Trunk room lamp does not light	Bulb burned out	Replace bulb
	Multi back up fuse (10A) blown	Check for short and replace fuse
	Trunk lid switch (4 doors) faulty	Check switch
	Tailgate switch (5 doors) faulty	Check switch
	Wiring or ground faulty	Repair if necessary

DAYTIME RUNNING LIGHTS

DRL CONTROL MODULE

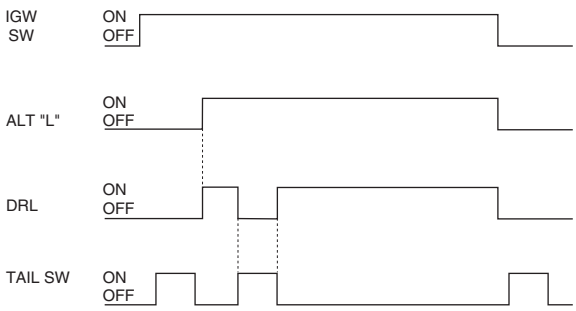
INSPECTION E26C44F2

1. The daytime running unit (A) is integrated in the junction box.
2. Daytime running unit (A) is installed at the right side strut housing.



LTJF521A

3. Check that the light operate according to the following timing chart.



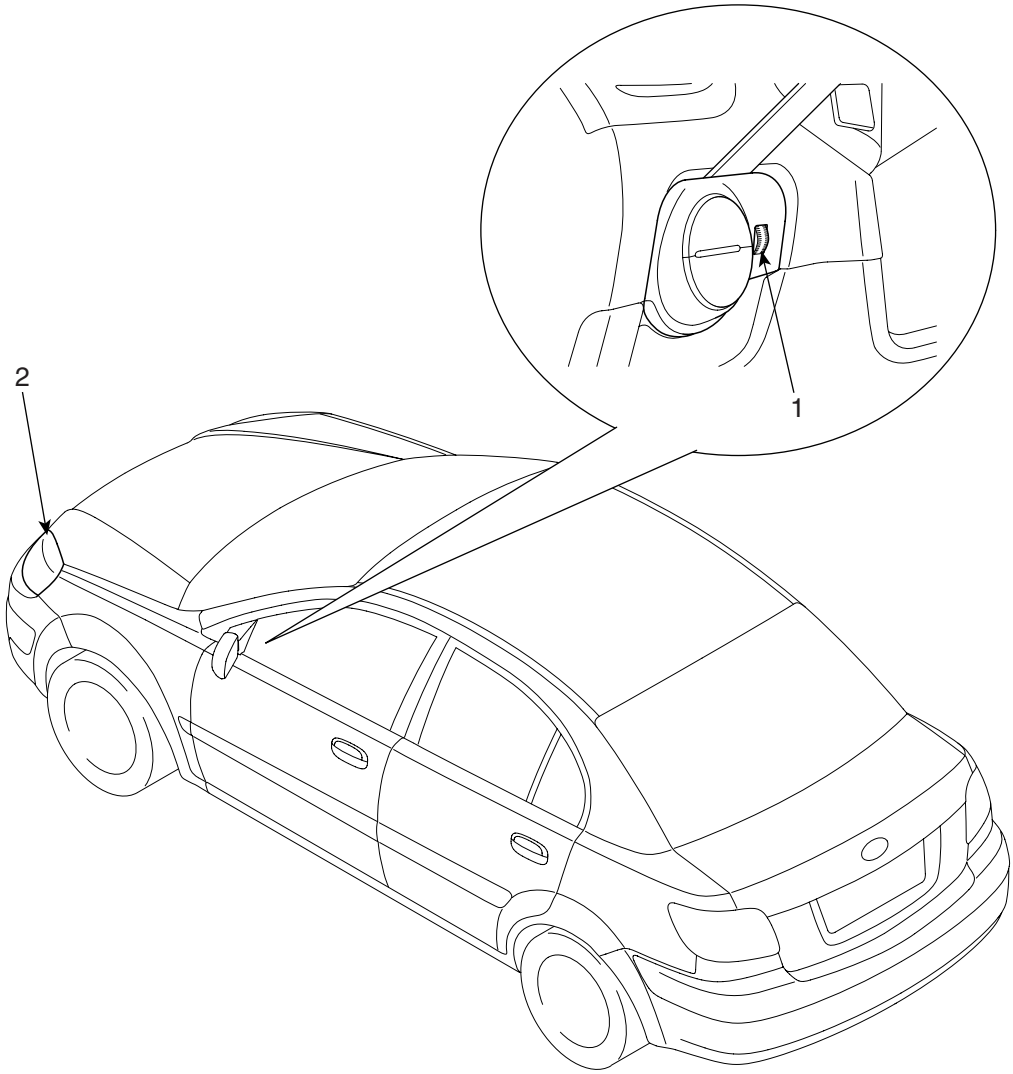
ETRF521B

4. 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 5.
5. 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 junction box (control unit) must be faulty; replace it.

HEAD LAMP LEVELING DEVICE

COMPONENT LOCATION ED84AED5

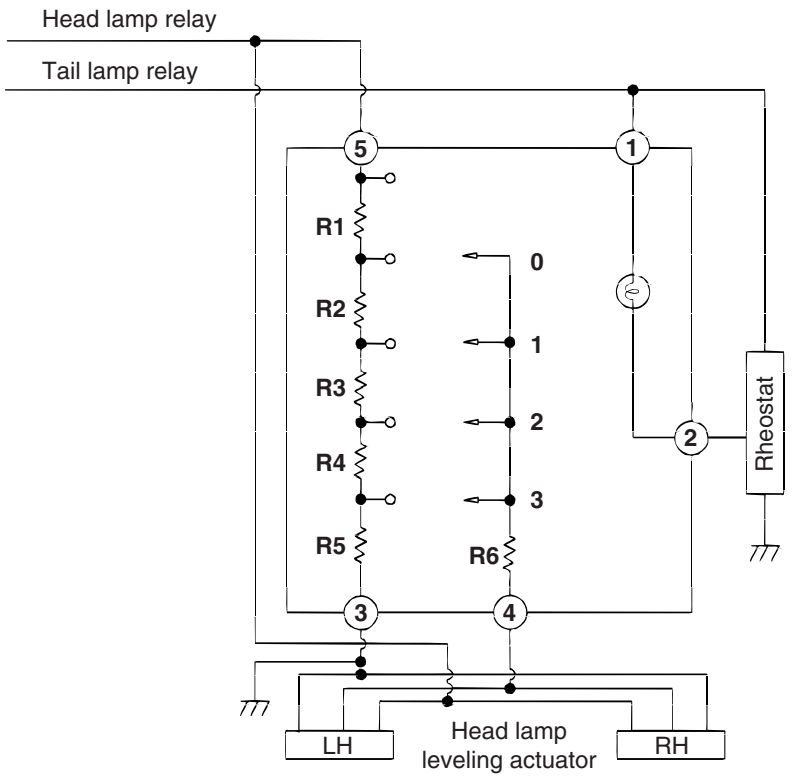
[LHD type is shown, RHD type is symmetrical]



1. Head lamp leveling switch
2. Head lamp leveling actuator (Built in head lamp assembly)

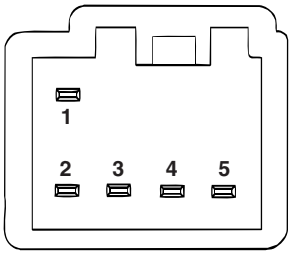
LTJF540A

CIRCUIT DIAGRAM E4AFA0EE



PIN CONNECTION

PIN NO	Description
1	Tail lamp relay
2	Ground
3	Ground
4	Actuator (+)
5	Head lamp relay



LTJF542A

HEAD LAMP LEVELING ACTUATOR

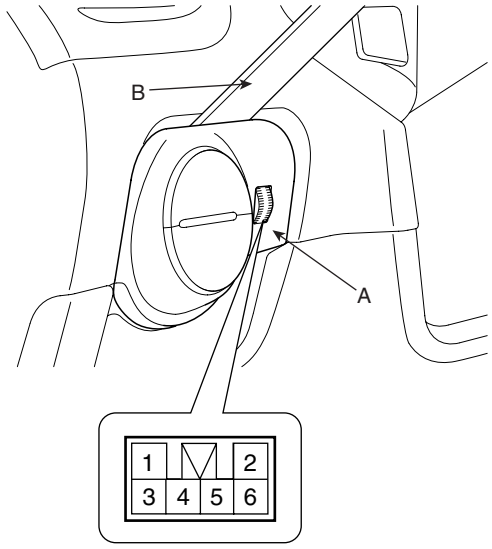
INSPECTION E62A9B7C

1. Ignition "ON".
2. Turn on the head lamp switch.
3. Check for operation. If the aim of the head lamps changes smoothly when the head lamp leveling switch is turned.
4. If the operation does not work 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 5.
5. Substitute with a known-good head lamp assembly and check for proper operation.

HEAD LAMP LEVELING SWITCH

INSPECTION EA8E24DC

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash pad switch (A) by using the scraper (B) and then disconnect the connectors. Take care of fixing clips.



LTJF541A

3. Connect the battery voltage between terminals 3 and 5.
4. Measure the voltage between terminals 3 and 4 (V) at each position.

Position No.	Rotation	Voltage (V)
0	0°	12.09 ± 0.5V
1	20°	10.15 ± 0.5V
2	40°	8.70 ± 0.5V
3	60°	7.70 ± 0.5V

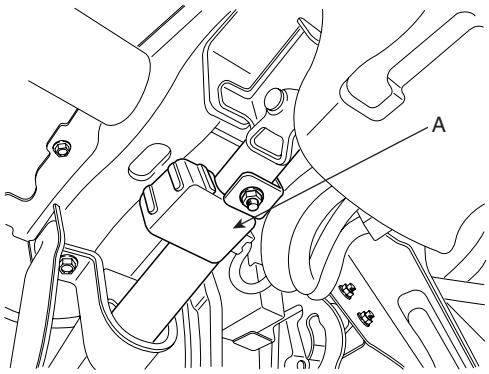
5. If the voltage is not as specified, replace the head lamp leveling switch.

IMMOBILIZER CONTROL SYSTEM

DESCRIPTION EF3AB1E3

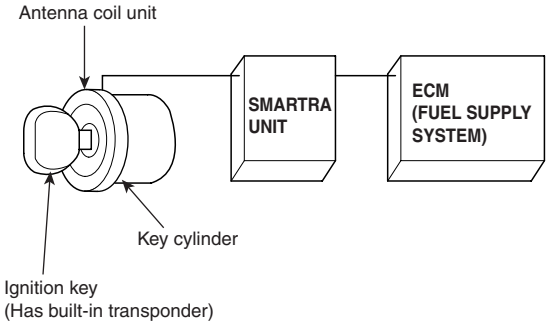
The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. SMARTRA type immobilizer
   - The SMARTRA system consists of a transponder located in the ignition key, a antenna coil, a SMARTRA unit, an indicator light and the ECM.
   - The SMARTRA communicates to the 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.



ATJF741A

   - 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 ECM.
   - If the proper key has been used, the 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.
   - If the wrong key has been used and the code was not received or recognized by the ECM the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.
   - If it is necessary to rewrite the 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.
   - The immobilizer system can store up to four key codes.
   - If the customer has lost his key, and cannot start the engine, contact KMC motor service station.

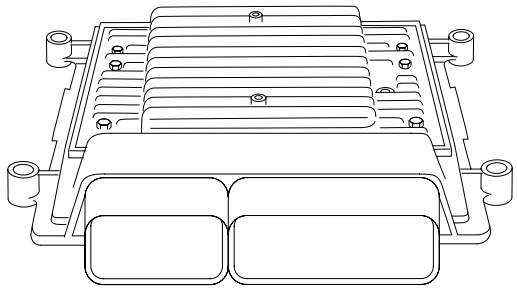


LTIF740B

COMPONENTS OPERATIONS EBB79C78

ECM (ENGINE CONTROL MODULE)

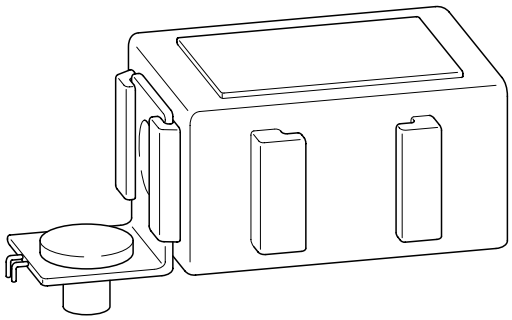
The ECM carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the ECM simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the ECM.



KTME741C

SMARTRA UNIT

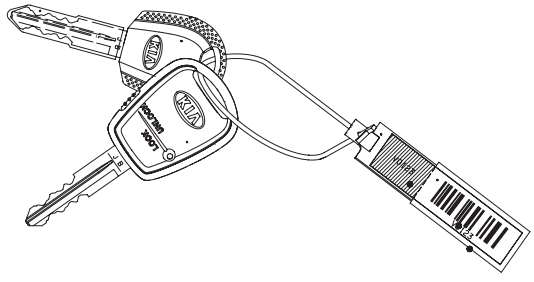
The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crush pad under panel close to the antenna coil for RF transmission and receiving.
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the 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 ECM and vice versa.



KTME741B

TRANSPONDER (BUILT-IN KEYS)

The transponder 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.

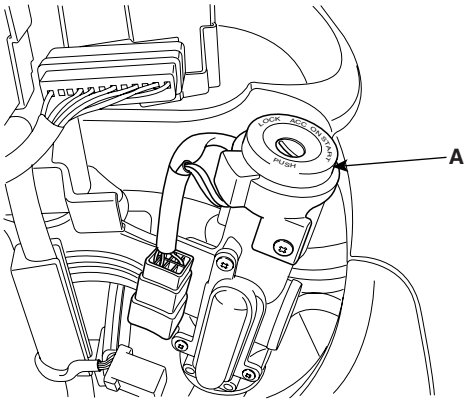


ATJF741I

ANTENNA COIL (A)

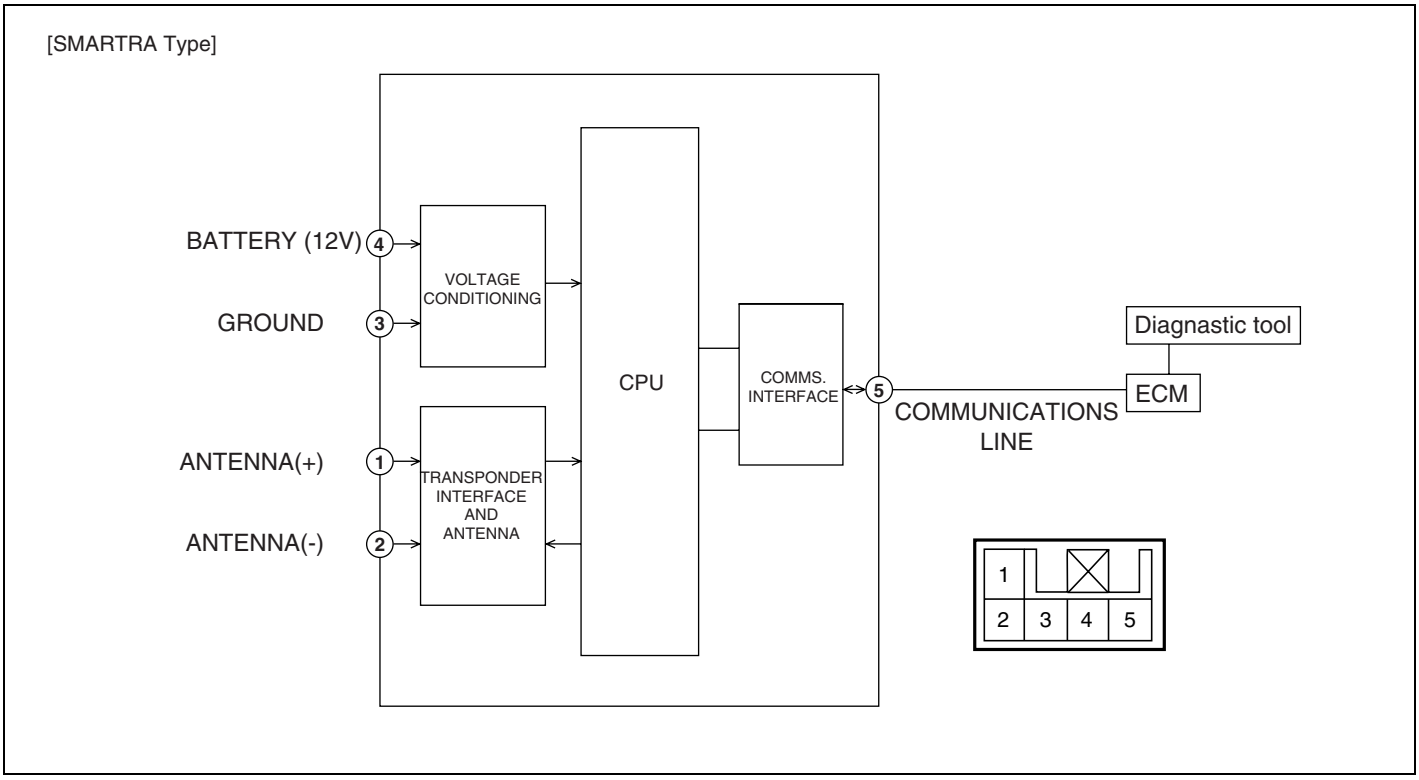
The antenna coil has the following functions.
- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA/ICU.

It is located directly in front of the steering handle lock.



ATJF781B

SYSTEM BLOCK DIAGRAM E3DA9A0A



LTJF740A

TEACHING PROCEDURES EEDB7E13

1. Key Teaching Procedure
   Key teaching must be done after replacing a defective ECM or when providing additional keys to the vehicle owner.

   The procedure starts with an ECM request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" ECM stores the vehicle specific data and the key teaching can be started. The "learnt" ECM compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.

   If incorrect vehicle specific data have been sent to the ECM three times, the ECM will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After 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 ECM stores the relevant data in the EEPROM and in the transponder. Then the 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 ECM from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).

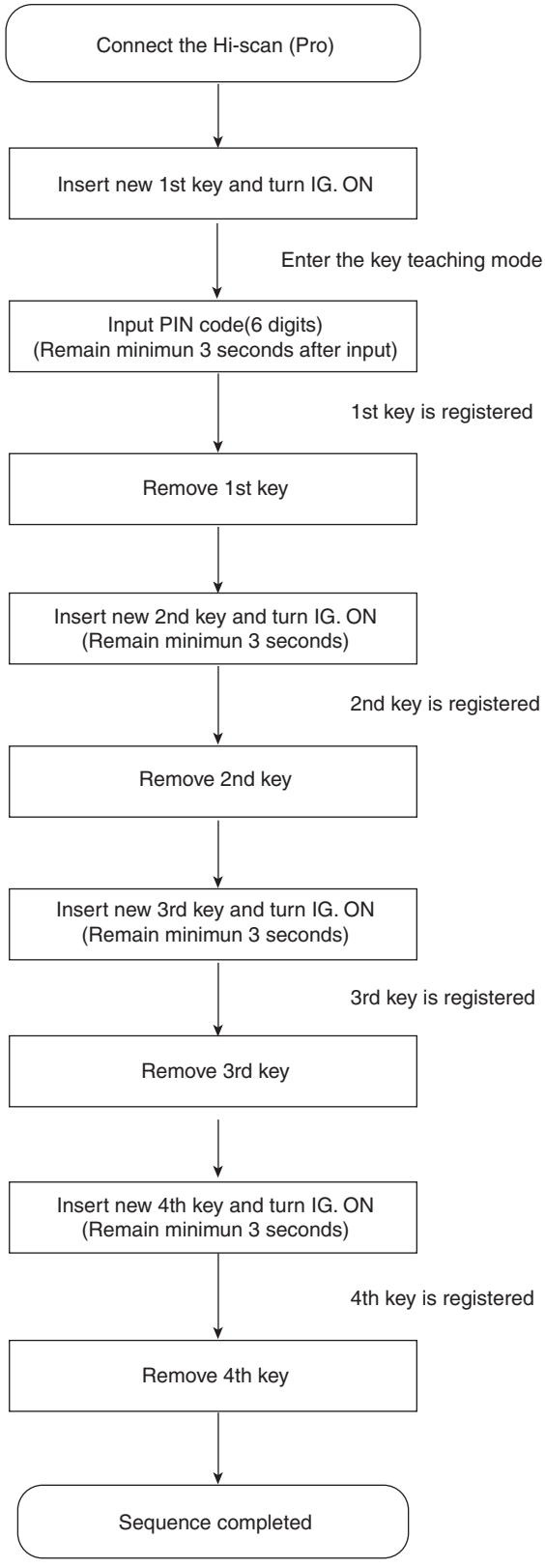
   The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the ECM. This rejects the key and a message is sent to the tester.

   The ECM rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the ECM detects different authenticators of a transponder and an ECM, the key is considered to be invalid.

   The maximum number of taught keys is 4.

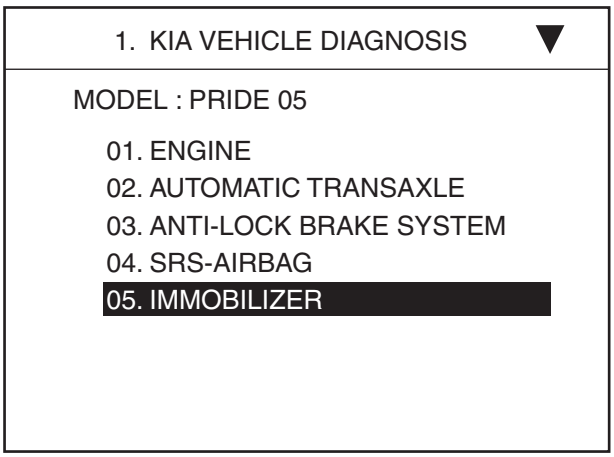
   If an error occurs during the Immobilizer Service Menu, the ECM status remains unchanged and a specific fault code is stored.

   If the ECM status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at ECM.

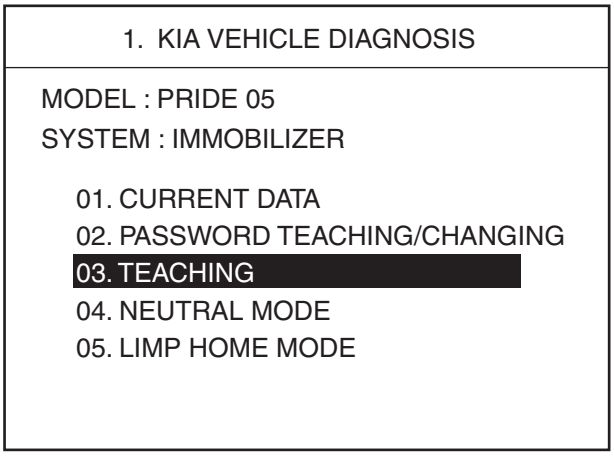


LTIF740M

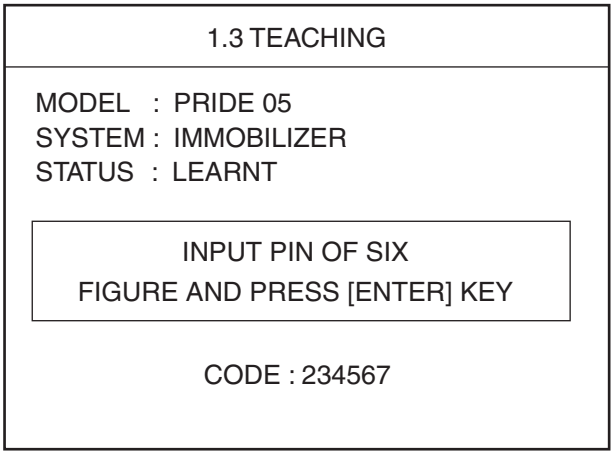
1) ECM learnt status.



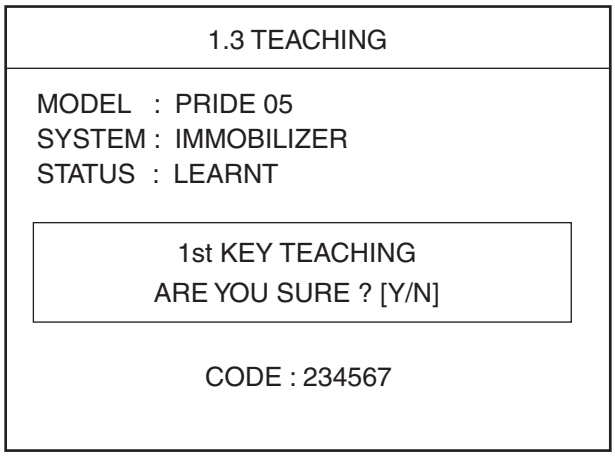
LTJF741A



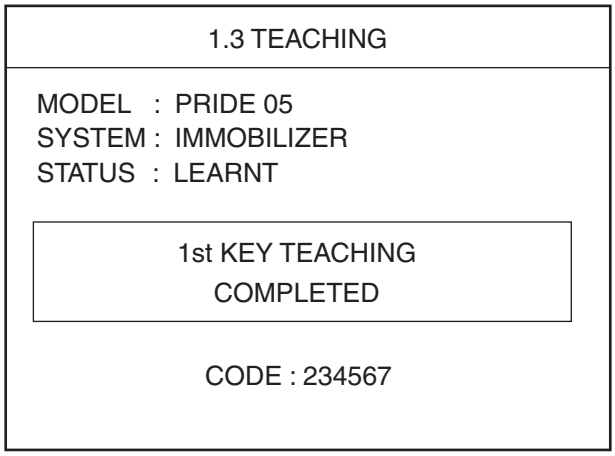
LTJF741B



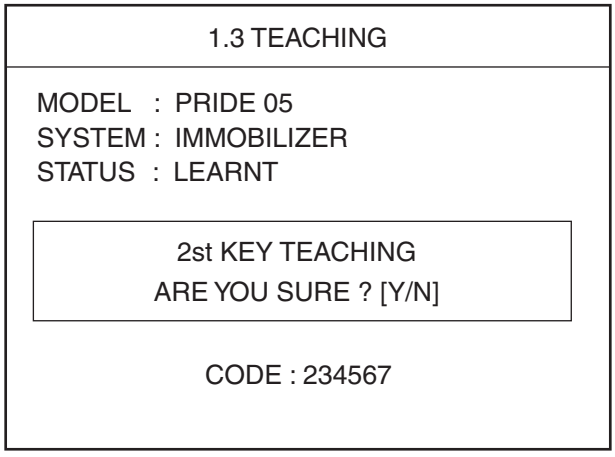
LTJF741C



LTJF741D



LTJF741E



LTJF741F

1.3 TEACHING

MODEL : PRIDE 05
SYSTEM : IMMOBILIZER
STATUS : LEARNT

2st KEY TEACHING
COMPLETED

CODE : 234567

LTJF741G

2) ECM virgin status.
After replacing new ECM, scantool displays that ECM is virgin status in Key Teaching mode "VIRGIN" status means that ECM has not matched any PIN code before.

1.3 TEACHING

MODEL : PRIDE 05
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

CODE : 234567

LTJF741H

1.3 TEACHING

MODEL : PRIDE 05
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

1st KEY TEACHING
ARE YOU SURE ? [Y/N]

CODE : 234567

LTJF741I

1.3 TEACHING

MODEL : PRIDE 05
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

1st KEY TEACHING
COMPLETED

CODE : 234567

LTJF741J

1.3 TEACHING

MODEL : PRIDE 05
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

2st KEY TEACHING
ARE YOU SURE ? [Y/N]

CODE : 234567

LTJF741K

1.3 TEACHING

MODEL : PRIDE 05
SYSTEM : IMMOBILIZER
STATUS : VIRGIN

2st KEY TEACHING
COMPLETED

CODE : 234567

LTJF741L

2. 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.

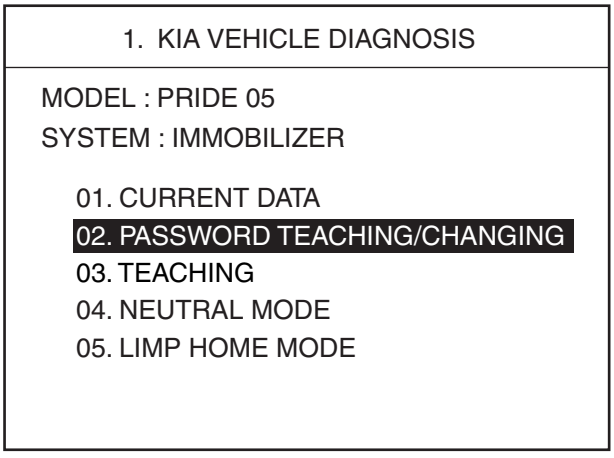
User password teaching is only accepted by a "learnt" ECM. Before first teaching of user password to an ECM, the status of the password is "virgin", limp home function is impossible.

The teaching is started by ignition on, with a valid key and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt".

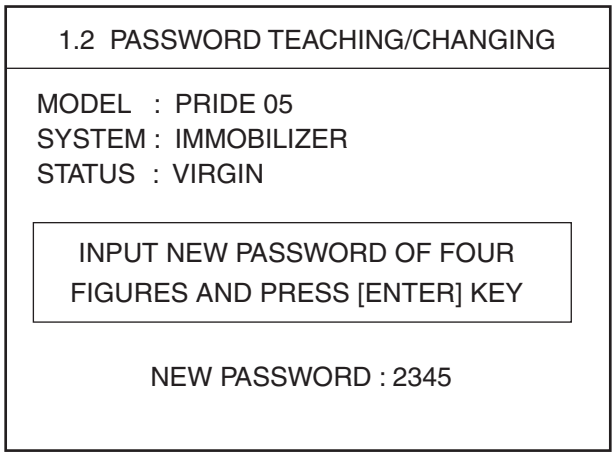
The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the ECM requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If incorrect user passwords or wrong vehicle specific data have been sent to the ECM three times, the 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.

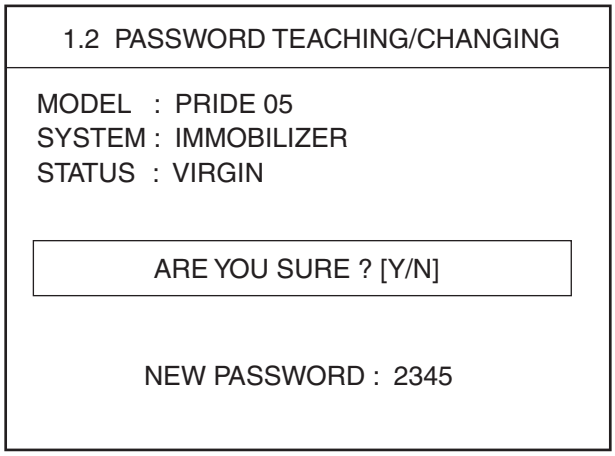
1) User password teaching



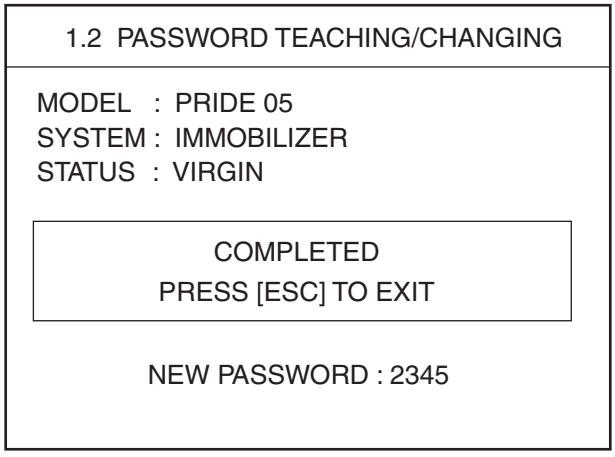
LTJF741M



LTJF741O



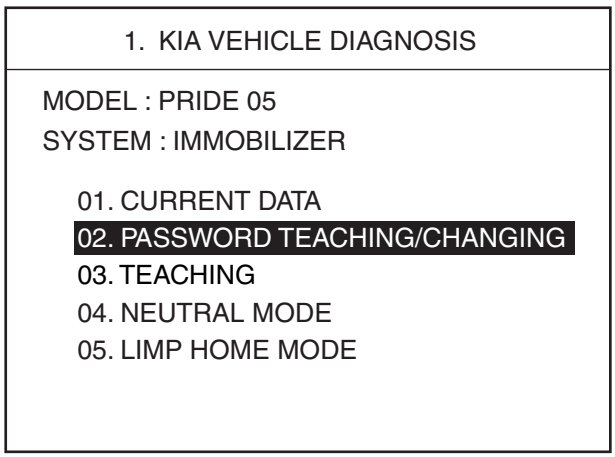
LTJF741P



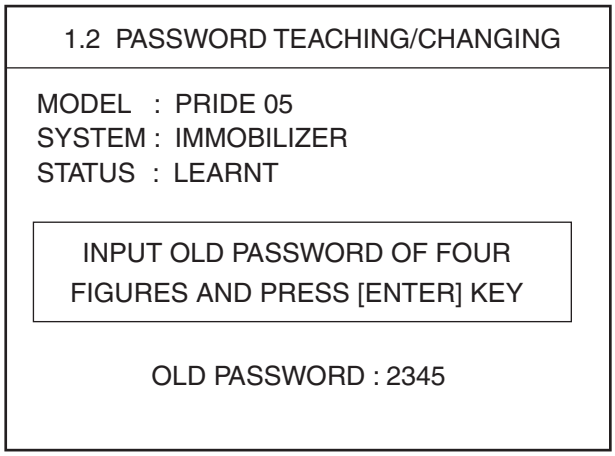
LTJF741Q

※ In case of putting wrong password, retry from first step after 10 seconds.

2) User password changing



LTJF741M



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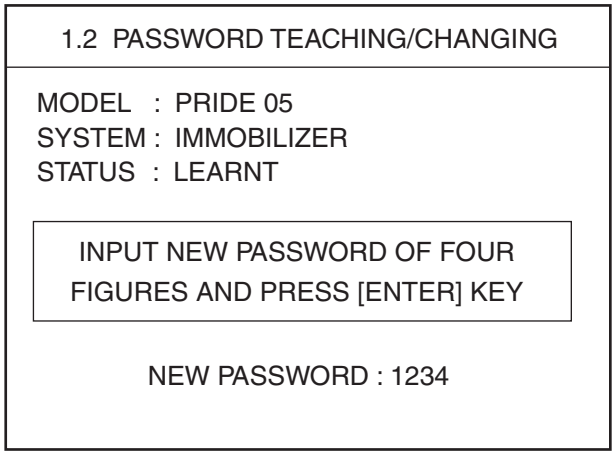

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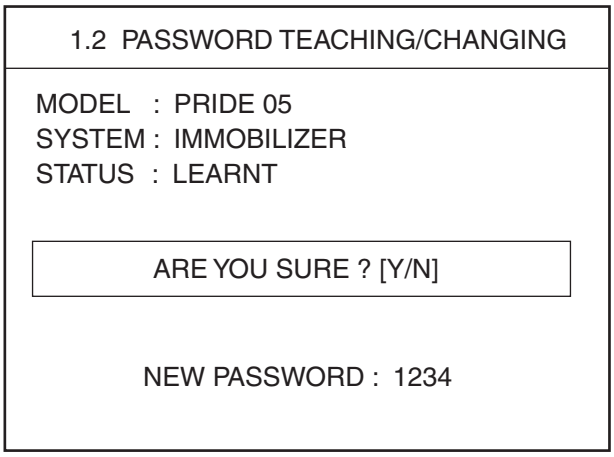

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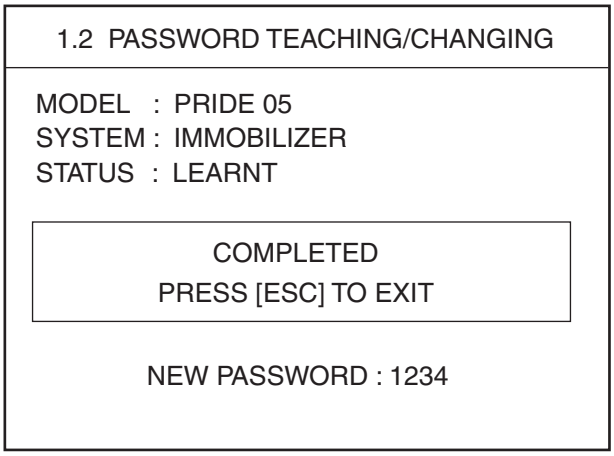
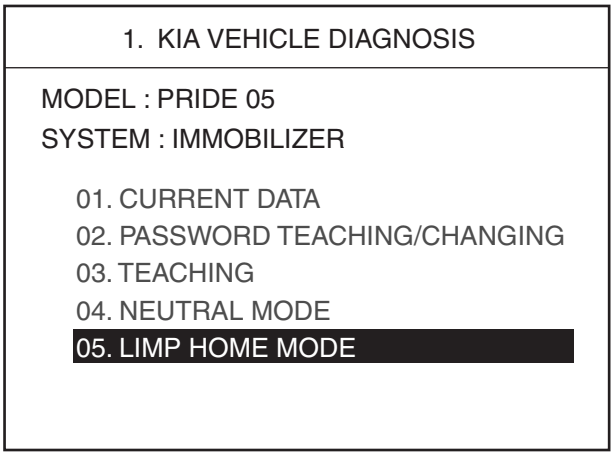


LTJF741V

LIMP HOME FUNCTION EDAAFCD9

1. LIMP HOME BY TESTER
   If the ECM detects the fault of the SMARTRA or transponder, the 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 ECM before. This password can be selected by the vehicle owner and is programmed at the service station.
   The user password can be sent to the ECM via the special tester menu.
   Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the 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 ECM will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time.
   After connecting the battery to the ECM, the timer starts again for one hour.



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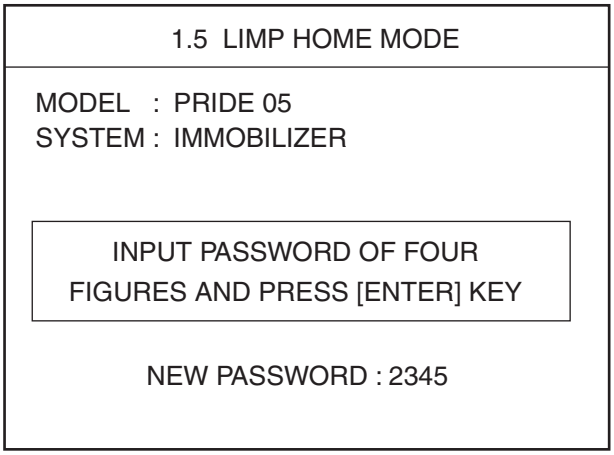

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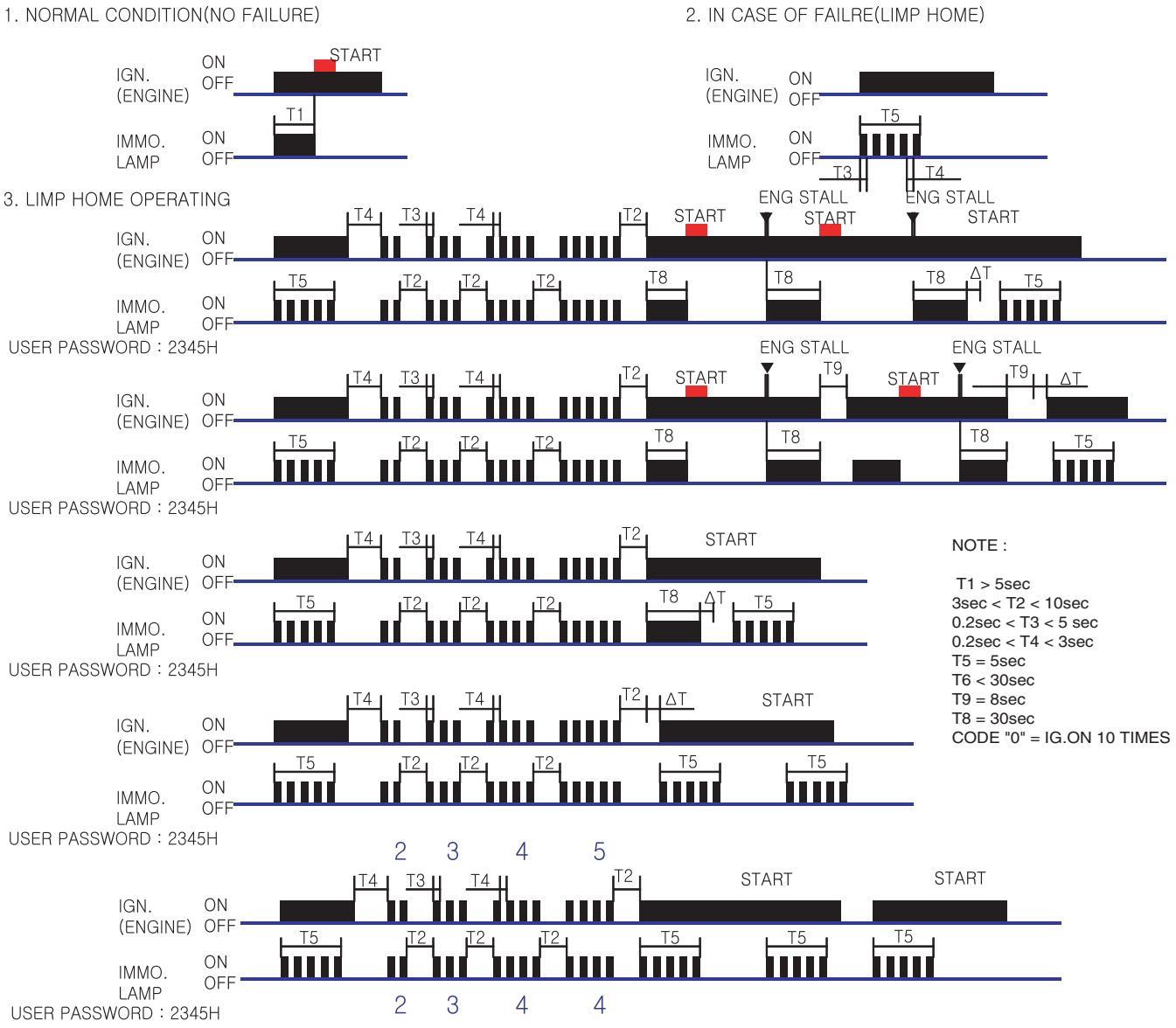
2. LIMP HOME BY IGNITION KEY
   The limp home can be activated also by the ignition key. The user password can be input to the ECM by a special sequence of ignition on/off.
   Only if the ECM is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM will 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 ECM is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.


1. NORMAL CONDITION(NO FAILURE)
IGN. (ENGINE)
IMMO. LAMP
ON
OFF
START
T1
2. IN CASE OF FAILRE(LIMP HOME)
T5
T3
T4
3. LIMP HOME OPERATING
USER PASSWORD : 2345H
T2
T8
T9
ΔT
ENG STALL
NOTE :
T1 > 5sec
3sec < T2 < 10sec
0.2sec < T3 < 5 sec
0.2sec < T4 < 3sec
T5 = 5sec
T6 < 30sec
T9 = 8sec
T8 = 30sec
CODE "0" = IG.ON 10 TIMES
2 3 4 5
2 3 4 4

LTJF740N

DIAGNOSIS OF IMMOBILIZER FAULTS EB4A1C7A

- 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
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 ECM	P1676 (SMARTRA message error)
SMARTRA fault	1. No response from SMARTRA 2. Antenna coil error 3. Communication line error (Open/Short etc.) 4. Invalid message from SMARTRA to 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)
ECM fault	1. Request from ECM is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (ECM message error)
ECM internal permanent memory (EEPROM) fault	1. ECM internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1695 (ECM memory error)
Invalid key fault	1. Virgin transponder at ECM status "Learnt" 2. Learnt (Invalid) Transponder at ECM status "Learnt"(Authentication fail)	P1696 (Authentication fail) P1698 (Invalid transponder)
Locked by timer	1. Exceeding the maximum limit of Twice IGN ON (≥ 32 times)	P1699 (Twice IG ON over trial)
Tester (HI-SCAN) fault	1. Request from tester is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1697 (Tester message error)

PROBLEMS AND REPLACEMENT PARTS: EE48F1ED

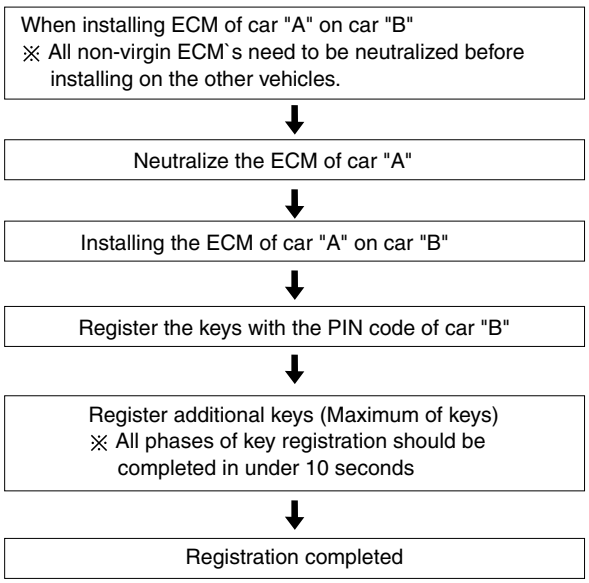
Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	ECM	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	NO
Unidentified vehicle specific data occurs	Key, ECM	YES
SMARTRA unit does not work	SMARTRA unit	NO

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, there is no special procedure required. A new SMARTRA device simply replaces the old one. There are no transponder-related data stored in this device.

1. Things to remember before a replacement (ECM)



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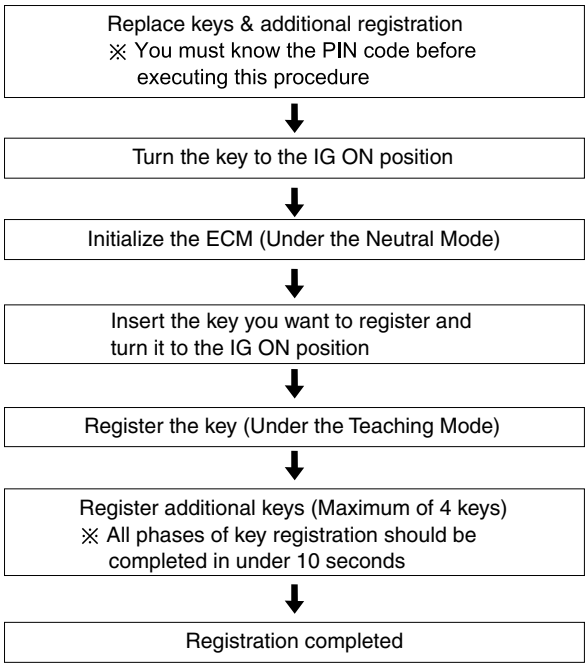
2. Things to remember before a replacement (Keys & Additional registration)



LTJF746B

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 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.*

NEUTRALISING OF ECM

The ECM can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the ECM is neutralized.

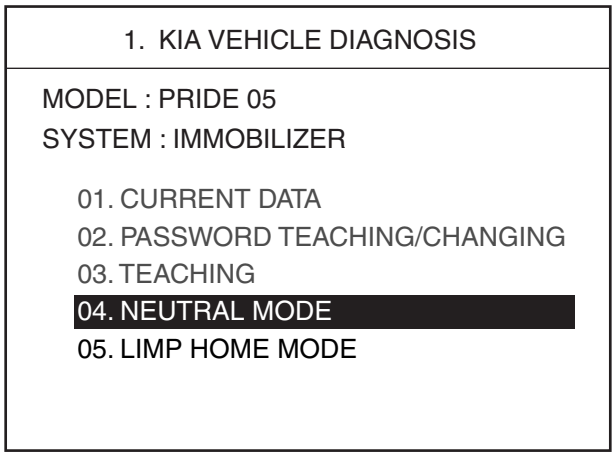
The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the ECM.

The teaching of keys follows the procedure described for the virgin 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 ECM.
Ex) when lost key, Neutralize the ECM then teach keys.
(Refer to the Things to do when Key & PIN Code the ECM can be set to the "neutral" status by a scanner. A valid ignition key is inserted and after ignition on is recorded, the ECM requests the vehicle specific data from the scanner. The communication messages are described at "Neutral Mode". After successfully receiving the data, the ECM is neutralized.
The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function is accepted by ECM.
The teaching of keys follows the procedure described for virgin ECM. The vehicle specific data have to be unchanged due to the unique programming of transponder. If data should be changed, new keys with virgin transponder are requested.

NOTE

- *neutralizing setting condition*
  - *In case of 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)



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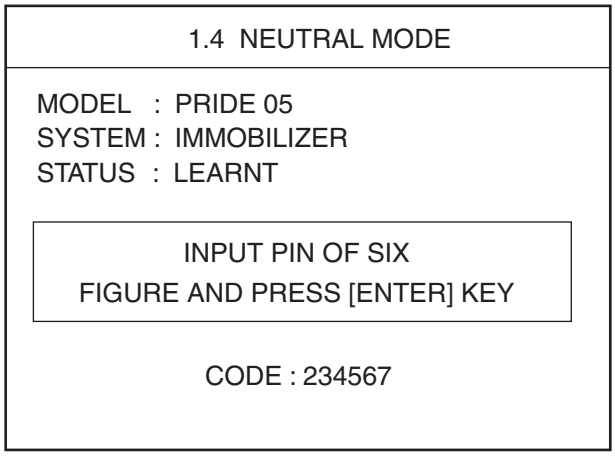
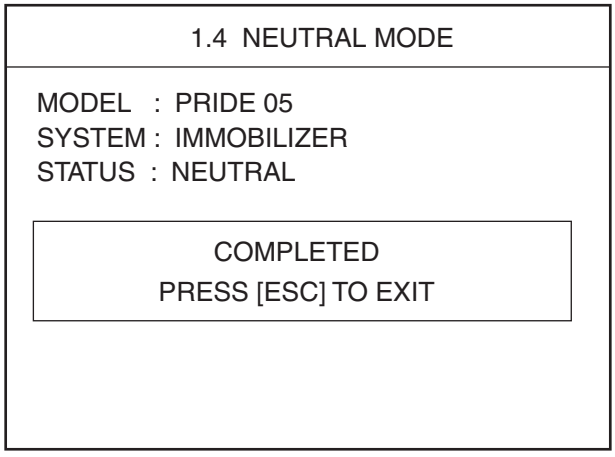


LTJF745E



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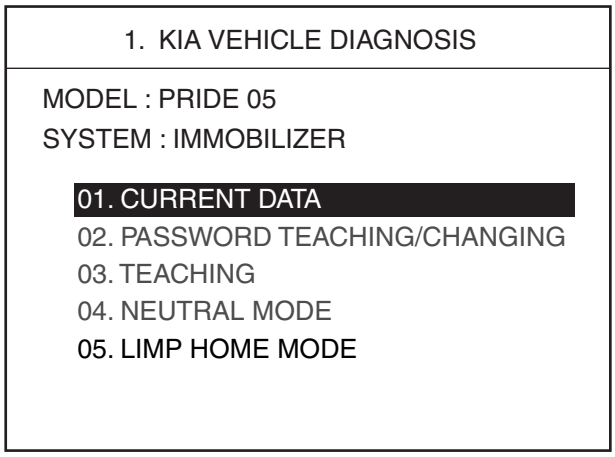
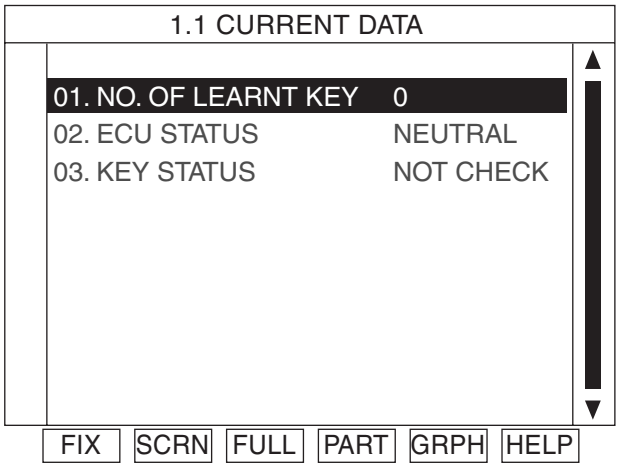


LTJF745C



LTJF745D

DTC P1610 NON-IMMOBILIZER-EMS CONNECTED TO AN IMMOBILIZER

GENERAL DESCRIPTION ED2CB093

The ECM and the SMARTRA communicate by dedicated line. During this communication of ECM and SMARTRA the K line of ECM cannot be used for communication. The ECM controls the communication either to SMARTRA or to other devices(e.g. scanner) on K line by switching of a multiplexer and specific communication procedures. The multiplexer is a part of ECM hard ware.

DTC DESCRIPTION EF5BBF2C

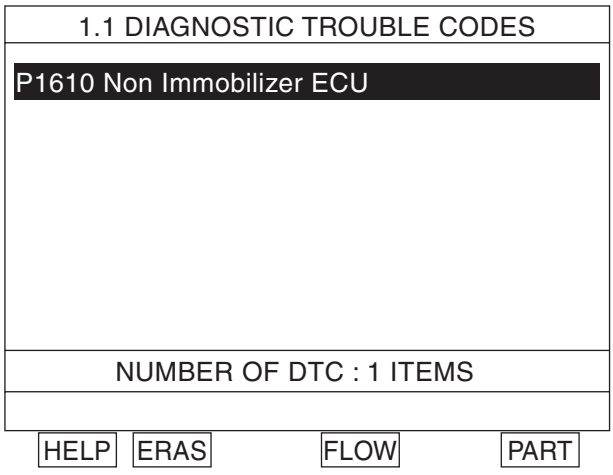
This DTC indicates that the vehicle which has a immobilizer system is equipped with non Immobilizer ECM.

DTC DETECTING CONDITION ECD4D37D

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty ECM
Detecting Criteria	• Equipped with non Immobilizer ECM	

MONITOR SCANTOOL DATA E4D3E6BF

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.



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3. Is the DTC "P1610 Non Immobilizer ECU" displayed?

YES

Replace ECM which has a Immobilizer system and perform key teaching.
And then go to "Verification of Vehicle Repair" procedure.

NO

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

VERIFICATION OF VEHICLE REPAIR E4465D5B

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

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1674 TRANSPONDER STATUS ERROR

GENERAL DESCRIPTION E4FAAADA

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 unique; therefore the content of transponder can never be modified or changed. The data are a string of 9 bytes defined by vehicle manufacturer.
The transponder memory is split into two strings called authenticator and key password after this programming the transponder memory is locked and the data (PIN code) cannot be read or changed respectively. The transponder status changes from "virgin" to "learnt" Additionally every transponder includes a unique IDE (Identifier number) of 32 bit. Unique means that the IDE of all transponder is different from each other. The IDE is programmed by the transponder manufacturer and is a read-only value. The authenticator and the key password are not transferred from ECM to transponder or vice versa. Only the results from the encryption algorithm are transferred. It is almost impossible to calculate the vehicle specific data from the encryption result.
For teaching of keys and special purposes the ECM is connected to the tester device.

When IG is ON, the coil supplies energy to the transponder which in turn accumulates energy in the condenser.
Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE (stored within the ASIC).

DTC DESCRIPTION E9BE25DC

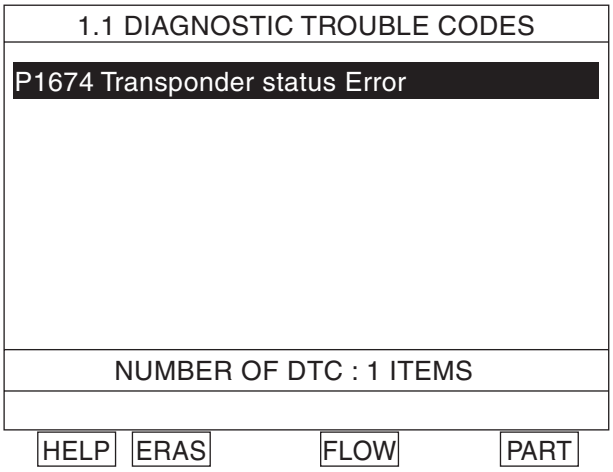
This DTC indicates that the TP is not in password mode, or Transponder transport data has been changed.

DTC DETECTING CONDITION E24D0A16

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting Factors	• Password mode invalid	
Detecting Window	• During Transponder Write or Read EEPROM Page	
Detecting Criteria	• TP not in password mode, or Transponder transport data has been changed	

MONITOR SCANTOOL DATA EFE0857E

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.



LTLJF742G

3. Is the DTC "P1674 Transponder status Error" displayed?

YES

Check Key status of the current data.
If Transponder is not virgin, check transponder which is registered other vehicles
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

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

VERIFICATION OF VEHICLE REPAIR E0D92C97

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

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1675 TRANSPONDER PROGRAMMING ERROR

GENERAL DESCRIPTION EA0C6B6A

Refer to DTC P1674.

DTC DESCRIPTION E46EBDFA

This DTC indicates that TP has Invalid Transponder Data.

DTC DETECTING CONDITION E9CC291F

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting Factors	• TP programming error	
Detecting Window	• During Transponder Write EEPROM Page request while Transponder is in authorized state.	
Detecting Criteria	• Corrupted data form Transponder (Tp), or more than one TP in the field, or no TP in the magnetic field.	

MONITOR SCANTOOL DATA E628FBAA

Refer to DTC P1690.

COMPONENT INSPECTION EE9A91C3

1. Check Transponder

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

   2) Perform neutral mode, key teaching and password teaching/changing.
   (Refer to "Reference Data in General Information")

   NOTE

   Be sure that PIN code is prepared before performing neutral mode.

   3) Is the neutral, teaching and password teaching/changing mode possible?

   YES

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

   NO

   Substitute with a known-good virgin Transponder and monitor CURRENT DATA.
   If the key status is displayed as "Virgin", replace Transponder.
   Perform key teaching mode in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECB38C77

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

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1676 SMARTRA MESSAGE ERROR

GENERAL DESCRIPTION ED15D0CE

Refer to DTC P1690.

DTC DESCRIPTION E5CA2C2D

This DTC indaicates that message from SMARTRA to ECM is invalid.

DTC DETECTING CONDITION E1DECD40

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or Short in SMARTRA Circuit • Faulty SMARTRA
Detecting Criteria	• No response from SMARTRA Invalid message from SMARTRA to ECM	

MONITOR SCANTOOL DATA ED31BFBB

Refer to DTC P1690.

COMPONENT INSPECTION EDE2B2AE

Refer to DTC P1675.

VERIFICATION OF VEHICLE REPAIR E578BF0B

Refer to DTC P1690.

DTC P1690 SMARTRA NO RESPONSE

GENERAL DESCRIPTION E8AAADCB

The SMARTRA carries out communication with the built-in transponder of the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving.

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 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 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 ECM and vice versa.

SMARTRA : SMARt TRansponder Antenna

DTC DESCRIPTION E1A44367

This DTC indicates that there is no response from SMARTRA because of communication line error.(Open or short etc.)

DTC DETECTING CONDITION E84DFA0A

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or Short in SMARTRA Circuit • Faulty SMARTRA
Detecting Criteria	• No response from SMARTRA (Communication Line Error - Open or Short etc.)	

SIGNAL WAVEFORM E59B667B

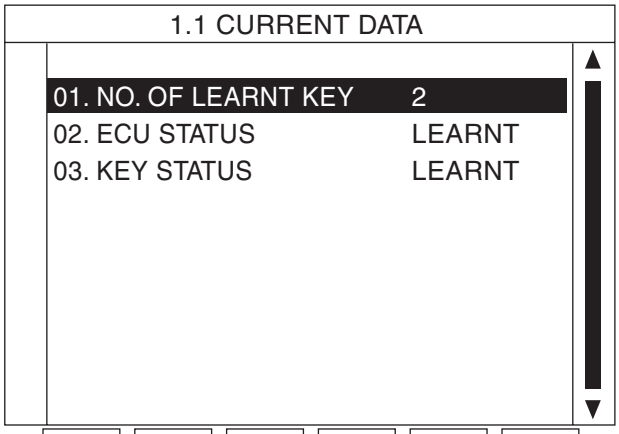


Fig 1

LTIF742A

EMS Status	Engine start with valid key	Engine start by limp home	Teaching of key	Teaching or changing of user password	Twice ignition of function
Not yet checked	No	No	No	No	No
Virgin	No	No	Yes	No	Yes, with virgin key
Learnt	Yes	Yes, with learnt user password	Yes	Yes	No
Neutral	No	No	Yes	No	No
Locked by timer	No	No	No	No	No

Fig 2

ETRF742B

1. ECM :

   1) Virgin(This is status at the end of ECM production line before delivery to customer)

   2) Neutral (This is a status that is erased all data regarding immobilizer by special command from scanner)

   3) Not Check (The status is stored in permanent memory (EEPROM or Flash etc.)
   In case of not plausible data from this circuit the ECM cannot check the status.

   4) Locked by timer (After a certain number of incorrect user Password(4) or PIN Code(6) the ECM is locked for one hour and no inputs are accepted during this time)

2. KEY :

   1) Virgin (It means the key in the key cylinder has not matched with ECM yet)

   2) Invalid (It means that data is mismatched between ECM and transponder)

   3) Not Checked (It means that ECM cannot check the transponder data in the key cylinder)
      - ECM cannot check the transponder data because of SMARTRA error or antenna coil error.
      - ECM cannot check the transponder data because of communication circuit problem between ECM and SMARTRA.
      - Key with NO Transponder
      - More than 1(One) Transponder in the magnetic field
      - No Transponder in the magnetic field
      - TP data blocked
      - TP data does not exist
      - TP data changed
      - TP Teaching error
      - Multiple TP data input

Current Data from Immobilizer will show the numbers of Key learnt, ECM status, and Key status as Fig 1. The current data provides an indication of the probable cause.
Fig 2. shows possibility of Engine start, Teaching or changing of user password according to ECM status.

MONITOR SCANTOOL DATA EFEDD5F5

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

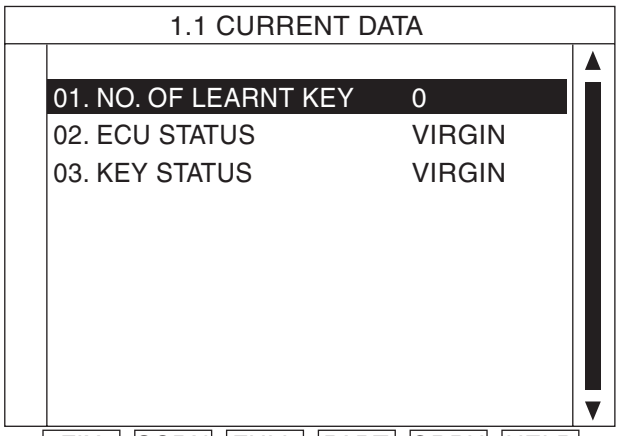


Fig 1

LTIF742C

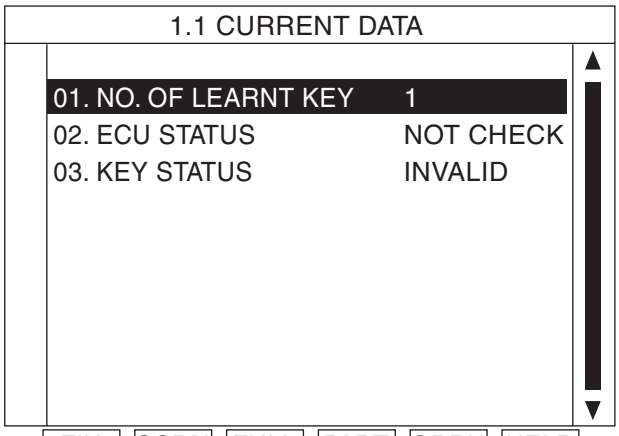


Fig 2

LTIF742D

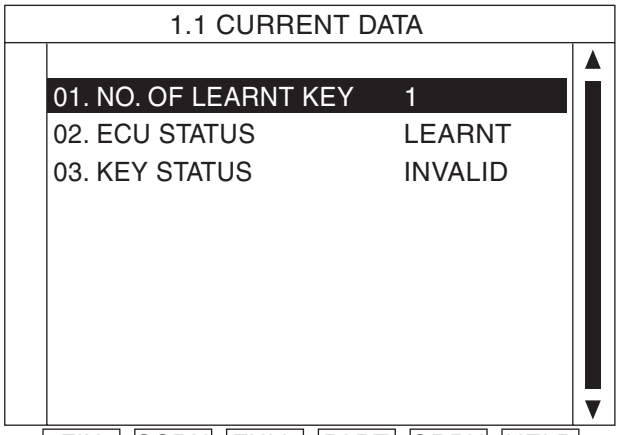


Fig 3

LTIF742E

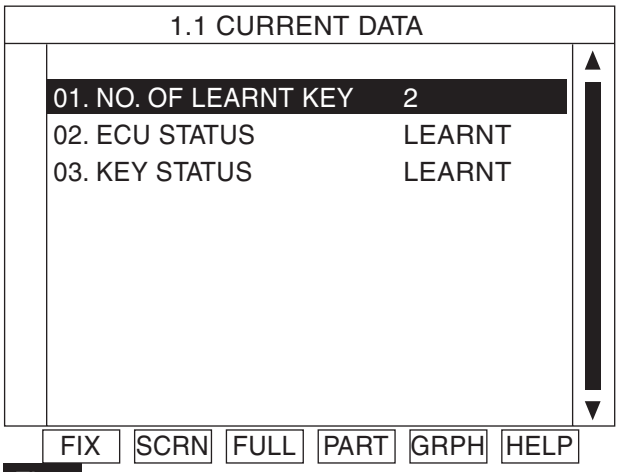


Fig 4

LTIF742F

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

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

NO

Go to "Terminal and connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION ED9E6DA5

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

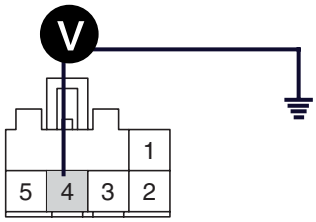
NO

Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION EFBACFCC

1. Ignition "OFF".
2. Disconnect SMARTRA connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 4 of the SMARTRA harness connector and chassis ground.

Specification : B+



3. Ground
4. Power

LTIF742G

5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Check open or short in power harness.
Check that 15A SENSOR fuse located between Main relay and Smartra is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION EEF0D31A

1. Check for short in harness.

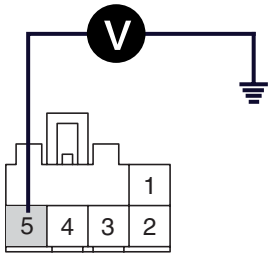
   1) Ignition "OFF".

   2) Disconnect SMARTRA connector.

   3) Ignition "ON" & Engine "OFF".

   4) Measure voltage between terminal 5 of the SMARTRA harness connector and chassis ground.

Specification : Approx. 5.48V



5. Signal

LTIF742H

   5) Is the measured voltage within specifications?

YES

Go to "Check for open in harness" as below.

NO

Check short in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

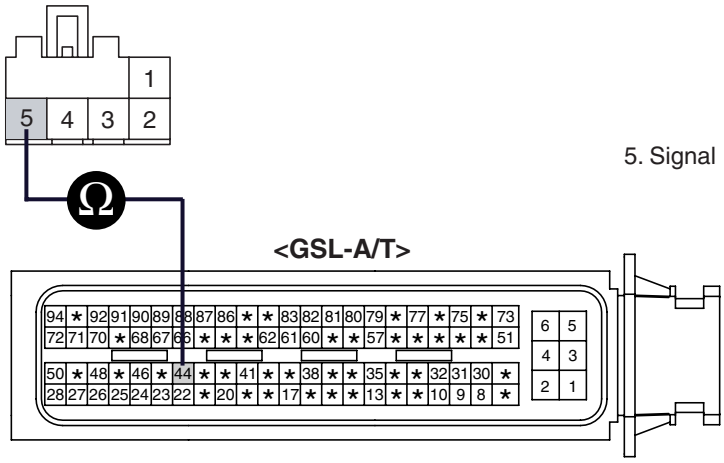
2. Check for open in harness

   1) Ignition "OFF".

   2) Disconnect SMARTRA connector.

   3) Measure resistance between terminal 5 of the SMARTRA harness connector and terminal 44(A/T-GSL) or 18(M/T-GSL) or 47(DSL) of ECM harness connector.

Specification : Approx. below 1Ω



LTJF742I

   4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION E1E16F4F

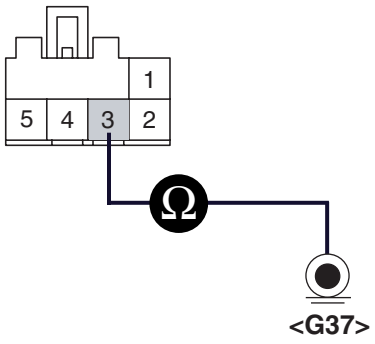
1. Check for open in harness between SMARTRA and Chassis ground.

   1) Ignition "OFF".

   2) Disconnect SMARTRA connector.

3) Measure resistance between terminal 3 of the SMARTRA harness connector and Chassis ground.

Specification : Approx. below 1Ω



3. Ground

LTJF742J

4) Is the measured resistance within specifications?

YES

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

NO

Check for open in ground harness.
Make sure that Chassis ground G37 is firmly tightened properly.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC1196D0

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

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1691 ANTENNA COIL ERROR

GENERAL DESCRIPTION ED11A9DC

This wireless communication runs on RF . The SMARTRA is mounted at the ignition lock close to the antenna coil for RF transmission and receiving. 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 EMS are converted into an RF signal, which is transmitted, to the transponder by the antenna.

DTC DESCRIPTION E70A3D4A

This DTC indicates that there is open or short in antenna coil circuit.

DTC DETECTING CONDITION E4DDBA09

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or short in coil circuit • Faulty Antenna Coil • Faulty SMARTRA
Detecting factors	• Antenna signal error	
Detecting Window	• Before transponder communications	
Detecting Criteria	• Antenna open/short circuit	

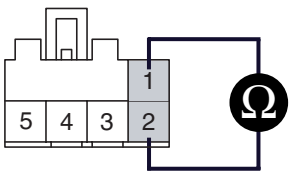
MONITOR SCANTOOL DATA ECA6C8C9

Refer to DTC P1690.

COMPONENT INSPECTION EC217FBC

1. Check Antenna Coil
   1) Ignition " OFF".
   2) Disconnect SMARTRA connector.
   3) Measure resistance between terminal 1 and 2 of the SMARTRA connector (Component side)

Specification : Approx. 8.5Ω



1. Antenna coil(+)
2. Antenna coil(-)

LTJF743F

4) Is the measured resistance within specifications?

YES

Go to " Check SMARTRA" as below.

NO

Check for open in harness between SMARTRA and Antenna coil, repair or replace as necessary.
Substitute with a known-good Antenna Coil and check for proper operation. If the problem is corrected, replace Antenna Coil. And then, go to "Verification of Vehicle Repair" procedure.

2. Check SMARTRA

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

2) Perform neutral mode, key teaching/changing and password teaching according to description in "System inspection" procedure.

NOTE

Be sure that PIN code is prepared before performing neutral mode.

3) Is Key teaching completed?

YES

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

NO

Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA and Go to "Verification of Vehicle Repair" procedure.

NOTE

In case of faulty SMARTRA, there are no special procedures required. A new SMARTRA device simply replaces the old one. (There are no transponder-related data stored in this device.)

VERIFICATION OF VEHICLE REPAIR EBB24E1D

Refer to DTC P1690.

DTC P1692 IMMOBILIZER LAMP ERROR

GENERAL DESCRIPTION EAF6EFCD

The driver is informed about successful authentication by immobilizer lamp at cluster. The lamp is "ON" after successful authentication until the detection of minimum engine speed for ECM operation (begin of engine cranking).
After the IG ON, the Immobilizer lamp will be turned ON for 30 seconds then, goes off if the immobilizer system is O.K.
In case of the immobilizer system is failed, the immobilizer lamp will be blinking for 5 times then goes off.

DTC DESCRIPTION E1D2F7CC

This DTC indicates that there is short in lamp circuit.

DTC DETECTING CONDITION ECEFC20B

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Short in Lamp circuit
Detecting Criteria	• Line : Short circuit	

SYSTEM INSPECTION EE91DAC1

1. Ignition "ON" & Engine "OFF".
2. Check Immobilizer indicator lamp.

   NOTE

   a. Normal Condition : After the IG ON, the Immobilizer lamp will be turned ON for 30 seconds then, goes off if the immobilizer system is O.K.
   b. Malfunction on Immobilizer system : The immobilizer lamp will be blinking for 5 times then goes off.

3. Is the immobilizer lamp operating correctly?

   YES

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

   NO

   Go to " Component Inspection" procedure.

COMPONENT INSPECTION E7BE47E1

1. Check Immobilizer indicator control

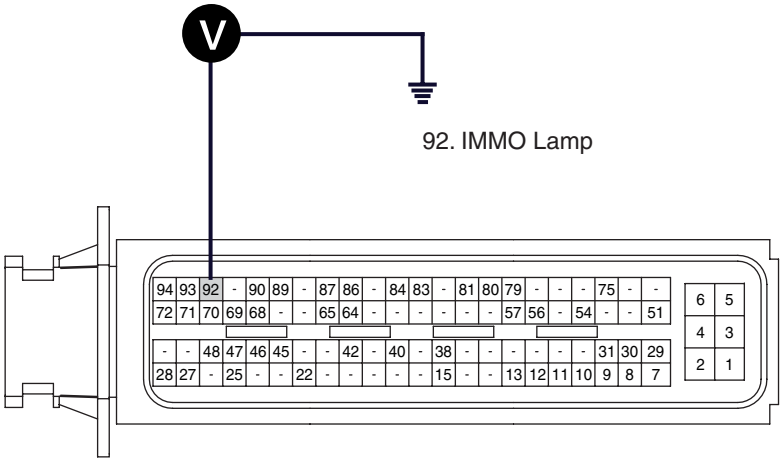
   1) Ignition "OFF"

   2) Disconnect ECM connector

   3) Ignition "ON" & Engine "OFF"

   4) Measure voltage between terminal 92 of ECM harness connector and chassis ground

Specification : Approx. 11 V



LTJF743L

5) Is the measured voltage within specifications?

YES

Go to " Check Immobilizer indicator bulb" as below

NO

Check for short to battery in the control circuit.
Repair or replace as necessary and then, go to "Verificatio of Vehicle Repair" procedure.

2. Check Immobilizer bulb

   1) Ignition "OFF"

   2) Disconnect ECM connector

   3) Jump between terminal 92 of ECM harness connector and Chassis ground with jumper wire.

   4) Ignition "ON" and Engine "OFF"

Specification : Immobilizer lamp "ON"

   5) Is the Immobilizer indicator lamp turned "ON"?

YES

Substitute with a known-good ECM and check for proper operation.
If the problem is corrected, replace ECM and then go to " Verification of Vehicle repair" procedure.

NOTE

In case of faulty ECM, it has to be replaced with "VIRGIN" or " NEUTRAL" ECM.

NO

Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EB06AFCB

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

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1693 TRANSPONDER NO RESPONSE ERROR / INVALID RESPONSE

GENERAL DESCRIPTION EDBA7FE9

Refer to DTC P1674.

DTC DESCRIPTION E0ACFC8D

This DTC indicates that the TP has invalid Transponder Data.

DTC DESCRIPTION ED45F8AA

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Transponder Key
Detecting factors	• Invalid Transponder Data	
Detecting Window	• During Transponder IDE • During Transponder Authentication requests • During Transponder Write EEPROM page requests • During Transponder Read EEPROM page requests	
Detecting Criteria	• Corrupted data form Transponder (Tp), or more than one TP in the field, or no TP in the magnetic field.	

MONITOR SCANTOOL DATA E6A3DFF5

Refer to DTC P1690.

COMPONENT INSPECTION EC7E3838

Refer to DTC P1675.

VERIFICATION OF VEHICLE REPAIR ED4F4625

Refer to DTC P1690.

DTC P1694 EMS MESSAGE ERROR

GENERAL DESCRIPTION E2B9E594

Refer to DTC P1610.

DTC DESCRIPTION E8209FDC

This DTC indicates that request from ECM is invalid or request has corrupt data.

DTC DETECTING CONDITION EC9CAC89

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty ECM
Detecting factors	• Request from Control unit is invalid	
Detecting Window	• End of ECM request message	
Detecting Criteria	• Protocol layer violation - Invalid request, Invalid check sum.)	

MONITOR SCANTOOL DATA EC541C0C

Refer to DTC P1690.

COMPONENT INSPECTION EB360A1C

1. Check ECM

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

   2) Perform Key Teaching Procedure in "Reference Data" described in General Information.

   3) Is the Key teaching completed?

      YES

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

      NO

      Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to " Verification of Vehicle repair" procedure.

NOTE

1. *Don't forget to prepare for the PIN of the vehicle before removing ECM from the vehicle.*
2. *Remember that substituting with a known-good ECM should be followed "The things to remember before replacement (ECM)".*
   (In case of faulty ECM, it has to be replaced with "VIRGIN" or " NEUTRAL" ECM.)
3. *Ensure that the correct PIN is entered when replacing a new ECM.*

VERIFICATION OF VEHICLE REPAIR ECFE4A9C

Refer to DTC P1690.

DTC P1695 EMS MEMORY ERROR

GENERAL DESCRIPTION E44D8E53

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).
The immobilizer data are stored by three independent entries.
The data from EEPROM are evaluated by "2 of 3 decision". That means all three entries are read and the content is compared before authentication process.
If the contents of all entries are equal, the authentication will run without additional measures.
If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective" is stored at ECM.
If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective" will be stored. The limp home function cannot be activated. The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

DTC DESCRIPTION E911C6D0

This DTC is indicates that not only ECM have inconsistent data of EEPROM for number of keys taught, user password state and invalid write operation to EEPROM but ECM can not recognize the unique PIN code during Key Authentication.

DTC DETECTING CONDITION E0EE2A4D

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty ECM
Detecting Criteria	• ECM internal permanent memory(EEPROM or Flash etc.) fault. • Invalid write operation to permanent memory(EEPROM or Flash etc.) fault.	

MONITOR SCANTOOL DATA EC64BD29

Refer to DTC P1690.

COMPONENT INSPECTION E21A9380

Refer to DTC P1694.

VERIFICATION OF VEHICLE REPAIR EC79815B

Refer to DTC P1690.

DTC P1696 AUTHENTICATION FAIL

GENERAL DESCRIPTION E4C66AB6

Refer to DTC P1693.

DTC DESCRIPTION E1BBAA1C

This DTC indicates that the TP(Transponder) status is Virgin or Invalid when ECM status is Learnt.(Authentication fail).

DTC DETECTING CONDITION E0EE32FC

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty TP(Virgin or Invalid)
Detecting Criteria	• Virgin TP at EMS STATUS "Learnt" • Learnt(Invalid) TP at EMS status "Learnt"(Authentication fail)	

MONITOR SCANTOOL DATA E8ABCFF0

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

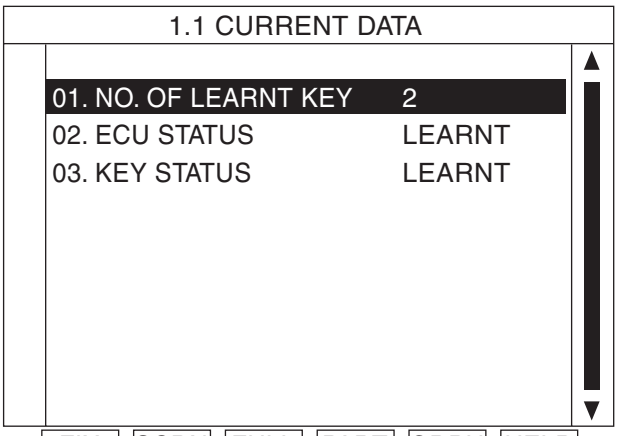


Fig 1

LTJF742L

Fig 1 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

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

NO

In case that key status is "Virgin".
The key is not registered yet.
Perform key teaching of the key and then go to "Verification of Vehicle Repair" procedure.

In case that key status is "Invalid"
The key is registered in other vehicles or the key is not registered when all the keys are registered.
Perform key teaching of all the keys again and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA8B87D2

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

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

DTC P1697 HI-SCAN MESSAGE ERROR

GENERAL DESCRIPTION EBDA848E

Refer to DTC P1610.

DTC DESCRIPTION ECFEDFF3

This DTC indicates that ECM received invalid tester message / unexpected requests from tester or ECM Locked by timer (e.g. exceeding the maximum limit of twice ignition On or teaching trials).

DTC DETECTING CONDITION E45A5228

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Poor connection between Scanner and DLC (Data Link connector) • Scanner Program Error • Locked by timer (e.g. exceeding the maximum limit of twice ignition On or teaching trials)
Detecting Criteria	• Request from Tester is Invalid(Tester Error) : (Protocol layer violation - Invalid request, check sum error etc.) • Locked by timer (e.g. exceeding the maximum limit of twice ignition On or teaching trials)	

MONITOR SCANTOOL DATA E000AF27

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

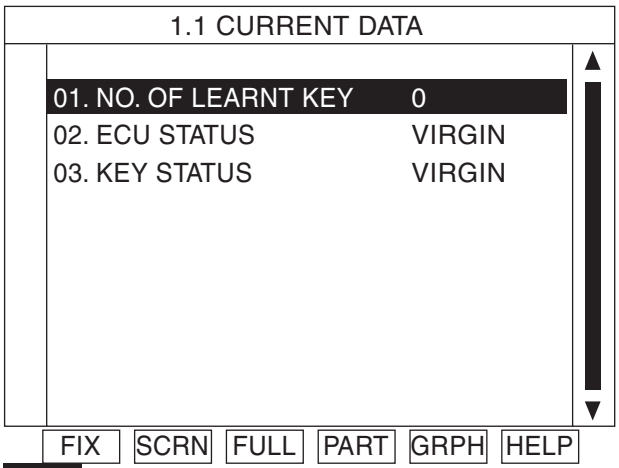


Fig 1

LTIF742C

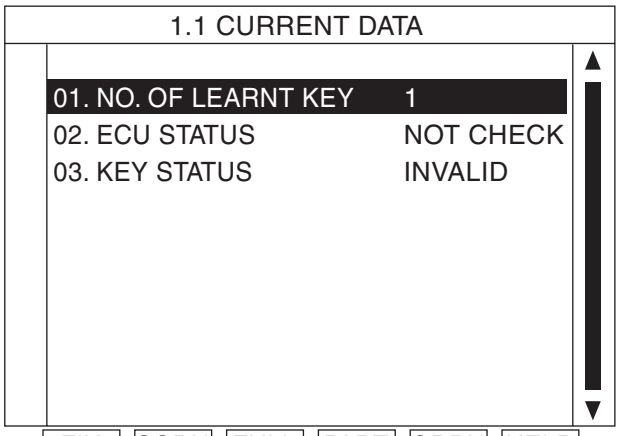


Fig 2

LTIF742D

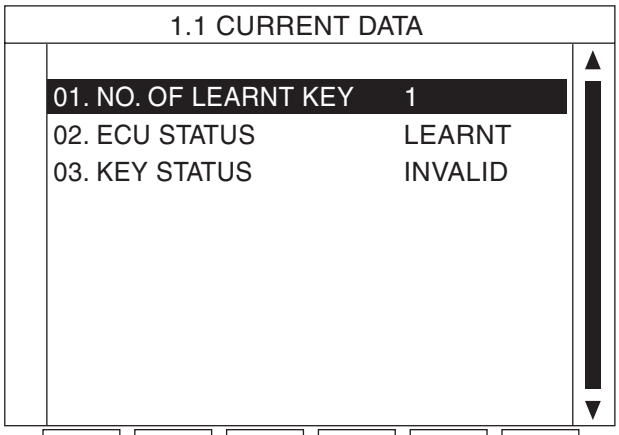


Fig 3

LTIF742E

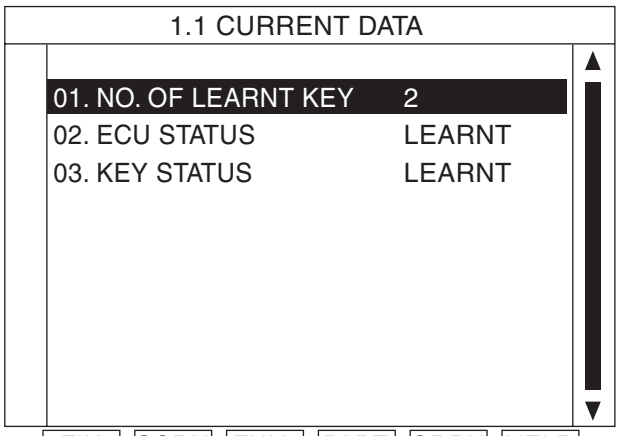


Fig 4

LTIF742F

Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Is the communication possible between scan tool and Immobilizer system?

YES

If communication between SMARTRA and ECM is OK, Check ECM status of the current data.
If ECM status is "Lock", Please wait for one hour with IG Key "ON" and then go to " Verification of Vehicle Repair" procedure.

NOTE

Disconnecting battery or others manipulation can not reduce this time. After connecting the battery the timer starts again for one hour.

NO

Check DLC cable connection between Scanner and DLC. And, update the scan tool program card with latest version. Finally try communication between scan tool and Immobilizer system.
If problem still continues, Substitute with a known-good scan tool and check for proper operation. If the problem is corrected, and then go to " Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E7AA3FD9

Refer to DTC P1690.

DTC P1699 TWICE OVERTRIAL

GENERAL DESCRIPTION E291A5EB

This is a special function for engine start by vehicle manufacturer. The engine can be started for moving from the production line to an area where the key teaching is proceeded.

DTC DESCRIPTION E3EAEC03

This DTC indicates that starting time of twice ignition 'ON' exceed the maximum limit.

DTC DETECTING CONDITION E13970DB

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Locked by timer
Detecting Criteria	• Exceeding the maximum limit of Twice IGN ON (≥ 32 times)	

MONITOR SCANTOOL DATA EA5732AB

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.
3. If the DTCs are retrieved again, monitor "CURRENT DATA" to check No. of Learnt key, ECM and KEY status.

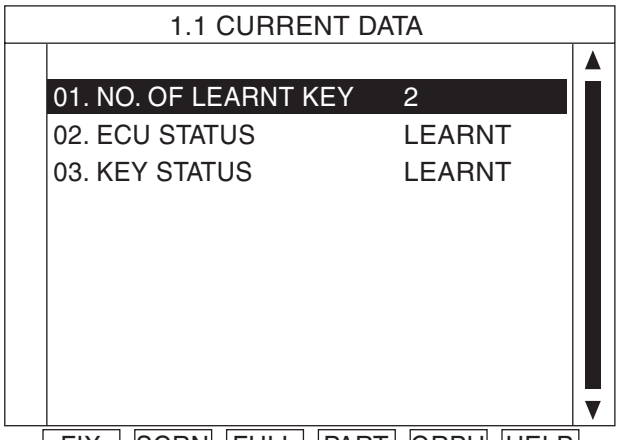


Fig 1

LTJF742L

Fig 1 : 2(two) Keys have been matched with ECM.

4. Is the ECM status displayed as "LOCK"?

YES

Wait for one hour with IG Key On.
Perform key teaching again and then go to " Verification of Vehicle Repair" procedure.

NOTE

Disconnecting battery or others manipulation can not reduce this time. After connecting the battery the timer starts again for one hour.

NO

Fault is intermittent caused by poor contact in the SMARTRA and/or ECM connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination. deterioration, or damage.

Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA4D7B19

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

1. Connect scan tool and monitor CURRENT DATA to check No. of Learnt key, ECM and KEY status.
2. Select Diagnostic Trouble Codes(DTCs)" mode and Clear the DTCs.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

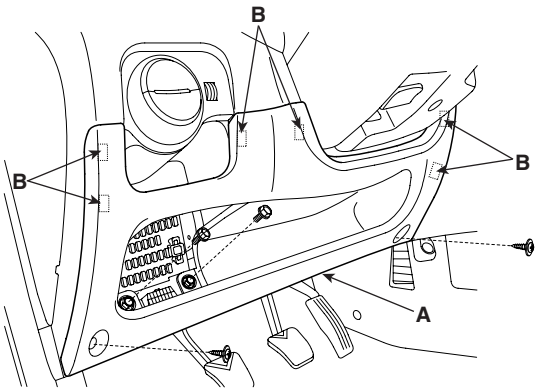
NO

System is performing to specification at this time.

IMMOBILIZER CONTROL UNIT

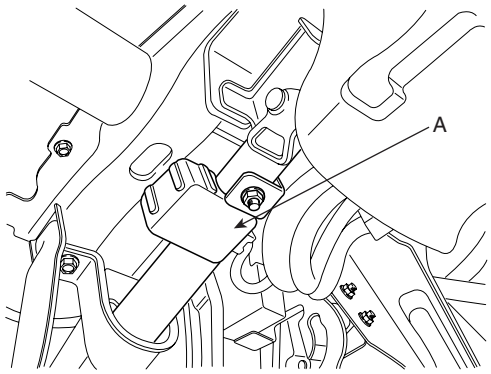
REPLACEMENT E7650442

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel(A) (Refer to the Body group - crash pad). Take care of fixing clips(B).



LTJF141A

3. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening the nut.



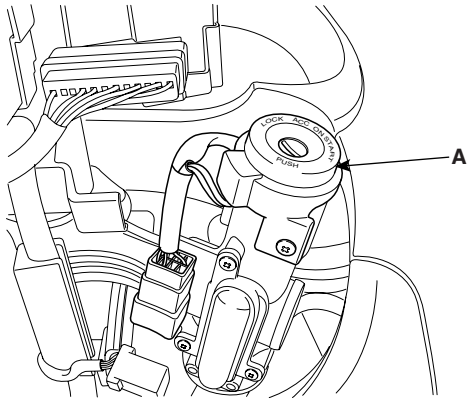
ATJF741A

4. Installation is the reverse of removal procedure.

TRANSPONDER KEY

REPLACEMENT E3DCD007

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column shaft (Refer to the ST group).
3. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A) after loosening the screw.



ATJF781B

4. Installation is the reverse of removal procedure.

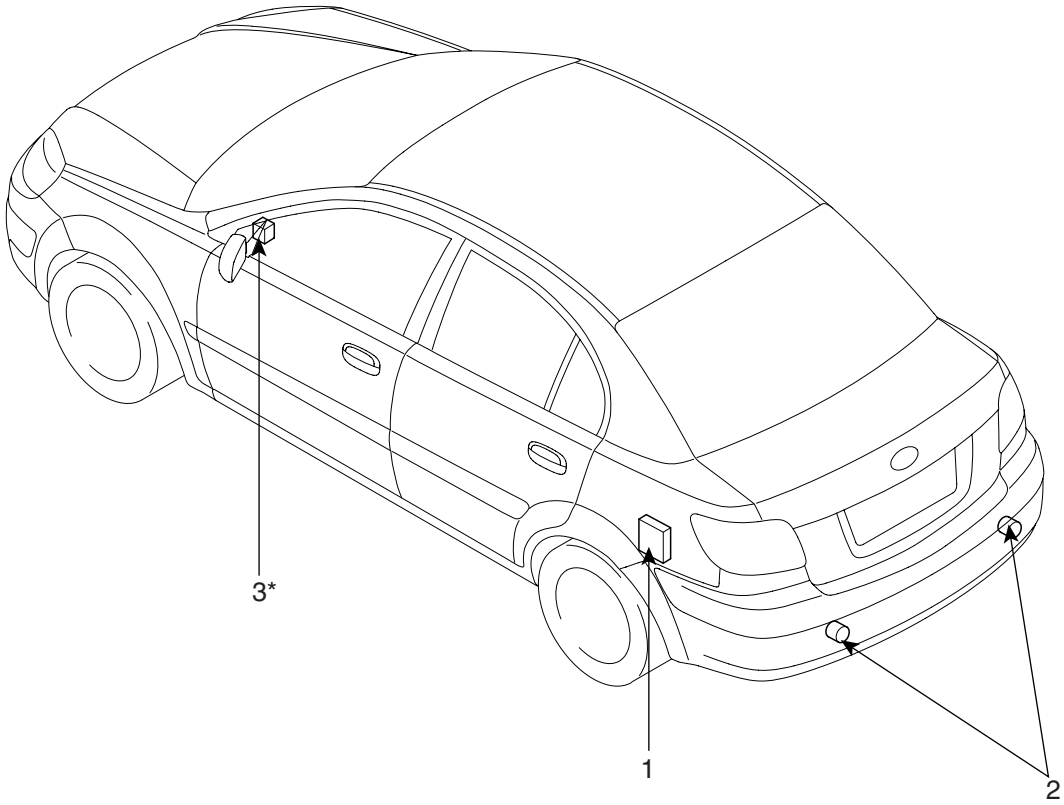
BACK WARNING SYSTEM

DESCRIPTION E10ED6FA

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, back warning 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).

COMPONENT LOCATION EDCAFCF0

The parts with asterisk(*) :
This illustration is shown the LHD type.
RHD type is symmetrical.



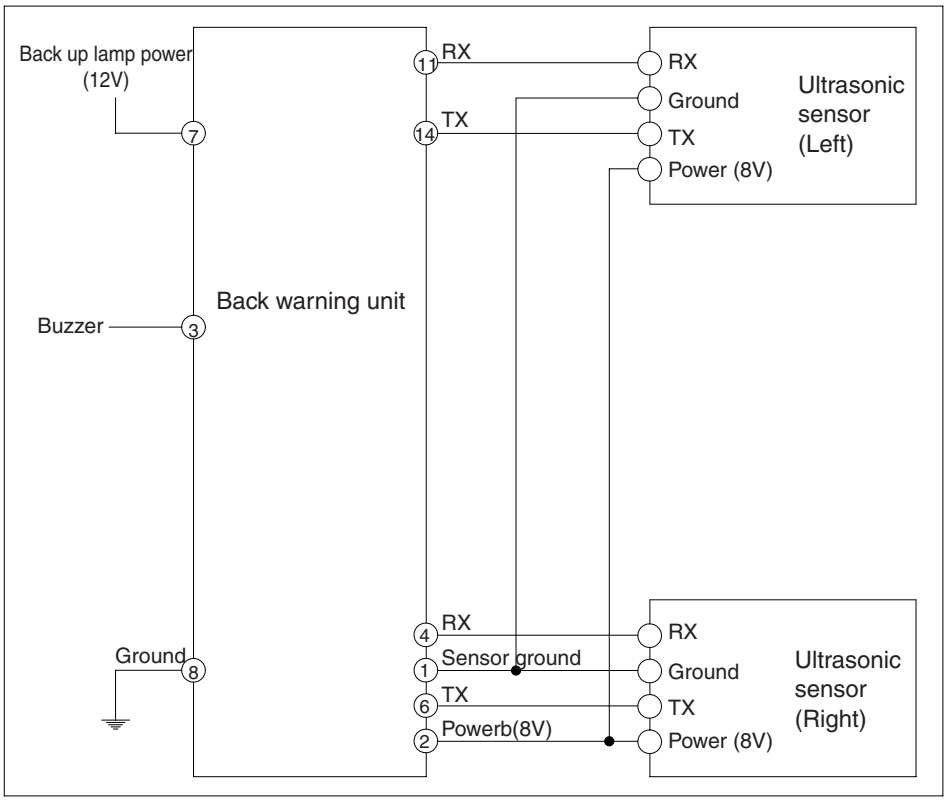
1. Back warning control unit
2. Ultrasonic Sensor
3. Buzzer

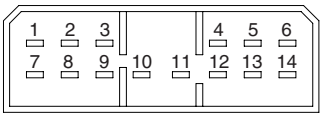
LTJF760A

SPECIFICATION ECC56E2E

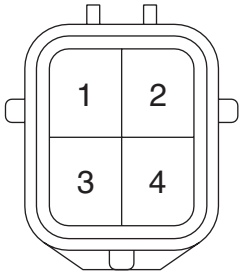
Item		Specification
Back warning control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 600 mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage rating	DC 8V
	Detecting range	40 cm ~ 120 cm
	Operation voltage	DC 6.0~9.0 V
	Operation current	MAX 100 mA
	Operation temperature	-30°C ~ + 80°C
	Beam width	Horizontal : 40 ± 5°, Vertical : 60 ± 5°
	Number of sensors	2 (Right, Left)
Piezo buzzer	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.2±0.5 KHz
		Sound level : 65 dB (DC 13V /m)

CIRCUIT DIAGRAM E0B8163D





(Back warning control unit connector)



(Ultrasonic sensor connector)

Pin configuration

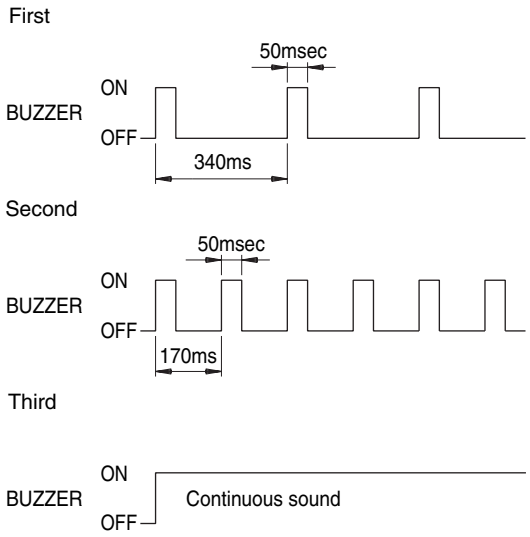
Pin No.	Signal	Test : Desired result
1	Sensor ground	0V
2	Sensor power	8V (While operating)
3	Buzzer	0V (While operating)
4	RX - Sensor(Right)	0~1V voltage change (Inspect waveform)
5	-	-
6	TX - Sensor(Right)	0~3V voltage change (Inspect waveform)
7	Back up lamp power	12V (While shifting to "R")
8	Ground	0V
11	RX - Sensor(Left)	0~1V voltage change (Inspect waveform)
12	-	-
14	TX - Sensor(Left)	0~3V voltage change (Inspect waveform)

PIN NO	SIGNAL
1	TX
2	RX
3	8V
4	GND

LTJF760B

ALARM RANGE ED779E88

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



LTJF976C

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.*

DIAGNOSIS

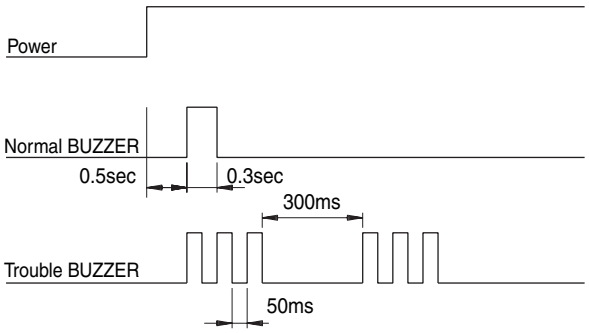
1. Operate with ignition switch on and shift the lever to position "R".

2. Then it checks the system condition.
   If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.5 seconds from power approval. In case of system failure, buzzer alarm is generated 3 times continuously with the interval of 0.3 seconds.

3. Effective operation range is 5km/h or less for the vehicle speed.

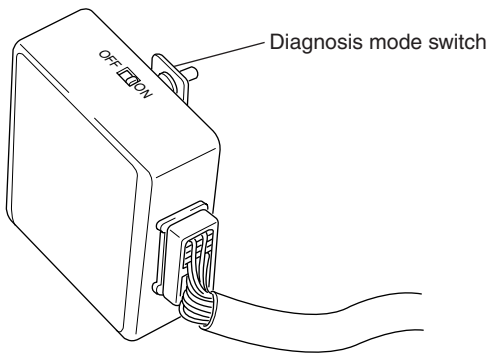
4. Diagnosis mode

   1) Ignition switch on and shift the lever to position "R", control unit checks the sensor condition, and generates buzzer sound for 0.3 seconds if it is O.K



LTCD210A

   2) Diagnosis mode
   Switch on diagnosis mode upon system failure.



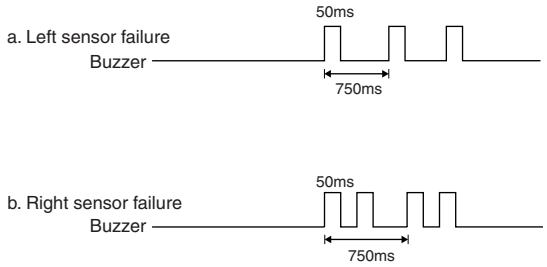
LTJF976E

In case of system failure, then it indicates the failed point as follows.

a. Left sensor failure : beep-beep
b. Right sensor failure : beep beep-beep beep

NOTE

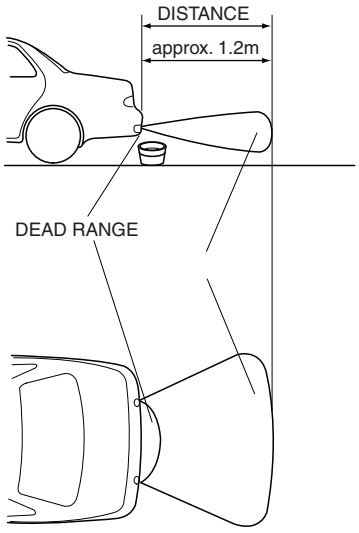
Upon failure of two or more sensors, it generates alarm in the order of Left-Right sensor.



LTJF760C

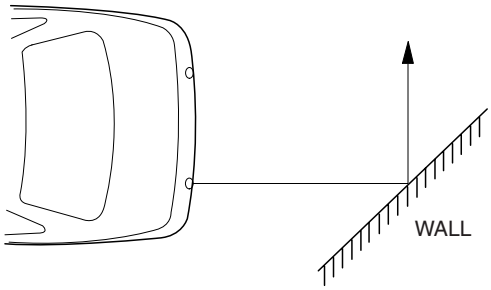
WARNING EB9F5BFB

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)



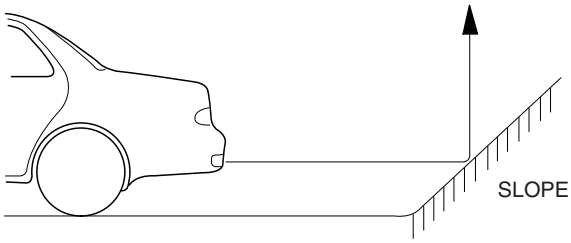
LT8C218A

4. Reversing toward the sloped walls.



LT8C218B

5. Reversing toward the sloped terrain.



LT8C218C

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.
   Back warning 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 trunk, 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.

BACK WARNING CONTROL MODULE

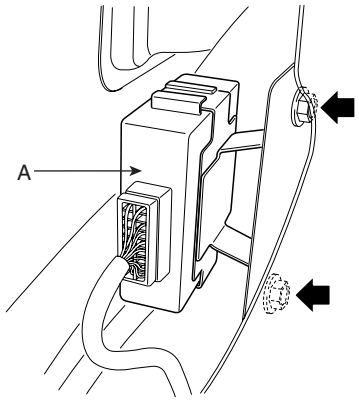
REPLACEMENT E1C5E1DE

1. Disconnect the negative (-) battery terminal.

2. Remove the left side trim of the trunk.

3. Loosen the mounting nuts and disconnect the connector.

4. Remove the back warning control unit (A) from the quarter panel.



ATJF761A

5. Installation is the reverse of removal procedure.

ULTRASONIC SENSOR

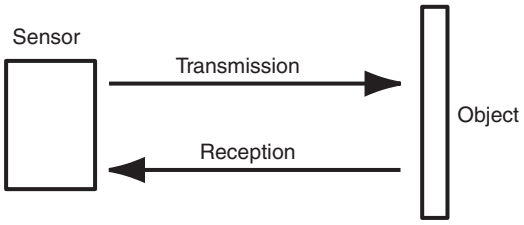
OPERATION PRINCIPLE E4FFF73C

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

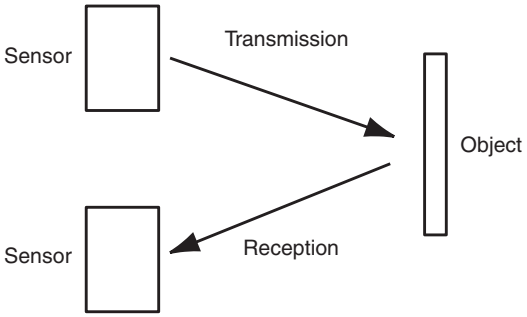
Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



ETRF762A

2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



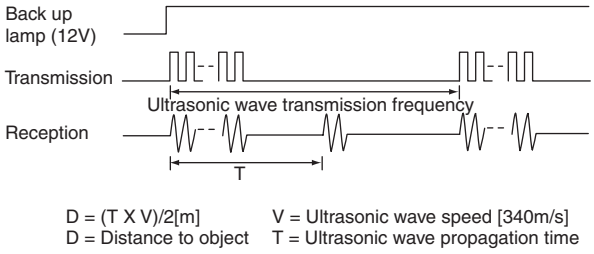
ETRF762B

MEASUREMENT PRINCIPLE

Back warning system (BWS) is a complementary device for reversing. BWS 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

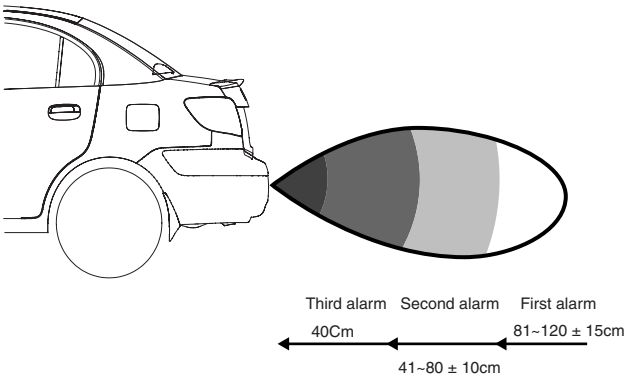
The basic principle of distance measurement using ultrasonic wave is:



ETRF762C

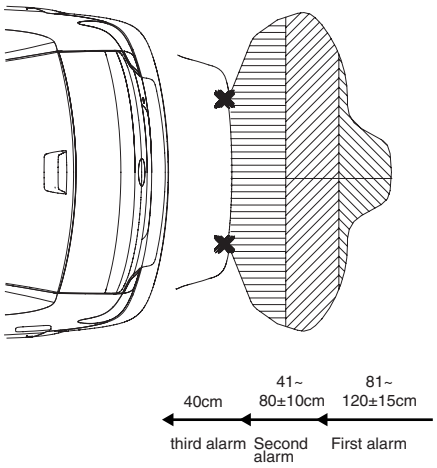
SENSOR DETECTION RANGE

[Vertical range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10Cm
2. Detection tolerance
   At 40cm :30˚ ± 20˚
   At 80cm : 15˚ ± 20˚
   At 120cm : 10˚ ± 20˚
3. At nearer distance than 40cm detection may occur.
4. Measurement condition : Room temperature (20℃), 90mm diameter, 3m 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 : 70˚ ± 20˚
   At 120cm : 20˚ ± 20˚
3. At nearer distance than 40Cm detection may occur.
4. Measurement condition : Room temperature (20℃), 90mm diameter, 3m length rod.

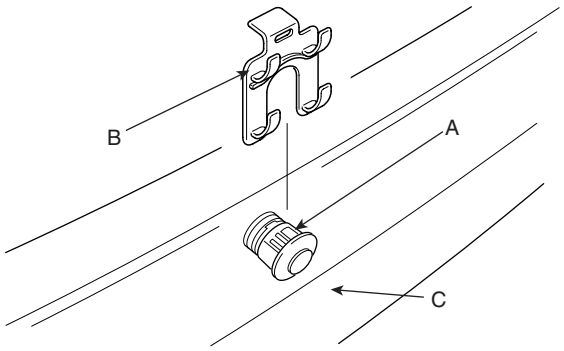
LTJF978A

NOTE

1. *14cm (Diameter) 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 (Diameter), 1m length.*

REPLACEMENT E37505F5

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper (Refer to the Body group - "Rear bumper")



LTJF762E

3. Disconnect the sensor connector at the inside of the rear bumper, and then pull the holder (B) up.
4. Remove the sensor (A) from the outside of rear bumper(C).
5. Installation is the reverse of removal procedure.

BUZZER

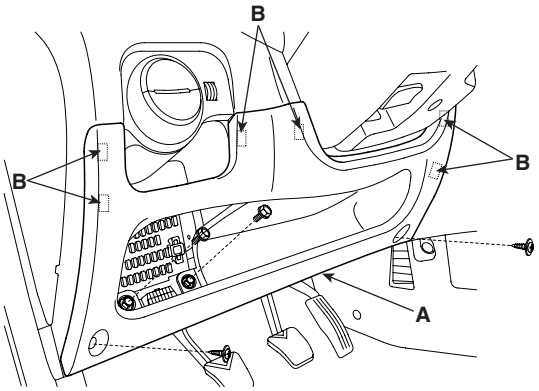
INSPECTION E4A86A2C

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.

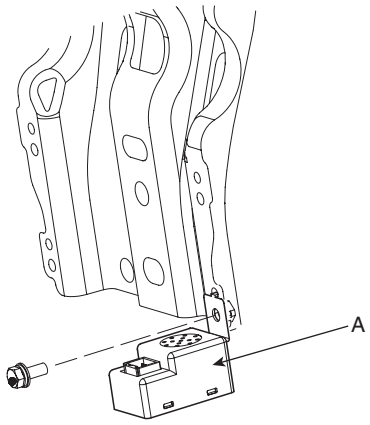
REPLACEMENT E6A35FCE

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel(A) (Refer to the Body group - crash pad). Take care of fixing clips(B).



LTJF141A

3. Remove the buzzer (A) after loosening the bolt and disconnecting the 2P connector from the next to the fuse box.



ATJF763A

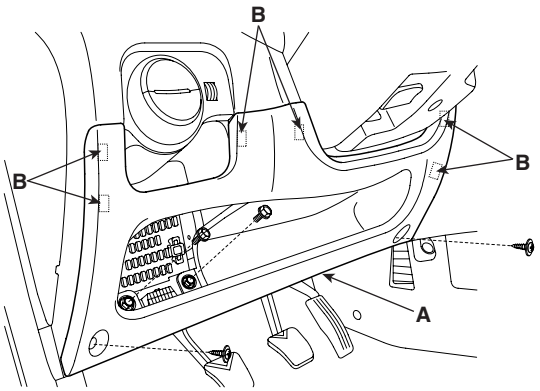
4. Installation is the reverse of removal procedure.

IGNITION SYSTEM

IGNITION SWITCH

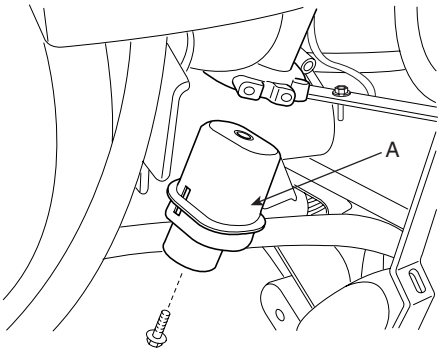
REPLACEMENT E7781AC0

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel(A) (Refer to the Body group - crash pad). Take care of fixing clips(B).



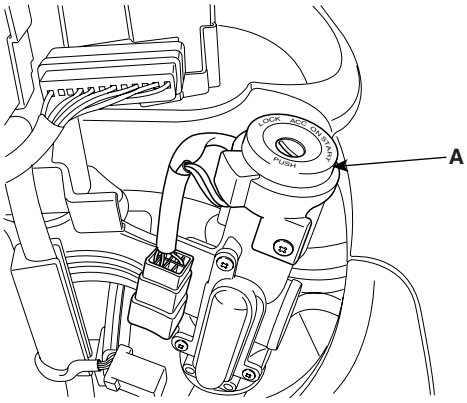
LTJF141A

3. Remove the ignition switch (A) after loosening the screw with IG ON and disconnecting the 6P connector.



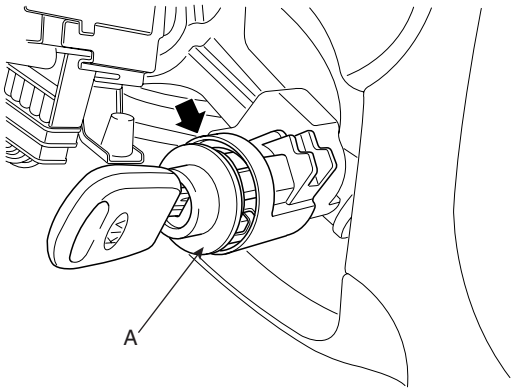
ATIE781A

4. Remove the steering column shaft (Refer to the ST group).
5. Remove the door warning switch after loosening the screws and disconnecting the 6P connector.



ATJF781B

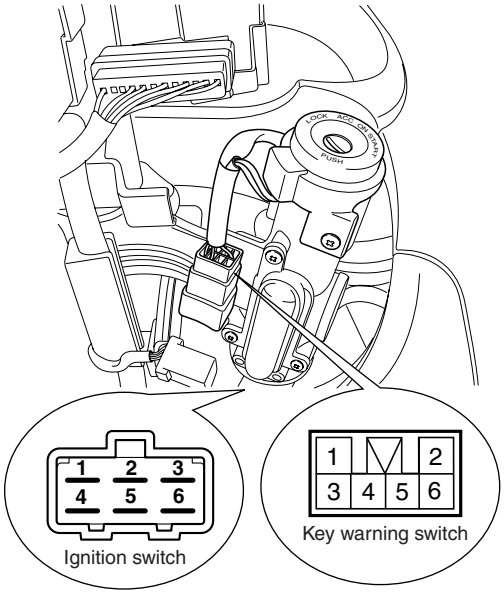
6. If it is necessary to remove the key lock cylinder (A), remove the key lock cylinder (A) after pushing lock pin with key ACC.



ATJF781C

7. Installation is the reverse of removal procedure.

INSPECTION E2AA9D57



LTJF781D

1. Disconnect the ignition switch connector and key warning switch connector 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 2	4	6	5	3	1	STEERING TRAVAL	TRAVAL	KEY WARNING SWITCH 5	6
LOCK	REMOVAL							LOCK			
	INSERT							LOCK	UNLOCK	○	○
ACC		○	○					UNLOCK			
ON		○	○	○	○	○					
START		○		○	○	○	○				

LTJF781E

Restraints

GENERAL

SUPPLEMENTAL RESTRAINTS SYSTEM CONTROL MODULE(SRSCM)
SRS CONTROL MODULE

AIR BAG MODULE (DRIVE SIDE)
AIR BAG MODULE AND CLOCK SPRING

AIR BAG MODULE (PASSENGER SIDE)
AIR BAG MODULE

AIR BAG MODULE (SIDE AIR BAG)
AIR BAG MODULE

AIR BAG MODULE (CURTAIN AIR BAG)
AIR BAG MODULE

SEAT BELT PRETENSIONER
SEAT BELT PRETENSIONER

SRS CONTROL SYSTEM
FRONT IMPACT SENSOR (FIS)
SIDE IMPACT SENSOR (SIS)

TROUBLESHOOTING

AIR BAG MODULE DISPOSAL

GENERAL

GENERAL E53BEEC8

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 driver and passenger 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. Safety sensor: Safety sensor is located in airbag ignition circuit. Safety sensor will operate airbag circuit at any deployment condition and release airbag circuit safely at normal driving condition. Safety sensor is a double contact electro-mechanical switch that will close detecting deceleration above certain criteria.

3. 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.

4. 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)

5. 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.

6. 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 thefault clearing should not happen.

7. 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.

8. Once airbag is deployed, SRSCM should not be used again but replaced.

9. SRSCM will determine whether passenger put on seat belt by the signal from built-in switch in seat belt buckle, and deploy front seat airbag at each set crash speed.

10. Side airbag deployment will be determined by SRSCM that will detect satellite sensor impact signal upon side crash, irrespective to seat belt condition.

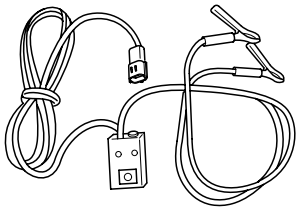
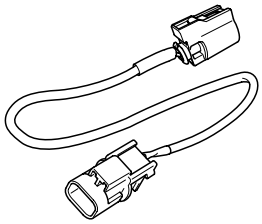
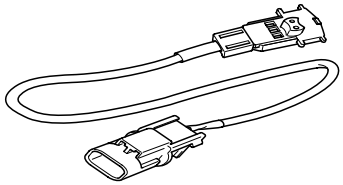
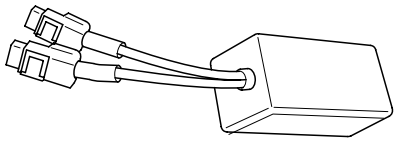
SPECIFICATION ED1EE56F

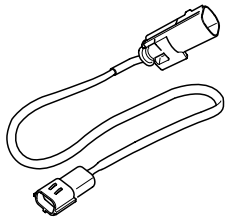
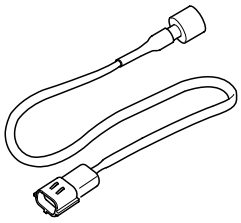
Item	Resistance (Ω)
Driver Airbag (DAB)	Gasoline : 1.925 ~ 3.074 Diesel : 2.025 ~ 2.974
Passenger Airbag (PAB)	1.878 ~ 2.442
Driver Side Airbag (DSAB)	1.804 ~ 2.568
Passenger Side Airbag (PSAB)	1.812 ~ 2.576
Driver Curtain Airbag (DCAB)	1.940 ~ 2.704
Passenger Curtain Airbag (PCAB)	1.948 ~ 2.712
Driver Seat Belt Pretensioner (BPT)	1.943 ~ 2.806
Passenger Seat Belt Pretensioner (BPT)	1.950 ~ 2.814

TIGHTENING TORQUES E3E794CE

Item	kgf·m	Nm	lb-ft
Driver Airbag (DAB)	0.8 ~ 1.1	7.9 ~ 10.8	5.8 ~ 8.0
Passenger Airbag (PAB)	Bolt : 0.9 ~ 1.4 Nut : 0.4 ~ 0.7	8.8 ~ 13.7 3.9 ~ 6.9	6.5 ~ 10.1 2.9 ~ 5.1
Curtain Airbag (CAB)	0.5 ~ 0.7	4.9 ~ 6.9	3.6 ~ 5.1
Side Airbag (SAB)	0.5 ~ 0.7	4.9 ~ 6.9	3.6 ~ 5.1
Seat Belt Anchor Bolt (BPT)	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
SRSCM Mounting Bolt	1.0 ~ 1.4	9.5 ~ 13.5	7.0 ~ 10.0
Front Impact Sensor (FIS) Mounting Bolt	1.0 ~ 1.4	9.5 ~ 13.5	7.0 ~ 10.0
Side Impact Sensor (SIS) Mounting Bolt	1.0 ~ 1.4	9.5 ~ 13.5	7.0 ~ 10.0

SPECIAL SERVICE TOOLS E1FD4ED4

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A	 ARIE500A	Airbag deployment tool
Deployment adapter 0957A-3F100	 ERKD001F	Use with deployment tool. (SAB)
Deployment adapter 0957A-38500	 ARIE500C	Use with deployment tool. (DAB, PAB, CAB, BPT)
Dummy 0957A-38200	 ARIE500D	Simulator to check the resistance of each wiring harness

Tool(Number and Name)	Illustration	Use
Dummy adapter 0957A-3F000	 ERKD001G	Use with dummy (PAB, SAB)
Dummy adapter 0957A-1C000	 ARIE500F	Use with dummy (DAB, CAB, BPT)

DAB : Driver Airbag
PAB : Passenger Airbag
SAB : Side Airbag
CAB : Curtain Airbag
BPT : Belt Pretensioner

PRECAUTIONS E49A2A46

GENERAL PRECAUTIONS

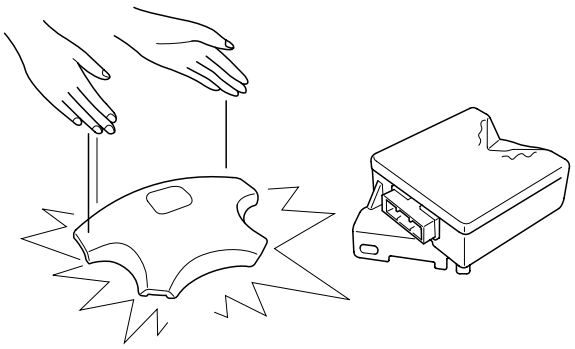
Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

- 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 is 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.



ERKD002V

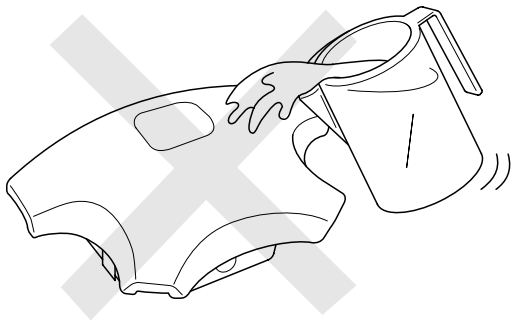
- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

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.



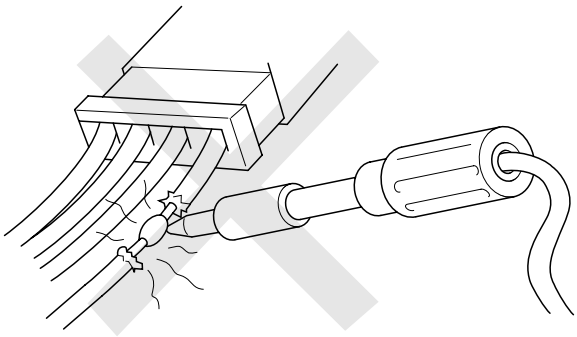
ERKD002Z

- 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 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. The airbags could accidentally deploy and cause damage or injury.
- After a collision in which the airbags were deployed, replace the front airbags and the SRS unit. After a collision in which the side airbag was deployed, replace the side airbag, the front impact sensor and side impact sensor on the side where the side airbag deployed and the SRS unit. 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 (less than 40°C/104°F) and dry (less than 80% relative humidity, no moisture) area.

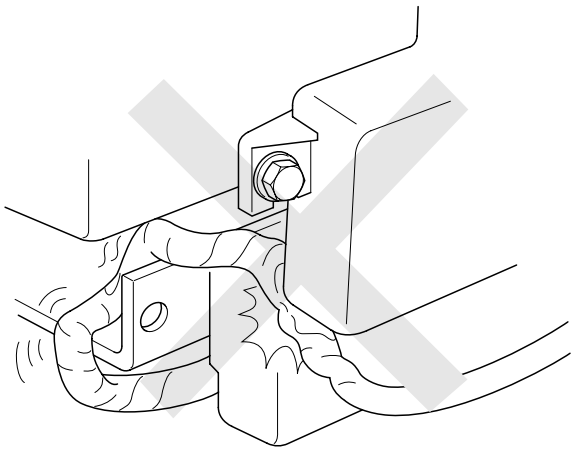
WIRING PRECAUTIONS

SRS wiring can be identified by special yellow outer covering (except the SRS circuits under the front seats).
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.



ERKD002Y

- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.

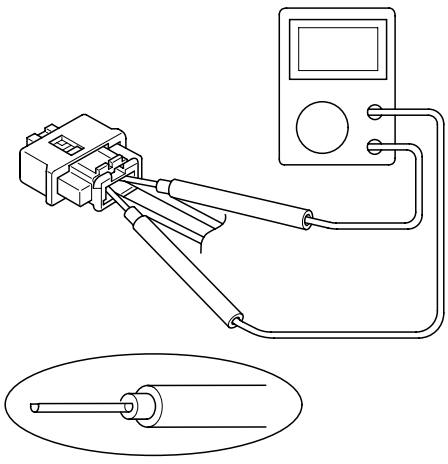


ERKD002X

- 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.



ERKD002W

- Use a u-shaped probe. Do not insert the probe forcibly.

- Use specificed service connectors for troubleshooting.
  Using improper tools could cause an error in inspection due to poor metal contact.

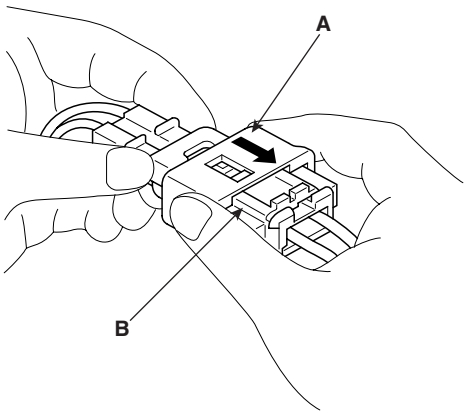
SPRING-LOADED LOCK CONNECTOR

Some SRS system connectors have a spring-loaded lock.

AIRBAG CONNECTOR(I)

DISCONNECTING

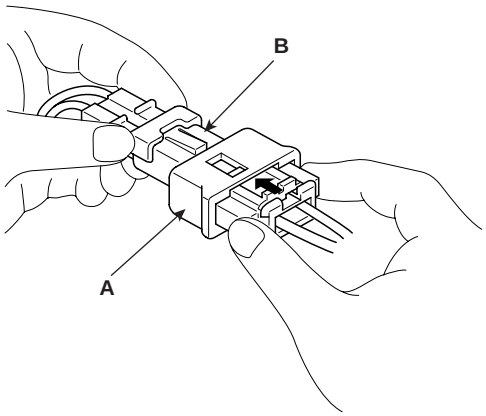
To release the lock, pull the spring-loaded sleeve (A) toward the stop (B) while holding the opposite half of the connector. Then pull the connector halves apart. Be sure to pull on the sleeve and not on the connector half.



ERKD511A

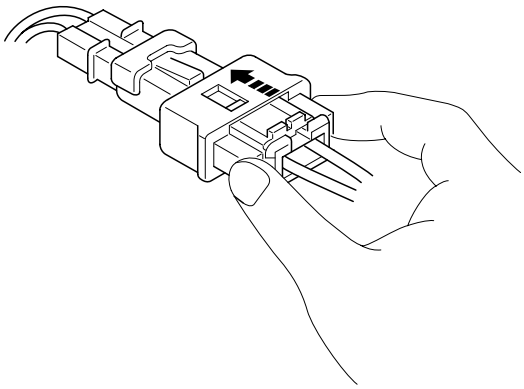
CONNECTING

1. To reconnect, hold the pawl-side connector half, and press on the back of the sleeve-side connector half in the direction shown. As the two connector halves are pressed together, the sleeve (A) is pushed back by the pawl (C). Do not touch the sleeve.



ERRF501P

2. When the connector halves are completely connected, the pawl is released, and the spring-loaded sleeve locks the connector.

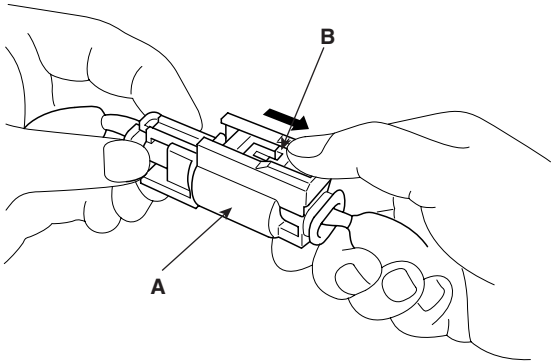


ERKD511C

AIRBAG CONNECTOR(II)

DISCONNECTING

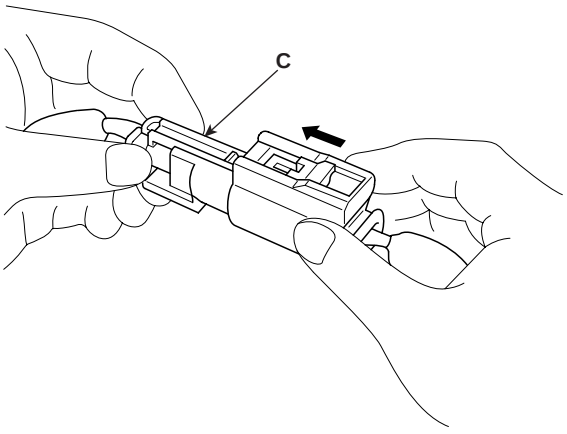
To release the lock, pull the spring-loaded sleeve (A) and the slider (B), while holding the opposite half of the connector. Pull the connector halves apart. Be sure to pull on the sleeve and not on the connector half.



ERKD511D

CONNECTING

Hold both connector halves and press firmly until the projection (C) of the sleeve-side connector clicks to lock.



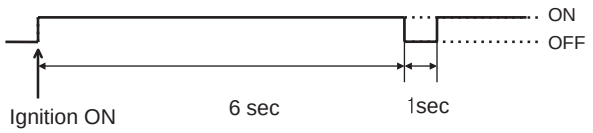
ERKD511E

WARNING LAMP ACTIVATION ED503A8B

WARNING LAMP BEHAVIOR AFTER IGNITION ON

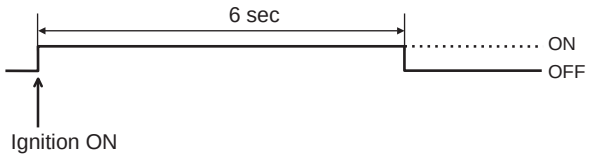
As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.
The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward. However, in order to indicate the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.

1. Active fault or historical fault counter is greater or equal to 10



BRIF500A

2. Normal or historical fault counter is less than 10



BRIF500B

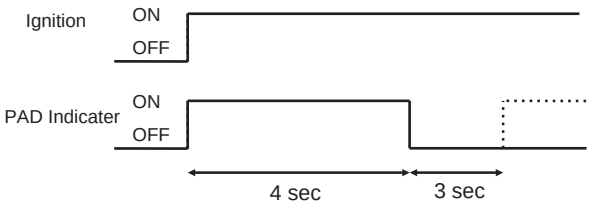
SRSCM INDEPENDENT WARNING LAMP ACTIVATION

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 SRSCM operation : warning lamp turned on continuously.
4. SRSCM not connected : warning lamp turned on continuously through the shorting bar.

PASSENGER AIRBAG DEACTIVATION (PAD) LAMP OPERATION

The SRSCM is designed with circuitry and software to drive a PAD lamp, which is used for depowered airbag system. For the PAD indicator circuitry to function properly, both the SRSCM and PAD indicator are sourced from the same ignition line. After ignition on, the PAD indicator will be turned on for 4 seconds and off for 3 seconds during the initialization phase. Thereafter the lamp will be turned on as long as the PAD switch is in the disabled position.



ERRF501U

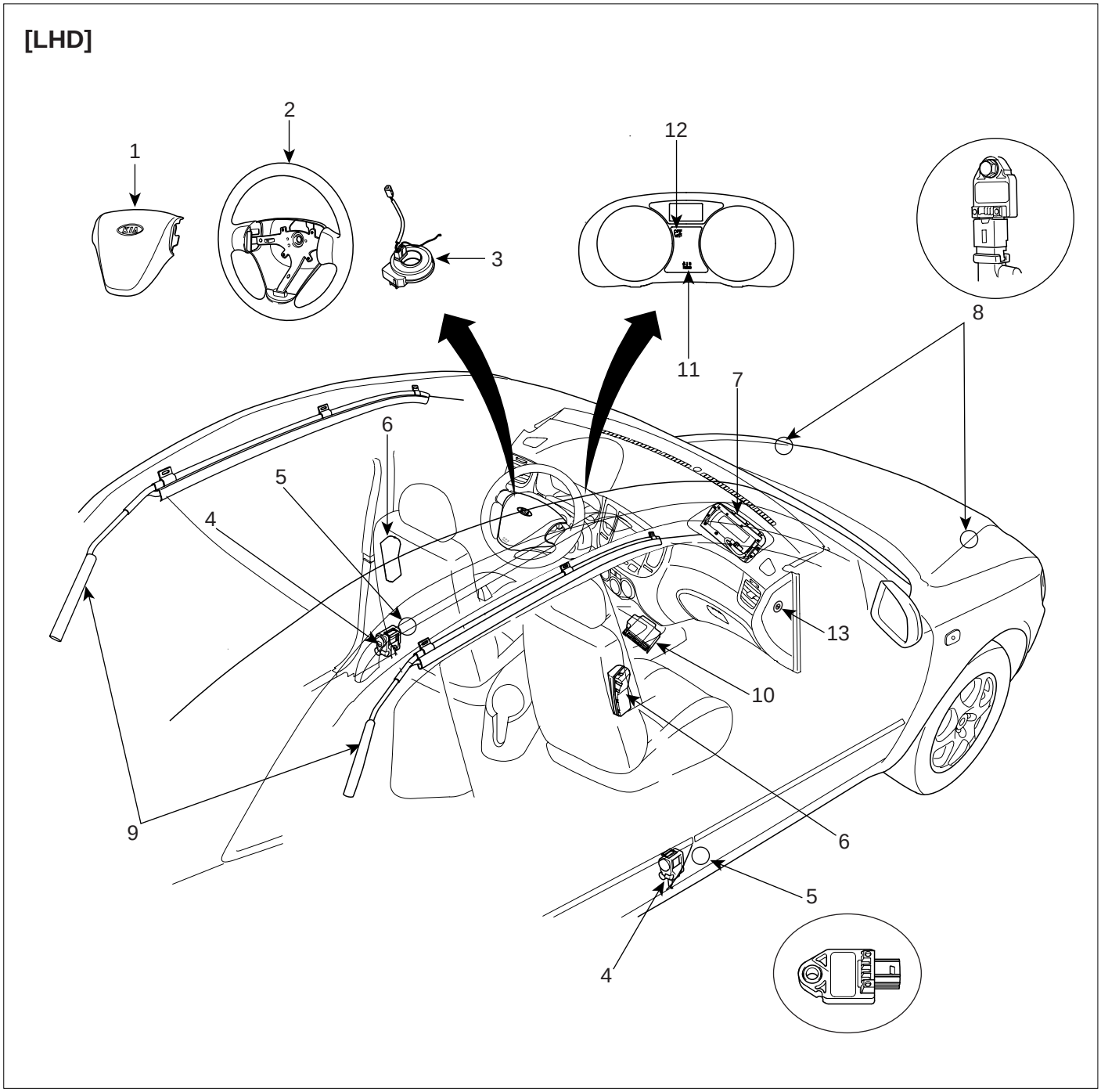
PASSENGER RESTRAINTS ACTIVATION WITH PAD SWITCH

The PAD switch affects the activation of the front passenger airbag only and the switch is controlled manually. The PAD switch will be functioned as follows:

PAD Switch status	PAD Lamp	PAB
Phase-up	ON → OFF	Default
Enabled position	OFF	Enable
Disabled position	ON	Disable
Fault	Based on PAB	Default

COMPONENTS E63D1ECA

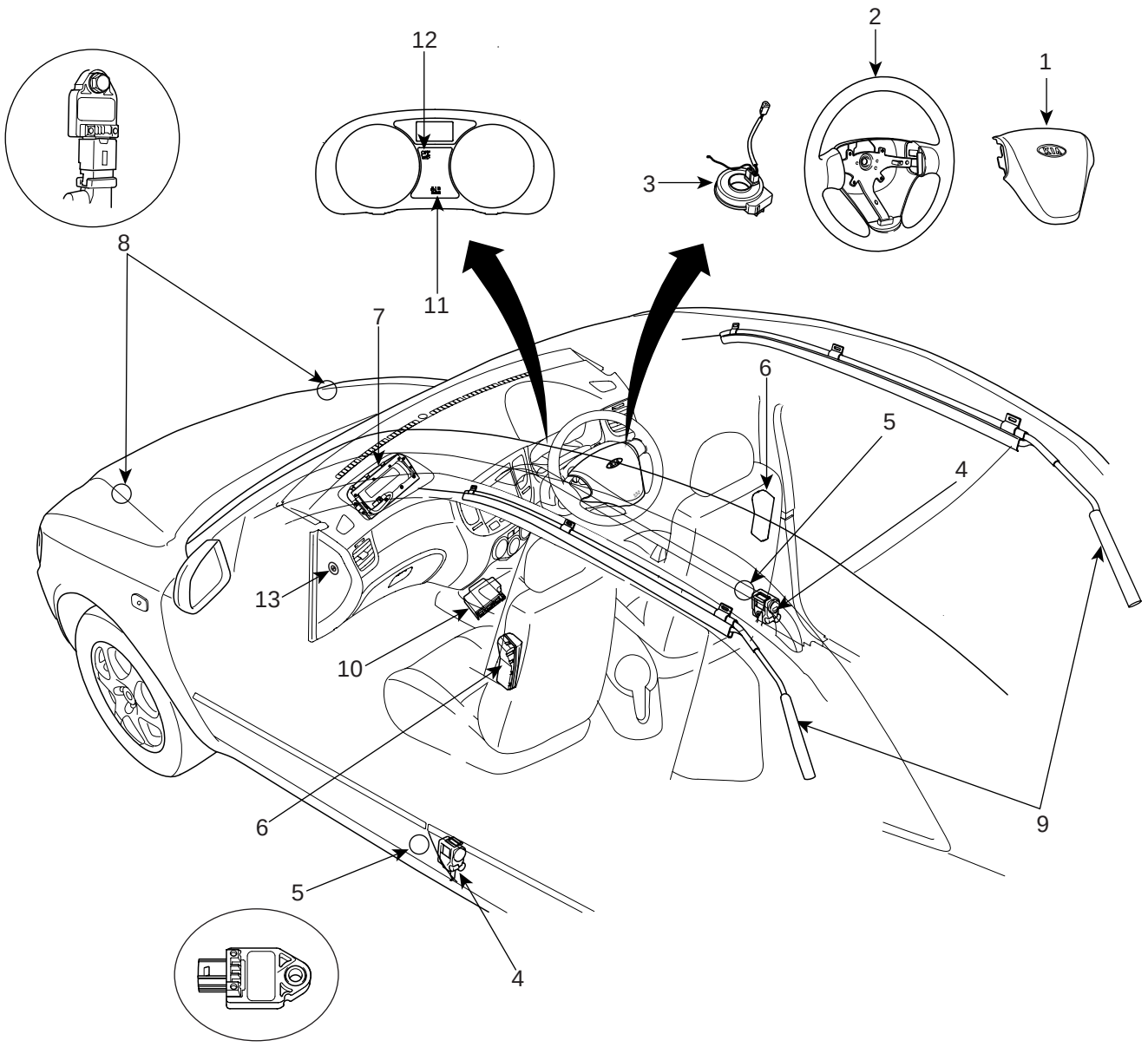
[LHD]



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. Passenger Airbag Deactivation (PAD) Lamp
13. PAD Switch

LRJF500A

[RHD]



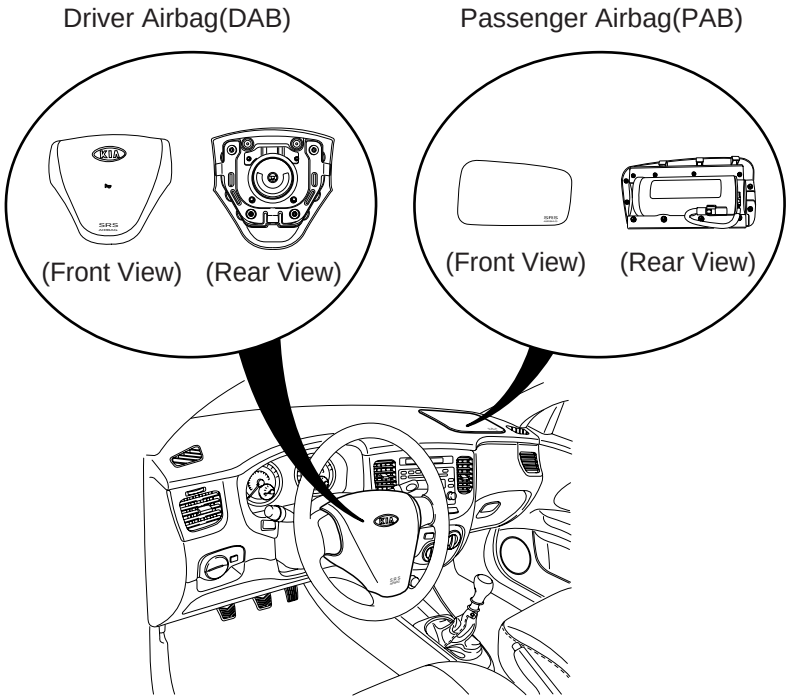
1. Driver Airbag (DAB)
2. Steering Wheel
3. Clock Spring
4. Seat Belt Pretensioner (BPT)
5. Side Impact Sensor (SIS)
6. Side Airbag (SAB)
7. Passenger Airbag (PAB)
8. Front Impact Sensor (FIS)
9. Curtain Airbag (CAB)
10. Supplemental Restraint System Control Module(SRSCM)
11. Airbag Warning Lamp
12. Passenger Airbag Deactivation (PAD) Lamp
13. PAD Switch

LRJF510A

COMPONENTS LOCATION

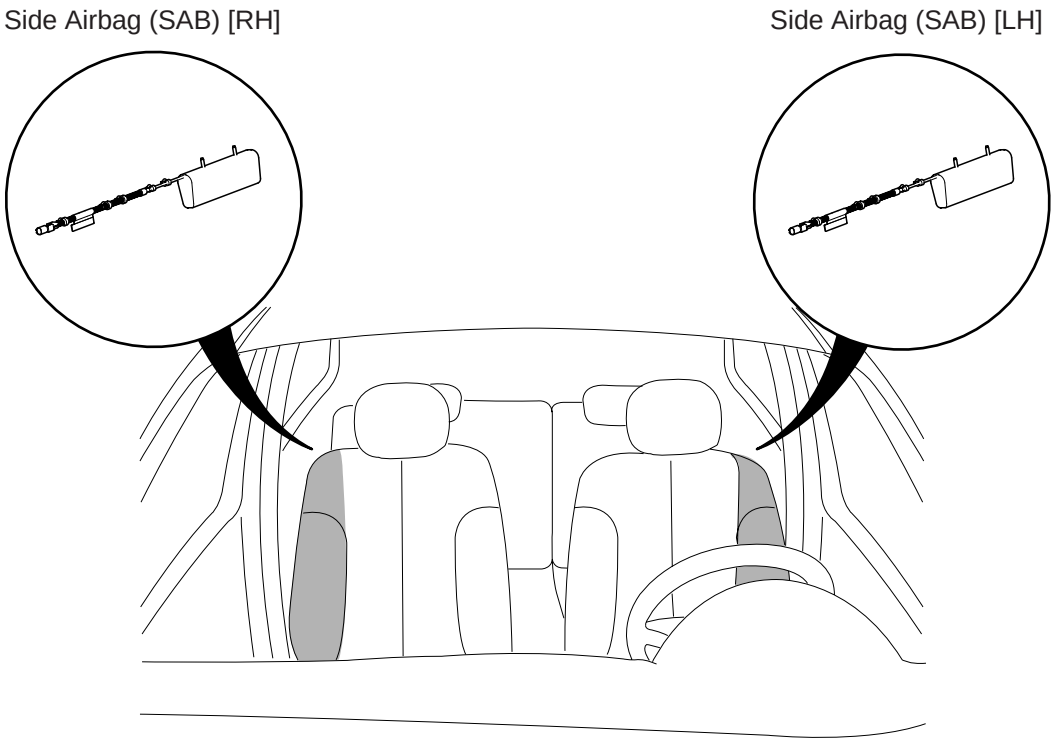
DRIVER AIRBAG(DAB) / PASSENGER AIRBAG(PAB)

This illustration is shown the LHD type.
RHD type is symmetrical.



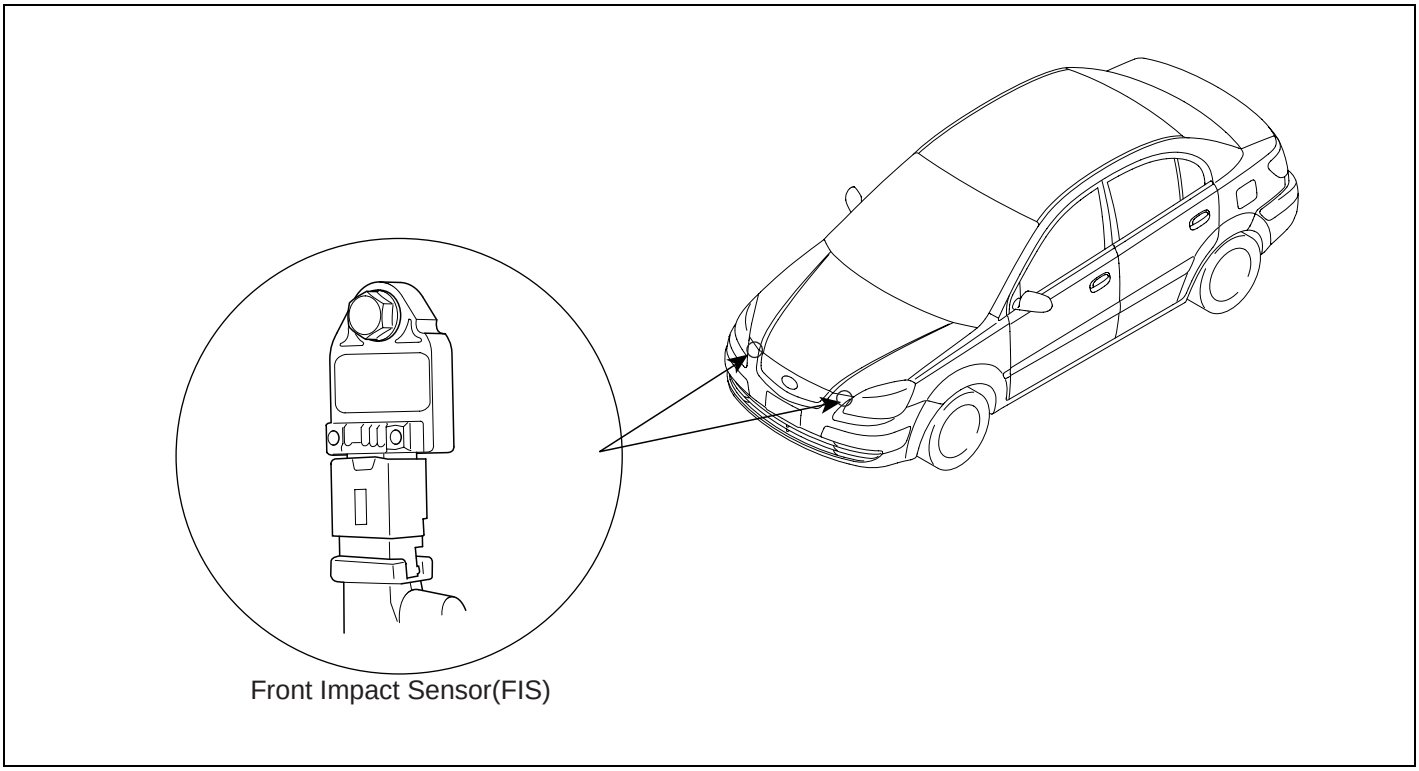
LRJF500B

SIDE AIRBAG (SAB)



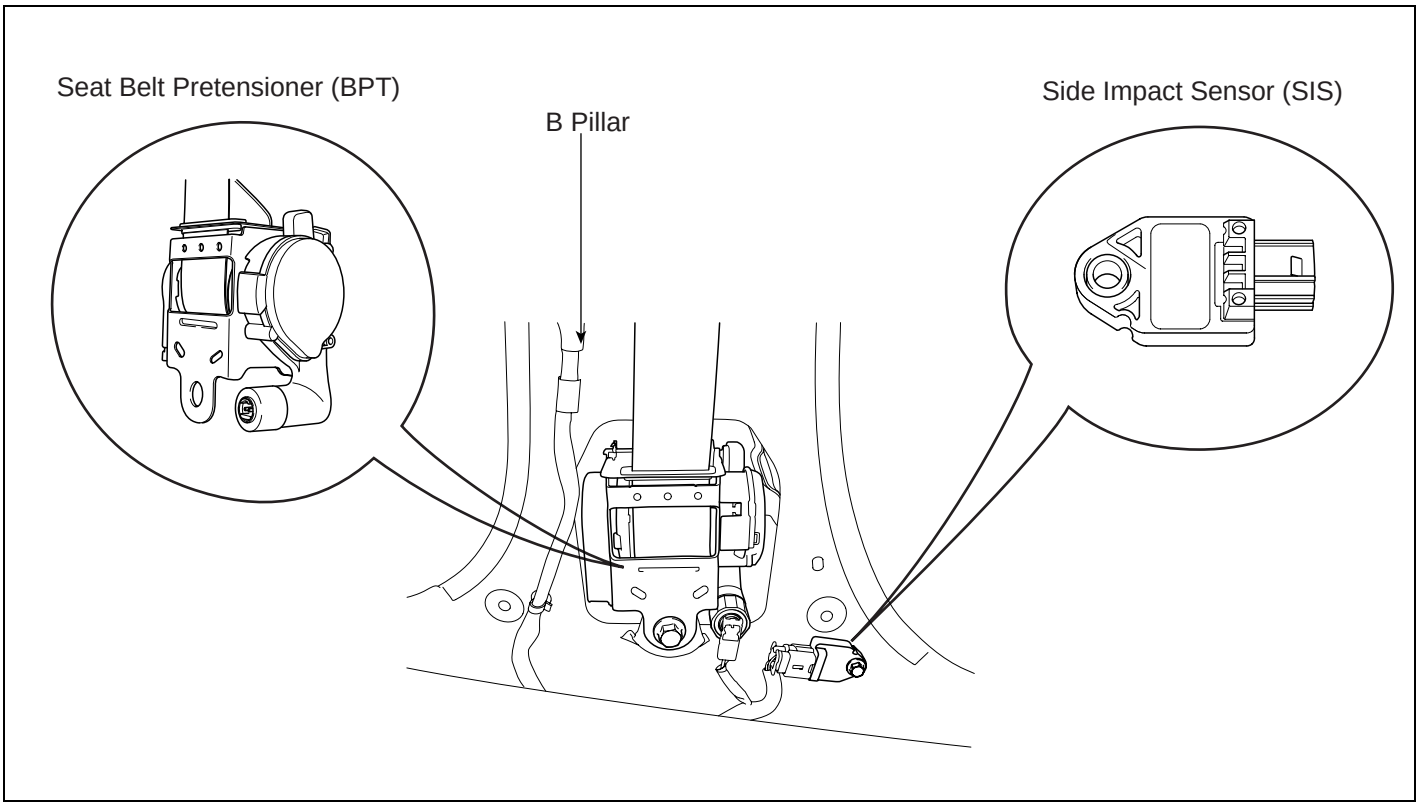
LRJF500C

FRONT IMPACT SENSOR(FIS)



LRJF500D

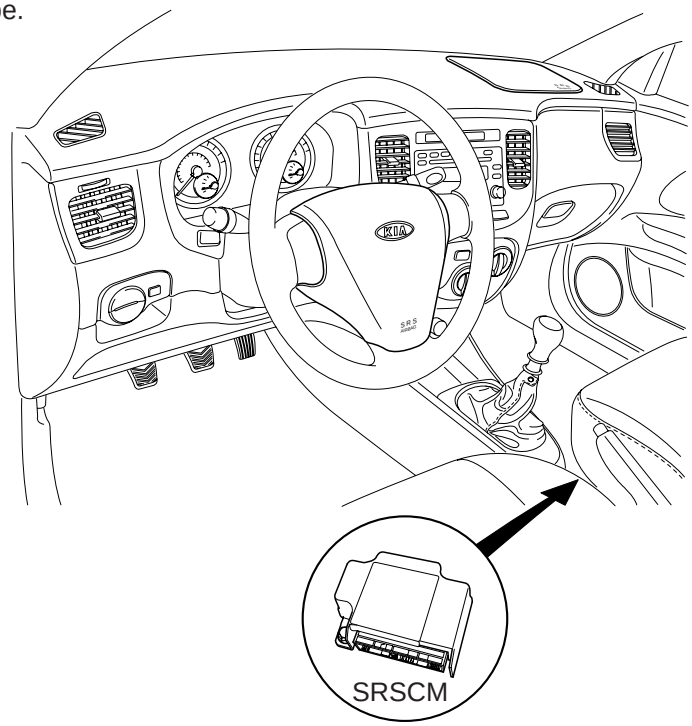
SEAT BELT PRETENSIONER(BPT) / SIDE IMPACT SENSOR(SIS)



LRJF500E

SUPPLEMENTAL RESTRAIN SYSTEM CONTROL MODULE(SRSCM)

This illustration is shown the LHD type.
RHD type is symmetrical.



LRJF500W

COMPONENT REPLACEMENT AFTER DEPLOYMENT

NOTE

Before doing any SRS repairs, use the Hi-Scan Pro 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
- Clock spring (when Driver Airbag deployed)

When the seat belt pretensioner(s) deployed after a collision, replace the following items.
- Seat belt pretensioner(s)
- SRSCM (if B1658 detected)
- Front impact sensors
- SRS wiring harnesses

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.

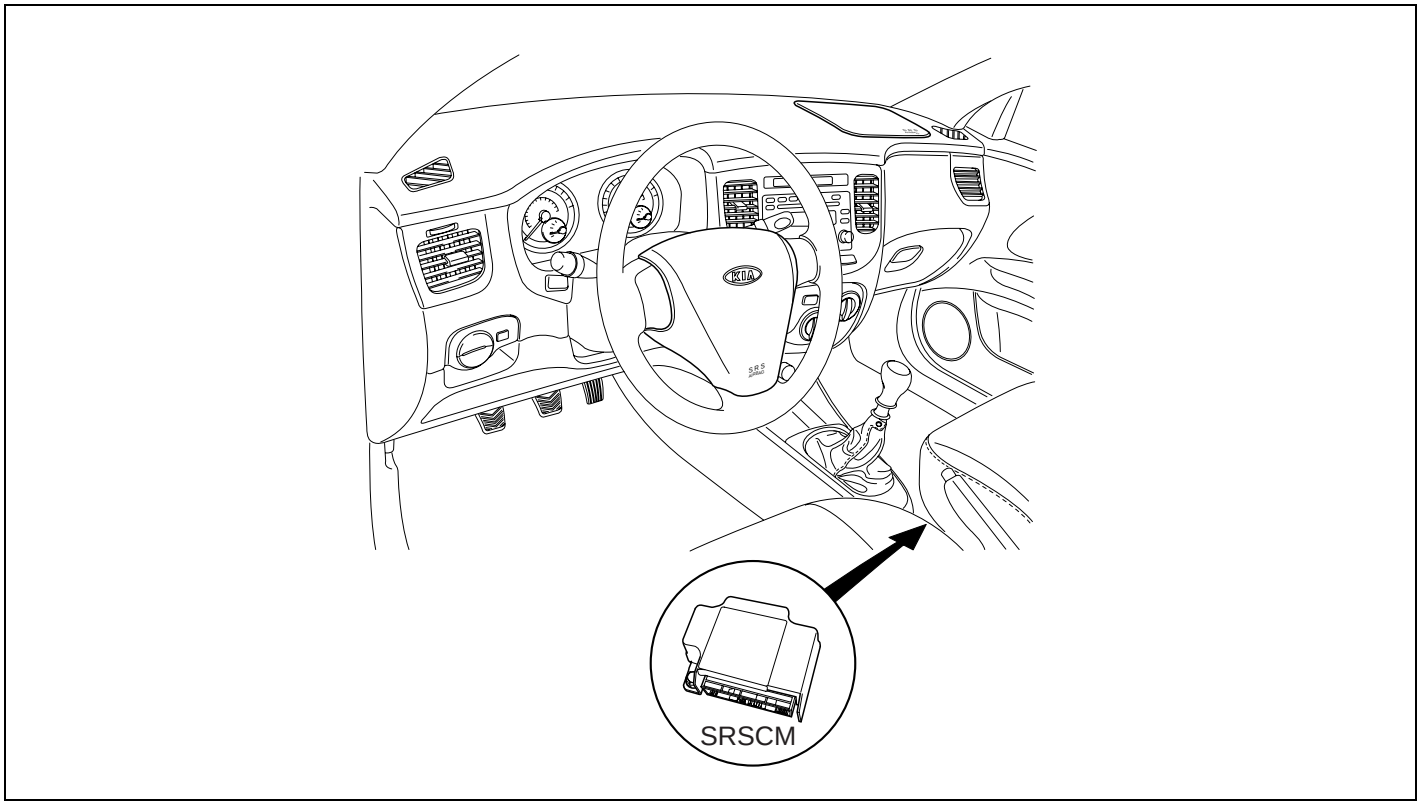
SUPPLEMENTAL RESTRAINTS SYSTEM CONTROL MODULE(SRSCM)

SRS CONTROL MODULE

DESCRIPTION EADBFC43

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 restrain 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 2 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.

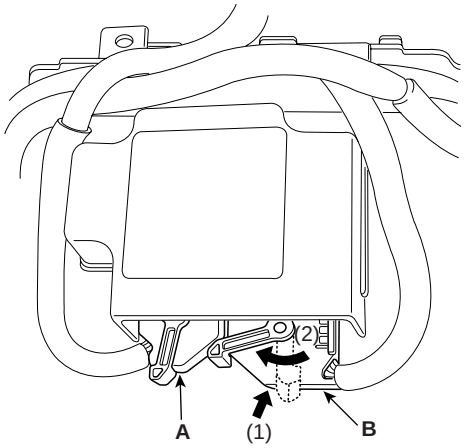
COMPONENTS EAF3C3C7



ARJF101F

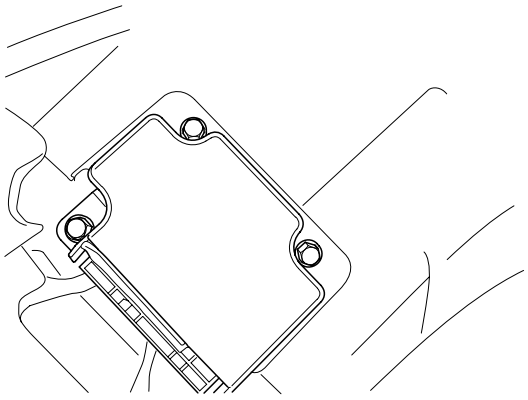
REMOVAL E1DA6328

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Disconnect the DAB, PAB, SAB, CAB and BPT connectors.
4. Remove the floor console. (Refer to BD group)
5. Press the lock(1), then pull back the connector lever(2) until it clicks.



ARJF101G

6. Disconnect the SRSCM harness connector(A) and (B) from the SRSCM.
7. Remove the SRSCM mounting bolts from the SRSCM, then remove the SRSCM.



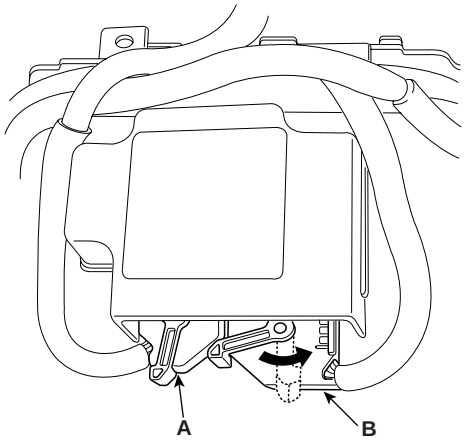
ARJF101H

INSTALLATION EAE7ED57

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Install the SRSCM with the SRSCM mounting bolts.

Tightening Torque (SRSCM Mounting Bolt)
: 1.0 ~ 1.4 kgf.m (9.5 ~ 13.5 Nm, 7.0 ~ 10.0 lb.ft)

4. Connect the SRSCM harness connector.



ARJF101I

5. Install the floor console. (Refer to BD group)
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:
   - Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

AIR BAG MODULE (DRIVE SIDE)

AIR BAG MODULE AND CLOCK SPRING

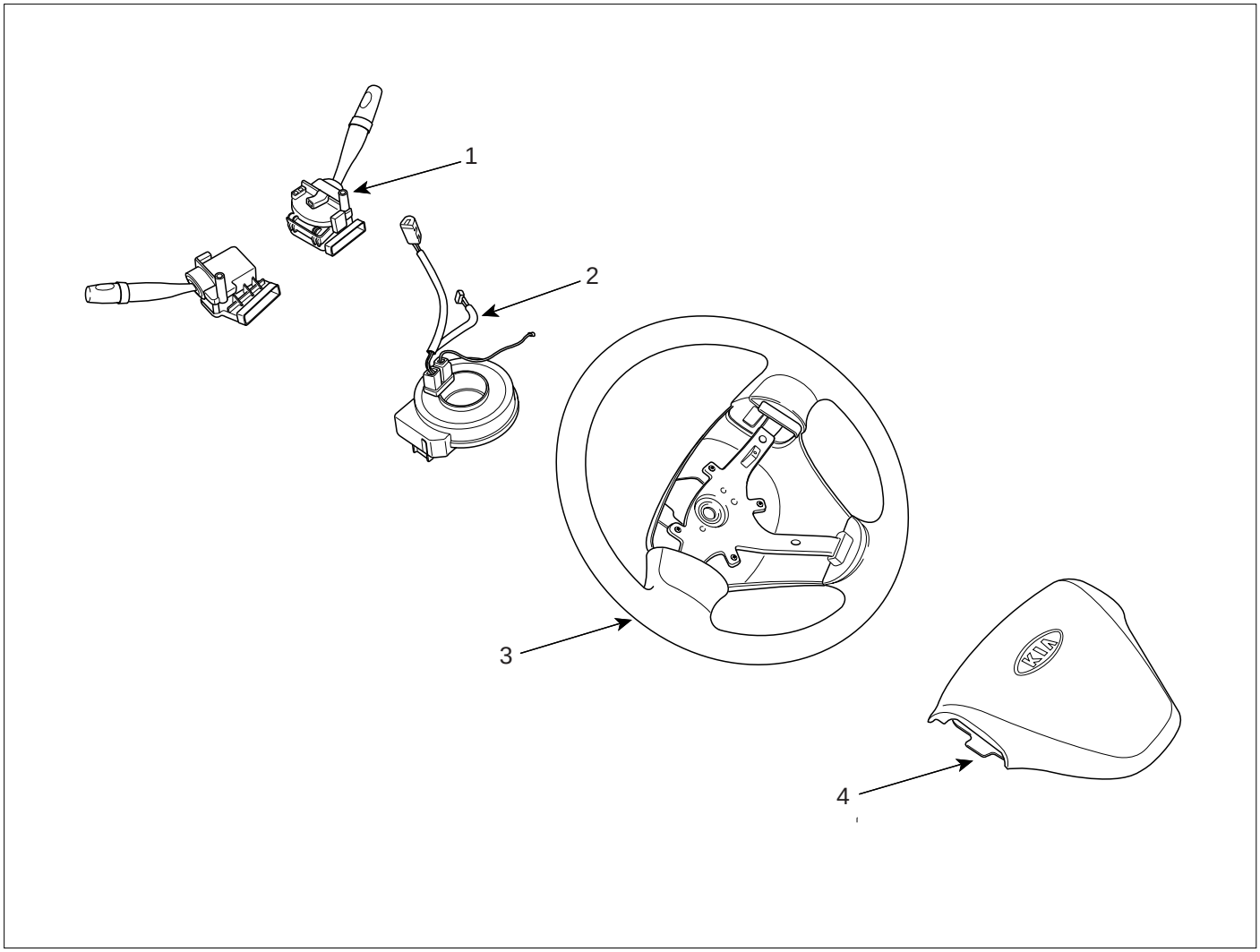
DESCRIPTION E8E2BE76

Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clockspring. 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.

COMPONENTS EEB9DC7E

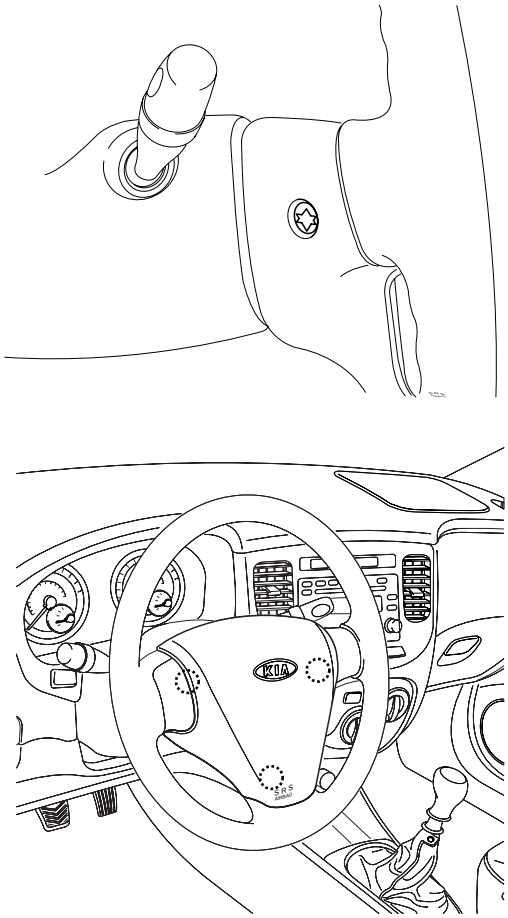


1. Multi-Function Switch
2. Clock Spring
3. Steering Wheel
4. Driver Airbag (DAB)

LRJF500F

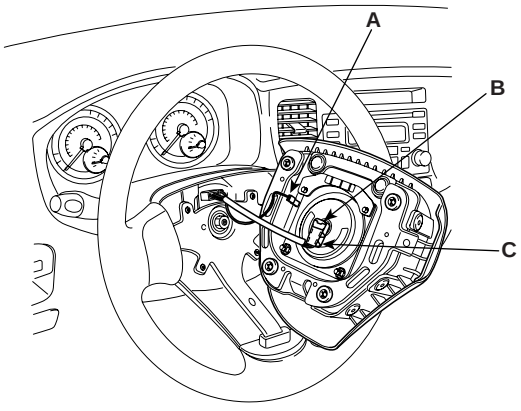
REMOVAL EAAD3AFB

1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. Remove the three airbag module mounting bolts.



ARJF102B

3. Disconnect the horn connector(A).



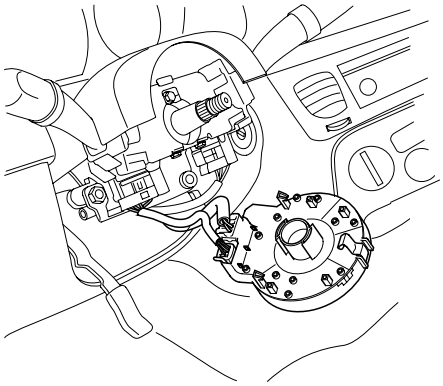
ARJF102C

4. Release the connector locking pin(B), then disconnect the driver airbag module connector(C).

⚠ *CAUTION*

The removed airbag module should be stored in a clean, dry place with the pad cover face up.

5. Remove the steering wheel and steering wheel column cover(Refer to ST group in the Workshop Manual).
6. Disconnect the clock spring and horn connector, then remove the clock spring.



ARJF102F

INSPECTION E19BBC8A

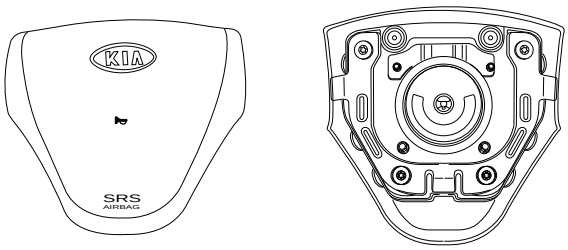
DRIVER AIRBAG (DAB)

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.



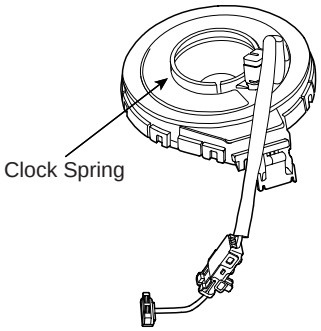
(Front View) (Rear View)

LRJF500X

5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

CLOCKSPRING

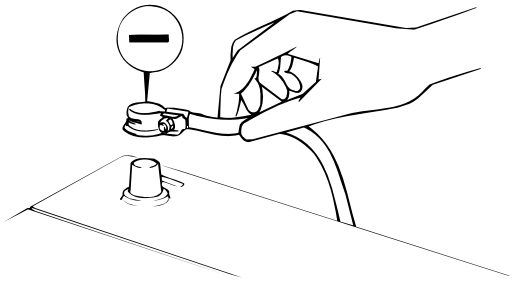
1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
2. Check connectors and protective tube for damage, and terminals for deformities.



LRJF500J

INSTALLATION E8EC387B

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.



ARCD512A

2. Remove ignition key from the vehicle.
3. Connect the clock spring harness connetor and horn harness connector to the clock spring.
4. Set the clock spring on neutral position and after turning the front wheels to the straight-ahead position, install the clock spring.
5. Install the steering wheel column cover and the steering wheel. (Refer to ST group)
6. Connect the Driver Airbag (DAB) module connector and horn connector, then install the Driver Airbag (DAB) module on the steering wheel.
7. Secure the Driver Airbag (DAB) with the new mounting bolts.

Tightening Torque (DAB Mounting Bolt)
: 0.8 ~ 1.1 Kgf.m (7.9 ~ 10.8 Nm, 5.8 ~ 8.0 lb.ft)

8. Connect the battery negative cable.
9. After installing the airbag, confirm proper system operation:
   - Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
   - Make sure horn button works.

AIR BAG MODULE (PASSENGER SIDE)

AIR BAG MODULE

DESCRIPTION EB10F6ED

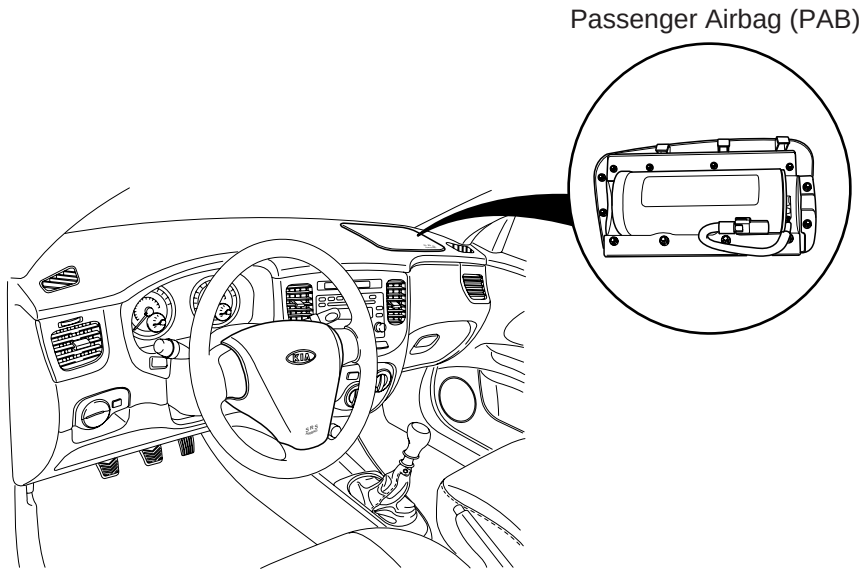
The passenger Airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

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.

COMPONENTS ECB38876

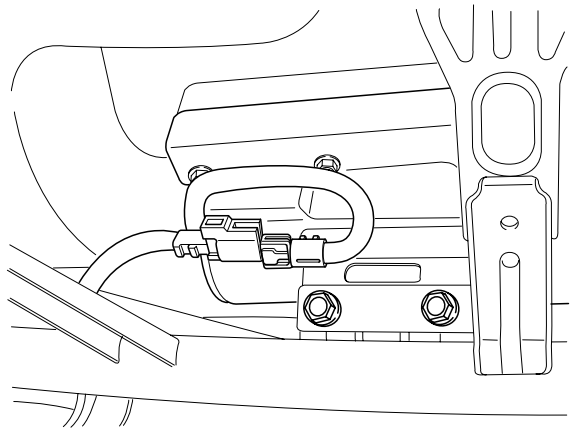
This illustration is shown the LHD type.
RHD type is symmetrical.



LRJF500G

REMOVAL ECBAEDE2

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box. (Refer to BD group)
3. Disconnect the PAB connector and remove the PAB mounting bolts.

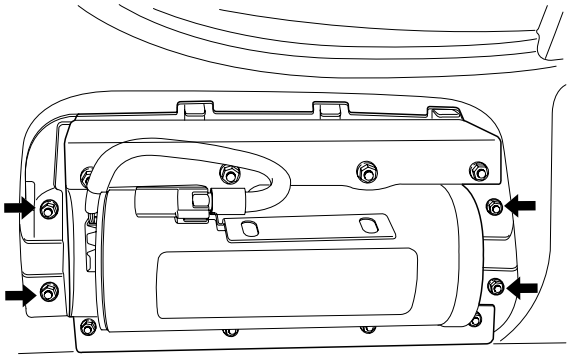


LRJF510G

4. Remove the crash pad. (Refer to BD group)
5. Remove the mounting nuts from the crash pad. Then remove the passenger airbag.

CAUTION

The removed airbag module should be stored in a clean, dry place with the pad cover face up.



LRJF510B

INSTALLATION E268A93D

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Place a Passenger Airbag (PAB) on the crash pad and tighten the Passenger Airbag (PAB) mounting nuts.

Tightening Torque
: 0.4 ~ 0.7 Kgf.m (3.9 ~ 6.9 N.m, 2.9 ~ 5.1 lb.ft)

4. Install the crash pad. (Refer to BD group)
5. Tighten the PAB mounting bolts.

Tightening Torque
: 0.9 ~ 1.4 Kgf.m (8.8 ~ 13.7 N.m, 6.5 ~ 10.1 lb.ft)

6. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
7. Reinstall the glove box. (Refer to BD group)
8. Reconnect the battery negative cable.
9. After installing the Passenger Airbag (PAB), confirm proper system operation:
   - Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

AIR BAG MODULE (SIDE AIR BAG)

AIR BAG MODULE

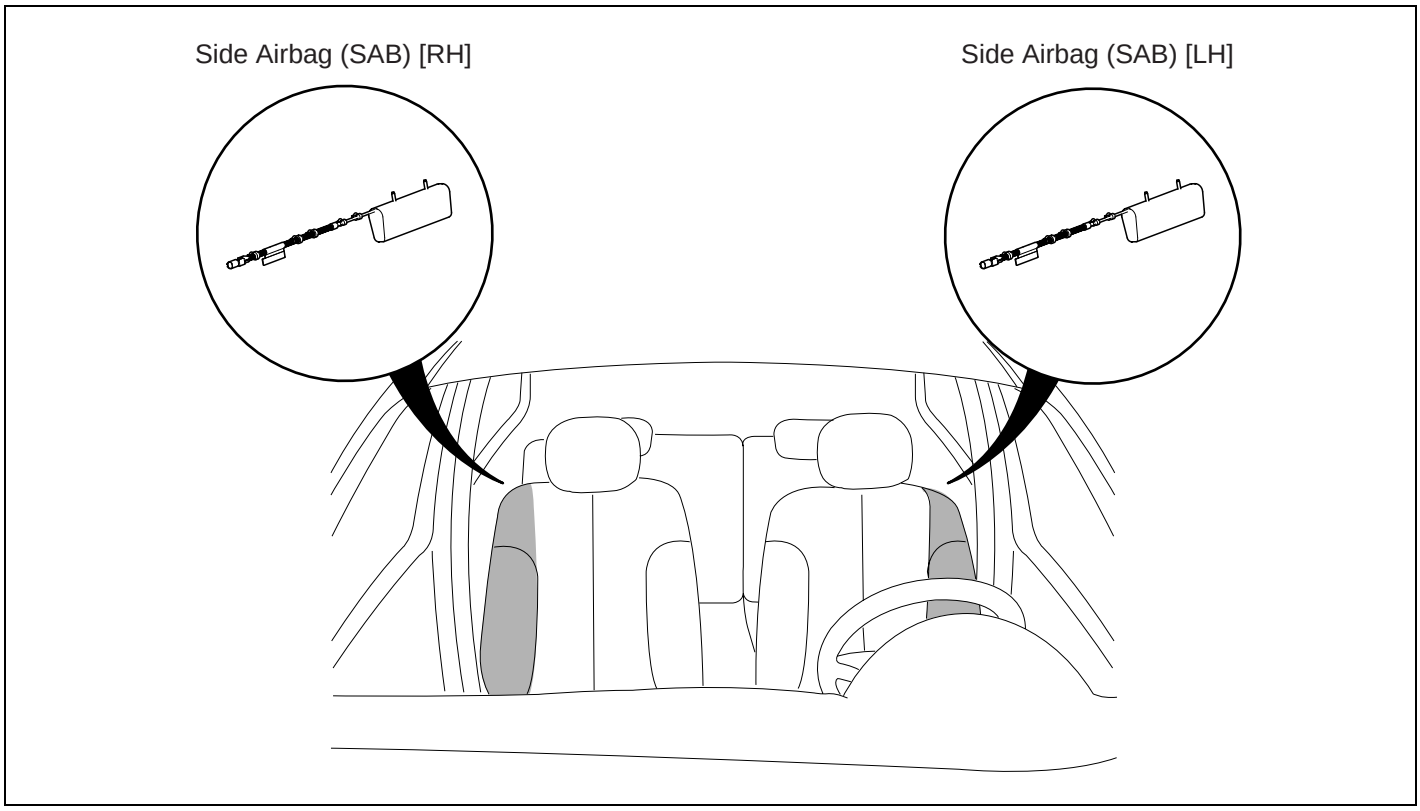
DESCRIPTION EBC04CAB

The two Side Airbags (SAB) are installed inside the driver and passenger seat and protects 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.

COMPONENTS EC8FBBFE



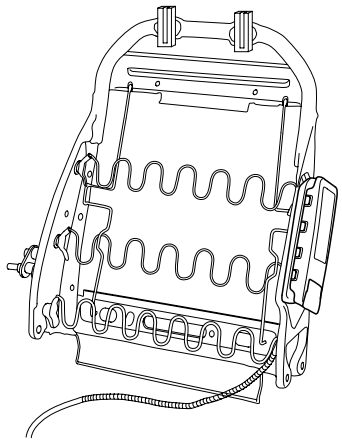
LRJF500C

REMOVAL EC1A53CE

1. Disconnect the battery negative cable and wait at least 3 minutes before beginning work.
2. Remove the front seat assambly.(Refer to BD group)
3. Remove the seat-back cover.(Refer to BD group)
4. Loosen the SAB mounting nuts and remove the SAB module.

CAUTION

The removed airbag module should be stored in a clean, dry place with the pad cover face up.



ARJF104A

INSTALLATION E50BC442

CAUTION

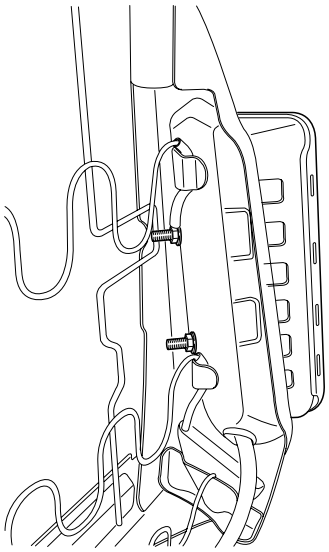
Be sure to install the harness wires not to be pinched or interfered with other parts.

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 seat-back cover is installed properly. Improper installation may prevent the proper deployment.*

1. Disconnect the battery negative cable and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Place a Side Airbag (SAB) on the seat-back frame and tighten the side airbag mounting nuts.

Tightening torque
: 0.5 ~ 0.7 Kgf.m (4.9 ~ 6.9 Nm, 3.6 ~ 5.1 lb.ft)



ARJF104B

4. Install the new seat-back cover.(Refer to BD group)
5. Install the seat assembly, 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 or interfering with other parts.
7. Reconnect the battery negative cable.
8. After installing the Side Airbag (SAB), confirm proper system operation:
   - Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

AIR BAG MODULE (CURTAIN AIR BAG)

AIR BAG MODULE

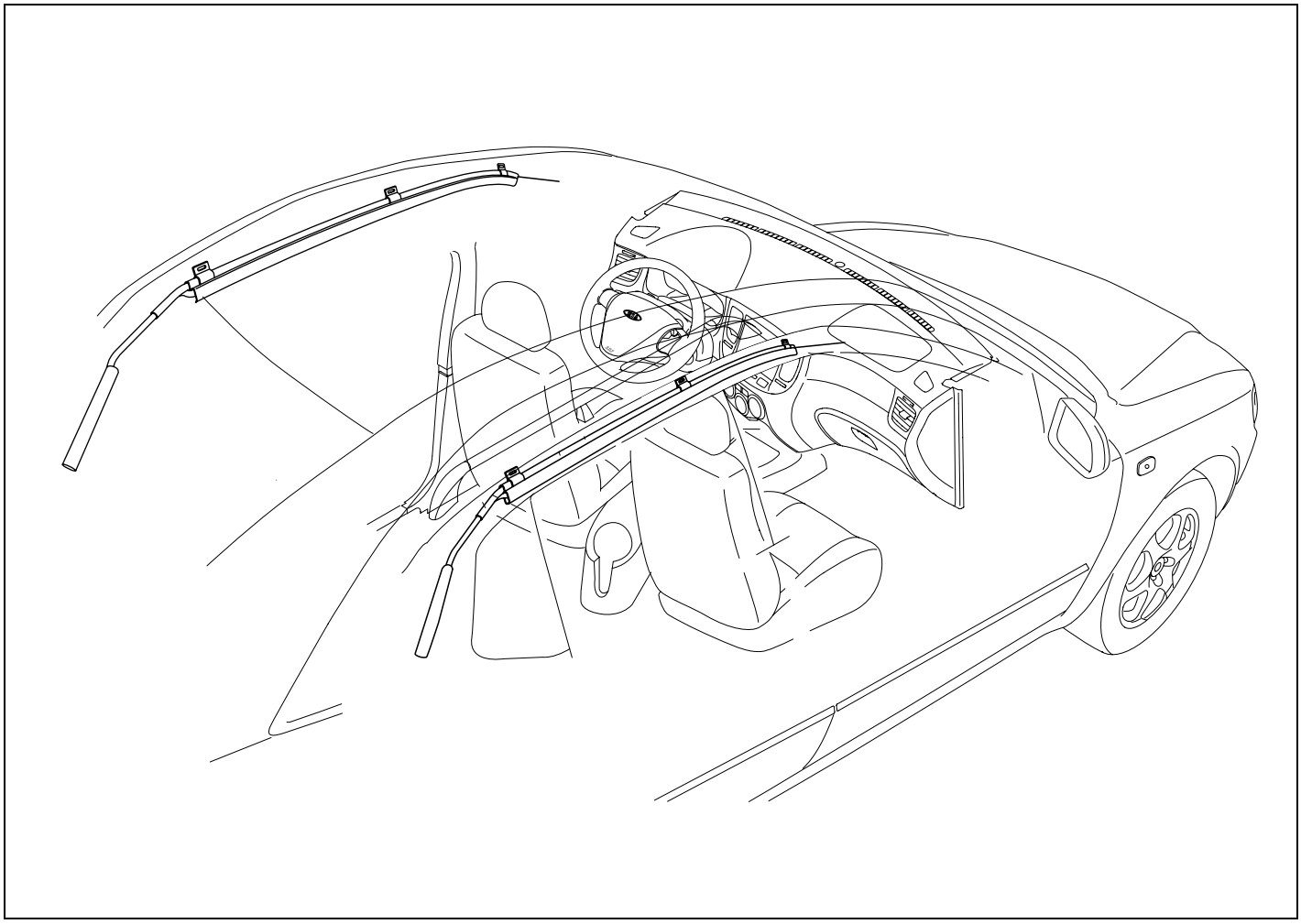
DESCRIPTION E7668D6B

Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passanger 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.

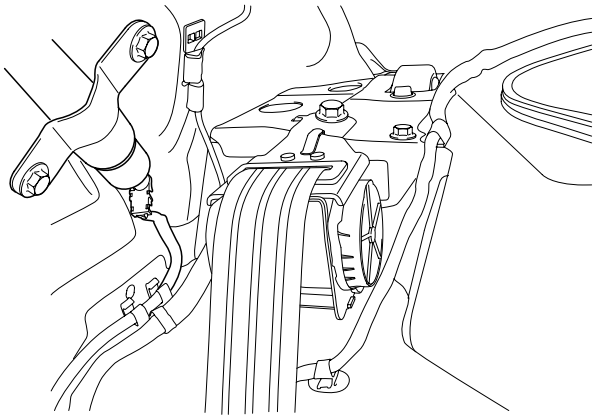
COMPONENTS E0AB88EE



ARJF105A

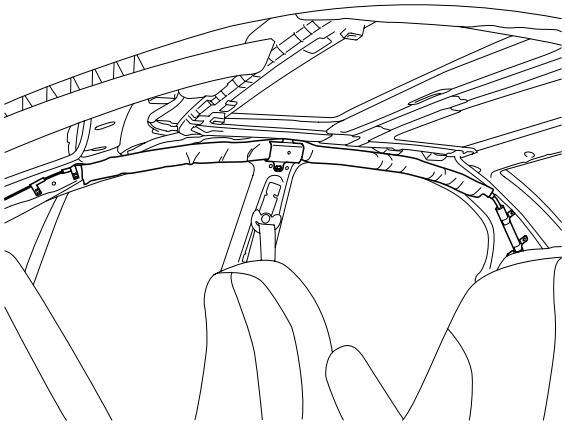
REMOVAL EBF7456B

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the following parts. (Refer to BD- group)
   - Interior trim
   - Headlining
3. Disconnect the Curtain Airbag harness connector.



ARJF105B

4. After loosening the mounting bolts, remove the curtain airbag.



ARJF105C

INSTALLATION EDC526EC

CAUTION

- ***Be sure to install the harness wires not to be pinched or interfered with other parts.***

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Install a Curtain Airbag (CAB) on the mounting bracket.

Tightening Torque (CAB Mounting Bolt)
: 0.5 ~ 0.7 Kgf.m(4.9 ~ 6.9 Nm, 3.6 ~ 5.1 lb.ft)

CAUTION

- ***Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.***

4. Install the inflator on the bracket.
5. Connect the CAB connector.
6. Reconnect the battery negative cable.
7. After installing the Curtain Airbag (CAB), confirm proper system operation:
   - Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

SEAT BELT PRETENSIONER

SEAT BELT PRETENSIONER

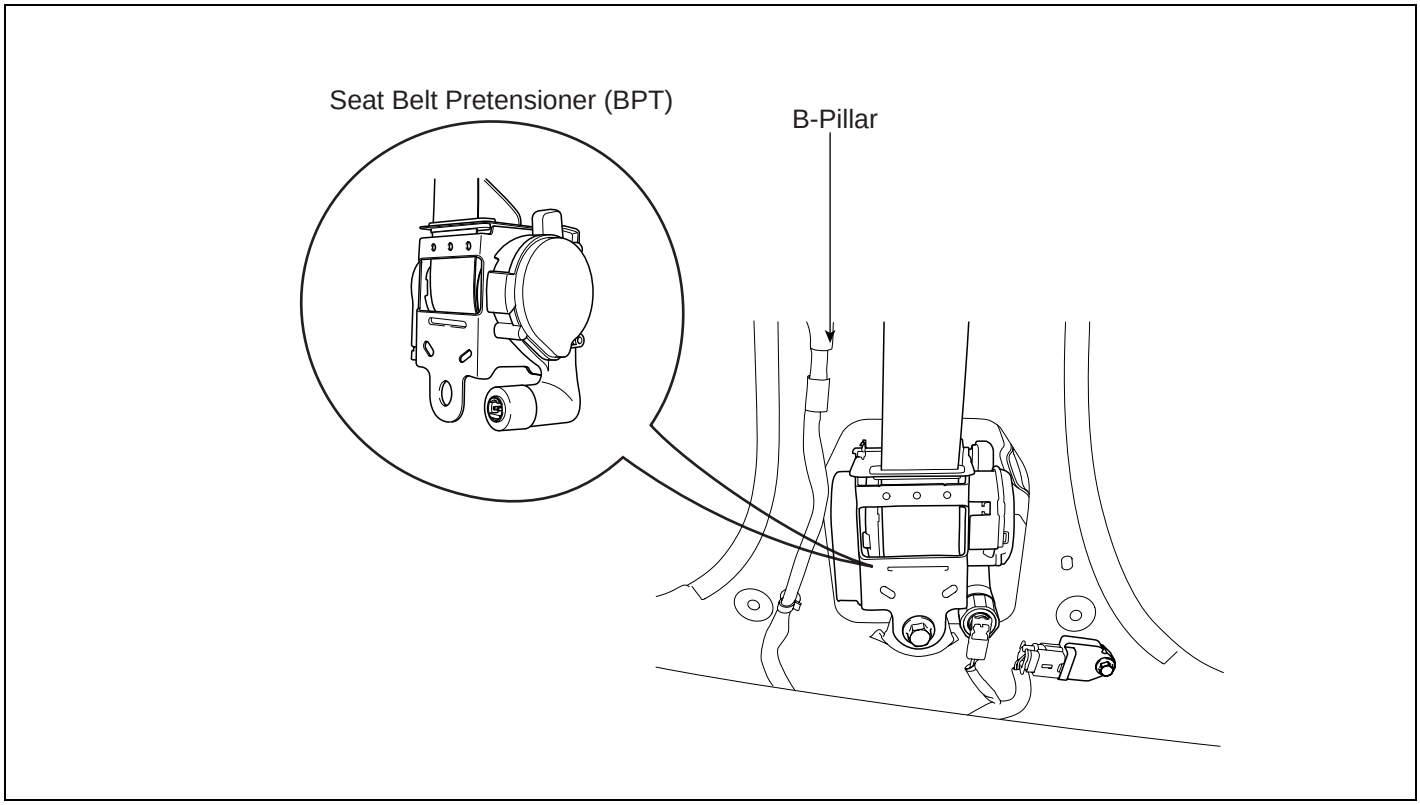
DESCRIPTION E9BFB4FB

The Seat Belt Pretensioners (BPT) are installed inside B-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.

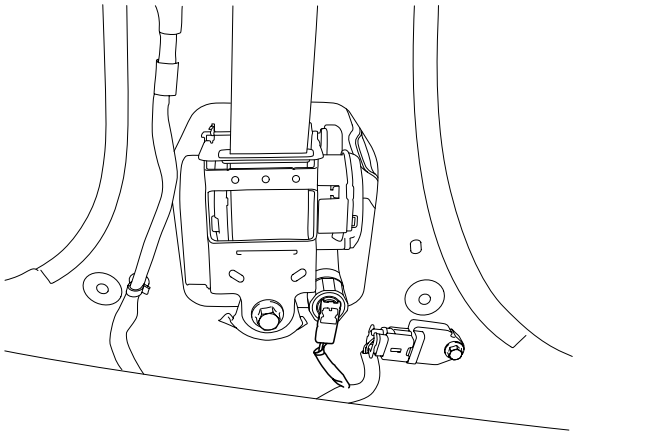
COMPONENTS EB2108B9



LRJF500H

REMOVAL EFEDACFF

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. Remove the center pillar trim. (Refer to BD group)
4. Disconnect the Seat Belt Pretensioner connector.



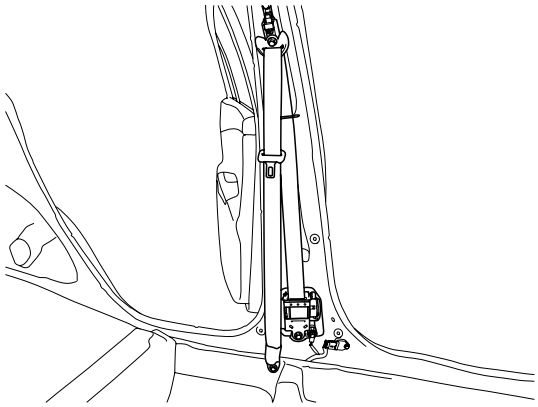
ARJF106B

5. Remove the lower anchor bolt.
6. Remove the upper anchor bolt.
7. Loosen the Seat Belt Pretensioner mounting bolt and remove the Seat Belt Pretensioner.

INSTALLATION E0640377

1. Disconnect the negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.
3. Install the Seat Belt Pretensioner (BPT) with bolt.
4. Install the upper and lower anchor bolts.

Tightening Torque (Seat Belt Anchor Bolt)
: 4.0 ~ 5.5 Kgf.m (39.2 ~ 53.9 Nm, 28.9 ~ 39.8 lb.ft)



ARJF106C

5. Install the center pillar trim.
6. Install the front seat assembly.
7. Reconnect the negative battery cable.
8. After installing the Seat Belt Pretensioner (BPT), confirm proper system operation:
   - Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

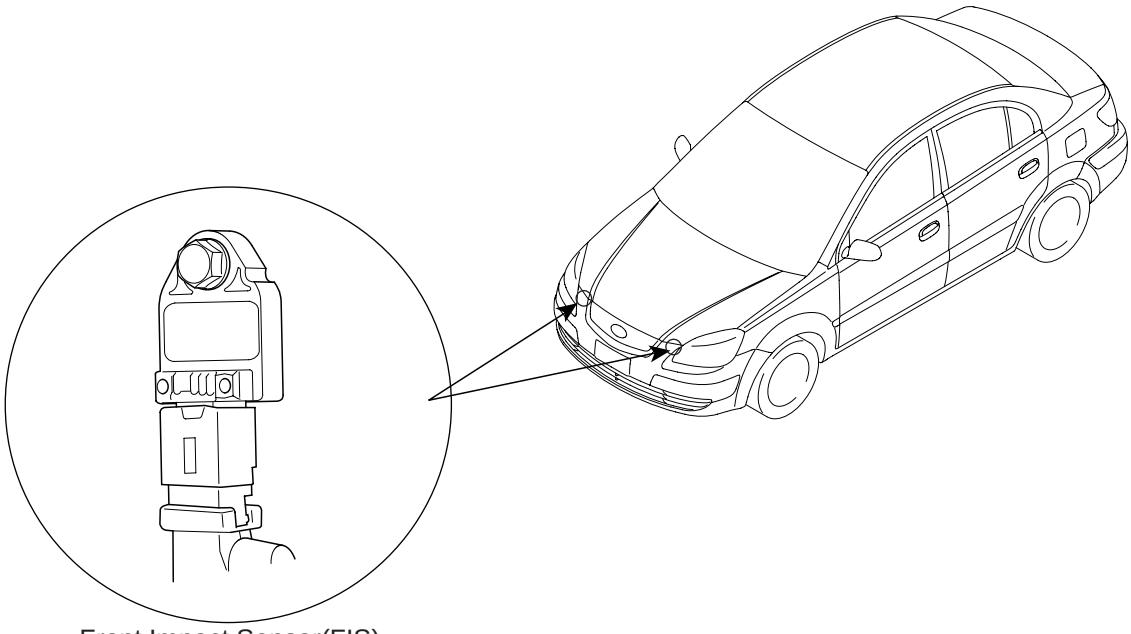
SRS CONTROL SYSTEM

FRONT IMPACT SENSOR (FIS)

DESCRIPTION EEC14D8E

The front impact sensors (FIS) are installed in the side member. They are remote sensors that detect acceleration due to a collision at their mounting locations. The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collition. The Front Impact Sensor(FIS) sends acceleration data to the SRSCM.

COMPONENTS EA27C4AF



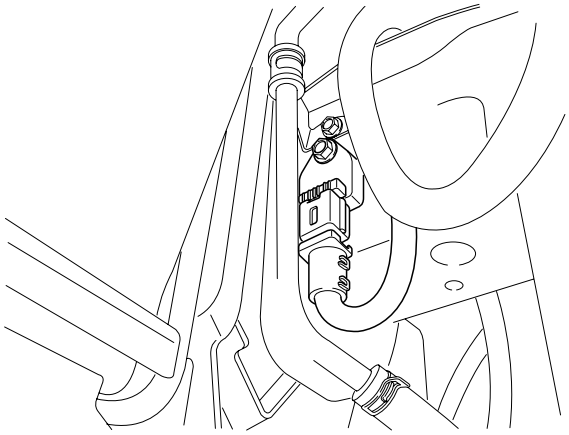
LRJF500D

REMOVAL E67ECBDB

CAUTION

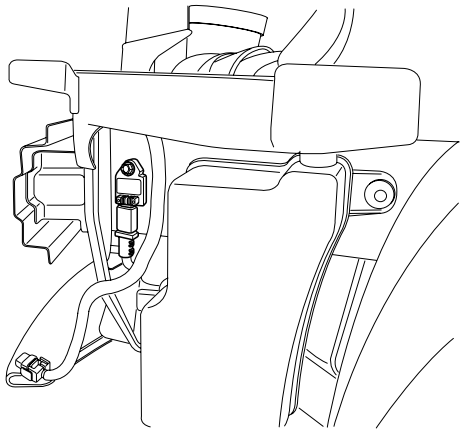
- ***Removal of the airbag must be performed according to the precautions/ procedures described previously.***
- ***Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).***
- ***Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.***

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the FIS mounting bolt then remove the Front Impact Sensor(RH).



ARJF107A

3. Remove the front bumper first(refer to BD group), then lossen the FIS mounting bolt to remove Front Impact Sensor.(LH)



ARJF107B

4. Disconnect the Front Impact Sensor connector.

INSTALLATION E5709AED

CAUTION

- ***Be sure to install the harness wire not to be pinched or interfere with other parts.***
- ***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 with bolt then connect the SRS harness connector to the Front Impact Sensor.

Tightening torque
: 1.0 ~ 1.4 Kgf.m (9.5 ~ 13.5 Nm, 7.0 ~ 10.0 lb.ft)

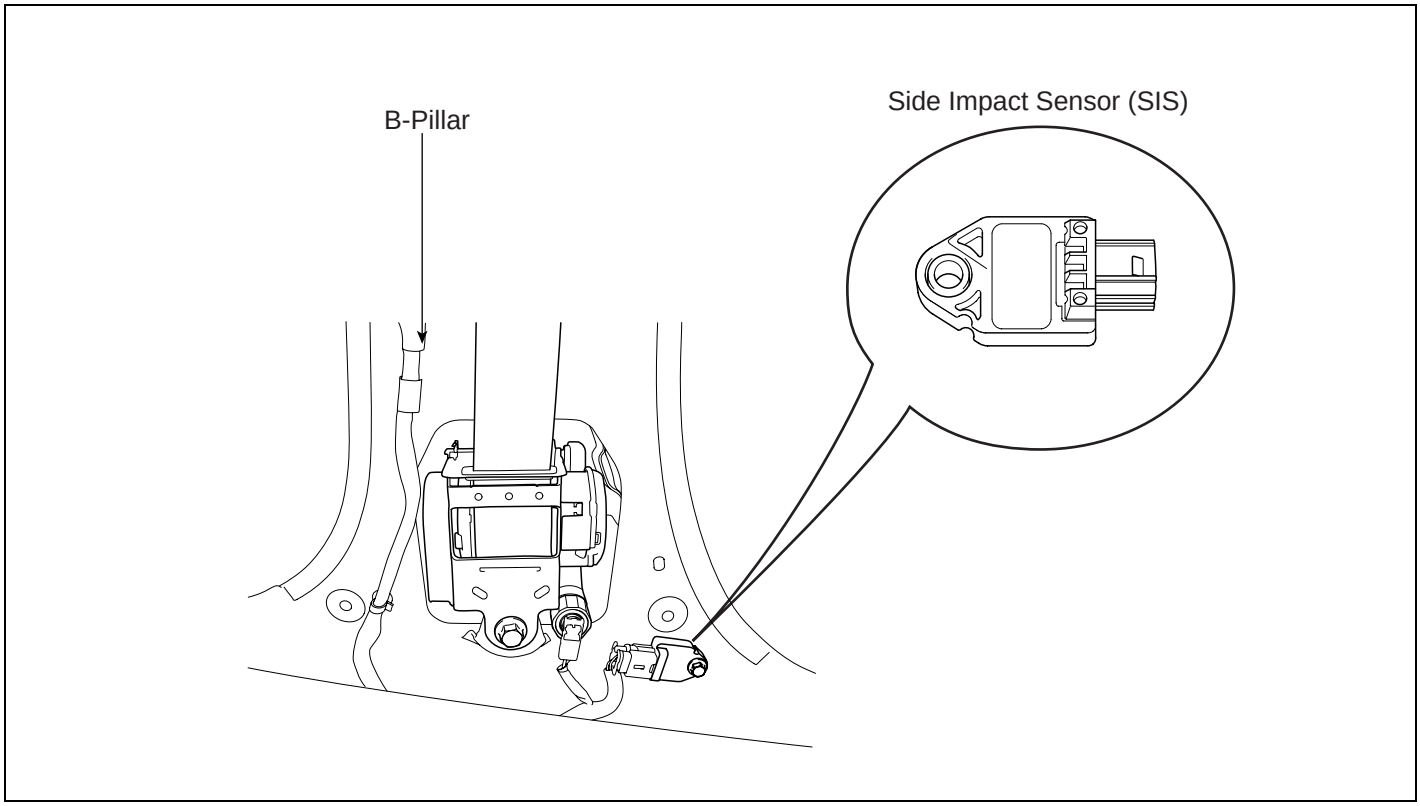
2. Install the front bumper.(LH)
3. Reconnect the negative battery cable.
4. After installing the Front Impact Sensor, confirm proper system operation: Turn the ignition switch ON the SRS indicator light should be turned on for about six seconds and then go off.

SIDE IMPACT SENSOR (SIS)

DESCRIPTION EC7C4226

The Side Impact Sensor (SIS) system consists of two front SIS which are installed inside the B-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.

COMPONENTS E048D4F5



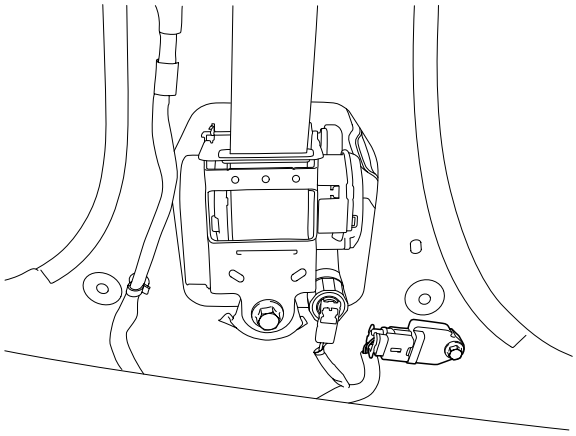
LRJF500I

REMOVAL EB7BBEF1

CAUTION

- ***Removal of the airbag must be performed according to the precautions/procedures described previously.***
- ***Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).***
- ***Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.***

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. Remove the center pillar trim. (Refer to BD group)
4. Disconnect the Side Impact Sensor connector.
5. Remove the SIS mounting bolt then remove the Side Impact Sensor.



ARJF108B

INSTALLATION EE61AA3F

CAUTION

- ***Be sure to install the harness wires not to be pinched or interfered with other parts.***
- ***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
1.0 ~ 1.4 Kgf.m (9.5 ~ 13.5 Nm, 7.0 ~ 10.0 lb.ft)

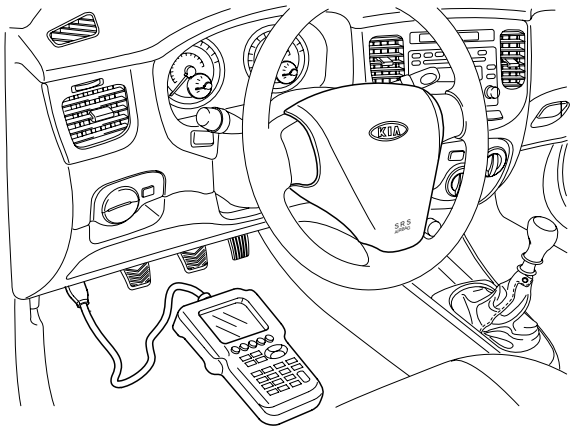
2. Install the center piller trim. (Refer to BD group)
3. Install the front seat assembly. (Refer to BD group)
4. Reconnect the negative battery cable.
5. After installing the Side Impact Sensor, confirm proper system operation: Turn the ignition switch ON, the SRS indicator light should be turned on for about six seconds and then go off.

TROUBLESHOOTING

DESCRIPTION EDEDCF3A

HI-SCAN CHECK

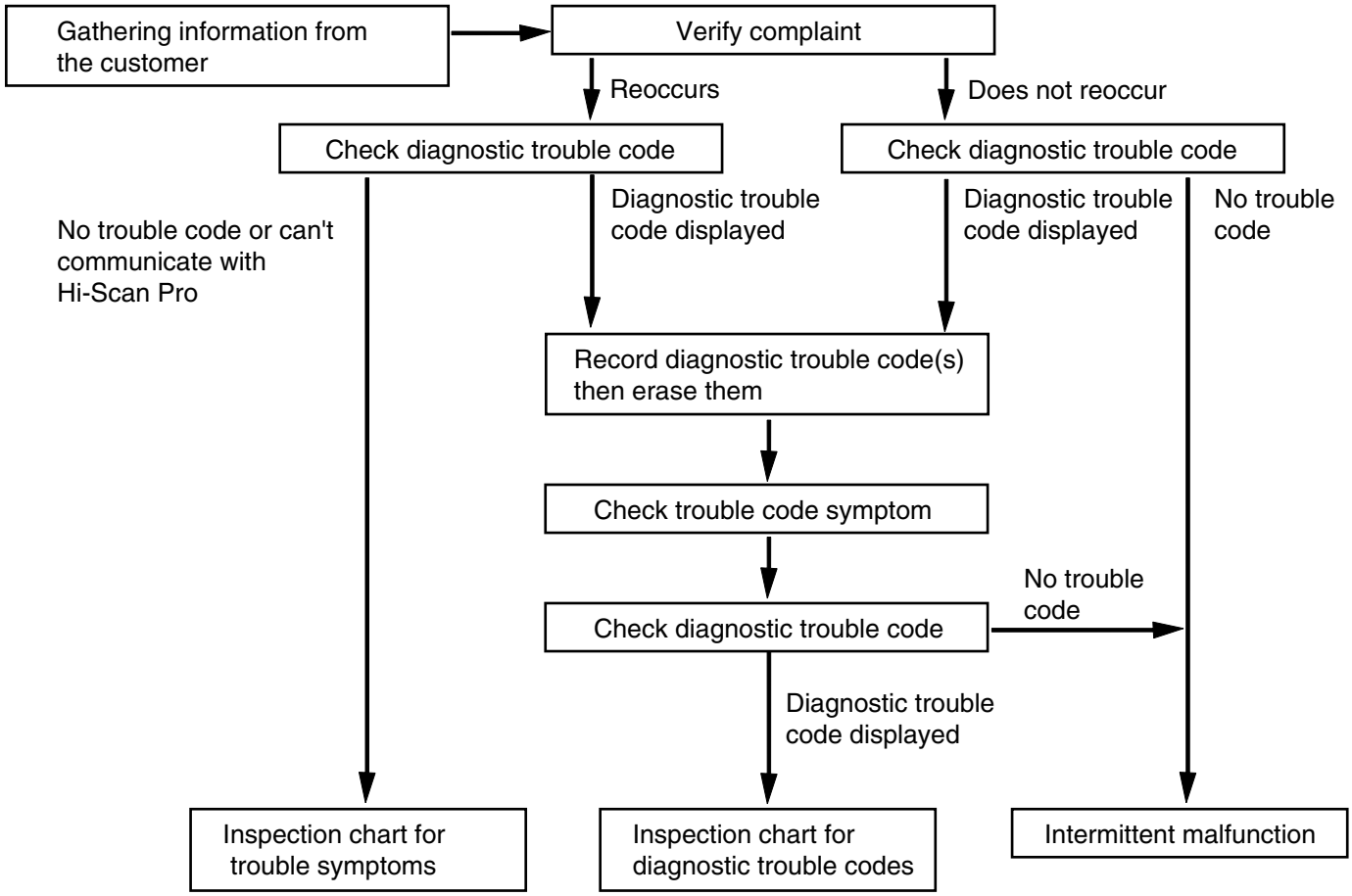
1. Turn the ignition switch off.
2. Connect the Hi-Scan Pro connector to the data link connector located under the crash pad.



ARJF200A

3. Turn the ignition switch on and power on the Hi-Scan Pro.
4. Read DTCs.
5. Find and repair the trouble, and clear the DTCs using Hi-Scan Pro.
6. Disconnect the Hi-Scan Pro.

DIAGNOSTIC TROUBLESHOOTING FLOW



ERA9035A

TERMINAL & CONNECTOR INSPECTION

Be sure to perform "TERMINAL & CONNECTOR INSPECTION" before doing "INSPECTION PROCEDURE" for troubleshooting of each DTC.

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.
2. Inspect terminals for damage and corrosion.

CAUTION

Avoid damaging connectors during the inspection process.

3. Are any problems found?

NO

▶ Go to next step (INSPECTION PROCEDURE).

YES

▶ After repairing the trouble part, check whether DTC occurs or not.

PREPARATION OF INSPECTION

1. Turn the ignition switch to LOCK.
2. Disconnect the battery negative cable from the battery and wait for at least 3 minutes.
3. Remove the DAB module and disconnect the DAB connector.
4. Disconnect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.
5. Disconnect the SRSCM connector.

CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

1. Install the DAB module and connect the DAB connector.
2. Connect the connector of the PAB, SAB, CAB, BPT, FIS and SIS.
3. Connect the SRSCM connector.
4. Connect the battery negative cable to the battery.
5. Connect a Hi-Scan(Pro) to the data link connector.
6. Turn the ignition switch to ON.
7. Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro)
8. Turn the ignition switch to LOCK and wait for at least 30 seconds.
9. Turn the ignition switch to ON and wait for at least 30 seconds.
10. Check the vehicle again with the Hi-Scan(Pro).
    Does the above DTC(s) go off?

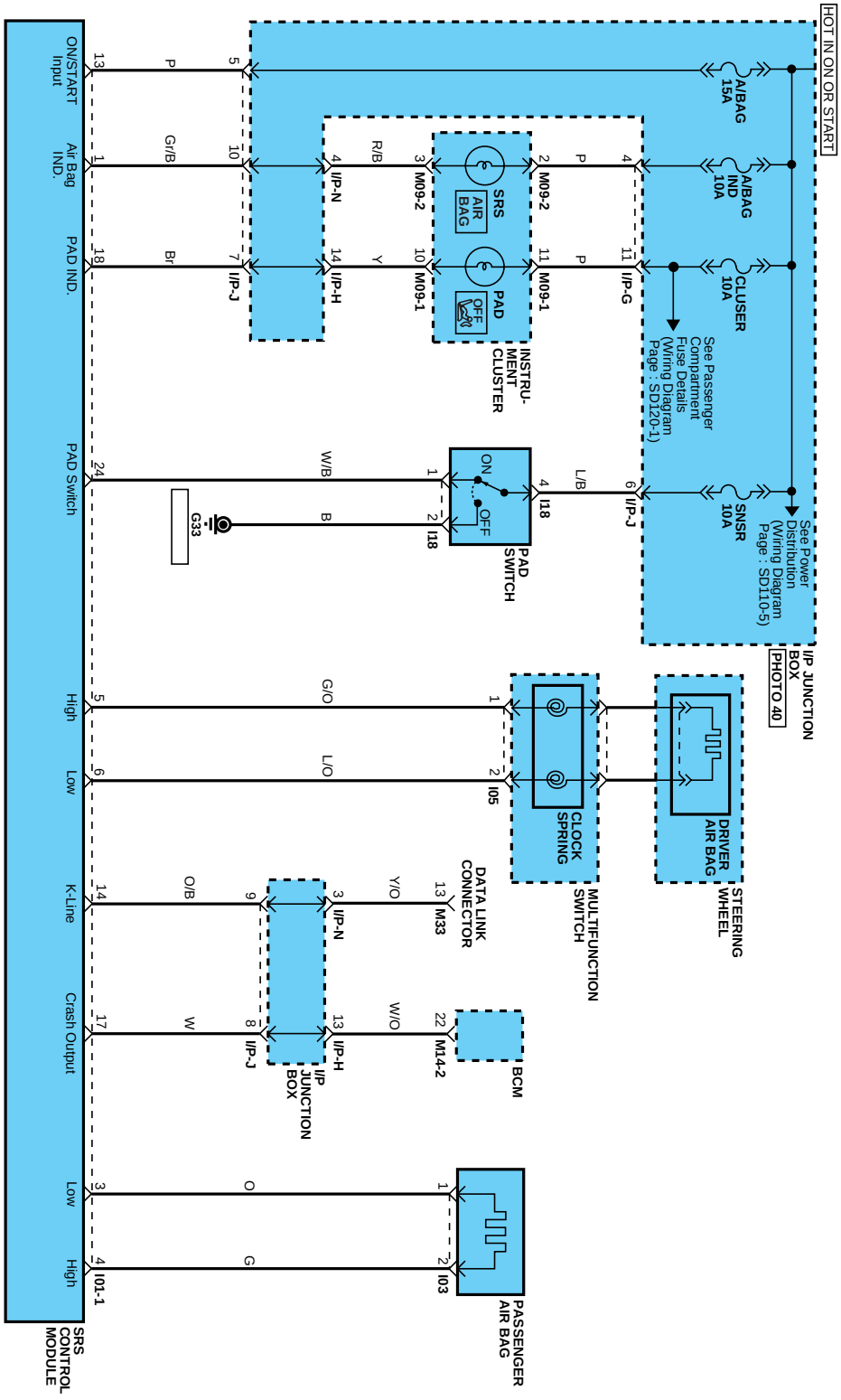
YES

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

NO

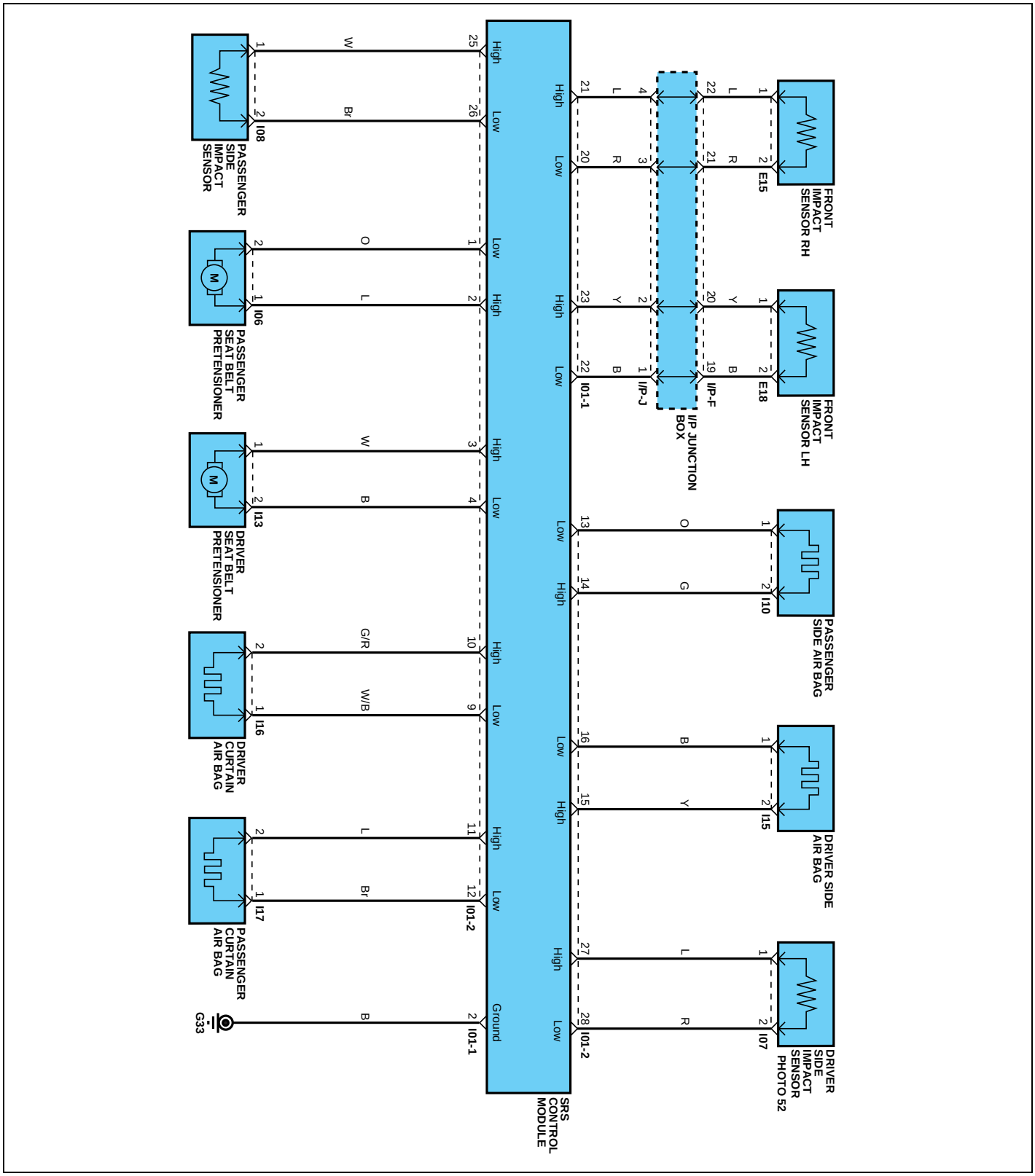
▶ Replace the SRSCM with a new one and then check the vehicle again. At this time, if the vehicle normally operates with a new one, the fault may be the SRSCM. Replace the SRSCM.

CIRCUIT DIAGRAM(1) E1DDE25B



LRJF500K

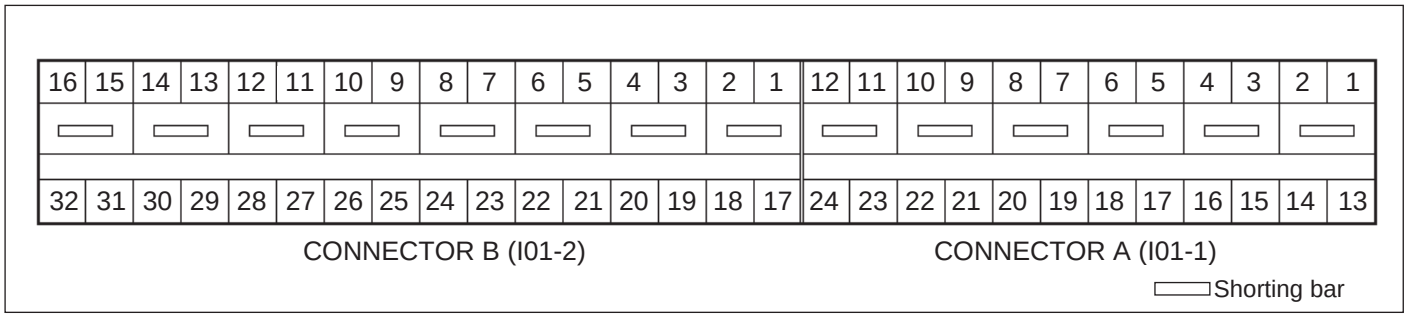
CIRCUIT DIAGRAM(2)



LRJF500L

SRSCM CONNECTOR TERMINAL EA93575E

SRSCM HARNESS CONNECTOR



Pin	Function (Connector A)	Pin	Function (Connector B)
1	Airbag Warning Lamp	1	Seat Belt Pretensioner [Front-Passenger] Low
2	Ground	2	Seat Belt Pretensioner [Front-Passenger] High
3	Passenger Airbag Low	3	Seat Belt Pretensioner [Front-Driver] High
4	Passenger Airbag High	4	Seat Belt Pretensioner [Front-Driver] Low
5	Driver Airbag High	5	-
6	Driver Airbag Low	6	-
7	-	7	-
8	-	8	-
9	-	9	Curtain Airbag [Driver] Low
10	-	10	Curtain Airbag [Driver] High
11	-	11	Curtain Airbag [Passenger] High
12	-	12	Curtain Airbag [Passenger] Low
13	Ignition	13	Side Airbag [Front-Passenger] Low
14	K-Line Diagnostic	14	Side Airbag [Front-Passenger] High
15	-	15	Side Airbag [Front-Driver] High
16	-	16	Side Airbag [Front-Driver] Low
17	Crash Output	17	-
18	PAD Lamp	18	-
19	-	19	-
20	Front Impact Sensor [Passenger] Low	20	-
21	Front Impact Sensor [Passenger] High	21	-
22	Front Impact Sensor [Driver] Low	22	-
23	Front Impact Sensor [Driver] High	23	-
24	PAD Switch	24	-
		25	Side Impact Sensor [Passenger] High
		26	Side Impact Sensor [Passenger] Low
		27	Side Impact Sensor [Driver] High
		28	Side Impact Sensor [Driver] Low
		29	-
		30	-
		31	-
		32	-

LRJF500M

DIAGNOSTIC TROUBLE CODES (DTC)

DTC	FAULT DESCRIPTION	PAGE
B1101	Battery Voltage too High	RT - 43
B1102	Battery Voltage too Low	RT - 43
B1328	Front Impact Sensor [Driver] Defect	RT - 46
B1329	Front Impact Sensor [Driver] Communication Error	RT - 46
B1333	Front Impact Sensor [Passenger] Defect	RT - 46
B1334	Front Impact Sensor [Passenger] Communication Error	RT - 46
B1346	Driver Airbag Resistance too High	RT - 49
B1347	Driver Airbag Resistance too Low	RT - 49
B1348	Driver Airbag Circuit Short to Ground	RT - 52
B1349	Driver Airbag Circuit Short to Battery	RT - 55
B1352	Passenger Airbag Resistance too High	RT - 58
B1353	Passenger Airbag Resistance too Low	RT - 58
B1354	Passenger Airbag Circuit Short to Ground	RT - 61
B1355	Passenger Airbag Circuit Short to Battery	RT - 63
B1361	Seat Belt Pretensioner [Front-Driver] Resistance too High	RT - 65
B1362	Seat Belt Pretensioner [Front-Driver] Resistance too Low	RT - 65
B1363	Seat Belt Pretensioner [Front-Driver] Circuit Short to Ground	RT - 68
B1364	Seat Belt Pretensioner [Front-Driver] Circuit Short to Battery	RT - 70
B1367	Seat Belt Pretensioner [Front-Passenger] Resistance too High	RT - 65
B1368	Seat Belt Pretensioner [Front-Passenger] Resistance too Low	RT - 65
B1369	Seat Belt Pretensioner [Front-Passenger] Circuit Short to Ground	RT - 68
B1370	Seat Belt Pretensioner [Front-Passenger] Circuit Short to Battery	RT - 70
B1378	Side Airbag [Front-Driver] Resistance too High	RT - 73
B1379	Side Airbag [Front-Driver] Resistance too Low	RT - 73
B1380	Side Airbag [Front-Driver] Circuit Short to Ground	RT - 76
B1381	Side Airbag [Front-Driver] Circuit Short to Battery	RT - 78
B1382	Side Airbag [Front-Passenger] Resistance too High	RT - 73
B1383	Side Airbag [Front-Passenger] Resistance too Low	RT - 73
B1384	Side Airbag [Front-Passenger] Circuit Short to Ground	RT - 76
B1385	Side Airbag [Front-Passenger] Circuit Short to Battery	RT - 78
B1395	Squib Interconnection Fault	RT - 80
B1400	Side Impact Sensor [Front-Driver] Defect	RT - 81
B1403	Side Impact Sensor [Front-Passenger] Defect	RT - 81
B1409	Side Impact Sensor [Front-Driver] Communication Error	RT - 81
B1410	Side Impact Sensor [Front-Passenger] Communication Error	RT - 81
B1473	Curtain Airbag [Driver] Resistance too High	RT - 84
B1474	Curtain Airbag [Driver] Resistance too Low	RT - 84

DTC	FAULT DESCRIPTION	PAGE
B1475	Curtain Airbag [Driver] Circuit Short to Ground	RT - 88
B1476	Curtain Airbag [Driver] Circuit Short to Battery	RT - 91
B1477	Curtain Airbag [Passenger] Resistance too High	RT - 84
B1478	Curtain Airbag [Passenger] Resistance too Low	RT - 84
B1479	Curtain Airbag [Passenger] Circuit Short to Ground	RT - 88
B1480	Curtain Airbag [Passenger] Circuit Short to Battery	RT - 91
B1527	Passenger Airbag Deactivation Switch Open or Short to Battery	RT - 94
B1528	Passenger Airbag Deactivation Switch Short or Short to Ground	RT - 98
B1529	Passenger Airbag Deactivation Switch Defect	RT - 102
B1530	Passenger Airbag Deactivation Switch Instability	RT - 102
B1620	Supplemental Restraint System Control Module Internal Fault (Replace SRSCM)	RT - 106
B1650	Crash Recorded - Frontal (Replace SRSCM)	RT - 107
B1651	Crash Recorded - Driver Side (Replace SRSCM)	RT - 107
B1652	Crash Recorded - Passenger Side (Replace SRSCM)	RT - 107
B1655	Crash Recorded - Passenger Side with PAB inhibited (Replace SRSCM)	RT - 107
B1657	Crash Recorded - Belt Pretensioner Only	RT - 107
B1658	Belt Pretensioner 6 times Deployment (Replace SRSCM)	RT - 107
B1659	Rear Impact Detected	RT - 107
B2500	SRS Warning Lamp Fault	RT - 109
B2505	Passenger Airbag Deactivation Lamp Fault	RT - 113

DTC B1101 BATTERY VOLTAGE TOO HIGH
DTC B1102 BATTERY VOLTAGE TOO LOW

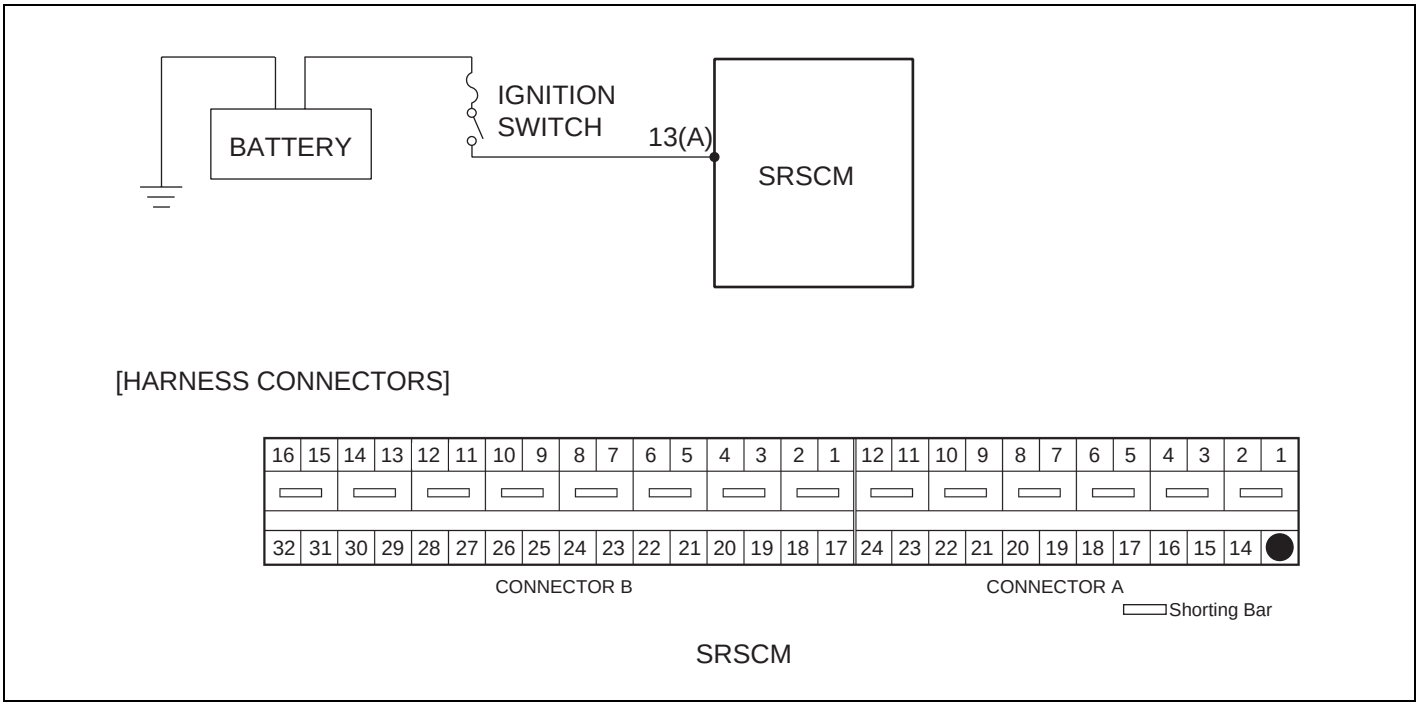
DTC DESCRIPTION E11B0B13

The SRSCM sets above DTC(s) if it detects that the battery voltage of restraints system is too high or too low. When the voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

DTC DETECTING CONDITION ECA9AB36

DTC	Condition	Probable cause
B1101	Battery Voltage > 16.0 V for 4 seconds after IG ON	• Battery • Alternator • Wiring Harness • SRSCM
B1102	Battery Voltage < 9.0 V for 4 seconds after IG ON	

SCHEMATIC DIAGRAM EE3735A9



LRJF500N

SPECIFICATION E8DF0ACF

Voltage : 9.0 ~ 16.0 V

TERMINAL & CONNECTOR INSPECTION E9F46BD0

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EFC197F8

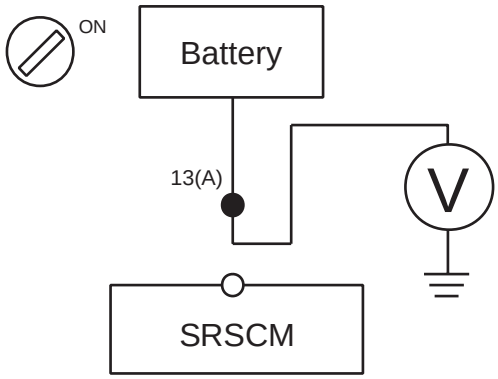
1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK SOURCE VOLTAGE

   1) Turn the ignition switch to ON.

   2) Measure voltage between the terminal 13(A) of SRSCM harness connector and chassis ground.

Specification (voltage) : 9.0 ~ 16.0 V



ERRF500Q

   3) Is the measured voltage within specification?

   NO

   ▶ Check the battery.

   YES

   ▶ Replace the SRSCM with a new one, and then check the vehicle again. At this time, if the vehicle normally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

3. CHECK THE BATTERY

   1) Check the battery.
   ● Refer to "EE" group in this SERVICE MANUAL.
   Is the battery normal?

   YES

   ▶ Check the alternator.

   NO

   ▶ Repair or replace the battery.(Refer to "EE" group in this SERVICE MANUAL)

4. CHECK ALTERNATOR

1) Check the altenator.
● Refer to "EE" group in this SERVICE MANUAL.
Is the alternator normal?

YES

▶ Check wiring harness.

NO

▶ Repair or replace the alternator.(Refer to "EE" group in this SERVICE MANUAL)

5. CHECK WIRING HARNESS

1) Check the wiring harness between the battery and SRSCM.
Is the wiring harness normal?

YES

▶ Check the DTC again.

NO

▶ Repair or Replace the wiring harness.

6. CHECK THE DTC AGAIN

1) Turn the ignition switch to LOCK and wait for at least 30 seconds.

CAUTION

Check again that the battery negative cable is disconnected from the battery.

2) Install the DAB module and connect the DAB connector.

3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

4) Connect the SRSCM connector.

5) Connect the battery negative cable to the battery.

6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC?

YES

▶ Perform the troubleshooting procedures associated with those codes.

NO

▶ Problem is intermittent or was repaired and SRSCM memory was not cleared.

DTC B1328 FRONT IMPACT SENSOR [DRIVER] DEFECT
DTC B1329 FRONT IMPACT SENSOR [DRIVER] COMMUNICATION ERROR
DTC B1333 FRONT IMPACT SENSOR [PASSENGER] DEFECT
DTC B1334 FRONT IMPACT SENSOR [PASSENGER] COMMUNICATION ERROR

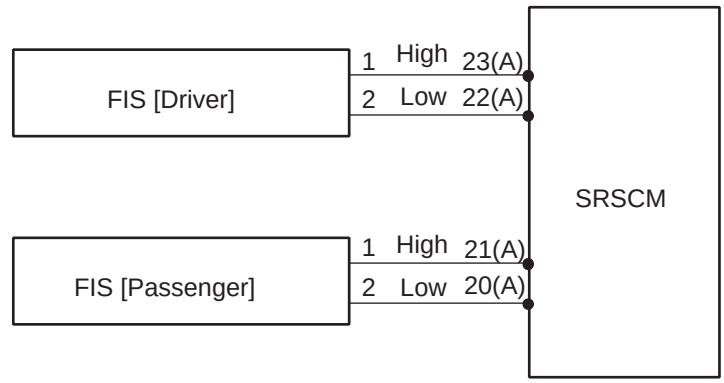
DTC DESCRIPTION EEC9B80E

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC DETECTING CONDITION E8EECFC5

DTC	Condition	Probable cause
B1328 B1329 B1333 B1334	• Open between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

SCHEMATIC DIAGRAM E7CC4BDA



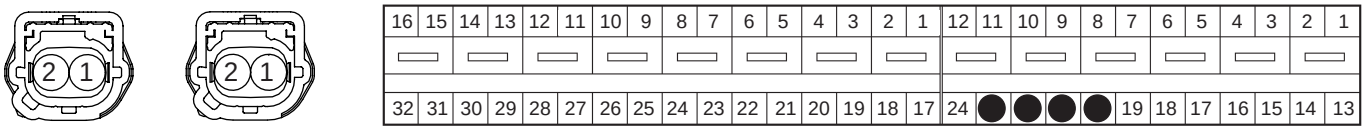
FIS [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 23(A)	FIS High
2	SRSCM Terminal 22(A)	FIS Low

FIS [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 21(A)	FIS High
2	SRSCM Terminal 20(A)	FIS Low

[HARNESS CONNECTOR]



FIS(Driver) FIS(Passenger) CONNECTOR B CONNECTOR A

Shorting Bar

SRSCM

LRJF200A

TERMINAL & CONNECTOR INSPECTION E7AC4BEE

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E757F81A

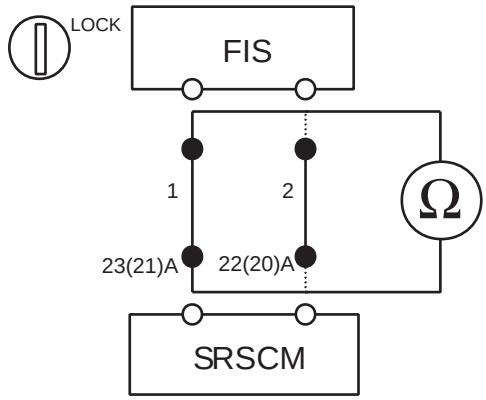
1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK FIS CIRCUIT

   1) Measure resistance between the terminal 1 of FIS harness connector and the terminal A 23(21) of SRSCM harness connector.

   2) Measure resistance between the terminal 2 of FIS harness connector and the terminal A 22(20) of SRSCM harness connector.

Specification (resistance) : below 1 Ω



KRRE500W

   3) Is the measured resistance within specification?

YES

▶ Check Front Impact Sensor.

NO

▶ Repair or replace the wiring harness between the FIS and the SRSCM.

3. CHECK FRONT IMPACT SENSOR

   1) Replace the front impact sensor(FIS) with a new one.
      ● Refer to "Front Impact Sensor(FIS)" section in this SERVICE MANUAL.

   2) Install the DAB module and connect the DAB connector.

   3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   4) Connect the SRSCM connector.

   5) Connect the battery negative cable to the battery.

   6) Connect a Hi-Scan(Pro) to the data link connector.

   7) Turn the ignition switch to ON and check the vehicle again.
      Does Hi-Scan (Pro) indicate any DTC related to FIS?

      YES

      ▶ Go to next step.

      NO

      ▶ Replace the Front Impact Sensor(FIS).

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1346 DRIVER AIRBAG RESISTANCE TOO HIGH
DTC B1347 DRIVER AIRBAG RESISTANCE TOO LOW

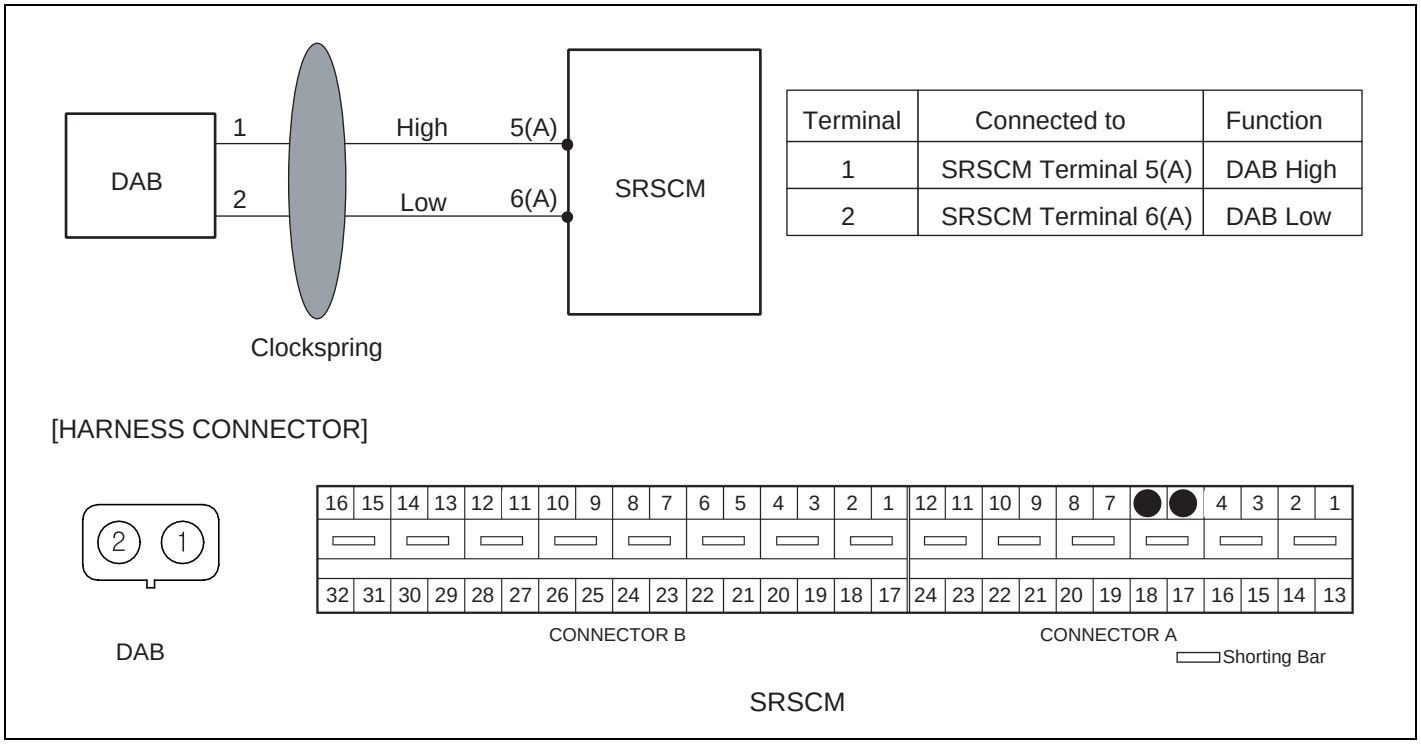
DTC DESCRIPTION E53CBAFE

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

DTC DETECTING CONDITION EEB1B377

DTC	Condition	Probable cause
B1346 B1347	• Too high or low resistance between DAB high(+) and DAB low (-) • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

SCHEMATIC DIAGRAM EA47D9A6



Terminal	Connected to	Function
1	SRSCM Terminal 5(A)	DAB High
2	SRSCM Terminal 6(A)	DAB Low

LRJF200B

SPECIFICATION E85E8D8F

DAB resistance : 1.925 ~ 3.074 Ω (Gasoline), 2.025 ~ 2.974 Ω (Diesel)

TERMINAL & CONNECTOR INSPECTION E109985D

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E9FC50CC

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK DAB RESISTANCE

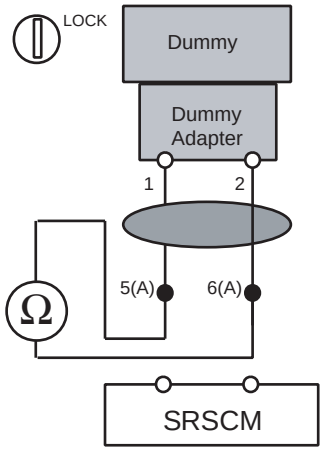
   CAUTION

   Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   1) Connect the Dummy and the Dummy Adapter on DAB harness connector.
      ●Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   2) Measure resistance between the terminal 5 and 6 of SRSCM harness connector(A).

DAB resistance : 1.925 ~ 3.074 Ω (Gasoline), 2.025 ~ 2.974 Ω (Diesel)



ERRF500T

   3) Is the measured resistance within specification?

   NO

   ▶ Check open circuit.

   YES

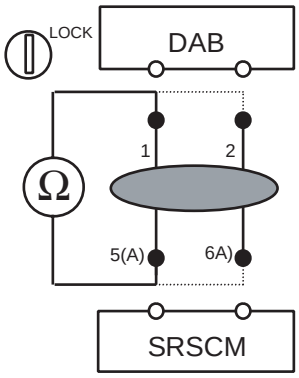
   ▶ Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT

   1) Measure resistance between the terminal 1 of DAB harness connector and the terminal 5 of SRSCM harness connector(A).

   2) Measure resistance between the terminal 2 of DAB harness connector and the terminal 6 of SRSCM harness connector(A).

Specification (resistance) : below 1 Ω



ERRF501X

3) Is the measured resistance within specification?

YES

▶ Check short circuit.

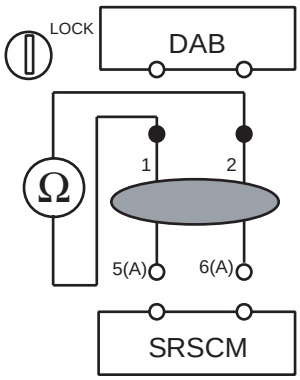
NO

▶ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

4. CHECK SHORT CIRCUIT

1) Measure resistance between the terminal 1 and 2 of DAB harness connector.

Specification (resistance) : ∞ Ω



ERRF501Y

2) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1348 DRIVER AIRBAG CIRCUIT SHORT TO GROUND

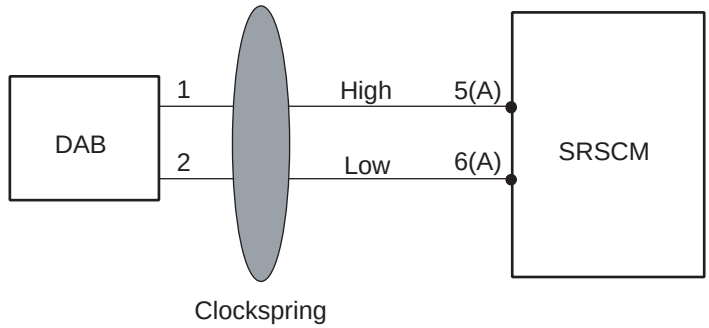
DTC DESCRIPTION EAAEA68D

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

DTC DETECTING CONDITION ECC9FE0D

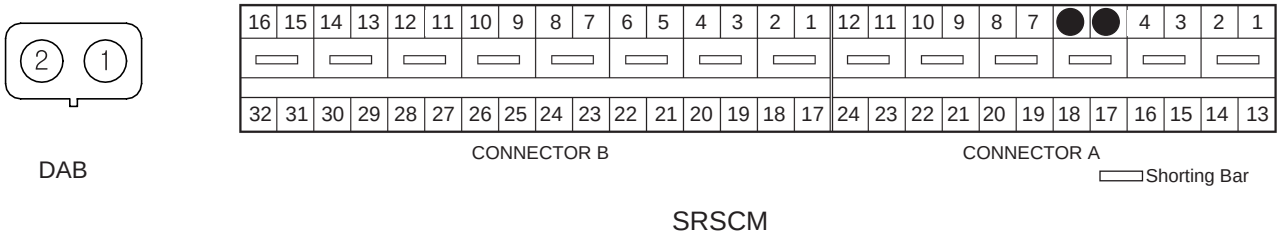
DTC	Condition	Probable cause
B1348	• Short to ground between DAB and clockspring • Short to ground between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

SCHEMATIC DIAGRAM EC580F7F



Terminal	Connected to	Function
1	SRSCM Terminal 5(A)	DAB High
2	SRSCM Terminal 6(A)	DAB Low

[HARNESS CONNECTOR]



LRJF200B

TERMINAL & CONNECTOR INSPECTION E640CFDF

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

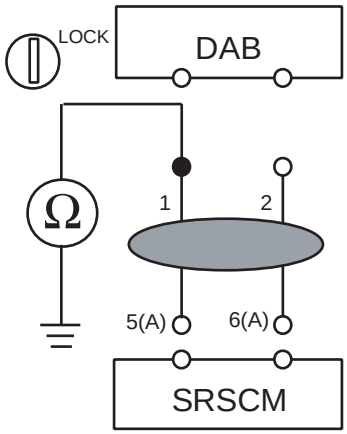
INSPECTION PROCEDURE E1CBBDED

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK SHORT TO GROUND

   1) Measure resistance between the terminal 1 of DAB harness connector and chassis ground.

Specification (resistance) : infinite



KRRE501B

   2) Is the measured resistance within specification?

YES

▶Check the DAB Module.

NO

▶ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE

   1) Replace the Driver Airbag(DAB) with a new one.
   ● Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

   2) Install the DAB module and connect the DAB connector.

   3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   4) Connect the SRSCM connector.

   5) Connect the battery negative cable to the battery.

   6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▶ Check the clockspring.

NO

▶ Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING

1) Check the clockspring.
Is the clockspring normal?

YES

▶ Go to next step.

NO

▶ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1349 DRIVER AIRBAG CIRCUIT SHORT TO BATTERY

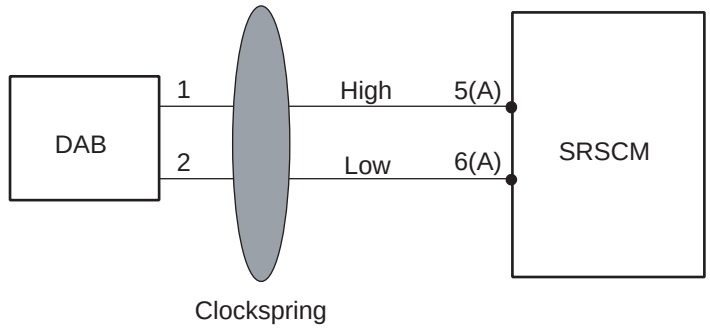
DTC DESCRIPTION E770EB29

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB). The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

DTC DETECTING CONDITION E02DDDDC

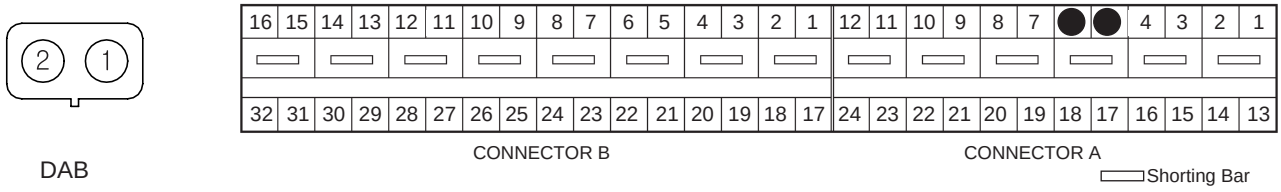
DTC	Condition	Probable cause
B1349	• Short to battery line between DAB and clockspring • Short to battery line between clockspring and SRSCM • Driver Airbag (DAB) Malfunction • Clockspring Malfunction • SRSCM Malfunction	• Short to battery line on wiring harness • Driver Airbag (DAB) squib • Clockspring • SRSCM

SCHEMATIC DIAGRAM EC17426D



Terminal	Connected to	Function
1	SRSCM Terminal 5(A)	DAB High
2	SRSCM Terminal 6(A)	DAB Low

[HARNESS CONNECTOR]



LRJF200B

TERMINAL & CONNECTOR INSPECTION E523B3A8

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E80054DD

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

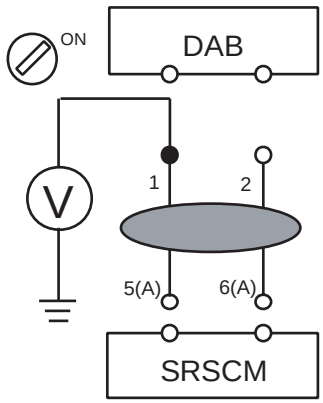
2. CHECK SHORT TO BATTERY LINE

   1) Connect the battery negative cable to the battery.

   2) Turn the ignition switch to ON.

   3) Measure voltage between the terminal 1 of DAB harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



KRRE501C

   4) Is the measured voltage within specification?

YES

▶Check the DAB module.

NO

▶ Repair or replace the wiring harness between the DAB and the clockspring or between the clockspring and the SRSCM.

3. CHECK THE DAB MODULE

   1) Replace the Driver Airbag(DAB) with a new one.
   ● "Refer to "Driver Airbag(DAB)" section in this SERVICE MANUAL.

   2) Install the DAB module and connect the DAB connector.

   3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   4) Connect the SRSCM connector.

   5) Connect the battery negative cable to the battery.

   6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to DAB?

YES

▶ Check the clockspring.

NO

▶ Replace the Driver Airbag(DAB).

4. CHECK THE CLOCKSPRING

1) Check the clockspring.
Is the clockspring normal?

YES

▶ Go to next step.

NO

▶ Replace the clockspring.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1352 PASSENGER AIRBAG RESISTANCE TOO HIGH
DTC B1353 PASSENGER AIRBAG RESISTANCE TOO LOW

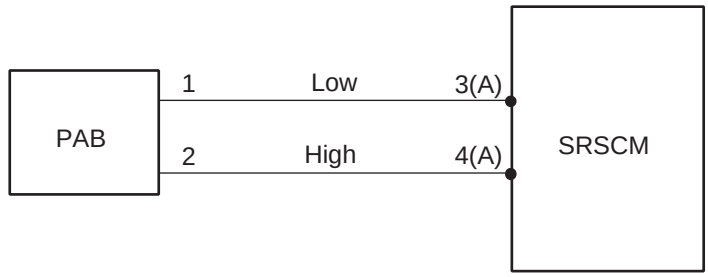
DTC DESCRIPTION E7DE543A

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

DTC DETECTING CONDITION E7CB128C

DTC	Condition	Probable cause
B1352 B1353	• Too high or low resistance between PAB high(+) and PAB low (-) • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

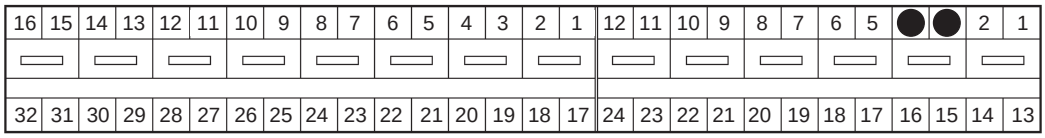
SCHEMATIC DIAGRAM ED6CEB3F



Terminal	Connected to	Function
1	SRSCM Terminal 3(A)	PAB Low
2	SRSCM Terminal 4(A)	PAB High

[HARNESS CONNECTOR]

PAB



CONNECTOR B CONNECTOR A

Shorting Bar

SRSCM

LRJF200C

SPECIFICATION EA9034CC

PAB resistance : 1.878 ~ 2.442 Ω

TERMINAL & CONNECTOR INSPECTION E64ECFBA

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E08F5EE1

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK PAB RESISTANCE

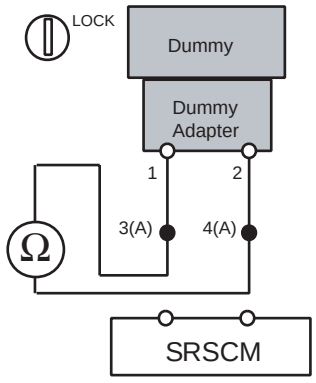
   CAUTION

   Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   1) Connect the Dummy and the Dummy Adapter on PAB harness connector.
      ● Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   2) Measure resistance between the terminal 4 and 3 of SRSCM harness connector(A).

PAB resistance : 1.878 ~ 2.442 Ω



LRJF200D

   3) Is the measured resistance within specification?

   YES

   ▶ Replace the Passenger Airbag(PAB) module.

   NO

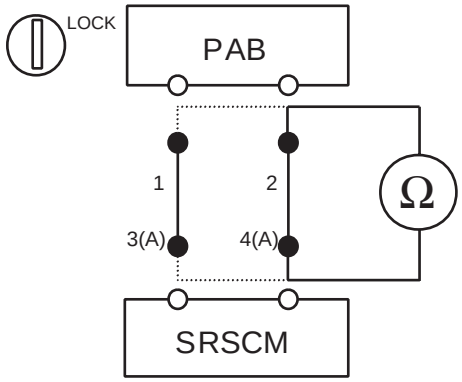
   ▶ Check open circuit.

3. CHECK OPEN CIRCUIT

   1) Measure resistance between the terminal 2 of PAB harness connector and the terminal 4 of SRSCM harness connector(A).

   2) Measure resistance between the terminal 1 of PAB harness connector and the terminal 3 of SRSCM harness connector(A).

Specification (resistance) : below 1 Ω



LRJF200E

3) Is the measured resistance within specification?

YES

▶ Check short circuit.

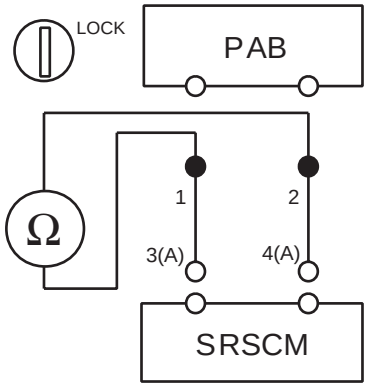
NO

▶ Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT

1) Measure resistance between the terminal 1 and 2 of PAB harness connector.

Specification (resistance) : infinite



LRJF200F

2) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the PAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1354 PASSENGER AIRBAG CIRCUIT SHORT TO GROUND

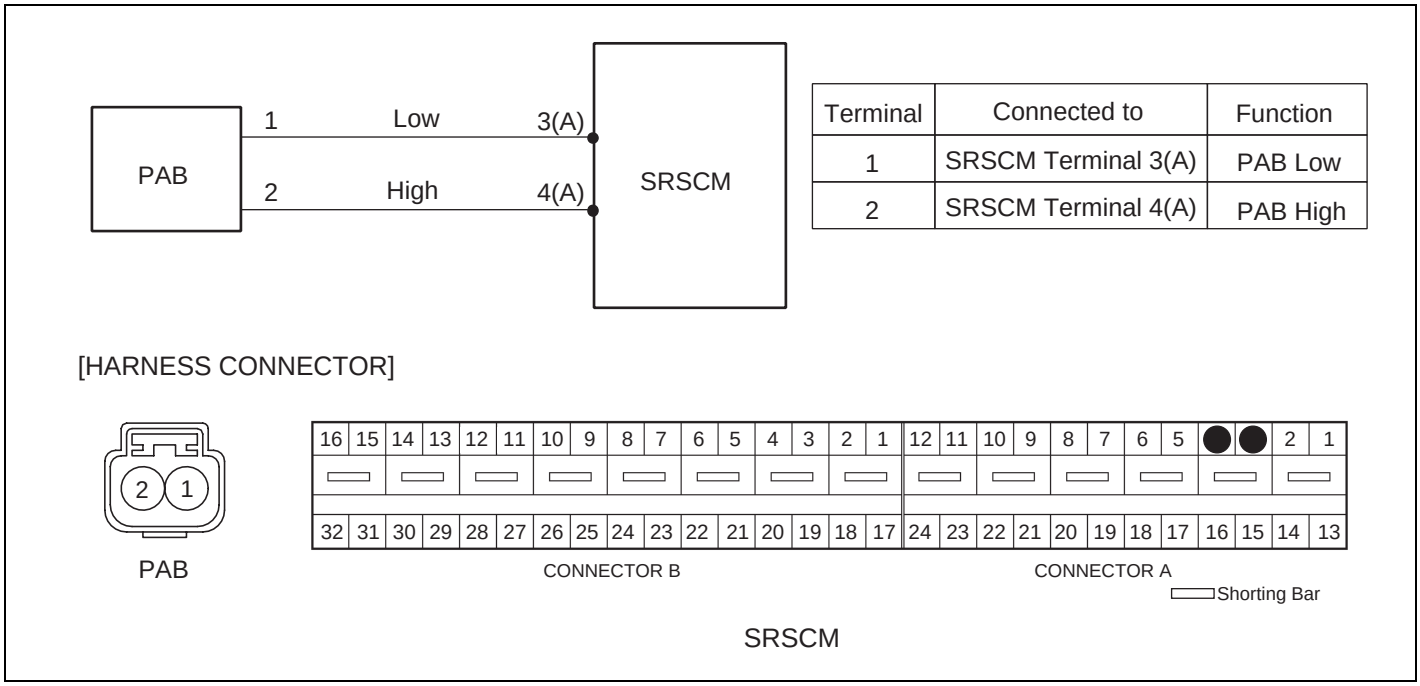
DTC DESCRIPTION E4CBE723

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

DTC DETECTING CONDITION EA43FC76

DTC	Condition	Probable cause
B1354	• Short to ground between PAB module and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to ground on wiring harness • Passenger Airbag (PAB) squib • SRSCM

SCHEMATIC DIAGRAM EF715DEC



Terminal	Connected to	Function
1	SRSCM Terminal 3(A)	PAB Low
2	SRSCM Terminal 4(A)	PAB High

LRJF200C

TERMINAL & CONNECTOR INSPECTION E3F3ACD1

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

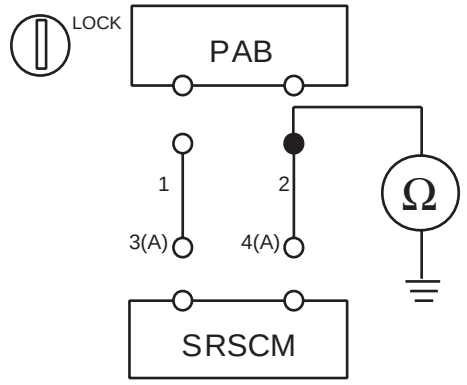
INSPECTION PROCEDURE E9C649D2

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK SHORT TO GROUND

1) Measure resistance between the terminal 2 of PAB harness connector and chassis ground.

Specification (resistance) : infinite



LRJF500O

2) Is the measured resistance within specification?

YES

▶ Check the PAB Module.

NO

▶ Repair or replace the wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE

1) Replace the Passenger Airbag (PAB) with a new one.
● Refer to "Passenger Airbag (PAB)" section in this SERVICE MANUAL.

2) Install the DAB module and connect the DAB connector.

3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

4) Connect the SRSCM connector.

5) Connect the battery negative cable to the battery.

6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to PAB?

YES

▶ Go to next step.

NO

▶Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1355 PASSENGER AIRBAG CIRCUIT SHORT TO BATTERY

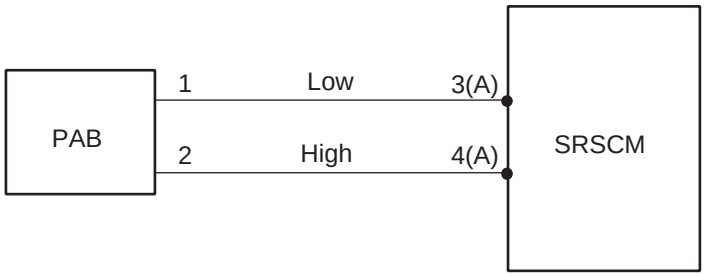
DTC DESCRIPTION EE4D5EB7

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB). The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

DTC DETECTING CONDITION E6D3E83D

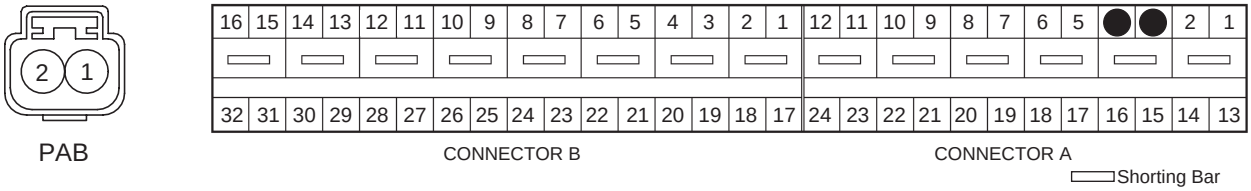
DTC	Condition	Probable cause
B1355	• Short to battery line between PAB and SRSCM • Passenger Airbag (PAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Passenger Airbag (PAB) squib • SRSCM

SCHEMATIC DIAGRAM E0EC5BD9



Terminal	Connected to	Function
1	SRSCM Terminal 3(A)	PAB Low
2	SRSCM Terminal 4(A)	PAB High

[HARNESS CONNECTOR]



LRJF200C

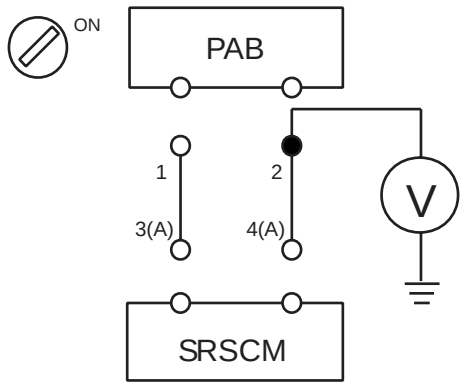
TERMINAL & CONNECTOR INSPECTION ED5B87B1

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EB9DF988

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)
2. CHECK SHORT TO BATTERY LINE
   1) Connect the battery negative cable to the battery.
   2) Turn the ignition switch to ON.
   3) Measure voltage between the terminal 2 of PAB harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



LRJF500P

4) Is the measured voltage within specification?

YES

▶ Check the PAB Module.

NO

▶ Repair the short to battery line circuit on wiring harness between the PAB and the SRSCM.

3. CHECK THE PAB MODULE

1) Replace the Passenger Airbag(PAB) with a new one.
● Refer to "Passenger Airbag(PAB)" section in this SERVICE MANUAL.

2) Install the DAB module and connect the DAB connector.

3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

4) Connect the SRSCM connector.

5) Connect the battery negative cable to the battery.

6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to PAB?

YES

▶ Go to next step.

NO

▶Replace PAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1361 SEAT BELT PRETENSIONER [FRONT-DRIVER] RESISTANCE TOO HIGH
DTC B1362 SEAT BELT PRETENSIONER [FRONT-DRIVER] RESISTANCE TOO LOW
DTC B1367 SEAT BELT PRETENSIONER [FRONT-PASSENGER] RESISTANCE TOO HIGH
DTC B1368 SEAT BELT PRETENSIONER [FRONT-PASSENGER] RESISTANCE TOO LOW

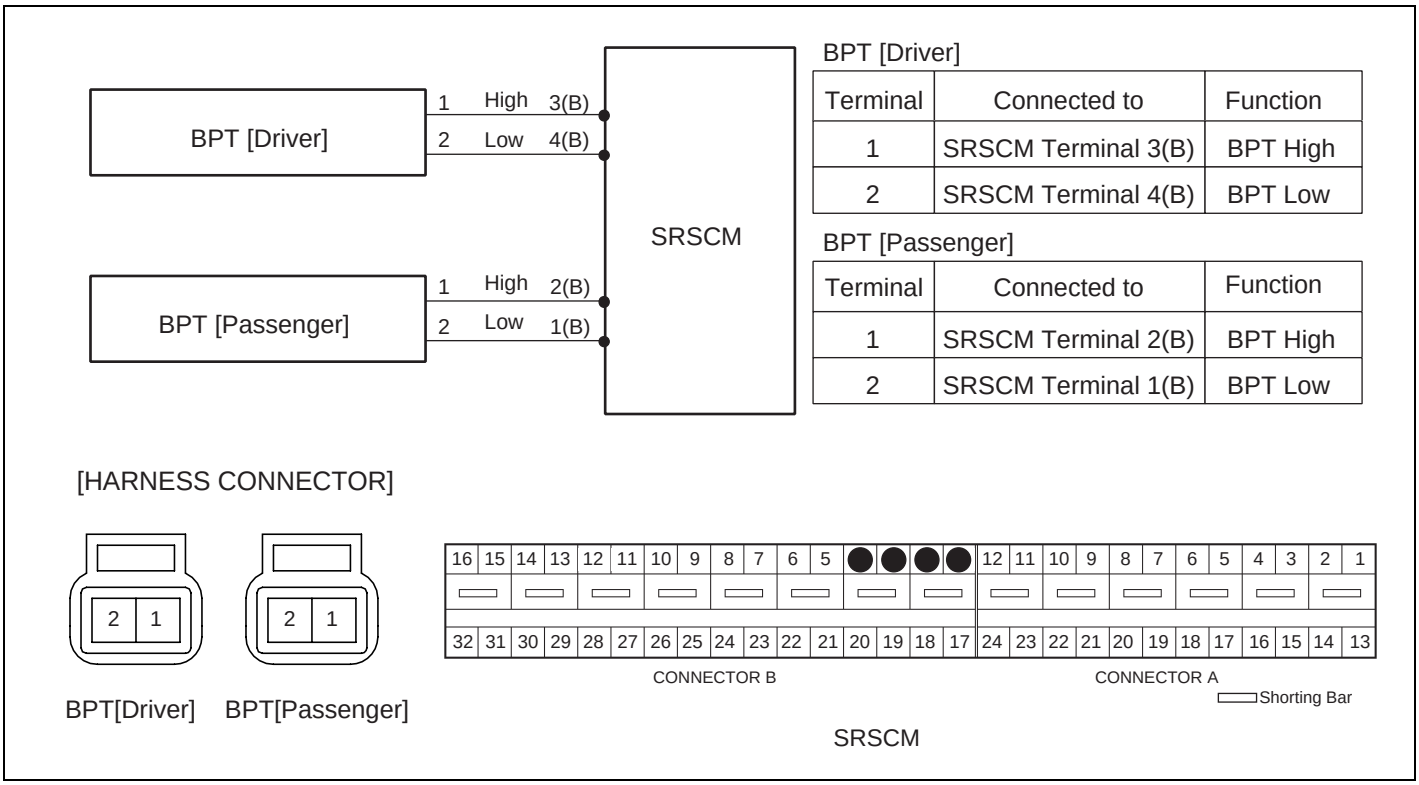
DTC DESCRIPTION E971A9E1

The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioners (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

DTC DETECTING CONDITION EE1BFD2A

DTC	Condition	Probable cause
B1361 B1362 B1367 B1368	• Too high or low resistance between BPT high(+) and BPT low (-) • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

SCHEMATIC DIAGRAM EA96DC50



BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

LRJF500Q

SPECIFICATION EFB7D75C

BPT resistance : 1.943 ~ 2.806 Ω (Driver), 1.950 ~ 2.814 Ω (Passenger)

TERMINAL & CONNECTOR INSPECTION EDFD317A

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E487FB3C

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK BPT RESISTANCE

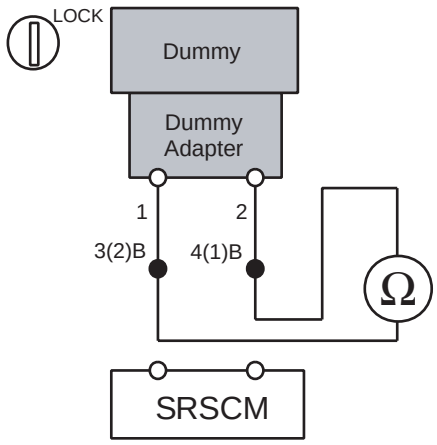
   CAUTION

   Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   1) Connect the Dummy and the Dummy Adapter on BPT harness connector.
      ● Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   2) Measure resistance between the terminal 3(2) and 4(1) of SRSCM harness connector(B).

BPT resistance : 1.943 ~ 2.806 Ω (Driver), 1.950 ~ 2.814 Ω (Passenger)



ERRF500X

   3) Is the measured resistance within specification?

YES

▶ Replace the Seat Belt Pretensioner(BPT) module.

NO

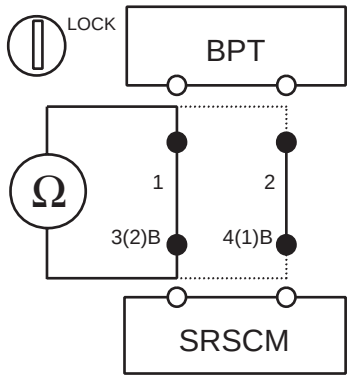
▶Check open circuit.

3. CHECK OPEN CIRCUIT

   1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 3(2) of SRSCM harness connector(B).

   2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(1) of SRSCM harness connector(B).

Specification (resistance) : below 1 Ω



LRJF500R

3) Is the measured resistance within specification?

YES

▶ Check short circuit.

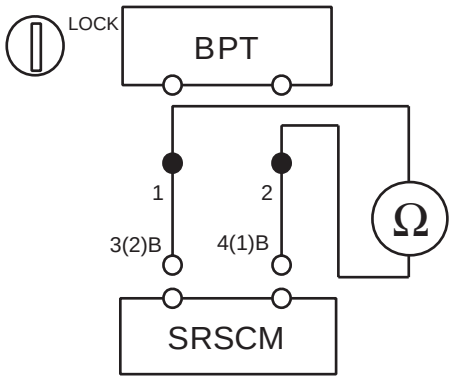
NO

▶ Repair or replace the wiring harness between the BPT and the SRSCM.

4. CHECK SHORT CIRCUIT

1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

Specification (resistance) : infinite



KRRE501M

2) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the BPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1363 SEAT BELT PRETENSIONER [FRONT-DRIVER] CIRCUIT SHORT TO GROUND
DTC B1369 SEAT BELT PRETENSIONER [FRONT-PASSENGER] CIRCUIT SHORT TO GROUND

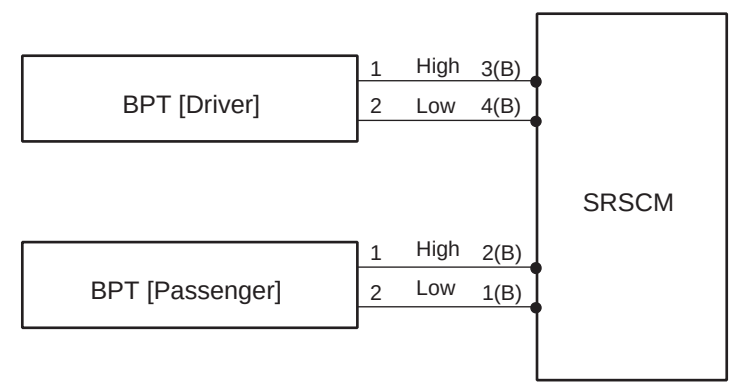
DTC DESCRIPTION EC7BCFB6

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects short to ground on the BPT circuit.

DTC DETECTING CONDITION ED4C2AEE

DTC	Condition	Probable cause
B1363 B1369	• Short to ground between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

SCHEMATIC DIAGRAM E15DDE9C



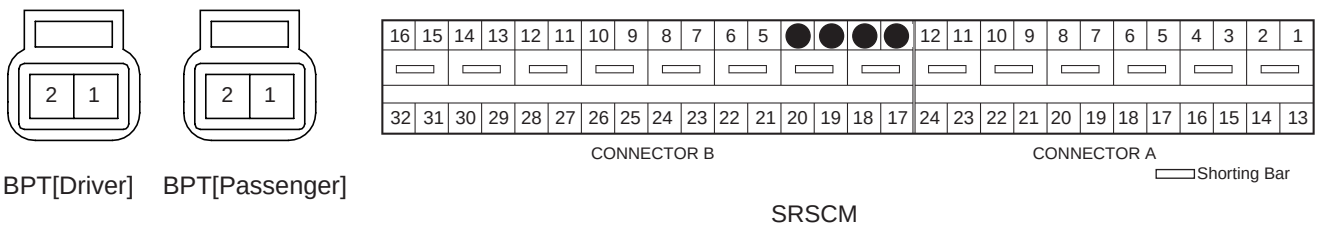
BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

[HARNESS CONNECTOR]



LRJF500Q

TERMINAL & CONNECTOR INSPECTION EABFBC8F

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E028D08E

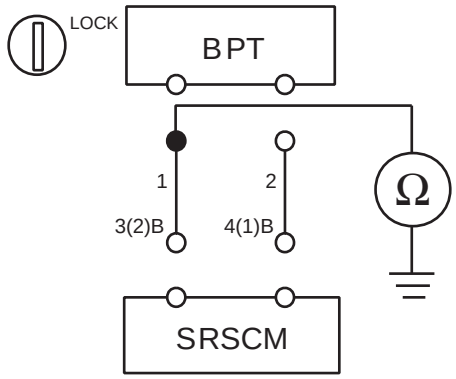
1. PREPARATION

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK SHORT TO GROUND

1) Measure resistance between the terminal 1 of BPT harness connector and chassis ground.

Specification (resistance) : infinite



KRRE501N

2) Is the measured resistance within specification?

YES

▶Check the BPT Module.

NO

▶ Repair or replace the wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE

1) Replace the Belt Pretensioner (BPT) with a new one.
● Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.

2) Install the DAB module and connect the DAB connector.

3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

4) Connect the SRSCM connector.

5) Connect the battery negative cable to the battery.

6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

YES

▶Go to next step.

NO

▶Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1364 SEAT BELT PRETENSIONER [FRONT-DRIVER] CIRCUIT SHORT TO BATTERY
DTC B1370 SEAT BELT PRETENSIONER [FRONT-PASSENGER] CIRCUIT SHORT TO BATTERY

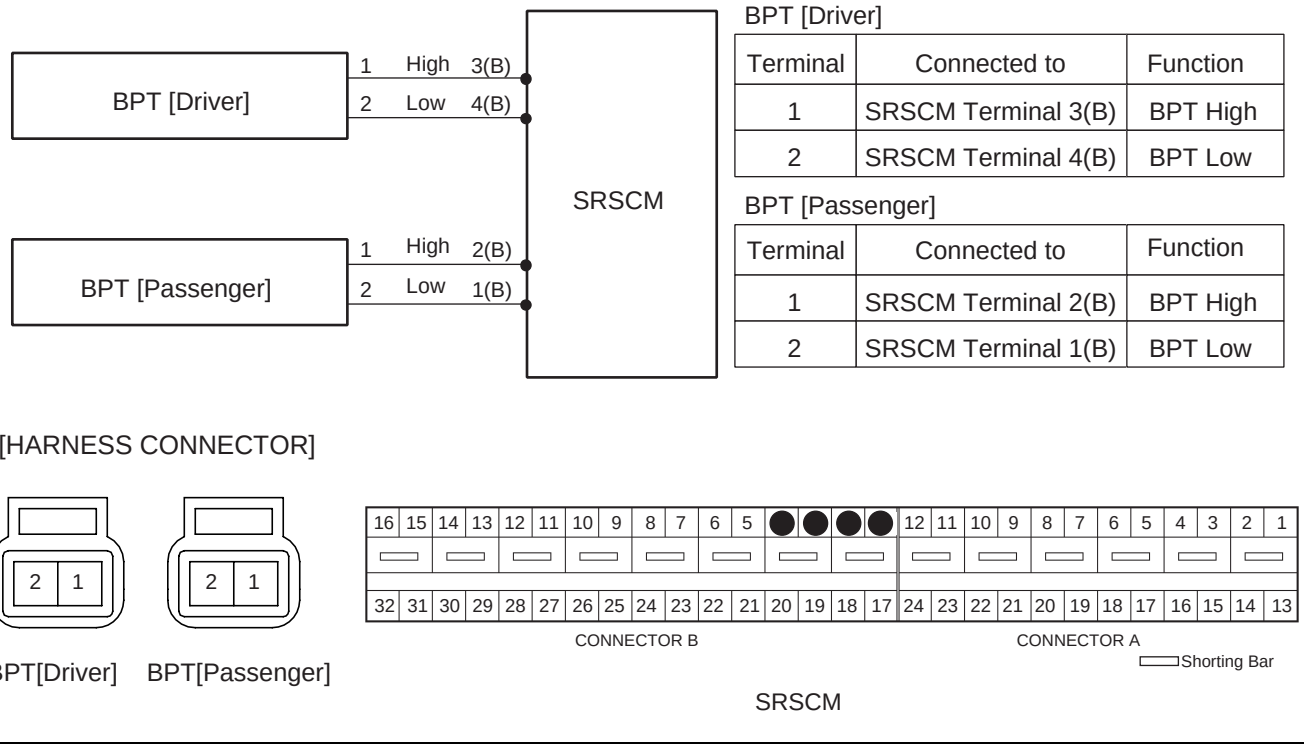
DTC DESCRIPTION E7B3F58C

The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects short to battery line on the BPT circuit.

DTC DETECTING CONDITION E2FB51D9

DTC	Condition	Probable cause
B1364 B1370	• Short to battery line between BPT and SRSCM • Seat Belt Pretensioner (BPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Seat Belt Pretensioner (BPT) squib • SRSCM

SCHEMATIC DIAGRAM EFFAE0D1



BPT [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 3(B)	BPT High
2	SRSCM Terminal 4(B)	BPT Low

BPT [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 2(B)	BPT High
2	SRSCM Terminal 1(B)	BPT Low

LRJF500Q

TERMINAL & CONNECTOR INSPECTION E5D56C81

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E2E40A22

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

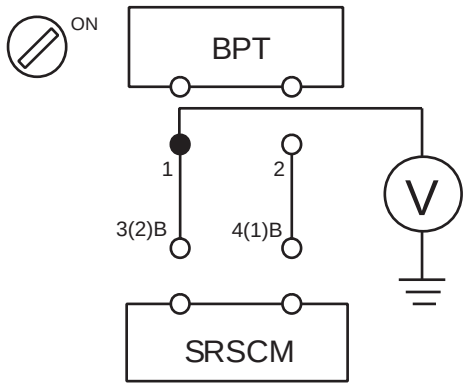
2. CHECK SHORT TO BATTERY LINE

   1) Connect the battery negative cable to the battery.

   2) Turn the ignition switch to ON.

   3) Measure voltage between the terminal 1 of BPT harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



KRRE501O

   4) Is the measured voltage within specification?

YES

▶ Check the BPT Module.

NO

▶ Repair the short to battery line circuit on wiring harness between the BPT and the SRSCM.

3. CHECK THE BPT MODULE

   1) Replace the Belt Pretensioner (BPT) with a new one.
   ● Refer to "Belt Pretensioner (BPT)" section in this SERVICE MANUAL.

   2) Install the DAB module and connect the DAB connector.

   3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   4) Connect the SRSCM connector.

   5) Connect the battery negative cable to the battery.

   6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to Belt Pretensioner (BPT)?

YES

▶ Go to next step.

NO

▶ Replace BPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1378 SIDE AIRBAG [FRONT-DRIVER] RESISTANCE TOO HIGH
DTC B1379 SIDE AIRBAG [FRONT-DRIVER] RESISTANCE TOO LOW
DTC B1382 SIDE AIRBAG [FRONT-PASSENGER] RESISTANCE TOO HIGH
DTC B1383 SIDE AIRBAG [FRONT-PASSENGER] RESISTANCE TOO LOW

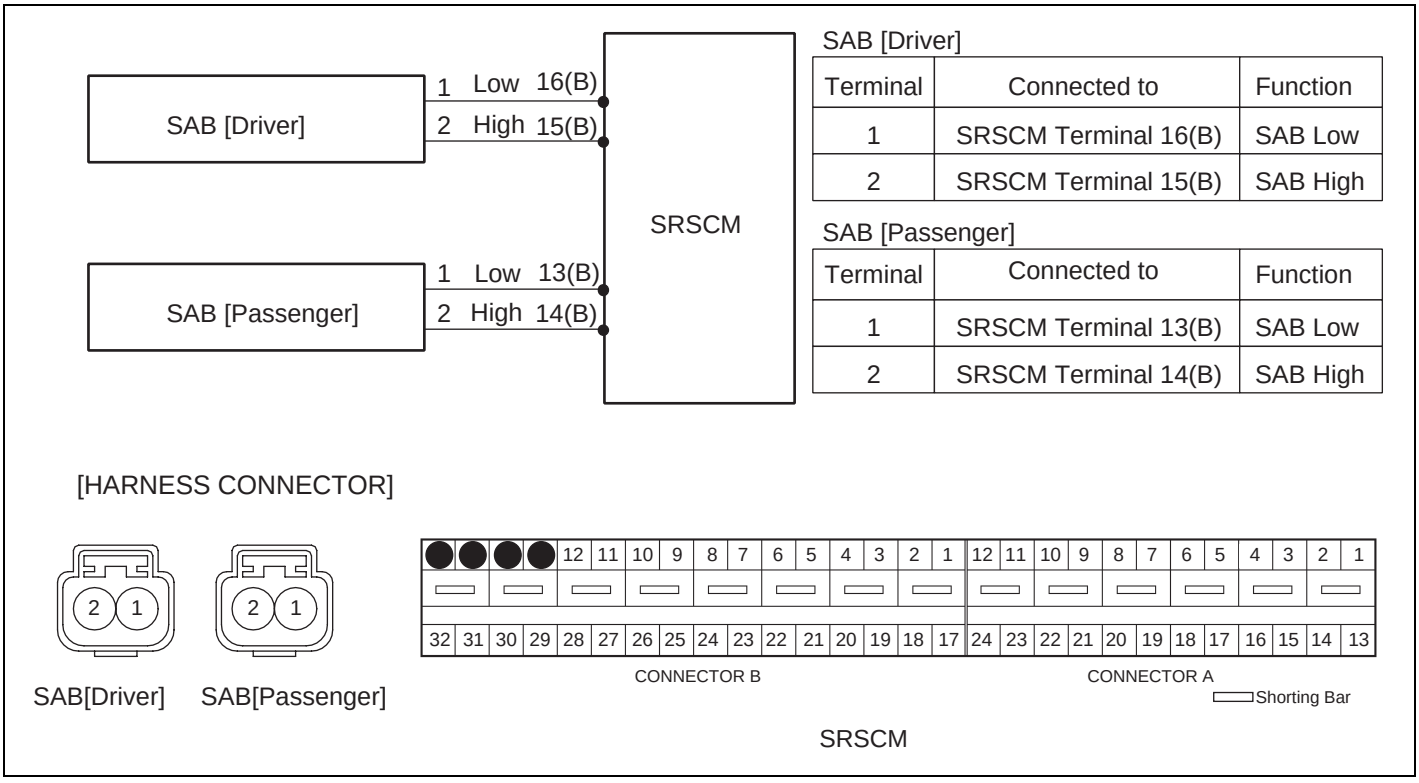
DTC DESCRIPTION EE647F4E

The Side Airbag circuit consists of the SRSCM and two Side Airbags (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

DTC DETECTING CONDITION E6FA7F4E

DTC	Condition	Probable cause
B1378 B1379 B1382 B1383	• Too high or low resistance between SAB high(+) and SAB low (-) • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

SCHEMATIC DIAGRAM E5A494A5



SAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 16(B)	SAB Low
2	SRSCM Terminal 15(B)	SAB High

SAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 13(B)	SAB Low
2	SRSCM Terminal 14(B)	SAB High

LRJF500S

SPECIFICATION ED1CF1A5

SAB resistance : 1.804 ~ 2.568 Ω (Driver), 1.812 ~ 2.576 Ω (Passenger)

TERMINAL & CONNECTOR INSPECTION EC34040C

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EA4C5A6D

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK SAB RESISTANCE

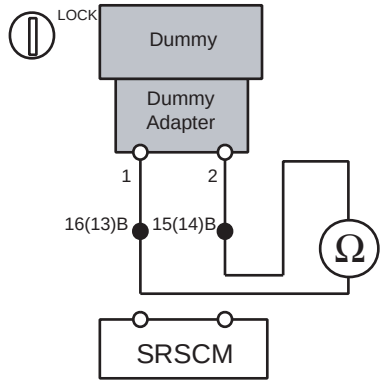
   CAUTION

   Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   1) Connect the Dummy and the Dummy Adapter on SAB harness connector.
      ● Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   2) Measure resistance between the terminal 15(14) and 16(13) of SRSCM harness connector(B).

SAB resistance : 1.804 ~ 2.568 Ω (Driver), 1.812 ~ 2.576 Ω (Passenger)



LRJF500Y

   3) Is the measured resistance within specification?

   YES

   ▶ Replace the Side Airbag(SAB) module.

   NO

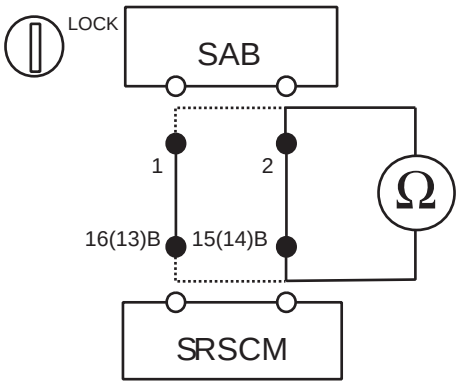
   ▶ Check open circuit.

3. CHECK OPEN CIRCUIT

   1) Measure resistance between the terminal 2 of SAB harness connector and the terminal 15(14) of SRSCM harness connector(B).

   2) Measure resistance between the terminal 1 of SAB harness connector and the terminal 16(13) of SRSCM harness connector(B).

Specification (resistance) : below 1 Ω



LRJF200H

3) Is the measured resistance within specification?

YES

▶ Check short circuit.

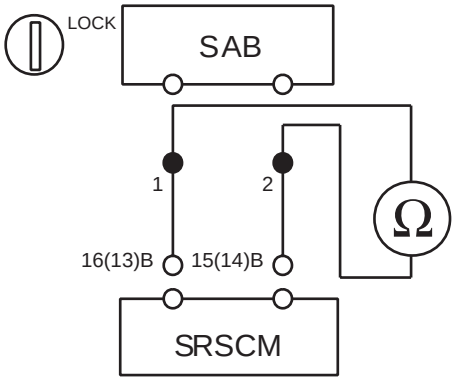
NO

▶ Repair or replace the wiring harness between the SAB and the SRSCM.

4. CHECK SHORT CIRCUIT

1) Measure resistance between the terminal 1 and 2 of SAB harness connector.

Specification (resistance) : infinite



LRJF200I

2) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the SAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1380 SIDE AIRBAG [FRONT-DRIVER] CIRCUIT SHORT TO GROUND
DTC B1384 SIDE AIRBAG [FRONT-PASSENGER] CIRCUIT SHORT TO GROUND

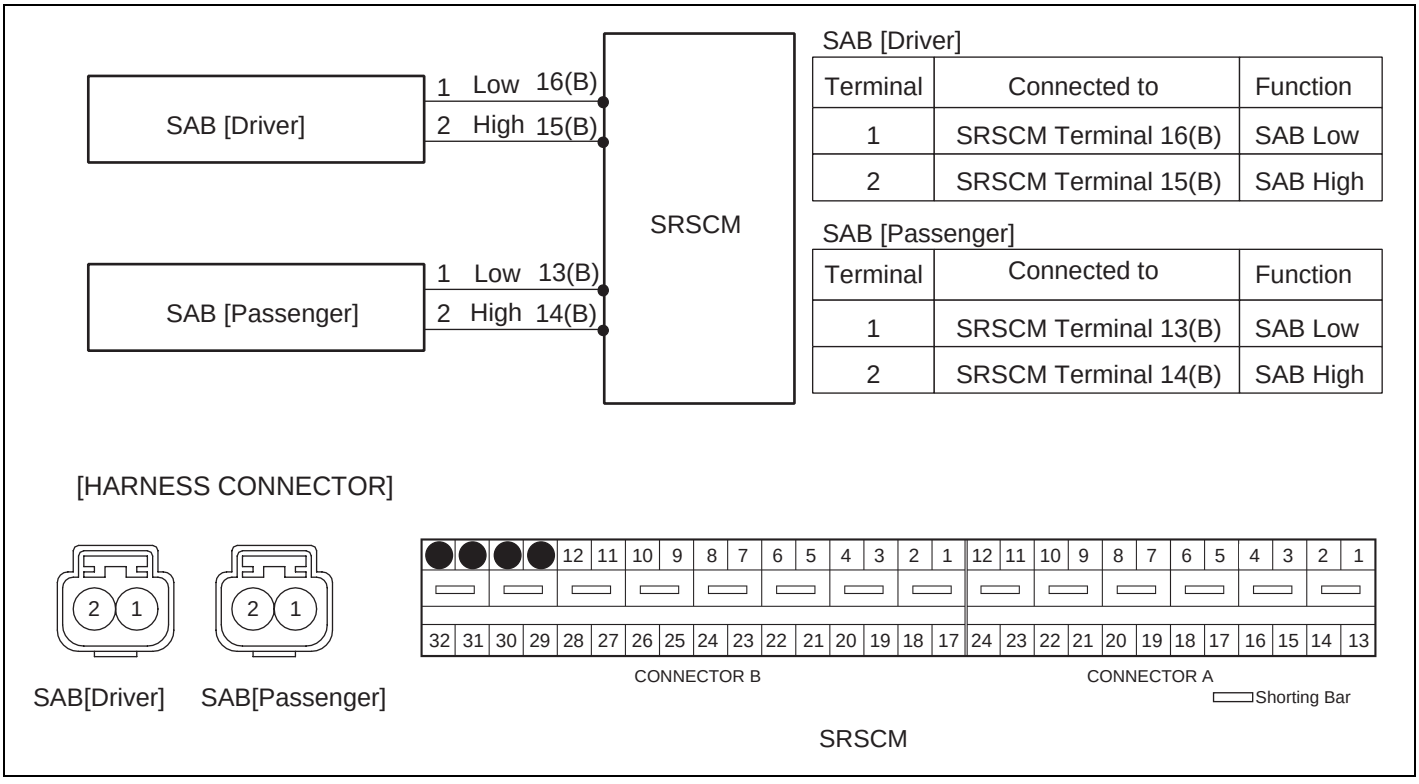
DTC DESCRIPTION E88141AF

The Side Airbag circuit consists of the SRSCM and two Side Airbags (SAB). The SRSCM sets above DTC(s) if it detects short to ground on the SAB circuit.

DTC DETECTING CONDITION EFA4FD7F

DTC	Condition	Probable cause
B1380 B1384	• Short to ground between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

SCHEMATIC DIAGRAM E807CC89



SAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 16(B)	SAB Low
2	SRSCM Terminal 15(B)	SAB High

SAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 13(B)	SAB Low
2	SRSCM Terminal 14(B)	SAB High

LRJF500S

TERMINAL & CONNECTOR INSPECTION E327299F

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

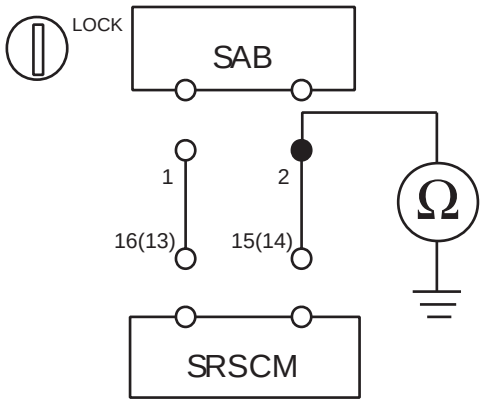
INSPECTION PROCEDURE EAE7FB7B

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK SHORT TO GROUND

1) Measure resistance between the terminal 2 of SAB harness connector and chassis ground.

Specification (resistance) : infinite



LRJF200J

2) Is the measured resistance within specification?

YES

▶ Check the SAB Module.

NO

▶ Repair or replace the wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE

1) Replace the Side Airbag(SAB) with a new one.
● Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

2) Install the DAB module and connect the DAB connector.

3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

4) Connect the SRSCM connector.

5) Connect the battery negative cable to the battery.

6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▶ Go to next step.

NO

▶ Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1381 SIDE AIRBAG [FRONT-DRIVER] CIRCUIT SHORT TO BATTERY
DTC B1385 SIDE AIRBAG [FRONT-PASSENGER] CIRCUIT SHORT TO BATTERY

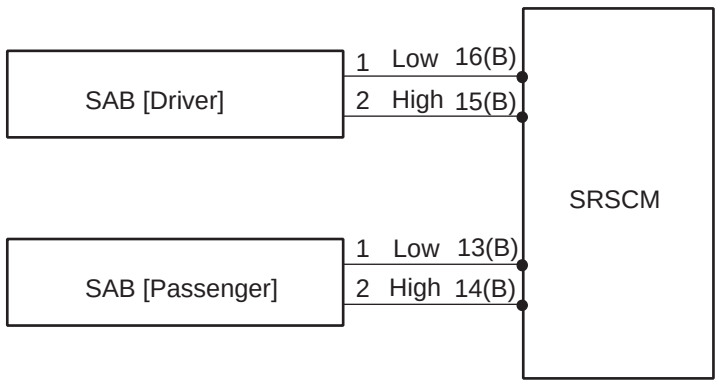
DTC DESCRIPTION ECA4DEDF

The Side Airbag circuit consists of the SRSCM and two Side Airbags (SAB). The SRSCM sets above DTC(s) if it detects short to battery line on the SAB circuit.

DTC DETECTING CONDITION EF8A2476

DTC	Condition	Probable cause
B1381 B1385	• Short to battery line between SAB and SRSCM • Side Airbag (SAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Side Airbag (SAB) squib • SRSCM

SCHEMATIC DIAGRAM E226ACCE



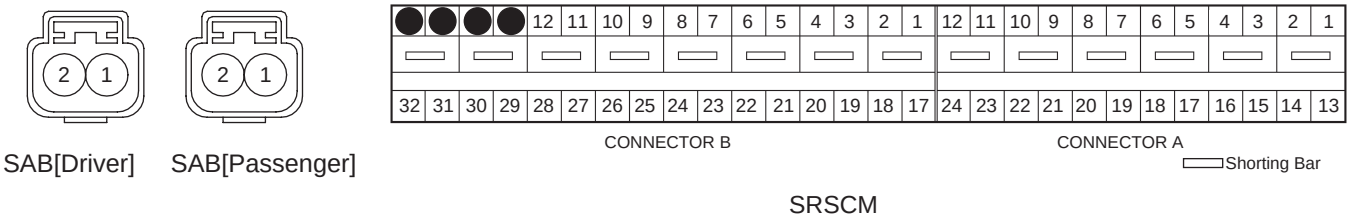
SAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 16(B)	SAB Low
2	SRSCM Terminal 15(B)	SAB High

SAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 13(B)	SAB Low
2	SRSCM Terminal 14(B)	SAB High

[HARNESS CONNECTOR]



SAB[Driver] SAB[Passenger] SRSCM

LRJF500S

TERMINAL & CONNECTOR INSPECTION EF42294A

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E7B23CFB

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

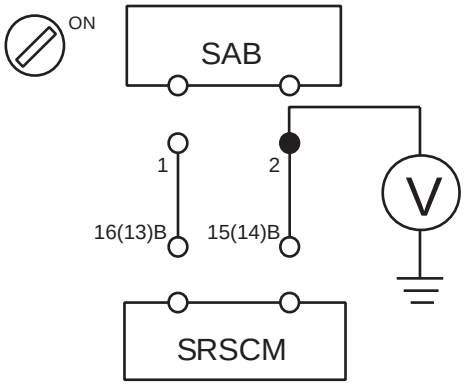
2. CHECK SHORT TO BATTERY LINE

1) Connect the battery negative cable to the battery.

2) Turn the ignition switch to ON.

3) Measure voltage between the terminal 2 of SAB harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



LRJF200K

4) Is the measured voltage within specification?

YES

▶ Check the SAB Module.

NO

▶ Repair the short to battery line circuit on wiring harness between the SAB and the SRSCM.

3. CHECK THE SAB MODULE

1) Replace the Side Airbag(SAB) with a new one.
● Refer to "Side Airbag(SAB)" section in this SERVICE MANUAL.

2) Install the DAB module and connect the DAB connector.

3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

4) Connect the SRSCM connector.

5) Connect the battery negative cable to the battery.

6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to Side Airbag(SAB)?

YES

▶ Go to next step.

NO

▶Replace SAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1395 SQUIB INTERCONNECTION FAULT

DTC DESCRIPTION EFFA1B51

While start up phase, SRSCM will measure cross link of squibs. If one of them is failed during interconnection test, then SRSCM will store interconnection fault. Once the interconnection fault is detected, it remains active continuously till the fault is erased. Only one fault code is assigned for all interconnection fault.

TERMINAL & CONNECTOR INSPECTION E5EAC8BC

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EA8F624F

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)
2. CHECK SHORT CIRCUIT
   1) Measure resistance between following squibs.(DAB - PAB, DAB - SAB, DAB - CAB, DAB - BPT, PAB - SAB, PAB - CAB, PAB - BPT, SAB - PAB, SAB - CAB, SAB - BPT, CAB - BPT)

Specification (resistance) : infinite

   2) Is the measured resistance within specification?

YES

▶ Go to nest stetp.

NO

▶ Repair or replace the wiring harness between two squibs.

3. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1400 SIDE IMPACT SENSOR [FRONT-DRIVER] DEFECT
DTC B1403 SIDE IMPACT SENSOR [FRONT-PASSENGER] DEFECT
DTC B1409 SIDE IMPACT SENSOR [FRONT-DRIVER] COMMUNICATION ERROR
DTC B1410 SIDE IMPACT SENSOR [FRONT-PASSENGER] COMMUNICATION ERROR

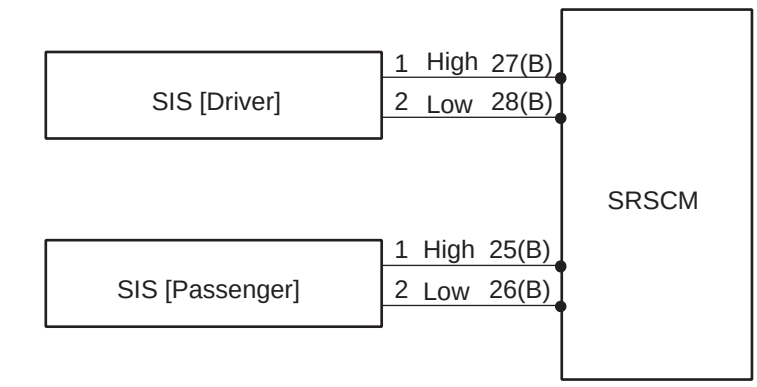
DTC DESCRIPTION E35E24D4

The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any SIS and the SRSCM.

DTC DETECTING CONDITION EF2B3EA5

DTC	Condition	Probable cause
B1400 B1403 B1409 B1410	• Open between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

SCHEMATIC DIAGRAM E8E1ACCE



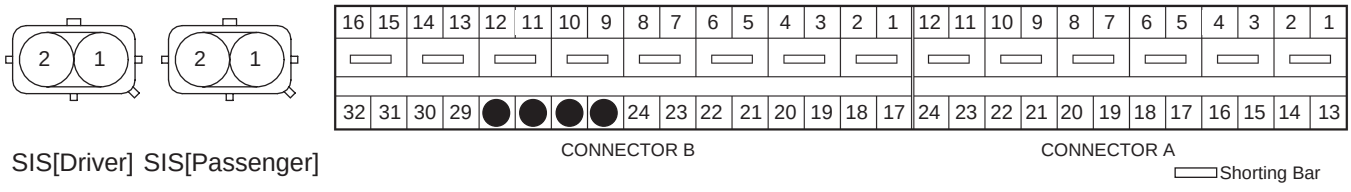
SIS [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 27(B)	SIS High
2	SRSCM Terminal 28(B)	SIS Low

SIS [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 25(B)	SIS High
2	SRSCM Terminal 26(B)	SIS Low

[HARNESS CONNECTOR]



LRJF200L

TERMINAL & CONNECTOR INSPECTION ECF29AD1

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E2C29796

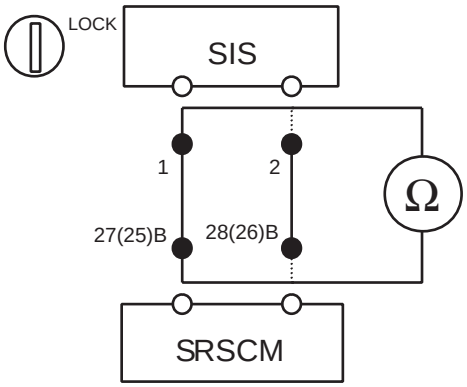
1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK SIS CIRCUIT

   1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 27(25) of SRSCM harness connector(B).

   2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 28(26) of SRSCM harness connector(B).

Specification (resistance) : below 1 Ω



ERRF502E

   3) Is the measured resistance within specification?

   YES

   ▶Check Side Impact Sensor.

   NO

   ▶ Repair or replace the wiring harness between the SIS and the SRSCM.

3. CHECK THE SIDE IMPACT SENSOR

   1) Replace the Side Impact Sensor(SIS) with a new one.
      ● Refer to "Side Impact Sensor(SIS)" section in this SERVICE MANUAL.

   2) Install the DAB module and connect the DAB connector.

   3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   4) Connect the SRSCM connector.

   5) Connect the battery negative cable to the battery.

   6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to Side Impact Sensor(SIS)?

YES

▶ Go to next step.

NO

▶ Replace SIS.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1473 CURTAIN AIRBAG [DRIVER] RESISTANCE TOO HIGH
DTC B1474 CURTAIN AIRBAG [DRIVER] RESISTANCE TOO LOW
DTC B1477 CURTAIN AIRBAG [PASSENGER] RESISTANCE TOO HIGH
DTC B1478 CURTAIN AIRBAG [PASSENGER] RESISTANCE TOO LOW

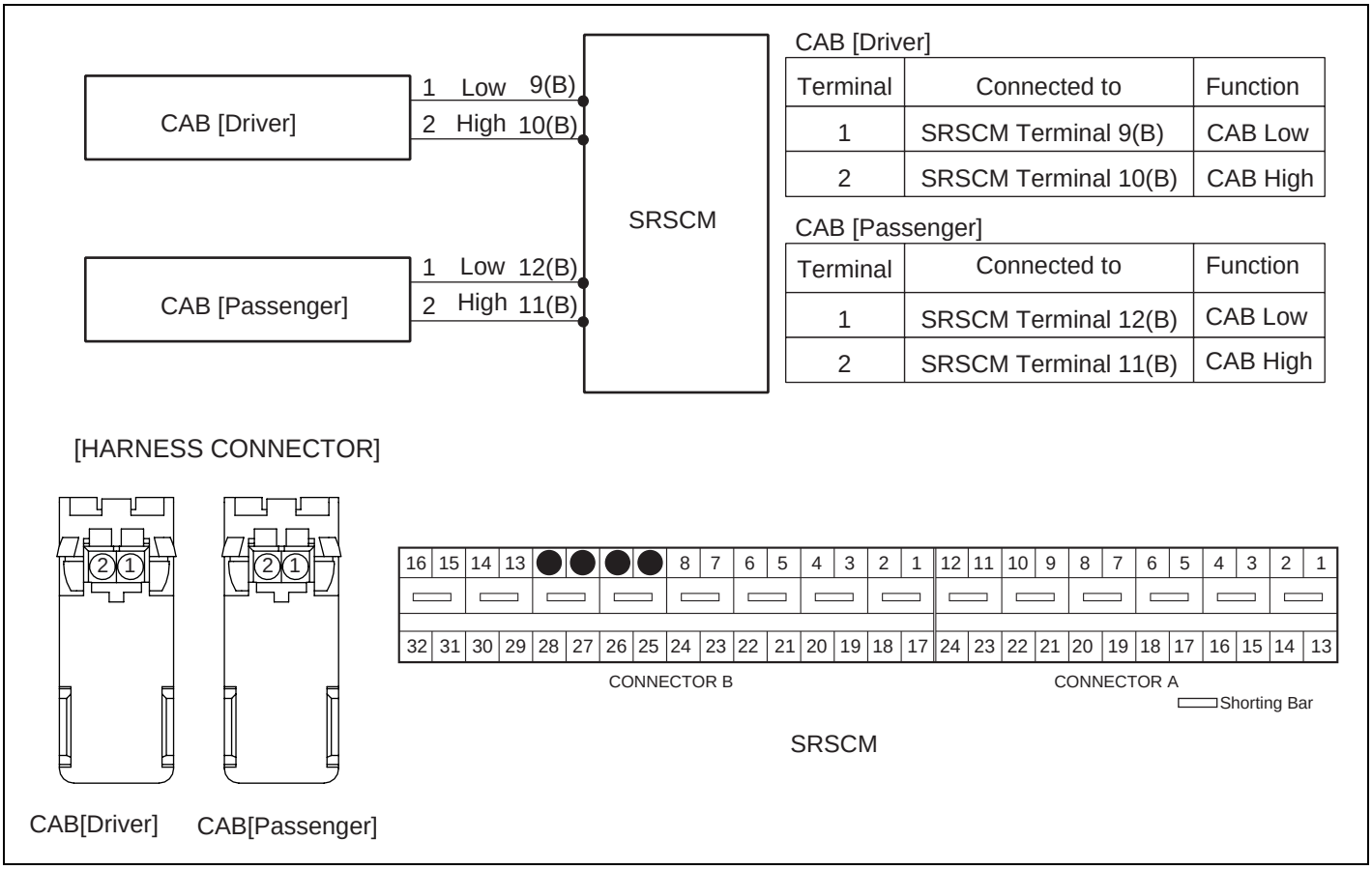
DTC DESCRIPTION E53ABC7A

The CAB squib circuit consists of the SRSCM and two Curtain Airbags(CAB). It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

DTC DETECTING CONDITION EFC0D018

DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low(-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

SCHEMATIC DIAGRAM E95F4DE8



CAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 9(B)	CAB Low
2	SRSCM Terminal 10(B)	CAB High

CAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 12(B)	CAB Low
2	SRSCM Terminal 11(B)	CAB High

LRJF200M

SPECIFICATION ED93269F

CAB resistance : 1.940 ~ 2.704 Ω (Driver), 1.948 ~ 2.712 Ω (Passenger)

TERMINAL & CONNECTOR INSPECTION EB0A19B1

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E290FBAF

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK CAB RESISTANCE

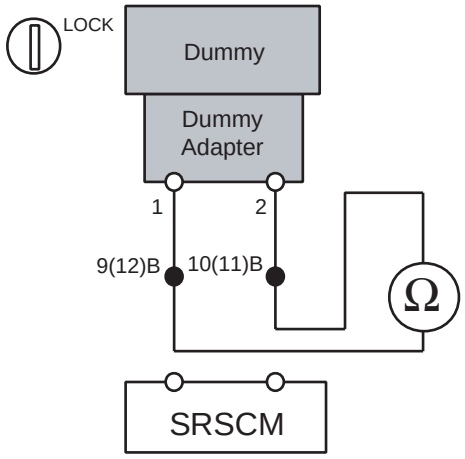
   CAUTION

   Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

   1) Connect the Dummy and the Dummy Adapter on CAB harness connector.
      ● Refer to "SPECIAL SERVICE TOOL" section in this SERVICE MANUAL for the SST No. of Dummy and Dummy Adapter.

   2) Measure resistance between the terminal 10(11) and 9(12) of SRSCM harness connector(B).

CAB resistance : 1.940 ~ 2.704 Ω (Driver), 1.948 ~ 2.712 Ω (Passenger)



LRJF200O

   3) Is the measured resistance within specification?

YES

▶ Replace the Curtain Airbag(CAB) module.

NO

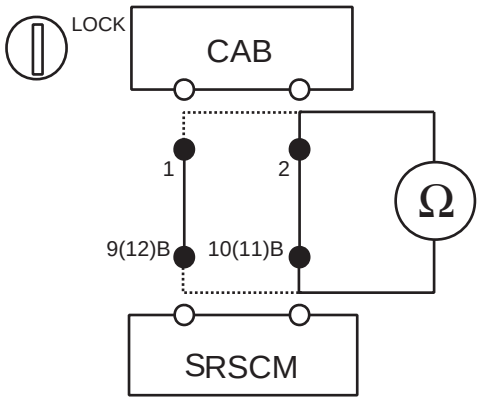
▶ Check open circuit.

3. CHECK OPEN CIRCUIT

1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 10(11) of SRSCM harness connector(B).

2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 9(12) of SRSCM harness connector(B).

Specification (resistance) : below 1 Ω



LRJF200P

3) Is the measured resistance within specification?

YES

▶ Check short circuit.

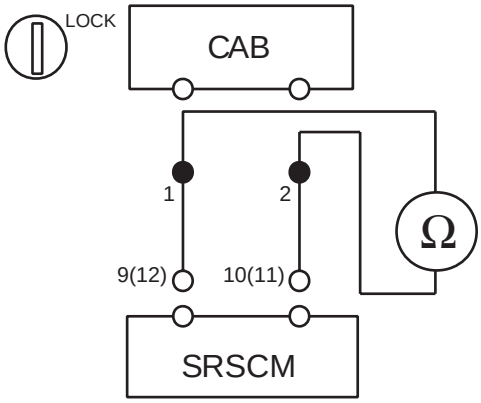
NO

▶ Repair or replace the wiring harness between the CAB and the SRSCM.

4. CHECK SHORT CIRCUIT

1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

Specification (resistance) : infinite



LRJF200Q

2) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the CAB and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1475 CURTAIN AIRBAG [DRIVER] CIRCUIT SHORT TO GROUND
DTC B1479 CURTAIN AIRBAG [PASSENGER] CIRCUIT SHORT TO GROUND

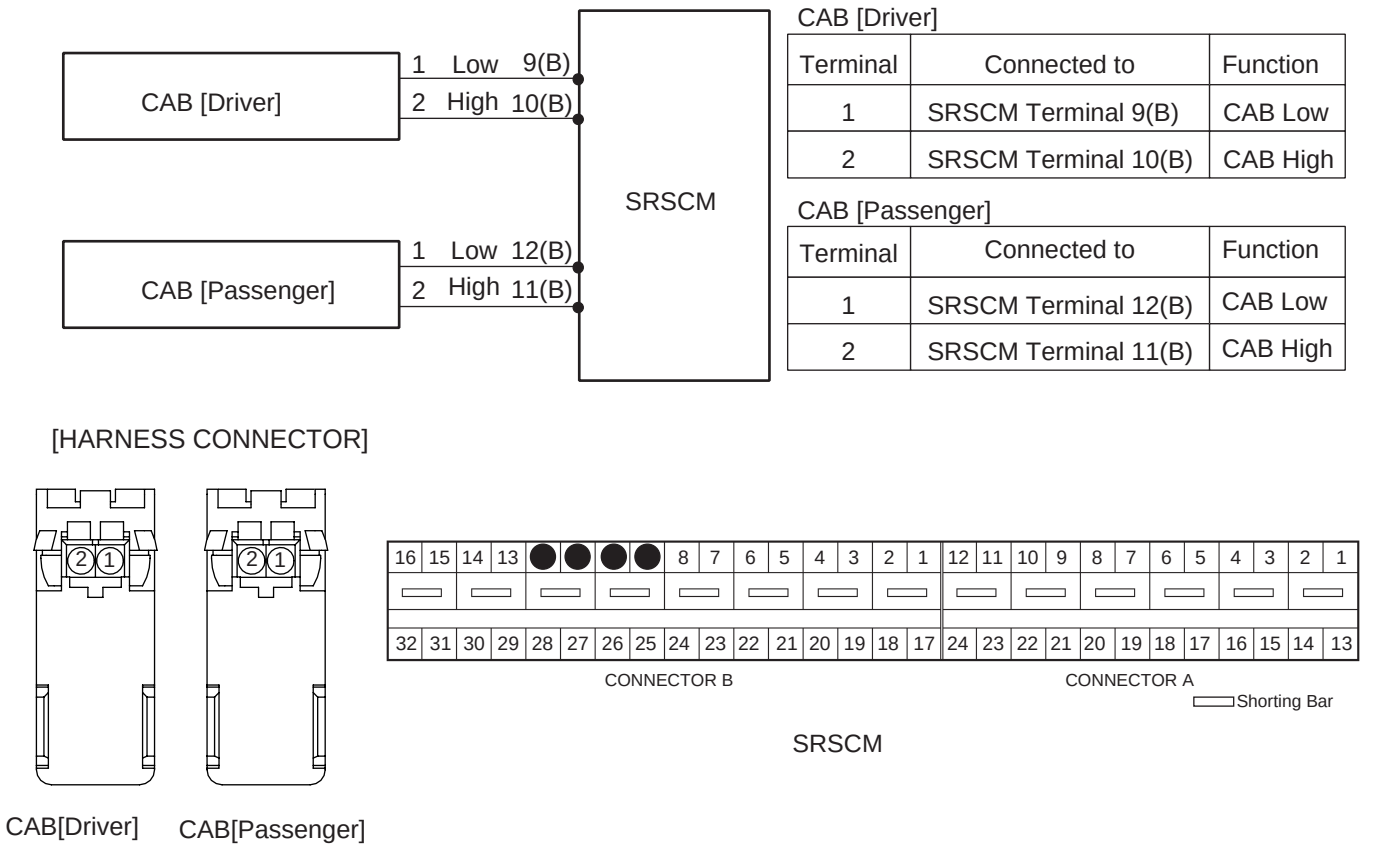
DTC DESCRIPTION E7C31D2B

The CAB squib circuit consists of the SRSCM and CAB. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when short to ground is detected in the CAB squib circuit.

DTC DETECTING CONDITION ED95CAE2

DTC	Condition	Probable cause
B1475 B1479	• Short to ground between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

SCHEMATIC DIAGRAM E39A9EAF



CAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 9(B)	CAB Low
2	SRSCM Terminal 10(B)	CAB High

CAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 12(B)	CAB Low
2	SRSCM Terminal 11(B)	CAB High

LRJF200M

TERMINAL & CONNECTOR INSPECTION E8E6D51E

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

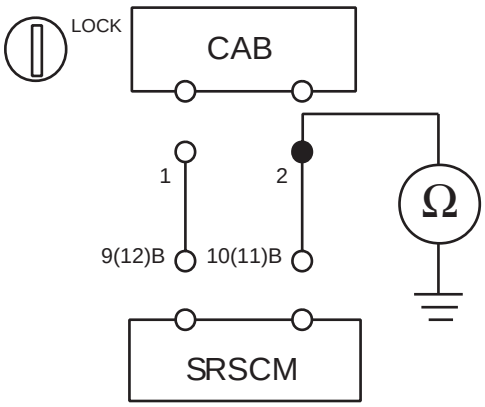
INSPECTION PROCEDURE E2F1B3C7

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK SHORT TO GROUND

   1) Measure resistance between the terminal 2 of CAB harness connector and chassis ground.

Specification (resistance) : infinite



LRJF200R

   2) Is the measured resistance within specification?

YES

▶ Check the CAB Module..

NO

▶ Repair or replace the wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE

   1) Replace the Curtain Airbag(CAB) with a new one.
   ● Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.

   2) Install the DAB module and connect the DAB connector.

   3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   4) Connect the SRSCM connector.

   5) Connect the battery negative cable to the battery.

   6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

YES

▶ Go to next step.

NO

▶ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1476 CURTAIN AIRBAG [DRIVER] CIRCUIT SHORT TO BATTERY
DTC B1480 CURTAIN AIRBAG [PASSENGER] CIRCUIT SHORT TO BATTERY

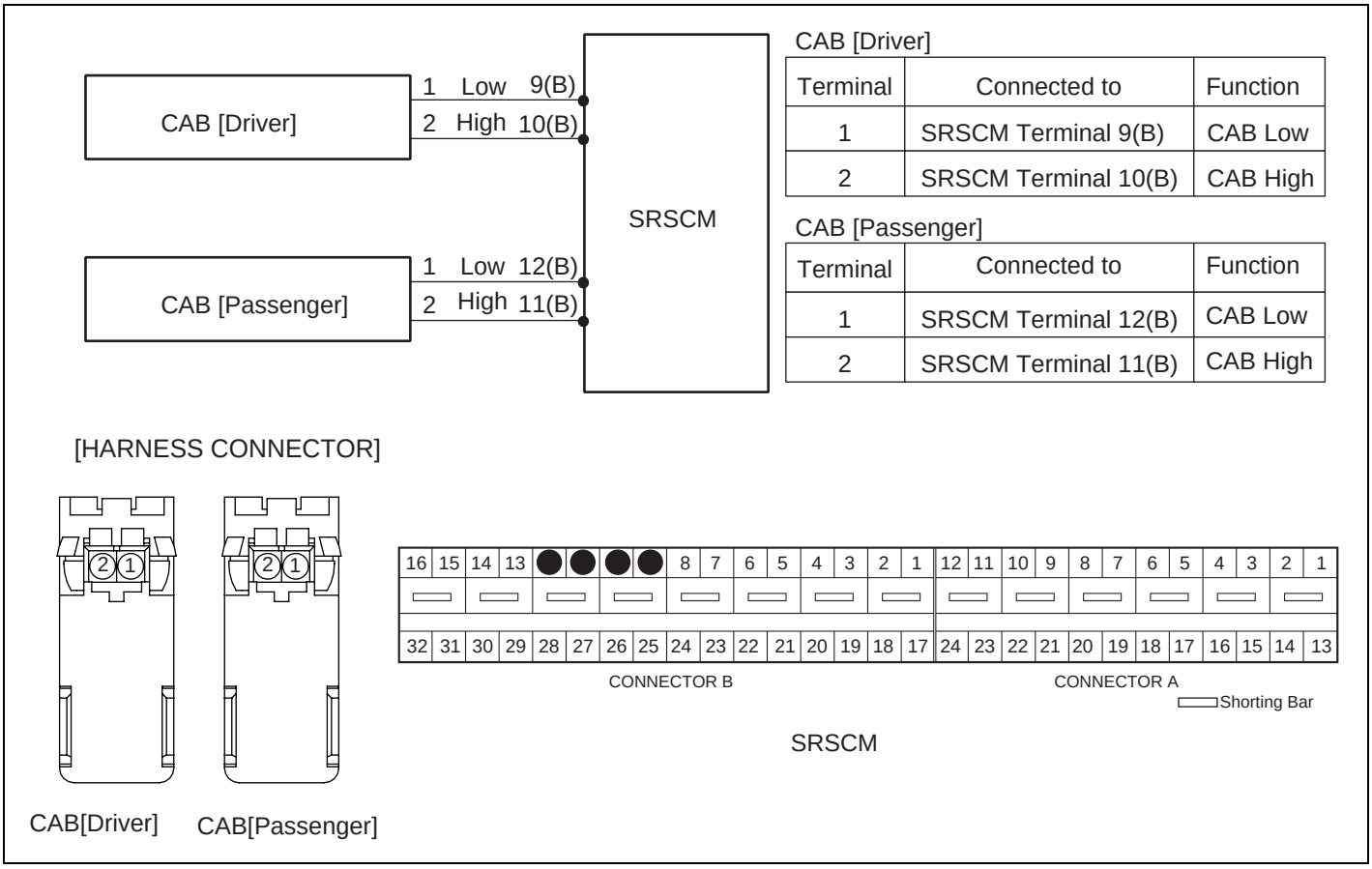
DTC DESCRIPTION EBA050FD

The CAB squib circuit consists of the SRSCM and CAB. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when short to battery is detected in the CAB squib circuit.

DTC DETECTING CONDITION E8C147B5

DTC	Condition	Probable cause
B1476 B1480	• Short to battery between CAB and SRSCM • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

SCHEMATIC DIAGRAM E2BA68E9



CAB [Driver]

Terminal	Connected to	Function
1	SRSCM Terminal 9(B)	CAB Low
2	SRSCM Terminal 10(B)	CAB High

CAB [Passenger]

Terminal	Connected to	Function
1	SRSCM Terminal 12(B)	CAB Low
2	SRSCM Terminal 11(B)	CAB High

LRJF200M

TERMINAL & CONNECTOR INSPECTION E39D886B

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EDBA5745

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

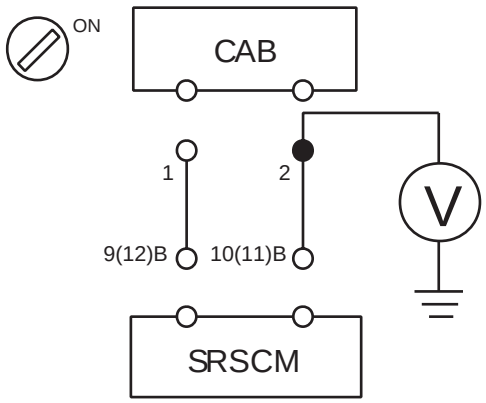
2. CHECK SHORT TO BATTERY LINE

   1) Connect the battery negative cable to the battery.

   2) Turn the ignition switch to ON.

   3) Measure voltage between the terminal 1 of CAB harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



LRJF200S

   4) Is the measured voltage within specification?

   YES

   ▶ Check the CAB Module.

   NO

   ▶ Repair the short to battery line circuit on wiring harness between the CAB and the SRSCM.

3. CHECK THE CAB MODULE

   1) Replace the Curtain Airbag(CAB) with a new one.
      ● Refer to "Curtain Airbag(CAB)" section in this SERVICE MANUAL.

   2) Install the DAB module and connect the DAB connector.

   3) Connect the connectors of the PAB, SAB, CAB, BPT, FIS and SIS.

   4) Connect the SRSCM connector.

   5) Connect the battery negative cable to the battery.

   6) Connect a Hi-Scan(Pro) to the data link connector.

7) Turn the ignition switch to ON and check the vehicle again.
Does Hi-Scan (Pro) indicate any DTC related to Curtain Airbag(CAB)?

YES

▶ Go to next step.

NO

▶ Replace CAB module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1527 PASSENGER AIRBAG DEACTIVATION SWITCH OPEN OR SHORT TO BATTERY

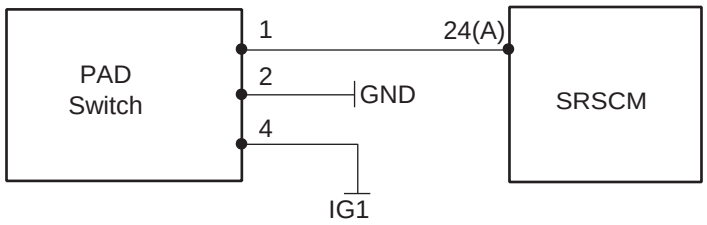
DTC DESCRIPTION ED2E5FCD

The deactication system for the passenger airbag consists of the SRSCM and the Passenger Airbag Deactivation(PAD) switch. The above DTC is recored when PAD switch open or short to battery is detected in the PAD circuit.

DTC DETECTING CONDITION E3D5FDF7

DTC	Condition	Probable cause
B1527	• Short to battery line between PAD switch and SRSCM • SRSCM malfunction • PAD switch malfunction	• PAD switch • Wiring harness • SRSCM

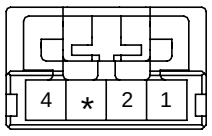
SCHEMATIC DIAGRAM EE75164C



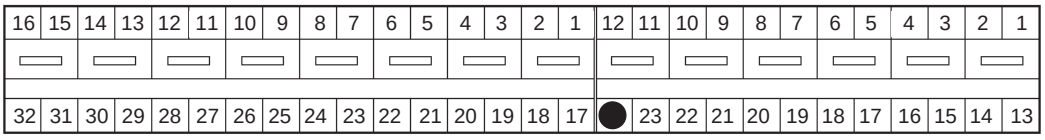
[PAD Switch]

Terminal	Connected to	Function
1	SRSCM Terminal 24(A)	PAD Switch
2	Ground	
4	IG1	Battery Voltage

[HARNESS CONNECTOR]



PAD SWITCH



SRSCM

LRJF500T

SPECIFICATION E1CD108D

PAD Switch Status	Current (mA)	Related DTC
Open or Short to Battery	< 2.71	B1527
PAB Enabled Position	2.96 ~ 5.01	
Defect	5.46 ~ 6.68	B1529
PAB Disabled Position	7.28 ~ 12.73	
Short or Short to Ground	> 13.87	B1528

TERMINAL & CONNECTOR INSPECTION E3C3B5DC

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EAB163DE

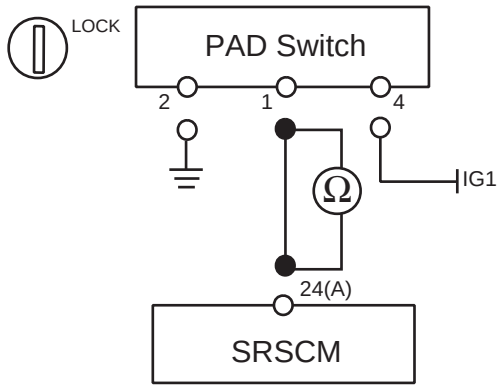
1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK OPEN CIRCUIT

   1) Disconnect the connector of the PAD switch.

   2) Measure resistance between the terminal 24 of the SRSCM harness connector(A) and 1 of PAD switch connector.

Specification (resistance) : below 1 Ω



LRJF500Z

   3) Is the measured resistance within specification?

YES

▶ Check short to battery line.

NO

▶ Replace the harness between the SRSCM and the PAD switch.

3. CHECK SHORT TO BATTERY LINE

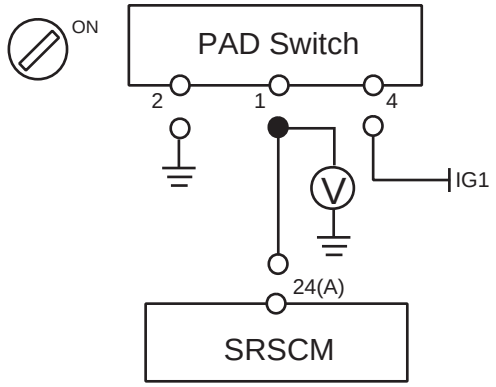
1) Connect the battery negative cable to the battery.

2) Turn the ignition switch to ON.

3) Turn the ignition switch to LOCK, and wait for 30 seconds.

4) Measure voltage between the terminal 1 of PAD switch harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



LRJF501A

5) Is the measured voltage within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the PAD switch and the SRSCM.

4. CHECK THE PAD SWITCH

1) Connect the SRSCM connector.

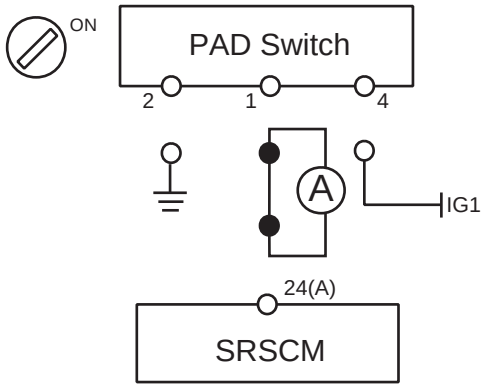
2) Connect the PAD switch.

3) Connect the battery negative cable to the battery.

4) Turn the ignition switch to ON.

5) Measure current between the terminal 24 of the SRSCM harness connector(A) and 1 of PAD switch connector.

Specification (current) :
PAD switch (Enabled position) : 2.96 ~ 5.01 mA
PAD switch (Disabled position) : 7.28 ~ 12.73 mA



LRJF501B

6) Is the measured current within specification?

YES

▶ Go to next step.

NO

▶ Replace the PAD switch.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1528 PASSENGER AIRBAG DEACTIVATION SWITCH SHORT OR SHORT TO GROUND

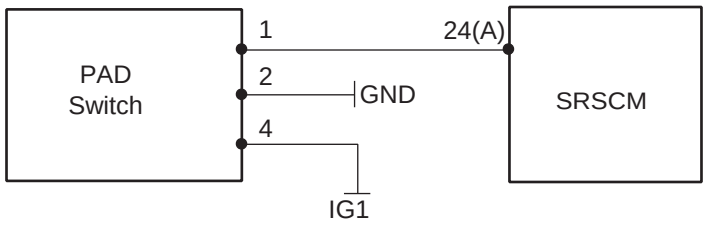
DTC DESCRIPTION EFB413DF

The deactivation system for the passenger airbag consists of the SRSCM and the Passenger Airbag Deactivation(PAD) switch. The above DTC is recored when PAD switch short or short to ground is detected in the PAD system circuit.

DTC DETECTING CONDITION E4A96CCA

DTC	Condition	Probable cause
B1528	• Short to ground between PAD switch and SRSCM • PAD switch malfunction • SRSCM malfunction	• PAD switch • Wiring harness • SRSCM

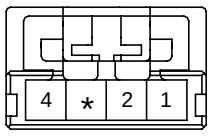
SCHEMATIC DIAGRAM E7A2A1B2



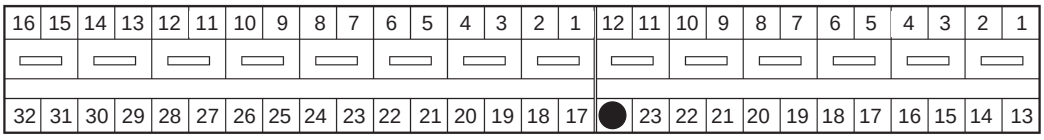
[PAD Switch]

Terminal	Connected to	Function
1	SRSCM Terminal 24(A)	PAD Switch
2	Ground	
4	IG1	Battery Voltage

[HARNESS CONNECTOR]



PAD SWITCH



SRSCM

LRJF500T

SPECIFICATION E97717F7

PAD Switch Status	Current (mA)	Related DTC
Open or Short to Battery	< 2.71	B1527
PAB Enabled Position	2.96 ~ 5.01	
Defect	5.46 ~ 6.68	B1529
PAB Disabled Position	7.28 ~ 12.73	
Short or Short to Ground	> 13.87	B1528

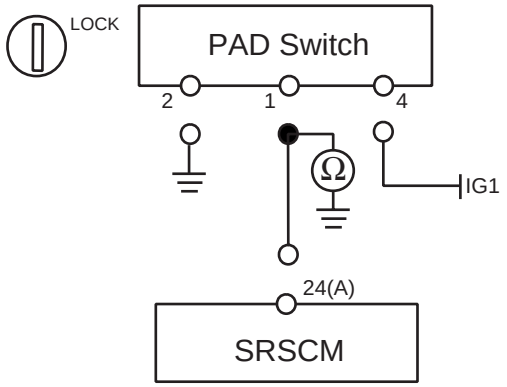
TERMINAL & CONNECTOR INSPECTION EE2CD656

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE E4D4D55D

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)
2. CHECK SHORT TO GROUND
   1) Disconnect the connector of the PAD switch.
   2) Measure resistance between the terminal 1 of PAD switch connector and chassis ground.

Specification (resistance) : infinite



LRJF501C

   3) Is the measured resistance within specification?

YES

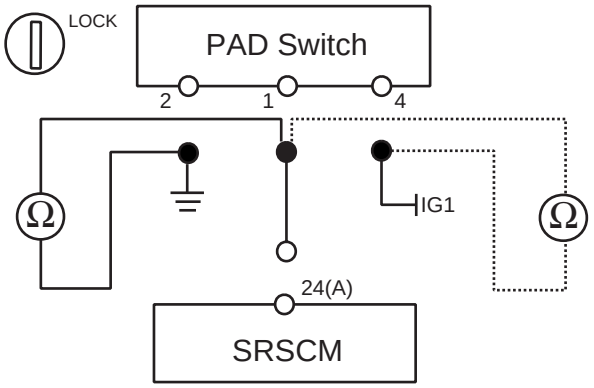
▶ Check short circuit.

NO

▶ Replace the harness between the SRSCM and the PAD switch.

3. CHECK SHORT CIRCUIT
   1) Measure resistance between 1 and 2 of PAD switch connector.
   2) Measure resistance between 1 and 4 of PAD switch connector.

Specification (resistance) : infinite



LRJF501D

3) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the PAD switch and the SRSCM.

4. CHECK THE PAD SWITCH

1) Connect the SRSCM connector.

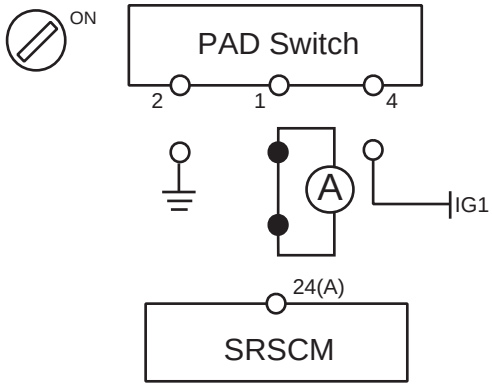
2) Connect the PAD switch.

3) Connect the battery negative cable to the battery.

4) Turn the ignition switch to ON.

5) Measure current between the terminal 24 of the SRSCM harness connector(A) and 1 of PAD switch connector.

Specification (current) :
PAD switch (Enabled positon) : 2.96 ~ 5.01 mA
PAD switch (Disabled positon) : 7.28 ~ 12.73 mA



LRJF501E

6) Is the measured current within specification?

YES

▶ Go to next step.

NO

▶ Replace the PAD switch.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1529 PASSENGER AIRBAG DEACTIVATION SWITCH DEFECT
DTC B1530 PASSENGER AIRBAG DEACTIVATION SWITCH INSTABILITY

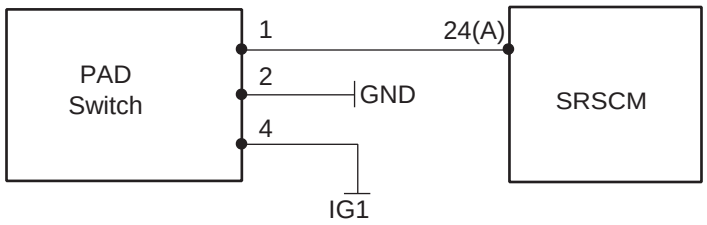
DTC DESCRIPTION EFDD4BE9

The deactivation system for the passenger airbag consists of the SRSCM and the Passenger Airbag Deactivation(PAD) switch. The above DTC is recored when the defect or instability of PAD switch is detected in the PAD system circuit.

DTC DETECTING CONDITION E9090BE4

DTC	Condition	Probable cause
B1529 B1530	• PAD switch malfunction • SRSCM malfunction	• PAD switch • Wiring harness • SRSCM

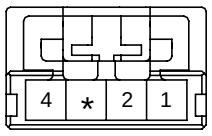
SCHEMATIC DIAGRAM EC8F4FA0



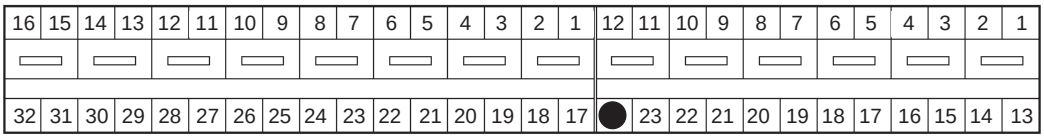
[PAD Switch]

Terminal	Connected to	Function
1	SRSCM Terminal 24(A)	PAD Switch
2	Ground	
4	IG1	Battery Voltage

[HARNESS CONNECTOR]



PAD SWITCH



SRSCM

LRJF500T

SPECIFICATION EE50F982

PAD Switch Status	Current (mA)	Related DTC
Open or Short to Battery	< 2.71	B1527
PAB Enabled Position	2.96 ~ 5.01	
Defect	5.46 ~ 6.68	B1529
PAB Disabled Position	7.28 ~ 12.73	
Short or Short to Ground	> 13.87	B1528

TERMINAL & CONNECTOR INSPECTION E10BC487

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EEB70A3B

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

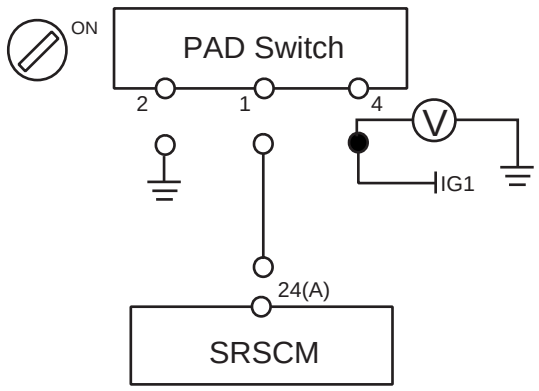
2. CHECK POWER SUPPLY

   1) Connect the battery negative cable to the battery.

   2) Turn the ignition switch to ON.

   3) Measure voltage between the terminal 4 of PAD switch connector and chassis ground.

Specification (voltage) : 9 ~ 16 V



LRJF501F

   4) Is the measured voltage within specification?

YES

▶ Check ground circuit.

NO

▶ Replace the harness between the battery line and the PAD switch.

3. CHECK GROUND CIRCUIT

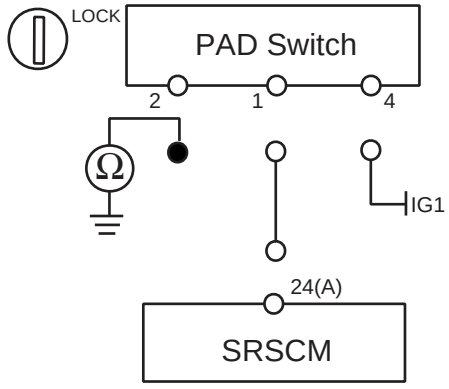
1) Turn the ignition switch to OFF.

2) Disconnect the battery negative cable from the battery.

3) Disconnect the connector of the PAD switch.

4) Measure resistance between the terminal 2 of PAD switch connector and chassis ground.

Specification (resistance) : 0 Ω



LRJF501G

5) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair or replace the wiring harness between the PAD switch and the chassis ground.

4. CHECK THE PAD SWITCH

1) Connect the SRSCM connector.

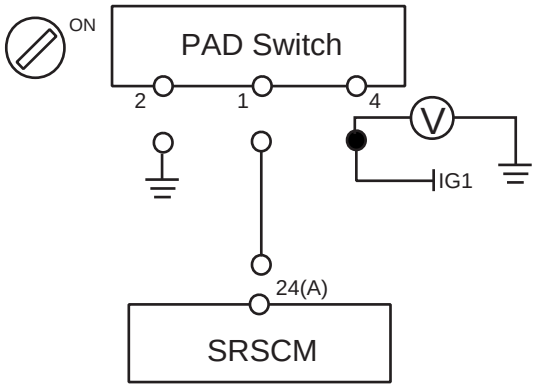
2) Connect the PAD switch.

3) Connect the battery negative cable to the battery.

4) Turn the ignition switch to ON.

5) Measure current between the terminal 24 of the SRSCM harness connector(A) and 1 of PAD switch connector.

Specification (current) :
PAD switch (Enabled positon) : 2.96 ~ 5.01 mA
PAD switch (Disabled positon) : 7.28 ~ 12.73 mA



LRJF501F

6) Is the measured current within specification?

YES

▶ Go to next step.

NO

▶ Replace the PAD switch.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B1620 SUPPLEMENTAL RESTRAINT SYSTEM CONTROL MODULE INTERNAL FAULT (REPLACE SRSCM)

DTC DESCRIPTION EC4C7FC1

The Supplemental Restraint System Control Module (SRSCM) runs diagnostics to monitor the condition of its internal circuits and all external components in the restraint system. If a fault is detected in the electronic accelerometor or in the microprocessor, the SRSCM will inhibit deployment to minimize the risk of inadvertent deployments.
Once an internal fault is qualified, the internal fault is latched and warning lamp will be turned on. If an internal fault is qulified, the SRSCM must be replaced. The Hi-Scan tool can't clear an internal fault. All internal faults are DTC B1620.

DTC DETECTING CONDITION EE0C6DDE

DTC	Condition	Probable cause
B1620	• SRSCM internal fault : acceleration sensor, microcomputer power supply, watchdog etc	• SRSCM

INSPECTION PROCEDURE E6D4CDCF

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool, the SRSCM should be replaced.

DTC B1650 CRASH RECORDED - FRONTAL (REPLACE SRSCM)
DTC B1651 CRASH RECORDED - DRIVER SIDE (REPLACE SRSCM)
DTC B1652 CRASH RECORDED - PASSENGER SIDE (REPLACE SRSCM)
DTC B1655 CRASH RECORDED - PASSENGER SIDE WITH PAB INHIBITED (REPLACE SRSCM)
DTC B1657 CRASH RECORDED - BELT PRETENSIONER ONLY
DTC B1658 BELT PRETENSIONER 6 TIMES DEPLOYMENT (REPLACE SRSCM)
DTC B1659 REAR IMPACT DETECTED

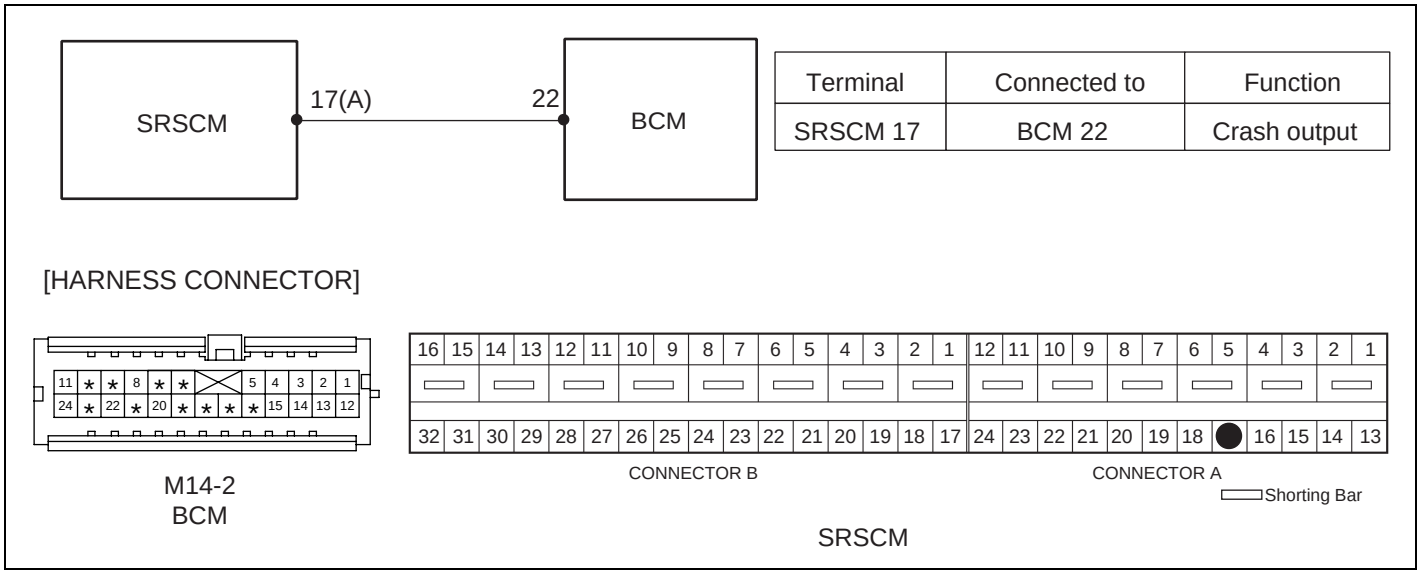
DTC DESCRIPTION E9D0B6D7

When a deployment of any restraint system for seat belt pretensioner and frontal and side air bags occurs, or when a rear crash is detected, the crash output is activated. The purpose of this output is to signal the BCM(Body Control Module) in the vehicle to unlock the vehicle doors. If a crash output is in progress, a second crash output signal will not be sent unless the first one is completed. The SRSCM doesn't perform diagnostics on the crash output function. After a frontal or side crash event is sensed and algorithm makes firing decision, above mentioned crash record is stored after squib deployment.

DTC DETECTING CONDITION EC23DE10

DTC	Condition	Probable cause
B1650 B1651 B1652 B1655 B1657 B1658 B1659	• Frontal crash • Side crash • Rear crash • Seat belt pretensioner only deployed	• SRSCM • Front Impact Sensor • Side Impact Sensor • Seat Belt Pretensioner

SCHEMATIC DIAGRAM ECCBBF56



Terminal	Connected to	Function
SRSCM 17	BCM 22	Crash output

LRJF500U

INSPECTION PROCEDURE EACB0C4A

If the above mentioned DTC is confirmed it can't be cleared by Hi-Scan tool except for the B1657 and B1659, and the SRSCM should be replaced. However, for the DTC B1657, Belt pretensioner only deployment, it can be erased for 5 times and the SRSCM can be reusable. If the deployment of Belt pretensioner reaches to 6 times, the SRSCM will set DTC B1658 and the SRSCM should be replaced accordingly. The DTC B1659, Rear impact detected, also can be erased.

DTC B2500 SRS WARNING LAMP FAULT

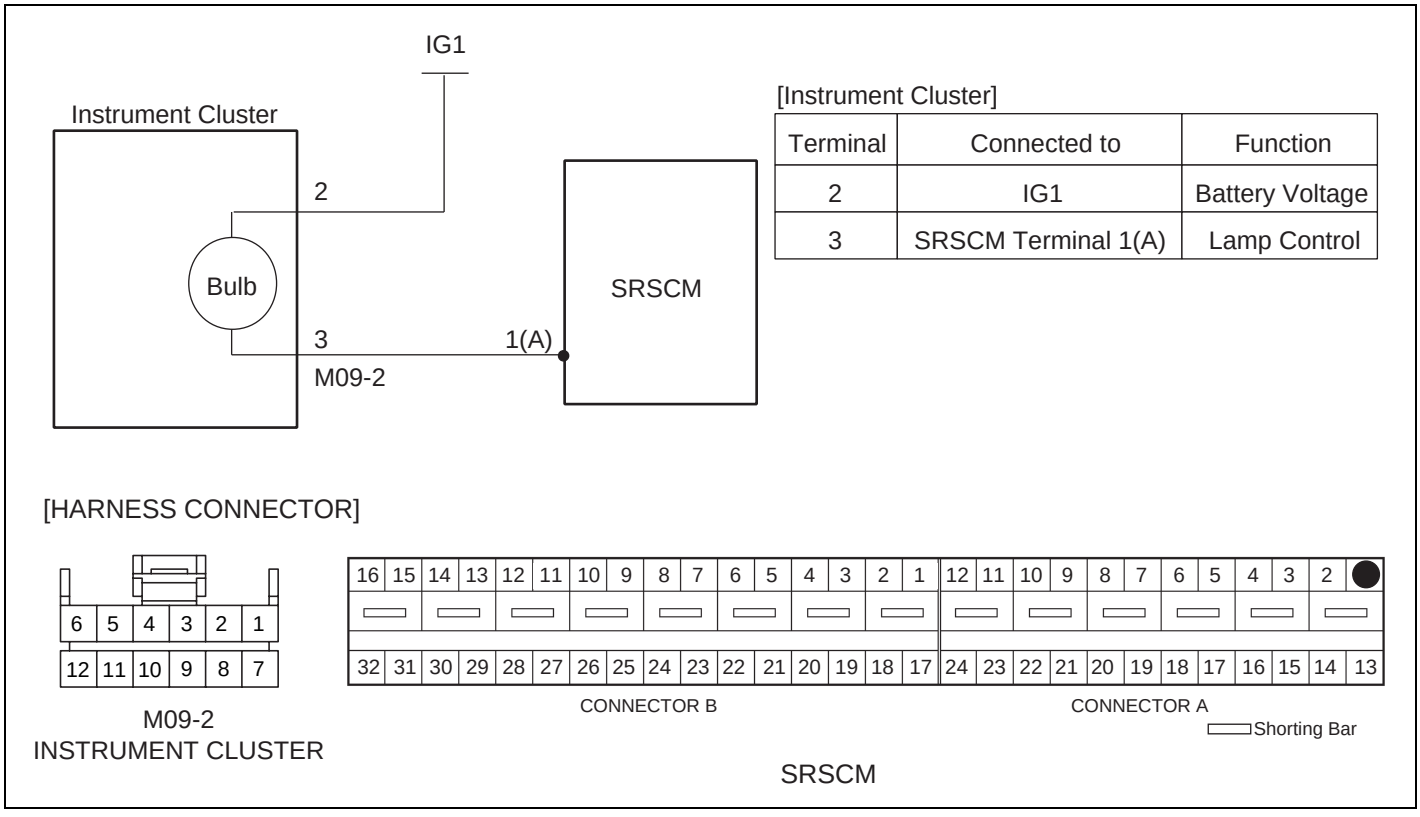
DTC DESCRIPTION E9AF10CB

The SRS warning lamp is located in the cluster. When the airbag system is normal, the SRS warning lamp turns on for approx. 6 seconds after the ignition switch is turned to ON, and then turns off automatically. If there is a malfunction in the airbag system, the SRS warning lamp lights up to inform the driver of the abnormality. The SRSCM shall measure the voltage at the SRS warning lamp output pin, both when the lamp is on and when the lamp is off, to detect whether the commanded state matches the actual state.

DTC DETECTING CONDITION E62A81F0

DTC	Condition	Probable cause
B2500	• Airbag fuse • Warning Lamp Bulb • Open between warning lamp and SRSCM • Short to ground or battery line between the warning lamp and SRSCM • SRSCM Malfunction	• Fuse • Warning lamp bulb • Wiring Harness • SRSCM

SCHEMATIC DIAGRAM E1097168



LRJF201A

TERMINAL & CONNECTOR INSPECTION E2E88F03

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EB82BCF6

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

2. CHECK THE FUSE

   1) Remove the airbag fuse and the airbag warning lamp fuse from junction box.

   2) Inspect the fuses. Are the fuses normal?

      YES

      ▶ Check the warning lamp bulb.

      NO

      ▶ Repair or replace the fuses.

3. CHECK THE WARNING LAMP BULB

   1) Remove the bulb from the instrument cluster.

   2) Inspect the bulb. Is the bulb normal?

      YES

      ▶Check source voltage.

      NO

      ▶ Repair or replace the bulb.

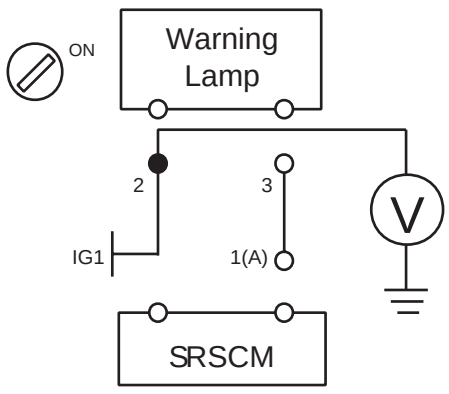
4. CHECK SOURCE VOLTAGE

   1) Connect the battery negative cable to the battery.

   2) Turn the ignition switch to ON.

   3) Measure voltage between the terminal 2 of the Instrument Cluster harness connector and chassis ground.

Specification (voltage) : 9 ~ 16 V



LRJF201B

4) Is the measured voltage within specification?

YES

▶ Check short to battery line.

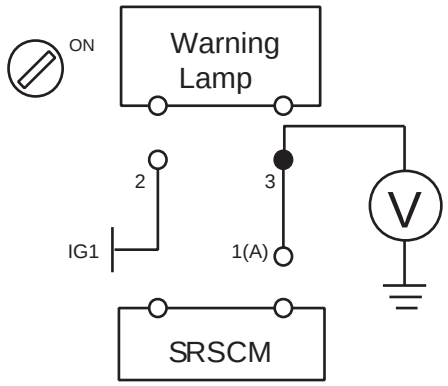
NO

▶ Repair or replace the wiring harness between ignition switch and the Warning Lamp.

5. CHECK SHORT TO BATTERY LINE

1) Measure voltage between the terminal 3 of the Instrument Cluster harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



LRJF201C

2) Is the measured voltage within specification?

YES

▶ Check short or short to ground.

NO

▶ Repair the short to battery line circuit on wiring harness between the SRSCM and the Warning Lamp.

6. CHECK SHORT OR SHORT TO GROUND

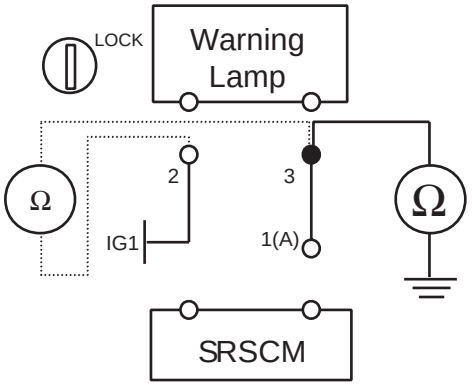
1) Turn the ignition switch to LOCK.

2) Disconnect the battery negative cable from the battery.

3) Measure resistance between the terminal 3 of the Instrument Cluster harness connector and chassis ground.

4) Measure resistance between the terminal 3 and 2 of the Instrument Cluster harness connector.

Specification (resistance) : infinite



LRJF201D

5) Is the measured resistance within specification?

YES

▶ Check open circuit.

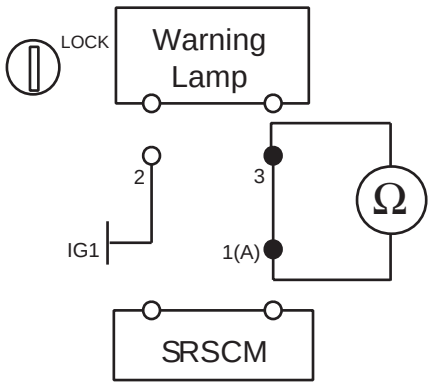
NO

▶ Repair the short or short to ground circuit on wiring harness between the SRSCM and the Warning Lamp.

7. CHECK OPEN CIRCUIT

1) Measure resistance between the terminal 3 of the Instrument Cluster connector and the terminal 1 of SRSCM harness connector(A).

Specification (resistance) : below 1 Ω



LRJF201E

2) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair the open circuit on wiring harness between the SRSCM and the Warning Lamp.

8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

DTC B2505 PASSENGER AIRBAG DEACTIVATION LAMP FAULT

DTC DESCRIPTION EBB8D5C6

The SRSCM shall detect and record the following situations. And a single fault code shall be assigned as PAD Lamp Fault for all PAD lamp fault conditions. This fault code shall be set whenever either of the fault conditions is detected. If both fault conditions are not detected, the fault code shall not be detected.

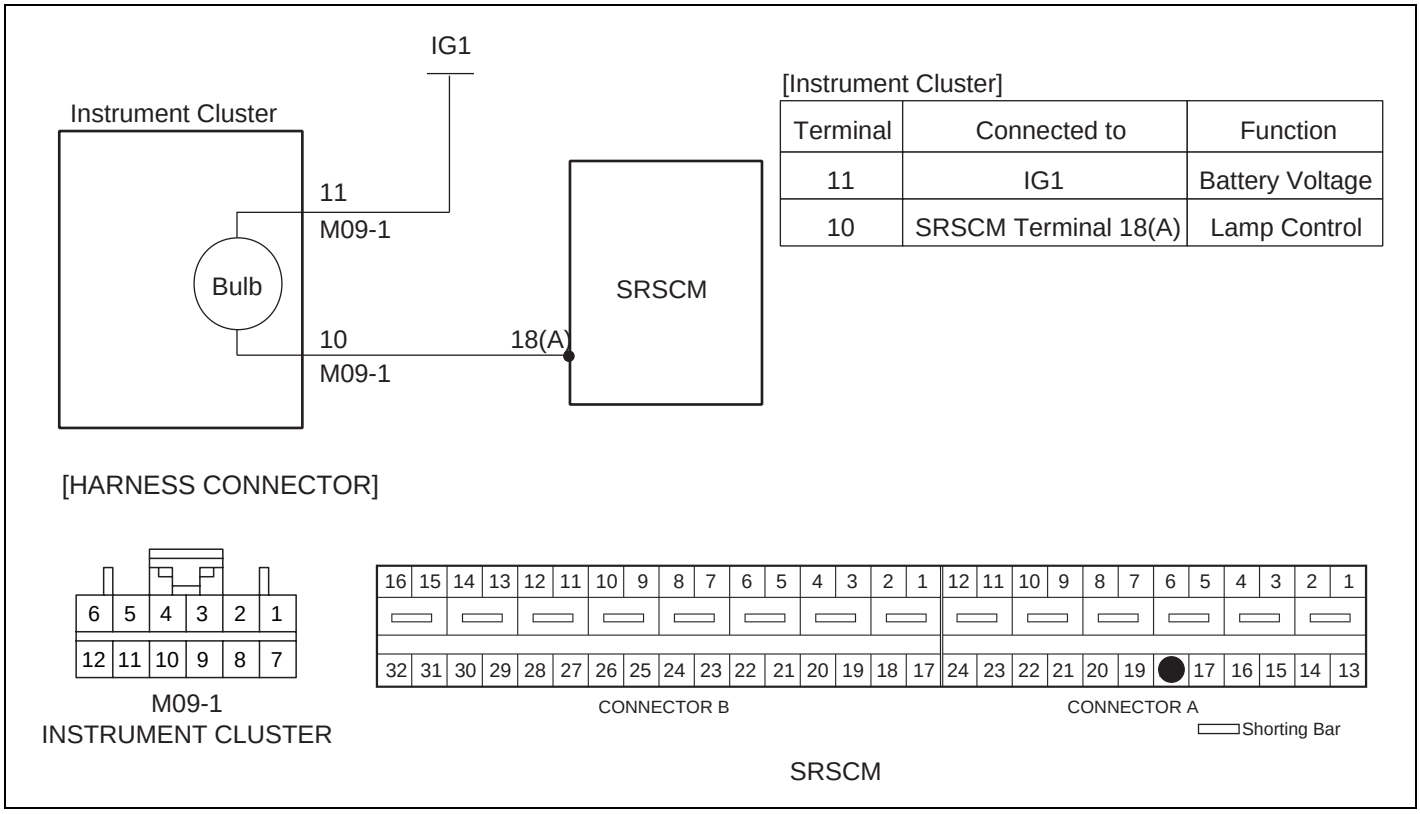
1. The bulb is short, or there is a short to battery condition on the PAD lamp input connection to the SRSCM. This condition is only detectable while the PAD lamp is commanded ON. If a short to battery condition is detected, the PAD lamp shall be commanded OFF for 15 seconds to protect the circuit.

2. The bulb is open, or there is a short to ground condition. This condition is only detectable while the PAD lamp is commanded OFF. If the PAD lamp is ON and a short to ground condition is present, the SRSCM shall command the PAD lamp OFF for a maximum of 1ms during each diagnostic cycle.

DTC DETECTING CONDITION E35CF223

DTC	Condition	Probable cause
B2505	• PAD lamp bulb open or short • Open between PAD lamp and SRSCM • Short to ground or battery line between PAD lamp and SRSCM • SRSCM malfunction	• Fuse • PAD lamp bulb • Wiring Harness • SRSCM

SCHEMATIC DIAGRAM E1DFFCFA



LRJF500V

TERMINAL & CONNECTOR INSPECTION EE3938E0

Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

INSPECTION PROCEDURE EADBBA20

1. PREPARATION
   Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)
2. CHECK THE FUSE
   1) Remove the airbag fuse and the PAD lamp fuse from junction box.
   2) Inspect the fuses. Are the fuses normal?

   YES

   ▶ Check the PAD lamp bulb.

   NO

   ▶ Repair or replace the fuses.
3. CHECK THE PAD LAMP BULB
   1) Remove the bulb from the instrument cluster.
   2) Inspect the bulb. Is the bulb normal?

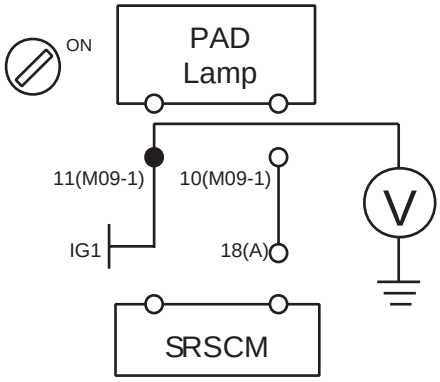
   YES

   ▶Check source voltage.

   NO

   ▶ Repair or replace the bulb.
4. CHECK SOURCE VOLTAGE
   1) Connect the battery negative cable to the battery.
   2) Turn the ignition switch to ON.
   3) Measure voltage between the terminal 11 of the Instrument Cluster(M09-1) harness connector and chassis ground.

Specification (voltage) : 9 ~ 16 V



LRJF510C

4) Is the measured voltage within specification?

YES

▶ Check short to battery line.

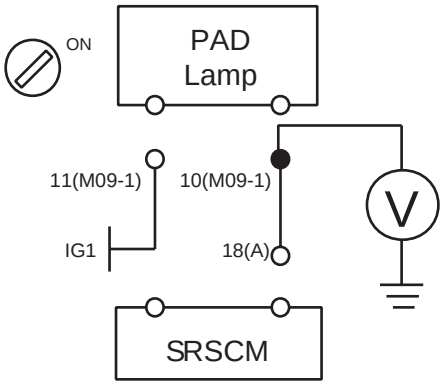
NO

▶ Repair or replace the wiring harness between ignition switch and the PAD Lamp.

5. CHECK SHORT TO BATTERY LINE

1) Measure voltage between the terminal 10 of the Instrument Cluster(M09-1) harness connector and chassis ground.

Specification (voltage) : Approximately 0 V



LRJF510D

2) Is the measured voltage within specification?

YES

▶ Check short or short to ground.

NO

▶ Repair the short to battery line circuit on wiring harness between the SRSCM and the PAD Lamp.

6. CHECK SHORT OR SHORT TO GROUND

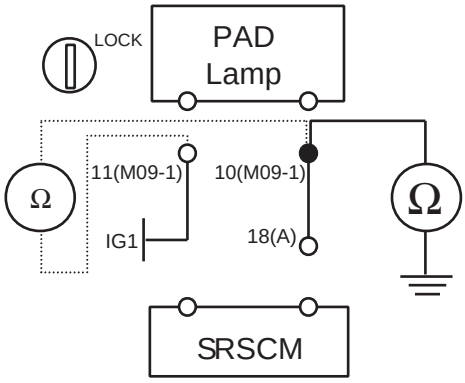
1) Turn the ignition switch to LOCK.

2) Disconnect the battery negative cable from the battery.

3) Measure resistance between the terminal 10 of the Instrument Cluster(M09-1) harness connector and chassis ground.

4) Measure resistance between the terminal 11(M09-1) and 10(M09-1) of the Instrument Cluster harness connector.

Specification (resistance) : infinite



LRJF510E

5) Is the measured resistance within specification?

YES

▶Check open circuit.

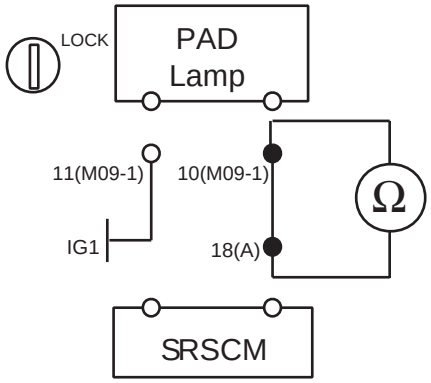
NO

▶ Repair the short or short to ground circuit on wiring harness between the SRSCM and the PAD Lamp.

7. CHECK OPEN CIRCUIT

1) Measure resistance between the terminal 10 of the Instrument Cluster(M09-1) connector and the terminal 18 of SRSCM harness connector(A).

Specification (resistance) : below 1 Ω



LRJF510F

2) Is the measured resistance within specification?

YES

▶ Go to next step.

NO

▶ Repair the open circuit on wiring harness between the SRSCM and the PAD Lamp.

8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
Refer to the DESCRIPTION in this TROUBLESHOOTING part.(See page RT - 37)

AIR BAG MODULE DISPOSAL

AIRBAG DISPOSAL E45A3823

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.

DRIVER'S AIRBAG :

1. Remove the driver's airbag and install the SST(0957A-38500).
2. Install the driver's airbag on the steering wheel.

FRONT PASSENGER'S AIRBAG :

1. Remove the glove box, then disconnect the 2P connector between the front passenger's airbag and SRS main harness.
2. Install the SST(0957A-38500).

SIDE AIRBAG :

1. Disconnect the 2P connector between the side airbag and side wire harness.
2. Install the SST (0957A-3F100).

CURTAIN AIRBAG :

1. Disconnect the 2P connector between the curtain airbag and wire harness.
2. Install the SST(0957A-38500).

SEAT BELT PRETENSIONER :

1. Disconnect the 2P connector from the seat belt pretensioner.
2. Install the SST(0957A-38500).
3. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
4. Connect a 12 volt battery to the tool.
5. 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)
6. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

ERKD002U

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.

Heating, Ventilation and Air Conditioning

GENERAL

AIR CONDITIONING SYSTEM
- DRIVE BELT
- COMPRESSOR OIL

A/C COMPRESSOR CONTROLS (MANUAL)
- COMPRESSOR
- CONDENSER
- A/C PRESSURE TRANSDUCER
- REFRIGERANT LINE

A/C COMPRESSOR CONTROLS (FULL AUTO)
- IN CAR SENSOR
- PHOTO SENSOR
- WATER TEMPERATURE SENSOR
- AMBIENT TEMPERATURE SENSOR
- EVAPORATOR TEMPERATURE SENSOR
- HUMIDITY SENSOR

HEATER
- HEATER UNIT
- PTC (POSITIVE TEMPERATURE COEFFICIENT) HEATER
- TEMPERATURE CONTROL ACTUATOR
- MODE CONTROL ACTUATOR

BLOWER CONTROLS
- BLOWER UNIT
- BLOWER MOTOR
- BLOWER RELAY
- POWER MOSFET
- BLOWER RESISTOR
- A/C AIR FILTER
- INTAKE ACTUATOR

BLOWER AND A/C CONTROLS (MANUAL)
- CONTROL PANEL

BLOWER AND A/C CONTROLS (AUTOMATIC)
- CONTROL PANEL

GENERAL

SPECIFICATION E3DE37F8

AIR CONDITIONER

Item		Specification	
		α1.4, α1.6 Engine (Gasoline)	**U 1.5 Engine (Diesel)**
Compressor	Type	6SBU16	
	Oil type & Capacity	ND-OIL8 (PAG), 120 ± 10cc	
	Pulley type	L5OS-TYPE	
	Displacement	160cc/rev	
Condenser	Heat rejection	12,000 ± 5% kcal/hr	9,500 ± 5% kcal/hr
APT (A/C pressure transducer)	The method to measure the pressure	Voltage = 0.025 * Pressure + 0.1 [kgf/cm²] Voltage = 0.001758 * Pressure + 0.074162 [PSIA]	
Expansion valve	Type	Block	
Refrigerant	Type	R-134a	
	Capacity [oz.(g)]	17.6 ± 0.88 (500 ± 25)	

BLOWER UNIT

Item		Specification
Fresh and recirculation	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	Auto + 8 speed (Automatic), 4 speed (Manual)
	Speed control	Power mosfet (Automatic), Blower resistor (Manual)
Air filter	Type	Particle filter

HEATER AND EVAPORATOR UNIT

Item		Specification
Heater	Type	Pin & Tube type
	Heating capacity	4,450 ± 10% kcal/hr
	PTC heater capacity	1000W + 5%/-10%
	Mode operating method	Actuator
	Temperature operating method	Actuator (Automatic), Cable (Manual)
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	ON : 5.0 ± 0.5 (41 ± 32.9), OFF: 3.0 ± 0.5 (37.4 ± 32.9)

TROUBLESHOOTING EEADB3BA

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.

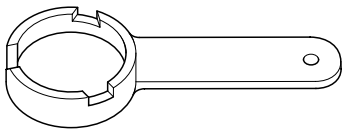
Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.
After correcting the malfunction, check the complete system to ensure that performance is satisfactory.

STANDARD :

Symptom	Suspect Area	See page
No blower operation	1. Blower fuse	-
	2. Blower relay	HA - 60
	3. Blower motor	HA - 58
	4. Power mosfet	HA - 62
	5. Heater & A/C controller	HA - 69, 74
	6. Wire harness	-
No air temperature control	1. Engine coolant capacity	-
	2. Heater & A/C controller	HA - 69, 74
No compressor operation	1. Refrigerant capacity	HA - 3
	2. A/C Fuse	-
	3. Magnetic clutch	HA - 20
	4. Compressor	HA - 16
	5. A/C pressure transducer	HA - 24
	6. A/C switch	HA - 69, 74
	7. Evaporator temperature sensor	HA - 39
	8. Wire harness	-
No cool comes out	1. Refrigerant capacity	HA - 3
	2. Refrigerant pressure	-
	3. Drive belt	HA - 14
	4. Magnetic clutch	HA - 20
	5. Compressor	HA - 16
	6. A/C pressure transducer	HA - 24
	7. Evaporator temperature sensor	HA - 39
	8. A/C switch	HA - 69, 74
	9. Heater & A/C controller	HA - 69, 74
	10. Wire harness	-

Symptom	Suspect Area	See page
Insufficient cooling	1. Refrigerant capacity	HA - 3
	2. Drive belt	HA - 14
	3. Magnetic clutch	HA - 20
	4. Compressor	HA - 16
	5. Condenser	HA - 21
	6. Expansion valve	HA - 47
	7. Evaporator	HA - 45
	8. Refrigerant lines	HA - 27
	9. A/C pressure transducer	HA - 24
	10. Heater & A/C controller	HA - 69, 74
No engine idle-up when A/C switch ON	1. Engine ECM	-
	2. Wire harness	-
No air inlet control	1. Heater & A/C controller	HA - 69, 74
No mode control	1. Heater & A/C controller	HA - 69, 74
	2. Mode actuator	
No cooling fan operation	1. Cooling fan fuse	-
	2. Fan motor	-
	3. Engine ECM	-
	4. Wire harness	-

SPECIAL TOOLS EF362B6F

Tool (Number and name)	Illustration	Use
09977-29000 Disc & hub assembly bolt remover	 EQA9002A	Removal and installation of disc & hub assembly

AIR CONDITIONING SYSTEM

INSTRUCTIONS E51EDFAD

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. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.

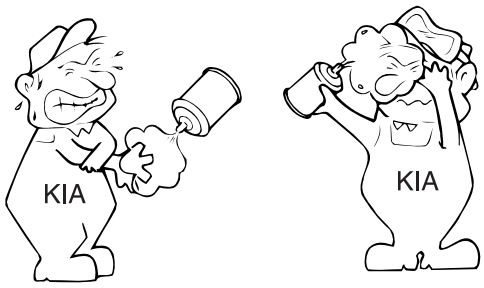
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check that the storage temperature is below 52°C (126°F).

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 the 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 :
   - When removing refrigerant components from a vehicle, cap immediately the components to prevent from the entry of moisture.
   - When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   - Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   - Use the recommended lubricant from a sealed container only.

7. If an accidental discharge in the system occurs, ventilate the work area before resuming service.



LQAC003A

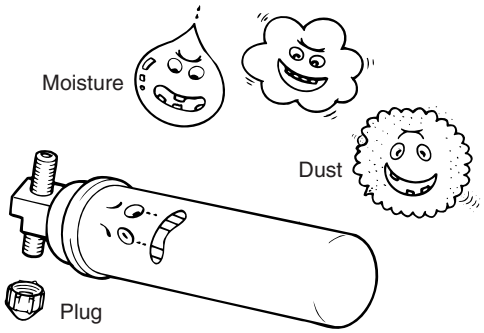
WHEN REPLACING PARTS ON A/C SYSTEM

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.

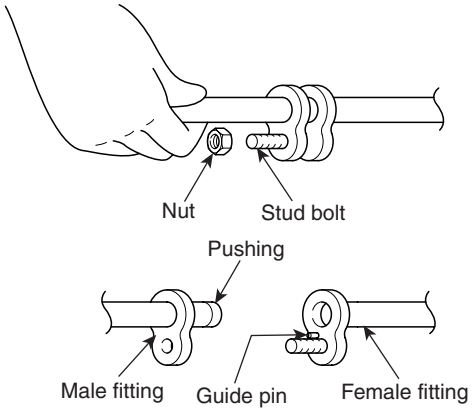


LQAC003B

WHEN INSTALLING CONNECTING PARTS

FLANGE WITH GUIDE PIN

Check the new O-ring for damage and lubricate it using compressor oil. Tighten the nut to specified torque.



LQAC003C

Size	Tightening torque [N.m (kg.m, lb.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.

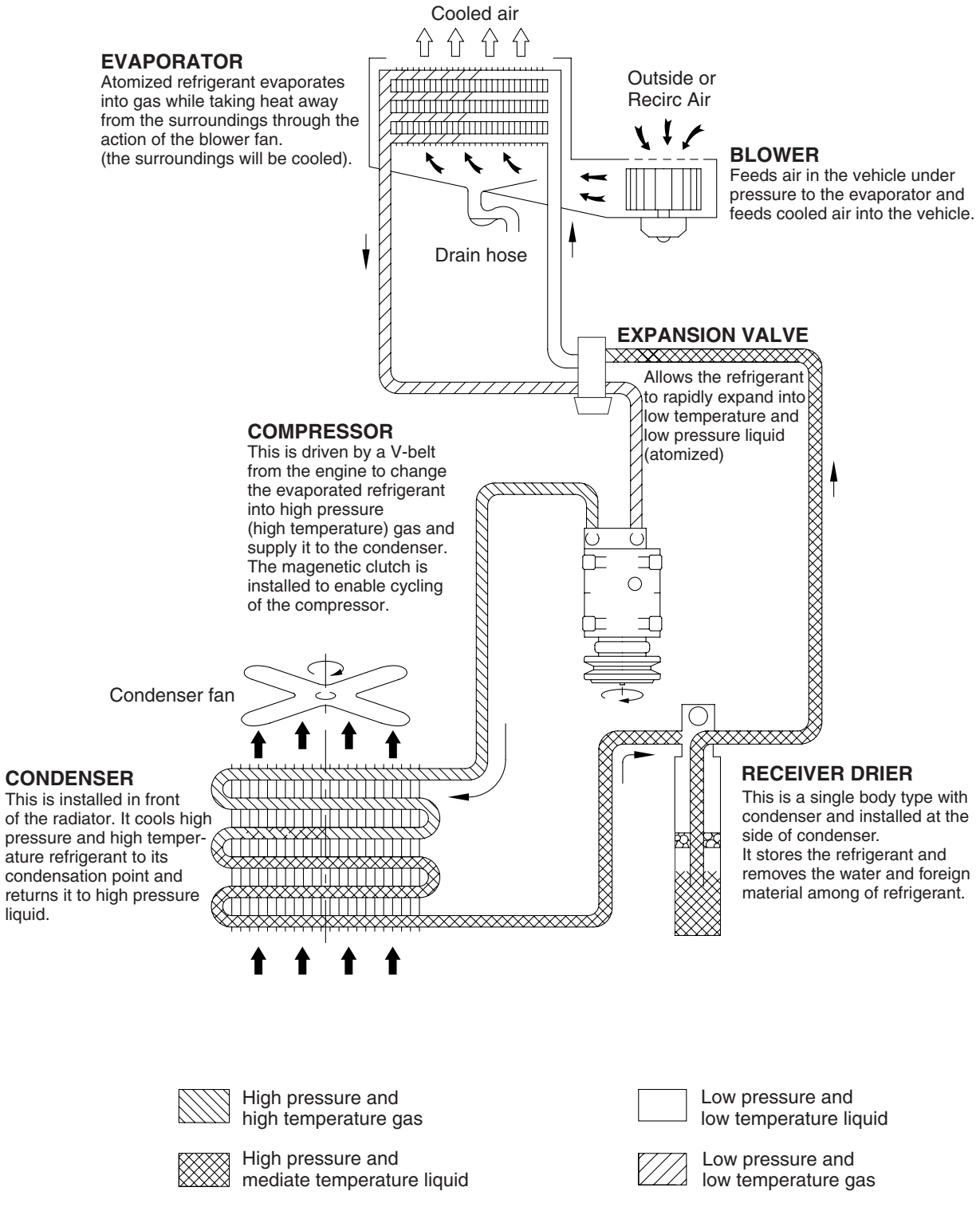
HANDLING TUBING AND FITTINGS

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 rebind 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.

REFRIGERATION CYCLE E108D784



EQRF004A

REFRIGERANT SYSTEM SERVICE BASICS E6ADFF15

REFRIGERANT RECOVERY

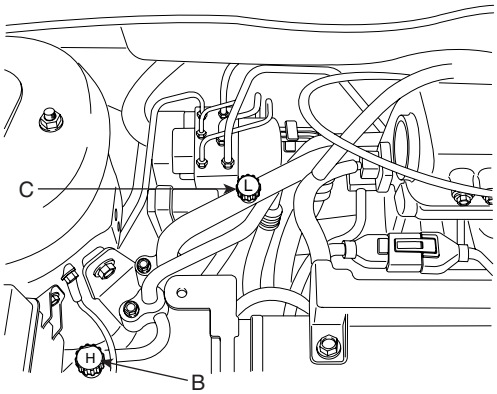
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

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 vapor.***

If accidental system discharge occurs, ventilate work area before resuming 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.



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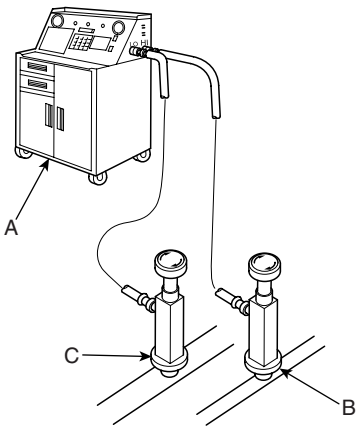


EQKE004A

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.

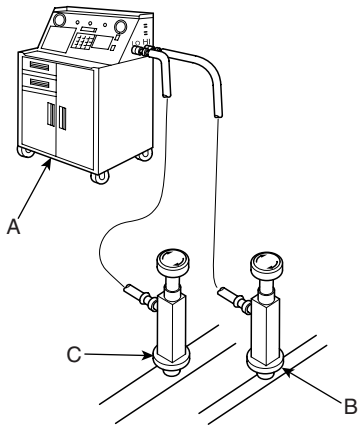
CAUTION

- ***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 resuming 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 days, the receiver/dryer should be replaced, and the system should be evacuated for several hours.)

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.



EQKE004A

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

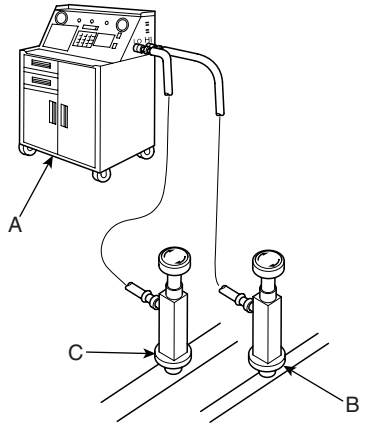
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

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 resuming 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.



EQKE004A

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 17.6 ± 0.88 oz. (500 ± 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.

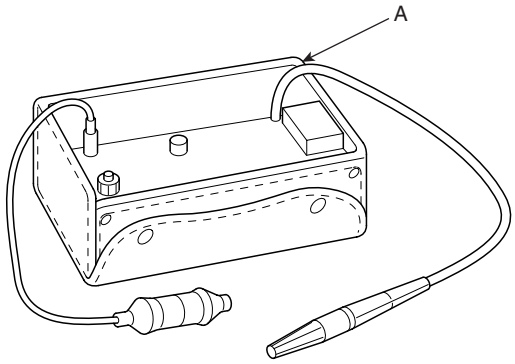
If a gas leak is detected, proceed as follows:

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.



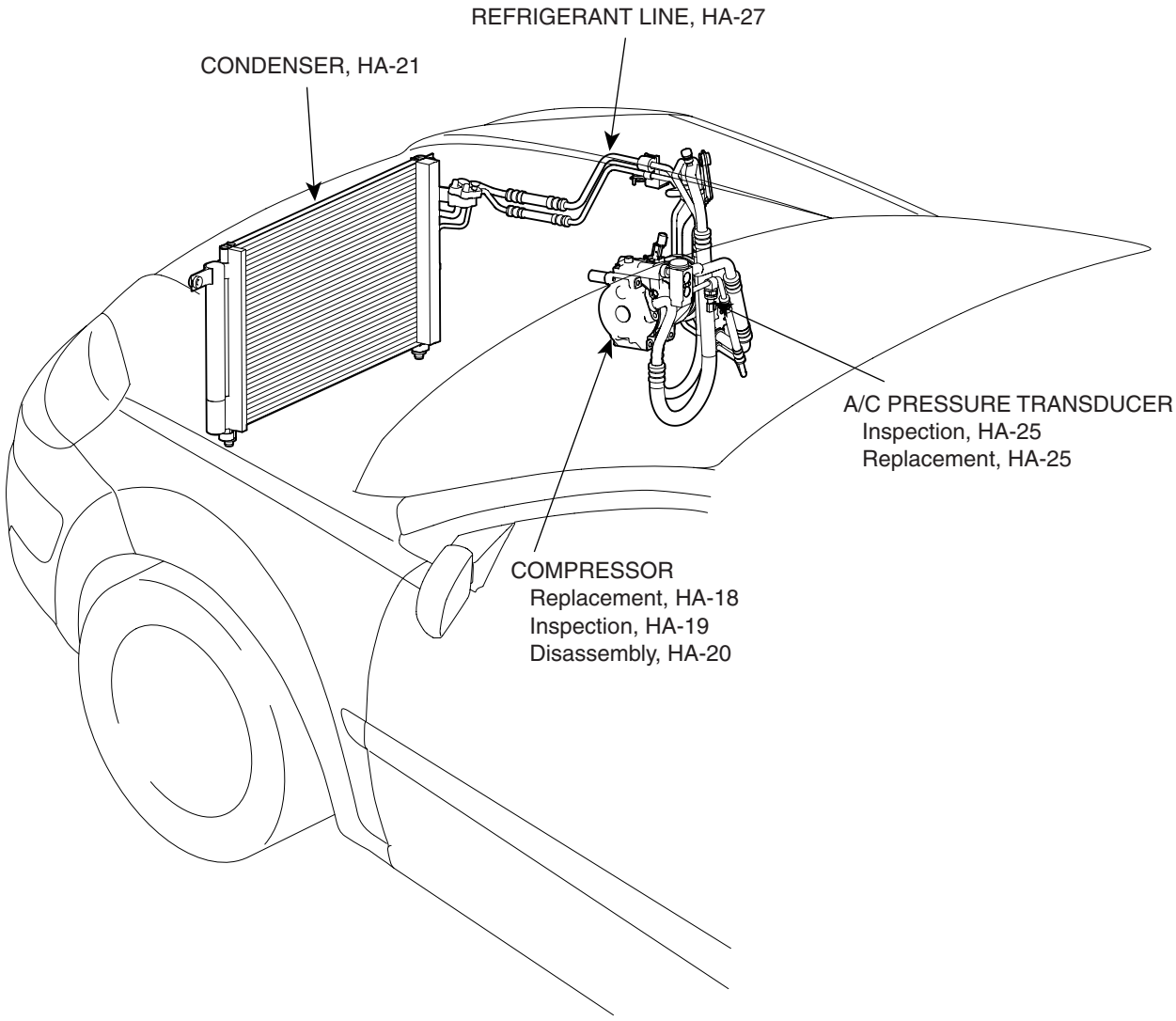
EQKE007A

COMPONENT LOCATION INDEX E717407A

ENGINE ROOM

[Gasoline]

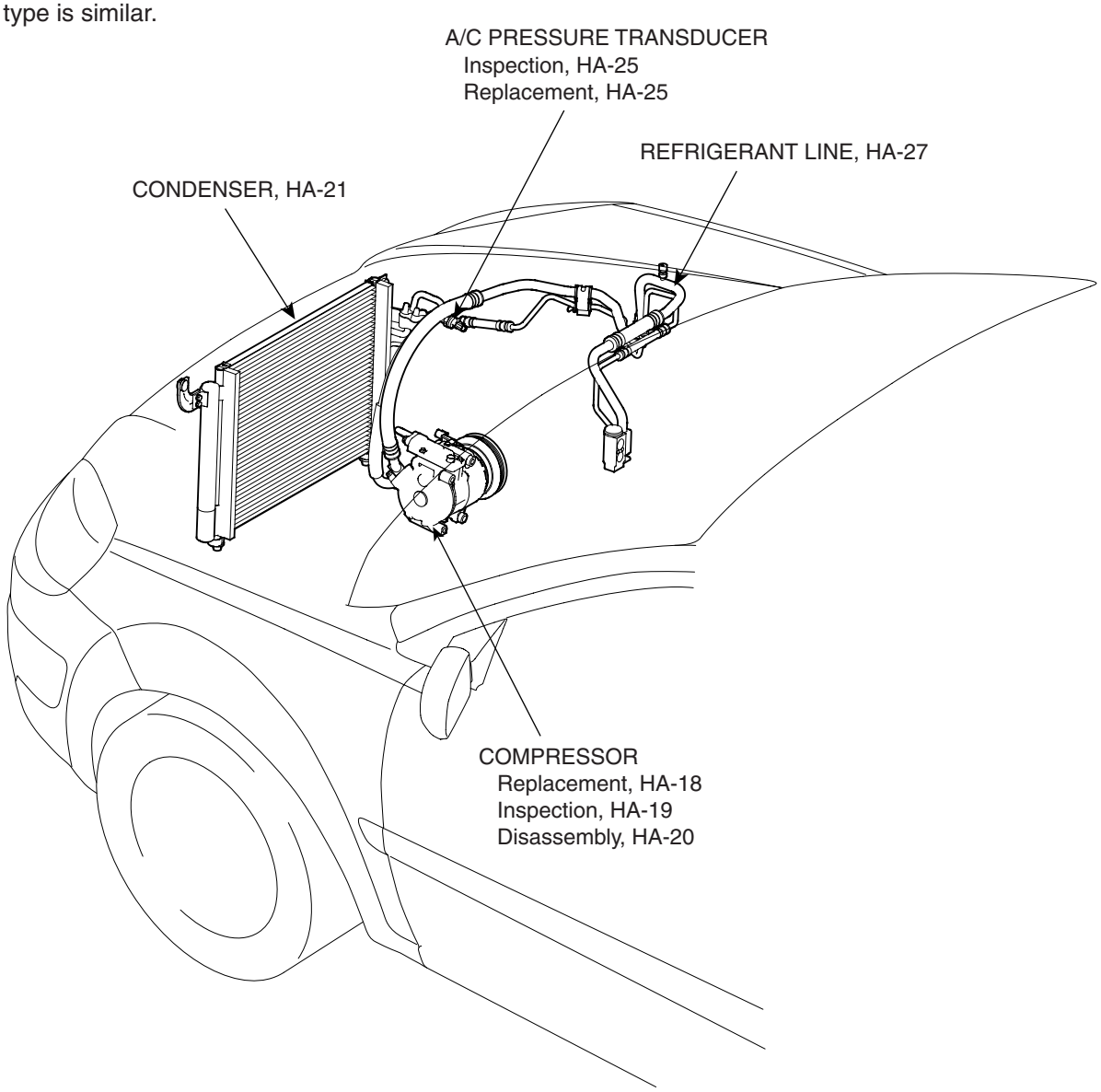
This illustration is shown the LHD type.
RHD type is similar.



LQJF001A

[Diesel]

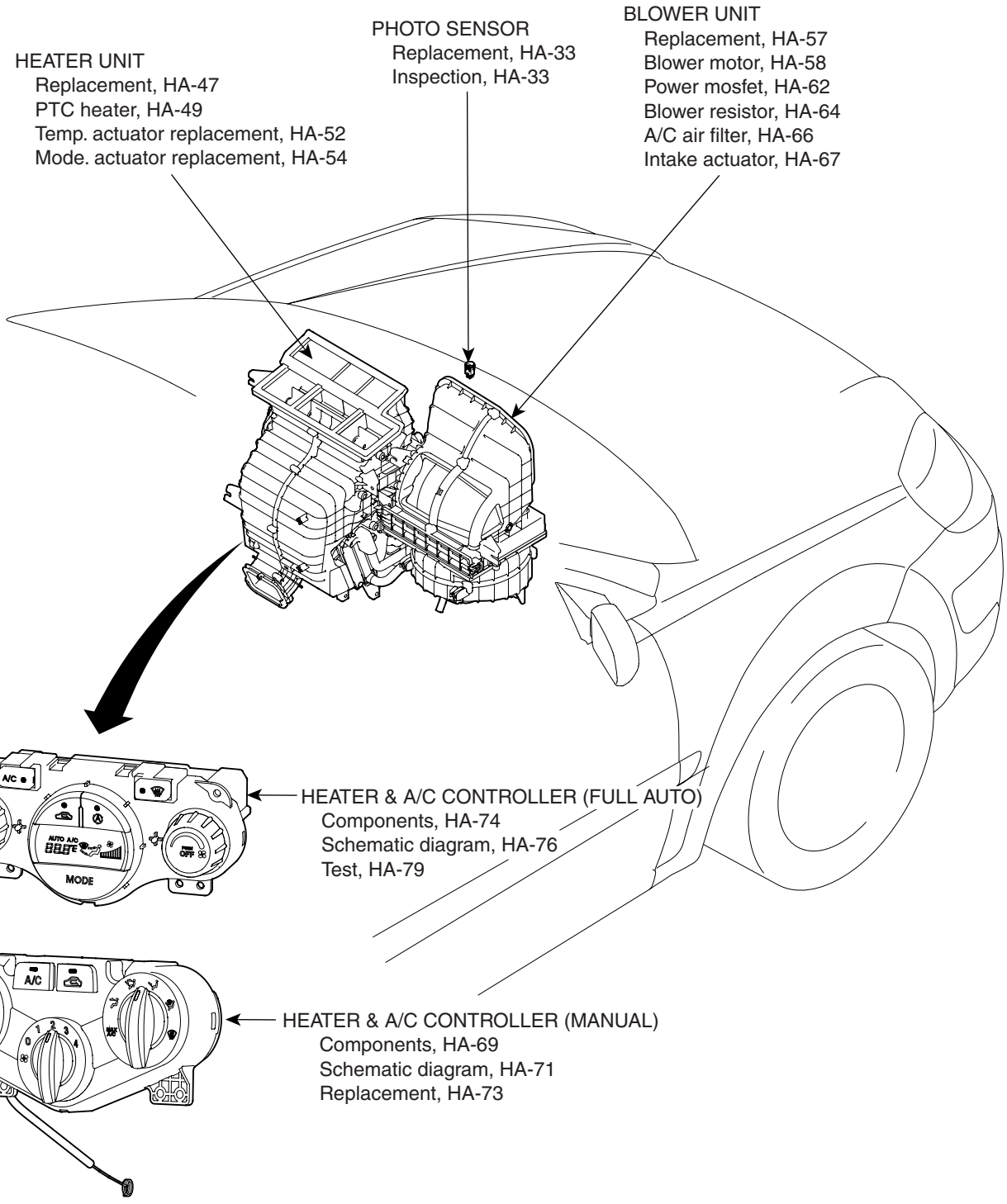
This illustration is shown the LHD type.
RHD type is similar.



LQJF001B

INTERIOR

This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF001C

DRIVE BELT

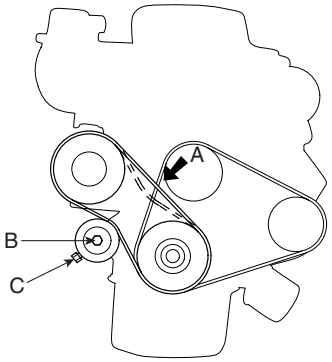
INSPECTION EC33A848

GASOLINE (α 1.4, α 1.6 ENGINE)

1. Compressor shall be operated once or twice a month even in seasons air conditioning is not required, and compressor belt tension shall be adjusted from time to time.

2. Apply a force of 98N (10kgf, 22lbf), and measure the deflection at the mid point (A) between the air condition compressor and crankshaft pulley.

Item	Capacity [when 10kg (22 lb) load applied]	Tension
New belt	5 ~ 5.5 mm (0.197 ~ 0.217 in.)	65 ± 5 kg (143 ± 11 lb)
Used belt	6 ~ 7 mm (0.0236 ~ 0.276 in.)	36 ± 5 kg (79 ± 11 lb)
Check after operation	About 8 mm (0.315 in.)	25 ~ 50 kg (55 ~ 110 lb)



AQJF005A

NOTE

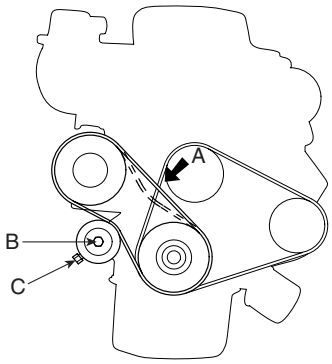
These items when adjusting belt tension :
- *If there are cracks or any damage evident on the belt, replace it with a new one.*
- *"Used belt" means a belt which has been used for five minutes or more.*
- *"New belt" means a belt which has been used for less than five minutes.*

ADJUSTMENT EF3F80F7

1. Loosen the tension mounting bolt (B).

2. Turn the adjusting bolt (C) to obtain the proper belt tension, and then retighten the mounting bolt (B).

3. Recheck the deflection of the A/C compressor belt.



AQJF005A

NOTE

Do not adjustment the drive belt of Diesel engine. Refer to EM group in case of Diesel engine.

COMPRESSOR OIL

INSPECTION E8B5A1AF

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:
120±10cc (4.05±0.34 fl.oz) - α engine, U engine

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 the system component parts, supply the following amount of oil to the component parts 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

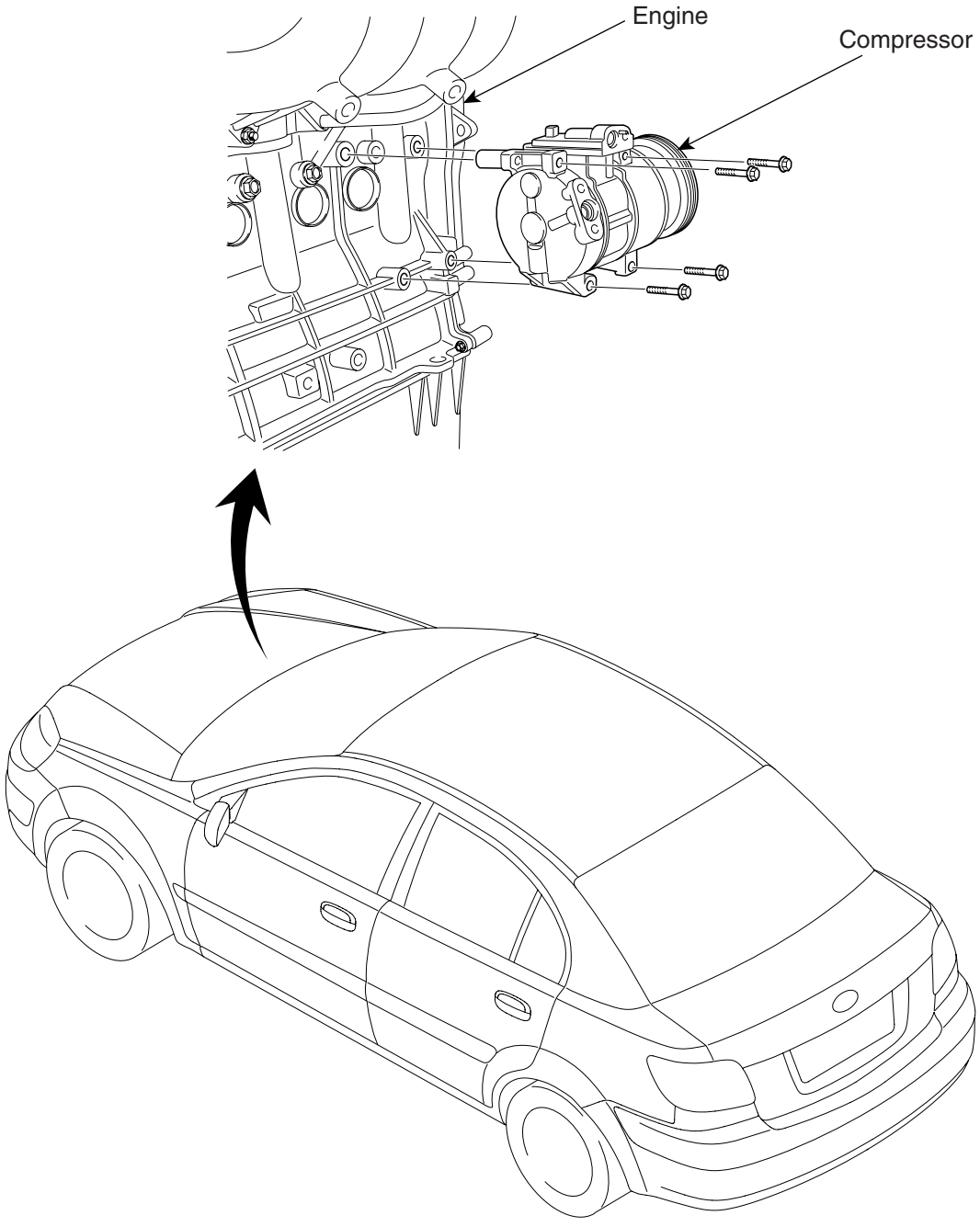
Even if no oil is drained from the removed compressor, don't drain more than 50cc from new compressor.

A/C COMPRESSOR CONTROLS (MANUAL)

COMPRESSOR

COMPONENT LOCATION E7DC78FB

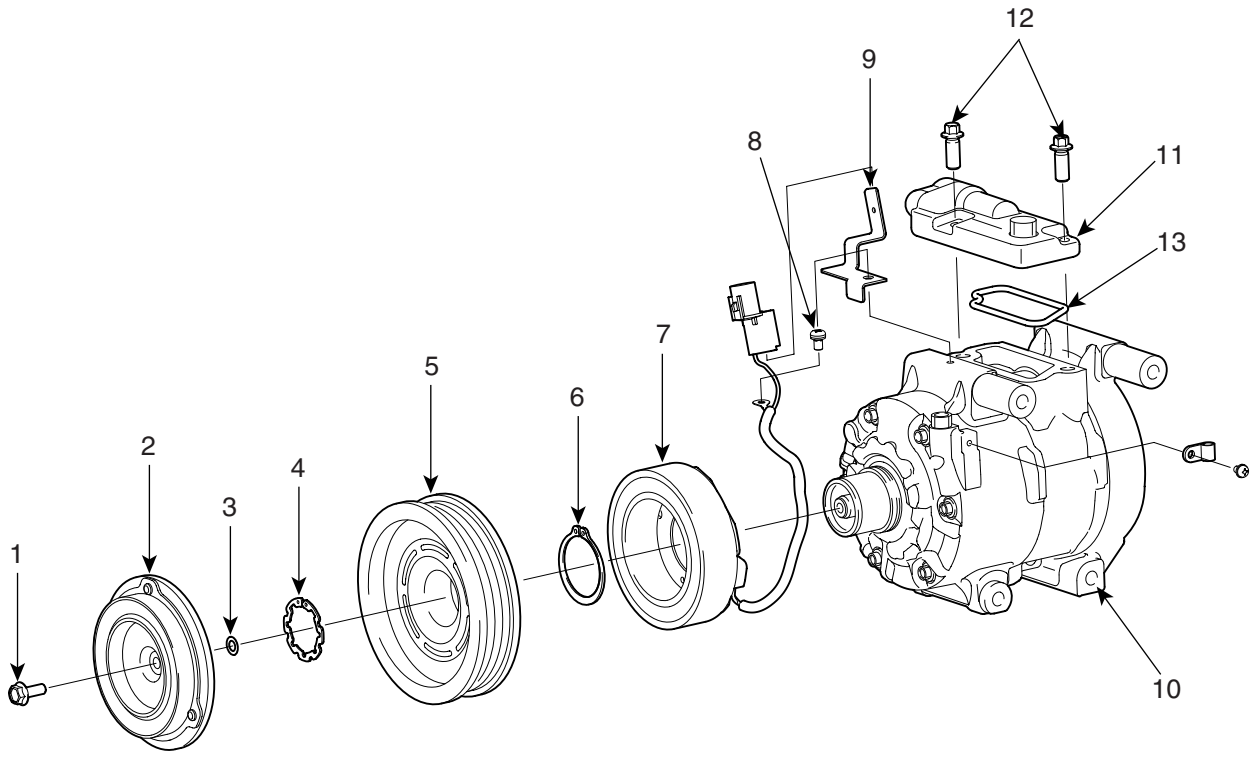
This illustration is shown the LHD type.
RHD type is similar.



LQJF105A

COMPONENTS EBF0CFB4

This illustration is shown the LHD type.
RHD type is similar.

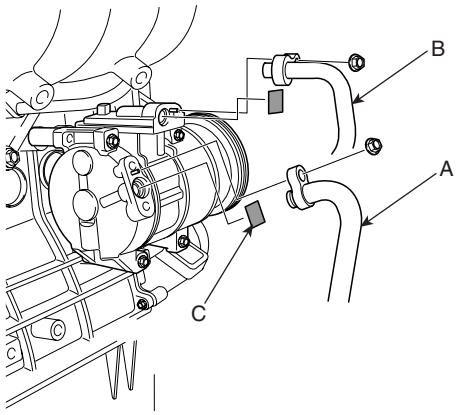


1. Bolt
2. Disc & hub assembly
3. Shim (Gap washer)
4. Retainer ring (Pulley)
5. Pulley
6. Retainer ring (Field coil)
7. Field coil
8. Screw
9. Connector bracket
10. Compressor assembly
11. Manifold
12. Bolt wrench
13. Gasket

LQJF105B

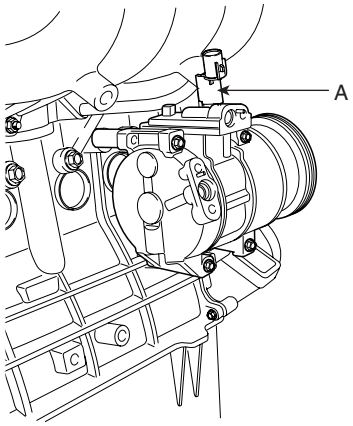
REMOVAL E65DAEF4

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 (Refer to HA-9).
4. Loosen the drive belt (Refer to HA-14).
5. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug (C) or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



AQJF105C

6. Disconnect the compressor clutch connector (A), and then remove 4 mounting bolts and the compressor.

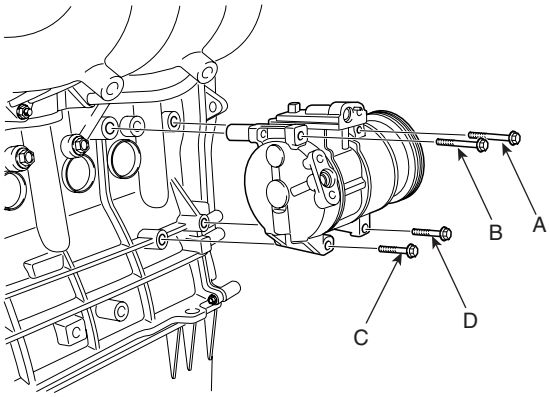


AQJF105D

INSTALLATION EC74AABB

1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.

Bolt	α Engine(1.4, 1.6)	U Engine
A	126 mm (4.96in.)	94 mm (3.70in.)
B	126 mm (4.96in.)	108 mm (4.25in.)
C	94 mm (3.70in.)	94 mm (3.70in.)
D	94 mm (3.70in.)	94 mm (3.70in.)



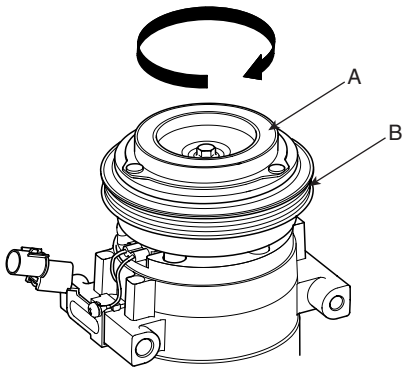
AQJF105E

2. Install in the reverse order of removal, and note these items.
   - 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 120cc(4.20 oz.) the result is the amount of oil you should drain from the new compressor (through the suction fitting).
   - 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.
   - To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
   - Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
   - 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.
   - Adjust the drive belt. (Refer to HA-14)
   - Charge the system and test its performance. (Refer to HA-10)

INSPECTION EA69EBC0

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.



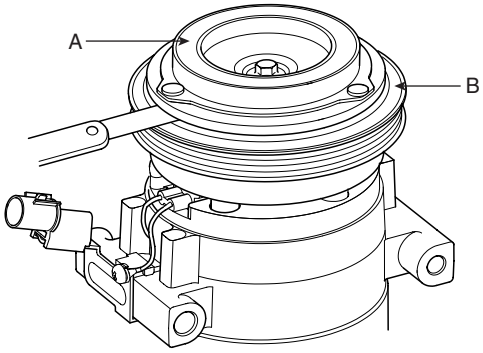
AQJF106A

3. Measure the clearance between the pulley (B) and the 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.)

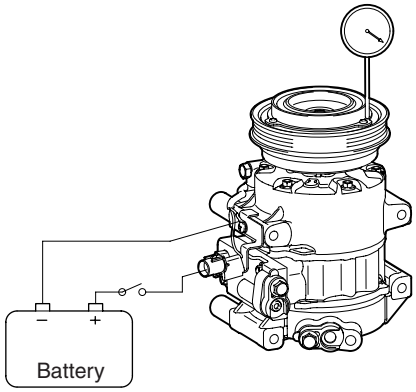
NOTE

The shims (gap washers) are available in seven thicknesses: 0.7mm, 0.8mm, 0.9mm, 1.0mm, 1.1mm, 1.2mm and 1.3mm.



AQJF106B

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.

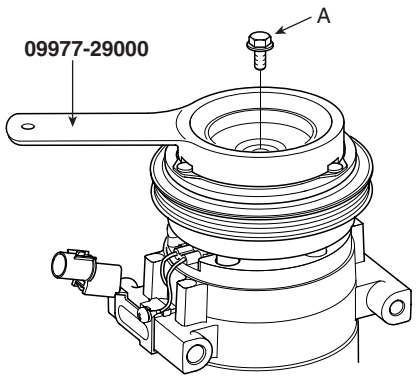


AQJF106C

DISASSEMBLY E91C1FC5

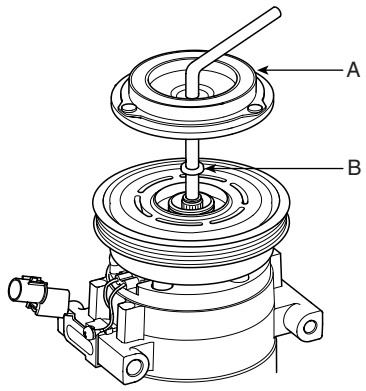
1. Remove the center bolt (A) while holding the disc & hub assembly with a commercially available disc & hub assembly bolt remover; Special tool number 09977-29000.

TORQUE : 10~15N.m (1.02~1.53kgf.m, 7.37~11lb.ft)



LQJF106D

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 (Refer to HA-19).

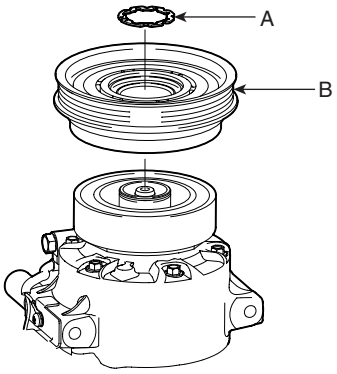


AQJF106E

3. If you remove the field coil, remove retainer ring (A) with retainer ring pliers.

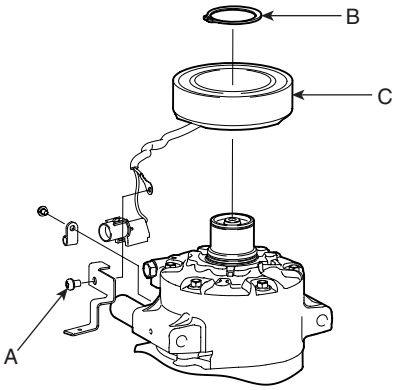
NOTE

- *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.*



AQJF106F

4. Remove the screw (A) from the field coil ground terminal. Remove the retainer ring (B) and then remove the field coil (C) from the shaft with a puller. Be careful not to damage the coil and compressor.



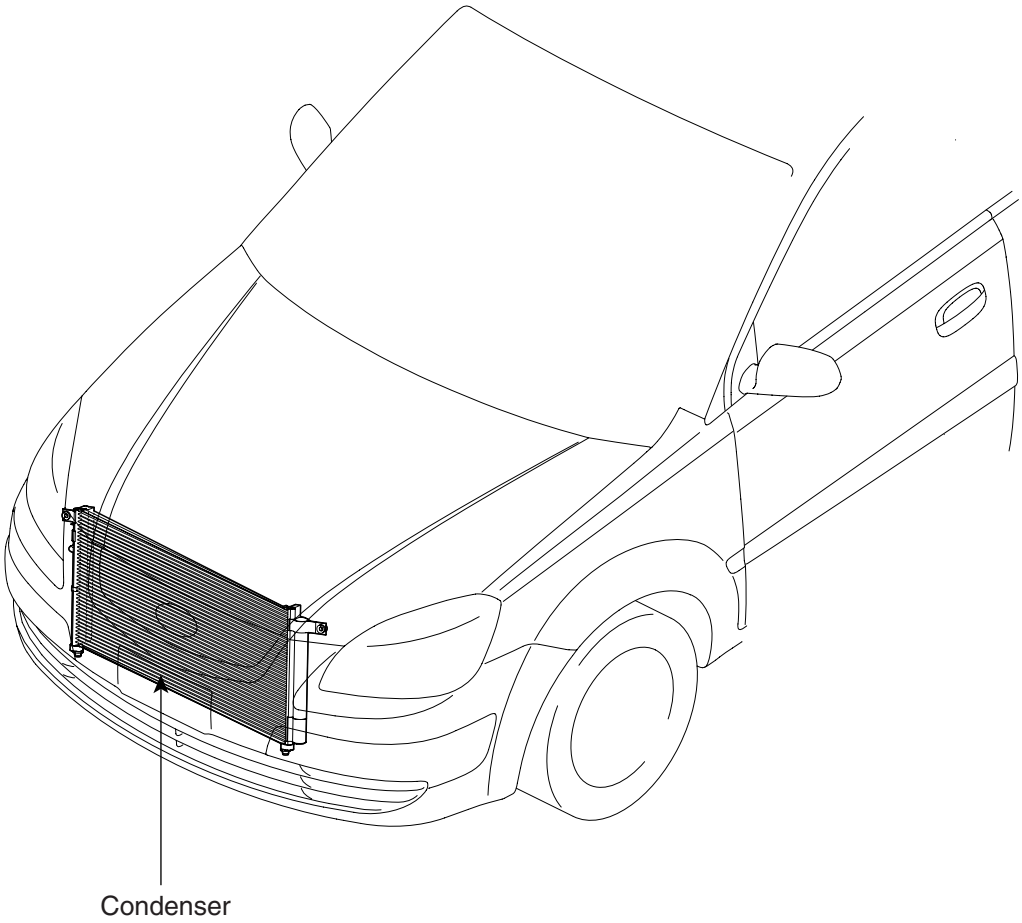
AQJF106G

5. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
   - Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
   - Install new retainer rings, and make sure they are fully seated in the groove.
   - Make sure that the pulley turns smoothly after its reassembled.

CONDENSER

COMPONENT LOCATION EA478C7A

This illustration is shown the LHD type.
RHD type is similar.



LQJF108A

INSPECTION E2FF5F11

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 pliers.

2. Check the condenser connections for leakage, and repair or replace it, if required.

REPLACEMENT EEBCE920

CONDENSER ASSEMBLY

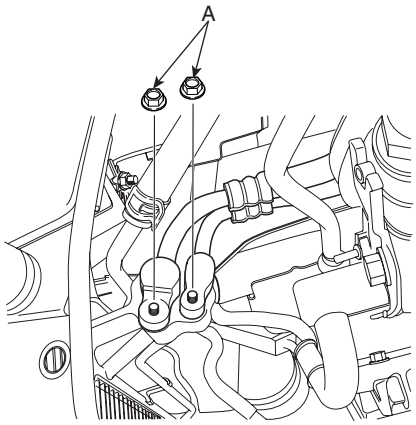
1. Recover the refrigerant with a recovery/ recycling/ charging station (Refer to HA-9).

2. Disconnect the negative (-) battery terminal.

3. Remove the radiator. (Refer to EM group - Radiator)

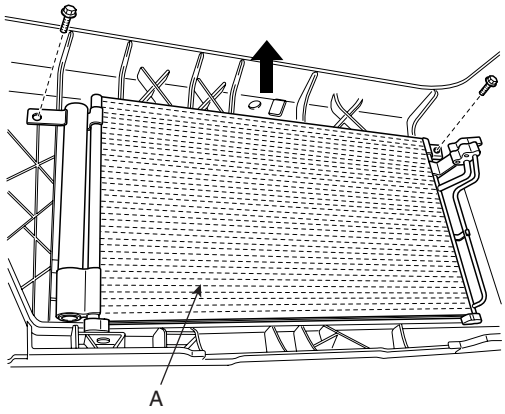
4. Remove 2 nuts (A), and then disconnect the discharge line and liquid line from the condenser.
   Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

TORQUE: 7.8~11.7N.m (0.8~1.2kgf.m, 5.9~8.7lb.ft)



AQJF108B

5. Remove 2 bolts, and then remove the condenser (A) by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser.



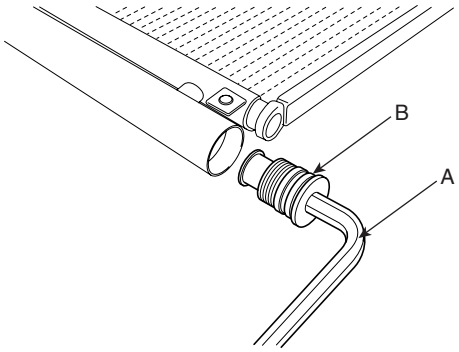
AQJF108C

6. Install in the reverse order of removal, and note these items :
   - If you're installing a new condenser, add refrigerant oil ND-OIL8.
   - 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. (Refer to HA-10)

DESICCANT

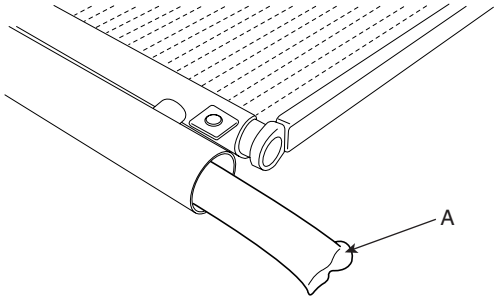
1. Remove the condenser, and then remove the bottom cap (B) with L wrench (A) from the condenser.

TORQUE: 20~25N.m (2.0~2.5kgf·m, 14.5~18.2lb-ft)



KQRE108D

2. Remove the desiccant (A) from condenser using a long nose plier. Check for crumbled desiccant and clogged bottom cap filter.



KQRE108E

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 sealed in vacuum before it is exposed to air for use.

5. Install the new bottom cap to the condenser.

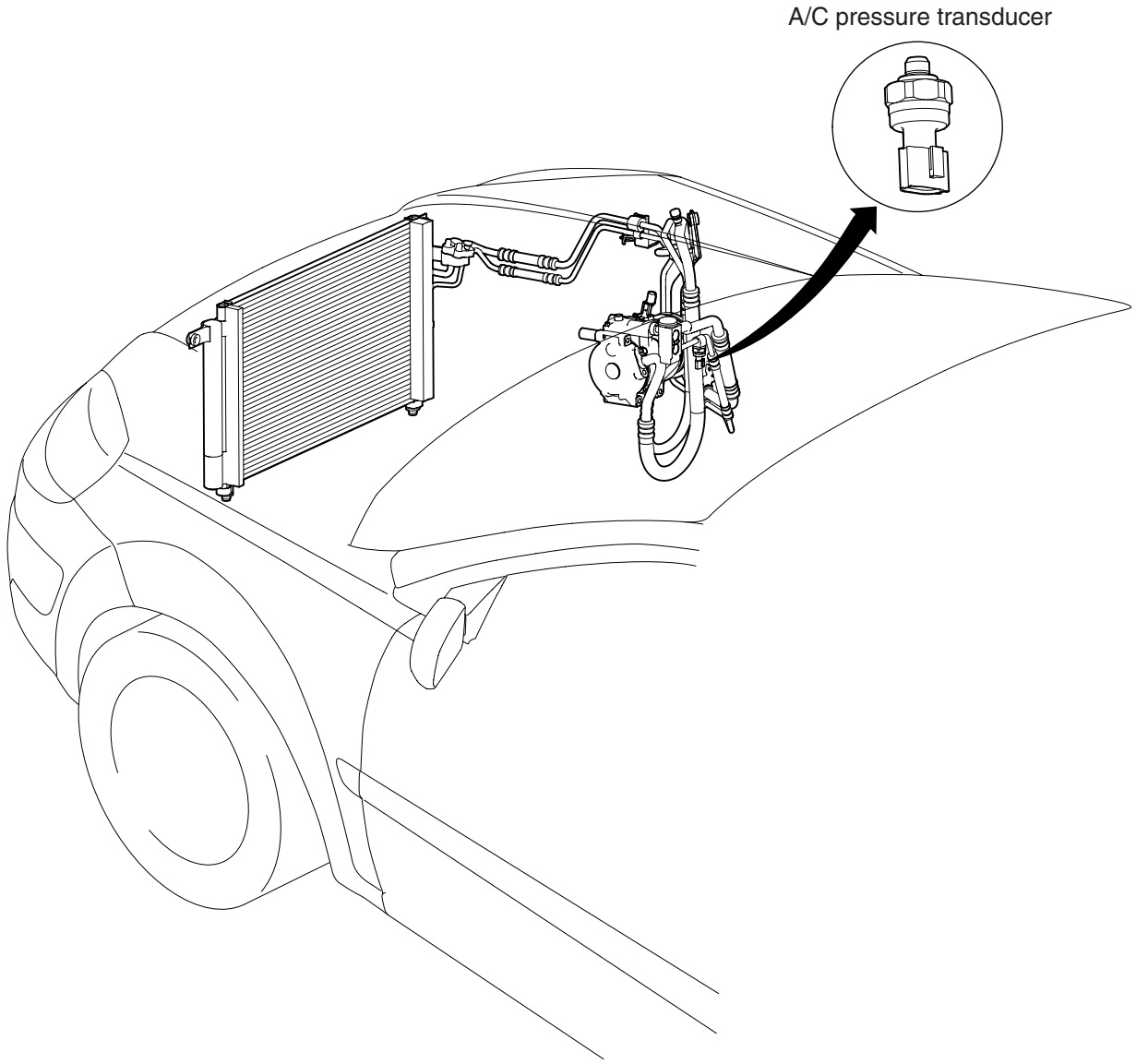
NOTE

- *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. (Refer to HA-10)*

A/C PRESSURE TRANSDUCER

COMPONENT LOCATION E9352DE6

This illustration is shown the LHD type.
RHD type is similar.



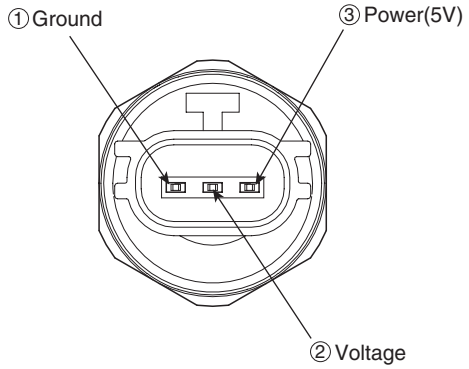
LQJF116A

DESCRIPTION EEBC2B5A

A/C pressure transducer convert the pressure value of high pressure line into voltage value after measure it. By converted voltage value, engine ECM controls cooling fan by operating it high speed or low speed. Engine ECM stop the operation of compressor when the temperature of refrigerant line is so high or so low irregularly to optimize air conditioning system.

INSPECTION E4BBDFE0

1. Measure the pressure of high pressure line by measuring voltage output between NO.1 and NO.2 terminals.



EQRF116B

2. Inspect the voltage value whether it is sufficient to be regular value or not.

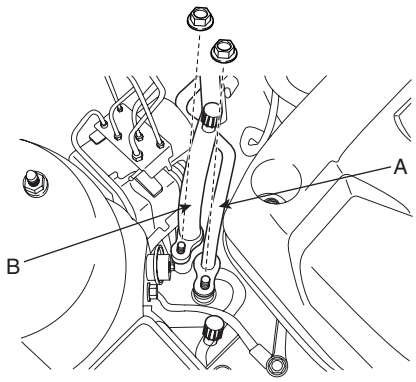
Voltage = 0.025 * Pressure + 0.1 [kgf/cm²]
Voltage = 0.001758 * Pressure + 0.074162 [PSIA]

3. If the measured voltage value is not specification, replace the A/C pressure transducer.

REPLACEMENT E5D7815E

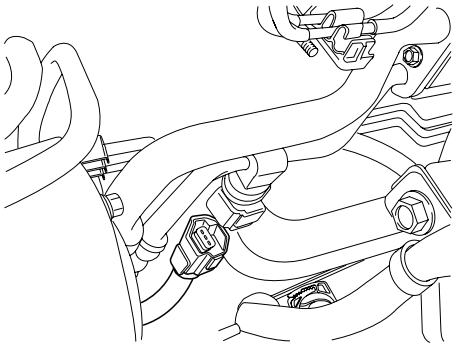
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/charging station. (Refer to HA-9)
3. Remove the discharge line (A) & suction line (B) for wide space.

TORQUE : 8~12N.m (0.8~1.2kgf.m, 5.8~8.7lb.ft)



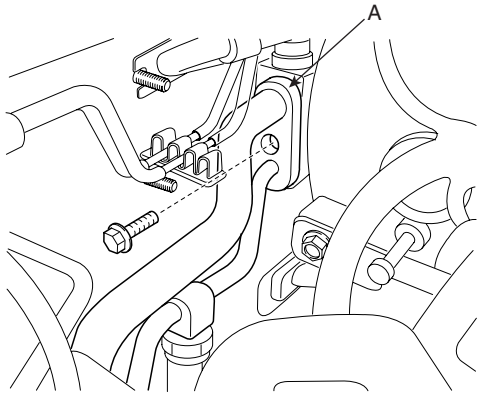
AQJF116B

4. Disconnect A/C pressure transducer connector (3P) (A).



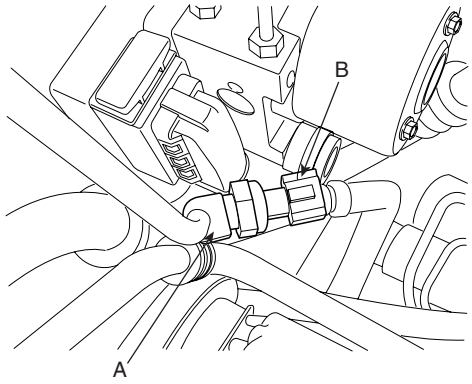
AQJF116C

5. Remove the bolt, and then remove the fitting part (A) which connected liquid & suction pipe from the expansion valve.



LQJF116D

6. Remove the A/C pressure transducer (B) with holding on to the fitting block (A) after pulling liquid & suction pipe.



AQJF116E

CAUTION

Take care that liquid & suction pipe are not bent.

7. Installation is the reverse order of removal.

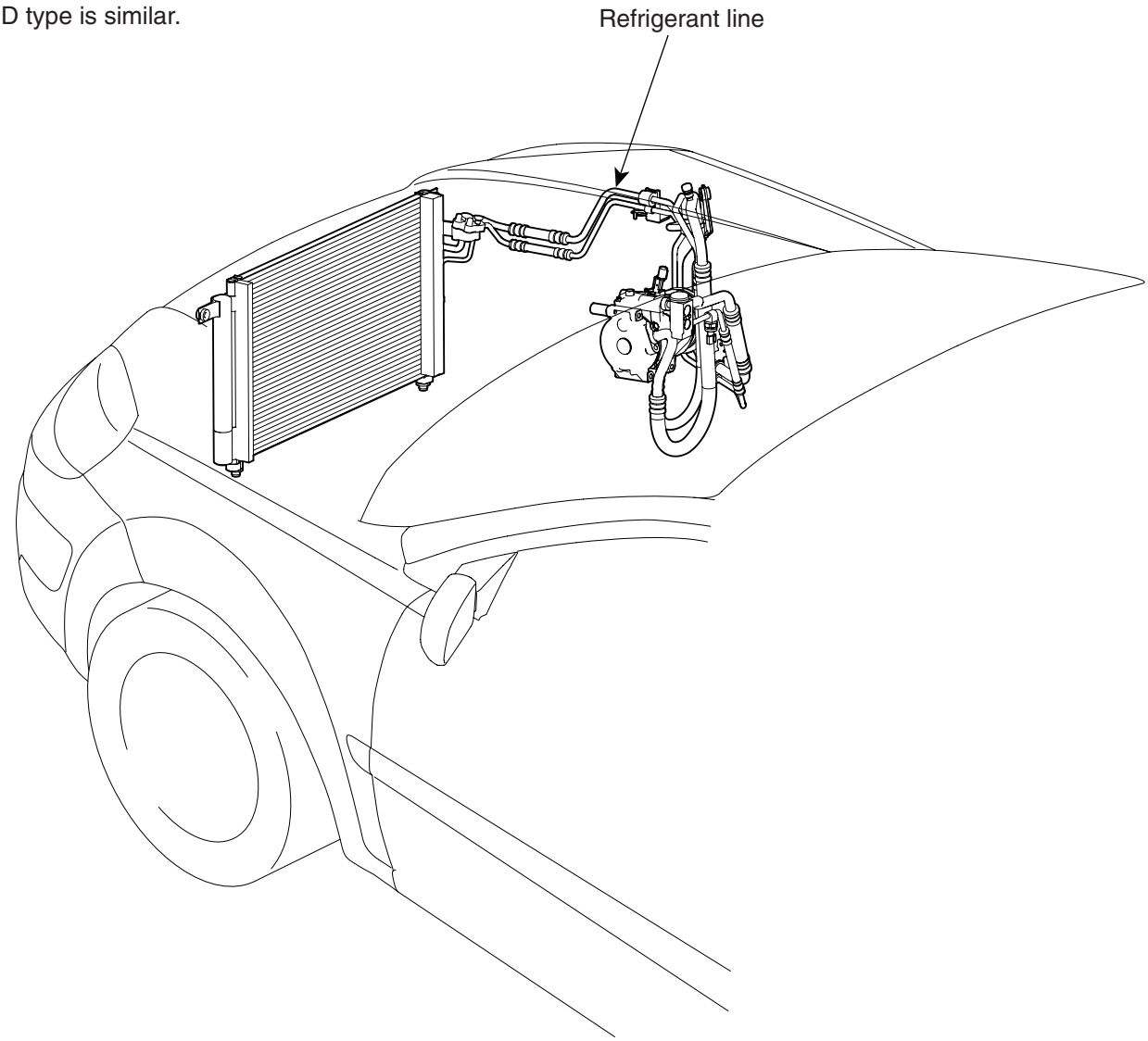
TORQUE : 10~12N.m (1.0~1.2kgf.m, 7.4~8.8lb.ft)

REFRIGERANT LINE

COMPONENT LOCATION EB77925A

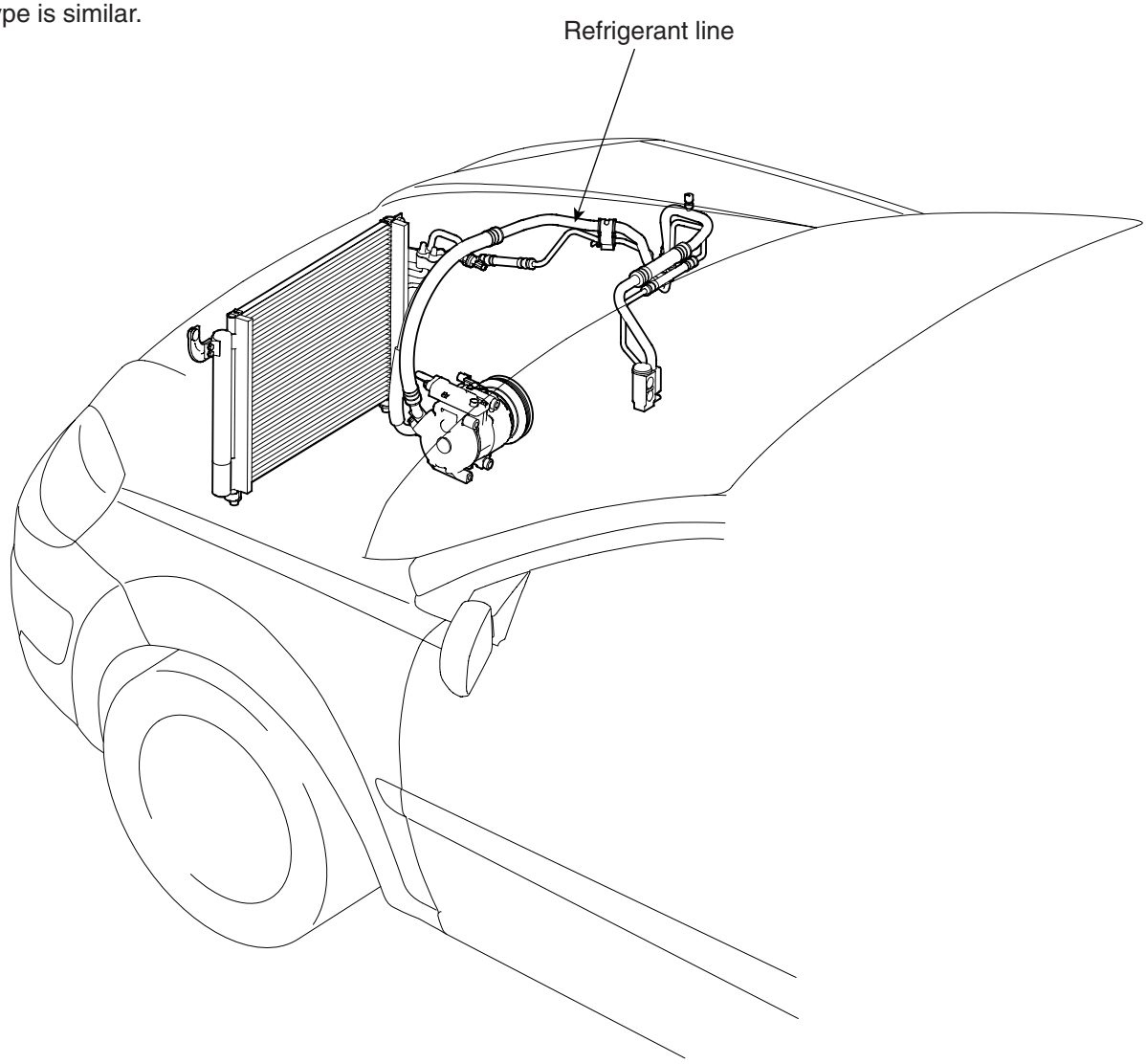
[Gasoline]

This illustration is shown the LHD type.
RHD type is similar.



LQJF113A

[Diesel]
This illustration is shown the LHD type.
RHD type is similar.



LQJF113B

REPLACEMENT E37CE9CE

1. Discharge refrigerant from refrigeration system (Refer to HA-9).

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 x Discharge hose	8 ~ 12	0.8~1.2	5.8 ~ 8.7
Condenser x Liquid tube			
Compressor x Discharge hose			
Compressor x Suction hose			
Expansion valve x Evaporator			

4. Evacuate air in refrigeration system and charge system with refrigerant (Refer to HA-9).

Specified amount : 500 ± 25g

5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant (Refer to HA-10).

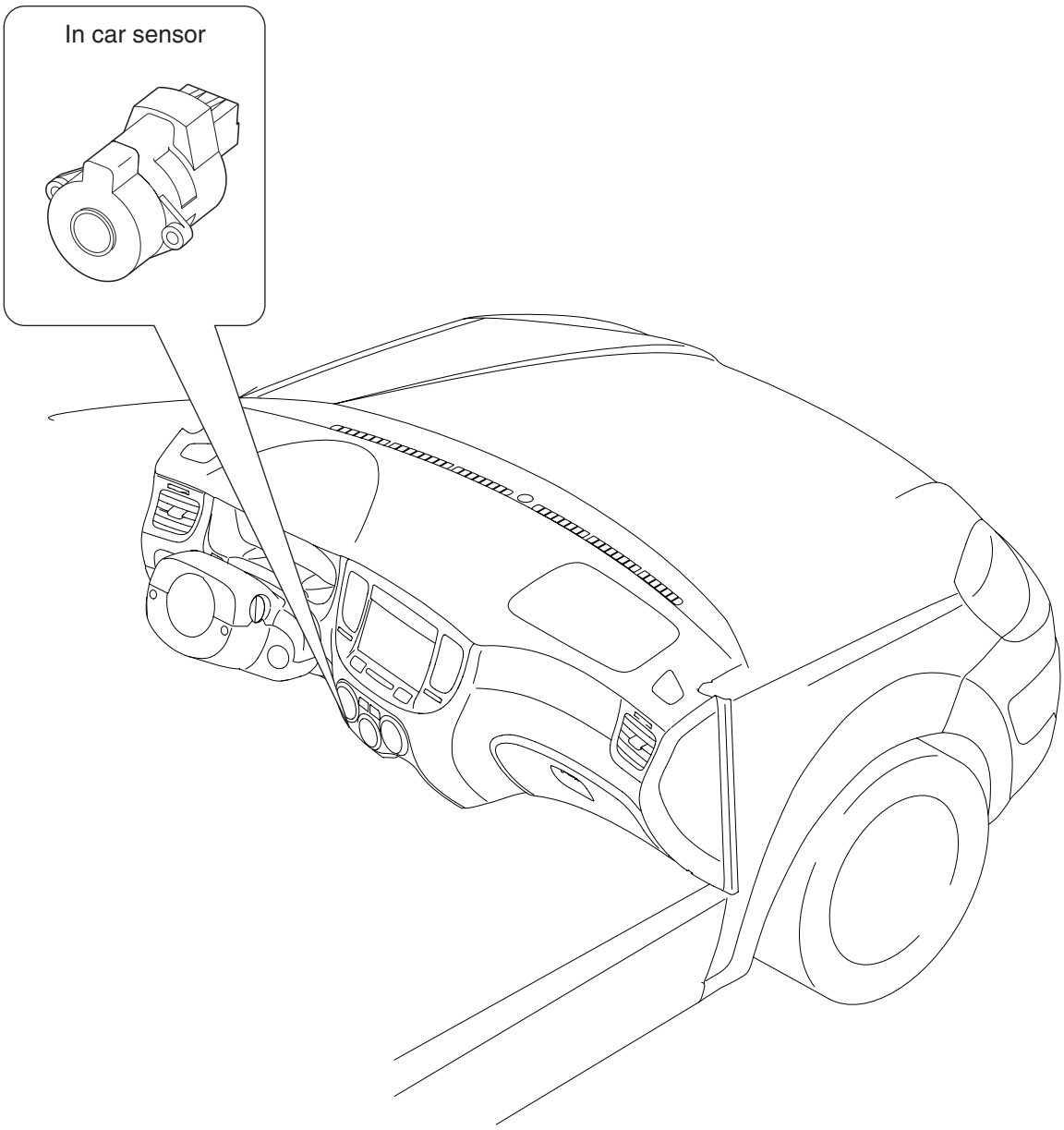
6. Inspect A/C operation.

A/C COMPRESSOR CONTROLS (FULL AUTO)

IN CAR SENSOR

COMPONENT LOCATION E57CBADC

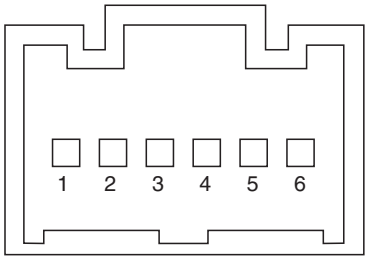
This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF201A

DESCRIPTION EEC45E64

1. In-car air temperature sensor is located at the center facia lower panel.
2. The sensor contains a thermistor which measures the temperature of the inside. The signal decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to heater control unit and according to this signal the control unit regulates incar temperature to intended value.



1. Motor(-)
2. Sensor ground (+)
3. Humidity sensor signal
4. In-car sensor temp. signal
5. 5V (Vcc)
6. Motor (+)

LQJF201C

INSPECTION E85A9243

1. Ignition "ON".
2. Blow air with changing temperature to the in car sensor air inlet. Measure sensor resistance between 2 and 4 terminals.

SPECIFICATION

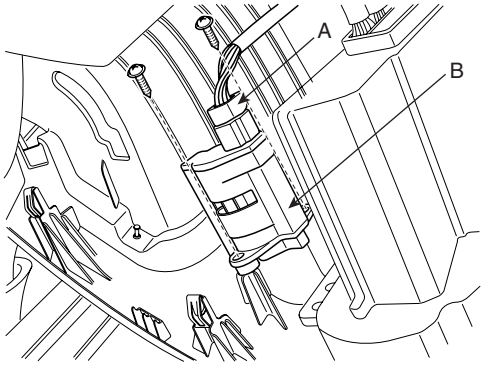
Temperature [°C(°F)]	Resistance between terminals 2and 4 (kΩ)
0 (32)	97.83 ± 2.61%
15 (59)	47.12 ± 1.45%
25 (77)	30.00 ± 1.20%
35 (95)	19.60 ± 1.44%
50 (122)	10.82 ± 2.26%

NOTE

In car sensor is negative type thermistor that resistance will rise with lower temperature, and reduce with higher temperature.

REPLACEMENT EE0FE419

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel. (Refer to BD group - Crash pad).
3. Disconnect the connector of in-car sensor (A).Loosen the mounting 2 screws and then remove the in-car sensor (B).



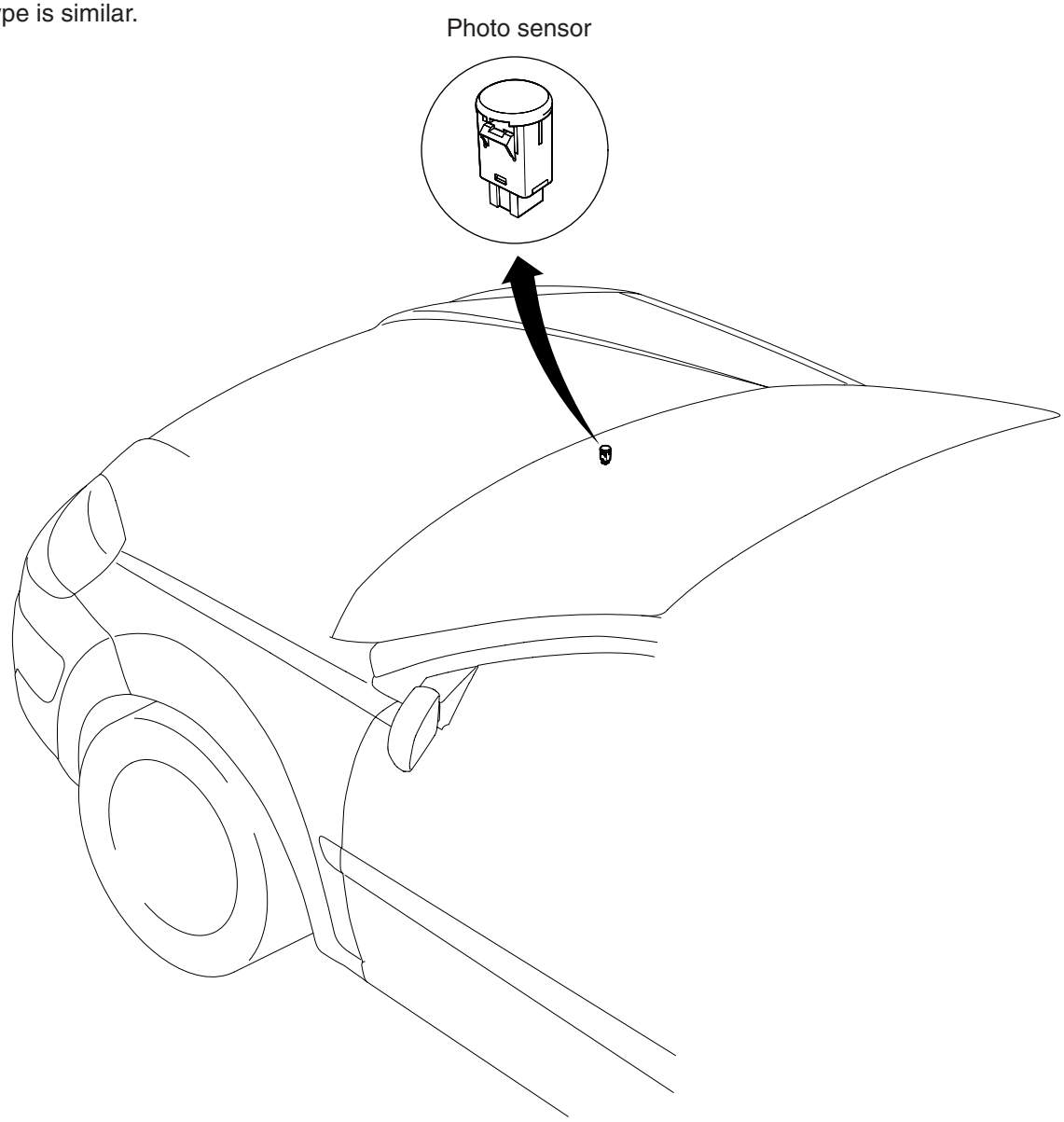
AQJF201C

4. Installation is the reverse order of removal.

PHOTO SENSOR

COMPONENT LOCATION EE6E5BBD

This illustration is shown the LHD type.
RHD type is similar.



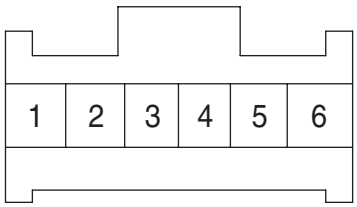
LQJF202A

DESCRIPTION E4FDA65E

1. The photo sensor (A) is located at the center of defrost nozzle.
2. The photo sensor contains a photovoltaic (sensitive to sunlight) diode. The solar radiation received by its light receiving portion, generates an electromotive force in proportion to the amount of radiation received which is transferred to the automatic temperature control module so that the solar radiation compensation will be performed.

INSPECTION ECB4C5A1

1. Ignition "ON".
2. Using the scan tool.
3. Emit intensive light toward photo sensor using a lamp, and check the output voltage change.
4. The voltage will rise with higher intensive light and reduce with lower intensive light.

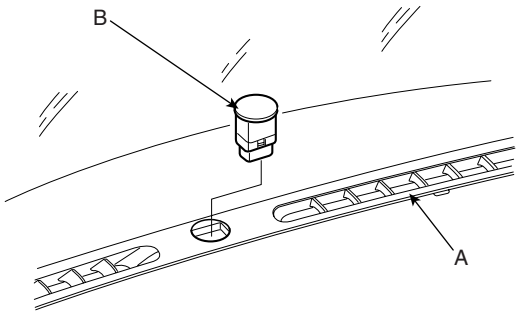


1. Ground
2. 5V (Vcc)
3. Signal
4. -
5. Photo sensor(+)
6. Photo sensor(-)

LQJF202B

REPLACEMENT E4D51EED

1. Disconnect the negative (-) battery terminal.
2. With the (-) driver, remove the photo sensor (B) from the center of defrost nozzle (A).



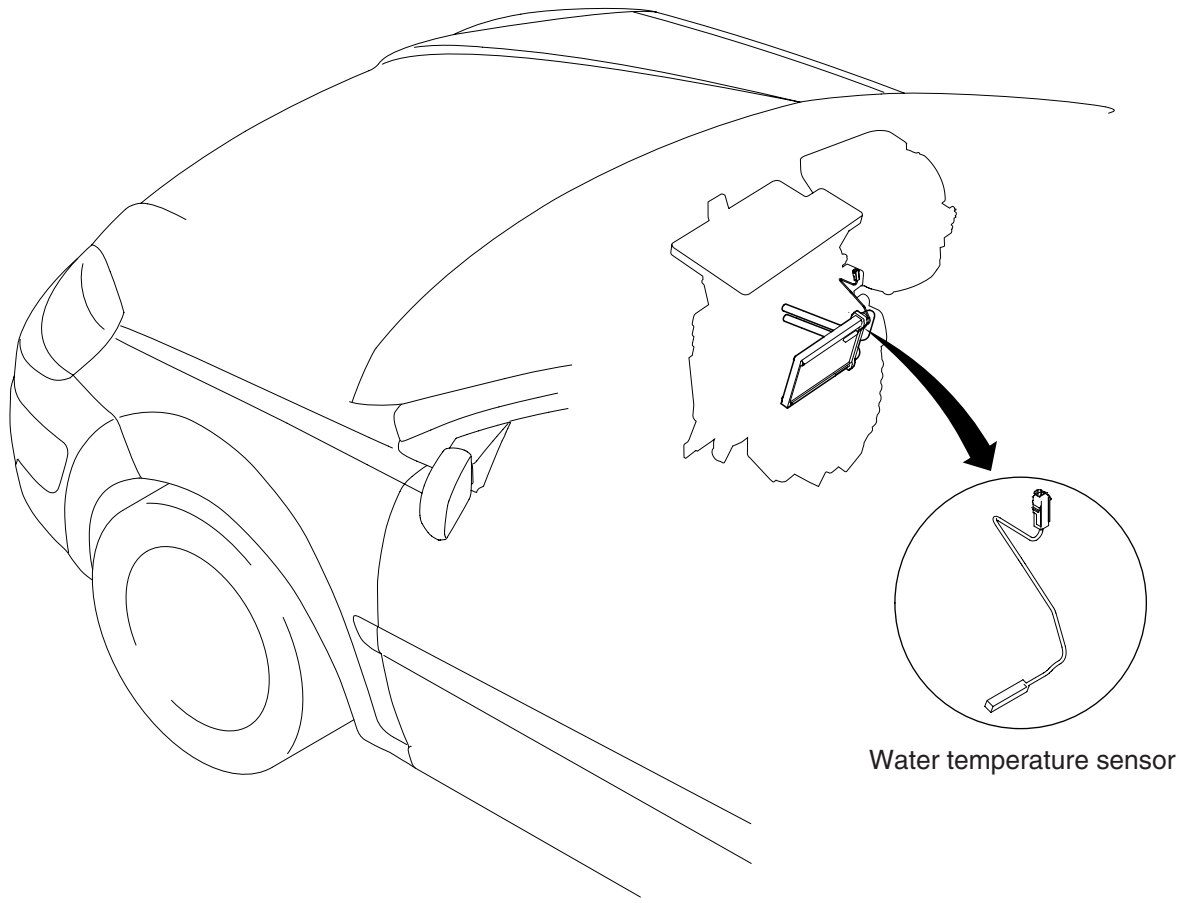
AQGE202D

3. Install in the reverse order of removal.

WATER TEMPERATURE SENSOR

COMPONENT LOCATION E4A493FF

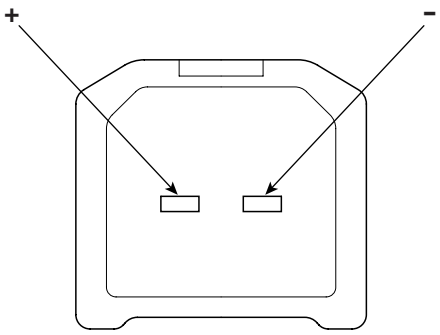
This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF203A

DESCRIPTION EC495F49

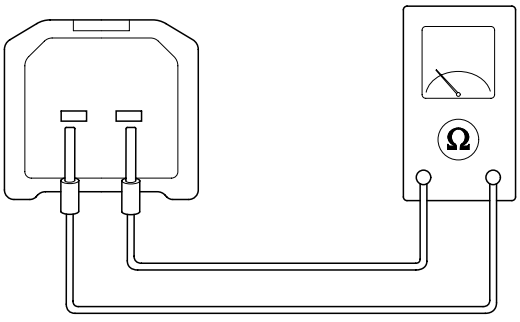
1. Water temperature sensor is located at the heater unit.
2. It detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.



AQIE203C

INSPECTION E0D27EEB

1. Ignition "ON".
2. Using the multi-tester, Measure resistance between terminal "1" and "2" of water temperature sensor.



AQIE203D

SPECIFICATION

Coolant temperature [°C(°F)]	Resistance (kΩ)	Voltage (V)
-10(14)	55.85 ± 3%	4.24 ± 3%
0(32)	32.91 ± 3%	3.83 ± 3%
10(50)	19.99 ± 3%	3.33 ± 3%
20(68)	12.51 ± 3%	2.78 ± 3%
30(86)	8.047 ± 3%	2.23 ± 3%
40(104)	5.311 ± 3%	1.73 ± 3%
50(122)	3.588 ± 3%	1.32 ± 3%
60(140)	2.476 ± 3%	0.99 ± 3%
70(158)	1.742 ± 3%	0.74 ± 3%
80(176)	1.246 ± 3%	0.55 ± 3%

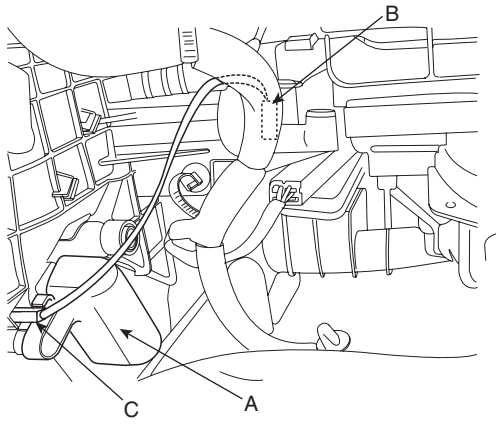
3. If the measured resistance is not specification, substitute with a known-good water temperature sensor and check for proper operation.
4. If the problem is corrected, replace the water temperature sensor.

NOTE

Negative type thermistor that resistance will rise with lower temperature, and reduce with higher temperature.

REPLACEMENT ECAC6CFA

1. Disconnect the negative (-) battery terminal.
2. Remove the grove box. (Refer to BD group)
3. Remove the heater core cover (A) after loosening 2 screws.



LQJF203E

4. Disconnect the connector (B) of water temperature sensor (C) and then remove the water temperature sensor by pulling out.
5. Installation is the reverse order of removal.

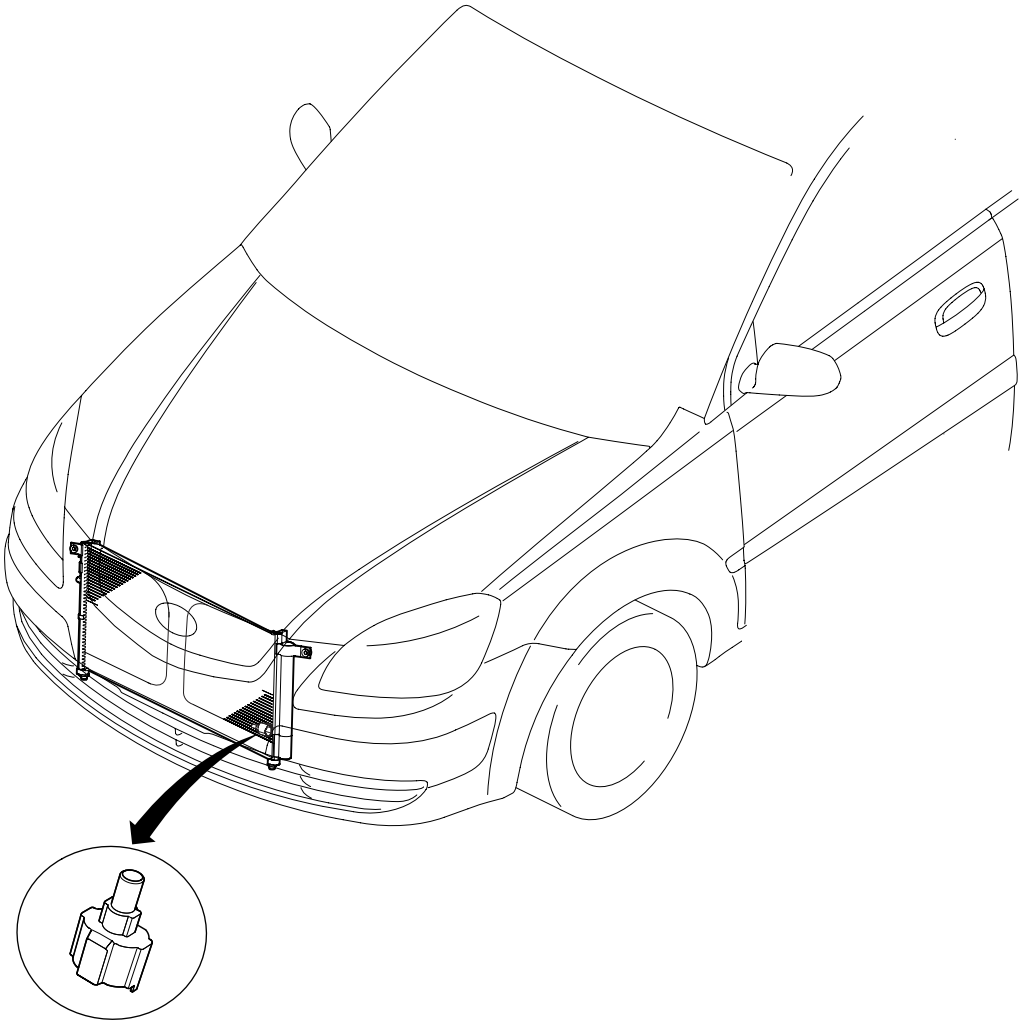
NOTE

Take care that wire of water temperature sensor is not to be damaged.

AMBIENT TEMPERATURE SENSOR

COMPONENT LOCATION EF2D8568

This illustration is shown the LHD type.
RHD type is similar.



Ambient temperature sensor

LQJF204A

DESCRIPTION E85D79C6

1. The ambient temperature sensor is located at the front side of the condenser and detects ambient air temperature. It is a negative type thermistor; resistance will increase with lower temperature, and decrease with higher temperatures.

2. The sensor output will be used for discharge temperature control, temperature regulation door control, blower motor level control, mix mode control and in-car humidity control.

NOTE

If the ambient temperature is below 2.0°C (35.6°F), the A/C compressor will be stopped.
The compressor will be operated by manual operating.

INSPECTION EFE850BA

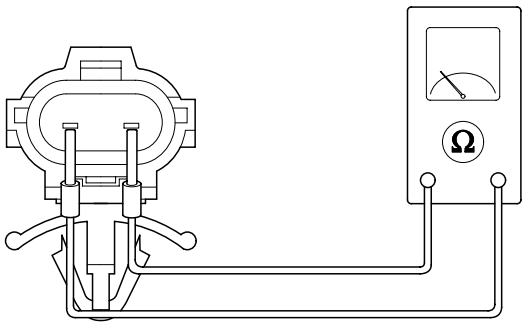
1. Ignition "OFF".

2. Disconnect ambient temperature sensor.

3. Check the resistance of ambient temperature sensor between terminals 1 and 2 whether it is changed by changing of the ambient temperature.

SPECIFICATION

Ambient temperature [°C(°F)]	Resistance between terminals 1 and 2 (kΩ)
-10 (14)	164 ± 3%
0 (32)	97.5 ± 3%
10 (50)	59.6 ± 3%
20 (68)	37.5 ± 3%



AQJF204B

4. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.

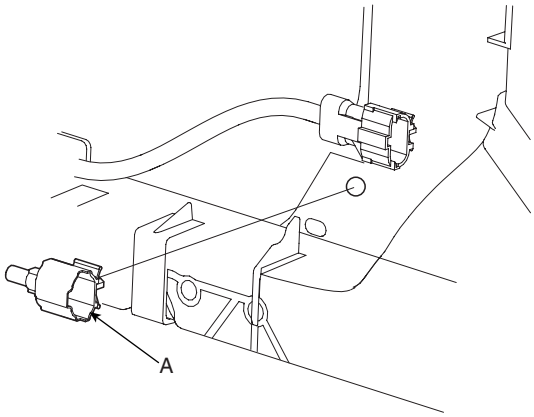
5. If the problem is corrected, replace the ambient temperature sensor.

REPLACEMENT E89FD9BF

1. Disconnect the negative (-) battery terminal.

2. Remove the front bumper. (Refer to BD group - Front bumper)

3. Remove the ambient temperature sensor (A).



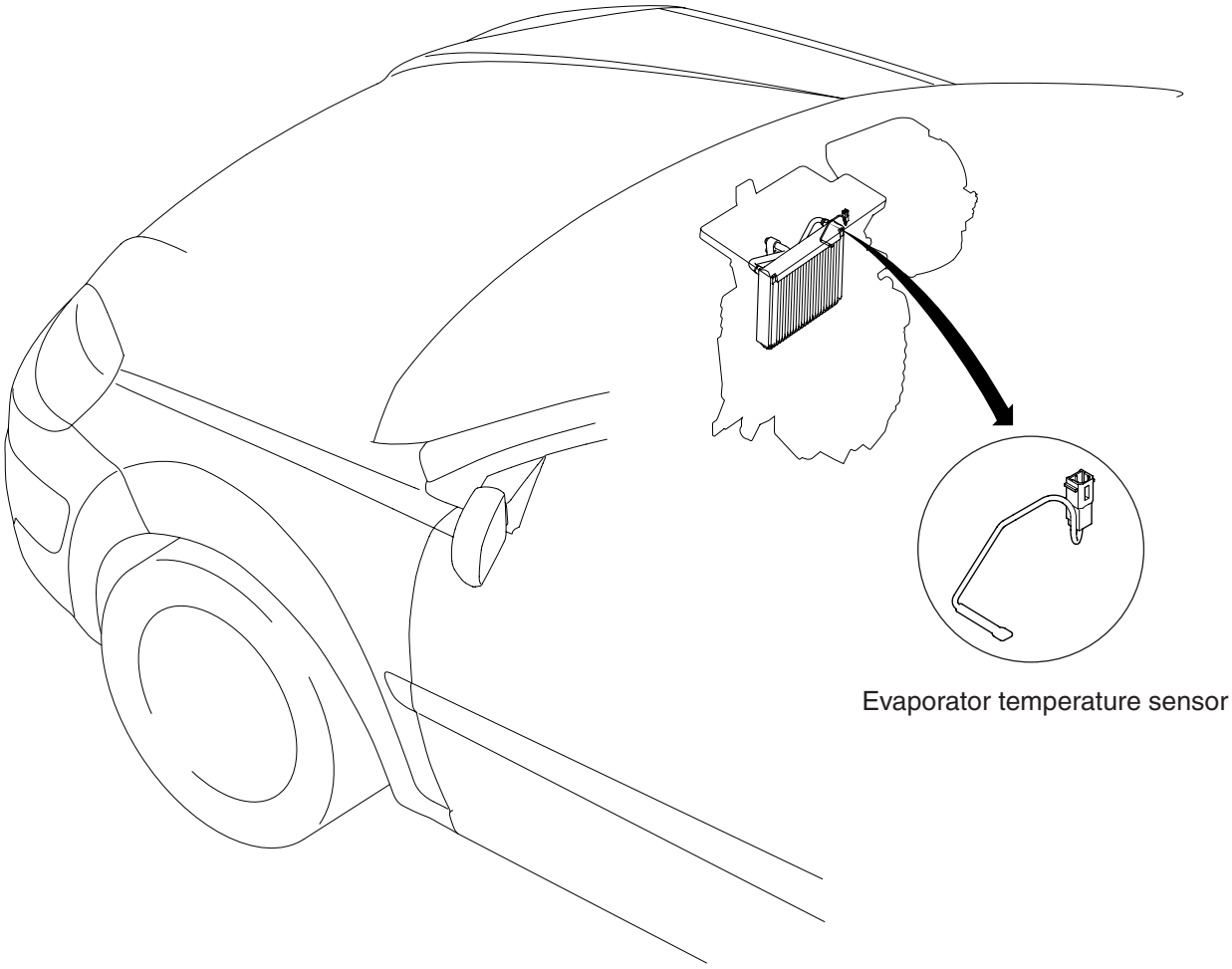
AQJF204E

4. Installation is the reverse order of removal.

EVAPORATOR TEMPERATURE SENSOR

COMPONENT LOCATION EA8060D8

This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF206A

DESCRIPTION EADFFD2E

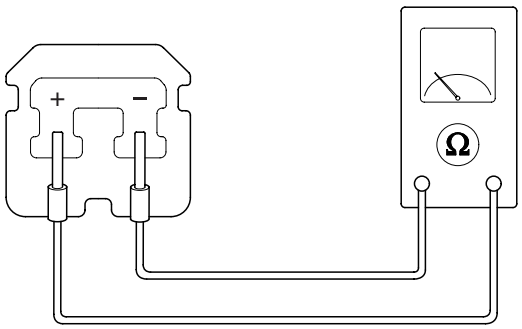
The evaporator temperature sensor will detect the evaporator core temperature and interrupt compressor relay power in order to prevent evaporator freezing by excessive cooling.
It is a negative type thermistor whose resistance is inversely proportional to temperature.

INSPECTION E89BA52E

1. Ignition "ON".
2. A/C switch "ON".
3. Using the multi-tester, Measure resistance between terminal "1" and "2" of evaporator temperature sensor.

SPECIFICATION

Evaporator core temperature [°C(°F)]	Resistance [kΩ]	Voltage [V]
-10 (14)	13.56	2.88 ± 0.5
-5 (23)	10.37	2.55 ± 0.5
0 (32)	8.000	2.22 ± 0.5
5 (41)	6.222	1.91 ± 0.5
10 (50)	4.877	1.64 ± 0.5
15 (59)	3.851	1.39 ± 0.5
20 (68)	3.063	1.17 ± 0.5
25 (77)	2.453	0.98 ± 0.5
30 (86)	1.978	0.83 ± 0.5
35 (95)	1.605	0.69 ± 0.5
40 (104)	1.310	0.58 ± 0.5
45 (113)	1.075	0.49 ± 0.5
50 (122)	0.888	0.41 ± 0.5

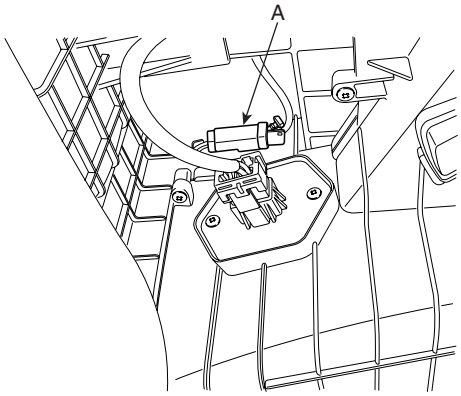


AQJF206B

4. If the measured resistance is not specification, substitute with a known-good evaporator temperature sensor and check for proper operation.
5. If the problem is corrected, replace the evaporator temperature sensor.

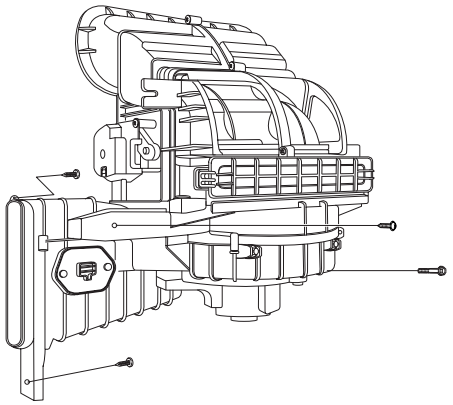
REPLACEMENT E65AB1F7

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad. (Refer to BD group - Crash pad)
3. Disconnect the evaporator sensor connector (A).



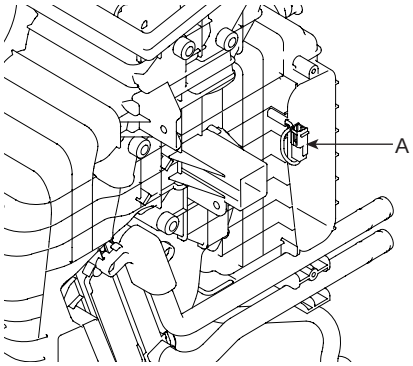
AQJF206C

4. Remove the blower unit from the heater unit after loosening a mounting bolt & 3 screrws.



AQJF206D

5. Remove the evaporator sensor (A) from evaporator core by pulling out.



AQJF206E

CAUTION

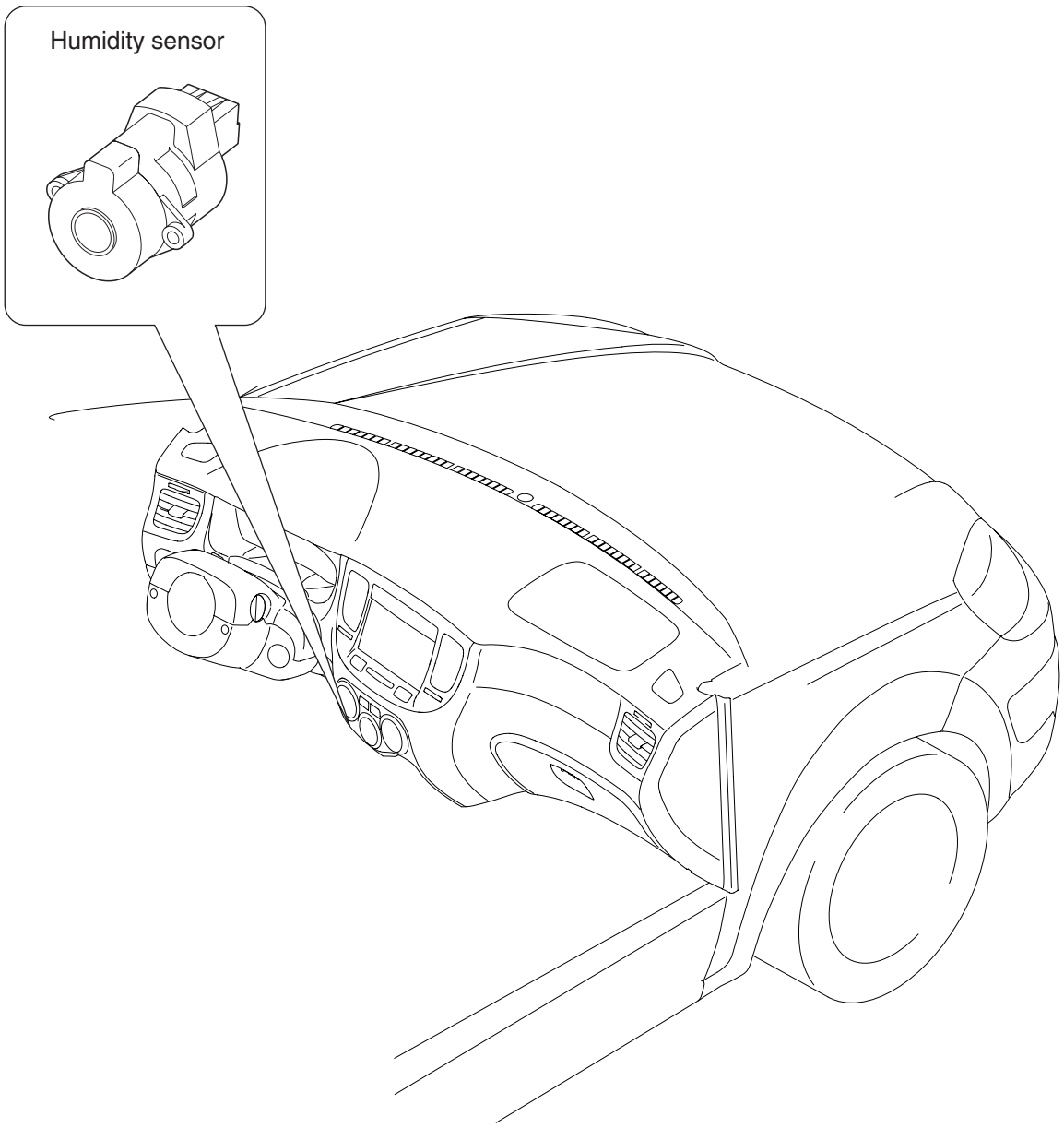
Take care that evaporator core pins are not bent.

6. Installation is the reverse order of removal.

HUMIDITY SENSOR

COMPONENT LOCATION EB5A332A

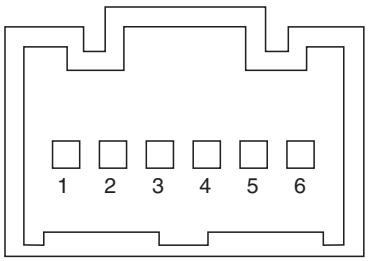
This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF208A

DESCRIPTION ECC2F2F5

1. Humidity sensor is located at the lower crush pad and detected in-car humidity for in-car humidity control.
2. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity preventing in car fogging.
   Air conditioner operation depends on ambient temperature and humidity.



1. Motor(-)
2. Sensor ground (+)
3. Humidity sensor signal
4. In-car sensor temp. signal
5. 5V (Vcc)
6. Motor (+)

LQJF201C

INSPECTION E2DAEA71

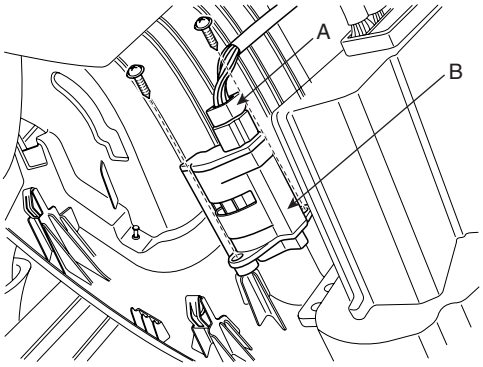
1. Ignition "ON".
2. Using the scan tool.
3. Check the frequency of humidity sensor between terminals 2 and 3.

Humidity (%)	Frequency between terminals 2and 3 (Hz)
30	6976 ± 5%
50	6728 ± 5%
60	6600 ± 5%
70	6468 ± 5%
80	6330 ± 5%
90	6186 ± 5%

4. If the measured resistance is not specification, substitute with a known-good humidity sensor and check for proper operation.
5. If the problem is corrected, replace the Humidity sensor.

REPLACEMENT E8AFF58B

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia lower panel (A). (Refer to BD group - Crash pad)
3. Disconnect the humidity sensor connector (A).
4. Loosen 2 screws and then remove the humidity sensor (B).



AQJF208B

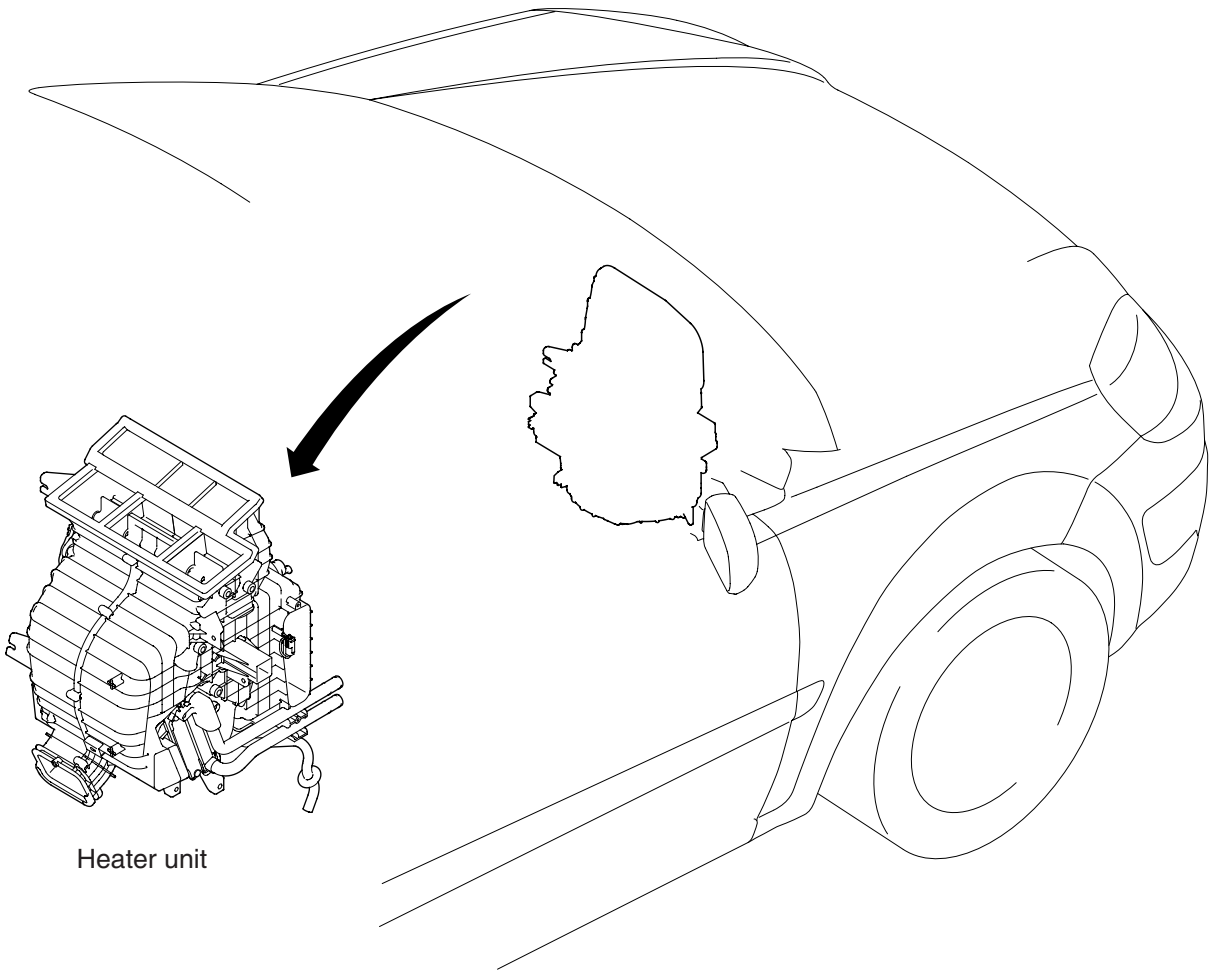
5. Installation is the reverse order of removal.

HEATER

HEATER UNIT

COMPONENT LOCATION E21AF6BF

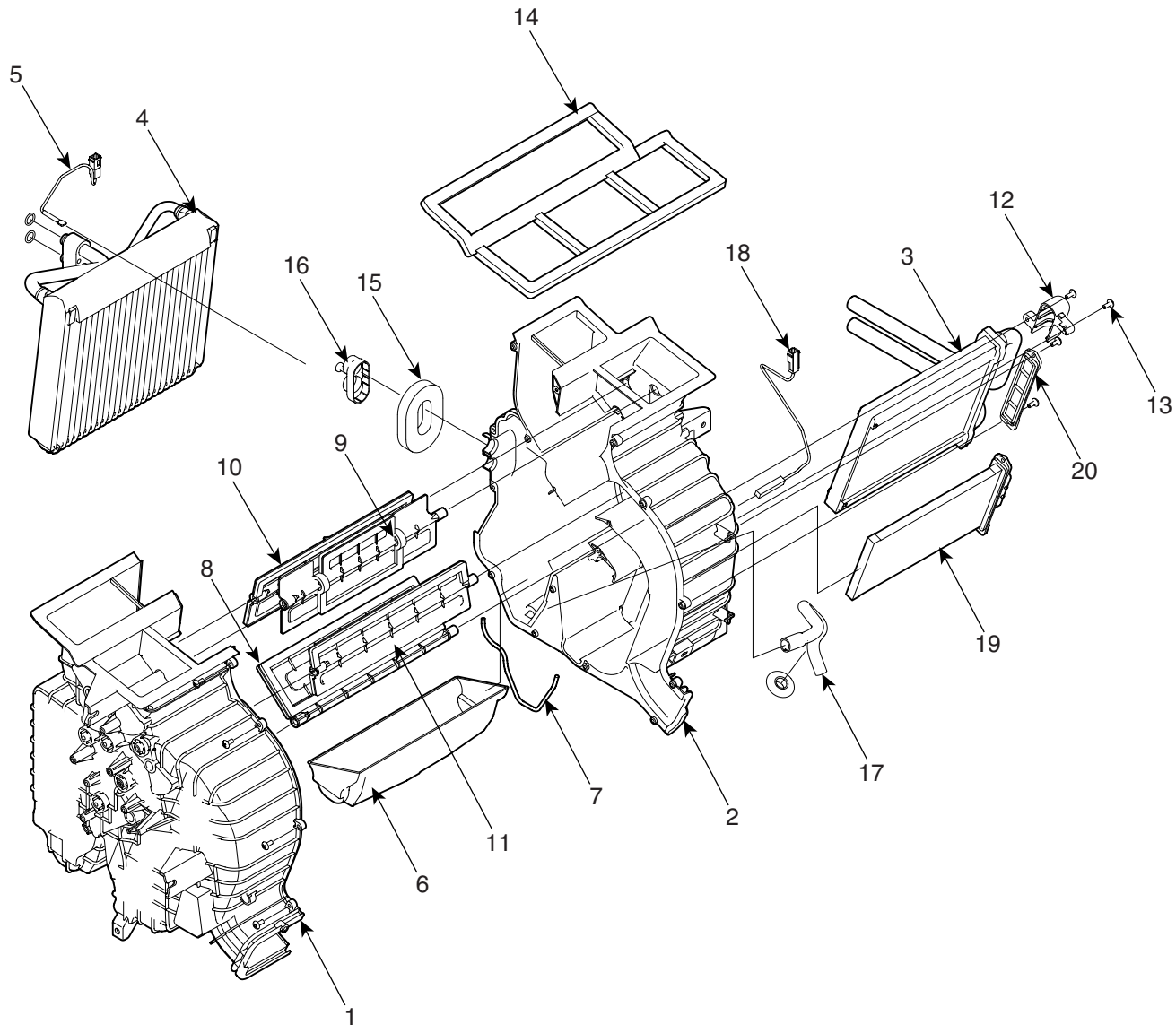
This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF300A

COMPONENTS E8FAED56

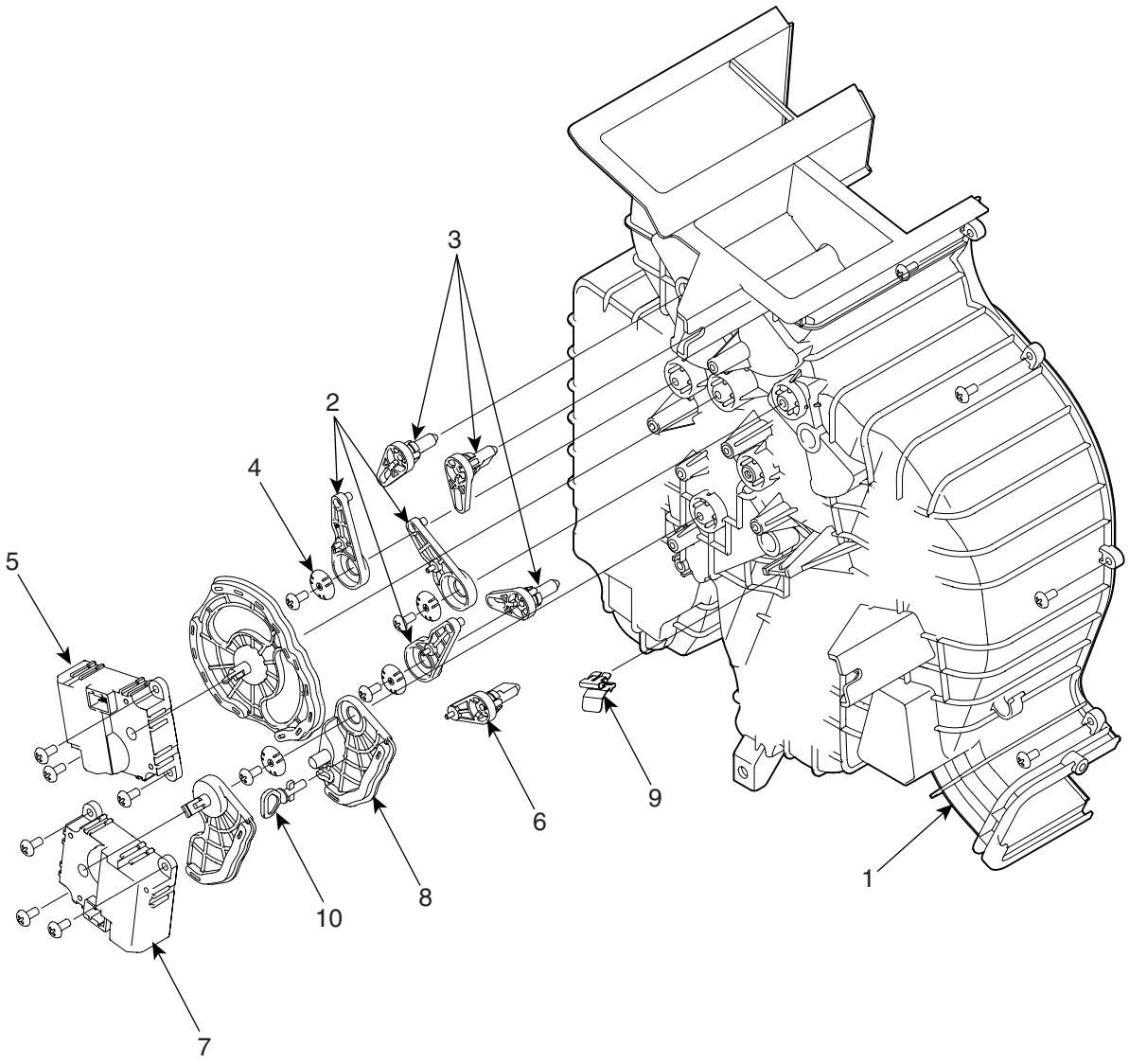
Heater unit (R) :
This illustration is shown the LHD type.
RHD type is symmetrical (L).



1. Heater case(L)
2. Heater case(R)
3. Heater core assembly
4. Evaporator assembly
5. Evaporator sensor
6. Lower case seal
7. Insert case seal
8. Temp door assembly
9. Vent door assembly
10. Defrost door assembly
11. Foot door assembly
12. Heater core cover
13. Tapping screw
14. Duct seal
15. Flange seal
16. Flange cap
17. Drain hose assembly
18. Water temperature sensor
19. PTC heater
20. PTC heater cover

LQJF300B

Heater unit (L) :
This illustration is shown the LHD type.
RHD type is symmetrical (R).

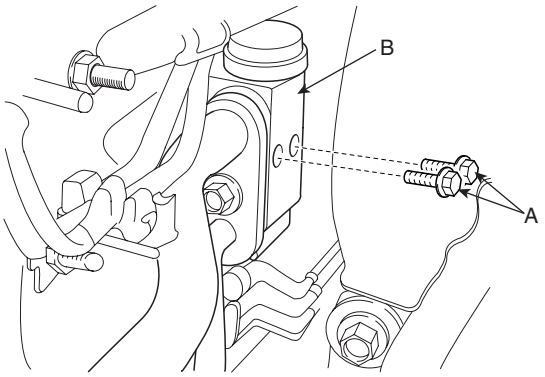


1. Heater case(L)
2. Sub mode lever
3. Door mode lever
4. Tension washer
5. Mode actuator assembly
6. Temp door lever
7. Temp actuator assembly
8. Temp main lever
9. Cable clip
10. Lever stopper

LQJF300F

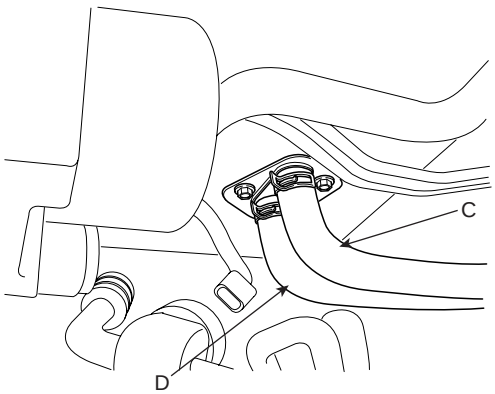
REPLACEMENT E035D46F

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station. (Refer to HA-10)
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.



AQJF300C

5. Disconnect the inlet (A) and outlet (B) heater hoses from the heater unit.

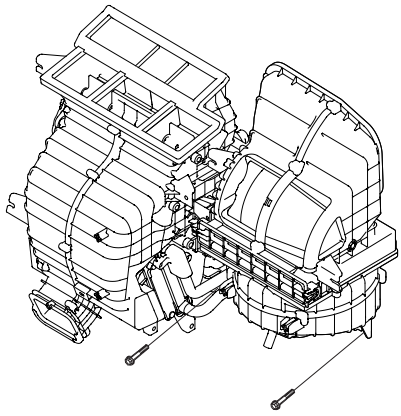


AQJF300D

CAUTION

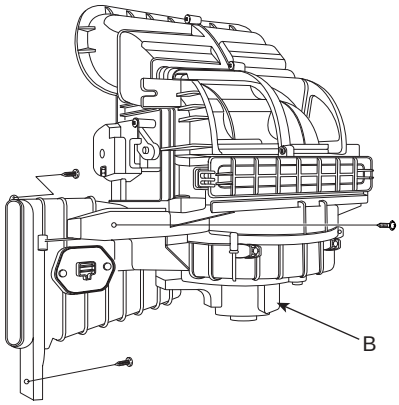
Engine coolant will run out when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

6. Remove the crash pad (Refer to BD group - Crash pad).
7. Remove the cowl cross bar assembly. (Refer to BD group - Crash pad)
8. Disconnect the connectors from the temperature control actuator, the mode control actuator and the evaporator temperature sensor.
9. Remove the heater & blower unit after loosening 2 mounting bolts.



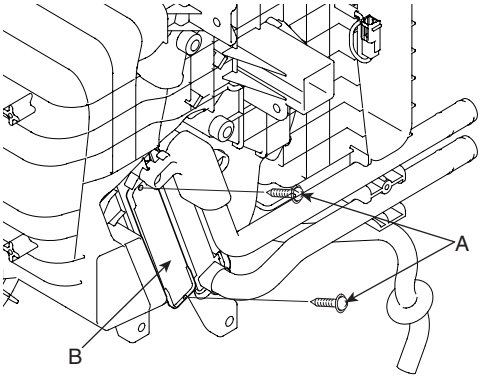
AQJF300E

10. Remove the blower unit (B) from heater unit after loosening 3 screws.



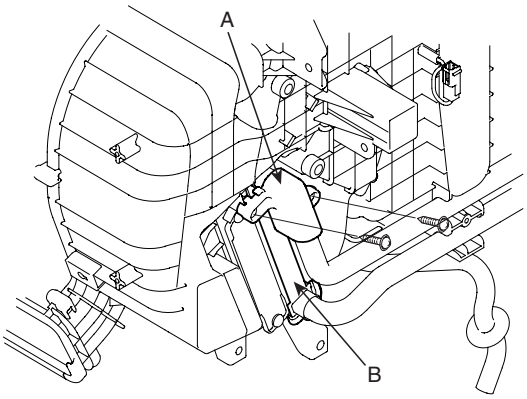
AQJF300G

11. Remove the self-tapping screws (A) and remove the PTC heater unit (B) or cover. (In case of PTC heater)



AQJF300H

12. Remove the heater core (B) after remove the cover (A).



AQJF300I

13. Be careful that the inlet and outlet pipe are not bent during heater core removal, and pull out the heater core.

14. Install the heater core in the reverse order of removal.

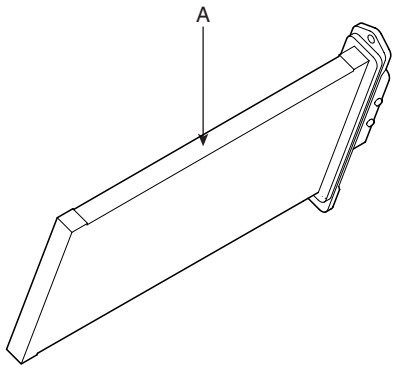
15. Installation is the reverse order of removal, and note these items :
    - If you're installing a new evaporator, add refrigerant oil (ND-OIL8).
    - Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
    - Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    - 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.
    - Apply sealant to the grommets.
    - Make sure that there is no air leakage.
    - Charge the system and test its performance.
    - Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    - Refill the cooling system with engine coolant.

PTC (POSITIVE TEMPERATURE COEFFICIENT) HEATER

DESCRIPTION EE43A4DE

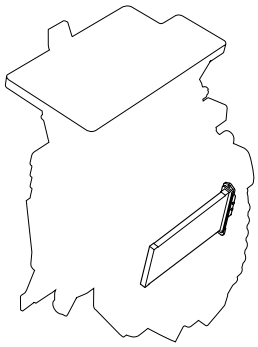
PTC (Positive Temperature Coefficient) heater (A) is an electric heater using a PTC element as an auxiliary heating device that supplements deficiency of interior heat source in highly effective diesel engine (U engine).

[LHD type is shown, RHD type is symmetrical]



LQJF301B

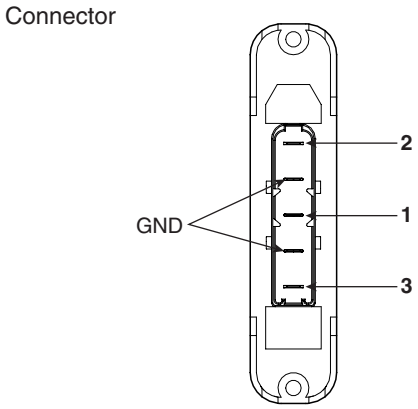
An electric heater heats up the interior by directly heating the air that passes through the heater.
PTC = positive Temperature Coefficient
The name itself implies that the element has a proportional resistance change sensitive to temperature. PTC heater is installed at the exit or the backside of heater core.



AQJF301A

OPERATION PRINCIPLE EB97878F

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.



LQJF301C

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.

INSPECTION EDB55C9A

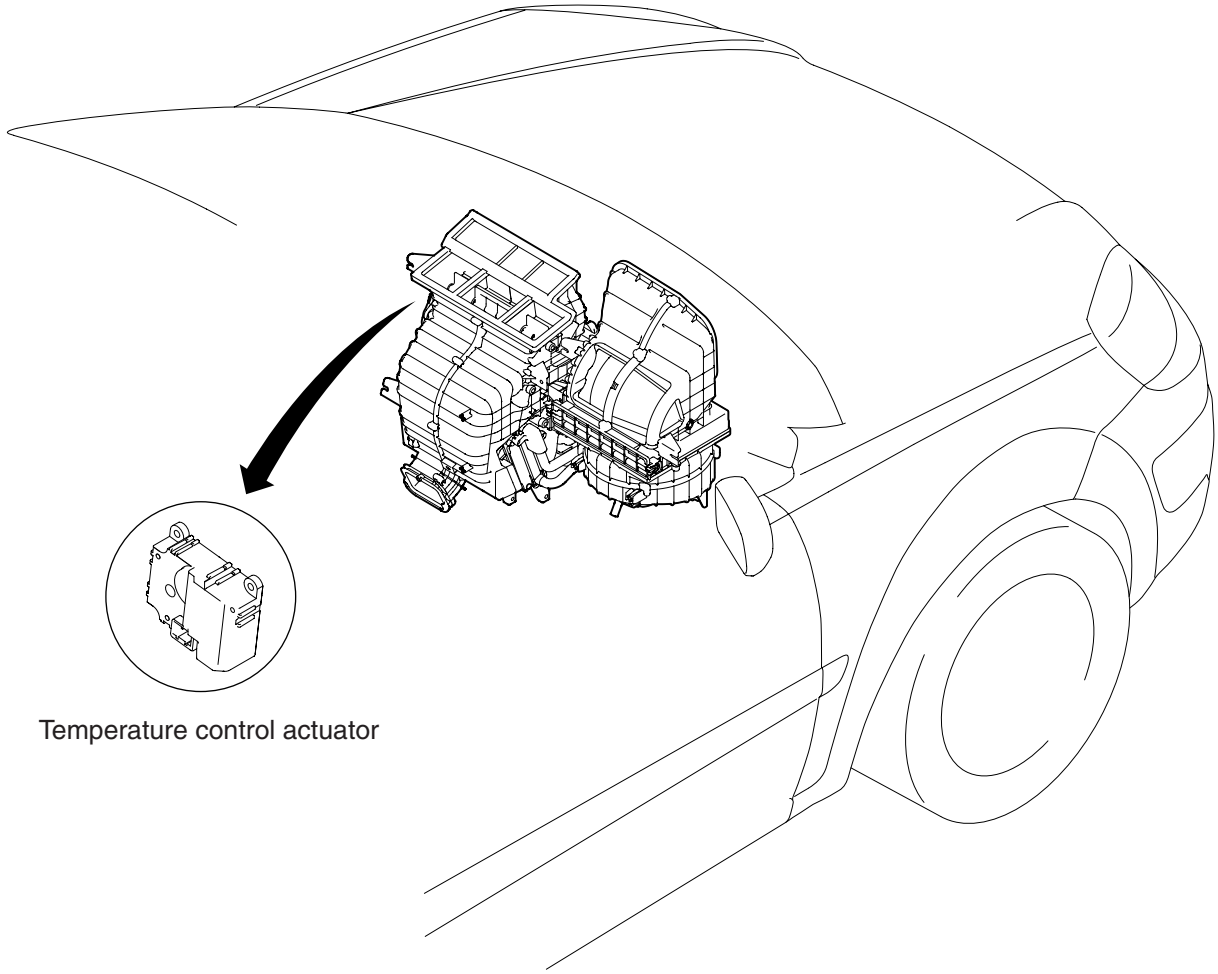
Inspect the PTC operation by confirmation logic as below.

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.

TEMPERATURE CONTROL ACTUATOR

COMPONENT LOCATION EAD6227D

This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF315A

DESCRIPTION E47CBA0E

1. Heater unit includes mode control actuator and temperature control actuator.

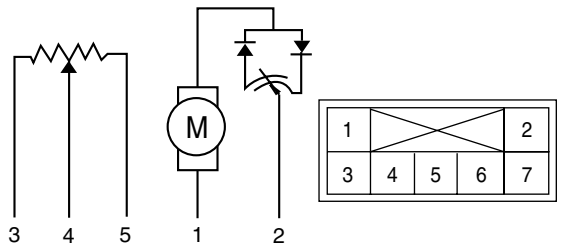
2. Temperature control actuator is located at the heater unit. It regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temperature door by operating temperature switch and then temperature will be regulated by the hot/cold air ratio decided by position of temperature door.

INSPECTION E5AFEB16

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 1 and grounding terminal 2.
   Verify that the temperature control actuator operates to the cool position when connecting in the reverse.



1. Hot position
2. Cool position
3. Sensor ground
4. Feedback signal
5. 5V (Vcc)
6. -
7. -

LQJF315B

4. Check the voltage between terminals 3 and 4.

SPECIFICATION

Door position	Voltage (3-4)	Error detecting
Max. cooling	0.3 ± 0.15V	Low voltage : 0.1V or less
Max. heating	4.7 ± 0.15V	High voltage : 4.9V or more

It will feedback current position of actuator to controls.

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.

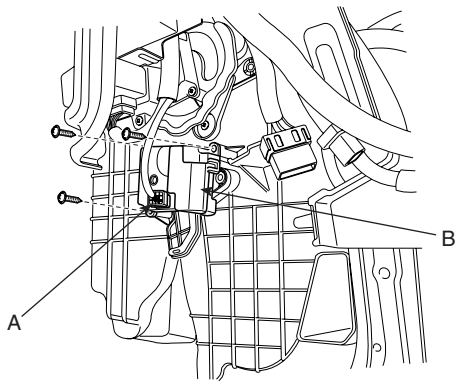
REPLACEMENT E12E87A7

1. Disconnect the negative (-) battery terminal.

2. Remove the driver's crash pad lower panel (Refer to BD group - Crash pad).

3. Disconnect the temperature control actuator connector (A) after removing the air duct.

4. Loosen the mounting screw and then remove the temperature control actuator (B).



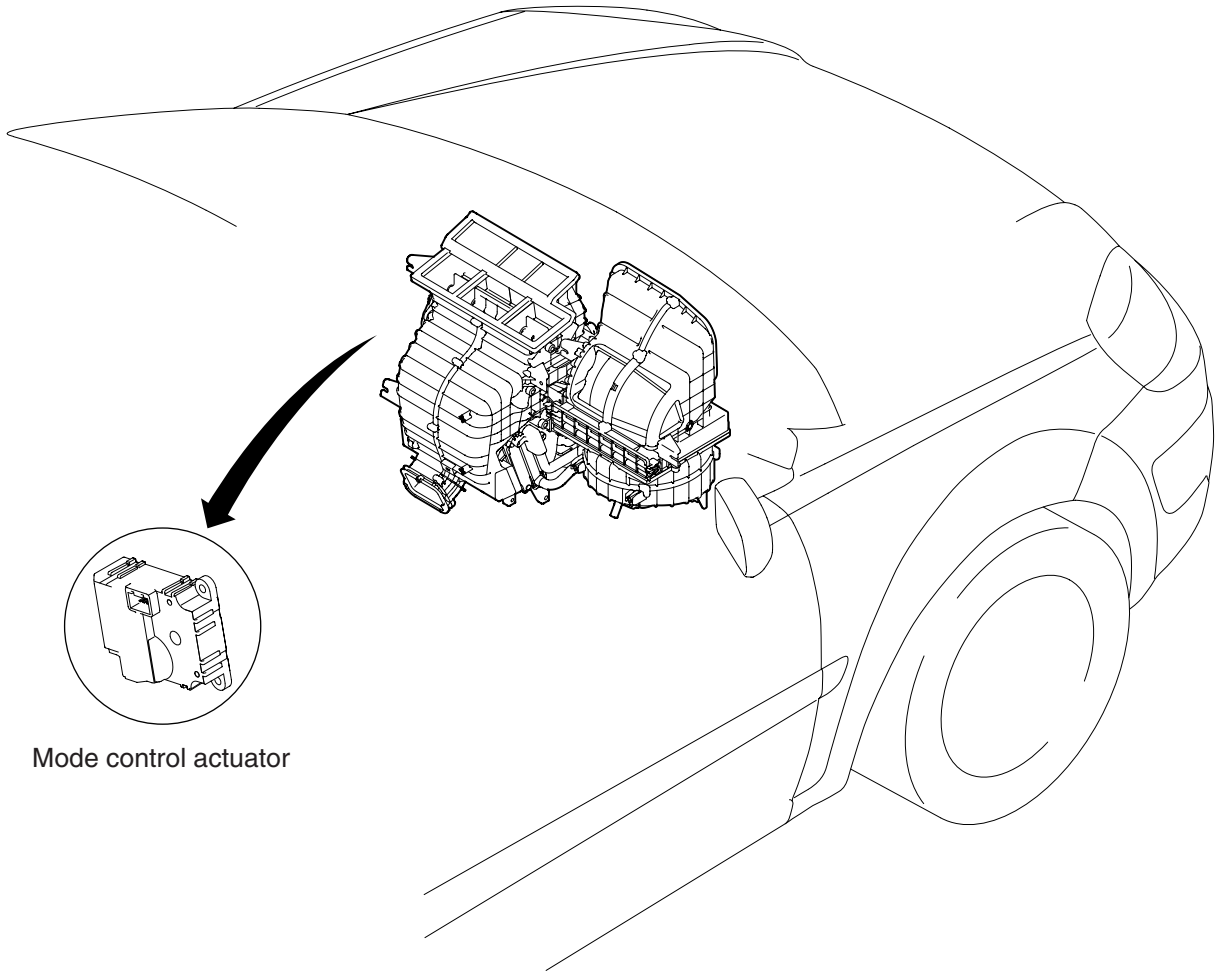
AQJF315C

5. Installation is the reverse order of removal.

MODE CONTROL ACTUATOR

COMPONENT LOCATION EA394AD4

This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF316A

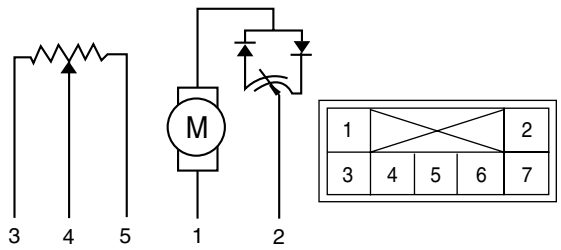
DESCRIPTION E9FC5DE0

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.

INSPECTION ED83BCFD

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 1 and grounding terminal 2. (RHD type : Vent mode)
4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse. (RHD type : Defrost mode)



1. Defrost mode
2. Vent mode
3. Sensor ground (RHD type :5V)
4. Feedback signal
5. 5V (Vcc) (RHD type : Sensor ground)
6. -
7. -

LQJF316B

5. Check the voltage between terminals 3 and 4. (RHD type : Terminal 4 and 5)

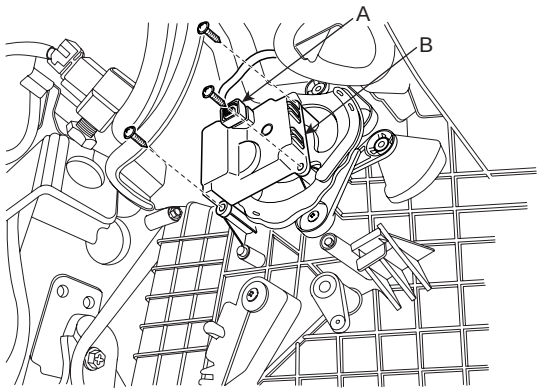
Door position	Voltage (3-4)	Error detecting
Vent	0.3 ± 0.15V	Low voltage : 0.1V or less
Defrost	4.7 ± 0.15V	High voltage : 4.9V or more

It will feedback current position of actuator to controls.

6. If the measured voltage is not specification, substitute with a known-good mode control actuator and check for proper operation.
7. If the problem is corrected, replace the mode control actuator.

REPLACEMENT E1B8CDC1

1. Disconnect the negative (-) battery terminal.
2. Remove the driver's crash pad lower panel. (Refer to BD group - Crash pad).
3. Disconnect the mode control actuator connector (A) after removing the air duct.
4. Loosen the mounting screws and then remove the mode control actuator (B).



AQJF316C

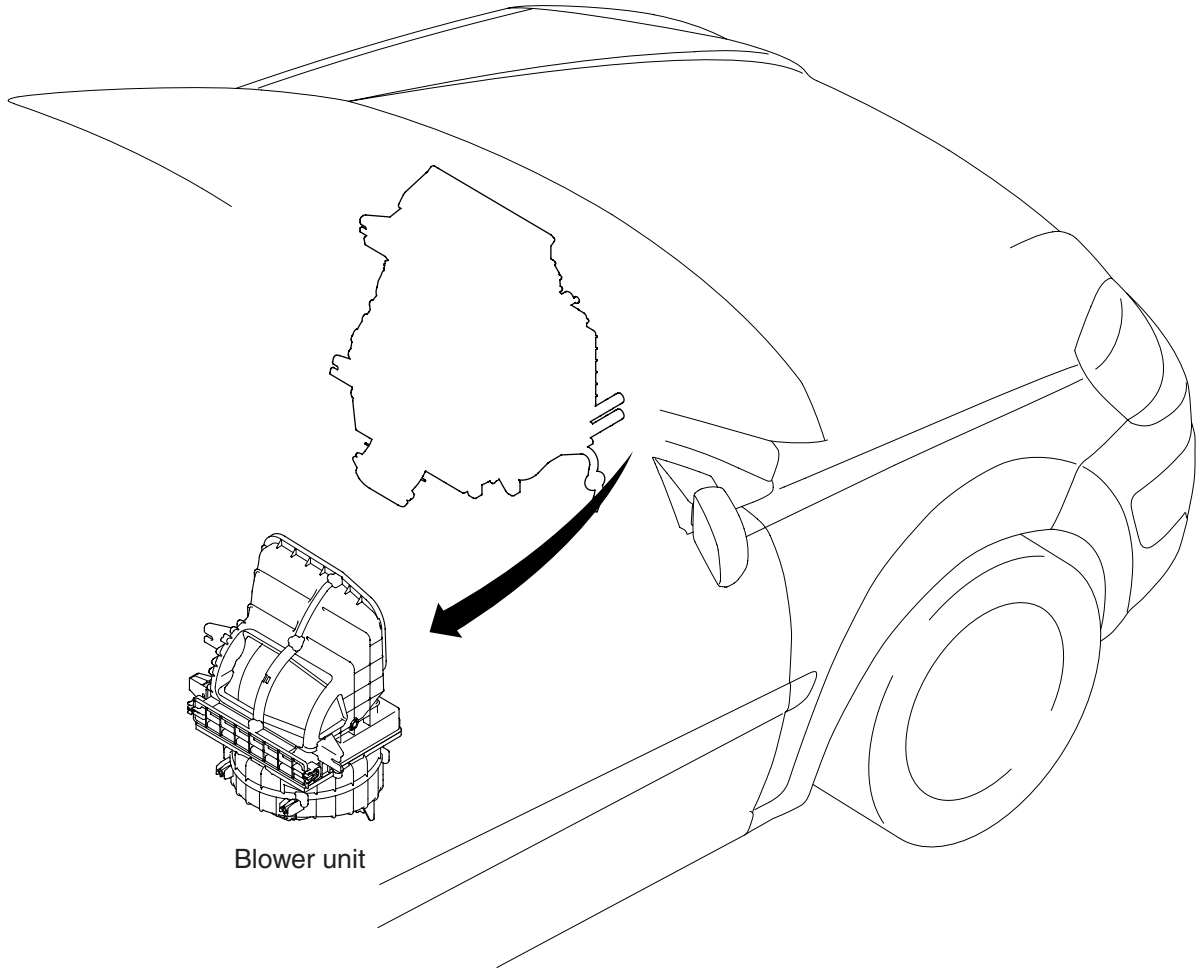
5. Installation is the reverse order of removal.

BLOWER CONTROLS

BLOWER UNIT

COMPONENT LOCATION EF2DD3FD

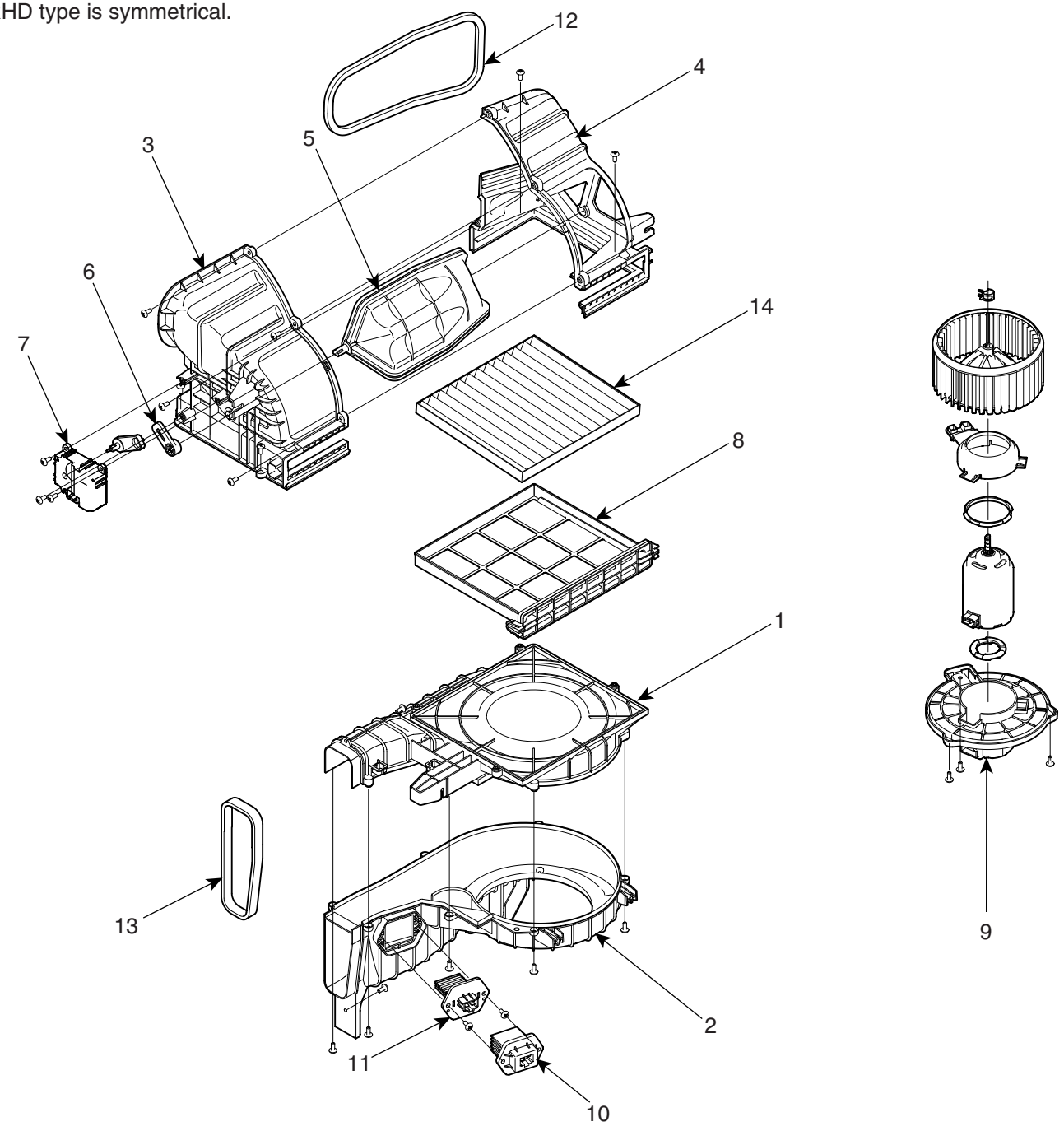
This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF350A

COMPONENTS EB0BF4AD

This illustration is shown the LHD type.
RHD type is symmetrical.

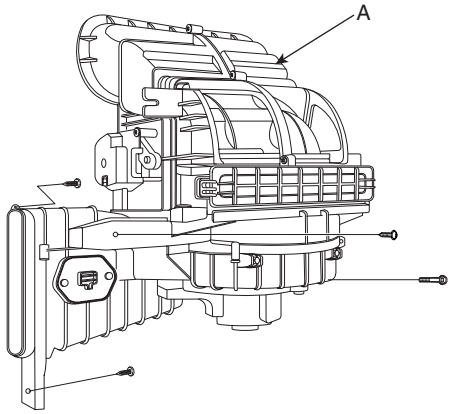


1. Upper case
2. Lower case
3. Intake case (L)
4. Intake case (R)
5. Intake door assembly
6. Intake door lever
7. Intake actuator
8. Filter cover
9. Blower motor assembly
10. Power mosfet
11. Blower resistor
12. Cowl seal
13. Heater mounting lining
14. Filter

LQJF350B

REPLACEMENT EAB36A87

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad.(Refer to BD group - Crash pad)
3. Disconnect the connectors from the fresh and recirculation actuator, the blower motor and power mosfet.
4. Remove the cowl cross bar assembly.(Refer to BD group - Crash pad)
5. Remove the blower unit (A) from the heater unit after loosening a mounting bolt and 3 screws.



AQJF350C

NOTE

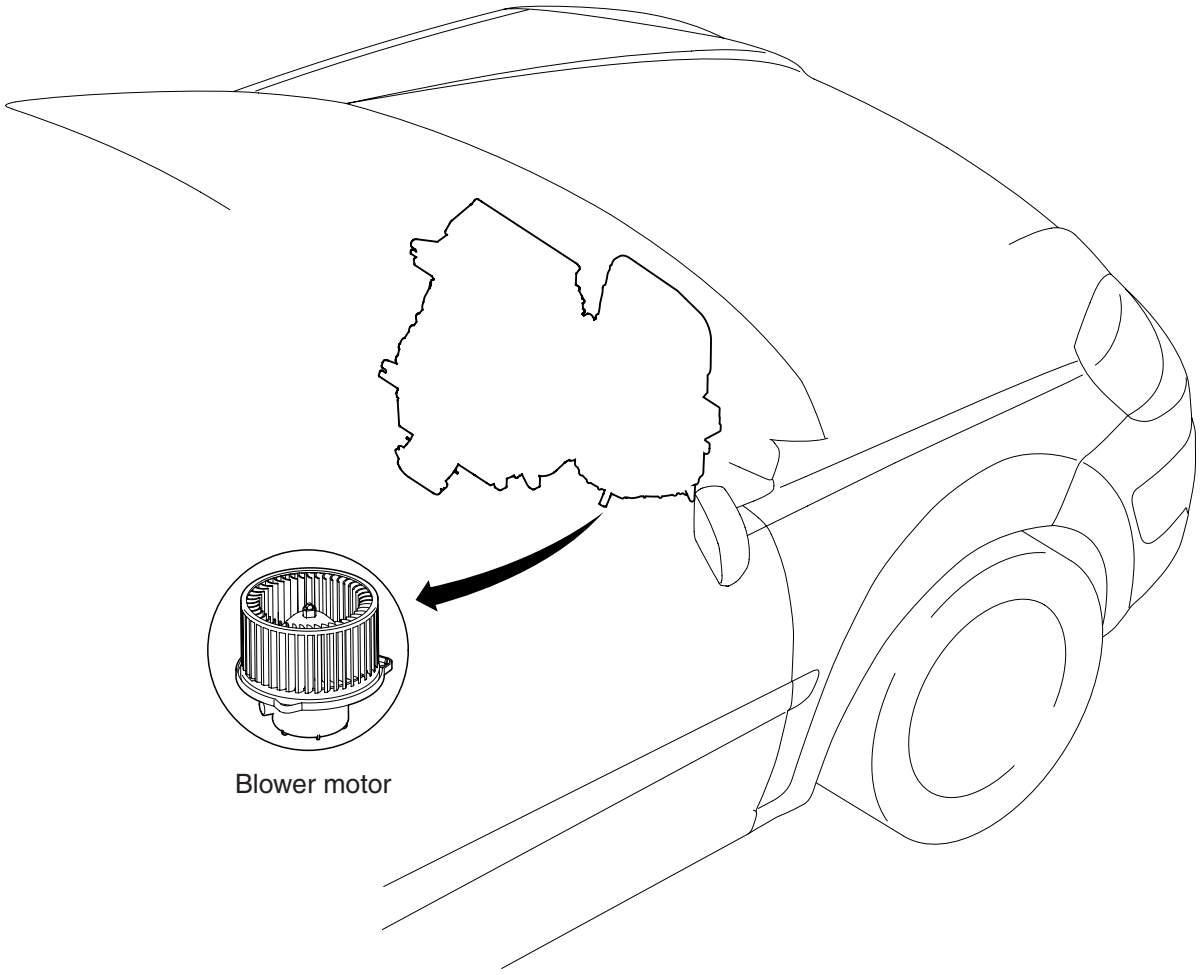
Make sure that there is no air leaking out of the blower and duct joints.

6. Installation is the reverse order of removal.

BLOWER MOTOR

COMPONENT LOCATION EFAAC8C9

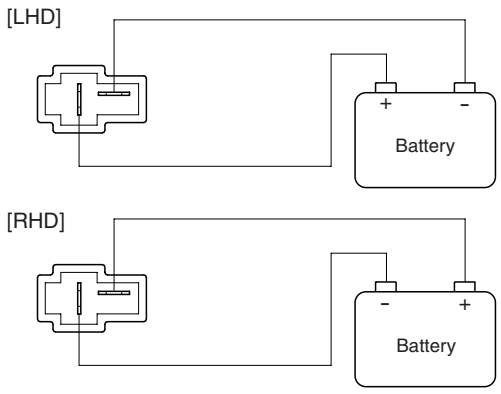
This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF352A

INSPECTION E30511AE

1. Connect the battery voltage and check the blower motor rotation.

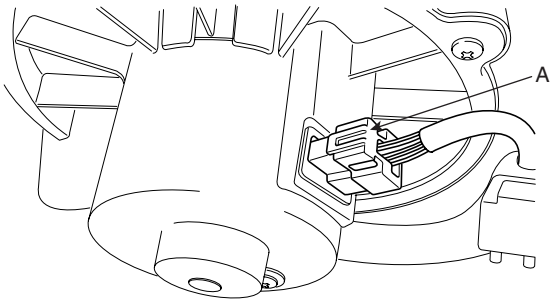


LQJF352C

2. If the blower motor voltage is not operated well, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

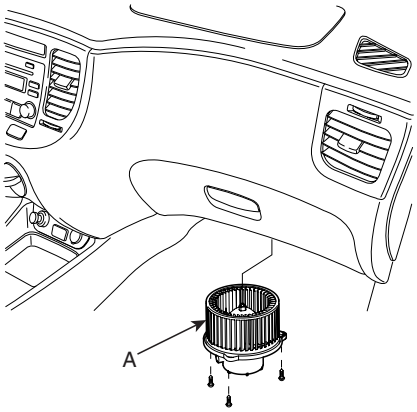
REPLACEMENT E751CD43

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector (A) of the blower motor.



AQJF352D

3. Remove the blower motor (A) after loosening the mounting screws.



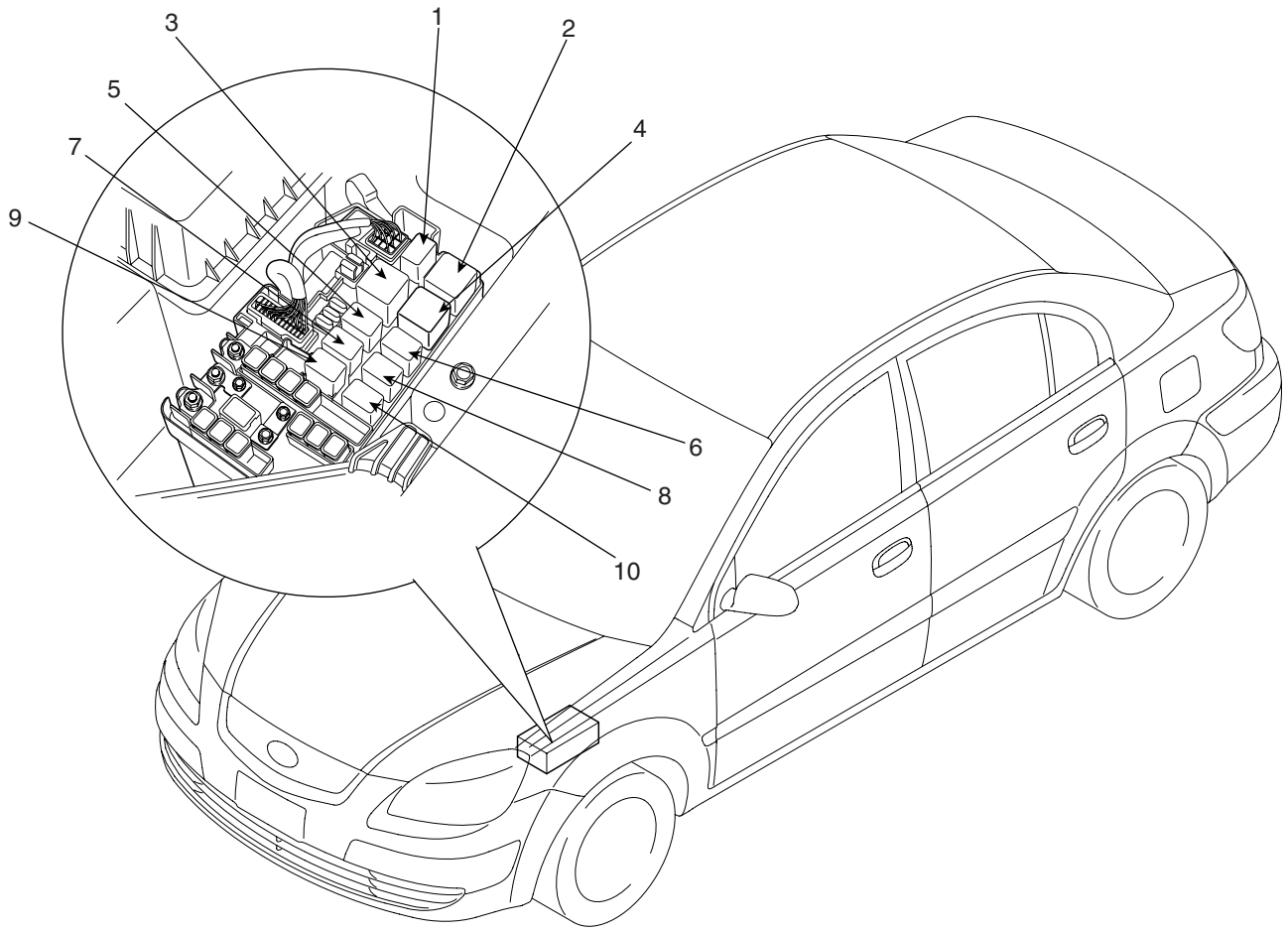
AQJF352B

4. Installation is the reverse order of removal.

BLOWER RELAY

COMPONENT LOCATION EC4191A8

[Engine room relay box(LHD) : LHD type is shown, RHD type is similar]



1. Horn relay
2. Fuel heater relay
3. Main relay
4. Blower relay
5. Fuel pump relay
6. Start relay
7. Radiator fan relay
8. Condenser fan relay 1
9. Condenser fan relay
10. A/C relay

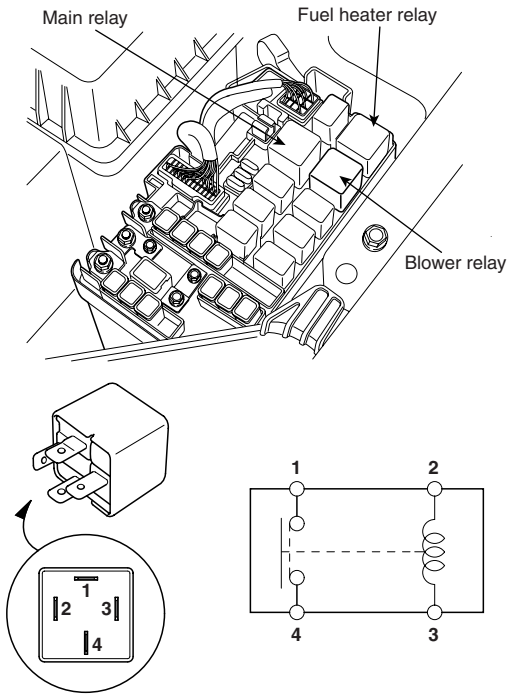
LQJF353A

INSPECTION E11DEB3E

Check for continuity between the terminals.

1. There should be continuity between No1 and No.4 terminals when power and ground are connected to No.2 and No.3 terminals.

2. There should be no continuity between No.1 and No.4 terminals when power is disconnected.



LTJF201C

Terminal / Position	2	3	1	4
Disconnected	○	○		
Connected	⊖	⊕	○	○

LQJF201D

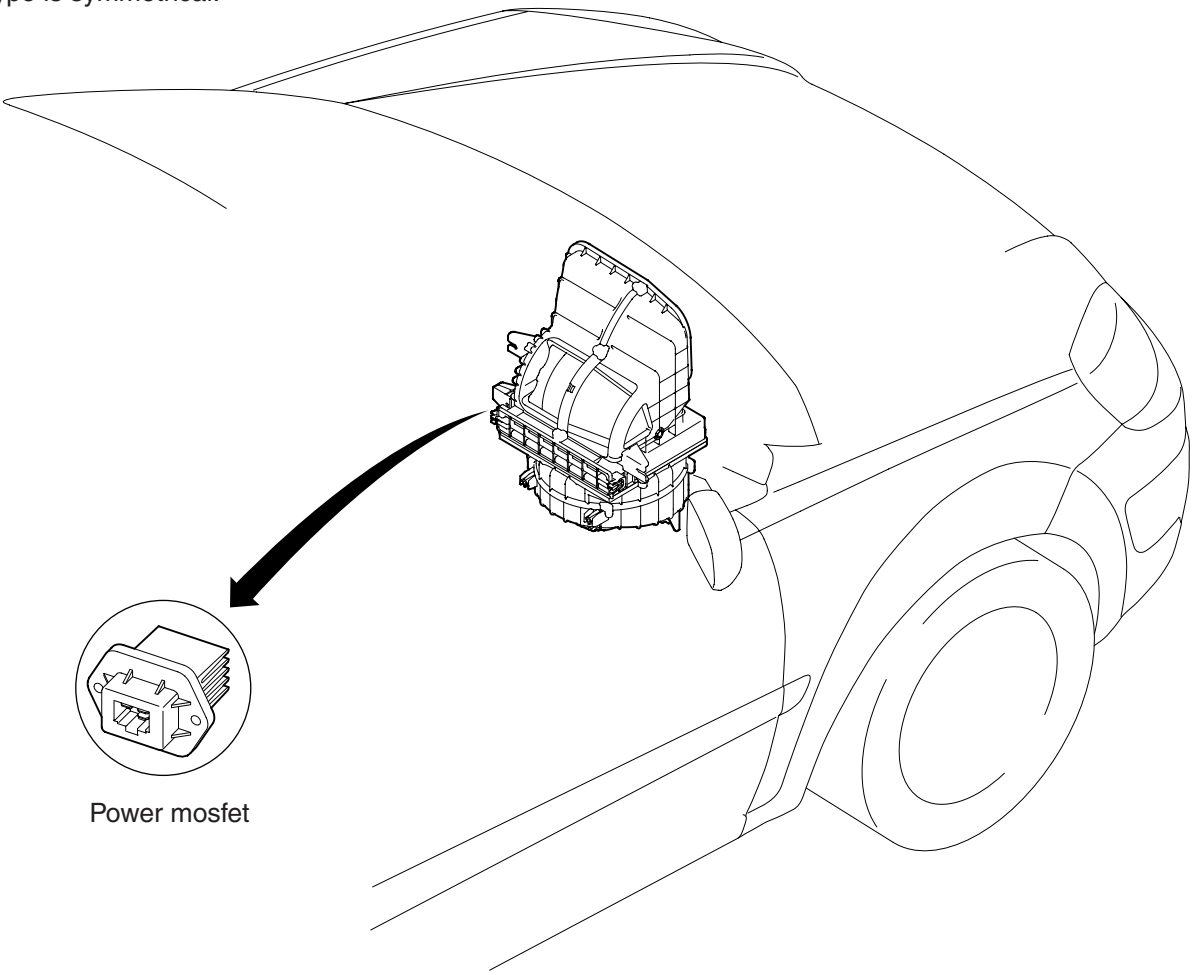
3. If the blower motor voltage is not operated well, substitute with a known-good blower relay and check for proper operation.

4. If the problem is corrected, replace the blower relay.

POWER MOSFET

COMPONENT LOCATION E2857855

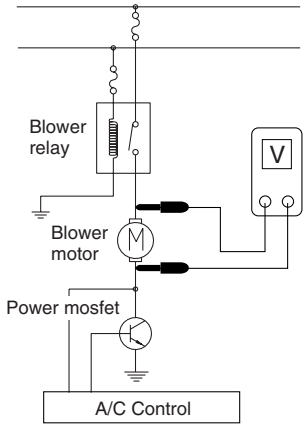
This illustration is shown the LHD type.
RHD type is symmetrical.



LQJF355A

INSPECTION EBC21310

1. Ignition "ON".
2. Manually operate the control switch and measure the voltage of blower motor between pin 1 and 2.
3. Select the control switch to raise voltage until high speed.



EQRF355C

SPECIFICATION

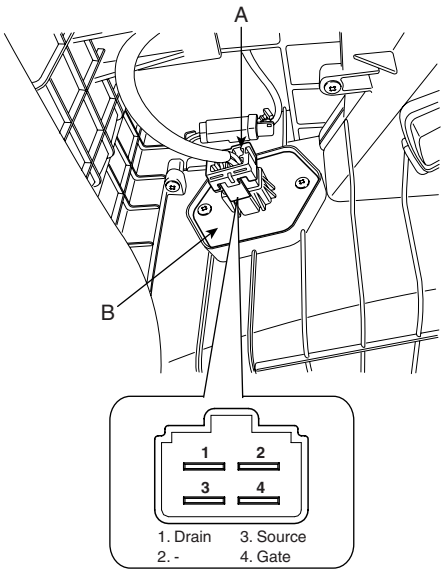
Fan	Motor Voltage
	Manual
First speed	3.8 ± 0.5V
Second speed	5.0 ± 0.5V
Third speed	6.2 ± 0.5V
Fourth speed	7.4 ± 0.5V
Fifth speed	8.6 ± 0.5V
Sixth speed	9.8 ± 0.5V
Seventh speed	11.0 ± 0.5V
eighth speed	Battery(+)

AUTO COOLING : Auto speed (4.5V~B+)
AUTO HEATING : Auto speed (4.5V~10.5V)

4. If the measured voltage is not specification, substitute with a known-good power mosfet and check for proper operation.
5. If the problem is corrected, replace the power mosfet.

REPLACEMENT ECC35B2A

1. Disconnect the negative (-) battery terminal.
2. Disconnect the power mosfet connector (A) at the connecting part between heater and blower unit.
3. Remove the power mosfet (B) after loosening the mounting screws.



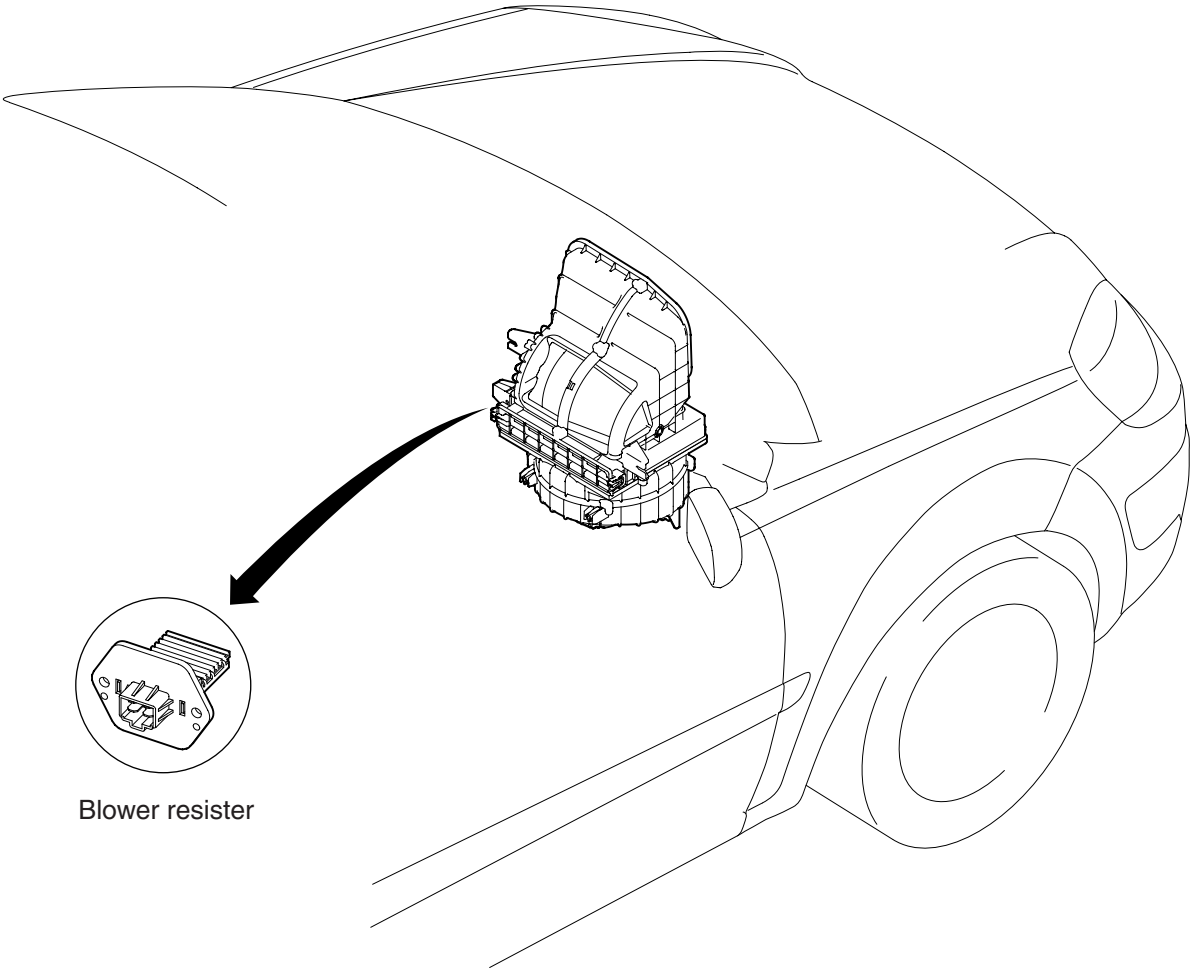
LQJF355C

4. Installation is the reverse order of removal.

BLOWER RESISTOR

COMPONENT LOCATION E9227EFE

This illustration is shown the LHD type.
RHD type is symmetrical.



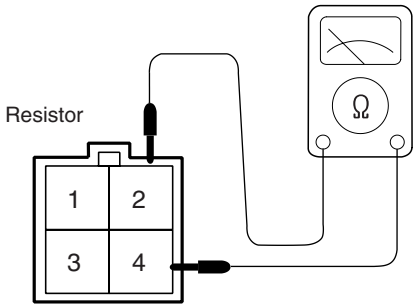
LQJF357A

INSPECTION EC4C0B26

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)

Terminal / Speed / Resistance ohmmeter	2	1	4	3	Resistance (Ω)
	MH	ML	HI	LO	
Measurement of resistance between each terminal			○—○		2.30 ± 5%
		○—○	○		1.0 ± 5%
	○	—	○		0.35 ± 5%

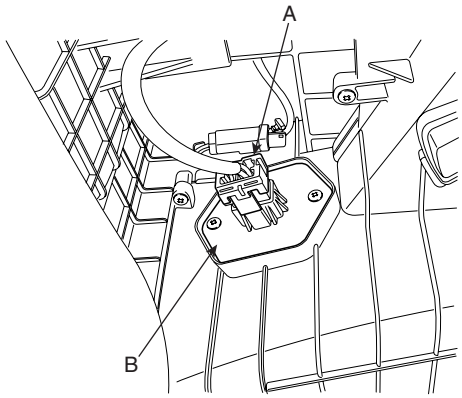
LQJF357B



LQJF357C

REPLACEMENT ECAFD569

1. Disconnect the negative (-) battery terminal.
2. Disconnect the blower resistor connector (A) at the connecting part blower unit.
3. Remove the blower resistor after loosening the mounting screws.



AQJF357C

4. Installation is the reverse order of removal.

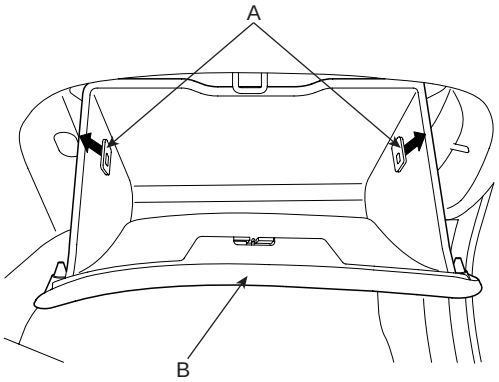
A/C AIR FILTER

DESCRIPTION EAF01F54

This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure comfortable interior environment.

REPLACEMENT EDACBFDA

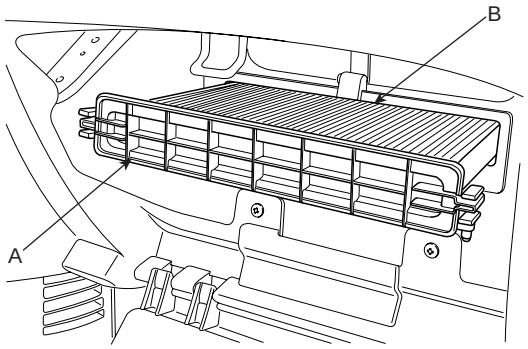
1. Open the glove box (B). Lower the glove box down completely by removing the glove box stopper (A) to the glove box.



AQJF359A

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.



AQJF359B

NOTE

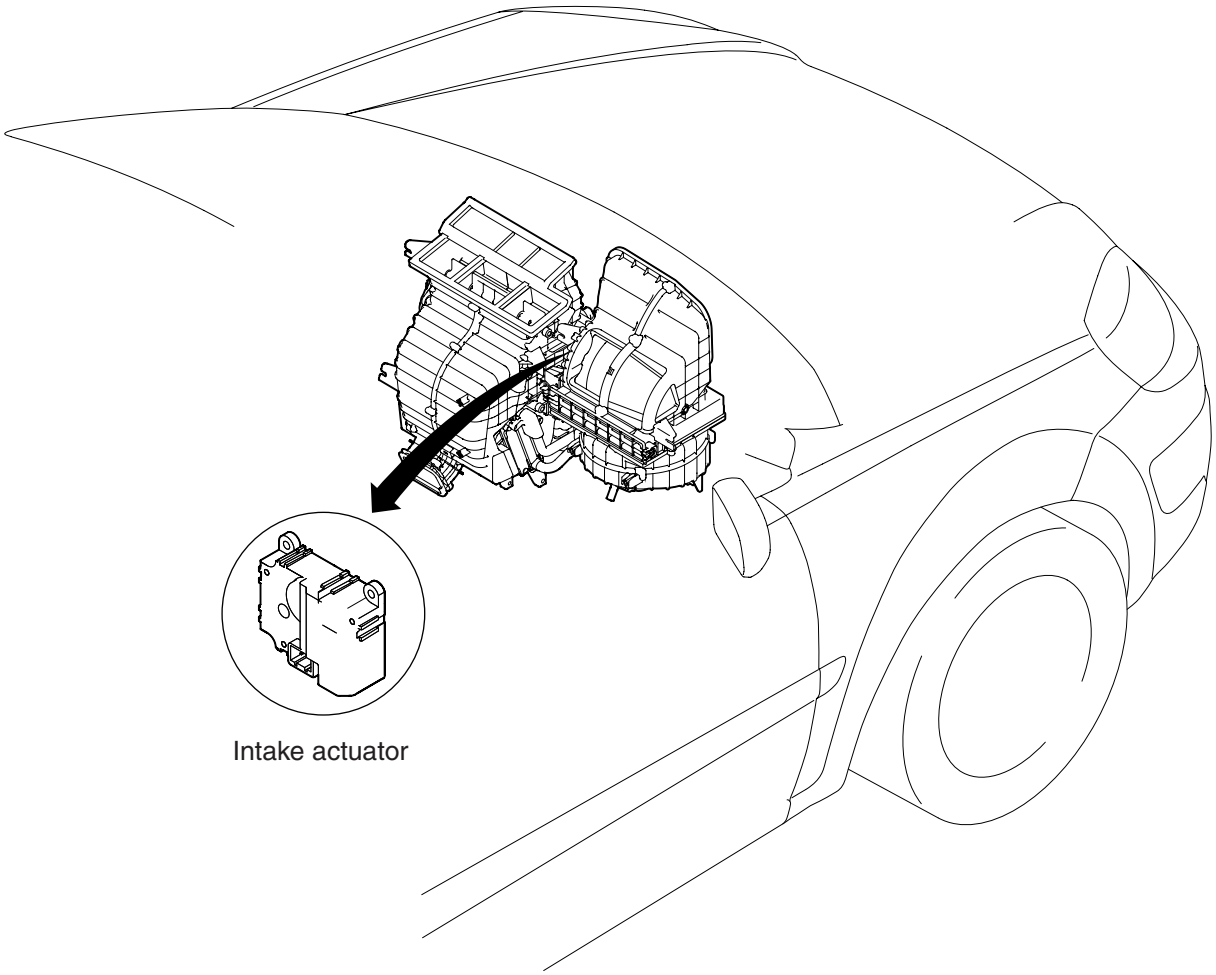
In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

Replacement period : 15,000 km (9320 mile)

INTAKE ACTUATOR

COMPONENT LOCATION ECC1384A

This illustration is shown the LHD type.
RHD type is symmetrical.



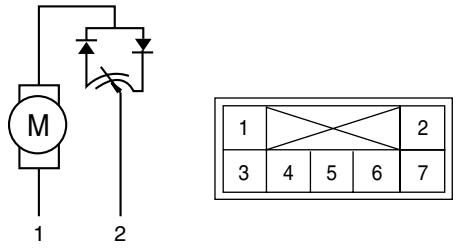
LQJF359C

DESCRIPTION EB890F0D

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.

INSPECTION E70DE75A

1. Ignition "OFF".
2. Disconnect the intake actuator connector.
3. Verify that the intake actuator operates to the recirculation position when connecting 12V to the terminal 1 and grounding terminal 2. (RHD type : Fresh position)
4. Verify that the intake actuator operates to the fresh position when connecting in the reverse. (RHD type : Recirculation position

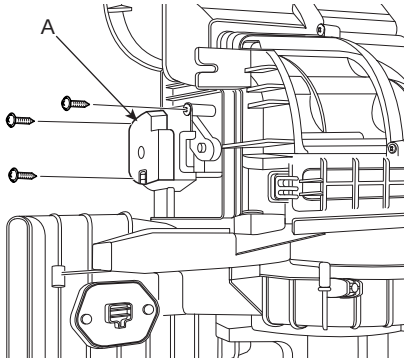


AQJF351B

5. If the intake actuator is not operated well, substitute with a known-good intake actuator and check for proper operation.
6. If the problem is corrected, replace the intake actuator.

REPLACEMENT E78285C4

1. Disconnect the negative (-) battery terminal.
2. Remove the glove box (Refer to BD group - Crash pad).
3. Disconnect the intake actuator connector.
4. Loosen the mounting screw and then remove the intake actuator (A) from the blower unit.



AQJF351C

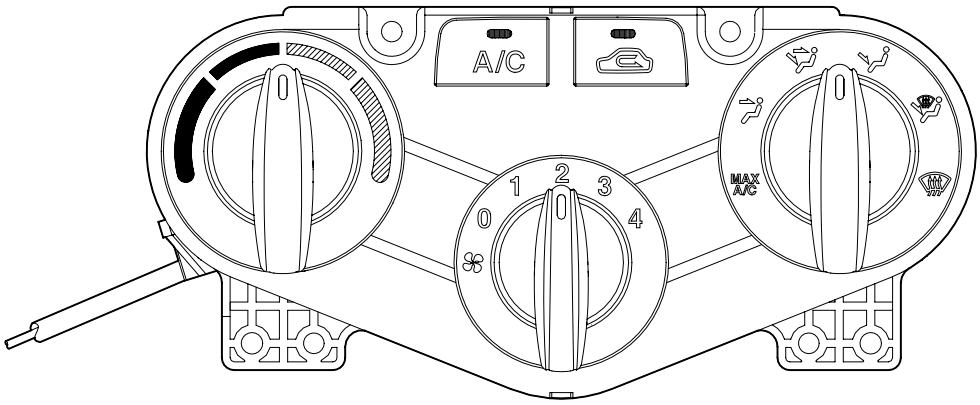
5. Installation is the reverse order of removal.

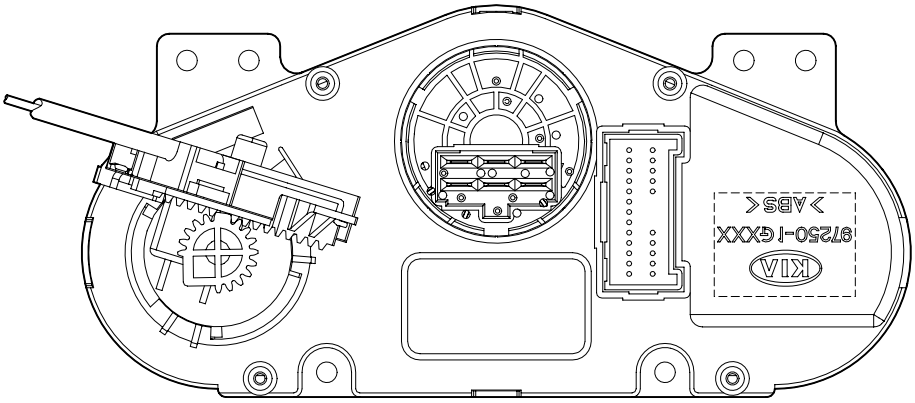
BLOWER AND A/C CONTROLS (MANUAL)

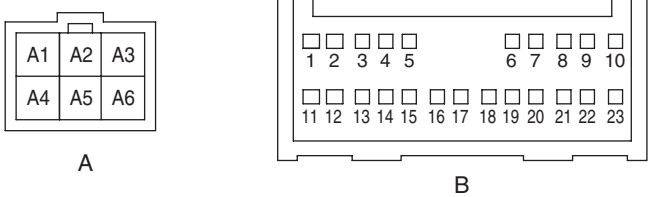
CONTROL PANEL

COMPONENT E42EA4EF

This illustration is shown the LHD type.
RHD type is similar.







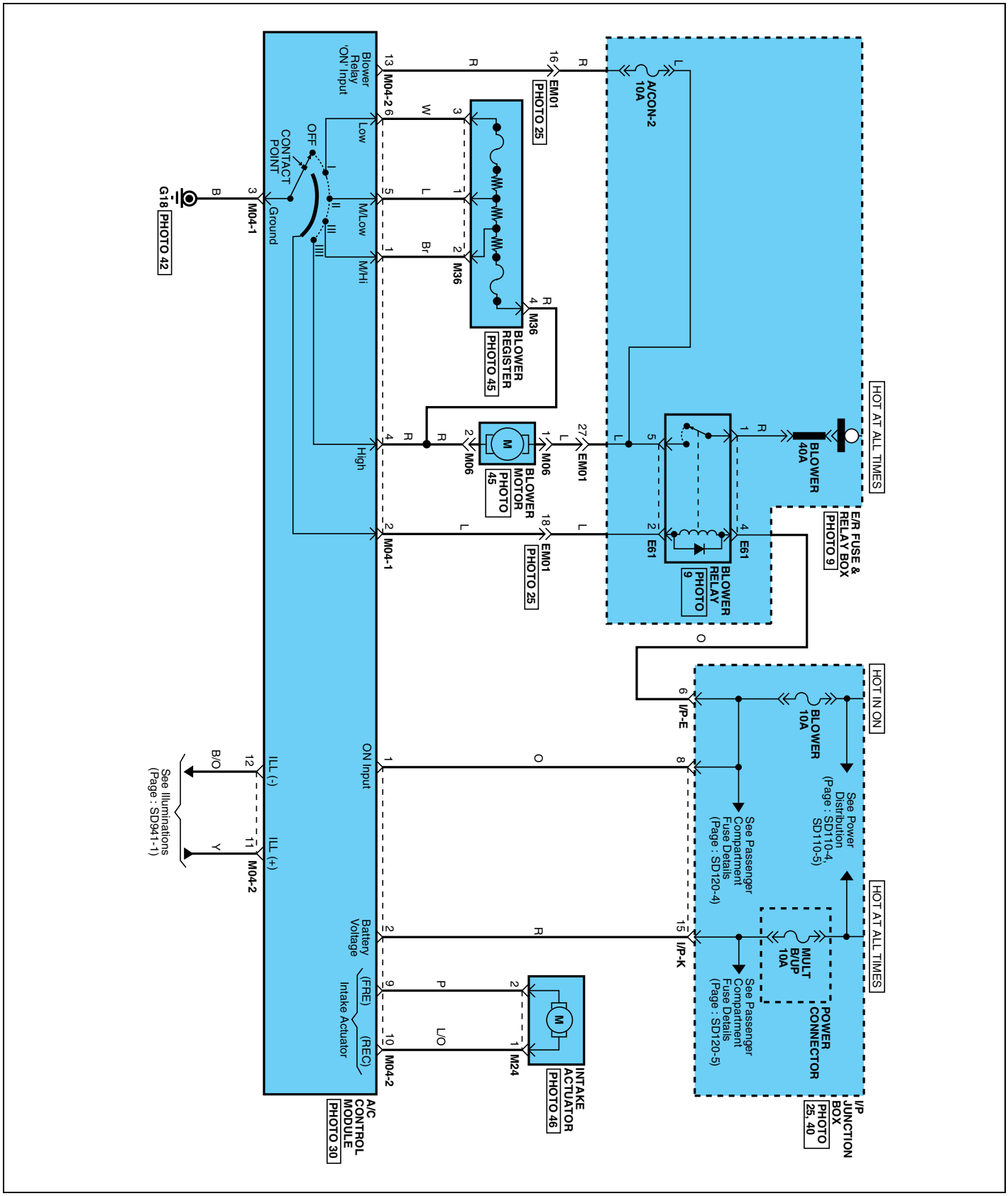
A B

LQJF450A

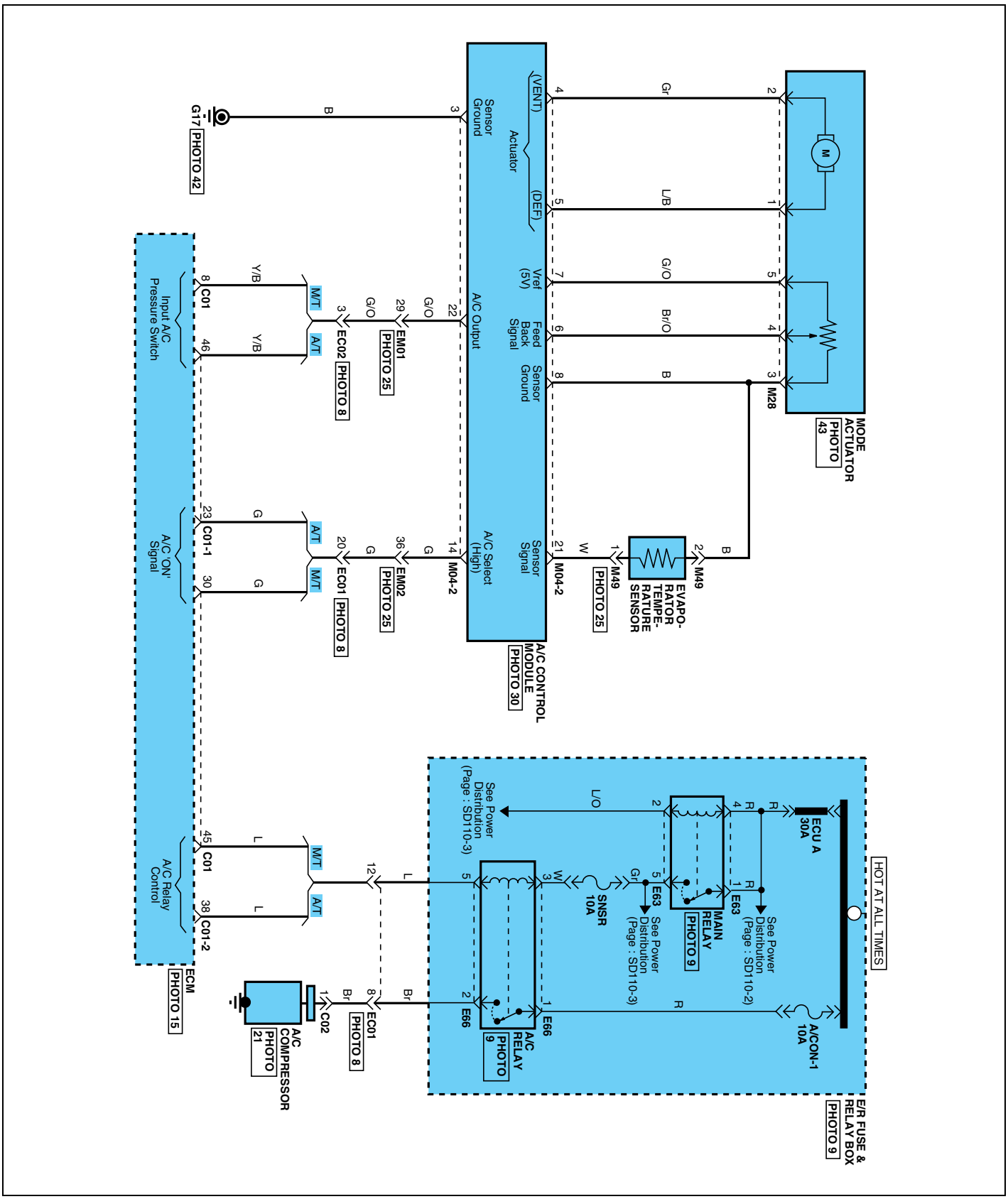
CONNECTOR PIN FUNCTION

CON-NEC-TOR	PIN	FUNCTION
Connec-tor (A)	1	Middle high
	2	Blower common out
	3	Ground
	4	High
	5	Middle low
	6	Low
Connec-tor (B)	1	IGN
	2	Battery (+)
	3	Ground
	4	Vent mode
	5	Defrost mode
	6	Mode feedback signal
	7	VCC
	8	Sensor ground
	9	Intake actuator (Fresh)
	10	Intake actuator (Recirculation)
	11	Tail lamp (+)
	12	Rheostat (-)
	13	Blower (+)
	14	A/C select
	15	PTC ON signal
	16	PTC relay 2
	17	PTC relay 3
	18	-
	19	-
	20	Blower select signal
	21	Evaporator sensor
	22	A/C output
	23	-

SCHEMATIC DIAGRAM EECD83FD



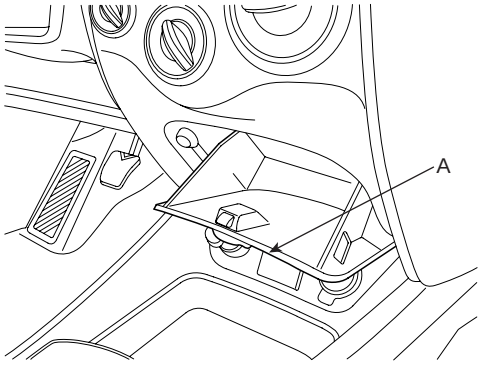
LQJF451C


MODE ACTUATOR PHOTO 43
M28
M
(VENT)
(DEF)
Actuator
Gr
L/B
G/O
Br/O
B
A/C CONTROL MODULE PHOTO 30
Sensor Ground
Vref (5V)
Feed Back Signal
Sensor Ground
A/C Output
A/C Select (High)
Sensor Signal
M04-2
EVAPORATOR TEMPERATURE SENSOR
M49
PHOTO 25
G17 PHOTO 42
EC02 PHOTO 8
EM01 PHOTO 25
EC01 PHOTO 8
EM02 PHOTO 25
M/T
A/T
Y/B
G/O
G
W
ECM PHOTO 15
C01
C01-1
C01-2
Input A/C Pressure Switch
A/C 'ON' Signal
A/C Relay Control
L
A/C COMPRESSOR PHOTO 21
C02
EC01 PHOTO 8
Br
E/R FUSE & RELAY BOX PHOTO 9
HOT AT ALL TIMES
ECU A 30A
A/CON-1 10A
MAIN RELAY PHOTO 9
E63
SNSR 10A
A/C RELAY PHOTO 9
E66
R
L/O
See Power Distribution (Page : SD110-2)
See Power Distribution (Page : SD110-3)
See Power Distribution (Page : SD110-3)

LQJF451D

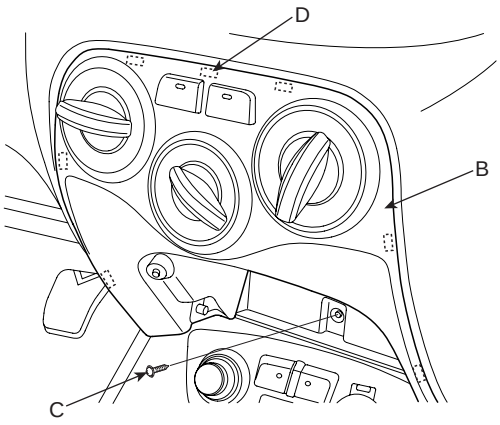
REPLACEMENT E9D5A4DC

1. Disconnect the negative (-) battery terminal.
2. Remove the ashtray (A).



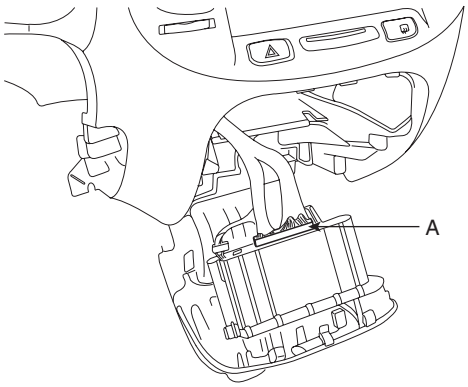
AQJF450C

3. Remove the center facia lower panel (B) by pulling it using a screw driver (-) after loosening a screw (A).Take care of fixing clips (D).



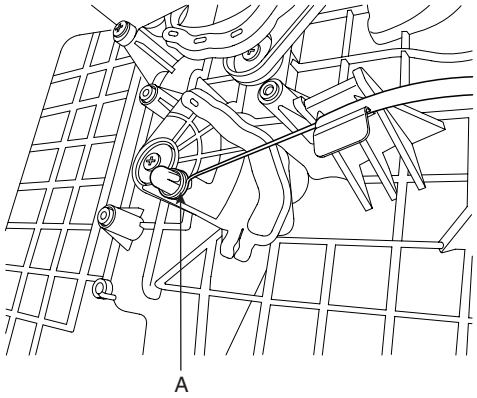
AQJF450D

4. Disconnect the connectors (A) from the center facia.



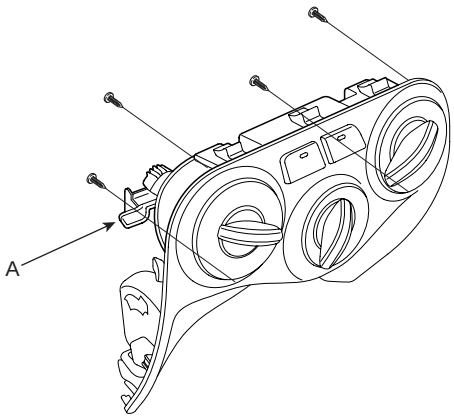
AQJF450H

5. Remove the heater & A/C controller temperature control cable (A).



AQJF450E

6. Remove the heater & A/C controller (A) after loosening 4 screws.



AQJF450F

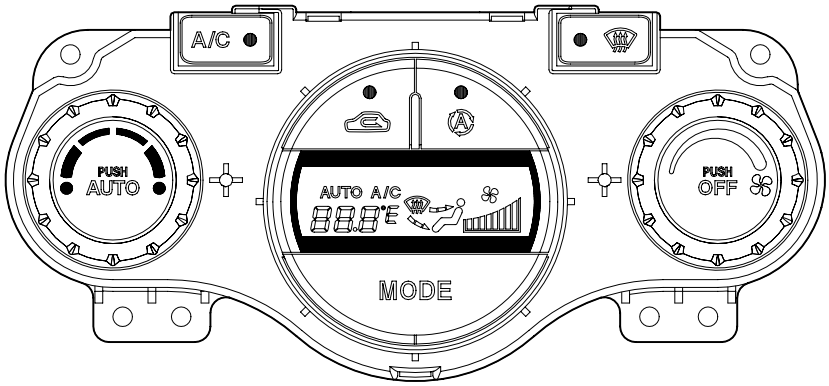
7. Installation is the reverse order of removal.

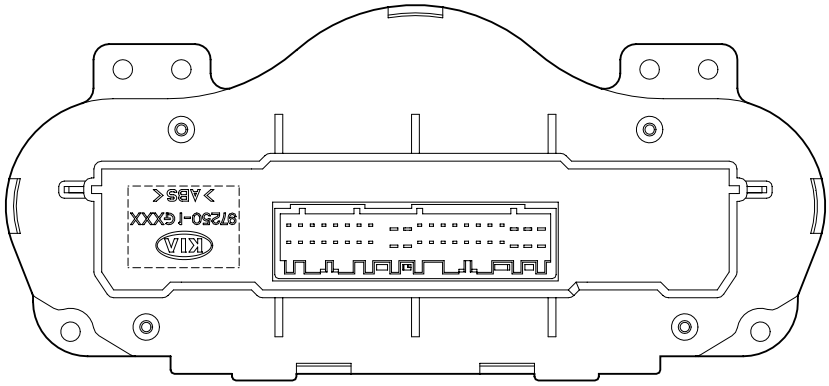
BLOWER AND A/C CONTROLS (AUTOMATIC)

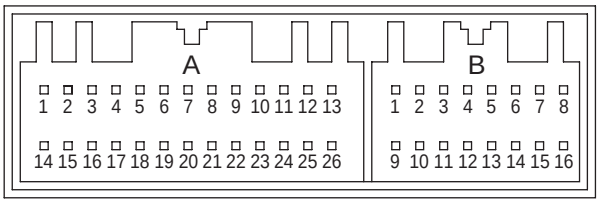
CONTROL PANEL

COMPONENT EEACEF28

This illustration is shown the LHD type.
RHD type is similar.







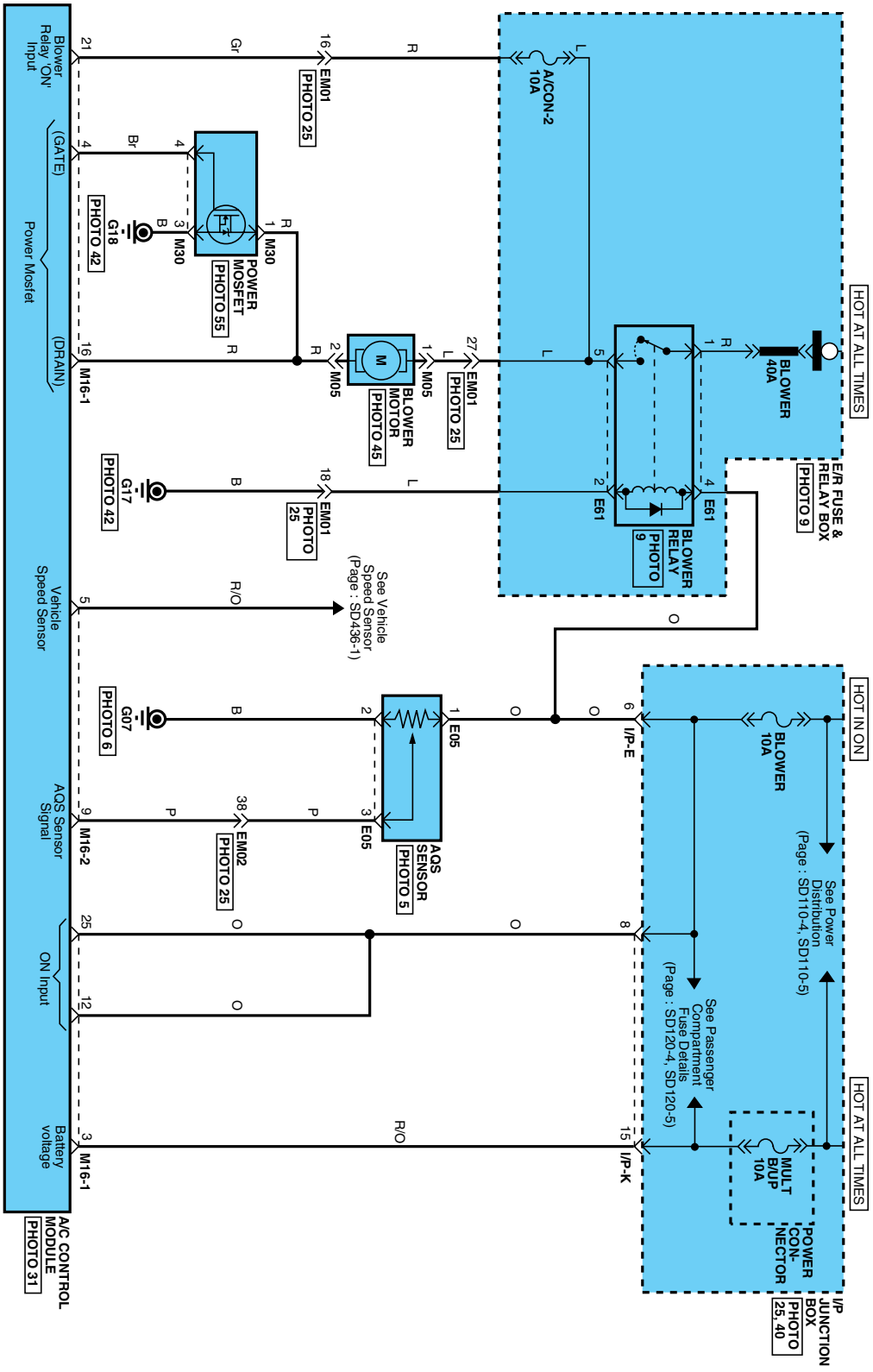
✱ ˚C⟷˚F : If you press the OFF button during 3 sec with pressing AUTO switch, ˚C is displayed ˚F with converting.

LQJF500A

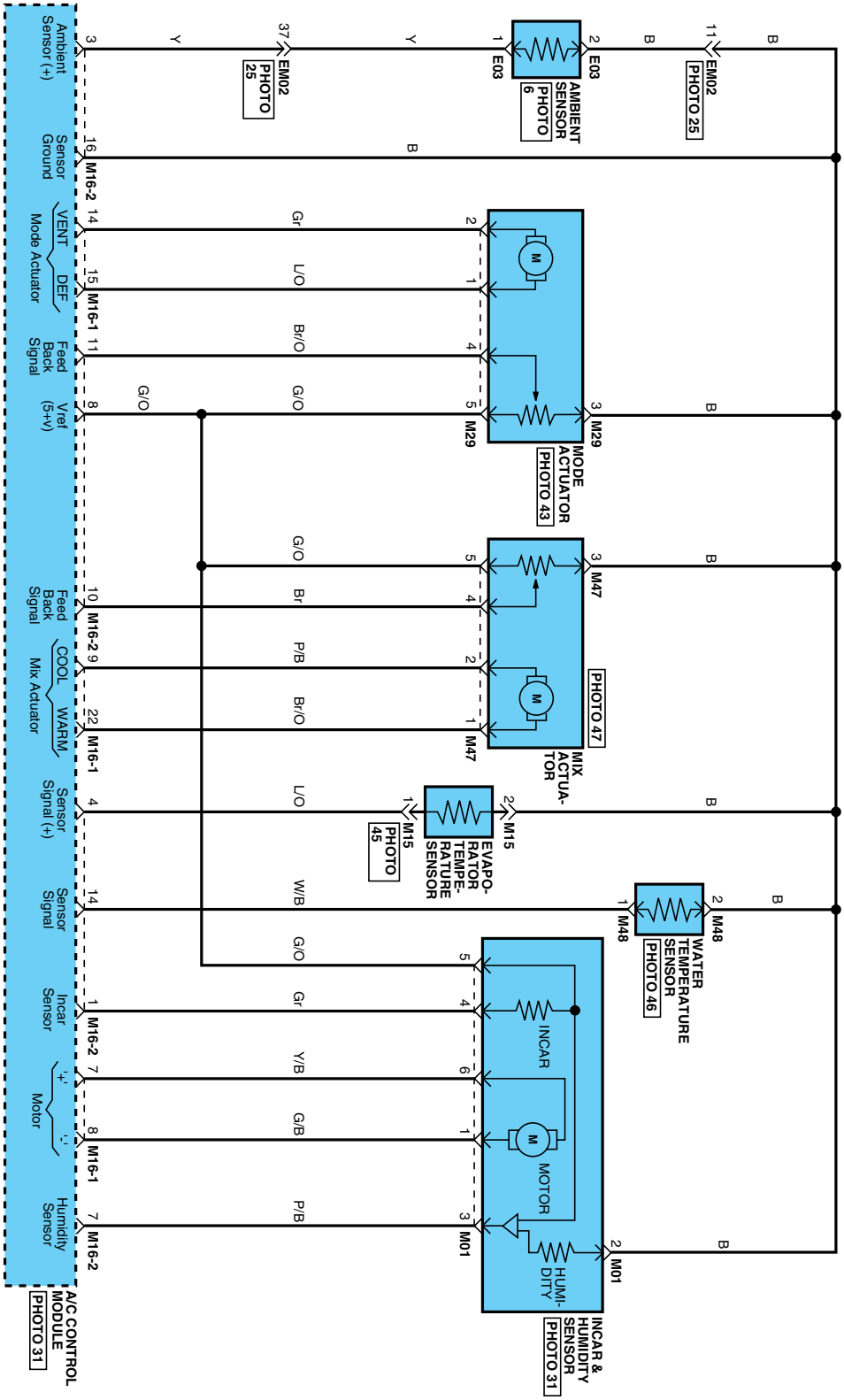
CONNECTOR PIN FUNCTION

CONNECTOR	PIN	FUNCTION	CONNECTOR	PIN	FUNCTION
CONNECTOR (A)	1	Rheostat	CONNECTOR (B)	1	In car sensor (+)
	2	Tail lamp (+)		2	A/C select signal
	3	Battery (+)		3	Ambient sensor (+)
	4	Power mosfet (Gate)		4	Evaporator temperature sensor (+)
	5	Power mosfet (Drain)		5	Speed sensor
	6	PTC on signal		6	-
	7	In car sensor motor (+)		7	Humidity sensor (+)
	8	In car sensor motor (-)		8	Sensor voltage (5V)
	9	Temp actuator (cool)		9	-
	10	Intake actuator (recirculation)		10	Temp actuator feedback signal
	11	-		11	Mode actuator feedback signal
	12	IGN 2		12	Photo sensor (+)
	13	Ground		13	Photo sensor ground
	14	Mode actuator (Vent)		14	Water temperature output
	15	Mode actuator (Defrost)		15	-
	16	Power mosfet (Drain)		16	Sensor ground
	17	A/C output			
	18	-			
	19	PTC relay 2			
	20	PTC relay 3			
	21	Blower (+)			
	22	Temp actuator (Warm)			
	23	Intake actuator (Fresh)			
	24	Blower select signal			
	25	IGN 2			
	26	Ground			

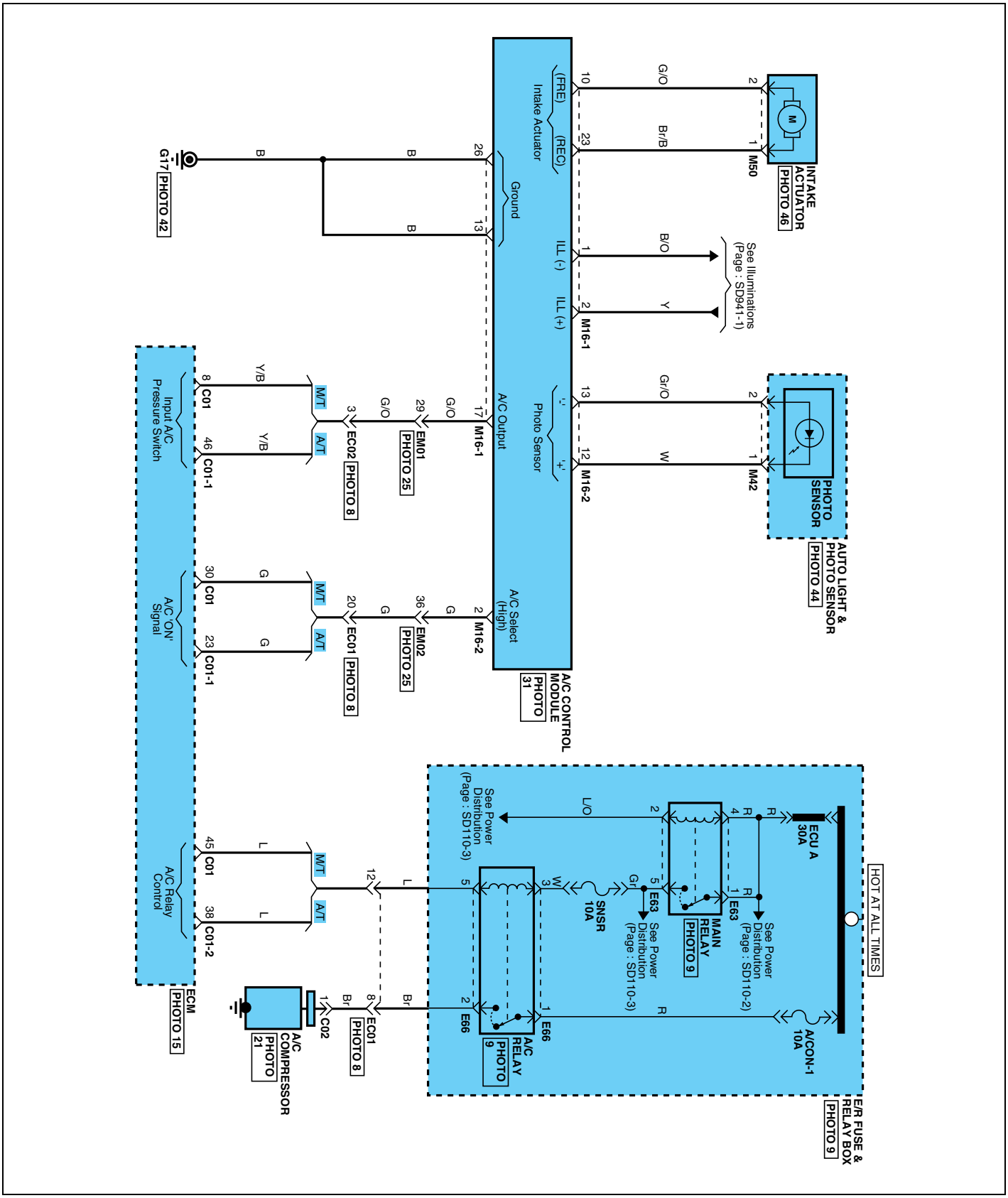
SCHEMATIC DIAGRAM E3626A0D



LQJF500B


A/C CONTROL MODULE
PHOTO 31
Ambient Sensor (+)
Sensor Ground
VENT
DEF
Mode Actuator
Feed Back Signal
Vref (5+V)
Feed Back Signal
COOL
WARM
Mix Actuator
Sensor Signal (+)
Sensor Signal
Incar Sensor
'+'
'-'
Motor
Humidity Sensor
M16-2
M16-1
EM02
PHOTO 25
E03
AMBIENT SENSOR
PHOTO 6
MODE ACTUATOR
PHOTO 43
M29
M47
MIX ACTUA-TOR
PHOTO 47
M15
PHOTO 45
EVAPO-RATOR TEMPE-RATURE SENSOR
M48
WATER TEMPERATURE SENSOR
PHOTO 46
INCAR
MOTOR
HUMI-DITY
M01
INCAR & HUMIDITY SENSOR
PHOTO 31
B
Y
Gr
L/O
Br/O
G/O
Br
P/B
W/B
Y/B
G/B

LQJF500C

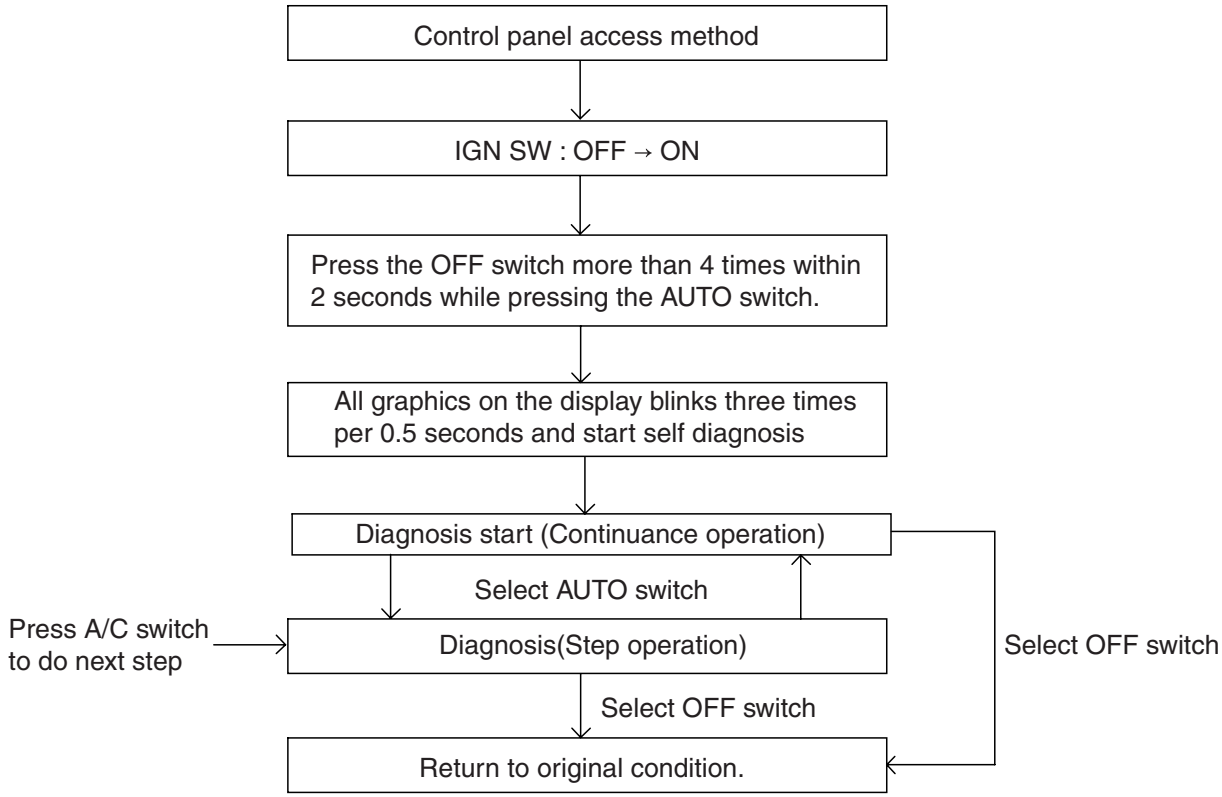

INTAKE ACTUATOR
PHOTO 46
M50
G/O
Br/B
(FRE)
(REC)
Intake Actuator
Ground
ILL (-)
ILL (+)
M16-1
See Illuminations (Page : SD941-1)
B/O
Y
G17
PHOTO 42
B
PHOTO SENSOR
M42
Gr/O
W
Photo Sensor
M16-2
AUTO LIGHT & PHOTO SENSOR
PHOTO 44
A/C Output
A/C Select (High)
A/C CONTROL MODULE
PHOTO 31
Input A/C Pressure Switch
A/C 'ON' Signal
A/C Relay Control
C01
C01-1
C01-2
M/T
A/T
Y/B
G/O
G
L
EC02
EC01
PHOTO 8
EM01
EM02
PHOTO 25
ECM
PHOTO 15
HOT AT ALL TIMES
ECU A 30A
See Power Distribution (Page : SD110-3)
See Power Distribution (Page : SD110-2)
L/O
R
Gr
W
SNSR 10A
MAIN RELAY
PHOTO 9
E63
A/C RELAY
E66
A/CON-1 10A
E/R FUSE & RELAY BOX
PHOTO 9
Br
EC01
PHOTO 8
C02
A/C COMPRESSOR
PHOTO 21

LQJF500D

SELF-DIAGNOSIS E5073145

The F.A.T.C. module self test feature will detect electrical malfunction and provide error codes for system components with suspected failures.

1. Self-diagnosis process



LQJF500E

NOTE

DTC data can be retrieved from the control panel directly.

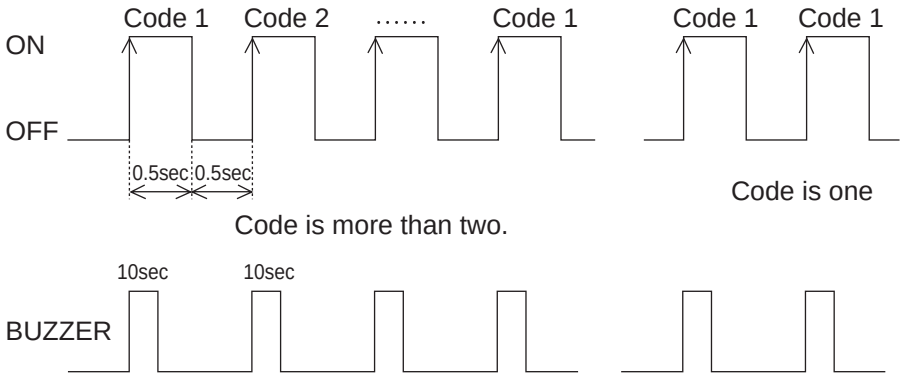
2. How to read self-diagnostic code
   After the display panel flickers three times every 0.5 second, the corresponding fault code flickers on the setup temperature display panel every 0.5 second and will show two figures. Codes are displayed in numerical format.

FAULT CODE

Fault code Control unit	Fail description
00	Normal
11	In-car temperature sensor open (High)
12	In-car temperature sensor short (Low)
13	Ambient temperature sensor open (High)
14	Ambient temperature sensor short (Low)
15	Water temperature sensor open (High)
16	Water temperature sensor short (Low)
17	Evaporator temperature sensor open (High)
18	Evaporator temperature sensor short (Low)
19	Air mix potentiometer open (Low) - Driver
19	Air mix potentiometer short (High) - Driver
20	Air mix motor (Driver)
21	Direction potentiometer open (Low) - Driver
21	Direction potentiometer short (High) - Driver
22	Direction control motor (Driver)
23	Humidity sensor open (High)
24	Humidity sensor short (Low)

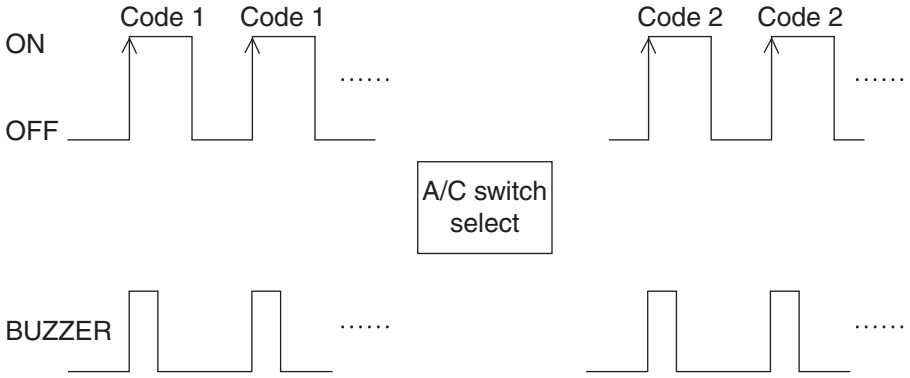
3. Fault code display

1) Continuance operation



LQIF356A

2) Step operation



LQIF356B

4. If fault codes are displayed during the check, Inspect malfunction causes by referring to fault codes.

5. Fail safe

1) In-car temperature sensor: Control with the value of 23°C (73.4°F)

2) Ambient temperature sensor: Control with the value of 20°C (67°F)

3) Evaporator temperature sensor: Control with the value of -2°C (28.4°F)

4) Humidity sensor: Doesn't control.

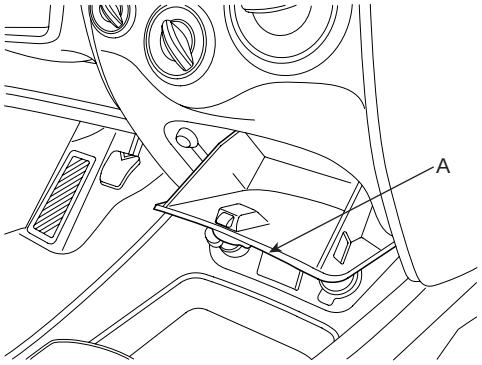
5) Photo sensor: None correction

6) Temperature control actuator (Air mix potentiometer):
- If temperature set 17°C-24.5°C, fix at maximum cooling position.
- If temperature set 25°C-32°C, fix at maximum heating position.

7) Mode control actuator (Direction potentiometer):
- Fix vent position, while selecting vent mode.
- Fix defrost position, while selecting all except vent mode.

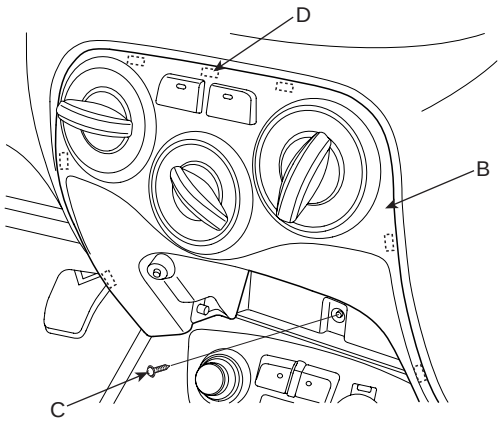
REPLACEMENT E57D7C05

1. Disconnect the negative (-) battery terminal.
2. Remove the ashtray (A).



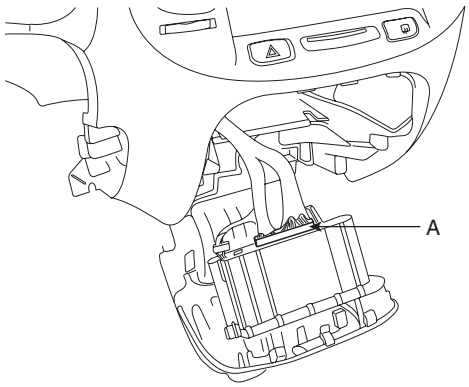
AQJF450C

3. Remove the center facia lower panel (B) by pulling it using a screw driver (-) after loosening a screw (A).Take care of fixing clips (D).



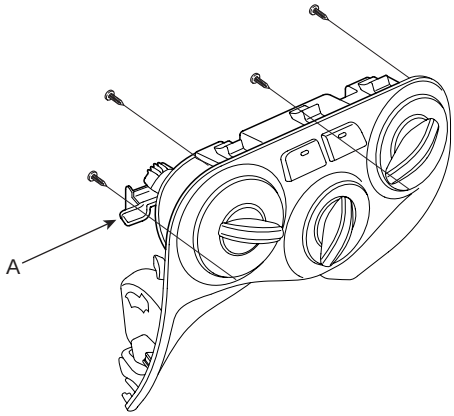
AQJF450D

4. Disconnect the connectors (A) from the center facia.



AQJF450H

5. Remove the Heater & A/C controller (A) after loosening 4 screws.

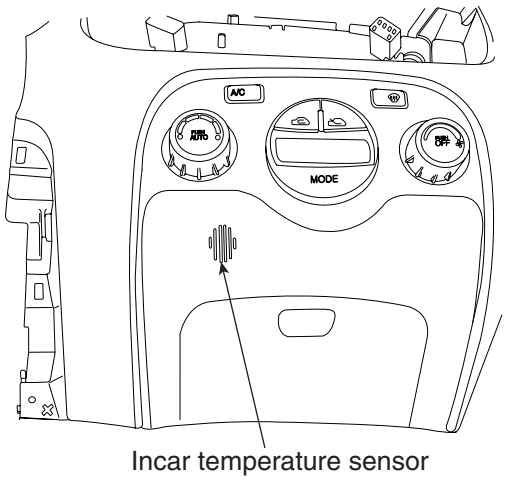


AQJF450F

6. Installation is the reverse order of removal.

CODE 11 : IN-CAR TEMPERATURE SENSOR OPEN (HIGH) E6CBA2AE

COMPONENT LOCATION



LQJF514E

GENERAL DESCRIPTION

The incar temperature sensor located at center facia panel. The signal, decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to Heater & A/C controller and according to this signal.

CODE DESCRIPTION

The Heater & A/C controller sets code 11 if there is a short circuit in incar temp. sensor signal harness or the measured resistance value of sensor is more than threshold value(about 1,000kΩ)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Resistance check	• Open Circuit in harness • Faulty incar temp. Sensor • Faulty Heater & A/C controller
Threshold value	• > 1,000 kΩ	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of 23°C(73°F)	

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	528.2	25(77)	30
-15(5)	218.2	35(95)	19.6
0(32)	97.83	60(140)	7.478
15(59)	47.12	80(176)	3.225

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

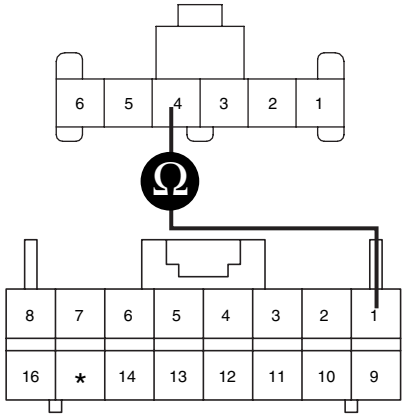
1. Check for open in harness.

   1) Ignition "OFF"

   2) Disconnect incar sensor connector.

3) Measure resistance between terminal "4" of incar temp. sensor and terminal "1" of Heater & A/C controller.

Specification : Approx. ∞Ω



AQJF515B

4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

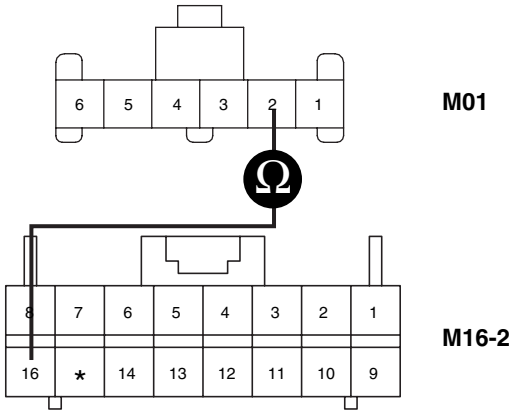
1. Check for open in ground harness.

   1) Ignition "OFF"

   2) Disconnect incar temp. sensor connector.

   3) Measure resistance between terminal "2" of incar temp. sensor and terminal "16" of Heater & A/C controller.

Specification : Approx. 0Ω



AQJF515C

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

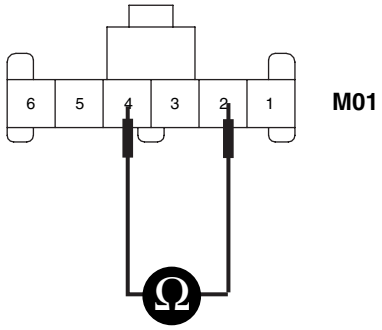
COMPONENT INSPECTION

1. Check incar temp. sensor.

   1) Ignition "OFF"

   2) Disconnect incar sensor connector.

   3) Measure resistance between terminal "4" and "2" of incar sensor.



AQJF514F

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	528.2	25(77)	30
-15(5)	218.2	35(95)	19.6
0(32)	97.83	60(140)	7.478
15(59)	47.12	80(176)	3.225

4) Is the measured resistance within specifications? (tolerance limits ± 3%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good incar sensor and check for proper operation.
If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

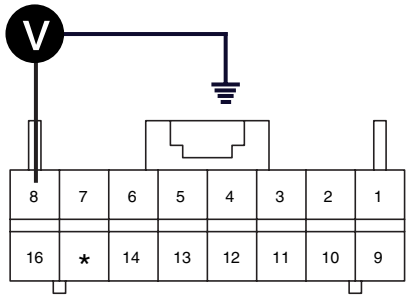
2. Check Heater & A/C controller.

1) Engine "ON"

2) Disconnect incar sensor connector.

3) Measure Voltage between terminal "8" of Heater & A/C controller and chassis ground.

Specification : Approx. 5V



M16-2

AQJF514C

4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

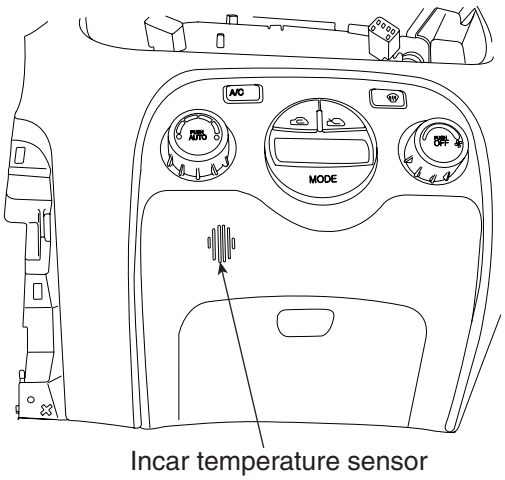
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 12 : IN-CAR TEMPERATURE SENSOR SHORT (LOW) E95B9F23

COMPONENT LOCATION



LQJF514E

GENERAL DESCRIPTION

The incar temperature sensor located at center facia panel. The signal, decided by the resistance value which changes in accordance with perceived inside temperature, is delivered to Heater & A/C controller and according to this signal.

CODE DESCRIPTION

The Heater & A/C controller sets code 12 if there is a short circuit in incar temp. sensor signal harness or the measured resistance value of sensor is less than threshold value(about 3.23kΩ)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Resistance check	• Short Circuit in harness • Faulty incar temp. Sensor • Faulty Heater & A/C controller
Threshold value	• < 3.23 kΩ	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of 23°C(73°F)	

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	528.2	25(77)	30
-15(5)	218.2	35(95)	19.6
0(32)	97.83	60(140)	7.478
15(59)	47.12	80(176)	3.225

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

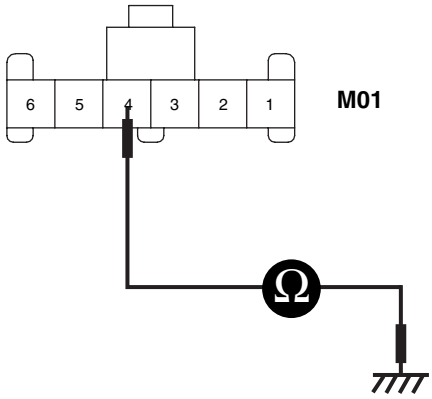
1. Check for short ground in harness.

   1) Ignition "OFF"

   2) Disconnect incar sensor connector.

3) Measure resistance between terminal "4" of incar sensor and chassis ground.

Specification : Approx. ∞Ω



AQJF514B

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

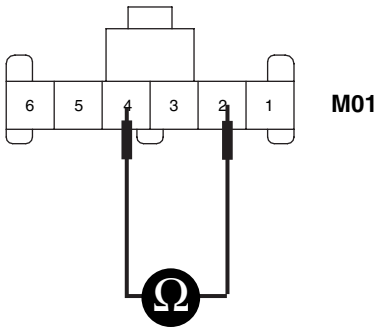
COMPONENT INSPECTION

1. Check incar temp. sensor.

1) Ignition "OFF"

2) Disconnect incar sensor connector.

3) Measure resistance between terminal "4" and "2" of incar sensor.



AQJF514F

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	528.2	25(77)	30
-15(5)	218.2	35(95)	19.6
0(32)	97.83	60(140)	7.478
15(59)	47.12	80(176)	3.225

4) Is the measured resistance within specifications? (tolerance limits ± 3%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good incar sensor and check for proper operation.
If the problem is corrected, replace incar sensor and then go to "Verification of Vehicle Repair" procedure.

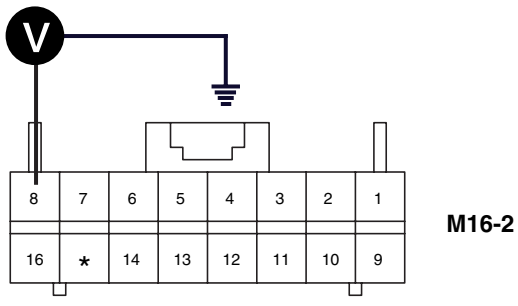
2. Check Heater & A/C controller

1) Engine "ON"

2) Disconnect incar sensor connector.

3) Measure Voltage between terminal "8" of Heater & A/C controller and chassis ground.

Specification : Approx. 5V



AQJF514C

4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there is the fault code, clear it.
2. Operate the vehicle and monitor the fault codes on the display panel.
3. Are any fault codes present?

YES

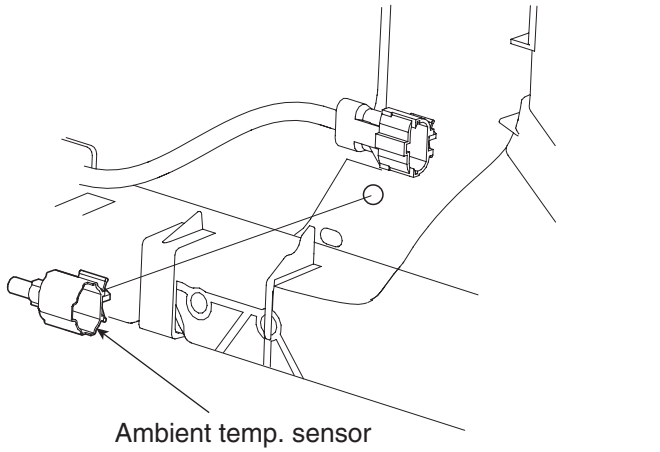
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 13 : AMBIENT TEMPERATURE SENSOR OPEN (HIGH) EADDFF61

COMPONENT LOCATION



LQJF516A

GENERAL DESCRIPTION

The ambient temperature senor located at the left side of the condenser, detects ambient air temperature. It is a negative type thermistor whose resistance is inversely proportional to temperature. Its output is used for discharge temperature sensor, sensor fail-safe, temperature regulation door lock, blower motor level control, mix mode control and in-car humidity control.

CODE DESCRIPTION

The Heater & A/C controller sets code 13 if there is a short circuit in ambient temp. sensor signal harness or the measured resistance value of sensor is more than threshold value(about 1,435kΩ)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Resistance check	• Open Circuit in harness • Faulty ambient temp. Sensor • Faulty Heater & A/C controller
Threshold value	• > 1,435 kΩ	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of 20°C(68°F)	

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	507	25(77)	30
-15(5)	215.3	35(95)	19.6
0(32)	97.5	45(113)	13.1
15(59)	47.1	70(158)	5.27

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

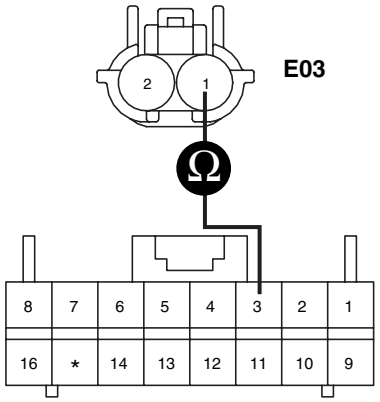
1. Check for open in harness.

   1) Ignition "OFF"

   2) Disconnect ambient temp. sensor connector.

3) Measure resistance between terminal "1" of ambient temp. sensor and terminal "3" of Heater & A/C controller.

Specification : Approx. 0Ω



AQJF518A

4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

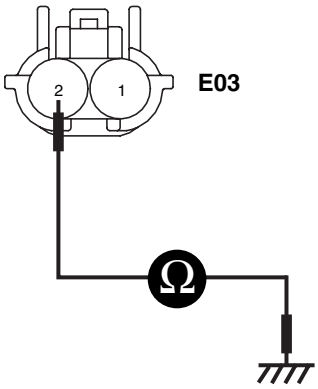
1. Check for open in ground harness.

   1) Ignition "OFF"

   2) Disconnect ambient temp. sensor.

   3) Measure resistance between terminal "2" of ambient temp. sensor and chassis ground.

Specification : Approx. 0 Ω



AQJF518B

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection " procedure.

NO

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

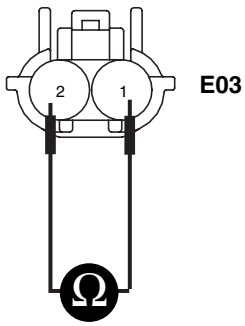
COMPONENT INSPECTION

1. Check Ambient temp. sensor.

   1) Ignition "OFF"

   2) Connect ambient temp. sensor connector.

   3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.



AQJF516D

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	507	25(77)	30
-15(5)	215.3	35(95)	19.6
0(32)	97.5	45(113)	13.1
15(59)	47.1	70(158)	5.27

4) Is the measured resistance within specifications? (tolerance limits ±3%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good ambient temp. sensor and check for proper operation.
If the problem is corrected, replace ambient temp. sensor and then go to "Verification of Vehicle Repair" procedure.

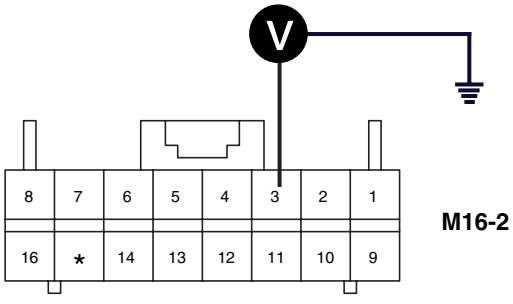
2. Check Heater & A/C controller

1) Engine "ON"

2) Disconnect ambient temp. sensor connector.

3) Measure voltage between terminal "3" of Heater & A/C controller and chassis ground.

Specification : Approx. 5V



AQJF516E

4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

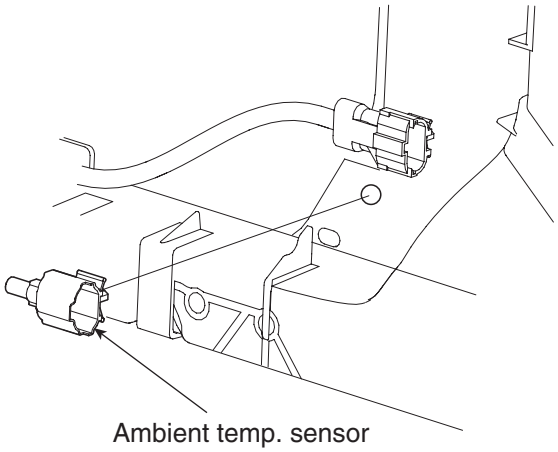
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 14 : AMBIENT TEMPERATURE SENSOR SHORT (LOW) EDF40DEC

COMPONENT LOCATION



LQJF516A

GENERAL DESCRIPTION

The ambient temperature senor located at the left side of the condenser, detects ambient air temperature. It is a negative type thermistor whose resistance is inversely proportional to temperature. Its output is used for discharge temperature sensor, sensor fail-safe, temperature regulation door lock, blower motor level control, mix mode control and in-car humidity control.

CODE DESCRIPTION

The Heater & A/C controller sets code 14 if there is a short circuit in ambient temp. sensor signal harness or the measured resistance value of sensor is less than threshold value(about 5.27kΩ)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Resistance check	• Short Circuit in harness • Faulty ambient temp. Sensor • Faulty Heater & A/C controller
Threshold value	• < 5.27 kΩ	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of 20°C(68°F)	

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	507	25(77)	30
-15(5)	215.3	35(95)	19.6
0(32)	97.5	45(113)	13.1
15(59)	47.1	70(158)	5.27

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

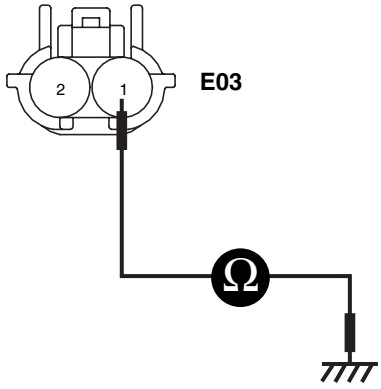
1. Check for short to ground in harness.

   1) Ignition "OFF"

   2) Disconnect ambient temp. sensor connector.

3) Measure resistance between terminal "1" of ambient temp. sensor and chassis ground.

Specification : Approx. ∞Ω



AQJF516C

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

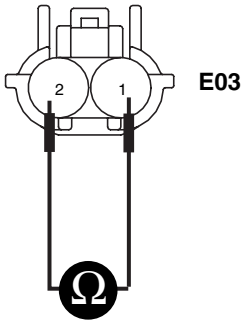
COMPONENT INSPECTION

1. Check Ambient temp. sensor.

1) Ignition "OFF"

2) Connect ambient temp. sensor connector.

3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.



AQJF516D

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	507	25(77)	30
-15(5)	215.3	35(95)	19.6
0(32)	97.5	45(113)	13.1
15(59)	47.1	70(158)	5.27

4) Is the measured resistance within specifications? (tolerance limits ±3%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good ambient temp. sensor and check for proper operation.
If the problem is corrected, replace ambient temp. sensor and then go to "Verification of Vehicle Repair" procedure.

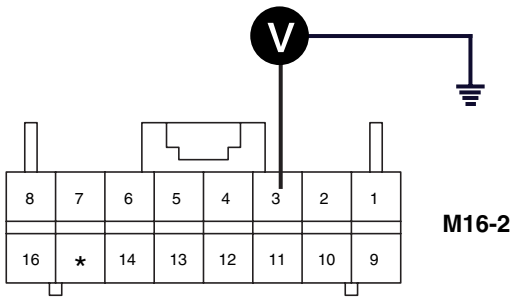
2. Check Heater & A/C controller

1) Engine "ON"

2) Disconnect ambient temp. sensor connector.

3) Measure voltage between terminal "3" of Heater & A/C controller and chassis ground.

Specification : Approx. 5V



AQJF516E

4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.
2. Operate the vehicle and monitor the fault codes on the display panel.
3. Are any fault codes present?

YES

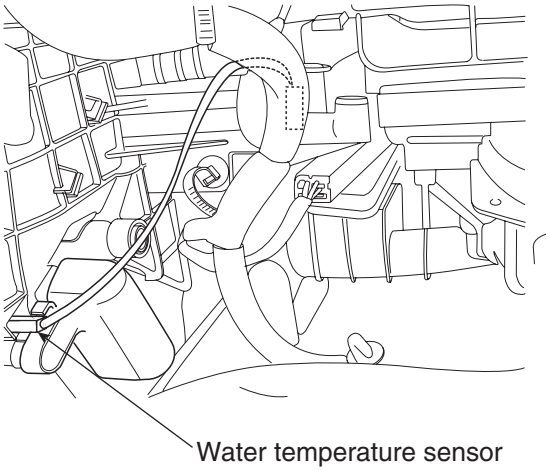
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 15 : WATER TEMPERATURE SENSOR OPEN (HIGH) EBECA224

COMPONENT LOCATION



LQJF512A

GENERAL DESCRIPTION

Water temp. sensor located at heater unit, detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

CODE DESCRIPTION

The Heater & A/C controller sets code 15 if there is an open circuit in water temp. sensor signal harness or the measured resistance value of the sensor is more than the threshold value(about 337.6kΩ)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Resistance check	• Open Circuit in harness • Faulty water temp. Sensor • Faulty Heater & A/C controller
Threshold value	• > 337.6 kΩ	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of 20°C(68°F)	

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	176.3	25(77)	10
-15(5)	73.6	35(95)	6.5
0(32)	32.9	60(140)	2.5
15(59)	15.8	80(176)	1.3

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

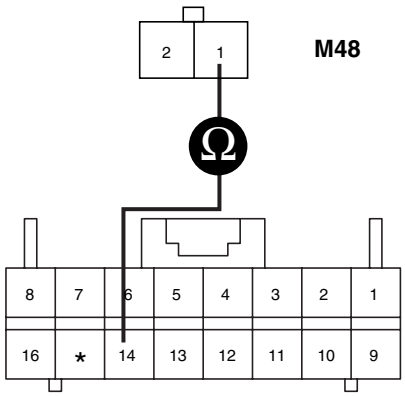
1. Check for open in harness.

   1) Ignition "OFF"

   2) Disconnect water temp. sensor connector.

3) Measure resistance between terminal "1" of water temp. sensor and terminal "14" of Heater & A/C controller.

Specification : Approx. 0 Ω



AQJF512C

4) Is the measured resistance within specifications?

YES

Go to "Ground circuit Inspection " procedure.

NO

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

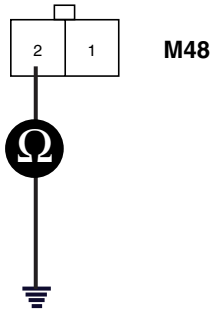
1. Check for open in ground harness.

   1) Ignition "OFF".

   2) Disconnect water temp. sensor connector.

   3) Measure resistance between terminal "2" of water temp. sensor and chassis ground.

Specification : Approx. 0 Ω



AQJF512D

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection " procedure.

NO

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

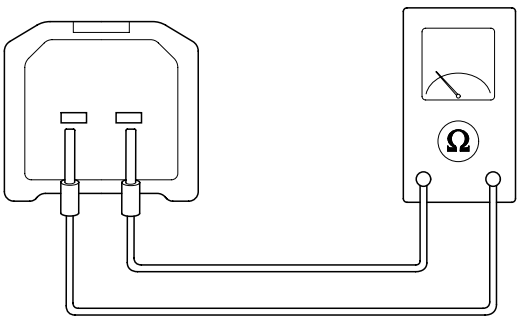
COMPONENT INSPECTION

1. Check water temp. sensor.

   1) Ignition "OFF"

   2) Disconnect water temp. sensor connector.

   3) Measure resistance between terminal "1" and "2" of water temp. sensor.



AQJF512E

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	176.3	25(77)	10
-15(5)	73.6	35(95)	6.5
0(32)	32.9	60(140)	2.5
15(59)	15.8	80(176)	1.3

4) Is the measured resistance within specifications? (tolerance limits ± 3%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good water temp. sensor and check for proper operation.
If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

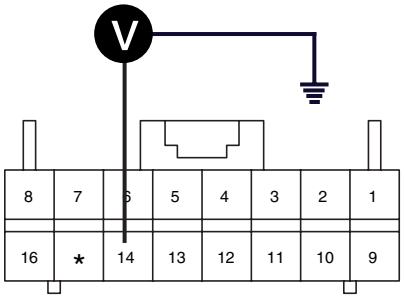
2. Check Heater & A/C controller

1) Engine "ON"

2) Disconnect water temp. sensor connector.

3) Measure Voltage between terminal "14" of Heater & A/C controller and chassis ground.

Specification : Approx. 5V



M16-2

AQJF512F

4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

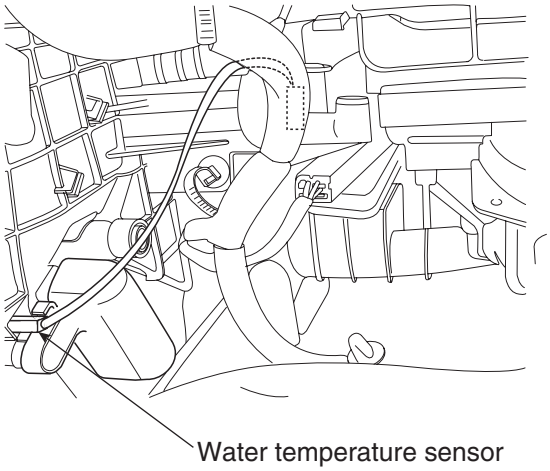
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 16 : WATER TEMPERATURE SENSOR SHORT (LOW) E54AA285

COMPONENT LOCATION



LQJF512A

GENERAL DESCRIPTION

Water temp. sensor located at heater unit, detects coolant temperature. Its signal is used for cold engine lockout control. When the driver operates the heater before the engine is warmed up, the signal from sensor causes the heater control unit to reduce blower motor speed until coolant temperature reaches the threshold value.

CODE DESCRIPTION

The Heater & A/C controller sets code 16 if there is an open circuit in water temp. sensor signal harness or the measured resistance value of the sensor is less than the threshold value(about 0.7kΩ)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Resistance check	• Short Circuit in harness • Faulty water temp. Sensor • Faulty Heater & A/C controller
Threshold value	• < 0.7 kΩ	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of 20°C(68°F)	

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	176.3	25(77)	10
-15(5)	73.6	35(95)	6.5
0(32)	32.9	60(140)	2.5
15(59)	15.8	80(176)	1.3

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

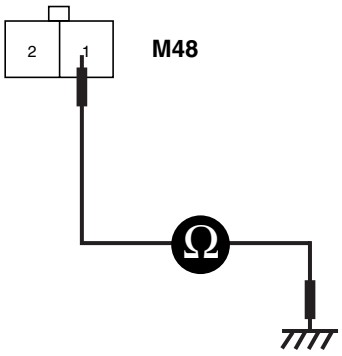
1. Check for short to ground in harness.

   1) Ignition "OFF"

   2) Disconnect water temp. sensor connector.

3) Measure resistance between terminal "1" of water temp. sensor and chassis ground.

Specification : Approx. 0 Ω



AQJF513B

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection " procedure.

NO

Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

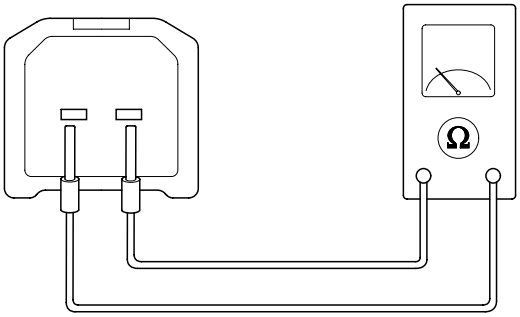
COMPONENT INSPECTION

1. Check water temp. sensor.

1) Ignition "OFF"

2) Disconnect water temp. sensor connector.

3) Measure resistance between terminal "1" and "2" of water temp. sensor.



AQJF512E

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	176.3	25(77)	10
-15(5)	73.6	35(95)	6.5
0(32)	32.9	60(140)	2.5
15(59)	15.8	80(176)	1.3

4) Is the measured resistance within specifications? (tolerance limits ± 3%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good water temp. sensor and check for proper operation.
If the problem is corrected, replace water temp. sensor and then go to "Verification of Vehicle Repair" procedure.

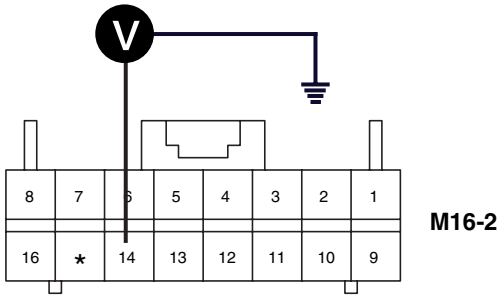
2. Check Heater & A/C controller

1) Engine "ON"

2) Disconnect water temp. sensor connector.

3) Measure Voltage between terminal "14" of Heater & A/C controller and chassis ground.

Specification : Approx. 5V



AQJF512F

4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.
2. Operate the vehicle and monitor the fault codes on the display panel.
3. Are any fault codes present?

YES

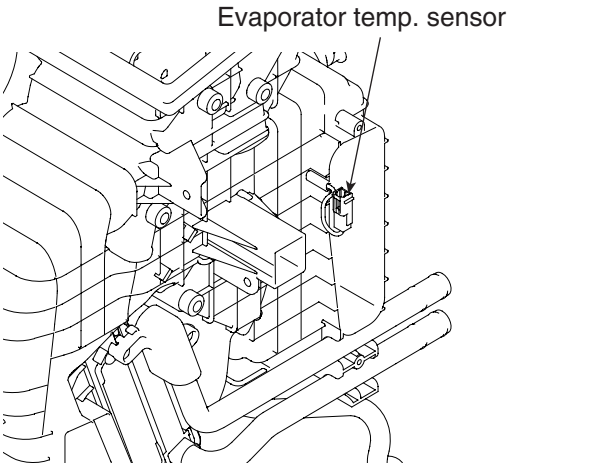
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 17 : EVAPORATOR TEMPERATURE SENSOR OPEN (HIGH) ECDABC75

COMPONENT LOCATION



LQJF519A

GENERAL DESCRIPTION

The Evaporator temperature sensor located on heater unit, detects the core temperature and interrupts compressor relay power, in order to prevent evaporator freezing by excessive cooling. It is a negative type thermistor whose resistance is inversely proportional to temperature.

CODE DESCRIPTION

The Heater & A/C controller sets code 17 if there is a short circuit in evaporator temp. sensor signal harness or the measured resistance value of sensor is more than threshold value(about 13.6kΩ)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Resistance check	• Open Circuit in harness • Faulty Evaporator temp. Sensor • Faulty Heater & A/C controller
Threshold value	• > 13.6 kΩ	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of -2°C(28.4°F)	

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-10(14)	13.6	15(59)	3.9
0(32)	8	30(86)	2
5(41)	6.2	40(104)	1.3
10(50)	4.9	50(122)	0.9

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

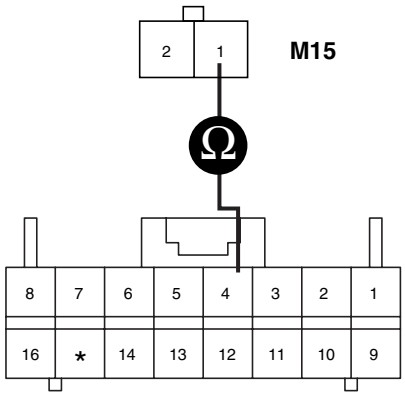
1. Check for open in harness.

   1) Ignition "OFF"

   2) Disconnect evaporator temp. sensor connector.

3) Measure resistance between terminal "1" of evaporator temp. sensor and terminal "4" of Heater & A/C controller.

Specification : Approx. 0 Ω



AQJF520B

4) Is the measured resistance within specifications?

YES

Go to "Ground circuit Inspection " procedure.

NO

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

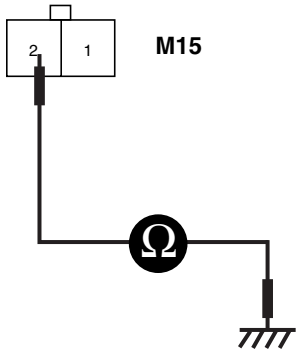
1. Check for open in ground harness.

   1) Ignition "OFF"

   2) Disconnect evaporator temp. sensor connector.

   3) Measure resistance between terminal "2" of evaporator temp. sensor and chassis ground.

Specification : Approx. 0 Ω



AQJF520C

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection " procedure.

NO

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

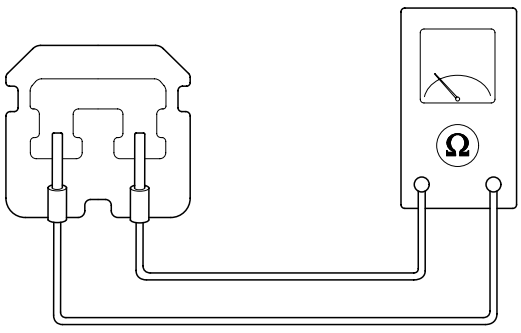
COMPONENT INSPECTION

1. Check evaporator temp. sensor.

   1) Ignition "OFF"

   2) Disconnect evaporator temp. sensor connector.

   3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.



AQJF519D

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-10(14)	13.6	15(59)	3.9
0(32)	8	30(86)	2
5(41)	6.2	40(104)	1.3
10(50)	4.9	50(122)	0.9

4) Is the measured resistance within specifications? (tolerance limits ±3%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good evaporator temp. sensor and check for proper operation.
If the problem is corrected, replace evaporator temp. sensor and then go to "Verification of Vehicle Repair" procedure.

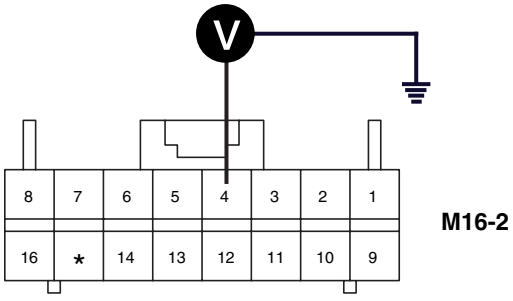
2. Check Heater & A/C controller.

1) Engine "ON"

2) Disconnect evaporator temp. sensor connector.

3) Measure voltage between terminal "4" of Heater & A/C controller and chassis ground.

Specification : Approx. 5V



M16-2

AQJF519E

4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

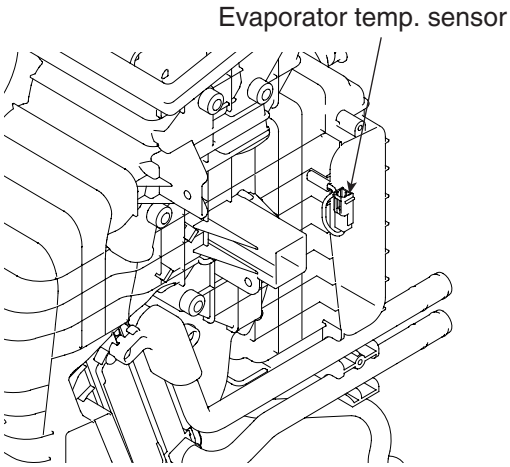
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 18 : EVAPORATOR TEMPERATURE SENSOR SHORT (LOW) EBBEED8F

COMPONENT LOCATION



LQJF519A

GENERAL DESCRIPTION

The Evaporator temperature sensor located on heater unit, detects the core temperature and interrupts compressor relay power, in order to prevent evaporator freezing by excessive cooling. It is a negative type thermistor whose resistance is inversely proportional to temperature.

CODE DESCRIPTION

The Heater & A/C controller sets code 18 if there is a short circuit in evaporator temp. sensor signal harness or the measured resistance value of sensor is less than threshold value(about 0.6kΩ)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Resistance check	• Short Circuit in harness • Faulty Evaporator temp. Sensor • Faulty Heater & A/C controller
Threshold value	• < 0.6 kΩ	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of -2°C(28.4°F)	

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-10(14)	13.6	15(59)	3.9
0(32)	8	30(86)	2
5(41)	6.2	40(104)	1.3
10(50)	4.9	50(122)	0.9

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

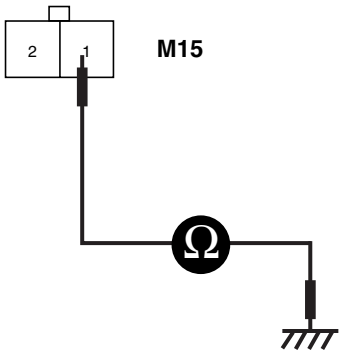
1. Check for short to ground in harness.

   1) Ignition "OFF"

   2) Disconnect evaporator temp. sensor connector.

3) Measure resistance between terminal "1" of evaporator temp. sensor and chassis ground.

Specification : Approx. ∞ Ω



AQJF519C

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection " procedure.

NO

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

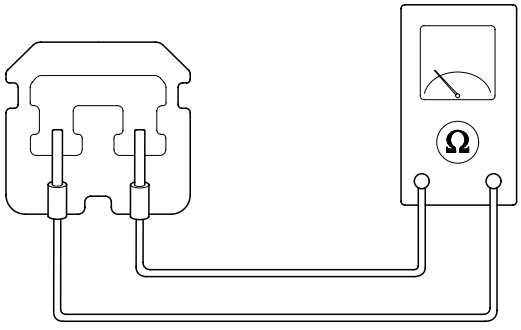
COMPONENT INSPECTION

1. Check evaporator temp. sensor.

1) Ignition "OFF"

2) Disconnect evaporator temp. sensor connector.

3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.



AQJF519D

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-10(14)	13.6	15(59)	3.9
0(32)	8	30(86)	2
5(41)	6.2	40(104)	1.3
10(50)	4.9	50(122)	0.9

4) Is the measured resistance within specifications? (tolerance limits ±3%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good evaporator temp. sensor and check for proper operation.
If the problem is corrected, replace evaporator temp. sensor and then go to "Verification of Vehicle Repair" procedure.

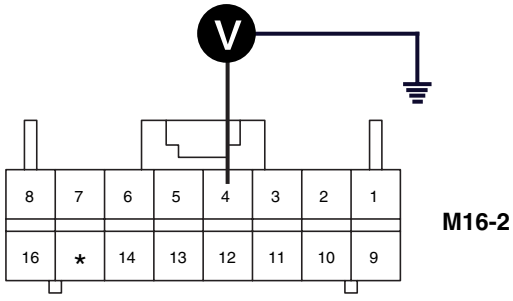
2. Check Heater & A/C controller.

1) Engine "ON"

2) Disconnect evaporator temp. sensor connector.

3) Measure voltage between terminal "4" of Heater & A/C controller and chassis ground.

Specification : Approx. 5V



AQJF519E

4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.
2. Operate the vehicle and monitor the fault codes on the display panel.
3. Are any fault codes present?

YES

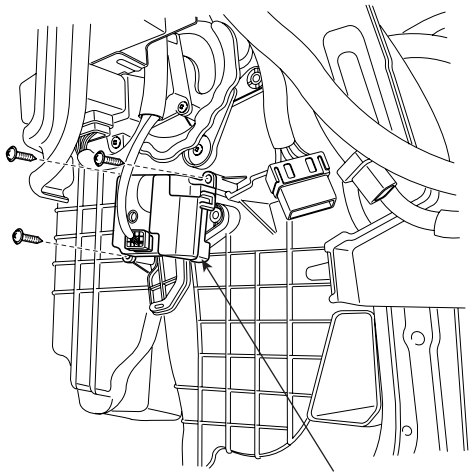
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 19 : AIR MIX POTENTIOMETER OPEN OR SHORT - DRIVER EEAAD58E

COMPONENT LOCATION



Temperature control actuator

LQJF521A

GENERAL DESCRIPTION

Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

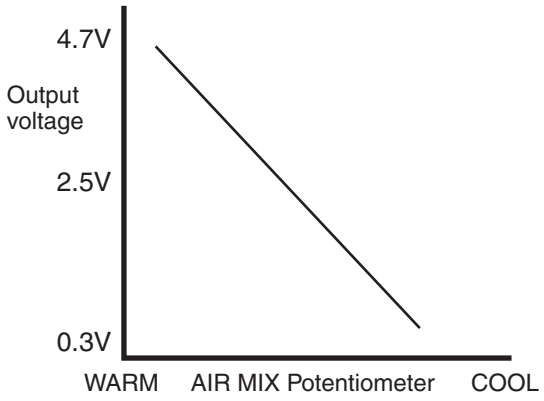
CODE DESCRIPTION

The Heater & A/C controller sets code 19 if there is an open circuit, poor connection or a short in the air mix potentiometer.

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Voltage check	• Poor connection of connected part • Open circuit in harness • Short circuit in harness • Faulty driver Air Mix potentiometer
Threshold value	• < 0.1V (OPEN) • > 4.9V (SHORT)	
Detecting time	• 0.3 sec	
Fail safe	• If temperature setting 17°C-24.5°C (63~76°F) fix at max. cooling position. • If temperature setting 25°C-32°C (77~90°F) fix at max. heating position.	

SPECIFICATION



LQIE521B

TERMINAL AND CONNECTOR INSPECTION

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

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

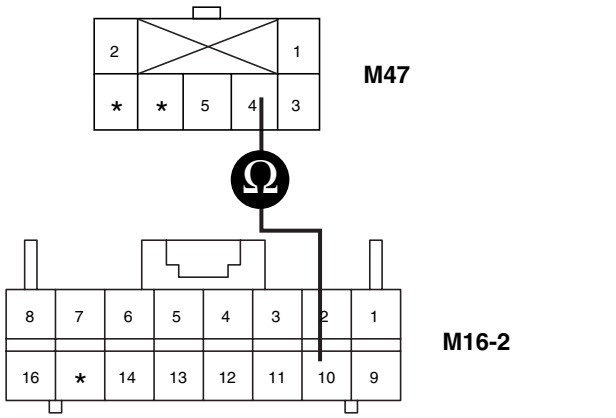
   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   1) Ignition "OFF"
   2) Disconnect Driver Air Mix potentiometer connector and Heater & A/C controller connector.
   3) Measure resistance between terminal "4" of Driver Air Mix Potentiometer and terminal "10" of Heater & A/C controller connector.

Specification : Approx. 0 Ω



AQJF521D

   4) Is the measured resistance within specifications?

      YES

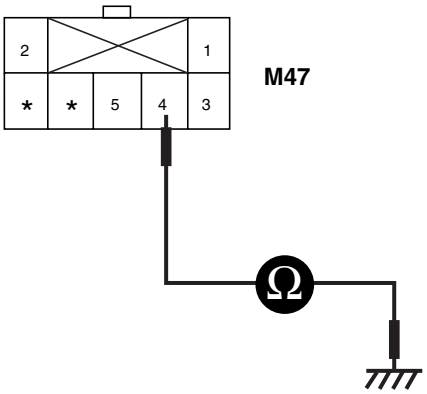
      Go to "Check for short to ground in harness" procedure.

      NO

      Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.
   1) Ignition "OFF"
   2) Disconnect Driver Air Mix potentiometer connector and Heater & A/C controller connector.
   3) Measure resistance between terminal "4" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx. ∞ Ω



AQJF521E

   4) Is the measured resistance within specifications?

      YES

      Go to "Power circuit Inspection" procedure.

      NO

      Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

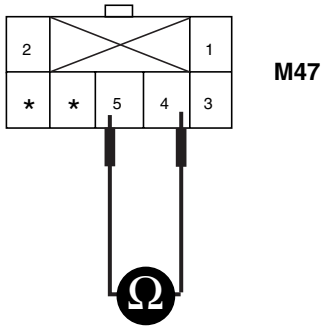
3. Check for short in harness.

   1) Ignition "OFF"

   2) Disconnect Driver Air Mix potentiometer connector.

   3) Measure resistance between terminal "5" and "4" of Driver Air Mix Potentiometer

Specification : Approx. ∞ Ω



AQJF522B

   4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

POWER SUPPLY CIRCUIT INSPECTION

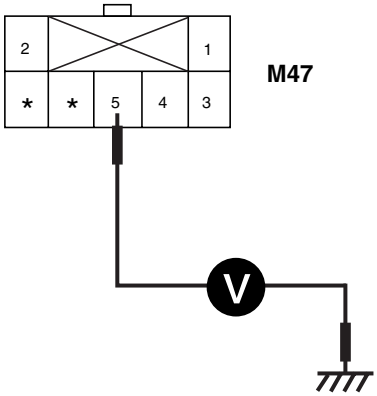
1. Check for short or open in harness.

   1) Ignition "ON"

   2) Connect Driver Air Mix Potentiometer connector.

   3) Measure voltage between terminal "5" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx. 5V



AQJF521F

   4) Is the measured voltage within specifications?

YES

Go to "Ground circuit Inspection" procedure.

NO

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

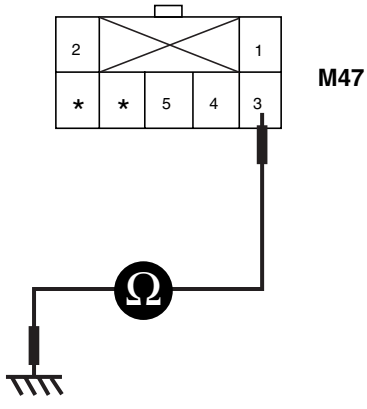
1. Check for open in harness.

   1) Ignition "OFF"

   2) Disconnect Driver Air Mix Potentiometer connector.

   3) Measure resistance between terminal "3" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx. 0 Ω



AQJF521G

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

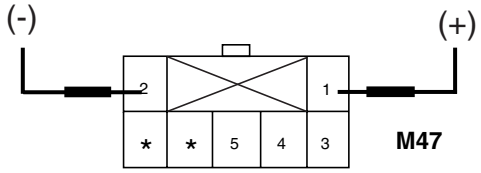
1. Check actuator motor.

1) Ignition "OFF"

2) Disconnect Driver Air Mix Potentiometer connector.

3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal 1 and grounding terminal 2.

4) Verify that the temperature actuator operates to the cool position when connecting in the reverse.



AQJF521H

5) Dose the actuator work properly?

YES

Go to "Check potentiometer" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

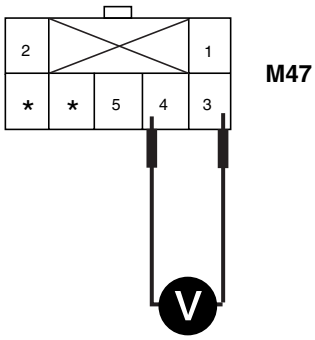
2. Check potentiometer

1) Ignition "ON"

2) Connect Driver Air Mix potentiometer connector.

3) Measure voltage between terminal "3" and "4" of Driver Air Mix potentiometer while operating the temp. switch.

Specification : Refer the specifications in fig 3)



AQJF521I

Door position	Voltage (3-4)	Error detecting
MAX. Cooling	0.3 ± 0.15V	Low voltage : 0.1V or less
MAX. Heating	4.7 ± 0.15V	High voltage : 4.9V or more

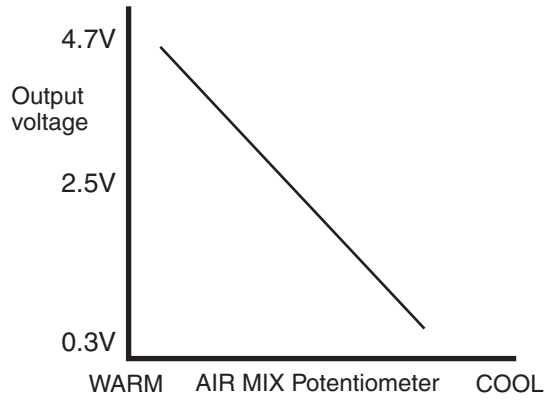


Fig 3

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of temperatur door.

LQJF521J

4) Is the measured voltage within specifications in fig3?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.
2. Operate the vehicle and monitor the fault codes on the display panel.
3. Are any fault codes present?

YES

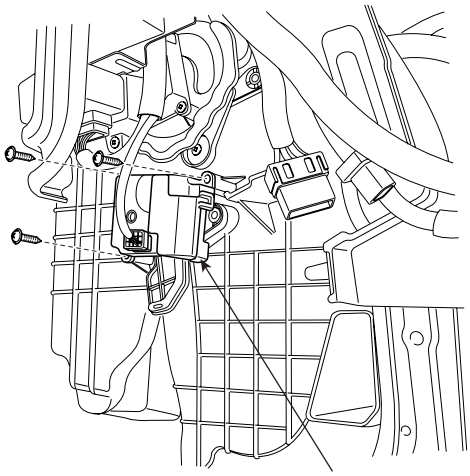
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 20 : AIR MIX MOTOR (DRIVER) E2FFB506

COMPONENT LOCATION



Temperature control actuator

LQJF521A

GENERAL DESCRIPTION

Temperature control actuator located at heater unit, regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temp. door by operating temp. motor and then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

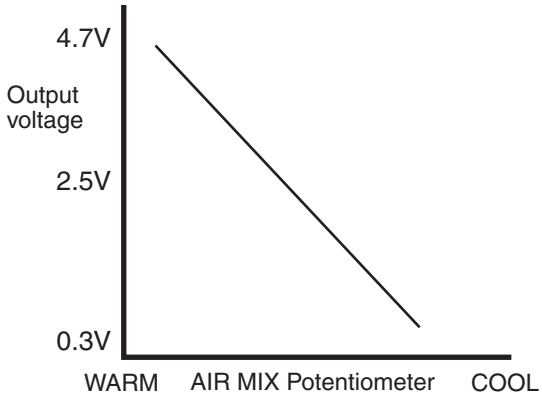
CODE DESCRIPTION

The Heater & A/C controller sets code 20 if the air mix actuator doesn't move to intended position within 40sec (In this case, Heater & A/C controller try to move temp. door for 2 sec. 5 times, every 20 sec. before setting code.)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Voltage check	• Poor connection of connected part • Open circuit in harness • Short circuit in harness • Faulty driver Air Mix potentiometer • Fault Heater & A/C controller
Threshold value	• When select temp. control switch, there is no voltage change of temp. door	
Detecting time	• 0.3 sec	
Fail safe	-	

SPECIFICATION



LQIE521B

TERMINAL AND CONNECTOR INSPECTION

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

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

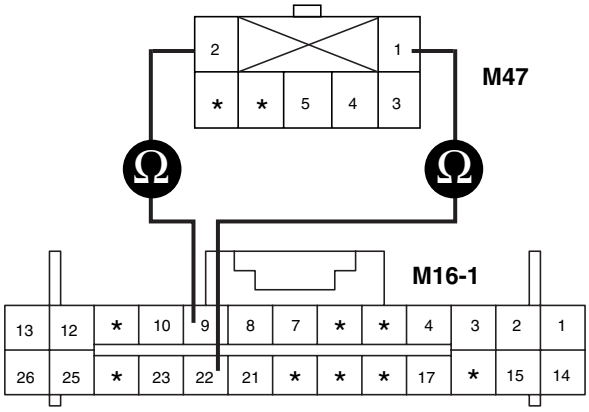
   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   1) Ignition "OFF"
   2) Disconnect Driver Air Mix potentiometer connector and Heater & A/C controller connector.

3) Measure resistance between terminal "1, 2" of Driver Air Mix Motor and terminal "9, 22" of Heater & A/C controller connector.

Specification : Approx. 0 Ω



AQJF525B

4) Is the measured resistance within specifications?

YES

Go to "Check for short to ground in harness" procedure.

NO

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

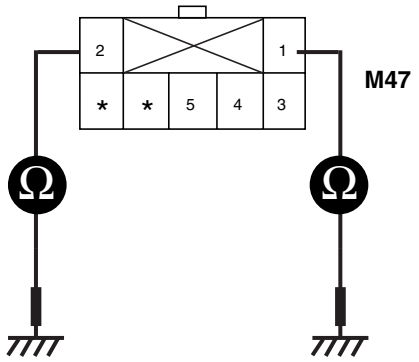
2. Check for short to ground in harness.

1) Ignition "OFF"

2) Disconnect Driver Air Mix potentiometer connector and Heater & A/C controller connector.

3) Measure resistance between terminal "1, 2" of Driver Air Mix Motor and chassis ground.

Specification : Approx. ∞ Ω



AQJF525C

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

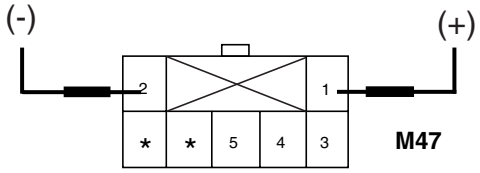
1. Check actuator motor.

1) Ignition "OFF"

2) Disconnect Driver Air Mix Potentiometer.

3) Verify that the temperature actuator operates to the hot position when connecting 12V to the terminal 1 and grounding terminal 2.

4) Verify that the temperature actuator operates to the cool position when the connections are reversed.



AQJF521H

5) Dose the actuator work properly?

YES

Go to "Check potentiometer" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

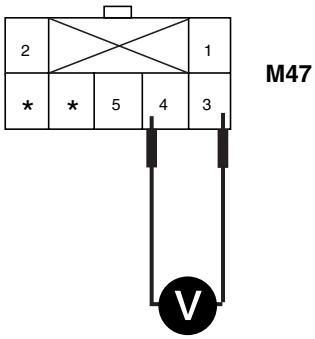
2. Check potentiometer

1) Ignition "ON"

2) Connect Driver Air Mix potentiometer connector.

3) Measure voltage between terminal "3" and "4" of Driver Air Mix potentiometer while operating the temp. switch.

Specification : Refer the specifications in fig 3)



AQJF521I

Door position	Voltage (3-4)	Error detecting
MAX. Cooling	0.3 ± 0.15V	Low voltage : 0.1V or less
MAX. Heating	4.7 ± 0.15V	High voltage : 4.9V or more

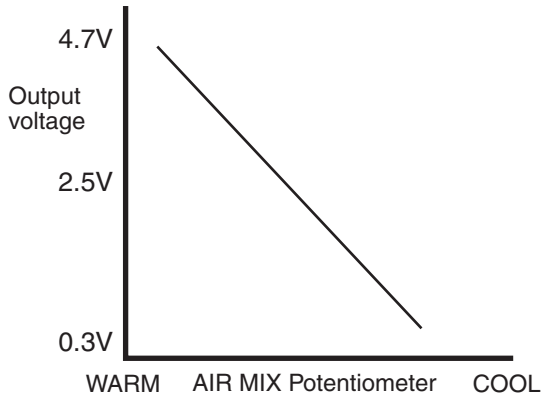


Fig 3

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of temperatur door.

LQJF521J

4) Is the measured voltage within specifications in fig3?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

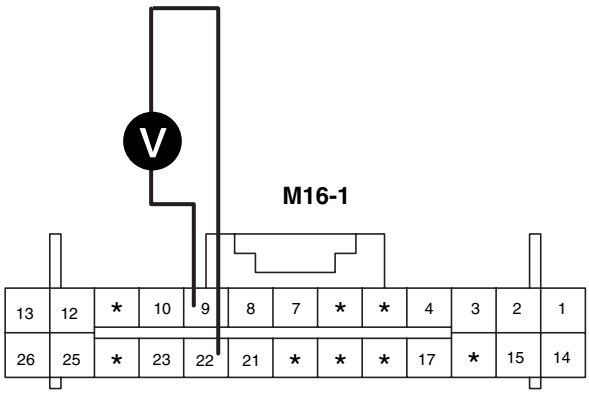
3. Check Heater & A/C controller

   1) Engine "ON"

   2) Connect Heater & A/C controller.

   3) Measure voltage between terminal "9" and "22" of Heater & A/C controller while operating the temp. switch.

Specification :Approx. 12V or - 12V



AQJF525E

   4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

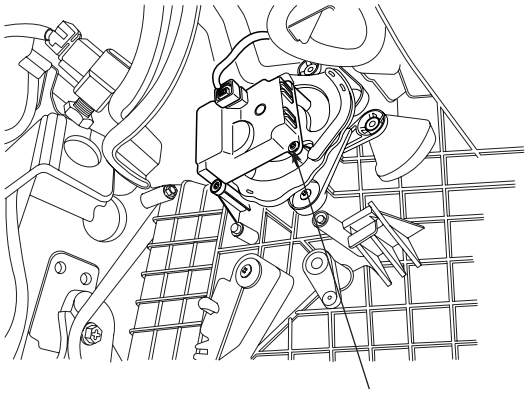
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 21 : DIRECTION POTENTIOMETER OPEN OR SHORT - DRIVER EB3BBA2F

COMPONENT LOCATION



LQJF523A

GENERAL DESCRIPTION

The mode control actuator mounted on heater unit, adjusts position of mode door by operating Direction Motor based on signal of Heater & A/C controller unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

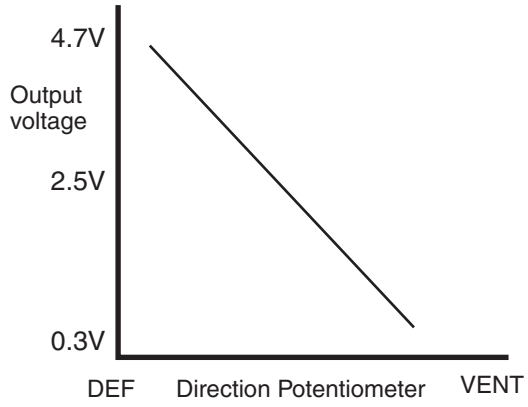
CODE DESCRIPTION

The Heater & A/C controller sets code 21 if there is an open circuit, poor connection or a short circuit in the Direction potentiometer.

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Voltage check	• Poor connection of connected part • Open circuit in harness • Short circuit in harness • Faulty driver direction potentiometer
Threshold value	• < 0.1V (OPEN) • > 4.9V (SHORT)	
Detecting time	• 0.3 sec	
Fail safe	• Fix vent position, while selecting vent mode. • Fix defrost position while selecting except vent mode.	

SPECIFICATION



LQIE523B

TERMINAL AND CONNECTOR INSPECTION

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

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

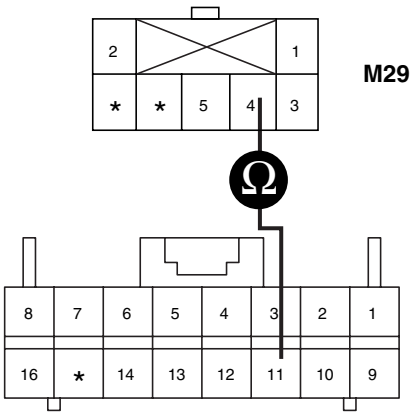
   NO

   Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   1) Ignition "OFF"
   2) Disconnect Driver mode Actuator connector and Heater & A/C controller connector.
   3) Measure resistance between terminal "4" of Driver Direction potentiometer and terminal "11" of Heater & A/C controller.

Specification : Approx. 0 Ω



AQJF523D

120

4) Is the measured resistance within specifications?

   YES

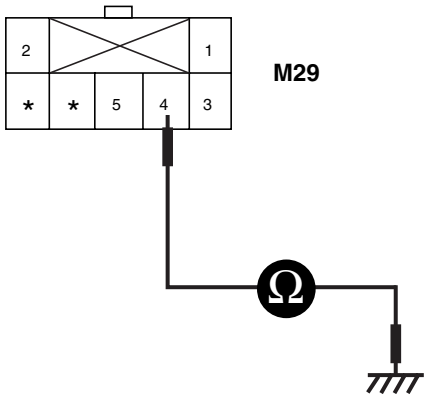
   Go to "Check for short to ground in harness" procedure.

   NO

   Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.
   1) Ignition "OFF"
   2) Disconnect Driver mode Actuator connector and Heater & A/C controller connector.
   3) Measure resistance between terminal "4" of Driver Direction potentiometer and chassis ground.

Specification : Approx. ∞ Ω



AQJF523E

4) Is the measured resistance within specifications?

   YES

   Go to "Power circuit Inspection" procedure.

   NO

   Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

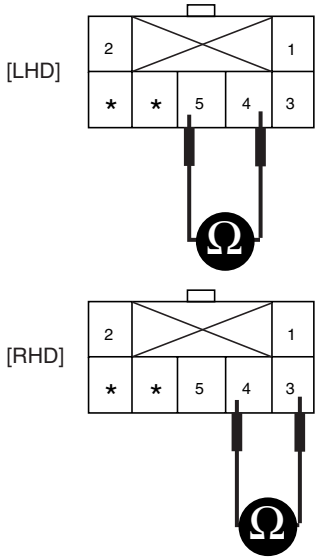
3. Check for short in harness.

   1) Ignition "OFF"

   2) Disconnect Driver mode Actuator connector and Heater & A/C controller connector.

   3) Measure resistance between terminal "4" and "5" of Driver Direction potentiometer. (RHD : Terminal "3 " and "4 ")

Specification : Approx. ∞ Ω



LQJF524B

   4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

POWER SUPPLY CIRCUIT INSPECTION

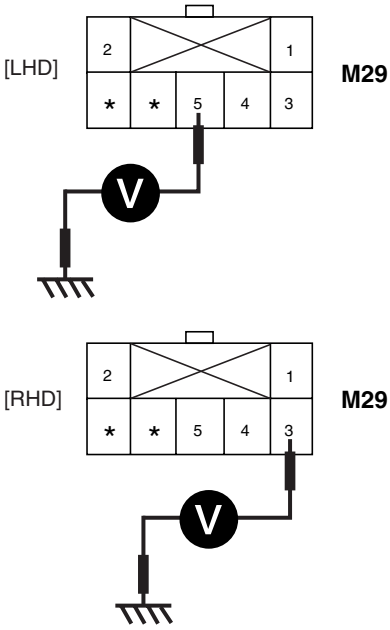
1. Check for short or open in harness.

   1) Ignition "ON"

   2) Connect Driver Direction potentiometer.

   3) Measure voltage between terminal "5" of Driver Direction potentiometer and chassis ground. (RHD : Terminal "3")

Specification : Approx. 5V



LQJF523F

   4) Is the measured voltage within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

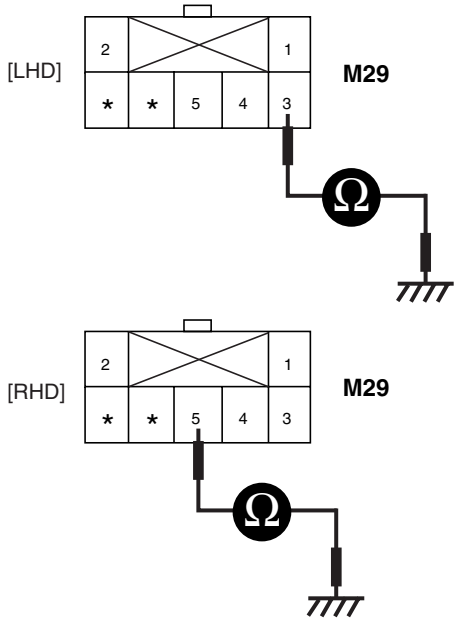
1. Check for open in ground harness.

   1) Ignition "OFF"

   2) Disconnect Driver mode Actuator connector.

   3) Measure resistance between terminal "3" of evaporator sensor and chassis ground.
   (RHD : Terminal "5")

Specification : Approx. 0 Ω



LQJF523G

   4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

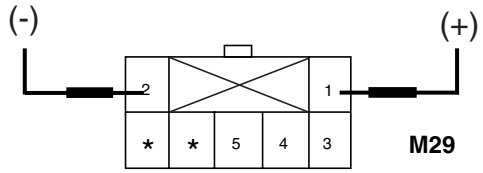
1. Check actuator.

   1) Ignition "OFF"

   2) Disconnect Driver Direction potentiometer.

   3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal 1 and grounding terminal 2.

   4) Verify that the mode actuator operates to the def mode when connecting in the reverse.



AQJF523H

   5) Dose the actuator work properly?

YES

Go to "Check potentiometer" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

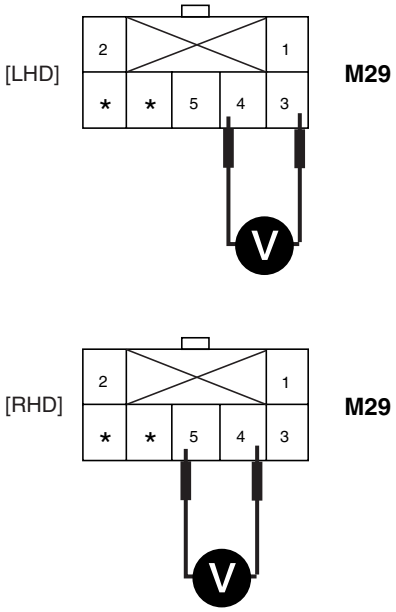
2. Check potentiometer

   1) Ignition "ON"

   2) Connect Driver Direction potentiometer connector.

   3) Measure voltage between terminal "4" and "3" of Driver Direction potentiometer as the mode switch is operated. (RHD : Terminal "4" and "5")

Specification : Refer the specifications in fig 3.



LQJF523I

Door position	Voltage (3-4)	Error detecting
VENT	0.3 ± 0.15V	Under voltage : 0.1V or less Over voltage : 4.9V or more
BI-LEVEL(1)	1.63 ± 0.4V	
FLOOR	2.63 ± 0.4V	
MIX	3.5 ± 0.4V	
DEF	4.7 ± 0.15V	

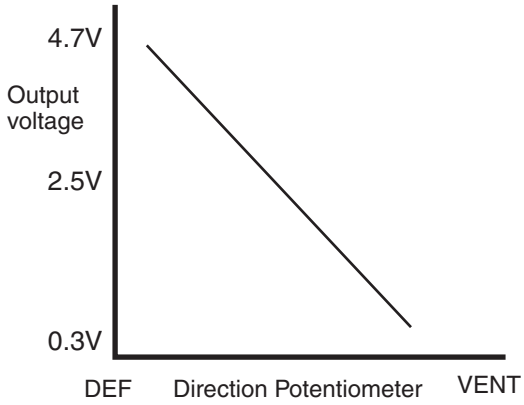


Fig 3

Fig 3) Specifications : Voltage value as a function of position of direction potentiometer.

LQJF523J

   4) Is the measured voltage within specifications in fig3?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

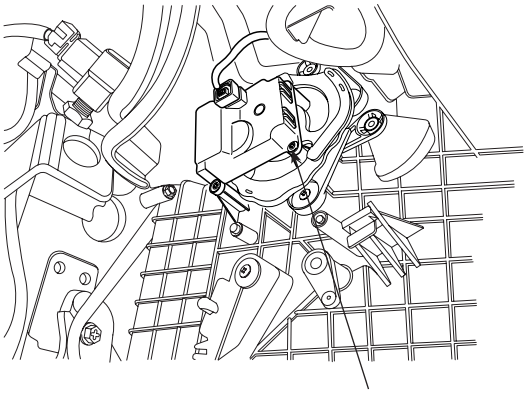
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 22 : DIRECTION CONTROL MOTOR (DRIVER) E5D83D18

COMPONENT LOCATION



LQJF523A

GENERAL DESCRIPTION

The mode control actuator mounted on heater unit, adjusts position of mode door by operating Direction Motor based on signal of Heater & A/C controller unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

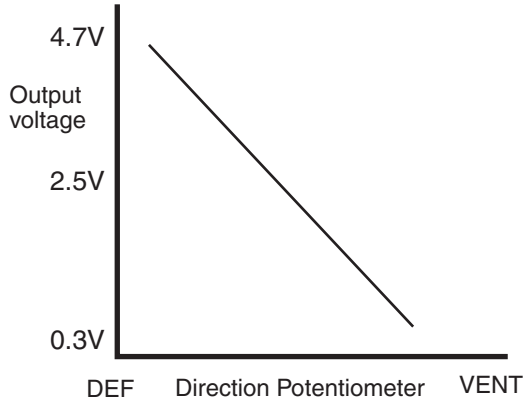
CODE DESCRIPTION

The Heater & A/C controller sets code 22 if the direction motor doesn't move to intended position within 40sec(In this case, A/C controller try to move mode door for 2sec. 3 times, every 20 sec. before setting code.)

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Voltage check	• Poor connection of connected part • Open circuit in harness • Short circuit in harness • Faulty driver direction potentiometer • Fault Heater & A/C controller
Threshold value	• There is no voltage change of mode feedback when select mode switch	
Detecting time	• 0.3 sec	
Fail safe	-	

SPECIFICATION



LQIE523B

TERMINAL AND CONNECTOR INSPECTION

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

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

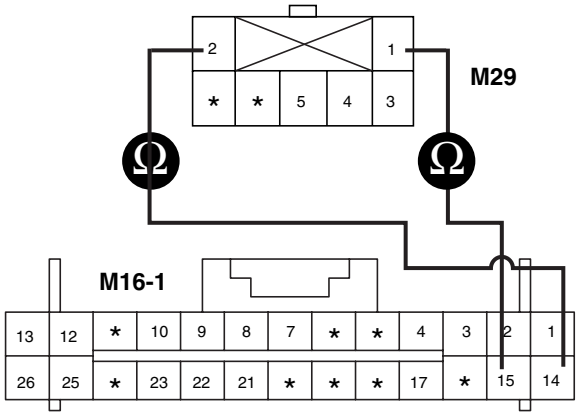
Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   1) Ignition "OFF"
   2) Disconnect Driver mode Actuator connector and Heater & A/C controller connector.

3) Measure resistance between terminal "1, 2" of Driver Direction Motor and terminal "14, 15" of Heater & A/C controller.

Specification : Approx. 0 Ω



AQJF526B

4) Is the measured resistance within specifications?

YES

Go to "Check for short to ground in harness" procedure.

NO

Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

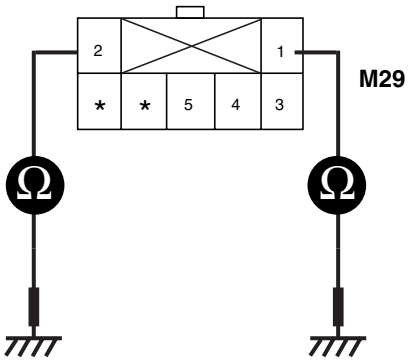
2. Check for short to ground in harness.

1) Ignition "OFF"

2) Disconnect Driver mode Actuator connector and Heater & A/C controller connector.

3) Measure resistance between terminal "1, 2" of Driver Direction Motor and chassis ground.

Specification : Approx. ∞ Ω



AQJF526C

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

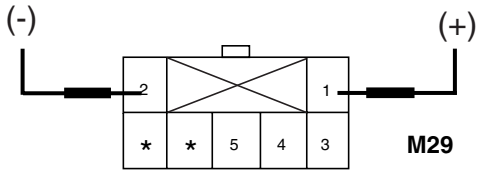
1. Check actuator.

1) Ignition "OFF"

2) Disconnect Driver Direction potentiometer.

3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal 1 and grounding terminal 2.

4) Verify that the mode actuator operates to the def mode when the connections are reversed.



AQJF523H

5) Dose the actuator work properly?

YES

Go to "Check potentiometer" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

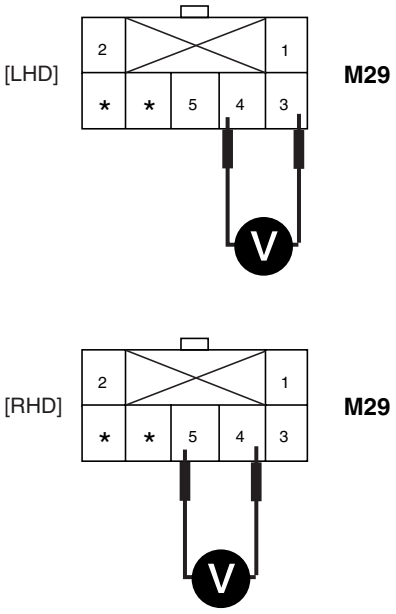
2. Check potentiometer

1) Ignition "ON"

2) Connect Driver Direction potentiometer connector.

3) Measure voltage between terminal "4" and "3" of Driver Direction potentiometer as the mode switch is operated. (RHD : Terminal "4" and "5")

Specification : Refer the specifications in fig 3.



LQJF523I

Door position	Voltage (3-4)	Error detecting
VENT	0.3 ± 0.15V	Under voltage : 0.1V or less Over voltage : 4.9V or more
BI-LEVEL(1)	1.63 ± 0.4V	
FLOOR	2.63 ± 0.4V	
MIX	3.5 ± 0.4V	
DEF	4.7 ± 0.15V	

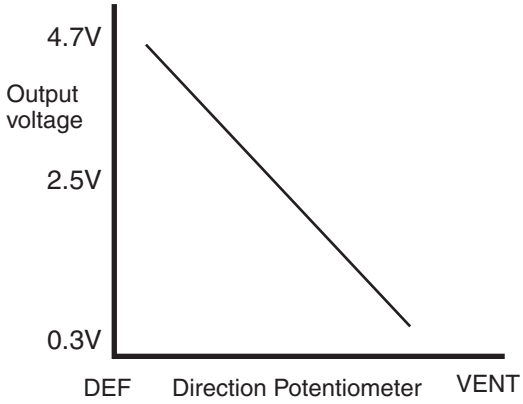


Fig 3

Fig 3) Specifications : Voltage value as a function of position of direction potentiometer.

LQJF523J

4) Is the measured voltage within specifications in fig3?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace actuator and then go to "Verification of Vehicle Repair" procedure.

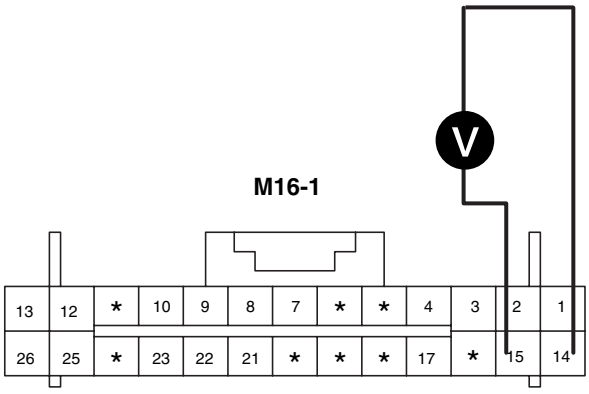
3. Check Heater & A/C controller

   1) Engine : "ON"

   2) Connect Heater & A/C controller connector.

   3) Measure voltage between terminal "14" and "15" of Heater & A/C controller while operating the mode switch.

Specification : Approx. 12V or - 12V



AQJF526H

   4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

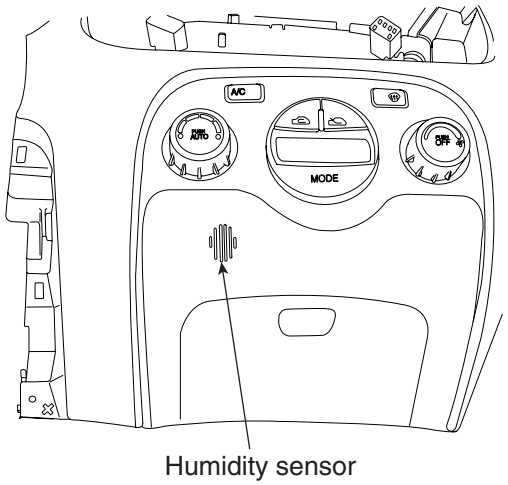
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 23 : HUMIDITY SENSOR OPEN (HIGH) EBBCFDB8

COMPONENT LOCATION



LQJF510A

GENERAL DESCRIPTION

Humidity sensor located at center facia panel, detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity for preventing in-car fogging. Air conditioner operation depends on ambient temperature and humidity.

CODE DESCRIPTION

The Heater & A/C controller sets code 23 if there is an open circuit or a short circuit with 5V line in humidity sensor signal harness.

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Frequency check	• Open Circuit in harness • Faulty Humidity Sensor • Faulty Heater & A/C controller
Threshold value	• When maintain high voltage (5V)	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of 10%	

SPECIFICATION

Relative humidity(%)	Frequency(Hz)	Relative humidity(%)	Frequency(Hz)
10	7,224	55	6,664
15	7,162	60	6,600
20	7,100	65	6,534
25	7,038	70	6,468
30	6,976	75	6,399
35	6,915	80	6,330
40	6,853	85	6,258
45	6,791	90	6,186
50	6,728	95	6,110

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

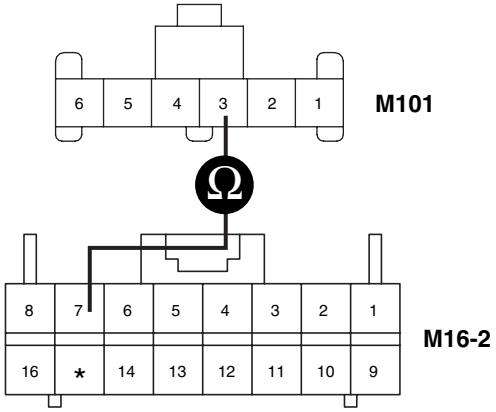
1. Check for open in harness.

   1) Ignition "OFF"

   2) Disconnect Humidity Sensor connector.

3) Measure resistance between terminal "3" of Humidity Sensor and terminal "7" of Heater & A/C controller.

Specification : Approx. 0 Ω



AQJF510C

4) Is the measured resistance within specifications?

YES

Go to "Ground circuit Inspection " procedure.

NO

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

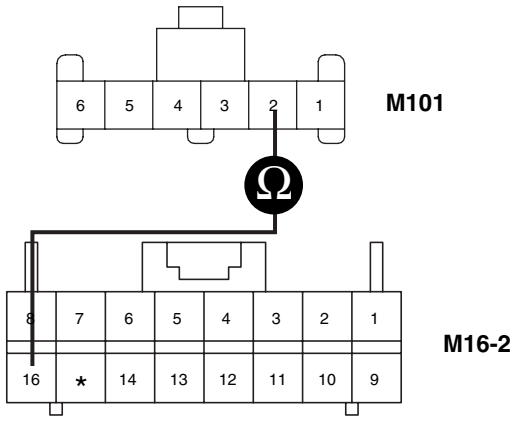
1. Check for open in ground harness.

   1) Ignition "OFF"

   2) Disconnect Humidity Sensor connector.

   3) Measure resistance between terminal "2" of Humidity Sensor and terminal "16" of Heater & A/C controller.

Specification :Approx. 0 Ω



AQJF510D

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection " procedure.

NO

Check for open in ground harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

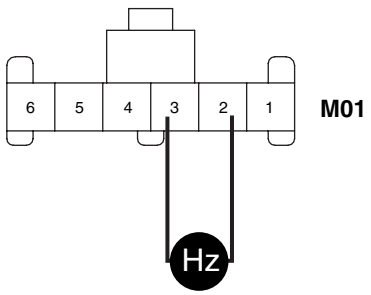
COMPONENT INSPECTION

1. Check Humidity Sensor.

   1) Engine "ON"

   2) Connect Humidity Sensor connector.

   3) Measure Frequency between terminal "3" and "2" of Humidity sensor while increasing humidity.



AQJF510E

SPECIFICATION

Relative humidity(%)	Frequency(Hz)	Relative humidity(%)	Frequency(Hz)
10	7,224	55	6,664
15	7,162	60	6,600
20	7,100	65	6,534
25	7,038	70	6,468
30	6,976	75	6,399
35	6,915	80	6,330
40	6,853	85	6,258
45	6,791	90	6,186
50	6,728	95	6,110

4) Is the measured frequency within specifications? (tolerance limits ± 5%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good Humidity sensor and check for proper operation.
If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure.

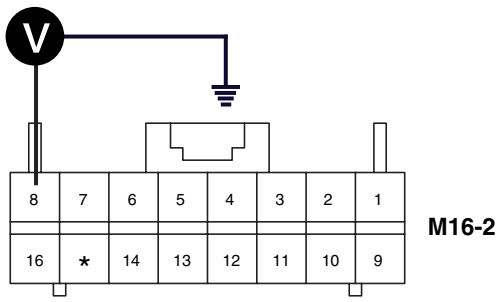
2. Check Heater & A/C controller

1) Engine "ON"

2) Disconnect Humidity Sensor connector.

3) Measure voltage value between terminal "8" of Heater & A/C controller and chassis ground.

Specification : 5V



AQJF510G

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

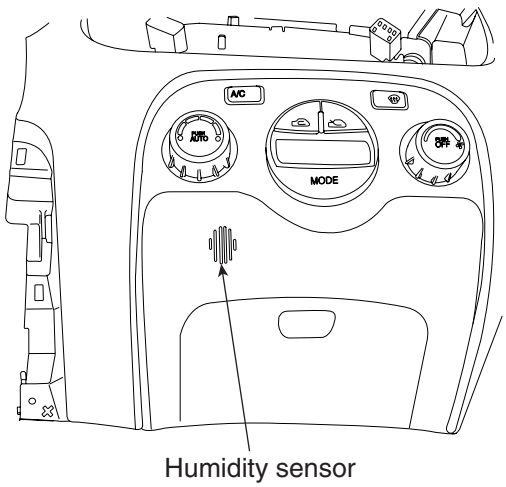
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

CODE 24 : HUMIDITY SENSOR SHORT (LOW) EC61FC3A

COMPONENT LOCATION



LQJF510A

GENERAL DESCRIPTION

Humidity sensor located at center facia panel, detects in-car humidity for in-car humidity control. If ambient air temperature or in-car humidity is outside certain range, it will turn on A/C to control in-car humidity for preventing in-car fogging. Air conditioner operation depends on ambient temperature and humidity.

CODE DESCRIPTION

The Heater & A/C controller sets code 24 if there is a open circuit or a short with ground circuit in humidity sensor signal harness.

CODE DETECTING CONDITION

Item	Detecting Condition	Possible cause
CODE Strategy	• Frequency check	• Open Circuit in harness • Short Circuit in signal harness • Faulty Humidity Sensor • Faulty Heater & A/C controller
Threshold value	• When maintain 0 voltage	
Detecting time	• 0.3 sec	
Fail safe	• Control with the value of 10%	

SPECIFICATION

Relative humidity(%)	Frequency(Hz)	Relative humidity(%)	Frequency(Hz)
10	7,224	55	6,664
15	7,162	60	6,600
20	7,100	65	6,534
25	7,038	70	6,468
30	6,976	75	6,399
35	6,915	80	6,330
40	6,853	85	6,258
45	6,791	90	6,186
50	6,728	95	6,110

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals.
   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

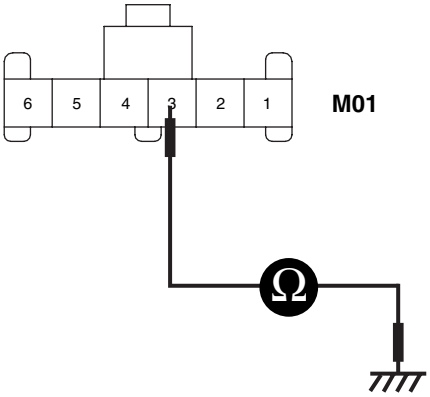
1. Check for short to ground in harness.

   1) Ignition "OFF"

   2) Disconnect Humidity Sensor connector.

3) Measure resistance between terminal "3" of Humidity Sensor and chassis ground.

Specification : Approx. ∞ Ω



AQJF511B

4) Is the measured resistance within specifications?

YES

Go to "Component Inspection " procedure.

NO

Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

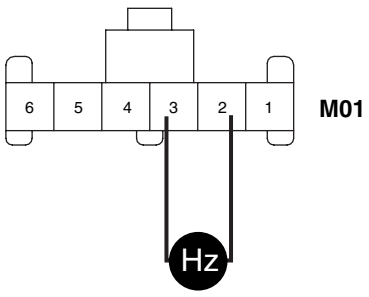
COMPONENT INSPECTION

1. Check Humidity Sensor.

1) Engine "ON"

2) Connect Humidity Sensor connector.

3) Measure Frequency between terminal "3" and "2" of Humidity sensor while increasing humidity.



AQJF510E

SPECIFICATION

Relative humidity(%)	Frequency(Hz)	Relative humidity(%)	Frequency(Hz)
10	7,224	55	6,664
15	7,162	60	6,600
20	7,100	65	6,534
25	7,038	70	6,468
30	6,976	75	6,399
35	6,915	80	6,330
40	6,853	85	6,258
45	6,791	90	6,186
50	6,728	95	6,110

4) Is the measured frequency within specifications? (tolerance limits ± 5%)

YES

Go to "Check Heater & A/C controller" procedure.

NO

Substitute with a known-good Humidity sensor and check for proper operation.
If the problem is corrected, replace Humidity sensor and then go to "Verification of Vehicle Repair" procedure.

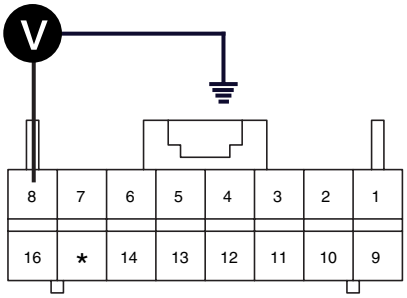
2. Check Heater & A/C controller

   1) Engine "ON"

   2) Disconnect Humidity Sensor connector.

   3) Measure voltage value between terminal "8" of Heater & A/C controller and chassis ground.

Specification : 5V



M16-2

AQJF510G

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good Heater & A/C controller and check for proper operation.
If the problem is corrected, replace Heater & A/C controller and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Operate self-diagnosis test. If there are fault codes, clear the codes.

2. Operate the vehicle and monitor the fault codes on the display panel.

3. Are any fault codes present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.