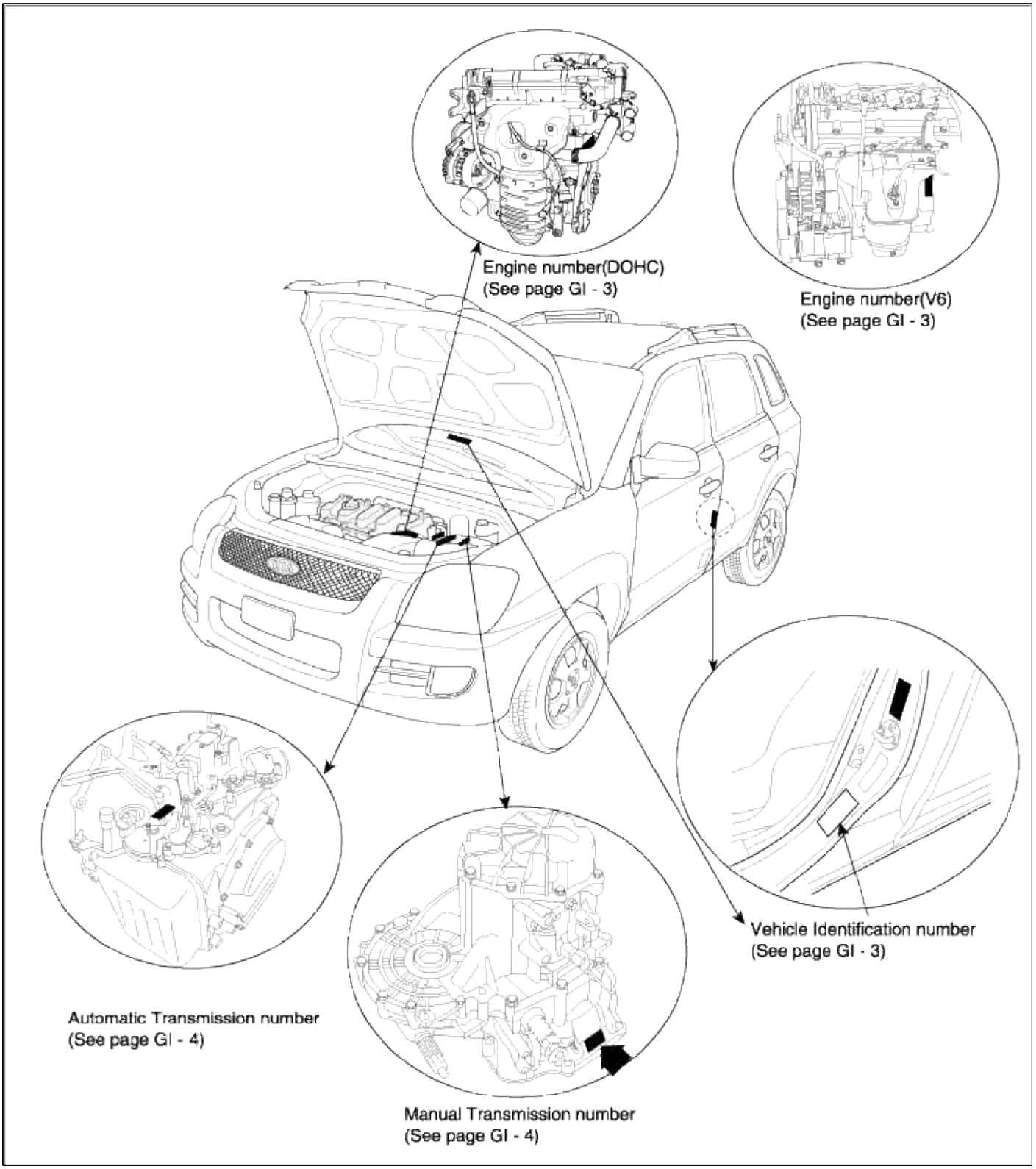
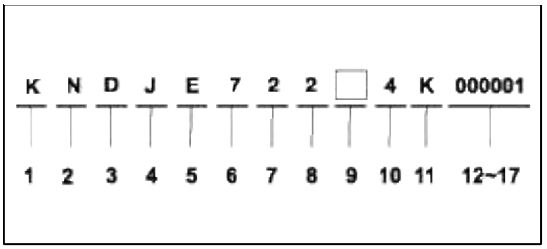
SPORTAGE(KM) > 2007 > G 2.0 DOHC > General Information

General Information > General Information > General Information

IDENTIFICATION NUMBER LOCATIONS



IDENTIFICATION NUMBER DESCRIPTION
VEHICLE IDENTIFICATION NUMBER

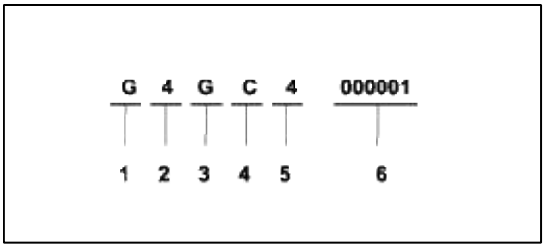


1 - 3 : Make / Vehicle type
- KND = Kia MPV
4 - 5 : Vehicle Line /Series
- JE = SPORTAGE 4x4
- JF = SPORTAGE 4x2
6 - 7: Body type
- 72 = 4Door Sport Utility Vehicle & GVW 1821 ~ 2270kg
8 : Engine type
- 2 = 2.0 Gasoline (G4GC) (Federal)
- 3 = 2.7 Gasoline (G6BA)
- 4 = 2.0 Gasoline (G4GC) (California)
9 : Transmission type
- Check digit
10 : Model year
- 4 = 2004, 5 = 2005
11 : Plant location
- K = Kwang-ju plant
12 - 17 : Sequential number
- 000001 ~ 999999

PAINT CODE

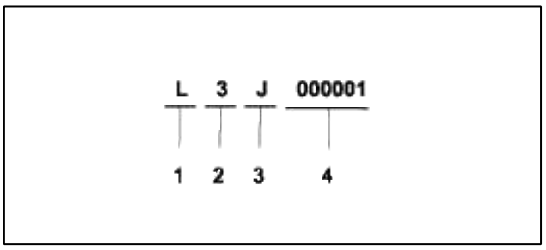
CODE	COLOR
UD	Clear White
S4	Grayish Silver
S6	Satin Silver
Y3	Greenish Gold
9L	Natural Oliv
1L	Vert Jade Pearl
K6	Smart Blue
3P	Volcanic Red
6D	Smokey Brown
9D	Black Cherry

ENGINE IDENTIFICATION NUMBER



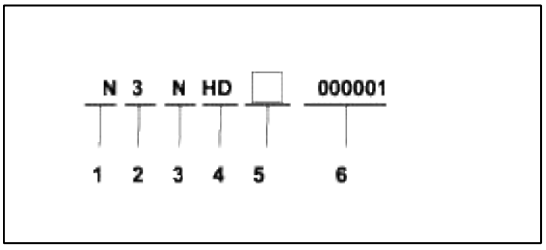
1. Engine fuel
   - G : Gasoline
2. Engine range
   - 4 : 4 cycle 4 cylinder
   - 6 : 4 cycle 6 cylinder
3. Engine development order
   - B : DELTA Engine
   - G : BETA Engine
4. Engine capacity
   - A : 2656cc (Gosoline)
   - C : 1975 cc (Gasoline)
5. Production year
   - 4 : 2004, 5 : 2005, 6 : 2006
6. Engine production sequence number
   - 000001 ~ 999999

TRANSMISSION IDENTIFICATION NUMBER
MANUAL



1. Model
   - L : M5GF1
2. Production year
   - 4 : 2004, 5 : 2005, 6 : 2006, 7 : 2007
3. Gear ratio
   - H : 4.063
   - J : 4.533
4. Transaxle production sequence number
   - 000001 ~ 999999

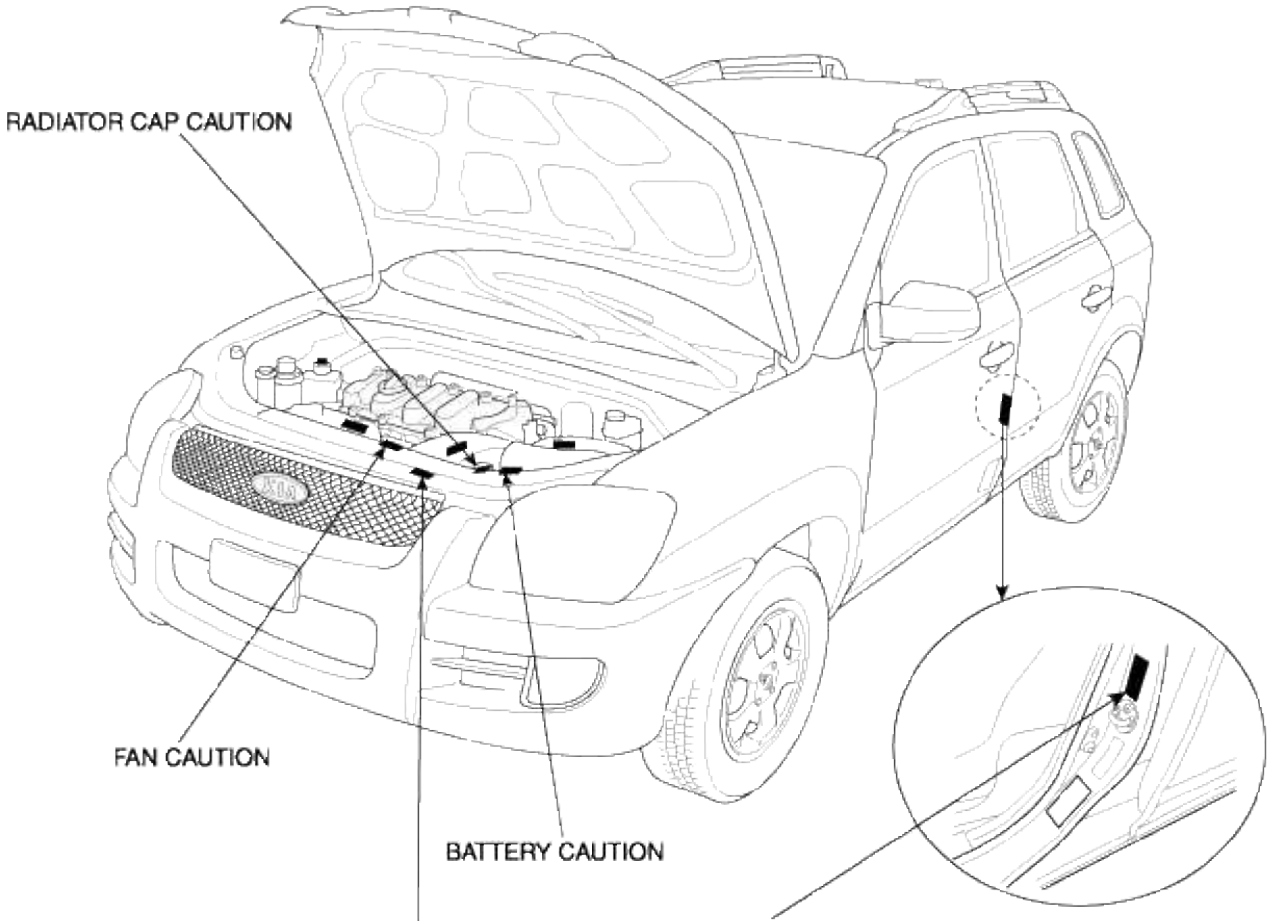
AUTOMATIC



1. Modle
   - N : F4A42-2
2. Production year
   - 4 : 2004, 5 : 2005, 6 : 2006, 7 : 2007
3. Gear ratio
   - N : 4.042
   - O : 4.407
   - R : 4.626

4. Detailed chassification
   - AD : 2.0 2WD
   - BD : 2.0 4WD
   - FD : 2.7 4WD
   - HD : 2.7 2WD
   - ID : 2.0 DSL 2WD + LSD
   - JD : 2.0 DSL 4WD
   - KD : 2.0 DSL 2WD
5. Spare
6. Transaxle production sequence number
   - 000001 ~ 999999

WARNING / CAUTION LABEL LOCATIONS



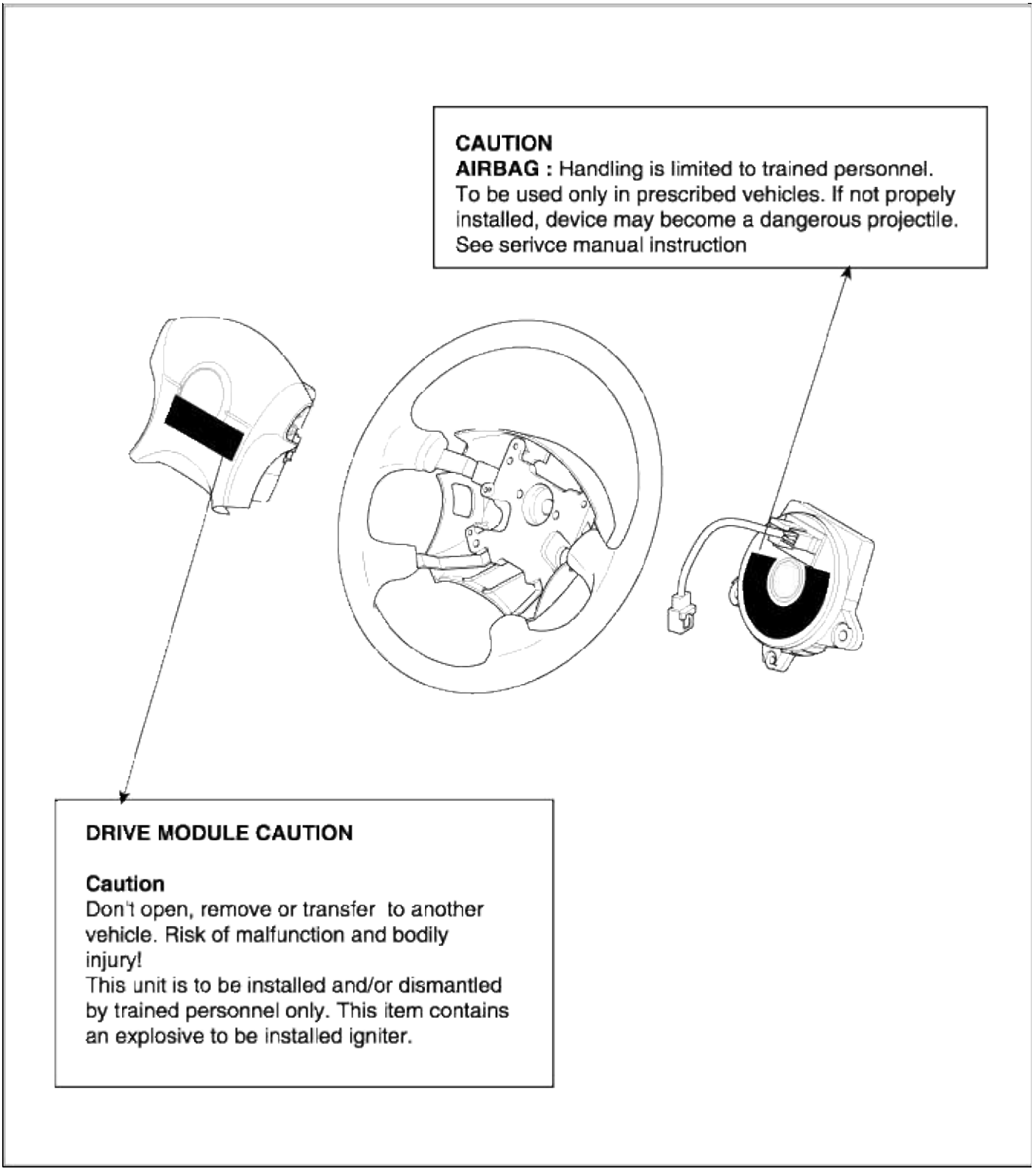
SIDE AIRBAG INFORMATION

ATTENTION

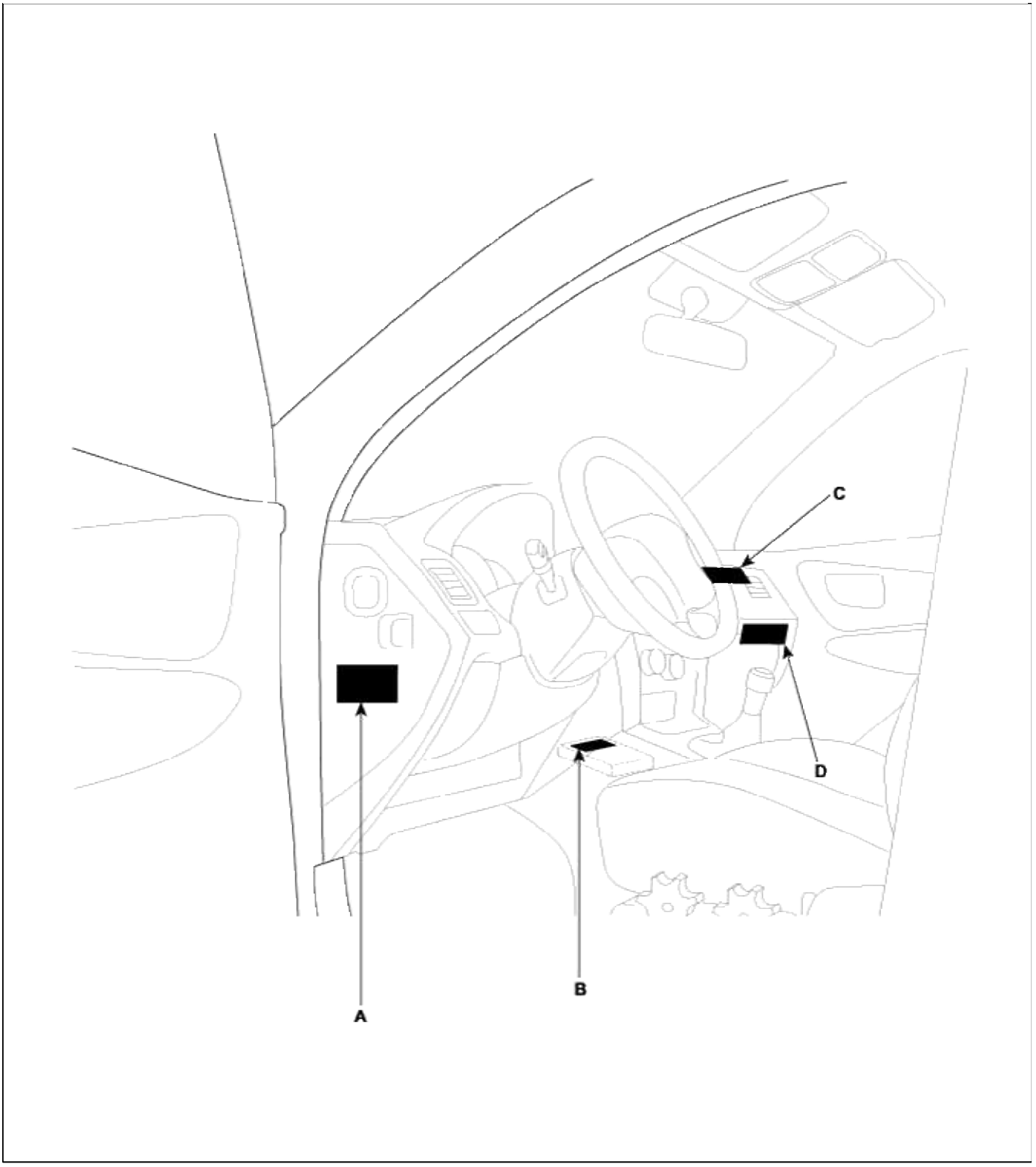
SRS VEHICLE
THIS CAR IS EQUIPPED WITH A SUPPLEMENTAL RESTRAINT SYSTEM. TO PROVIDE CONTINED RELIABLITY, CERTAIN ELEMENTS OF THE SUPPLEMENTAL RESTRAINT SYSTEM SHALL BE SERVICED OR REPLACED BY AUTHORIZED DEALER TEN YEARS AFTER VEHICLE LABEL. FOR FURTHER INFORMATION. SEE OWNER'S MANUAL.

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.

AIR BAG WARNING / CAUTION LABEL



AIR BAG WARING / CAUTION LABEL (CONT'D)



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 seat.
- 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.

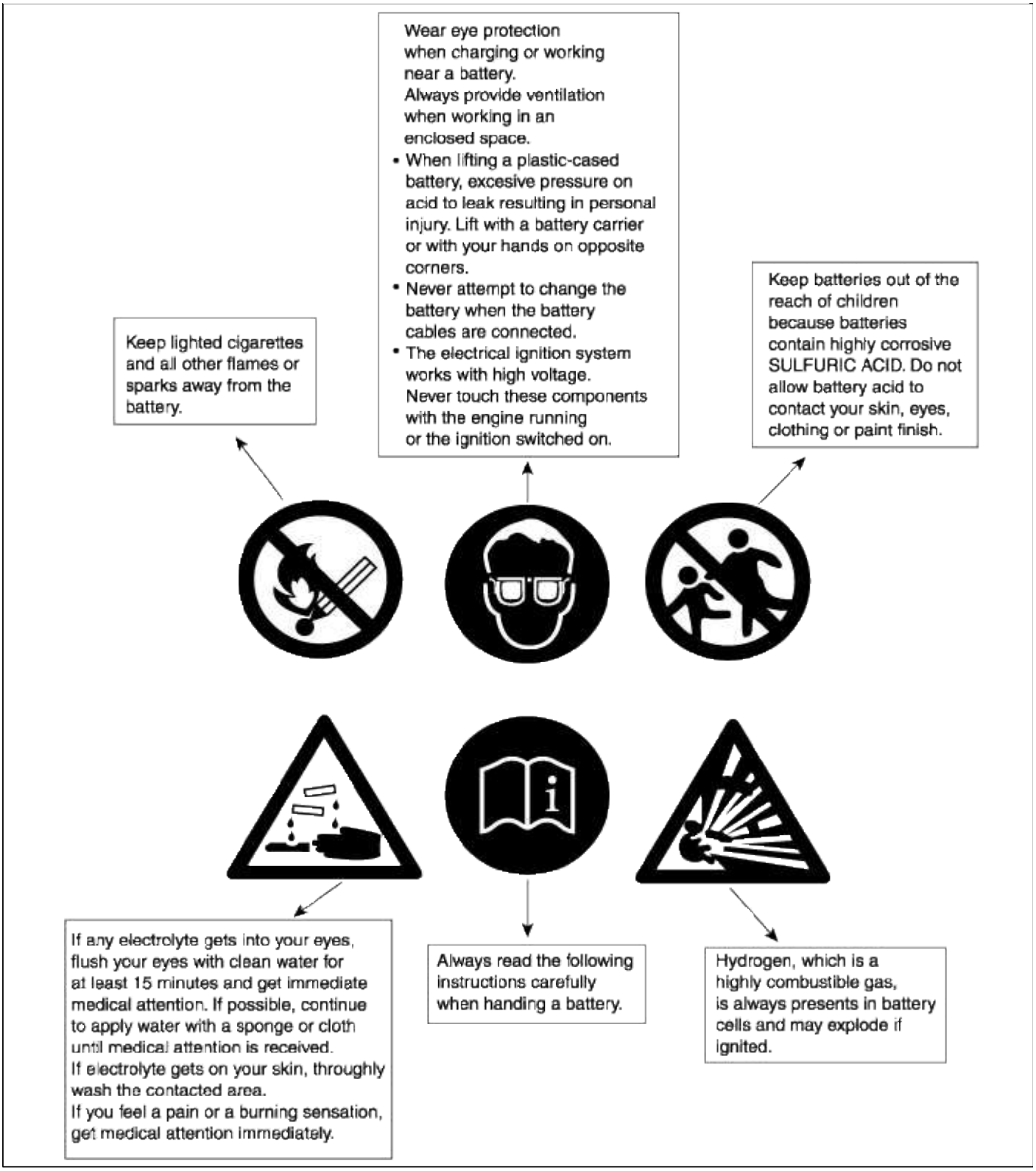
D : SUPPLEMENTAL RESTRAINT SYSTEM (AIRBAG) INFORMATION

- 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



LIFT AND SUPPORT POINTS

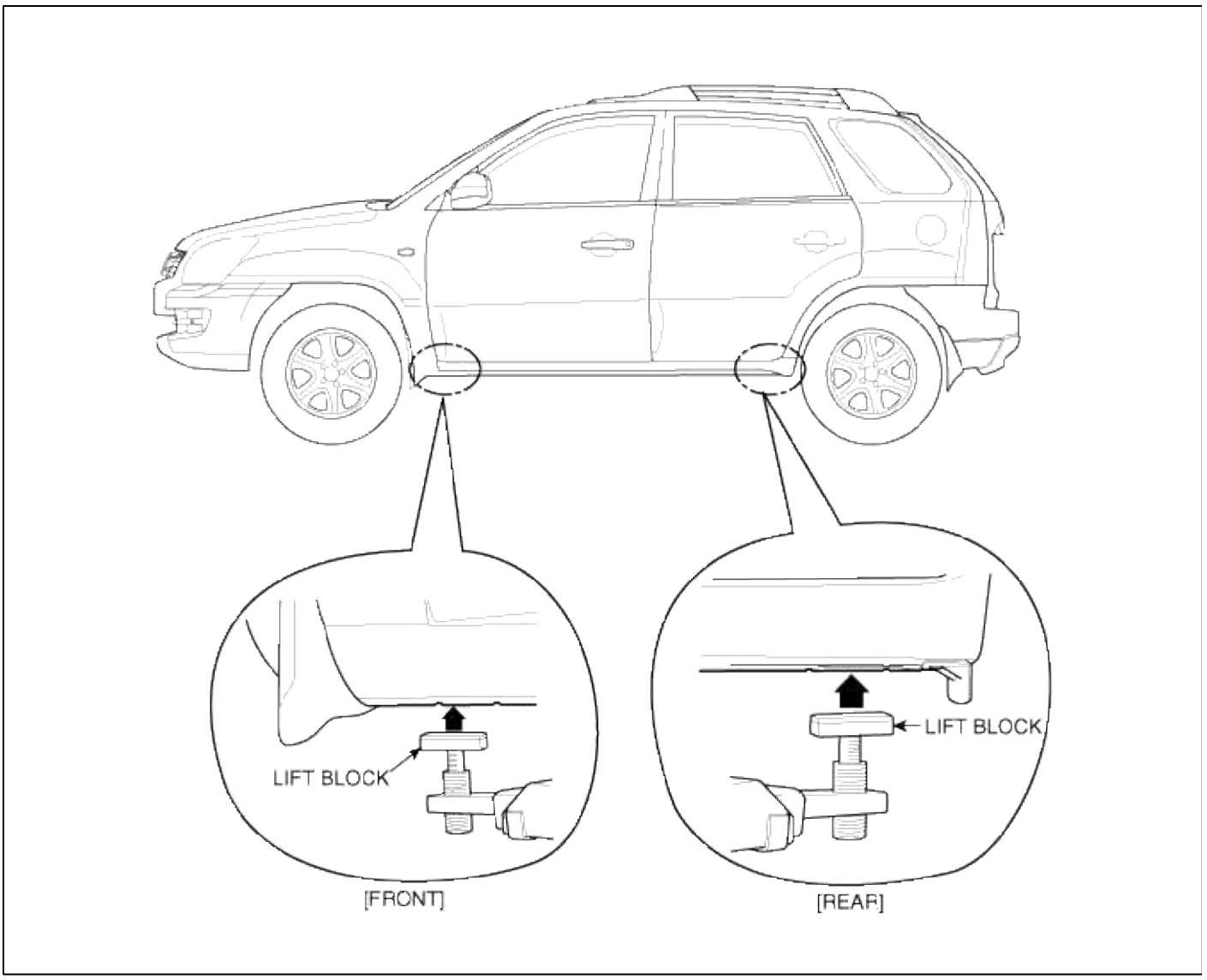
WARNING

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

NOTE

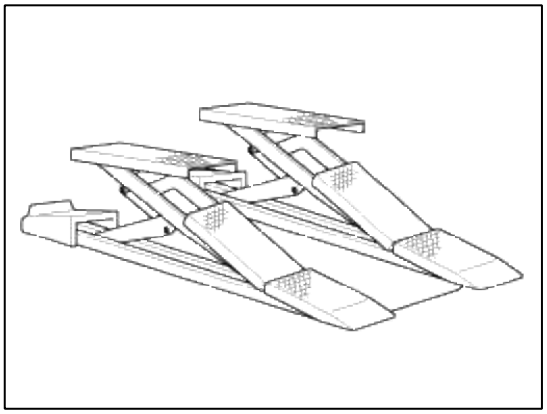
- Since each tire/wheel assembly weights approximately 30lbs (14kg), placing the front wheels in the luggage area can assist with the weight distribution.
- Use the same support points to support the vehicle on safety stands.

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.

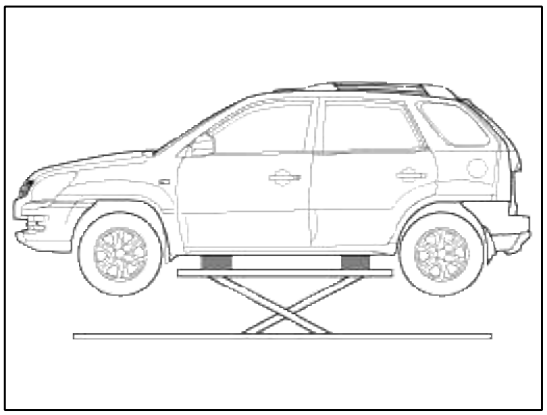


1.

WARNING



Fuel tank cauld be damaged or broken when using the lift in the illustration above. So, install the rubber or wooden block on the position supporting the lift and then lift up the vehicle.
Minimum height of the block is 8cm.



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.

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

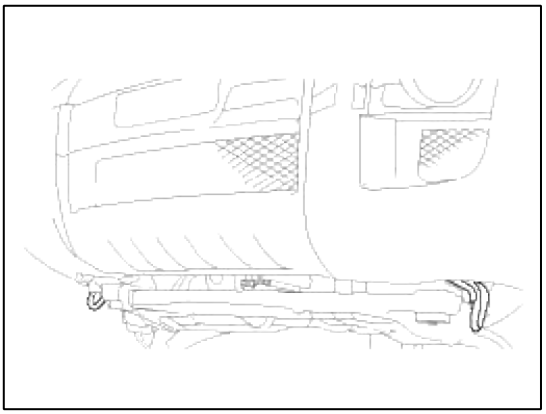
- Release the parking brake.
- Start the engine.
- Shift to [D] position, then [N] position.

- Turn off the engine.

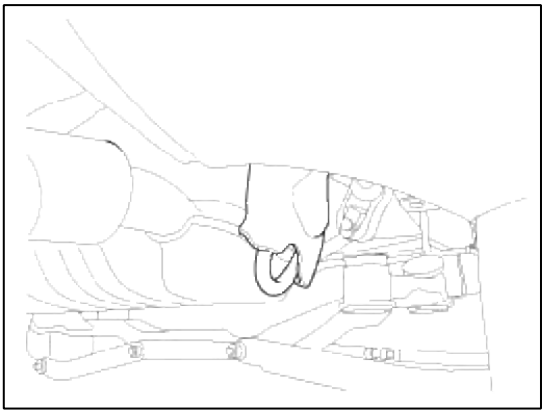
CAUTION

- 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.

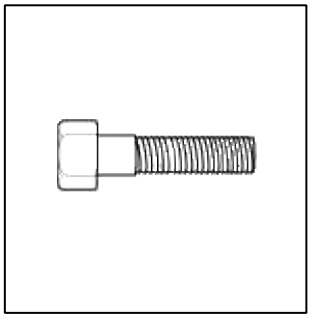
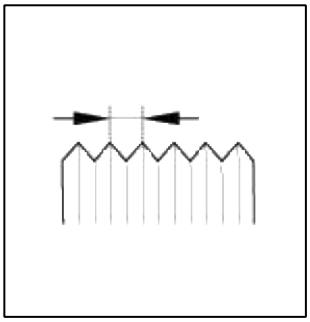
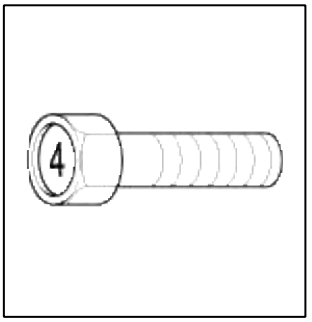
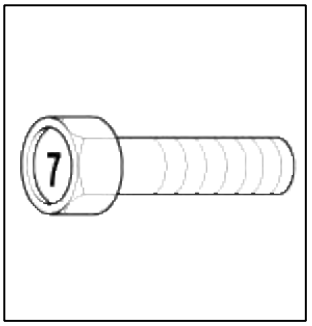
Front :



Rear :



TIGHTENING TORQUE TABLE OF STANDARD PARTS

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kg.cm, lb.ft)	
		Head Mark 4	Head Mark 7
			
M5	0.8	3 ~ 4 (30 ~ 40, 2.2 ~ 2.9)	5 ~ 6 (50 ~ 60, 3.6 ~ 4.3)
M6	1.0	5 ~ 6 (50 ~ 50, 3.6 ~ 4.3)	9 ~ 11 (90 ~ 110, 6.5 ~ 8.0)
M8	1.25	12 ~ 15 (120 ~ 150, 9 ~ 11)	20 ~ 25 (200 ~ 250, 14.5 ~ 18.0)
M10	1.25	25 ~ 30 (250 ~ 300, 18 ~ 22)	30 ~ 50 (300 ~ 500, 22 ~ 36)
M12	1.25	35 ~ 45 (350 ~ 450, 25 ~ 33)	60 ~ 80 (600 ~ 800, 43 ~ 58)
M14	1.5	75 ~ 85 (750 ~ 850, 54 ~ 61)	120 ~ 140 (1,200 ~ 1,400, 85 ~ 100)
M16	1.5	110 ~ 130 (1,100 ~ 1,300, 80 ~ 94)	180 ~ 210 (1,800 ~ 2,100, 130 ~ 150)
M18	1.5	160 ~ 180 (1,600 ~ 1,800, 116 ~ 130)	260 ~ 300 (2,600 ~ 3,000, 190 ~ 215)
M20	1.5	220 ~ 250 (2,200 ~ 2,500, 160 ~ 180)	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)
M22	1.5	290 ~ 330 (2,900 ~ 3,300, 210 ~ 240)	480 ~ 550 (4,800 ~ 5,500, 350 ~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

NOTE

1. The torques shown in the table are standard values under the following conditions :
   - Nuts and bolts are made of galvanized steel bar.
   - Galvanized plain steel washers are inserted.
   - All nuts, bolts and plain washers are dry.
2. The torques shown in the table are not applicable :
   - When spring washers, toothed washers and the like are inserted.
   - If plastic parts are fastened.
   - If self-tapping screws or self-locking nuts are used.
   - If threads and surfaces are coated with oil.
3. 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	Gasoline	API SL(SJ) or ABOVE, ILSAS GF-3 and ABOVE
	Disesl	API CF -4 or ABOVE, ACEA B4 OR ABOVE
Transaxle	Manual	GENUINE PART MTF 75W/90 (API GL - 4)
	Auto	DIAMOND ATF SP-III, SK ATF SP-III
Power Steering		PSF -3
Brake Steering		DOT 3, DOT 4 or equivalent
Coolant		Ethlyene glycol base for aluminum radiator
Transaxle linkage, parking breake cable mechanism, hood, door latch, seat adjuster, tailgate latch, door hinges, tailgate hinge		Multipurpose grease NIGL grade #2

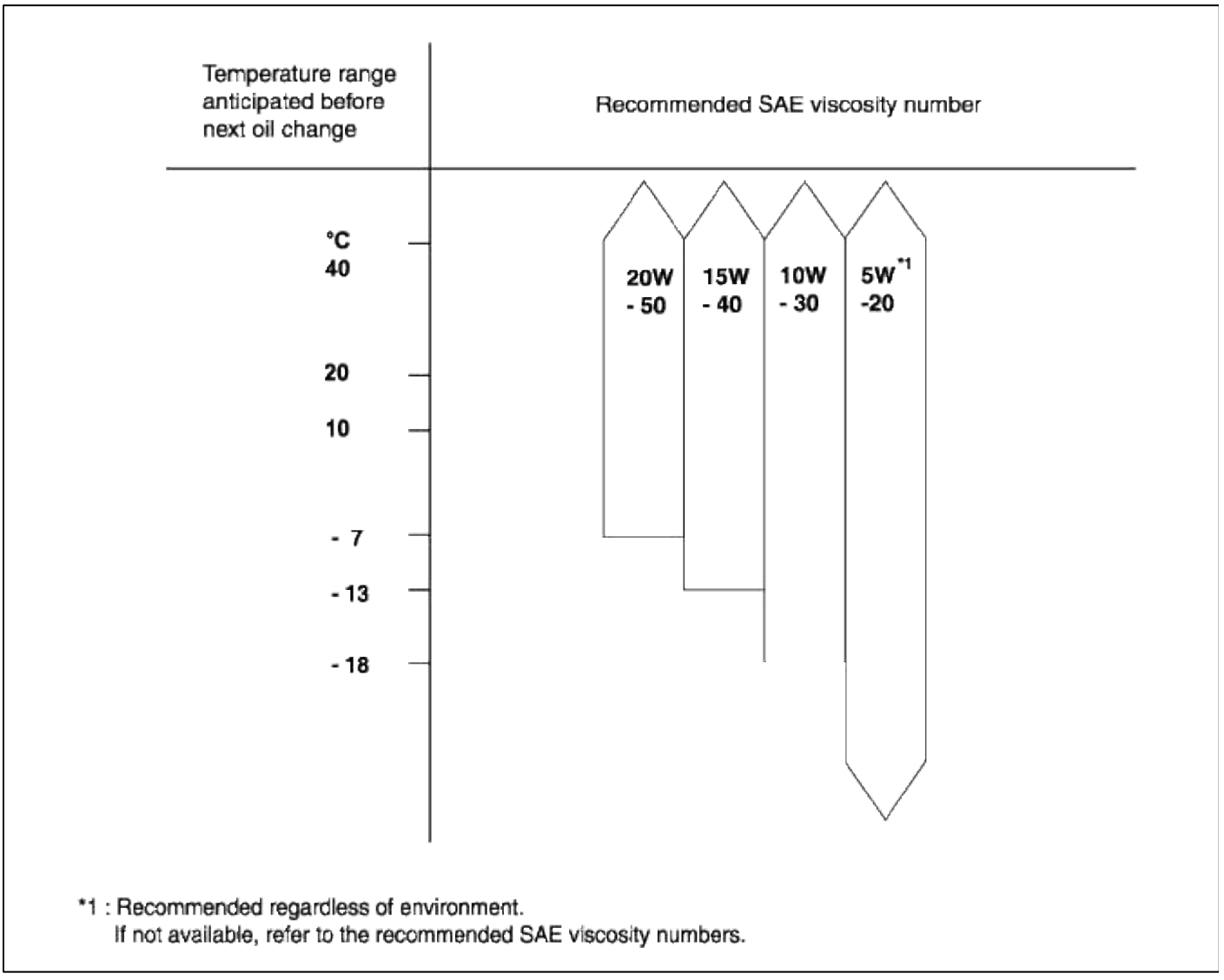
WARNING

Always use Genuine Kia motors parts and recommedended fluid.
Using any other type of parts and fluid can cause serious damage to vehicle.

LUBRICANTS CAPACITIES

Description		2.7	2.0
Engine oil	Oil pan	4.2 (4.44, 3.70)	3.7 (3.90, 3.26)
	Oil filter	0.3 (0.32, 0.26)	0.3 (0.32, 0.26)
	Total	4.5 (4.75, 3.96)	4.0 (4.23, 3.52)
Cooling system		7.8 (8.2, 6.8)	6.0 (6.4, 5.31)
Manual transaxle		2.15 (2.3, 1.86)	2.15 (2.3, 1.86)
Automatic transaxle		7.8 (8.2, 6.8)	7.8 (8.2, 6.8)
Power steering		0.9 (0.95, 0.79)	0.9 (0.95, 0.79)

Capacities : [liter (U.S.qts, Imp.qts)]
SELECTION OF ENGINE OIL (Gasoline)
RECOMMENDED ILSAC classification : GF-3 OR ABOVE
RECOMMENDED API classification : SL(SJ) OR ABOVE
RECOMMENDED SAE viscosity grades :



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.
3. 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

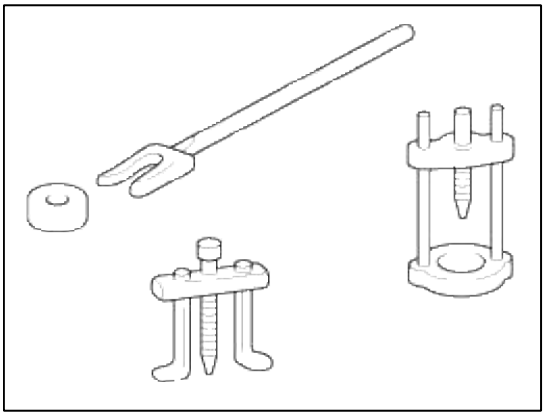
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched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

PREPARATION OF TOOLS AND MESURING EQUIPMENT

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

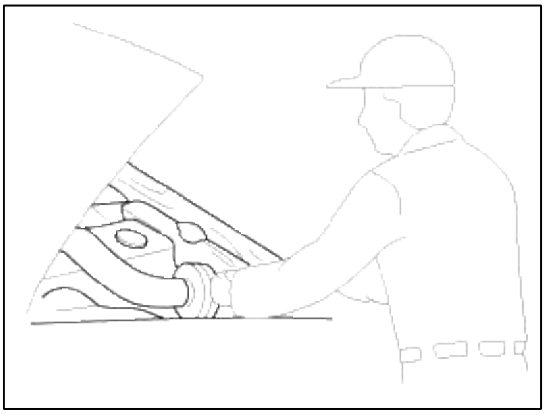
SPECIAL TOOLS

Use special tools when they are required.



REMOVAL OF PARTS

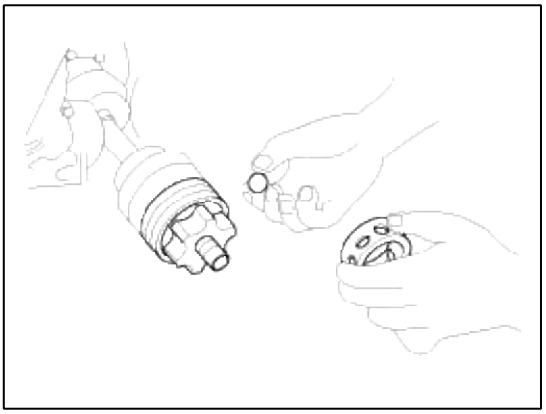
First find the cause of the problem and then determine whether removal or disassembly before starting the job.



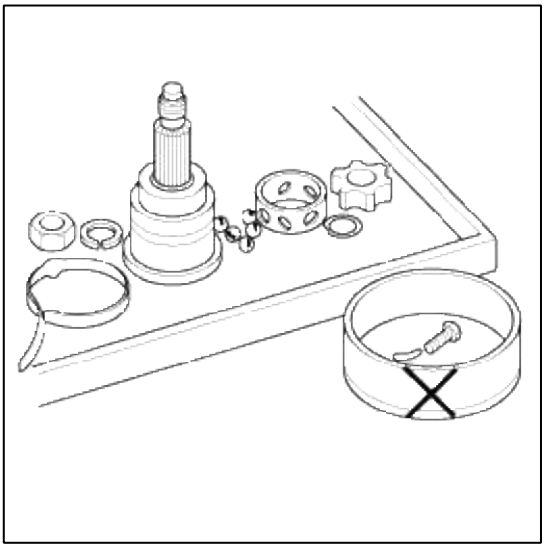
DISASSEMBLY

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

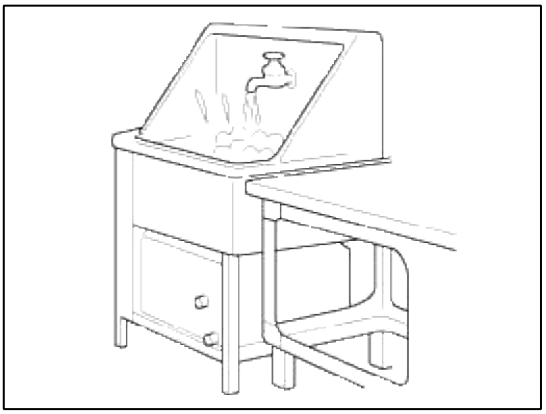
1. **Inspection of parts**
   Each part, when removed, should be carefulley on spected for malfunction, deformation, damage, and other problems.



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



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



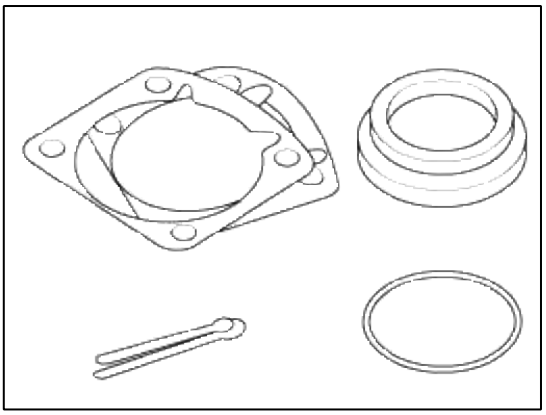
PARTS
When replacing parts, use KIA MOTORS genuine parts.

REPLACEMENT

Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.

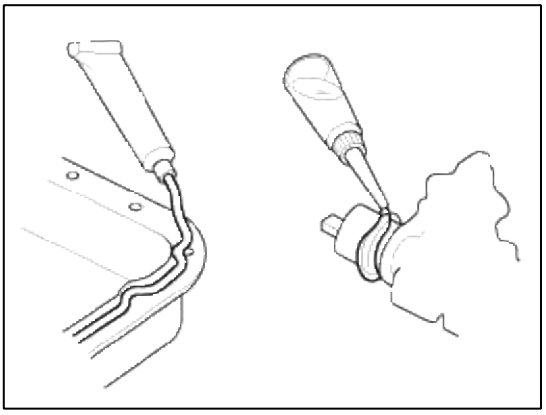
If removed, the following parts should always be replaced with new ones.

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



Depending on their location.

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

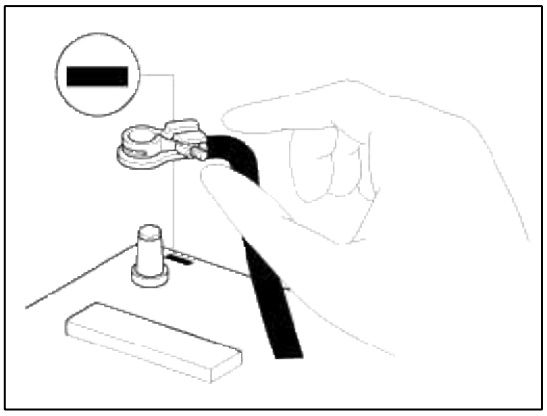


ADJUSTMENT

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

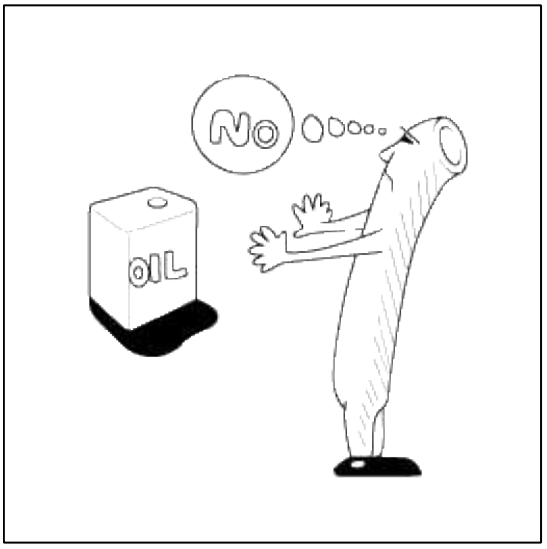
ELECTRICAL SYSTEM

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.



RUBBER PARTS AND TUBES

Always prevent gasoline or from touching rubber parts or tubing.



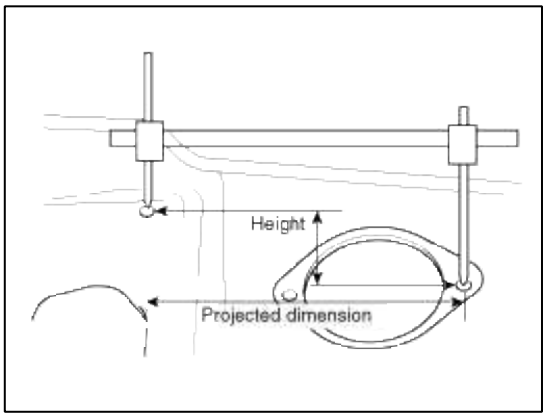
MEASURING BODY DIMENSIONGS

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

DIMENSIONS PROJECTED

1. These are the dimensions measured when the measurement points are projected from the vehicle's surface, and are the reference dimensions used for used for body alterations.

2. If the length of the tracking gauge probes is adjustable, measure it by lengthening one of two probes as long as the different value in height of the two surface.

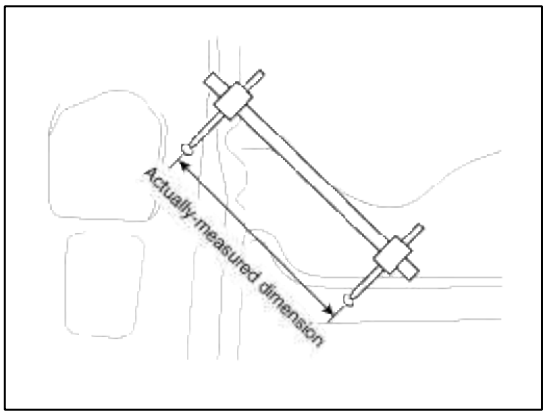


MEASURING ACTUAL DIMENSIONS

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

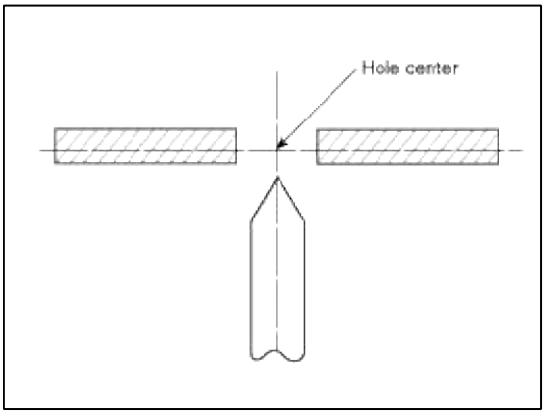
NOTE

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



MEASUREMENT POINT

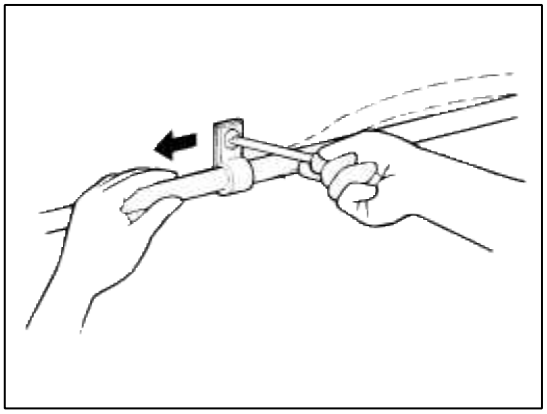
Measurements should be taken at the center fo the hole.



CHECKING CABLES AND WIRES

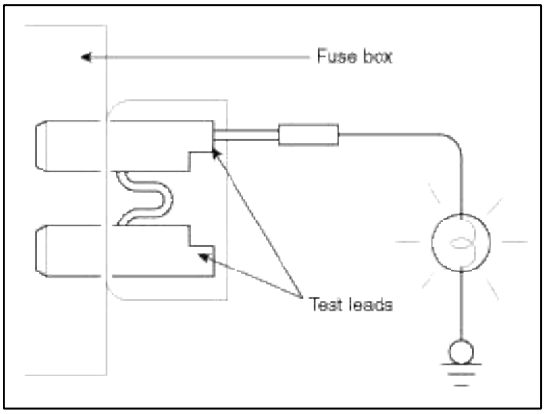
1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open corcuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic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

6. Check grounded parts to verify that there is complete continuity between thier 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 firmy to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vehicle body and the engine.



CHECK FUSES

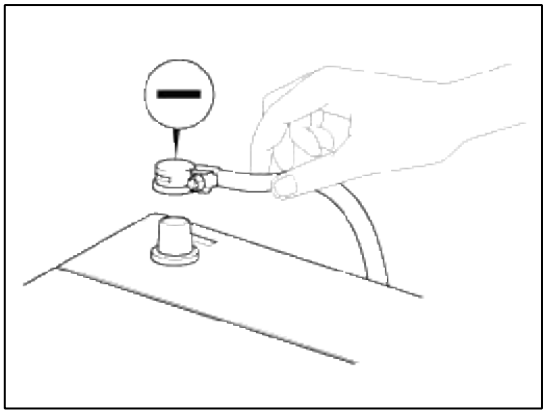
A blade type fuse test taps provided to allow checking the fuse itself without removing if from the fuse box. The fuse is good if the test lamp lights up when one lead is connected to the test taps (one at a time) and the other lead is grounded. (Turn the ignition switch so that the fuse circuit becomes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



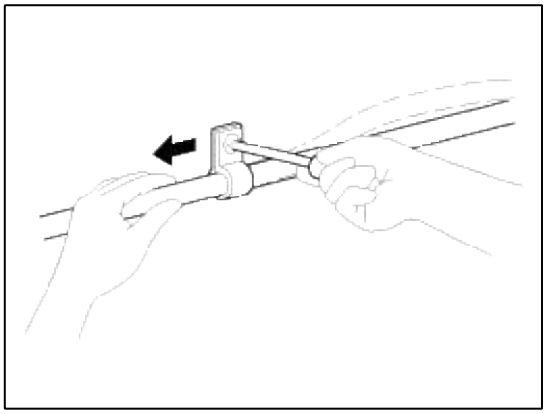
SERIVICING THE ELECTRICAL SYSTEM

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

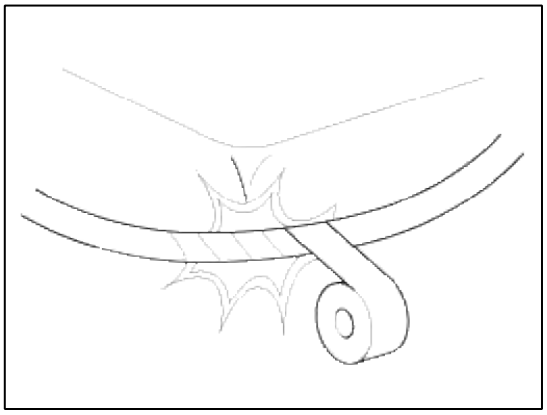
> NOTE
>
> In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained by the computer will be cleared. There fore, if necessary, read the diagnostic before removing the battery cable.



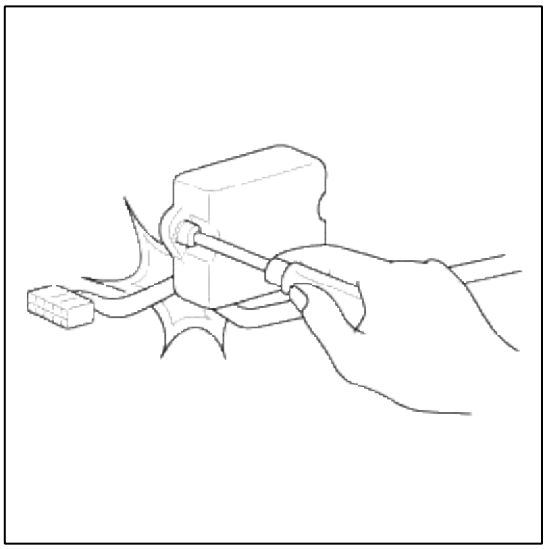
2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surronding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



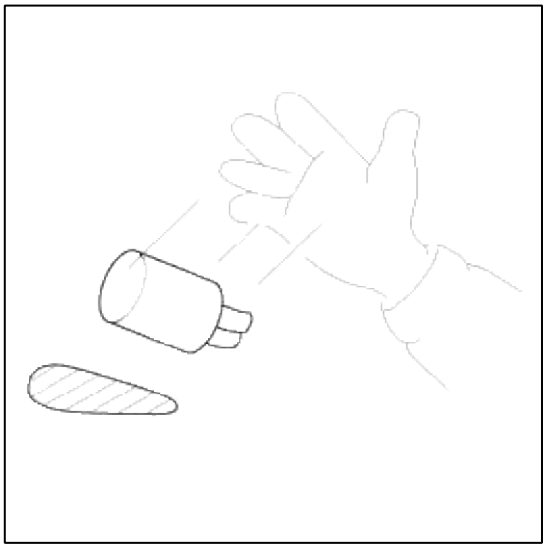
3. If any section of a wiring harness interferes with the edge of a parts, or a corner, wrap the section of the harness with tape or something similar in order to protect if from damage.



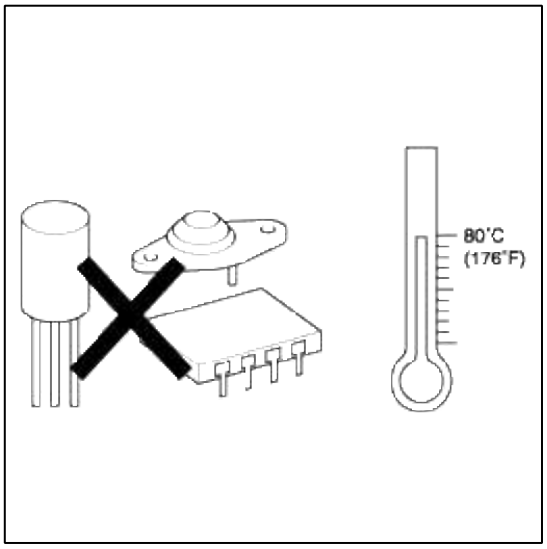
4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



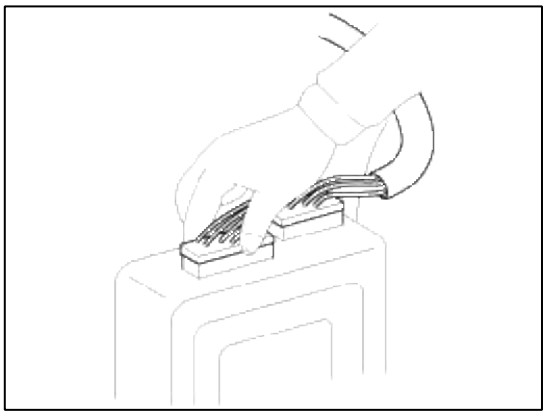
5. Never throw relays, sensors or electrical parts, or expose them to strong shock.



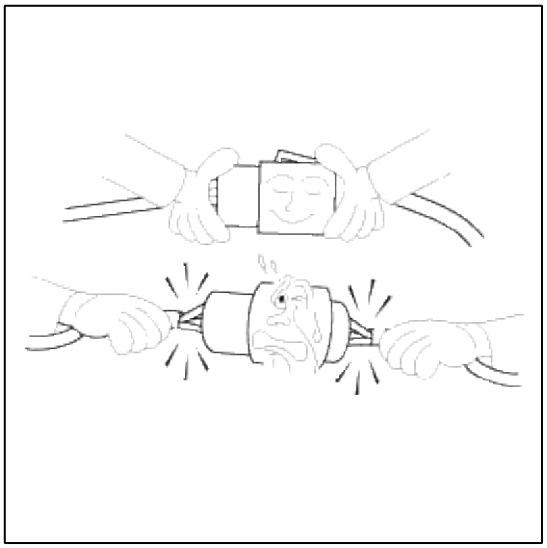
6. The electronlic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80°C (176°F), remove the electronic parts before hand.



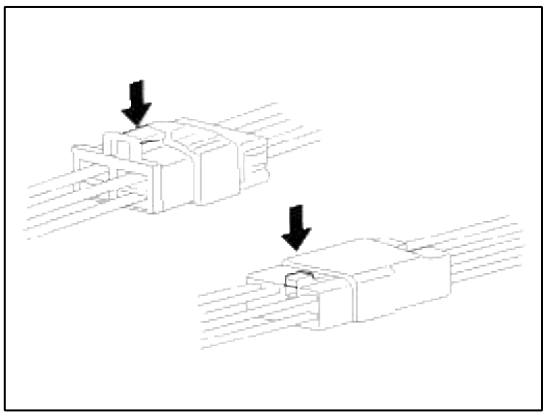
7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.



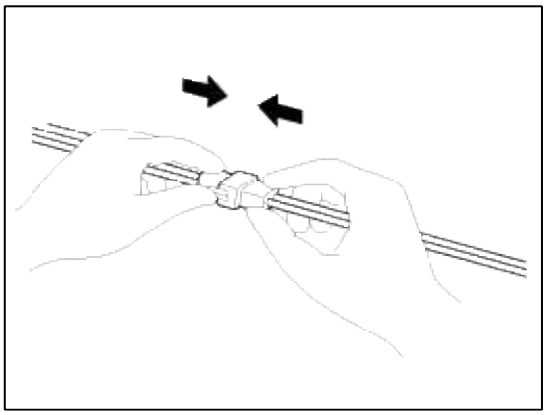
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



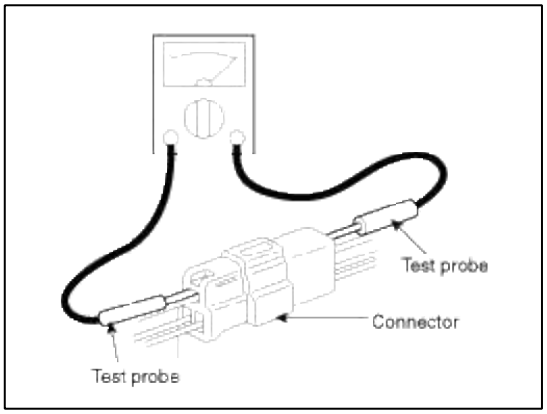
9. Disconnect connector which have catches by pressing in the direction of the arrows shown the illustration.



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



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



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

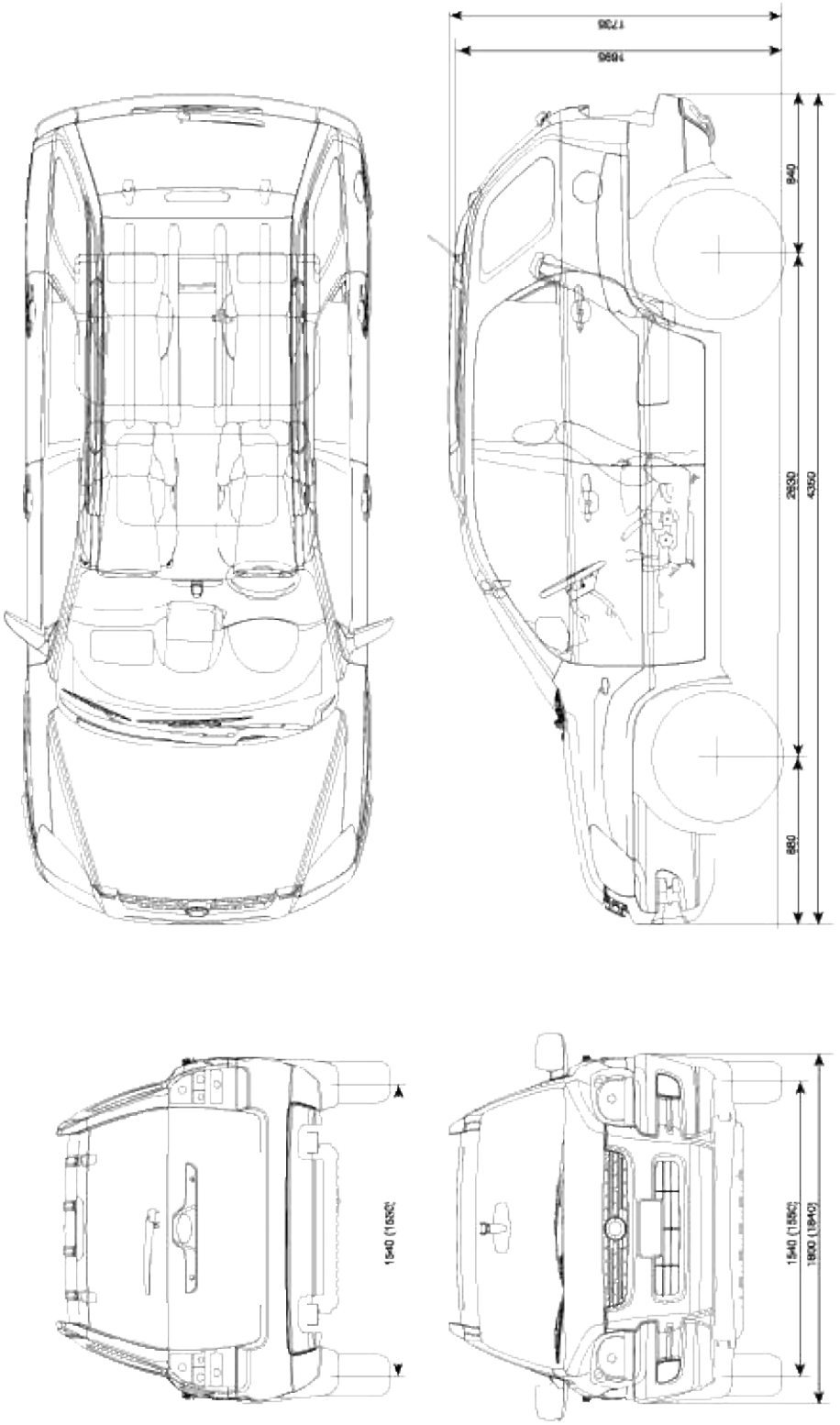
PRECAUTIONS FOR CATALYTIC CONVERTER

CAUTION

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

1. Use only unleaded gasoline.
2. Do not run the engine while the car is at rest for a long time. Avoid running the engine at fast idle for more than 10minutes and idle speed for more than 20 minutes.
3. 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



Unit : mm

MAINTENANCE SCHEDULE
SCHEDULE 1 - NORMAL MAINTENANCE

MAINTENANCE INTERVALS / MAINTENANCE ITEM		Number of months or Miles (kilometers), whichever comes first													
	Monhs	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105
	miles x 1,000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105
	(km x 1,000)	(12)	(24)	(36)	(48)	(60)	(72)	(84)	(96)	(108)	(120)	(132)	(144)	(156)	(168)
Drive belts *1	2.0L	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	2.7L				I				I				I		
Engine oil and engine oil filter		Replace every 7,500 miles or 12 months													
Manual transaxle fluid			I		I		I		I		I		I		I
Auto transaxle fluid			I		I		I		I		I		I		I
Transfer case fluid (4WD) *2		Inspect every 25,000 miles and replace every 60,000 miles													
Rear differential fluid (4WD) *2		Inspet every 25,000 miles													
Propellar shaft clean, bolt retighten(4WD)			I		I		I		I		I		I		I
Engine timing belt					I				R				I		
Air cleaner element		I	I	R	I	I	R	I	I	R	I	I	R	I	I
Spark plugs	2.0L (Platinum coated)								R						
	2.7L (Iridium coated)	Replace every 100,000 miles or 10 years													
Valve clearance	2.0L	Inspect every 60,000 miles or 48 months													
Water pump		Inspect when replacing the drive belt or timing belt													
Engine coolant *3		At first, replace at 60,000 miles or 60 months ; after that, replace every 30,000 miles or 24 months													
Fuel filter						R					R				
Fuel tank, cap, lines and hoses		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Vaccum and crankcase ventilation hoses					I				I				I		
Air filter for EVAP canister		Inspect every 30,000 miles or 24 months													
Battery condition			I		I		I		I		I		I		I
Brake lines, hoses and connections			I		I		I		I		I		I		I
Brake pedal		Inspect frequently depending on the condition													
Parking brake			I		I		I		I		I		I		I
Disc brakes and pads		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Drum brakes and linings		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Exhaust pipe and muffler			I		I		I		I		I		I		I
Throttle body cleaning (with removing carbon) *4		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Brake/clutch fluid			I		I		I		I		I		I		I
Power steering fluid		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Steering operation, linkage and hoses		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Front suspension ball joints					I				I				I		
Driveshaft and boots		Inspect every 15,000 miles or 12 months													
Driveshaft u-joints			I		I		I		I		I		I		I
Tire	Pressure	Please refer to SS Gr.													
	Tread wear	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Chassis/body nuts and bolts					I				I				I		
All locks and hinges		L	L	L	L	L	L	L	L	L	L	L	L	L	L
Air conditioner refrigerant *		Inspect refrigerant amount annually													
Air conditioner compressor *		Inspect operation annually													
Air conditioner air filter *		Replace every 10,000 miles													

I : Inspect and, if necessary, adjust, correct, clean or replace.
R : Replace or change. L : Lubricate. * If equipped
*1 : The drive belt should be replaced when cracks occur or tension is reduced excessively.
*2 : Transfer case fluid and rear differential fluid should be changed anytime they have been submerged in water.
*3 : Coolant level adjustment and leak : Inspect regularly.
*4 : Be careful not to damage to the emission control system when cleaning the throttle body.

SCHEDULE 2 - SEVERE MAINTENANCE

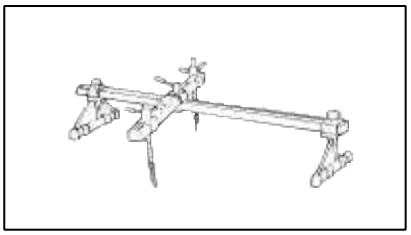
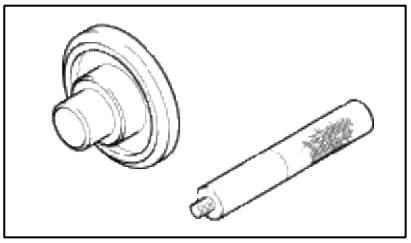
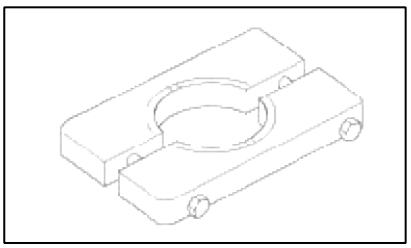
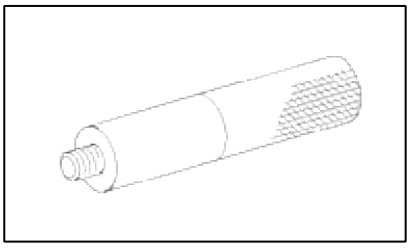
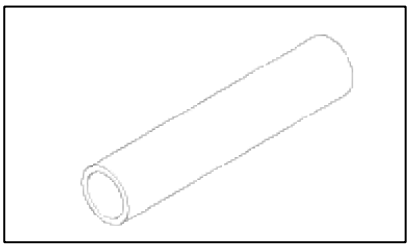
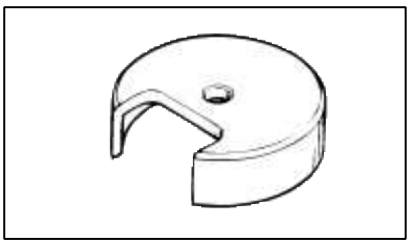
MAINTENANCE INTERVALS / MAINTENANCE ITEM		Number of months or Miles (kilometers), whichever comes first													
	Monhs	5	10	15	20	25	30	35	40	45	50	55	60	65	70
	miles x 1,000	5	10	15	20	25	30	35	40	45	50	55	60	65	70
	(km x 1,000)	(8)	(16)	(24)	(32)	(40)	(48)	(56)	(64)	(72)	(80)	(88)	(96)	(104)	(112)
Drive belts *1	2.0L	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	2.7L						I						I		
Engine oil and engine oil filter		Replace every 3,000 miles or 3 months													
Manual transaxle fluid			I		I		I		I		I		R		I
Auto transaxle fluid				I			R			I			R		
Transfer case fluid (4WD) *2						R					R				
Rear differential fluid (4WD) *2											R				
Propellar shaft clean, bolt retighten(4WD)				I			I			I			I		
Engine timing belt					I				R				I		
Air cleaner element		Inspect more frequently depending on the condition and if necessary, replace													
Spark plugs		Inspect more frequently depending on the condition and if necessary, replace													
Valve clearance	2.0L	Inspect every 60,000 miles or 48 month													
Water pump		Inspect when replacing the drive belt or timing belt													
Engine coolant *3		At first, replace at 60,000 miles or 60 months ; after that, replace every 30,000 miles or 24 months													
Fuel filter		Replace every 37,500 miles													
Fuel tank, cap, lines and hoses		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Vaccum and crankcase ventilation hoses		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Air filter for EVAP canister		Replace every 30,000 miles or 24 months													
Battery condition			I		I		I		I		I		I		I
Brake lines, hoses and connections		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Brake pedal		Inspect frequently depending on the condition													
Parking brake		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Disc brakes and pads		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Drum brakes and linings		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Exhaust pipe and muffler			I		I		I		I		I		I		I
Throttle body cleaning (with removing carbon) *4		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Brake/clutch fluid		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Power steering fluid		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Steering operation, linkage and hoses		I	I	I	I	I	I	I	I	I	I	I	I	I	I
Front suspension ball joints					I				I				I		
Driveshaft and boots		Inspect every 7,500 miles or 6 months													
Driveshaft u-joints			I		I		I		I		I		I		I
Tire	Pressure	Please refer to SS Gr.													
	Tread wear	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Chassis/body nuts and bolts					I				I				I		
All locks and hinges		L	L	L	L	L	L	L	L	L	L	L	L	L	L
Air conditioner refrigerant *		Inspect refrigerant amount annually													
Air conditioner compressor *		Inspect operation annually													
Air conditioner air filter *		Replace every 10,000 miles													

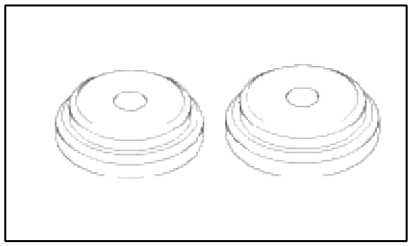
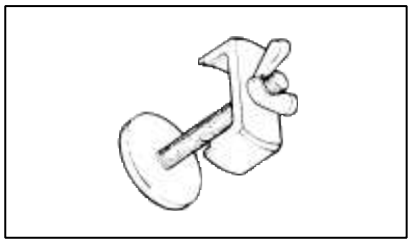
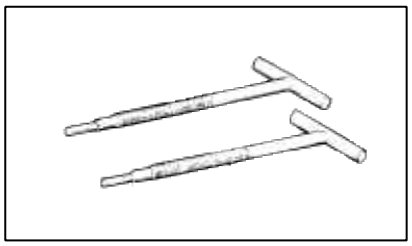
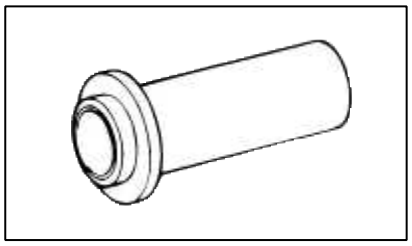
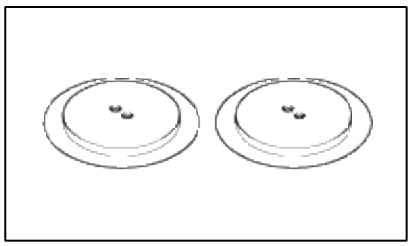
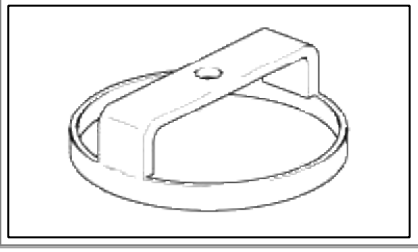
I : Inspect and, if necessary, adjust, correct, clean or replace.
R : Replace or change. L : Lubricate. * If equipped
*1 : The drive belt should be replaced when cracks occur or tension is reduced excessively.
*2 : Transfer case fluid and rear differential fluid should be changed anytime they have been submerged in water.
*3 : Coolant level adjustment and leak : Inspect regularly.
*4 : Be careful not to damage to the emission control system when cleaning the throttle body.

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Automatic Transaxle System

Automatic Transaxle System > General Information > Special Service Tools (F4A42-2)

SPECIAL TOOLS

TOOL (Number and name)	Illustration	Use
09200 - 38001 Engine support fixture		Removal and installation of transaxle.
09431-39000 Oil seal installer		Installation of differential oil seal.
09433-21000 Removing plate		1. Removal of transafer driven gear taper bearing (Use with 09432-33800). 2. Removal of differential ball bearing.
09500-11000 Bar		Installation of differential bearing outer race. (Use with 09532-11500)
09455-33200 Bearing installer		Installation of differential ball bearing and output shaft taper roller bearing.
09453-21100 Spring compressor		Removal and installation of the low and reverse brake snap ring (Use with 9453-21000).

09532-11500 Bearing installer		Installation of differential bearing outer race (Use with 09500-11000).
09453-21000 Snap ring / spring compressor		1. Removal and installation of low and reverse brake snap ring. 2. Removal and installation of overdrive clutch snap ring (Use with 09456-39000).
09452-33100 Oil pump remover		Removal of the oil pump.
09452-21200 Oil pump oil seal installer		Installation of the oil pump oil seal.
09456-39100 A/B Clearance dummy plate		Measurement of low and reverse brake and second brake end plays.
09456-39000 Spring compressor		Removal and installation of low and reverse brake or overdrive clutch snap ring.

Automatic Transaxle System > General Information > Specifications (F4A42-2)

SPECIFICATION

Item		F4A42	
Torque converter type		3-element, 1-stage, 2-phase type	
Transaxle type		4-speed forward, 1-speed reverse	
Engine displacement		2.0 GSL	2.7 GSL
Gear ratio	1st	2.842	2.842
	2nd	1.529	1.529
	3rd	1.000	1.000
	4th	0.712	0.712
	Reverse	2.480	2.480
Final gear ratio	2WD	4.626	4.042
	4WD	4.626	4.407
Shift pattern		Variable	
Shift range		4range (P-R-N-D) + Sports mode	
Shift range valve		PWM ; 5EA(Duty control)	
Stall speed		2.0(GSL) : 2400~3000rpm, 2.7(GSL) : 2100~2700rpm	
Planetary gear		2EA(Output planetary/Overdrive planetary)	
Clutch		3EA	
Brake		2EA	
OWC		1EA	

SERVICE SPECIFICATIONS

Items	Standard value
Output shaft preload	0.01-0.09 mm (0.0004-0.0035 in)
Brake reaction plate end play	0-0.16 mm (0-0.0063 in)
Low and reverse brake end play	1.65-2.11mm (0.065-0.083 in)
Second brake end play	0.79-1.25 mm (0.0311-0.0492 in)
Underdrive sun gear end play	0.25-0.45 mm (0.0098-0.0177 in)
Input shaft end play	0.70-1.20 mm (0.0276-0.0472 in)
Differential case preload	0.045-0.105 mm (0.0018-0.0041 in)
Underdrive clutch end play(wave disk)	1.25-1.45 mm (0.0492-0.057 in)
Overdrive clutch return spring retainer end play	0-0.09 mm (0-0.0035 in)
Overdrive clutch end play(wave disk)	1.6-1.8 mm (0.0630-0.0709 in)
Reverse clutch end play	1.5-1.7 mm (0.0590-0.0609 in)
Backlash between differential side gear and pinion	0.025-0.150 mm (0.001-0.006 in)

TIGHTENING TORQUE

ITEM	Nm	kgf.cm	lb-ft
Wiring harness bracket	20 ~ 26	200 ~ 260	14 ~ 18
Control cable bracket bolt	20 ~ 26	200 ~ 260	14 ~ 18
Eye bolt	30 ~ 45	300 ~ 450	22 ~ 33
Oil cooler feed tube	10 ~ 12	100 ~120	7 ~ 8
Input shaft speed sensor	10 ~ 12	100 ~ 120	7 ~ 8
Output shaft speed sensor	10 ~ 12	100 ~ 120	7 ~ 8
Manual control lever	18 ~ 25	180 ~ 250	13 ~ 18
Transaxle range switch	10 ~ 12	100 ~ 120	7 ~ 8
Speedometer gear	4 ~ 6	40 ~ 60	3 ~ 4
Valve body cover	8 ~ 10	80 ~ 100	6 ~ 7
Valve body mounting bolt	10 ~ 12	100 ~ 120	7 ~ 8
Oil temperature sensor	10 ~ 12	100 ~ 120	7 ~ 8
Manual control shaft detent	5 ~ 7	50 ~ 70	4 ~ 5
Rear cover	20 ~ 26	200 ~ 260	14 ~ 18
Torque converter housing	42 ~ 54	420 ~ 540	29 ~ 38
Oil pump	20 ~ 26	200 ~ 260	14 ~ 18
Transfer drive gear	16 ~ 22	160 ~ 220	11 ~ 15
Output shaft lock nut	160 ~ 180	1600 ~ 1800	110 ~ 126
Output shaft bearing retainer	20 ~ 26	200 ~ 260	14 ~ 18
Oil filler plug	29 ~ 34	290 ~ 340	21.4 ~ 25.1
Oil drain plug	40 ~ 50	400 ~ 500	29 ~ 36
Transfer drive gear lock nut	180 ~ 210	1800 ~ 2100	126 ~ 147
Differential drive gear to subframe bolts	130 ~ 140	1300 ~ 1400	91 ~ 98
Valve body	10 ~ 12	100 ~ 120	7 ~ 8
Solenoid valve support	5 ~ 7	50 ~ 70	4 ~ 5
Plate	5 ~ 7	50 ~ 70	4 ~ 5
Pressure check plug	8 ~ 10	80 ~ 100	6 ~ 7
Front roll stopper bracket to subframe bolts	40 ~ 55	400 ~ 550	29 ~ 40
Front roll stopper insulator bolt and nut	50 ~ 65	500 ~ 650	36 ~ 47
Front roll stopper bracket to transaxle bolts	60 ~ 80	600 ~ 800	43 ~ 58
Rear roll stopper bracket	40 ~ 55	400 ~ 550	29 ~ 40

Rear roll stopper insulator bolt and nut	50 ~ 65	500 ~ 650	36 ~ 47
Rear roll stopper bracket to transaxle bolts	60 ~ 80	600 ~ 800	43 ~ 58
Transaxle mounting sub bracket nut	60 ~ 80	600 ~ 800	43 ~ 58
Transaxle mounting bracket bolts	40 ~ 55	400 ~ 550	29 ~ 40
Transaxle mounting insulator bolt	90 ~ 110	900 ~ 1100	65 ~ 80

LUBRICANT

Item	Specified lubricant	Quantity
Transmission oil	Diamond ATF SP-III	7.8ℓ(8.2 Us qt, 6.9Imp.qt)

SEALANT

Item	Specified Sealant
Rear cover Torque converter housing Valve body cover	Three Bond - TB 1281B or LOCTITE - FMD - 546
Transmission case side cover	Three Bond - TB 1389 or LOCTITE - 518
Side cover	Three Bond - TB 1389 or LOCTITE - 518/587

Automatic Transaxle System > Automatic Transaxle System > Description and Operation (F4A42-2)

Description

The automatic transmission is a combination of 3-element 2-phase 1-stage torque converter and double shaft electrocally-controlled unit which provides 4 speeds forward and 1 reverse. The entire unit is in line with the engine.

Characteristics

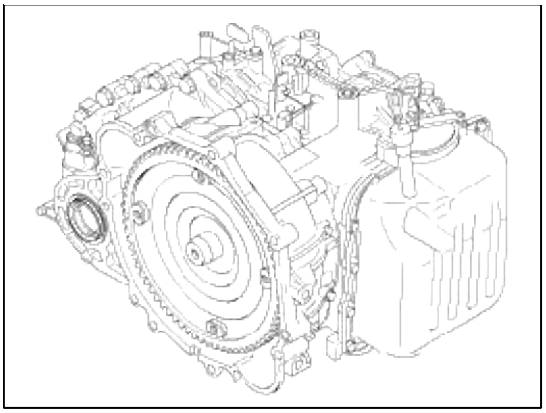
HIVEC: Hyundai Intelligent Vehicle Electronic Control

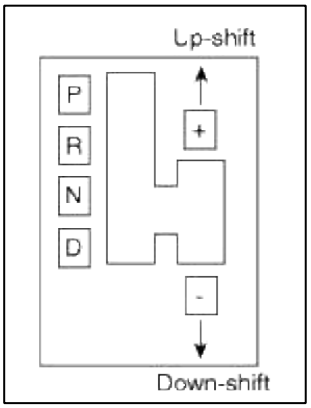
It differs significantly compared to previous T/M such as alpha, Bcta or KM series automatic transaxles.

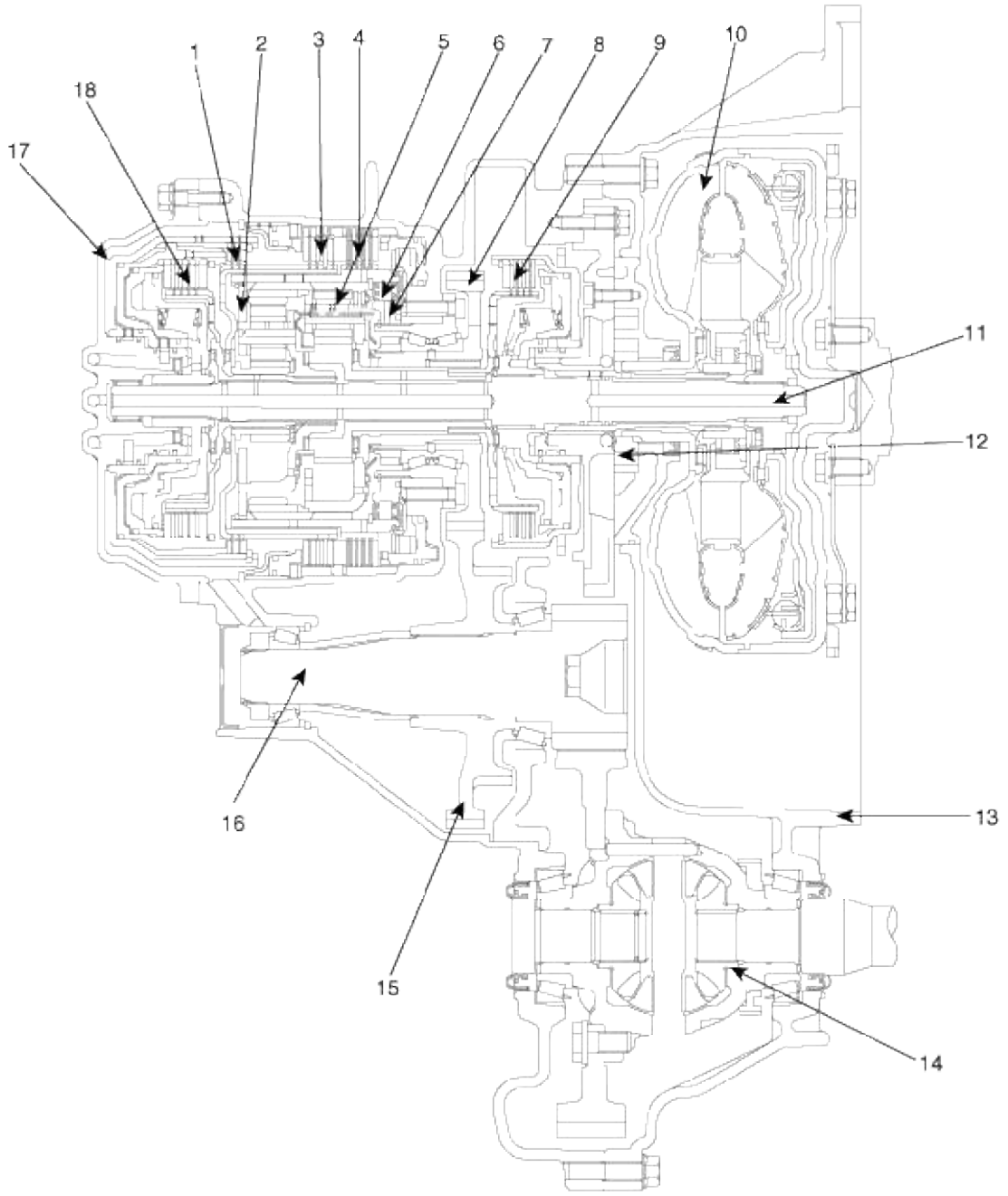
Hyundai vehicles adopted with an engine volume of 2.0 liters or more has the HIVEC automatic transaxle developed and produced by Hyundai.

Some of the characteristics include:

- Different power transfer
- Different component layout
- New shift logic(HIVEC) to improve shift feeling
- Position of Valve Body
- Variable shift pattern
- Communication protocol and method



Item	Details
Weight Reduction	1. Aluminum oil pump - 2.3kg Approx 2. Pressed parts - Retainer and hub of brakes and clutches - Carrier of planetary gear set
Better shift quality	1. Independent control of clutches and brakes enabled better control of hydraulic pressure and skip shift possible (4 to 2, 3 to 1) 2. During N to D or N to R shift, feedback control adopted. 3. When starting from Creep condition, reduction of shock.(Creep condition is controlled with 1st gear) 4. Solenoid valve frequency is increased for more accurate control. 35Hz to 61.3Hz except DCCSV that is 35Hz. 5. HIVEC adoption for better shift feeling. 6. Variable shift pattern.
Increase in Power train efficiency	1. Variable oil level - An oil dam is incorporated in the case to temporarily contain ATF, so the damage of power train is decreased at low temperatures
Dynamic drive by sports mode	- Manual shifting possible 

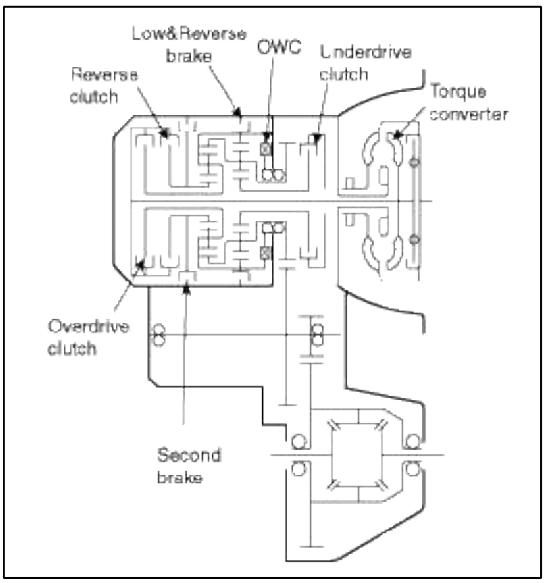


1. Reverse clutch
2. Overdrive planetary gear set
3. Second brake
4. Low-reverse brake
5. Output plantary gear set
6. Oneway clutch
7. Oneway clutch inner race
8. Transfer drive gear
9. Underdrive clutch
10. Torque converter
11. Input shaft
12. Oil pump
13. Converter housing
14. Differential
15. Transfer driven gear
16. Output shaft
17. Rear cover
18. Overdrive clutch

MECHANICAL SYSTEM

OPERATION COMPONENTS AND FUNCTION

Operating Element	Symbol	Function
Under drive clutch	UD	Connect input shaft and under drive sun gear
Reverse clutch	REV	Connect input shaft and reverse sun gear
Overdrive clutch	OD	Connect input shaft and over drive carrier
Low&Reverse brake	LR	Hold LR annulus gear and OD carrier
Second brake	2ND	Hold reverse sun gear
One way clutch	OWC	Restrict the rotating direction of low & reverse annulus gear



Operating elements

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					●	
R			●		●	
N					●	
D1	●				●	○
D2	●			●		
D3	●	●				
D4		●		●		

1) O : OWC is operated when shifts from 1st gear to 2nd gear.
2) L&R brake is released in 1st gear when the vehicle speed is more than 5KPH approximately.
Torque converter and shaft
The torque converter consists of a impeller(pump), turbine and stator assembly in a single unit. The pump is connected to the engine crankshaft and turns as the engine turns. This drawing force is transmitted to the turbine through the oil which is recycled by the stator.
The transmission has two parallel shafts ; the input shaft and the output shaft. Both shafts are in line with the engine crankshaft. The input shaft includes the overdrive clutch, reverse clutch, underdrive clutch, one way clutch, 2ND brake, low&reverse brake, overdrive planetary carrier, output planetary carrier and transfer drive gear. The output shaft includes the transfer driven gear.

CLUTCHES

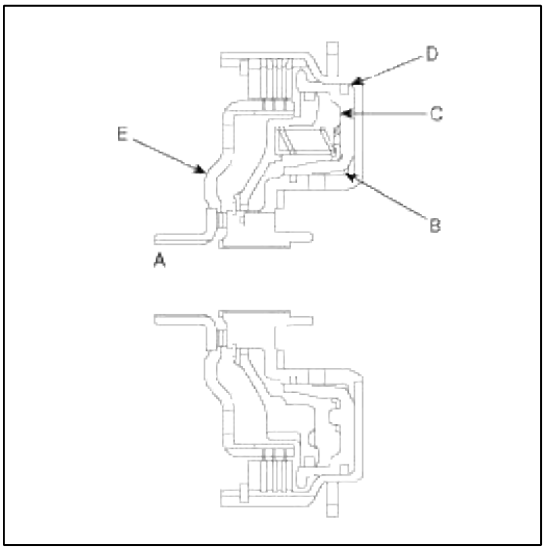
The gear changing mechanism utilizes three multi-disc clutches. The retainers of these clutches are fabricated from high-precision sheet metal for lightness and ease of production. Also, more responsive gearshifts at high engine speeds are achieved by a pressure-balanced piston mechanism that cancels out centrifugal hydraulic pressure. This mechanism replaces the conventional ball check valve.

UNDERDRIVE CLUTCH

The underdrive clutch operates in 1st, 2nd, and 3rd gears and transmits driving force from the input shaft to the underdrive sun gear(A).

The components comprising the under clutch are as illustrated below.

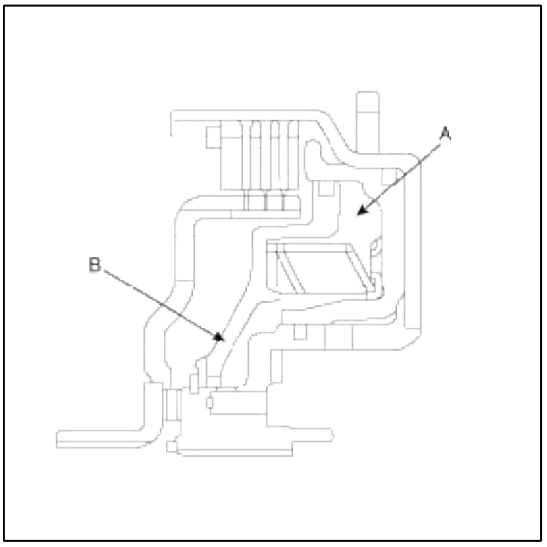
Hydraulic pressure acts in the piston pressure chamber(B) (between the piston(c) and retainer) and thus pushes the piston(C). In turn, the piston depresses the clutch discs and thereby transmits driving force from the retainer(D) to the hub(E) side.



At high speed, fluid remaining in the piston pressure chamber is subjected to centrifugal force and attempts to push the piston.

However, fluid in the balance fluid chamber(A) (the space between the piston and return spring retainer(B)) is also subjected to centrifugal force.

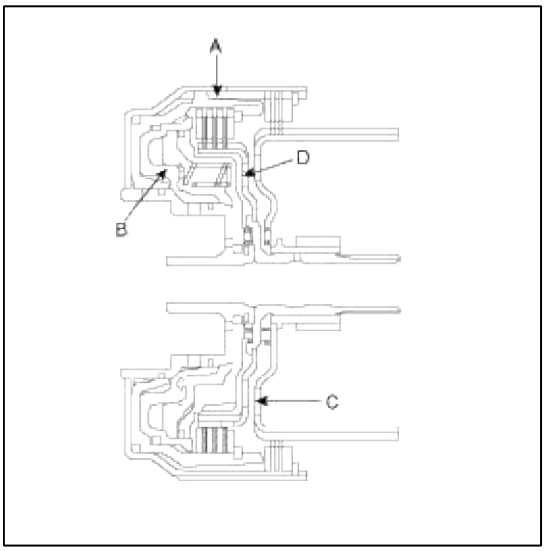
Thus, the hydraulic pressure on one side of the piston cancels out the hydraulic pressure on the other side, and the piston does not move.



REVERSE CLUTCH AND OVERDRIVE CLUTCH

The reverse clutch(C) operates when the reverse gear is selected and transmits driving force from the input shaft to the reverse sun gear.

The overdrive clutch(D) operates in 3rd and 4th gears and transmits driving force from the input shaft to the overdrive planetary carrier and low-reverse annulus gear.



BRAKES

The gear changing mechanism utilizes two multi-disc brakes.

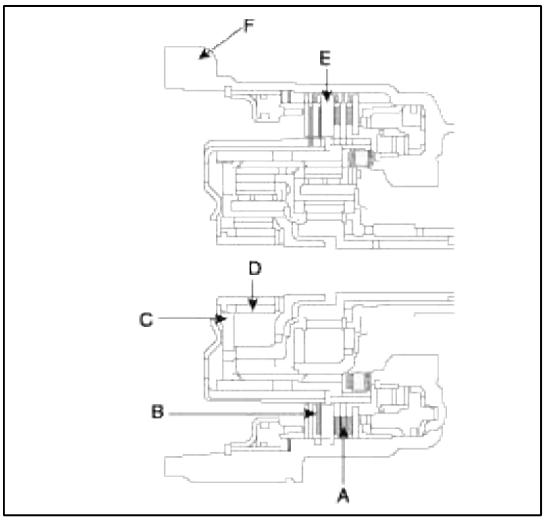
LOW&REVERSE BRAKE AND SECOND BRAKE

The low&reverse brake(A) operates in 1st and reverse gears, when the vehicle is parked, and during manual operation. It locks the low&reverse annulus gear and overdrive planetary carrier to the case.

The second(C) brake(B) operates in 2nd and 4th gears and locks the reverse sun gear(D) to the case.

The components comprising the low&reverse brake and second brake are as illustrated below.

As shown, the discs and plates of the two brakes are arranged on either side of the rear cushion plate(E), which is itself secured to the case(F) by a snap ring.

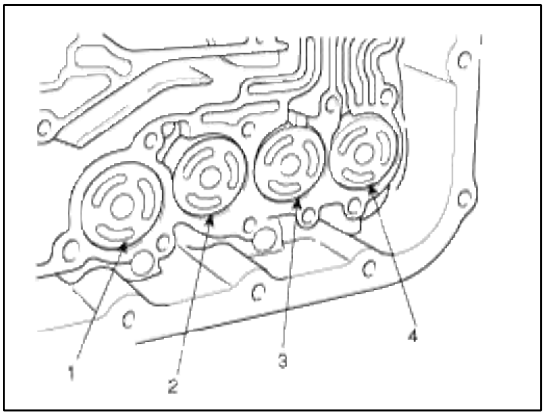


OWC

To improve the shift feeling from 1st. to 2nd gear, OWC was adopted on the Low&reverse brake annulus gear. Instead of hydraulic fixing by Low&reverse brake at the 1st gear, this mechanical fixing device was used. This structure is not new concept, because this OWC already has been installed on the:

ACCUMULATORS

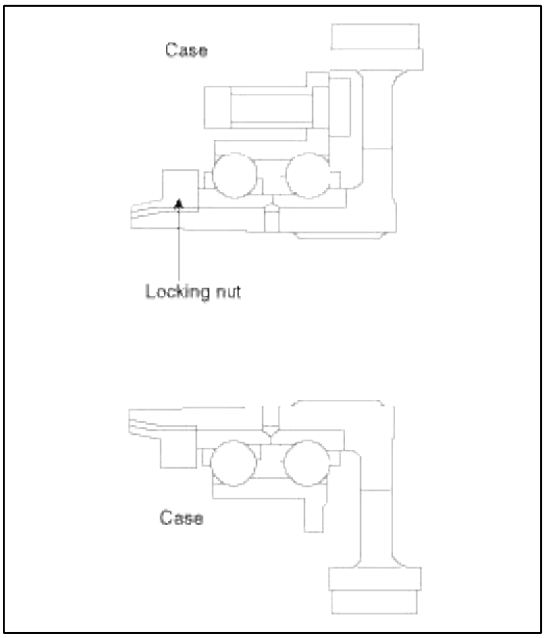
Number	Function Name	Color
1	Low&Reverse Brake	None
2	Underdrive Clutch	Yellow
3	Second Brake	Blue
4	Overdrive Clutch	None



Objective
* Energy (hydraulic pressure) storage
* Impact and pulsation damping when solenoid valves operating
* Operation as spring element
* Smooth shifting by preventing sudden operation of clutches and brakes

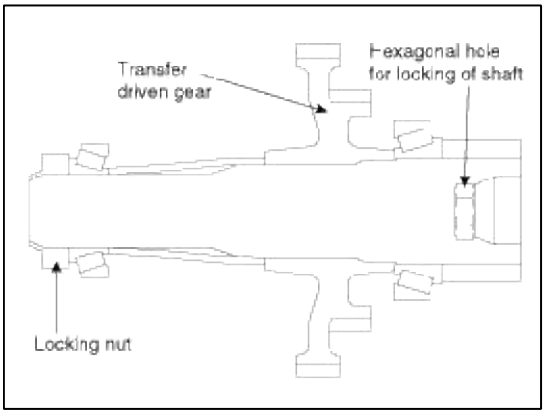
TRANSFER DRIVE GEAR

With the transfer drive gear, increased tooth height and a higher contact ratio have reduced gear noise.
Also, the bearing that supports the drive gear is a preloaded type that eliminates rattle, and the rigidity of the gear mounting has been increased by bolting the bearing directly onto the case.



OUTPUT SHAFT/TRANSFER DRIVEN GEAR

As shown in the illustration below, the transfer driven gear is press-fitted onto the output shaft, and the output shaft is secured by a locking nut and supported by bearings.
The locking nut has a left-handed thread, and a hexagonal hole in the other end of the shaft enables the shaft to be held in position for locking nut removal.



MANUAL CONTROL SYSTEM

MANUAL CONTROL LEVER

The manual control lever is fitted to the top of the valve body and is linked to the parking roller rod and manual control valve pin.

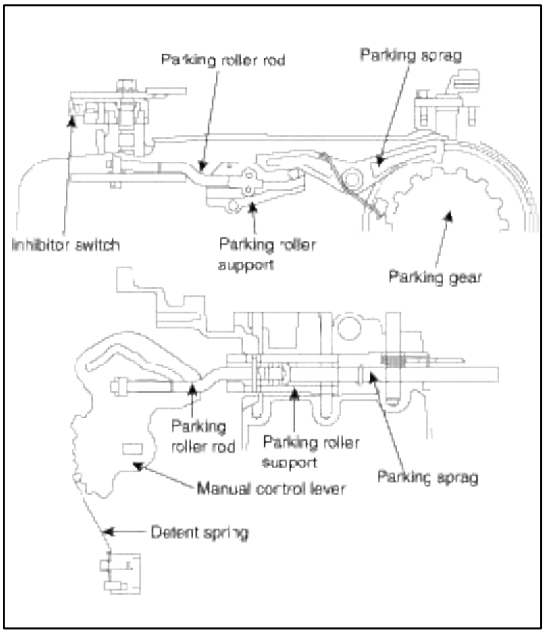
A detent mechanism is provided to improve the gear shift feeling during manual selection.

PARKING MECHANISM

When the manual control lever is moved to the parking position, the parking roller rod moves along the parking roller support and pushes up the parking sprag.

As a result, the parking sprag meshes with the transfer driven gear (parking gear), thereby locking the output shaft.

To minimize the operating force required, a roller is fitted to the end of the rod.



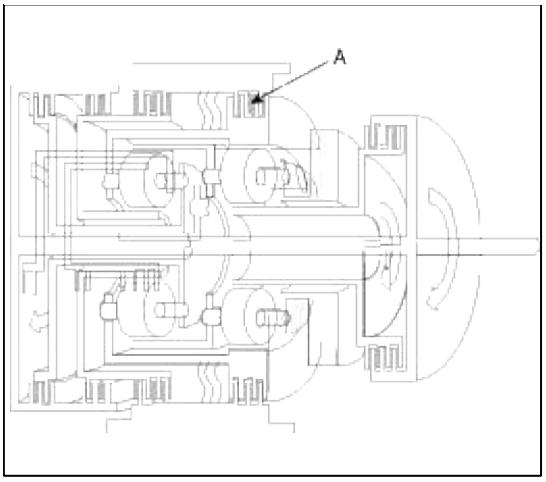
POWER TRAIN

P POSITION

Hydraulic pressure is applied to the LR brake and the RED brake, so power is not transmitted from the input shaft to the UD clutch or OD clutch, and the output shaft is locked by the park brake pawl interlocking the park gear.

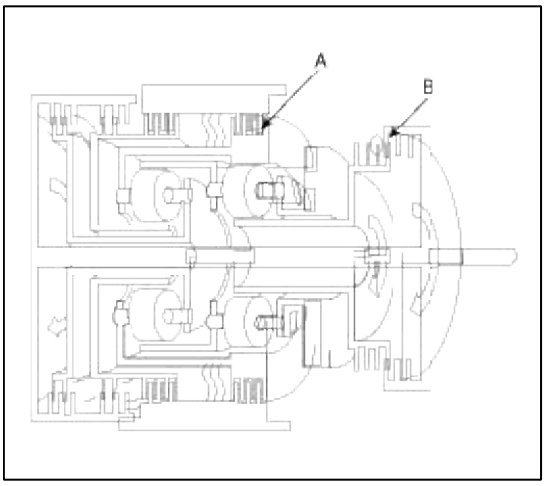
N POSITION

Hydraulic pressure is applied to the LR brake(A) and the RED brake, so power is not transmitted from the input shaft to the UD clutch or OD clutch.



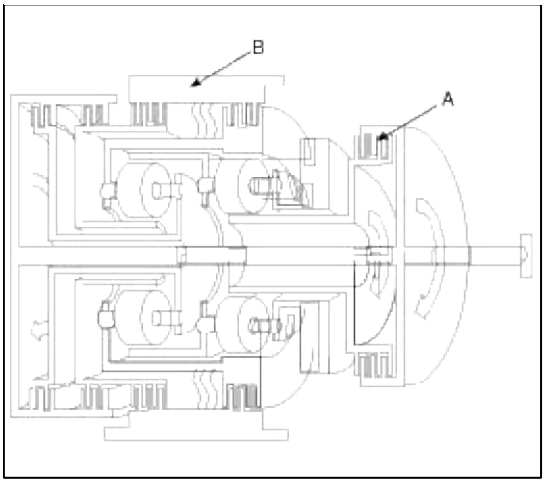
1st GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch(B) the LR brake(A) and the one way clutch(OWC), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the LR brake locks the LR annulus gear to the case.The UD sun gear of the planetary gear drives the output pinion gear, and the LR brake locks the annulus gear, and the output pinion drives the output carriers, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



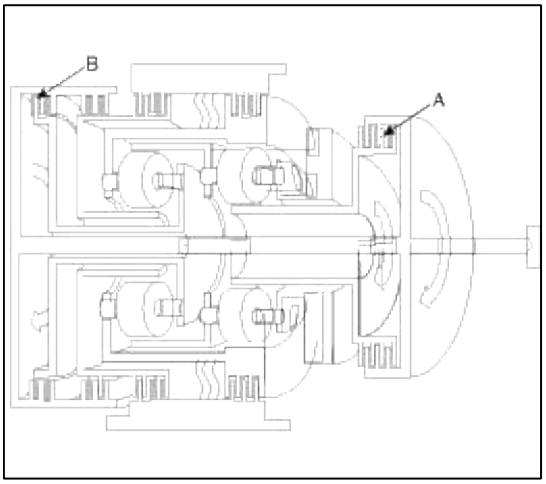
2nd GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch(A) the 2nd brake(B) and the one way clutch(OWC), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the 2nd brake locks the reverse sun gear to the case.The UD sun gear of the planetary gear drives the output pinion gear and the LR annulus gear, and the LR annulus gear drives the OD planetary carriers, and OD planetary carriers drives OD pinion gear, and the OD pinion gear drives the output carriers, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



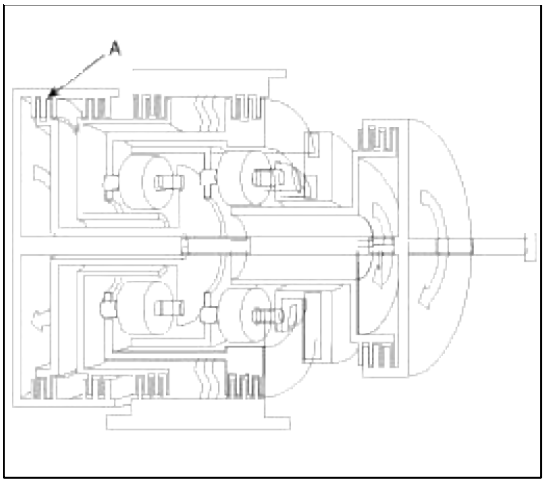
3rd GEAR POWER FLOW

Hydraulic pressure is applied to the UD clutch(A) and the OD clutch(B), then the UD clutch transmits driving force from the input shaft to the UD sun gear, and the OD clutch transmits driving force from the input shaft to the overdrive planetary carrier and low&reverse annulus gear.The UD sun gear of the planetary gear drives the output pinion gear and the LR annulus gear, and the LR annulus gear drives the OD pinion gear through the OD planetary carrier, and the OD pinion gear drives the reverse sun gear and the output carrier.The OD clutch drives the OD carrier, and the OD carrier drives the OD pinion gear, and the OD pinion gear drives the reverse sun gear and the output carrier, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



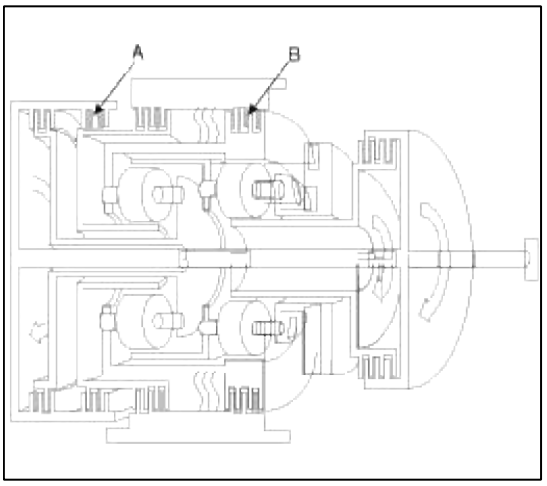
4th GEAR POWER FLOW

Hydraulic pressure is applied to the OD clutch(A) and the 2nd brake(B), then the OD clutch transmits driving force from the input shaft to the OD planetary carrier and LR annulus gear, and the 2nd brake locks the reverse sun gear to the case.The OD clutch drives the OD carrier, and the OD carrier drives the OD pinion gear and the LR annulus gear, and the OD pinion gear drives the output carrier, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



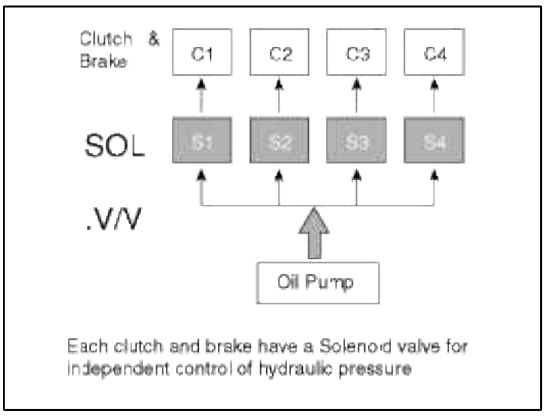
Rev GEAR POWER FLOW

Hydraulic pressure is applied to the reverse clutch(A) and the LR brake(B), then the reverse clutch transmits driving force from the input shaft to the reverse sun gear, and the LR brake locks the LR annulus gear and OD planetary carrier to the case.The reverse clutch drives the reverse sun gear, and the reverse sun gear drives the output carrier through the OD pinion gear, and the output carrier drives the transfer drive gear, and the transfer drive gear drives the transfer driven gear of the output shaft, and power is transmitted to the differential gear through the differential drive gear.



Hydraulic Control System

DESCRIPTION



- Better and smoother shift quality.
- In order to prevent ATF leakage from the valve body or each elements, the exhaust ports have been grouped into only one with an addition of a check ball.

- If a failure occurs in its electric control, the switch valve and fail safe valve is able to move to enable 3rd speed drive or reverse.
- The hydraulic system consists of oil pump, regulator valve, solenoid valves, pressure control valve and valve body.

OPERATION COMPONENTS AND FUNCTIONS

Oil Pump

The oil pump is made of aluminum to reduce its weight. The oil pump is not a serviceable part; it must be replaced as a pump assembly.

Do not disassemble the pump as improper alignment during assembly will cause pump failure and could cause damage to the transaxle.

When removing the oil pump from the T/M case, the S.S.T. (09452-33100) must be used.

OPERATION OF EACH VALVE

Torque converter pressure control valve : The function of this valve is to maintain a constant pressure within the torque converter.

Damper clutch control valve : Its function is to control the hydraulic pressure that acts on the Damper Clutch.

Manual valve :The position of the manual valve is determined by the selector lever and applies or cuts line pressure to different valves.

Pressure control valve&Solenoid valve : The pressure control valve prevents a rapid decrease in hydraulic pressure when the clutch becomes disengaged. It also reduces the sharp increase in input shaft speed during clutch to clutch control.

Switch valve : When the OD clutch is applied, the hydraulic pressure is applied to the regulator valve via the switch valve. Hence, the line pressure is reduced at 3rd and 4th gear.

Fail Safe Valve-A : During fail safe mode, this valve releases the pressure in the LR Brake.

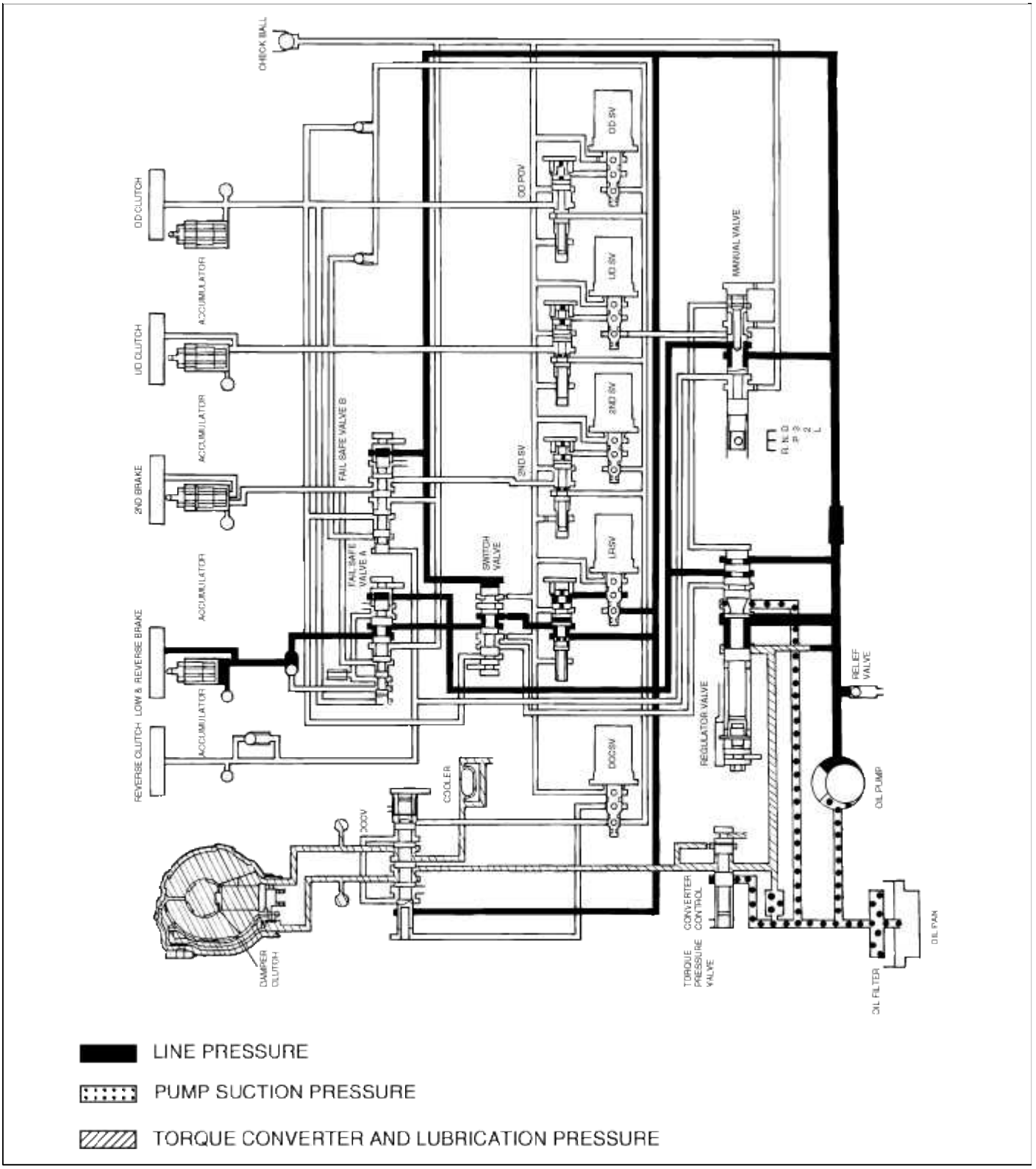
Fail Safe Valve-B : During fail safe mode, this valve cuts the pressure from the 2nd pressure control valve to 2nd brake.

Hydraulic flow

P and N position

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned off, and the LR pressure solenoid valve is moved to the left side.
- The 2nd solenoid valve is turned on, and the 2nd pressure solenoid valve remains in the right side.
- The UD solenoid valve is turned on, and the UD pressure solenoid valve remains in the right side.
- The OD solenoid valve is turned on, and the OD pressure solenoid valve remains in the right side.
- The line pressure is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, DCCV, LR solenoid valve, LR pressure control valve).
- The fail-safe valve B moves to the left side by the line pressure through the manual valve.
- The switch valve moves to the left side by the line pressure.
- The line pressure is supplied to the DCCV, and DCCV moves to the right side.
- The line pressure is supplied to the LR pressure control valve and the LR solenoid valve, and TCM(PCM) turns off the LR solenoid valve, so the line pressure is supplied to the LR brake through the switch valve and the fail-safe valve A.
- The regulator valve moves to the left side by the line pressure through the manual valve, and the line pressure is supplied to the torque converter pressure control valve and the oil pump.

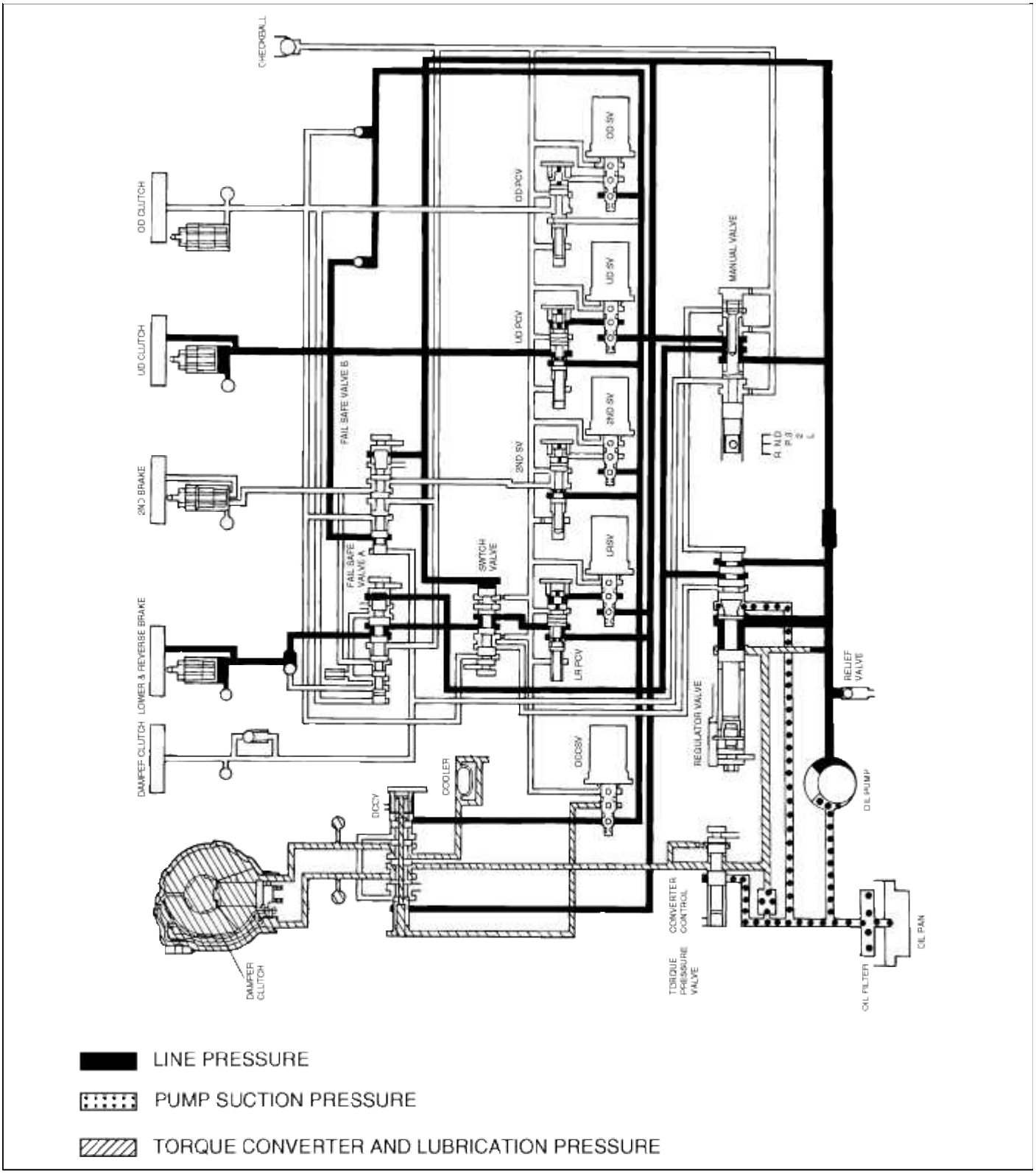


D position : 1st gear

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned off, and the LR pressure solenoid valve is moved to the left side.
- The 2nd solenoid valve is turned on, and the 2nd pressure solenoid valve remains in the right side.
- The UD solenoid valve is turned off, and the UD pressure solenoid valve is moved to the left side.
- The OD solenoid valve is turned on, and the OD pressure solenoid valve remains in the right side.
- The line pressure is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, damper clutch control valve, LR solenoid valve, LR pressure control valve).

- The line pressure through the manual valve is supplied to each element (DCCV, 2nd solenoid valve, 2nd pressure control valve, OD solenoid valve, OD pressure control valve, UD solenoid valve, UD pressure control valve).
- The fail-safe valve B moves to the left side by the line pressure.
- The switch valve moves to the left side by the line pressure.
- The line pressure is supplied to the DCCV, and TCM(PCM) turns off the DCCSV, so the DCCV remains in the right side
- The line pressure is supplied to the LR pressure control valve and the LR solenoid valve, and TCM(PCM) turns off the LR solenoid valve, so the line pressure is supplied to the LR brake through the switch valve and the fail-safe valve A.
- The line pressure is supplied to the UD pressure control valve and the UD solenoid valve, and TCM(PCM) turns off the UD solenoid valve, so the line pressure is supplied to the UD clutch and the fail-safe valve B.
- The regulator valve moves to the left side by the line pressure through the manual valve, and the line pressure is supplied to the torque converter pressure control valve and the oil pump.

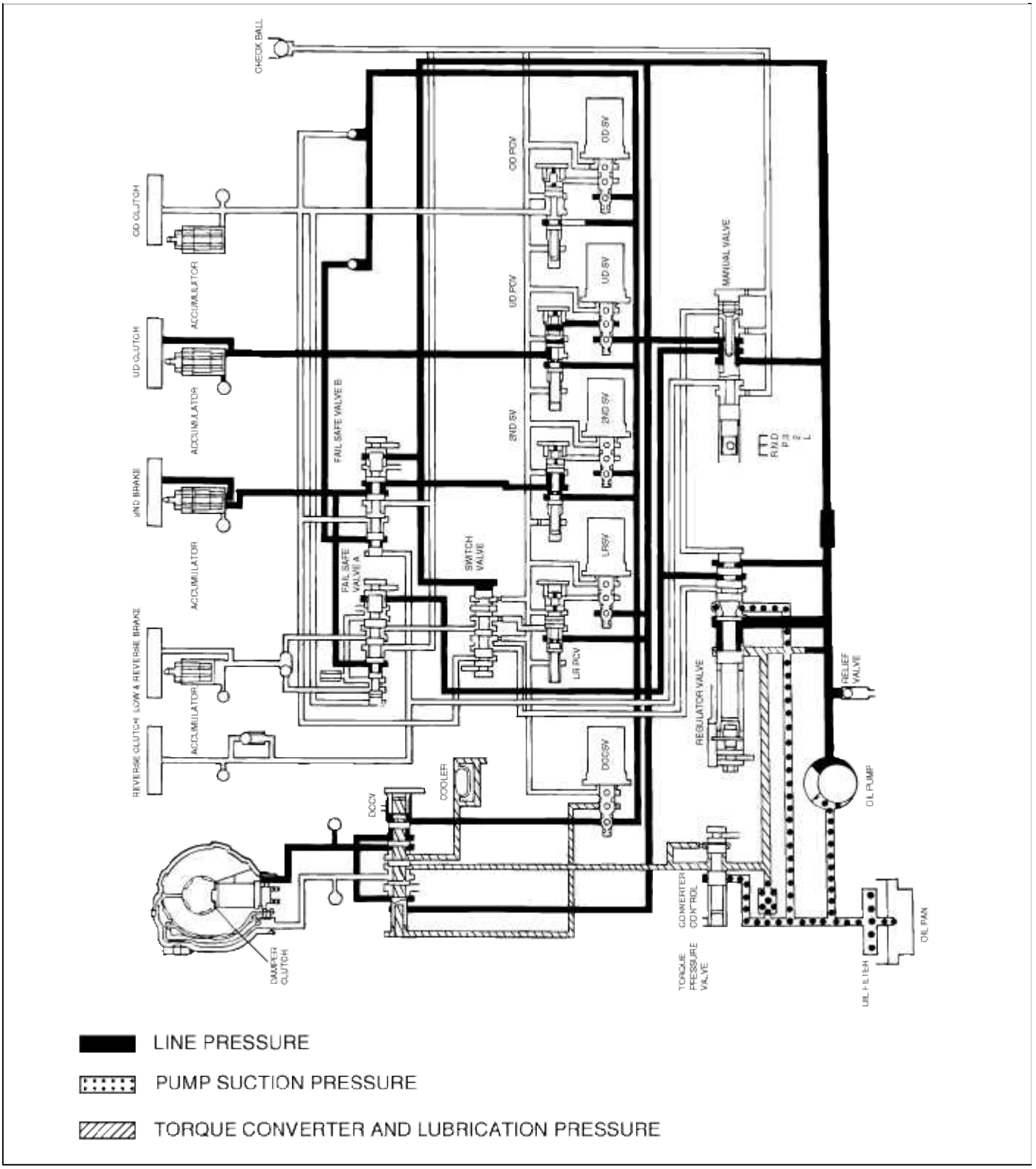


D position : 2nd gear

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned on, and the LR pressure solenoid valve remains in the right side.
- The 2nd solenoid valve is turned off, and the 2nd pressure solenoid valve is moved to the left side.
- The UD solenoid valve is turned off, and the UD pressure solenoid valve is moved to the left side.
- The OD solenoid valve is turned on, and the OD pressure solenoid valve remains in the right side.
- The line pressure is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, damper clutch control valve, LR solenoid valve, LR pressure control valve).

- The line pressure through the manual valve is supplied to each element (DCCV, 2nd solenoid valve, 2nd pressure control valve, OD solenoid valve, OD pressure control valve, UD solenoid valve, UD pressure control valve).
- The fail-safe valve B moves to the right side by the line pressure through 2nd pressure control valve and the line pressure through the UD pressure control valve.
- The pressure through the manual valve is supplied to the fail-safe valve A, and the fail-safe valve A moves to the left side
- The switch valve moves to the left side by the line pressure.
- The line pressure is supplied to the DCCV and the DCCSV, and TCM(PCM) turns off the DCCSV, so the DCCV remains in the right side
- The line pressure is supplied to the 2nd pressure control valve and the 2nd solenoid valve, and TCM(PCM) turns off the 2nd solenoid valve, so the line pressure is supplied to the 2nd brake and the fail-safe valve A through the fail-safe valve B.
- The line pressure is supplied to the UD pressure control valve and the UD solenoid valve, and TCM(PCM) turns off the UD solenoid valve, so the line pressure is supplied to the UD clutch and the fail-safe valve B.
- The regulator valve moves to the left side by the line pressure through the manual valve, and the line pressure is supplied to the torque converter pressure control valve and the oil pump.

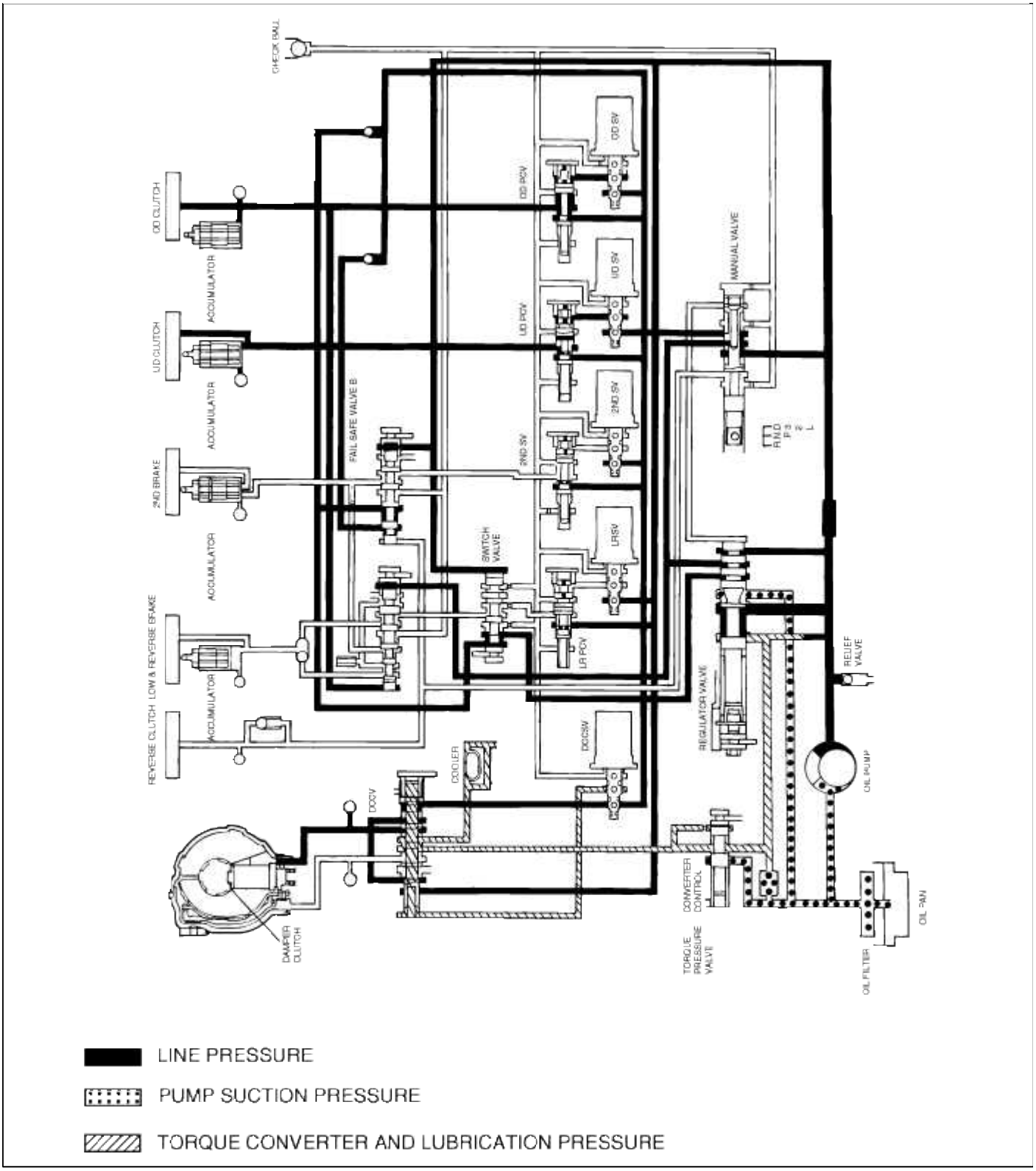


D position : 3rd gear

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned on, and the LR pressure solenoid valve remains in the right side.
- The 2nd solenoid valve is turned on, and the 2nd pressure solenoid valve remains in the right side.
- The UD solenoid valve is turned off, and the UD pressure solenoid valve is moved to the left side.
- The OD solenoid valve is turned off, and the OD pressure solenoid valve is moved to the left side.
- The line pressure is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, DCCV, LR solenoid valve, LR pressure control valve).

- The line pressure through the manual valve is supplied to each element (DCCSV, 2nd solenoid valve, 2nd pressure control valve, OD solenoid valve, OD pressure control valve, UD solenoid valve, UD pressure control valve).
- The fail-safe valve B moves to the right side by the line pressure through the UD pressure control valve and the line pressure through the OD pressure control valve.
- The pressure is supplied to the fail-safe valve A through the OD pressure control valve, but the fail-safe valve A does not move to the right side
- The line pressure is supplied to the DCCV and the DCCSV, and TCM(PCM) turns on the DCCSV, and the DCCV moves to the left side, and the damper clutch is operated.
- The line pressure is supplied to the UD pressure control valve and the UD solenoid valve, and TCM(PCM) turns off the UD solenoid valve, so the line pressure is supplied to the UD clutch and the fail-safe valve B.
- The line pressure is supplied to the OD pressure control valve and the OD solenoid valve, and TCM(PCM) turns off the OD solenoid valve, so the line pressure is supplied to the OD clutch and the fail-safe valve A/B and the switch valve.
- The switch valve moves to the right side by the line pressure through the OD pressure control valve.
- The regulator valve moves to the left side by the pressure through the manual valve and the pressure through the switch valve.

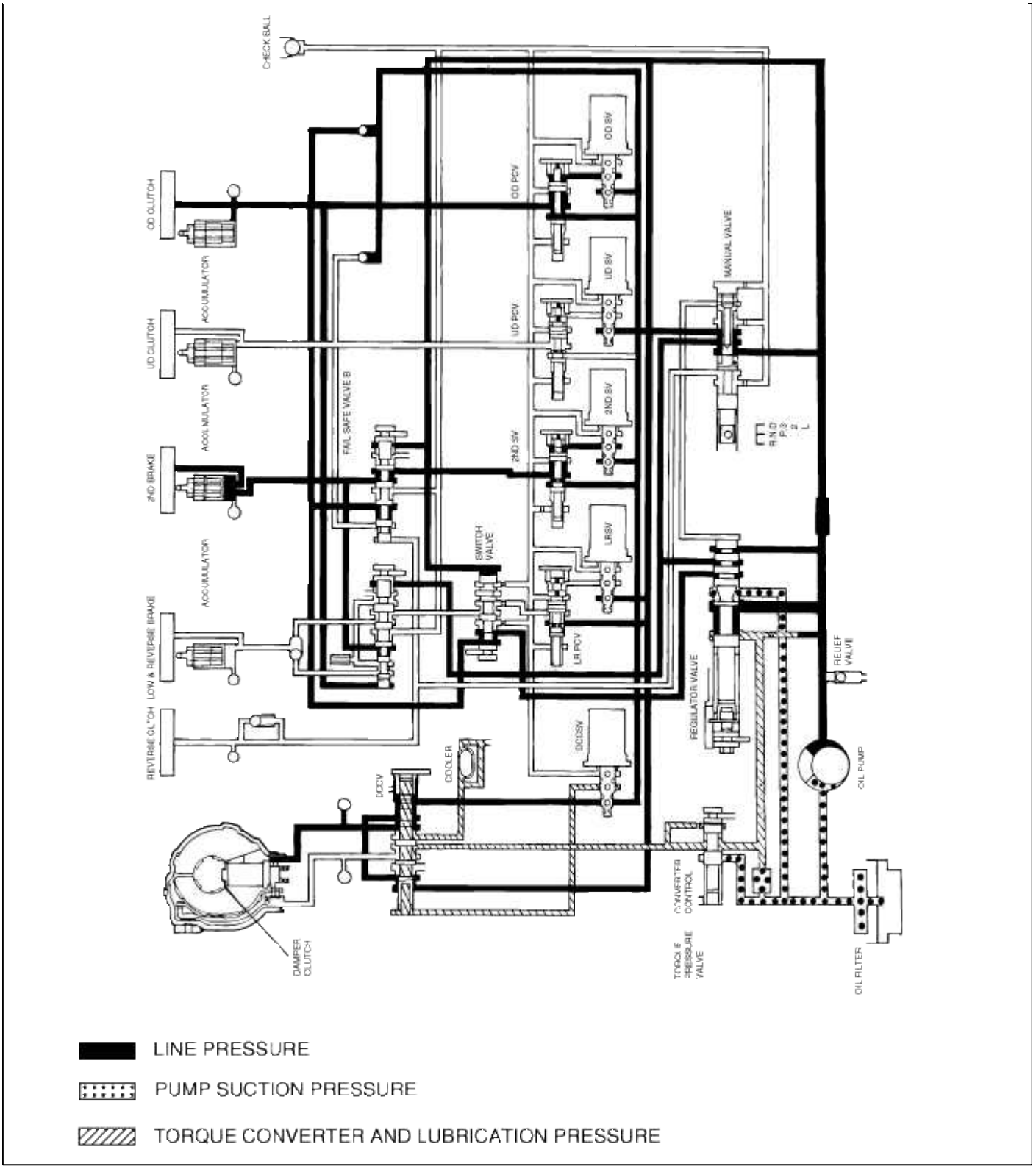


D position : 4th gear

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned on, and the LR pressure solenoid valve remains in the right side.
- The 2nd solenoid valve is turned off, and the 2nd pressure solenoid valve is moved to the left side.
- The UD solenoid valve is turned on, and the UD pressure solenoid valve remains in the right side.
- The OD solenoid valve is turned off, and the OD pressure solenoid valve is moved to the left side.
- The line pressure through the manual valve is supplied to the regulator valve and the fail-safe valve A.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, DCCV, LR solenoid valve, LR pressure control valve).

- The line pressure through the manual valve is supplied to each element (DCCSV, 2nd solenoid valve, 2nd pressure control valve, OD solenoid valve, OD pressure control valve, UD solenoid valve, UD pressure control valve).
- The fail-safe valve B moves to the right side by the line pressure through the 2nd pressure control valve and the line pressure through the OD pressure control valve.
- The line pressure through the OD pressure control valve is supplied to the fail-safe valve A, and the fail-safe valve A moves to the right side by the line pressure through the fail-safe valve B and the line pressure through the OD pressure control valve.
- The line pressure is supplied to the DCCV and the DCCSV, and TCM(PCM) turns on the DCCSV, so DCCV moves to the right side, and the damper clutch is operated.
- The line pressure is supplied to the OD pressure control valve and the OD solenoid valve, and TCM(PCM) turns off the OD solenoid valve, so the line pressure is supplied to the OD clutch and the fail-safe valve A/B and the switch valve.
- The line pressure is supplied to the 2nd pressure control valve and the 2nd solenoid valve, and TCM(PCM) turns off the 2nd solenoid valve, so the line pressure through the 2nd pressure control valve is supplied to the 2nd brake through the fail-safe valve B.
- The regulator valve moves to the left side by the line pressure through the manual valve and the line pressure through the switch valve.

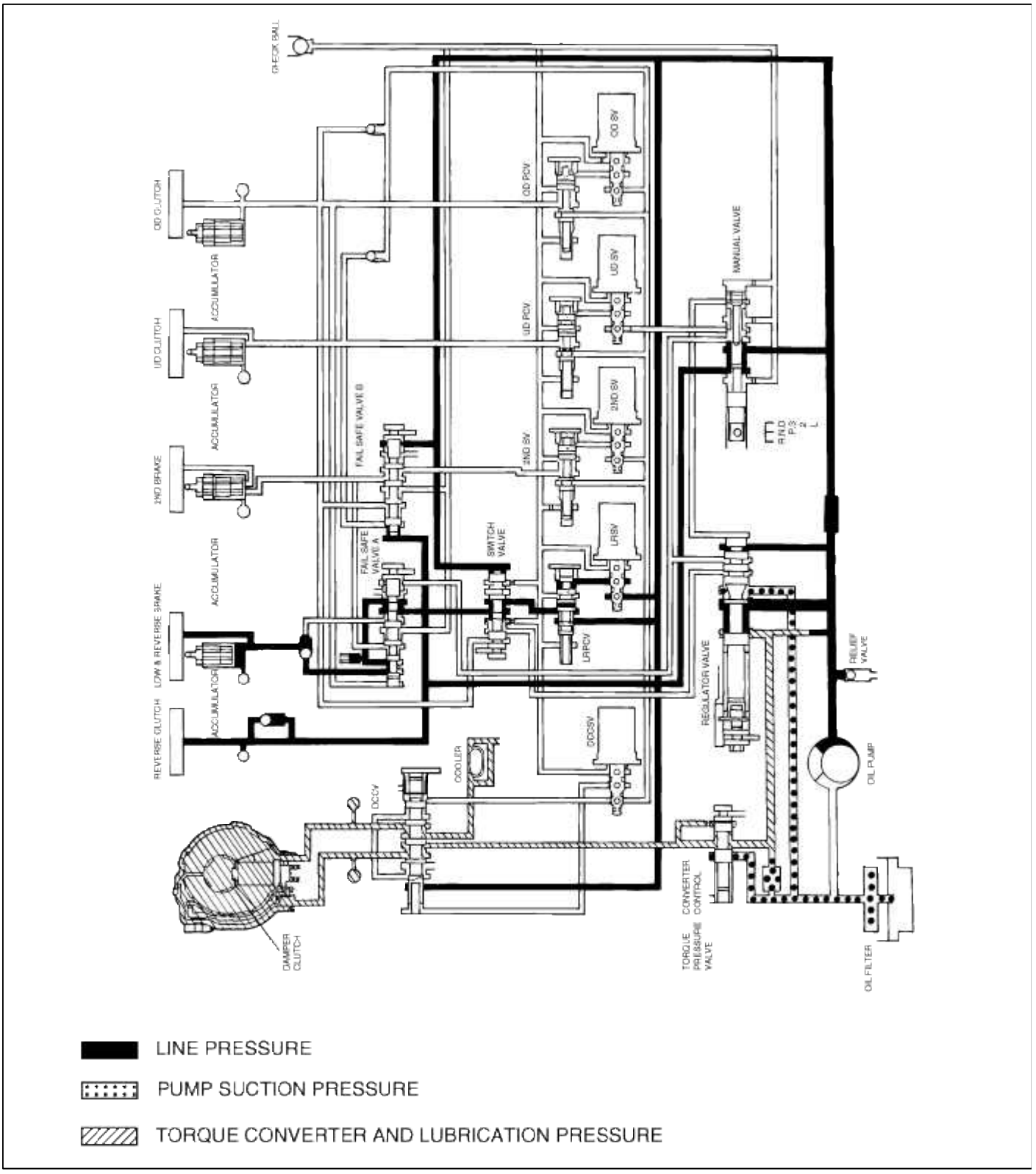


Reverse position

The TCM(PCM) controls the solenoid valves. The conditions of the solenoid valve and positions of the solenoid valve are as follows :

- The LR solenoid valve is turned off, and the LR pressure solenoid valve is moved to the left side.
- The 2nd solenoid valve is turned on, and the 2nd pressure solenoid valve remains in the right side.
- The UD solenoid valve is turned on, and the UD pressure solenoid valve remains in the right side.
- The OD solenoid valve is turned on, and the OD pressure solenoid valve remains in the right side.
- The line pressure through the manual valve is supplied to the reverse clutch and the fail-safe valve B.
- The line pressure is supplied to each element (fail-safe valve B, switch valve, DCCV, LR solenoid valve, LR pressure control valve).

- The fail-safe valve B moves to the left side by the line pressure.
- The switch valve moves to left side by the line pressure, and the line pressure through the LR pressure control valve is supplied to the LR brake through the fail-safe valve A.
- The line pressure is supplied to the DCCV, so the DCCV remains in the right side.
- The fail-safe valve A moves to the right side by the line pressure through the switch valve.
- The line pressure is supplied to the LR pressure control valve and the LR solenoid valve, and TCM(PCM) turns off the LR solenoid valve, and the line pressure is supplied to the LR brake through the LR pressure control valve and the switch valve and the fail-safe valve A.
- The regulator valve moves to the right side due to the lock of line pressure through the manual valve, and the line pressure is higher than in the other gear ranges.



Electronic Control System

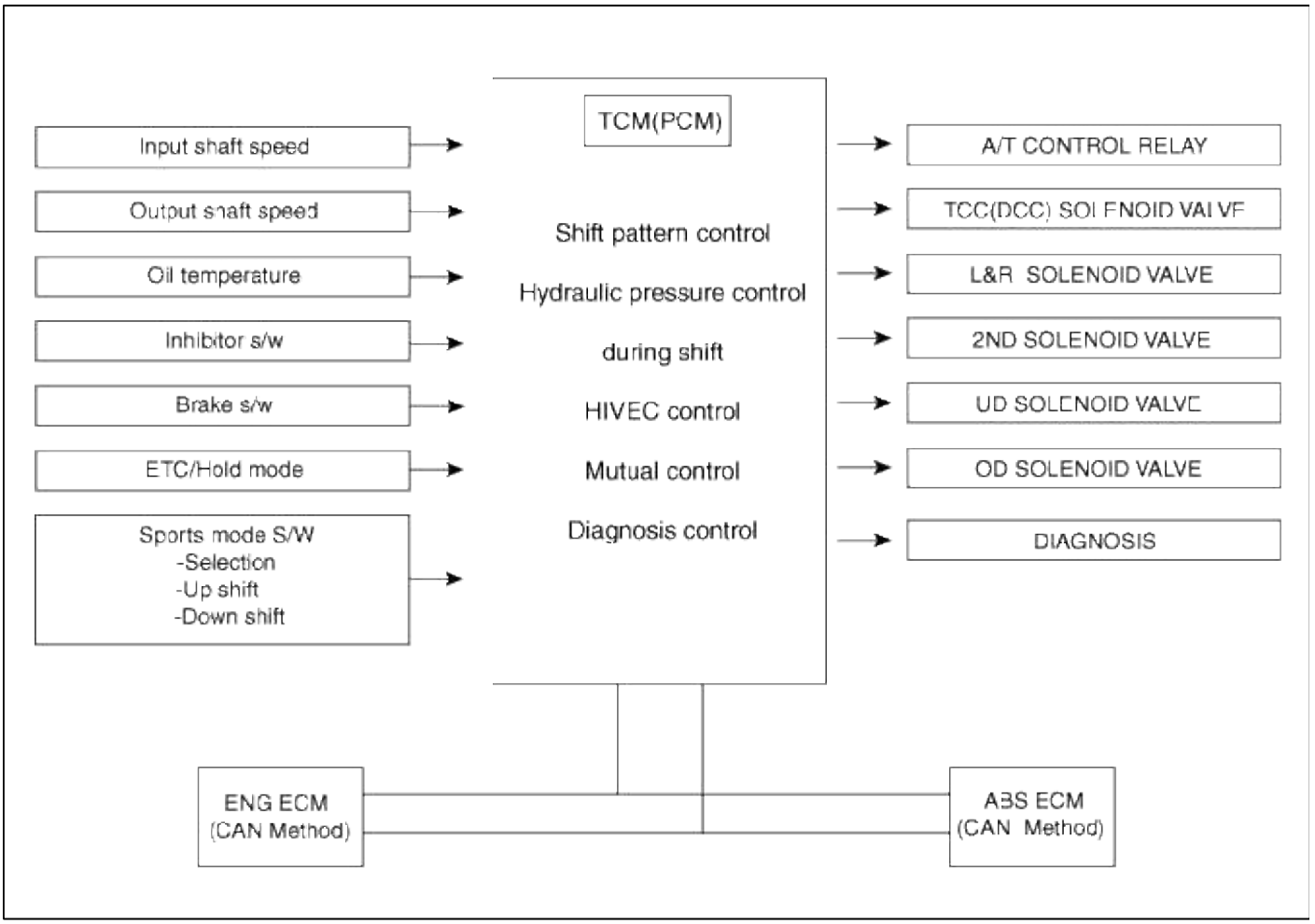
DESCRIPTION

The electronic control system used in the new generation auto transaxle is far superior to the previous systems. This system is able to adopt a variable shift pattern for smooth and problem free shifting.

A solenoid valve is applied to each of the clutches and brakes and is independently controlled. Feedback control and correction control is performed in all gears as well as utilization of mutual control system to increase shift feeling.

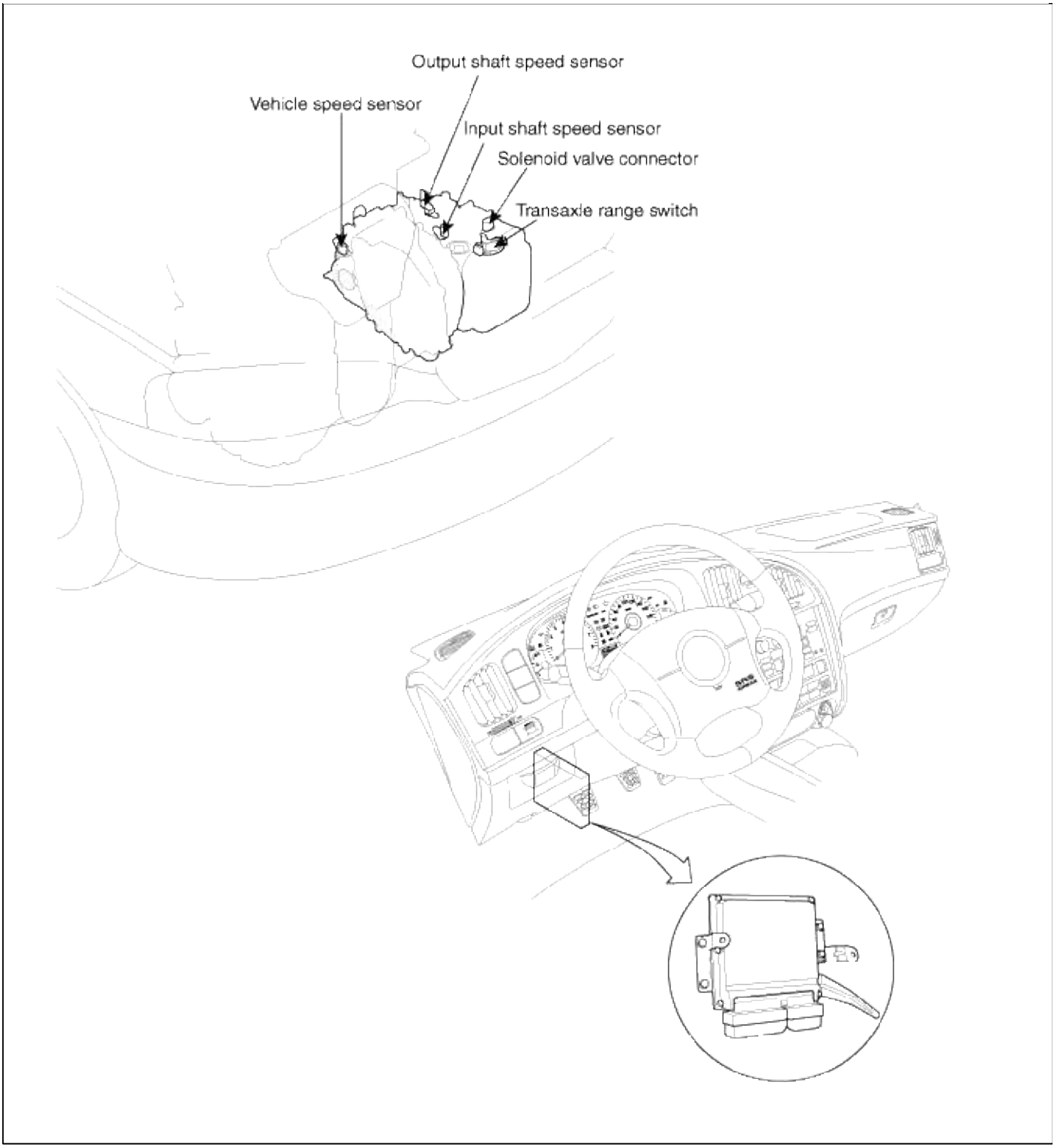
The torque converter damper clutch uses a partial lock up and full lock-up system. An additional control method called the HIVEC system (neural network) is adopted to increase shift feeling.

Block Diagram (CAN)



ELECTRIC CONTROL LOCATION

The TCM(PCM) is located below the dashboard. However, in the ß-engine vehicles, there is not TCM(PCM).



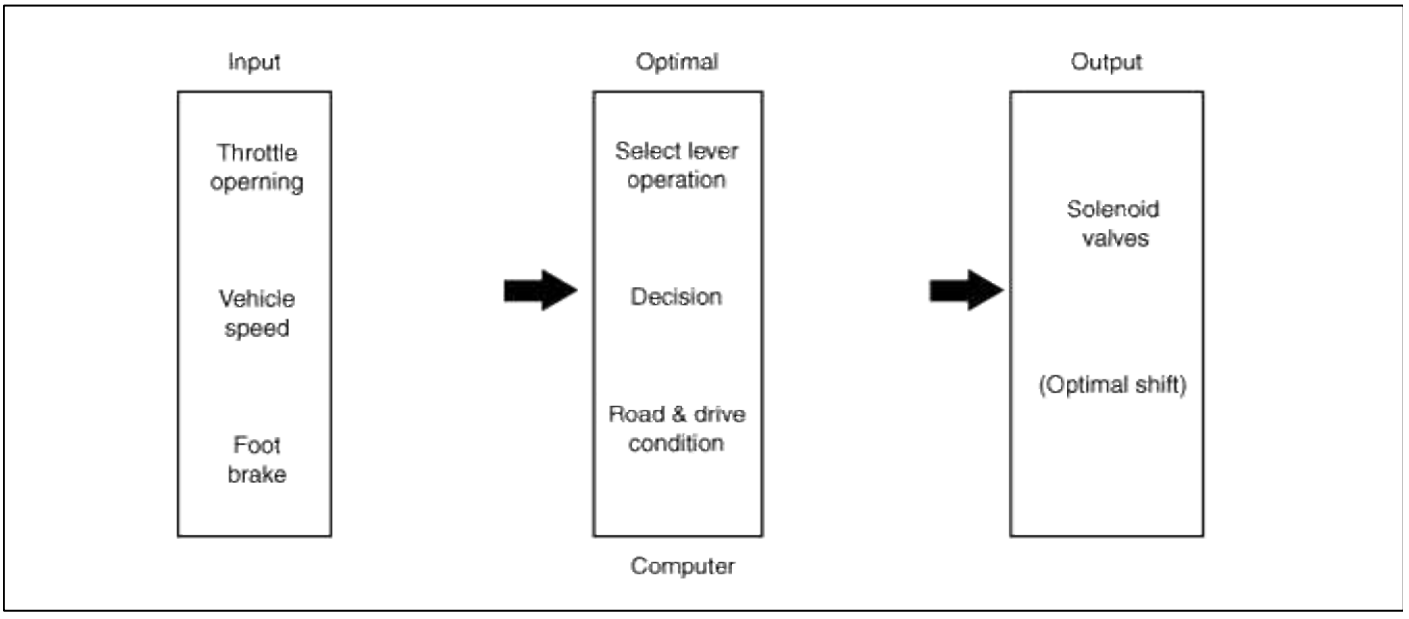
OPERATING COMPONENTS AND FUNCTIONS

Sensor	Function
Input shaft speed sensor	Detect turbine speed at UD retainer
Output shaft speed sensor	Detect T/F drive gear speed at T/F driven gear (4A/T)
Crank angle sensor	Detect engine speed
TPS(Gasoline)	Throttle opening ratio by potentiometer
Air conditioner switch	A/C load by thermister
Inhibitor switch	Select lever position by contact switch
Brake switch	Brake pedal position
Vehicle speed sensor	Detect vehicle speed by speedometer driven gear
Sport mode switch	Sport mode On/Off signal
Kick down servo switch	Kick down piston position
Vehicle speed sensor	Vehicle speed
Sport mode up-shift switch	Sport mode up-shift signal
Sport mode downshift switch	Sport mode downshift signal
Request of torque reduction	Send the request of torque reduction to ECM
ABS-ECM, Engine ECM	CAN communication

HIVEC
HIVEC uses information from various inputs and feedback adaptation and selects the best appropriate gear position and shift timing under all possible driving conditions.

CONTROL FOR ALL DRIVING CONDITION

This function makes TCM(PCM) decide optimal gear range under all driving condition. The optimal operation of the manual shift lever by several drivers' and various driving condition is pre-set in the TCM(PCM). On the basis of mapping data, TCM(PCM) decides the driving condition from throttle opening, vehicle speed and brake signal. And then TCM(PCM) controls the gear position optimally. Optimal gear position is achieved under various driving condition by HIVEC logic.
Optimal control for all driving condition

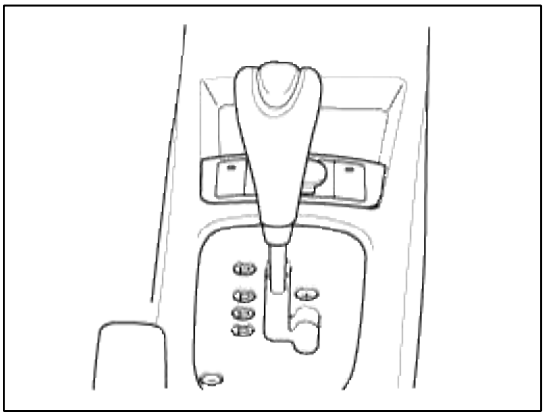


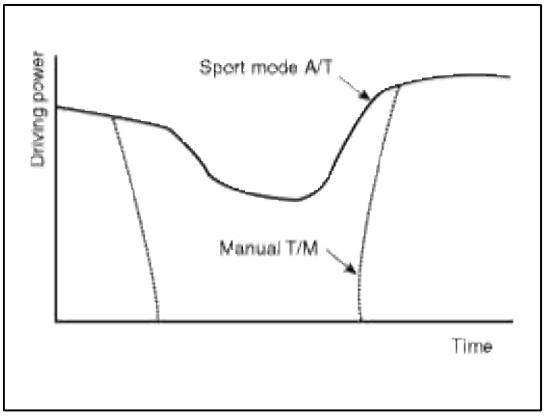
HIVEC INHIBIT CONDITIONS

- ATF temperature below 40°C(104°F).
- When standard pattern is not used.
  • Inhibitor switch: P, R, N, L
  • Extremely low temperature mode
  • Lower emission shift pattern
  • ATF control variable shift pattern
- During fail safe mode (3rd gear hold)
- In case of prohibition of Intelligent shift
  • TPS faulty (Short: P1702, Open: 1701)
  • ATF Temperature sensor faulty (P1712)
  • Stop lamp s/w faulty (P0703)
- TCM faulty (Check engine lamp ON)
- After IG ON until first time stop lamp S/W comes ON→OFF.

Sports Mode

Sports Mode Switch



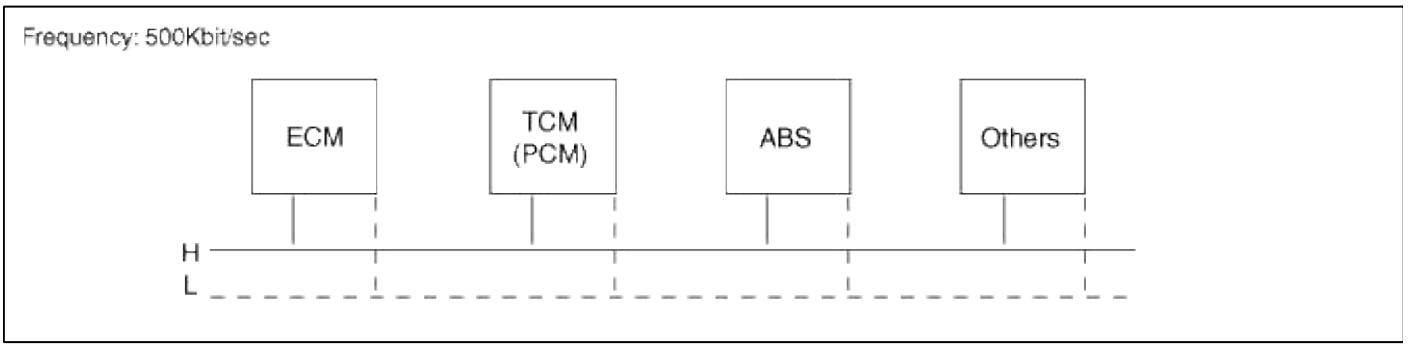


Sports mode allows the manual up-shift and downshift with the accelerator pedal depressed. The prompt response and shift would be obtained due to the continuous shifting without cutting of driving power. The shifting time is also decreased about 0.1sec during up-shift, 0.2sec during downshift. As the selector lever is pushed upward or downward one time, the gear is up shifted or downshifted by one gear.

Signals of sports mode switch

Items	Mode S/W	UP S/W	DOWN S/W
D range selection	OFF	OFF	OFF
Sports mode selection	ON	OFF	OFF
Sports mode up-shift selection	ON	ON	OFF
Sports mode downshift selection	ON	OFF	ON

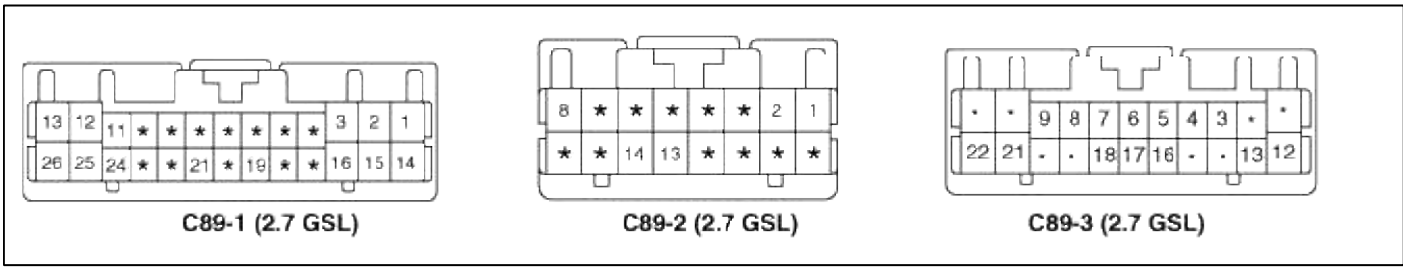
Controller Area Network (CAN)
Previously, for different computers in the vehicle to share the same information, each signal required a different pin and wiring. However, with the introduction of a CAN system, only two lines are required to achieve the same function. The information is in digital format.



Input signals to TCM(PCM) through 'CAN communication'
- Engine rpm, TPS signal
- A/CON signal, Engine coolant temperature
- Quantity of intake airflow, Vehicle speed
- Shift holding signal (FTCS ON)

Output signals from TCM(PCM) through 'CAN communication'
- Request signal for torque reduction
- ATF temperature, TCM(PCM) type, TCM(PCM) error or not
- Damper clutch ON, OFF / Gear position

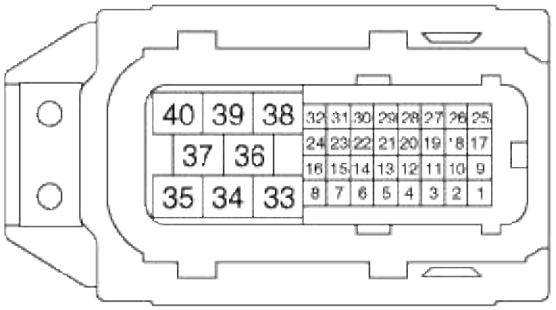
TCM(PCM) PIN DESCRIPITION



Terminal Number		Description
	1	SOLENOID VALVE(UD)
	2	POWER 1(SOLENOID VALVE)
	3	POWER 2(SOLENOID VALVE)
	4	-

C89-1	5	-
	6	-
	7	-
	8	AUTO CRUISE
	9	-
	10	-
	11	POWER(IG.1)
	12	GROUND POWER
	13	GROUND POWER
	14	SOLENOID VALVE(OD)
	15	SOLENOID VALVE(DCC)
	16	SOLENOID VALVE(2ND)
	17	-
	18	-
	19	POWER FOR FLASH ROM
	20	-
	21	SHIFT POSITION SIGNAL
	22	-
	23	-
	24	POWER(IG.1)
	25	GROUND FOR POWER
	26	GROUND FOR POWER
C89-2	1	SENSOR-INPUT SPEED
	2	SENSOR-OUTPUT SPEED
	3	-
	4	-
	5	-
	6	-
	7	-
	8	POWER FOR S-RAM
	9	-
	10	-
	11	-
	12	-
	13	GROUND FOR SENSOR
	14	OIL TEMPERATURE SENSOR

	15	-
	16	-
C89-1	1	-
	2	-
	3	CAN-'HIGH'
	4	CAN-'LOW'
	5	INHIBITOR SW.(P)
	6	INHIBITOR SW.(N)
	7	SPT SELECT SW.
	8	SPT DOWN SW.
	9	STOP LAMP SW.
	10	-
	11	-
	12	SOLENOID VALVE(LR/DIR)
	13	K-LINE
	14	-
	15	-
	16	INHIBITOR SW.(R)
	17	INHIBITOR SW.(D)
	18	SPT UP SW.
	19	-
	20	-
	21	A/T CONTROL RELAY
	22	GROUND FOR SIGNAL



C18-2(2.0 GSL)

Terminal NO.		PIN Description
	1	-

C18-2	2	-
	3	-
	4	-
	5	Sports down switch
	6	Inhibiter switch(N)
	7	-
	8	-
	9	-
	10	-
	11	Auto cruise
	12	-
	13	Sports up switch
	14	Inhibiter switch(R)
	15	-
	16	-
	17	-
	18	Sensor ground
	19	Stop switch
	20	Output speed sensor
	21	Sports select switch
	22	Inhibiter switch(P)
	23	-
	24	Shift signal(PWM)
	25	-
	26	Oil temperature sensor
	27	-
	28	Input speed sensor
C18-2	29	Inhibiter switch(D)
	30	-
	31	-
	32	A/T relay
	33	Solenoid valve(OD)
	34	-
	35	Solenoid valve(DCC)
	36	Power source(SOL.)
	37	Ground1

	38	Solenoid valve(LR)
	39	Solenoid valve(2ND)
	40	Solenoid valve(UD)

TCM INPUT/OUTPUT SIGNAL VOLTAGE CHECK SHEET

Gasoline 2.7 Engine (C89-1,2,3)

No.		SIGNAL NAME	CONDITION	INPUT/OUTPUT SIGNAL		TEST RESULT	REMARK
				TYPE	Level		
C89-1	1	UD Solenoid	Shifting	Pulse	HI : V_BAT LO : Max . 1.0V	14.5V 0.31V	
	2 3	A/T PWR Source	IG Off IG On	DC	Max. 1.0V V_BAT	0.0mV 12.7V	"L"
	4	1ST Lamp	1st Speed Otherwise	DC	V_BAT Max. 1.0V	13.8V 8mV	
	5	3rd Lamp	3rd Speed Otherwise	DC	V_BAT Max. 1.0V	13.8V 8mV	
	6	N.A	-	-	-	-	
	7	N.A	-	-	-	-	
	8	ACC Cancel SIG	Non-operating Operating	DC	V_BAT Max. 0.5V		
	9	N.A	-	-	-	-	
	10	N.A	-	-	-	-	
	11 24	V_IG	IG Off IG On	DC	Max. 0.5 V V_BAT	0.0mV 12.4V	TCM(PCM)
	12	GND_PWR1	Idle	DC	Max. 50 mV	0.0mV	
	13	GND_PWR2	Idle	DC	Max. 50 mV	-2.0mV	
	14	OD Solenoid	Shifting	Pulse			
	15	Damper Clutch Solenoid	Lock_Up On	Pulse	HI : V_BAT LO : Max. 1.0V	14.5V 0.31V	
	16	2ND Solenoid	Shifting	Pulse	HI : V_BAT LO : Max. 1.0V	14.4V 0.27V	
	17	2nd Lamp	2nd Speed Otherwise	DC	V_BAT Max. 1.0V	13.8V 8mV	
	18	4th Lamp	4th Speed Otherwise	DC	V_BAT Max. 1.0V	13.8V 8mV	
	19	Flash PWR Source	IG On IG Off	DC	4.0~5.0V Max. 0.5 V	4.5V 0.0mV	Flash ROM

C89-1	20	N.A	-	-	-	-	
	21	N.A	-	-	-	-	
	22	N.A	-	-	-	-	
	23	N.A	-	-	-	-	
	25	GND_PWR3	Idle	DC	Max. 50 mV	-2.0mV	
	26	GND_PWR4	Idle	DC	Max. 50 mV	-2.0mV	
C89-2	1	Speed Sensor-Input	Idle	Pulse	HI : Min. 4.0V LO : Max. 1.0V	4.96V 354mV	
	2	Speed Sensor-Output	30kph	Pulse	HI : Min. 4.0V LO : Max. 1.0V	4.95V 359mV	
	3	N.A	-	-	-	-	
	4	N.A	-	-	-	-	
	5	N.A	-	-	-	-	
	6	N.A	-	-	-	-	
	7	N.A	-	-	-	-	
	8	V_BAT	Key removal Always	DC vol. Current	Below 1.0 mA V_BAT	0.41mA 12.6V	TCM(PCM)
	9	N.A	-	-	-	-	
	10	N.A	-	-	-	-	
	11	N.A	-	-	-	-	
	12	N.A	-	-	-	-	
	13	GND_Sensor	Idle	DC	Max. 50 mV	22mV	OTS/PG-B
	14	Oil Temp. Sensor_ATM	Idle	Analog	0.5V ~ 4.5V	2.5V	at 60.0°C
	15	N.A	-	-	-	-	
	16	N.A	-	-	-	-	
	1	N.A	-	-	-	-	
	2	N.A	-	-	-	-	
	3	CAN_HI	-	Pulse	2.0 ~ 3.0V 2.75~4.5V	2.51V 3.52V	(Commnicatio speed : 500kbps)
	4	CAN_LO	-	Pulse	2.0 ~ 3.0V 0.5~2.25V	2.48V 1.49V	(Commnicatio speed : 500kbps)

C89-3	5	P Range Selection	P Position Otherwise	DC	V_BAT Max. 1.0V	13.8V 21mV	
	6	N Range Selection	N Position Otherwise	DC	V_BAT Max. 1.0V	13.8V 21mV	
	7	SPT Select Selection	Select Position Otherwise	DC	V_BAT Max. 1.0V	14.1V 21mV	
	8	SPT Down Selection	Down Position Otherwise	DC	V_BAT Max. 1.0V	13.9V 26mV	
	9	Brake SW(N.O)	Release Push	DC	Max. 0.5V V_BAT	13.4V 0.0mV	
	10	N.A	-	-	-	-	
	11	N.A	-	-	-	-	
C89-3	12	LR Solenoid	Shifting	Pulse	HI : V_BAT LO : Max . 1.0V	14.4V 0.27V	
	13	Diagnosis "K"	Scan tool communication	Pulse	HI : Min V_BAT 70% LO : Max. V_BAT 30%	11.3V 0.21V	(Commnicatio speed: >10.4kbps)
	14	N.A	-	-	-	-	
	15	N.A	-	-	-	-	
	16	R Range Selection	R Position Otherwise	DC	V_BAT Max. 1.0V	13.4V 0mV	
	17	D Range Selection	D Position Otherwise	DC	V_BAT Max. 1.0V	13.8V 28mV	
	18	SPT Up Selection	Up Position Otherwise	DC	V_BAT Max. 1.0V	13.9V 21mV	
	19	N.A	-	-	-	-	
	20	N.A	-	-	-	-	
	21	RLY A/T Control	RLY Off RLY On	DC	Max. 1.0V V_BAT	0.0mV 12.8V	"S2"
	22	GND_Sensor	Idle	DC	Max. 50 mV	8mV	TCM(PCM) Signal

GASOLINE 2.0 ENGINE (C18-2)

PIN No.	SIGNAL	CONDITION	INPUT. OUTPUT VALUE		TEST RESULT	REMARK
			TYPE	LEVEL		

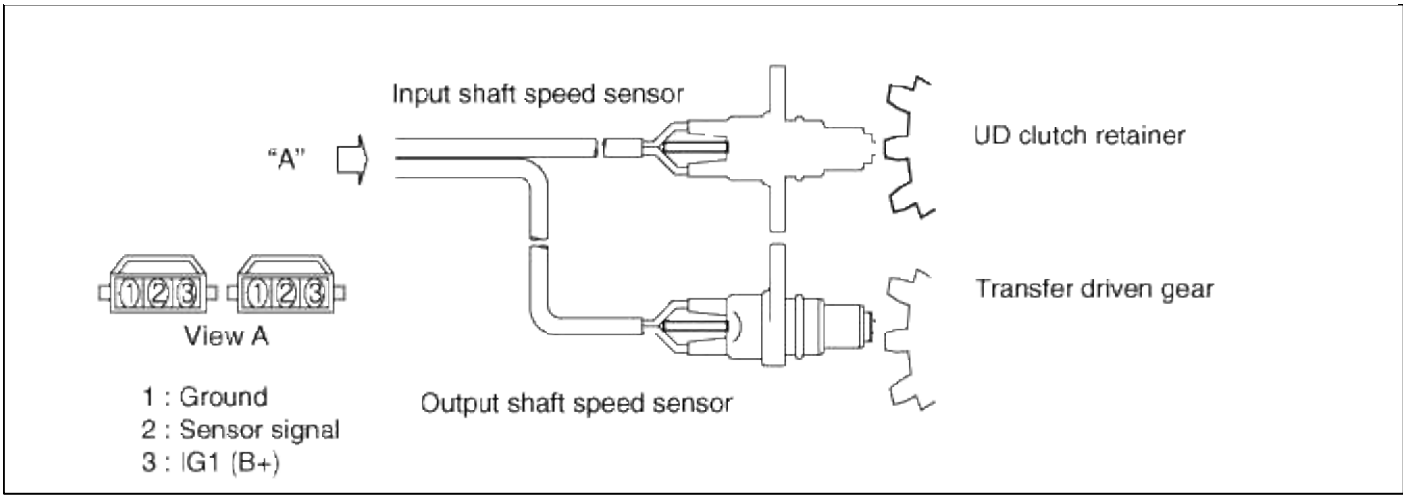
5	Sport down SW	DOWN ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Sport mode down SW
		Others			0.2V	
6	N-SW	N ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Inhibitor SW (N)
		Others			0.2V	
9	V_ATREL	ON	Power		12.4V (Vbatt Level)	Batt. Voltage after A/T RELAY
		OFF			0.2V	
11	Auto cruise	Auto cruise ON	PULL UP INPUT	Vlow < 1.8V Vhigh > 4.2V	12.37V (Vbatt Level)	Auto cruise input from Cruise controller
		Auto cruise OFF			0.2V	
13	Sport up SW	UP ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Sport mode up SW
		Others			0.2V	
14	R-SW	R ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Inhibitor SW (R)
		Others			0.2V	
18	Sensor GND	Always	Power		GND level (0V)	
19	BRAKE SW	Brake ON	Sens	Vlow < 1.0V Vhigh > 6V	12.37V (Vbatt Level)	Detect BW input with open status detection function
		Brake OFF			0.2V	
20	Output speed	No signal: 1009 RPM	Pulse	Vlow < 1.8V Vhigh > 4.2V		Duty 50±20%, 1.116kHz
21	Sport SEL. SW	SEL. ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Sport mode Select SW
		Others			0.2V	
22	P-SW	P ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Inhibitor SW (P)
		Others			0.2V	
24	Trip computer		PWM	3.0 < I < 5.0 A	50Hz	Sports Mode P,R,N,D range : 100% 1st gear : 12.5% 2nd gear : 27.5% 3rd gear : 42.5 % 4th gear : 57.5 %

26	Oil Temperature sensor		Analog	V = -0.3~VB	85°C → 0.8V	
28	Input speed	Ne signal: 2068 RPM	Pulse	Vlow < 1.8V Vhigh > 4.2V Active : high		Duty 50±20%, 2.049kHz
29	D-SW	D ON	Static signal	Vlow < 1.8V Vhigh > 4.2V Active : high	12.37V (Vbatt Level)	Inhibitor SW (D)
		Others			0.2V	
32	A/T Relay	A/T ON	Static signal	Norminal load current 1.1A	11.44V (Vbatt Level)	
		A/T OFF			0.2V	
33	Solenoid valve(OD)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st,2nd : 2kHz, 30% Positive duty (VB:12V) 3rd,4th: 100% Positive duty
35	Solenoid valve(DCC)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st,2nd : 100% Positive duty 3rd,4th: unknown
37	Power GND	Always	Power		GND level	
38	Solenoid valve(LR)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st: 100% Positive duty 2nd,3rd,4th:2kHz, 30% Positive duty (VB:12V)
39	Solenoid valve(2ND)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st,3rd:2kHz, 30% Positive duty (VB:12V) 2nd,4th : 100% Positive duty
40	Solenoid valve(UD)	→	PWM	Signal: 3.0 < Isol < 5.0A Supply : V_ATREL.		1st,2nd,3rd : 100% Positive duty 4th: 2kHz, 30% Positive duty (VB:12V)

Sensors

Input shaft & Output shaft speed sensor

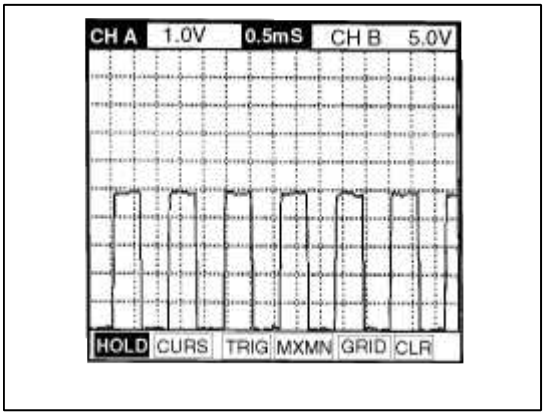
- Type: Hall sensor
- Current consumption: 22mA (MAX.)
- Sensor body and sensor connector have been unified as one.



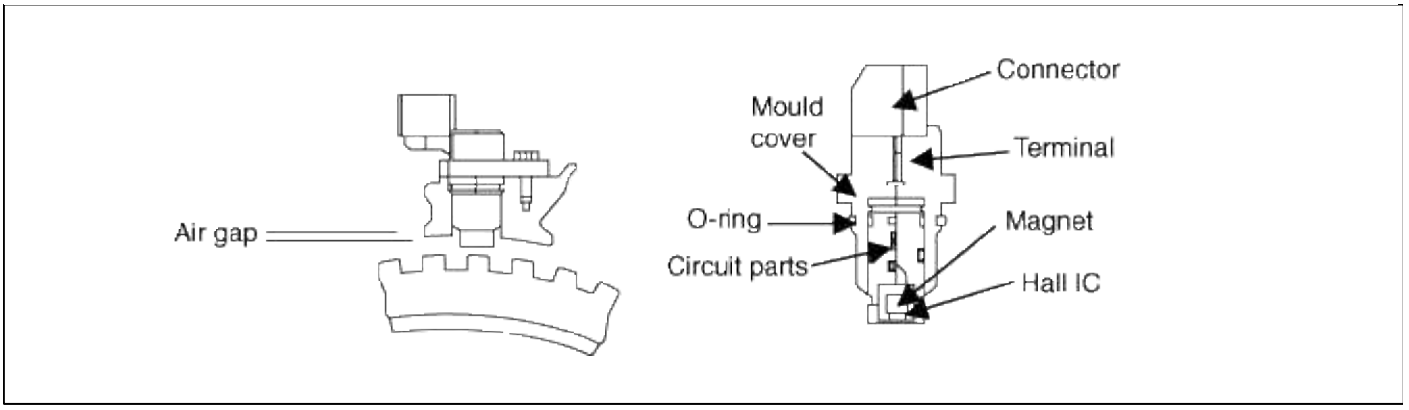
Hall type sensor: specification

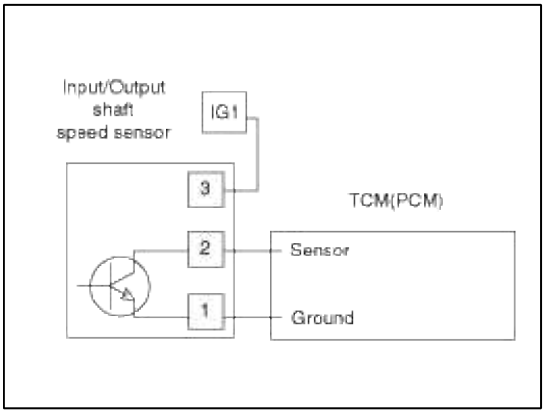
Air gap (mm)	Input shaft speed sensor	1.3
	Output shaft speed sensor	0.85
Coil Resistance	Input shaft speed sensor	over 1MΩ
	Output shaft speed sensor	over 1MΩ
Peak-Peak Voltage	High	4.8~5.2V
	Low	0.8V

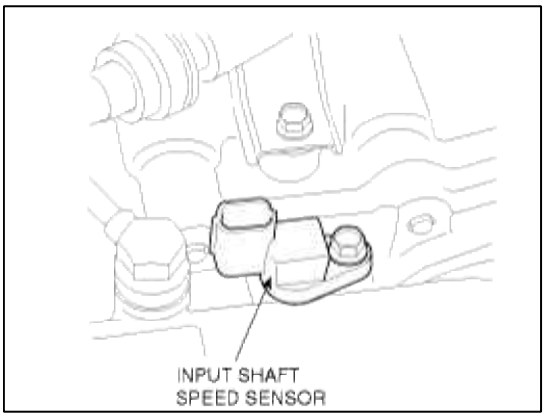
Wave Form With High-scan

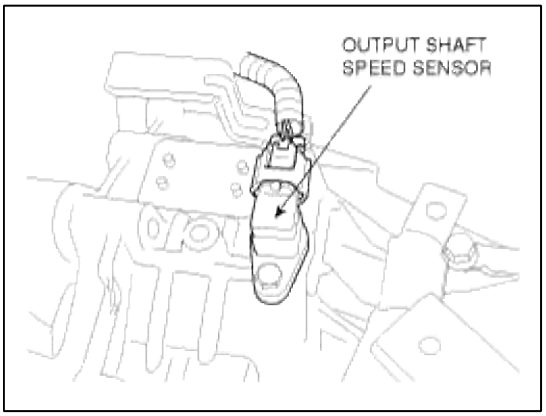


Hall Type Sensor: Structure & Interface







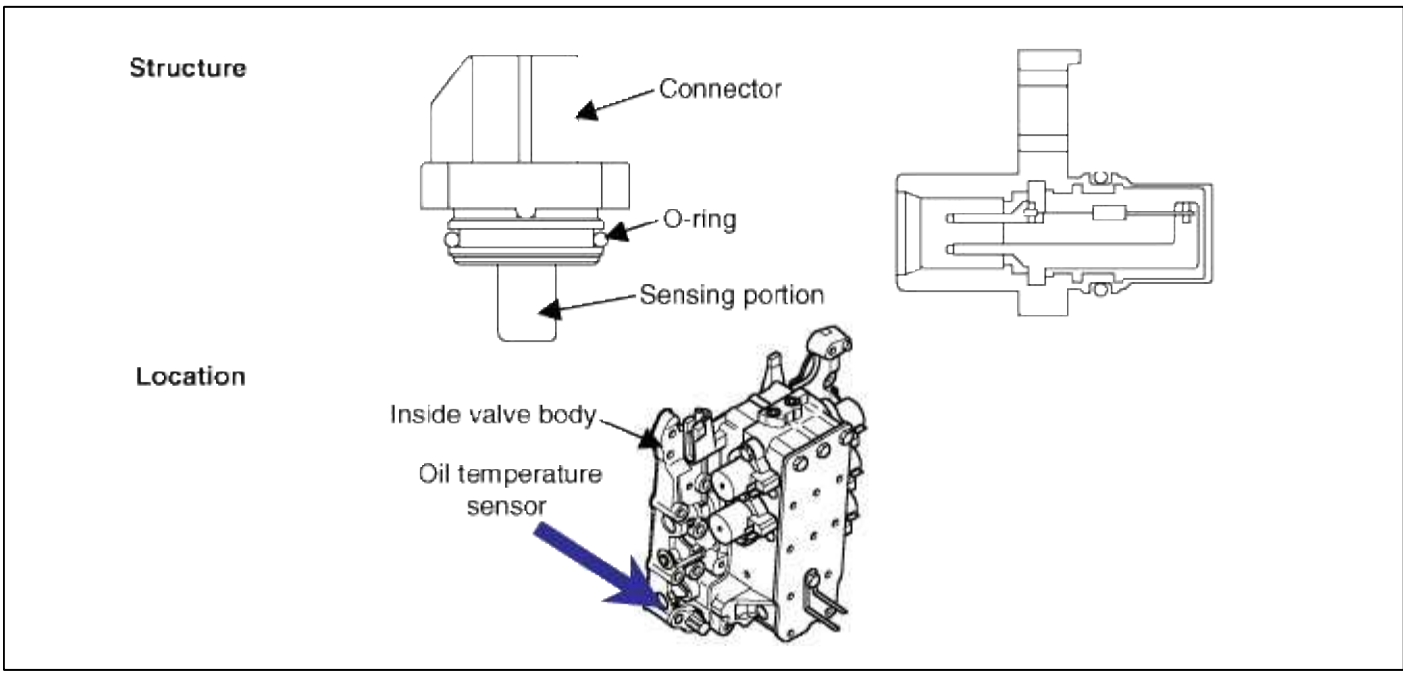


Oil Temperature Sensor

The oil temperature sensor is of the thermistor type, and senses the automatic transaxle fluid temperature. Using the signal from this sensor, TCM(PCM) controls the shift pattern optimally during shift. In order to operate the damper clutch, this signal is also referred.

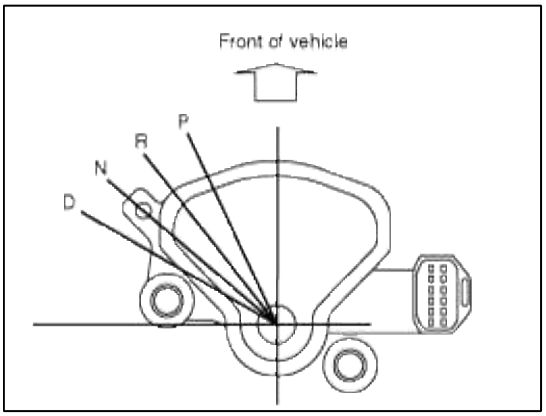
- Range of temperature : -40°C~145°C(-40°F~293°F)
- Type: Separated type (High / Low temperature)
- Standard value of internal resistance

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		

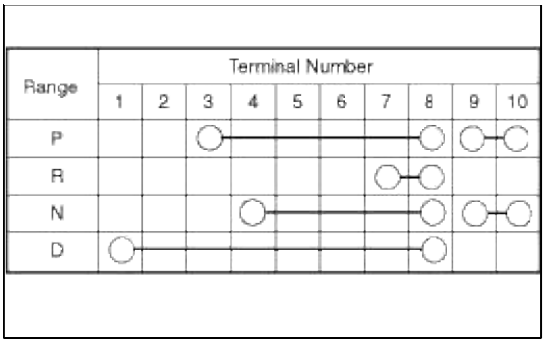


Inhibitor Switch

- Type: Rotary contact type
- Range of temperature : -40°C~145°C(-40°F~293°F)



Inhibitor Switch - Continuity check



Actuators

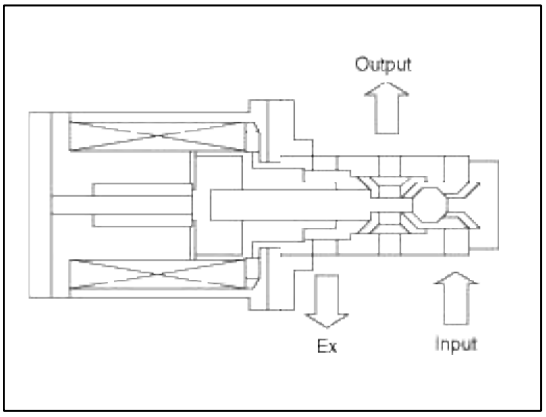
Solenoid Valve for Pressure Control

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

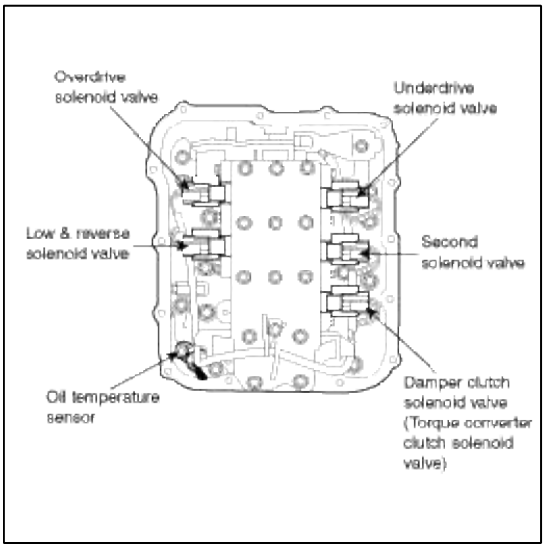
LR, 2ND, UD, OD, RED: 61.27Hz [at the ATF temp. -20°C above(-4°F above)]

DCC: 30.64Hz

- Internal resistance: 2.6Ω or more
- Surge voltage: 56 V



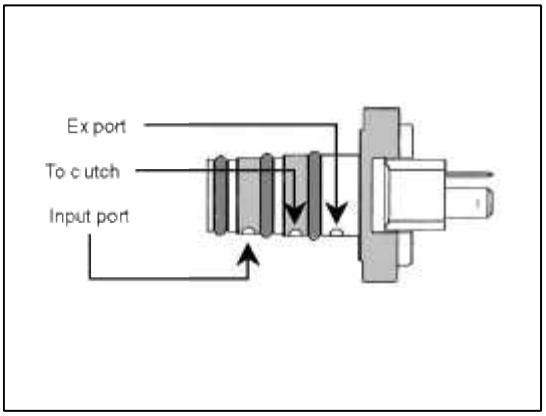
Location



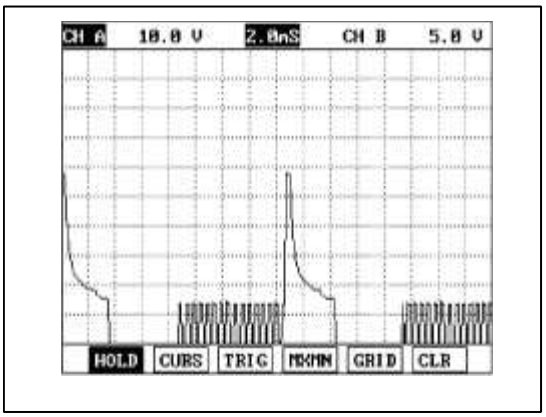
Identification Color of Each Solenoid Valves

Solenoid valve	Wire color	Housing	Frequency
UD sol. valve	White, Red, Red	Black	61.27 Hz
OD sol. valve	Orange, Red	Black	61.27 Hz
L/R sol. valve	Brown, Yellow	Milky white	61.27 Hz
2nd sol. valve	Green, Red, Red	Milky white	61.27 Hz
DCC sol. valve	Blue, Yellow, Yellow	Black	34.64 Hz
ATF temp. Sensor	Black, Red	Black	

- L/R solenoid valve controls the direct clutch in 5A/T as well as low-reverse brake



Wave Form with High-scan
Solenoid valve ON: Hydraulic pressure is released from corresponding clutch or brake.
Solenoid valve OFF: Hydraulic pressure is supplied to corresponding clutch or brake.
Except) DCCSV: When the DCCSV is ON, the damper clutch is operated.



Controlled Pressure

Solenoid valve	Duty 0%	Duty 50%	Duty 75%	Duty 100%
UD, OD, LR, 2ND	10.5±0.1	6.4±0.25	3.6±0.25	0.1 or less
DCC	10.5±0.1	5.9±0.3	3.2±0.3	0.1 or less

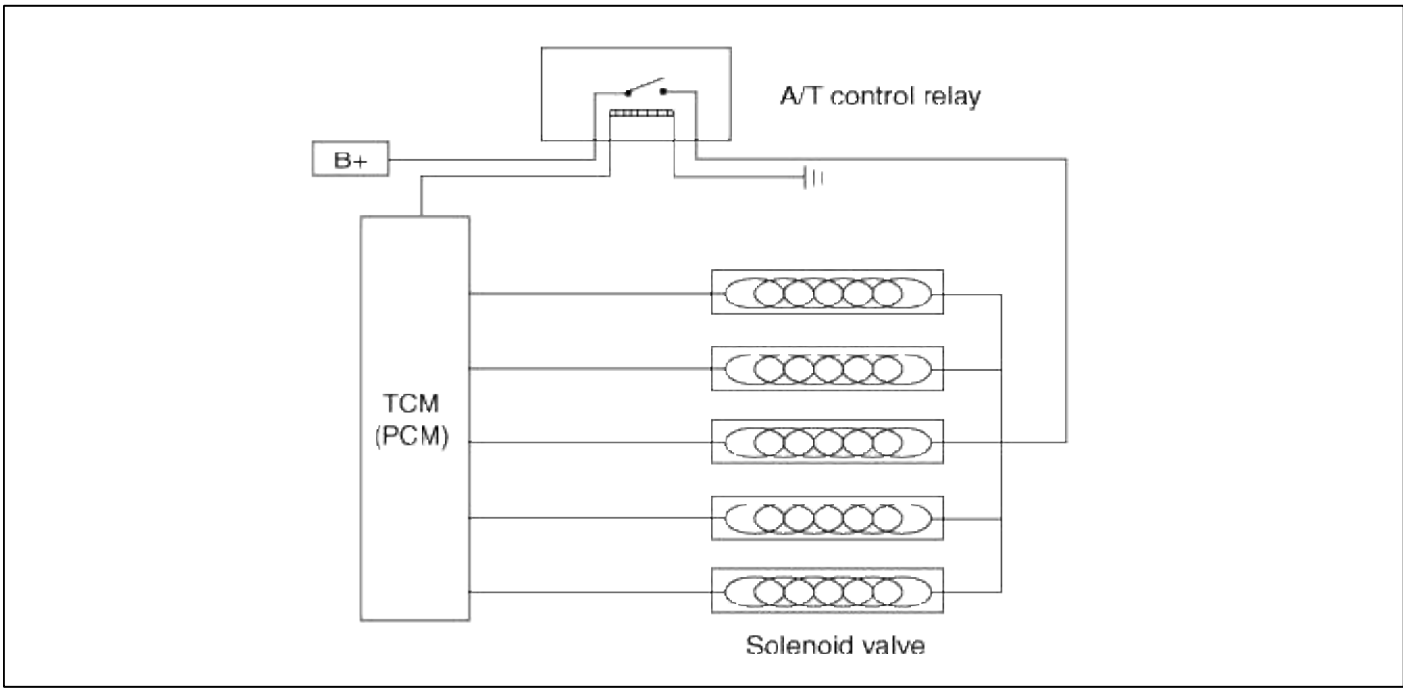
Solenoid Valves Schedule

Position	Solenoid valves				
Operation	LR	2ND	UD	OD	* DCC
1st gear	OFF	ON	OFF	ON	OFF
2nd gear	ON	OFF	OFF	ON	OFF
3rd gear	ON	ON	OFF	OFF	ON
4th gear	ON	OFF	ON	OFF	ON
Reverse	OFF	ON	ON	ON	OFF
N, P (STD. mode)	OFF	ON	ON	ON	OFF
N, P (Hold mode)	ON	OFF	ON	ON	OFF

*: Reference value.
(DCC solenoid valve will be ON when the operating condition is satisfied)

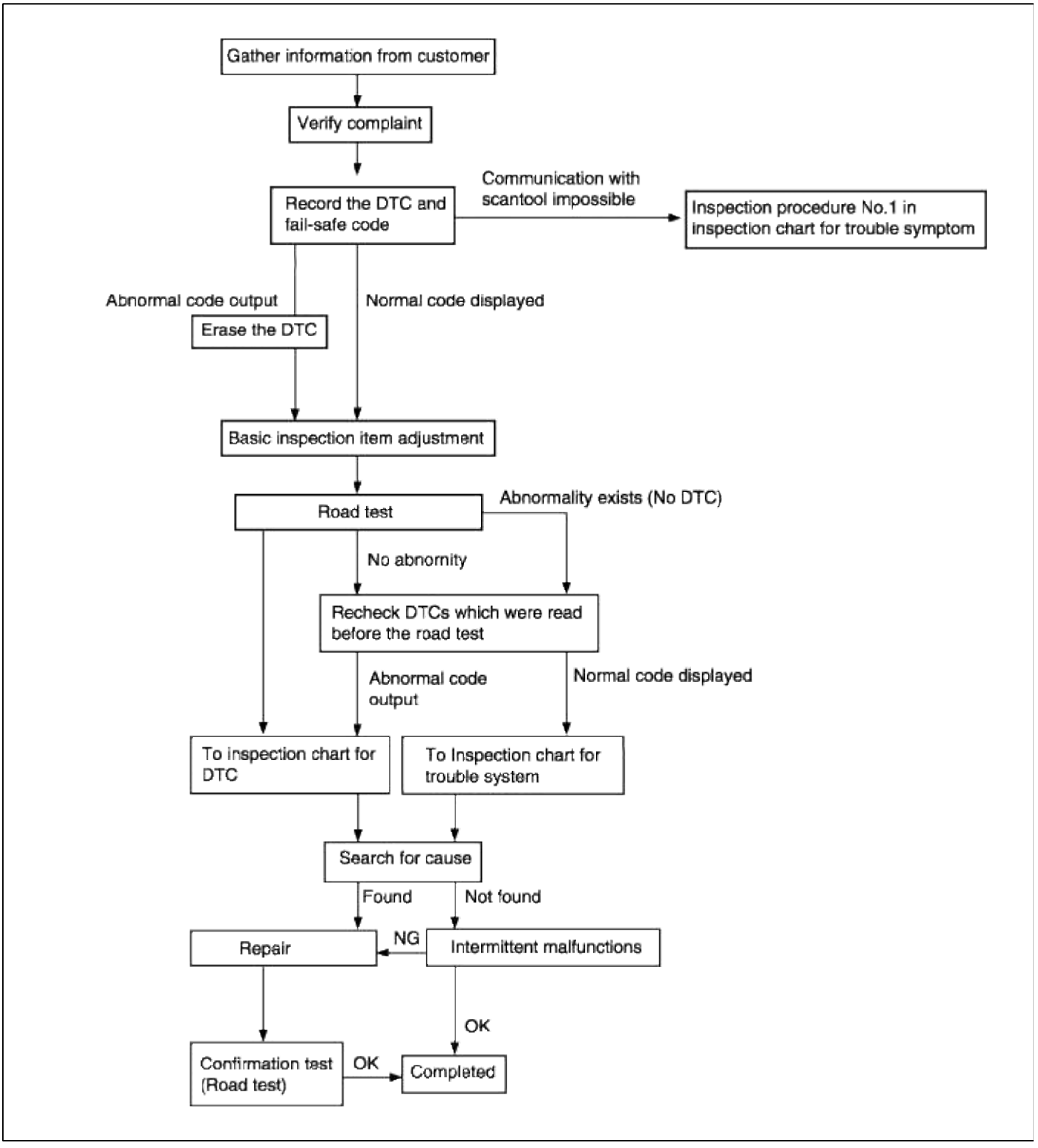
A/T Control Relay

The control relay supplies power to the solenoid valves.
As soon as the A/T control relay is ON, the battery voltage is directly supplied to solenoid valves and each solenoid valve is operated when the TCM grounds the opposite terminal. → (-) Control At fail safe condition, the power is cut causing 3 gear hold.



TROUBLESHOOTING

DIAGNOSIS FLOW



INSPECTION CHART FOR TROUBLE SYMPTOMS

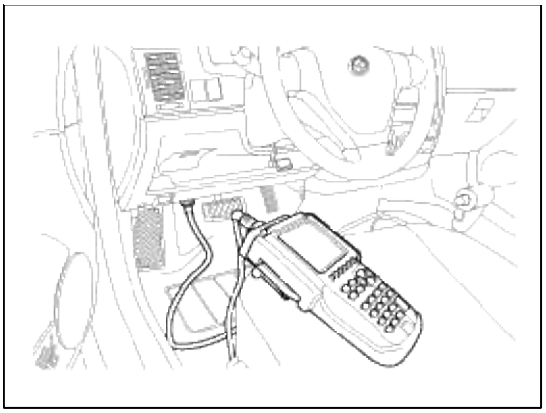
Trouble symptom	Probable cause
Communication with HI-SCAN is not possible If communication with the HI-SCAN is not possible, the cause is probably a defective diagnosis line or the TCM(PCM) is not functioning.	- Malfunction diagnosis line - Malfunction of connector - Malfunction of the TCM(PCM)

Driving impossible	**Starting impossible** Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump.	- Malfunction of the engine system - Malfunction of the torque converter - Malfunction of the oil pump
	Does not move forward If the vehicle does not move forward when the selector lever is shifted from N to D, 3, 2 or L range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	- Abnormal line pressure - Malfunction of the underdrive solenoid valve - Malfunction of the underdrive clutch - Malfunction of the valve body
	Does not reverse If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	- Abnormal reverse clutch pressure - Abnormal low and reverse brake pressure - Malfunction of the low and reverse brake solenoid valve - Malfunction of the reverse clutch - Malfunction of the low and reverse brake - Malfunction of the valve body
	Does not move (forward or reverse) If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the power train, oil pump or valve body.	- Abnormal line pressure - Malfunction of power train - Malfunction of the oil pump - Malfunction of the valve body
Malfunction when starting	**Engine stalling when shifting** If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch solenoid valve, valve body or torque converter (damper clutch malfunction).	- Malfunction of the engine system - Malfunction of the damper clutch control solenoid valve - Malfunction of the valve body - Malfunction of the torque converter (Malfunction of the damper clutch)
	Shocks when changing from N to D and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	- Abnormal underdrive clutch pressure - Abnormal low and reverse brake pressure - Malfunction of the underdrive solenoid valve - Malfunction of the valve body - Malfunction of the idle position switch
Malfunction when starting	**Shocks when changing from N to R and large time lag** If abnormal shocks or a time lag of 2	- Abnormal reverse clutch pressure - Abnormal low and reverse brake pressure

	seconds or more occur when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	- Malfunction of the low and reverse solenoid valve - Malfunction of the reverse clutch - Malfunction of the low and reverse brake - Malfunction of the valve body - Malfunction of the idle position switch
	Shocks when changing from N to D, N to R and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	- Abnormal line pressure - Malfunction of the oil pump - Malfunction of the valve body
Malfunction when shifting	**Shocks and running up** If shocks occur when driving due to up shifting or down shifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	- Abnormal line pressure - Malfunction of each solenoid valve - Malfunction of the oil pump - Malfunction of the valve body - Malfunction of each brake or each clutch
Displaced shifting points	**All points** If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or of a solenoid valve.	- Malfunction of the output shaft speed sensor - Malfunction of the throttle position sensor - Malfunction of each solenoid valve - Abnormal line pressure - Malfunction of the valve body - Malfunction of the TCM(PCM)
	Some points If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	- Malfunction of the valve body
Does not shift	**No diagnosis codes** If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the transaxle range switch, or TCM(PCM)	- Malfunction of the transaxle range - Malfunction of the TCM(PCM)
Malfunction while driving	**Poor acceleration** If acceleration is poor even if down shifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	- Malfunction of the engine system - Malfunction of the brake or clutch
Malfunction while driving	**Vibration** If vibration occurs when driving at constant	- Abnormal damper clutch pressure - Malfunction of the engine system

	speed or when accelerating and deceleration in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch control solenoid valve, torque converter or valve body.	- Malfunction of the damper clutch control solenoid valve - Malfunction of the torque converter - Malfunction of the valve body
Transaxle range switch system The cause is probably a malfunction of the inhibitor switch circuit, ignition switch circuit or a defective TCM(PCM).		- Malfunction of the transaxle range switch - Malfunction of the ignition switch - Malfunction of connector - Malfunction of the TCM(PCM)
Idle position switch system The cause is probably a defective idle position switch circuit, or a defective TCM(PCM).		- Malfunction of the triple pressure switch - Malfunction of connector - Malfunction of the TCM(PCM)
Triple pressure switch system The cause is probably a defective dual pressure switch circuit or a defective TCM(PCM).		- Malfunction of the triple pressure switch - Malfunction of connector - Malfunction of A/C system - Malfunction of the TCM(PCM)
Vehicle speed sensor system The cause is probably a defective vehicle speed sensor circuit or a defective TCM(PCM).		- Malfunction of the vehicle speed sensor - Malfunction of connector - Malfunction of the TCM(PCM)

HOW TO USE SCAN TOOL
INSTRUCTION
With the advent of electronic control vehicles, the system efficiency increases with the complexities, as you would realize.
As medical diagnostic devices do, the advanced testers can help identify and fix the problems.
The scan tool can provide you with the versatile and user friendly monitoring capabilities.
SCAN TOOL FUNCTION
Scan tool offers the following functionality:
Diagonstic trouble codes
Freeze frame data
Current data
Actuation test
HOW TO CONNECT
For vehicles with 16 pin Data Link Connector(DLC), power is supplied from the DLC terminal through the DLC CABLE without the need for an additional power supply.
For connections between the Hi-scan and these vehicle data link terminals the DLC CABLE 16 is all that is required.

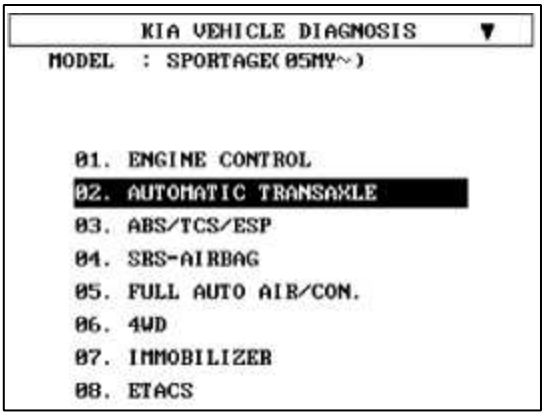


HOW TO SELECT VEHICLE AND SYSTEM

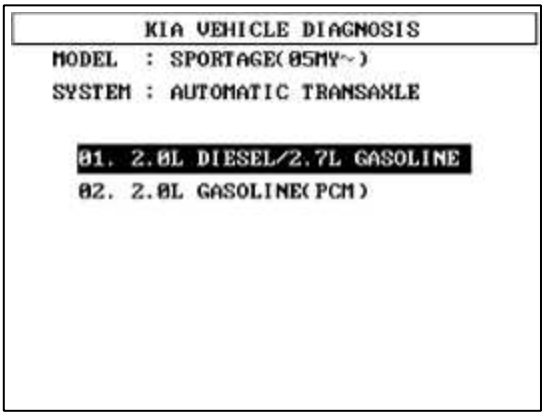
OPERATION FLOW

1. Select "KIA VEHICLE DIAGNOSIS"
2. Select "VEHICLE NAME"

3. Select "AUTOMATIC TRANSAXLE SYSTEM"



4. Select the engine model.



BASIC APPLICATION

Having connected and turned on scan tool, the vehicle and system selection must be made from the 1.0 KIA VEHICLE DIAGNOSIS SCREEN.

The support functions vary according to vehicles. Therefore, the correct selection must be made.
Selection may be made by scrolling up or down the screen and pressing ENTER, or by using the numeric keypad to select the appropriate option number and pressing ENTER.
HOW TO READ DTC

OPERATION FLOW

1. Select vehicle and system
   (Refer to How to select vehicle and system)
2. Select 1.1 DIAGNOSTIC TROUBLE CODES

MODE APPLICATION

At this level, Diagnostic trouble codes(DTC) are displayed for the selected TCM.
HOW TO ERASE DTC

OPERATION FLOW

1. Select "1.1 DIAGNOSTIC TROUBLE CODES"
   (Refer to How to read DTC)
2. Select "ERAS" key on the Diagnostic Trouble codes mode.
3. Select "1.2.2. ERASE FAULT CODE"

MODE APPLICATION

"ERAS"
This soft function key will clear the DTC currently held in the memory of the selected TCM.
If this option is selected, a message requesting confirmation of the ERAS request will be displayed.
The YES or NO key should be used to confirm or cancel the request to clear the current DTC.
DTC TROBLESHOOTING INDEX

TCM(PCM) DTCs (GSL 2.7)

DTC No.	DESCRIPTION	SEE PAGE
P0560	Back-Up BATTERY LINE OPEN	TR-
P0605	EEPROM Abnormal	TR-
P0703	BRAKE SWITCH CIRCUIT	TR-
P0707	TRANS.RANGE SENSOR-LOW	TR-
P0708	TRANS.RANGE SENSOR-HIGH	TR-
P0711	FLUID TEMPERATURE.SENSOR RATIONALITY	TR-
P0712	FLUID TEMPERATURE.SENSOR CIRCUIT-LOW	TR-
P0713	FLUID TEMPERATURE.SENSOR CIRCUIT-HIGH	TR-
P0715	INPUT SPEED SENSOR CIRCUIT	TR-
P0720	OUTPUT SPEED SENSOR CIRCUIT	TR-
P0731	Gear 1 Incorrect Ratio	TR-
P0732	Gear 2 Incorrect Ratio	TR-
P0733	Gear 3 Incorrect Ratio	TR-
P0734	Gear 4 Incorrect Ratio	TR-
P0736	REVERSE INCORRECT RATIO	TR-
P0741	Torque Converter Clutch Circuit Stuck off	TR-
P0742	Torque Converter Clutch Circuit Stuck on	TR-
P0743	DCC(TCC) Solenoid - Open or ground short(Torque Converter Clutch Circuit Electrical)	TR-

P0750	LR Solenoid - Open or ground short(SCSV "A" CIRCUIT MAL.)	TR-
P0755	UD Solenoid - Open or ground short(SCSV "B" CIRCUIT MAL.)	TR-
P0760	2ND Solenoid - Open or ground short(SCSV "C" CIRCUIT MAL.)	TR-
P0765	OD Solenoid - Open or ground short(SCSV "D" CIRCUIT MAL.)	TR-
P0885	A/T RELAY CIRCUIT MAL	TR-
P1500	VEHICLE SPEED SENSOR CIRCUIT	TR-
U0001	CAN COMMUNICATION BUS OFF	TR-
U0100	NO ID From ECU	TR-

TCM(PCM) DTCs (GSL 2.0)

DTC No.	DESCRIPTION	SEE PAGE
P0703	BRAKE SWITCH CIRCUIT	TR-
P0707	TRANS.RANGE SENSOR-LOW	TR-
P0708	TRANS.RANGE SENSOR-HIGH	TR-
P0711	FLUID TEMPERATURE.SENSOR RATIONALITY	TR-
P0712	FLUID TEMPERATURE.SENSOR CIRCUIT-LOW	TR-
P0713	FLUID TEMPERATURE.SENSOR CIRCUIT-HIGH	TR-
P0717	INPUT SPEED SENSOR CIRCUIT	TR-
P0721	OUTPUT SPEED SENSOR	TR-
P0722	OUTPUT SPEED SENSOR CIRCUIT	TR-
P0731	Gear 1 Incorrect Ratio	TR-
P0732	Gear 2 Incorrect Ratio	TR-
P0733	Gear 3 Incorrect Ratio	TR-
P0734	Gear 4 Incorrect Ratio	TR-
P0736	REVERSE INCORRECT RATIO	TR-
P0741	Torque Converter Clutch Circuit Stuck off	TR-
P0743	DCC(TCC) Solenoid - Open or ground short(Torque Converter Clutch Circuit Electrical)	TR-
P0750	LR Solenoid - Open or ground short(SCSV "A" CIRCUIT MAL.)	TR-
P0755	UD Solenoid - Open or ground short(SCSV "B" CIRCUIT MAL.)	TR-
P0760	2ND Solenoid - Open or ground short(SCSV "C" CIRCUIT MAL.)	TR-
P0765	OD Solenoid - Open or ground short(SCSV "D" CIRCUIT MAL.)	TR-
P0885	A/T RELAY CIRCUIT MAL	TR-
U0001	CAN COMMUNICATION BUS OFF	TR-
U0100	NO ID From ECU	TR-

SERVICE DATA LIST(WITH SCAN TOOL)

No.	ITEM NAME	UNIT	DATA	Data Description	Failure
1	ENGINE RPM	rpm	700 rpm	Current Engine rpm	0 rpm
2	VEHICLE SPEED	km/h	0km/h	Current Vehicle speed	0km/h
3	THROTTLE P.SENSOR	%	12.5%	Current TPS open angle	0%
4	INPUT SPEED(PG-A)	rpm	700 rpm	Input speed rpm. Always output rpm when turning start ON	0 rpm
5	OUTPUT SPEED(PG-B)	rpm	0 rpm	Output speed rpm. Always output rpm when driving	0 rpm
6	DCC(TCC) SOLENOID DUTY	%	0%	Control 0% → 100% when operating Damper Clutch	
7	DAMPER CLUTCH SLIP	rpm	260 rpm	Current Damper clutch slip ratio	0 rpm
8	LR SOLENOID DUTY	%	100%	Control 100% → 0% when operating brake	0%
9	UD SOLENOID DUTY	%	100%	Control 100% → 0% when operating clutch	0%
10	2ND SOLENOID DUTY	%	100%	Control 100% → 0% when operating clutch	0%
11	OD SOLENOID DUTY	%	100%	Control 100% → 0% when operating clutch	0%
12	OIL TEMPERATURE	°C	40°C	Current Oil temperature	80°C (176°F)
13	SHIFT POSITION	N,P,REV/1st G/…/5th G	D	Current shift position	P, N
14	TRANSAXLE RANGE SW	P,N/R/D/SPORTS	D	Current shift lever position	P, N
15	A/CON SWITCH	OFF/ON/-/NOT SUPP	OFF	-	
16	IDLE STATUS	OFF/ON/-/NOT SUPP	ON	When idling, ON	
17	BRAKE SWITCH	OFF/ON/-/NOT SUPP	ON	When braking, ON	
18	CRUISE SWITCH	OFF/ON/-/NOT SUPP			
19	SPORT MODE SELECT SW	OFF/ON/-/NOT SUPP	ON	When selecting sport mode, ON	
20	SPORT MODE UP SW	OFF/ON/-/NOT SUPP	ON	When Selecting Sport mode up, ON	
21	SPORT MODE DOWN SW	OFF/ON/-/NOT SUPP	ON	When selecting sport mode down, ON	

22	A/T CONTROL RELAY VOLT	V	12.9V		0V
23	ENGINE TORQUE	%	20%		
24	HIVEC MODE	A/B/C/D/-/F	F	A/B/C/D is control mode, F is release mode	F

HIVEC -SAT(SIEMENS ADAPTIVE TRANSMISSION CONTROL) Mode (Shift Patten)

Shift patten	Description(Help)	SCAN DISPLAY
ECONOMY	Economy Driver shift patten for flat road	A
MEDIUM	Shift patten for medium road	B
SPORTS	Shift patten for sport road	C
LOAD 1	Shift patten for low land, slow grade and slope	D
LOAD 3	Shift patten for downhill road	F

Actuator inspection

NO	ITEM NAME	Actuator Driving	Condition
1	LR SOLENOID(SCSV A)	Solenoid valve driven for 5 sec.	1. IG Key ON 2. Inhibitor SW normal 3. P range 4. Vehicle speed 0km/h 5. Engine stop 6. No failure 7. TPS < 1V
2	UD SOLENOID(SCSV B)		
3	2ND SOLENOID(SCSV C)		
4	OD SOLENOID(SCSV D)		
5	TORQUE CONVERTER SOLENOID VALVE		
6	A/T CONTROL RELAY	OFF for 3 sec.	-
7	INTELLIGENT SHIFT PROHIBIT	Prohibit until IG off	-
8	CLEAR LEARNING VALUE	-	-

ROAD TEST

No.	Condition	Operation	Judgment value	Check item
1	Ignition switch : OFF	Ignition switch (1) ON	Battery voltage (mV)	Control relay
2	• Ignition switch : ON • Engine : Stopped • Selector lever position : P	Selector lever position (1) P, (2) R, (3) N, (4) D	(1) P, (2) R, (3) N, (4) D	Transaxle range switch
		Accelerator pedal (1) Released (2) Half depressed (3) Depressed	(1) 400~1,000 mV (2)Gradually rises from (1) (3) 4,500~5,000 mV	Throttle position sensor
		Brake pedal (1) Depressed (2) Released	(1) ON (2) OFF	Brake switch

3	• Ignition switch : ST • Engine : Stopped	Starting test with lever P or N range	Starting should be possible	Starting possible or impossible
4	Warming up	Drive for 15 minutes or more so that the automatic fluid temperature becomes 70~90°C(158~194°F)	Gradually rises to 70~90°C(158~194°F)	Oil temperature sensor
5	• Engine : Idling • Selector lever position : N	A/C switch (1) ON (2) OFF	(1) ON (2) OFF	Triple pressure switch
		Accelerator pedal (1) Released (2) Half depressed	(1) ON (2) OFF	Idle position switch
			(1) 600~900 rpm (2) Gradually rises from (1)	
			(1) Data changes	Communication with engine-ECU
		Selector lever position (1) N→D (2) N→R	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Malfunction when starting
6	Selector lever position : N (Carry out on a flat and straight road)	Selector lever position and vehicle speed 1. Idling in 1st gear (Vehicle stopped) 2. Driving at constant speed of 20 km/h(12mph) in 1st gear 3. Driving at constant speed of 30 km/h(19mph) in 2nd gear 4. Driving at 50 km/h(31mph) in 3rd gear with accelerator fully closed 5. Driving at constant speed of 50 km/h(31mph) in 4th gear	(2) 1st, (4) 3rd, (3) 2nd, (5) 4th	Shift condition
			(2) 0%, (4) 100%, (3) 100%, (5) 100%	Low and reverse solenoid valve
			(2) 0%, (4) 0%, (3) 0%	Underdrive solenoid valve
			(1) 100%, (2) 0%, (3) 100%	Second solenoid valve
			(2) 100%, (3) 100%, (4) 0%	Overdrive solenoid valve
			(1) 0km/h (4) 50km/h	Vehicle speed sensor
			(4) 1,800 ~ 2,100rpm	Input shaft speed sensor
			(4) 1,800 ~ 2,100rpm	Output shaft speed sensor
	Selector lever position : D (Carry out on a flat and	• Accelerate to 4th gear at a throttle position sensor output of 1.5V	For (1), (2) and (3), the reading should be the same as the	Malfunction when shifting

7	straight road)	(accelerator opening angle of 30 %). • Gently decelerate to a standstill. • Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). • While driving at 60 km/h(37mph) in 4th gear, shift down to 3rd gear. • While driving at 40 km/h(25mph) in 3rd gear, shift down to 2nd gear. • While driving at 20 km/h(12mph) in 2nd gear, shift down to 1st gear.	specified output shaft torque, and no abnormal shocks should occur. For (4), (5) and (6), downshifting should occur immediately after the shifting operation is made.	Displaced shift points Does not shift Does not shift from 1 to 2 or 2 to 1 Does not shift from 2 to 3 or 3 to 2 Does not shift from 3 to 4 or 4 to 3
8	Selector lever position : N (Carry out on a flat and straight road)	Move selector lever to R range drive at constant speed of 10km/h(6mph)	The ratio between input and output shaft speed sensor data should be the same as the gear ratio when reversing.	Does not shift

TORQUE CONVERTER STALL TEST

This test measures the maximum engine speed when the selector lever is in the D or R position. The torque converter stalls to test the operation of the torque converter, starter motor, one-way clutch operation, the holding performance of the clutches, and brakes in the transaxle.

CAUTION

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

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

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

Stall speed :
2.0(GSL) : 2400~3000 rpm
2.7(GSL) : 2100~2700 rpm

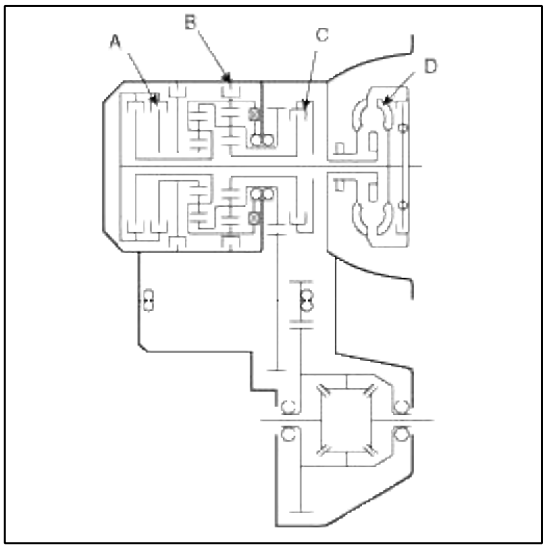
CAUTION

- The throttle should not be left fully open for any more than five seconds.
- If carrying out the stall test two or more times, move the selector 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.

6. Move the selector lever to the "R" position and carry out the same test again.

TORQUE CONVERTER STALL TEST CONCLUSION

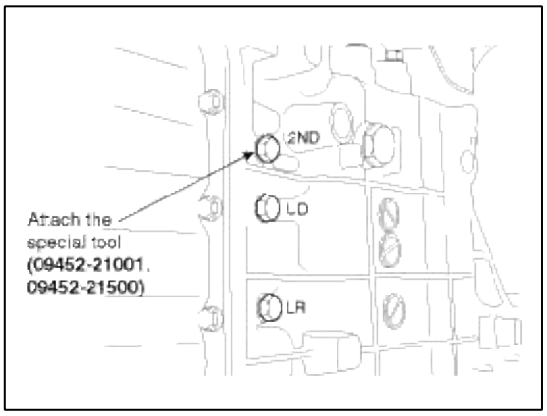
1. Stall speed is too high in both "D" and "R" ranges
   A. Low line pressure
   B. Low & reverse brake(B) slippage
2. Stall speed is to high in "D" range only
   A. Underdrive clutch(C) slippage
3. Stall speed is too high in "R" range only
   A. Reverse clutch(A) slippage
4. Stall speed too low in both "D" and "R" ranges
   A. Malfunction of torque converter(D)
   B. Insufficient engine output

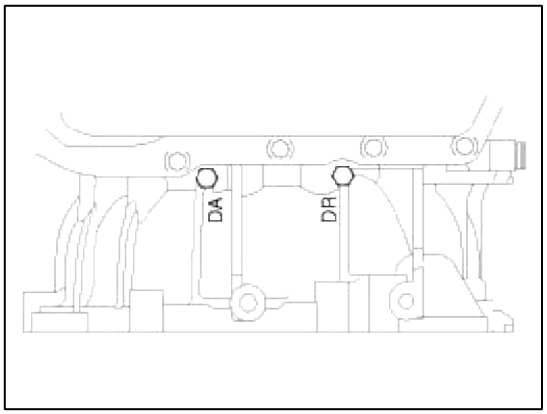


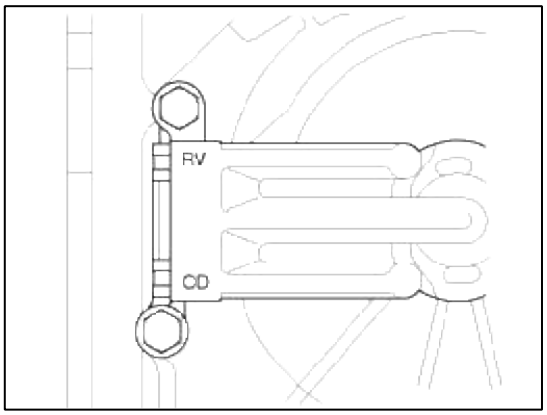
HYDRAULIC PRESSURE TEST

1. Warm up the engine until the automatic transaxle fluid temperature is 80-100°C(176~212°F).
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the special tool (oil pressure gauge) to each pressure discharge port.
4. Measure the hydraulic pressure at each port under the conditions given in the standard hydraulic pressure table, and check that the measured values are within the standard value ranges.

5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.







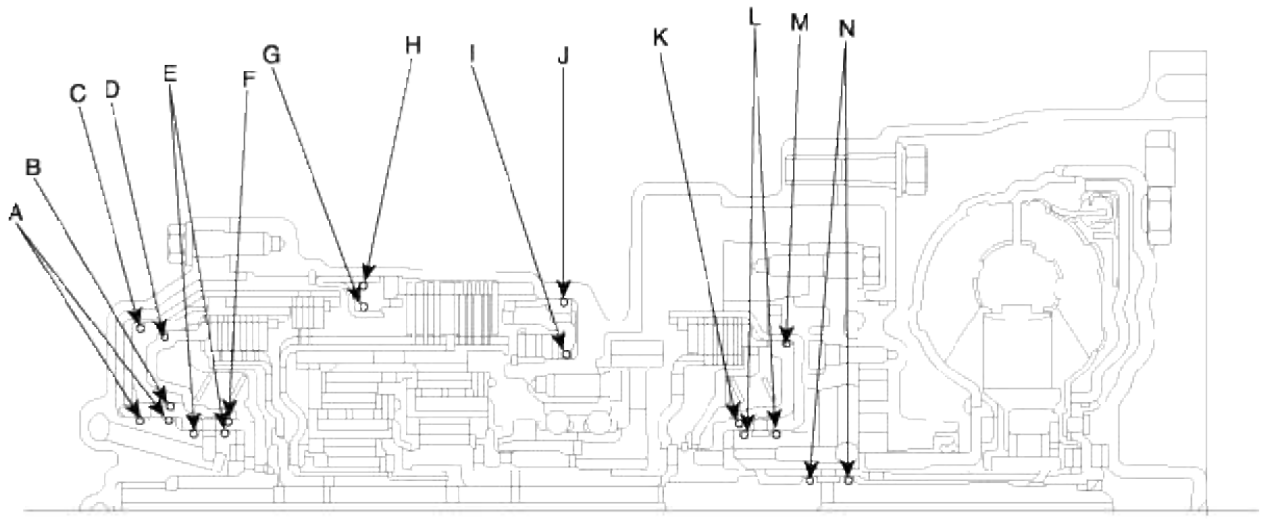
STANDARD HYDRAULIC PRESSURE TEST

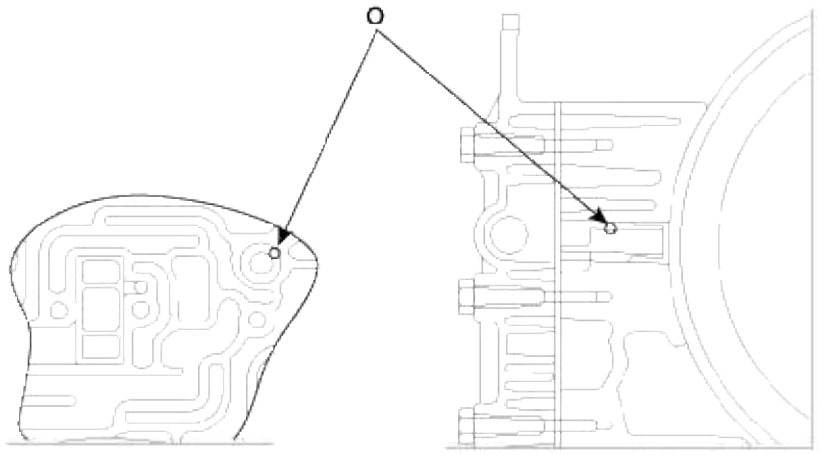
Measurement condition			Standard hydraulic pressure kPa (psi)					
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low and reverse brake pressure	Second brake pressure	Torque converter pressure
P	-	2,500	-	-	-	310-390 (45-56)	-	250-350 (36-56)
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	500-700 (185-256)
N	2,500	-	-	-	-	310-390 (45-56)	-	250-390 (36-56)
	1st gear	2,500	1,010-1,050			1,010-1,050		500-700

	1st gear	2,500	1,050 (146-152)	-	-	1,050 (146-152)	-	(73-101)
D	2nd gear	2,500	1,010-1,050 (146-152)	-	-	-	1,010-1,050 (146-152)	500-700 (73-101)
	3rd gear	2,500	590-690 (85-100)	-	590-690 (85-100)	-	-	450-650 (65-94)
	4th gear	2,500	-	-	590-690 (85-100)	-	590-690 (85-100)	450-650 (65-94)

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

OIL SEAL LOCATION





HYDRAULIC PRESSURE TEST DIAGNOSIS TABLE

Trouble symptom	Probable cause
All hydraulic pressures are high	Incorrect transmission control cable adjustment
	Malfunction of the regulator valve
All hydraulic pressures are low	Incorrect transmission control cable adjustment
	Malfunction of the oil pump

	Clogged oil filter
	Clogged oil cooler
	Malfunction of the regulator valve
	Malfunction of the relief valve
	Incorrect valve body installation
Hydraulic pressure is abnormal in "R" range only	Malfunction of the regulator valve
	Clogged orifice
	Incorrect valve body installation
Hydraulic pressure is abnormal in "3" or "4" range only	Malfunction of the regulator valve
	Clogged orifice
	Incorrect valve body installation
	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Malfunction of the regulator valve
	Malfunction of the switch valve
	Clogged orifice
	Incorrect valve body installation
Only underdrive hydraulic pressure is abnormal	Malfunction of the oil seal K
	Malfunction of the oil seal L
	Malfunction of the oil seal M
	Malfunction of the underdrive solenoid valve
	Malfunction of the underdrive pressure control valve
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal	Malfunction of the oil seal A
	Malfunction of the oil seal B
	Malfunction of the oil seal C
	Clogged orifice
	Incorrect valve body installation
Only overdrive hydraulic pressure is abnormal	Malfunction of the oil seal D
	Malfunction of the oil seal E
	Malfunction of the oil seal F
	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Malfunction check ball

	Clogged orifice
	Incorrect valve body installation
Only low and reverse hydraulic pressure is abnormal	Malfunction of the oil seal I
	Malfunction of the oil seal J
	Malfunction of the low and reverse solenoid valve
	Malfunction of the low and reverse pressure control valve
	Malfunction of the switch valve
	Malfunction of the fail safe valve A
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only second hydraulic pressure is abnormal	Malfunction of the oil seal G
	Malfunction of the oil seal H
	Malfunction of the oil seal O
	Malfunction of the second solenoid valve
	Malfunction of the second pressure control valve
	Malfunction of the fail safe valve B
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal	Malfunction of the oil cooler
	Malfunction of the oil seal N
	Malfunction of the damper clutch control solenoid valve
	Malfunction of the damper clutch control valve
	Malfunction of the torque converter pressure control valve
	Clogged orifice
Pressure applied to non operating element	Incorrect valve body installation
	Incorrect transmission control cable adjustment
	Malfunction of the manual valve
	Malfunction of check ball
	Incorrect valve body installation

Automatic Transaxle System > Automatic Transaxle System > Repair procedures (F4A42-2)

SERVICE ADJUSTMENT PROCEDURE

Automatic transaxle fluid

INSPECTION

1. Drive the vehicle until the fluid reaches normal operating temperature 70~80°C (158~176°F).
2. Place the vehicle on a level surface.

3. Move the selector lever through all gear position. This will fill the torque converter and the hudraulic system with fluid and move the selector lever to the "N" (Neutral) or "P" (Park) position.
4. Before removing the oil level gauge, wipe all contaminants from around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.

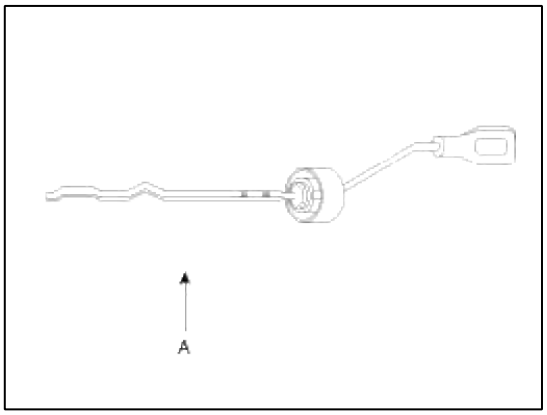
> NOTE
>
> If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction materials, a transaxle overhaul may be necessary.

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

Auto transaxle fluid:
DIAMOND ATF SP-III, SK ATF SP-III
Quantity : 7.8ℓ (8.2 US qt, 6.9 lmp.qt)

> NOTE
>
> Low fluid level can cause a variety of a abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles, which are compressable. 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 acuse the same conditions which occur with low fluid level, resulting in accelerated deterioration of automatic transaxle fluid. In either case, air bubbles can cause overheating, and fluid oxidation, which can interfere with normal valve, clutch, and brake operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

6. Insert the oil level gauge securely.



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

REPLACEMENT

If you have a fluid changer, use this changer to replace the fluid. If you do not, replace it using the following procedure.

1. Disconnect the hose, which connects the transmission and the oil cooler which is within the radiator only in 2.0L engine(2.7L-the oil cooler is separated).

2. Start the engine and let the fluid drain out.

Running conditions : "N" range with engine idling.

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

3. Romove the drain plug from the bottom of the transmission case to drain the fluid.
4. Install the drain plug with a new gasket, and tighten it to the specified torque.

TORQUE :
40 ~ 50Nm (400 ~ 500 kgf.cm, 29 ~ 36 lb-ft)

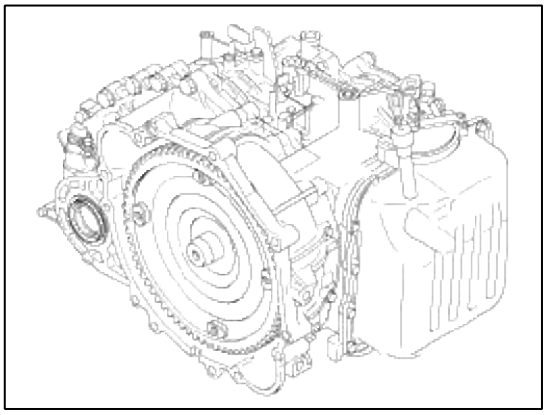
5. Pour the new fluid in through the oil filler tube.

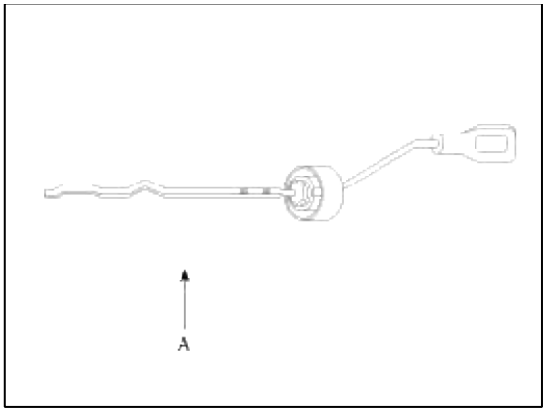
> CAUTION
>
> Stop pouring if the full volume of fluid cannot be poured in.

6. Repeat the procedure in step (2).

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

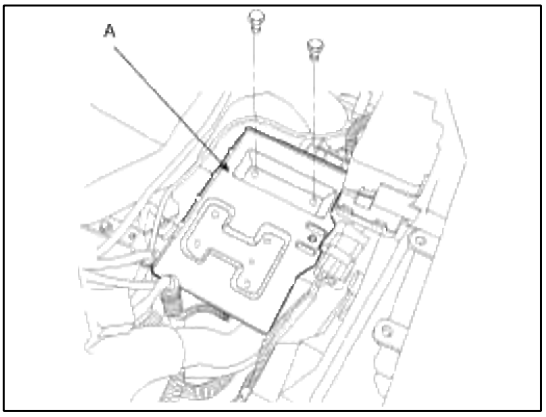
7. Pour the new fluid in through the oil filler tube.
8. Reconnect the hose, which was disconnected in step (1) above, and firmly replace the oil level gauge.(In case of this "replace", this means after wiping off any dirt around the oil level gauge, insert it into the filler tube.)
9. Start the engine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



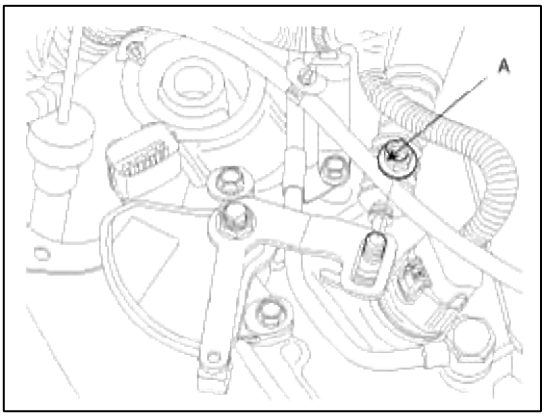


TRANSAXLE RANGE SWITCH (INHIBITOR SWITCH)
REPLACEMENT

1. Pull up the parking brake.
2. Position the shift lever in 'N' range.
3. Remove the air cleaner assembly.
4. Remove the battery.
5. Remove the battery tray(A).

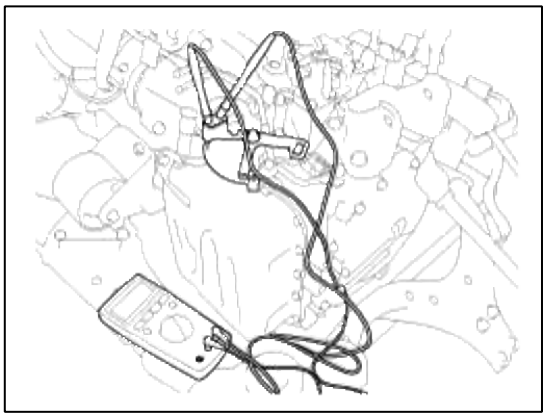


6. Remove the inhibiter switch connector.
7. Remove the shift cable mounting nut(A).



8. Remove the inhibiter switch loosening the mounting bolts.

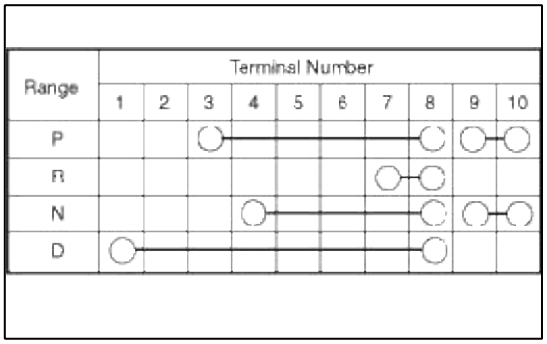
9. Refering to 'INSPECTION', check for continuity. If there is an error, replace the inhibiter switch.



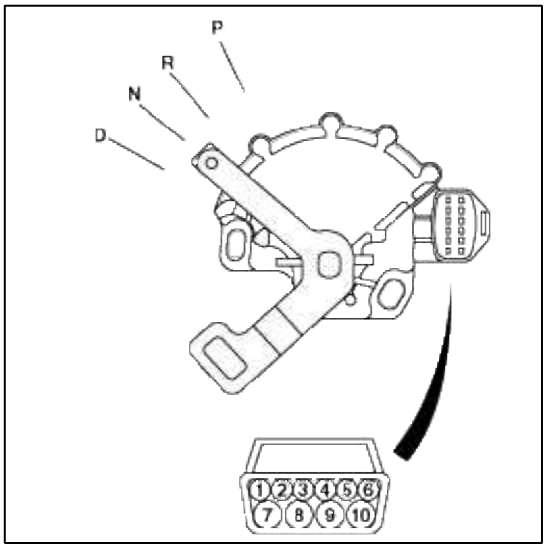
10. After tightening the shift cable mounting nut, connect the inhibiter switch.
11. Install the battery, battery tray and the air cleaner assembly.

INSPECTION

1. Check for the starter motor when the ignition switch is at 'START' position and the shift lever at 'P' or 'N' range.
2. Check for the rear lamp when the ignition switch if it does not work properly.
3. Check for the inhibiter switch if it does not work properly.
4. If the inhibiter switch is not fixed in a proper position, reassemble it in the right position.
5. Re-check 1 and 2.
6. Using a scan tool, confirm the DTCs.
7. Disconnect the battery (-) terminal and the inhibiter switch.
8. Check for continuity between terminals at the switch connector.



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

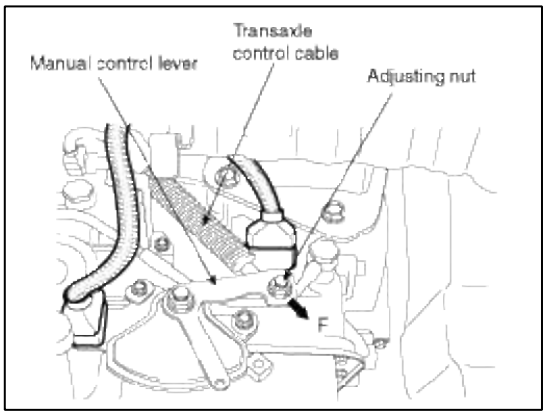


9. If there are not continuity between the terminals in the table above for each switch position, replace the inhibiter switch.

ADJUSTMENT

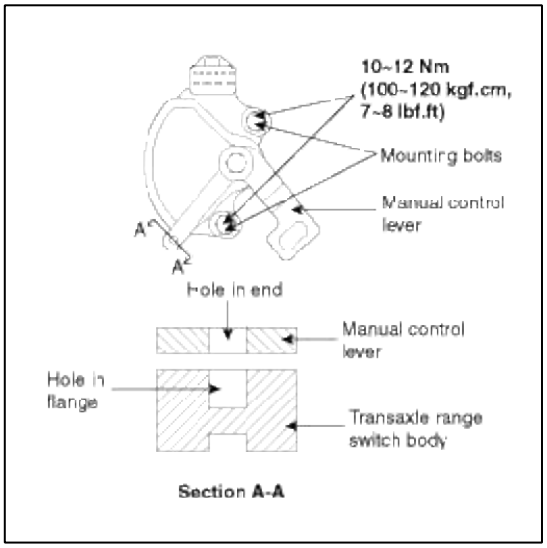
1. Set the select lever to the "N" position.
2. Loosen the control cable to manual control lever coupling nut to free the cable and lever.

3. Set the manual control lever to the neutral 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. Tighten the transaxle range switch body mounting bolts to the specified torque. Make sure at this time that the position of the switch body did not move.

TORQUE :
10~12Nm (100~120kgf.cm, 7~8lb-ft)



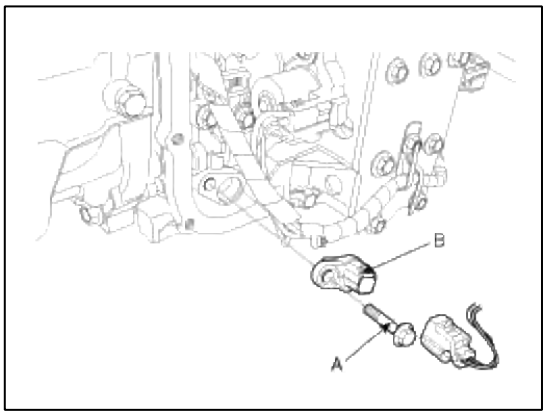
6. Gently pull the transmission control cable in the direction of the arrow, and then tighten the adjusting nut.
7. Check that the select lever is in the "N" position.

OIL TEMPERATURE SENSOR

REPLACEMENT

1. Remove the automatic transaxle assembly.
2. Remove the valve body cover(refer to the overhaul manual).
3. Disconnect the oil temperature sensor connector.

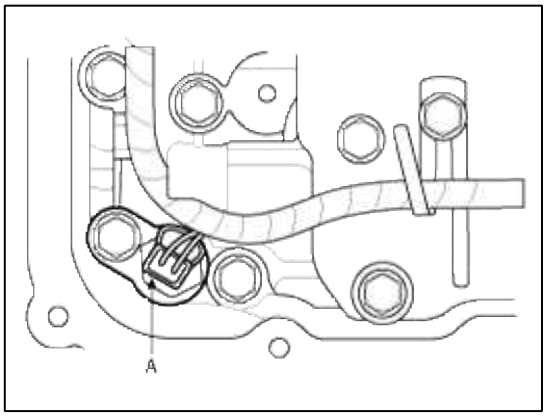
4. Remove the oil temperature sensor(B), loosening the mounting bolt(A).



5. Replace the sensor with the new one and reassemble the rest of the parts.

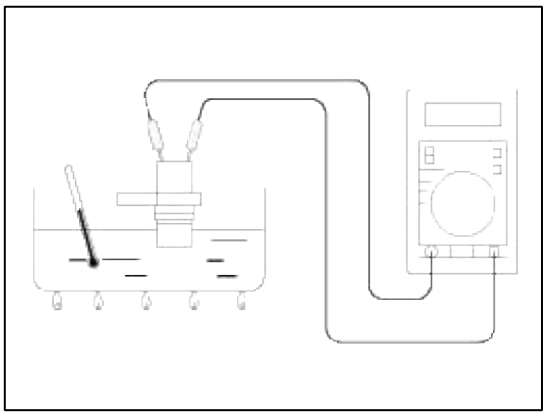
INSPECTION

1. Remove the oil temperature sensor(A).



2. Measure the resistance between the terminal 1 and 2 of the sensor connector.

Temp.[°C(°F)]	Resistance(KΩ)
0(32) 100(212)	18.6 0.63



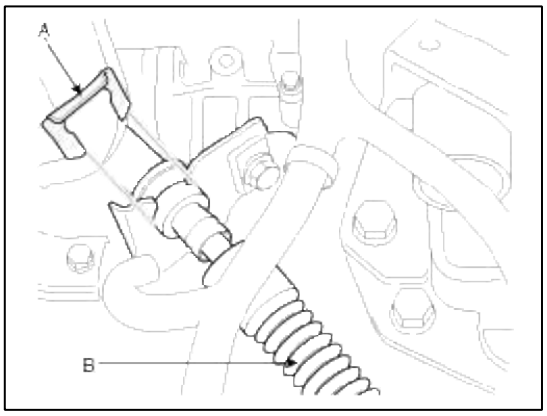
3. If the value is out of the specfication, replace the oil temperature sensor.

INPUT SHAFT SPEED SENSOR

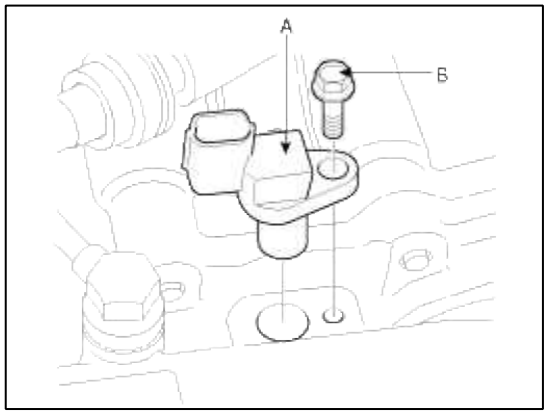
REPLACEMENT

1. Remove the battery and air cleaner (see "Transaxle range switch replacement").
2. Remove the transaxle range switch connector.
3. Remove the control cable to transaxle range switch mounting nut.

4. Remove the clip(A) of the control cable(B).



5. Remove the control cable mounting bracket.
6. Remove the input shaft speed sensor(A).
   (1) Disconnect the input shaft speed sensor connector.
   (2) Remove the bolt(B).



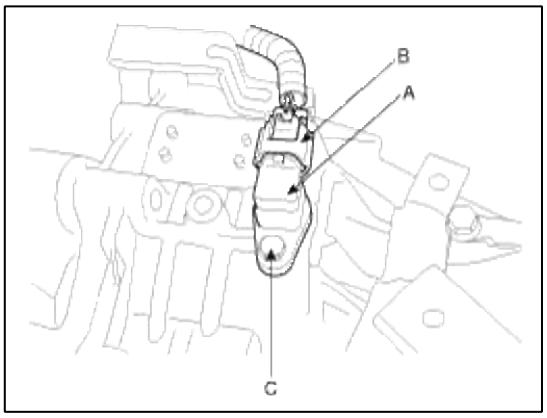
   (3) Inspect the input shaft speed sensor bore.
7. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
8. Install the input shaft speed sensor.
9. Install the control cable mounting bracket.
10. Connect the input shaft speed sensor connector.
11. Install the holder of the control cable.
12. Adjust the control cable to transaxle range switch and tighten the transaxle manual lever to the control cable mounting nut. (see "Automatic transaxle shift control installation")
13. Installation is the reverse of removal.

OUTPUT SHAFT SPEED SENSOR

REPLACEMENT

1. Remove the battery and air cleaner. (see "Transaxle range switch replacement")

2. Remove the output shaft speed sensor(A).



(1) Disconnect the output shaft speed sensor connector(B).

(2) Remove the bolt(C).

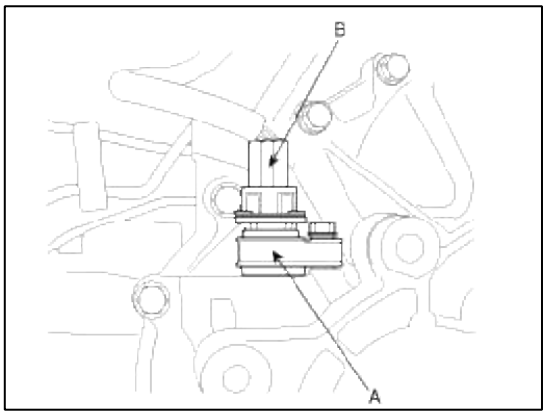
(3) Inspect the output shaft speed sensor bore.

3. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
4. Installation is the reverse of removal.

VEHICLE SPEED SENSOR

REPLACEMENT

1. Lift up the vehicle.
2. Remove the vehicle speed sensor(A).



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

(2) Remove the bolt (10 mm(0.4 in)).

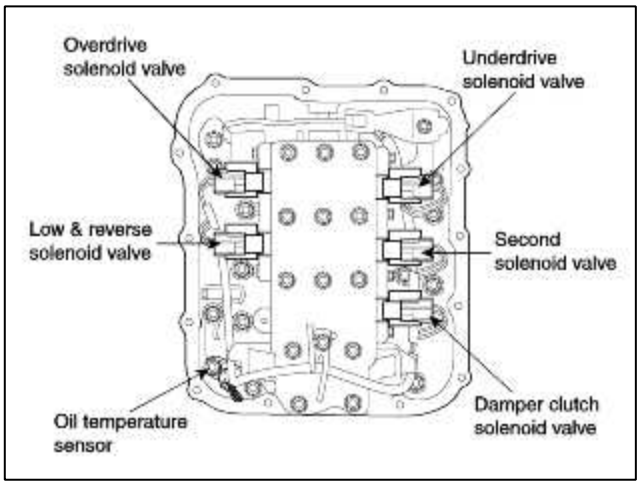
(3) Inspect the vehicle speed sensor bore.

3. Inspect the O-ring for nicks or cut. Install a new O-ring as necessary.
4. Apply a light coat of automatic transaxle fluid to the O-ring seal before installation.
5. Install the vehicle speed sensor.
6. Connect the vehicle speed sensor connector.
7. Installation is the reverse of removal.

SOLENOID VALVE CHECK

1. Remove the valve body cover.

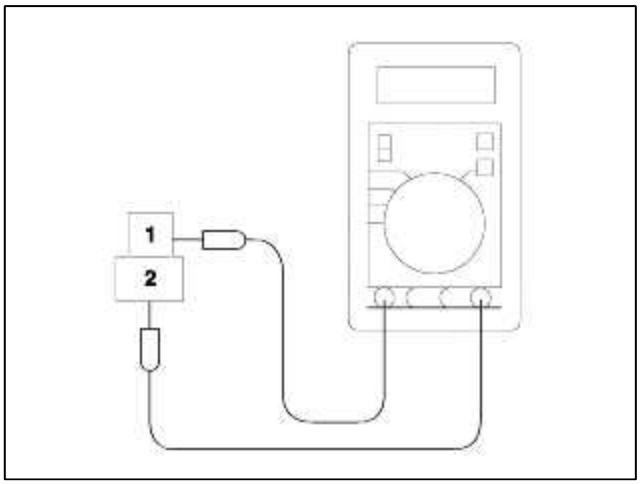
2. Disconnect the connectors of each solenoid valve.



3. Measure the resistance between terminals 1 and 2 of each solenoid valve.

Standard value :

Name	Resistance
Damper clutch solenoid valve	2.7 ~ 3.4Ω (at 20°C(68°F))
Low and reverse solenoid valve	
Second solenoid valve	
Underdrive solenoid valve	
Overdrive solenoid valve	

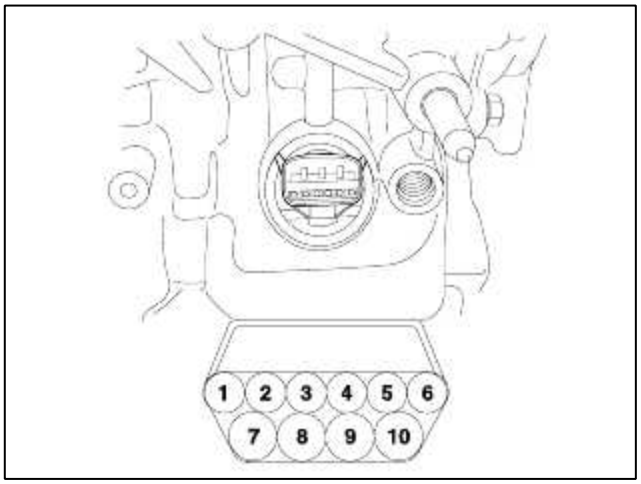


4. If the resistance is outside the standard value, replace the solenoid valve.

NOTE

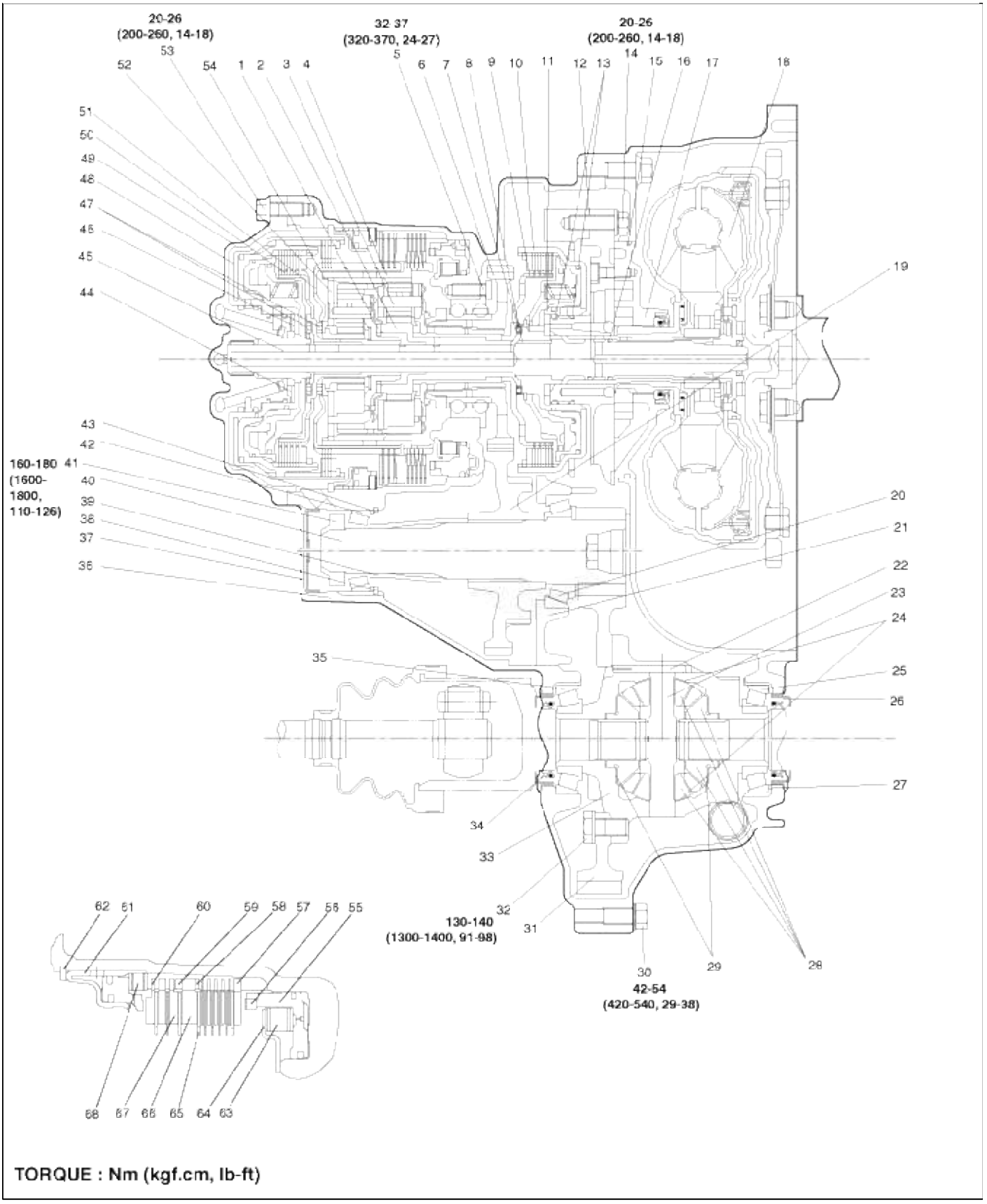
Resistance of the solenoid valve connector.

Terminal No.	Name	Resistance
7 & 10	Damper clutch solenoid valve	2.7 ~ 3.4Ω (at 20°C(68°F))
10 & 6	Low & reverse solenoid valve	
9 & 4	Second solenoid valve	
9 & 3	Underdrive solenoid valve	
9 & 5	Overdrive solenoid valve	



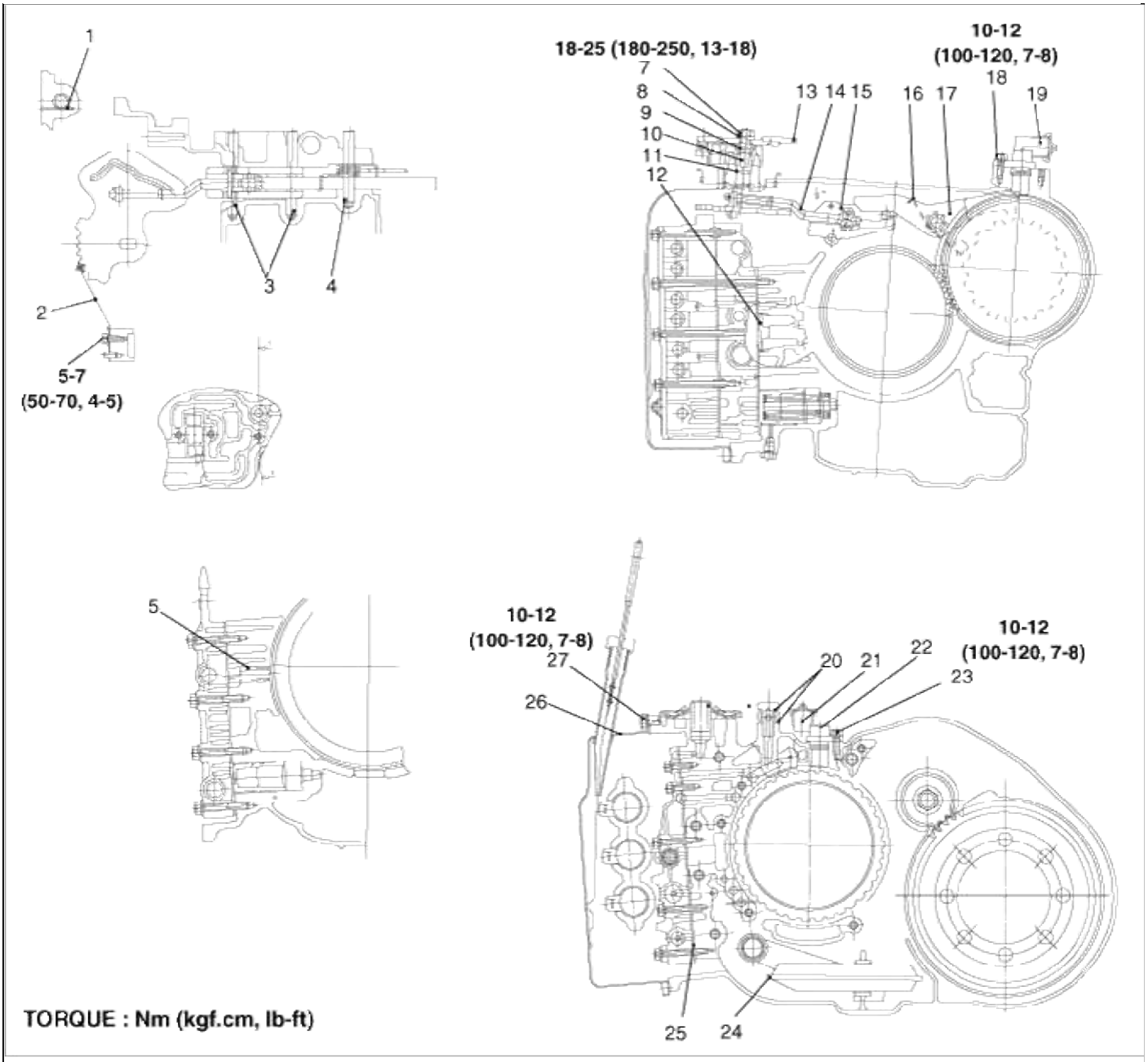
Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Components and Components Location (F4A42-2)

COMPONENTS (1)


20-26
(200-260, 14-18)
32 37
(320-370, 24-27)
20-26
(200-260, 14-18)
160-180
(1600-1800, 110-126)
130-140
(1300-1400, 91-98)
42-54
(420-540, 29-38)
TORQUE : Nm (kgf.cm, lb-ft)

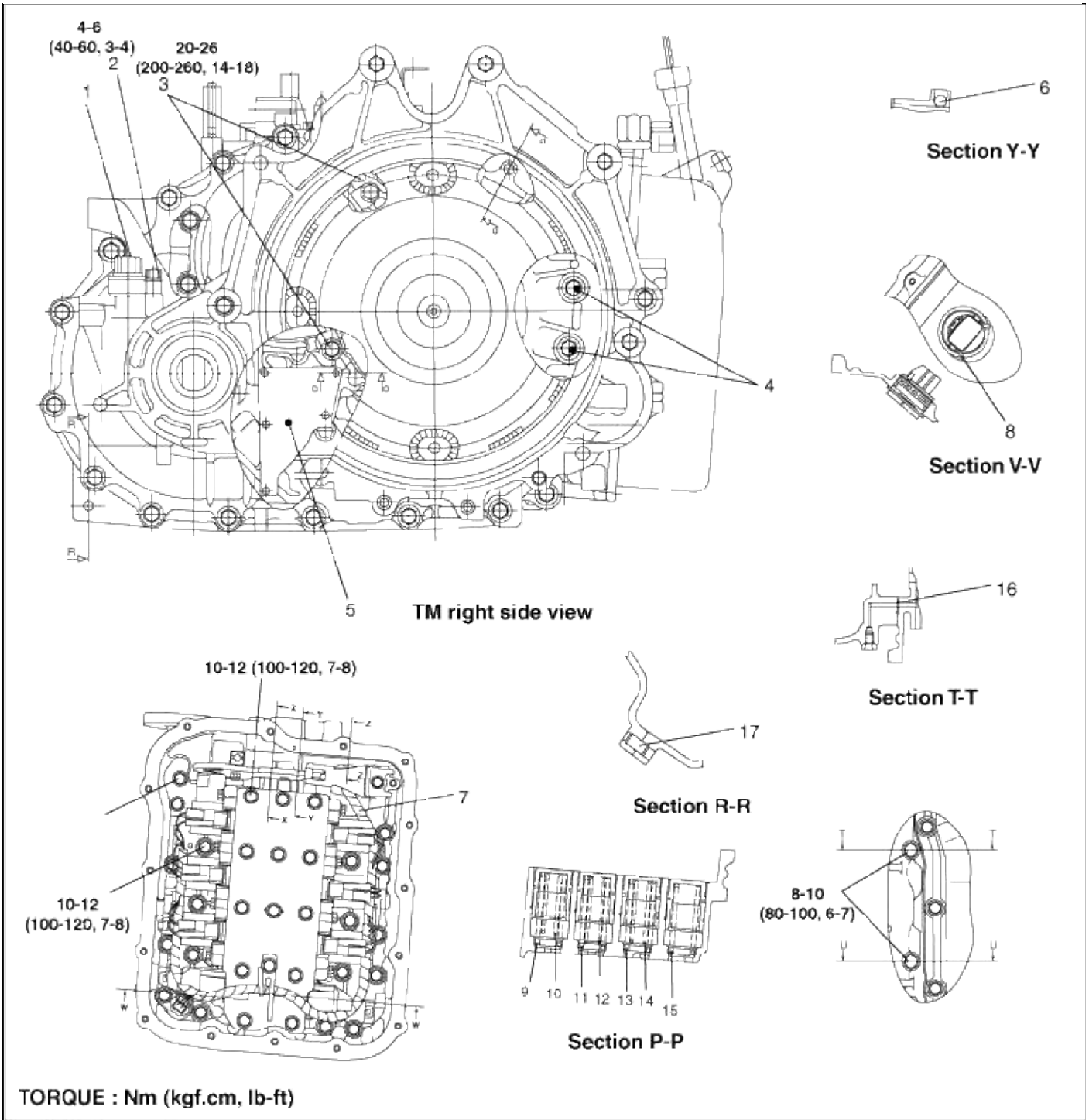
1. Thrust bearing
2. Underdrive sun gear
3. Output carrier
4. Low and reverse annulus gear
5. Bolt
6. Transfer drive gear
7. Snap ring
8. Thrust bearing
9. Underdrive clutch hub
10. Underdrive clutch
11. Thrust washer
12. Oil pump gasket
13. Seal ring
14. Flange bolt
15. O-ring
16. Seal ring
17. Oil pump
18. Torque converter
19. Transfer driven gear
20. Taper roller bearing
21. Bearing retainer
22. Lock pin
23. Pinion shaft
24. Washer
25. Taper roller bearing
26. Oil seal
27. Differential spacer
28. Differential gear
29. Differential spacer set
30. Flange bolt
31. Differential drive gear
32. Fly wheel bolt
33. Differential case
34. Oil seal
35. Transmission case
36. One-way Clutch Inner Race
37. Sealing cap
38. Output spacer set
39. Collar
40. Output shaft
41. Locking pin
42. Roller bearing
43. Snap ring
44. Thrust race
45. Input shaft
46. Thrust bearing
47. Thrust bearing
48. Return & O/D clutch
49. Rear cover
50. O/D clutch hub
51. Return sun gear
52. Output carrier
53. Flange bolt
54. Snap ring
55. Low and reverse brake piston
56. Wave spring
57. Brake pressure plate
58. Snap ring
59. Snap ring set
60. Brake pressure plate
61. 2nd brake retainer
62. Snap ring
63. 2nd brake return spring
64. Brake disc
65. Brake reaction plate
66. Brake plate
67. Brake spring retainer
68. Low and reverse return spring

COMPONENTS (2)



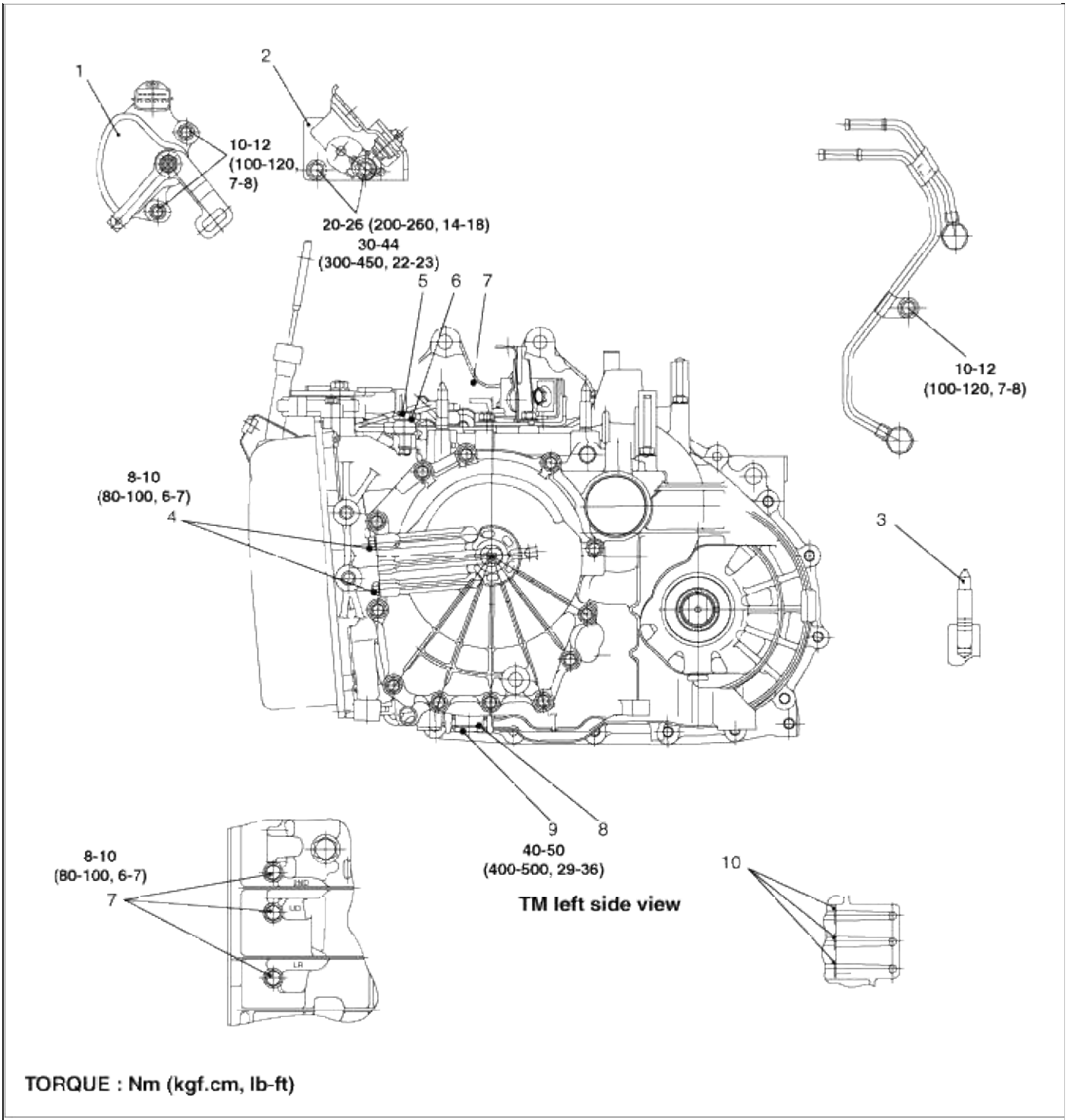
1. Roller
2. Detent spring
3. Parking roller shaft
4. Parking spring shaft
5. Oil seal
6. 2nd brake retainer
7. Flange nut
8. Spring washer
9. Oil ring
10. Manual control shaft
11. Oil ring
12. Oil strainer
13. Manual control lever
14. Parking roller rod
15. Parking roller shaft
16. Parking sprag
17. Parking sprag shaft
18. Flange bolt
19. Output speed sensor
20. Eye bolt
21. Gasket
22. Input speed sensor
23. Flange bolt
24. Oil filter
25. Valve body gasket
26. Valve body
27. Flange bolt

COMPONENTS (3)



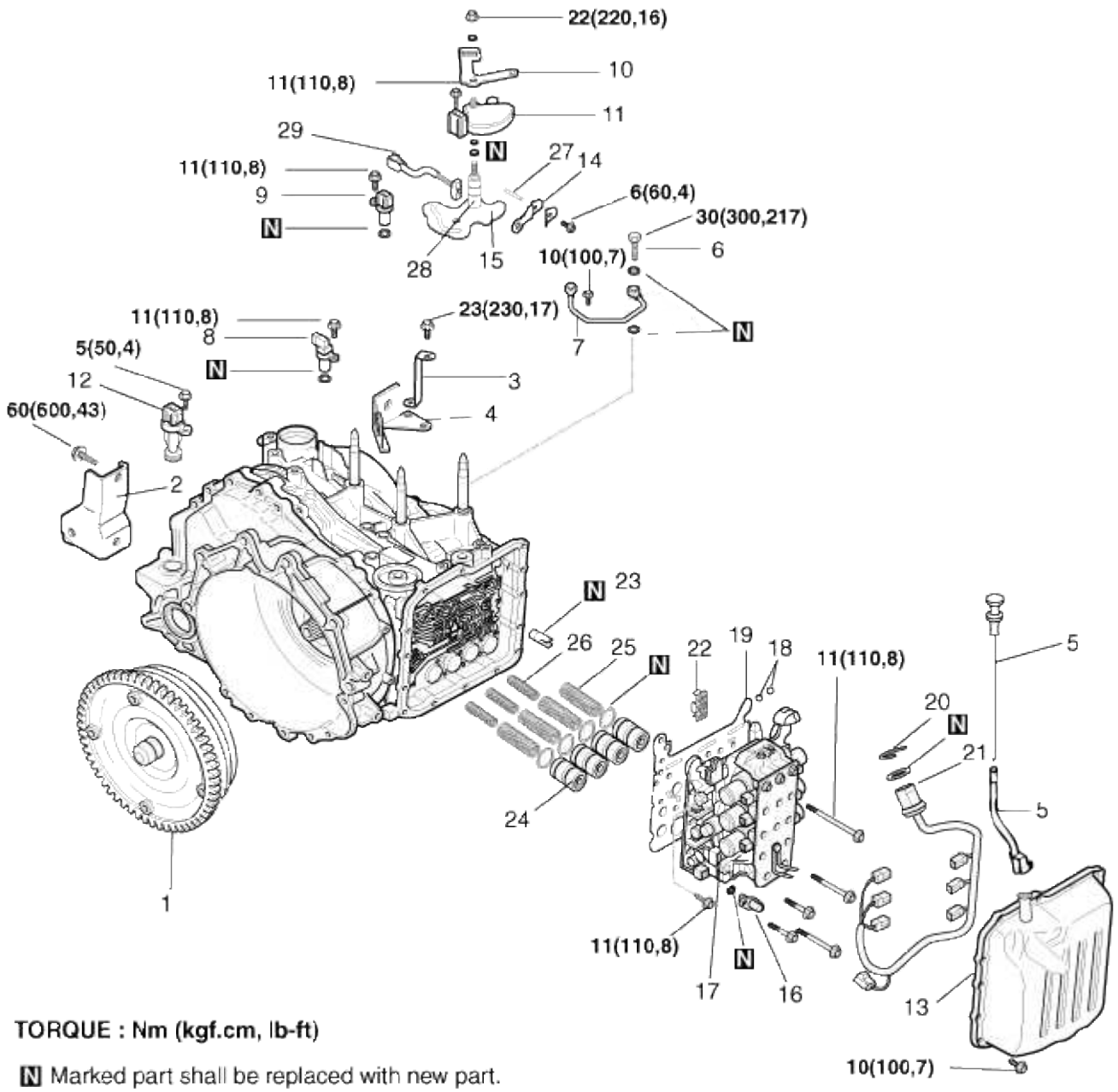
1. Vehicle speed sensor
2. Washer
3. Seal bolt
4. Flange bolt
5. Oil guide
6. Steel ball
7. Harness
8. Snap ring
9. Coil spring
10. Coil spring
11. Coil spring
12. Coil spring
13. Coil spring
14. Coil spring
15. Coil spring
16. O-ring
17. Dowel pin

COMPONENTS (4)

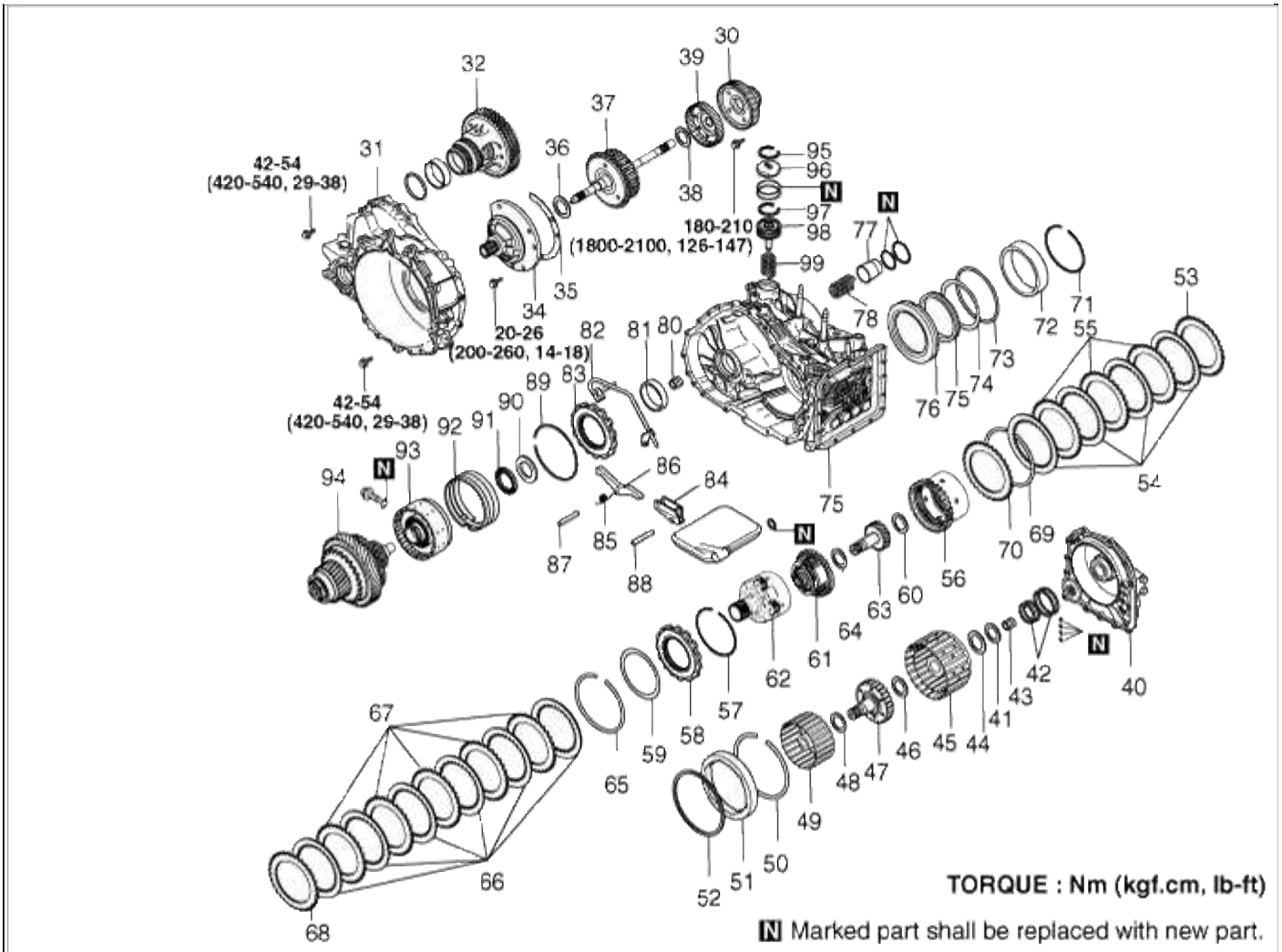


1. Inhibitor switch
2. Control cable bracket
3. Stud
4. Pressure check plug
5. Eye bolt
6. Gasket
7. Converter housing
8. Gasket
9. Magnet plug
10. Accumulator piston

COMPONENTS (5)



1. Torque converter
2. Roll stopper bracket
3. Harness bracket
4. Shift cable bracket
5. Oil level gauge
6. Eye bolt
7. Oil cooler feed tube
8. Output speed sensor
9. Input speed sensor
10. Manual control lever
11. Inhibitor switch
12. Speedometer gear
13. Valve body cover
14. Detent spring
15. Manual control shaft assembly
16. Oil temperture sensor
17. Valve body
18. Steel ball
19. Gasket
20. Snap ring
21. Solenoid valve harness
22. Strainer
23. 2nd brake retainer oil seal
24. Accumulator piston
25. Accumulator spring
26. Accumulator spring
27. Manual control lever shaft roller
28. Manual control lever shaft
29. Parking roller rod

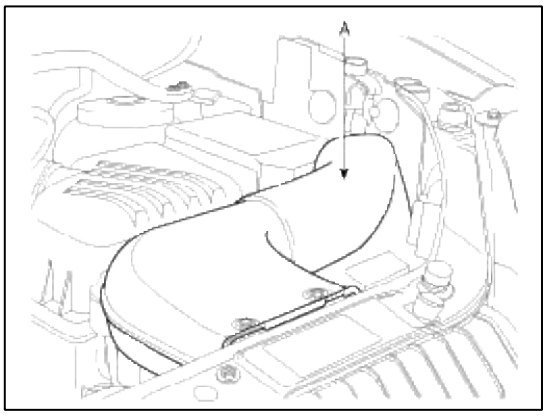


30. Transfer drive gear set
31. Converter housing
32. Differential
33. Oil filter
34. Oil pump
35. Gasket
36. Thrust washer #1
37. Underdrive clutch & input shaft
38. Thrust bearing #2
39. Underdrive clutch hub
40. Rear cover
41. Thrust race #8
42. Seal ring
43. Input shaft rear bearing
44. Thrust bearing #7
45. Reverse & overdrive clutch
46. Thrust bearing #6
47. Overdrive clutch hub
48. Thrust bearing #5
49. Planet carrier reverse sun gear
50. Snap ring
51. 2nd brake piston
52. Return spring
53. Pressure plate
54. 2nd brake disc
55. 2nd brake plate
56. Low & reverse annulus gear
57. Snap ring
58. One-way clutch 1
59. Stopper plate
60. Thrust bearing #4
61. Overdrive planetary carrier
62. Output planetary carrier
63. Underdrive sun gear
64. Thrust bearing #3
65. Snap ring
66. LR brake disc
67. LR brake plate
68. Pressure plate
69. Snap ring
70. Reaction plate
71. Snap ring
72. Inner race
73. Wave spring
74. Spring retainer
75. Return spring
76. LR brake piston
77. Accumulator piston
78. Spring
79. Transaxle case
80. Needle bearing
81. Outer race
82. Pipe
83. One-way clutch 2
84. Parking roller support
85. Hole spring
86. Parking ball spring
87. Parking ball shaft
88. Parking roller support shaft
89. Snap ring
90. Thrust race
91. Thrust bearing
92. Reduction brake band
93. Direct clutch
94. Direct planetary carrier
95. Snap ring
96. Reduction brake band
97. Snap ring
98. Reduction brake piston
99. Reduction brake spring

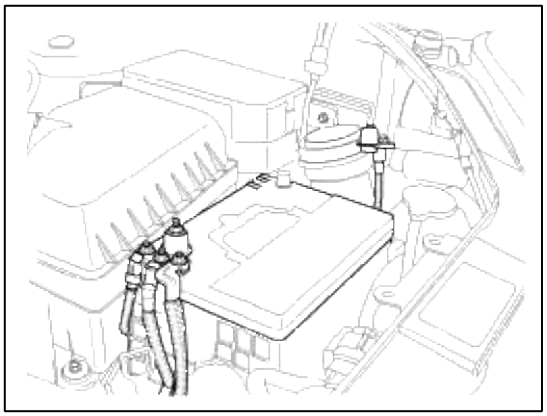
Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Repair procedures (F4A42-2)

REMOVAL

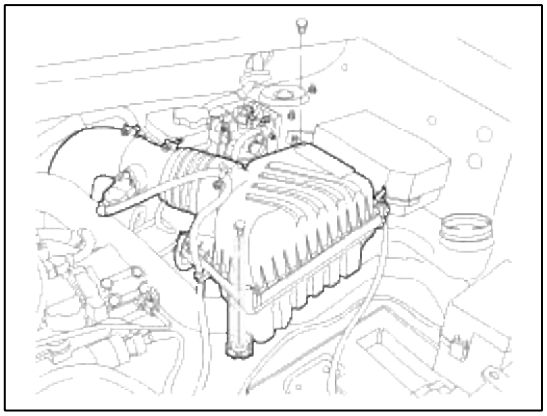
1. Remove the air duct(A).



2. Remove the battery.

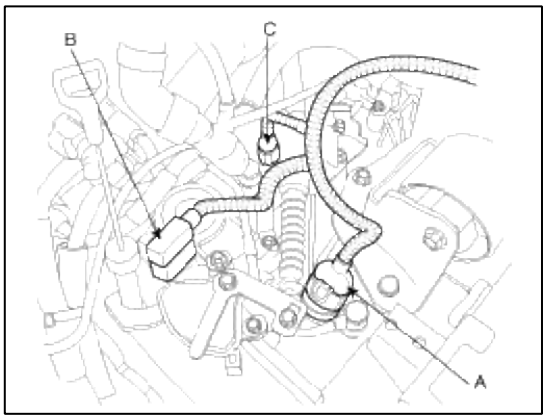


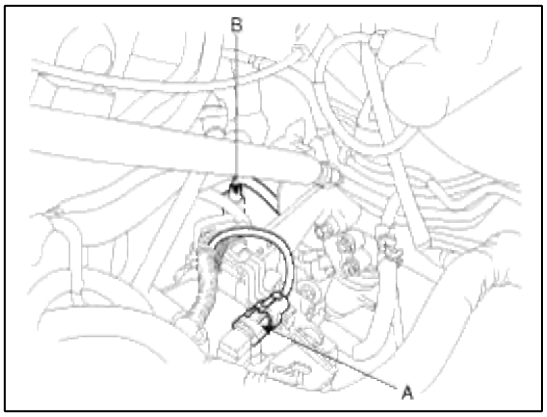
3. Remove the battery tray.
4. Remove the air cleaner assembly.



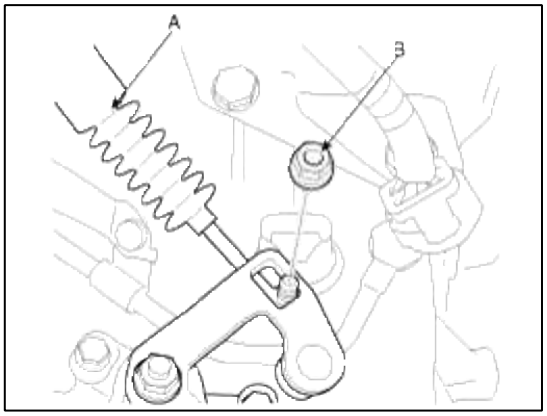
5. Remove the intercooler inlet pipe.

6. Disconnect the connectors relevant to the transaxle.

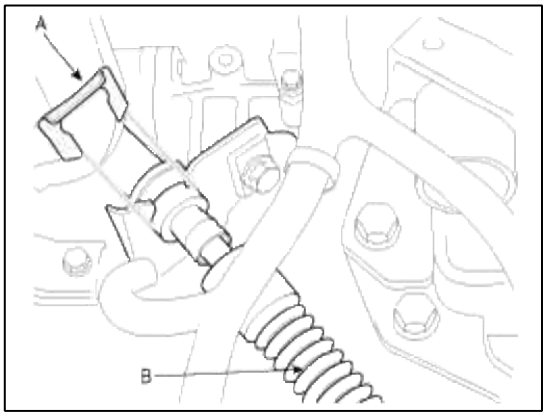




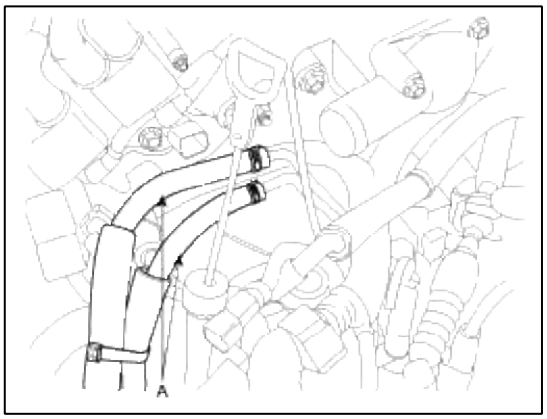
7. Disconnect the ground earth wire.
8. Remove the bolt(B) which mounts the clutch release cylinder(A) to the inhibiter switch.



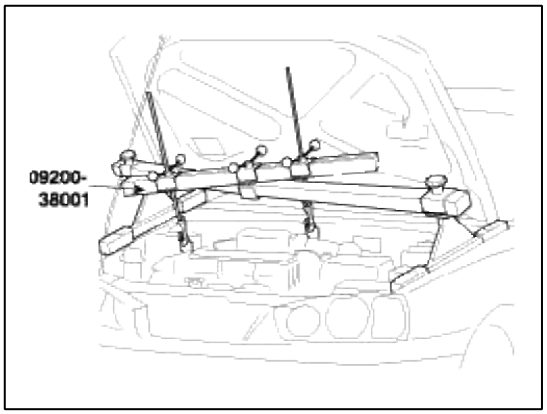
9. Detach the clutch release cylinder(B) clip(A).



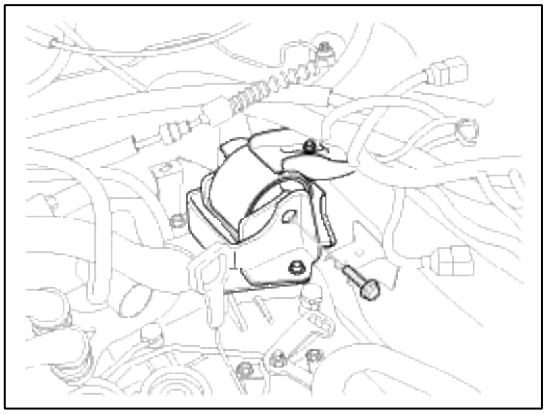
10. Detach the hoses(A), loosening the oil cooler hose clamps.

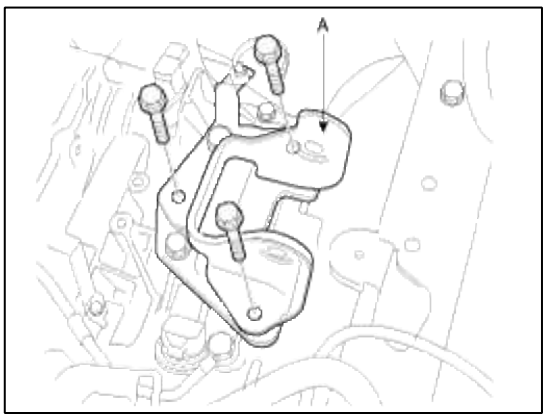


11. Using SST(09200-38001), support the engine.

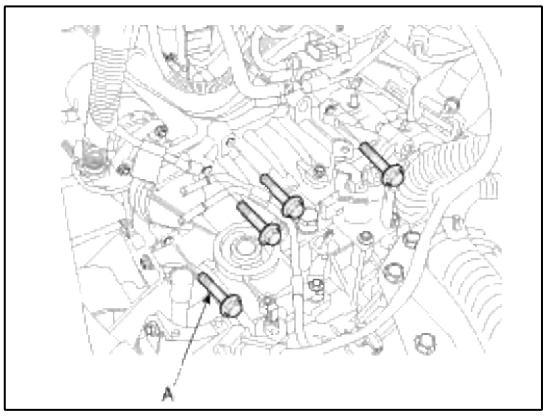


12. Remove the trasaxle mounting bracket(A) bolts.

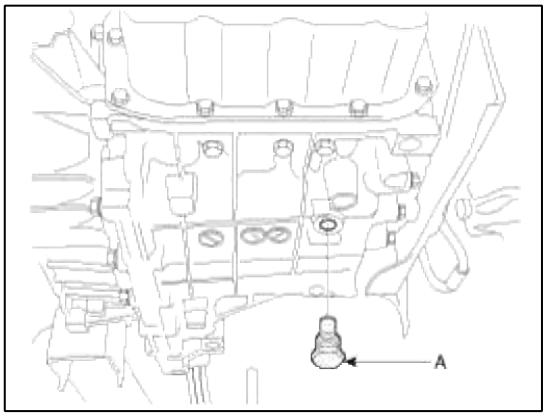




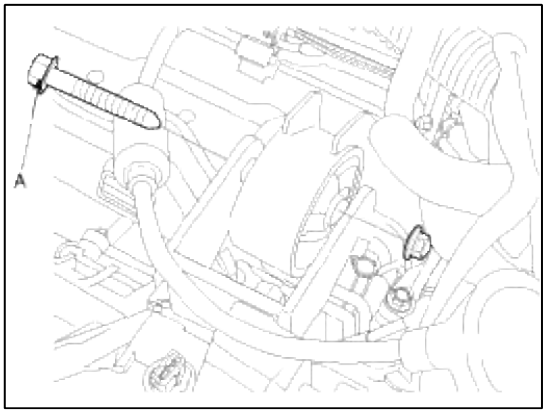
13. Remove the transaxle upper mounting bolts(A).



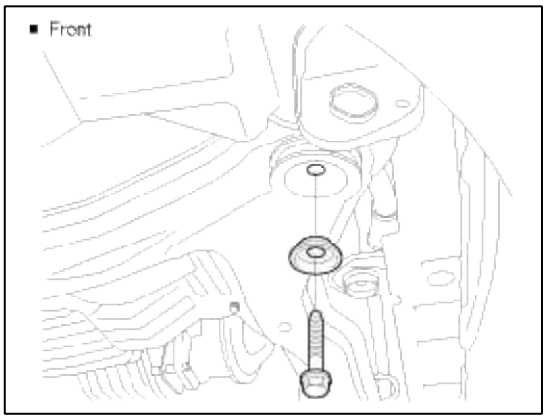
14. Remove the bolts which mount the transaxle to the front sub frame.
15. Lift up the vehicle.
16. After removing the oil drain plug(A), Drain the fluid.

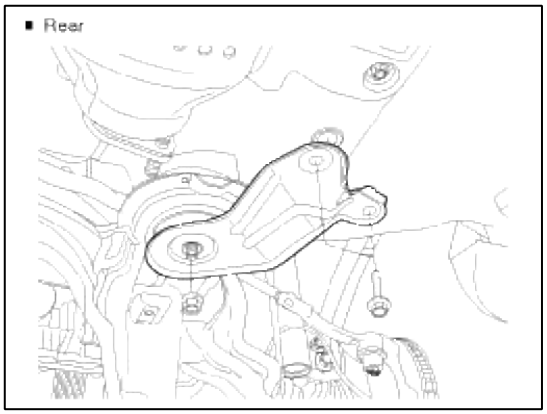


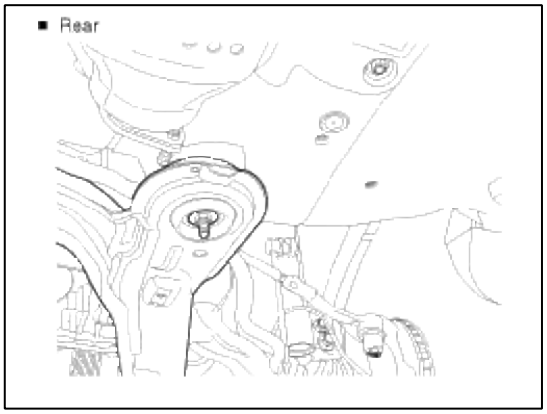
17. Support the transaxle with a jack.
18. Remove the steering column bolt(See 'ST' group).
19. Remove the driveshafts (See 'DS' group-'DRIVESHAFT').
20. Remove the bolt(A) which mounts the transaxle to the rear sub-frame.



21. Remove the sub-frame. If it is a 4 wheel drive vehicle(4WD), remove the propeller shaft first(See 'DS' group-'PROPELLER SHAFT').







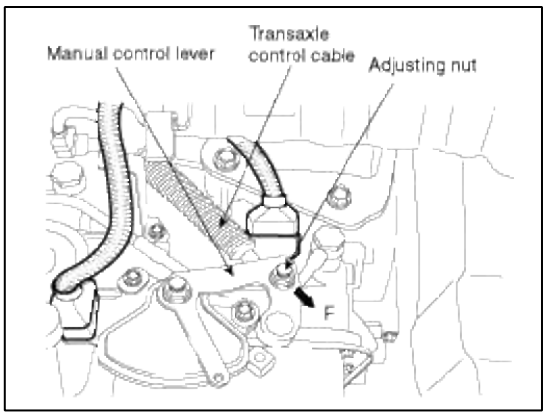
22. Remove the transaxle lower mounting bolts.
23. Remove the transaxle assembly.

INSTALLATION

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.



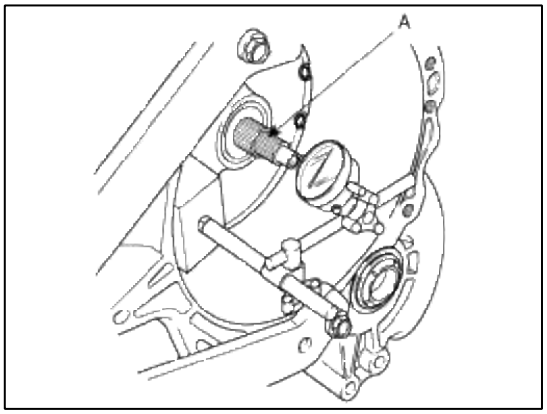
3. Installation is the reverse of removal.

DISASSEMBLY

CAUTION

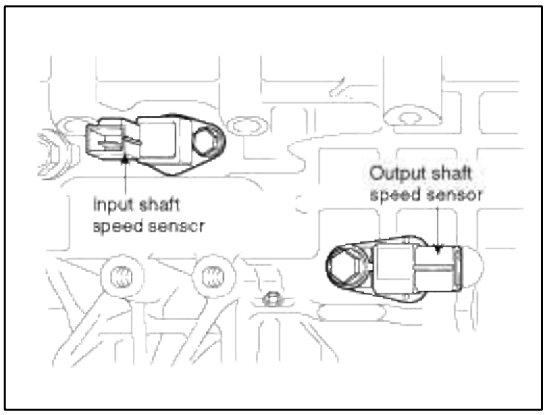
- Because the automatic transmission is manufactured from high-precision parts, sufficient care must be taken not to scratch or damage these parts during disassembly and reassembly.
- The working area should be convered with a rubber mat to keep it clean at all times.
- Do not wear any cloth gloves and do not use any rags during disassembly. Use nylon cloth or paper towels if you need to use something.
- Parts which have been disassembled should all be cleaned. Metal parts can be cleaned with normal detergent but they should be dried completely using compressed air.
- Clutch discs, plastic thrust plates and rubber parts should be cleaned with automatic transmission fluid (ATF) so that they do not become dirty.
- If the transmission body has been damaged, disassemble and clean the cooler system also.

1. Remove the torque converter and set aside.
2. Measure the input shaft(A) end play.

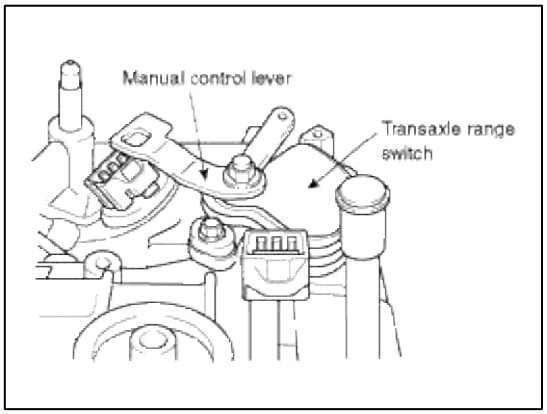


3. Remove the left and right roll stopper brackets.
4. Remove the wiring harness bracket.
5. Remove the control cable support bracket.
6. Remove the dipstick.

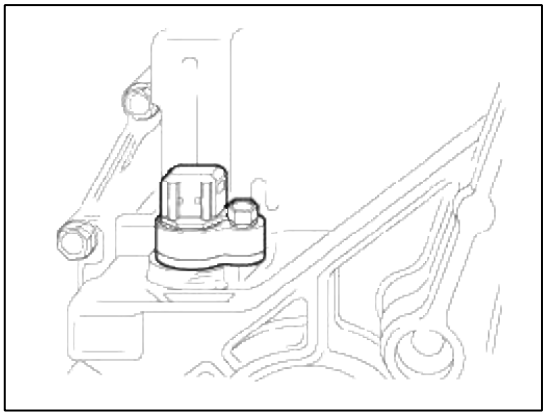
7. Remove the oil cooler feed tube, gasket, and eye bolt.
8. Remove the input shaft speed sensor and the output shaft speed sensor.



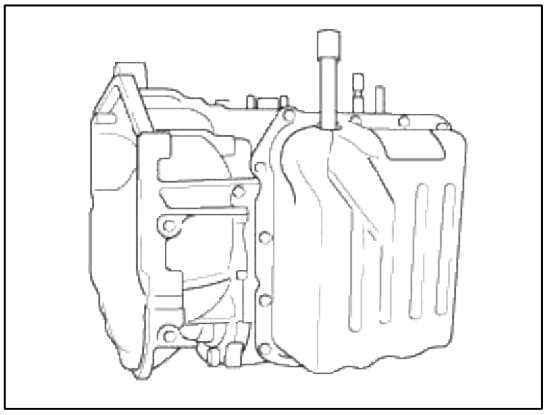
9. Remove the manual control lever, then remove the transaxle range switch.



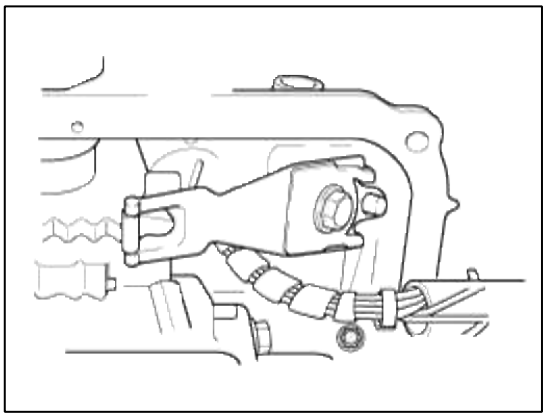
10. Remove the vehicle speed sensor.



11. Remove the valve body cover.



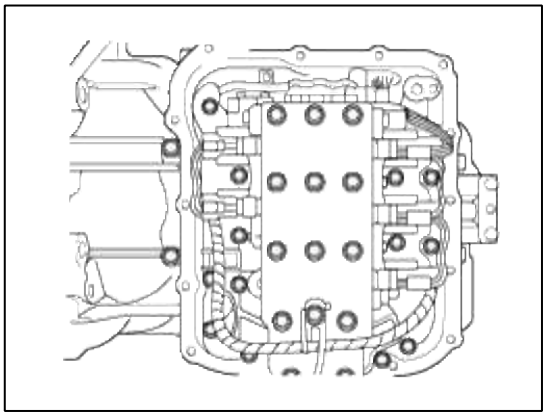
12. Remove the manual control shaft detent.



13. Disconnect the harness connectors of the valve body.

CAUTION

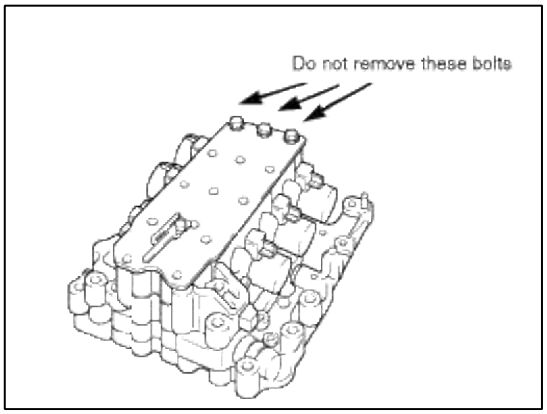
To prevent damage to transaxle components make sure that the manual control lever and the park/neutral switch have been removed before attempting to remove the valve body.



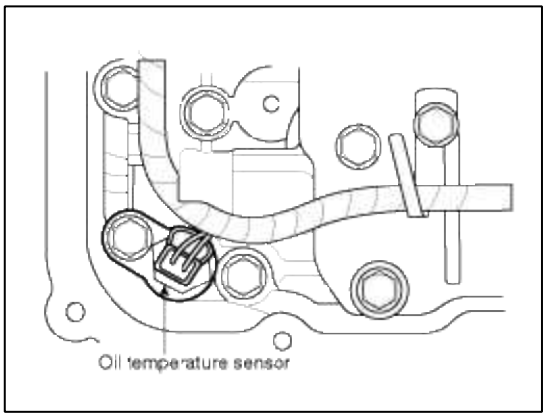
NOTE

The valve body mounting bolts are different lengths. Note the locations of the bolts to aid in assembly.

14. Remove 28 of the valve body mounting bolts. Do not remove the bolts shown in the illustration at this time.



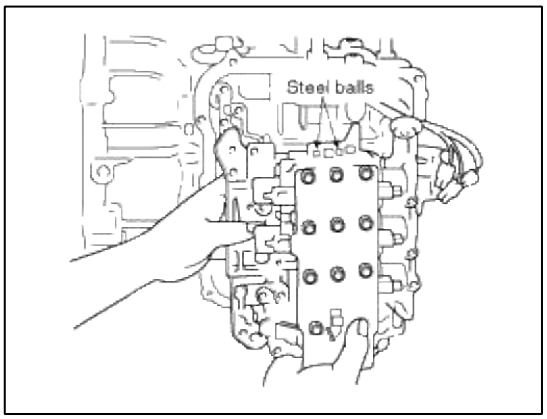
15. Remove the oil temperature sensor.



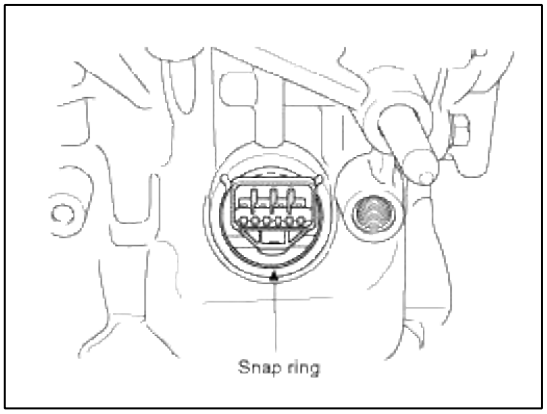
16. Remove the valve body, gasket, and the 2 steel balls.

NOTE

Make sure not to lose the 2 steel balls.



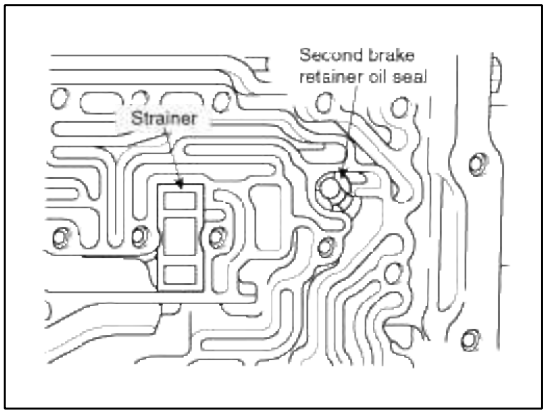
17. Remove the solenoid valve wiring harness snap ring.



18. Remove the solenoid valve harness.
19. Remove the strainer.

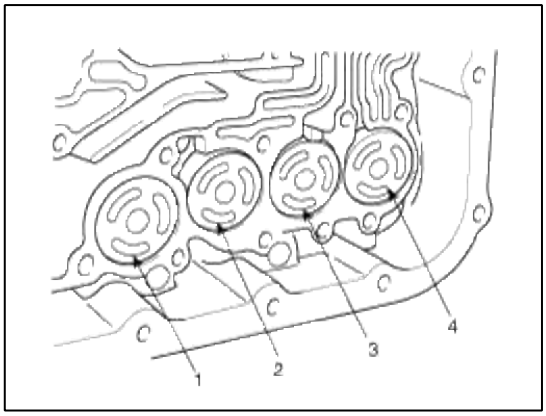
20. Remove the second brake retainer oil seal.

> CAUTION
>
> The second brake retainer oil seal must be removed before removing the transaxle powertrain components from the case or damage to the seal will occur.

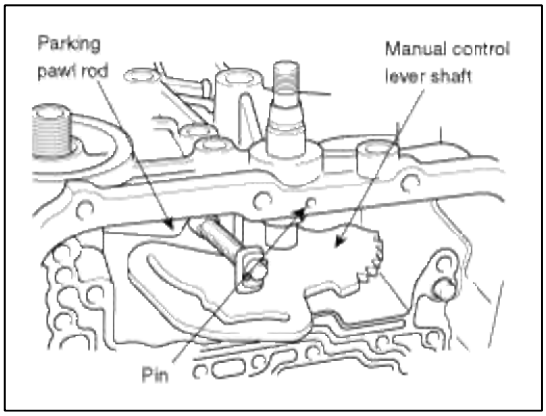


21. Remove the 4 accumulator pistons, the 4 large springs, and the 3 small springs.

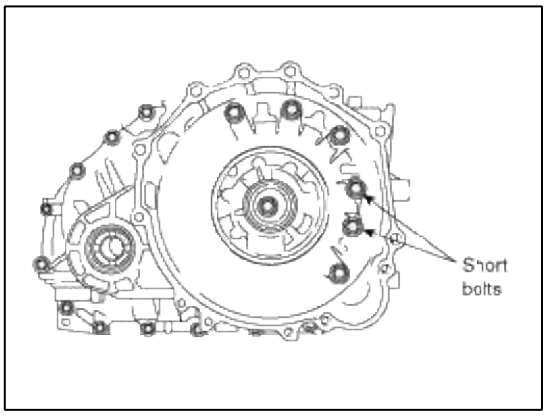
Number	Functional Name
1	Low&Reverse Brake
2	Underdrive Clutch
3	Second Brake
4	Overdrive Clutch



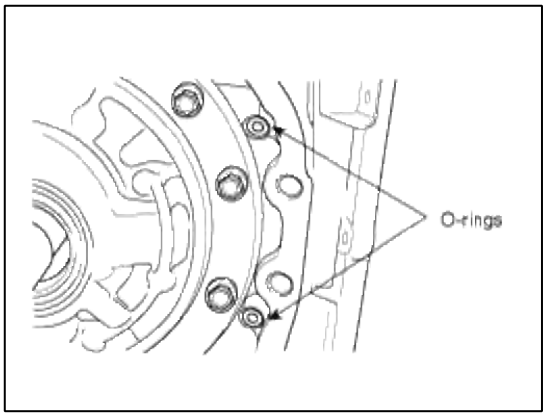
22. Remove the manual control lever shaft pin (roller).
23. Remove the manual control lever shaft.
24. Remove the parking pawl rod.



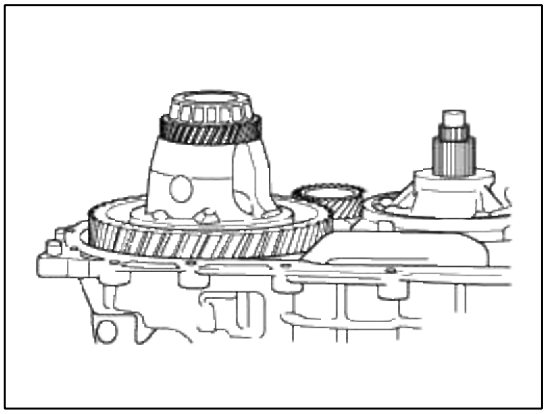
25. Remove the torque converter housing and 18 mounting bolts. Tap the housing off with a non-metallic hammer.



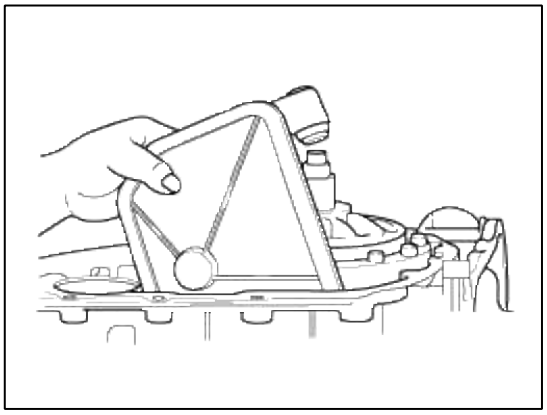
26. Remove the 2 O-rings from the case.



27. Remove the differential.

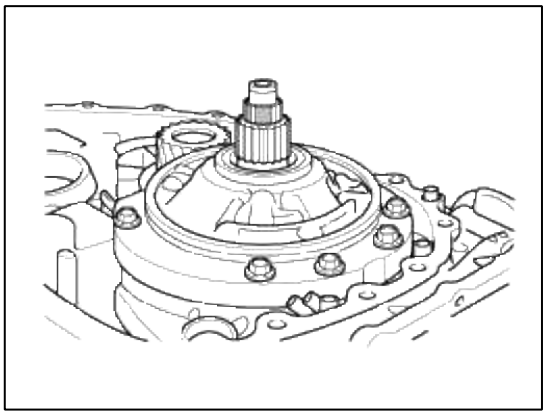


28. Remove the main oil filter.

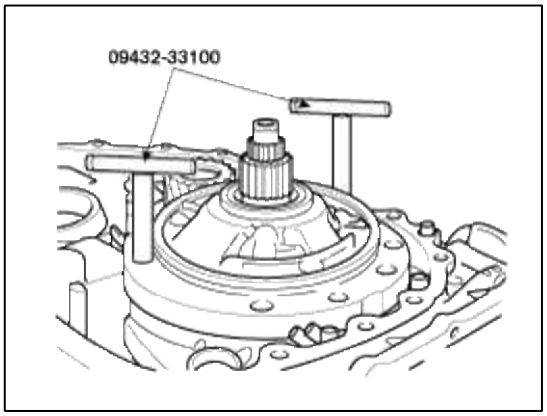


29. Remove oil pump mounting bolts.

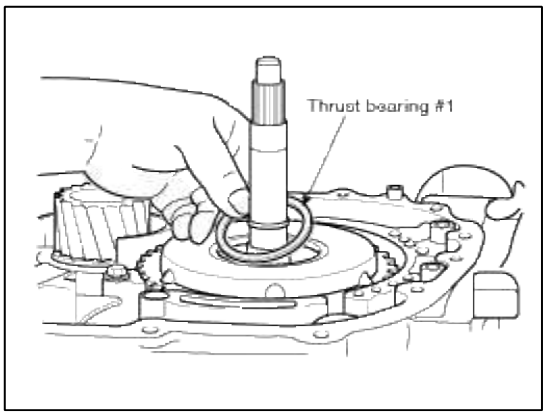
> CAUTION
>
> The oil pump is not serviceable, it must be replaced as a pump assembly. Do not disassemble the pump as improper alignment during assembly will cause pump failure and could cause damage to the transaxle.



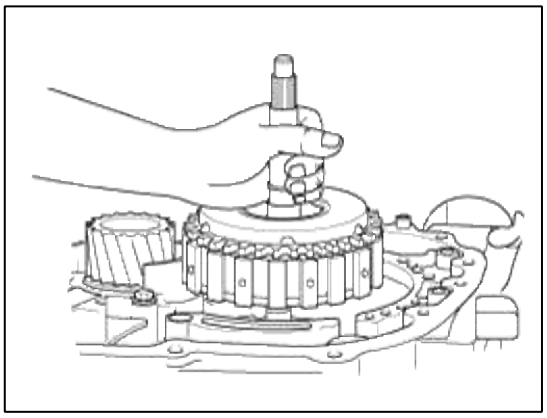
30. Install the special tool (09452-33100), as shown in the illustration.



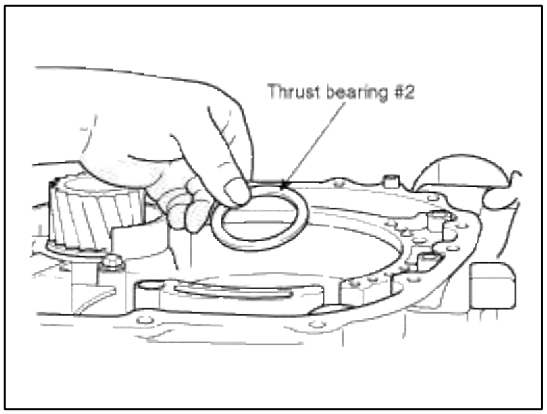
31. Remove the oil pump by turning special tool screws clockwise.
32. Remove the oil pump gasket.
33. Remove thrust bearing #1.



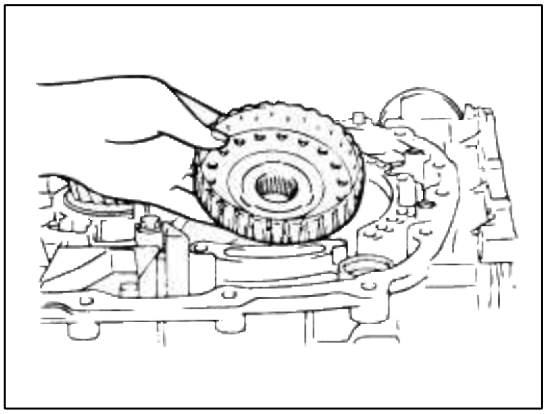
34. Grasp the input shaft, then pull out the underdrive clutch and input shaft as an assembly.



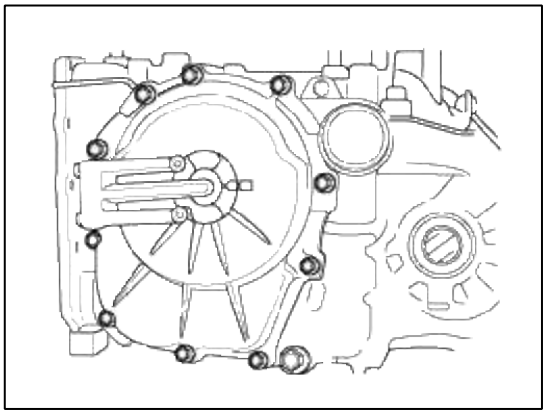
35. Remove thrust bearing #2.



36. Remove the underdrive clutch hub.



37. Remove the rear cover and mounting bolts.

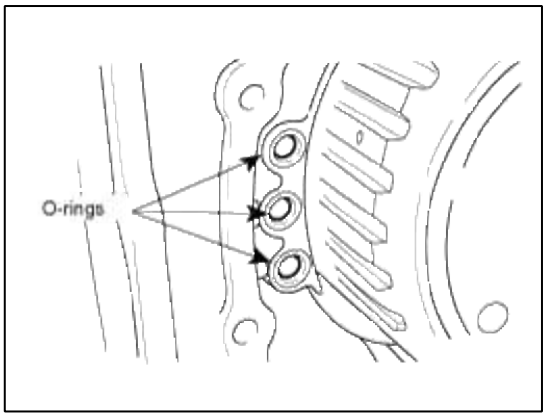


38. Remove the thrust race #8.

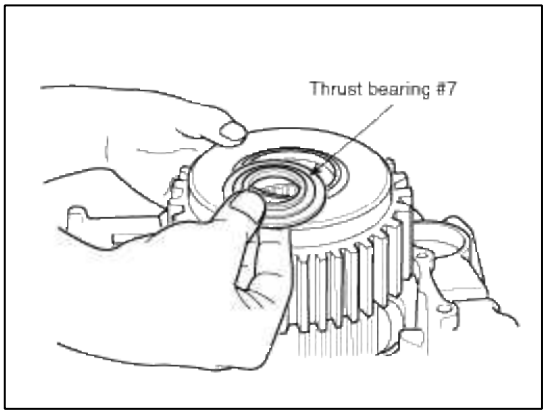
39. Remove the 4 seal rings.

> NOTE
>
> Do not remove the input shaft rear bearing unless directed to do so by the instructor.
> Once this bearing has been removed, it MUST be replaced.

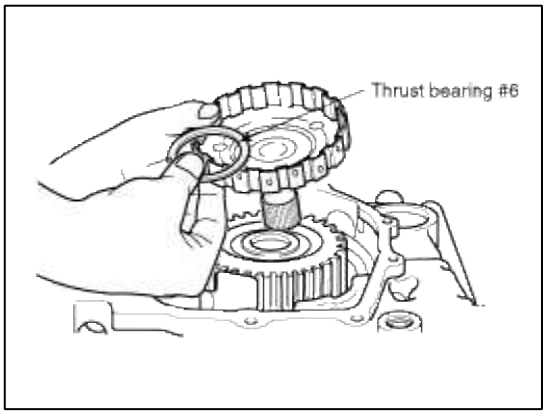
40. Remove the 3 O-rings.



41. Remove thrust bearing #7.

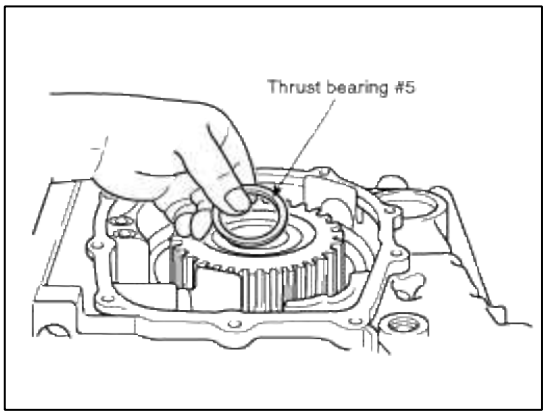


42. Remove the reverse and overdrive clutch.
43. Remove thrust bearing #6.

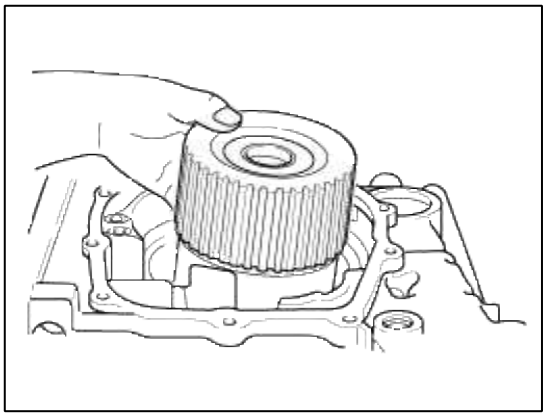


44. Remove the overdrive clutch hub.

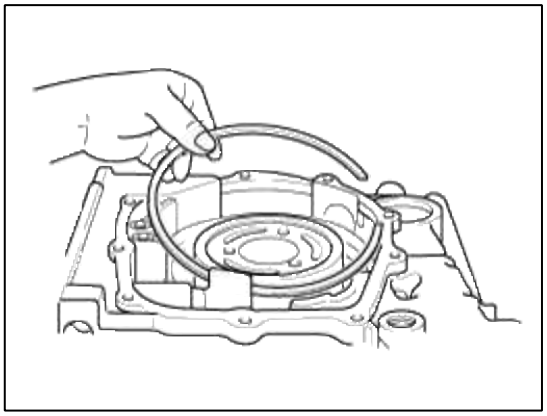
45. Remove thrust bearing #5.



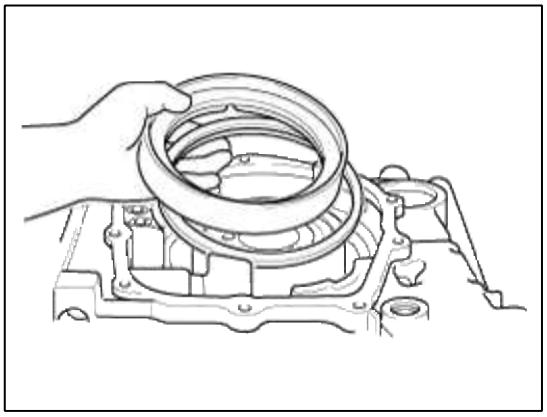
46. Remove the planetary reverse sun gear.



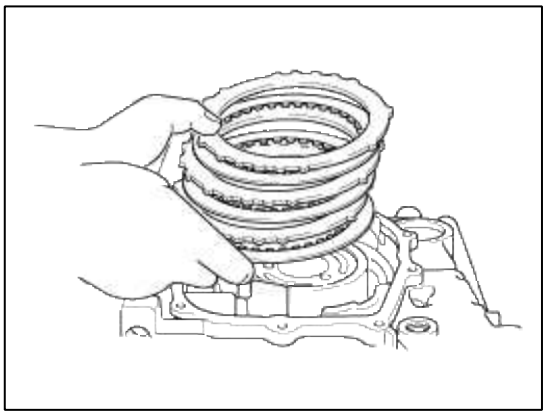
47. Remove the second brake piston snap ring.



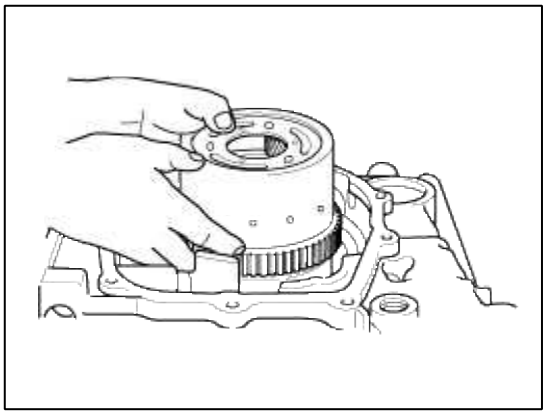
48. Remove the second brake piston and return spring.



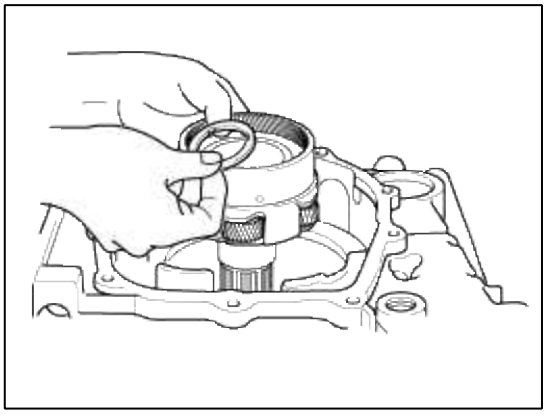
49. Remove the second brake pressure plate, 3 brake discs, and 2 brake plates.



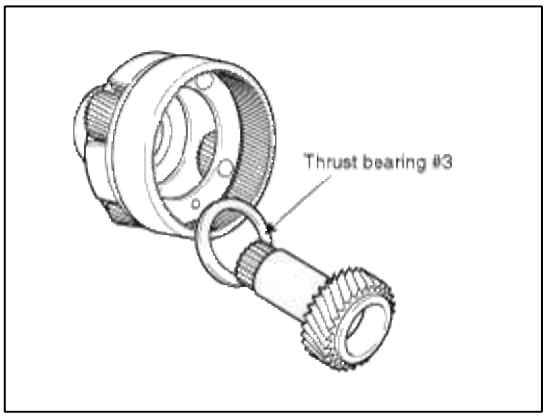
50. Remove the overdrive planetary carrier.



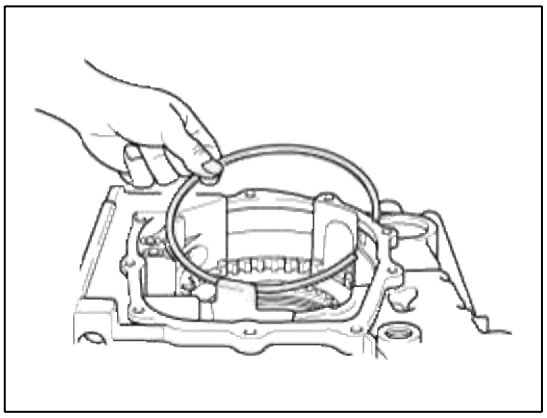
51. Remove thrust bearing #4.



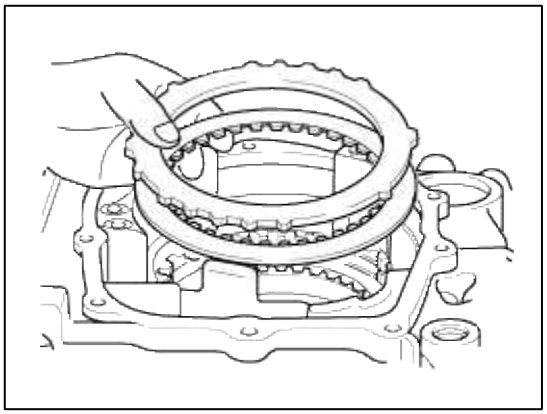
52. Remove the output planetary carrier.
53. Remove the underdrive sun gear.
54. Remove thrust bearing #3.



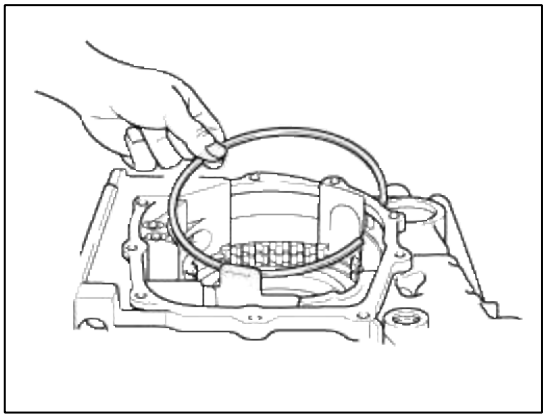
55. Remove the low and reverse reaction plate snap ring.



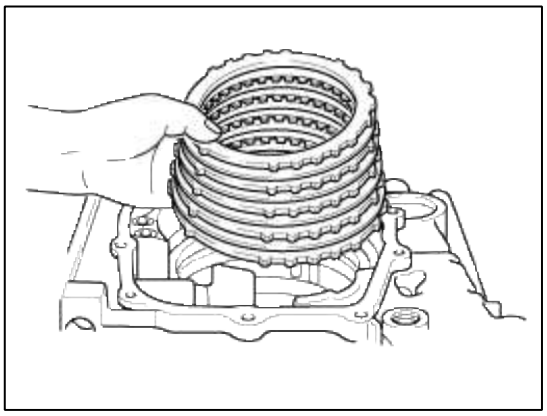
56. Remove the low and reverse reaction plate and brake disc.



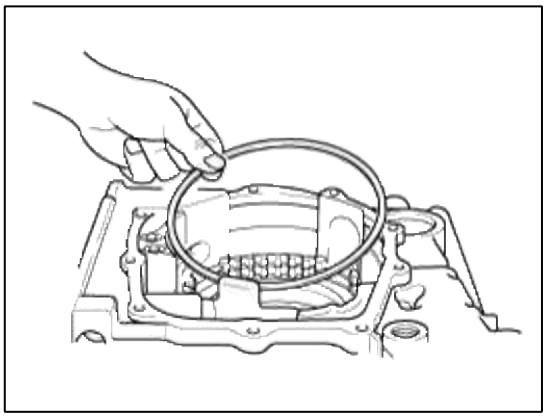
57. Remove the low and reverse brake snap ring.



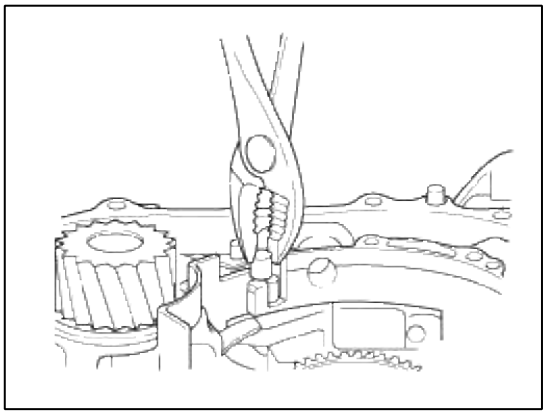
58. Remove the low and reverse 6 brake discs, 5 brake plates, and brake pressure plate.



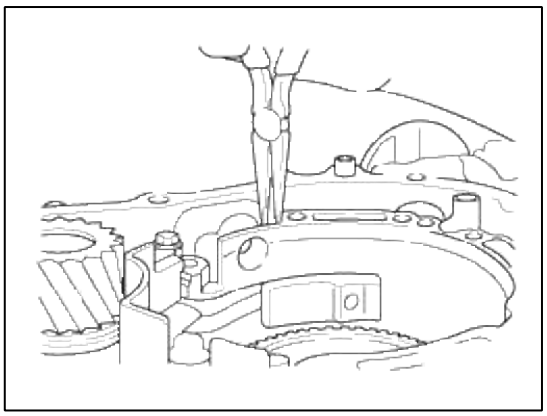
59. Remove the wave spring.



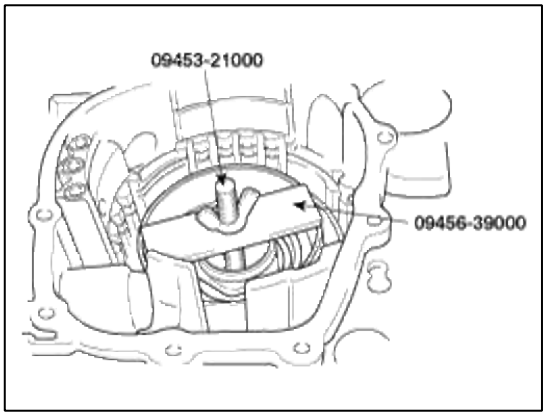
60. Remove the parking pawl shaft.
61. Remove the spacer.



62. Remove the parking pawl spring. Note the orientation of the spring to aid in reassembly.
63. Remove the 2 parking roller support shafts.

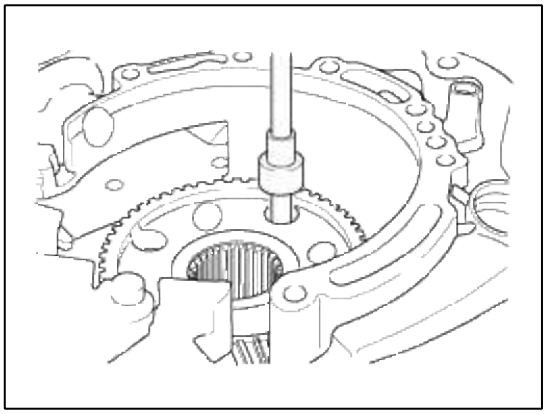


64. Remove the parking pawl case.
65. Remove the parking roller support.
66. Remove the snap ring.

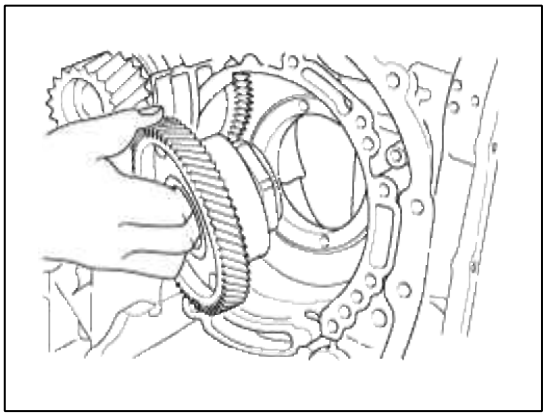


67. Remove the spring retainer.

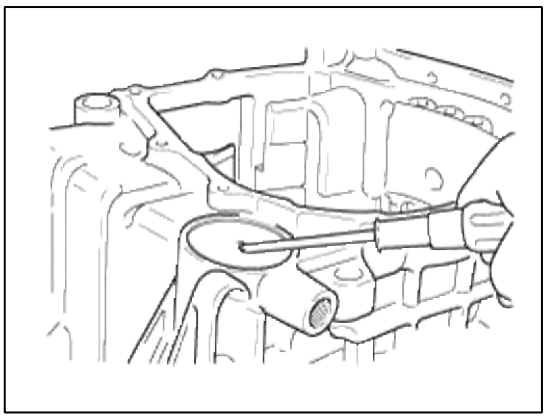
68. Remove the return spring.
69. Remove the low and reverse brake piston. Use compressed air directed into the valve body passage.
70. Remove the 7 transfer gear mounting bolts.



71. Remove the transfer drive gear.



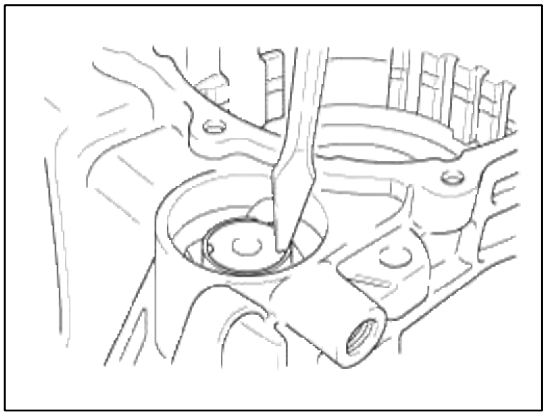
72. Remove the plastic cap, if present.



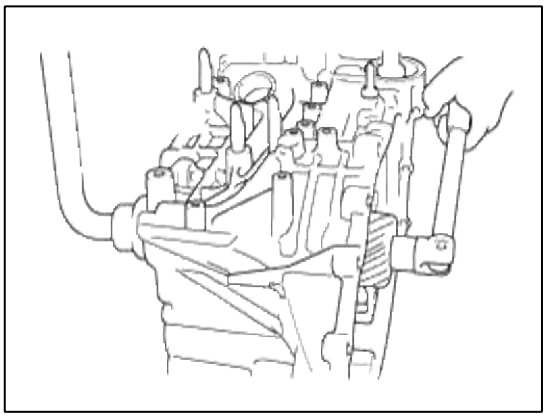
73. Straighten the locking tab of the output shaft locking nut, if bent.

NOTE

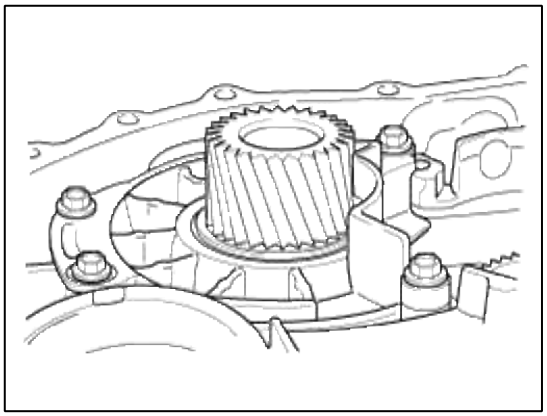
The output shaft locking nut is left-hand thread.



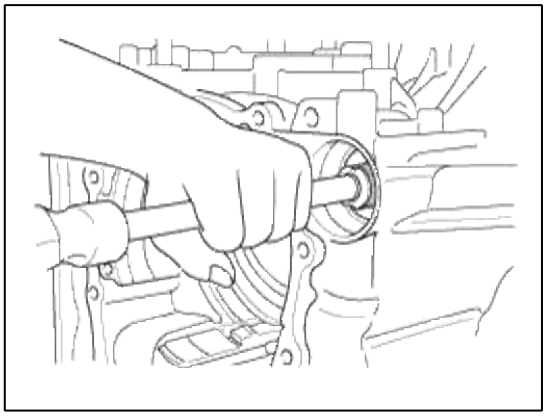
74. Remove the output shaft locking nut.



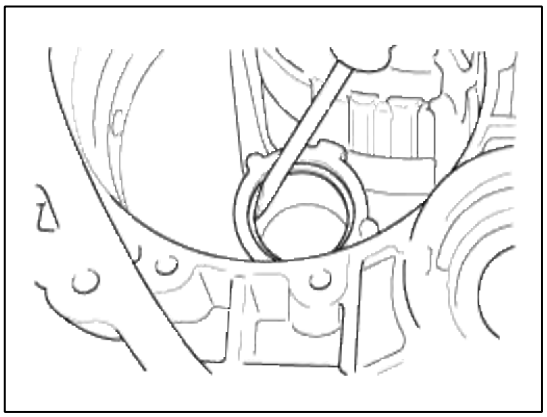
75. Remove the output shaft bearing retainer mounting bolts.



76. Tap out the output shaft, tapered roller bearing, and the collar from the back side.



77. Tap out the bearing outer race and spacer using a suitable driver.



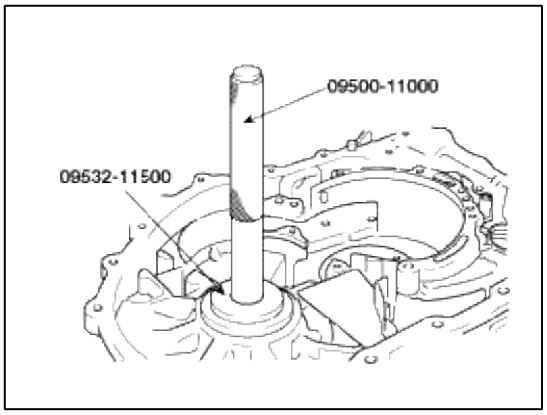
78. Remove the snap ring.
79. Remove the differential bearing outer race and spacer from the torque converter housing.
80. Remove the differential bearing outer race from the transaxle case.

REASSEMBLY

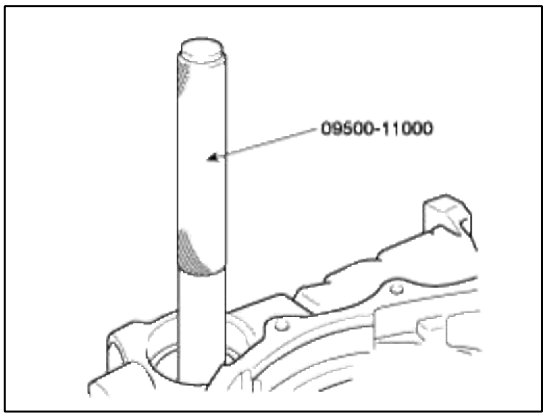
CAUTION

- Never reuse the gasket, O-ring, oil seal, etc. Always replace with a new one when reassembling.
- Never use grease other than blue petrolatum jelly and white Vaseline.
- Apply ATF to friction components, rotating parts, and sliding parts before installation. Immerse a new clutch disc or brake disc in ATF for at least two hours before assembling them.
- Never apply sealant or adhesive to gaskets.
- When replacing a bushing, replace the assembly which it belongs to.
- Never use any cloth gloves or any rags during reassembly.
  Use nylon cloth or paper towels if you need to use something. Change the oil in the cooler system.

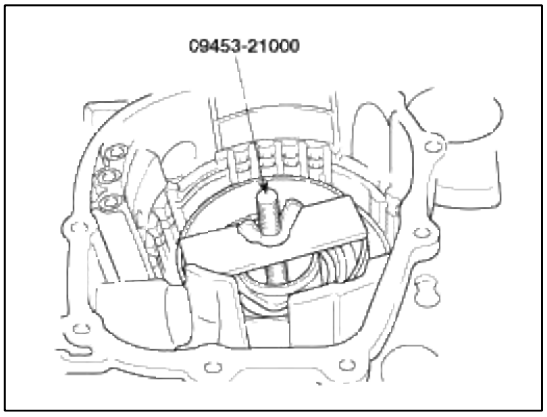
1. Tap the differential bearing outer race into the transaxle case using special tools tools (09500-11000 and 09532-11500).



2. Tap the output shaft bearing outer race into the transaxle case using special tool (09500-11000).

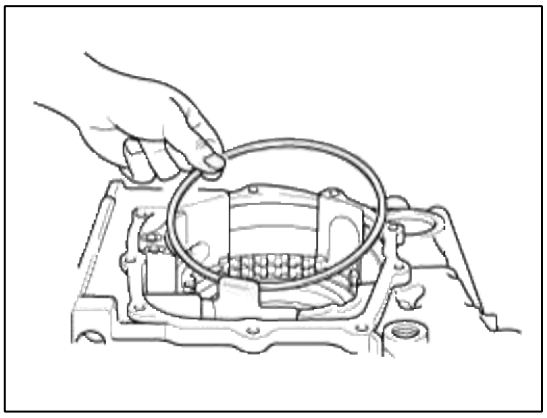


3. Install the spacer and the snap ring.
4. Install the low and reverse brake piston, return spring, and spring retainer.
5. Install the snap ring using special tools (09453-21000). To be sure that you have the correct snap ring, measure the thickness and compare it to the chart in the general parts of the service manual.

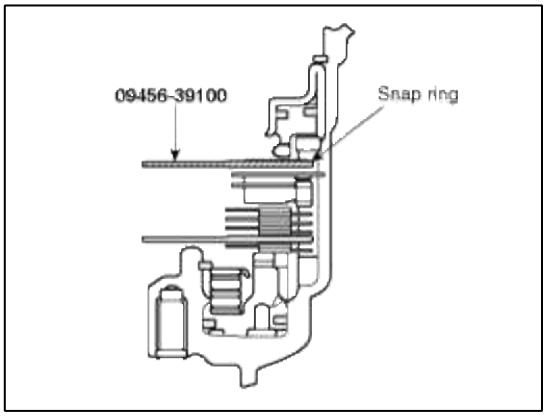


6. Install the wave spring.

> NOTE
>
> In steps 7 through 9, you will determine the actual clearance between the low and reverse brake discs and plates when the clutch is released.

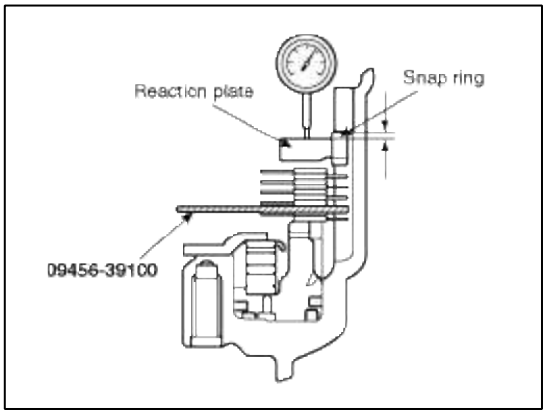


7. Replace the pressure plate of the low and reverse brake, then install the brake discs, 5 brake plates and the snap ring.



8. Install the low and reverse reaction plate and the old snap ring.
9. With a dial indicator installed, move the special tool up and down to measure the end play.

Standard value :
0-0.16 mm (0-0.0063 in)

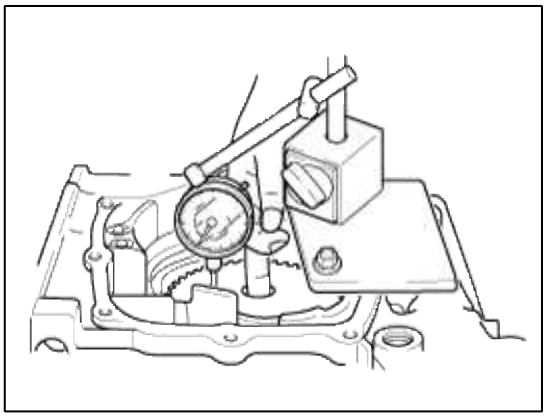


If the end play is incorrect, measure the old snap rig, then select the proper snap rig from the chart shown in the service manual and recheck the clearance.

10. Remove the special tool.

> NOTE
>
> In steps 11 through 16, you will determine the actual clearance between the second brake discs and plates when the clutch is released.

11. Install the 3 second brake discs and 2 plates.
12. Install the second brake return spring, second brake piston, and snap ring.
13. Install a dial indicator as shown in the illustration.

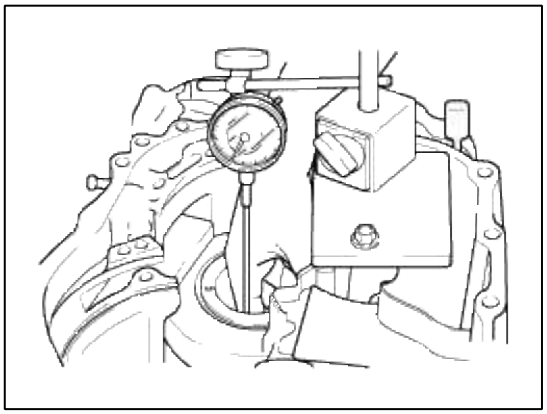


14. Move up and down, while observing the end play.
15. To determine the proper thickness of the second brake pressure plate.

Standard value :
0.79-1.25 mm (0.0311-0.0492 in)

16. If the standard value is incorrect, select a pressure plate of the proper thickness from the chart in the general parts of the service manual and recheck the clearance.

> NOTE
>
> In steps 18 through 21, you will determine the actual clearance between the low-reverse brake discs and plates when the clutch is released.

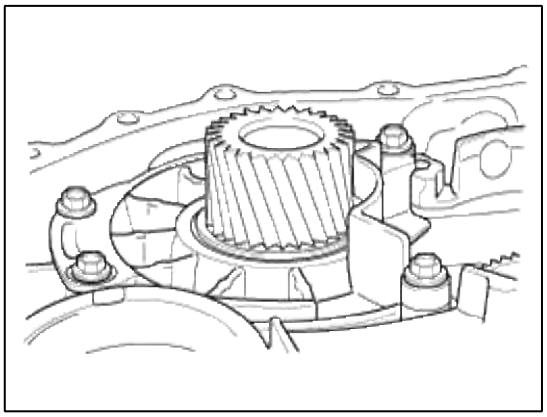


17. Install the special tool in place of the low/reverse brake pressure plate.
18. Install the 6 brake discs, 5 brake plates and snap ring.
19. Turn the transaxle upside down, install a dial indicator, as shown in the illustration.
20. Move the special tool up and down while observing the end play.

21. To determine the proper thickness of the low/reverse brake pressure plate.

Standard value :
1.65-2.11 mm (0.0650-0.0830 in)

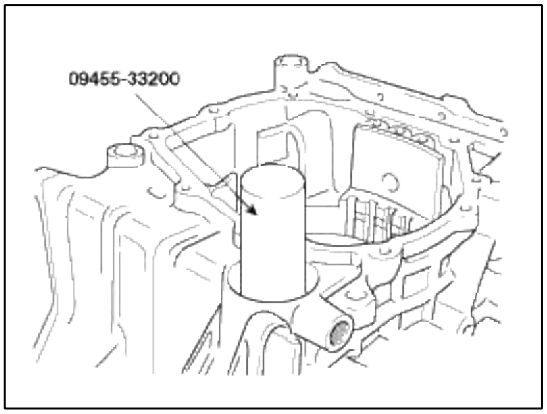
22. If the standard value is incorrect, select a pressure plate of the proper thickness from the chart in the service manual and recheck the clearance.
23. Remove the special tool.
24. Install the output shaft.
25. Install the output bearing retainer mounting bolts. Tighten the bolts to 23 Nm (230 kg·cm, 17 lb·ft) of torque.



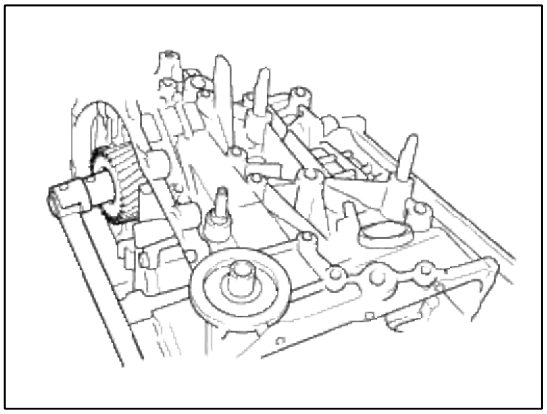
26. Install the output shaft collar and tapered roller bearing using special tool (09455-33200).

NOTE

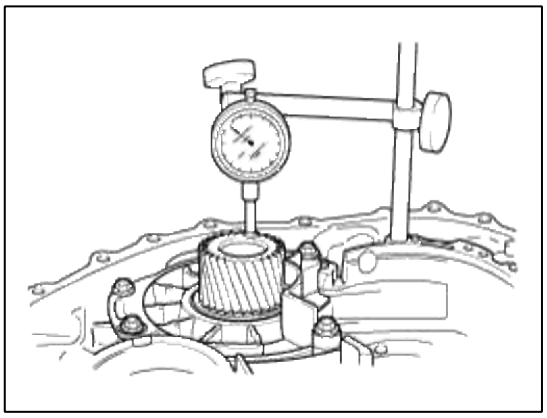
The output shaft locking nut is left-hand thread.



27. Apply ATF and install the locking nut and tighten to 123 lb ft. Loosen the nut one full turn, then retighten the nut to 123 lb ft and stake the nut.



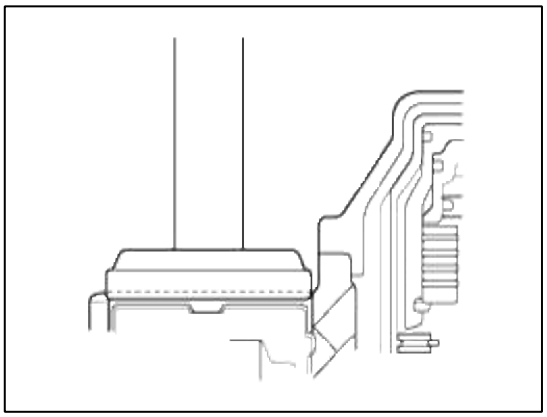
28. Install a dial indicator as shown in the illustration.



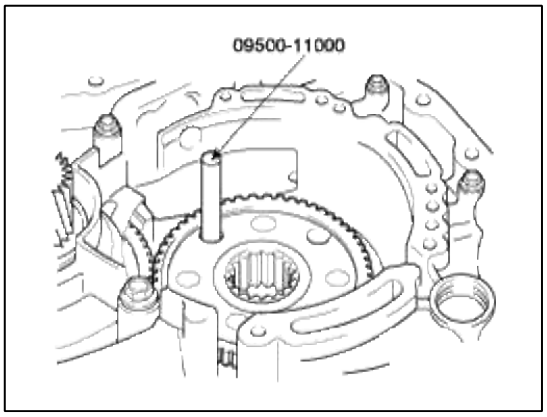
29. Move the output shaft in and out to measure the end lay.

Standard value :
0.01-0.09 mm (0.0004-0.0035 in)

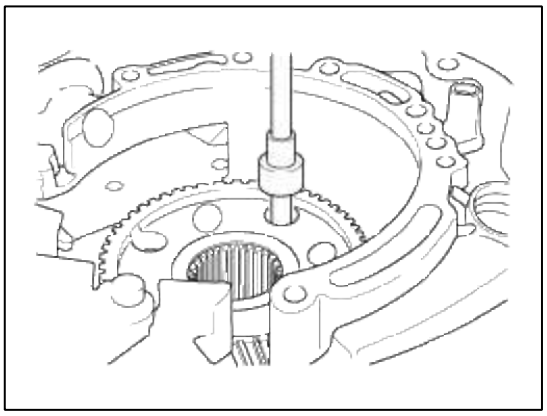
30. If the standard value is incorrect, use this formula to select the correct spacer from the chart in the general parts of the service manual.
31. Install the output shaft protective cap.



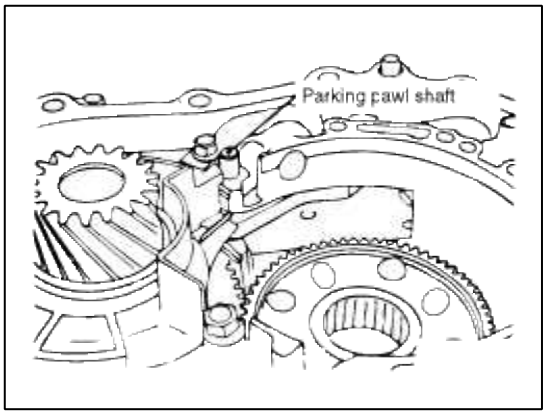
32. Install the transfer drive gear using special tool (09500-11000).



33. Install the 7 transfer gear mounting bolts. Tighten the bolts to 19 Nm (190 kgf.cm, 14 lbf.ft).



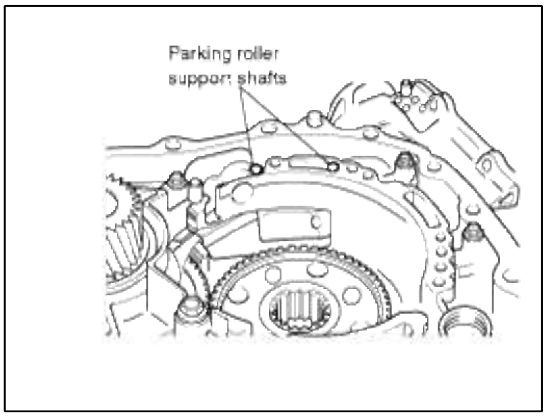
34. Install the parking pawl, spacer and spring, then install the parking pawl shaft.



35. Install the parking roller support, then the two parking roller support shafts.

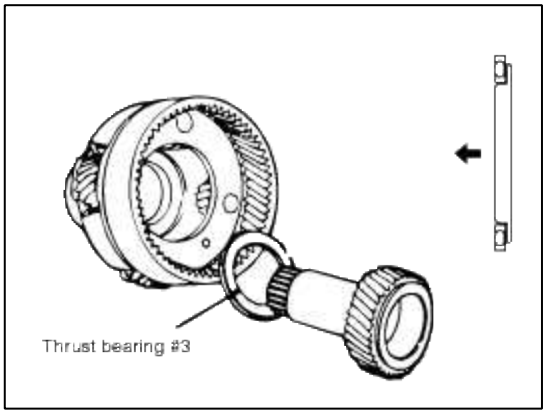
CAUTION

Be sure to install the thrust bearing in the proper direction.

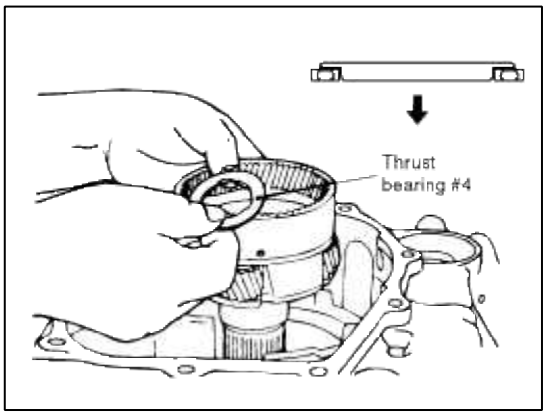


36. Install the underdrive sun gear and thrust bearing #3 to the output planetary carrier.

> **CAUTION**
>
> Be sure to install the thrust bearing in the proper direction.

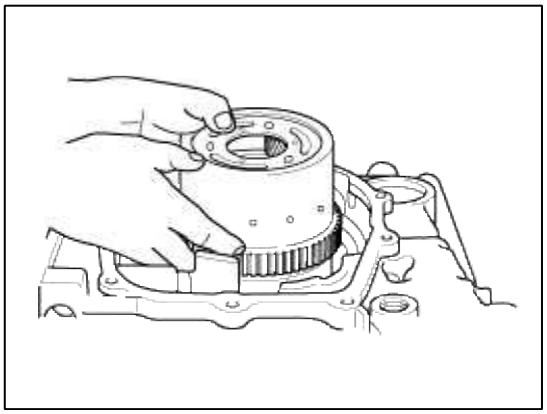


37. Install the output planetary carrier and thrust bearing #4.

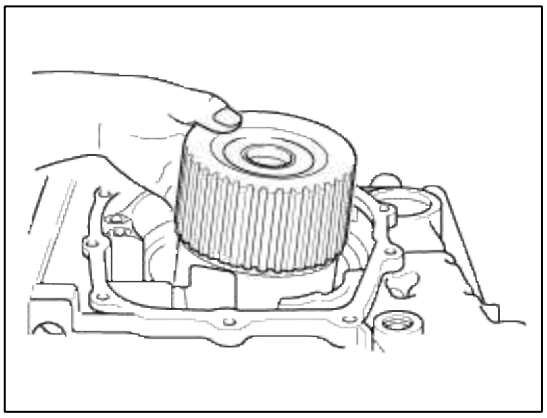


38. Install the overdrive planetary carrier.

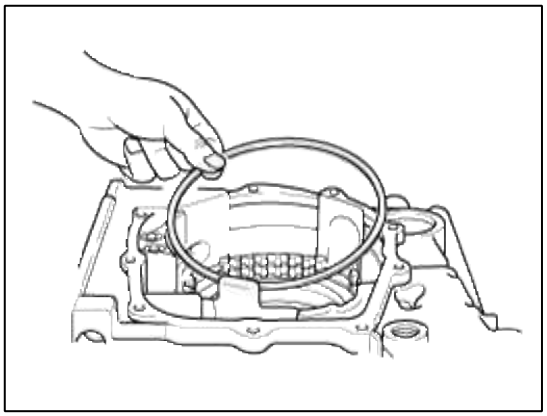
> **NOTE**
>
> Rotating the output shaft will help align the clutch teeth and help the carrier seat.



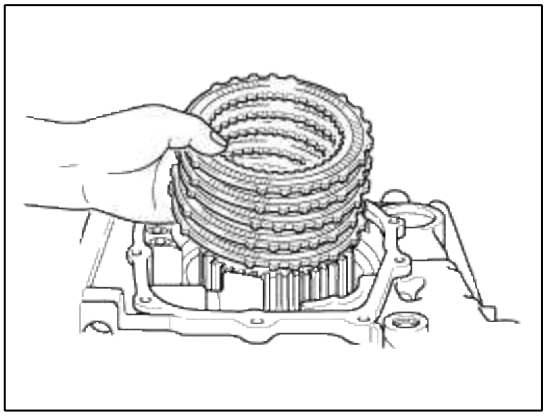
39. Install the reverse planetary sun gear.



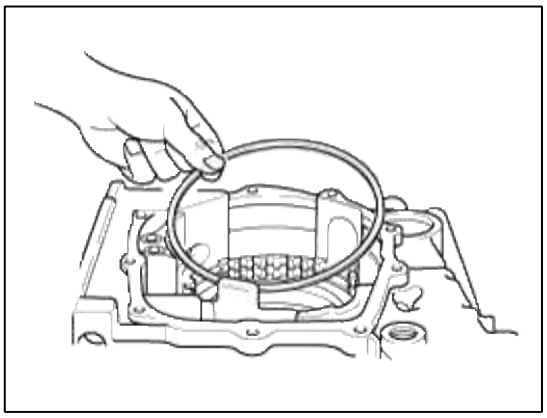
40. Install the wave spring.



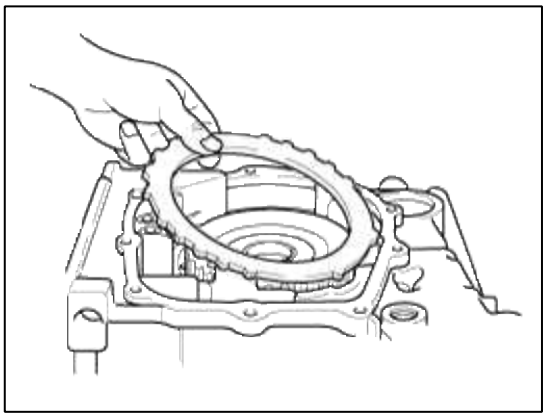
41. Install the low/reverse pressure plate, 6 brake discs, and 5 brake plates.



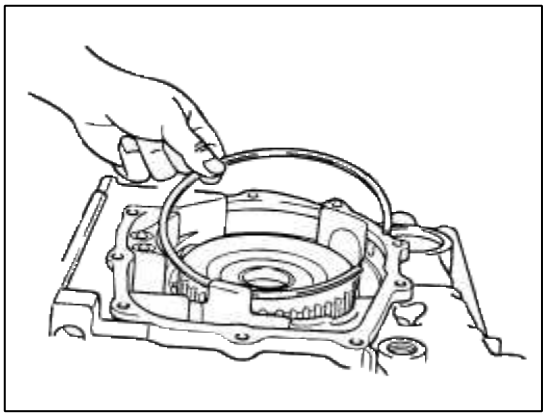
42. Install the snap ring.



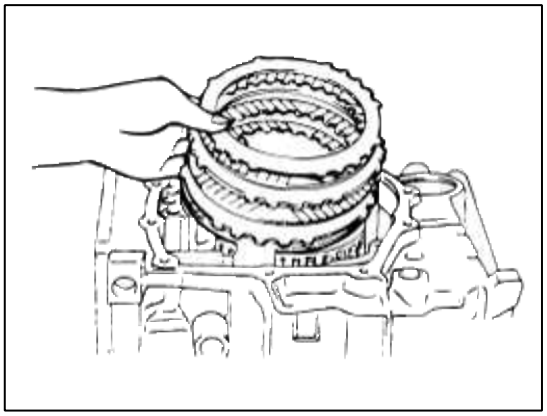
43. Install the reaction plate.



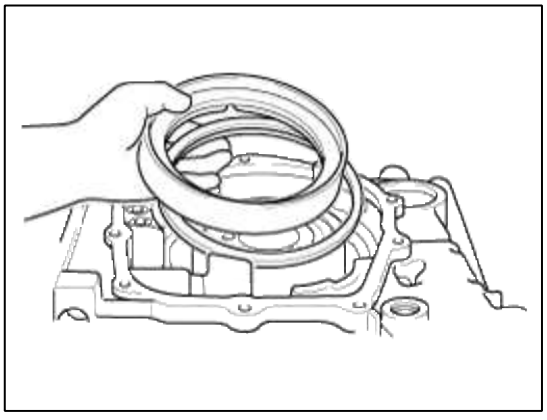
44. Install the snap ring.



45. Install the second brake pressure plate, 3 brake discs, and 2 brake plates.

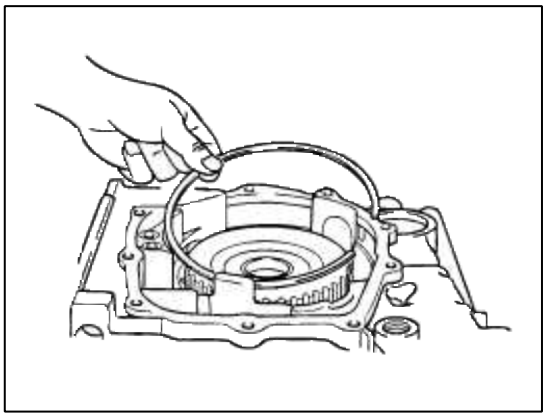


46. Install the return spring and second brake piston.



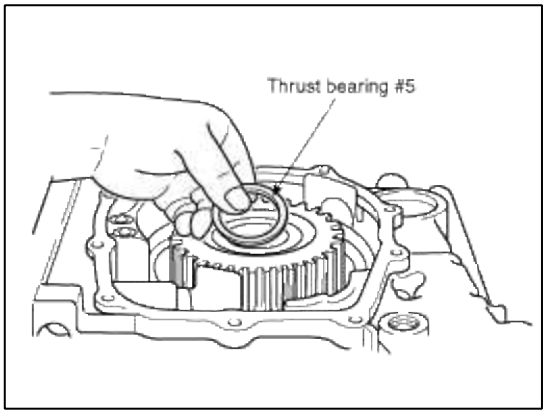
47. Install the snap ring.

> CAUTION
>
> Be sure to install the thrust bearing in the proper direction.



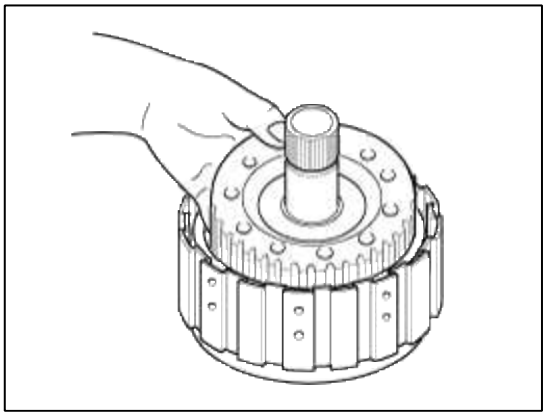
48. Install thrust bearing #5.

> CAUTION
>
> Be sure to install the thrust bearing in the proper direction.

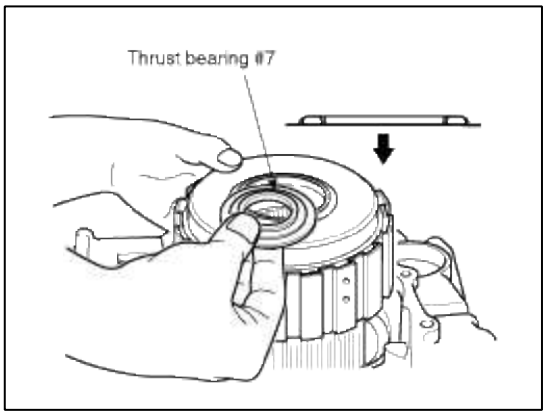


49. Install the overdrive clutch hub and thrust bearing #6 to the reverse and overdrive clutch.

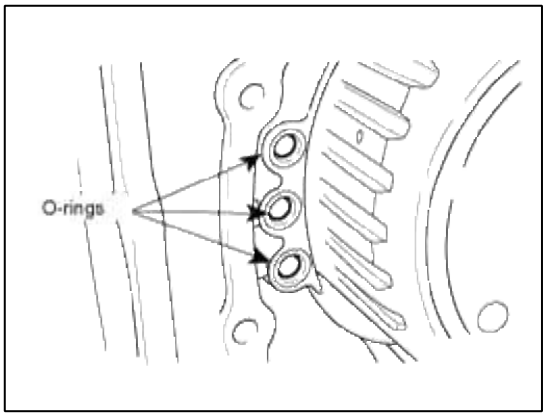
> CAUTION
>
> Be sure to install the thrust bearing in the proper direction.



50. Install the reverse and overdrive clutch and thrust bearing #7.

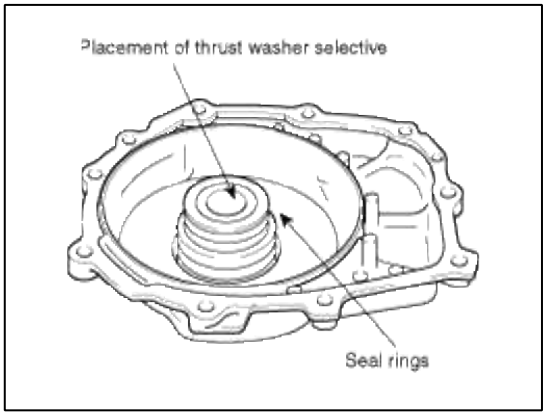


51. Install the three O-rings.



52. Install the 3 seal rings into the rear cover.

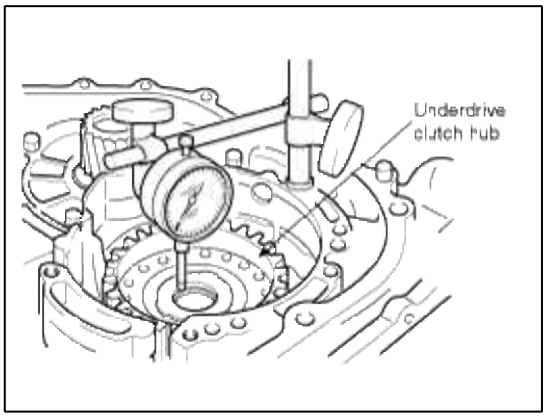
> NOTE
>
> The cover should be clean and dry for step 56. It is only being installed to measure the underdrive sun gear end play.



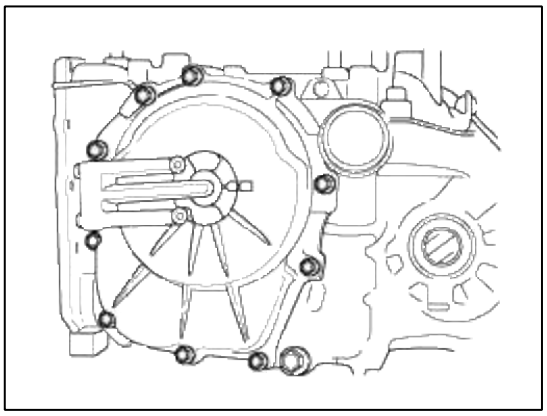
53. Install the used thrust race #8 and rear cover.

54. Using a dial indicator, measure the end play of the underdrive sun gear.

Standard value :
0.25-0.45 mm (0.0098-0.0177 in)



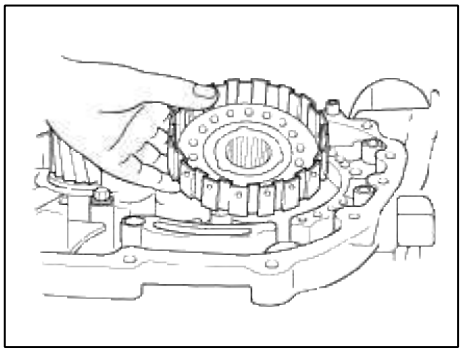
55. If the end play exceeds the standard value, measure the used race with a micrometer and select the proper size from the chart in the service manual.
56. Reinstall the rear cover and mounting bolts. Tighten the mounting bolts to 23 Nm (230 kgf.cm, 17 lbf.ft).



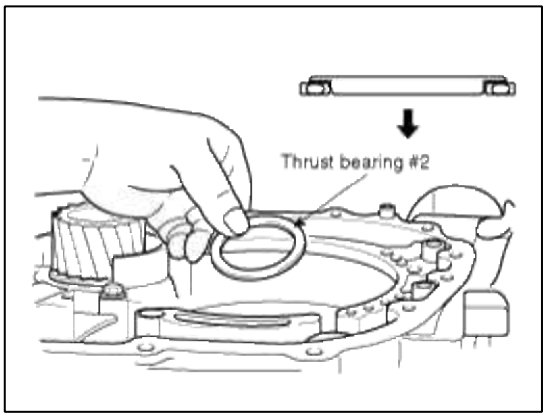
57. Install the underdrive clutch hub.

CAUTION

Be sure to install the thrust bearing in the proper direction.



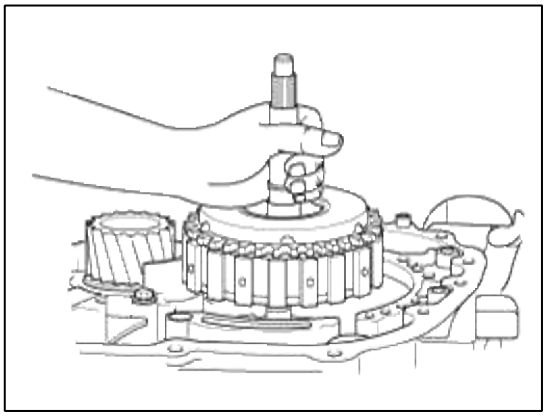
58. Install thrust bearing #2.



59. Grasp the input shaft and lower the underdrive clutch into position.

NOTE

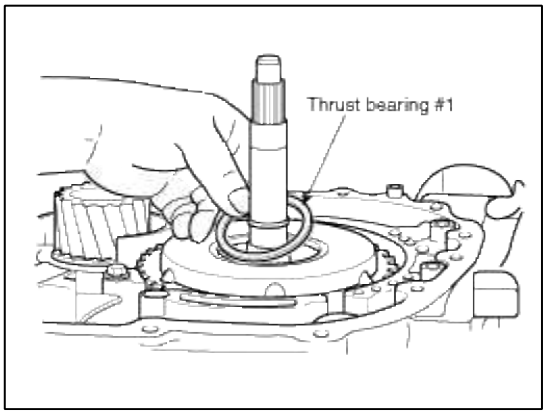
Looking into the hole where the input speed sensor mounts to the case will help you ensure that the underdrive clutch is fully seated.



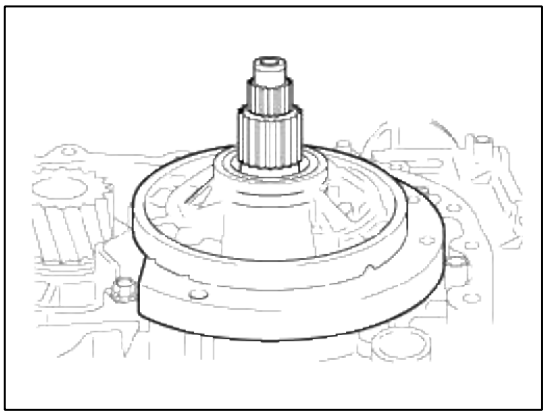
60. Install the used thrust bearing #1.

CAUTION

Be sure to use a new oil pump gasket.

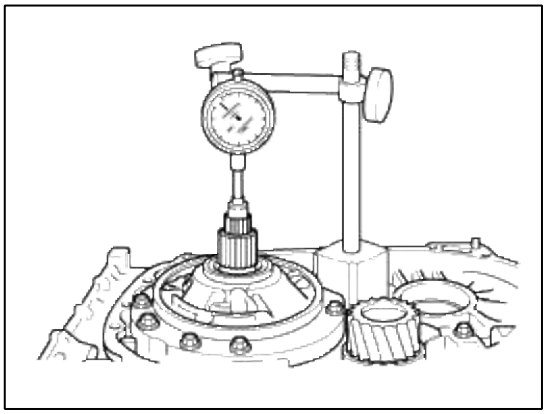


61. Install the oil pump, a new gasket, and the oil pump mounting bolts.

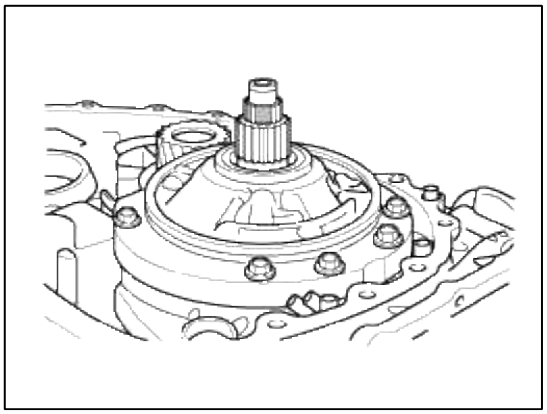


62. Using a dial indicator, measure the end play of the input shaft.

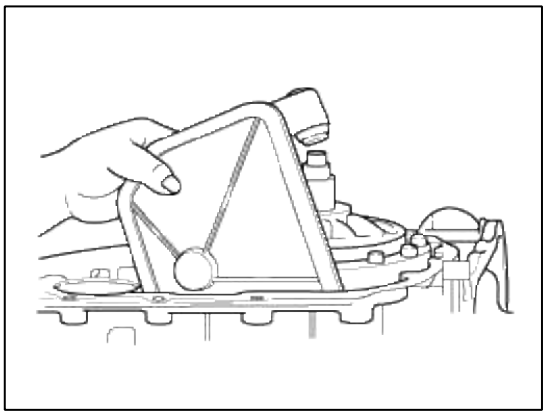
Standard value :
0.70-1.20 mm (0.0276-0.0472 in)



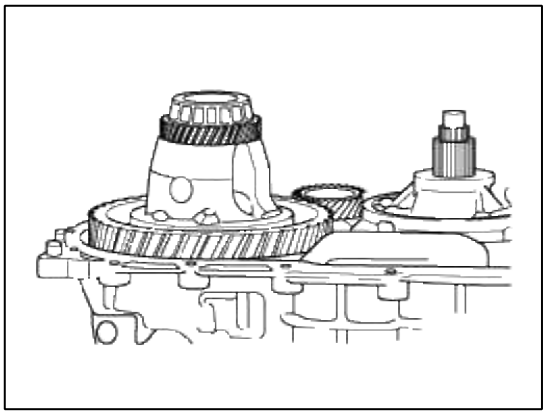
63. If the end play exceeds the standard value, measure the used race with a micrometer and select the proper size from the chart in the service manual.
64. Reinstall the oil pump and mounting bolts. Tighten the mounting bolts to 23 Nm (230 kgf.cm, 17 lbf.ft).



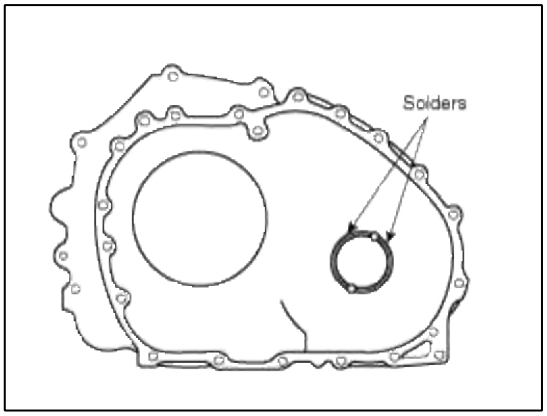
65. Install the oil internal filter.



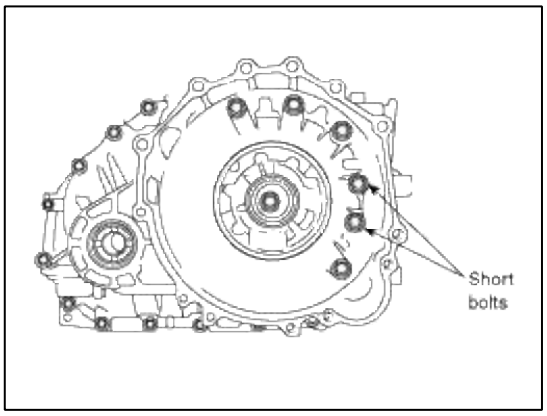
66. Install the differential.



67. Place two strips of solder, approximately 10 mm (0.39 in) long and 3 mm (0.12 in) thick, on the torque converter housing.



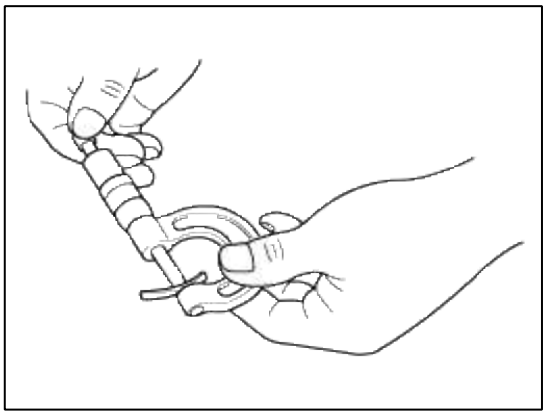
68. Install the torque converter housing and mounting bolts. Tighten the bolts to 47 Nm (470 kgf.cm, 35 lbf.ft) of torque.



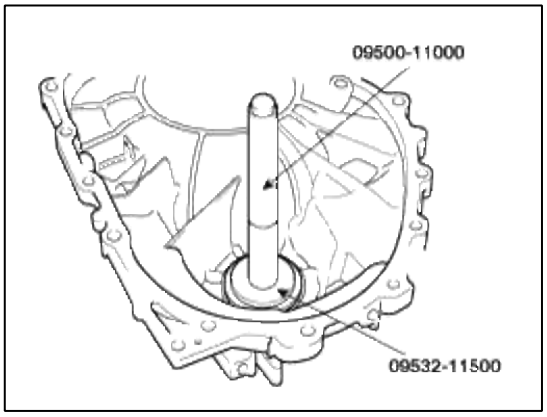
69. Remove the torque converter housing, the bolts and the solder.
70. Using a micrometer, measure the thickness of the pressed solder.

71. Select a spacer that will give the following clearance.

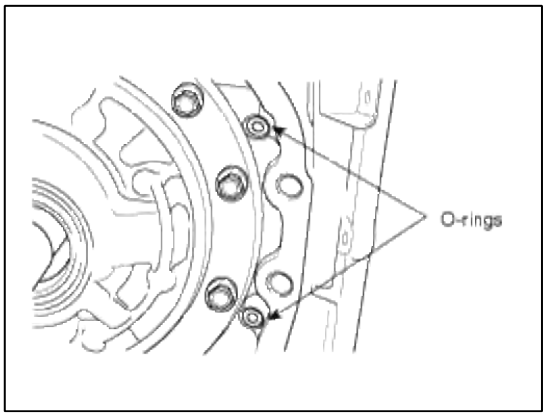
Standard value :
0.045 mm (0.0018 in)-0.105 mm (0.0041 in)



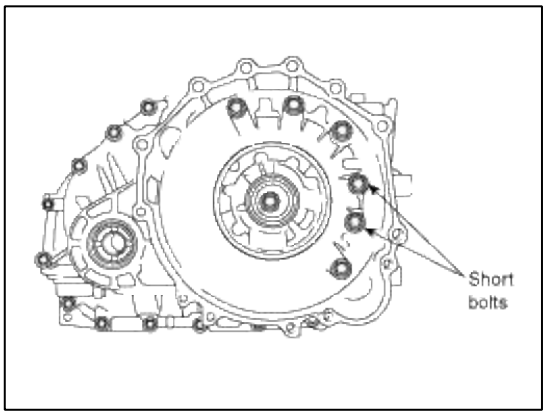
72. Install the differential spacer selected in the previous step in the torque converter housing.
73. Use special tools 09532-11500 and 09500-11000 to press in the differential bearing outer race.



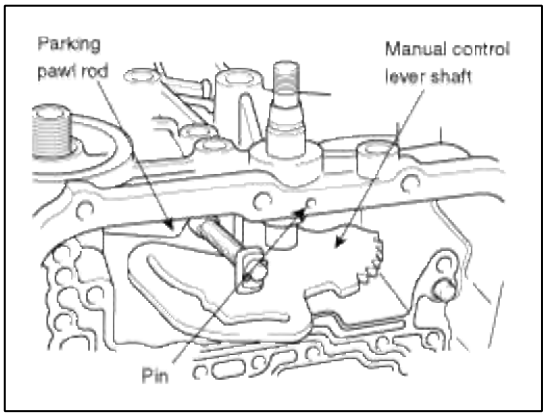
74. Install the two O-rings.



75. Install the torque converter housing and mounting bolts. Tighten the bolts to 47 Nm (470 kgf.cm, 35 lbf.ft) of torque.

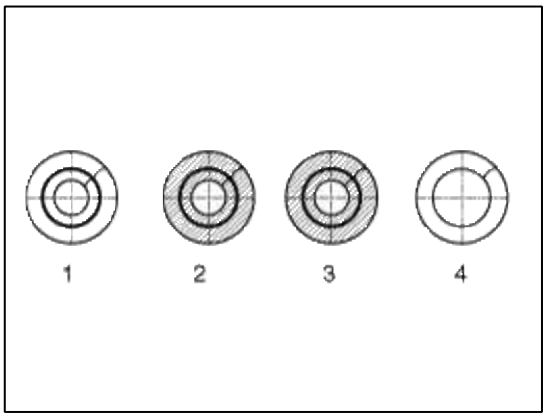


76. Install the manual control lever shaft and parking pawl.



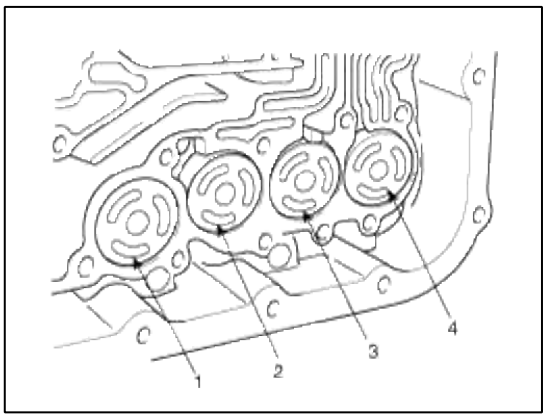
77. Install the manual control shaft roller.
78. Install the three small springs and three larger springs into the accumulator pistons. The accumulator springs are identified in the illustration and in the chart below.

Number	Function Name
1	Low&Reverse Brake
2	Underdrive Clutch
3	Second Brake
4	Overdrive Clutch



79. Install the accumulators with the springs according to the illustration and the chart below. The accumulators should be flush with the transaxle case.

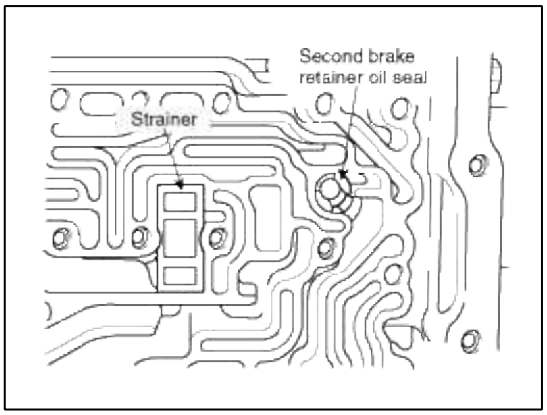
Number	Function Name	Color
1	Low&Reverse Brake	None
2	Underdrive Clutch	Yellow
3	Second Brake	Blue
4	Overdrive Clutch	None



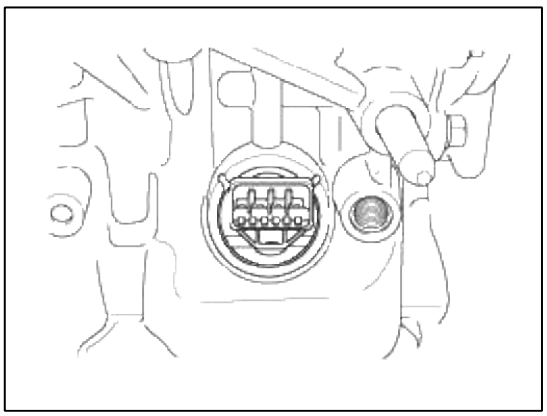
80. Install the strainer and the second brake retainer oil seal.

NOTE

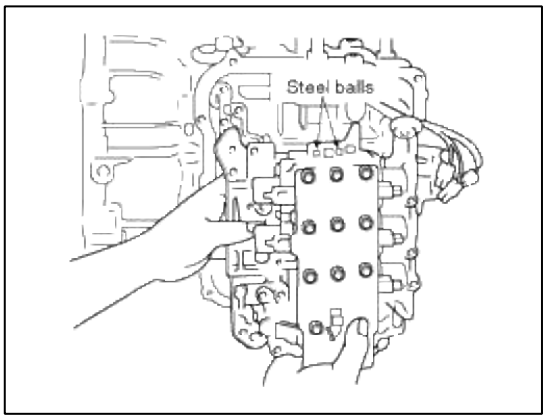
The oil seal orientation in the illustration.



81. Install the solenoid wiring harness, then install the snap ring in its groove.

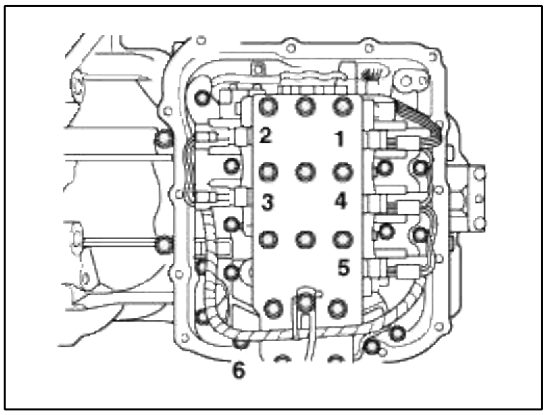


82. Install the valve body, gasket, and two steel balls.

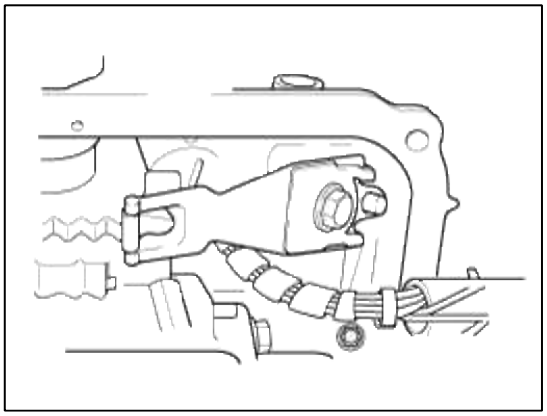


83. Install the oil temperature sensor. Tighten the mounting bolt to 11 Nm (110 kgf.cm, 8 lbf.ft).
84. Install 28 valve body mounting bolts. Tighten all valve body mounting bolts to 11 Nm (110 kgf.cm, 8 lbf.ft).
85. Connect the solenoid wiring and temperature sensor connectors according to the illustration and the chart below.

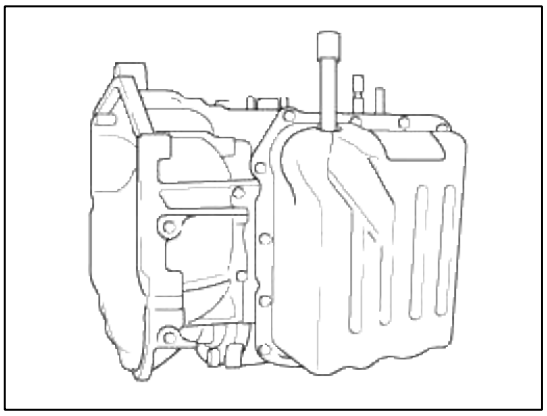
No.	Part to be connected	Wire color	Connector housing color
1	Underdrive solenoid valve	White, Red, Red	Black
2	Overdrive solenoid valve	Orange, Red	Black
3	Low&Reverse solenoid valve	Brown, Yellow	Milky White
4	Second solenoid valve	Green, Red, Red	Milky White
5	Damper clutch control solenoid valve	Blue, Yellow, Yellow	Black
6	Oil temp. sensor	Black, Red	Black



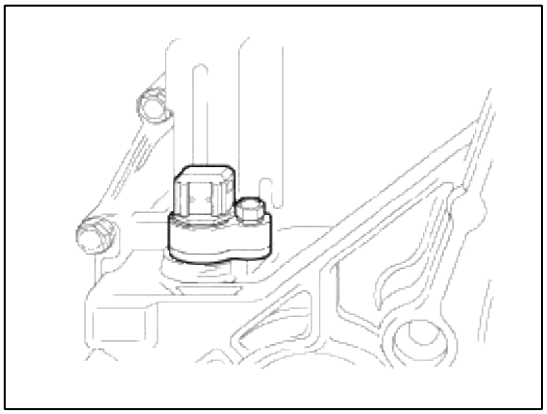
86. Install the manual control shaft detent. Tighten the nut to 6 Nm (60 kgf.cm, 4.4 lbf.ft) of torque.



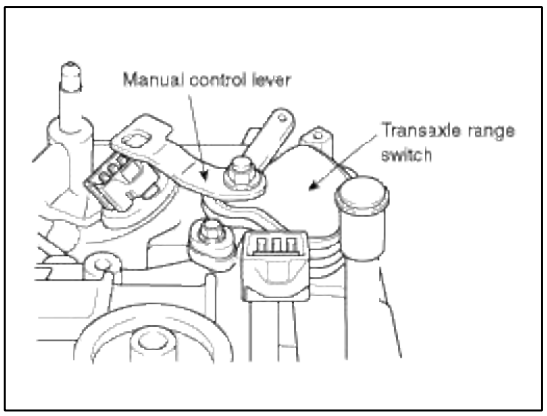
87. Install the valve body cover and mounting bolts. Tighten the mounting bolts to 9 Nm (90 kgf.cm, 7 lbf.ft) of torque.



88. Install the vehicle speed sensor and mounting bolt. Tighten the mounting bolt to 5 Nm (50 kgf.cm, 4 lbf.ft) of torque.



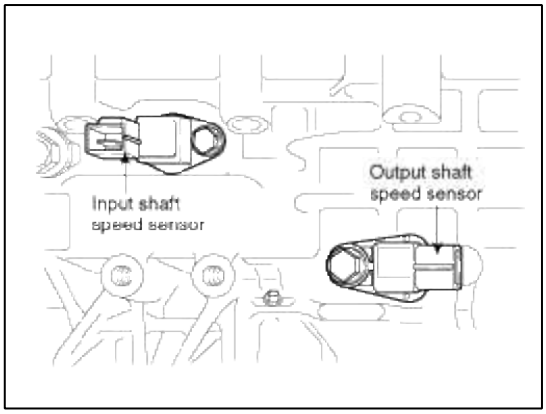
89. Install the park/neutral position switch. Tighten the mounting bolt to 11 Nm (110 kgf.cm, 8 lbf.ft) of torque.



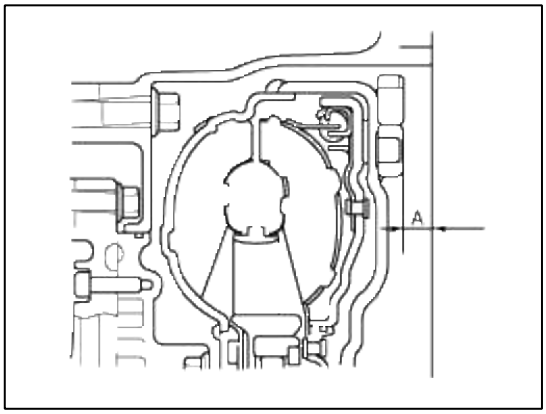
90. Install the manual control lever. Tighten the mounting nut to 22 Nm (220 kgf.cm, 16 lbf.ft) of torque.

91. Install the input and output shaft speed sensors. Tighten the mounting bolts to 11 Nm (110 kgf.cm, 8 lbf.ft) of torque.

> CAUTION
>
> Make sure that you are installing the correct oil filter. While the engine oil filter and the transaxle oil filter locksimilar, their filtering action is different. Installing the wrong oil filter could cause damage to the transaxle. Transaxle oil filters are identified as A/T ONLY.



92. Install the cooler feed tube with a new gasket and the eye bolt. Tighten the eye bolt to 30 Nm (300 kgf.cm, 22 lbf.ft) of torque.



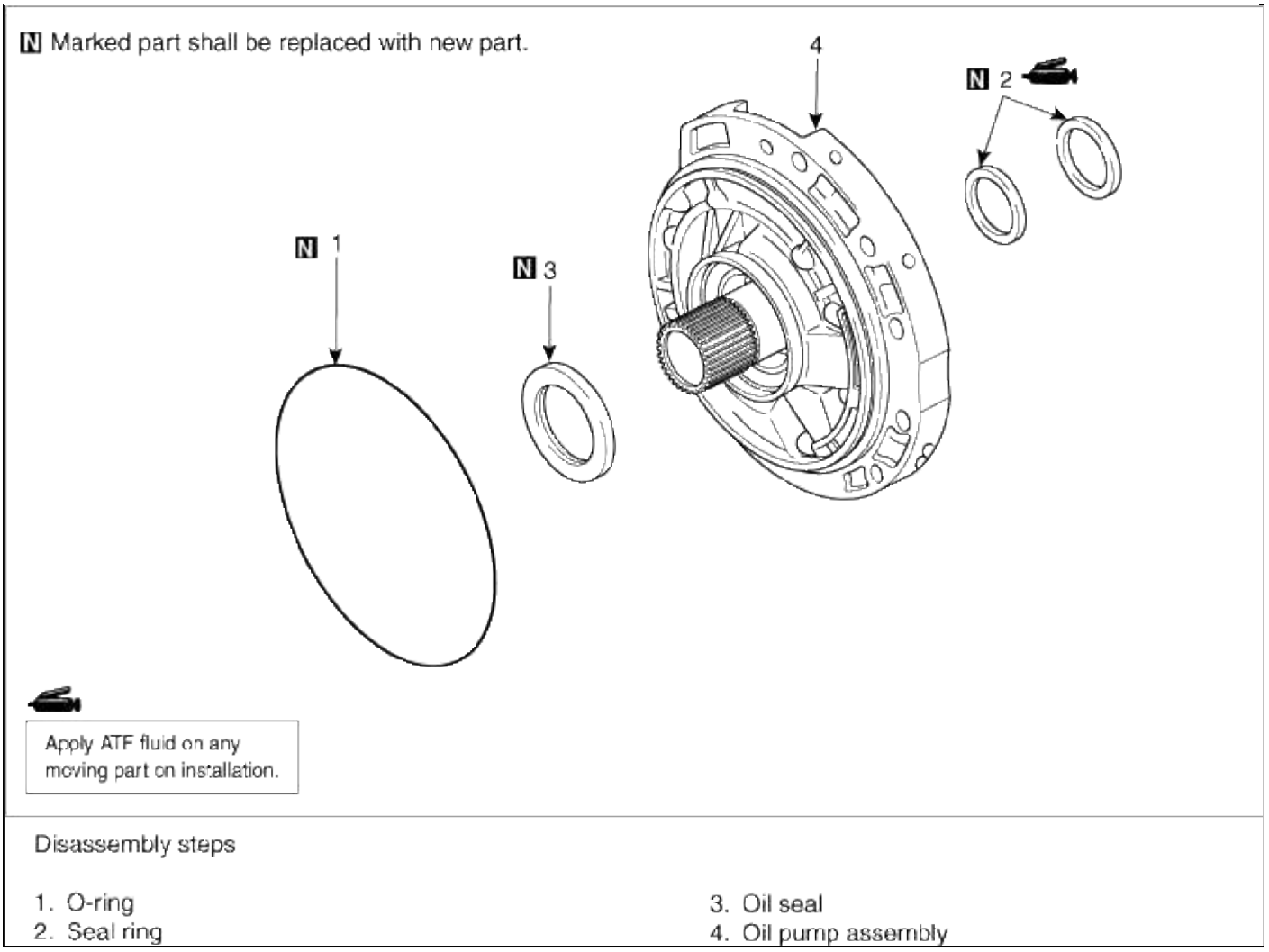
93. Install the dipstick.
94. Install the control cable bracket. Tighten the mounting bolt to 23 Nm (230 kgf.cm, 17 lbf.ft).
95. Install the wiring harness bracket. Tighten the mounting bolt to 23 Nm (230 kgf.cm, 17 lbf.ft).
96. Install the two roll stopper brackets. Tighten the mounting bolts to 69 Nm (690 kgf.cm, 51 lbf.ft).
97. Install the torque convertor and secure it so that dimension A.
    Meets the reference value.

Reference value :
approx. 12.2 mm (0.480 in)

> CAUTION
>
> Apply ATF to the oil pump drive hub before installing the torque converter. Be careful not to damage the oil pump seal.

Automatic Transaxle System > Hydraulic System > Oil Pump > Components and Components Location (F4A42-2)

COMPONENTS



Disassembly steps

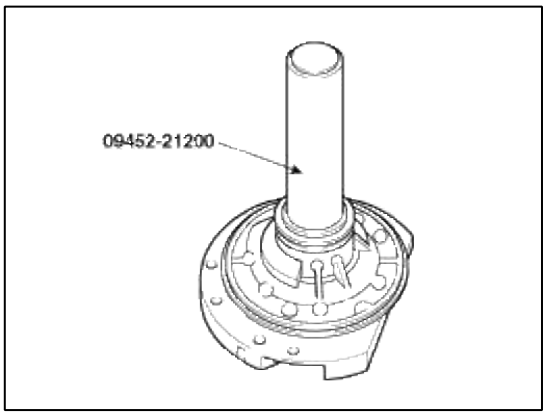
1. O-ring
2. Seal ring
3. Oil seal
4. Oil pump assembly

Automatic Transaxle System > Hydraulic System > Oil Pump > Repair procedures (F4A42-2)

REASSEMBLY

Oil seal replacement

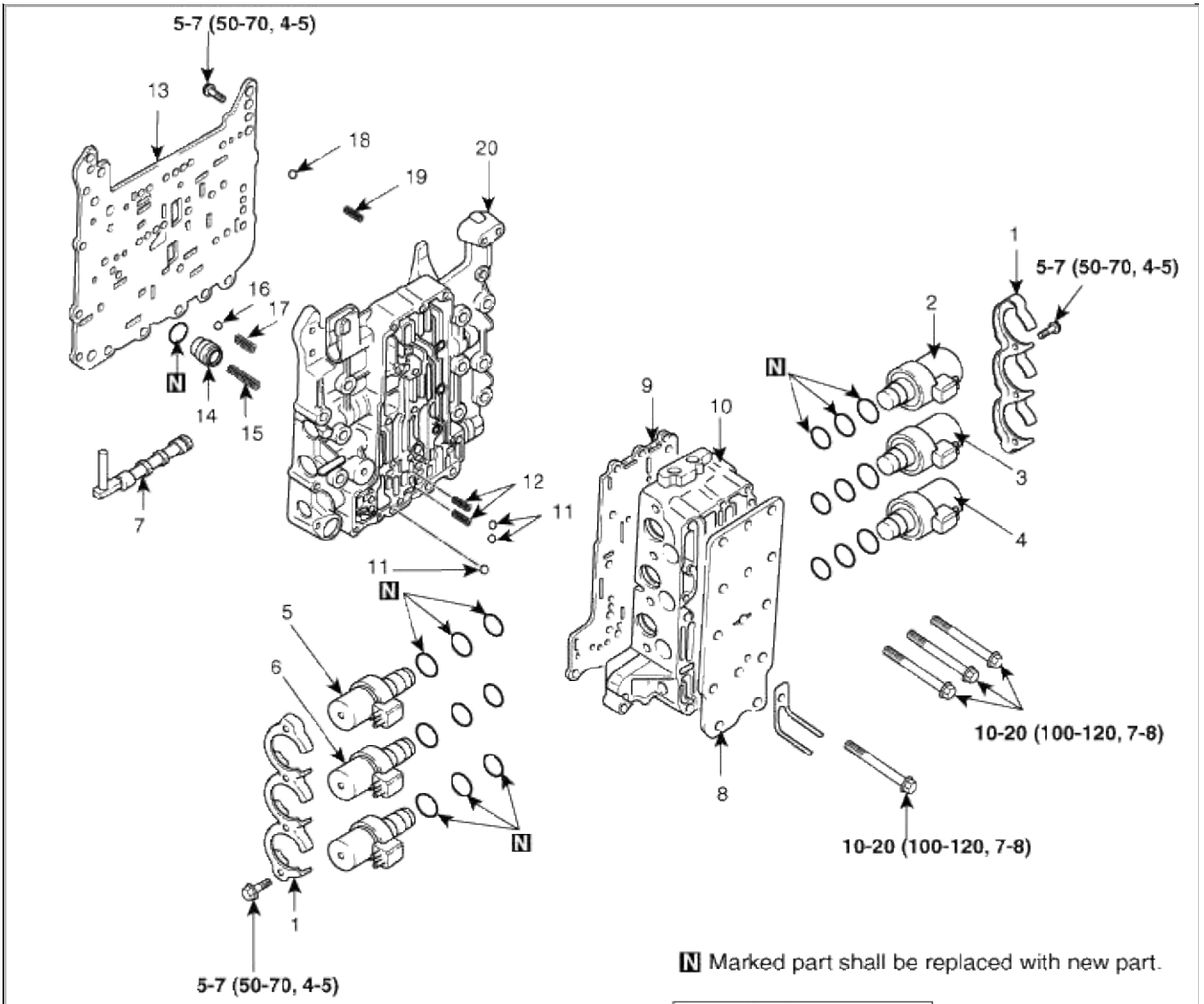
1. Using the special tool (09452-21200), install the oil seal to the pump housing.



2. Apply a thin coat of automatic transaxle fluid to the lip of the oil seal before installation.

Automatic Transaxle System > Valve Body System > Valve Body > Components and Components Location (F4A42-2)

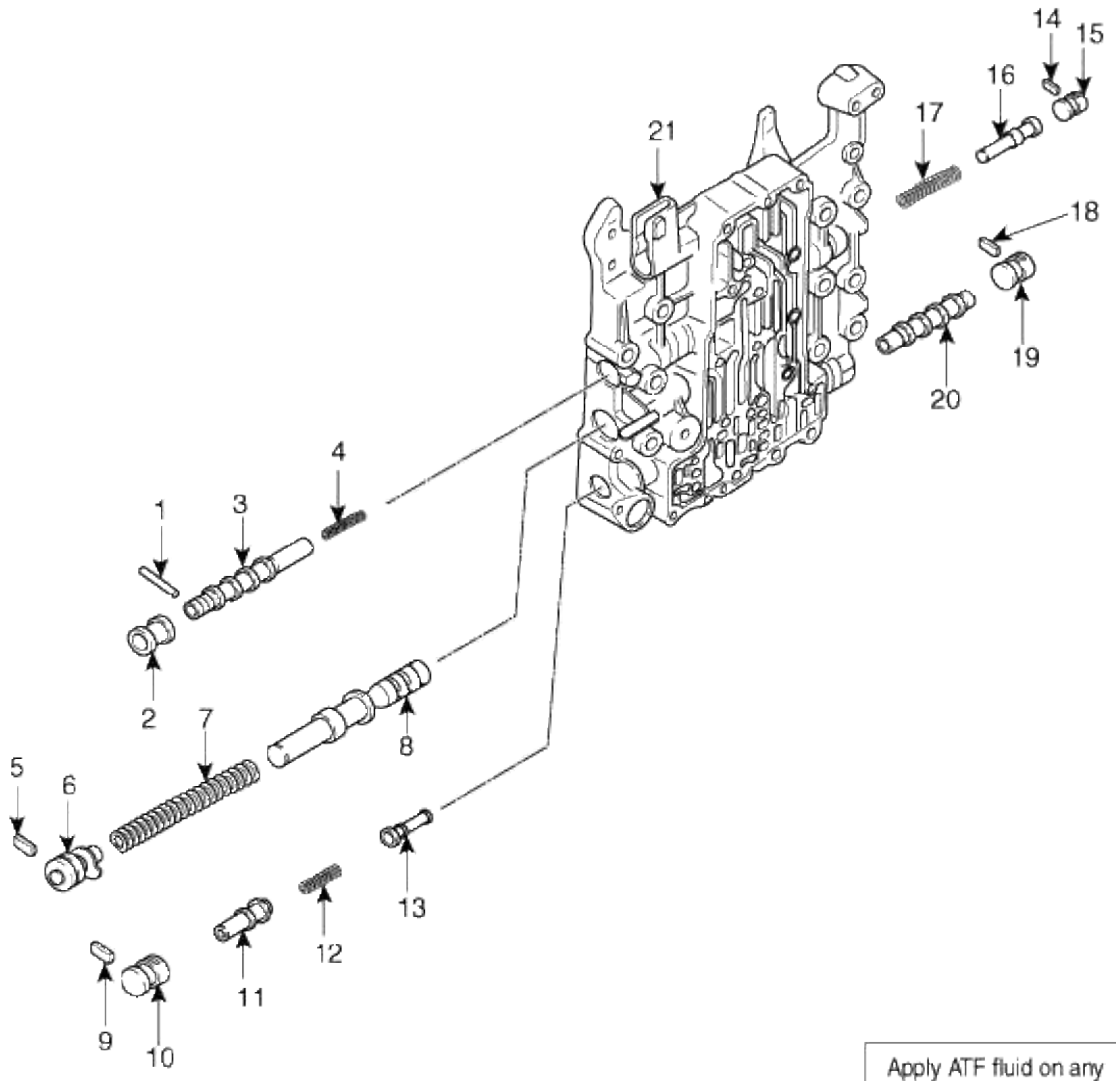
COMPONENTS



Disassembly steps

1. Solenoid valve support
2. UD clutch solenoid valve
3. 2nd brke solenoid valve
4. Damper clutch control solenoid valve
5. OD clutch solenoid valve
6. Low and reverse brake solenoid valve
7. Manual valve
8. Cover
9. Plate
10. Outside valve body assembly
11. Still ball (Orfice check ball)
12. Spring
13. Plate
14. Damping valve
15. Damping valve spring
16. Steel ball (line relief)
17. Spring
18. Steel ball (Orfice check ball)
19. Spring
20. Inside valve body assembly

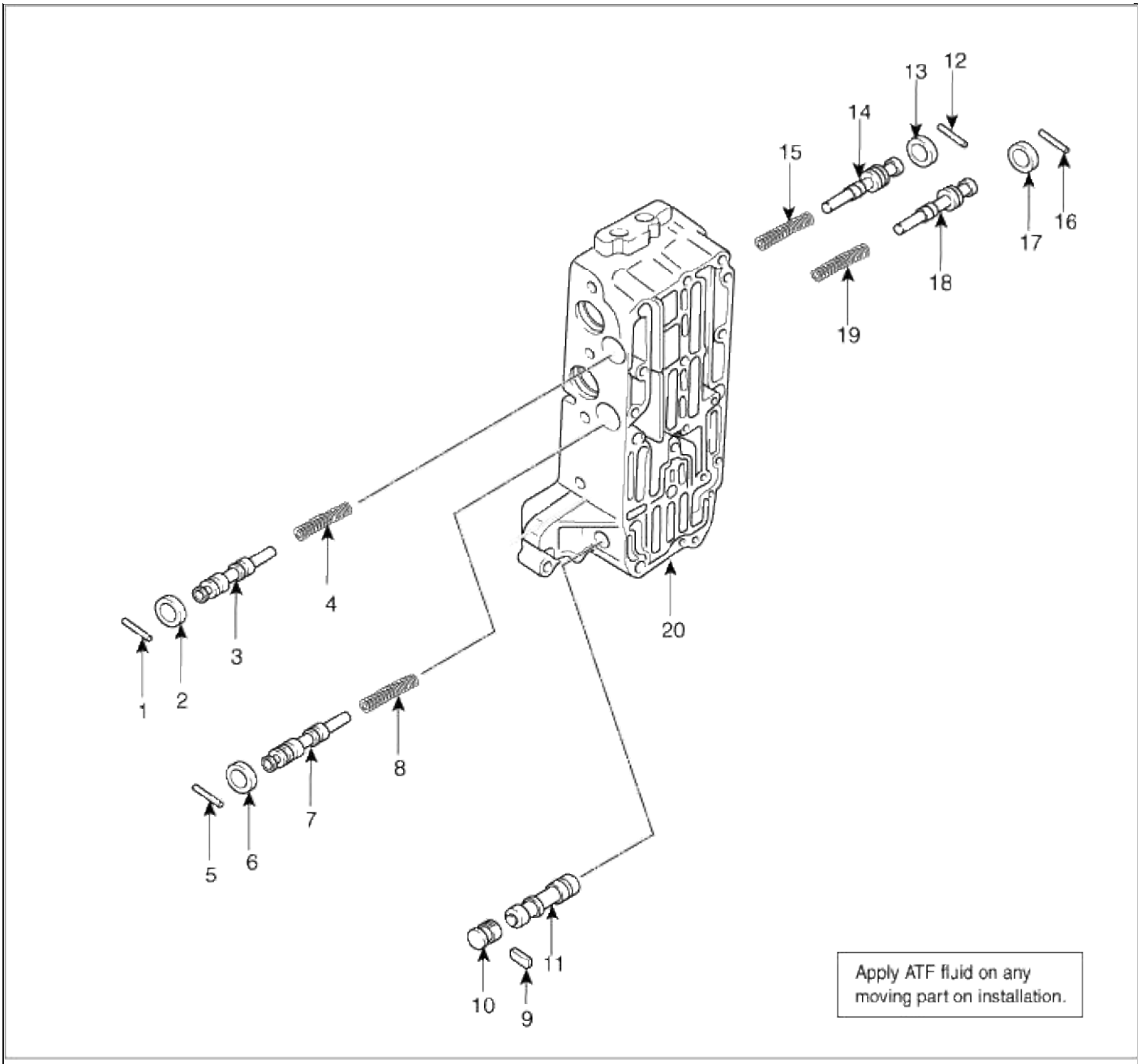
INSIDE VALVE BODY



Disassembly

1. Roller
2. Damper clutch control valve sleeve
3. Damper clutch control valve
4. Damper clutch control valve spring
5. Plate
6. Screw
7. Regulator valve spring
8. Regulator valve
9. Plate
10. Fail-safe valve A sleeve
11. Fail-safe valve A2
12. Fail-safe valve A sprint
13. Fail-safe valve A1
14. Plate
15. Plug
16. Torque converter valve
17. Torque converter valve spring
18. Plate
19. Fail-safe valve B sleeve
20. Fail-safe valve
21. Inside valve body

OUTSIDE VALVE BODY



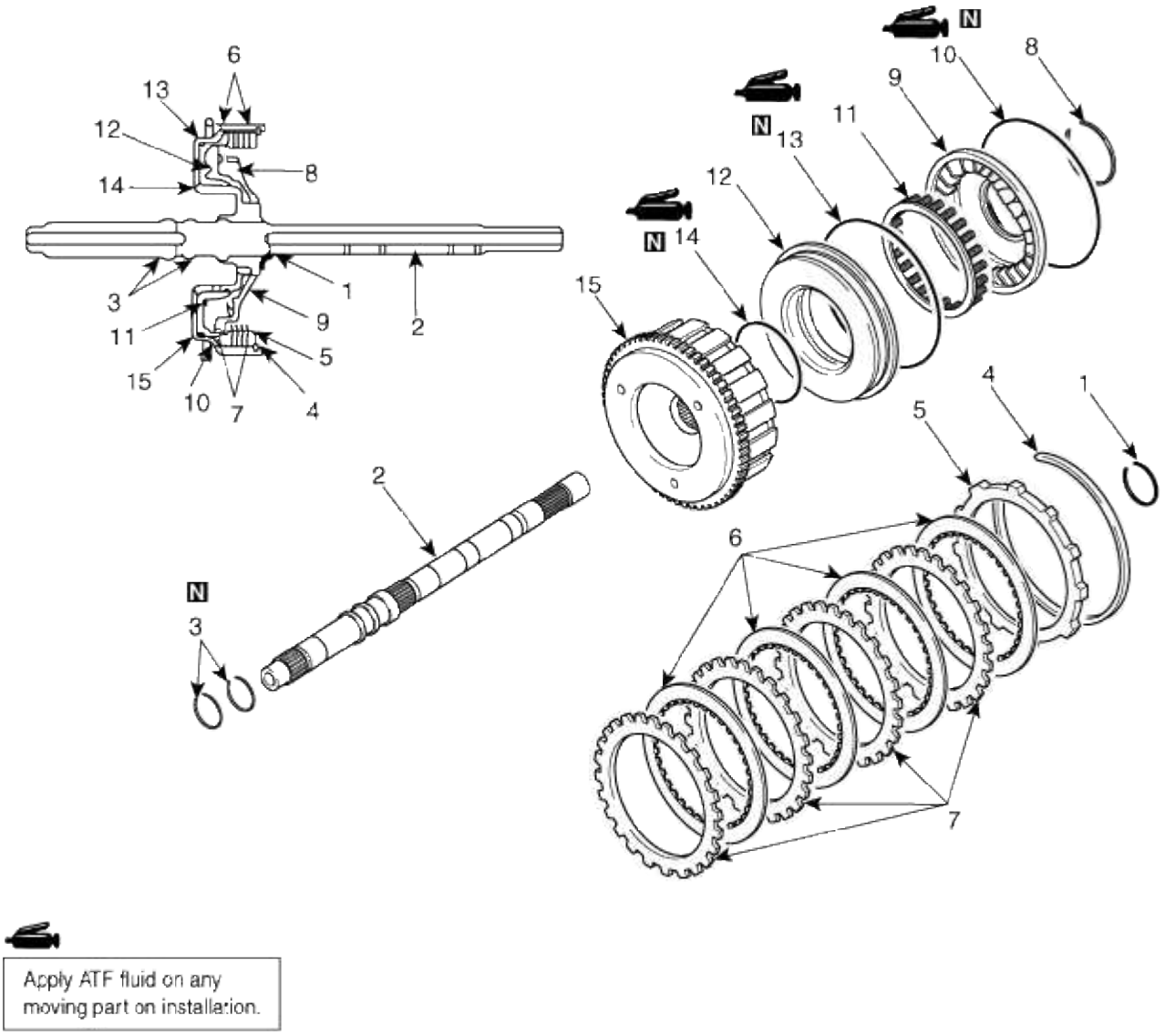
Disassembly

1. Roller
2. Overdrive pressure control valve sleeve
3. Overdrive pressure control valve
4. Overdrive pressure control valve spring
5. Roller
6. Low-reverse pressure control valve sleeve
7. Low-reverse pressure control valve
8. Low-reverse pressure control valve spring
9. Plate
10. Plug
11. Switching valve
12. Roller
13. Underdrive pressure control valve sleeve
14. Underdrive pressure control valve
15. Underdrive pressure control valve spring
16. Roller
17. Second pressure control valve sleeve
18. Second pressure control valve
19. Second pressure control valve spring
20. Outside valve body

Automatic Transaxle System > Clutch & Brake > Underdrive Clutch > Components and Components Location (F4A42-2)

COMPONENTS

N Marked part shall be replaced with new part.



Disassembly steps

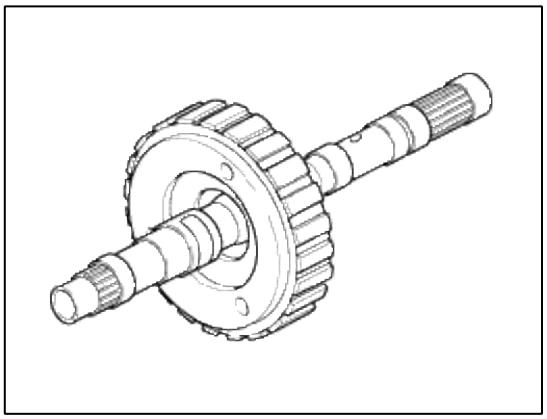
1. Snap ring
2. Input shaft
3. Seal ring
4. Snap ring
5. Clutch reaction plate
6. Clutch disc
7. Clutch plate
8. Snap ring
9. Spring retainer
10. D-ring
11. Return spring
12. Underdrive clutch piston
13. D-ring
14. D-ring
15. Underdrive clutch retainer

Automatic Transaxle System > Clutch & Brake > Underdrive Clutch > Repair procedures (F4A42-2)

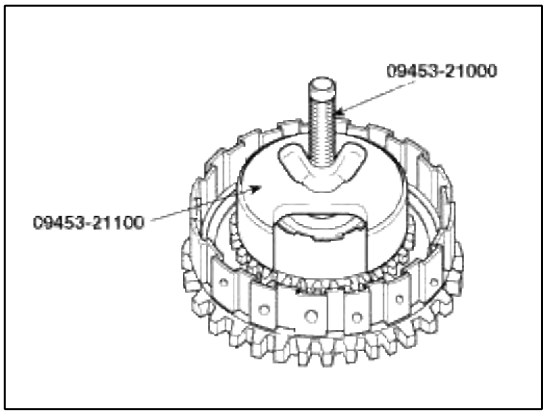
DISASSEMBLY

1. Remove the input shaft snap ring.
2. Remove the input shaft.
3. Remove the 2 seal rings.
4. Remove the clutch reaction plate snap ring.
5. Remove the clutch reaction plate.

6. Remove the 4 clutch discs and 4 clutch plates.



7. Compress the clutch return springs using special tools, 09453-24000 and 09453-21000 then remove the clutch spring retainer snap ring.

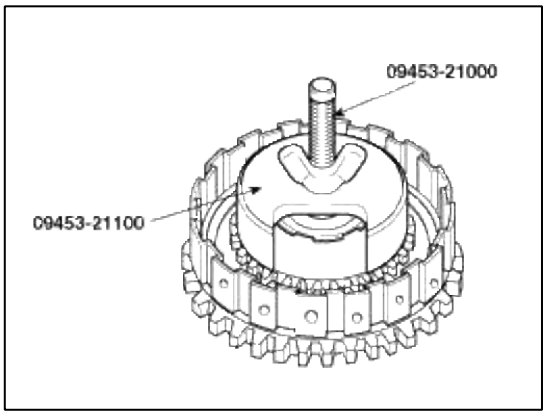


8. Remove the clutch spring retainer.
9. Remove the D-ring seal.
10. Remove the clutch return spring.
11. Remove the underdrive clutch piston using compressed air.
12. Remove the 2 D-ring seals.

REASSEMBLY

1. Install the 2 D-ring seals.
2. Install the underdrive clutch piston.
3. Install the clutch return spring.
4. Install the D-ring seal.
5. Install the clutch spring retainer.

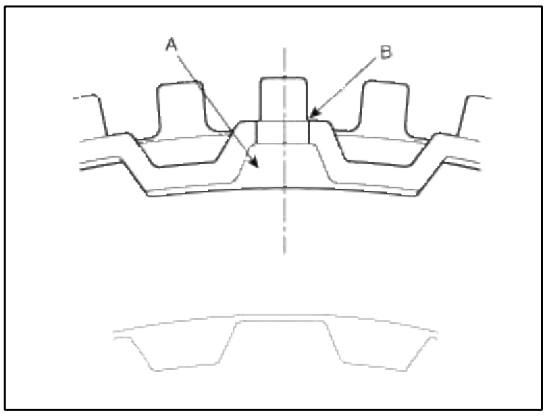
6. Compress the clutch return springs using special tools, 09453-21100 and 09453-21000, then install the clutch spring retainer snap ring.



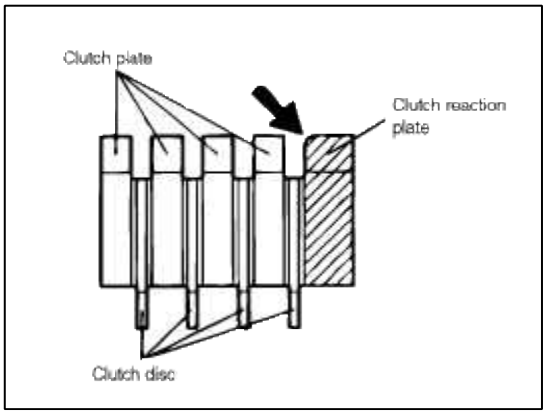
CAUTION

Dip each clutch disc in ATF before assembling.

7. Align the spaces between the teeth (A) on the clutch plates, clutch discs, and reaction plate to the outer circumference hole (B) in the underdrive clutch retainer.

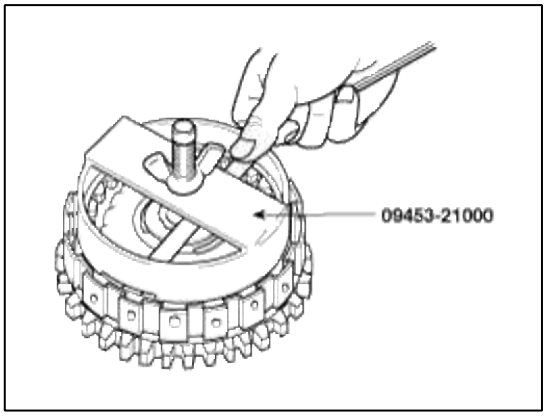


8. Install the 4 clutch discs and the 4 clutch plates.
9. Install the clutch reaction plate with the shear droop toward the clutch disc.
10. Install the clutch reaction plate snap ring.

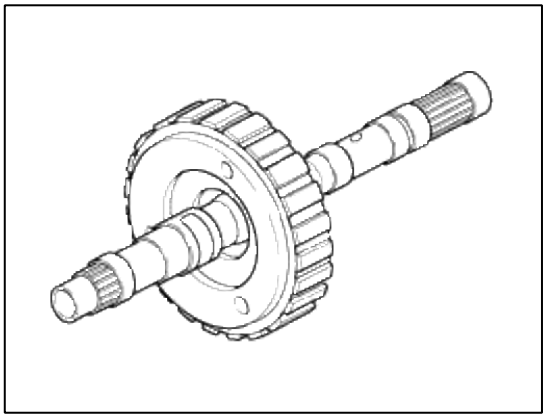


11. Install special tools, MD998924 and MB991628, as shown, then check the clearance between the snap ring and the reaction plate using a feeler gauge.

Standard value :
1.6-1.8 mm (0.0630-0.0709 in)



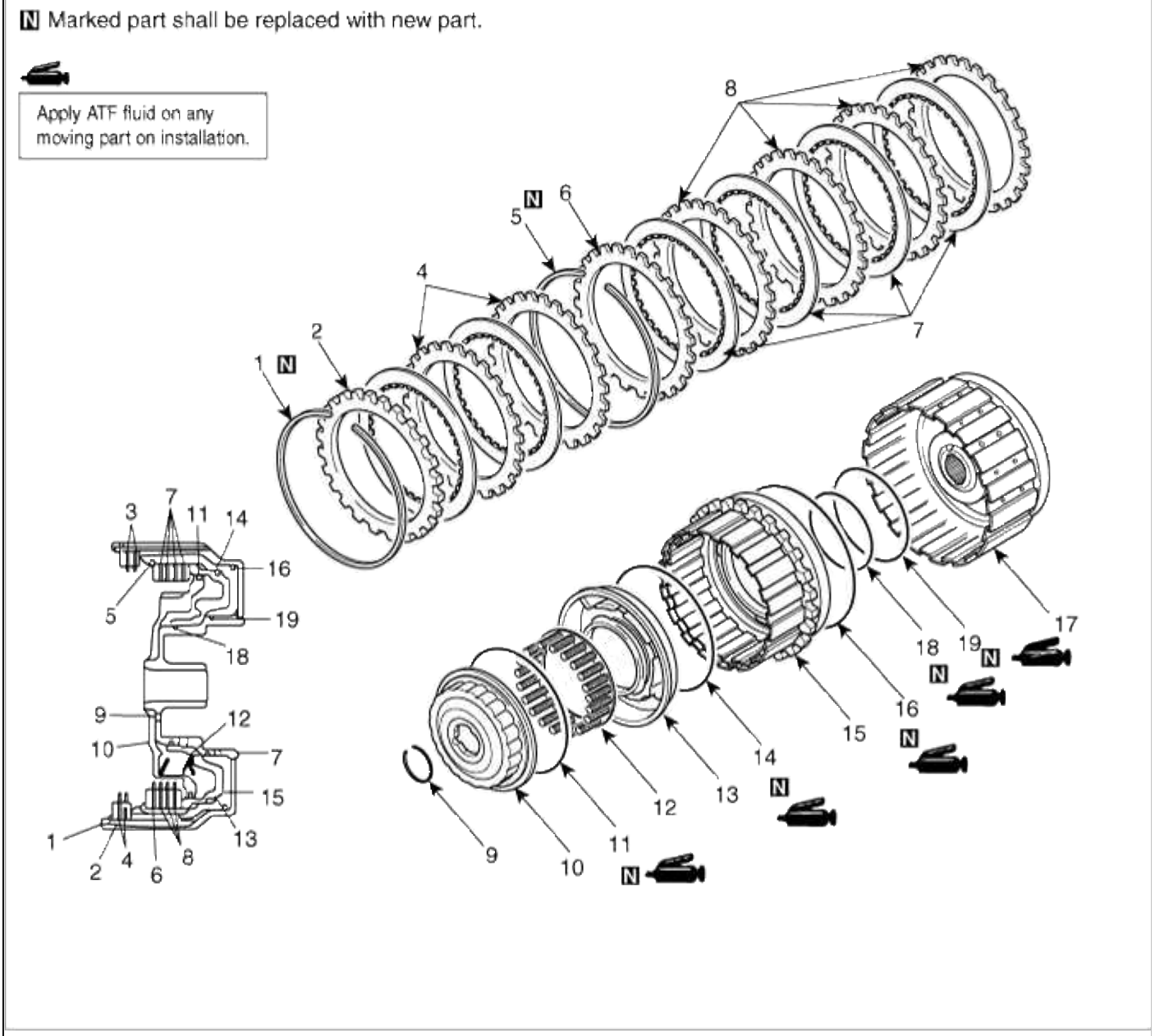
12. If the clearance is correct, measure the old snap ring, then select the correct size from the chart in the service manual.
13. Install the seal rings.
14. Install the input shaft.



15. Install the input shaft snap ring.

Automatic Transaxle System > Clutch & Brake > Reverse and Overdrive Clutch > Components and Components Location (F4A42-2)

COMPONENTS



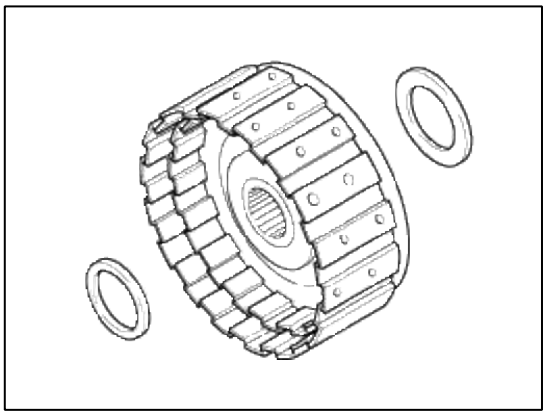
Disassembly steps

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

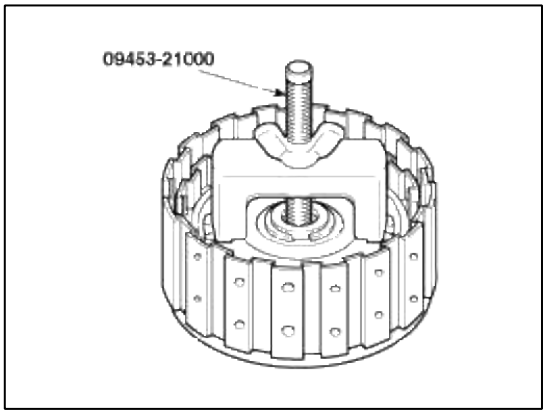
Automatic Transaxle System > Clutch & Brake > Reverse and Overdrive Clutch > Repair procedures (F4A42-2)

DISASSEMBLY

1. Remove the overdrive clutch reaction plate snap ring.



2. Remove the overdrive clutch reaction plate.
3. Remove the 2 overdrive clutch discs and 2 plates.
4. Remove the reverse clutch reaction plate snap ring.
5. Remove the reverse clutch reaction plate.
6. Remove the 4 reverse clutch discs and 4 plates.
7. Compress the clutch return springs using special tools, 09453-21000 then remove the clutch spring retainer snap ring.

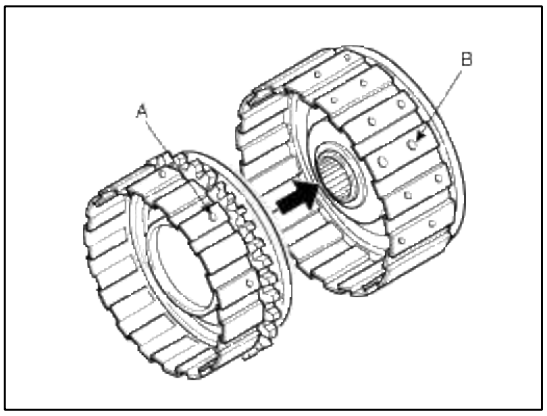


8. Remove the clutch spring retainer.
9. Remove the D-ring seal.
10. Remove the clutch return spring.
11. Remove the overdrive clutch piston using compressed air.
12. Remove the D-ring seal.
13. Remove the Reverse clutch piston.
14. Remove the 3 D-ring seals.

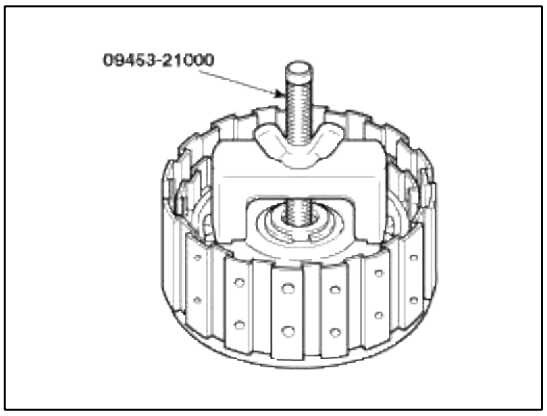
REASSEMBLY

1. Install the 3 D-ring seals.

2. Align the outer circumference holes (A and B) on the reverse piston and the reverse piston retainer before assembly.

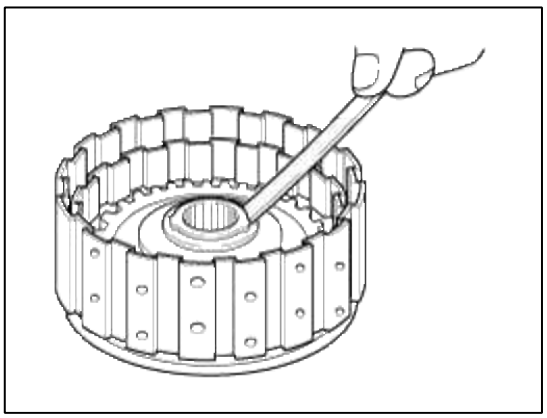


3. Install the Reverse clutch piston.
4. Install the D-ring seal.
5. Install the overdrive clutch piston.
6. Install the clutch return spring.
7. Install the D-ring seal.
8. Install the clutch spring retainer.
9. Compress the clutch return springs using special tools, 09453-21000 then install the clutch spring retainer snap ring.



10. Check the clearance between the snap ring and the return spring retainer

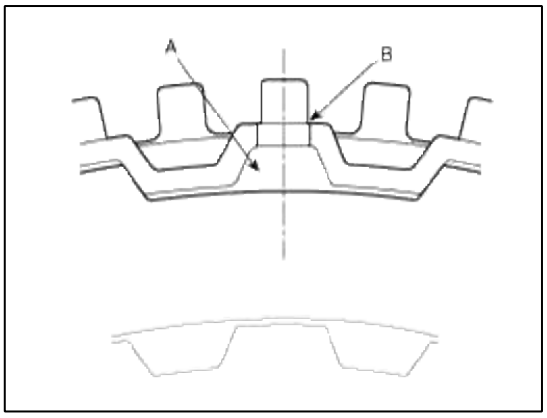
Standard value :
0.01-0.09 mm (0.0004-0.0035 in)



11. If the clearance is incorrect, measure the old snap ring, then select the correct size from the chart in the service manual.

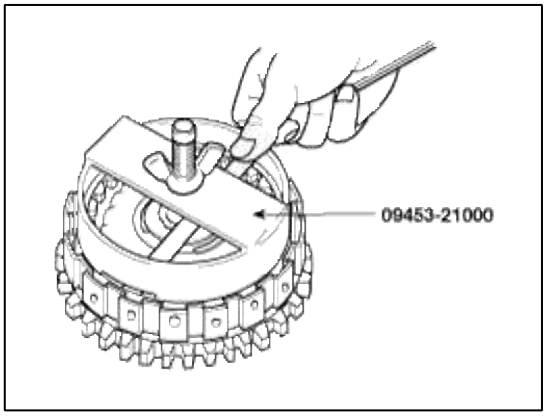
> CAUTION
>
> Dip each clutch disc in ATF before assembling.

12. Align the spaces between the teeth (A) on the clutch plates, clutch discs, and reaction plate to the outer circumference hole (B) in the reverse clutch retainer.



13. Install the 4 reverse clutch discs and 4 plates.
14. Install the reverse clutch reaction plate.
15. Install the reverse clutch reaction plate snap ring.
16. Install special tools, 09453-21000 as shown, then check the clearance between the snap ring and the reaction plate using a feeler gauge.

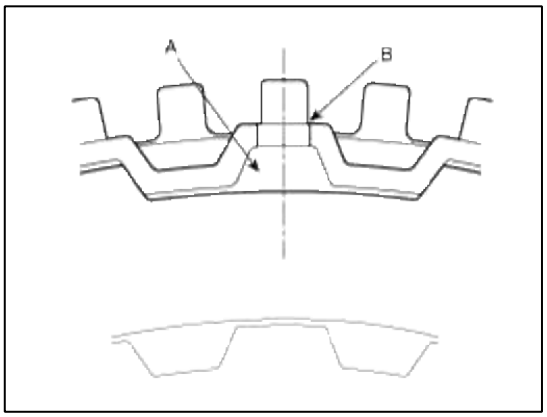
Standard value :
1.6-1.8 mm (0.0630-0.0709 in)



17. If the clearance is incorrect, measure the old snap ring, then select the correct size from the chart in the service manual.

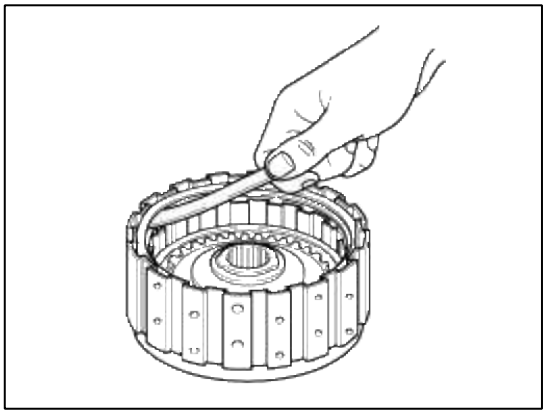
> WARNING
>
> Dip each clutch disc in ATF before assembling.

18. Align the spaces between the teeth (A) on the clutch plates, clutch discs, and reaction plate to the outer circumference hole (B) in the overdrive clutch retainer.



19. Install the 2 overdrive clutch discs and 2 plates.
20. Install the overdrive clutch reaction plate.
21. Install the overdrive clutch reaction plate snap ring.
22. Check the clearance between the snap ring and the clutch reaction plate.

Standard value :
1.5-1.7 mm (0.0590-0.0670 in)

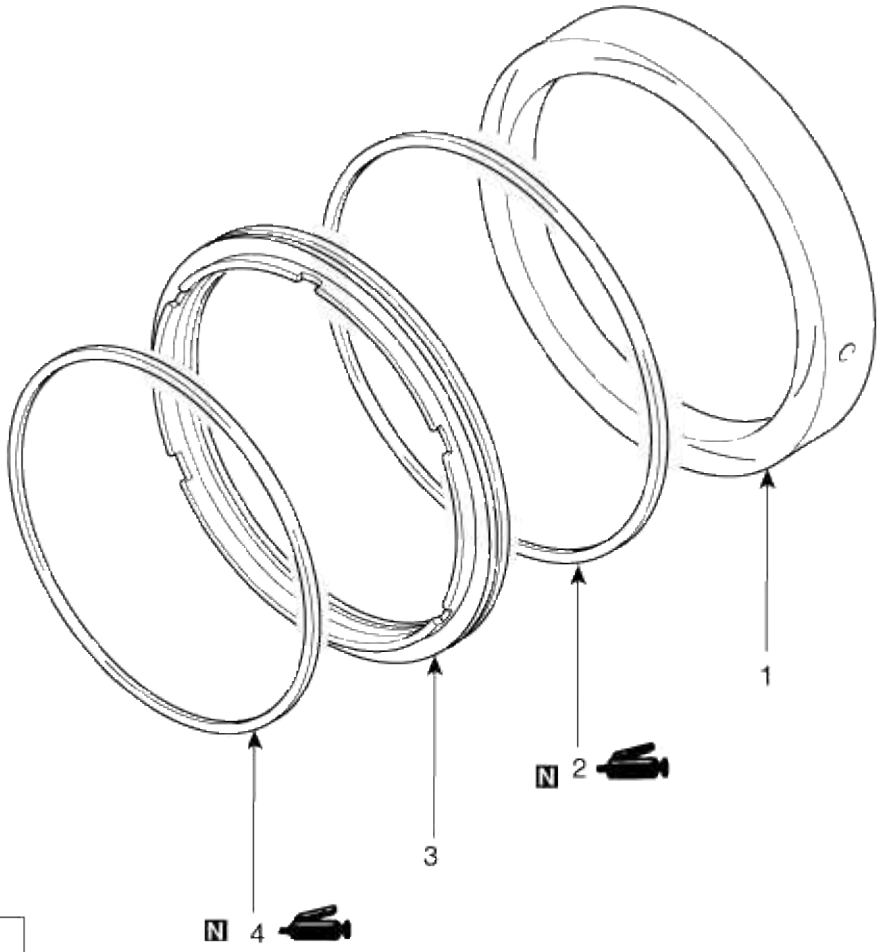


23. If the clearance is incorrect, measure the old snap ring, then select the correct size from the chart in the service manual.

Automatic Transaxle System > Clutch & Brake > Second Brake > Components and Components Location (F4A42-2)

COMPONENTS

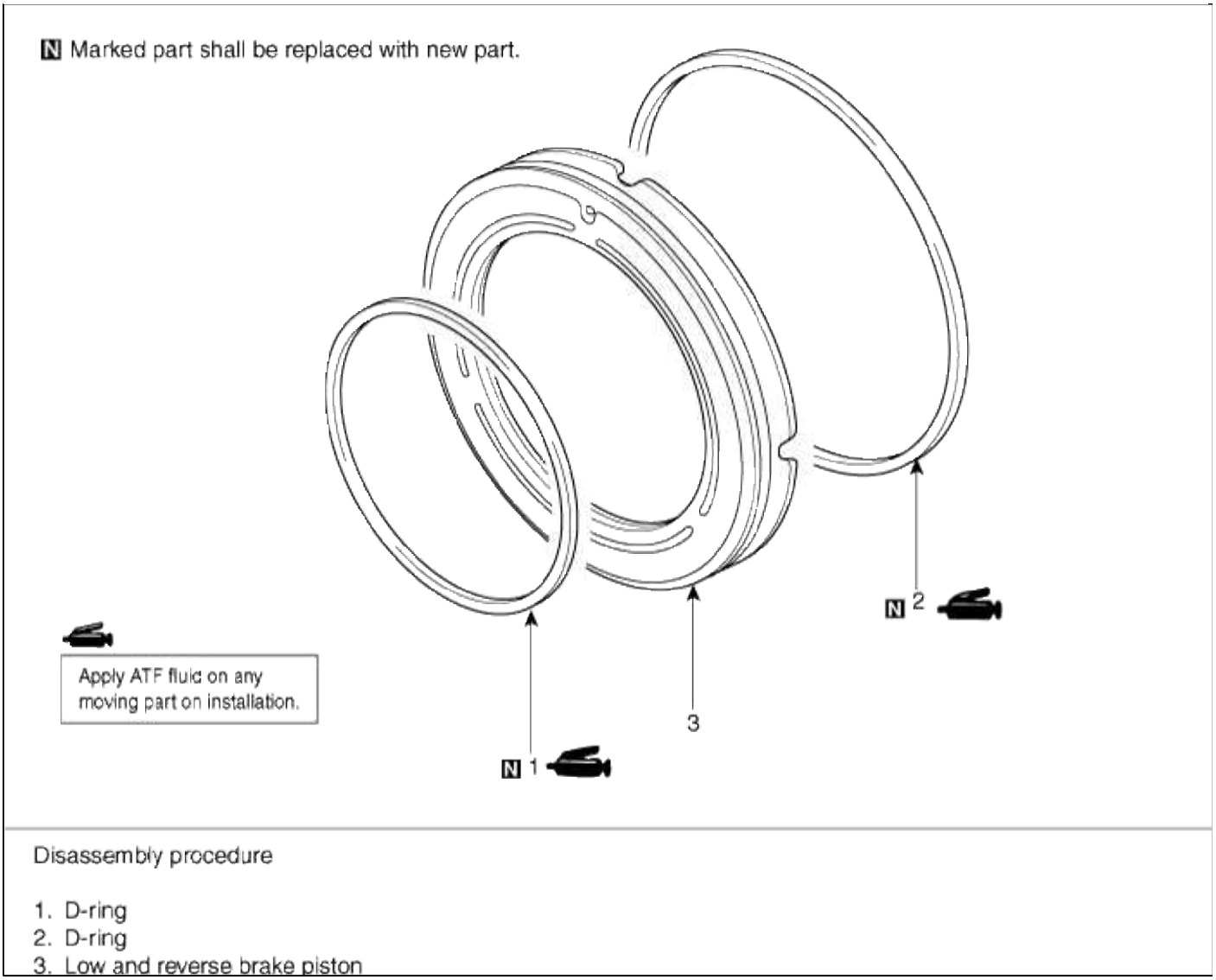
N Marked part shall be replaced with new part.



Disassembly procedure
1. Second brake retainer
2. O-ring
3. Second brake piston
4. O-ring

Automatic Transaxle System > Clutch & Brake > Low and Reverse Brake > Components and Components Location (F4A42-2)

COMPONENTS



Disassembly procedure

1. D-ring
2. D-ring
3. Low and reverse brake piston

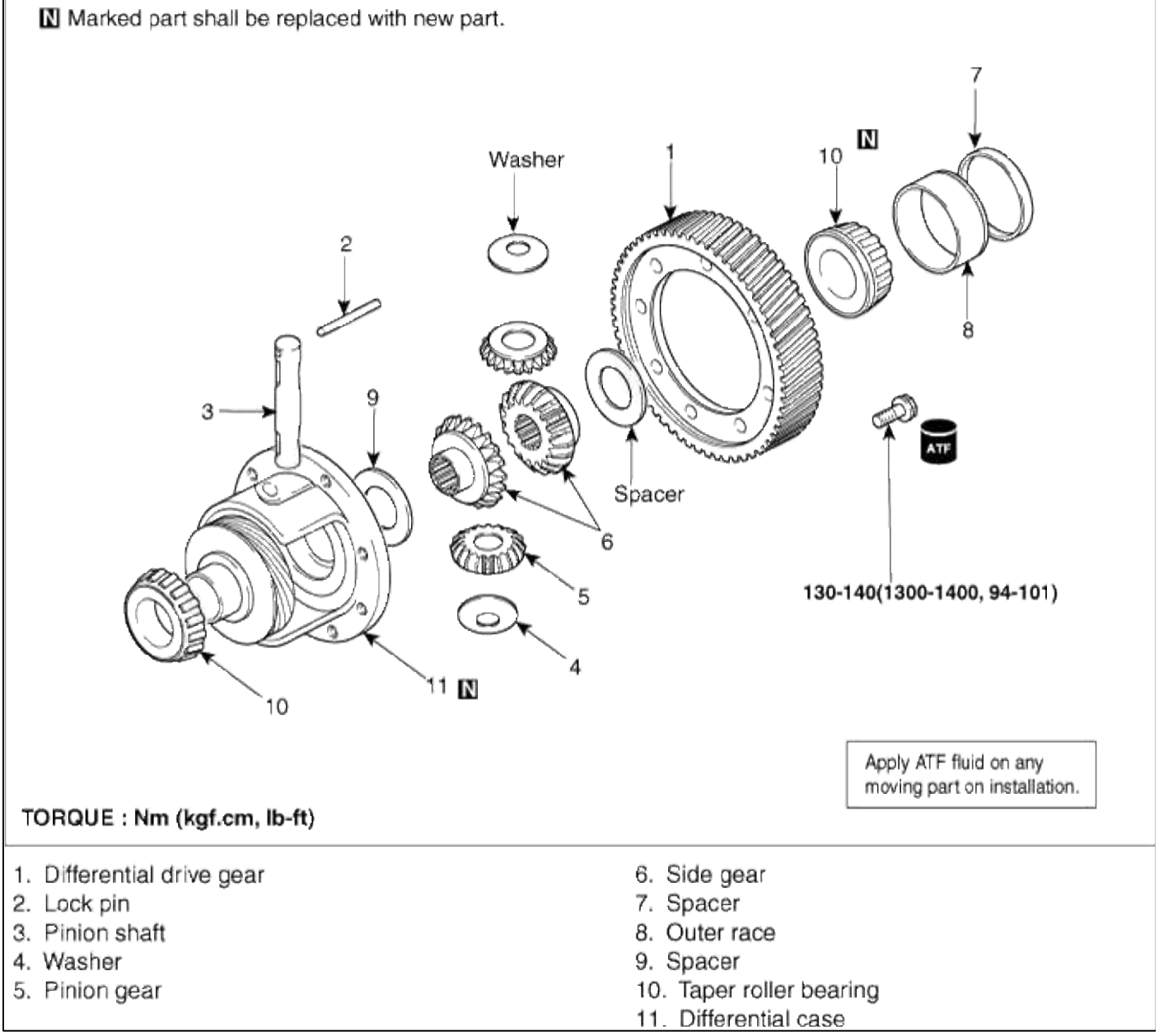
Automatic Transaxle System > Clutch & Brake > Low and Reverse Brake > Repair procedures (F4A42-2)

REASSEMBLY

Apply ATF or white Vaseline on the O-ring and install it caring not to damage it.

Automatic Transaxle System > Gear System > Differential > Components and Components Location (F4A42-2)

COMPONENTS

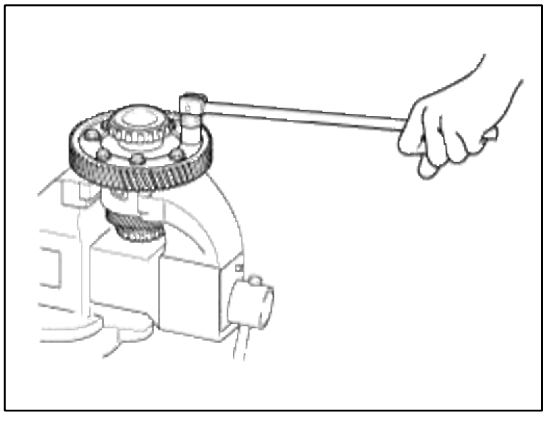


1. Differential drive gear
2. Lock pin
3. Pinion shaft
4. Washer
5. Pinion gear
6. Side gear
7. Spacer
8. Outer race
9. Spacer
10. Taper roller bearing
11. Differential case

Automatic Transaxle System > Gear System > Differential > Repair procedures (F4A42-2)

DISASSEMBLY

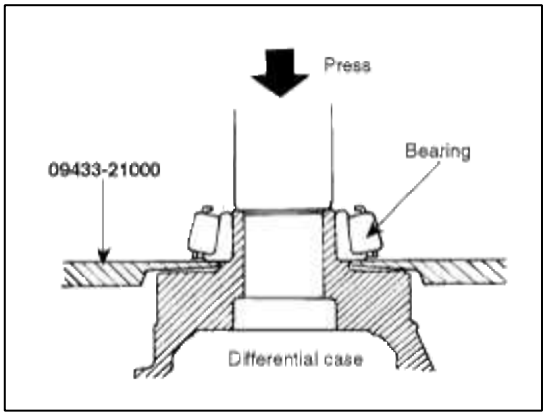
1. Clamp the differential case in a vise.
2. Remove the differential drive retaining bolts and remove the differential drive gea from the case.



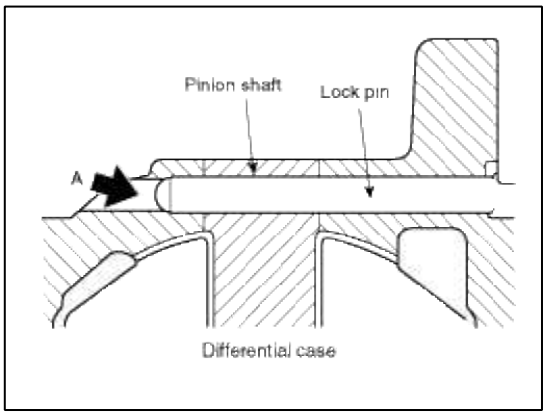
3. Remove the taper bearing using the special tool (09433-21000).

CAUTION

Do not reuse the bearing removed from the shaft.



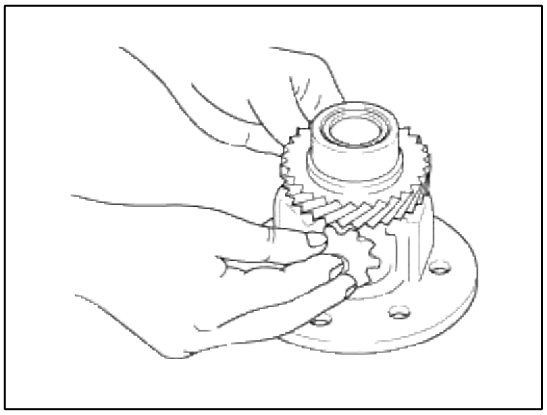
4. Drive out the lock pin from the hole A using a punch.



5. Drive out the pinion shaft.

REASSEMBLY

1. Install the spacer on the back of the side gear and then install the gear in the differential case.

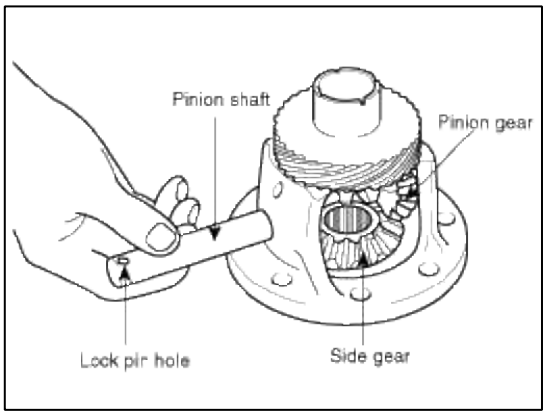


CAUTION

- When installing a new side gear, use a spacer of medium thickness [0.83-0.92 mm (0.33-0.036 in)].
- Do not reuse the lock pin.
- The lock pin head must be sunk below the flange surface of the differential case.

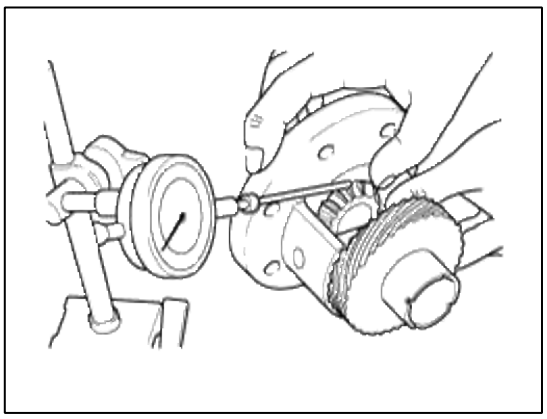
2. Set the washer on the back of each pinion and insert the two pinions to specified position while engaging them with the side gears by turning them.

3. Insert the pinion shaft.



4. Measure the backlash between the side gears and pinions.

Standard value :
0.025-0.150 mm (0.001-0.006 in)
0.025-0.0150 mm (0.001-0.006 in)



5. If the backlash is out of specification, disassemble and install the correct spacer, reassemble and remeasure.

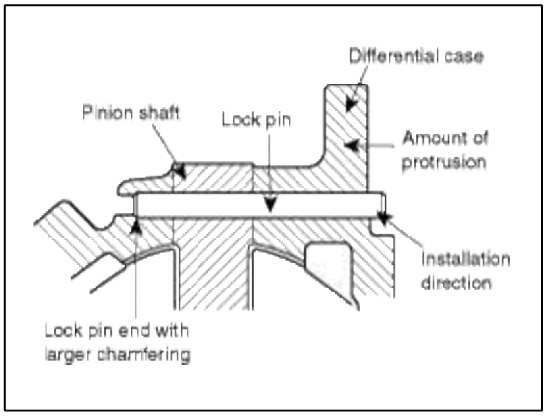
CAUTION

Adjust the backlash of both side gears to the same specification.

6. Align the pinion shaft lock pin hole with the case lock pin hole and insert the lock pin.

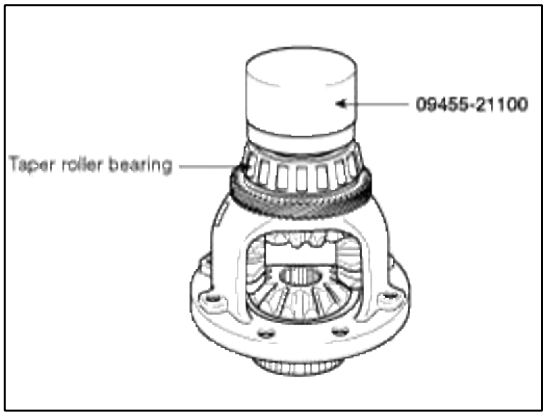
CAUTION

- Do not reuse the lock pin.
- The lock pin head must not protrude more than 3 mm (0.0118 in) gear in the differential case.



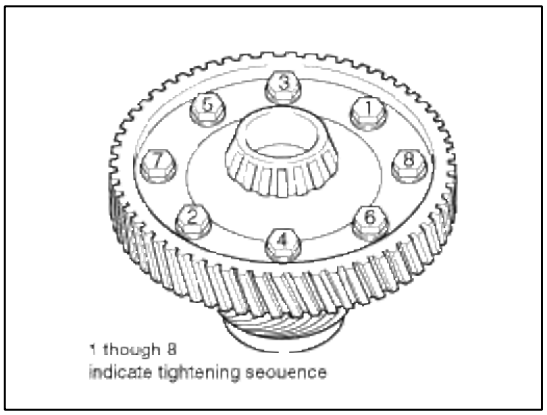
7. Install the tapered roller bearing on both sides of the differential case using the special tool (09455-21100).

> CAUTION
>
> When press-fitting the bearing, press on the inner race only.



8. Apply specified sealant to the entire threads of the bolts. Tighten to specifications using the sequence shown in the illustration.

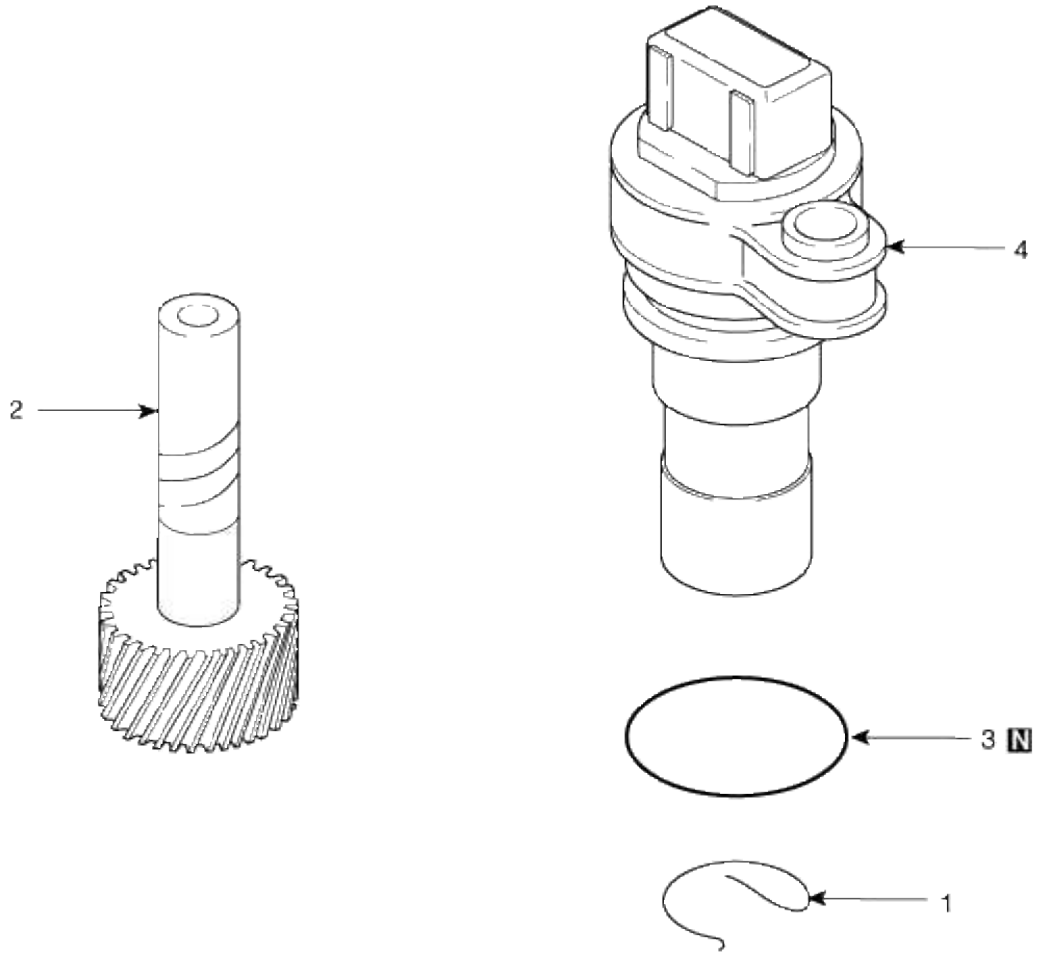
> CAUTION
>
> If a bolt is reused, remove the old sealant from the threads.



Automatic Transaxle System > Gear System > Speedometer Driven Gear Assembly > Components and Components Location (F4A42-2)

COMPONENTS

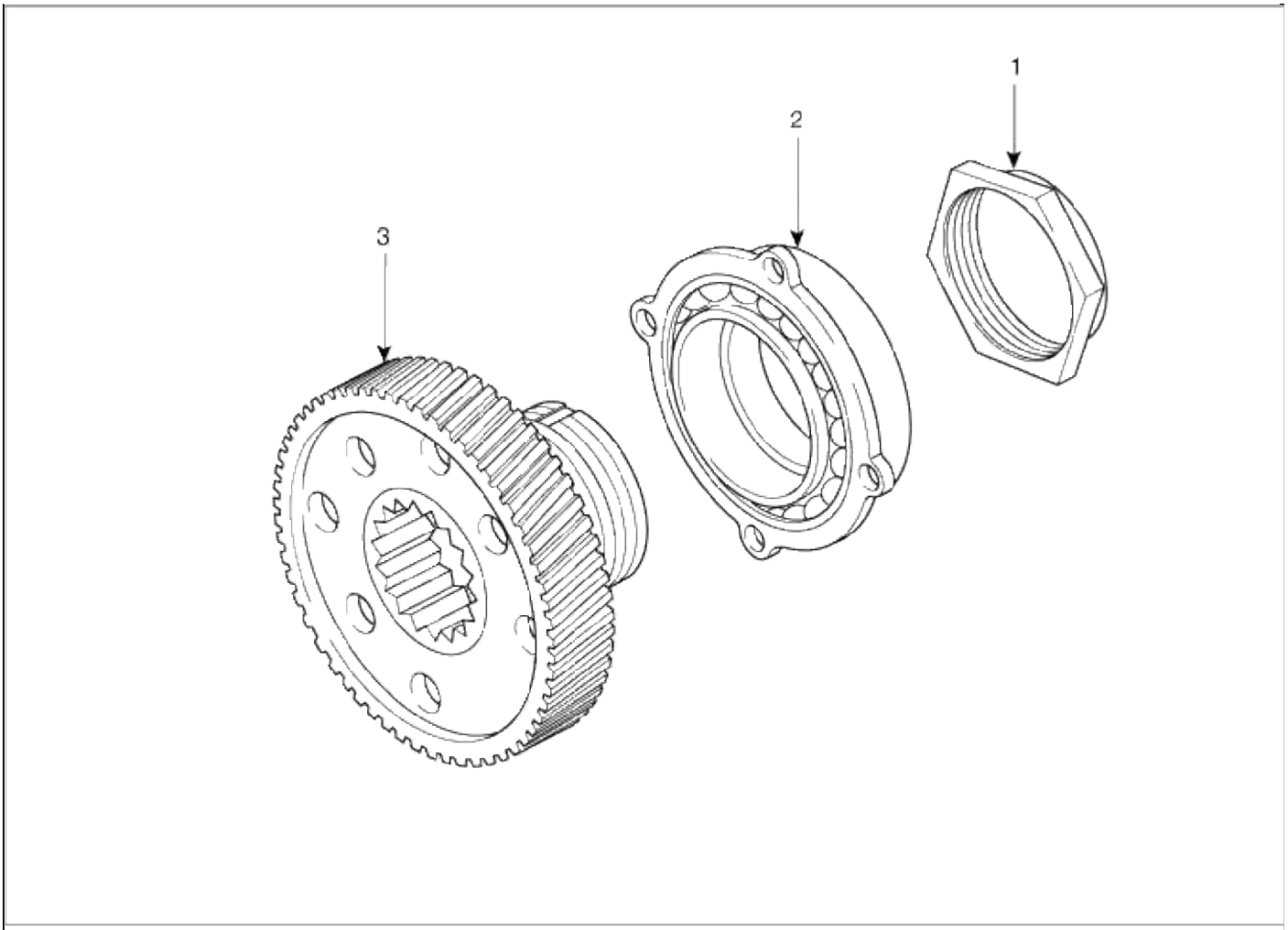
[N] Marked part shall be replaced with new part.



1. E-clip
2. Speedometer driven gear
3. O-ring
4. Sleeve

Automatic Transaxle System > Gear System > Transfer Drive Gear > Components and Components Location (F4A42-2)

COMPONENTS

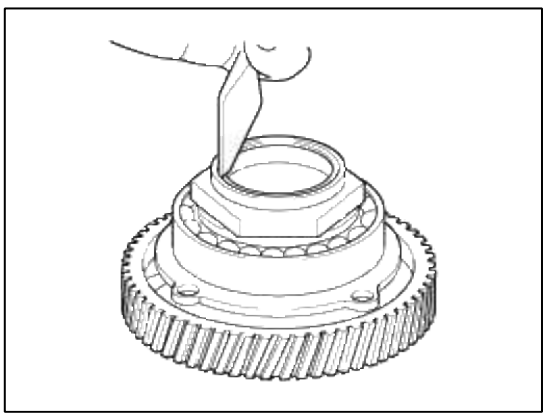


1. Locking nut
2. Transfer drive gear bearing
3. Transfer drive gear

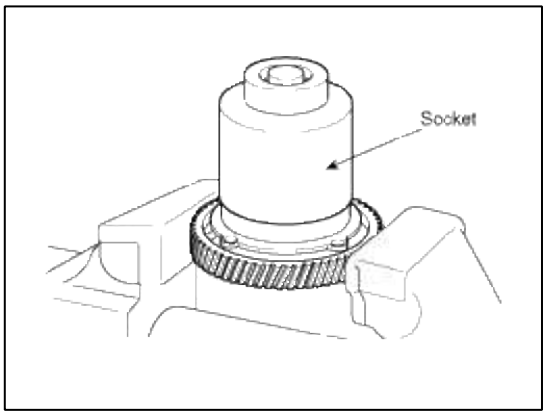
Automatic Transaxle System > Gear System > Transfer Drive Gear > Repair procedures (F4A42-2)

DISASSEMBLY

1. Loosen the locking nut caulking.

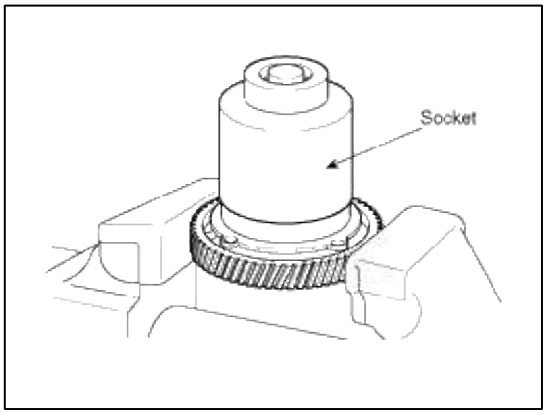


2. Remove the lock by using socket.

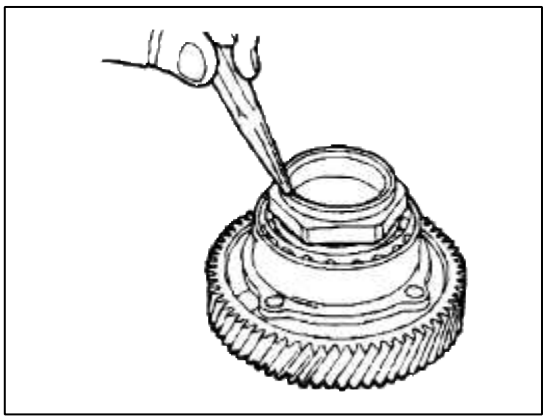


REASSEMBLY

1. Apply ATF to the new locking nut and tighten to the specified torque. And loosen 1 turn and tighten to the specified torque again.

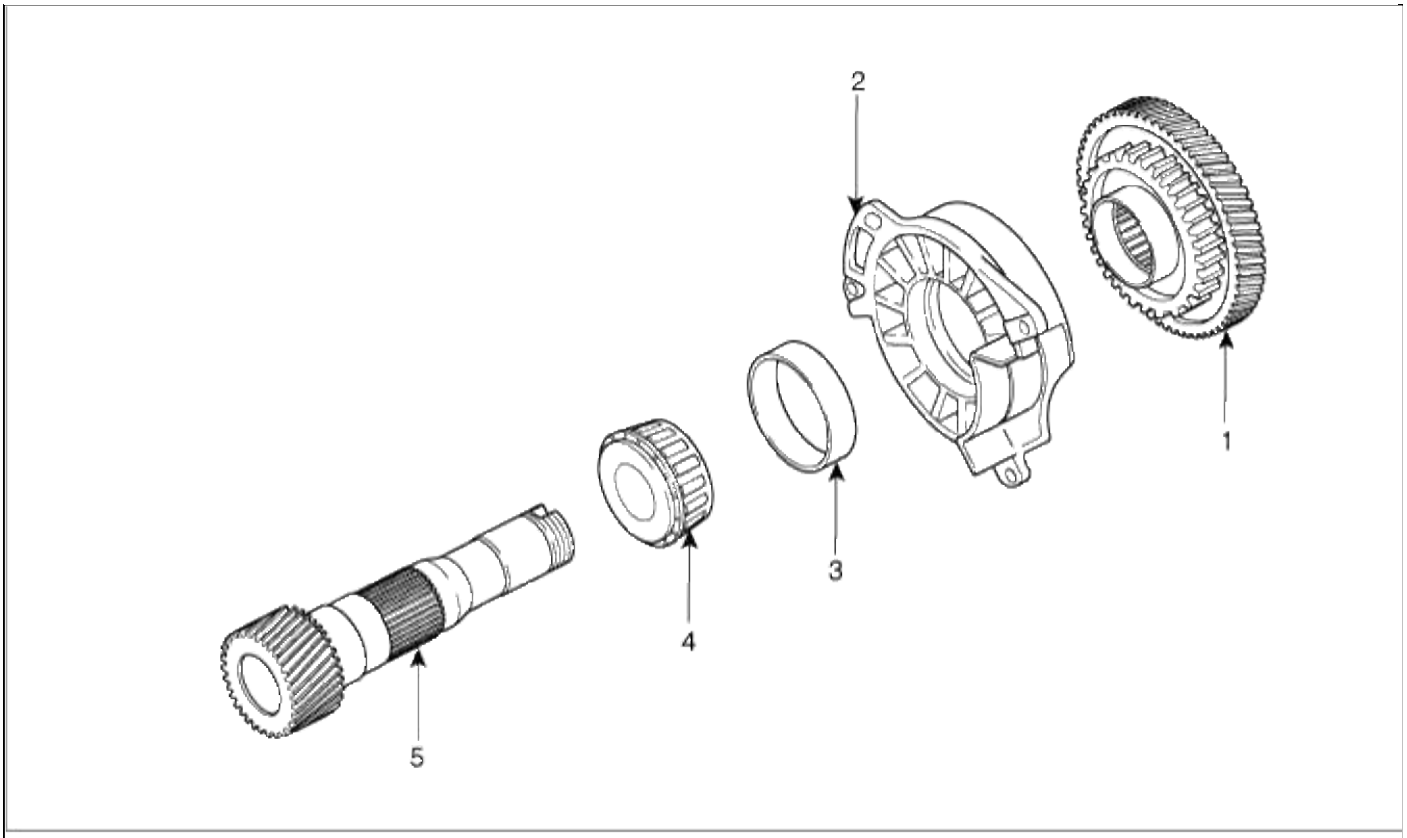


2. Caulk the locking nut by using punch.



Automatic Transaxle System > Gear System > Output Shaft > Components and Components Location (F4A42-2)

COMPONENTS



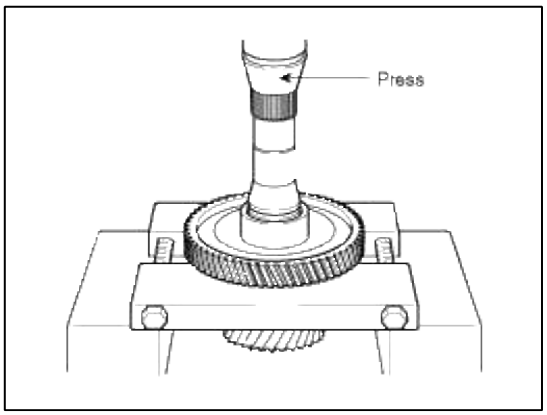
Disassembly steps

1. T/F driven gear
2. Bearing retainer
3. Outer race
4. Taper roller bearing
5. Output shaft

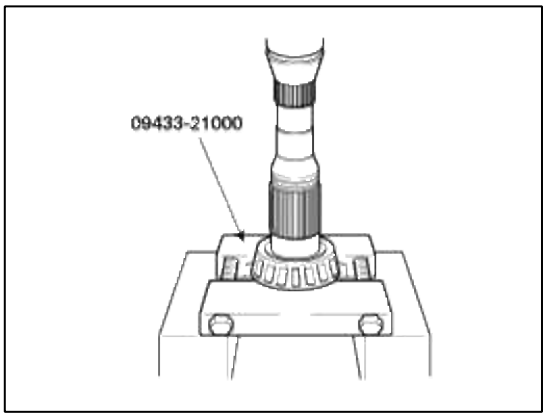
Automatic Transaxle System > Gear System > Output Shaft > Repair procedures (F4A42-2)

REASSEMBLY

1. Remove the transfer driven gear by press.

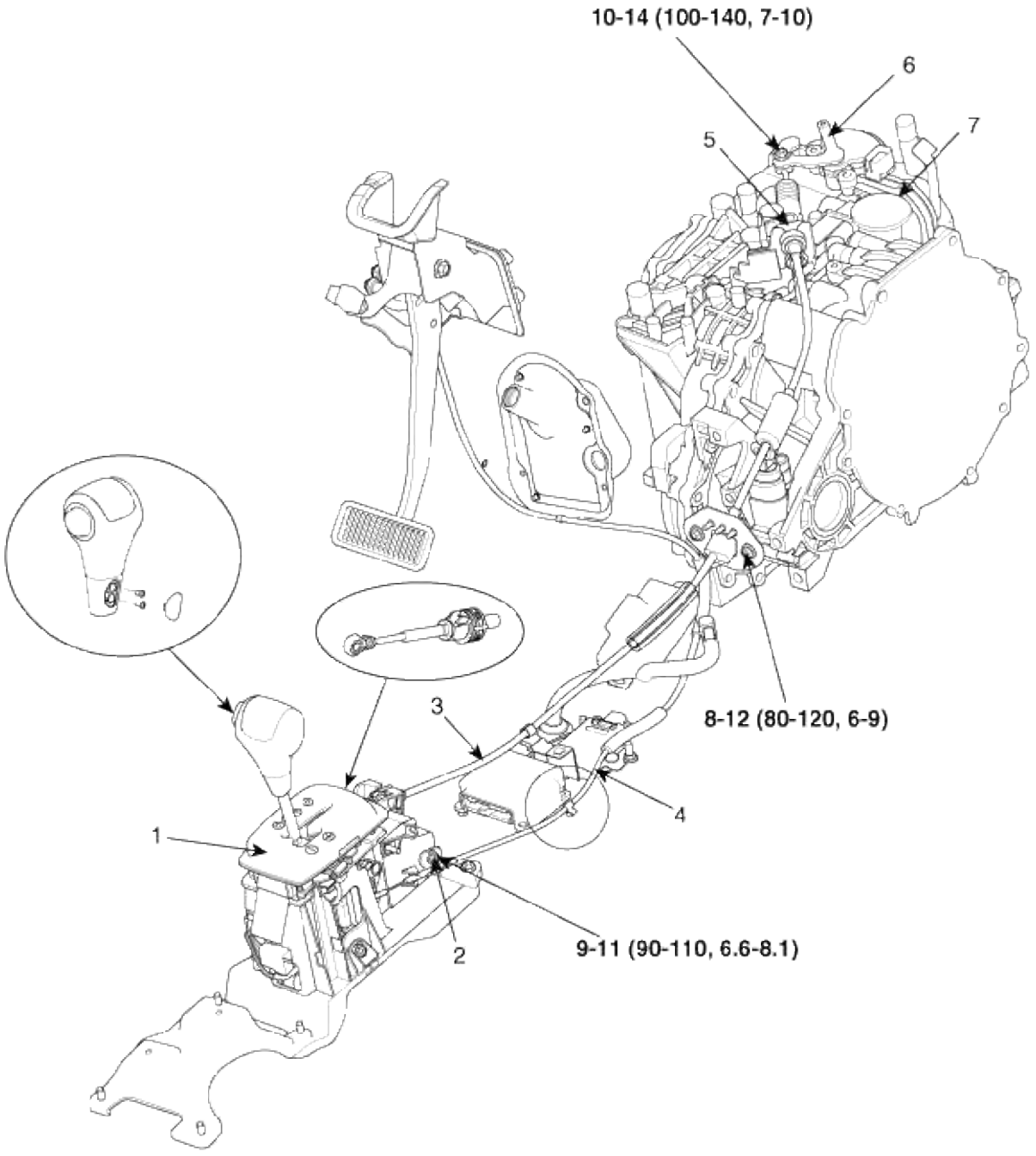


2. Remove the taper roller bearing.



Automatic Transaxle System > Automatic Transaxle Control System > Shift Lever > Components and Components Location (F4A42-2)

COMPONENTS



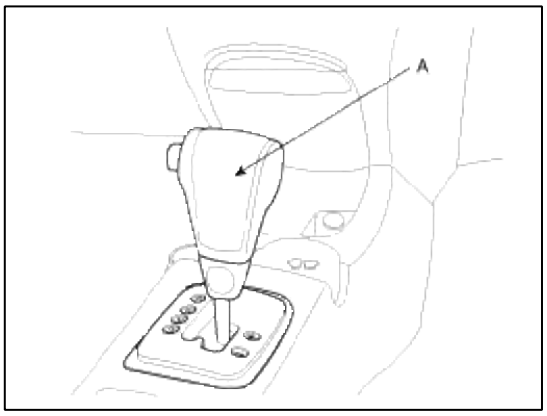
TORQUE : Nm (kgf.cm, lb-ft)

1. Shift lever assembly
2. Shift lock cable nut
3. AT cable
4. Shift lock cable
5. Pin
6. Shift lever (AT side)
7. Automatic transaxle

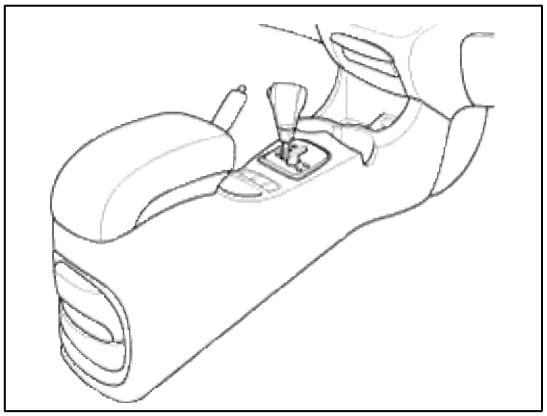
Automatic Transaxle System > Automatic Transaxle Control System > Shift Lever > Repair procedures (F4A42-2)

REMOVAL

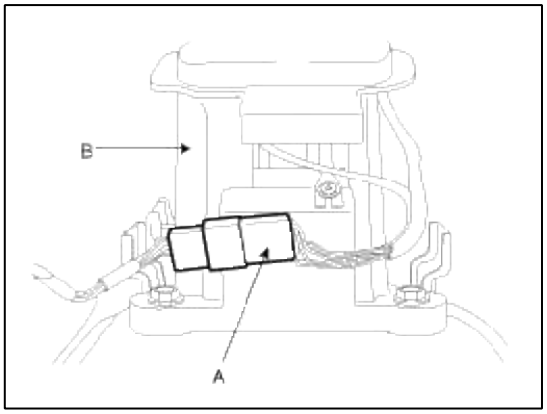
1. Remove the shift lever knob(A).



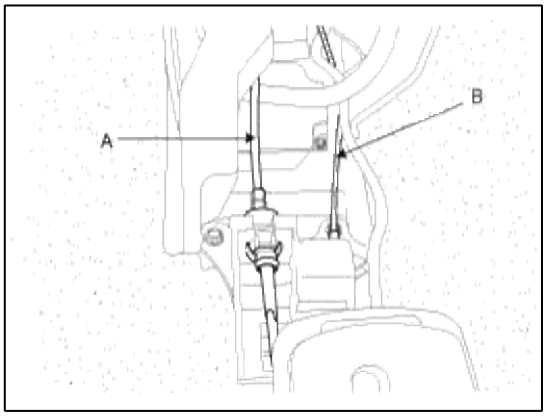
2. Disconnect the three connectors.
3. Remove the console cover. (Screw:10EA, Fastener:4EA)



4. Remove the sports mode connector(A) from the shift lever(B).



5. Remove the control cable(A) and shift lock cable(B).



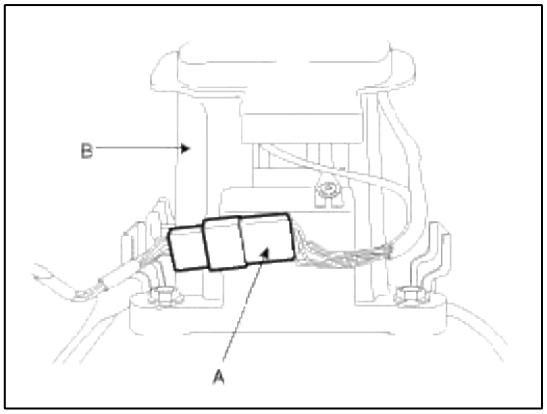
6. Remove the shift lever assembly. (Bolt:4EA)

INSTALLATION

1. Install the shift lever assembly. (Bolt:4EA)

TORQUE :
18-25Nm (180-250kgf.cm, 13.3-18.4lb-ft)

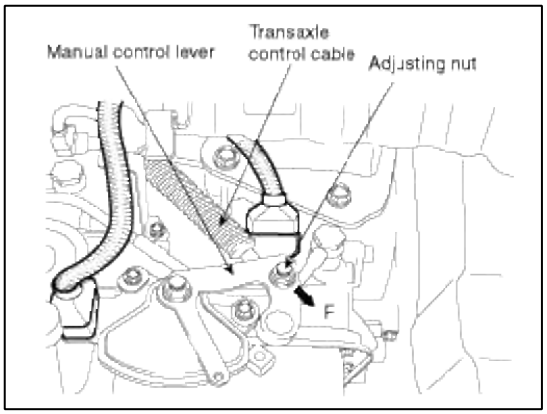
2. Install the cable.
3. Connect the sports mode connector.



4. Inspect the shift lock. (Refer to shift lock inspection)
5. Connect the three connectors.
6. Install the console cover. (Screw:10EA, Fastener:4EA)
7. Install the shift lever knob.

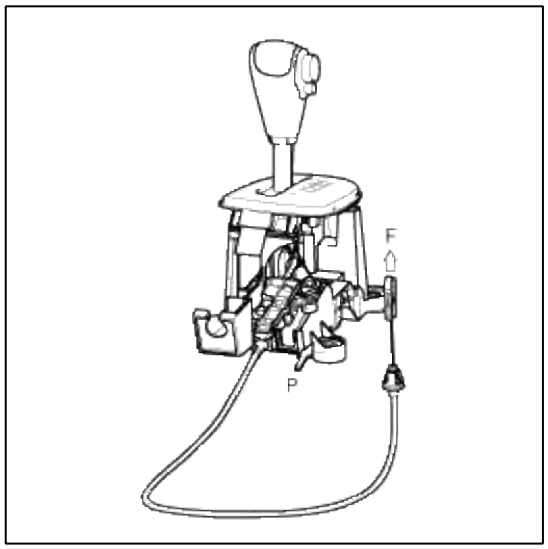
INSPECTION

1. Adjusting method for T/M control cable
   (1) Set room side lever and T/M side lever to "N" position.
   (2) Connect gear selector lever and shift cable.
   (3) Connect T/M side lever to cable in a following orders.
      A. Push cable lightly to "F" direction shown to eliminate FREE PLAY of cable.
      B. Tighten adjusting nut.



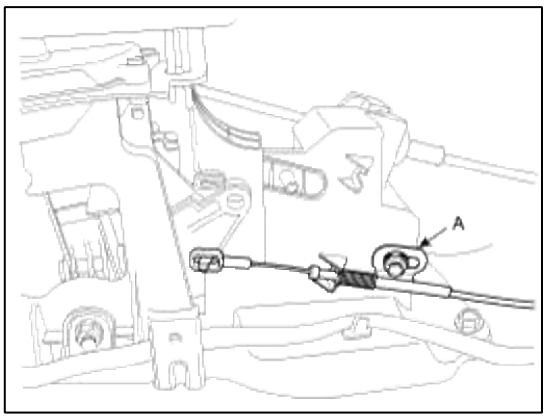
   (4) After adjustment, ensure that the transaxle gear selector lever operates properly by moving the lever to each gear position.

2. Shift lock
   (1) With shift lever at "P" position and brake pedal not depressed. Push button cannot be operated.



   (2) With IG key at the position other than "LOCK"(may be at "ACC") and brake pedal stroke 15-25mm (0.59-0.98 in) (with shift lever at "P" position). Push button can be operated and shift lever can be shifted smoothly to out of "P" range.
   (3) With brake pedal not depressed. Shift lever can be shifted smoothly to "P" position from other positions.
   (4) Brake pedal should operate smoothly without catching at all positions.

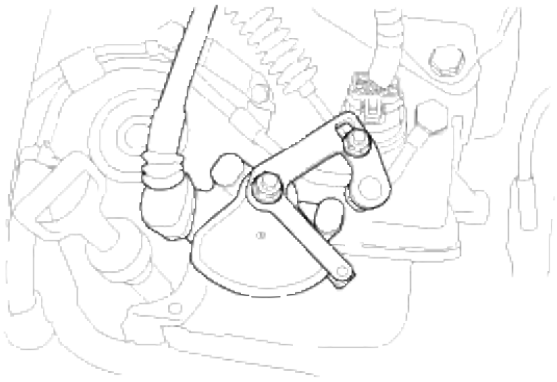
Adjusting procedure for "P" shift lock cable
1. Check that each lock cam(A) is shown below.



2. Loosen nut "A" securing shift lock cable to shift lever assembly.
3. Adjust cable by sliding the cable housing. The shift lock cam must remain stationary during this step.
4. Tighten shift lock cable mounting nut "A".
5. Verify correct operation.

Automatic Transaxle System > Troubleshooting > P0707

COMPONENT LOCATION



GENERAL DESCRIPTION

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

The TCM(PCM) sets this code when the Transaxle Range Switch has no output signal for more than 30 seconds.

DTC DETECTING CONDITION

[2.7 GSL]

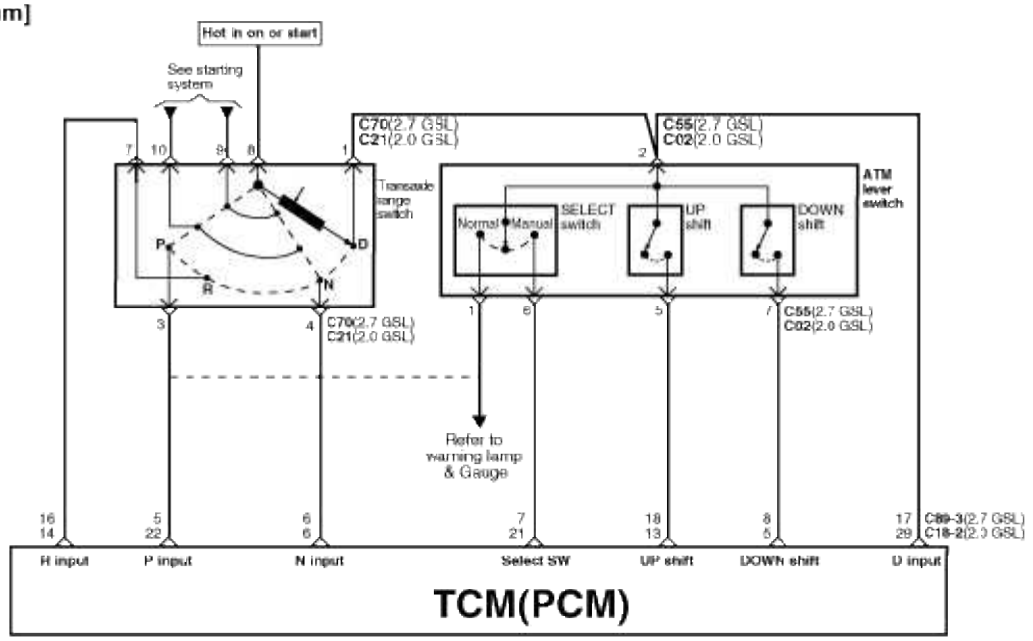
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for No signal	• Open or short in circuit • Faulty TRANSAXLE RANGE SWITCH • Faulty TCM(PCM)
Enable Conditions	• Continuous	
Threshold value	• No signal detected	
Diagnostic Time	• More than 30sec	
Fail Safe	• Recognition as previous 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. - When sports mode S/W is ON without P,R,N, D-RANGE signals, it is regarded sports mode.(DTC is not set)	

[2.0 GSL]

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 ≥ 400rpm and TPS ≥ 10%	
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. - When sports mode S/W is ON without P,R,N, D-RANGE signals, it is regarded as sports mode.(DTC is not set)	

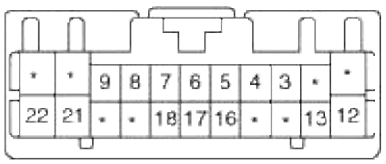
SCHEMATIC DIAGRAM

[Circuit Diagram]

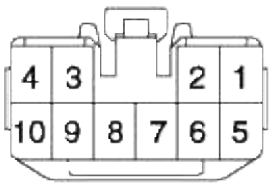


[Harness Connector]

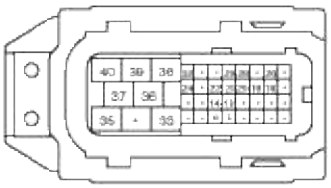
C70(2.7 GSL)
C21(2.0 GSL)



C89-3(2.7 GSL)



C55(2.7 GSL)
C02(2.0 GSL)



C18-2(2.0 GSL)

[Connetion Information]

Shift Lever / Terminal	P	R	N	D	Connection
1				O	TCM(C89-3 No.17) TCM(C18-2 No.29)
3	O				TCM(C89-3 No.5) TCM(C18-2 No.22)
4			O		TCM(C89-3 No.6) TCM(C18-2 No.6)
7		O			TCM(C89-3 No.16) TCM(C18-2 No.14)
8	O		O	O	Ignition switch(IG 1)
9	O		O		Starting motor
10	O		O		Ignition switch(start)

TERMINAL & 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 vehicle Repair" procedure.

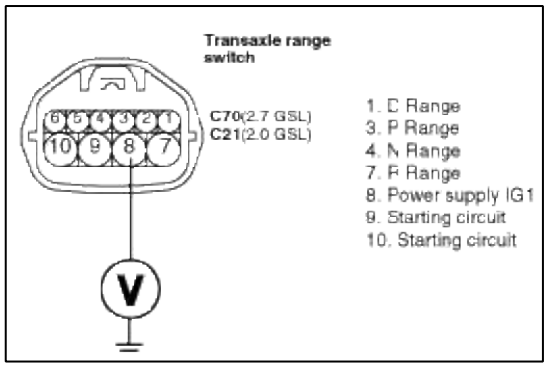
NO

Go to "Power Supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

   Specification : approx. B+



   (4) Is voltage within specifications?

   YES

   Go to "Signal circuit inspection" procedure.

   NO

   Check that Fuse 24-10A is installed or not blown.
   Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

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.

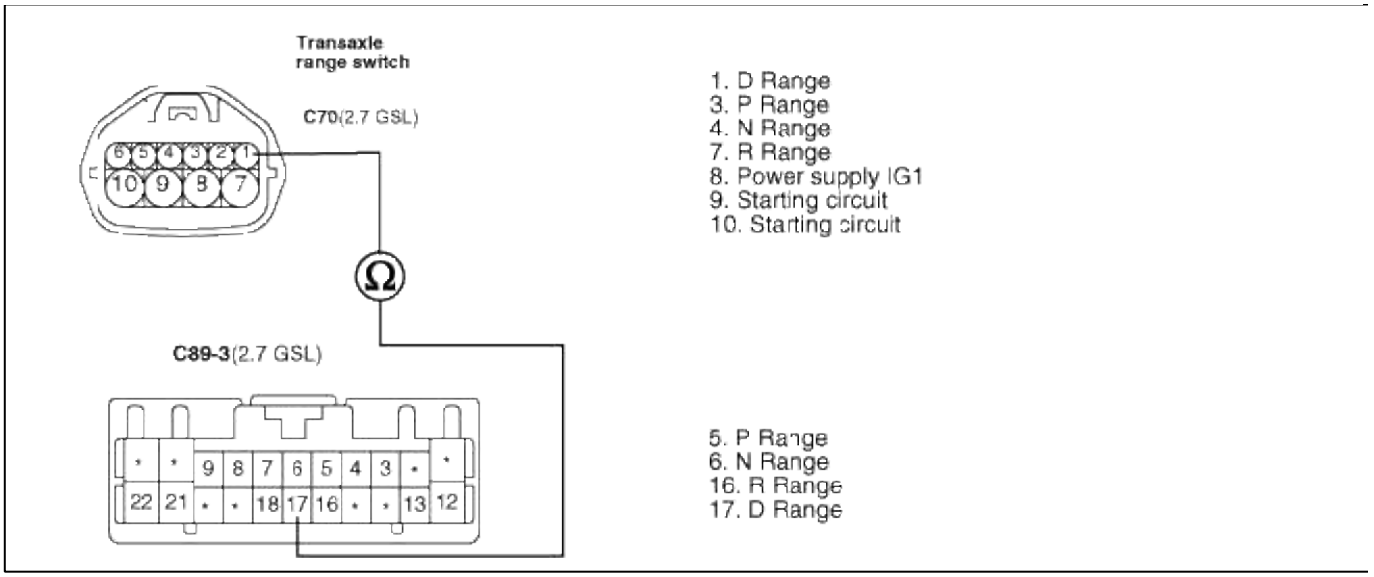
   Specification : Shown below

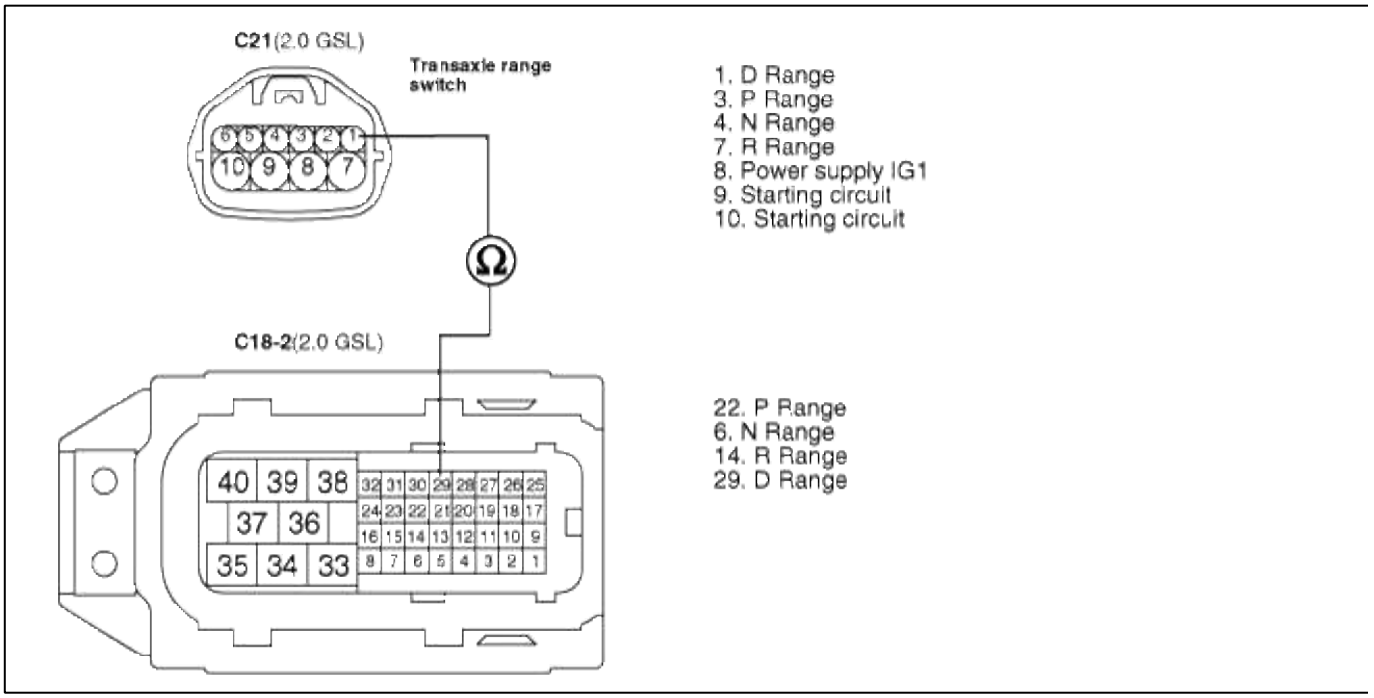
[2.7 GSL]

Pin No of "TRANSAXLE RANGE SWITCH"	C70 No.1	C70 No.3	C70 No.4	C70 No.7
Pin No of "TCM(PCM)" harness	C89-3 No.17	C89-3 No.5	C89-3 No.6	C89-3 No.16
Specification	0Ω	0Ω	0Ω	0Ω

[2.0 GSL]

Pin No of "TRANSAXLE RANGE SWITCH"	C21 No.1	C21 No.3	C21 No.4	C21 No.7
Pin No of "TCM(PCM)" harness	C18-2 No.29	C18-2 No.22	C18-2 No.6	C18-2 No.14
Specification	0Ω	0Ω	0Ω	0Ω





4. Is resistance within specifications?

YES

Go to "Component inspection" procedure.

NO

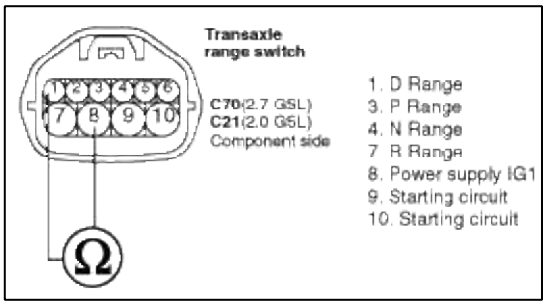
Check for Open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "TRANSAXLE RANGE SWITCH".

3. Measure the resistance between each terminal of the sensor.

Specification : approx. 0 Ω



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

[RANGE SWITCH continuity check table]

4. Is resistance within specifications?

YES

Substitute with a known-good TCM(PCM) and check for proper operation. If the problem is corrected, replace PCM/TCM 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

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

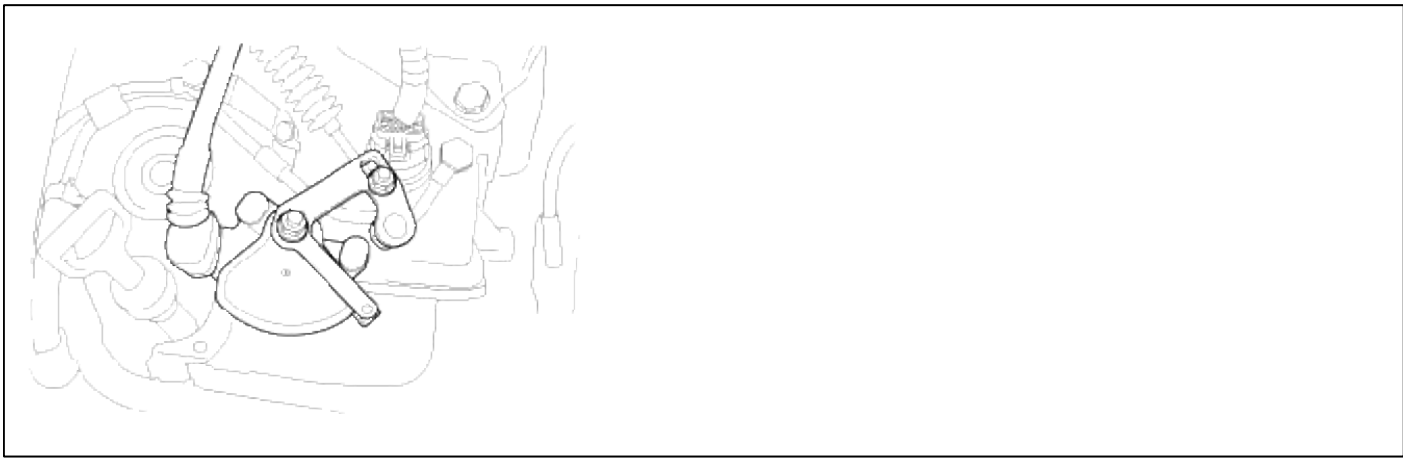
System performing to specification at this time.

SPECIFICATION

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

Automatic Transaxle System > Troubleshooting > P0708

COMPONENT LOCATION



GENERAL DESCRIPTION

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 Tansaxle 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

The TCM sets this code when the Transaxle Range Switch outputs multiple signals for more than 30 seconds.

DTC DETECTING CONDITION

[2.7 GSL]

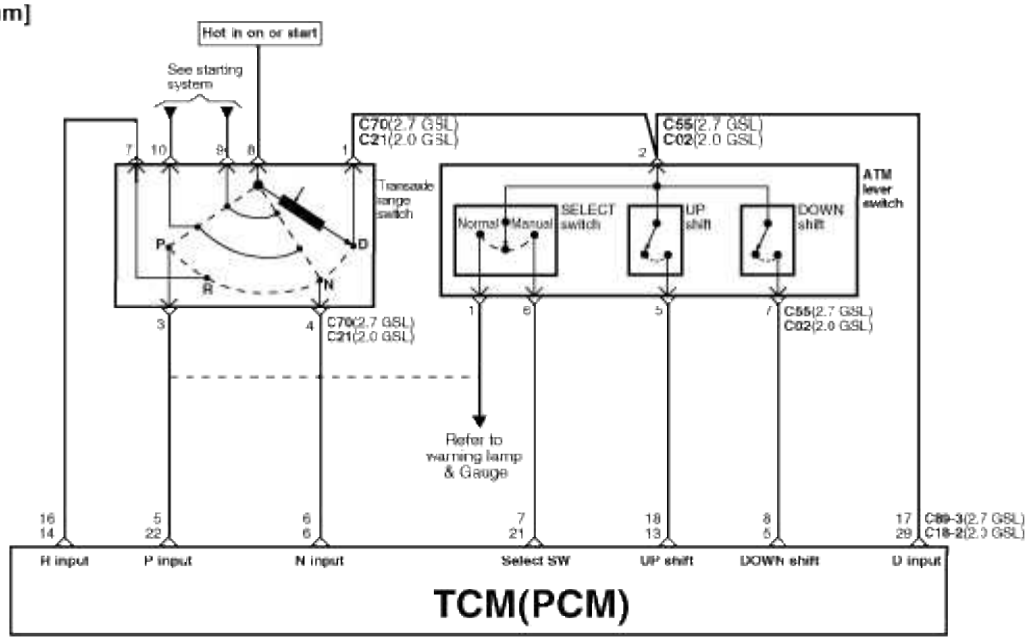
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for multiple signals	• Open or short in TRANSAXLE RANGE SWITCH • Faulty TRANSAXLE RANGE SWITCH • Faulty TCM(PCM)
Enable Conditions	• Continuous	
Threshold value	• Multiple signal	
Diagnostic Time	• More than 30sec	
Fail Safe	• Recognition 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 TCM(PCM) detects multiple signals or no signal, then it holds the 3rd gear position.	

[2.0 GSL]

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	• Always	
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.	

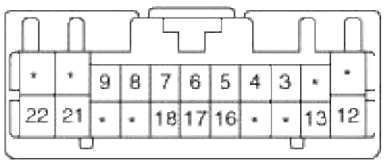
SCHEMATIC DIAGRAM

[Circuit Diagram]

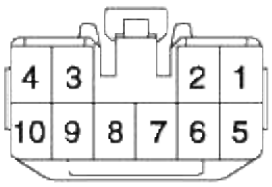


[Harness Connector]

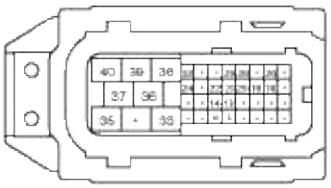
C70(2.7 GSL)
C21(2.0 GSL)



C89-3(2.7 GSL)



C55(2.7 GSL)
C02(2.0 GSL)



C18-2(2.0 GSL)

[Connetion Information]

Shift Lever / Terminal	P	R	N	D	Connection
1				O	TCM(C89-3 No.17) TCM(C18-2 No.29)
3	O				TCM(C89-3 No.5) TCM(C18-2 No.22)
4			O		TCM(C89-3 No.6) TCM(C18-2 No.6)
7		O			TCM(C89-3 No.16) TCM(C18-2 No.14)
8	O		O	O	Ignition switch(IG 1)
9	O		O		Starting motor
10	O		O		Ignition switch(start)

TERMINAL & 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 vehicle Repair" procedure.

NO

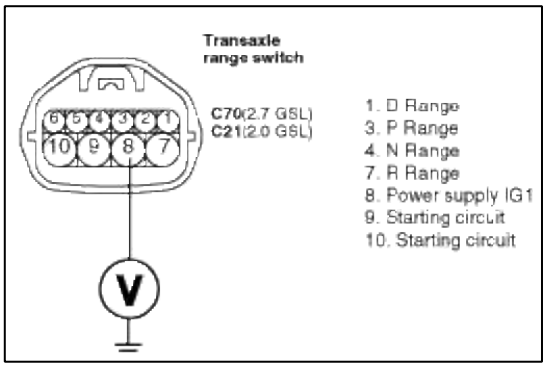
Go to "Power Supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "TRANSAXLE RANGE SWITCH" connector.
2. Ignition "ON" & Engine "OFF".

3. Measure voltage between terminal "8" of the sensor harness connector and chassis ground.

Specification : Approx. B+



4. Is voltage within specifications?

YES

Go to "Signal circuit inspection" procedure.

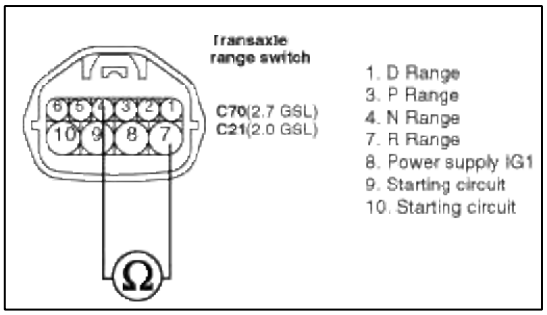
NO

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

SIGNAL CIRCUIT INSPECTION

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

Specification : Infinite



4. Is resistance within specifications?

YES

Go to "Component inspection" procedure.

NO

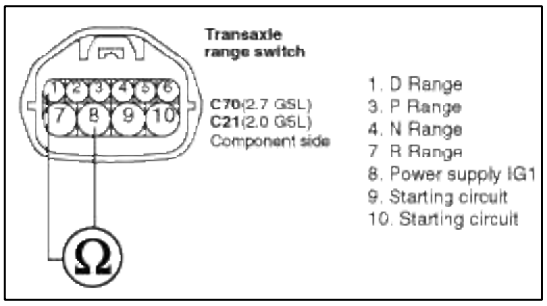
Check for Open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "TRANSAXLE RANGE SWITCH".

3. Measure the resistance between each terminal of the sensor.

Specification : Approx. 0 Ω



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

[RANGE SWITCH continuity check table]

4. Is resistance within specifications?

YES

Substitute with a known-good TCM(PCM) and check for proper operation. If the problem is corrected, replace PCM/TCM 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

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

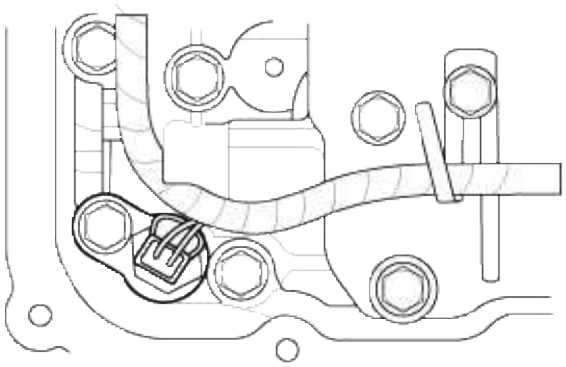
System performing to specification at this time.

SPECIFICATION

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

Automatic Transaxle System > Troubleshooting > P0711

COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic TRANSAXLE 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.

DTC DESCRIPTION

This DTC code is set when the ATF temperature output voltage is lower than a 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).

DTC DETECTING CONDITION

[2.7 GSL]

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 1) JUMP	• -4°F(-20°C) ≤ OIL TEMP ≤ 248°F(120°C), In condition that Oil TEMP is changed over 10 degrees during 10 sec	
Enable Conditions 2) STUCK ON HIGH TEMP	• OIL TEMP ≥ 86°F(30°C) and In case of OIL TEMP is higher 15 degrees than WATER TEMP	
Enable Conditions 3) STUCK ON LOW TEMP	• OIL TEMP ≤ 86°F(30°C) • Engine speed ≥ 1000rpm • Maintenance time : 10minutes In condition that OIL TEMP is changed less than 5 degrees	
Threshold value		
Diagnostic Time		

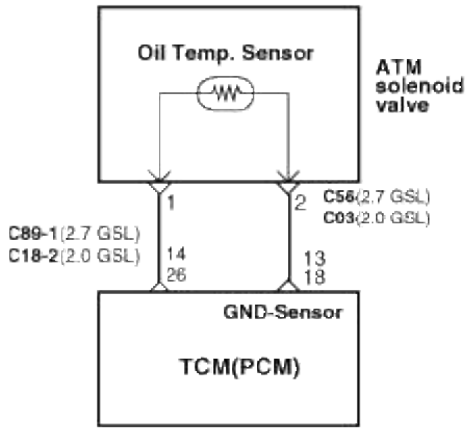
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C(176°F)	

[2.0 GSL]

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		• Check rationality	• Sensor signal circuit is short to ground • Faulty sensor • Faulty TCM(PCM)
Enable Conditions	**Case 1**	• Engine speed≥1000rpm and Output speed≥1000rpm for 5min cumulative and Engine coolant temperature has changed by more than 40°C(104°F) since start up and other OTS related error is not detected. In condition that Oil TEMP is not changed more than 2°C(36°F)	
	Case 2	• OTS output at IG-OFF≥50°C(122°F) and the engine coolant temperature at IG-OFF≥73.5°C(164°F) and the engine coolant temperature have decreased over 34°C(93°F) from IG-OFF of the previous trip. In condition that OTS TEMP is not changed morethan 2°C(36°F)	
	Case 3	• Output speed ≥ 1000rpm, Engine speed ≥ 1000rpm for 5min cumulative and the engine coolant temperature≥73.5°C(164°F). In condition that OTS output ≤ -23.5°C(-10.3°F)	
Threshold value		• -	
Diagnostic Time		• -	
Fail Safe		• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C(176°F)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

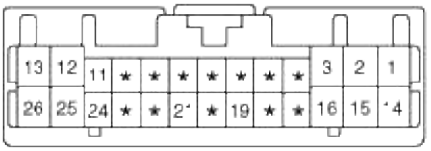


[Connection Information]

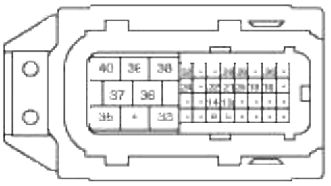
Terminal	Connection	Function
1	C89-1 No.14 C18-2(2.0 GSL) No.26	Sensor signal
2	C89-1 No.13 C18-2(2.0 GSL) No.18	Sensor ground

[Harness Connector]

C56(2.7 GSL)
C03(2.0 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

TERMINAL & 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 vehicle Repair" procedure.

NO

Go to "Component inspection" procedure.

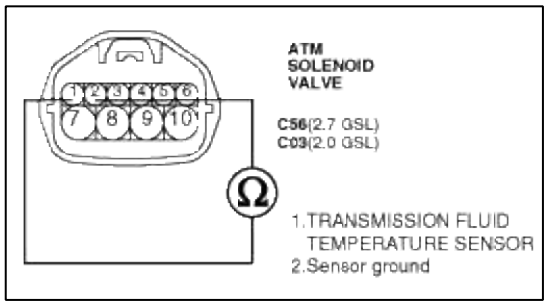
COMPONENT INSPECTION

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		



   (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

(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.

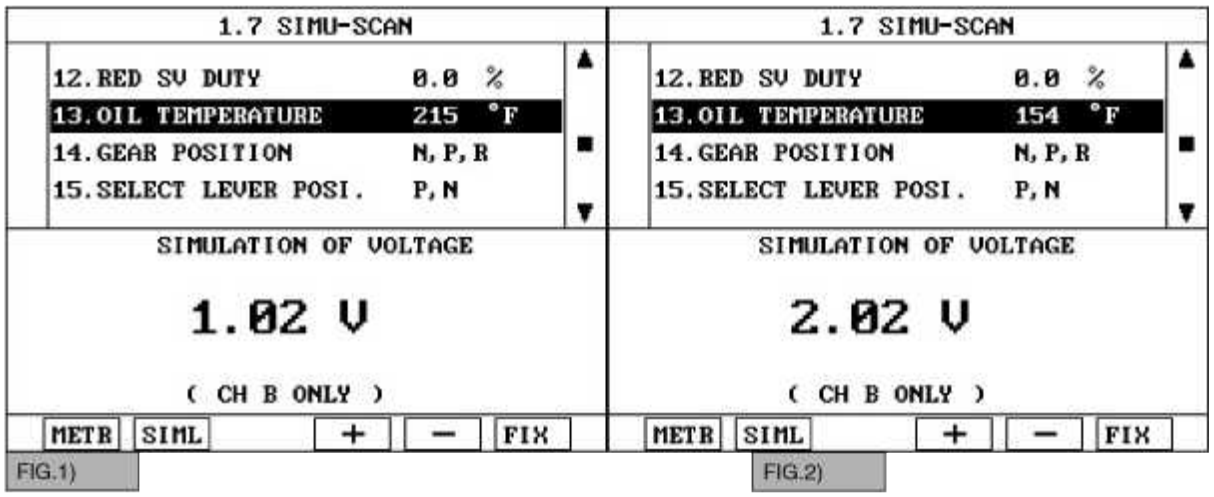


FIG.1) INPUT 1.02V → 215°F
FIG.2) INPUT 2.02V → 154°F

※ The values are subject to change according to vehicle model

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

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorat 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, re TCM(PCM) as necessary 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. 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.

SPECIFICATION

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		

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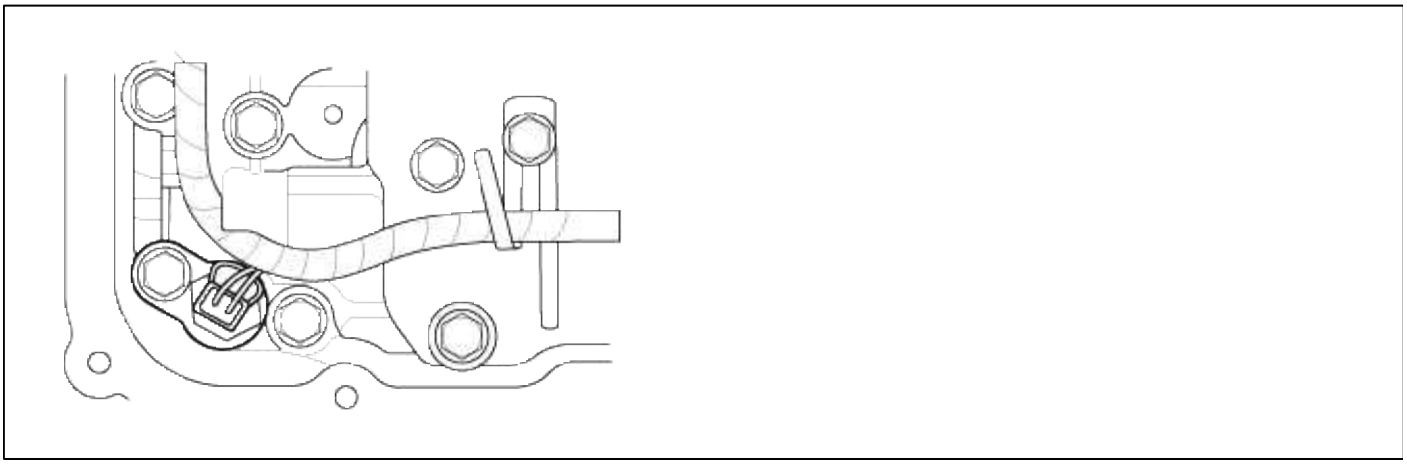
COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic TRANSAXLE 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 TRANSAXLE 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

This DTC code is set when the ATF temperature output voltage is lower than a 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).

DTC DETECTING CONDITION

[2.7 GSL]

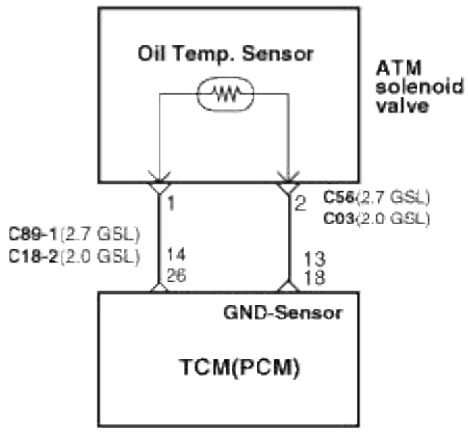
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for ground short	• Sensor signal circuit is short to ground • Faulty sensor • Faulty TCM(PCM)
Enable Conditions	• Continuous	
Threshold value	• Voltage < 0.49V	
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C(176°F)	

[2.0 GSL]

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for Voltage range	• Sensor signal circuit is short to ground • Faulty sensor • Faulty TCM(PCM)
Enable Conditions	• Always	
Threshold value	• Voltage < 0.05V	
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C(176°F)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

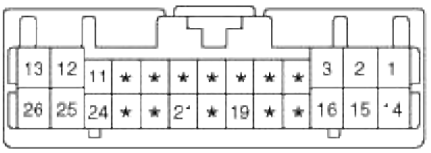


[Connection Information]

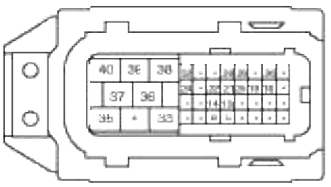
Terminal	Connection	Function
1	C89-1 No.14 C18-2(2.0 GSL) No.26	Sensor signal
2	C89-1 No.13 C18-2(2.0 GSL) No.18	Sensor ground

[Harness Connector]

C56(2.7 GSL)
C03(2.0 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

TERMINAL & 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 vehicle Repair" procedure.

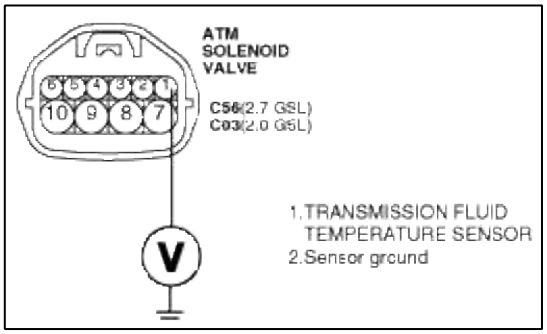
NO

Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

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

Specification : Approx. 5V



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

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		

(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.

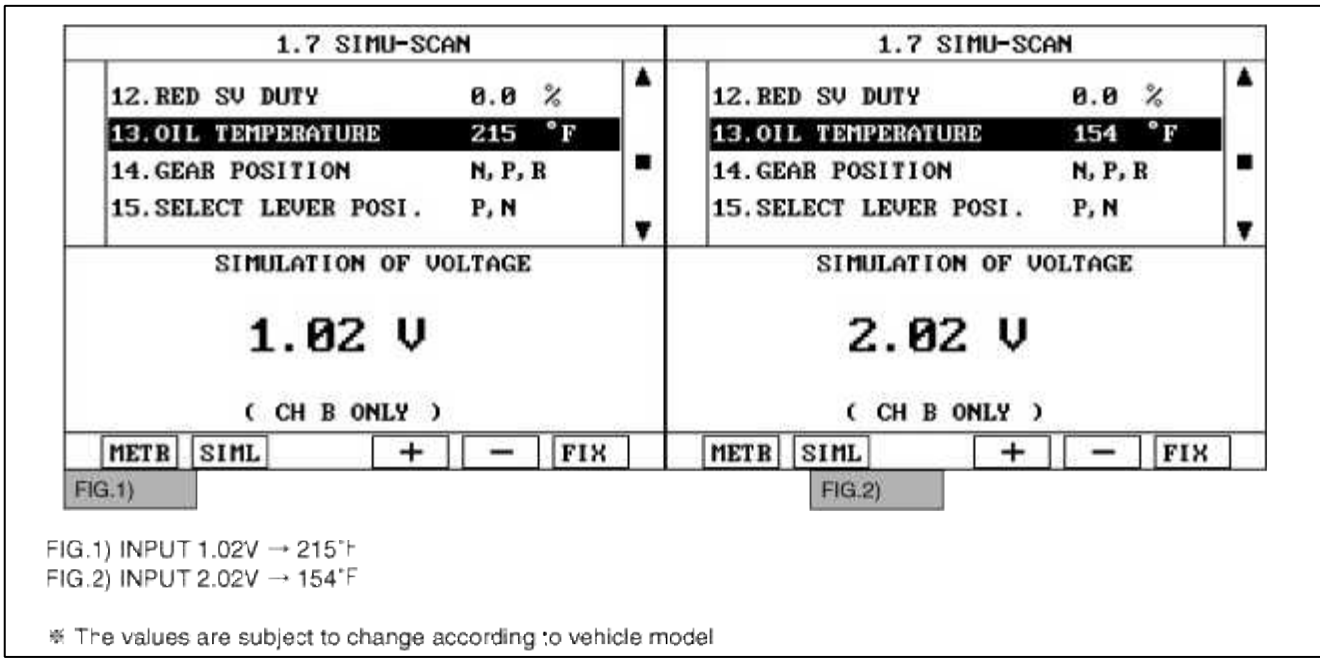


FIG.1) INPUT 1.02V → 215°F
FIG.2) INPUT 2.02V → 154°F

※ The values are subject to change according to vehicle model

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

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorat 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, re TCM(PCM) as necessary 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. 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.

SPECIFICATION

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		

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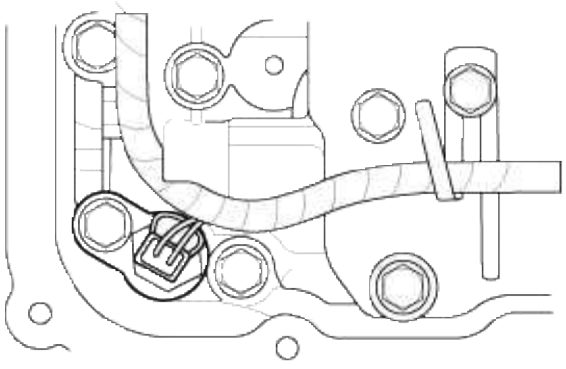
COMPONENT LOCATION



GENERAL DESCRIPTION

The automatic TRANSAXLE 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 TRANSAXLE 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

This DTC code is set when the ATF temperature output voltage is lower than a 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).

DTC DETECTING CONDITION

[2.7 GSL]

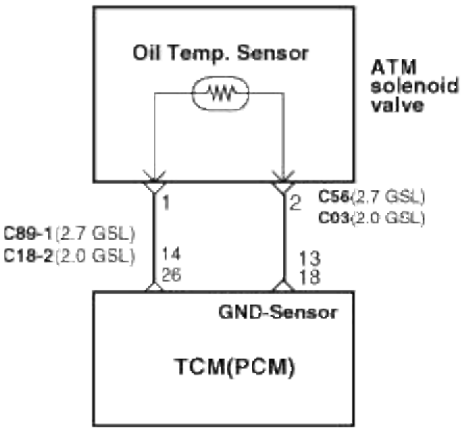
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open in circuit • Faulty sensor • Faulty TCM(PCM)
Enable Conditions (1)	• Engine speed > 2000rpm • Output speed > 1000rpm • Accumulated time in above condition : 10 min	
Enable Conditions (2)	• Enable Conditions(1) or • Engine speed > 700rpm • Engine Coolant Temperature > 35°C(95°F) • Accumulated time in above condition : 60 sec	
Threshold value	• Voltage > 4.5V	
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited. • Fluid temperature is regarded as 80°C(176°F)	

[2.0 GSL]

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for Voltage range	• Sensor signal circuit is short to ground • Faulty sensor • Faulty TCM(PCM)
Enable Conditions	• Always	
Threshold value	• Voltage ≥ 0.49V	
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C(176°F)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

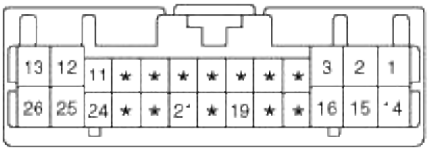


[Connection Information]

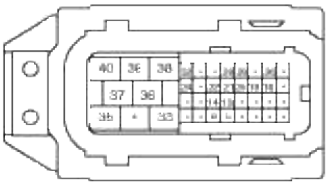
Terminal	Connection	Function
1	C89-1 No.14 C18-2(2.0 GSL) No.26	Sensor signal
2	C89-1 No.13 C18-2(2.0 GSL) No.18	Sensor ground

[Harness Connector]

C56(2.7 GSL)
C03(2.0 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

TERMINAL & 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 vehicle Repair" procedure.

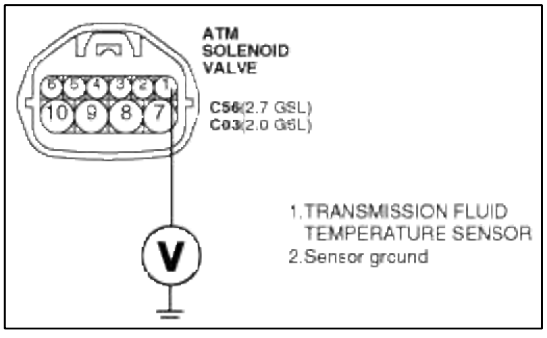
NO

Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

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

Specification : Approx. 5V



4. Is voltage within specifications?

YES

Go to "Ground circuit inspection" procedure.

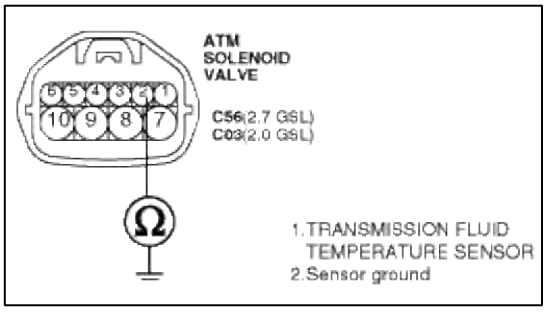
NO

Check for short to ground in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

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



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

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		

(4) Is resistance within specifications?

YES

Go to "CHECK TCM(PCM)" as below.

NO

Replace OIL 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 OIL TEMPERATURE SENSOR signal circuit.

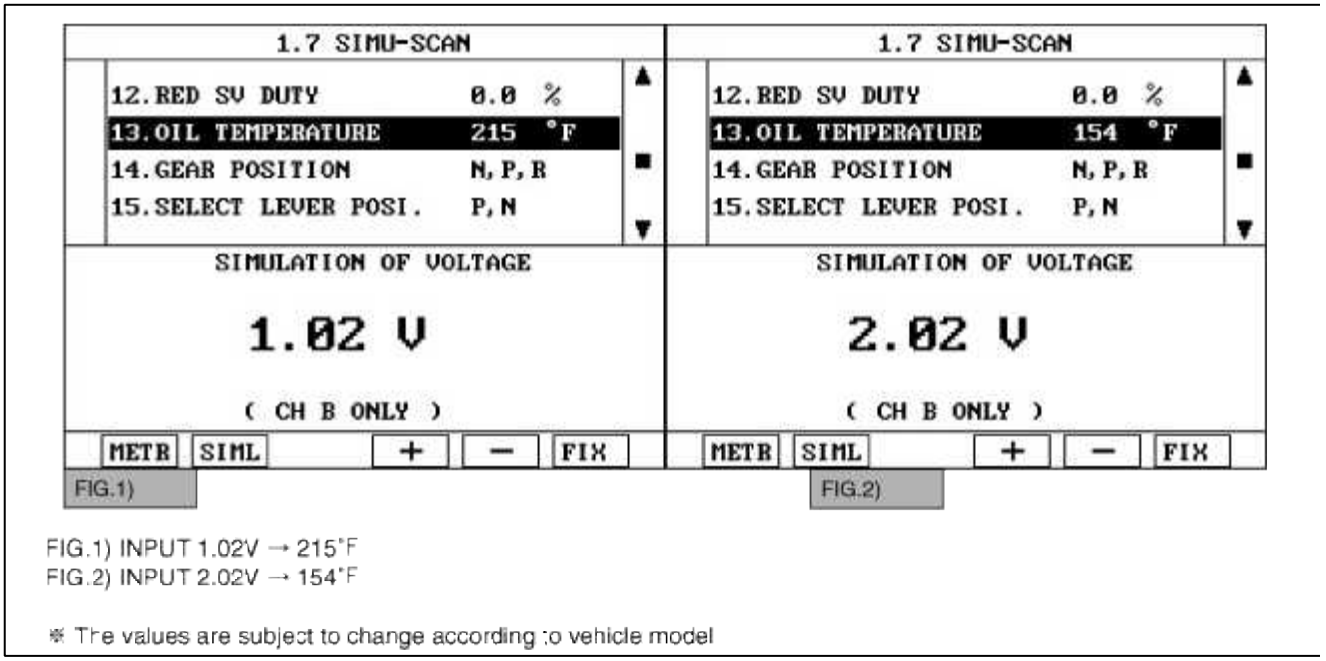


FIG.1) INPUT 1.02V → 215°F
FIG.2) INPUT 2.02V → 154°F

※ The values are subject to change according to vehicle model

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

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorat 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, re TCM(PCM) as necessary 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. 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.

SPECIFICATION

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		

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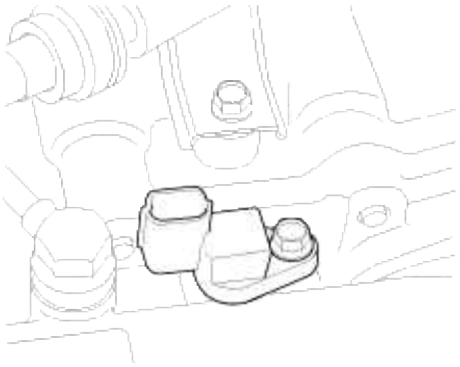
COMPONENT LOCATION



GENERAL DESCRIPTION

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

DTC DESCRIPTION

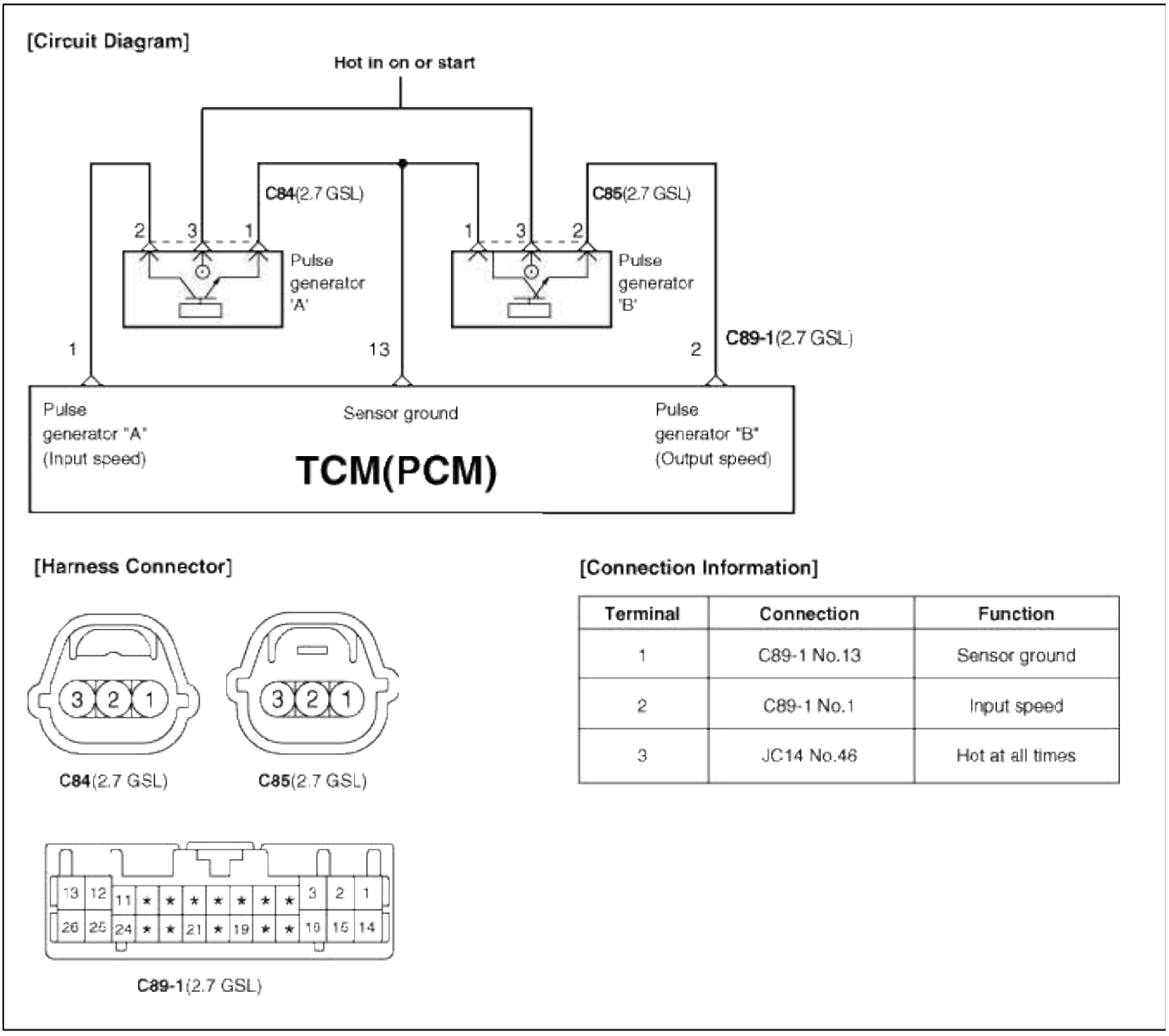
The TCM(PCM) sets this code if an output pulse-signal is not detected, from the input speed sensor, when the vehicle is running faster than 30 km/h. The Fail-Safe function will be set by the TCM(PCM) if this code is detected.

DTC DETECTING CONDITION

[2.7 GSL]

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 INPUT SPEED SENSOR • Faulty TCM(PCM)
Enable Conditions	• Vehicle speed is over 30 Km/h(19 mph) in D,3,2,L(A/T range swhitch) and SP(SPORTS MODE) • But do not check the DTC in below condition - A/T oil temp sensor voltage >4.5 V - Eng revolution < 2600 rpm	
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)	

SCHEMATIC DIAGRAM



Terminal	Connection	Function
1	C89-1 No.13	Sensor ground
2	C89-1 No.1	Input speed
3	JC14 No.46	Hot at all times

MONITOR SCANTOOL DATA

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

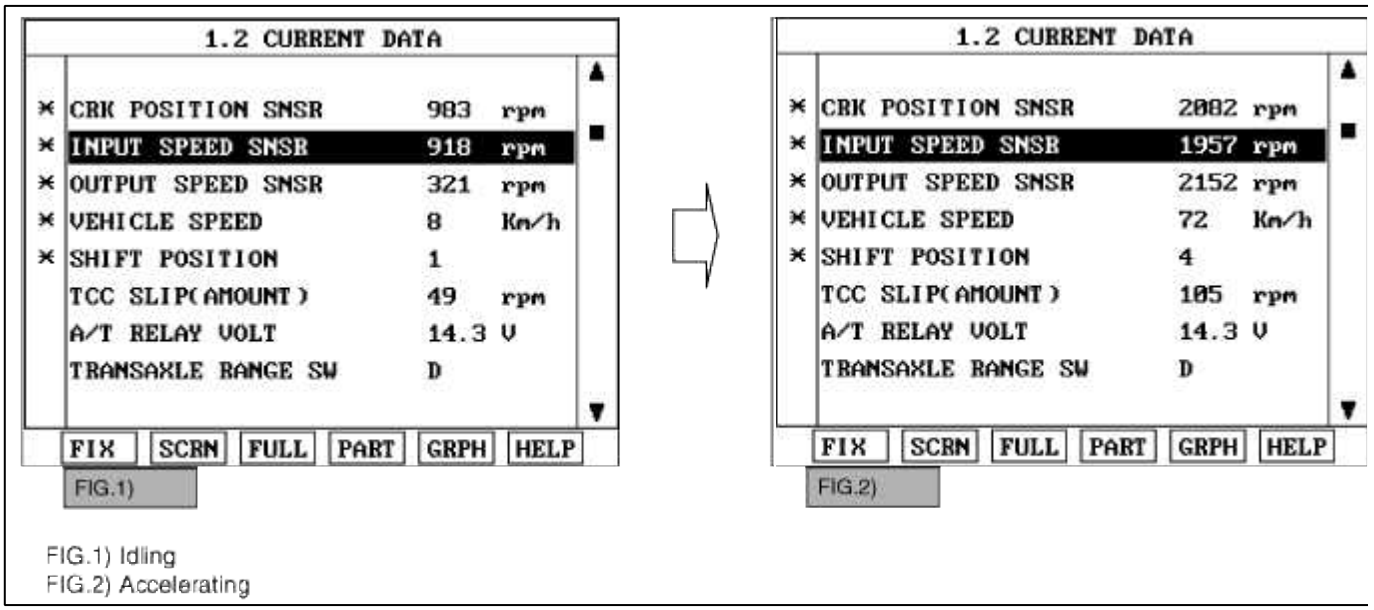


FIG.1) Idling
FIG.2) Accelerating

5. Does "input speed 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 "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

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 Supply circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

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. 5V

4. Is voltage within specification?

YES

Go to "Power Supply circuit Inspection" procedure.

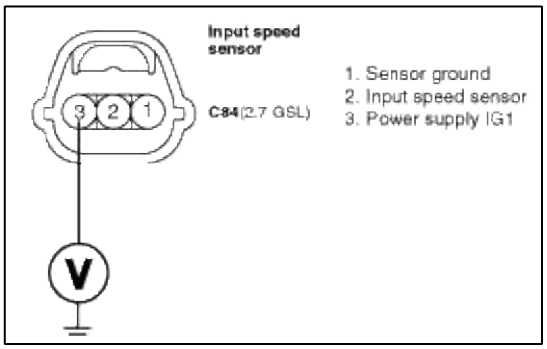
NO

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.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : approx. B+



4. Is voltage within specification ?

YES

Go to "Ground circuit inspection" procedure.

NO

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

GROUND CIRCUIT INSPECTION

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

Specification : approx. 0 Ω

4. Is resistance within specification ?

YES

Go to "Component Inspection" procedure.

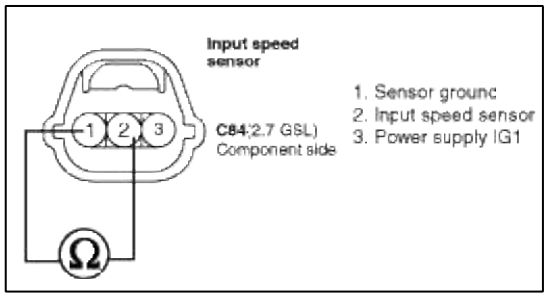
NO

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

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

Specification : Refer to " Reference data"



   (4) Is resistance within specifications?

[REFERENCE DATA]

Data	Reference Data	
Current	22 mA	
Air Gap	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	1(red) - 2(black)	Infinite
	1(black) - 2(red)	Approx. 3.89 MΩ
	1(red) - 3(black)	Approx. 6.55 MΩ
	1(black) - 3(red)	Approx. 5.27 MΩ
	2(red) - 3(black)	Approx. 17.5 MΩ
	2(black) - 3(red)	Infinite

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.

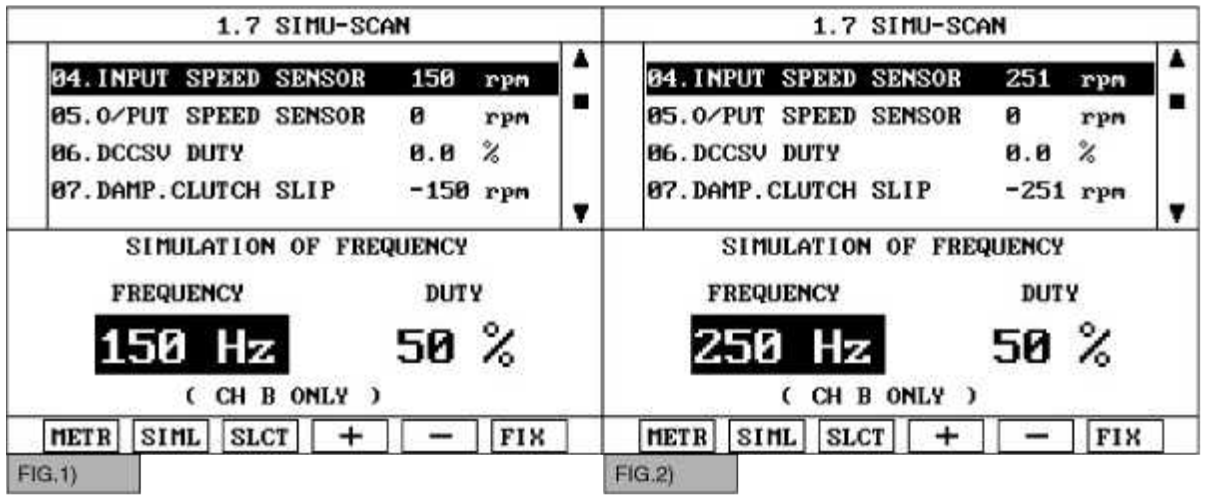


FIG.1) INPUT 150Hz → 150rpm
FIG.2) INPUT 250Hz → 250rpm

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

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorat 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, re TCM(PCM) as necessary 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. 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 ?

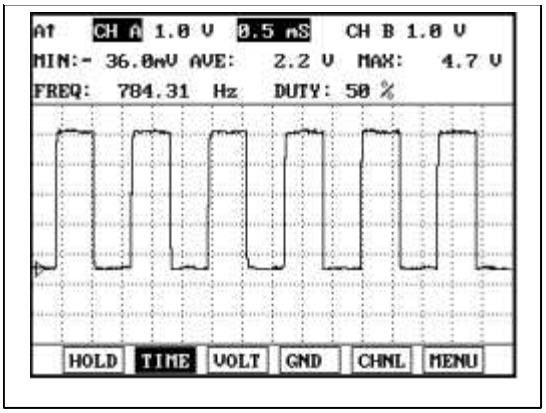
YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

SIGNAL WAVEFORM



SPECIFICATION

Input shaft & Output shaft speed sensor

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

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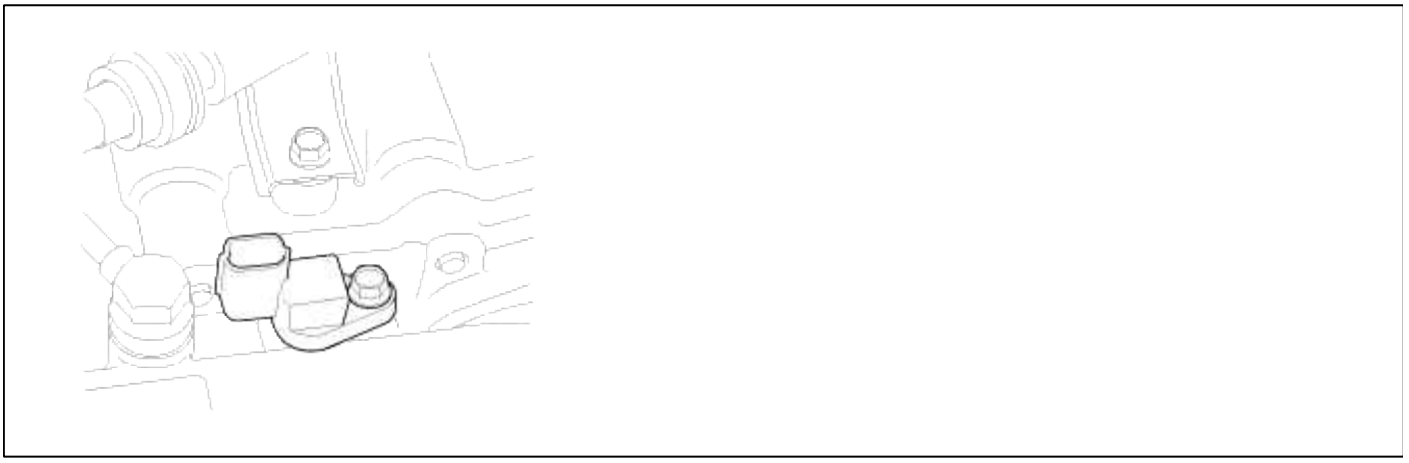
COMPONENT LOCATION



GENERAL DESCRIPTION

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

DTC DESCRIPTION

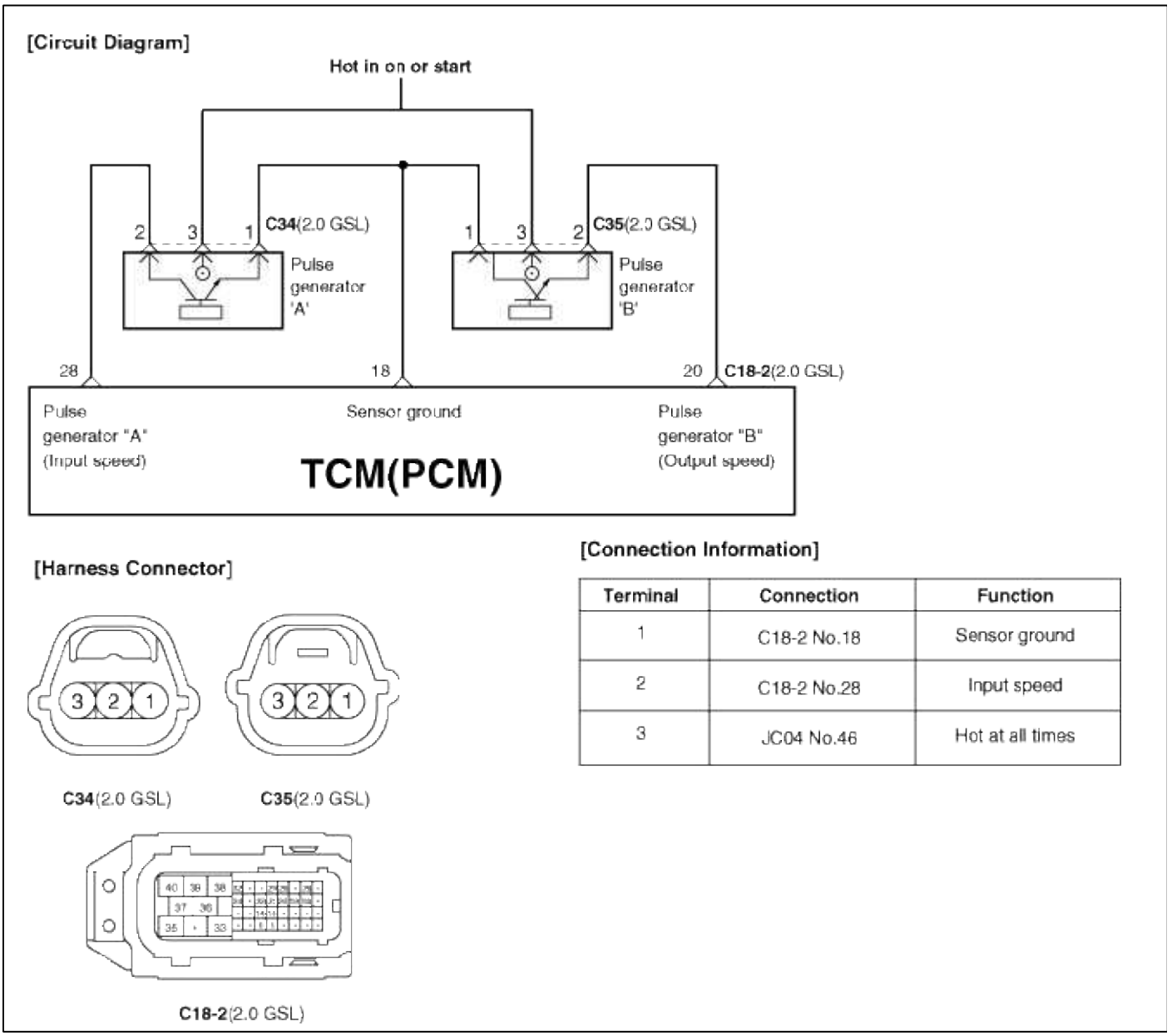
The TCM(PCM) sets this code if an output pulse-signal is not detected, from the input speed sensor, when the vehicle is running faster than 30 km/h. The Fail-Safe function will be set by the TCM(PCM) if this code is detected.

DTC DETECTING CONDITION

[2.0 GSL]

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 INPUT SPEED SENSOR • Faulty TCM(PCM)
Enable Conditions	• Vehicle speed is over 19 Mile/h(30 Km/h) and Engine speed≥2000rpm in D,3,2,L(A/T range swhitch) and SP(SPORTS MODE)	
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)	

SCHEMATIC DIAGRAM



MONITOR SCANTOOL DATA

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

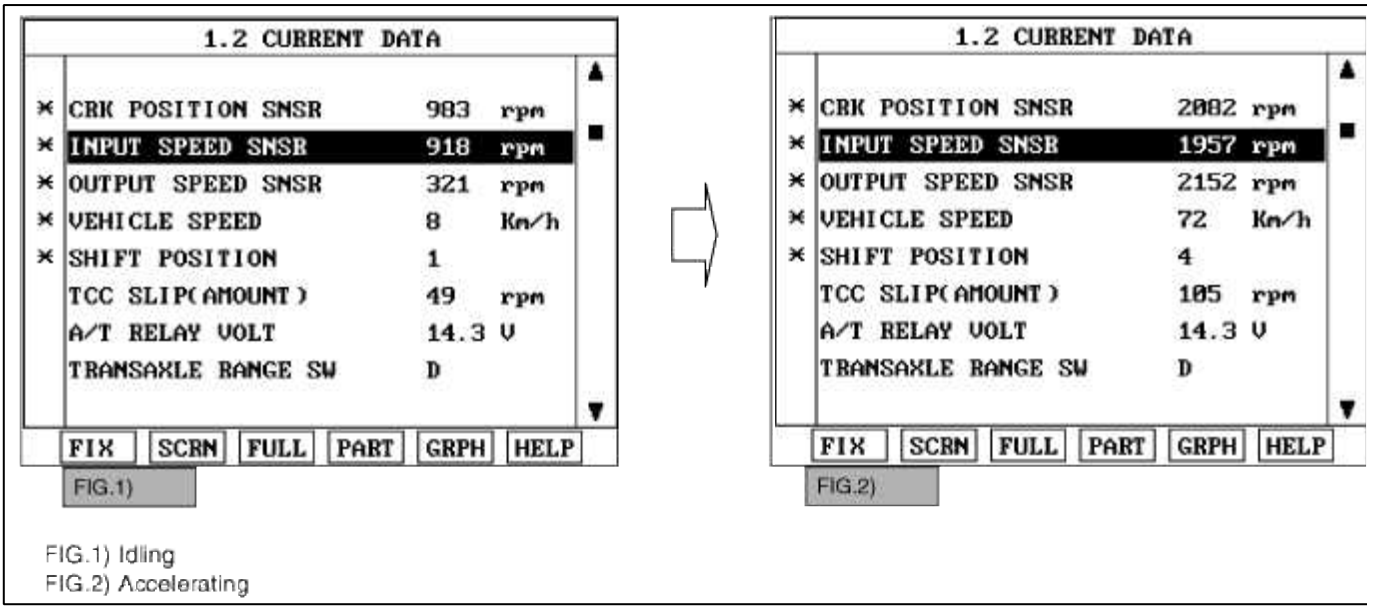


FIG.1) Idling
FIG.2) Accelerating

5. Does "input speed 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 "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

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

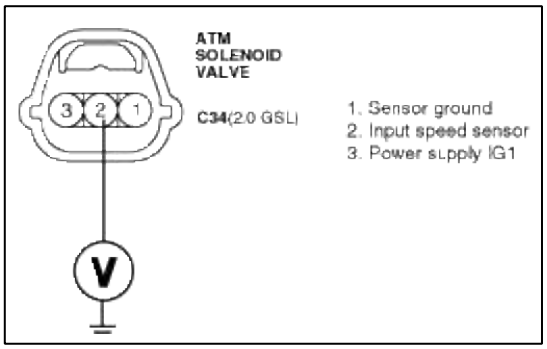
Go to "Signal Supply circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

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. 5V



4. Is voltage within specification?

YES

Go to "Power Supply circuit Inspection" procedure.

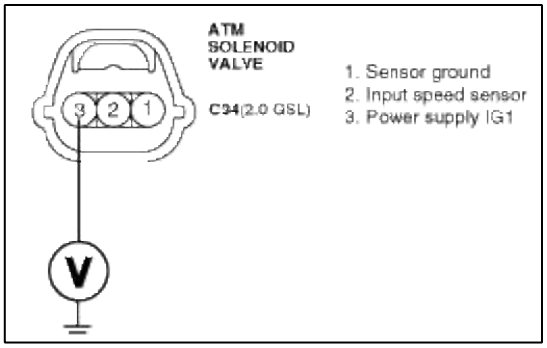
NO

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.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : approx. B+



4. Is voltage within specification ?

YES

Go to "Ground circuit inspection" procedure.

NO

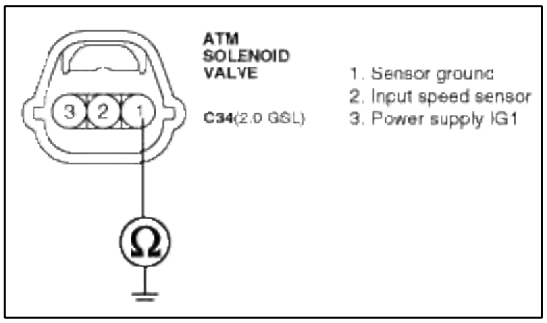
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.

3. Measure resistance between terminal "1" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0 Ω



4. Is resistance within specification ?

YES

Go to "Component Inspection" procedure.

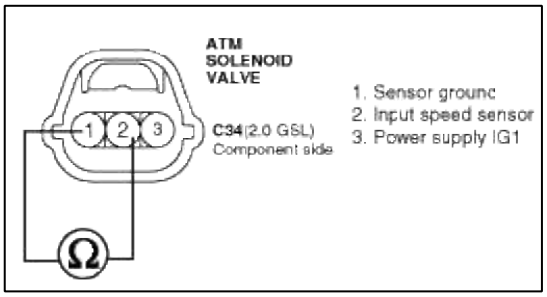
NO

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

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

Specification : Refer to " Reference data"



(4) Is resistance within specifications?

[REFERENCE DATA]

Data	Reference Data	
Current	22 mA	
Air Gap	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	1(red) - 2(black)	Infinite
	1(black) - 2(red)	Approx. 3.89 MΩ
	1(red) - 3(black)	Approx. 6.55 MΩ
	1(black) - 3(red)	Approx. 5.27 MΩ
	2(red) - 3(black)	Approx. 17.5 MΩ
	2(black) - 3(red)	Infinite

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.

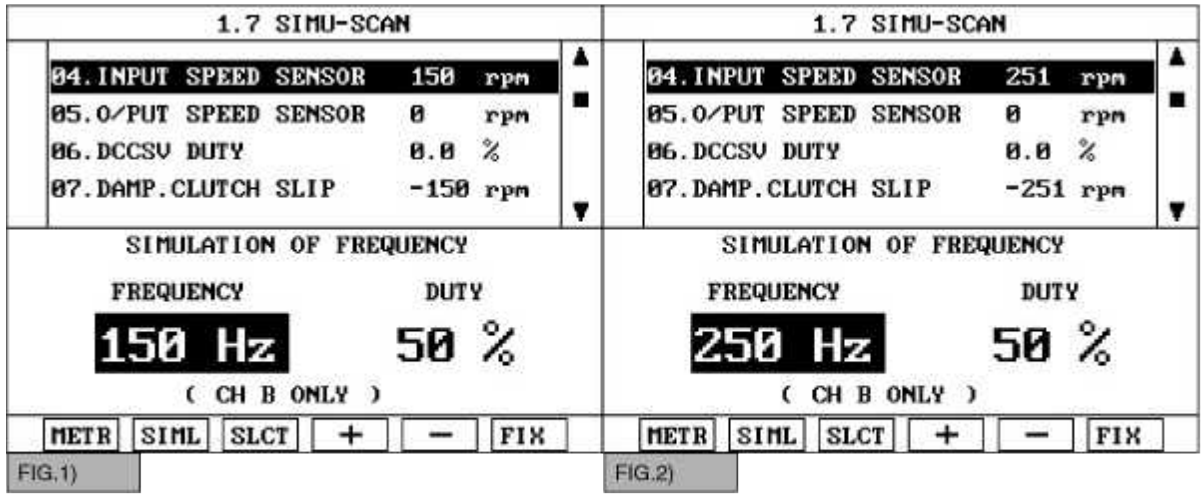


FIG.1) INPUT 150Hz → 150rpm
FIG.2) INPUT 250Hz → 250rpm

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

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorat 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, re TCM(PCM) as necessary 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. 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 ?

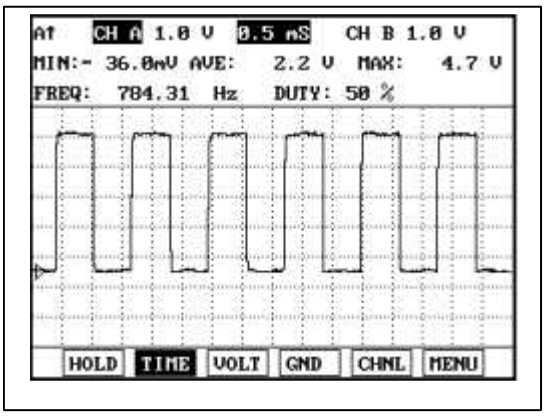
YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

SIGNAL WAVEFORM



SPECIFICATION

Input shaft & Output shaft speed sensor

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

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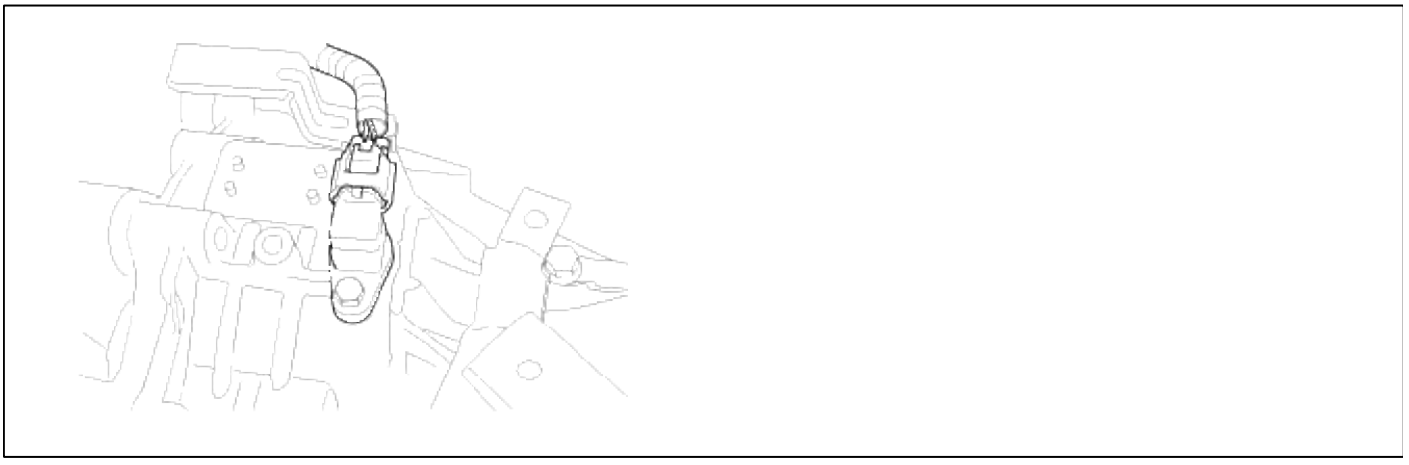
COMPONENT LOCATION



GENERAL DESCRIPTION

The Output Speed Sensor outputs pulse-signals according to the revolutions of the output shaft of the transmission.

The Output Speed Sensor is installed in front of the Transfer Drive Gear to determine the Transfer Drive Gear rpms by counting the frequency of the pulses. This value, together with the throttle position data, is mainly used to decide the optimum gear position.

DTC DESCRIPTION

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.

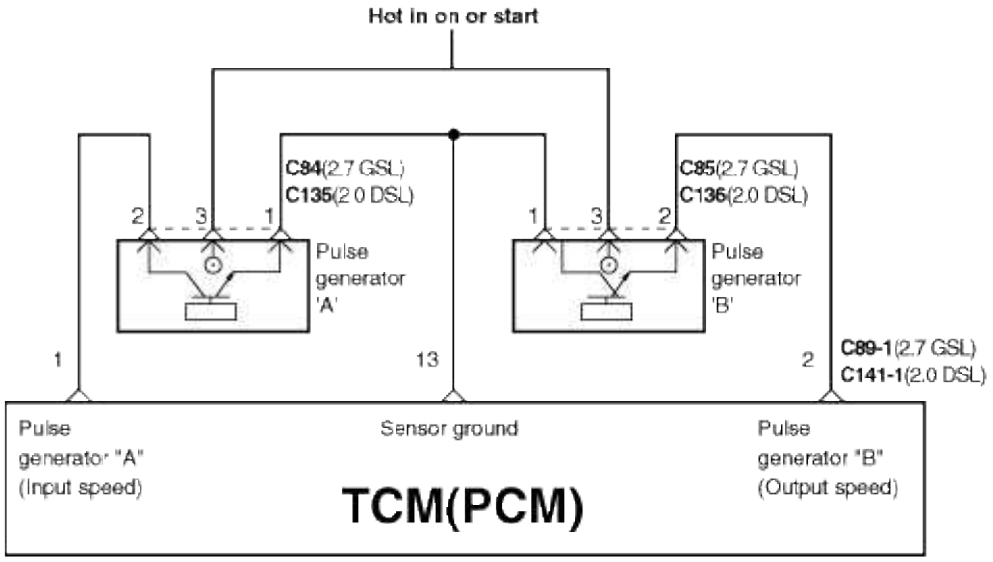
DTC DETECTING CONDITION

[2.7 GSL]

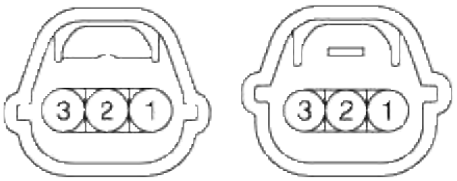
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Speed rationality check	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty OUTPUT SPEED SENSOR • Faulty TCM(PCM)
Enable Conditions	• Vehicle speed is over 30 Km/h(19 mph) in D,3,2,L(A/T range swhitch) and SP(SPORTS MODE) • DTC detection inhibited - A/T oil temp sensor voltage >4.5 V - Eng revolution < 2600 rpm	
Threshold value	• If the output from the output speed sensor is continuously 50% lower than the value calculated by vehicle speed sensor	
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)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

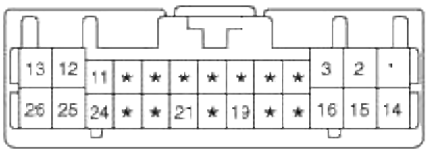


[Harness Connector]



C84(2.7 GSL)
C135(2.0 DSL)

C85(2.7 GSL)
C136(2.0 DSL)



C89-1(2.7 GSL)
C141-1(2.0 DSL)

[Connection Information]

Terminal	Connection	Function
1	C89-1/C141-1 No.13	Sensor ground
2	C89-1/C141-1 No.1	Input speed
3	JC14/JC104 No.46	Hot at all times

MONITOR SCANTOOL DATA

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

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

Specification : Increasing Gradually

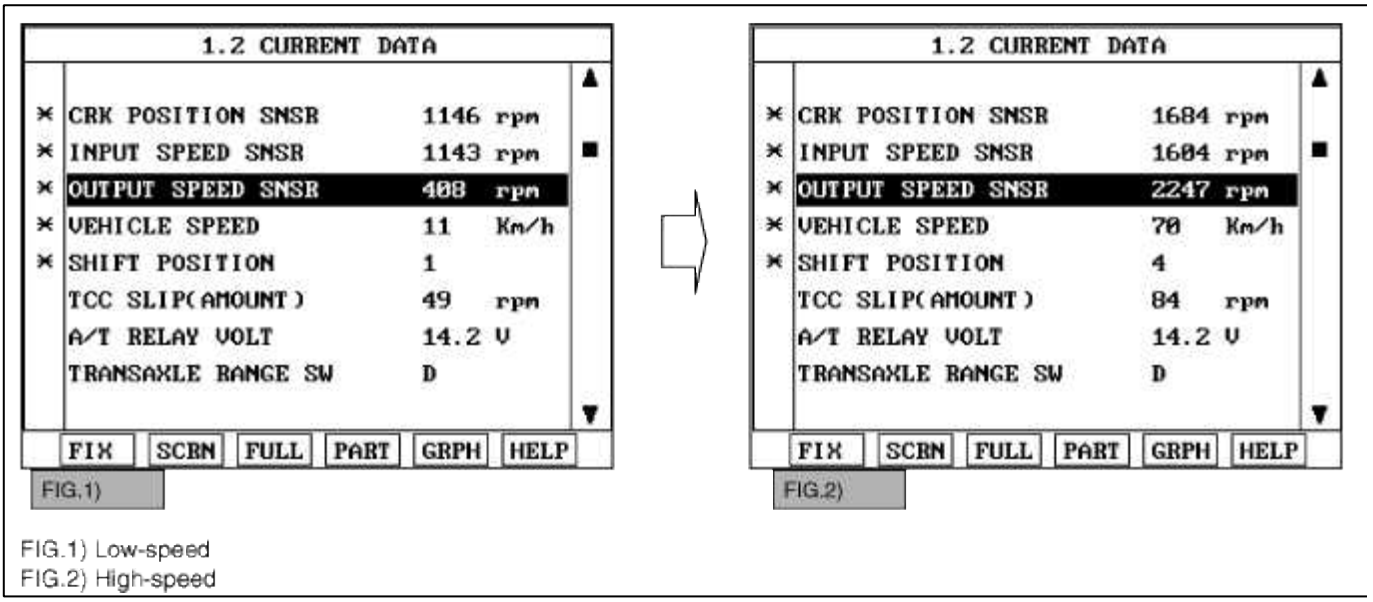


FIG.1) Low-speed
FIG.2) High-speed

5. Does "output speed 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 "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

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

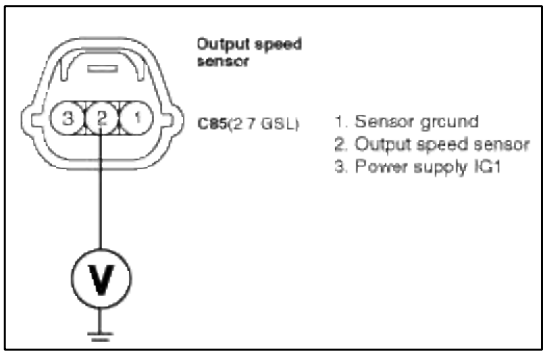
Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.

3. Measure voltage between terminal "2" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 5V



4. Is voltage within specification?

YES

Go to "Power Supply circuit Inspection" procedure.

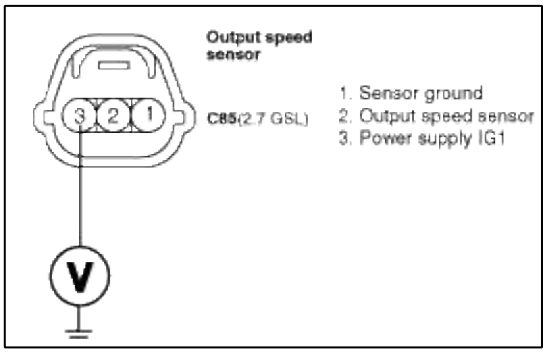
NO

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.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : approx. B+



4. Is voltage within specification?

YES

Go to "Ground circuit inspection" procedure.

NO

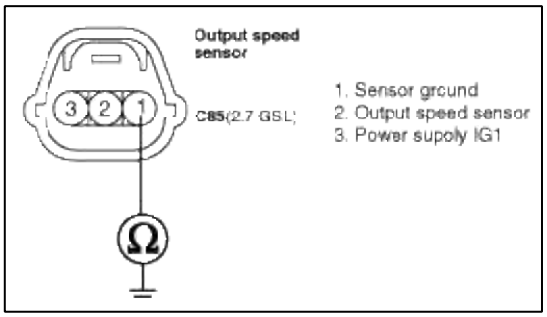
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.

3. Measure resistance between terminal "1" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0 Ω



4. Is resistance within specification?

YES

Go to "Component Inspection" procedure.

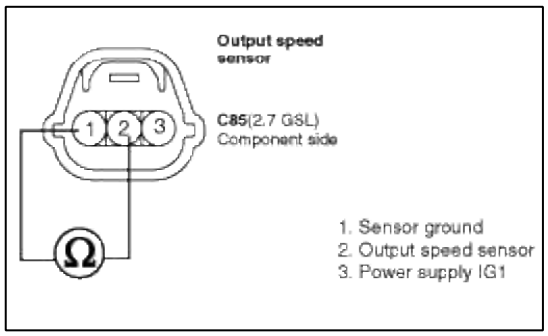
NO

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

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

Specification : Refer to " Reference data"



(4) Is resistance within specifications?

[REFERENCE DATA]

Data	Reference Data	
Current	22 mA	
Air Gap	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	1(red) - 2(black)	Infinite
	1(black) - 2(red)	Approx. 3.89 MΩ
	1(red) - 3(black)	Approx. 6.55 MΩ
	1(black) - 3(red)	Approx. 5.27 MΩ
	2(red) - 3(black)	Approx. 17.5 MΩ
	2(black) - 3(red)	Infinite

YES

Go to "CHECK TCM(PCM)" as below.

NO

Replace "OUTPUT SPEED SENSOR" 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 signal circuit.

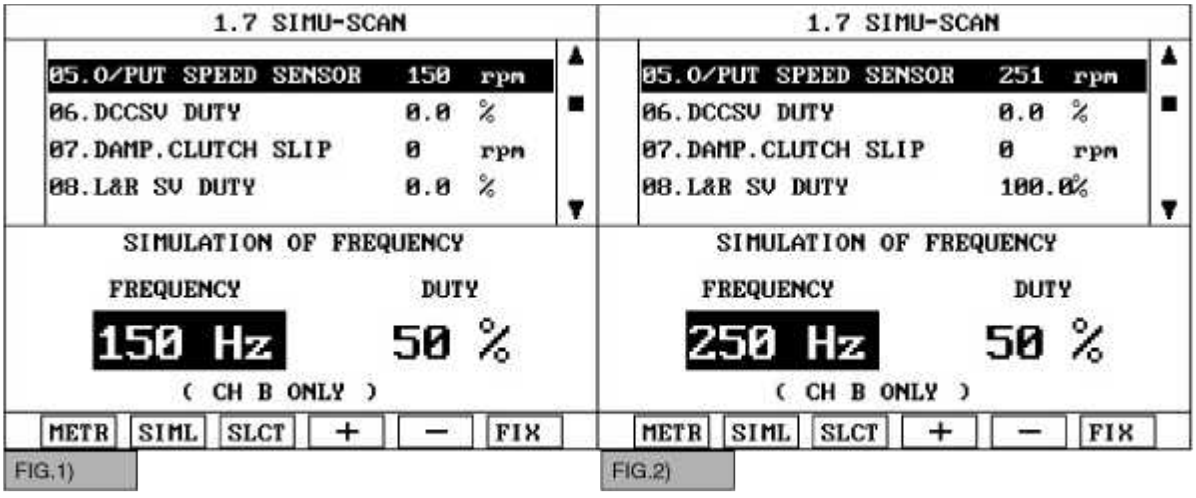


FIG.1) OUTPUT 150Hz → 150rpm
FIG.2) OUTPUT 250Hz → 250rpm

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

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorat 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, re TCM(PCM) as necessary 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. 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 ?

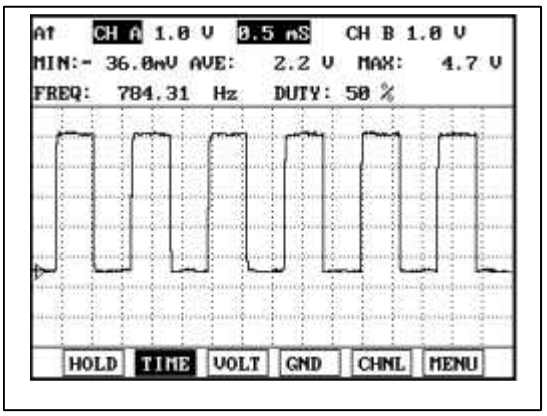
YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

SIGNAL WAVEFORM



SPECIFICATION

Input shaft & Output shaft speed sensor

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

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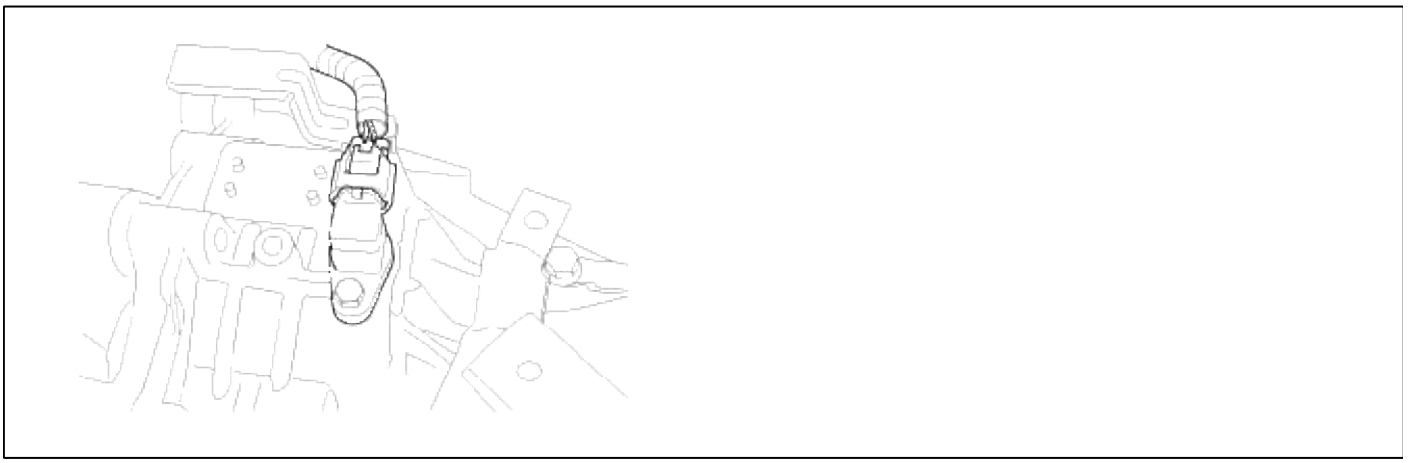
COMPONENT LOCATION



GENERAL DESCRIPTION

The Output Speed Sensor outputs pulse-signals according to the revolutions of the output shaft of the transmission.

The Output Speed Sensor is installed in front of the Transfer Drive Gear to determine the Transfer Drive Gear rpms by counting the frequency of the pulses. This value, together with the throttle position data, is mainly used to decide the optimum gear position.

DTC DESCRIPTION

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.

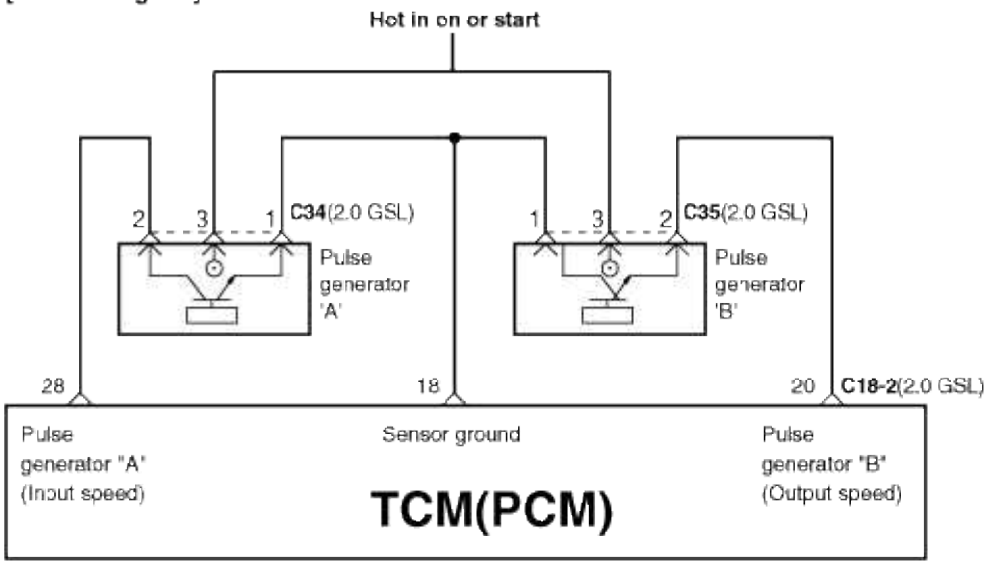
DTC DETECTING CONDITION

[2.0 GSL]

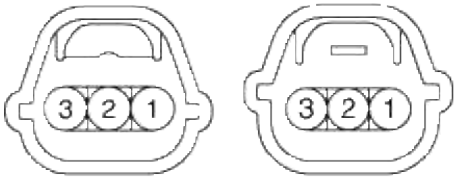
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Speed rationality check	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty OUTPUT SPEED SENSOR • Faulty TCM(PCM)
Enable Conditions	• Vehicle speed is over 31 Mile/h(50 Km/h) in D,3,2,L(A/T range swhitch) and SP(SPORTS MODE)	
Threshold value	• If the output from the output speed sensor is continuously 50% lower or higrer than the value calculated by vehicle speed sensor	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd or 2nd gear • Apply an electric current to Solenoide valve • Manual shifting is possibe (2 nd → 3 rd, 3 rd → 2 nd)	

SCHEMATIC DIAGRAM

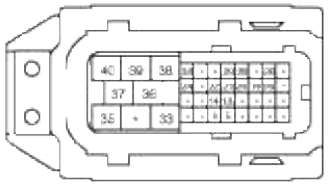
[Circuit Diagram]



[Harness Connector]



C34(2.0 GSL) C35(2.0 GSL)



C18-2(2.0 GSL)

[Connection Information]

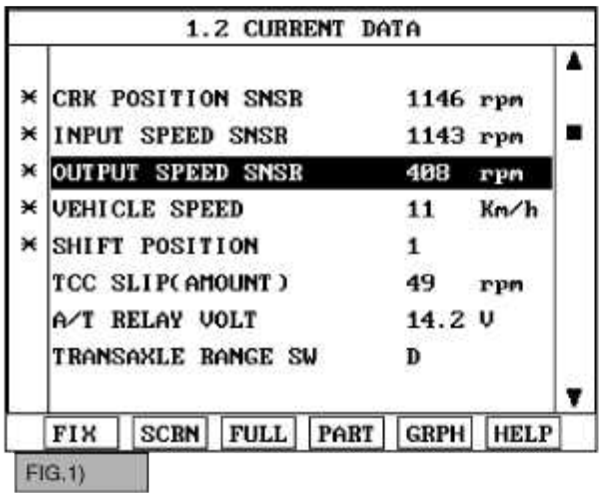
Terminal	Connection	Function
1	C18-2 No. 18	Sensor ground
2	C18-2 No. 20	Input speed sensor
3	JC04 No. 46	Hot at all times

MONITOR SCANTOOL DATA

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

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

Specification : Increasing Gradually



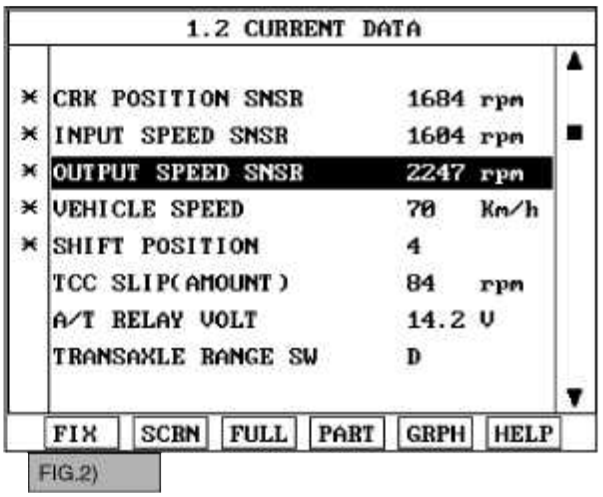


FIG.1) Low-speed
FIG.2) High-speed

5. Does "output speed 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 "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

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

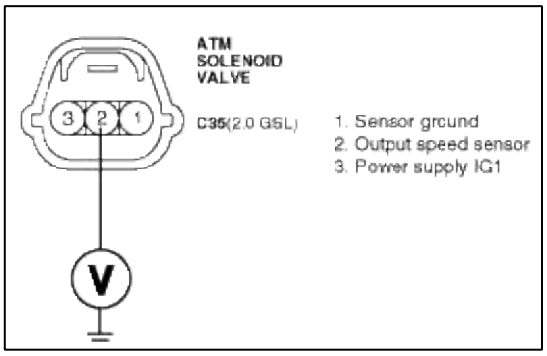
Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.

3. Measure voltage between terminal "2" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 5V



4. Is voltage within specification?

YES

Go to "Power Supply circuit Inspection" procedure.

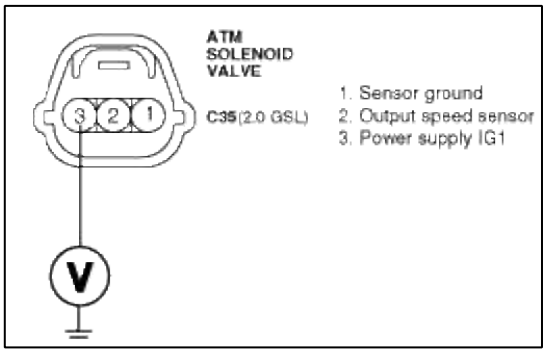
NO

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.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : approx. B+



4. Is voltage within specification?

YES

Go to "Ground circuit inspection" procedure.

NO

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

GROUND CIRCUIT INSPECTION

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

Specification : approx. 0 Ω

4. Is resistance within specification?

YES

Go to "Component Inspection" procedure.

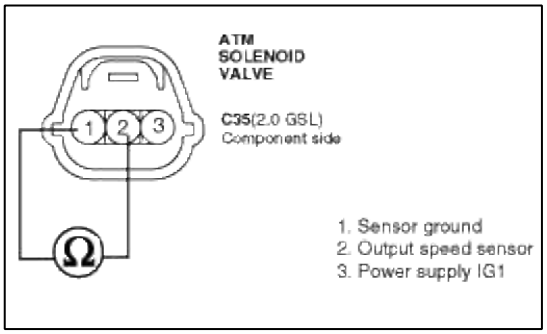
NO

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

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

Specification : Refer to " Reference data"



   (4) Is resistance within specifications?

[REFERENCE DATA]

Data	Reference Data	
Current	22 mA	
Air Gap	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	1(red) - 2(black)	Infinite
	1(black) - 2(red)	Approx. 3.89 MΩ
	1(red) - 3(black)	Approx. 6.55 MΩ
	1(black) - 3(red)	Approx. 5.27 MΩ
	2(red) - 3(black)	Approx. 17.5 MΩ
	2(black) - 3(red)	Infinite

YES

Go to "CHECK TCM(PCM)" as below.

NO

Replace "OUTPUT SPEED SENSOR" 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 signal circuit.

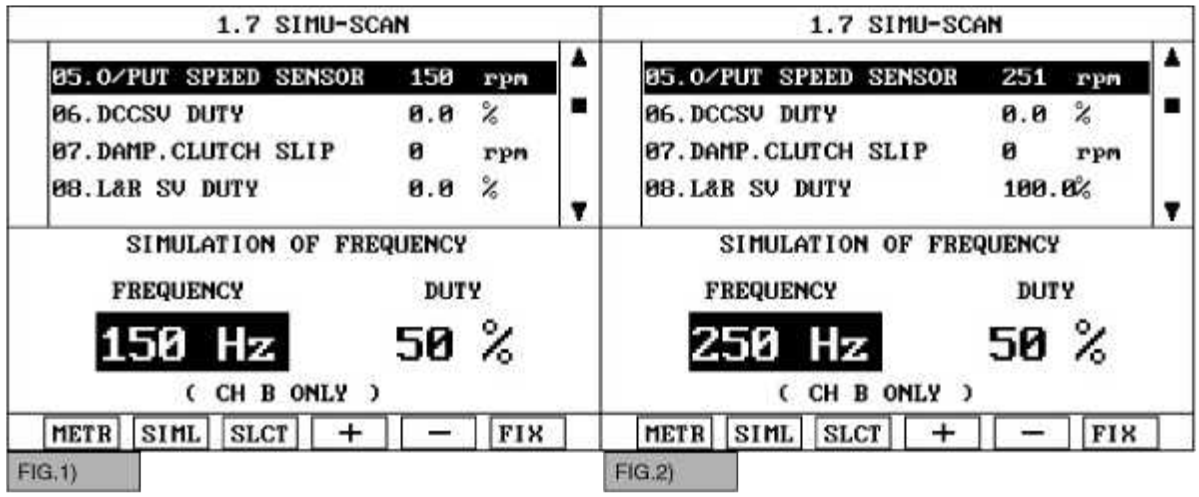


FIG.1) OUTPUT 150Hz → 150rpm
FIG.2) OUTPUT 250Hz → 250rpm

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

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorat 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, re TCM(PCM) as necessary 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. 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 ?

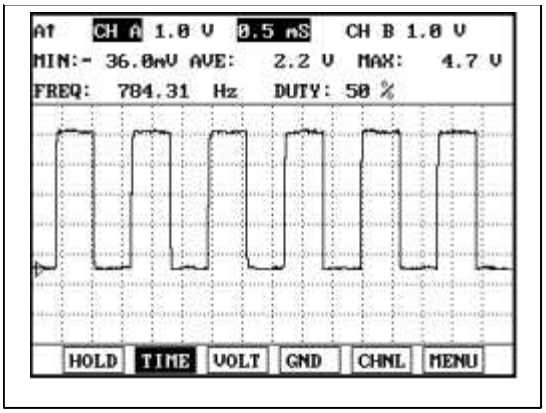
YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

SIGNAL WAVEFORM



SPECIFICATION

Input shaft & Output shaft speed sensor

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

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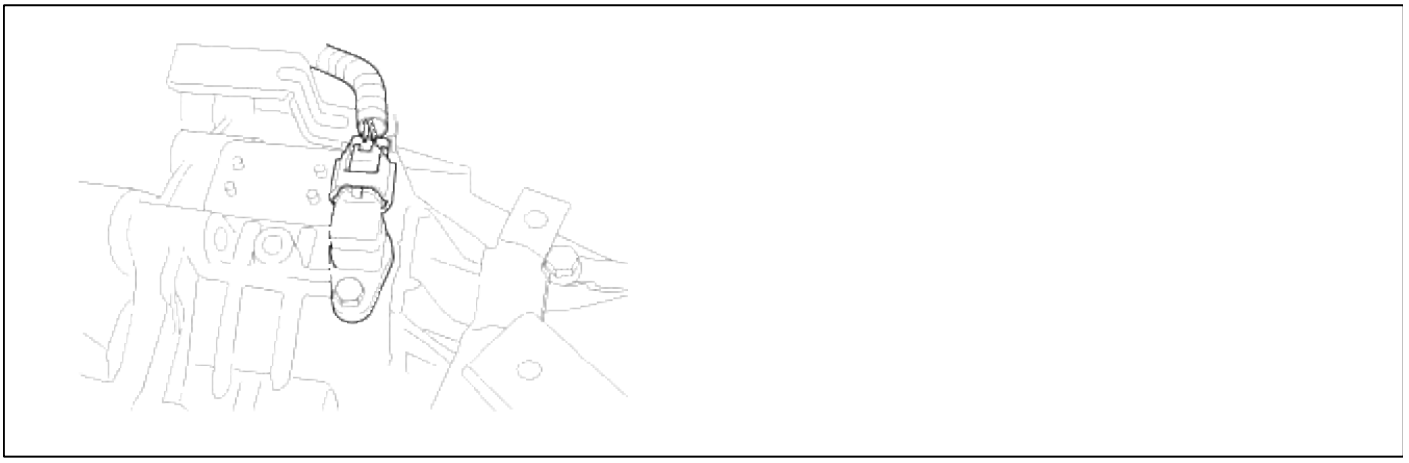
COMPONENT LOCATION



GENERAL DESCRIPTION

The Output Speed Sensor outputs pulse-signals according to the revolutions of the output shaft of the transmission. The Output Speed Sensor is installed in front of the Transfer Drive Gear to determine the Transfer Drive Gear rpms by counting the frequency of the pulses. This value, together with the throttle position data, is mainly used to decide the optimum gear position.

DTC DESCRIPTION

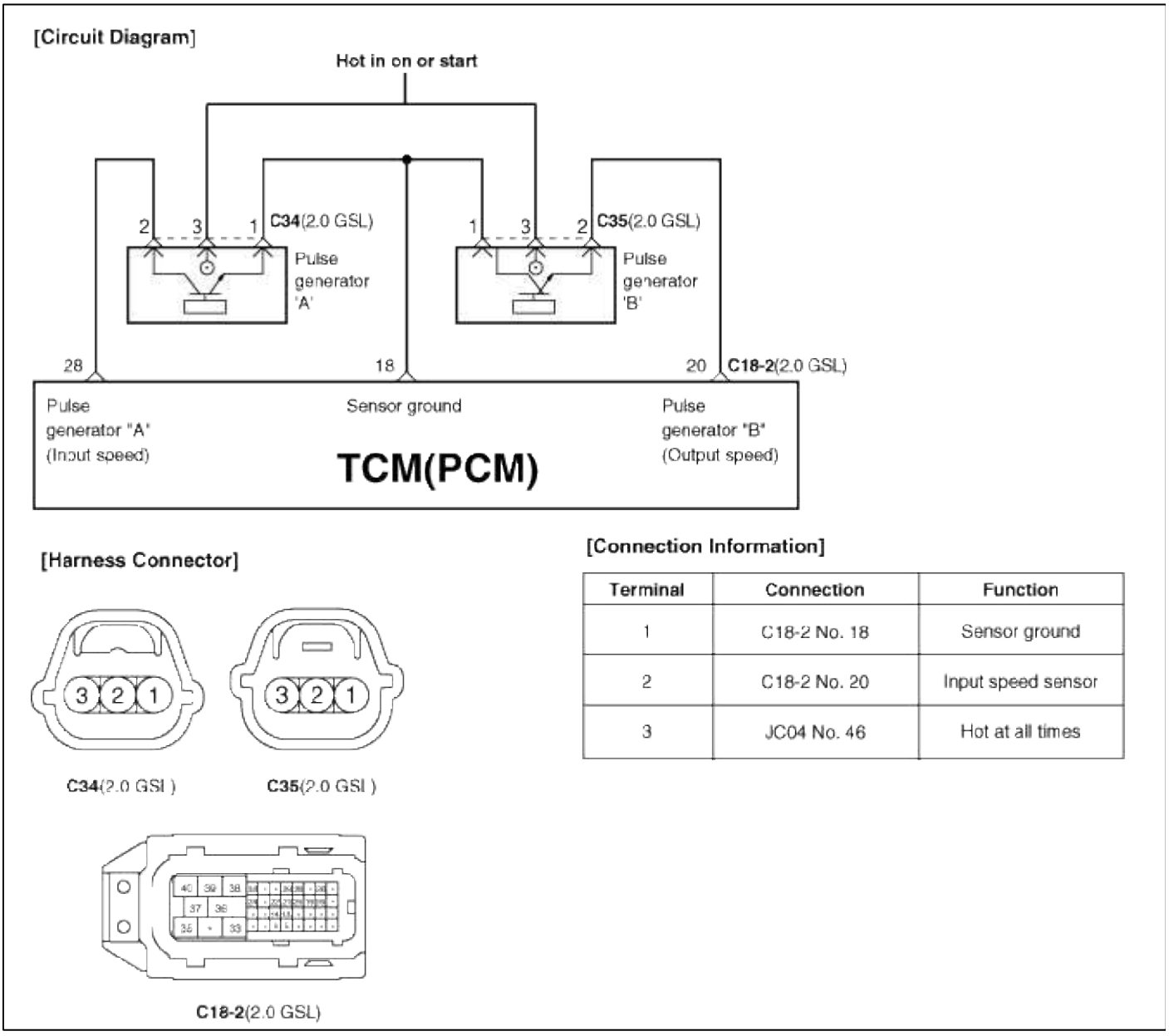
The TCM(PCM) sets this code if the calculated value of the pulse-signal is noticeably different from the value calculated, using the Vehicle Speed Sensor output, when the vehicle is running faster than 30 km/h. The TCM(PCM) will initiate the fail safe function if this code is detected.

DTC DETECTING CONDITION

[2.0 GSL]

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	• Vehicle speed is over 19 Mile/h(30 Km/h) and Engine speed≥2000rpm in D,3,2,L(A/T range swhitch) and SP(SPORTS MODE)	
Threshold value	• No signal	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd or 2nd gear • Apply an electric current to Solenoide valve • Manual shifting is possibe (2 nd → 3 rd, 3 rd → 2 nd)	

SCHEMATIC DIAGRAM

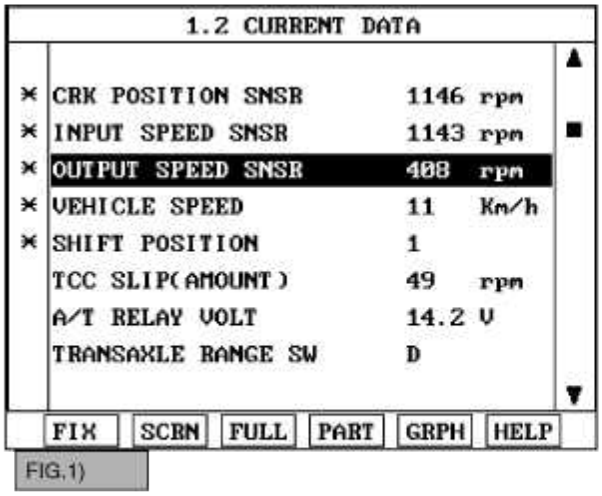


Terminal	Connection	Function
1	C18-2 No. 18	Sensor ground
2	C18-2 No. 20	Input speed sensor
3	JC04 No. 46	Hot at all times

MONITOR SCANTOOL DATA

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

Specification : Increasing Gradually



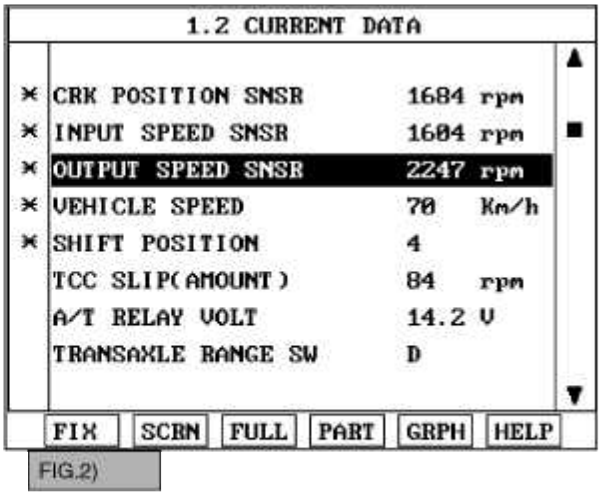


FIG.1) Low-speed
FIG.2) High-speed

5. Does "output speed 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 "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

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

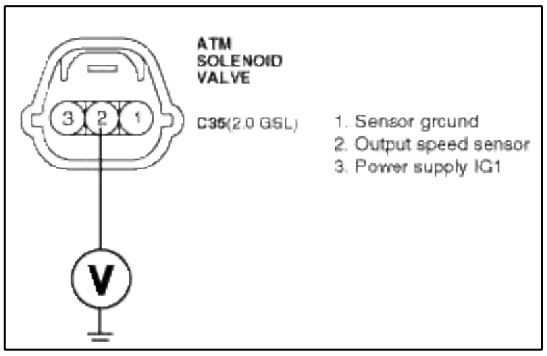
Go to "Signal circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.

3. Measure voltage between terminal "2" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 5V



4. Is voltage within specification?

YES

Go to "Power Supply circuit Inspection" procedure.

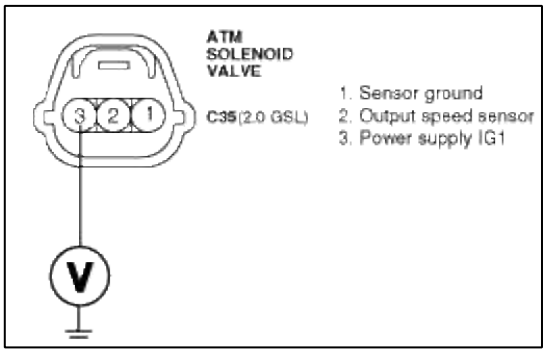
NO

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.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : approx. B+



4. Is voltage within specification?

YES

Go to "Ground circuit inspection" procedure.

NO

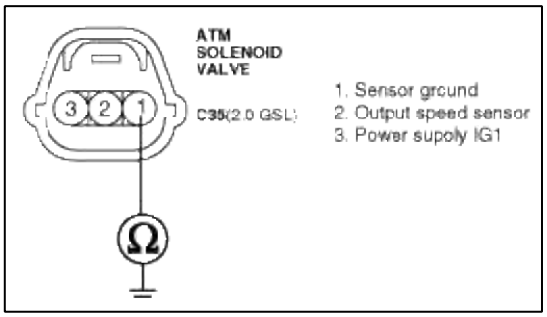
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR" connector.

3. Measure resistance between terminal "1" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : approx. 0 Ω



4. Is resistance within specification?

YES

Go to "Component Inspection" procedure.

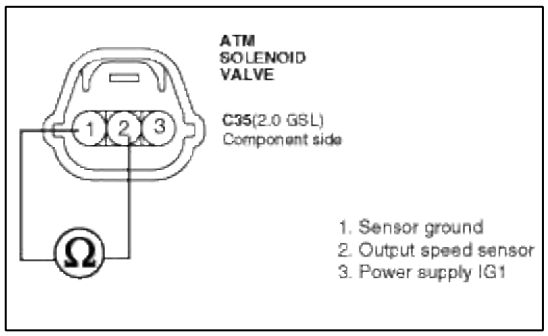
NO

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

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

Specification : Refer to " Reference data"



(4) Is resistance within specifications?

[REFERENCE DATA]

Data	Reference Data	
Current	22 mA	
Air Gap	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	1(red) - 2(black)	Infinite
	1(black) - 2(red)	Approx. 3.89 MΩ
	1(red) - 3(black)	Approx. 6.55 MΩ
	1(black) - 3(red)	Approx. 5.27 MΩ
	2(red) - 3(black)	Approx. 17.5 MΩ
	2(black) - 3(red)	Infinite

YES

Go to "CHECK TCM(PCM)" as below.

NO

Replace "OUTPUT SPEED SENSOR" 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 signal circuit.

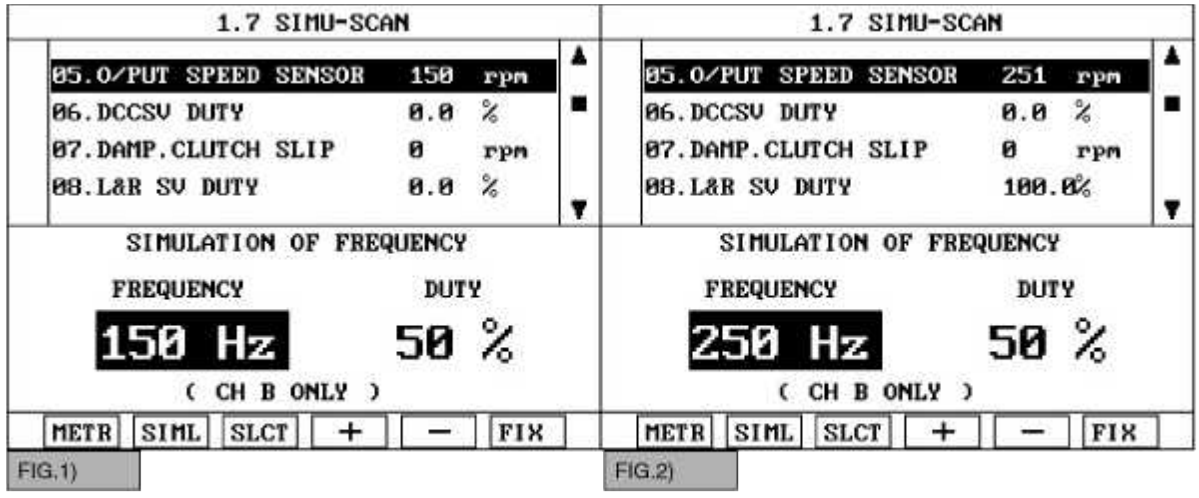


FIG.1) OUTPUT 150Hz → 150rpm
FIG.2) OUTPUT 250Hz → 250rpm

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

YES

Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deteriorat 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, re TCM(PCM) as necessary 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. 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 ?

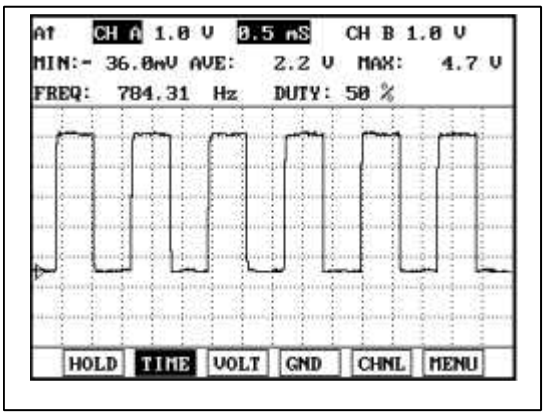
YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

SIGNAL WAVEFORM



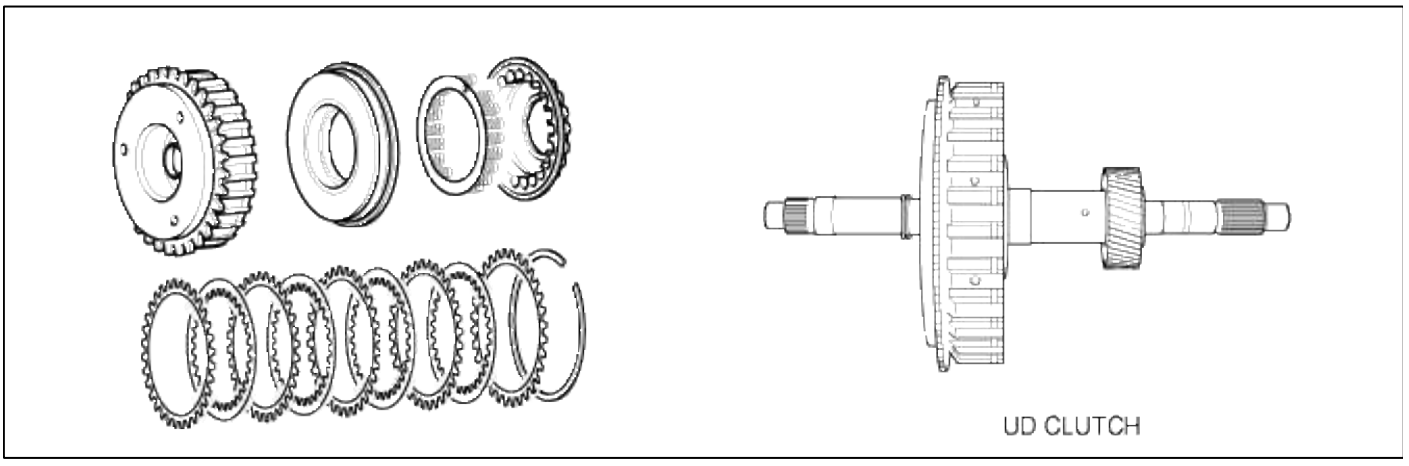
SPECIFICATION

Input shaft & Output shaft speed sensor

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

Automatic Transaxle System > Troubleshooting > P0731

COMPONENT LOCATION



GENERAL DESCRIPTION

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 output speed is 1000 rpm and the 1st gear ratio is 2.842, then the input speed is 2,842 rpm.

DTC DESCRIPTION

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.

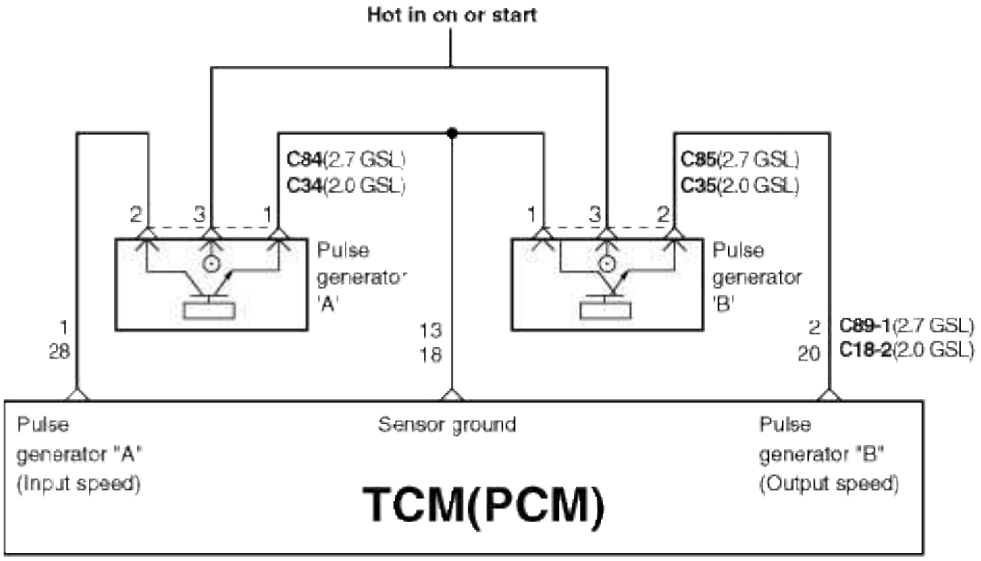
DTC DETECTING CONDITION

[2.7 GSL]/ [2.0 GSL]

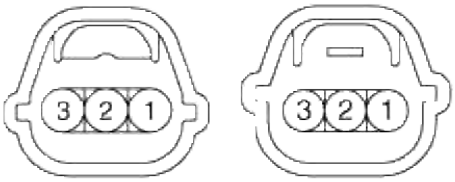
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 1st gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or LR brake or Oneway clutch
Enable Conditions	• Engine speed >450rpm • Output speed >350rpm • Shift stage 1st. gear • Input speed >0rpm • A/T oil temp sensor voltage <4.5V • Voltage of Battery >10V • TRANSAXLE RANGE SWITCH is normal	
Threshold value	• input speed/1st gear ratio - output speed|≥200rpm /1st. gear ratio	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0731 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

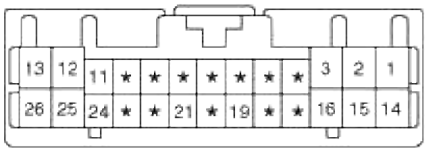


[Harness Connector]

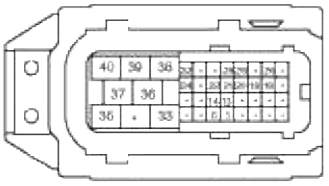


C84(2.7 GSL)
C34(2.0 GSL)

C85(2.7 GSL)
C35(2.0 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Input Shaft Speed Sensor]

Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.1 C18-2 No.28	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

[Output Shaft Speed Sensor]

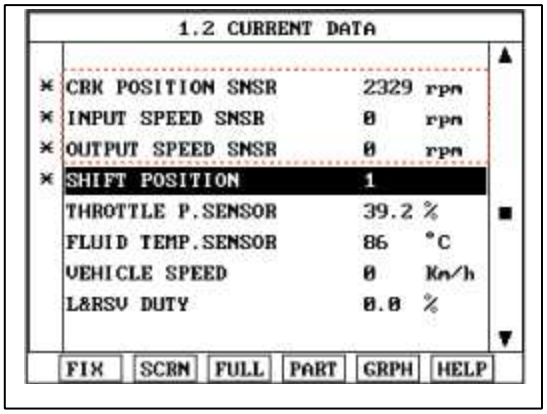
Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.2 C18-2 No.20	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

MONITOR SCANTOOL DATA

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 :
2.0(GSL) : 2400~3000rpm
2.7(GSL) : 2100~2700rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					●	
R			●		●	
N					●	
D1	●				●	○
D2	●			●		
D3	●	●				
D4		●		●		

Low & Reverse Brake is released When the Vehicle speed over the 5 MPH(7Km/h).

Stall test procedure in D1 and reason

Procedure

A. Warm up the engine

B. 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 D

Reason for stall test

A. If there is no mechanical defaults in A/T, every slippage occur in torque converter.

B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.

C. If 1st gear operating part has faults, input speed revolution will be out of specification.

D. 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 "Signal Circuit Inspection" procedure.

NO

Go to "Component inspection" procedure.

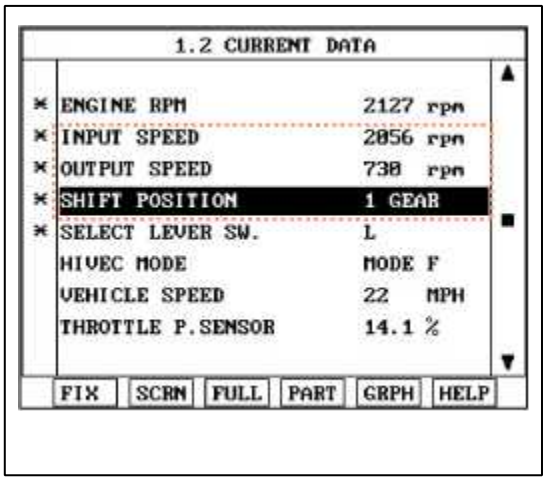
CAUTION

- 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 : 80~100°C (176~212°F).
  - Engine coolant temperature : 80~100°C (176~212°F).
- 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

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 1st 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

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

Specification : shown below

Measurement condition			Standard hydraulic pressure kPa (psi)					
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low and reverse brake pressure	Second brake pressure	Torque converter pressure
P	-	2,500	-	-	-	310-390 (45-56)	-	250-350 (36-56)
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	500-700 (185-256)
N	2,500	-	-	-	-	310-390 (45-56)	-	250-390 (36-56)
D	1st gear	2,500	1,010-1,050 (146-152)	-	-	1,010-1,050 (146-152)	-	500-700 (73-101)
	2nd gear	2,500	1,010-1,050 (146-152)	-	-	-	1,010-1,050 (146-152)	500-700 (73-101)
	3rd gear	2,500	590-690 (85-100)	-	590-690 (85-100)	-	-	450-650 (65-94)
	4th gear	2,500	-	-	590-690 (85-100)	-	590-690 (85-100)	450-650 (65-94)

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

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.

SIGNAL WAVEFORM

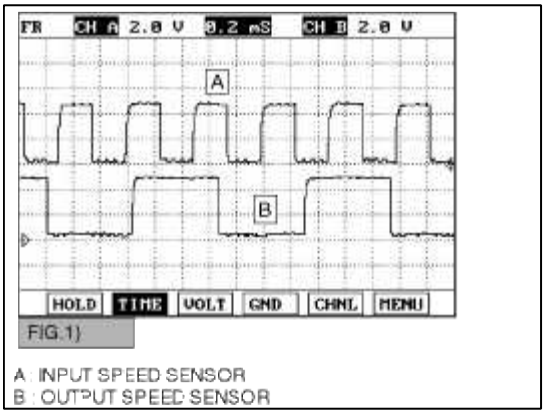
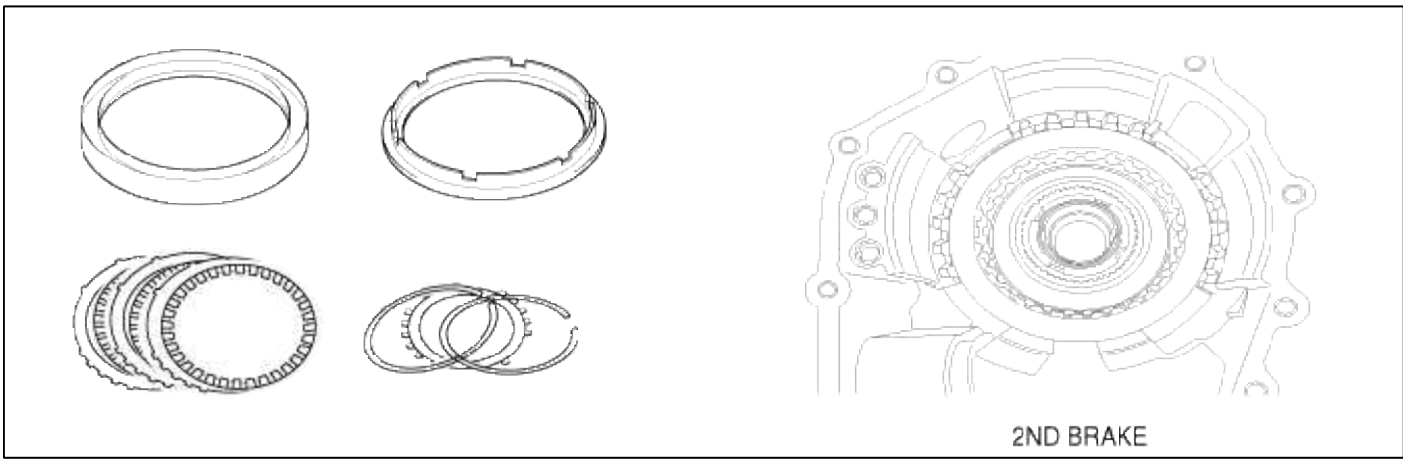


FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

Automatic Transaxle System > Troubleshooting > P0732

COMPONENT LOCATION



GENERAL DESCRIPTION

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 output speed is 1000 rpm and the 2nd gear ratio is 1.529, then the input speed is 1,529 rpm.

DTC DESCRIPTION

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.

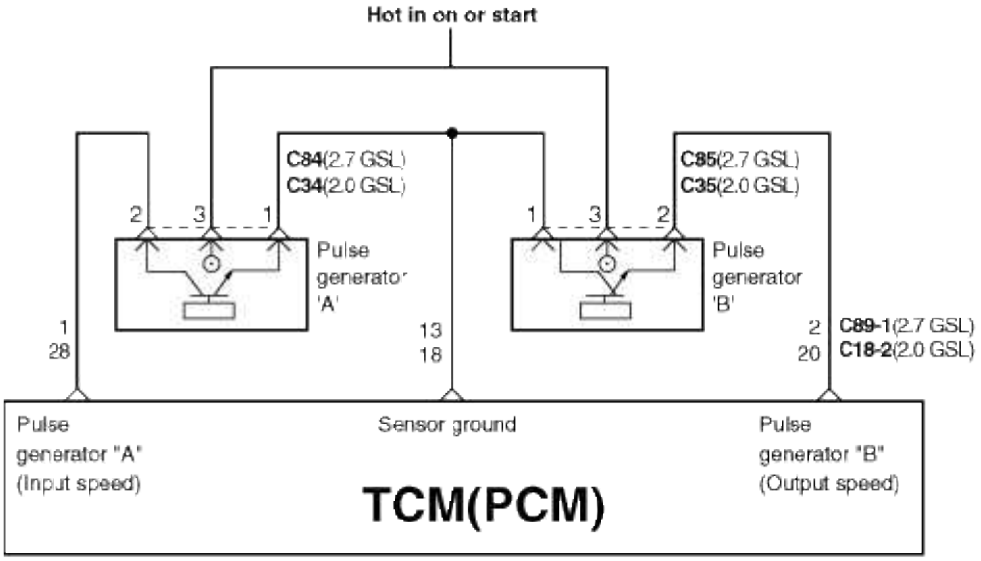
DTC DETECTING CONDITION

[2.7 GSL]/ [2.0 GSL]

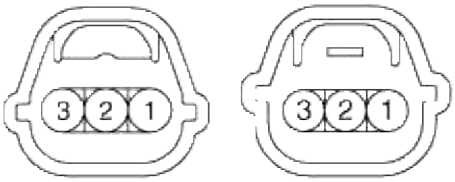
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 2nd gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or 2nd brake
Enable Conditions	• Engine speed >450rpm • Output speed >350rpm • Shift stage 2nd. gear • Input speed >0rpm • A/T oil temp sensor voltage <4.5V • Voltage of Battery >10V • TRANSAXLE RANGE SWITCH is normal	
Threshold value	• input speed/2nd gear ratio - output speed|≥200rpm /2nd. gear ratio	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3 rd gear. (If diagnosis code P0732 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

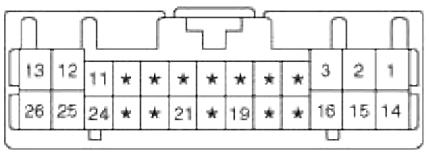


[Harness Connector]

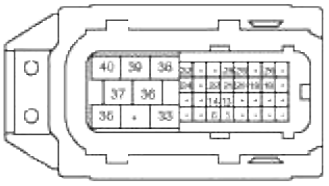


C84(2.7 GSL)
C34(2.0 GSL)

C85(2.7 GSL)
C35(2.0 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Input Shaft Speed Sensor]

Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.1 C18-2 No.28	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

[Output Shaft Speed Sensor]

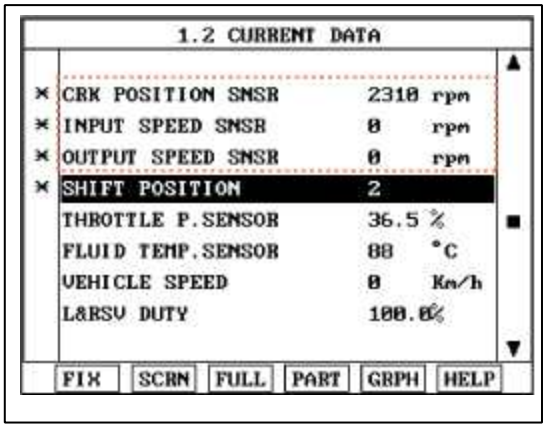
Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.2 C18-2 No.20	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

MONITOR SCANTOOL DATA

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 "2".

Specification :
2.0(GSL) : 2400~3000rpm
2.7(GSL) : 2100~2700rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					●	
R			●		●	
N					●	
D1	●				●	○
D2	●			●		
D3	●	●				
D4		●		●		

Low & Reverse Brake is released When the Vehicle speed over the 5 MPH(7Km/h).

Stall test procedure in D2 and reason

Procedure

A. Warm up the engine

B. 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 D2

Reason for stall test

A. If there is are mechanical defaults in A/T, all slippage occurs in the torque converter.

B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.

C. If 2nd brake system(2nd gear operating part) has faults, input speed revolution will be out of specification.

D. If wheels pin occurs, the applied brake force is not adequate. Retry using more brake force.

5. Is "STALL TEST " within specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Go to "Component Inspection" procedure.

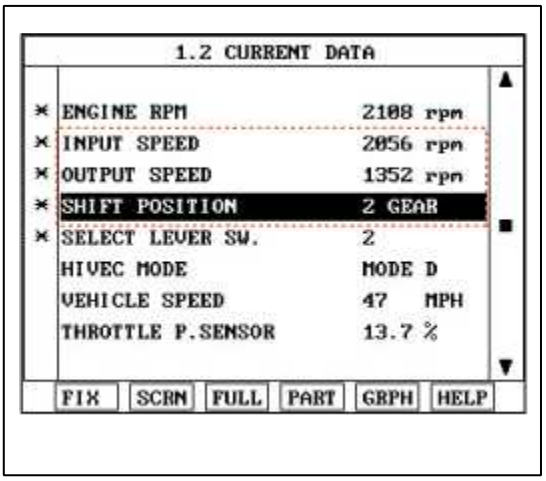
CAUTION

- 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 : 80~100°C (176~212°F).
  - Engine coolant temperature : 80~100°C (176~212°F).
- 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

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



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

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

Specification : shown below

Measurement condition			Standard hydraulic pressure kPa (psi)					
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low and reverse brake pressure	Second brake pressure	Torque converter pressure
P	-	2,500	-	-	-	310-390 (45-56)	-	250-350 (36-56)
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	500-700 (185-256)
N	2,500	-	-	-	-	310-390 (45-56)	-	250-390 (36-56)
D	1st gear	2,500	1,010-1,050 (146-152)	-	-	1,010-1,050 (146-152)	-	500-700 (73-101)
	2nd gear	2,500	1,010-1,050 (146-152)	-	-	-	1,010-1,050 (146-152)	500-700 (73-101)
	3rd gear	2,500	590-690 (85-100)	-	590-690 (85-100)	-	-	450-650 (65-94)
	4th gear	2,500	-	-	590-690 (85-100)	-	590-690 (85-100)	450-650 (65-94)

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

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.

SIGNAL WAVEFORM

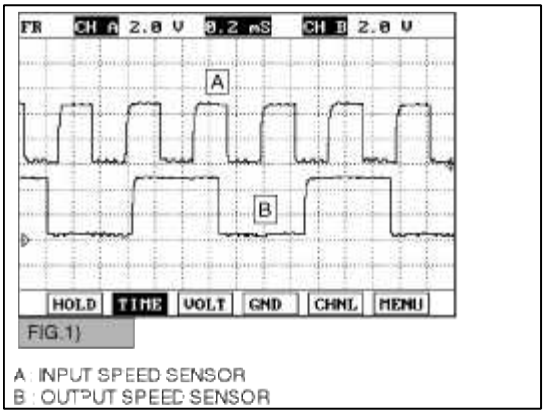
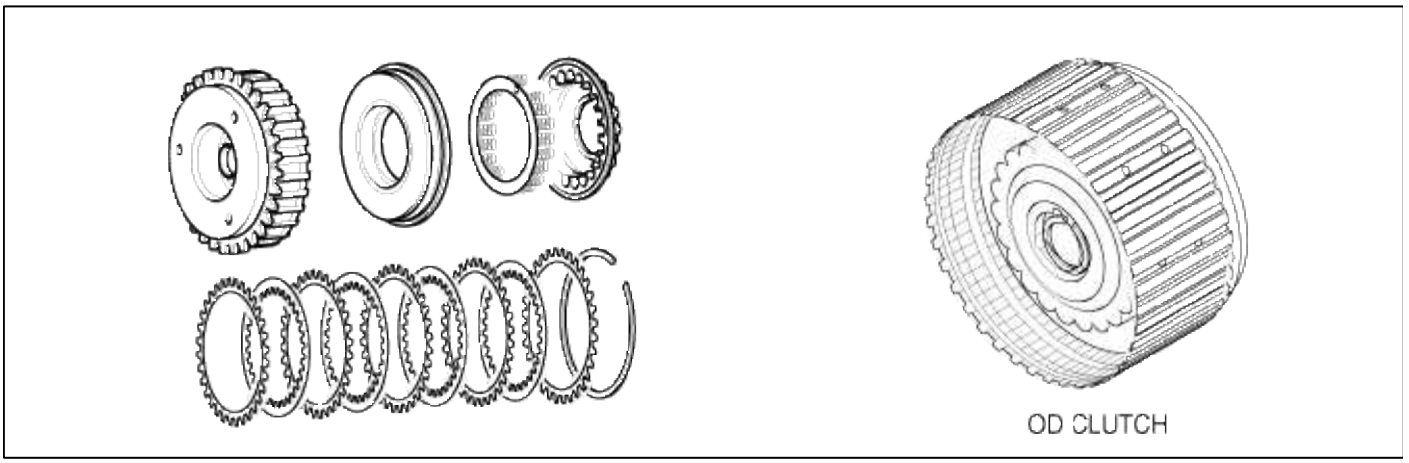


FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

Automatic Transaxle System > Troubleshooting > P0733

COMPONENT LOCATION



GENERAL DESCRIPTION

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 output speed is 1,000 rpm and the 3rd gear ratio is 1.000, then the input speed is 1,000 rpm.

DTC DESCRIPTION

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.

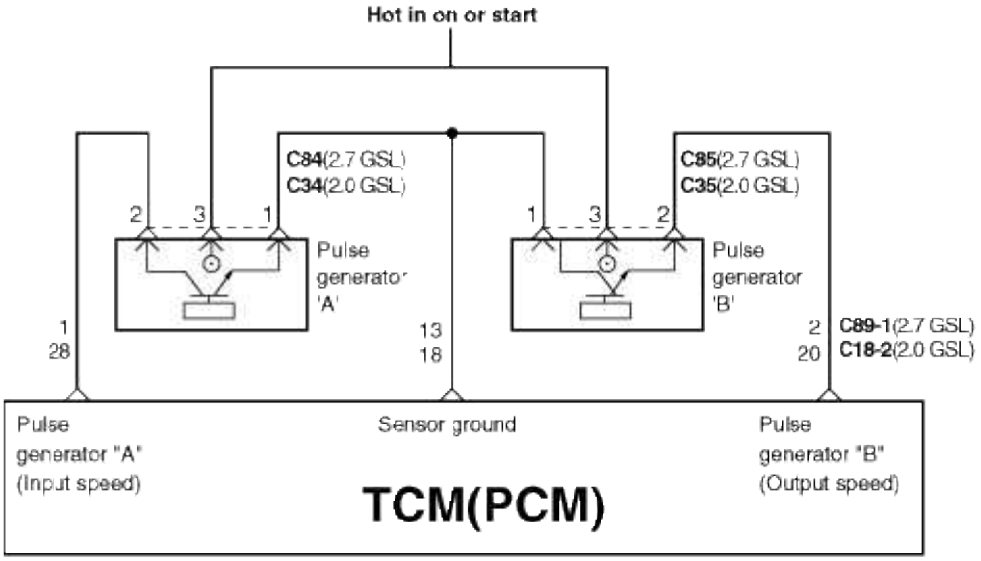
DTC DETECTING CONDITION

[2.7 GSL]/ [2.0 GSL]

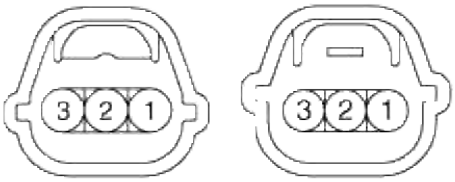
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 3rd gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or OD clutch
Enable Conditions	• Engine speed >450rpm • Output speed >350rpm • Shift stage 3rd. gear • Input speed >0rpm • A/T oil temp sensor voltage <4.5V • Voltage of Battery >10V • TRANSAXLE RANGE SWITCH is normal	
Threshold value	• input speed/3rd gear ratio - output speed|≥200rpm /3rd. gear ratio	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0733 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

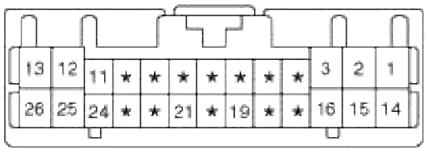


[Harness Connector]

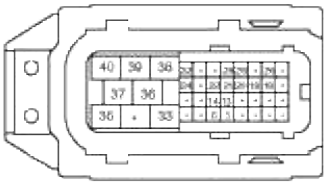


C84(2.7 GSL)
C34(2.0 GSL)

C85(2.7 GSL)
C35(2.0 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Input Shaft Speed Sensor]

Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.1 C18-2 No.28	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

[Output Shaft Speed Sensor]

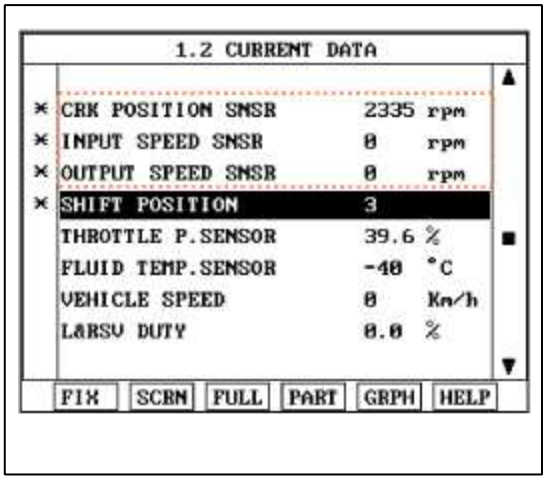
Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.2 C18-2 No.20	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

MONITOR SCANTOOL DATA

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. Disconnect the solenoide valve connector and perform the "STALL TEST".

Specification :
2.0(GSL) : 2400~3000rpm
2.7(GSL) : 2100~2700rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					●	
R			●		●	
N					●	
D1	●				●	○
D2	●			●		
D3	●	●				
D4		●		●		

Low & Reverse Brake is released When the Vehicle speed over the 5 MPH(7Km/h).

Stall test procedure in D3 and reason

Procedure

A. Warm up the engine

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

Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in torque converter.

B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.

C. If OD clutch system(3rd gear operating part) has faults, input speed revolution will be out of specification.

D. If output speed revolution is output. It means that the foot brake force is not applied fully. Retesting using greater braking force is required.

5. Is "STALL TEST " within specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Go to "Component Inspection" procedure.

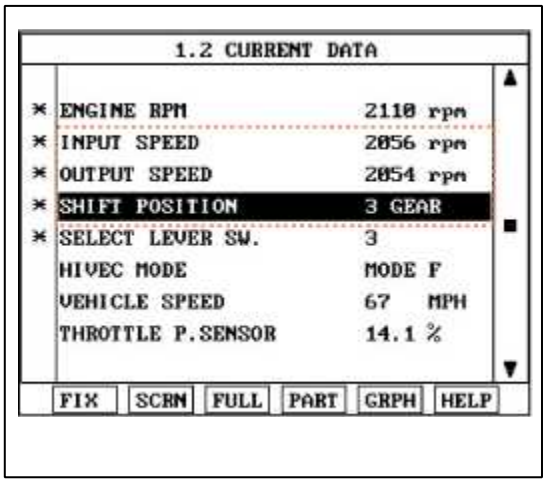
CAUTION

- 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 : 80~100°C (176~212°F).
  - Engine coolant temperature : 80~100°C (176~212°F).
- 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 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 rpm to let the A/T fluid cool down before carrying out subsequent tests.

SIGNAL CIRCUIT INSPECTION

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



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

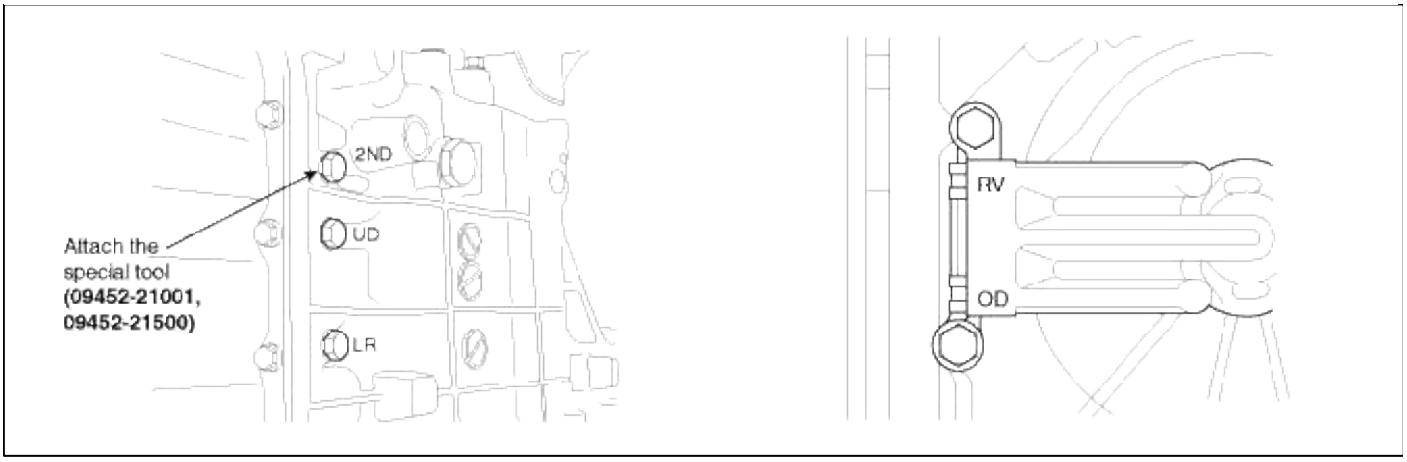
YES

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



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

Specification : shown below

Measurement condition			Standard hydraulic pressure kPa (psi)					
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low and reverse brake pressure	Second brake pressure	Torque converter pressure
P	-	2,500	-	-	-	310-390 (45-56)	-	250-350 (36-56)
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	500-700 (185-256)
N	2,500	-	-	-	-	310-390 (45-56)	-	250-390 (36-56)
D	1st gear	2,500	1,010-1,050 (146-152)	-	-	1,010-1,050 (146-152)	-	500-700 (73-101)
	2nd gear	2,500	1,010-1,050 (146-152)	-	-	-	1,010-1,050 (146-152)	500-700 (73-101)
	3rd gear	2,500	590-690 (85-100)	-	590-690 (85-100)	-	-	450-650 (65-94)
	4th gear	2,500	-	-	590-690 (85-100)	-	590-690 (85-100)	450-650 (65-94)

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

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.

SIGNAL WAVEFORM

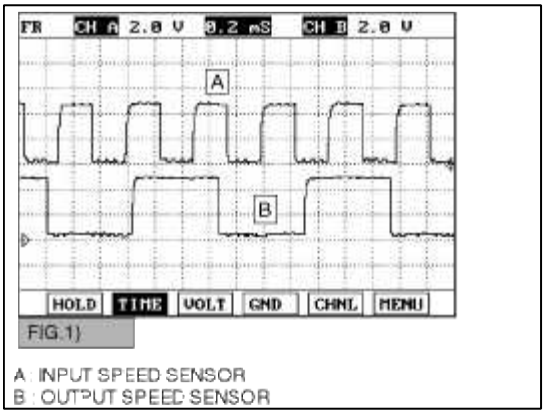
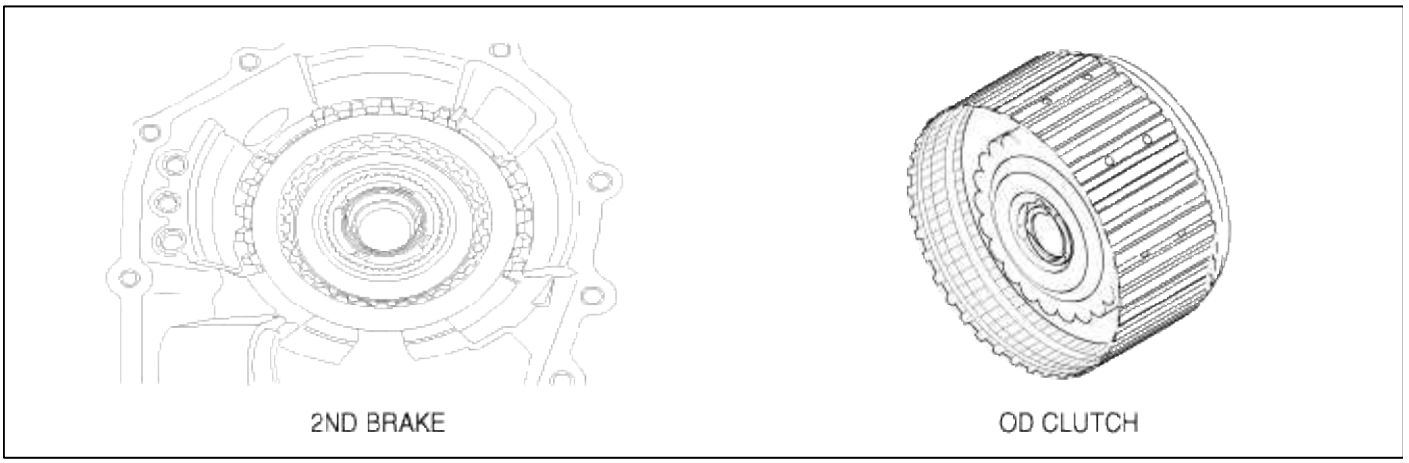


FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

Automatic Transaxle System > Troubleshooting > P0734

COMPONENT LOCATION



GENERAL DESCRIPTION

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 output speed is 1,000 rpm and the 4th gear ratio is 0.712, then the input speed is 712 rpm.

DTC DESCRIPTION

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.

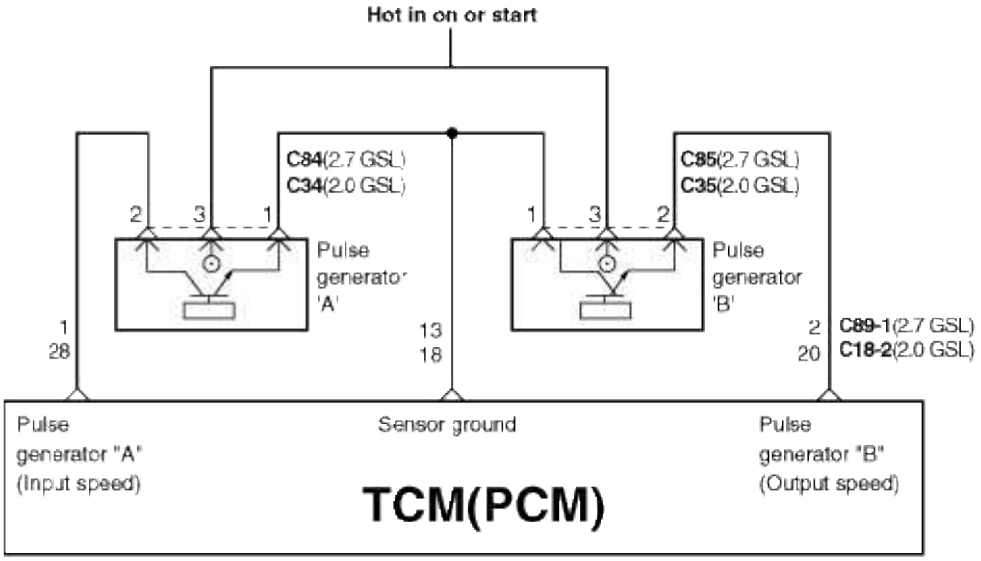
DTC DETECTING CONDITION

[2.7 GSL]/ [2.0 GSL]

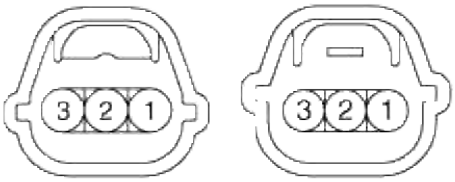
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• 4th gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or 2nd brake
Enable Conditions	• Engine speed >450rpm • Output speed >900rpm • Shift stage 4th. gear • Input speed >0rpm • A/T oil temp sensor voltage <4.5V • Voltage of Battery >10V • TRANSAXLE RANGE SWITCH is normal	
Threshold value	• input speed/4th gear ratio - output speed|≥200rpm /4th. gear ratio	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0734 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

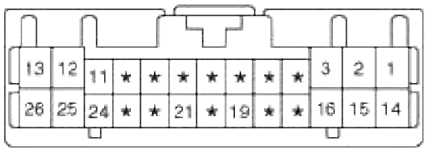


[Harness Connector]

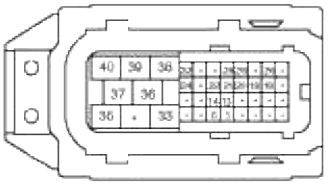


C84(2.7 GSL)
C34(2.0 GSL)

C85(2.7 GSL)
C35(2.0 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Input Shaft Speed Sensor]

Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.1 C18-2 No.28	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

[Output Shaft Speed Sensor]

Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.2 C18-2 No.20	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

MONITOR SCANTOOL DATA

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

OPERATING ELEMENT OF EACH SHIFTING RANGE

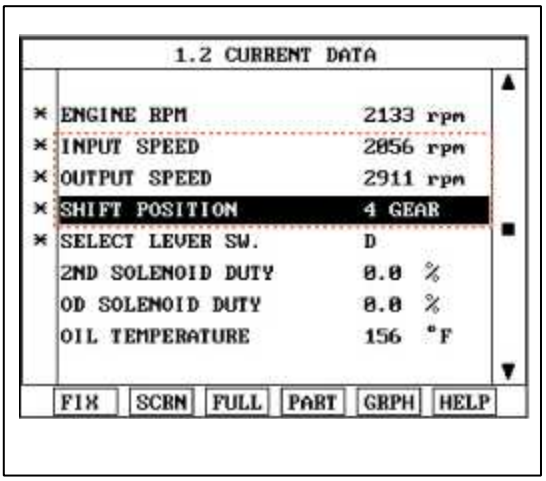
	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					●	
R			●		●	
N					●	
D1	●				●	○
D2	●			●		
D3	●	●				
D4		●		●		

Low & Reverse Brake is released When the Vehicle speed over the 5 MPH(7Km/h).

SIGNAL CIRCUIT INSPECTION

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 while driving the vehicle on a level road.

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



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

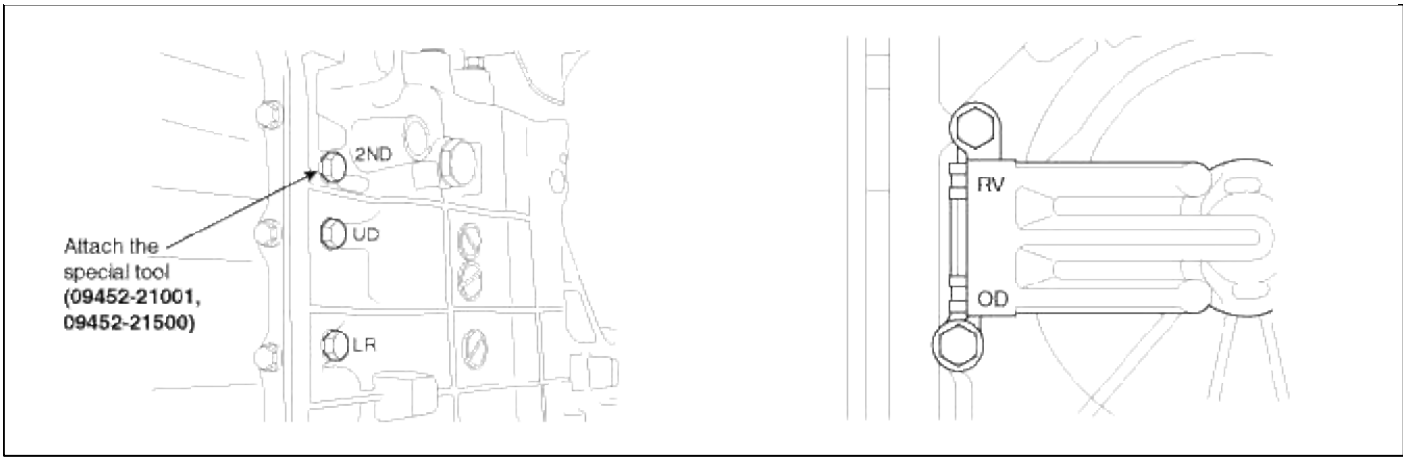
YES

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



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

Specification : shown below

Measurement condition			Standard hydraulic pressure kPa (psi)					
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low and reverse brake pressure	Second brake pressure	Torque converter pressure
P	-	2,500	-	-	-	310-390 (45-56)	-	250-350 (36-56)
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	500-700 (185-256)
N	2,500	-	-	-	-	310-390 (45-56)	-	250-390 (36-56)
D	1st gear	2,500	1,010-1,050 (146-152)	-	-	1,010-1,050 (146-152)	-	500-700 (73-101)
	2nd gear	2,500	1,010-1,050 (146-152)	-	-	-	1,010-1,050 (146-152)	500-700 (73-101)
	3rd gear	2,500	590-690 (85-100)	-	590-690 (85-100)	-	-	450-650 (65-94)
	4th gear	2,500	-	-	590-690 (85-100)	-	590-690 (85-100)	450-650 (65-94)

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

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.

SIGNAL WAVEFORM

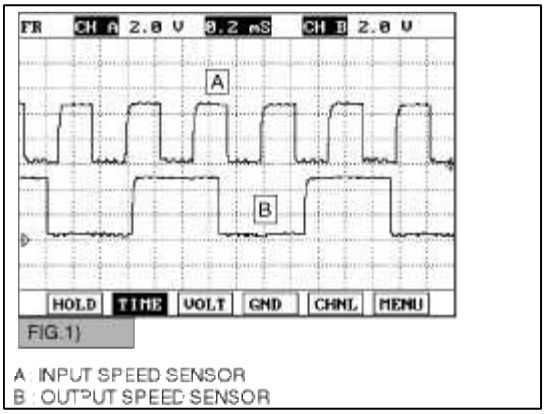
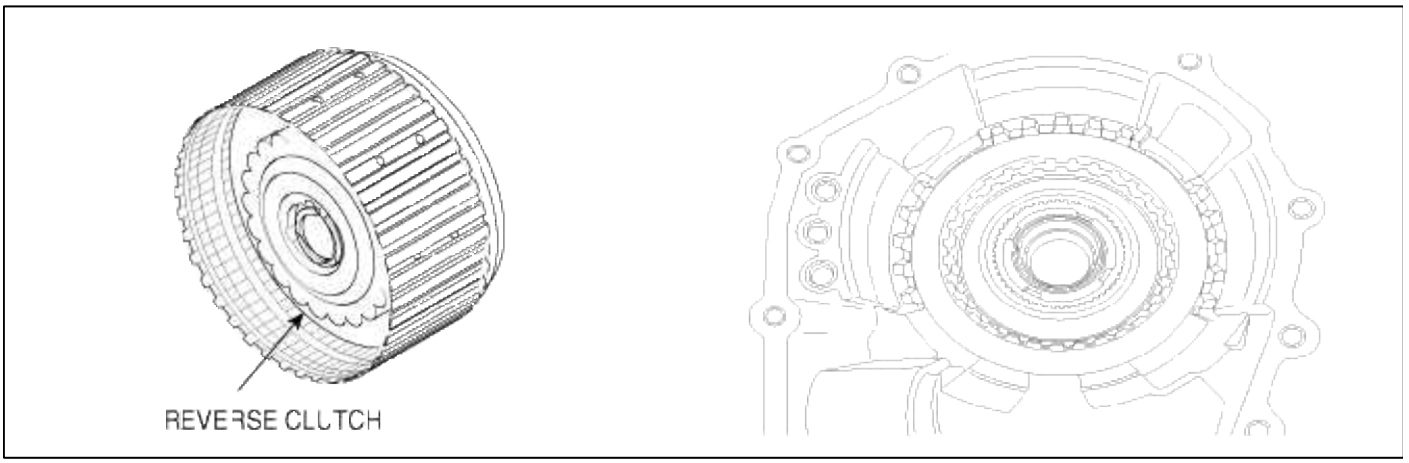


FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

Automatic Transaxle System > Troubleshooting > P0736

COMPONENT LOCATION



GENERAL DESCRIPTION

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 output speed is 1,000 rpm and the reverse gear ratio is 2.480, then the input speed is 2,480 rpm.

DTC DESCRIPTION

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.

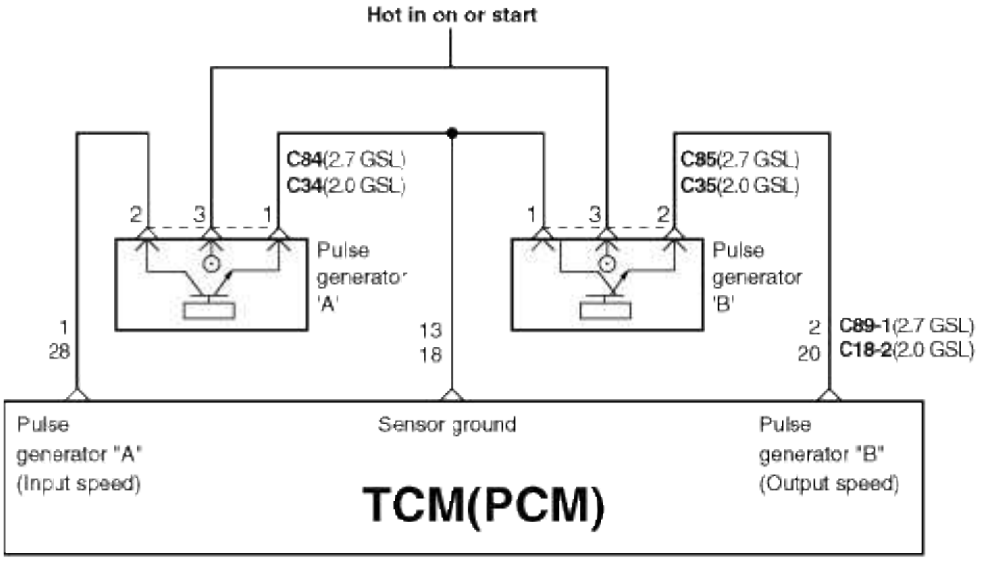
DTC DETECTING CONDITION

[2.7 GSL]/ [2.0 GSL]

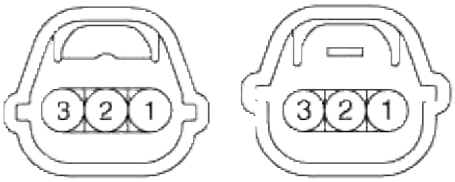
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Reverse gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty RVS clutch or L/R brak
Enable Conditions	• Engine speed >450rpm • Output speed >900rpm • Shift stage Rev. gear • Input speed >0rpm • A/T oil temp sensor voltage <4.5V • Voltage of Battery >10V • TRANSAXLE RANGE SWITCH is normal	
Threshold value	• input speed/Rev gear ratio - output speed|≥200rpm /Rev. gear ratio	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0736 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM

[Circuit Diagram]

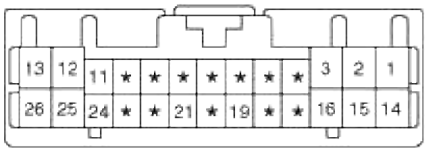


[Harness Connector]

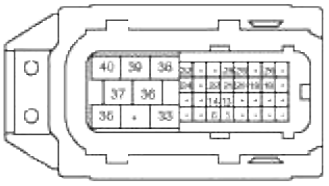


C84(2.7 GSL)
C34(2.0 GSL)

C85(2.7 GSL)
C35(2.0 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Input Shaft Speed Sensor]

Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.1 C18-2 No.28	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

[Output Shaft Speed Sensor]

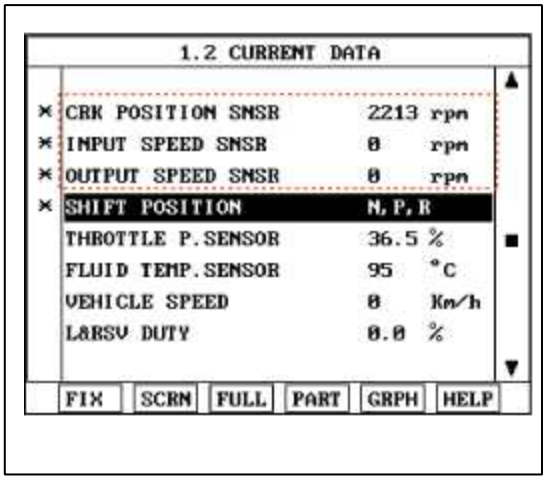
Terminal	Connection	Function
1	C89-1 No.13 C18-2 No.18	Sensor ground
2	C89-1 No.2 C18-2 No.20	Input speed
3	JC14 No.46 JC04 No.46	Hot at all times

MONITOR SCANTOOL DATA

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 "R".

Specification :
2.0(GSL) : 2400~3000rpm
2.7(GSL) : 2100~2700rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC
P					●	
R			●		●	
N					●	
D1	●				●	○
D2	●			●		
D3	●	●				
D4		●		●		

Low & Reverse Brake is released When the Vehicle speed over the 5 MPH(7Km/h).

Stall test procedure in Reverse and reason

Procedure

A. Warm up the engine

B. Fully depress the brake pedal, then place the transaxle gear lever into "R" range. Press and hold the accelerator pedal to the floor for no more than eight seconds while observing the engine, input speed, and output speed RPM values.

* The slippage of REVERSE clutch and L/R brake can be detected by stall test in R range

Reason for stall test

A. If there is no mechanical defaults in A/T, all slippage occurs in the torque converter.

B. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.

C. If reverse clutch and L/R brake system(reverse gear operating parts) has faults, input speed revolution will be out of specification.

D. 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 "Signal Circuit Inspection" procedure.

NO

Go to "Component Inspection" procedure.

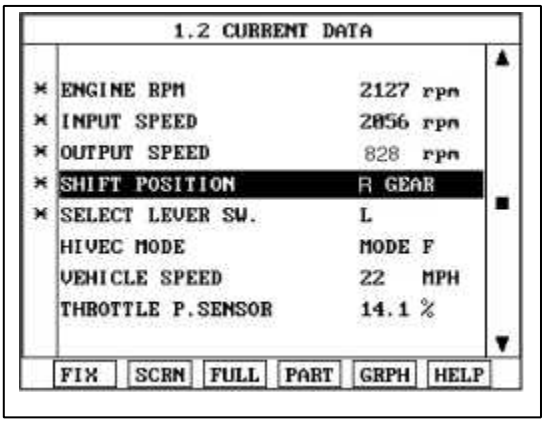
CAUTION

- 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 : 80~100°C (176~212°F).
  - Engine coolant temperature : 80~100°C (176~212°F).
- 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 seconds.
- 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 tests.

SIGNAL CIRCUIT INSPECTION

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 "R" gear.

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



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

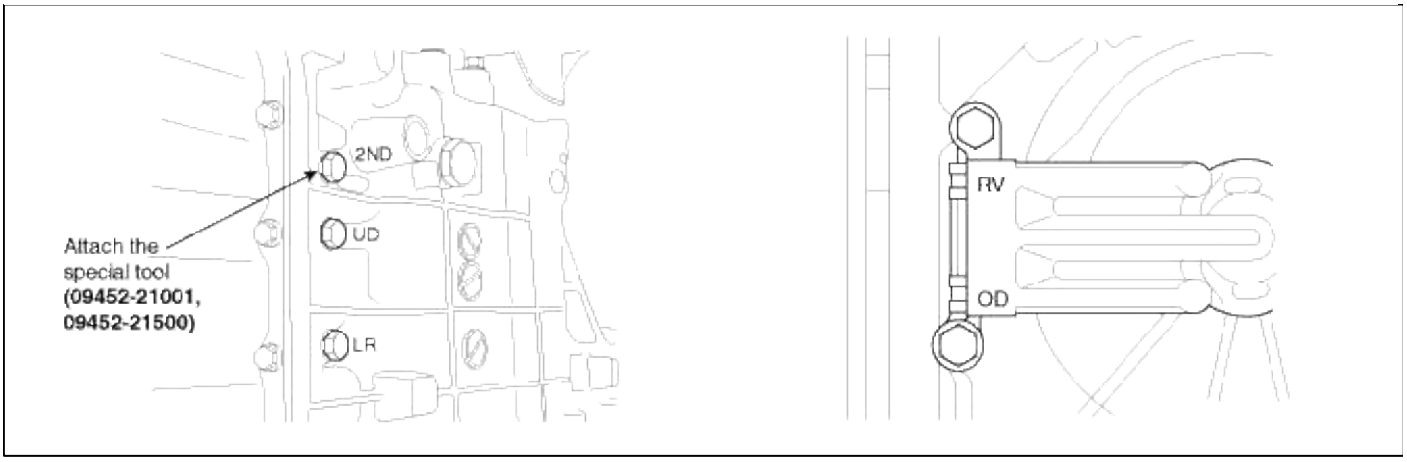
YES

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



1. Connect Oil pressure gauge to "RV" and "LR" port.
2. Engine "ON".
3. Drive a car with gear position R.
4. Compare it with referance data as below.

Specification : shown below

Measurement condition			Standard hydraulic pressure kPa (psi)					
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure	Reverse clutch pressure	Overdrive clutch pressure	Low and reverse brake pressure	Second brake pressure	Torque converter pressure
P	-	2,500	-	-	-	310-390 (45-56)	-	250-350 (36-56)
R	Reverse	2,500	-	1,270-1,770 (185-256)	-	1,270-1,770 (185-256)	-	500-700 (185-256)
N	2,500	-	-	-	-	310-390 (45-56)	-	250-390 (36-56)
D	1st gear	2,500	1,010-1,050 (146-152)	-	-	1,010-1,050 (146-152)	-	500-700 (73-101)
	2nd gear	2,500	1,010-1,050 (146-152)	-	-	-	1,010-1,050 (146-152)	500-700 (73-101)
	3rd gear	2,500	590-690 (85-100)	-	590-690 (85-100)	-	-	450-650 (65-94)
	4th gear	2,500	-	-	590-690 (85-100)	-	590-690 (85-100)	450-650 (65-94)

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

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.

SIGNAL WAVEFORM

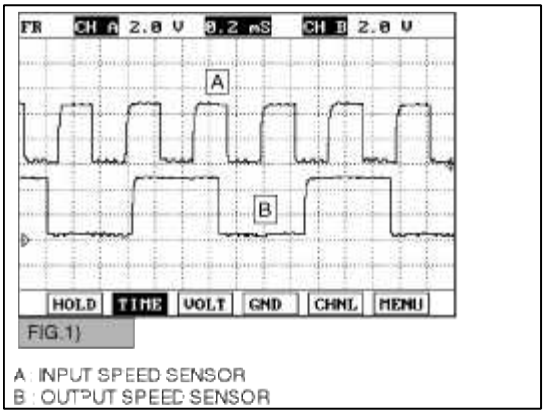


FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

Automatic Transaxle System > Troubleshooting > P0741

GENERAL DESCRIPTION

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

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

[2.7 GSL]

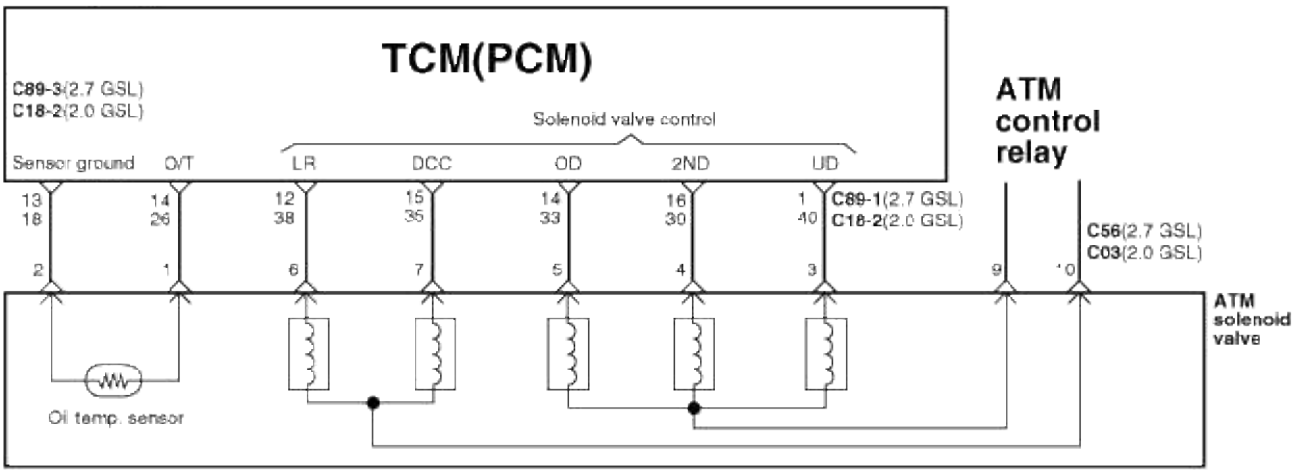
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "OFF"	TORQUE CONVERTER(DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty TCM(PCM)
Enable Conditions	• Throttle position >1.5V • Output speed >1000rpm • Solenoid status OFF • A/T range switch D,SP • Time after TCC release >5secs	
Threshold value	• (rationality-low) Calculated slip (engine speed-input speed)<5rpm or (rationality-high) Calculated slip >-5rpm	
Diagnostic Time	• More than 5sec	
Fail Safe	• Damper clutch abnormal system (If diagnosis code P0741 is output four times, TORQUE CONVERTER(DAMPER) CLUTCH is not controlled by TCM(PCM))	

[2.0 GSL]

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	• During the connect control	
Threshold value	• Detect 2 times the Lock-up clutch control duty=100% for 2sec	
Diagnostic Time	• 1 event	
Fail Safe	• Damper clutch abnormal system (If diagnosis code P0741 is output four times, TORQUE CONVERTER(DAMPER) CLUTCH is not controlled by TCM(PCM))	

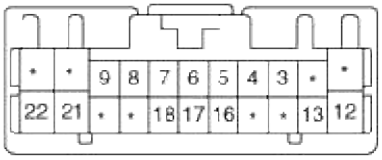
SCHEMATIC DIAGRAM

[Circuit Diagram]

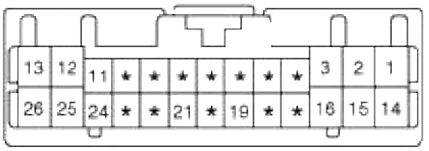


[Harness Connector]

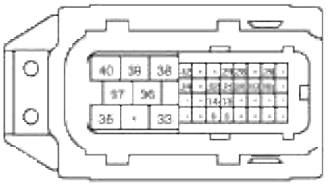
C56(2.7 GSL)
C03(2.0 GSL)



C89-3(2.7 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Connection Information]

Terminal	Connection	Function
1	C89-1 No.14, C18-2 No.26	Oil temp. sensor signal
2	C89-3 No.13, C18-2 No.18	Sensor ground
3	C89-1 No.1, C18-2 No.40	UD solenoid signal
4	C89-1 No.16, C18-2 No.39	2ND solenoid signal
5	C89-1 No.14, C18-2 No.33	OD solenoid signal
6	C89-1 No.12, C18-2 No.38	LR solenoid signal
7	C89-1 No.15, C18-2 No.35	DCC solenoid signal
9	JC14 No.23, JC04 No.23	ATM control relay
10	JC14 No.23, JC104 No.23	ATM control relay

COMPONENT INSPECTION

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?

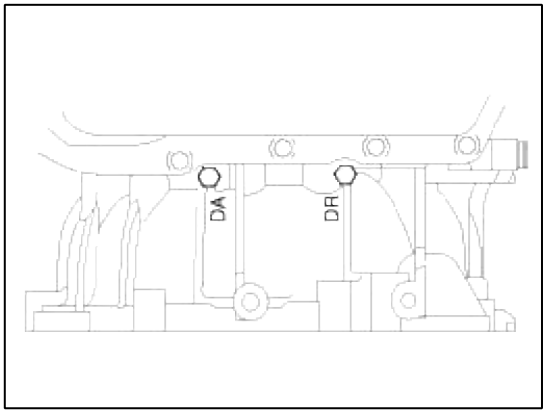
   YES

   Go to "CHECK OIL PRESSURE" as below.

   NO

   Replace "TCC SOLENOID VALVE" as necessary and Go to "Verification Vehicle Repair" procedure.

2. CHECK OIL PRESSURE



   (1) Connect Oil pressure gauge to "DA" 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. 6.1kg/cm²

   (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

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 System > Troubleshooting > P0742

GENERAL DESCRIPTION

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

The TCM(PCM) increases the duty ratio to engage the Damper Clutch by monitoring the slip rpms (difference vlaue beteween engine speed and turbine speed). If a very small amount of slip rpm is maintained though the TCM(PCM) applies 0% duty ratio value, then the TCM(PCM) determines that the Torque Converter Clutch is stuck ON and sets this code.

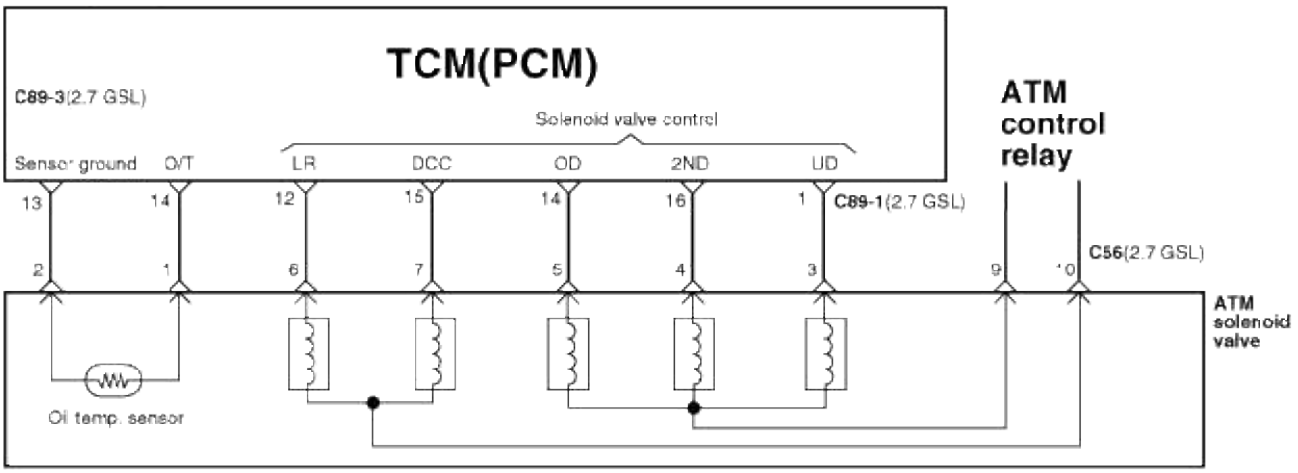
DTC DETECTING CONDITION

[2.7 GSL]

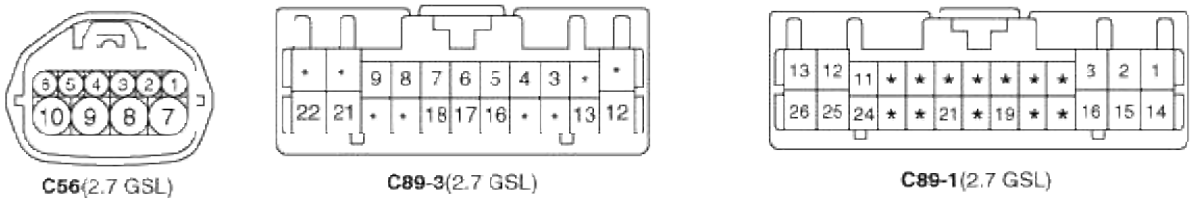
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "ON"	TORQUE CONVERTER(DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty TCM(PCM)
Enable Conditions	• Throttle position >1.5V • Output speed >1000rpm • Solenoid status OFF • A/T range switch D,SP • Time after TCC release >5secs	
Threshold value	• (rationality-low) Calculated slip (engine speed-input speed)<5rpm or (rationality-high) Calculated slip >-5rpm	
Diagnostic Time	• More than 5sec	
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

[Circuit Diagram]



[Harness Connector]



C56(2.7 GSL) C89-3(2.7 GSL) C89-1(2.7 GSL)

[Connection Information]

Terminal	Connection	Function
1	C89-1 No.14	Oil temp. sensor signal
2	C89-3 No.13	Sensor ground
3	C89-1 No.1	UD solenoid signal
4	C89-1 No.16	2ND solenoid signal
5	C89-1 No.14	OD solenoid signal
6	C89-1 No.12	LR solenoid signal
7	C89-1 No.15	DCC solenoid signal
9	JC14 No.23	ATM control relay
10	JC14 No.23	ATM control relay

COMPONENT INSPECTION

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?

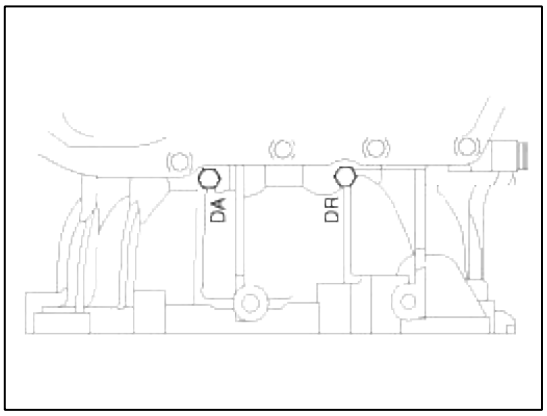
YES

Go to "CHECK OIL PRESSURE" as below.

NO

Replace "TCC SOLENOID VALVE" as necessary and Go to "Verification Vehicle Repair" procedure.

2. CHECK OIL PRESSURE



(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. 6.1kg/cm²

(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

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

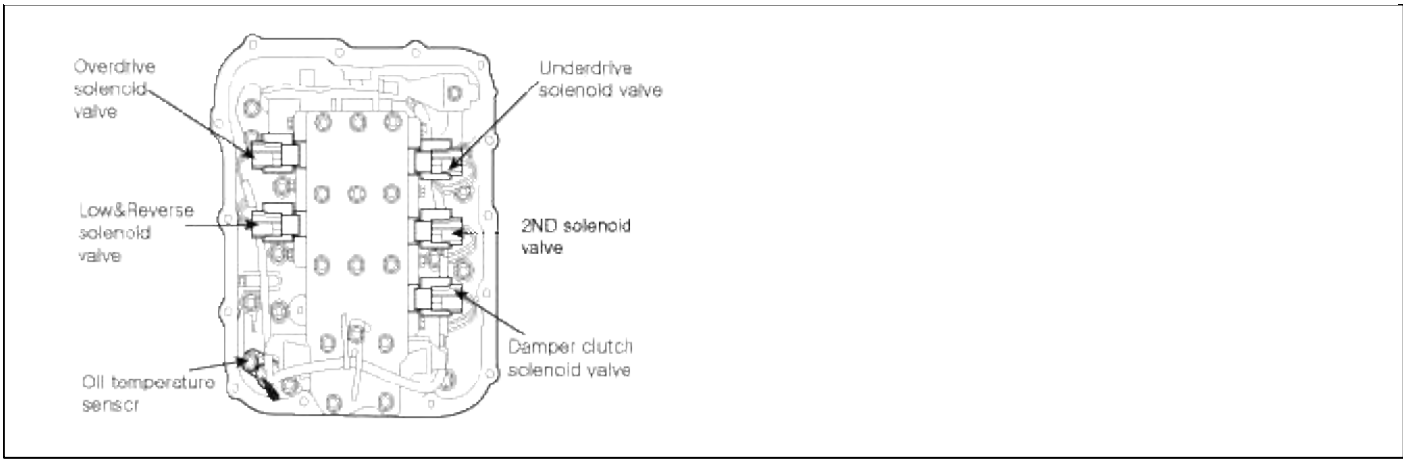
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P0743

COMPONENT LOCATION



GENERAL DESCRIPTION

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

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

[2.7 GSL]

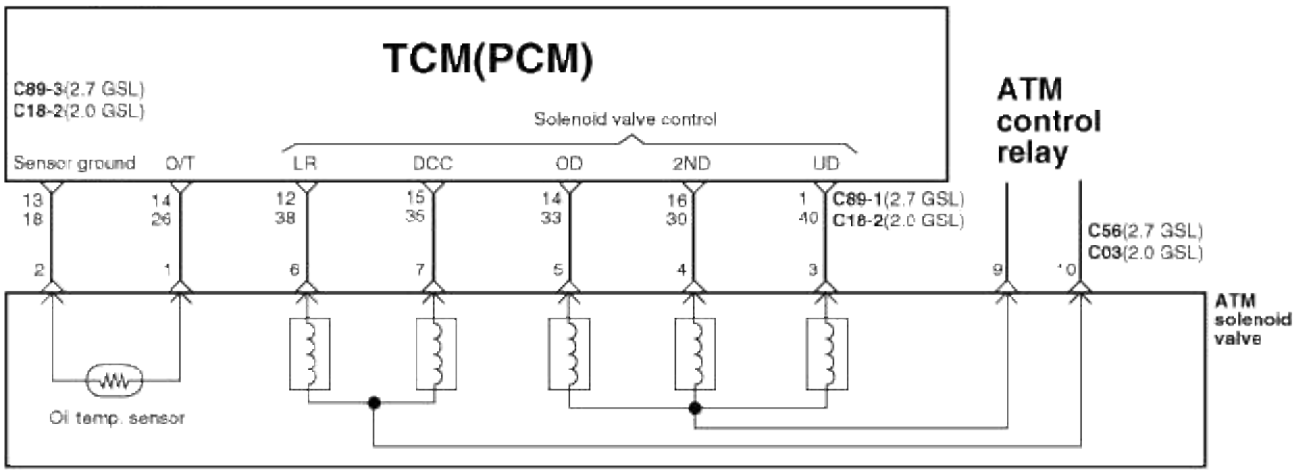
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	TORQUE CONVERTER(DAMPER) CLUTCH : TCC • Open or short in circuit • Faulty TCC SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• Solenoid status Either solid ON or OFF • Voltage of Battery >10V	
Threshold value	• Voltage <3V	
Diagnostic Time	• more than 320 ms	
Fail Safe	• Locked in 3 rd gear.(Control relay off)	

[2.0 GSL]

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	TORQUE CONVERTER(DAMPER) CLUTCH : TCC • Open or short in circuit • Faulty TCC SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• 16V > Voltage Battery >10V • In gear state(no gear shifting) 500msec is passed from turn on the relay	
Threshold value	• Feedback voltage from DCC control solenoide > Vb-2V and DCC control duty is 100% • Feedback voltage from DCC control solenoide ≤ 5.5V and DCC control duty is 0%	
Diagnostic Time	• More than 500 ms	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

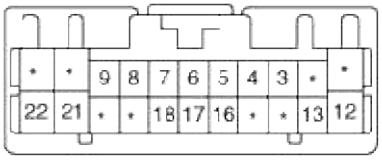
SCHEMATIC DIAGRAM

[Circuit Diagram]

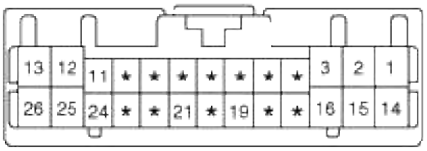


[Harness Connector]

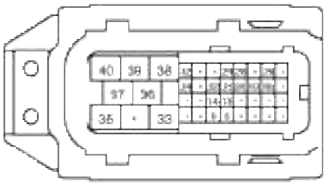
C56(2.7 GSL)
C03(2.0 GSL)



C89-3(2.7 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Connection Information]

Terminal	Connection	Function
1	C89-1 No.14, C18-2 No.26	Oil temp. sensor signal
2	C89-3 No.13, C18-2 No.18	Sensor ground
3	C89-1 No.1, C18-2 No.40	UD solenoid signal
4	C89-1 No.16, C18-2 No.39	2ND solenoid signal
5	C89-1 No.14, C18-2 No.33	OD solenoid signal
6	C89-1 No.12, C18-2 No.38	LR solenoid signal
7	C89-1 No.15, C18-2 No.35	DCC solenoid signal
9	JC14 No.23, JC04 No.23	ATM control relay
10	JC14 No.23, JC104 No.23	ATM control relay

TERMINAL & 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 then go to "Verification of Vehicle Repair" procedure.

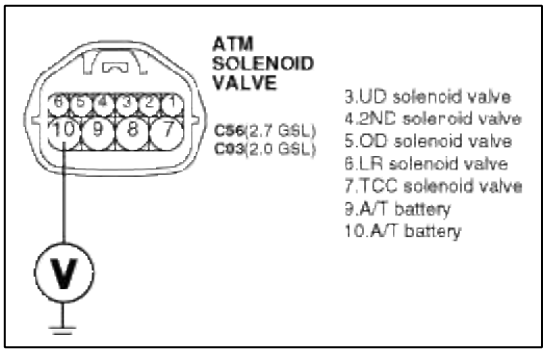
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between teminal "10" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

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



4. Is voltage within specifications?

YES

Go to "Signal circuit inspection" procedure.

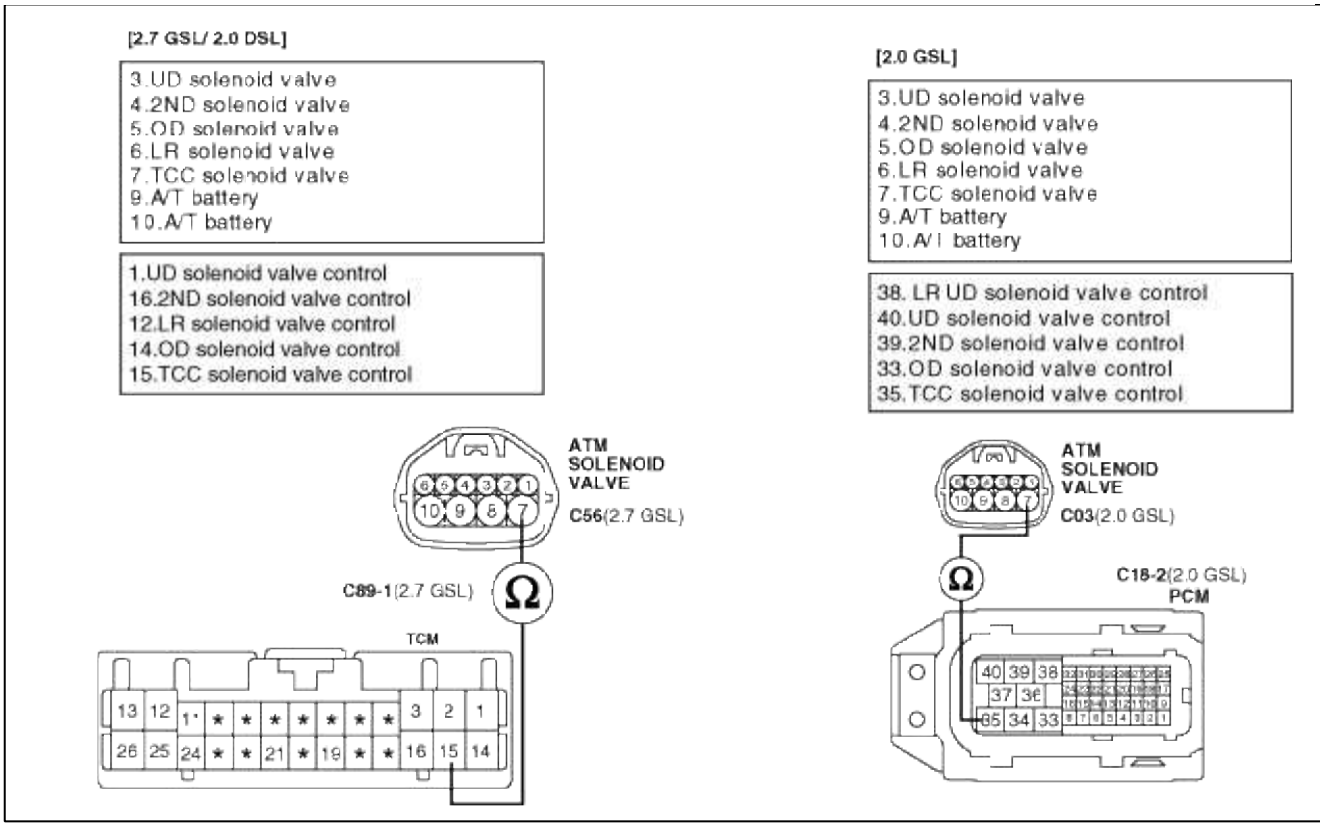
NO

Check that A/T-30A Fuse in engine room junction is installed or not blown.
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection.
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector and "TCM(PCM)" connector.
   (3) Measure resistance between terminal "7" of the ATM SOLENOID VALVE harness connector and terminal " of the TCM(PCM) harness connector.

Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

Go to "Check signal circuit short Inspection" procedure.

NO

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

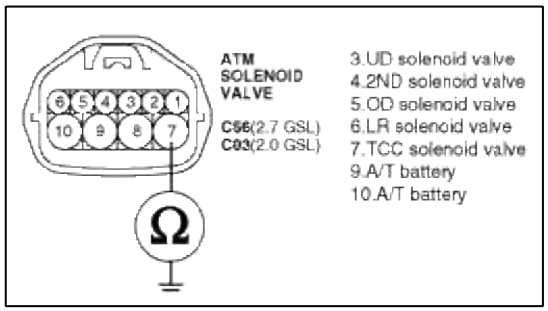
2. Check signal circuit short inspection

(1) Ignition "OFF".

(2) Disconnect "A/T SOLENOID VALVE" connector and "TCM(PCM)" connector

(3) Measure resistance between terminal "7" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

Go to "Component Inspection" procedure.

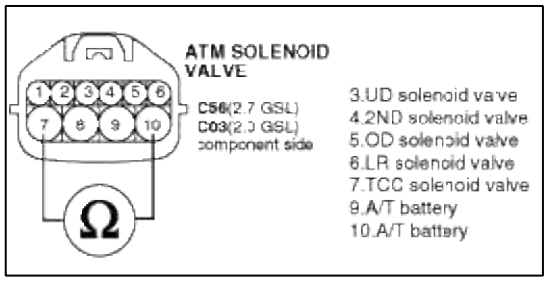
NO

Check for short to ground in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "7" and terminal "10" of the ATM SOLENOID VALVE harness connector.

   Specification: Approximately 2.7~3.4 Ω [20°C(68°F)]



   (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

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

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. 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.

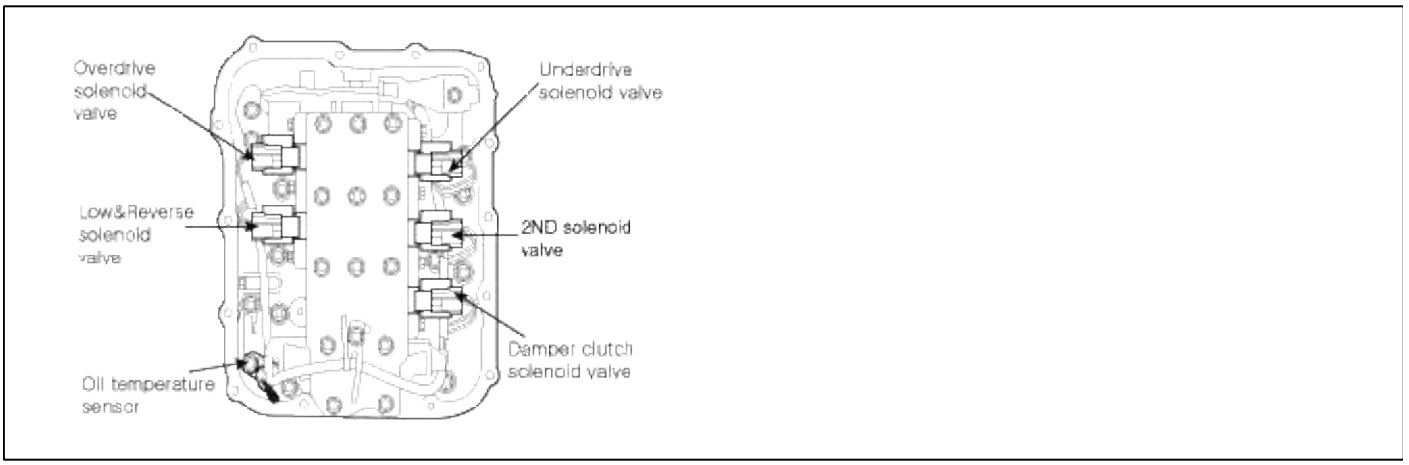
SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -30°C~130°C(-22~266°F)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C(-4°F) above)
  - DCC : 30.64Hz
- Internal resistance : 2.7~3.4Ω[20°C(68°F)]
- Surge voltage : 56 V

Automatic Transaxle System > Troubleshooting > P0750

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission by utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The HIVEC Automatic Transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions). The LR Brake is engaged in the 1st gear and reverse gear positions.

DTC DESCRIPTION

The TCM(PCM) checks the Low and Reverse 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 the Low and Reverse control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

[2.7 GSL]

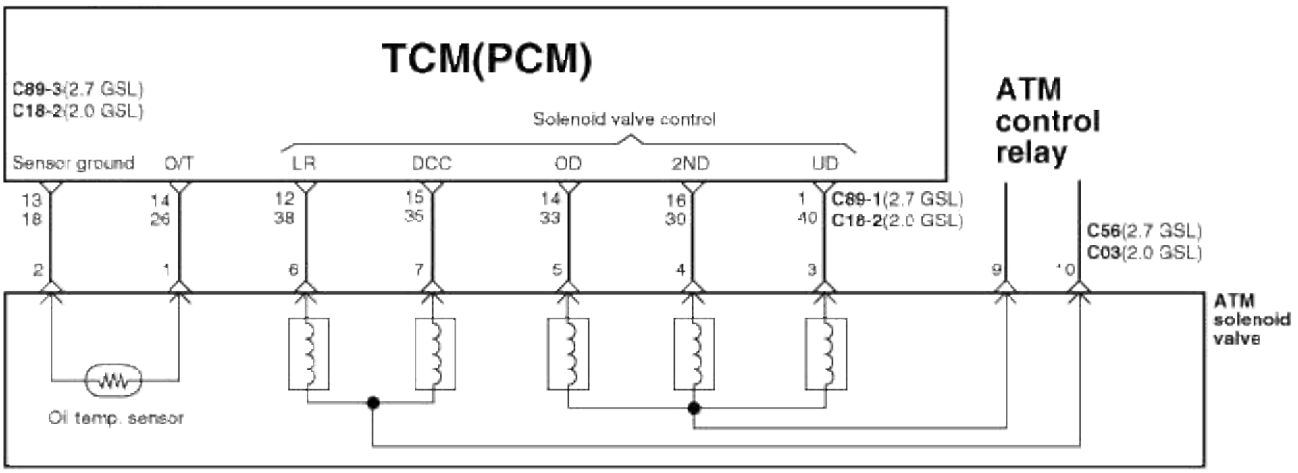
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty LR SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• Solenoid status Either solid ON or OFF • Voltage of Battery >10V	
Threshold value	• Voltage <3V	
Diagnostic Time	• More than 320 ms	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

[2.0 GSL]

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty LR SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• 16V > Voltage Battery >10V • In gear state(no gear shifting) 500msec is passed from turn on the relay	
Threshold value	• Feedback voltage from LR control solenoide > Vb-2V and LR control duty is 0% • Feedback voltage from LR control solenoide ≤ 5.5V and LR control duty is 100%	
Diagnostic Time	• More than 320 ms	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

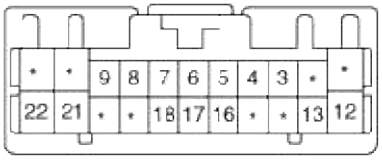
SCHEMATIC DIAGRAM

[Circuit Diagram]

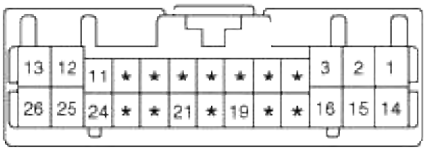


[Harness Connector]

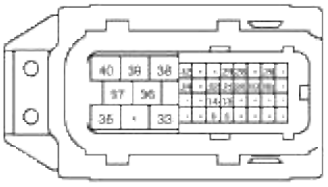
C56(2.7 GSL)
C03(2.0 GSL)



C89-3(2.7 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Connection Information]

Terminal	Connection	Function
1	C89-1 No.14, C18-2 No.26	Oil temp. sensor signal
2	C89-3 No.13, C18-2 No.18	Sensor ground
3	C89-1 No.1, C18-2 No.40	UD solenoid signal
4	C89-1 No.16, C18-2 No.39	2ND solenoid signal
5	C89-1 No.14, C18-2 No.33	OD solenoid signal
6	C89-1 No.12, C18-2 No.38	LR solenoid signal
7	C89-1 No.15, C18-2 No.35	DCC solenoid signal
9	JC14 No.23, JC04 No.23	ATM control relay
10	JC14 No.23, JC104 No.23	ATM control relay

TERMINAL & 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 then go to "Verification of Vehicle Repair" procedure.

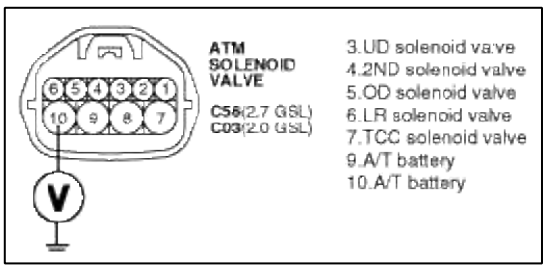
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal"10" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

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



4. Is voltage within specifications?

YES

Go to "Signal circuit inspection" procedure.

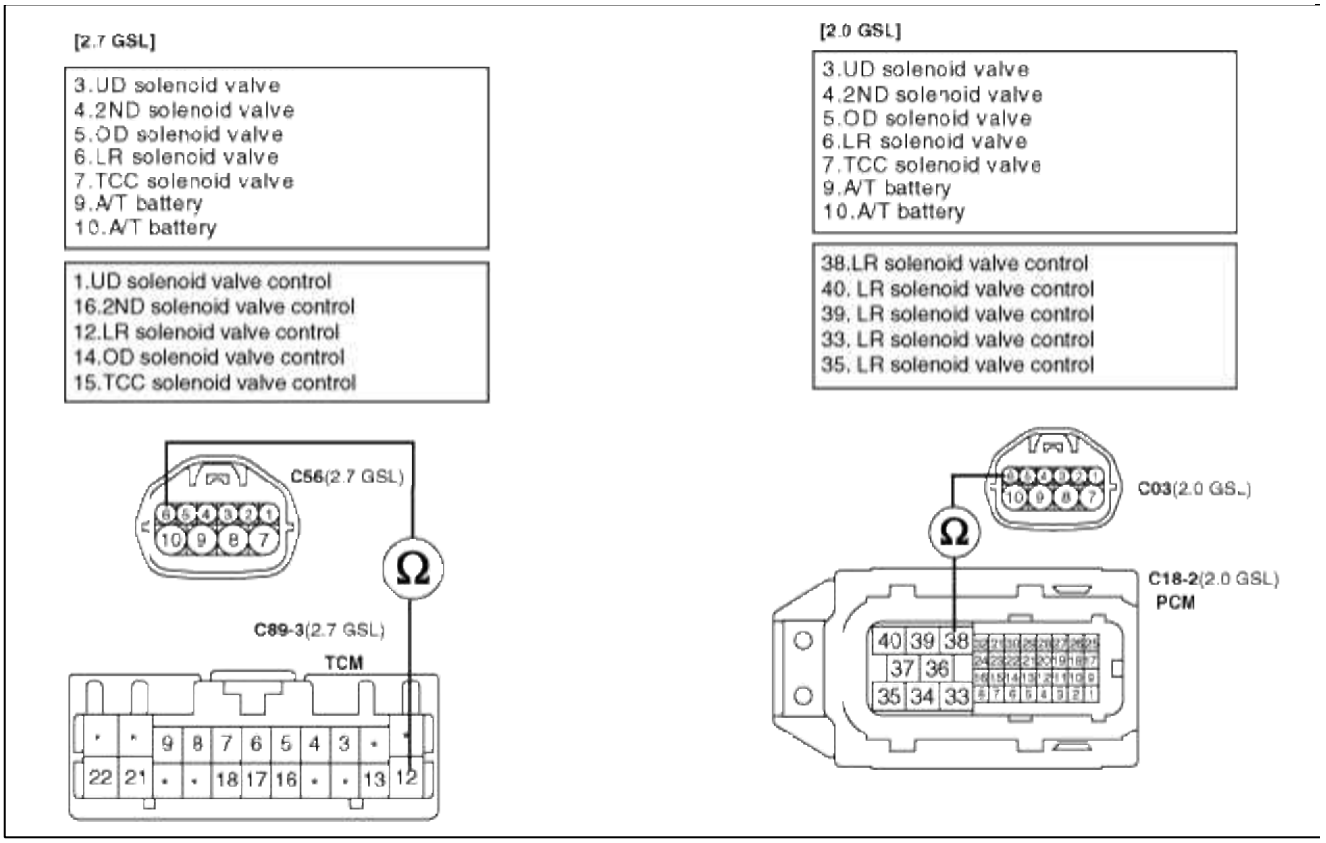
NO

Check that A/T-20A Fuse in engine room junction is installed or not blown.
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector and "PCM/TCM" connector.
   (3) Measure resistance between terminal "6" of the ATM SOLENOID VALVE harness connector and terminal " of the TCM(PCM) harness connector

Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

Go to "Check signal circuit short Inspection" procedure.

NO

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

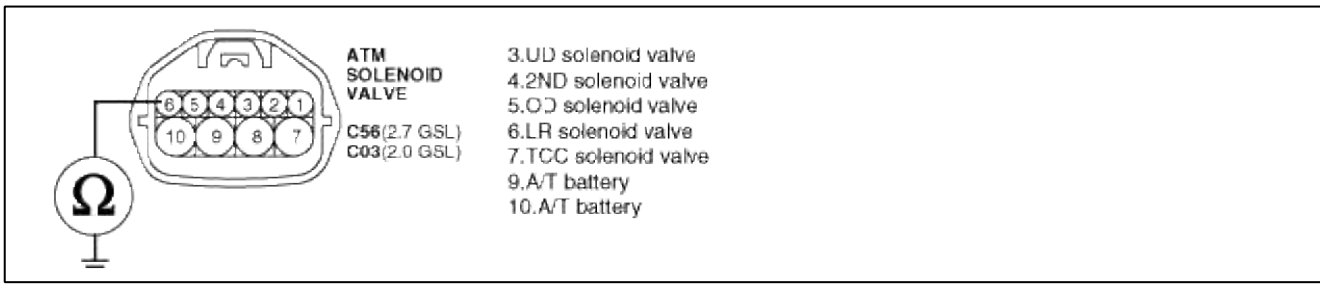
2. Check signal circuit short inspection

(1) Ignition "OFF".

(2) Disconnect "A/T SOLENOID VALVE" connector and "TCM(PCM)" connector.

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

Specification: Infinite



(4) Is resistance within specifications?

YES

Go to "Component Inspection" procedure.

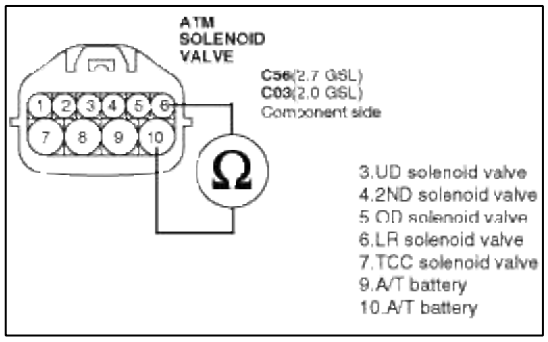
NO

Check for short to ground in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedu

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "6" and terminal "10" of the ATM SOLENOID VALVE harness connector.

   Specification: Approximately 2.7~3.4 Ω [20°C(68°F)]



   (4) Is resistance within specification?

   YES

   Go to "CHECK TCM(PCM)" as below.

   NO

   Replace LR 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 LR 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

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

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. 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.

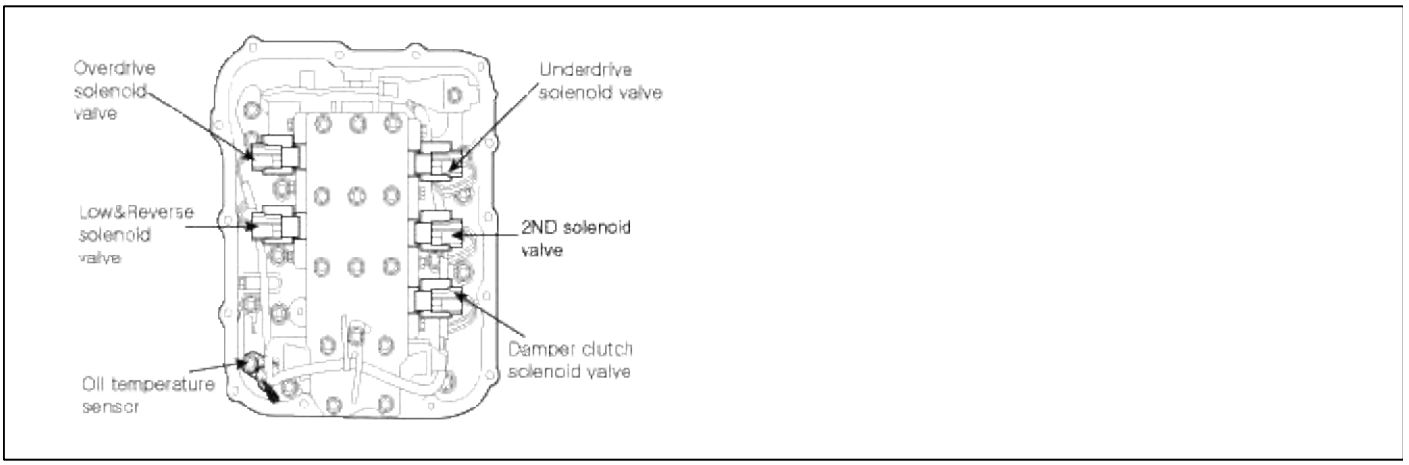
SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
- Internal resistance : 2.7~3.4Ω(68°F or 20°C)
- Surge voltage : 56 V

Automatic Transaxle System > Troubleshooting > P0755

COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission by utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The HIVEC Automatic Transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions). The LR Brake is engaged in the 1st gear and reverse gear positions.

DTC DESCRIPTION

The TCM(PCM) checks the Low and Reverse 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 the Low and Reverse control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

[2.7 GSL]

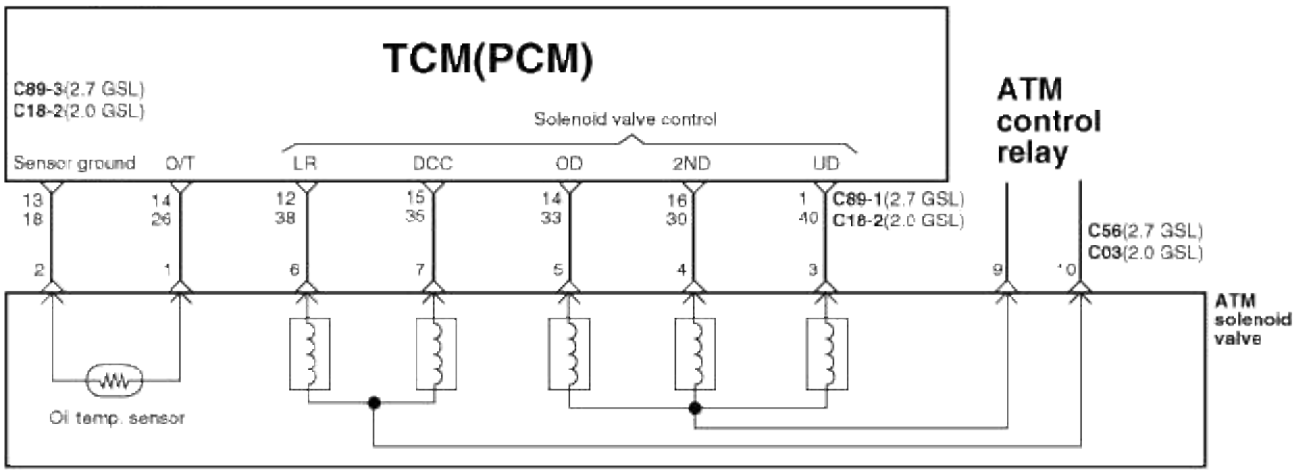
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty UD SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• Solenoid status Either solid ON or OFF • Voltage of Battery >10V	
Threshold value	• Voltage <3V	
Diagnostic Time	• More than 320 ms	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

[2.0 GSL]

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty UD SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• 16V > Voltage Battery >10V • In gear state(no gear shifting) 500msec is passed from turn on the relay	
Threshold value	• Feedback voltage from UD control solenoide > Vb-2V and UD control duty is 0% • Feedback voltage from UD control solenoide ≤ 5.5V and UD control duty is 100%	
Diagnostic Time	• more than 320 ms	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

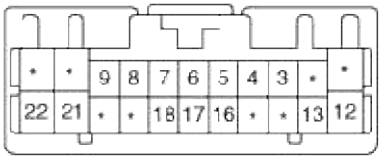
SCHEMATIC DIAGRAM

[Circuit Diagram]

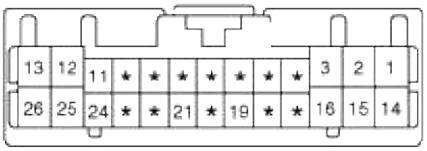


[Harness Connector]

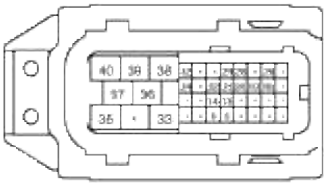
C56(2.7 GSL)
C03(2.0 GSL)



C89-3(2.7 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Connection Information]

Terminal	Connection	Function
1	C89-1 No.14, C18-2 No.26	Oil temp. sensor signal
2	C89-3 No.13, C18-2 No.18	Sensor ground
3	C89-1 No.1, C18-2 No.40	UD solenoid signal
4	C89-1 No.16, C18-2 No.39	2ND solenoid signal
5	C89-1 No.14, C18-2 No.33	OD solenoid signal
6	C89-1 No.12, C18-2 No.38	LR solenoid signal
7	C89-1 No.15, C18-2 No.35	DCC solenoid signal
9	JC14 No.23, JC04 No.23	ATM control relay
10	JC14 No.23, JC104 No.23	ATM control relay

TERMINAL & 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 then go to "Verification of Vehicle Repair" procedure.

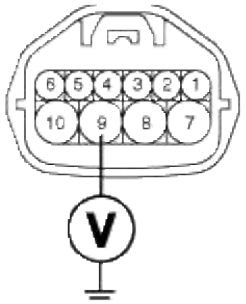
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal "9" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

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



ATM SOLENOID VALVE

C56(2.7 GSL)
C03(2.0 GSL)

3.UD solenoid valve
4.2ND solenoid valve
5.OD solenoid valve
6.LR solenoid valve
7.TCC solenoid valve
9.A/T battery
10.A/T battery

4. Is voltage within specifications?

YES

Go to "Signal circuit inspection" procedure.

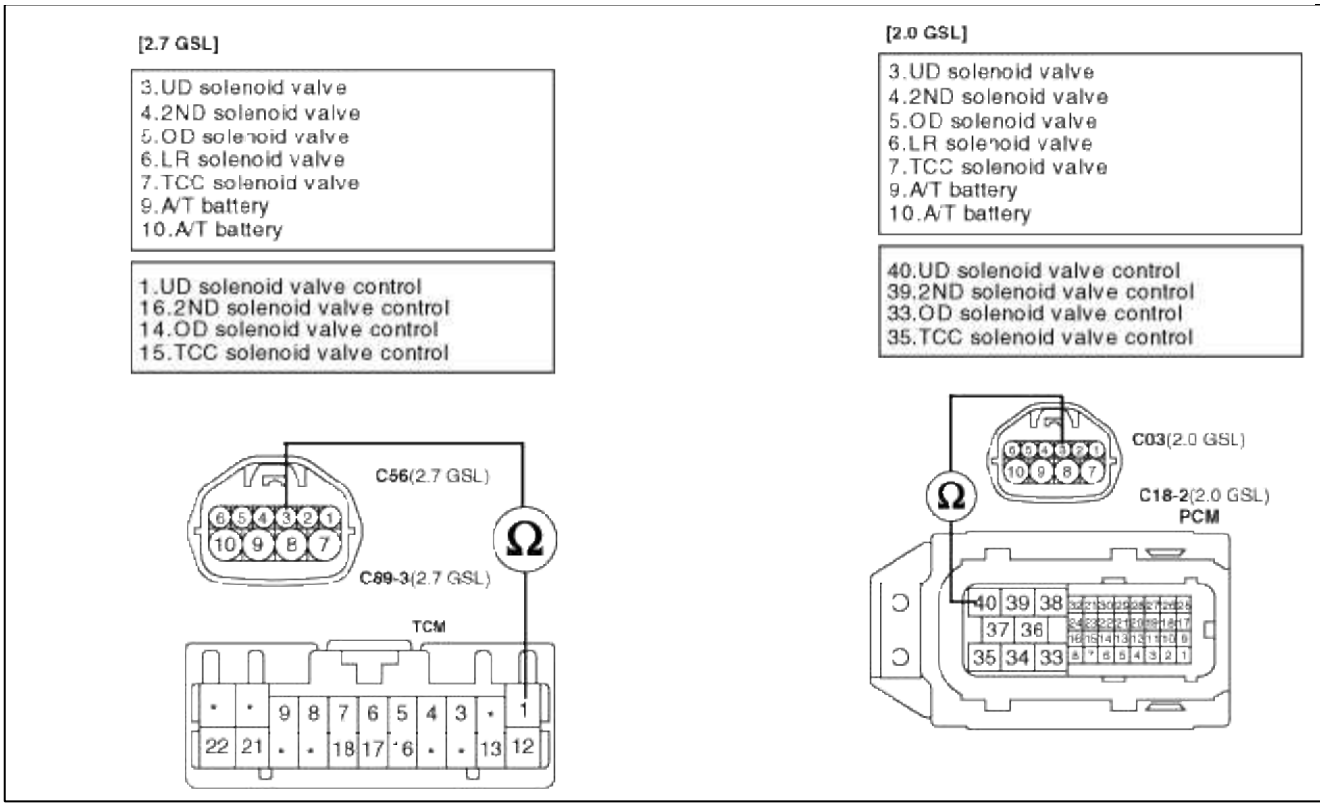
NO

Check that A/T-30A Fuse in engine room junction is installed or not blown.
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

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

Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

Go to "Check signal circuit short Inspection" procedure.

NO

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

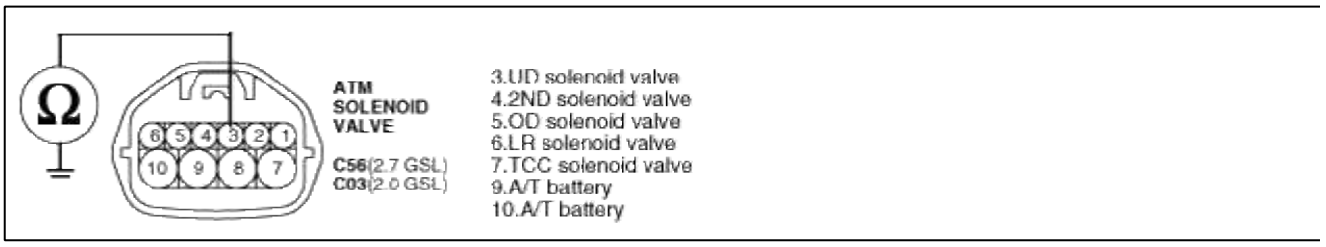
2. Check signal circuit short inspection

(1) Ignition "OFF".

(2) Disconnect "A/T SOLENOID VALVE" connector and "TCM(PCM)" connector.

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

Specification: Infinite



(4) Is resistance within specifications?

YES

Go to "Component Inspection" procedure.

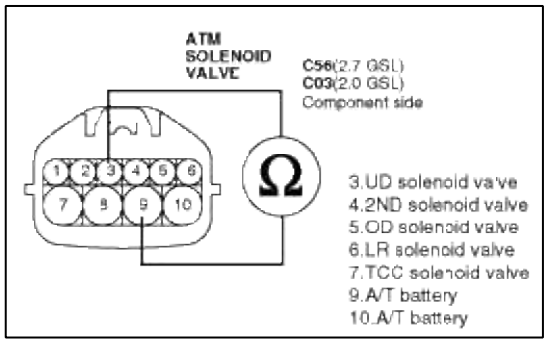
NO

Check for short to ground in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedu

COMPONENT INSPECTION

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

   Specification: Approximately 2.7~3.4 Ω [20°C(68°F)]



   (4) Is resistance within specification?

   YES

   Go to "CHECK TCM(PCM)" as below.

   NO

   Replace UD 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 UD 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

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

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. 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.

SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
- Internal resistance : 2.7~3.4Ω(68°F or 20°C)
- Surge voltage : 56 V

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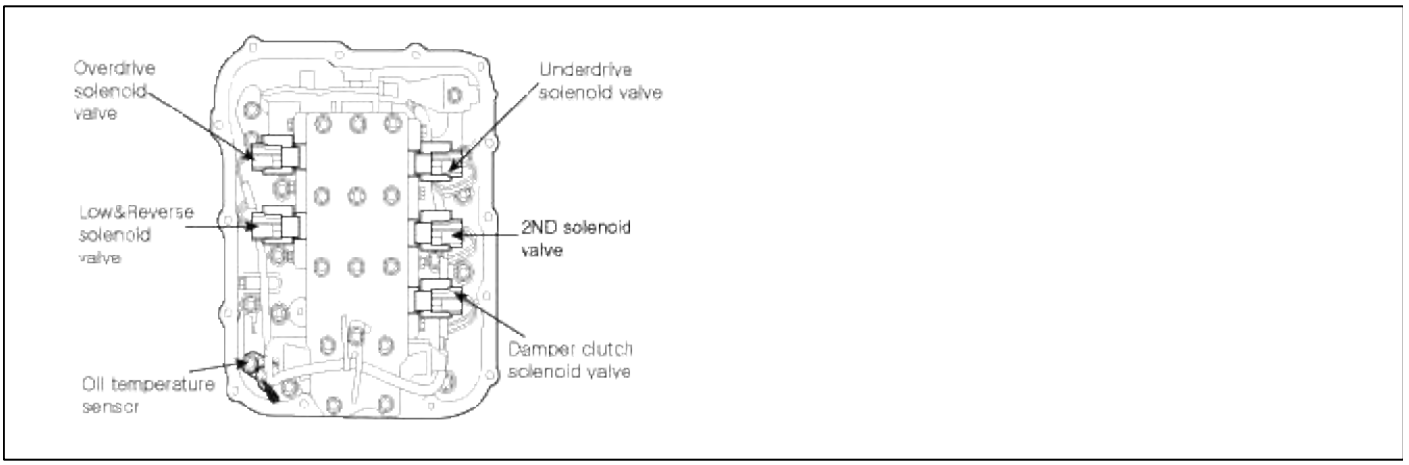
COMPONENT LOCATION



GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission by utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The HIVEC Automatic Transmission consists of a: LR (Low and Reverse Brake), 2ND (2nd Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch), and a RED (Reduction Brake, only for 5 speed transmissions). The LR Brake is engaged in the 1st gear and reverse gear positions.

DTC DESCRIPTION

The TCM(PCM) checks the Low and Reverse 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 the Low and Reverse control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

[2.7 GSL]

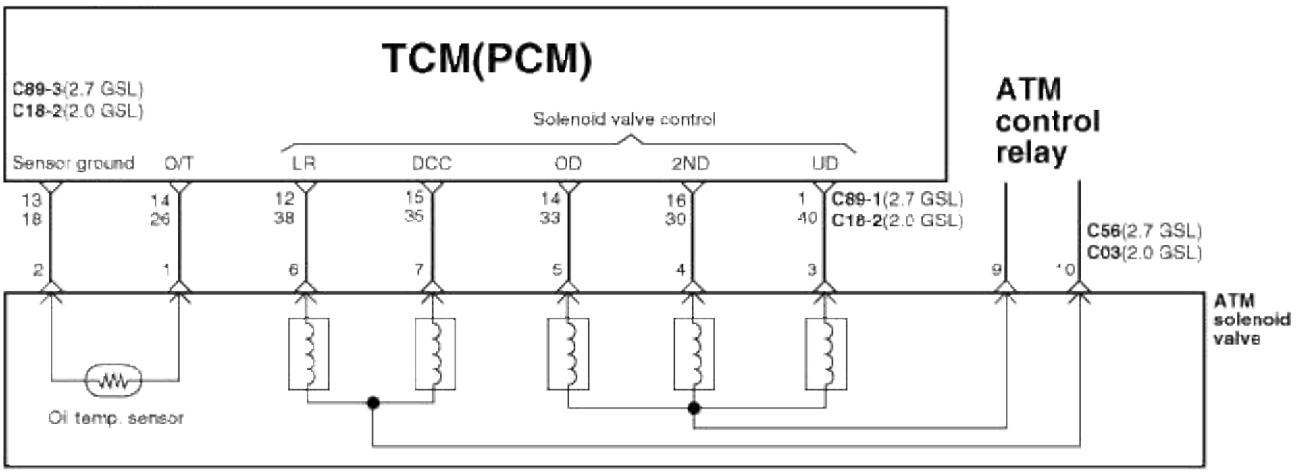
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty 2nd SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• Solenoid status Either solid ON or OFF • Voltage of Battery >10V	
Threshold value	• Voltage <3V	
Diagnostic Time	• More than 320 ms	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

[2.0 GSL]

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty 2nd SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• 16V > Voltage Battery >10V • In gear state(no gear shifting) 500msec is passed from turn on the relay	
Threshold value	• Feedback voltage from 2nd control solenoide > Vb-2V and 2nd control duty is 0% • Feedback voltage from 2nd control solenoide ≤ 5.5V and 2nd control duty is 100%	
Diagnostic Time	• more than 320 ms	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

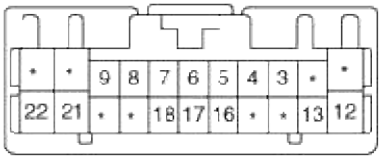
SCHEMATIC DIAGRAM

[Circuit Diagram]

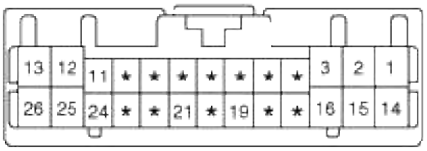


[Harness Connector]

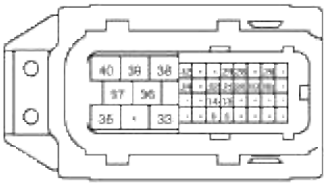
C56(2.7 GSL)
C03(2.0 GSL)



C89-3(2.7 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Connection Information]

Terminal	Connection	Function
1	C89-1 No.14, C18-2 No.26	Oil temp. sensor signal
2	C89-3 No.13, C18-2 No.18	Sensor ground
3	C89-1 No.1, C18-2 No.40	UD solenoid signal
4	C89-1 No.16, C18-2 No.39	2ND solenoid signal
5	C89-1 No.14, C18-2 No.33	OD solenoid signal
6	C89-1 No.12, C18-2 No.38	LR solenoid signal
7	C89-1 No.15, C18-2 No.35	DCC solenoid signal
9	JC14 No.23, JC04 No.23	ATM control relay
10	JC14 No.23, JC104 No.23	ATM control relay

TERMINAL & 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 then go to "Verification of Vehicle Repair" procedure.

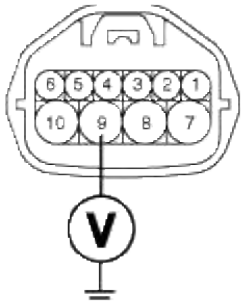
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal "9" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON

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



ATM SOLENOID VALVE

C56(2.7 GSL)
C03(2.0 GSL)

3.UD solenoid valve
4.2ND solenoid valve
5.OD solenoid valve
6.LR solenoid valve
7.TCC solenoid valve
9.A/T battery
10.A/T battery

4. Is voltage within specifications?

YES

Go to "Signal circuit inspection" procedure.

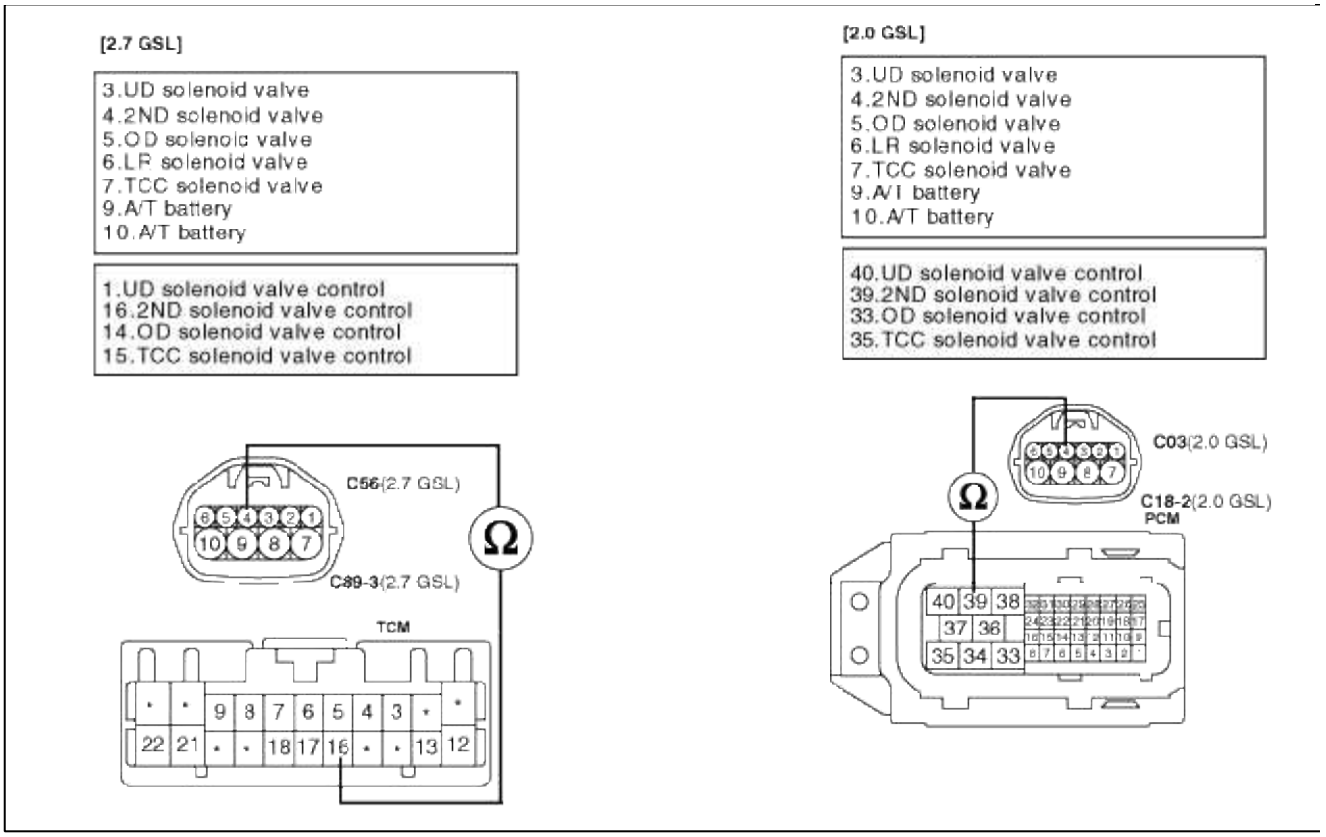
NO

Check that A/T-30A Fuse in engine room junction is installed or not blown.
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

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

Specification: approx. 0 Ω



(4) Is resistance within specifications?

YES

Go to "Check signal circuit short Inspection" procedure.

NO

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

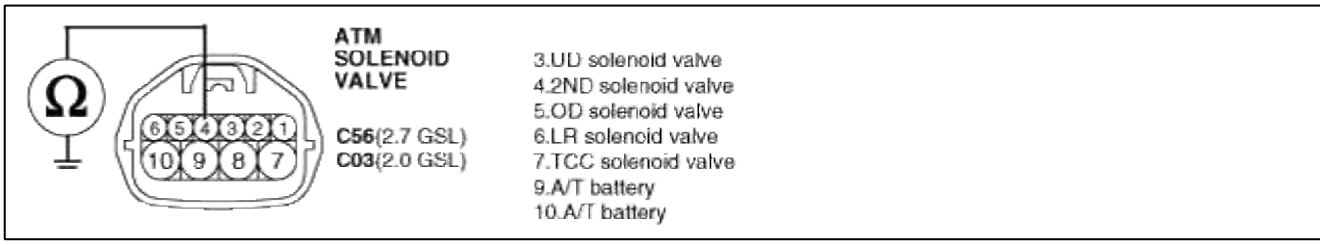
2. Check signal circuit short inspection

(1) Ignition "OFF".

(2) Disconnect "A/T SOLENOID VALVE" connector and "TCM(PCM)" connector.

(3) Measure resistance between terminal "4" of the ATM SOLENOID VALVE harness and chassis ground.

Specification: Infinite



(4) Is resistance within specifications?

YES

Go to "Component Inspection" procedure.

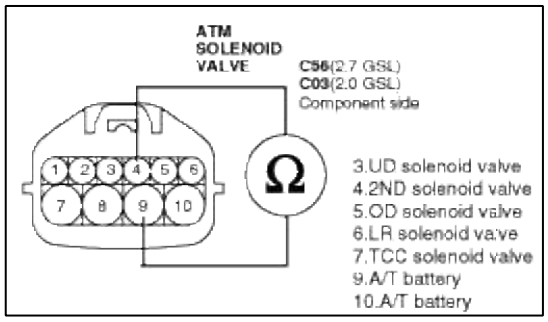
NO

Check for short to ground in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedu

COMPONENT INSPECTION

1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector.
   (3) Measure resistance between terminal "4" and terminal "9" of the ATM SOLENOID VALVE harness connector.

   Specification: Approximately 2.7~3.4 Ω [20°C(68°F)]



   (4) Is resistance within specification?

   YES

   Go to "CHECK TCM(PCM)" as below.

   NO

   Replace 2nd 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 2ND SOLENOID VALVE Actuator Testing Function?

   YES

   Go to "Verification Vehicle Repair" procedure.

   NO

   Replace TCM(PCM) and Go to "Verification Vehicle Repair" procedure.

   ACTUATOR TEST CONDITION

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

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. 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.

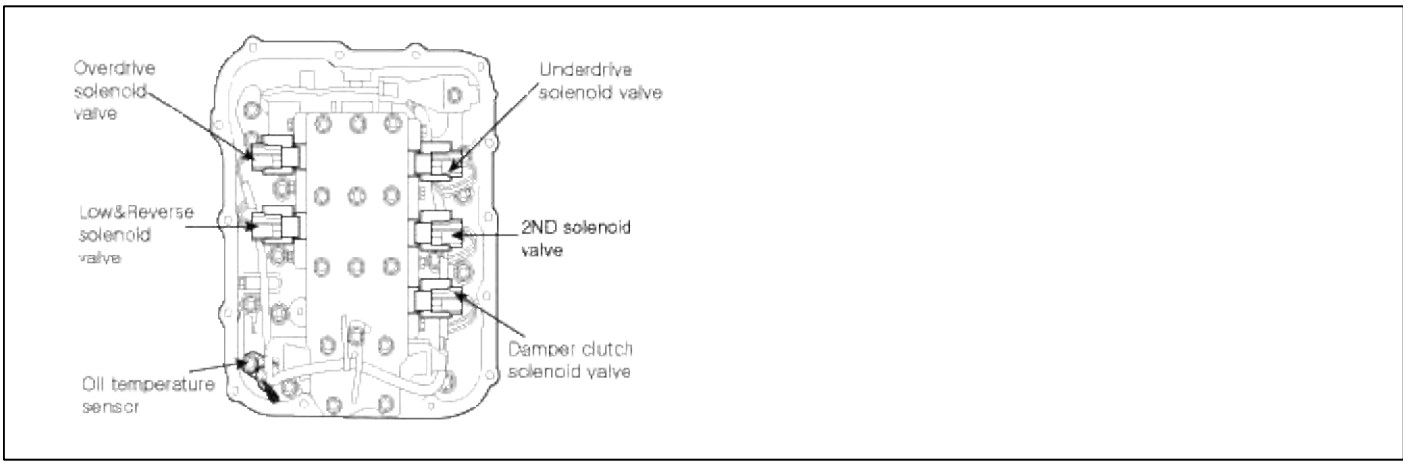
SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
- Internal resistance : 2.7~3.4Ω(68°F or 20°C)
- Surge voltage : 56 V

Automatic Transaxle System > Troubleshooting > P0765

COMPONENT LOCATION



GENERAL DESCRIPTION

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

DTC DESCRIPTION

The TCM(PCM) checks the Under Drive 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 the OVER DRIVE CLUTCH drive control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

[2.7 GSL]

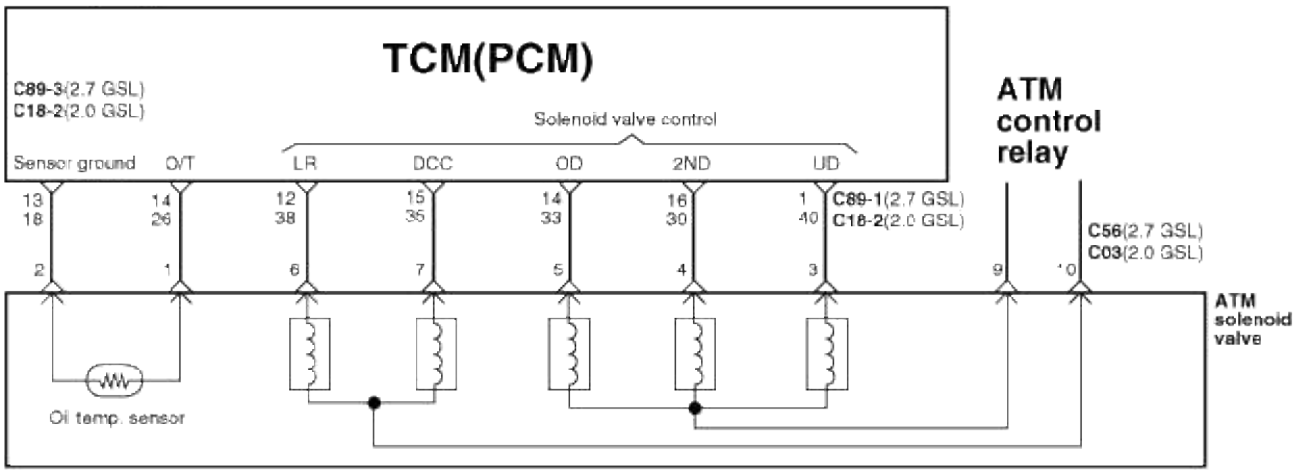
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty OD SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	• Solenoid status Either solid ON or OFF • Voltage of Battery >10V	
Threshold value	• Voltage <3V	
Diagnostic Time	• More than 320 ms	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

[2.0 GSL]

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		• Check voltage range	• Open or short in circuit • Faulty OD SOLENOID VALVE • Faulty TCM(PCM)
Enable Conditions	**Case1**	• 16V > Voltage Battery >10V	
	Case2	• Voltage Battery >10V • OIL TEMP. ≥ -23.5°C(-10.3°F) • 2nd gear and not downshifting • Engine speed ≥ 450rpm • Output speed > 100rpm • Input speed > 0rpm • Inhibitor switch is normal and after 2sec is passed from IG ON	
Threshold value	**Case1**	• Feedback voltage from 2nd control solenoide>Vb-2V and 2nd control duty is 0% • Feedback voltage from 2nd control solenoide≤5.5V and 2nd control duty is 100%	
	Case2	• input speed/3rd gear ratio - output speed ≤ 50rpm	
Diagnostic Time		• More than 320 ms	
Fail Safe		• Locked in 3 rd gear.(Control relay off)	

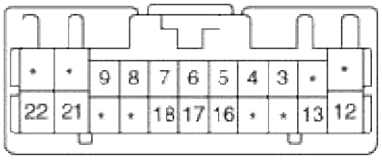
SCHEMATIC DIAGRAM

[Circuit Diagram]

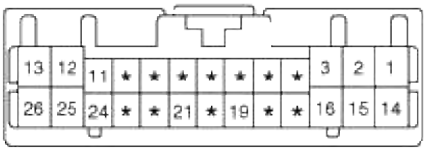


[Harness Connector]

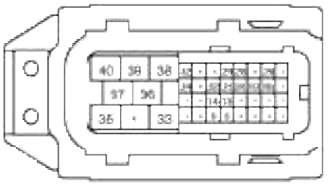
C56(2.7 GSL)
C03(2.0 GSL)



C89-3(2.7 GSL)



C89-1(2.7 GSL)



C18-2(2.0 GSL)

[Connection Information]

Terminal	Connection	Function
1	C89-1 No.14, C18-2 No.26	Oil temp. sensor signal
2	C89-3 No.13, C18-2 No.18	Sensor ground
3	C89-1 No.1, C18-2 No.40	UD solenoid signal
4	C89-1 No.16, C18-2 No.39	2ND solenoid signal
5	C89-1 No.14, C18-2 No.33	OD solenoid signal
6	C89-1 No.12, C18-2 No.38	LR solenoid signal
7	C89-1 No.15, C18-2 No.35	DCC solenoid signal
9	JC14 No.23, JC04 No.23	ATM control relay
10	JC14 No.23, JC104 No.23	ATM control relay

TERMINAL & 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 then go to "Verification of Vehicle Repair" procedure.

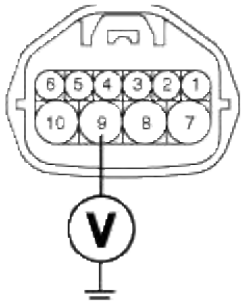
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. Measure voltage between terminal "9" of the sensor harness connector and chassis ground.
3. Turn ignition switch OFF → ON.

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



ATM SOLENOID VALVE

C56(2.7 GSL)
C03(2.0 GSL)

3.UD solenoid valve
4.2ND solenoid valve
5.OD solenoid valve
6.LR solenoid valve
7.TCC solenoid valve
9.A/T battery
10.A/T battery

Is voltage within specifications?

YES

Go to "Signal circuit inspection" procedure.

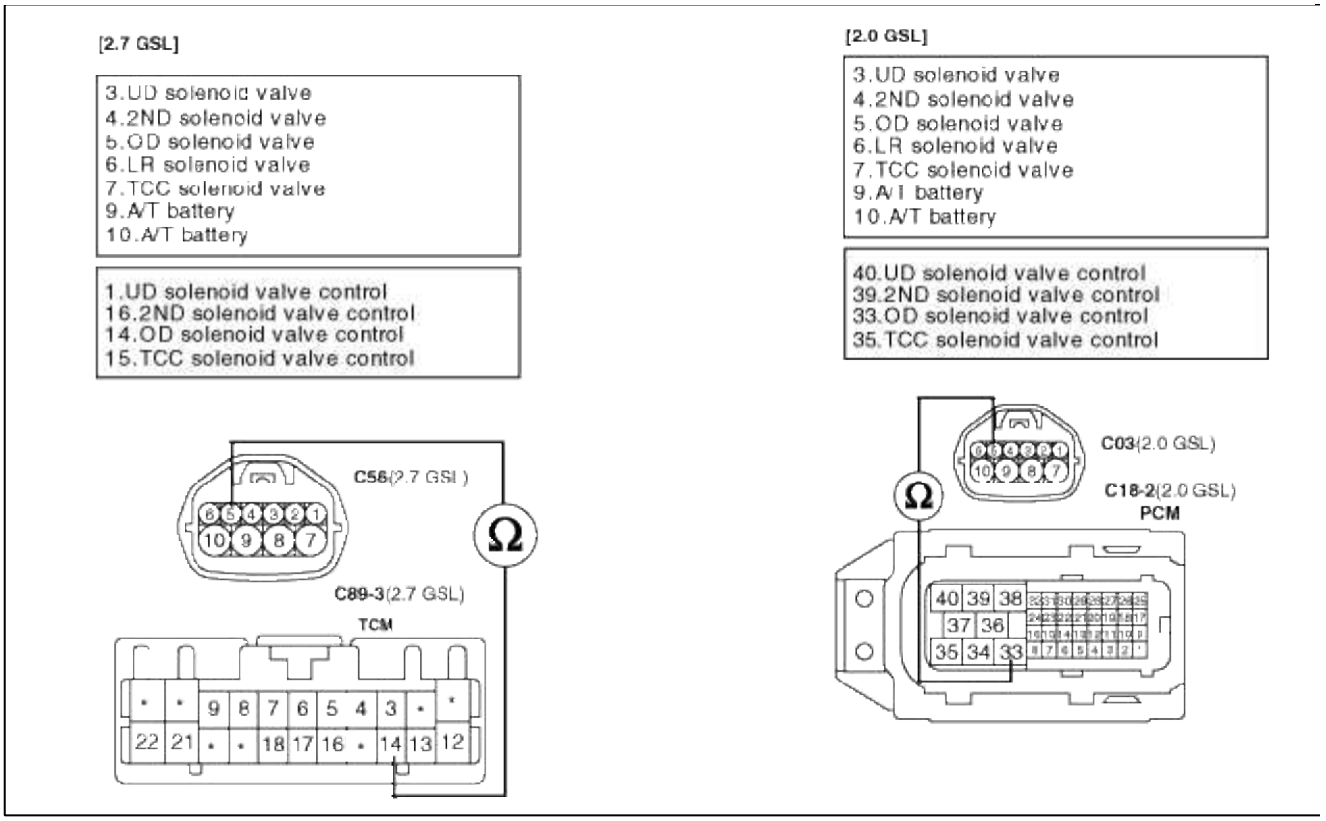
NO

Check that A/T-30A Fuse in engine room junction is installed or not blown.
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check signal circuit open inspection
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector and "TCM(PCM)" connector.
   (3) Measure resistance between terminal "5" of the ATM SOLENOID VALVE harness connector and terminal " of the TCM(PCM) harness connector

Specification: approx. 0 Ω



Is resistance within specifications?

YES

Go to "Check signal circuit short Inspection" procedure.

NO

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

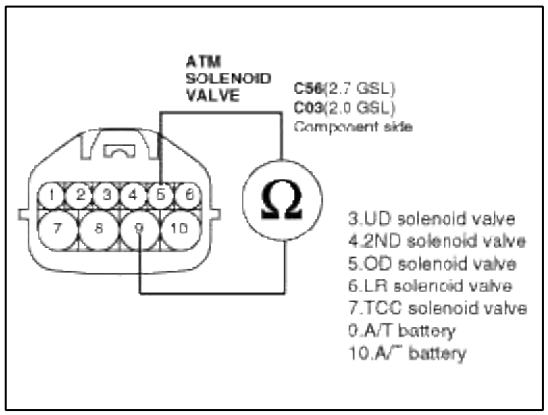
2. Check signal circuit short inspection

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

(2) Disconnect "A/T SOLENOID VALVE" connector and "TCM(PCM)" connector.

(3) Measure resistance between terminal "5" and terminal "9" of the ATM SOLENOID VALVE harness.

Specification: Infinite



(4) Is resistance 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

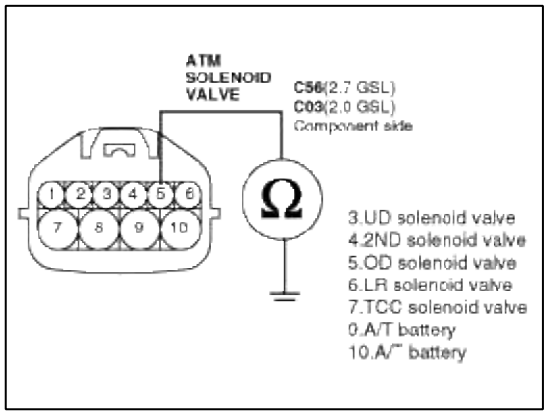
1. CHECK SOLENOID VELVE

(1) Ignition "OFF".

(2) Disconnect "A/T SOLENOID VALVE" connector.

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

Specification: Approximately 2.7~3.4 Ω [20°C(68°F)]



(4) Is resistance within specification?

YES

Go to "CHECK TCM(PCM)" as below.

NO

Replace OD 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 Solenoide valve Actuator test and Operate Actuator test.

(4) Can you hear operating sound for OD SOLENOID VALVE Actuator Testing Function?

YES

Go to "Verification Vehicle Repair" procedure.

NO

Replace TCM(PCM) and Go to "Verification Vehicle Repair" procedure.

ACTUATOR TEST CONDITION

A. IG SWITCH ON

B. TRANSAXLE RANGE SWITCH is normal

C. P RANGE

D. Vehicle Speed 0km/h

E. Throttle position sensor < 1V

F. IDLE SWITCH ON

G. ENGINE RPM 0

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. 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.

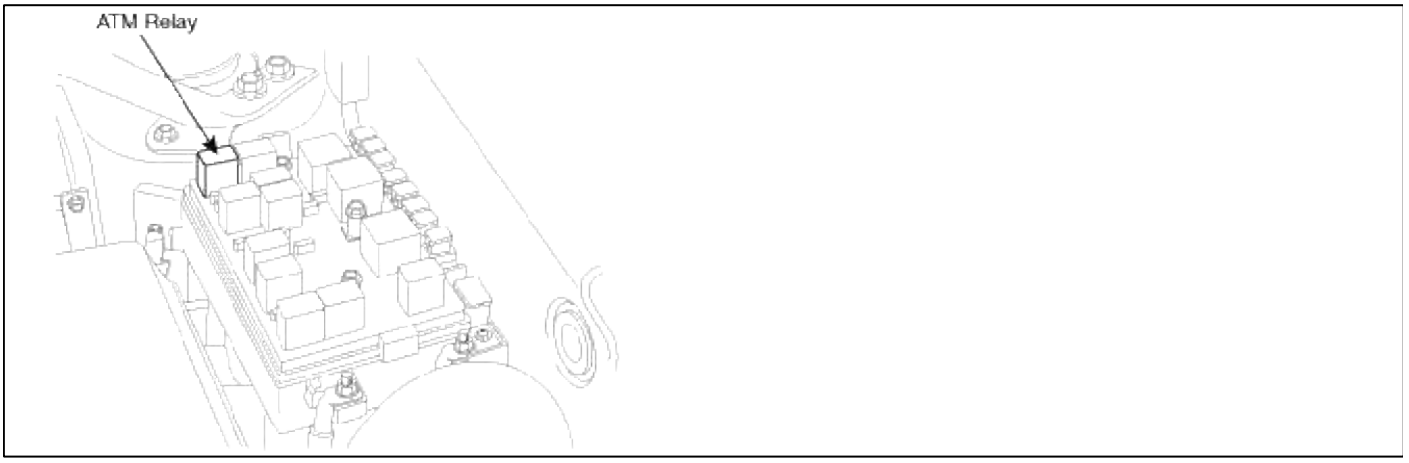
SPECIFICATION

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -22~266°F(-30°C~130°C)
- Frequency :
  - LR, 2ND, UD, OD, RED : 61.27Hz (at the ATF temp. -20°C above)
  - DCC : 30.64Hz
- Internal resistance : 2.7~3.4Ω(68°F or 20°C)
- Surge voltage : 56 V

Automatic Transaxle System > Troubleshooting > P0885

COMPONENT LOCATION



GENERAL DESCRIPTION

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

DTC DESCRIPTION

The TCM(PCM) checks the A/T control relay signal by monitoring the contol signal. If, after the igniton key is turned on, an unexpected voltage value, which is quite a bit lower than battery voltage is detected, the TCM(PCM) sets this code.

DTC DETECTING CONDITION

[2.7 GSL]

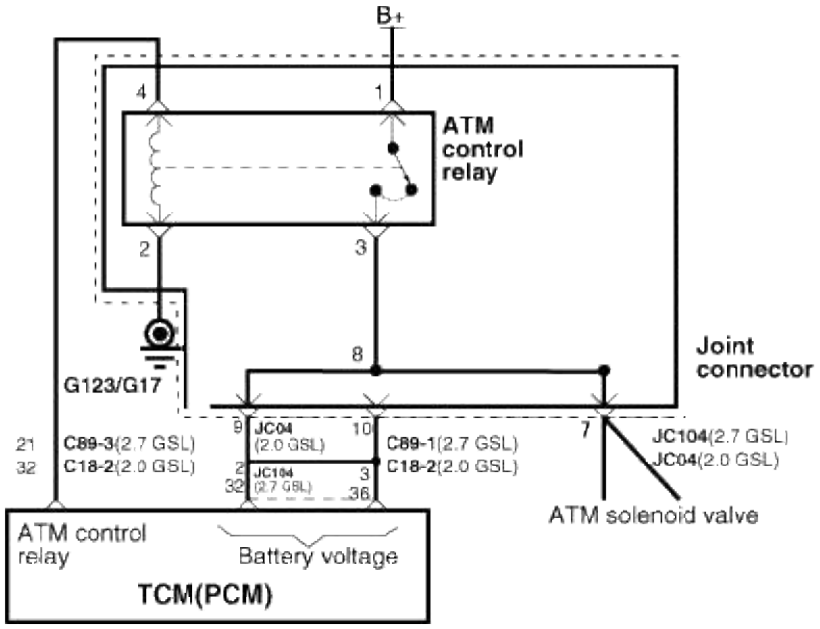
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty TCM(PCM)
Enable Conditions	• Voltage of Battery >9V • Time after TCM(PCM) turns on >0.5sec	
Threshold value	• Voltage <7V	
Diagnostic Time	• 0.1sec	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

[2.0 GSL]

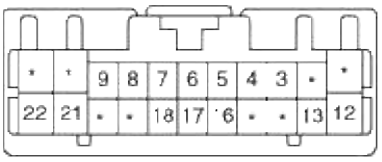
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty A/T control relay • Faulty TCM(PCM)
Enable Conditions	• 22V > Voltage Battery >9V • Time after TCM(PCM) turns on >0.5sec	
Threshold value	• Voltage < 7V orVoltage > 24.5V	
Diagnostic Time	• 0.1sec	
Fail Safe	• Locked in 3rd gear.(Control relay off)	

SCHEMATIC DIAGRAM

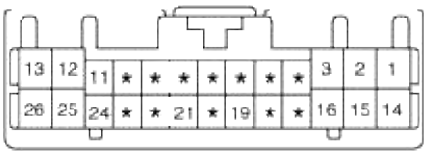
[Circuit Diagram]



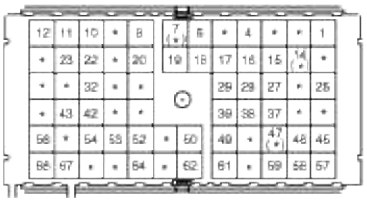
[Harness Connector]



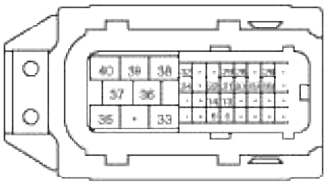
C89-3(2.7 GSL)



C89-1(2.7 GSL)



JC104(2.7 GSL)
JC04(2.0 GSL)



C18-2(2.0 GSL)

[Connection Information]

Terminal	Connection	Function
1	-	Hot at all times
2	G123/G17	Ground
3	89-1 No.2 or 3, C18-2 No.36	Joint connector
4	89-3 No.2*, C18-2 No.32	ATM control relay signal

TERMINAL & 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 then go to "Verification of Vehicle Repair" procedure.

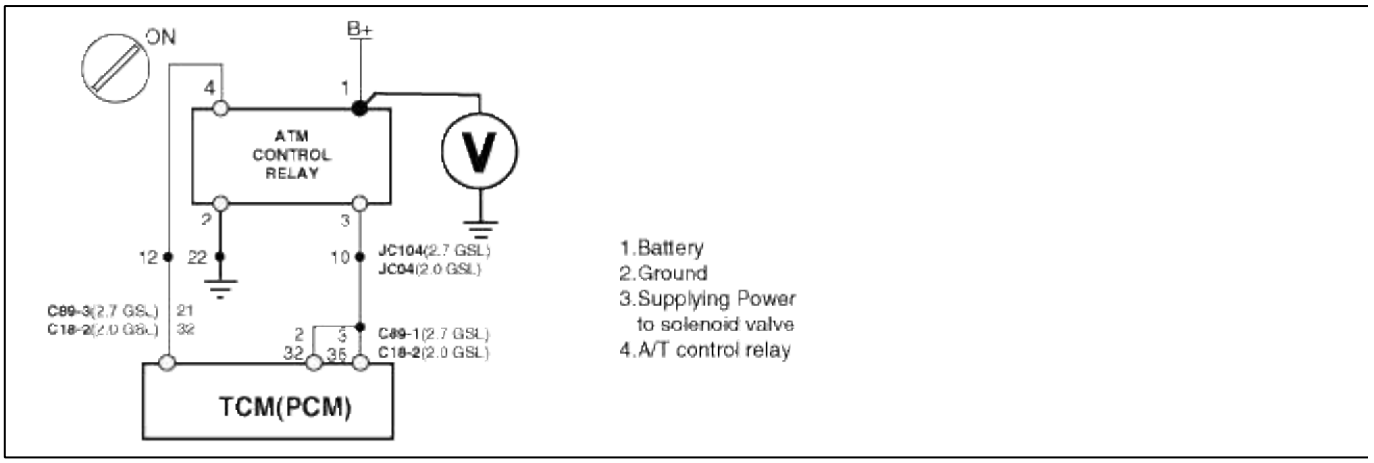
NO

Go to "Power Supply circuit inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "A/T CONTROL RELAY" connector.
3. Measure the voltage between terminal "1" of the "A/T CONTROL RELAY" harness connector and chassis groun

Specification : Approx. B+



4. Is voltage within specifications?

YES

Go to "Signal circuit inspection" procedure.

NO

Check that A/T-30A Fuse in engine room junction is installed or not blown.

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

SIGNAL CIRCUIT INSPECTION

1. CHECK A/T control relay harness

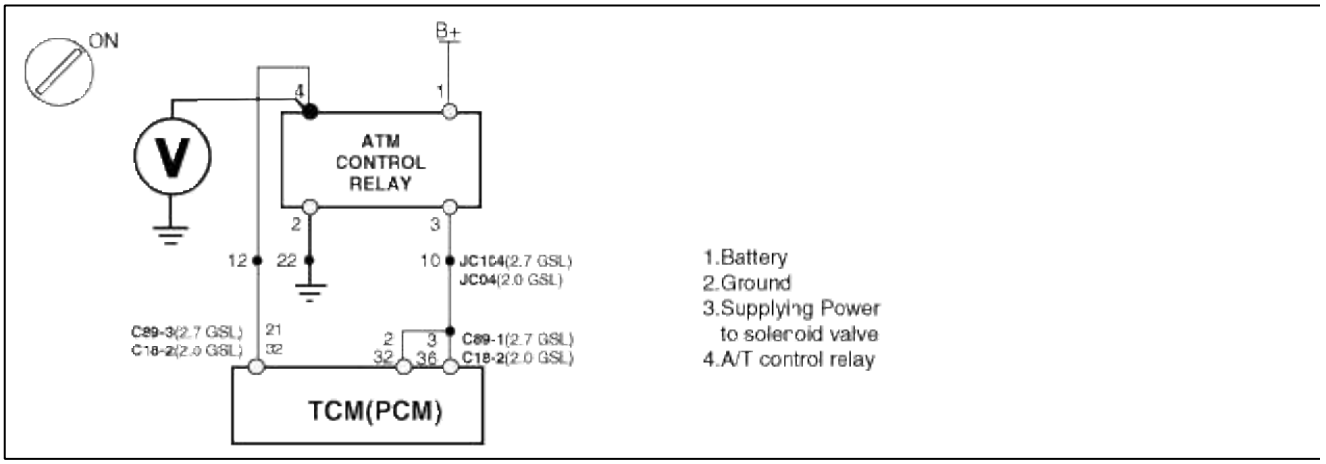
(1) Ignition "OFF".

(2) Disconnect the "A/T CONTROL RELAY" connector.

(3) Measure the voltage between terminal "4" of the "A/T CONTROL RELAY" harness connector and chassis gı

(4) Turn ignition switch OFF → ON.

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



(5) Is voltage within specifications?

YES

Go to "Check Supplying Power to solenoid valve" procedure.

NO

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

If signal circuit is OK, Substitute with a known-good TCM(PCM) and check for proper operation. If the pr is corrected, replace TCM(PCM) and then go to "Verification of Vehicle Repair" procedure.

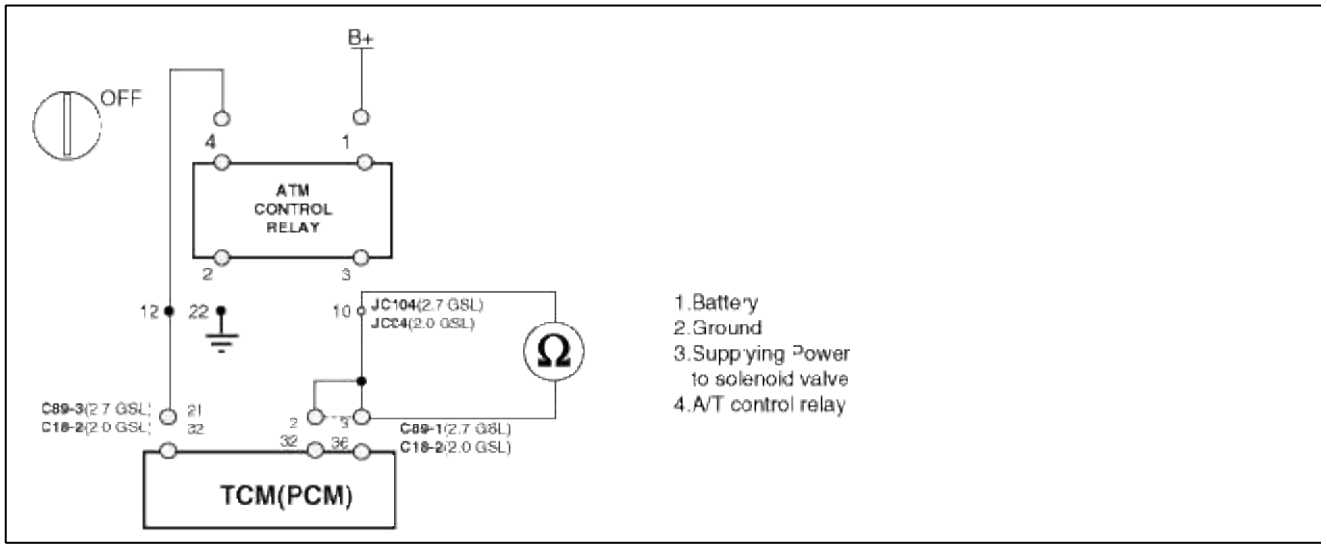
2. CHECK Supplying Power to solenoid valve harness

(1) Ignition "OFF".

(2) Disonnect the "A/T CONTROL RELAY" and TCM(PCM) connector.

(3) Measure the resistance between terminal "3" of the "A/T CONTROL RELAY" harness connector and termina 3/ 32 or 36" of the TCM(PCM) harness connector

Specification : Approx. 0 Ω



(4) Is resistance within specifications?

YES

Go to "Ground circuit inspection" procedure.

NO

Check for Open in JC104/ JC04 joint connector.

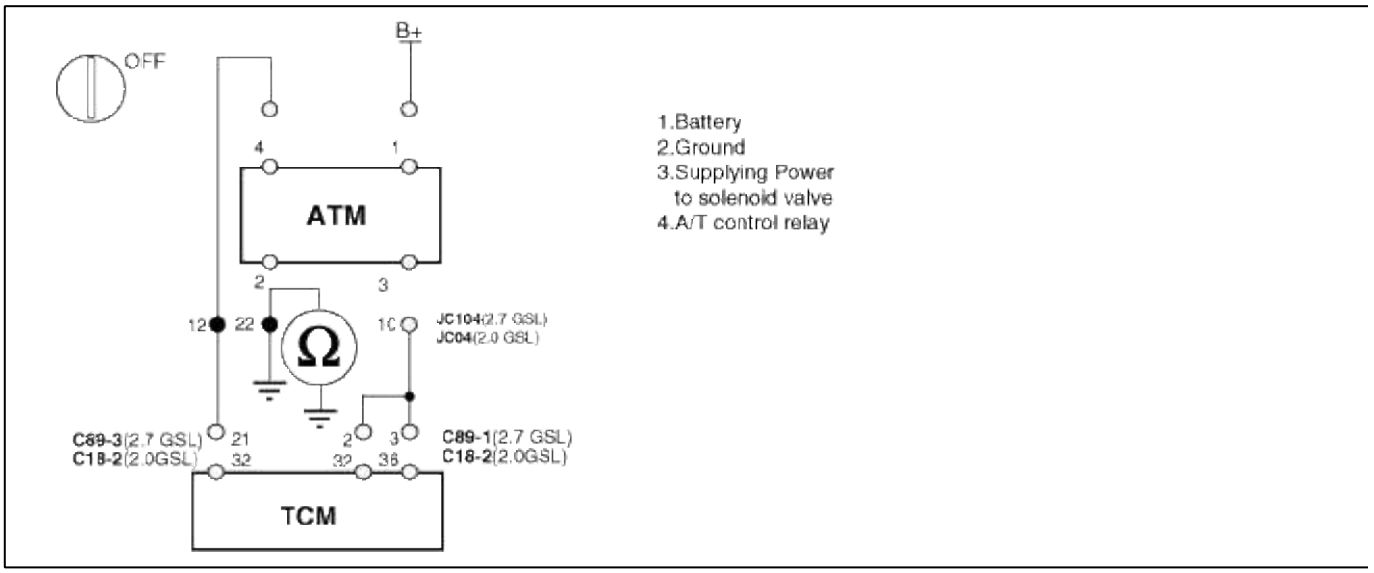
Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Connect the "A/T CONTROL RELAY" connector.

3. Measure the resistance between terminal "2" of the "A/T CONTROL RELAY" harness connector and chassis ground.

Specification : Approx. 0 Ω



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

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

Specification: Shown below

Item	Terminal No	
Resistance	1(red) - 3(pink)	INFINITE
	2(black) - 4(pink)	
supply(B+) to number 4 and supply (B-) to number 2.	1(red) - 3(pink)	0 Ω

4. Is resistance with in specification?

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

Replace ATM CONTROL RELAY 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. 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

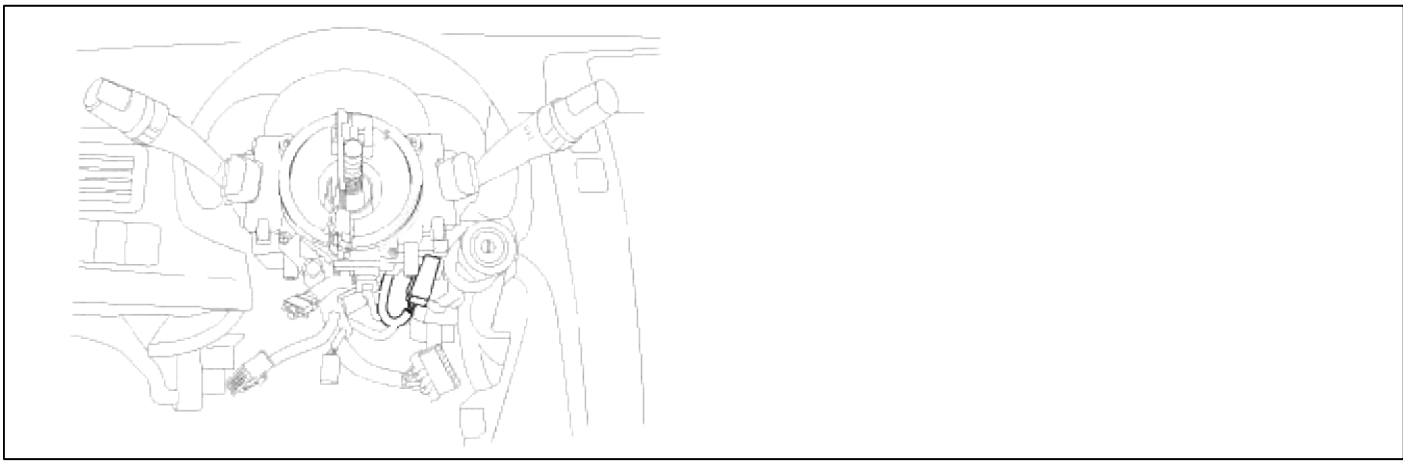
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P1716

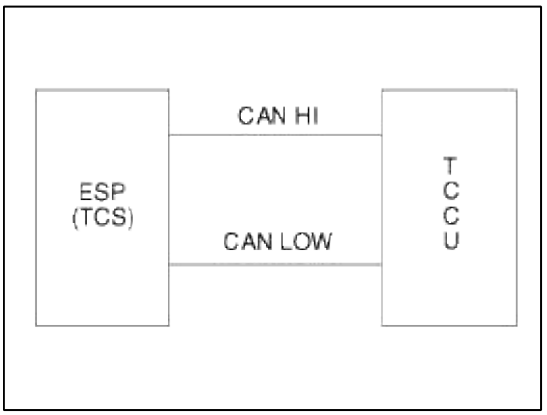
COMPONENT LOCATION



GERNERAL DESCRIPTION

Steering wheel sensor which is contactless and analog type measures the absolute pressure by using the "MR" effect. you must execute initialization by using SCAN TOOL after installing new or reinstalling old steering wheel angle sensor.

This signal which is a angle velocity of steering wheel is made use of sensing the rotating direction & neutrality of steering wheel. In case ESP system is applied to the vehicle steering angle sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



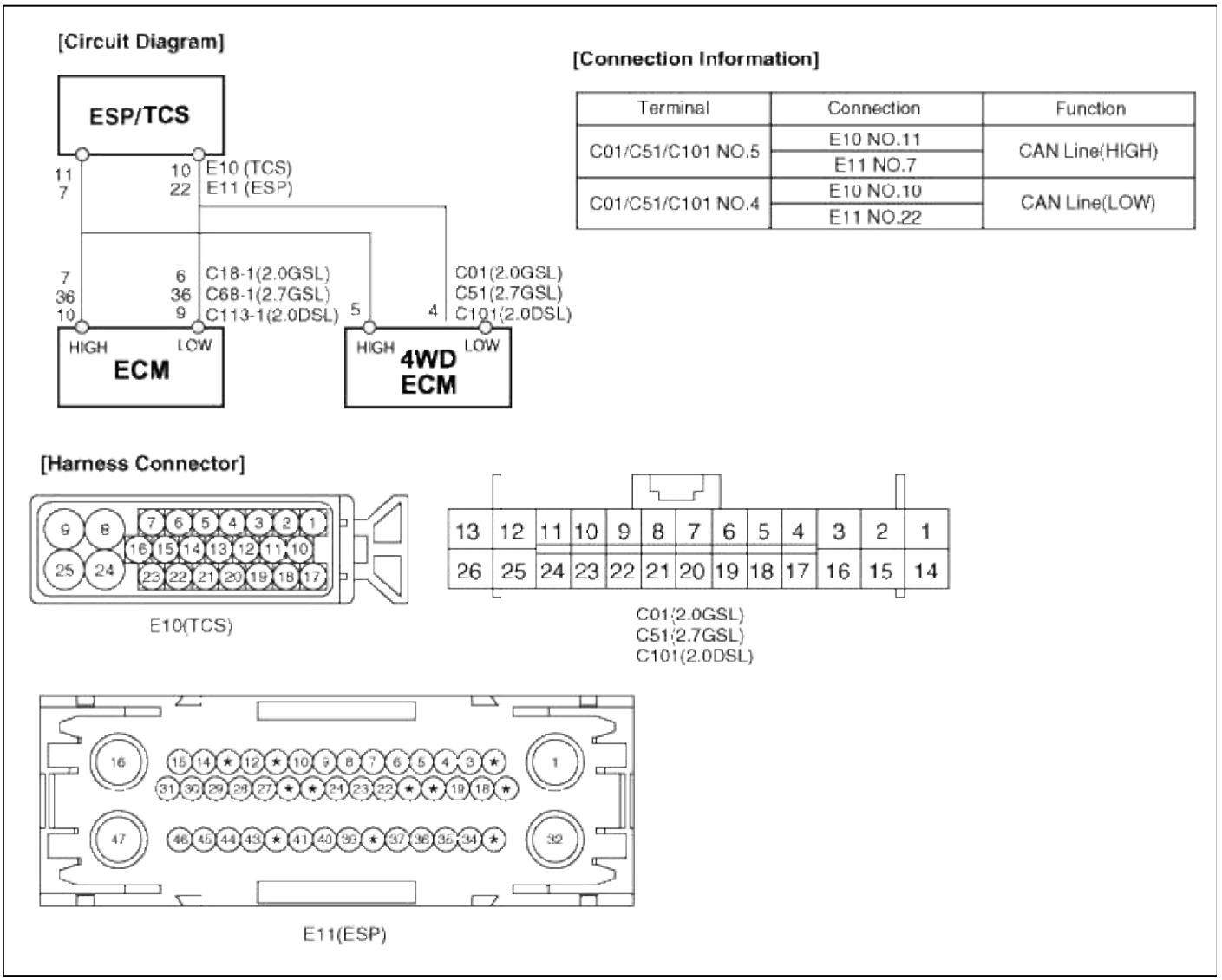
DTC DESCRIPTION

This failure code is related to the TCCU communication line of the ESP application system and is set if input signal to TCCU is in"Loss of signal out of range".

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• Steering Angle sensor,ESP, TCCU connector looseness and poor terminal to wire connection • open/short in CAN line. • Steering Angle sensor faulty. • Faulty ESP MODULE. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• FFFH	
Diagnostic Time		
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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.

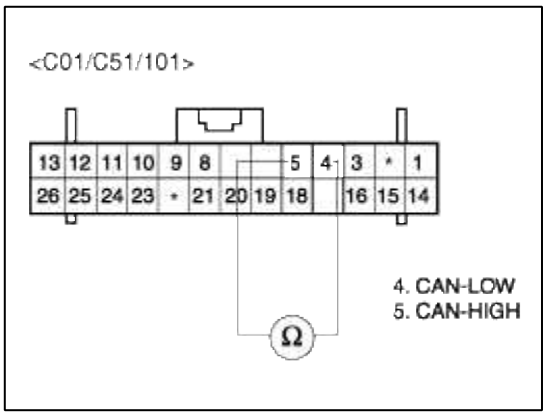
NO

Go to "CAN(Signal Error) comm. Line Inspection " procedure.

CAN(Signal Error) comm. Line Inspection

1. Ignition "OFF".
2. Measure resistance between terminal "4" of the TCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value ?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for the signal or component of ESP control module.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

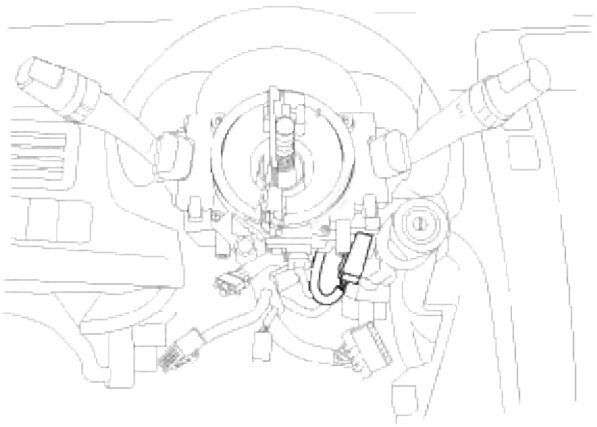
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

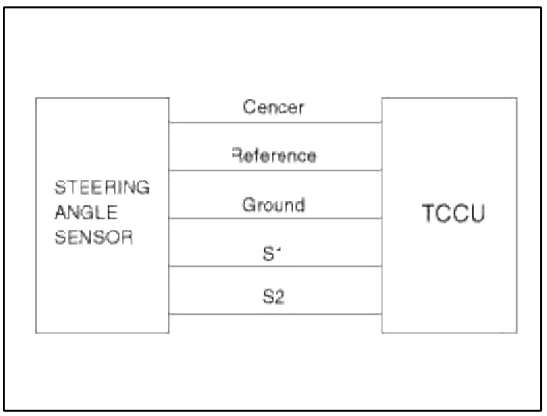
Automatic Transaxle System > Troubleshooting > P1717

COMPONENT LOCATION



GERNERAL DESCRIPTION

Steering wheel sensor which is contactless and analog type measures the absolute pressure by using the "MR" effect. you must execute initialization by using SCAN TOOL after installing new or reinstalling old steering wheel angle sensor.This signal which is a angle velocity of steering wheel is made use of sensing the rotating direction & neutrality of steering wheel. In case ESP system is applied to the vehicle steering angle sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



DTC DESCRIPTION

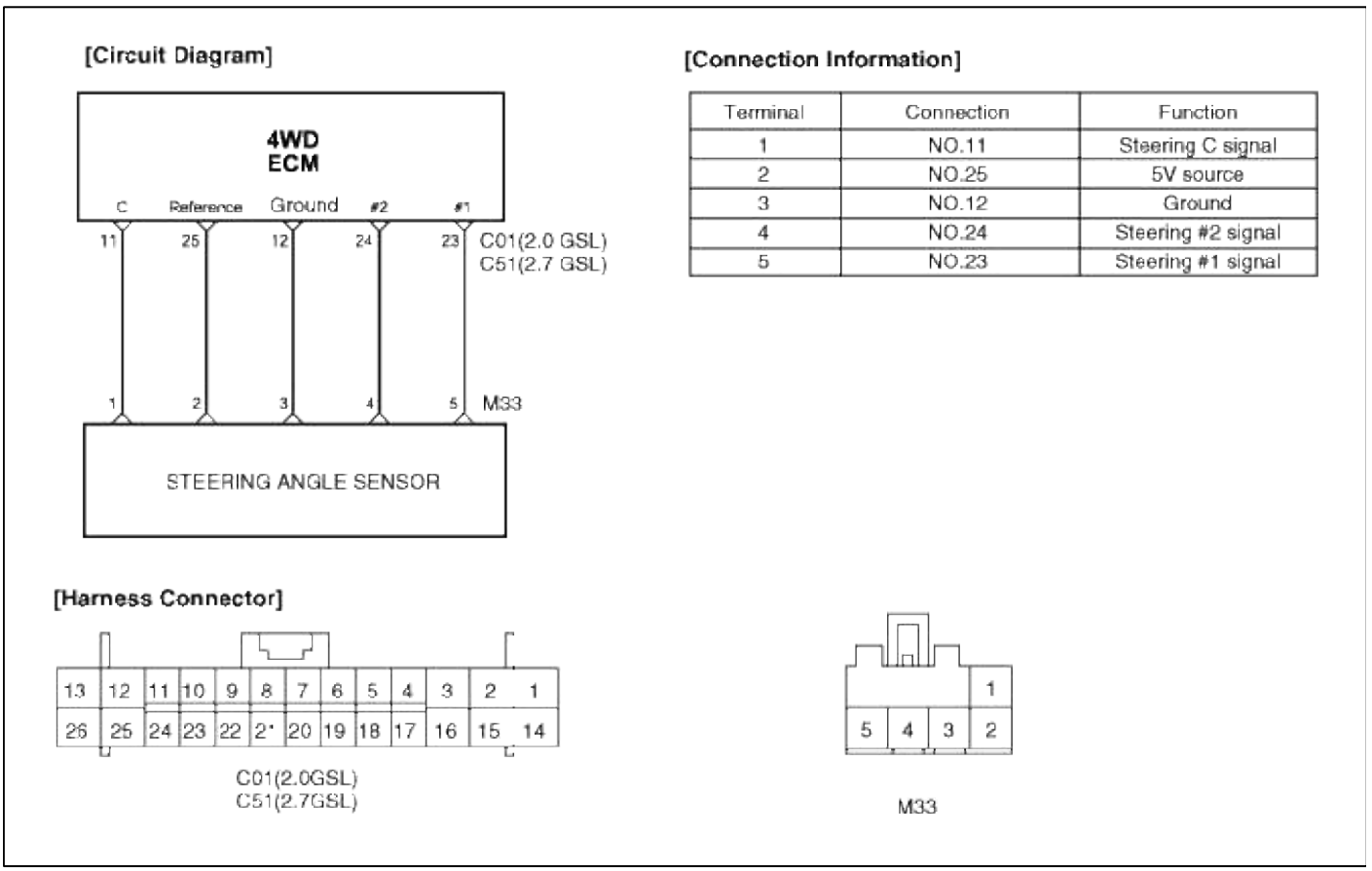
This failure code is related to the Steering angle sensor 1 and is set if input signal to TCCU is in"Loss of signal out of range".

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) application system and is set if input signal to TCCU is in"Loss of signal out of range".

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• Steering Angle sensor,ESP, TCCU connector looseness and poor terminal to wire connection. • Steering angle sensor circuit open/short. • Faulty Steering angle sensor. • Faulty TCCU.
Enable Conditions	• V<4.5 for 1.0 sec self clearing	
Threshold Value	• > 4.5VDC	
Diagnostic Time	• 1 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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

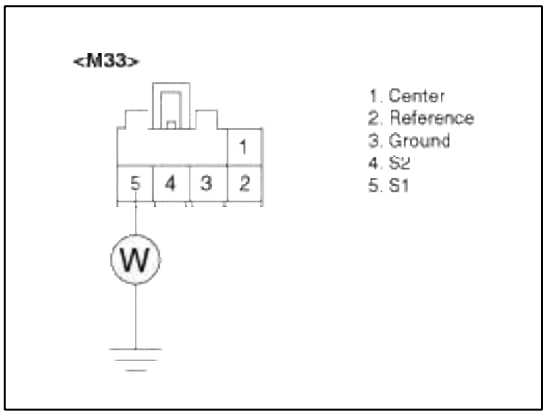
Go to " Steering angle sensor 1 Signal Inspection " procedure.

Steering angle sensor 1 Signal Inspection

1. Engine "ON".
2. Connect TCCU, Steering angle sensor connector.
3. Monitor signal waveform between terminal 5 of Steering angle sensor harness connector M33 and chassis ground.

4. Turn steering Wheel to the right or left.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is Steering angle sensor 1 Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

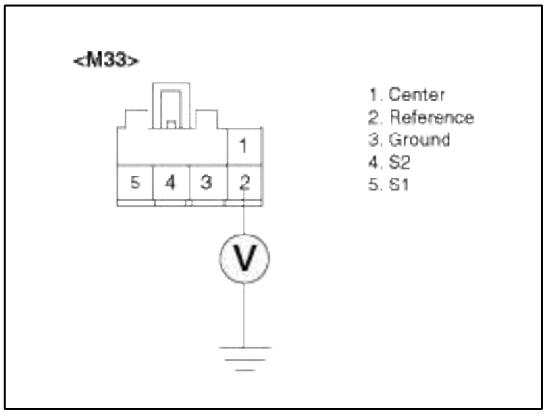
NO

Go to " Steering angle sensor Reference voltage inspection " procedure.

Steering angle sensor Reference voltage inspection

1. Ignition "ON",Engine "OFF".
2. TCCU, Steering angle sensor connector : Connect.
3. Measure voltage between terminal 2 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 5V



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is voltage display near the specified value.

YES

Go to " Steering angle sensor ground harness open circuit inspection " procedure.

NO

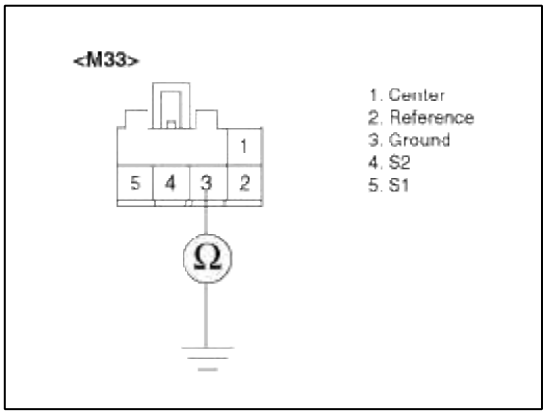
Check for Steering angle sensor Reference harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor ground harness open circuit inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Connect.
3. Measure resistance between terminal 3 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor 1 ,short to signal line ground Inspection " procedure.

NO

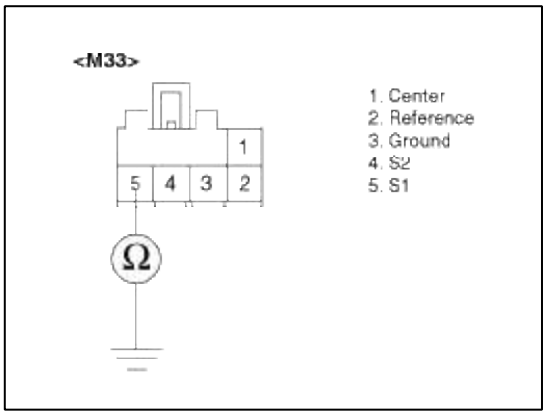
Check for open circuit of Steering angle sensor ground harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor 1 ,short to signal line ground Inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Disconnect.

3. Measure resistance between terminal 5 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor #1 signal line open Inspection " procedure.

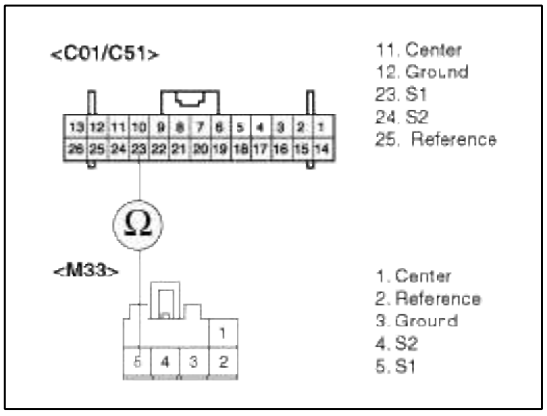
NO

Check for short to ground circuit of Steering angle sensor #1Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure?

Steering angle sensor 1 signal line open Inspection

1. Ignition "ON",Engine "OFF".
2. TCCU, Steering angle sensor connector : Disconnect.
3. Measure resistance between terminal 5 of Steering angle sensor harness connector M33 and terminal 23 of TCCU harness connector.

Specification : Approx. 0Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good TCCU or Steering angle sensor and check for proper operation.
If the problem is corrected, replace TCCU and then go to "Verification of Vehicle Repair" procedure.

NO

Check for open circuit of Steering angle sensor #1 Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

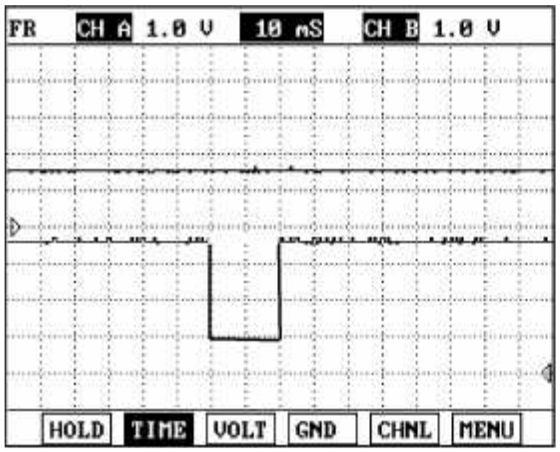
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

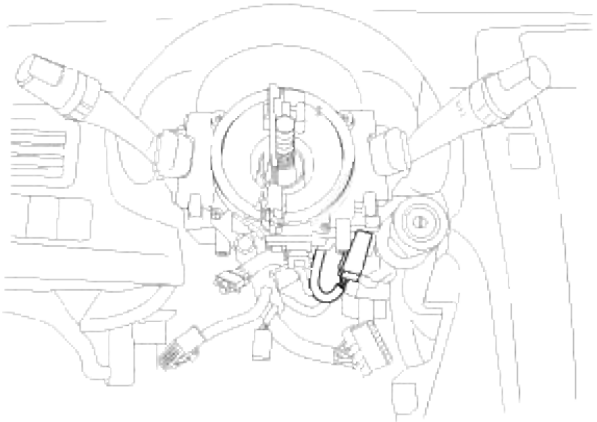
SIGNAL WAVEFROM



[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine conditions.

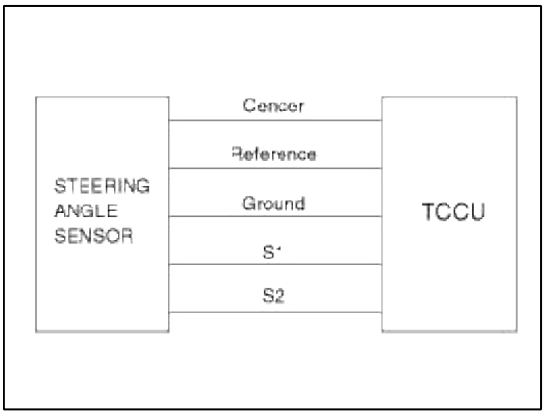
Automatic Transaxle System > Troubleshooting > P1718

COMPONENT LOCATION



GERNERAL DESCRIPTION

Steering angle sensor is a hole plate between the photo-controller LED and the photo transistor. As the hole plate rotates during steering wheel rotation, an electrical signal will be generated depending on whether the LED light passes through the plate to the photo-transistor or not.
This signal which is a angle velocity of steering wheel is made use of sensing the rotating direction & neutrality of steering wheel. In case ABS(ESP) system is applied to the vehicle steering angle sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



DTC DESCRIPTION

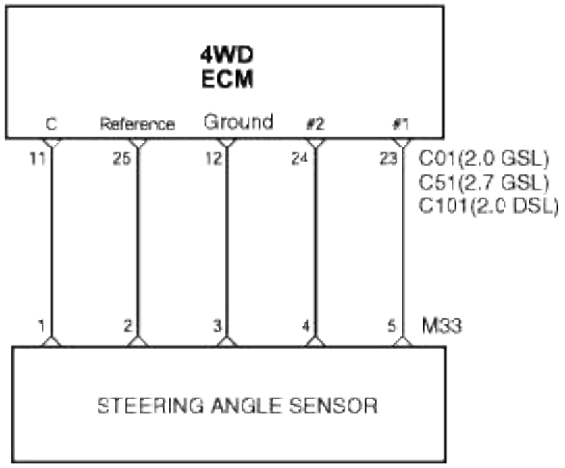
This failure code is related to the Steering angle sensor #2 and is set if input signal to TCCU is "Loss of signal out of range".
This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) application system and is set if input signal to TCCU is in"Loss of signal out of range".

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• Steering Angle sensor, TCCU connector looseness and poor terminal to wire connection. • Steering angle sensor circuit open/short. • Faulty Steering angle sensor. • Faulty TCCU.
Enable Conditions	• V<4.5 for 1.0 sec self clearing	
Threshold Value	• > 4.5VDC	
Diagnostic Time	• 1 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM

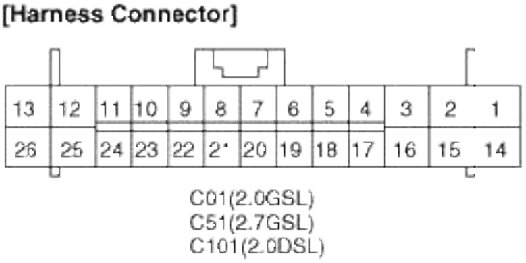
[Circuit Diagram]

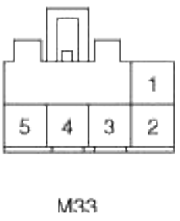


[Connection Information]

Terminal	Connection	Function
1	NO.11	Steering C signal
2	NO.25	5V source
3	NO.12	Ground
4	NO.24	Steering #2 signal
5	NO.23	Steering #1 signal

[Harness Connector]





TERMINAL & 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

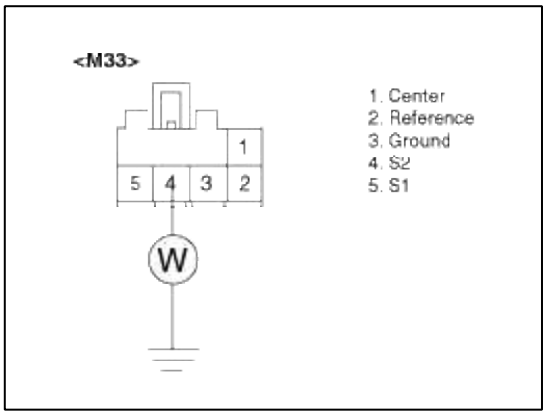
Go to " Steering angle sensor 2 Signal Inspection " procedure.

Steering angle sensor 2 Signal Inspection

1. Engine "ON".
2. Connect TCCU, Steering angle sensor connector.
3. Monitor signal waveform between terminal 4 of Steering angle sensor harness connector M33 and chassis ground.

4. Turn steering Wheel to the right or left.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is Steering angle sensor 2 Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

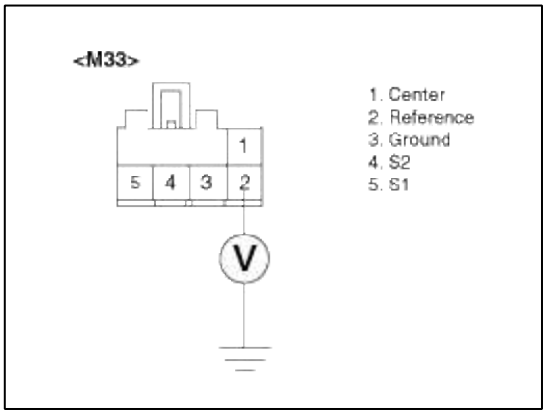
NO

Go to " Steering angle sensor Reference voltage inspection " procedure.

Steering angle sensor Reference voltage inspection

1. Ignition "ON",Engine "OFF".
2. TCCU, Steering angle sensor connector : Connect.
3. Measure voltage between terminal 2 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 5V



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is voltage display near the specified value.

YES

Go to " Steering angle sensor ground harness open circuit inspection " procedure.

NO

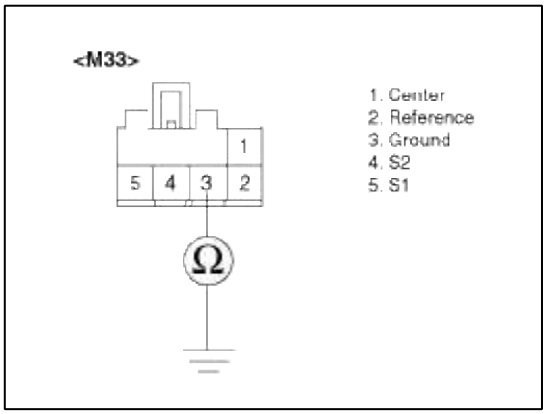
Check for Steering angle sensor Reference harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor ground harness open circuit inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Connect.
3. Measure resistance between terminal 3 of Steering angle sensor harness connector M33 and chassis ground.

Specification : < 1 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor 2 ,short to signal line ground Inspection " procedure.

NO

Check for open circuit of Steering angle sensor ground harness.

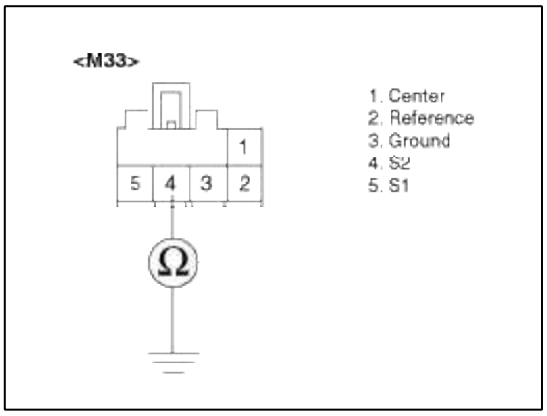
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor 2 ,short to signal line ground Inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Disconnect.

3. Measure resistance between terminal 4 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor #2 signal line open Inspection " procedure.

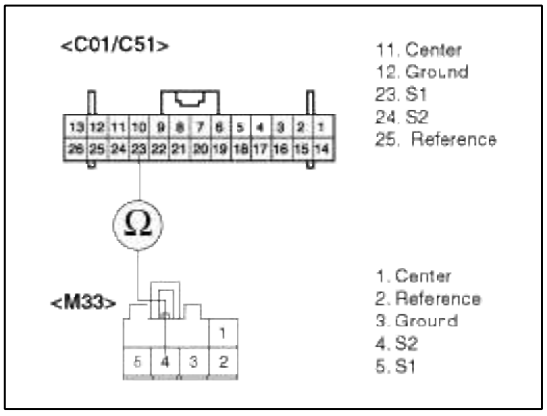
NO

Check for short to ground circuit of Steering angle sensor #2 Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure?

Steering angle sensor #2 signal line open inspection

1. Ignition "OFF"
2. TCCU, Steering angle sensor connector : Disconnect.
3. Measure resistance between terminal 4 of Steering angle sensor harness connector M33 and terminal 24 of TCCU harness connector.

Specification : Approx. 0 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good TCCU or Steering angle sensor and check for proper operation. If the problem is corrected, replace TCCU and then go to "Verification of Vehicle Repair" procedure.

NO

Check for open circuit of Steering angle sensor #2 Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

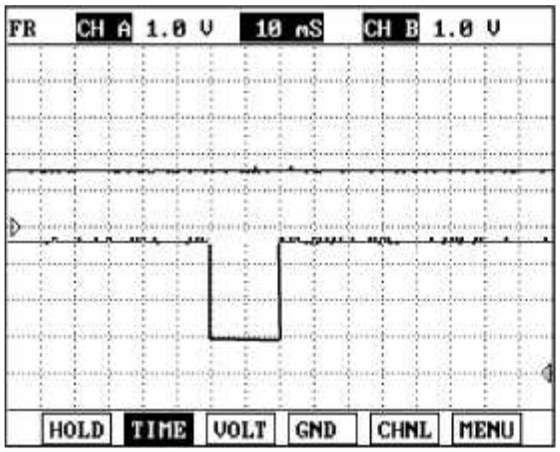
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

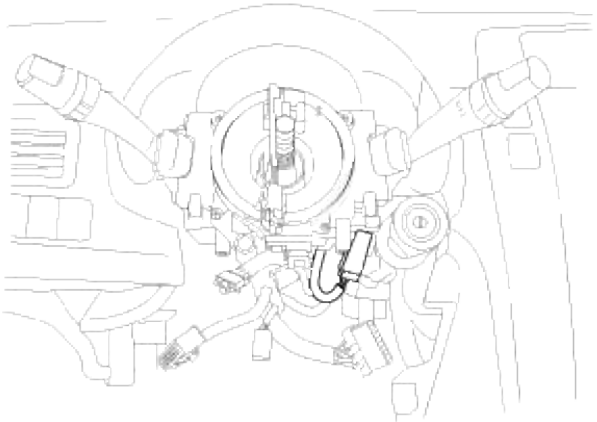
SIGNAL WAVEFROM



[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine conditions.

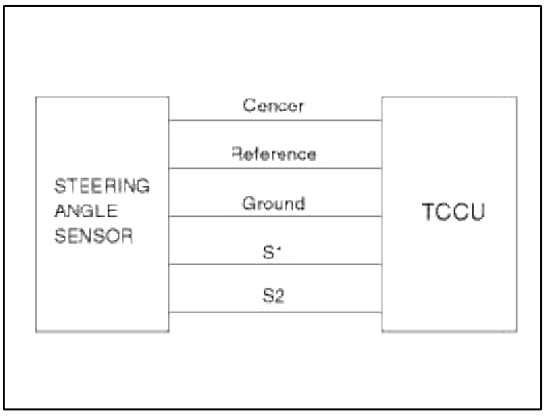
Automatic Transaxle System > Troubleshooting > P1719

COMPONENT LOCATION



GERNERAL DESCRIPTION

Steering angle sensor is a hole plate between the photo-controller LED and the photo transistor. As the hole plate rotates during steering wheel rotation, an electrical signal will be generated depending on whether the LED light passes through the plate to the photo-transistor or not.
This signal which is a angle velocity of steering wheel is made use of sensing the rotating direction & neutrality of steering wheel. In case ABS(ESP) system is applied to the vehicle steering angle sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



DTC DESCRIPTION

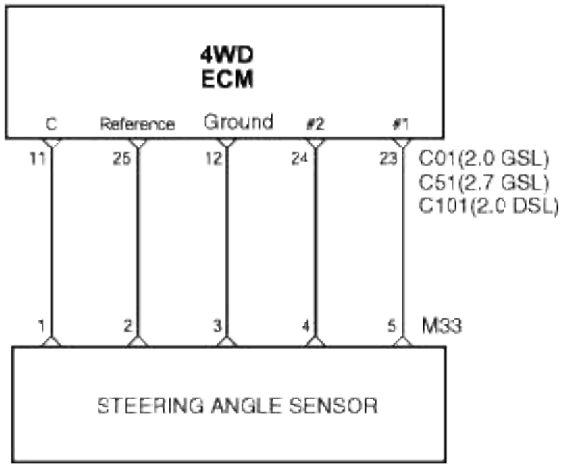
This failure code is related to the Steering angle sensor N and is set if input signal to TCCU is "Loss of signal out of range".
This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) application system and is set if input signal to TCCU is in"Loss of signal out of range".

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• Steering Angle sensor, TCCU connector looseness and poor terminal to wire connection. • Steering angle sensor circuit open/short. • Faulty Steering angle sensor. • Faulty TCCU.
Enable Conditions	• V<4.5 for 1.0 sec self clearing	
Threshold Value	• > 4.5VDC	
Diagnostic Time	• 1 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM

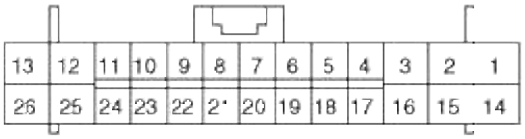
[Circuit Diagram]



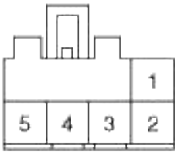
[Connection Information]

Terminal	Connection	Function
1	NO.11	Steering C signal
2	NO.25	5V source
3	NO.12	Ground
4	NO.24	Steering #2 signal
5	NO.23	Steering #1 signal

[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)
C101(2.0DSL)



M33

TERMINAL & 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

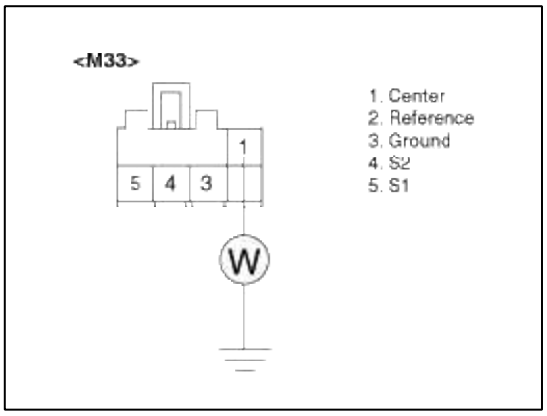
Go to " Steering angle Neutral Signal Inspection " procedure.

Steering angle Neutral Signal Inspection

1. Engine "ON".
2. Connect TCCU, Steering angle sensor connector.
3. Monitor signal waveform between terminal 1 of Steering angle sensor harness connector M33 and chassis ground.

4. Turn steering Wheel to the right or left.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is Steering angle Neutral Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

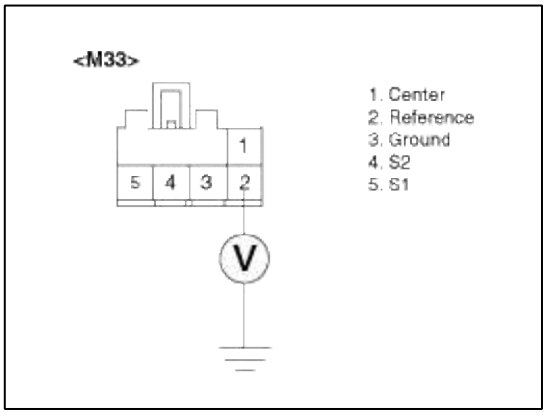
NO

Go to " Steering angle sensor Reference voltage inspection " procedure.

Steering angle sensor Reference voltage inspection

1. Ignition "ON",Engine "OFF".
2. TCCU, Steering angle sensor connector : Connect.
3. Measure voltage between terminal 2 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 5V



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is voltage display near the specified value?

YES

Go to " Steering angle sensor ground harness open circuit inspection " procedure.

NO

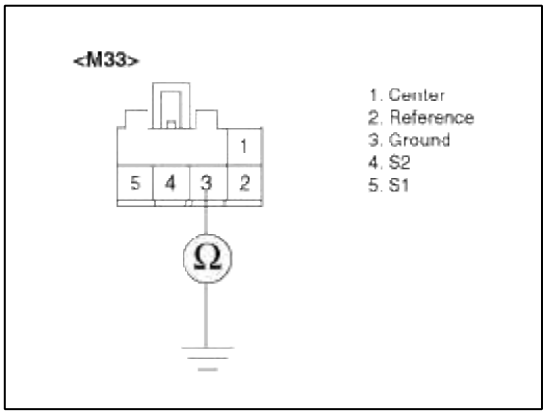
Check for Steering angle sensor Reference harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor ground harness open circuit inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Connect.
3. Measure resistance between terminal 3 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor ground harness open circuit inspection " procedure.

NO

Check for open circuit of Steering angle sensor ground harness.

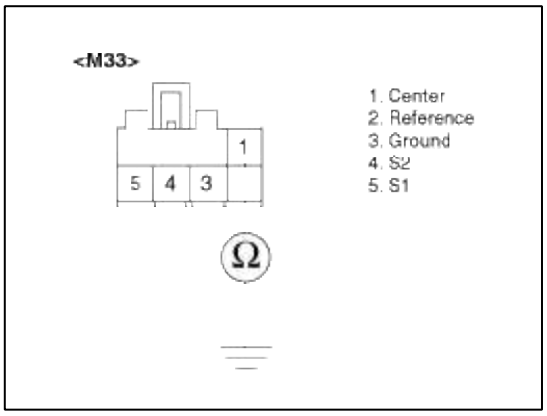
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle Neutral Signal ,short to signal line ground Inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Disconnect.

3. Measure resistance between terminal 1 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle Neutral signal line open Inspection " procedure.

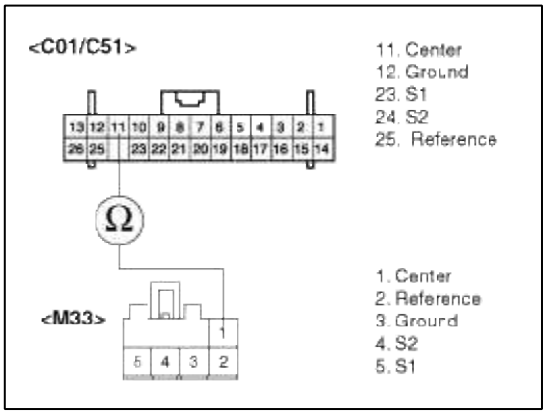
NO

Check for short to ground circuit of Steering angle Neutral Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle Neutral signal open Inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Disconnect.
3. Measure resistance between terminal 1 of Steering angle sensor harness connector M33 and terminal 11 of TCCU harness connector C.

Specification : Approx. 0 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good TCCU or Steering angle sensor and check for proper operation.
If the problem is corrected, replace TCCU and then go to "Verification of Vehicle Repair" procedure.

NO

Check for open circuit of Steering angle sensor Neutral Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

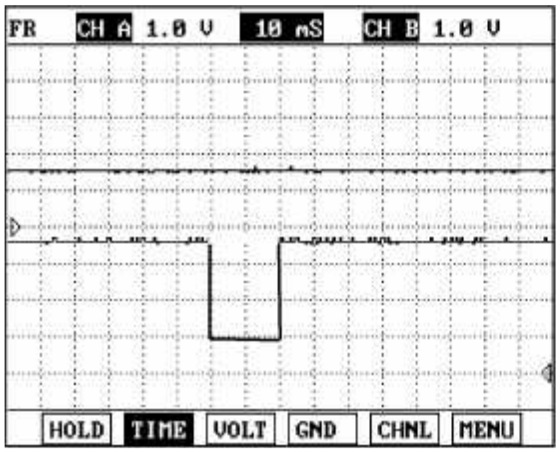
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

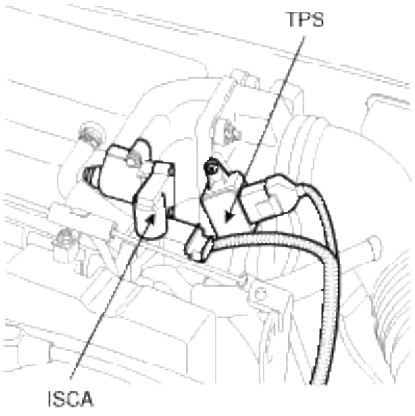
SIGNAL WAVEFROM



[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine conditions.

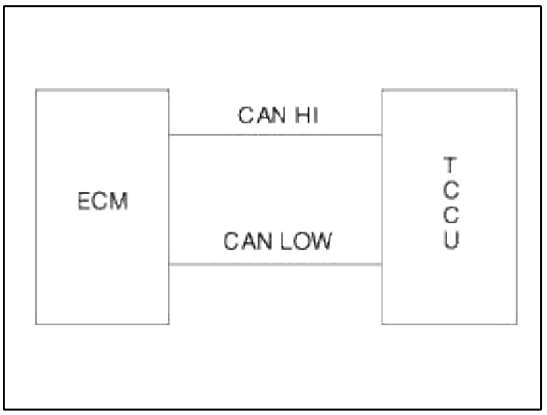
Automatic Transaxle System > Troubleshooting > P1726

COMPONENT LOCATION



GERNERAL DESCRIPTION

The TPS signal is transmitted to the 4WD ECU via CAN communication with the engine ECU. This signal is used as one of the criteria for determining the amount of torque distribution between the front and rear wheel.



DTC DESCRIPTION

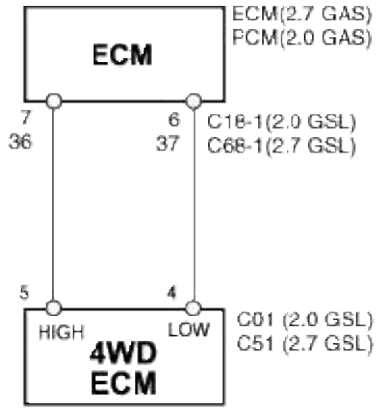
This DTC code is related to TPS and is set If there is no input signal to TCCU or the signal is out of specified range.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• ECM,TCCU connector looseness and poor terminal to wire connection. • CAN HIGH/LOW circuit open/short. • APS(TPS) faulty. • Faulty ECM. • Faulty TCCU.
Enable Conditions	• Message present 1.0 sec self clearing	
Threshold Value	• Input CAN Message : FHH • Can Signal Lost : No Signal	
Diagnostic Time	• 1 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM

[Circuit Diagram]



[Connection Information]

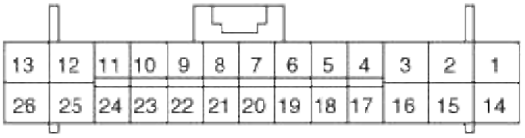
<2.0 GASOLINE>

Terminal	Connection	Furction
C18-1 NO 7	C01 NO.5	CAN (HIGH)
C18-1 NO 6	C01 NO.4	CAN (LOW)

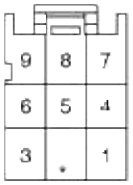
<2.7 GASOLINE>

Terminal	Connection	Furction
C68-1 NO.36	C51 NO.5	CAN (HIGH)
C68-1 NO.37	C51 NO.4	CAN (LOW)

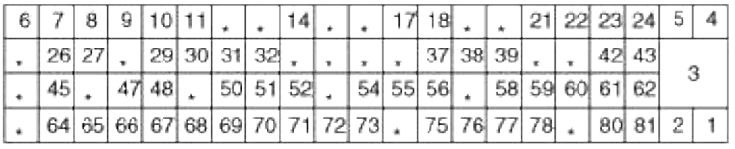
[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)



C68-1



C18-1

TERMINAL & 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

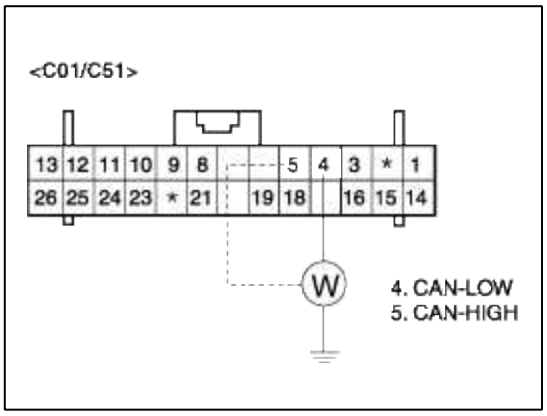
Go to " CAN Signal Inspection " procedure.

CAN Signal Inspection

1. Ignition ON, Engine : OFF.
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 and 5 of TCCU harness connector and chassis ground.

4. Shift to N Range.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

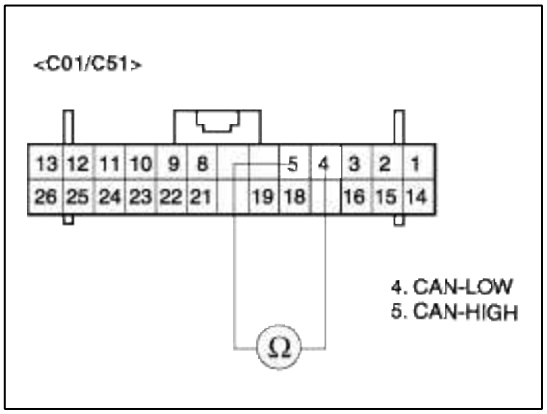
NO

Go to "CAN comm. Line Inspection" procedure.

CAN comm. Line Inspection

1. Ignition "OFF".
2. Measure resistance between terminal "4" of the TCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of Engine control module.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

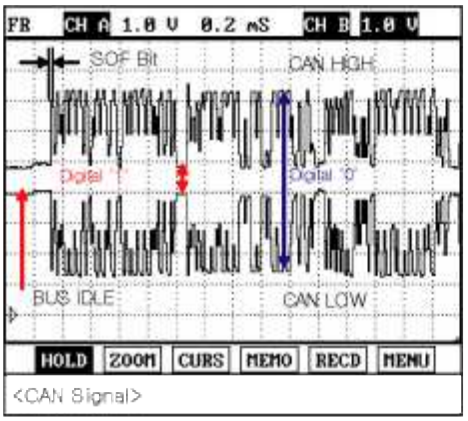
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

SIGNAL WAVEFROM



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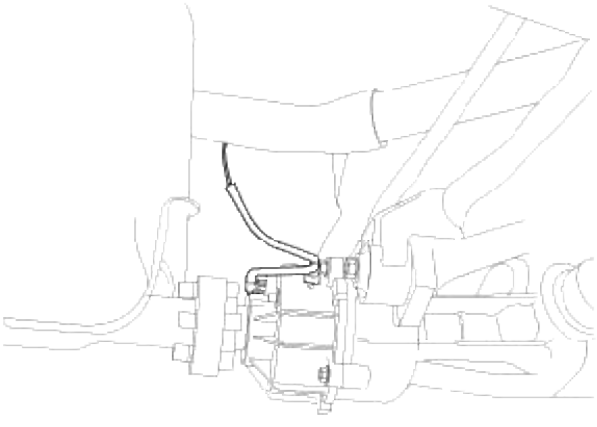
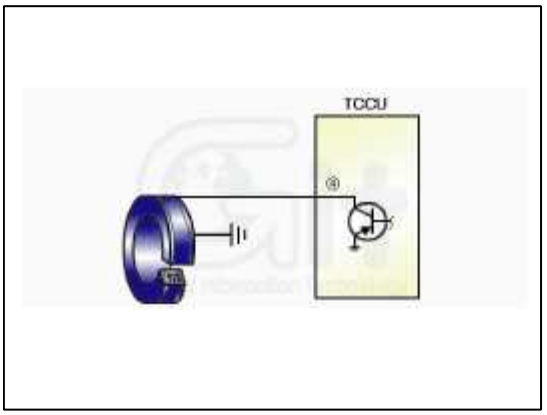
COMPONENT LOCATION



GERNERAL DESCRIPTION

4WD ECM(TCCU) uses voltage to control EMC (Electric Magnet Clutch). EMC distributes suitable toque with slippage of multi-plate clutch.



DTC DESCRIPTION

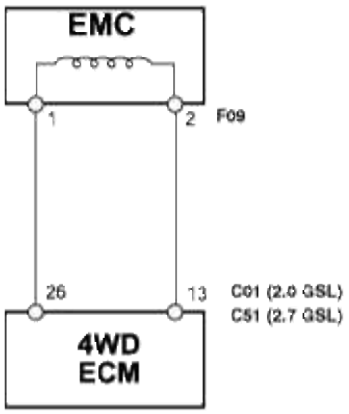
This DTC code is related to the EMC and is set If EMS harness has an open or short to battery source.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Short/ Open to Battery	• Power supply malfunction. • .EMC,TCCU connector looseness and poor terminal to wire connection. • EMC circuit open or short to battery. • Faulty EMC motor. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• 25 occurances	
Diagnostic Time		
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM

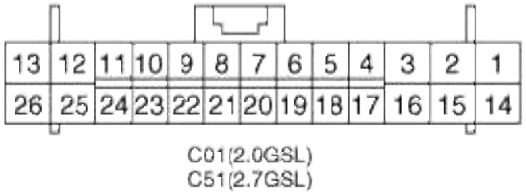
[Circuit Diagram]

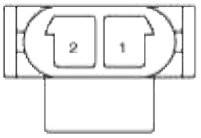


[Connection Information]

Terminal	Connection	Function
F09 No.1	C01/C51 No.26	EMC output
F09 No.2	C01/C51 No.13	EMC GND

[Harness Connector]





F09

TERMINAL & 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

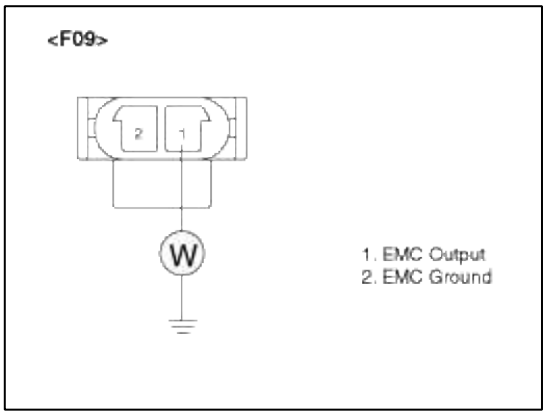
Go to "EMC Signal Inspection " procedure.

EMC Signal Inspection

1. Engine : Idling.
2. EMC connector : Connect.
3. Monitor signal waveform between terminal 1 of F09 harness connector and chassis ground.

4. Shift to N Range.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is EMC Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

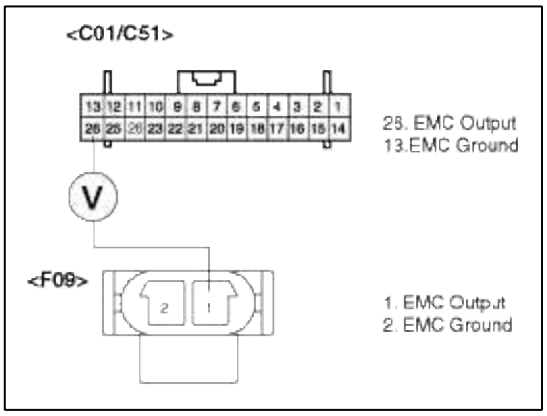
NO

Go to " EMC wiring battery short Inspection " procedure.

EMC wiring battery short Inspection

1. Ignition "OFF".
2. Electric Magnet Valve Clutch,TCCU connector : Disconnect.
3. Ignition "ON"
4. Measure voltage between terminal 1 or 2 of Electric Magnet Valve Clutch harness connector F09 and terminal 26 or 13 of TCCU harness connector.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is resistance display near the specified value?

YES

Go to " EMC harness open Inspection " procedure.

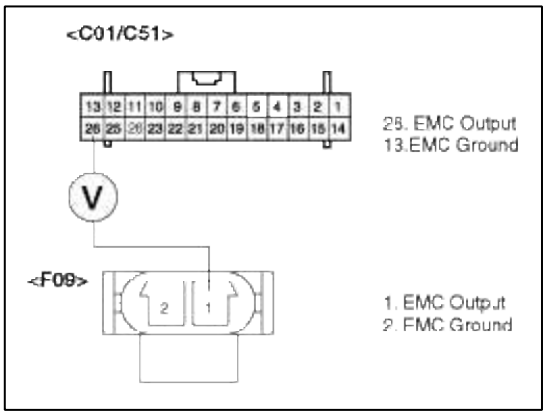
NO

Check for short to battery in EMC harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

EMC harness open Inspection

1. Ignition "OFF".
2. Electric Magnet Valve Clutch, TCCU connector : Disconnect.
3. Measure resistance between terminal 1 or 2 of Electric Magnet Valve Clutch harness connector F09 and terminal 26 or 13 of TCCU harness connector.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition

4. Is resistance display near the specified value?

YES

Go to " Component inspection " procedure

NO

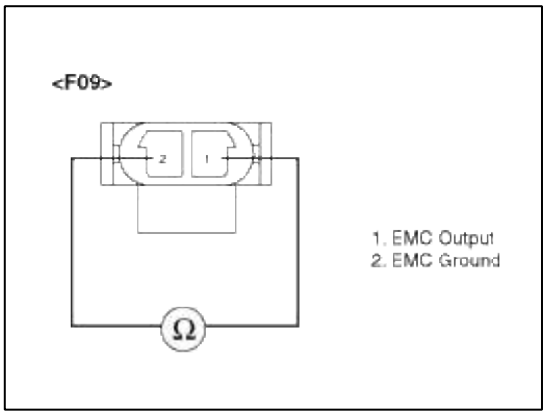
Check for open in EMC harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition OFF.
2. F09 Electric Magnet Valve Clutch connector : Disconnect.

3. Measure resistance between 1 & 2

Specification : Approx. 1.8 ~ 2.2 Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "EMC coil" and check for proper operation.
If the problem is corrected, replace "EMC coil" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

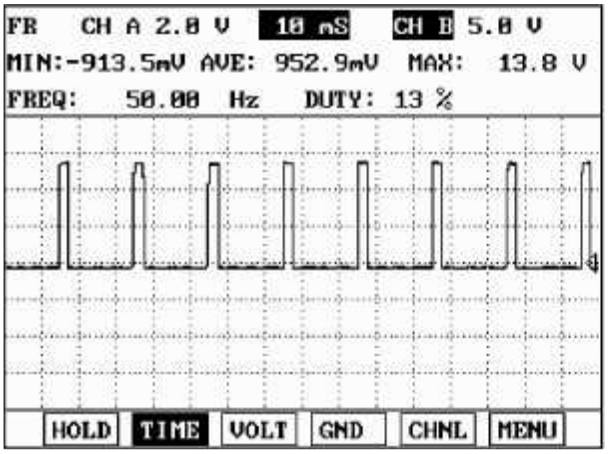
YES

Go to the applicable troubleshooting procedure.

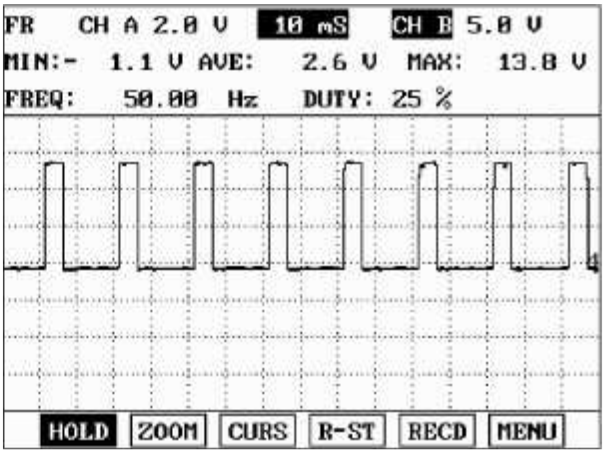
NO

System is performing to specification at this time.

SIGNAL WAVEFROM



[Idling]

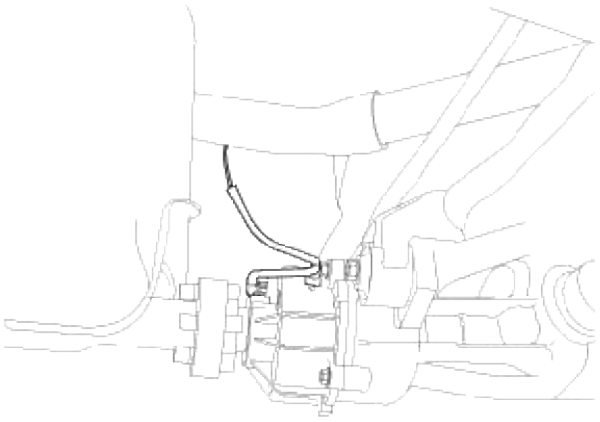


[Throttle Valve Open]

[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine condition.

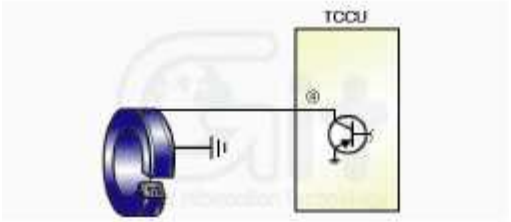
Automatic Transaxle System > Troubleshooting > P1729

COMPONENT LOCATION



GERNERAL DESCRIPTION

4WD ECM(TCCU) uses voltage to control EMC (Electric Magnet Clutch). EMC distributes suitable toque with slippage of multi-plate clutch.



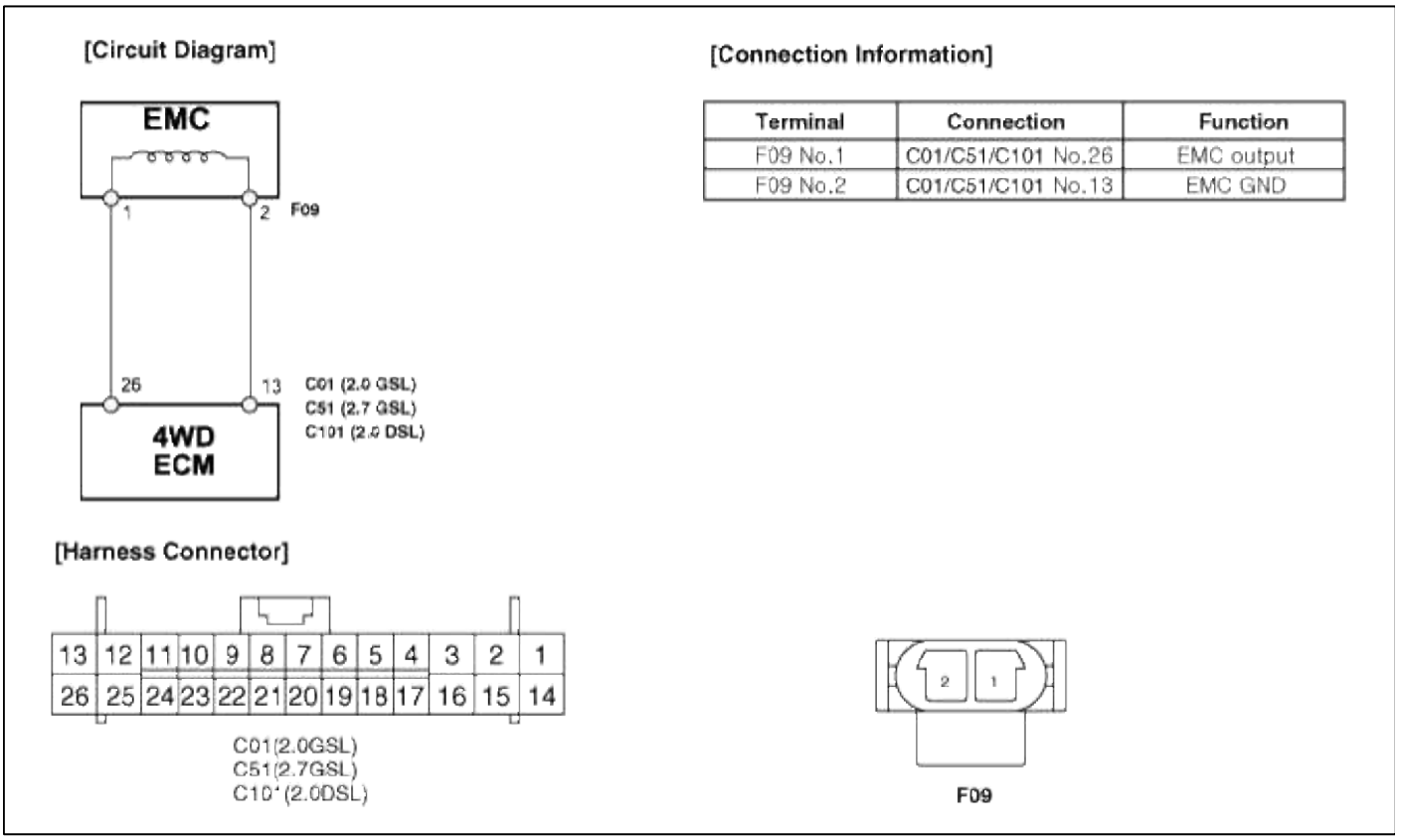
DTC DESCRIPTION

This DTC code is related to the EMC and is set If EMS harness has an short or short to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Short to Ground	• EMC,TCCU connector looseness and poor terminal to wire connection. • EMC circuit open or short to ground.. • Faulty EMC motor. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• 25 occurances	
Diagnostic Time		
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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.

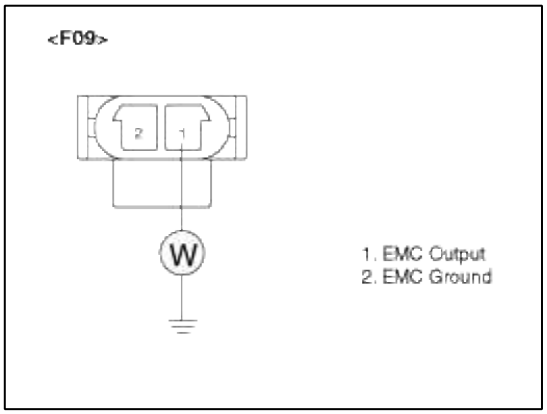
NO

Go to "EMC Signal Inspection " procedure.

EMC Signal Inspection

1. Engine : Idling.
2. EMC connector : Connect.
3. Monitor signal waveform between terminal 1 of F09 harness connector and chassis ground.
4. Shift to N Range.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is EMC Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

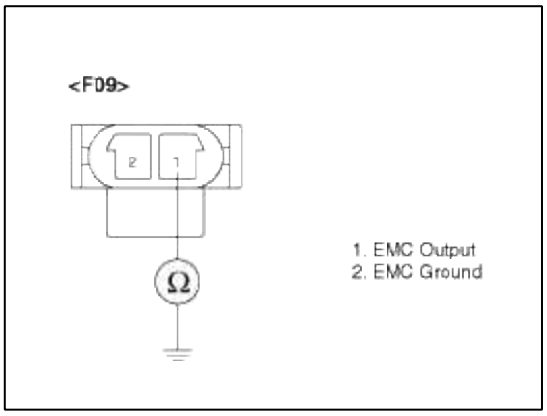
Go to " EMC wiring ground short Inspection " procedure.

EMC wiring ground short Inspection

1. Ignition "OFF".
2. Electric Magnet Valve Clutch connector : Disconnect.
3. Measure resistance between terminal 1 of Electric Magnet Valve Clutch harness connector F09 and chassis ground.

4. Repeat step 3 for the other pin.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is resistance display near the specified value?

YES

Go to " EMC wiring short Inspection " procedure.

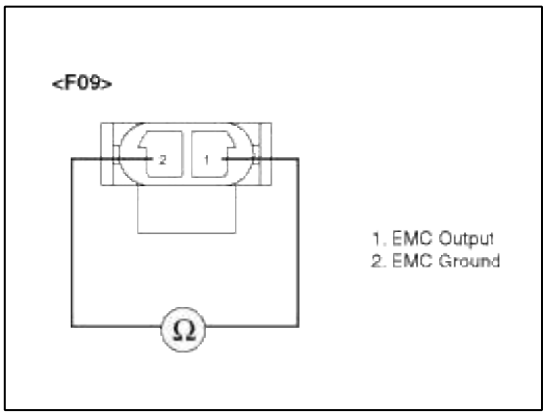
NO

Check for short to ground in EMC harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

EMC wiring short Inspection

1. Ignition "OFF".
2. Electric Magnet Valve Clutch, TCCU connector : Disconnect.
3. Measure resistance between 1 & 2.

Specification : ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition

4. Is resistance display near the specified value?

YES

Go to " Component inspection " procedure.

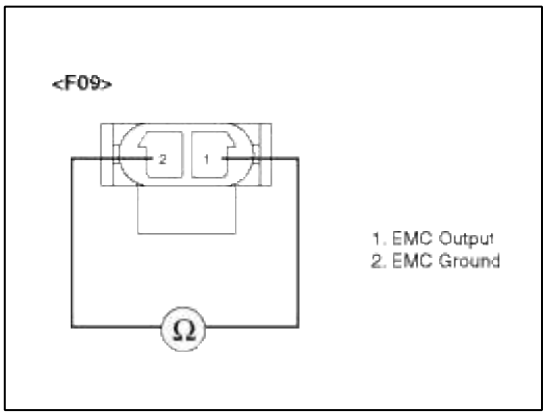
NO

Check for open in EMC harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition OFF.
2. F09 Electric Magnet Valve Clutch connector : Disconnect.
3. Measure resistance between 1 & 2

Specification : Approx. 1.8 ~ 2.2 Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "EMC coil" and check for proper operation.
If the problem is corrected, replace "EMC coil" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

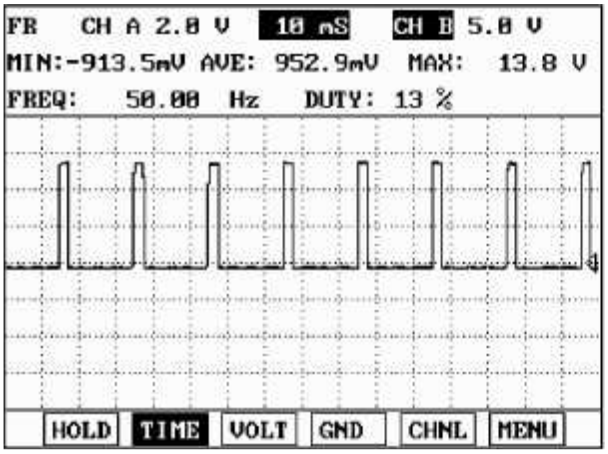
YES

Go to the applicable troubleshooting procedure.

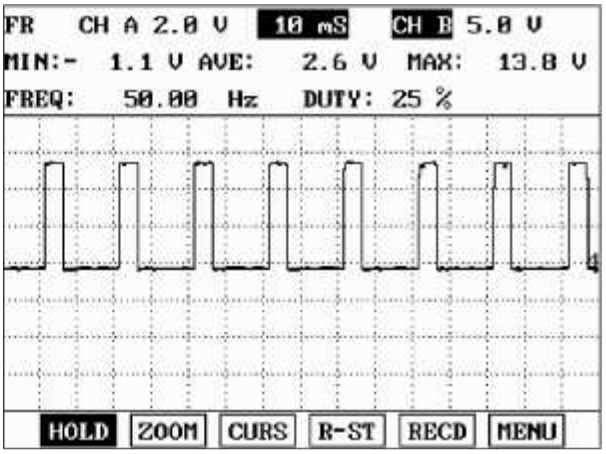
NO

System is performing to specification at this time.

SIGNAL WAVEFROM



[Idling]



[Throttle Valve Open]

[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine condition.

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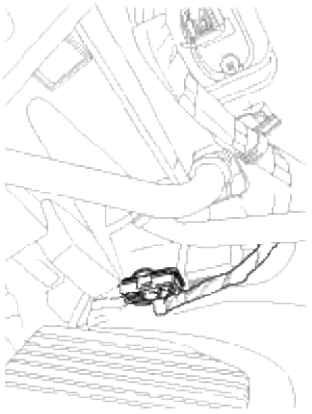
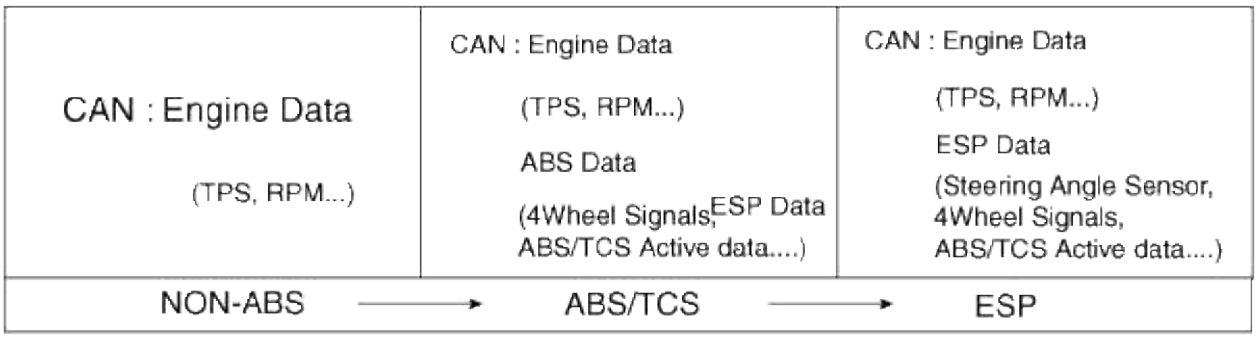
COMPONENT LOCATION



GERNERAL DESCRIPTION

The TPS signal is transmitted to the 4WD ECU via CAN communication with the engine ECU. This signal is used as one of the criteria for determining the amount of torque distribution between the front and rear wheel.



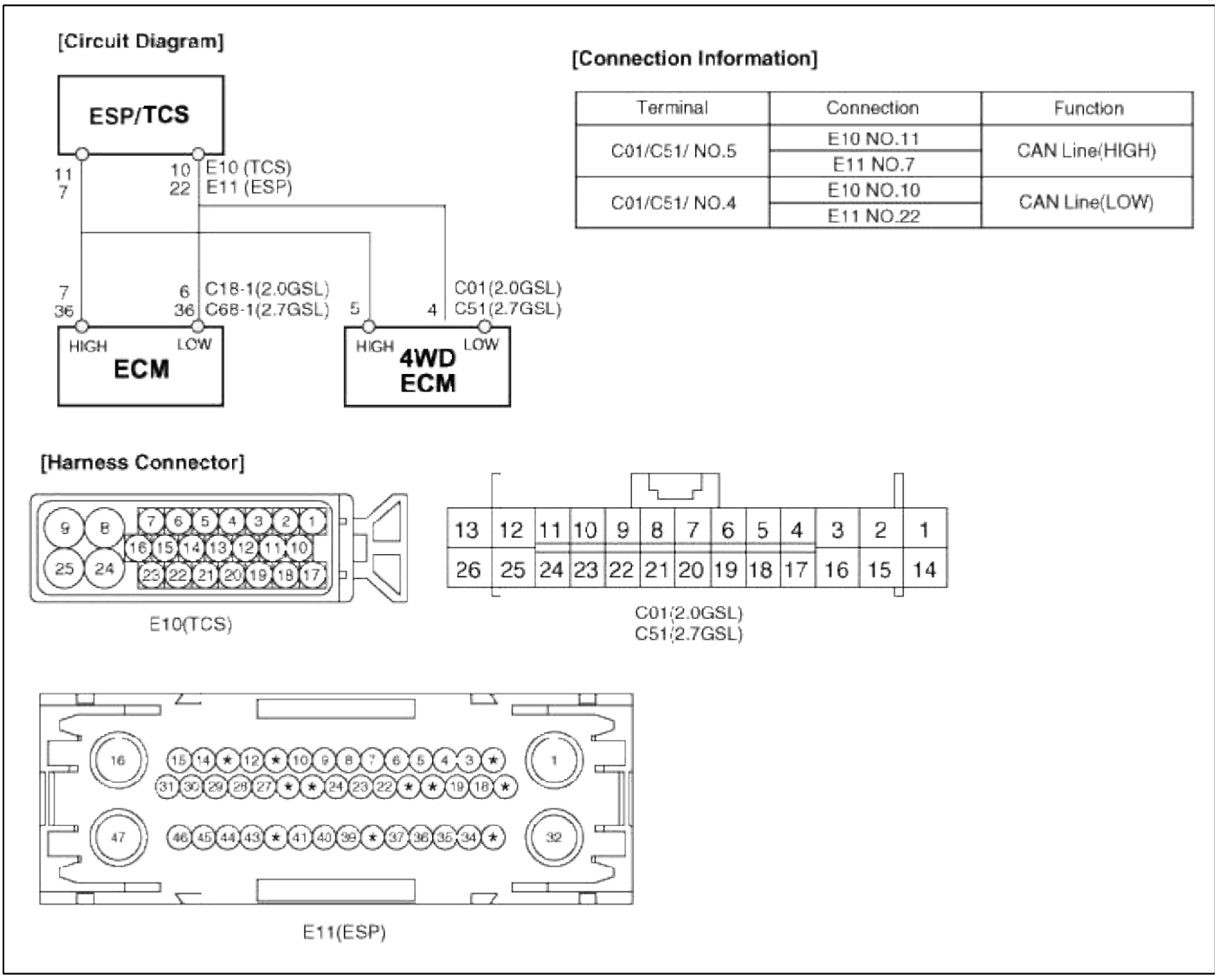
DTC DESCRIPTION

This failure code is set if CAN BUS ERROR that means wrong TCCU installation is continued for more than 1sec.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Invalid part number	• Part Number. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• 1 occurances	
Diagnostic Time	•	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



VERIFICATION OF VEHICLE REPAIR

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

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

YES

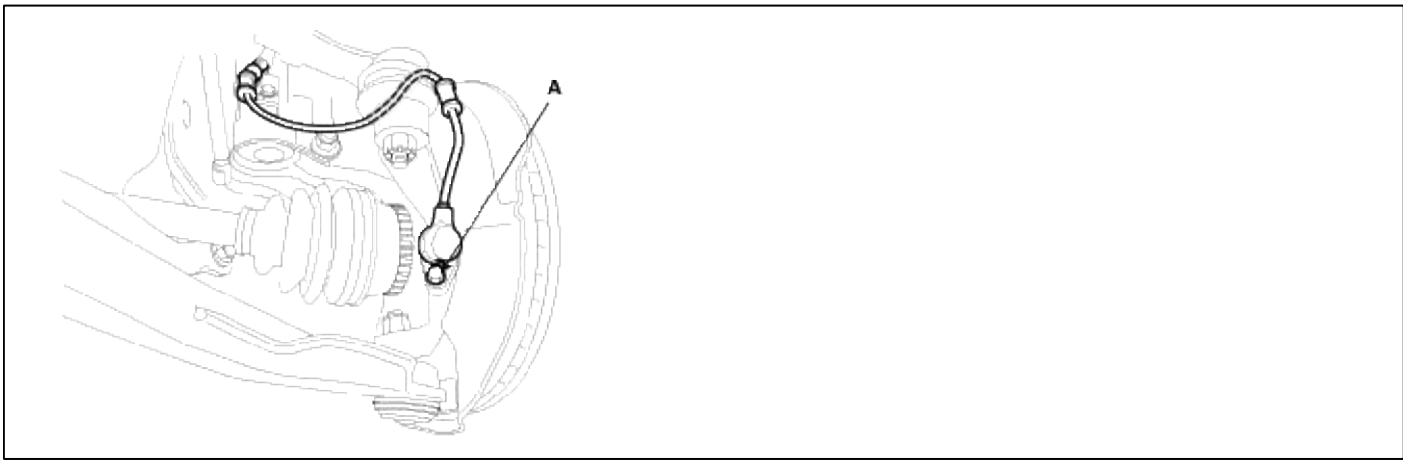
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Automatic Transaxle System > Troubleshooting > P1750A

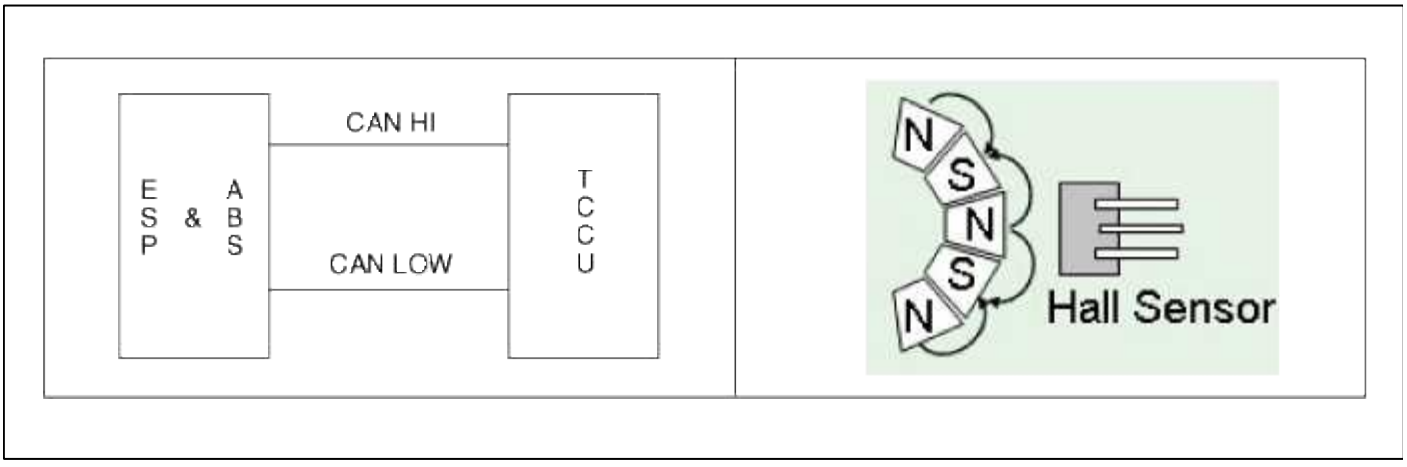
COMPONENT LOCATION



GERNERAL DESCRIPTION

Wheel speed sensor is active hall-sensor type. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

In case ABS(or ESP) system is applied to the vehicle, wheel speed sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



DTC DESCRIPTION

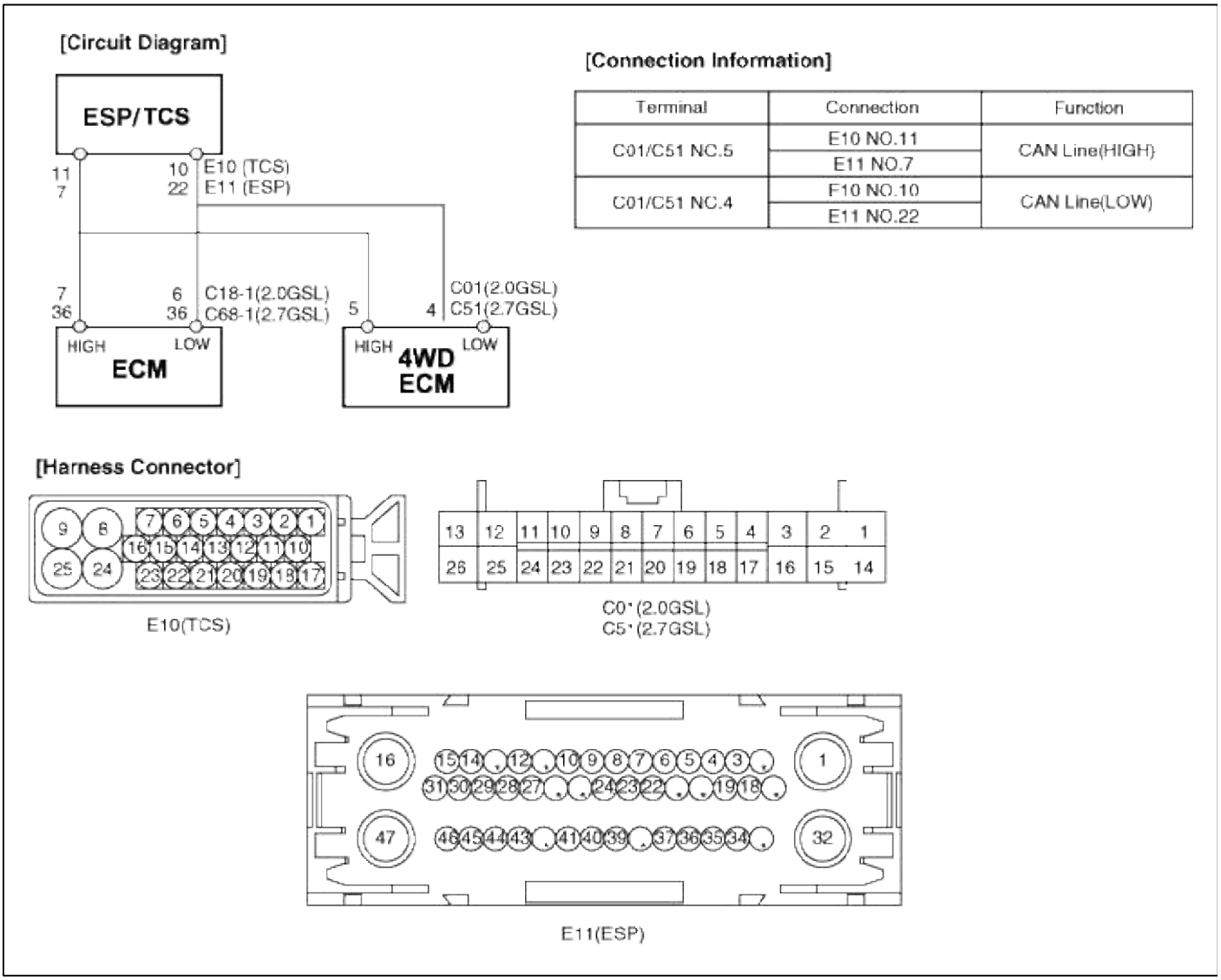
This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) and is set if

there is no input signal to TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • Wheel sensor comm line circuit open/short. • Faulty Wheel sensor. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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.

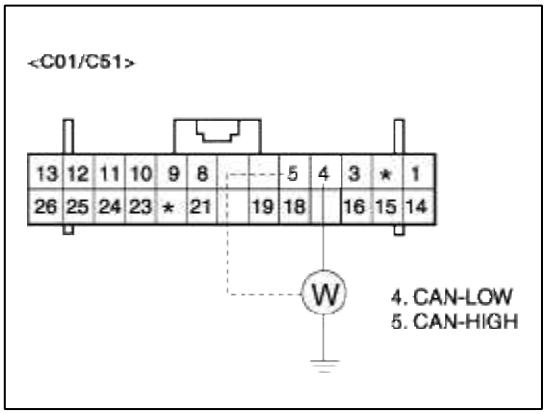
NO

Go to " CAN(SPEED SENSOR)comm. Line Signal Inspection " procedure.

CAN(SPEED SENSOR)comm. Line Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.
4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(FLSS)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

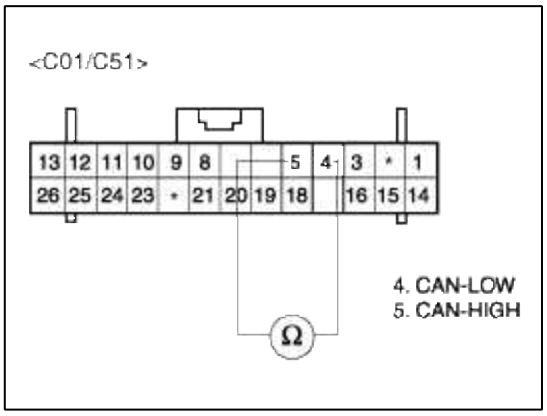
Go to "CAN(SPEED SENSOR) comm. Line Inspection" procedure.

CAN(SPEED SENSOR) comm. Line Inspection

1. Ignition "OFF".

2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

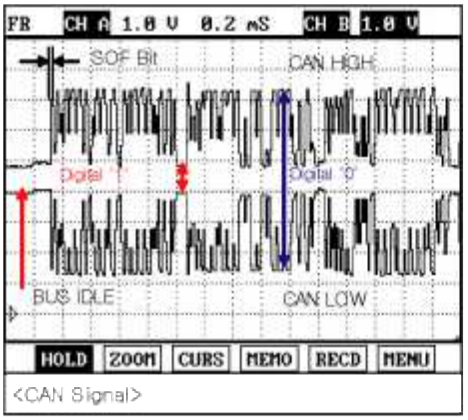
YES

Go to the applicable troubleshooting procedure.

NO

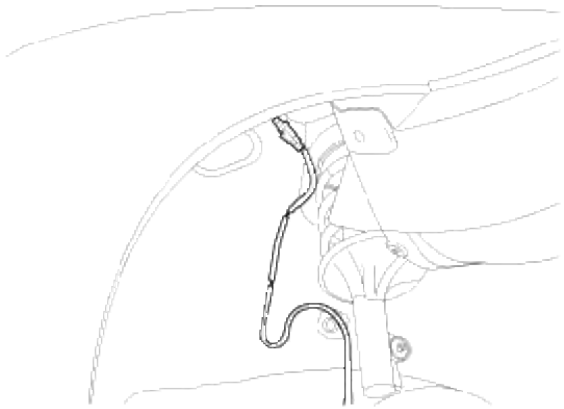
System is performing to specification at this time.

SIGNAL WAVEFROM



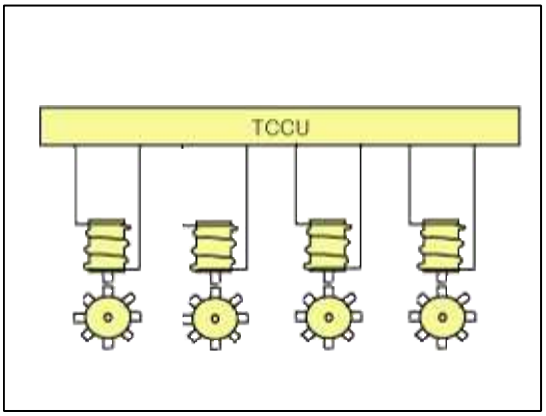
Automatic Transaxle System > Troubleshooting > P1750B

COMPONENT LOCATION



GERNERAL DESCRIPTION

When the tone wheel rotates, adjacent to the sensor pole component, an alternating current signal is generated in the coil with a frequency proportional to the wheel speed.
Wheel Speed Sensor generates a signal which is sent to TCCU.



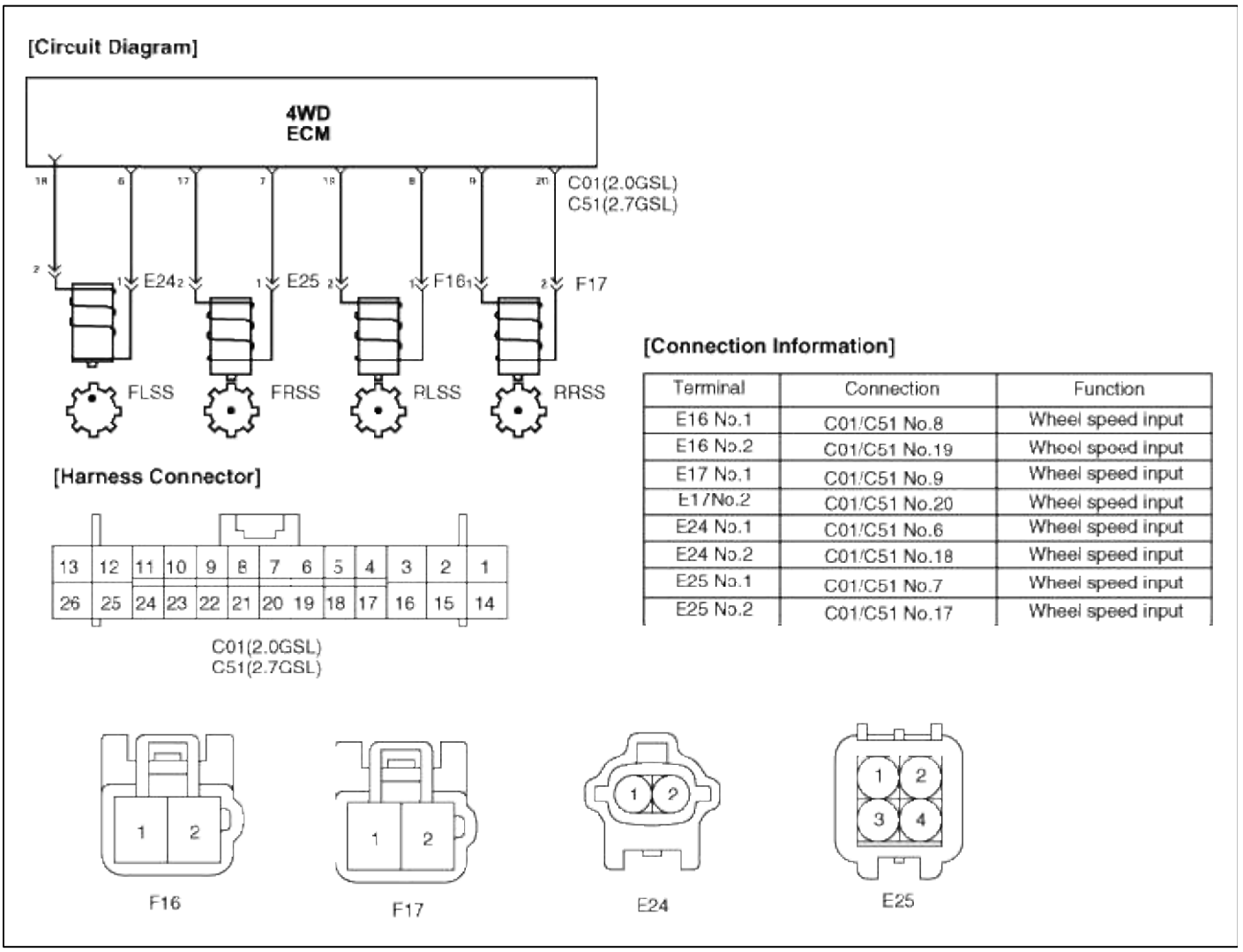
DTC DESCRIPTION

This failure code is related to the Wheel Speed Sensor and is set if no signal is received by TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• Wheel speed sensor,TCCU connector looseness and poor terminal to wire connection • wheel speed circuit open or short to battery • wheel speed sensor airgap • Faulty wheel speed. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



Terminal	Connection	Function
E16 No.1	C01/C51 No.8	Wheel speed input
E16 No.2	C01/C51 No.19	Wheel speed input
E17 No.1	C01/C51 No.9	Wheel speed input
E17No.2	C01/C51 No.20	Wheel speed input
E24 No.1	C01/C51 No.6	Wheel speed input
E24 No.2	C01/C51 No.18	Wheel speed input
E25 No.1	C01/C51 No.7	Wheel speed input
E25 No.2	C01/C51 No.17	Wheel speed input

TERMINAL & 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.

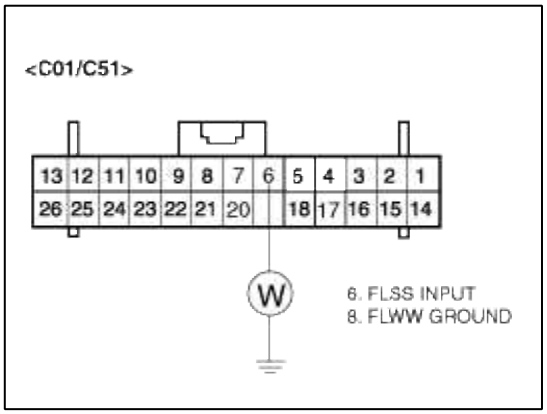
NO

Go to " FLSS Signal Inspection" procedure.

FLSS Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 6 of TCCU harness connector and chassis ground.
4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is FLSS Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

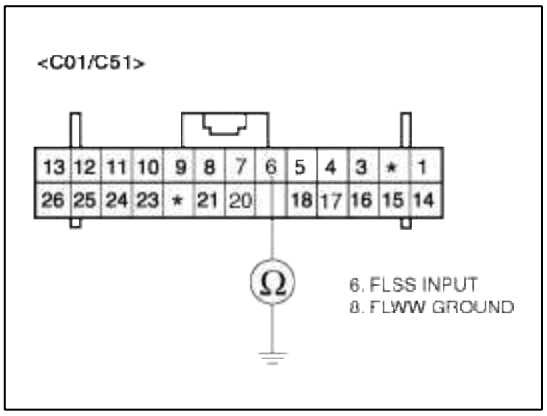
Go to " FLSS input circuit line ground short inspection " procedure.

FLSS input circuit line ground short inspection

1. Ignition "OFF".
2. TCCU, FLSS connector : Disconnect.

3. Measure resistance between terminal 6 of TCCU harness connector and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " FLSS input circuit line open inspection " procedure.

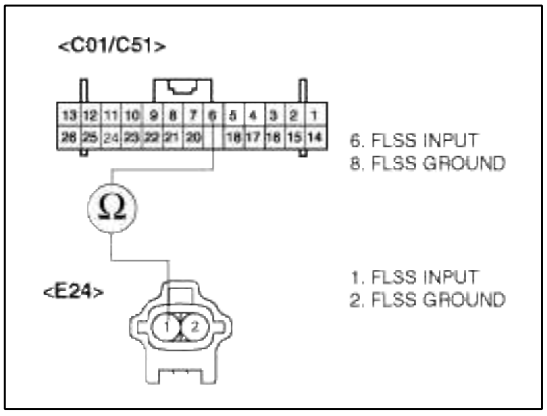
NO

Check for ground to short circuit of FLSS circuit
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

FLSS input circuit line open inspection

1. Ignition OFF
2. TCCU, FLSS connector : Disconnect.
3. Measure resistance between terminal 6 of TCCU harness connector and terminal 1 of FLSS harness connector E24 .

Specification : Approx. 1Ω below



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " FLSS ground line open inspection " procedure.

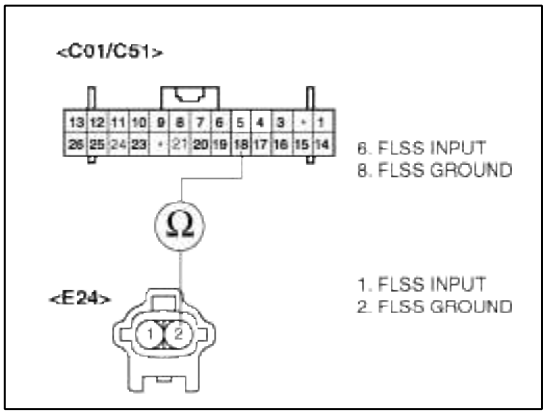
NO

Check for open circuit of FLSS circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

FLSS ground line open inspection

1. Ignition OFF
2. TCCU, FLSS connector : Disconnect.
3. Measure resistance between terminal 8 of TCCU harness connector and terminal 2 of FLSS harness connector E24.

Specification : Approx. 1Ω below



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to "Component inspection" procedure.

NO

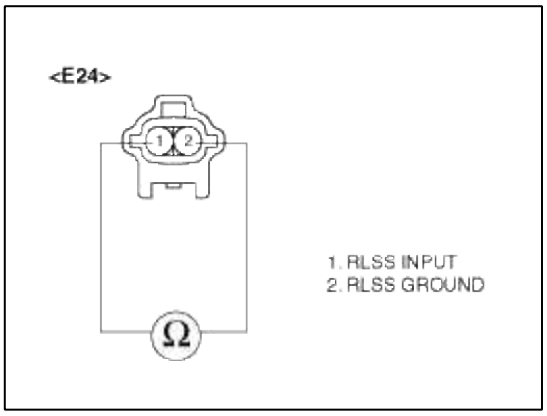
FLSS ground circuit open checking.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition OFF
2. Speed Sensor,TCCU connector : Disconnect.

3. Measure resistance between terminal 1 and 2 of FLSS harness connector E24.

Specification : Approx. 1.1±0.05Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to"Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "Speed Sensor" and check for proper operation. If the problem is corrected, replace "Speed Sensor" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

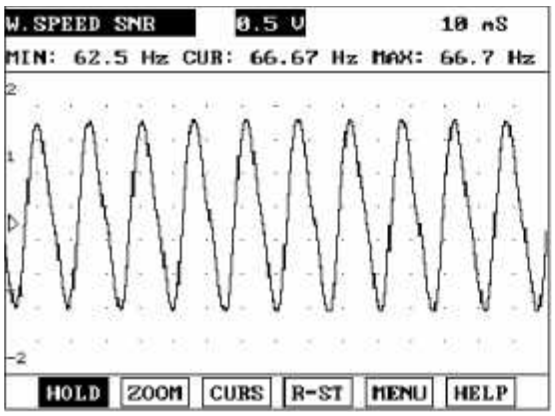
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

SIGNAL WAVEFROM



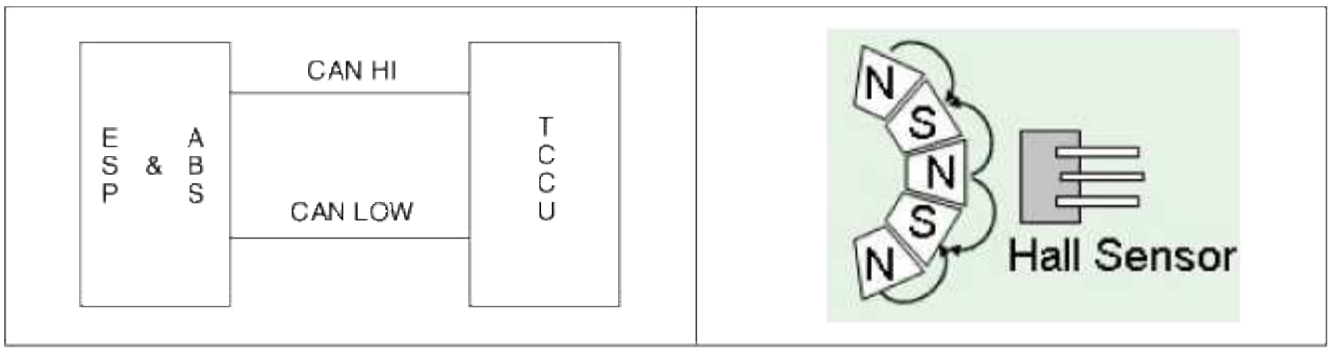
[CAUTION]The above value is just for reference. The actual value may differ from it according to various engine condition.

Automatic Transaxle System > Troubleshooting > P1751A

COMPONENT LOCATION

GERNERAL DESCRIPTION

Wheel speed sensor is active hall-sensor type and good at temperature and noise charateristic. 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.
In case ABS(or ESP) system is applied to the vehicle, wheel speed sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



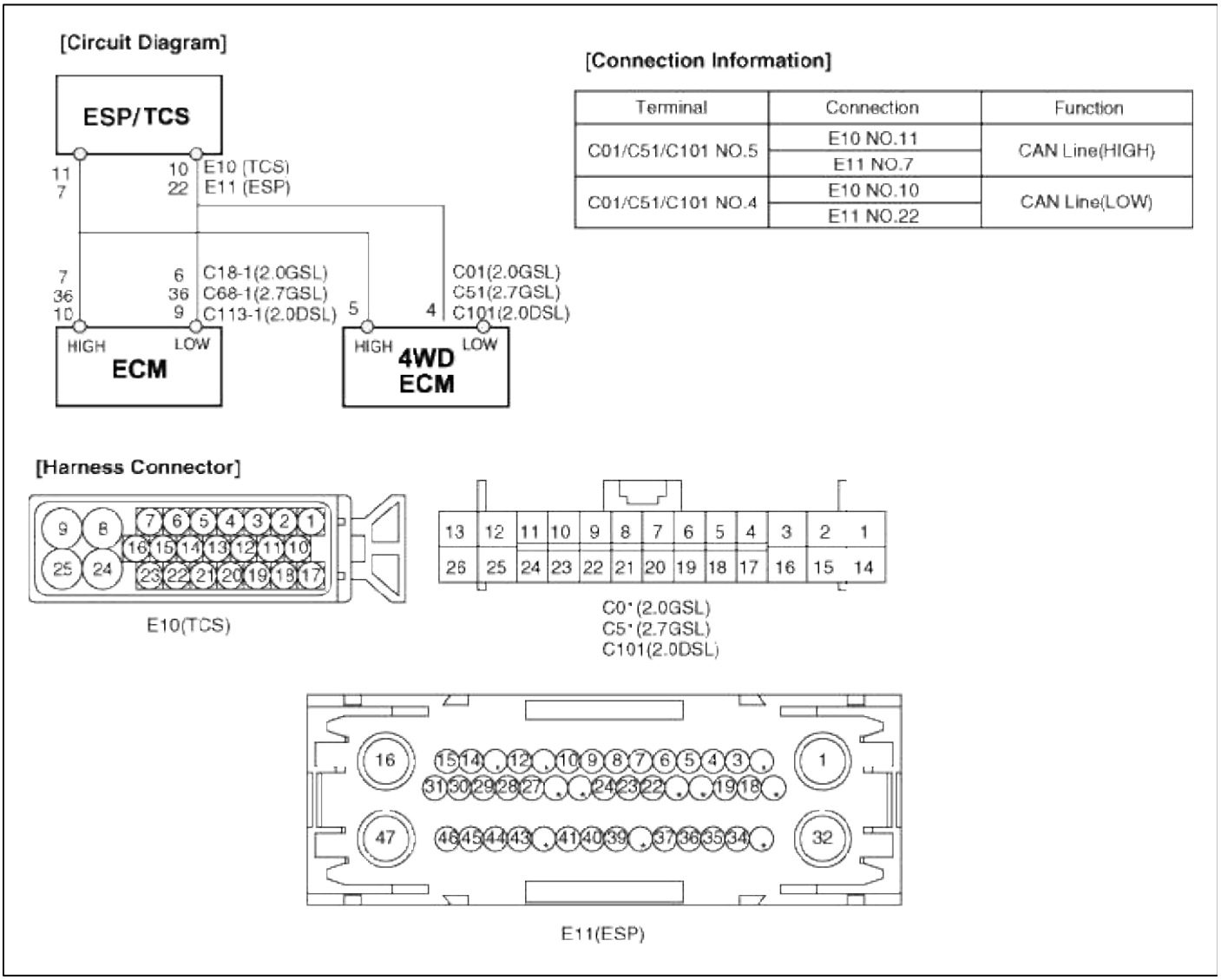
DTC DESCRIPTION

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • Wheel sensor comm line circuit open/short. • Faulty Wheel sensor. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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.

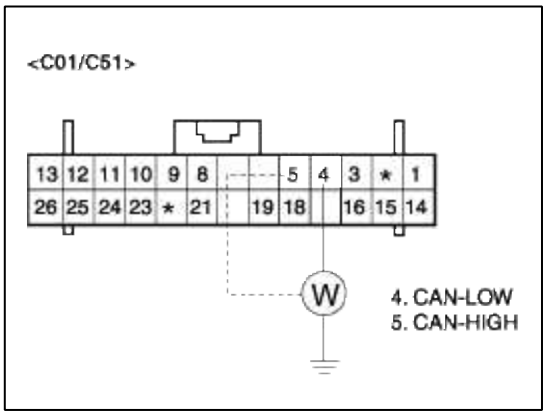
NO

Go to " CAN(SPEED SENSOR)comm. Line Signal Inspection " procedure.

CAN(SPEED SENSOR)comm. Line Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.
4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(FRSS)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

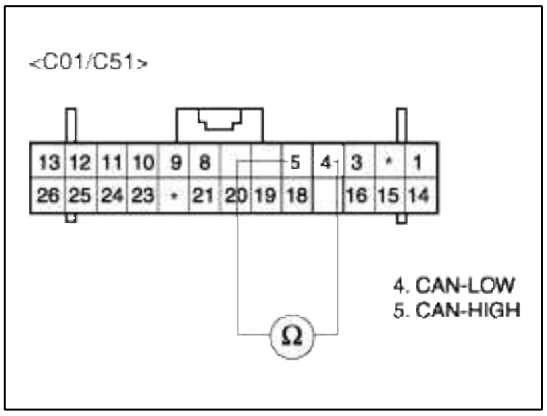
Go to "CAN(SPEED SENSOR) comm. Line Inspection" procedure.

CAN(SPEED SENSOR) comm. Line Inspection

1. Ignition "OFF".

2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

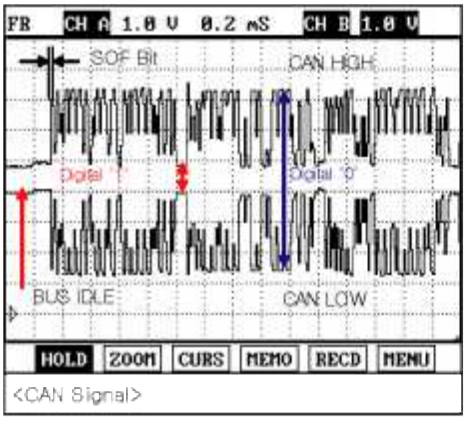
YES

Go to the applicable troubleshooting procedure.

NO

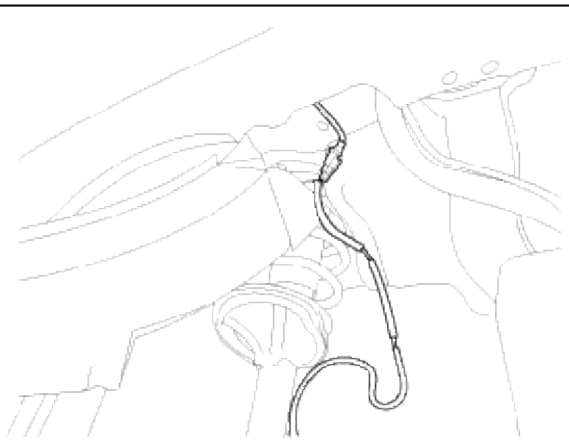
System is performing to specification at this time.

SIGNAL WAVEFROM



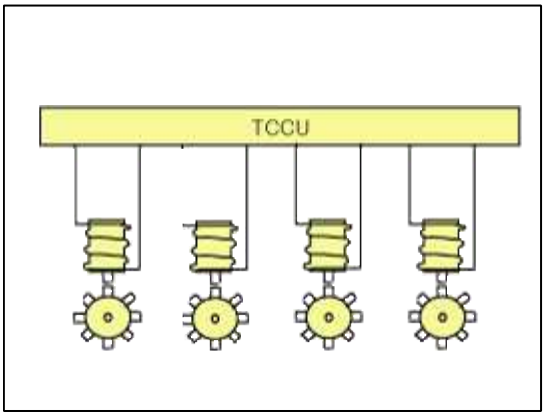
Automatic Transaxle System > Troubleshooting > P1751B

COMPONENT LOCATION



GERNERAL DESCRIPTION

When the tone wheel rotates, adjacent to the sensor pole component, an alternating current signal is generated in the coil with a frequency proportional to the wheel speed.
Wheel Speed Sensor generates a signal which is sent to TCCU.



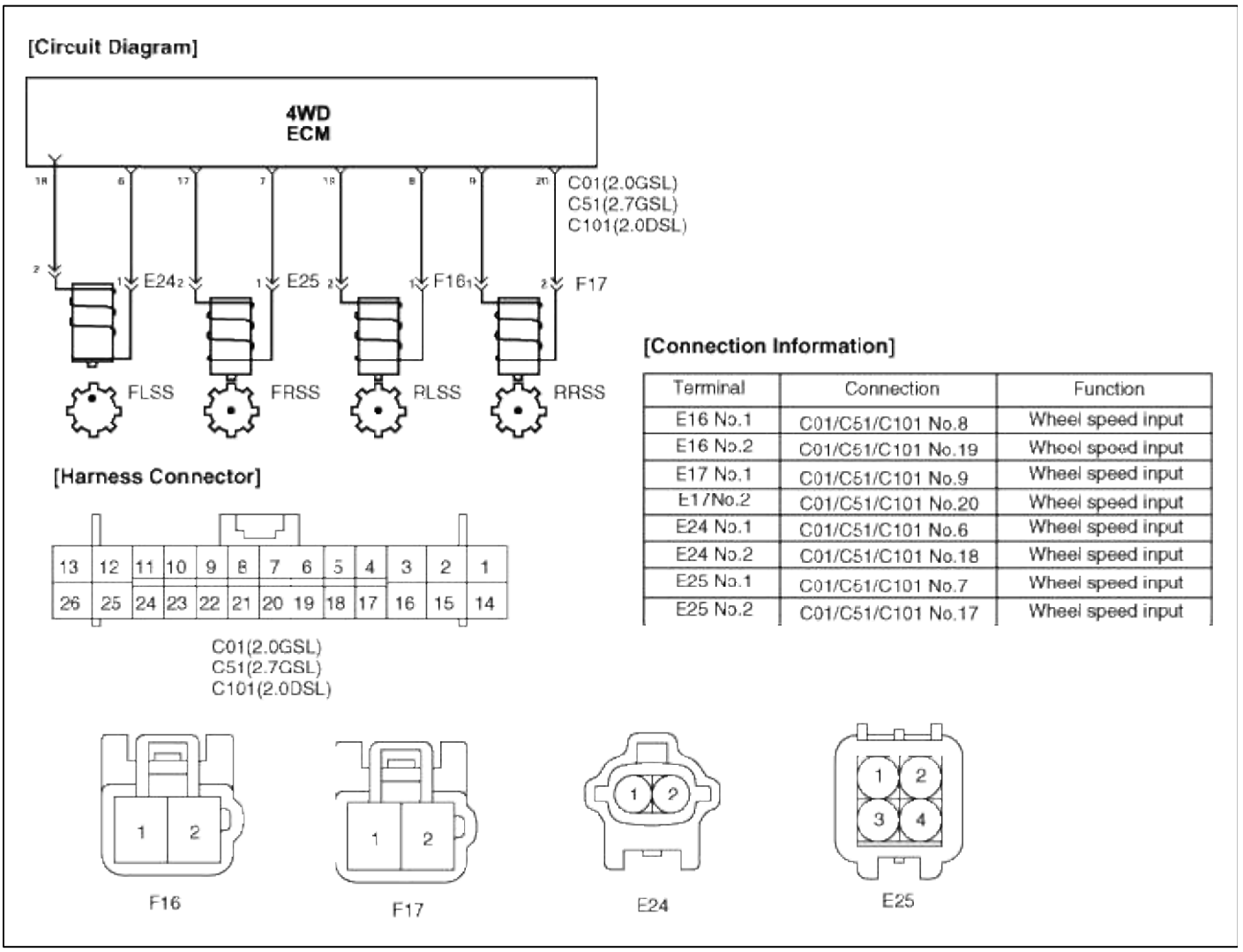
DTC DESCRIPTION

This failure code is related to the Wheel Speed Sensor and is set if no signal is received by TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• Wheel speed sensor,TCCU connector looseness and poor terminal to wire connection. • wheel speed circuit open or short to battery. • wheel speed sensor airgap • Faulty wheel speed. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



Terminal	Connection	Function
E16 No.1	C01/C51/C101 No.8	Wheel speed input
E16 No.2	C01/C51/C101 No.19	Wheel speed input
E17 No.1	C01/C51/C101 No.9	Wheel speed input
E17No.2	C01/C51/C101 No.20	Wheel speed input
E24 No.1	C01/C51/C101 No.6	Wheel speed input
E24 No.2	C01/C51/C101 No.18	Wheel speed input
E25 No.1	C01/C51/C101 No.7	Wheel speed input
E25 No.2	C01/C51/C101 No.17	Wheel speed input

TERMINAL & 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.

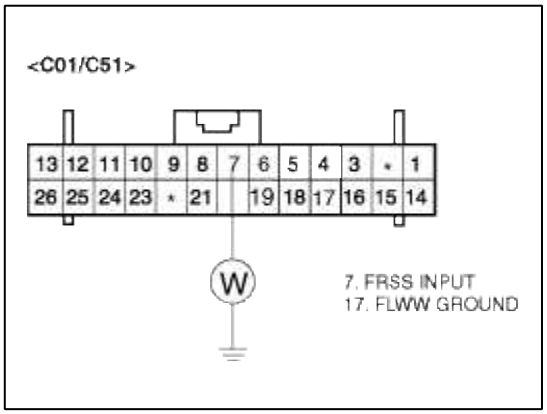
NO

Go to " FRSS Signal Inspection" procedure.

FRSS Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 7 of TCCU harness connector and chassis ground.
4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is FRSS Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

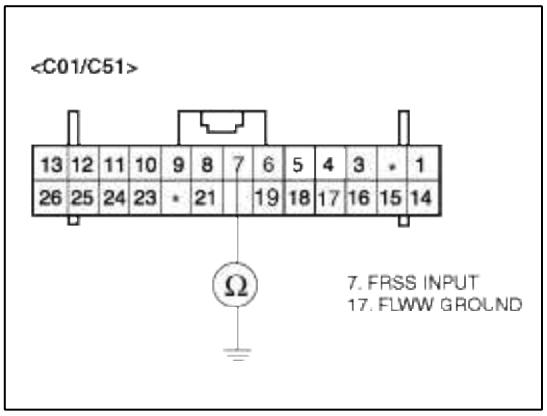
Go to " FRSS input circuit line ground short inspection " procedure.

FRSS input circuit ground short inspection

1. Ignition "OFF".
2. TCCU, FRSS connector : Disconnect.

3. Measure resistance between terminal 7 of TCCU harness connector and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " FRSS input circuit line open inspection " procedure.

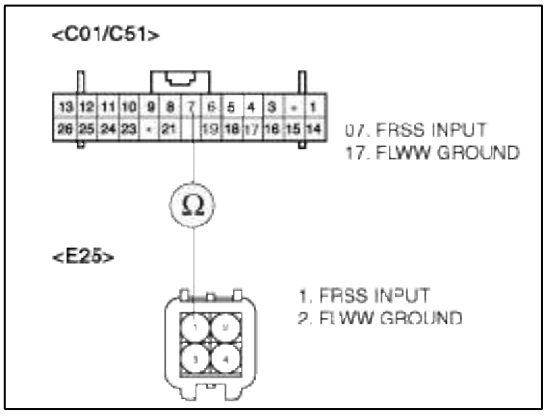
NO

Check for ground to short circuit of FRSS circuit
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

FRSS input circuit open inspection

1. Ignition OFF
2. TCCU, FRSS connector : Disconnect.
3. Measure resistance between terminal 7 of TCCU harness connector and terminal 1 of FRSS harness connector E25.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " FRSS ground line open inspection " procedure.

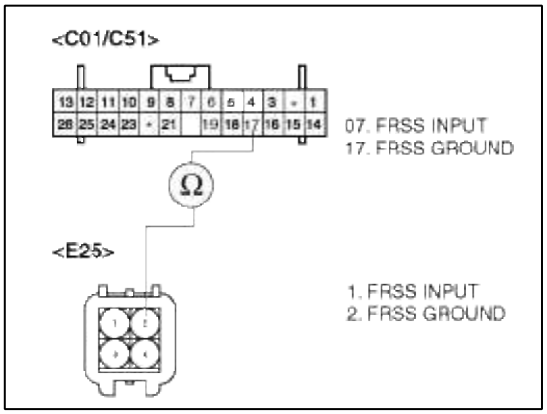
NO

Check for open circuit of FRSS circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

FRSS ground circuit open inspection

1. Ignition OFF
2. TCCU, FRSS connector : Disconnect.
3. Measure resistance between terminal 17 of TCCU harness connector and terminal 2 of FRSS harness connector E25.

Specification : Approx. 1Ω below



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to "Component inspection" procedure.

NO

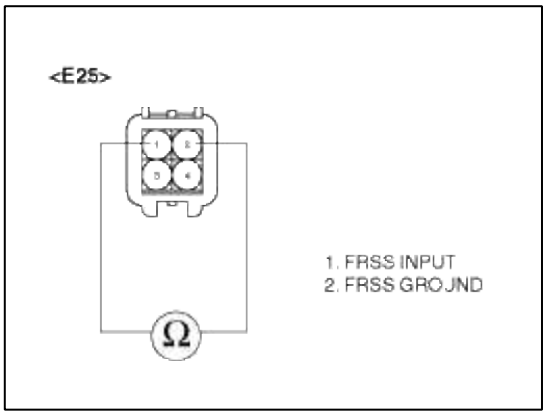
FRSS ground circuit open checking.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition OFF
2. Speed Sensor,TCCU connector : Disconnect

3. Measure resistance between terminal 1& 2 of FRSS harness connector E25.

Specification : Approx. 1.1±0.05Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to"Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "Speed Sensor" and check for proper operation. If the problem is corrected, replace "Speed Sensor" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

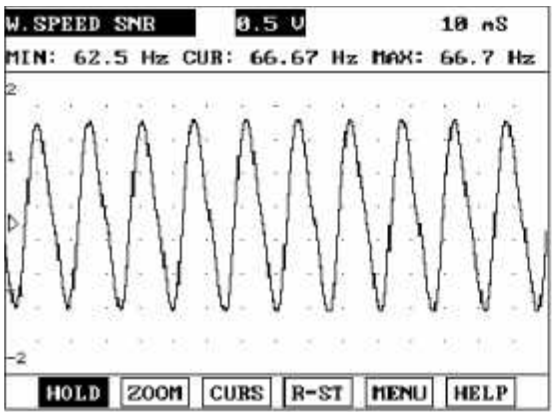
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

SIGNAL WAVEFROM



[CAUTION]The above value is just for reference. The actual value may differ from it according to various engine condition.

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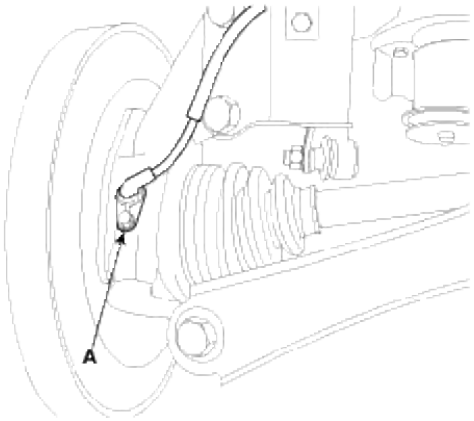
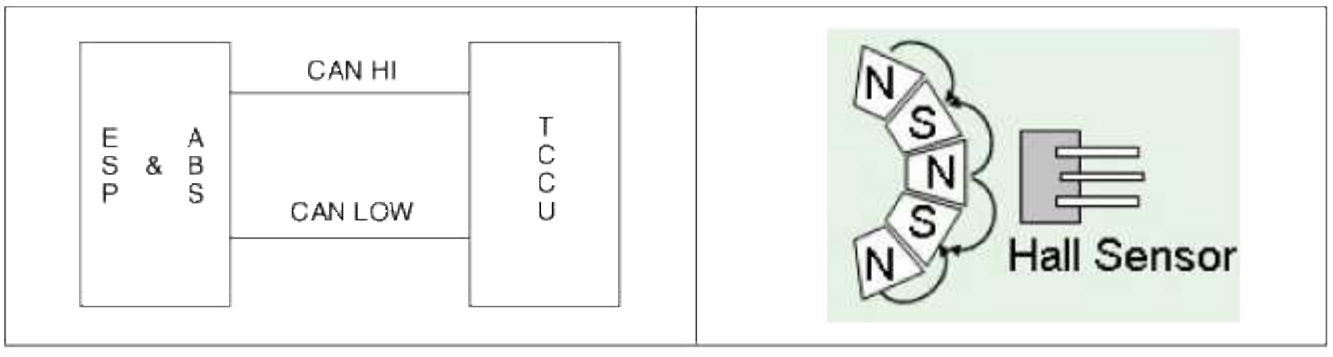
COMPONENT LOCATION



GERNERAL DESCRIPTION

Wheel speed sensor is active hall-sensor type and good at temperature and noise charateristic. 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.
In case ABS(or ESP) system is applied to the vehicle, wheel speed sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



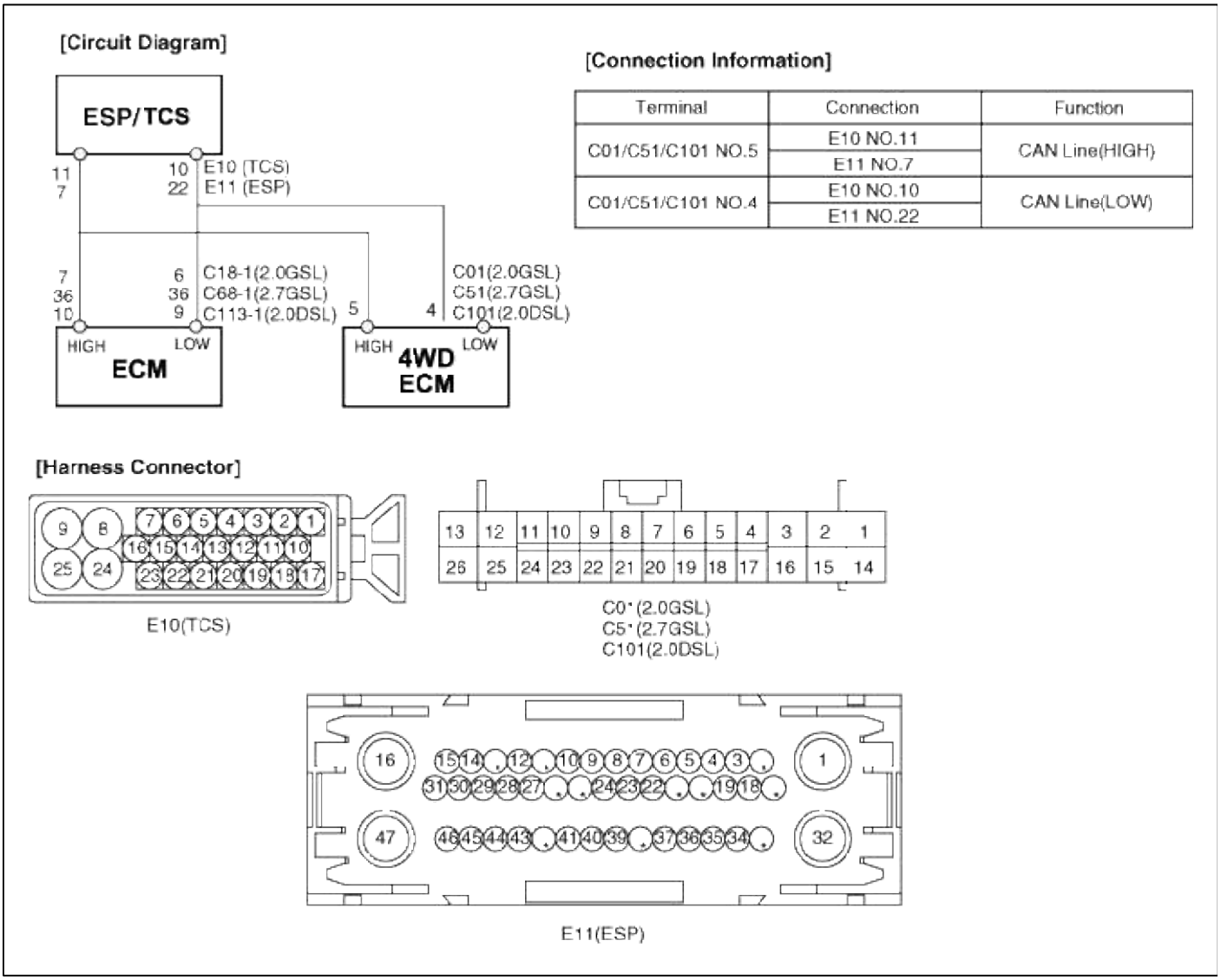
DTC DESCRIPTION

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • Wheel sensor comm line circuit open/short. • Faulty Wheel sensor. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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.

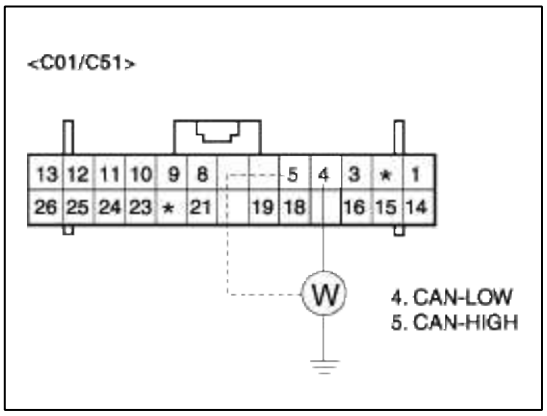
NO

Go to " CAN(SPEED SENSOR)comm. Line Signal Inspection " procedure.

CAN(SPEED SENSOR)comm. Line Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.
4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(RLSS)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

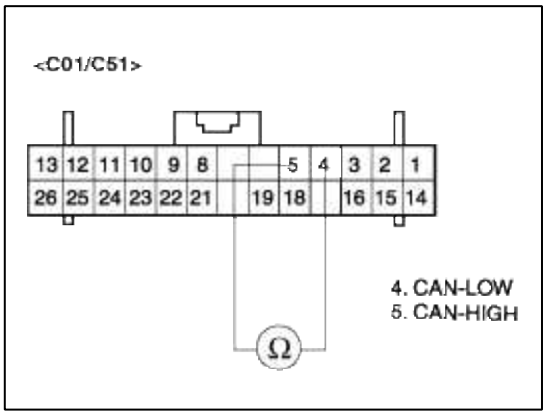
Go to "CAN(SPEED SENSOR) comm. Line Inspection" procedure.

CAN(SPEED SENSOR) comm. Line Inspection

1. Ignition "OFF".

2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

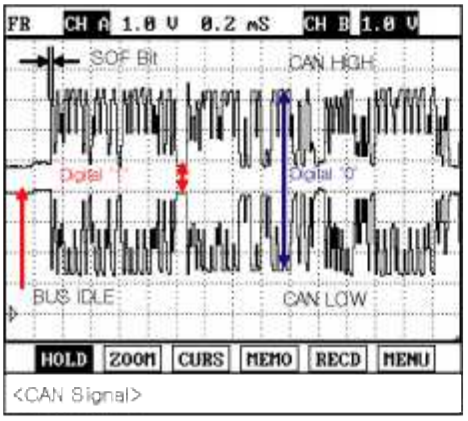
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

SIGNAL WAVEFROM



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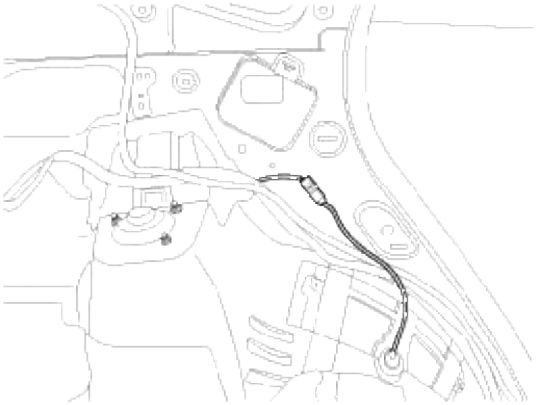
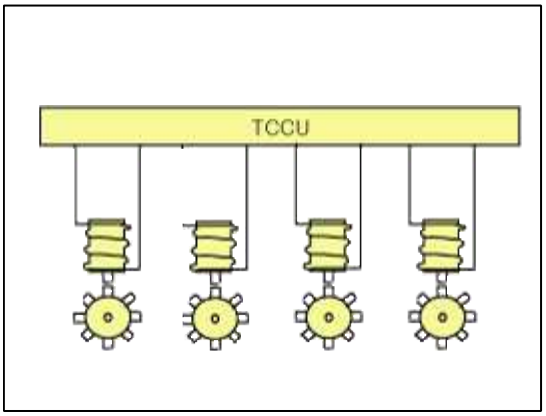
COMPONENT LOCATION



GERNERAL DESCRIPTION

When the tone wheel rotates, adjacent to the sensor pole component, an alternating current signal is generated in the coil with a frequency proportional to the wheel speed.
Wheel Speed Sensor generates a signal which is sent to TCCU.



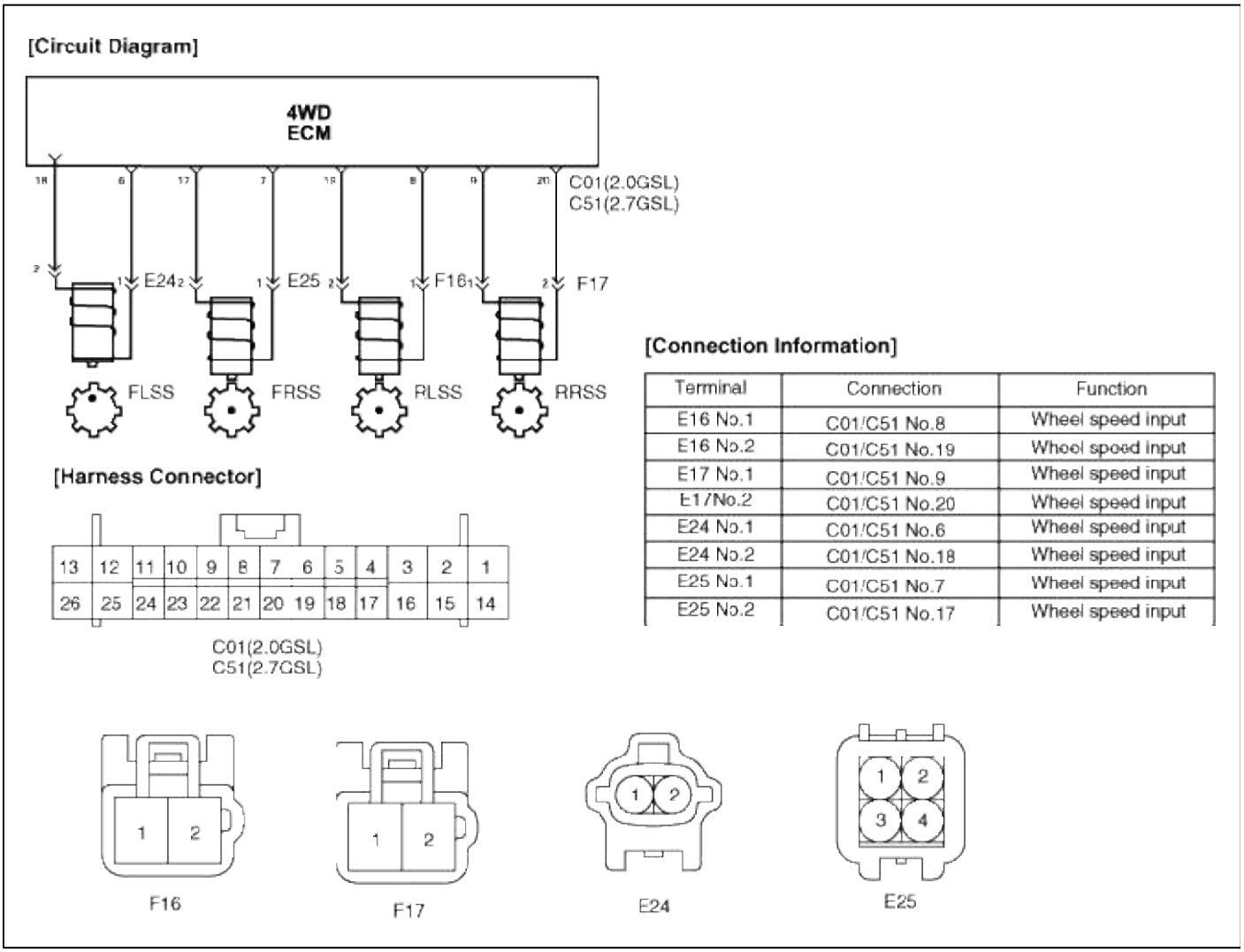
DTC DESCRIPTION

This failure code is related to the Wheel Speed Sensor and is set if no signal is received by TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• Wheel speed sensor,TCCU connector looseness and poor terminal to wire connection. • wheel speed circuit open or short to battery. • wheel speed sensor airgap • Faulty wheel speed. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



Terminal	Connection	Function
E16 No.1	C01/C51 No.8	Wheel speed input
E16 No.2	C01/C51 No.19	Wheel speed input
E17 No.1	C01/C51 No.9	Wheel speed input
E17No.2	C01/C51 No.20	Wheel speed input
E24 No.1	C01/C51 No.6	Wheel speed input
E24 No.2	C01/C51 No.18	Wheel speed input
E25 No.1	C01/C51 No.7	Wheel speed input
E25 No.2	C01/C51 No.17	Wheel speed input

TERMINAL & 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.

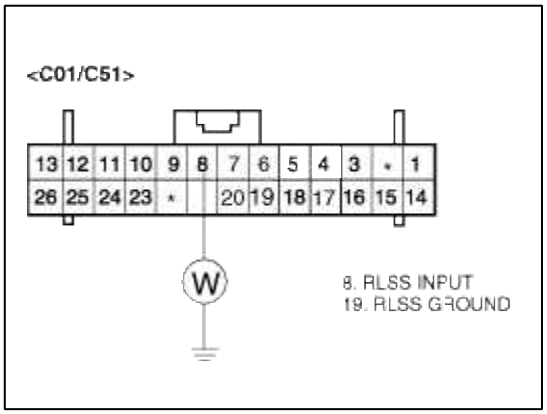
NO

Go to " RLSS Signal Inspection" procedure.

RLSS Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 8 of TCCU harness connector and chassis ground.
4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is RLSS Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

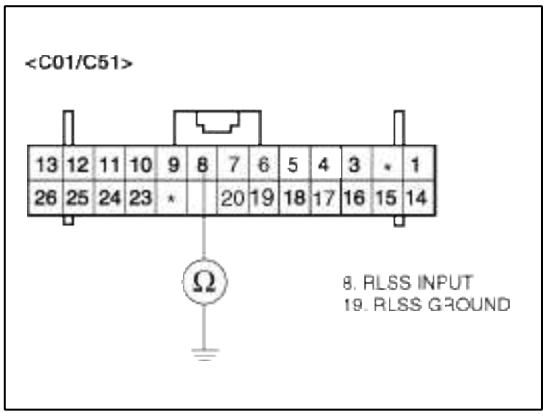
Go to " RLSS input circuit line ground short inspection " procedure.

RLSS input circuit ground short inspection

1. Ignition "OFF".
2. TCCU, RLSS connector : Disconnect.

3. Measure resistance between terminal 8 of TCCU harness connector and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " RLSS input circuit line open inspection " procedure.

NO

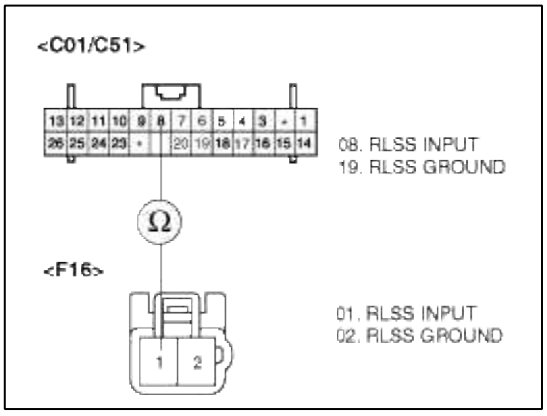
Check for ground to short circuit of RLSS circuit

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

RLSS input circuit line open inspection

1. Ignition OFF
2. TCCU, RLSS connector : Disconnect.
3. Measure resistance between terminal 8 of TCCU harness connector and terminal 1 of RLSS harness connector F16.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " RLSS ground line open inspection " procedure.

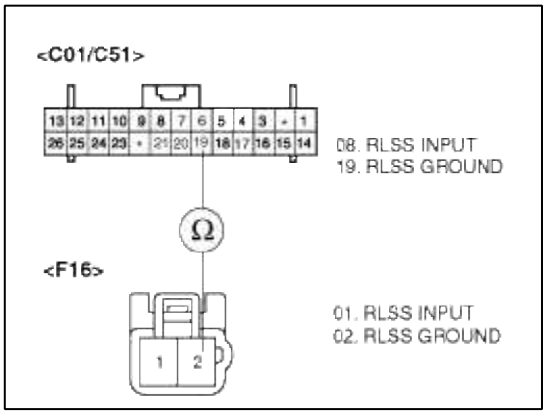
NO

Check for open circuit of RLSS circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

RLSS ground line open inspection

1. Ignition OFF
2. TCCU, RLSS connector : Disconnect.
3. Measure resistance between terminal 19 of TCCU harness connector and terminal 2 of RLSS harness connector F16.

Specification : Approx. 1Ω below



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to "Component inspection" procedure.

NO

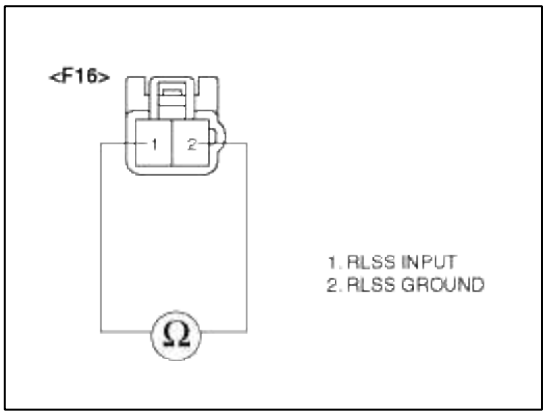
RLSS ground circuit open checking.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition OFF
2. Speed Sensor,TCCU connector : Disconnect

3. Measure resistance between terminal 1& 2 of RLSS harness connector F16.

Specification : Approx. 1.1±0.05Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to"Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "Speed Sensor" and check for proper operation. If the problem is corrected, replace "Speed Sensor" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

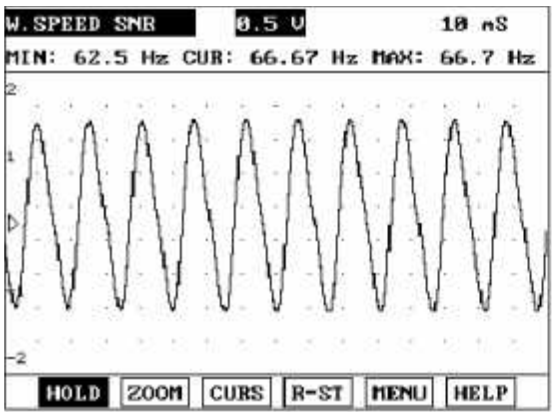
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

SIGNAL WAVEFROM



[CAUTION]The above value is just for reference. The actual value may differ from it according to various engine condition.

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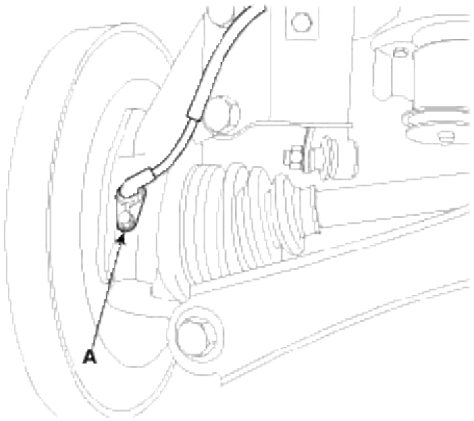
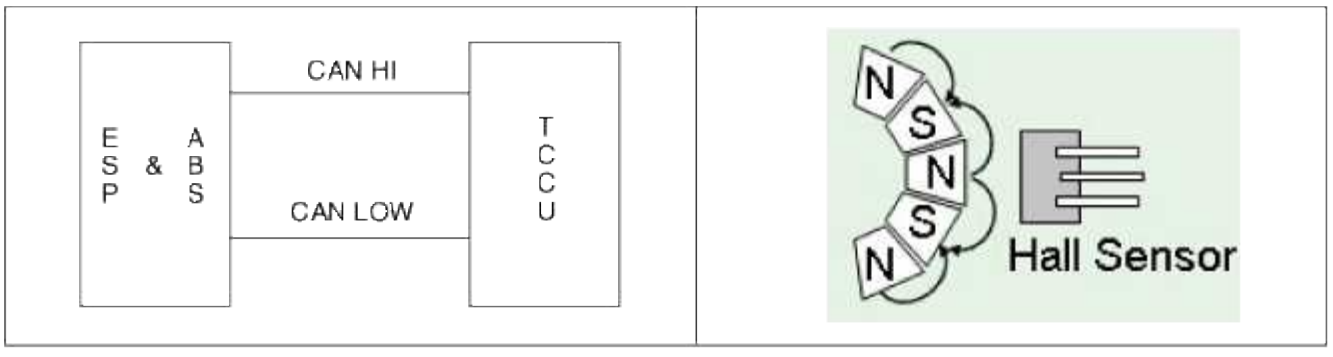
COMPONENT LOCATION



GERNERAL DESCRIPTION

Wheel speed sensor is active hall-sensor type and good at temperature and noise charateristic. 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.
In case ABS(or ESP) system is applied to the vehicle, wheel speed sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



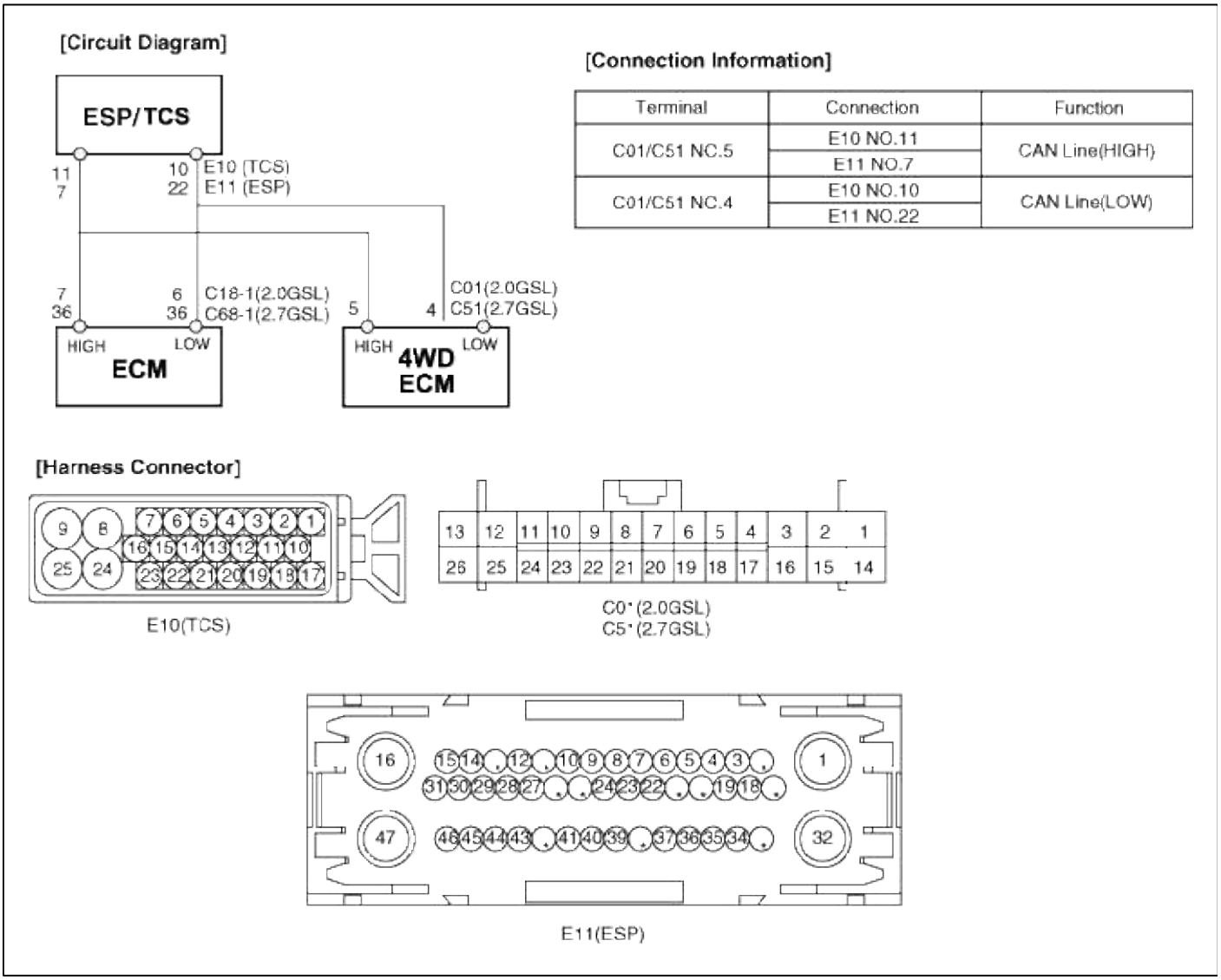
DTC DESCRIPTION

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • Wheel sensor comm line circuit open/short. • Faulty Wheel sensor. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph(19mph)	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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.

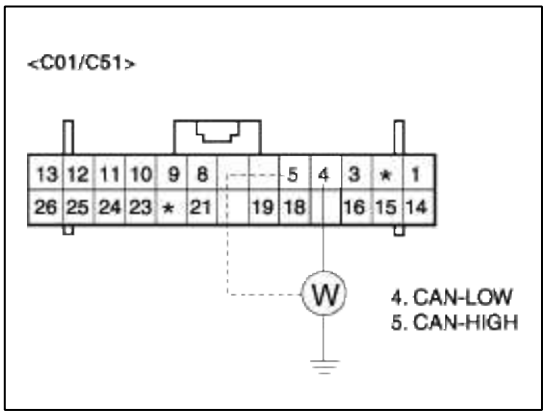
NO

Go to " CAN(SPEED SENSOR)comm. Line Signal Inspection " procedure.

CAN(SPEED SENSOR)comm. Line Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.
4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(RRSS)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

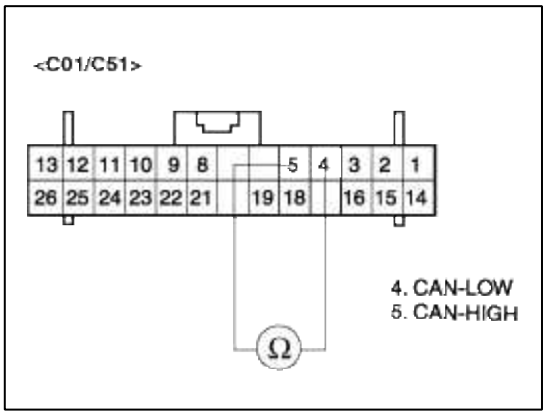
Go to "CAN(SPEED SENSOR) comm. Line Inspection" procedure.

CAN(SPEED SENSOR) comm. Line Inspection

1. Ignition "OFF".

2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

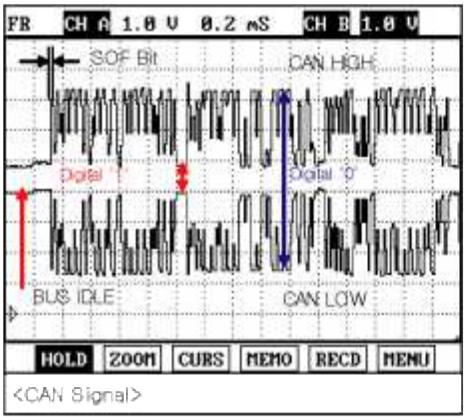
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

SIGNAL WAVEFROM



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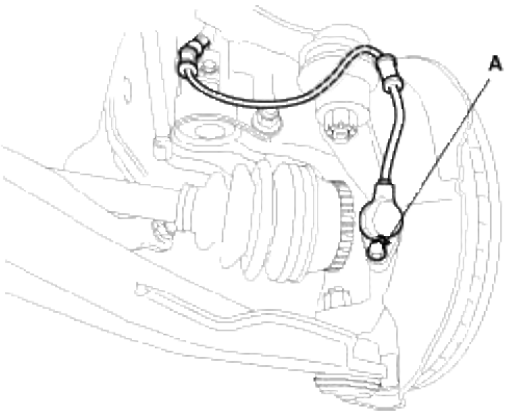
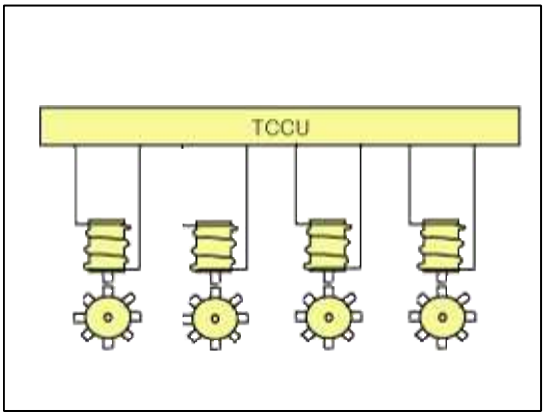
COMPONENT LOCATION



GERNERAL DESCRIPTION

When the tone wheel rotates, adjacent to the sensor pole component, an alternating current signal is generated in the coil with a frequency proportional to the wheel speed.
Wheel Speed Sensor generates a signal which is sent to TCCU.



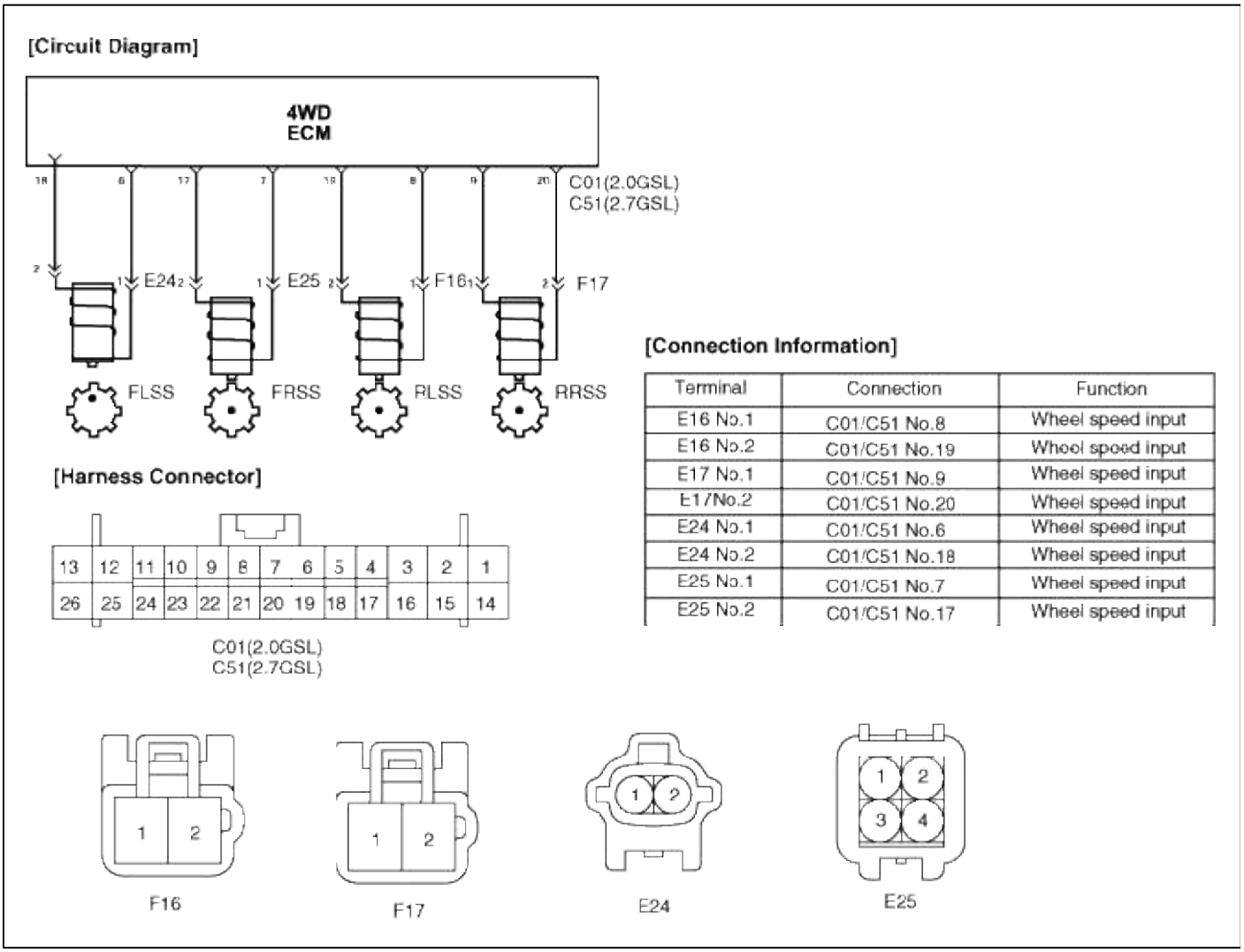
DTC DESCRIPTION

This failure code is related to the Wheel Speed Sensor and is set if no signal is received by TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• Wheel speed sensor,TCCU connector looseness and poor terminal to wire connection. • wheel speed circuit open or short to battery. • wheel speed sensor airgap • Faulty wheel speed. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph(19mph)	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



Terminal	Connection	Function
E16 No.1	C01/C51 No.8	Wheel speed input
E16 No.2	C01/C51 No.19	Wheel speed input
E17 No.1	C01/C51 No.9	Wheel speed input
E17No.2	C01/C51 No.20	Wheel speed input
E24 No.1	C01/C51 No.6	Wheel speed input
E24 No.2	C01/C51 No.18	Wheel speed input
E25 No.1	C01/C51 No.7	Wheel speed input
E25 No.2	C01/C51 No.17	Wheel speed input

TERMINAL & 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.

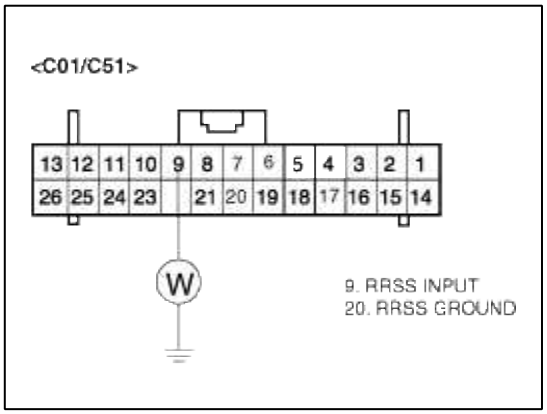
NO

Go to " RRSS Signal Inspection" procedure.

RRSS Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 9 of TCCU harness connector and chassis ground.
4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is RRSS Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

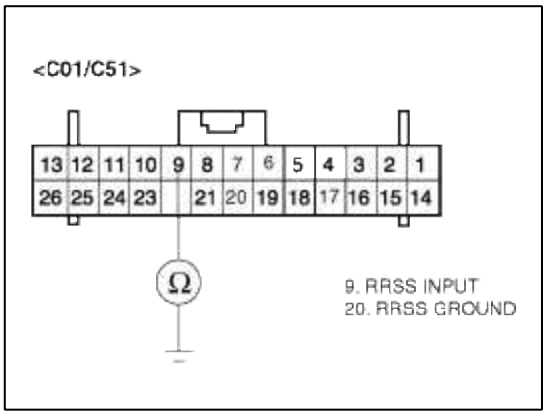
Go to " RRSS input circuit line ground short inspection " procedure.

RRSS input circuit ground short inspection

1. Ignition "OFF".
2. TCCU, RRSS connector : Disconnect.

3. Measure resistance between terminal 9 of TCCU harness connector and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " RRSS input circuit line open inspection " procedure.

NO

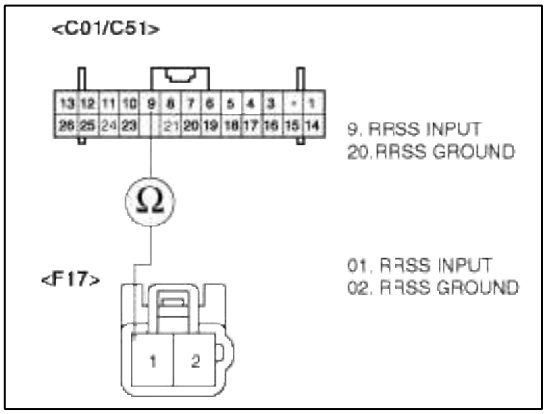
Check for ground to short circuit of RRSS circuit

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

RRSS input circuit open inspection

1. Ignition OFF
2. TCCU, RRSS connector : Disconnect.
3. Measure resistance between terminal 9 of TCCU harness connector and terminal 1 of RRSS harness connector F17.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " RRSS ground line open inspection " procedure.

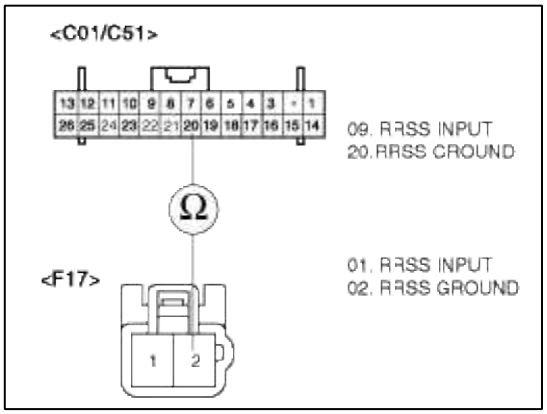
NO

Check for open circuit of RRSS circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

RRSS ground line open inspection

1. Ignition OFF
2. TCCU, RRSS connector : Disconnect.
3. Measure resistance between terminal 20 of TCCU harness connector and terminal 2 of RRSS harness connector F17.

Specification : Approx. 1Ω below



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to "Component inspection" procedure.

NO

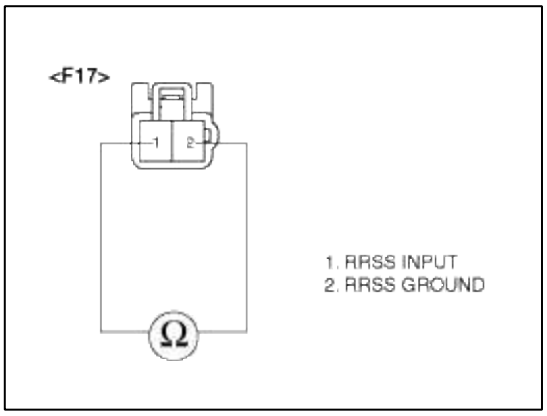
RRSS ground circuit open checking.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition OFF
2. Speed Sensor,TCCU connector : Disconnect

3. Measure resistance between terminal 1& 2 of RRSS harness connector F17.

Specification : Approx. 1.1±0.05Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to"Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "Speed Sensor" and check for proper operation. If the problem is corrected, replace "Speed Sensor" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

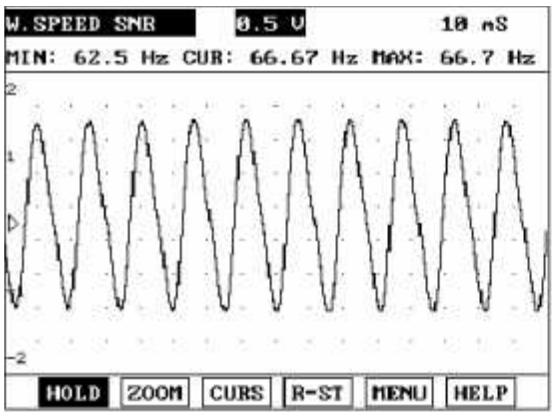
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

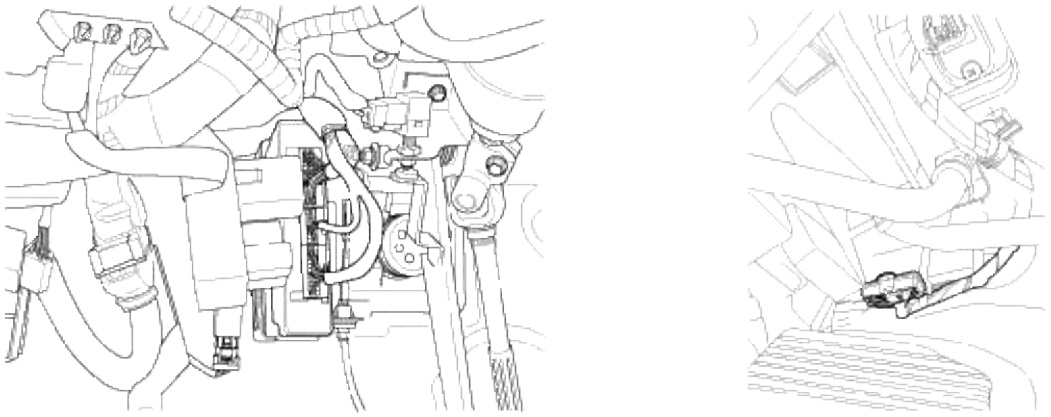
SIGNAL WAVEFROM



[CAUTION]The above value is just for reference. The actual value may differ from it according to various engine condition.

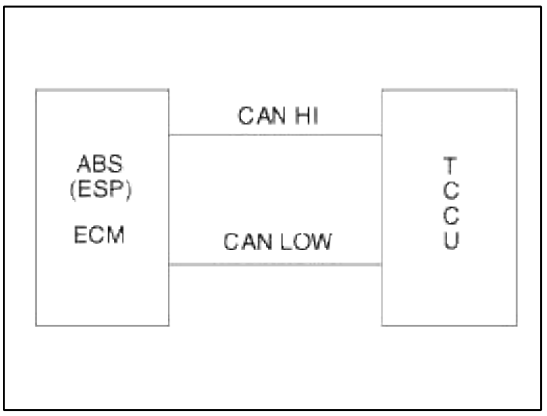
Automatic Transaxle System > Troubleshooting > P1766

COMPONENT LOCATION



GERNERAL DESCRIPTION

CAN communication is filled to permit the exchange of multiple signals between electronic control units through the use of two common data lines.



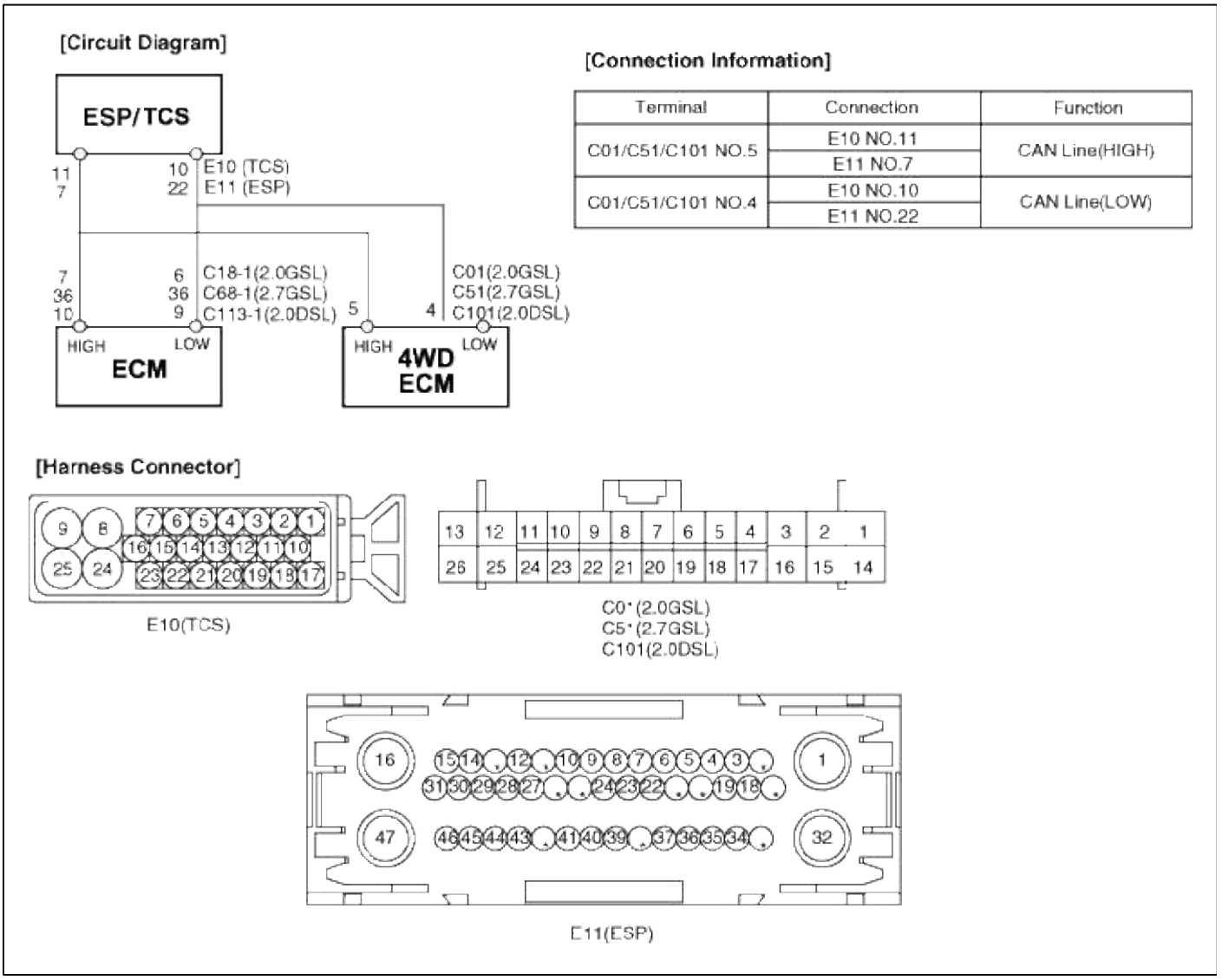
DTC DESCRIPTION

This failure code is set if CAN BUS ERROR on TCCU is continued for more than 1sec which is caused by poor contact on CAN BUS or the failure of ECM and ABS(ESP).

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Transmit error/loss of communication	• CAN Bus. • ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • CAN comm line circuit open/short. • Faulty ECU. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• CAN transmit counter exceeds 255	
Diagnostic Time	•	
MIL on condition	•	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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.

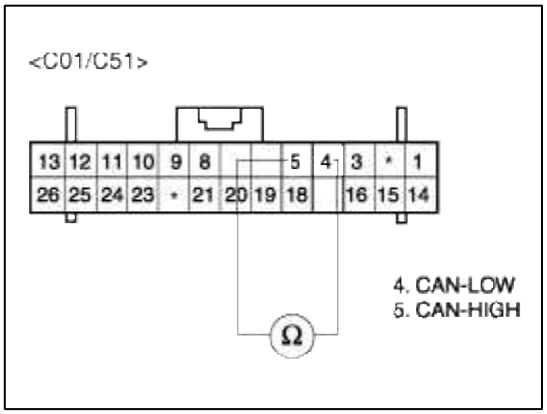
NO

Go to " CANcomm. Line Inspection " procedure.

CAN(ECM-ITM)comm. Line Signal Inspection

1. Engine : ON.
2. Measure resistance between terminal "4" of the TCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is CAN(TCOMMUNICATIOM BUS OFF) Signal display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of Control module(ECU, ESP, ABS)
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

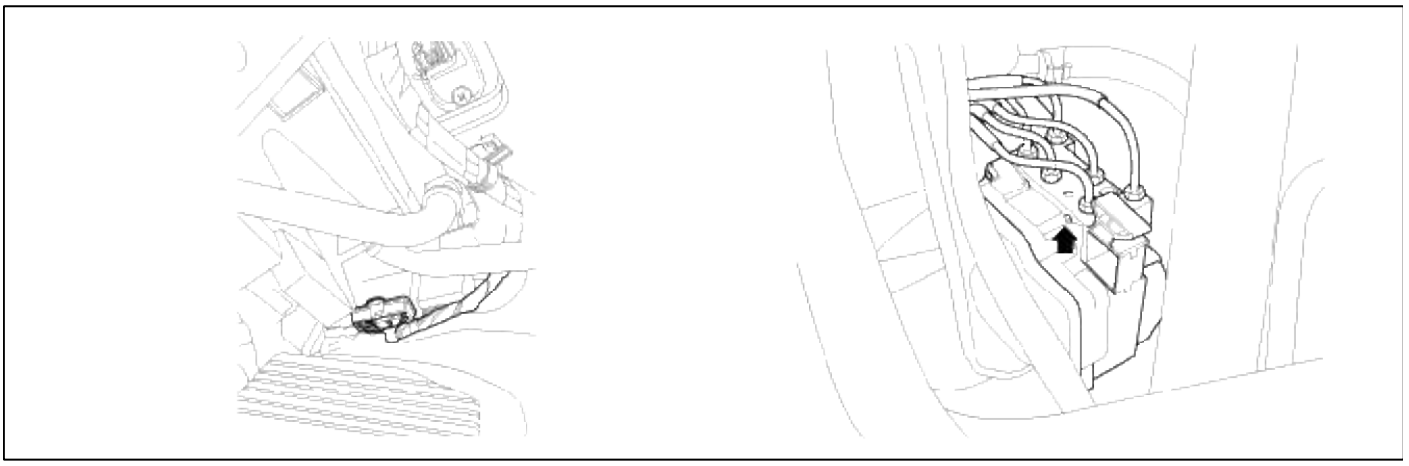
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

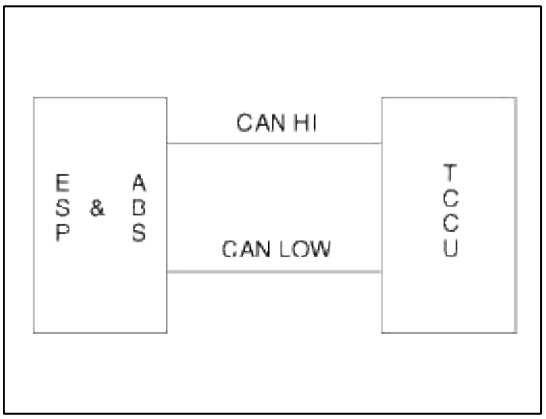
Automatic Transaxle System > Troubleshooting > P1767

COMPONENT LOCATION



GERNERAL DESCRIPTION

In case of the vehicle installed ESP & TCS(ABC CONTROL MODULE), ABS control module sends the wheel speed signal to 4WD(ECU) by CAN comunication after ABS control module recieves the wheel speed signal.



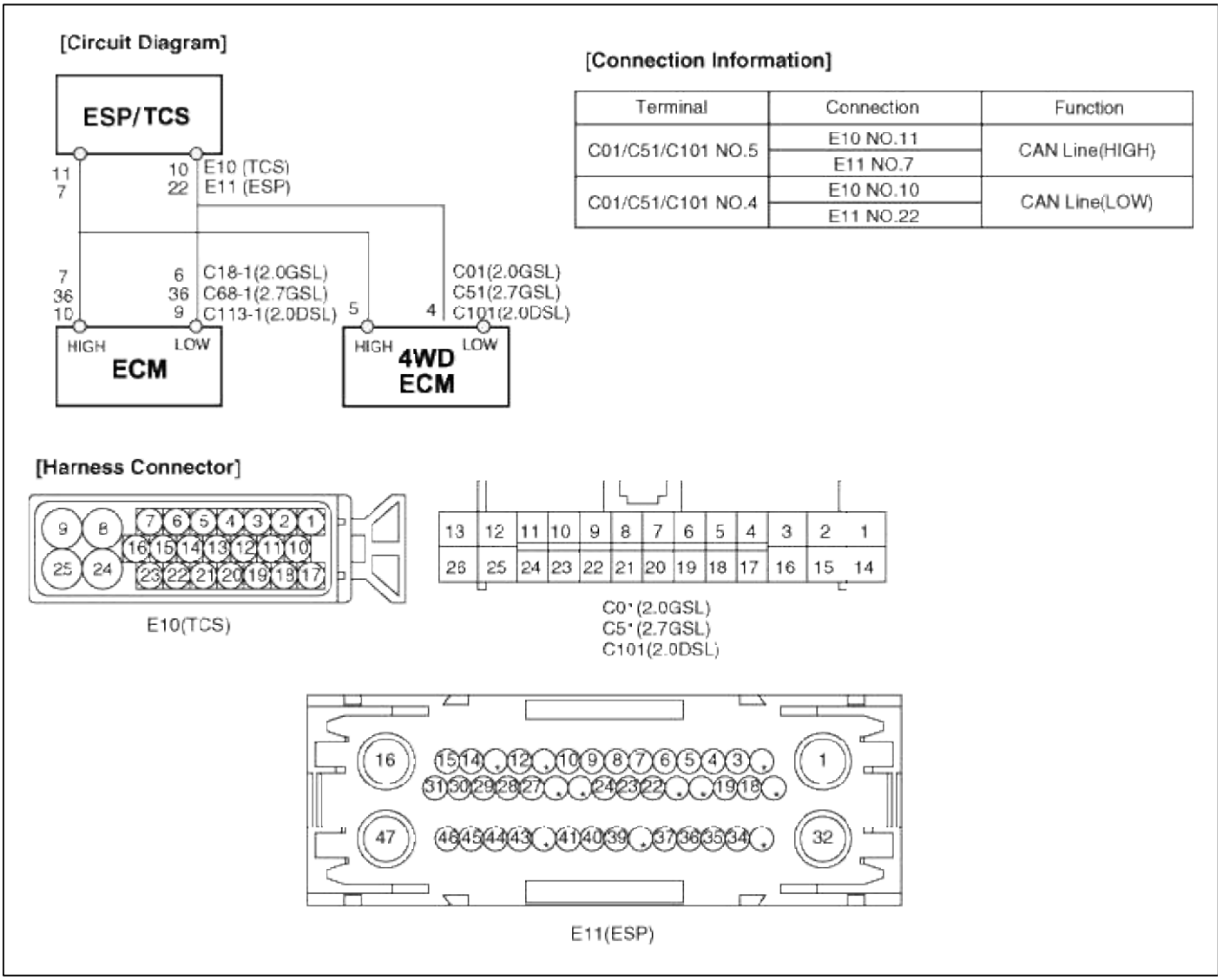
DTC DESCRIPTION

This failure code is related to the communication line between ESP(ABC CONTROL MODULE) and is set if CAN BUS ERROR that means wrong TCCU installation is continued for more than 1sec.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of Signal	• ABS Active. • ABS MODULE connector looseness and poor terminal to wire connection. • CAN comm line circuit open/short. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• Loss of 0153H Message	
Diagnostic Time	•	
MIL on condition	• No Set	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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

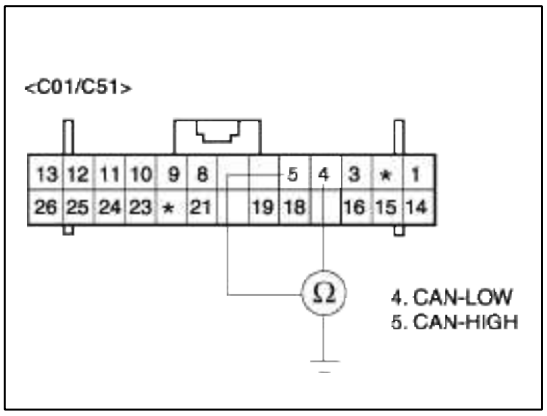
Go to " CAN(ABS ACTIVE SIGNAL)comm. Line Signal Inspection " procedure.

CAN(ABS ACTIVE SIGNAL)comm. Line Signal Inspection

1. Engine: ON

2. Measure resistance between terminal "4" of the TCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is CAN(ABS ACTIVE ERROR) Signal display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

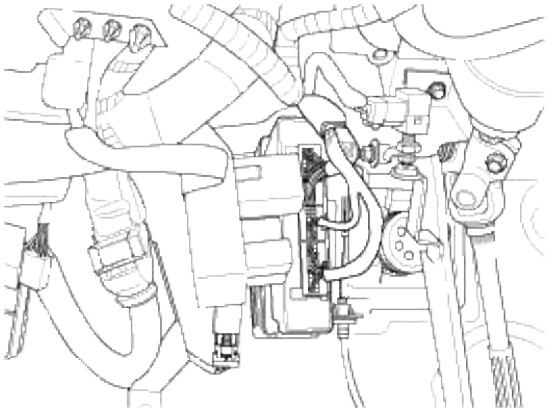
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

Automatic Transaxle System > Troubleshooting > U0100

COMPONENT LOCATION



GENERAL DESCRIPTION

The TCM can either receive data from the Engine Control Module or ABS control module, or it can send data to the ECM andABSCM by using CAN communication. The CAN communicaton is one of the vehicle communications method, which is now widely used to transfer the vehicle data.

DTC Description

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

[2.7 GSL]

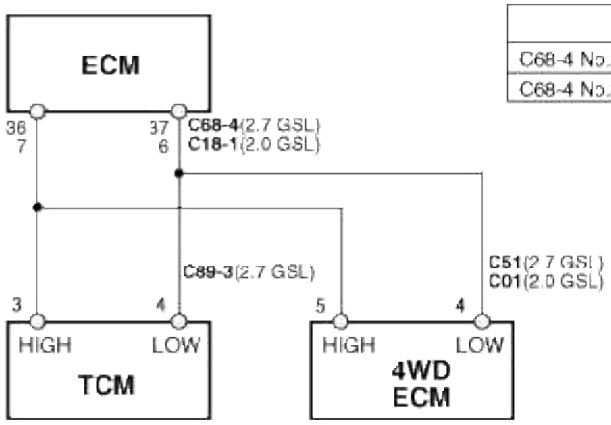
Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or Short in CAN communication harness • Faulty ECM • Faulty TCM
Enable Conditions	• IG switch ON • No actuator test • No FAIL SAFE status of 3rd gear holding • No FAIL in PG-A,B • Power voltage ≥ 10V is detected for a series of 0.5 sec • Engine STOP	
Threshold value	• In case of no ECU information	
Diagnostic Time	• 1.5 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	

[2.0 GSL]

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 ≥ 1000rpm and 5000msec passed from IG "on"	
Threshold value	• No message from ems	
Diagnostic Time	• 1.5 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	

SCHEMATIC DIAGRAM

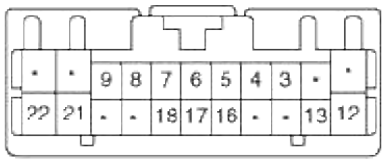
[Circuit Diagram]



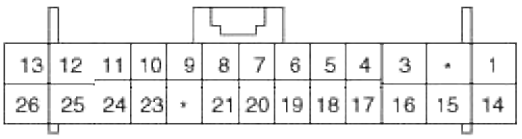
[Connection Information]

Terminal	Connection	Function
C68-4 No.36/ C18-1 No.7	C89-3 No.3	CAN Communication(HIGH)
C68-4 No.37/ C18-1 No.6	C89-3 No.4	CAN Communication(LOW)

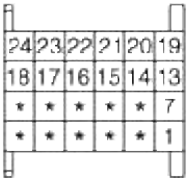
[Harness Connector]



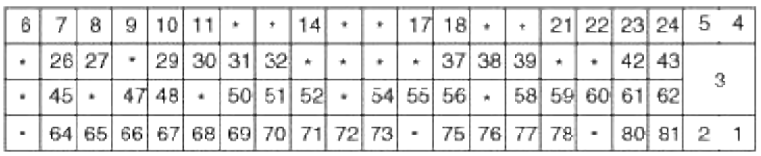
C89-3(2.7 GSL)



C51(2.7 GSL)
C01(2.0 GSL)



C68-4(2.7 GSL)



C18-1(2.0 GSL)

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. 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.

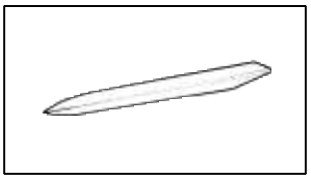
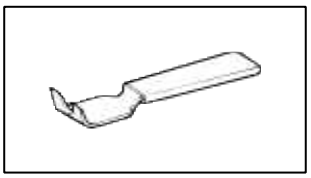
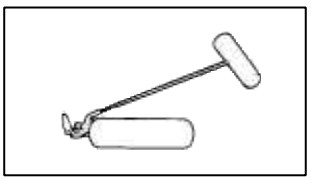
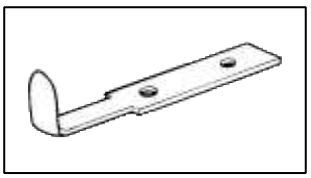
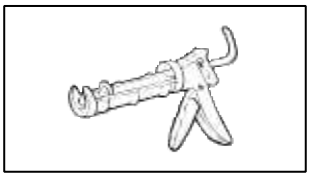
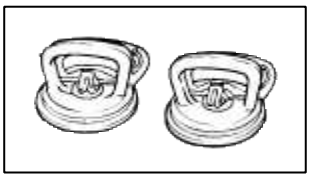
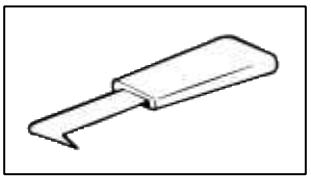
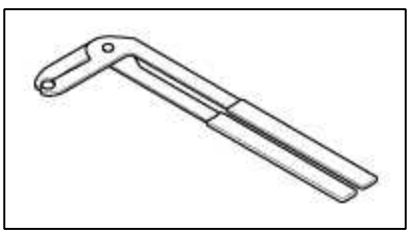
NO

System performing to specification at this time.

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Body (Interior and Exterior)

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

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09800-21000 Ornament remover		Trim removal
09853-31000 Headliner clip remover		Removal of the headliner clip
09861-31100 Sealant cut-out tool		Cutting the sealant of the windshield (use with 09861-312000)
09861-31200 Sealant cutting blade		Cutting the sealant of the windshield (use with 09861-31100)
09861-31300 Sealant gun		Application of the sealant to the windshield
09861-31400 Glass hold		Removal and installation of the windshield
09861-31000 Windshield molding remover		Removal of the windshield molding
09880-4F000 Hogring clip installer		Installation of the hogring clip

Body (Interior and Exterior) > General Information > Troubleshooting

TROUBLESHOOTING

Symptom	Suspect	Remedy
Wind noise around door	Weatherstrip not folding firmly	Adjust hit door
	Improperly installed weatherstrip	Repair or replace
	Improperly closed door	Adjust
	Improperly fit door	Adjust
	Improperly clearance between door glassAnd division channel	Adjust
	Deformed door	Repair or replace
Water leaks from sunroof	Dirt accumulated in drain tube	Clear dirt inside of drain
	Broken or dislocated drain tube, defectiveor cracked clip	Check tube installation and flange contact
	Clogged drain tube	Blow air into drain to remove dirt
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loosen or deformed deflector, gaps in body work	Retighten adjust or 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 dose 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 and rearwindow	Defective seal	Fill with sealant
	Defective flange	Correct

Body (Interior and Exterior) > General Information > Specifications

SPECIFICATIONS

HOOD Type	 Rear hinged, rod type
FRONT DOOR Construction Regulator system Locking	 Front hinged, frame door construction X-ARM type system Pin-fork system
REAR DOOR Construction Regulator system Locking system	 Front hinged, frame door construction X-ARM type Pin-fork system
TAILGATE Type	 Inner hinged, gas lifter type
GLASS THICKNESS Windshield glass Front door glass Rear door glass Rear window glass	Laminated clear, tinted 5mm 3.5mm 3.2mm
SEAT BELTS Front	 3 point type with Emergency Locking Retractor(E.L.R)
Rear	3 point type with Emergency Locking Retractor(E.L.R) 2 point type

TIGHTENING TORQUE

Items	Nm	Kgf·m	lb·ft
Front and rear doors Door hinge to body Door hinge to door	 33.3~41.2 21.6~26.5	 3.4~4.2 2.2~2.7	 24.6~30.4 15.9~19.5
Tailgate Trunk lid hinge to body Trunk lid hinge to trunk lid Trunk lid latch to trunk lid	 6.9~10.8 6.9~10.8 6.9~10.8	 0.7~11 0.7~11 0.7~11	 5.1~8.0 5.1~8.0 5.1~8.0
Hood Hood hinge to body Hood hinge to hood Hood latch to body	 21.6~26.5 21.6~26.5 6.9~10.8	 2.2~2.7 2.2~2.7 0.7~1.1	 16~19.5 16~19.5 5.1~6.5
Seat Front seat mounting bolts and nut Rear seat mounting bolts	 43.1~64.7 43.1~64.7	 4.4~6.6 4.4~6.6	 31.8~47.7 31.8~47.7
Seat belt Front seat belt height adjuster Front seat belt buckle mounting bolt Front seat belt anchor mounting bolt Front seat belt low anchor Front seat belt upper anchor Rear seat belt anchor attaching bolt Rear seat belt retractor mounting bolt	 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9 39.2~53.9	 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5 4.0~5.5	 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8 28.9~39.8

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

REPLACEMENT

HOOD REPLACEMENT

NOTE

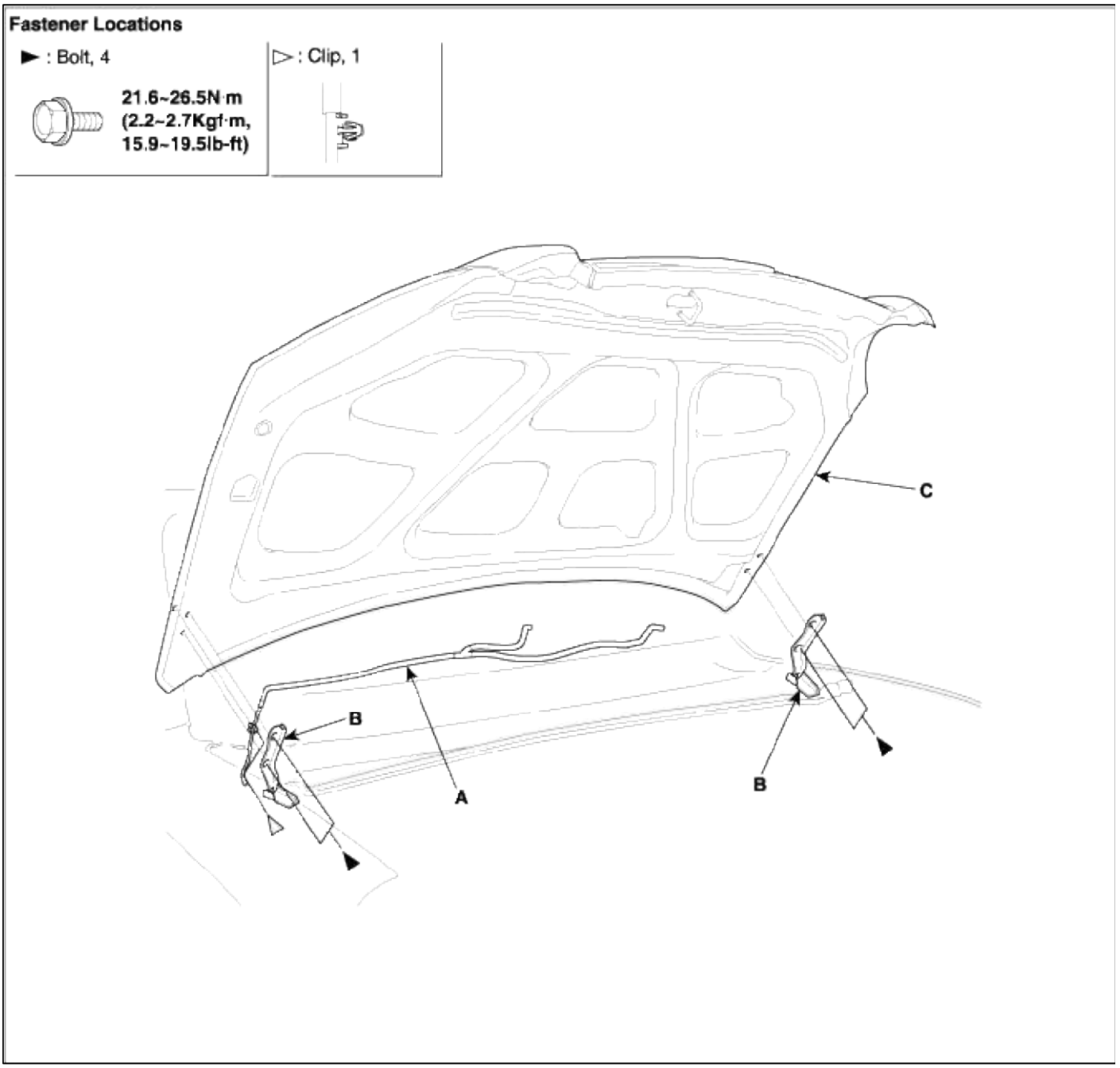
- When removing and installing the hood, an assistant is necessary.
- Take care not to damage the hood and body.

1. Remove the hood insulator.
2. Disconnect the windshield washer nozzle connecting tube(A).
3. After loosening the hood hinge (B) mounting bolts, remove the hood(C).

4. Installation is the reverse of removal.

NOTE

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

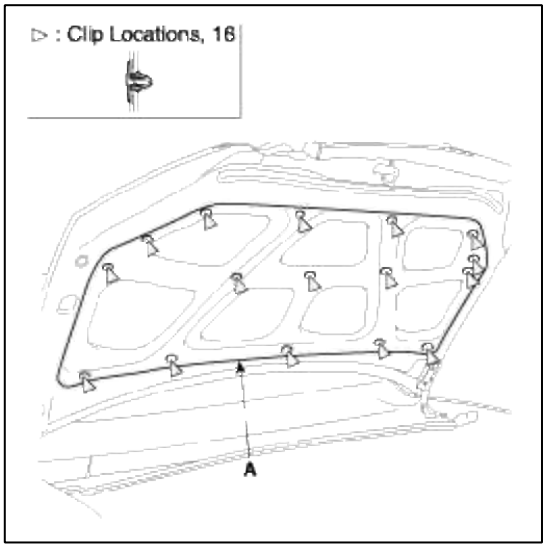


HOOD INSULATOR REPLACEMENT

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

NOTE

Take care not to scratch the hood panel.



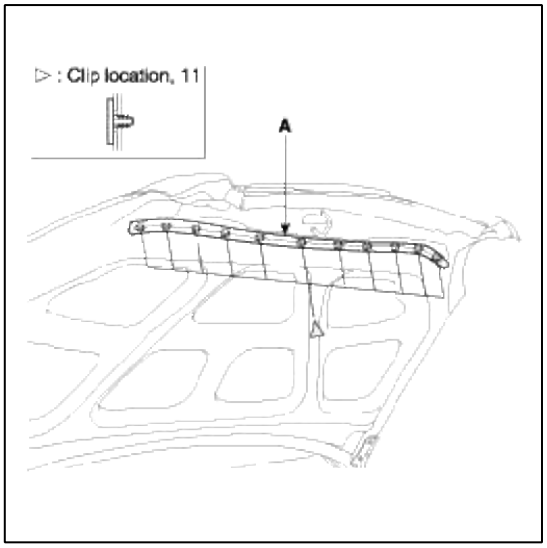
2. Installation is the reverse of removal.

NOTE

- Replace any damaged clips.

HOOD SEAL WEATHERSTRIP REPLACEMENT

1. Detach the clips, then remove the hood weathersrip(A).



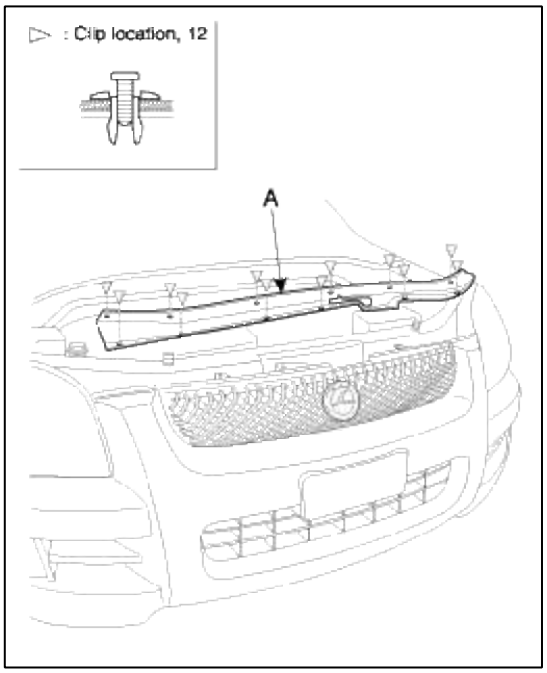
2. Installation is the reverse of removal.

NOTE

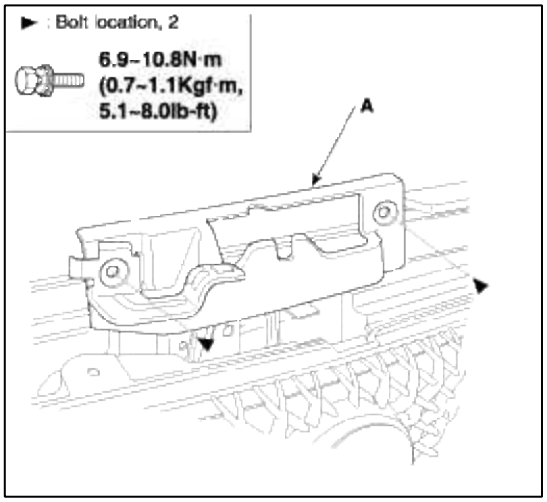
- Replace any damaged clips.

HOOD LATCH REPLACEMENT

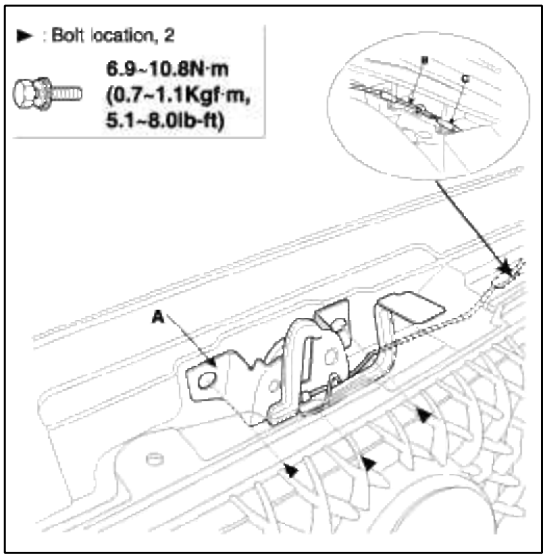
1. Remove the undercover(A).



2. Remove the latch cover(A).



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



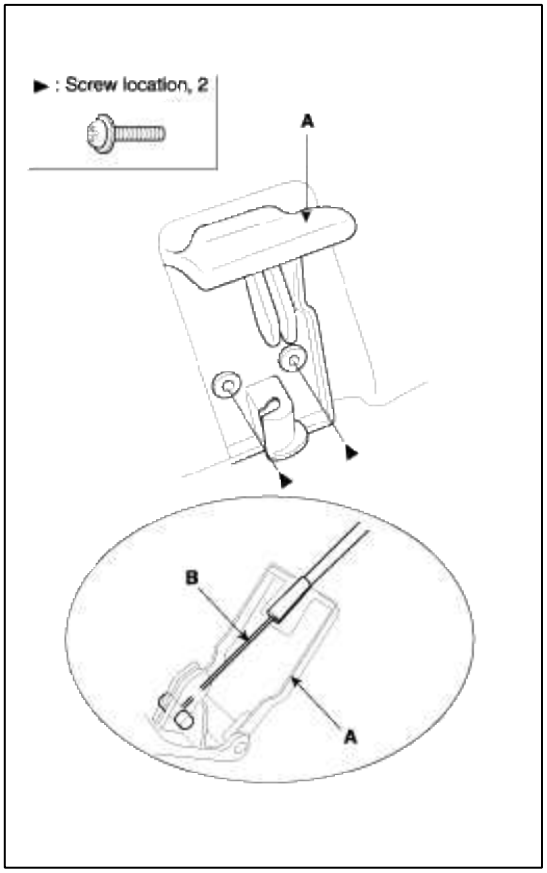
4. Installation is the reverse of removal.

NOTE

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

HOOD LATCH RELEASE HANDLE REPLACEMENT

1. Remove the screws, then remove the hood release handle(A).
2. Disconnect the hood latch cable(B).



3. Installation is the reverse of removal.

NOTE

- Make sure the hood ; latch cable is connected properly.
- Make sure the opens properly.

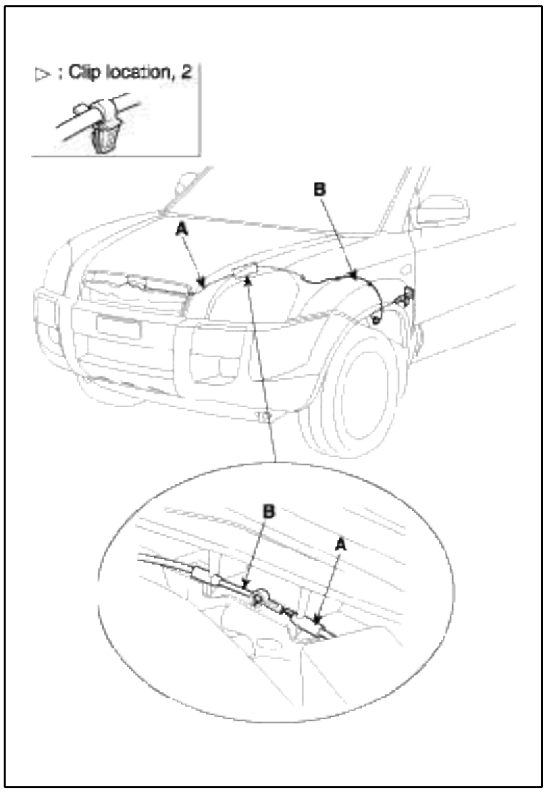
HOOD LATCH RELEASE CABLE REPLACEMENT

1. Remove the following items:
   A. Hood latch.
   B. Hood latch release handle.

2. Using a clip remover, detach the clips from the body, then disconnect the hood latch cable(A) and release cable(B).

NOTE

- Take care not to bend the cable.



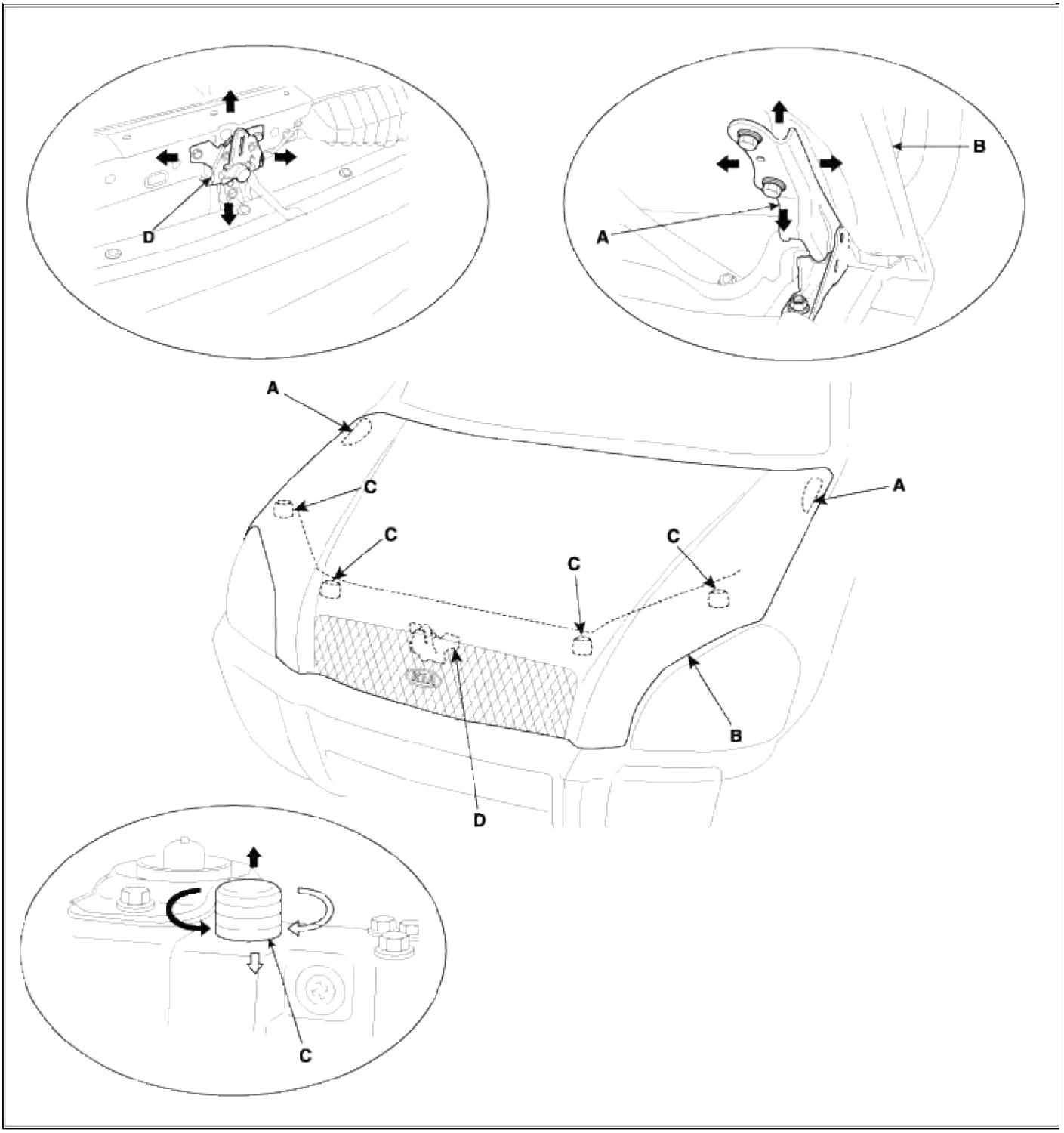
3. Installation is the reverse of removal.

NOTE

- Make sure the hood latch cable is connected properly.
- Replace any damaged clips.

ADJUST HOOD

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



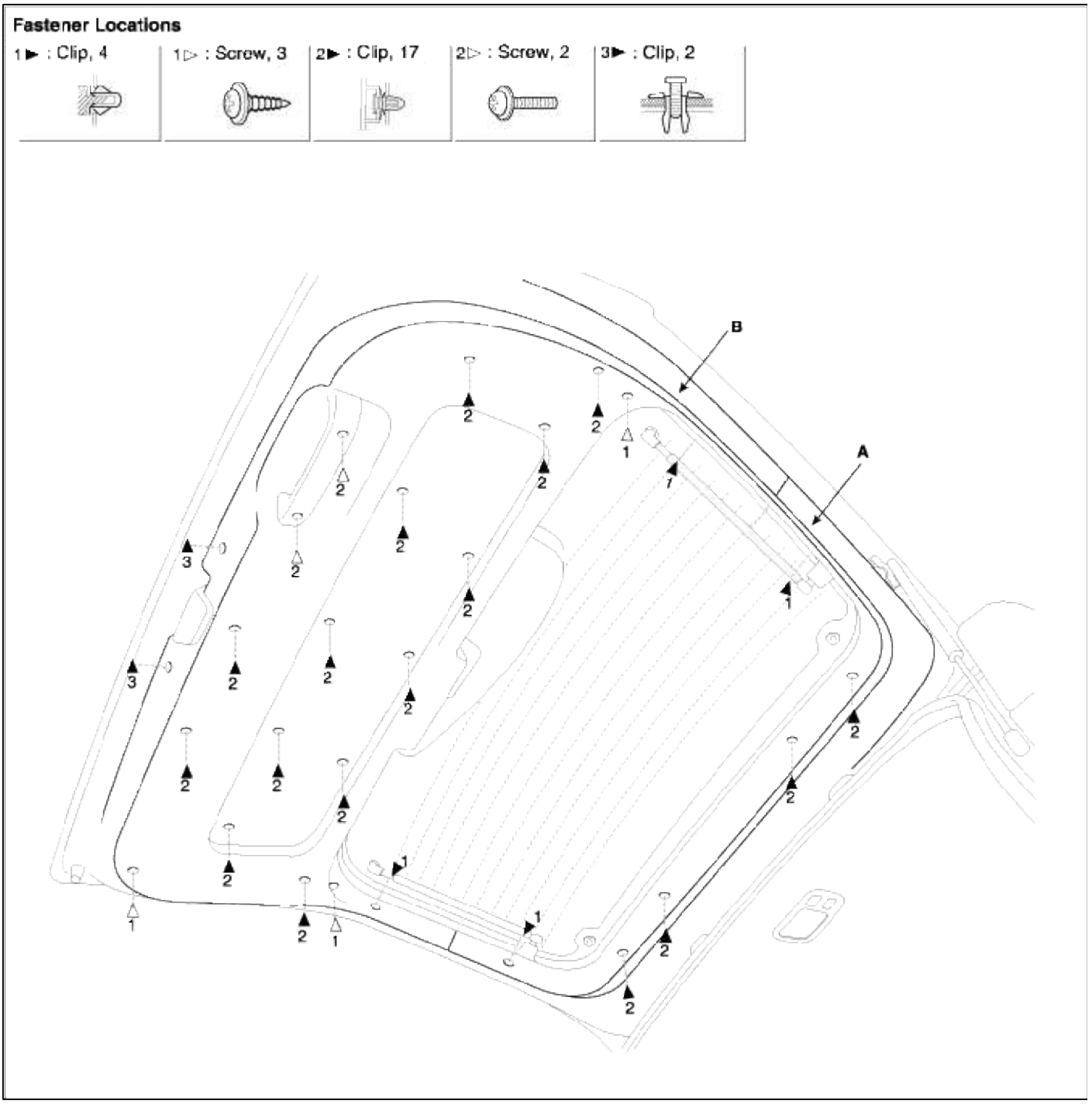
Body (Interior and Exterior) > Exterior > tail gate > Repair procedures

REPLACEMENT

TAILGATE TRIM REPLACEMENT

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Wear gloves to protect hands from injury.
- Open the tailgate glass.
- After loosening the screws the remove the tailgate trim(A).
- Remove the upper trim(B).
- Replace and damaged clips.



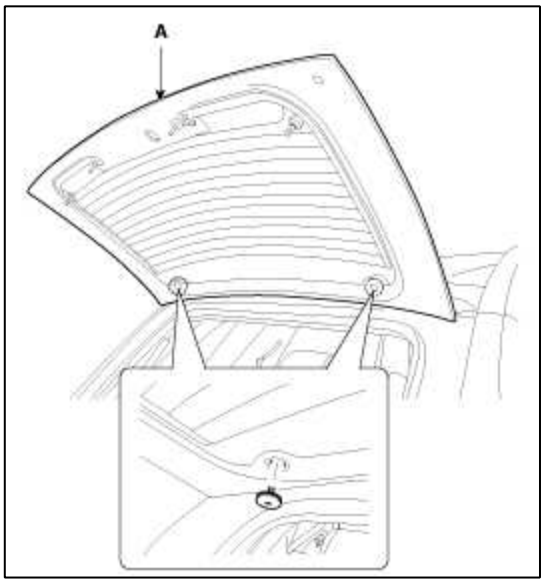
TAILGATE GLASS REPLACMENT

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to scratch the surface the tailgate glass.
- Wear gloves to protect hands from injury.

1. Remove the rear wiper arm.
   (Refer to the BE group - "Rear Wiper/Washer")
2. Remove the rear wiper motor.
   (Refer to the BE group - "Rear Wiper/Washer")
3. Remove the rear glass defogger.
   (Refer to the BE group - "Rear Glass Defogger")
4. Remove the tailgate lifter.
   (Refer to the BD group - "Tailgate")
5. Using a star wrench and then loosen the mounting bolts (B).
6. Remove the tailgate glass (A).

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



7. Installation is the reverse of removal.

NOTE

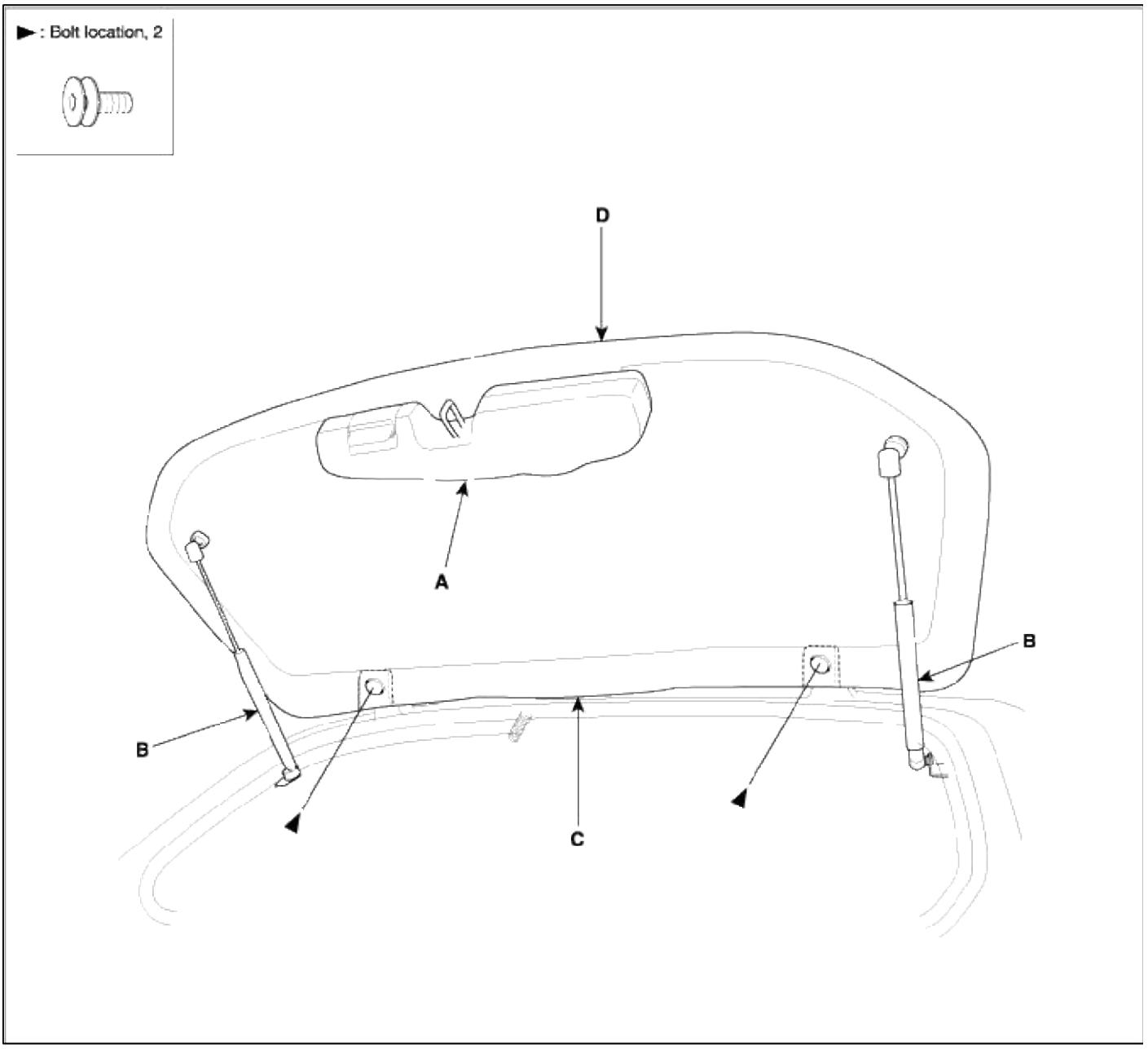
• Make sure the connector is plugged in properly.

TAILGATE GLASS REPLACMENT

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Take care not to scratch the surface the tailgate glass.
- Wear gloves to protect hands from injury.

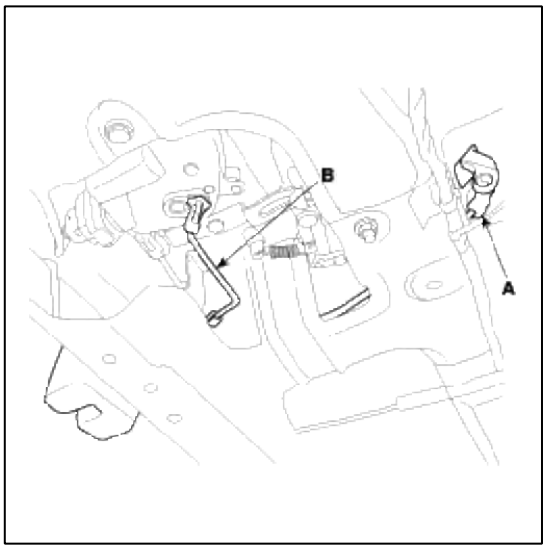
1. Remove the following items:
   A. Rear wiper assembly (A).
   B. Tailgate lifter(B).
2. After loosing the mounting bolts, Remove the Tailgate glass (D).



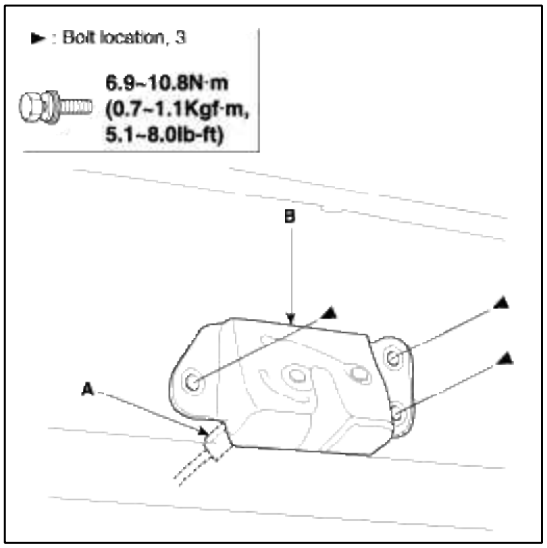
TAILGATE LATCH REPLACMENT

1. Remove the tailgate trim.

2. Disconnect the outside handle rod (A) and actuator rod(B).



3. Loosen the latch mounting bolts and disconnect the connector(A),remove Tailgate latch(B).



4. Installation is the reverse of removal .

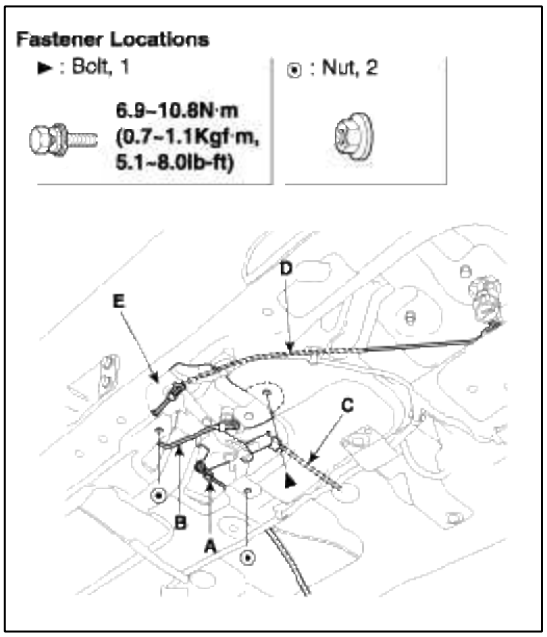
NOTE

- Make sure the tailgate open properly and locks securely.

ACTUATOR ASSEMBLY REPLACMENT

1. Remove the tailgate trim.
2. Disconnect the outside handle rod(A), actuator rod(B),glass latch rod(C), key cylinder(D) and connector.

3. After loose the mounting bolt and nuts, then remove the actuator assembly.

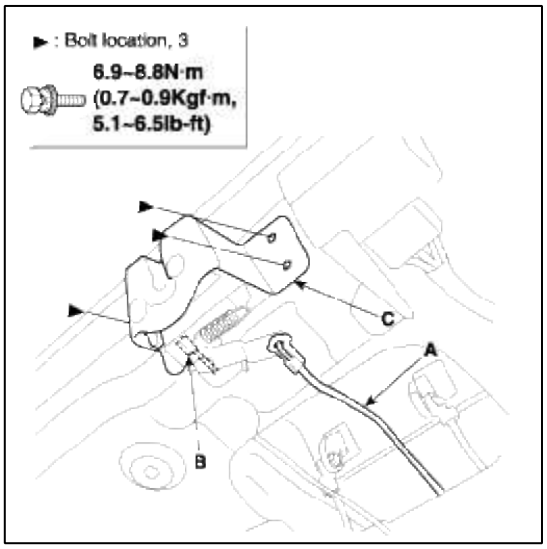


4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the tailgate open properly and locks securely.

TAILGATE GLASS LATCH REPLACEMENT

1. Remove the tailgate trim.
2. Disconnect the tailgate glass latch rod(A).
3. After loosening the mounting bolts, disconnect the connector(B) and remove the tailgate glass latch(C).



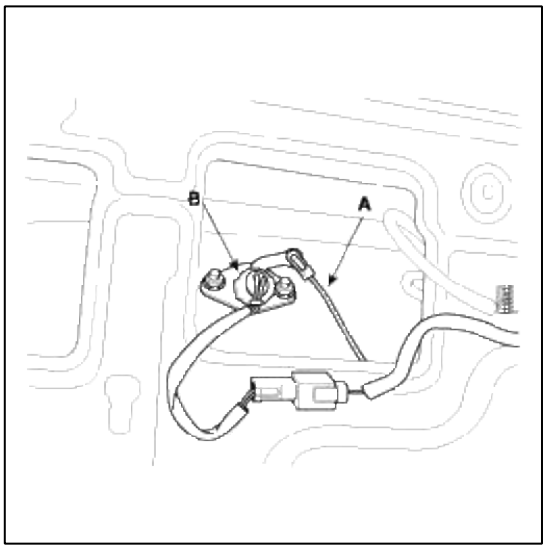
4. Installation is the reverse of removal.

> NOTE
>
> - Make sure the tailgate open properly and locks securely.

KEY HOLDER REPLACEMENT

1. Remove the tailgate trim.
2. Remove the tailgate garnish.

3. Disconnect the key rod (A) and connector.

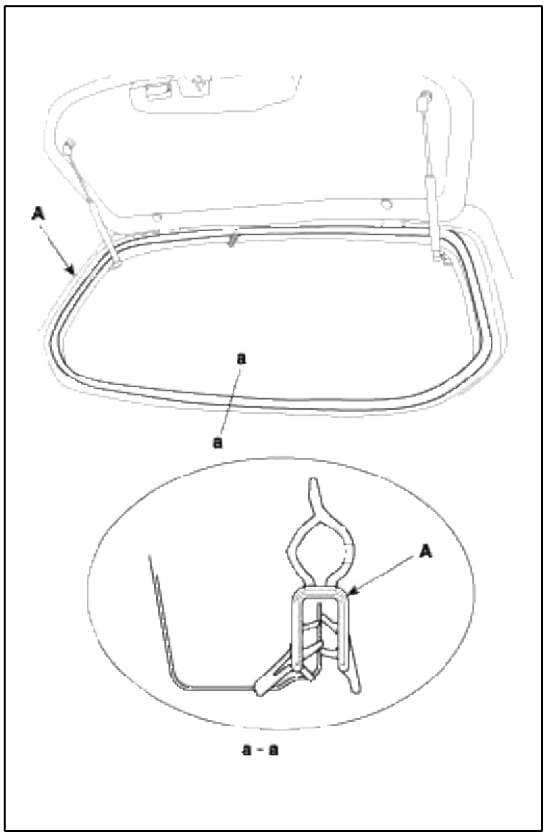


4. Remove the key holder(B).
5. Installation is the reverse of removal.

> NOTE
>
> - Make sure the tailgate open properly and locks securely.

GLASS WEATHERSTRIP REPLACEMENT

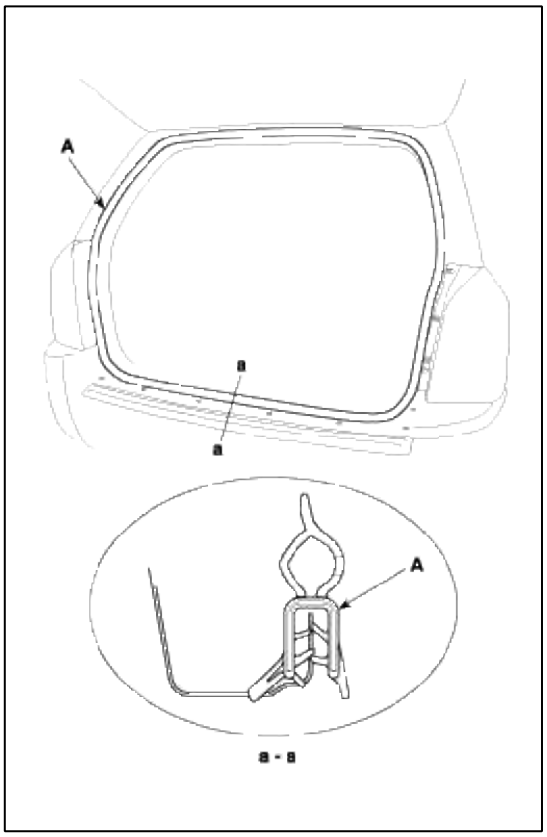
1. After disconnecting the tailgate lifter, remove the glass weathersrip (A).



2. Installation is the reverse of removal.

TAILGATE WEATHERSTRIP REPLACMENT

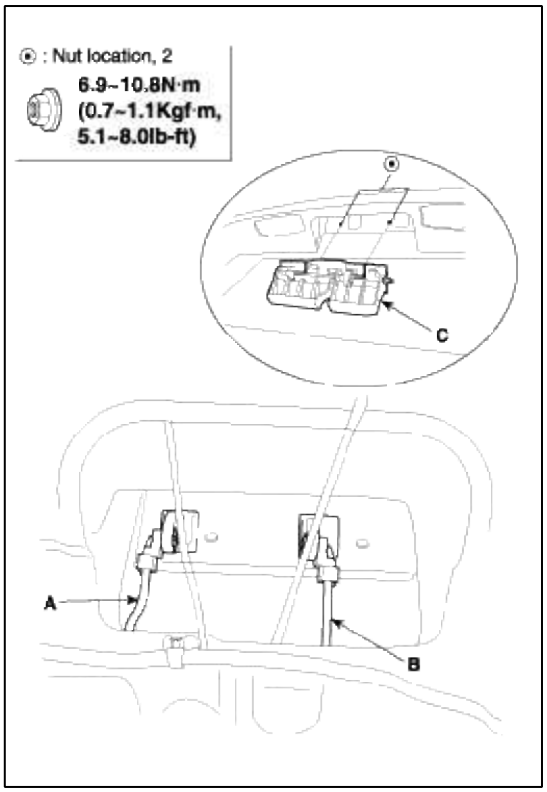
1. Remove the tailgate weatherstrip (A).



2. Installation is the reverse of removal.

TAILGATE OUTSIDE HANDLE REPLACEMENT

1. Remove the tailgate trim.
2. Disconnect the outside handle rod(A) and latch rod(B).



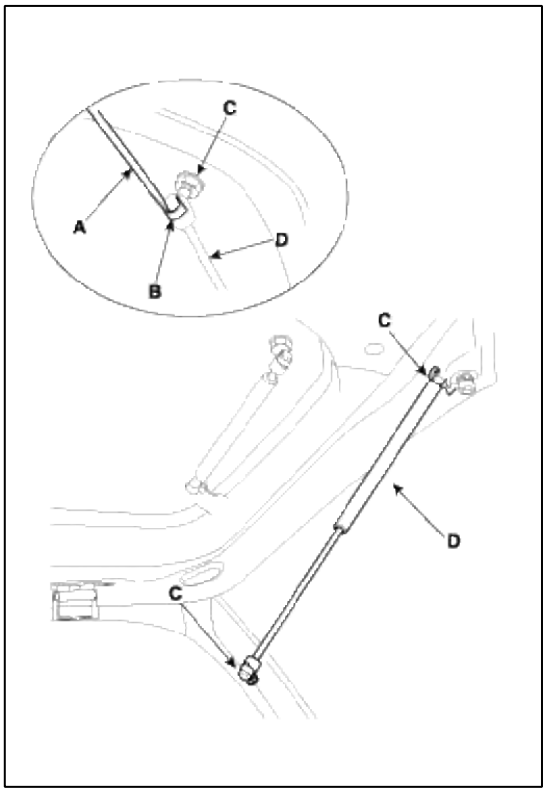
3. Loosen the inside handle (C) mounting bolts.

4. Installation is the reverse of removal.

> NOTE
>
> Make sure the tailgate open properly and locks securely.

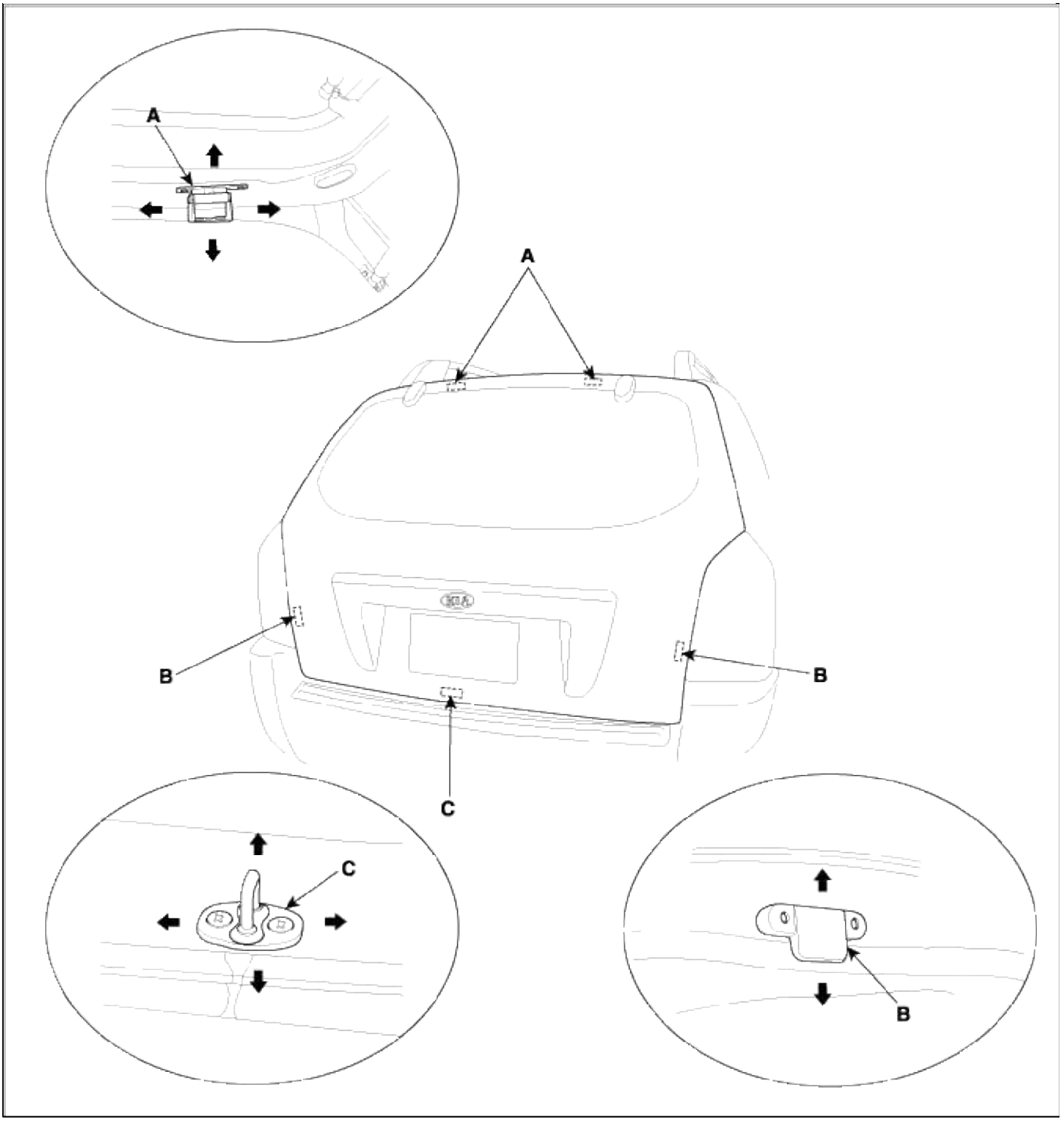
LIFTER REPLACMENT

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



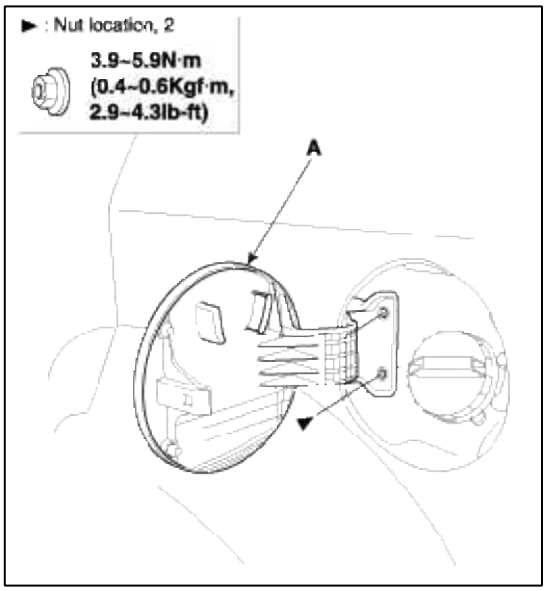
ADJUSTMENT

1. Adjust the tailgate alignment.
   A. After loosening the tailgate hinge(A) mounting bolt, adjust the tailgate by moving it up or down, or right or left.
   B. Adjust the tailgate fit by turning the tailgate side bumpers(B).
   C. Adjust the striker(C) by moving it up or down, or right or left.
2. Make sure the trunk lid opers and locks securely.



FUEL FILL DOOR REPLACEMENT

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



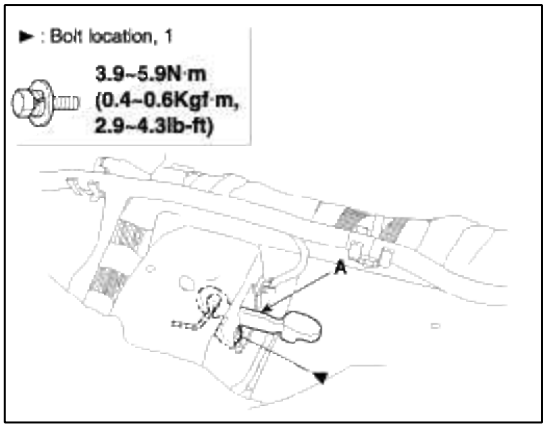
2. Installation is the reverse of removal.

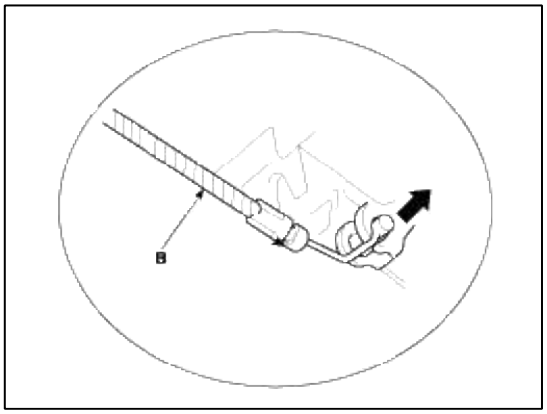
NOTE

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

RELEASE HANDLE REPLACEMENT

1. Remove the front door scuff trim and center pillar lower trim.
2. Loosen the release handle (A), mounting bolt.
   Disconnect the release cable (B). then remove the release handle.





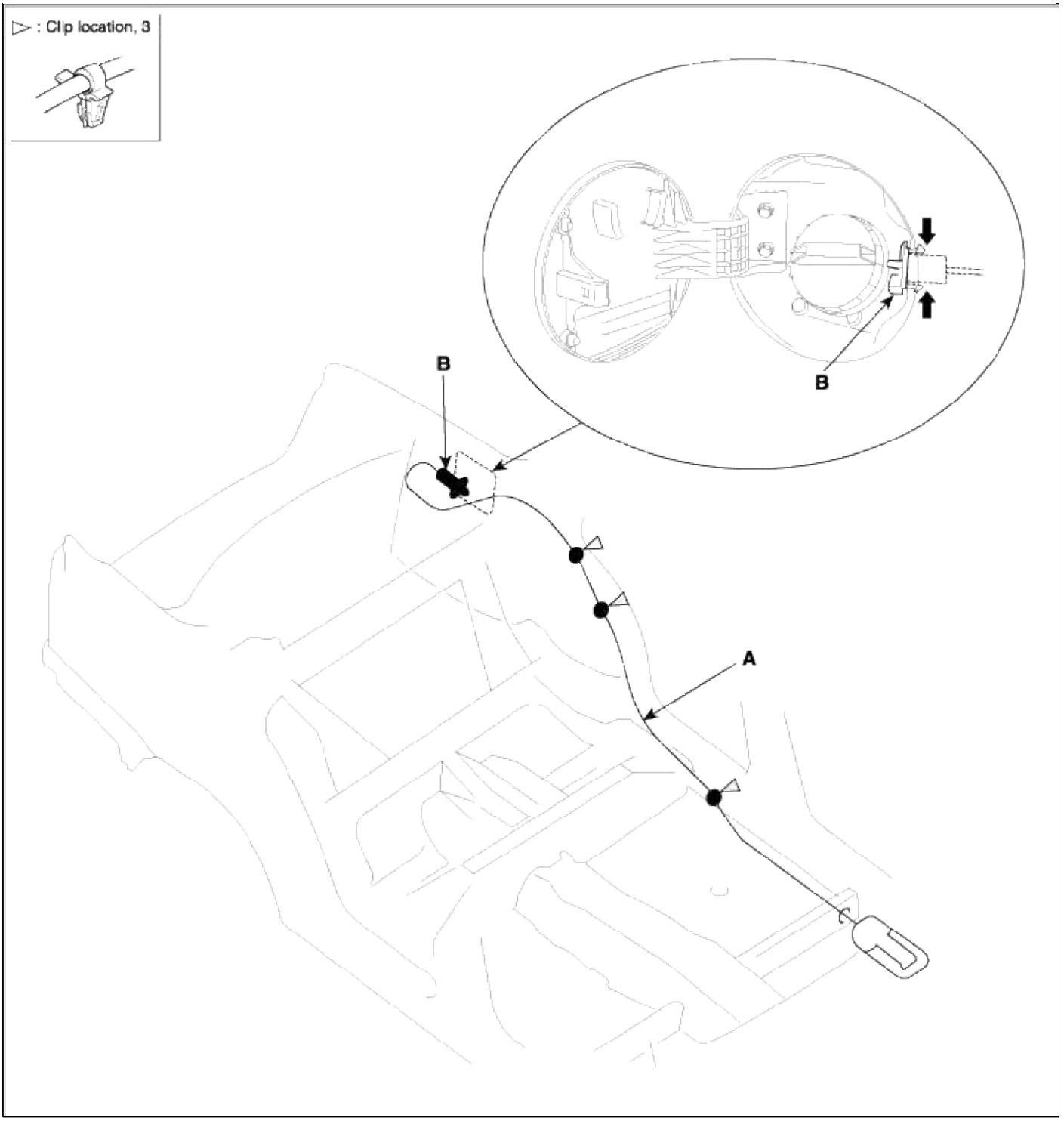
3. Installation is the reverse of removal.

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

FUEL FILLER DOOR RELEASE CABLE REPLACEMENT

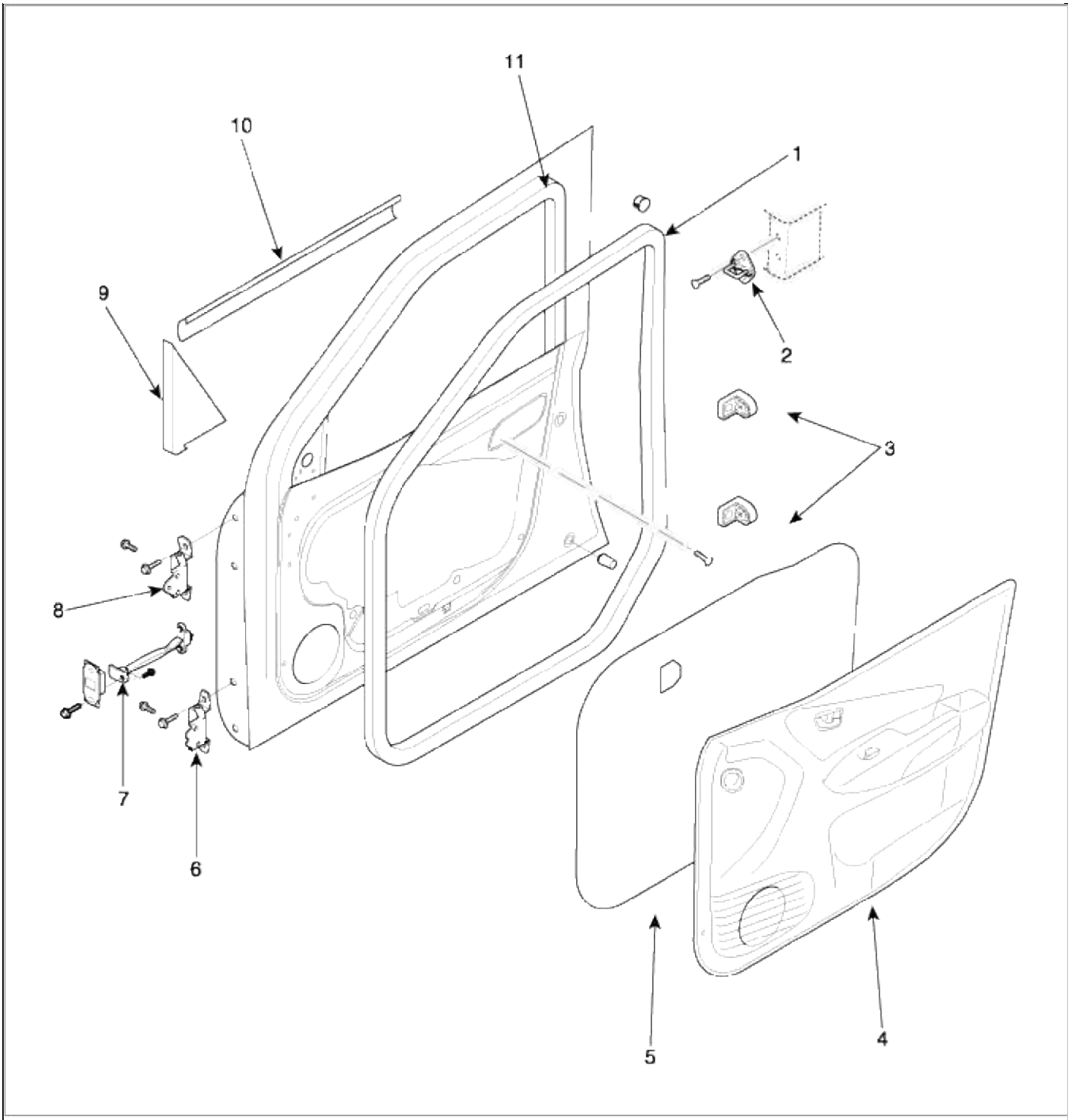
1. Remove the following items:
   A. Front seat.
   B. Rear seat.
   C. Front/rear door scuff trim LH.
   D. Center pillar lower trim.
   E. Luggage side trim.
   F. Fuel fill door release handle.
2. Disconnect the fuel filler door release cable from the release handle.
3. Remove the release cable (A) from the clip, and disconnect the fuel filler door catch (B), then remove the fuel filler door cable from the vehicle.

> NOTE
>
> Make sure the fuel fill door opens properly and locks.

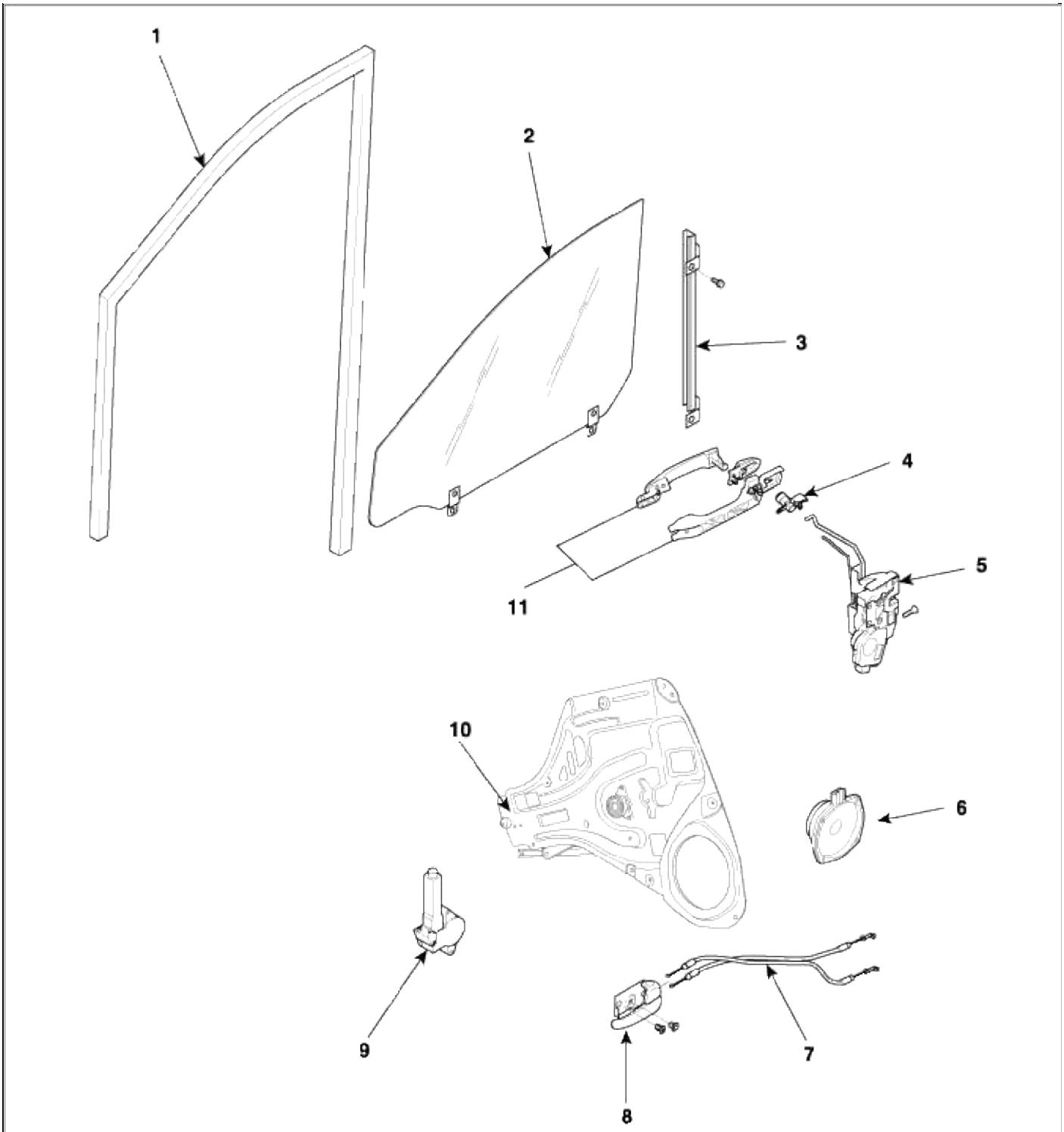


Body (Interior and Exterior) > Exterior > front door > Components and Components Location

COMPONENTS



1. Door weather stip
2. Striker
3. Retainer
4. Door trim
5. Door trim seal
6. Door hinge
7. Door checker
8. Door hinge
9. Quadrant inner cover
10. Door belt weather strip
11. Door panel



1. Glass molding
2. Glass
3. Chanel
4. Key cylinder
5. Latch
6. Speaker
7. Inside handle cable
8. Inside handle
9. Power window moter
10. Door module
11. Outside handle assembly

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

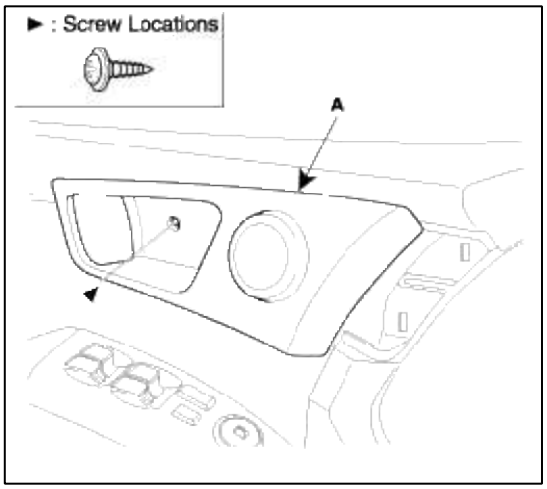
REPLACEMENT

DOOR TRIM REPLACEMENT

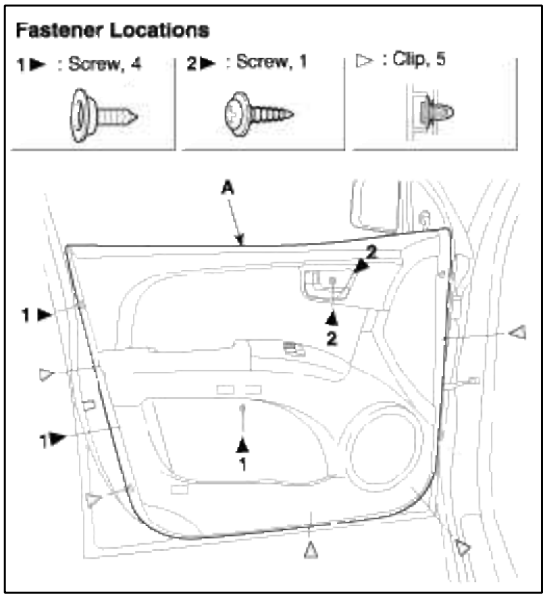
NOTE

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

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



3. Loosen the door trim(A) mounting screws. Disconnect the power window switch connector(B), power mirror connector(C), and door courtesy lamp connector(D).



4. Remove the door trim seal.
5. Installation is the reverse of removal.

NOTE

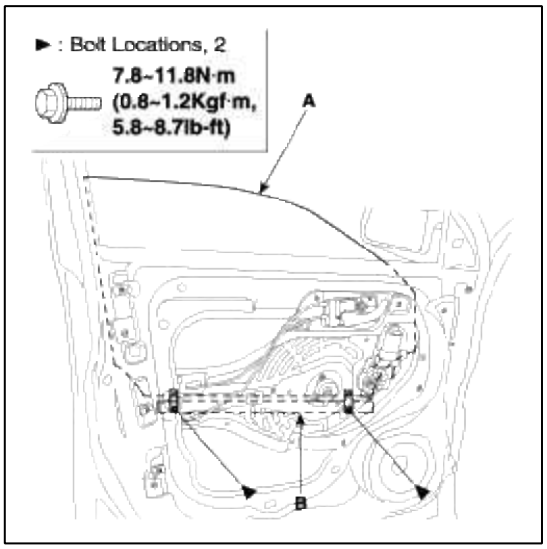
- Roll the glass and down to see if it moves freely without binding.
- Make sure the door locks and opens properly.

GLASS REPLACEMENT

1. Remove the front door trim.

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).

> **CAUTION**
>
> - Take care not to drop the glass or scratch the glass surface.

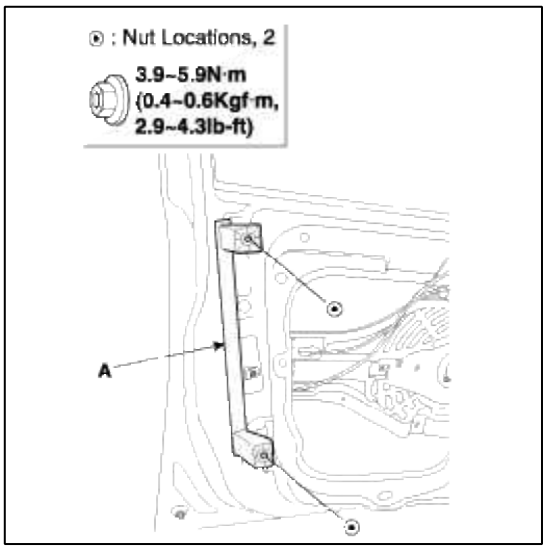


3. Installation is the reverse of removal.

> **NOTE**
>
> - Make sure the door locks and opens properly.
> - Adjust the position of the glass as necessary.

REAR CHANNEL REPLACEMENT

1. Remove the front door trim.
2. Remove the glass.
3. After disconnecting the glass molding, remove the rear channel (A).

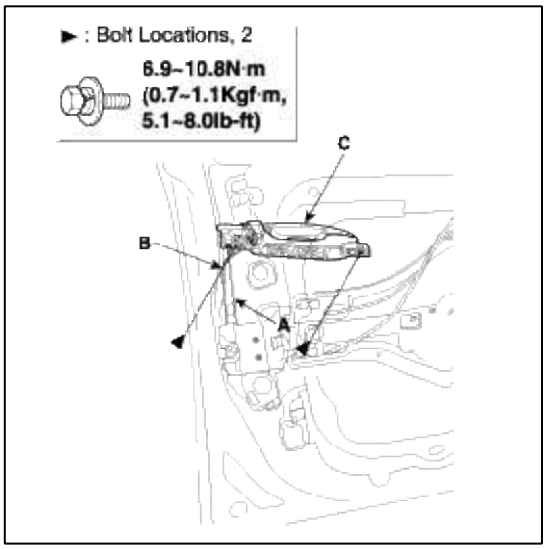


4. Installation is the reverse of removal.

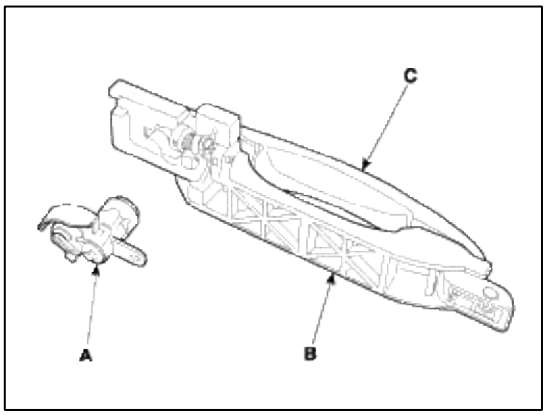
OUTSIDE HANDLE REPLACEMENT

1. Remove the following items;
   A. Door trim.
   B. Glass.
   C. Rear channel.

2. Disconnect the outside handle rod (A) and lock rod (B).
3. After removing the outside handle mounting bolt, remove the outside handle base (C) and key cylinder.



4. After removing key cylinder (A) and outside handle base (B), remove the outside handle lever(C).



5. Installation is the reverse of removal.

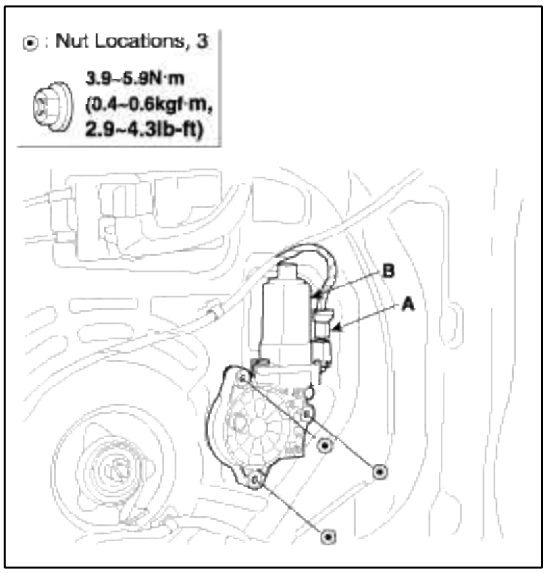
NOTE

- Roll the glass and down to see if it moves freely without binding.
- Make sure the door locks and opens properly.

POWER WINDOW MOTOR REPLACEMENT

1. Remove the front door trim.

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



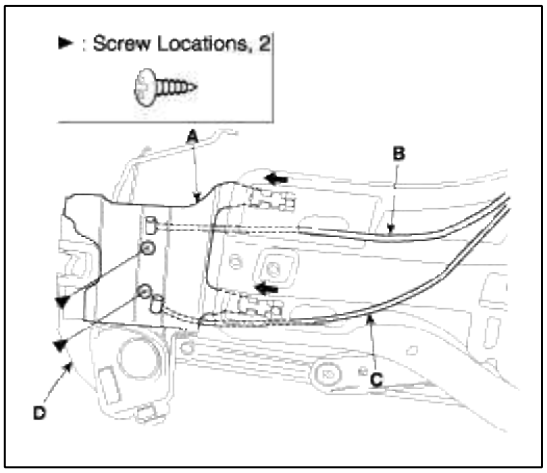
3. Installation is the reverse of removal.

NOTE

- Roll the glass and down to see if it moves freely without binding.
- Make sure the door locks and opens properly.

LATCH ASSEMBLE REPLACEMENT

1. Remove the front door trim.
2. Remove the glass.
3. Remove the door module.
4. Lock cable(B), inside handle cable(C) then remove the latch assemble(D).



5. Installation is the reverse of removal.

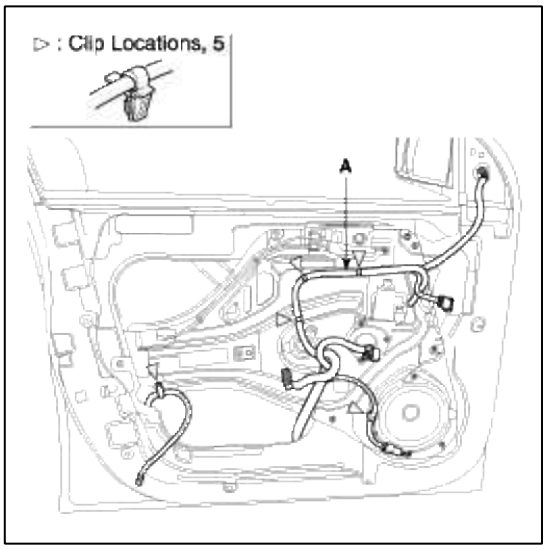
NOTE

- Roll the glass and down to see if it moves freely without binding.

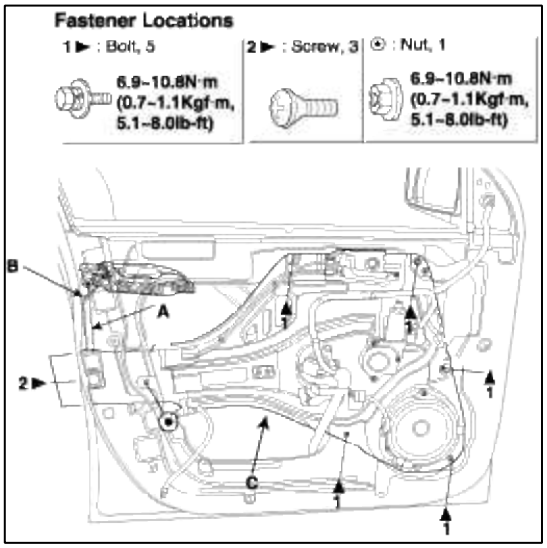
DOOR MODULE REPLACEMENT

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

3. Disconnect the wiring harness (A).



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



5. Installation is the reverse of removal.

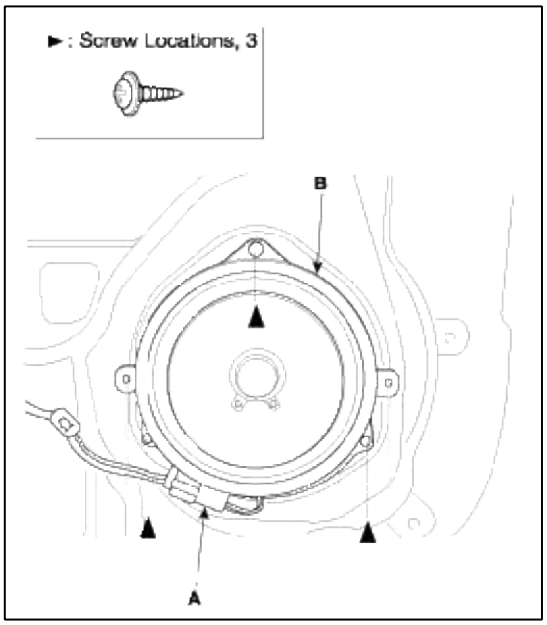
NOTE

- Roll the glass up and down to see if it moves freely without binding.
- Make sure the door locks and opens properly.

SPEAKER REPLACMENT

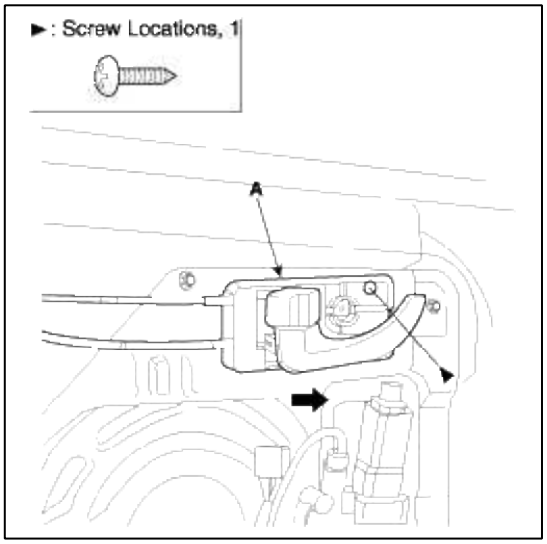
1. Remove the front door trim.
2. Disconnect the speaker connector (A), and remove the speaker (B).

3. Installation is the reverse of removal.

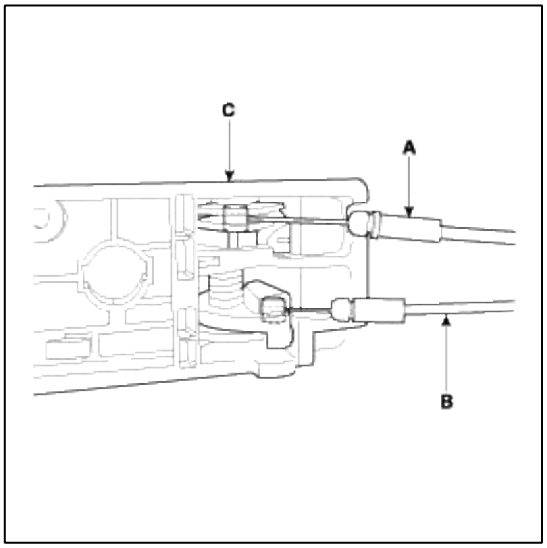


INSIDE HANDLE REPLACMENT

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



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



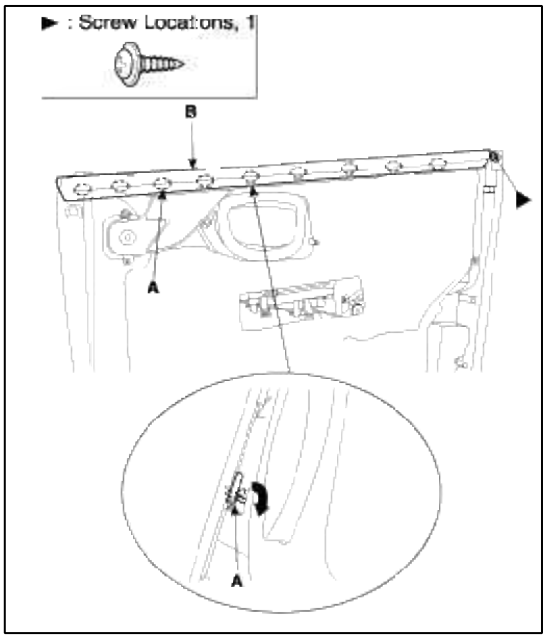
4. Remove the inside handle(C).

5. Installation is the reverse of removal.

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

DOOR BELT WEATHERSTRIP REPLACMENT

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



3. Installation is the reverse of removal.

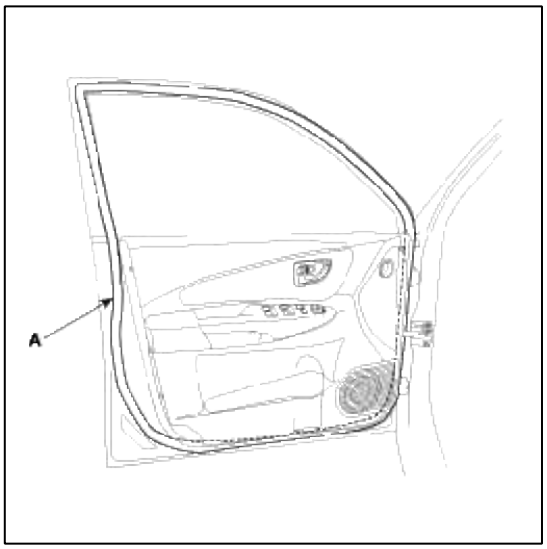
GLASS RUN REPLACMENT

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

4. Installation is the reverse of removal.

DOOR WEATHEESTRIP REPLACMENT

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



2. Installation is the reverse of removal.

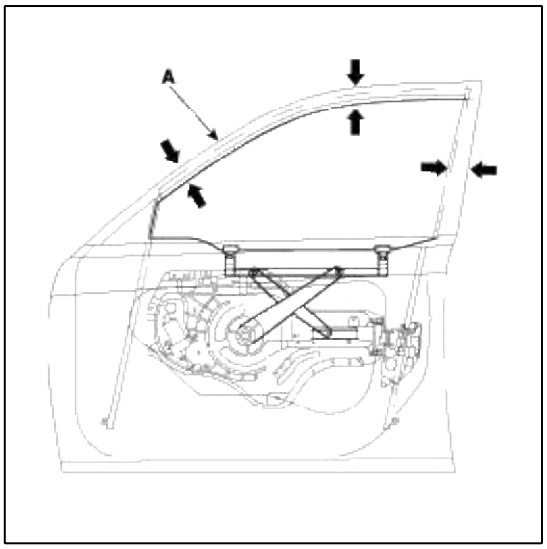
ADJUSTMENT

GLASS ADJUSTMENT

NOTE

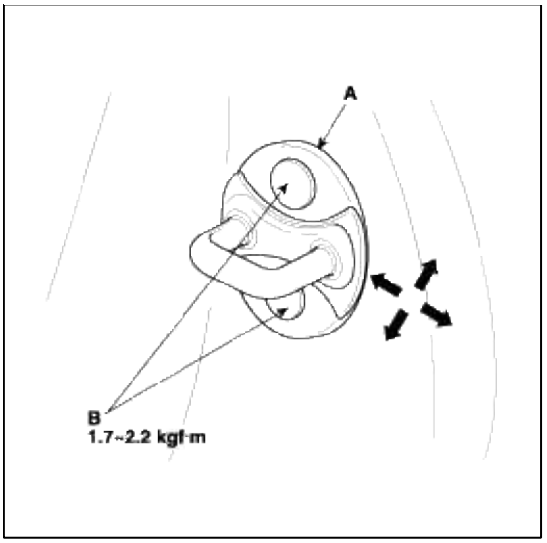
- Check the glass run channel for damage or deterioration, and replace them if necessary.

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



2. Chack that the glass moves smoothly.

DOOR STRIKER ADJUSTMENT

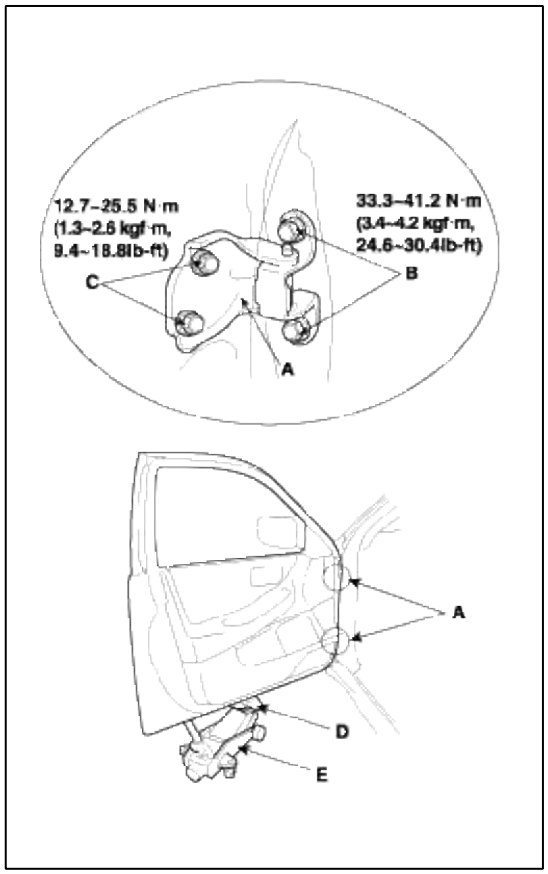


DOOR POSITION ADJUSTMENT

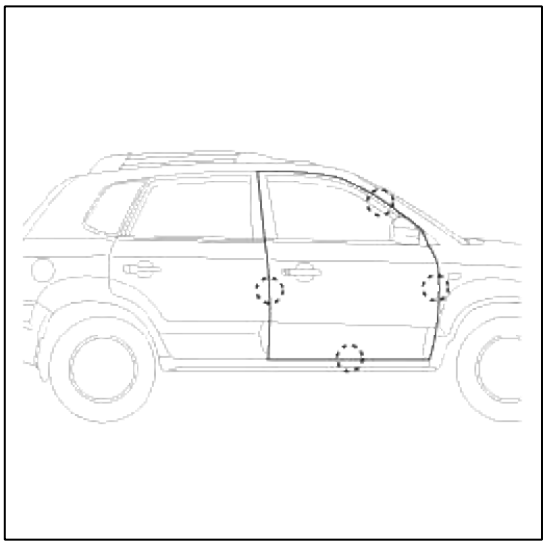
NOTE

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

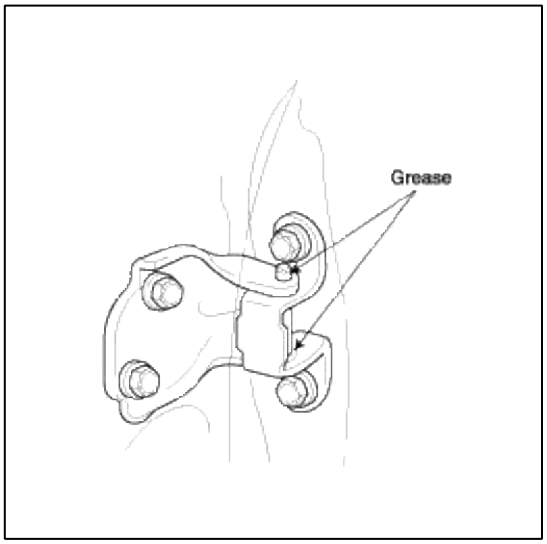
1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust at the hinges(A):
   A. Loosen the door mounting bolts(B) slightly, and move the door IN or OUT until it aligns flush with the body.
   B. Loosen the hinge mounting bolts (C) slightly, and move the door BACKWARD or FORWARD,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



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



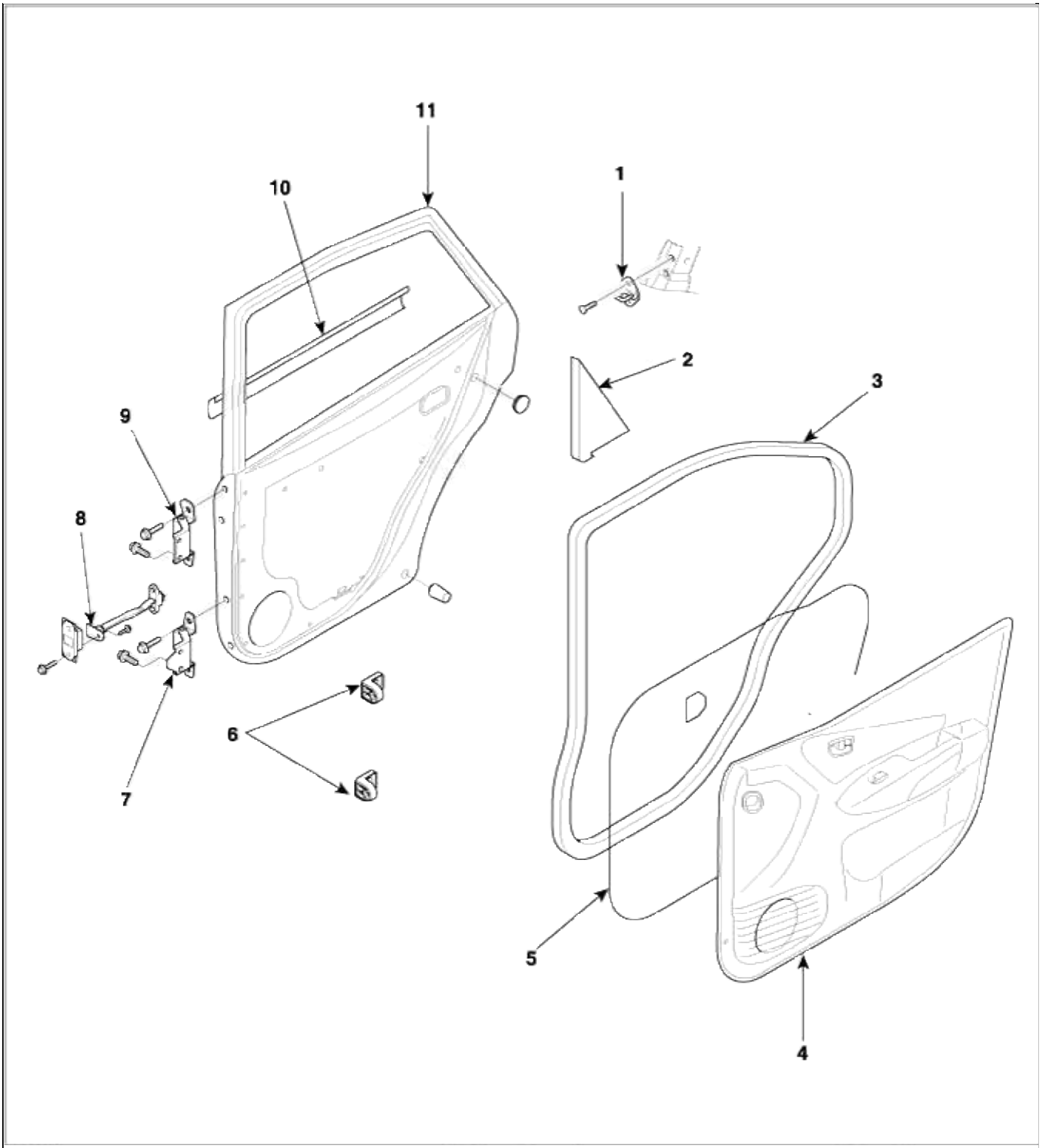
4. Grease the pivot portions of the hinges indicated by the arrows.



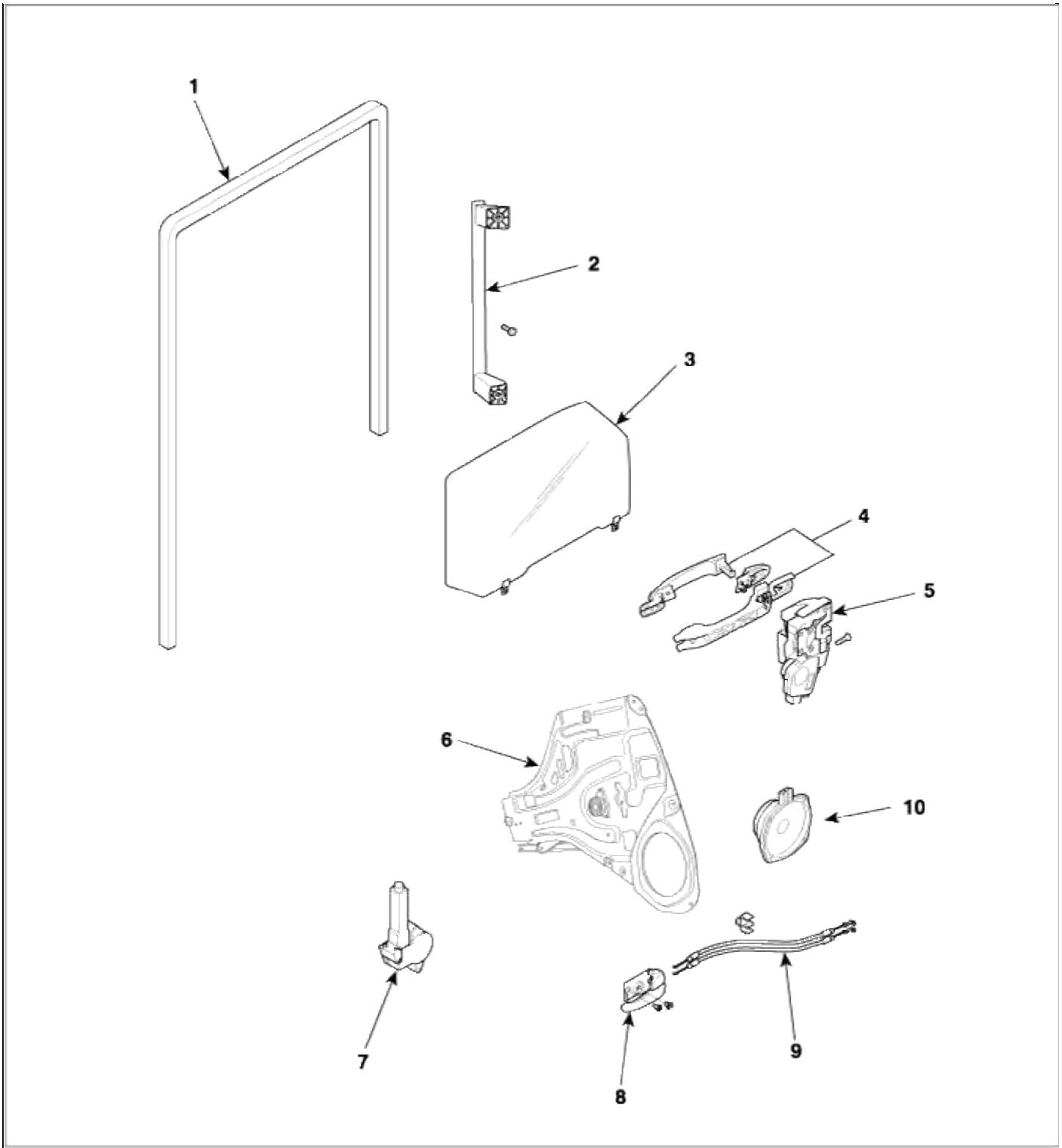
5. Check for water leaks.

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

COMPONENTS



1. Striker
2. Delta molding
3. Door weatherstip
4. Door trim
5. Door trim seal
6. Retainer
7. Door hinge
8. Door checker
9. Door hinge
10. Door belt weatherstip
11. Door panel



1. Glass molding
2. Chanel
3. Glass
4. Out side handle assemble
5. Latch
6. Door modlue
7. Power window moter
8. Inside handle
9. Inside handle cable
10. Speaker

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

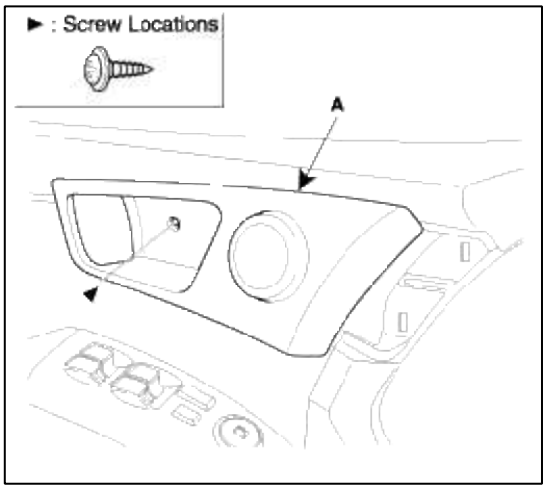
REPLACMENT

REMOVE REAR DOOR TRIM

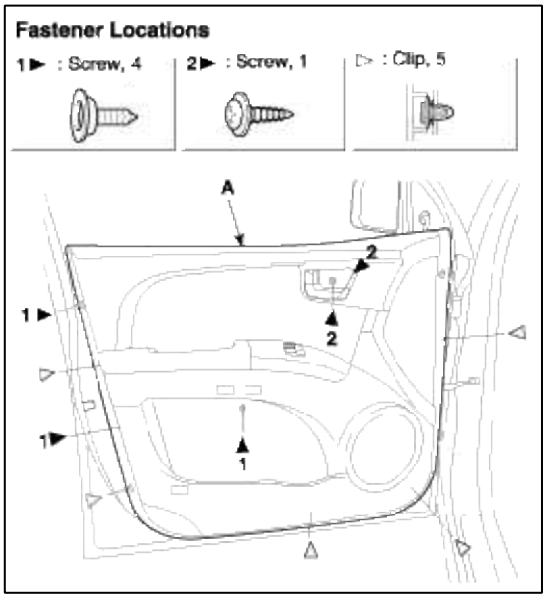
CAUTION

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

1. Remove the inside handle cover (A).



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



3. Remove the door trim seal.
4. Installation is the reverse of removal.

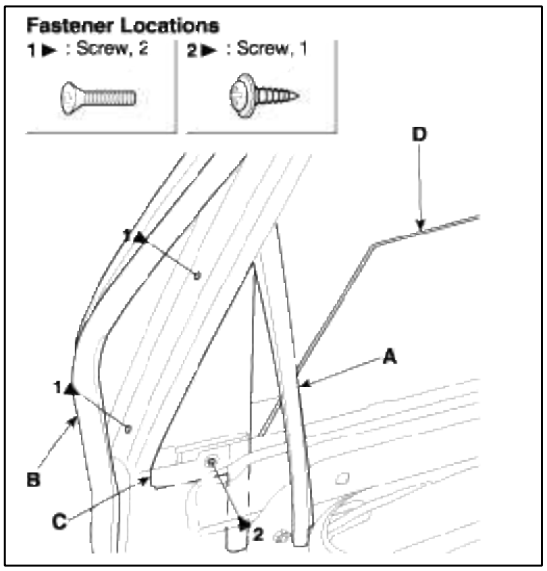
NOTE

- Roll the glass and down to see if it moves freely without binding.
- Make sure the door locks and opens properly.

GLASS REPLACMENT

1. Remove the rear door trim.

2. After disconnecting the glass run (A) and weatherstrip (B), then remove the delta molding(C).



3. After loosening the mounting bolt, remove the glass(D).

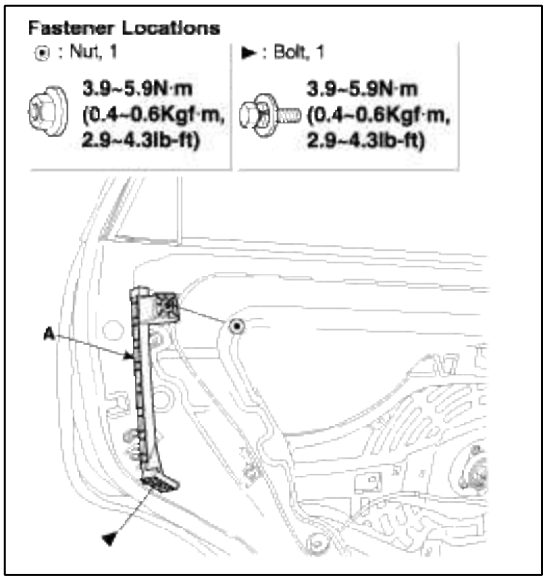
> CAUTION
>
> - Take care not to drop the glass and scratch the glass surface.

4. Installation is the reverse of removal.

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

REAR CHANNEL REPLACMENT

1. Remove the rear door trim.
2. Remove the glass.
3. Remove the rear channel mounting bolt and remove the chanel from the door assembly.

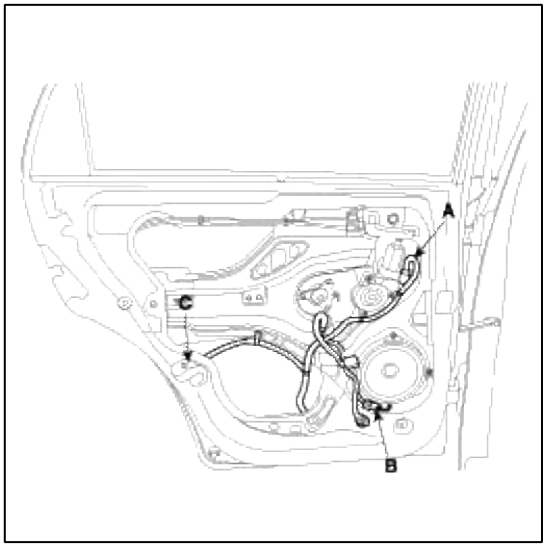


4. Installation is the reverse of removal.

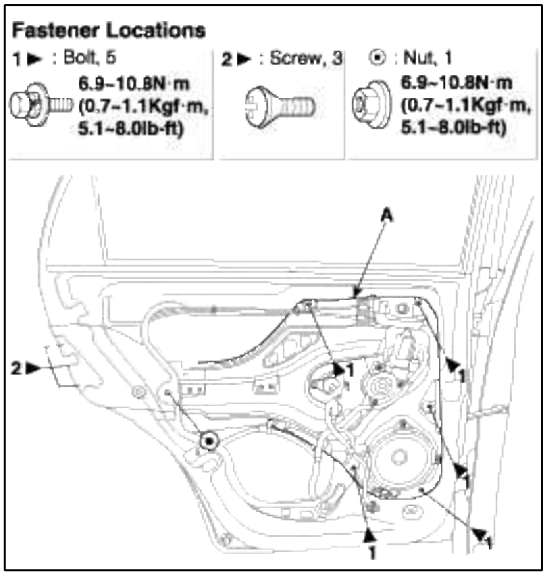
> NOTE
>
> - Roll the glass up down to see if move freely without binding.

DOOR MODULE REPLACMENT

1. Remove the rear door trim.
2. Remove the glass.
3. Remove the rear channel.
4. Disconnect the power window motor connector(A),speaker connector(B), and actuator connector(C).



5. Remove the door module assembly(A).



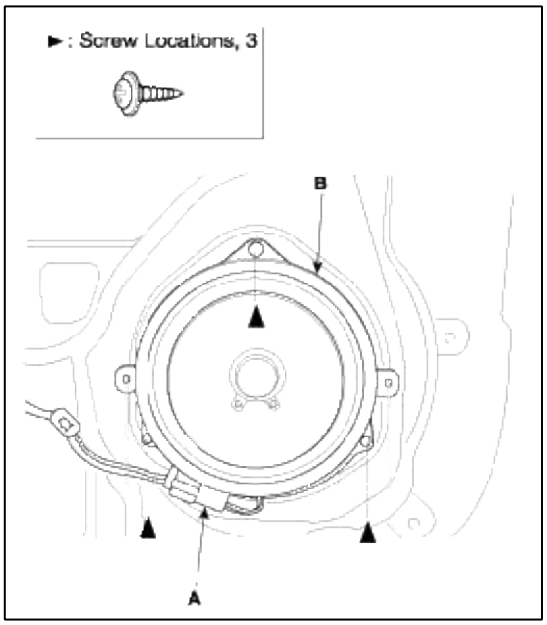
6. Installation is the reverse of removal.

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

SPEAKER REPLACMENT

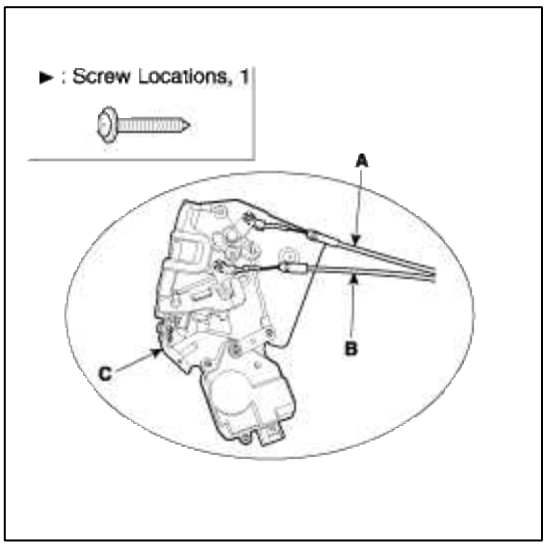
1. Remove the rear door trim.
2. After disconnecting the speaker connector (A), remove the speaker (B).

3. Installation is the reverse of removal.



REAR DOOR LATCH REPLACEMENT

1. Remove the rear door trim.
2. Remove the glass.
3. Remove the rear door module.
4. Remove the latch cover, then disconnect the lock cable (A) and inside handle cable (B). Remove the rear door latch(C).

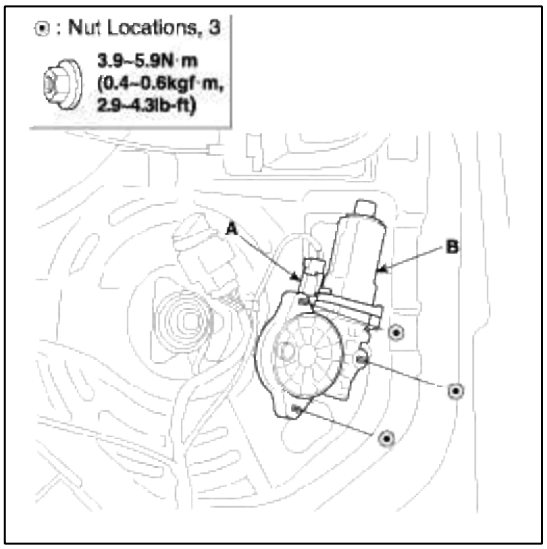


5. Installation is the reverse of removal.

POWER WINDOW MOTOR REPLACMENT

1. Remove the rear door trim.
2. Disconnect the power window motor connector (A).

3. After loosening the mounting nut, remove the power window motor (B).



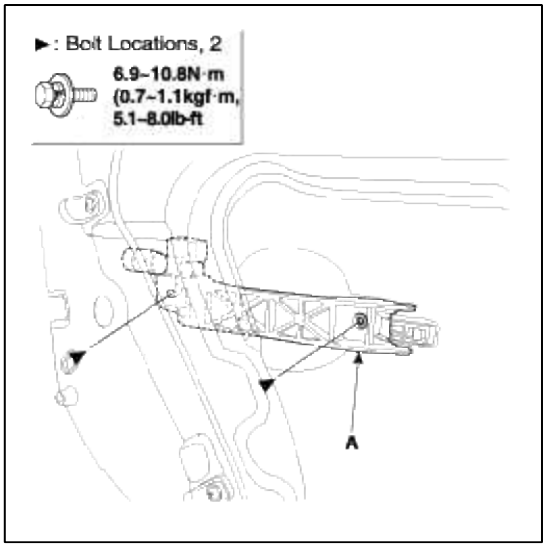
4. Installation is the reverse of removal.

NOTE

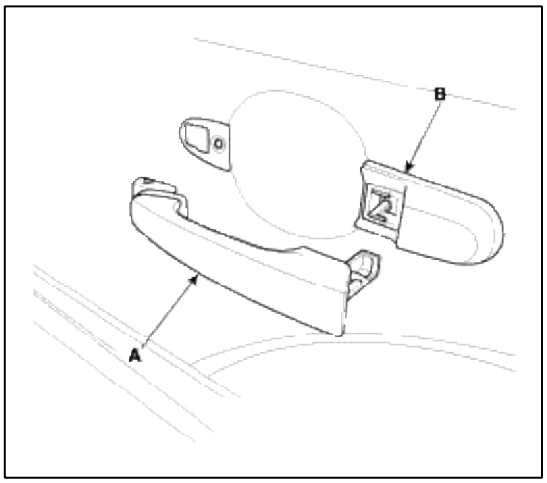
- Roll the glass up down to see if move freely without binding.

OUTSIDE HANDLE REPLACEMENT

1. Remove the rear door trim.
2. Remove the glass.
3. Remove the rear channel.
4. Remove the outside handle base (A).



5. Remove the outside hand lever (A) and cover (B).



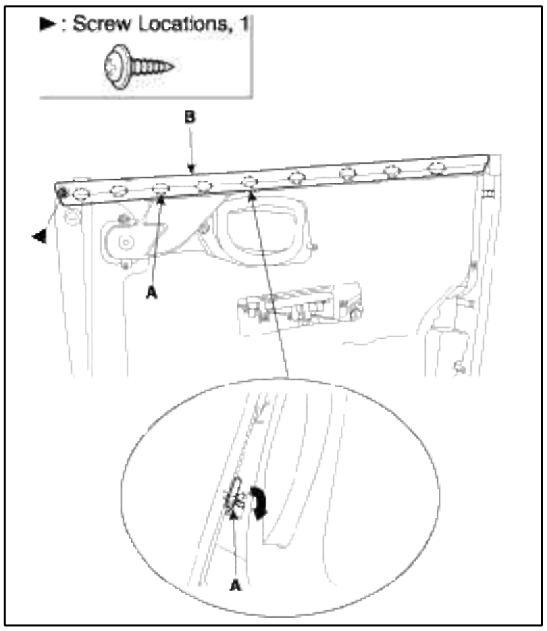
6. Installation is the reverse of removal.

NOTE

- Make sure the door locks and opens properly.

DOOR BELT WEATHERSTRIP REPLACEMENT

1. Release the hooks (A) and then remove the door belt weatherstrip(B).

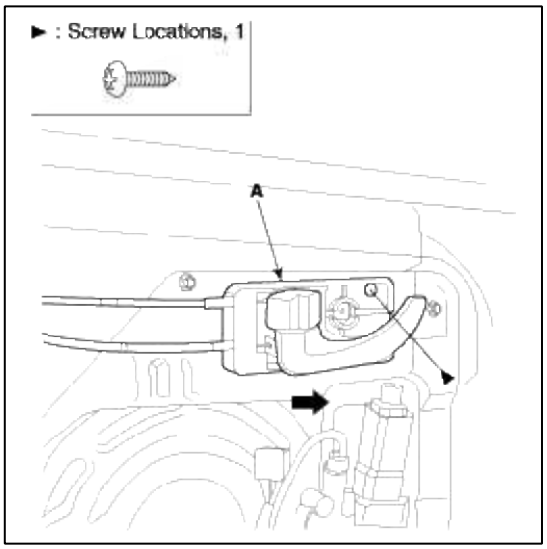


2. Installation is the reverse of removal.

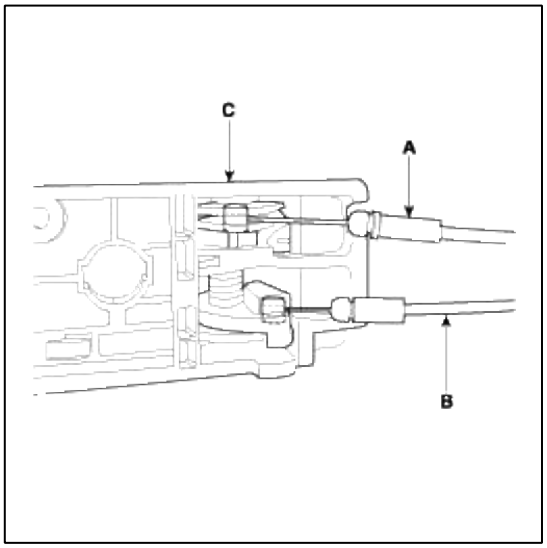
INSIDE HANDLE REPLACEMENT

1. Remove the rear door trim.

2. Loosen the inside handle(A) forward to disconnect from the door module.



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



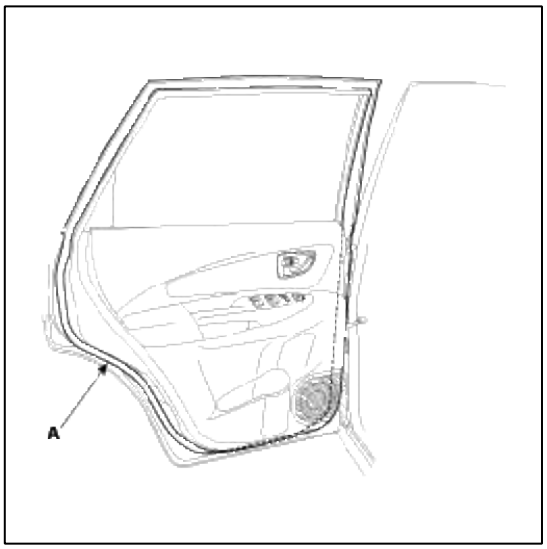
4. Remove the inside handle(C).
5. Installation is the reverse of removal.

NOTE

- Make sure the door locks and opens properly.

DOOR WEATHERSTRIP REPLACEMENT

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



2. Installation is the reverse of removal.

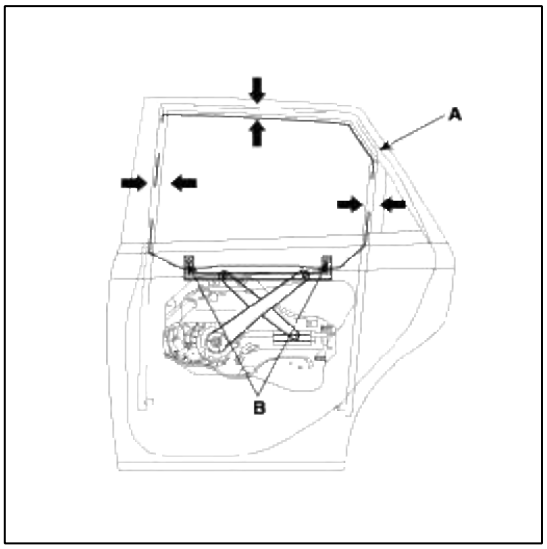
ADJUSTMENT

GLASS ADJUSTMENT

NOTE

- Check the weatherstrip and glass run channel for dabage or deterioration, and replace them if necessary.

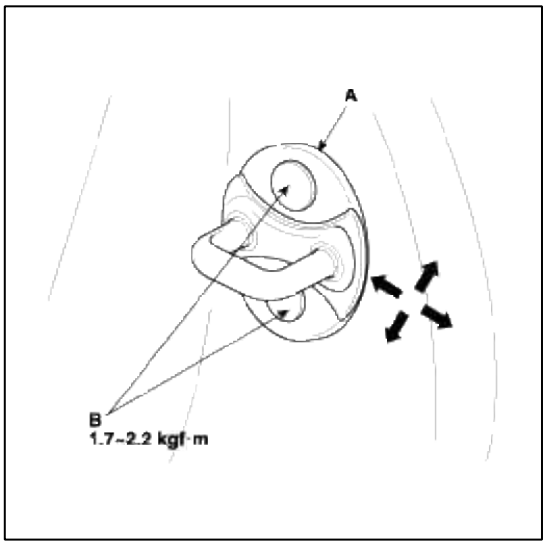
1. Remove the rear door trim.
2. Carefully move the glass(A) until you can see the glass mounting bolts(B), then loosen them.



3. Push the glass against the center channel, the tighten the glass mounting bolts.
4. Check that the glass moves smoothly.

DOOR STRIKER ADJUSTMENT

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



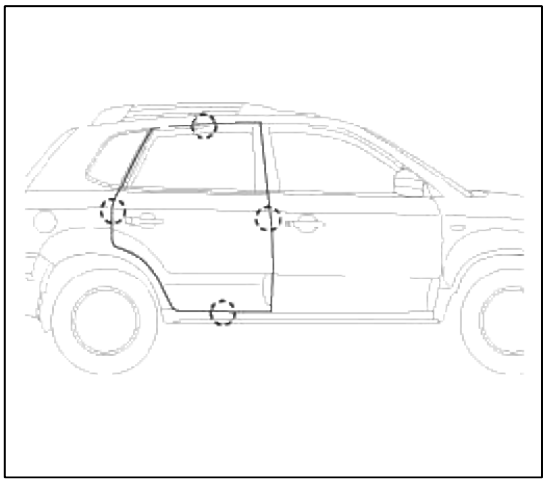
2. Make sure the door locks and opens properly.

DOOR POSITION ADJUSTMENT

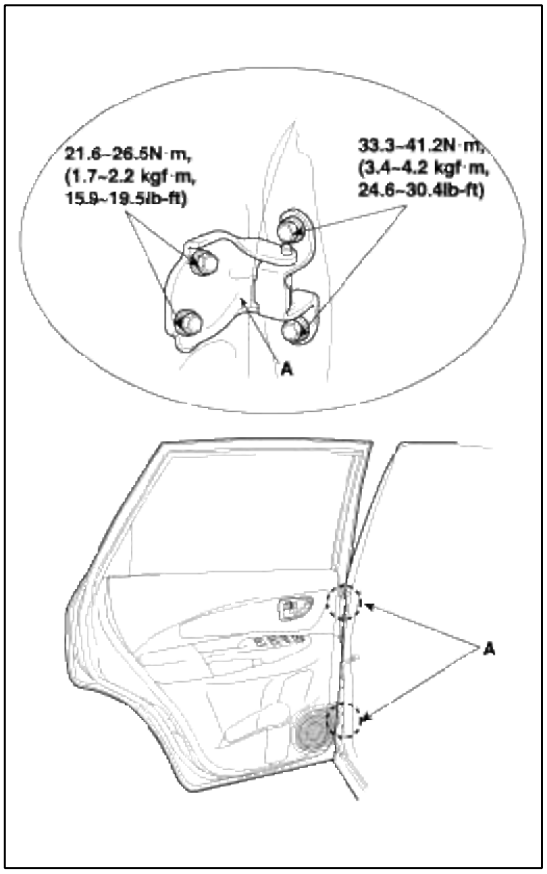
NOTE

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

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



2. Adjust at the hinge(A):
   Loosen the hinge mounting bolts(C) slightly, and move the door BACKWARD or FORWARD, UP or DOWN ad necessary to equalize the gaps.



3. Check that the door edges are parallel.

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

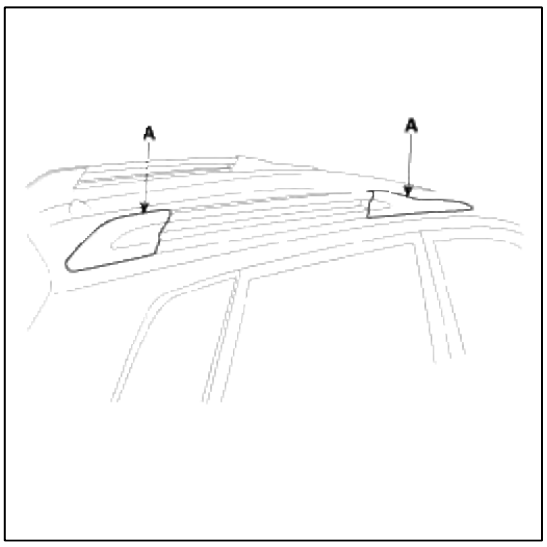
REPLACEMENT

ROOF RACK REPLACEMENT

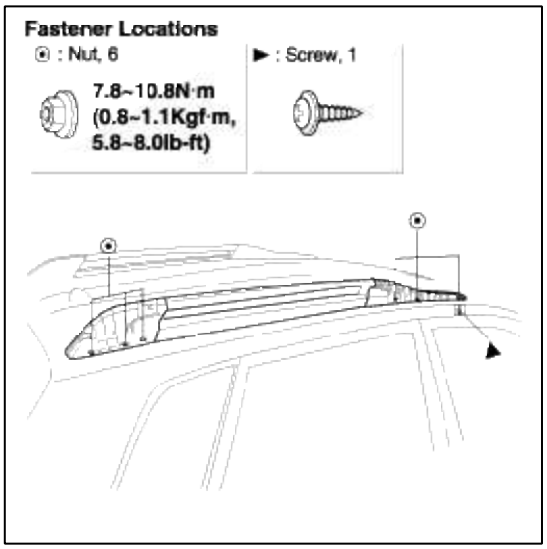
NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
- Take care not to scratch the body surface.

1. Remove the rack cover (A).



2. Remove the roof rack(A).



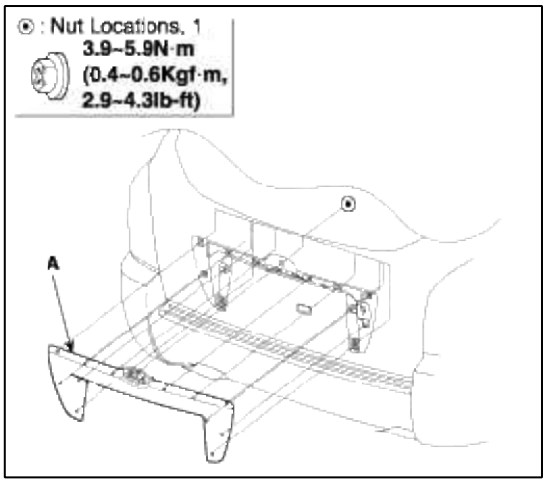
3. Installation is the reverse of removal.

TAILGATE GARNISH REPLACEMENT

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
- Take care not to scratch the body surface.

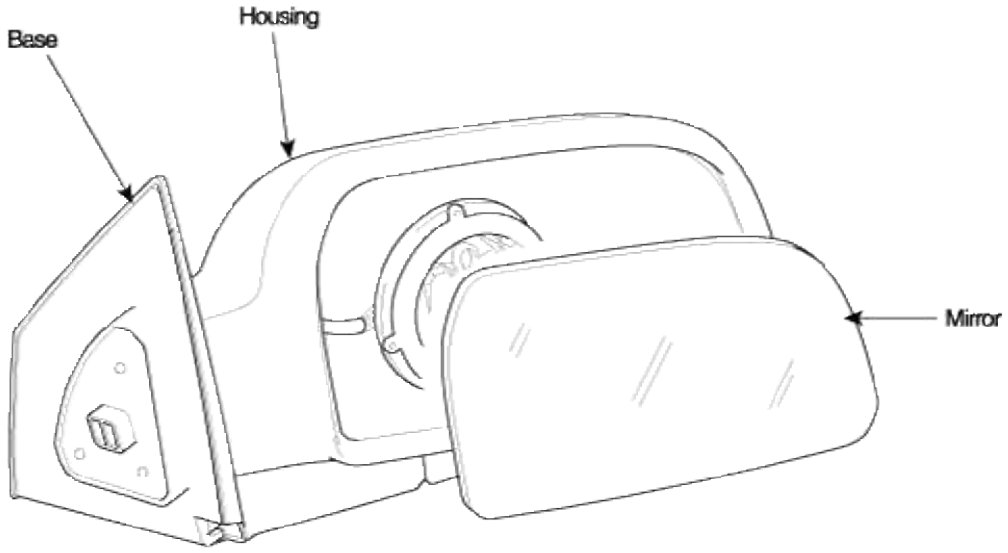
1. Remove the tailgate trim.
2. Remove the key cylinder.
3. Move the tailgate garnish(A).
4. Installation is the reverse of removal.



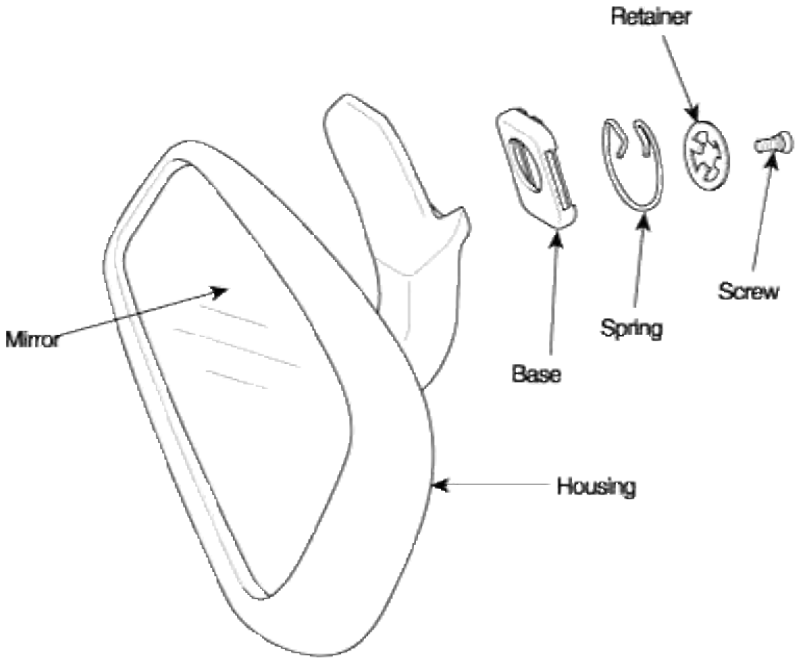
Body (Interior and Exterior) > Exterior > mirror > Components and Components Location

COMPMNEMTS

[Outside rearview mirror]



[Inside rearview mirror]



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

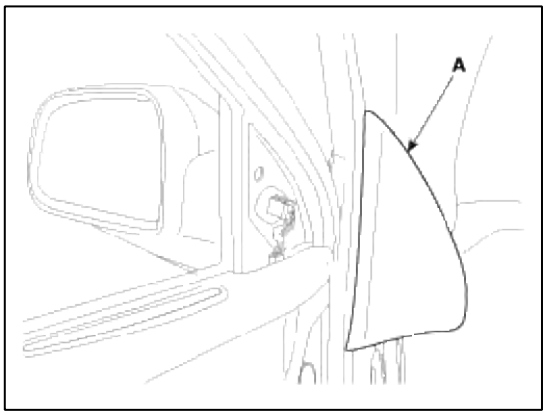
REPLACEMENTC

OUTSIDE REAR VIEW MIRROR REPLACEMENT

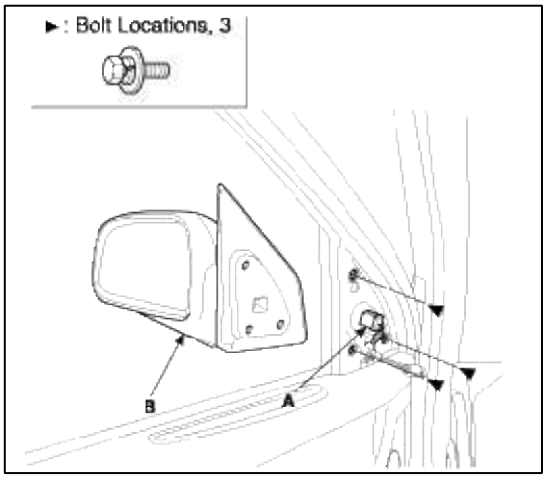
NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
- Take care not to scratch the body surface.

1. Remove the quadrant inner cover(A).



2. Remove the door trim(See Page BD-23).
3. After disconnecting the connector (A), remove the outside rear view mirror(B).

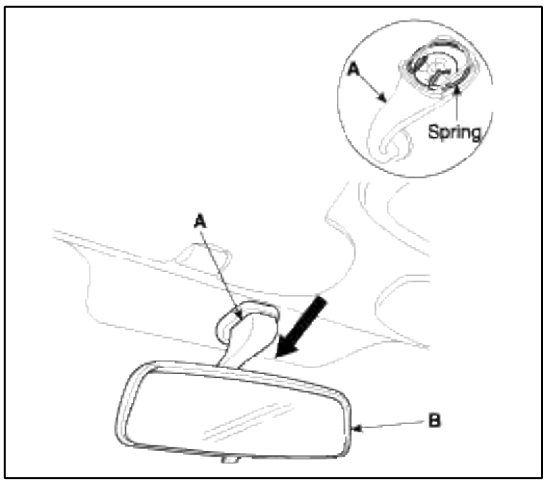


4. Installation is the reverse of removal.

INSIDE REAR VIEW MIRROR REPLACEMENT

MANUAL MIRROR

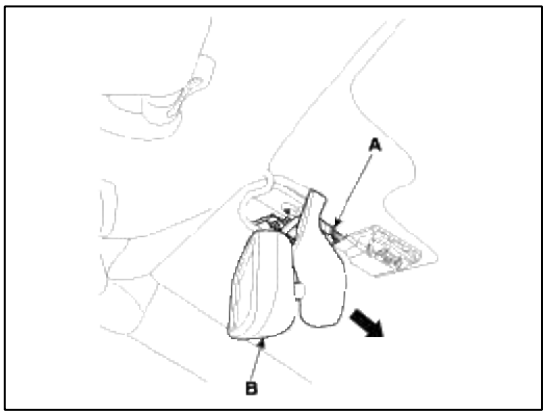
1. Push the inside rear view mirror base(A) down to remove the inside rear view mirror assembly(B).
2. Installation is the reverse of removal.



ECM MIRROR REPLACEMENT

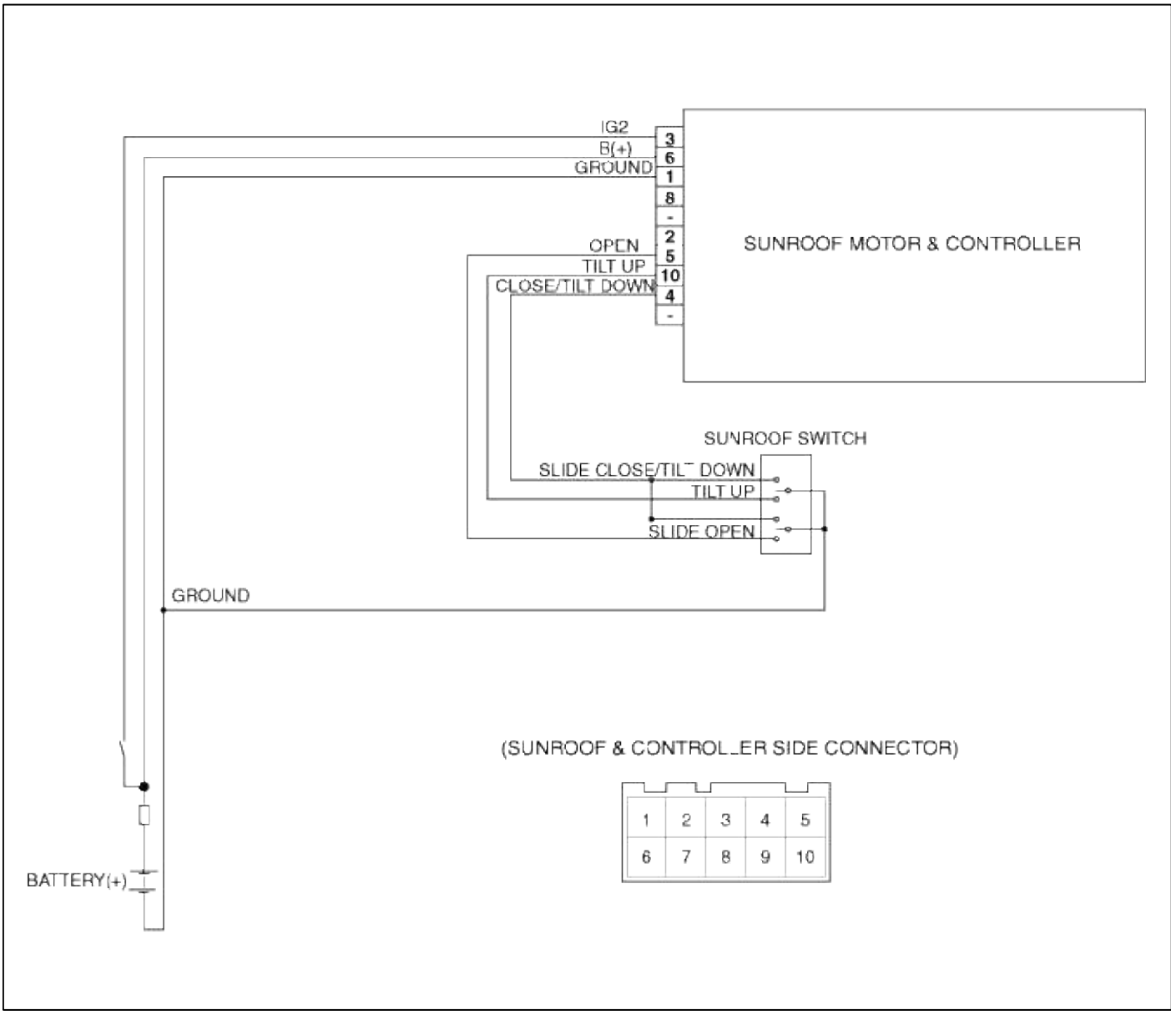
1. Remove the cover and connector (A).
2. Push the ECM mirror base down to remove the ECM mirror assembly (B).

3. Installation is the reverse of removal.



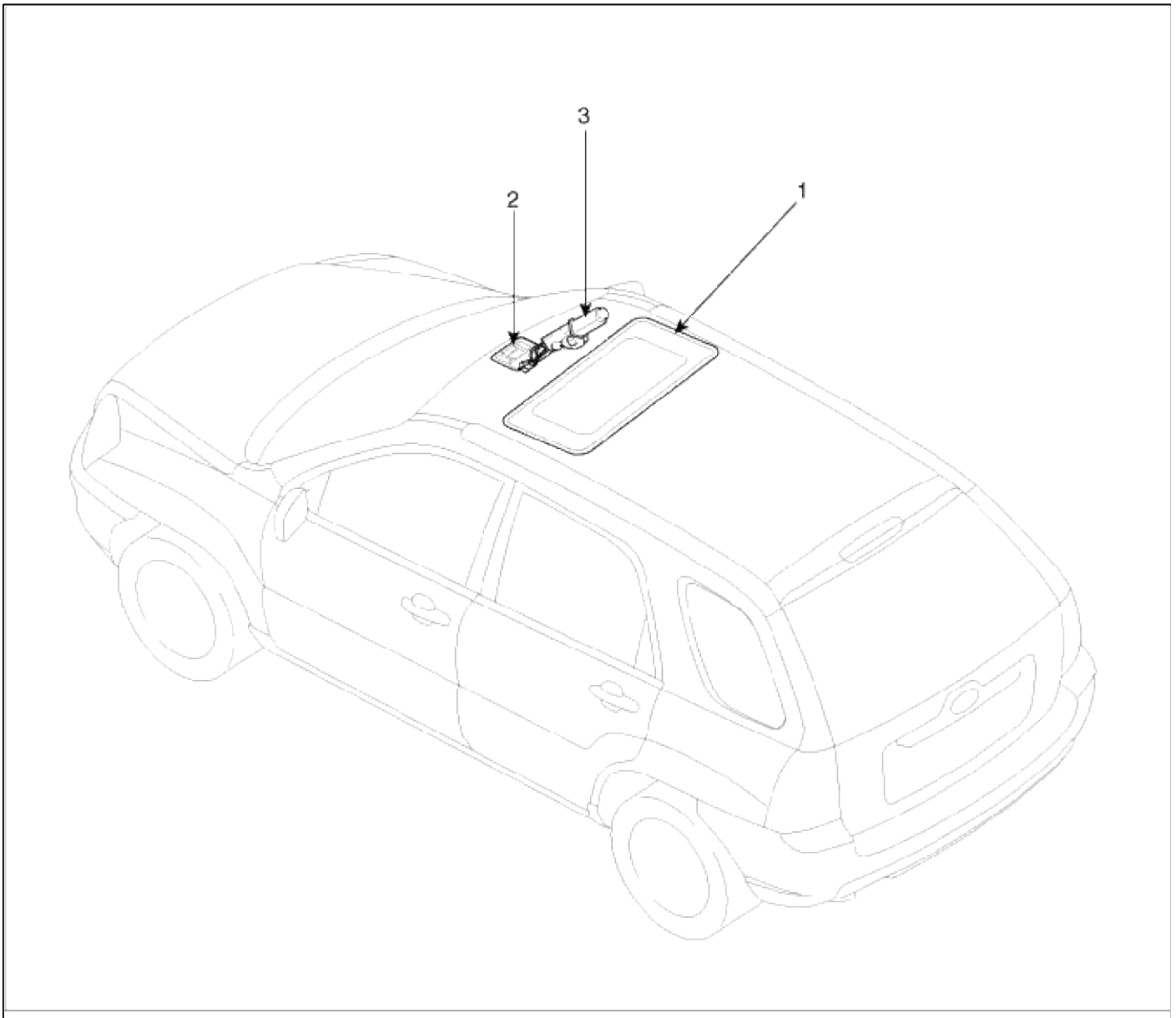
Body (Interior and Exterior) > Sun Roof > Schematic Diagrams

CIRCUIT DIAGRAM



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

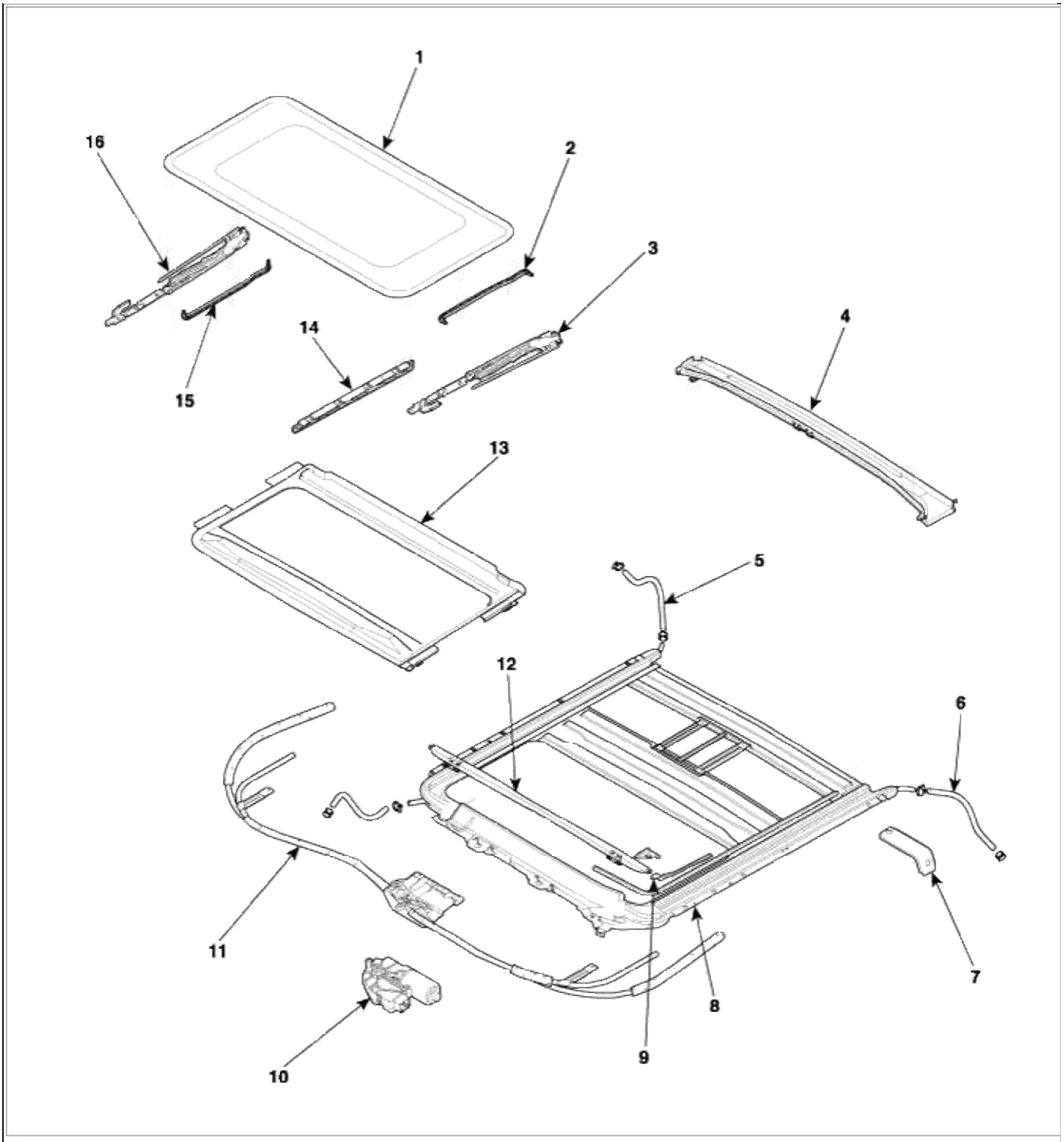
COMPONENTS



1. Sunroof
2. Sunroof switch
3. Sunroof motor & controller

Body (Interior and Exterior) > Sun Roof > sun roof assembly > Components and Components Location

COMPONENTS



1. Glass	5. Drain tube	9. Deflector link	13. Sunshade
2. Drip link	6. Drain tube	10. Motor	14. Decoration cover
3. Guide assembly	7. Set bracket	11. Drive unit	15. Drip link
4. Drip rail	8. Frame	12. Deflector	16. Guide assembly

Body (Interior and Exterior) > Sun Roof > sun roof assembly > Repair procedures

REPLACEMENT

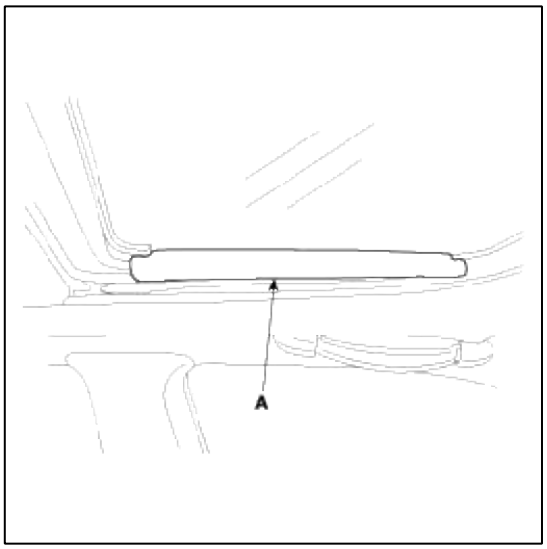
NOTE

Put on gloves to protect your hands.

GLASS REPLACEMENT

1. Close the glass fully and slide the sunshade all the way back.

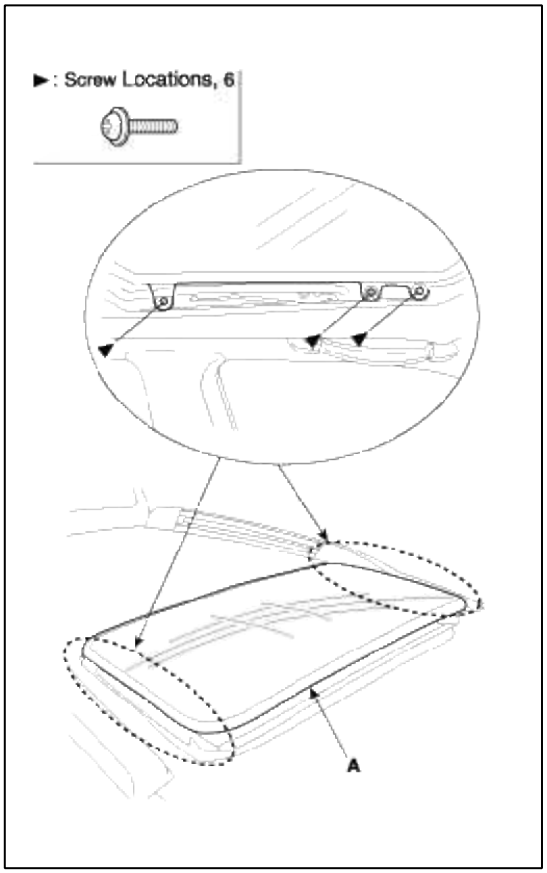
2. Remove both decoration covers (A).



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

NOTE

Do not damage the roof panel.

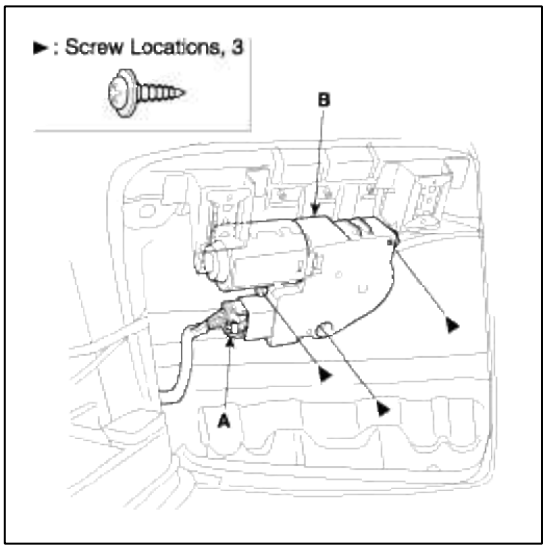


4. Installation is the reverse of removal, and adjust the glass height alignment. Check for water leaks. Do not use high-pressure water.

MOTOR AND CONTROLLER REPLACEMENT

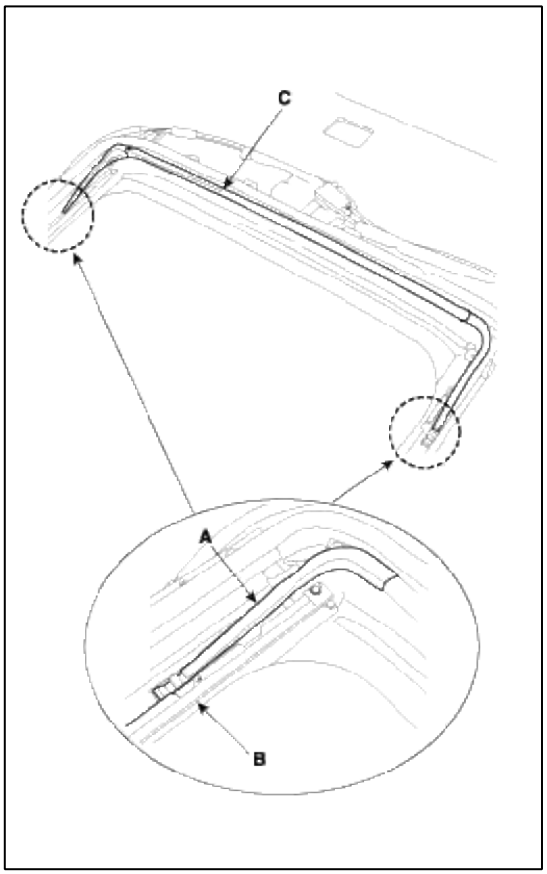
1. Remove the over head console.
2. Disconnect the motor connector (A), remove the screws and then remove the motor (B).

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).
3. Installation is the reverse of removal.



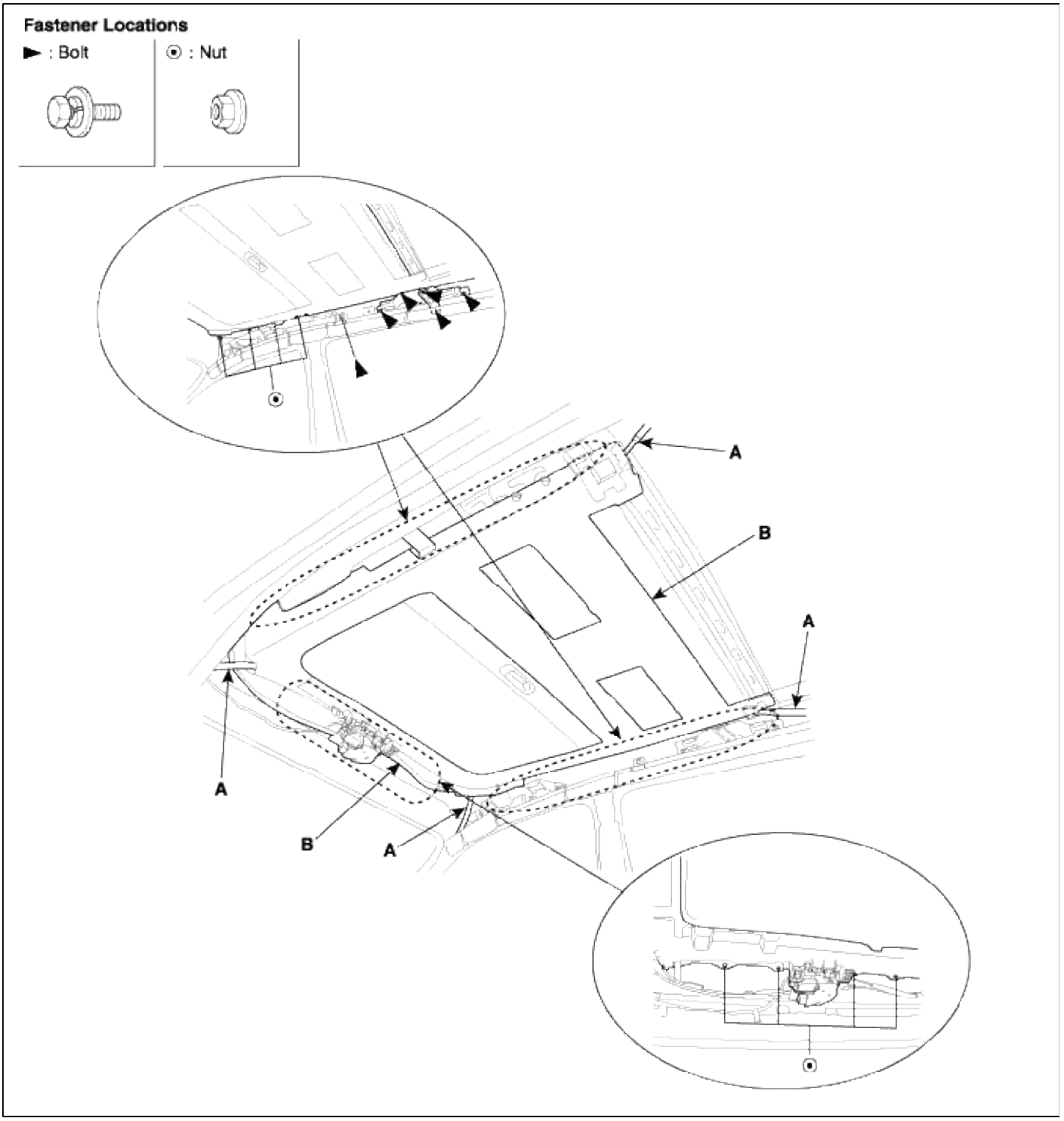
SUNROOF ASSEMBLY REPLACEMENT

1. Remove the follows parts;
   A. Front and rear door scuff trim.
   B. Front, center and rear pillar trim.
   C. Headlining.
   D. Assist handle bracket.
   E. Sunroof glass.
2. Disconnect the drain tubes (A).

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

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

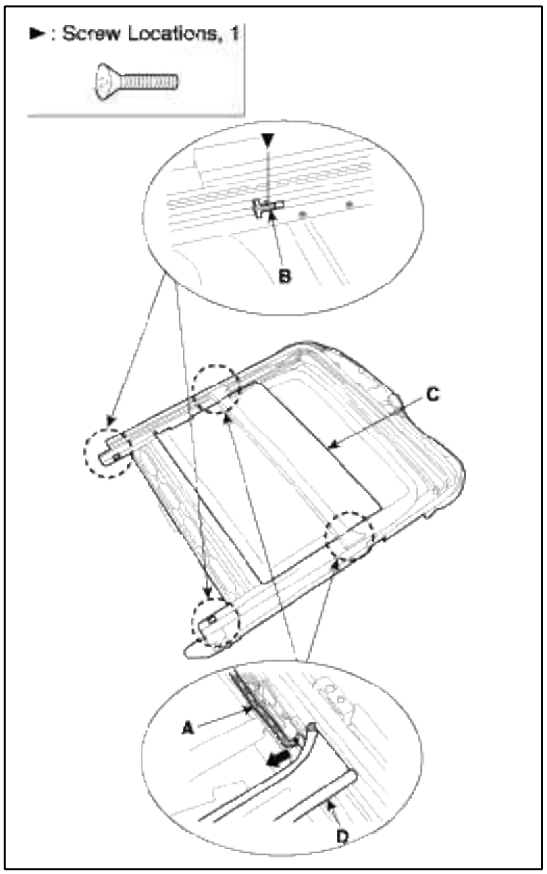
4. Installation is the revers of removal.



SUNSHADE AND DRIP RAIL REPLACEMENT

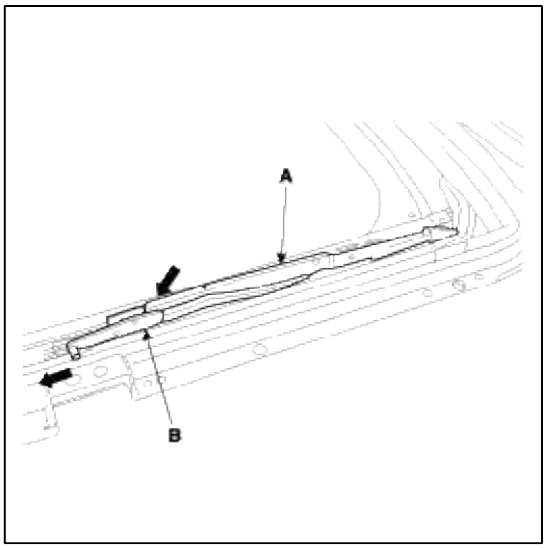
1. Remove the sunroof assembly.
2. Remove the drip link (A) and sunshade stopper (B).
3. Remove the sunshade (C) and drip rail (D).

4. Installation is the reverse of removal.

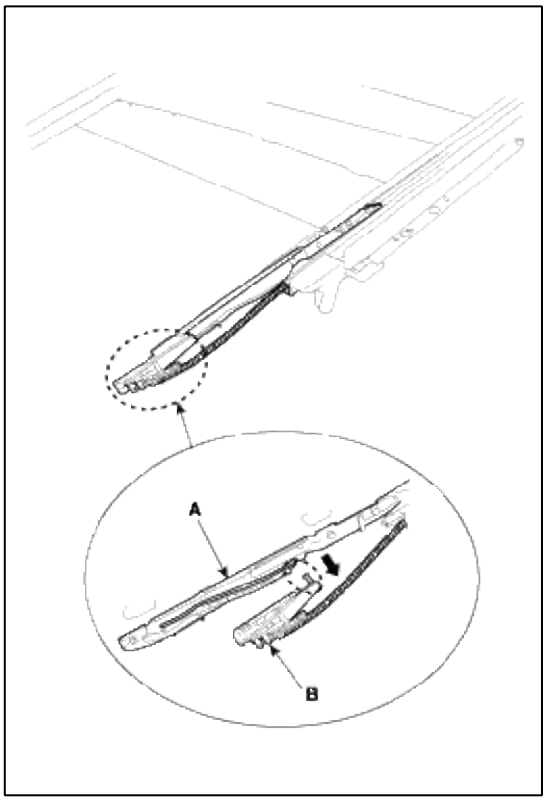


GUIDE ASSEMBLY REPLACEMENT

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



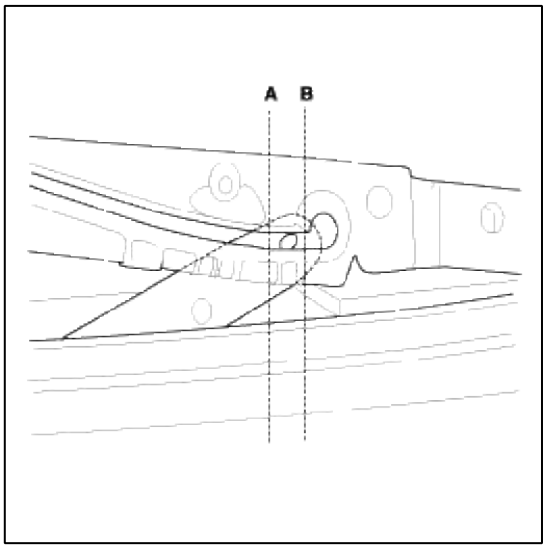
3. Remove the guide (A) and slide (B).



4. Installation is the reverse of removal.

CAUTION

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

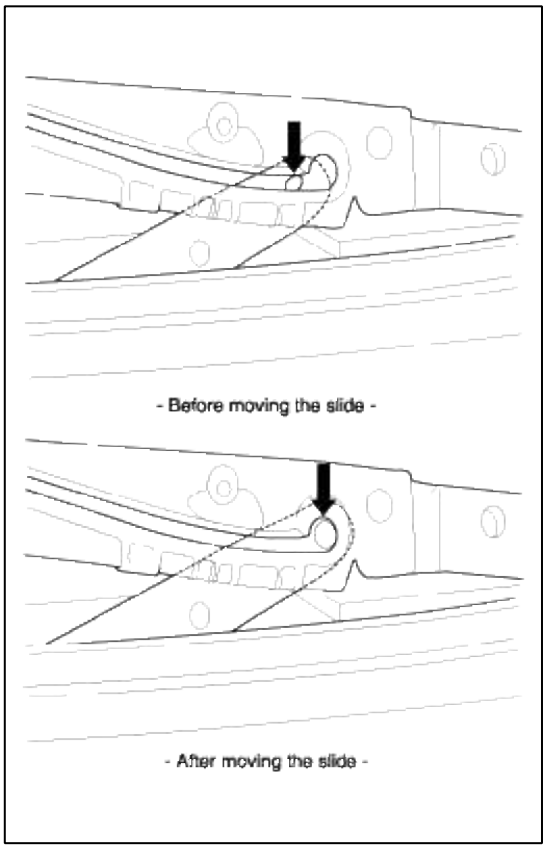


Adjustment

How to initialize motor

1. Completely close the sunroof press and hold the CLOSE button for more 5 seconds.

2. Release the CLOSE button press the TILT UP button until the sunroof has tilted up completely. Release the TILT UP button.



3. Press and hold the TILT UP button. The sunroof should briefly raise above, then return to, the maximum TILT UP position.
4. Release the TILT UP button.

MOTOR INITIALIZATION IS REQUIRED WHEN

1. First operation the vehicle after maunfacture it.
2. Initial value is erased or damaged because of electrical circuit malfuntion, battery disconnect, or battry discharge.
3. After opening the sunroof manually.

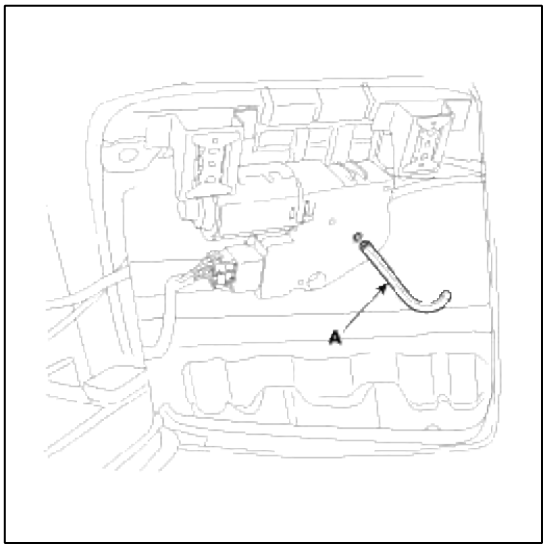
OPERATING THE SUNROOF EMERGENCY HANDLE

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

CAUTION

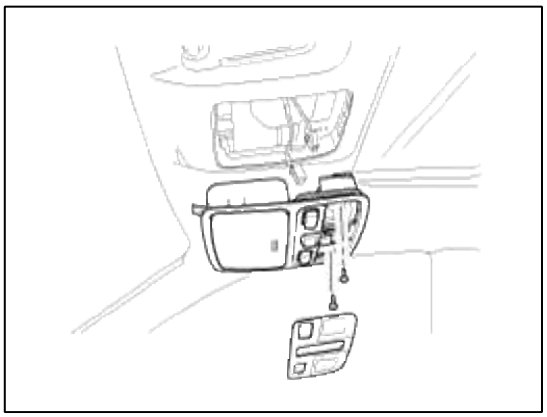
Do not use power tools to operate the sunroof.
Damage to the components may occur.



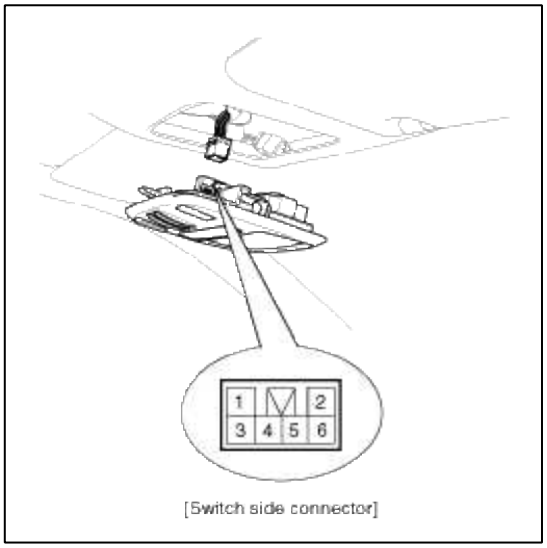
Body (Interior and Exterior) > Sun Roof > sun roof switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the lens from the overhead console then loose the 2 screws holding the overhead console.



3. Disconnect the connector (6P) of sunroof switch and the connector (2P) of map lamp 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.



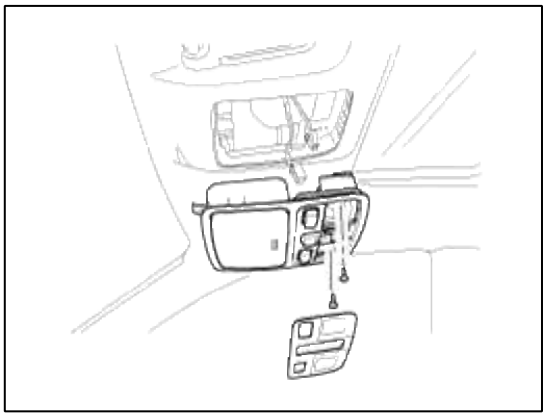
[Switch side connector]

Position \ Terminal	2	4	5	6
Slide open	○			○
Slide close	○	○		
Tilt up	○		○	
Tilt down	○	○		

Body (Interior and Exterior) > Sun Roof > sun roof moter > Repair procedures

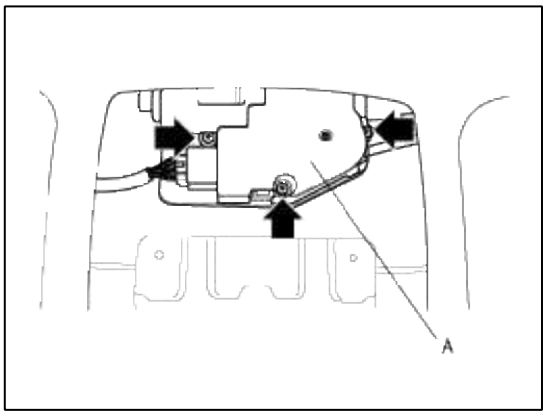
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the lens from the overhead console then loose the 2 screws holding the overhead console.



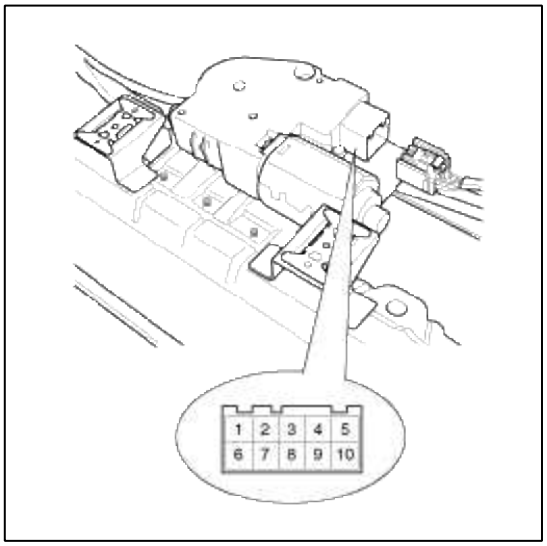
3. Disconnect the connector (6P) of sunroof switch and the connector (2P) of map lamp then remove the overhead console lamp assembly from the headliner.

4. Remove the sunroof motor (A) after removing 3 screws and disconnect.



INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Apply the battery voltage to terminal 3, 6 and ground the terminal 1.



3. Ground the terminals as below table, and check that the sunroof unit operates as below table.

Function \ Terminal	5	10	4
Tilt up		⊖	
Tilt down			⊖
Slide close			⊖
Slide open	⊖		

RESETTING THE SUNROOF

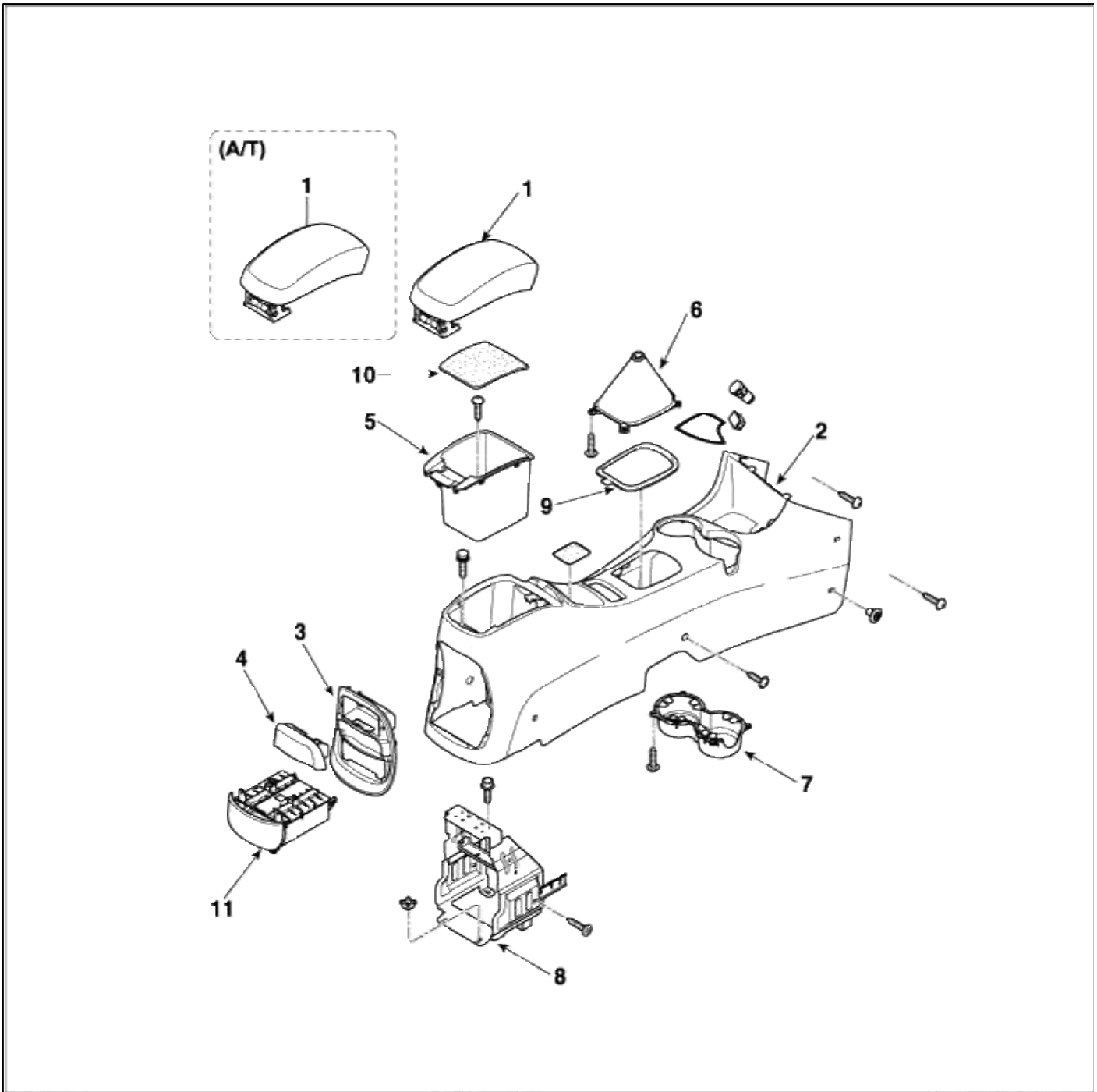
Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows:.

1. Turn the ignition key to the ON position.
2. According to the position of the sunroof, do as follows.
   (1) In case that the sunroof has closed completely or been tilted :
   Press the TILT 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.

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

COMPONENTS



1. Armrest
2. Floor console
3. End cover
4. Ashtray
5. Storage box
6. Boot assy-Gear shift lever
7. Cup holder
8. Rear bracket assy
9. Indi cator
10. Storage box cover
11. Rear cup holder

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

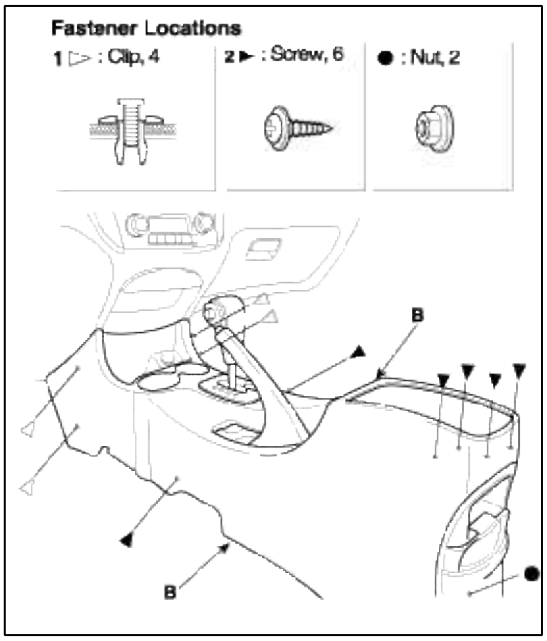
REPLACEMENT

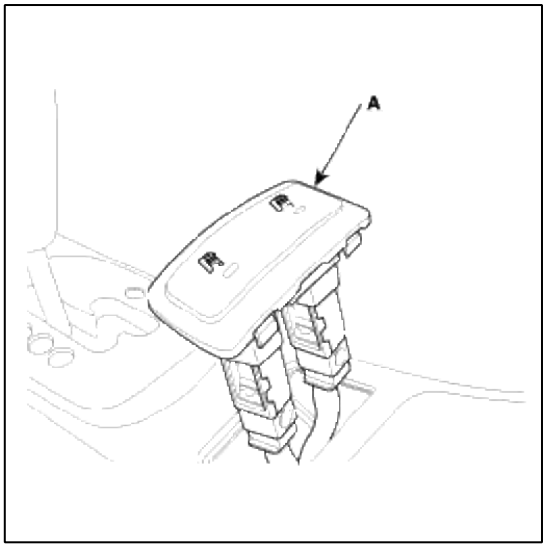
FLOOR CONSOLE REPLACEMENT

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
- Take care not to scratch the body surface.

1. Remove the storage box.
2. Remove the armrest assembly.
3. Remove the rear end cover.
4. After disconnecting the seat heater connector (A), remove the console assembly(B).



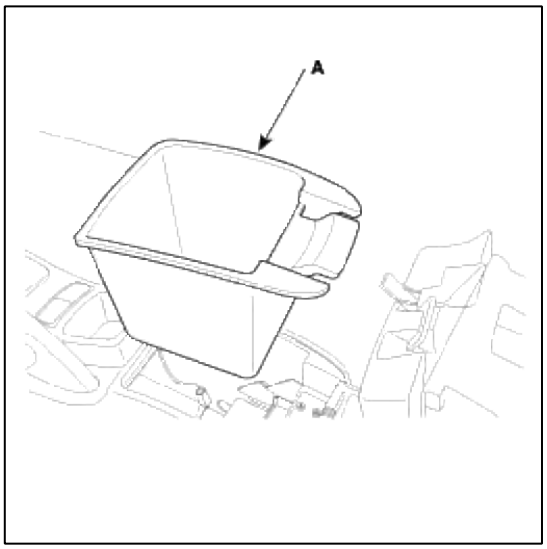


5. Installation is the reverse of removal.

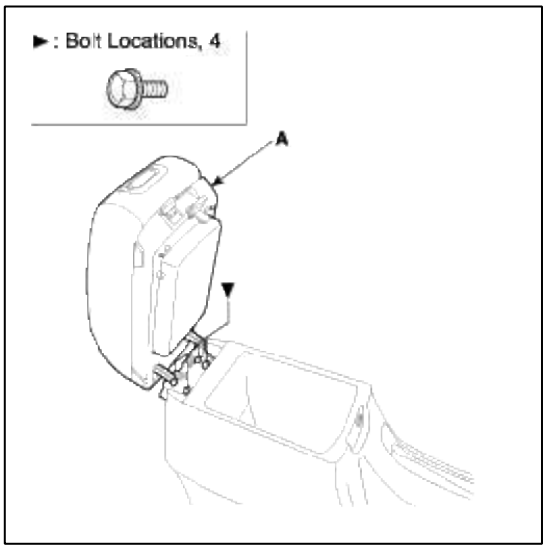
FLOOR CONSOLE ARMREST REPLACEMENT

1. Remove the storage box ped.

2. After loosening the storage box mounting bolt, then remove the storage box(A).

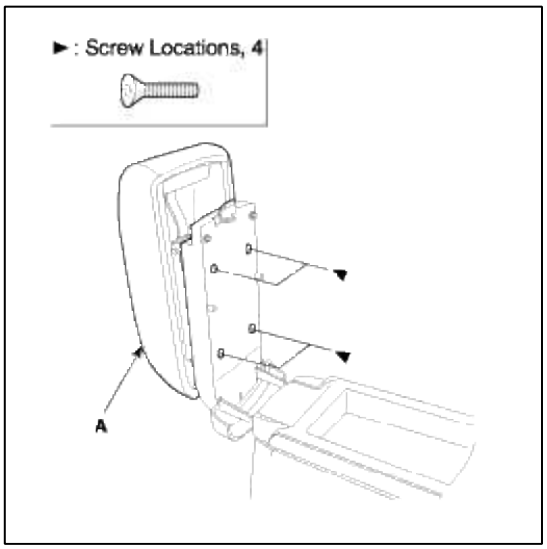


3. After loosening the armrest mounting bolt, then remove the armrest(A).
4. Installation is the reverse of removal.

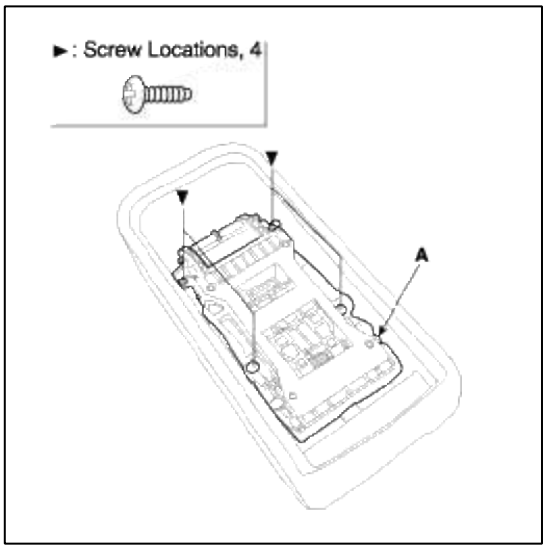


POP-UP UNIT REPLACEMENT

1. Loosen the armrest cover(A) mounting screws.



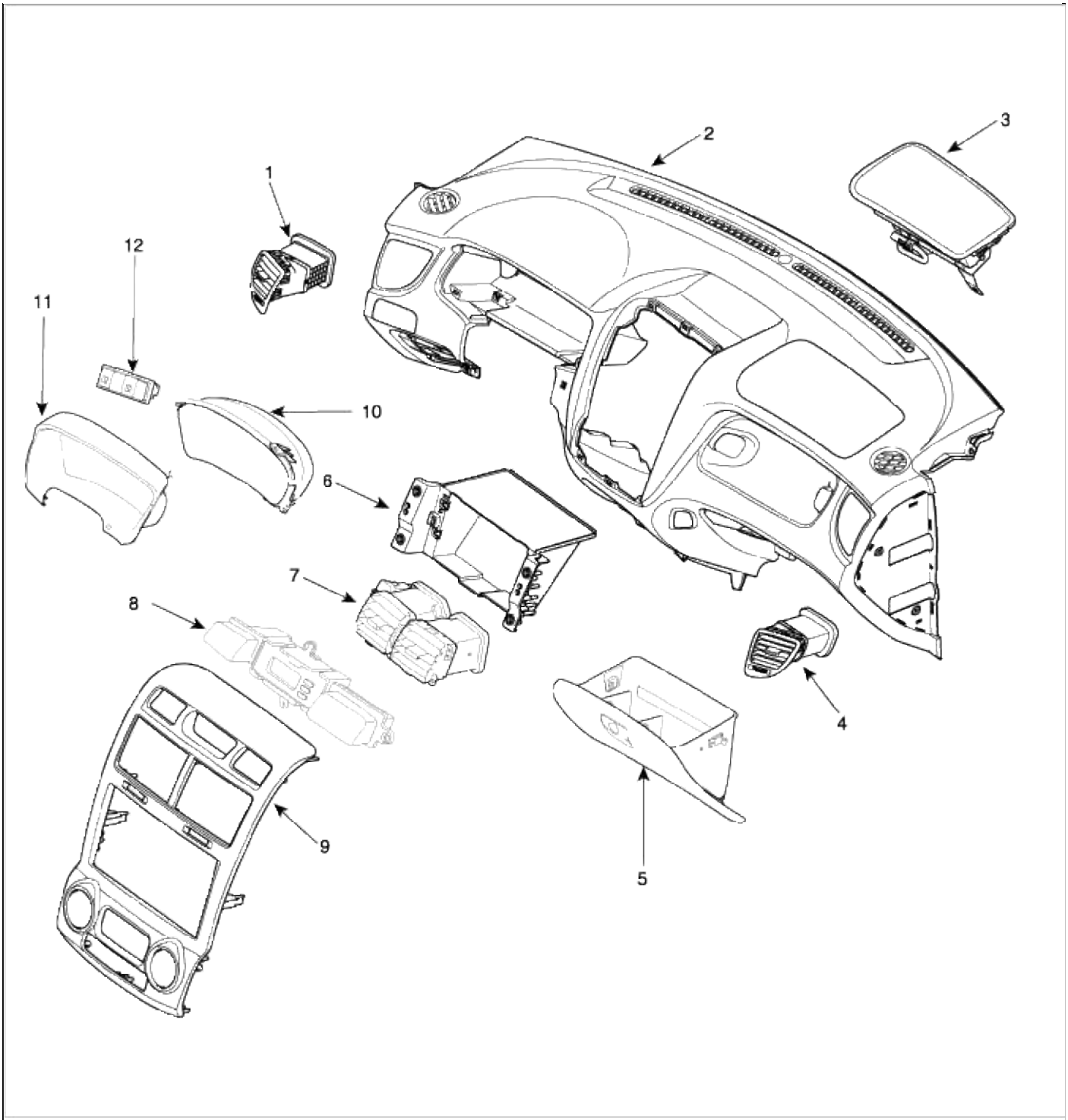
2. Remove the pop-up unit(A).



3. Installation is the reverse of removal.

Body (Interior and Exterior) > Interior > crash pad > Components and Components Location

COMPMNENTS



1. Air vent
2. Main crash pad
3. Air bag
4. Air vent
5. Glove box
6. Audio
7. Air vent
8. Clock assemble
9. Center facia panel
10. Cluster
11. Cluster facia panel
12. Switch assemble

Body (Interior and Exterior) > Interior > crash pad > Repair procedures

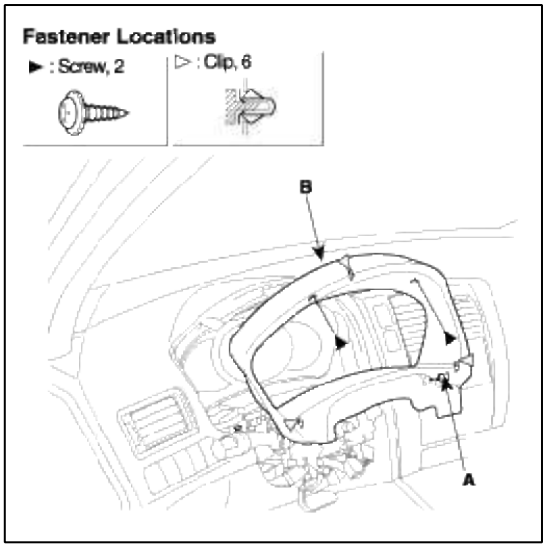
REPLACEMENT

CLUSTER FACIA PANEL REPLACEMENT

NOTE

- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
- Take care not to scratch the body surface.

1. Tilt the steering column down.
2. After disconnecting the trip sensor connector (A), remove the cluster facia panel(B).



3. Installation is the reverse of removal.

NOTE

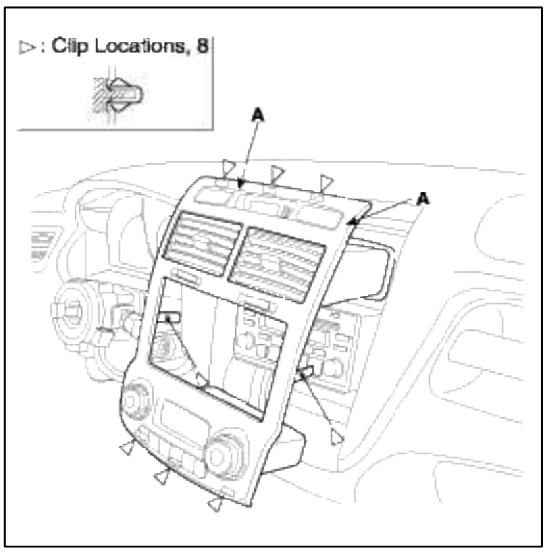
- Make sure the connector is plugged properly.
- Replace any damage clips.

CENTER FACIA PANEL REPLACEMENT

1. Disconnect the following items to remove the center facia panel(A).

CAUTION

- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
  Take care not to scratch the body surface.



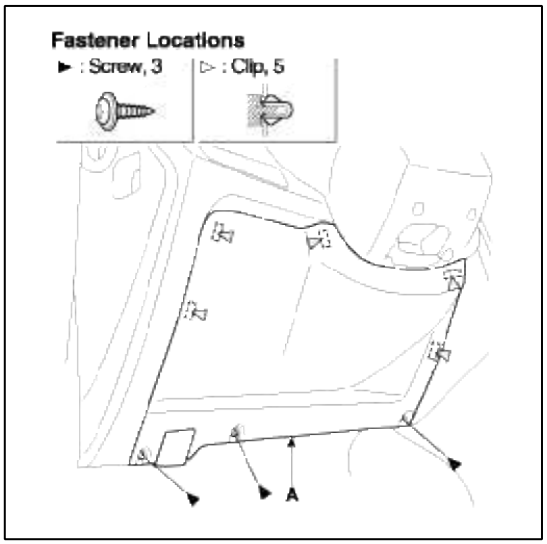
2. Installation is the reverse of removal.

NOTE

- Make sure the connector is plugged properly.

LOWER CRASH PAD PANEL REPLACEMENT

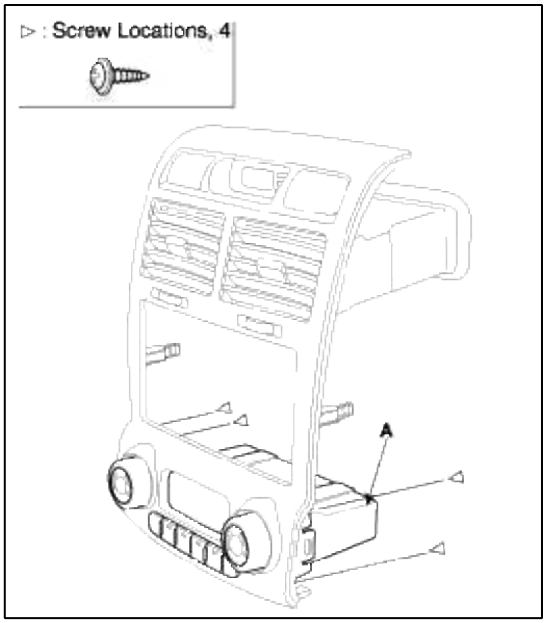
1. Disconnect the hood release cable from the hood release handle.
2. Remove the lower crash pad panel(A).



3. Installation is the reverse of removal.

HEATER CONTROL UNIT REPLACEMENT

1. Remove the center facia panel.
2. Loosen the screws. Remove the heater control unit(A).



3. Installation is the reverse of removal.

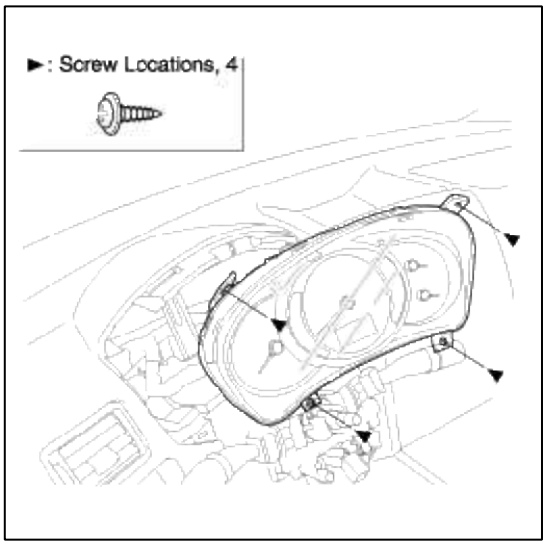
NOTE

- Make sure the connector is plugged properly.

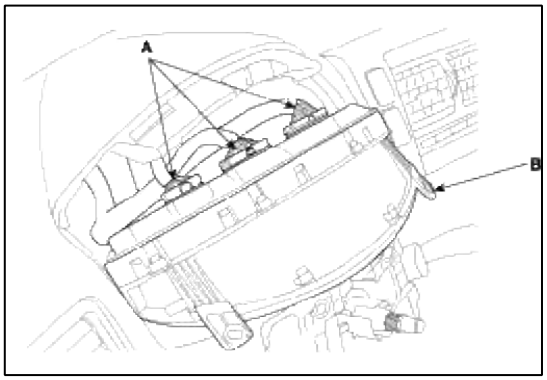
CLUSTER REPLACEMENT

1. Remove the cluster facia panel.

2. Loosen the screws.



3. Disconnect the cluster connector (A), then remove the cluster(B).



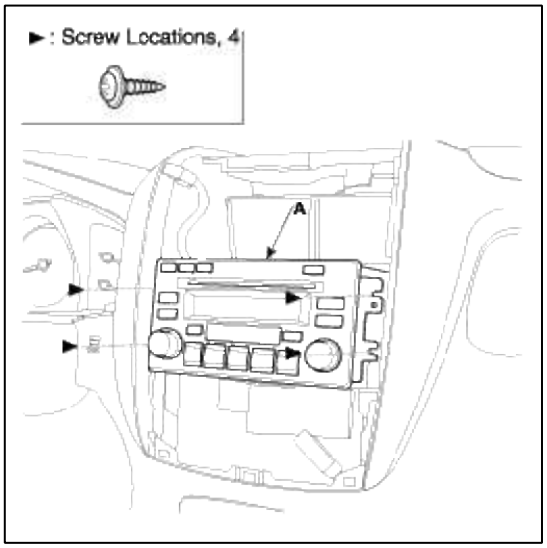
NOTE

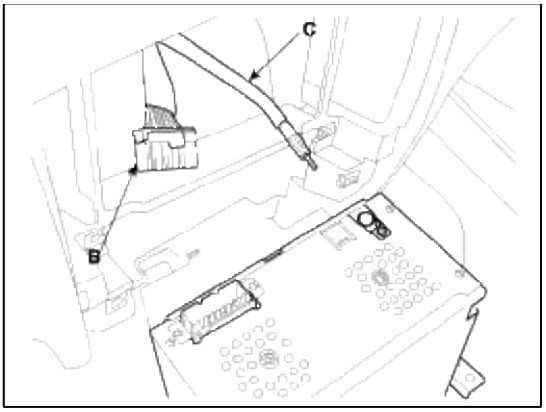
- Make sure the connector is plugged properly.

4. Installation is the reverse of removal.

AUDIO ASSEMBLY REPLACEMENT

1. Remove the center facia panel.
2. Loosen the screws.
3. Disconnect the audio connector(B) and antenna cable(C), then remove the audio assembly (A).





4. Installation is the reverse of removal.

NOTE

- Make sure the connector is plugged properly.

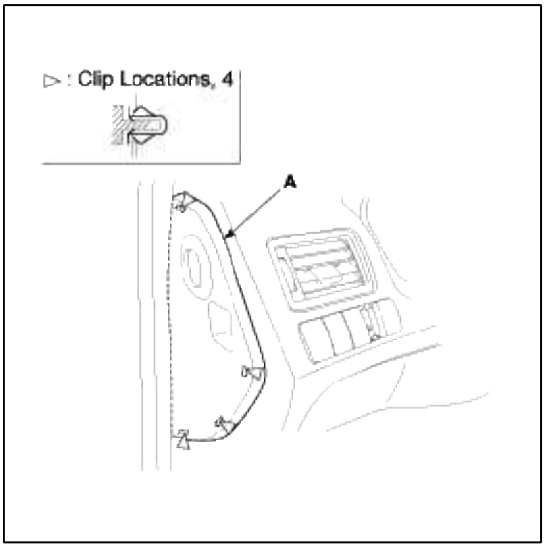
COVER REPLACEMENT

CAUTION

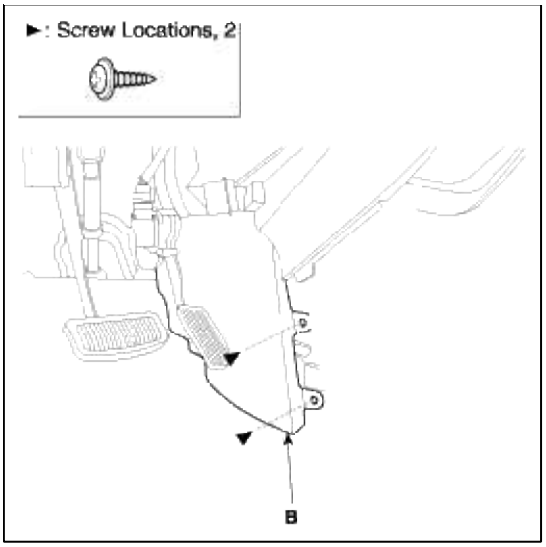
- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the crash pad side cover(A), crash pad center under cover(B).

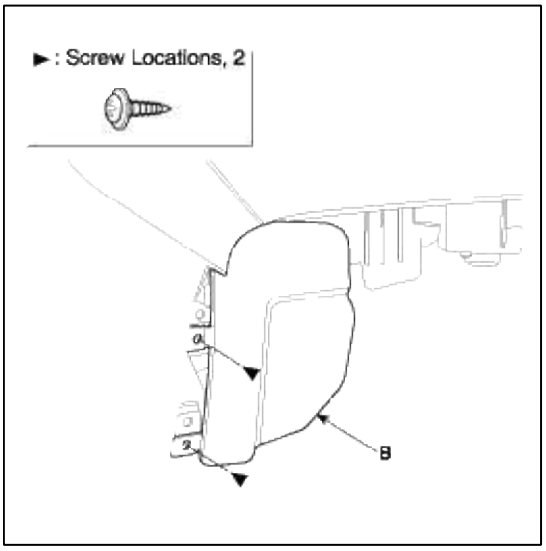
CRASH PAD SIDE COVER



Drive's center lower side cover



Passenger's center lower side cover

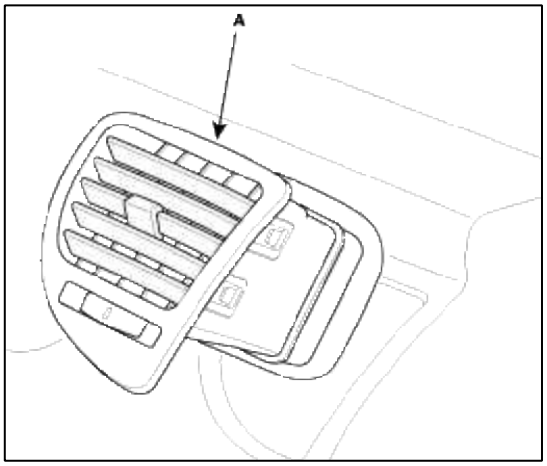


AIR VENT REPLACEMENT

CAUTION

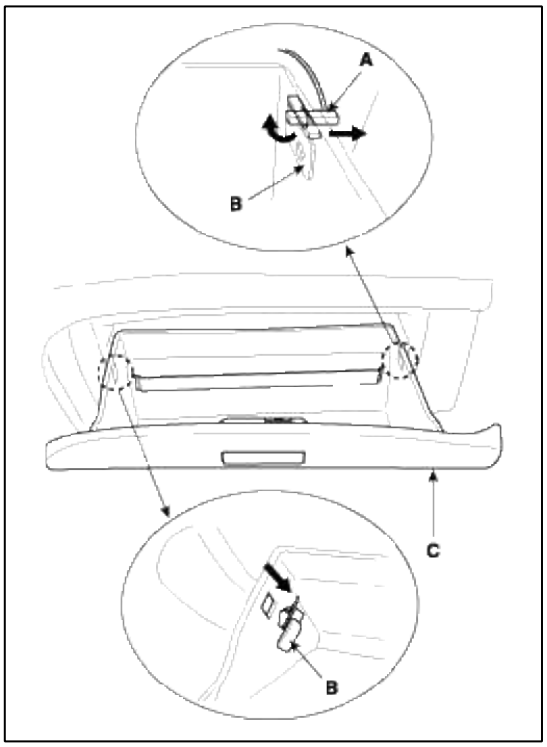
- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the air vent (A) by detaching the clips.

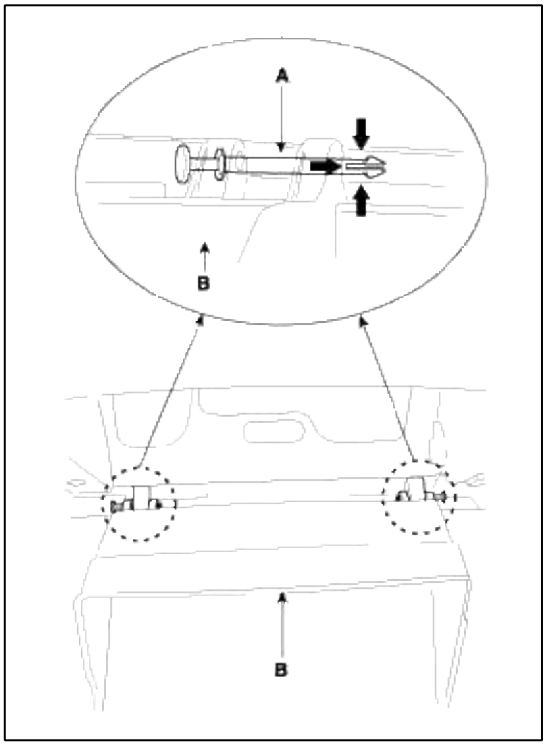


GLOVE BOX REPLACEMENT

1. Disconnect the air damper(A) and guide(B) from the glove box(C).



2. Disconnect the pin(A), then remove the glove box(B).



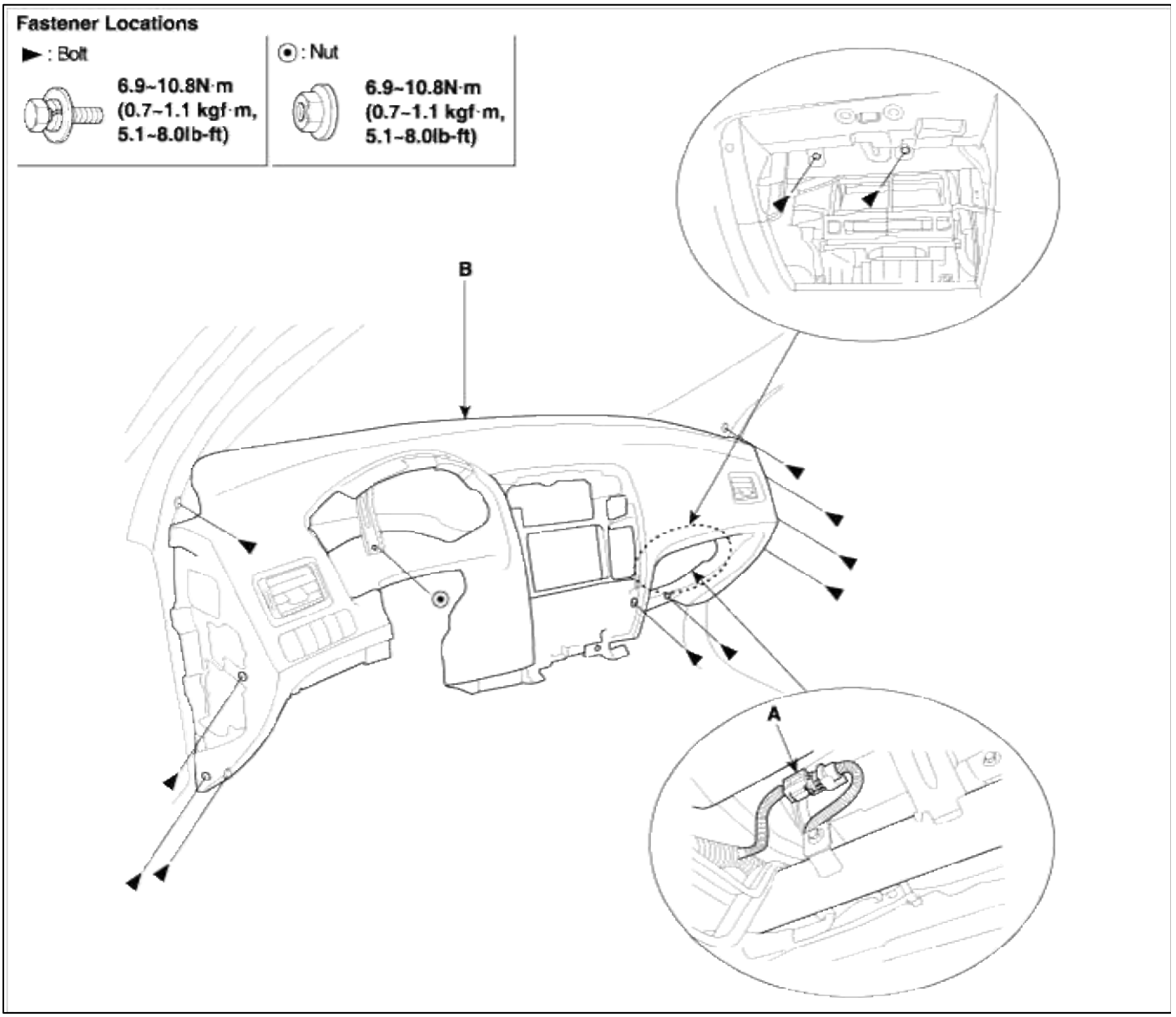
3. Installation is the reverse of removal.

MAIN CRASH PAD REPLACEMENT

NOTE

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

1. Remove the following items;
   A. Front seat.
   B. Cluster facia panel, cluster.
   C. Audio assembly.
   D. Glove box.
   E. Side cover, crash pad center under cover.
   F. Front pillar trim.
   G. Steering wheel.
2. Disconnect the passenger's air bag connector(A).
3. Loosen the bolts and nut, then remove the crash pad(B).
4. Installation is the reverse of removal.



Body (Interior and Exterior) > Interior > interior trim > Repair procedures

REPLACEMENT

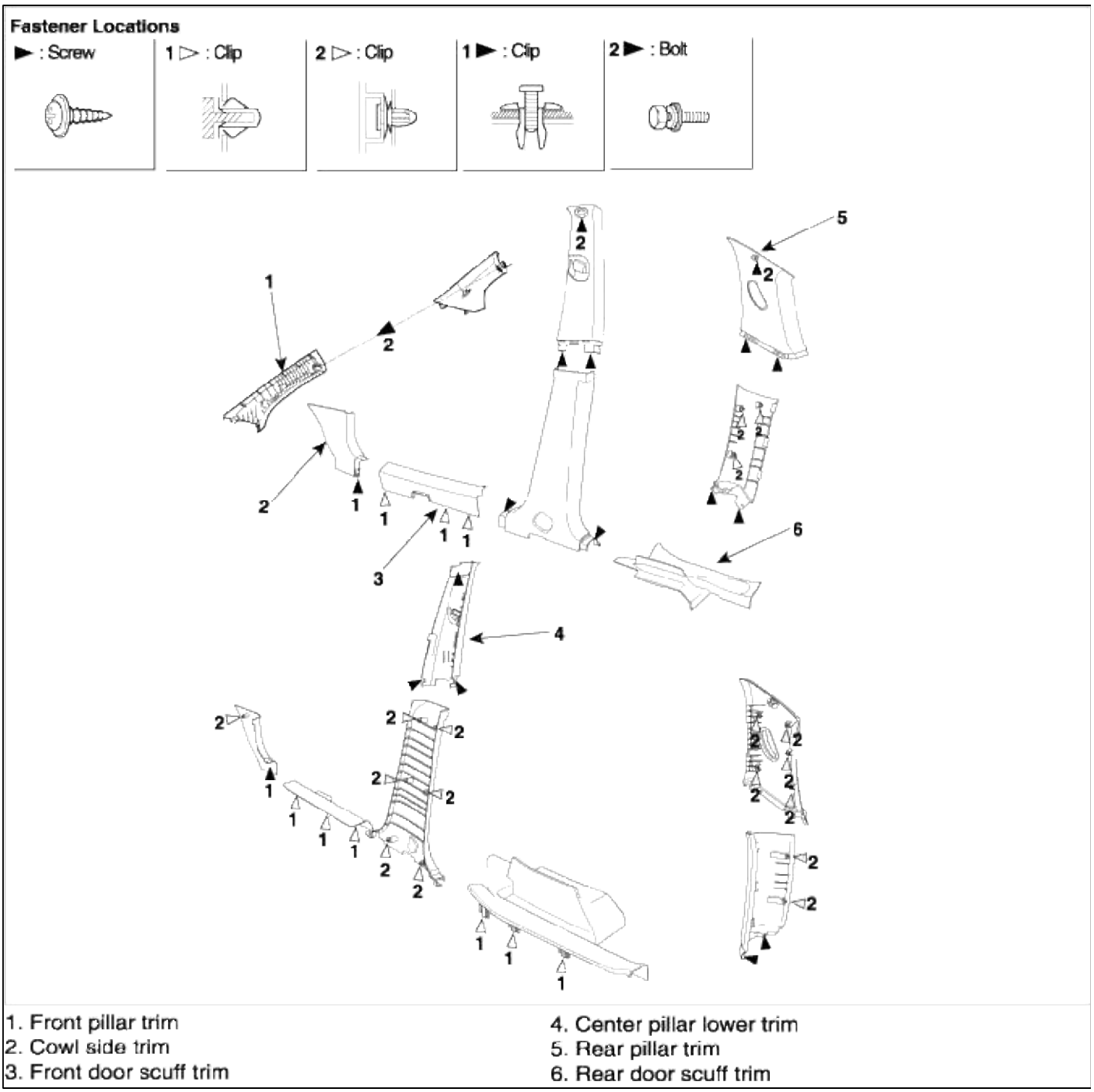
FLOOR AND SIDE AREA

1. Remove the trims.

NOTE

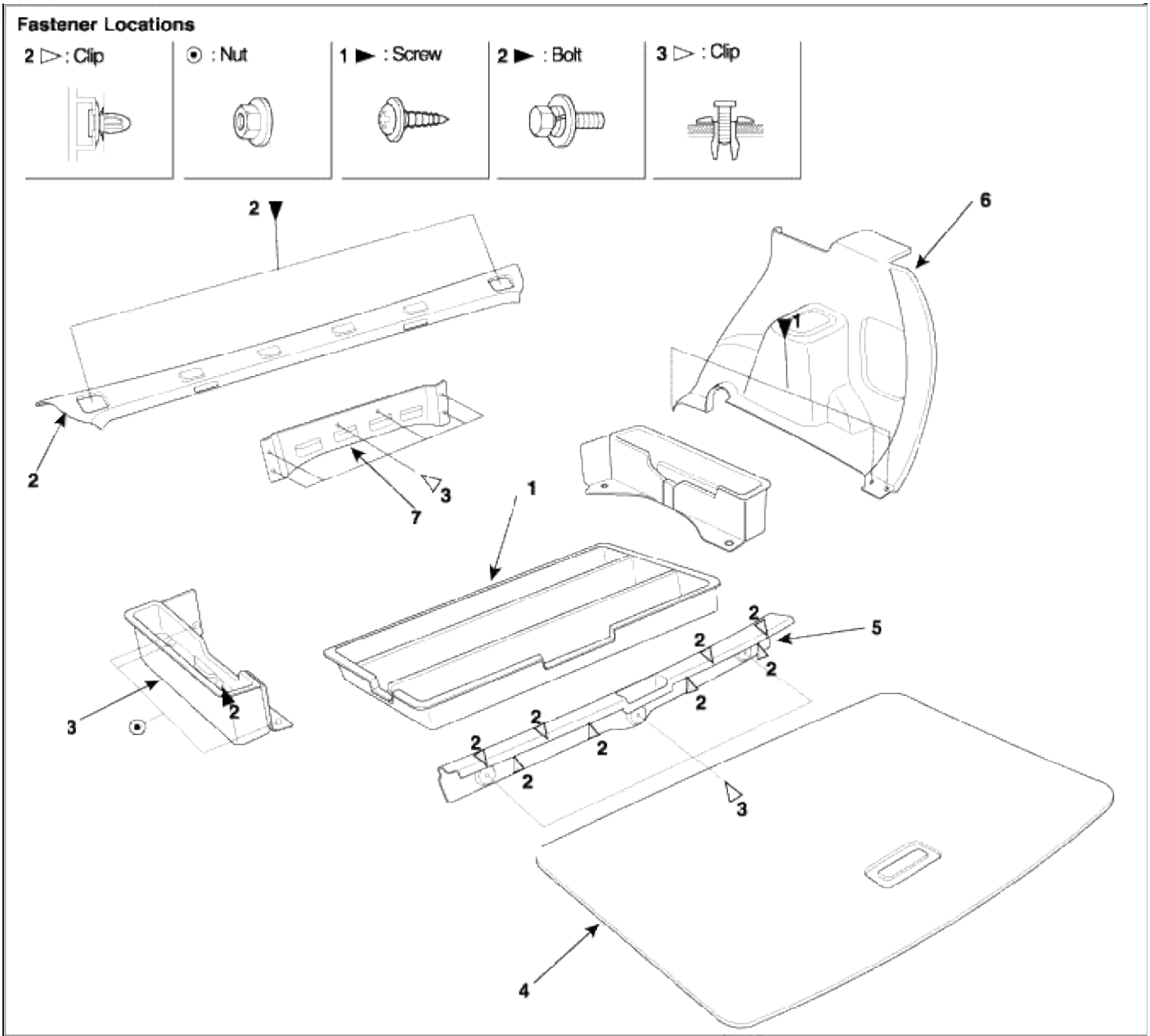
- When prying with a flat-tip screwdriver, wrap it with protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to bend or scratch the trim and panels.

2. Installation is the reverse of removal.

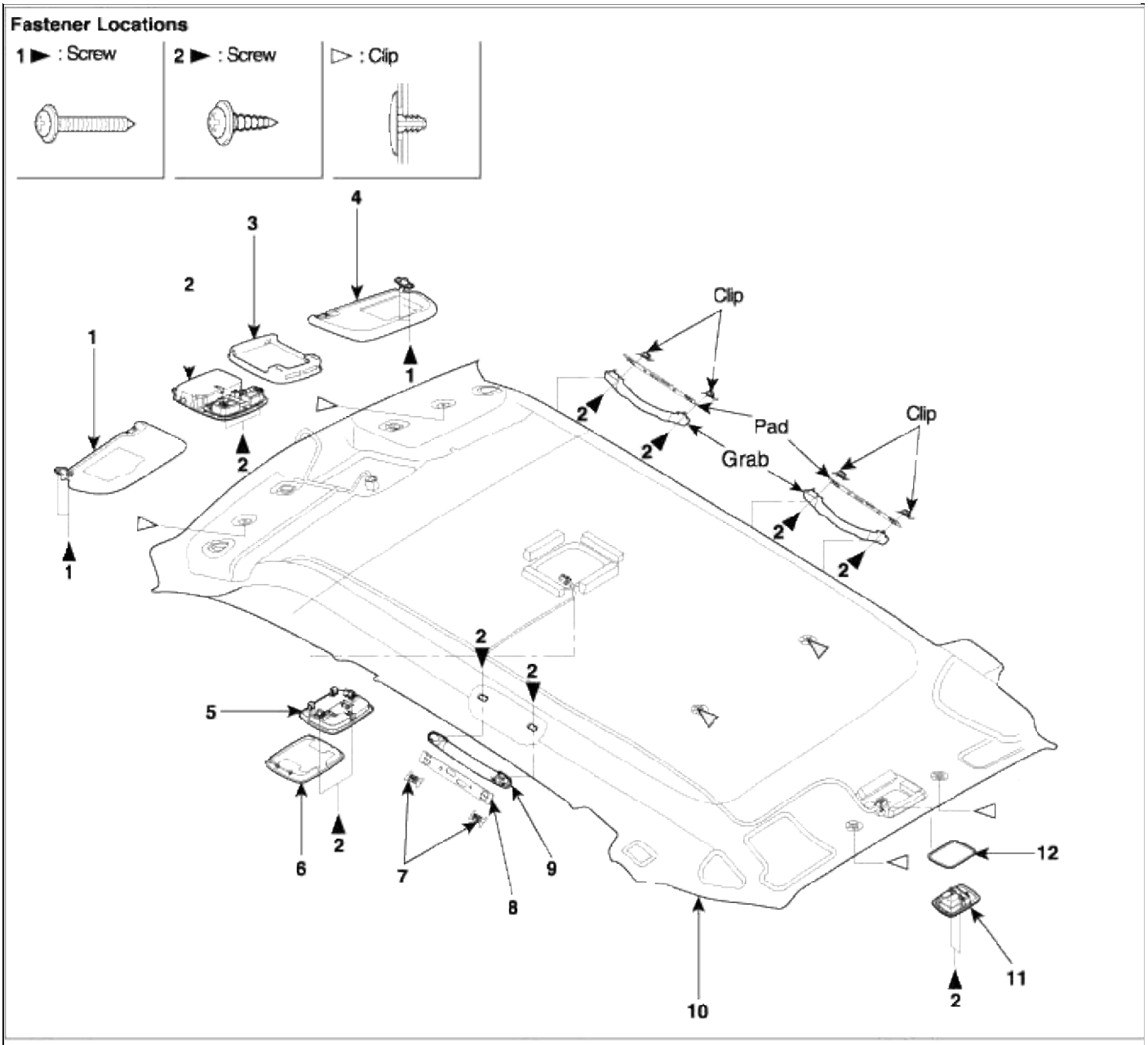


1. Front pillar trim
2. Cowl side trim
3. Front door scuff trim
4. Center pillar lower trim
5. Rear pillar trim
6. Rear door scuff trim

TRUNK AREA


Fastener Locations
2 ▷ : Clip
⊙ : Nut
1 ▶ : Screw
2 ▶ : Bolt
3 ▷ : Clip
1. Luggage center tray
2. Road floor front trim
3. Luggage side tray
4. Floor mat
5. Transverse trim
6. Luggage side trim
7. Luggage partion panel

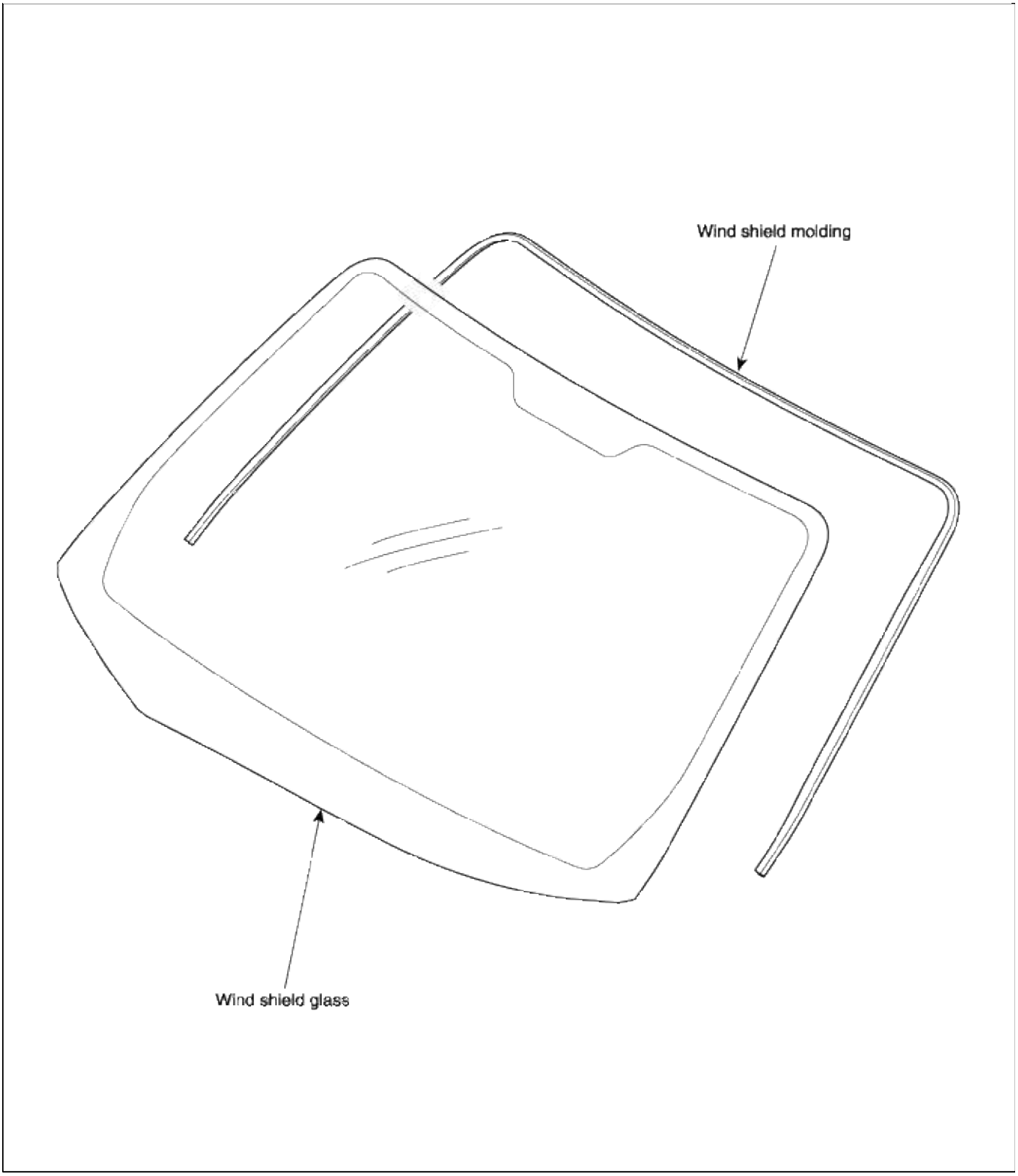
ROOF AREA



1. Sunvisor	5. Room lamp	9. Grab
2. Over head console	6. Lens	10. Head lining
3. Bracket	7. Clip	11. Cargo lamp
4. Sunvisor	8. Pad	12. Bracket

Body (Interior and Exterior) > Interior > windshield glass > Components and Components Location

COMPONENTS



Body (Interior and Exterior) > Interior > windshield glass > Repair procedures

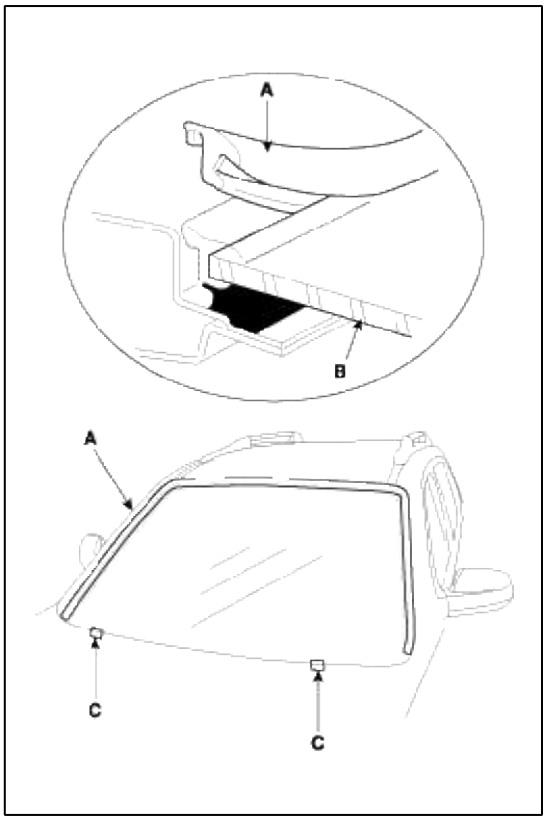
REPLACEMENT

REMOVAL

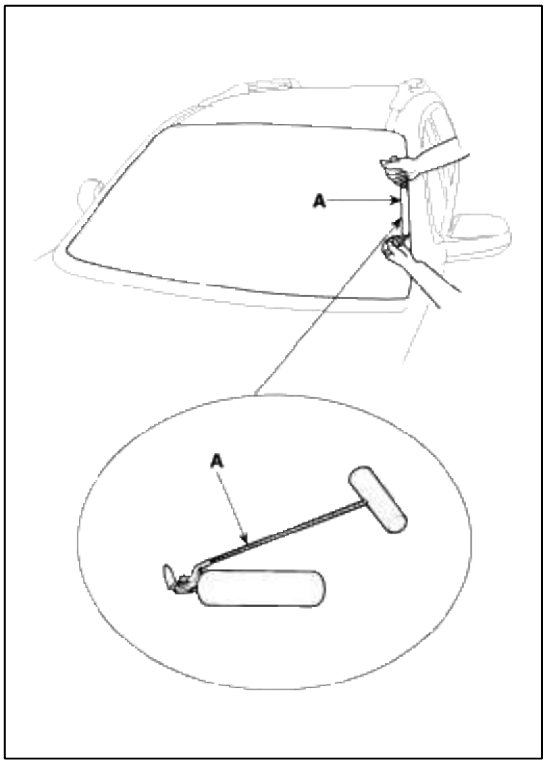
NOTE

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

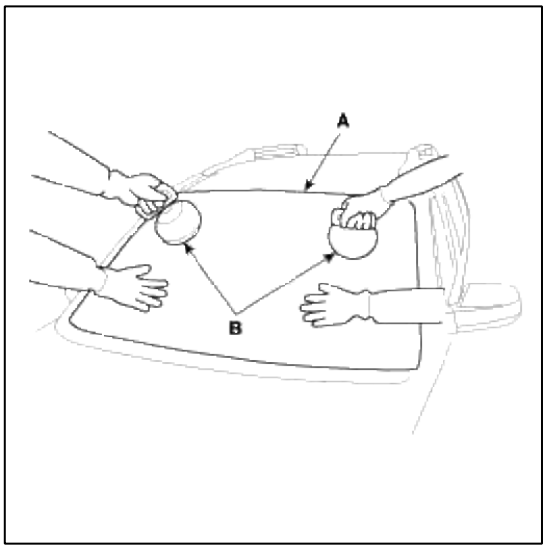
1. Remove the following items:
   A. Outside rear view mirror.
   B. Sunvisors and holders, both sides, overhead console, Grab handles, both sides.
   C. Front pillar trim, both sides.
   D. Windshield wiper arms and cowl cover.
2. Remove the molding (A) from the edge of the windshield (B). If necessary, cut the molding with a utility knife.
3. Remove the spacer (C).



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)].

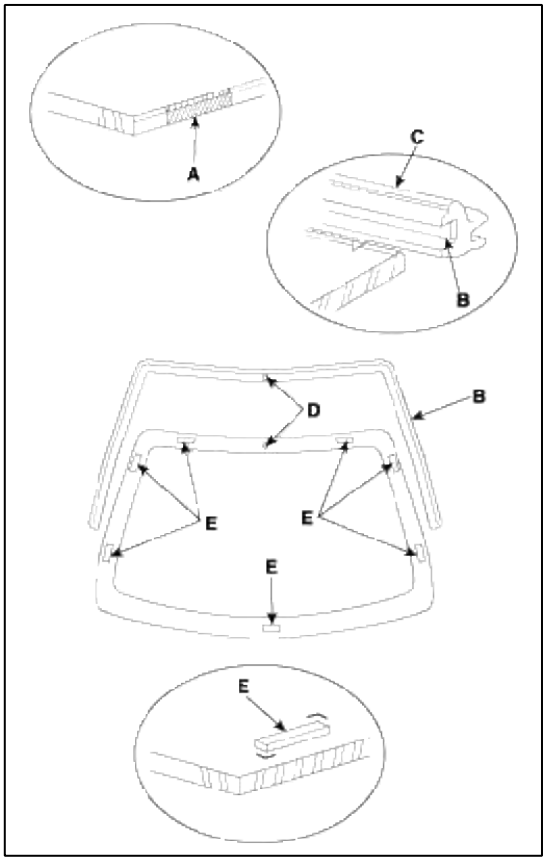


6. Remove the winshield (A) carefully using the glass holder [B(09861-31100)].



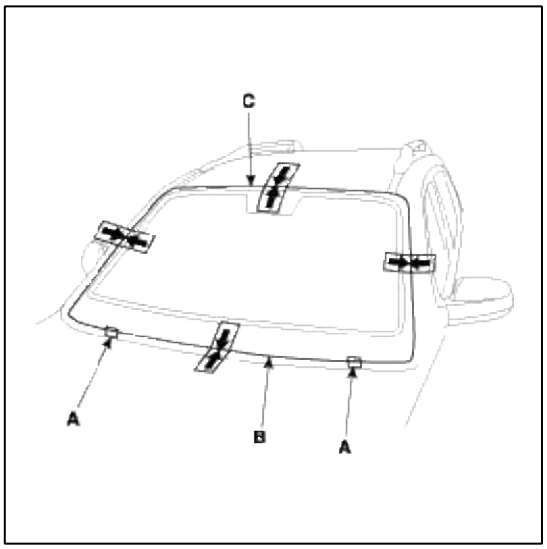
INSTALLTION

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:
   A. Do not scrape down to the painted surface of the body; damaged paint will interfere with proper bonding.
   B. Remove the rubber dam and fasteners from the body.
   C. 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 both-sided 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.



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).

6. Remove the windshield.

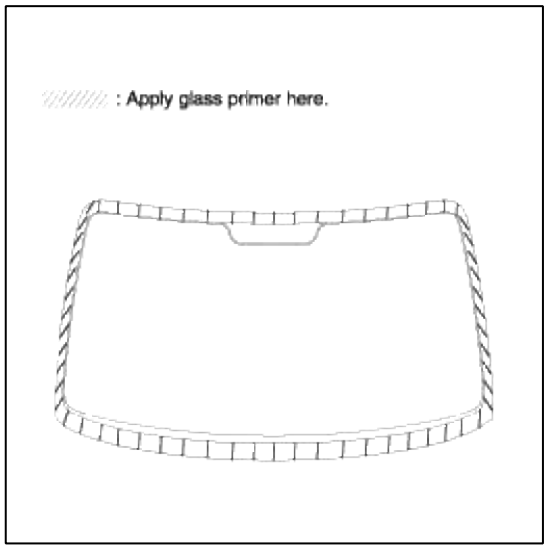


7. Apply a light coat of glass primer to the outside of the fasteners.

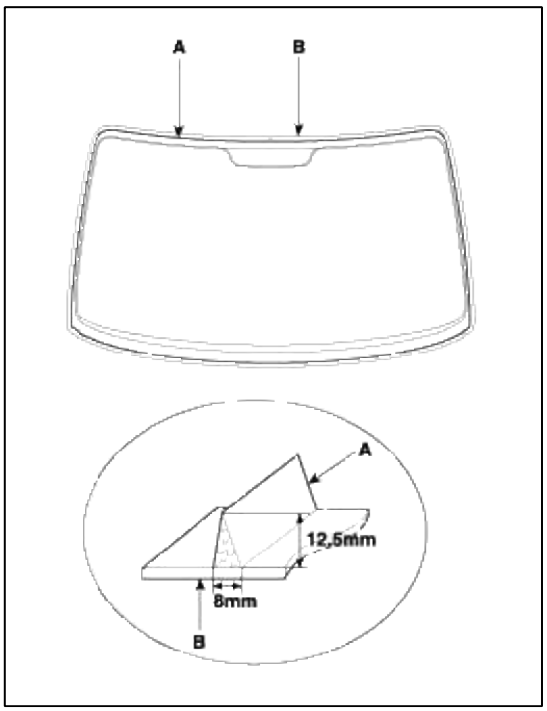
NOTE

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

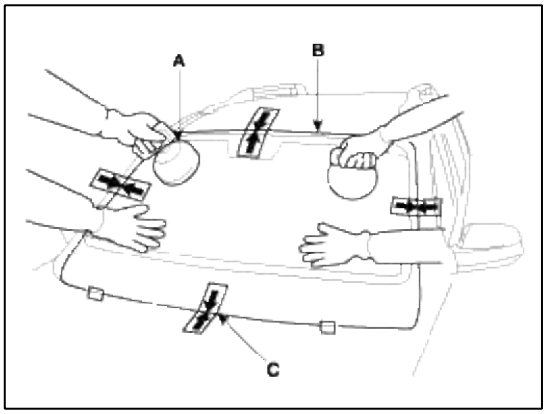
8. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes:
   A. Do not apply glass primer to the body, and be careful not to mixup glass and body primer sponges.
   B. Never touch the primed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



9. 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.



10. 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.



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

Body (Interior and Exterior) > Interior > quarter glass > Repair procedures

REPLACEMENT

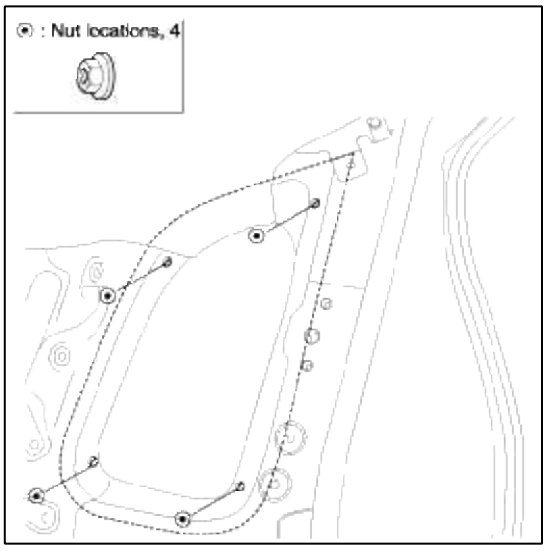
REMOVAL

NOTE

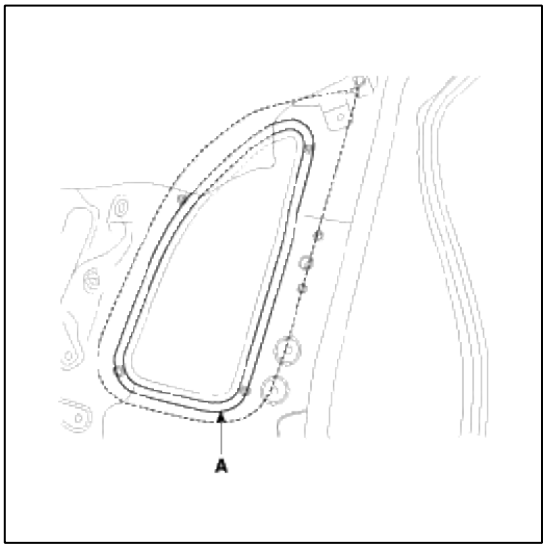
- Put on gloves to protect your hands.
- Take care not to damage body surface and other parts.

1. Remove the following parts:
    A. Rear seat assembly.
    B. Rear door scuff trim.
    C. Self covering trim.
    D. Luggage side trim.
    E. Rear seat belt upper anchor bolt.
    F. Rear pillar trim.

2. Loosen the quarter fixed glass (A) mounting nut.



3. Cut out the sealant using the sealant cutting tool [A(09801-311000)].

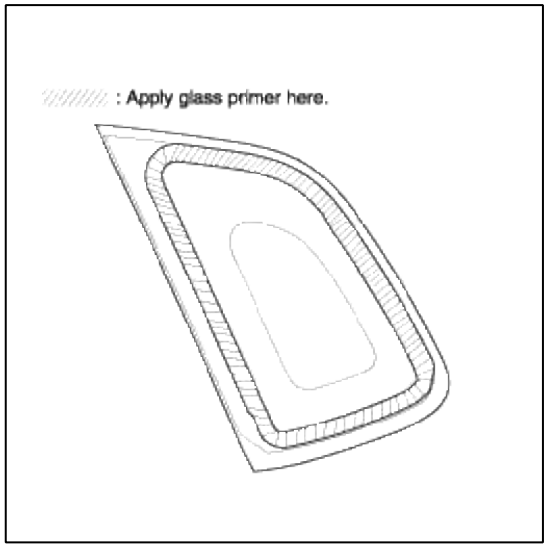


4. Remove the quarter fixed glass.

INSTALLATION

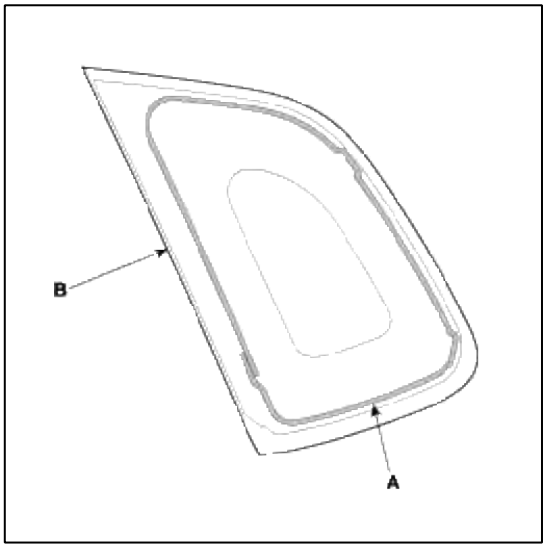
1. With a putt knife, scrape the old adhesive smooth to a thickness of about 2mm (0.08 in.) on the bonding surface around the entire quarter fixed glass flange.
   A. Do not scrape down to the painted surface of the body; damaged paint will interfere with proper bonding.
   B. Mask off surrounding surfaces before painting.
   C. Remove the fasteners from the body.
2. Clean the body bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the surface.

3. With a sponge, apply a light coat of glass primer along the edge of the quarter fixed glass as shown, then lightly wipe it off with gauze or cheesecloth:
   A. Do not apply body primer to the quarter fixed glass, and do not get body and glass primer sponges mixed up.
   B. Never touch the primed surfaces with your hands. If you do, the adhesive may not bond to the quarter fixed glass properly, causing a leak after the quarter fixed glass in installed.
   C. Keep water, dust, and abrasive materials away from the primed surface.

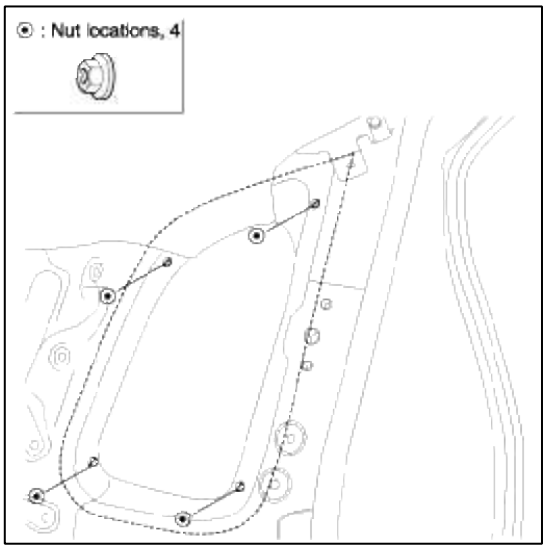


4. With a sponge, apply a light coat of body primer to the original adhesive remaining around the flange. Let the body primer dry for at least 10 minutes.
   A. Do not apply glass primer to the body, and be careful not to mix up glass and body primer sponges.
   B. Never touch the primed surfaces with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

5. 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 quarter fixed glass (B) as shown. Apply the adhesive within 30 minutes after applying the glass primer. Make a slightly thicker bead at each corner.



6. Install the quarter fixed glass.



7. Let the adhesive dry for at least one hour, then spray water over the rear window and check for leaks. Mark the leaking areas, let the rear window dry, then seal with sealant. Let the vehicle stand for at least four hours after rear window installation. If the vehicle has to be used within the first four hours, it must be driven slowly.
8. Reinstall all remaining removed parts.

Body (Interior and Exterior) > Bumper > front bumper > Repair procedures

FRONT BUMPER

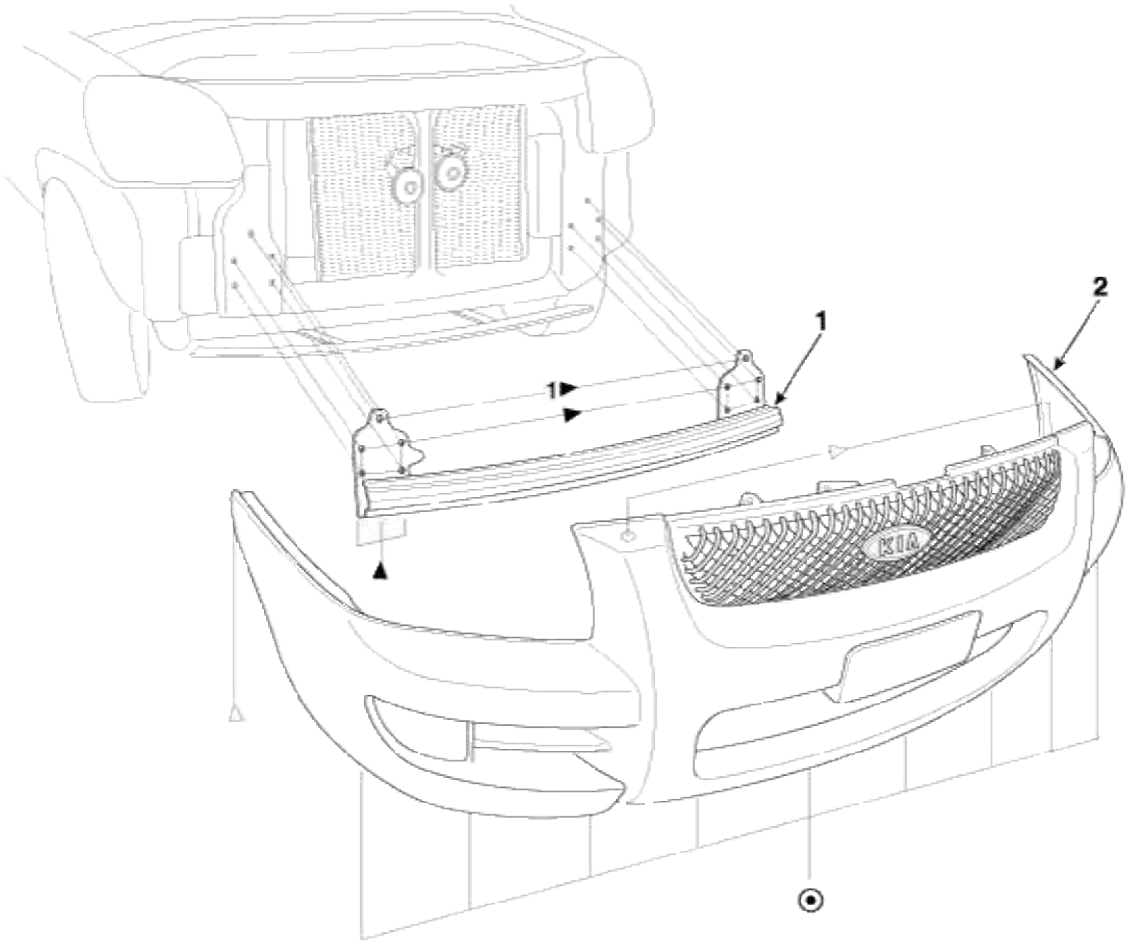
REPLACEMENT

NOTE

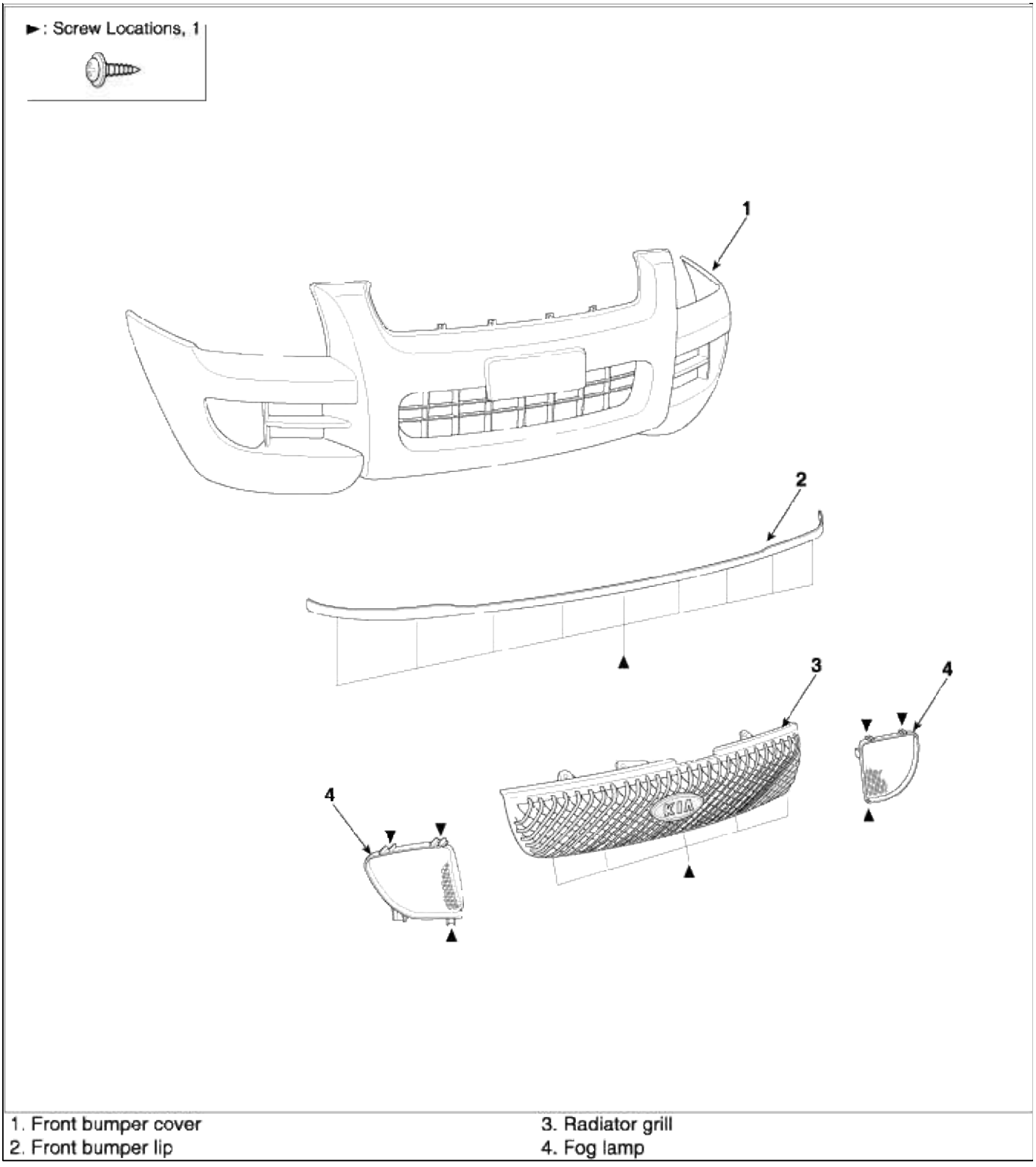
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts to prevent damage.
- Remove the under cover.
- Put on gloves to protect your hands.
- Take care not to bend or scratch the cover and other parts.
- Replace any damage clips.

Fastener Locations

► : Bolt, 14	▷ : Screw, 4	⊙ : Clip, 8	1► : Nut, 2
6.9~10.8N·m (0.7~1.1Kgf·m, 5~8lb-ft)			**6.9~10.8N·m (0.7~1.1Kgf·m, 5~8lb-ft)**



1. Front bumper cover
2. Front bumper rail



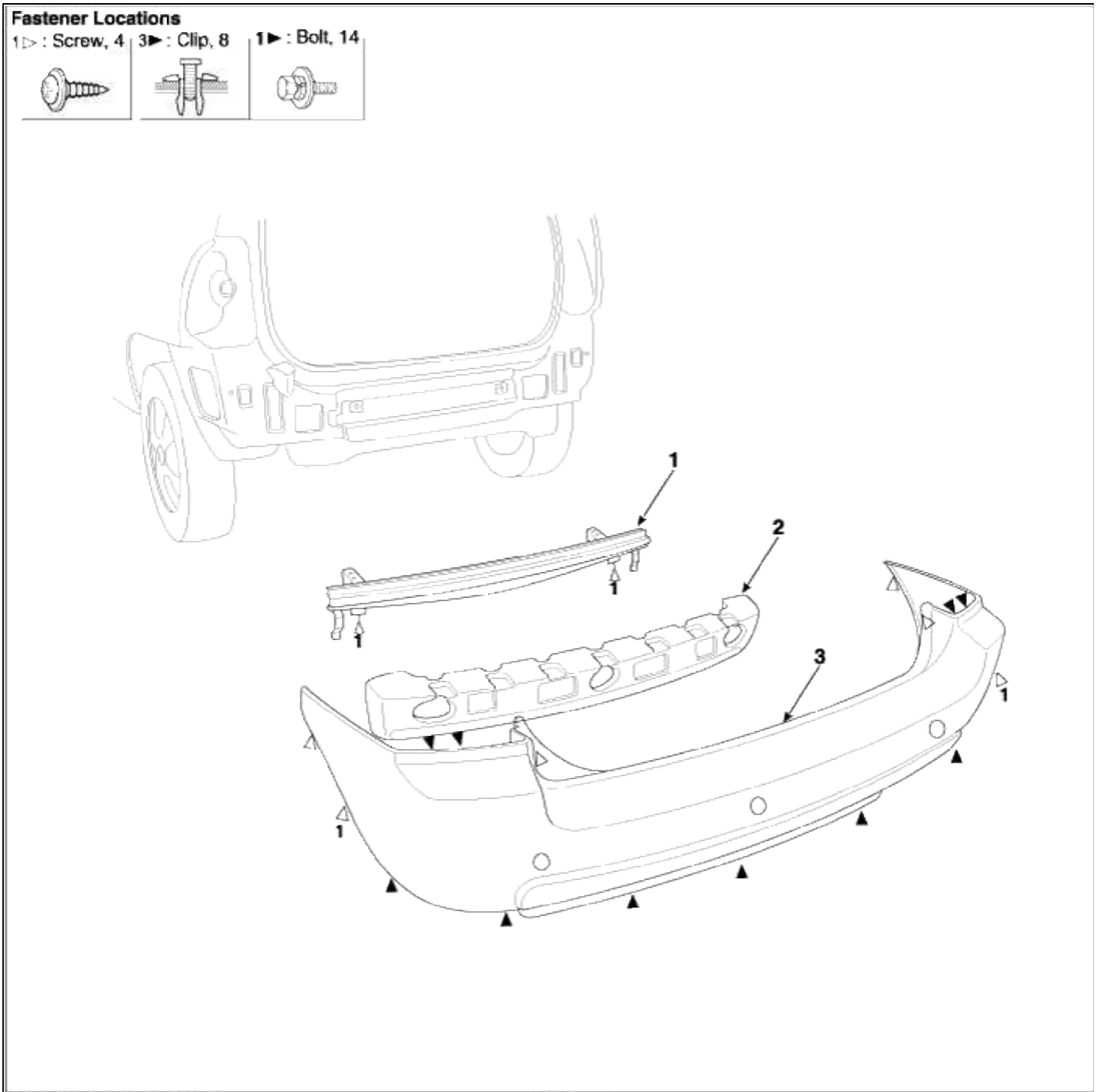
1. Front bumper cover
2. Front bumper lip
3. Radiator grill
4. Fog lamp

Body (Interior and Exterior) > Bumper > rear bumper > Repair procedures

REPLACEMENT

NOTE

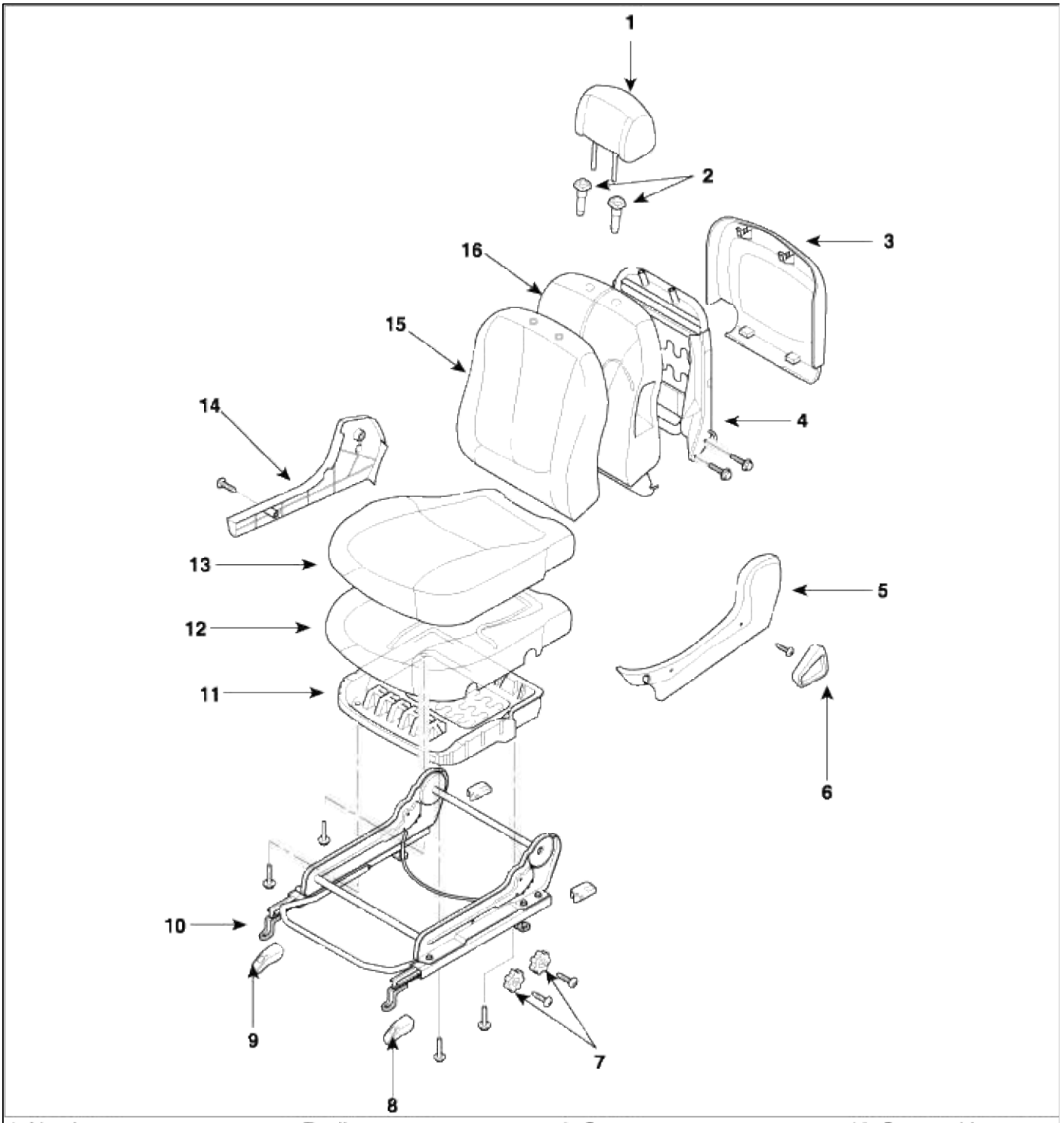
- Remove the rear combination lamps first.
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts to prevent damage.
- Put on gloves to protect your hands.
- Take care not to bend or scratch the cover and other parts.
- Replace any damage clips.



1. Rear bumper beam
2. Energy absorber
3. Rear bumper cover

Body (Interior and Exterior) > Seat & Power Seat > front seat > Components and Components Location

COMPONENTS



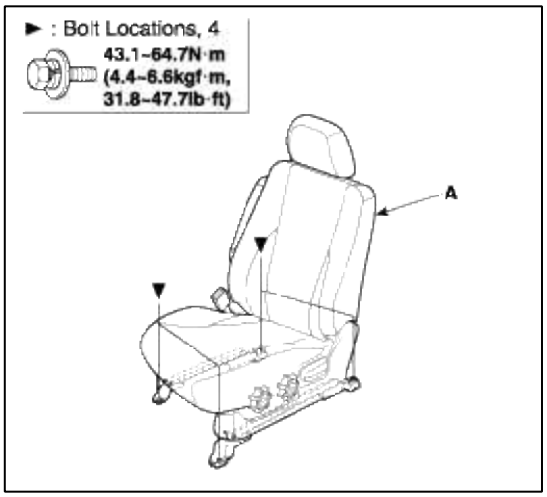
1. Head rest	5. Recliner cover	9. Cover	13. Seat cushion cover
2. Head rest Guide	6. Recliner lever	10. Seat track assemble	14. Recliner cover
3. Back panel	7. Heigh adjuster knob	11. Seat cushion frame	15. Seat back cover
4. Back frame	8. Cover	12. Seat cushion pad	16. Seat back pad

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

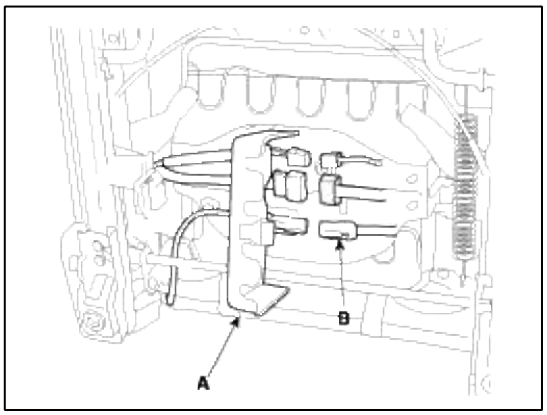
REPLACEMENT

SEAT ASSEMBLY REPLACEMENT

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



2. Open the connector box(A).
   Disconnect the connector (B), and remove the seat assembly.



3. Installation is the reverse of removal.

CAUTION

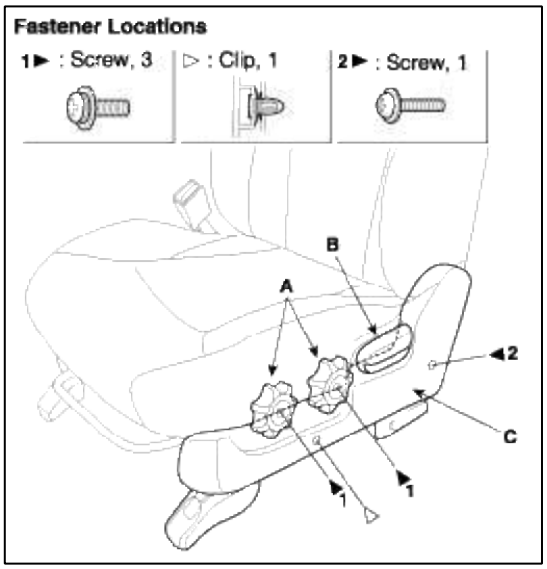
SEAT MOUNTING BOLT INSTALLATION PROCEDURE

- Set the seat into the full rearward position
  Check that each slide is locked, and then tighten the front mounting bolt temporarily.
- Set the seat into the full forward position
  Check that each slide is locked, and then tighten the rear mounting bolt completely.
- Set the seat into the full rearward position.
  Check the front mounting bolt completely.
- Check that the seat operates to and fro smoothly And the locking portion locks properly.

RECLINER COVER, KNOB AND HEIGHT KNOB REPLACEMENT

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

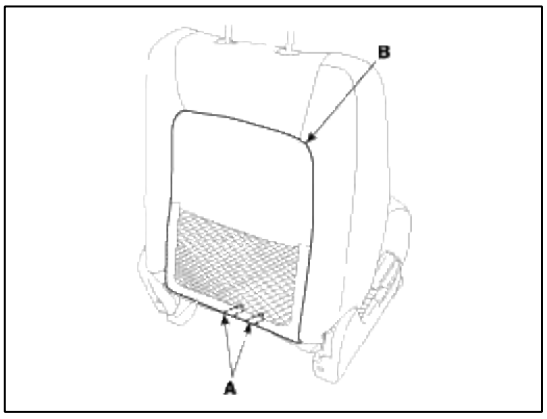
2. Loosen the recliner mounting screw and clip, then remove the recliner cover(C).



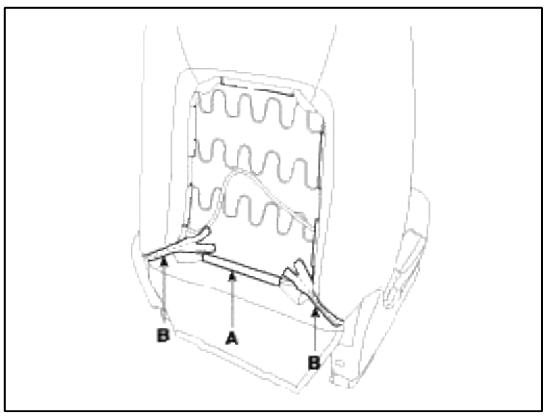
3. Installation is the reverse of removal.

SEAT BACK COVER REPLACEMEN

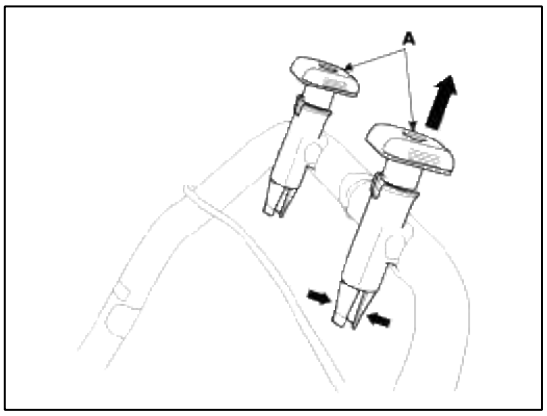
1. After disconnecting the scuff band(A), remove the seat back panel(B).



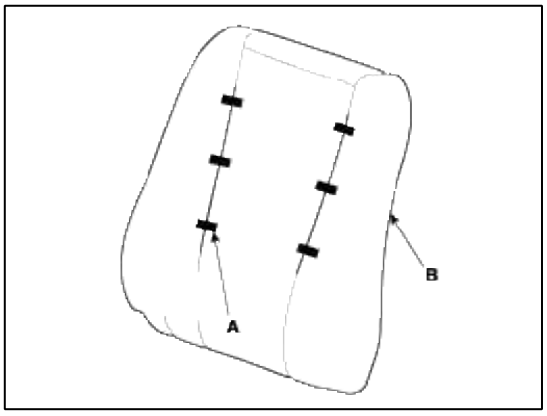
2. Disconnect the protector (A) from the back frame, then open the zipper(B).



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



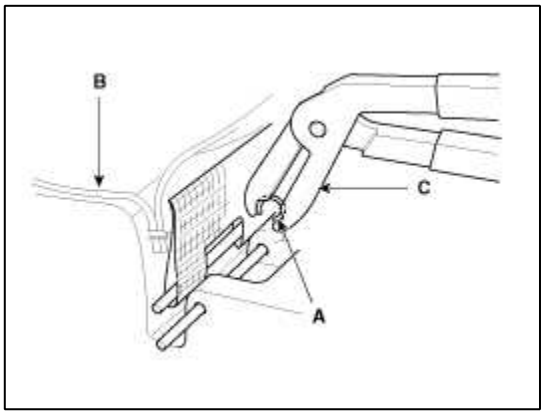
4. After removing the hogring clips (A) on the front of seat back and remove the seat back cover(B).



5. Installation is the reverse of removal.

NOTE

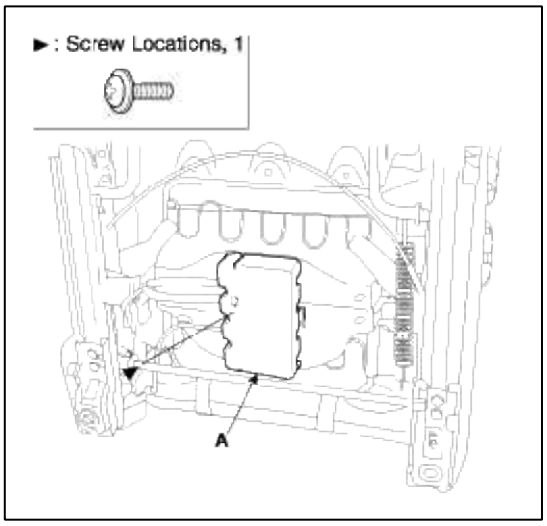
- To prevent wrinkles, make sure the material is stretched evenly over the cover(A) before securing the hogring clips(B).
- Replace the hogring clips with new ones using special tool(C).



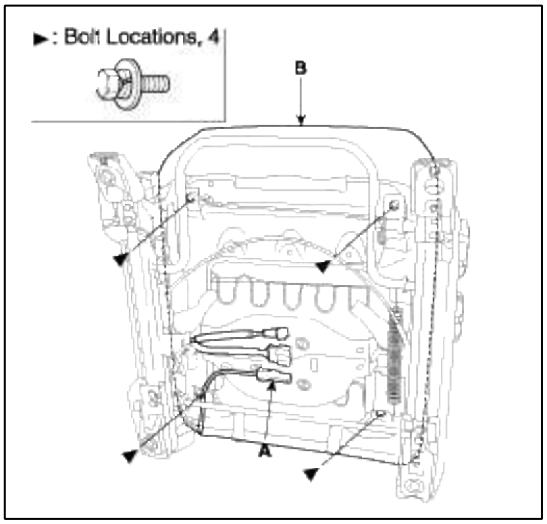
SEAT CUSHION COVER REPLACEMENT

1. Remove the seat assembly.
2. Disconnect the scuff band.

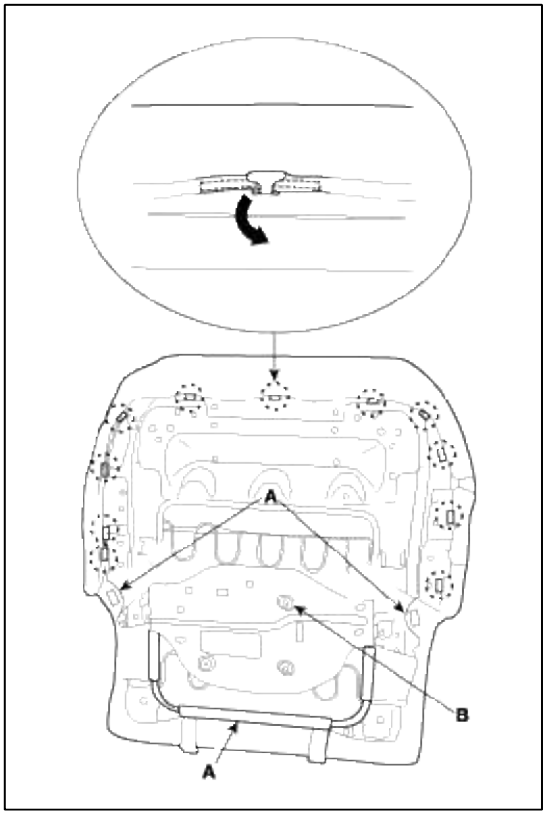
3. Remove the connector box(A).



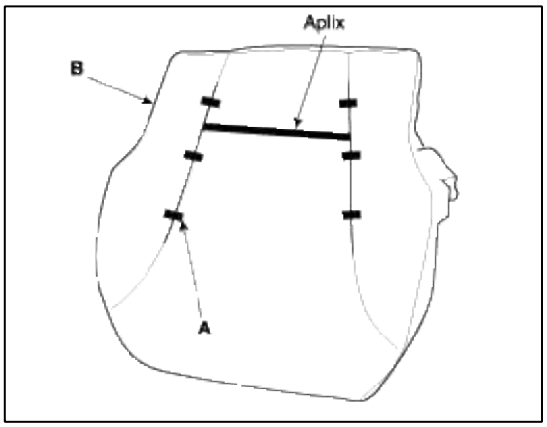
4. Remove the connectors (A). After loosening the mounting bolts, remove the cushion(B).



5. Disconnect the protector (A) from the cushion frame (B).



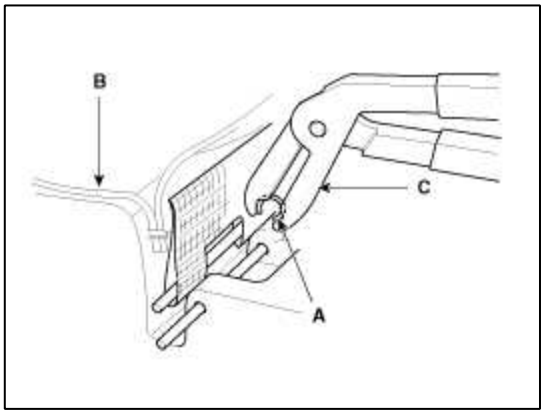
6. After removing the hogring clips (A) on the front of seat cushion and remove the seat cushion cover(B).



7. Installation is the reverse of removal.

NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover (A) before securing the hogring clips(B).
- Replace the hogring clips with new ones using special tool(C).

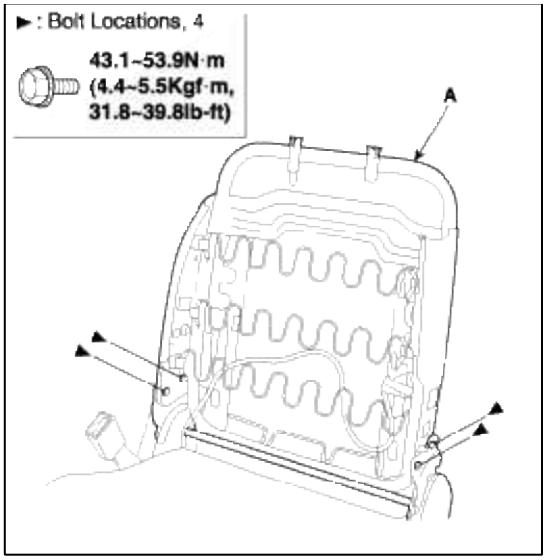


SEAT BACK FRAME REPLACEMENT

1. Remove the seat back panel.
2. Remove the headrest guide.
3. Remove the seat back cover and pad from the frame.
4. Loosen the mounting bolts, then remove the seat back frame(A).

NOTE

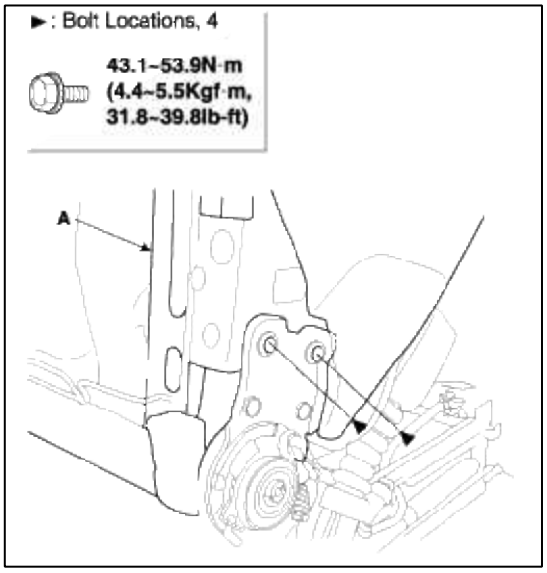
- Remove the side air bag for replacing side air bag installation seat.
- Before service, be fully aware of precautions and service procedure relevant to air bag(Seepage RT- “Airbag”)



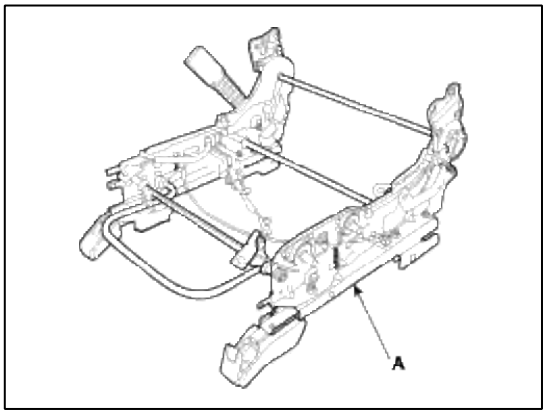
5. Installation is the reverse of removal.

SEAT TRACK REPLACEMENT

1. After removing the seat back panel, disconnect the protector and open the zipper.
2. Remove the seat back assembly(A).



3. Remove the seat cushion.
4. Remove the recliner cover, recliner knob and height adjuster knob(Seepage BD-75).
5. Remove the seat track(A).



6. Installation is the reverse of removal.

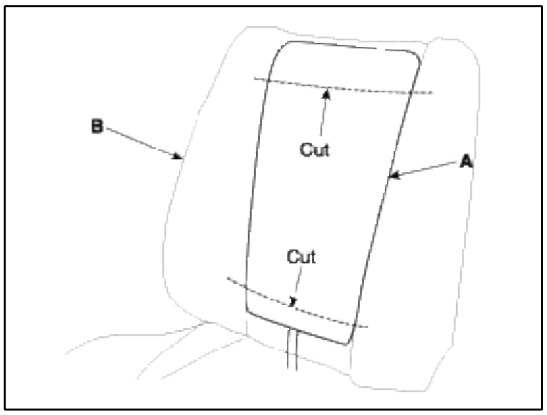
SEAT BACK HEATER REPLACEMENT

1. Remove the seat back cover.
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

- Ensure the replacement heater is fitted properly during.

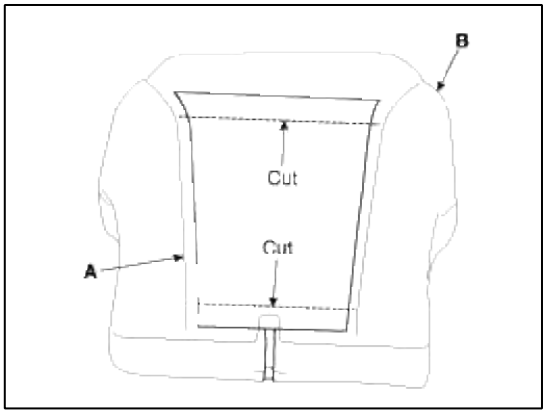


SEAT CUSHION HEATER REPLACEMENT

1. Remove the seat cushion cover.
2. Cut the heater(A) attached to the pad(B), as shown in the picture.
3. Take off the paper from to the backside of the heater assembly.
4. Attach the heater to the main part of pad.
5. Installation is the reverse of removal.

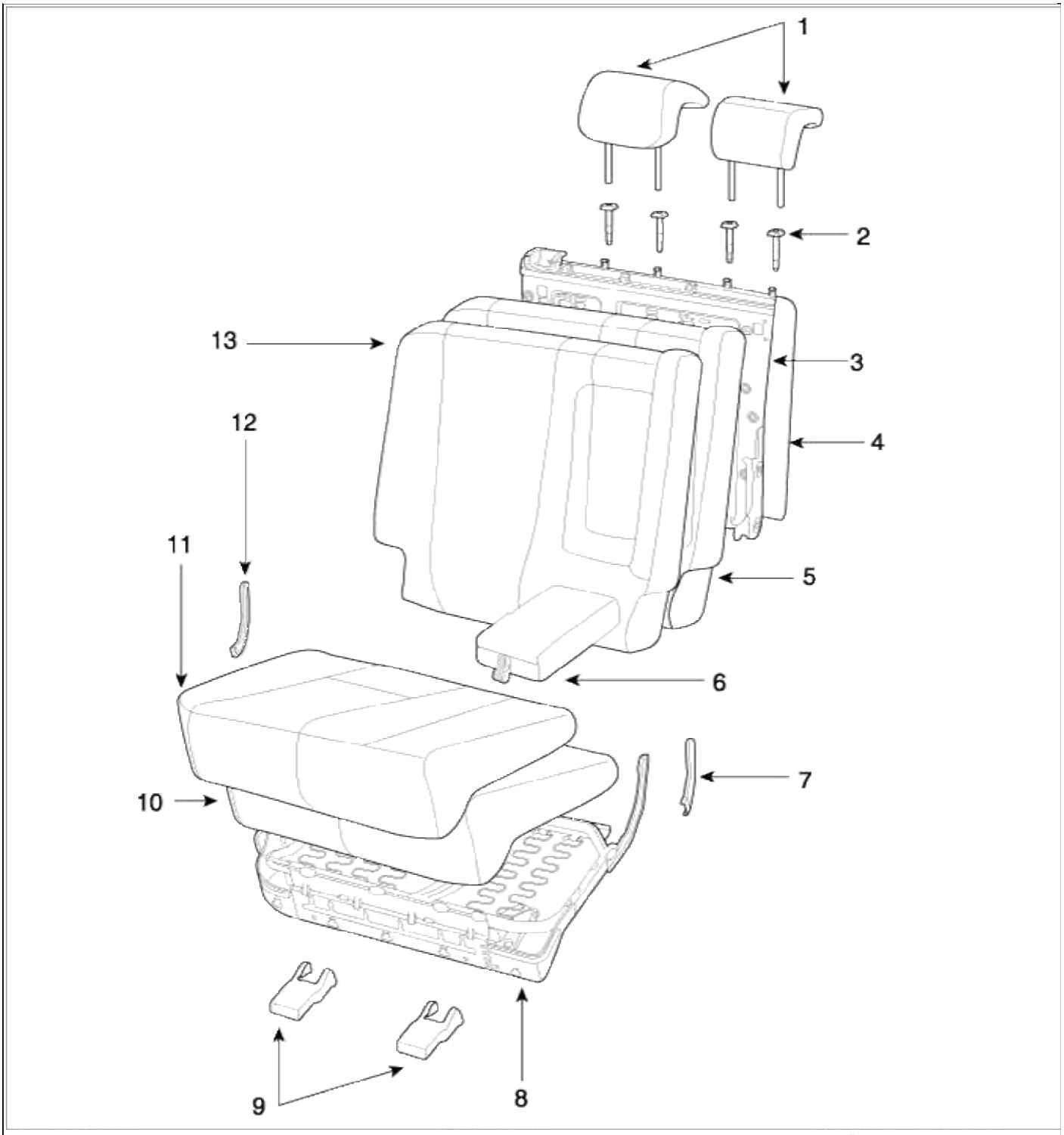
CAUTION

- Ensure the replacement heater is fitted properly during.



Body (Interior and Exterior) > Seat & Power Seat > rear seat > Components and Components Location

COMPONENTS



1. Head rest
2. Head rest guide
3. Seatback frame
4. Seatback panel
5. Seatback pad
6. Armrest
7. Hinge cover
8. Seat cushion frame
9. Cover
10. Seat cushion pad
11. Seat cushion cover
12. Hinge cover
13. Seatback cover

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

REPLACEMENT

SEAT ASSEMBLY REPLACEMENT

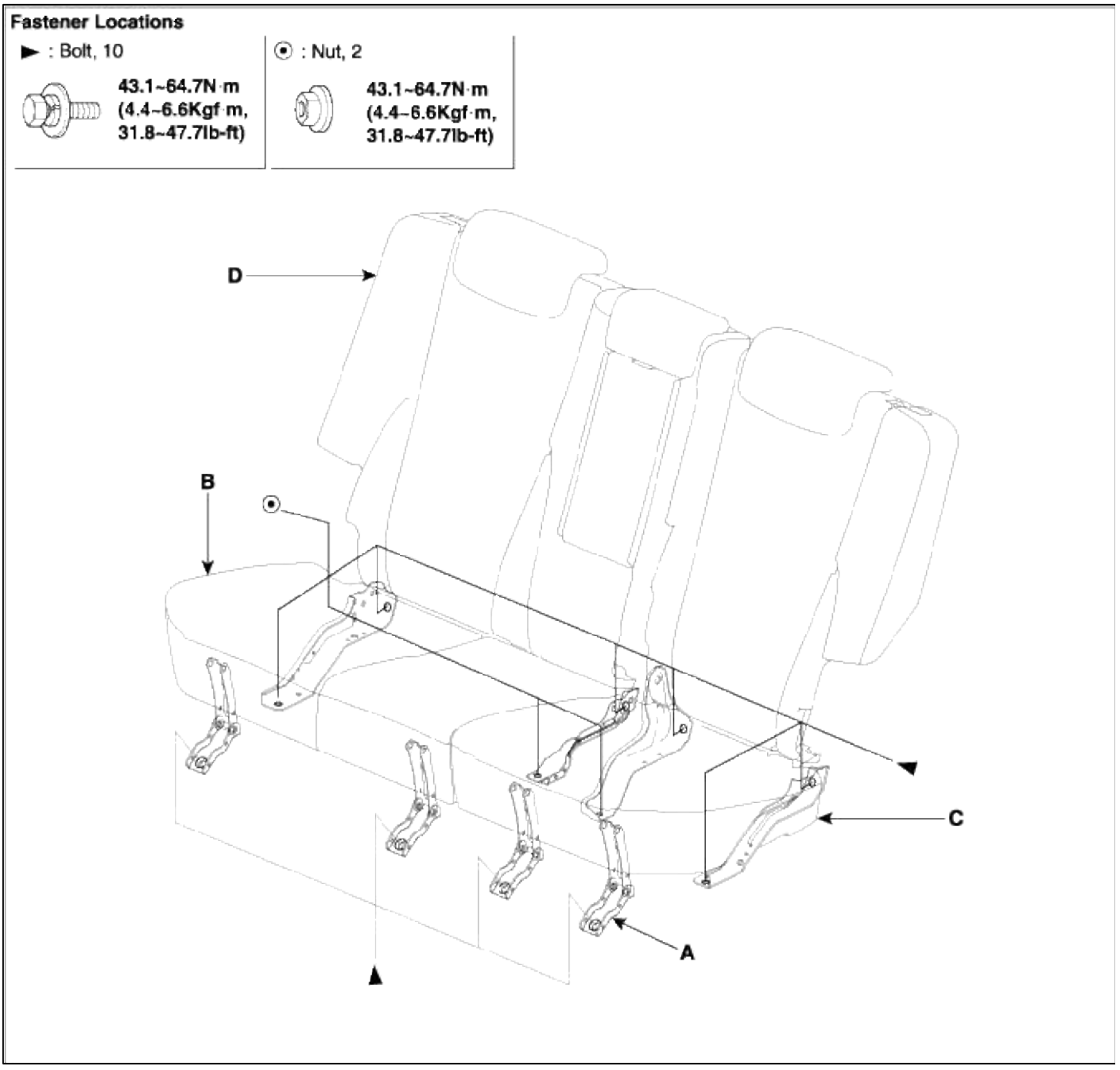
1. After disconnect the cushion frame hinge(A) cover, loosen the mounting bolts. Fold the cushion(B).
2. Loosen the recliner hinge (C)mounting nut and bolts, then rear seat assembly(D).

3. Installation is the reverse of removal.

NOTE

SEAT MOUNTING BOLT AND NUT INSTALLATION PROCEDURE.

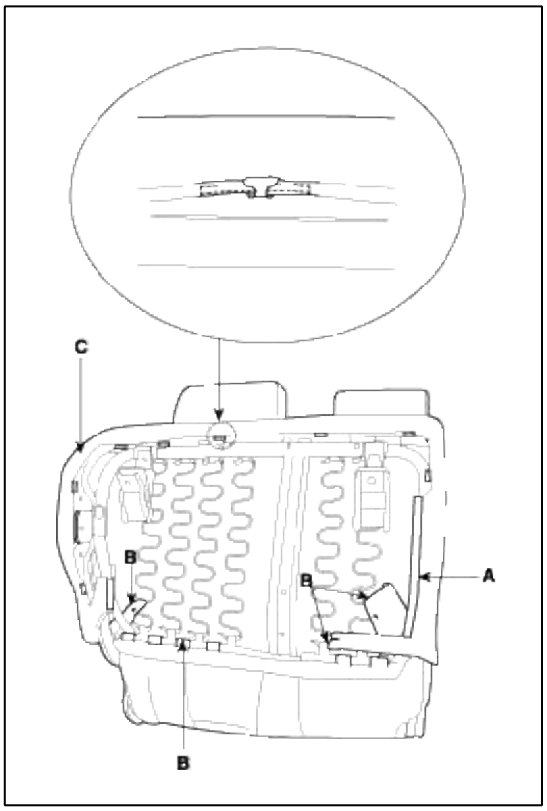
- Tighten temporarily in the order of nut and bolt on the front of recliner hinge installation part.
- After completely tightening the bolt on the back of the recliner hinge installation part, tighten the bolt on the front of it completely.
- Setting down the seat cushion, tighten the mounting bolt of the cushion frame hinge.
- Check if reclining the seat and folding seat back operate smoothly.



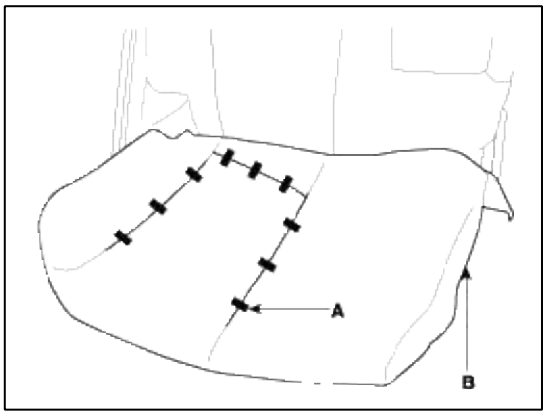
SEAT CUSHION COVER REPLACEMENT

1. After loosening cushion frame hinge mounting bolts, fold the cushion.

2. Remove the protector (A) and hogring clip (B), then remove the cushion(C).



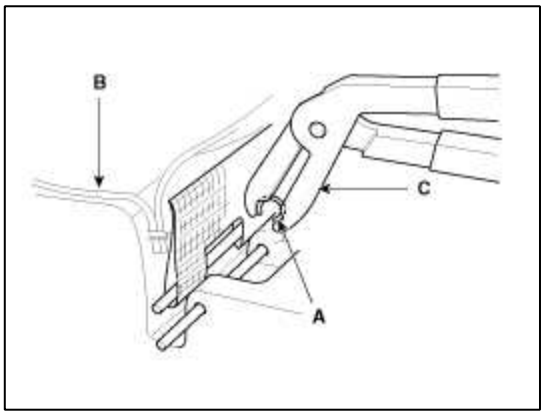
3. Pull out the hogring clips (A) on the front of seat cushion, remove the seat cushion cover(B).



4. Installation is the reverse of removal.

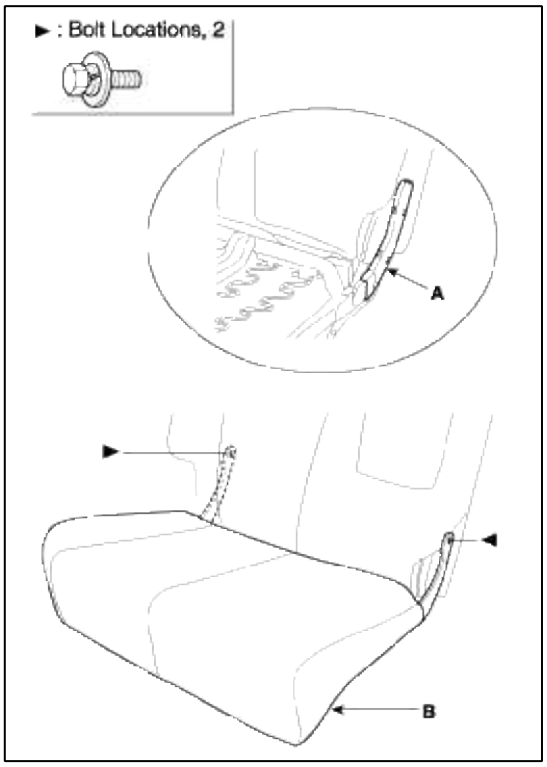
NOTE

- To prevent wrinkles, make sure the material is stretched evenly over the cover(B) before securing the hogring clips(A).
- Replace the hogring clips with new ones using special tool(C).

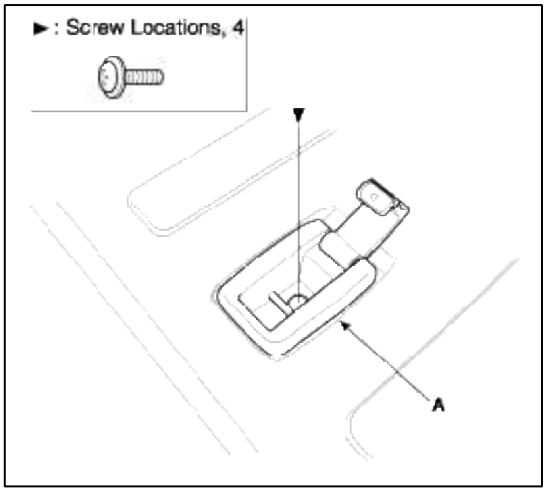


SEATBACK COVER REPLACEMENT

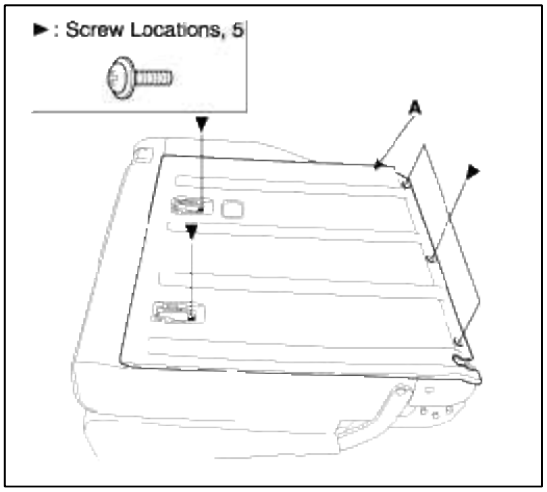
1. Remove the following items;
   A. Headrest.
   B. Armrest.
2. Remove the back folding hinge cover(A).
   After loosening the mounting bolts, remove the cushion(B).



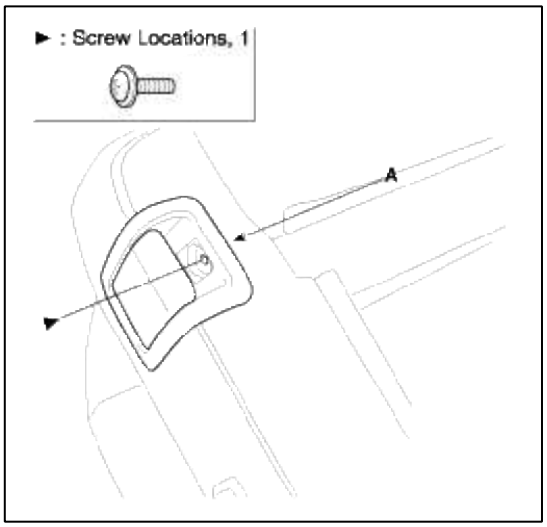
3. After folding the seat back, remove the shopping hook (A) from the back panel.



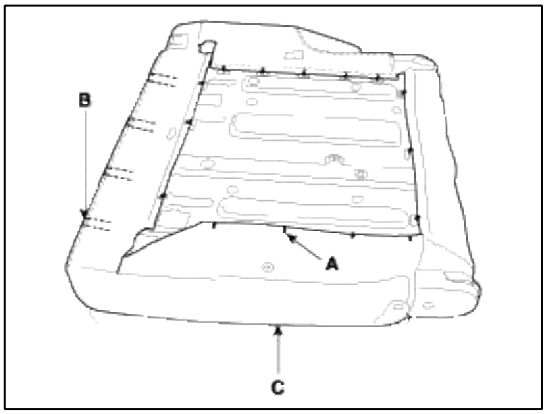
4. Remove the back panel (A).



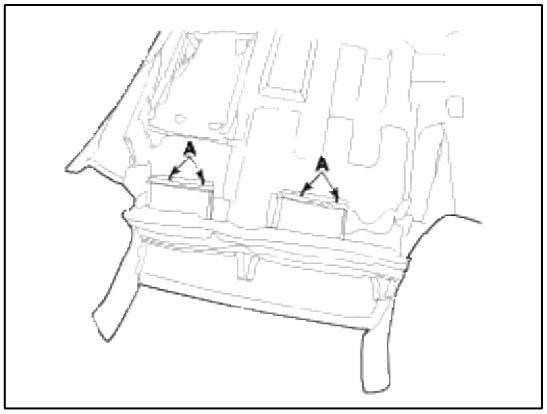
5. Remove the recliner lever cover (A).



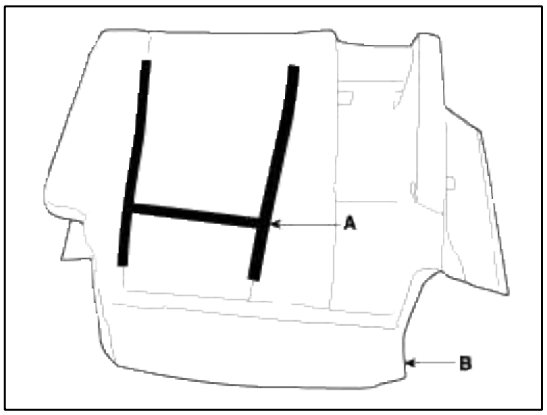
6. Remove the hogring clip (A) and headrest guide (B), then remove the seat back assembly(C).



7. Remove the hogring clip (A) of the pad.



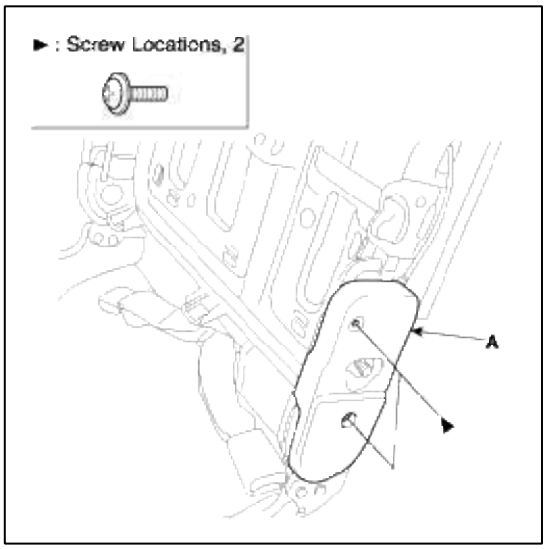
8. Disconnect the aplix (A) on the front of seat back, remove the back cover (B).



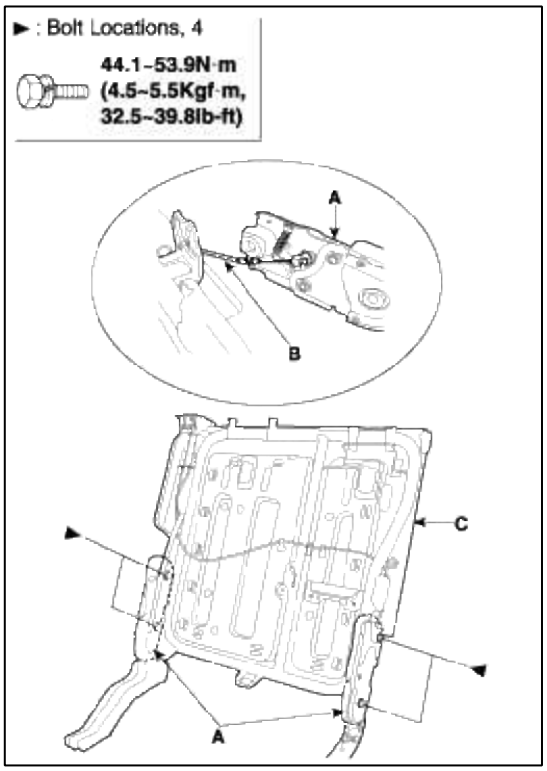
9. Installation is the reverse of removal.

SEAT BACK FRAME AND RECLINER REPLACEMENT

1. Remove the seat back cover.
2. Remove the recliner (A).



3. Loosen the recliner (A) mounting bolt.
   After disconnecting the recliner cable (B),remove the seat back frame(C).

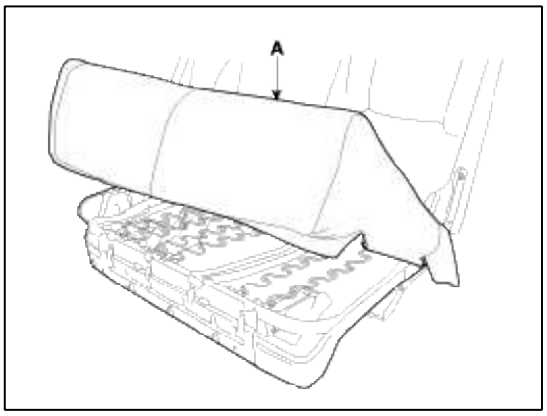


4. Installation is the reverse of removal.

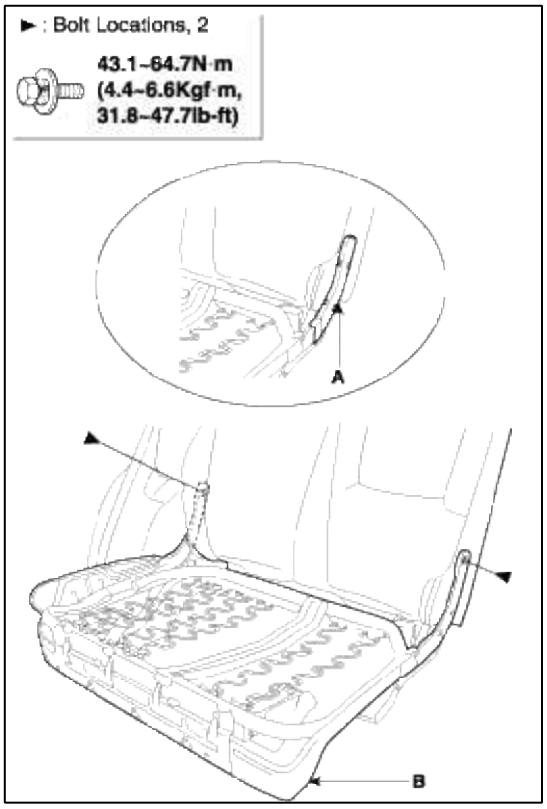
SEAT CUSHION FRAME REPLACEMENT

1. Remove the seat cushion.

2. Disconnect the protector and remove the hogring clip. Remove the cushion assembly (A).



3. Loosen the back folding cover (A). After loosening the mounting, remove the cushion frame (B).

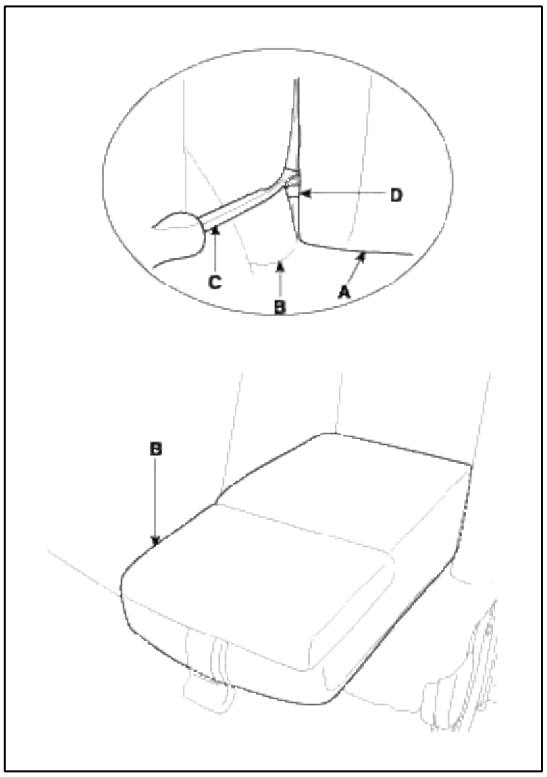


4. Installation is the reverse of removal.

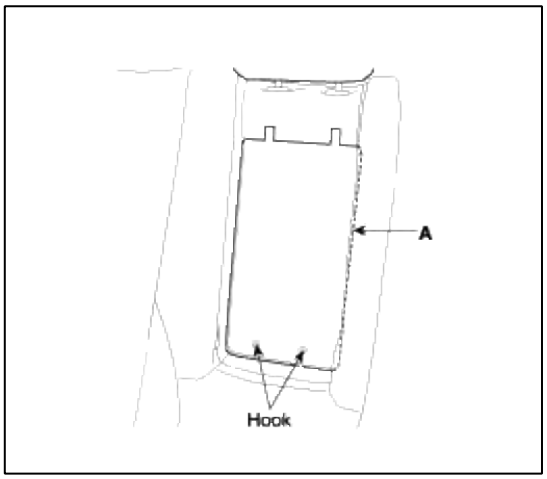
ARMREST REPLACEMENT

1. Squeeze out the gap between the seat back (A) and the armrest(B) to open using a screwdriver(C) and remove the bushing(D).

2. Pushing the armrest to the left, remove the arm rest.



3. Remove the armrest cover(A).

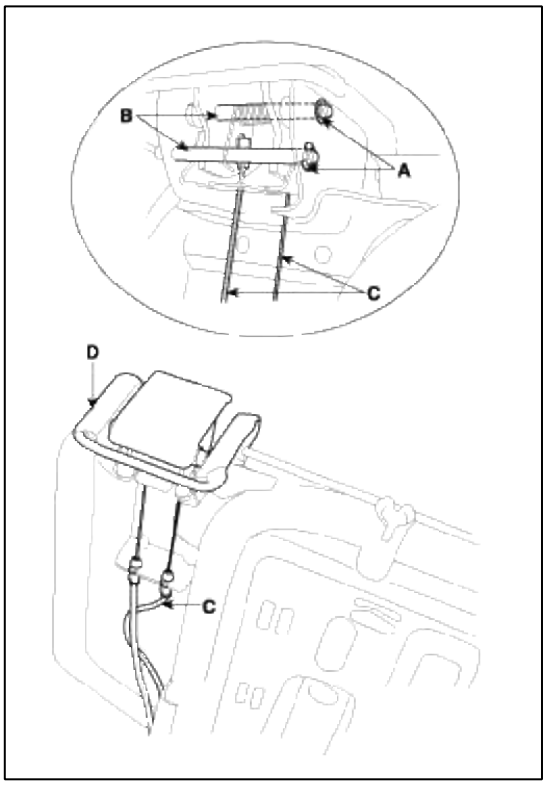


4. Installation is the reverse of removal.

RECLINER LEVER REPLACEMENT

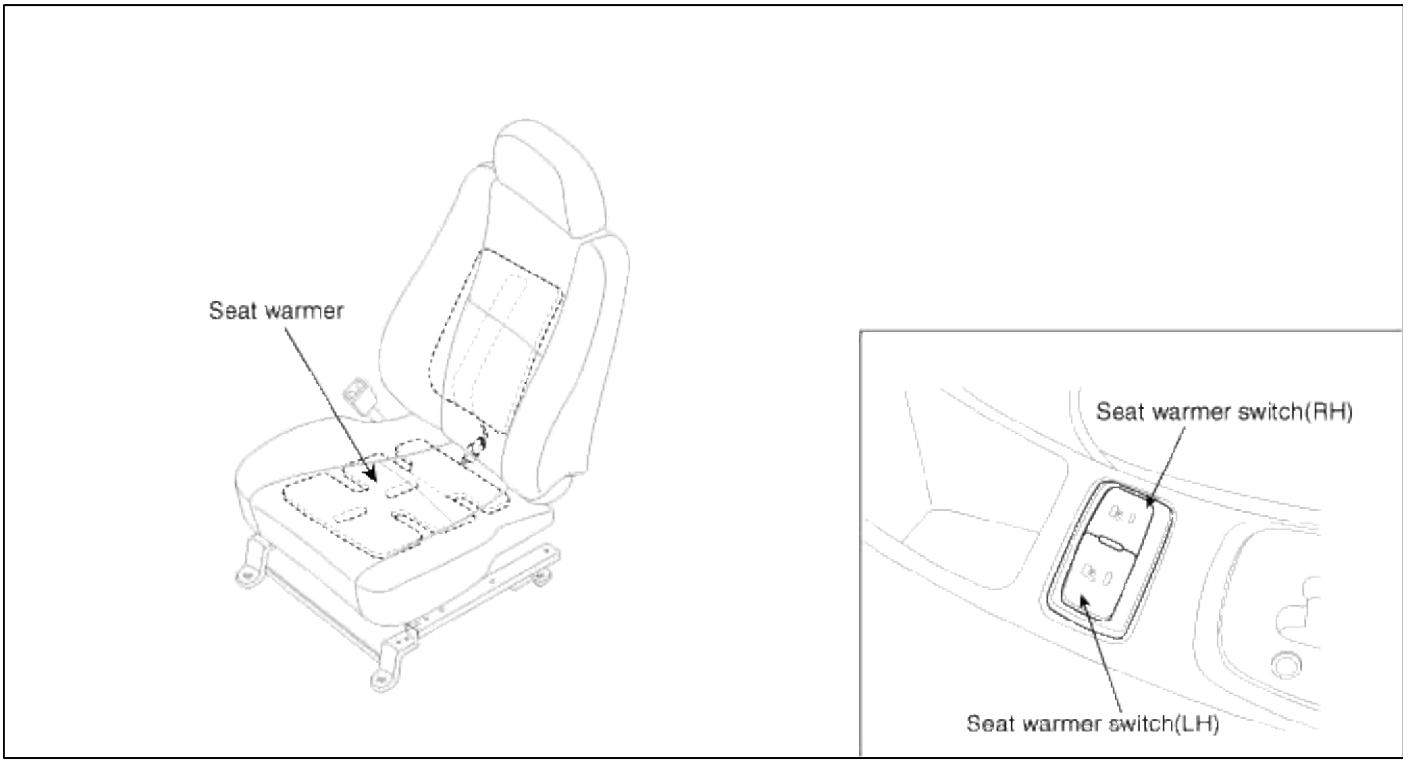
1. Remove the seat back frame.
2. After removing the “E” ring (A) from the recliner mounting pin, remove the recliner mounting pin (B).
3. Disconnect the recliner cable wire (C), then remove the recliner lever (D).

4. Installation is the reverse of removal.



Body (Interior and Exterior) > Seat Heater > Components and Components Location

COMPONENTS

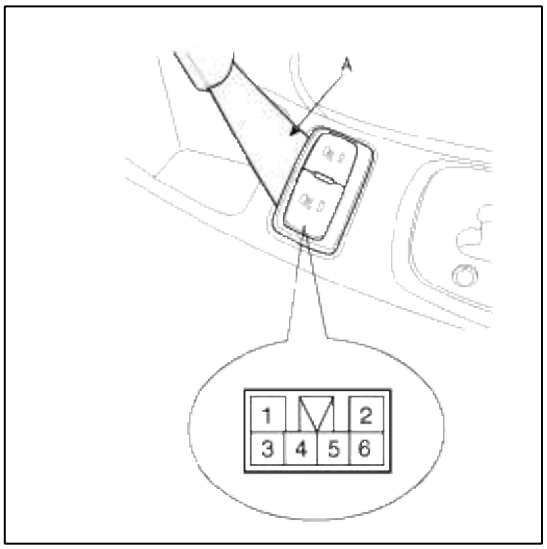


Body (Interior and Exterior) > Seat Heater > Seat Heater switch > Repair procedures

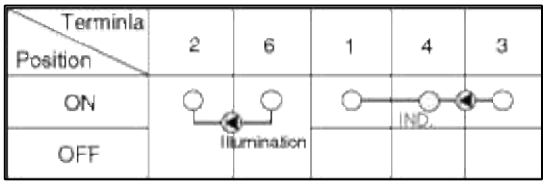
INSPECTION

1. Disconnect the negative (-) battery terminal.

2. Remove the seat warmer switch from the floor console upper cover with scraper (A).

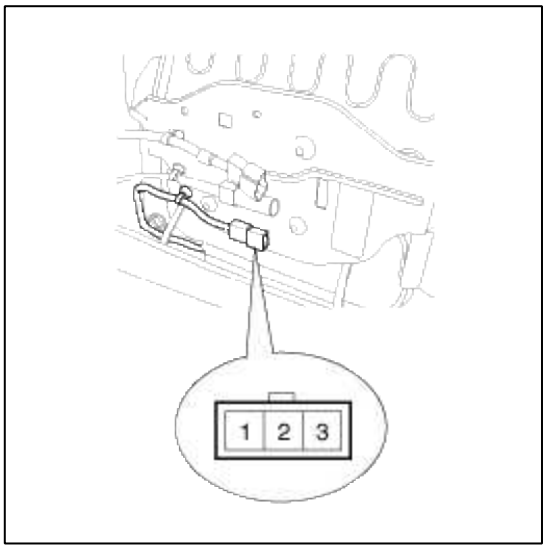


3. Check for continuity between the terminals in each switch position according to the table.

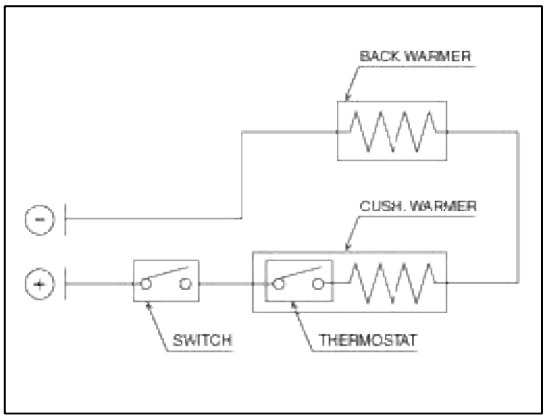


SEAT WARMER INSPECTION

1. Check for continuity and measure the resistance between No.1 and NO.3 terminals.



Standard value: 2.34Ω ± 10%
(Cushion: 1.19Ω ± 10%, Back: 1.15Ω ± 10%)

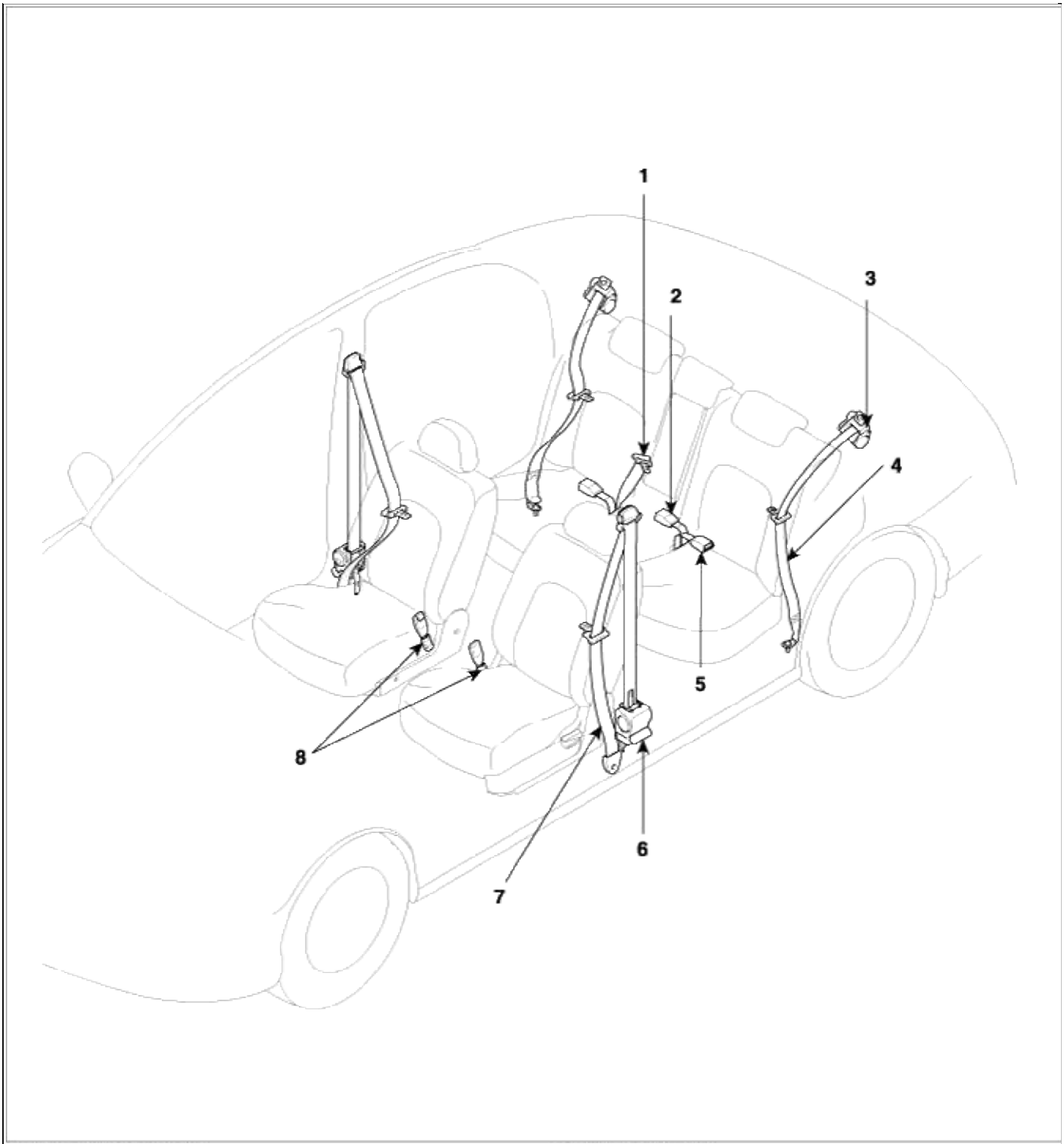


2. Operate the seat warmer after connecting the 2P connector, and then check for the thermostat by measuring the temperature of seat surface.
3. Check for continuity between the terminals after disconnecting the 3P connector.

Standard value :
28 ±3.5°C(Continuity), 37 ±3.0°C(Short)

Body (Interior and Exterior) > Seat Belt > front seat belt > Components and Components Location

COMPONENTS



1. Rear center seat belt
2. Rear center seat buckle
3. Rear seat belt retractor
4. Rear seat belt
5. Rear seat buckle
6. Front seat retractor
7. Front seat belt
8. Front seat buckle

Body (Interior and Exterior) > Seat Belt > front seat belt > Repair procedures

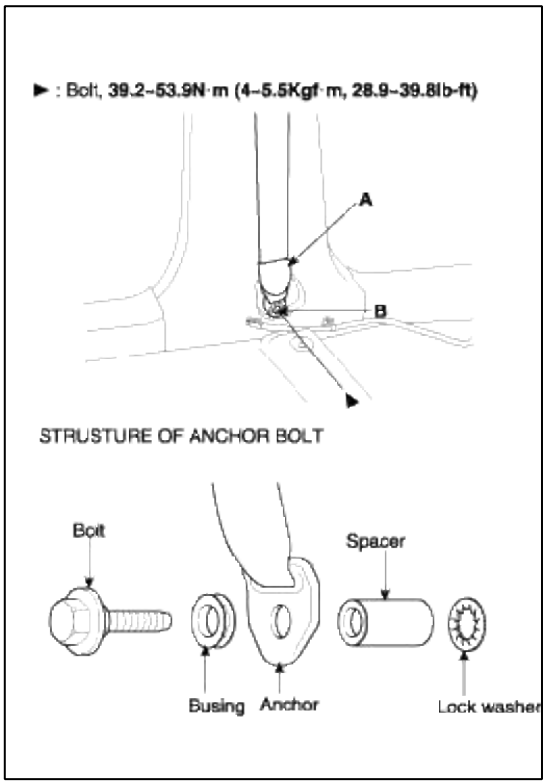
REPLACEMENT

FRONT SEAT BELT

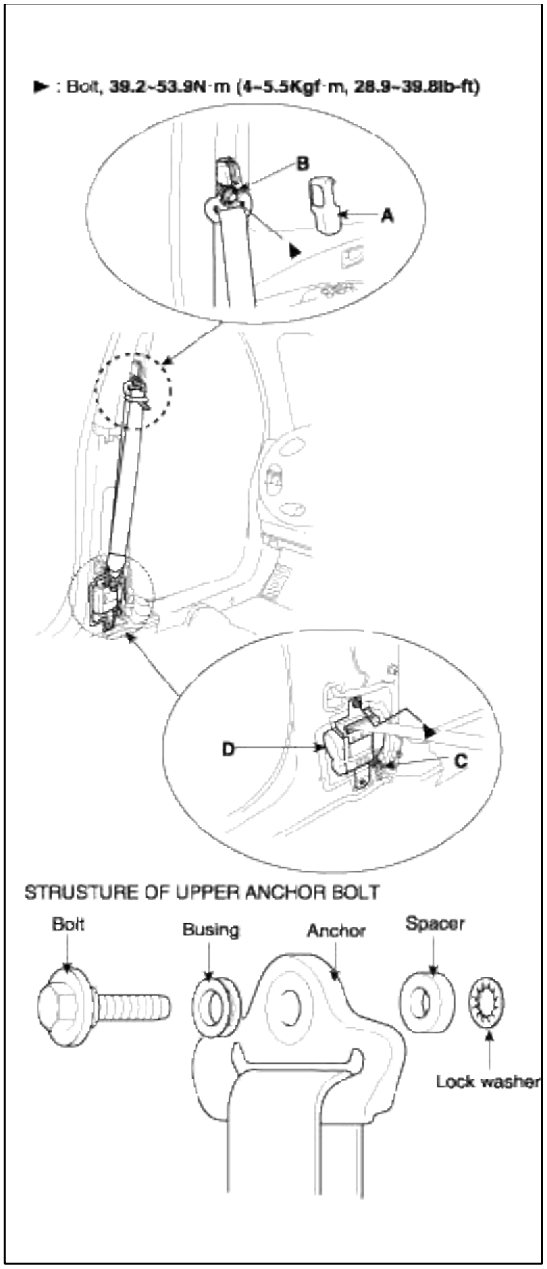
CAUTION

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

1. Remove the following items;
   A. Front seat assembly.
   B. Front and rear door scarf trim.
2. After raise the lower anchor cover(A), loosen the lower anchor mounting bolt(B).



3. Remove the center pillar lower trim.
4. Remove the upper anchor cover (A), then loosen the upper anchor(B).
5. After disconnecting the pretensioner connector lock pin, remove the connector(C). loosen the mounting bolt, then remove the pretensioner(D).



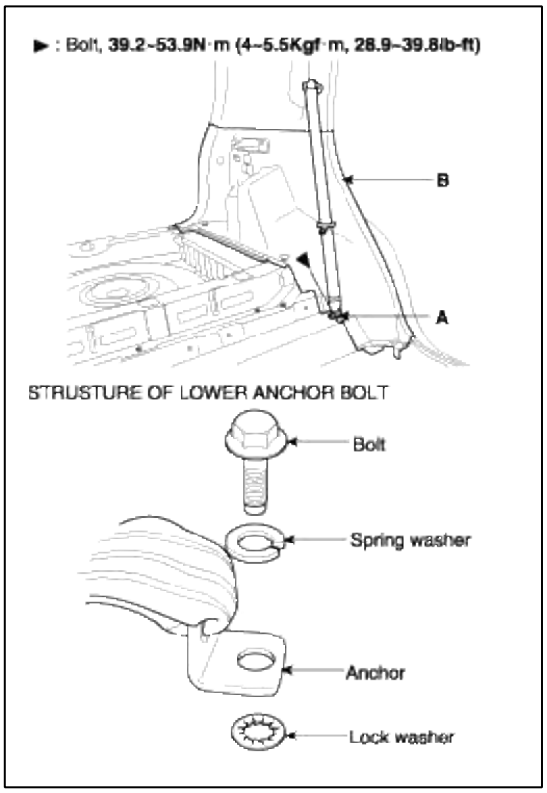
REAR SEAT BELT REPLACEMENT

CAUTION

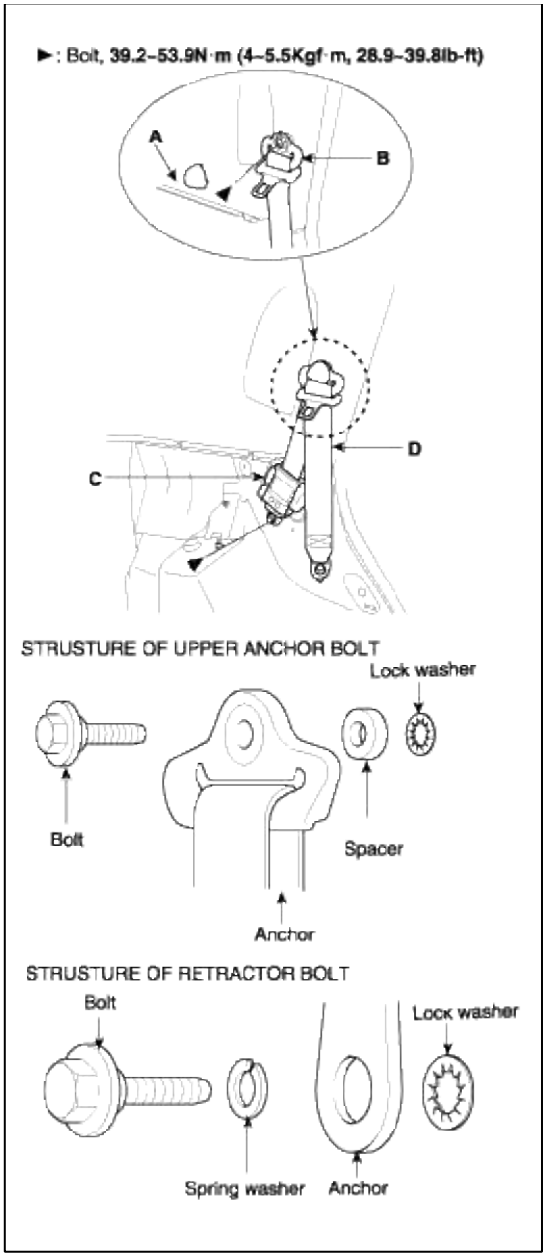
When installing the seat belt, make sure not to damage the retractor.

1. Remove the following items;
   A. Rear seat assembly.
   B. Front and rear door scarf trim.
   C. Self covering trim.
   D. Trunk trim.
2. Remove the lower anchor (A).

3. Remove the luggage side trim.



4. Remove the upper anchor cover (A), then loosen the mounting bolt. Remove the upper anchor (B).
5. After loosening the retractor (C) mounting bolt, remove the rear seat belt (D).

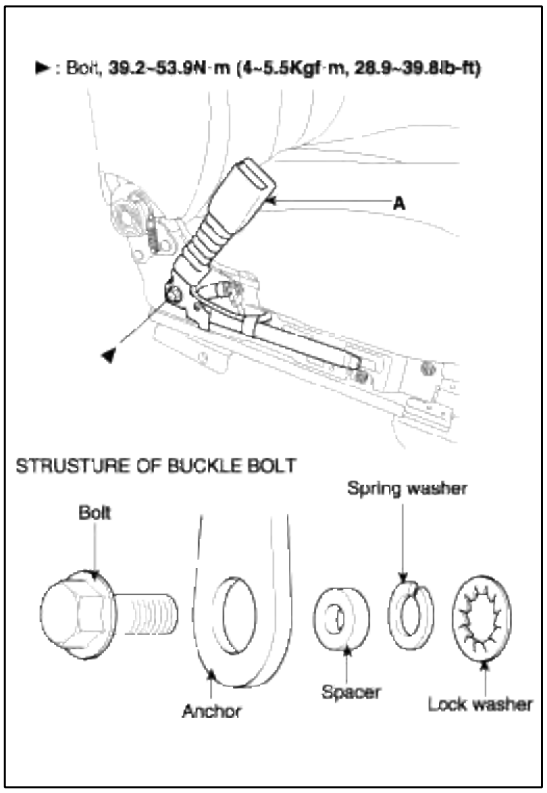


6. Installation is the reverse of removal.

FRONT SEAT BELT BUCKLE REPLACEMENT

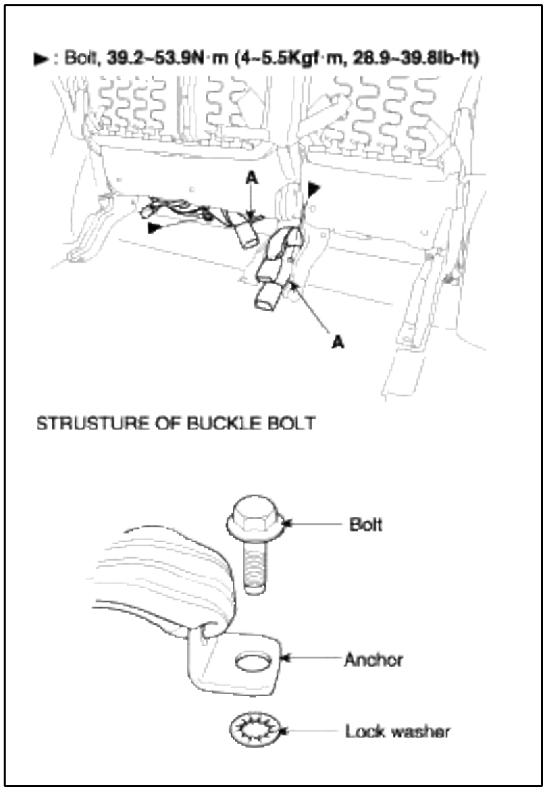
1. Remove the following items;
   A. Front seat assembly.
   B. Front seat recliner cover.
2. Remove the seat belt buckle (A).

3. Installation is the reverse of removal.



REAR SEAT BELT BUCKLE REPLACEMENT

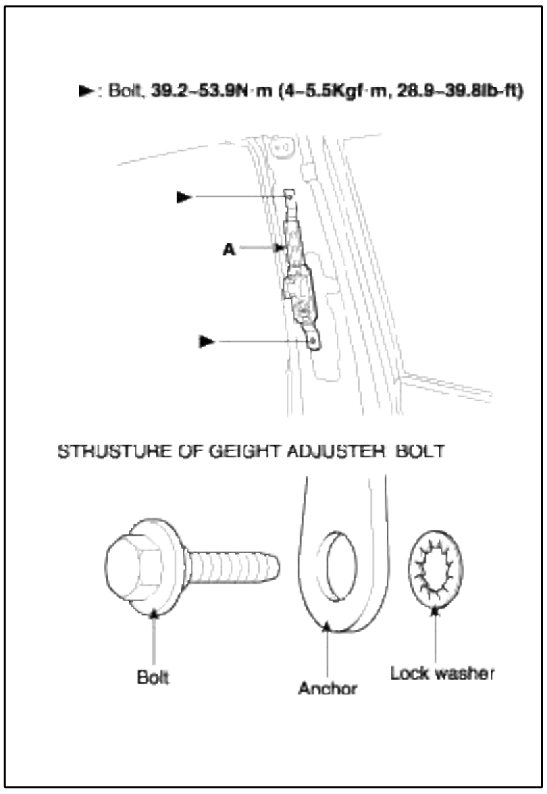
1. After cushion frame hinge mounting bolts, fold the cushion.
2. Remove the seat belt buckle (A).
3. Installation is the reverse of removal.



HEIGHT ADJUSTER REPLACEMENT

1. Remove the following items;
   A. Front seat assembly.
   B. Front and rear door scuff trim.
   C. Front seat belt lower ,upper trim.
   D. Center pillar lower and upper trim.

2. Loosen the mounting bolt, then remove the height adjuster (A).
3. Installation is the reverse of removal.



SPORTAGE(KM) > 2007 > G 2.0 DOHC > Body Electrical System

Body Electrical System > General Information > General Information

GENERAL TROUBLESHOOTING INFORMATION

BEFORE TROUBLESHOOTING

1. Check applicable fuses in the appropriate fuse/relay box.
2. Check the battery for damage, state of charge, and clean and tight connections.

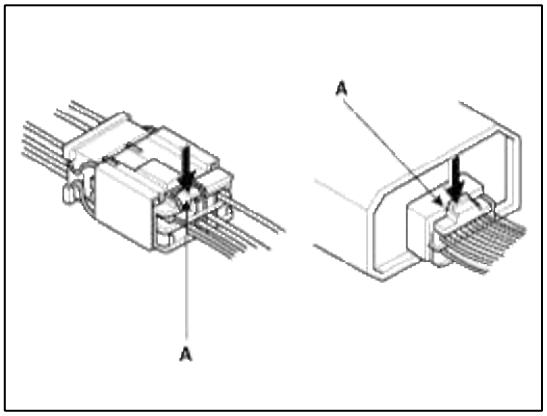
NOTE

- 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.

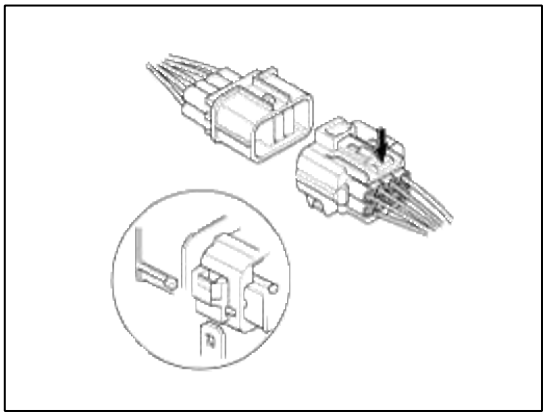
3. Check the alternator belt tension.

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).

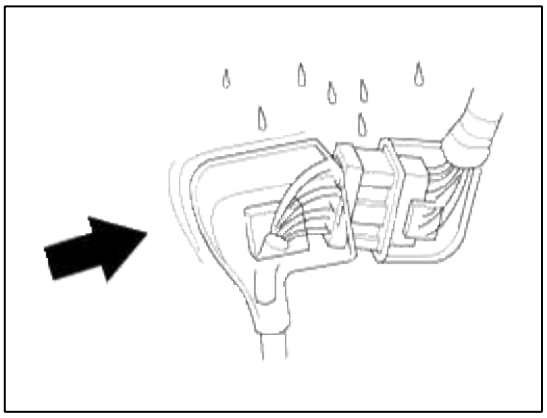


4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).

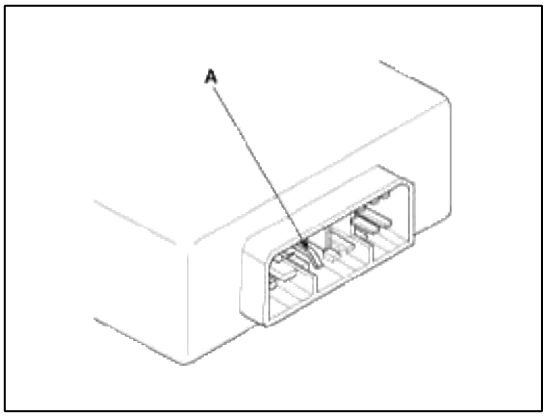


6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.

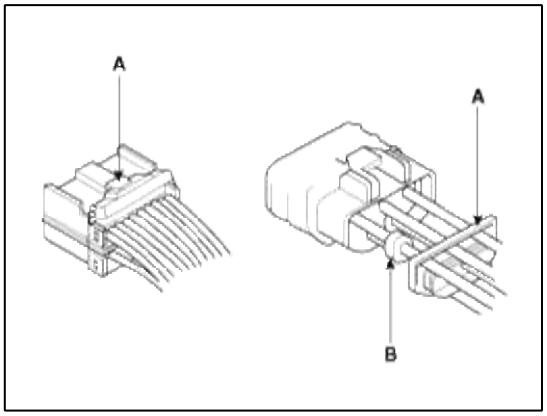
7. Always reinstall plastic covers.



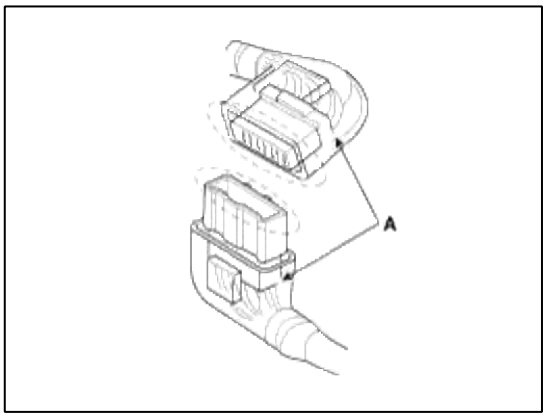
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



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

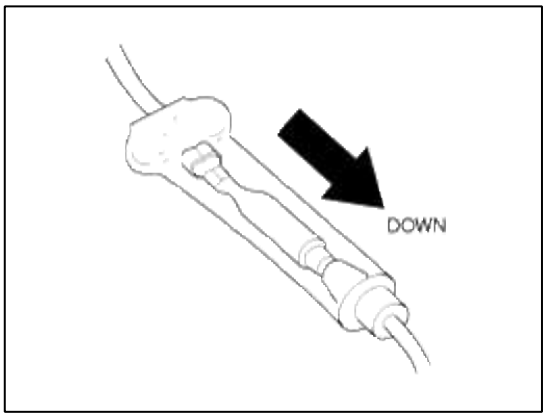


10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.



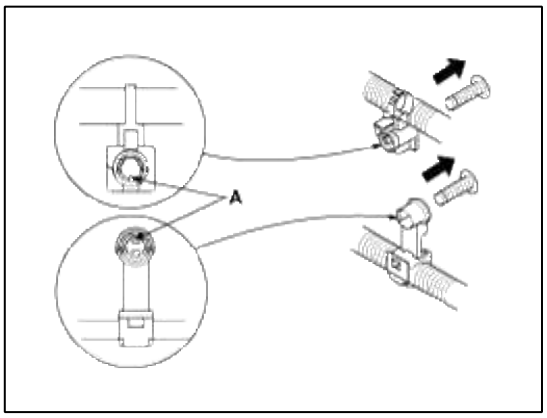
11. Insert the connector all the way and make sure it is securely locked.

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

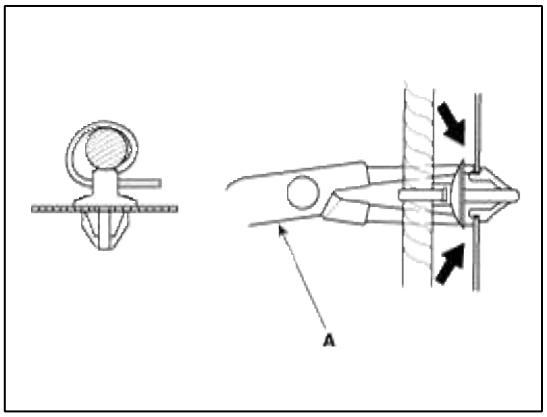


HANDLING WIRES AND HARNESSES

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

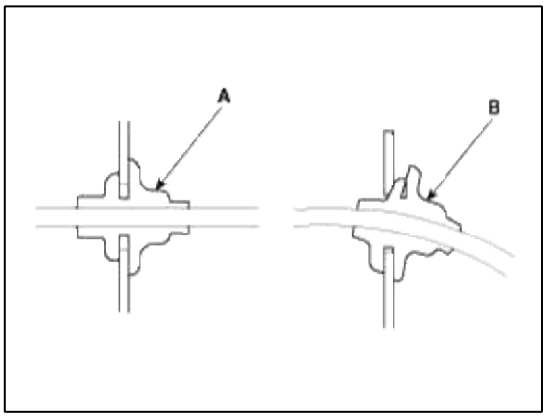


3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



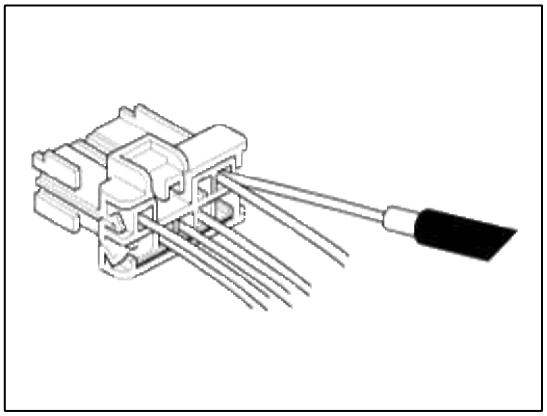
4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.

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

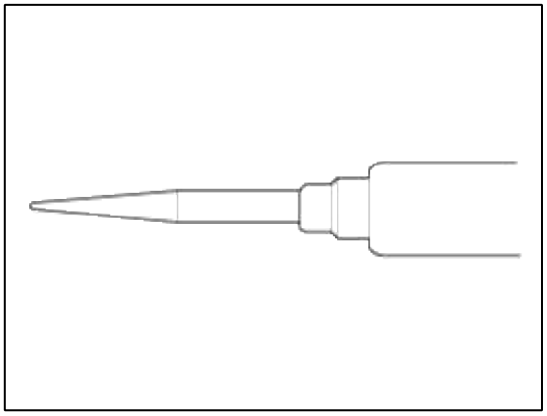


TESTING AND REPAIRS

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



5. Use a probe with a tapered tip.



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.

Body Electrical System > General Information > Troubleshooting

TROUBLESHOOTING

INSTRUMENTS AND WARNING SYSTEM

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	Room lamp fuse (10A) 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

LIGHTING SYSTEM

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
	Ignition fuse (LOW:10A, HIGH:20A) blown	Check for short and replace fuse
	Head lamp fuse (15A) blown	Check for short and replace fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	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
	ETACS faulty	Check ETACS
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (10A) blown	Check for short and replace fuse
	ETACS faulty	Check ETACS
	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
	ETACS faulty	Check ETACS
Back up lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (15A) blown	Check for short and replace fuse
	Room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (15A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Map lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tailgate room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse

	Tailgate switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

AUDIO SYSTEM

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.

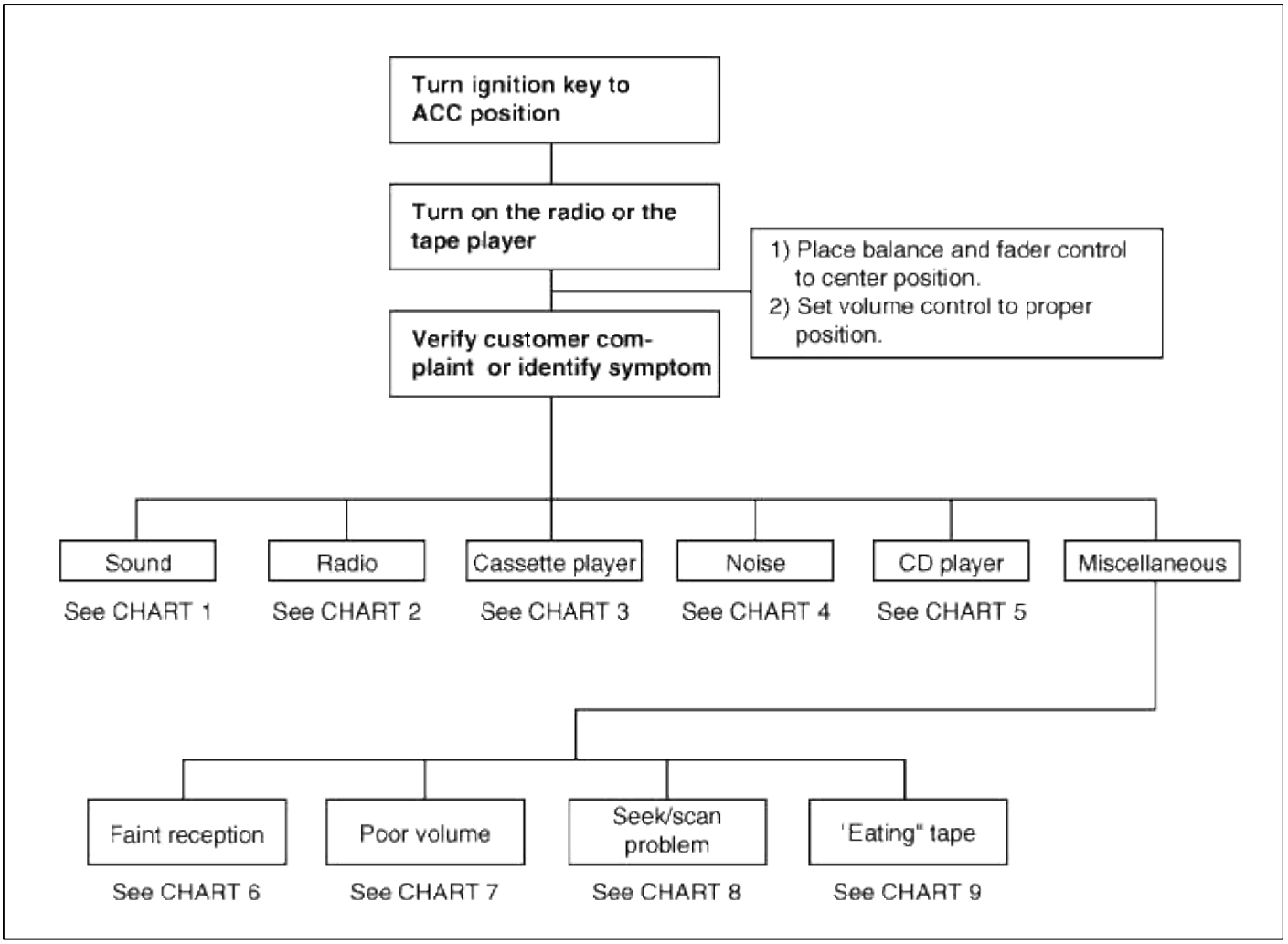
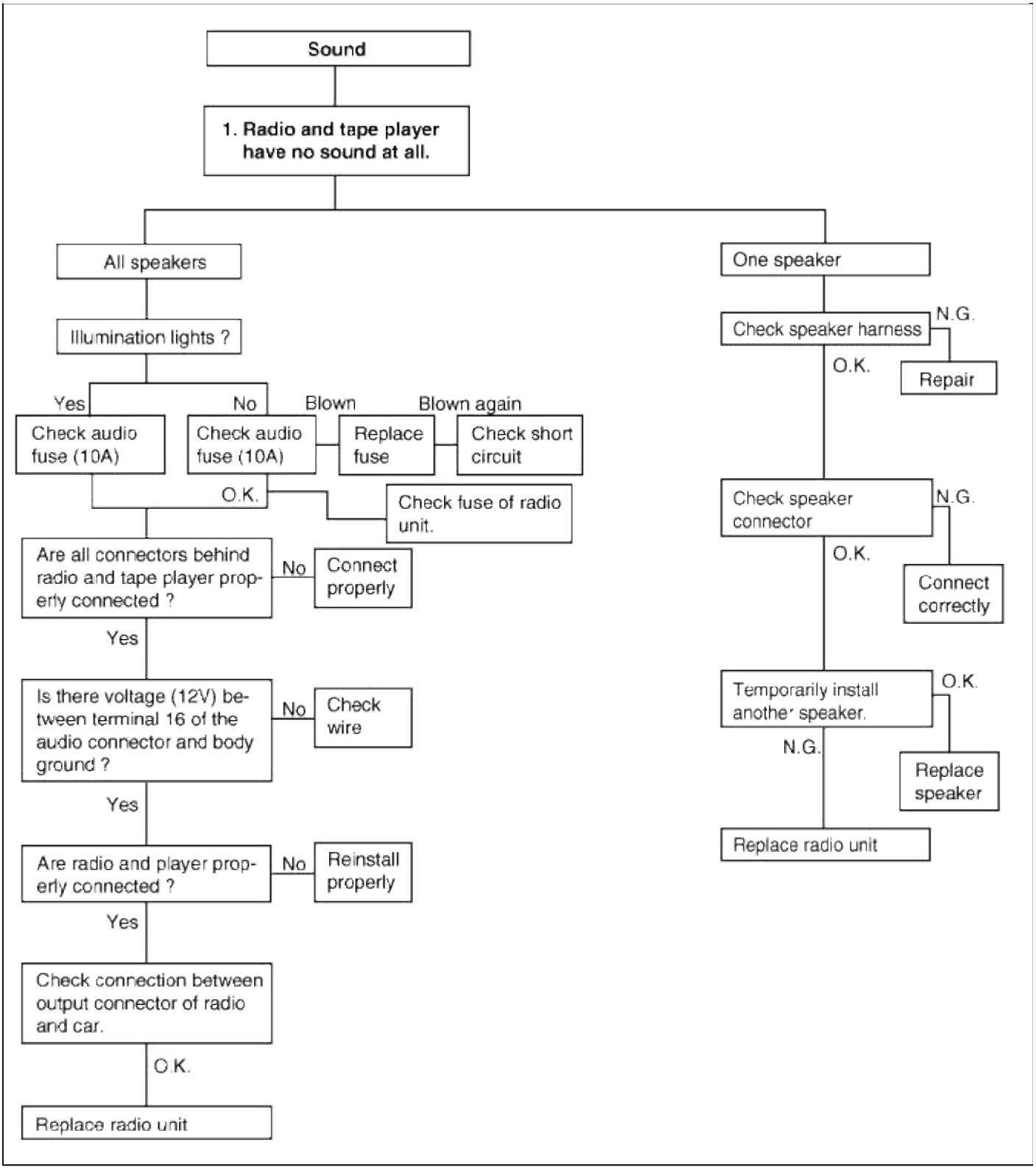


Chart 1


Sound
1. Radio and tape player have no sound at all.
All speakers
Illumination lights ?
Yes
No
Blown
Blown again
Check audio fuse (10A)
Check audio fuse (10A)
Replace fuse
Check short circuit
O.K.
Check fuse of radio unit.
Are all connectors behind radio and tape player properly connected ?
No
Connect properly
Yes
Is there voltage (12V) between terminal 16 of the audio connector and body ground ?
No
Check wire
Yes
Are radio and player properly connected ?
No
Reinstall properly
Yes
Check connection between output connector of radio and car.
O.K.
Replace radio unit
One speaker
Check speaker harness
N.G.
O.K.
Repair
Check speaker connector
N.G.
O.K.
Connect correctly
Temporarily install another speaker.
O.K.
N.G.
Replace speaker
Replace radio unit

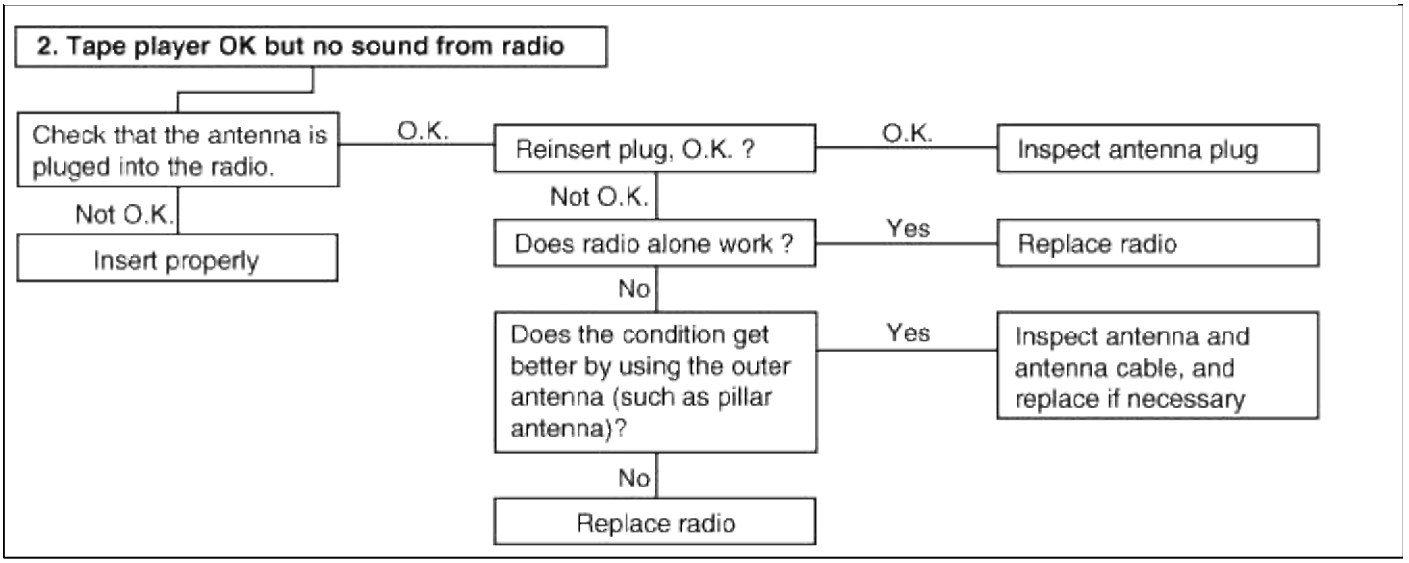


Chart 2

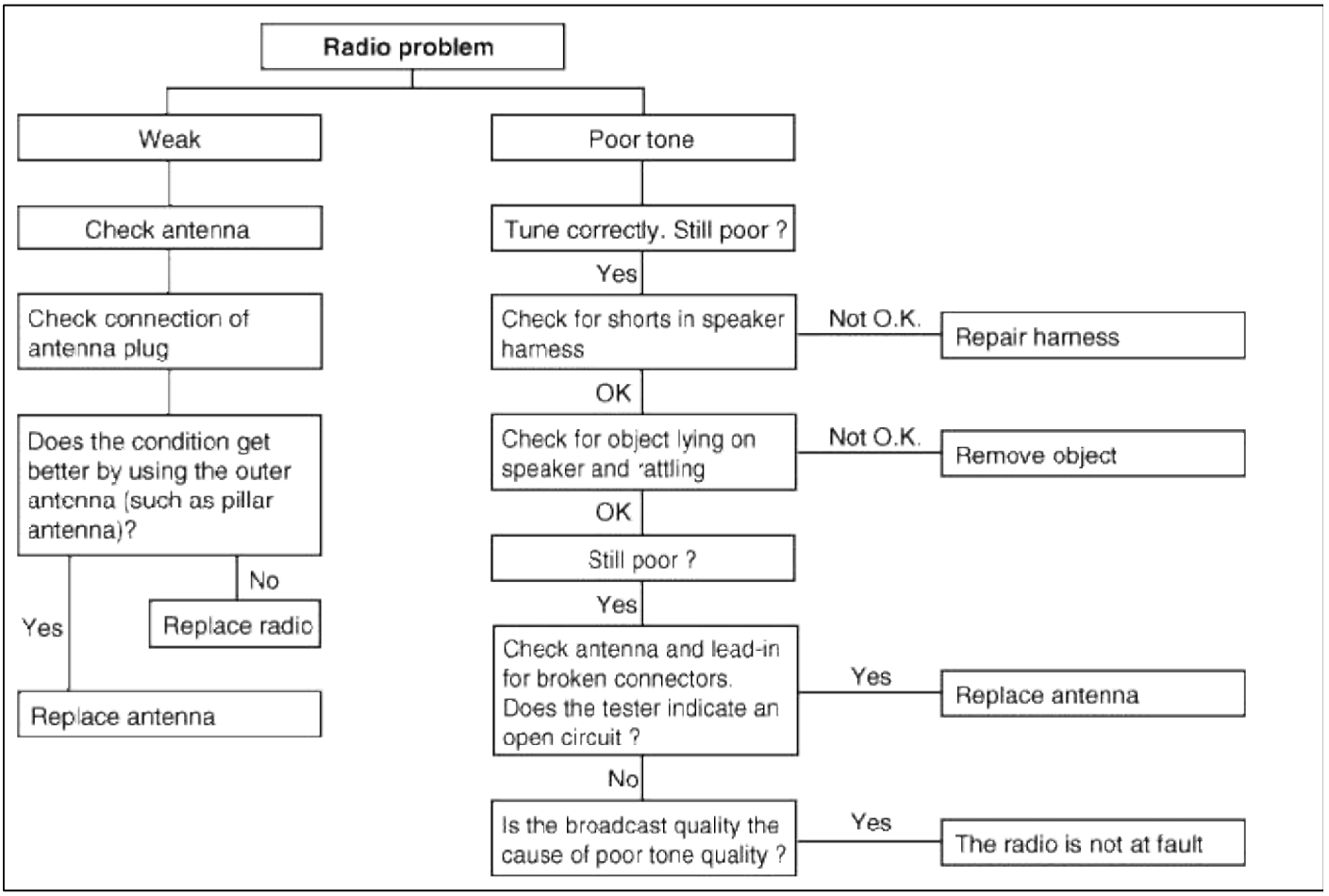


Chart 3

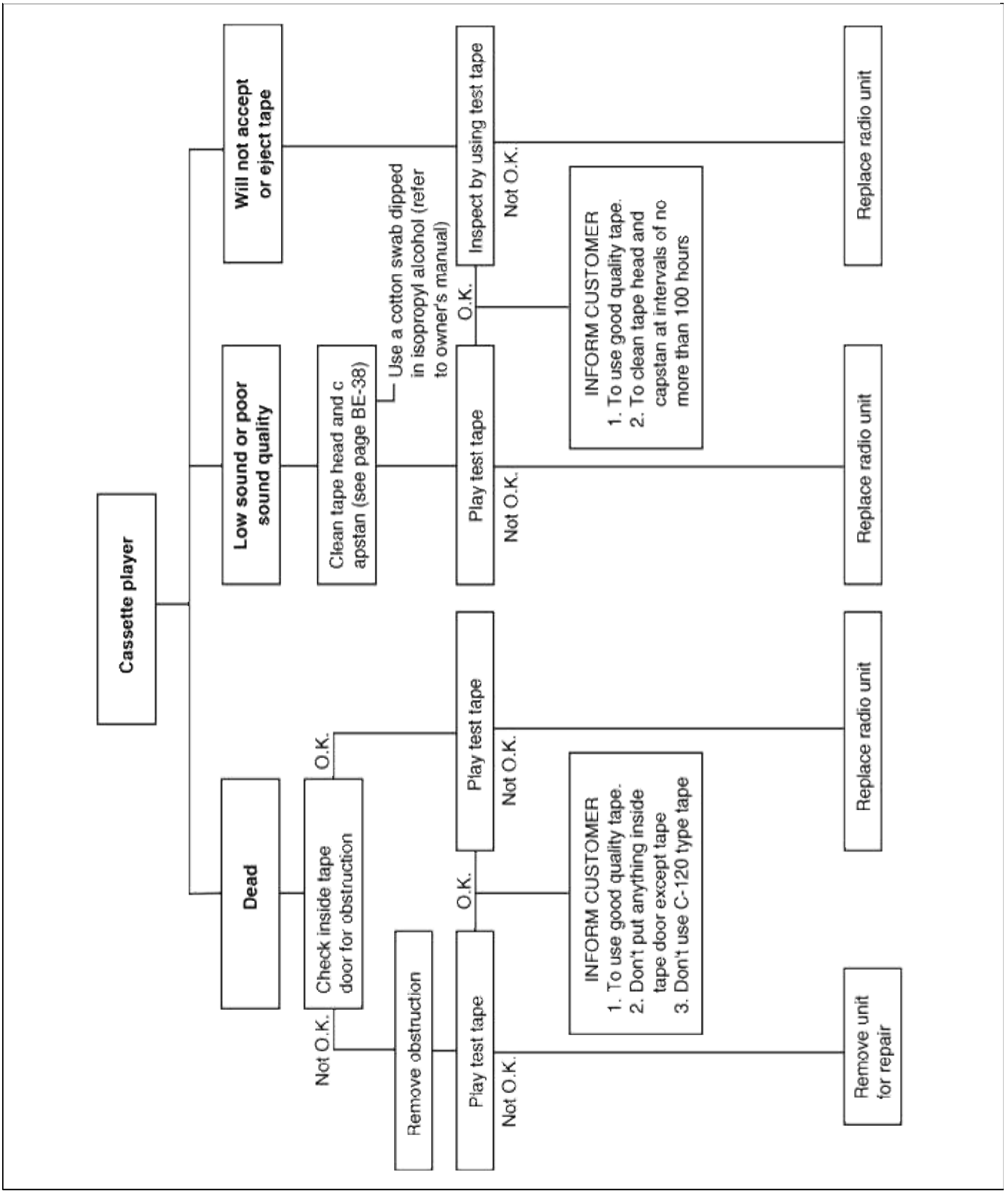
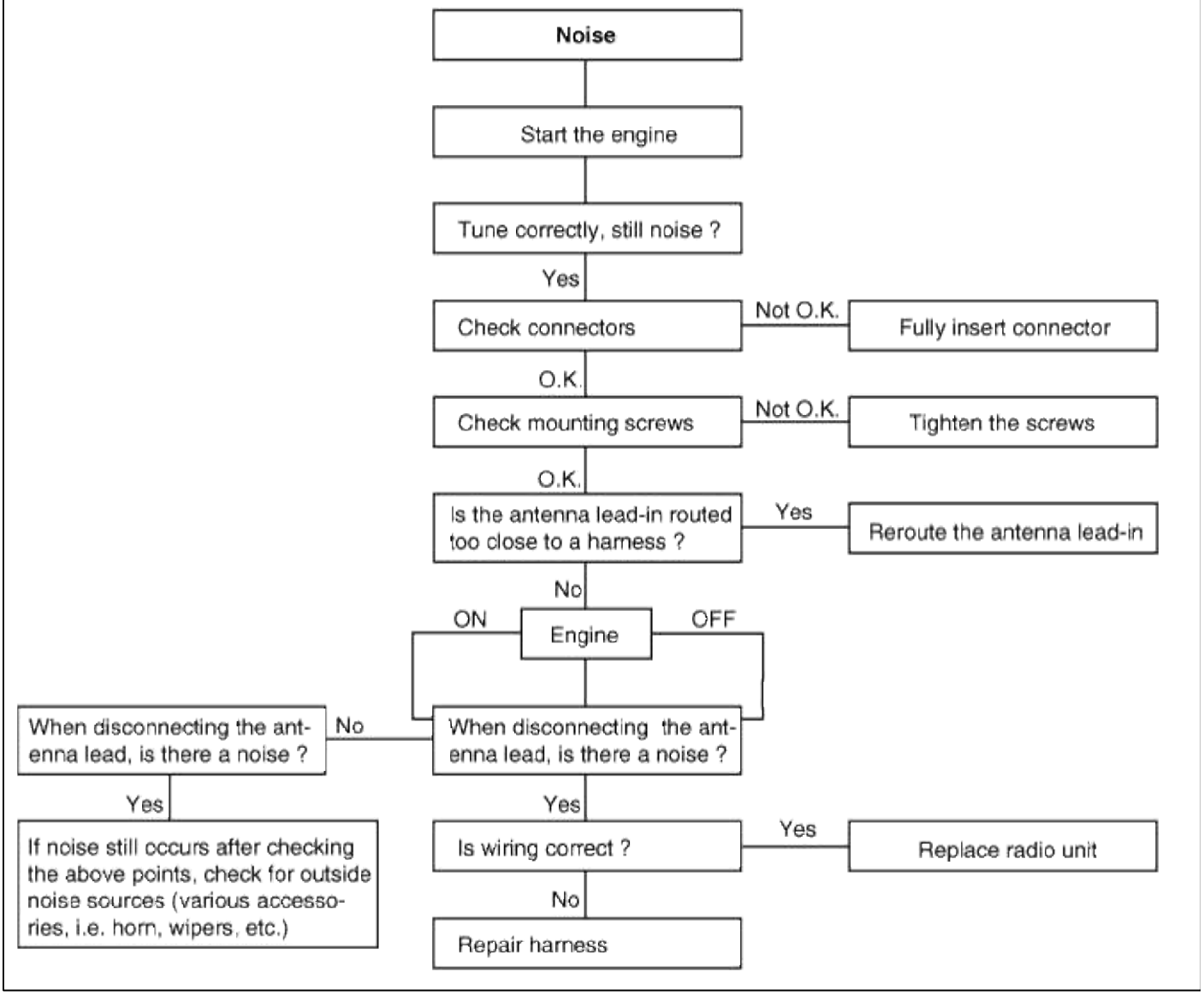

Cassette player
Will not accept or eject tape
Inspect by using test tape
Not O.K.
Replace radio unit
O.K.
Use a cotton swab dipped in isopropyl alcohol (refer to owner's manual)
Low sound or poor sound quality
Clean tape head and c apstan (see page BE-38)
Play test tape
Not O.K.
Replace radio unit
O.K.
INFORM CUSTOMER
1. To use good quality tape.
2. To clean tape head and capstan at intervals of no more than 100 hours
Dead
Check inside tape door for obstruction
O.K.
Play test tape
Not O.K.
Replace radio unit
Not O.K.
Remove obstruction
O.K.
INFORM CUSTOMER
1. To use good quality tape.
2. Don't put anything inside tape door except tape
3. Don't use C-120 type tape
Play test tape
Not O.K.
Remove unit for repair

Chart 4

1. RADIO


Noise
Start the engine
Tune correctly, still noise ?
Yes
Check connectors
Not O.K.
Fully insert connector
O.K.
Check mounting screws
Not O.K.
Tighten the screws
O.K.
Is the antenna lead-in routed too close to a harness ?
Yes
Reroute the antenna lead-in
No
ON
Engine
OFF
When disconnecting the antenna lead, is there a noise ?
No
When disconnecting the antenna lead, is there a noise ?
Yes
If noise still occurs after checking the above points, check for outside noise sources (various accessories, i.e. horn, wipers, etc.)
Yes
Is wiring correct ?
Yes
Replace radio unit
No
Repair harness

2. TAPE

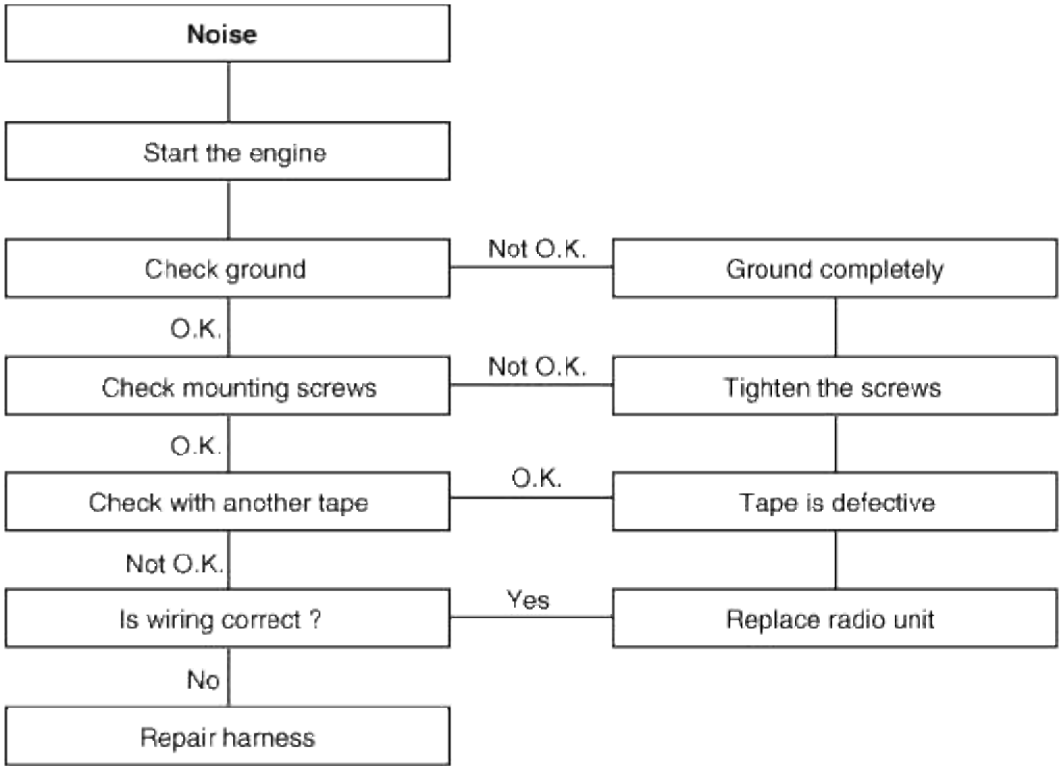
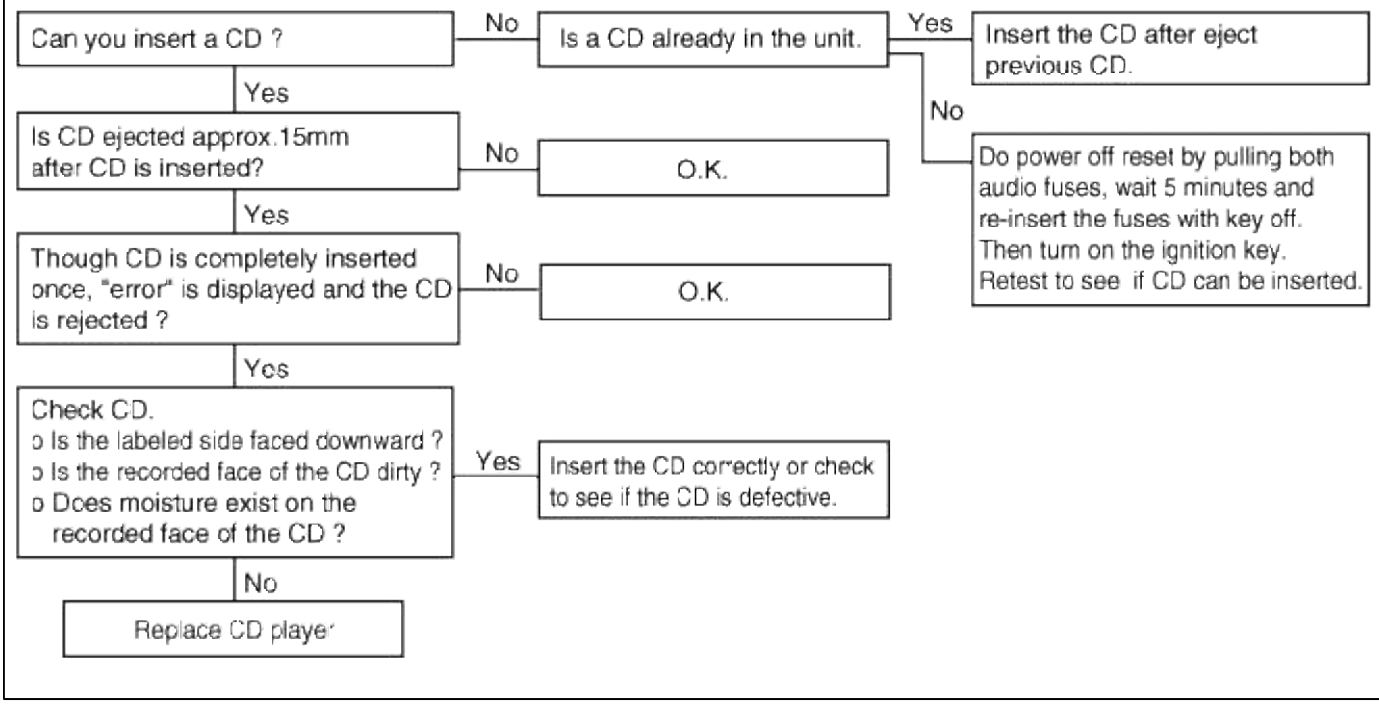
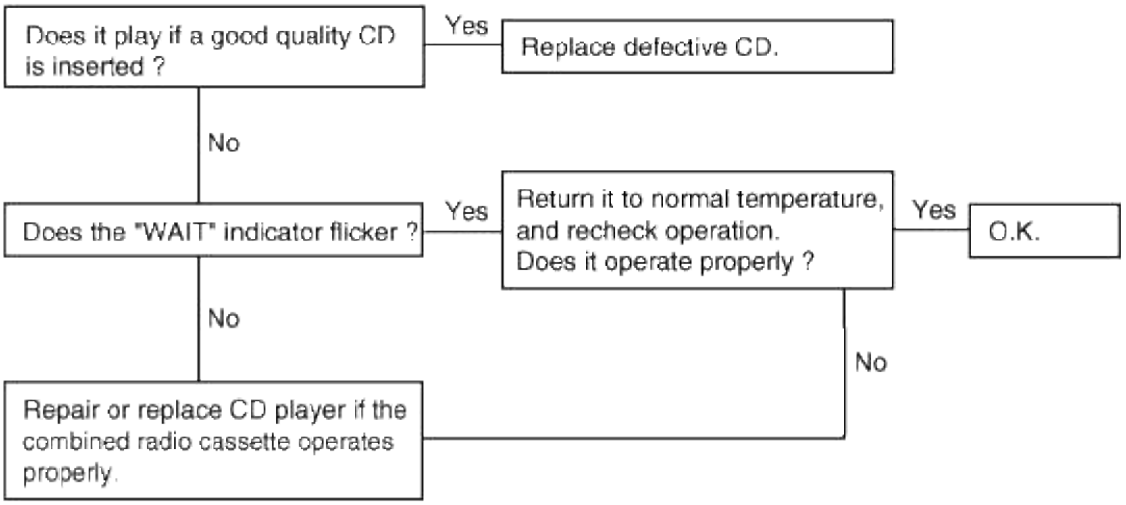


Chart 5

1. CD WILL NOT BE ACCEPTED

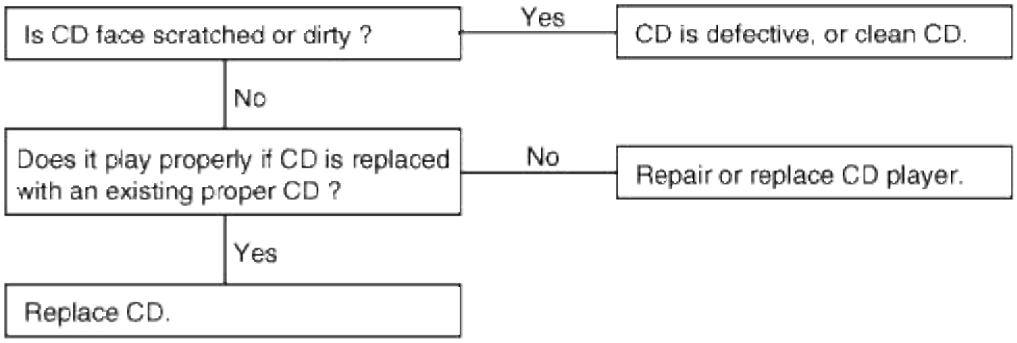


2. NO SOUND

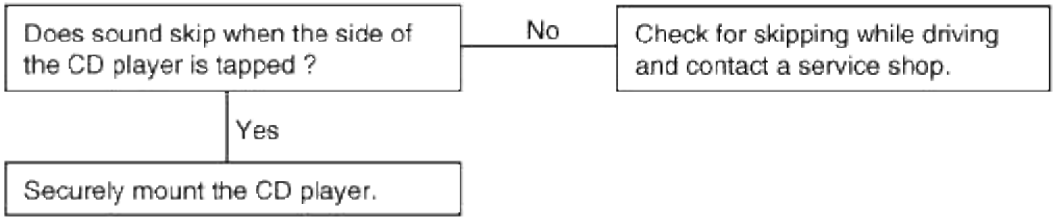


3. CD SOUND SKIPS

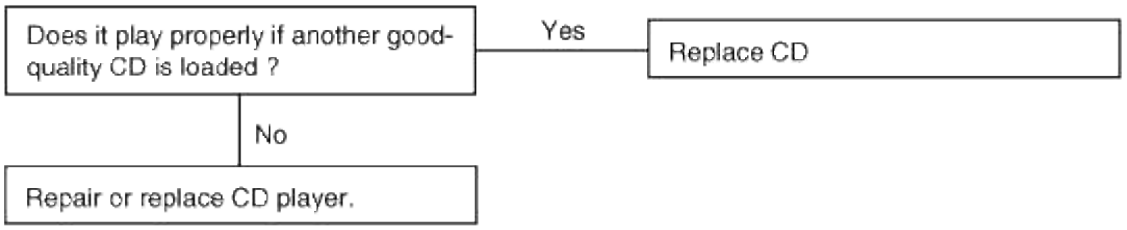
1) Sound sometimes skips when parking.



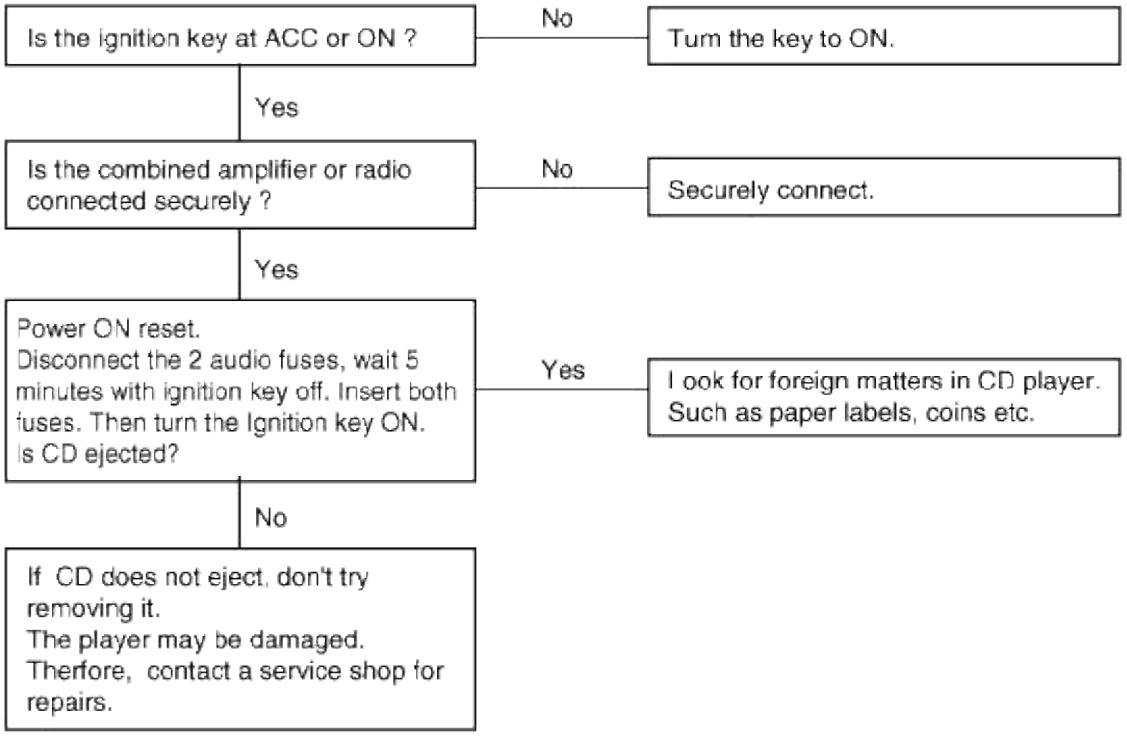
2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)



4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER

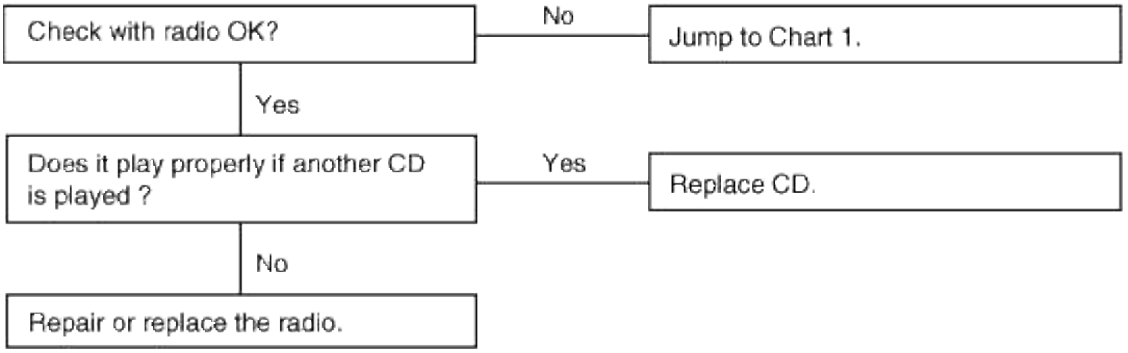


Chart 6

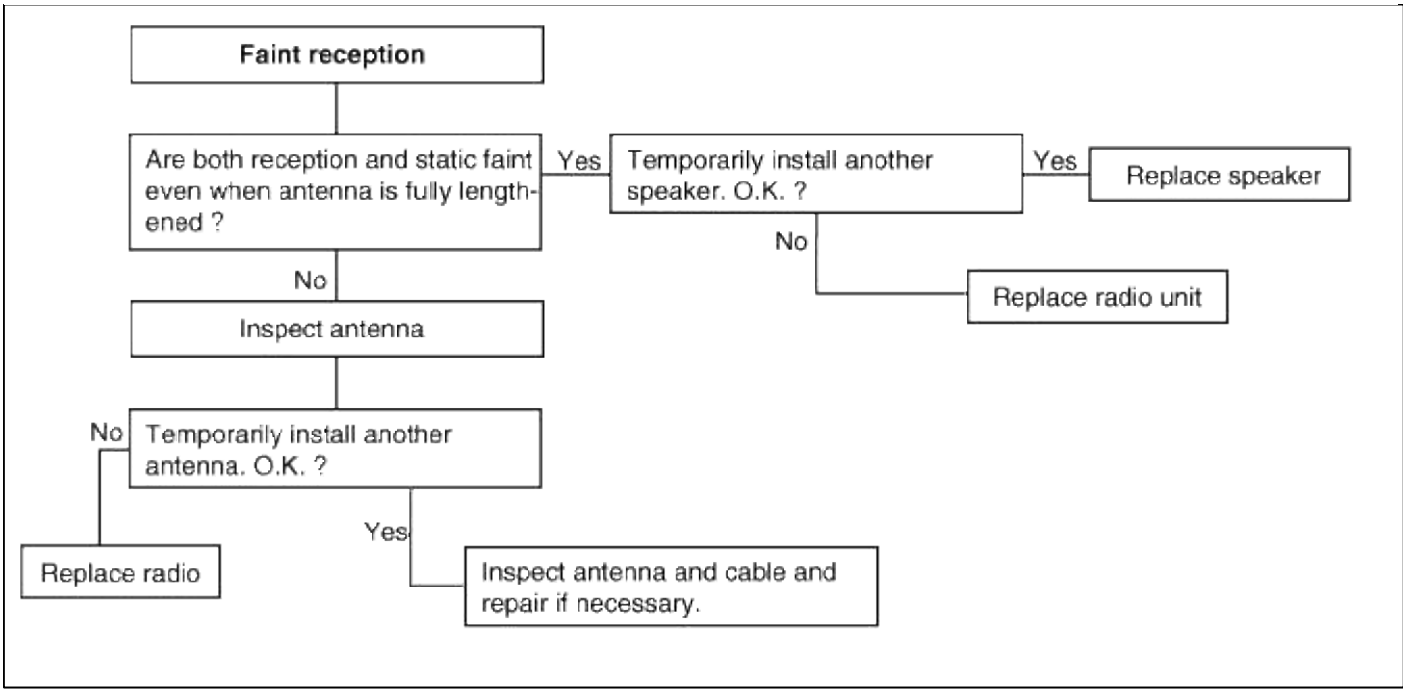


Chart 7

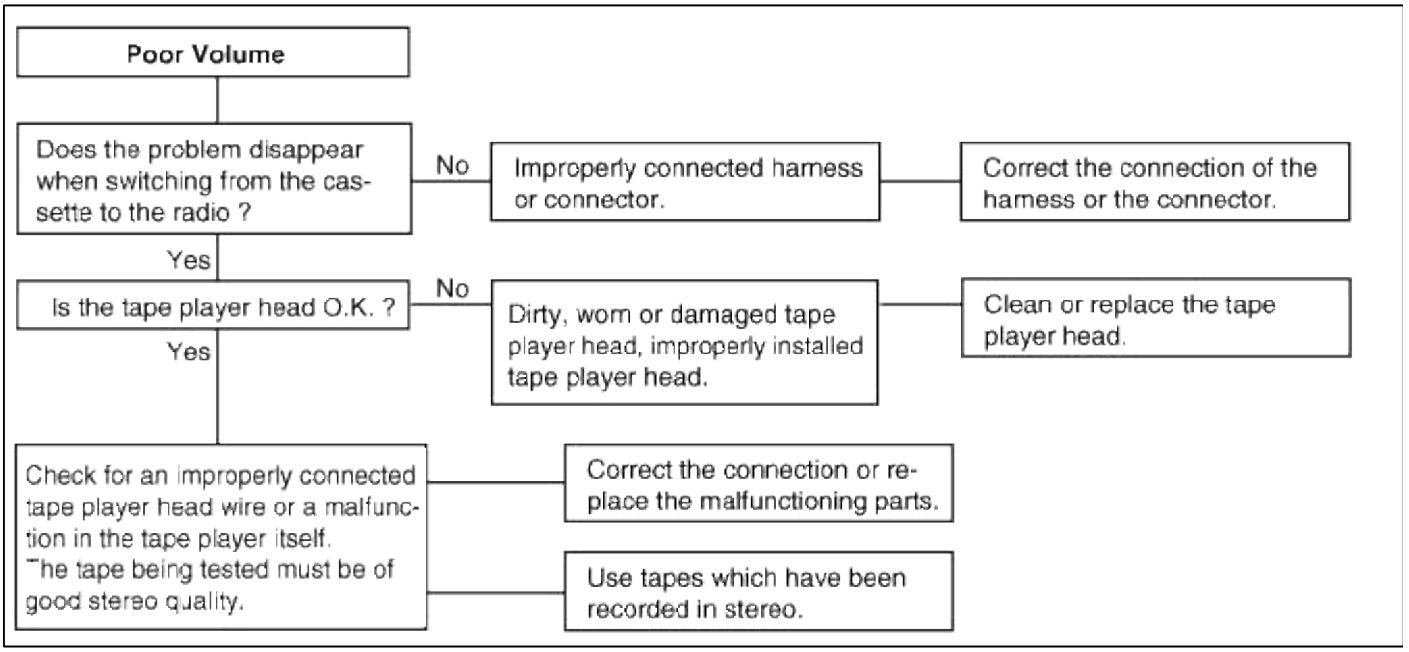


Chart 8

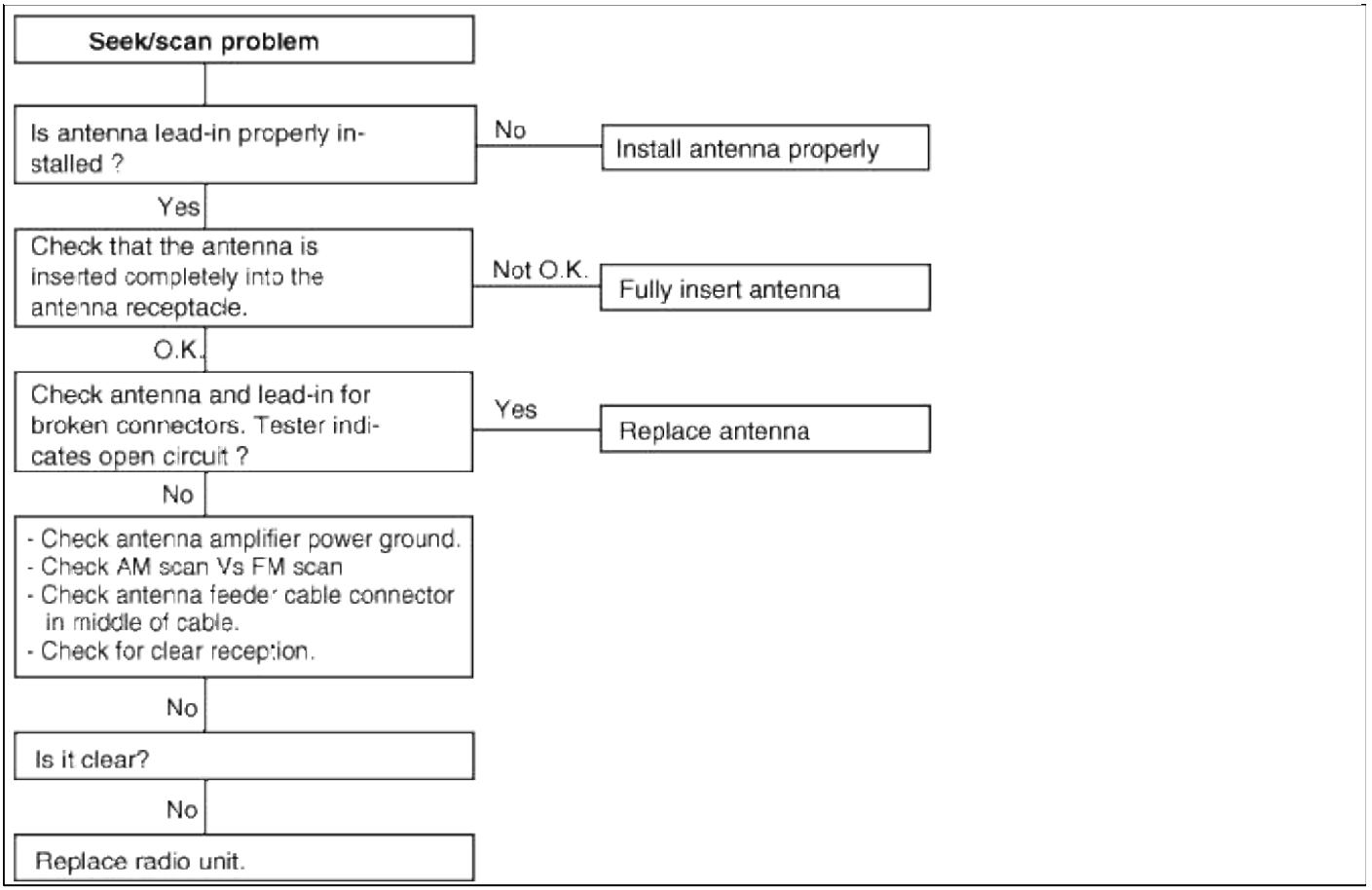
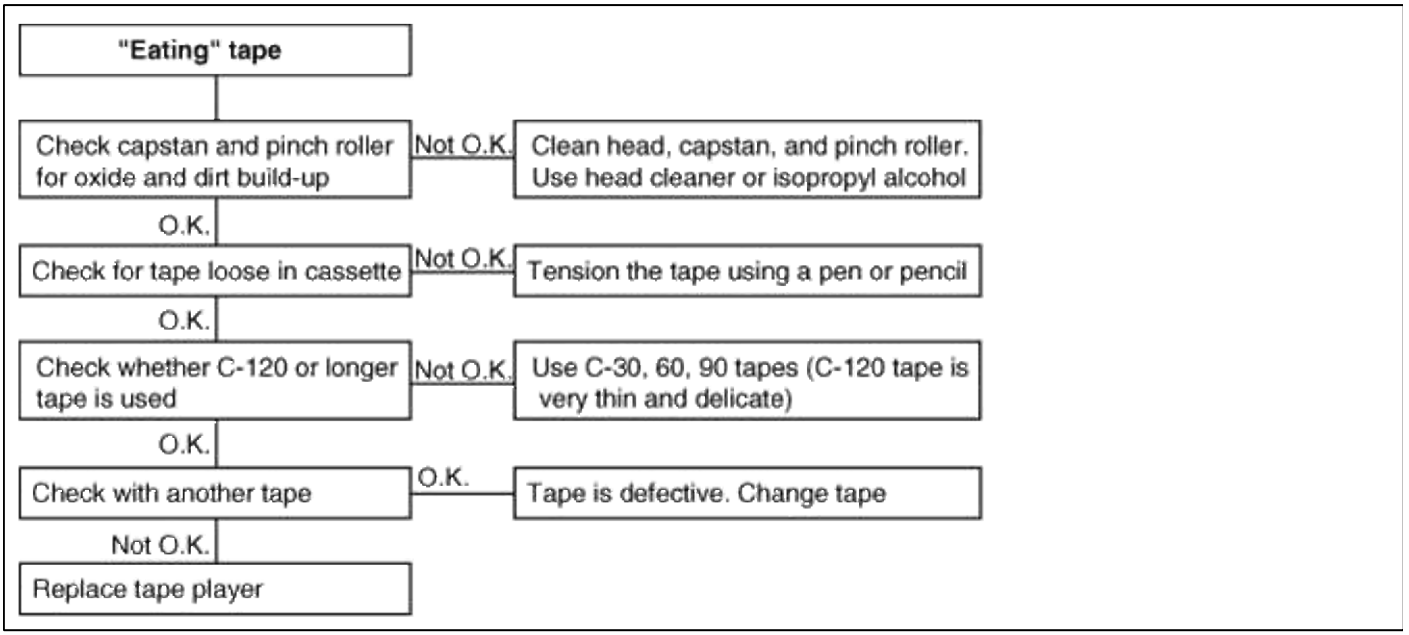
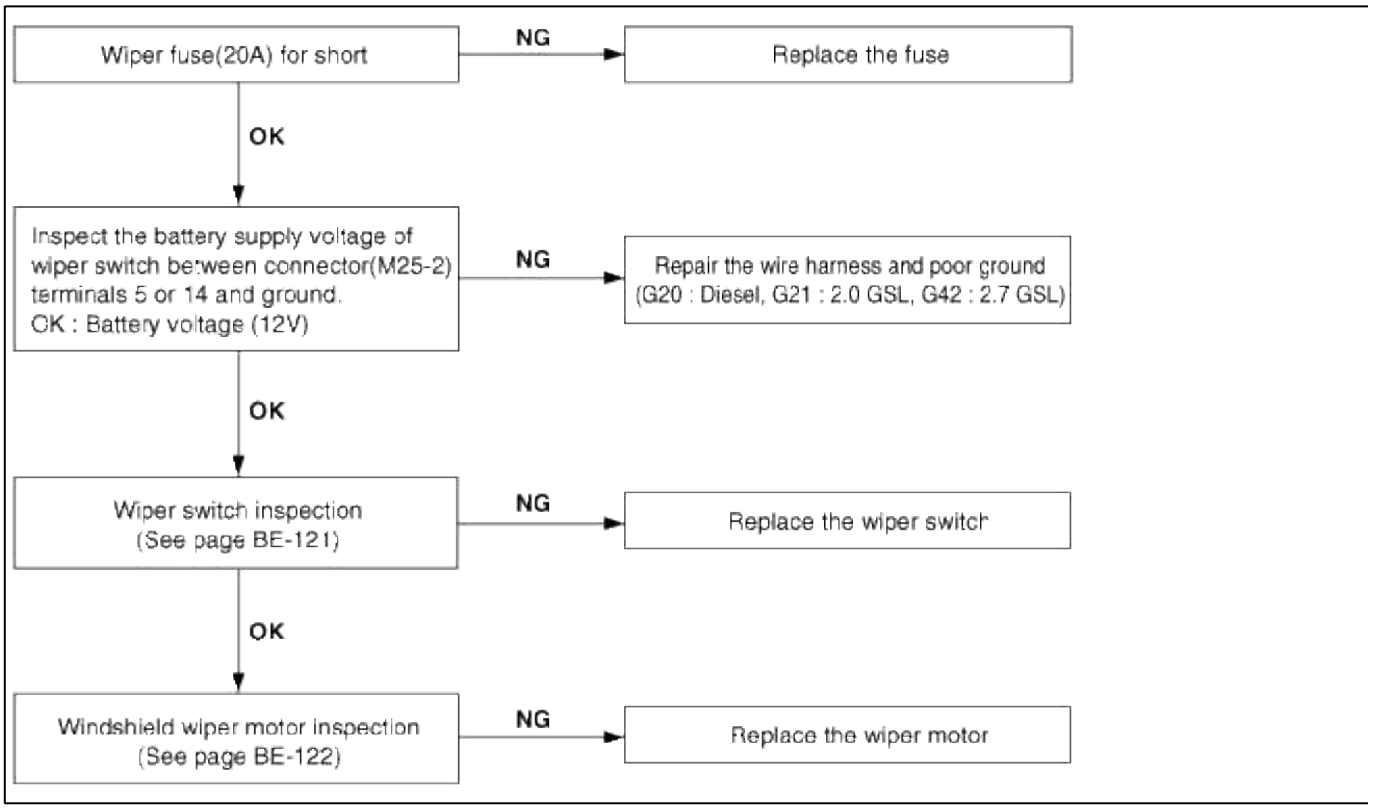


Chart 9

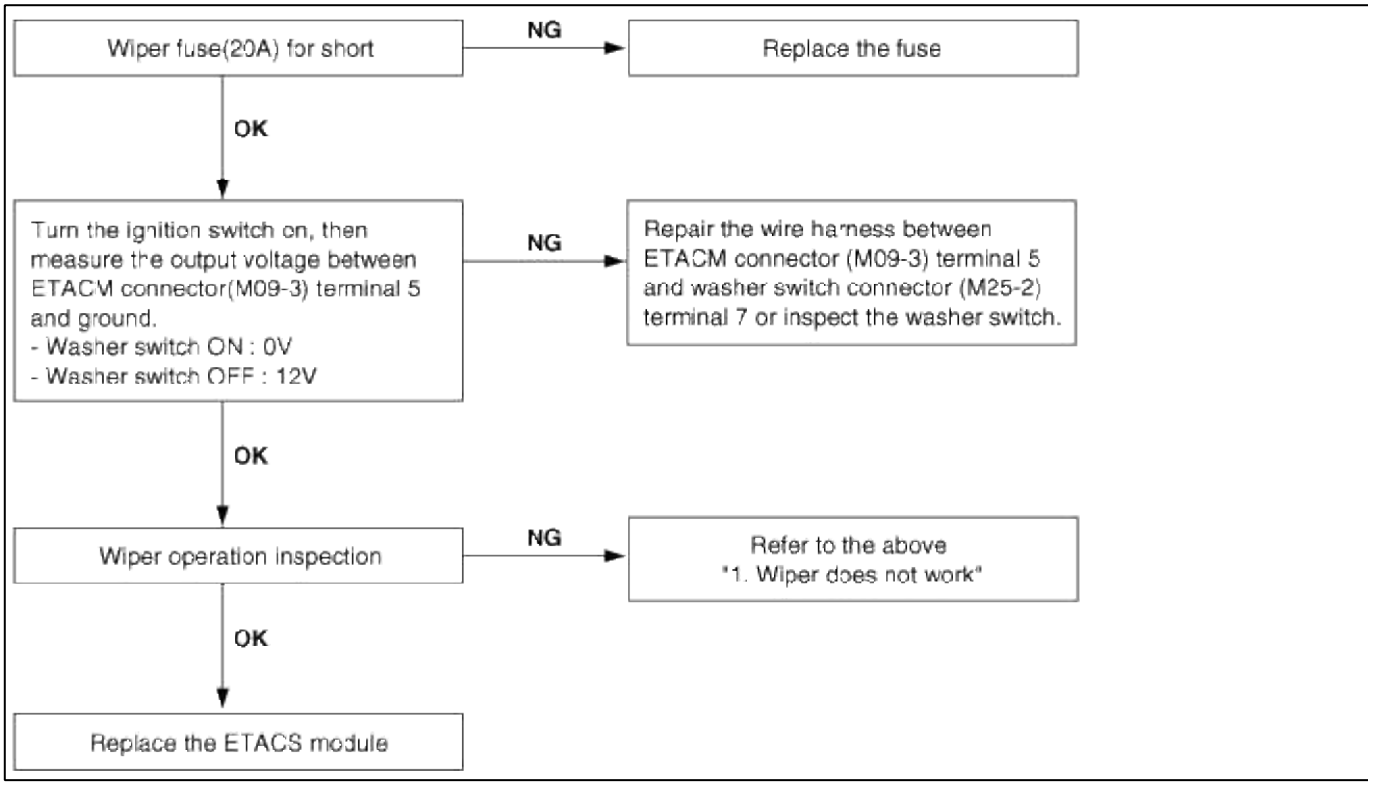


WINDSHIELD WIPER

1. Wiper low and wiper high do not work.

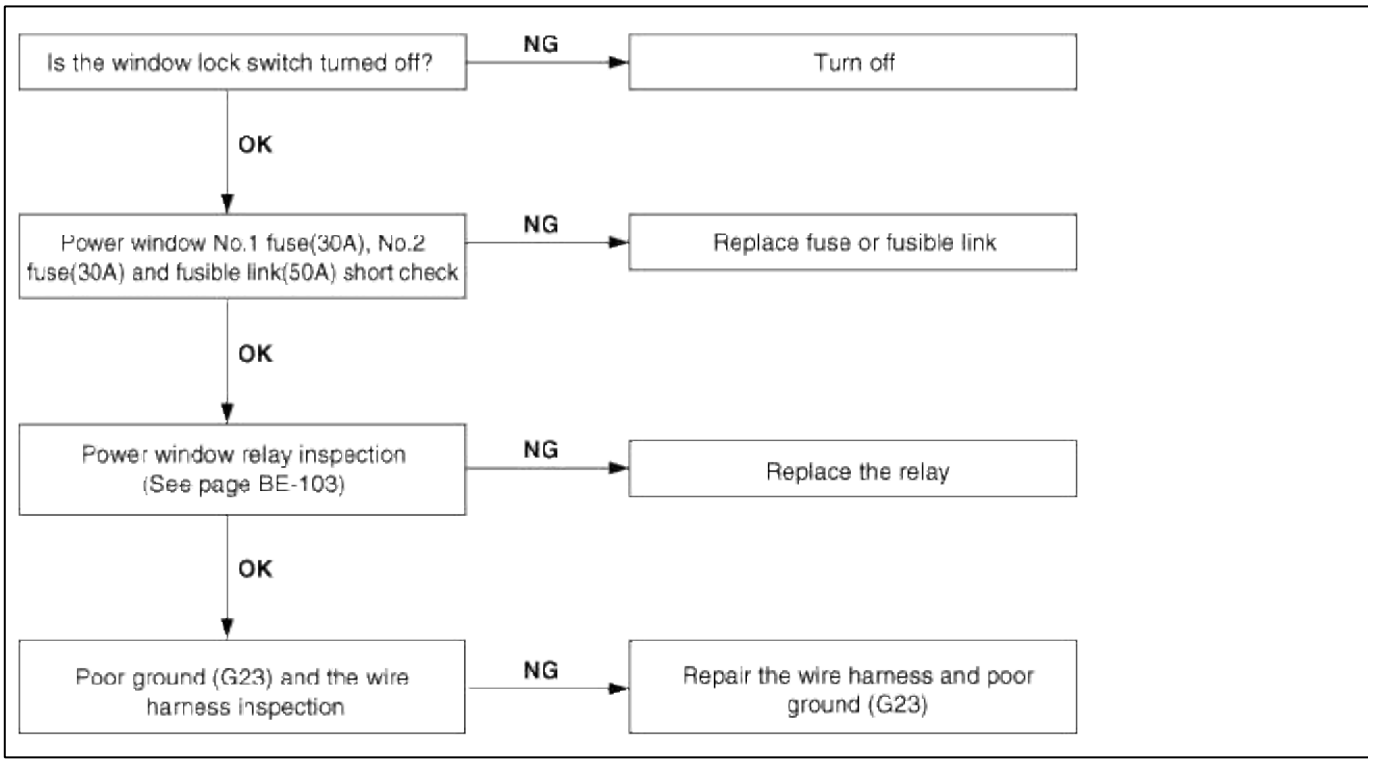


2. When washer switch is on, wiper does not work.

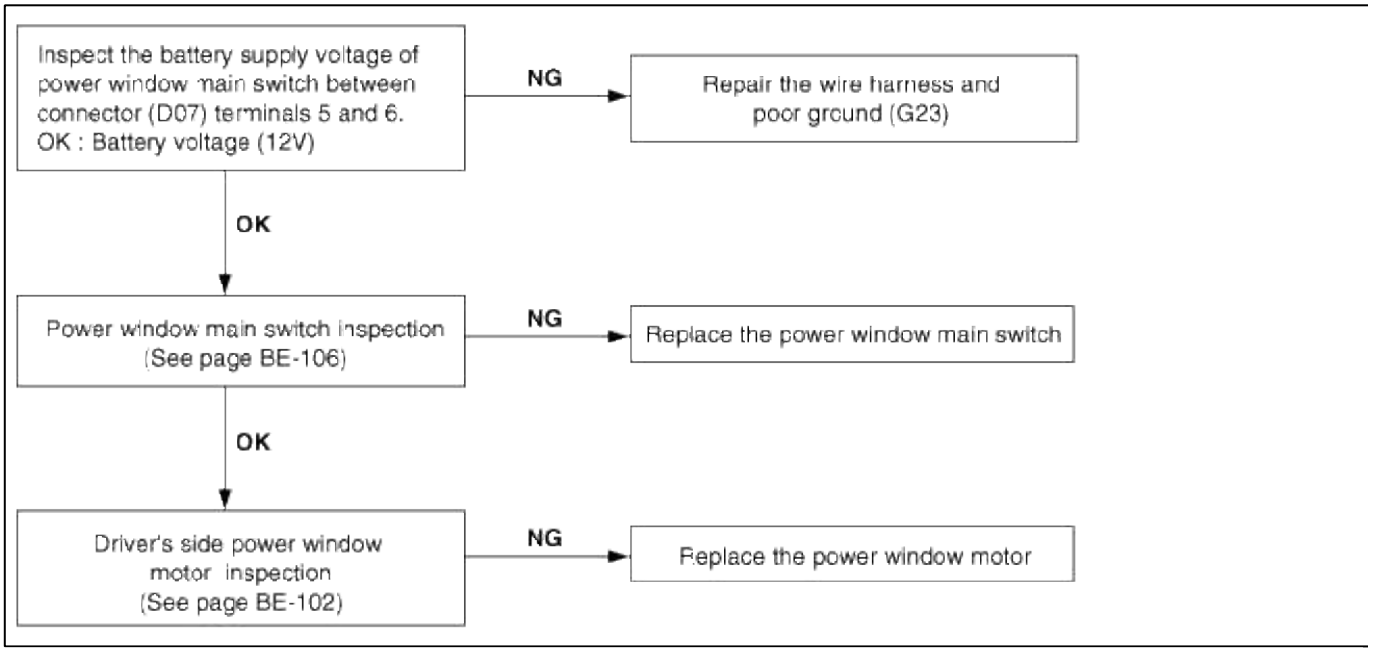


POWER WINDOW

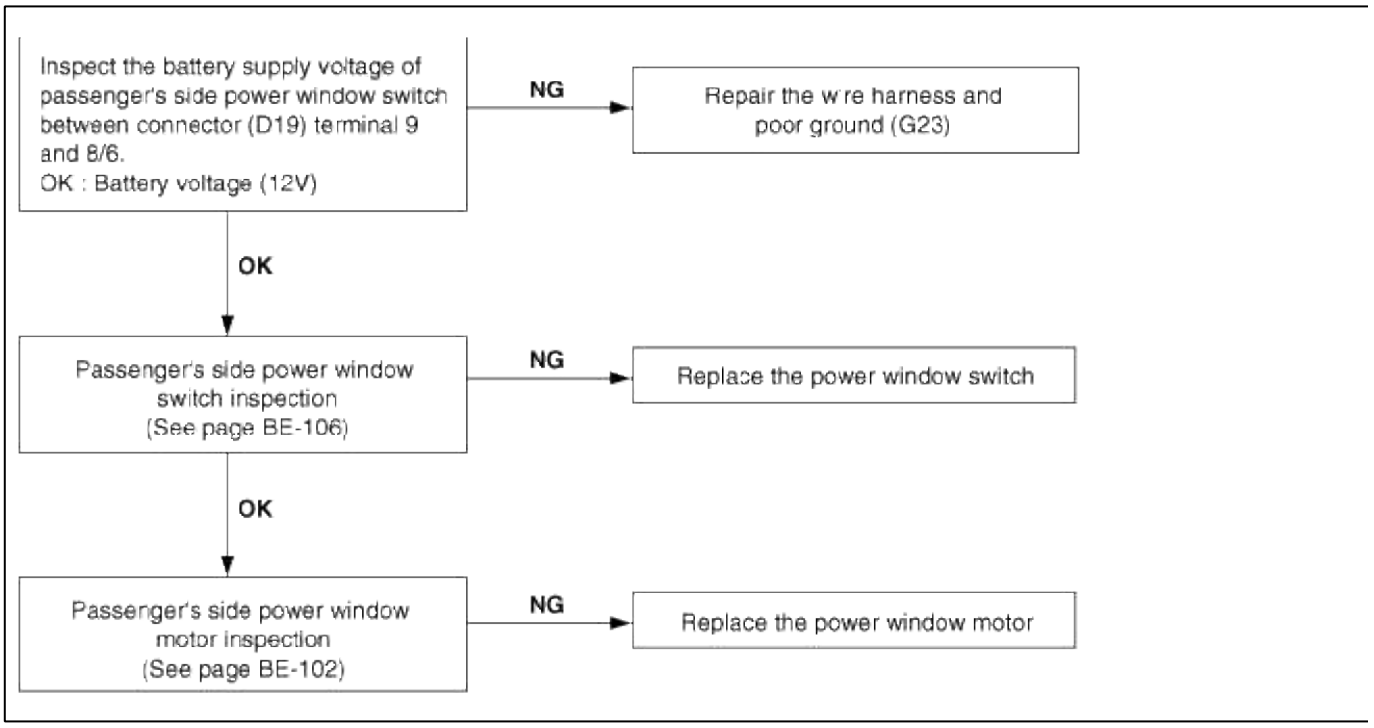
1. No windows operate from the main switch on the driver's door.



2. Driver's side window does not operate.

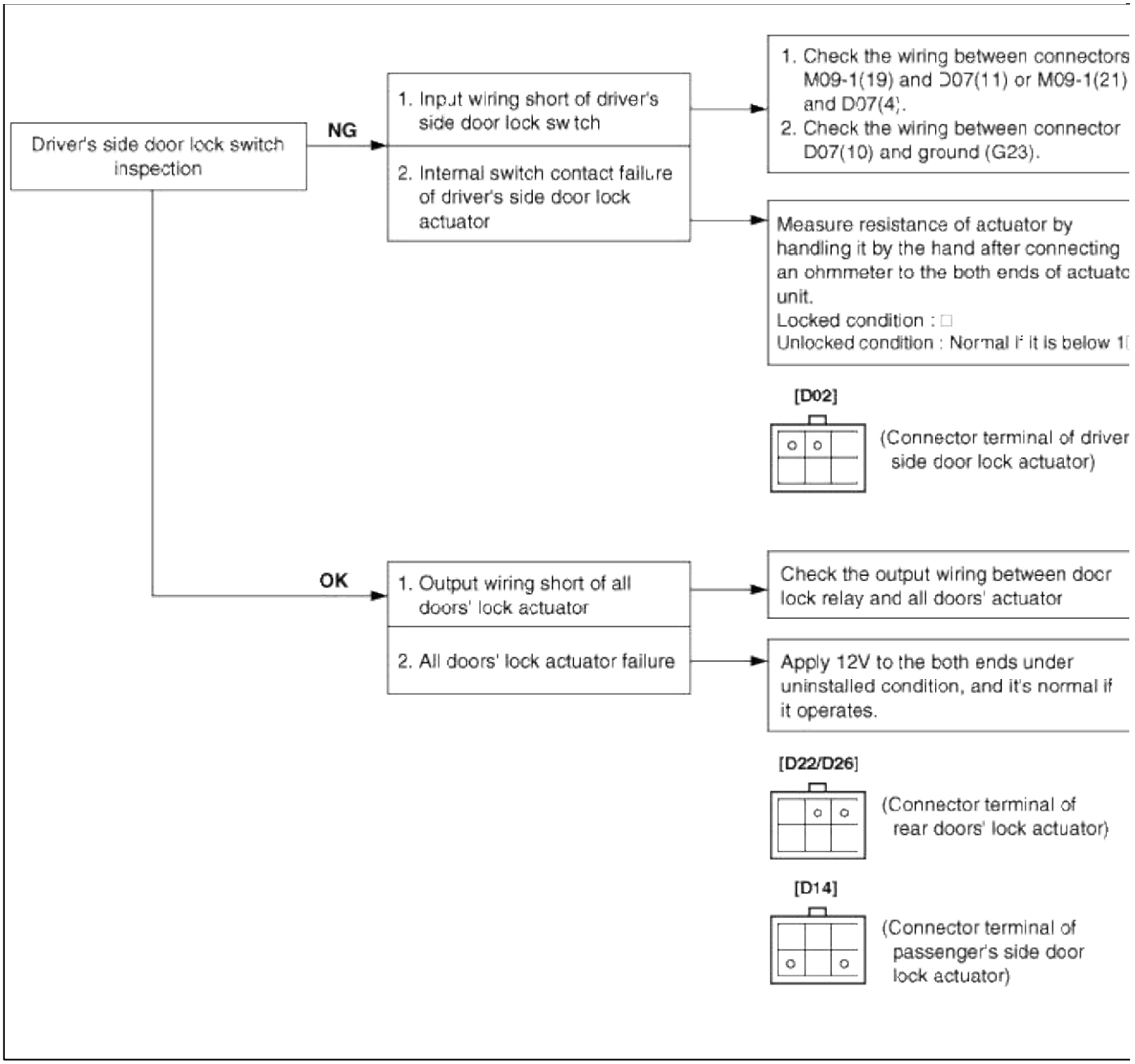


3. Passenger's side window does not operate.

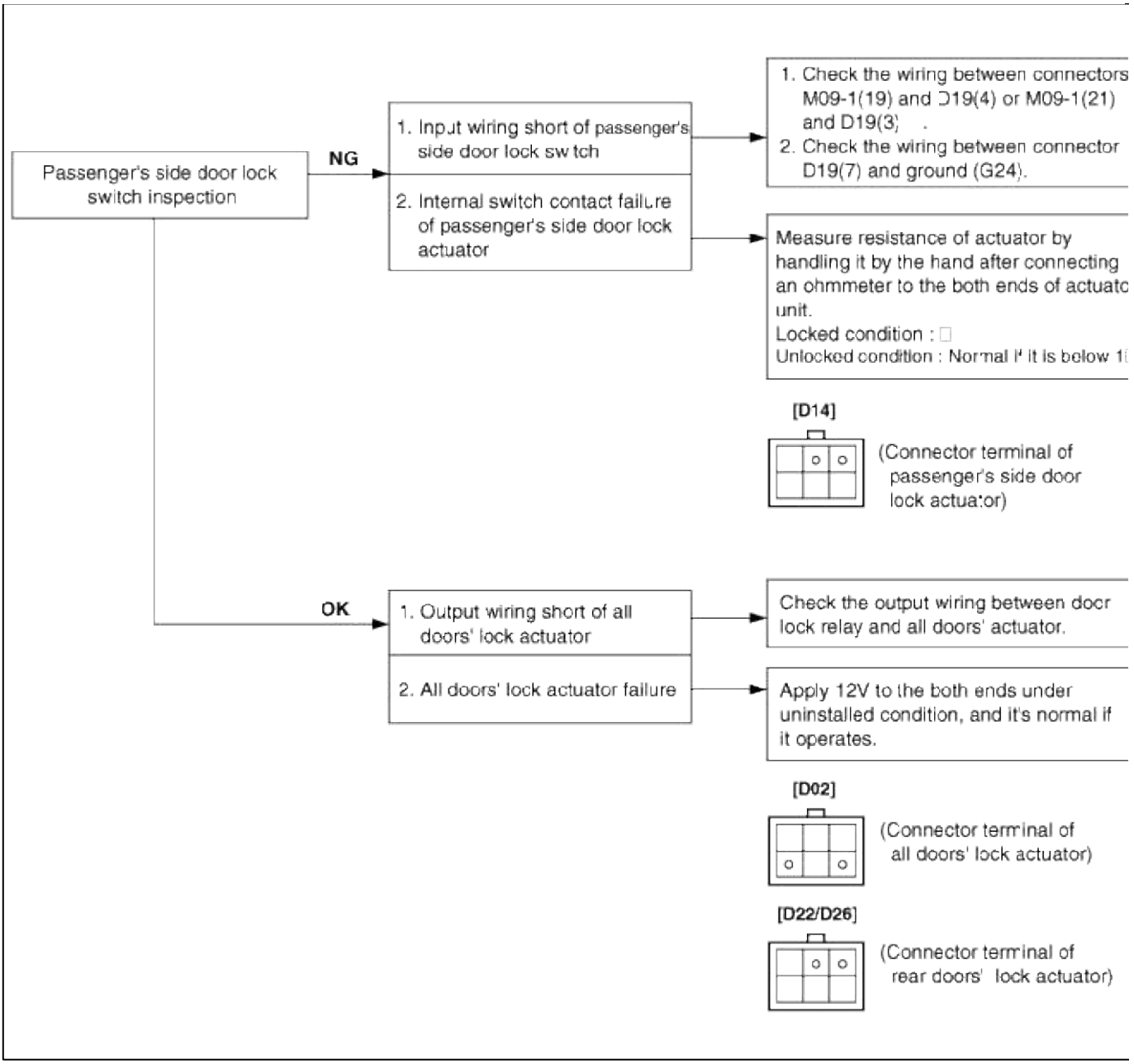


POWER DOOR LOCK

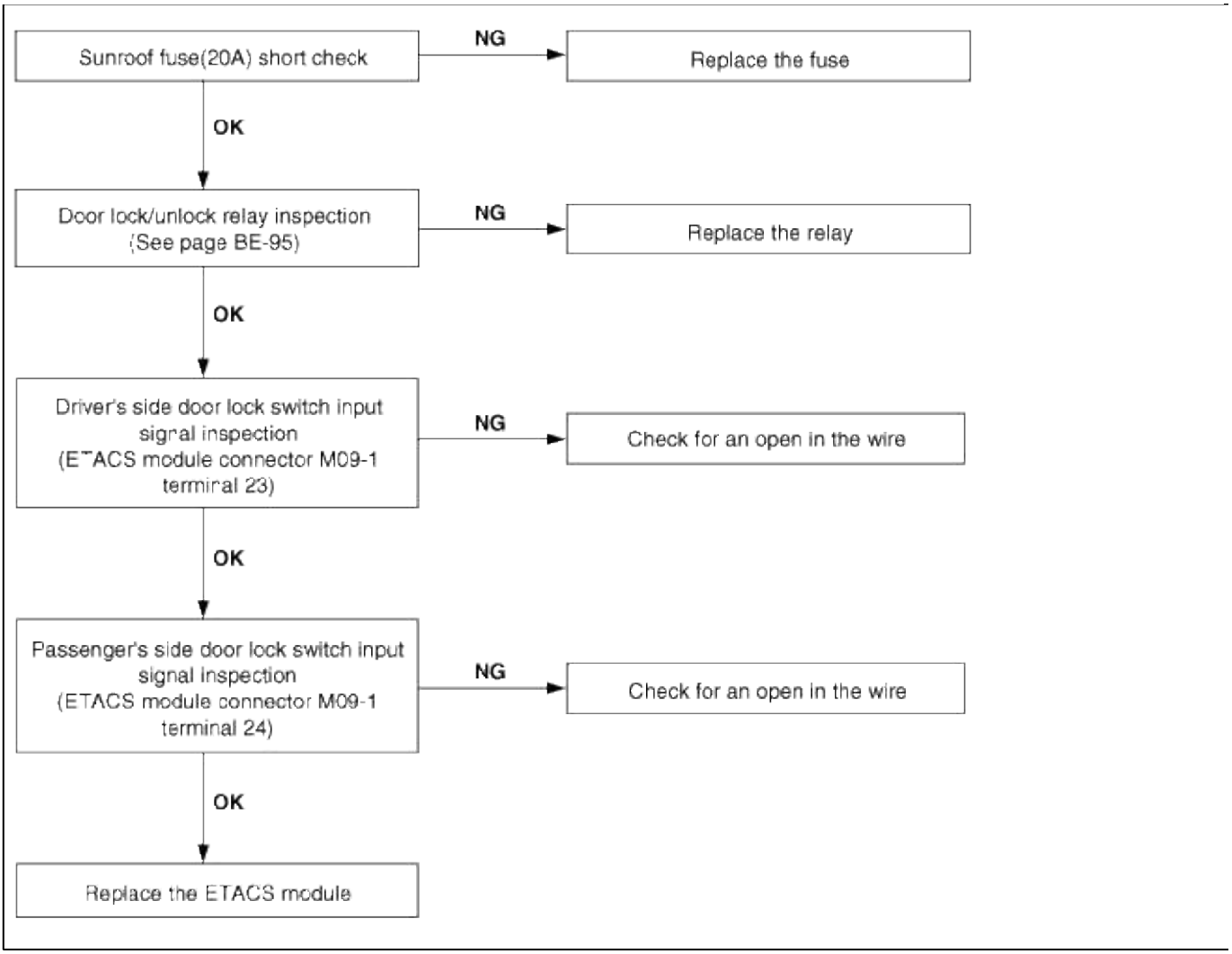
1. Lock function works but unlock function does not work. → Since door unlock relay is malfunctioning, replace the door unlock relay.
2. Unlock function works but lock function does not work. → Since door lock relay is malfunctioning, replace the door lock relay.
3. When passenger side knob is controlled, all doors locks, but when driver side knob is controlled, all doors do not lock.



4. When driver side knob is controlled. All doors lock. But when the passenger side knob is controlled, all doors do not lock.

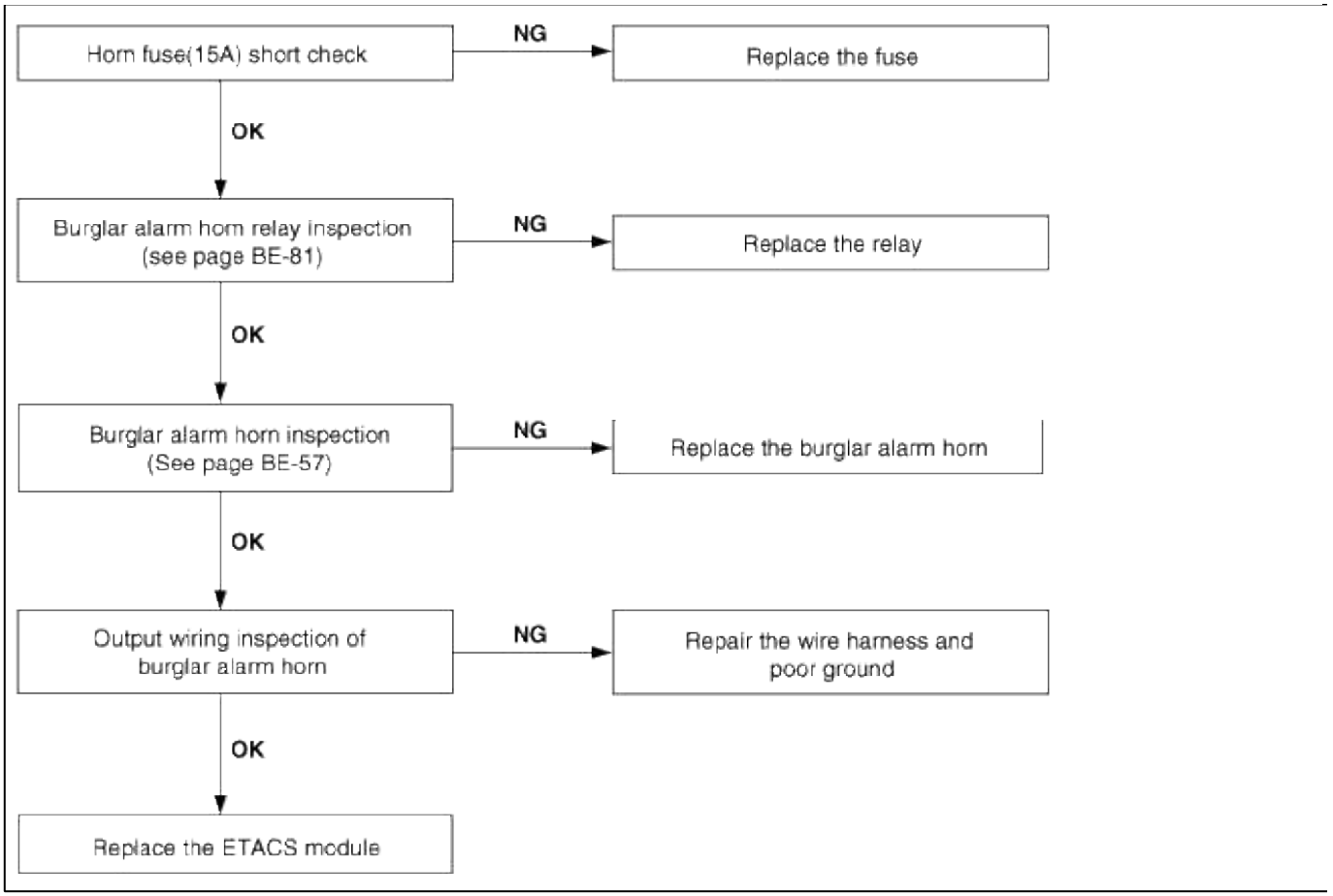


5. Both sides do not lock either.

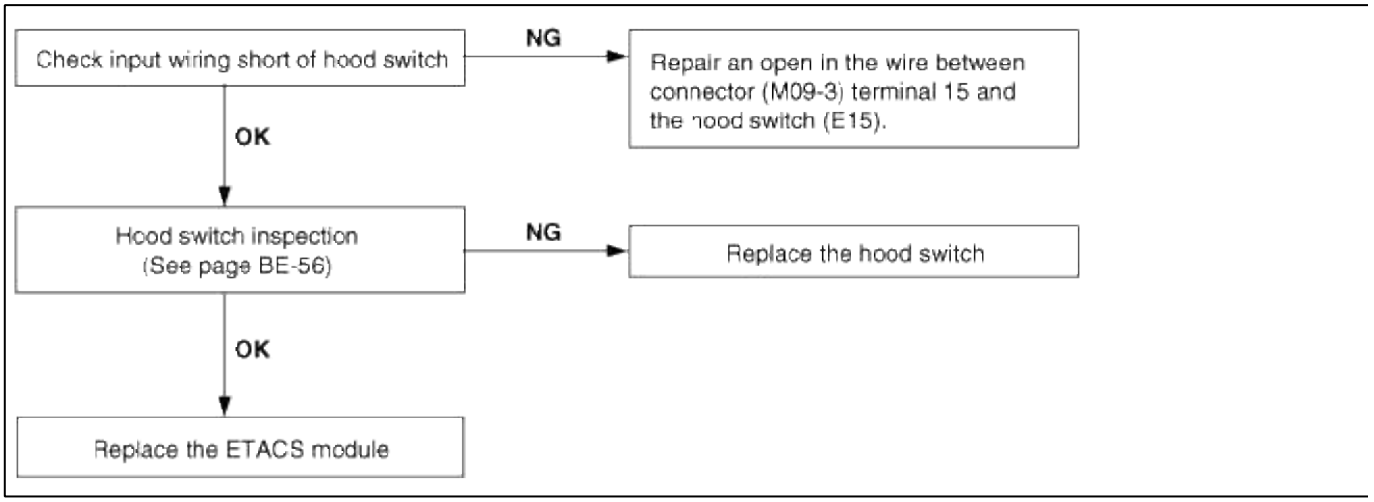


KEYLESS ENTRY & BURGLAR ALARM SYSTEM

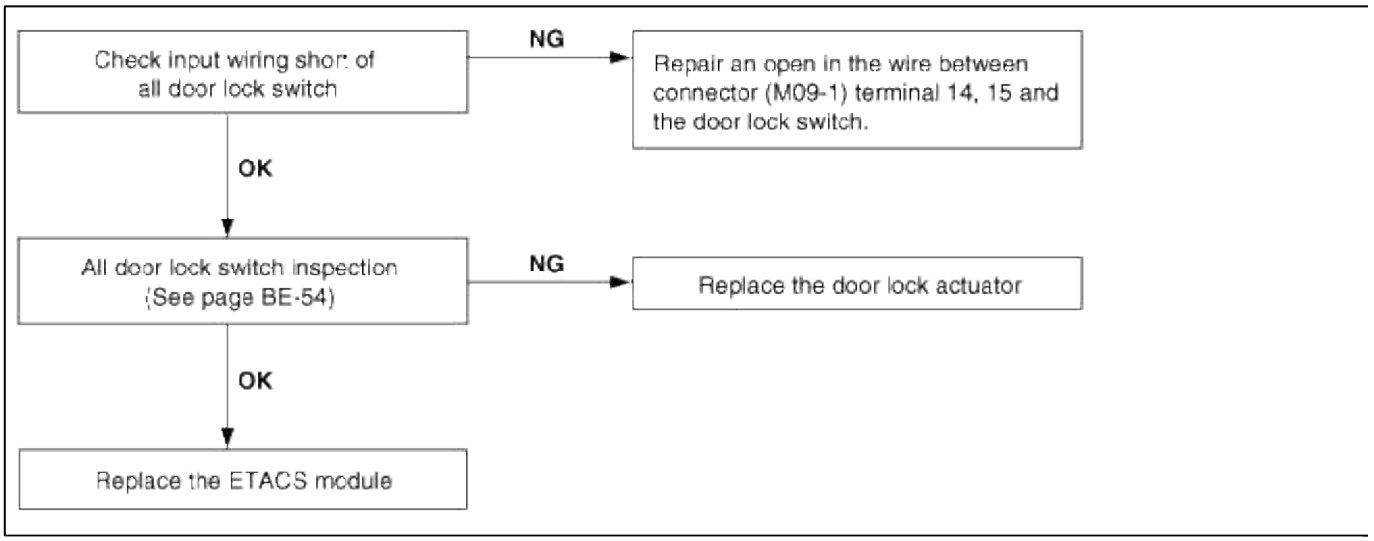
1. Alarm does not work. (Hazard lamp works)



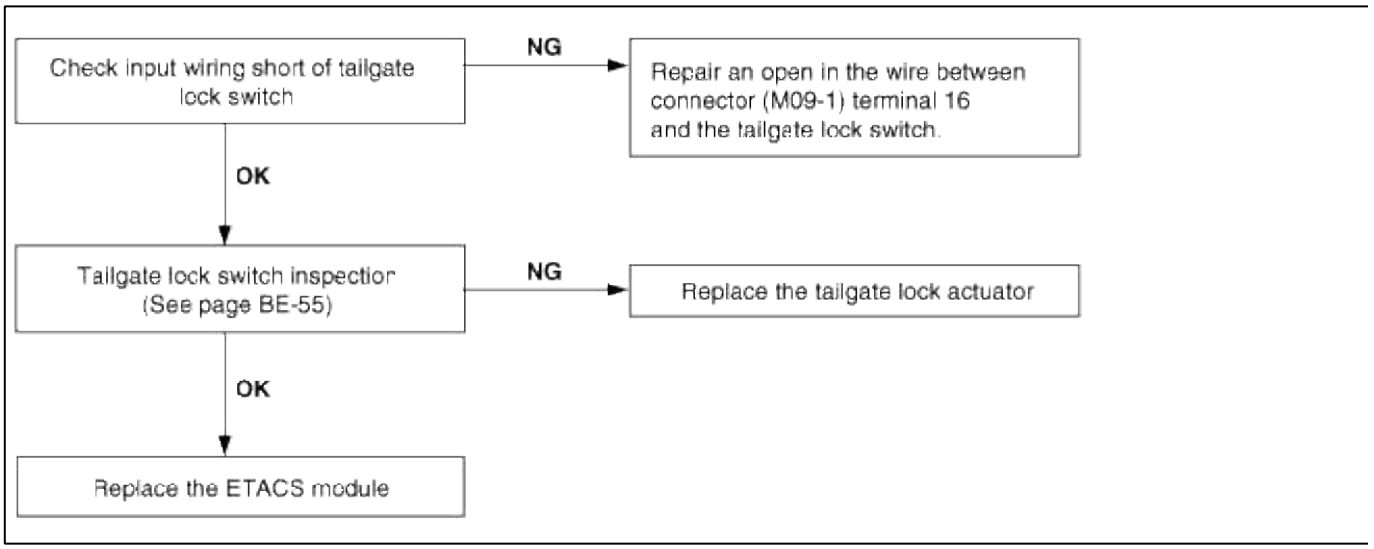
2. When hood is opened inside the car, burglar horn does not work.



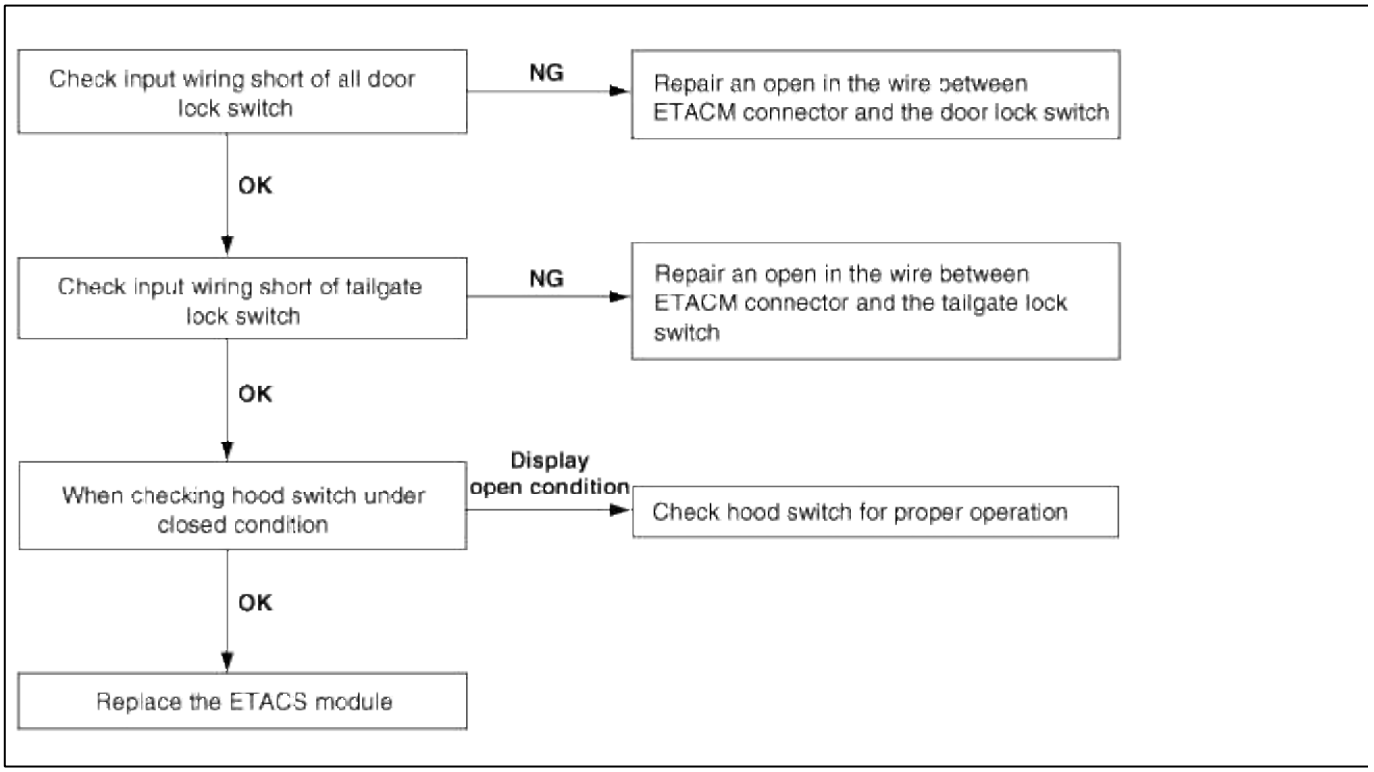
3. When door is opened inside the car, burglar horn does not work (If tailgate and hood is opened, alarm works)



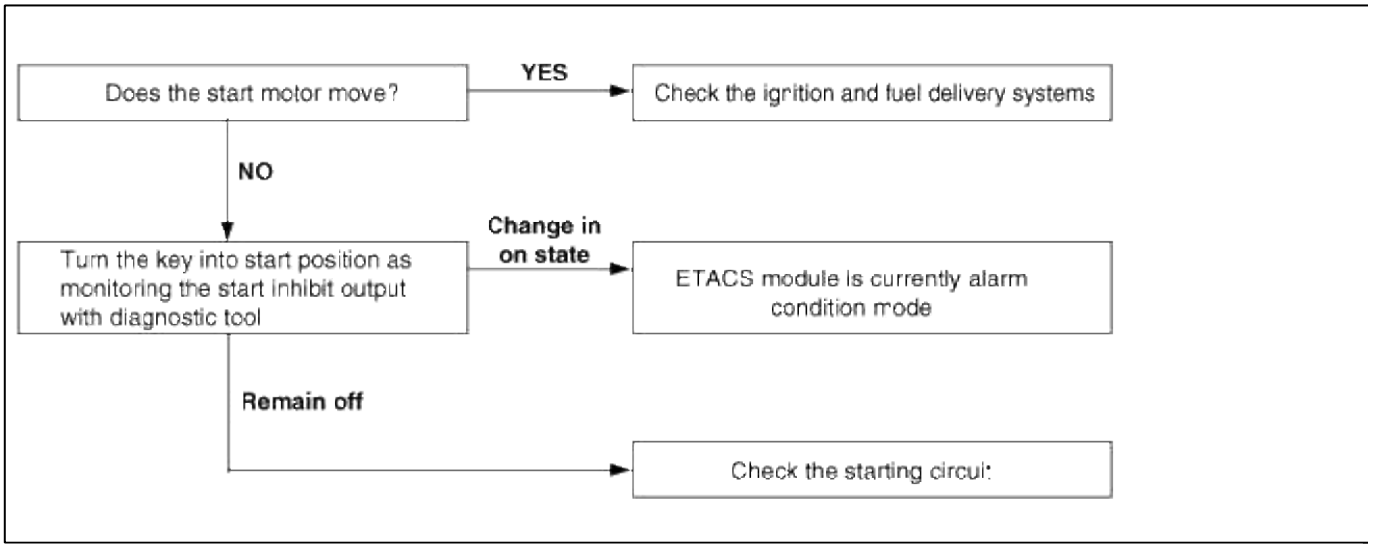
4. When tailgate is opened inside the car, siren does not work.



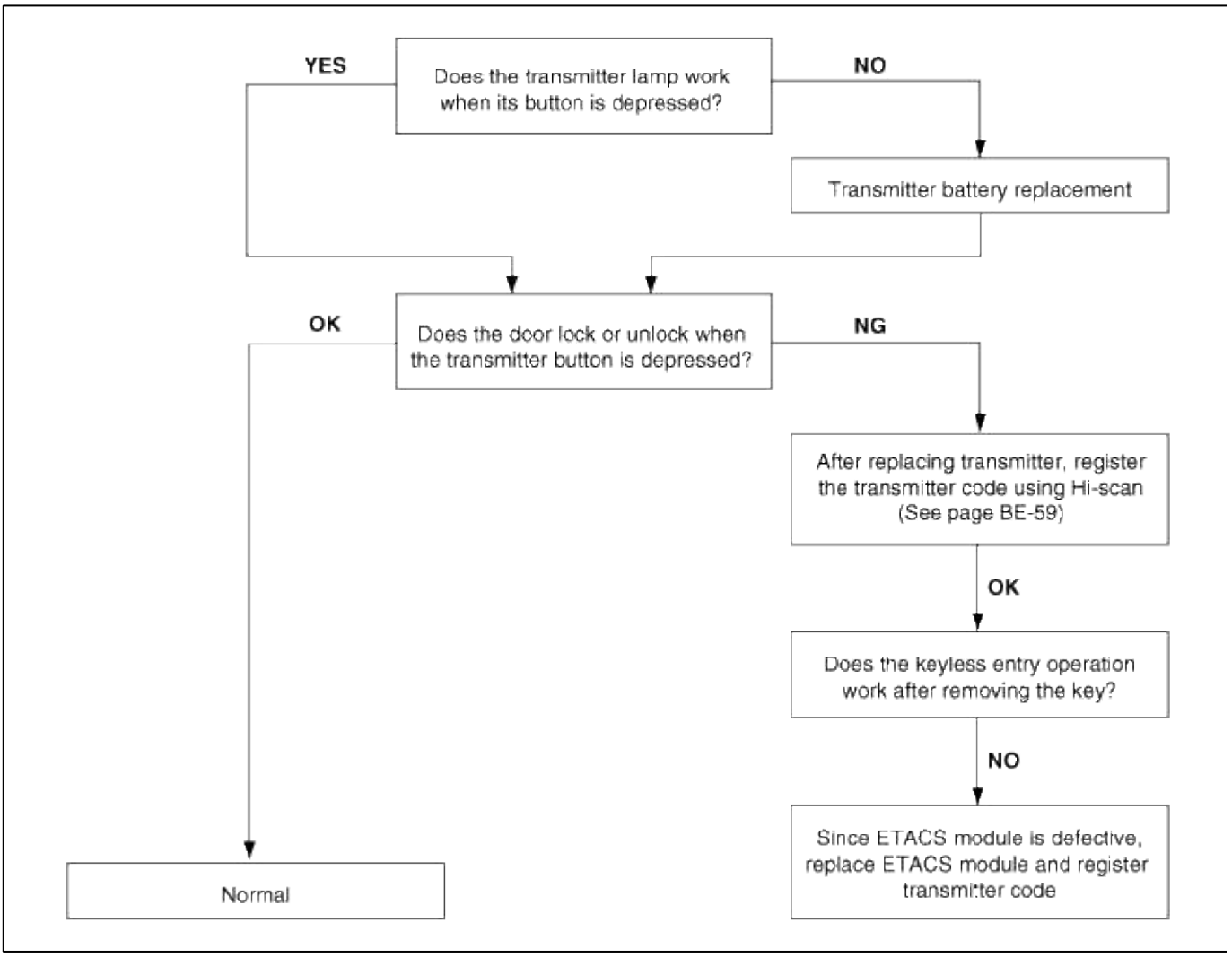
5. When the vehicle is locked by the transmitter, central door lock function works but hazard lamp doesn't blink.



6. Engine does not start, even when the alarm is disarmed.

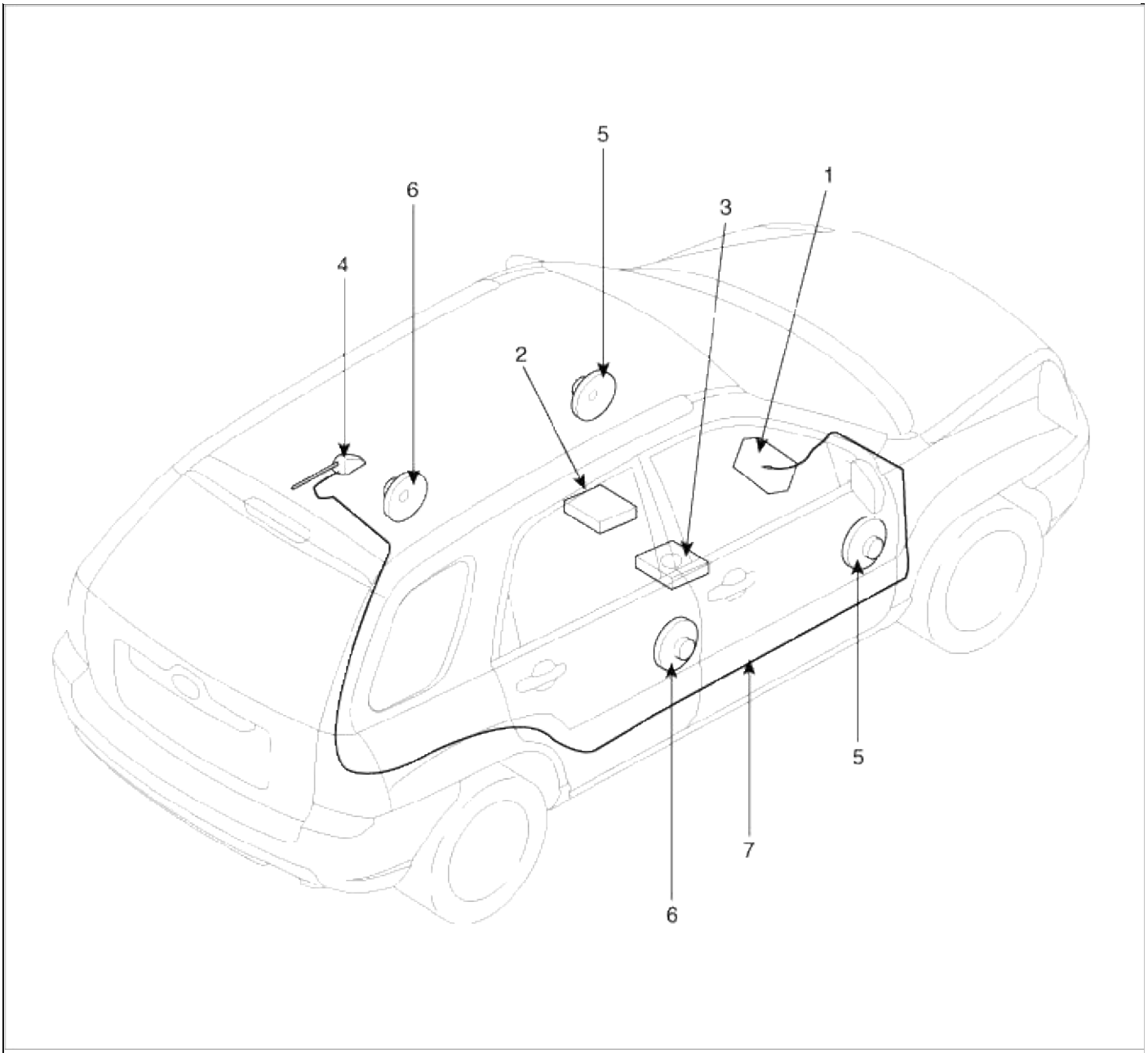


7. Central door lock function works, but keyless entry system does not work.



Body Electrical System > Audio > Components and Components Location

COMPONENTS



1. Audio unit
2. External amp
3. Woofer speaker
4. Roof antenna
5. Front door speaker
6. Rear door speaker
7. Antenna feeder cable

Body Electrical System > Audio > Specifications

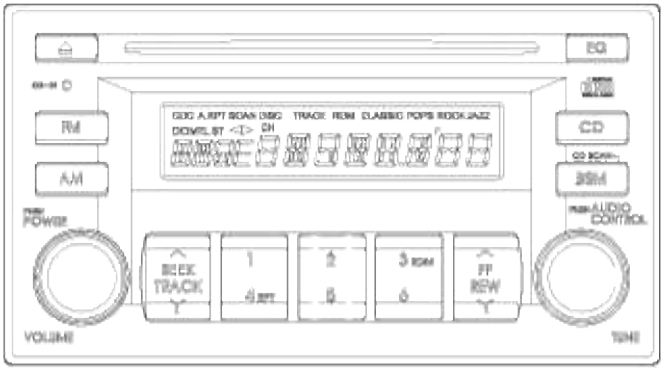
SPECIFICATION

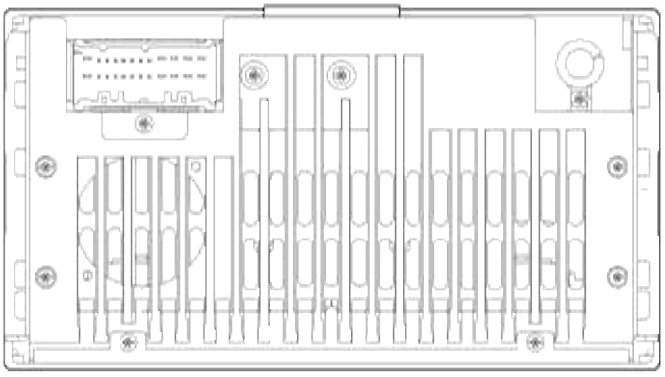
Item		Specification		
Model		AM/FM/CD (M445)	AM/FM/Cassette /MP3 (M455)	AM/FM/Cassette /6CDC (M465)
Power supply		DC 14.4V		
Rated output		Max 43W x 4		Maw 50W x 4
Speaker impedance		4Ω x 4		2Ω x 4
Antenna		80PF 75Ω		
Tuning type		PLL synthesized type		
The others		-		External amp, Sub woofer
Frequency range / Channel space	FM	87.5~107.9 MHz/ 200KHz		
	AM	530~1710 KHz/ 10KHz		

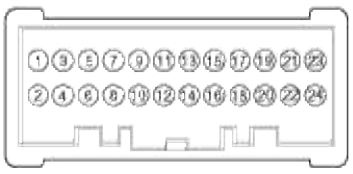
Body Electrical System > Audio > Audio Unit > Components and Components Location

COMPONENT

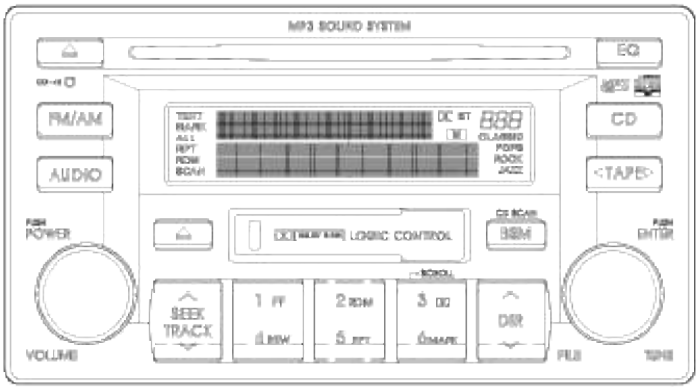
[AM/FM/CD-M445]

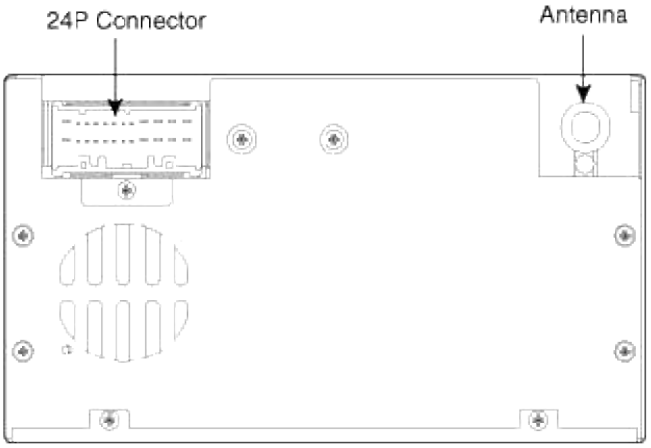


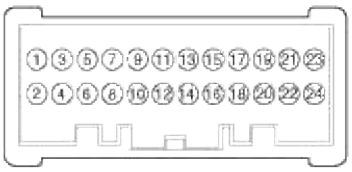


Audio connector	Terminal	Description	Terminal	Description
	1	Ground	13	Remote control ground
	2	Battery	14	Steering remote control
	3	Antenna B+	15	Illumination (-)
	4	ACC	16	Illumination (+)
	5	-	17	Rear left speaker (-)
	6	-	18	Rear left speaker (+)
	7	Tweeter n (R)	19	Rear right speaker (-)
	8	Tweeter n (L)	20	Rear right speaker (+)
	9	Ground	21	Front right speaker (-)
	10	Twiter ground	22	Front right speaker (+)
	11	MUTE	23	Front left speaker (-)
	12	Rear-arm remote control	24	Front left speaker (+)

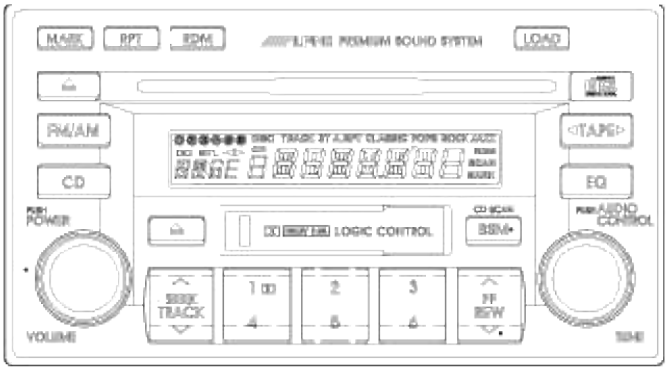
[AM/FM/Cassette/MP3-M455]

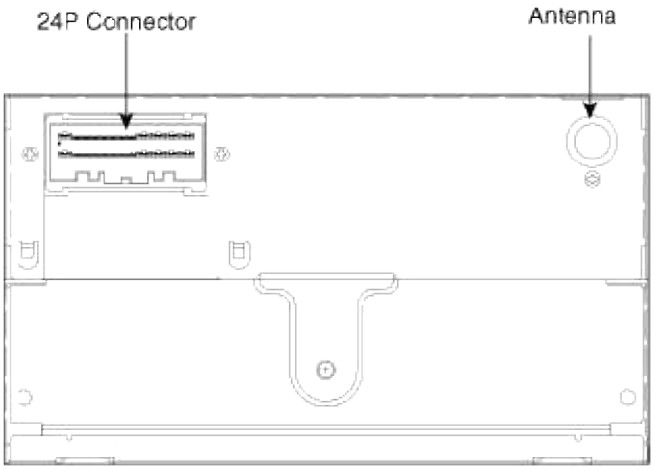


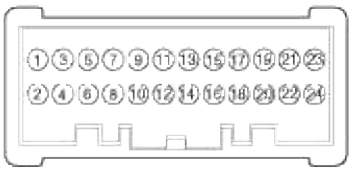


Audio connector	Terminal	Description	Terminal	Description
	1	Ground	13	Remote control ground
	2	Battery	14	Steering remote control
	3	Antenna B+	15	Illumination (-)
	4	ACC	16	Illumination (+)
	5	-	17	Rear left speaker (-)
	6	-	18	Rear left speaker (+)
	7	Tweeter in (R)	19	Rear right speaker (-)
	8	Tweeter in (L)	20	Rear right speaker (+)
	9	Ground	21	Front right speaker (-)
	10	Twiter ground	22	Front right speaker (+)
	11	MUTE	23	Front left speaker (-)
	12	Rear-arm remote control	24	Front left speaker (+)

[AM/FM/Cassette/6CDC-M465]





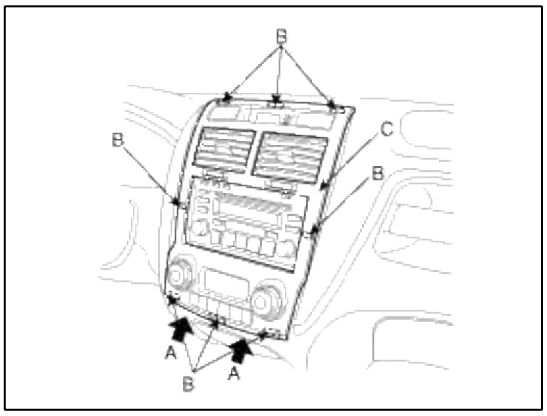
Audio connector	Terminal	Description	Terminal	Description
	1	Ground	13	Remote control ground
	2	Battery	14	Steering remote control
	3	Antenna B+	15	Illumination (-)
	4	ACC	16	Illumination (+)
	5	-	17	Rear left speaker (-)
	6	-	18	Rear left speaker (+)
	7	Tweeter in (R)	19	Rear right speaker (-)
	8	Tweeter in (L)	20	Rear right speaker (+)
	9	Ground	21	Front right speaker (-)
	10	Twiter ground	22	Front right speaker (+)
	11	MUTE	23	Front left speaker (-)
	12	Rear-arm remote control	24	Front left speaker (+)

Body Electrical System > Audio > Audio Unit > Repair procedures

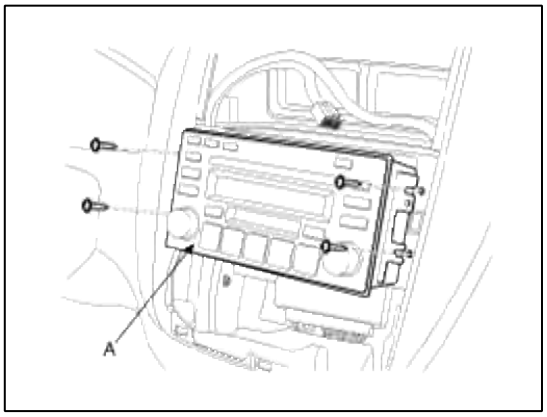
REPLACEMENT

1. Disconnect the negative (-) battery terminal.

2. Remove the center facia panel (C) after pulling it by using regular screwdriver(-) at part (A).Take care of fixing clips (B).



3. Remove the connectors.
4. Remove the mounting screws then remove the audio unit assembly (A).

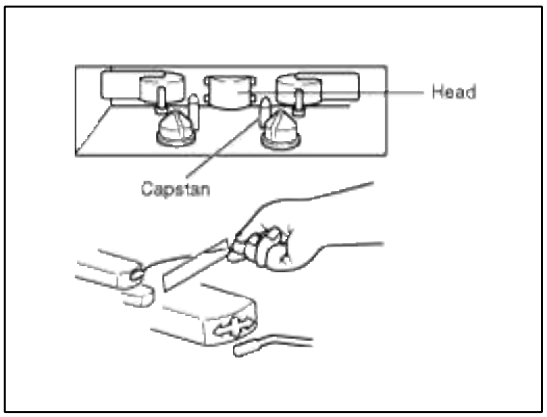


5. Installation is the reverse of removal.

INSPECTION

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.



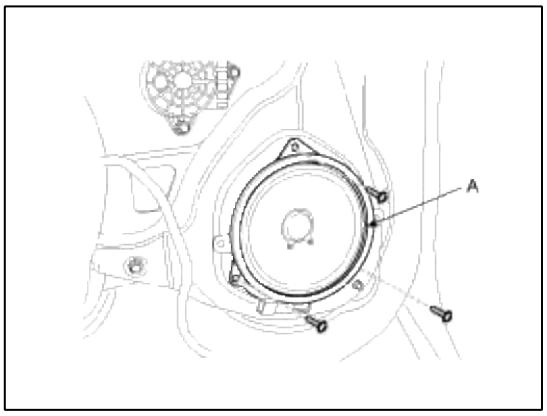
Body Electrical System > Audio > Speakers > Repair procedures

REPLACEMENT

FRONT SPEAKER

1. Remove the front door trim panel (Refer to the BD group - front door).

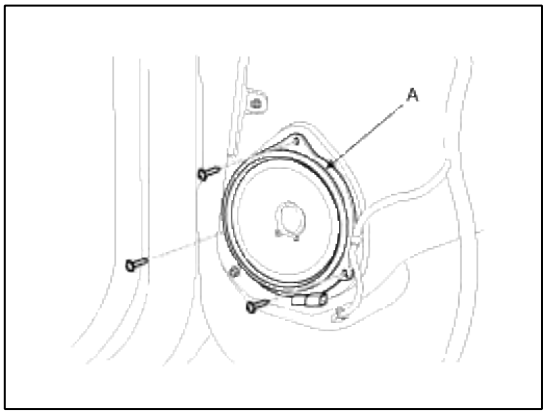
2. Remove the front speaker (A) after removing 3 screws.



3. Installation is the reverse of removal.

REAR SPEAKER

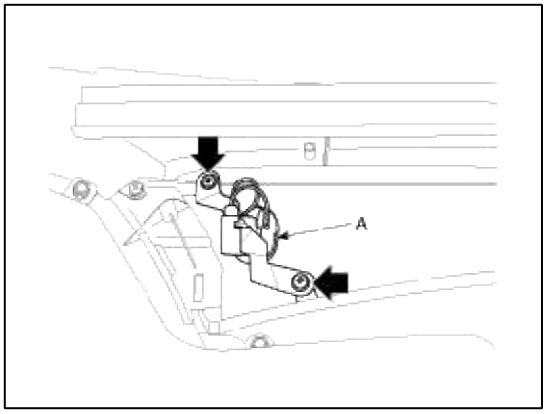
1. Remove the rear door trim panel (Refer to the BD group - rear door).
2. Remove the rear speaker(A) after removing 3 screws.



3. Installation is the reverse of removal.

TWEETER SPEAKER

1. Remove the front door trim panel (Refer to the BD group - front door).
2. Remove the tweeter speaker (A) after removing 2 screws.

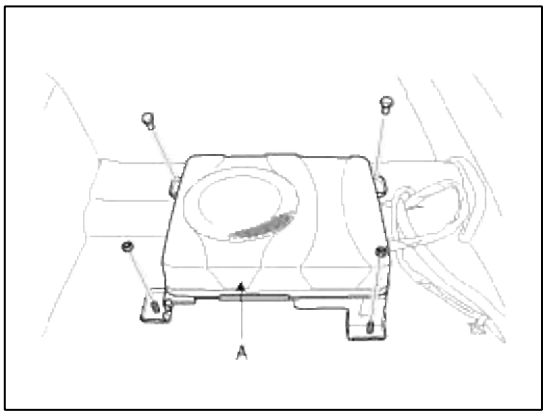


3. Installation is the reverse of removal.

WOOFER SPEAKER

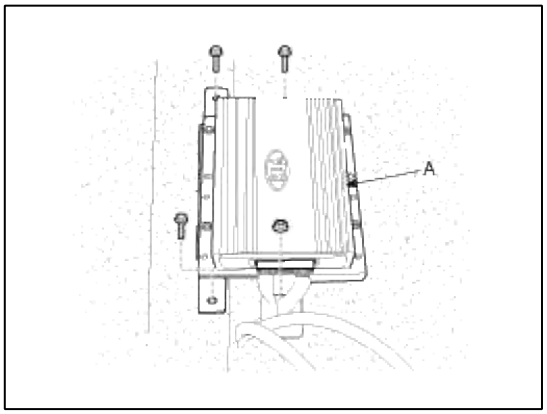
1. Remove the assist side seat.(Refer to the BD group - front seats)

2. Remove the woofer speaker(A) from the assist side floor after removing 2 bolts and 2 nuts.



EXTERNAL AMP

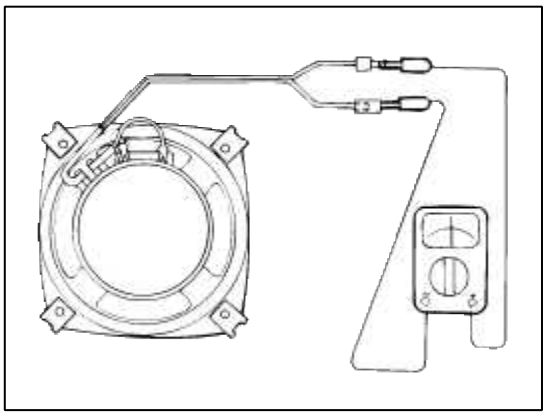
1. Remove the driver seat.(Refer to the BD group - front seats)
2. Remove the external amp (A) from the floor beyond the driver seat after removing 3 bolts and 1nut.



3. Installation is the reverse of removal.

INSPECTION

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.
2. If a clicking sound is emitted from the speaker when the ohmmeter is connected to the speaker terminals, the speaker is OK.

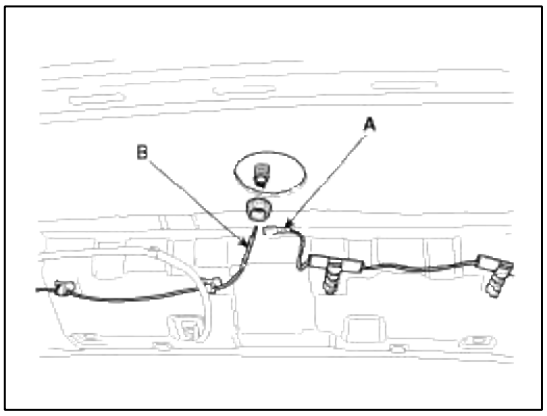


Body Electrical System > Audio > Antenna > Repair procedures

REPLACEMENT

1. Remove the rear roof trim (Refer to BD group-roof trim).
2. Disconnect the 1P connector (A) and antenna jack (B) from the roof antenna.

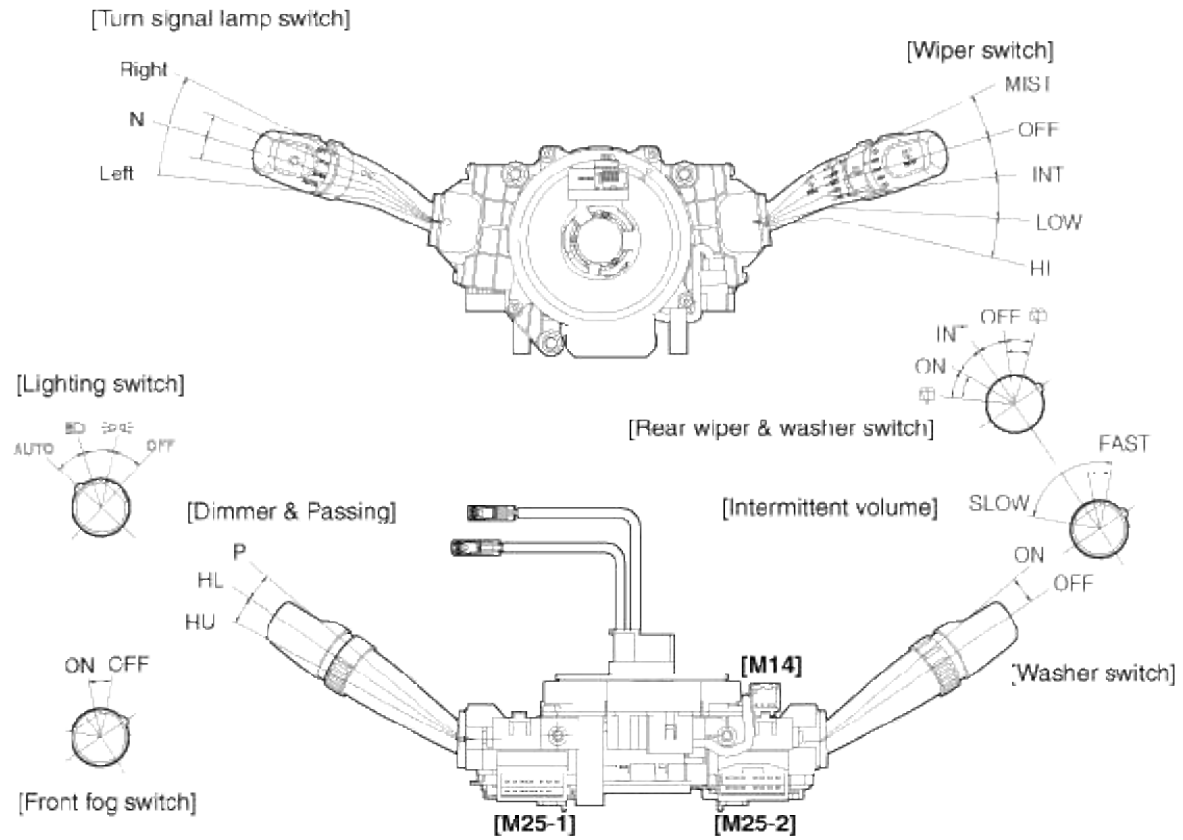
3. Remove the roof antenna after removing a nut.



4. Installation is the reverse of removal.

Body Electrical System > Multifunction switch > Components and Components Location

COMPONENTS



[M25-1]

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

[M25-2]

1	2	3	4	5	6	7
8	9	10	11	12	13	14

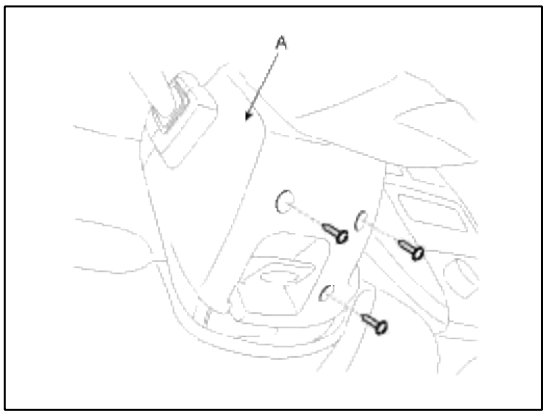
Circuit connection

Connector No.	Terminal No.	Description	Connector No.	Terminal No.	Description
M25-1	1	Head lamp passing	M25-2	1	Wiper high speed
	2	Head lamp high beam power		2	Wiper low speed
	7	Turn signal lamp (RH)		3	Wiper parking
	8	Flasher unit power		4	Mist switch
	9	Turn signal lamp (LH)		5	Wiper & washer power
	10	Head lamp low beam power		6	Intermittent wiper
	11	Dimmer & passing ground		7	Front washer switch
	12	Front fog switch		8	-
	13	Front fog switch ground		9	Rear wiper & washer ground
	14	Tail lamp switch		10	Intermittent rear wiper
	15	Head lamp switch		11	Rear wiper
	16	Auto light switch		12	Rear washer
	17	Lighting switch ground		13	Intermittent wiper volume
	18	-		14	Intermittent wiper ground

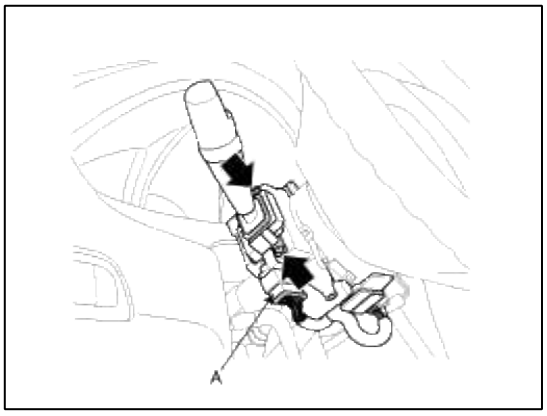
Body Electrical System > Multifunction switch > Repair procedures

REPLACEMENT

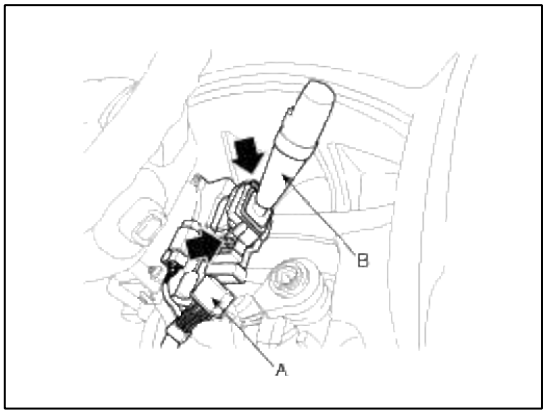
1. Remove the steering column upper and lower shrouds (A) after removing 3 screws.



2. Remove the light switch (B) after loosening its 2 screws and connector (A).



3. Remove the wiper switch (B) after loosening its 2 screws and connector (A).

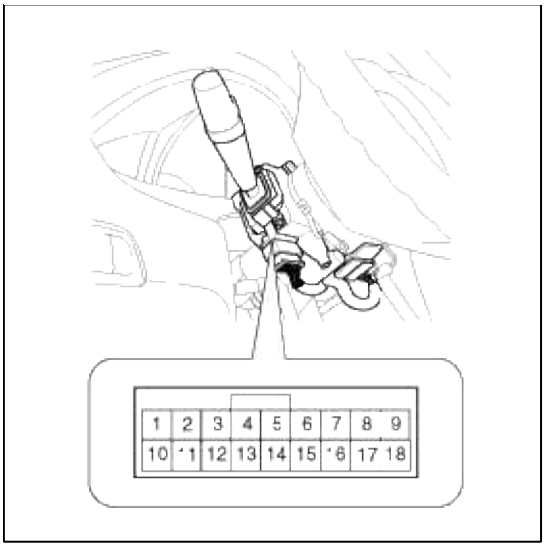


4. Installation is the reverse of removal.

INSPECTION

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.



LIGHTING SWITCH (AUTO LIGHT)

Terminal / Position	14	15	16	17
OFF				
I	○			○
II	○	○		○
AUTO			○	○

LIGHTING SWITCH

Terminal / Position	14	15	16	17
OFF				
I	○			○
I	○	○		○

DIMMER AND PASSING SWITCH

Terminal / Position	1	2	10	11
HU		○		○
HL			○	○
P	○	○		○

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

TURN SIGNAL SWITCH

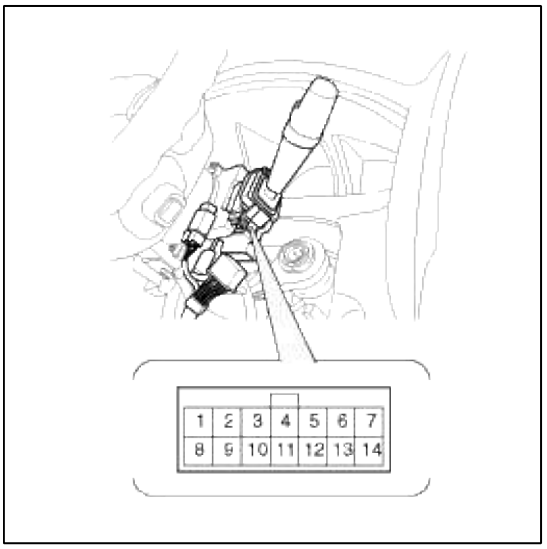
Hazard switch / Terminal	Trun signal switch	7	8	9
OFF	L		○	○
	N			
	R	○	○	

FRONT FOG LAMP SWITCH

Terminal / Position	12	13
OFF		
ON	○	○

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.



WIPER SWITCH

Terminal / Position	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○			○			
HI	○				○			

WASHER SWITCH

Terminal / Position	5	7
OFF		
ON	○	○

REAR WIPER & WASHER SWITCH

Terminal / Position	9	10	11	12
Rear washer	○			○
OFF				
INT	○	○		
ON	○		○	
Rear washer	○			○

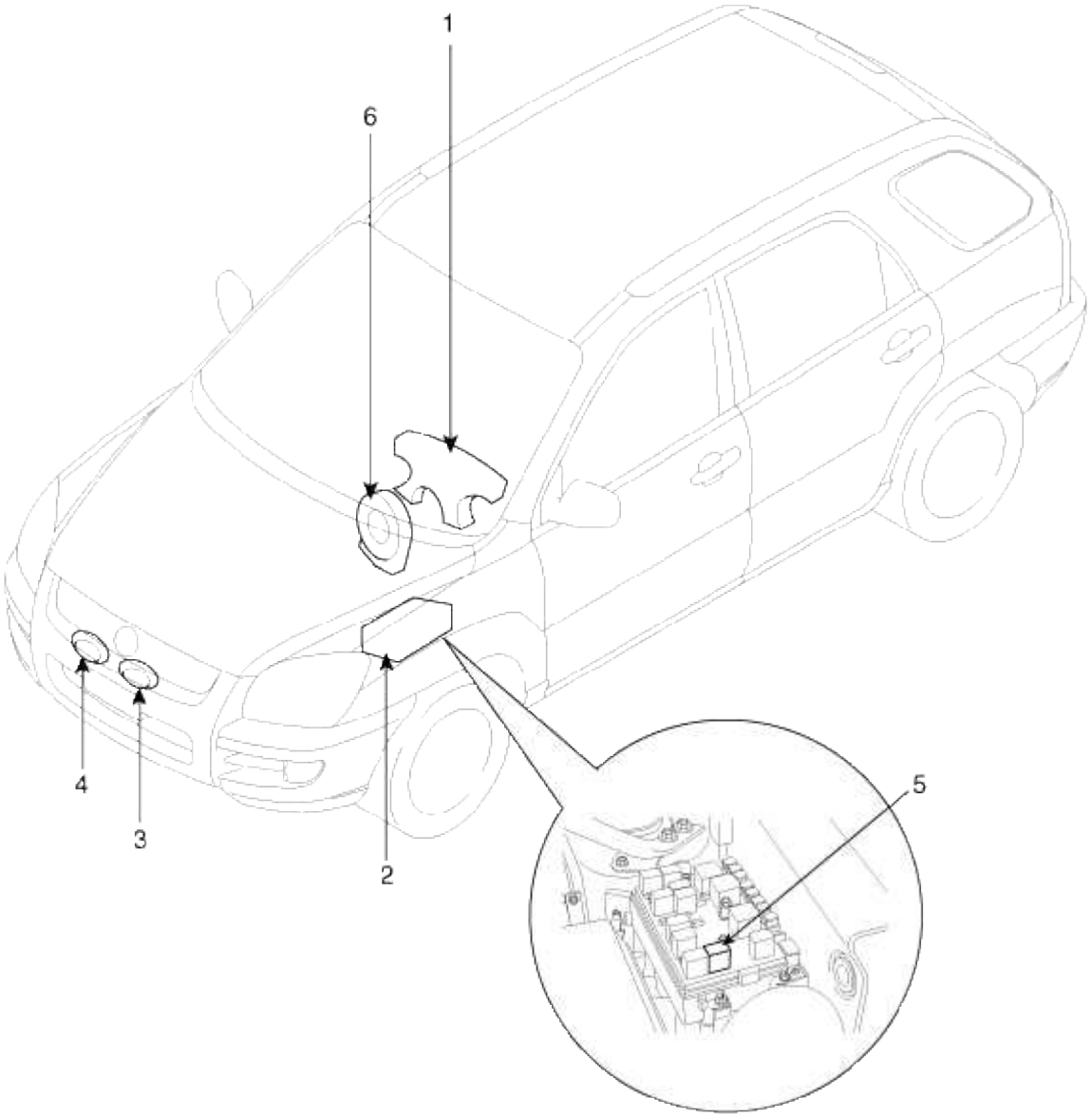
Body Electrical System > Multifunction switch > Specifications

SPECIFICATIONS

Items	Specifications
Rated voltage	DC 12 V
Operating temperature range	-30°C ~ +80°C (-22 ~ +176°F)
Rated load Dimmer & passing switch Lighting switch Turn signal & lane change switch Front fog lamp switch Wiper & mist switch Washer switch Variable intermittent volume switch Rear wiper & washer switch	 High : 15A (Relay load) Low : 10A (Relay load) Passing : 15A (Relay load) Lighting : 1A (Relay load) 6.6±0.5A (Lamp load) 1A (Relay load) Low, High : 4A (Motor load) Intermittent : 0.22±0.05A (Relay load) Lock : Max. 23A (Motor load) Mist : 4A (Motor load) 4A (Motor load) Max. 25mA Rear wiper : 200mA (Relay load) Rear washer : 4A (Motor load)

Body Electrical System > Horn > Components and Components Location

COMPONENTS



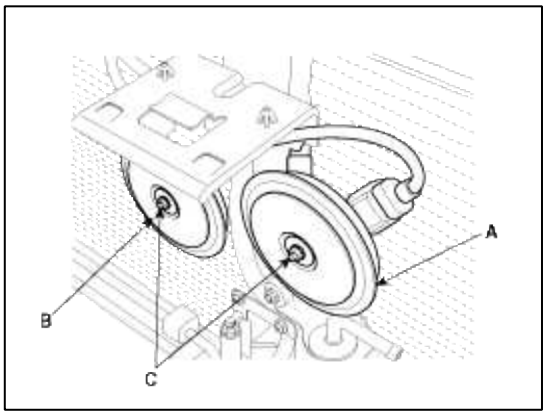
1. Horn switch
2. Relay box (Engine room compartment)
3. Horn (High pitch)
4. Horn (Low pitch)
5. Horn relay
6. Clock spring

Body Electrical System > Horn > Repair procedures

REPLACEMENT

1. Remove the front bumper. (Refer to the BD group - front bumper).

2. Remove the bolt (C) and disconnect the horn connector, then remove the high pitch horn (A) and low pitch horn (B).



3. Installation is the reverse of removal.

INSPECTION

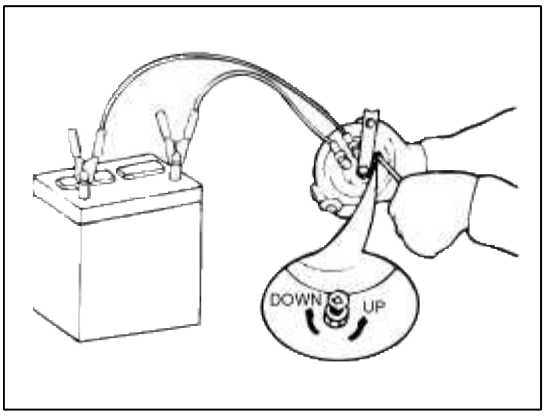
Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The horn should make a sound. If the horn fails to make a sound, replace it.

ADJUSTMENT

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

NOTE

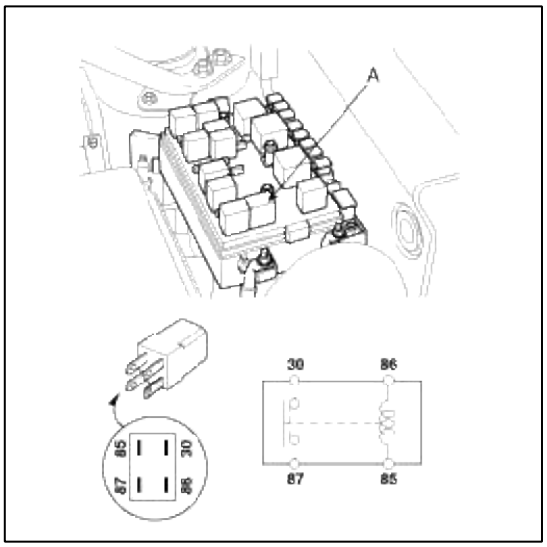
After adjustment, apply a small amount of paint around the screw head to keep it from loosening.



HORN RELAY INSPECTION

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

3. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.



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

Body Electrical System > Keyless Entry And > Description and Operation

DESCRIPTION

BURGLAR ALARM SYSTEM

The burglar alarm system is armed automatically after the doors, hood, and 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 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 ETACS module must receive signals that the doors, hood, and tailgate are closed and locked. When everything is closed and locked, none of the control unit inputs are grounded.

If anything is opened or improperly unlocked after the system is armed, the ETACS 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 ETACS 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 ETACS.

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 button, all doors lock. When you push the UNLOCK button 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.

PANIC MODE

The panic mode rigs the ETACS to sound the alarm with the remote transmitter in order to attract attention. When the PANIC button is pressed and held for 0.5 seconds, the alarm will sound and exterior lights will flash for about 30 seconds.

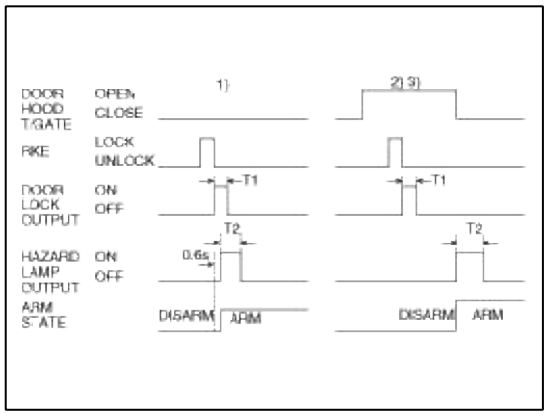
The panic mode can be canceled at any time by pressing any button on the remote transmitter or by turning the ignition switch ON. The panic mode will not function if the ignition switch is ON.

FUNCTION

ANTI-THEFT FUNCTION

1. ARM function
   (1) When using LOCK on the RKE (Remote Keyless Entry) the doors will lock, the hazard lamp will blink once within .06 seconds (max 0.06seconds) and the anti-theft system will ARM, if the following conditions have been met.
      A. The ignition key is removed from the ignition switch.
      B. All entry points are closed (doors, trunk 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) If LOCK is activated on the RKE while the anti-theft system is already in the ARM mode, the hazard lamp will blink once. (If, however, any of the vehicle entry points is unlocked the anti-theft system will lock the door, the hazard lamp will blink once, and the system will re-ARM itself.
   (5) 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.
   (6) 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.
   (7) If the UNLOCK signal is sent by the RKE, and either the ignition key is not inserted or entry (door, trunk, 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).
   (8) In steps 7), when UNLOCK is activated within the initial 30 seconds, another period of 30 seconds occurs.
   (9) Automatic lock will not function if an entry point is opened within 30 seconds of activating UNLOCK.

(10) Once the 30 seconds have passed, after the initial UNLOCK, the anti-theft system will lock the doors, blink the hazard lamps and then ARM.



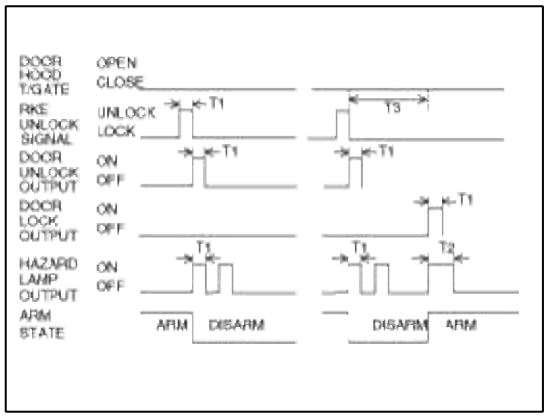
T1 : 0.5 sec,
T2 : 1.0 ± 0.1 sec.

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)

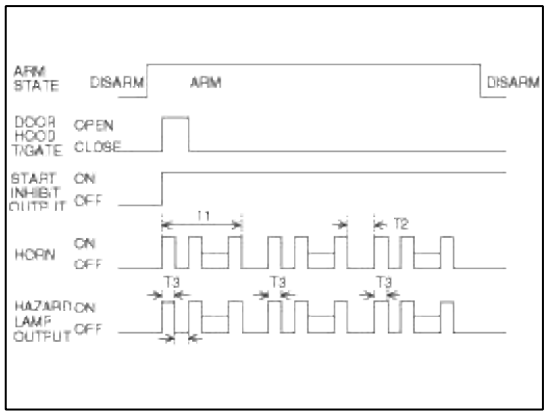
(2) In DISARM mode, the alarm and start inhibitor do not function.

(3) When repeating UNLOCK on the RKE, the hazard lamps blink 2 times and the doors unlock.



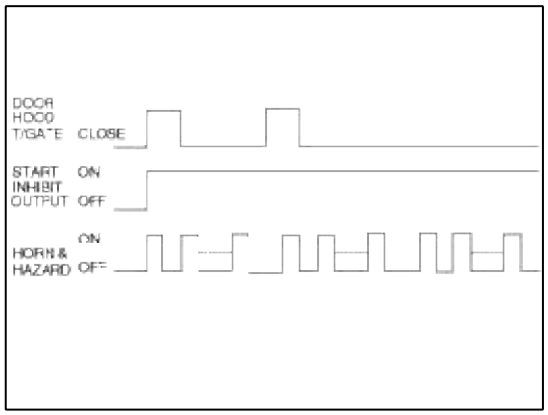
T1 : 0.5 sec,
T2 : 1.0 ± 0.1 sec,
T3 : 30 sec.

3. ALARM Function
   (1) 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.
   (2) Output intervals for the horn alarm and hazard lamps are identical.
   (3) 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.)

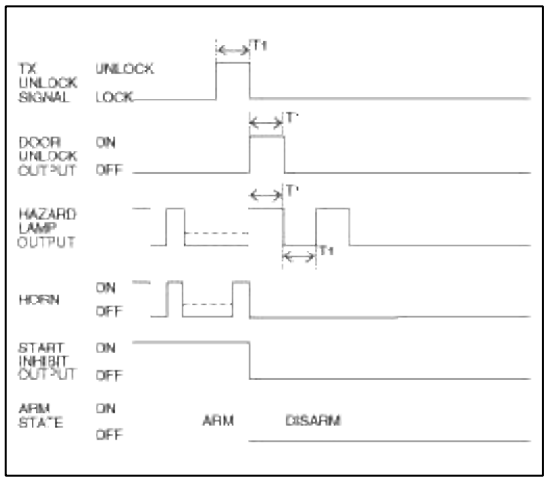


T1 : 27 ± 2 sec,
T2 : 10 ± 1 sec,
T3 : 0.5 ± 0.1 sec.

4. New alarm condition during active alarm activation.
   (1) If a new alarm condition occurs during the initial alarm sequence, the start inhibitor will remain on and only the horn alarm will continue. (The alarm will continue even if the point of entry is closed.)

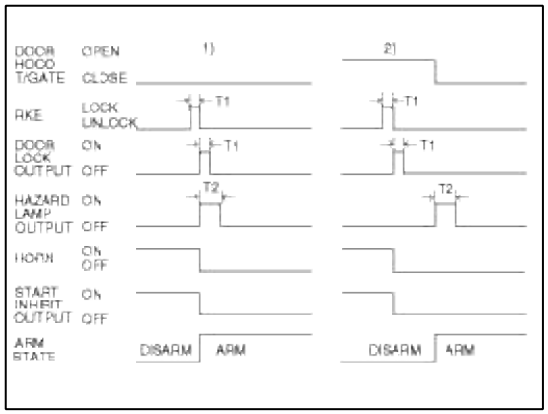


5. Activating RKE UNLOCK during an alarm sequence
   (1) If the RKE UNLOCK is activated during an alarm sequence, UNLOCK will output and hazard lamps blink 2 times the anti-theft system will DISARM.
   The horn, hazard lamps and start inhibitor will be off.



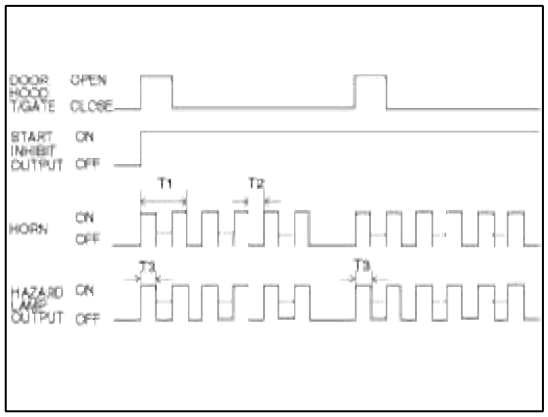
T1 : 0.5 sec.

6. RKE controlled LOCK during an alarm sequence
   (1) When a RKE (Remote Keyless Entry) controlled LOCK occurs during an alarm sequence, but after the door, that had been broken-in, has been closed the following occurs:
      A. All entry points are checked and then LOCK occurs.
      B. Horn alarm and start inhibitor are set to off.
      C. Hazard lamp blinks once.
      D. Anti-Theft system is set to ARM.
   (2) When a RKE controlled LOCK occurs during an alarm sequence, but the broken-in door remains opened the following occurs:
      A. All entry points are checked and then LOCK occurs.
      B. Horn alarm and start inhibitor are set to off.
         (If the door is then closed the hazard lamp will blink once and the Anti-Theft system will ARM)



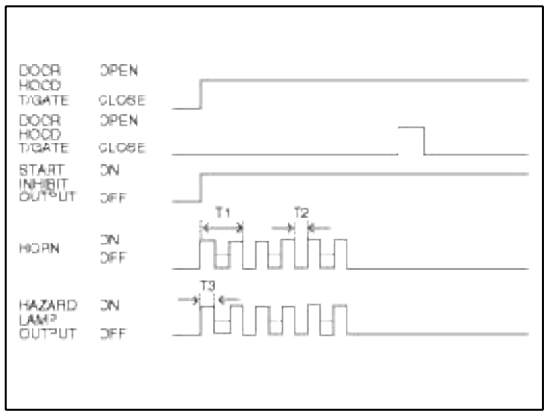
T1 : 0.5 sec,
T2 : 1.0 ± 0.1 sec.

7. New condition occurs after an alarm.
   (1) When all the doors are opened after the doors were closed and locked after an alarm is ON 3 times, the horn alarm, hazard lamps and start inhibitor will engage again.



T1 : 27 ± 2 sec,
T2 : 10 ± 1 sec,
T3 : 0.5 ± 0.1 sec.

(2) If an alarm occurs due to an open point of entry, and then an unaffected door is opened, the start inhibitor will remain ON, but the horn alarm will not restart.



T1 : 27 ± 2 sec,
T2 : 10 ± 1 sec,
T3 : 0.5 ± 0.1 sec.

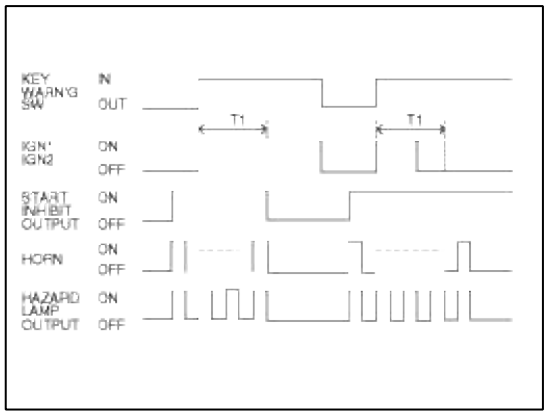
8. Alarm clearance

(1) When choosing LOCK on the RKE (Remote Keyless Entry) either during or after alarm activation, the alarm is cleared.

(2) When choosing UNLOCK on the RKE either during or after alarm activation, the alarm is cleared.

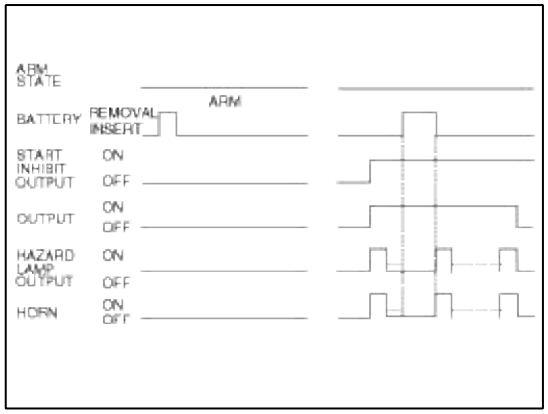
(3) If the ignition key is turned to ON for 30 seconds either during or after alarm activation the alarm will be cleared and the start inhibitor reset.

(4) If during an alarm sequence the ignition key is turned ON and then OFF within 30 seconds, the alarm will continue.

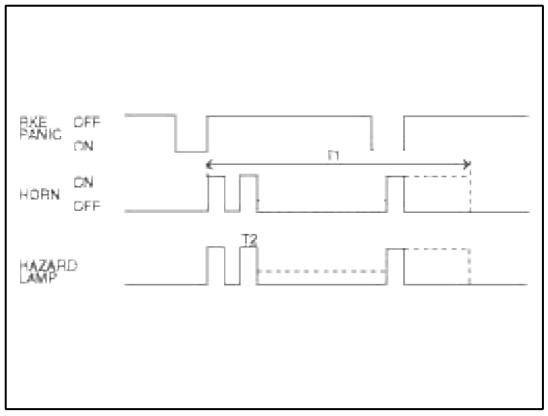


T1 : 30 sec.

9. Battery separation
   (1) When the battery is reconnected after having been disconnected/removed while in ARM mode. ARM mode continues.
   (2) When the battery is reconnected after having been disconnected/removed, and after the alarm completes, the alarm will restart.
   (3) When battery is reconnected after having been disconnected/ removed during an active alarm, the alarm sequence will restart from the beginning.



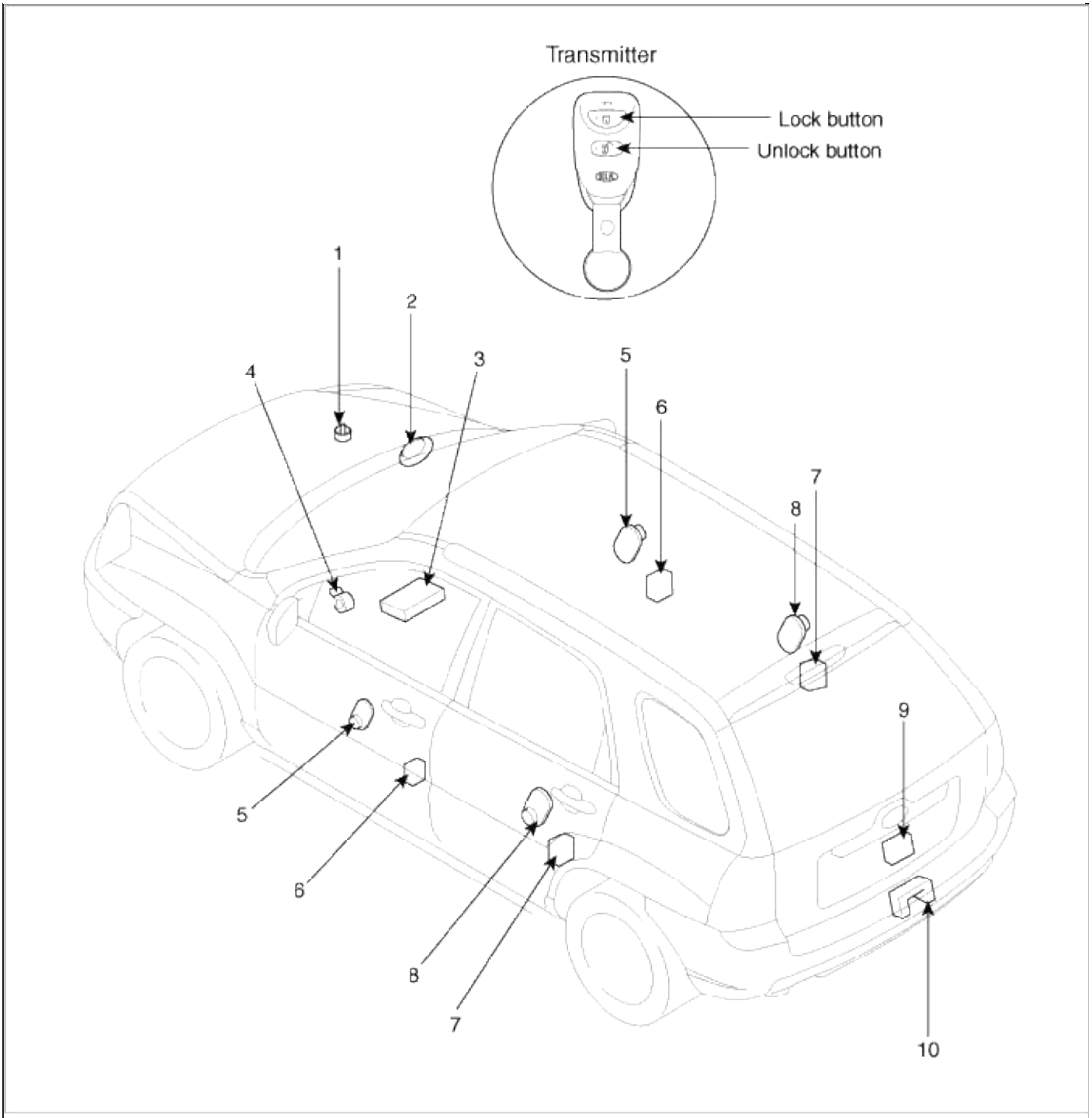
10. Panic
   (1) If panic on the RKE (Remote Keyless Entry) is activated while in ARM mode, alarm activation will be set to hold for 30 seconds. If during the 30 seconds someone breaks in, panic mode is cleared and the alarm activates.
   (2) When panic on the RKE is activated while in DISARM mode, the horn alarm and hazard lamps will activate for 30seconds.
   (3) If LOCK, UNLOCK, or panic is activated on the RKE control during Steps 1) or 2), panic mode will be cleared.
   (4) When a panic signal is received during or after an alarm, the alarm turns OFF, the start inhibitor is set to OFF, and panic mode is set to ON.
   (5) Panic mode will not start if the ignition key is IN or ON even if a panic signal is received.
   (6) Panic mode operates independently from entry points (door, hood, trunk) being opened or closed.



T1 : 27 ± 2 sec,
T2 : 30 ± 1 sec,
T3 : 0.5 ± 0.1 sec(Duty 50%)

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

COMPONENTS



1. Hood switch
2. Burglar horn
3. ETACS module
4. Key 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 & switch
10. Tailgate switch

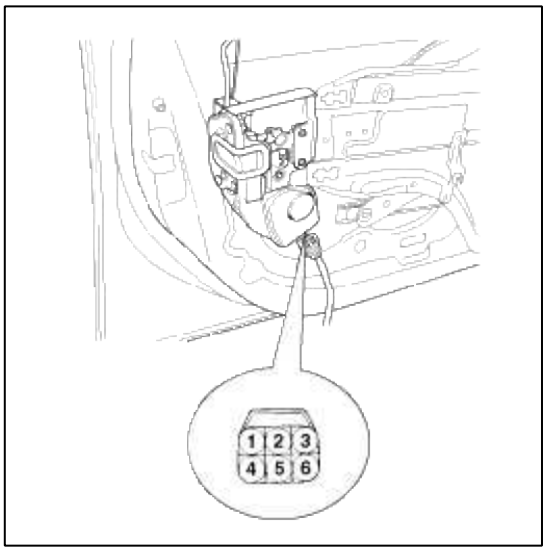
Body Electrical System > Keyless Entry And > Repair procedures

INSPECTION

FRONT DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to the BD group - front door)

2. Disconnect the 6P connector from the actuator.

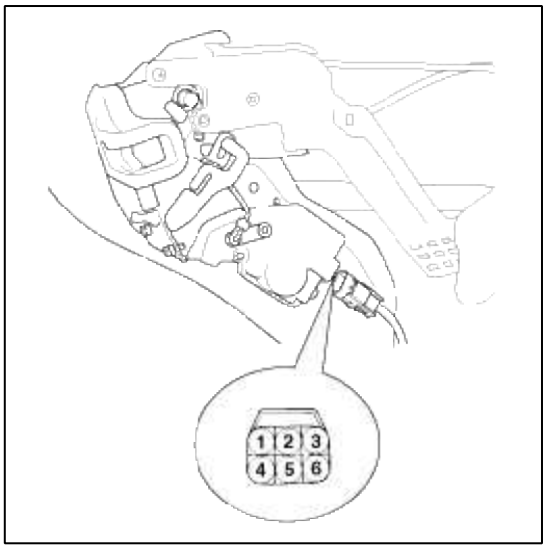


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		4	6
Front left	Lock	⊖	⊕
	Unlock	⊕	⊖
Front right	Lock	⊕	⊖
	Unlock	⊖	⊕

REAR DOOR LOCK ACTUATOR INSPECTION

1. Remove the rear door trim panel. (Refer to the BD group - rear door)
2. Disconnect the 6P connector from the actuator.



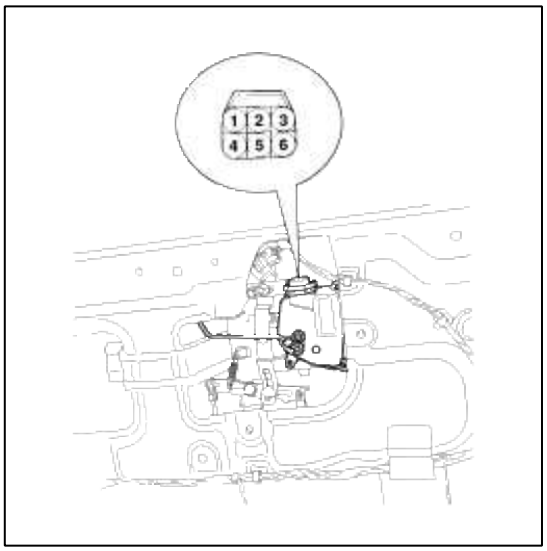
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	3
Rear left	Lock	⊕	⊖
	Unlock	○	⊕
Rear right	Lock	⊖	⊕
	Unlock	⊕	⊖

TAILGATE LOCK ACTUATOR INSPECTION

1. Remove the tailgate trim panel.(Refer to the BD group - tailgate)

2. Disconnect the 6P connector from the actuator.

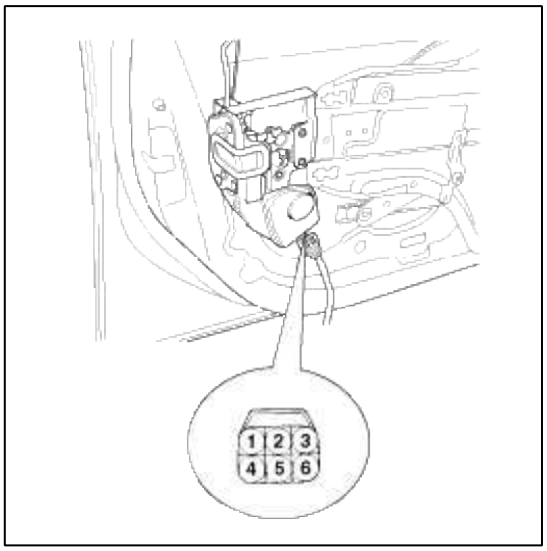


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Terminal / Position	4	6
LOCK	⊕	⊖
UNLOCK	⊖	⊕

FRONT DOOR LOCK SWITCH INSPECTION

1. Remove the front door trim panel. (Refer to the BD group - front door)
2. Disconnect the 6P connector from the actuator.



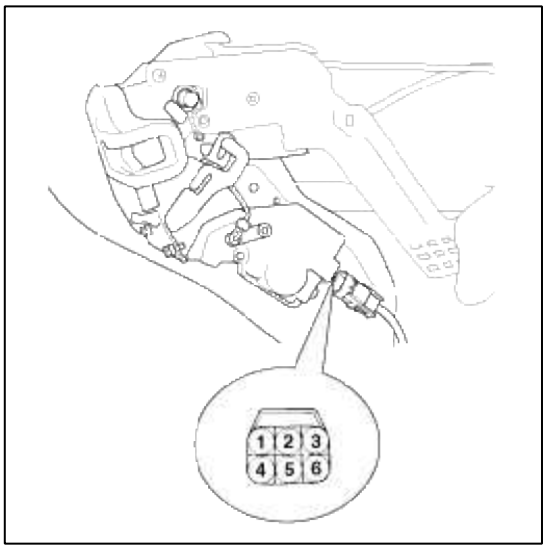
3. Check for continuity between the terminals in each switch position according to the table.

Position / Terminal		1	2	3
Front left	Lock	○		○
	Unlock	○	○	
Front right	Lock	○		○
	Unlock		○	○

REAR DOOR LOCK SWITCH INSPECTION

1. Remove the rear door trim panel. (Refer to the BD group - rear door)

2. Disconnect the 6P connector from the actuator.



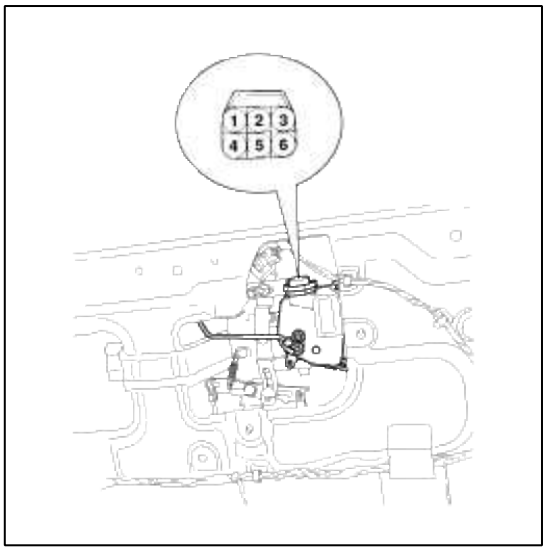
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		4	5	6
Rear left	Lock		○	○
	Unlock	○		○
Rear right	Lock	○		○
	Unlock		○	○

TAILGATE LOCK SWITCH INSPECTION

Remove the tailgate trim panel.

1. Remove the tailgate trim panel. (Refer to the BD group - tailgate)
2. Disconnect the 6P connector from the actuator.

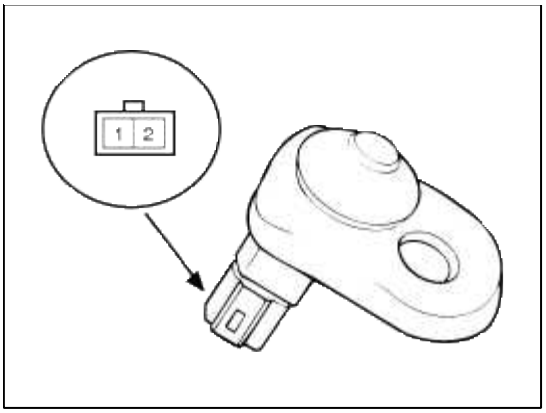


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	4	5	6
Lock		○	○
Unlock	○		○

DOOR SWITCH INSPECTION

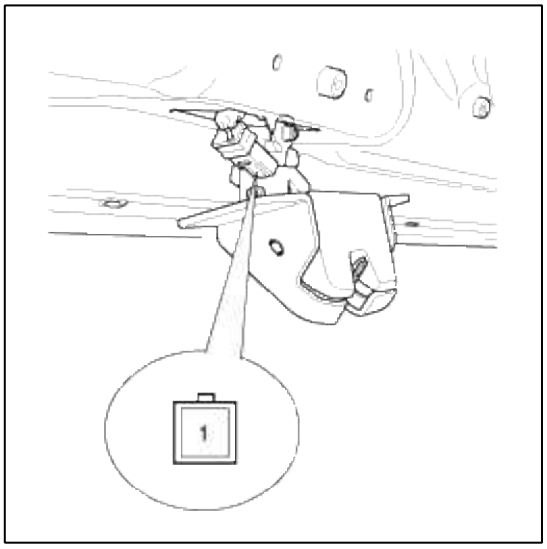
Remove the door switch and check for continuity between the terminals.



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

TAILGATE OPEN SWITCH INSPECTION

1. Remove the tailgate trim panel.
2. Remove the tailgate latch after removing 3 bolts and disconnect the 1P connector from the tailgate switch.

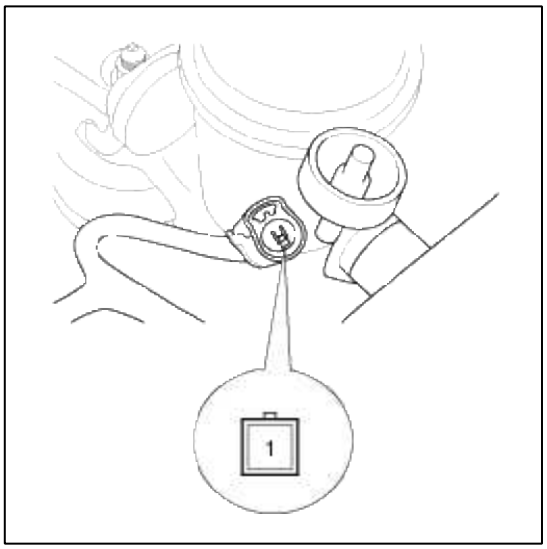


3. Check for continuity between the terminals according to the table.

Terminal / Position	1	Ground
Tailgate open	○	○
Tailgate close		

HOOD SWITCH INSPECTION

1. Disconnect the 1P connector from the hood switch.



2. Check for continuity between the terminals and ground according to the table.

Terminal / Position	Ground (Body)	1
Hood open (Free)	○	○
Hood close (Push)		

KEY WARNING SWITCH INSPECTION

1. Remove the driver's crash pad lower panel. (see BD group-crash pad)
2. Disconnect the 6P connector from the key warning switch.

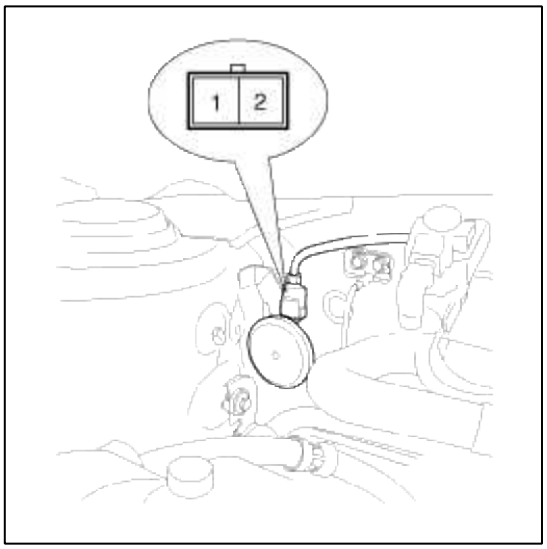
3. Check for continuity between the terminals in each position according to the table.

Terminal / Key position	5	6
Insert	○	○
Removal		

BURGLAR HORN INSPECTION

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.



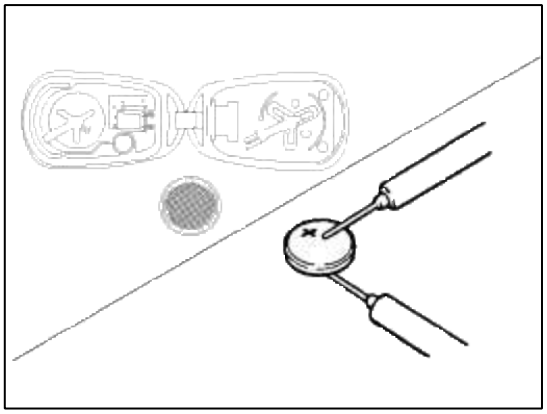
3. The burglar horn should make a sound. If the burglar horn fails to make a sound replace it.

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

INSPECTION

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V

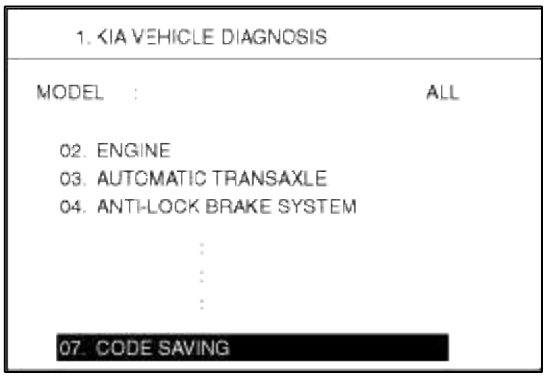


3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter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

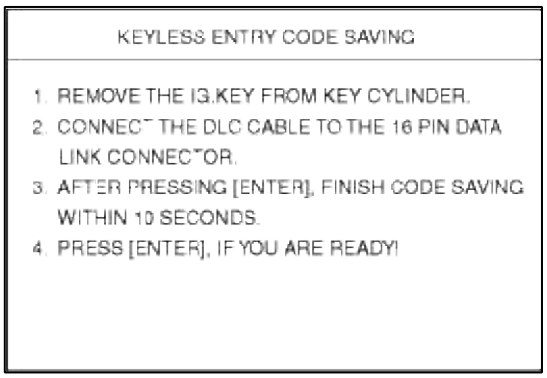
TRANSMITTER CODE REGISTRATION

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.

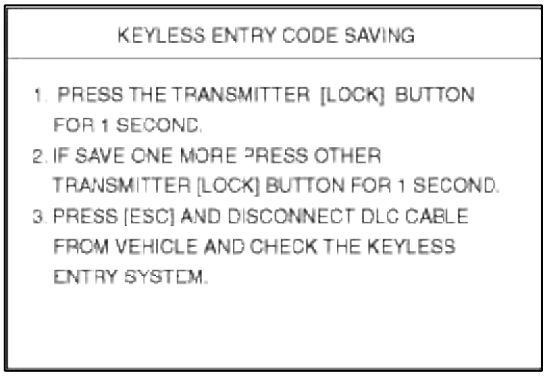
2. Select the vehicle model and then do "CODE SAVING".



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



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 3 and then code saving is completed.



Body Electrical System > Keyless Entry And > Transmitter > Specifications

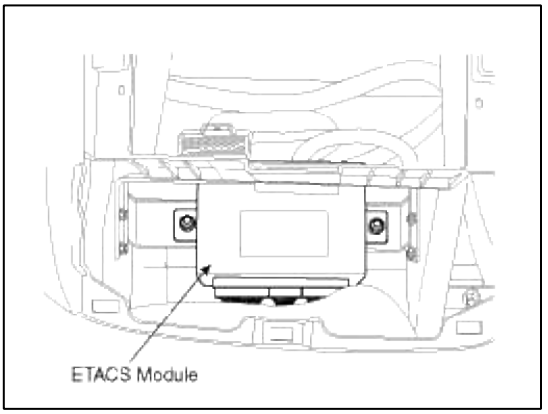
SPECIFICATIONS

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 Door unlock Tailgate open (option) panic
Transmission frequency	315.00 MHz

Body Electrical System > ETACS (Electronic Time > Description and Operation

DESCRIPTION

ETACS module (A) receives various input switch signals controlling time and alarm functions for the intermittent wiper timer, washer timer, 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.



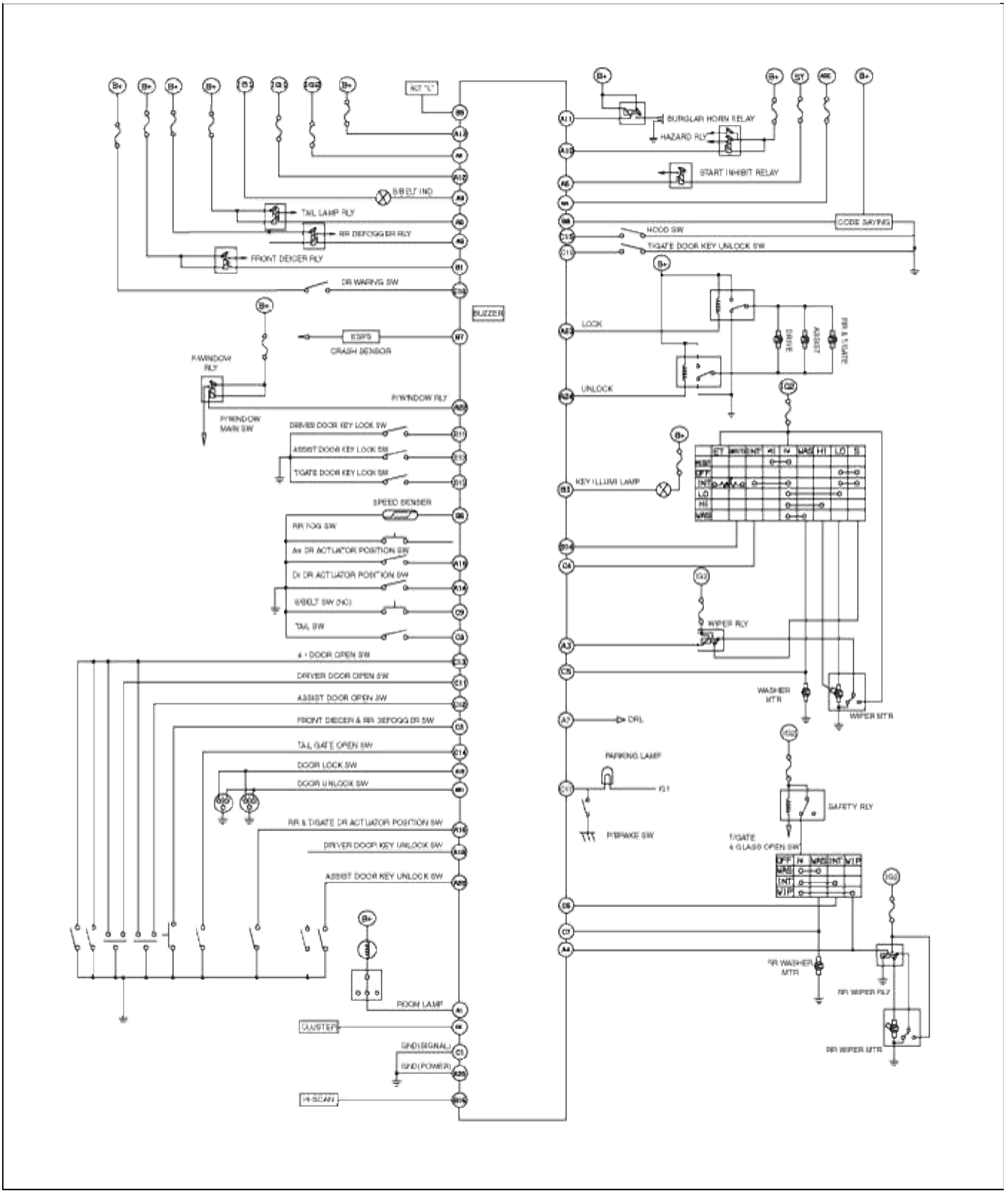
Body Electrical System > ETACS (Electronic Time > Specifications

SPECIFICATIONS

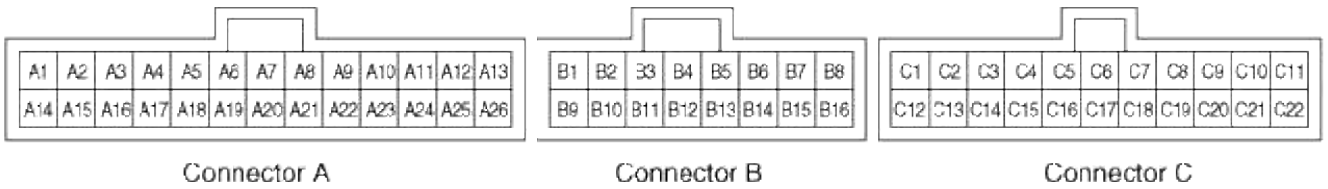
Items	Specifications
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-22°F~176°F(-30°C~ 80°C)
Insulation resistance	100MΩ or more
Dark current	Less than 6mA (12.8 V) - ETACS & Receiver Less than 4mA (12.8V) - ETACS
Rated load Burglar alarm horn Burglar alarm relay Horn relay Tail lamp relay Front fog lamp relay Rear defogger relay Tail gate safety relay Power window timer relay Seat belt warning indicator Key hole illumination lamp Room lamp Intermittent wiper relay Central door actuator Rear wiper relay Windshield deicer relay Door lock relay Door unlock relay Hazard lamp relay Driver door unlock relay	DC 12V, 3.5A (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 1.4W (Lamp load) DC 12V, 2W (Lamp load) DC 12V, 10W (Lamp load) DC 12V, 200mA (Inductance load) DC 12V, 25A (Actuator load) : 5EA DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load) DC 12V, 200mA (Inductance load)

Body Electrical System > ETACS (Electronic Time > ETACS Module > Schematic Diagrams

CIRCUIT DIAGRAM



ETACS CONNECTOR TERMINALS



Terminal No.	Connector A	Connector B	Connector C
1	Room lamp	Windshield deicer relay	Ground
2	IGN 2	-	Cluster
3	Wiper relay	Key hole illumination	Windshield deicer & Rear defogger switch
4	Rear wiper relay	-	Intermittent wiper switch
5	Start inhibit relay	Alternator (L)	Washer switch
6	Rear defogger relay	Speed sensor	Intermittent rear wiper switch
7	D.R.L	Crash sensor	Rear washer switch
8	Tail lamp relay	Code saving	Tail lamp switch
9	Seat belt indicator	-	Seat belt switch
10	Hazard lamp relay	-	Key warning switch
11	Burglar horn relay	-	Driver door open switch
12	IGN1	-	Assist door open switch
13	B+ [For ETACS]	-	4 door open switch
14	Driver door unlock switch	Intermittent wiper volume	Tailgate open switch
15	Assist door unlock switch	-	Hood switch
16	Rear & Tailgate unlock switch	Diagnosis	Tailgate door key unlock switch
17	-		Parking brake switch
18	Driver door key unlock switch		Head lamp switch
19	Door lock switch		Front fog lamp switch
20	Assist door key unlock switch		-
21	Door unlock switch		ACC
22	Power window relay		-
23	Door lock relay		
24	Door unlock relay		
25	-		
26	Ground		

ETACS MODULE INPUT SIGNAL TEST

Pin No.	Input signal name	Test condition	Measured value	Ordinary
A1	Room lamp	Door open	1V or less	10V or more
A2	IGN 2	Ignition switch ON	Battery voltage	1V or less
A3	Wiper relay	Intermittent wiper, washer switch ON	1V or less	10V or more
A4	Rear wiper relay	Rear intermittent wiper, washer switch ON	Battery voltage	1V or less
A5	Start inhibit relay	Engine start condition	1V or less	10V or more
A6	Rear defogger relay	Windshield deicer switch & Rear defogger switch ON	1V or less	10V or more
A7	D.R.L	Tail lamp switch ON	1V or less	10V or more
A8	Tail lamp relay	Tail lamp switch ON	1V or less	10V or more
A9	Seat belt indicator	Seat belt is unbuckled	1V or less / 10V or more (1sec period)	1V or less
A10	Hazard lamp relay	Remote control LOCK/UNKOCK	1V or less / 10V or more (1sec period)	10V or more
A11	Burglar horn relay	Remote control LOCK/UNKOCK	1V or less / 10V or more (1sec period)	10V or more
A12	IGN1	Ignition switch ON	Battery voltage	1V or less
A13	B+ [For ETACS]	Constant	Battery voltage	1V or less
A14	Driver door unlock switch	Driver door UNLOCK	5~12V	1V or less
A15	Assist door unlock switch	Assist door UNLOCK	5~12V	1V or less
A16	Rear & Tailgate unlock switch	Rear & Tail gate UNLOCK	5~12V	1V or less
A17	-	-	-	-
A18	Driver door key unlock switch	Driver door key UNLOCK switch ON	5~12V	1V or less
A19	Door lock switch	Door LOCK ON	5~12V	1V or less
A20	Assist door key unlock switch	Assist door key unlock switch ON	5~12V	1V or less
A21	Door unlock switch	Door unlock switch ON	5~12V	1V or less
A22	Power window relay	Ignition switch ON	1V or less	10V or more
A23	Door lock relay	Remote control & Central door LOCK	1V or less	10V or more

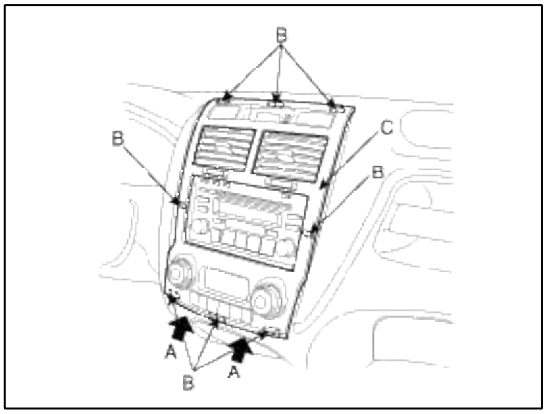
A24	Door unlock relay	Remote control & Central door UNLOCK	1V or less	10V or more
A25	-	-	-	-
A26	Ground	Constant	1V or less	1V or less
B1	Windshield deicer relay	Windshield deicer & Rear defogger switch ON	1V or less	10V or more
B2	-	-	-	-
B3	Key hole illumination	Key hole illumination ON	1V or less	10V or more
B5	Alternator (L)	Engine start condition	Battery voltage	1V or less
B6	Speed sensor	Speed sensor input	1V or less / 10V or more (1sec period)	10V or more
B7	Crash sensor	Crash sensor signal input	1V or less	10V or more
B8	Code saving	Code saving	1V or less	10V or more
B14	Intermittent wiper volume	Intermittent wiper volume ON	12V→0V	10V or more
B16	Diagnosis	Diagnostic tool signal	1V or less	10V or more
C1	Ground	Constant	1V or less	10V or more
C2	Cluster	Cluster signal input	1V or less	10V or more
C3	Windshield deicer & Rear defogger switch	Windshield deicer & Rear defogger switch ON	1V or less	10V or more
C4	Intermittent wiper switch	Intermittent wiper switch ON	10V or more	1V or less
C5	Washer switch	Washer switch ON	10V or more	1V or less
C6	Intermittent rear wiper switch	Intermittent rear wiper switch ON	10V or more	1V or less
C7	Rear washer switch	Rear washer switch ON	10V or more	1V or less
C8	Tail lamp switch	Tail lamp switch ON	5~12V	1V or less
C9	Seat belt switch	Seat belt is unbuckled	1V or less	10V or more
C10	Key warning switch	Key is inserted into the ignition switch	10V or more	1V or less
C11	Driver door open switch	Driver door open	1V or less	10V or more
C12	Assist door open switch	Assist door open	1V or less	10V or more
C13	4 door open switch	4 door open	1V or less	10V or more

C14	Tailgate open switch	Tailgate open	1V or less	10V or more
C15	Hood switch	Hood open	1V or less	10V or more
C16	Tailgate door key unlock switch	Tailgate door key unlock	1V or less	10V or more
C17	Parking brake switch	Parking brake switch ON	1V or less	10V or more
C18	Head lamp switch	Head lamp switch ON	1V or less	10V or more
C19	Front fog lamp switch	Front fog lamp switch ON	1V or less	10V or more
C20	-	-	-	-
C21	ACC	ACC	10V or more	1V or less

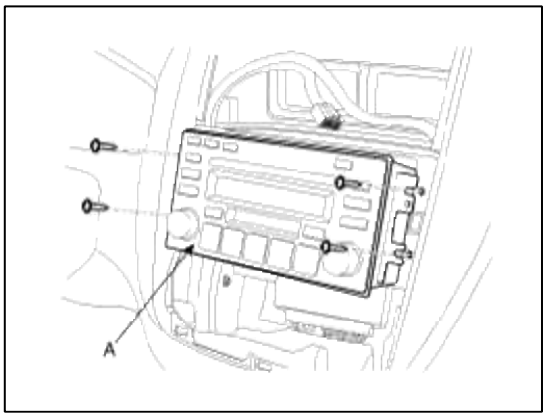
Body Electrical System > ETACS (Electronic Time > ETACS Module > Repair procedures

REPLACEMENT

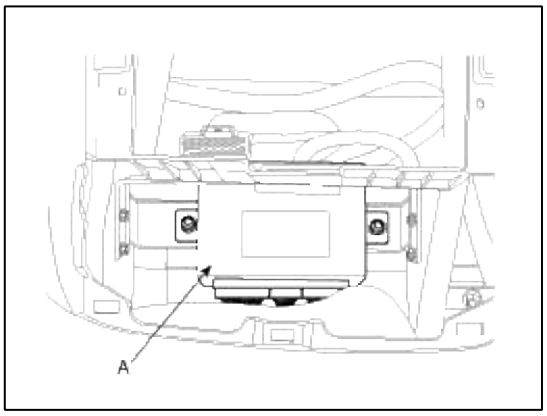
1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel (C) after pulling it by using regular screw driver (-) at part (A). Take care of fixing clips (B).



3. Remove the connectors.
4. Remove the mounting screws then remove the audio unit (A) assembly.



5. Remove the antenna cable and ETACS module (A) after removing 2 nuts.

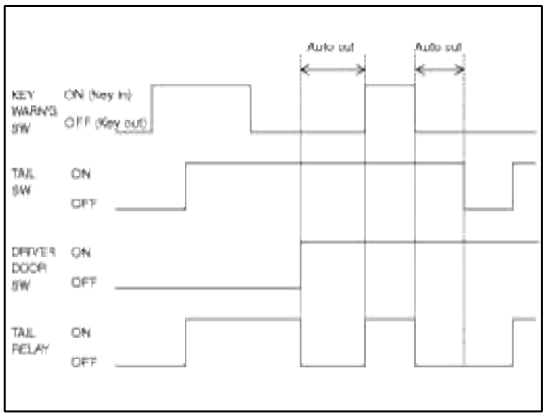


6. Installation is the reverse of removal.

INSPECTION

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's door opened, the tail lamp should be automatically turned OFF.
   (2) With the ignition switch ON, if the driver's 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.
   (5) In case of battery disconnection-connection in auto cut mode, preserve auto cut mode.



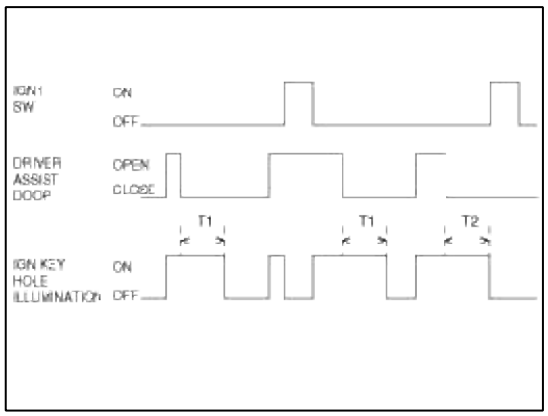
2. IGNITION KEYHOLE ILLUMINATION

(1) Ignition keyhole illumination is turned ON when the driver or passenger door is opened.

(2) The "ON" state for ignition keyhole illumination is delayed 10 seconds when the door is closed as in step 1).

(3) Ignition keyhole illumination is turned off if the ignition switch is turned ON as in Step 1) & 2).

(4) Ignition keyhole illumination is turned off if ARM state is entered. See steps 1) & 2).



T1 : 10 ± 1 sec,
T2 : 0 ~ 10 sec.

3. 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 IG ON/OFF in door open state, room lamp output is ON.

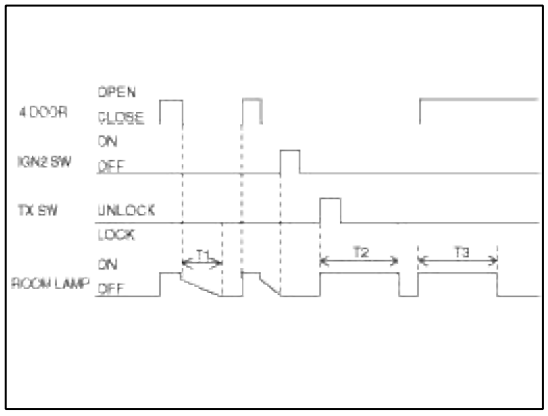
(4) When remote control UNLOCK is received, room lamp is turned on for 30 seconds.

(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.

(6) During on for 30 seconds, when Remote control LOCK receive (ARM condition) or IG2 is ON,put out lights after sensitize for 2 seconds.

(7) During ON for 30 seconds, when produce all doors LOCK in driver/Assist/4door close state (But, hood & tail gate door exception), put out lights after sensitize for 2 seconds.

(8) 30 seconds delay function is suspended when it is door open during 30 seconds delay action regard to remote control UNLOCK.(Function achievement by sensitization room lamp)



T1 : 5.5 ±1 sec.,
T2 : 30 ±5 sec.,
T3 : 20 ±1 min.

4. CENTRAL DOOR LOCK/UNLOCK

(1) Central door lock/unlock

Function \ Option		Centeral door Lock	Transmitter (RKE)
Door key UNLOCK	Driver	2-Turn unlock	2-Turn unlock
	Assist	2-Turn unlock	2-Turn unlock
Transmitter (RKE)	Lock	-	All lock
	Unlock	-	Driver 2-Turn
Driver knob	Lock	All lock	All lock
	Unlock	Driver unlock	Driver unlock
Assist knob	Lock	All lock	All lock
	Unlock	Assist unlock	Assist unlock
Main door Lock switch	Lock	All lock	All lock
	Unlock	Al unlock	Al unlock

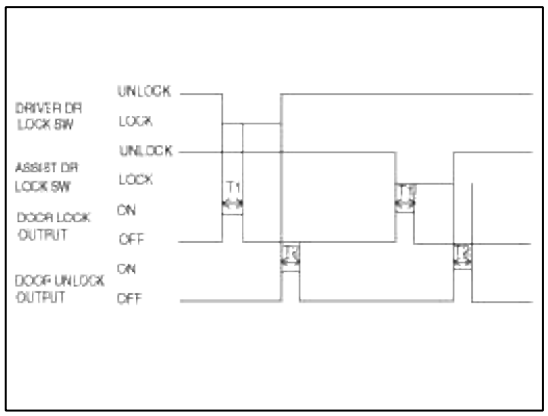
(2) Installation of the battery should not change the state of the locks. (Knob is LOCK state, do not produce LOCK output even if connect battery despite UNLOCK state,)

(3) Signals of duration less than 60 milliseconds will be ignored.

(4) When UNLOCK is input during LOCK output, the LOCK output stops immediately and the UNLOCK output continues. (Vice versa)

(5) When the LOCK/UNLOCK signal is received by the remote control, the LOCK/UNLOCK output continues for 0.5 seconds.

(6) When the hazard lamp is on during the LOCK/UNLOCK by the remote control, the LOCK/UNLOCK signal by the remote control shall be ignored.



T1,2 : 0.5 ±0.1 sec.

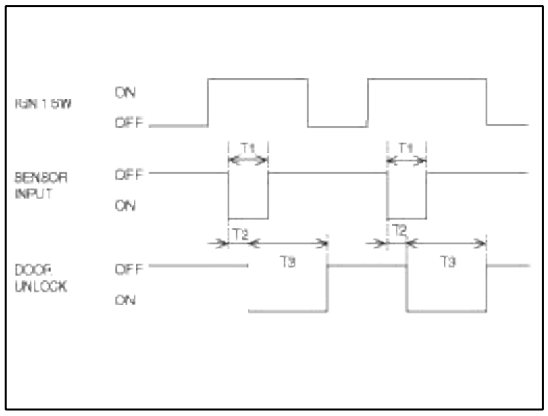
5. CRASH DOOR UNLOCK

(1) If IG1 is on and a crash signal is received, send an unlock pulse to the door locks.

(2) This function is prior in all door lock functions.

(3) If door lock switch is locked in door lock switch is unlocked state, after the first crash unlock output, issue unlock pulse for again 5 sec.

(4) Only one crash unlock can occur during one ignition on cycle.



T1 : 0.2 ± 0.02 sec.,
T2 : 0.04 sec.,
T3 : 5 ± 0.5sec.

6. IGNITION KEY REMINDER

(1) If the key is in the ignition and the driver's door or assist door is open and the vehicle is locked using driver's knob or assist knob, then the central locking system will issue an unlock pulse of duration 1 second to the all doors, thus preventing locking of the vehicle.

(2) If a Knob remains locked, then the central locking shall issue a maximum of 3 pulses of 0.5 second duration to unlock the vehicle. If during these pulses, the door lock knob becomes unlocked, stop the next pulse.

(3) If during the 3 pulses door is closed or the key is removed, stop the next pulse.

(4) If after the 3 unlock pulses the knob remains in the locked state, the condition is remembered. 1sec unlock (reset) pulse is issued if there is a change in any of the following inputs: Door warning switch, driver door switch, assist door switch, driver door lock switch, assist door lock switch.

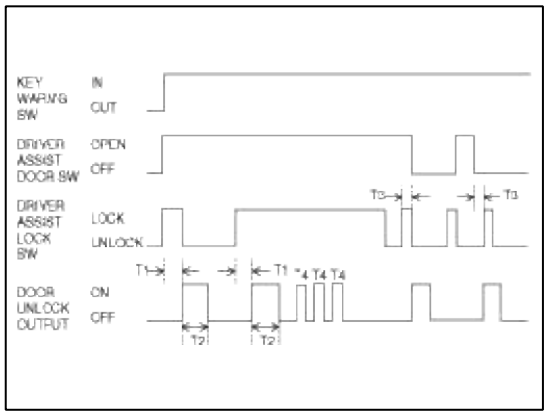
(5) If a door is open and locked and a key is inserted, issue one unlock pulse of duration 1 sec. (At KEY is inserted after driver seat unlock in 2 turn UNLOCK vehicle, no issue one unlock pulse)

(6) When Door is closed in 0.5 seconds after LOCK, an unlock pulse of duration 1sec shall be issued.

(7) When is Power window main switch LOCK, issue one unlock pulse immediately after 0.5 second LOCK. (Key warning switch = Keyless switch)

(8) To further prevent locking of keys in ignition, a guard time of 0.5 seconds is introduced after a door is closed. When key is in ignition and the door changes from open to close and a lock occurs within 0.5 sec, an unlock pulse of duration 1 sec shall be issued.

(9) If door warning switch is off and ignition input is on then ignition key reminder function is disabled. (If vehicle speed is greater than 3 km/h, ignition key reminder function is disabled.)



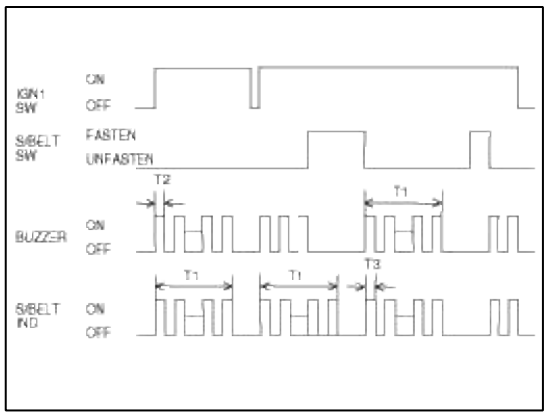
T1 : MAX 0.1 sec.,
T2 : 1.0 sec.,
T3 : 0 sec. < T3 < 0.5 sec.
T4 : 0.5 sec.

7. SEAT BELT WARNING TIMER

(1) When the ignition is switched ON, the seat belt warning indicator will illuminate (period: 1.0 sec., duty rate: 50%) and the chime bell will sound (period: 1.0 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.

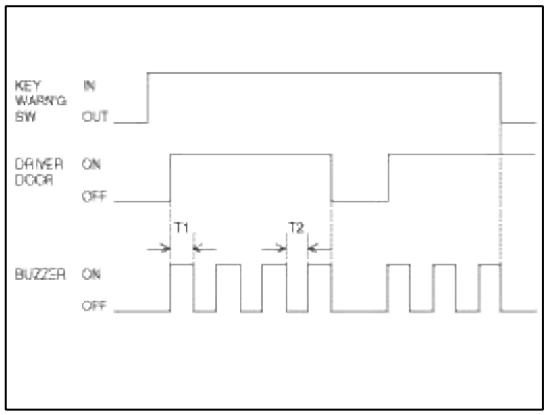


T1 : 6 ± 1 sec.,
T2 : 0.5 ± 0.1 sec (ON TIME).,
T3 : 0.3 ± 0.1 sec. (ON,OFF TIME)

8. KEY OPERATED WARNING

(1) If the key is in the ignition and the driver's door is opened, the buzzer is sounded (period: 1.0 sec., duty rate: 50%).

(2) If the ignition key is removed, or the door is closed, the buzzer is switched OFF immediately.

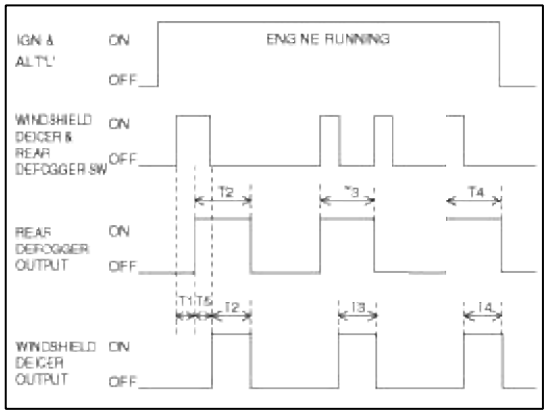


T1,T2 : 0.5±0.1sec.

9. WINDSHIELD DEICER & REAR DEFOGGER TIMER

(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.



T1 : 0.06 ± 0.01 sec.,

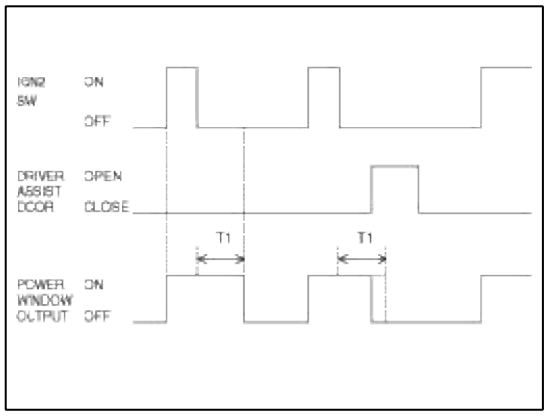
T2 : 20 ± 1 min.

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's door or assist door is opened, window power output is turned OFF immediately.

(3) When the driver's door or assist door is opened, the power window relay output is turned OFF immediately.

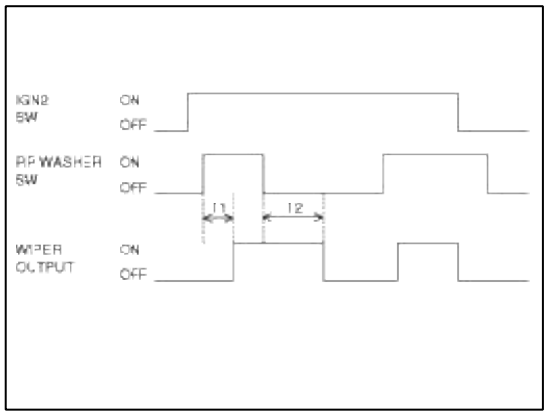


T1 : 30 ± 3 sec.

11. REAR WIPER AND WASHER

(1) If rear washer switch is turned on while the ignition switch is ON, rear wiper output will turn ON after 0.3 sec.

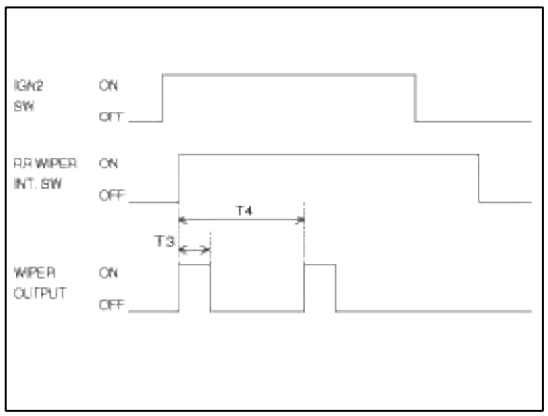
(2) If rear washer switch is turned OFF, rear wiper output remains ON for up to 3.8 sec.(T2).



T1 : 0.3

T2 : 2.5 ~ 3.8 sec.

(3) When the ignition switch is ON, if the intermittent rear wiper switch is turned ON, rear wiper output will remain ON for up to 0.7 sec. (T3).



T3 : 0.7 ± 0.1sec.,

T4 : 5 ± 0.5sec.

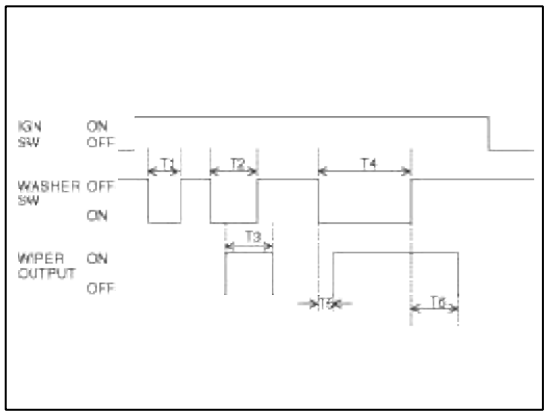
12. WIPER RELATED TO WASHER

(1) When the ignition switch is turned ON:

A. If washer switch is turned on, wiper output is ON after 0.3 sec. (T5)

B. If washer switch is turned OFF, wiper output is OFF after 3.8 sec. (T6)

(2) If the washer switch is turned OFF within 0.6 sec.(T2) of the ignition switch the wiper will remain ON for up to 0.7 sec.(T3) from the moment that washer switch is turned OFF.

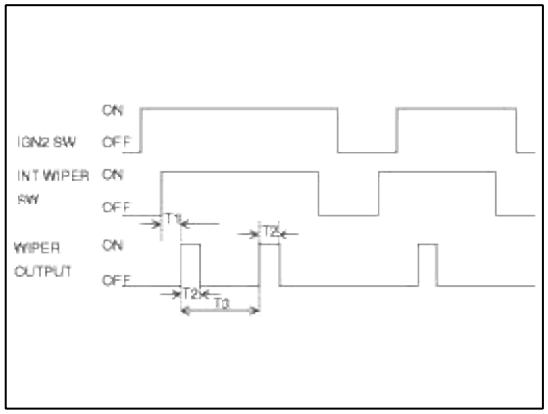


T1 : Less than 0.2 sec.
T2 : 0.2 ~0.6 sec. (MIST Function)
T3 : 0.7 ± 0.1sec.
T4 : More than 0.6 sec.
T5 : 0.3sec.
T6 : 2.5 ~3.8 sec.

13. VARIABLE INTERMITTENT WIPER (WINDSHIELD WIPER)

(1) With the ignition switch ON, if the intermittent wiper switch is turned on, wiper output is ON according to the setting.

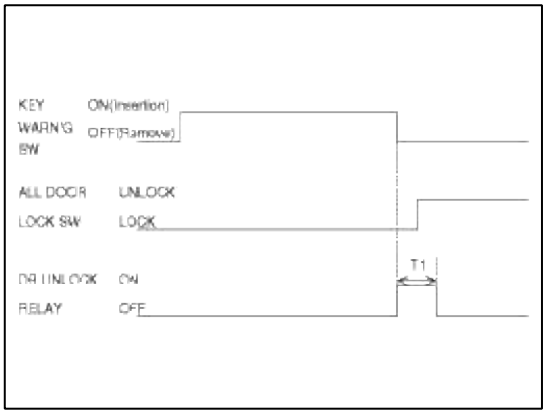
(2) When the intermittent wiper switch is ON, if the ignition switch is turned ON , wiper output is ON.



T1 : MAX 0.5 sec.,
T2 : 0.7 ± 0.1sec.,
T3 : 2.6 ± 0.7 sec. (FAST),
T3 : 18.0 ± 1.0sec. (SLOW) Car speed 0 Km

14. KEY REMOVE DOOR UNLOCK

Issue on door unlock pulse in case is locked state between all door at KEY separation after IGN SW OFF.



T1: 0.5 ± 0.5sec.

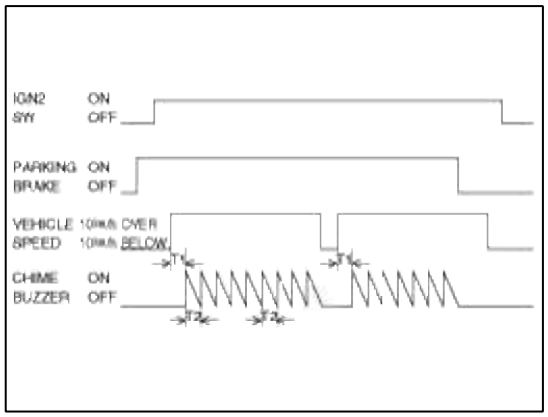
15. PARKING START WARNING

(1) When Ignition 2 is on and the park brake switch is on, if the vehicle speed is greater than 10km/h, then the chime buzzer is activated within 2 - 3 sec at a period of 1sec.

(2) While execute 2) clause in following case, output does OFF immediately.

A. If the vehicle speed falls below 10km/h the chime buzzer is deactivated.

B. If the park brake switch is off, the chime buzzer is deactivated.



T1 : 2.5 ± 0.5 sec.

T2 : 1.0 ± 0.1 sec.

16. 2-TURN UNLOCK

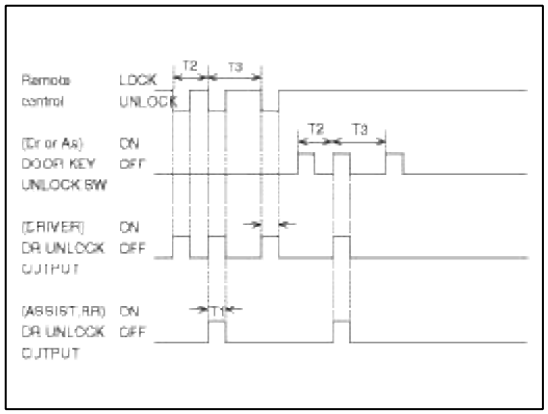
(1) When driver / assist key unlock signal is recived, only driver door/assist door unlock pulse are issued, if remote control unlock signal is received, only driver door pulse is issued.

(2) After 2) clauses action, when re-input by driver or assist key unlock or remote control unlock signal within T2 all door unlock pulse is issued.

(3) When unlock signal re-inputs ater T2 after 2) clauses acton, do only driver door unlock pulse are issued.(When door is inputed unlock signal in unlock state, no again unlock pulse is issued.

(4) When remote control signal is again received in driver unlock & harzard pulse is issuing by remote control unlock, all door unlock pulse issued and hazard pulse is issued 2 th.

(5) When input again remote unlock signal in 4 sec after driver unlock output & hazard output by unlock, all door unlock & hazard pulse is issued 2 th.



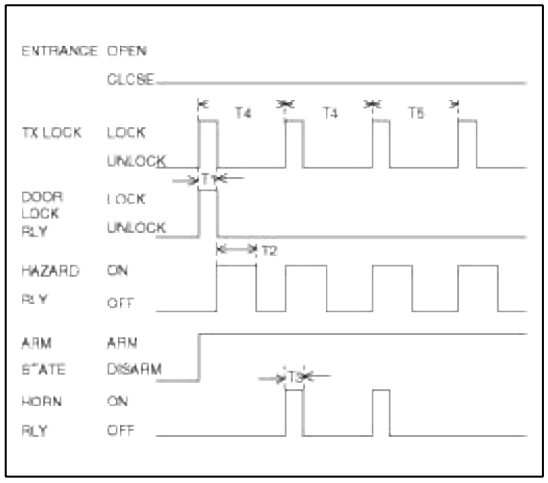
T1 : 0.5±0.1S

T2 : Less than 4 sec

T3 : More than 4 sec

17. HORN ANSWER BACK

(1) In the lock (arm state) state by transmitter lock, when received again transmitter lock signal within 4 sec after receive finally transmitter lock signal, horn pulse (30ms) is issued.

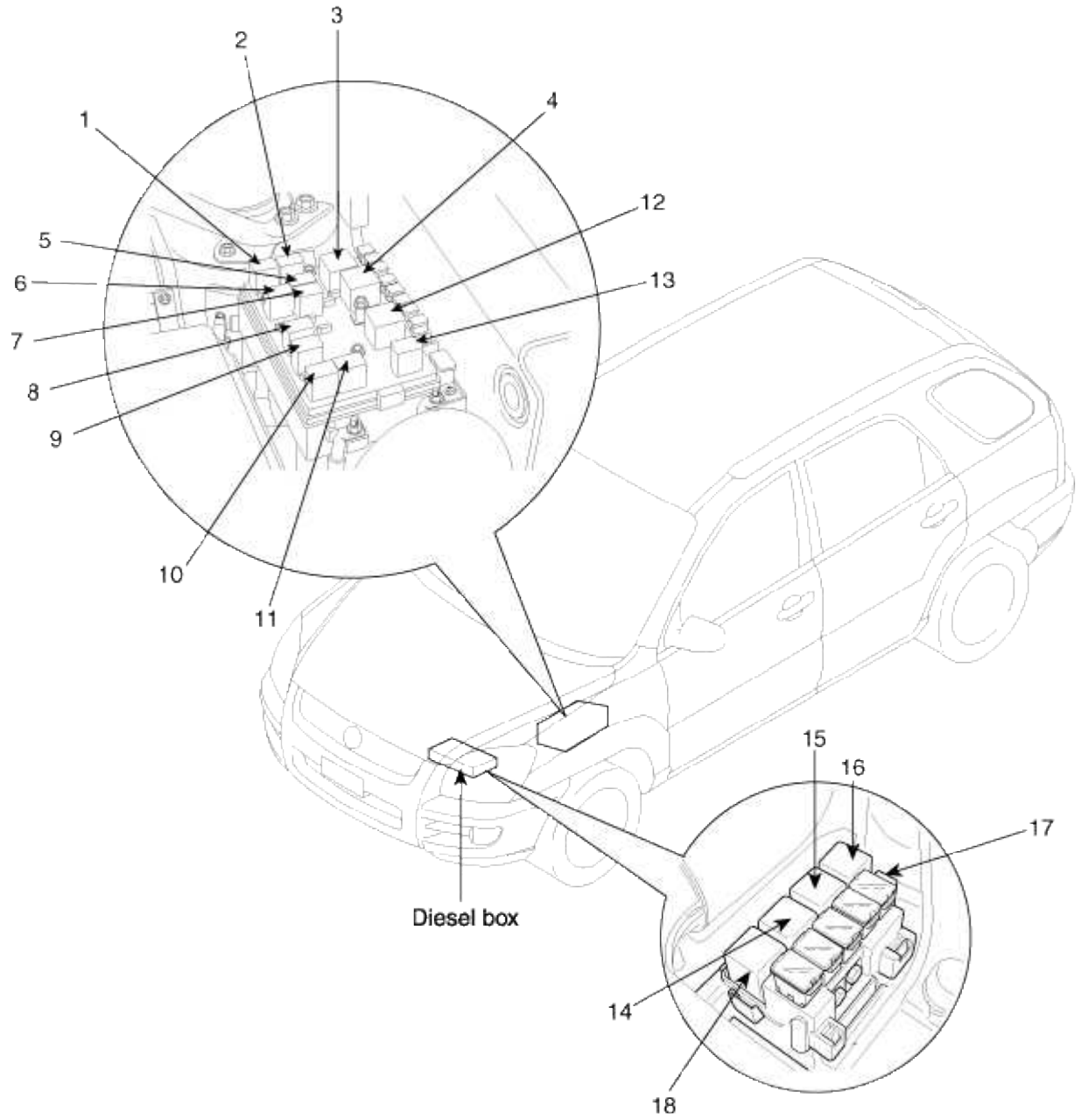


T1 : 0.5 ± 0.1 sec
T2 : 1.0 ± 0.1 sec
T3 : 30ms sec ± 5 ms
T4 : Less than 4 sec
T5 : More than 4 sec

Body Electrical System > Fuses And Relays > Components and Components Location

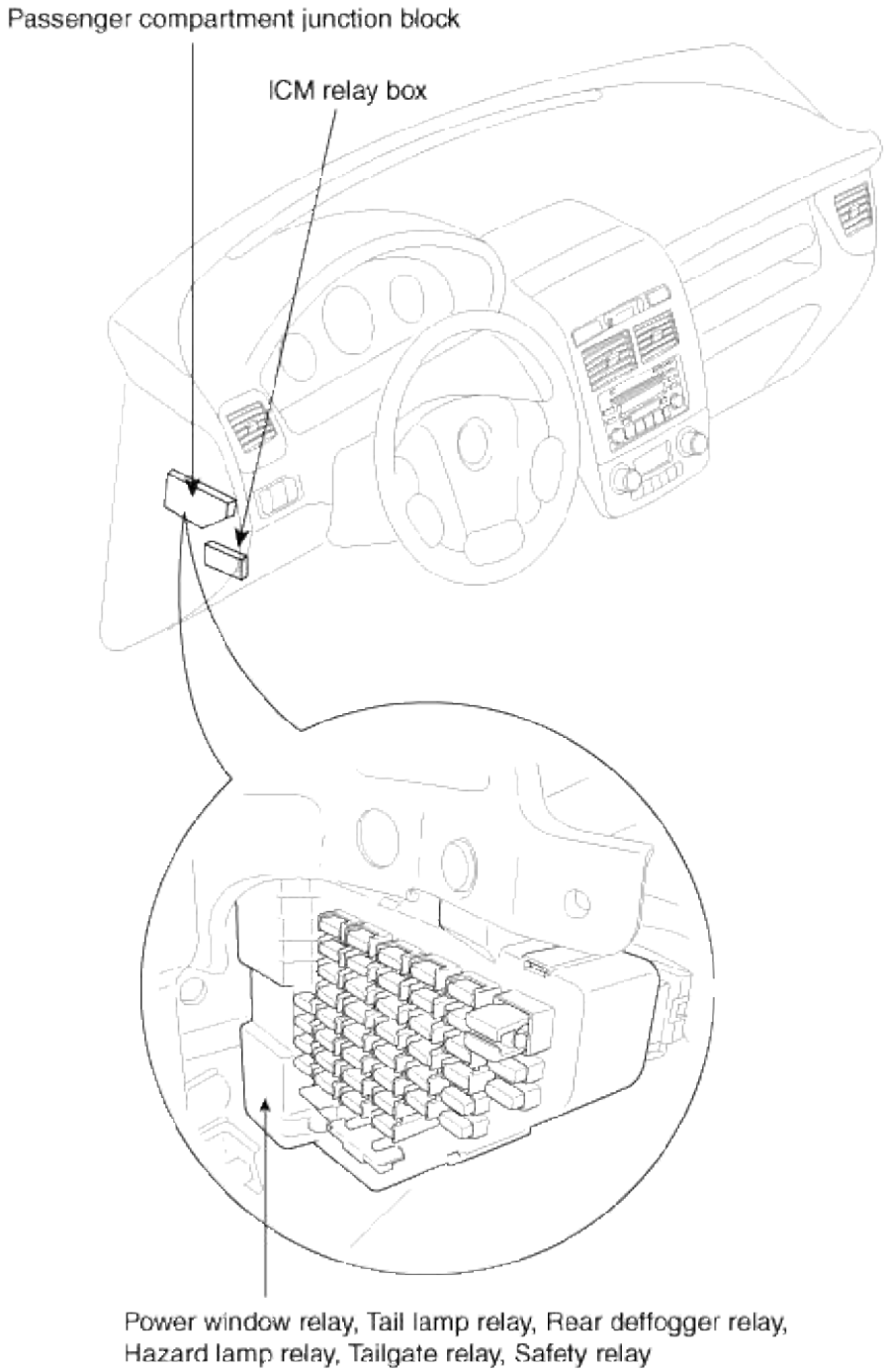
COMPONENTS

[ENGINE ROOM RELAY BOX]



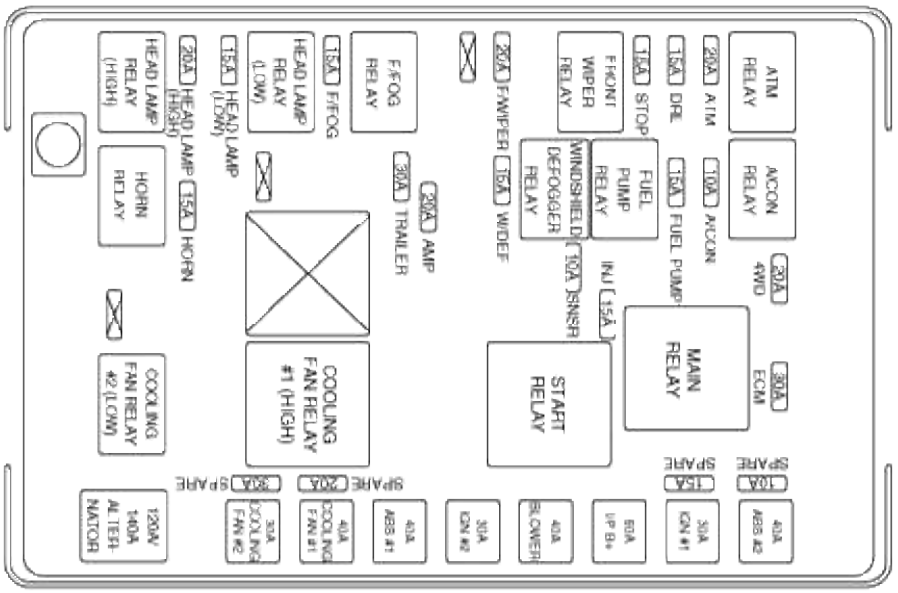
1. A/T relay
2. Air-conditioner relay
3. Main relay
4. Start relay
5. Fuel pump relay
6. Wiper relay
7. Windshield deicer relay
8. Front fog lamp relay
9. Head lamp relay(Low)
10. Head lamp relay(High)
11. Horn relay
12. Condenser fan #1 relay
13. Condenser fan #2 relay
14. PTC heater relay #1
15. PTC heater relay #2
16. PTC heater relay #3
17. Fuel filter heater relay
18. Glow relay

[Passenger compartment relay box]



Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Components and Components Location

COMPONENT



CIRCUIT

FUSE	(A)	Circuit Protected
ALTERNATOR	120A/140A	Battery, Alternator
I/P B+	60A	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
COOLING FAN #1	40A	Cooling Fan Relay #1 (HIGH)
COOLING FAN #2	30A	Cooling Fan Relay #2 (LOW)
IGN #1	30A	Ignition Switch (IG1, ACC)
IGN #2	30A	Ignition Switch (IG2, START), Start Relay
ECM	30A	Main Relay, Fuel Pump Relay, SNSR 10A, INJ 10A, ECM
TRAILER	30A	Trailer Power Outlet
4WD	20A	4WD ECM
F/WIPER	20A	Front Wiper Relay, Front Wiper motor, Multifunction Switch
AMP	20A	Sub Woofer, AMP #1
HEAD LAMP (HIGH)	20A	Head Lamp Relay (HIGH)
ATM	20A	ATM Relay
FUEL PUMP	15A	Fuel Pump Relay
INJ	15A	ECM, Injector, ISA, CVVT Oil Control Valve, Canister Close Valve, Variable Intake Manifold Control Motor #1, #2
STOP	15A	Stop Lamp Switch
W/DEF	15A	Windshield Defogger Relay
F/FOG	15A	F/FOG Relay
HEAD LAMP (LOW)	15A	Head Lamp Relay (LOW)
HORN	15A	Horn Relay, Alternator, Siren Relay
A/CON	10A	A/CON Relay
SNSR	10A	MAF Sensor, O_2 Sensor ECM SMATRA, Crank Shaft Position Sensor
DRL	15A	DRL Control Module

※USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

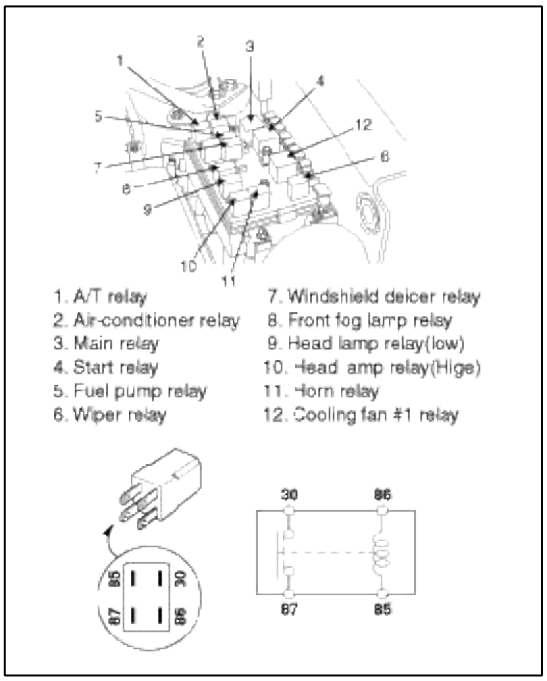
INSPECTION

POWER RELAY TEST (TYPE A)

Check for continuity between the terminals.

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.

2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.

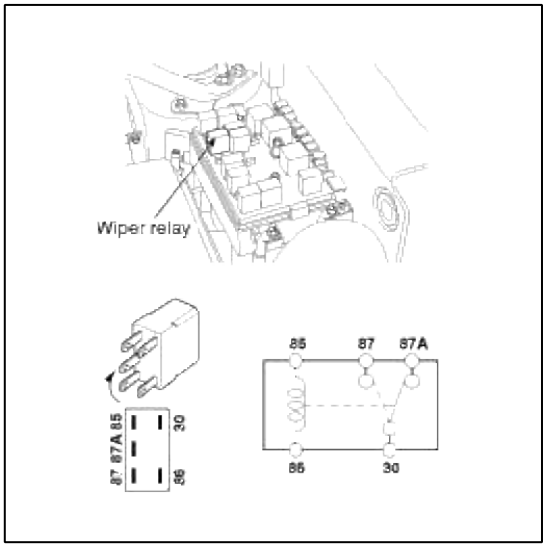


Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

POWER RELAY TEST (TYPE B)

Check for continuity between the terminals.

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87A terminals when power is disconnected.



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

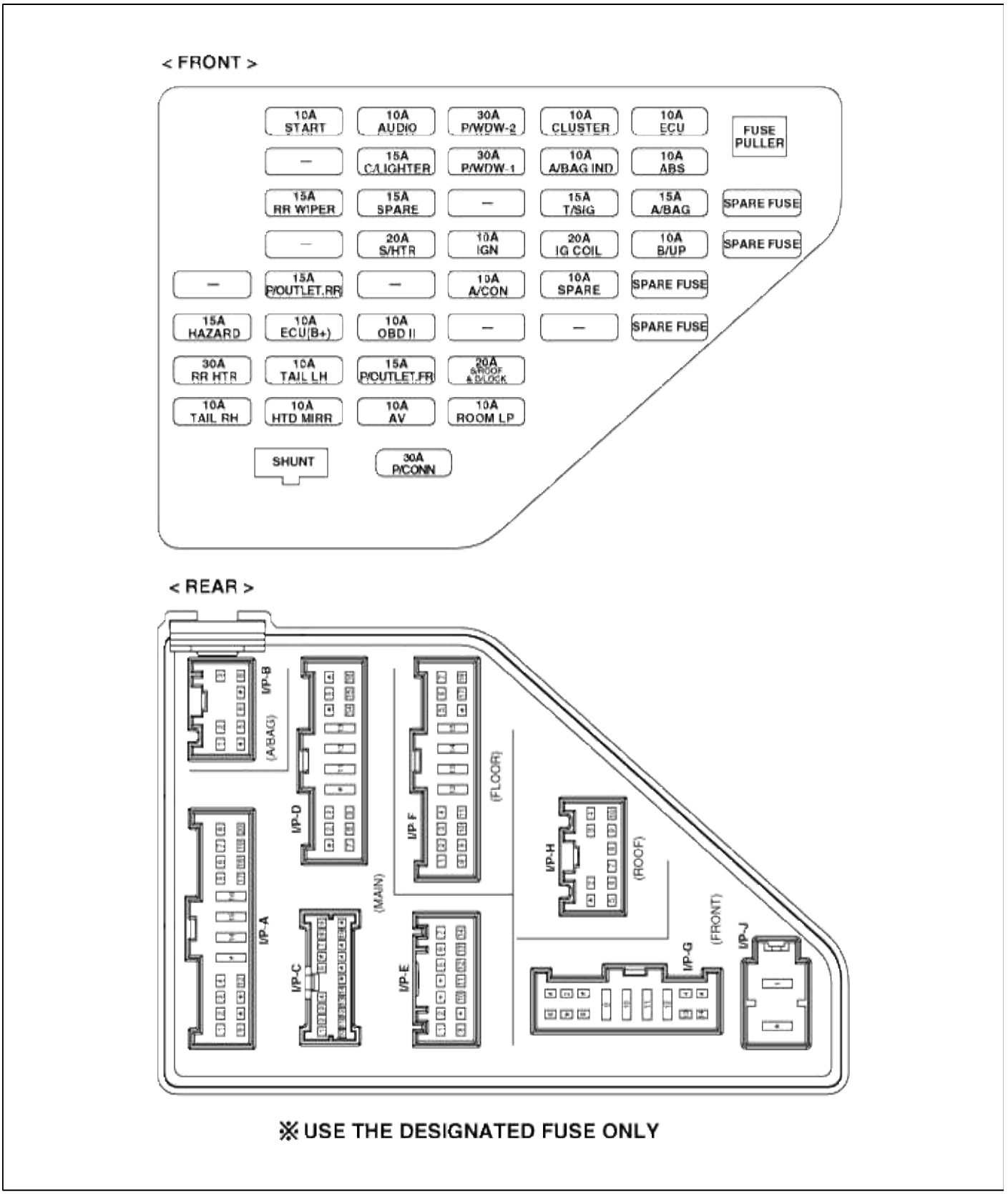
FUSE INSPECTION

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.

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Components and Components Location

COMPONENTS



FUSE	(A)	Circuit Protected
TAIL RH	10A	Rear Combi Lamp RH, Head Lamp RH, F/FOG Relay, Telltale Lamp, Trailer Lamp Connector
RR HTR	30A	Rear Defogger Relay, Contact, ETACM
HAZARD	15A	Hazard Relay, Hazard Switch, ETACM, Instrument Cluster Multifunction Switch, Rear Combi Lamp, Head Lamp, Side Repeater Lamp,Trailer Lamp Connector
HTD MIRR	15A	Power Outside Mirror Motor LH/RH, A/C Control Module
TAIL LH	10A	Head Lamp LH, Rear Combi Lamp LH, License Lamp LH/RH
ECU(B+)	10A	TCM, Immobilizer Control Module
P/OUTLET. RR	15A	Rear Power Outlet
RR WIPER	15A	Instrument Cluster, ETACM, Luggage Lamp, Cargo Lamp, Tailgate Switch, Rear Window Switch, Rear Wiper Relay, Multifunction Switch, Rear Defogger Relay
START	10A	Burglar Alarm Relay, Cruise Control Module, Start Relay Transaxle Range Switch, Ignition Lock Switch
AV	10A	Audio
P/OUTLET. FR	15A	Front Power Outlet
OBD II	10A	Data Link Connector, Multipurpose Check Connector
S/HTR	20A	Seat Warmer Switch LH/RH
C/LIGHTER	15A	Cigarette Lighter
AUDIO	10A	Power Outside Mirror Switch, Digital Clock, ETACM Audio
ROOM LP	10A	Key Remind Switch, Instrument Cluster, ETACM, Room Lamp A/C Control Module, Digital Clock, Luggage Lamp, Front Door Lamp LH/RH, Map Lamp, Cargo Lamp, Sunroof Switch
S/ROOF & D/LOCK	20A	Door Lock / Unlock Relay, Sunroof Controller, 2Turn Unlock Relay
A/CON	10A	A/C Control Module, ETACM, Blower Relay, Sunroof Controller Electro Chromic Mirror
IGN	10A	Head Lamp Relay, AQS Sensor, DRL Control Module, F/FOG Relay
P/WDW -1	30A	Front Power Window Switch LH Rear Power Window Switch LH
P/WDW -2	30A	Front Power Window Switch LH/RH Rear Power Window Switch RH
IG COIL	20A	Ignition Coil
T/SIG	15A	Hazard Switch, Auto Light & Photo Sensor
A/BAG IND	10A	Instrument Cluster
CLUSTER	10A	Instrument Cluster, ETACM, Immobilizer Contro Module Pre-excitation Resistor, Alternator, DRL Control Module
B/UP	10A	Back-up Lamp Switch, Transaxle Range Switch
A/BAG	15A	SRS Control Module, PODS Module, Telltale Lamp
ABS	10A	ABS Control Module, ESP Control Module, G-sensor, TCS Switch, ESP Switch, Steering Angle Sensor
ECU	10A	Immobilizer Control Module, Vehicle Speed Sensor, ECM, TCM Pulse Generator 'A'/'B', Cruise Control Module, 4WD ECM, Stop Lamp Switch, Multifunction Switch

※ USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Repair procedures

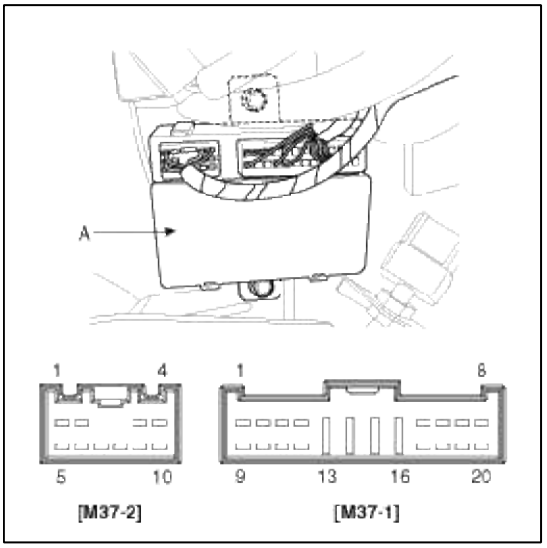
FUSE INSPECTION

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.

ICM (Integrated circuit module) RELAY

The ICM is united with many kinds of relay and installed at the below the relay box(passenger compartment).



ICM (Integrated circuit module) RELAY TEST

DOOR LOCK RELAY

Check for continuity between the terminals.

1. There should be continuity between the No.17 and No.19 terminals when power and ground are connected to the No.17 and No.20 in the M37-1 terminals.
2. There should be no continuity between the No.17 and No.19 terminals when power is disconnected.

DOOR UNLOCK RELAY

Check for continuity between the terminals.

1. There should be continuity between the No.17 and No18 terminals when power and ground are connected to the No.17 and No.5 in the M37-1 terminal.
2. There should be no continuity between the No.7 and No.18 terminals when power is disconnected.

BURGLAR ALARM

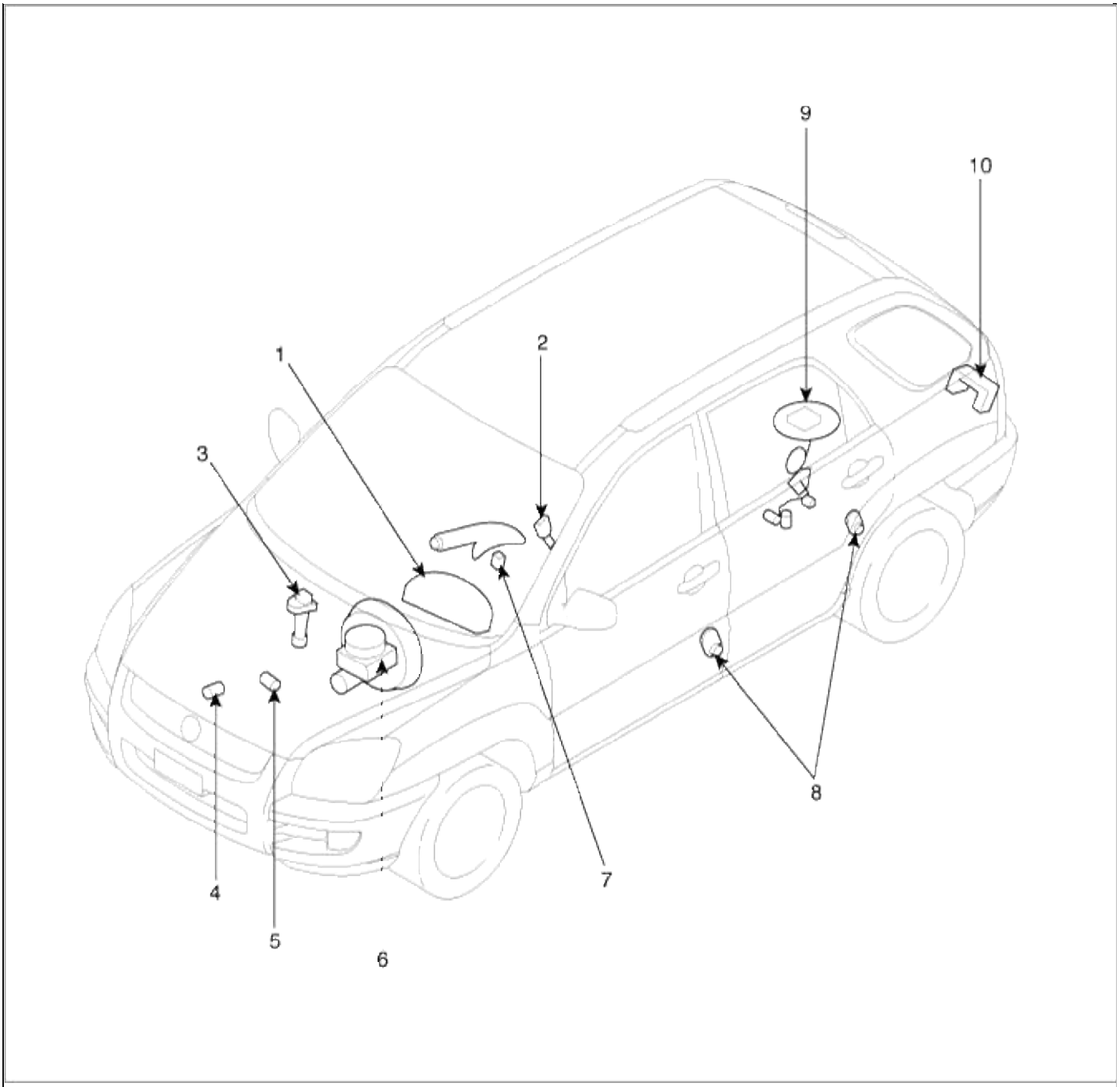
1. There should be continuity between the No.7 and No.9 terminals when power and ground are connected to the No.7 and No.8 in the M37-2 terminals.
2. There should be no continuity between the No.7 and No.9 terminals when power is disconnected.

BURGLAR ALARM HORN

1. There should be continuity between the No.6 and No.5 terminals when power and ground are connected to the No.6 and No.1 in the M37-2 terminals.
2. There should be no continuity between the No.6 and No.5 terminals when power is disconnected.

Body Electrical System > Indicators And Gauges > Components and Components Location

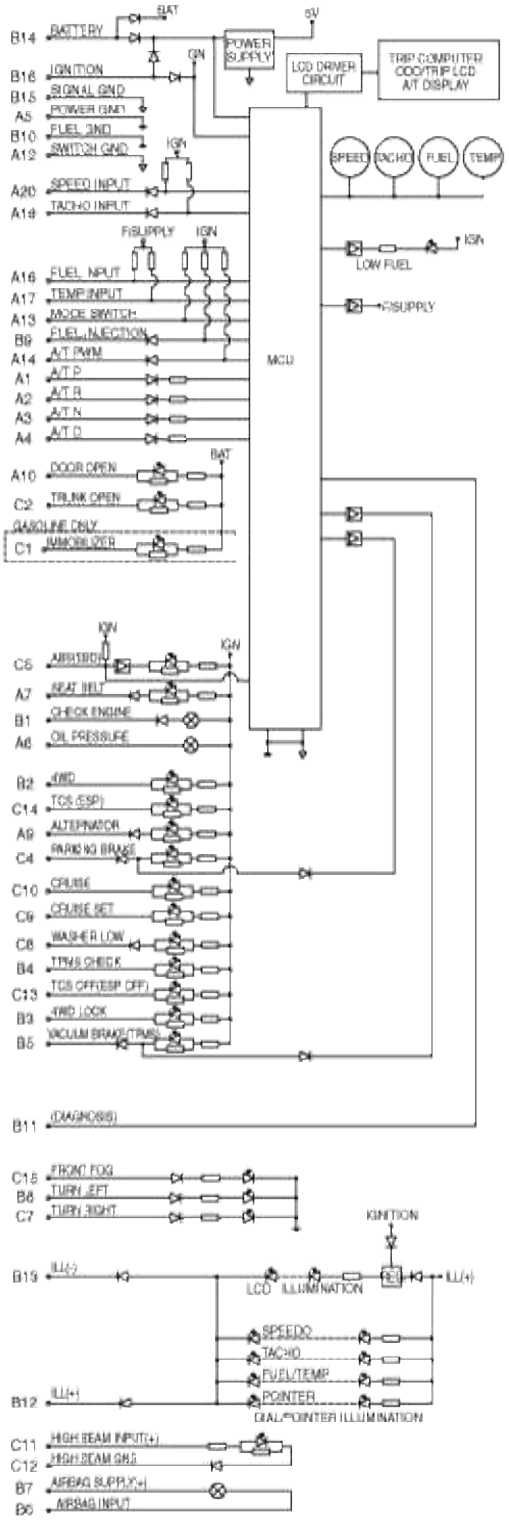
COMPONENTS



1. Cluster assembly
2. Seat belt switch
3. Vehicle speed sensor
4. Engine coolant temperature sender
5. Oil pressure switch
6. Brake fluid level warning switch
7. Parking brake switch
8. Door switch
9. Fuel gauge sender
10. Tailgate switch

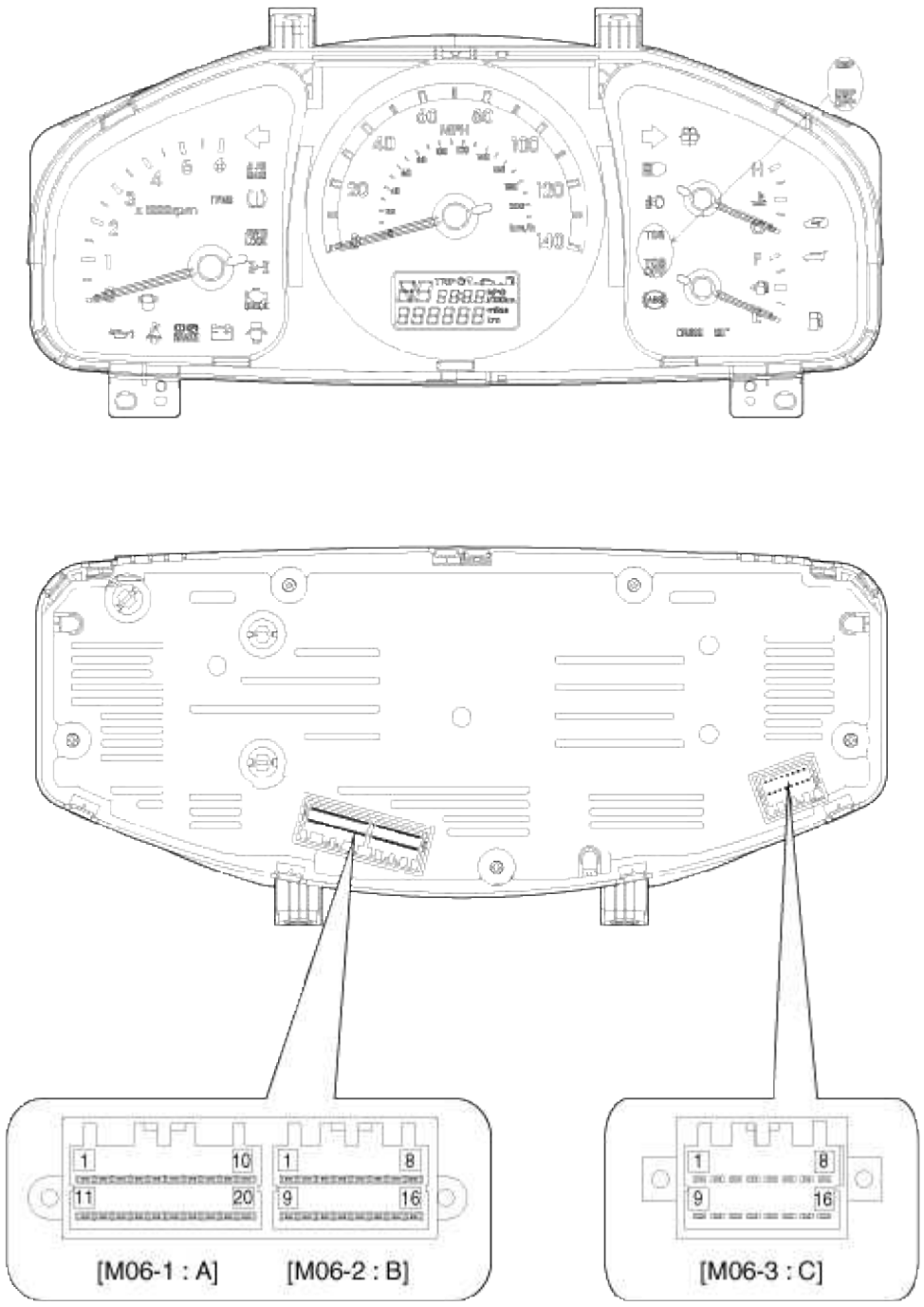
Body Electrical System > Indicators And Gauges > Instrument Cluster > Schematic Diagrams

CIRCUIT DIAGRAM



Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location

COMPONENTS

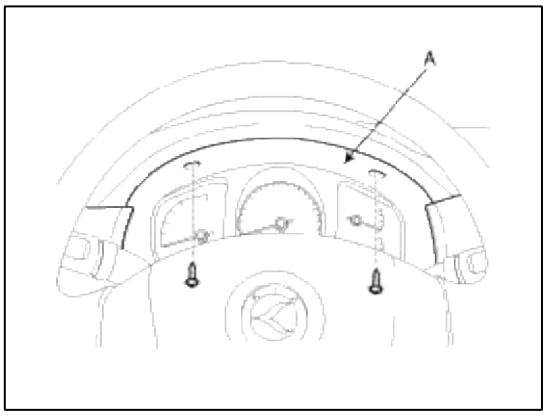


Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

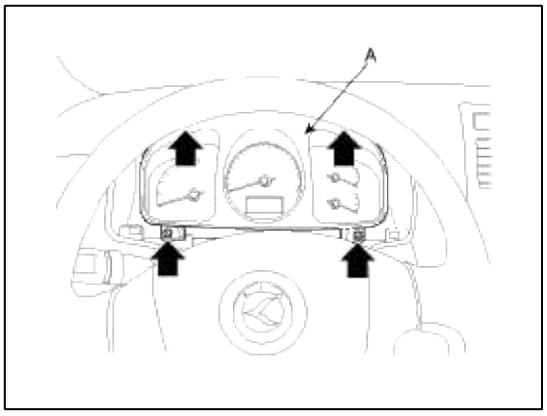
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel (A) after removing 2 screws.

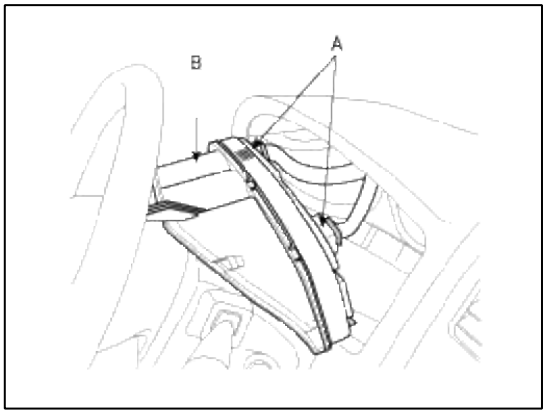
3. Remove the trip switch connector.



4. Remove the cluster (A) from the housing after removing 4 screws.



5. Remove the cluster connecter (A) and the cluster (B).



6. Installation is the reverse of removal.

INSPECTION

SPEEDOMETER

1. Adjust the pressure of the tires to the specified level.

2. 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.

Velocity (km/h)	20	40	60	80	100
Tolerance (km/h)	+4.0 +0.0	+4.0 +0.0	+4.6 +0.6	+5.2 +1.2	+6.2 +2.2
Velocity (km/h)	120	140	160	180	200
Tolerance (km/h)	+7.0 +2.4	+8.0 +3.4	+9.0 +4.4	+10.0 +5.0	+11.0 +6.0

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	+3.0 +0.0	+3.0 +0.0	+3.0 +0.0	+3.8 +0.8
Velocity (MPH)	80	100	120	
Tolerance (MPH)	+4.8 +1.2	+5.6 +2.0	+6.6 +3.0	

VEHICLE SPEED SENSOR

1. Connect the positive (+) lead from battery to terminal 3 and negative (-) lead to terminal 1.
2. Connect the positive (+) lead from tester to terminal 2 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 1 and 2.
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.

TACHOMETER

1. Connect the scan tool to the diagnostic link connector or install a tachometer.

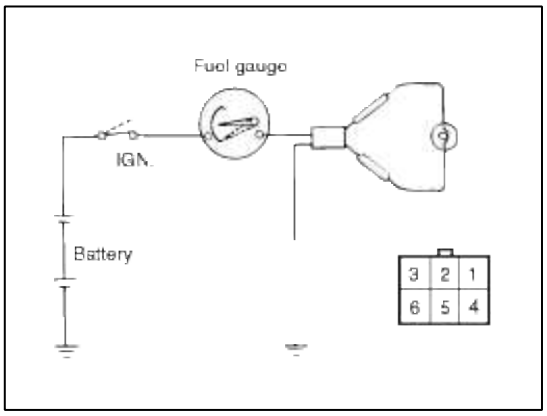
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

> **CAUTION**
>
> • Reversing the connections of the tachometer will damage the transistor and diodes inside.
> • When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution(rpm)	1,000	2,000	3,000	4,000
Tolerance(rpm)	±100	±125	±150	±150
Revolution(rpm)	5,000	6,000	7,000	
Tolerance(rpm)	±150	±180	±210	

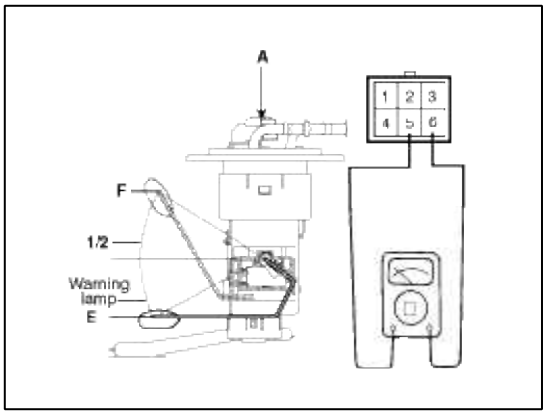
FUEL GAUGE

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 wattages, 12V test bulb to terminals 2 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



FUEL SENDER

1. Using an ohmmeter, measure the resistance between terminals 5 and 6 at each float level.



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

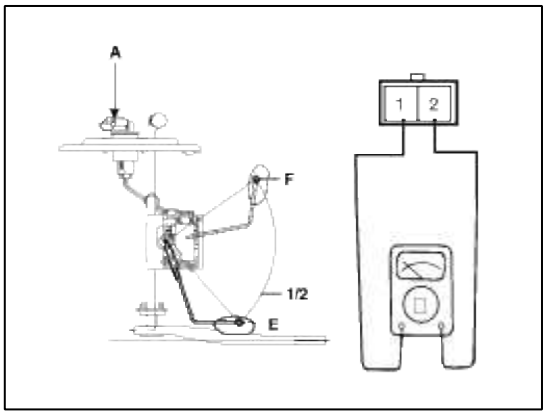
Position	Resistance(Ω)
Sender (E)	104.8 ± 1
Warning lamp	89.9 ± 1
1/2	13.7 ± 1
Sender (F)	4.2 ± 1

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.

SUCTION FUEL GAUGE SENDER

1. Using an ohmmeter, measure the resistance between terminals 1 and 2 of SUB sender connector (A) at each float level.



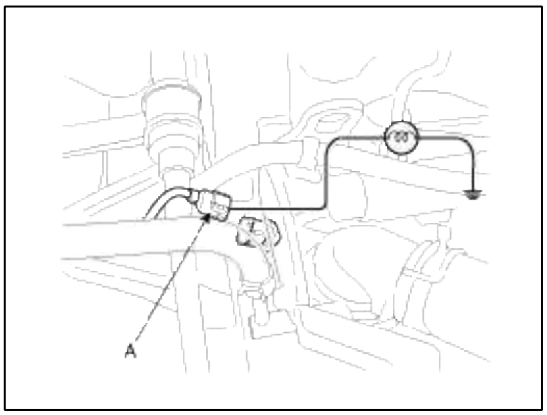
2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

Position	Resistance(Ω)
Sender (E)	95.2 ± 1
1/2	90.2 ± 1
Sender (F)	3.8 ± 1

3. If the height resistance is unsatisfied, replace the fuel sender as an assembly.

ENGINE COOLANT TEMPERATURE GAUGE

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. If operation is not specified, replace the engine coolant temperature gauge. Then recheck the system.



ENGINE COOLANT TEMPERATURE SENDER

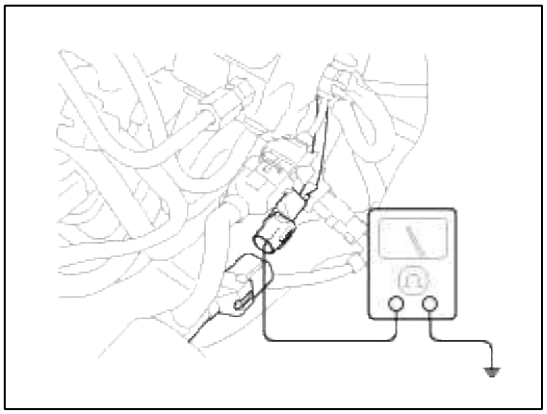
1. Using an ohmmeter, measure the resistance between the terminal 2 of sender connector and ground.

2. If the resistance value is not as shown in the table, replace the temperature sender.

Temperature (°C)	49	71	Engine
Gauge angle (°)	-23	-1 ± 2	-
Resistance (Ω)	128	53.8	Gasoline
Temperature (°C)	110	127.4	Engine
Gauge angle (°)	1 ± 2	23 ± 5	-
Resistance (Ω)	16.1	14.1	Gasoline

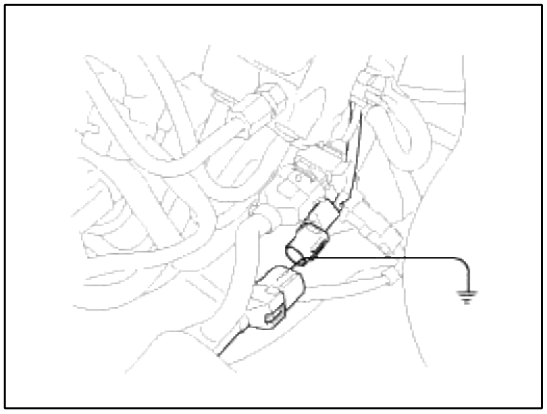
OIL PRESSURE SWITCH

1. Check that there is continuity between the oil press switch terminal (A) and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



OIL PRESSURE WARNING LAMP

1. Disconnect the connector from the warning switch and ground the terminal on the wire harness side connector.
2. Turn the ignition switch ON. Check that the warning lamp lights up.If the warning lamp doesn't light, test the bulb or inspect the wire harness.



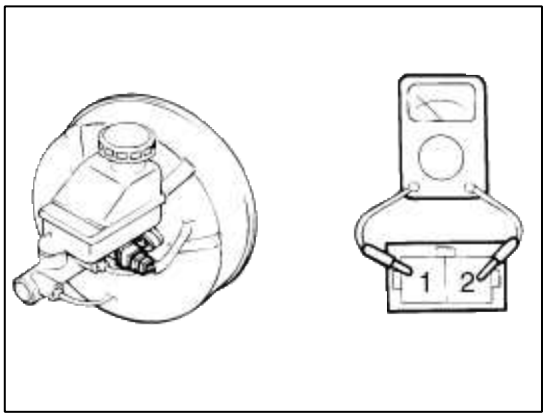
BRAKE FLUID LEVEL WARNING SWITCH

1. Remove the connector from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.

BRAKE FLUID LEVEL WARNING LAMP

1. Start the engine.
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.

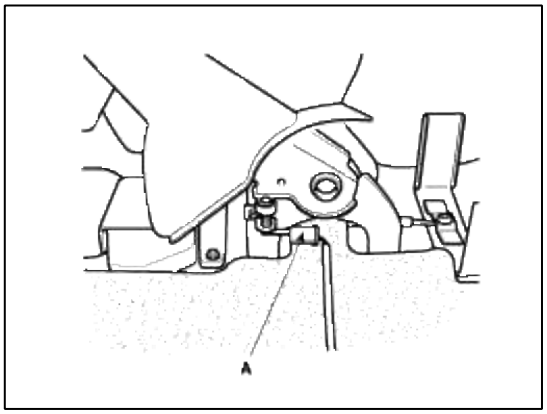
5. Verify that the warning lamp lights.



PARKING BRAKE SWITCH

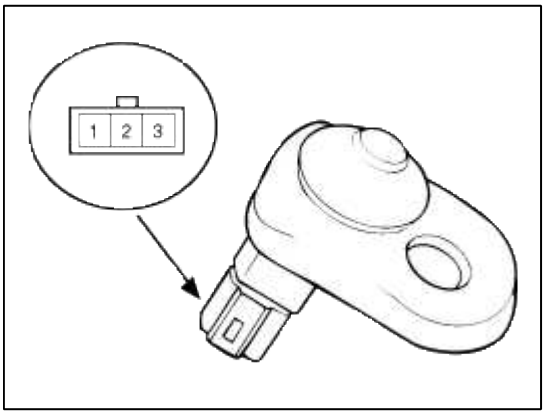
The parking brake switch (A) is a pulling type. It is located under the parking brake lever. To adjust, move the switch mount up and down with the parking brake lever released all the way.

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.



DOOR SWITCH

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



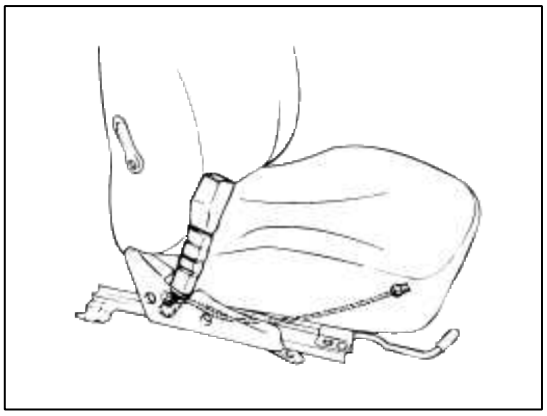
Terminal / Position	1	2	Ground
Free(Door open)	○	○	○
Push(Door close)			

SEAT BELT SWITCH

1. Remove the connector from the switch.

2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



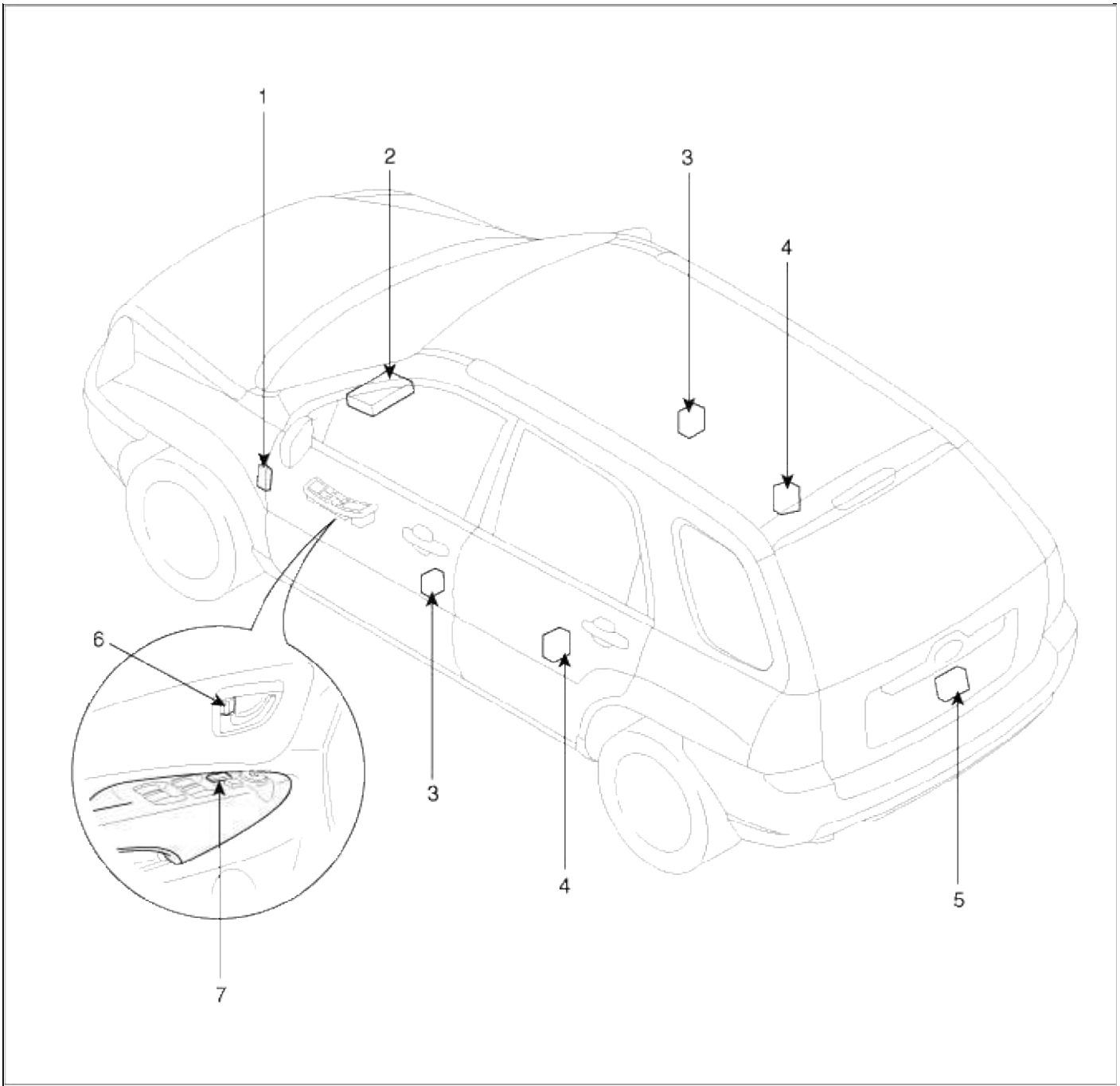
SEAT BELT WARNING LAMP

With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

Body Electrical System > Power Door Locks > Components and Components Location

COMPONENTS



1. ICM relay box
2. ETACS module
3. Front door lock actuator & switch
4. Rear door lock actuator & switch
5. Tailgate lock actuator & switch
6. Door lock knob
7. Door lock switch

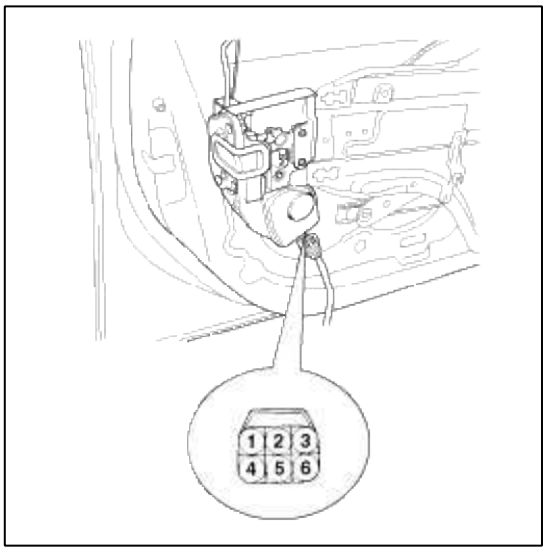
Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

INSPECTION

FRONT DOOR LOCK ACTUATOR INSPECTION

1. Remove the front door trim panel. (Refer to the BD group-front door)

2. Disconnect the 6P connector from the actuator.

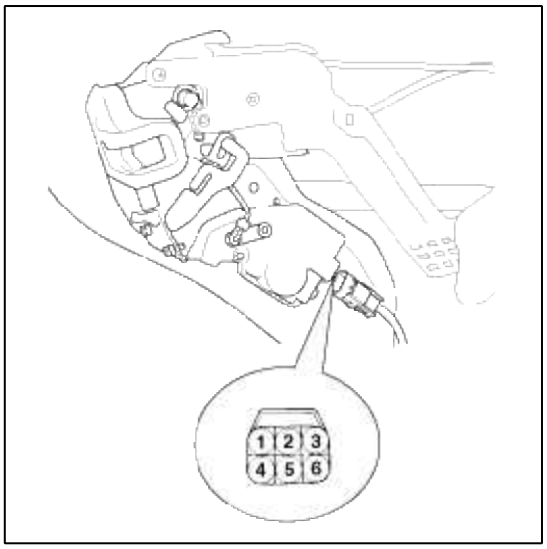


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		4	6
Front left	Lock	⊖	⊕
	Unlock	⊕	⊖
Front right	Lock	⊕	⊖
	Unlock	⊖	⊕

REAR DOOR LOCK ACTUATOR INSPECTION

1. Remove the rear door trim panel. (see BD group-rear door)
2. Disconnect the 6P connector from the actuator.



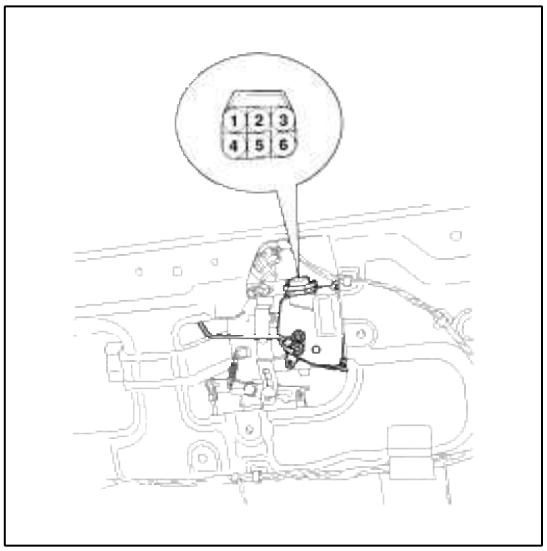
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		2	3
Rear left	Lock	⊕	⊖
	Unlock	○	⊕
Rear right	Lock	⊖	⊕
	Unlock	⊕	⊖

TAILGATE LOCK ACTUATOR INSPECTION

1. Remove the tailgate trim panel. (see BD group-tailgate)

2. Disconnect the 6P connector from the actuator.

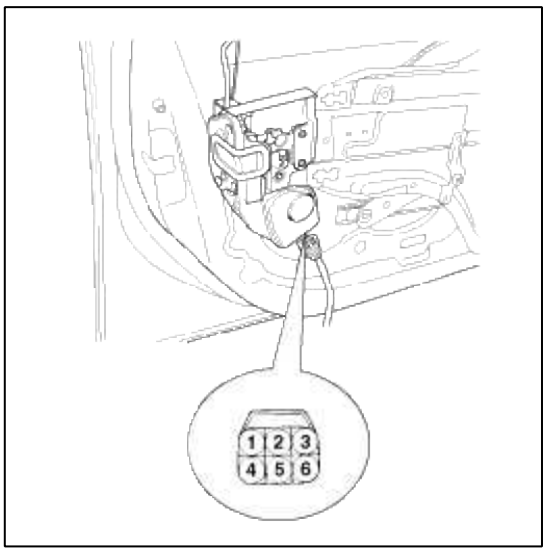


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	1	2
Lock	⊕	⊖
Unlock	⊖	⊕

FRONT DOOR LOCK SWITCH INSPECTION

1. Remove the front door trim panel. (Refer to the BD group - front door)
2. Disconnect the 6P connector from the actuator.



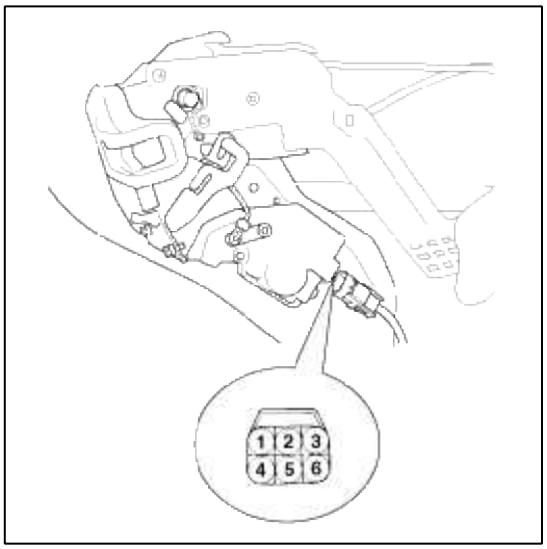
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	2	3
Front left	Lock	○		○
	Unlock	○	○	
Front right	Lock	○		○
	Unlock		○	○

REAR DOOR LOCK SWITCH INSPECTION

1. Remove the rear door trim panel. (Refer to the BD group - rear door)

2. Disconnect the 6P connector from the actuator.

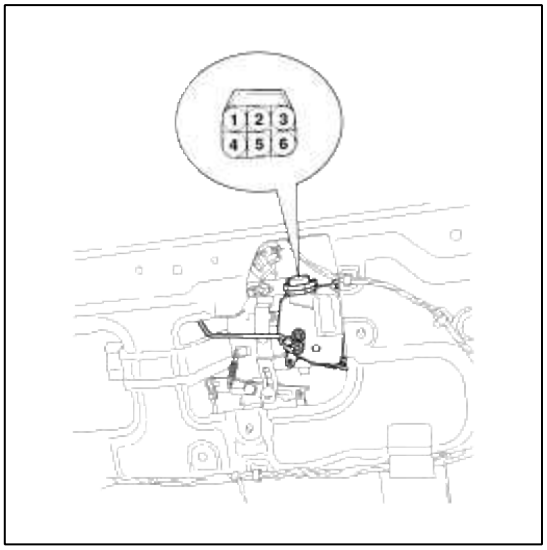


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		4	5	6
Rear left	Lock		○	○
	Unlock	○		○
Rear right	Lock	○		○
	Unlock		○	○

TAILGATE LOCK SWITCH INSPECTION

1. Remove the tailgate trim panel. (see BD group - tailgate)
2. Disconnect the 6P connector from the actuator.



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

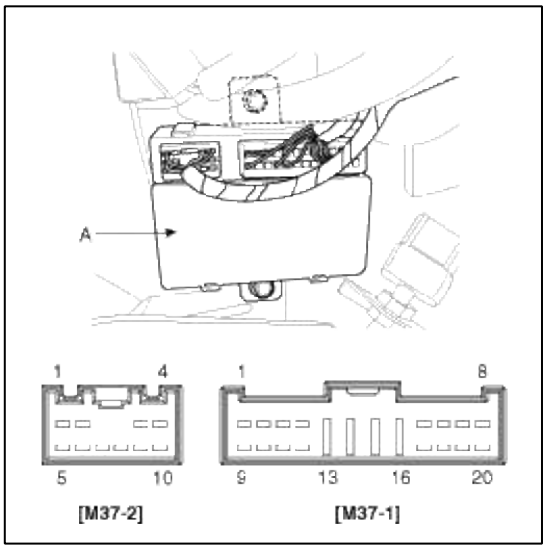
Position \ Terminal	4	5	6
Lock		○	○
Unlock	○		○

Body Electrical System > Power Door Locks > Power Door Lock Relay > Repair procedures

INSPECTION

1. Remove the negative (-) battery terminal.
2. Remove the driver side crash pad lower panel.

3. Remove the ICM relay box (A) after loosening 2 mounting nuts and removing 3 connectors under the junction box(Passenger compartment).



4. Check for continuity between the terminals.

DOOR LOCK

Check for continuity between the terminals.

1. There should be continuity between the No.17 and No.19 terminals when power and ground are connected to the No.17 and No.20 in the M37-1 terminals.
2. There should be no continuity between the No.17 and No.19 terminals when power is disconnected.

DOOR UNLOCK

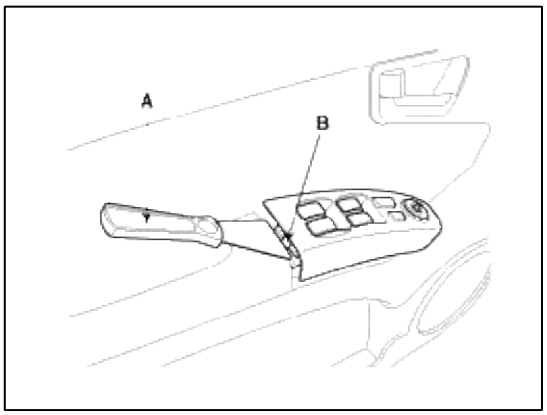
1. There should be continuity between the No.17 and No.18 terminals when power and ground are connected to the No.17 and No.5 in the M37-1 terminals.
2. There should be no continuity between the No.17 and No.18 terminals when power is disconnected.

Body Electrical System > Power Door Locks > Power Door Lock Switch > Repair procedures

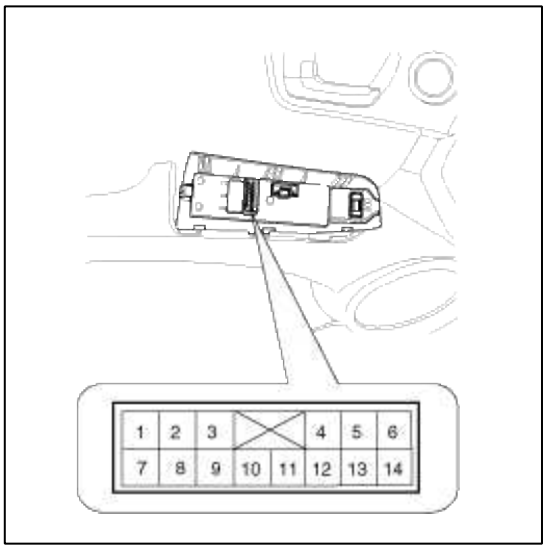
INSPECTION

DRIVER'S DOOR LOCK SWITCH INSPECTION

1. Remove the negative (-) battery terminal.
2. Remove the power window switch module by pressing fixing clip part (B) with scraper (A).



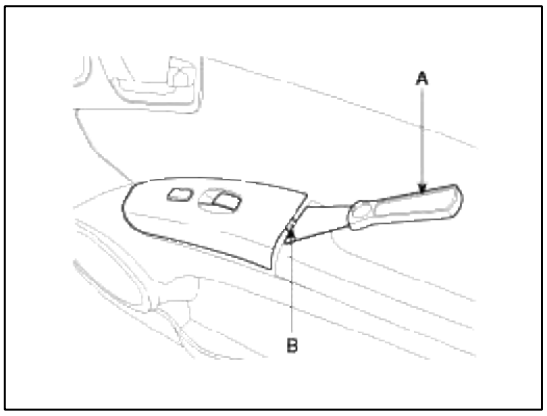
3. Check for continuity between the terminals in each switch position according to the table.



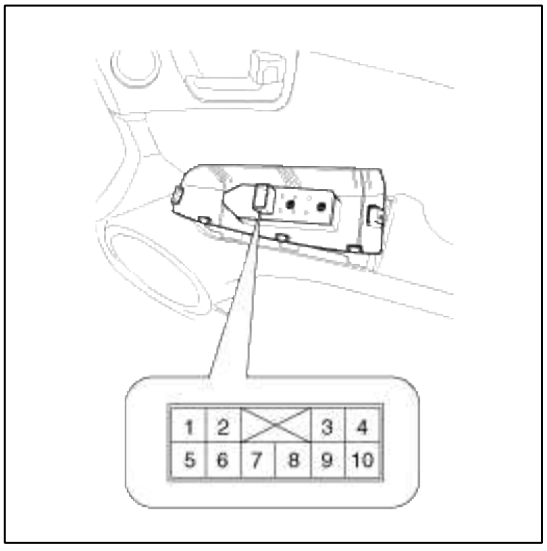
Position \ Terminal	4	10	11
Lock		○	○
Unlock	○	○	

ASSIST DOOR LOCK SWITCH INSPECTION

1. Remove the negative (-) battery terminal.
2. Remove the power window switch module by pressing fixing clip part (B) with scraper (A).



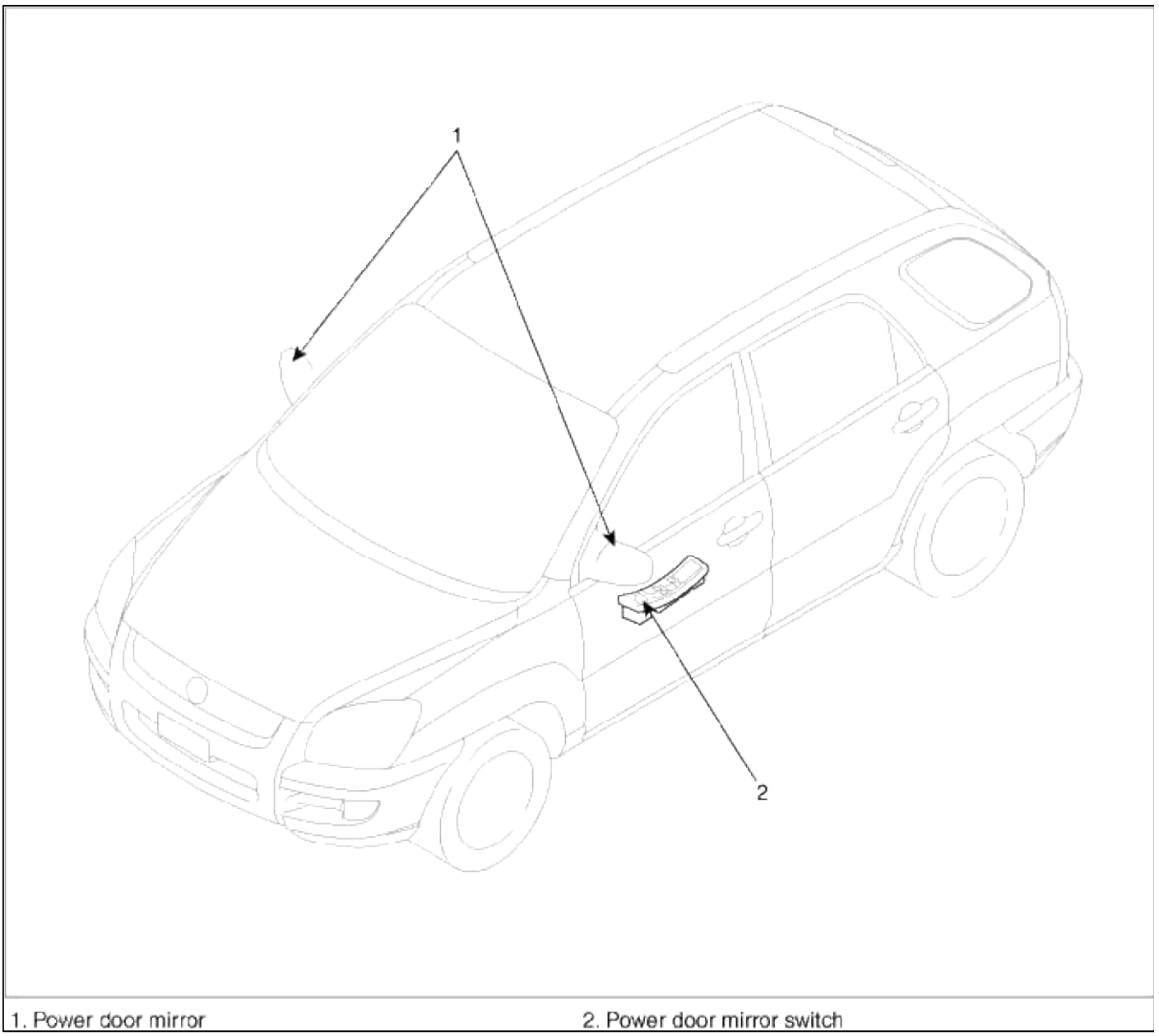
3. Check for continuity between the terminals in each switch position according to the table.



Terminal / Position	3	4	7
Lock		○	○
Unlock	○		○

Body Electrical System > Power Door Mirrors > Components and Components Location

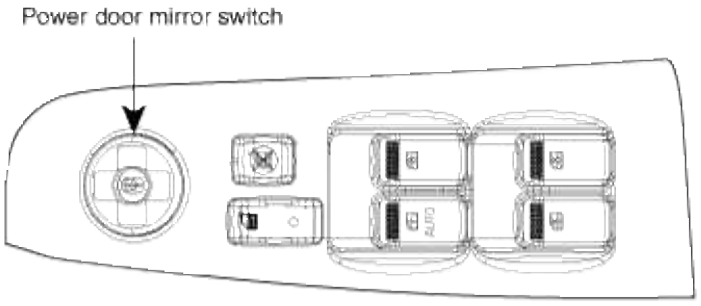
COMPONENTS

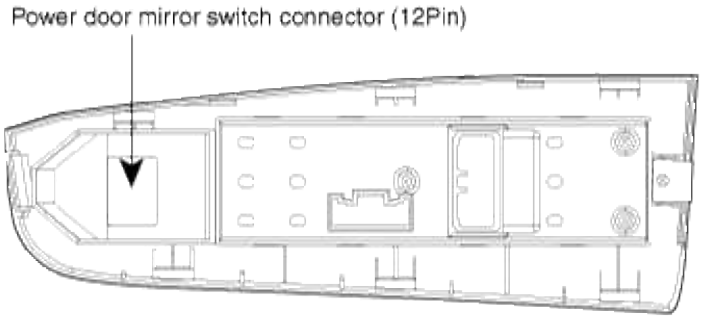


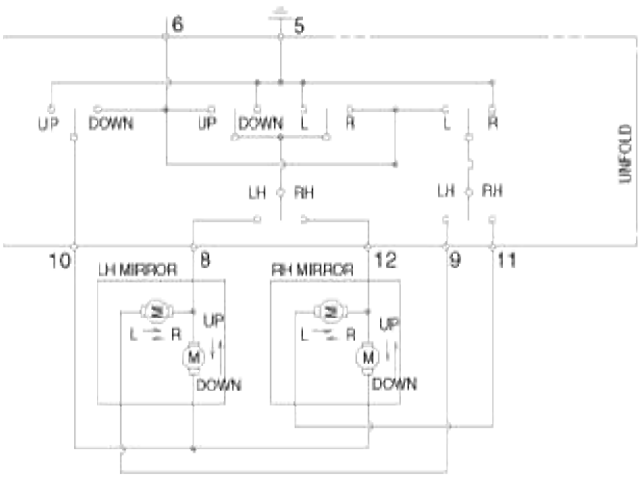
1. Power door mirror
2. Power door mirror switch

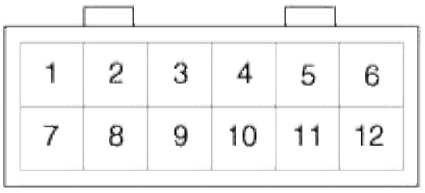
Body Electrical System > Power Door Mirrors > Power out side mirror switch > Schematic Diagrams

CIRCUIT DIAGRAM









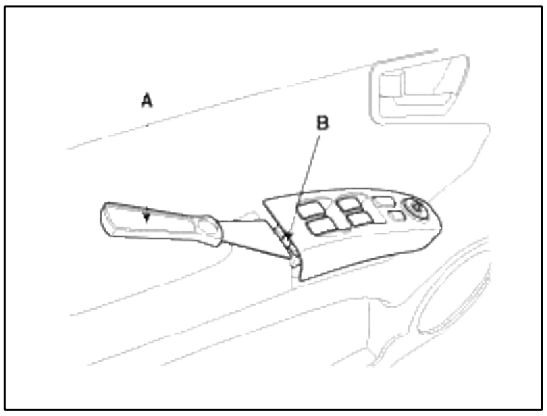
[Power door mirror switch connector]

Body Electrical System > Power Door Mirrors > Power out side mirror switch > Repair procedures

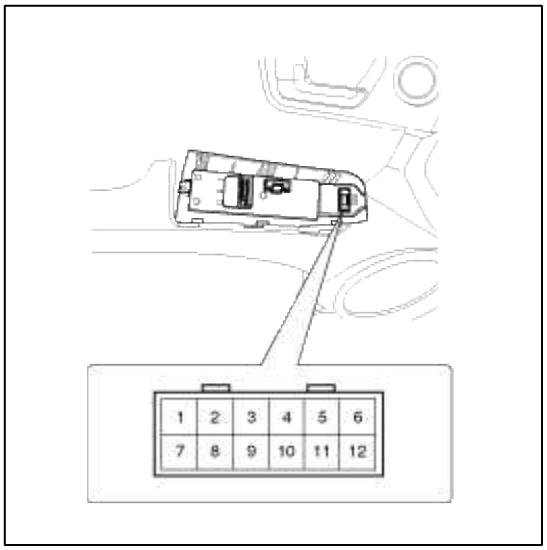
INSPECTION

1. Remove the negative (-) battery terminal.

2. Remove the power window switch module by pressing fixing clip part (B) with scraper (A).



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



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

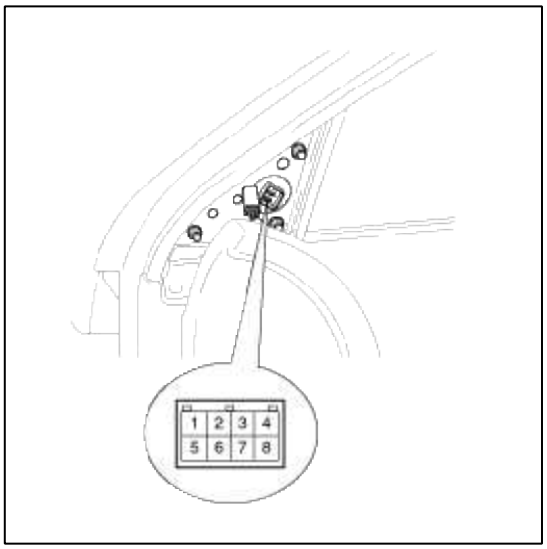
Class	Terminal / Direction	5	6	8	9	10	11	12
Left	UP	○		○	○	○		
	DOWN	○		○	○			
	OFF	○		○	○	○		
	LEFT	○		○		○		
	RIGHT	○			○			
Right	UP	○				○	○	○
	DOWN	○					○	○
	OFF	○				○	○	○
	LEFT		○				○	
	RIGHT		○					

Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

INSPECTION

1. Disconnect the power door mirror connector from the harness.

2. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



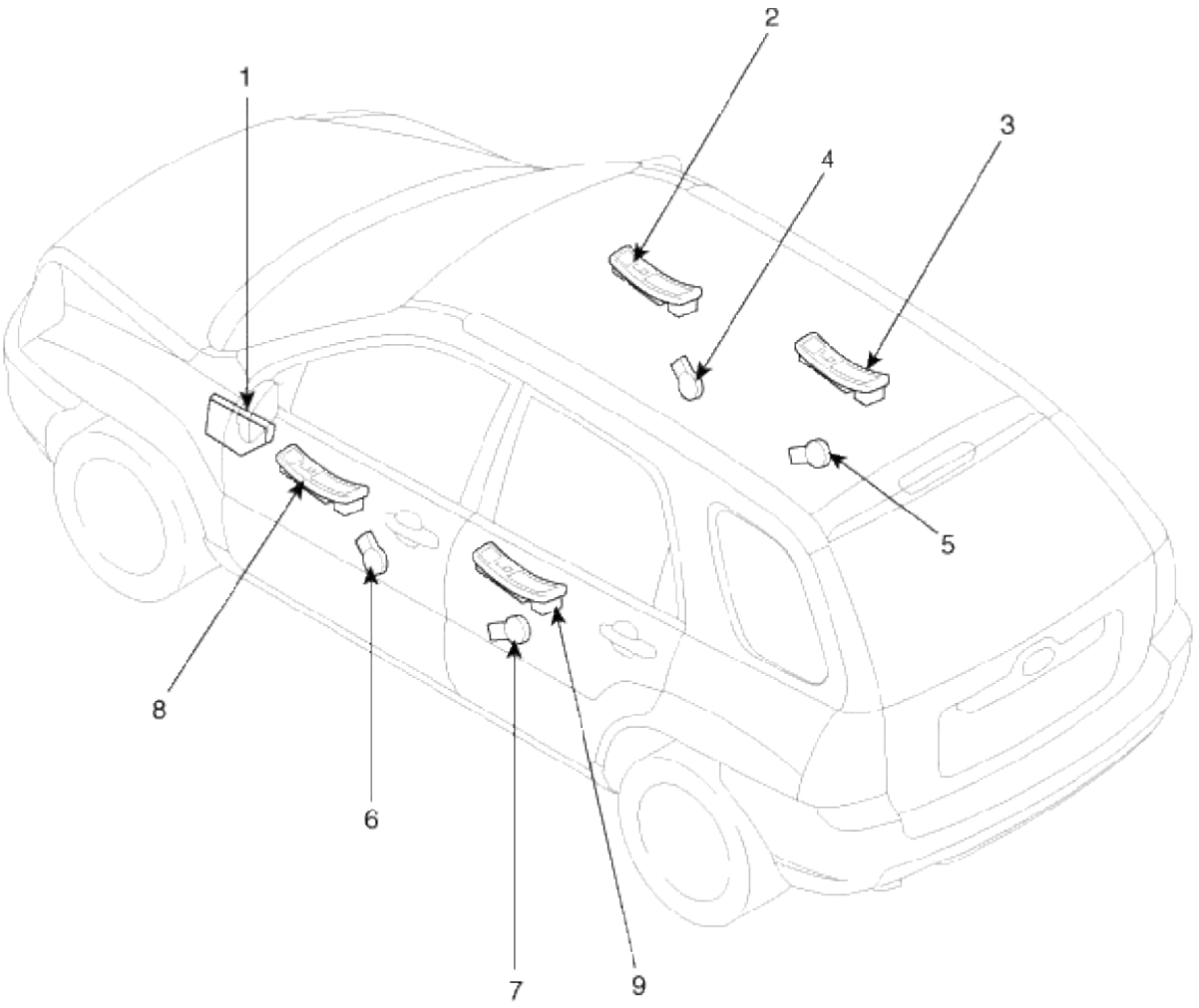
Terminal / Position	1	2	3
UP	⊕	⊕	⊖
DOWN	⊖	⊖	⊕
OFF	⊕	⊕	⊕
LEFT	⊖	⊕	⊖
RIGHT	⊕	⊖	⊕

MIRROR HEATER INSPECTION

Terminal / Position	7	8
Heater	○——	——○

Body Electrical System > Power Windows > Components and Components Location

COMPONENTS



1. Passenger compartment junction box (Power window relay)
2. Assist window switch
3. Rear window switch
4. Front window motor
5. Rear window motor
6. Front window motor
7. Rear window motor
8. Driver window main switch
9. Rear window switch

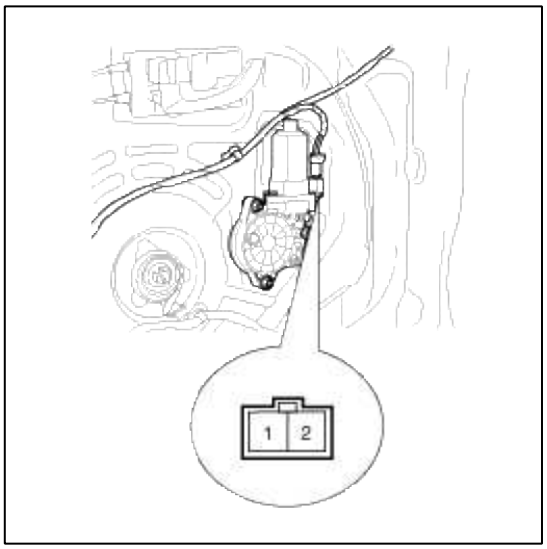
Body Electrical System > Power Windows > Power Window Motor > Repair procedures

INSPECTION

FRONT POWER WINDOW MOTOR INSPECTION

1. Remove the front door trim panel. (Refer to the BD group-front door)

2. Disconnect the 2P connector from the motor.

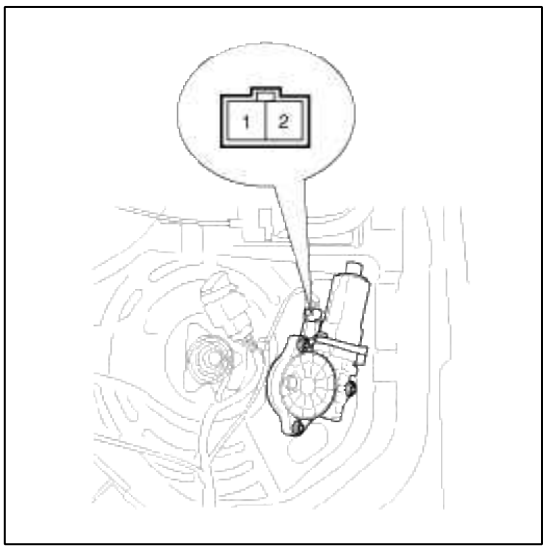


3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Position		Terminal	1	2
LH	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖
RH	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕

REAR POWER WINDOW MOTOR INSPECTION

1. Remove the rear door trim panel. (Refer to the BD group-rear door)
2. Disconnect the 2P connector from the motor.



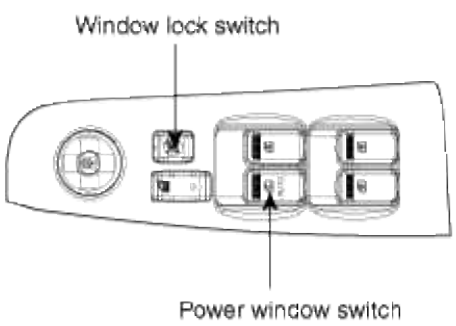
3. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

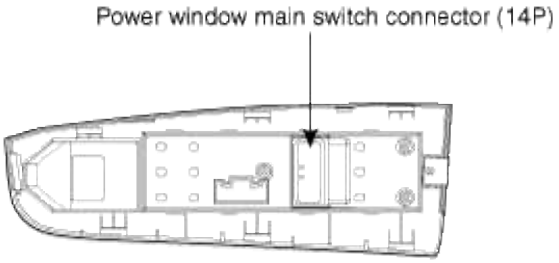
Position		Terminal	1	2
LH	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖
RH	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕

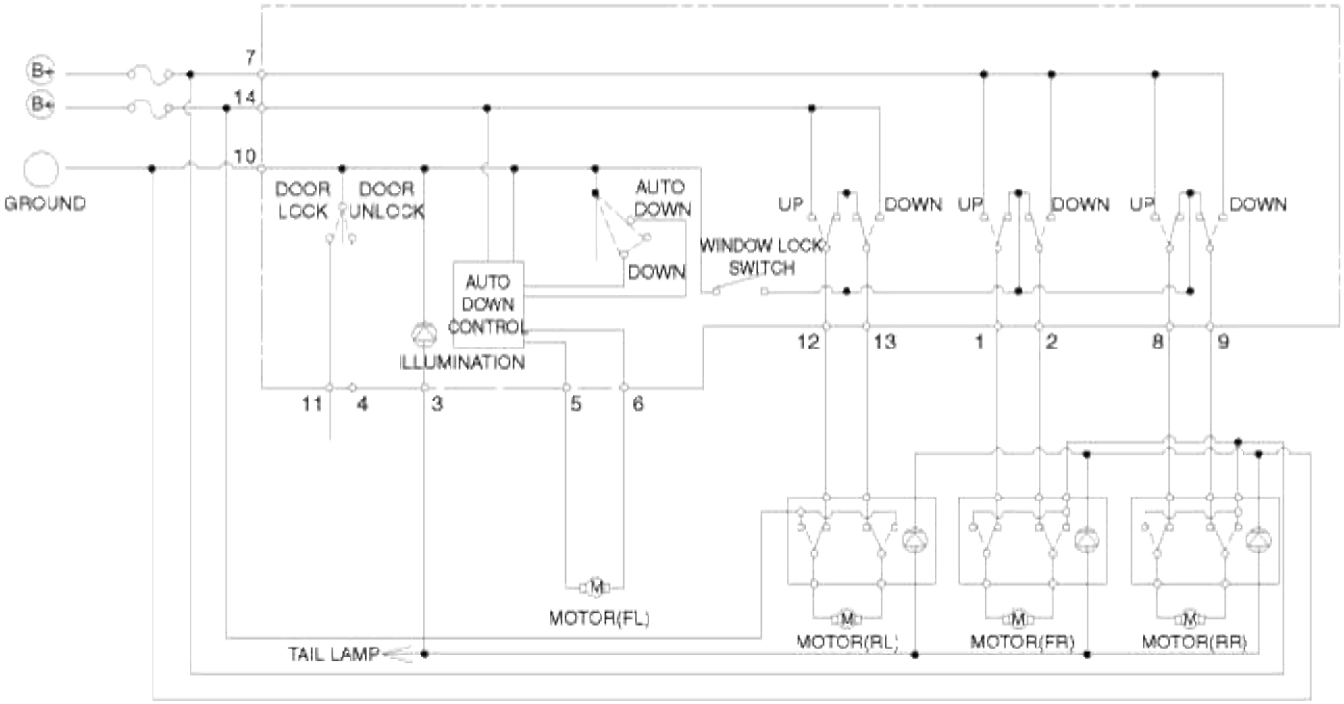
Body Electrical System > Power Windows > Power Window Switch > Schematic Diagrams

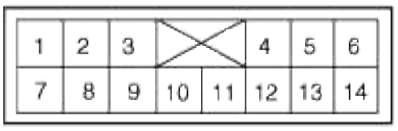
CIRCUIT DIAGRAM

[Power window main switch : Auto down type]



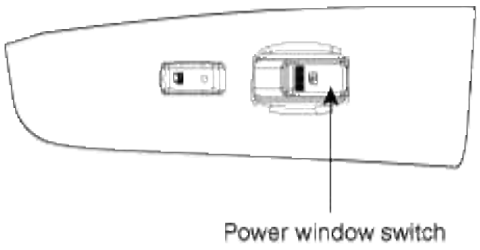


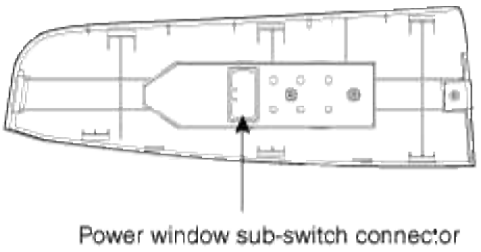


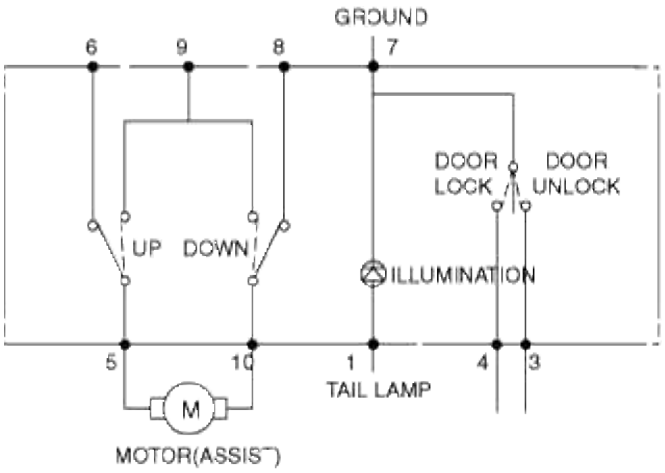


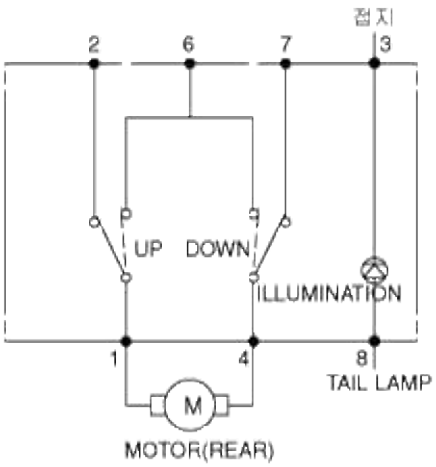
(Power window main switch connector)

[Power window sub-switch]

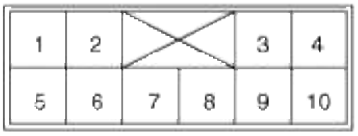




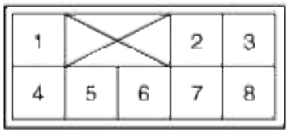




[With door lock switch : Assist]



[Without door lock switch : Assist or Rear]



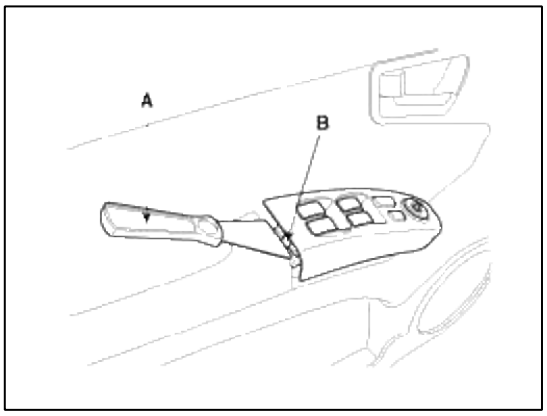
Body Electrical System > Power Windows > Power Window Switch > Repair procedures

INSPECTION

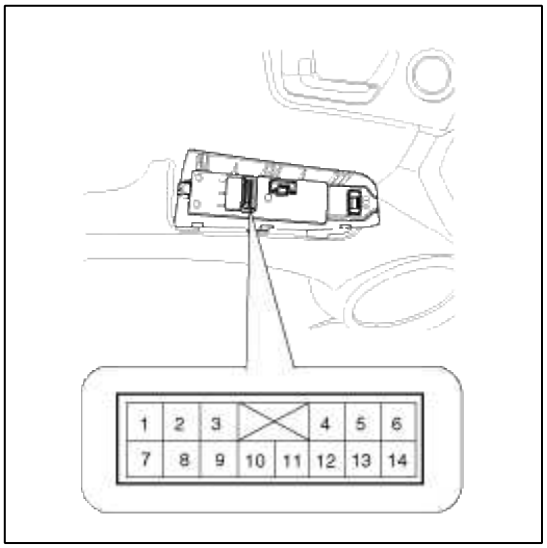
POWER WINDOW MAIN SWITCH INSPECTION

1. Remove the negative (-) battery terminal.

2. Remove the power window switch module by pressing fixing clip part (B) with scraper (A).



3. Check for continuity between the terminals. If the continuity condition is not normal, replace the switch.



POWER WINDOW LOCK SWITCH

Terminal / Position	1	10
NORMAL	○	○
LOCK		

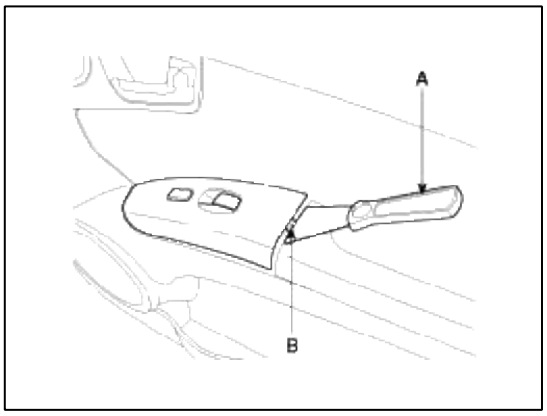
Terminal / Position	Front left				Front right			
	14	5	6	10	1	7	2	10
UP	○		○	○	○		○	○
OFF		○	○	○	○		○	○
DOWN	○		○		○		○	○

Terminal / Position	Rear left				Rear right			
	12	14	13	10	8	7	9	10
UP	○		○	○	○		○	○
OFF	○		○	○	○		○	○
DOWN	○		○		○		○	○

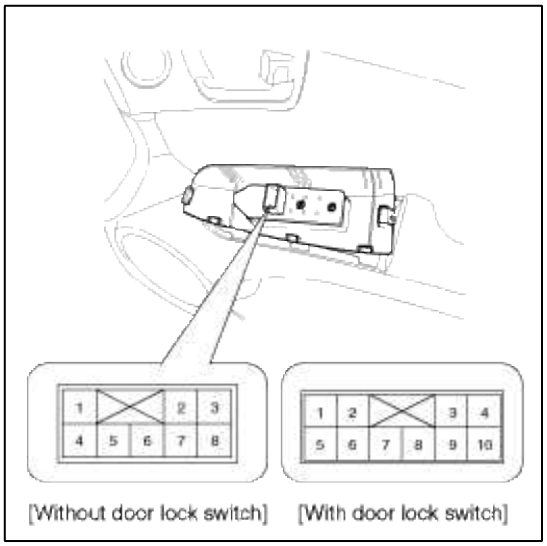
ASSIST POWER WINDOW SWITCH

1. Remove the negative (-) battery terminal.

2. Remove the power window switch module by pressing fixing clip part (B) with scraper (A).



3. Check for continuity between the terminals. If the continuity condition is not normal, replace the switch.



[WITHOUT DOOR LOCK SWITCH]

Terminal / Position	1	2	4	6	7
UP	○		○	○	○
OFF	○	○	○		○
DOWN	○	○	○	○	

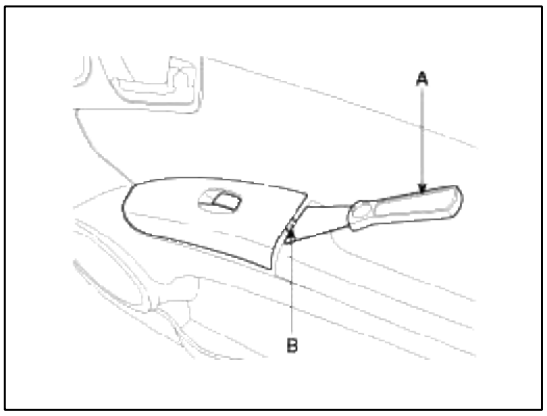
[WITH DOOR LOCK SWITCH]

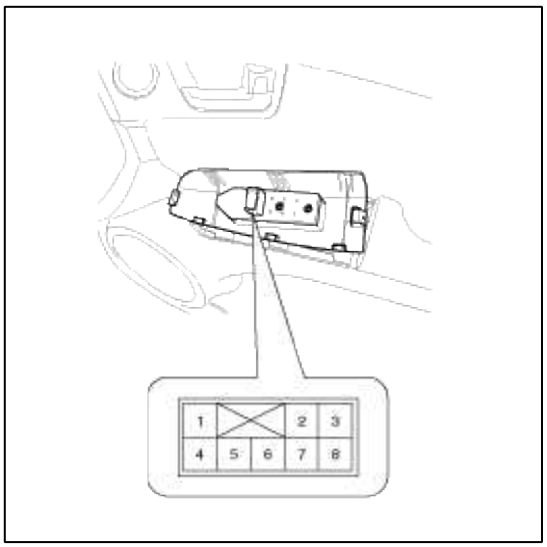
Terminal / Position	5	6	8	9	10
UP	○		○	○	○
OFF	○	○	○		○
DOWN	○	○		○	○

REAR POWER WINDOW SWITCH INSPECTION

1. Remove the negative (-) battery terminal.

2. Remove the power window switch module by pressing fixing clip part (B) with scraper (A).





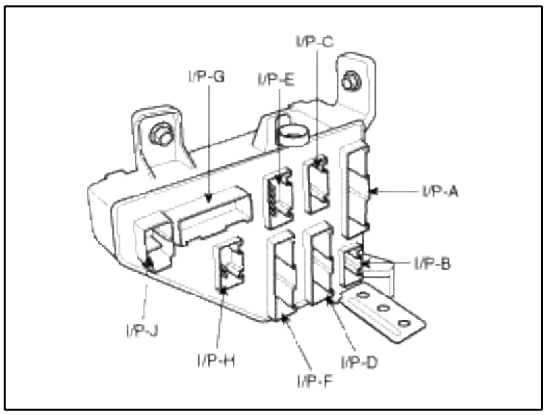
Terminal / Position	1	2	4	6	7
UP	○		○	○	○
OFF	○	○	○		○
DOWN	○	○	○	○	

Body Electrical System > Power Windows > Power Window Relay > Repair procedures

INSPECTION

1. Remove 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-J terminal and No.12 or 13 in the I/P-F terminal when power and ground are connected to the No.1 in the I/P-J terminal and No.12 in the I/P-C terminal.

5. There should be no continuity between the No.1 in the I/P-J terminal and No.12 or 13 in the I/P-F terminal when power is disconnected.



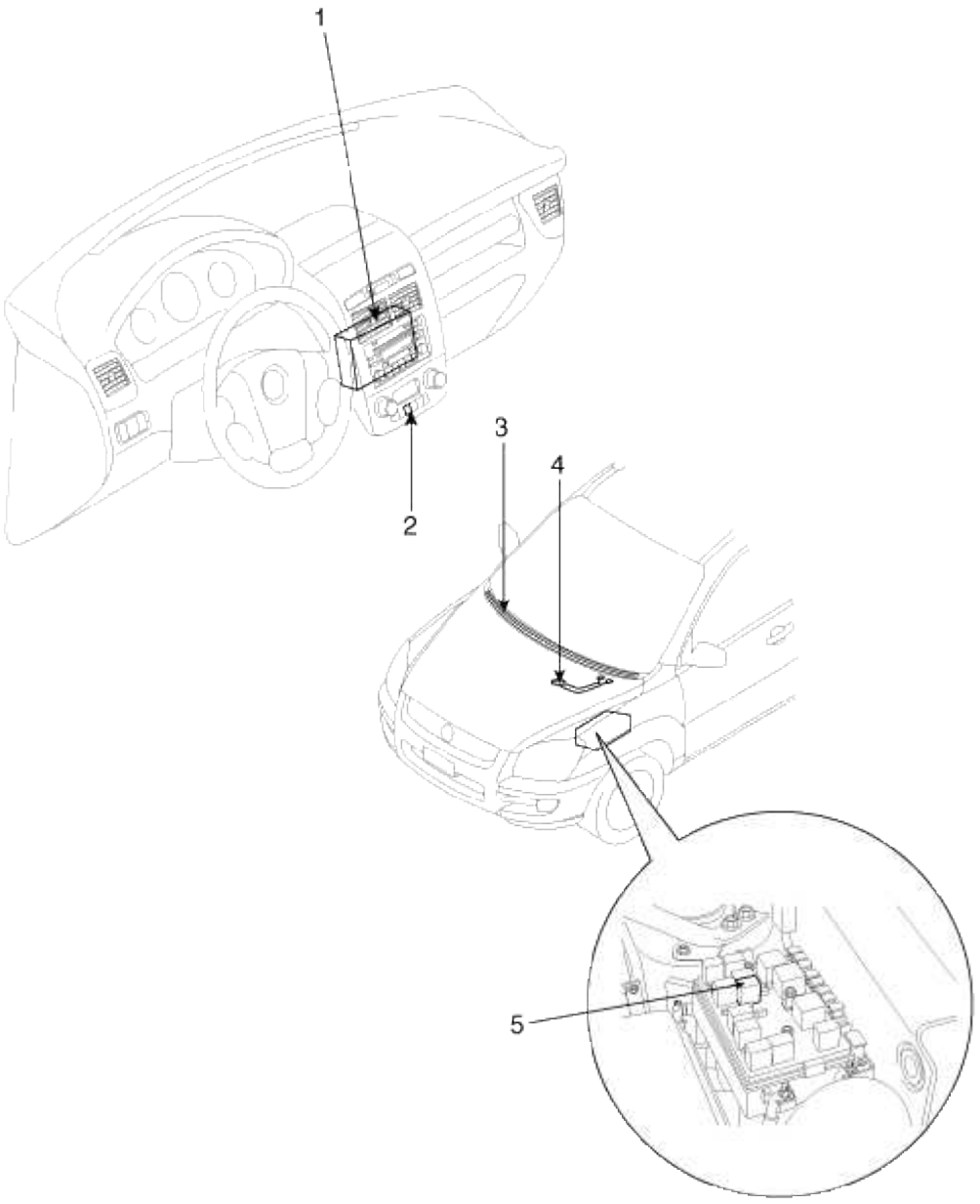
Terminal / Position	I/P-F (12 or 13)	I/P-J (1)	I/P-C (12)	I/P-J (1)
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Windshield Deicer > Components and Components Location

COMPONENTS

Windshield glass deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the lower part of windshield glass, switch and relay. ETACS module receives an input signal from the deicer switch, then controls relay. Operating condition is the same that of rear window defogger system.

Since the alternator "L" is switched ON, if the deicer switch is ON, then deicer output is ON for 20 minutes.



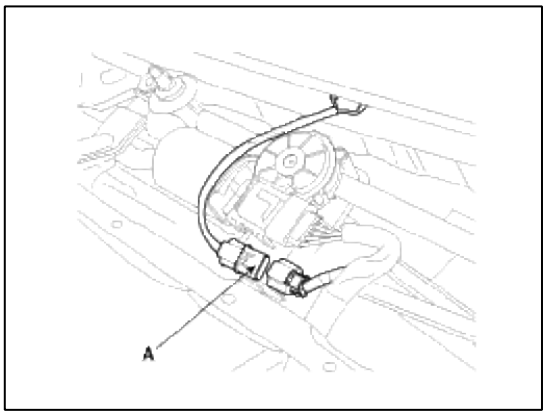
1. ETACS module
2. Windshield glass deicer switch
3. Windshield glass deicer
4. Deicer connector
5. Windshield glass deicer relay

Body Electrical System > Windshield Deicer > Windshield Deicer > Repair procedures

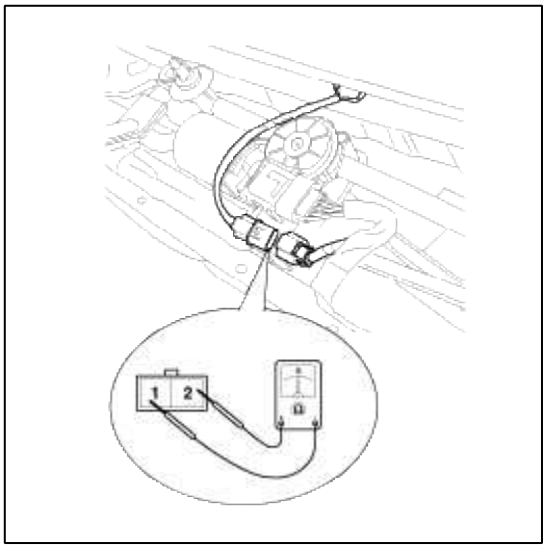
INSPECTION

1. Remove the cowl top cover.(Refer to wiper)

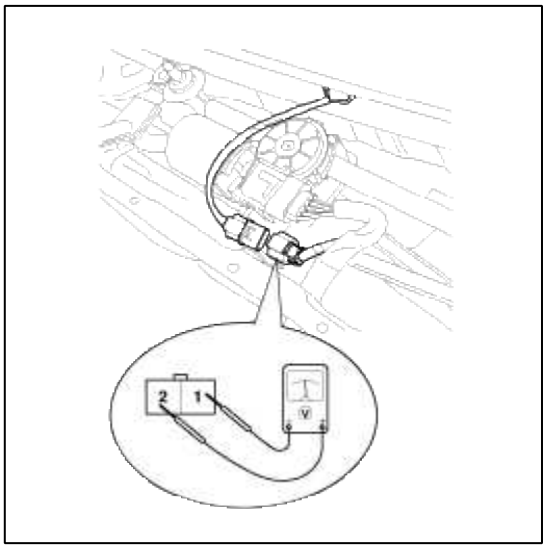
2. Disconnect the windshield glass deicer connector (A) from the wiper motor linkage.



3. Check for continuity between the terminals of deicer lines.



4. Turn the ignition switch ON and the windshield deicer switch ON, then measure the voltage between the terminals of harness side deicer connector.



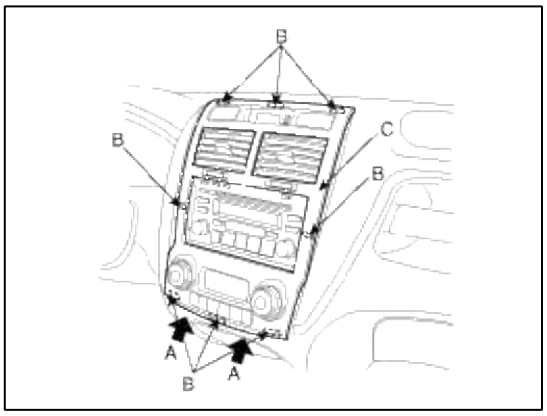
O K : approx. Battery voltage

Body Electrical System > Windshield Deicer > Windshield Deicer Switch > Repair procedures

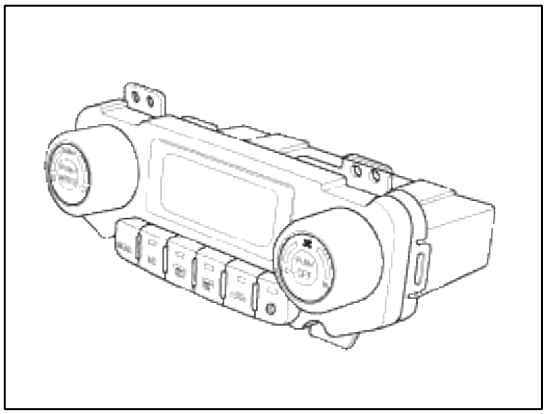
INSPECTION

1. Remove the negative (-) battery terminal.

2. Remove the center facia panel (C) by pressing hole of part (A) with driver. Take care of fixing clip (B).



3. Disconnect the connectors.
4. Using an ohmmeter, inspection the continuity between the terminals after removing to the switch connector.

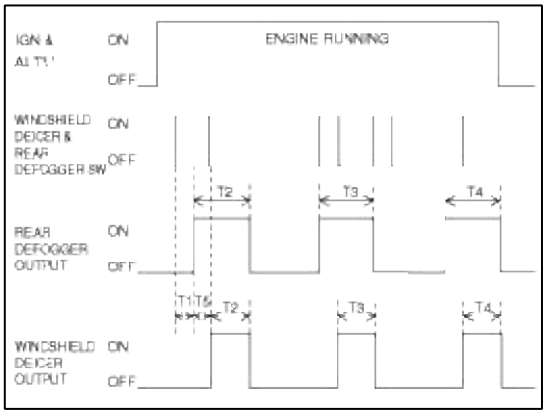


Position \ Terminal	M05-2 (7)	M05-1 (3)	M04-2 (21)	M04-2 (13)	M04-1 (26)
ON (Manual)	○—○				
ON (Auto)			○	○	○
OFF					

Body Electrical System > Windshield Deicer > Windshield Deicer Timer > Repair procedures

INSPECTION

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.

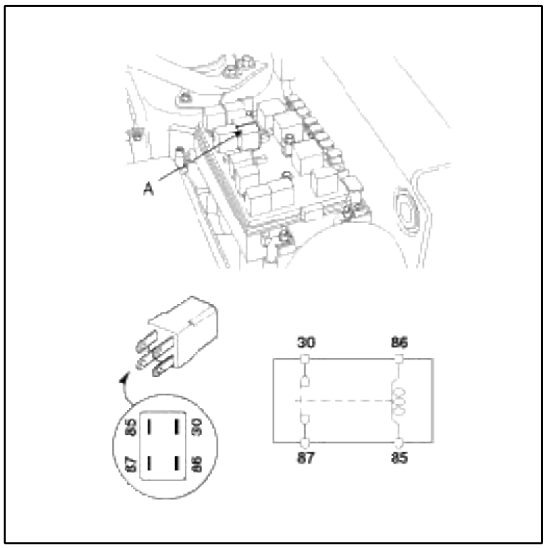


T1 : 0.06 ± 0.01 sec.,
T2 : 20 ± 1 min.

Body Electrical System > Windshield Deicer > Windshield Deicer Relay > Repair procedures

INSPECTION

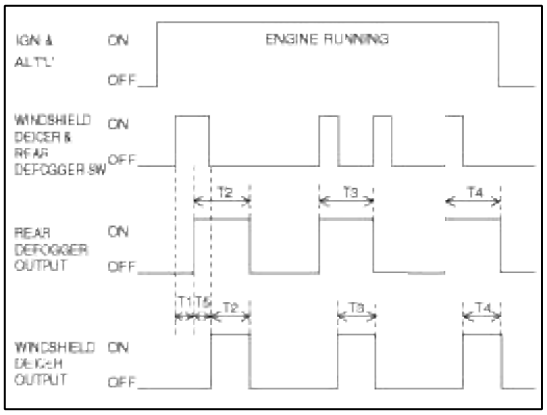
1. Remove the negative (-) battery terminal.
2. Remove the windshield deicer relay (A) from the engine room relay box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.86 and No.85 terminals.
5. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.



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

INSPECTION

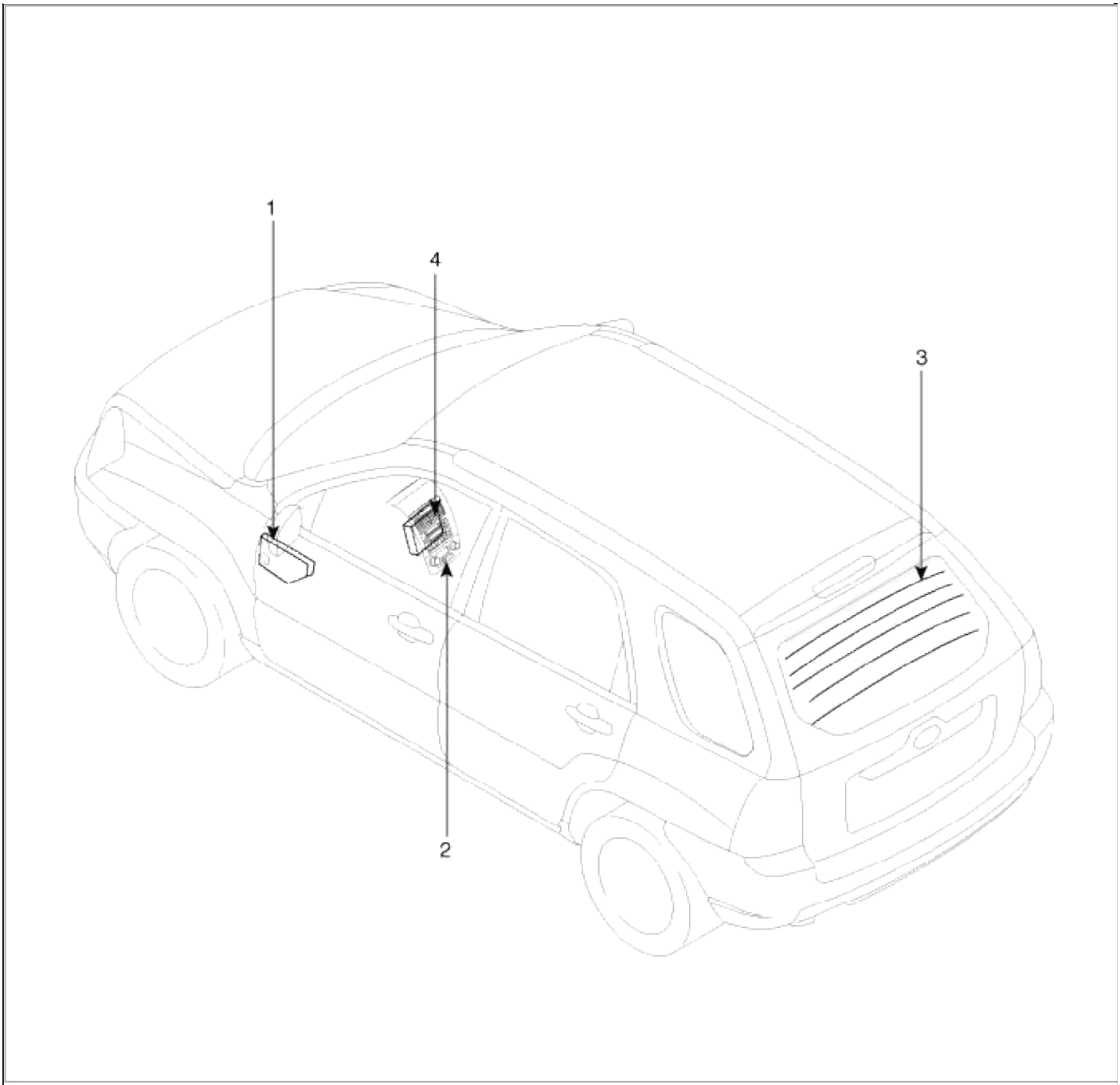
1. Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.



T1 : 0.06 ± 0.01 sec.,
T2 : 20 ± 1 min.

Body Electrical System > Rear Window Defogger > Components and Components Location

COMPONENTS



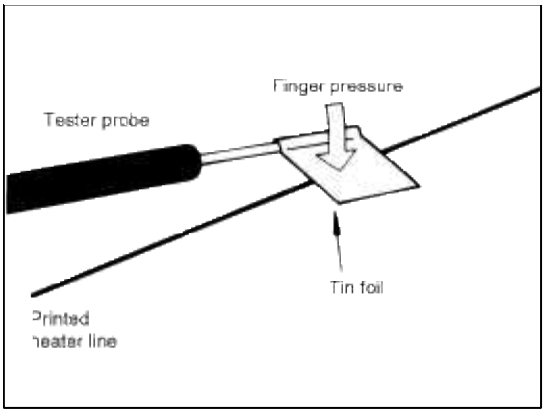
1. Passenger compartment junction box
2. Rear window defogger switch
3. Rear window defogger
4. ETACS module

Body Electrical System > Rear Window Defogger > Rear Window Defogger Printed Heater > Repair procedures

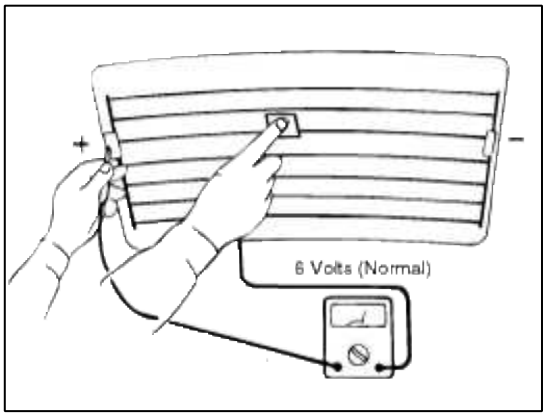
INSPECTION

CAUTION

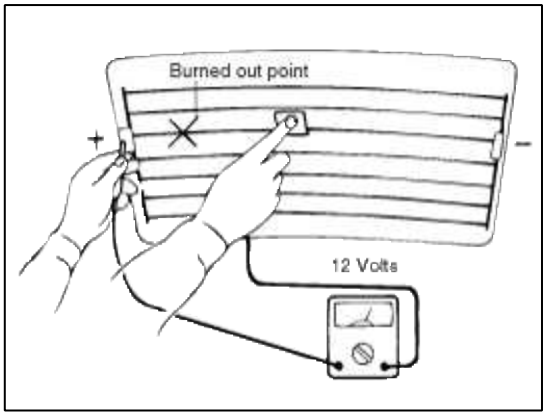
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



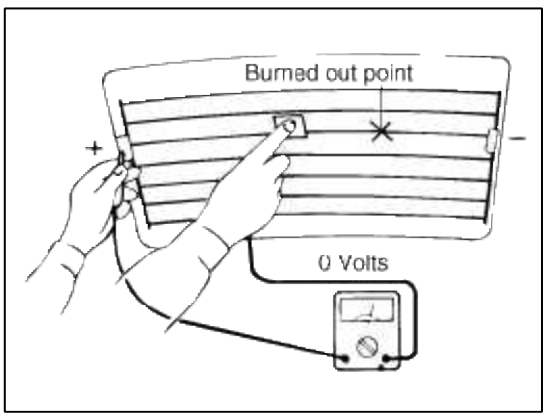
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



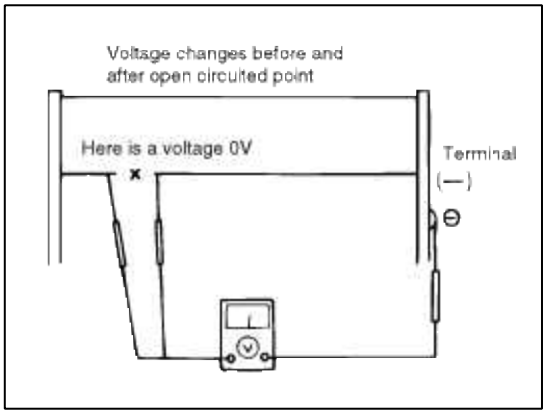
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



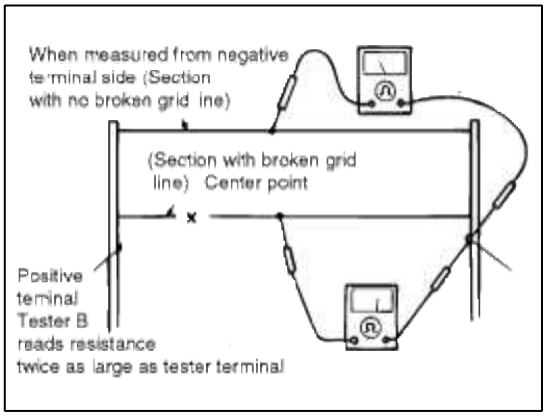
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.

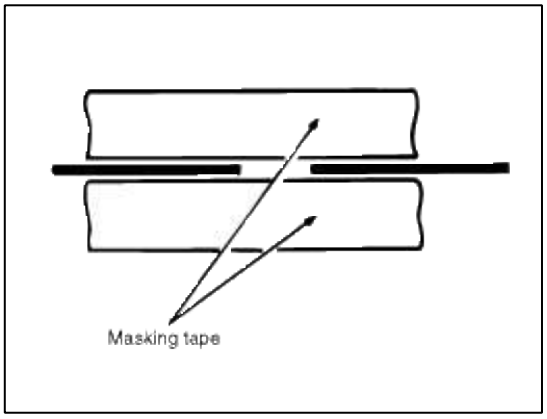


REPAIR OF BROKEN HEATER LINE

Prepare the following items :

1. Conductive paint.
2. Paint thinner.
3. Masking tape
4. Silicone remover.
5. Using a thin brush :

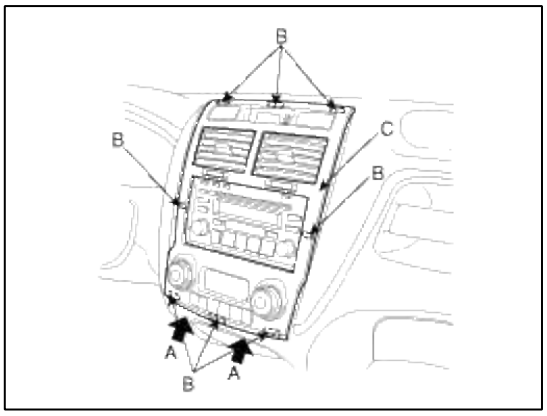
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



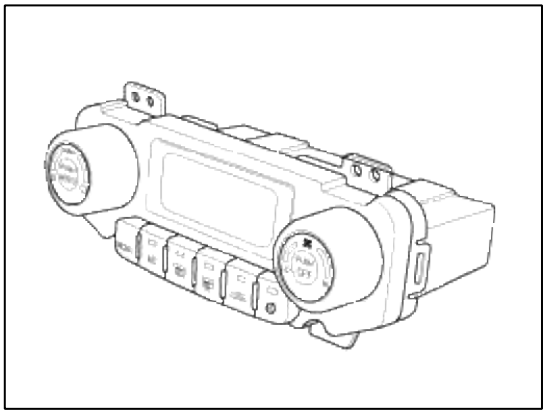
Body Electrical System > Rear Window Defogger > Rear Window Defogger Switch > Repair procedures

INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel (C) after pulling it by using regular screw driver(-) at part (A). Take care of fixing clips (B).



3. Disconnect the connectors.
4. Using an ohmmeter, inspection the continuity between the terminals after removing to the switch connector.



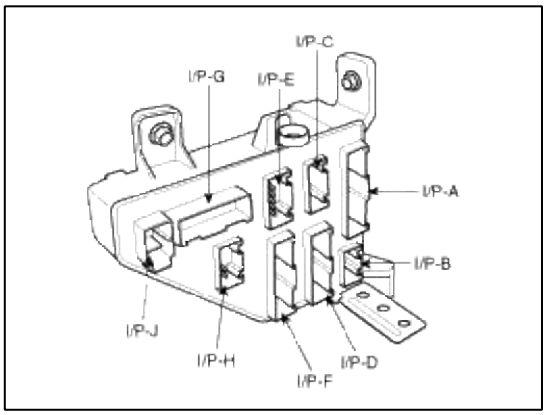
Terminal / Position	M05-2 (7)	M05-1 (3)	M04-2 (21)	M04-2 (13)	M04-1 (26)
ON (Manual)	○	○			
ON (Auto)			○	○	○
OFF					

Body Electrical System > Rear Window Defogger > Rear Window Defogger Relay > Repair procedures

INSPECTION

1. Remove 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-J terminal and No.7 in the I/P-F terminal when power and ground are connected to the No.14 in the I/P-D terminal and No.7 in the I/P-C terminal.

5. There should be no continuity between the No.1 in the I/P-J terminal and No.7 in the I/P-F terminal when power is disconnected.

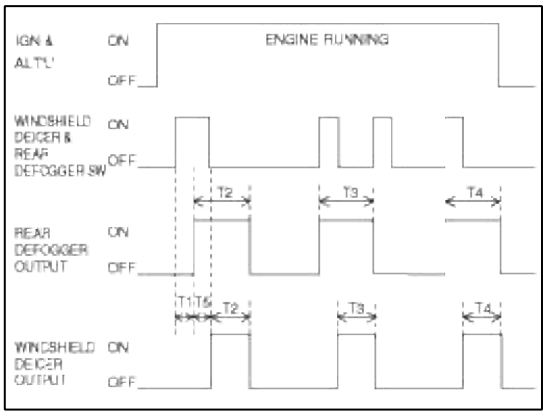


Terminal / Position	I/P-C (7)	I/P-D (14)	I/P-J (1)	I/P-F (7)
Disconnectec	○ — ○			
Connected	⊖ — ⊕		○ — ○	

Body Electrical System > Rear Window Defogger > Rear Window Defogger Timer > Repair procedures

INSPECTION

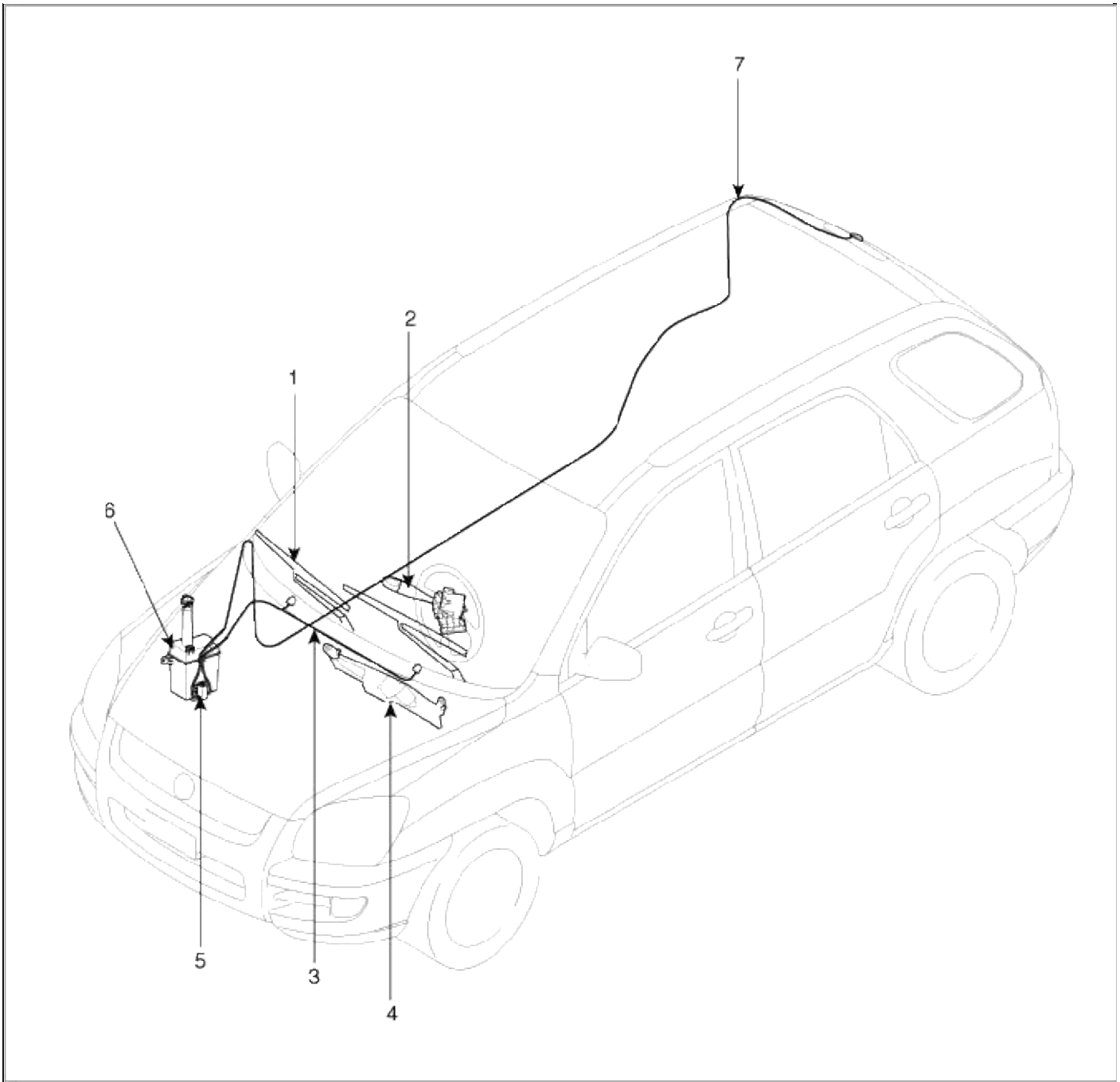
1. Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (See step 1), or if ignition is switched OFF, the defogger will shut OFF.



T1 : 0.06 ± 0.01 sec.,
T2 : 20 ± 1 min.

Body Electrical System > Windshield Wiper/Washer > Components and Components Location

COMPONENT

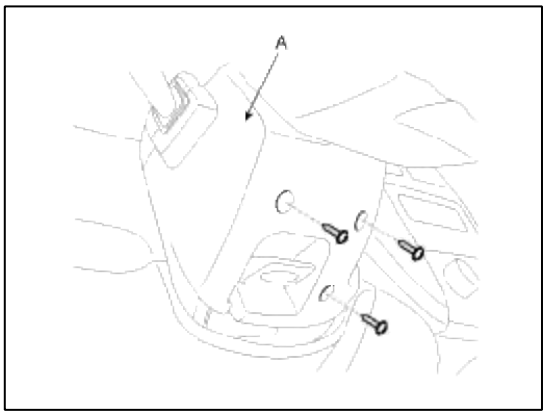


1. Windshield wiper arm & blade
2. Wiper & washer switch
3. Windshield washer hose
4. Windshield washer motor & linkage
5. Washer motor
6. Washer reservoir
7. Rear washer hose

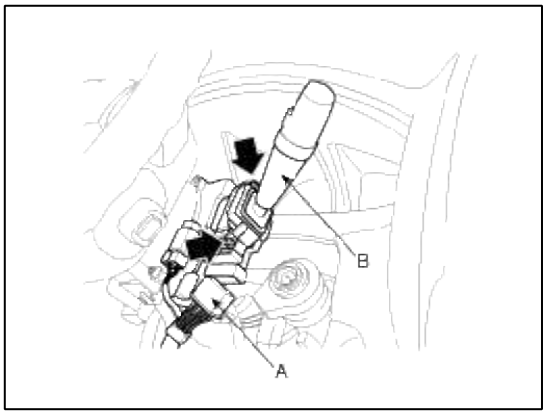
Body Electrical System > Windshield Wiper/Washer > Windshield Wiper/Washer Switch > Repair procedures

REPLACEMENT

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



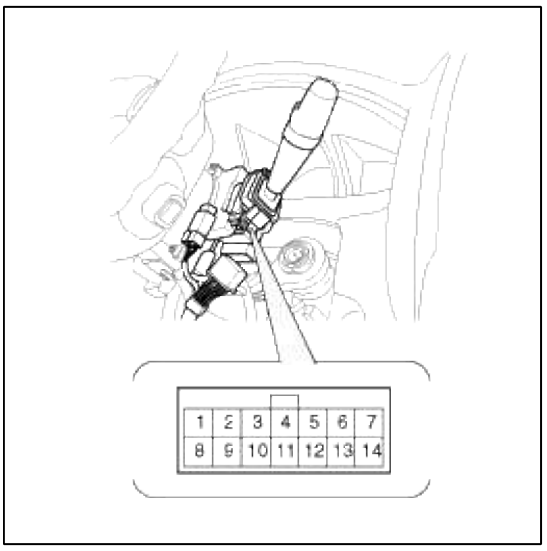
2. Remove the wiper switch (B) after loosening its 2 screws and connector (A).



3. Installation is the reverse of removal.

INSPECTION

Check for continuity between the terminals while operating the wiper and washer switch. If it is not normal condition, replace wiper and wiper switch.



WIPER SWITCH

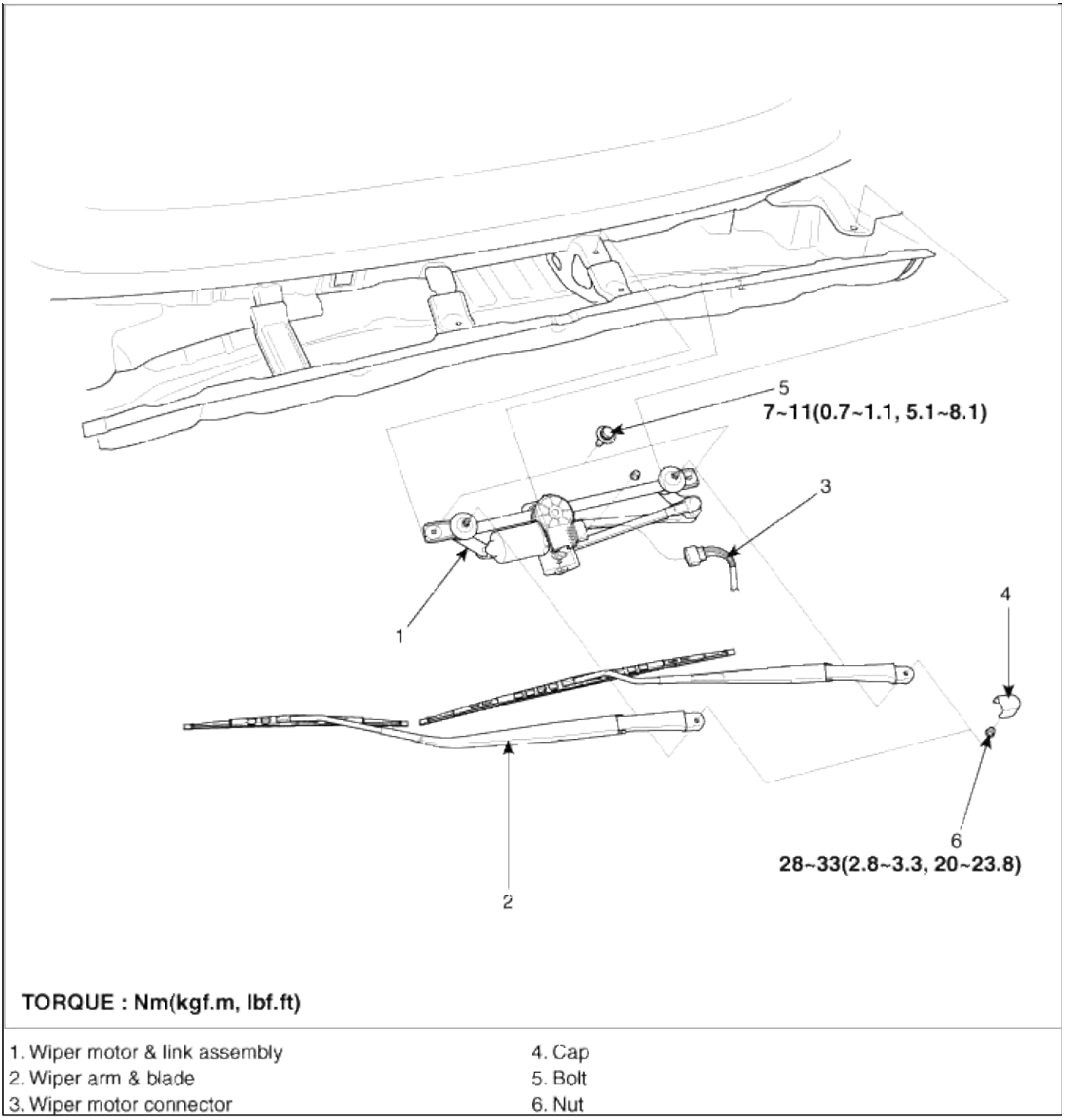
Terminal / Position	1	2	3	4	5	6	13	14
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○			○			
HI	○				○			

WASHER SWITCH

Terminal / Position	5	7
OFF		
ON	○	○

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Components and Components Location

COMPONENTS



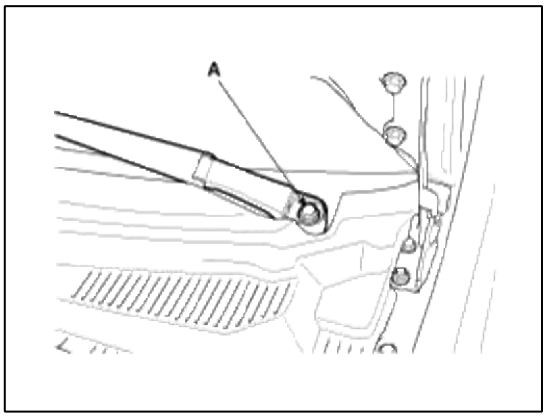
1. Wiper motor & link assembly	4. Cap
2. Wiper arm & blade	5. Bolt
3. Wiper motor connector	6. Nut

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures

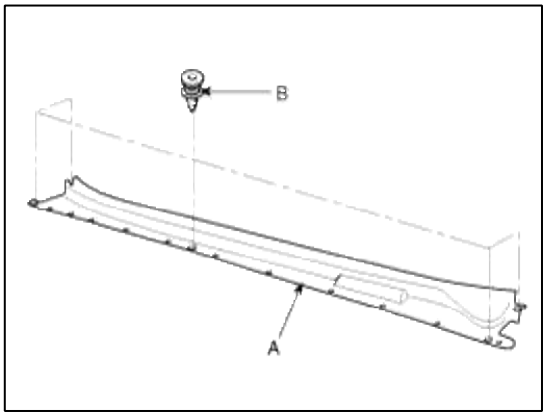
REMOVAL

1. Remove the windshield wiper arm and blade after removing a nut (A).

TORQUE :
28~33 Nm (2.8~3.3 kgf.m,20~23.8 lbf.ft)

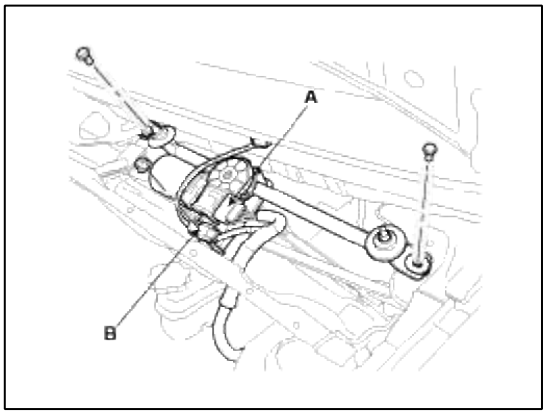


2. Remove the weather strip then remove the cowl top cover (A) after removing 3 clips (B).



3. Remove the windshield wiper motor and linkage assembly after removing 2 bolts and a nut. Disconnect the wiper motor connector (A) and windshield deicer connector (B) from the wiper motor & linkage assembly.

TORQUE :
7~11Nm (0.7~1.1kgf.m, 5.1~8.1 lbf.ft)

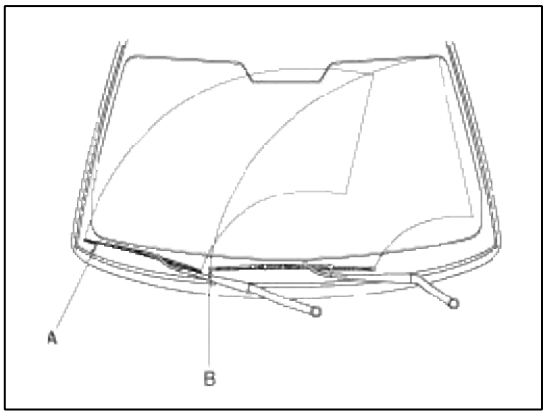


4. Installation is the reverse of removal.

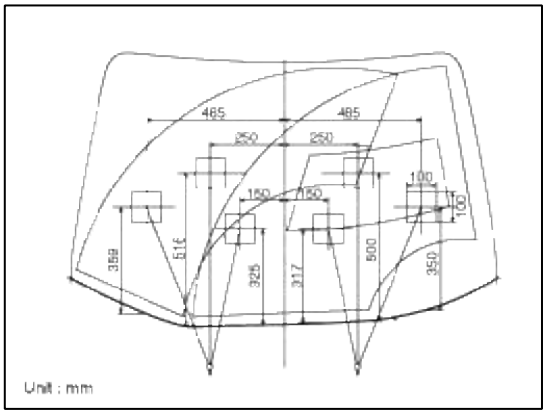
INSTALLATION

1. Install the wiper arm and blade to the specified position.

Specified position	A	B
Distance [in (mm)]	1.26 ± 0.2 (32 ± 5)	1.26 ± 0.2 (32 ± 5)



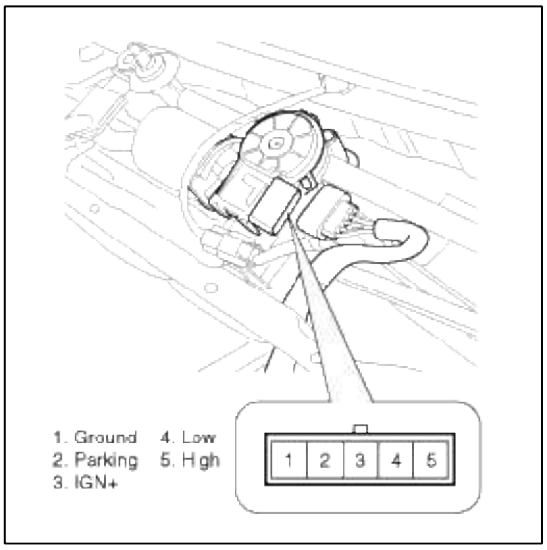
2. Set the washer nozzle on the specified spray position.



INSPECTION

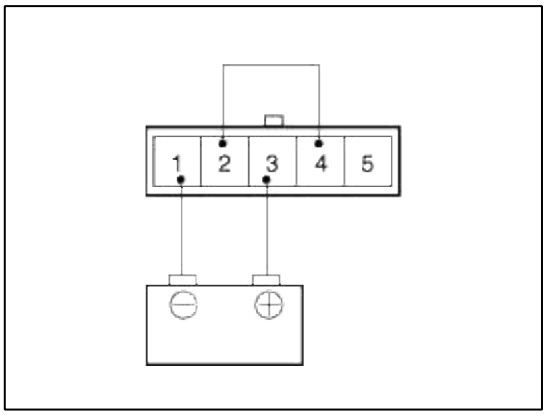
SPEED OPERATION CHECK

1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 1.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 5 and the negative (-) lead to terminal 1.
5. Check that the motor operates at high speed.



AUTOMATIC STOP OPERATION CHECK

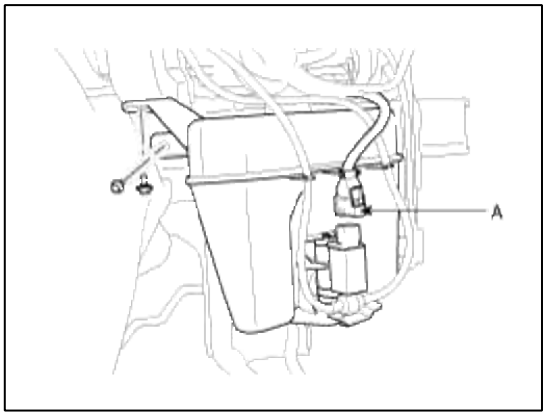
1. Operate the motor at low speed using the stalk control
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 4
3. Connect terminals 4 and 2.
4. Connect the positive (+) lead from the battery to terminal 3 and the negative (-) lead to terminal 1.
5. Check that the motor stops running at the off position.



Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover. (Refer to BD group - Front bumper)
3. Remove the washer hose and the washer motor connector (A).
4. Remove the washer reservoir after removing 2 bolts.

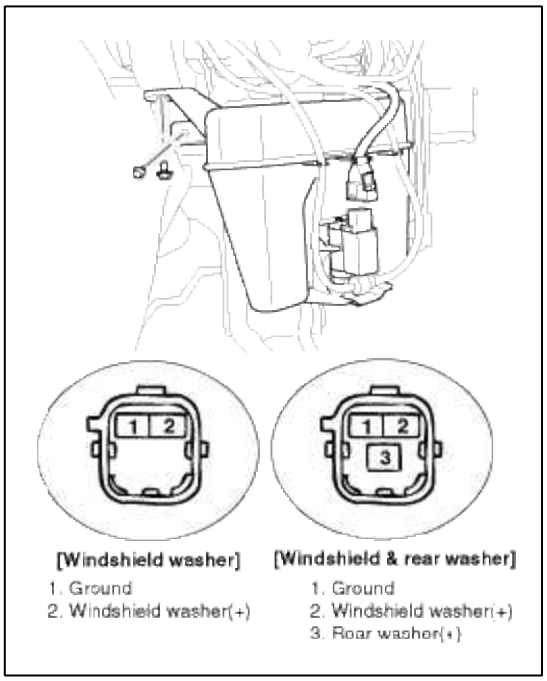


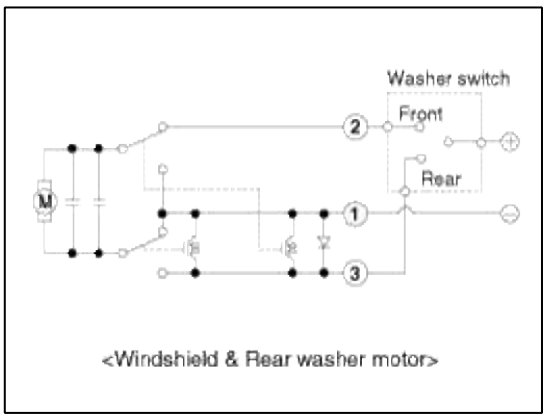
5. Installation is the reverse of removal.

INSPECTION

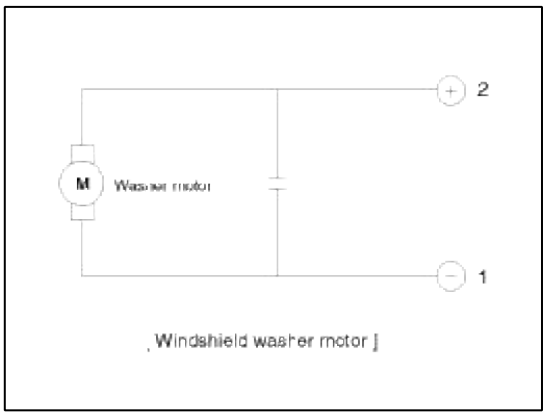
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Connect positive (+) battery cables to terminal 2 and negative (-) battery cables to terminal 1 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.

4. If they are abnormal, replace the washer motor.





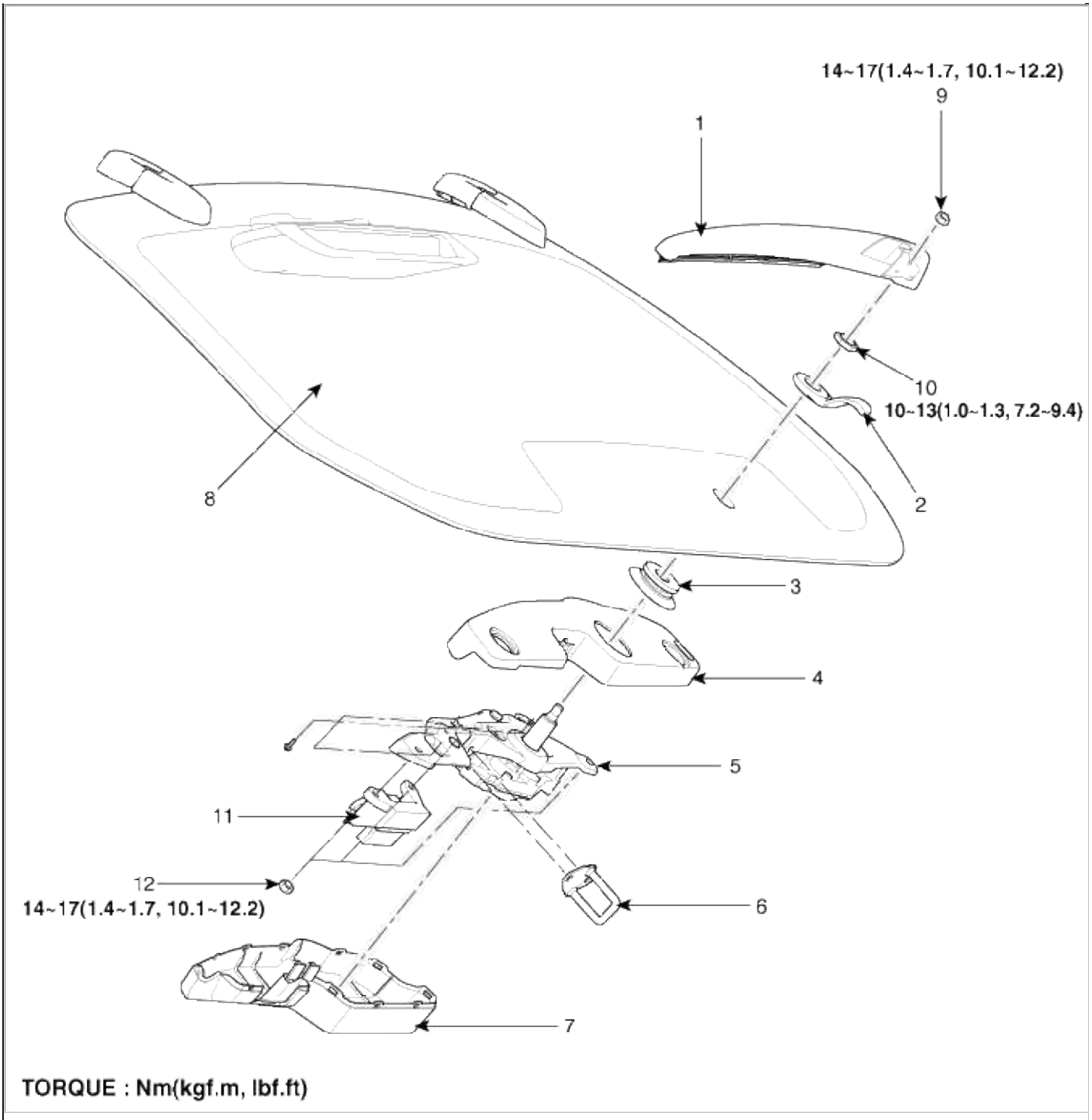
<Windshield & Rear washer motor>



, Windshield washer motor]

Body Electrical System > Rear Wiper/Washer > Components and Components Location

COMPONENT



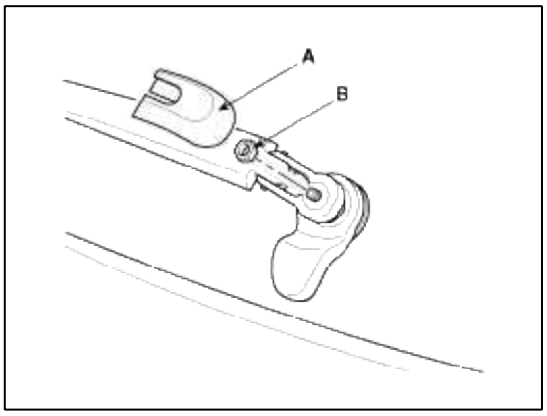
1. Rear wiper arm & blade
2. Tailgate glass handle
3. Grommet
4. Cover
5. Rear wiper motor assembly
6. Striker
7. Cover
8. Tailgate glass
9. Nut
10. Nut
11. Switch
12. Nut

Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Repair procedures

REMOVAL

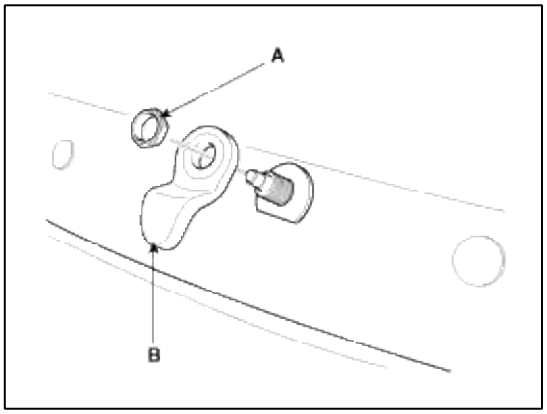
1. Detach the wiper cap (A), then remove the rear wiper arm after removing a nut (B).

Tightening torque Nut(B) :
14~17 Nm (1.4~1.7 kgf.m, 10.1~12.3 lbf.ft)



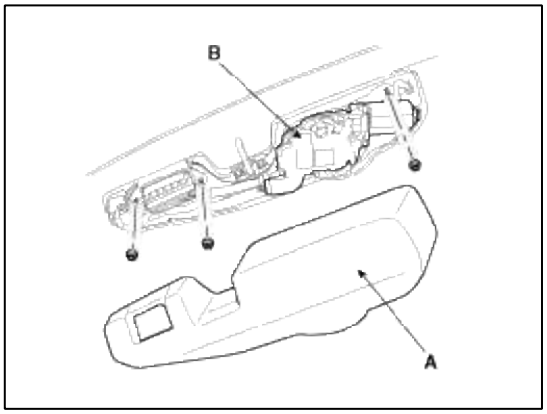
2. Remove the handle (B) after removing a nut (A).

Tightening torque Nut (A) :
10~13 Nm (1.0~1.3 kgf.m, 7.2~9.4 lbf.ft)



3. Open the tailgate glass then remove the rear wiper motor cover (A).
4. Disconnect the rear wiper motor connector then remove the rear wiper motor (B) after removing 3 nuts.

Tightening torque Nut :
14~17 Nm (1.4~1.7 kgf.m, 10.1~12.3 lbf.ft)



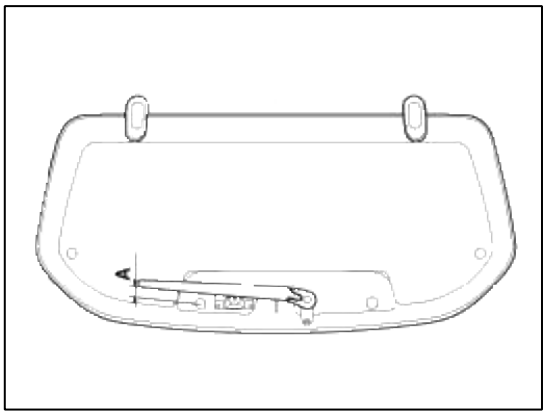
5. Installation is the reverse of removal.

INSTALLATION

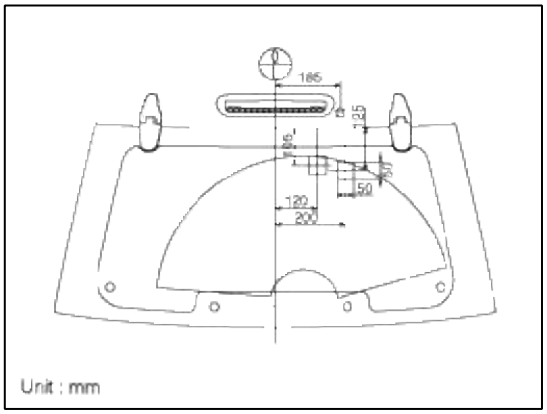
1. Install the rear wiper arm and blade to the specified position.

Specified position	A
Distance	19 ± 5 mm

Specified position : The first deicer line from bottom of the rear window.

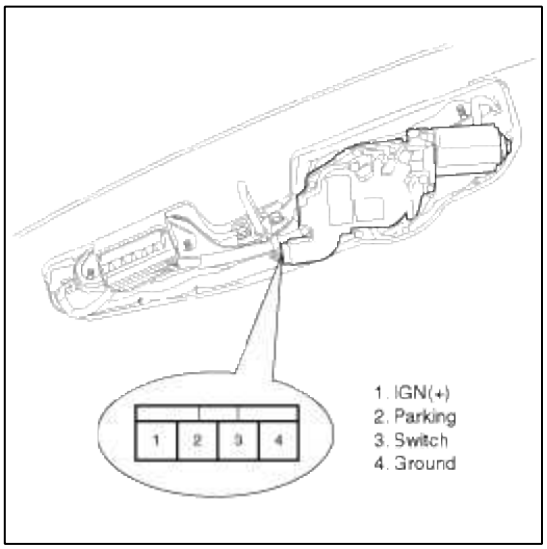


2. Set the rear washer nozzle on the specified spray position.



INSPECTION

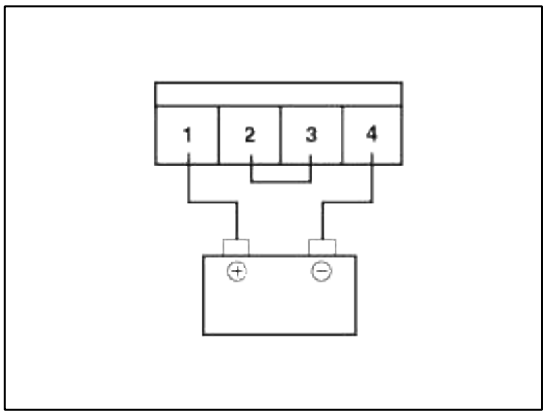
1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 3 and 4 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.



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 3.
3. Connect terminals 2 and 3.

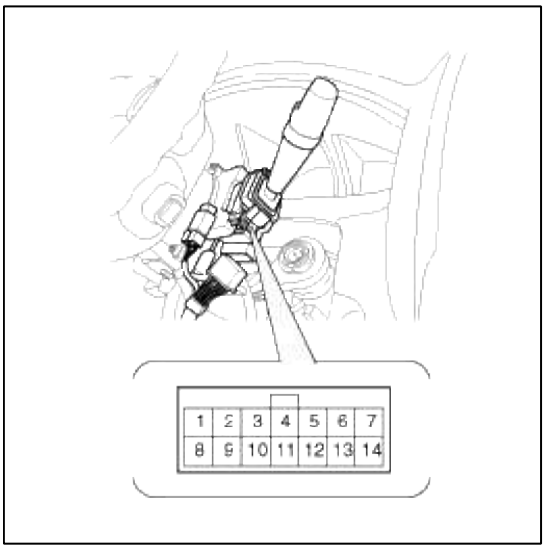
4. Connect the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 4.
5. Check that the motor stops running at the off position.



Body Electrical System > Rear Wiper/Washer > Rear Washer Switch > Repair procedures

INSPECTION

With the rear wiper & washer switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



REAR WIPER & WASHER SWITCH

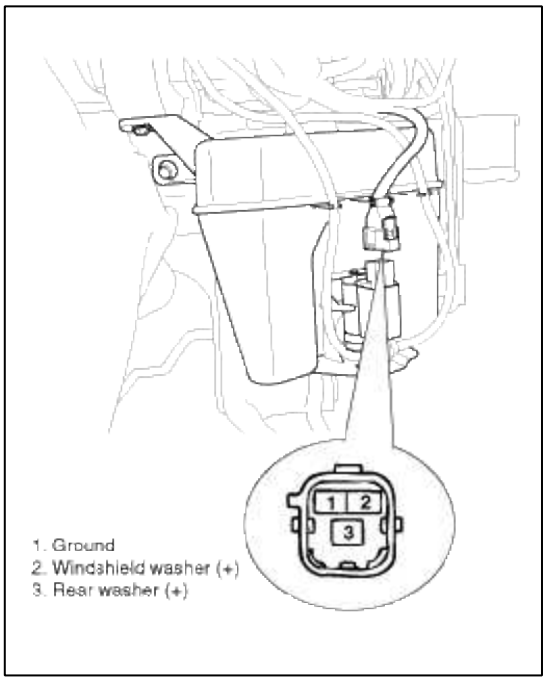
Terminal / Position	9	10	11	12
Rear washer	○			○
OFF				
INT	○	○		
ON	○		○	
Rear washer	○			○

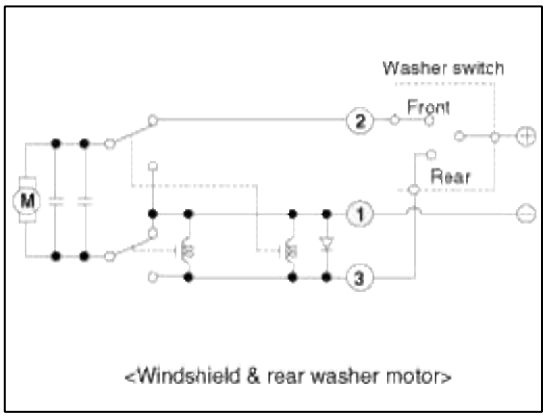
Body Electrical System > Rear Wiper/Washer > Rear Washer Motor > Repair procedures

INSPECTION

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.
2. Remove the front bumper cover. (Refer to the BD group- Front bumper cover)
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.



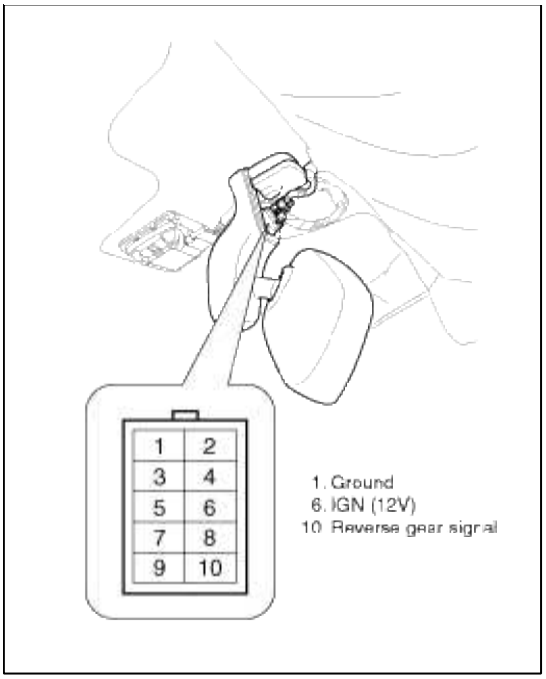


<Windshield & rear washer motor>

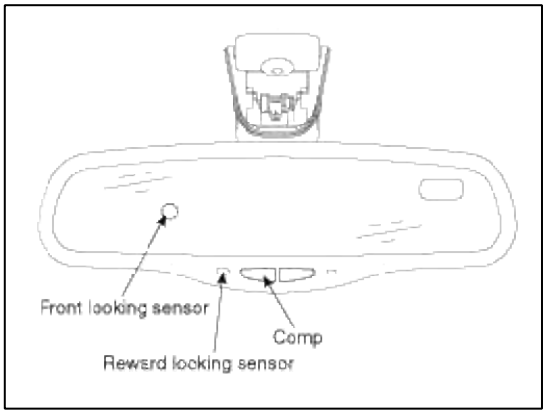
Body Electrical System > Electro chromic Inside Rear View Mirror > Description and Operation

DESCRIPTION

The ECM (Electro Chromic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night. The front looking sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 10~70%. But, when the reverse gear is engaged, it stops functioning.



1. The front looking sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.



COMPASS MIRROR

FUNCTION OF THE COMPASS MIRROR

1. Push the 'COMP' button lower of the rear view mirror to turn on the function of the compass mirror so that displays a sign of a direction on the small board in the upper-right side of the mirror.
2. Push the 'COMP' button again to turn off its function.

Calibration procedure

If the compass has been calibrated or set to variance zone number incorrectly, or you are driving in specific places (tunnel, parking lot in building, underground parking lot, near transformer substation, etc.), some phenomenon is occur as follows:

- The display read "C".
- The compass headings become inaccurate.
- The compass heading is not changed.
- Some compass headings are not displayed.
- The compass headings are inaccurate in long distance driving.

This compass automatically calibrates itself while the vehicle is driven as your route takes you in complete circles.. If the vehicle's compass headings become inaccurate continuously, the compass should be manually calibrated as

follows:

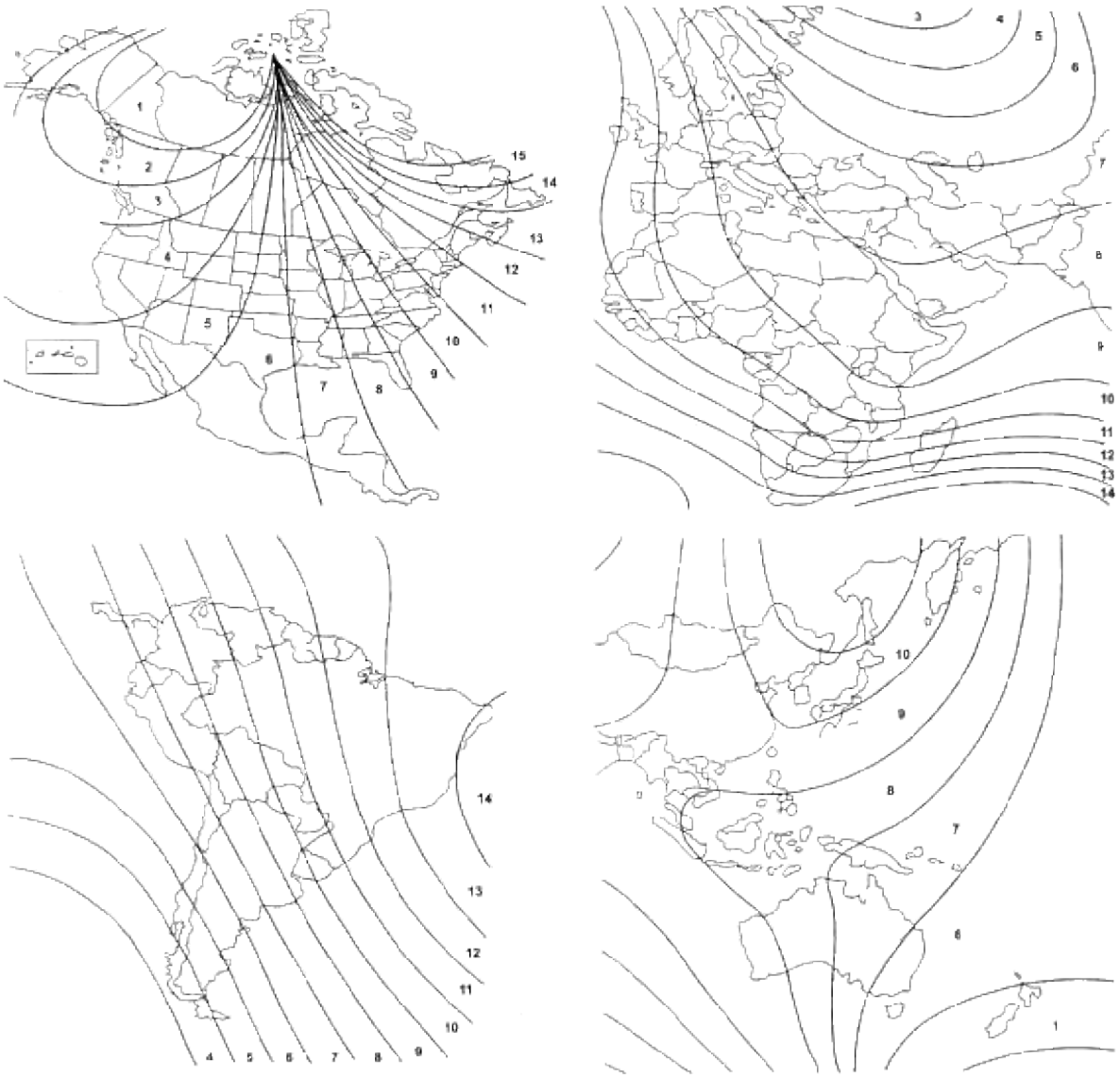
1. Move the vehicle from the large steel structure or electric power supply cable.
2. Turn on the compass by pressing the COMP button.
3. Check the zone number by pressing the COMP button for more than 4 seconds until the current zone number appears in the display.
   To re-calibrate, hold the COMP button for 3 seconds until C is displayed. If the zone number is different for your country, set the correct zone number referring to "Setting the compass zone" and do the "Calibration procedure" again.
4. Drive your vehicle in at least 2 circles at less than 5 miles per hour (8 km/h) until the compass heading appears. Driving in a circle in right-handed direction and opposite direction are possible and if possible, stop the wiper operation.
5. If the vehicle's compass headings become inaccurate as before, do the following procedure again.

> NOTE
>
> If new vehicle is first driven or if the battery has been disconnected, do the calibration procedure as above.

Setting the compass zone

This compass must be set to compensate for the variation between true north and magnetic north. To set variation:

1. Find your current location and variance zone number on the zone map.
2. Press the COMP button for more than 4 seconds. The current zone number will appear in the display.
3. Release and press the COMP button until the new zone number appears in the display. After you stop pressing the button in, the display will show a compass direction within a few seconds.



WARNING

1. Do not install the ski rack, antenna, etc. which are attached to the vehicle by means of a magnet. They affect the operation of the compass
2. If the compass deviates from the correct indication soon after repeated adjustment, have the compass checked at an authorized dealer.
3. The compass may not indicate the correct compass point in tunnels or while driving up or down a steep hill. (The compass returns to the correct compass point when the vehicle moves to an area where the geomagnetism is stabilized.)

Body Electrical System > Electro chromic Inside Rear View Mirror > Repair procedures

INSPECTION

Check it by the procedure below to see if the function of the ECM is normal.

1. Turn the ignition key to the "ON" position.
2. Cover the front looking sensor to stop functioning.

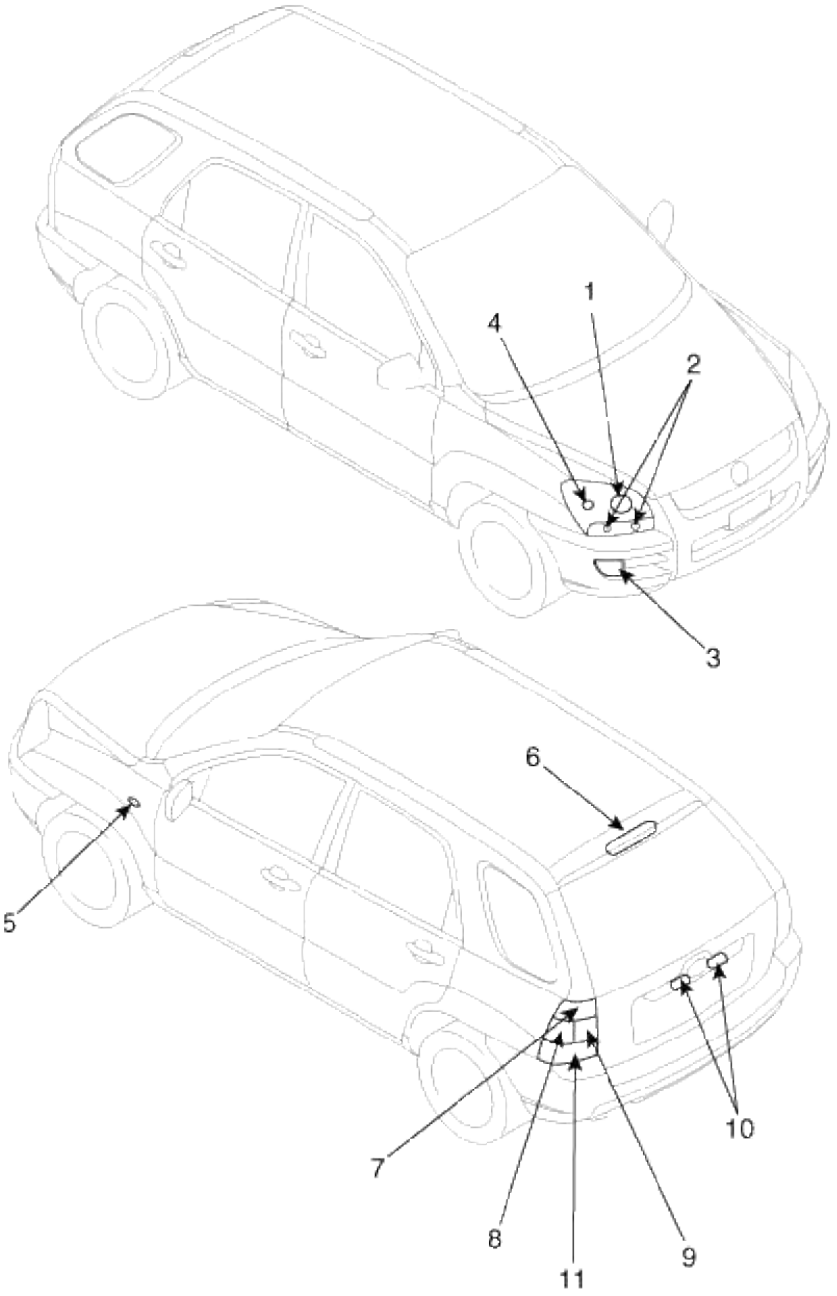
3. Head a light to the rearward looking sensor.
4. The ECM should be darkened as soon as the rearward looking sensor detects the light.

> NOTE
>
> If this test is performed in daytime, the ECM may be darkened as soon as the front looking sensor is covered.

5. When the reverse gear is engaged, the ECM should not be darkened
6. When heading lights to both the front looking and rearward looking sensors, the ECM should not be darkened.

Body Electrical System > Lighting System > Components and Components Location

COMPONENTS



1. Head lamp(High/Low)
2. Front turn signal lamp
3. Front fog lamp
4. Position lamp
5. Side repeater lamp
6. High mounted stop lamp
7. Tail/stop lamp
8. Rear turn signal lamp
9. Back up lamp
10. License plate lamp
11. Tail lamp

Body Electrical System > Lighting System > Specifications

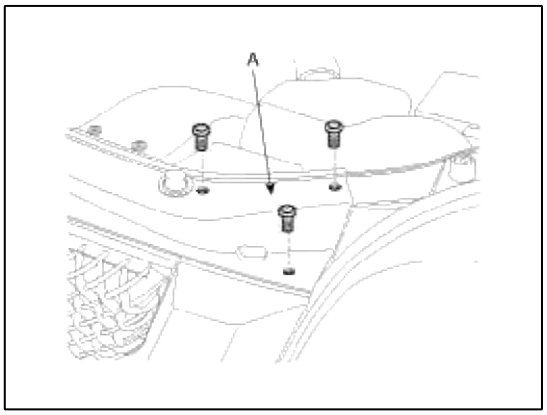
SPECIFICATION

Items	Bulb Wattage(W)
Head lamp (High/Low)	60/55
Front turn signal lamp	27
Front position lamp	5
Front fog lamp	35
Rear tail/stop lamp	8/28
Rear tail lamp	8/28
Back up lamp	17
Rear turn signal lamp	27
License plate lamp	5
Side repeater	5
Room lamp	10
Overhead console lamp	10 x 2
High mounted stop lamp	LED
Glove box lamp	5
Trunk room lamp	5
Door courtesy lamp	5

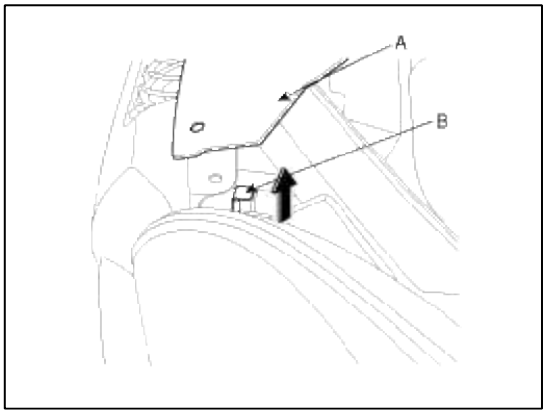
Body Electrical System > Lighting System > Head Lamps > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Loose the fastener of radiator grill cover (A) and the mounting bolts.

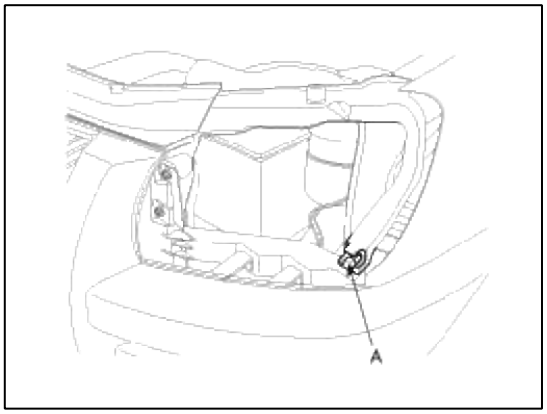


3. Remove the mounting bar (B) by pulling up after raising the radiator grill cover (A).



4. Remove the head lamp assembly after disconnecting the lamp connector.

> NOTE
>
> Take care that holding clip (A) is not to be damaged.



5. Installation is the reverse of removal.

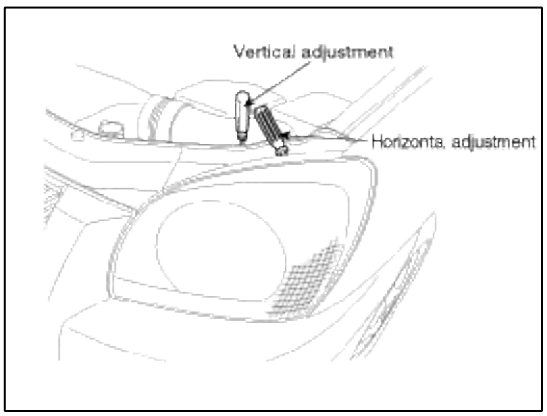
HEAD LAMP AIMING INSTRUCTIONS

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 :

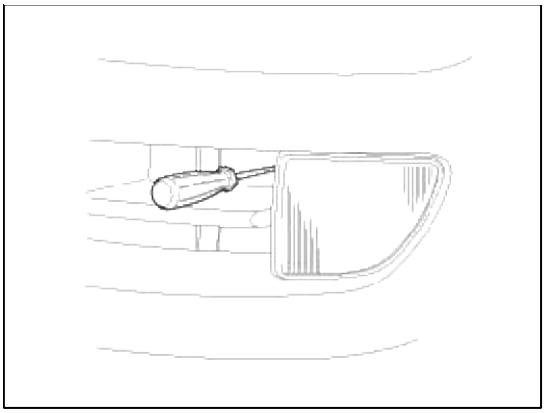
1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing 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.



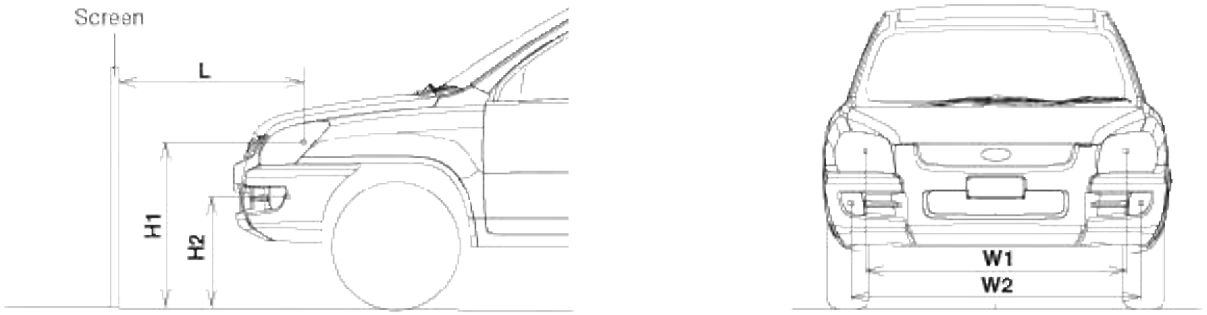
FRONT FOG LAMP AIMING

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.



HEAD LAMP AND FOG LAMP AIMING POINT

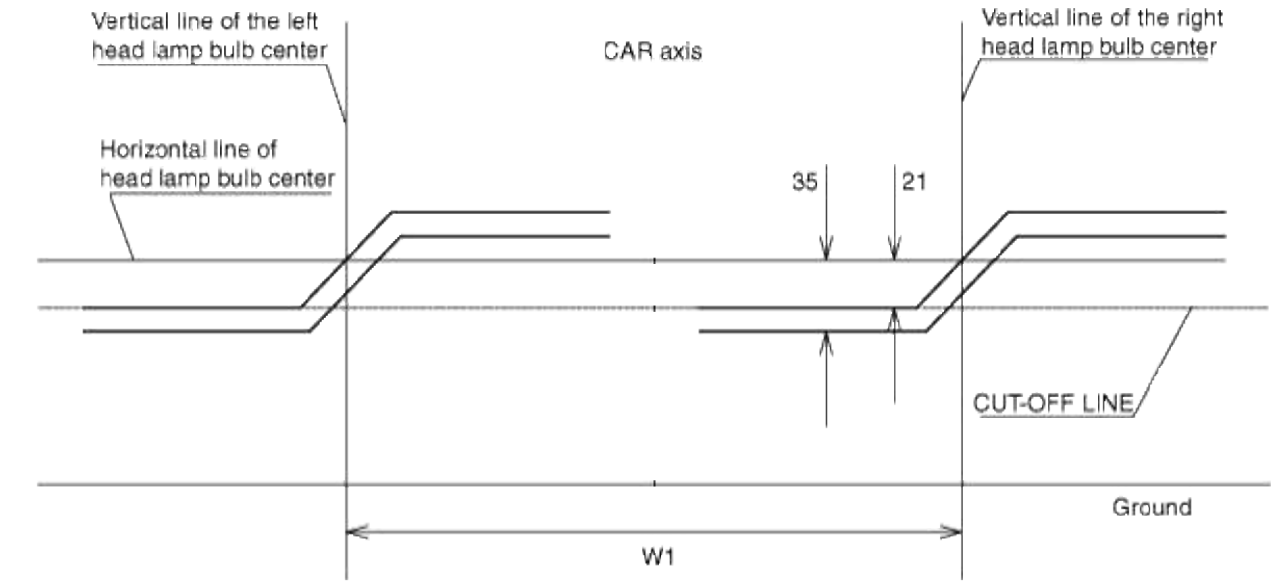


H1 : Height between the head lamp bulb conter and ground(High/low beam)
H2 : Height between the fog lamp bulb conter and ground
W1 : Distance between the two head lamp bulbs centers(High/low beam)
W2 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen

Unit : in(mm)

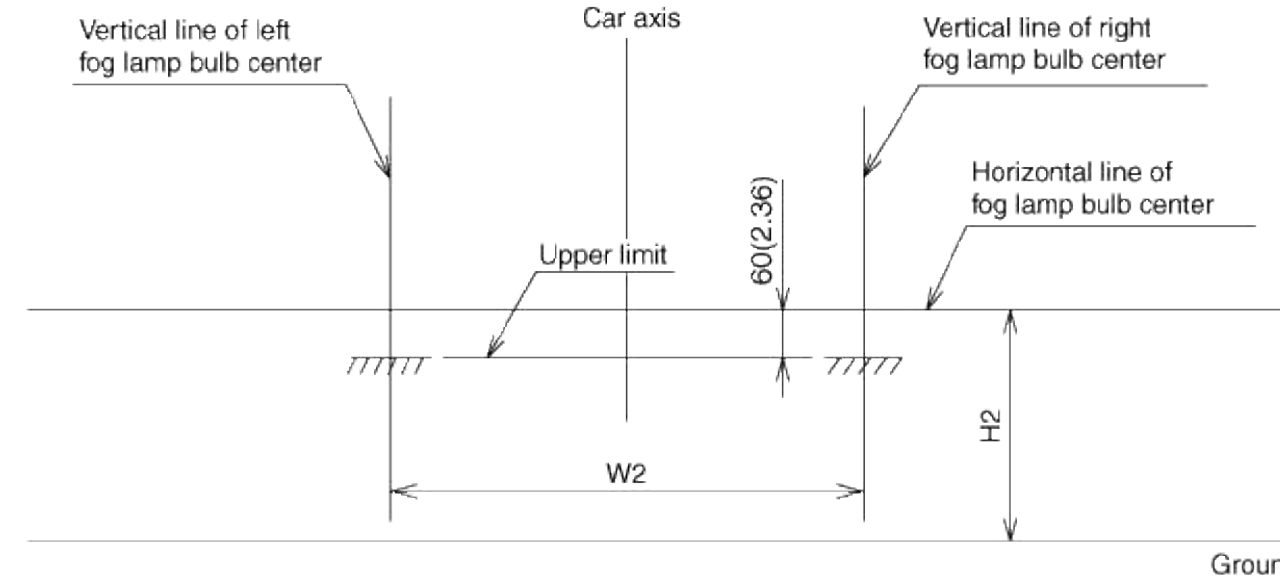
Vehicle condition	H1	H2	W1	W2	I
Without driver	34.1(866)	22.6(573)	53.5(1,360)	59.4(1,510)	118.1(3,000)
With driver	33.9(862)	22.4(569)			

1. Turn the low beam on without driver aboard.
   The cut-off line should be projected in the allowable range (shaded region).



Unit : mm

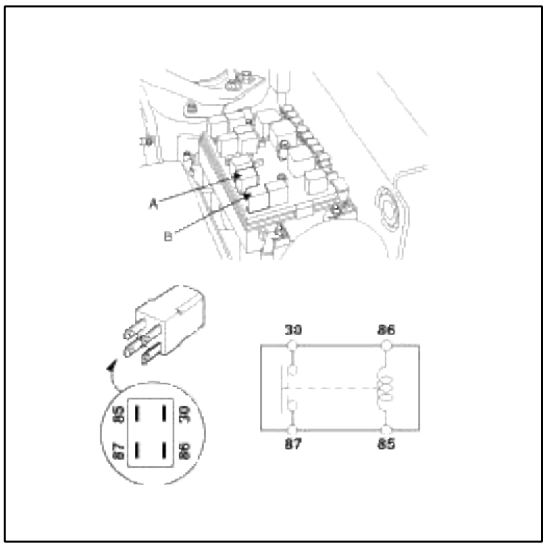
2. Turn the front fog lamp on without the driver aboard.
   The cut-off line should be projected in the allowable range (shaded region)



Unit : mm(in.)

HEAD LAMP RELAY INSPECTION

1. Pull out the head lamp relay (Low) (A) and head lamp relay (High) (B) from the engine compartment relay box.



2. Check for continuity between terminals. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals
3. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.

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

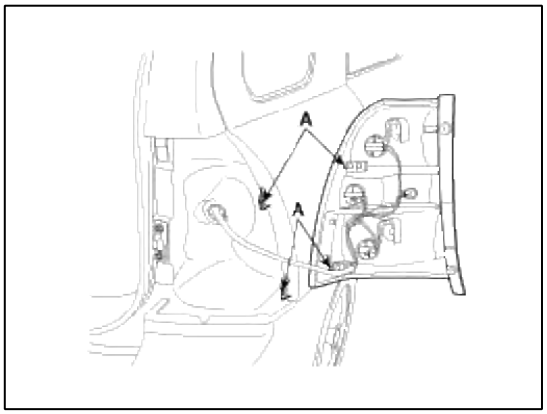
Body Electrical System > Lighting System > Turn Signal Lamp > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Loose the screws holding the rear combination lamp then disconnect the 6P connector.

NOTE

Take care that holding clip (A) is not to be damaged.



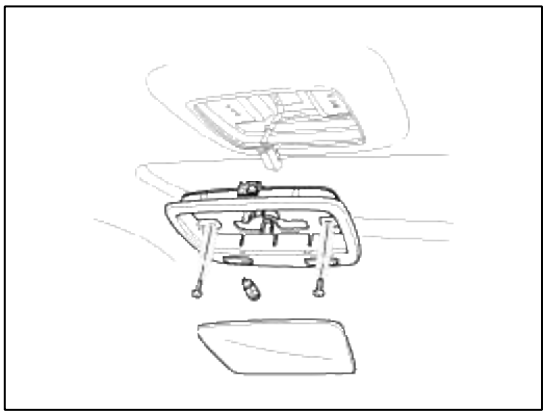
3. Remove the rear combination lamp and replace the bulbs; stop & tail lamp, turn signal lamp, back up lamp.
4. Installation is the reverse of removal.

Body Electrical System > Lighting System > Room Lamp > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens from the room lamp with a flat-tip screwdriver then replace the bulb.

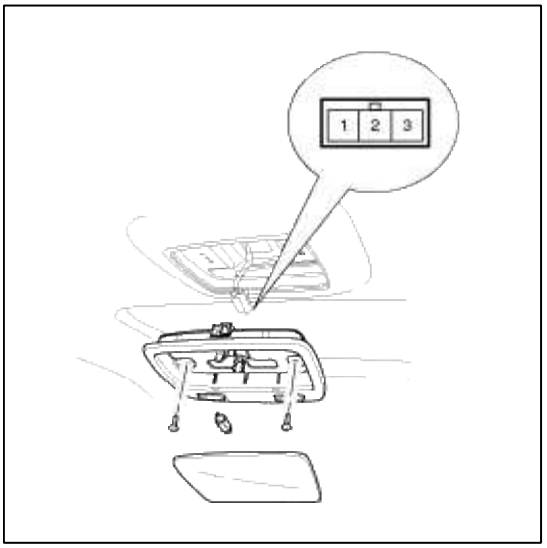
3. Remove the room lamp assembly after removing 2 screws and disconnecting the 3P connector.



4. Installation is the reverse of removal.

INSPECTION

Remove the room lamp assembly then check for continuity between terminals.



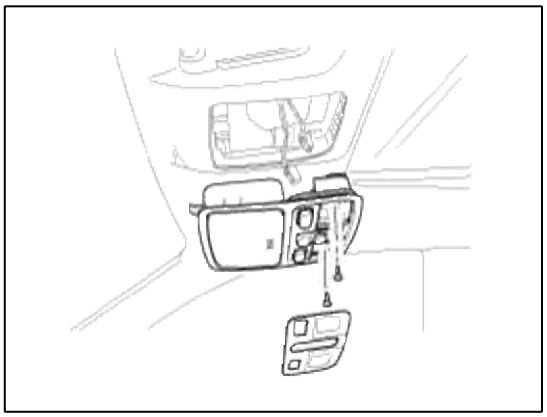
Terminal / Position	1	2	3
ON		●	●
DOOR	●	●	
OFF			

Body Electrical System > Lighting System > Overhead Console Lamp > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the lens from the overhead console then loose the 2 screws holding the overhead console.

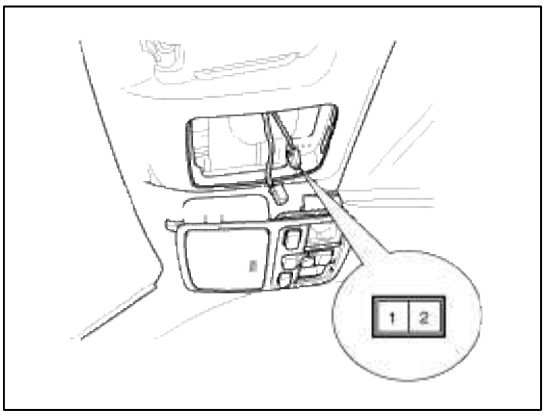
3. Disconnect the connector (6P) of sunroof switch and the connector (2P) of map lamp then remove the overhead console lamp assembly from the headliner.



4. Installation is the reverse of removal.

INSPECTION

Remove the overhead console lamp assembly then check for continuity between terminals.



Sort / Position / Terminal	Map lamp switch			
	LH		RH	
	ON	OFF	ON	OFF
1	●		●	
2	●		●	

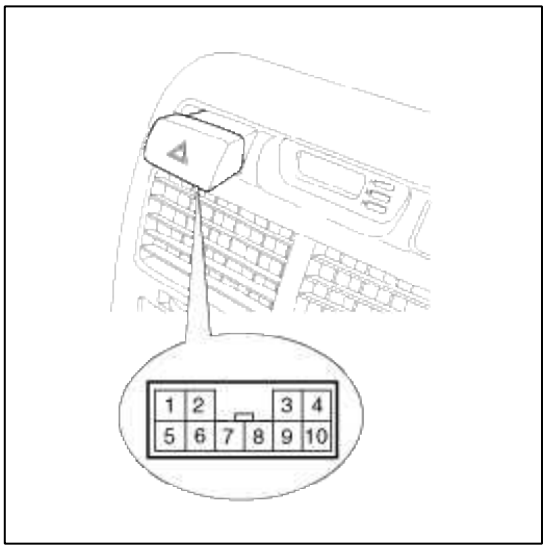
Body Electrical System > Lighting System > Hazard Lamp Switch > Repair procedures

INSPECTION

HAZARD LAMP SWITCH

1. Disconnect the negative (-) battery terminal.

2. Remove the hazard lamp switch from the center facia panel and disconnect the 10P connector.

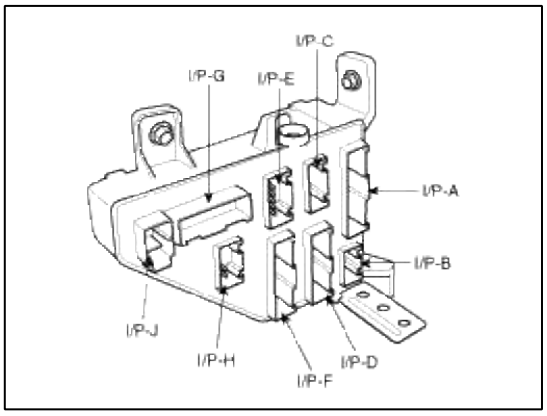


3. Operate the switch and check for continuity between terminals with an ohmmeter.

Terminal / Position	2	3	6	9	10	5	7	8
OFF	○	○				○		○
ON	Illumination		○	○	○		○	○

HAZARD LAMP RELAY INSPECTION

1. Remove 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-J terminal and No.11/No.10 in the I/P-G terminal when power and ground are connected to the No.1 in the I/P-J terminal and No.4 in the I/P-C terminal.
5. There should be no continuity between the No.1 in the I/P-J terminal and No.11/No.10 in the I/P-G terminal when power is disconnected.



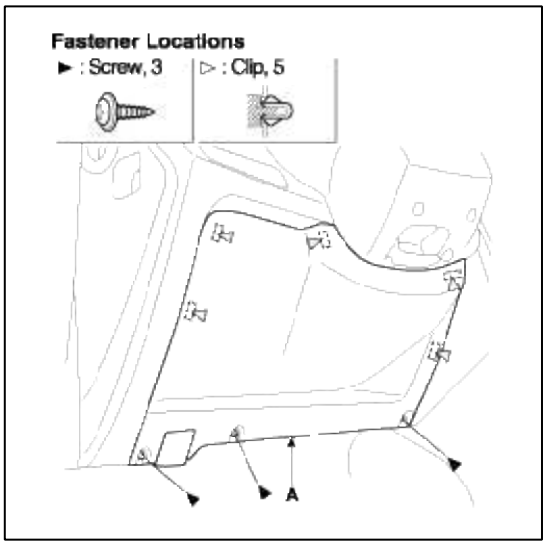
Terminal / Position	I/P-J (1)	I/P-G (11or10)	I/P-C (4)	I/P-J (1)
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Lighting System > Flasher Unit > Repair procedures

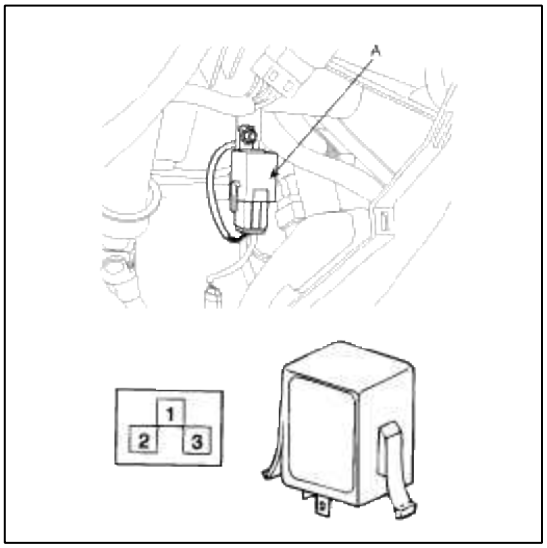
INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Disconnect the hood release cable from the hood release handle

3. Remove the lower crash pad panel (A).



4. Remove the flasher unit (A) after loosening the nut and disconnecting the connector.



5. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.
6. Connect the two turn signal lamps in parallel to terminals 1 and 3. Check that the bulbs turn on and off.

NOTE

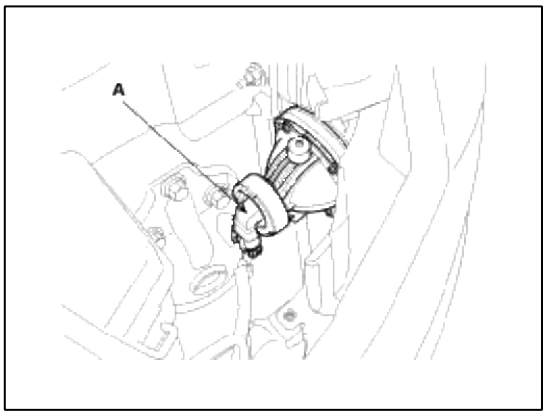
The turn signal lamps should flash 60 to 120 times per minute. If one of the front or rear turn signal lamps has an open circuit, the number of flashes will be more than 120 per minute. If operation is not as specified, replace the flasher unit.

Body Electrical System > Lighting System > Front Fog Lamps > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper.
   (Refer to the BD group - front bumper).

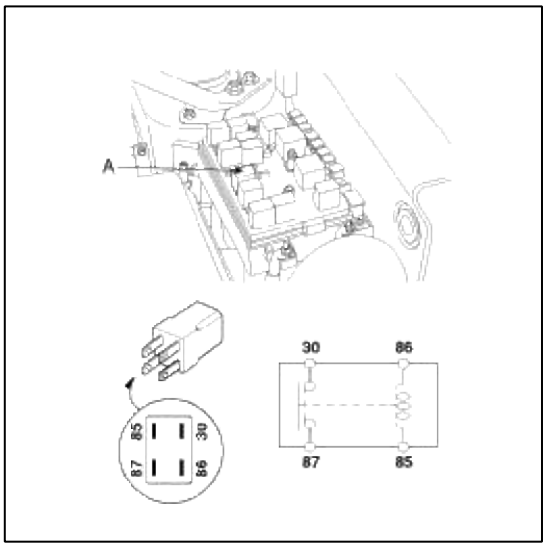
3. Remove the front fog lamp (A) after loosening the screws and disconnecting the fog lamp connector.



4. Installation is the reverse of removal.

FRONT FOG LAMP RELAY INSPECTION

1. Pull out the front fog lamp (A) relay from the engine compartment relay box.
2. Check for continuity between terminals. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
3. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



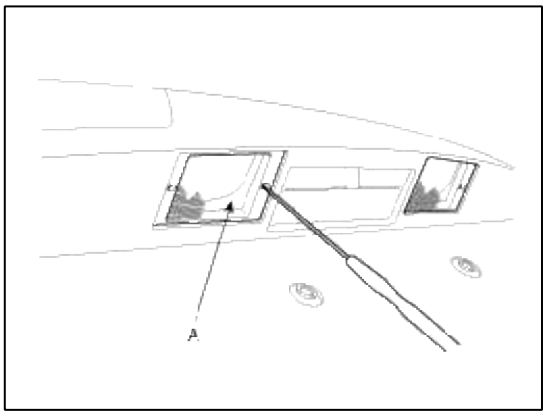
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Body Electrical System > Lighting System > License Lamps > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.

2. Remove the license plate lamp after removing 2 screws and lens (A).



3. Replace the bulb.
4. Installation is the reverse of removal.

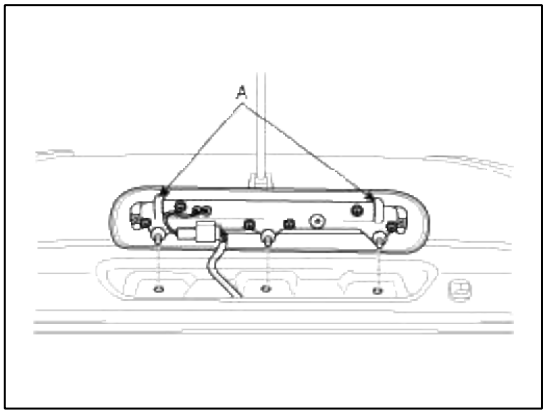
Body Electrical System > Lighting System > High Mounted stop lamp > Repair procedures

HIGH MOUNTED STOP LAMP REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Open the tail gate and then loose the mounting nuts.
3. Remove the high mounted stop lamp after disconnecting the connector of high mounted stop lamp.

NOTE

Take care that holding clip (A) is not to be damaged.



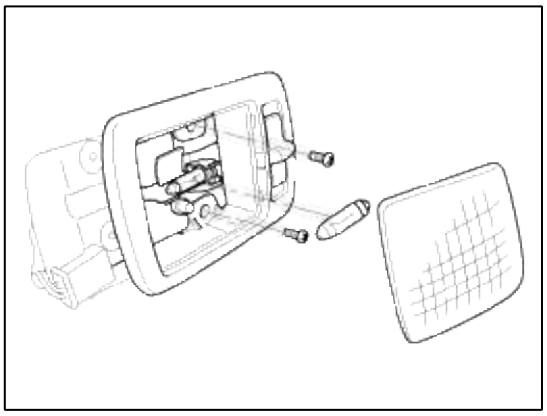
4. Installation is the reverse of removal.

Body Electrical System > Lighting System > Trunk Lamps > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens from the trunk room lamp with a flat-tip screwdriver then replace the bulb.

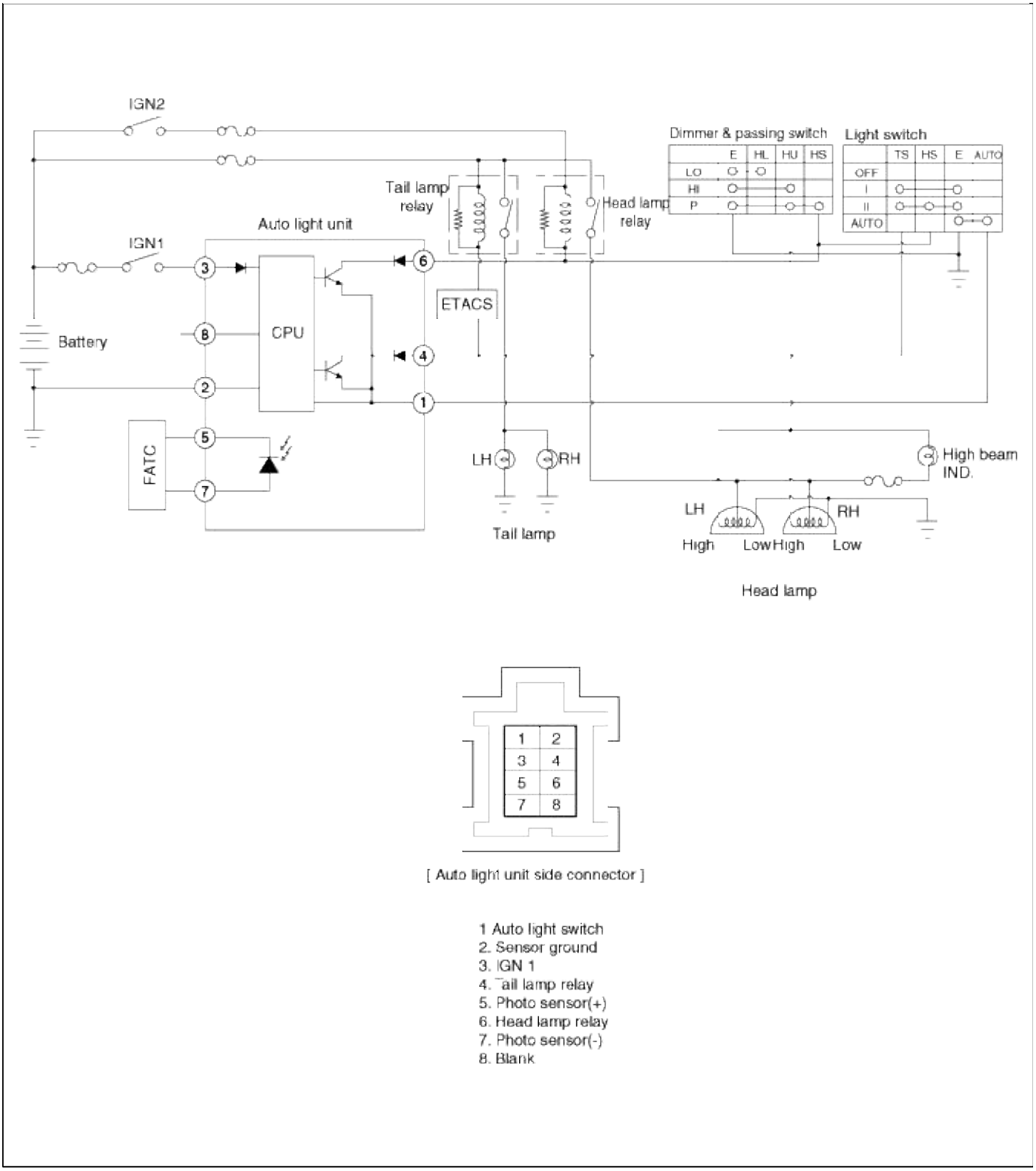
3. Remove the trunk room lamp assembly after removing 2 screws and disconnecting the 3P connector.



4. Installation is the reverse of removal.

Body Electrical System > Auto Lighting Control System > Schematic Diagrams

CIRCUIT DIAGRAM



[Auto light unit side connector]

1. Auto light switch
2. Sensor ground
3. IGN 1
4. Tail lamp relay
5. Photo sensor(+)
6. Head lamp relay
7. Photo sensor(-)
8. Blank

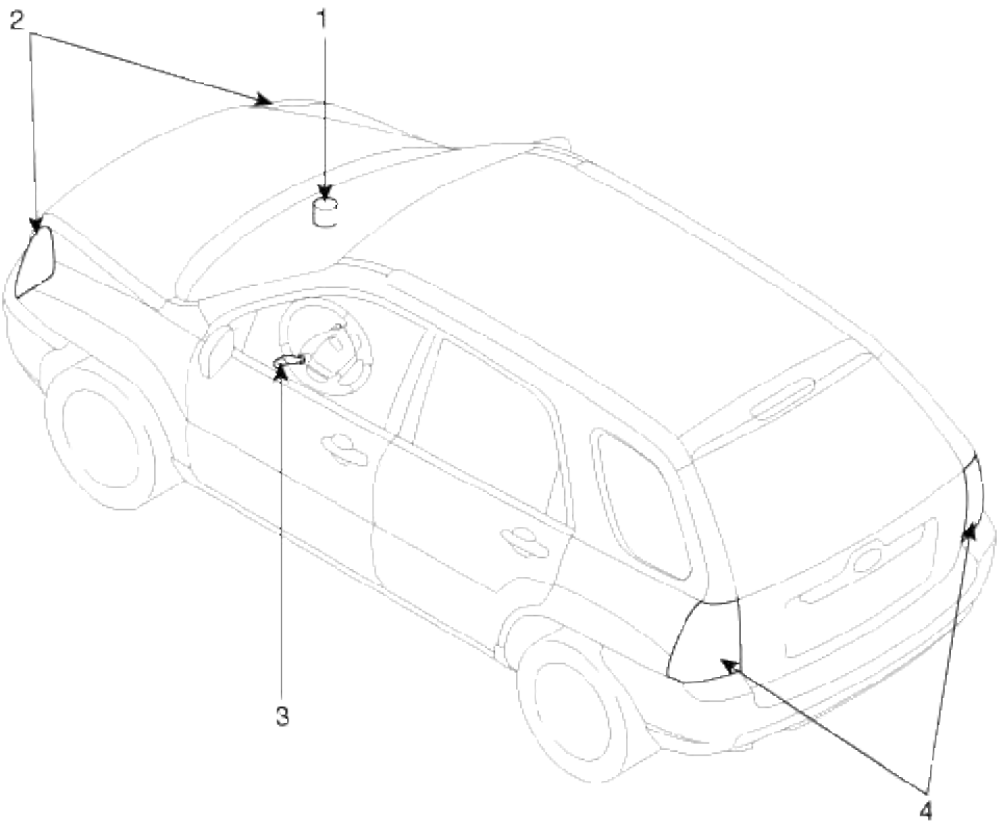
Body Electrical System > Auto Lighting Control System > Description and Operation

DESCRIPTION

The auto light control system operates by using the auto light switch.
If you set the multi-function switch to "AUTO" position, the tail lamp and head lamp will be turned automatically on or off according to external illumination.

Body Electrical System > Auto Lighting Control System > Components and Components Location

COMPONENTS



1. Auto light unit
2. Head lamps
3. Lighting switch (Auto)
4. Tail lamps

Body Electrical System > Auto Lighting Control System > Specifications

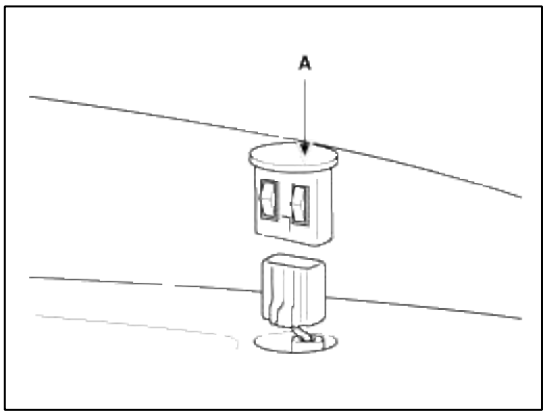
SPECIFICATIONS

Items	Specifications
Rated voltage	12V
Load	Max. 200mA (Relay load)
Detection illuminations Tail lamp / Head lamp	ON : 24 ± 5.2 (Lux), 0.81 ±0.05 (V) OFF : 48 ± 10.5 (Lux), 1.41 ±0.05 (V)

Body Electrical System > Auto Lighting Control System > Auto Light Contorl unit > Repair procedures

AUTO LIGHT SENSOR INSPECTION

1. Remove the photo & auto light sensor (A) after removing the defroster center cover.



2. Disconnect the 8P connector from the auto light sensor then inspect the connector on the wire harness side, as shown in the chart.

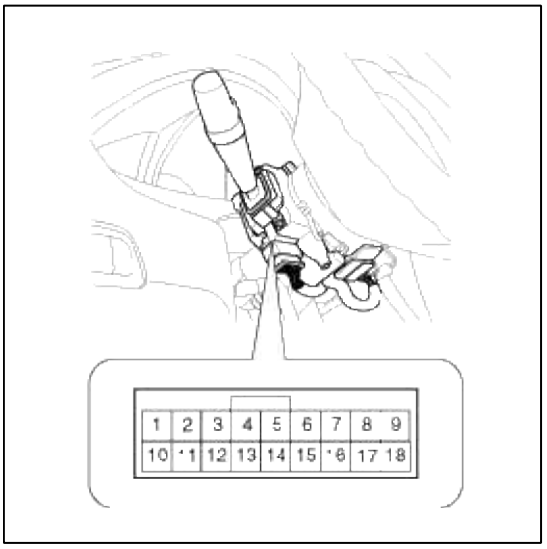
Tester connection	Condition	Specified condition
1-Ground	Auto light switch ON	Continuity
2-Ground	Constant	Continuity
3-Ground	Ignition switch ON	12V
4-Ground	Constant	5V
	Tail lamp switch ON	0V
6-Ground	Ignition switch ON	12V
	Head lamp switch ON	0V

3. If the circuit is not as specified, inspect the circuits connected to other parts.

Body Electrical System > Auto Lighting Control System > Auto Light Switch > Repair procedures

INSPECTION

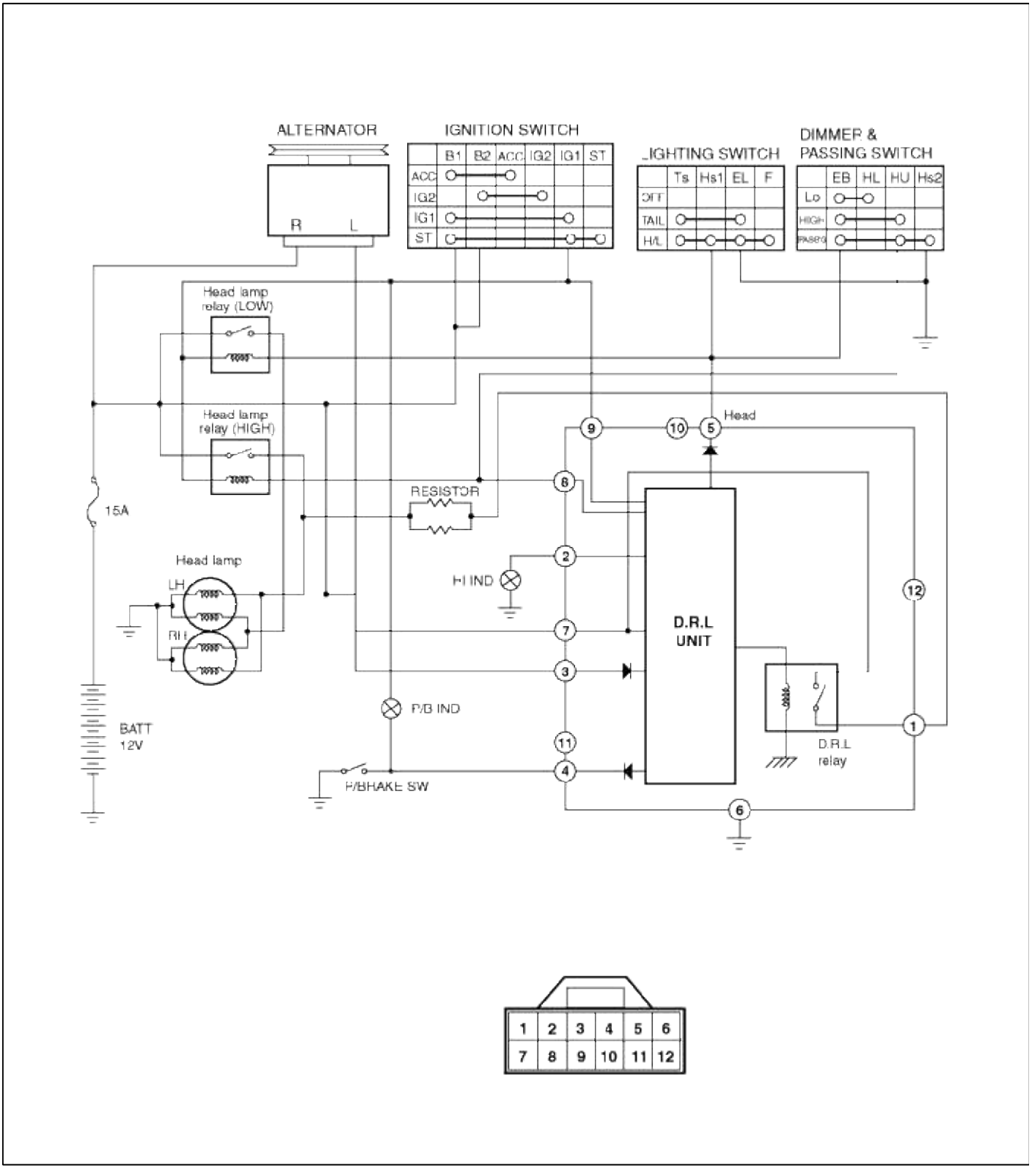
Operate the auto light switch, and then check for continuity between terminals of 18P multi-function switch connector.



Terminal / Position	14	15	16	17
OFF				
I	○			○
II	○	○		○
AUTO			○	○

Body Electrical System > Daytime Running Lights > Schematic Diagrams

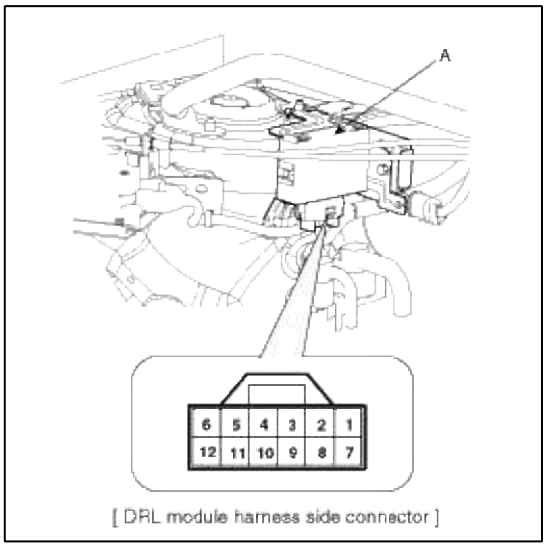
CIRCUIT DIAGRAM



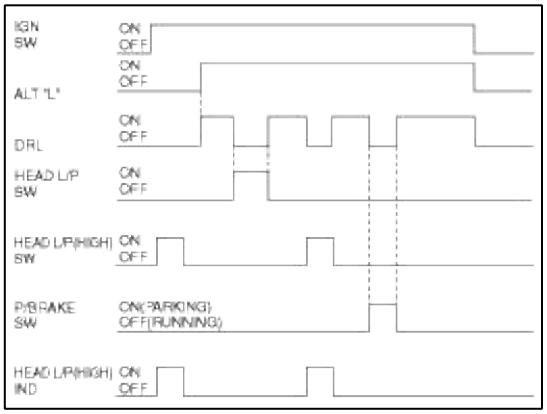
Body Electrical System > Daytime Running Lights > Repair procedures

INSPECTION

1. Daytime running unit & resister assembly (A) is installed at the right side strut housing.



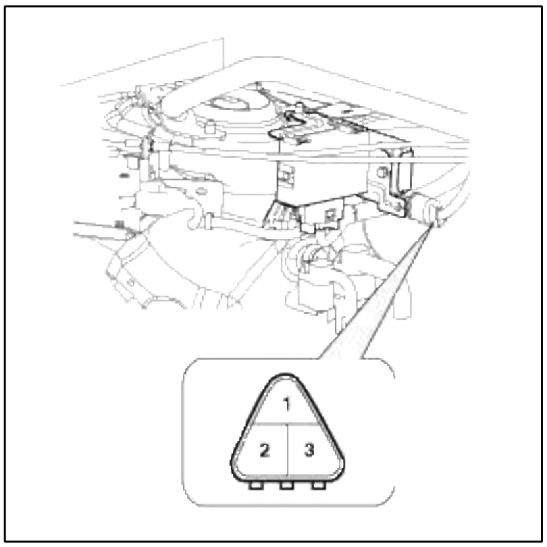
2. Check that the light operate according to the following timing chart.

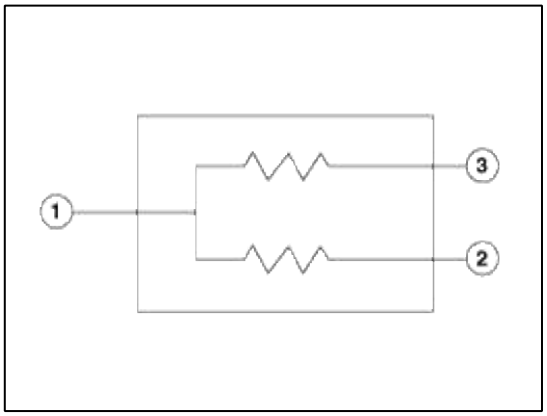


3. Inspect the connector and terminals to be sure they are all making good contact. If the terminals are bent, loose or corroded, repair them as necessary, and recheck the system. If the terminals look OK, go to step 4.
4. Make these input tests at the connector If any test indicates a problem, find and correct the cause, then recheck the system. If all the input tests prove OK, the control unit must be faulty; replace it.

Terminal	Test condition	Test: Desired result
1	Under all conditions	Check for voltage to ground : There should be continuity.
2	Under all conditions	Check for voltage to ground : There should be continuity.
3	Engine running	Check for voltage to ground : There should be battery voltage.
4	P/brake switch ON	Check for voltage to ground : There should be continuity.
5	IG1	Check for voltage to ground : There should be battery voltage.
6	Under all conditions	Check for voltage to ground : There should be continuity.
7	Under all conditions	Check for voltage to ground : There should be battery voltage.
8	IG1	Check for voltage to ground : There should be battery voltage.
9	IG1	Check for voltage to ground : There should be battery voltage.
10	-	-
11	-	-
12	-	-

5. Check for resistance between the terminals of the resistor in each position according to the table.

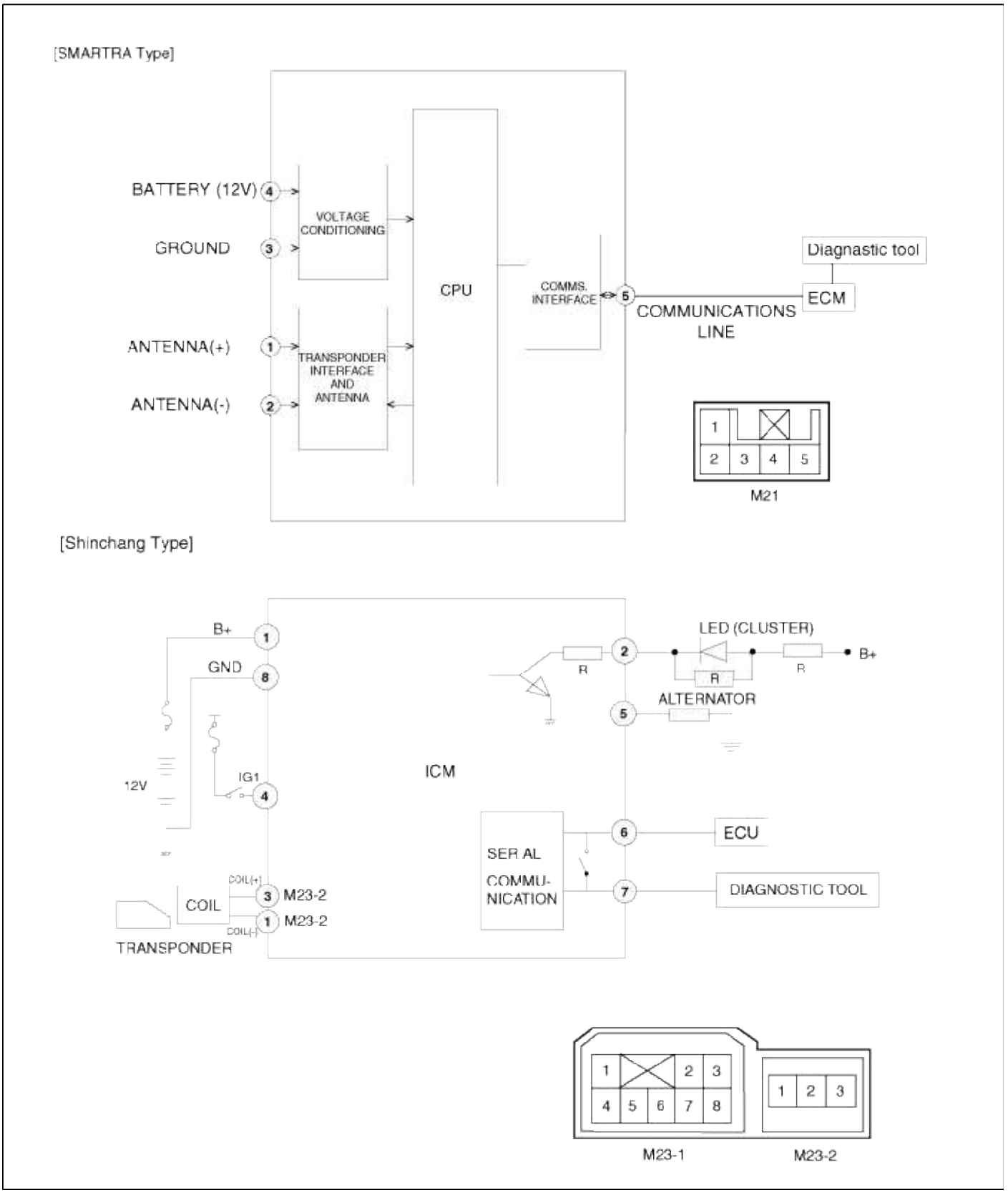




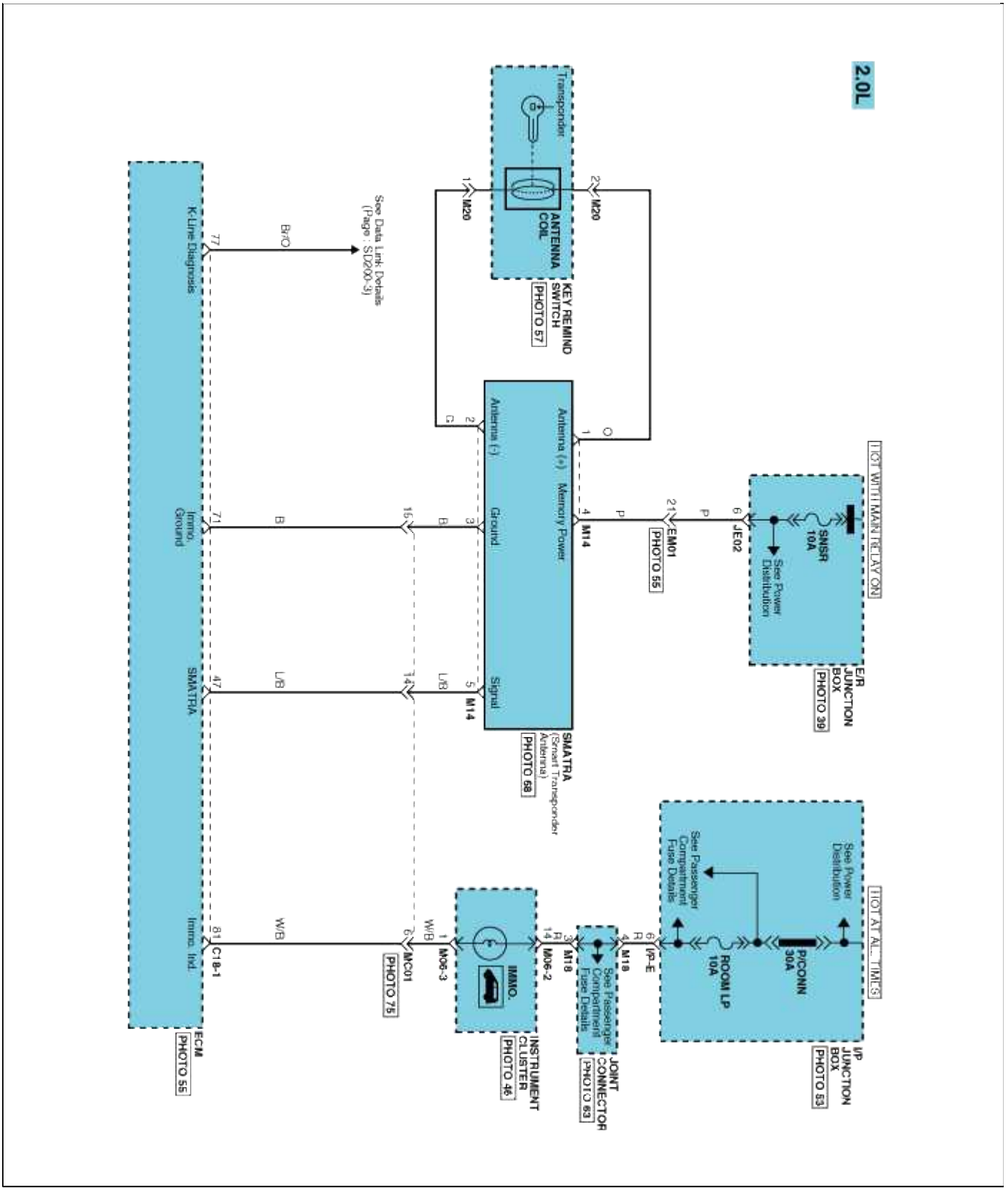
Terminal	Specified value (Ω)
1-2	1.6 ± 5%
1-3	1.6 ± 5%

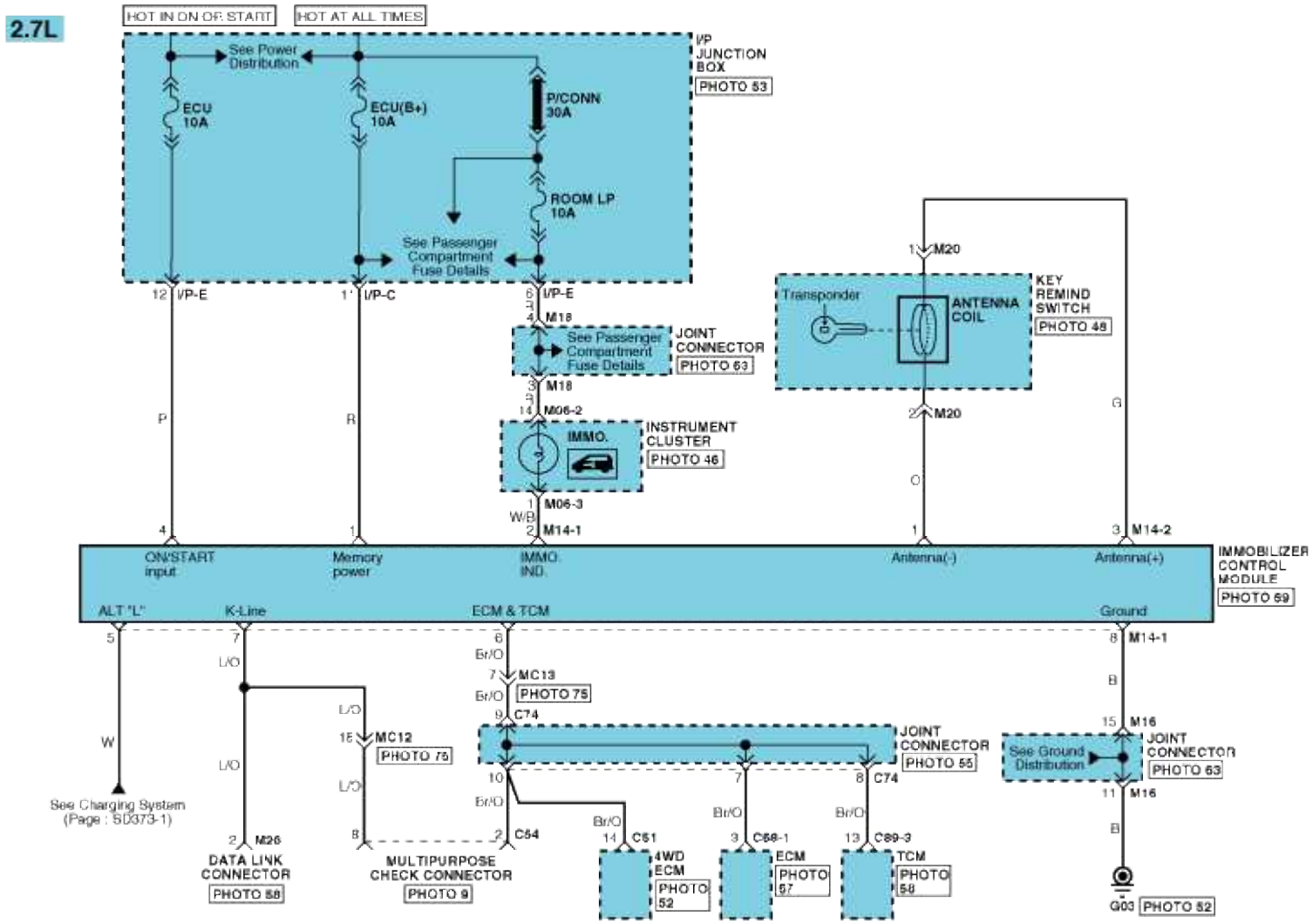
Body Electrical System > Immobilizer System > Schematic Diagrams

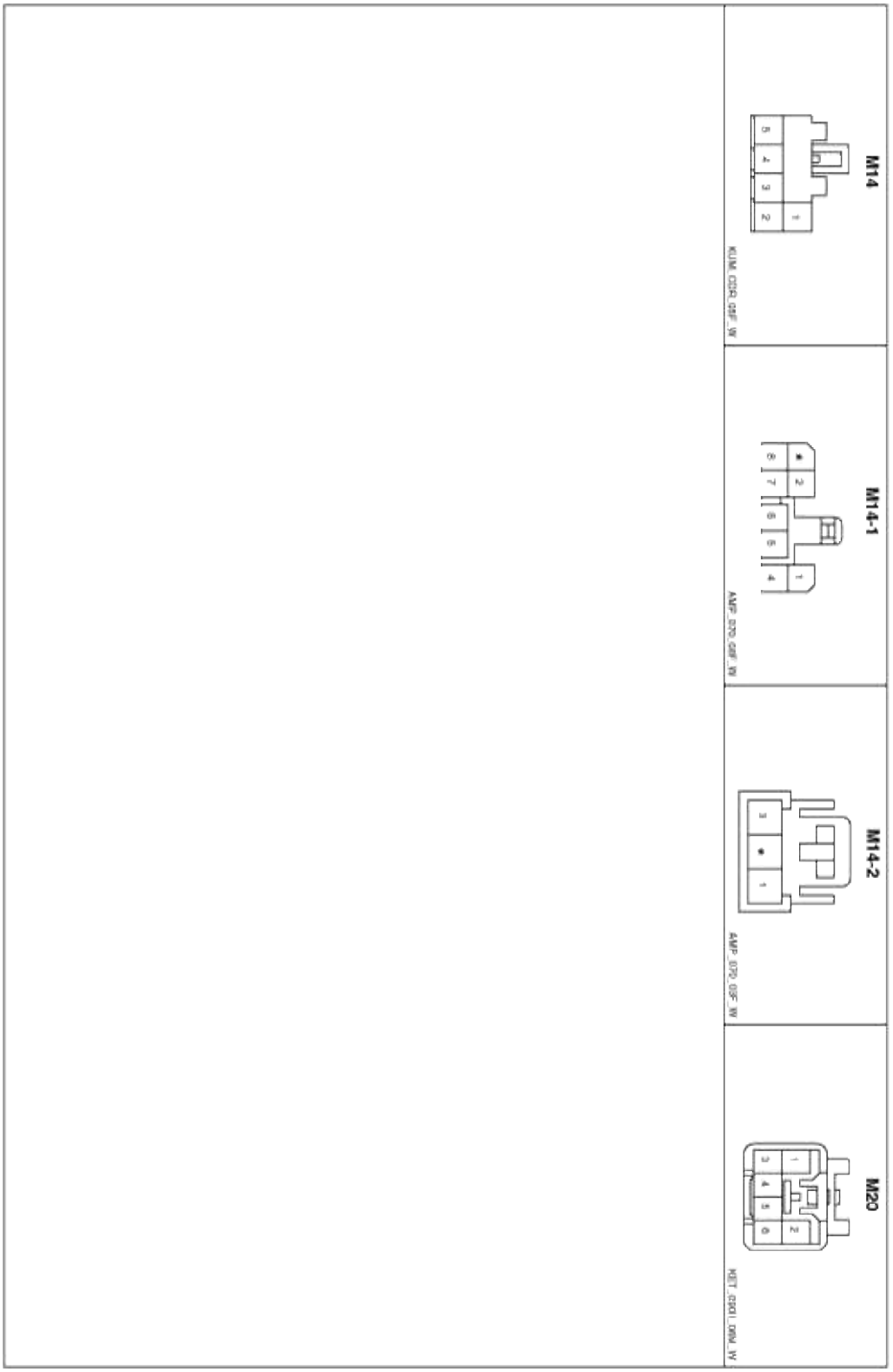
SYSTEM BLOCK DIAGRAM



CIRCUIT DIAGRAM


2.0L
[IGT WITH MAIN RELAY ON]
[IGT AT ALL TIMES]
E/R JUNCTION BOX
PHOTO 39
SNSR 10A
See Power Distribution
JE02
EM01
PHOTO 55
M14
Antenna (+)
Memory Power
Antenna (-)
Ground
Signal
SMATRA (Smart Transponder Antenna)
PHOTO 58
Transponder
ANTENNA COIL
KEY REMIND SWITCH
PHOTO 57
M20
See Data Link Details (Page : SL02-3)
K-Line Diagnosis
SMATRA
Immo. Ground
Immo. Ind.
ECM
PHOTO 55
I/P JUNCTION BOX
PHOTO 53
P/OONN 30A
ROOM LP 10A
See Passenger Compartment Fuse Details
I/P-E
M18
M19
JOINT CONNECTOR
PHOTO 63
M06-2
M06-3
IMMO.
INSTRUMENT CLUSTER
PHOTO 46
MC01
PHOTO 75
C18-1
Br/O
B
L/B
W/B


2.7L
HOT IN ON OR START
HOT AT ALL TIMES
See Power Distribution
I/P JUNCTION BOX
PHOTO 53
ECU 10A
ECU(B+) 10A
P/CONN 30A
ROOM LP 10A
See Passenger Compartment Fuse Details
I/P-E
I/P-C
M18
See Passenger Compartment Fuse Details
JOINT CONNECTOR
PHOTO 63
M06-2
IMMO.
INSTRUMENT CLUSTER
PHOTO 46
M06-3
M14-1
M20
Transponder
ANTENNA COIL
KEY REMIND SWITCH
PHOTO 48
M14-2
ON/START input
Memory power
IMMO. IND.
Antenna(-)
Antenna(+)
IMMOBILIZER CONTROL MODULE
PHOTO 69
ALT "L"
K-Line
ECM & TCM
Ground
MC13
PHOTO 75
C74
MC12
PHOTO 75
JOINT CONNECTOR
PHOTO 55
M16
See Ground Distribution
JOINT CONNECTOR
PHOTO 63
See Charging System (Page : SD373-1)
M26
DATA LINK CONNECTOR
PHOTO 58
MULTIPURPOSE CHECK CONNECTOR
PHOTO 9
C54
C51
4WD ECM
PHOTO 52
C58-1
ECM
PHOTO 57
C89-3
TCM
PHOTO 58
G03
PHOTO 52



Body Electrical System > Immobilizer System > Description and Operation

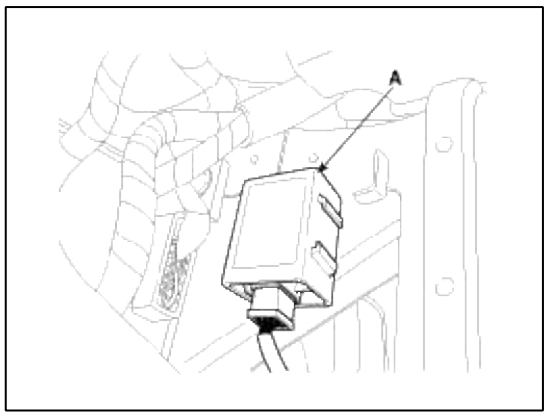
DESCRIPTION

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

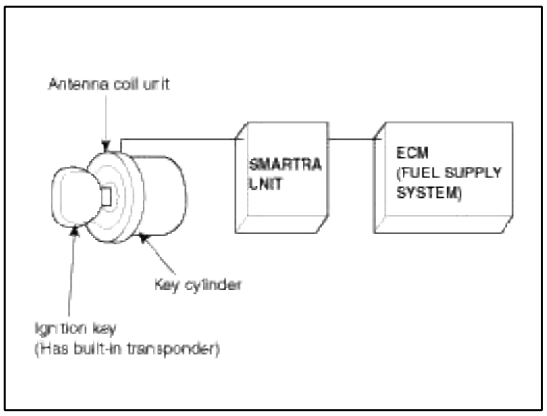
There are two types of immobilizer.

One is a "SMARTRA (SMART TRansponder Antenna)" type and another is a "shinchang" type.

1. SMARTRA type immobilizer
   A. The "SMARTRA" type immobilizer system is applied to the D2.0 engine and β 2.0 engine.
   B. The SMARTRA system consists of a transponder located in the ignition key, a antenna coil, a SMARTRA unit (A), an indicator light and the ECM.
   C. 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.



   D. 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.
   E. 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.
   F. 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.
   G. 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.
   H. The immobilizer system can store up to four key codes.
   I. If the customer has lost his key, and cannot start the engine, contact Kia motor service station.

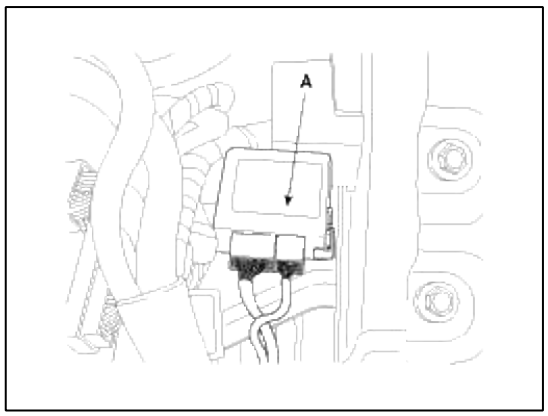


2. Shinchang type immobilizer

A. The "Shinchang " type immobilizer system is applied to the δ 2.7 engine.

B. The shinchang system consists of a transponder located in the ignition key, a antenna coil, an ICU (Immobilizer control unit), an indicator light and the ECM.

C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the antenna coil to the ICU (A).

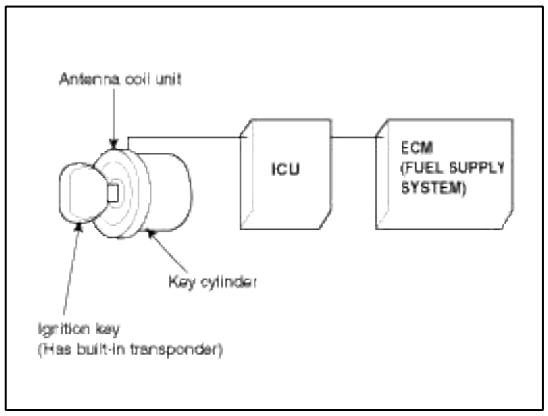


D. If the ID code transmitted from the key does not match the pre-registered code in the ICU, injection is not performed by the engine ECM. Hence, each vehicle has a set of keys containing a unique ID code which are registered on the ICU. This signal is captured by the antenna coil located in the front section of the steering handle lock and transmitted to the ICU. The ICU analyses and verifies the signal to determine if the signal matches the pre-registered code. If the signal is verified, the ICU transmits a message to the engine ECM to allow injection. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the ICU has recognized the code sent by the transponder. If the signal is not verified by the ICU, fuel injection is not performed by the engine ECM. The indicator light will continue blinking for five seconds until the ignition switch is turned OFF. Communication between ICU and ECM communicates through the K-line of ECM. K-line is also used for the Communication between ECM and scan tool. There is a relay inside of ICU to switch the communication.

E. If it is necessary to rewrite the ICU 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.

F. The immobilizer system can store up to four key codes.

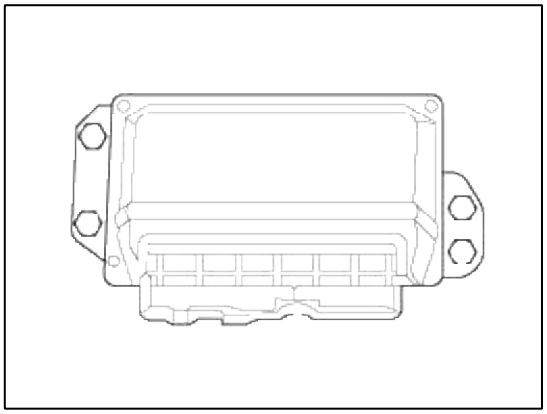
G. If the customer has lost his key, and cannot start the engine, contact Kia motor service station.



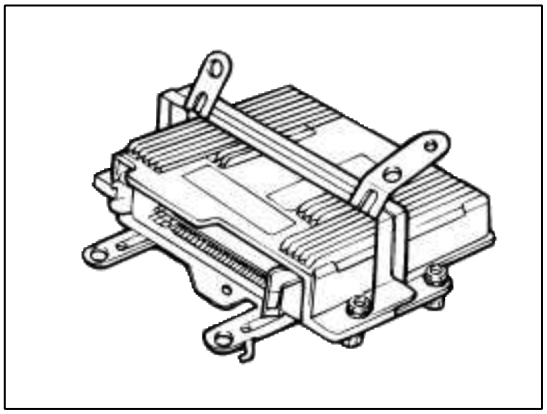
COMPONENTS OPERATIONS

ECM (Engine Control Module)

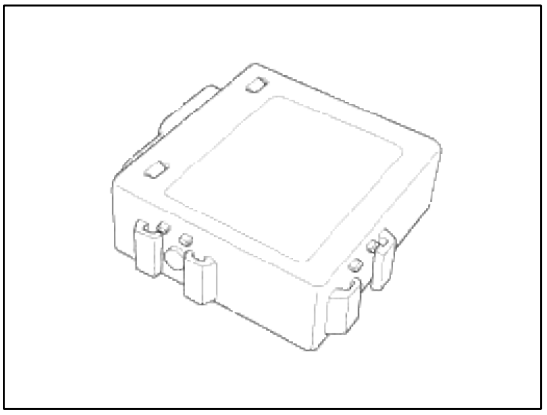
1. SMARTRA type immobilizer
   The ECM carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the ECM simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the ECM.



2. Shinchang type immobilizer
   In the Ignition ON position, the engine ECM receives information from the ICU and permits injection to take place.

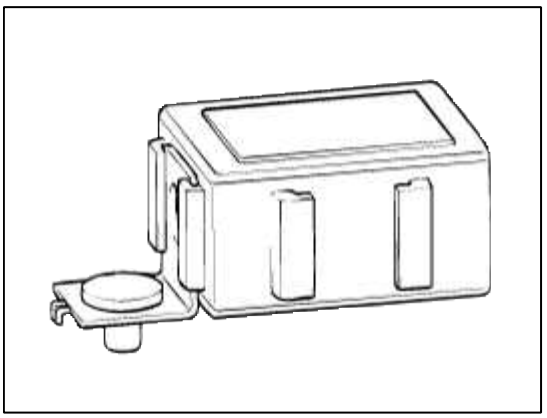


ICU (Immobilizer Control Unit)
The ICU carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The ICU is mounted behind of the crush pad under panel close to the antenna coil for RF transmission and receiving.
The ICU carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the ICU simultaneously. Only if the results are equal, transmits the signal to the ECM to permits injection. The data of all transponders, which are valid for the vehicle, are stored in the ICU.

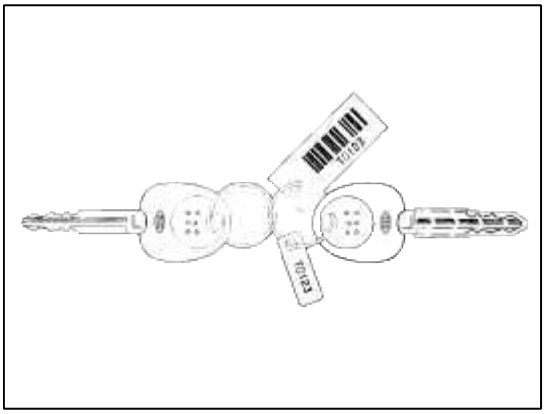


SMARTRA unit
The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crush pad under panel close to the antenna coil for RF transmission and receiving.
The RF signal 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.

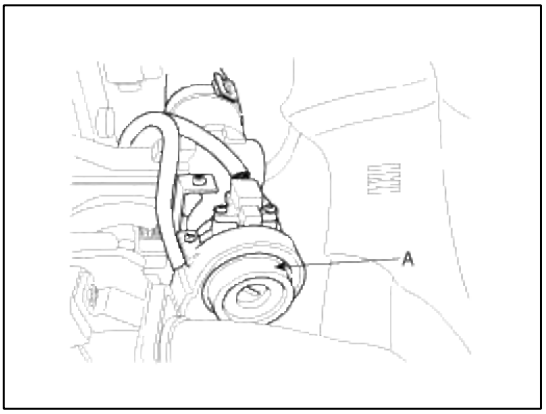


TRANSPONDER (Built-in keys)
The transponder has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.



Antenna coil
The antenna coil (A) has the following functions.
- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA/ICU.

It is located directly in front of the steering handle lock.



Immobilizer indicator (if equipped)
This light illuminates when the immobilizer key is inserted and turned to the ON position to start the engine.

At this time, you can start the engine. The light goes out after the engine is running. In case this light goes out before you start the engine, you must turn to the LOCK position and restart the engine.
If this light blinks when the ignition switch is in the ON position before starting the engine, have the system checked by an authorized Kia Dealer.

Body Electrical System > Immobilizer System > Troubleshooting

DIAGNOSIS OF IMMOBILIZER FAULTS

- Communication between the ECM and the SMARTRA/ICU.
- Function of the SMARTRA/ICU and the transponder.
- Data (stored in the ECM/ICU related to the immobilizer function.

The following table shows the assignment of immobilizer related faults to each type:

[β2.0 engine]

Immobilizer Related Faults	Fault types	Diagnostic codes
SMARTRA fault	1. Communication line error (Open/Short etc.) 2. Invalid message from SMARTRA to ECM.	P1690 (SMARTRA error)
Antenna coil fault	1. Antenna coil error.	P1691 (Antenna error)
Transponder 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). 4. Transponder not in the password mode. 5. Transponder transport data has been changed. 6. Transponder programming error.	P1693 (Transponder error)
ECM fault	1. Request from ECM is invalid. (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (ECU signal 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 (Mismatch error)

[δ2.7 engine]

Immobilizer Related Faults	Fault types	Diagnostic codes
ICU internal permanent memory (EEPROM) fault	1. ICU internal permanent memory (EEPROM) fault. 2. Invalid write operation to permanent memory (EEPROM).	P1677 (EMS VIN data error)
ICU fault	1. Communication line error (Open/Short etc.) 2. Invalid message from ICU to ECM.	P1678 (EMS no request)
ICU fault	1. Request from ICU is invalid. (Protocol layer violation- Invalid request, check sum error etc.)	P1679 (EMS data fail)
Antenna coil fault	1. Antenna coil error	P1691 (Antenna error)
Transponder 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). 4. Transponder not in the password mode. 5. Transponder transport data has been changed. 6. Transponder programming error.	P1693 (Transponder error)
Invalid key fault	1. Virgin transponder at EMS status "Learnt". 2. Learnt (Invalid) Transponder at EMS status "Learnt"(Authentication fail).	P1698 (Transponder invalid)

Body Electrical System > Immobilizer System > Repair procedures

TEACHING PROCEDURES

1. Key Teaching Procedure

Key teaching must be done after replacing a defective ECM (ICU) or when providing additional keys to the vehicle owner.

The procedure starts with an ECM (ICU) request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" ECM (ICU) stores the vehicle specific data and the key teaching can be started. The "learnt" ECM (ICU) 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 (ICU) three times, the ECM (ICU) 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.

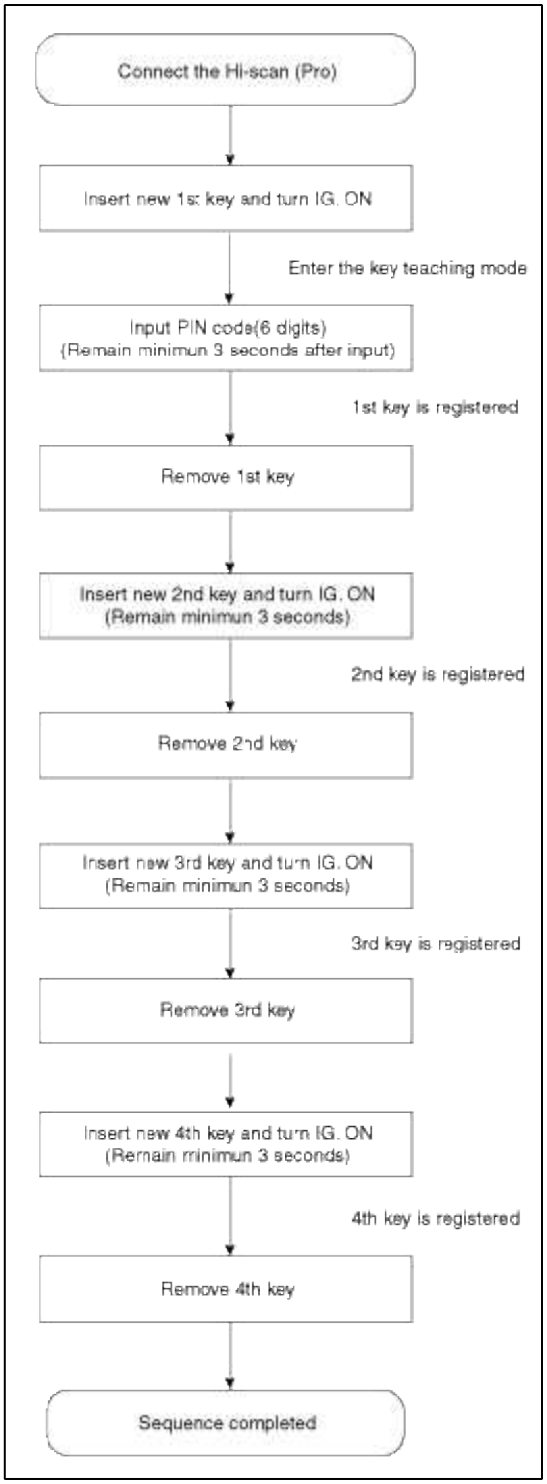
The key teaching is done by ignition on with the key and additional tester commands. The ECM (ICU) stores the relevant data in the EEPROM and in the transponder. Then the ECM (ICU) runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.

If the key is already known to the ECM (ICU) 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).

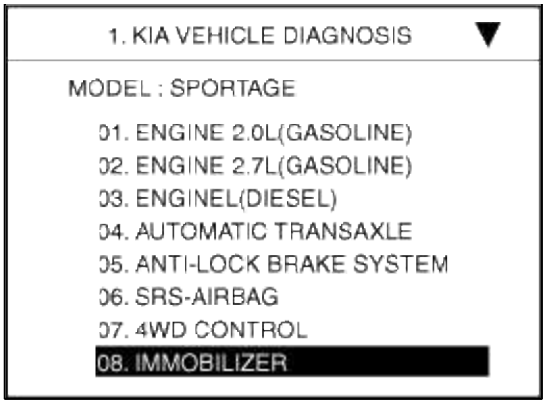
The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the ECM (ICU). This rejects the key and a message is sent to the tester.

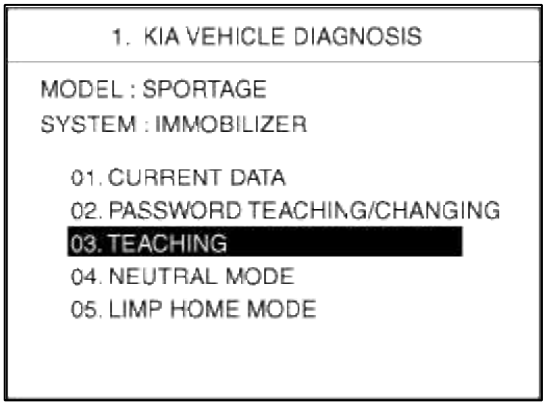
The ECM (ICU) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key

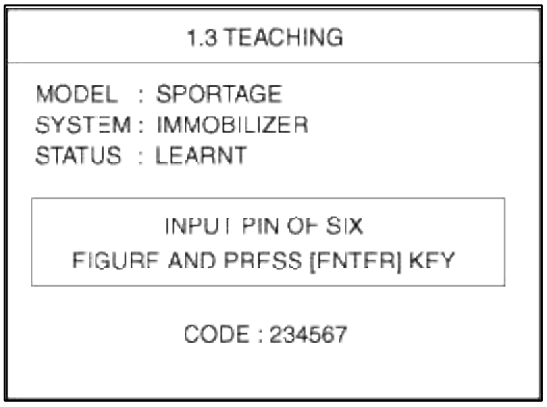
can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the ECM (ICU) detects different authenticators of a transponder and an ECM (ICU), the key is considered to be invalid.
The maximum number of taught keys is 4
If an error occurs during the Immobilizer Service Menu, the ECM (ICU) status remains unchanged and a specific fault code is stored.
If the ECM (ICU) 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 (ICU).

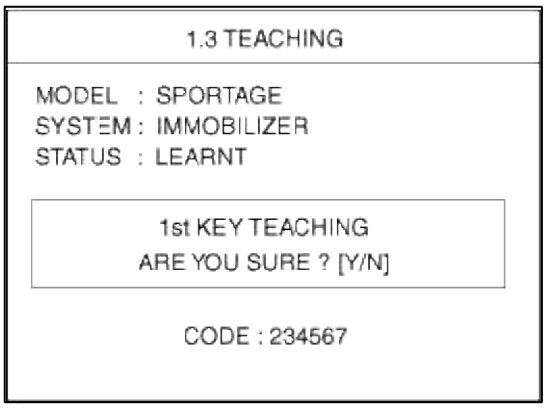


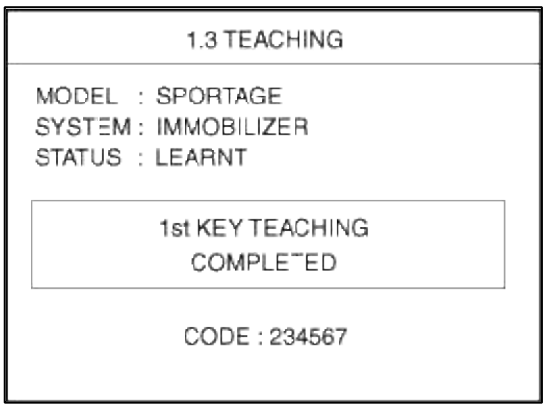
(1) ECM learnt status.

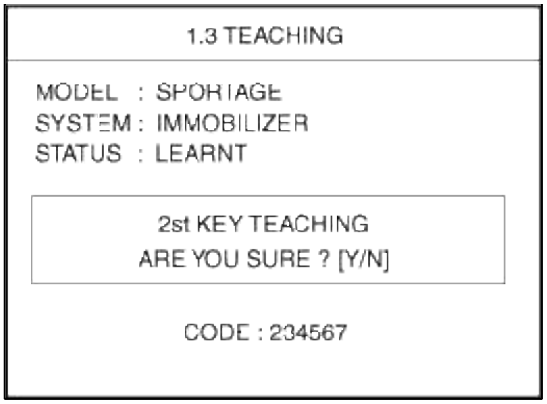

1. KIA VEHICLE DIAGNOSIS
MODEL : SPORTAGE
01. ENGINE 2.0L(GASOLINE)
02. ENGINE 2.7L(GASOLINE)
03. ENGINEL(DIESEL)
04. AUTOMATIC TRANSAXLE
05. ANTI-LOCK BRAKE SYSTEM
06. SRS-AIRBAG
07. 4WD CONTROL
08. IMMOBILIZER

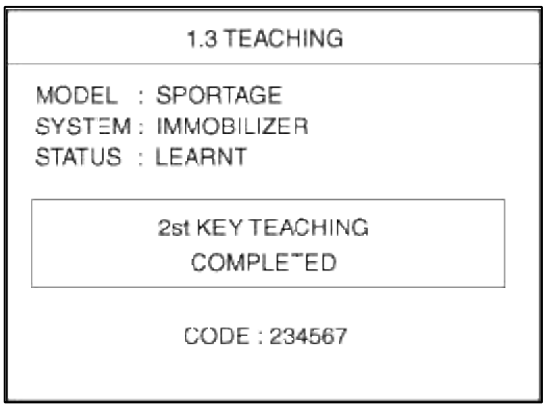

1. KIA VEHICLE DIAGNOSIS
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE


1.3 TEACHING
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567


1.3 TEACHING
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : LEARNT
1st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567

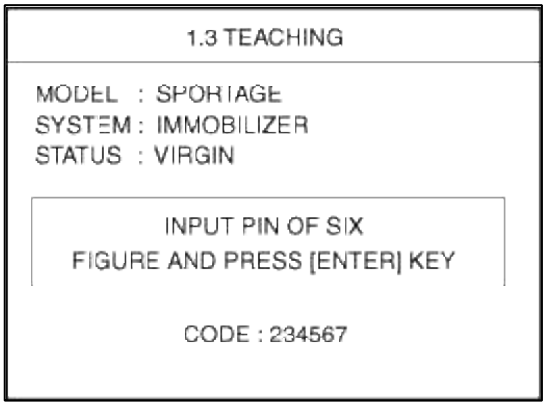

1.3 TEACHING
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : LEARNT
1st KEY TEACHING
COMPLETED
CODE : 234567

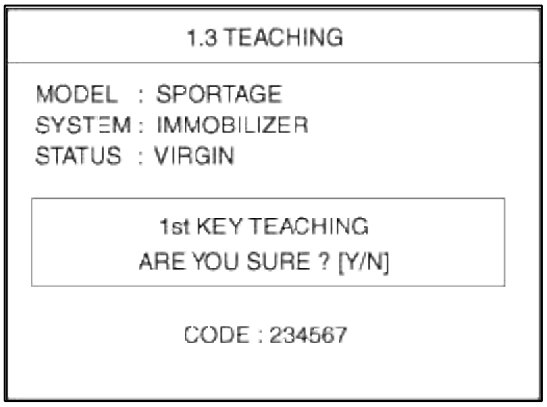


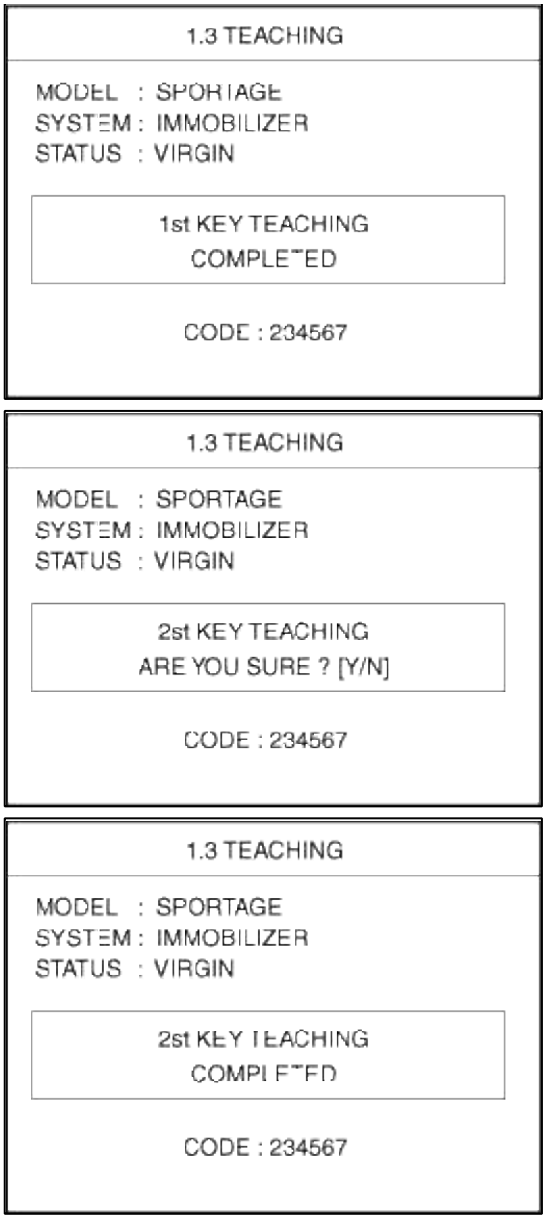


(2) ECM virgin status.

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.







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.

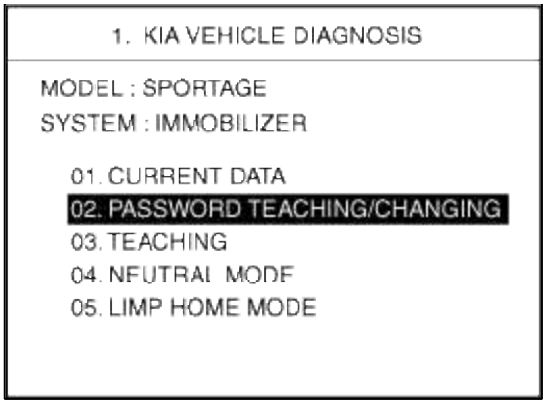
User password teaching is only accepted by a "learnt" ECM (ICU). Before first teaching of user password to an ECM (ICU), the status of the password is "virgin" No limp home function is possible.

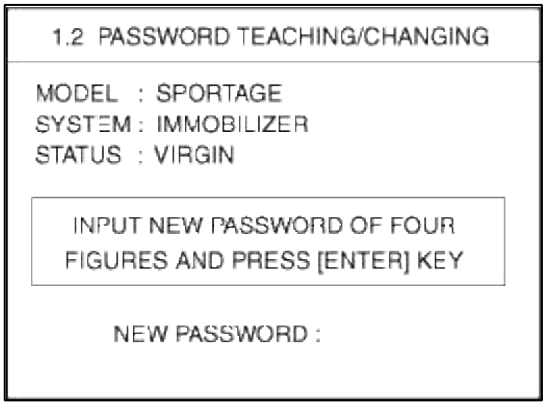
The teaching is started by ignition on, with a valid key and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt".

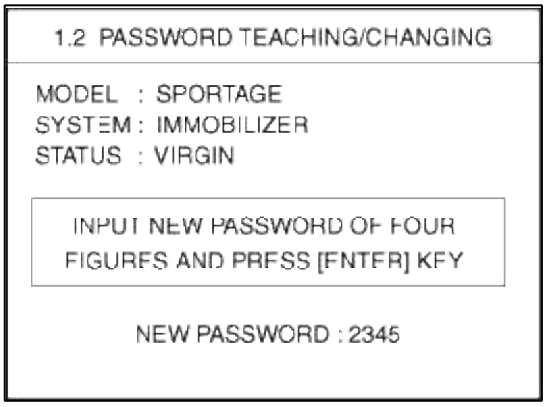
The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the ECM (ICU) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

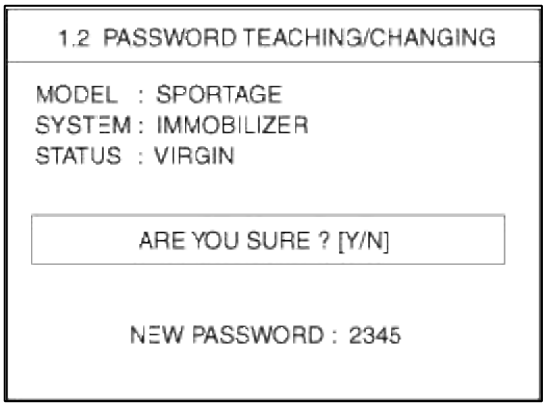
If incorrect user passwords or wrong vehicle specific data have been sent to the ECM (ICU) three times, the ECM (ICU) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

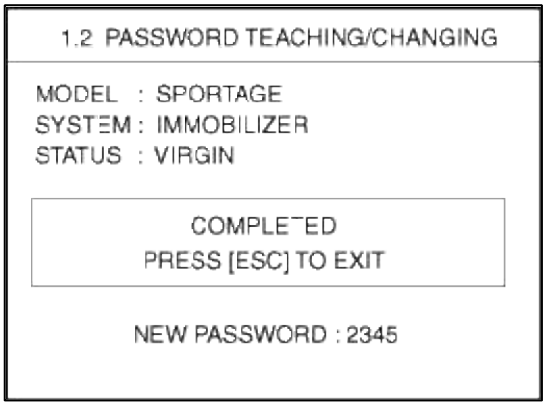
(1) User password teaching


1. KIA VEHICLE DIAGNOSIS
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE


1.2 PASSWORD TEACHING/CHANGING
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY
NEW PASSWORD :

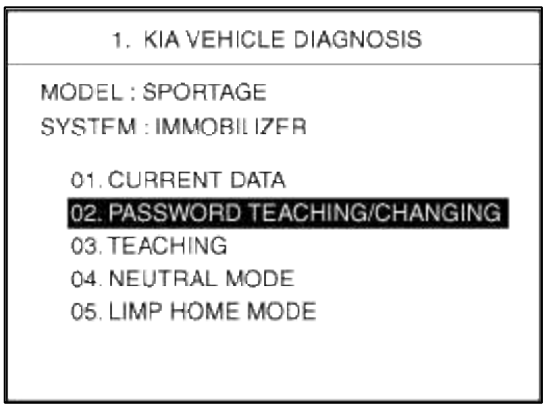

1.2 PASSWORD TEACHING/CHANGING
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY
NEW PASSWORD : 2345

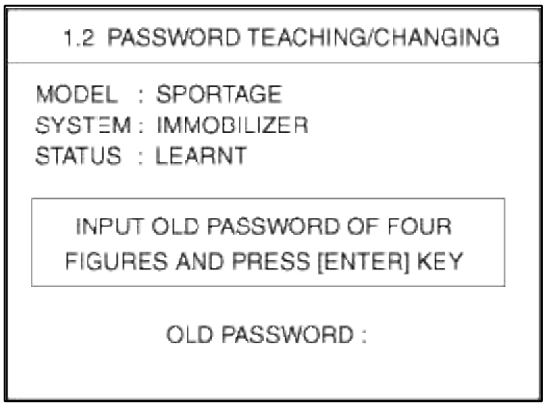

1.2 PASSWORD TEACHING/CHANGING
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
ARE YOU SURE ? [Y/N]
NEW PASSWORD : 2345

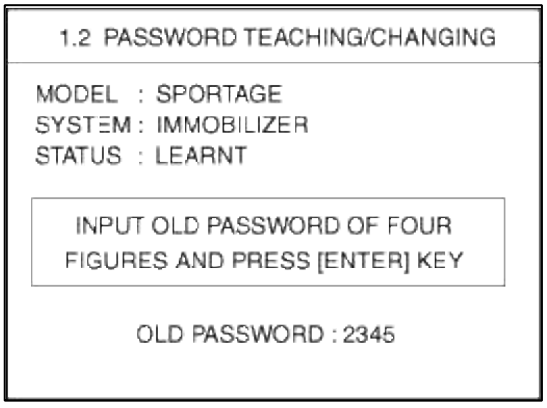

1.2 PASSWORD TEACHING/CHANGING
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
COMPLETED
PRESS [ESC] TO EXIT
NEW PASSWORD : 2345

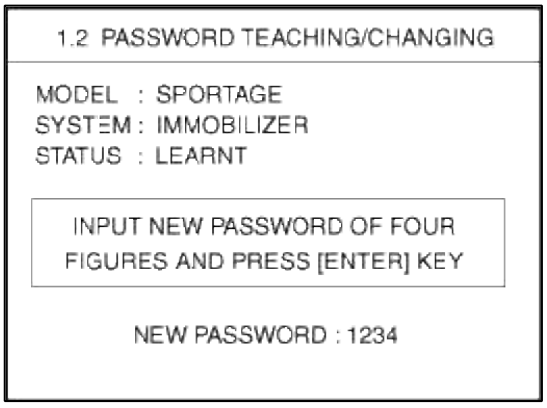
In case of putting wrong password, retry from first step after 10 seconds.

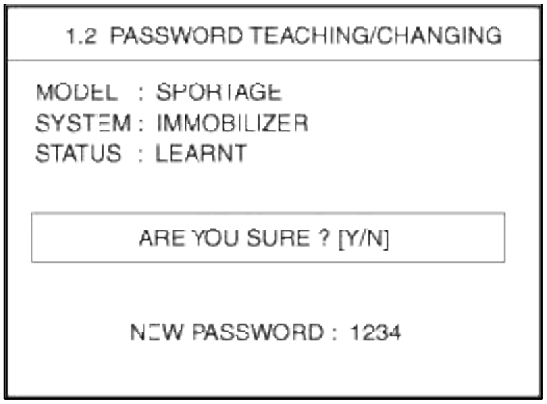
(2) User password changing

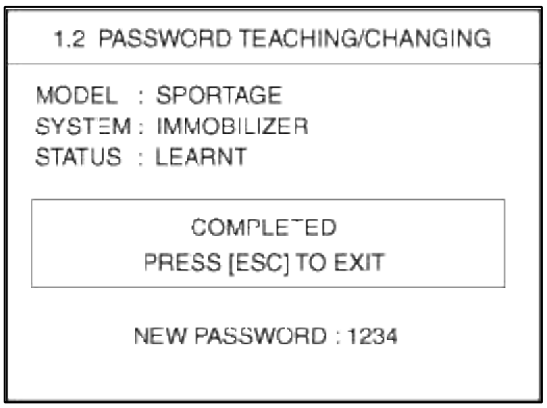












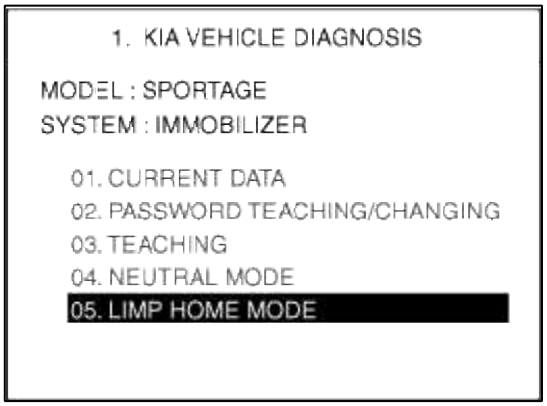
LIMP HOME FUNCTION

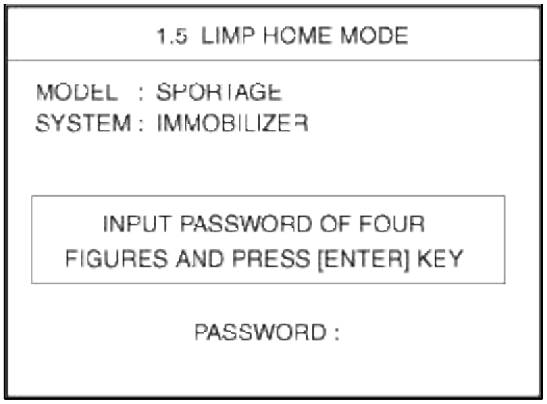
1. LIMP HOME BY TESTER

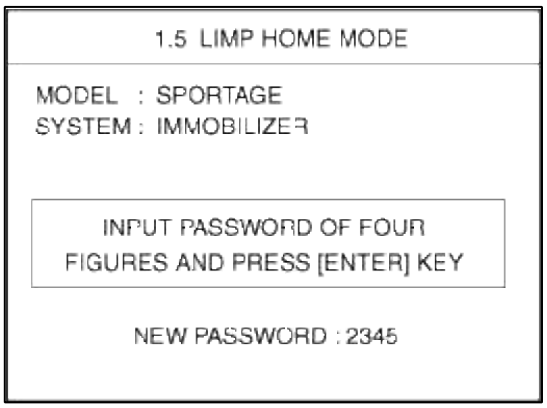
If the ECM (ICU) detects the fault of the SMARTRA or transponder, the ECM (ICU) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the ECM (ICU) before. This password can be selected by the vehicle owner and is programmed at the service station. The user password can be sent to the ECM (ICU) via the special tester menu.

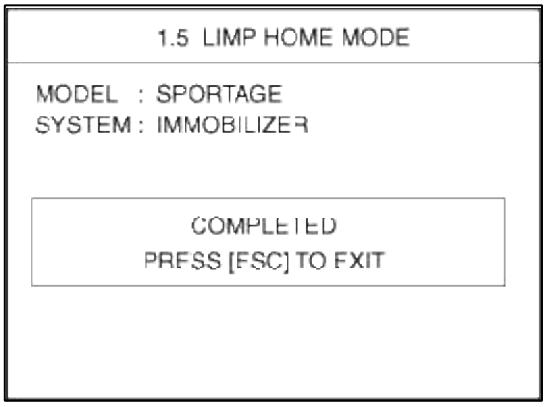
Only if the ECM (ICU) is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM (ICU) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.

If the wrong user password is sent, the ECM (ICU) 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 (ICU), the timer starts again for one hour.







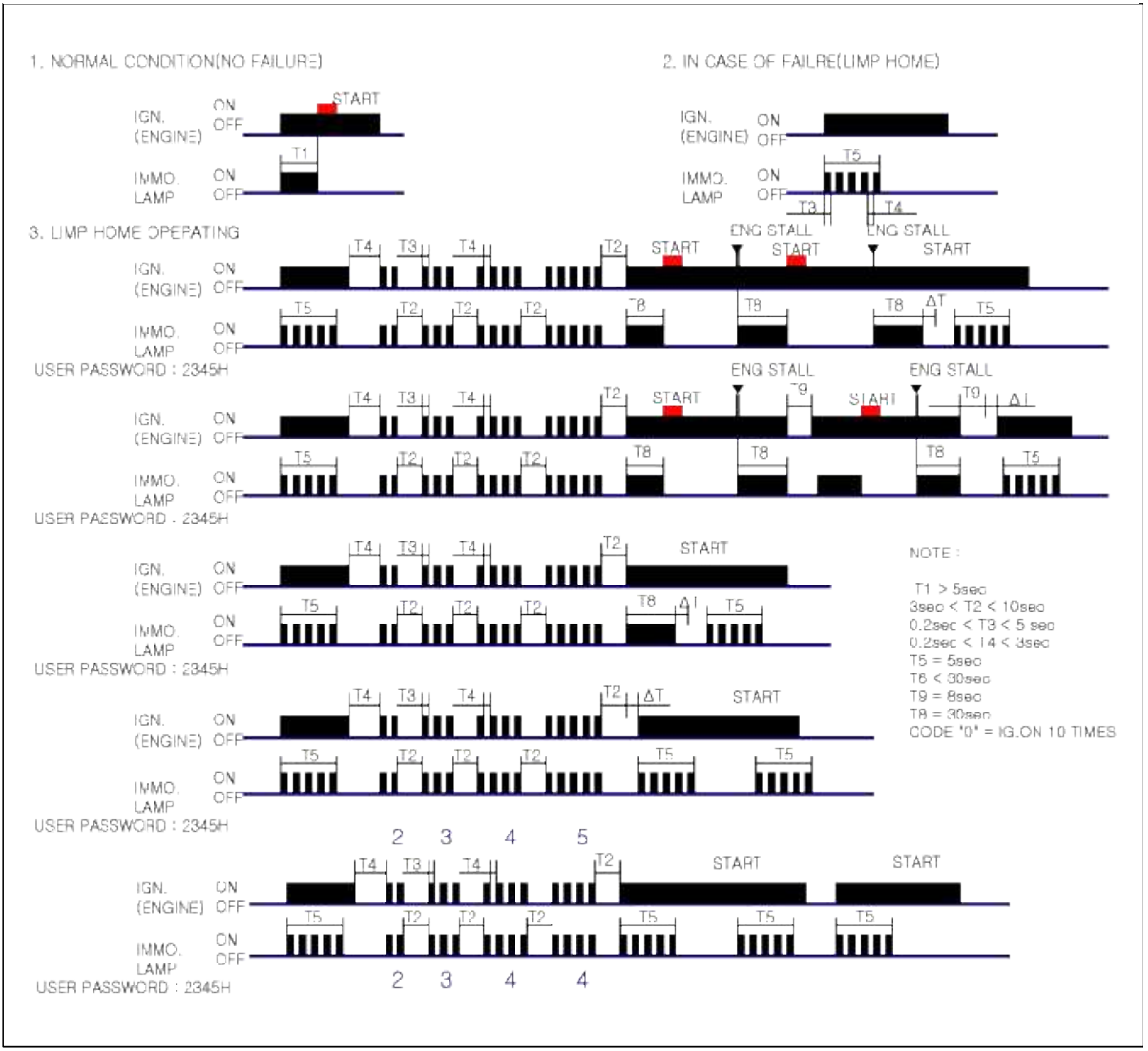


2. LIMP HOME BY IGNITION KEY

   The limp home can be activated also by the ignition key. The user password can be input to the ECM (ICU) by a special sequence of ignition on/off.

   Only if the ECM (ICU) is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM (ICU) 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 (ICU) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



PROBLEMS AND REPLACEMENT PARTS:

Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM/ICU does not work	ECM/ICU	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, ECM/ICU	YES
SMARTRA unit does not work	SMARTRA unit	NO

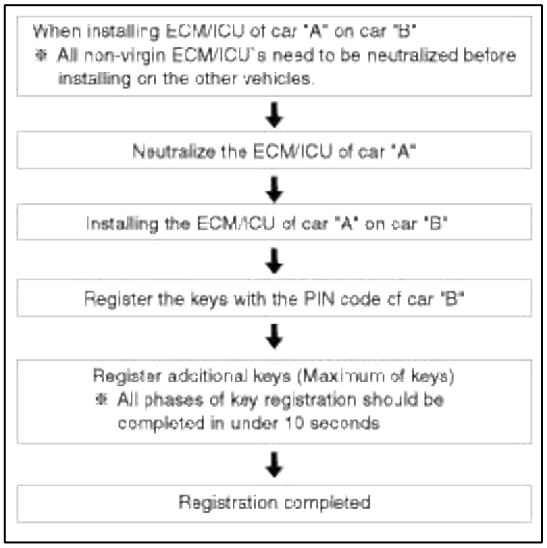
REPLACEMENT OF ECM/ICU AND SMARTRA

In case of a defective ECM/ICU, the unit has to be replaced with a "virgin" or "neutral" ECM/ICU. All keys have to be taught to the new ECM/ICU. Keys, which are not taught to the ECM/ICU, are invalid for the new ECM/ICU

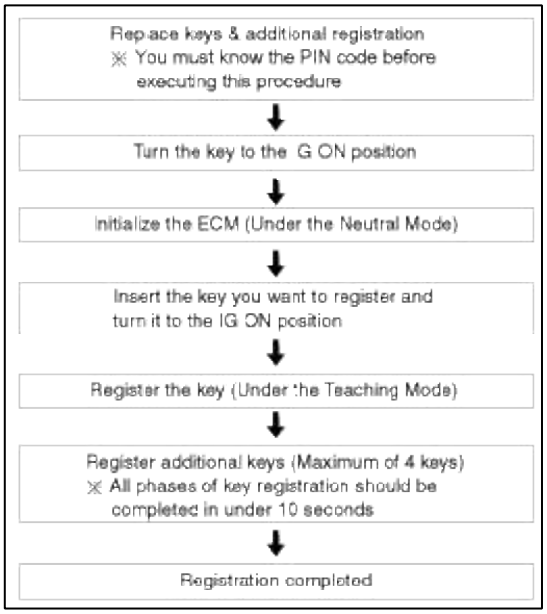
(Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

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/ICU)



2. Things to remember before a replacement (Keys & Additional registration)



NOTE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
   (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
   Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

NEUTRALISING OF ECM/ICU

The ECM/ICU can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the ECM/ICU requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the ECM/ICU is neutralized.

The ECM/ICU remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the ECM/ICU.

The teaching of keys follows the procedure described for the virgin ECM/ICU. 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.

[β2.0 engine]

This function is for neutralizing the ECM and Key. 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.

[δ2.7 engine]

This function is for neutralizing the ICU and ECU.

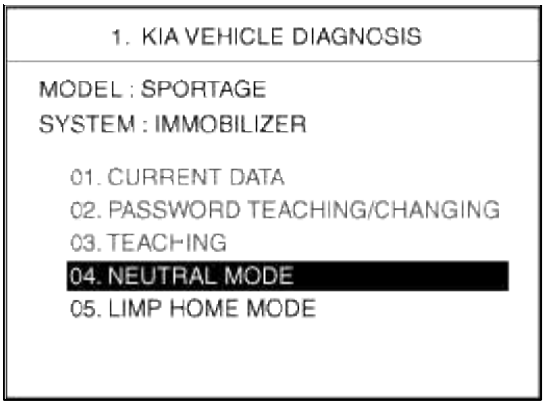
When replacing the ICU and ECM, The ICU and ECM need neutralization by scanner.

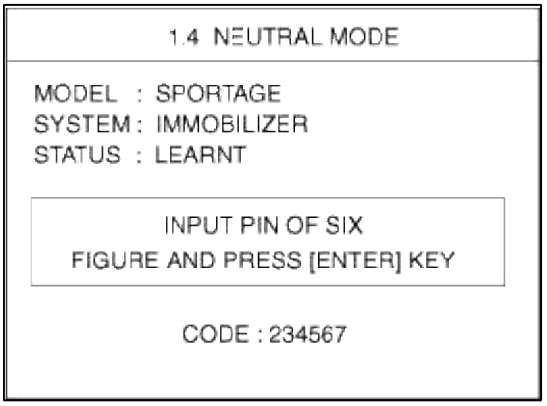
When neutralized, EEPROM data (VIN code, Password, Pin code, Key data) in the immobilizer are erased.

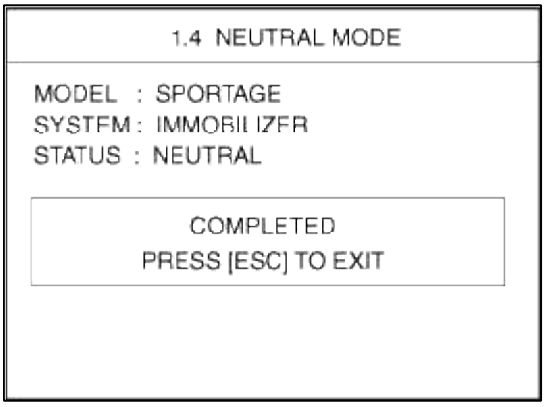
After doing neutralization of ICU by scanner, it is necessary to turn the key "OFF → ON" Because ECM is neutralized by ICU.

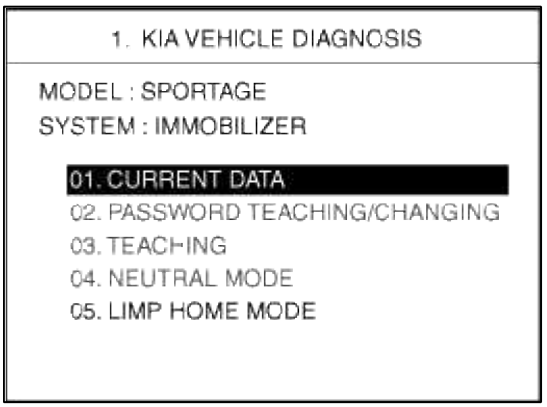
NOTE

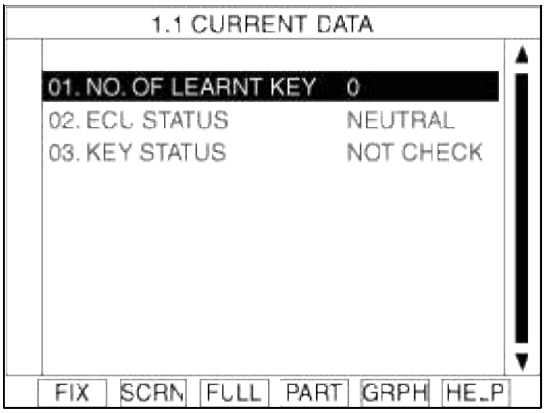
- Neutralizing setting condition
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
    : PIN code (6) & user password (4) deletion.
    : Locking of ECM (except key teaching permission)


1. KIA VEHICLE DIAGNOSIS
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE


1.4 NEUTRAL MODE
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567


1.4 NEUTRAL MODE
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
STATUS : NEUTRAL
COMPLETED
PRESS [ESC] TO EXIT

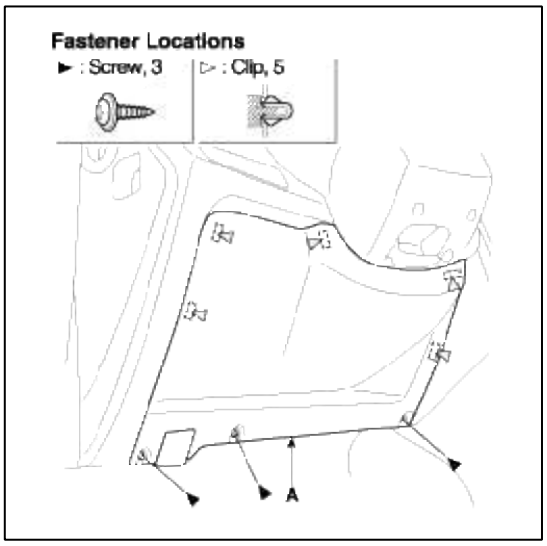

1. KIA VEHICLE DIAGNOSIS
MODEL : SPORTAGE
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE



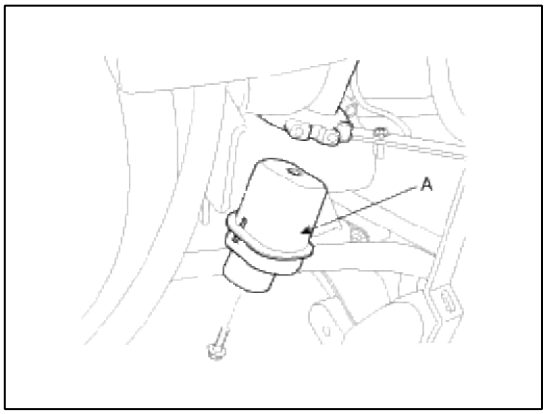
Body Electrical System > Ignition System > Ignition Switch > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the hood release cable from the hood release handle.
3. Remove the lower crash pad panel (A).

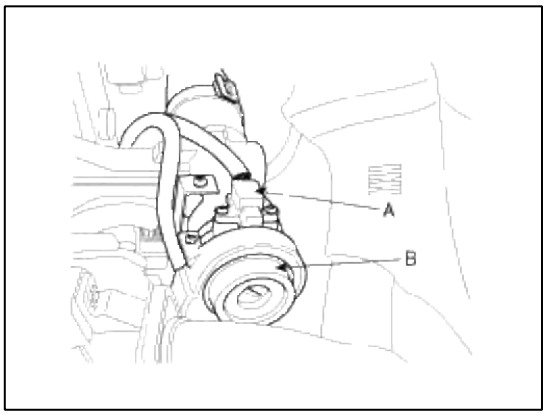


4. Remove the ignition switch (A) after loosening the screw and disconnecting the 6P connector.

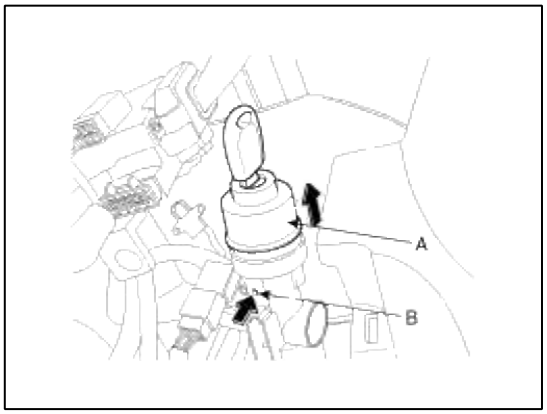


5. Remove the steering column shaft (Refer to the ST group).

6. Remove the key warning switch (A) and key illumination lamp (B) after loosening the screws and disconnecting the 6P connector.

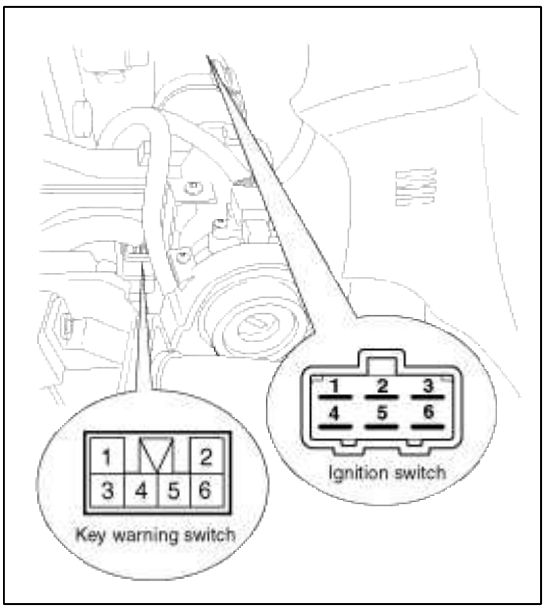


7. If it is necessary to remove the key lock cylinder (A), remove the key lock cylinder (A after pushing lock pin (B) with key ACC.



8. Installation is the reverse of removal procedure.

INSPECTION



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		KEY WARNING SWITCH 5	6	KEY HOLE ILLUMINATION 3	4
LOCK	REMOVAL							LOCK					
	INSERT							LOCK	UNLOCK				
ACC	INSERT	○—○						UNLOCK					
ON	INSERT	○—○—○			○—○			UNLOCK		○—○			
START	INSERT	○—○—○			○—○—○			UNLOCK		○—○			

Body Electrical System > Troubleshooting > P1677

GENERAL DESCRIPTION

Immobilizer Control Unit (ICU) supplies power to the coil antenna, receives and analyses signal from the transponder, transmits signal to engine ECM and stores VIN(Not the number on the bulkhead of vehicle but Vehicle Identification Number for Immobilizer) data which composes of ID code and password.

DTC DESCRIPTION

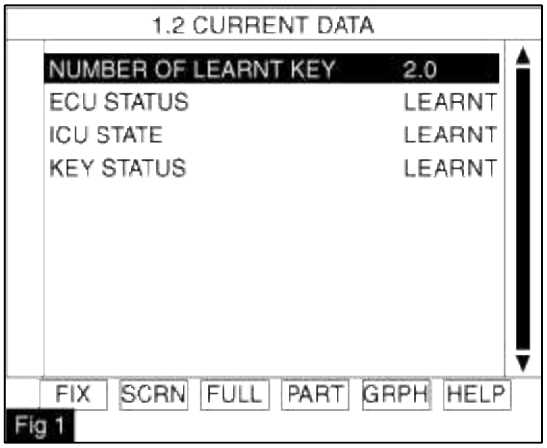
ICU stores VIN which composes of ID code and password. This DTC indicates that the data in the ECM is inconsistent with the data in the ICU.

DTC DETECTING CONDITION

Item	Detecting condition	Possible cause
Enable Condition	• IG ON	• Faulty EMS
Detecting factors	• EMS VIN DATA error	
Detecting Criteria	• Inconsistent data between EMS and ICU	

MONITOR SCANTOOL DATA

1. Ignition "ON" and Engine "OFF".
2. After connecting Scantool, Monitor the DTCs and CURRENT DATA to check key status.



3. Are both Key and ECU status learnt?

YES

Fault is intermittent caused by poor contact in the ICU and/or the engine ECU connector or was repaired and ICU 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

If ECU status is "NOT YET CHECKED" is displayed, check engine ECU and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> Be sure that P1677 can be displayed, when engine ECU has a different VIN DATA(Engine ECU is replaced by another vehicle's ECU) with ICU.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scan tool and monitor "CURRENT DATA".
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.

SIGNAL WAVEFORM AND DATA

Current Data

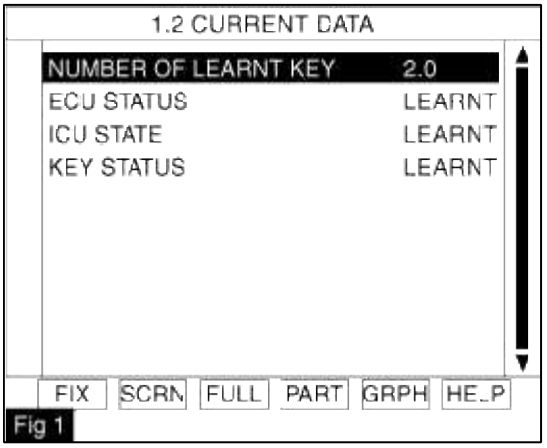


Fig 1

EMS Status	Engine start with valid key	Eng ne start by limp home	Teaching of key	Teaching or changing of user password
Not yet checked	No	No	No	No
Virgin	No	No	Yes	No
Learnt	Yes	Yes, with learnt user password	Yes	Yes
Neutral	No	No	Yes	No
Locked by timer	No	No	No	No

Fig 2

Current Data from Immobilizer will show the numbers of Key learnt, ECM status, ICU status, and Key status as Fig 1.
Immobilizer function table depending on ECM status as Fig 2.
The current data provides an indication of the probable cause.

1. ECU : VIN - It is Vehicle ID number which consists of ID code and password, not the vehicle body number,
   (1) Virgin (This is status that ECM does not memorize VIN)
   (2) Neutral (This is a status that VIN is erased on the ECM by special command from scantool)
   (3) Learnt (This is a status that VIN is learnt on the ECM by special command from scantool)
   (4) Not yet checked (The status is stored in permanent memory (EEPROM or Flash etc.).
   In case of not plausible data from this circuit the EMS cannot check the status.
2. ICU : VIN - It is Vehicle ID number which consists of ID code and password, not the vehicle body number,
   (1) Virgin (This is status that ICU does not memorize VIN)
   (2) Neutral (This is a status that VIN is erased on the ICU by special command from scantool)
   (3) Learnt (This is a status that VIN is learnt on the ICU by special command from scantool)
   (4) Not yet checked (The status is stored in permanent memory (EEPROM or Flash etc.).
   In case of not plausible data from this circuit the ICU cannot check the status.
   (5) 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)
3. KEY :
   (1) Virgin (It means the key in the key cylinder has not matched with ICU yet)
   (2) Learnt (It means the key in the key cylinder has matched with ICU)
   (3) Invalid (mismatched)
      A. Key with NO Transponder
      B. More than 1(One) Transponder in the magnetic field
      C. No Transponder in the magnetic field
      D. TP data blocked
      E. TP data does not exist
      F. TP data changed
      G. TP Teaching error
      H. Multiple TP data input
   (4) Not yet checked [The status is stored in permanent memory (EEPROM or Flash etc)].
   In case of not plausible data from this circuit the ICU cannot check the status.

Body Electrical System > Troubleshooting > P1678

GENERAL DESCRIPTION

In the Ignition ON position, the engine ECM receives information from the ICM and permits injection to take place If the CODE memorized in ECM matches the ICM data.
When the ID code from the transponder is verified by the ICM then the registering sequence is complete and a answer signal is sent to the ECM.
The ICM sends a START or NO START signal to the ECM.

DTC DESCRIPTION

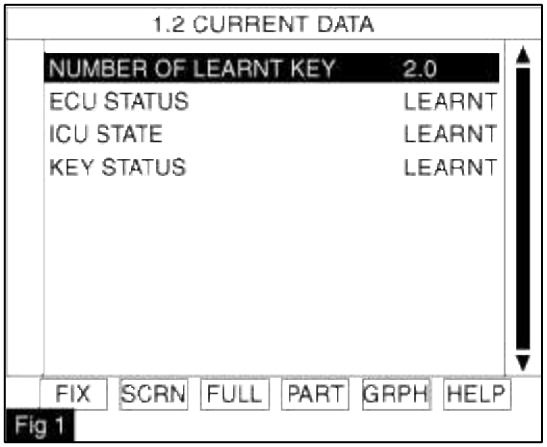
This DTC is defined as that there is no request code from EMS for 5 sec after ignition ON.

DTC DETECTING CONDITION

Item	Detecting condition	Possible cause
Enable Condition	• IG ON	• Open in harness between EMS and ICU • Faulty EMS
Detecting factors	• EMS no request	
Detecting Criteria	• No request from EMS for 5 sec	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. After connecting Scantool, Monitor the DTCs and CURRENT DATA to check key status.



3. Are both Key and ECU status learnt?

YES

Go to "W/Harness Inspection" procedure.

NO

If ECU status is not yet checked" is displayed, check engine ECU and then go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> Be sure that P1678 can be displayed, when engine ECU is replaced by "Non-immobilizer" engine ECU.

TERMINAL AND CONNECTOR INSPECTION

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 "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

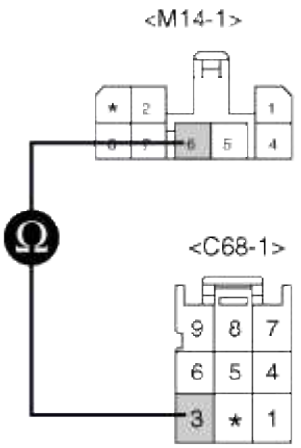
1. Ignition "OFF".
2. Disconnect ICU and engine ECU connector.

3. Measure resistance between terminal "6" of the ICU harness and "3" of the engine ECU harness.

Specification : Approx. 0Ω

NOTE

The ICU communicate with the engine ECU by dedicated communication line.



6. ECM

4. Is measured resistances within specification?

YES

Go to "Verification of Vehicle Repair " procedure.

NO

Check for open or short in signal harness. Repair as necessary 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. Connect scan tool and monitor "CURRENT DATA".
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.

Body Electrical System > Troubleshooting > P1679

GENERAL DESCRIPTION

When the ID code from the transponder is verified by the ICU then the registering sequence is complete and a answer signal is sent to the EMS.
The ICU sends a START or NO START signal to the EMS.

DTC DESCRIPTION

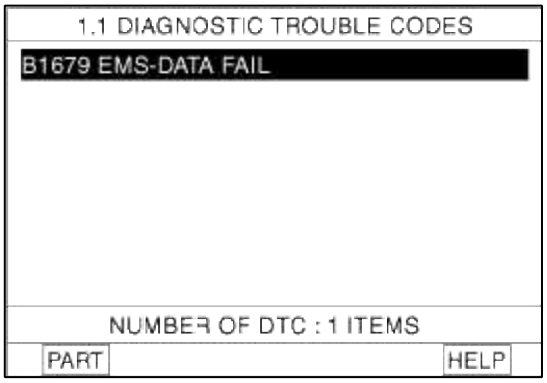
This DTC is defined as Invalid request from EMS or corrupted data.

DTC DETECTING CONDITION

Item	Detecting condition	Possible cause
Enable Condition	• IG ON	• Faulty EMS • Faulty ICU
Detecting factors	• EMS Data fail	
Detecting Criteria	• Data frame error • Check sum error • Message error	

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Connect Scan tool and clear the DTCs.



3. Is DTC P1679 displayed again?

YES

Go to "Component Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the ICU and/or the antenna coil connector or was repaired and ICU 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.

COMPONENT INSPECTION

Check ECU

1. Ignition "ON" and Engine "OFF".
2. Neutralize ICU and engine ECU with scanner.

NOTE

1. Be sure that PIN code is prepared before performing neutralization and key teaching.
2. After doing neutralization of ICU by scanner, It is necessary to turn the key "OFF → ON". Because ECM is neutralized by ICU.

3. Substitute with a known-good neutral ECU, and perform key teaching.
4. Monitor CURRENT DATA and DTCs.

5. Is DTC P1679 displayed again?

YES

Go to "Check ICU" procedure as below.

NO

Replace the engine ECU and Perform key, password teaching.

> NOTE
>
> Before replace the engine ECU, perform neutralization of the ICU.

Check for proper operation and the go to "Verification of Vehicle Repair" procedure.

Check ICU

1. Ignition "ON" and Engine "OFF".
2. Neutralize ICU and engine ECU with scanner.

> NOTE
>
> 1. Be sure that PIN code is prepared before performing neutralization and key teaching.
> 2. After doing neutralization of ICU by scanner, It is necessary to turn the key "OFF → ON". Because ECM is neutralized by ICU.

3. Substitute with a known-good neutral ICU, and perform key teaching.
4. Monitor CURRENT DATA and DTCs.
5. Is DTC P1679 displayed again?

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

Replace the ICU and Perform key, password teaching.

> NOTE
>
> Neutralize the engine ECU before replacing the ICU.

Check for proper operation and the 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 monitor "CURRENT DATA".
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.

Body Electrical System > Troubleshooting > P1690

GENERAL DESCRIPTION

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.

DTC DESCRIPTION

[β2.0 ENGINE]

This DTC is defined that ECM has No answer or Invalid message from SMARTRA to ECM because of SMARTRA faulty.

DTC DETECTING CONDITION

[β2.0 ENGINE]

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or Short in SMARTRA Circuit • Faulty SMARTRA • Faulty ECM
Detecting Criteria	• No answer from SMARTRA • Invalid message from SMARTRA to ECM	

MONITOR SCANTOOL DATA

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.

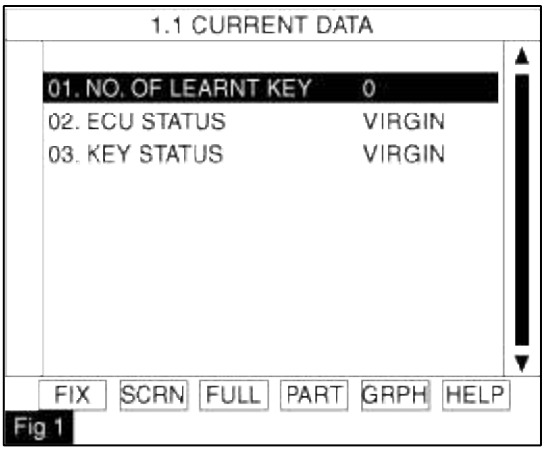


Fig 1

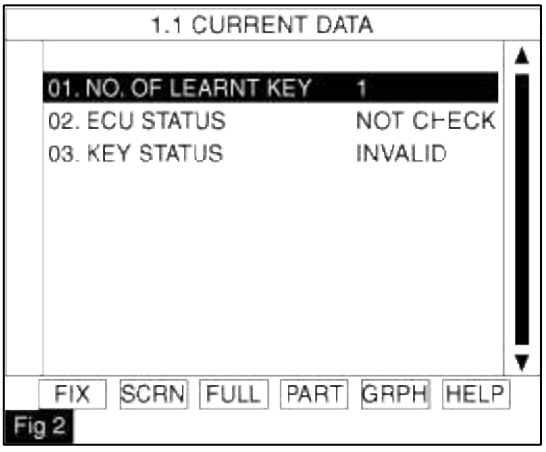
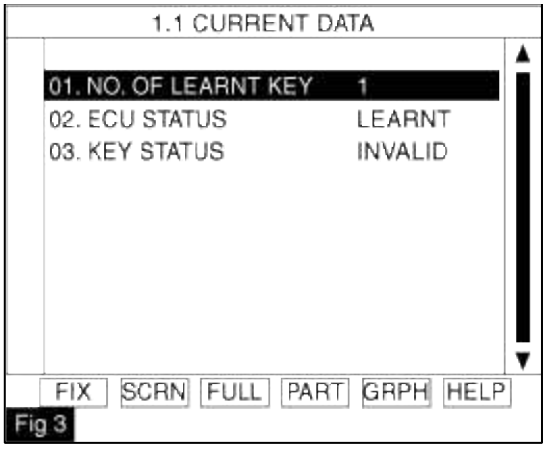


Fig 2



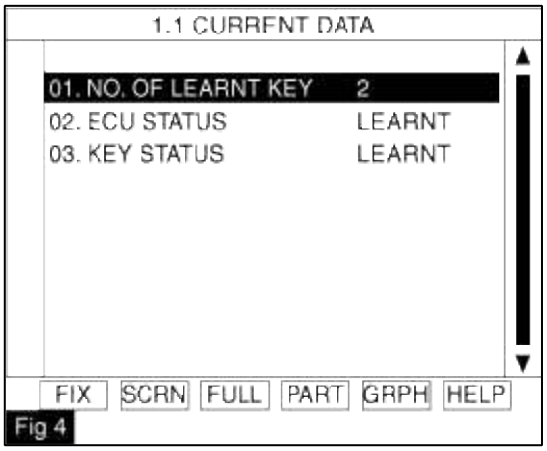


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

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 "W/Harness 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

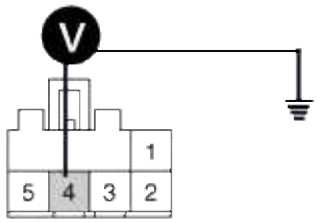
Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. 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

5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

NO

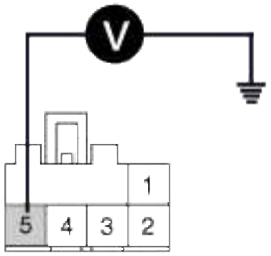
Check open or short in power harness.
Check that 10A SENSOR fuse located between Control relay and Smartra is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

[β2.0 ENGINE]

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. 6.0V



5. Signal

(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.

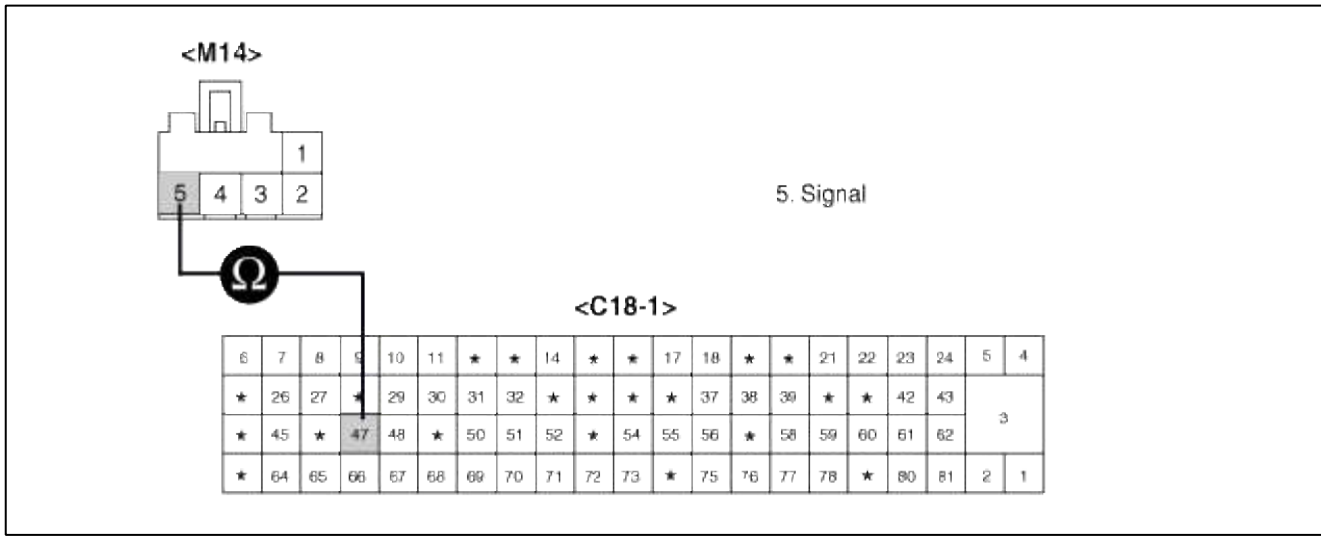
2. Check for open in harness

(1) Ignition "OFF".

(2) Disconnect SMARTRA connector.

(3) Measure resistance between terminal 5 of the SMARTRA harness connector and terminal 47 of ECM harness connector.

Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

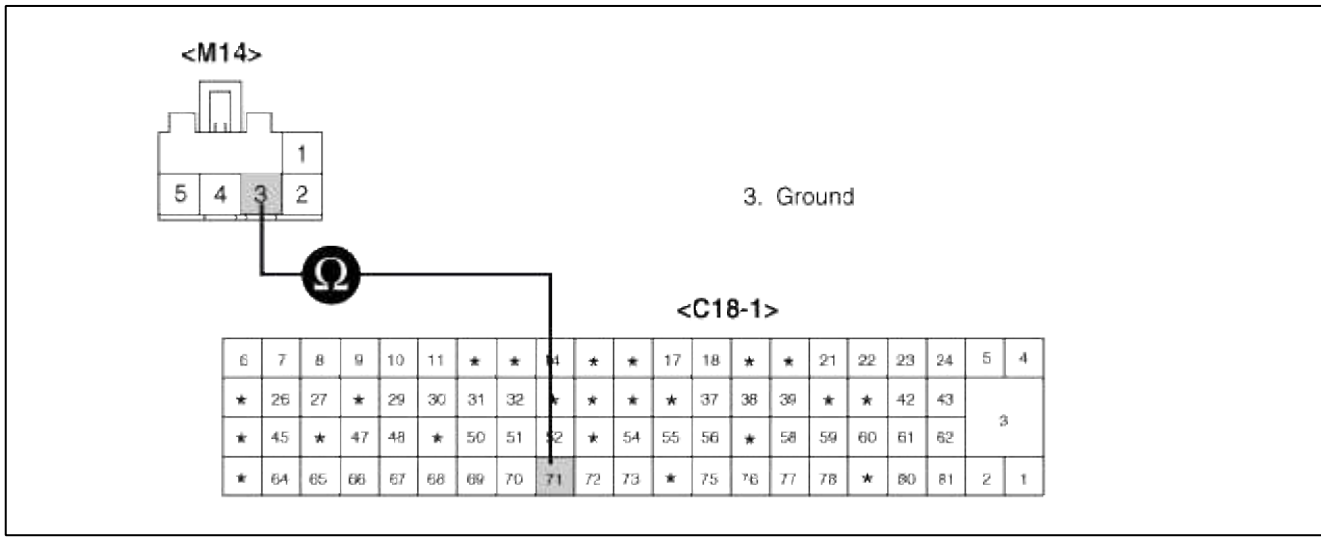
NO

Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION
[β2.0 ENGINE]

1. Check for open in harness between SMARTRA and ECM.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 3 of the SMARTRA harness connector and terminal 71 of ECM harness connector.

   Specification : Approx. below 1Ω



   (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

[β2.0 ENGINE]

1. 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

Go to " Check ECM " as below.

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.)

2. Check ECM

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

(2) Perform Key teaching/changing mode again.

(3) Is the Key teaching completed?

YES

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 repair(1)" in "System Inspection" procedure. (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

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.

SIGNAL WAVEFORM

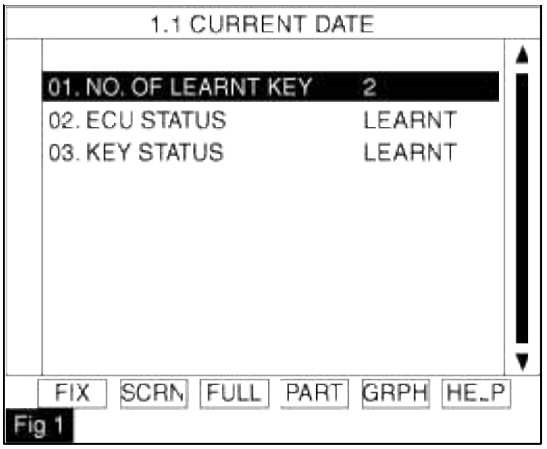


Fig 1

EMS Status	Engine start with valid key	Eng ne start by limp home	Teaching of key	Teaching or changing of user password
Not yet checked	No	No	No	No
Virgin	No	No	Yes	No
_earnt	Yes	Yes, with learnt user password	Yes	Yes
Neutral	No	No	Yes	No
Locked by timer	No	No	No	No

Fig 2

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 (mismatched)
      A. Key with NO Transponder
      B. More than 1(One) Transponder in the magnetic field
      C. No Transponder in the magnetic field
      D. TP data blocked
      E. TP data does not exist
      F. TP data changed
      G. TP Teaching error
      H. 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.

Body Electrical System > Troubleshooting > P1691

GENERAL DESCRIPTION
[β2.0 ENGINE]

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.

[δ2.7 ENGINE]

The coil antenna has the following functions.

1. The coil antenna supplies energy to the transponder.
2. The coil antenna receives signal from the transponder.
3. The coil antenna sends transponder signal to the ICU.

It is located directly in front of the steering handle lock.

DTC DESCRIPTION

This DTC is defined as Antenna coil open or short circuit.

DTC DETECTING CONDITION

[β2.0 ENGINE]

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or short in coil circuit • Faulty Antenna Coil • Faulty SMARTRA • Faulty ECM
Detecting factors	• Antenna signal error	
Detecting Window	• Before transponder communications	
Detecting Criteria	• Antenna open/short circuit	

[δ2.7 ENGINE]

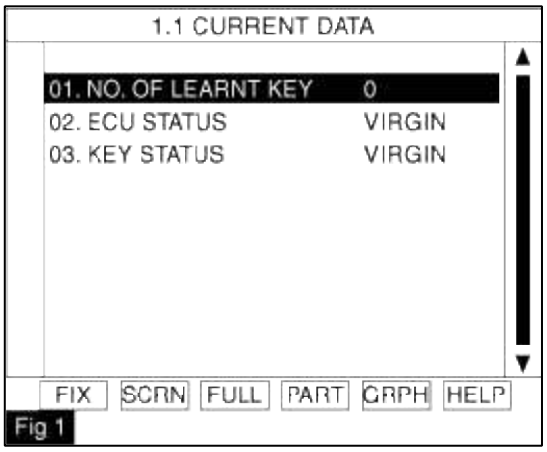
Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Open or short in coil circuit • Faulty Antenna Coil
Detecting factors	• Antenna signal error	
Detecting Window	• Before transponder communications	
Detecting Criteria	• Antenna open/short circuit	

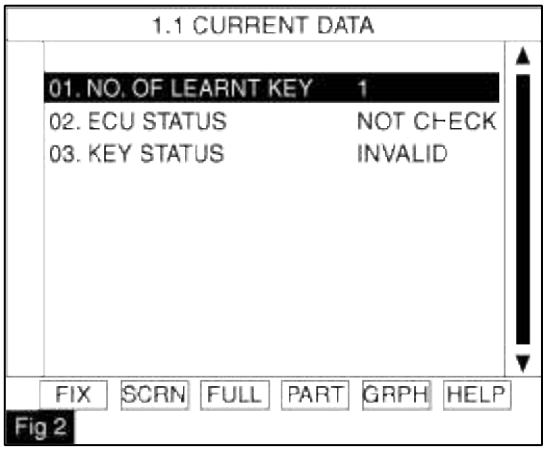
MONITOR SCANTOOL DATA

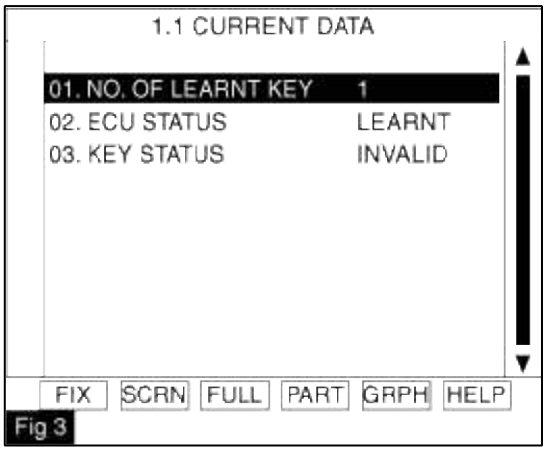
[β2.0 ENGINE]

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.







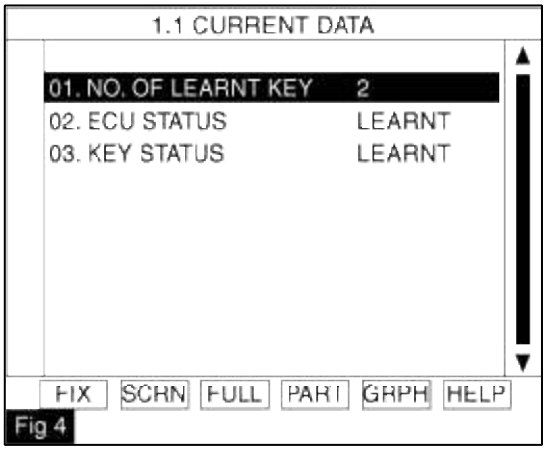


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

4. Are both Key and ECM status learnt?

YES

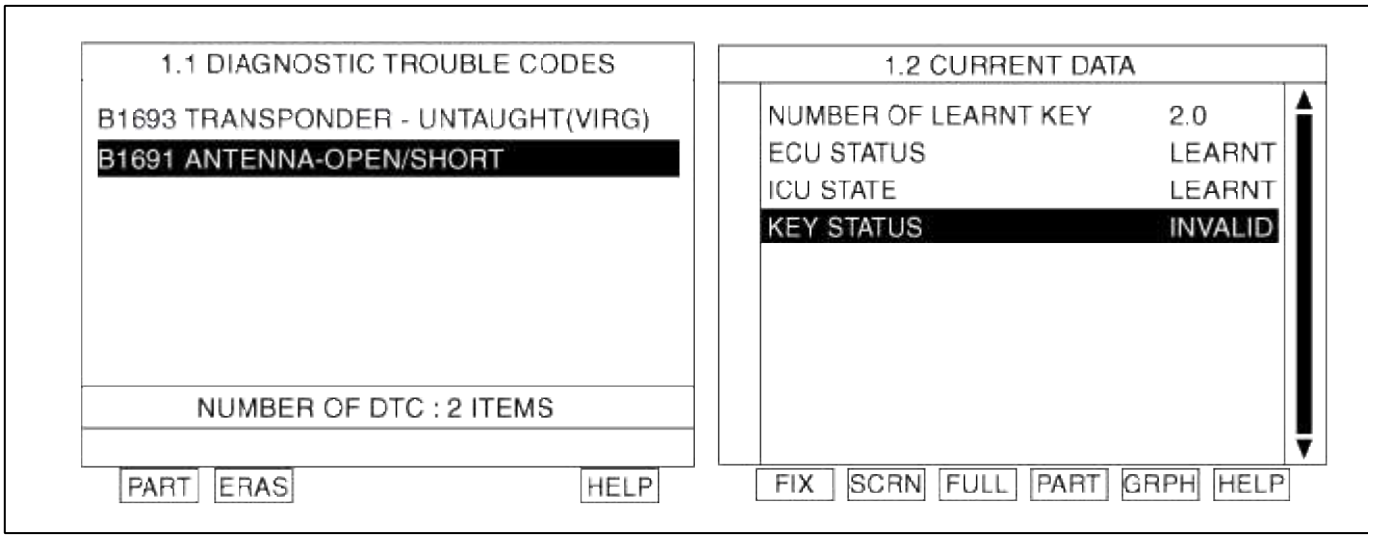
Fault is intermittent caused by poor contact in the SMARTRA's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
Repair or replace as necessary and then go to "Verification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

NO

Go to "W/Harness Inspection" procedure.

[δ2.7 ENGINE]

1. Ignition "ON" & Engine "OFF.
2. After connecting Scantool, Monitor the DTCs and CURRENT DATA to check key status.



NOTE

When DTC P1691 occurs, DTC P1693 can be displayed simultaneously.

3. Are DTCs and CURRENT DATA displayed as above when using another virgin or learnt key?

YES

Go to "W/Harness Inspection" procedure.

NO

If key status changed from "invalid" to "virgin or learnt", This is not antenna coil (antenna harness) problem. Substitute with a known-good Transponder and check for proper operation. If the problem is corrected, replace a virgin Transponder and then go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

[β2.0 ENGINE]

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.

[δ2.7 ENGINE]

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

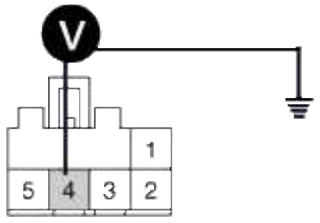
Go to "Control Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

[β2.0 ENGINE]

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

5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

NO

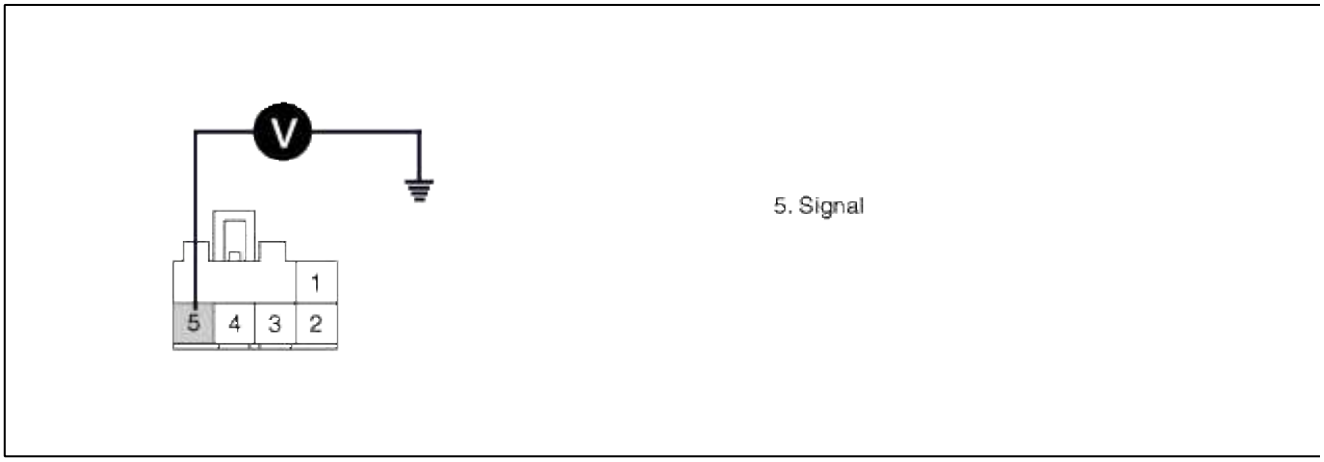
Check open or short in power harness.
Check that 10A SENSOR fuse located between Control relay and Smartra is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

[β2.0 ENGINE]

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. 6.0V



   (5) Is the measured voltage within specifications?

   YES

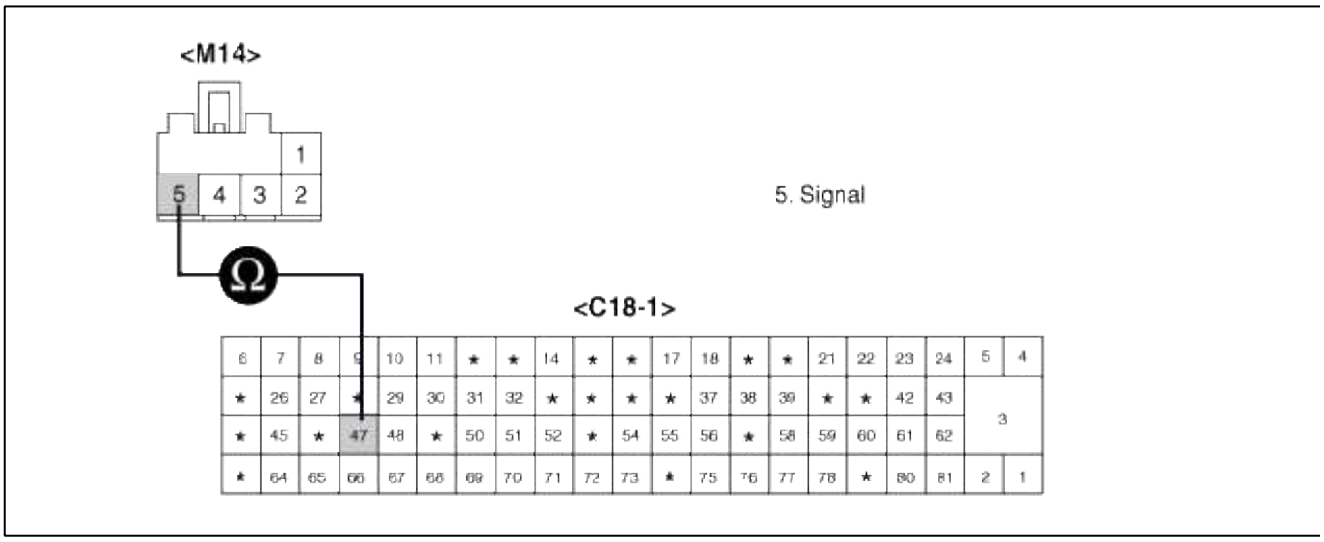
   Go to "Check for open in harness" as below.

   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 47 of ECM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

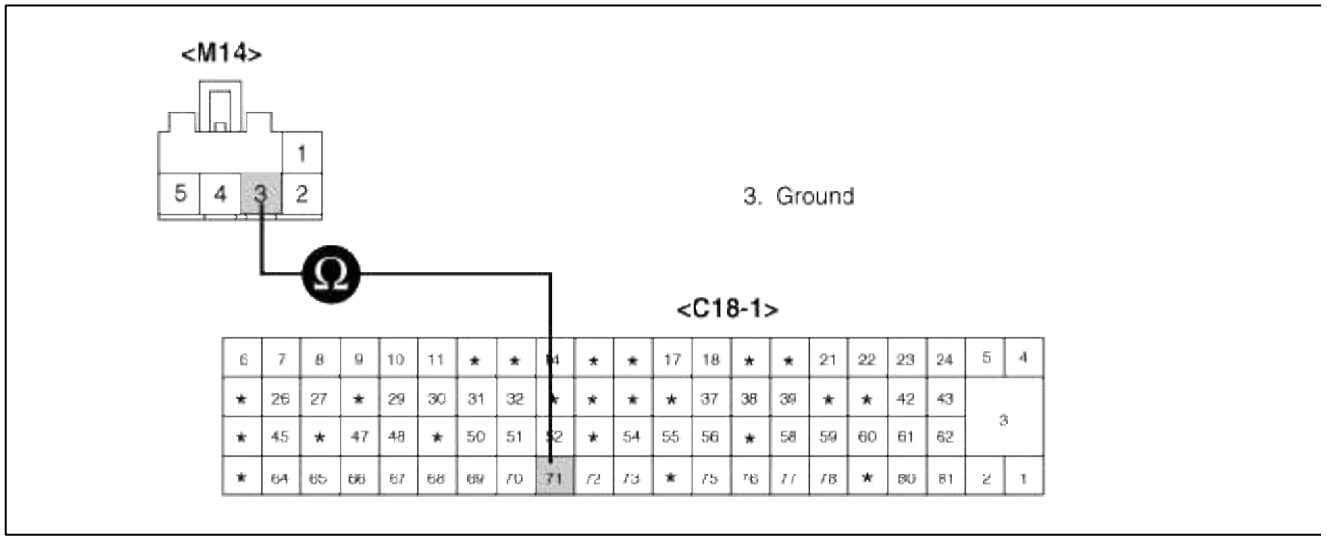
Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

[β2.0 ENGINE]

1. Check for open in harness between SMARTRA and ECM.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 3 of the SMARTRA harness connector and terminal 71 of ECM harness connector.

Specification : Approx. below 1Ω



(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.

CONTROL CIRCUIT INSPECTION

[δ2.7 ENGINE]

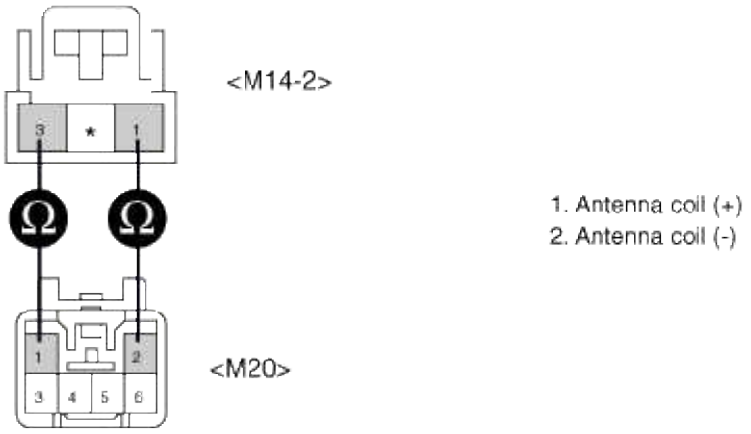
1. Ignition "OFF".
2. Disconnect ICU and Antenna coil connector.

3. Measure resistance between terminal "1(3)" of the ICU harness and "2(1)" of the Antenna coil harness.

Specification : Approx. 0Ω

NOTE

ICM energizes antenna coil from Antenna coil (+) to Antenna coil (-).



4. Are measured resistances within specification?

YES

Go to "Component Inspection" procedure.

NO

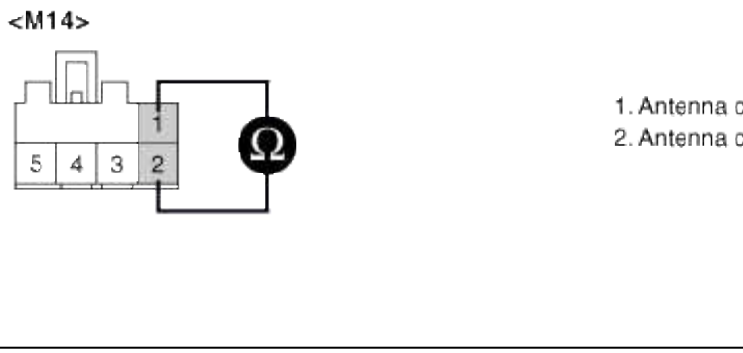
Check for open or short in signal harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

[β2.0 ENGINE]

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. 8.6Ω



(4) Is the measured resistance within specifications?

YES

Go to " Check SMARTRA" as below.

NO

Substitute with a known-good Antenna Coil and check for proper operation. If the problem is corrected, repl 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

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.)

[δ2.7 ENGINE]

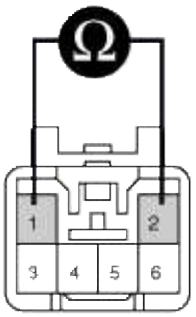
1. Check antenna coil

(1) Ignition "OFF".

(2) Disconnect Antenna coil connector.

(3) Measure resistance between terminal "1" and "2" of the Antenna coil harness.

Specification : Approx. 7.5Ω



<M20>

1. Antenna coil (+)
2. Antenna coil (-)

(4) Is measured resistance within specification?

YES

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

NO

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.

VERIFICATION OF VEHICLE REPAIR

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.

Body Electrical System > Troubleshooting > P1693

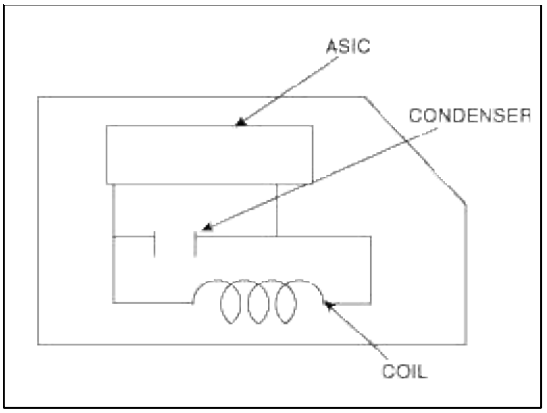
GENERAL DESCRIPTION

[β2.0 ENGINE]

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).

[δ2.7 ENGINE]

A transponder is incorporated in the head section of the key. The antenna coil supplies energy to the transponder. The transponder 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).



When Ignition is set 'ON' the ICM receives a request signal from the ECM and starts ID Code registering sequence.
If the ID code format from the transponder is not correct, the ICM repeatedly performs the registering sequence.
When the correct ID code format is registered, the code is verified by the ICM.
If the code is not verified, the registering sequence is repeated a maximum of 5 times which is equivalent to 1 second duration.
Once the correct ID code is registered and verified after Ignition is turned ON, the registering sequence is not reperformed until Ignition is turned OFF.

DTC DESCRIPTION

[β2.0 ENGINE]
This DTC is defined as Invalid Transponder Data , Transponder program error and Password mode invalid.
[δ2.7 ENGINE]
This DTC is defined as Invalid(More than one TP or No TP in the magnetic field) Transponder Data.

DTC DETECTING CONDITION

[β2.0 ENGINE]

Item		Detecting Condition	Possible cause
Enable Condition		• IG ON	• Transponder Error • Faulty SMARTRA • Faulty ECM
Detecting Factors		• Invalid Transponder Data (Case 1) • Transponder Program Error (Case 2) • Password mode invalid (Case 3)	
Case 1	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 field.	
Case 2	Detecting Window	• During Transponder Write EEPROM Page request while transponder is in authorized state.	
	Detecting Criteria	• Corrupted data from Transponder(TP),or more than one TP in the field or no TP in the field.	
Case 3	Detecting Window	• During Transponder Write or Read EEPROM Page.	
	Detecting Criteria	• TP not in password mode, or Transponder transport data has been changed.	

[δ2.7 ENGINE]

Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty Transponder
Detecting Factors	• Transponder error	
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

[β2.0 ENGINE]

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.

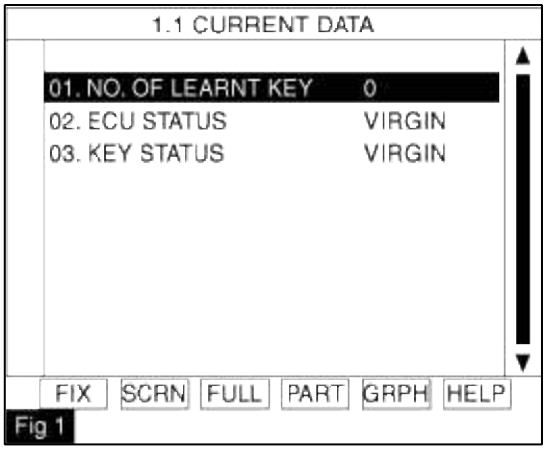


Fig 1

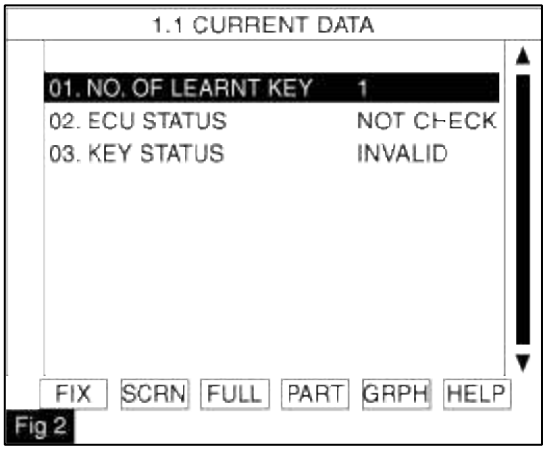


Fig 2

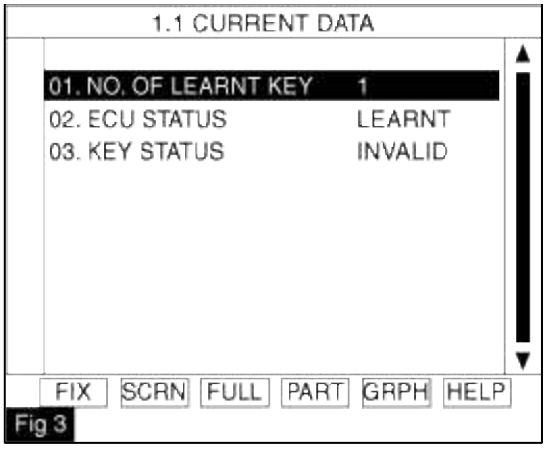


Fig 3

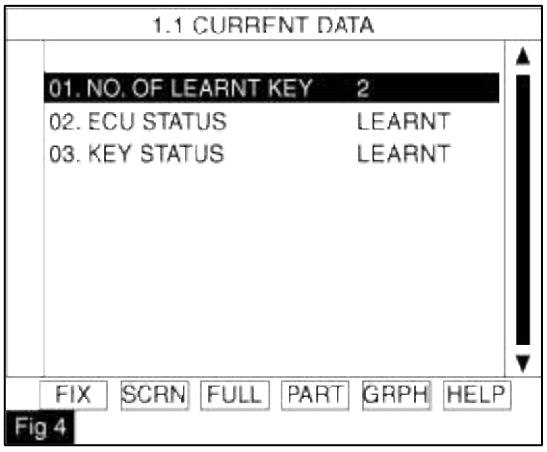


Fig 4

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.

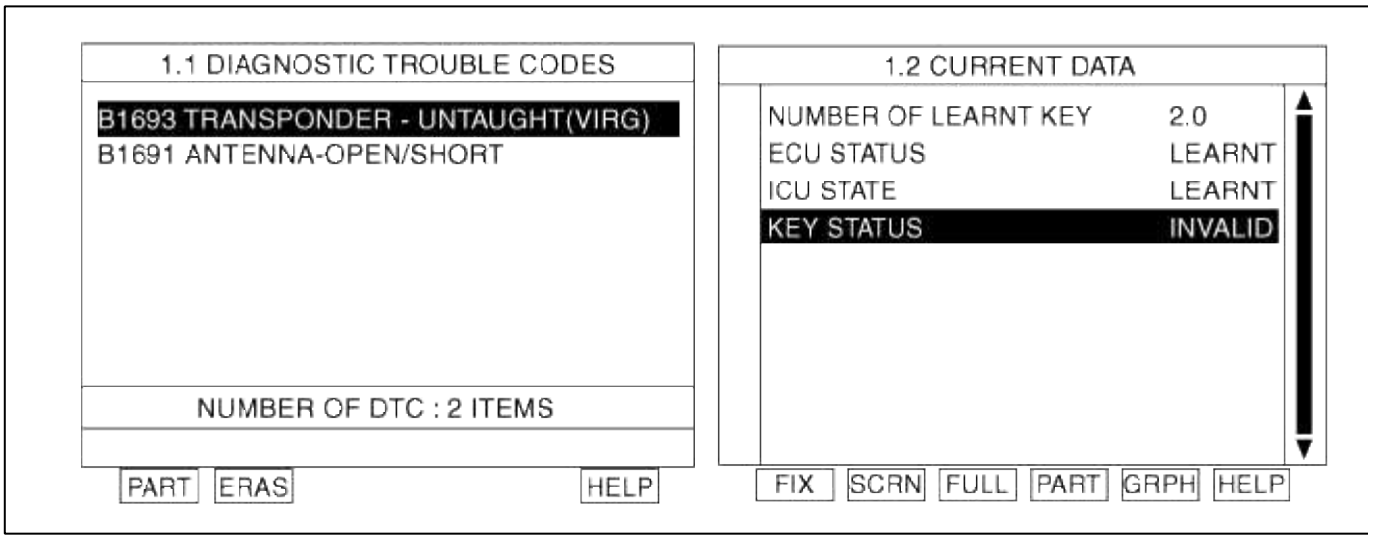
NO

Go to "W/Harness Inspection" procedure.

[δ2.7 ENGINE]

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

2. After connecting Scantool, Monitor the DTCs and CURRENT DATA to check key status.



NOTE

When DTC P1693 occurs, DTC P1691 can be displayed simultaneously.

3. Are DTSs and CURRENT DATA displayed as above when using another virgin or learnt key?

YES

If key status not changed from "invalid" to "virgin or learnt", This is not transponder(key) problem.
Check for "antenna coil(harness) refer to P1691 antenna error" and then go to "Verification of Vehicle repair" procedure.

NO

If key status changed from "invalid" to "virgin or learnt", Substitute with a known-good Transponder and check for proper operation.
If the problem is corrected, replace a virgin Transponder and then go to "Verification of Vehicle Repair" procedure.

NOTE

1. When replacing the key, it is necessary to teach the key.
2. Be sure that PIN code is prepared before performing key teaching.

COMPONENT INSPECTION

[β2.0 ENGINE]

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 completed?

   YES

   Go to " Check SMARTRA" as below.

   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 (Refer to things to remember before a repair(2) in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

2. Check SMARTRA
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform the Neutral, Teaching, and Password teaching/ changing mode according to 2. ECM neutralization, 3.Key Teaching Procedure, 4. Password teaching/Changing in "Reference Data" described in General Information.

> NOTE
>
> Be sure that PIN code is prepared before performing neutral mode.

   (3) Is Key teaching completed?

   YES

   Go to " Check ECM " as below.

   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.)

3. 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
   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 repair(1)" in "System Inspection" procedure. (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

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.

Body Electrical System > Troubleshooting > P1695

GENERAL DESCRIPTION

[β2.0 ENGINE]

This DTC is defined as 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 DESCRIPTION

[β2.0 ENGINE]

This DTC is defined as that ECM, indicator or scantool have some problem.

DTC DETECTING CONDITION

[β2.0 ENGINE]

Item		Detecting Condition	Possible cause
Enable Condition		• IG ON	• Faulty ECM
Detecting Criteria	EEPROM	• Inconsistent data of EEPROM • Invalid write operation to EEPROM	

MONITOR SCANTOOL DATA

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.

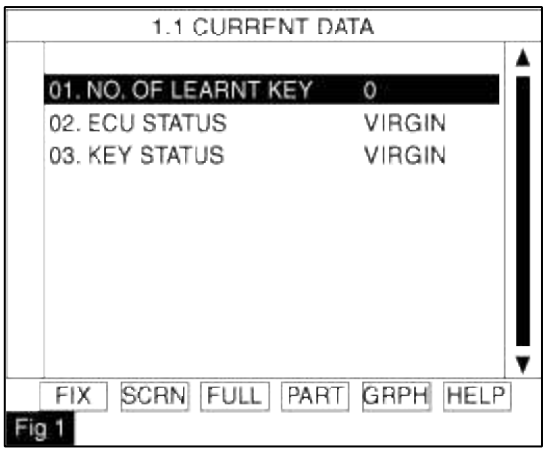


Fig 1

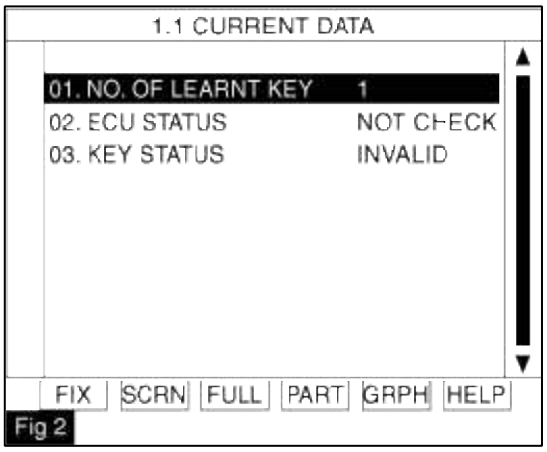


Fig 2

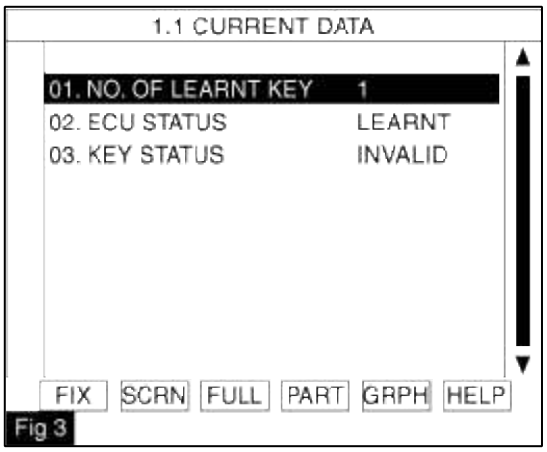


Fig 3

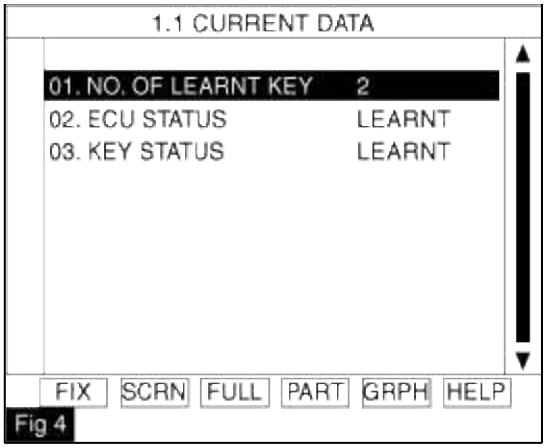


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

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 "W/Harness Inspection" procedure.

COMPONENT INSPECTION

1. Check ECM
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform the Neutral, Teaching, and Password teaching/ changing mode according to 2. ECM neutralization, 3.Key Teaching Procedure, 4. Password teaching/Changing in "Reference Data" described in General Information.
   (3) Are both neutral and teaching mode 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 repair(1) in "Reference Data in General Information" (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

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.

Body Electrical System > Troubleshooting > P1696

GENERAL DESCRIPTION

[β2.0 ENGINE]

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

[β2.0 ENGINE]

This DTC is defined as that ECM, indicator or scantool have some problem.

DTC DETECTING CONDITION

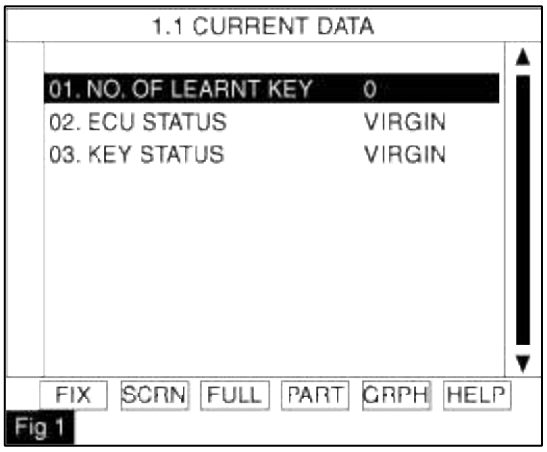
[β2.0 ENGINE]

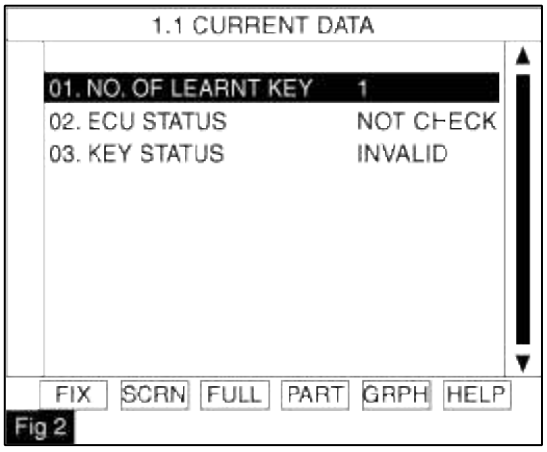
Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Scantool Error • Faulty Transponder • Faulty SMARTRA • Faulty ECM
Immobilizer indicator or ECM Faults	• Not plausible VSS data stored at ECM. • Virgin key at Learnt ECM. • No valid data from SMARTRA after 3 attempts by ECM. • Invalid tester message or unexpected requests by tester(e.g. exceeding the maximum limit of twice IG ON or teaching trials)	

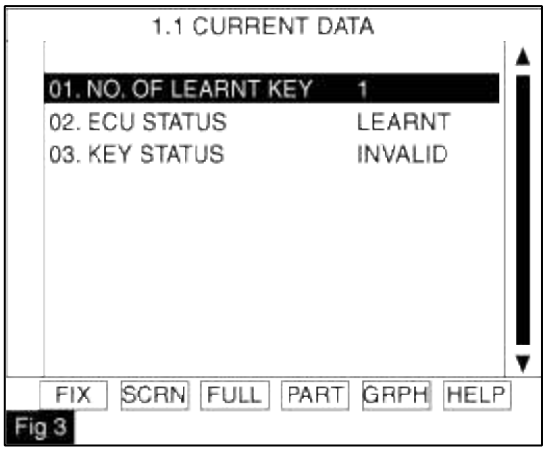
MONITOR SCANTOOL DATA

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.







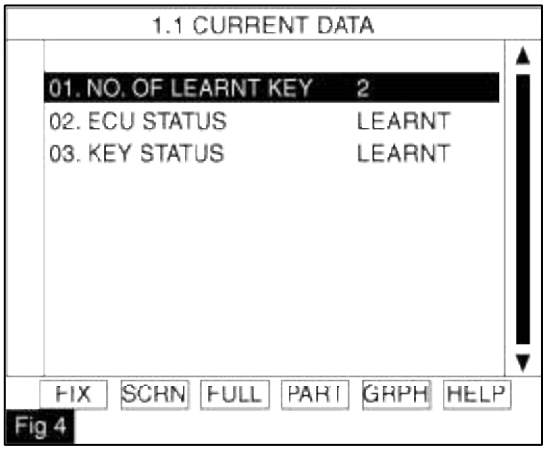


Fig 1 : ECM has not matched with any Key yet.
Fig 2 : ECM Internal Failure.
Fig 3 : IG On with unmatched key.
Fig 4 : 2(two) Keys have been matched with ECM.

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 "W/Harness Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

[β2.0 ENGINE]

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

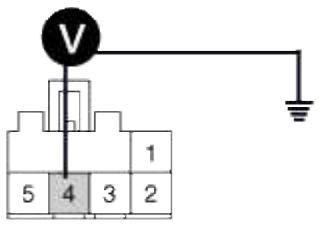
Go to " Power Circuit Inspection " procedure.

POWER SUPPLY CIRCUIT INSPECTION

[β2.0 ENGINE]

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

5. Is the measured voltage within specifications?

YES

Go to "Signal Circuit Inspection" procedure.

NO

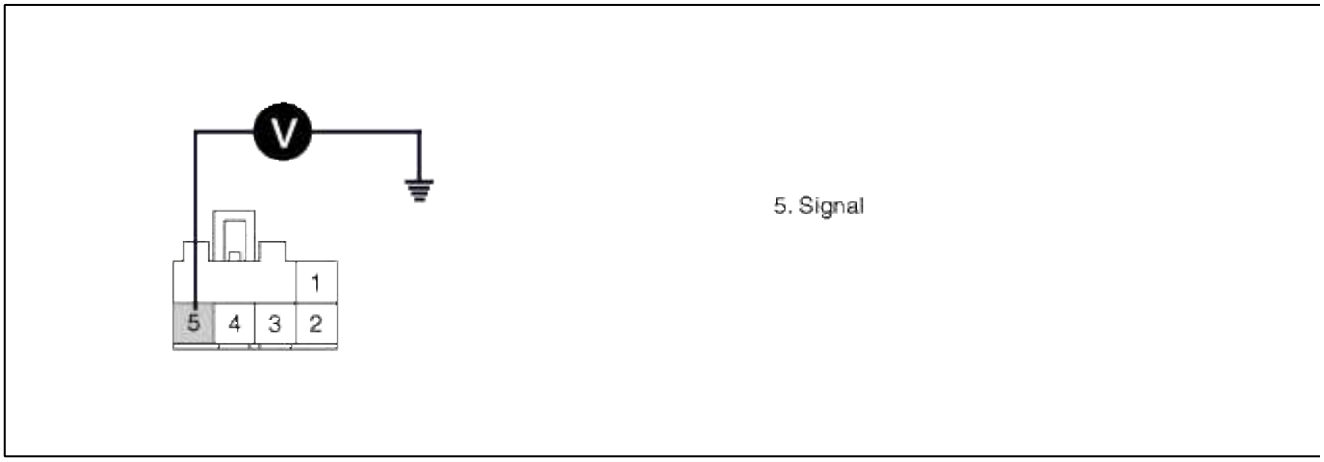
Check open or short in power harness.
Check that 10A SENSOR fuse located between Control relay and Smartra is open or blown off.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

SIGNAL CIRCUIT INSPECTION

[β2.0 ENGINE]

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. 6.0V



   (5) Is the measured voltage within specifications?

   YES

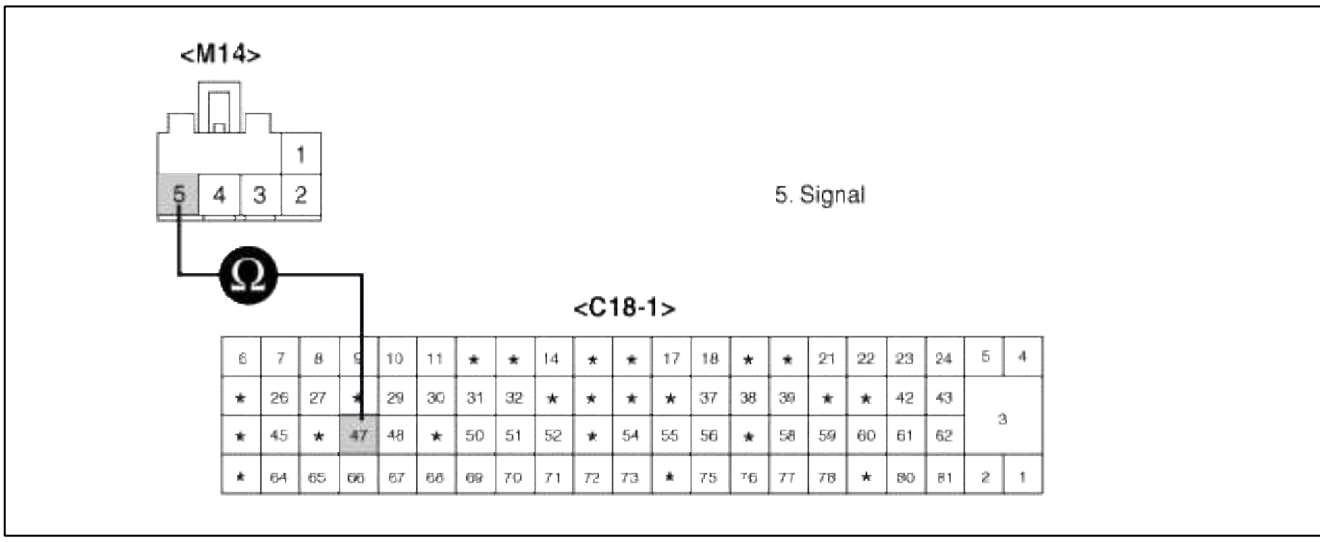
   Go to "Check for open in harness" as below.

   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 47 of ECM harness connector.

   Specification : Approx. below 1Ω



(4) Is the measured resistance within specifications?

YES

Go to "Ground Circuit Inspection" procedure.

NO

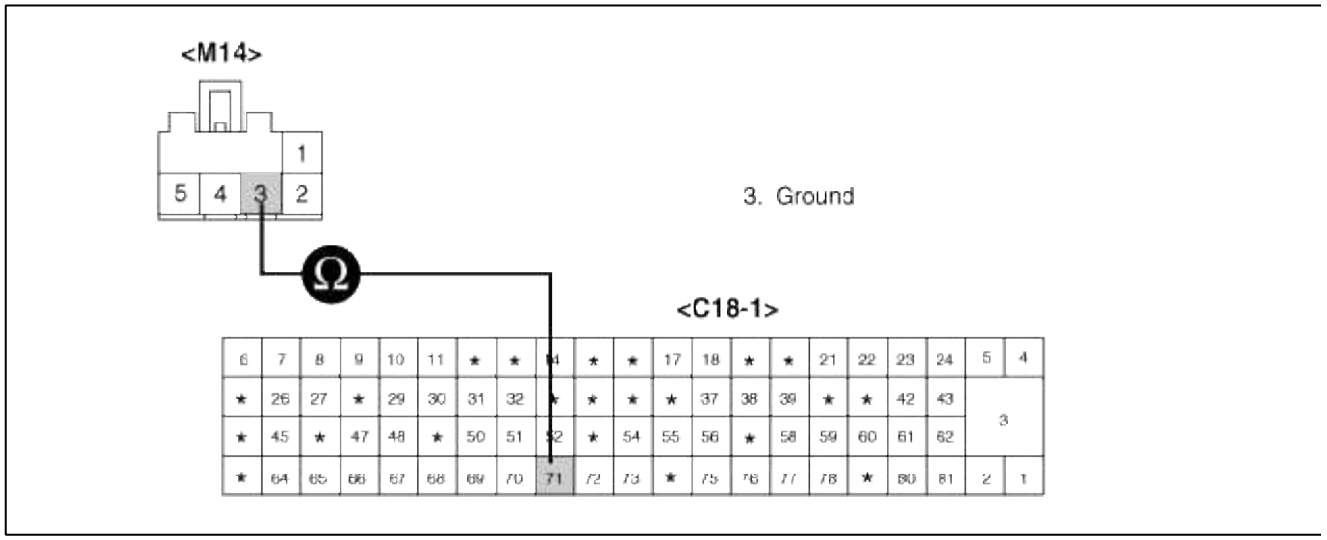
Check for open in signal harness.
Repair as necessary and go to "Verification of Vehicle repair" procedure.

GROUND CIRCUIT INSPECTION

[β2.0 ENGINE]

1. Check for open in harness between SMARTRA and ECM.
   (1) Ignition "OFF".
   (2) Disconnect SMARTRA connector.
   (3) Measure resistance between terminal 3 of the SMARTRA harness connector and terminal 71 of ECM harnes connector.

Specification : Approx. below 1Ω



(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

[β2.0 ENGINE]

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 completed?

   YES

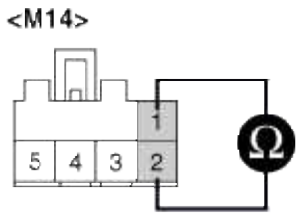
   Go to "Check Antenna Coil" as below.

   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 (Refer to things to remember before a repair(2) in " Reference Data"
   Go to "Verification of Vehicle Repair" procedure.

2. 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. 8.6Ω



1. Antenna coil(+)
2. Antenna coil(-)

   (4) Is the measured resistance within specifications?

   YES

   Go to " Check SMARTRA" as below.

   NO

   Substitute with a known-good Antenna Coil and check for proper operation. If the problem is corrected, repl
   Antenna Coil. And then, go to "Verification of Vehicle Repair" procedure.

3. 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

Fault is intermittent caused by poor contact in the SMARTRA 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

Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA and go to "Check ECM" as below.

> 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.)

4. Check ECM
   (1) Ignition " ON" & Engine "OFF".
   (2) Perform Key teaching/changing mode again.
   (3) Is the 1st Key teaching completed?

YES

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 repair(1)" in "System Inspection" procedure. (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

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

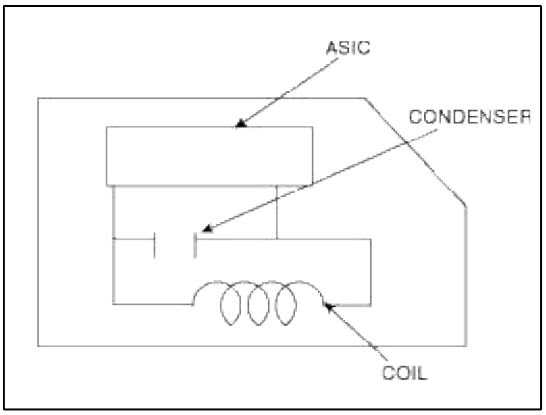
System is performing to specification at this time.

Body Electrical System > Troubleshooting > P1698

GENERAL DESCRIPTION

[δ2.7 ENGINE]

A transponder is incorporated in the head section of the key. The antenna coil supplies energy to the transponder. The transponder 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).



When Ignition is set 'ON' the ICM receives a request signal from the ECM and starts ID Code registering sequence. If the ID code format from the transponder is not correct, the ICM repeatedly performs the registering sequence. When the correct ID code format is registered, the code is verified by the ICM.
If the code is not verified, the registering sequence is repeated a maximum of 5 times which is equivalent to 1 second duration.
Once the correct ID code is registered and verified after Ignition is turned ON, the registering sequence is not reperformed until Ignition is turned OFF.

DTC DESCRIPTION

[δ2.7 ENGINE]

This DTC is defined as Invalid(virgin or invalid) Transponder Data.

DTC DETECTING CONDITION

[δ2.7 ENGINE]

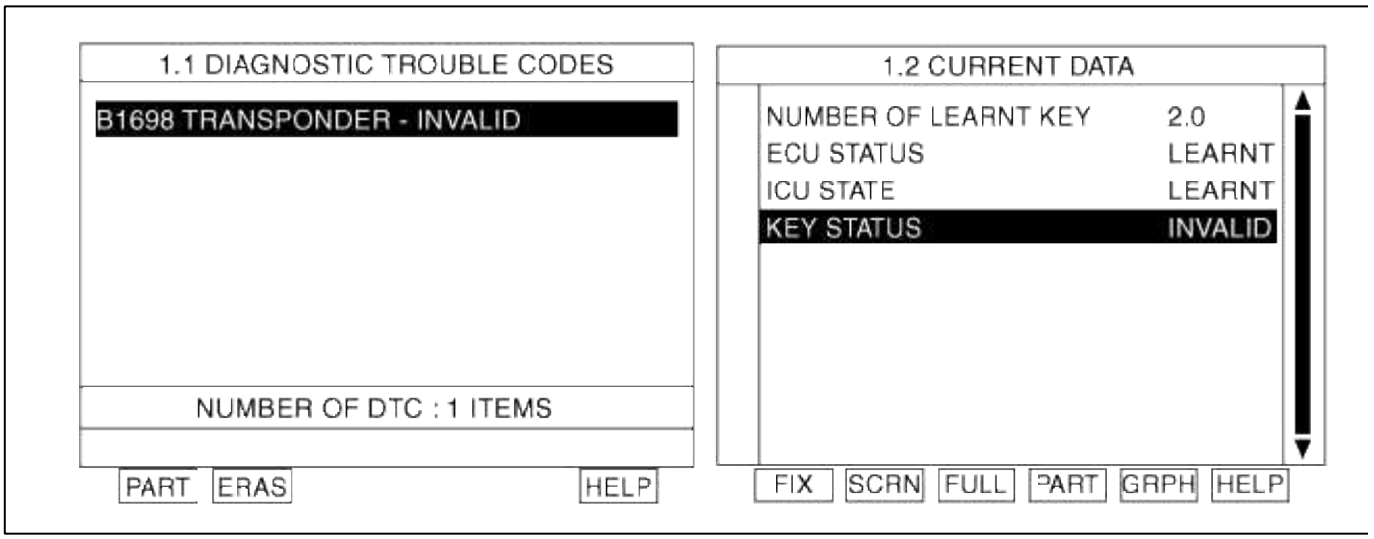
Item	Detecting Condition	Possible cause
Enable Condition	• IG ON	• Faulty TP(Virgin or Invalid)
Detecting Factors	• Invalid TP	
Detecting Criteria	• Virgin TP at EMS STATUS "Learnt" • Learnt(Invalid) TP at EMS status "Learnt"(Authentication fail)	

MONITOR SCANTOOL DATA

[δ2.7 ENGINE]

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

2. After connecting Scantool, Monitor the DTCs and CURRENT DATA to check key status.



3. Are DTSs and CURRENT DATA displayed as above?

YES

If key status is "invalid" is displayed, check transponder(key) and then go to "Verification of Vehicle Repair" procedure.

NOTE

1. Be sure that P1698 is displayed, when transponder(key) is unintentionally exchanged with another key.
2. Be sure that P1698 is displayed, when using virgin transponder(key) with learnt ICU.
3. Be sure that P1698 is displayed by abnormal stop when key teaching is performed by learnt key(with same PIN code)

NO

Fault is intermittent caused by poor contact in the ICU and/or the antenna coil connector or was repaired and ICU 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

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.

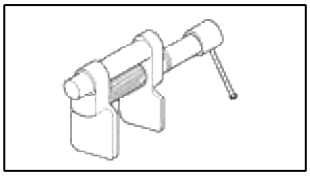
NO

System is performing to specification at this time.

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Brake System

Brake System > General Information > Special Service Tools

SPECIAL TOOL

ToolL(Number and Name)	Illustration	Use
09581-11000 Piston expander		Spreading the front disc brake piston

Brake System > General Information > Troubleshooting

TROUBLESHOOTING

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Rear brake shoe clearance(Out of adjustment) 5. Master cylinder (Faulty)	repair air·bleed replace adjust replace
Brake drag	1. Brake pedal freeplay (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Rear brake shoe clearance(Out of adjustment) 5. Pad or lining (Cracked or distorted) 6. Piston (Stuck) 7. Piston (Frozen) 8. Anchor or Return spring (Faulty) 9. Booster system (Vacuum leaks) 10. Master cylinder (Faulty)	adjust adjust repair adjust 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. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored)	repair air·bleed replace replace adjust adjust replace replace

	9. Booster system (Vacuum leaks)	repair
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or Return spring (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage)	replace adjust replace replace clean replace replace replace replace
Brake fades	1. master cylinder	replace
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 > General Information > Specifications

SPECIFICATION (ABS & TCS)

Part	Item		Sandard Value	Remark
HECU(Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor (MGH-25)	·ABS system:ABS & EBD contorl ·FTCS system:ABS &EBD control (Both Brake and Engine control)
	Type		Motor, valve relay intergrated type	
	Operating voltage		10 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 110 °C(-40 ~ 230 °F)	
	Motor power		180 W	
	Pump orifice		Ø0.5 mm(0.0197 in.)	
	Accumulator capacity	LPA	MC : 3.0 cc / MCP3.0 cc	LPA:Low pressure accumulator
		HPA	0.13 cc	HPA:High pressure accumulator

	Valve	Inlet valve(NO)	Front : Ø0.71 mm (0.0280 in.) Rear : Ø0.315 mm (0.0124in.)	NO valve:4
		Outlet valve(NC)	Front : Ø0.56 mm (0.0220 in.) Rear : Ø0.355 mm (0.0140 in.)	NC valve:4
	Traction Control valve relief pressure		120 bar	With TCS
Warning lamp	Operating voltage		12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, brake oil, EBD failure ·TCS W/L:TCS failure
	Current consumption		80 mA	
Wheel speed sensor(CBS)	Internal resistance		1385 ± 110 Ω	23 ± 5 °C
	Output range		15 ~ 2000 HZ	
	Min. Voltage peak		130 mVp.p(15 HZ) 200 mVp.p(1000 HZ)	Max.air gap
	Air gap		0.2 ~ 1.3 mm (0.0079 ~ 0.0512 in.)	
Active wheel speed sensor(ABS)	Supply voltage		DC 12 V	
	Output current low		5.9 ~ 8.4 mA	Typ.7 mA
	Output current High		11.8 ~ 16.8 mA	Typ.14 mA
	Frequency range		1 ~ 2000 HZ	
	Air gap		0.5 ~ 1.5 mm (0.019 ~ 0.0591 in.)	
	Tone wheel		48 teeth	

SPECIFICATION(ESP)

Part	Item	Standard value	Remark
	System	4 channel 4 sensor(MGH-25)	·Total control(ABS, EBD, TCS, ESP) ·CAN communication with ECU & TCU
	Type	Motor, valve relay intergrated type	
	Operating voltage	10 V ~ 16 V(DC)	
	Operating temperature	-40 ~ 110 °C(-40 ~ 230 °F)	
	Motor power	250 W	

HECU(Hydraulic and Electronic Control Unit)	Pump orifice		Ø0.5 mm(0.0197 in.)	
	Accumulator capacity	LPA	MCS : 3.0 cc / MCP : 3.0 cc	LPA:Low pressure accumulator
		HPA	0.13cc	HPA:High pressure accumulator
	Valve	Inlet valce(NO)	Front: Ø0.71 mm(0.0280 in.) Rear: Ø0.315 mm(0.0124 in.)	NO valve:4
		Outlet valve(NC)	Front: Ø0.56 mm(0.0220 in.) Rear: Ø0.355 mm(0.0140 in.)	NC valve:4
	Traction Control valve relief pressure		120~150 bar	
Warning lamp	Operating voltage		12 V	·ESP Operating Lamp ·ESP Warning Lamp
	Current consumption		80 mA	
Active wheel speed sensor	Supply voltage		DC 12 V	
	Output current low		5.9 ~ 8.4 mA	
	Output current high		11.8 ~ 16.8 mA	
	Frequency range		1 ~ 2000 HZ	
	Airgap		0.5 ~ 1.5 mm (0.02 ~ 0.06 in)	
Steering Wheel Angle Sensor	Operating Voltage		9 V ~ 16 V	
	Current Consumption		Max 100 mA	
	High Output voltage		3.0 V ~ 4.1 V	
	Low output voltage		1.3 V ~ 2.0 V	
	Operating Angular velocity		Max 1500 °/sec	
Yaw-rate & G sensor	Operating Voltage		4.75 V ~ 5.25 V	
	Current Consumption		Max. 65 mA	
	Output Voltage		0.5 V ~ 4.5 V	
	Yaw Sensor Operating Range		± 75 ° /s	
	G Sensor Operating Range		± 1.5 G	
	Nominal Offset		2.5 V	
Master Pressure	Operating Voltage		4.75 V ~ 5.25 V	
	Current Consumption		Max. 15 mA	
	Output Voltage Range		0.5 V ~ 4.4 V	

Sensor	Output Pressure Range	0 ~ 200 bar	
	Max Pressure	350 bar	
	Nominal Offset	0.5 V	

SPECIFICATIONS

Item	Specification
Master cylinder · Type · I.D. mm(in.)(CBS/ABS) · Piston stroke mm(in) · Output port(CBS/ABS) · Fluid level warning sensor	 Tandem type 23.8 / 25.4(0.937 / 1.0) 30 ~ 32(1.18 ~ 1.26) 4port / 4port Provided
Proportioning valve · Cut-in pressure(Split point) · Decompression ratio	 15 Kgf /cm² 0.27 : 1 (2WD) 0.32 : 1(4WD)
Brake booster · Type · Effective dia. mm(in.) · Boosting ratio	 Vacuum 8+9 in 9 : 1
Front brake(Disc) · Type · Disc O.D. · Disc I.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D.	 Floating type with ventilated disc 280 mm(11.02 in) 172 mm (6.77 in.) 26 mm(1.02 in) 11 mm(0.43 in) single piston 60 mm (2.36 in.)
Rear brake(Disc) · Type · Disc O.D. (2WD/4WD) · Parking Brake Drum I.D · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D	 Floating type with solid disc 262 / 284 mm (10.31 / 11.18 in.) 190 mm(7.48 in.) 10 mm (0.39 in.) 10 mm (0.39 in.) single piston 34 mm (1.34 in.)
Parking brake · Type · Actuation · Cable arrangement	 V type Mechanical brake acting on rear wheels Lever

O.D=Outer Diameter
I.D=Inner Diameter

NOTE

CBS : Conventional Brake System

SERVICE STANDARD

Item	Standard value	Service limit
Brake pedal height	163 mm(6.42 in.)	
Brake pedal full stroke	128 mm (5.04 in.)	
Brake pedal free play	3~8 mm(0.11~0.31 in.)	
Brake pedal to floorboard clearance	82 mm(3.23 in.)	
Stop lamp switch outer case to pedal stopper clearance	0.5 ~ 1.0 mm (0.02~0.04 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 (20Kgf, 44lb force)	7 ~ 8 clicks	
Front disc brake pad thickness	11 mm (0.43 in.)	2 mm (0.079 in.)
Front disc thickness (minimum)	26 mm (1.024 in.)	24.4 mm (0.961 in.)
Front disc runout		Max.0.03 mm (0.001 in.)
Front disc thickness variation		Max.0.005 mm (0.0002 in.)
Rear drum brake lining thickness	4.5 mm (0.177 in.)	1.0 mm (0.039 in.)
Rear drum brake drum I.D.	228.6 mm (9 in.)	Max.230.6 mm (9.079 in.)
Rear disc brake pad thickness	10 mm (0.394 in.)	2 mm (0.079 in.)
Rear disc brake disc thickness	10 mm (0.394 in.)	8 mm (0.315 in.)
Rear disc runout		Max.0.03 mm (0.001 in.)
Rear disc thickness variation		Max.0.005 mm (0.0002 in.)

TIGHTENING TORQUE

Item	Nm	Kgf·cm	lb-ft
Proportioning valve to master cylinder	34.30~53.90	350~550	25.45~39.99
Master cylinder to booster mounting nut	7.84~11.76	80~120	5.82~8.72
Brake booster mounting nut	12.74~15.68	130~160	9.45~11.63
Brake booster vacuum hose fitting to surge tank	14.70~17.64	150~180	10.91~13.09
Bleeder screw	6.86~12.74	70~130	5.09~9.45
Brake tube nut, brake hose	12.74~16.66	130~170	9.45~12.36
Caliper assembly to knuckle	78.40~98.00	800~1000	58.2~72.7
Brake hose to front caliper	24.50~29.40	250~300	18.18~21.81
Brake hub flange nut	196.00~254.80	2000~2600	145.4~189
Push rod locking nut	15.68~21.56	160~220	11.63~15.99
Caliper guide rod bolt	21.56~31.36	220~320	15.99~23.26

TIGHTENING TORQUE (ABS & TCS)

Item	Nm	kgf·cm	lb-ft
Active wheel speed sensor mounting bolt on the brake plate ·Front ·Rear	 7.84~8.82 7.84~8.82	 80~90 80~90	 5.82~6.54 5.82~6.54
Hydraulic & electronic control unit mounting bolt	7.84~8.82	80~100	5.82~7.27
Hydraulic & electronic control unit mounting bracket bolt	16.66~25.48	170~260	12.36~18.9
Brake tubes nut	11.74~16.66	130~170	9.45~12.36
Air bleeder screw	6.86~12.74	70~130	5.09~9.45

TIGHTENING TORQUE (ESP)

Item	Nm	kgf·cm	lb-ft
Yaw rate & lateral acceleration sensor Nut	7.84~10.78	80~110	5.82~8.0
Steering wheel nut	39.2~49	400~500	29.1~36.4
Master cylinder pressure sensor	22.09~26.13	224~265	16.29~19.27

Brake System > Brake System > Description and Operation

EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION) OPERATION

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.

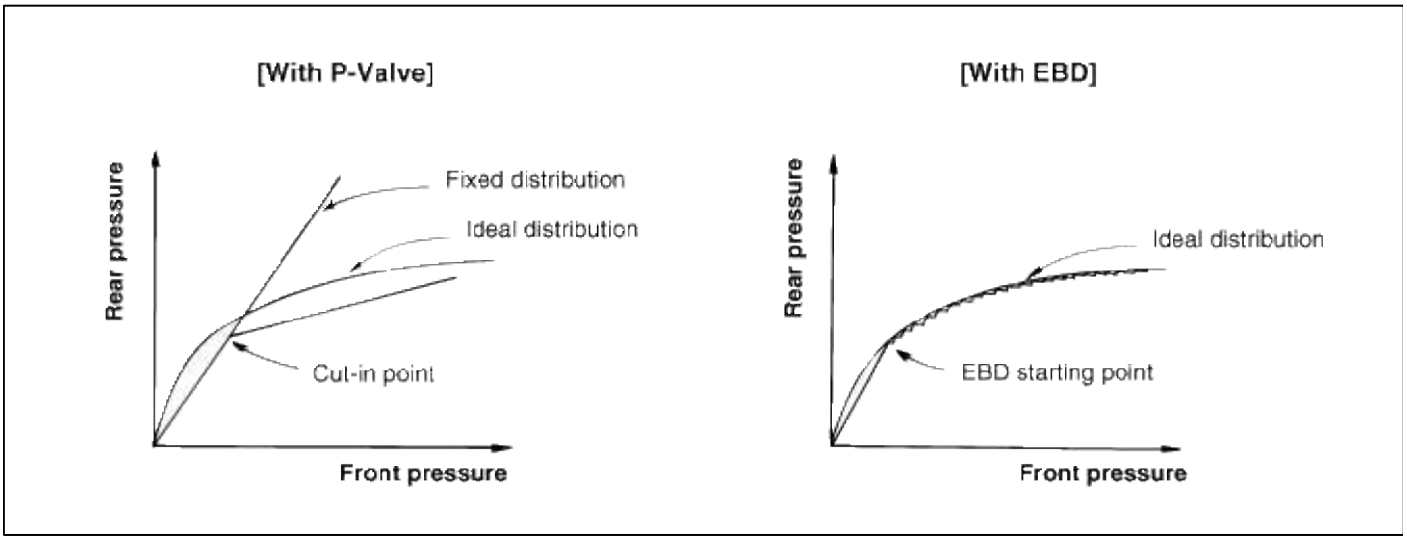
It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.

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



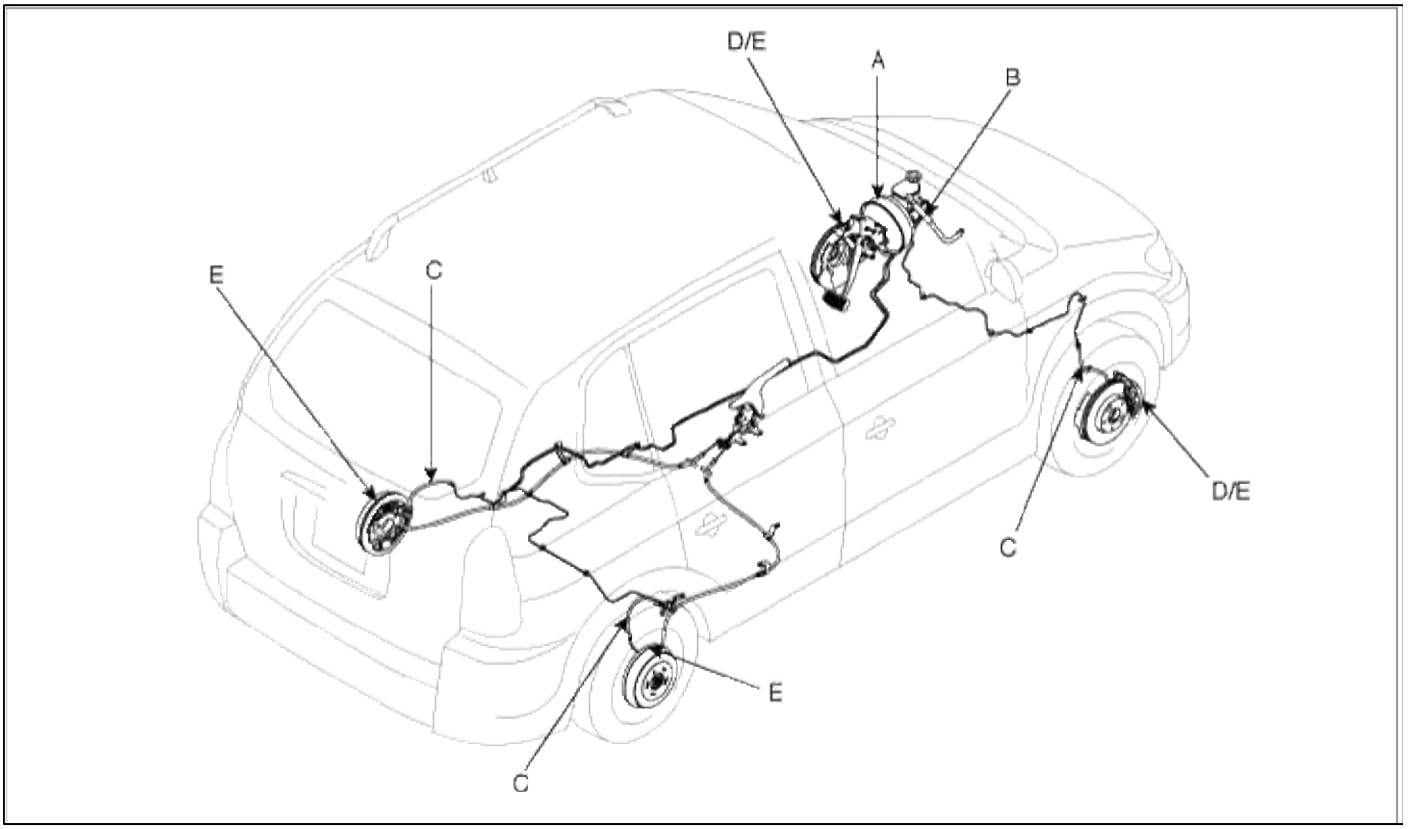
Brake System > Brake System > Repair procedures

Operation and Leakage Check

Check all of the following items:

Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. 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.

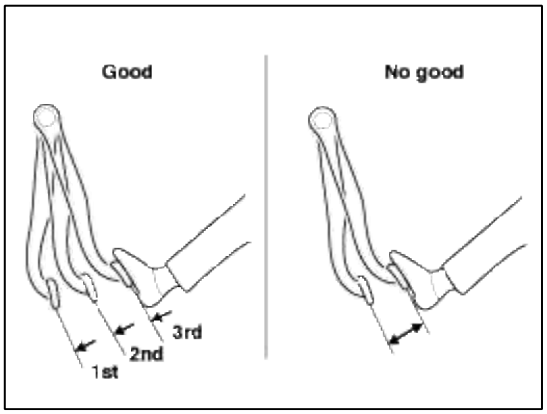
Wheel cylinder piston cup and dust cover (E)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, replace the wheel cylinder.



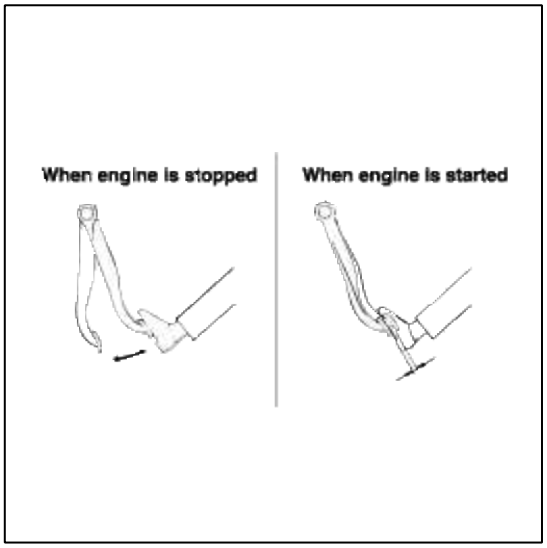
BRAKE BOOSTER OPERATING TEST

For simple checking of the brake booster operation, carry out the following tests.

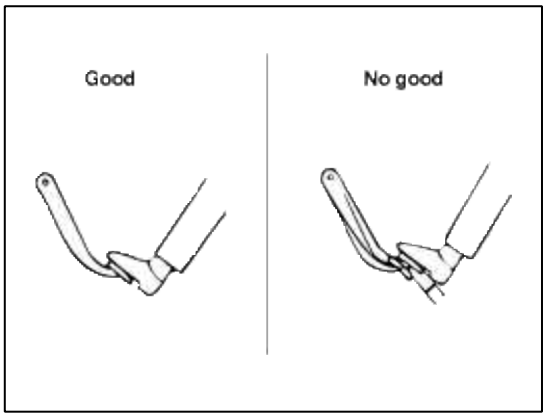
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is defective.



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.



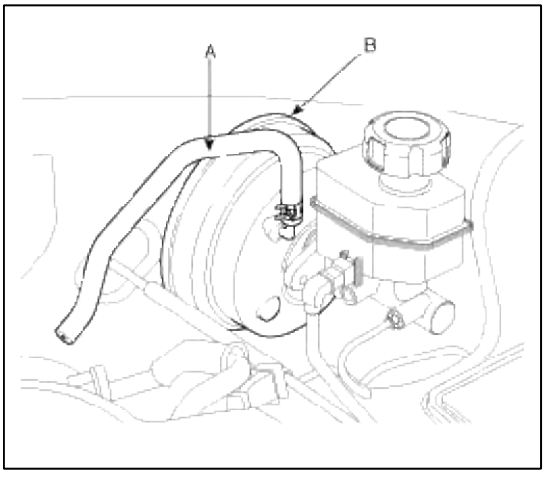
3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective.
   If the above three tests are okay, the booster performance 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.



VACUUM HOSE (CHECK VALVE)

INSPECTION

1. Disconnect the brake booster vacuum hose (check valve built in) (A) at the booster (B).
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.

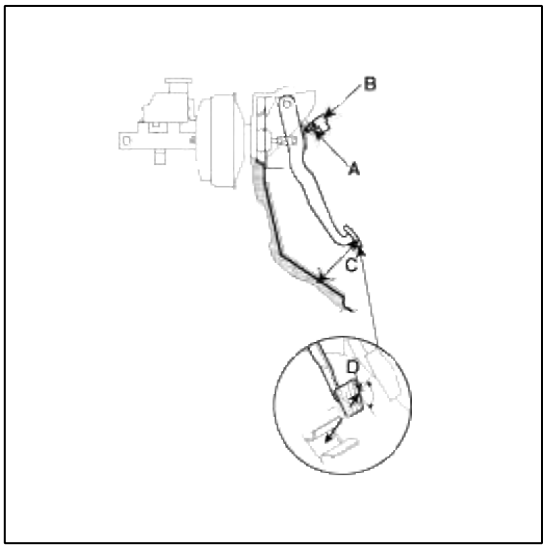


BRAKE PEDAL BRAKE SWITCH ADJUSTMENT

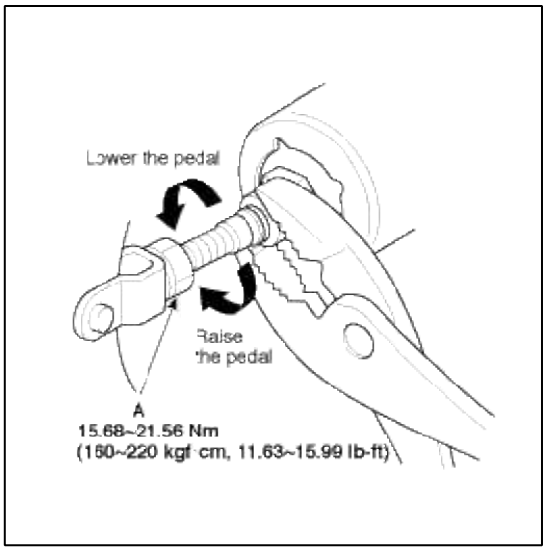
PEDAL HEIGHET

1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and brake off the brake switch (B) unil 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): 163mm(6.41 in.)

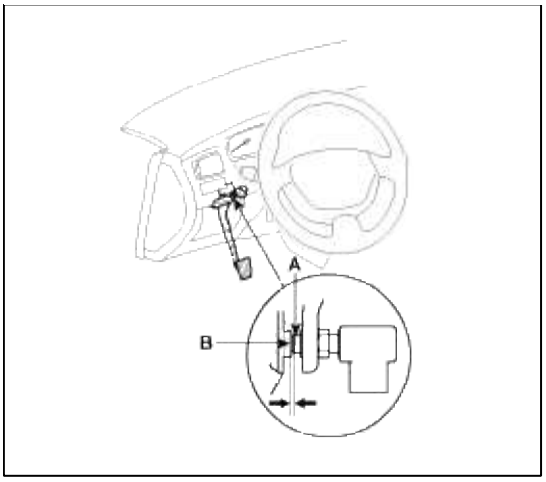


3. Loosen the pushrod locknut (A), and screw the pushrod in or out with pliers until the standard pedal height from the floor is reached. After adjustment, tighten the locknut firmly. Do not adjust the pedal height with the pushrod depressed.



BRAKE SWITCH CLEARANCE

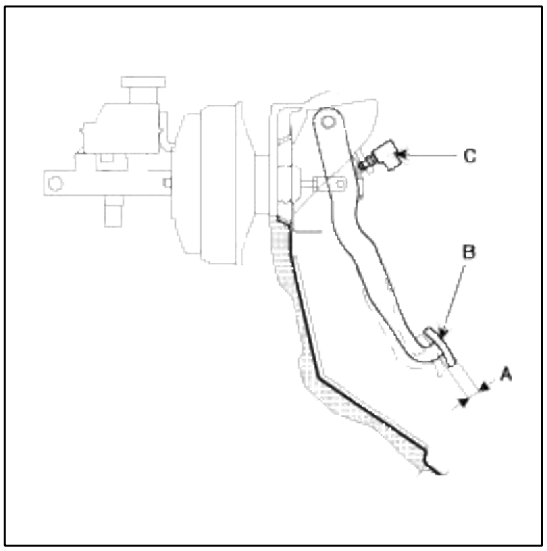
Screw in the brake switch until its plunger is fully depressed (threded end (A) touching the pad (B) on the pedal arm) then adjust the switch 3/4 turn to until clearance between the brake switch connector. Make sure that the brake lights go off when the pedal is released.



PEDAL FREE PLAY

1. With the engine off, inspect the pedal free play (A) on the pedal pad (B) by pushing the pedal by hand.

Free play: 3 ~ 8 mm (0.11 ~ 0.31 in.)

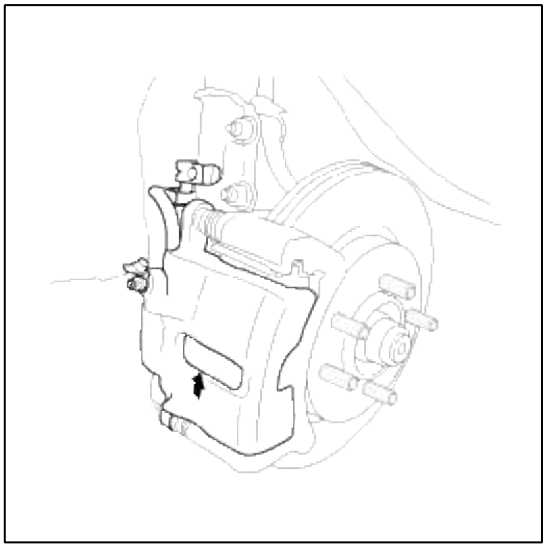


2. If the pedal free play is out of specification, adjust the brake switch (C). If the pedal free play is insufficient, it may result in brake drag.

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.)



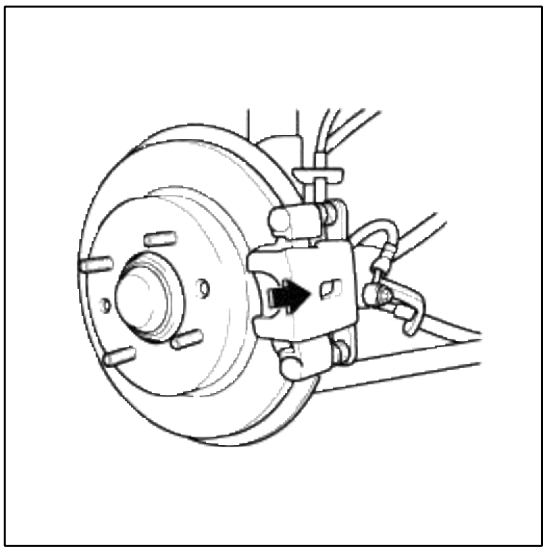
CAUTION

- If the pad lining thickness is out of specilfication, 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 rear disk 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.)

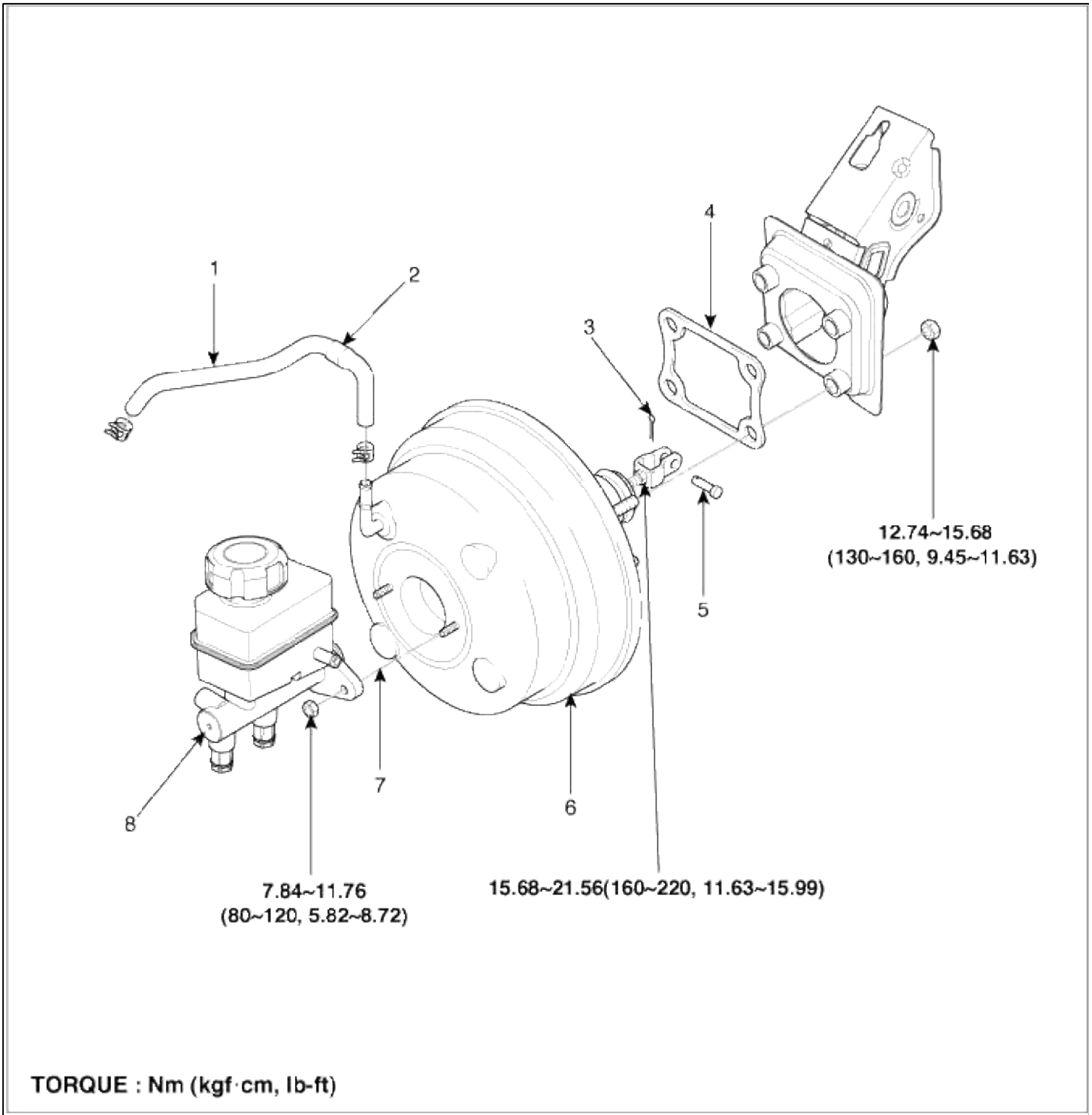


CAUTION

- 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 System > Brake System > Brake Booster > Components and Components Location

COMPONENTS

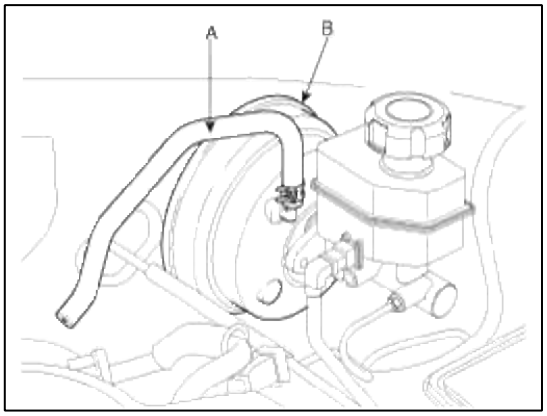


1. Vacuum hose
2. Check valve
3. Snap pin
4. Seal
5. Clevis pin
6. Brake booster
7. Vacuum switch
8. Master cylinder

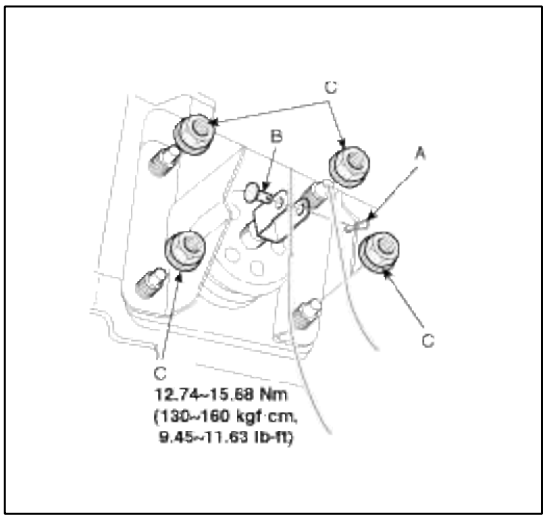
Brake System > Brake System > Brake Booster > Repair procedures

Removal

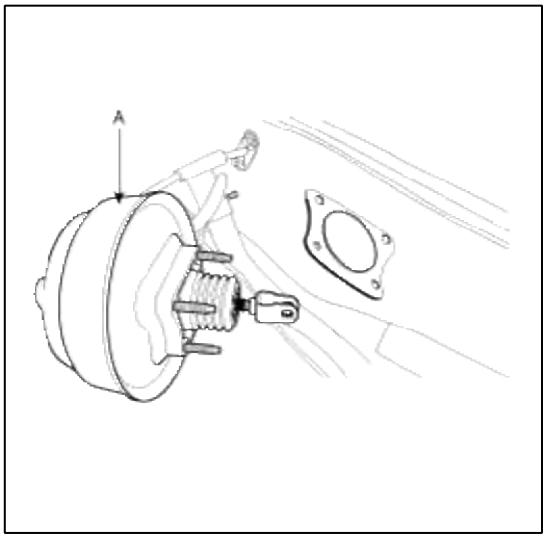
1. Remove the master cylinder.
2. Disconnect the vacuum hose (A) from the brake booster (B).



3. Remove the snap pin (A) and pin (B).



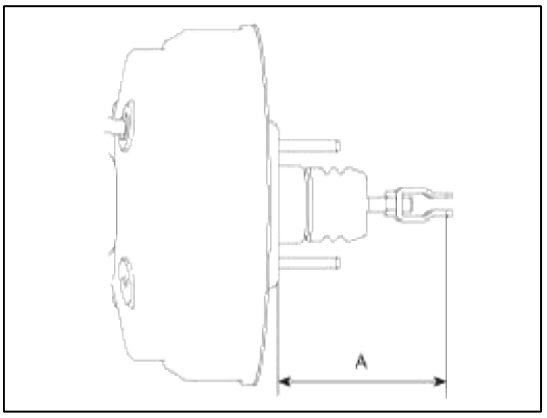
4. Remove the four booster mounting nuts (C).
5. Remove the brake booster (A).



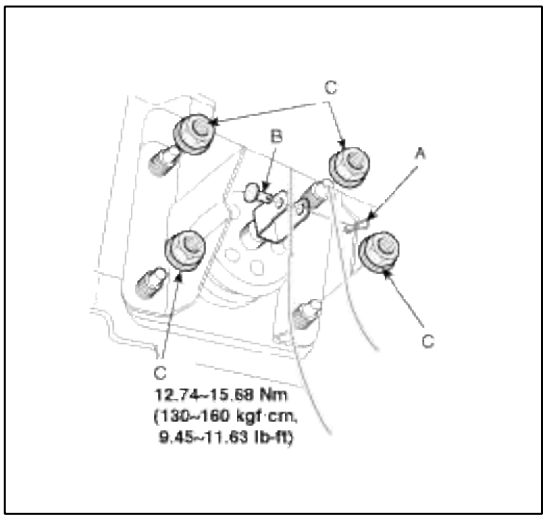
INSTALLATION

1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length (A): 106 ± 0.5 mm (4.173 ± 0.019 in.)



1. Insert the booster and tighten the nuts (C).



2. Connect the booster push rod and brake pedal with a pin (B) and install a snap pin (A) to the pin (B).

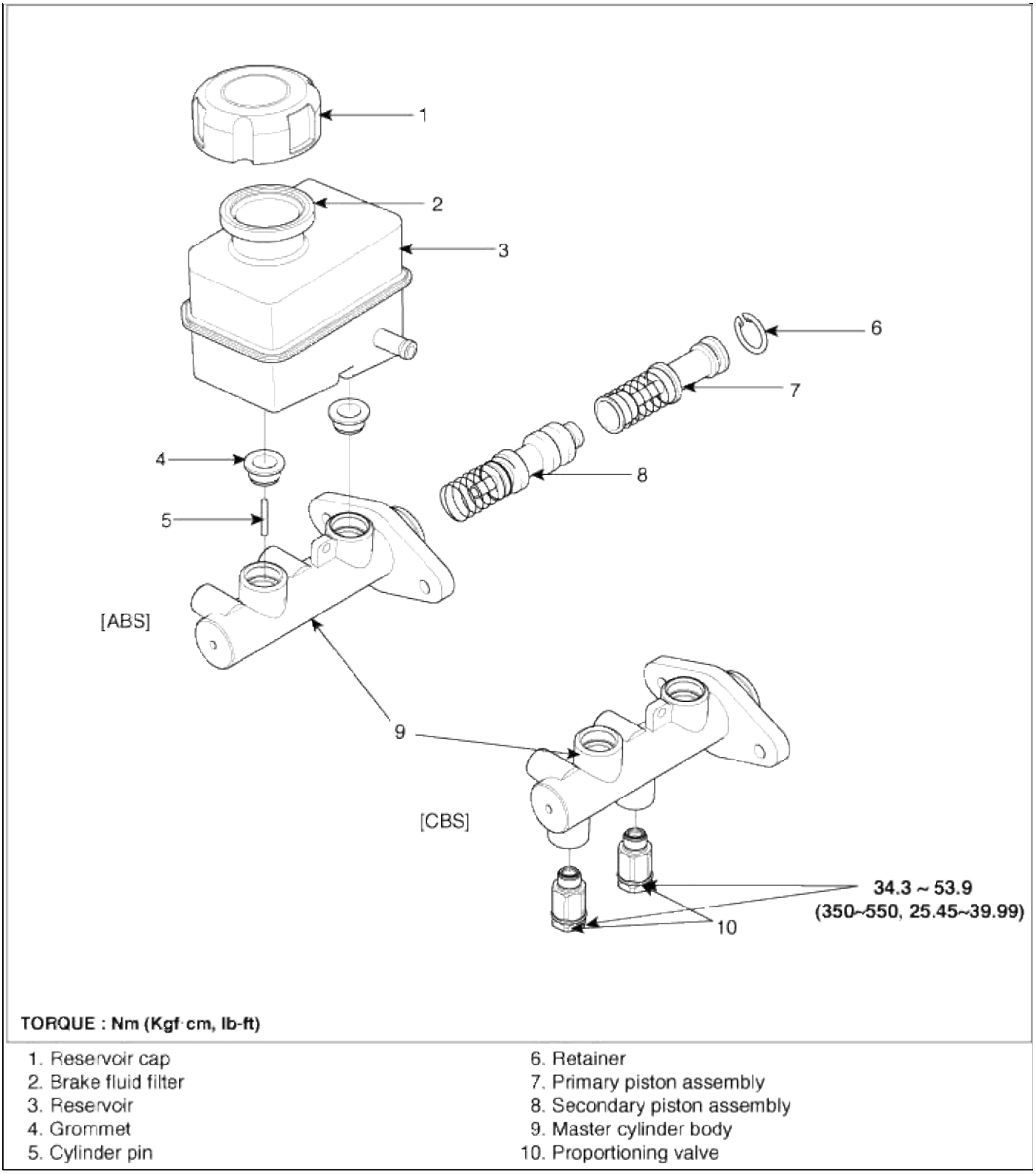
CAUTION

Grease the pin before installing the snap pin.
Always use a new snap pin.

3. Install the master cylinder.
4. Connect the vacuum hose to the brake booster.
5. After filling the brake reservoir with brake fluid, bleed the system.
6. Check for fluid leakage.
7. Check and adjust the brake pedal for proper operation.

Brake System > Brake System > Master Cylinder > Components and Components Location

COMPONENTS



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

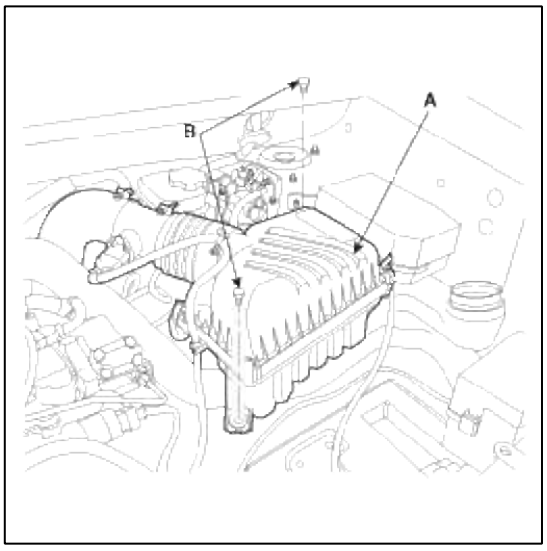
Brake System > Brake System > Master Cylinder > Repair procedures

REMOVAL

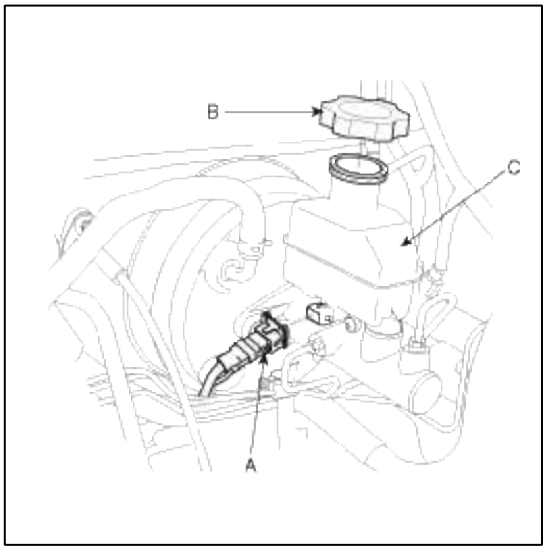
NOTE

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.

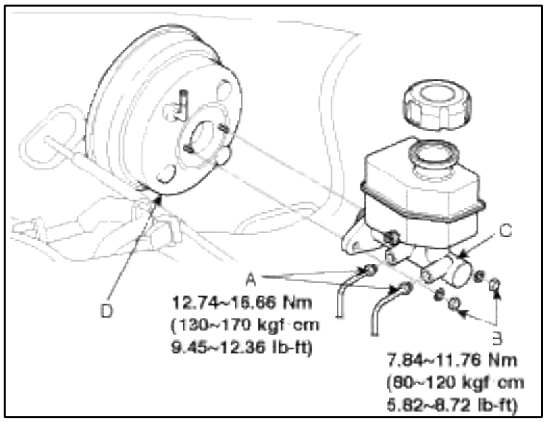
1. Remove air cleaner mounting bolts (B) from the air cleaner mounting bracket and air cleaner body (A).



2. Disconnect the brake fluid level switch connectors (A), and remove the reservoir cap (B).



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.

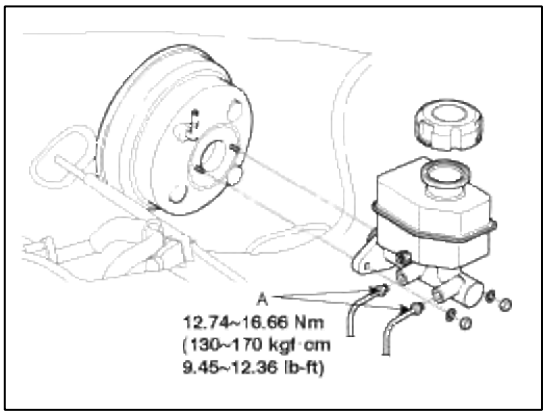


5. Remove the master cylinder mounting nuts (B) and washers.
6. Remove the master cylinder(C) from the brake booster (D). Be careful not to bend or damage the brake lines when removing the master cylinder.

INSTALLATION

1. Install the master cylinder on the brake booster with 2 nuts.

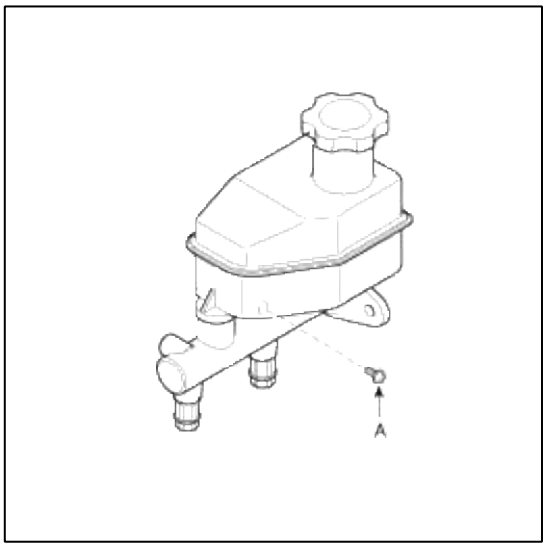
2. Connect 2 brake tubes(A) and the brake fluid level sensor connector.



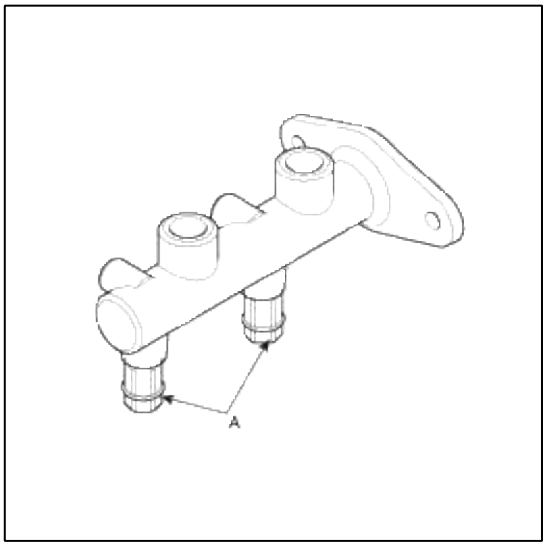
3. Fill the brake reservoir with the brake fluid and bleed the brake system.

DISASSEMBLY

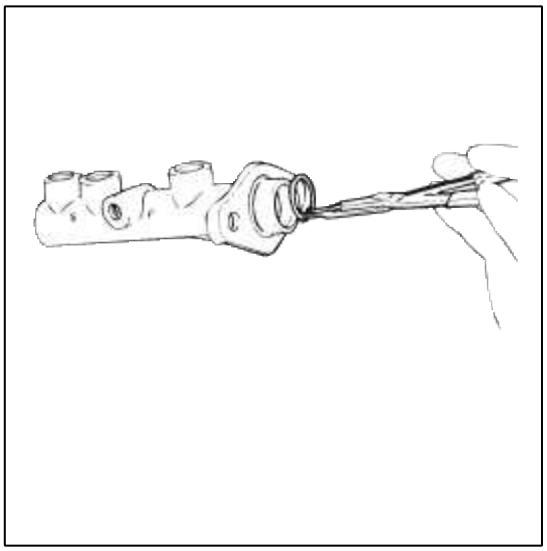
1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the fluid level sensor.
3. Remove the reservoir from the master cylinder, after remove mounting screw (A).



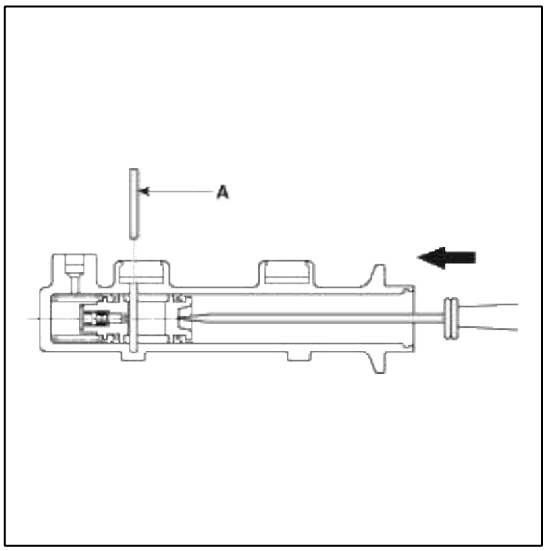
4. Remove the proportioning valves (A) - CBS only.



5. Remove the retainer ring by using the snap ring pliers then remove the primary piston assembly.



6. Remove the pin with the secondary piston pushed completely using a screwdriver. Remove the secondary piston assembly.



NOTE

Do not disassemble the primary and secondary piston assembly.

INSPECTION

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.

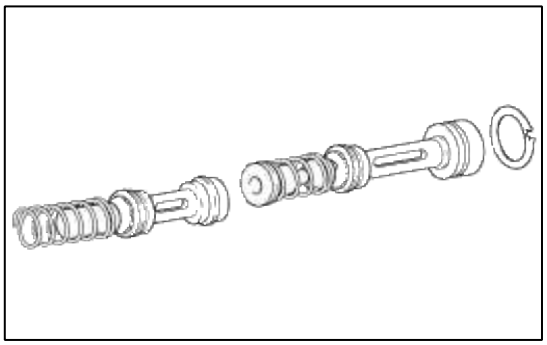
CAUTION

- If the cylinder bore is damaged, replace the master cylinder assembly.
- Wash the contaminated parts in alcohol.

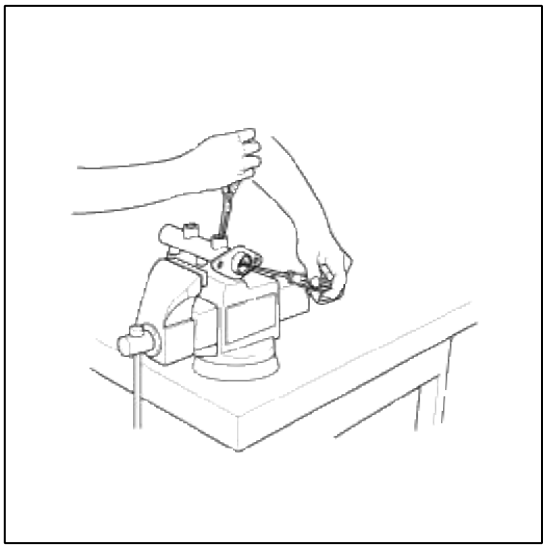
REASSEMBLY

1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.

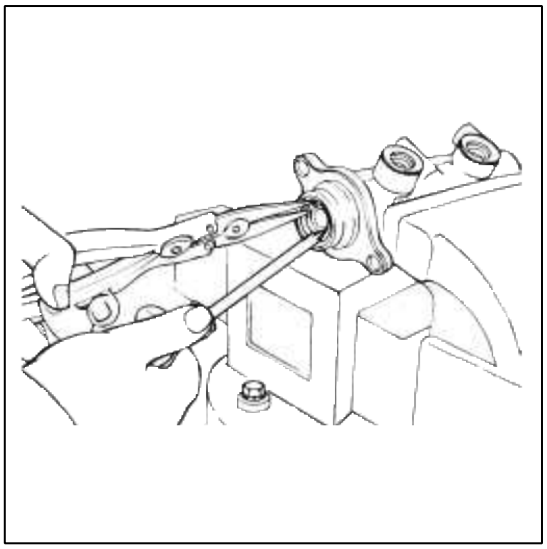
2. Carefully insert the springs and pistons in the proper direction.



3. Press the piston with a screwdriver and install the cylinder pin.



4. Press the piston with a screwdriver and install the retainer ring.



5. Mount two grommets.
6. Install the reservoir on the cylinder.

Brake System > Brake System > Proportioning Valve > Description and Operation

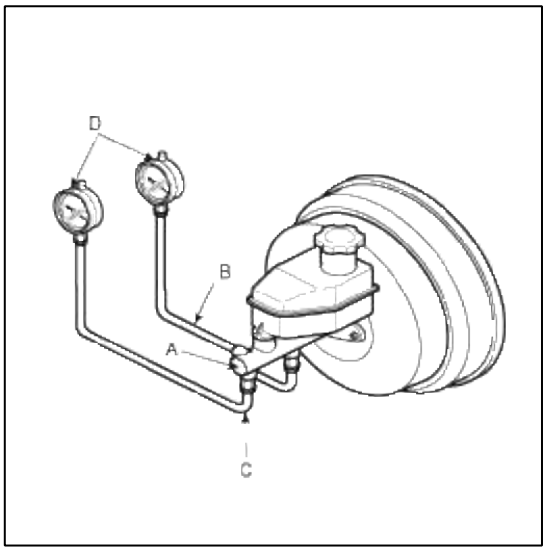
DESCRIPTION

Do not disassemble the proportioning valve. The proportioning valve makes the ideal distribution of fluid pressure to the front and rear brakes to prevent the brakes from skidding in the event of rear wheel lock up and to obtain a higher brake efficiency within the range of service brake application.

Brake System > Brake System > Proportioning Valve > Repair procedures

INSPECTION

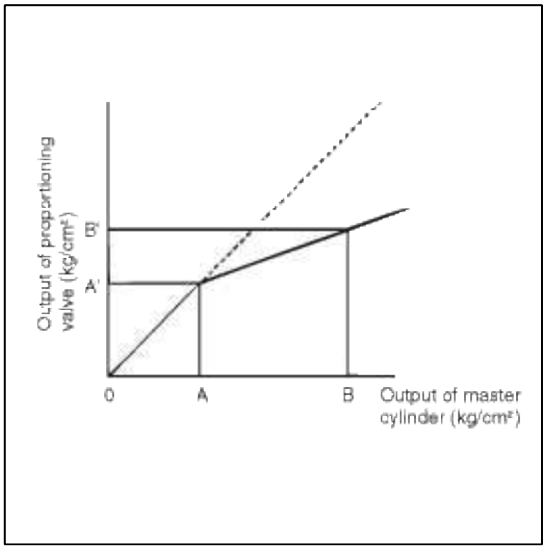
1. Remove the front brake tube (B) and rear brake tube (C) from the master cylinder (A).
2. Connect two pressure gauges (D); one to the output valve of the front (B) and rear (C) brake.



NOTE

Be sure to bleed the system after connecting the pressure gauges.

3. With the brake applied, measure the front pressure and the rear pressure.
   If the measured pressures are within the specified range as illustrated, the proportioning valve is good.



4. Reconnect the brake lines in their original positions and bleed the system.

NOTE

This table shows characteristics of the proportioning valve as the pressure increases.

2WD

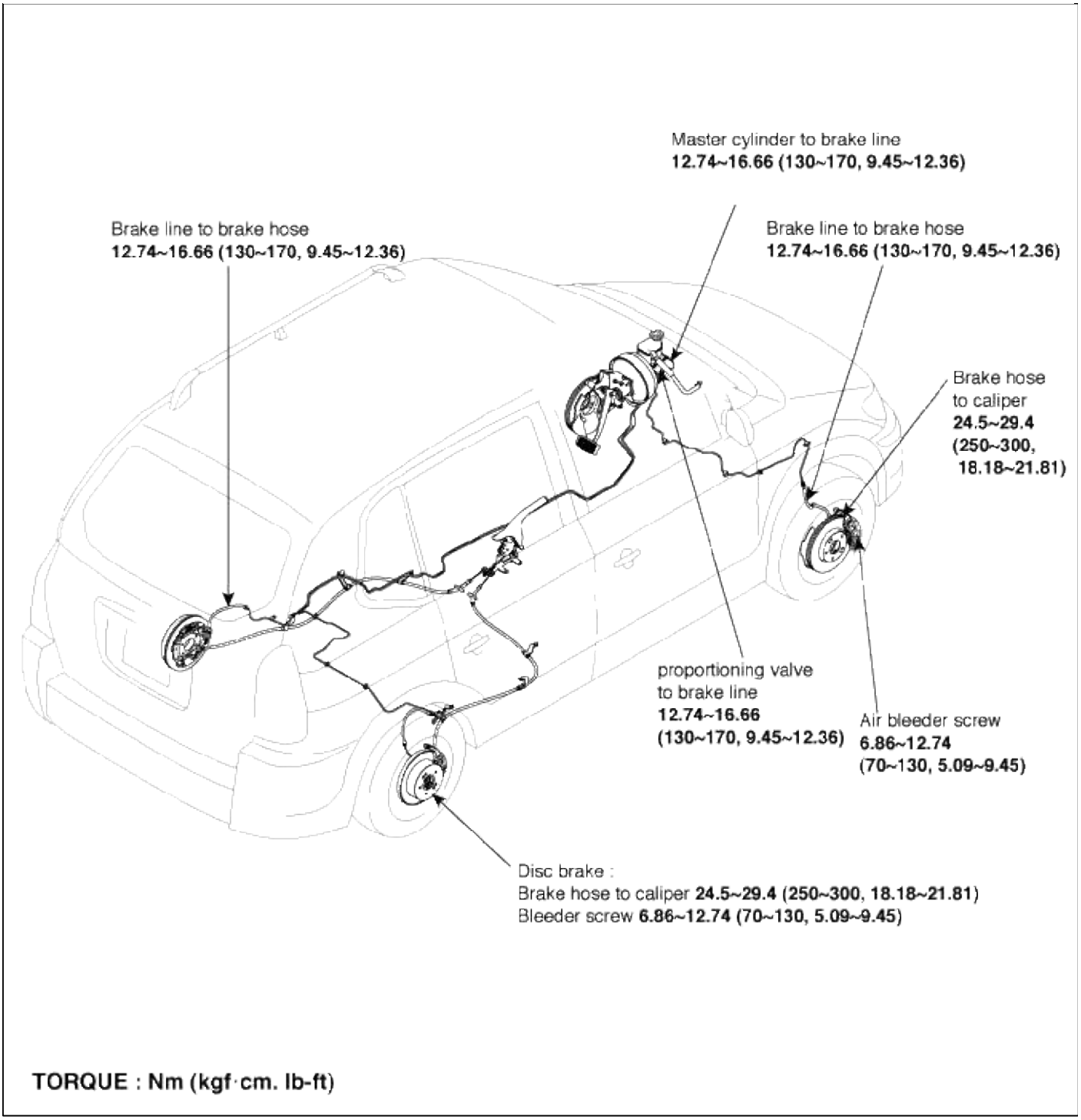
Front	Rear
A : 15 kg/cm² (1.47 MPa, 213 psi)	A' : 15 kg/cm² (1.47 MPa, 213 psi)
B : 80 kg/cm² (7.84 MPa, 1137 psi)	B' : 35.8 ± 3 kg/cm² (3.51 ± 0.3 MPa, 509 ± 42 psi)

4WD

Front	Rear
A : 15 kg/cm² (1.47 MPa, 213 psi)	A' : 15 kg/cm² (1.47 MPa, 213 psi)
B : 80 kg/cm² (7.84 MPa, 1137 psi)	B' : 32.5 ± 3 kg/cm² (3.19 ± 0.3 MPa, 462 ± 42 psi)

Brake System > Brake System > Brake Line > Components and Components Location

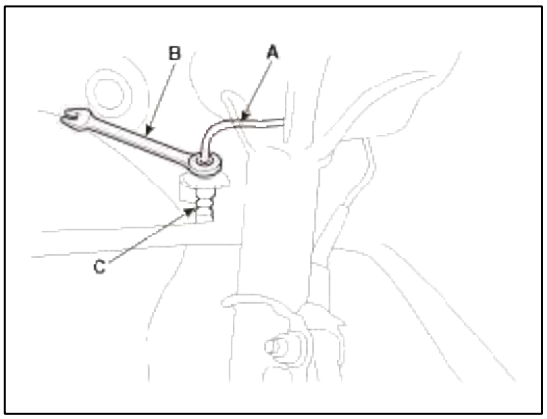
COMPONENT



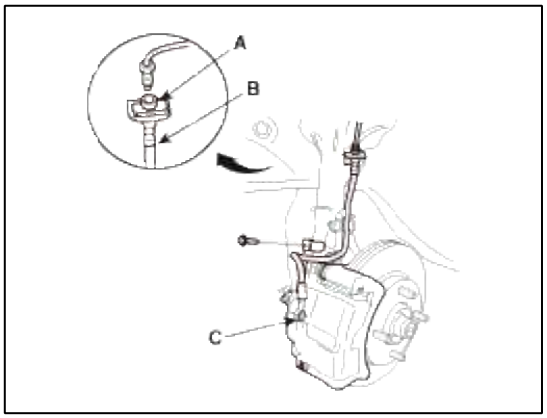
Brake System > Brake System > Brake Line > Repair procedures

REMOVAL

1. Disconnect the brake hose(C) from the brake line(A) using a 10mm flare-nut wrench(B).



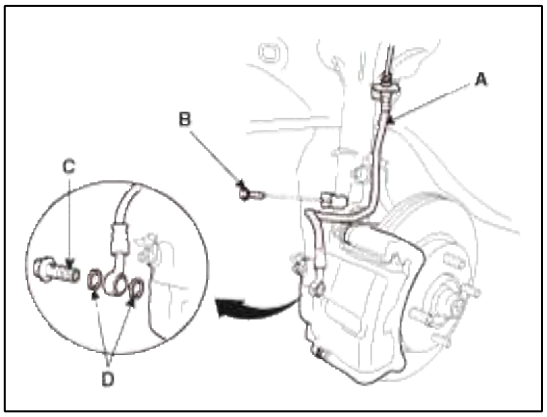
2. Remove the brake hose clip(A) from the brake hose(B).



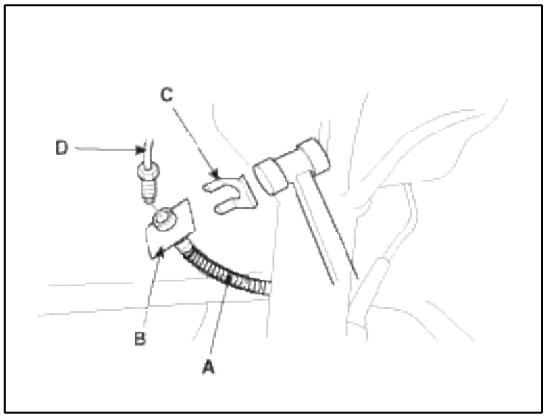
3. Remove the connector bolt from the caliper(C), and disconnect the brake hose from the caliper.

INSTALLATION

1. Install the brake hose(A) on the knuckle with 12mm flange bolt (B) first, then connect the brake hose to the caliper with the connector bolt (C) and new sealing washers (D).



2. Install the brake hose (A) on the upper brake hose bracket (B) with a new brake hose clip (C).



3. Connect the brake hose (D) to the brake line.

4. After installing the brake hose, bleed the brake system.

INSPECTION

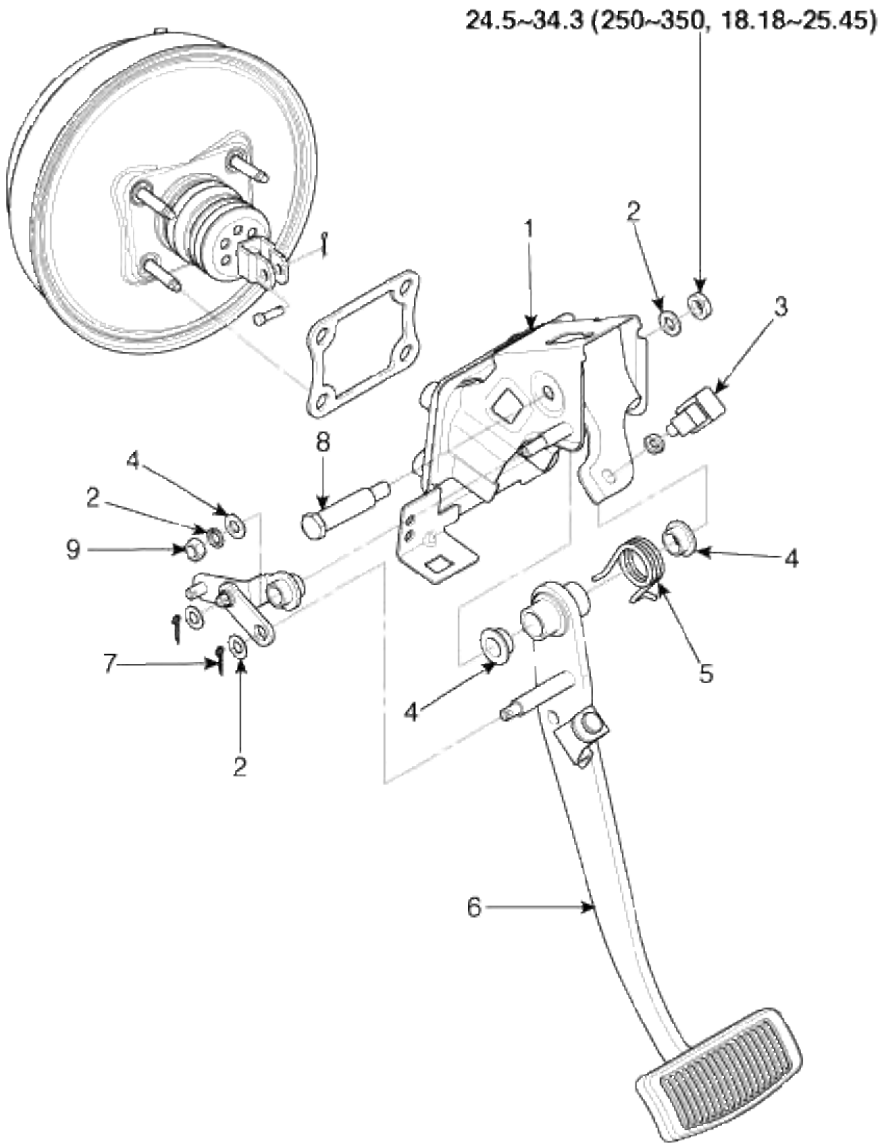
- Check the brake tubes for cracks, crimps and corrosion.
- Check the brake hoses for cracks, damaged and oil leakage.
- Check the brake tube flare nuts for damage and oil leakage.

INSPECTION

- Check the brake tubes for cracks, crimps and corrosion.
- Check the brake hoses for cracks, damaged and oil leakage.
- Check the brake tube flare nuts for damage and oil leakage.

Brake System > Brake System > Brake Pedal > Components and Components Location

COMPONENTS



TORQUE : Nm (Kgf·cm, lb-ft)

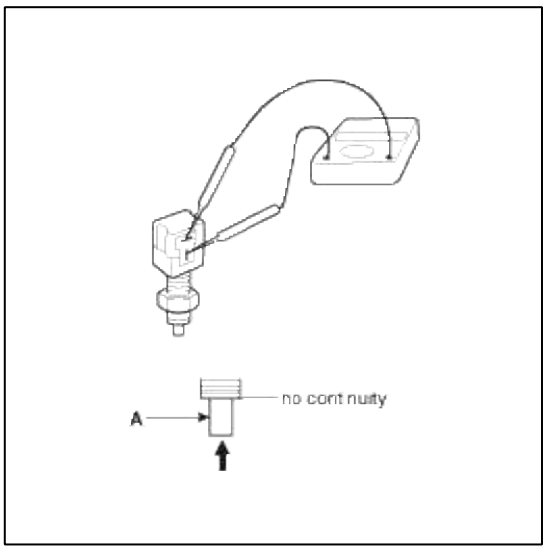
1. Member assembly bracket
2. Washer
3. Stop lamp switch
4. Bushing
5. Return spring
6. Brake pedal
7. Snap pin
8. Bolt
9. Nut

Brake System > Brake System > Brake Pedal > Repair procedures

INSPECTION

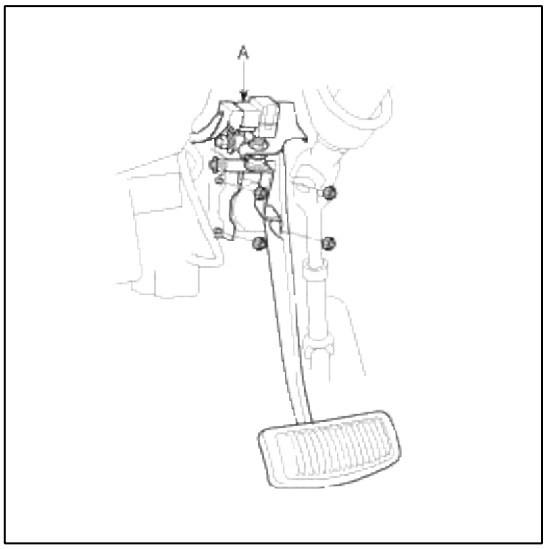
1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.

4. Check the stop lamp switch
   (1) Connect a circuit tester to the connector (1-2terminals) of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
   (2) The stop lamp switch is in good condition if there is no continuity when plunger is pushed.



REMOVAL

1. Remove the lower crash pad.(reference to BD-"crash pad")
2. Pull down steering column shaft after removing 4 bolts.
3. Remove the stop lamp switch connector (A).
4. Remove the shift lock cable (A/T).



5. Remove the pin and snap pin.
6. Loosen the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

INSTALLATION

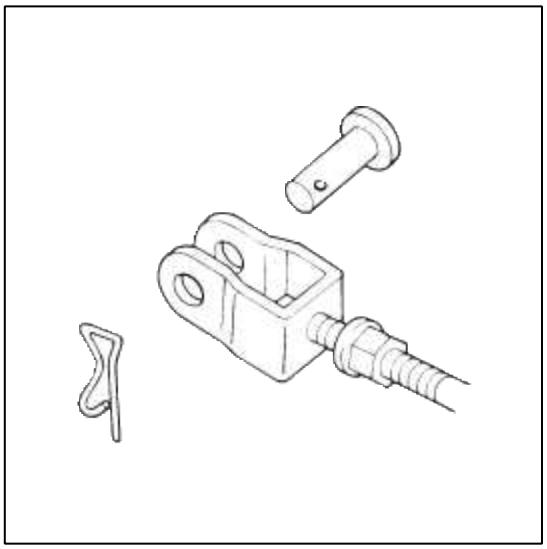
1. Installation is the reverse of removal.

CAUTION

Coat the inner surface of the bushings with the specified grease.

Specified grease:Chassis grease MS 511-3

2. Before inserting the pin, apply the specified grease to the joint pin.



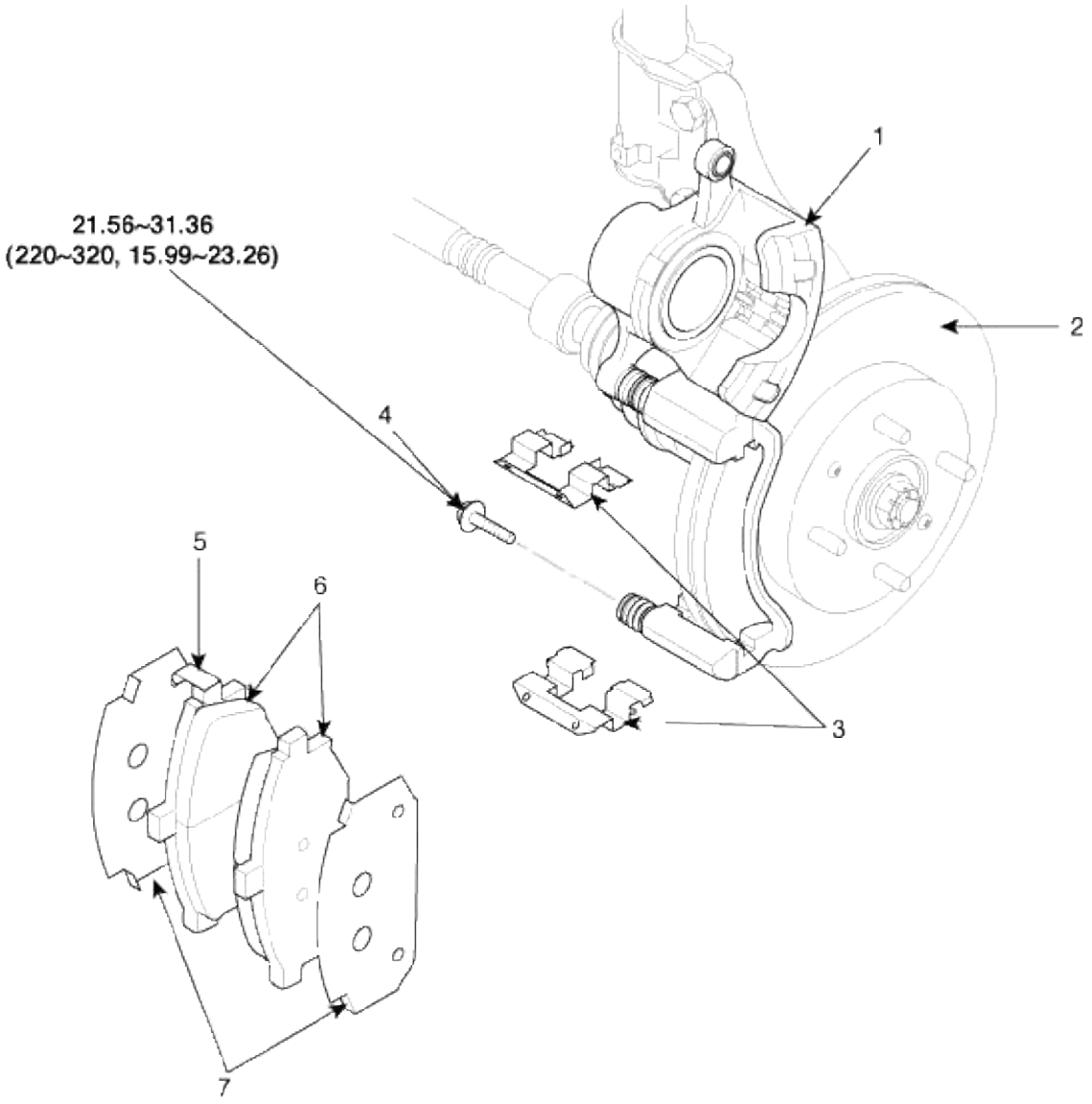
3. Install the nuts with specified torque, when installing the brake pedal.

TORQUE : Nm(Kgf·cm,lb-ft); 12.74 ~ 15.68(130 ~ 160, 9.45 ~ 11.63)

4. Adjust the brake pedal height and free play.
5. Install the stop lamp switch.

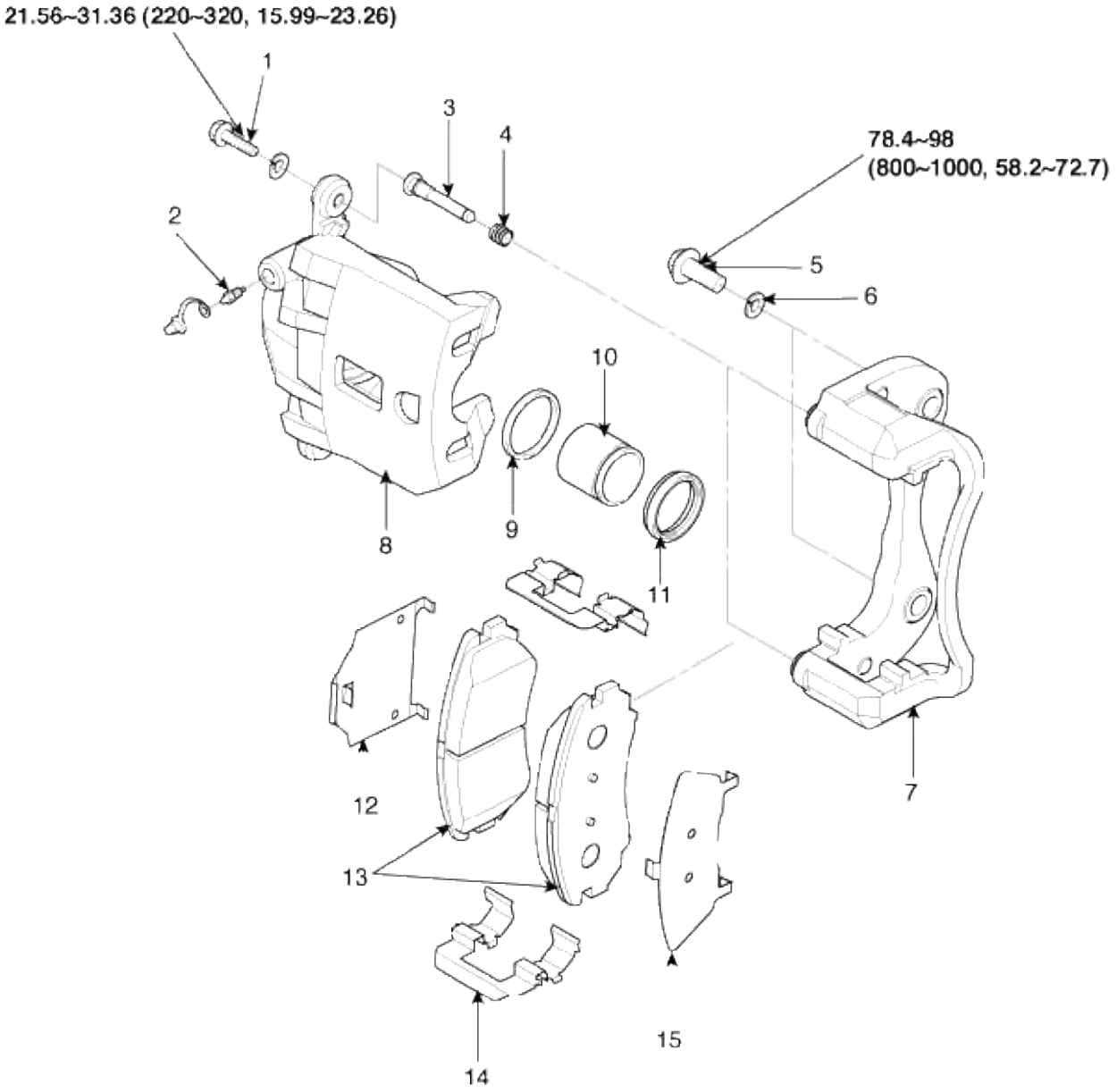
Brake System > Brake System > Front Disc Brake > Components and Components Location

COMPONENTS



TORQUE: Nm (kgf·cm, lb-ft)

1. Brake caliper
2. Brake disc
3. Pad retainers
4. Guide rod bolt
5. Indicator
6. Brake pads
7. Brake pad shims



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. Inner shim
13. Brake pad
14. Pad retainer
15. Outer shim

Brake System > Brake System > Front Disc Brake > Repair procedures

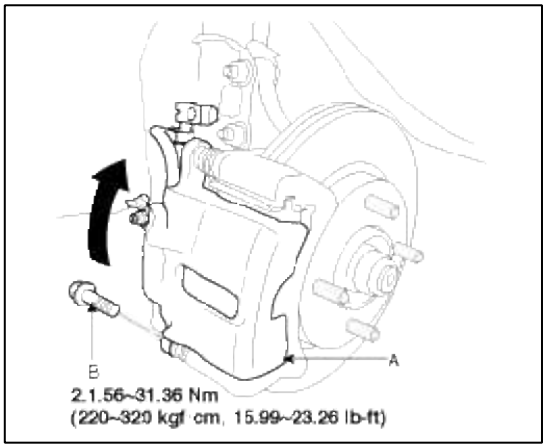
REMOVAL

CAUTION

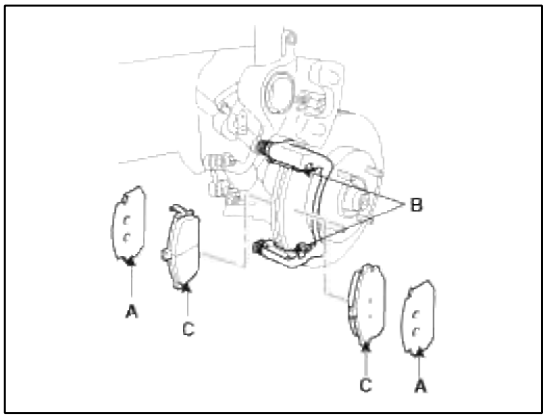
Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.

- Avoid breathing dust particles.
- Never use on air hose or brush to clean brake assemblies.

1. Lossen the front wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported. Remove the front wheels.
2. Remove the guide rod bolt(B), After raise the caliper assembly(A), support it with a wire.

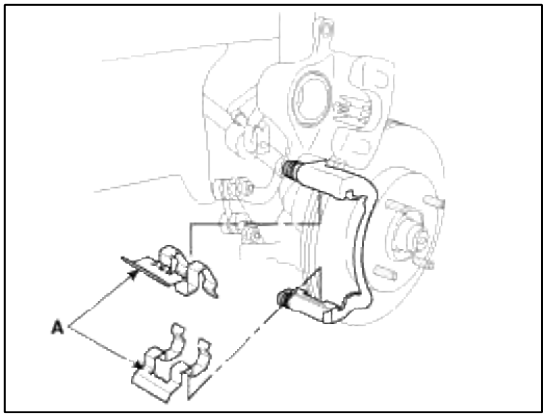


3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.

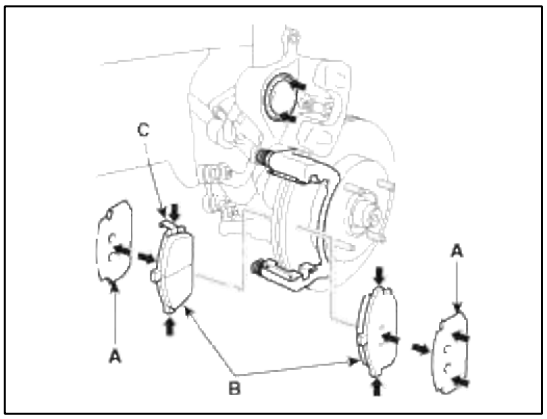


INSTALLATION

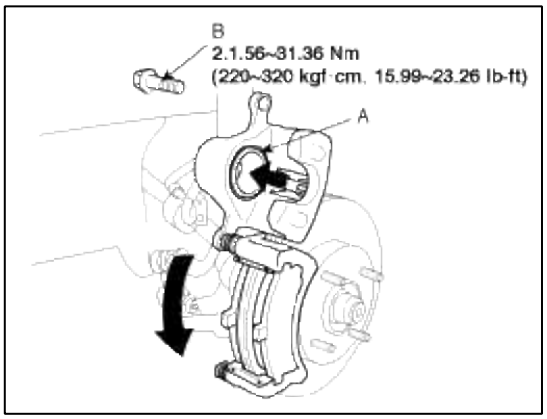
1. Install the pad retainers (A) on the caliper bracket.



2. Check the foreign material at the pad shims (A) and the back of the pads (B).
   Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.

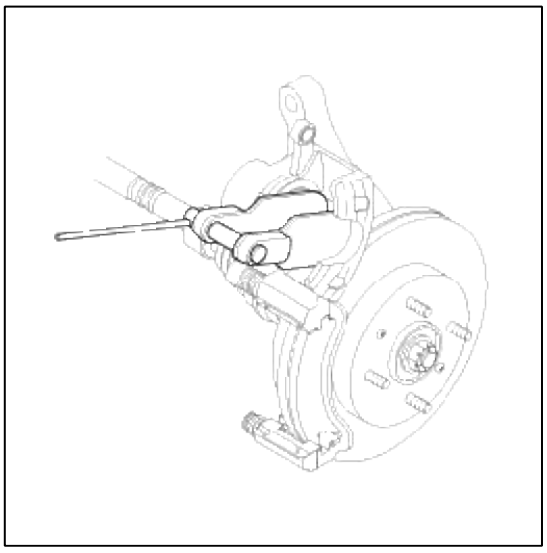


3. Install the brake pads (B) and pad shims (A) correctly. Install the pad with the wear indicator (C) on the inside. If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.
4. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.
5. Pivot the caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification.



NOTE

Insert the piston in the cylinder using the special tool (09581-11000).



6. 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.
> Be sure to do this before driving the vehicle.

7. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

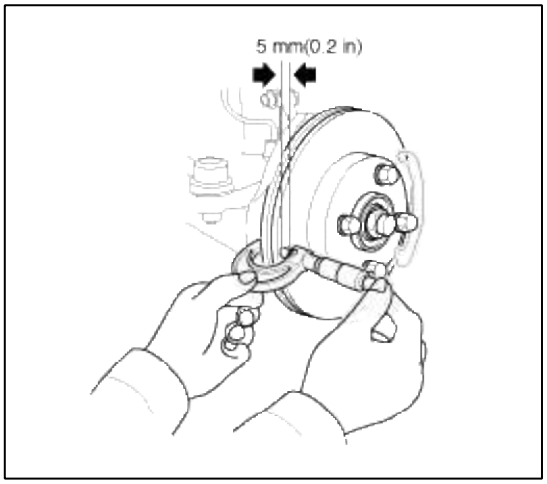
INSPECTION

FRONT BRAKE DISC THICKNESS CHECK

1. Remove all rust and contramination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5 mm) front the brake disc outer circle.

   Front brake disc thickness
   Standard value : 26.0 mm(1.024 in.)
   Limit : 24.4 mm(0.961 in.)

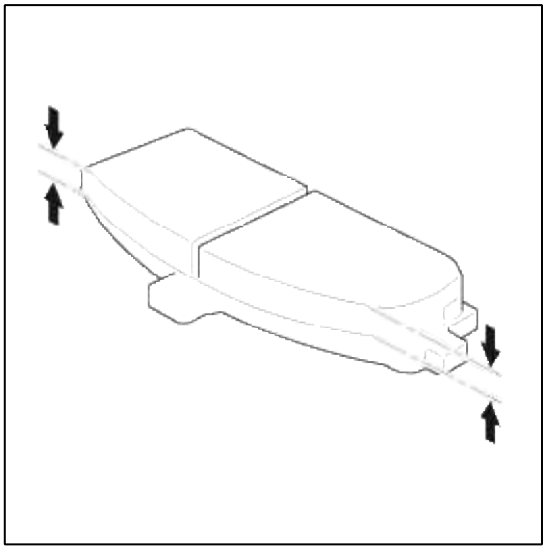
2. Thickness variation should not exceed 0.005 mm (0.0004 in.) (circumference) and 0.01 mm (in.)(radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.



FRONT BRAKE PAD CHECK

1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness
Standard value : 11 mm (0.43 in.)
Service limit : 2.0 mm (0.0787 in.)



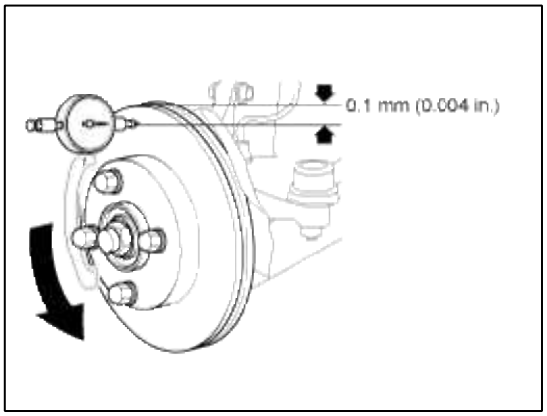
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

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 : 0.1 mm (0.004 in.) or less
Extremly tight specification : 0.04 mm (0.0016 in.)

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.

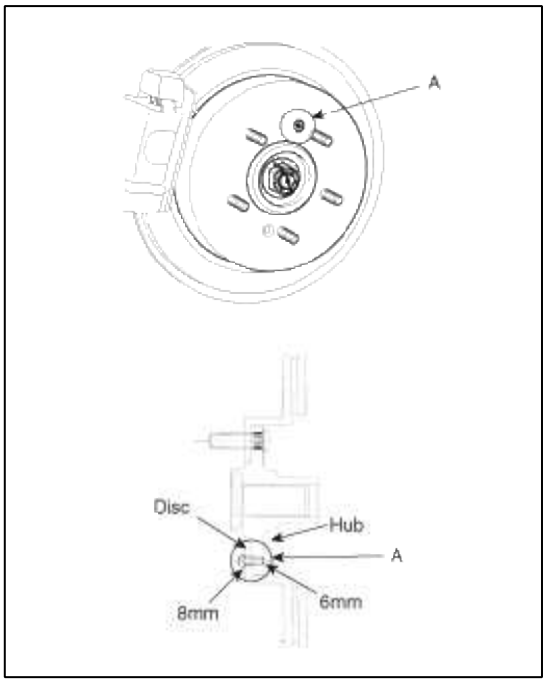


Seize of Front brake disc

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.

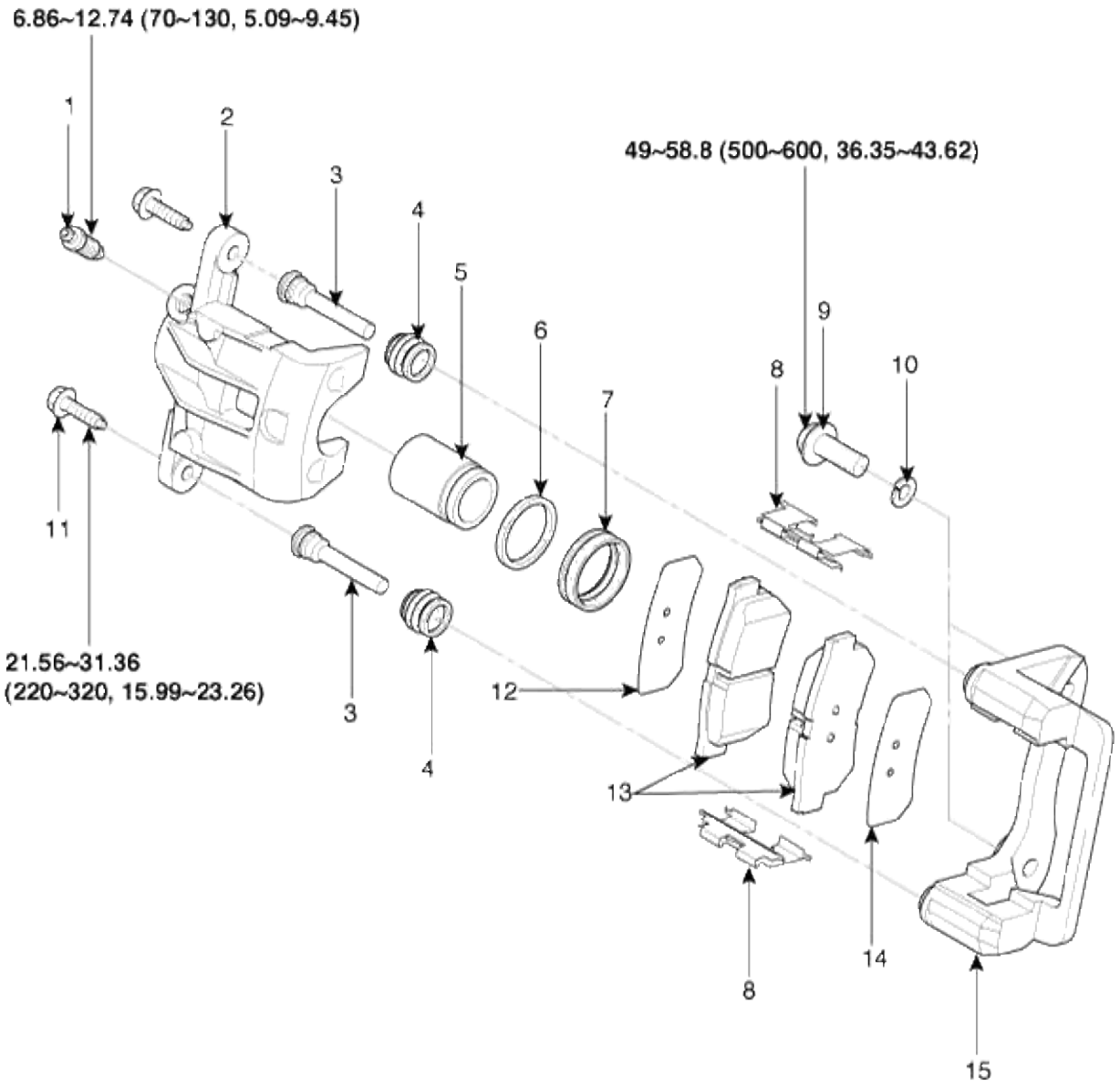
NOTE

Be careful not to use the hammer. The disc can be damaged if you remove the disc from the hub by hammer.



Brake System > Brake System > Rear Disc Brake > Components and Components Location

COMPONENTS



TORQUE : Nm (kgf·cm, lb-ft)

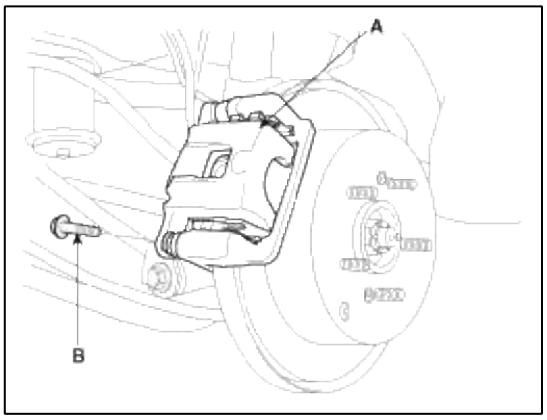
1. Bleeder screw
2. Caliper body
3. Guide rod
4. Boot
5. Piston
6. Piston seal
7. Piston boot
8. Pad retainer
9. Caliper mounting bolt
10. Washer
11. Guide rod bolt
12. Inner shim
13. Brake Pad
14. Outer shim
15. Caliper bracket

Brake System > Brake System > Rear Disc Brake > Repair procedures

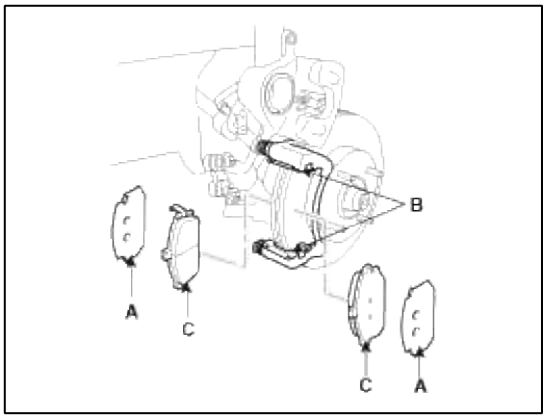
REMOVAL

1. Raise the rear of the vehicle and make sure it is securely supported. Remove the rear wheel.

2. Remove the guide rod bolt(B), After raise the caliper assembly(A), support it with a wire.

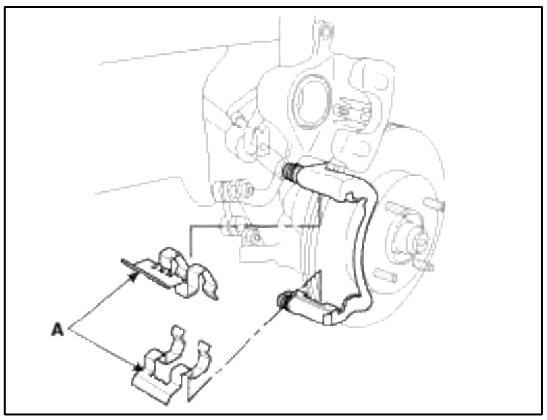


3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.

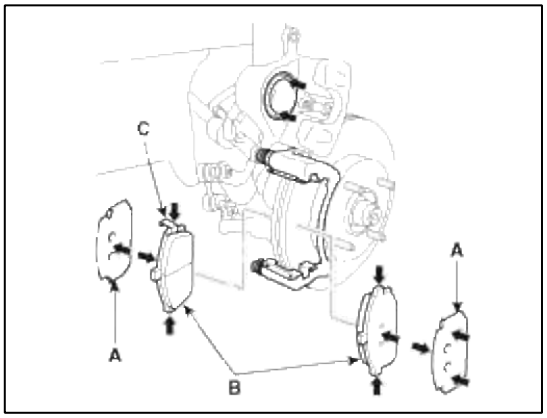


INSTALLATION

1. Install the pad retainers(A) on the caliper bracket.

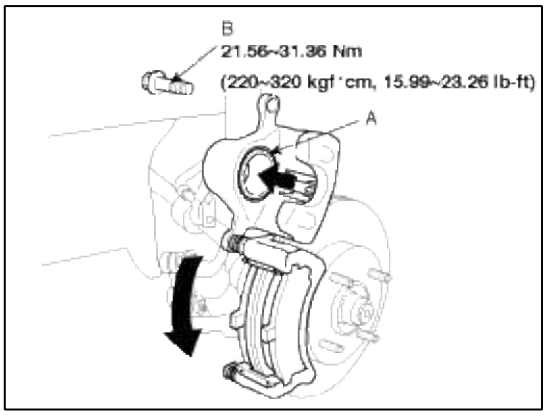


2. Check the foreign material at the pad shim (A) and the back of the pads (B).



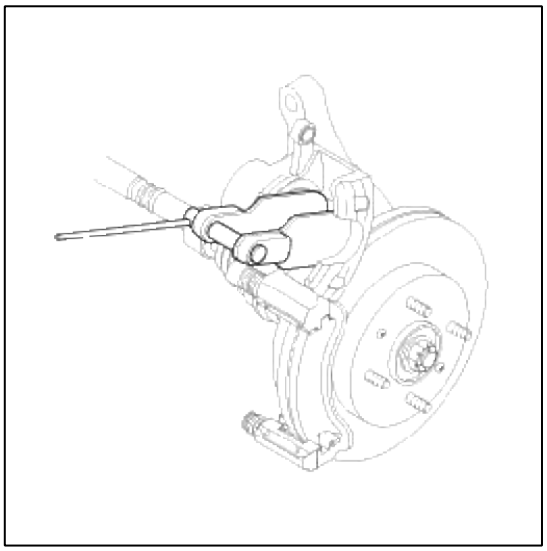
3. Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.

4. Install the brake pads (B) and pad shims (A) 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 position to prevent a momentary loss of braking efficiency.
5. Push in the piston (A) 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 (B) and torque it to proper specification



NOTE

Insert the piston in the cylinder using the special tool(09581-11000).



7. Depress the brake pedal several time 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.

8. After installaion, check for leaks at hose and line joints or connections, and retighten if necessary.

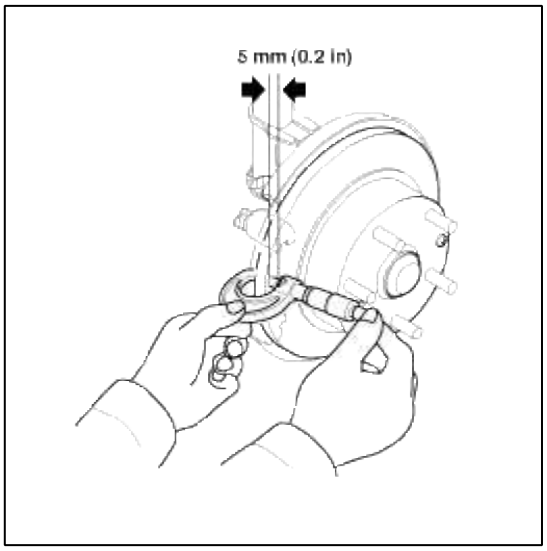
INSPECTION

REAR BRAKE DISC THICKNESS CHECK

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 points, al least, of the same distance (5 mm) from the brake disk outer circle.

Rear brake disc thickness
Standard value : 10.0 mm (0.39 in.)
Limit : 8.0 mm (0.315 in.)

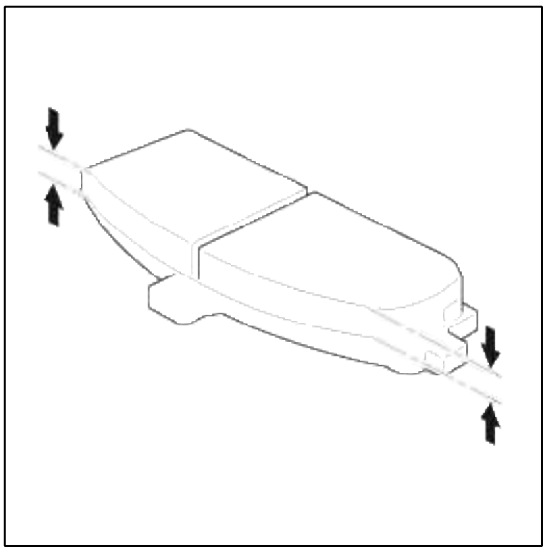
2. Thickness variation should not exceed 0.005 mm(0.0002 in.) (circumference) and 0.01 mm(0.0004 in.) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly for left and right of the vehicle.



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.)

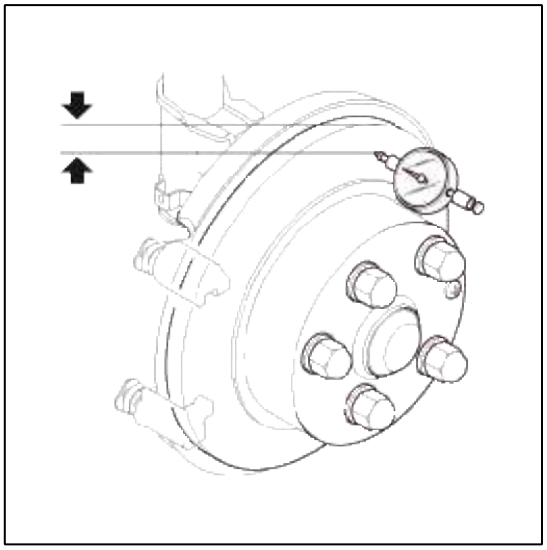


2. Check that grease is applied, and the pad and backing metal for damage.

REAR BRAKE DISC RUN OUT CHECK

1. Place a dial gauge 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 : 0.1 mm (0.004 in.) or less



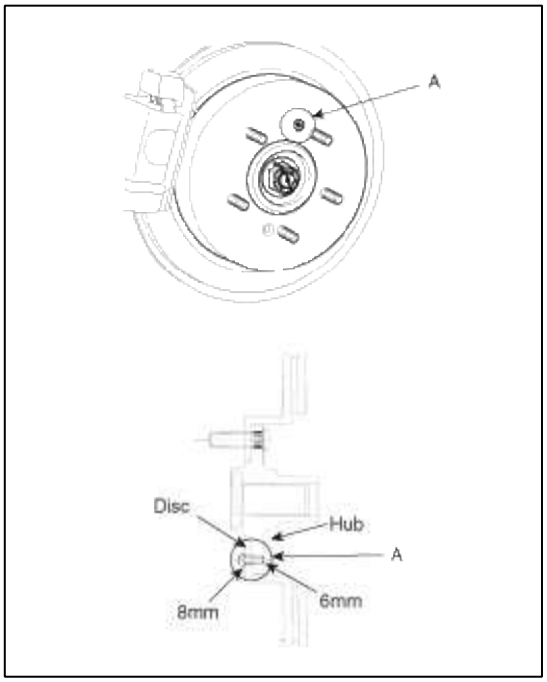
2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

Seize of 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.

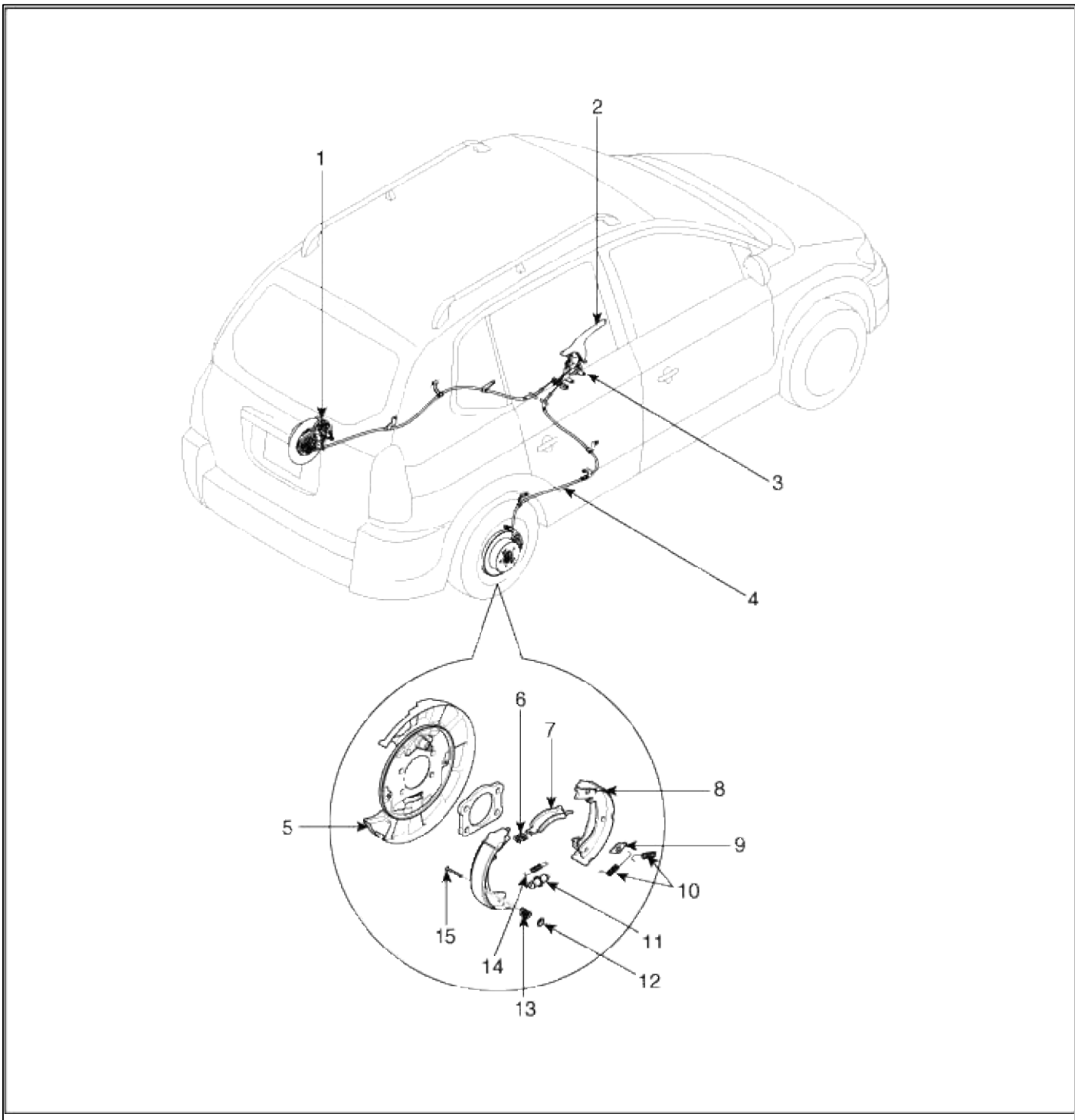
NOTE

Be careful not to use the hammer. The disc can be damaged if you remove the disc from the hub by hammer.



Brake System > Parking Brake System > Components and Components Location

COMPONENTS



1. Rear brake caliper
2. Parking brake lever
3. Parking brake switch
4. Parking brake cable
5. Backing plate
6. Thrust spring
7. Thrust
8. Shoes & linings
9. Shoe guide
10. Return spring
11. Adjuster
12. Cup washer
13. Shoe hold down spring
14. Return spring
15. Shoe hold down pin

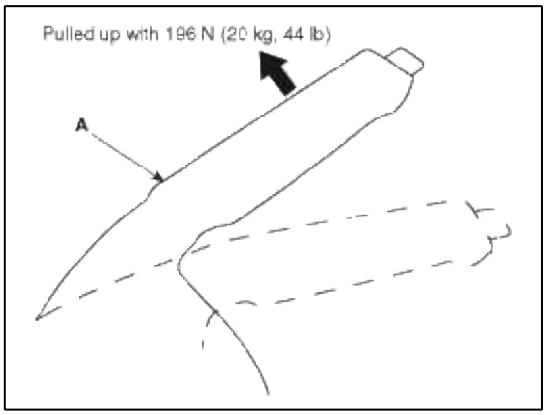
Brake System > Parking Brake System > Repair procedures

Parking brake check and adjustment

INSPECTION

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.

Lever locked clicks:7~8



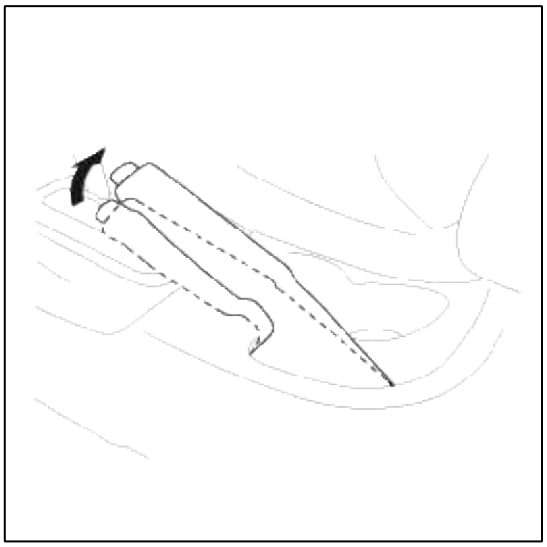
2. Adjust the parking brake if the lever clicks are out of specification.

ADJUSTMENT

NOTE

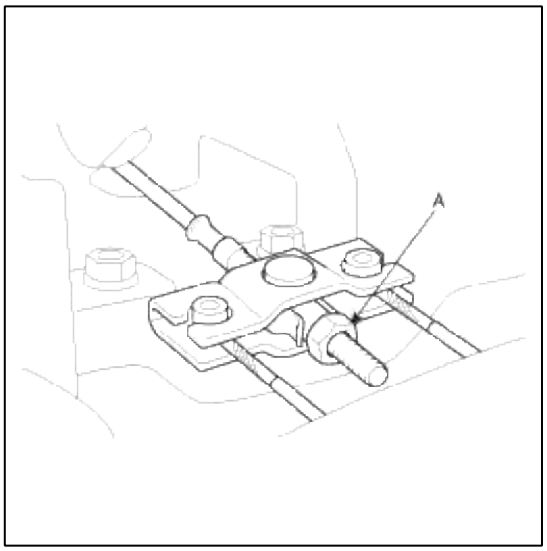
After rear brake caliper servicing, loosen the parking brake adjusting nut, start the engine and depress the brake pedal several times to set the self-adjusting brake before adjusting the parking brake.

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.



3. Remove the floor console.

4. Tighten the adjusting nut (A) until the parking brakes are dragged slightly when the rear wheels are turned.

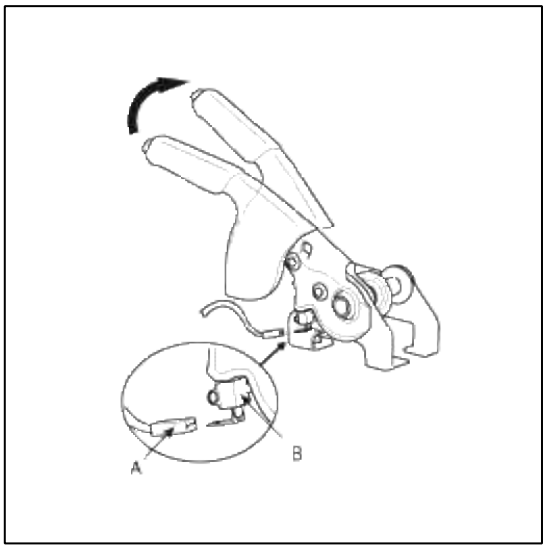


5. Release the parking brake lever completely, and check if parking brakes are not dragged when the rear wheels are turned. Readjust if necessary.
6. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up completly.
7. Reinstall the floor console.

Brake System > Parking Brake System > Parking Brake Switch > Repair procedures

INSPECTION

1. Remove the floor console and the switch (B) from the connector (A).



2. Inspect the continuity between (-) terminal and the ground.
   A. When the brake lever is pulled, there should be the continuity between them.
   B. When the brake lever is released, there should be no continuity between them.

Brake System > Parking Brake System > Parking Brake Assembly > Repair procedures

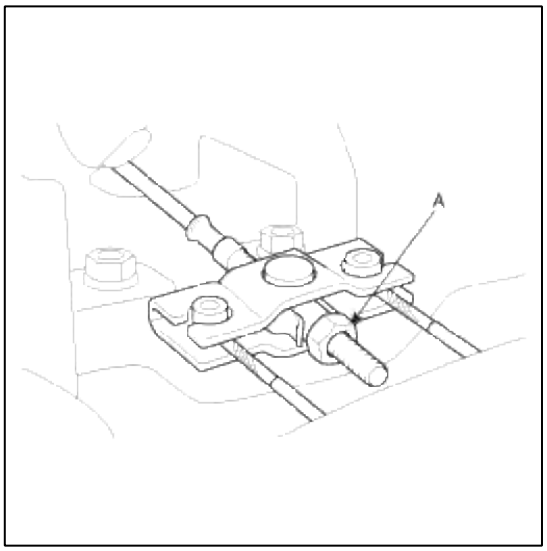
REMOVAL

NOTE

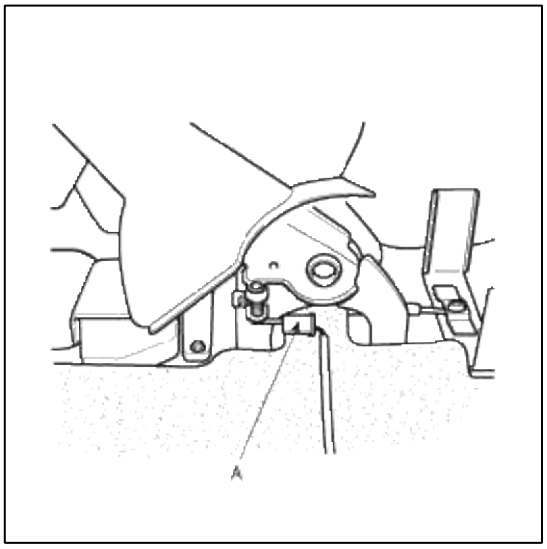
The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

1. Remove the floor console.

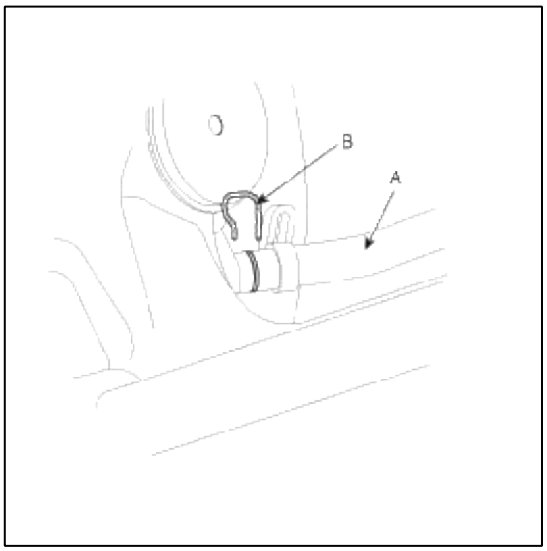
2. Loosen the adjusting nut (A) and remove the parking brake cables.



3. Disconnect the connector(A) of the parking brake switch connector.



4. Remove the bolts and parking brake lever assembly(A).
5. Remove the wheel and tire.
6. Remove the parking brake cable from the brake shoe.
7. Remove the parking brake cable retaining ring (B), from the parking brake cable (A).



8. Remove the parking brake cable assembly.

INSTALLATION

1. Install the removed parts in the reverse order of removal.
2. Apply the specified grease to each sliding parts of the ratchet plate or the ratchet pawl.

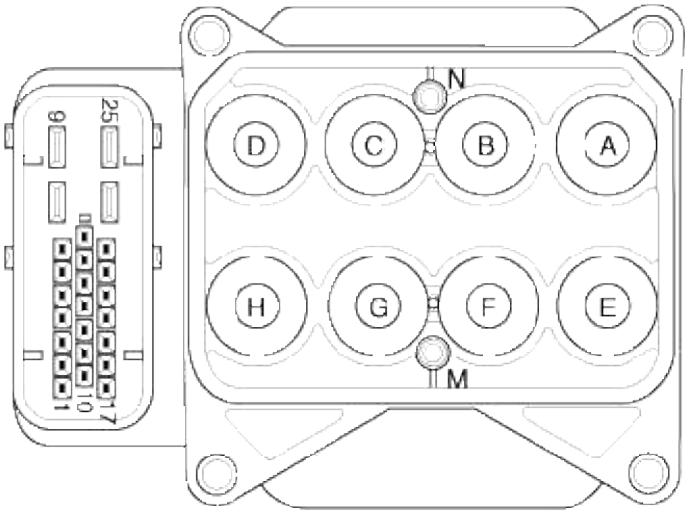
Specified grease :
Multi purpose grease SAE J310, NLGI No.2

3. After installing the parking brake cable adjuster, adjust the parking brake lever stroke (Refer to the parking brake check and adjustment).

Brake System > ABS(Anti-Lock Brake System) > Schematic Diagrams

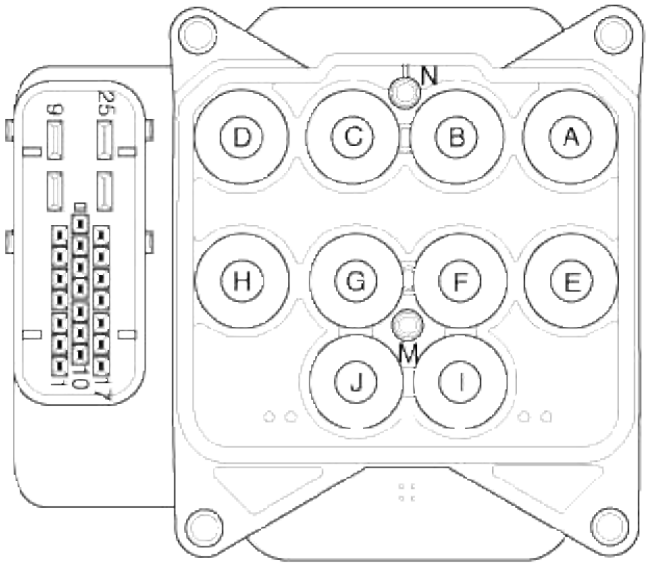
HECU EXTERNAL DIAGRAM

[ABS ECU]



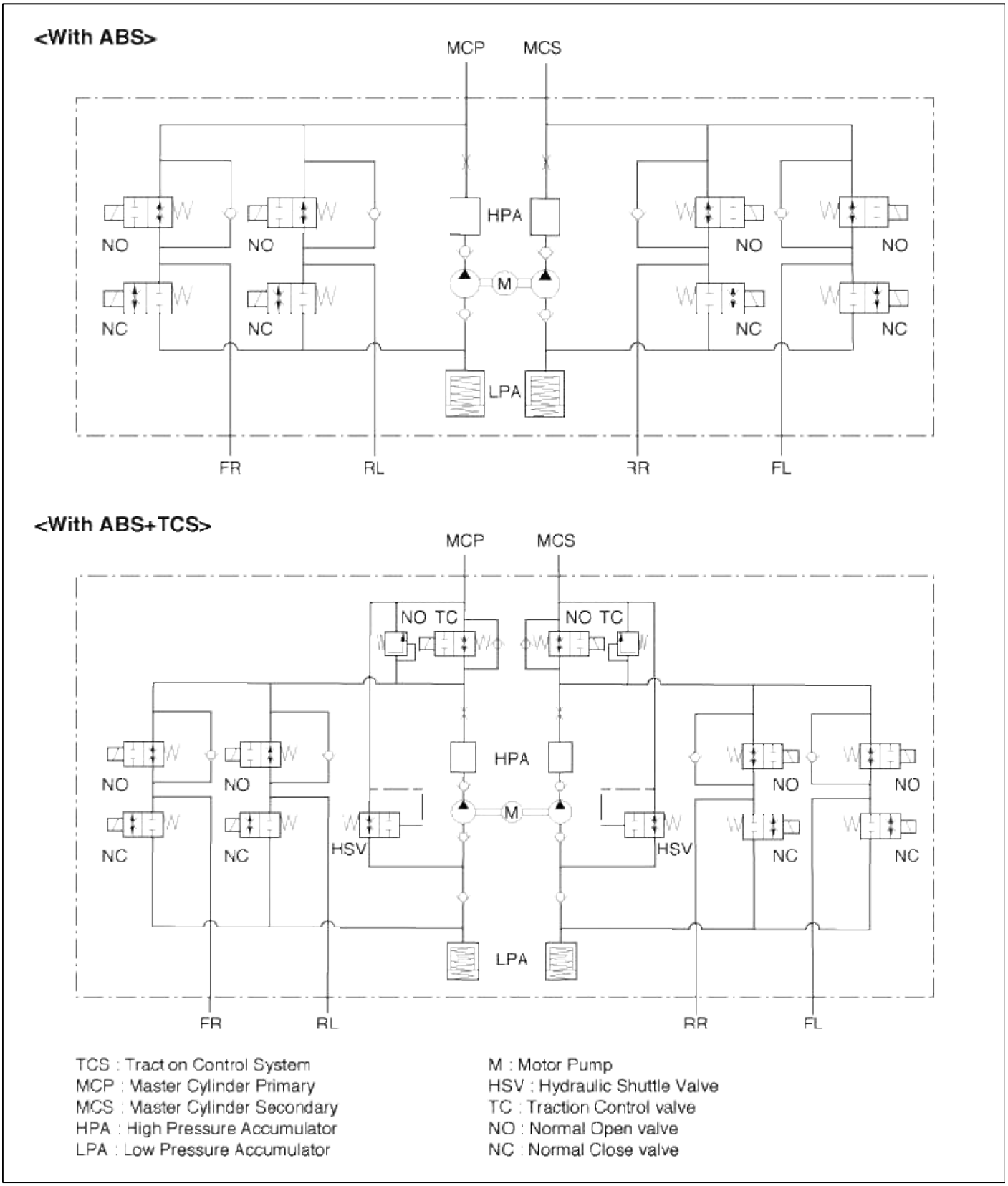
A : INLET VALVE(FR)
B : INLET VALVE(RL)
C : INLET VALVE(RR)
D : INLET VALVE(FL)
E : OUTLET VALVE(FR)
F : OUTLET VALVE(RL)
G : OUTLET VALVE(RR)
H : OUTLET VALVE(FL)
M : MOTOR(+)
N : MOTOR(GND)

[TCS ECU]

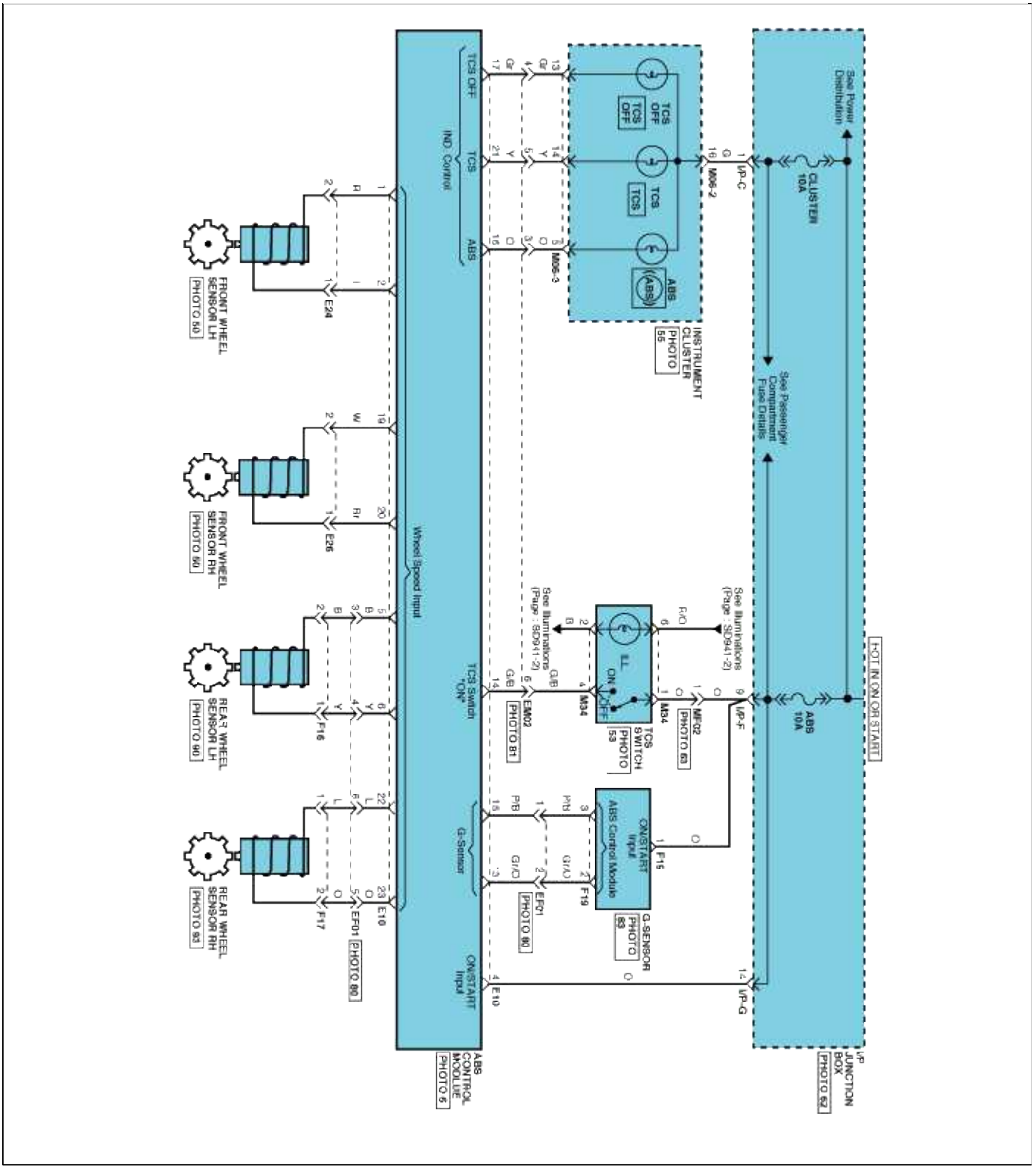


A : INLET VALVE(FR)
B : INLET VALVE(RL)
C : INLET VALVE(RR)
D : INLET VALVE(FL)
E : OUTLET VALVE(FR)
F : OUTLET VALVE(RL)
G : OUTLET VALVE(RR)
H : OUTLET VALVE(FL)
I : TRACTION VALVE(TCR)
J : TRACTION VALVE(TCL)
M : MOTOR(+)
N : MOTOR(GND)

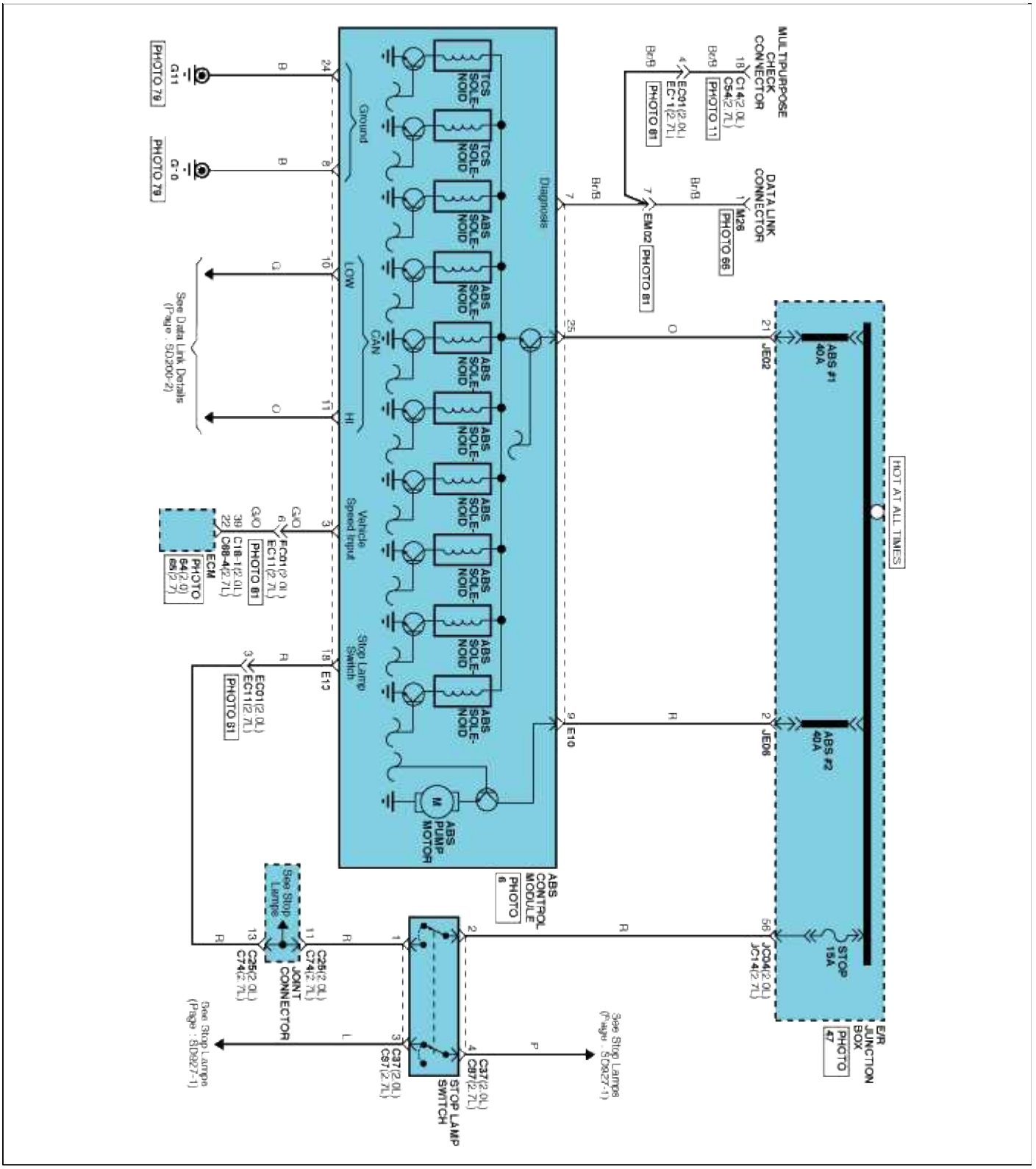
HYDRAULIC SYSTEM DIAGRAM



CIRCUIT DIAGRAM(1)-ABS/TCS



CIRCUIT DIAGRAM(2)-ABS/TCS



ABS/TCS CONNECTOR INPUT/OUTPUT

Connector Terminal		Specification	Remark
No	Description		
4	IGNITION1( )	Over voltage range: 16.5 ± 0.5 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 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	
3	SENSOR FRONT RIGHT OUTPUT	Max current : I < 2 mA External pull up resister : 10 KΩ < R Output duty : 50 ± 20 %	
16	ABS/EBD W/LAMP DRIVE	Max. current: I < 200 mA Max. output low voltage : V < 1.2 V	
17	TCS W/LAMP DRIVE		with TCS
21	TCS F/LAMP DRIVE		with TCS
14	TCS 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	with TCS
11	CAN BUS LINE(HIGH)	Max. current : I < 10 mA	with TCS
10	CAN BUS LINE(LOW)		
1	SENSOR FRONT LEFT POWER	- Output voltage : IGN[V] ± 1 V - Output current : Max 30 mA	
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		
21	ABS ACTIVE SIGNAL	Max. current : I < 200 mA	with 4WD
13	G SENSOR SIGNAL	Input Voltage : 0 ≤ V ≤ 5.0 V	with 4WD
15	G SENSOR GROUND	Rated current : I < 10 mA	
7	DIAGNOSIS INPUT/OUTPUT	Input voltage : VIL < 0.3 IGN[V] VIH > 0.7 IGN[V] Output voltage : VOL < 0.2 IGN[V] VOH > 0.8 IGN[V]	

Brake System > ABS(Anti-Lock Brake System) > Description and Operation

DESCRIPTION

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)

This specification is for the wiring design and installation of ABS/TCS/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 16V), 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.

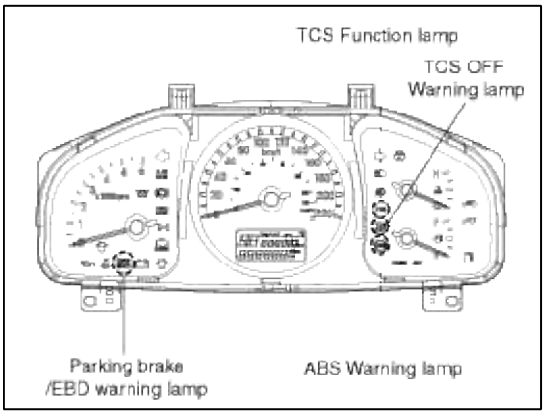
Pump Motor Checking

The ECU performs a pump motor test at a speed of 12km/h 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).



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 Warning Lamp / parking brake 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.

TCS Warning Lamp (TCS system)

The TCS warning lamp indicates the self-test and failure status of the TCS.

The TCS 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 TCS functions by failure.
- When driver trun off the TCS function by on/off switch.
- During diagnostic mode.

TCS Function Lamp (TCS system)

The TCS function lamp indicates the self-test and operating status of the TCS.

The TCS Function lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the TCS control is operating. (Blinking - 2Hz)

TCS On/Off Switch (TCS system)

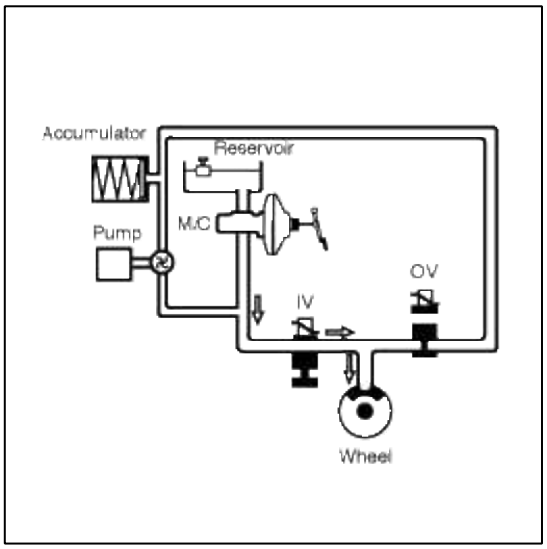
The TCS On/Off Switch shall be used to toggle the TCS function between On/Off states based upon driver input.
The On/Off switch shall be a normally open, momentary contact switch.
Closed contacts switch the circuit to ignition.
Initial status of the TCS function is on and switch toggle the state.

ABS, TCS CONTROL

1. NORMAL BRAKING without ABS

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	

When braking, the hydraulic pressure in the M/C is increased. The pressure reaches the wheel brake via the current less open inlet valve IV. The current less closed outlet valve OV is closed. For the sake of simplicity the diagram is limited to only the solenoid valve pair of one brake circuit. The wheel speed is reduced as the brake pressure increases, in the extreme case until the wheel locks.

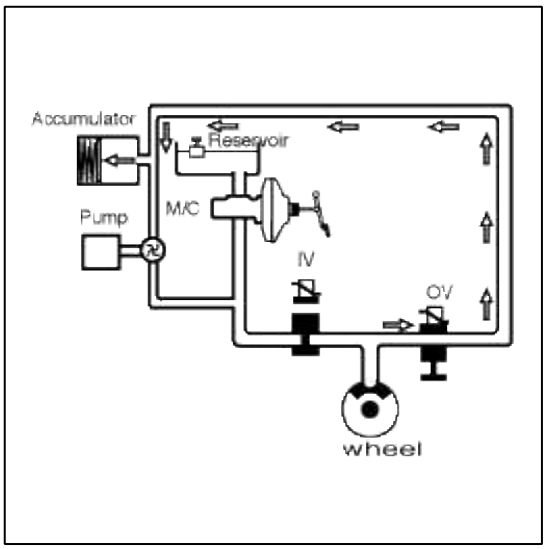


2. With ABS

(1) DUMP MODE

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	ON	CLOSE	Master cylinder Wheel cylinder	ON
Outlet valve (NC)	ON	OPEN	Wheel cylinder Reservoir	

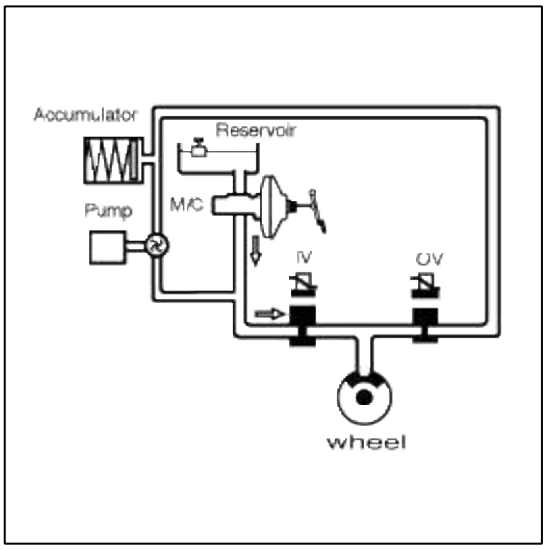
If the wheel speed decreases, there is still a tendency to lock; the brake pressure on the corresponding wheel must be reduced accordingly. For this, the outlet valve OV is opened, the inlet valve IV remains closed.
The brake pressure to the low-pressure accumulator is reduced. The wheel in danger of locking gains speed again.



(2) HOLD MODE

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	ON	CLOSE	Master cylinder Wheel cylinder	OFF
Outlet valve (NC)	OFF	CLOSE	Wheel cylinder Reservoir	

When a wheel (or several) tends to lock the inlet valve IV is first closed to avoid a further increase in brake pressure. The outlet valve OV remains closed: the brake pressure is kept constant.



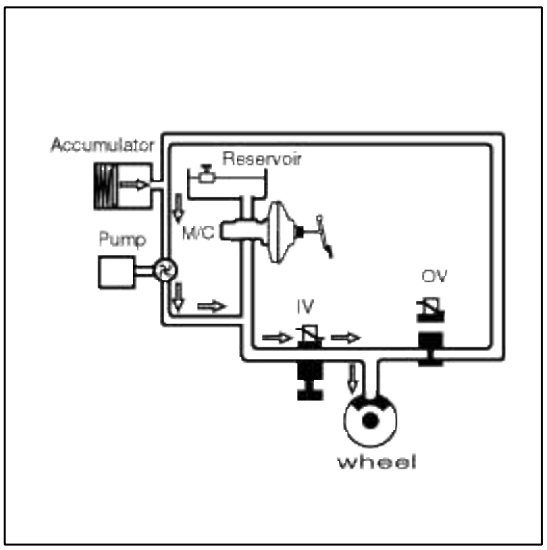
(3) INCREASE MODE

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	OPEN	Master cylinder Wheel cylinder	ON
Outlet valve (NC)	OFF	CLOSE	Wheel cylinder Reservoir	

For optimum brake from the certain wheel acceleration a brake pressure increase is necessary. For this, the inlet valve IV is opened and the outlet valve OV is closed. The pump of the unit starts to run and aspirates the necessary quantity of fluid from the Lowpressure accumulator, in order to produce the necessary brake pressure for the pressure increase phase in seconds.
With an increase in the brake pressure the wheel speed is reduced. These control phases are repeated until the ABS control unit no longer detects any tendency of the wheels to lock.

NOTE

During ABS control function, the brake pedal only moves in accordance with the volume requirement of the wheels. Becauseof a sudden change in friction coefficient this pedal movement may increase slightly.



3. Fail Safe Function
If there is a problem with the ABS system, the Failsafe function operates, turning off the relay which supplies the power to the solenoid valve, stoping the output of the control signal, and turning on the ABS warning lamp in order to warn the user of malfunction of the ABS system.
Conventional brake system operates under the circumstance.

TRACTION CONTROL SYSTEM (TCS)

FUNCTION

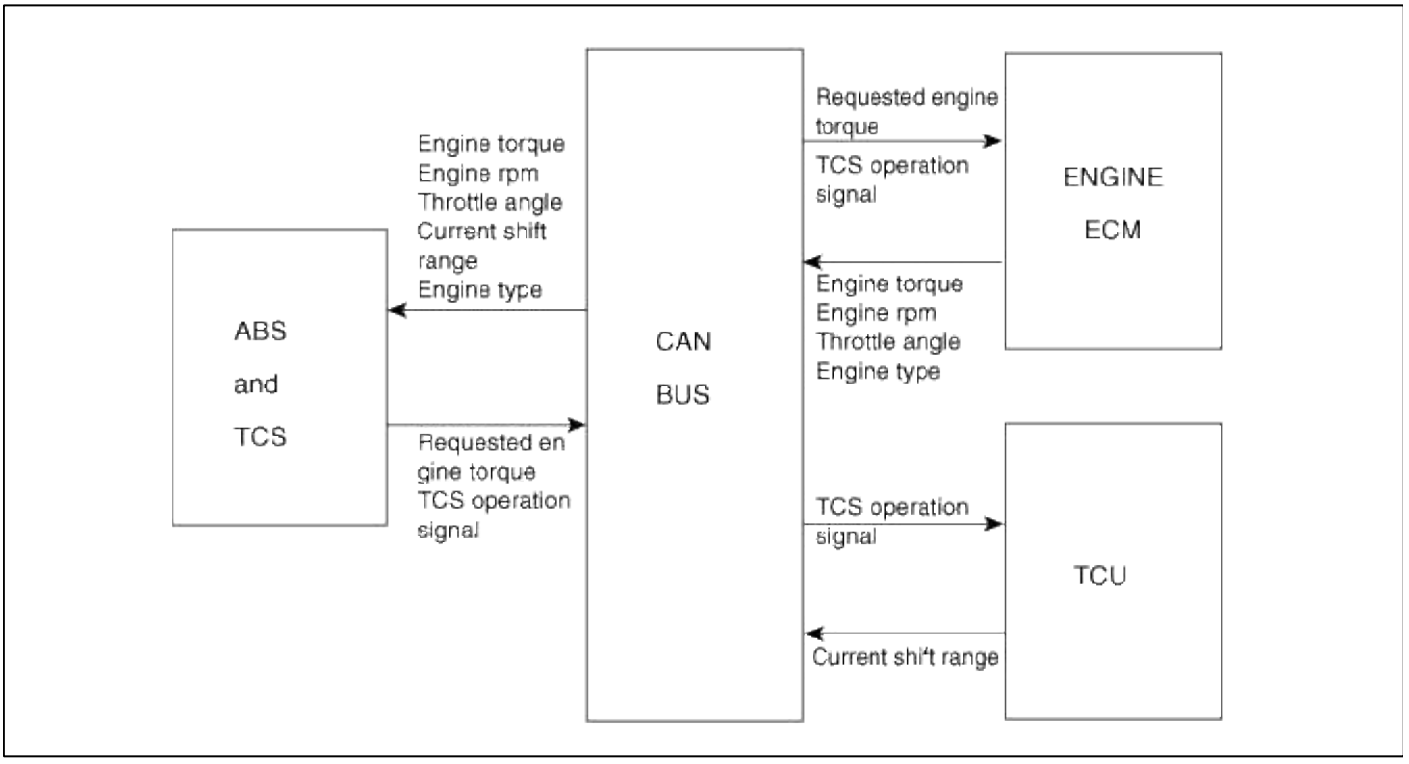
1. Main performance
A. Traction: Lower vibration and higher launchability, acceleration and climbability by slip control.
B. Cornering and passing: Stable cornering and passing.
C. Steering stability: Control traction force traverse vector prior to provide easy turning when turning the steering wheel.

2. General TCS features
   A. Improved drivability. Minor operation of acceleration is not necessary in launching and acceleration on slippery road.
   B. More stable cornering by stable acceleration on normal road condition.
   C. TCS system will compare vehicle speed received from rear wheel speed sensor and driving wheel speed from front wheel speed sensor on slippery road condition, and provide optimum slipping rate of driving wheels.

TYPE

FULL TRACTION CONTROL SYSTEM (FTCS)

1. The TCS control module (HECU) controls TCS control. It includes ABS control module.
2. HECU will compare signals from front (driving) and rear wheel speed sensors to detect driving wheels slip.
3. Upon detecting driving wheels slip, HECU will perform TCS control. The TCS control will include brake TCS (BTCS) control.
4. HECU will transmit engine torque reduction request, fuel cut cylinder number, and TCS control request signals in accordance with slip level to engine ECM and TCM through BUS line which will provide CAN communication for TCS control.
5. Engine ECM will perform fuel cut as requested by HECU and retard ignition timing as per engine torque reduction request signal.
6. TCM will hold shift position by TCS control time according to TCS operation signal. Then enhanced acceleration by kick-down will not occur.



BRAKE TRACTION CONTROL SYSTEM (BTCS)

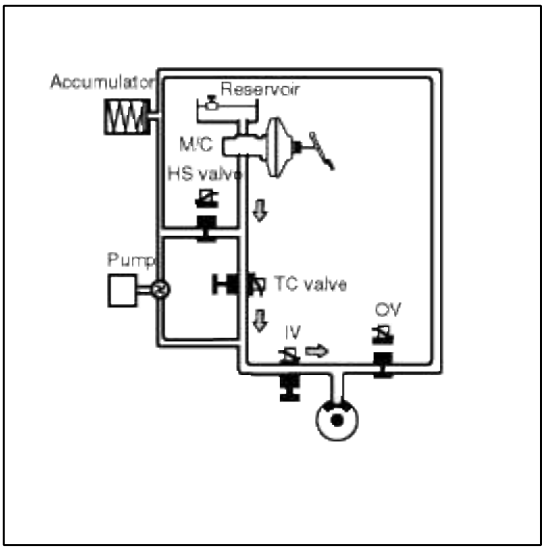
1. On TCS control, only brake control will be performed. (engine and TCM control will not happen)
2. Controlled by motor pump output pressure.

TRACTION CONTROL SYSTEM (TCS)

1. NORMAL MODE

Solenoid valve	State	Valve	Motor pump	TC valve
Inlet (NO)	OFF	OPEN	OFF	OFF
Outlet (NC)	OFF	CLOSE		

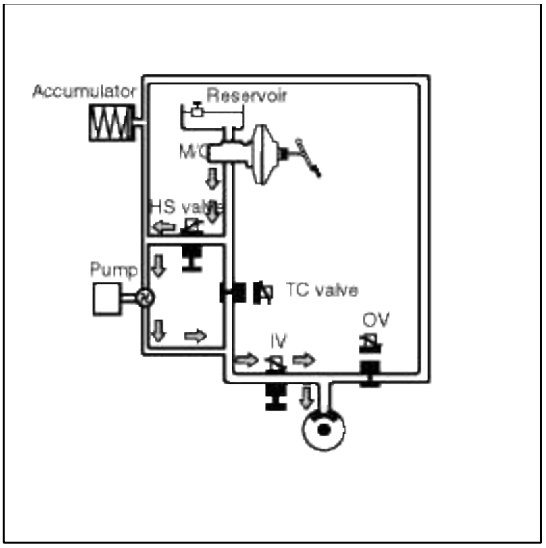
A. In the normal driving condition, TC valve (normally open) is the passage between the master cylinder and the each wheel cylinder.
B. When brake pedal is applied, brake pressure is delivered to the wheel cylinders via NO-TC valve and all solenoid valves inside the hydraulic unit are deactivated.
C. In case of TCS malfunction, it does not affect brake operation.



2. PRESSURE INCREASE MODE

Solenoid valve	State	Valve	Motor pump	TC valve
Inlet (NO)	FRONT: OFF REAR: ON	FRONT: OPEN REAR: CLOSE	ON	ON
Outlet (NC)	OFF	CLOSE		

A. If a front wheel spin is detected, TCS begins a brake control to decrease a wheel spin.
B. Hydraulic shuttle valve (HSV) is opened.
Brake fluid is supplied from the master cylinder by motor operation to the spin wheel via HSV.
C. TC valve is closed (ON).
Brake pressure generated from motor pump is delivered only to the front wheel.
D. Inlet valve remains open to deliver the brake pressure generated from motor pump to the spinning wheels.



3. PRESSURE DUMP MODE

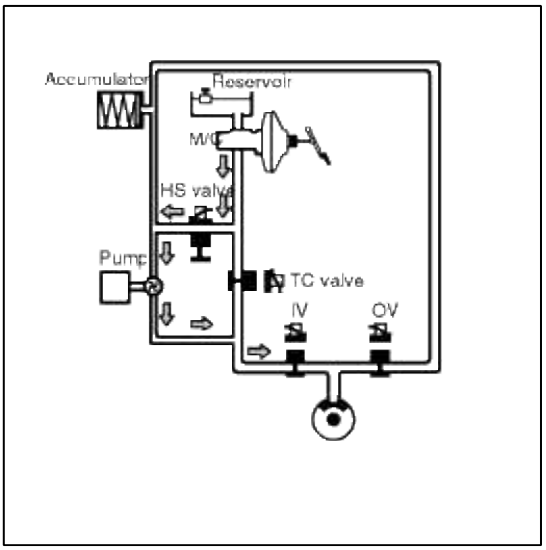
Solenoid valve	State	Valve	Motor pump	TC valve
Inlet (NO)	ON	CLOSE	ON	ON
Outlet (NC)	FRONT : ON REAR : OFF	FRONT : OPEN REAR : CLOSE		

A. When the wheel deceleration is under the threshold and the wheel spin is reduced under a slip threshold, applied brake pressure is reduced to get an optimum traction force.

B. Outlet valve is open to release the brake pressure and inlet valve is closed to block the pressure increase from the motor pump.

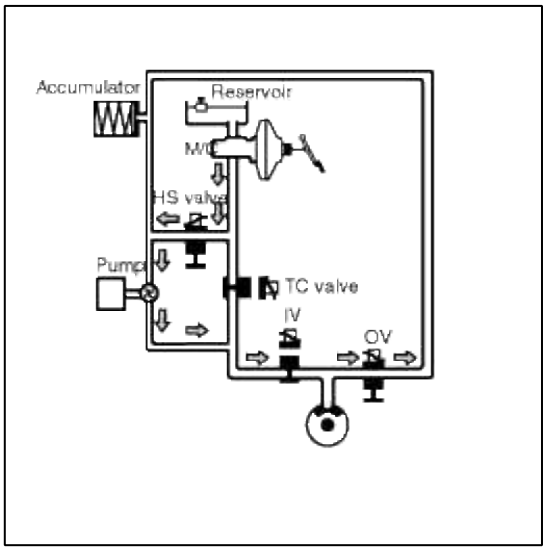
C. Hydraulic shuttle valve (HSV) remains opened, TC valve is ON.

D. Motor is ON, to dump the brake fluid being released from the lock-up wheel.



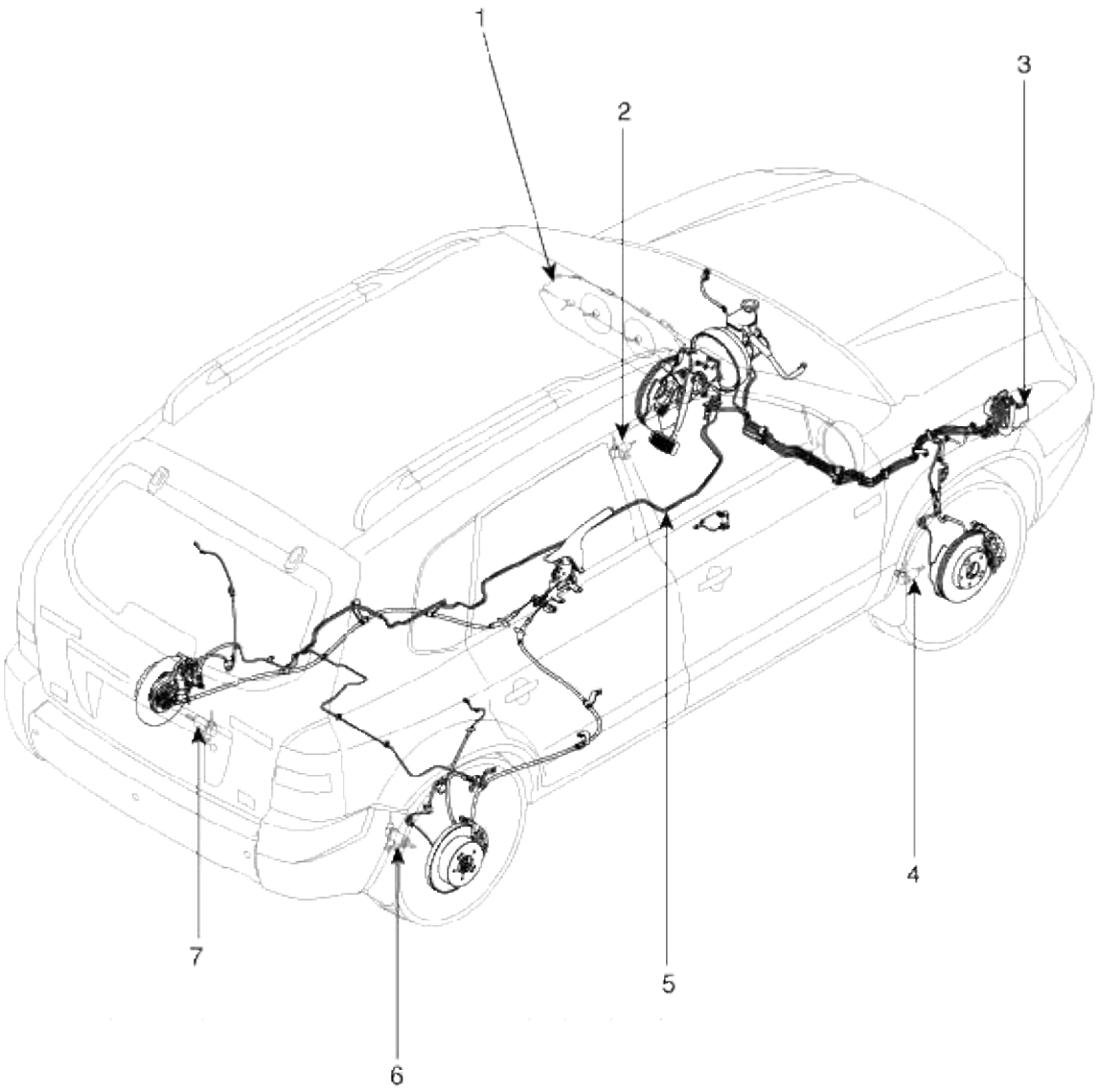
4. PRESSURE HOLD MODE

Solenoid valve	State	Valve	Motor pump	TC valve
Inlet (NO)	ON	CLOSE	ON	ON
Outlet (NC)	OFF	CLOSE		



Brake System > ABS(Anti-Lock Brake System) > Components and Components Location

COMPONENTS

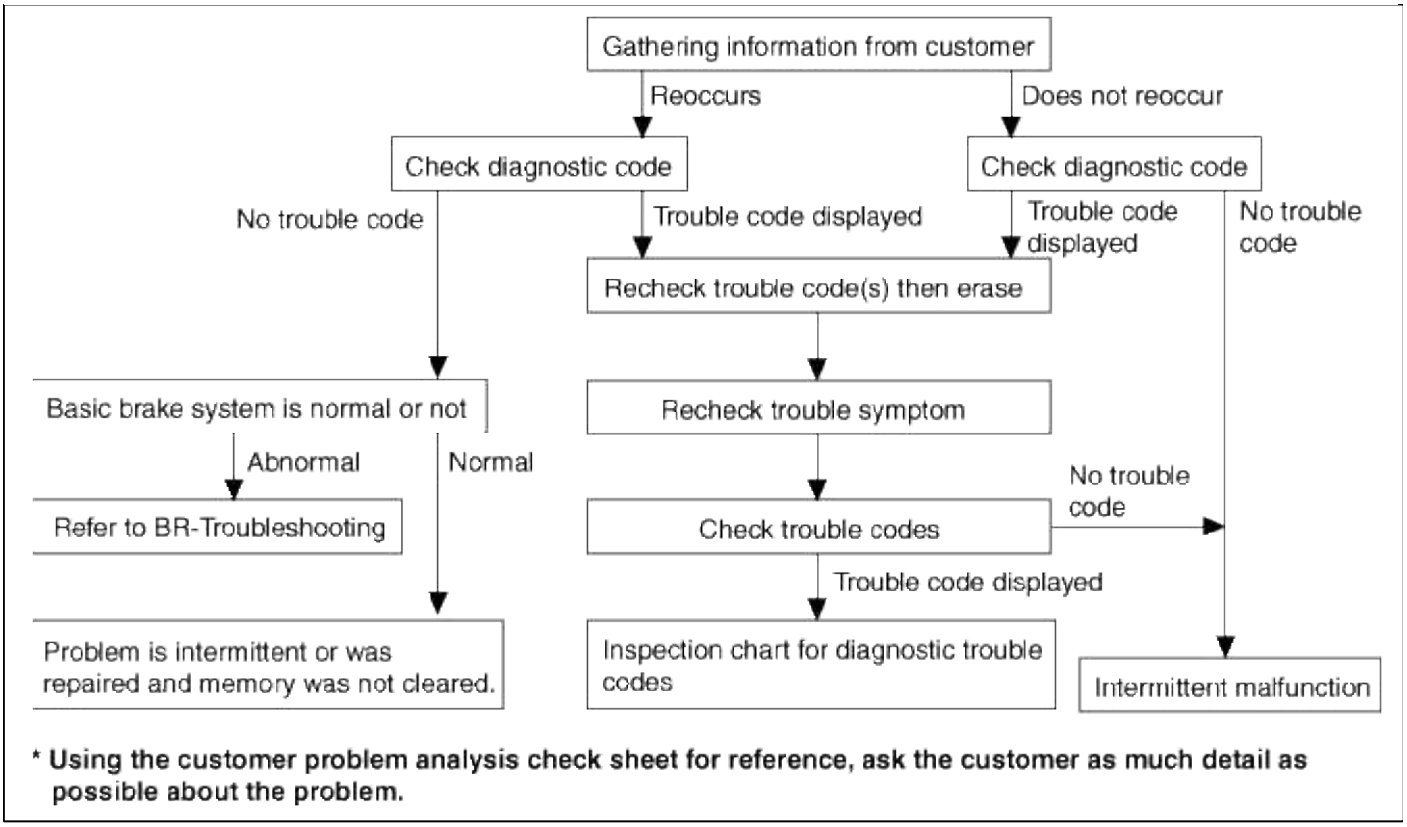


1. Cluster
   - ABS Warning lamp
   - EBD/Parking brake warning lamp
2. Front left wheel speed sensor
3. ABS control module (HECU)
4. Front right wheel speed sensor
5. Hydraulic line
6. Rear right wheel speed sensor
7. Rear left wheel speed sensor

Brake System > ABS(Anti-Lock Brake System) > Troubleshooting

TROUBLESHOOTING

STANDARD FLOW OF DIAGNSTIC TROUBLESHOOTING



NOTES WITH REGARD TO DIAGNOSIS

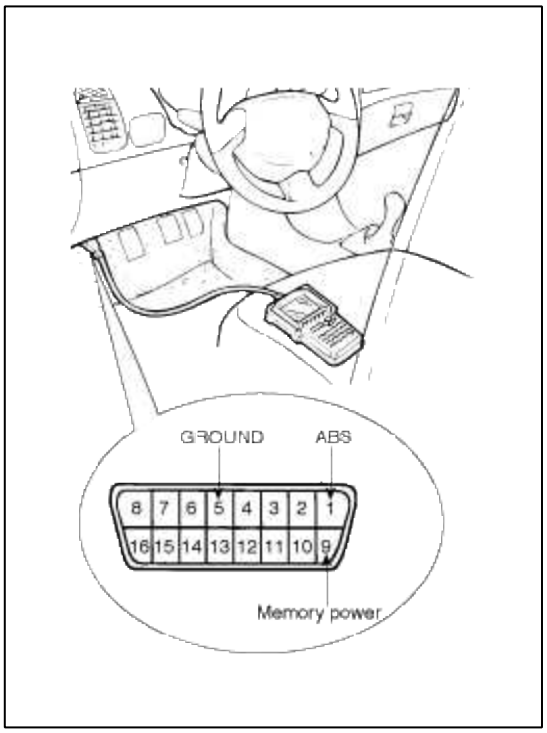
The phenomena listed in the following table are not abnormal.

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.	

HI-SCAN (PRO) CHECK

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.



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.

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)

PROBLEM SYMPTOMS TABLE

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 - 75
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 - 77
Communication with Hi-scan (pro) is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line	BR - 79
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 - 80
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU	BR - 81
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU	BR - 82
Brake warning lamp is abnormal.	1. Brake oil level sensor 2. Parking brake switch 3. Brake warning lamp circuit	BR - 83

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

1. CHECK THE DTC RECONFIRMING THAT THE NORMAL CODE IS OUTPUT.

1. Connect the Hi-Scan (pro) w th the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.

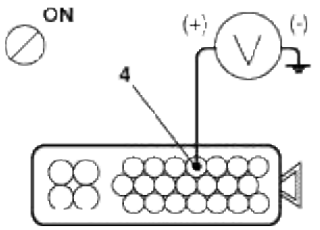
Is the normal code output?

Yes	No	Erase the DTC and recheck using Hi-Scan (pro).

2. 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+**



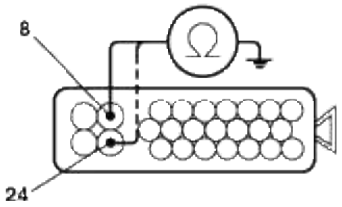
Is the voltage within specification?

Yes	No	Check the harness or connector between the fuse (10A) in the passenger compartment junction block and the ABS control module. Repair if necessary.

3. 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	No	Repair an open in the wire and ground point.

4. CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.

OK	NG	Repair or replace the wheel speed sensor.

5. CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.

OK	NG	Repair the hydraulic lines for leakage.

The problem is still occurring, replace the ABS control module.

ABS Does Not Operate Intermittently

1. CHECK THE DTC RECONFIRMING THAT THE NORMAL CODE IS OUTPUT.

1. Connect the Hi-Scan (pro) to the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.

Is the normal code output?

Yes	No	Erase the DTC and recheck using Hi-Scan (pro).

2. CHECK THE WHEEL SPEED SENSOR CIRCUIT.

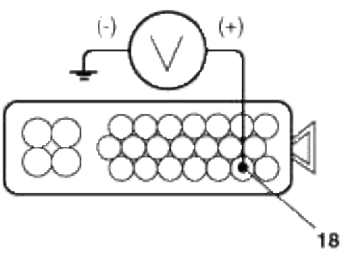
Refer to the DTC troubleshooting procedures.

OK	NG	Repair or replace the wheel speed sensor.

3. 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	No	Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.

4. CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines (Refet to BR-17).

OK	
NG	Repair the hydraulic lines for leakage.

If the problem still occurs, replace the ABS control module.

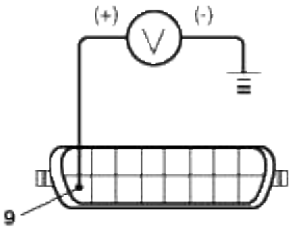
Communication With Hi-Scan (pro) Is Not Possible.
(Communication With Any System Is Not Possible)

1. 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?

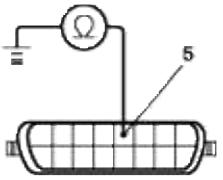


Yes	
No	Repair an open in the wire. Check and replace fuse (15A) from the passenger compartment junction block

2 . 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.

Communication With Hi-Scan (pro) Is Not Possible.
(Communication With ABS Only Is Not Possible)

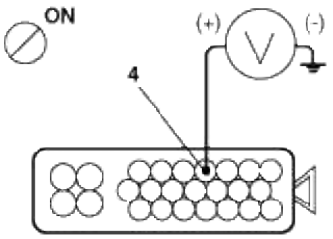
1. CHECK FOR CONTINUITY IN THE DIAGNOSIS LINE

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	No	Repair an open in the wire.

2. CHECK THE POWER SOURCE OF ABS CONTROL MODULE



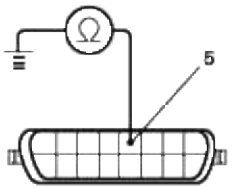
1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 4 of the ABS control module harness side connector and body ground.

- **Specification: approximately B+**

Is voltage within specification?

Yes	No	Check the harness or connector between the fuse (10A) in the passenger compartment junction block and the ABS control module. Repair if necessary.

3 . CHECK FOR POOR GROUND



Check for continuity between terminal 5 of the data link connector and ground point.

Is there continuity?

Yes	No	Repair an open in the wire or poor ground.

Replace the ABS control module and recheck.

When Ignition Key Is Turned ON (Engine OFF), The ABS Warning Lamp Does Not Light Up.

1 . PROBLEM VERIFICATION

Disconnect the connector from the ABS control module and turn the ignition switch ON.

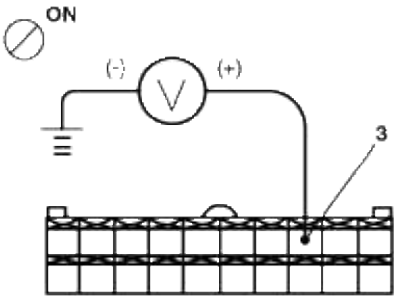
Does the ABS warning lamp light up?

No	Yes	Check for short circuit in the ABS control module connector.

2 . 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 3 of the cluster harness side connector and body ground.

- **Specification: approximately B+**



Is voltage within specification?

No	Yes	Repair bulb or instrument cluster assembly.

3 . CHECK FOR BLOWN FUSE

Check continuity of fuse (10A) from the passenger compartment junction block.

Is there continuity?

Yes	No	Replace the blown fuse.

Repair an open in the wire between terminals 12 of I/P-H connector and 3 of cluster connector.

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

1 . 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	Yes	Repair circuit indicated by code output.

2 . CHECK INSTRUMENT CLUSTER

Disconnect the cluster connector and turn the ignition switch ON.

Does the ABS warning lamp remains ON?

No	Yes	Replace the instrument cluster.

3 . CHECK FOR OPEN IN THE WIRE

Check for continuity in the wire between cluster and ABS control module.

Is there continuity?

Yes	No	Repair an open in the wire between cluster and ABS control module.

Replace the ABS control module and recheck.

Brake Warning Lamp Is Abnormal

1. CHECK PARKING BRAKE SWITCH CIRCUIT

OK	NG	Repair or replace parking brake switch circuit.

2. CHECK BRAKE OIL LEVEL WARNING SWITCH CIRCUIT		
OK	NG	Repair or replace brake oil level warning switch circuit.

3. CHECK BRAKE WARNING LAMP CIRCUIT IN CLUSTER		
OK	NG	Repair or replace the instrument cluster.

4. CHECK FOR OPEN OR SHORT CIRCUIT IN HARNESS AND CONNECTOR		
OK	NG	Repair or replace the harness and connector.
Replace the ABS control module and recheck.		

BLEEDING OF BRAKE SYSTEM

This procedure should be followed to ensure adequate bleeding of air and filling of the ABS unit, brake lines and master cylinder with brake fluid.

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

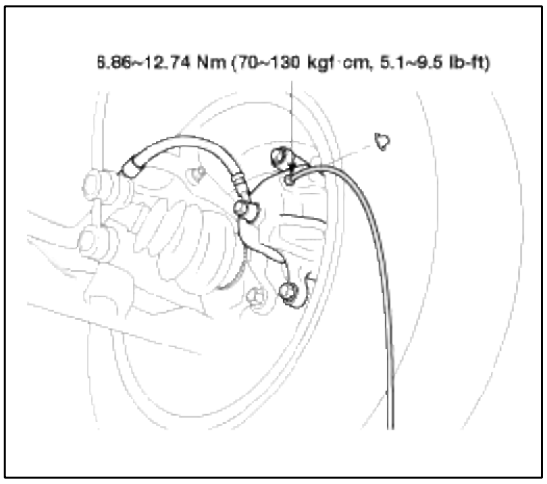
CAUTION

If there is any brake fluid on any painted surface, wash it off immediately.

NOTE

When pressure bleeding, do not depress the brake pedal.
Recommended fluid..... DOT3 or DOT4

2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.



3. Connect the hi-scan (pro) to the data link connector located underneath the dash panel.

4. 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.

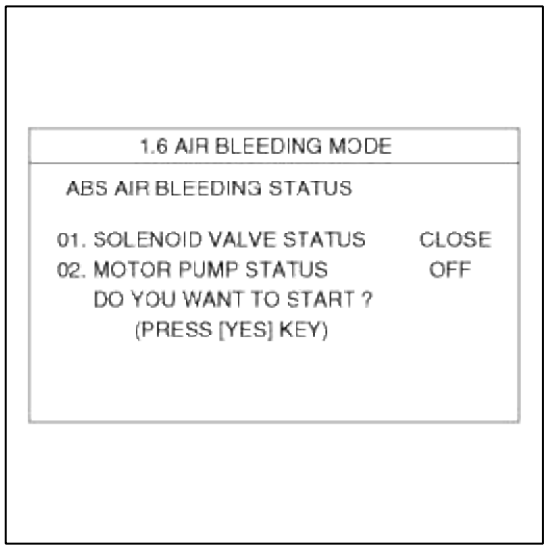
(1) Select kia vehicle diagnosis.

(2) Select vehicle name.

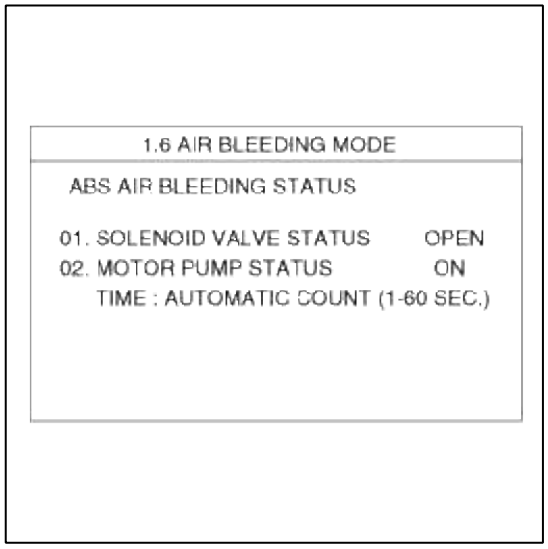
(3) Select Anti-Lock Brake system.

(4) Select air bleeding mode.

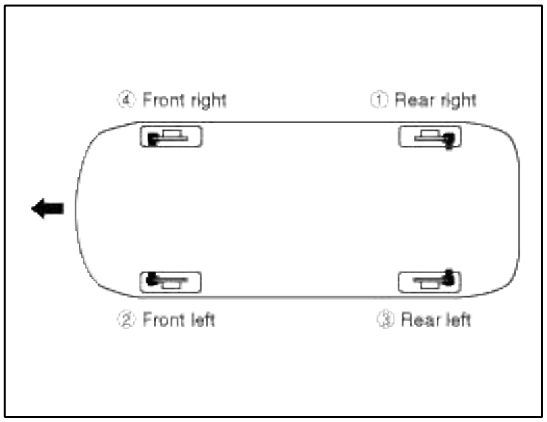
(5) Press "YES" to operate motor pump and solenoid valve.



(6) Wait 60 sec. before operating the air bleeding.
(If not, you may damage the motor.)



5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.
6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

Bleed screw tightening torque:
6.86~12.74 Nm (70 ~130 kgf·cm, 5.1 ~ 9.5 lb·ft)

DIAGNOSTIC TROUBLE CODE CHART (DTC)

Follow an inspection procedure of a detected DTC in the chart below.

NOTE

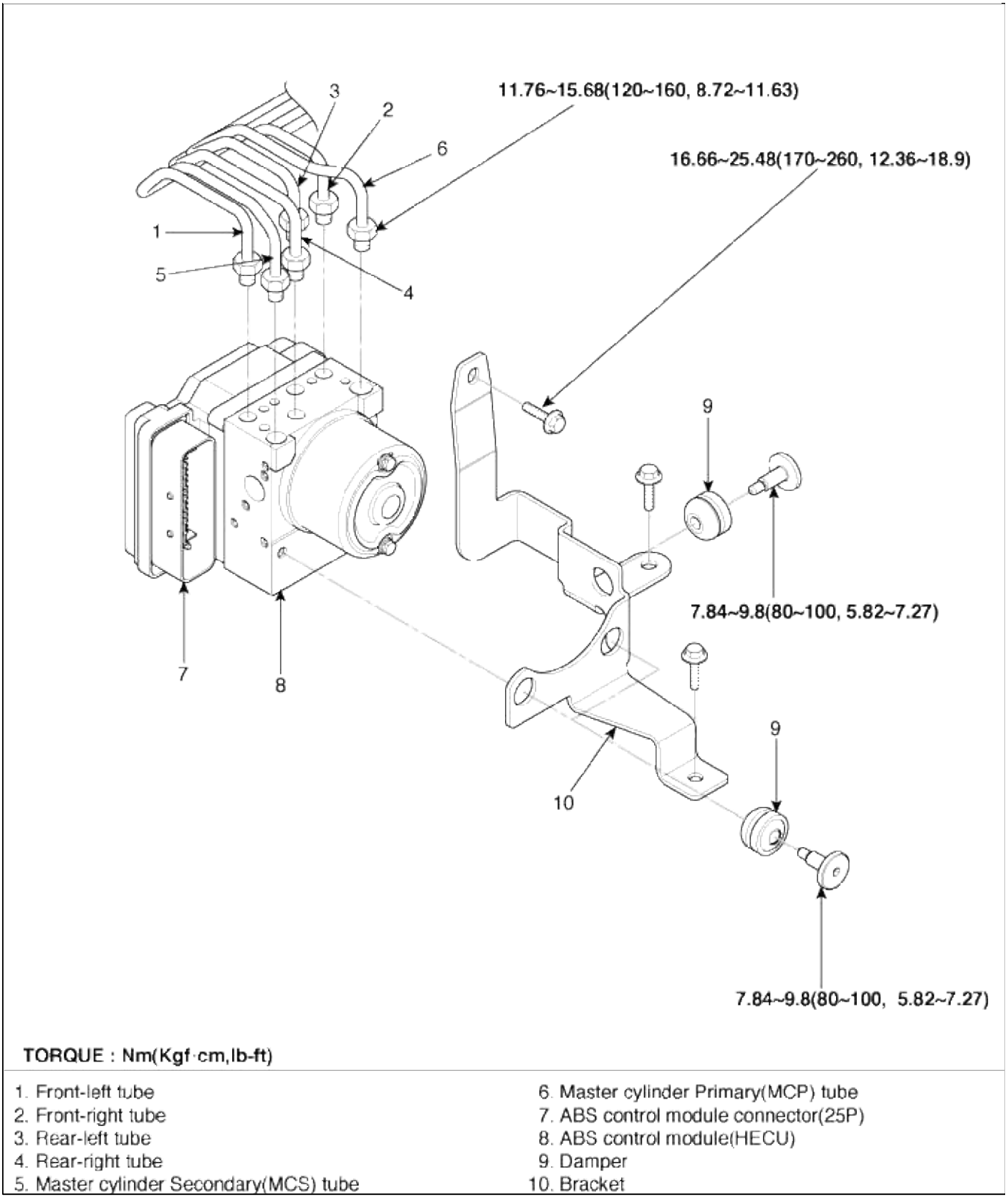
EBD Δ - warning lamp "ON", in case of errors on more than 2 wheels.

DTC	DESCRIPTION	WARNING LAMP "ON"				DTC MEMORY	REMARK	SEE PAGE
		ABS	EBD	TCS	ESP			
C1101	Battery voltage high	○	○	○	○	○		BR-84
C1102	Battery voltage low	○	○	○	○	○		BR-87
C1200	Wheel speed sensor FR-LH open/short	○	○	○	○	○		BR-89
C1201	Wheel speed sensor FR-LH range/performance/intermittent	○	Δ	○	○	○		BR-91
C1202	Wheel speed sensor FR-LH invalid/no signal	○	Δ	○	○	○		BR-95
C1203	Wheel speed sensor FR-RH open/short	○	Δ	○	○	○		BR-89
C1204	Wheel speed sensor FR-RH range/performance/intermittent	○	Δ	○	○	○		BR-91
C1205	Wheel speed sensor FR-RH invalid/no signal	○	Δ	○	○	○		BR-95
C1206	Wheel speed sensor RR-LH open/short	○	Δ	○	○	○		BR-89
C1207	Wheel speed sensor RR-LH range/performance/intermittent	○	Δ	○	○	○		BR-91
C1208	Wheel speed sensor RR-LH invalid/no signal	○	Δ	○	○	○		BR-95
C1209	Wheel speed sensor RR-RH open/short	○	Δ	○	○	○		BR-89
C1210	Wheel speed sensor RR-RH range/performance/intermittent	○	Δ	○	○	○		BR-91
C1211	Wheel speed sensor RR-RH invalid/no signal	○	Δ	○	○	○		BR-95
C1604	ECU hardware error	○	○	○	○	○		BR-98
C2112	Valve relay error	○	○	○	○	○		BR-99
C2380	ABS/TCS/ESP valve error	○	○	○	○	○		BR-101
C2402	Motor - electrical	○	×	○	○	○		BR-103
C1274	G sensor - electrical	○	×	○	○	○	4WD	BR-106
C1275	G sensor - signal	○	×	○	○	○	4WD	BR-108
C1503	TCS/ESP switch error	×	×	○	○	○	TCS/ESP	BR-110
C1605	CAN harware error	×	×	○	○	○	TCS/ESP	BR-113

C1611	CAN time-out EMS	×	×	○	○	○	TCS/ESP	BR-114
C1612	CAN time-out TCU	×	×	○	○	○	TCS/ESP	BR-115
C1613	CAN wrong message	×	×	○	○	○	TCS/ESP	BR-116
C1616	CAN bus off	×	×	○	○	○	TCS/ESP	BR-117
C2227	Excessive temperature of brake disc	×	×	○	○	○	TCS/ESP	BR-118
C1112	Sensor source voltage	×	×	○	○	○	ESP	BR-119
C1235	Pressure sensor(primary) - electrical	×	×	×	○	○	ESP	BR-120
C1237	Pressure sensor(secondary) - electrical	×	×	×	○	○	ESP	BR-122
C1259	Steering angle sensor - electrical	×	×	×	○	○	ESP	BR-124
C1260	Steering angle sensor - signal	×	×	×	○	○	ESP	BR-126
C1282	Yaw rate & lateral G sensor - electrical	×	×	×	○	○	ESP	BR-128
C1283	Yaw rate & lateral G sensor - signal	×	×	×	○	○	ESP	BR-130
C1513	Brake switch error	×	×	×	○	○	ESP	BR-132

Brake System > ABS(Anti-Lock Brake System) > ABS Control Module > Components and Components Location

COMPONENTS



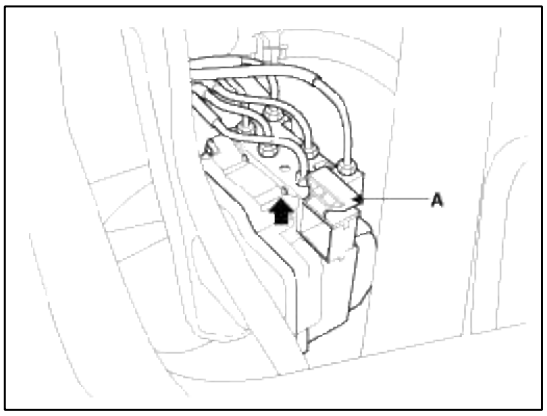
TORQUE : Nm(Kgf·cm,lb-ft)

1. Front-left tube
2. Front-right tube
3. Rear-left tube
4. Rear-right tube
5. Master cylinder Secondary(MCS) tube
6. Master cylinder Primary(MCP) tube
7. ABS control module connector(25P)
8. ABS control module(HECU)
9. Damper
10. Bracket

Brake System > ABS(Anti-Lock Brake System) > ABS Control Module > Repair procedures

REMOVAL

1. Disconnect the double lock (A) from the HECU.



2. Disconnect the brake tube from the HECU by unlocking the nuts centerclockwise with a spanner.

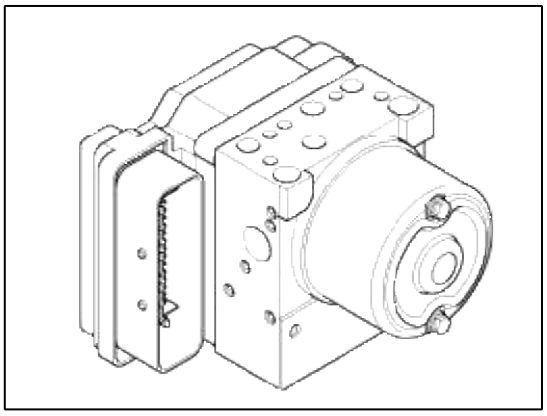
NOTE

- Do not spill brake fluid on vehicle; it may damage the pailt; if brake fluid gets on the paint, wash it off immediately with water.
- Take care not to damage or deform the brake lines during removal and installation.
- To prevent the brake fluid from spilling, plug and cover the hose ends and joints with a shop towel or equivalent material.

3. Remove the three HECU brake mounting bolts disassembly the HECU with the bracket.

CAUTION

1. Never attempt to disassemble the HECU.
2. The HECU must be transported and stored in an upright position and with the ports sealed.



4. Remove the three HECU mounting bolts and remove the HECU from the bracket.

INSTALLATION

1. Installation is the reverse of removal.

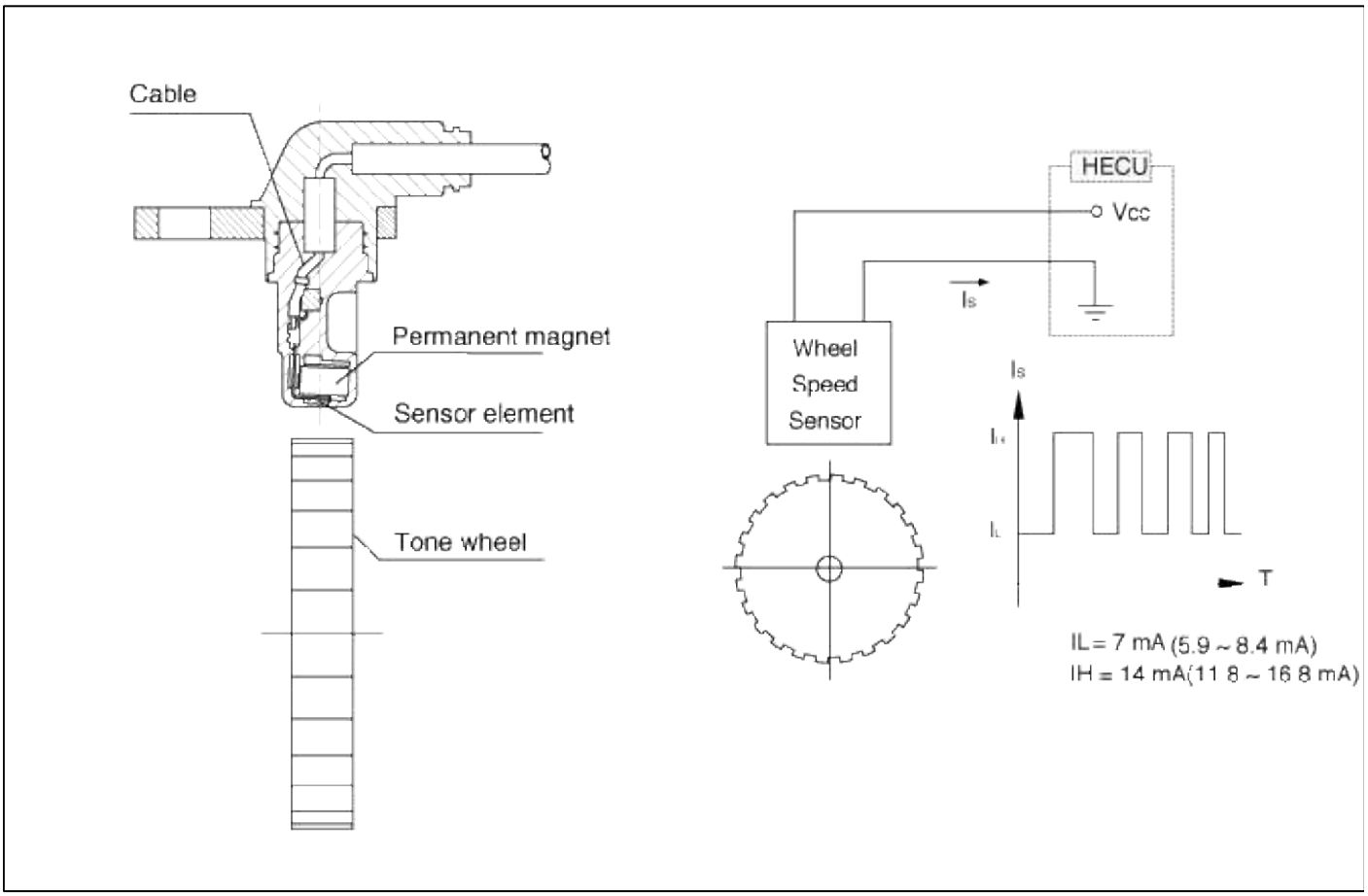
2. Tighten the HECU mounting bolts and brake tube nuts to the specified torque.

Tightening torque
HECU mounting bolt:
7.84 ~ 9.8 Nm (80 ~ 100 kgf·cm, 5.82 ~ 7.27 Ib-ft)
HECU bracket mounting bolt:
16.66 ~ 25.48 Nm (170 ~ 260 kgf·cm, 12.36 ~ 18.9 Ib-ft)
Brake tube nut:
12.74 ~ 16.66 Nm (130 ~ 170 kgf·cm, 9.45 ~ 12.36 Ib-ft)

Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Description and Operation

DESCRIPTION

A toothed rotor is fixed to the rotating member of the wheel, and the sensor is fixed to the static member of the suspension. As the wheel rotates the toothed rotor causes magnetic flux changes in the magnetic field of the permanent magnet. The sensor element senses these changes. Depending on the flux changes the sensor sends a signal out to the ECU. The change in magnet flux thus the sensor signal is directly related to the wheel speed. The controller monitors the sensor signal, compares the four wheel-speed signals and initiates action as required.

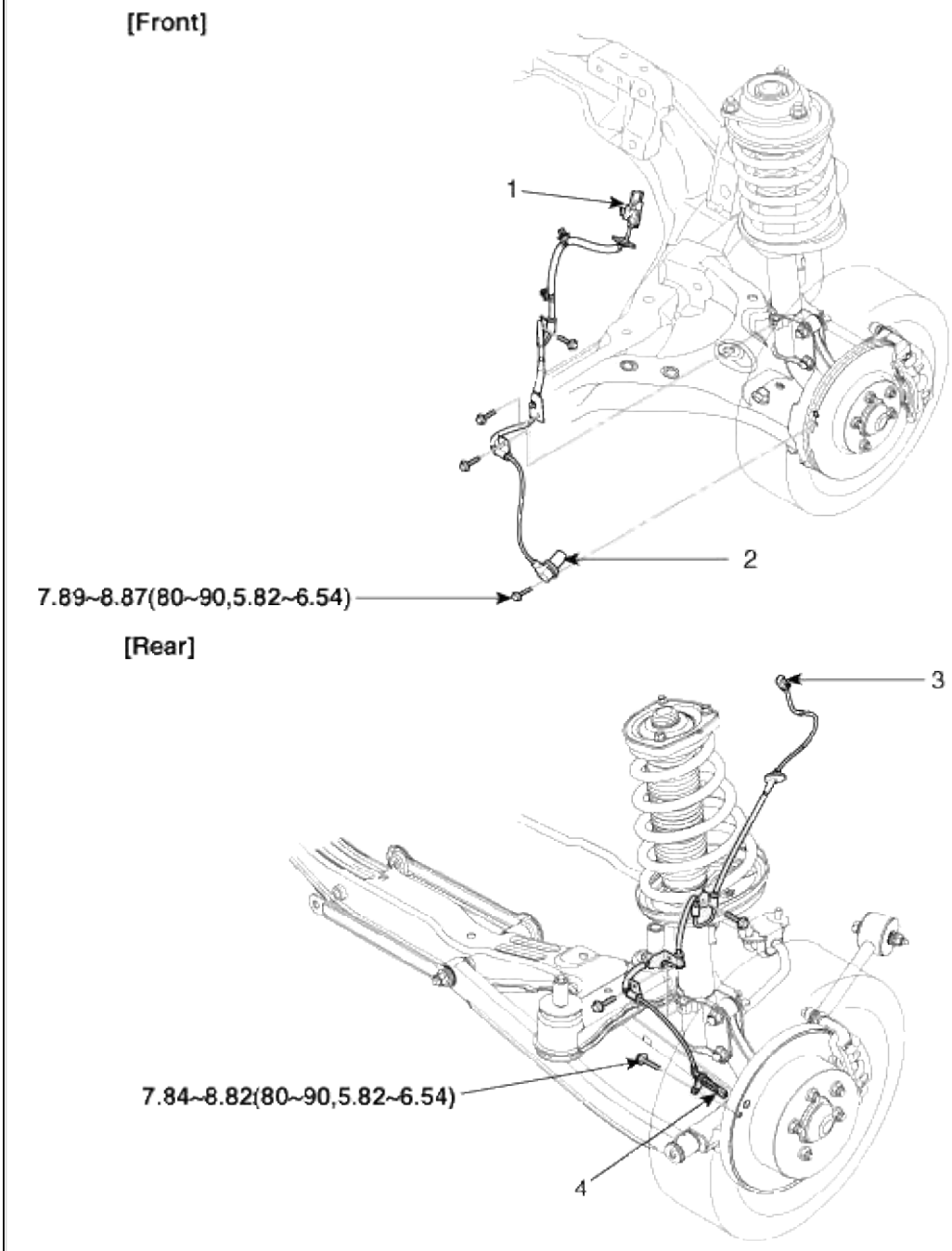


SPECIFICATIONS

Item		Standard Value		Remark
Supply voltage		DC 12 V		
Operating temperature		-40 ~1 20 °C		R = 100 Ω
Output current range		Low	7 mA(5.9 ~ 8.4 mA)	
		High	14 mA(11.8 ~ 16.8 mA)	
Frequency range		1 ~ 2000 Hz		
Airgap		0.5 ~ 1.5 mm(0.0197 ~ 0.0591 in.)		
Tone wheel	Number	48		

Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Components and Components Location

COMPONENTS



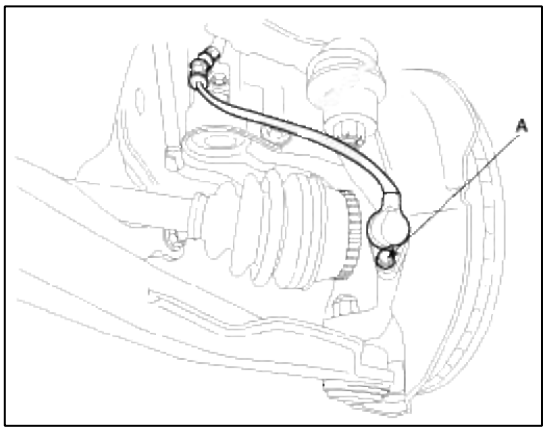
1. Front wheel speed sensor connector
2. Front wheel speed sensor
3. Rear wheel speed sensor connector
4. Rear wheel speed sensor

Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Repair procedures

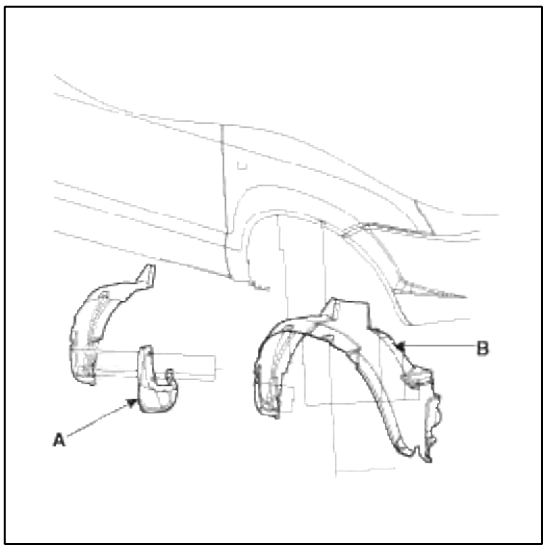
REMOVAL

FRONT WHEEL SPEED SENSOR

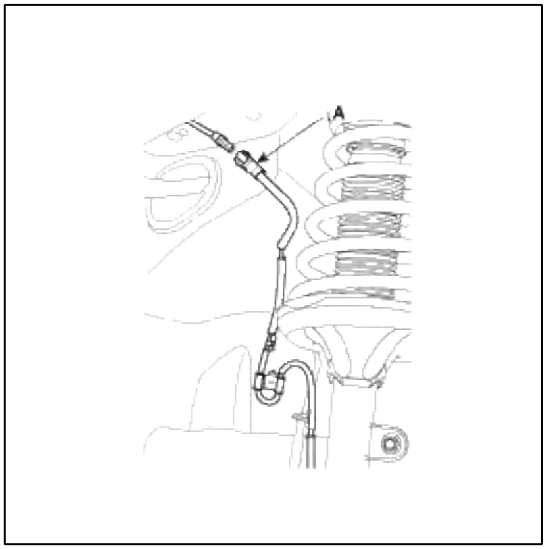
1. Remove the front wheel speed sensor mounting bolt (A).



2. Remove the front wheel guard (B), after removing the mud guard (A).

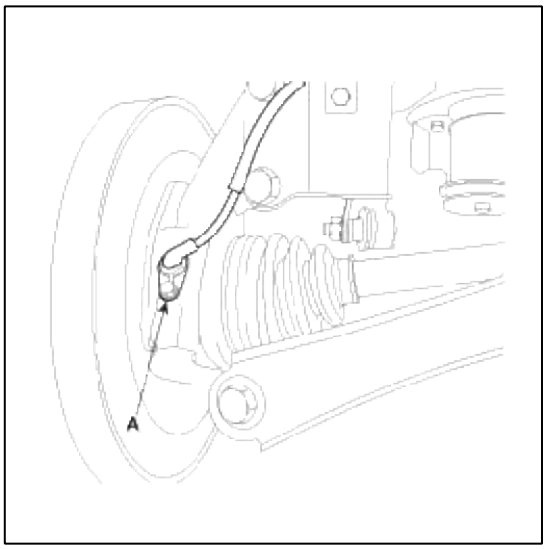


3. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector (A).

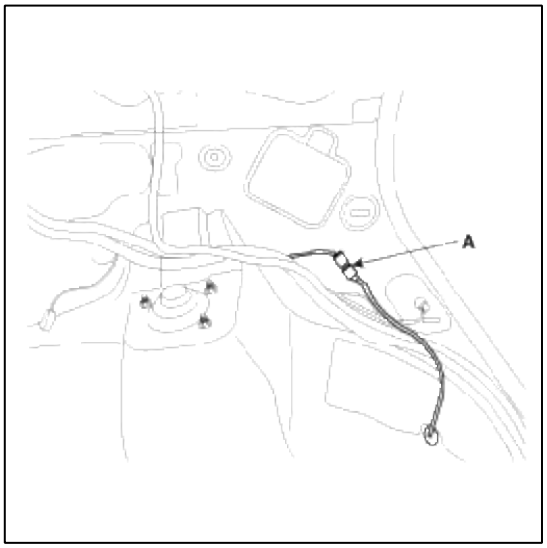


REAR WHEEL SPEED SENSOR

1. Remove the rear wheel speed sensor mounting bolt (A).



2. Remove the rear seat side pad then disconnect the rear wheel speed sensor connector (A).

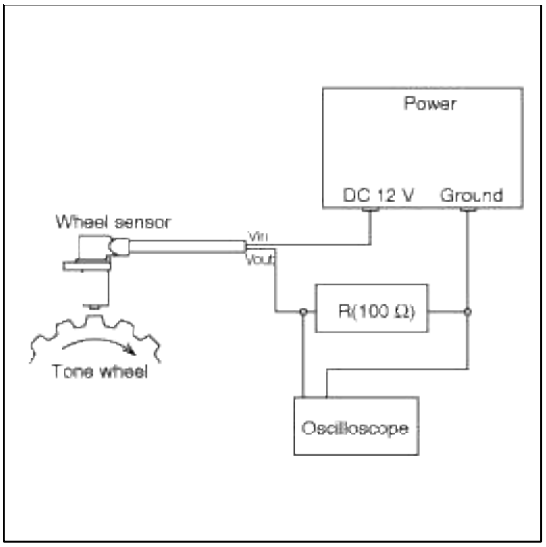


INSPECTION

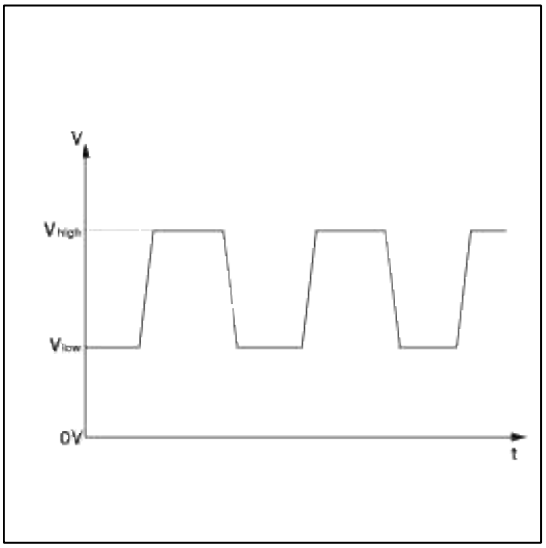
1. Measure the output voltage between the teminal of the wheel speed sensor and the body ground.

CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 100Ω resister must be used as shown.



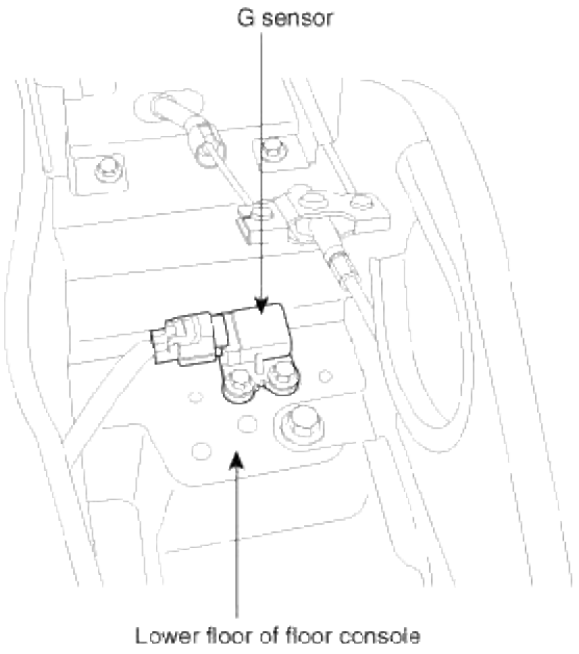
1. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

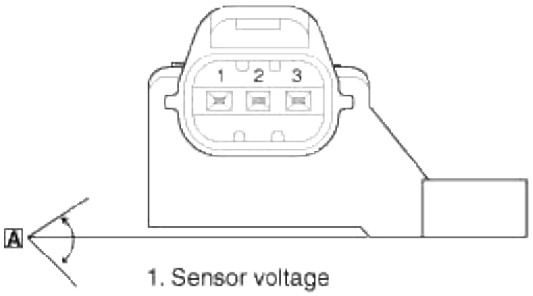


- V_low : 590 mV ~ 840 mV
- V_high : 1.18 V ~ 1.68 V
- Frequency range : 1 ~ 2,000 Hz

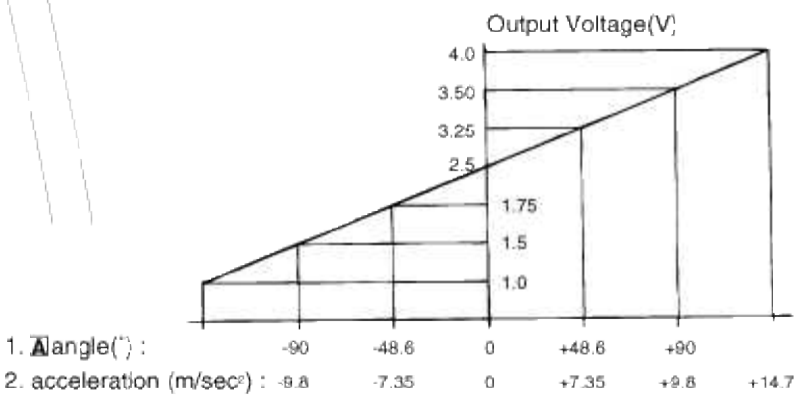
Brake System > ABS(Anti-Lock Brake System) > G Sensor > Components and Components Location

COMPONENTS





1. Sensor voltage
2. Sensor output
3. Ground



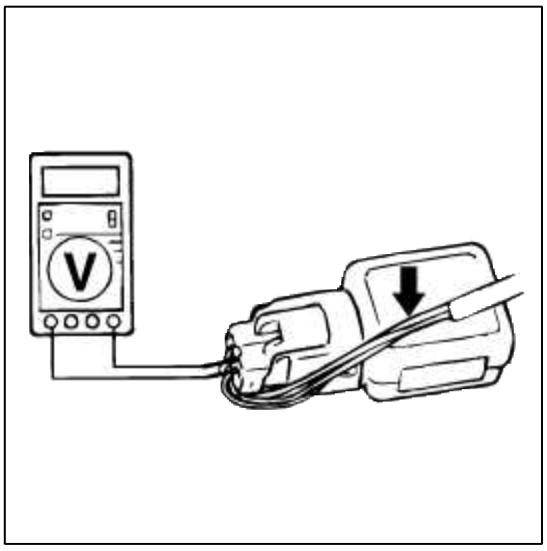
[OUTPUT CHARACTERISTIE]

Brake System > ABS(Anti-Lock Brake System) > G Sensor > Repair procedures

INSPECTION

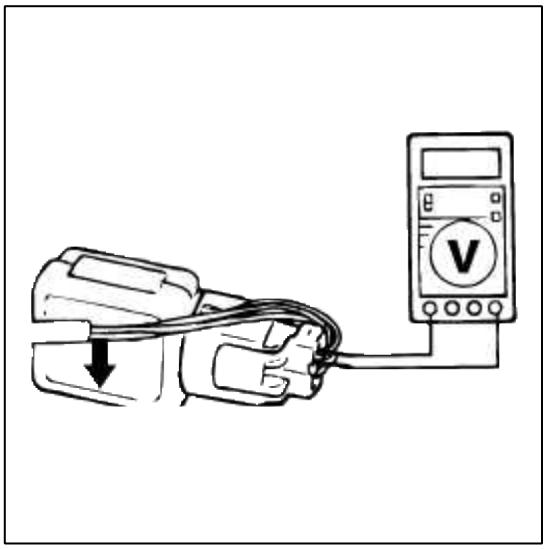
1. Connect a tester to both 2 and 3 terminals of the G sensor.
2. Measure the output voltage when IGN is on.

Specification : 2.5 V



3. Measure the output voltage between 2 and 3 terminals, posing the arrow mark on the G sensor downward.

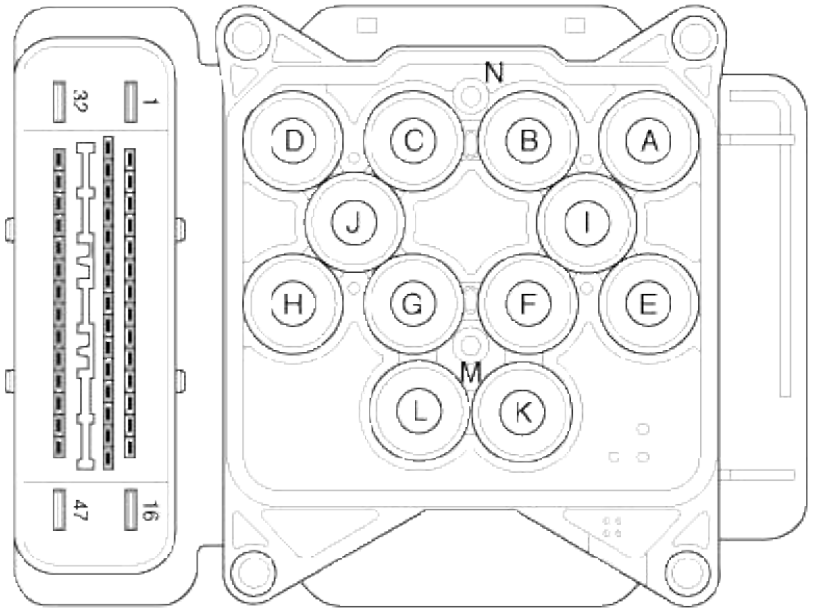
Specification : 3.5 V



4. Replace the G sensor if the output voltage is not on the specification.

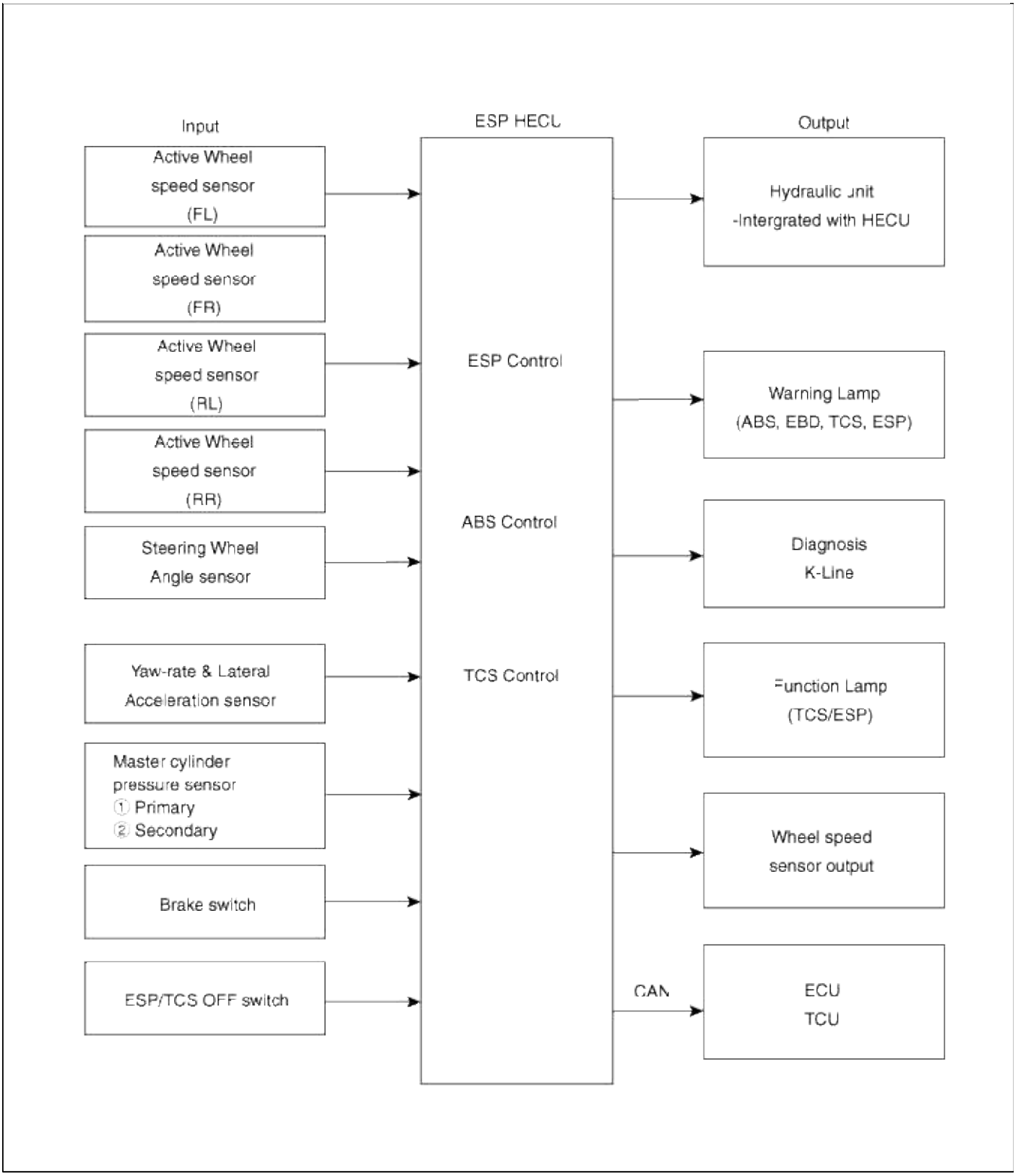
Brake System > ESP(Electronic Stability Program) System > Schematic Diagrams

esp hecu external diagram

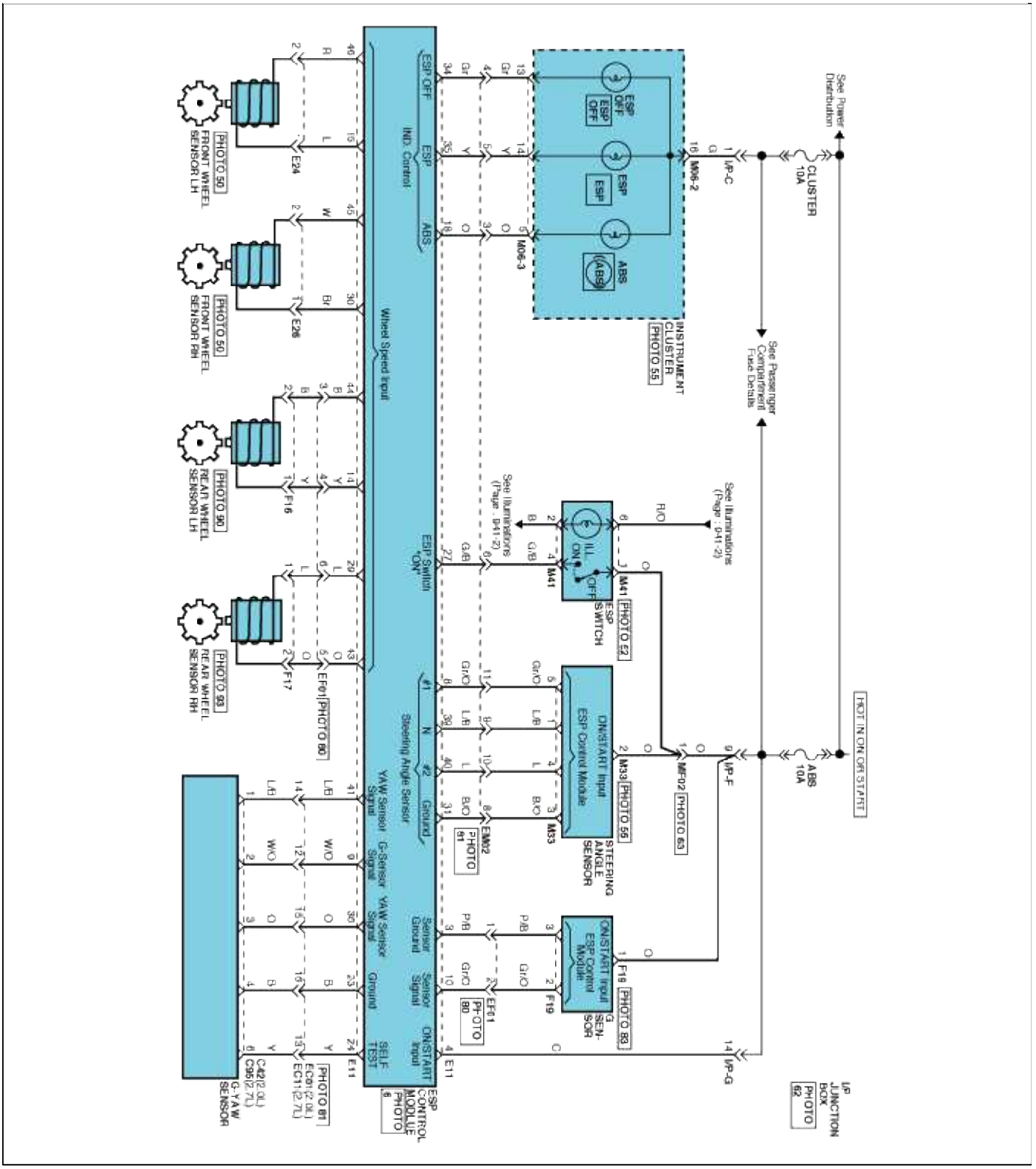


A : INLET VALVE(FR)
B : INLET VALVE(RL)
C : INLET VALVE(RR)
D : INLET VALVE(FL)
E : OUTPUT VALVE(FR)
F : OUTPUT VALVE(RL)
G : OUTPUT VALVE(RR)
H : OUTPUT VALVE(FL)
I : ELECTRIC SHUTTLE VALVE(ESV-R)
J : ELECTRIC SHUTTLE VALVE(ESV-L)
K : TRACTION VALVE (TCR)
L : TRACTION VALVE (TCL)
M : MOTOR(+)
N : MOTOR(GND)

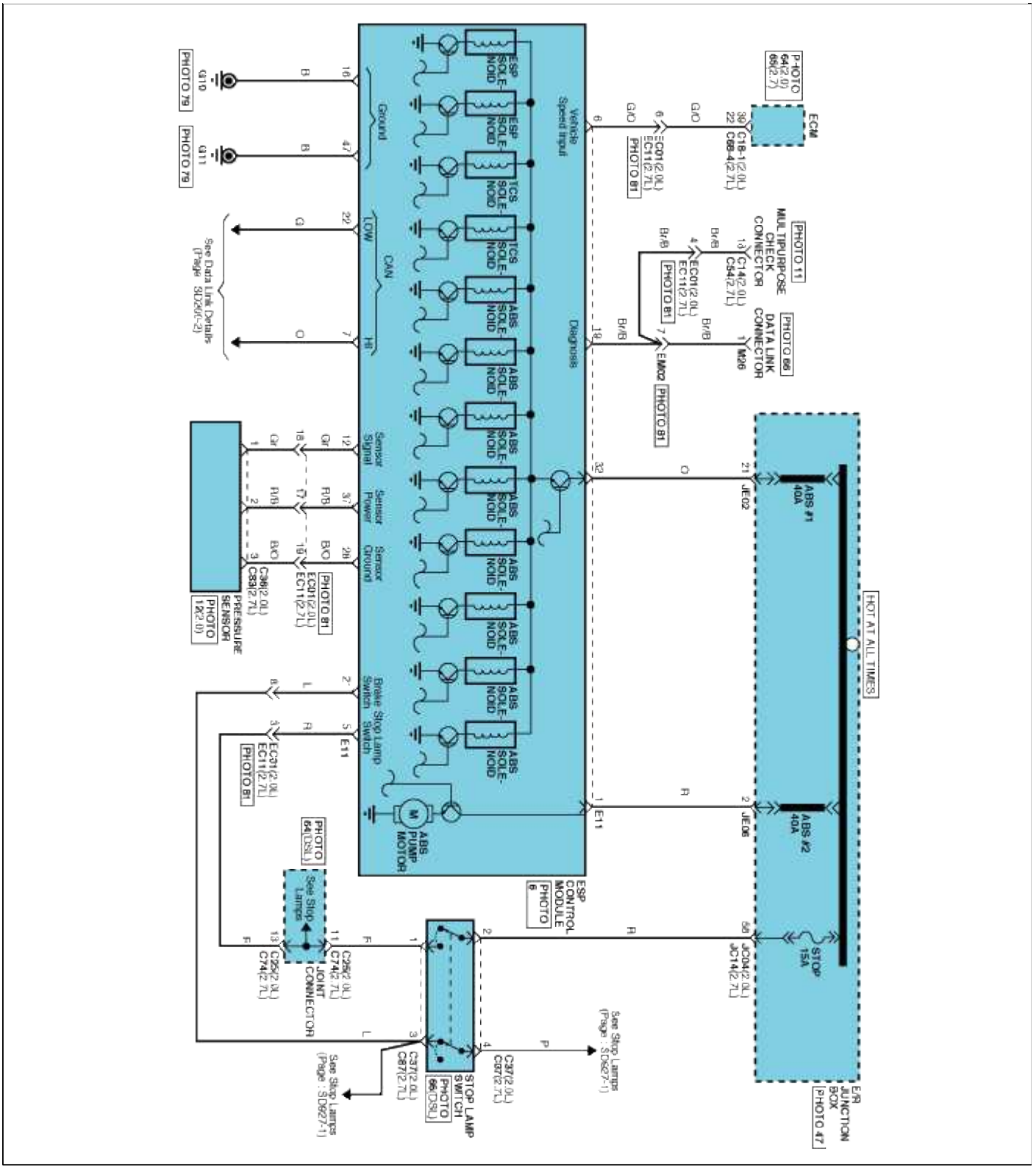
input and output diagram



circuit diagram(1)-ESP



circuit diagram(2)-ESP



esp connector input/output

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 < 30A	
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 < 10mA Max Output voltage : 4.9V ≤ V ≤ 5.1V	
36	YAW SENSOR POWER	Max Output current : I < 65 mA Max Output voltage : 4.9 V ≤ V ≤ 5.1 V	
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		
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	
10	G SENSOR SIGNAL Input Voltage	Input Voltage: 0 ≤ V ≤ 5.0 V	with 4WD
3	G SENSOR GROUND	Rated current: I < 10 mA	
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)	

Brake System > ESP(Electronic Stability Program) System > Description and Operation

description of ESP

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 needfor 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 dynamicsof the vehicle, active yaw control stabilizes the vehicle about its vertical axis.

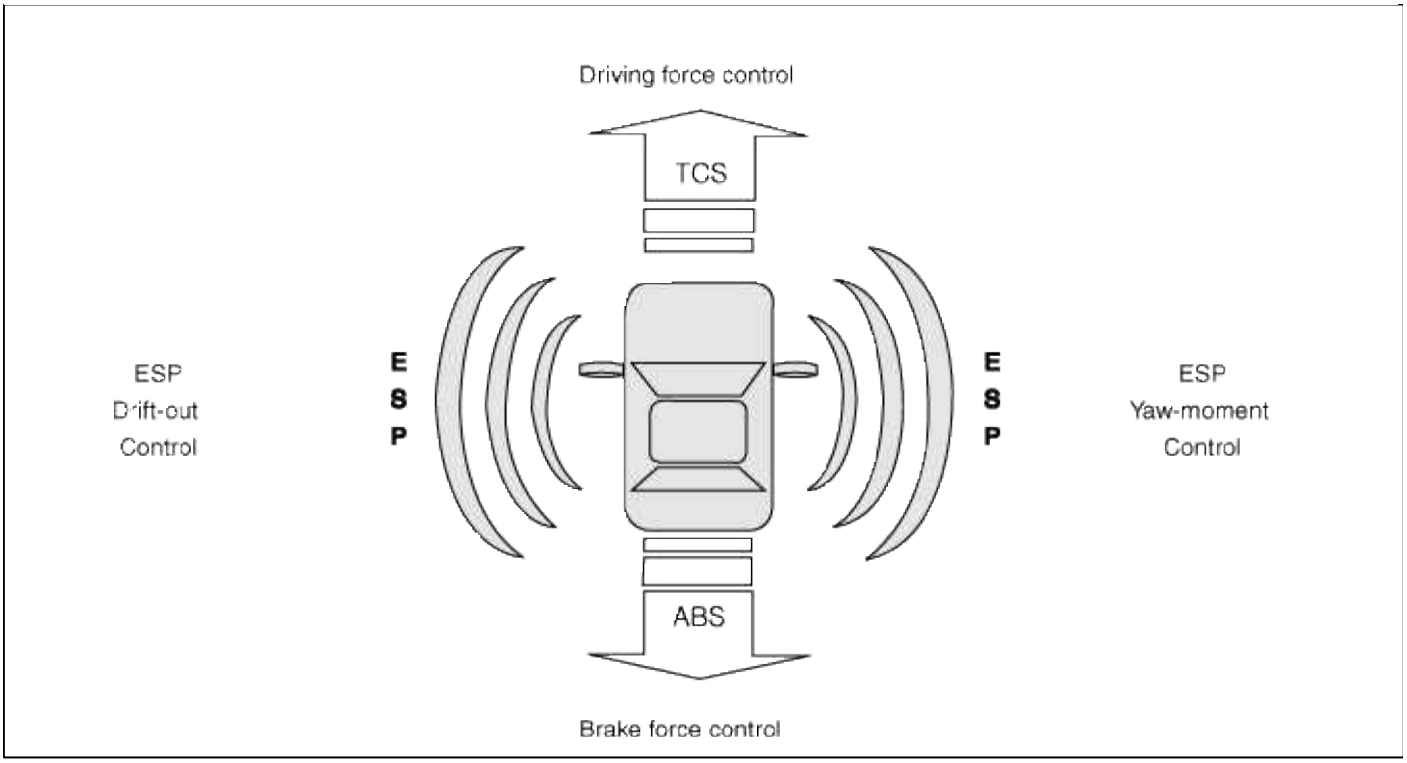
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.

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 MK 20 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.



DESCRIPTION OF ESP CONTROL

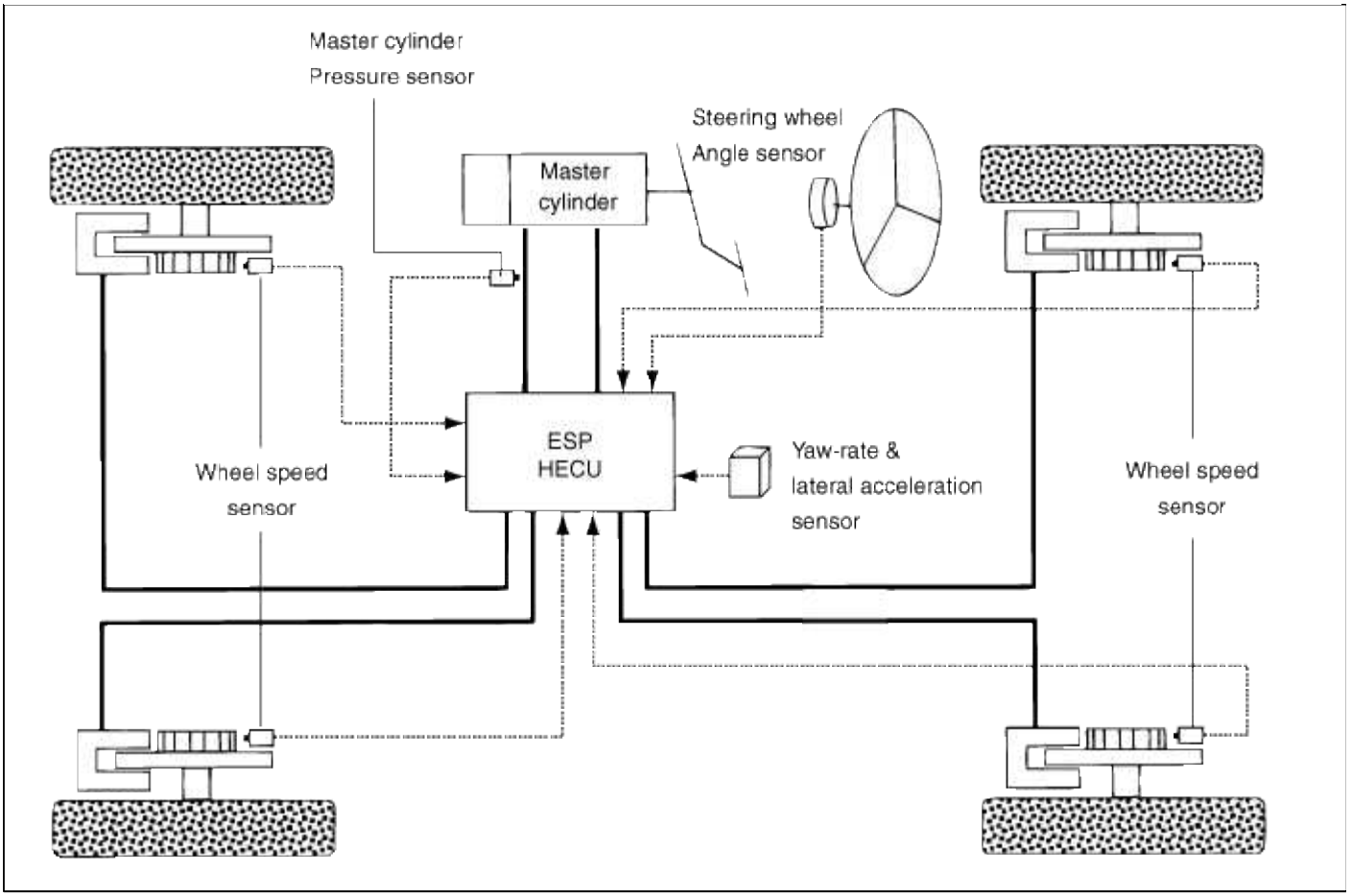
ESP system includes ABS/EBD, TCS and AYC function.

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.

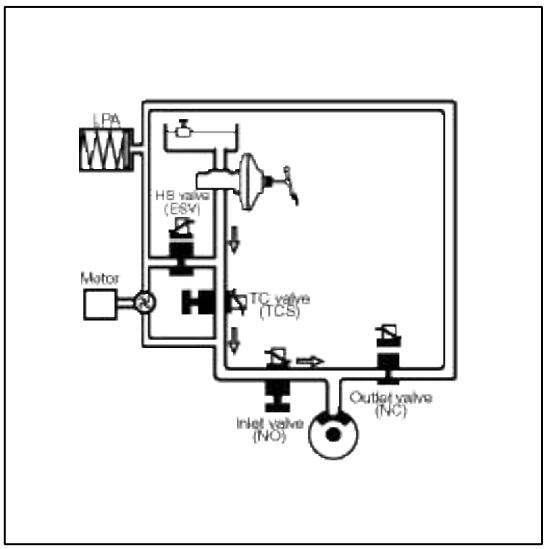
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake 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)



ESP OPERATION MODE

1. ESP Non-operation-Normal braking.



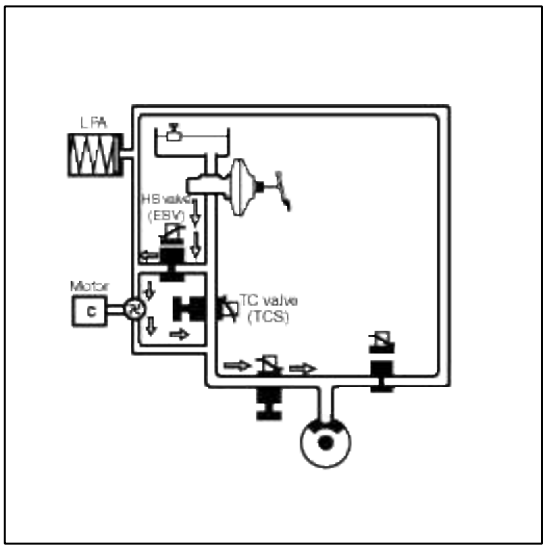
Operation

In this position, the inlet valve and the TCS valve are open, the electrically operated shuttle valve and the outlet valve are closed.

ESV : Electric reversing valve.

Solenoid valve	Continuity	Valve	Motor pump	TC Valve
IN (NO)	OFF	OPEN	OFF	OFF
OUT (NC)	OFF	CLOSE		

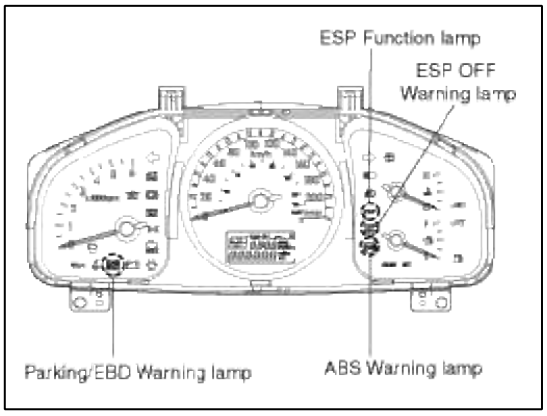
2. ESP operation



Operation

The on/off booster builds up a pressure of approx. 10 bar in order to enable the ESP pump to suck brake fluid at low temperatures. In this position, the inlet valve is driven in a pulsed cycle. The TCS valve is closed. The outlet valve remains closed. The electrically operated shuttle valve is opened. The hydraulic pressure is led to the wheel brakes which are to be applied for a brief period of time.

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		



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 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.

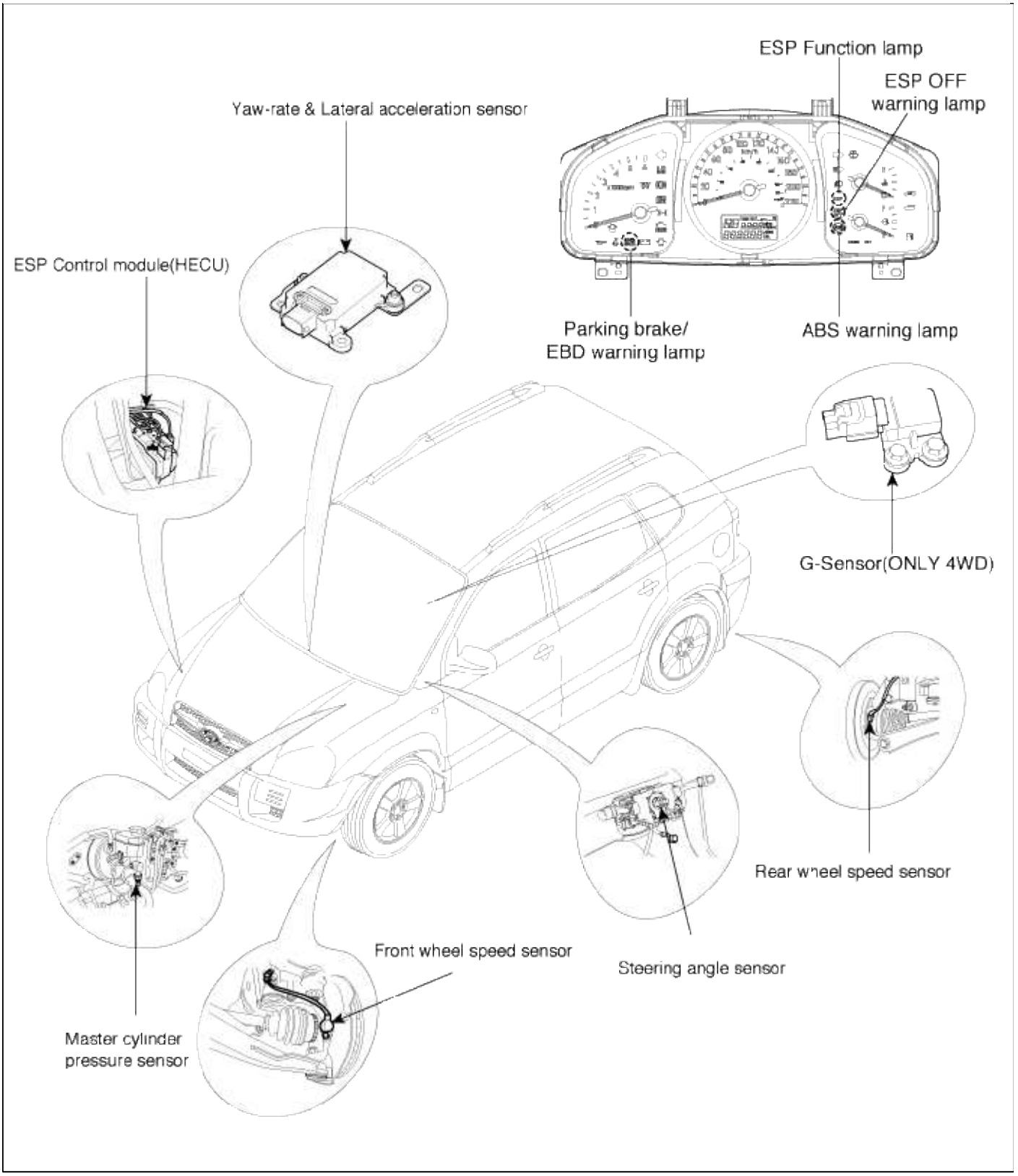
ESP Function Lamp (ESP system)
The ESP function lamp indicates the self-test and operating status of the ESP.
The ESP Function lamp operates under the following conditions :

- 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.

Brake System > ESP(Electronic Stability Program) System > Components and Components Location

components



Brake System > ESP(Electronic Stability Program) System > Troubleshooting

FAILURE DIAGNOSIS

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

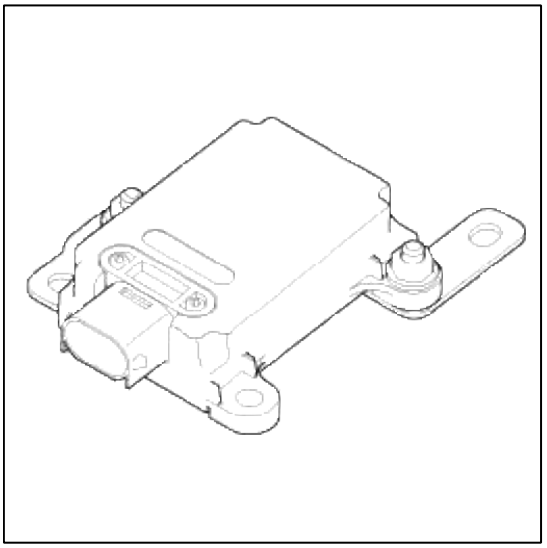
1. ABS warning lamp turns on when ABS is fail.
2. TCS warning lamp turns on when TCS is fail.
3. ESP operation lamp turns on and TCS OFF warning lamp blinks when ESP is fail.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

Brake System > ESP(Electronic Stability Program) System > Yaw-rate and Lateral G Sensor > Description and Operation

DESCRIPTION

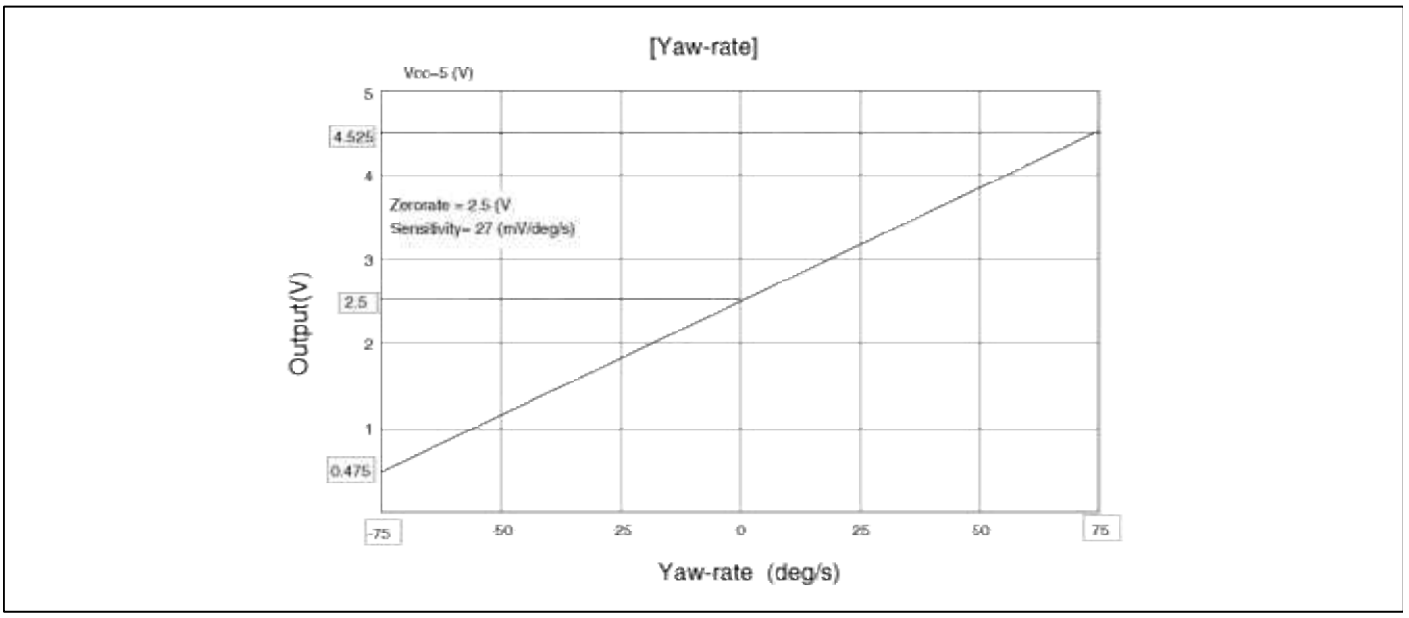
1. The yaw-rate & lateral G sensor is applied for the ESP system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.

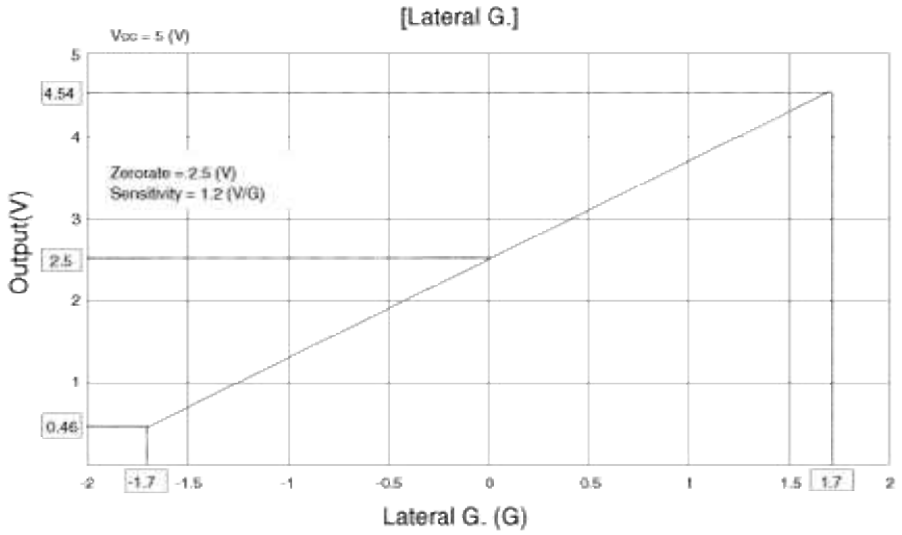


specifications

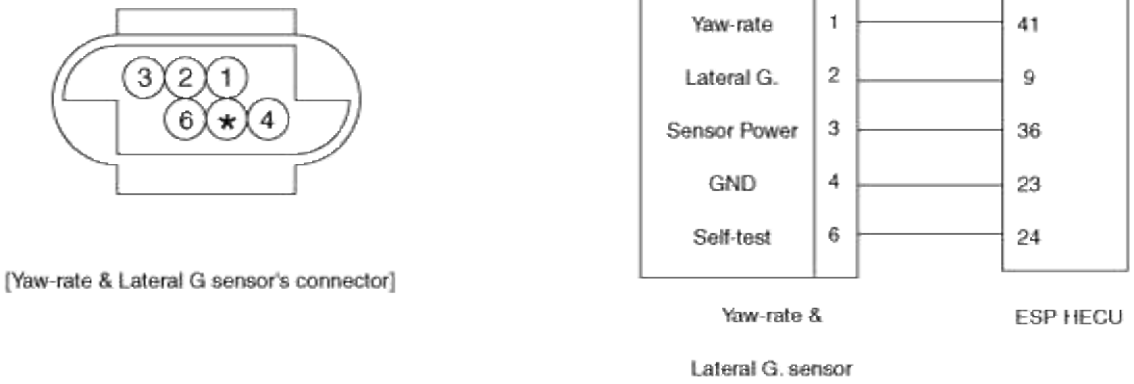
Item		Specification	Remark
Operating voltage		4.75 ~ 5.25 V	
Current consumption		less than 65 mA	
Output voltage range		0.5 ~ 4.5 V	
Operating temperature		-40 ~ 85 °C	
Yaw-rate sensor	Measurement range	-75 ~ +75 °/sec	
	Output voltage range	0.5 ~ 4.5 V	
	Sensitivity	26.67 mV(°/sec.)	
	Zero rate output	2.5 V	
	Frequency response	18 ~ 22 Hz	
Lateral G. sensor	Measurement range	-1.5 ~ +1.5 g	
	Output voltage range	0.5 ~ 4.5 V	
	Sensitivity	0.136 V/g	
	Zero rate output	2.5 V	
	Frequency response	50 Hz	

output characteristic





external diagram



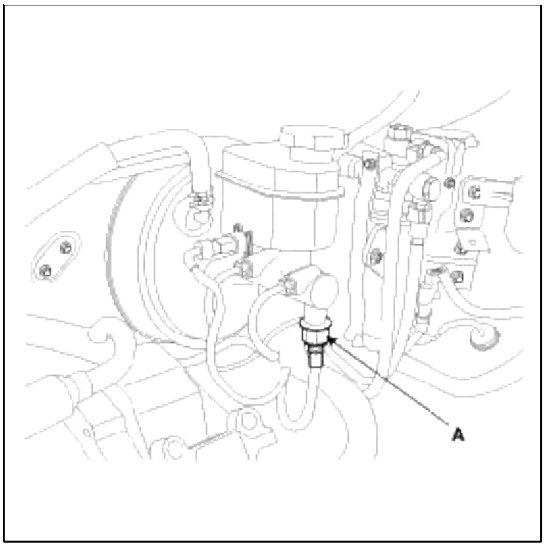
Brake System > ESP(Electronic Stability Program) System > Master Cylinder Pressure Sensor > Description and Operation

DESCRIPTION

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 disks, one is fixed and the other movable, so that changes the distance of the two disks.

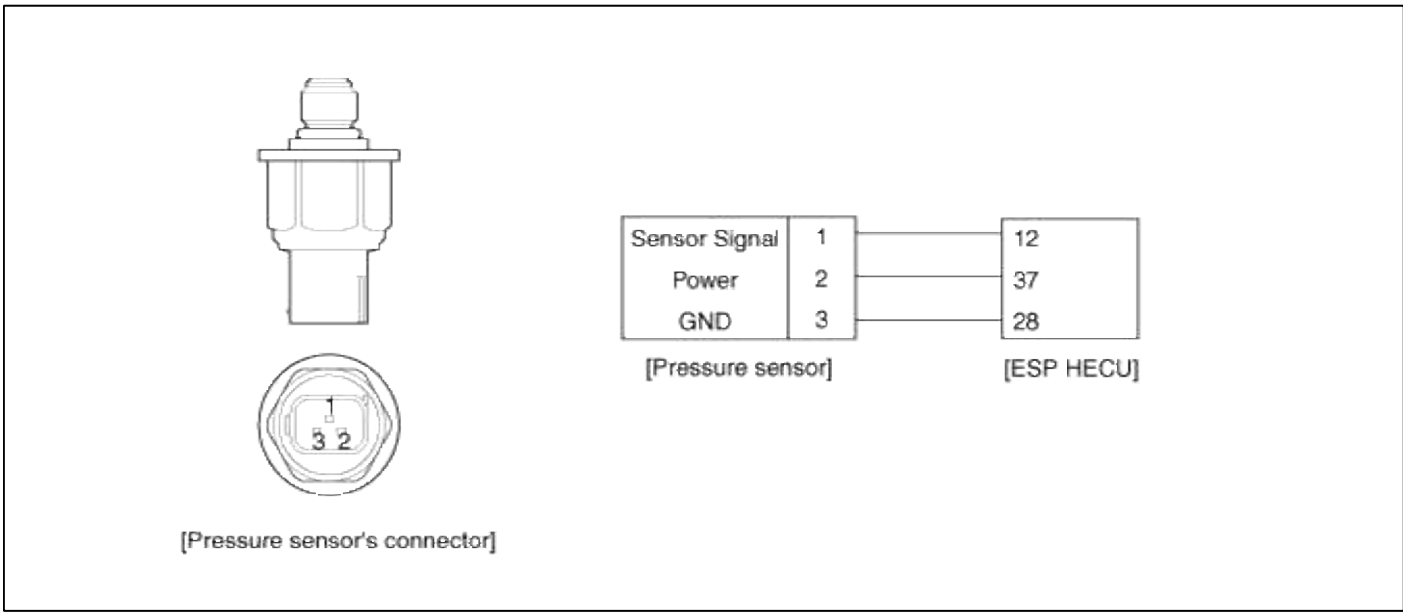
(Max. measurable pressure is 200bar.)



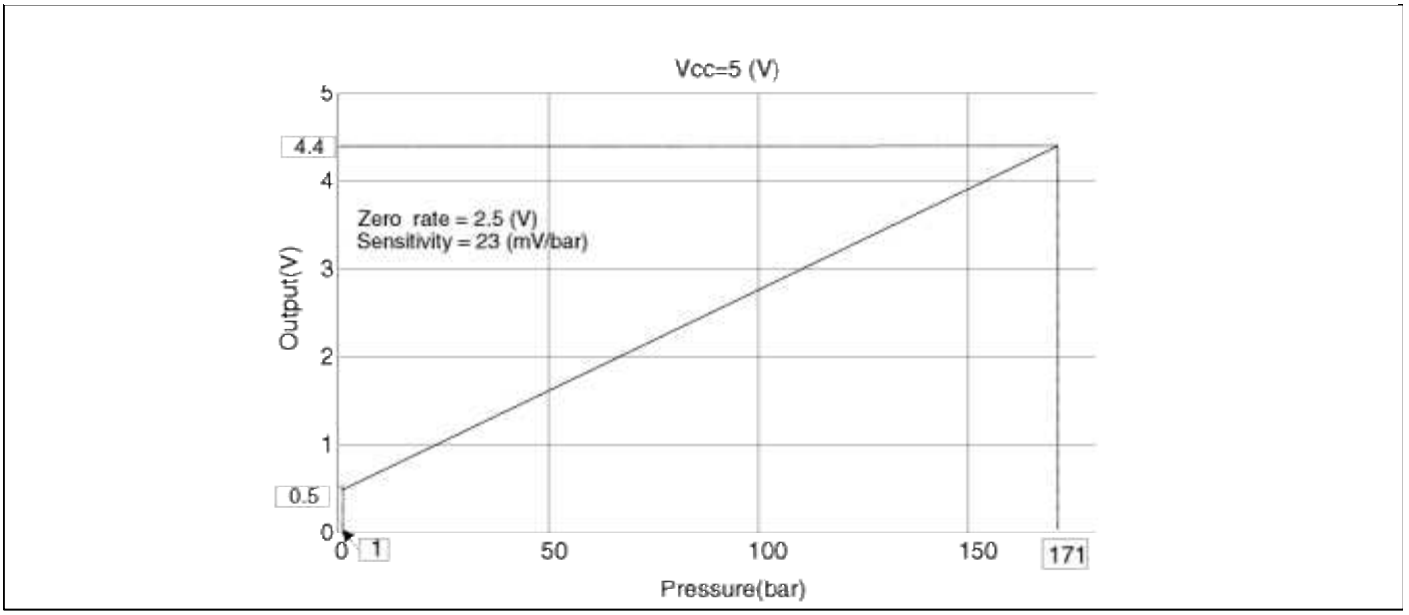
SPECIFICATIONS

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



OUTPUT CHARACTERISTIC



Brake System > ESP(Electronic Stability Program) System > ESP OFF Switch > Description and Operation

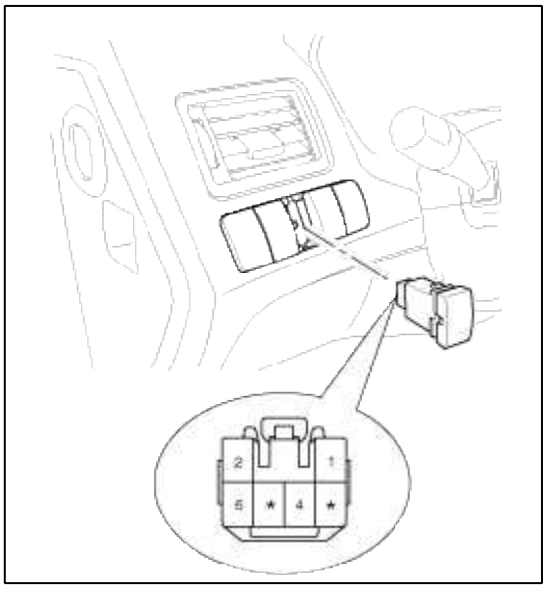
DESCRIPTION

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.

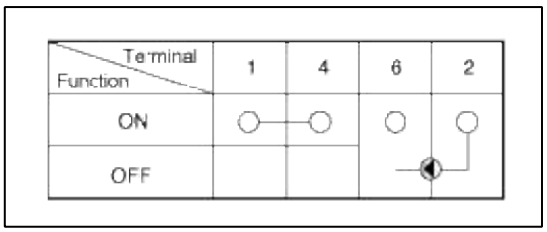
Brake System > ESP(Electronic Stability Program) System > ESP OFF Switch > Repair procedures

INSPECTION

1. Remove the ESP OFF switch from the switch panel on the crushpad of the driver's side.

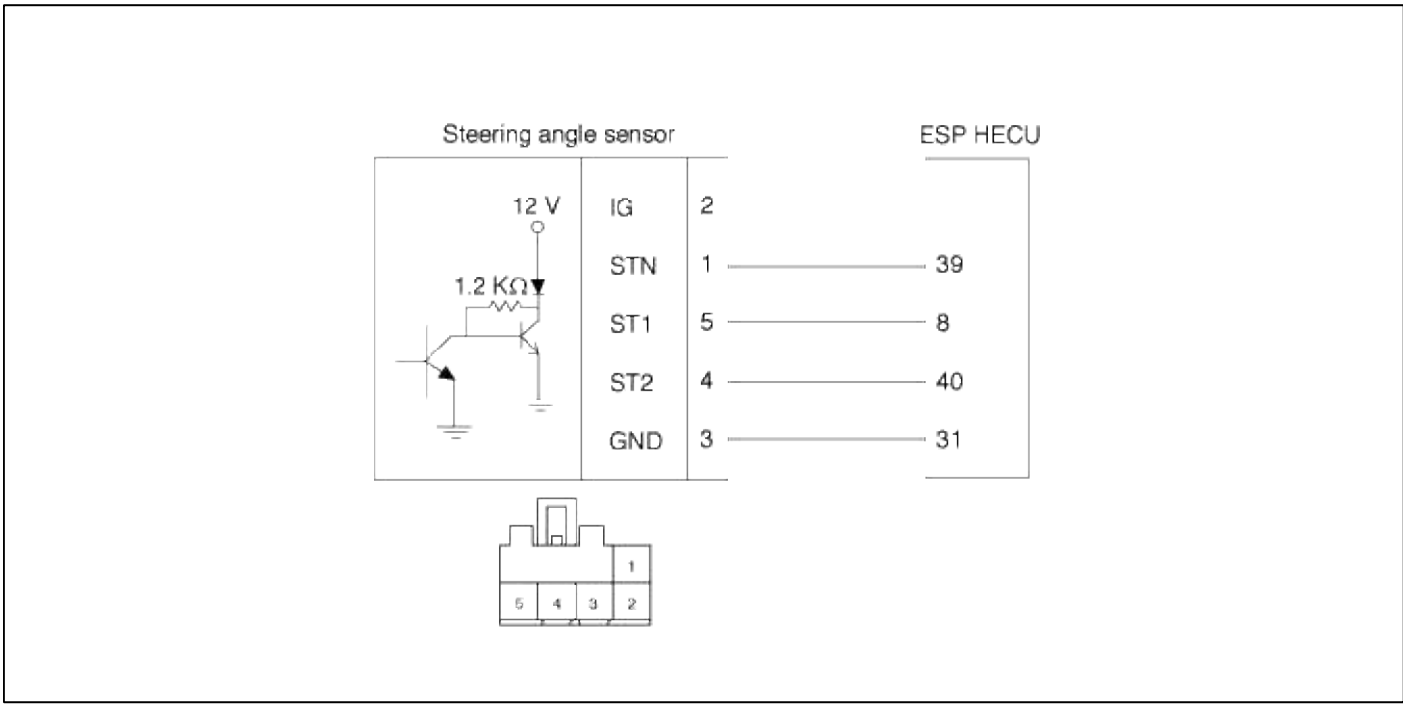


2. Check the continuity between the switch terminals as the ESP OFF switch is engaged.

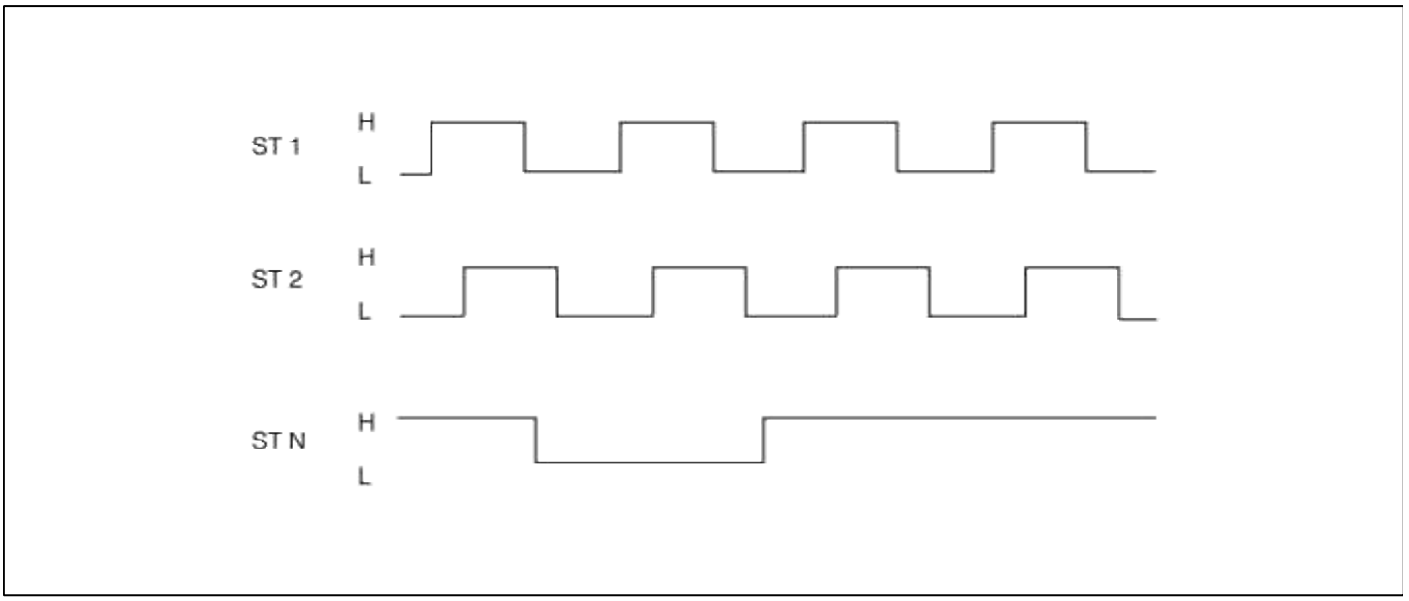


Brake System > ESP(Electronic Stability Program) System > Steering Angle Position Sensor > Schematic Diagrams

CIRCUIT DIAGRAM



output characteristic



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		

Brake System > ESP(Electronic Stability Program) System > Steering Angle Position Sensor > Description and Operation

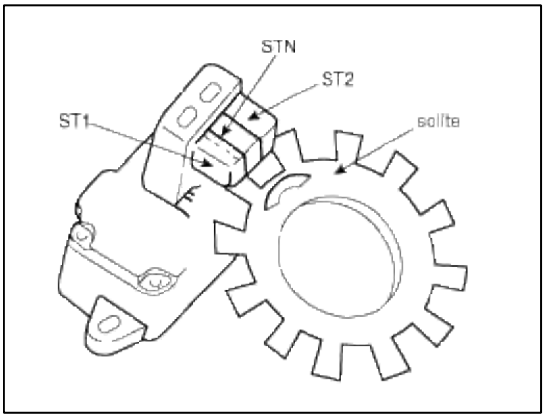
DESCRIPTION

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.

OPERATION

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.



specifications

Item	Specification
Operating Voltage	9 V ~ 16 V
Operating temperature	-30 °C ~ 75 °C
Current consumption	Max. 100 mA
Pulse duty	50 ± 10 %
Pulse width	8 °/1pulse
Voltage(HIGH)	3.0 V ~ 4.1 V
Voltage(LOW)	1.3 V ~ 2.0 V
Steering angle velocity	Max 1500 °/sec

Brake System > Troubleshooting > C1101

DESCRIPTION

This code shows in case that the power source for the HECU drops lower than or rises higher than the specified value.

If the power source returns within the specified value, this code will not show any longer.

CAUTION

Before carrying out the following inspection, check and recharge, if necessary, the battery.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1101 (High Voltage) C1102 (Low Voltage)	**High Voltage:** 1. When Vign more than 16 ± 0.5 V is continued for 500msec. 2. When Vign more than 19 ± 0.5 V is continued for 49msec. 3. if the voltage recover normal operating range, the controller is reset **Low Voltage :** 1. When Vign less than 9.5 V ± 0.5 V is continued for 500 msec during Vref more than or equal to 7 Km/h (4 MPH). 2. When Vign less than 8.5 V ± 0.5 V is continued for 500 msec during Vref less than or equal to 7 Km/h (4 MPH) or ABS, TCS(ESP) control. 3. When Vign less than 7.2 V ± 0.5 V is continued for 28 msec. 4. If IGN voltage is recovered to normal operating voltage, the system recovers to normal state.	- Open/short in power supply circuit - Faulty power source - Faulty HECU

FAILSAFE FUNCTION

High voltage :

The system is disabled. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

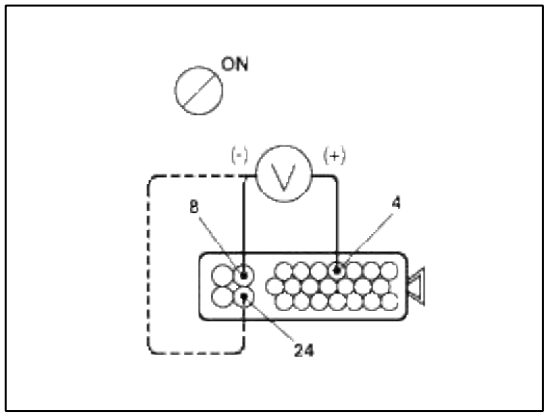
Low voltage :

1. Without the ABS control : inhibit the ABS, TCS(ESP) control of front wheels and allow the ABS control of rear wheels, deactivating the motor, and the ABS, TCS(ESP) warning lamps are switched on. When the voltage recover to the normal operating range, enable ABS function and ABS, TCS(ESP) warning lamps are switched off and erase the error code
2. With the ABS control : inhibit ABS control of the front wheels and allow ABS control of the rear wheels, deactivating the motor. the ABS, TCS(ESP) warning lamps are directly switched on and the state keeps continuously. the error code is always stored.

INSPECTION PROCEDURE

1. CHECK POWER BETWEEN TERMINAL OF HECU CONNECTOR.
   (1) Disconnect the connector from the ABS control module, and then turn the ignition switch ON.
   (2) Measure the voltage between terminals 4(+) and 8(-) or 24(-) of the HECU connector.

   Specification: 9.4 ~ 17 V

   Is the voltage within the specification?

   YES

   Check the HECU connector.If no error is founded, replace the HECU and recheck.

   NO

   Check battery.

2. CHECK BATTERY.
   Measure the voltage between positive(+) and negative(-) terminals of the battery.
   Is the voltage below 9.4 V?

   YES

   Check and replace the battery.

   NO

   Check circuit for continuity between bettery and HECU.

3. CHECK CIRCUIT FOR CONTINUITY BETWEEN BATTERY AND HECU.
   Check the resistance between terminal 4(+) of the HECU connector and battery positive(+) terminal.
   Is the resistance below 1 Ω?

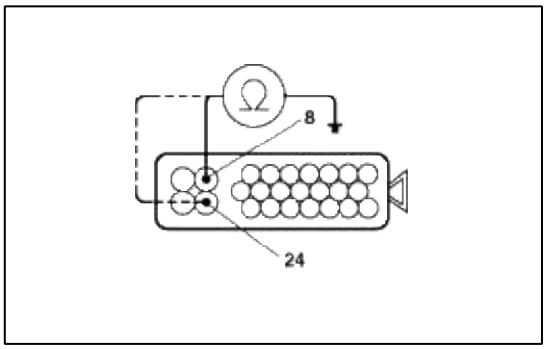
   NO

   Repair harness or connector.

   YES

   Check circuit for continuity between the HECU and body ground.

4. CHECK CIRCUIT FOR CONTINUITY BETWEEN THE HECU AND BODY GROUND.
Measure the resistance between terminals 8(-), 24(-) of the HECU connector and the body ground.



Is the resistance below 1 Ω?

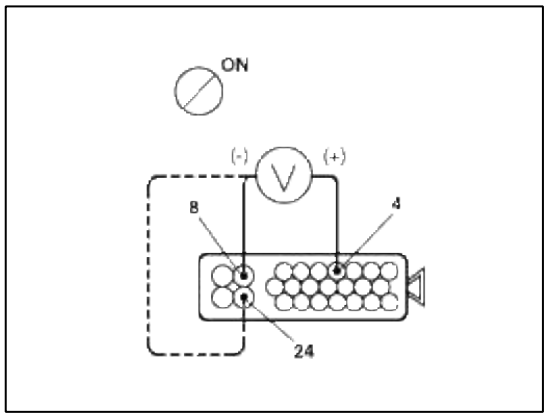
NO

Check and readjust the installing of the body ground.

YES

Check voltage beween the HECU connector.

5. CHECK VOLTAGE BETWEEN THE HECU CONNECTOR.
(1) Turn the ignition switch ON.
(2) Measure the voltage between terminals 4(+) and 8(-), 24(-) of the HECU connector.



Is the voltage above 17 V?

YES

Repair and replace, if necessary, the charging system.

NO

Repeat the inspection procedure.

Brake System > Troubleshooting > C1102

DESCRIPTION

This code shows in case that the power source for the HECU drops lower than or rises higher than the specified value.
If the power source returns within the specified value, this code will not show any longer.

CAUTION

Before carrying out the following inspection, check and recharge, if necessary, the battery.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1101 (High Voltage) C1102 (Low Voltage)	**High Voltage:** 1. When Vign more than 16 ± 0.5 V is continued for 500msec. 2. When Vign more than 19 ± 0.5 V is continued for 49msec. 3. if the voltage recover normal operating range, the controller is reset **Low Voltage :** 1. When Vign less than 9.5 V ± 0.5 V is continued for 500 msec during Vref more than or equal to 7 Km/h (4 MPH). 2. When Vign less than 8.5 V ± 0.5 V is continued for 500 msec during Vref less than or equal to 7 Km/h (4 MPH) or ABS, TCS(ESP) control. 3. When Vign less than 7.2 V ± 0.5 V is continued for 28 msec. 4. If IGN voltage is recovered to normal operating voltage, the system recovers to normal state.	- Open/short in power supply circuit - Faulty power source - Faulty HECU

FAILSAFE FUNCTION

High voltage :

The system is disabled. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

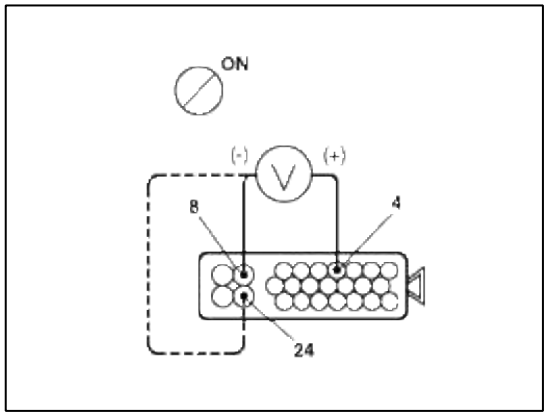
Low voltage :

1. Without the ABS control : inhibit the ABS, TCS(ESP) control of front wheels and allow the ABS control of rear wheels, deactivating the motor, and the ABS, TCS(ESP) warning lamps are switched on. When the voltage recover to the normal operating range, enable ABS function and ABS, TCS(ESP) warning lamps are switched off and erase the error code
2. With the ABS control : inhibit ABS control of the front wheels and allow ABS control of the rear wheels, deactivating the motor. the ABS, TCS(ESP) warning lamps are directly switched on and the state keeps continuously. the error code is always stored.

INSPECTION PROCEDURE

1. CHECK POWER BETWEEN TERMINAL OF HECU CONNECTOR.
   (1) Disconnect the connector from the ABS control module, and then turn the ignition switch ON.
   (2) Measure the voltage between terminals 4(+) and 8(-) or 24(-) of the HECU connector.

Specification: 9.4 ~ 17 V



Is the voltage within the specification?

YES

Check the HECU connector.If no error is founded, replace the HECU and recheck.

NO

Check battery.

2. CHECK BATTERY.
Measure the voltage between positive(+) and negative(-) terminals of the battery.
Is the voltage below 9.4 V?

YES

Check and replace the battery.

NO

Check circuit for continuity between bettery and HECU.

3. CHECK CIRCUIT FOR CONTINUITY BETWEEN BATTERY AND HECU.
Check the resistance between terminal 4(+) of the HECU connector and battery positive(+) terminal.
Is the resistance below 1 Ω?

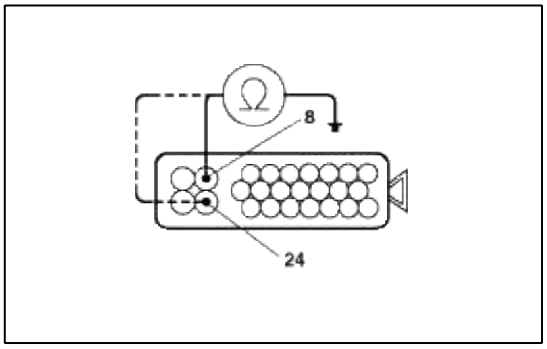
NO

Repair harness or connector.

YES

Check circuit for continuity between the HECU and body ground.

4. CHECK CIRCUIT FOR CONTINUITY BETWEEN THE HECU AND BODY GROUND.
Measure the resistance between terminals 8(-), 24(-) of the HECU connector and the body ground.



Is the resistance below 1 Ω?

NO

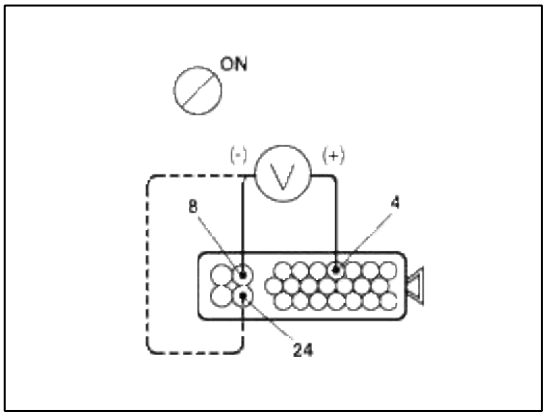
Check and readjust the installing of the body ground.

YES

Check voltage beween the HECU connector.

5. CHECK VOLTAGE BETWEEN THE HECU CONNECTOR.
(1) Turn the ignition switch ON.

(2) Measure the voltage between terminals 4(+) and 8(-), 24(-) of the HECU connector.



Is the voltage above 17 V?

YES

Repair and replace, if necessary, the charging system.

NO

Repeat the inspection procedure.

Brake System > Troubleshooting > C1112

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1112	**[Abnormal sensor power] :** - During sensor power ON, If the voltage of sensor power is out of the range of 5 ±0. 5 V for 500 ms, The failure is recognized. - During sensor power OFF, If the voltage of sensor power is out of the range of 0.5 ± 0.1 V for 500 ms, The failure is recognized. - If the YAW or lateral sensor signal pin has a short circuit to a battery, The failure is recognized.	- Faulty Sensor Power - Faulty HECU

FAILSAFE FUNCTION

The ESP function is inhibited, while the ABS and EBD controls allowed.
The ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

Brake System > Troubleshooting > C1200

DESCRIPTION

The HECU receives wheel speed signals from the four wheel speed sensors.
The wheel signals are converted to voltage signals by the signal converting circuit and given as input to the HECU.
The HECU checks an open or short in the circuit of the wheel speed sensor.
If more than one wheel speed sensor malfunctions, the system stops.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1200 (FL) C1203 (FR) C1206 (RL) C1209 (RR)	*Active Sensor ; If the sensor signal current is continuously out of the specified range of 4 mA ± 10 ~ 22 mA ± 10 for 140 msec, the failure is detected. * Passive Sensor ; When the offset voltage of the sensor is outside the specified range of 2 V ± 10 % ~ 4 V ± 10 % for 140 msec, the failure is detected.	- Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels.
After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON but the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased. After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

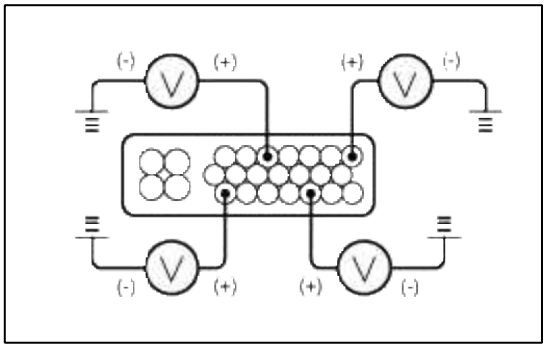
INSPECTION PROCEDURE

1. CHECK POWER FOR WHEEL SPEED SENSOR

Measure the voltage between an appropriate wheel sensor(+) terminal and the body ground (see the table below).

DTC	Terminal
C1200 (Front-left) C1203 (Front-right) C1206 (Rear-left) C1209 (Rear-right)	1 19 5 23

Specification:Battery positive(+)



Is the voltage within the specification?

NO

Repair short to power in the (+) circuit between the HECU and the appropriate wheel sensor.

YES

Check output of the wheel speed sensor

2. CHECK OUTPUT OF THE WHEEL SPEED SENSOR

Check the voltage between terminals (see the table below)of the HECU and the body ground.

DTC	Terminal
C1200 (Front-left) C1203 (Front-right) C1206 (Rear-left) C1209 (Rear-right)	2 20 6 22

Specification:0.4 ~ 2.2 V

Is the voltage within the specification?

YES

Replace the wheel sensor and recheck.

NO

Repair the wire between the HECU and the wheel speed sensor.

Brake System > Troubleshooting > C1201

DESCRIPTION

This code shows in case that a speed signal from any of the 4 wheel speed sensors does not match to the others at any speed.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1201 (FL) C1204 (FR) C1207 (RL) C1210 (RR)	**Speed Jump :** This monitoring is performed for the period that the velocity of each wheel exceeds 2 km/h (1 mph). - Controller counts the number of the wheel acceleration of 100 g[(25 km/h ; 15 mph) 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[(10k m/h ; 6 mph) 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 ; 15 mph) 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 ; 15 mph) for 7 ms] causes the controller to start monitoring this failure and to comparethe 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. - In 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. **Wrong Exciter :**	- Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty rotor or wheel bearing - Faulty HECU

	- Max. wheel velocity exceeds 20 km/h (12 mph) and the wheel velocity is 40 % of max. wheel velocity. if this condition is lasted for 2 minutes. - Max. wheel velocity exceeds 40 km/h (24 mph) and the wheel velocity is 60 % of max. wheel velocity. if this condition is lasted for 2 minutes. - Faulty installing of wheel speed sensor	

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- More than two wheels malfunction.

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. MONITOR SCANTOOL DATA
   (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(FL)" parameter on the Scantool.

Specification : Approx. 40 km/h or more(24 mph or more)

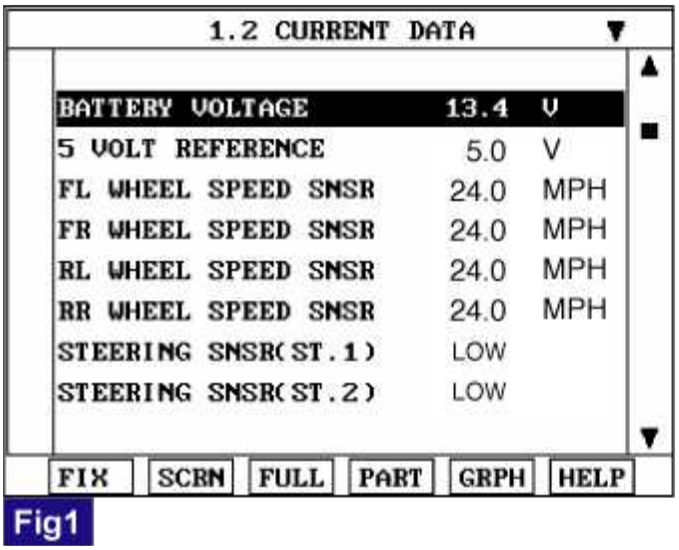


Fig1

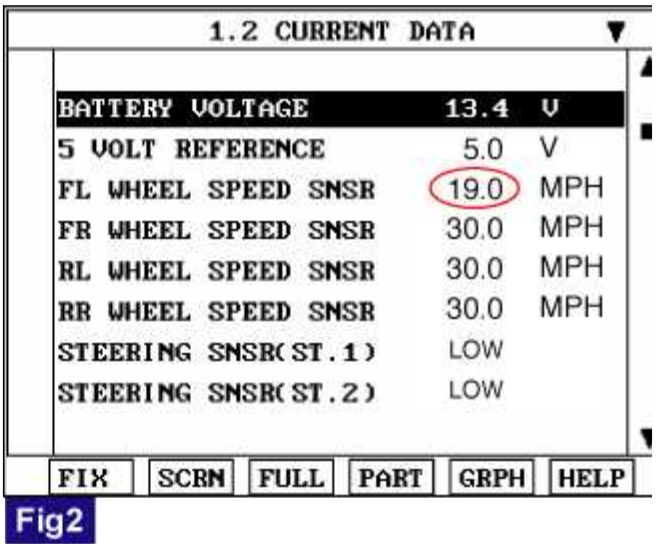


Fig2

Fig 1) Test Condition : Drive vehicle in 40 km/h or more. (24 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 50 km/h or more. (30 mph or more) Tone wheel Abnormal data

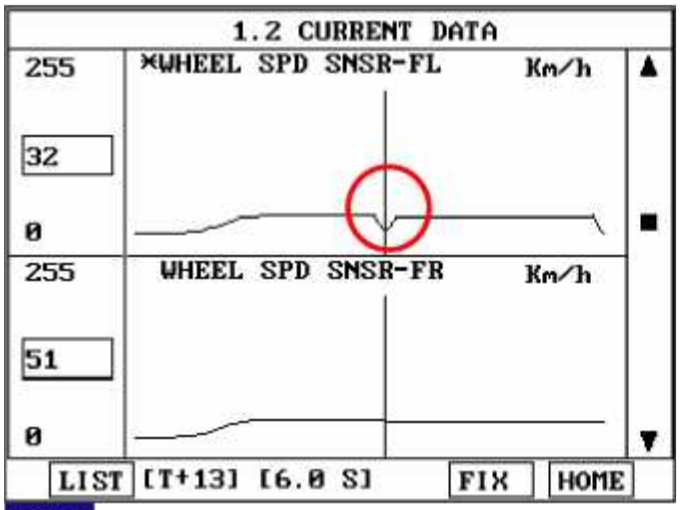


Fig3

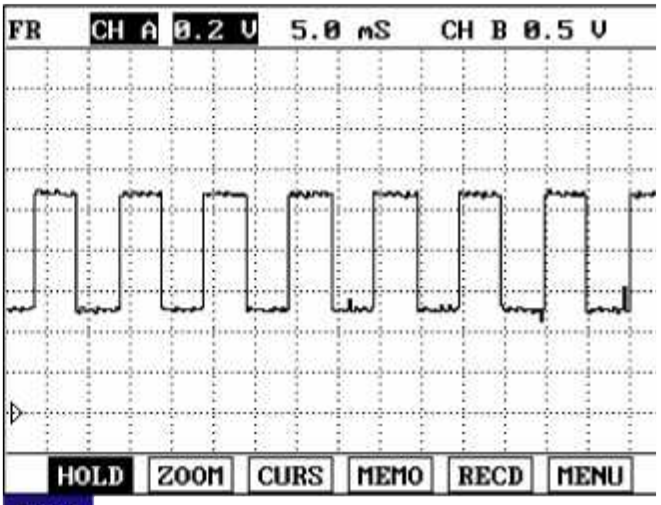


Fig4

Fig 3) Test Condition : Drive vehicle in 50 km/h or more. (30 mph or more) Tone wheel Abnormal data
Fig 4) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data

Is parameter displayed within specifications?

YES

Fault is intermittent caused by faulty Wheel speed sensor(FL) 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 c 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.

2. COMPONENT INSPECTION
(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(FL) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

3. 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) 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.

Brake System > Troubleshooting > C1202

DESCRIPTION

This code shows in case that there is no signal from any of the wheel speed sensors caused by an air gap, etc.

DTC DETECTING CONDITION

DTC No	Condition	Cause
C1202 (FL) C1205 (FR) C1208 (RL) C1211 (RR)	**Large AirGap :** This monitoring is performed for the period that the minimum velocity rises from 2 km/h to 10 km/h (1 mph to 6 mph). - When the minimum wheel velocity is 2 km/h and the velocity of other wheels exceed 10 km/h (6 mph) with the less than acceleration of 0.4 g, the controller start comparing the velocity of other wheels except the min. wheel. if their difference below 4 km/h (2 mph) is continued for 140 msec, Otherwise, if their difference beyond 4 km/h (2 mph) or more than 0.4 g is continued for 2 minutes. - In < 0.4 g, when the velocity of more than two wheels is 2 km/h (1 mph) and the max. wheel velocity exceeds 10 km/h (6 mph), the condition iscontinued for 20 sec. Otherwise, In more than 0.4 g, the condition is 2 minutes. - After velocity of 4 wheel exceeds 10 km/h (6 mph), when velocity of 1 wheel or 2 wheel is 2 km/h (1 mph) and difference of other 2 wheel velocity is less than 4 km/h (2 mph) under that those velocity is more than 10 km/h (6 mph), if	- Faulty installing of wheel speed sensor - Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty rotor or wheel bearing

	that conditions are continued for 12 seconds. **Long Term ABS mode :** - During the ABS control cycle, if the wheel velocity of 2 km/h (1 mph) is lasted for more than 12 sec. - If the ABS control cycle is continued for more than 36 sec.	- Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- More than two wheels malfunction.

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. MONITOR SCANTOOL DATA
   (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(6 mph or more)
   (4) Monitor the "Wheel speed sensor(FL)" parameter on the Scantool.

Specification : Approx. 10 km/h or more(6 mph or more)

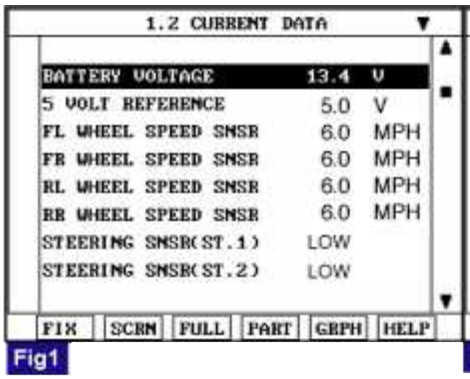


Fig1

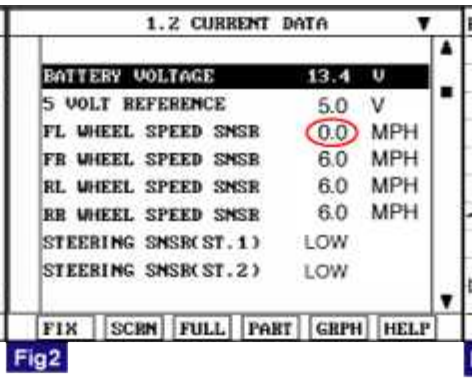


Fig2

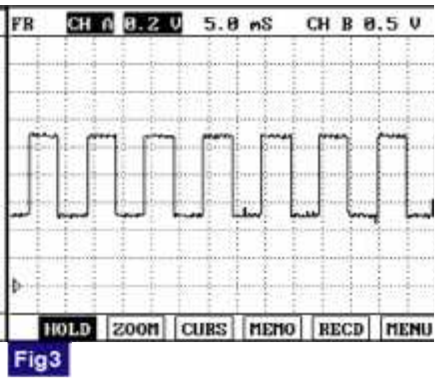


Fig3

Fig 1) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Abnormal Data
Fig 3) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal wave

Is parameter displayed within specifications?

YES

Fault is intermittent caused by faulty Wheel speed sensor(FL) 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 c 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.

2. COMPONENT INSPECTION

(1) Ignition "OFF".

(2) Engine "ON".

(3) Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 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(FL) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

3. 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) 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. 10 km/h or more(6 mph or more))

(4) Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Brake System > Troubleshooting > C1203

DESCRIPTION

The HECU receives wheel speed signals from the four wheel speed sensors.
The wheel signals are converted to voltage signals by the signal converting circuit and given as input to the HECU.
The HECU checks an open or short in the circuit of the wheel speed sensor.
If more than one wheel speed sensor malfunctions, the system stops.

DTC DETECTING CONDITION

DTC No	**Condition**	Possible Cause
C1200 (FL) C1203 (FR) C1206 (RL) C1209 (RR)	*Active Sensor ; If the sensor signal current is continuously out of the specified range of 4 mA ± 10 ~ 22 mA ± 10 for 140 msec, the failure is detected. * Passive Sensor ; When the offset voltage of the sensor is outside the specified range of 2 V ± 10 % ~ 4 V ± 10 % for 140 msec, the failure is detected.	- Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON but the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased. After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON but the EBD warning lamp is OFF.

- More than two wheels malfunction

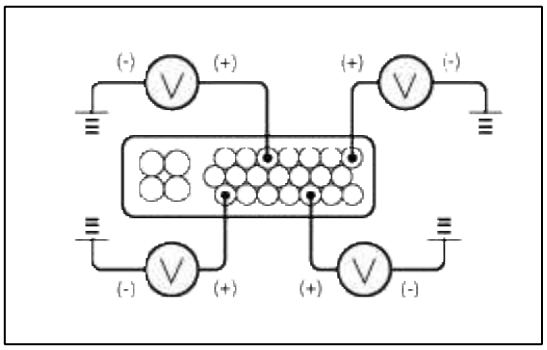
The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. CHECK POWER FOR WHEEL SPEED SENSOR
   Measure the voltage between an appropriate wheel sensor(+) terminal and the body ground (see the table below).

DTC	Terminal
C1200 (Front-left) C1203 (Front-right) C1206 (Rear-left) C1209 (Rear-right)	1 19 5 23

Specification:Battery positive(+)



Is the voltage within the specification?

NO

Repair short to power in the (+) circuit between the HECU and the appropriate wheel sensor.

YES

Check output of the wheel speed sensor

2. CHECK OUTPUT OF THE WHEEL SPEED SENSOR
   Check the voltage between terminals (see the table below)of the HECU and the body ground.

DTC	Terminal
C1200 (Front-left) C1203 (Front-right) C1206 (Rear-left) C1209 (Rear-right)	2 20 6 22

Specification:0.4 ~ 2.2 V

Is the voltage within the specification?

YES

Replace the wheel sensor and recheck.

NO

Repair the wire between the HECU and the wheel speed sensor.

Brake System > Troubleshooting > C1204

DESCRIPTION

This code shows in case that a speed signal from any of the 4 wheel speed sensors does not match to the others at any speed.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1201 (FL) C1204 (FR) C1207 (RL) C1210 (RR)	**Speed Jump :** This monitoring is performed for the period that the velocity of each wheel exceeds 2 km/h (1 mph). - Controller counts the number of the wheel acceleration of 100 g[(25 km/h ; 15 mph) 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[(10k m/h ; 6 mph) 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 ; 15 mph) 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 ; 15 mph) for 7 ms] causes the controller to start monitoring this failure and to comparethe 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. - In 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. **Wrong Exciter :** - Max. wheel velocity exceeds 20 km/h (12 mph) and the wheel velocity is 40 % of max. wheel velocity. if this condition is lasted for 2 minutes. - Max. wheel velocity exceeds 40 km/h (24 mph) and the wheel velocity is 60 % of max. wheel velocity. if this condition is lasted for 2 minutes. - Faulty installing of wheel speed sensor	- Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty rotor or wheel bearing - Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- More than two wheels malfunction.

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD

warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. MONITOR SCANTOOL DATA

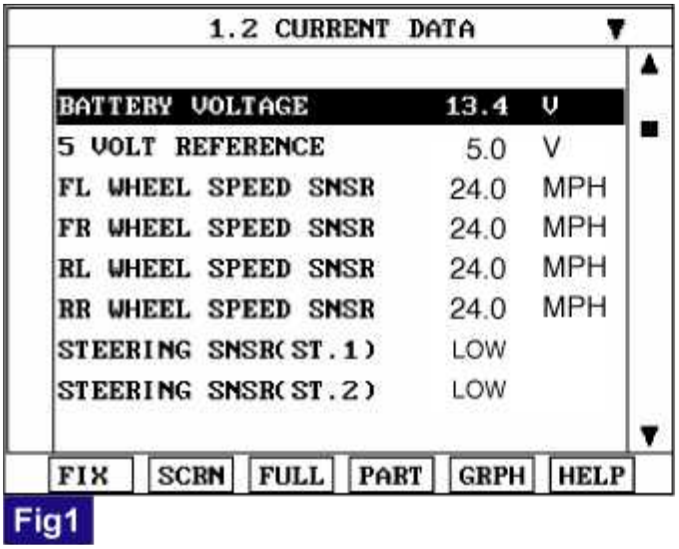
(1) Connect scantool to Data Link Connector(DLC)

(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(FL)" parameter on the Scantool.

Specification : Approx. 40 km/h or more(24 mph or more)



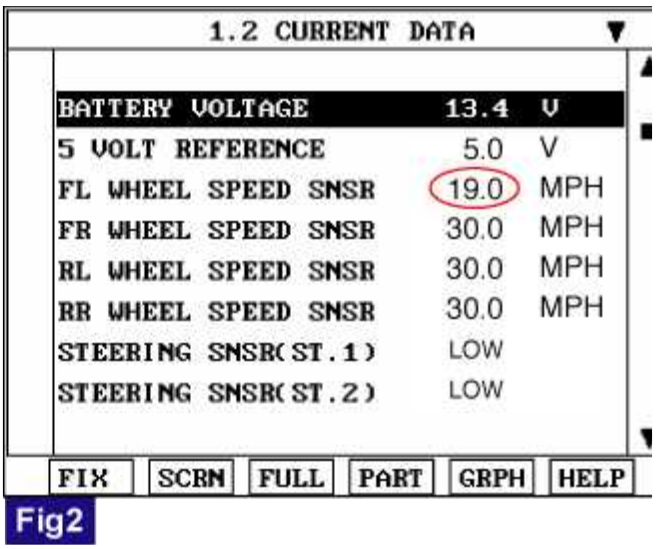
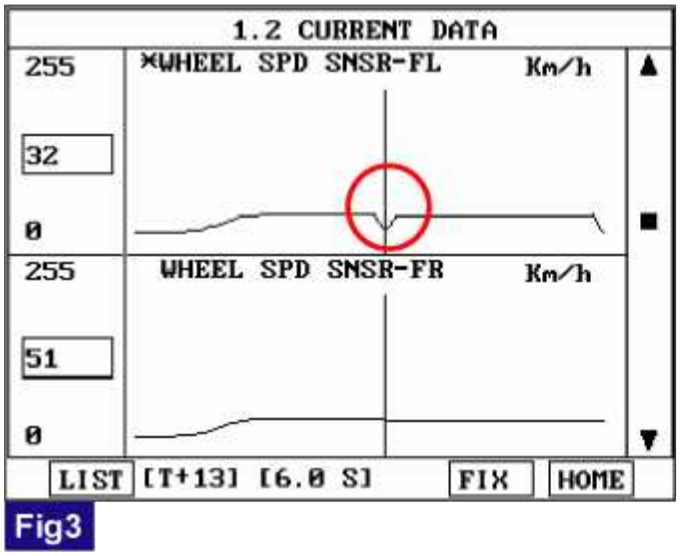


Fig 1) Test Condition : Drive vehicle in 40 km/h or more. (24 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 50 km/h or more. (30 mph or more) Tone wheel Abnormal data



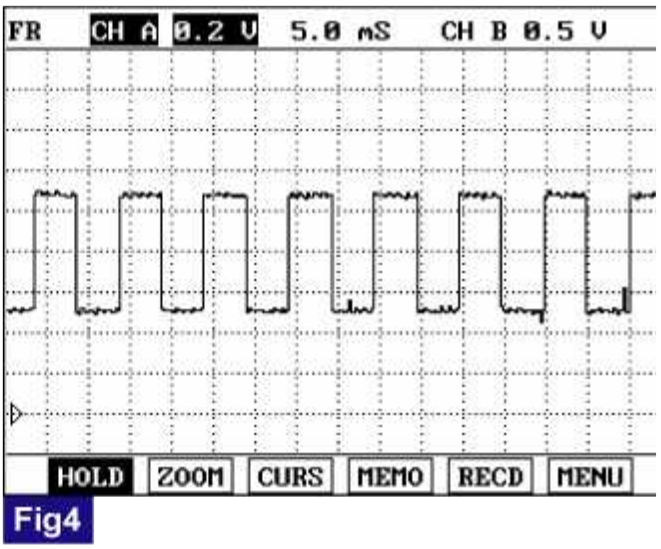


Fig 3) Test Condition : Drive vehicle in 50 km/h or more. (30 mph or more) Tone wheel Abnormal data
Fig 4) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data

Is parameter displayed within specifications?

YES

Fault is intermittent caused by faulty Wheel speed sensor(FL) 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 c 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.

2. COMPONENT INSPECTION

(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(FL) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

3. 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) 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.

Brake System > Troubleshooting > C1205

DESCRIPTION

This code shows in case that there is no signal from any of the wheel speed sensors caused by an air gap, etc.

DTC DETECTING CONDITION

DTC No	Condition	Cause
C1202 (FL) C1205 (FR) C1208 (RL) C1211 (RR)	**Large AirGap :** This monitoring is performed for the period that the minimum velocity rises from 2 km/h to 10 km/h (1 mph to 6 mph). - When the minimum wheel velocity is 2 km/h and the velocity of other wheels exceed 10 km/h (6 mph) with the less than acceleration of 0.4 g, the controller start comparing the velocity of other wheels except the min. wheel. if their difference below 4 km/h (2 mph) is continued for 140 msec, Otherwise, if their difference beyond 4 km/h (2 mph) or more than 0.4 g is continued for 2 minutes. - In < 0.4 g, when the velocity of more than two wheels is 2 km/h (1 mph) and the max. wheel velocity exceeds 10 km/h (6 mph), the condition iscontinued for 20 sec. Otherwise, In more than 0.4 g, the condition is 2 minutes. - After velocity of 4 wheel exceeds 10 km/h (6 mph), when velocity of 1 wheel or 2 wheel is 2 km/h (1 mph) and difference of other 2 wheel velocity is less than 4 km/h (2 mph) under that those velocity is more than 10 km/h (6 mph), if that conditions are continued for 12 seconds. **Long Term ABS mode :** - During the ABS control cycle, if the wheel velocity of 2 km/h (1 mph) is lasted for more than 12 sec. - If the ABS control cycle is continued for more than 36 sec.	- Faulty installing of wheel speed sensor - Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty rotor or wheel bearing - Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- More than two wheels malfunction.

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. MONITOR SCANTOOL DATA

(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(6 mph or more)

(4) Monitor the "Wheel speed sensor(FL)" parameter on the Scantool.

Specification : Approx. 10 km/h or more(6 mph or more)

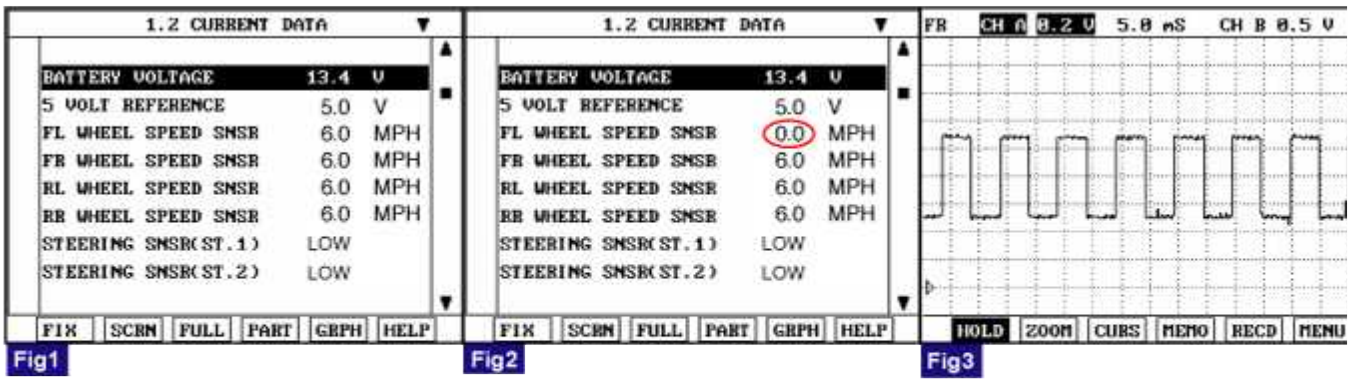


Fig 1) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Abnormal Data
Fig 3) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal wave

Is parameter displayed within specifications?

YES

Fault is intermittent caused by faulty Wheel speed sensor(FL) 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 c 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.

2. COMPONENT INSPECTION

(1) Ignition "OFF".

(2) Engine "ON".

(3) Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 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(FL) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

3. 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) 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. 10 km/h or more(6 mph or more))

(4) Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Brake System > Troubleshooting > C1206

DESCRIPTION

The HECU receives wheel speed signals from the four wheel speed sensors.
The wheel signals are converted to voltage signals by the signal converting circuit and given as input to the HECU.
The HECU checks an open or short in the circuit of the wheel speed sensor.
If more than one wheel speed sensor malfunctions, the system stops.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1200 (FL) C1203 (FR) C1206 (RL) C1209 (RR)	*Active Sensor ; If the sensor signal current is continuously out of the specified range of 4 mA ± 10 ~ 22 mA ± 10 for 140 msec, the failure is detected. * Passive Sensor ; When the offset voltage of the sensor is outside the specified range of 2 V ± 10 % ~ 4 V ± 10 % for 140 msec, the failure is detected.	- Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON but the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased. After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON but the EBD warning lamp is OFF.

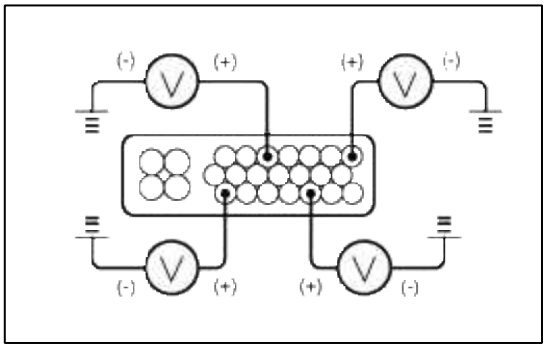
- More than two wheels malfunction
The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. CHECK POWER FOR WHEEL SPEED SENSOR
Measure the voltage between an appropriate wheel sensor(+) terminal and the body ground (see the table below).

DTC	Terminal
C1200 (Front-left) C1203 (Front-right) C1206 (Rear-left) C1209 (Rear-right)	1 19 5 23

Specification:Battery positive(+)



Is the voltage within the specification?

NO

Repair short to power in the (+) circuit between the HECU and the appropriate wheel sensor.

YES

Check output of the wheel speed sensor

2. CHECK OUTPUT OF THE WHEEL SPEED SENSOR
Check the voltage between terminals (see the table below)of the HECU and the body ground.

DTC	Terminal
C1200 (Front-left) C1203 (Front-right) C1206 (Rear-left) C1209 (Rear-right)	2 20 6 22

Specification:0.4 ~ 2.2 V

Is the voltage within the specification?

YES

Replace the wheel sensor and recheck.

NO

Repair the wire between the HECU and the wheel speed sensor.

Brake System > Troubleshooting > C1207

DESCRIPTION

This code shows in case that a speed signal from any of the 4 wheel speed sensors does not match to the others at any speed.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1201 (FL) C1204 (FR) C1207 (RL) C1210 (RR)	**Speed Jump :** This monitoring is performed for the period that the velocity of each wheel exceeds 2 km/h (1 mph). - Controller counts the number of the wheel acceleration of 100 g[(25 km/h ; 15 mph) 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[(10k m/h ; 6 mph) 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 ; 15 mph) 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 ; 15 mph) for 7 ms] causes the controller to start monitoring this failure and to comparethe 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. - In 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. **Wrong Exciter :** - Max. wheel velocity exceeds 20 km/h (12 mph) and the wheel velocity is 40 % of max. wheel velocity. if this condition is lasted for 2 minutes. - Max. wheel velocity exceeds 40 km/h (24 mph) and the wheel velocity is 60 % of max. wheel velocity. if this condition is lasted for 2 minutes. - Faulty installing of wheel speed sensor	- Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty rotor or wheel bearing - Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.

After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- More than two wheels malfunction.

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. MONITOR SCANTOOL DATA

(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(FL)" parameter on the Scantool.

Specification : Approx. 40 km/h or more(24 mph or more)

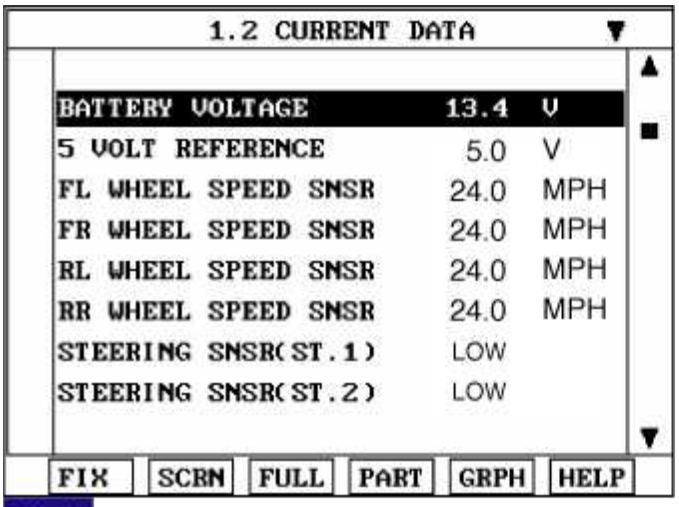


Fig1

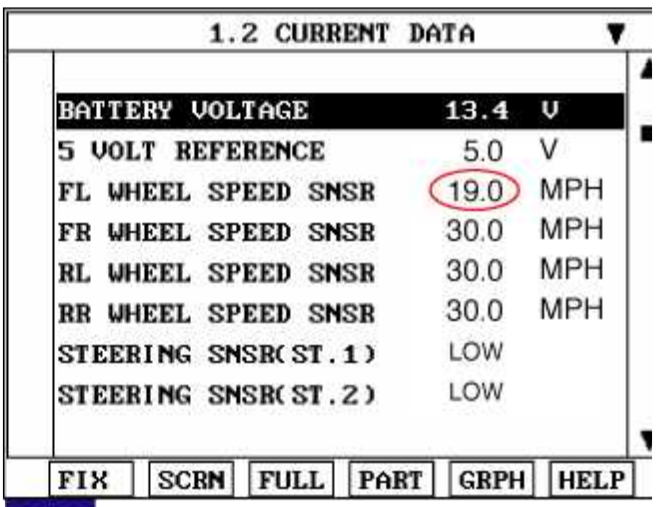


Fig2

Fig 1) Test Condition : Drive vehicle in 40 km/h or more. (24 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle in 50 km/h or more. (30 mph or more) Tone wheel Abnormal data

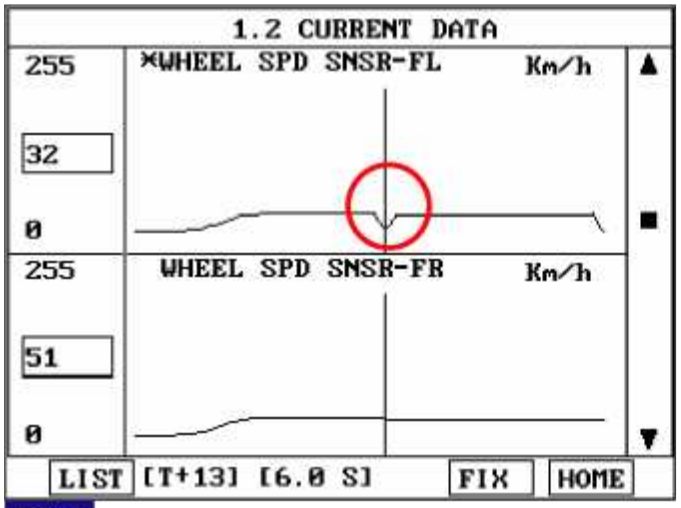


Fig3

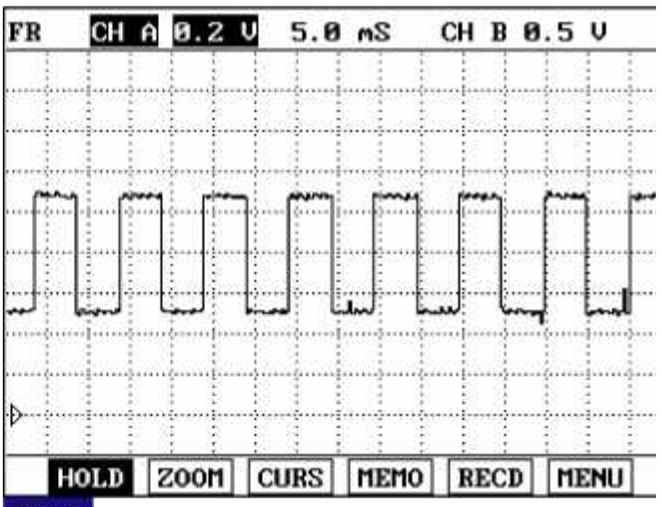


Fig4

Fig 3) Test Condition : Drive vehicle in 50 km/h or more. (30 mph or more) Tone wheel Abnormal data
Fig 4) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data

Is parameter displayed within specifications?

YES

Fault is intermittent caused by faulty Wheel speed sensor(FL) 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 c 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.

2. COMPONENT INSPECTION

(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(FL) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

3. 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) 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.

Brake System > Troubleshooting > C1208

DESCRIPTION

This code shows in case that there is no signal from any of the wheel speed sensors caused by an air gap, etc.

DTC DETECTING CONDITION

DTC No	Condition	Cause
C1202 (FL) C1205 (FR) C1208 (RL) C1211 (RR)	**Large AirGap :** This monitoring is performed for the period that the minimum velocity rises from 2 km/h to 10 km/h (1 mph to 6 mph). - When the minimum wheel velocity is 2 km/h and the velocity of other wheels exceed 10 km/h (6 mph) with the less than acceleration of 0.4 g, the controller start comparing the velocity of other wheels except the min. wheel. if their difference below 4 km/h (2 mph) is continued for 140 msec, Otherwise, if their difference beyond 4 km/h (2 mph) or more than 0.4 g is continued for 2 minutes. - In < 0.4 g, when the velocity of more than two wheels is 2 km/h (1 mph) and the max. wheel velocity exceeds 10 km/h (6 mph), the condition iscontinued for 20 sec. Otherwise, In more than 0.4 g, the condition is 2 minutes. - After velocity of 4 wheel exceeds 10 km/h (6 mph), when velocity of 1 wheel or 2 wheel is 2 km/h (1 mph) and difference of other 2 wheel velocity is less than 4 km/h (2 mph) under that those velocity is more than 10 km/h (6 mph), if that conditions are continued for 12 seconds. **Long Term ABS mode :** - During the ABS control cycle, if the wheel velocity of 2 km/h (1 mph) is lasted for more than 12 sec. - If the ABS control cycle is continued for more than 36 sec.	- Faulty installing of wheel speed sensor - Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty rotor or wheel bearing - Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD

warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased. After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- More than two wheels malfunction.

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. MONITOR SCANTOOL DATA

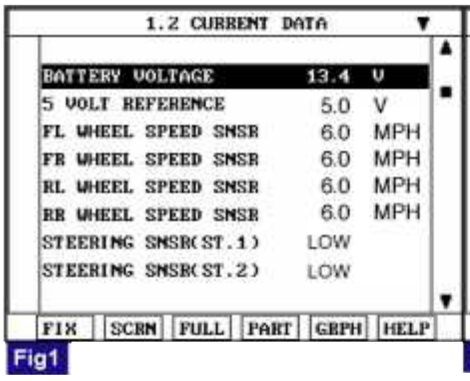
(1) Connect scantool to Data Link Connector(DLC)

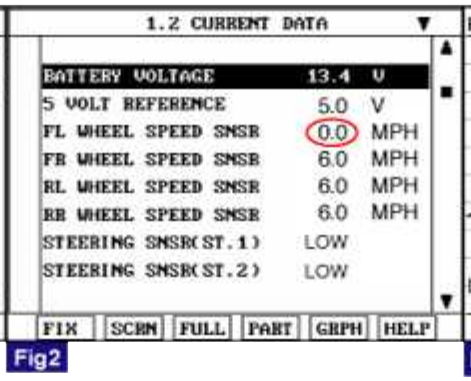
(2) Engine "ON".

(3) Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more)

(4) Monitor the "Wheel speed sensor(FL)" parameter on the Scantool.

Specification : Approx. 10 km/h or more(6 mph or more)





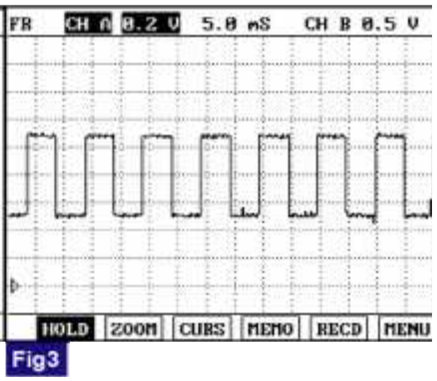


Fig 1) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Abnormal Data
Fig 3) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal wave

Is parameter displayed within specifications?

YES

Fault is intermittent caused by faulty Wheel speed sensor(FL) 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 c 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.

2. COMPONENT INSPECTION

(1) Ignition "OFF".

(2) Engine "ON".

(3) Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 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(FL) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

3. 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) 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. 10 km/h or more(6 mph or more))

(4) Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Brake System > Troubleshooting > C1209

DESCRIPTION

The HECU receives wheel speed signals from the four wheel speed sensors.
The wheel signals are converted to voltage signals by the signal converting circuit and given as input to the HECU.
The HECU checks an open or short in the circuit of the wheel speed sensor.
If more than one wheel speed sensor malfunctions, the system stops.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1200 (FL) C1203 (FR) C1206 (RL) C1209 (RR)	*Active Sensor ; If the sensor signal current is continuously out of the specified range of 4 mA ± 10 ~ 22 mA ± 10 for 140 msec, the failure is detected. * Passive Sensor ; When the offset voltage of the sensor is outside the specified range of 2 V ± 10 % ~ 4 V ± 10 % for 140 msec, the failure is detected.	- Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON but the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased. After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

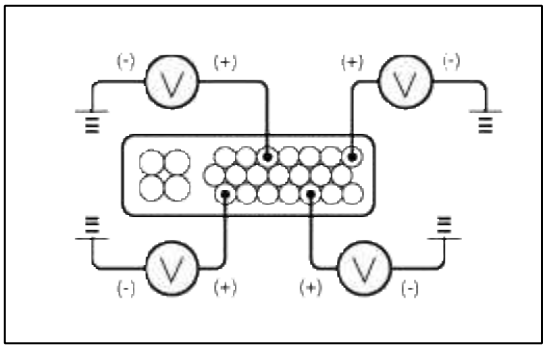
INSPECTION PROCEDURE

1. CHECK POWER FOR WHEEL SPEED SENSOR

Measure the voltage between an appropriate wheel sensor(+) terminal and the body ground (see the table below).

DTC	Terminal
C1200 (Front-left)	1
C1203 (Front-right)	19
C1206 (Rear-left)	5
C1209 (Rear-right)	23

Specification:Battery positive(+)



Is the voltage within the specification?

NO

Repair short to power in the (+) circuit between the HECU and the appropriate wheel sensor.

YES

Check output of the wheel speed sensor

2. CHECK OUTPUT OF THE WHEEL SPEED SENSOR

Check the voltage between terminals (see the table below)of the HECU and the body ground.

DTC	Terminal
C1200 (Front-left) C1203 (Front-right) C1206 (Rear-left) C1209 (Rear-right)	2 20 6 22

Specification:0.4 ~ 2.2 V

Is the voltage within the specification?

YES

Replace the wheel sensor and recheck.

NO

Repair the wire between the HECU and the wheel speed sensor.

Brake System > Troubleshooting > C1210

DESCRIPTION

This code shows in case that a speed signal from any of the 4 wheel speed sensors does not match to the others at any speed.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1201 (FL) C1204 (FR) C1207 (RL) C1210 (RR)	**Speed Jump :** This monitoring is performed for the period that the velocity of each wheel exceeds 2 km/h (1 mph). - Controller counts the number of the wheel acceleration of 100 g[(25 km/h ; 15 mph) 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[(10k m/h ; 6 mph) 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 ; 15 mph) 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 ; 15 mph) for 7 ms] causes the controller to start monitoring this failure and to comparethe 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. - In 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. **Wrong Exciter :**	- Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty rotor or wheel bearing - Faulty HECU

	- Max. wheel velocity exceeds 20 km/h (12 mph) and the wheel velocity is 40 % of max. wheel velocity. if this condition is lasted for 2 minutes. - Max. wheel velocity exceeds 40 km/h (24 mph) and the wheel velocity is 60 % of max. wheel velocity. if this condition is lasted for 2 minutes. - Faulty installing of wheel speed sensor	

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- More than two wheels malfunction.

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. MONITOR SCANTOOL DATA
   (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(FL)" parameter on the Scantool.

Specification : Approx. 40 km/h or more(24 mph or more)

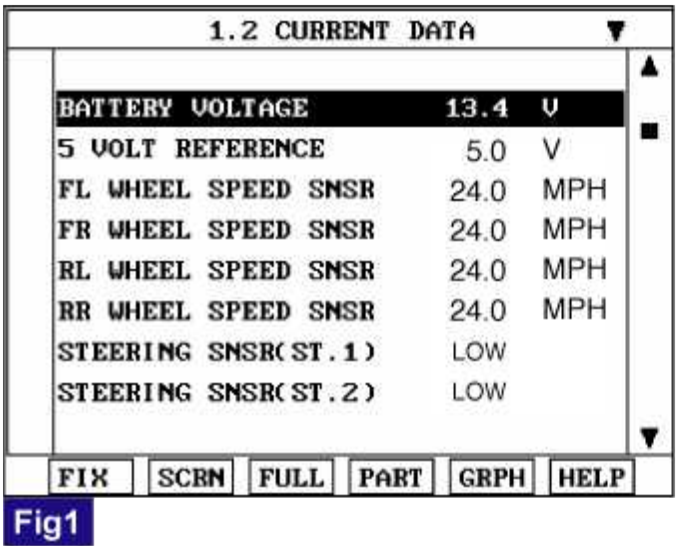


Fig1

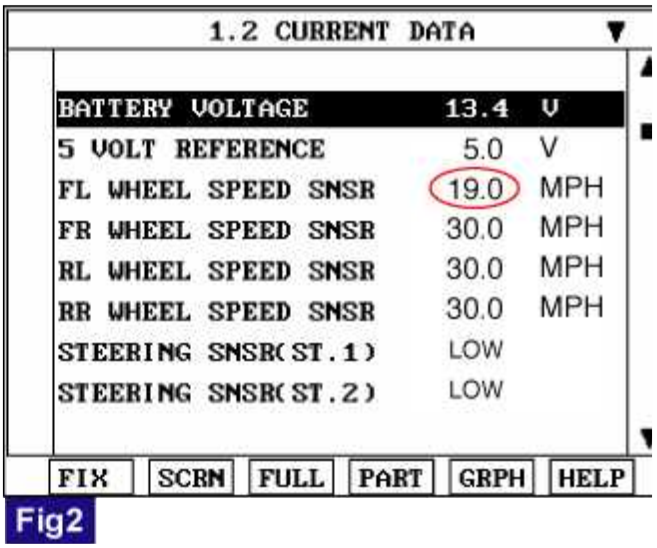


Fig2

Fig 1) Test Condition : Drive vehicle in 40 km/h or more. (24 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 50 km/h or more. (30 mph or more) Tone wheel Abnormal data

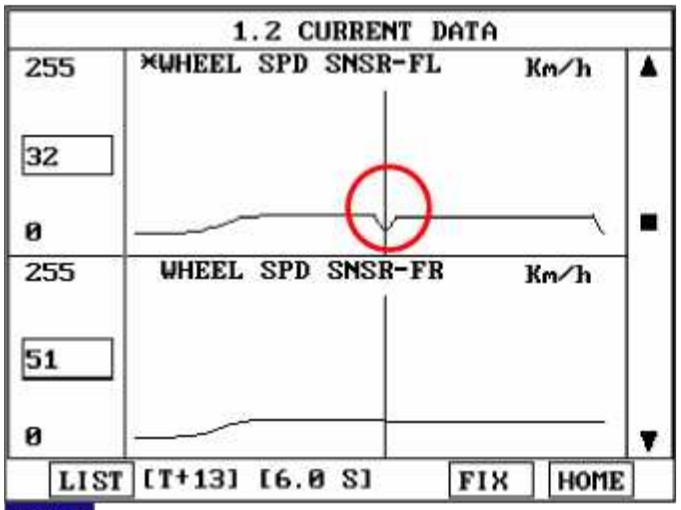


Fig3

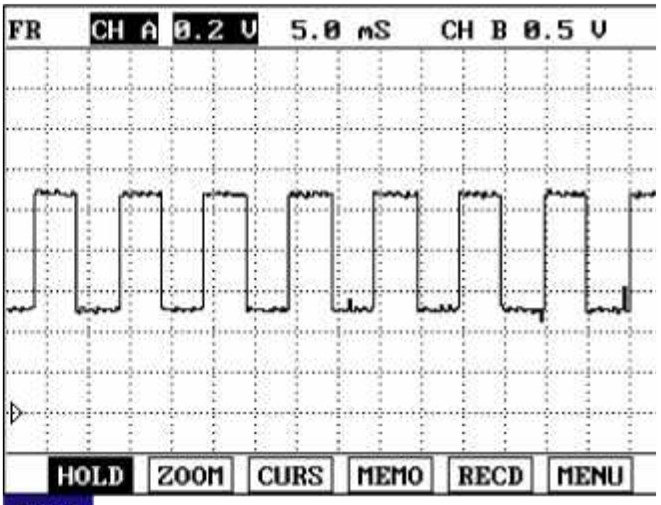


Fig4

Fig 3) Test Condition : Drive vehicle in 50 km/h or more. (30 mph or more) Tone wheel Abnormal data
Fig 4) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data

Is parameter displayed within specifications?

YES

Fault is intermittent caused by faulty Wheel speed sensor(FL) 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 c 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.

2. COMPONENT INSPECTION

(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(FL) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

3. 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) 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.

Brake System > Troubleshooting > C1211

DESCRIPTION

This code shows in case that there is no signal from any of the wheel speed sensors caused by an air gap, etc.

DTC DETECTING CONDITION

DTC No	Condition	Cause
C1202 (FL) C1205 (FR) C1208 (RL) C1211 (RR)	**Large AirGap :** This monitoring is performed for the period that the minimum velocity rises from 2 km/h to 10 km/h (1 mph to 6 mph). - When the minimum wheel velocity is 2 km/h and the velocity of other wheels exceed 10 km/h (6 mph) with the less than acceleration of 0.4 g, the controller start comparing the velocity of other wheels except the min. wheel. if their difference below 4 km/h (2 mph) is continued for 140 msec, Otherwise, if their difference beyond 4 km/h (2 mph) or more than 0.4 g is continued for 2 minutes. - In < 0.4 g, when the velocity of more than two wheels is 2 km/h (1 mph) and the max. wheel velocity exceeds 10 km/h (6 mph), the condition iscontinued for 20 sec. Otherwise, In more than 0.4 g, the condition is 2 minutes. - After velocity of 4 wheel exceeds 10 km/h (6 mph), when velocity of 1 wheel or 2 wheel is 2 km/h (1 mph) and difference of other 2 wheel velocity is less than 4 km/h (2 mph) under that those velocity is more than 10 km/h (6 mph), if	- Faulty installing of wheel speed sensor - Open/short in circuit of wheel speed sensor - Faulty wheel speed sensor - Faulty rotor or wheel bearing

	that conditions are continued for 12 seconds. **Long Term ABS mode :** - During the ABS control cycle, if the wheel velocity of 2 km/h (1 mph) is lasted for more than 12 sec. - If the ABS control cycle is continued for more than 36 sec.	- Faulty HECU

FAILSAFE FUNCTION

Sensor malfunction without ABS control :

- One wheel sensor malfuntion

Only the ABS, TCS(ESP) functions are inhibited. the ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp is OFF.

- More than two wheels malfunction

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. the ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

Sensor malfunction with ABS control :

- One front wheel malfunction

Inhibit the ABS control of a wheel with a malfunctioning sensor and maintain the ABS control of other wheels. After the ABS control has completed, the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- One rear wheel malfunction

Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
After the controller completes the ABS control, Only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON and the EBD warning lamp is OFF.

- More than two wheels malfunction.

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. MONITOR SCANTOOL DATA
   (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(6 mph or more)
   (4) Monitor the "Wheel speed sensor(FL)" parameter on the Scantool.

Specification : Approx. 10 km/h or more(6 mph or more)

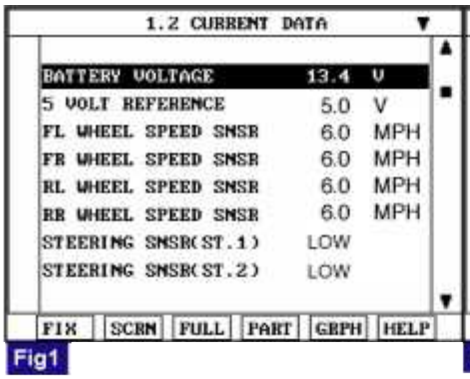


Fig1

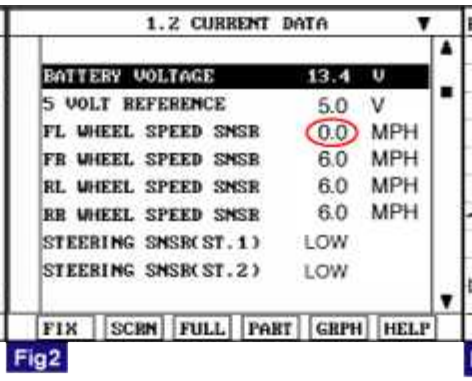


Fig2

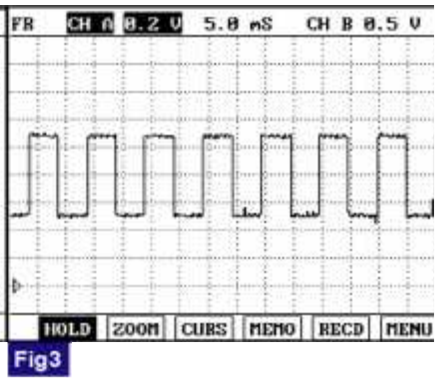


Fig3

Fig 1) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Abnormal Data
Fig 3) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal wave

Is parameter displayed within specifications?

YES

Fault is intermittent caused by faulty Wheel speed sensor(FL) 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 c 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.

2. COMPONENT INSPECTION

(1) Ignition "OFF".

(2) Engine "ON".

(3) Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 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(FL) and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

3. 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) 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. 10 km/h or more(6 mph or more))

(4) Are any DTCs present ?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Brake System > Troubleshooting > C1235

GENERAL DESCRIPTION

Master cylinder pressure sensor is used for detecting the pressure delivered to wheels when the brake system is working.

DTC DESCRIPTION

This code sets when there is an open or short in the circuit of the pressure sensor.

DTC DETECTING CONDITION

DTC No.	Detecting Condition	Possible Cause
C1235	**[Open, short to BATT/GND]** - When Vmcp > 4.8 ± 0.1 V or Vmcp < 0.2 ± 0.1 V continue 1 sec, - When sensor self test form is against to sensor specification - While the vehicle is stopped after driving over 40 kph for 3 times, If predefined value of pressure signal is not detected, ECU detect the failure after sensor self test. - The monitoring starts 1 sec after power up.	- Open/Short in the pressure sensor circuit - Faulty the pressure sensor - Faulty installation of the pressure sensor - Faulty HECU

FAILSAFE FUNCTION

The ESP function is inhibited, while the ABS and EBD controls allowed.
The ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK INSTALLATION OF PRESSURE SENSOR
   (1) Check if the pressure sensor is properly installed on the master cylinder.
   Is the pressure sensor installed properly?
   NO
   Reinstall the pressure sensor properly.
   YES
   Check power to the pressure sensor
2. CHECK POWER TO THE PRESSURE SENSOR
   (1) Disconnect the pressure sensor connector, and measure the voltage between terminals 1(-) and 3(+) of the pressure sensor connector.

   Specification : 4.8 ~ 5.2 V

   Is the voltage within the specification?
   NO
   Check harness and connector between the HECU and the pressure sensor.
   YES
   Check output voltage of pressure sensor

3. CHECK OUTPUT VOLTAGE OF PRESSURE SENSOR

(1) Measure the voltage between terminal 2 of the pressure sensor connector and the body ground.

Specification : 0.5 ~ 4.5V

Is the output voltage within the specification?

NO

Check harness and connector of the pressure sensor. If there is no error on the harness and the connector, replace the pressure sensor and recheck.

YES

Check output voltage of HECU connector

4. CHECK OUTPUT VOLTAGE OF HECU CONNECTOR

(1) Measure the voltage between terminal 12 of the HECU connector and the body ground.

Specification : 0.5 ~ 4.5V

Is the voltage within the specification?

NO

Repair harness and connector between the HECU and the pressure sensor.

YES

After clearing the DTC and driving the vehicle at 40 Km/h (24 mph) or more, if the ESP lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1237

GENERAL DESCRIPTION

Master cylinder pressure sensor is used for detecting the pressure delivered to wheels when the brake system is working.

DTC DESCRIPTION

This code sets when there is an irregular or no signal of the pressure sensor.

DTC DETECTING CONDITION

DTC No.	Detecting Condition	Possible Cause
C1237	**[Noisy signal, offset, stick]** - 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 detect the failure.	- Open/Short in the pressure sensor circuit - Faulty the pressure sensor - Faulty installation of the pressure sensor - Faulty HECU

FAILSAFE FUNCTION

The ESP function is inhibited, while the ABS and EBD controls allowed.
The ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK INSTALLATION OF PRESSURE SENSOR

Check if the pressure sensor is properly installed on the master cylinder.
Is the installation proper ?

NO

Reinstall the pressure sensor properly.

YES

Check power to the pressure sensor

2. CHECK POWER TO THE PRESSURE SENSOR

Disconnect the pressure sensor connector, and measure the voltage between terminals 1 and 3 of the pressure sensor connector.

Specification : 4.8 ~ 5.2 V

Is the power voltage within the specification?

NO

Check harness and connector between the HECU and the pressure sensor.

YES

Check output voltage of pressure sensor

3. CHECK OUTPUT VOLTAGE OF PRESSURE SENSOR

Measure the output voltage between terminal 2 of the pressure sensor connector and the body ground.

Specification : 0.5 ~ 4.5 V

Is the output voltage within the specification?

NO

Check harness and connector of the pressure sensor. If there is no error on the harness and the connector, replace the pressure sensor and recheck.

YES

After clearing the DTC and driving the vehicle at 40 Km/h (24 mph) speed or more, if the ESP lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1259

GENERAL DESCRIPTION

Steering angle sensor is a plate between the photo-controller LED and the photo transistor. As the plate rotates with steering wheel rotation, an electrical signal will be generated depending on whether the LED light passes through the plate to the photo-transistor or not. The signal is the steering wheel operation angular velocity and used to detect the steering wheel turning direction.

DTC DESCRIPTION

This code will set when there is an open or short in the circuit of the steering angle sensor.

DTC DETECTING CONDITION

DTC No.	Detecting Condition	Possible Cause
C1259	1.When Vsas > 4.4 or Vsas < 1.1 or 2.3 V < Vsas < 2.7 V continue 1 sec, 2.The Monitoring starts 1 sec after Power Up.	- Faulty steering angle sensor - Faulty installation of steering angle sensor - Faulty HECU

FAILSAFE FUNCTION
The ESP function is inhibited, while the ABS and EBD controls allowed.
The ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK INSTALLATION OF STEERING ANGLE SENSOR
   Check if the steering angle sensor is properly installed.
   Is the installation proper?

   NO
   Reinstall the steering angle sensor properly.

   YES
   Check power of steering angle sensor

2. CHECK POWER TO THE STEERING ANGLE SENSOR
   Disconnect the steering angle sensor connector, and measure the voltage between terminals 2 and 3 of the steering angle sensor connector.

   Specification : 9 ~ 16 V

   Is the voltage within the specification?

   NO
   Check harness and connector between the HECU and the steering angle sensor.

   YES
   Check output voltage of steering angle sensor

3. CHECK OUTPUT VOLTAGE OF STEERING ANGLE SENSOR
   Measure the voltage between terminal 1,4, and 5 of the steering angle sensor connector and the body ground.

   Specification : High : 3.0 ~ 4.1 V
   Low : 1.3 ~ 2.0 V

   Is the voltage within the specification?

   NO
   Check harness and connector of the steering angle sensor. If there is no error on the harness and the connector, replace the steering angle sensor and recheck.

   YES
   Check output of HECU connector

4. CHECK OUTPUT OF HECU CONNECTOR
Measure the voltage between terminal 8,40, and 39 of the HECU connector and the body ground.

Specification : High : 3.0 ~ 4.1 V
Low : 1.3 ~ 2.0 V

Is the voltage within the specification?

NO

Repair harness and connector between the HECU and the steering angle sensor.

YES

After clearing the DTC and driving the vehicle at 40 Km/h (24 mph) speed or more, if the ESP lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1260

GENERAL DESCRIPTION

Steering angle sensor is a plate between the photo-controller LED and the photo transistor. As the plate rotates with steering wheel rotation, electrical signal will be generated depending on whether the LED light passes through the plate to the photo-transistor or not. The signal is the steering wheel operation angular velocity and used to detect the steering wheel turning direction.

DTC DESCRIPTION

This code shows in case that there is an irregular or no signal of the steering angle sensor.

DTC DETECTING CONDITION

DTC No.	Detecting Condition	Possible Cause
C1260	**[Offset error, stick]** - 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 larger 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 degrees ↔ - 60 ± 5 degrees, If STN is not detected low, ECU detects the failure. - While steering angle sensor wheel through center, If steering angle sensor is against specification three times, ECU detect the failure. - When ther curve is detected after driving straight, if estimated value and measured value of the sensor indicate in the opposite direction for 2 times.	- Open/short in circuit of steering angle sensor - Faulty steering angle sensor - Faulty installATION of steering angle sensor - Faulty HECU

FAILSAFE FUNCTION

The ESP function is inhibited, while the ABS and EBD controls allowed.
The ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK INSTALLATION OF STEERING ANGLE SENSOR
Check if the steering angle sensor is properly installed.
Is the installation proper?

NO
Reinstall the steering angle sensor properly.

YES
Check power of steering angle sensor

2. CHECK POWER OF STEERING ANGLE SENSOR
Disconnect the steering angle sensor connector, and measure the voltage between terminal 2 and 3 of the steering angle sensor connector.

Specification : 9 ~ 16 V

Is the voltage within the specification?

NO
Check harness and connector between the HECU and the steering angle sensor.

YES
Check output signal of steering angle sensor

3. CHECK OUTPUT SIGNAL OF STEERING ANGLE SENSOR
(1) Check if both ST1 and ST2 alternate High and Low signal, rotating the wheel.
(2) Check if STN has Low signal, rotating the wheel at 360 degree in one direction.
Is the signal of the steering angle sensor normal?

NO
Check harness and connector of the steering angle sensor. If no error on the harness and the connector, replace the steering angle sensor and recheck.

YES
After clearing the DTC and driving the vehicle at 40 Km/h (24 mph) speed or more, if the ESP lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1274

DTC DETECTING CONDITION

DTC No	Condition	Possible Caese
C1274	When the voltage of Gsensor signal is more than 4.5 V or less than 0.6 V for 250 msec continuously.	- Open/short in G-sensor circuit. - Faulty G-sensor - Faulty installation of G-sensor - Faulty HECU

FAILSAFE FUNCTION
Only the ABS, TCS(ESP) functions are inhibited. The ABS,TCS(ESP) warning lamps are ON, but the EBD warning lamp OFF.

INSPECTION PROCEDURE

1. CHECK SHORT IN CIRCUIT TO BATTERY(+).
   (1) Disconnect the connector from the HECU.
   (2) Turn the ignition switch ON.
   (3) Measure the voltage between terminal 13 of the HECU connector and the body ground.
   Is the voltage above 4.5 V?
   YES
   Repair short in the circuit to battery(+) between the G-sensor and the HECU.
   NO
   Check short in circuit to ground.
2. CHECK SHORT IN CIRCUIT TO GROUND.
   (1) Disconnect the connector from the HECU.
   (2) Measure the resistance between terminal 13 of the HECU connector and the body ground.
   Is the resistance below 1 Ω?
   YES
   Repair short in the circuit to the body ground between the G-sensor and the HECU.
   NO
   Check output in HECU connector
3. CHECK OUTPUT IN HECU CONNECTOR.
   (1) Disconnect the connector from the HECU and turn the ignition switch ON.
   (2) Measure the voltage between terminals 13(+) and 15(-) of the HECU connector.
   Is the voltage within 0.6 V ~ 4.5 V?
   YES
   Check the HECU harness or connector.
   NO
   If necessary, replace the HECU then recheck.
4. CHECK OUTPUT IN G-SENSOR CONNECTOR.
   (1) Turn the ignition switch ON.
   (2) Measure the voltage between terminals 2(+) and 3(-) of the G-sensor connector.

   Specification: approximately 3.5 V

   Is the voltage within the specification?
   NO
   Replace the G-sensor.
   YES
   Replace the HECU then recheck.

Brake System > Troubleshooting > C1275

DTC DETECTING CONDITION

DTC No	Condition	Possible Caese
C1275	- When vehicle speed is more than10 km/h(6 mph) and the brake light switch is off, '|G|>0.5 G' for 20 sec continuously. - When ' |min. wheel speed| / dt ≥0.2 G and |G| ≤0.1 G' for 60 sec continuously.	- Open/short in G-sensor circuit. - Faulty G-sensor - Faulty installtaion of G-sensor - Faulty HECU

FAILSAFE FUNCTION
Only the ABS, TCS(ESP) functions are inhibited. The ABS,TCS(ESP) warning lamps are ON, but the EBD warning lamp OFF.

INSPECTION PROCEDURE

1. CHECK OPEN/SHORT IN CIRCUIT OF G-SENSOR.
   (1) Turn the ignition switch ON.
   (2) Measure the output voltage between terminals 2(+) and 3(-) of the G-sensor connector.
   Is the voltage within 0.6 V ~ 4.5 V?
   NO
   Repair an open or short in the circuit between the G-sensor and the HECU.
   YES
   Check installtaion of G-sensor
2. CHECK THE INSTALLATION OF G-SENSOR
   Visually check for the installation of the G-sensor.
   Be sure to install the G-sensor with the arrow mark to be facing forward direction.
   Is it installed correctly?
   NO
   Reinstall the G-sensor and recheck.
   YES
   Check output voltage in G-sensor connector
3. CHECK OUTPUT VOLTAGE IN G-SENSOR CONNECTOR.
   Turn the ignition switch ON.
   Measure the voltage between terminals 2(+) and 3(-) of the G-sensor connector.

   Specification : approximately 2.5 V

   Incline the G-sensor to 90 degrees angle then measure the voltage between terminals 2(+) and 3(-) of the G-sensor connector.

   Specification : approximately 3.5 V

   Is the voltage within the specification?
   NO
   Replace the G-sensor.
   YES
   Replace the HECU then recheck.

Brake System > Troubleshooting > C1282

GENERAL DESCRIPTION

The yaw-rate & Lateral G sensor are used for the stability of a vehicle. The yaw-rate is used to measure angular velocity while the Lateral G is to measure the force that moves the vehicle away from the center, when a vehicle is cornering.

DTC DESCRIPTION

This code sets when there is an open or short in the circuit of the yaw-rate & lateral G sensor.

DTC DETECTING CONDITION

DTC No.	Detecting Condition	Possible Cause
C1282	**[Lateral G sensor open, short to GND]** - When Vlg >4.90±0.05V or Vlg <0.10±0.05V continue 1sec, - The monitoring starts 1sec after power up. **[YAW rate sensor open, short to GND]** - When Vyaw > 4.90 ± 0.05 V or Vyaw < 0.10 ± 0.05 V continue 1sec, - The monitoring starts 1sec after power up. **[CBIT / self test]** - 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.	- Yaw Rate & Lateral G Sensor Open, short to GND - Faulty Yaw Rate & Lateral G Sensor - Faulty HECU

FAILSAFE FUNCTION

The ESP function is inhibited, while the ABS and EBD controls allowed.
The ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK POWER OF YAW-RATE & LATERAL G SENSOR

   Disconnect the connector from the yaw-rate& Lateral G sensor, and measure the voltage between terminals 3 and 4 of the yaw-rate& Lateral G sensor.

   Specification : 4.75 ~ 5.25 V

   Is the voltage within the specification?

   NO

   Check harness and connector between the HECU and the yaw-rate & lateral G sensor.

   YES

   Check output of yaw-rate & lateral G sensor

2. CHECK OUTPUT OF YAW-RATE & LATERAL G SENSOR
   (1) When the ignition switch is OFF, measure the voltage between terminal 1 of the yaw-rate sensor connector and the body ground.
   (2) When the ignition switch is OFF, measure the voltage between terminal 2 of the lateral G sensor connector and the body ground.

   Specification : 2.25 ~ 2.75 V

   Is the voltage within the specification?

   NO

   Check harness and connector of the yaw-rate & lateral G sensor. If no error on harness and connector, replace and recheck the yaw-rate & lateral G sensor.

   YES

   Check output voltage of HECU connector for yaw-rate & lateral G sensor

3. CHECK OUTPUT VOLTAGE OF HECU CONNECTOR FOR YAW-RATE&LATERAL G SENSOR
   (1) When the ignition switch is OFF, measure the output voltage between terminal 41 of the HECU connector and the ground.
   (2) When the ignition switch is OFF, measure the output voltage between terminal 9 of the HECU connector and the ground.

   Specification : 2.25 ~ 2.75 V

   Is the output voltage within the specification?

   NO

   Repair harness and connector between the HECU and the yaw-rate & lateral G sensor.

   YES

   After clearing the DTC and driving the vehicle at 40 Km/h (24 mph) speed or more, if the ESP lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1283

GENERAL DESCRIPTION

The yaw-rate & Lateral G sensor are used for the stability of a vehicle. The yaw-rate is used to measure angular velocity while the Lateral G is used to measure the force that moves the vehicle away from the center, when a vehicle is cornering.

DTC DESCRIPTION

This code shows in case that there is an irregular or no signal of the yaw-rate & lateral G sensor.

DTC DETECTING CONDITION

DTC No.	Detecting Condition	Possible Cause
C1283	**[Lateral G sensor noisy signal, offset error, stick]** - During standstill if lateral G value is larger than 0.7 g and continue 2 sec, The failure is recognized - If noise of input signal is happened 429 times in 5sec , Which the amplitude of the sensor signal is larger than predefined value(standstill : 0.3 g , driving:0.5 g ~ 1.0 g), The failure is recognized. The difference between estimated value and measured value of the sensor is larger than 0.3 g ~, The failure is recognized. - When the difference between estimated value and measured value of the sensor is lager than 0.3 g ~(it's value change according to vehicle dynamic state), the difference value add and subtract. When sum Total value is larger than predefined value, The failure is recognized - When GND of yaw rate sensor and lateral G sensor are open. **[YAW rate sensor noisy signal, offset error, stick]** - During standstill if yaw rate value is larger than 7 deg/s, And continue 2 sec, The failure is recognized - If noise of input signal is happened 429 times in 5sec , Which the amplitude of the sensor signal is larger than predefined value(standstill : 8 deg/s , driving:15 deg/s ~ 30 deg/s), The failure is recognized. - When the difference between estimated value and measured value of the sensor is lager than 7 deg/s ~ (it's value change according to vehicle dynamic state), the difference value add and subtract. When sum Total value is larger than predefined value, The failure is recognized. - GND of yaw rate sensor and lateral G sensor are open.	- Yaw Rate & Lateral G Sensor Open, short to GND - Faulty Yaw Rate & Lateral G Sensor - Faulty HECU

FAILSAFE FUNCTION

The ESP function is inhibited, while the ABS and EBD controls allowed.

The ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK POWER OF YAW-RATE & LATERAL G SENSOR

   Disconnect the connector from the yaw-rate& Lateral G sensor, and measure the voltage between terminal 3 and 4 of the yaw-rate& Lateral G sensor.

   Specification : 4.75 ~ 5.25 V

   Is the voltage within the specification?

   NO

   Check harness and connector between the HECU and the yaw-rate & lateral G sensor.

   YES

   Check output of yaw-rate & lateral G sensor

2. CHECK OUTPUT OF YAW-RATE & LATERAL G SENSOR
   (1) When the ignition switch is OFF, measure the output voltage between terminal 1 of the yaw-rate sensor connector and the body ground.
   (2) When the ignition switch is OFF, measure the output voltage between terminal 2 of the lateral G sensor connector and the body ground.

   Specification : 2.25 ~ 2.75 V

   Is the output voltage within the specification?

   NO
   Check harness and connector of the yaw-rate & lateral G sensor. If ther is no error on harness and connector, replace and recheck the yaw-rate & lateral G sensor.

   YES
   Check output voltage of HECU connector for yaw-rate & lateral G sensor
3. CHECK OUTPUT VOLTAGE OF HECU CONNECTOR FOR YAW-RATE&LATERAL G SENSOR
   (1) When the ignition switch is OFF, measure the output voltage between terminal 41 of the HECU connector and the body ground.
   (2) When the ignition switch is OFF, measure the output voltage between terminal 9 of the HECU connector and the body ground.

   Specification : 2.25 ~ 2.75 V

   Is the output voltage within the specification?

   NO
   Repair harness and connector between the HECU and the yaw-rate & lateral G sensor.

   YES
   Check output of yaw-rate & lateral G sensor when vehicle cornering
4. CHECK OUTPUT OF YAW-RATE&LATERAL G SENSOR WHEN VEHICLE CORNERING.
   Check if any change of the voltage of the yaw-rate & lateral G sensor, when the vehicle is cornering.
   Is there any change of the voltage of the sensor?

   NO
   Replace and recheck the yaw-rate & lateral G sensor.

   YES
   After clearing the DTC and driving the vehicle at 40 Km/h (24 mph) speed or more, if the ESP lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1503

DESCRIPTION

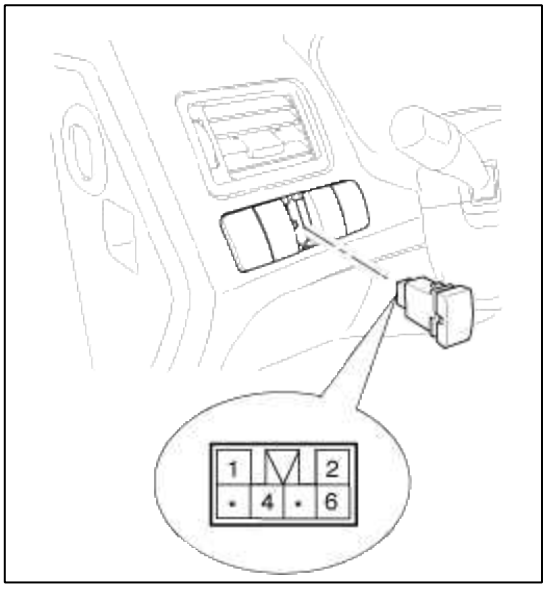
The TCS(ESP) OFF switch is for ON/OFF of TCS(ESP) function.
When the TCS(ESP) OFF switch is pushed, the TCS(ESP) system stops and the TCS(ESP) OFF lamp is ON.

DTC DETECTING CONDITION

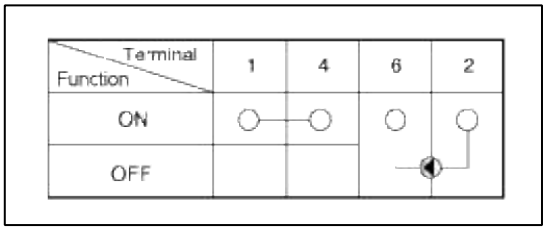
DTC No	Condition	Possible Cause
C1503	When the TCS/ESP switch is ON for 1 min.	- Open/short in TCS/ESP switch circuit. - Faulty TCS/ESP switch - Faulty HECU

FAILSAFE FUNCTION
The TCS/ESP function is inhibited, while the ABS and EBD controls allowed.
The TCS/ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE
1. CHECK TCS(ESP) OFF SWITCH
(1) Remove the TCS(ESP) OFF switch from the panel of the driver's side crash pad.
(2) Check for the continuity between the TCS(ESP) OFF switch terminals, when the TCS(ESP) OFF switch is ON.



Is there continuity between terminals 1 and 4 of the TCS (ESP) switch connector?



NO
Replace with a new TCS(ESP) OFF switch.

YES
Check short in circuit of TCS/ESP Switch

2. CHECK SHORT IN CIRCUIT OF TCS/ESP SWITCH
(1) Remove the TCS(ESP) OFF switch from the panel of the driver's side crashpad.
(2) After the ignition switch is ON, measure the voltage between terminal 4 of the TCS(ESP) OFF switch connector and the body ground.

Specification : Battery positive (B+)

Is the voltage within the specification?

NO

(1) Check and replace fuse(10 A).
(2) Check and repair harness and connector.

YES

Check open/short in circuit between TCS(ESP) OFF switch and the HECU.

3. CHECK OPEN/SHORT IN CIRCUIT BETWEEN TCS(ESP) OFF SWITCH AND THE HECU
Check an open or short in the circuit between terminal 4 of TCS(ESP) OFF switch connector and terminal 14 (ESP:27) of the HECU connector.
Is the circuit normal?

NO

Check and repair the circuit between the switch and the HECU.

YES

After clearing the DTC and driving the vehicle at 40 Km/h (24 mph) speed or more, if the TCS(ESP) lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1513

GENERAL DESCRIPTION

The brake lamp switch is a normal-open(NO) type, and the brake switch is a normal-close(NC) type.

DTC DESCRIPTION

This code will set when there is an open or short in the circuit of the brake switch, or if there is an error on the brake switch.

DTC DETECTING CONDITION

DTC No.	Detecting Condition	Possible Cause
C1513	**[Open, short to BATT/GND, switch trouble]** - If both BLS and BS have a same state and MCP> 20 bar for 500ms, The failure is recognized. - Outside an ABS/TCS/ESP control, and after normal operation of MCP, If the pressure sensor signal is higher than 20 bar and BLS is low for 3 sec, The failure is recognized. - If the BLS/BS changed more than 40 times and MCP>20 bar for 5 sec, The failure is recognized. - While Vref > 10 KPH, TPS > 5 %, MCP<7 bar, if BLS is high over 1 minute, The failure is recognized.	- Brake switch Open, short to GND - Faulty brake switch - Faulty HECU

FAILSAFE FUNCTION

The ESP function is inhibited, while the ABS and EBD controls allowed.
The ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK OPEN/SHORT IN CIRCUIT OF BRAKE SWITCH

(1) Disconnect the connector from the HECU, and measure the voltage between terminal 21 of the HECU connector and the body ground, not pushing the brake pedal.

Specification : Battery (B+)

(2) Disconnect the connector from the HECU, and measure the voltage between terminal 21 of the HECU connector and the body ground, pushing the brake pedal.

Specification : 0 V

Is the voltage within the specification?

NO

Repair harness and connector of the brake switch.

YES

Check open/short in circuit of brake lamp switch

2. CHECK OPEN/SHORT IN CIRCUIT OF BRAKE LAMP SWITCH

(1) Disconnect the connector from the HECU, and measure the voltage between terminal 18(ESP:5) of the HECU connector and the body ground, not pushing the brake pedal.

Specification : 0 V

(2) Disconnect the connector from the HECU, and measure the voltage between terminal 18(ESP:5) of the HECU connector and the body ground, pushing the brake pedal.

Specification : Battery (B+)

Is the voltage within the specification?

NO

Repair harness and connector of the brake lamp switch.

YES

After clearing the DTC and driving the vehicle at 40 Km/h (24 mph) or more, if the ESP lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1604

DTC DETECTING CONDITION

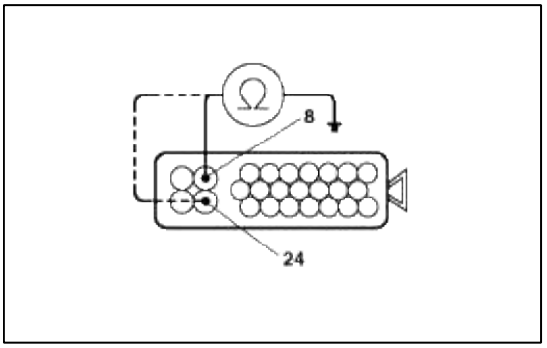
DTC No	Condition	Possible Cause
C1604	- When the MCU can't erase or write a data of the EEPROM. - If the master/slave processor detects abnormal operation in RAM, status register, interrupt, timer, A/D converter and cycle time.	- EEPROM Failure of HECU - MCU failure of HECU

FAILSAFE FUNCTION

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. CHECK CIRCUIT FOR CONTINUITY BETWEEN THE HECU AND BODY GROUND.



Measure the resistance between terminals 8(-), 24(-) of the HECU connector and the body ground.
Is the resistance below 1 Ω?

NO

Check and readjust the installing of the body groud.

YES

After cleaning the DTC and driving the vehicle at 40 km/h (24 mph) speed or more, if the ABS warning lamp is ON and the same DTC shows again, replace the HECU and recheck.

Brake System > Troubleshooting > C1605

DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and EMS/TCU.

DTC DESCRIPTION

This code shows in case that there is an error on the CAN hardware. In this case, replace the HECU and check.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1605	In case that CAN has hardware failure.	- Faulty CAN bus

FAILSAFE FUNCTION

The TCS/ESP function is inhibited, while the ABS and EBD controls allowed.
The TCS/ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

Brake System > Troubleshooting > C1611

DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and EMS/TCU.
This code shows in case that there is no signal to the CAN from EMS.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1611	1. In case that EMS1 or EMS2 message was not received for more than 500 ms within normal voltage condition. 2. The monitoring starts 2000 ms after power up.	- Open/short in CAN bus circuit. - Faulty CAN bus - Faulty EMS - Faulty HECU

FAILSAFE FUNCTION

The TCS/ESP function is inhibited, while the ABS and EBD controls allowed.
The TCS/ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK DTC DETECTED IN HI-SCAN
   (1) Clear the DTC related to the CAN, from the EMS or TCU by using the HI-SCAN.
   (2) Check if any DTC related to the CAN is detected again, when the ignition switch ON.

   Is any DTC related to the CAN, detected again?

   NO

   Problem is intermittent and the HECU memory was not cleared.

   YES

   Check component.
2. CHECK COMPONENT
   (1) Ignition "OFF".
   (2) Ignition "ON"
   (3) Does warning lamp remain On ?

   YES

   Substitute with a known-good EMS and check for proper operation. If problem is corrected, replace EMS 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 EMS and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure. After a repair, it is essential to verify that the fault has been corrected.
3. VERIFICATION OF VEHICLE REPAIR
   (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.

Brake System > Troubleshooting > C1612

DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and EMS/TCU. This code shows in case that there is no signal to the CAN from TCU.

DRC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1612	1. In case that TCU message was not received for more than 500 ms within normal voltage condition. 2. The monitoring starts 2000 ms after power up.	- Open/short in CAN bus circuit. - Faulty CAN bus - Faulty TCU - Faulty HECU

FAILSAFE FUNCTION

The TCS/ESP function is inhibited, while the ABS and EBD controls allowed.
The TCS/ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

1. CHECK DTC DETECTED IN HI-SCAN
   (1) Clear the DTC related to the CAN, from the EMS or TCU by using the HI-SCAN.
   (2) Check if any DTC related to the CAN is detected again, when the ignition switch ON.

   Is any DTC related to the CAN, detected again?

   NO

   Problem is intermittent and the HECU memory was not cleared.

   YES

   Check component

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

3. VERIFICATION OF VEHICLE REPAIR
(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.

Brake System > Troubleshooting > C1613

DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and EMS/TCU. This code shows in case that EMS misunderstands a vehicle with A/T to with M/T. In this case check if it is correct the information received from EMS by using the HI-SCAN.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1613	1. In case that the information about transmission is different in the EMS2 and TCU within normal voltage condition. 2. The monitoring starts 2000 ms after power up.	- Faulty CAN bus - Faulty EMS or TCU

FAILSAFE FUNCTION

The TCS/ESP function is inhibited, while the ABS and EBD controls allowed.
The TCS/ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

Brake System > Troubleshooting > C1616

DESCRIPTION

The CAN is for sending and receiving the information for TCS(ESP) control, between the HECU and ECM/TCM.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C1616	In case CAN BUS off state continued for more than 100ms.	- Open/short in CAN bus circuit. - Faulty CAN bus - Faulty HECU

FAILSAFE FUNCTION

The TCS/ESP function is inhibited, while the ABS and EBD controls allowed.
The TCS/ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

INSPECTION PROCEDURE

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

2. VERIFICATION OF VEHICLE REPAIR
   (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.

Brake System > Troubleshooting > C2112

DESCRIPTION

The HECU makes the valve relay OFF, when the ignition switch is turned ON, but ON during its initial check. The HECU checks the valve relay by checking the voltage of the valve power monitoring wire and comparing the signals from the valve relay. The HECU also checks continuity of the valve power monitoring wire.

DTC DESRIPTION

This code shows in case that there is no continuity of the valve power monitoring wire.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C2112	- If the valve relay is switched on and the reference voltage of valve relay, less than 5 ± 0.5 V continuously for 56 ms, the failure is detected. - If the valve relay is switched off and the reference voltage of valve relay, more than 6 ± 0.5 V continuously for 56 ms, the failure is detected. - If the valve relay is switched off and all solenoid drivers are switched off and reference voltage of valve relay, less than 2.5 ± 0.5 V continuously for 56 ms, the failure is detected.	- Open/short in the valve relay circuit - Faulty HECU

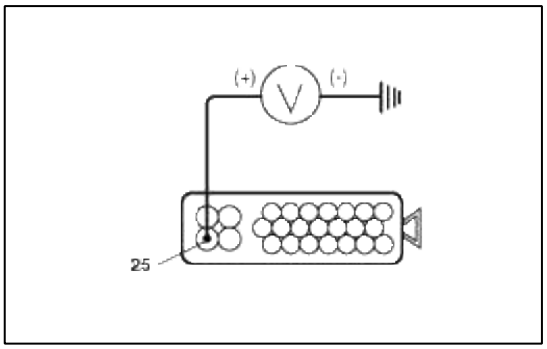
FAILSAFE FUNCTION

The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE

1. CHECK POWER SOURCE OF MOTOR.
   (1) Disconnect the connector from the HECU.
   (2) Measure the voltage between the terminals 25(+) and ground(-).

   Specification: Battery positive(+)

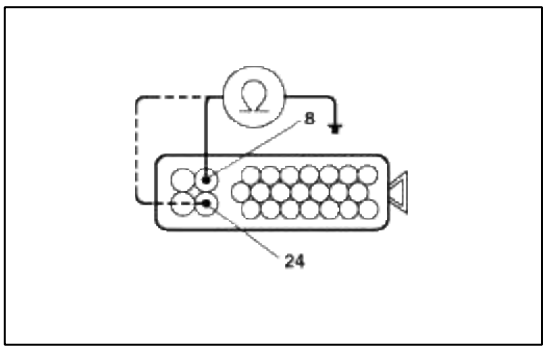


   Is the voltage within the specification?

   NO
   1) Check ABS fuse (10 A) and fusible link (40 A).
   2) Check and repair harness or connector.

   YES
   Check circuit for continuity to ground.

2. CHECK CIRCUIT FOR CONTINUITY TO GROUND.



   (1) Disconnect the connector from the HECU.
   (2) Measure the resistance between terminals 8(-), 24(-) of the HECU connector and the body ground.

   Is the resistance below 1 Ω?

   NO
   Check and readjust the installing of the body ground.

   YES
   Test motor actuation by using hi-scan (pro)

3. TEST MOTOR ACTUATION BY USING HI-SCAN (PRO).
   Is the sound of motor operating heard?

   YES
   Check repair, if necessary, harness and connector.

   NO
   Replace the HECU then recheck.

Brake System > Troubleshooting > C2227

DESCRIPTION

The TCS controls the brake by using the motor pump.
When the TCS operates, The TCS detects overheating of the brake disk.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C2227	1.When the calculated temperature of disc is higher than 500 °C. 2.If the calculated temperature drops below 300 °C, the controller recovers to normal state. 3.When IGN switched OFF, ECU calculate temperature of disc until calculated temperature drops below 80 °C by BATT1 power.	- Brake disc over working

FAILSAFE FUNCTION
The TCS/ESP function is inhibited, while the ABS and EBD controls allowed.
The TCS/ESP warning lamp is ON, but the ABS and EBD warning lamps OFF.

Brake System > Troubleshooting > C2380

DESCRIPTION
The HECU monitors the solenoid valve operating circuit. If there is no continuity of the solenoid valve, when the HECU switches the solenoid valve ON, it is a cause an open or short in the circuit of the solenoid coil or harness.

DTC DESRIPTION
This code shows in case that there is an open or short in the circuit of the solenoid coil or harness.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C2380	- If the valve relay is switched ON and corresponding solenoid driver OFF and the voltage of solenoid, less than 3.5 ± 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, more than 1.5 ± 0.5 V continuously for 56 ms, the failure is detected.	- Open/short in the solenoid valve circuit. - Faulty HECU

FAILSAFE FUNCTION
The system stops. the ABS, TCS(ESP) and the EBD functions are inhibited. The ABS, TCS(ESP) and the EBD warning lamps are ON. The valve relay and all solenoids are OFF.

INSPECTION PROCEDURE
1. CHECK THE DTC
(1) Clear the DTC using the Hi-Scan(pro).
(2) Turn the ignition wsitch OFF.
(3) Turn the ignition switch ON, and check if the same DTC is stored in the memory.
Is the same DTC output?

NO
Problem is intermittent and the HECU memory was not cleared.

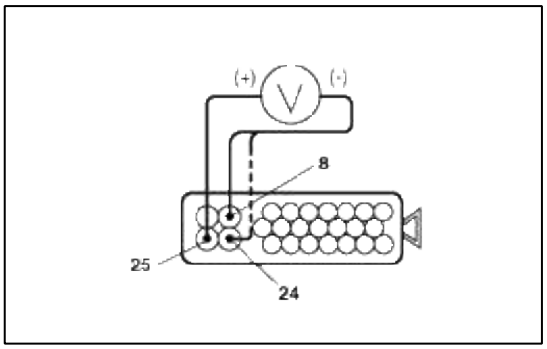
YES
Check power source of valve relay

2. CHECK POWER SOURCE OF VALVE RELAY

(1) Disconnect the connector from the HECU.

(2) Measure the voltage between the terminals 25 and 8, 24 of the HECU connector.

Specification: Battery positive(B+)



Is the voltage within the specification?

NO

(3) Check and replace fuse (10 A) and fusible link (40 A).

(4) Check and repair harness or connector.

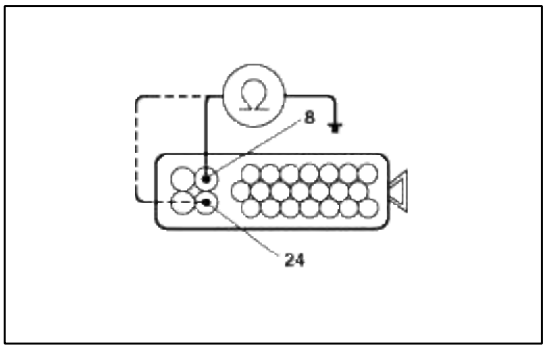
YES

Check circuit for continuity to ground.

3. CHECK CIRCUIT FOR CONTINUITY TO GROUND.

(1) Disconnect the connector from the HECU.

(2) Measure the resistance between terminals 8(-), 24(-) of the HECU connector and the body ground.



Is the resistance below 1 Ω?

NO

Check and readjust the installing of the body ground.

YES

Replace the HECU then recheck.

Brake System > Troubleshooting > C2402

DESCRIPTION

When the ABS system operates, the HECU turns the ABS motor relay ON so that the ABS pump motor is operated.

DTC DESRIPTION

This code is set when there is no signal to the motor monitoring wire or if there is an error with the motor power.

CAUTION

Keep the vehicle idling because the constant operation of the ABS motor while testing the actuator will shall cause the discharging of the battery, when testing the actuator.

DTC DETECTING CONDITION

DTC No	Condition	Possible Cause
C2402	**[Motor relay open, motor short to GND] :** - If the motor relay is switched ON and Vmr < (Vign - (4 ± 0.5 V)) continued for 49 msec,the failure is detected. **[Motor open, motor short to BATT] :** - After 1.8 sec from the time that motor relay is switched OFF, Vmr > 4±0.5V continued for 1.8 sec, the failure is detected. **[Motor lock] :** - After motor relay is switched OFF, VMR is measured. If the time which Vmr > 1 ± 0.1 V is less than evaluation time, recheckis performed again for a maximum of three times. When VMR is not normal even on the third recheck, the controller recognizes it as failure. If the motor relay is swithched OFF and motor power supply voltage < 4 V continued for 200 ms, the failure is detected. **[Motor fuse open] :** - If the motor relay is switched OFF and Vmrp < 4 ± 0.5 V continued for 1 sec, the failure is detected.	- Open/short in motor regal or motor circuit. - Motor lock - Faulty HECU

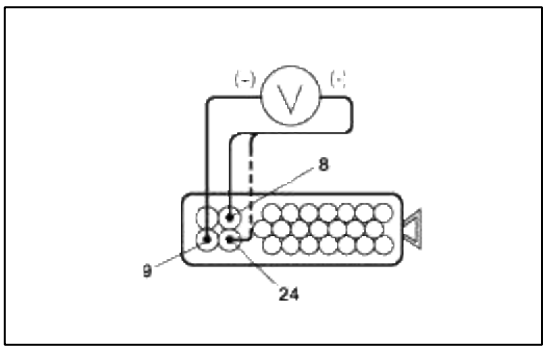
FAILSAFE FUNCTION

1. Motor error without the ABS control : only the ABS, TCS(ESP) functions are inhibited. The ABS, TCS(ESP) warning lamps are ON, but the EBD warning lamp OFF.
2. Motor error with the ABS control : inhibit the ABS control of front wheels, allow ABS control of the rear wheels. After the ABS control has completed, the ABS, TCS(ESP) warning lamps are ON.

INSPECTION PROCEDURE

1. CHECK POWER SOURCE OF MOTOR.
   (1) Disconnect the connector from the HECU.
   (2) Measure the voltage between the terminals 9(+) and 8(-), 24(-) of the HECU connector.

   Specification: Battery positive(+)



Is the voltage within the specification?

NO

Check ABS fuse (10 A) and fusible link (30 A).
Check and repair harness or connector.

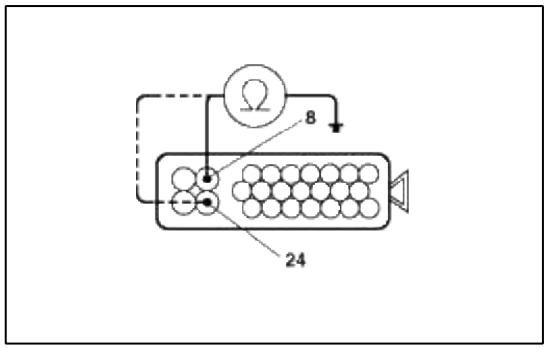
YES

Check circuit for continuity to ground.

2. CHECK CIRCUIT FOR CONTINUITY TO GROUND.

(1) Disconnect the connector from the HECU.

(2) Measure the resistance between terminals 8(-), 24(-) of the HECU connector and the body ground.



Is the resistance below 1 Ω?

NO

Check and readjust the installing of the body ground.

YES

Test motor actuation by using hi-scan (pro)

3. TEST MOTOR ACTUATION BY USING HI-SCAN (PRO).

Is the sound of motor operating heard?

YES

Check repair, if necessary, harness and connector.

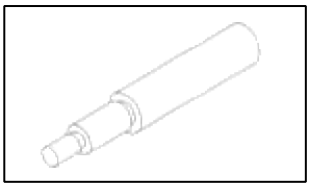
NO

Replace the HECU then recheck.

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Clutch System

Clutch System > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustraion	Use
09411-11000 Clutch disc guide		Installation of the clutch disc.

Clutch System > General Information > Troubleshooting

TROUBLESHOOTING

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 the clutch assembly or bearing	Repair
	A noise is heard when the car suddenly rolled up	Damaged pilot bushing	Replace

with the clutch partially engaged		
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 burred	Repair as necessary
	Faulty of the clutch pressure plate	Replace the clutch cover
Clutch slips	Insufficient of the clutch pedal free play	Adjust the pdal free play
	Clogged of the hydraulic system	Repair or replace parts
	Clutch disc lining oily or worn out	Inspect the clutch disc
	Faulty of the 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 the clutch diaphragm spring	Replace the clutch cover
	Worn or broken torsion spring	Replace the clutch disc
	Loose the engine mounts	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 > General Information > Specifications

SPECIFICATIONS

Clutch operation method	Hydraulic type
Clutch disc Type	Single dry with diaphragm
Faling diameter(Outter × innter)	235 × 155mm(9.25×6.10 in)
Clutch cover assembly Type	Diaphragm spring strap
Clutch release cylinder inner diameter	20.64mm(0.81in)
Clutch master cylinder inner diameter	15.87mm(0.62 in)

SERVICE STANDARD

Standard value Clutch disc thickness [When free] Distance between inner pad and clutch pedal Clutch pedal free play Clutch pedal stroke Clutch pedal height	 8.5 ± 0.3 mm (0.326 ~ 0.350 in) 252 ± 2mm(9.84 ~ 10.00 in) 6 ~ 13 mm (0.24 ~ 0.51 in) 150 mm (5.9 in) 189.5 mm (7.46 in)
Limit Clutch disc rivet sink Diaphragm spring end height difference Clutch replease cylinder clearance to piston Clutch master cylinder clearance to piston	 0.3 mm (0.011 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
Ignition lock switch	8 ~ 10	80 ~ 100	5.9 ~ 7.4
Clutch pedal mounting	25 ~ 35	250 ~ 350	18.4 ~ 25.8
Clutch tube to clutch oil regulator	13 ~ 17	130 ~ 170	9.6 ~ 12.5
Clutch tube to clutch master cylinder	12 ~ 16	120 ~ 160	8.9 ~ 11.8
Clutch tube to clutch hose	13 ~ 17	130 ~ 170	9.6 ~ 12.5
Clutch release cylinder to clutch hose	25 ~ 35	250 ~ 350	18.4 ~ 25.8
Clutch oil regulator mounting	6 ~ 8	60 ~ 80	4.4 ~ 5.9

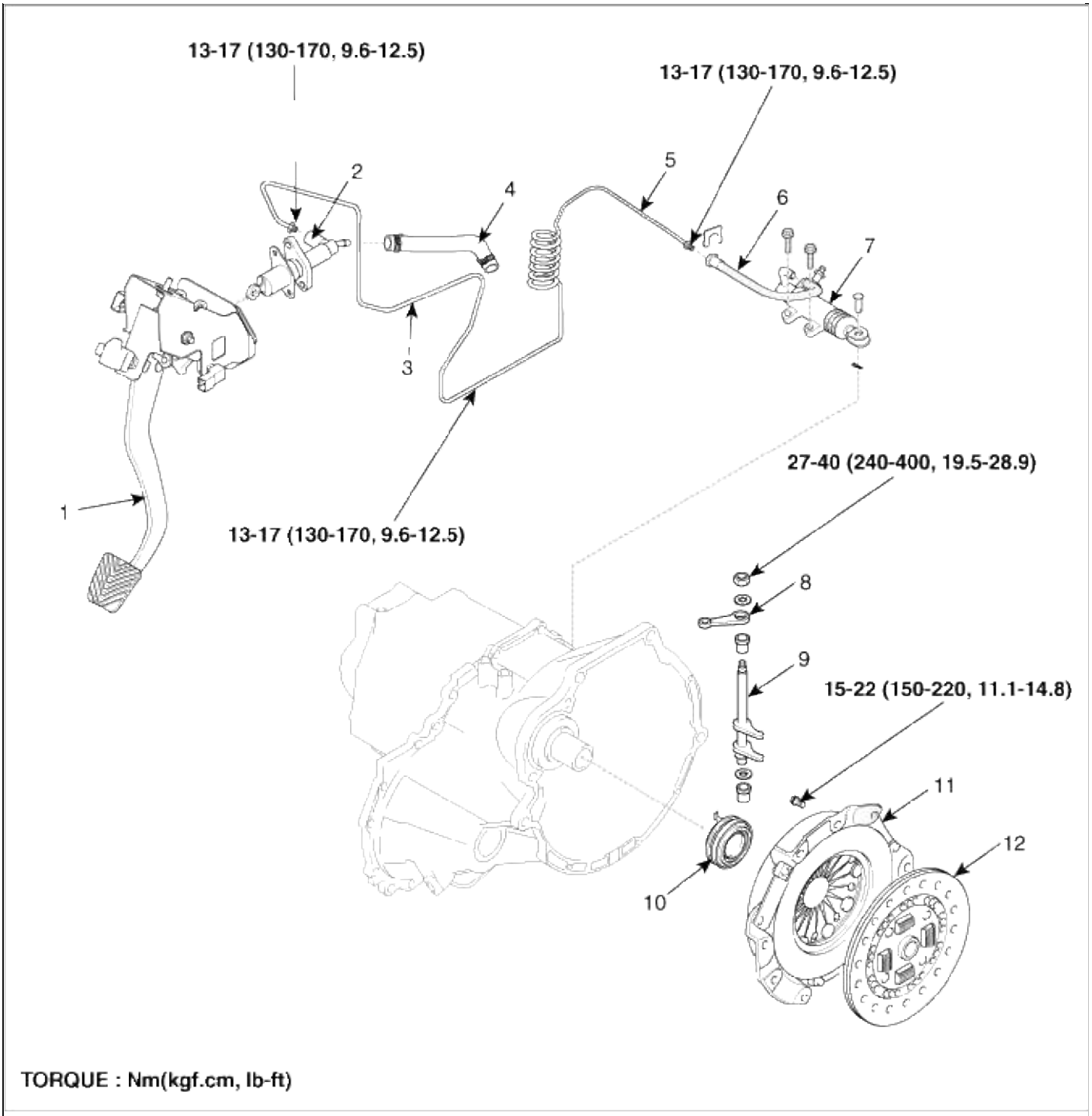
Clutch release cylinder bledder screw	12 ~ 20	120 ~ 220	8.9 ~ 14.8
Clutch cover	15 ~ 22	150 ~ 220	11.1 ~ 14.8
Clutch mounting	43 ~ 55 8 ~ 10	430 ~ 550 (3EA) 80 ~ 100 (2EA)	5.9 ~ 7.4
Clutch release lever fork nut	27 ~ 40	270 ~ 400	19.5 ~ 28.9

LUBRICANTS

Items	Specified lubricants	Quantity
Contact surface of release bearing and fulcrum of clutch release fork	CASMOLY L 9508	As required
Inner surface of clutch release bearing	CASMOLY L 9508	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 L 9508	0.29 g
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.2	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 L 9508	As required
Input shaft spline	CASMOLY L 9508	As required

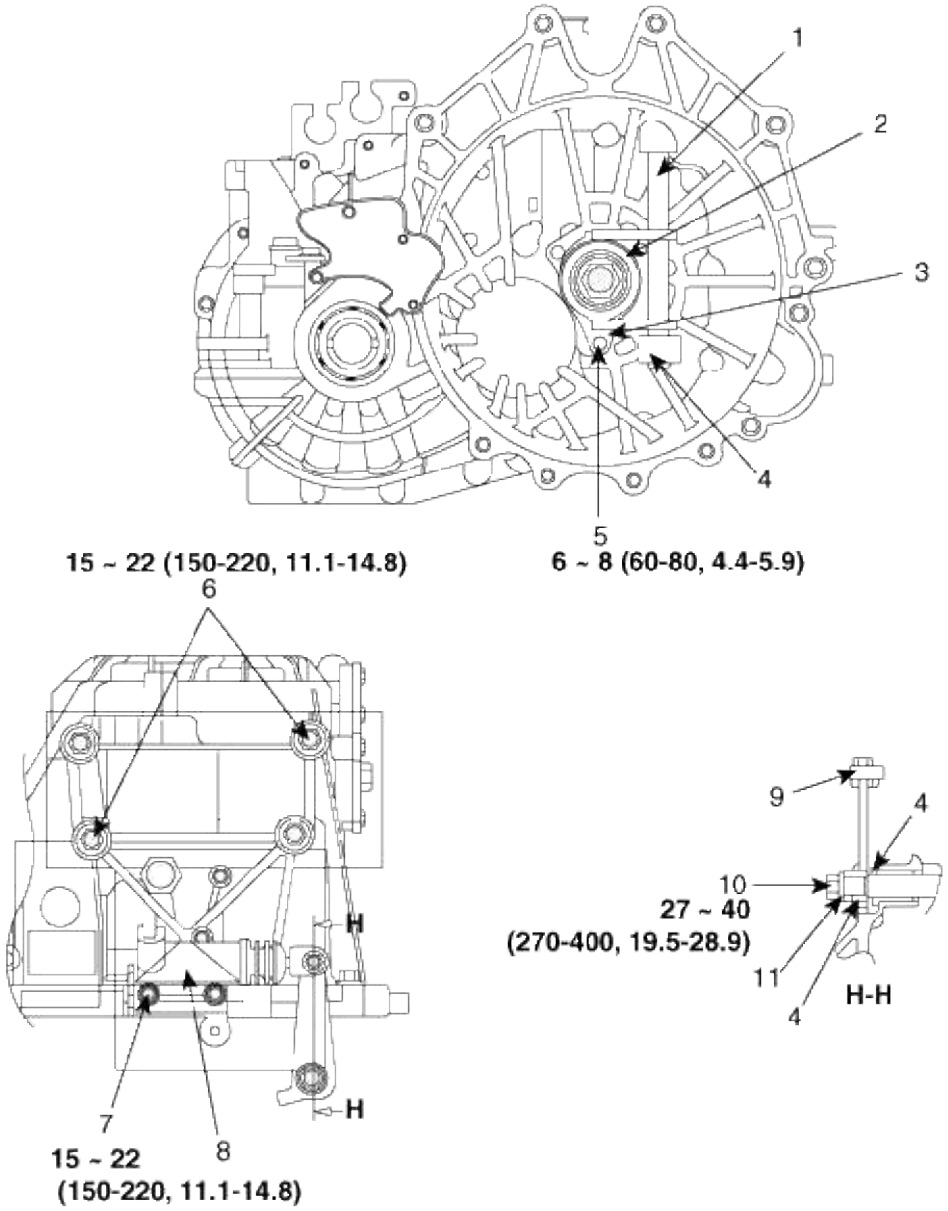
Clutch System > Clutch System > Components and Components Location

COMPONENTS(1)



1. Clutch pedal
2. Master cylinder
3. Master cylinder hose
4. Flexible hose
5. Clutch tube
6. Clutch tube hose
7. Release cylinder
8. Release lever
9. Release fork
10. Release bearing
11. Clutch disc cover
12. Clutch disc

COMPONENTS(2)



TORQUE : Nm(kgf.cm, lb-ft)

1. Clutch release fork shaft
2. Clutch release bearing
3. Release bearing sleeve
4. Bushing
5. Bolt
6. Stud
7. Clutch release cylinder bolt
8. Clutch release cylinder
9. Clutch pin
10. Nut
11. Spring washer

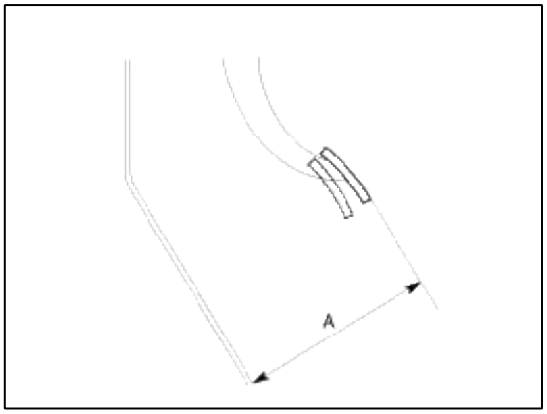
Clutch System > Clutch System > Repair procedures

SERVICE ADJUSTMENT PROCEDURE

CLUTCH PEDAL INSPECTION AND ADJUSTMENT

1. Measure the clutch pedal height (from the face of the pedal pad to the floorboard) and the distance between inner pad and clutch pedal.

Standard value:
(A) 252 ± 2 mm (9.84 ~ 10.00 in.)
(B) 189.5 mm (7.46 in.)

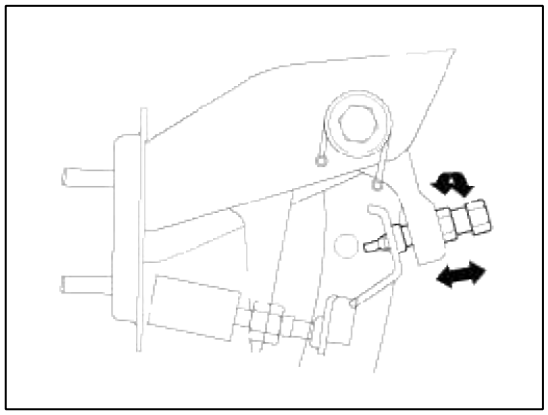


2. If the clutch pedal height and distance is not within the standard value range, adjust as follows:
   (1) Turn and adjust the bolt, then secure by tightening the lock nut.

> NOTE
>
> After the adjustment, tighten the bolt until it reaches the pedal stopper, and then tighten the lock nut.

   (2) Turn the push rod to agree with the standard value and then secure the push rod with the lock nut.

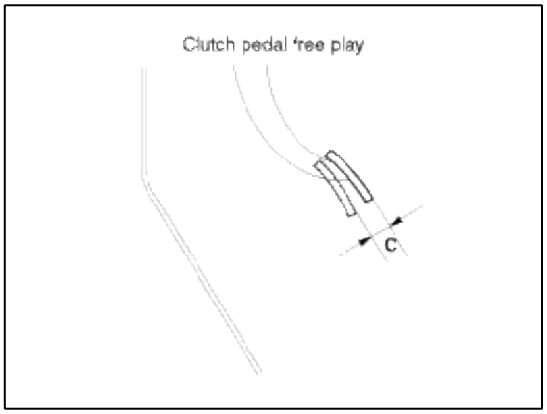
> CAUTION
>
> When adjusting the clutch pedal height or the clutch pedal clevis pin play, be careful not to push the push rod toward the master cylinder.



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: (C) 6 ~ 13 mm (0.24~0.52 in.)

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.



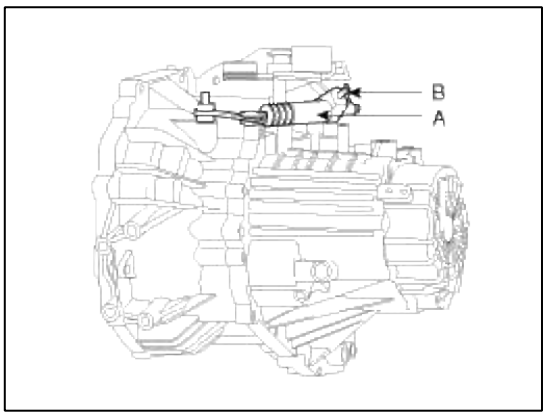
BLEEDING

CAUTION

Use the specified fluid. Avoid mixing different brands of fluid.

Specified fluid: SAE J1703 (DOT 3 or DOT 4)

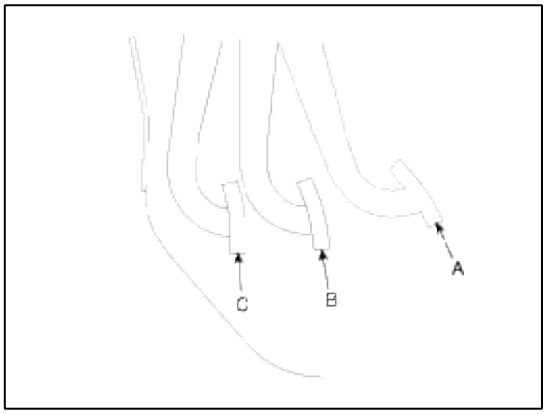
1. Loosen the bleeder screw(B) at the clutch release cylinder(A).



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.

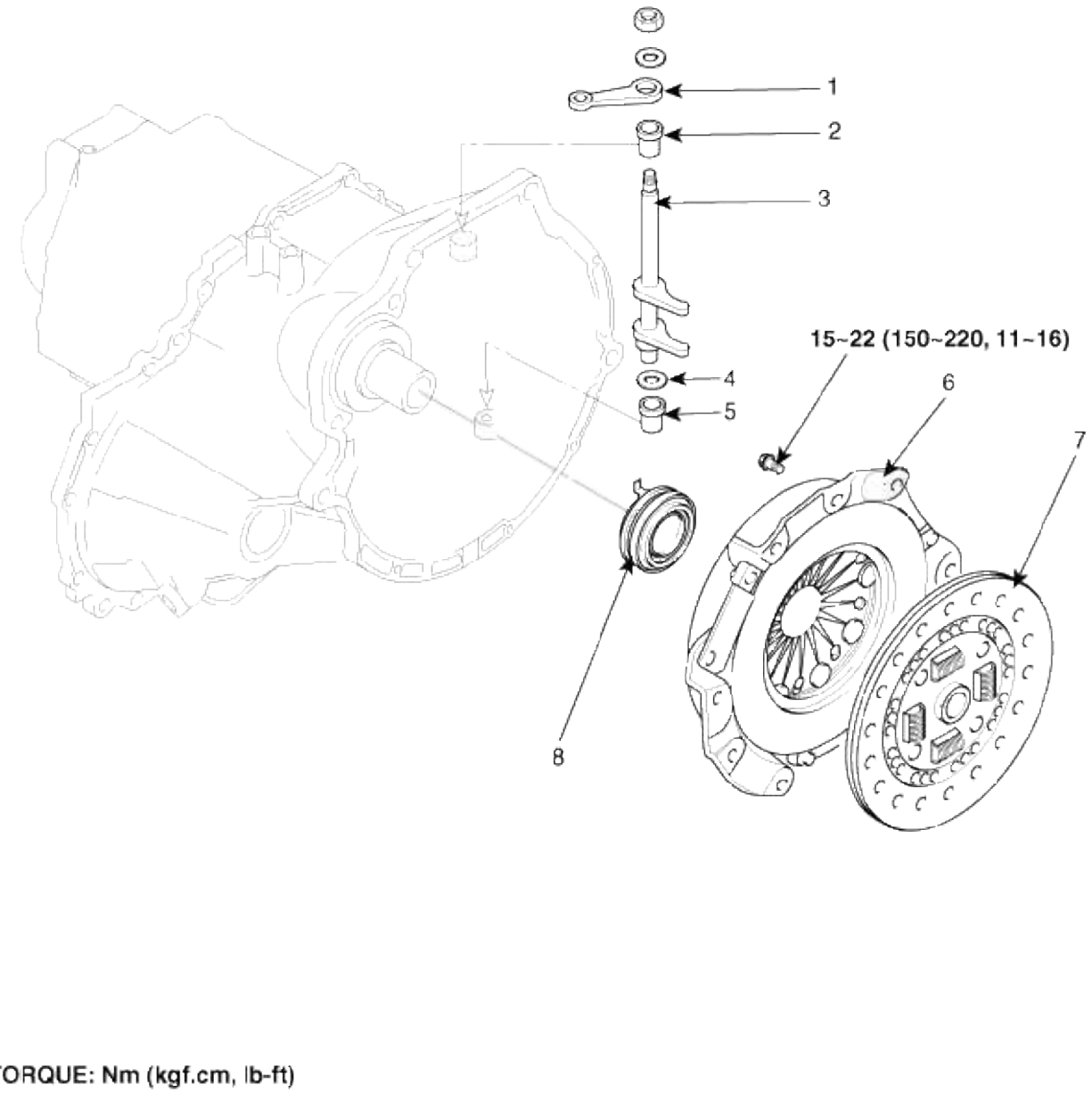
CAUTION

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.



Clutch System > Clutch System > Clutch Cover And Dinode > Components and Components Location

COMPONENETS



TORQUE: Nm (kgf.cm, lb-ft)

1. Clutch Release lever
2. Bushing
3. Clutch Release fork
4. Packing
5. Bushing
6. Clutch cover assembly
7. Clutch disc
8. Clutch Release bearing

Clutch System > Clutch System > Clutch Cover And Dinode > Repair procedures

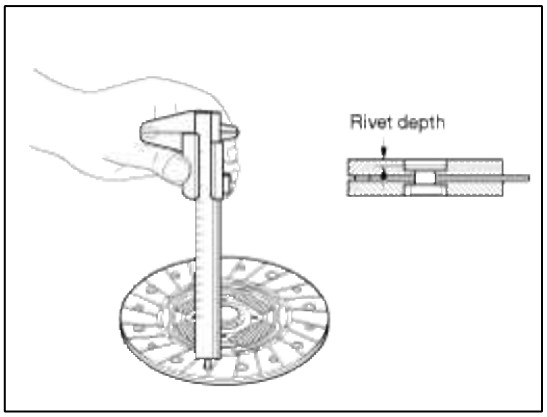
INSPECTION

Clutch cover assembly

1. Check the diaphragm spring end for wear and uneven height.
2. Check the pressure plate surface for wear, cracks and color change.
3. Check the rivets for looseness and replace the clutch cover assembly if necessary.

Clutch disc

1. Check the clutch facing for loose rivets, uneven contact, deterioration due to seizure, adhesion of oil, or grease, and replace the clutch disc if defective.
2. Measure the thickness of the disc when free.



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

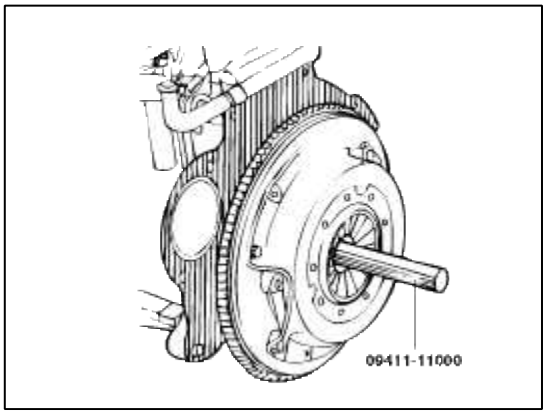
The release bearing is packed with grease. Do not use cleaning solvent or oil.

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

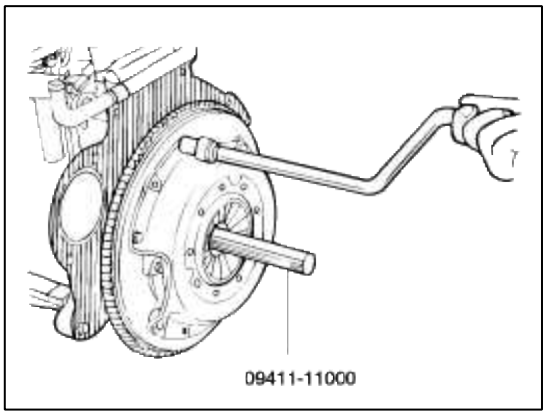
REPLACEMENT

1. Remove the transaxle assembly.(See 'TR' group - 'Manual Transaxle')
2. Insert the special tool (09411-11000) in the clutch disc to prevent the disc from falling.



3. 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 flange.

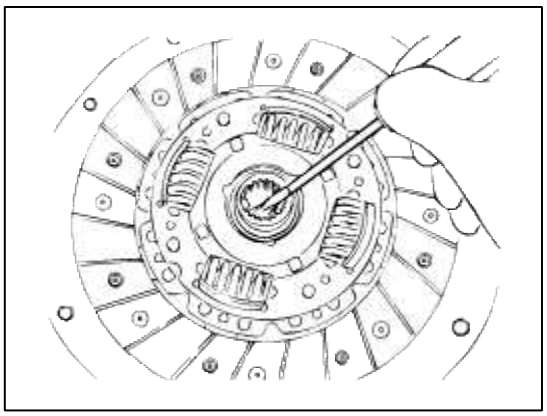
> NOTE
>
> Do not clean the clutch disc or the release bearing with cleaning solvent.



4. Remove the release fork shaft and bushing.
5. Apply multipurpose grease to the spline of the disc.

Grease: CASMOLY L 9508 0.2gr

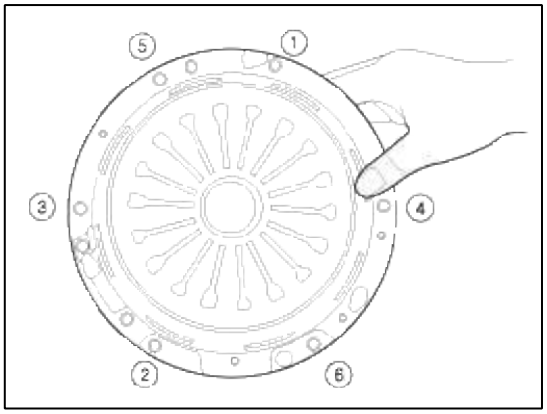
> CAUTION
>
> When installing the clutch, apply grease to each part, but be careful not to apply excessive grease.
> It can cause clutch slippage and judder.



6. Install the clutch disc assembly to the flywheel using the special tool (09411-11000).

7. Install the clutch cover assembly to the flywheel and temporarily tighten the bolts one or two steps at a time in a star pattern.

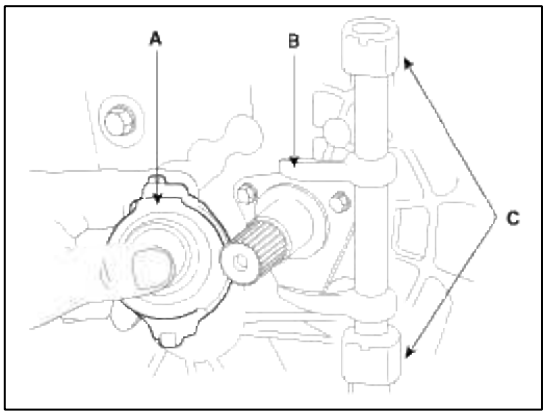
Tightening torque
Clutch cover bolt:
15 ~ 22 Nm (150~220 kgf.cm, 11~16 lb-ft)



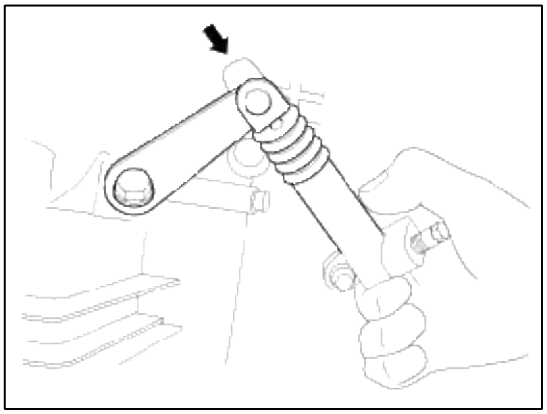
8. Align the bearing (A) to the release fork (B) and then install it to the sleeve of the housing.

CAUTION

Apply multipurpose grease (CASMOLY L9508) to the bearing sleeve, contact point of the release fork (B) and the bushing inner surface (C).



9. Install the release lever to the release fork.



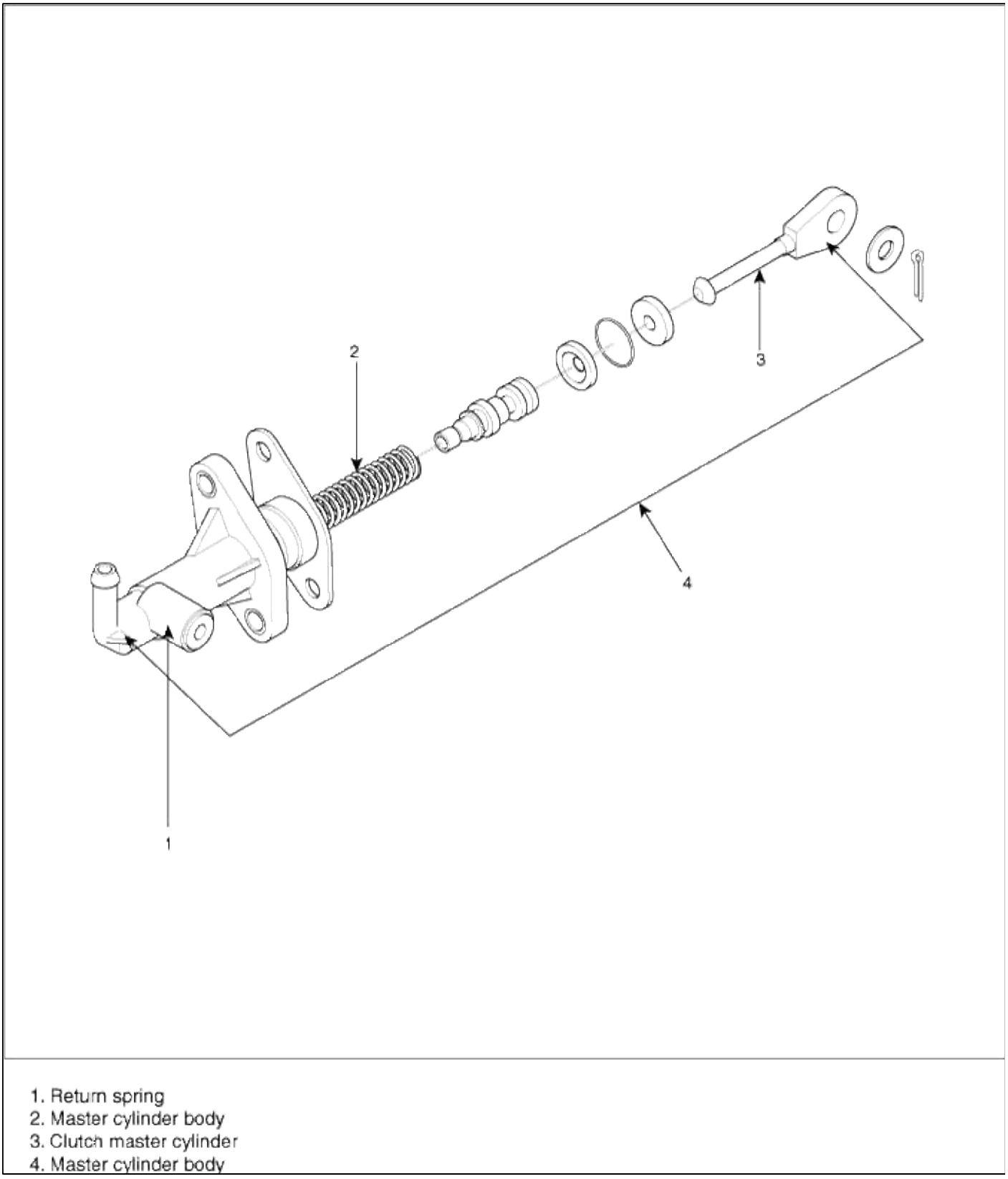
10. Install the transaxle assembly to the engine.

CAUTION

If the transaxle assembly is installed to the engine without performing this step, the release bearing can be separated, as the release fork rotates freely.

Clutch System > Clutch System > Clutch Master Cylinder > Components and Components Location

COMPONENETS

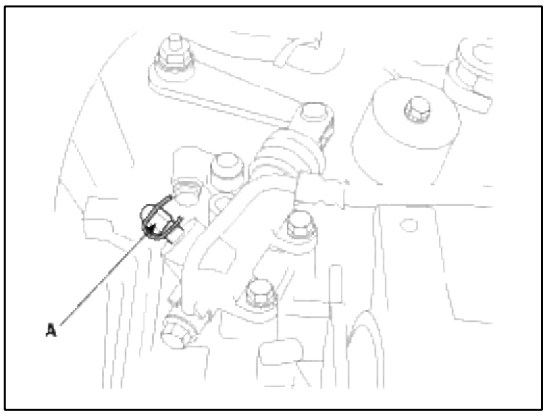


1. Return spring
2. Master cylinder body
3. Clutch master cylinder
4. Master cylinder body

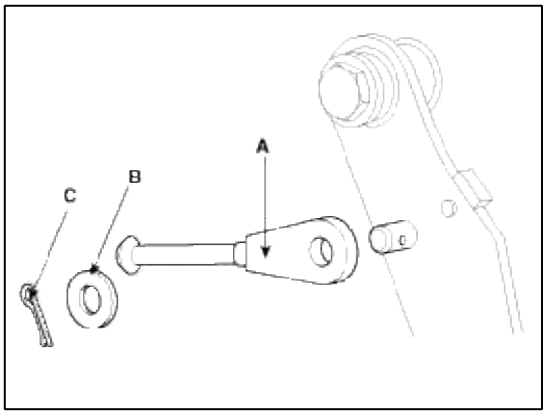
Clutch System > Clutch System > Clutch Master Cylinder > Repair procedures

REMOVAL

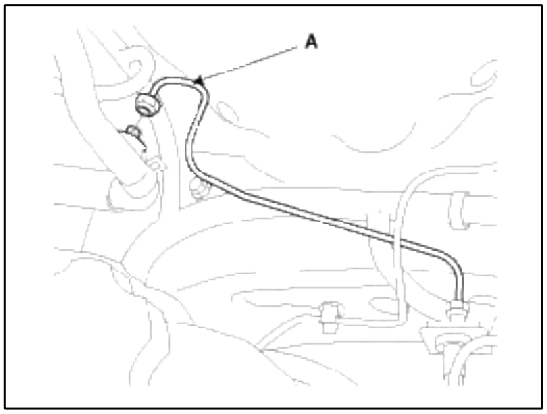
1. Drain the clutch fluid through the bleed plug (A).



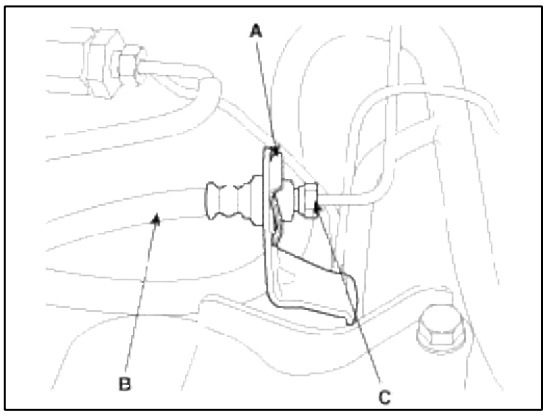
2. Remove clutch master cylinder connecting rod (A), split pin (cotter pin) (C) and washer (B).



3. Disconnect the clutch tube (A) (master cylinder side).

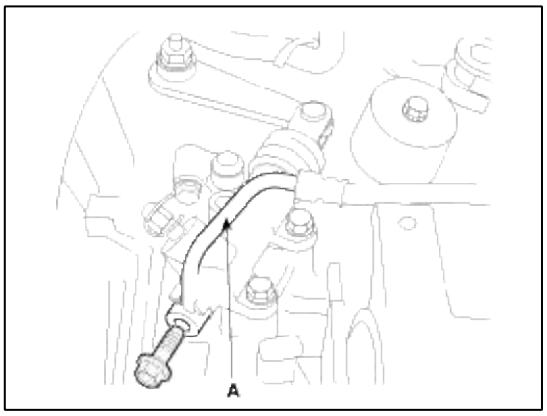


4. Remove the master cylinder mounting nuts.
5. Remove the clutch line clips (A).
6. Hold the nut on the clutch hose (B) and loosen the flare nut (C) on the clutch tube.

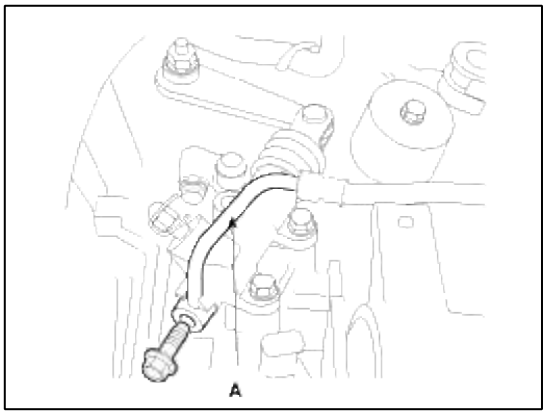


7. Remove the clutch tube.

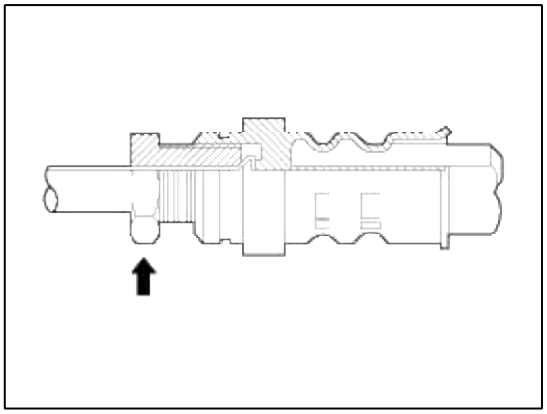
8. Disconnect the clutch hose (A) (release cylinder side).



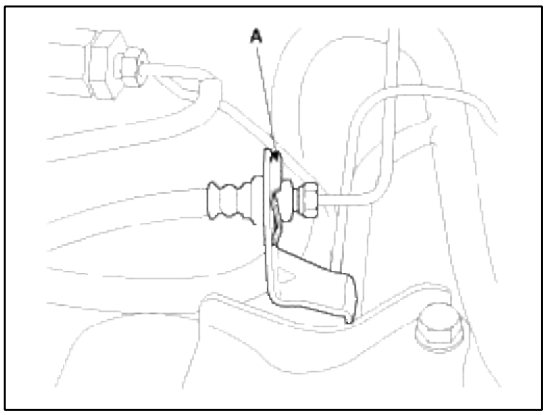
9. Connect the clutch tube (A) (release cylinder side).



10. Temporarily tighten the flare nut by hand, then tighten it to the specified torque, being careful that the clutch hose does not become twisted.



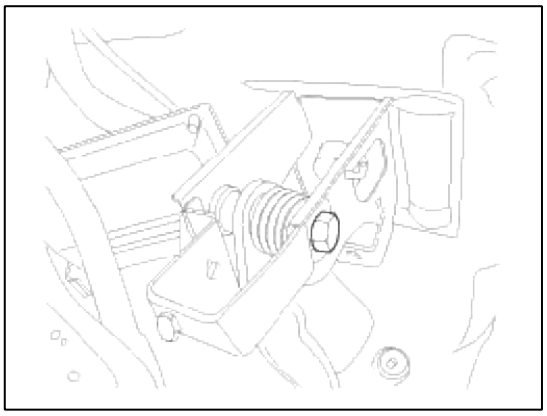
11. Install the clutch tube and clips (A).



12. Install the master cylinder.

13. Apply the specified grease to the clevis pin and washer.

Wheel bearing grease: SAE J310a, NLGI NO. 2



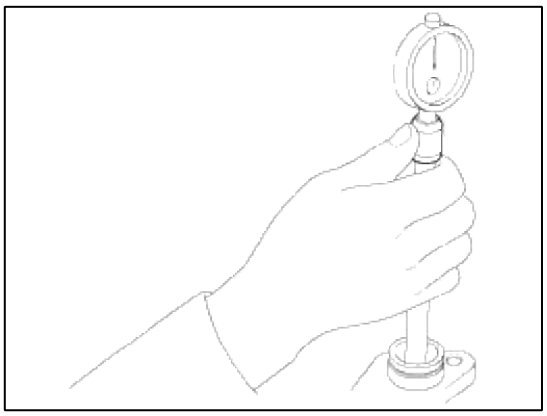
14. Install the push rod to the clutch pedal.
15. Pour the clutch fluid into the clutch master cylinder.
16. Bleed the clutch system.

INSPECTION

1. Check the inside of the cylinder body for rust, pitting or scoring.
2. Check the piston cup for wear or distortion.
3. Check the piston for rust, pitting or scoring.
4. Check the clutch tube line for clogged.
5. Measure the master cylinder inside diameter and the piston outside diameter with a cylinder gauge micrometer.

NOTE

Measure the inside diameter of the master cylinder at three places (bottom, middle, and top) in a perpendicular direction.

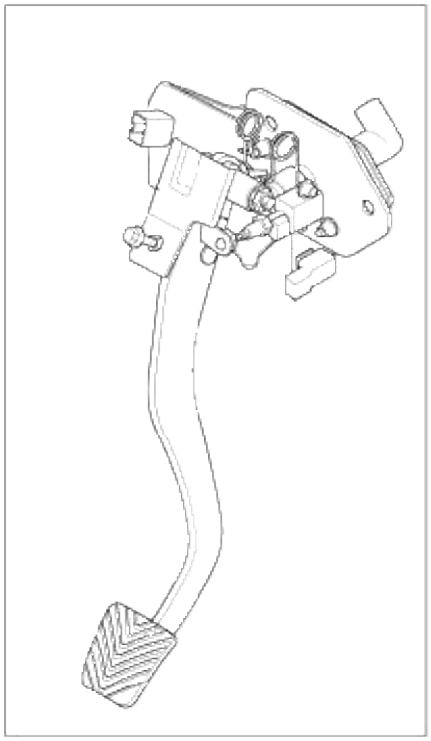


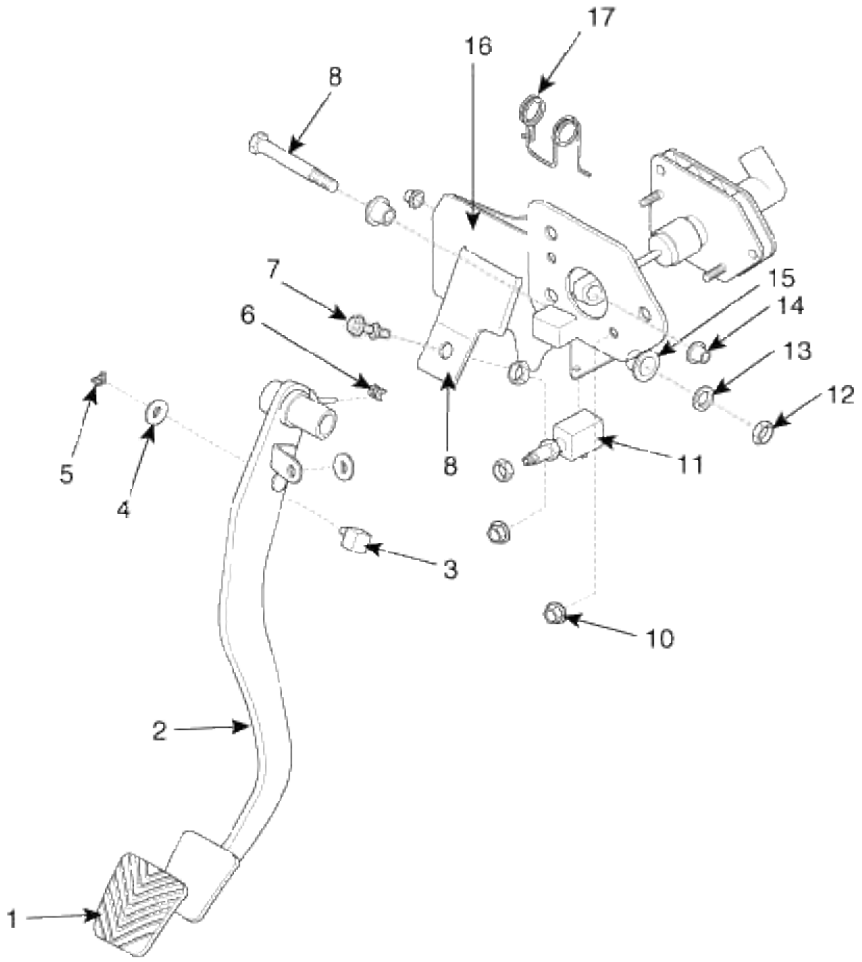
6. If the master cylinder-to-piston clearance exceeds the limit, replace the master cylinder and/or piston assembly.

Limit: 0.15 mm (0.006 in.)

Clutch System > Clutch System > Clutch Pedal > Components and Components Location

COMPONENTS





1. Pedal pad
2. Clutch pedal
3. Pedal stopper
4. Washer
5. Split pin
6. Bushing
7. Bolt
8. Hinge bolt
9. Stopper bracket
10. Locking nut
11. Ignition lock switch
12. Nut
13. Spring washer
14. Bushing
15. Pedal bushing
16. Clutch plate
17. Return spring

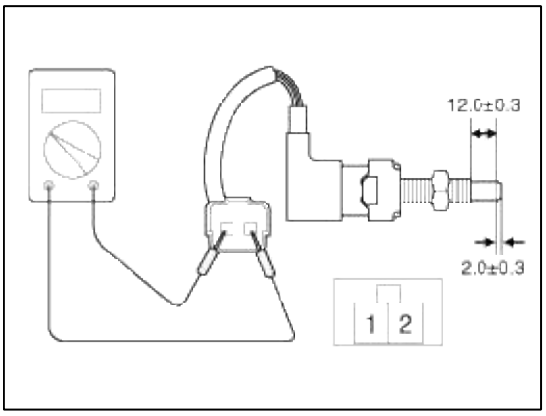
Clutch System > Clutch System > Clutch Pedal > Repair procedures

INSPECTION

1. Check the pedal shaft and bushing for wear.
2. Check the clutch pedal for bending or torsion.
3. Check the return spring for damage or deterioration.
4. Check the pedal pad for damage or wear.

Ignition lock switch inspection

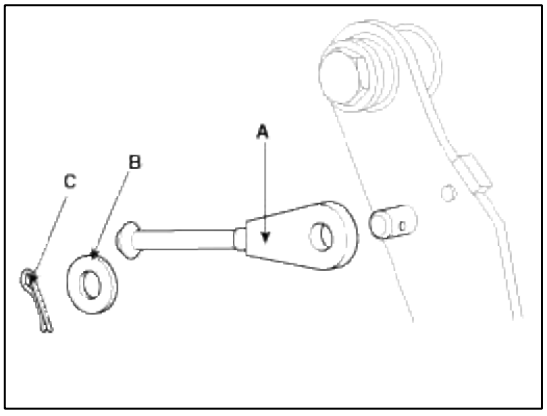
Condition \ Termina	1	2
Pushed	●	●
Free		



RETURING TEST OF CLUTCH PEDAL.
Deformation of pedal pad must be MAX. 5mm after repeating the test 20 times (sudden return from full stroke).

REPLACEMENT

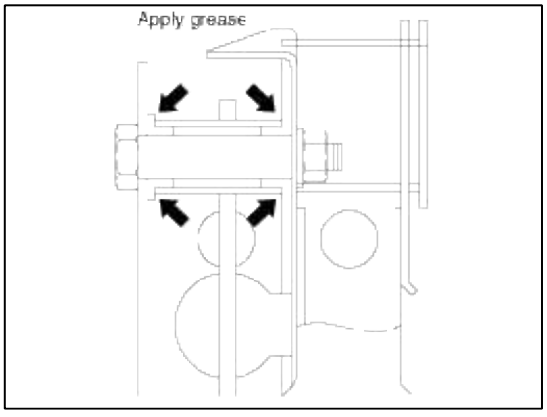
1. Remove the clutch master cylinder connecting rod (A), washer (B), and split pin (C).



2. Remove the clutch pedal mounting bolts.
3. Apply the specified grease to the clutch pedal and bushings.

Chassis grease: SAE J310a, NLGI No.1

4. Install the clutch pedal mounting bolt.



5. Apply the specified grease to the clevis pin and washer.

Wheel bearing grease: SAE J310, NLGI No.2

6. Install the push rod to the clutch pedal.

ADJUSTMENT

NOTE

- Check for the ignition lock switch.
- Before adjusting, remove the driver's floor seat.

1. After loosening the ignition lock switch nut, move it back until it has no contact with the clutch pedal arm.
2. Check for the specification below.

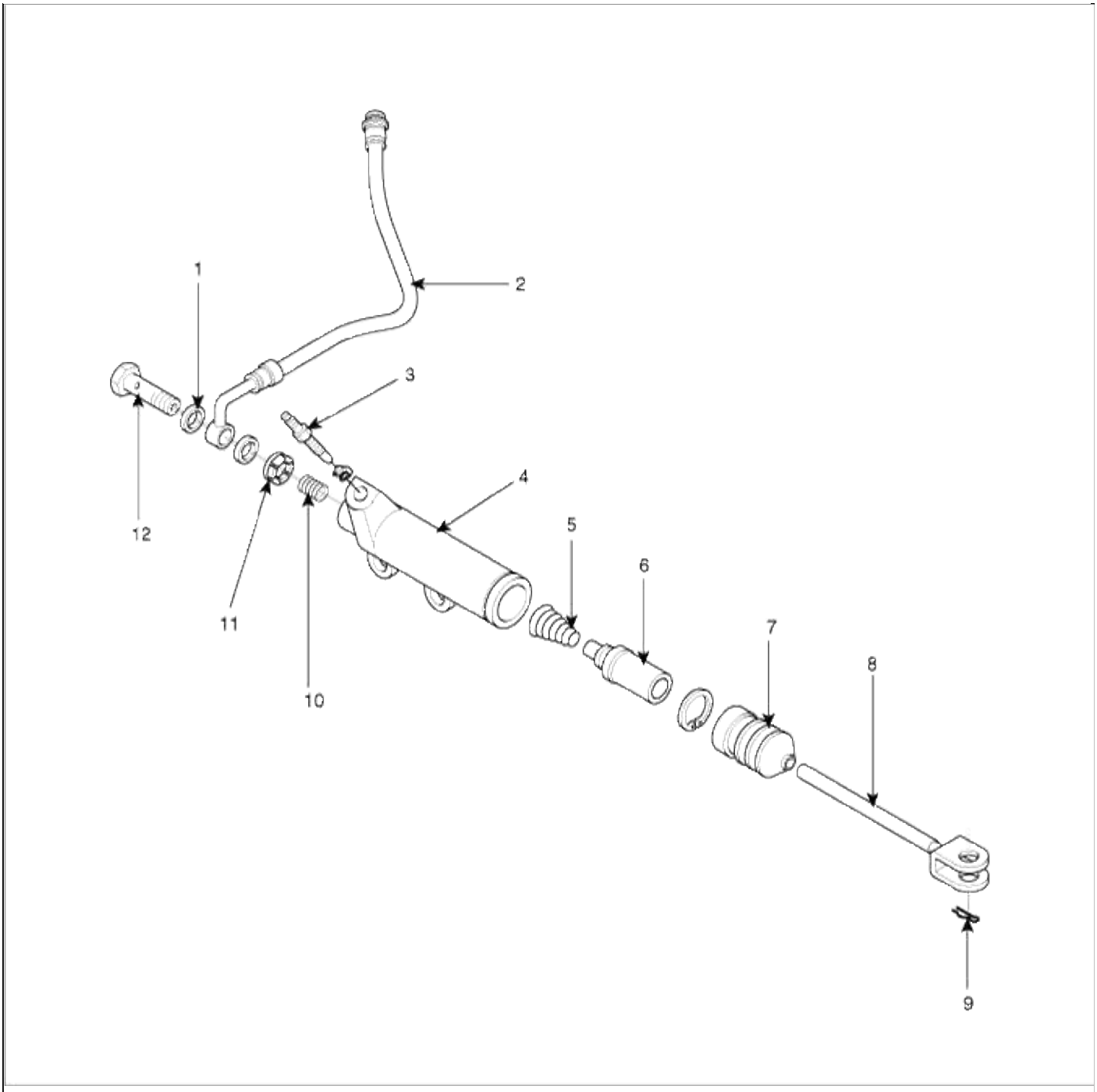
Clutch pedal stroke : 150 mm (5.9 in)
Clutch pedal free play : 6 ~ 13 mm (0.24 ~ 0.51 in)
Distance between the inner pad and clutch pedal : 250 ~ 254 mm (9.84 ~ 10.00 in)

3. Fix the ignition switch whtn its signal is OFF pressing the pedal slowly 52 ~ 58 mm (2.0 ~ 2.3 in).
   Tighten the fixing nut with specification

TORQUE : 8~ 10 Nm (80 ~ 100 kgf·cm, 5.9 ~ 7.4 lbf·ft)

Clutch System > Clutch System > Clutch Release Bearing > Components and Components Location

COMPONENTS

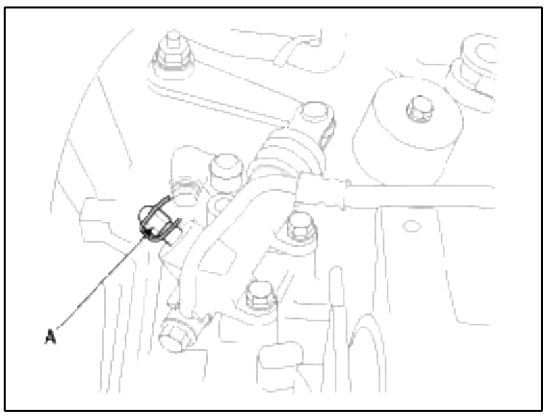


1. Gasket
2. Clutch hose
3. Bleeder screw
4. Recease cylinder
5. Return spring
6. Piston
7. Boot
8. Push rod
9. Cotter pin
10. Valve spring
11. Valve plate
12. Union bolt

Clutch System > Clutch System > Clutch Release Bearing > Repair procedures

REPLACEMENT

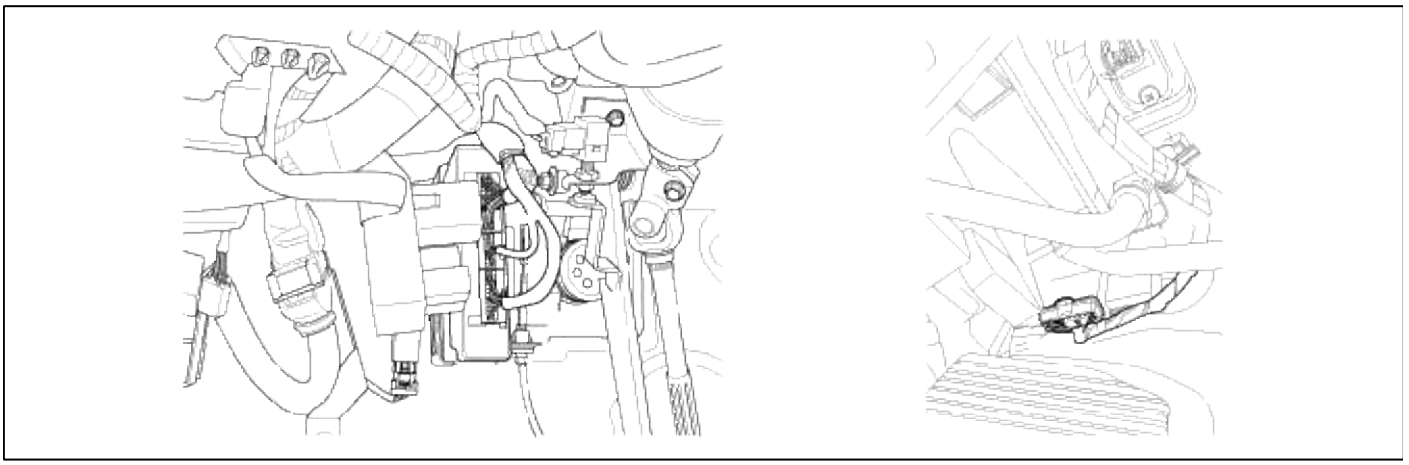
1.



2. Clamp the clutch hose between the clutch release cylinder and the clutch tube.
3. Drain the fluid from the release cylinder by loosening the bleeder screw, then removing the bolt from the clutch hose.
   Use a suitable container to catch the fluid.
4. Remove the clutch release cylinder by loosening the mounting bolt.
5. Install the new clutch release cylinder.
6. Remove the clamp from the clutch hose.
   Ensure the brake master cylinder fluid level is correct, then bleed the clutch release cylinder.

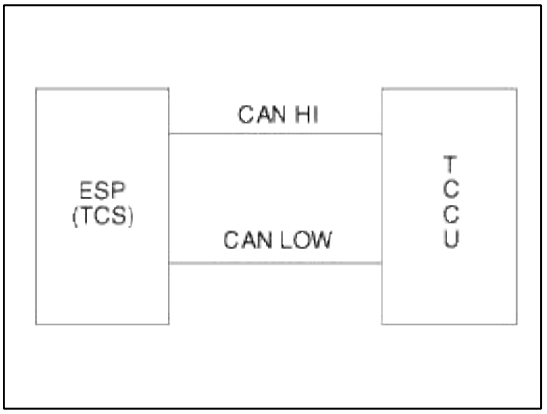
Clutch System > Troubleshooting > P1764

COMPONENT LOCATION



GERNERAL DESCRIPTION

CAN communication is filled to permit the exchange of multiple signals between electronic control units through the use of two common data lines.



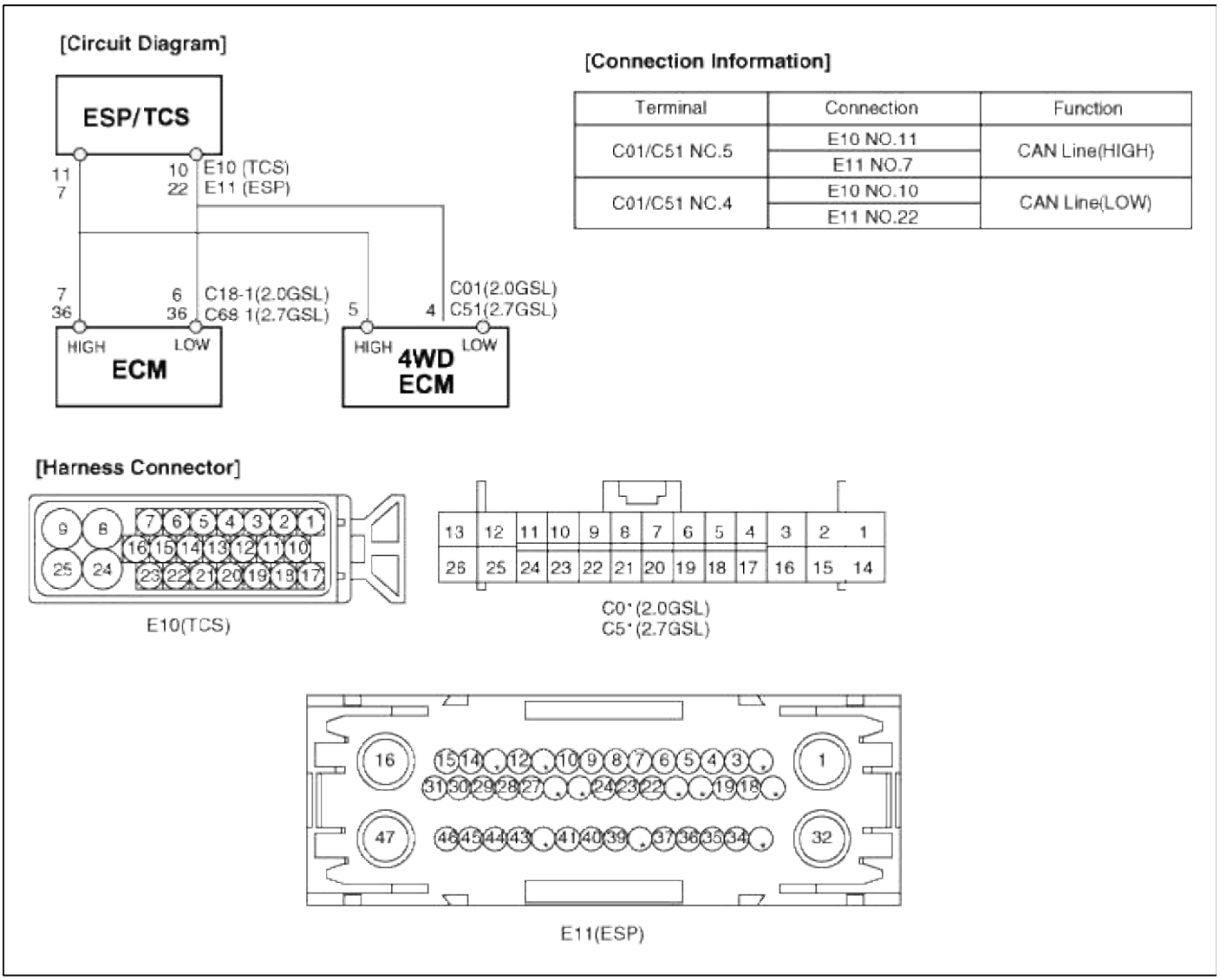
DTC DESCRIPTION

This failure code is related to the TCCU communication line between ECU and 4WD(ECU) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• ECU-ITM Communication Line, or ECU side malfunction	• ECM,TCCU connector looseness and poor terminal to wire connection. • CAN HIGH/LOW circuit open/short. • Faulty ECM. • Faulty TCCU.
Enable Conditions	• Message present 1.0 sec self clearing	
Threshold Value	• Loss of Signal	
Diagnostic Time	• 1 sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM



TERMINAL & 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.

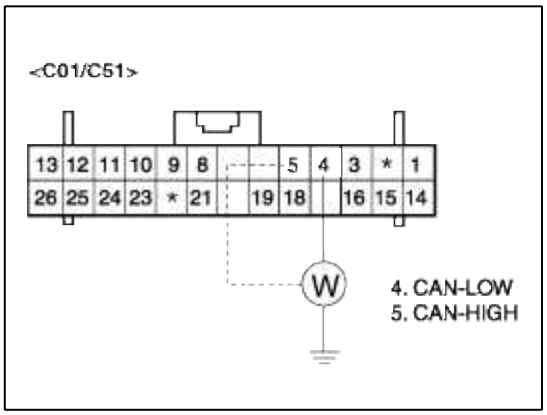
NO

Go to " CAN(ECU-ITM)comm. Line Signal Inspection " procedure.

CAN(ECM-ITM)comm. Line Signal Inspection

1. Ignition ON, Engine : OFF
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.
4. Shift to N Range.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

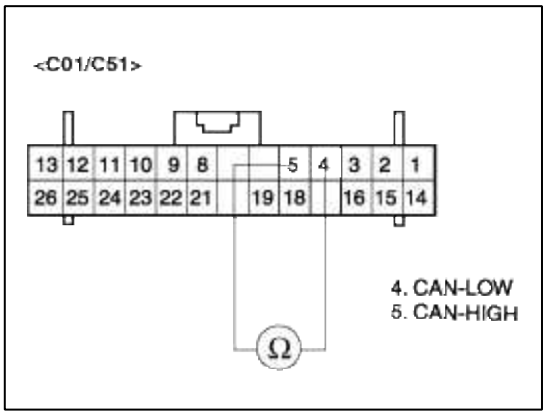
Go to "CAN(ECM-ITM) comm. Line Inspection" procedure.

CAN(ECM-ITM) comm. Line Inspection

1. Ignition "OFF".

2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

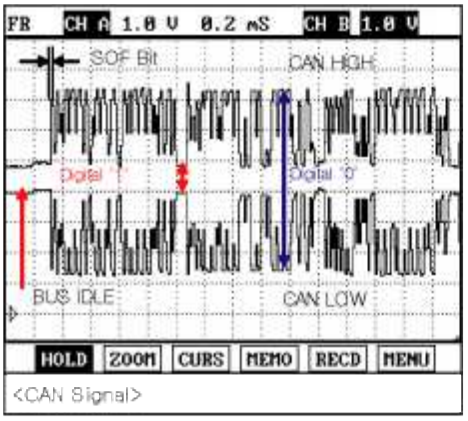
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

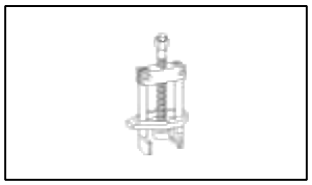
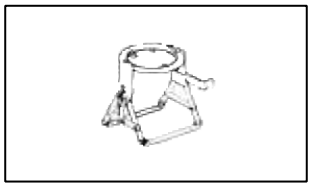
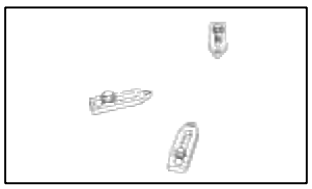
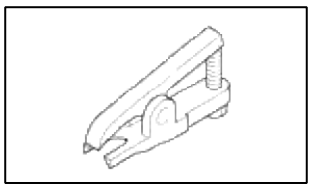
SIGNAL WAVEFROM


FR
CH A 1.0 V 0.2 mS
CH B 1.0 V
SOF Bit
CAN HIGH
Digital '1'
Digital '0'
BUS IDLE
CAN LOW
HOLD
ZOOM
CURS
MEMO
RECD
MENU
<CAN Signal>

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Driveshaft and axle

Driveshaft and axle > General Information > Special Service Tools

SPECIAL TOOLS

Tool(Number and Name)	Illustration	Use
09495-33000 Puller		Removal of wheel bearing inner race from a hub.
09517-43401 Working base		Support for the differential carrier
09517-43500 Adapter		
09568-34000 Ball joint puller		Separation of a lower arm and a tie rod end ball joint.

Driveshaft and axle > General Information > Troubleshooting

TROUBLESHOOTING

Symptom	Possible cause	Remedy
Vehicle pulls to one side	Galling of drive shaft ball joint	Replace
	Wear, rattle or galling of wheel bearing	Replace
	Defective front suspension and steering	Adjust or replace
Vibration	Wear, damage or bending of drive shaft	Replace
	Drive shaft rattle and hub serration	Replace
	Wear, rattle or scratching of wheel bearing	Replace
Shimmy	Improper wheel balance	Adjust or replace
	Defective front suspension and steering	Adjust or replace
Excessive noise	Wear, damage or bending of drive shaft	Replace
	Drive shaft rattle and hub serration	Replace
	Drive shaft rattle and side gear serration	Replace
	Wear, rattle or galling of wheel bearing	Replace

	Loose hub nut	Adjust or replace
	Defective front suspension and steering	Adjust or replace
Quire-noise from the rear hub, occurs when driving on rugged roads	Cap separation from the hub bearing	Remove the rear hub check the hub bearing cap. Install a new cap if necessary.

Driveshaft and axle > General Information > Specifications

SPECIFICATION

Type			Joint type		Assembly range length	
			Inner	Outer	Left	Right
FRONT DRIVESHAFT						
2WD	2.7GSL	AT	UTJ-II#25	BJ#25	536.5	531.5
	2.0GSL	MT/AT	UTJ-II#24	BJ#25	536.4	824.2
4WD	2.7GSL	AT	UTJ-II#25	BJ#25	536.5	536.4
	2.0GSL	AT	UTJ-II#24	BJ#25	536.4	536.4
		MT	UTJ-II#24	BJ#25	536.4	536.4(Ø24)
Max. permissible angle			Inner	46.5°	Outer	23°
REAR DRIVESHAFT						
4WD	ALL		TJ#22	BJ#22	670	670
Max. permissible angle			Inner	46.5°	Outer	23°
REAR DIFFERENTIAL CARRIER						
Oil type			Hypoid gear oil (GL-5, 80W/SAE90)			
Oil capacity			Approx. 0.75 ~ 0.80 ℓ (0.79 ~ 0.84 US qt.)			
Reduction gear type			Hypoid gear			
Reduction gear ratio			3.091			
Final drive gear backlash mm(in)			0.10 ~ 0.15 (0.0039 ~ 0.0059)			
Differential gear backlash mm(in)			0 ~ 0.076 (0 ~ 0.003)			

NOTE

BJ : Birfield Joint
TJ : Tripod Joint
UTJ-II : U-type Tripod Joint

TIGHTENING TORQUE

Items		Nm	Kgf·m	lbf·ft
Front hub	Wheel nut	90 ~ 110	9 ~ 11	66.4 ~ 81.2
	Driveshaft castle nut	200 ~ 280	20 ~ 28	147.5 ~ 206.6
	Break caliper mounting bolt	50 ~ 60	5 ~ 6	36.9 ~ 44.3
	Lower arm mounting bolt	100 ~ 120	10 ~ 12	73.8 ~ 88.5
	Strut lower mounting bolt	140 ~ 160	14 ~ 16	103.3 ~ 118.0
	Tie rod end ball joint mounting nut	45 ~ 60	4.5 ~ 6	33.2 ~ 44.3
Rear	Wheel nut	90 ~ 110	9 ~ 11	66.4 ~ 81.2
	Break caliper mounting bolt	50 ~ 60	5 ~ 6	36.9 ~ 44.3
	Break disc(drum) mounting screw	5 ~ 6	0.5 ~ 0.6	3.7 ~ 4.4
	Dust cover mounting bolt	50 ~ 60	5 ~ 6	36.9 ~ 44.3
	Strut lower mounting nut	140 ~ 160	14 ~ 16	103.3 ~ 118.0
	Trailing arm mounting bolt	100 ~ 120	10 ~ 12	73.8 ~ 88.5
	Hub bearing flange nut[2WD]	200 ~ 260	20 ~ 26	147.5 ~ 191.8
	Driveshaft castle nut[4WD]	200 ~ 280	20 ~ 28	147.5 ~ 206.6
	Suspension arm mounting nut[2WD]	160 ~ 180	16 ~ 18	118.0 ~ 132.8
	Suspension arm mounting nut[4WD]	140 ~ 160	14 ~ 16	103.3 ~ 118.0
Propeller shaft	Front propeller shaft mounting bolt	50 ~ 60	5 ~ 6	36.9 ~ 44.3
	Propeller shaft center bearing bracket mounting bolt	50 ~ 65	5.0 ~ 6.5	36.9 ~ 47.0
	Rear propeller shaft mounting bolt	100 ~ 120	10 ~ 12	73.8 ~ 88.5
Differential	Rear differential mounting bolt	90 ~ 120	9 ~ 12	66.4 ~ 88.5
	Differential cover mounting bolt	40 ~ 50	4 ~ 5	29.5 ~ 36.9

CAUTION

Replace self-locking nuts with new ones after removal.

LUBRICANTS

FRONT DRIVESHAFT

[2WD]

Items	Recommended	Quantity
UTJ-II#24 + BJ#24 type (2.0GSL ALL)		
UTJ-II#24 boot grease	RTA-R (SK Chemical)	160g +10g
BJ#24 boot grease	RBA (SK Chemical)	130g +10g
UTJ-II#25 + BJ#25 type (2.7GSL AT)		
UTJ-II#25 boot grease	RTA-R (SK Chemical)	200g +10g
BJ#25 boot grease	RBA (SK Chemical)	160g +10g

[4WD]

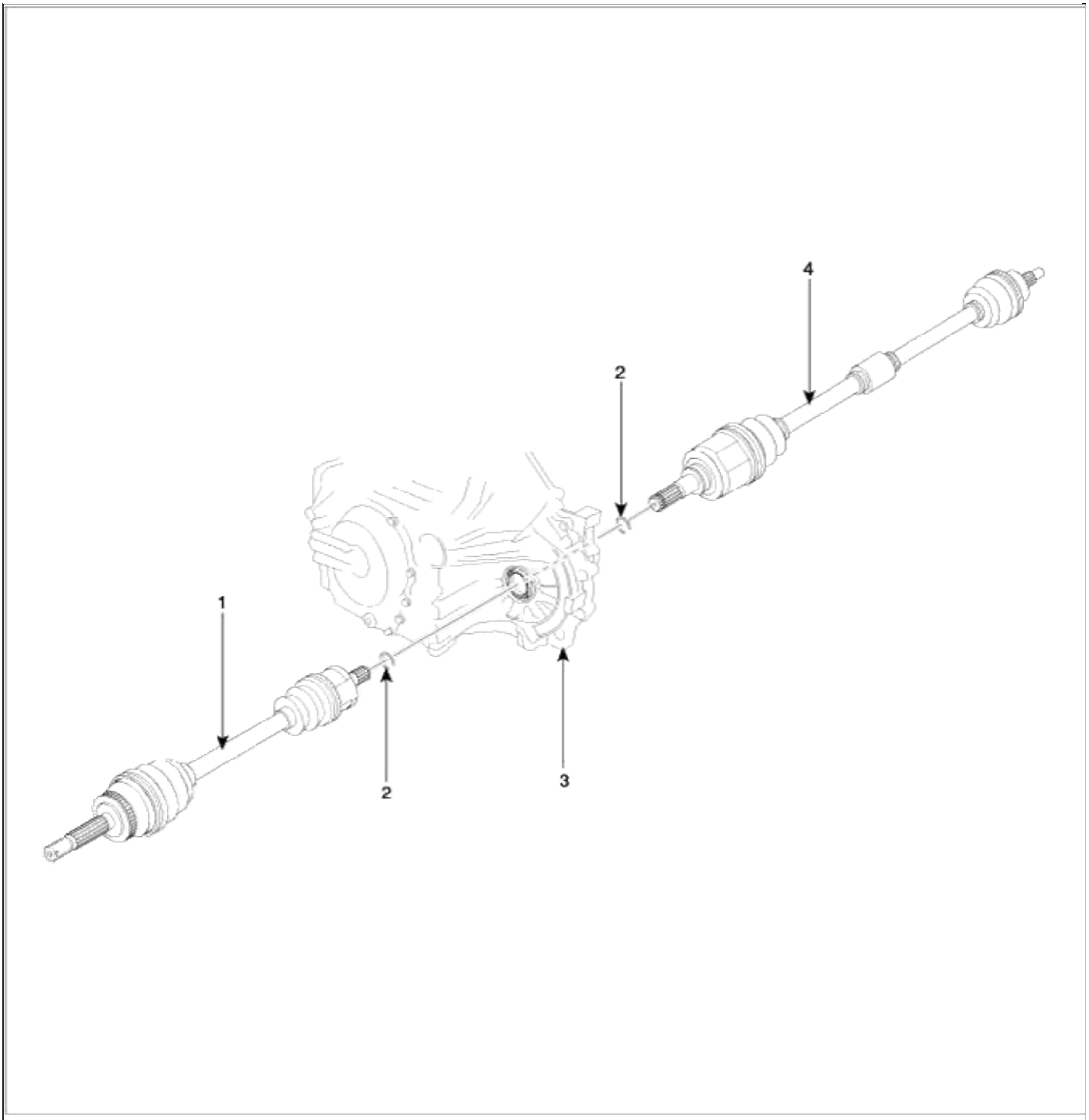
UTJ-II#24 + BJ#24 type (2.0GSL ALL)		
UTJ-II#24 boot grease	RTA-R (SK Chemical)	160g +10g
BJ#24 boot grease	RBA (SK Chemical)	130g +10g
UTJ-II#25 + BJ#25 type (2.7GSL AT)		
UTJ-II#25 boot grease	RTA-R (SK Chemical)	200g +10g
BJ#25 boot grease	RBA (SK Chemical)	160g +10g

REAR DRIVESHAFT (4WD)

TJ#22 - BJ#22 type (ALL)		
TJ#22 boot grease	RTA-R (SK Chemical)	110g +10g
BJ#22 boot grease	RBA (SK Chemical)	100g +10g

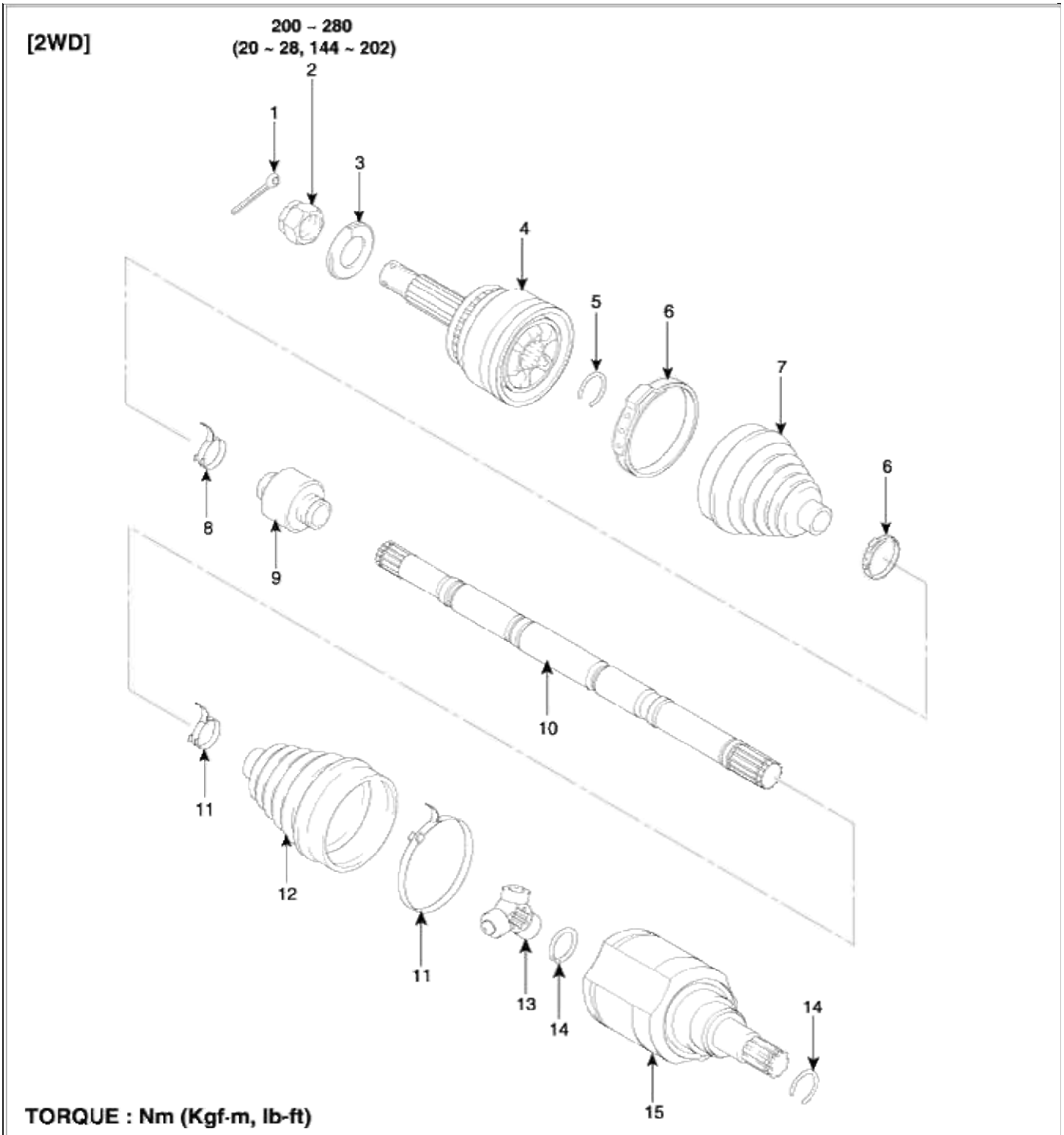
Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location

COMPONENTS

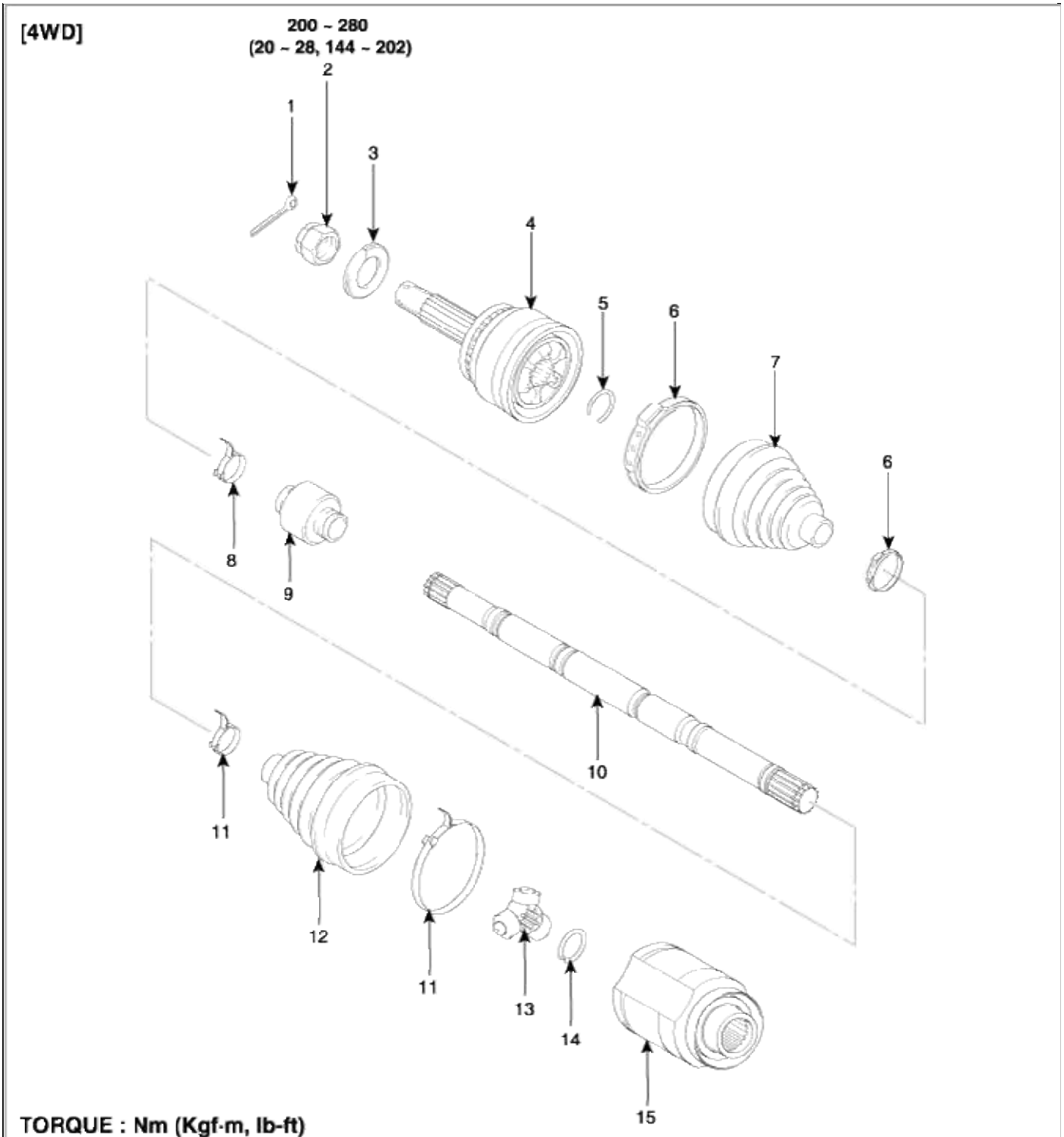


1. Driveshaft (LH)
2. Circlip
3. Transaxle
4. Driveshaft (RH)

COMPONENTS



1. Split pin
2. Castle nut
3. Washer
4. BJ assembly
5. Clip A
6. BJ boot band
7. BJ boot
8. Dynamic damper band
9. Dynamic damper
10. Shaft
11. UTJ boot band
12. UTJ boot
13. Trunion assembly
14. Circlip
15. UTJ assembly



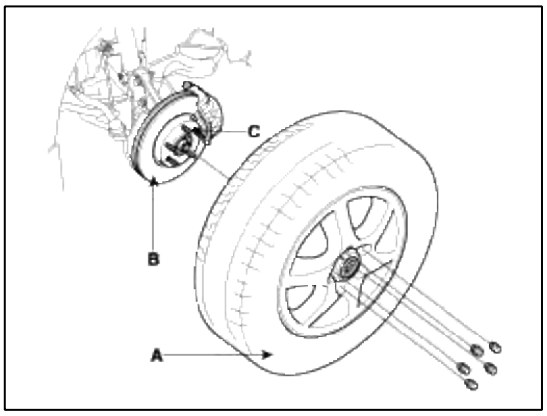
1. Split pin	5. Clip A	9. Dynamic damper	13. Trunion assembly
2. Castle nut	6. BJ boot band	10. Shaft	14. Circlip
3. Washer	7. BJ boot	11. UTJ boot band	15. UTJ assembly
4. BJ assembly	8. Dynamic damper band	12. UTJ boot	

Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.

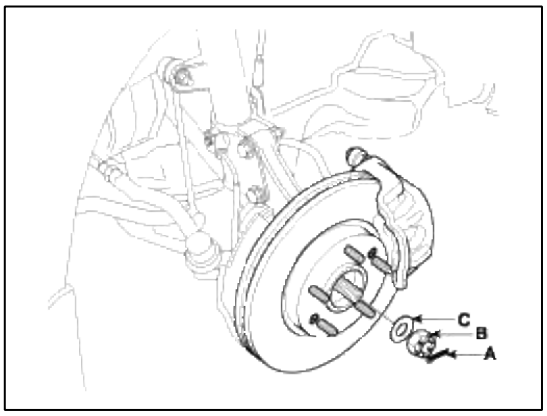
2. Remove the front wheel and tire(A) from front hub(B).



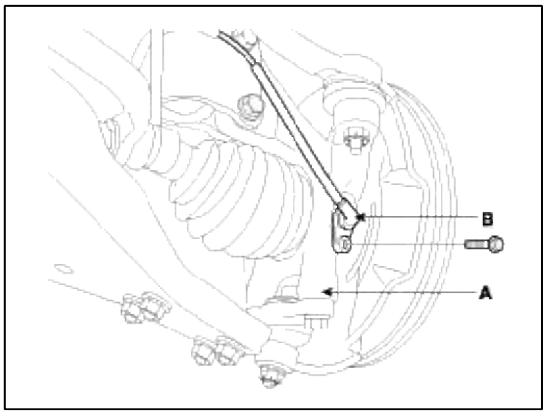
CAUTION

Be careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

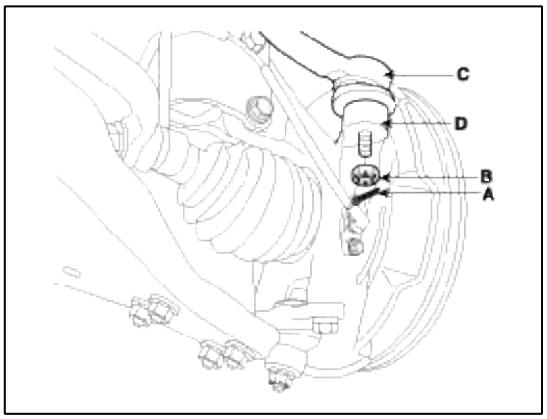
3. Remove the split pin(A), then remove castle nut(B) and washer(C) from the front hub under applying the break.



4. Remove the wheel speed sensor(B) from the knuckle(A).



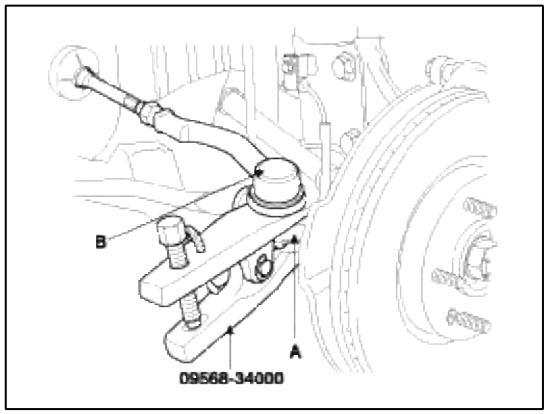
5. Disconnect the tie rod end ball joint(C) from the knuckle(D) using the special tool(09568-34000).



A. Remove the split pin(A).

B. Remove the castle nut(B).

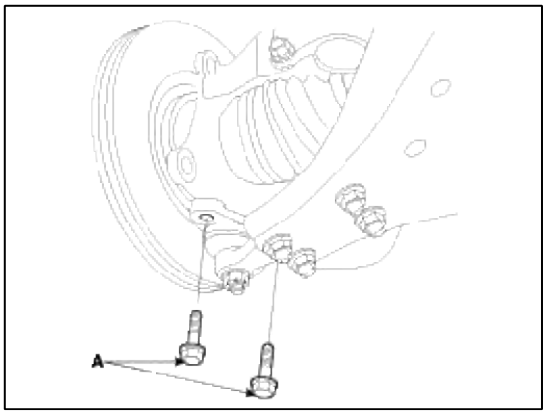
C. Disconnect the ball joint(C) from knuckle(D) using the special tool(09568-34000).



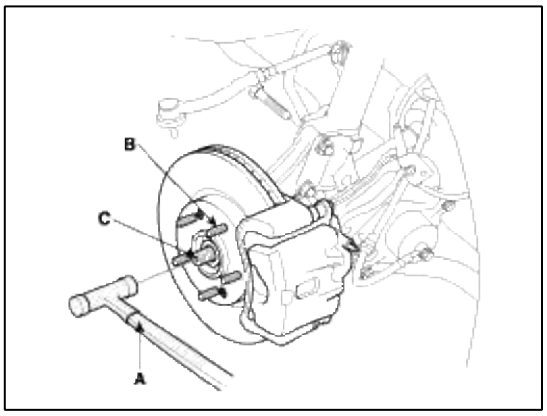
CAUTION

Apply a few drops of oil to the special tool.(Boot contact part)

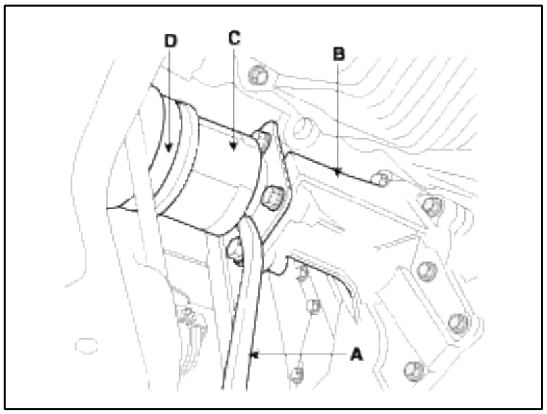
6. Remove the lower arm ball joint mounting bolts(A).



7. Using a plastic hammer(A), disconnect the driveshaft(C) from the axle hub(C).



8. Push the axle hub(B) outward and separate the driveshaft(C) from the axle hub(B).
9. Insert a pry bar(A) between the transaxle case(B) and joint case(C), and separate the driveshaft(D) from the transaxle case.



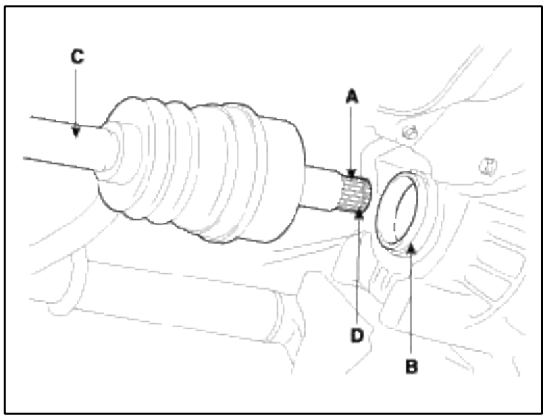
CAUTION

- 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(0.28in)
- Do not pull the driveshaft by excessive force it may cause components inside the axle shaft joint kit to dislodge resulting in a torn boot or a damaged bearing.
- Plug the hole of the transaxle case with the oil seal cap to prevent contamination.
- Support the driveshaft properly.
- Replace the retainer ring whenever the driveshaft is removed from the transaxle case.

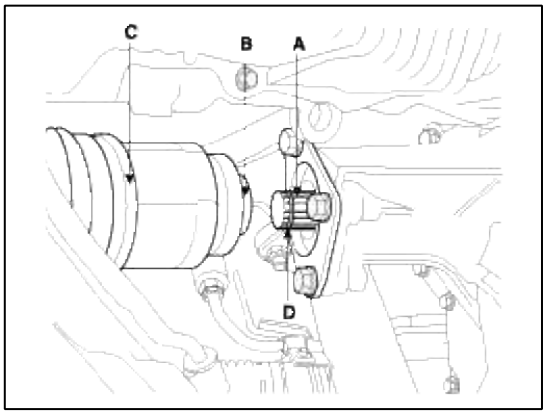
INSTALLATION

1. Apply gear oil on the driveshaft oil seal case contacting surface(B) and transaxle case splines(A).

[2WD]

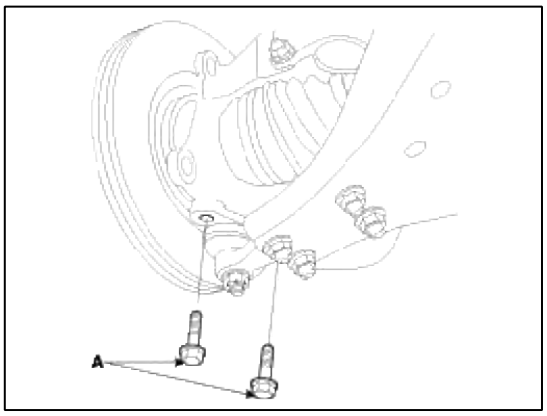


[4WD]



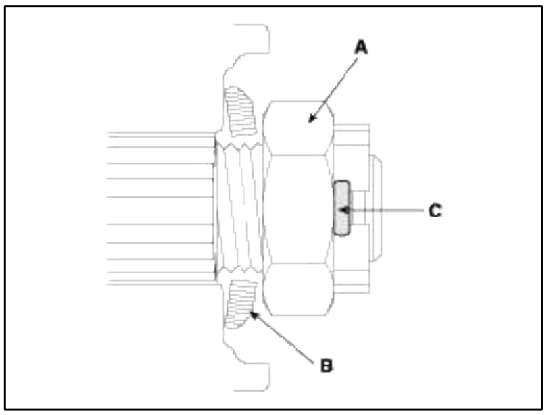
2. Before installing the driveshaft(C), set the opening side of the circlip(D) facing downward.
3. After installation, check that the driveshaft cannot be removed by hand.
4. Install the drive shaft into the knuckle.
5. Install the lower arm mounting bolts(A).

Tightening torque :
100 ~ 120 Nm (10 ~ 12 Kgf·m, 73.8 ~ 88.5 lb-ft)



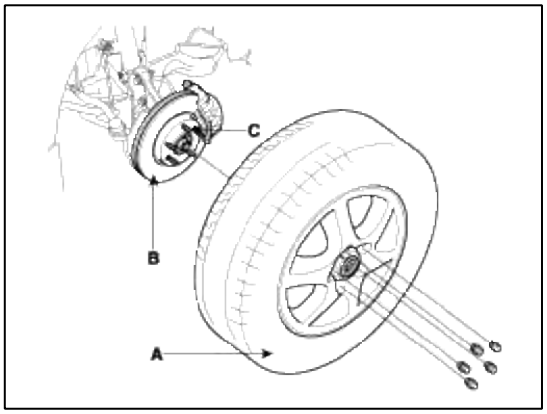
6. After installing the washer(B) with convex surface outward, install the castle nut(A) and the split pin(C).

Tightening torque :
200 ~ 280 Nm (20 ~ 28 Kgf·m, 147.5 ~ 206.6 lb-ft)



7. Install the front wheel and tire(A) on the front hub(B).

Tightening torque :
90 ~ 110 Nm (9 ~ 11 Kgf·m, 66.4 ~ 81.2 lb-ft)



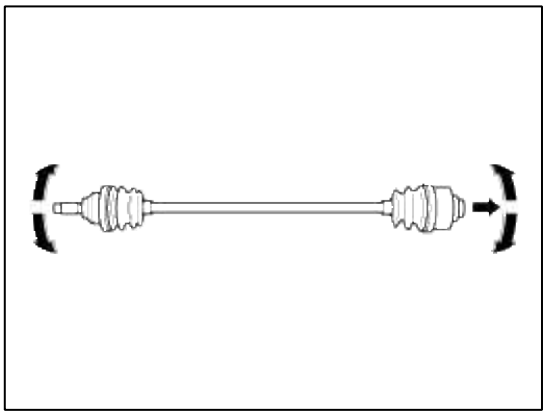
CAUTION

Be careful not to damage the hub bolts(C) then install the front wheel and tire(A).

INSPECTION

1. Check the driveshaft boots for damage and deterioration.
2. Check the ball joint for wear and damage.
3. Check the splines for wear and damage.

4. Check the dynamic damper for cracks, wear and position



5. Check the driveshaft for cracks and wears.

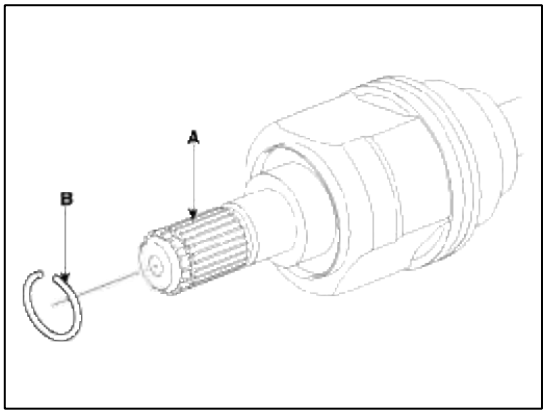
DISASSEMBLY

DRIVESHAFT (2WD)

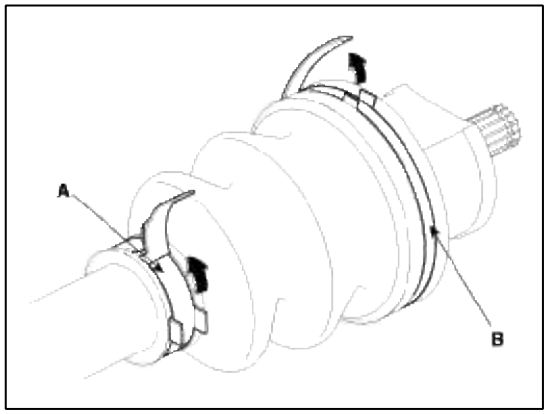
CAUTION

- Do not disassemble the BJ assembly.
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

1. Remove the circlip(B) from driveshaft splines(A) of the transaxle side UTJ case.

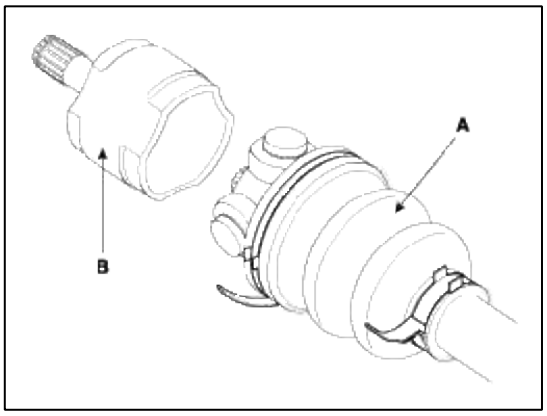


2. Remove the both boot clamps from the transaxle side UTJ case.
   A. Using a plier or flat-tipped (-) screwdriver, remove the both clamps(UTJ boot band(B), boot band(A)) of the transaxle side.



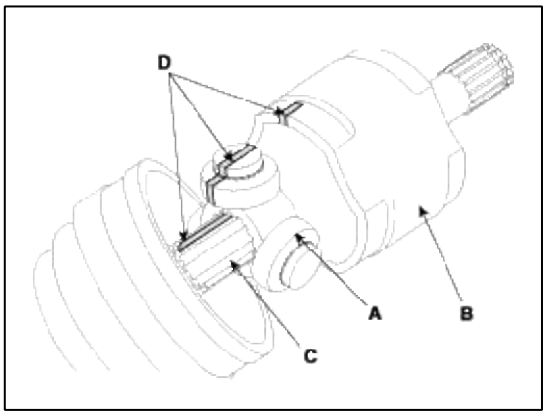
3. Pull out the boot from the transaxle side joint(UTJ).

4. While dividing joint(UTJ) boot(A) of the transaxle side, wipe the grease in UTJ case(B) and collect them respectively.

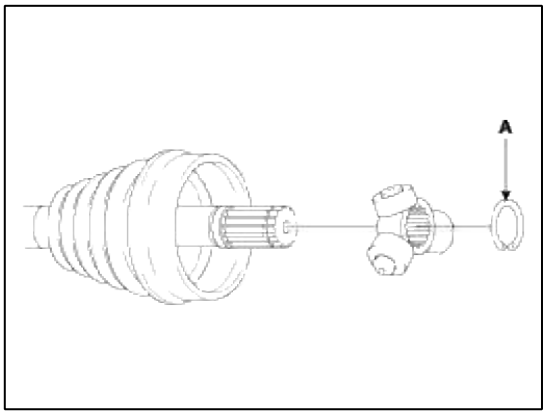


CAUTION

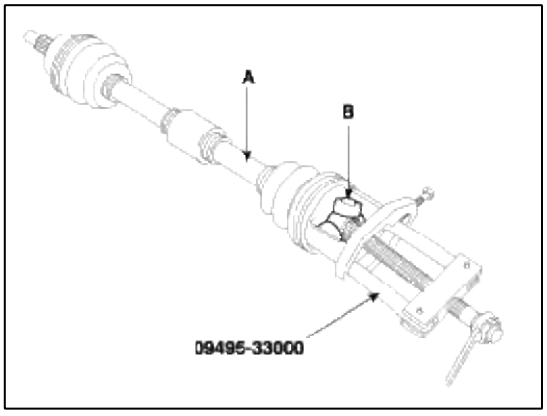
- Be careful not to damage the boot.
- According to below the illustrated, put marks(D) on roller of trunion assembly(A), UTJ case(B) and spline part(C), for providing assembly.



5. Using a plier or flat-tipped (-)screwdriver, remove the circlip(A).

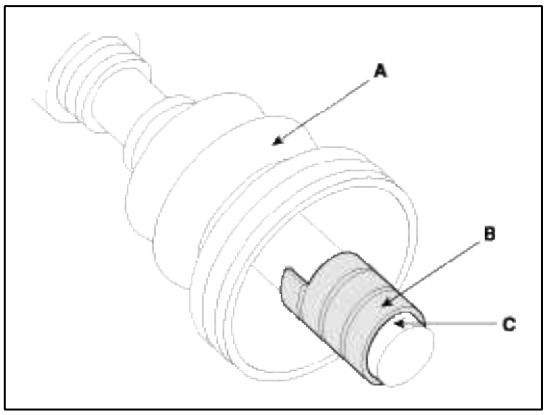


6. Remove the trunion assembly(B) from the driveshaft(A) using the special tool(09495-33000).

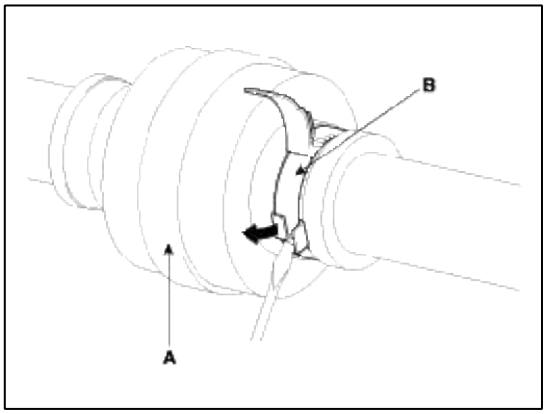


7. Clean the trunion assembly.
8. Remove the boot(A) of the transaxle side joint(UTJ).

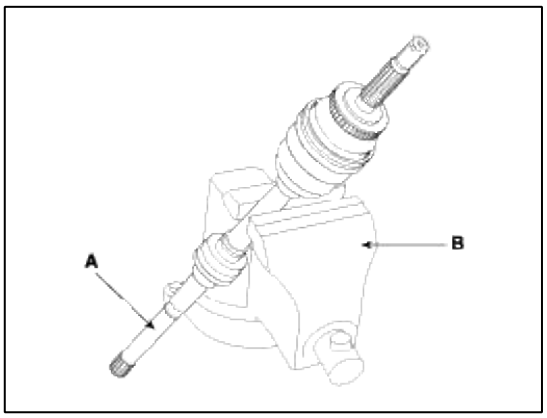
> CAUTION
>
> For reusing the boot(A), wrap tape(B) around the driveshaft splines(C) to protect the boot(A).



9. Using a plier or flat-tipped (-) screwdriver, remove the both side of clamp(B) of the dynamic damper(A).

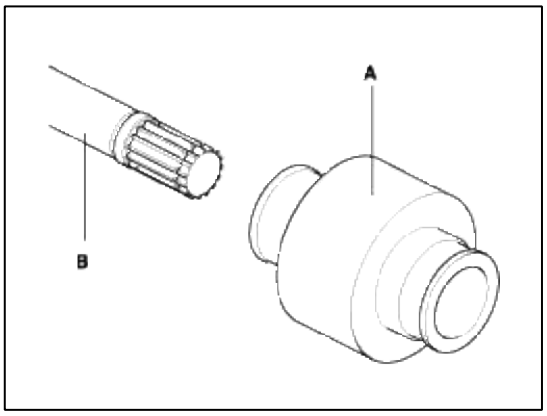


10. Fix the driveshaft(A) with a vise(B) as illustrated.

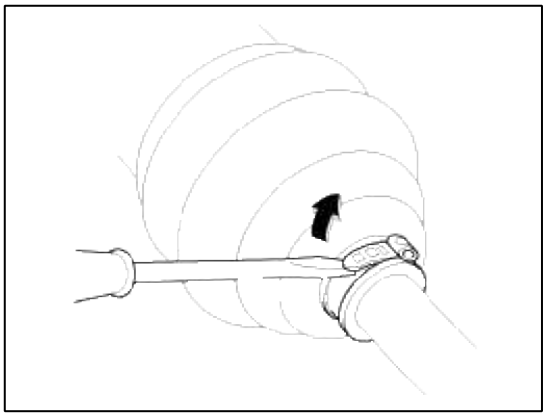


11. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.

12. Saperate the dynamic damper(A) from the shaft(B) carefully.



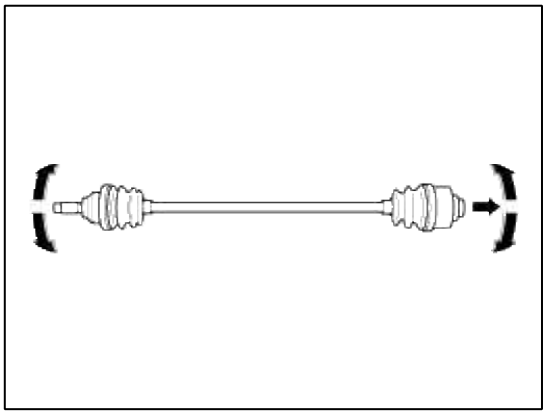
13. Using a plier or flat-tipped (-) screwdriver, remove the clamp on the side of wheel.



14. Pull out the joint(BJ) on the side of wheel into the transaxle direction.
    Be carefull not to damage the boot.

INSPECTION

1. Check the driveshaft boots for damage and deterioration.
2. Check the ball joint for wear and damage.
3. Check the splines for wear and damage.
4. Check the dynamic damper for cracks, wear and position

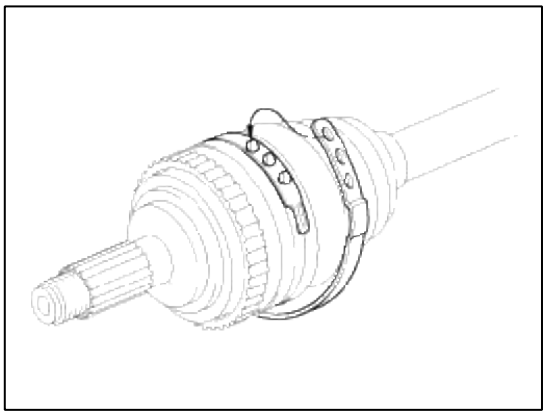


5. Check the driveshaft for cracks and wears.

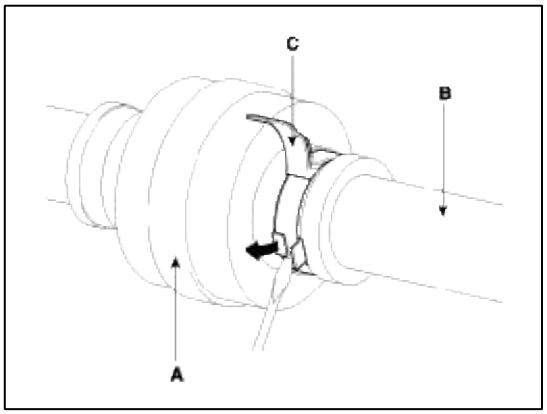
REASSEMBLY

1. Wrap tape around the driveshaft splines (UTJ side) to prevent damage to the boots.
2. Apply grease to the driveshaft and install the boots. (See page DS - 4)

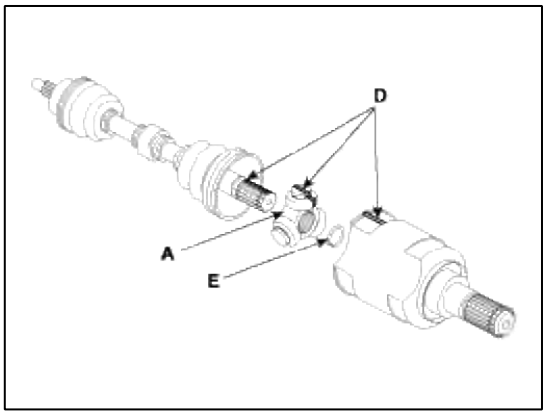
3. Install the clamps to both boots.

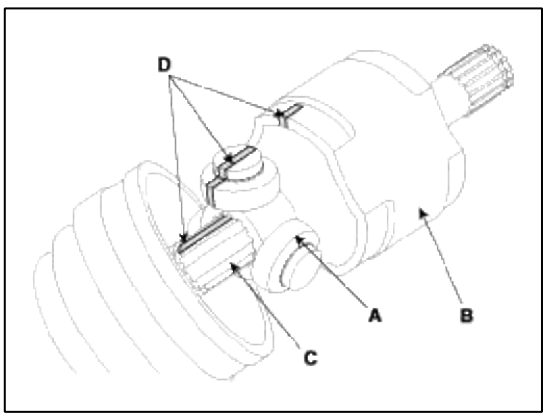


4. To reassemble the dynamic damper(A), keeping the shaft(B) in the straight, tighten the dynamic damper(A) with dynamic band(C), as the illustration.



5. Install the UTJ boot bands and UTJ boot.
6. Install the trunion assembly(A) and the circlip(E) to the spline(C) on the drivershaft.
   At this time align the marks(D) each other.



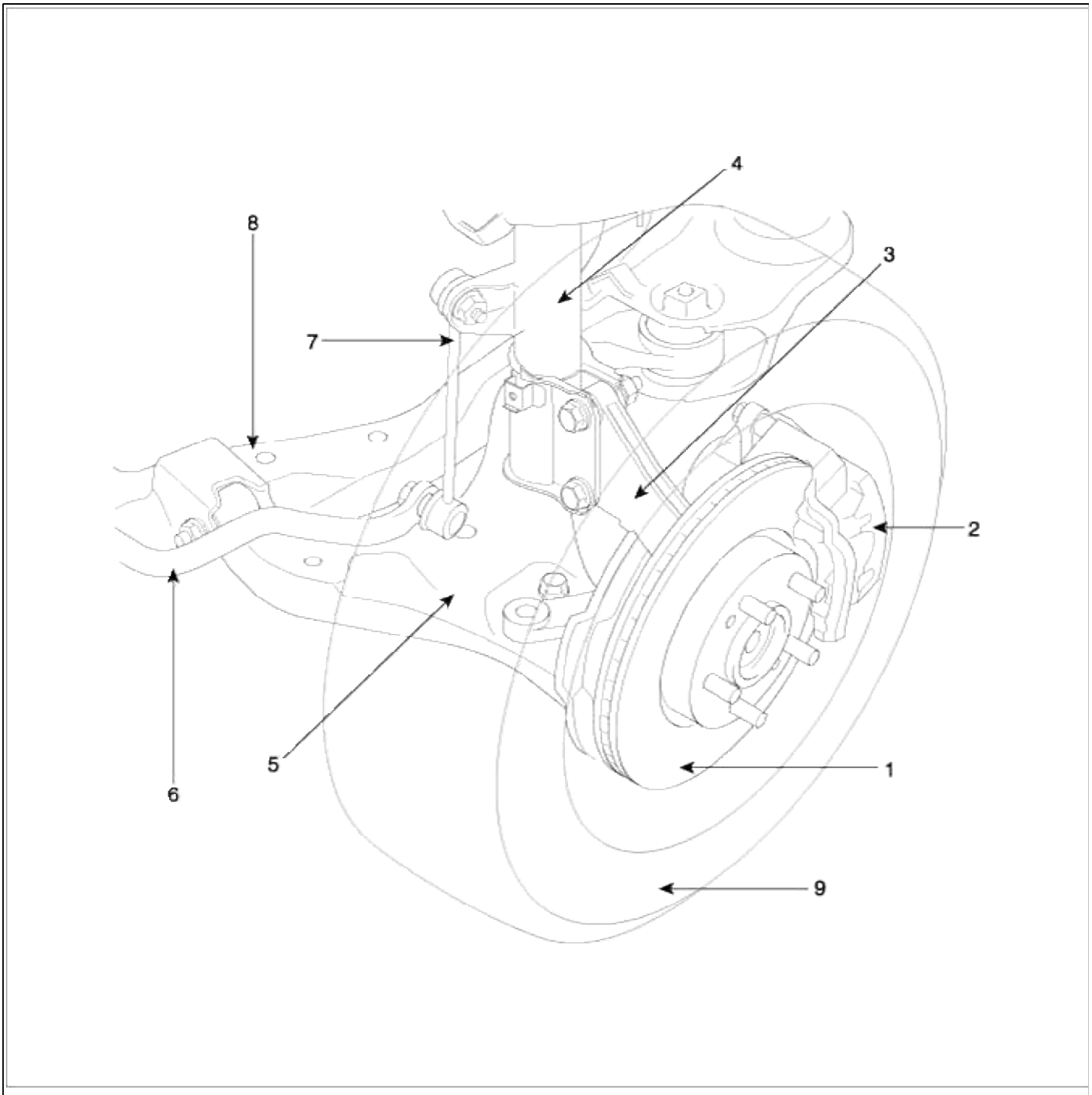


7. Add the specified grease to the UTJ as mush as wiped away at inspection.
8. Install the boots.
9. Tighten the UTJ boot bands.

10. To control the air in the UTJ boot, keep the specified distance between the boot bands when they are tightened.

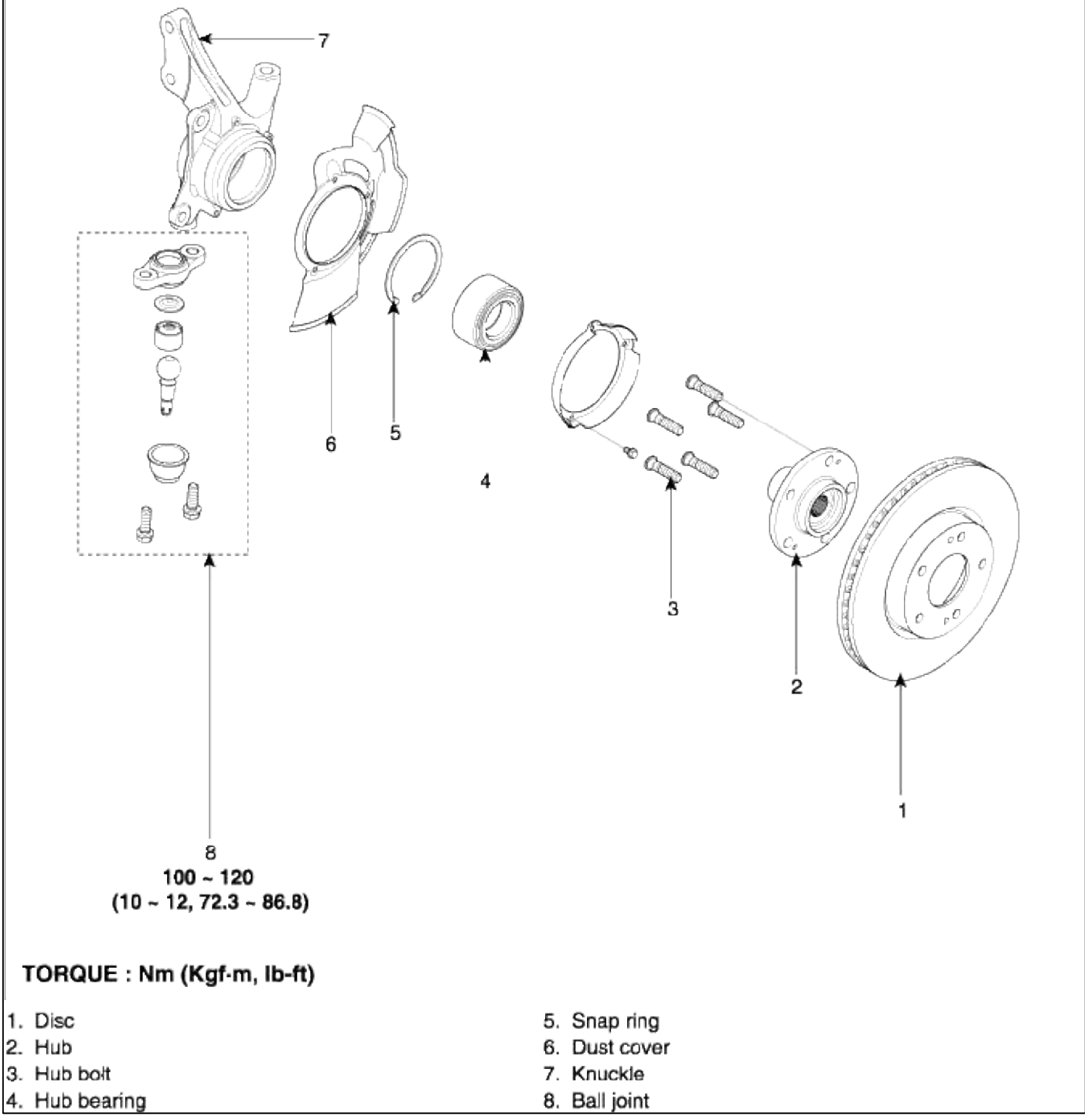
Driveshaft and axle > Front Axle Assembly > Front Hub / Axle > Components and Components Location

COMPONENT LOCATION



1. Disc
2. Caliper
3. Knuckle
4. Strut assembly
5. Lower arm
6. Stabilizer bar
7. Stabilizer bar link
8. Sub-frame
9. Tire

COMPONENTS



TORQUE : Nm (Kgf-m, lb-ft)

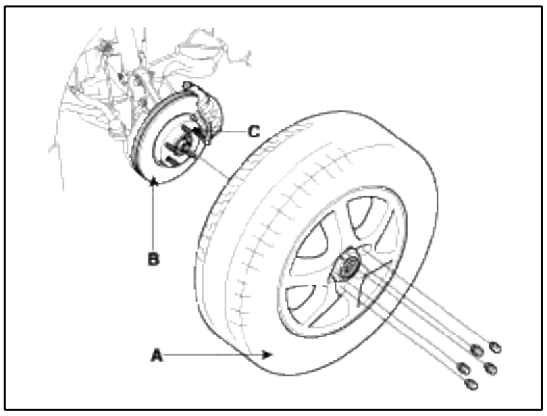
1. Disc
2. Hub
3. Hub bolt
4. Hub bearing
5. Snap ring
6. Dust cover
7. Knuckle
8. Ball joint

Driveshaft and axle > Front Axle Assembly > Front Hub / Axle > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.

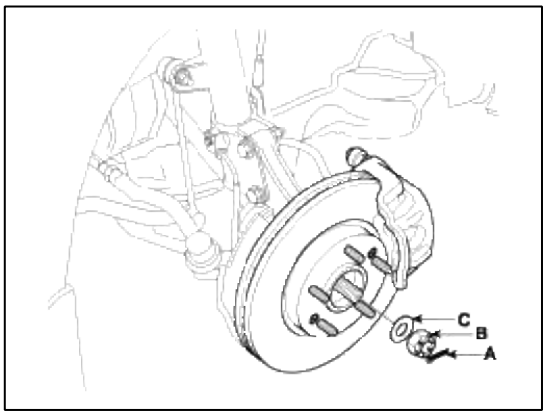
2. Remove the front wheel and tire(A) from front hub(B).



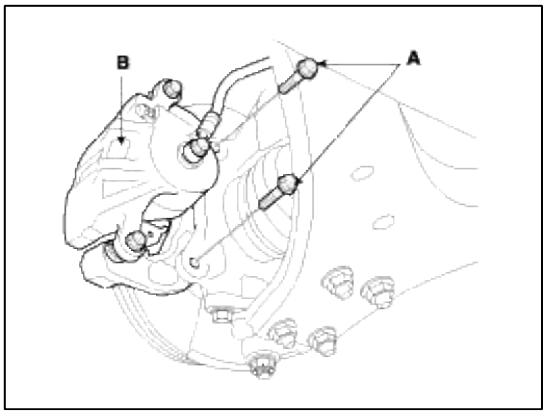
CAUTION

Be careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

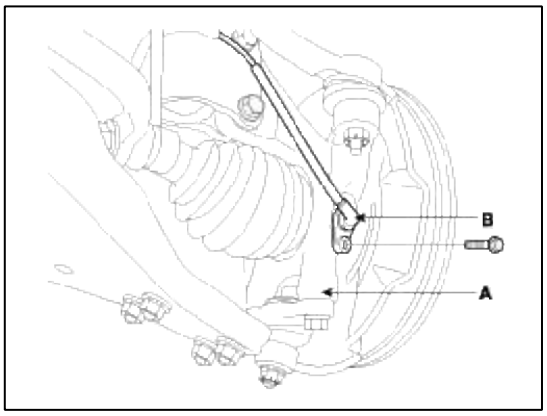
3. Remove the split pin(A), then remove castle nut(B) and washer(C) from the front hub under applying the break.



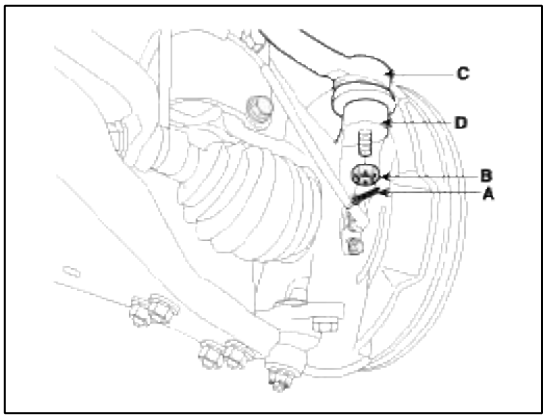
4. Remove the caliper mounting bolts(A), and hang the caliper assembly(B) to one side. To prevent damage to the caliper assembly or brake hose, use a short piece of wire to hang the caliper from the undercarriage.



5. Remove the wheel speed sensor(B) from the knuckle(A).



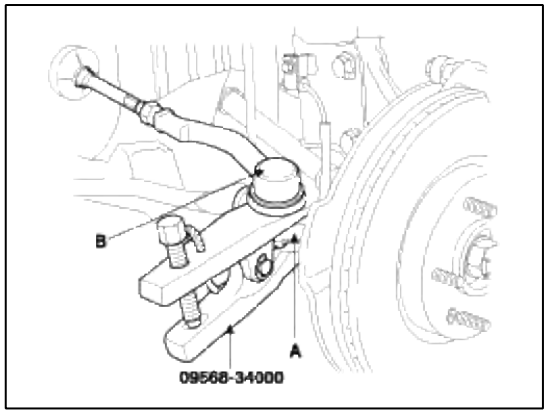
6. Disconnect the tie rod end ball joint(C) from the knuckle(D) using the special tool(09568-34000).



A. Remove the split pin(A).

B. Remove the castle nut(B).

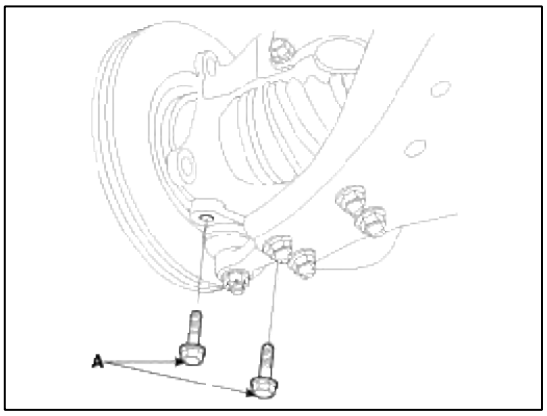
C. Disconnect the ball joint(C) from knuckle(D) using the special tool(09568-34000).



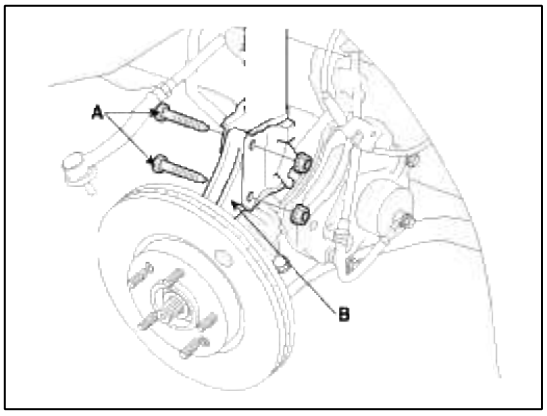
CAUTION

Apply a few drops of oil to the special tool. (Boot contact part)

7. Remove the lower arm ball joint mounting bolts(A).



8. Remove the strut lower arm mounting bolts(A).

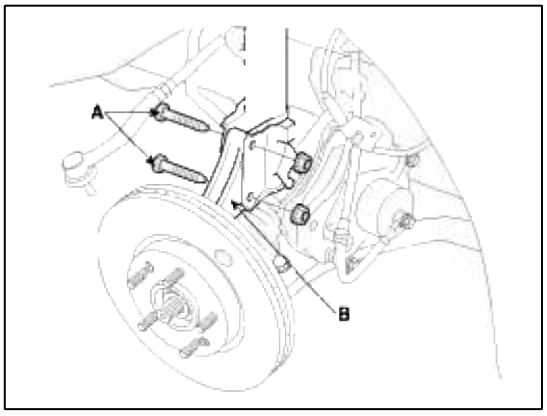


9. Remove the hub and the knuckle assembly(B).

> CAUTION
>
> Be careful not to damage the boot and rotor teeth.

INSTALLATION

1. Install the hub and the knuckle assembly(B).

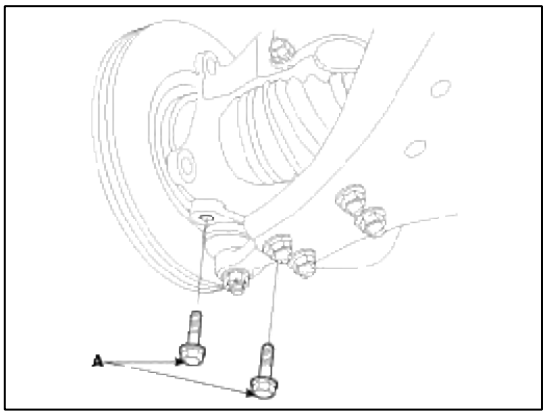


2. Install the strut lower mounting bolts(A).

Tightening torque :
140 ~ 160 Nm (14 ~ 16 Kgf·m, 103.3 ~ 118 lb-ft)

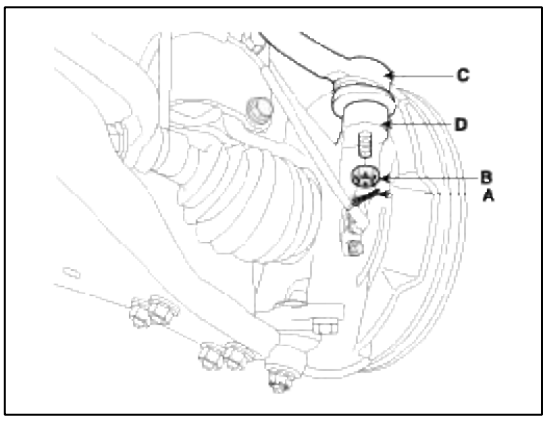
3. Install the lower arm ball joint mounting bolts(A).

Tightening torque :
100 ~ 120 Nm (10 ~ 12 Kgf·m, 73.8 ~ 88.5 lb-ft)



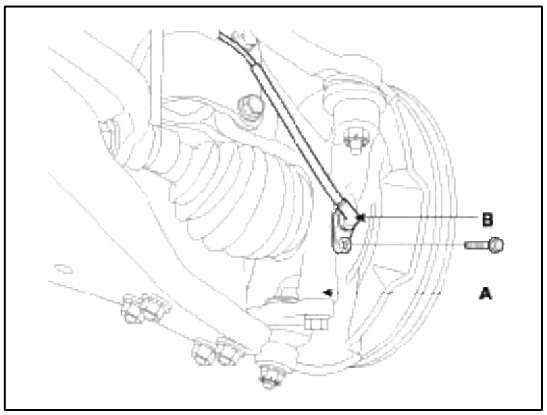
4. Install the tie rod end ball joint(C) from the knuckle.

Tightening torque :
45 ~ 60 Nm (4.5 ~ 6 Kgf·m, 33.2 ~ 44.3 lb-ft)



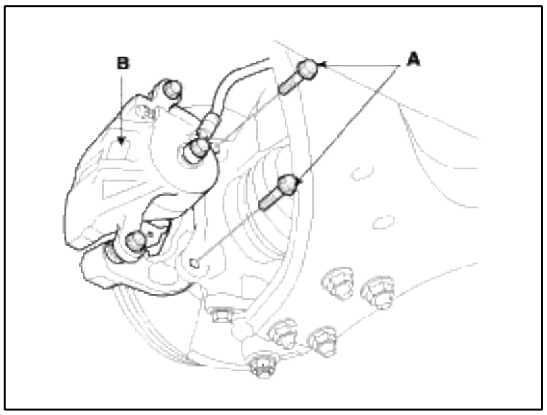
A. Install the castle nut(B).
B. Install the split pin(A).

5. Install the wheel speed sensor(A).



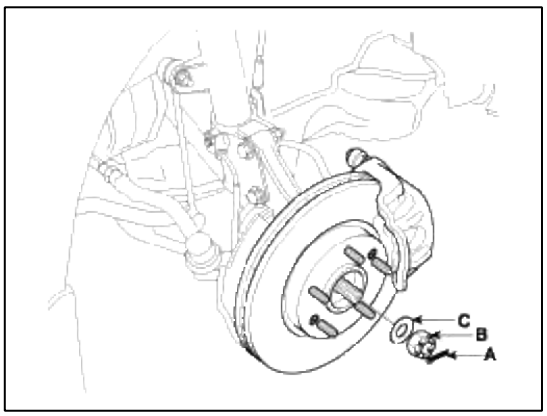
6. Install the brake caliper(B), and then tighten the mounting bolts(A).

Tightening torque :
50 ~ 60 Nm (5 ~ 6 Kgf·m, 36.9 ~ 44.3 lb-ft)



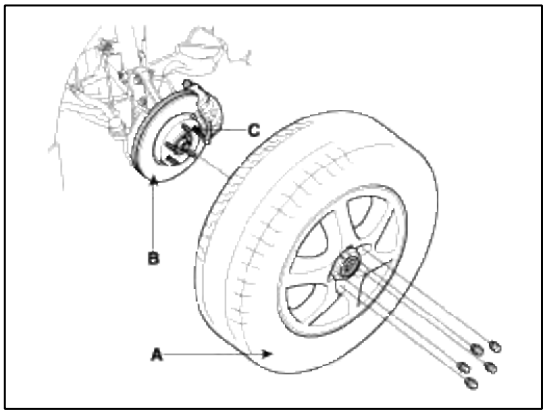
7. Install the washer(C), castle nut(B) and split pin(A) from the front hub.

Tightening torque :
200 ~ 280 Nm (20 ~ 28 Kgf·m, 147.5 ~ 206.6 lb-ft)



8. Install the front wheel and tire(A) on the front hub(B).

Tightening torque :
90 ~ 110 Nm (9 ~ 11 Kgf·m, 66.4 ~ 81.2 lb-ft)



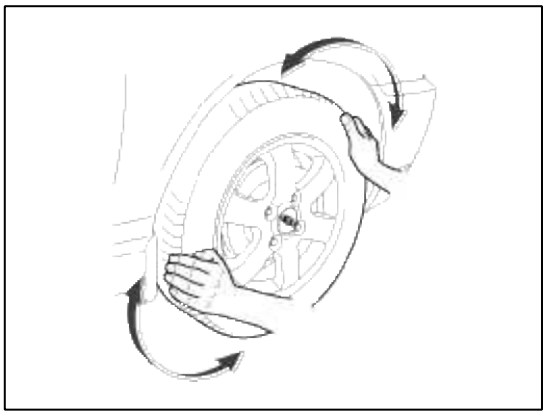
CAUTION

Be careful not to damage the hub bolts(C) then install the front wheel and tire(A).

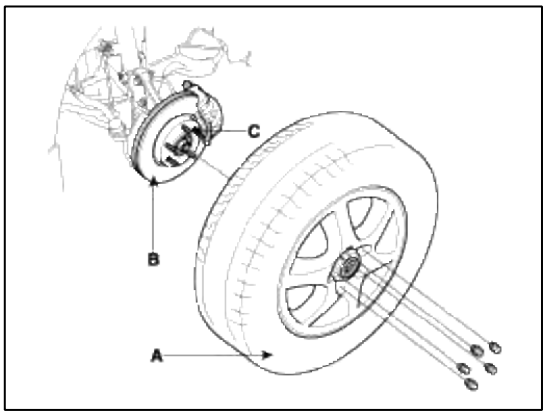
ON-VEHICLE INSPECTION

WHEEL BEARING PLAY INSPECTION

1. Inspection the play of the bearing while the vehicle is jacked up.



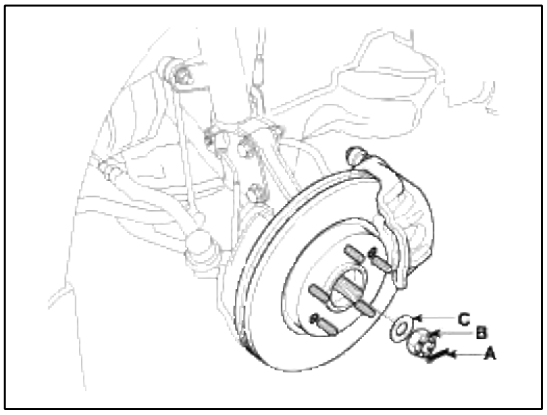
2. If there is any play, loosen the wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported.
3. Remove the front wheel and tire(A) from front hub(B).



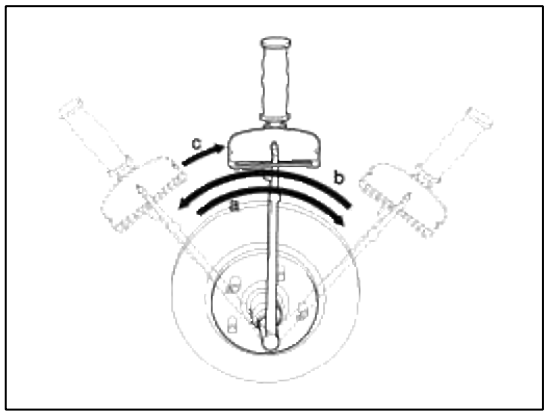
CAUTION

Be careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

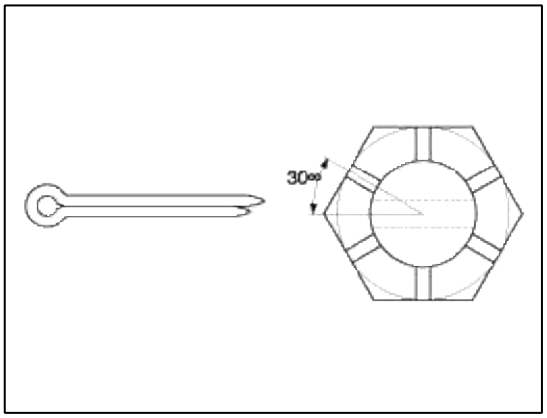
4. Remove the split pin(A), then remove castle nut(B) and washer(C) from the front hub under applying the break.



5. Tighten the hub bearing nut by the following procedures.
   A. Hub bearing nut must be fastened with torque 280 Nm (28 kgf·m, 202.5 lb-ft) and rear hub must be rotated above 3 times enough for secure placement of hub bearing.
   B. Unfasten hub bearing nut until its tightening torque is 0 Nm (kgf·m, lb-ft)
   C. Hub bearing nut must be fastened again with torque 200 Nm (20 kgf·m, 144.7 lb-ft)



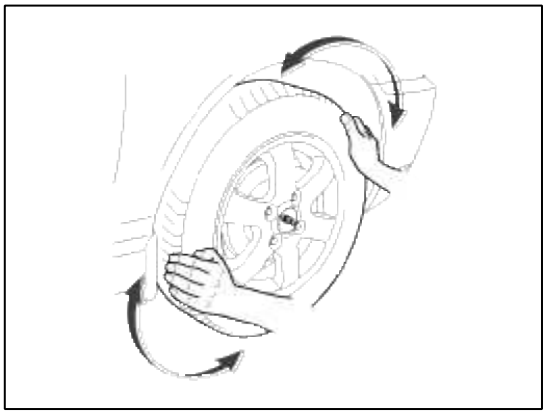
   D. Assemble split pin.
   E. If the direction of split pin is not in line with the hole of knuckle unfasten hub bearing nut within 30° and assemble sprit pin.



ON-VEHICLE INSPECTION

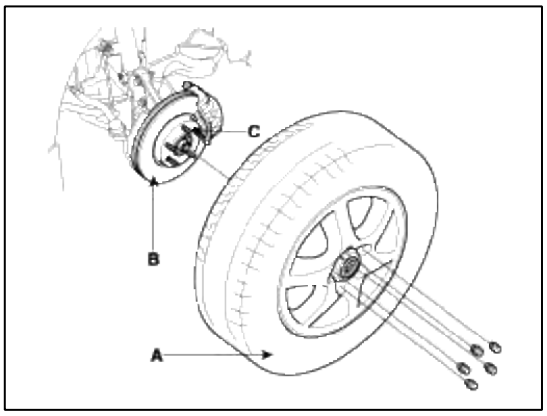
WHEEL BEARING PLAY INSPECTION

1. Inspection the play of the bearing while the vehicle is jacked up.



2. If there is any play, loosen the wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported.

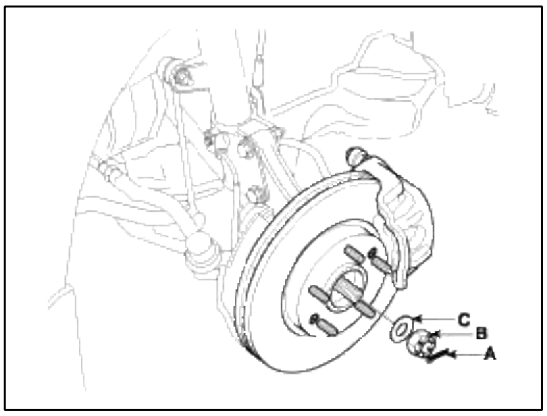
3. Remove the front wheel and tire(A) from front hub(B).



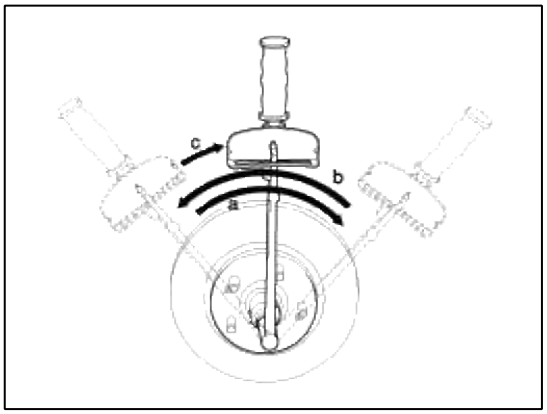
CAUTION

Be careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

4. Remove the split pin(A), then remove castle nut(B) and washer(C) from the front hub under applying the break.

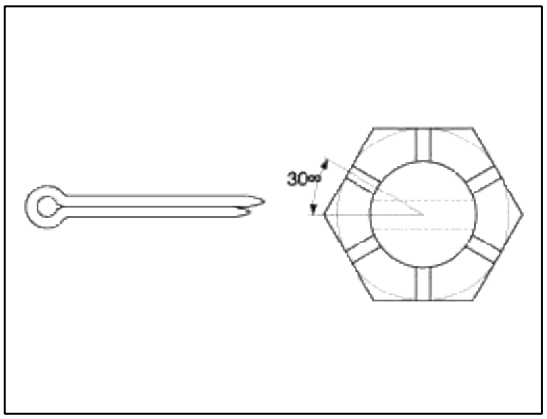


5. Tighten the hub bearing nut by the following procedures.
   A. Hub bearing nut must be fastened with torque 280 Nm (28 kgf·m, 202.5 lb-ft) and rear hub must be rotated above 3 times enough for secure placement of hub bearing.
   B. Unfasten hub bearing nut until its tightening torque is 0 Nm (kgf·m, lb-ft)
   C. Hub bearing nut must be fastened again with torque 200 Nm (20 kgf·m, 144.7 lb-ft)



   D. Assemble split pin.

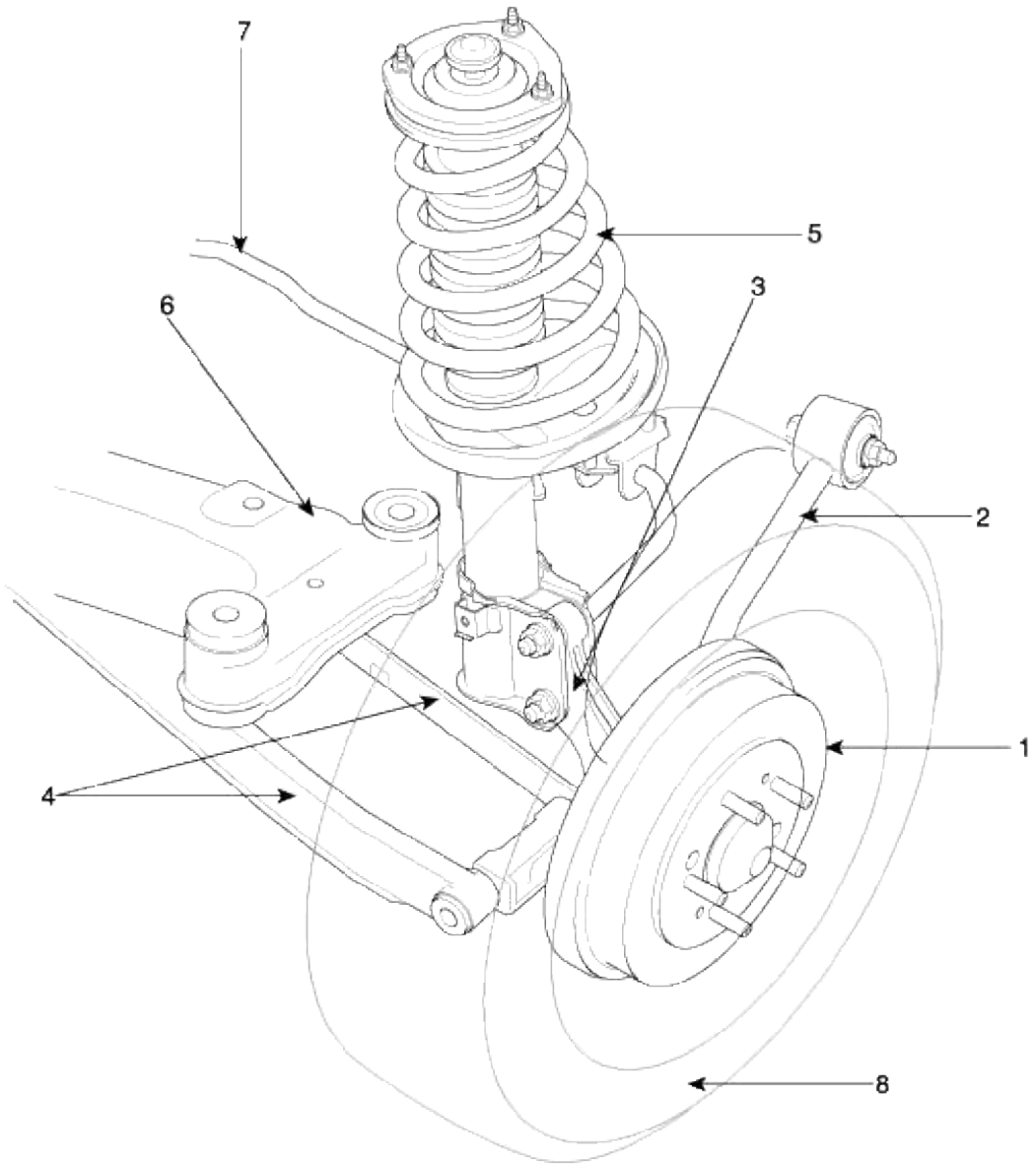
E. If the direction of split pin is not in line with the hole of knuckle unfasten hub bearing nut within 30° and assemble sprit pin.



Driveshaft and axle > Rear Axle Assembly > Rear Hub / Carrier > Components and Components Location

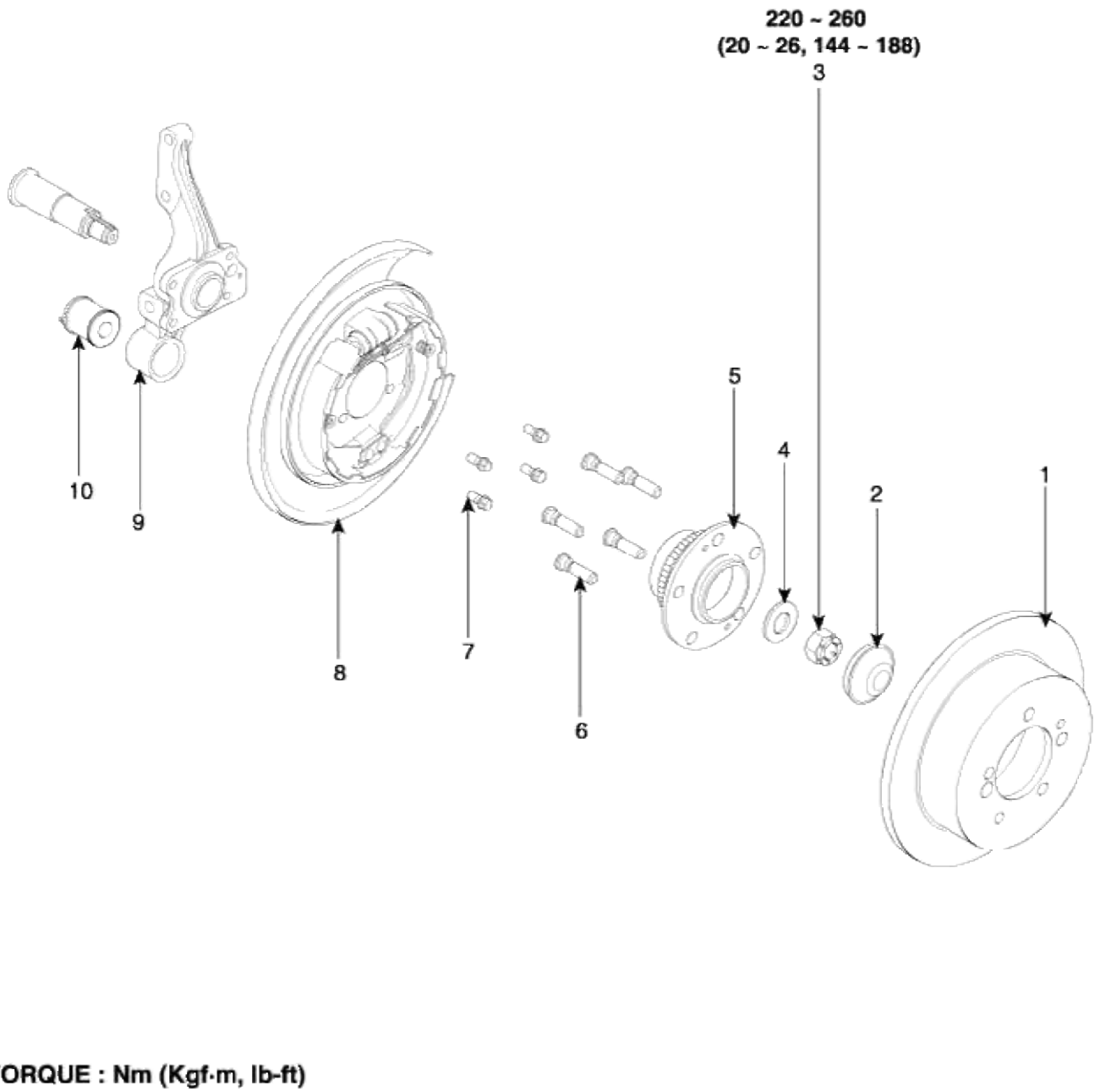
COMPONENT LOCATION

[2WD]



1. Disc brake
2. Trailing arm
3. Axle carrier
4. Suspension arm
5. Strut assembly
6. Cross member
7. Stabilizer bar
8. Tire

COMPONENTS



TORQUE : Nm (Kgf·m, lb-ft)

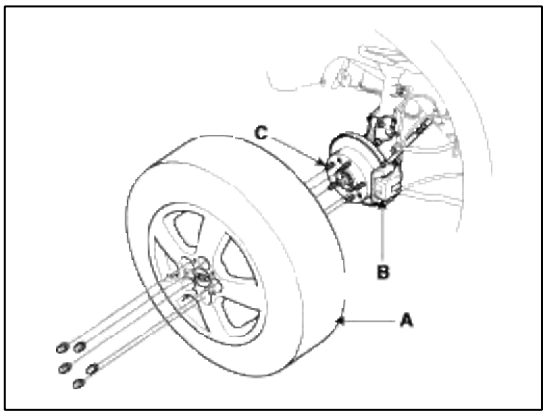
1. Disc
2. Hub cap
3. Castle nut
4. Washer
5. Hub
6. Hub bolt
7. Dust cover mounting bolt
8. Rear parking brake assembly
9. Axle carrier
10. Bushing

Driveshaft and axle > Rear Axle Assembly > Rear Hub / Carrier > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.

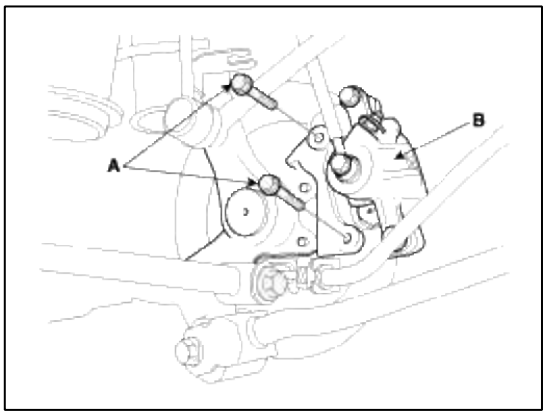
2. Remove the rear wheel and tire(A) from rear hub(B).



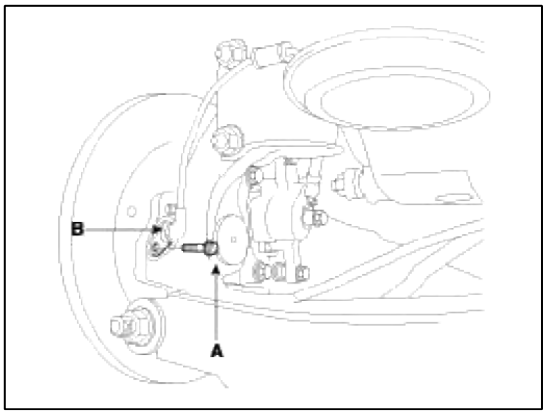
CAUTION

Be careful not to damage the hub bolts(C) then remove the rear wheel and tire(A).

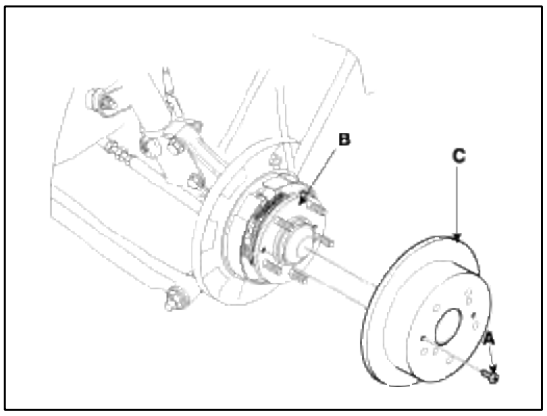
3. Remove the caliper mounting bolts(A), and hang the caliper assembly(B) to one side. To prevent damage to the caliper assembly or brake hose, use a short piece of wire to hang the caliper from the undercarriage.



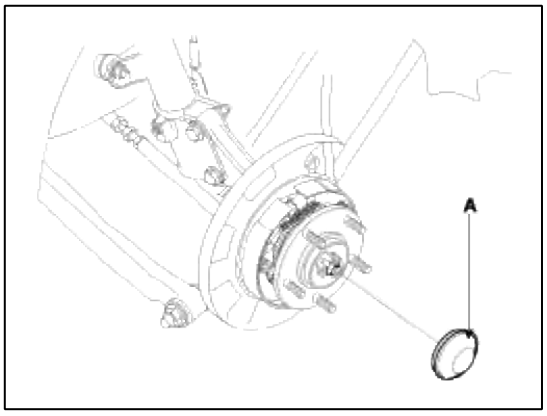
4. Remove the wheel speed sensor(B) from the axle carrier(A).



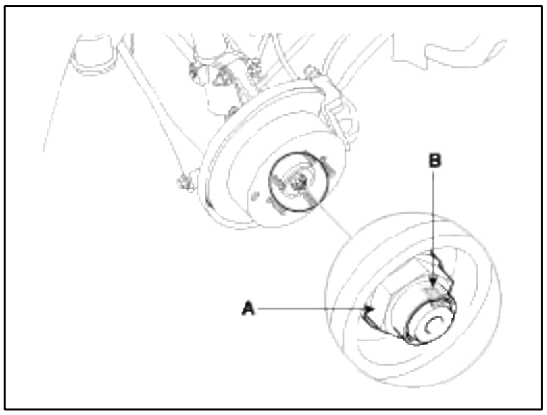
5. Loosen the brake disc mounting screw(A), and then remove the brake disc(C) from the hub(B).



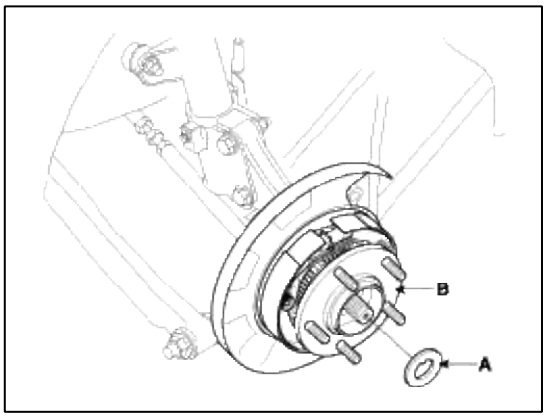
6. Using a (-)screwdriver, remove the hub cap(A).



7. Remove the hub bearing flange nut(A).
   A. Using a flat-tipped (-)screwdriver, spread out the groove(B) on the flange nut(A)
   B. Loosen the hub bearing flange nut(A).

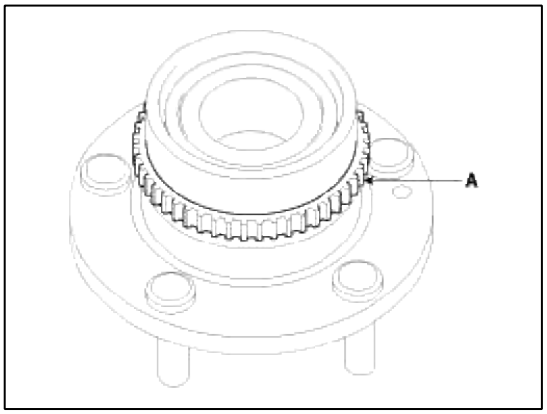


8. Remove the rear hub washer(A) and rear hub assembly(B).



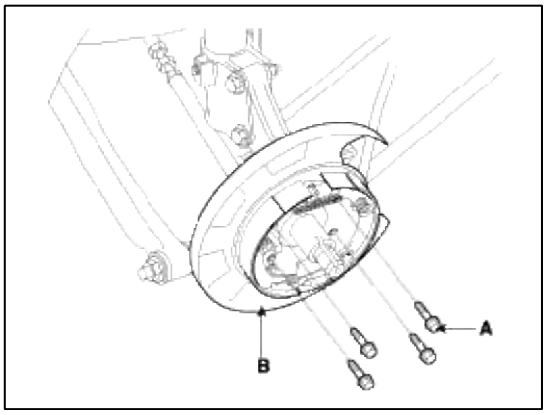
CAUTION

- Be careful not disassembly the rear hub assembly.
- For vehicles equipped with ABS.

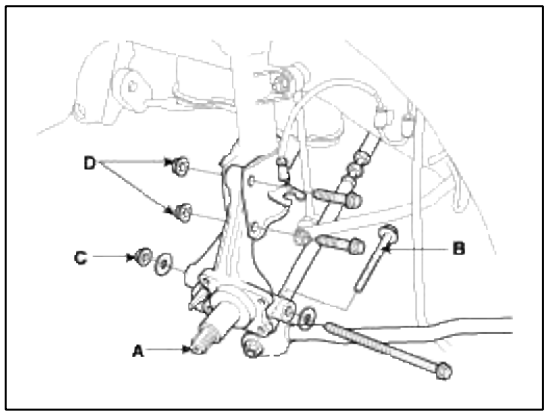


- Care must be taken not to scratch or damage the teeth of the rotor(A).
- The rotor must never be dropped.
- If the teeth of the rotor are chipped, it results in deformation of the rotor. It will make it impossible to detect the wheel rotation speed accurately and to operate the system normally.

9. Loosen the rear dust cover mounting bolts(A) and then remove the rear parking brake assembly(B).



10. Remove the rear axle carrier(A).
    A. Remove the trailing arm mounting bolt(B).
    B. Remove the suspension arm mounting nut(C).
    C. Remove the strut mounting nuts(D).



INSTALLATION

1. Install the rear axle carrier(A).
    A. Install the strut mounting nuts(D).

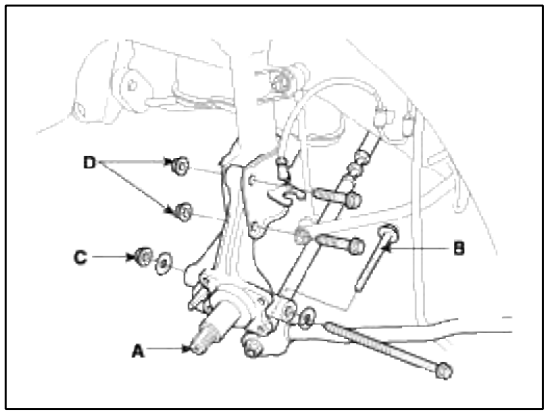
Tightening torque :
140 ~ 160 Nm (14 ~ 16 Kgf·m, 103.3 ~ 118.0 lb-ft)

    B. Install the suspension arm mounting nut(C).

Tightening torque :
160 ~ 180 Nm (16 ~ 18 Kgf·m, 118.0 ~ 132.8 lb-ft)

    C. Install the trailing arm mounting bolt(B).

Tightening torque :
100 ~ 120 Nm (10 ~ 12 Kgf·m, 73.8 ~ 88.5 lb-ft)

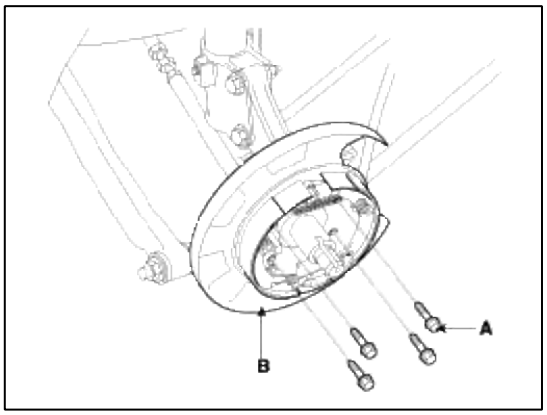


CAUTION

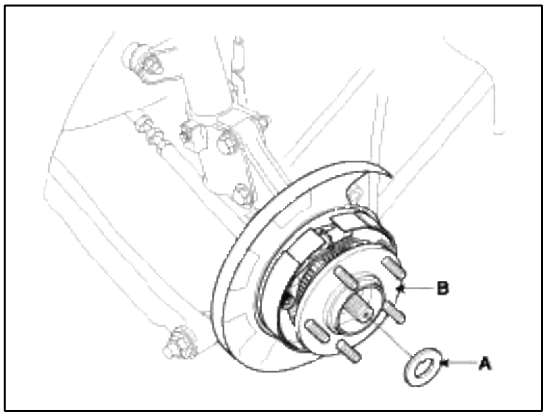
Replace the self-locking nut with new ones after removal.

2. Install the rear dust cover(B) and then tighten the mounting bolts(A).

Tightening torque :
50 ~ 60 Nm (5 ~ 6 Kgf·m, 36.9 ~ 44.3 lb-ft)

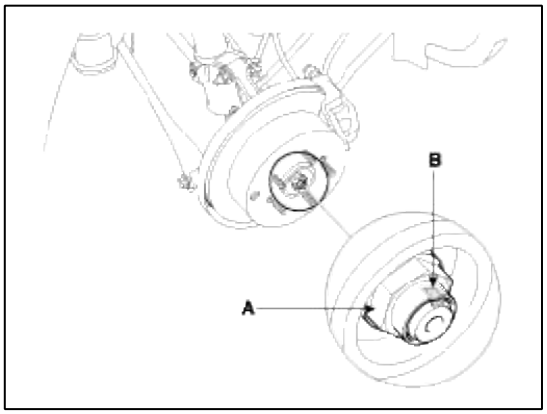


3. Install the hub assembly(B) and hub washer(A).



4. After tightening the hub bearing flange nut(A), caulk the concave portion(B) of the spindle by crimping the nut.

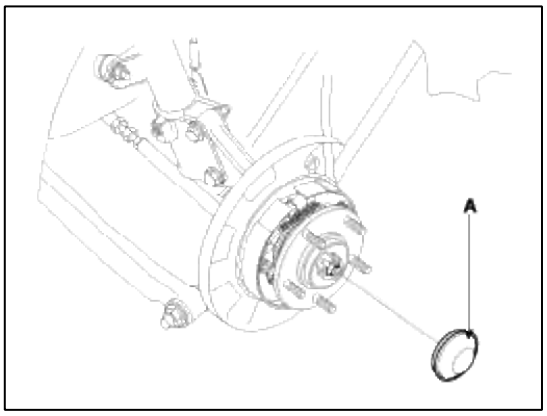
Tightening torque :
200 ~ 260 Nm (20 ~ 26 Kgf·m, 147.5 ~ 191.8 lb-ft)



CAUTION

Replace the flange nut with new ones after removal.

5. Install the hub cap(A).

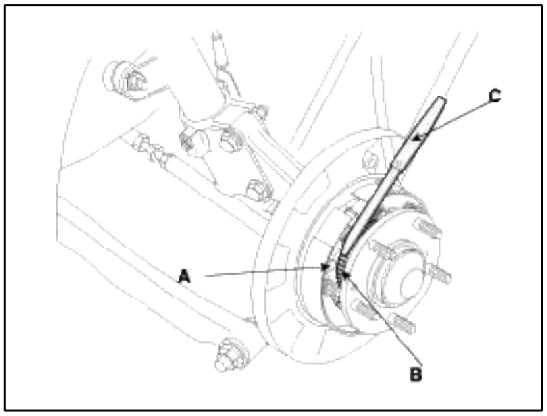


CAUTION

Replace the hub cap with new ones after removal.

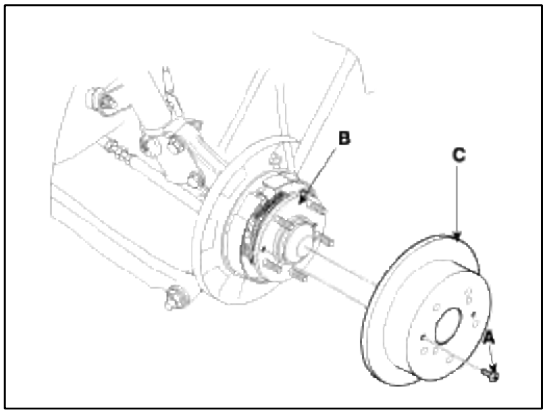
6. Installation of the rear speed sensor(A).(For vehicles equipped with ABS):
   Insert a feeler gauge(C) into the space between the pole piece of the speed sensor(A) and the rotor teeth(B) surface, and then tighten the speed sensors(A) at the position where the clearance at all places is within the standard value.

Standard value :
Clearance : 0.5 ~ 1.5mm (0.02 ~ 0.06 in)



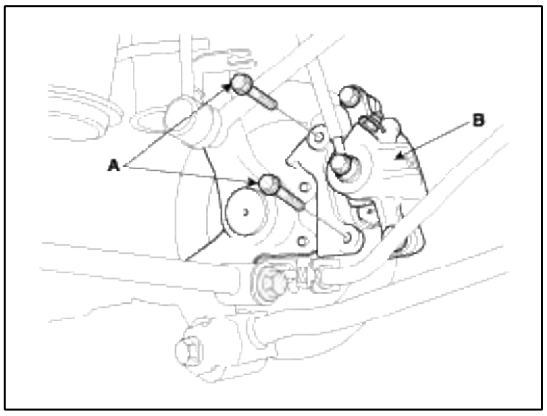
7. Install the brake disc(C) from the hub(B), then tighten the brake disc mounting screw(A).

Tightening torque :
5 ~ 6 Nm (0.5 ~ 0.6 Kgf·m, 3.7 ~ 4.4 lb-ft)



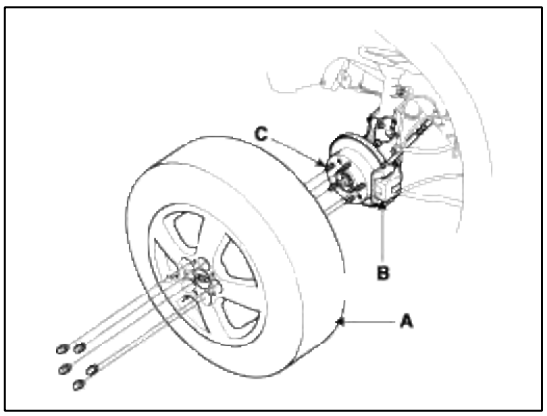
8. Install the brake caliper(B), then tighten the mounting bolt(A).

Tightening torque :
50 ~ 60 Nm (5 ~ 6 Kgf·m, 36.9 ~ 44.3 lb-ft)



9. Install the rear wheel and tire(A) on the rear hub(B).

Tightening torque :
90 ~ 110 Nm (9 ~ 11 kgf·m, 66.4 ~ 81.2 lb-ft)



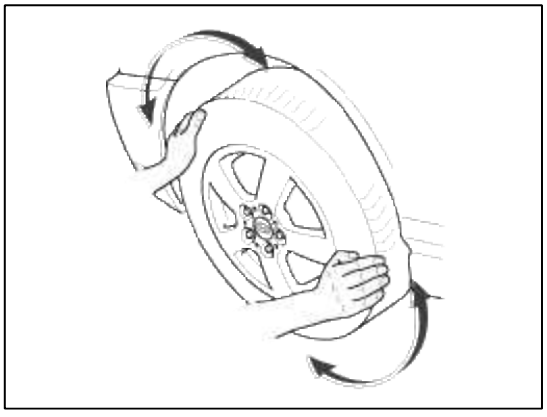
CAUTION

Be careful not to damage the hub bolts(C) then install the rear wheel and tire(A).

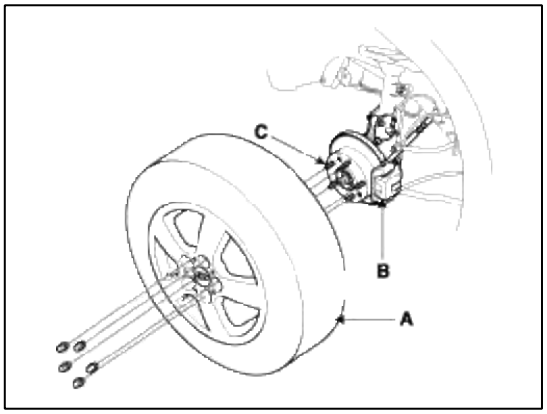
ON-VEHICLE INSPECTION

WHEEL BEARING PLAY INSPECTION

1. Inspection the play of the bearing while the vehicle is jacked up.



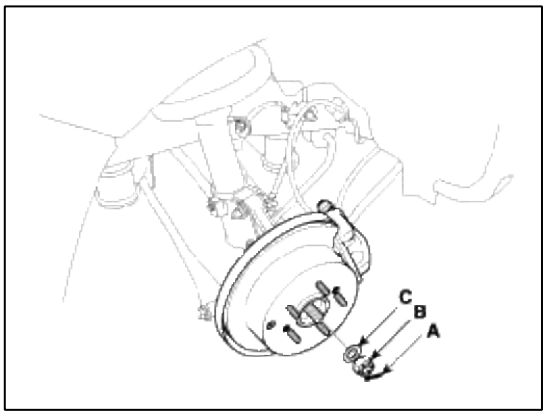
2. If there is any play, loosen the wheel nuts slightly. Raise the rear of the vehicle, and make sure it is securely supported.
3. Remove the rear wheel and tire(A) from rear hub(B).



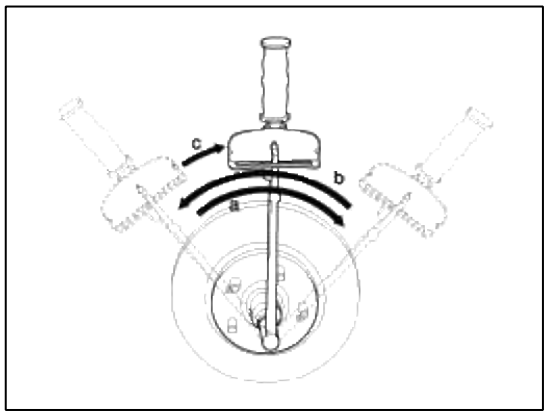
CAUTION

Be careful not to damage the hub bolts(C) then remove the rear wheel and tire(A).

4. Remove the split pin(A), then remove castle nut(B) and washer(C) from the rear hub under applying the break.

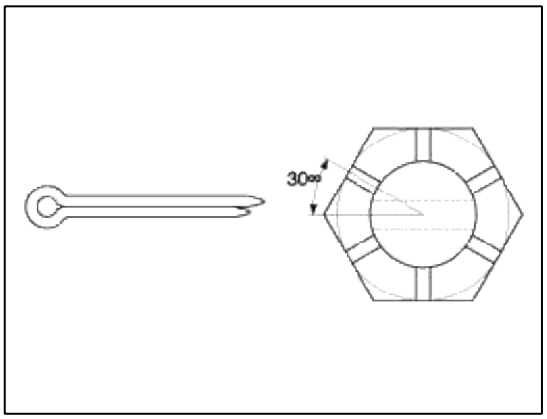


5. Tighten the hub bearing nut by the following procedures.
   A. Hub bearing nut must be fastened with torque 280 Nm (28 kgf·m, 202.5 lb-ft) and rear hub must be rotated above 3 times enough for secure placement of hub bearing.
   B. Unfasten hub bearing nut until its tightening torque is 0 Nm (kgf·m, lb-ft)
   C. Hub bearing nut must be fastened again with torque 200 Nm (20 kgf·m, 144.7 lb-ft)



   D. Assemble split pin.

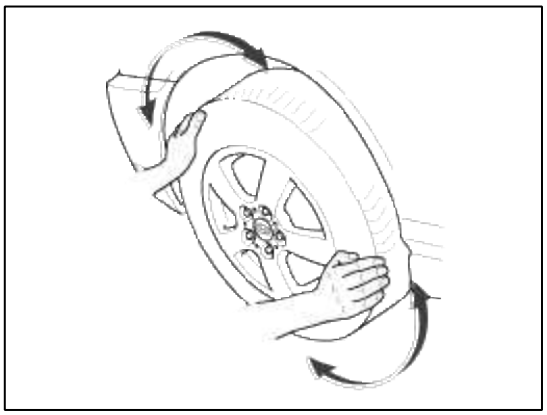
E. If the direction of split pin is not in line with the hole of knuckle unfasten hub bearing nut within 30° and assemble split pin



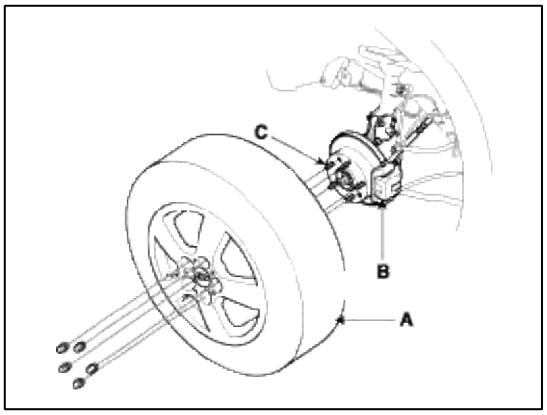
ON-VEHICLE INSPECTION

WHEEL BEARING PLAY INSPECTION

1. Inspection the play of the bearing while the vehicle is jacked up.



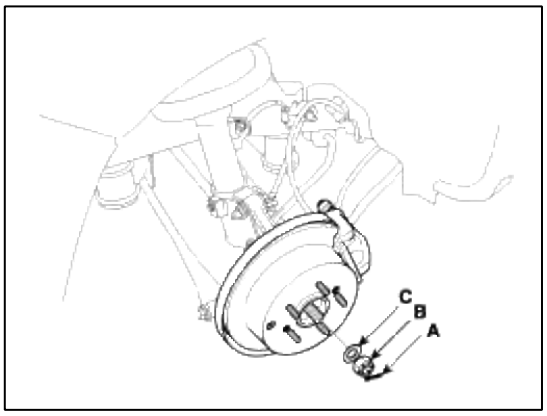
2. If there is any play, loosen the wheel nuts slightly. Raise the rear of the vehicle, and make sure it is securely supported.
3. Remove the rear wheel and tire(A) from rear hub(B).



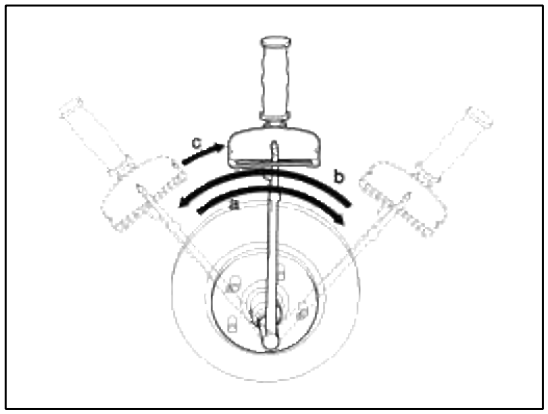
CAUTION

Be careful not to damage the hub bolts(C) then remove the rear wheel and tire(A).

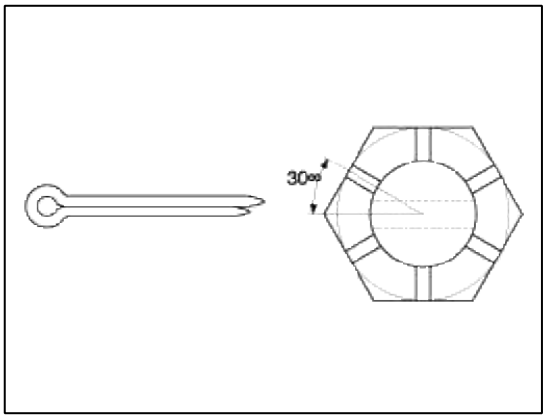
4. Remove the split pin(A), then remove castle nut(B) and washer(C) from the rear hub under applying the break.



5. Tighten the hub bearing nut by the following procedures.
   A. Hub bearing nut must be fastened with torque 280 Nm (28 kgf·m, 202.5 lb-ft) and rear hub must be rotated above 3 times enough for secure placement of hub bearing.
   B. Unfasten hub bearing nut until its tightening torque is 0 Nm (kgf·m, lb-ft)
   C. Hub bearing nut must be fastened again with torque 200 Nm (20 kgf·m, 144.7 lb-ft)



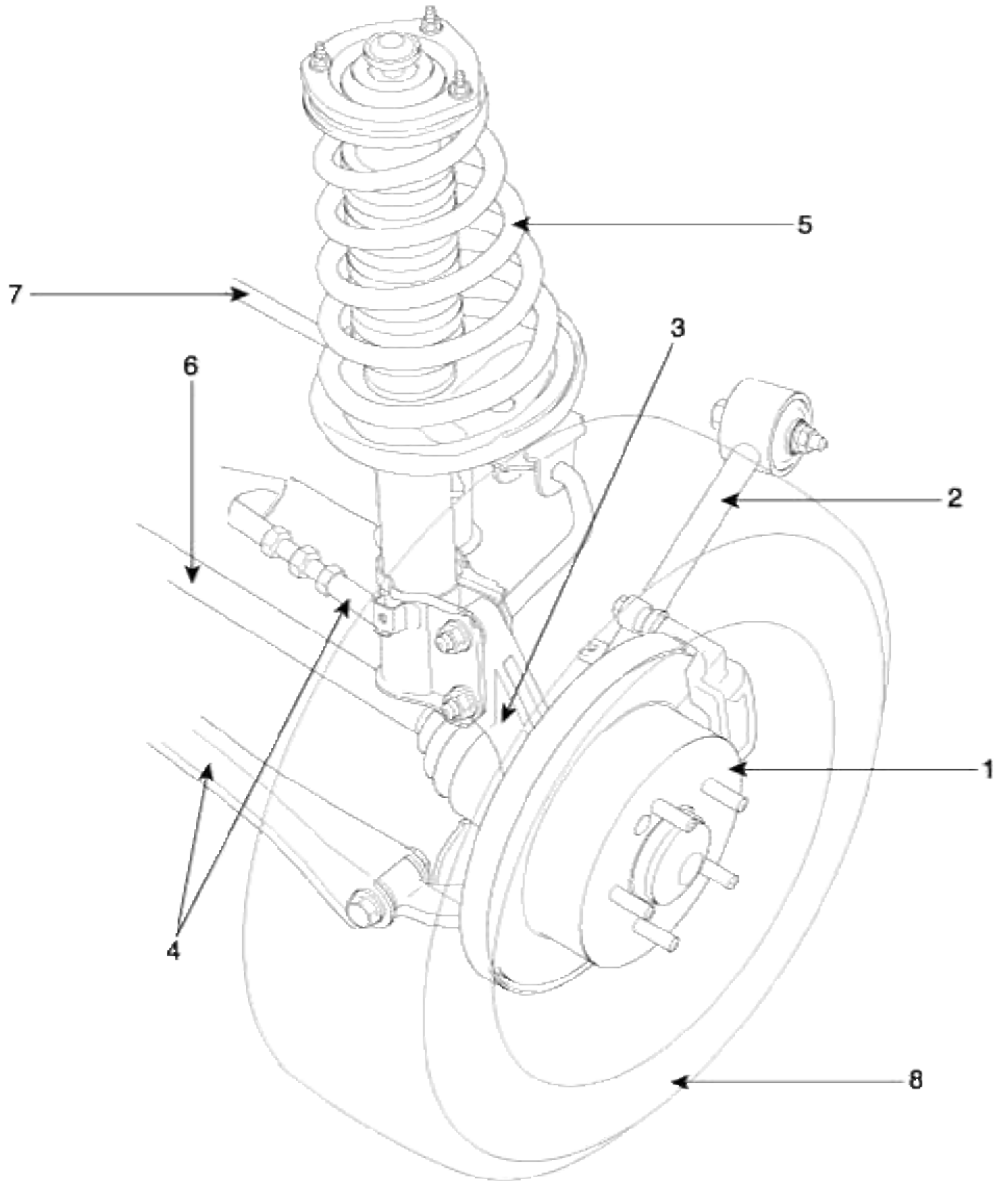
   D. Assemble split pin.
   E. If the direction of split pin is not in line with the hole of knuckle unfasten hub bearing nut within 30° and assemble split pin



Driveshaft and axle > Rear Axle Assembly > Rear Hub / Axle > Components and Components Location

COMPONENT LOCATION

[4WD]



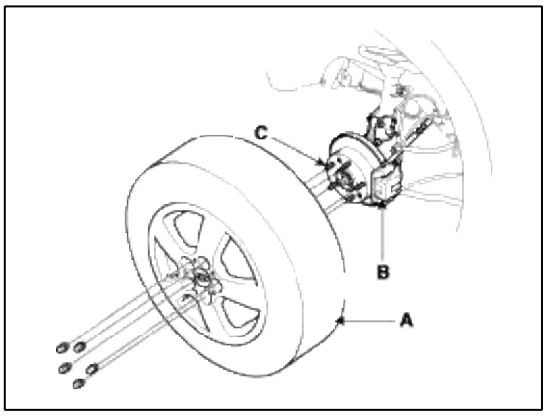
1. Disc brake
2. Trailing arm
3. Axle carrier
4. Suspension arm
5. Strut assembly
6. Drive shaft
7. Stabilizer bar
8. Tire

Driveshaft and axle > Rear Axle Assembly > Rear Hub / Axle > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.

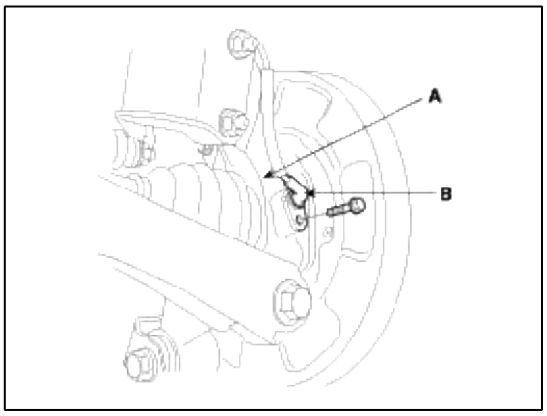
2. Remove the rear wheel and tire(A) from rear hub(B).



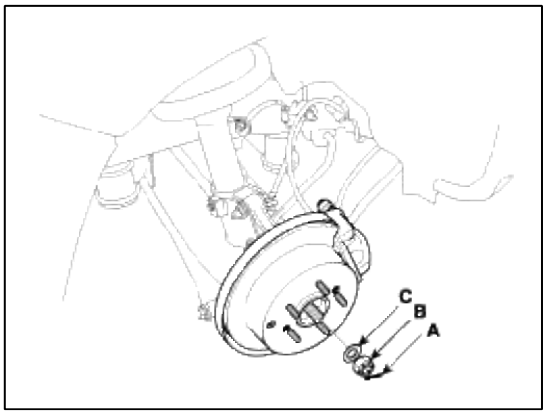
CAUTION

Be careful not to damage the hub bolts(C) then remove the rear wheel and tire(A).

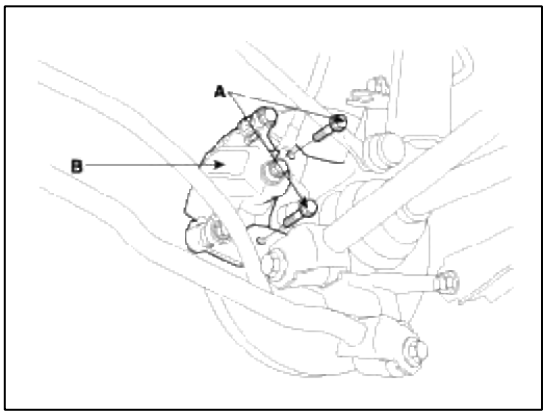
3. Remove the wheel speed sensor(B) from the axle carrier(A).



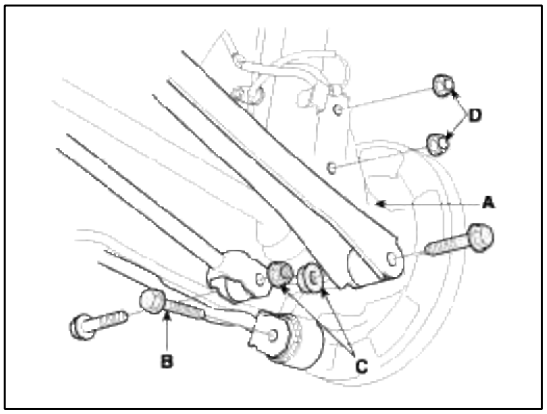
4. Remove the split pin(A), then remove castle nut(B) and washer(C) from the rear hub under applying the break.



5. Remove the caliper mounting bolts(A), and hang the caliper assembly(B) to one side. To prevent damage to the caliper assembly or brake hose, use a short piece of wire to hang the caliper from the undercarriage.



6. Remove the rear axle assembly(A).
   A. Remove the trailing arm mounting bolt(B).
   B. Remove the suspension arm mounting nuts(C).
   C. Remove the strut mounting nuts(D).



INSTALLATION

1. Install the rear axle assembly(A).
   A. Install the strut mounting nuts(D).

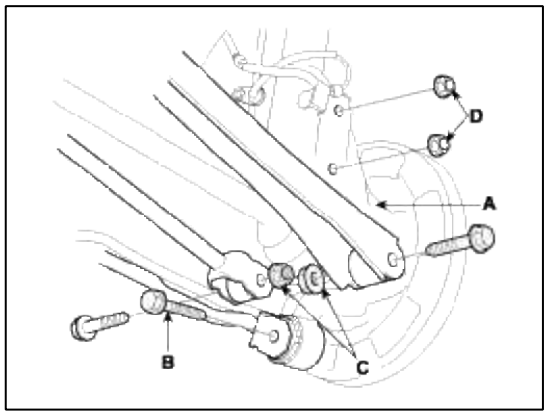
Tightening torque :
140 ~ 160 Nm (14 ~ 16 Kgf·m, 103.3 ~ 118 lb-ft)

   B. Install the suspension arm mounting nuts(C).

Tightening torque :
140 ~ 160 Nm (14 ~ 16 Kgf·m, 103.3 ~ 118 lb-ft)

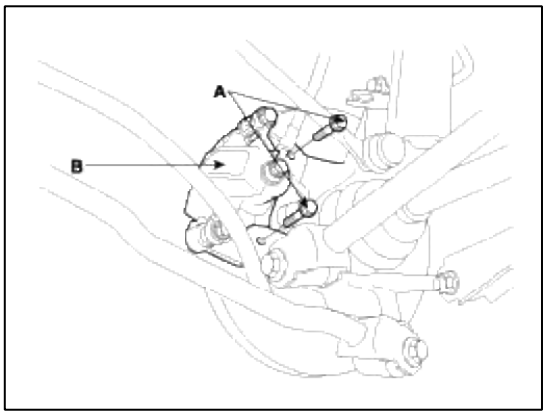
C. Install the trailing arm mounting bolt(B).

Tightening torque :
100 ~ 120 Nm (10 ~ 12 Kgf·m, 73.8 ~ 88.5 lb-ft)



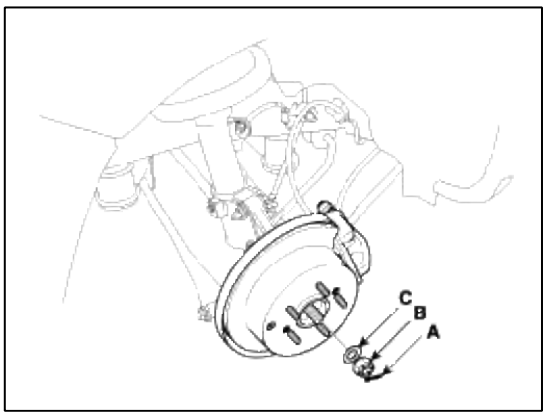
2. Install the brake caliper(B), then tighten the mounting bolt(A).

Tightening torque :
50 ~ 60 Nm (5 ~ 6 Kgf·m, 36.9 ~ 44.3 lb-ft)

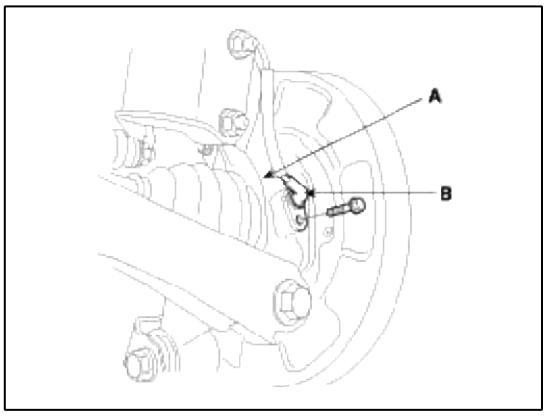


3. Install the washer(C), castle nut(B) and split pin(A) from the rear hub.

Tightening torque :
200 ~ 280 Nm (20 ~ 28 Kgf·m, 147.5 ~ 206.6 lb-ft)

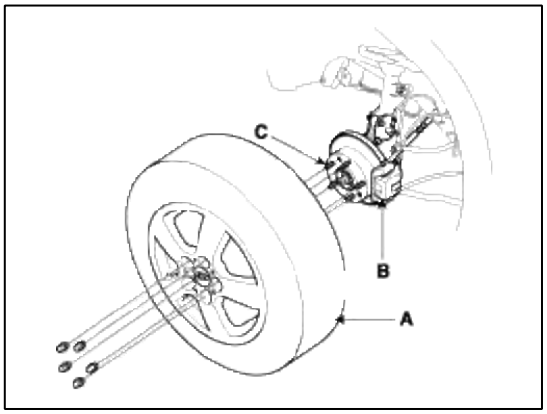


4. Install the wheel speed sensor(B) from the axle carrier(A).



5. Install the rear wheel and tire(A) on the rear hub(B).

Tightening torque :
90 ~ 110 Nm (9 ~ 11 Kgf·m, 66.4 ~ 81.2 lb-ft)



CAUTION

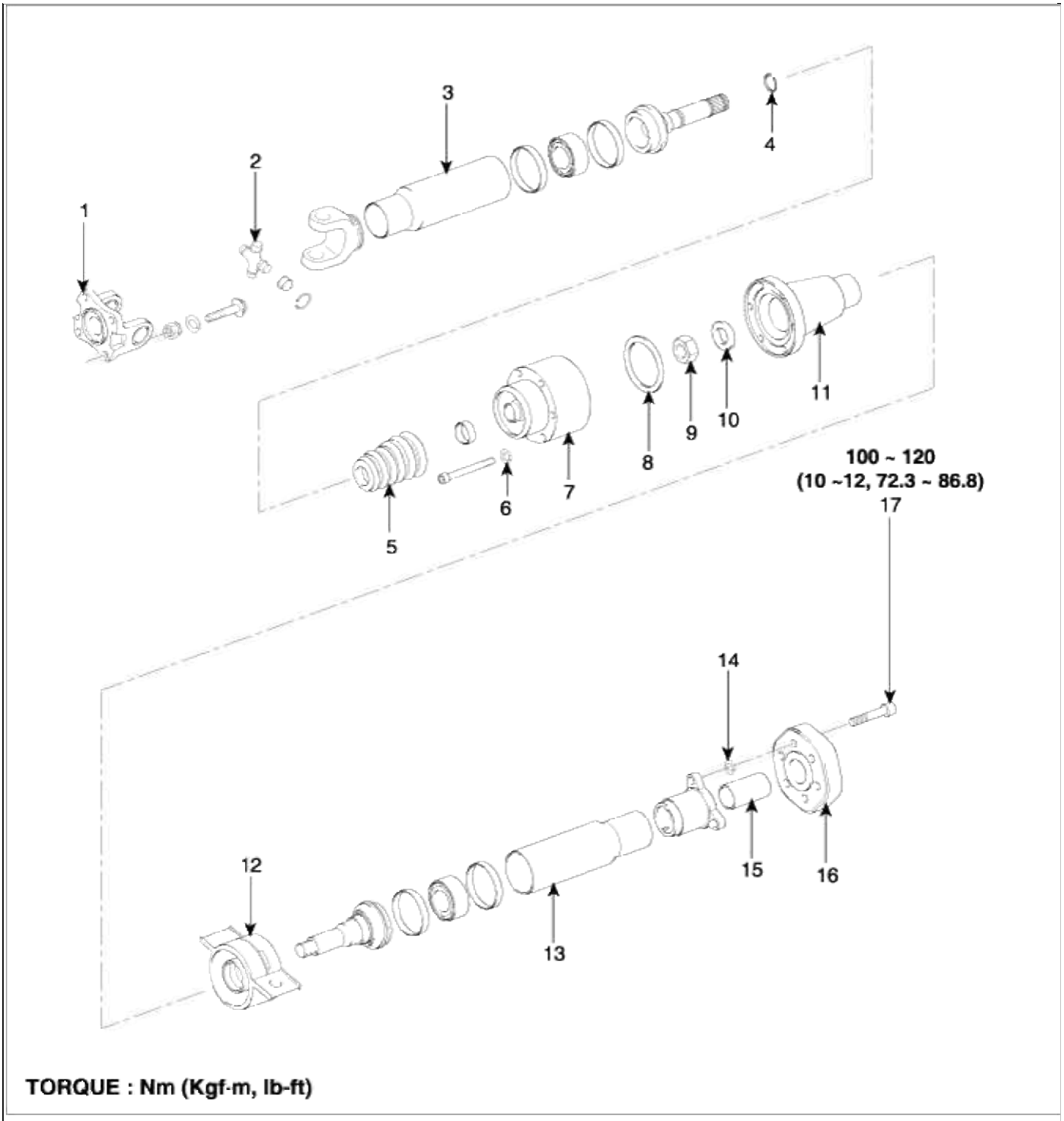
Be careful not to damage the hub bolts(C) then install the rear wheel and tire(A).

INSPECTION

1. Check the hub bearing for wear or damage.
2. Check the carrier for cracks.

Driveshaft and axle > Propeller Shaft Assembly > Propeller Shaft > Components and Components Location

COMPONENTS



TORQUE : Nm (Kgf-m, lb-ft)

1. Flange yoke
2. Universal joint assembly
3. Front tube
4. Snap ring(VL)
5. LJ boot
6. Spring washer
7. VL joint
8. Sealing
9. Nut
10. Spring washer
11. Companion flange
12. Center bearing
13. Rear tube
14. Plain washer
15. Center device
16. Rubber coupling
17. Bolt

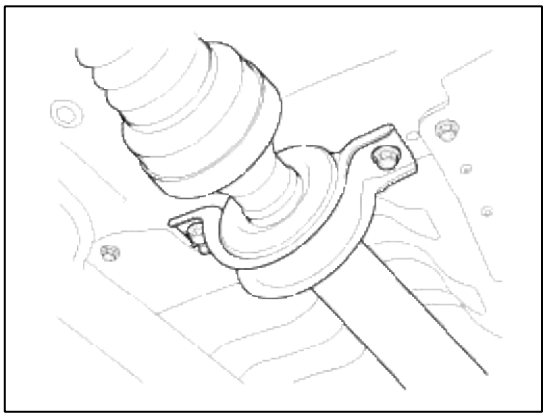
Driveshaft and axle > Propeller Shaft Assembly > Propeller Shaft > Repair procedures

INSPECTION

VL JOINT AND BOOTS

1. Shift the transmission to Neutral.
2. Raise the vehicle off the ground, and support it with safety stands in the proper locations.

3. Check the center support bearing for excessive play or rattle and rubber for rent. If the center support has excessive play or rattle and rubber has rent, replace the propeller shaft assembly.

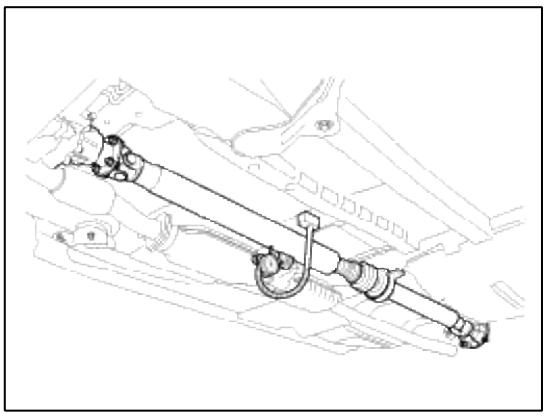


4. Check the VL joint boots for damage and deterioration. If the boots are damaged or deteriored. replace the propeller shaft assembly.
5. Check the VL joints for excessive play or rattle.
   If the universal joints have excessive play or rattle, replace the propeller shaft assembly.

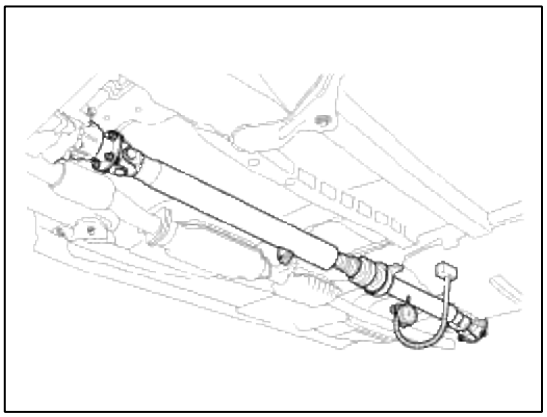
PROPELLER SHAFT RUNOUT

1. Install a dial indicator with its needle on the center of front propeller shaft or rear propeller shaft.
2. Turn the other propeller shaft slowly and check the runout. Repear this procedure for the other propeller shaft.

Front Propeller Shaft Runout : 0.3mm (0.012in)



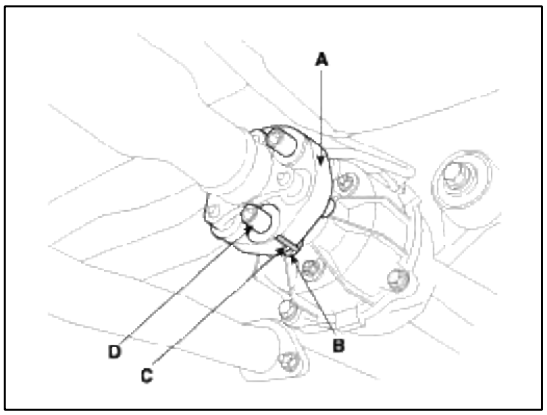
Rear Propeller Shaft Runout : 0.3mm (0.012in)



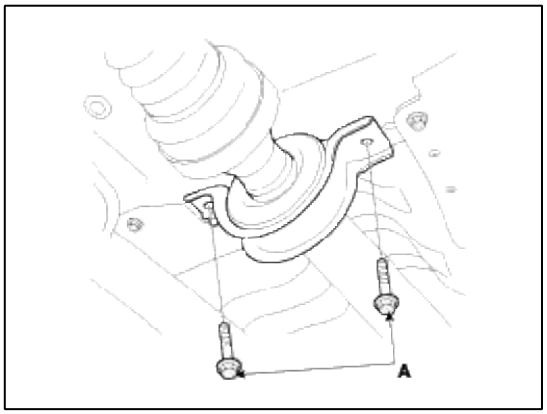
3. If the runout on either propeller shaft exceeds the service limit, replace the propeller shaft assembly.

REMOVAL

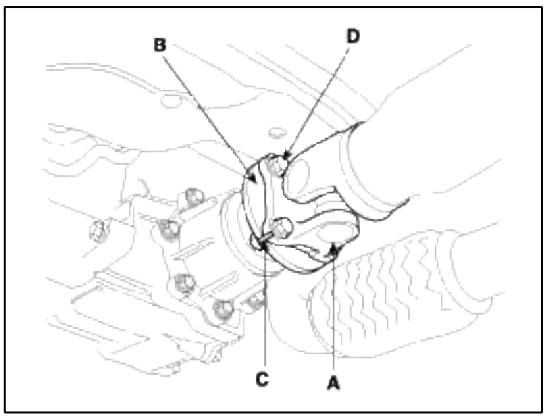
1. After making a match mark(C) on the rubber coupling(A) and rear differential companion(B), remove the propeler shaft mounting bolts(D).



2. Remove the center bearing bracket mounting bolts(A).



3. After making a match mark(C) on the flange yoke(A) and transaxle companion(B), remove the propeller shaft mounting bolts(D).



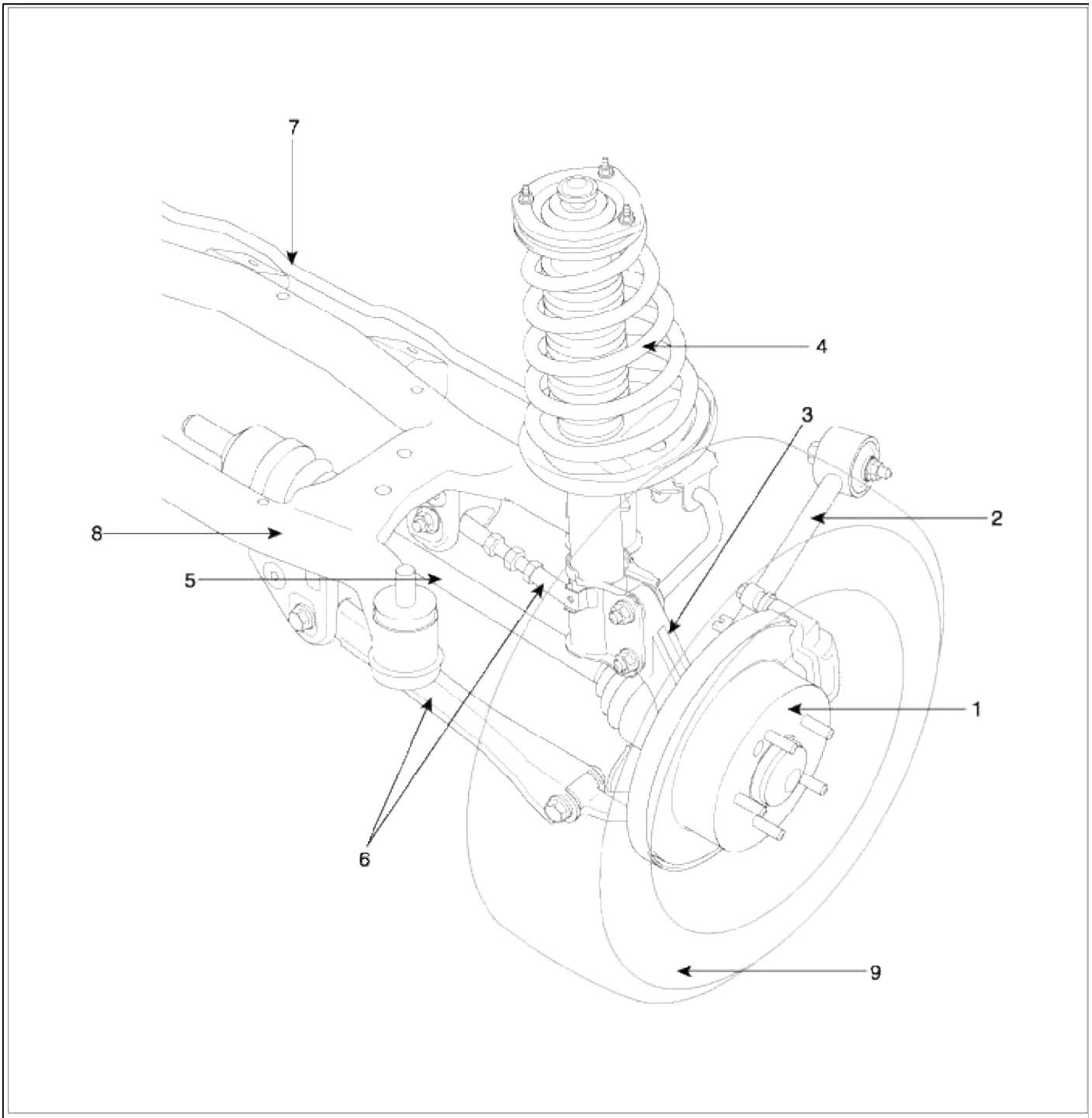
INSTALLATION

1. Installation is the reverse of the removal procedures.
2. Install according to match mark of transaxle companion (or rear differential companion) and propeller shaft.

Items	Nm	Kgf·m	lbf·ft
Front propeller shaft mounting bolt	50 ~ 60	5 ~ 6	36.9 ~ 44.3
Center bearing bracket mounting bolt	50 ~ 65	5 ~ 6.5	36.9 ~ 47
Rear propeller shaft mounting bolt	100 ~ 120	10 ~ 12	73.8 ~ 88.5

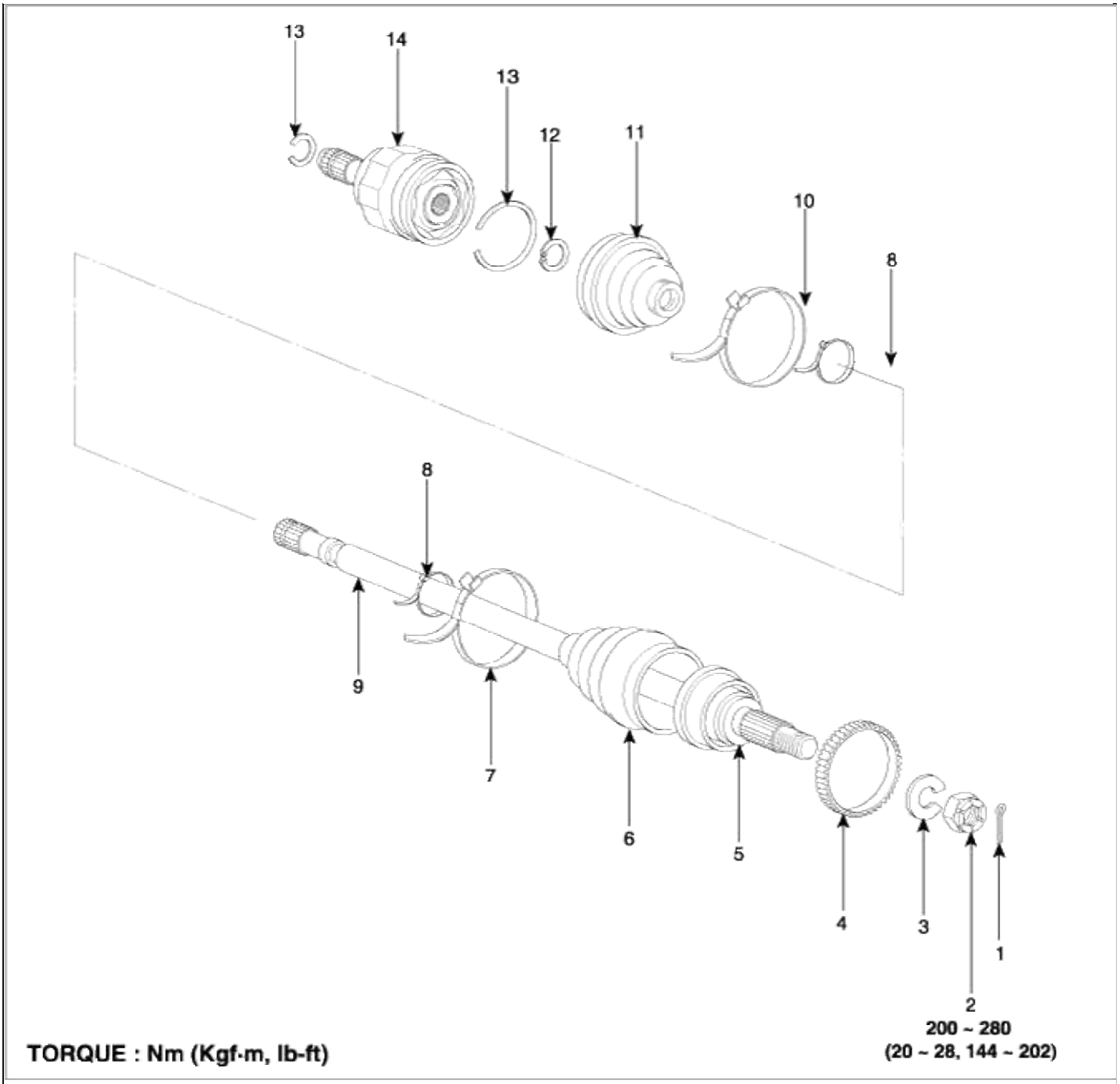
Driveshaft and axle > Rear Driveshaft Assembly > Rear Driveshaft > Components and Components Location

COMPONENT LOCATION



1. Disc brake assembly
2. Trailing arm
3. Axle carrier
4. Strut assembly
5. Driveshaft
6. Suspension arm
7. Stabilizer bar
8. Cross member
9. Tire

COMPONENTS



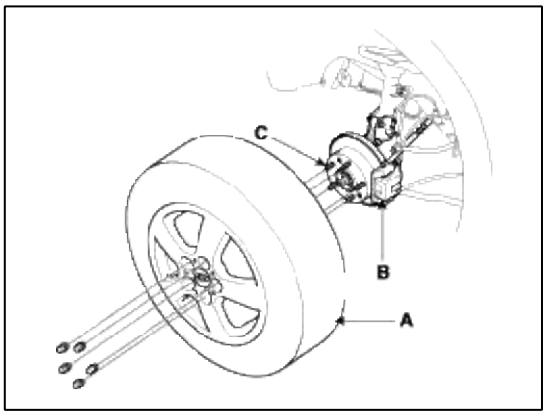
1. Split pin
2. Castle nut
3. Washer
4. Dust cover & Tone wheel
5. BJ assembly
6. BJ boot
7. BJ boot big part band
8. Boot small part band
9. Shaft
10. TS boot big part band
11. TS boot
12. Snap ring
13. Circlip
14. TS assembly

Driveshaft and axle > Rear Driveshaft Assembly > Rear Driveshaft > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.

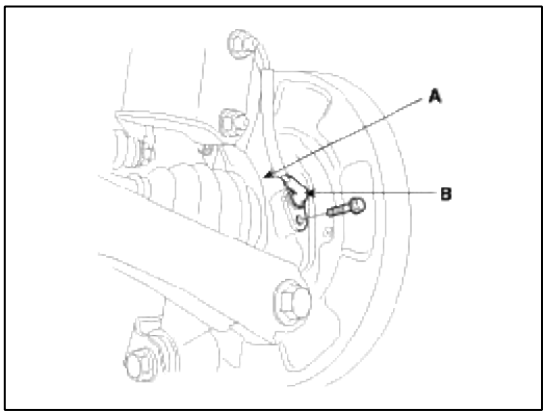
2. Remove the rear wheel and tire(A) from rear hub(B).



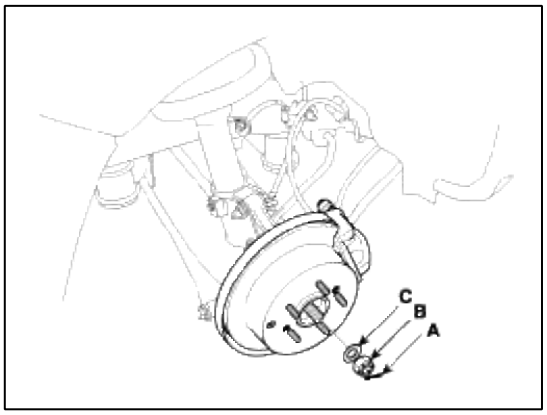
CAUTION

Be careful not to damage the hub bolts(C) then remove the rear wheel and tire(A).

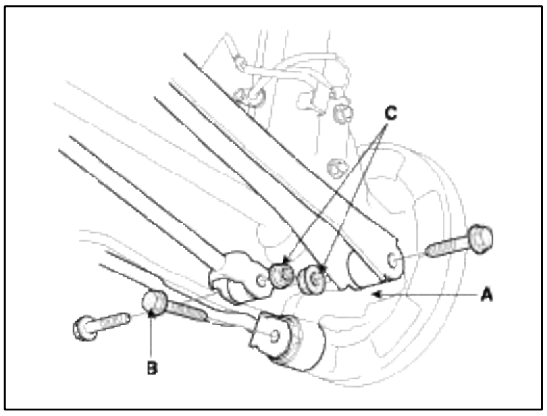
3. Remove the wheel speed sensor(B) from the axle carrier(A).



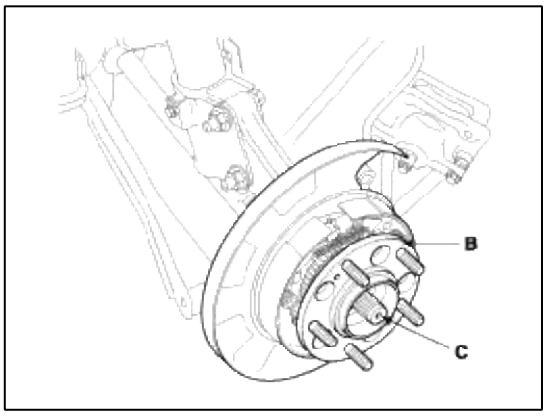
4. Remove the split pin(A), then remove castle nut(B) and washer(C) from the rear hub under applying the break.



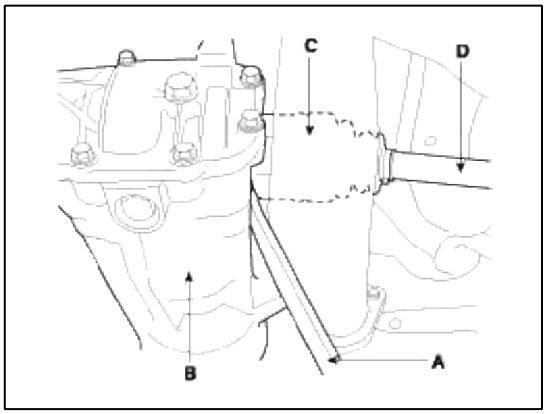
5. Remove the trailing arm mounting bolt(B) from the knuckle(A).



6. Remove the suspension arm mounting nuts(C).
7. Push the axle hub(B) outward and separate the driveshaft(C) from the axle hub(B).



8. Insert a pry bar(A) between the differential case(B) and joint case(C), and separate the driveshaft(D) from the differential case.

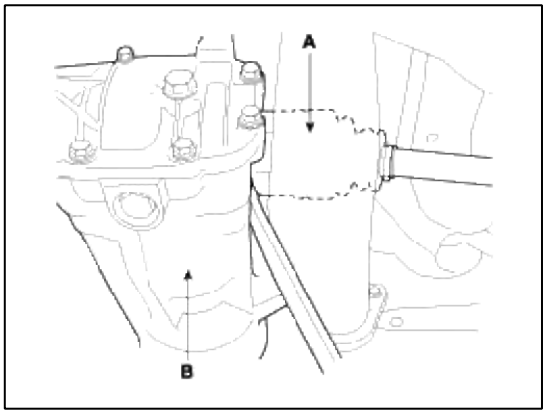


CAUTION

- 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(0.28in).
- Do not pull the driveshaft by excessive force because it may cause components inside the BJ or TJ joint kit to dislodge resulting in a torn boot or a damaged bearing.
- Plug the hole of the transaxle case with the oil seal cap to prevent contamination.
- Support the driveshaft properly.
- Replace the retainer ring whenever the driveshaft is removed from the transaxle case.

INSTALLATION

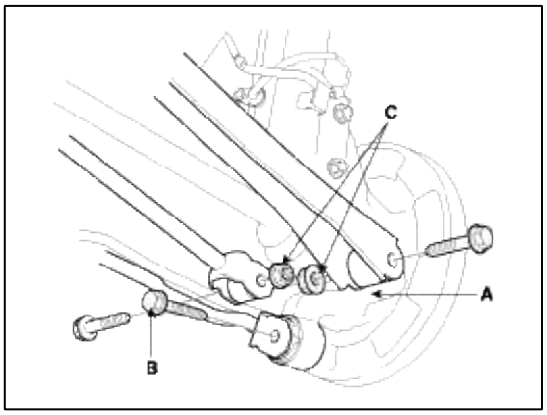
1. Apply gear oil on the driveshaft differential case(B) contacting surface(B) and driveshaft(A) splines.



2. Before installing the driveshaft(A), set the opening side of the circlip facing downward.

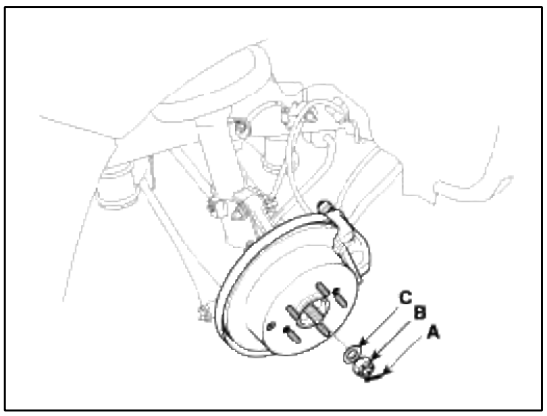
3. After installation, check that the driveshaft(A) cannot be removed by hand.
4. Install the BJ into the knuckle.
5. Install the suspension arm mounting nuts(C) and trailing arm mounting bolt(B) from the knuckle(B).

Tightening torque :
Suspension arm mounting nuts(C)
140 ~ 160 Nm (14 ~ 16 Kgf·m, 103.8 ~ 118 lb-ft)
Trailing arm mounting bolt(B)
100 ~ 120 Nm (10 ~ 12 Kgf·m, 73.8 ~ 88.5 lb-ft)

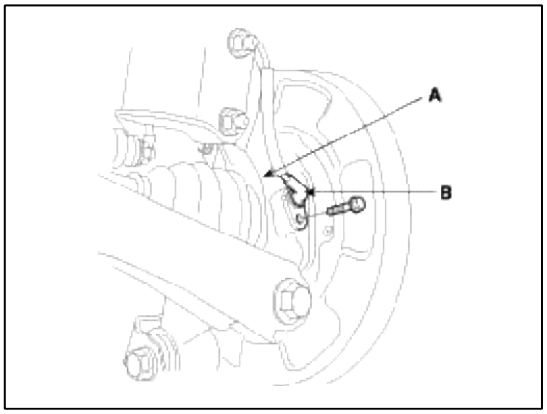


6. Install the washer(C), castle nut(B) and split pin(A) from the rear hub.

Tightening torque :
200 ~ 280 Nm (20 ~ 28 Kgf·m, 147.5 ~ 206.6 lb-ft)

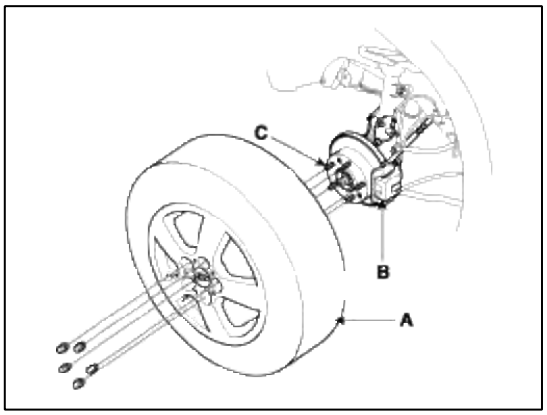


7. Install the wheel speed sensor(B) from the knuckle(A).



8. Install the rear wheel and tire(A) on the rear hub(B).

Tightening torque :
90 ~ 110 Nm (9 ~ 11 Kgf·m, 66.4 ~ 81.2 lb-ft)

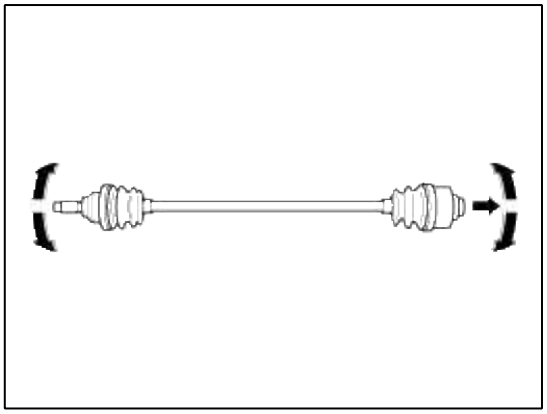


CAUTION

Be careful not to damage the hub bolts(C) then install the rear wheel and tire(A).

INSPECTION

1. Check the driveshaft boots for damage and deterioration.
2. Check the ball joint for wear and damage.
3. Check the splines for wear and damage.
4. Check the dynamic damper for cracks, wear and position.



5. Check the driveshaft for cracks and wears.

DISASSEMBLY

DRIVESHAFT (RH)

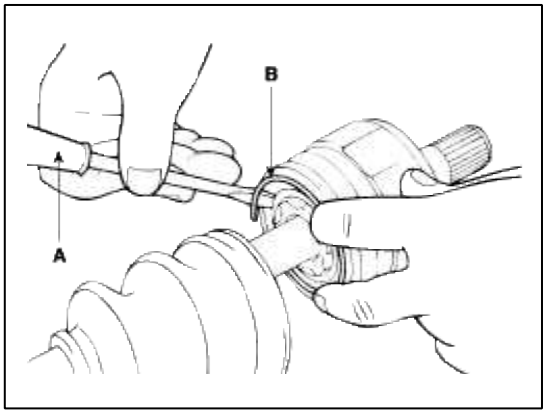
CAUTION

- Do not disassemble the BJ assembly.
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot band should be replaced with a new one.

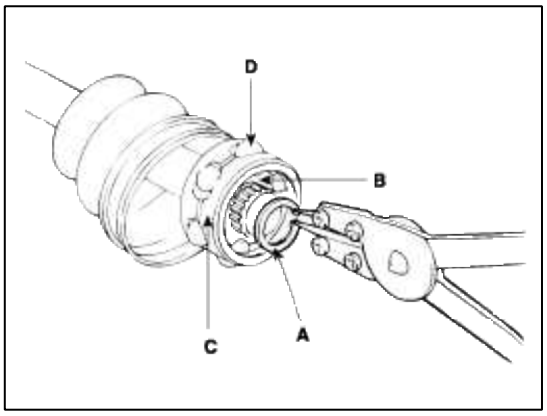
1. Remove the TJ boot bands and pull the TJ boot from the TJ outer race.
   A. Using a plier or flat-tipped (-) screwdriver, remove the LH boot band and LH TJ boot band from the driveshaft
   B. Remove RH boot band and RH TJ boot band in the same way of LH removal procedure.

> CAUTION
>
> Be careful not to damage the boot.

2. Remove the circlip(B) with a flat-tipped (-)screwdriver(A).

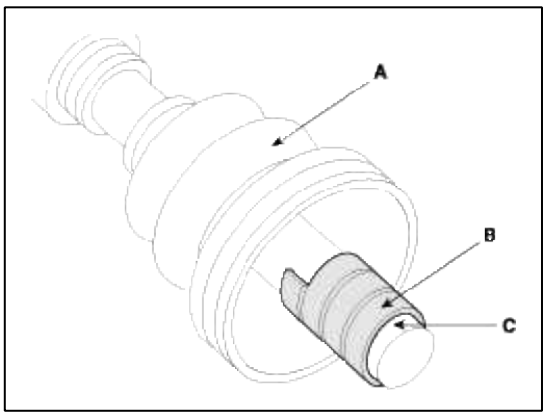


3. Pull out the driveshaft from the TJ outer race.
4. Remove the snap ring(A) and take out the inner race(B), cage(C) and balls(D) as an assembly.



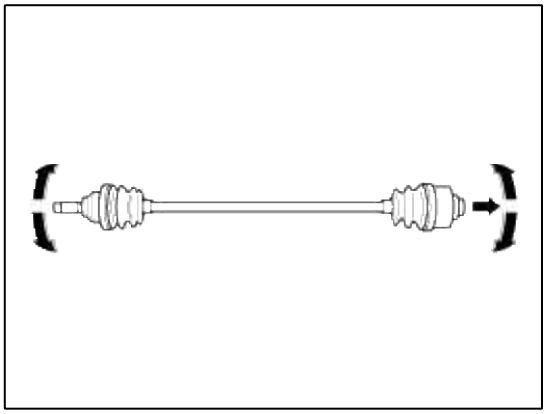
5. Clean the inner race, cage and balls without disassembling.
6. Remove the BJ. boot bands and pull out the TJ boot and BJ boot.

> CAUTION
>
> If the boot(A) is to be reused, wrap tape(B) around the driveshaft splines(C) to protect the boot(A).



INSPECTION

1. Check the driveshaft boots for damage and deterioration.
2. Check the ball joint for wear and damage.
3. Check the splines for wear and damage.
4. Check the dynamic damper for cracks, wear and position.



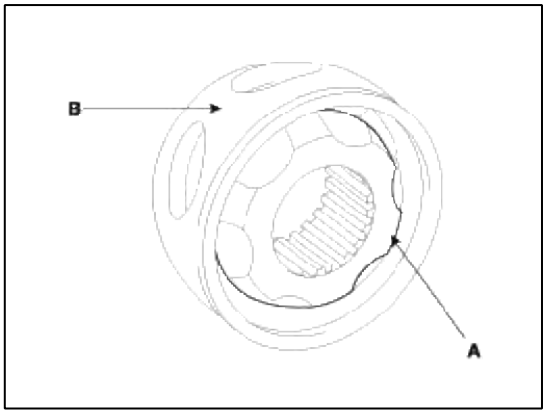
5. Check the driveshaft for cracks and wears.

REASSEMBLY

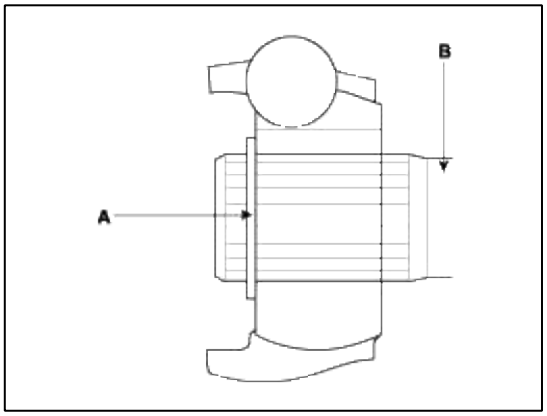
1. Wrap tape around the driveshaft splines (TJ side) to prevent damage to the boots.
2. Apply grease to the driveshaft and install the boots.
3. Apply the specified grease to the inner race(A) and cage(B). Install the cage(B) so that it is offset on the race as shown.

CAUTION

Use the grease included in the repair kit.



4. Apply the specified grease to the cage and fit the balls into the cage.
5. Position the chamfered side(A) as shown in the illustration. Install the inner race on the driveshaft(B), and then the snap ring.

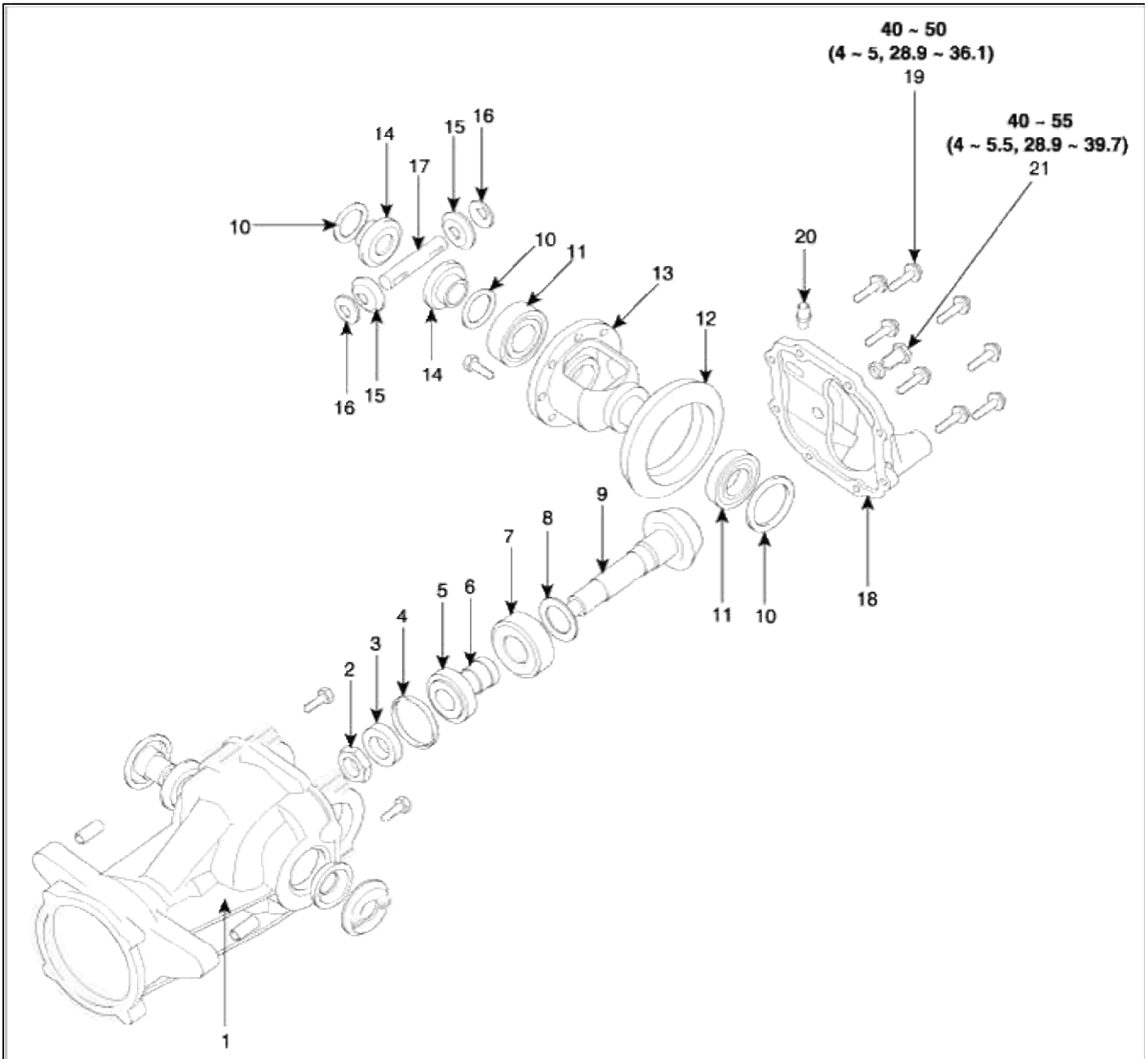


6. Apply the specified grease to the outer race and install the BJ outer race onto the driveshaft. (See page DS - 4)
7. Apply the specified grease into the TJ boot and install the boot with a clip. (See page DS - 4)

8. Tighten the TJ boot bands.
9. Add the specified grease to the BJ as much as wiped away at inspection.
10. Install the boots.
11. Tighten the BJ boot bands.
12. To control the air in the TJ boot, keep the specified distance between the boot bands when they are tightened.

Driveshaft and axle > Differential Carrier Assembly > Rear Differential Carrier > Components and Components Location

COMPONENTS



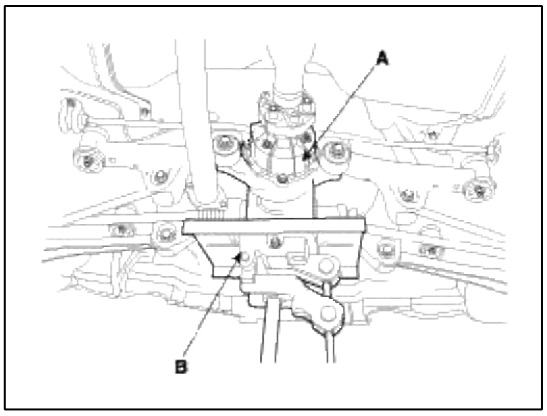
TORQUE : Nm (Kgf-m, lb-ft)

1. Differential carrier
2. Pinion locking nut
3. Oil seal guide
4. Pinion oil seal
5. Outer pinion bearing
6. Pinion bearing spacer
7. Inner pinion bearing
8. Inner bearing adjust shim
9. Driver gear
10. Oil seal
11. Differential side bearing
12. Ring gear
13. Differential
14. Cam side gear
15. Pinion gear
16. Thrust washer
17. Differential pinion shaft
18. Differential cover
19. Differential cover mountin bolts
20. Breather
21. Filler plug

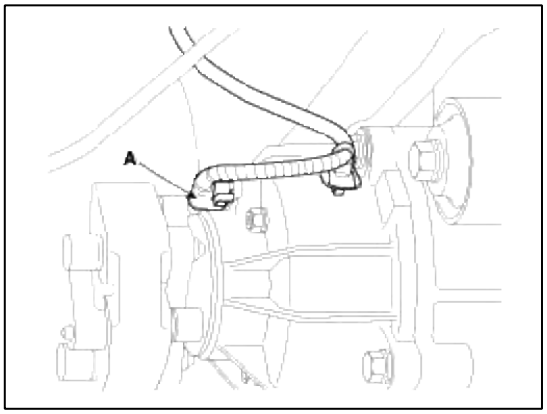
Driveshaft and axle > Differential Carrier Assembly > Rear Differential Carrier > Repair procedures

REMOVAL

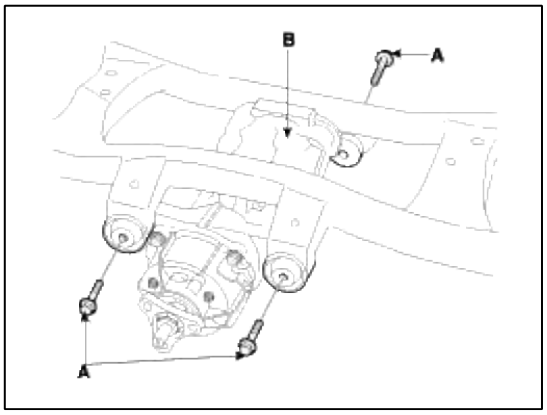
1. Drain the differential gear oil.
2. Remove the rear drive shaft. (See page DS - 43)
3. Remove the propeller shaft. (See page DS - 39)
4. Support the differential assembly(B) with the jack(A).



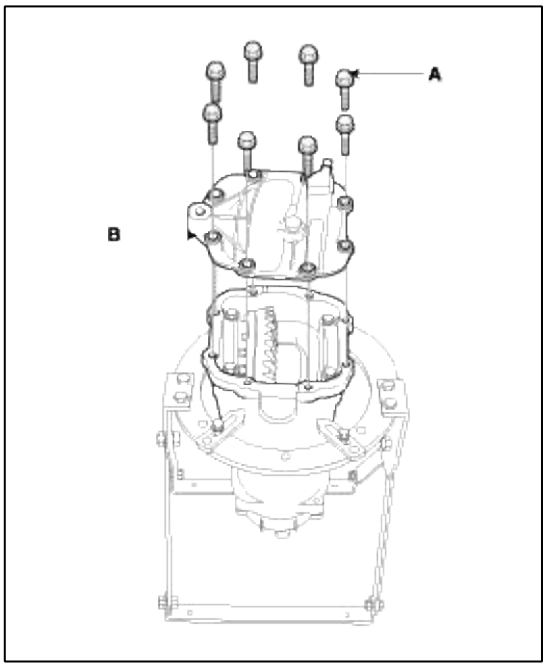
5. Disconnect the coupling control connector(A).



6. After loosen the differential mounting bolts(A), and remove the differential(B).



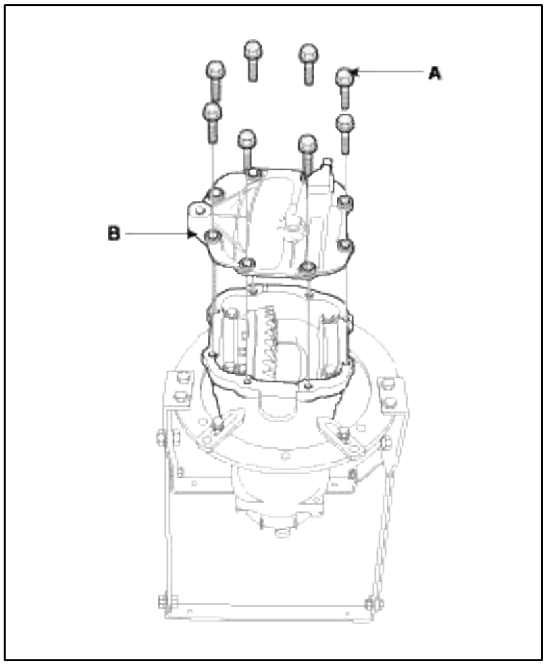
7. After loosen the cover bolts(A), and remove the differential cover(B).



INSTALLATION

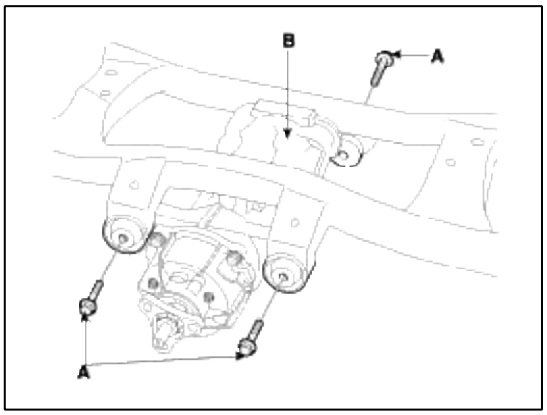
1. After apply liquid gasket, install the differential cover(B), and install the mounting bolts(A).

Tightening torque :
40 ~ 50 Nm (4 ~ 5 Kgf·m, 29.5 ~ 36.9 lb-ft)

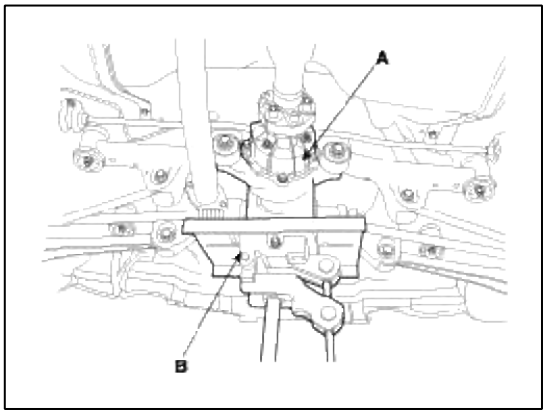


2. After install the differential(B), and install the mounting bolts(A).

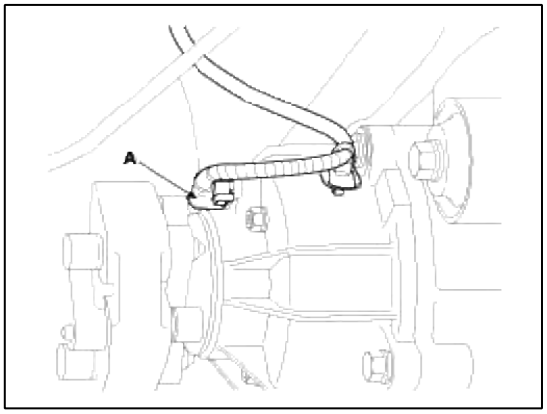
Tightening torque :
90 ~ 120 Nm (9 ~ 12 Kgf·m, 66.4 ~ 88.5 lb-ft)



3. Using the transaxle jack(B), install the differential assembly(A).



4. Connect the coupling control connector(A).



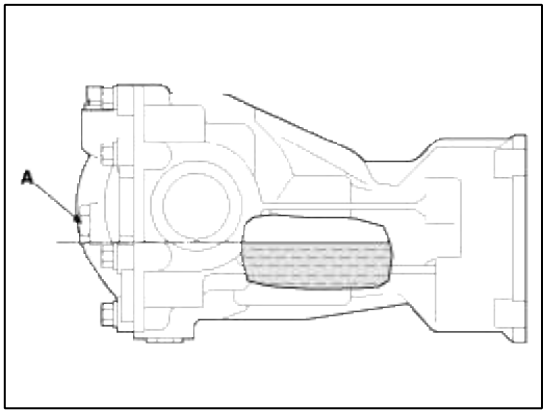
5. Install the propeller shaft. (See page DS - 39)
6. Install the rear drive shaft. (See page DS - 47)

7. Fill the gear oil.

Specified lubricant :
Hypoid gear oil (GL-5, 80W / SAE 90),
Oil quantity : Fill the reservoir to the plug hole
(approx. 0.75 ~ 0.80L)

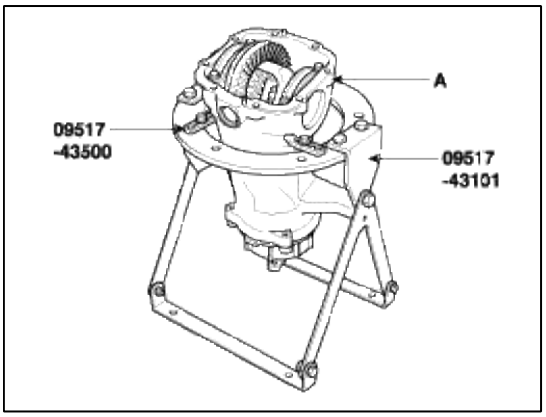
CAUTION

Be sure to fill the gear oil below the lower end of the filler plug(A).



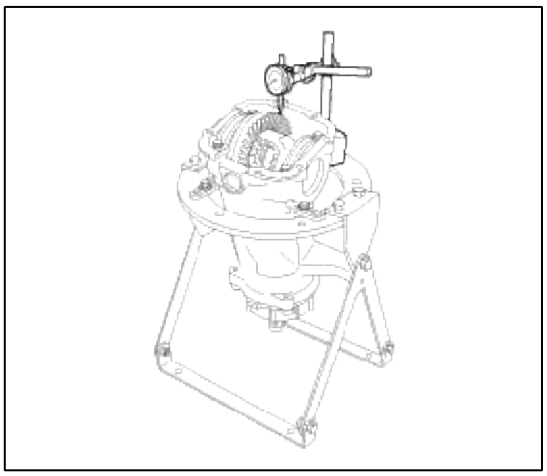
INSPECTION

Install the differential carrier assembly(A) with the special tools(09517-43401 & 09517-43500).
Then carry out the following inspection.



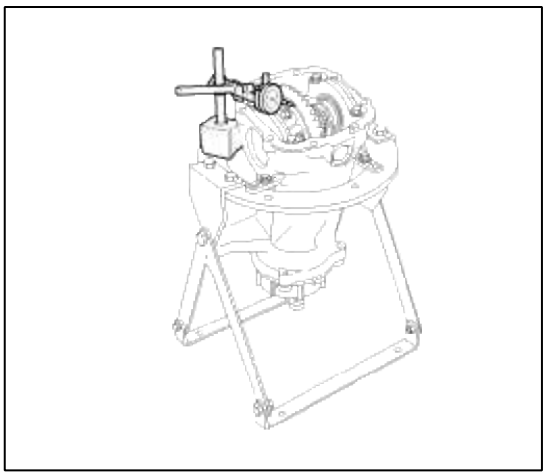
1. Check the final drive gear backlash by the following procedure.
   A. Place the drive pinion and move the drive gear to check backlash is within the standard range.

> NOTE
>
> Measure at 4 points on the gear periphery.
>
> Standard value : 0.10 ~ 0.15mm (0.0039 ~ 0.0059in)



2. Check the drive gear back-face lash by the following procedure.
   A. Place a dial gauge on the back-face of the drive gear and measure the runout.

> Limit mm(in) : 0.05 (0.002)



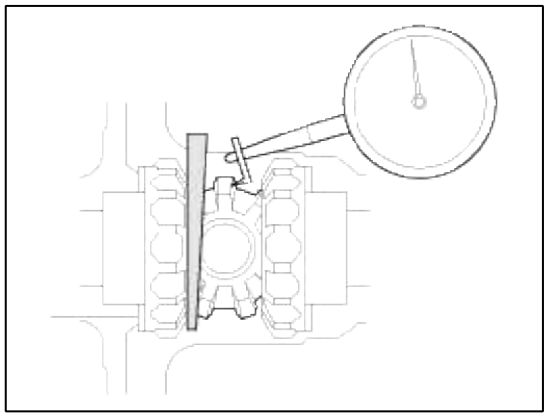
   B. If the runout is beyond the limit, check that there are no foreign substances between the drive gear and differential case and, that the bolts fixing the drive gear are not loose.

3. Check the differential carrier backlash by the following procedure.
   A. Fix the side gear with a wedge so it cannot move and measure the differential gear backlash with a dial indicator on the pinion gear.

   Standard value : 0 ~ 0.076mm (0 ~ 0.003in)

   NOTE

   Take the measurements at two places on the pinion gear.

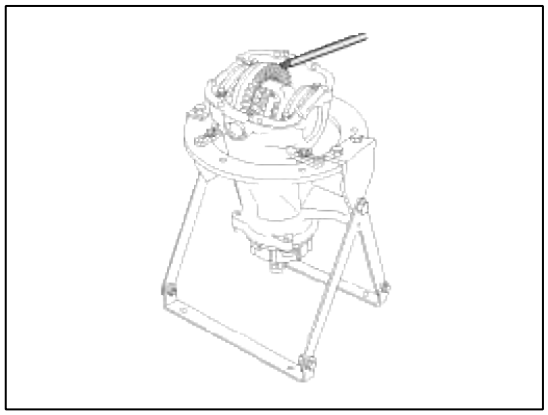


   B. If the backlash exceeds the limit, adjust using side bearing spacers.

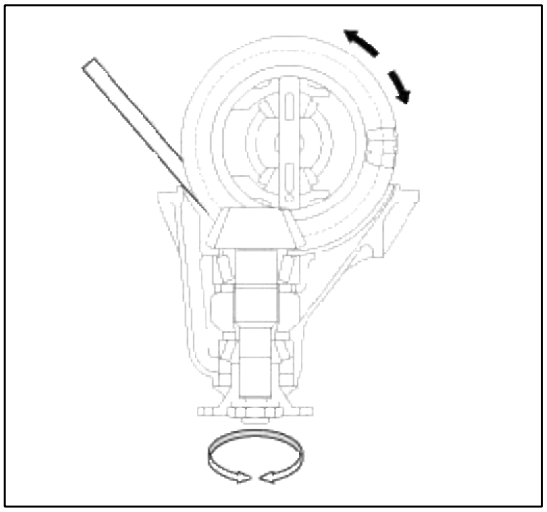
   NOTE

   If adjustment is impossible, replace the side gear and pinion gear as a set.

4. Check the tooth contact of the final drive gear by the following procedure.
   A. Apply the same amount of machine blue slightly to both surfaces of the drive gear teeth.



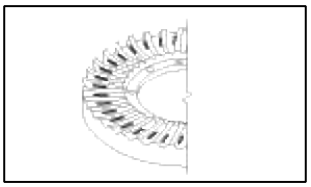
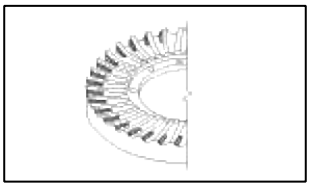
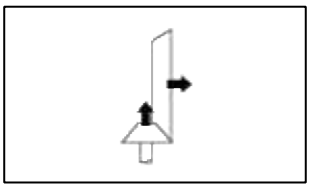
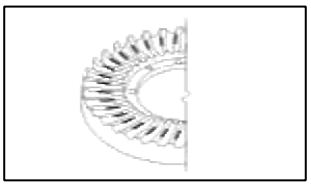
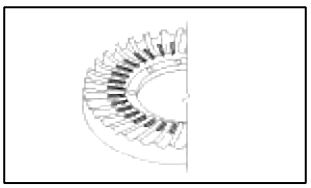
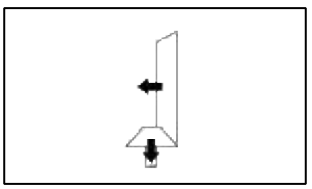
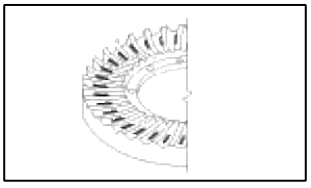
B. Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that some torque (approximately 18.4 ~ 22.1 lbf) is applied to the drive pinion.



CAUTION

If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

C. Check the tooth contact pattern.

Tooth contact	Contact state	Solution	
Standard contact			
Heal contact		Increase the thickness of the pinion height adjusting shim, and position the drive pinion closer to the center of the drive gear. Also, for backlash adjustment, reposition the drive gear further from the drive pinion.	
Face contact			
Toe contact		Decrease the thickness of the pinion height adjusting shim, and position the drive pinion further from the center of the drive gear. Also, for backlash adjustment, reposition the drive gear closer to the drive pinion.	
Flank contact			

NOTE

- Tooth contact pattern is a method for judging the result of the adjustment of drive pinion height and final drive gear backlash. The adjustment of drive pinion height and final drive gear backlash should be repeated until the tooth contact patterns are similar to the standard tooth contact pattern.
- When you cannot obtain a correct pattern, the drive gear and drive pinion have exceeded their limits. Both gears should be replaced as a set.

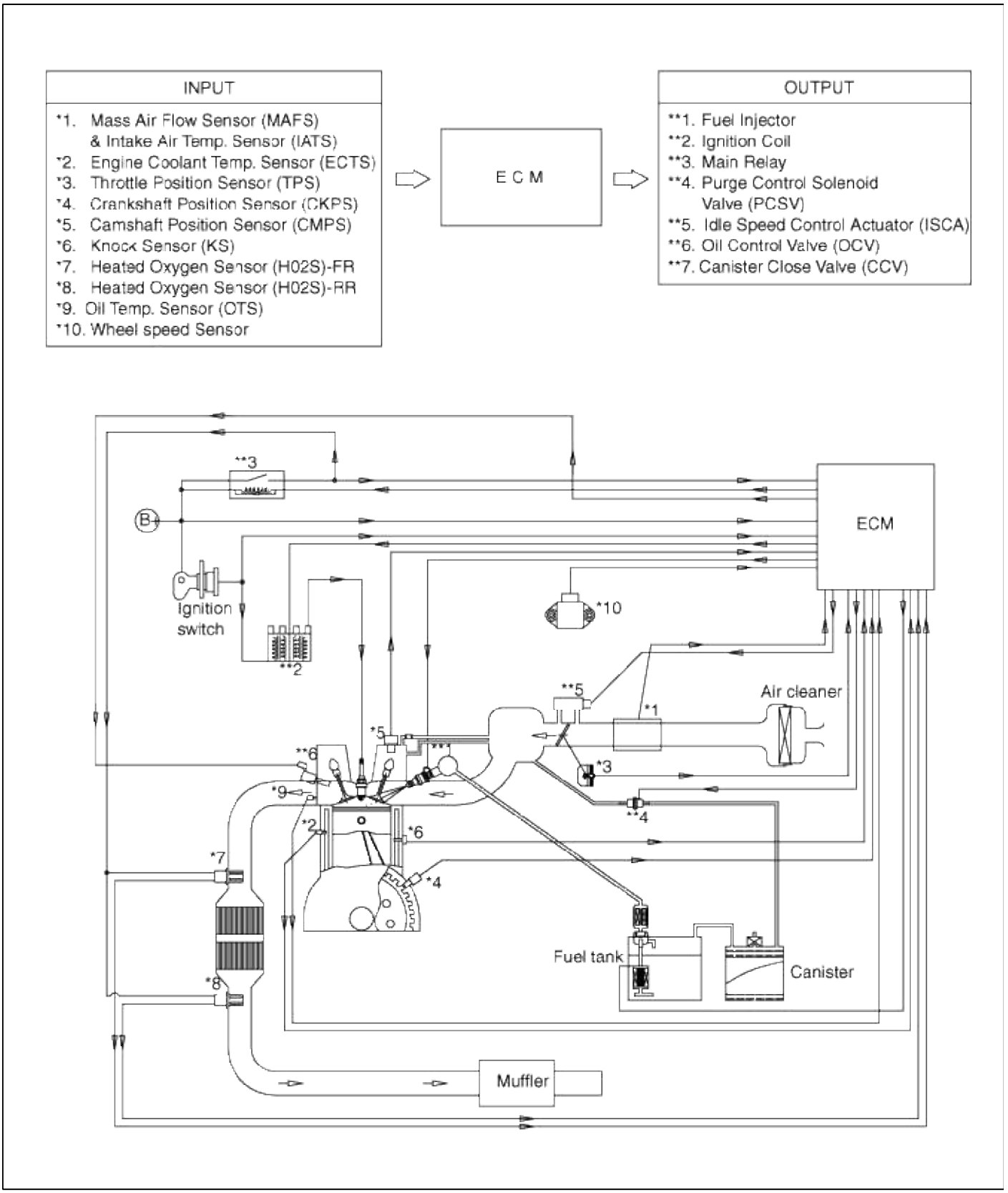
5. Check the oil leaks and the lip part for chew or wear.
6. Check the bearings for wear or discoloration..
7. Check the gear carrier for cracks.
8. Check the drive pinion and drive gear for wear or cracks.
9. Check the side gears, pinion gears and pinion shaft for wear or damage.
10. Check the side gear spline for wear or damage.

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Emission Control System

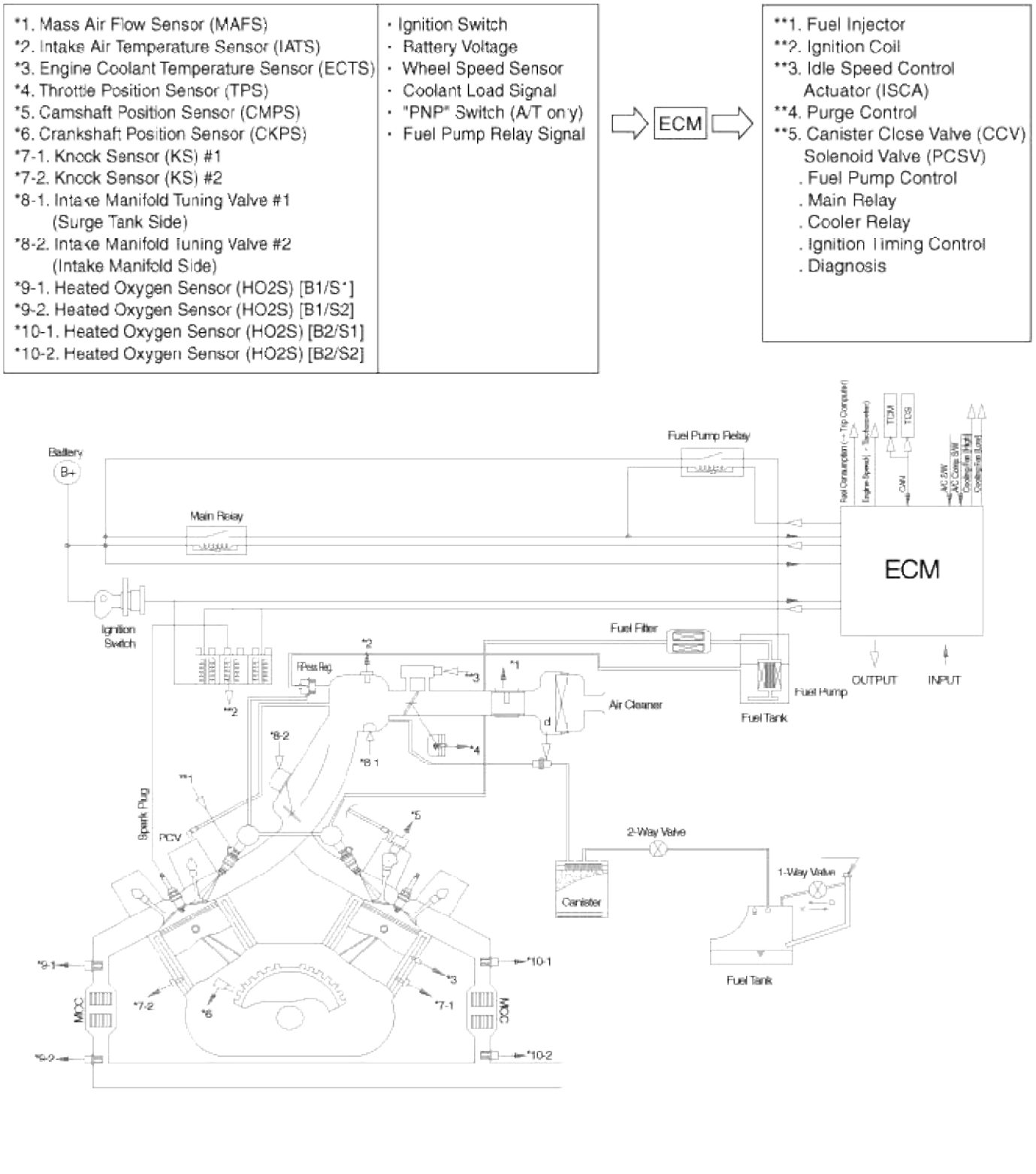
Emission Control System > General Information > Schematic Diagrams

SCHEMATIC DIAGRAM

[2.0 DOHC]



[2.7 V6]



Emission Control System > General Information > Description and Operation

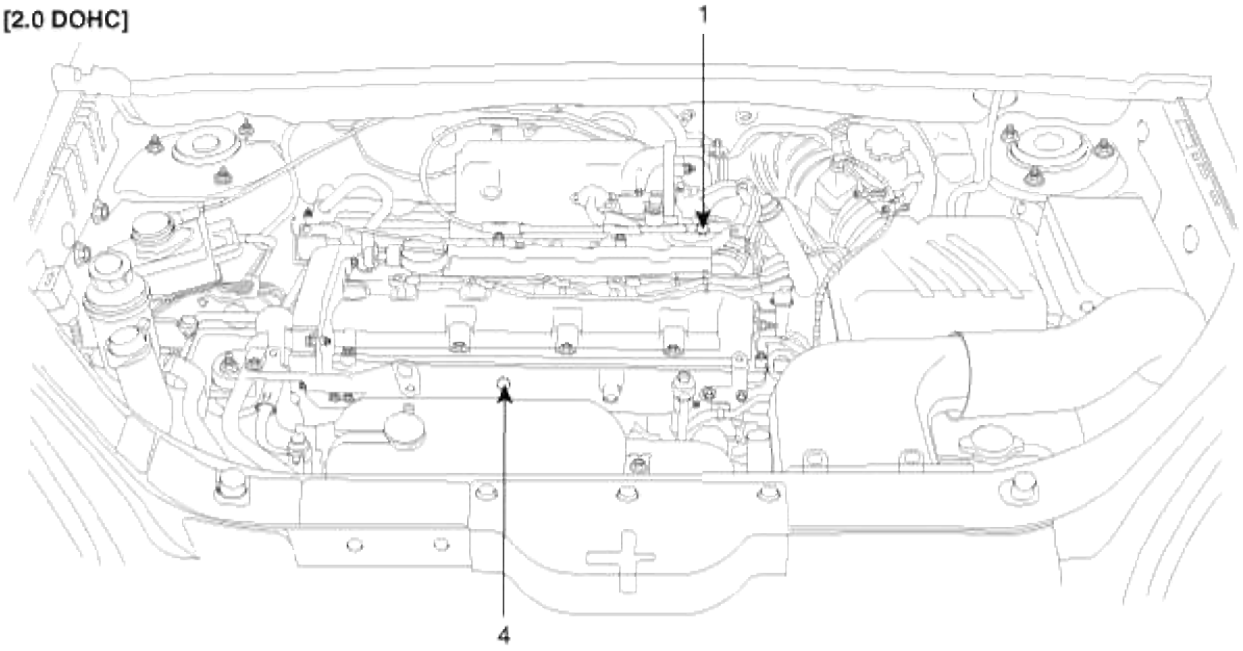
COMPONENTS

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

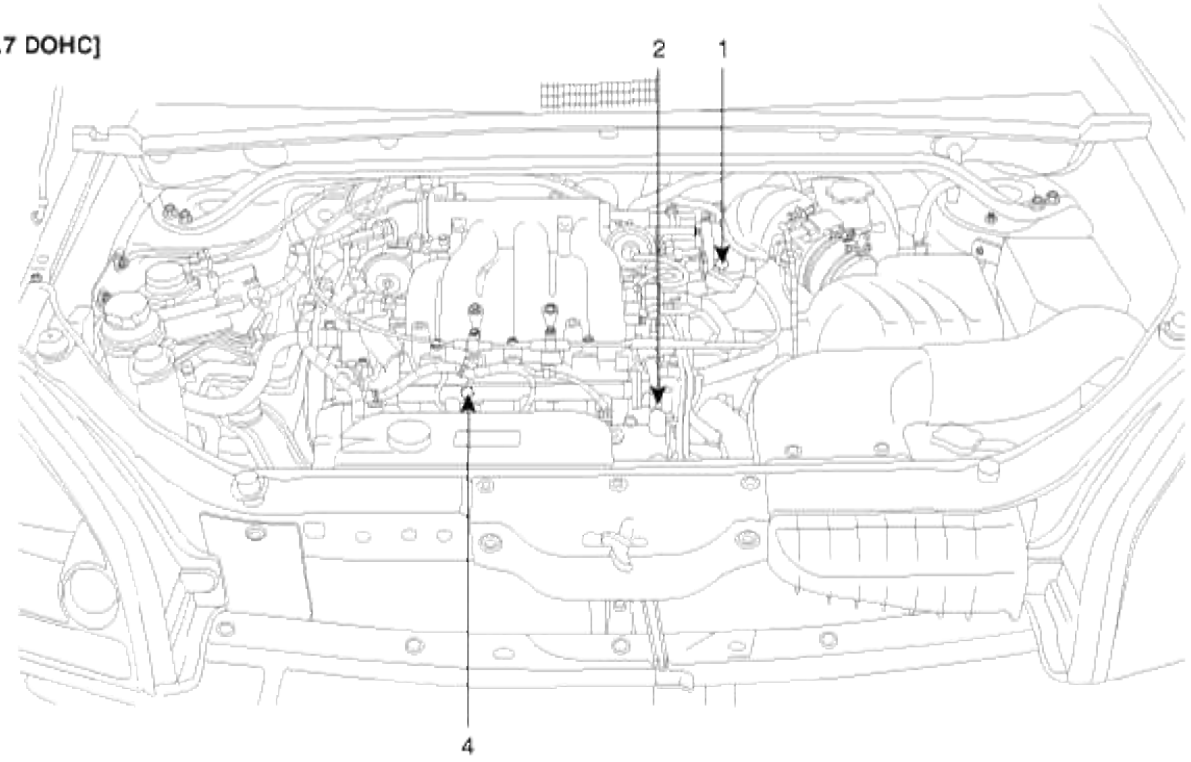
Emission Control System > General Information > Components and Components Location

COMPONENTS LOCATION

[2.0 DOHC]

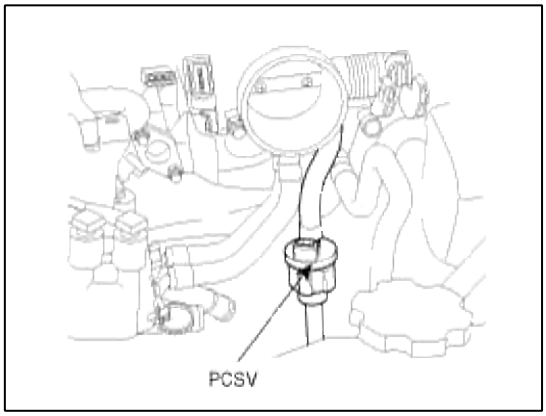
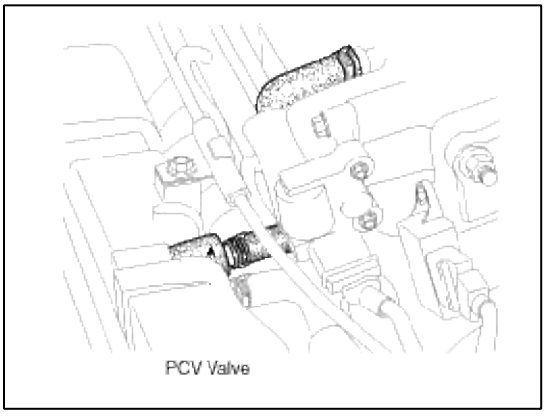
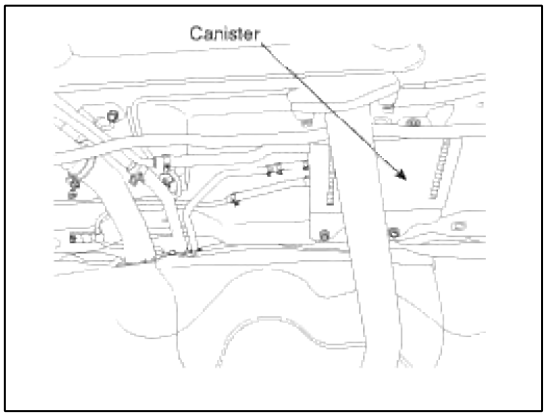
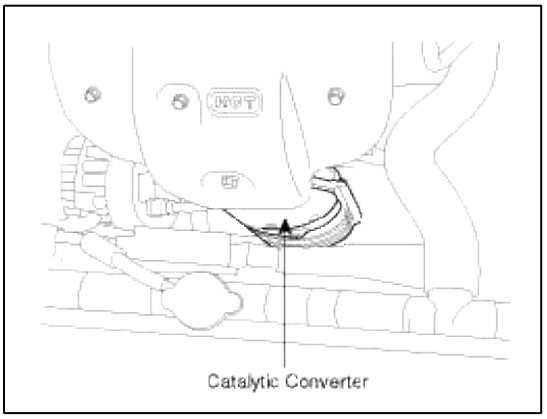
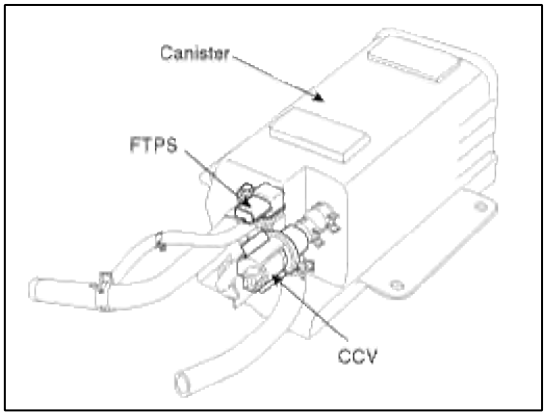


[2.7 DOHC]

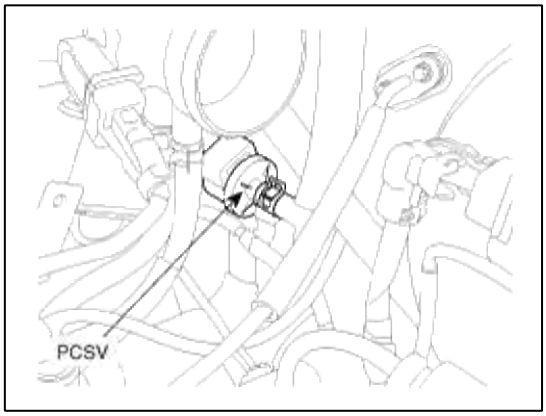
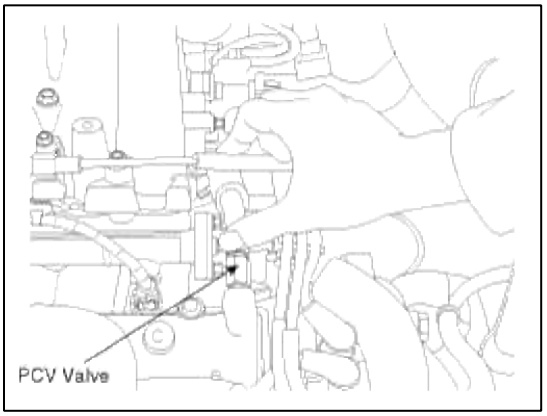
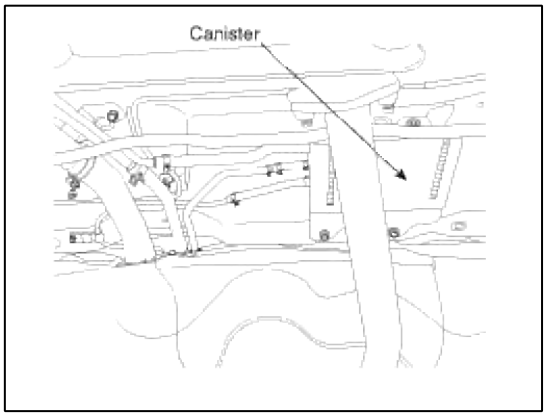
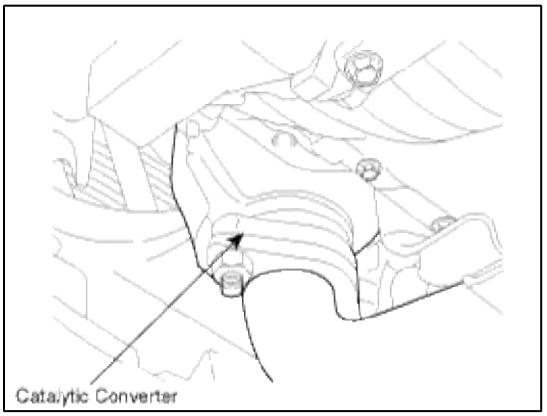
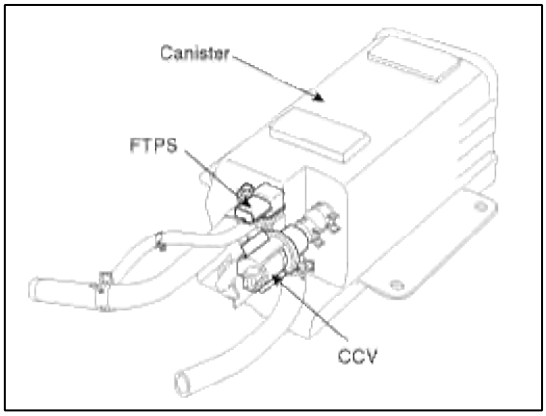


1. Purge Control Solenoid Valve (PCSV)
2. PCV Valve
3. Canister
4. Catalytic Converter
5. Fuel Tank Pressure Sensor (FTPS)
6. Canister Close Valve (CCV)

[2.0 DOHC]

1.Purge Control Solenoid Valve (PCSV)	2. PCV Valve
	
3. Canister	4. Catalytic Converter
	
5. Fuel Tank Pressure Sensor (FTPS) 6. Canister Close Valve (CCV)	
	

[2.7 V6]

1. Purge Control Solenoid Valve (PCSV)	2. PCV Valve
	
3. Canister	4. Catalytic Converter
	
5. Fuel Tank Pressure Sensor (FTPS) 6. Canister Close Valve (CCV)	
	

Emission Control System > General Information > Troubleshooting

TROUBLESHOOTING

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

Emission Control System > General Information > Specifications

SPECIFICATIONS

Item	Specification	
Purge Control Solenoid Valve (PCSV)	Type	Duty Control type
	Resistance (Ω)	24.5 ~ 27.5 at 20 °C (68 °F)
Fuel Tank Pressure Sensor (FTPS)	Type	Piezo-Resistivity type
	Output Voltage	Approx. 2.5V at idle
Canister Close Valve (CCV)	Type	ON/OFF Control type
	Resistance	23.0 ~ 26.0 Ω at 20°C (68°F)

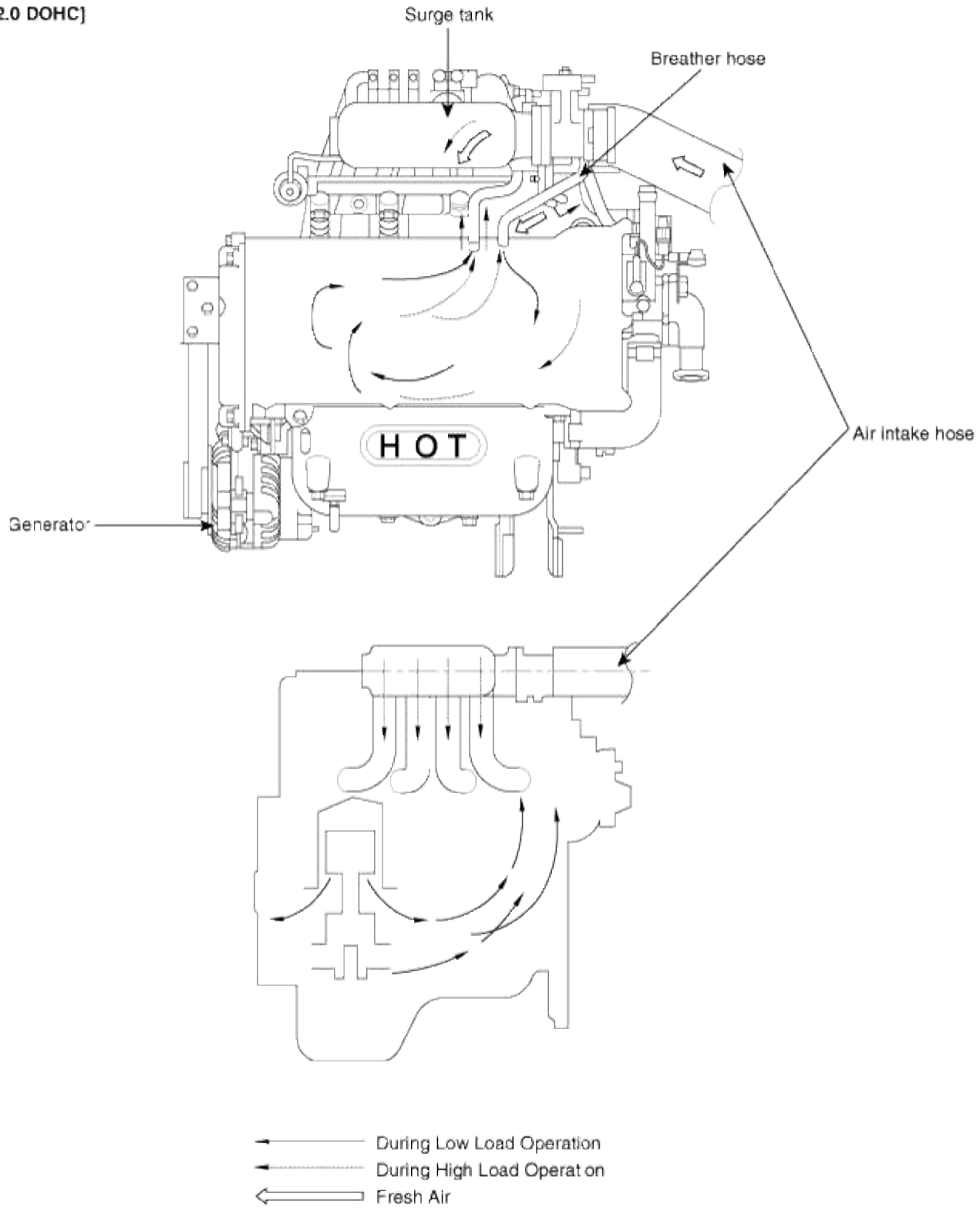
TIGHTENING TORQUES

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

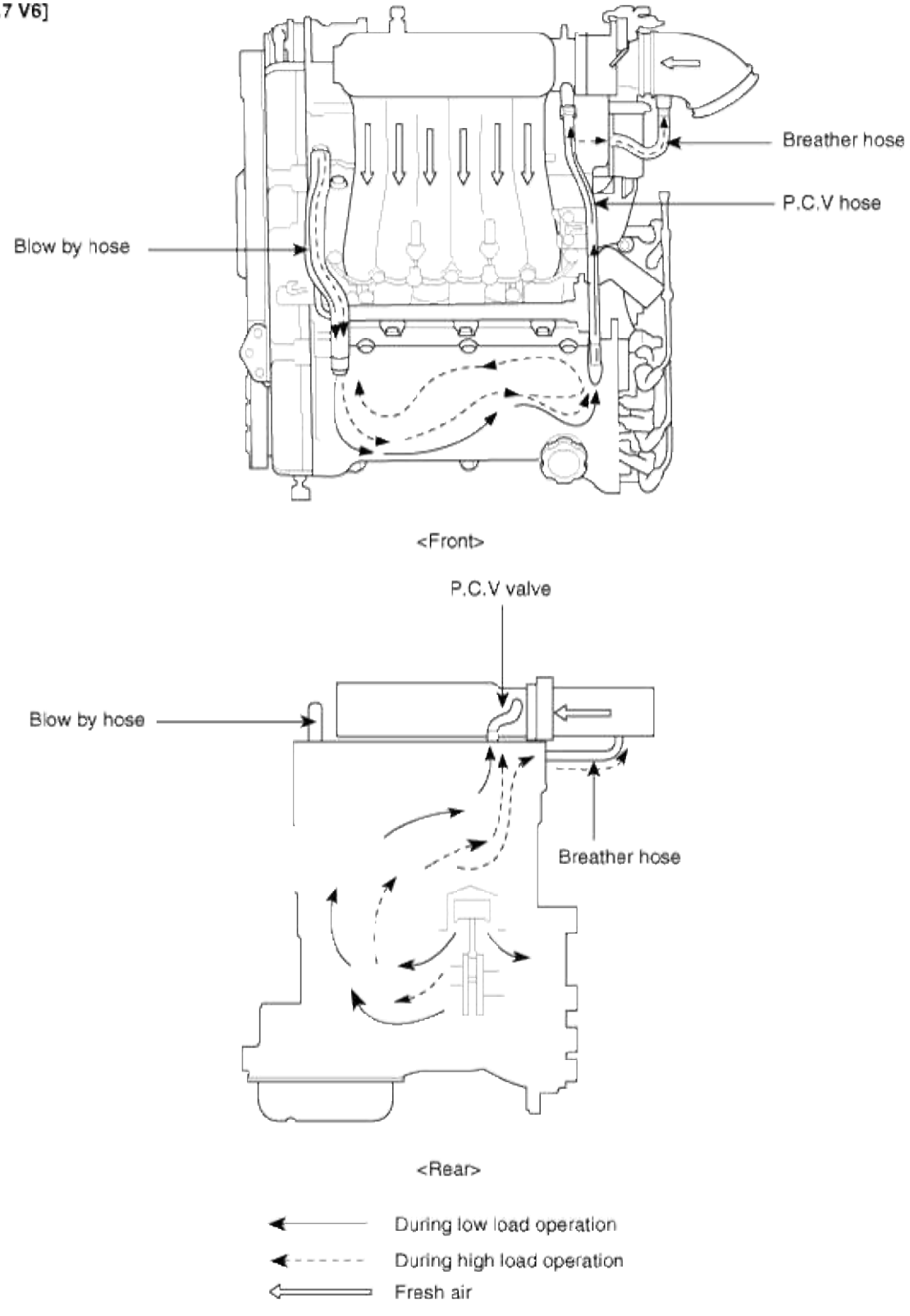
Emission Control System > Crankcase Emission Control System > Components and Components Location

COMPONENTS LOCATION

[2.0 DOHC]

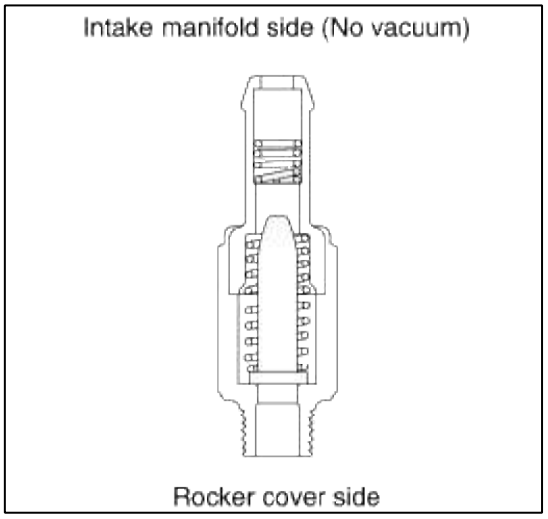

Surge tank
Breather hose
Air intake hose
HOT
Generator
During Low Load Operation
During High Load Operat on
Fresh Air

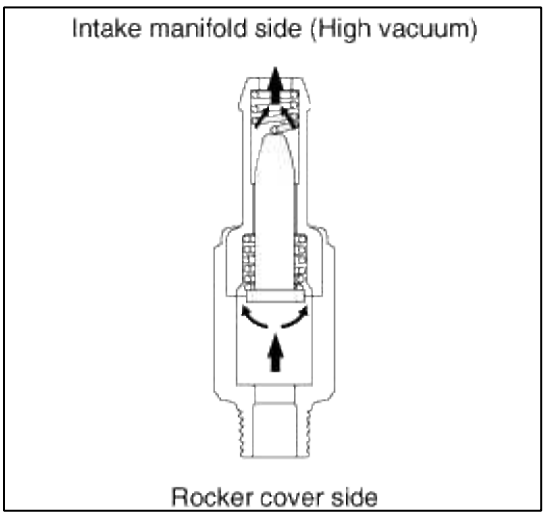
[2.7 V6]



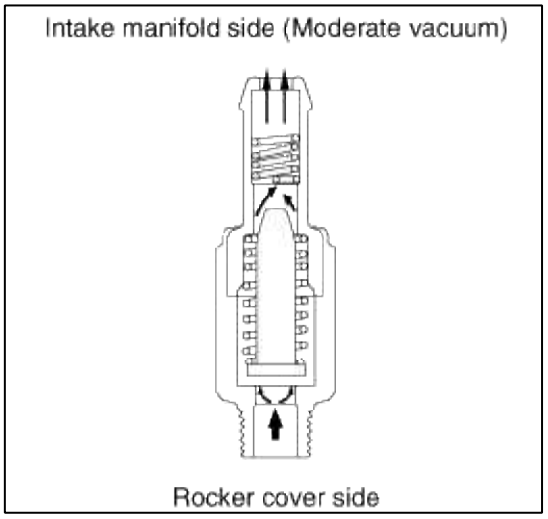
Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Description and Operation

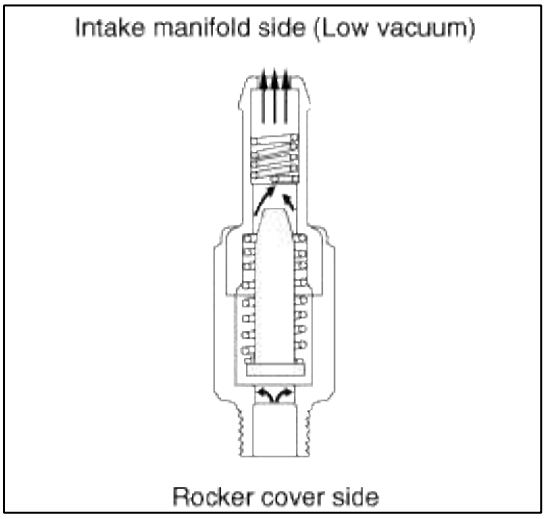
OPERATION





Engine condition	Not running	Engine condition	Idling or decelerating
PCV valve	Not operating	PCV valve	Fully operating
Vacuum passage	Restricted	Vacuum passage	Small





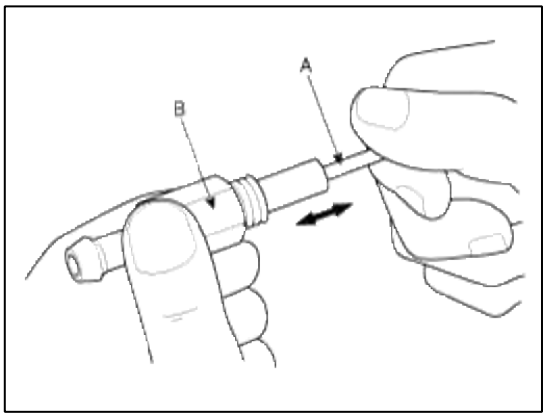
Engine condition	Normal operation	Engine condition	Accelerating and high load
PCV valve	Properly operating	PCV valve	Slightly operating
Vacuum passage	Large	Vacuum passage	Very large

Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Repair procedures

INSPECTION

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.

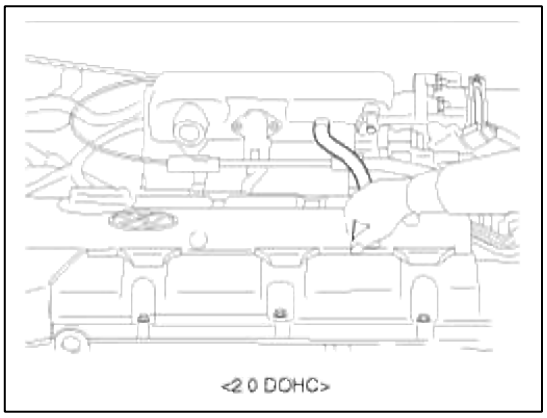


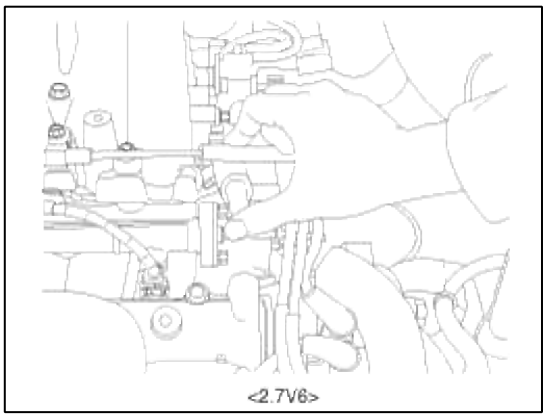
REMOVAL

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.





3. If vacuum is not felt, clean the PCV valve and ventilation hose in cleaning solvent, or replace it if necessary.

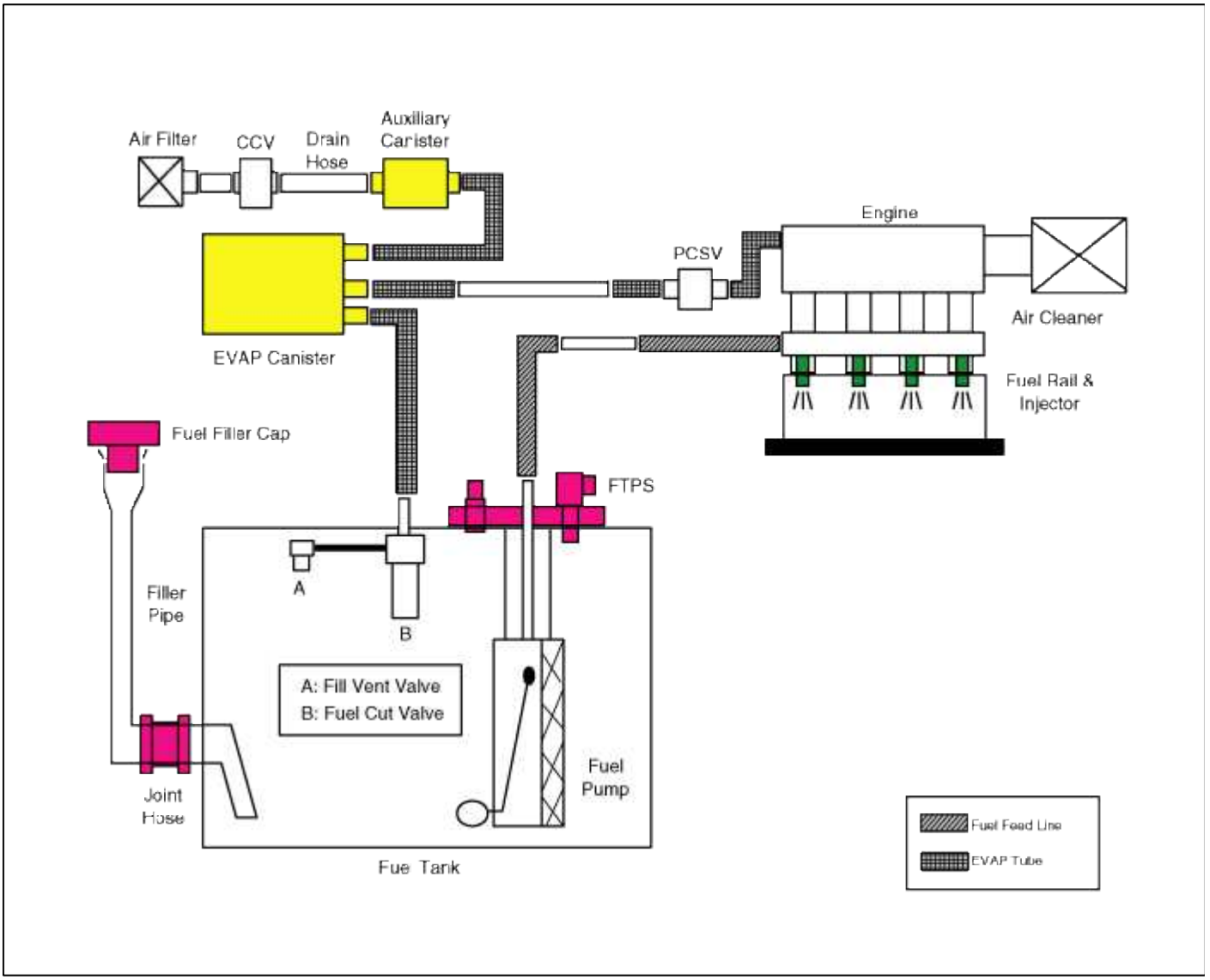
INSTALLATION

Install the PCV valve and tighten to the specified torque.

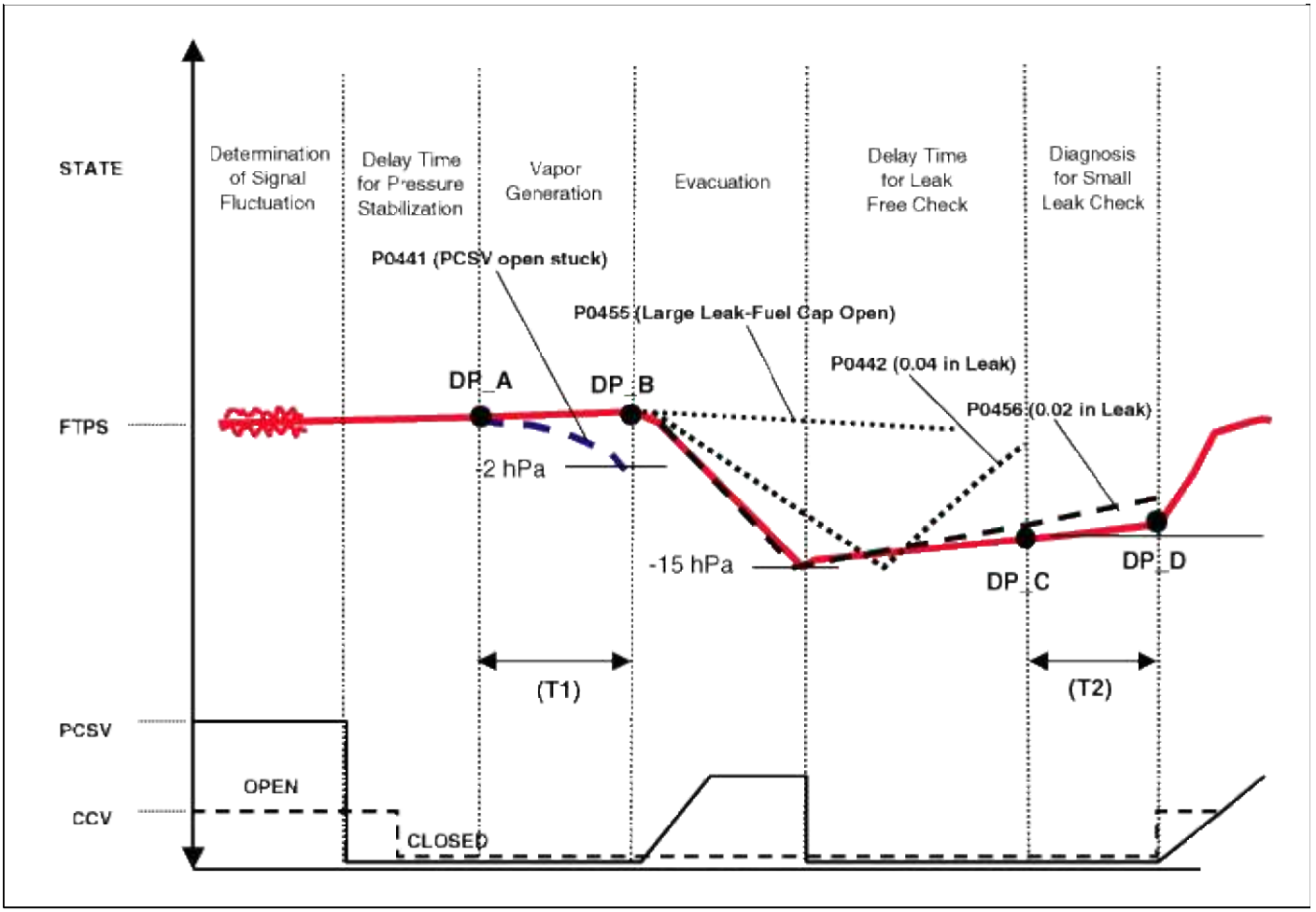
PCV valve tightening toraue:
7.8 ~ 11.8N·m (0.8 ~ 1.2kgf·m, 5.8 ~ 8.7lbf·ft)

Emission Control System > Evaporative Emission Control System > Description and Operation

DESCRIPTION



EVAP. SYSTEM MONITORING



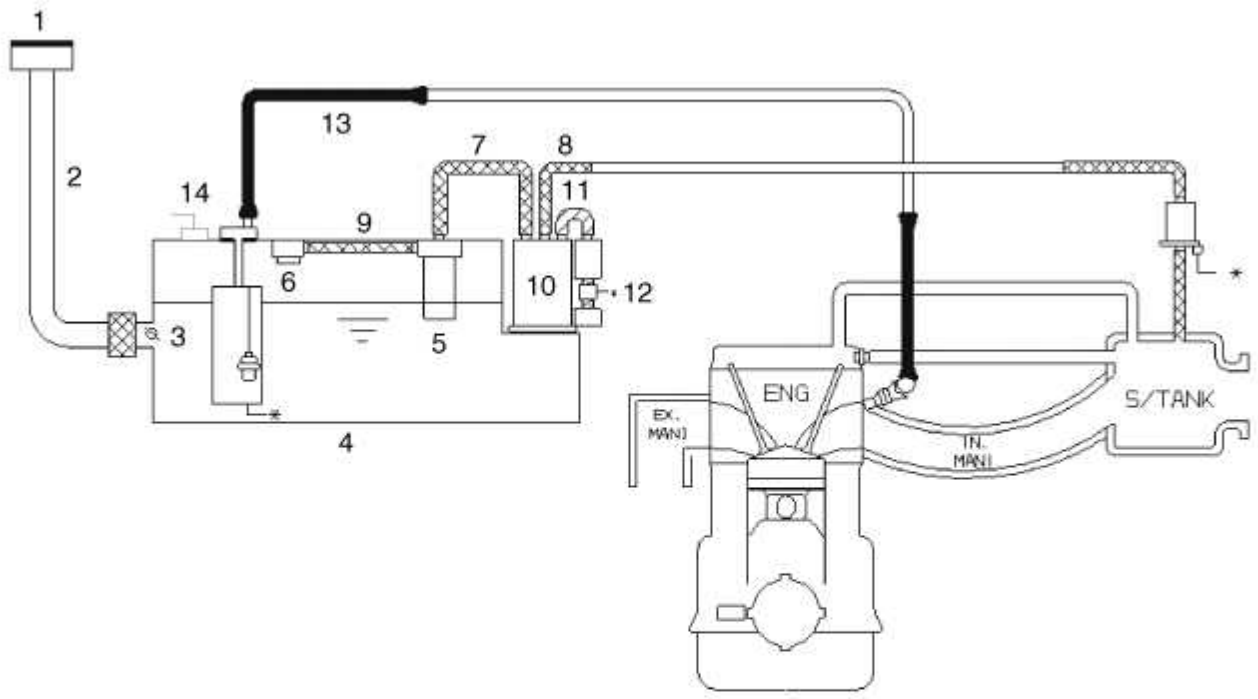
DESCRIPTION

This system consists of a fill vent valve, fuel shut-off valve, fuel cut valve (for roll over), two way valve (pressure/vacuum relief), fuel liquid/vapor separator which is installed beside the filler pipe, charcoal canister which is mounted under the rear floor LH side member and protector, tubes and miscellaneous connections.

While refueling, ambient air is drawn into the filler pipe so as not to emit fuel vapors in the air. The fuel vapor in the tank is then forced to flow into the canister via the fill vent valve. The fuel liquid/vapor separator isolates liquid fuel and passes the pure vapor to the charcoal canister.

While the engine is operating, the trapped vapor in the canister is drawn into the intake manifold and then into the engine combustion chamber. According to this purge process, the charcoal canister is purged and recovers its absorbing capability.

COMPONENTS

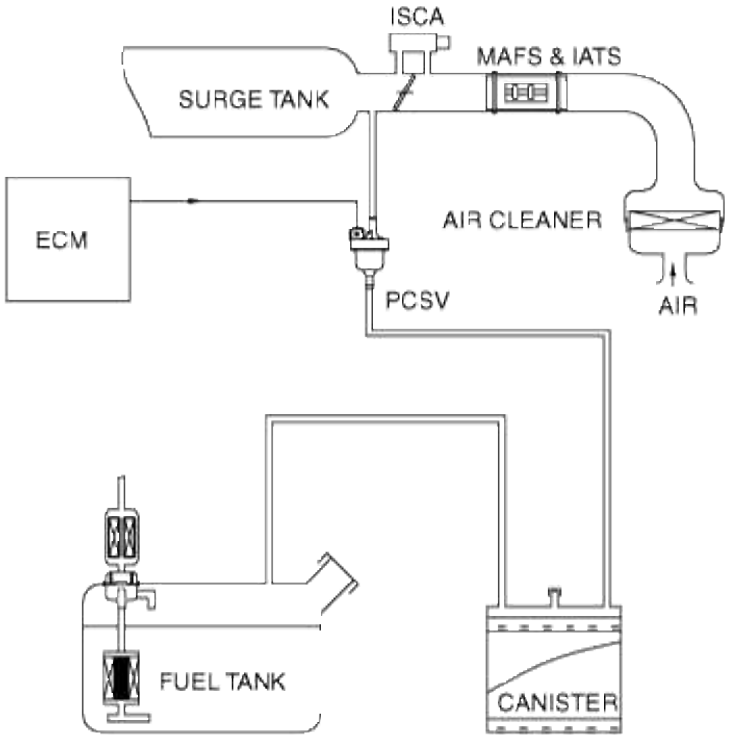


1. Filler cap
2. Fuel filler pipe
3. Check valve
4. Fuel tank
5. ORVR control valve
6. Vapor valve
7. EVAP. Hose
8. EVAP. Hose
9. EVAP. Hose
10. Canister
11. Drain hose
12. Canister Close Valve (CCV)
13. Fuel feed line
14. Fuel Tank Pressure Sensor (FTPS)

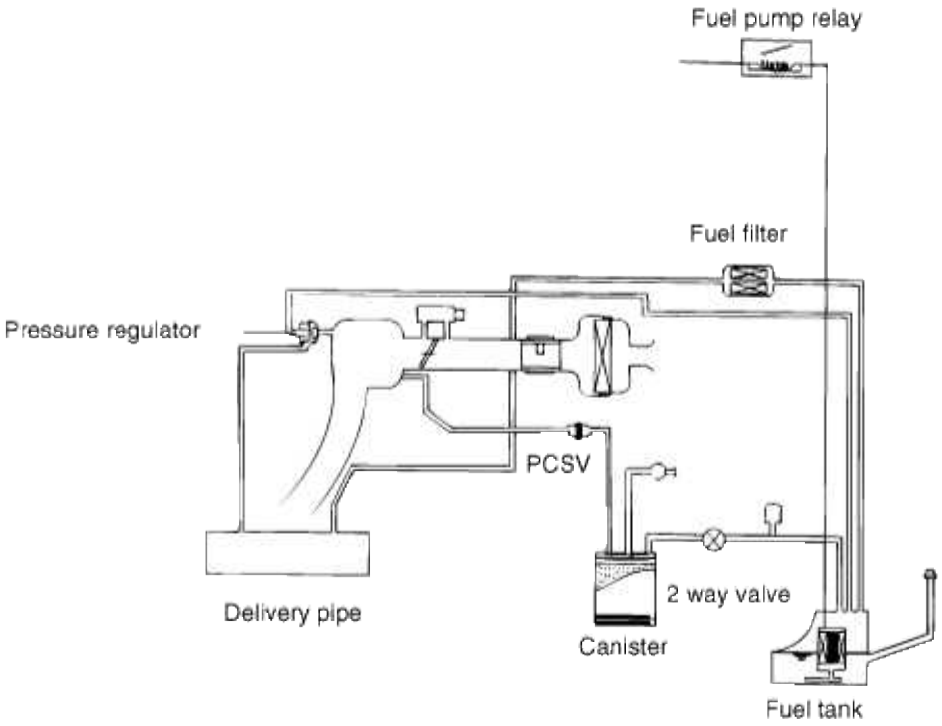
Emission Control System > Evaporative Emission Control System > Components and Components Location

SCHEMATIC DIAGRAM

[2.0 DOHC]



[2.7 V6]



Emission Control System > Evaporative Emission Control System > Repair procedures

INSPECTION

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		

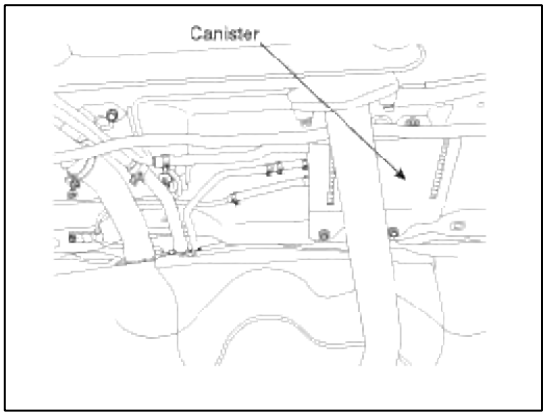
WHEN ENGINE IS WARM

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

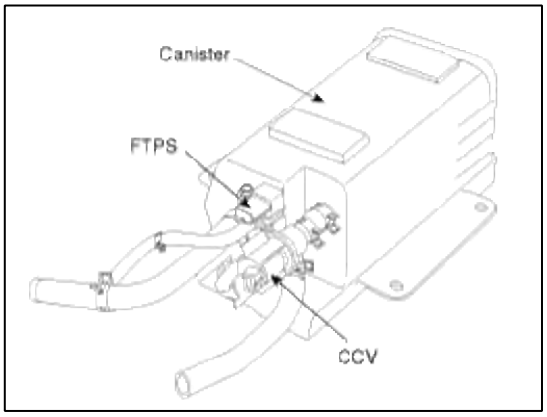
Emission Control System > Evaporative Emission Control System > Canister > Repair procedures

INSPECTION

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.



Emission Control System > Evaporative Emission Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

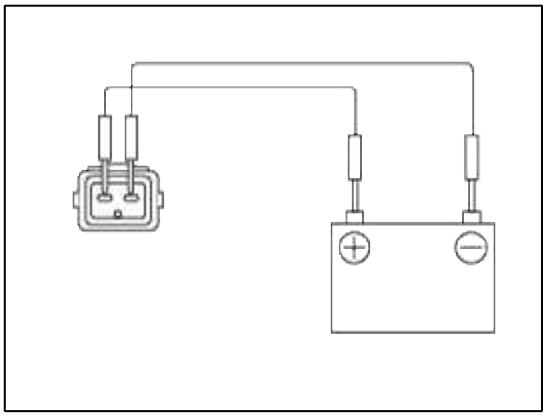
INSPECTION

NOTE

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

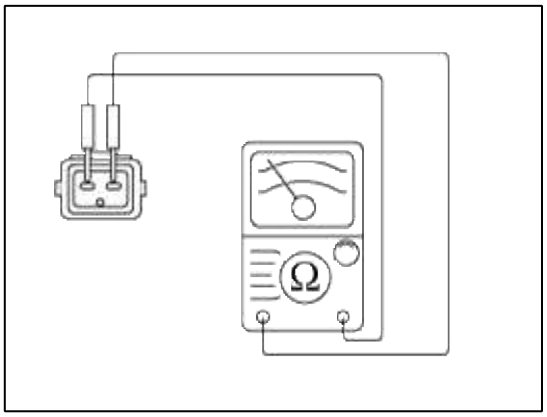
1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-striped vacuum hose was connected.
4. Apply vacuum and check when voltage is applied to the PCSV and when the voltage is discontinued.

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



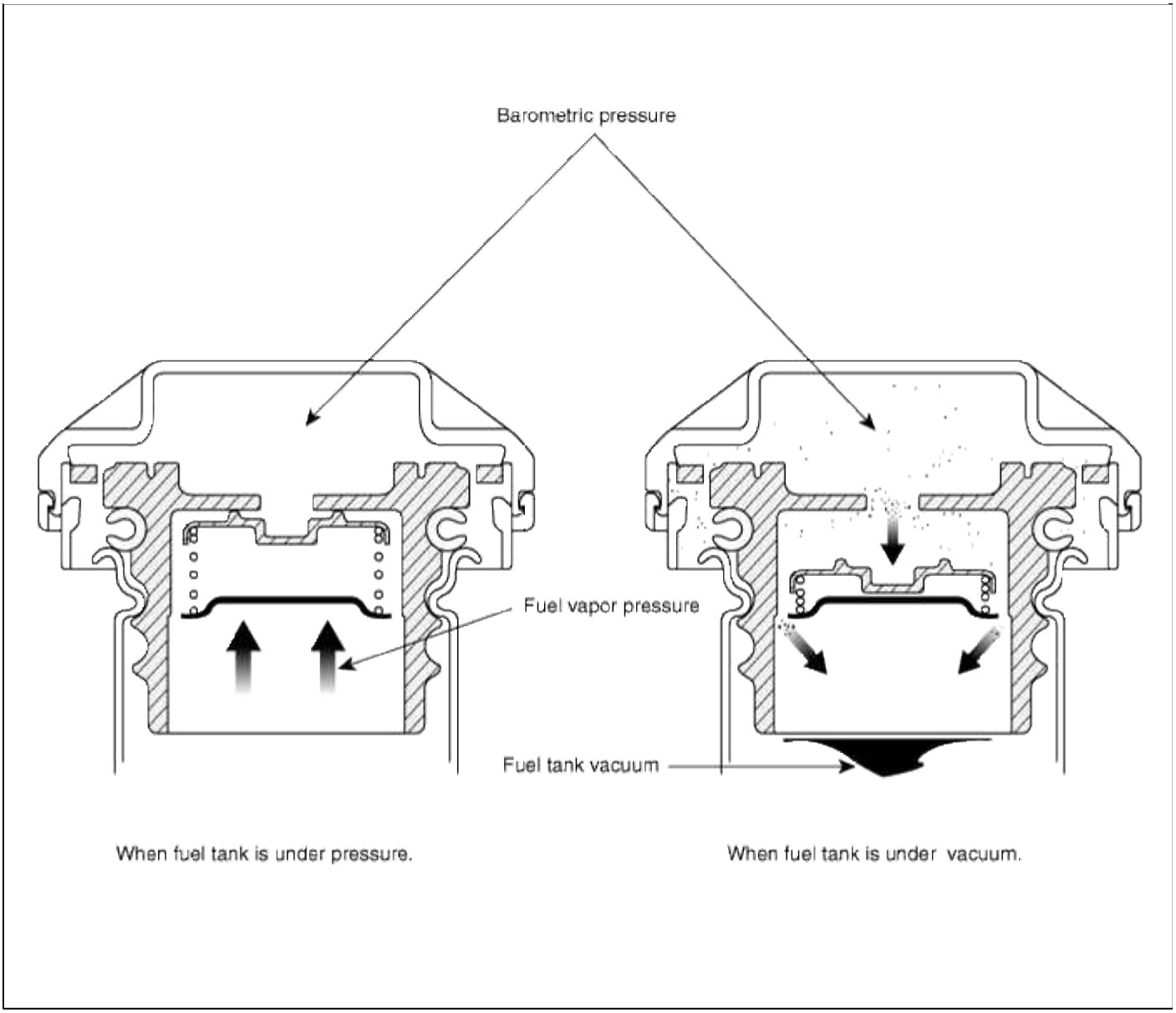
5. Measure the resistance between the terminals of the solenoid valve.

PCSV coil resistance (Ω):
24.5 ~ 27.5 Ω at 20°C (68°F)



Emission Control System > Evaporative Emission Control System > Fuel Filler Cap > Description and Operation

DESCRIPTION



Emission Control System > Exhaust Emission Control System > Description and Operation

DESCRIPTION

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]

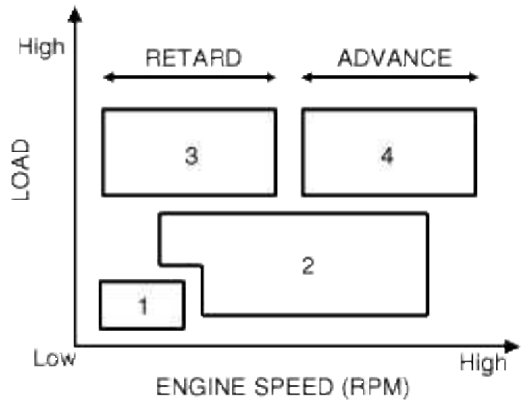
This in turn allows the engine to produce exhaust gases of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants (1) hydrocarbons (HC), (2) carbon monoxide (CO), and (3) oxides of nitrogen (NOx) into harmless substances. There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

Emission Control System > Exhaust Emission Control System > CVVT (Continuously Variable Valve Timing) System > Description and Operation

DESCRIPTION

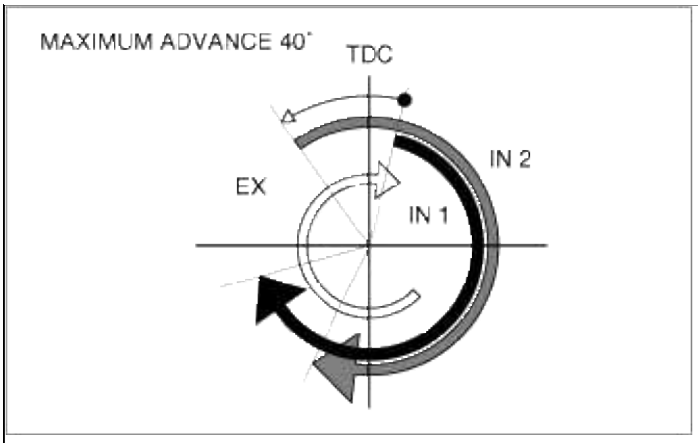
The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.
The intake valve timing is optimized by CVVT system depending on engine rpm.
This CVVT system improves fuel efficiency and reduces 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.

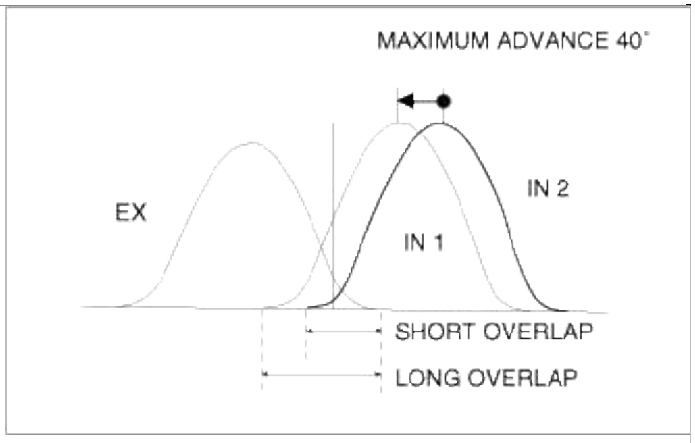


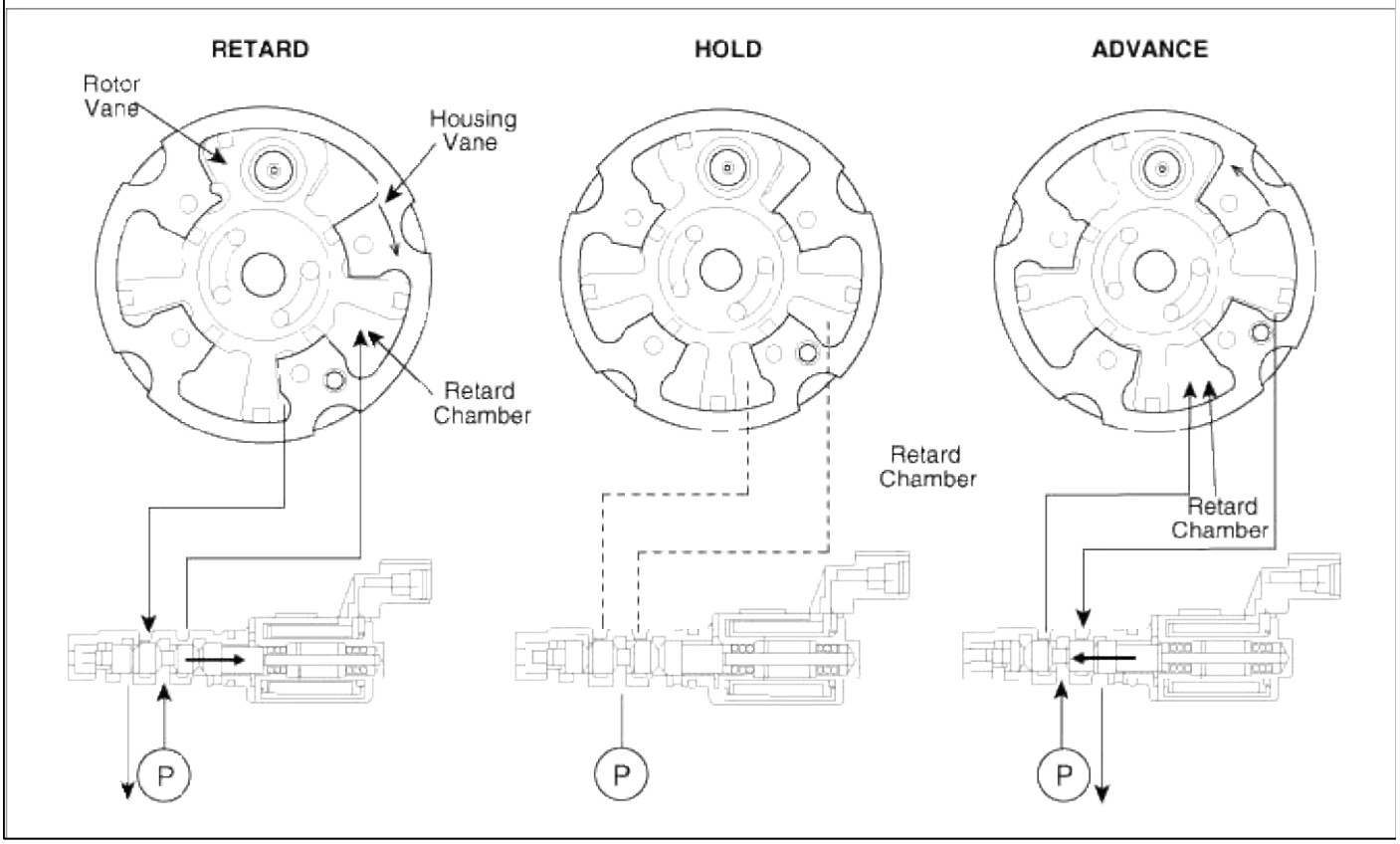
Driving Condition	Intake Valve Timing	Effect
Light load (1)	Retard	Stable combustion
Part load (2)	Advance	Enhanced fuel economy and exhaust emissions
High load& Low rpm (3)	Advance	Enhanced torque
High load& High rpm (4)	Retard	Enhanced Power

OPERATION [2.0 DOHC]

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.







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.

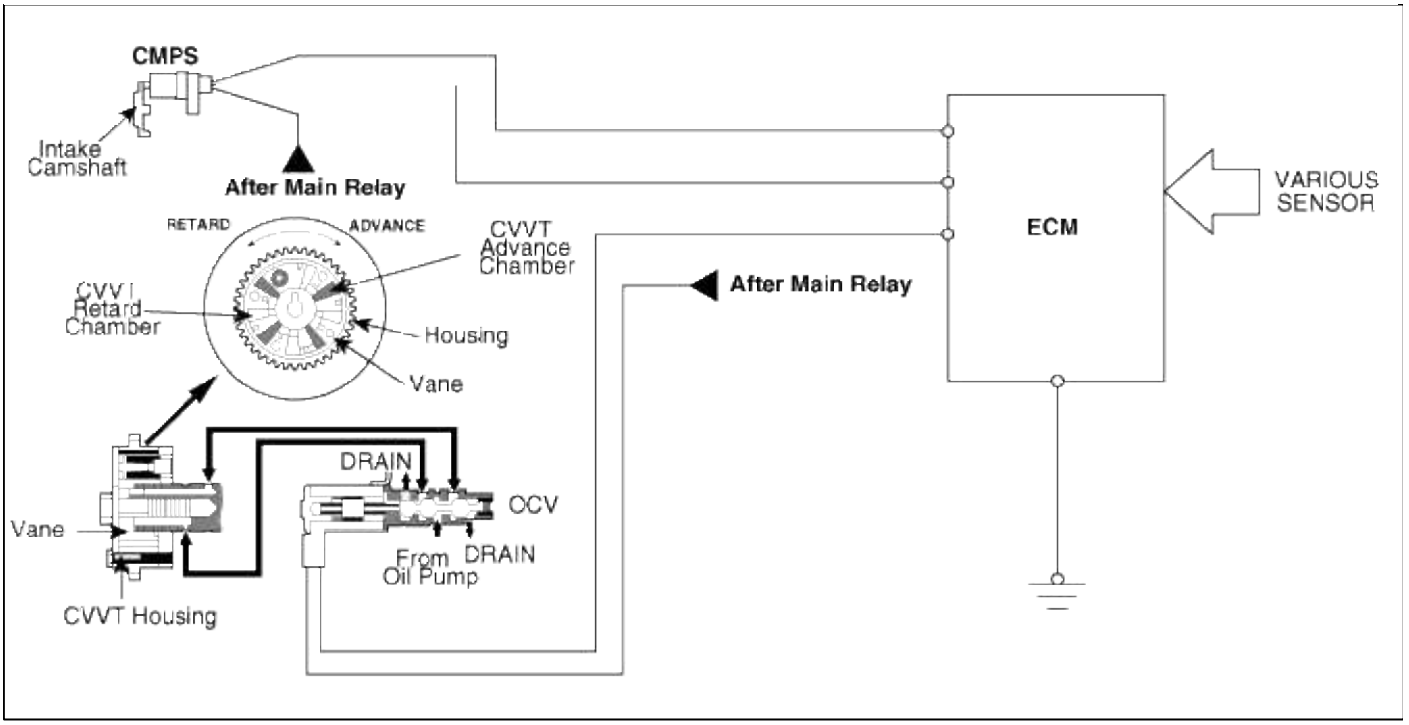
The OCV (Oil-flow Control Valve) spool location at this time is as follows.

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).

Emission Control System > Exhaust Emission Control System > CVVT (Continuously Variable Valve Timing) System > Components and Components Location

COMPONENTS LOCATION [2.0 DOHC]



Emission Control System > Troubleshooting > P0420

COMPONENT LOCATION

GENERAL DESCRIPTION

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO2S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front. The output voltage of the rear HO2S copies the voltage of the front HO2S.To monitor the system, the lean-to-rich switches of the front HO2S to the rear HO2S is counted. The ratio of rear switches to front switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer rear switches than front switches, that is, a ratio closer to zero.

DTC DESCRIPTION

The ECM calculates oscillation size of rear HO2S signal which represents catalyst conversion properties. This

oscillation size will determine if catalyst conversion is low due to aging or poisoning from leaded fuel or misfiring. The ECM sets P0420 if the average of calculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold.

DTC DETECTING CONDITION

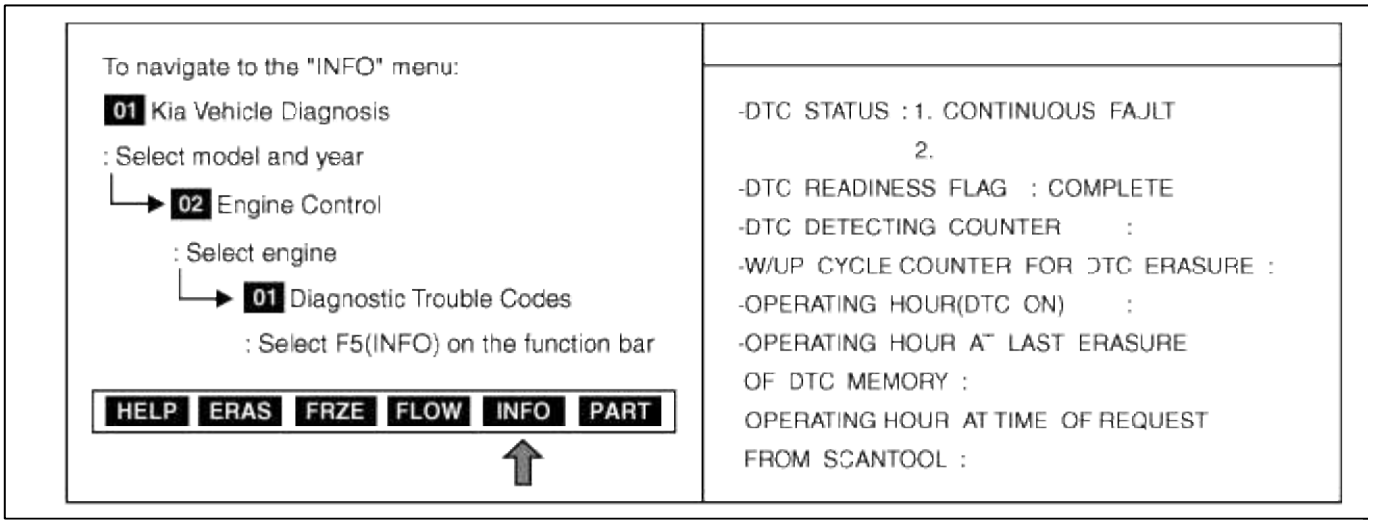
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of the signal ratio of upstream and downstream O2 sensor in a load and speed range	• Exhaust gas leaks • Rear HO2S malfunction • Three way catalyst converter malfunction
Enable Conditions	• 400(752°F)< Catalyst model temperature <600°C(1112°F) • Coolant temperature >70°C(158) • Lambda control within limit • 800rpm< Engine speed < 2500rpm • Air mass flow <250 mg/stk • No misfire is detected • Not transient condition	
Threshold Value	• Averaged malfunction index > 0.7	
Diagnostic Time	• 120 lambda controller cycles	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

EXHAUST SYSTEM INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   A. Exhaust system between HO2S and Three way catalyst for air leakage
   B. Damage, and for loose or missing hardware.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Rear HO2S Inspection " procedure.

REAR HO2S INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   A. Ensure that the HO2S is securely installed.(Pigtail and wiring harness not making contact with the exhaust pipe)
   B. Check for corrosion on terminals.
   C. Check for terminal tension. (at the HO2S and at the ECM)
   D. Any road damage.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "TWC Inspection " procedure

TWC INSPECTION

1. Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
   A. Severe discoloration caused by excessive temperature.
   B. Dents and holes.
   C. Internal rattle caused by a damaged catalyst.
2. Also, ensure that the TWC is a proper original equipment manufacturer part.
3. Was a problem found?

YES

Replace TWC and go to "Verification of Vehicle Repair" procedure.

NO

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

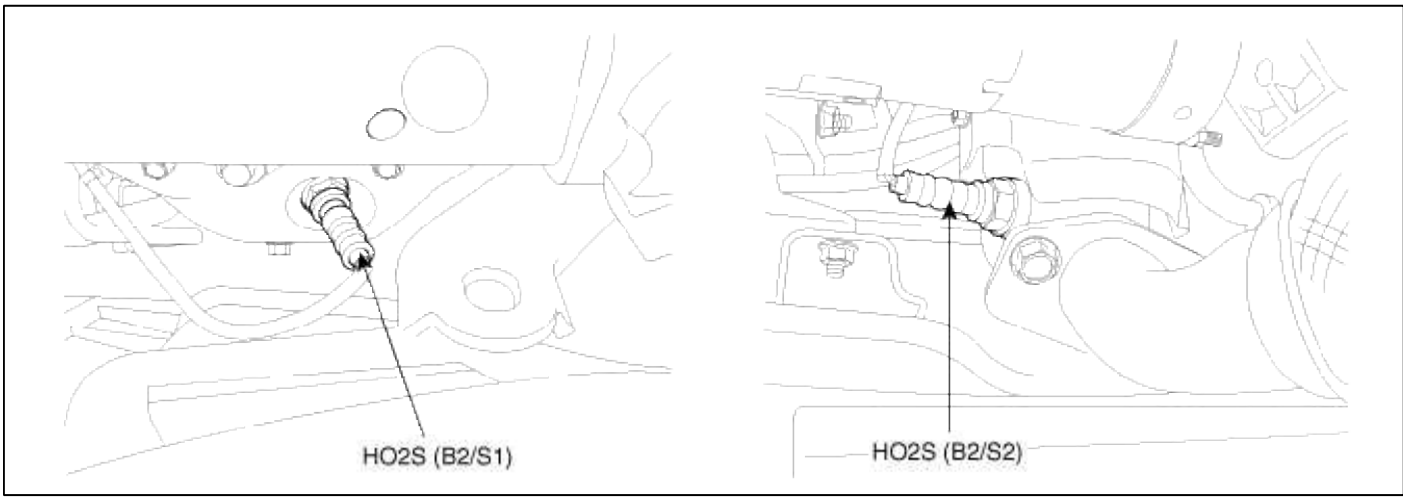
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Emission Control System > Troubleshooting > P0430

COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO2S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front. The output voltage of the rear HO2S copies the voltage of the front HO2S.To monitor the system, the lean-to-rich switches of the front HO2S to the rear HO2S is counted. The ratio of rear switches to front switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer rear switches than front switches, that is, a ratio closer to zero.

DTC DESCRIPTION

The ECM calculates oscillation size of rear HO2S signal which represents catalyst conversion properties. This oscillation size will determine if catalyst conversion is low due to aging or poisoning from leaded fuel or misfiring. The ECM sets P0430 if the average of calculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold.

DTC DETECTING CONDITION

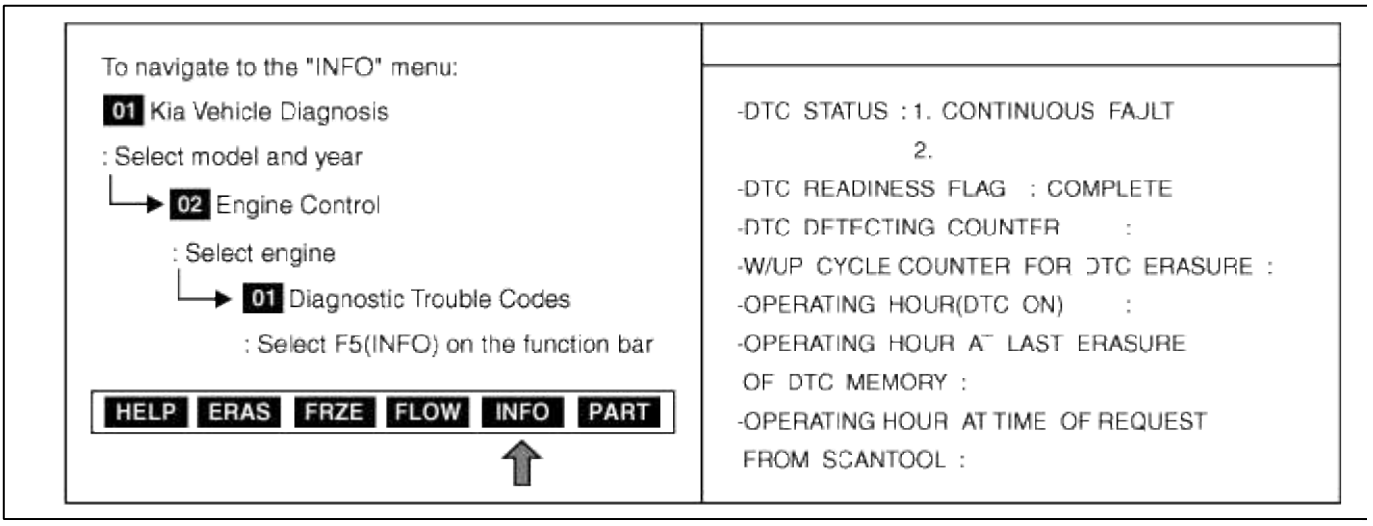
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of the signal ratio of upstream and downstream O2 sensor in a load and speed range	• Exhaust gas leaks • Rear HO2S malfunction • Three way catalyst converter malfunction
Enable Conditions	• 400(752°F)< Catalyst model temperature <600°C(1112°F) • Coolant temperature >70°C(158) • Lambda control within limit • 800rpm< Engine speed < 2500rpm • Air mass flow <250 mg/stk • No misfire is detected • Not transient condition	
Threshold Value	• Averaged malfunction index > 0.7	
Diagnostic Time	• 120 lambda controller cycles	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

EXHAUST SYSTEM INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   A. Exhaust system between HO2S and Three way catalyst for air leakage
   B. Damage, and for loose or missing hardware.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Rear HO2S Inspection " procedure.

REAR HO2S INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   A. Ensure that the HO2S is securely installed.(Pigtail and wiring harness not making contact with the exhaust pipe)
   B. Check for corrosion on terminals.
   C. Check for terminal tension. (at the HO2S and at the ECM)
   D. Any road damage.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "TWC Inspection " procedure

TWC INSPECTION

1. Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
   A. Severe discoloration caused by excessive temperature.
   B. Dents and holes.
   C. Internal rattle caused by a damaged catalyst.
2. Also, ensure that the TWC is a proper original equipment manufacturer part.
3. Was a problem found?

YES

Replace TWC and go to "Verification of Vehicle Repair" procedure.

NO

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

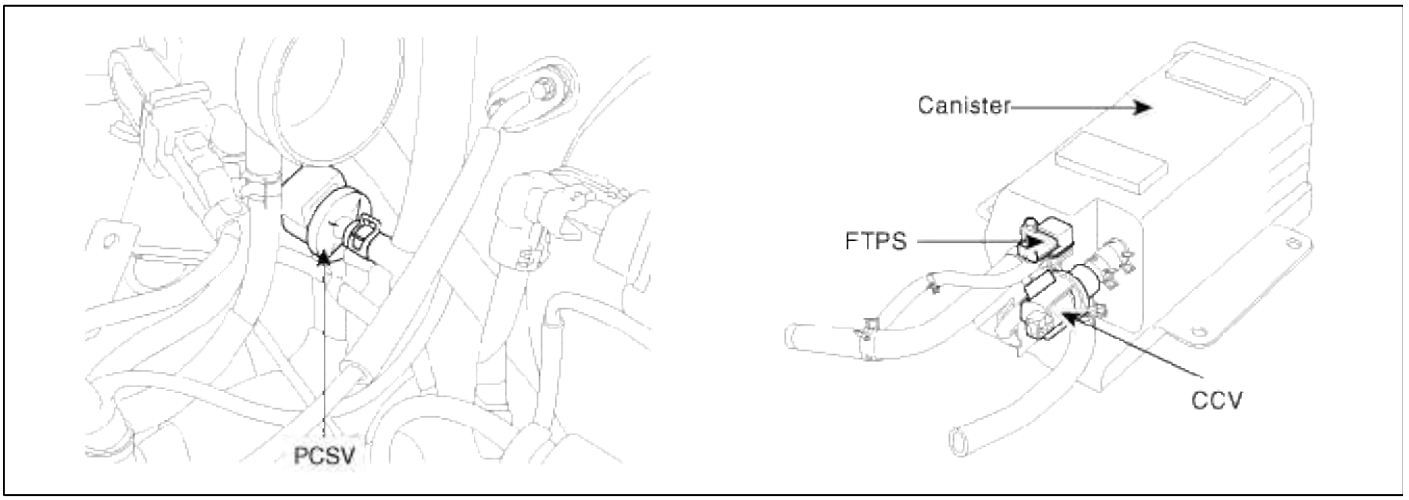
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Emission Control System > Troubleshooting > P0441

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustlon. This valve is actuated by the purge control signal from the ECM and controls fuel vapor from the canister to the intake manifold.

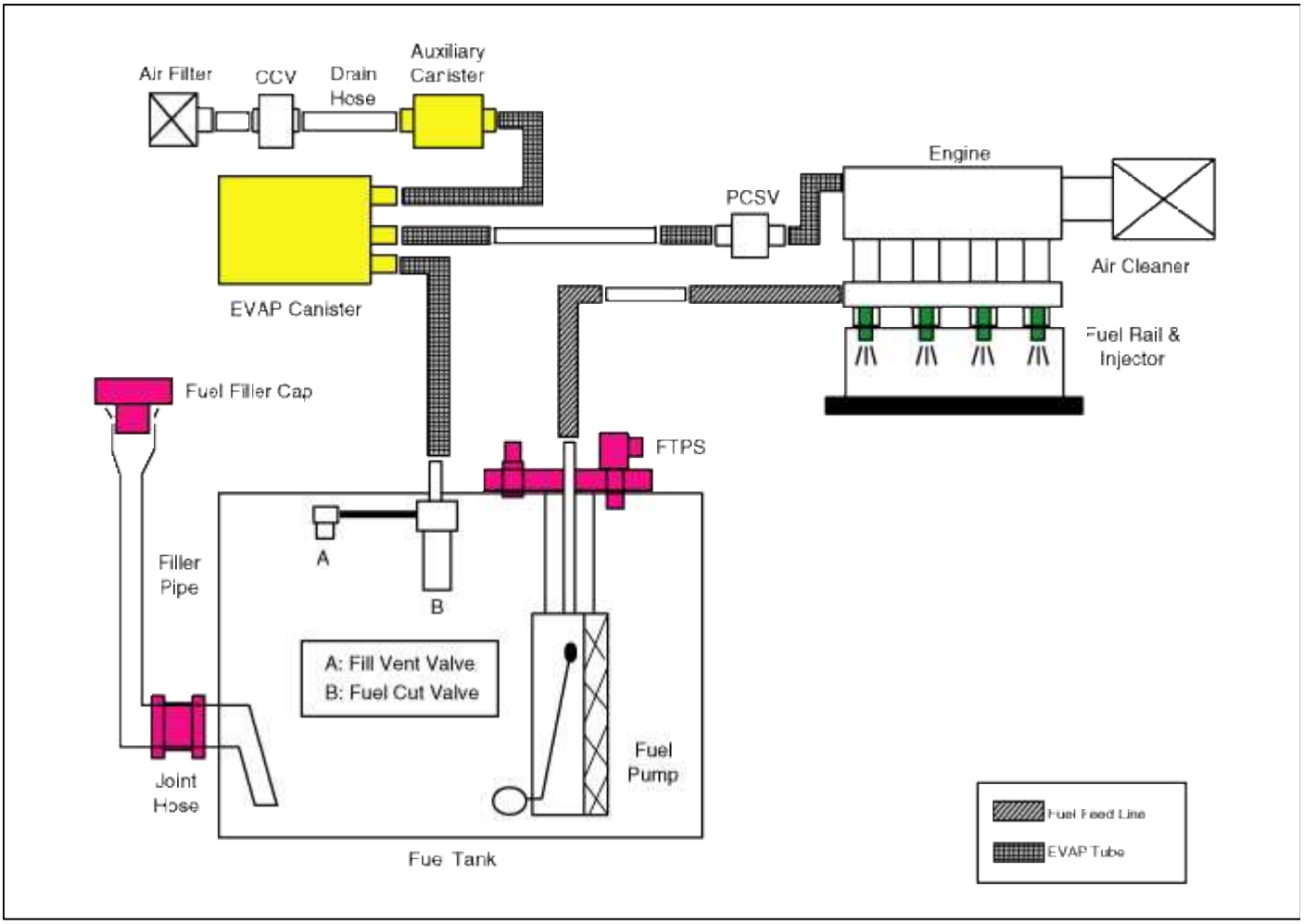
DTC DESCRIPTION

During "test of vapour generation" a new value from the tank pressure sensor is measured and compared with the start pressure at beginning of "test of vapour generation".
The ECM sets DTC P0441 if the pressure signal decrease occurs and the difference is below the predetermined threshold. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor(DTP) signal with underpressure	• Leakage on hose to PCSV • Faulty PCSV
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Pressure fluctuation in fuel tank < -2hPa during vapor generation period	
Diagnostic Time	• 10 sec. In idle	
Fall Safe	• EVAP. System monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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. Check the following conditions:
   (1) Check for damaged harness and terminals: contact resistance, oxidation, bent or broken terminals.
   (2) Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks and poor terminal to wire connection.

> NOTE
>
> Using a suitable male pin to ensure that contact in sockets is good. The pin should remain in position when pulled gently.

   (3) Is a problem found?

   YES

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

> NOTE
>
> EVAP. Leakage Test enable conditions
> - Following conditions must be fulfilled to start the test.
>
> 1. Engine warm up at Idle Status
> 2. No relevant DTC
> 3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

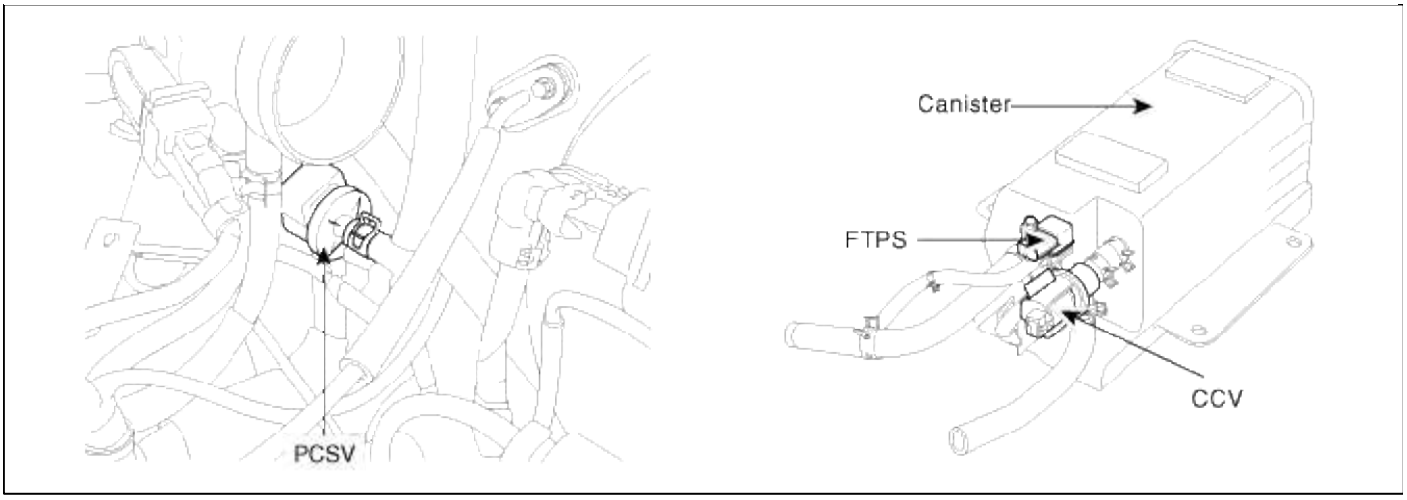
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Emission Control System > Troubleshooting > P0442

COMPONENT LOCATION



GENERAL DESCRIPTION

Due to the increasing ambient temperature of the fuel and the return of unused hot fuel from the engine, fuel vapors are generated in the tank. In order to control the release of these vapors to the atmosphere, the evaporative emissions control system is used. The evaporative emission control system reduces hydrocarbon (HC) emissions by trapping fuel tank vapors until they can be burned in the combustion process. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold. The evaporative emission control system is made up of a fuel tank that can be completely sealed from outside air, a Fuel Tank Pressure Sensor (FTPS), a Canister Close Valve (CCV) that seals the canister from the outside air, a canister filled with activated charcoal granules, a Purge Control Solenoid Valve (PCSV). The evaporative emission system can be checked for leaks by sealing the system off from the outside air, creating a vacuum, and monitoring if the system can hold that vacuum sufficiently for a set amount of time. If it cannot, a leak exists somewhere in the system.

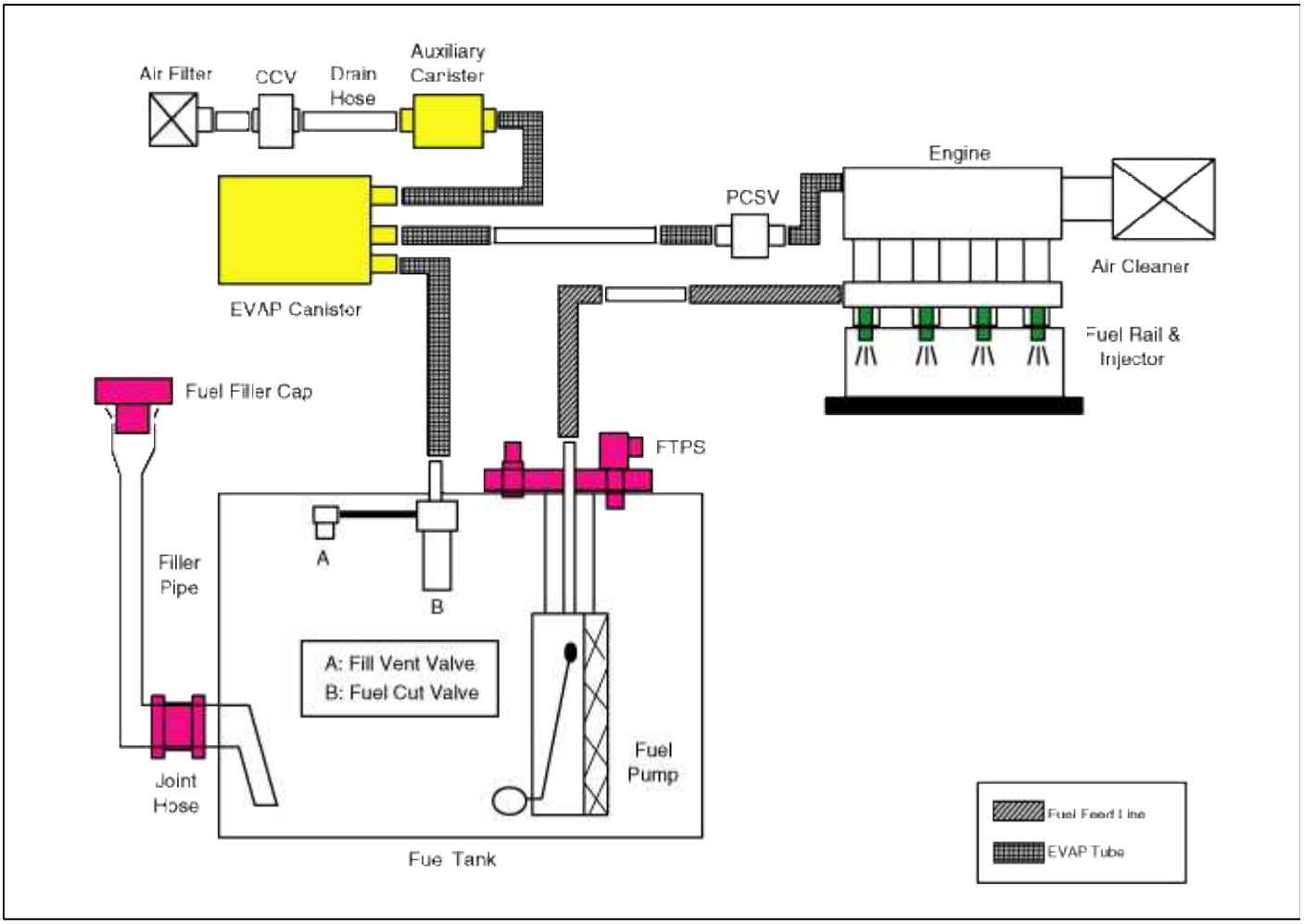
DTC DESCRIPTION

The ECM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. After vacuum generation, the ECM measures pressure differential curve in the fuel tank and sets DTC P0442 or P0456 if the vacuum generated within a monitoring period increases above a defined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor(DTP) signal with underpressure	• Fuel filler cap damage or missing • Faulty or damaged fuel filler pipe • Leaking, disconnected or plugged fuel vapor lines. • Fuel in lines due to faulty Rollover Valve • On-Board Refueling Vapor Recovery Valve (ORVR valve) or stuck closed CCV. • Improperly installed or stuck Purge Control Solenoid Valve (PCSV). • Faulty Fuel Tank Pressure Sensor (FTPS). • Leaking canister
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Pressure fluctuation in fuel tank < -2hPa during vapor generation period	
Diagnostic Time	• 26 sec. In idle	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

> NOTE
>
> EVAP. Leakage Test enable conditions
> - Following conditions must be fulfilled to start the test.
>
> 1. Engine warm up at Idle Status
> 2. No relevant DTC
> 3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

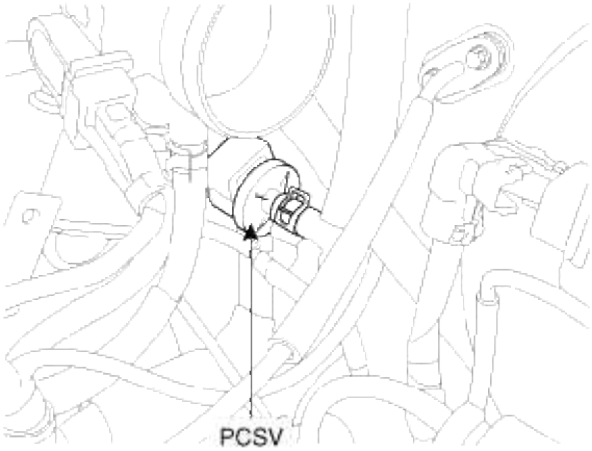
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Emission Control System > Troubleshooting > P0444

COMPONENT LOCATION



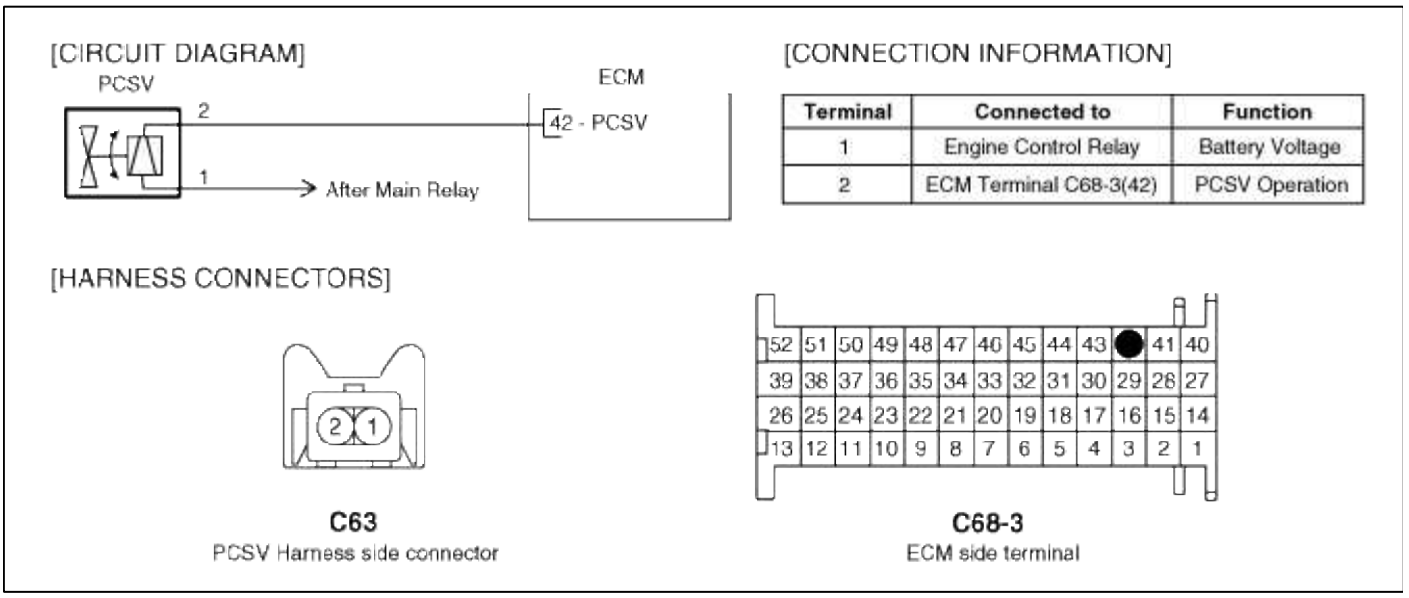
GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open in PCSV harness • Contact resistance in connectors • Faulty PCSV
Enable Conditions	• 10V< Battery voltage	
Threshold Value	• Open circuit	
Diagnostic Time	• 3 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

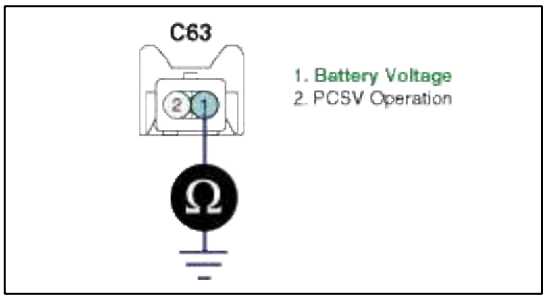
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

2. Measure voltage between terminal 1 of the PCSV harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

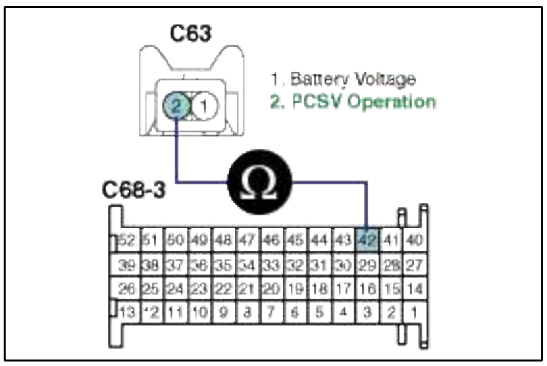
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminals 2 of the PCSV harness connector and 42 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

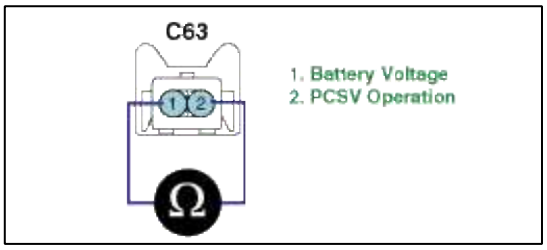
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect PCSV connector.

3. Measure resistance between terminals 1 and 2 of the PCSV connector(Component side).

Specification : Approx. 24.5~27.5Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check PCSV for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

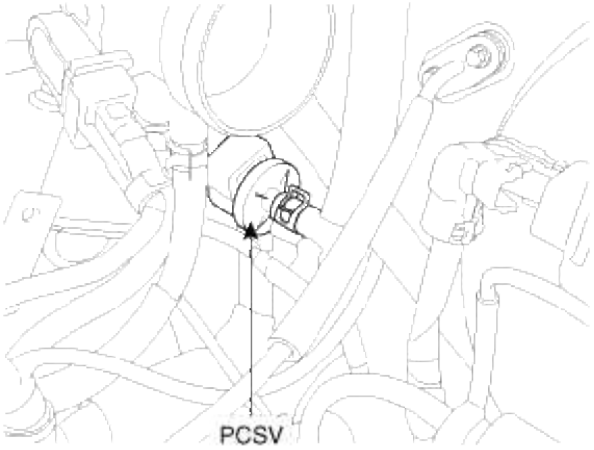
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		PCSV Resistance (Ω)
(°C)	(°F)	
20	68	24.5~27.5

Emission Control System > Troubleshooting > P0445

COMPONENT LOCATION



GENERAL DESCRIPTION

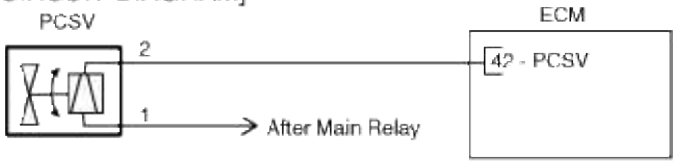
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short in PCSV harness • Contact Resistance in connectors • Faulty PCSV
Enable Conditions	• 10V< Battery voltage	
Threshold Value	• Short to ground or Short to Battery	
Diagnostic Time	• 3 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

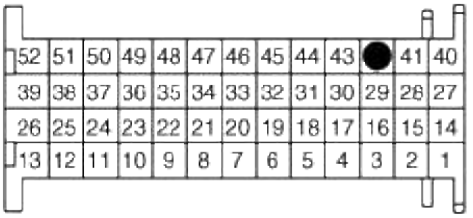


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Engine Control Relay	Battery Voltage
2	ECM Terminal C68-3(42)	PCSV Operation

[HARNESS CONNECTORS]

C63
PCSV Harness side connector



C68-3
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

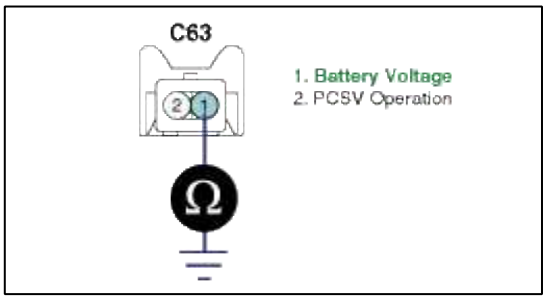
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the PCSV harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

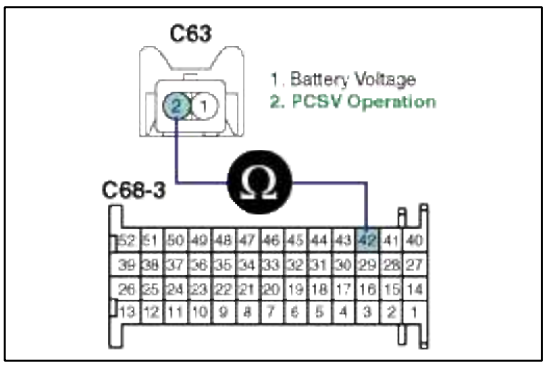
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect ECM connector.
   (3) Measure resistance between terminals 2 of the PCSV harness connector and 42 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



(4) Is resistance within the specification?

YES

Go to next step as below.

NO

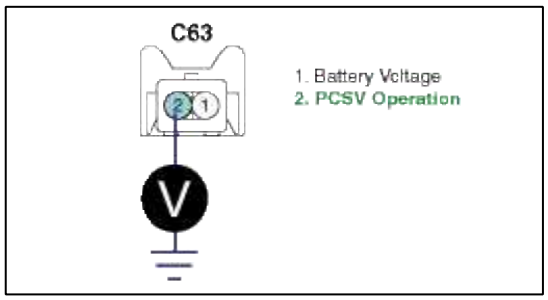
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in control circuit.

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

(2) Measure voltage between terminal 2 of the PCSV harness connector and chassis ground.

Specification : Approx. 0V



(3) Is voltage within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

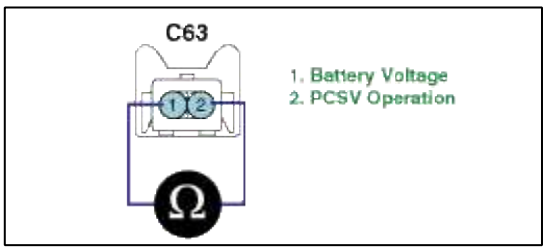
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect PCSV connector.
3. Measure resistance between terminals 1 and 2 of the PCSV connector(Component side).

Specification : Approx. 24.5~27.5Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check PCSV for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

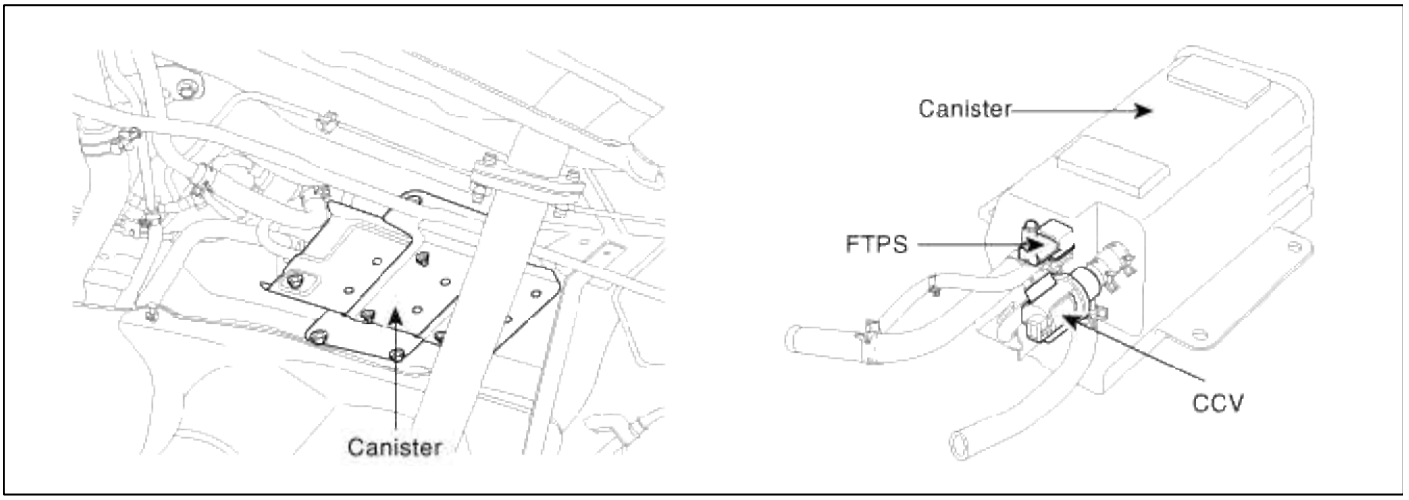
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		PCSV Resistance (Ω)
(°C)	(°F)	
20	68	24.5~27.5

Emission Control System > Troubleshooting > P0447

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emissions system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

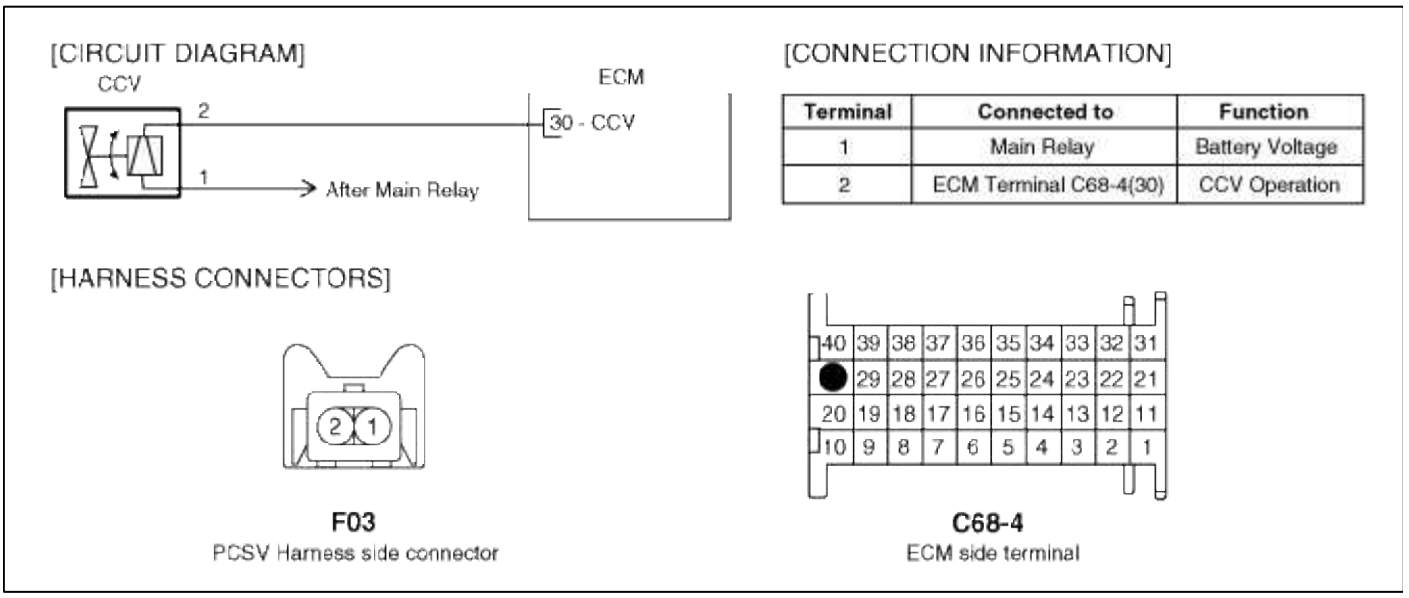
DTC DESCRIPTION

ECM sets DTC P0447 if the ECM detects that the CCV control line is open.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open in CCV harness • Contact resistance in connectors • Faulty CCV.
Enable Conditions	• Battery voltage > 10V	
Threshold Value	• Line break	
Diagnostic Time	• 3 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

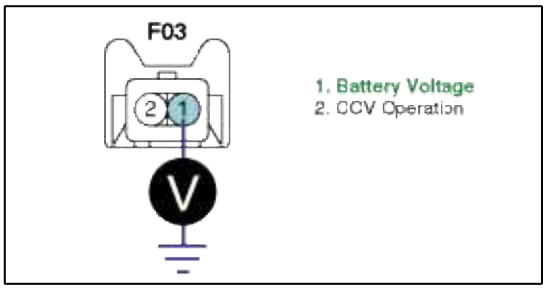
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

2. Measure voltage between terminal 1 of the CCV harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

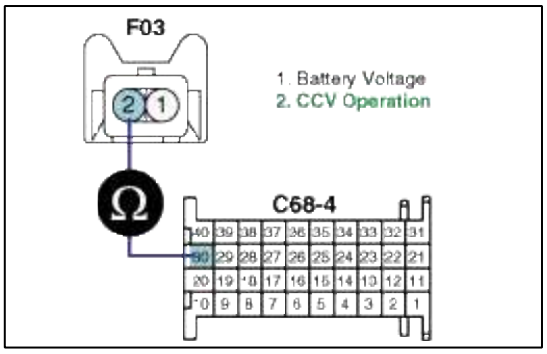
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminals 2 of the CCV harness connector and 30 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

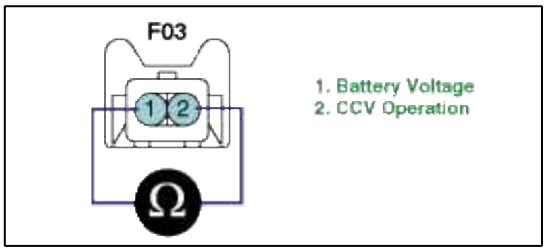
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect CCV connector.

3. Measure resistance between terminals 1 and 2 of the CCV connector(Component side).

Specification : Approx. 23~26Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check CCV for contamination, deterioration, or damage. Substitute with a known-good CCV and check for proper operation. If the problem is corrected, replace CCV 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

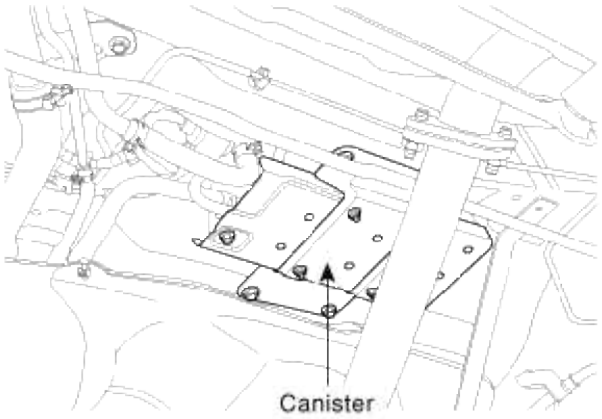
Go to the applicable troubleshooting procedure.

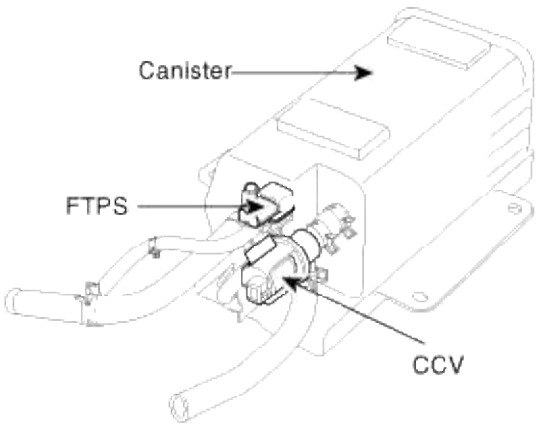
SPECIFICATION

Temp.(°F)		CCV Resistance(Ω)
(°C)	(°F)	
20	68	23~26

Emission Control System > Troubleshooting > P0448

COMPONENT LOCATION





GENERAL DESCRIPTION

The evaporative emissions system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

DTC DESCRIPTION

ECM sets DTC P0448 if the ECM detects that the CCV control line is short to ground or short to battery line.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short in CCV harness • Contact resistance in connectors • Faulty CCV
Enable Conditions	• Battery voltage > 10V	
Threshold Value	• Short to ground or Short to Battery	
Diagnostic Time	• 3 sec.	
MIL On Condition	• 2 Driving Cycles	

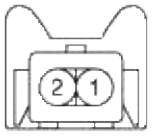
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

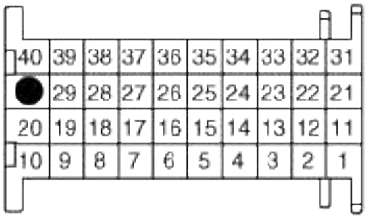
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal C68-4(30)	CCV Operation

[HARNESS CONNECTORS]



F03
PCSV Harness side connector



C68-4
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

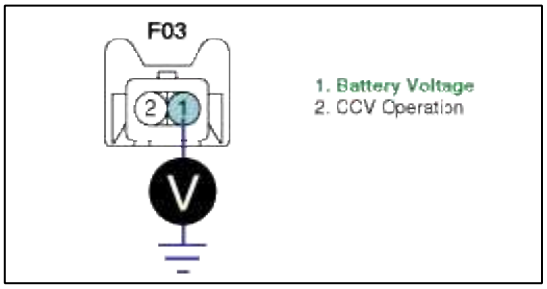
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the CCV harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

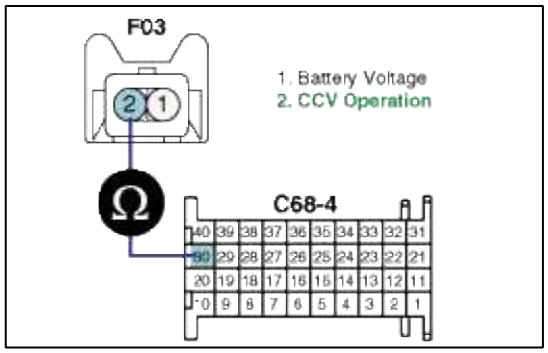
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect ECM connector.
   (3) Measure resistance between terminals 2 of the CCV harness connector and 30 of the ECM harness connector(C68-4).

   Specification : Approx. 0Ω



   (4) Is resistance within the specification?

   YES

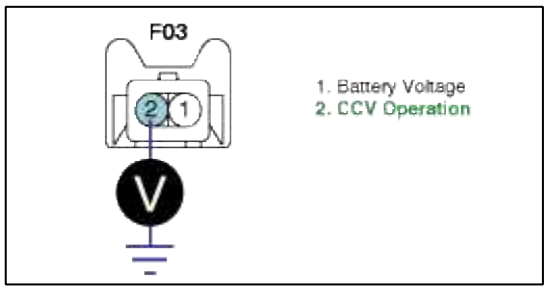
   Go to "Control Circuit Inspection" procedure

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in control circuit
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between terminal 2 of the CCV harness connector and chassis ground

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

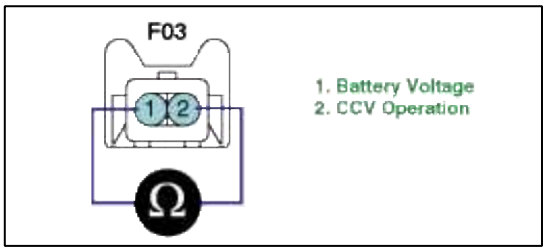
   Repair as necessary and go to "Verification of Vehicle Repair" procedure

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect CCV connector.

3. Measure resistance between terminals 1 and 2 of the CCV connector(Component side).

Specification : Approx. 23~26Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check CCV for contamination, deterioration, or damage. Substitute with a known-good CCV and check for proper operation. If the problem is corrected, replace CCV 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

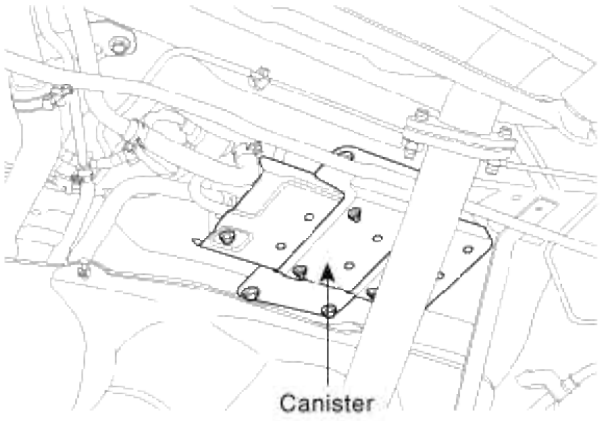
Go to the applicable troubleshooting procedure.

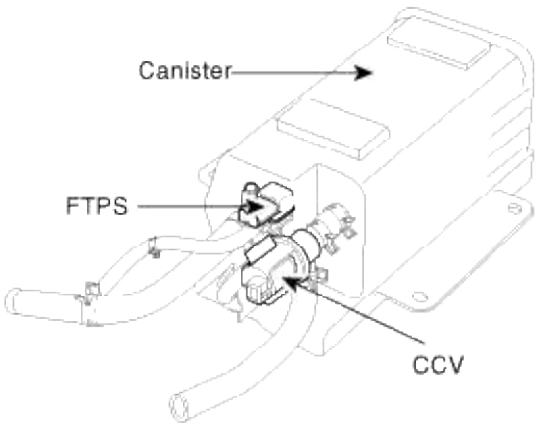
SPECIFICATION

Temp.(°F)		CCV Resistance(Ω)
(°C)	(°F)	
20	68	23~26

Emission Control System > Troubleshooting > P0449

COMPONENT LOCATION





GENERAL DESCRIPTION

The evaporative emissions system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

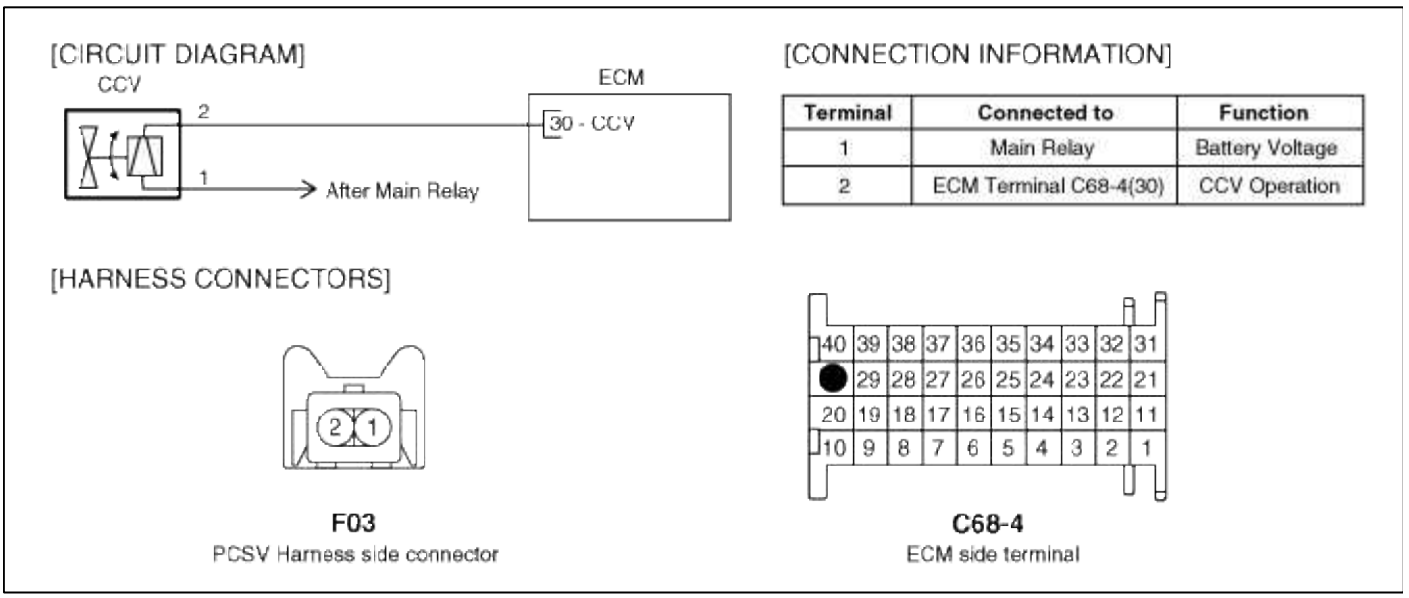
DTC DESCRIPTION

The ECM measures pressure in the fuel tank by means of tank pressure sensor during all engine operating states except engine stop and start. The DTC P0449 is set if pressure is lower than predetermined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor(DTP) signal with underpressure	• Canister Air-Filter contamination • Faulty CCV
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Voltage of differential fuel tank pressure <1.5V	
Diagnostic Time	• 200 sec.	
Fall Safe	• EVAP. emission control function is disabled • EVAP. System monitoring is inhibited • Fuel Tank Pressure Sensor monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

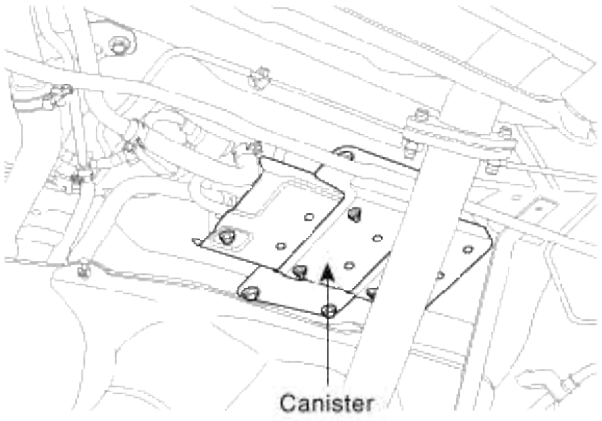
Go to the applicable troubleshooting procedure.

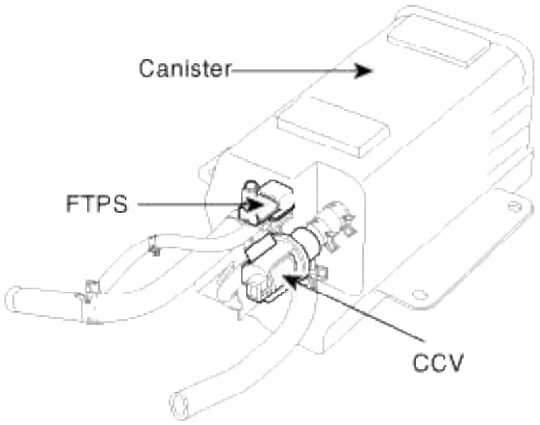
SPECIFICATION

Temp.(°F)		CCV Resistance(Ω)
(°C)	(°F)	
20	68	23~26

Emission Control System > Troubleshooting > P0451

COMPONENT LOCATION





GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

DTC DESCRIPTION

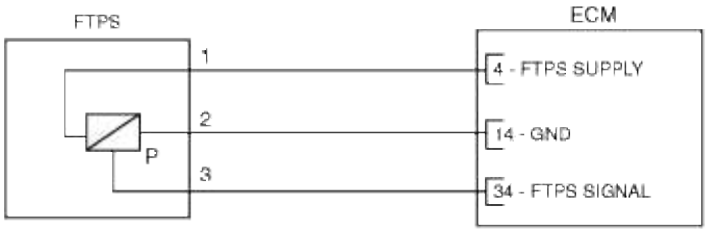
The ECM monitors pressure in the fuel tank by means of Fuel Tank Pressure Sensor (FTPS) during purge control valve opening or closing phase. This monitoring will determine if pressure sensor signal is stuck. The ECM sets DTC P0451 if pressure variation is smaller than the predetermined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check signal oscillations	• Contact resistance in connectors • Faulty FTPS
Enable Conditions	• Minimum time in part load : 90 sec. • Vehicle speed once above threshold : 45km/h(28mph)	
Threshold Value	• Difference between max./min.voltage < 0.015V	
Diagnostic Time	• Immediate	
Fail Safe	• EVAP. System monitoring is inhibited • Fuel Tank Pressure Sensor monitoring is inhibited • Canister close valve monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



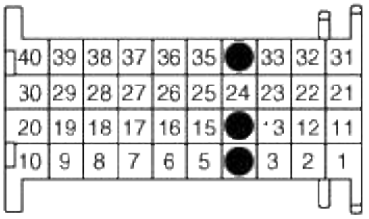
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-4(4)	Reference voltage
2	ECM Terminal C68-4(14)	Sensor ground
3	ECM Terminal C68-4(34)	FPTS Signal

[HARNESS CONNECTORS]

F14

ECTS Harness side connector



C68-4

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

Go to "Fuel Tank Pressure Sensor(FTPS) inspection" procedure

FUEL TANK PRESSURE SENSOR INSPECTION

1. Start engine and install scan tool.
2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification : Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed

A. Approx. 0~2 mmHg(2.5V) at Ig. On
B. Approx. 0 mmHg at 1400rpm
C. Approx. -2 mmHg at 4000rpm

3. Is signal value within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

A. Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.

B. Check for open or short in FTPS harness. Repair as necessary.
If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

NOTE

EVAP. Leakage Test enable conditions
- Following conditions must be fulfilled to start the test.
  1. Engine warm up at Idle Status
  2. No relevant DTC
  3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

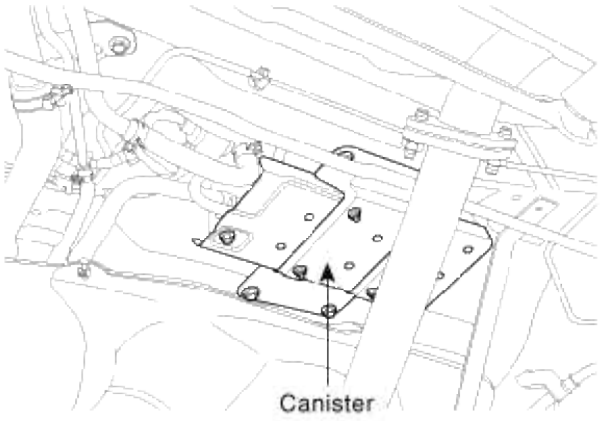
Go to the applicable troubleshooting procedure.

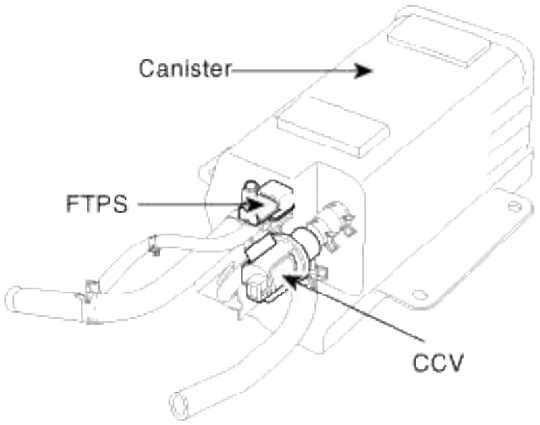
NO

System performing to specification at this time.

Emission Control System > Troubleshooting > P0452

COMPONENT LOCATION





GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

DTC DESCRIPTION

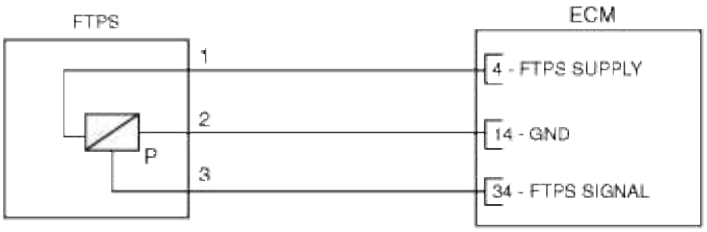
ECM sets DTC P0452 if the ECM detects signal voltage lower than the possible range of a properly operating FTPS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to ground in FTPS harness • Open in FTPS harness • Contact resistance in connectors • Faulty FTPS.
Enable Conditions	• Battery voltage > 11V	
Threshold Value	• Signal voltage <0.35V	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



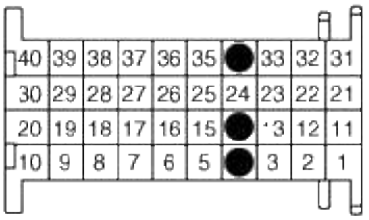
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-4(4)	Reference voltage
2	ECM Terminal C68-4(14)	Sensor ground
3	ECM Terminal C68-4(34)	FPTS Signal

[HARNESS CONNECTORS]

F14

ECTS Harness side connector



C68-4

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

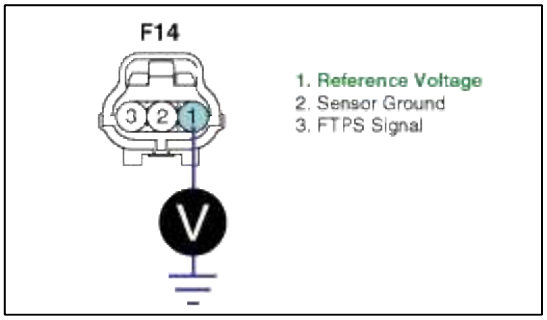
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect FTPS connector.
3. Ignition "ON" & Fngine "OFF".
4. Measure voltage between terminal 1 of the FTPS harness connector and chassis ground.

Specification : Approx. 5V



5. Is voltage within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

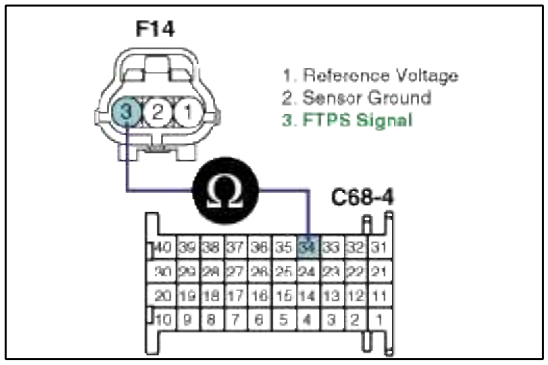
1. Check for open in signal circuit.

(1) Ignition "OFF".

(2) Disconnect ECM connector.

(3) Measure resistance between terminals 3 of the FTPS harness connector and 34 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



(4) Is resistance within the specification?

YES

Go to next step as below.

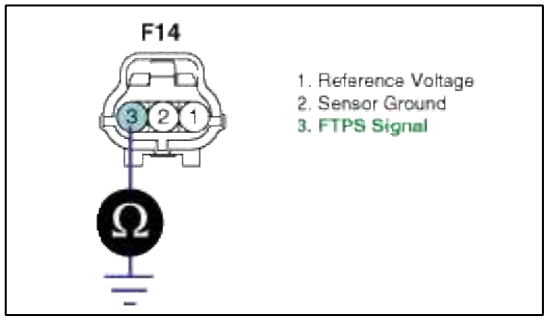
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal circuit

(1) Measure resistance between terminal 3 of the FTPS harness connector and chassis ground

Specification :Infinite



(2) Is resistance within the specification?

YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

FUEL TANK PRESSURE SENSOR INSPECTION

1. Start engine and install scan tool.
2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification : Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed

A. Approx. 0~2 mmHg(2.5V) at Ig. On
B. Approx. 0 mmHg at 1400rpm
C. Approx. -2 mmHg at 4000rpm

3. Is signal value within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

A. Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
B. Check for open or short in FTPS harness. Repair as necessary.
If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

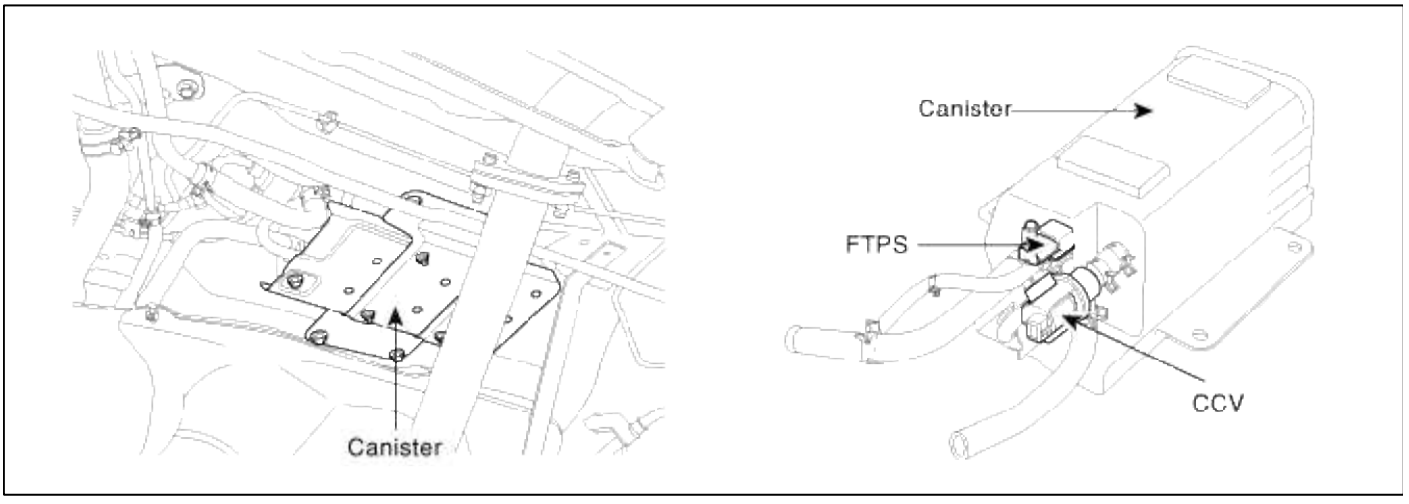
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Emission Control System > Troubleshooting > P0453

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

DTC DESCRIPTION

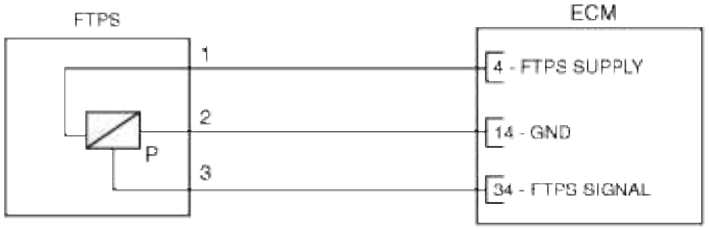
ECM sets DTC P0453 if the ECM detects signal voltage higher than the possible range of a properly operating FTPS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to battery in FTPS harness • Contact resistance in connectors • Faulty FTPS
Enable Conditions	• Battery voltage > 11V	
Threshold Value	• Signal voltage < 4.78V	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



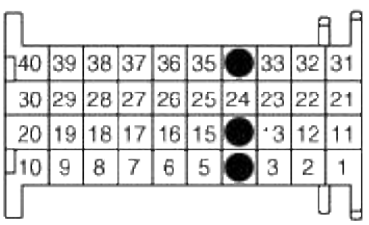
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-4(4)	Reference voltage
2	ECM Terminal C68-4(14)	Sensor ground
3	ECM Terminal C68-4(34)	FPTS Signal

[HARNESS CONNECTORS]

F14

ECTS Harness side connector



C68-4

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

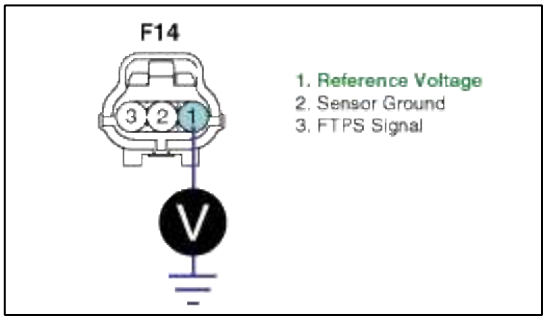
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : Approx. 5V



5. Is voltage within the specification?

YES

Go to "Ground Circuit Inspection" procedure.

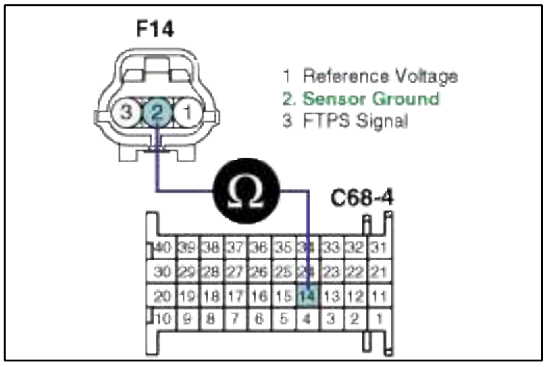
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminals 2 of the FTPS harness connector and 14 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Signal Circuit Inspection" procedure

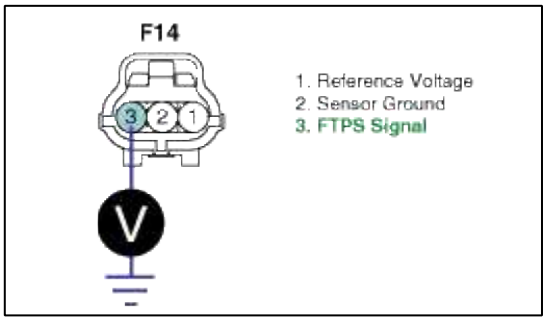
NO

Check for a open/short circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION

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

Specification : Approx. 0V



3. Is voltage within the specification?

(1) YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

FUEL TANK PRESSURE SENSOR INSPECTION

1. Start engine and install scan tool.
2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification : Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed

A. Approx. 0~2 mmHg(2.5V) at Ig. On
B. Approx. 0 mmHg at 1400rpm
C. Approx. -2 mmHg at 4000rpm

3. Is signal value within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

A. Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
B. Check for open or short in FTPS harness. Repair as necessary.
If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

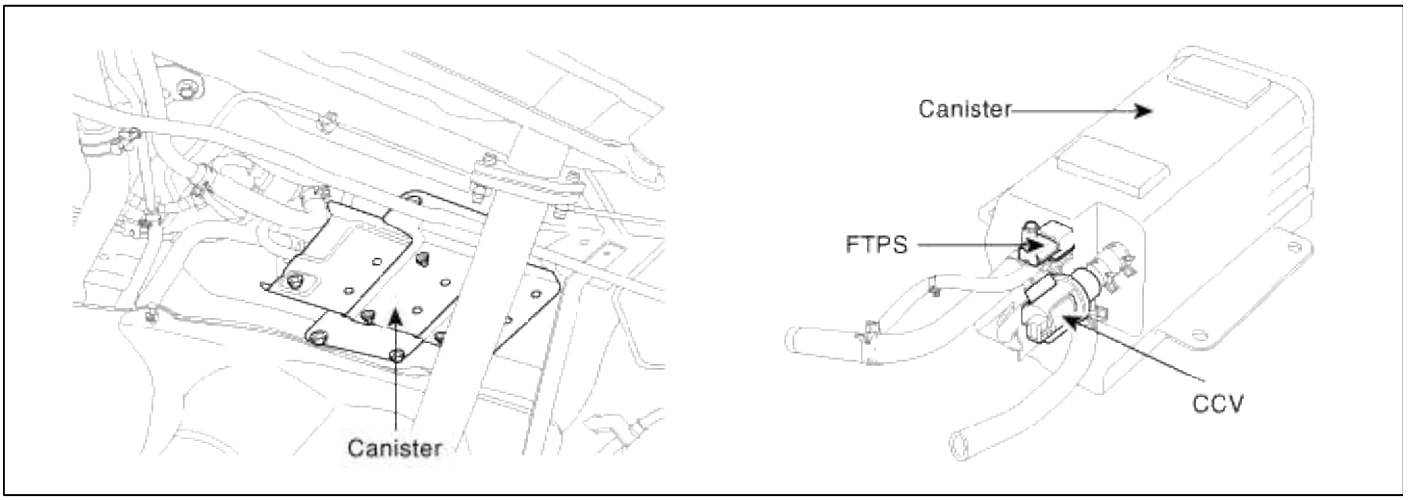
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Emission Control System > Troubleshooting > P0454

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

DTC DESCRIPTION

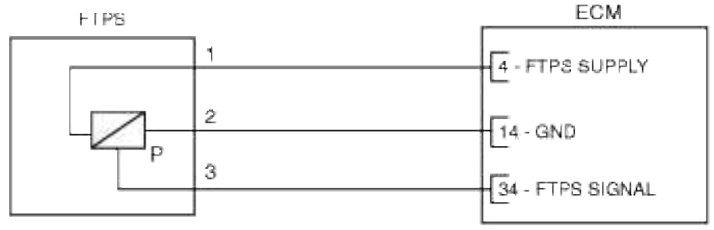
The ECM monitors pressure stability in the fuel tank by means of Fuel Tank Pressure Sensor (FTPS) for predetermined duration just before start the leakage monitoring to detect noise signal of pressure sensor. The ECM sets DTC P0454 if the pressure fluctuation is bigger than predetermined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor signal noise check	• Contact resistance in connectors • Faulty FTPS
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Signal fluctuation > 0.5hPa	
Diagnostic Time	• Immediate	
Fail Safe	• EVAP. System monitoring is inhibited • Fuel Tank Pressure Sensor monitoring is inhibited • Canister close valve monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



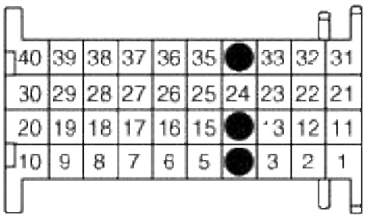
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-4(4)	Reference voltage
2	ECM Terminal C68-4(14)	Sensor ground
3	ECM Terminal C68-4(34)	FPTS Signal

[HARNESS CONNECTORS]

F14

ECTS Harness side connector



C68-4

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

Go to "Fuel Tank Pressure Sensor(FTPS) inspection" procedure

FUEL TANK PRESSURE SENSOR INSPECTION

1. Start engine and install scan tool.
2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification : Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed

A. Approx. 0~2 mmHg(2.5V) at Ig. On
B. Approx. 0 mmHg at 1400rpm
C. Approx. -2 mmHg at 4000rpm

3. Is signal value within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

A. Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
B. Check for open or short in FTPS harness. Repair as necessary.
If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

NOTE

EVAP. Leakage Test enable conditions
- Following conditions must be fulfilled to start the test.
  1. Engine warm up at Idle Status
  2. No relevant DTC
  3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

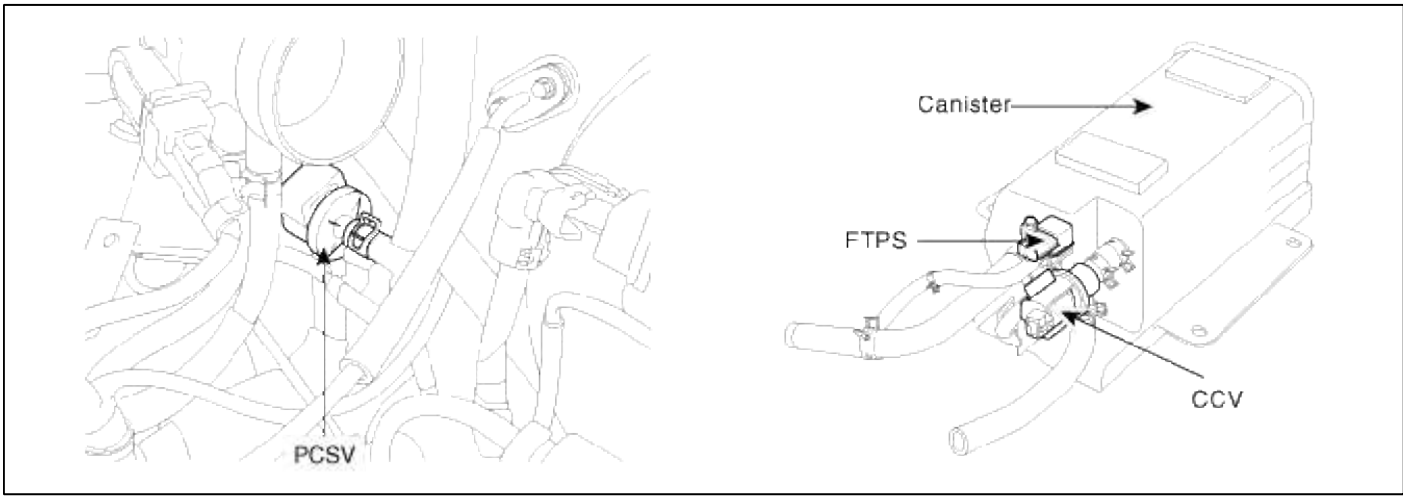
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Emission Control System > Troubleshooting > P0455

COMPONENT LOCATION



GENERAL DESCRIPTION

Due to the increasing ambient temperature of the fuel and the return of unused hot fuel from the engine, fuel vapors are generated in the tank. In order to control the release of these vapors to the atmosphere, the evaporative emissions control system is used. The evaporative emission control system reduces hydrocarbon (HC) emissions by trapping fuel tank vapors until they can be burned in the combustion process. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold. The evaporative emission control system is made up of a fuel tank that can be completely sealed from outside air, a Fuel Tank Pressure Sensor (FTPS), a Canister Close Valve (CCV) that seals the canister from the outside air, a canister filled with activated charcoal granules, a Purge Control Solenoid Valve (PCSV). The evaporative emission system can be checked for leaks by sealing the system off from the outside air, creating a vacuum, and monitoring if the system can hold that vacuum sufficiently for a set amount of time. If it cannot, a leak exists somewhere in the system.

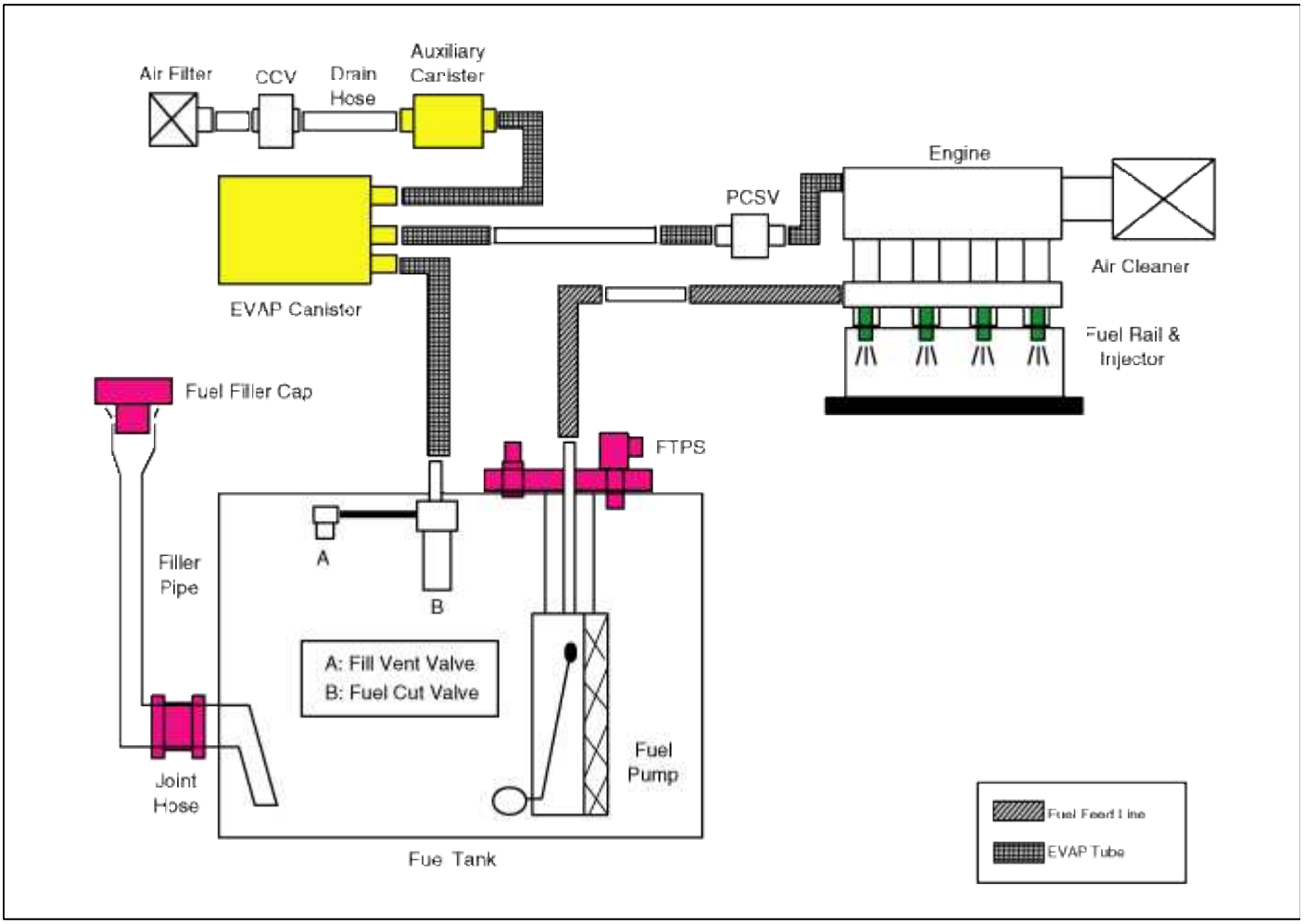
DTC DESCRIPTION

The ECM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. This vacumm generation phase will determine if there is a large leak like tank cap open or canister shut off valve (CCV) stuck open. The ECM sets DTC P0455 if the pressure in the fuel tank does not drop as low as predetermined threshold during predetermined maximum vacuum generation period.
If the same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor(DTP) signal with underpressure	• Leakage in EVAP. System
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Pressure fluctuation in fuel tank >-12hPa for 13 seconds during underpressure period	
Diagnostic Time	• 24 sec. in idle	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

> NOTE
>
> EVAP. Leakage Test enable conditions
> - Following conditions must be fulfilled to start the test.
>
> 1. Engine warm up at Idle Status
> 2. No relevant DTC
> 3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

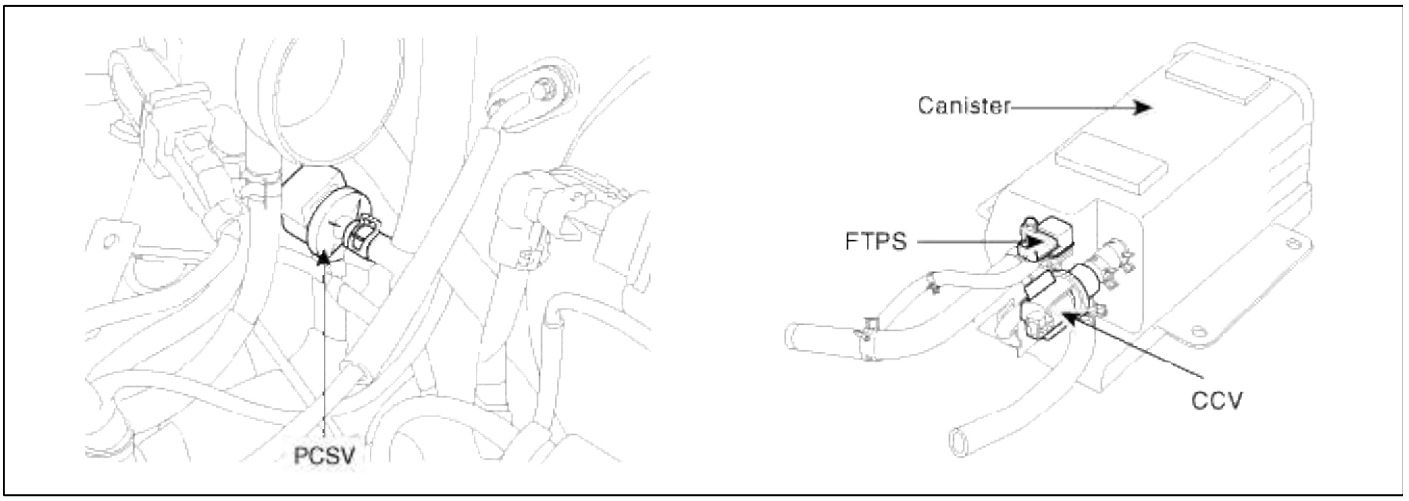
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Emission Control System > Troubleshooting > P0456

COMPONENT LOCATION



GENERAL DESCRIPTION

Due to the increasing ambient temperature of the fuel and the return of unused hot fuel from the engine, fuel vapors are generated in the tank. In order to control the release of these vapors to the atmosphere, the evaporative emissions control system is used. The evaporative emission control system reduces hydrocarbon (HC) emissions by trapping fuel tank vapors until they can be burned in the combustion process. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold. The evaporative emission control system is made up of a fuel tank that can be completely sealed from outside air, a Fuel Tank Pressure Sensor (FTPS), a Canister Close Valve (CCV) that seals the canister from the outside air, a canister filled with activated charcoal granules, a Purge Control Solenoid Valve (PCSV). The evaporative emission system can be checked for leaks by sealing the system off from

the outside air, creating a vacuum, and monitoring if the system can hold that vacuum sufficiently for a set amount of time. If it cannot, a leak exists somewhere in the system.

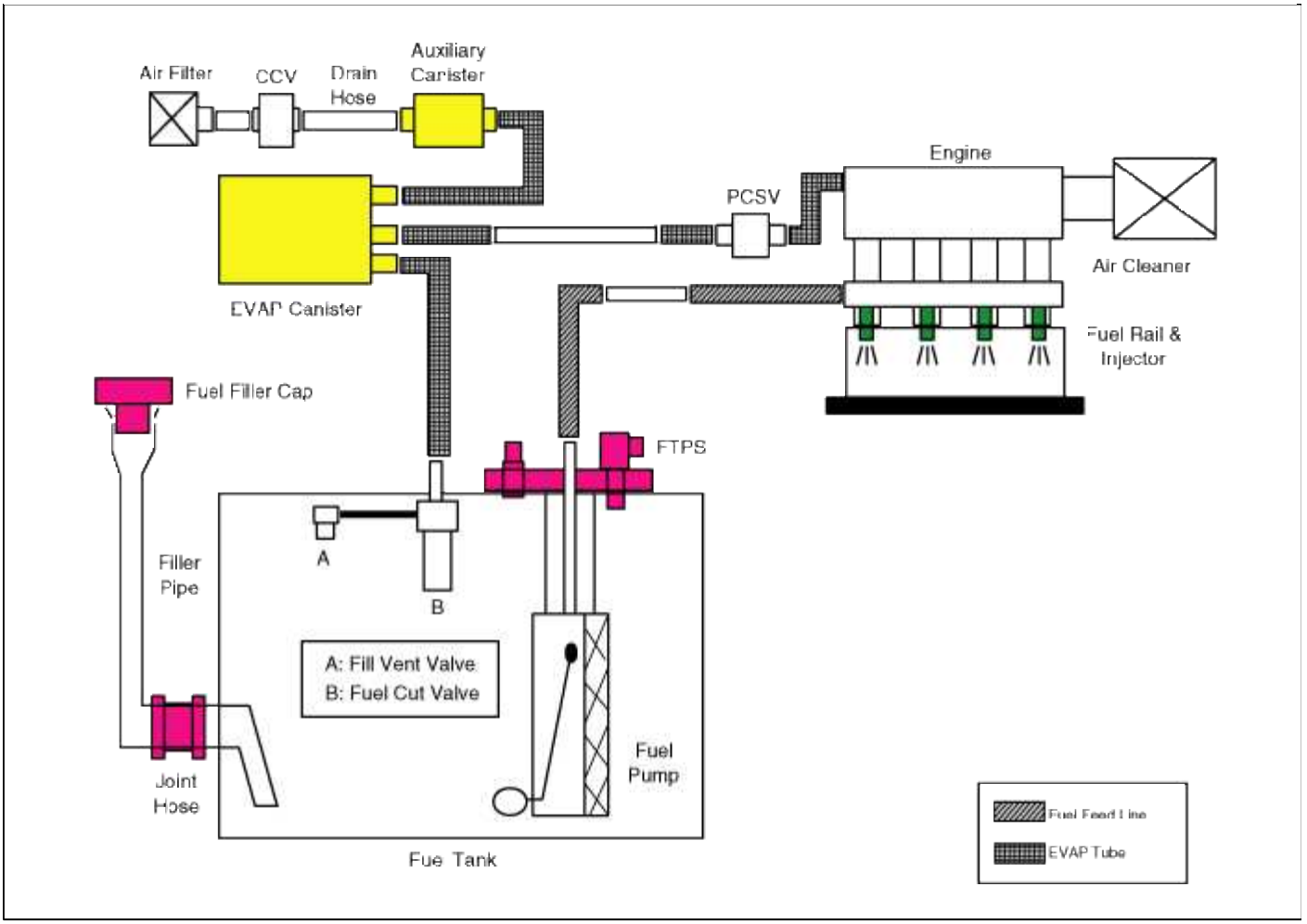
DTC DESCRIPTION

The ECM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. After vacuum generation, the ECM measures pressure differential curve in the fuel tank and sets DTC P0442 or P0456 if the vacuum generated within a monitoring period increases above a defined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor (DTP) signal with underpressure	• Leakage in EVAP system line • Defective CCV,PCSV or FTPS
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• 0.41mm < leak.diameter <0.8mm	
Diagnostic Time	• 39 sec. in idle	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

> NOTE
>
> EVAP. Leakage Test enable conditions
> - Following conditions must be fulfilled to start the test.
>
> 1. Engine warm up at Idle Status
> 2. No relevant DTC
> 3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Engine Electrical System

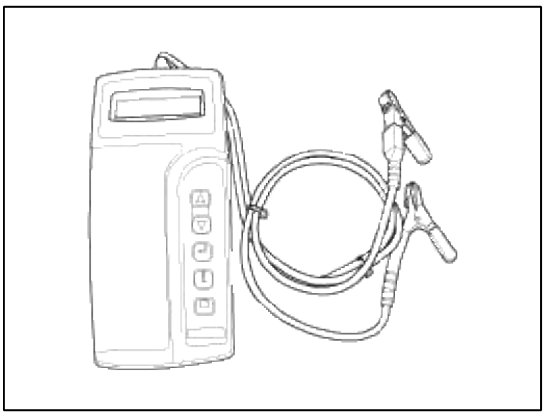
Engine Electrical System > General Information > General Information

THE MICRO 570 ANALYZER

The MICRO 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

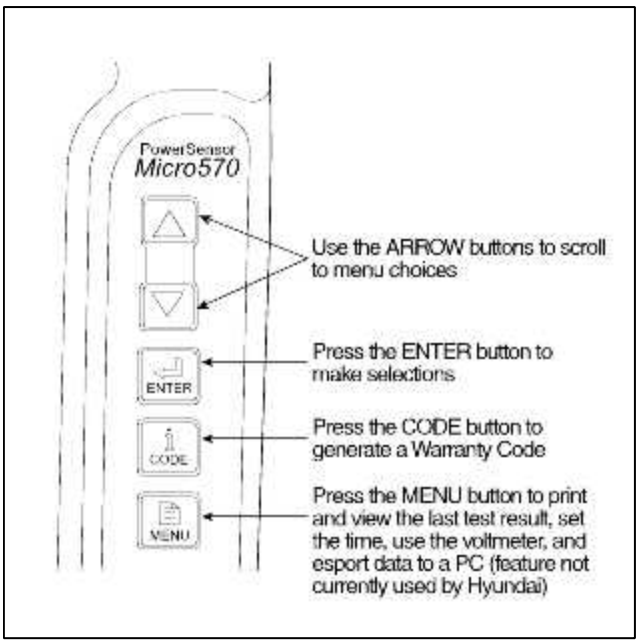
CAUTION

Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.



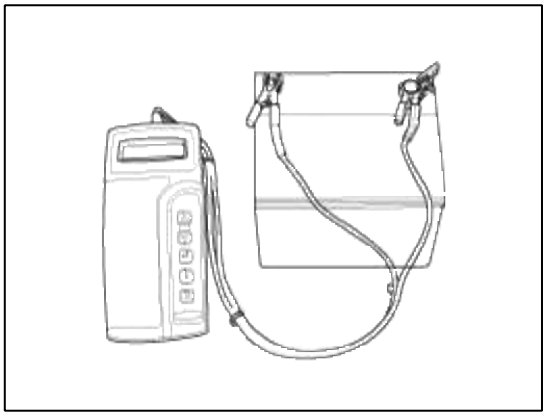
KEYPAD

The MICRO570 button on the key pad provide the following functions :



BATTERY TEST PROCEDURE

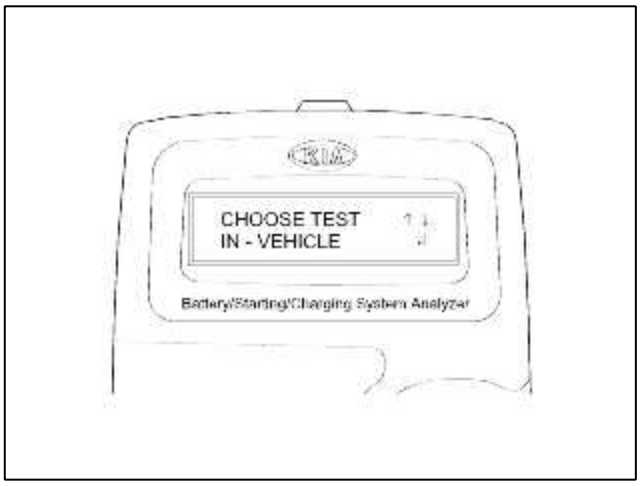
1. Connect the tester to the battery.
   A. Red clamp to battery positive (+) terminal.
   B. Black clamp to battery negative (-) terminal.



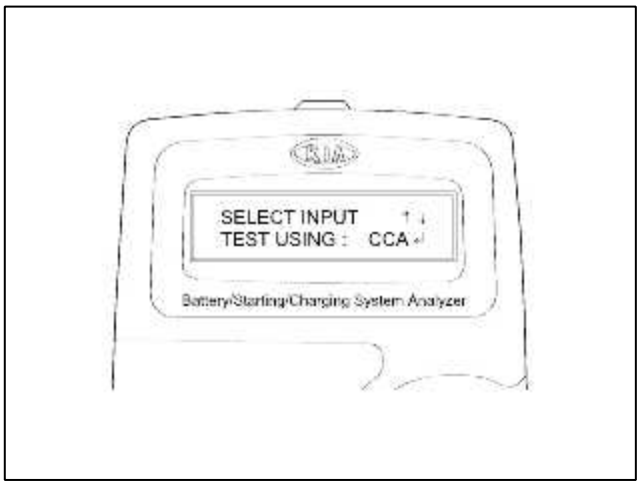
CAUTION

Connect clamps securely. If "CHECK CONNECTION" message is displyed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN A VEHICLE" or "OUT OF A VEHICLE".
   Make your selection by pressing the arrow buttons; then press ENTER.



3. Choose either CCA or CCP and press the ENTER button.



NOTE

- CCA : Cold cranking amps, is an SAE specification for cranking batteried at 0°F (-18°C).
- CCP : Cold cranking amps, is an SAe specification for korean manufacturer'sfor cranking batteried at 0°F (-18°C).

4. Set the CCA value displyed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.

NOTE

The battery ratings(CCA) displyed on the tester must be identical to the ratings marked on battery label.

5. The tester (Micro570) displays battery test results including voltage and battery ratings.
   A relevant action must be given according to the test results by referring to the battery test results as shown in the table below.

6. To conduct starter test, continuously, press ENTER.

BATTERY TEST RESULTS

RESULT ON PRINTER	REMEDY
Good battery	No action is required
Good recharge	Battery is in a good state Recharge the battery and use
Charge & Retest	Battery is not charged properly → Charge and test the battery again (Failure to charge the battery fully may read incorrect measurement value)
Replace battery	→ Replace battery and recheck the charging system. (Improper connection between battery andvehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery)
Bad cell-replace	→ Charge and retest the battery. And than, test results may cause "REPLACE BATTERY", replacebattery and recheck the charging system

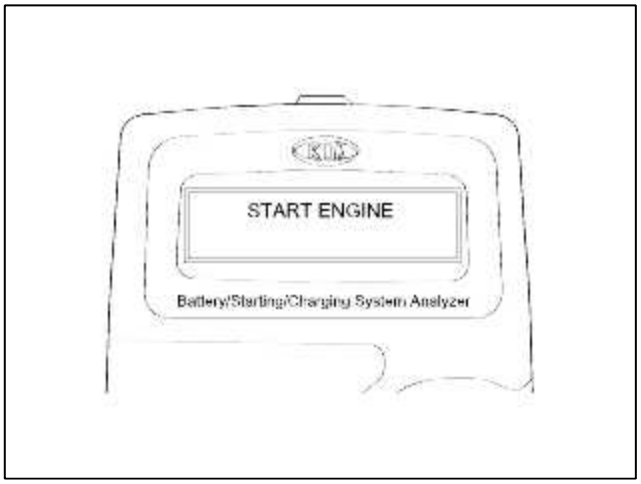
WARNING

Whenever filing a claim for battery, the print out of the battery test results must be attached.

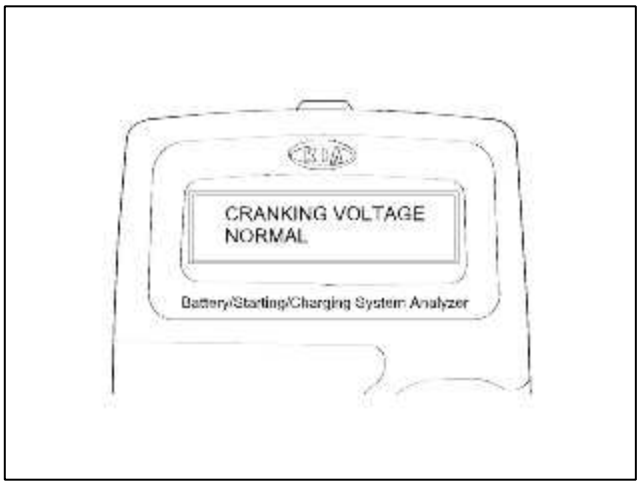
STARTER TEST PROCEDURE

1. After the battery test, press ENTER immediately for the starter test.

2. After pressing ENTER key, start the engine.



3. Cranking voltage and starter test results will be displayed on the screen.
   Take a relevant action according to the test results by referring to the starter test results as given below.



4. To continue charging system test, press ENTER.

STARTER TEST RESULTS

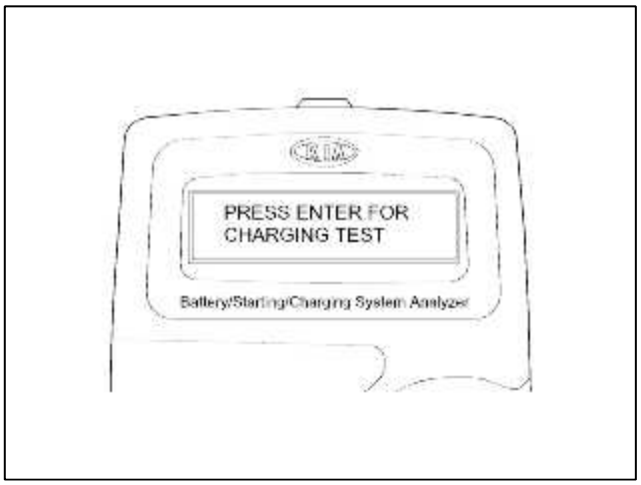
RESULT ON PRINTER	REMEDY
Cranking voltage normal	System shows a normal starter draw
Cranking voltage low	Cranking voltage is lower than normal level → Check starter
Charge battery	The state of battery charge is too low to test → Charge the battery and retest
Replace battery	→ Replace battery If the vehicle is not started though the battery condition of "Good and fully charged" is displayed. → Check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. → If the engine does crank, check fuel system.

NOTE

When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.

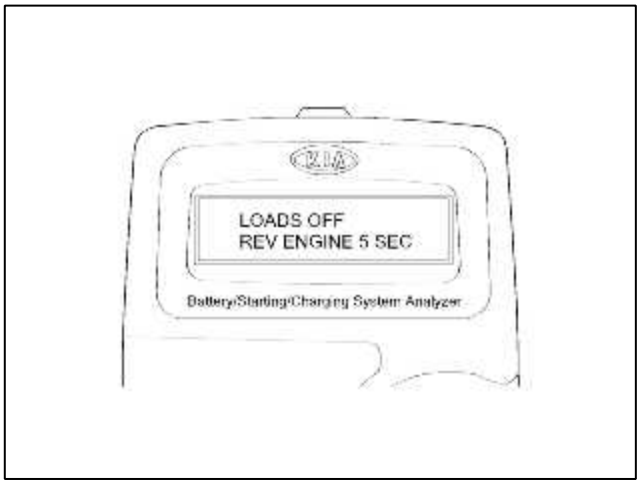
CHARGING SYSTEM TEST PROCEDURE

1. Press ENTER to begin charging system test.

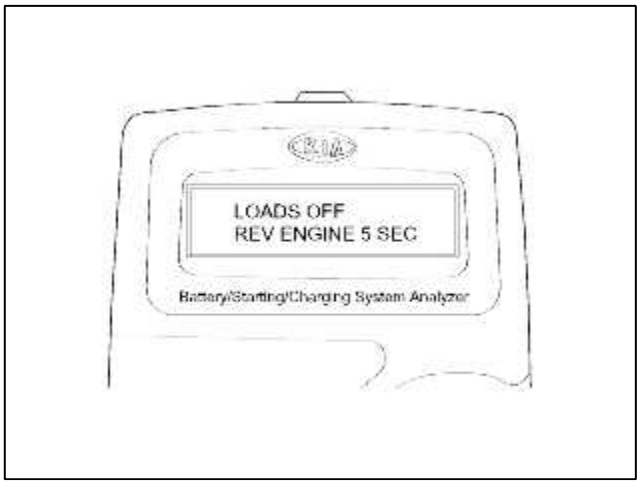


2. If ENTER button is pressed, the tester displays the actual voltage of alternator.
   Press ENTER to test the charging system.

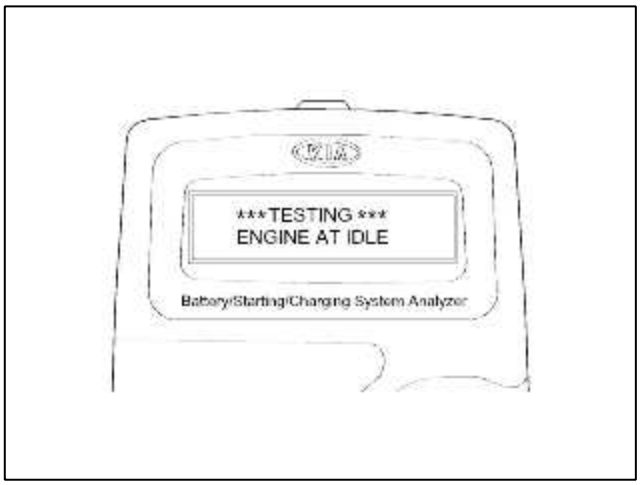
3. Turn off all electrical load and rev engine for 5 seconds with pressing the accelerator pedal.



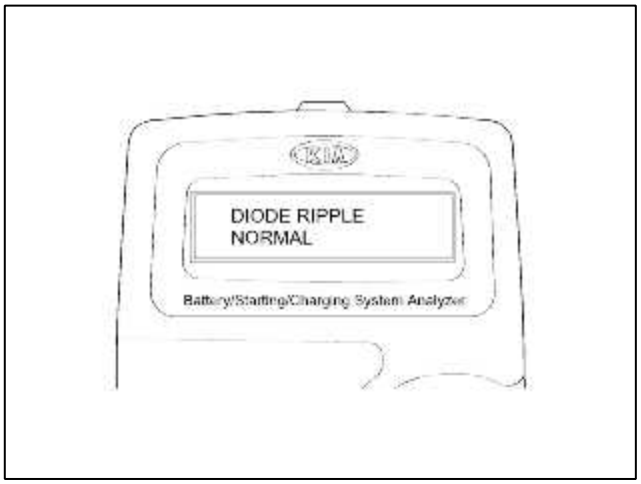
4. Press ENTER.



5. The MICRO 570 analyzer charging system output at idle for comparision to other readings.



6. Take a relevant action according to the test results by referring to the table below after shutting off the engine and disconnect the tester clamps from the battery.



CHARGING SYSTEM TEST RESULTS

RESULT ON PRINTER	REMEDY
Charging system normal/Diode ripple normal	Charging system is normal
No charging voltage	Alternator does not supply charging current to battery → Check belts, connection between alternator and battery Replace belts or cable or alternator as necessary
Low charging voltage	Alternator does not supply charging current to battery and electrical load to system fully → Check belts and alternator and replace as necessary
High charging voltage	The voltage from alternator to battery is higher than normal limit during voltage regulating. → Check connection and ground and replace regulator as necessary → Check electrolyte level in the battery
Excess ripple detected	One or more diodes in the alternator is not functioning properly → Check alternator mounting and belts and replace as necessary

Engine Electrical System > General Information > Troubleshooting

TROUBLESHOOTING

IGNITION SYSTEM

Symptom	Suspect Area	Remedy (See Page)
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch Ignition coil Spark plugs Ignition wiring disconnected or broken Spark plug cable	Inspect See page EE-19 See page EE-17 Inspect See page EE-17
Rough idle or stalls	Ignition wiring Ignition coil Spark plug cable	Inspect See page EE-19 See page EE-17
Engine hesitates/poor acceleration	Spark plugs and spark plug cable Ignition wiring	See page EE-17 Inspect
Poor mileage	Spark plugs and spark plugs cable	See page EE-17

CHARGING SYSTEM

Symptom	Suspect Area	Remedy (See Page)
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 connections See page EE-27
Charging warning indicator does not go out with engine running (Battery requires frequent recharging)	Drive belt loose or worn Battery cables loose, corroded or worn Fuse blown Fusible link blown Electronic voltage regulator or generator Wiring	See page EE-23, 36 See page EE-39 Check fuses Replace fusible link See page EE-27 Repair wiring
Engine hesitates/poor acceleration Overcharge	Drive belt loose or worn Wiring connection loose or open circuit Fusible link blown Poor grounding Electronic voltage regulator or generator Worn battery Electronic voltage regulator Voltage sensing wire	See page EE-23, 36 Tighten loose connection or repair wiring Replace fusible link Repair See page EE-27 Replace battery See page EE-27 Repair wire

STARTING SYSTEM

Symptom	Suspect Area	Remedy (See Page)
Engine will not crank	Battery charge low Battery cables loose, corroded or worn out Transaxle range switch (Vehicle with automatic transaxle only) Fusible link blown Starter motor faulty Ignition switch faulty	Charge or replace battery Repair or replace cables See page TR group-automatic transaxle Replace fusible link See page EE-44 Inspect
Engine cranks slowly	Battery charge low Battery cables loose, corroded or worn out Starter motor	Charge or replace battery Repair or replace cables See page EE-44
Starter keeps running	Starter motor Ignition switch	See page EE-44 Inspect
Starter spins but engine will not crank	Short in wiring Pinion gear teeth broken or starter motor Ring gear teeth broken	Repair wiring See page EE-44 See page EM group-fly wheel

CRUISE CONTROL SYSTEM

NOTE

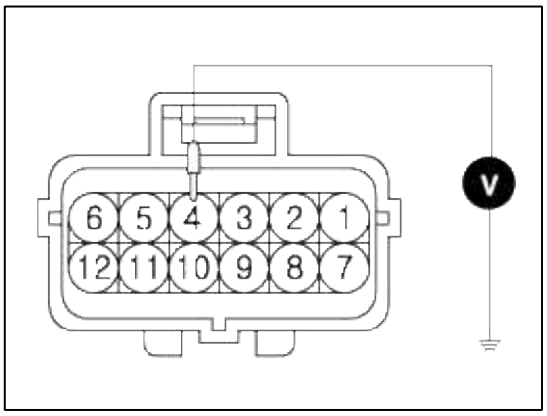
Before troubleshooting :
- Check the ECM(10A), Horn(10A), ECU #3(10A) and ECU B+(15A) fuse in the under - hood fuse/relay box.
- Check that the horn sounds.
- Check the tachometer to see if it works properly.

Symptom	Suspect Area	See Page
Cruise control cannot be set	Remocon switch Brake switch A/T gear position switch Cruise control unit	See page EE-57 See page EE-58 See page TR group-automatic transaxle See page EE-8
Cruise control cannot be set but indicator light does not go on	Dimming circuit in gauge Cruise control unit	See page EE-8 See page EE-8
Cruise speed is noticeably higher or lower than what was set	Vehicle speed sensor Cruise control unit and actuator cable deflection Cruise control unit	See page TR group-automatic transaxle See page EE-58 See page EE-8
Excessive overshooting or undershooting when trying to set speed	Cruise control unit and actuator cable deflection Vehicle speed sensor Cruise control unit	See page EE-58 See page TR group-automatic transaxle See page EE-8
Speed fluctuation on a flat road with cruise control set	Vehicle speed sensor Cruise control unit and actuator cable deflection Cruise control unit	See page TR group-automatic tranxaxle See page EE-58 See page EE-8

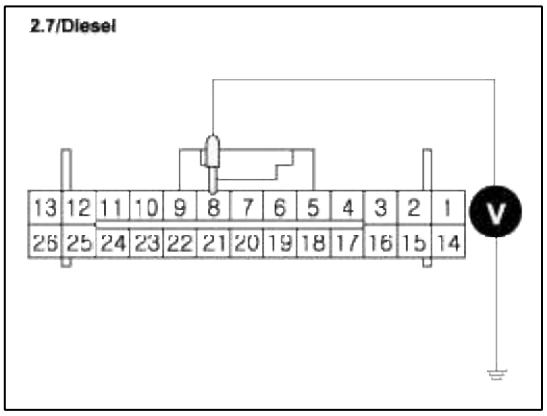
Vehicle does not decelerate or accelerate accordingly when SET/RESUME/CANCEL button is pushed	Remocon switch Cruise control unit	See page EE-57 See page EE-8
Cruise control does not cancel when shift lever is moved to N position (A/T)	A/T gear position switch Cruise control unit	See page TR group-automatic tranxaxle See page EE-8
Set speed is not cancelled when brake pedal is pushed	Brake switch Cruise control unit	See page EE-58 See page EE-8
Cruise control will not cancel when main switch is pushed OFF	Remocon switch Cruise control unit	See page EE-57 See page EE-8
Cruise control will not cancel when CANCEL button is pushed	Remocon switch Cruise control unit	See page EE-57 See page EE-8
Set speed will not resume when RESUME button (with main switch on, when set speed is temporarily cancelled)	Remocon switch Cruise control unit	See page EE-57 See page EE-8
The transmission shifts down slower than normal when going up a hill with the cruise control on (A/T)	Troubleshooting the cruise control communication circuit	See page EE-8

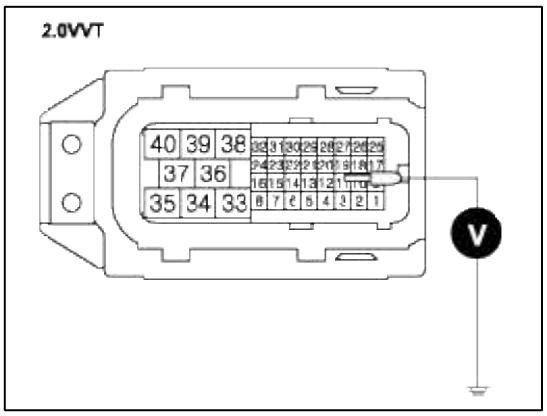
CRUISE CONTROL COMMUNICATION CIRCUIT TROUBLESHOOTING (A/T)

1. Start the engine.
2. Turn on the cruise control main switch, then drive the vehicle to speeds over 25 mph (40km/h) with the cruise control.
   Does the cruise control operate ?
   - Go to step 3.
   - Check the cruise control unit or cruise control actuator.
3. Measure the voltage between the O/D control terminal of the cruise control unit connector and ground.
   Is there approx. 1V?
   - Go to step 4.
   - Replace the cruise control unit.



4. Measure the voltage between the cruise control terminal of the TCM(or PCM) connector and ground.





Is there approx. 1V?

- Check for loosen connectors. If necessary replace the TCM and recheck. (See Page TR group-automatic transaxle)
- Repair short or open in the wire between the TCM (or PCM) terminal and cruise control unit.

Engine Electrical System > General Information > Specifications

SPECIFICATION

IGNITION SYSTEM

Item			Specifications	
			2.7	2.0
Ignition coil	Type		Mold coil type	Mold coil type
	Primary resistance		0.96 ± 10%(Ω)	0.58 ± 10%(Ω)
	Secondary resistance		12.5 ± 15%(kΩ)	8.8 ± 15%(kΩ)
Spark plugs	Unleaded	NGK	IFR5G-11	PFR5N-11
		CHAMPION	-	RC10PYPB4
	Gap		1.0 mm ~ 1.1 mm	

STARTING SYSTEM

Item			Specifications	
			2.7	2.0
Starter	Type		Reduction drive (with planetary gear)	
	Rated voltage		12V, 1.2KW	12V, 1.2KW
	No. of pinion teeth		8	8
	No-load charasteristics	Voltage	11V	11V
		Amperage	90A, MAX	90A, MAX
		Speed	2,800rpm, MIN	3,000rpm, MIN
	Commutator diameter	Standard	29.4 mm (1.157 in.)	
		Limit	28.4 mm (1.118 in.)	
	Undercut depth	Standard	0.5 mm (0.02 in.)	
		Limit	0.2 mm (0.008 in.)	

CHARGING SYSTEM

Item		Specifications	
		2.7	2.0
Alternator	Type	Battery voltage sensing	
	Rated voltage	12V, 120A	13.5V, 90A
	Speed	1,000 ~ 18,000 rpm	
	Voltage regulator	Electronic built-in type	
	Regulator setting voltage	14.55 ± 0.2V	14.4 ± 0.3V
	Temperrature compensation	-3.5 ± 1mV/°C	-10 ± 3mV/°C
Battery	Type	MF 68 AH	MF 60 AH
	Cold cranking amperage at-18°C (0°F)	600A	550A
	Reserve capacity	113min	92min
	Specific gravity at 20°C (77°F)	1.280 ± 0.01	1.280 ± 0.01

NOTE

- 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.
- REVERSE 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°F)

AUTO CRUISE CONTROL SYSTEM

Items	Specification
Setting error	Within ± 1.5Km/h on level road
Vehicle speed memory variation	No variation
Setting time	0.1sec max.
Resuming time	0.1sec max.
Minimum operating speed	40 ± 2Km/h
Cancel speed range	15 ± 2Km/h
Maximum memorized speed	160 ± 2Km/h
Pulling force	127N(13Kgf)
Main switch serial resistance value	3.9kΩ ± 1%
Command switch serial resistance value	SET switch : 220Ω ± 1%
	RESUME switch : 910Ω ± 1%

TIGHTENING TORQUE

Items	Nm	kg·cm	lb-ft
Generator terminal (B+)	5 ~ 7	50 ~ 70	3.6 ~ 5.1
Starter motor terminal (B+)	10 ~ 12	100 ~ 120	7.3 ~ 8.8
Battery terminal	4 ~ 6	40 ~ 60	2.9 ~ 4.3
Spark plug	20 ~ 30	200 ~ 300	15 ~ 22

Engine Electrical System > Ignition System > Description and Operation

DESCRIPTION

Engine Electrical System > Ignition System > Repair procedures

ON-VEHICLE INSPECTION

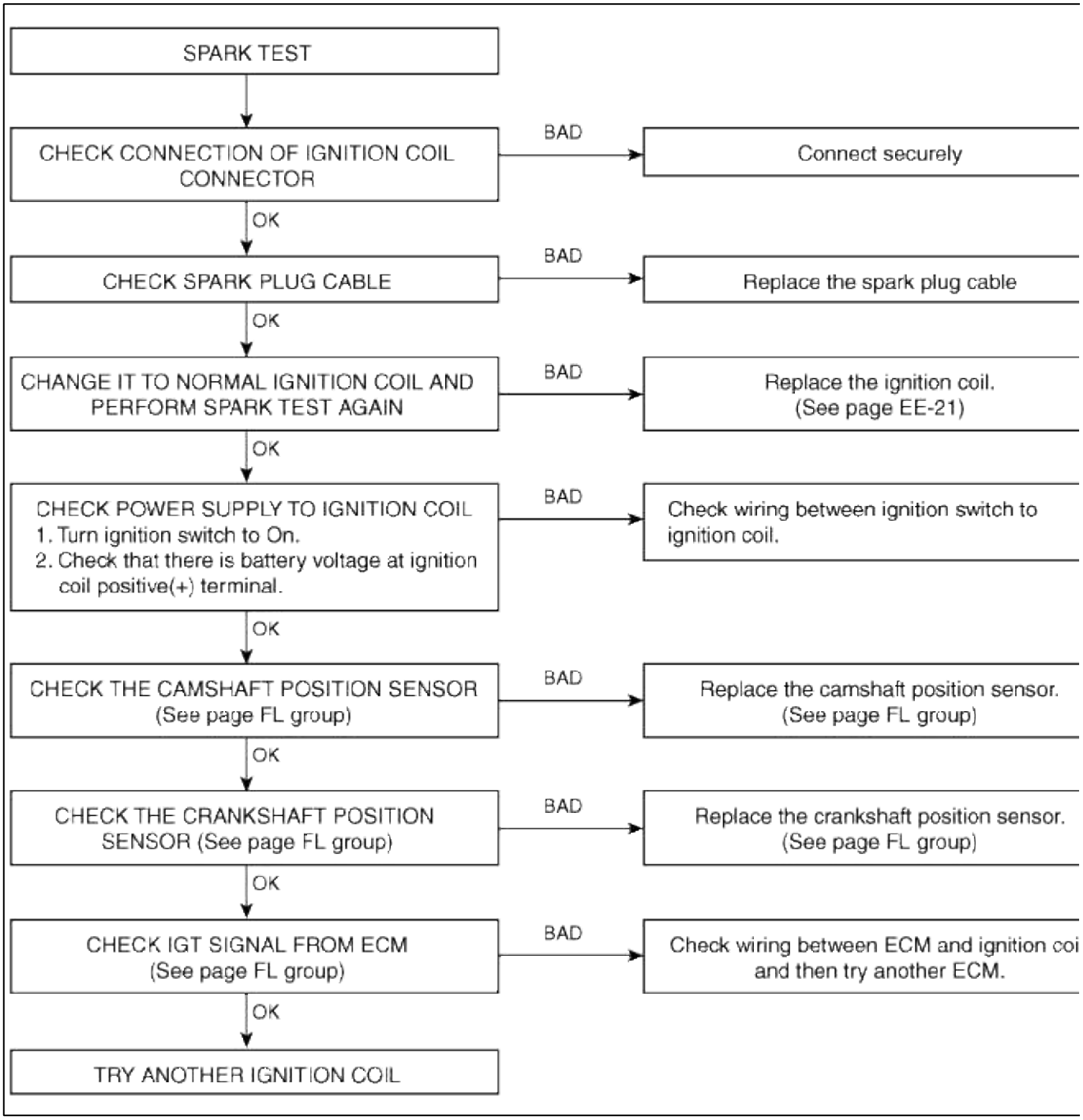
INSPECT SPARK TEST

1. Remove the spark plug cable.
2. Using a spark plug socket, remove the spark plug.
3. Remove the ignition coil.
4. Install the spark plugs to each spark plug cable.
5. Ground the spark plugs.

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

NOTE

To prevent gasoline from being injected from injectors during this test, crank the engine for no more then 5~10 seconds at time.



7. Using a spark plug socket, install the spark plugs.
8. Install the spark plug cable and ignition coil.

INSPECT SPARK PLUG AND SPARK PLUG CABLE

2.0

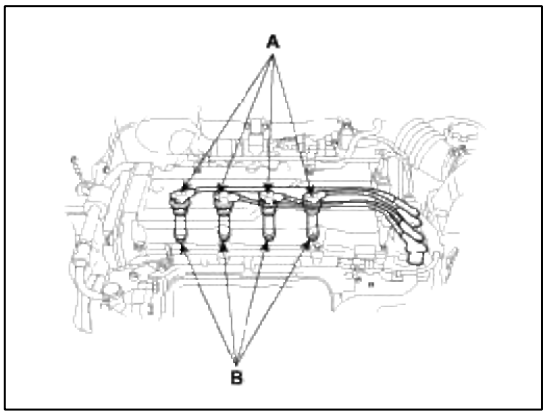
1. Remove the spark plug cable(A).

NOTE

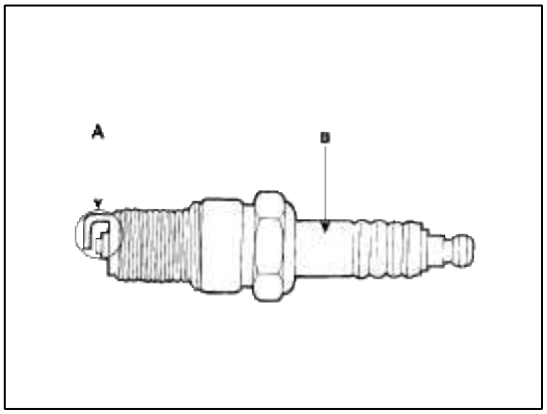
When removing the spark plug cable, pull on the spark plug cable boot (not the cable), as it may be damaged.

2. Using a spark plug socket, remove the spark plug(B).

> CAUTION
>
> Be careful that no contaminats enter through the spark plug holes.

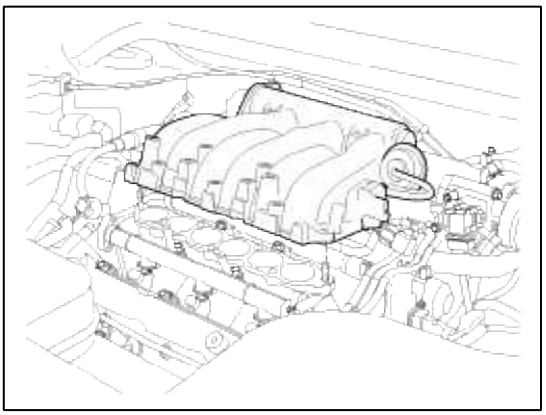


3. Inspect the electrodes(A) and ceramic insulator(B).



2.7

1. Remove the engine cover.
2. Disconnect the VIS actuator connectors and injector connectors.
3. Remove the accelerator cable.
4. Remvoe surge tank sub assembly.



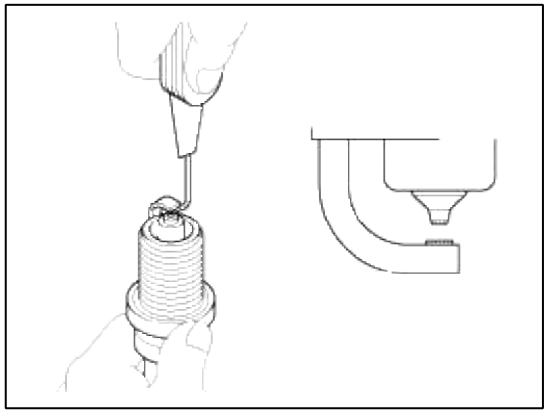
5. Remove the spark plug cable.
6. Remvoe the spark plug.
7. Inspect the electrodes and ceramic insulator.

1. **INSPECTION OF ELECTRODES**

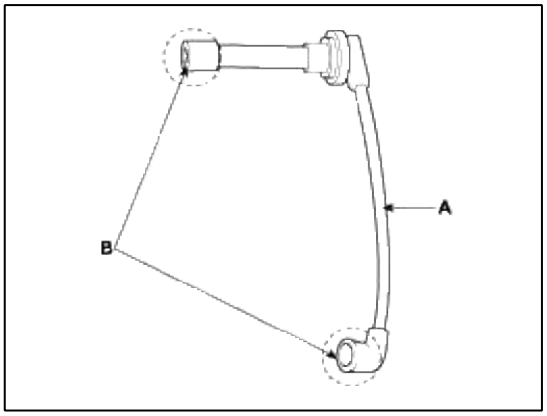
CONDITION	DARK DEPOSITS	WITHE DEPOSITS
DESCRIPTION	- Fuel mixture too rich - Low air intake	- Fuel mixture too lean - Advanced ignition timing - Insufficient plug tightening

A. Check the electrode gap(A).

Standard (New)
1.0~1.1 mm (0.039~0.043 in.)

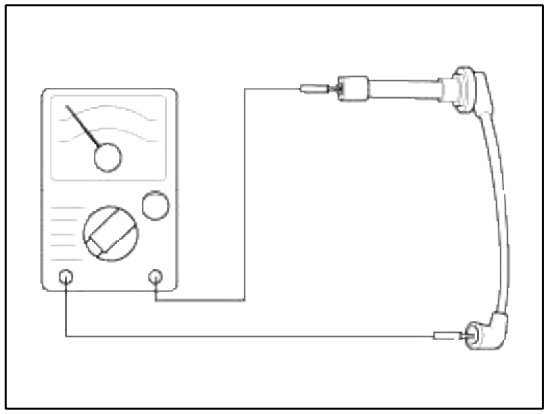


B. Carefully remove the spark plug cable by pulling on the rubber boots(A).
Check the condition of the spark plug cable terminals(B), if any terminal is corroded, clean it, and if it broken or distorted, replace the spark plug cable.



C. Connect the ohmmeter probes and measure resistance.

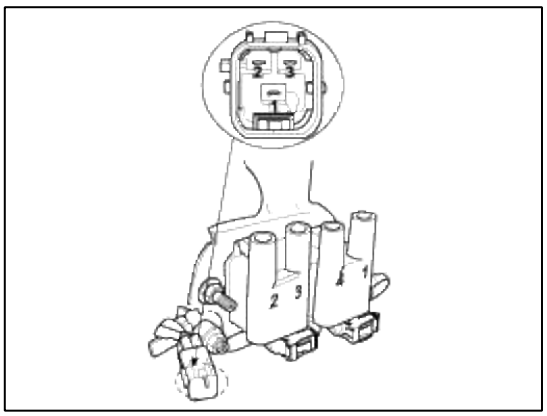
RESISTANCE : 5.6KΩ/m ± 20%



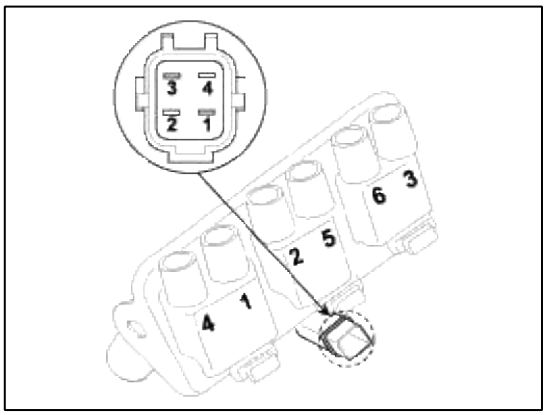
D. Resistance should not be higher than 10KΩ per meter of cable.
If resistance is higher, replace the cable.

INSPECT IGNITION COIL

1. Measure the primary coil resistance between terminals 1-2 and 1-3.



Measure the primary coil resistance between terminals 1-4, 2-4 and 3-4.



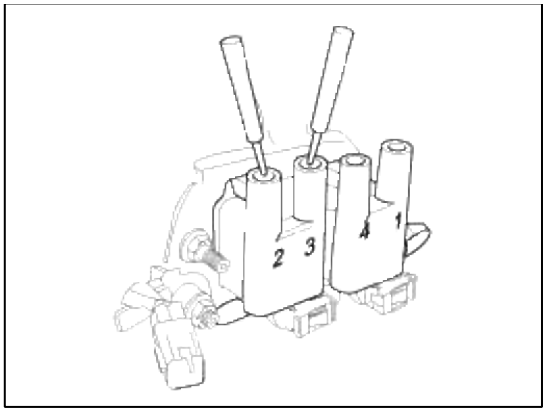
Standard value :
0.58Ω ± 10% (2.0)
0.96Ω ± 10% (2.7)

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

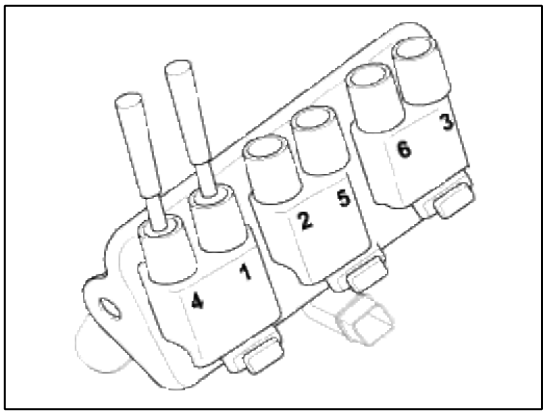
Standard value :
8.8kΩ ± 15% (2.0)
12.5kΩ ± 15% (2.7)

CAUTION

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



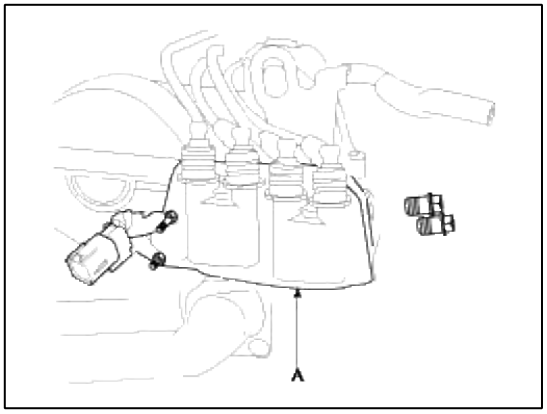
Measure the secondary coil resistance between the high-voltage terminals for the No.1 and No.4 cylinders, No.2 and No.5 cylinders and No.3 and No.6 cylinders.

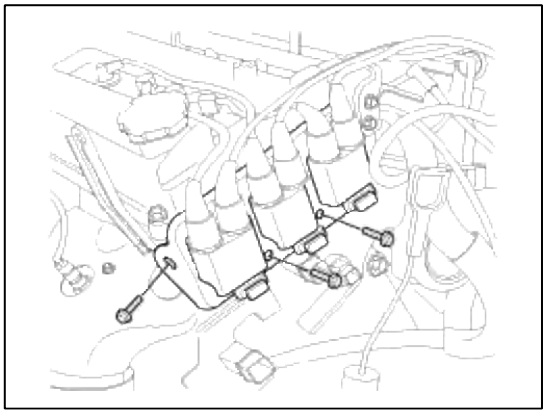


REPLACEMENT

IGNITION COIL

1. Remove the engine cover.
2. Disconnect the spark plug cable and connector.
3. Remove the ignition coil(A).
4. Installation is the reverse of removal.





CRANKSHAFT POSITION SENSOR

1. Disconnect the crankshaft position sensor connector.
2. Remove the crankshaft position sensor(A).

Engine Electrical System > Charging System > Description and Operation

DESCRIPTION

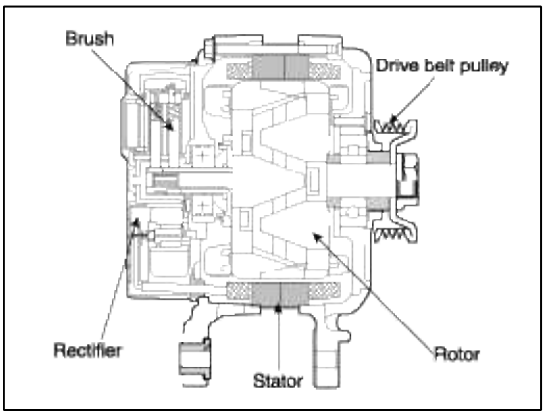
GASOLINE

The charging system included a battery, an generator with a built-in regulator, and the charging indicator light and wire.

The generator has eight built-in diodes (four positive and four negtive), each rectifying AC current to DC current. Therefore, DC curent appears at generator "B" terminal.

In addition, the charging voltage of this generator is regulated by the battery voltage detection system.

The generator is regulated by the battery voltage detection system. The main components of the generator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.



Engine Electrical System > Charging System > Repair procedures

ON-VEHICLE INSPECTION

CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Do not perform tests with a high voltage insulation resistance tester.
- Never disconnect the battery while the engine is running.

CHECK BATTERY VOLTAGE

1. After having driven the vehicle and in the case that 20 minutes have not passed after having stopped the engine, 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°C)

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

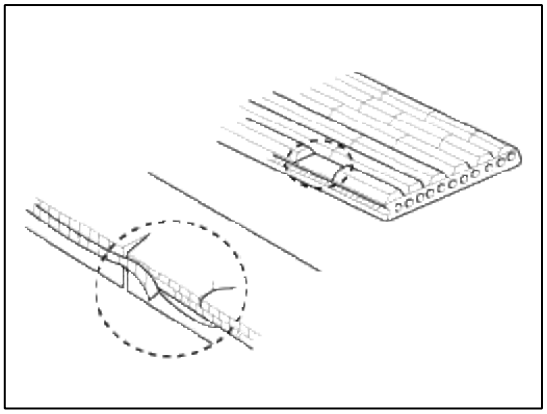
CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

1. Check that the battery terminals are not loose or corroded.
2. Check the fusible link and 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.

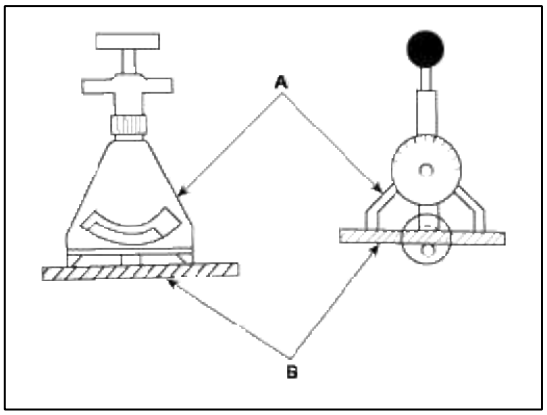
> NOTE
>
> Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.

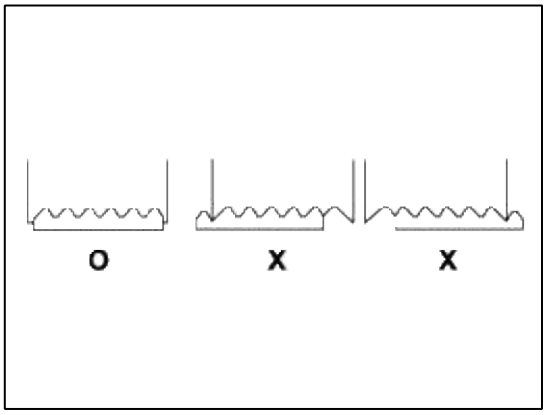


2. Using a belt tension gauge(A), measure the drive belt(B) tension.
   DRIVE BELT TENSION

New belt	540~640 N (121~143 lb)
Used belt	340~490 N (77~110 lb)

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





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 it.
4. Start the engine. Check that the light goes off.

INSPECT CHARGING SYSTEM

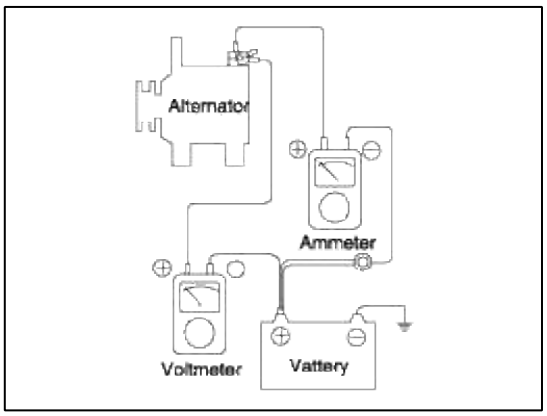
PREPARATION

1. Turn the ignition switch to "OFF".

NOTE

To find abnormal conditions of the connection, actions should not be taken on the two terminals and each connection during the test.

2. Connect a digital voltmeter between the alternator "B" terminal and battery (+) lead wire to the battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.



CONDITIONS FOR THE TEST

1. Start the engine.
2. Switch on the headlamps, blower motor and so on. And then, read the voltmeter under this condition.

RESULT

1. The voltmeter may indicate the 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 fusible link to the battery (+) terminal. Check for loose connections, color change due to an overheated harness, etc. Correct them before testing again.

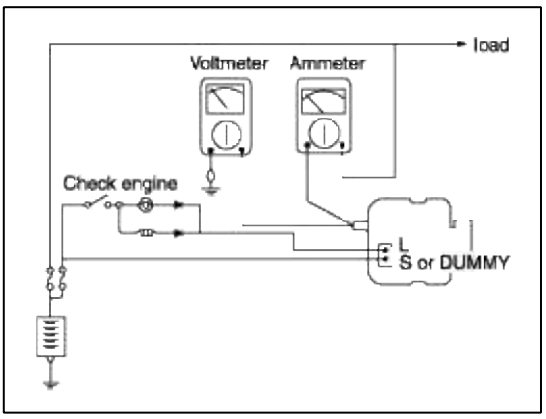
3. Upon completion of the test, set the engine speed at idle. Turn off the head lamps, blower motor and the ignition switch.

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 in good condition. The battery checking method is described in "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.
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.



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 the alternator "B" terminal and battery (-) terminal, a blown fusible link or poor grounding is suspected.
2. Start the engine and turn on the headlights.
3. Set the headlights 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 starts 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.

63A min.

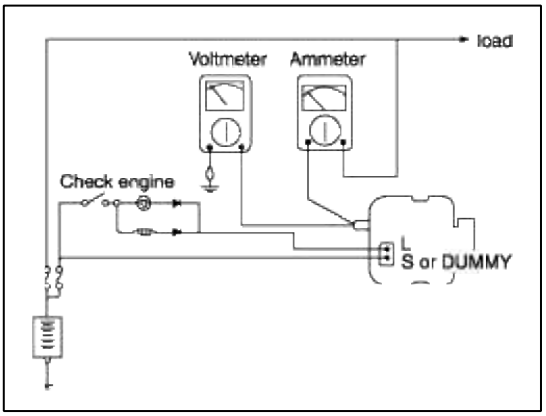
NOTE

- 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 headlights 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.

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. For battery checking method, see "BATTERY".
   Check the alternator drive belt tension.
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.



TEST

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

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 (-), or the fusible link is blown.

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

   GASOLINE

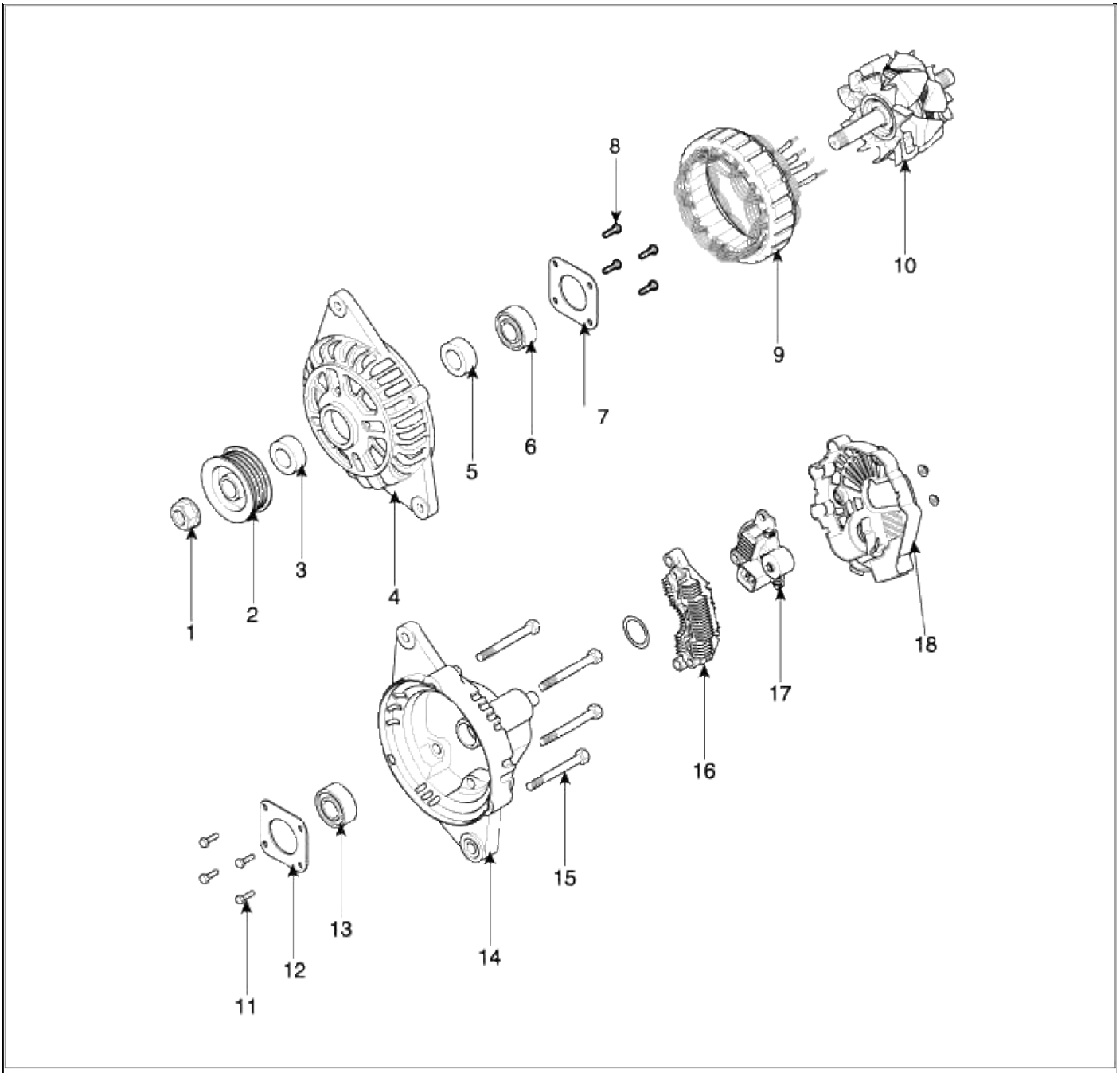
Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-20 (-4)	14.2 ~ 15.4
20 (68)	14.0 ~ 15.0
60 (140)	13.7 ~ 14.9
80 (176)	13.5 ~ 14.7

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.

Engine Electrical System > Charging System > Alternator > Components and Components Location

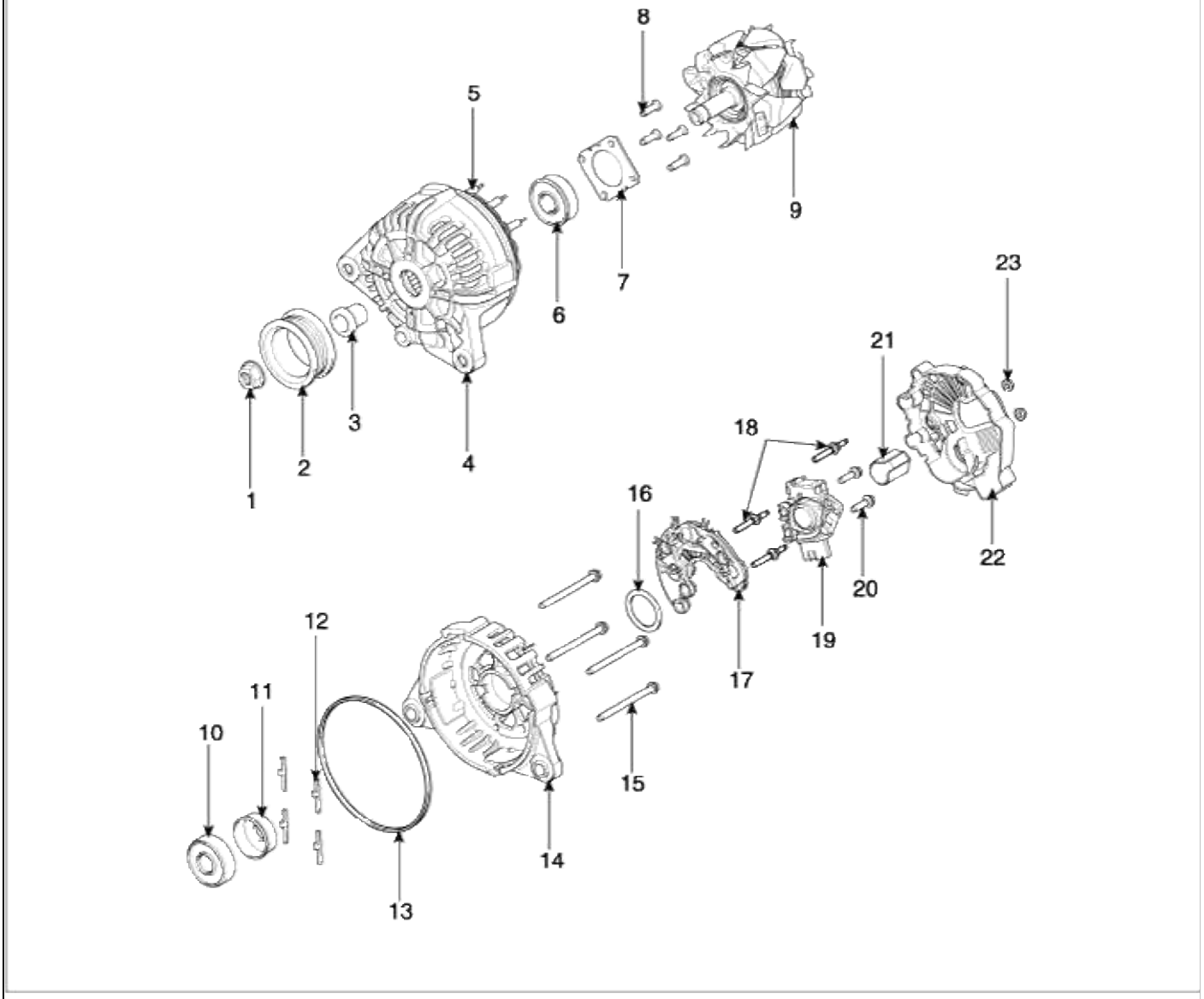
COMPONENTS

GASOLINE (2.0)



1. Nut
2. Pulley
3. Spacer
4. Front bracket
5. Spacer
6. Bearing
7. Bearing cover
8. Bolts
9. Stator
10. Rotor
11. Bolts
12. Bearing cover
13. Bearing
14. Rear bracket
15. Through bolts
16. Rectifier
17. Brush holder
18. Rear cover

GASOLINE (2.7)



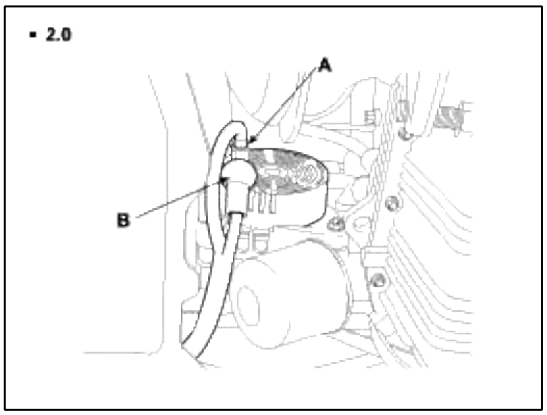
1. Nut
2. Pulley
3. Bushing
4. Front cover assembly
5. Stator coil
6. Front bearing
7. Front bearing cover
8. Front bearing cover bolt
9. Rotor coil
10. Rear bearing
11. Rear bearing cover
12. Damper
13. Packing
14. Rear cover
15. Through bolt
16. Seal
17. Rectifier assembly
18. Stud bolt
19. Brush holder assembly
20. Brush holder bolt
21. Guard
22. Cover
23. Cover nut

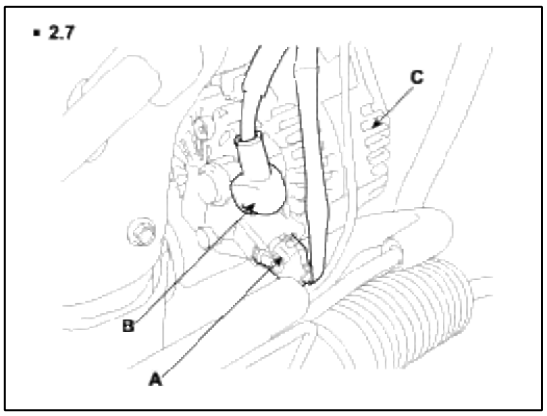
Engine Electrical System > Charging System > Alternator > Repair procedures

REPLACEMENT

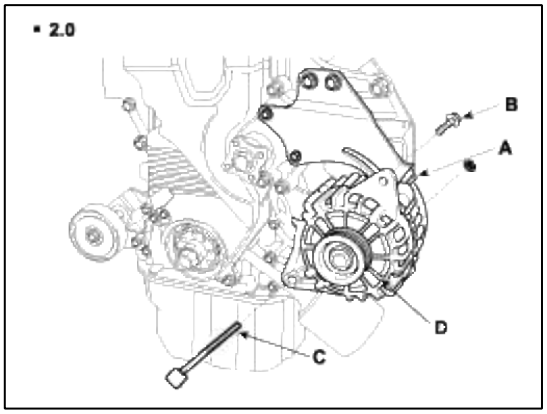
1. Disconnect the battery negative terminal first, then the positive terminal.

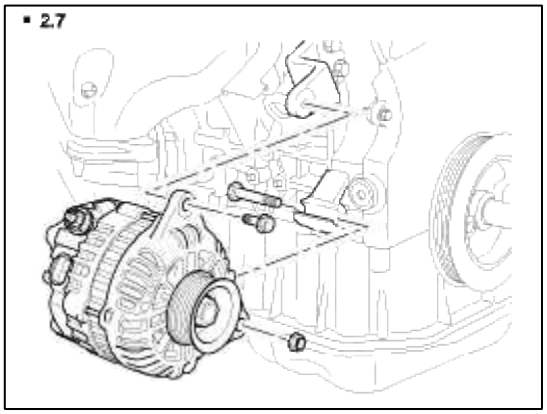
2. Deisconnect the alternator connector(A) and "B" terminal cable(B) from the alternator(C).





3. Remove the adjusting bolt(A) and mounting bolt(B), then remove the alternator belt.
4. Pull out the through bolt(C), then remove the alternator(D).



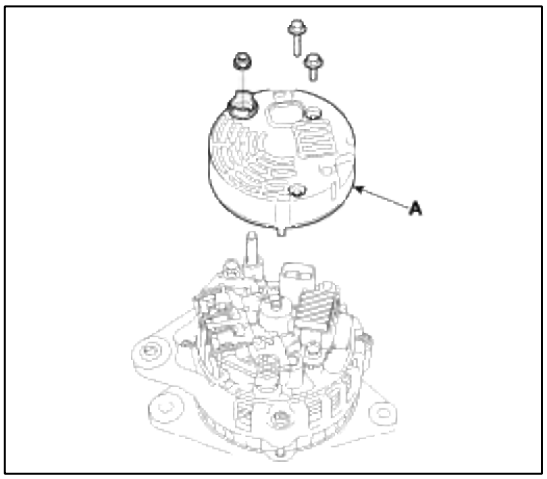


5. Installation is the reverse of removal.
6. Adjust the alternator belt tension after installation (See page EE-36).

DISASSEMBLY

GASOLINE (2.0)

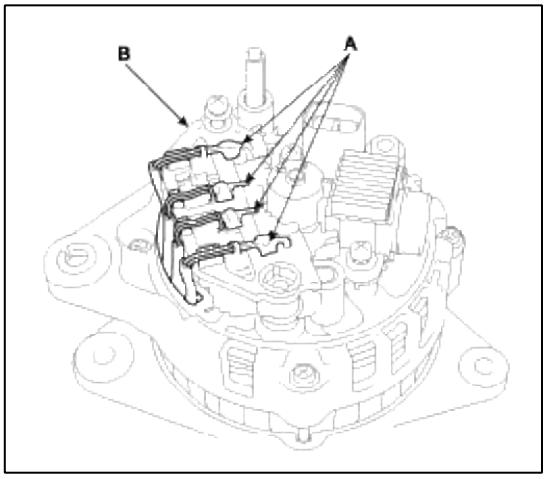
1. Remove the rear cover(A).



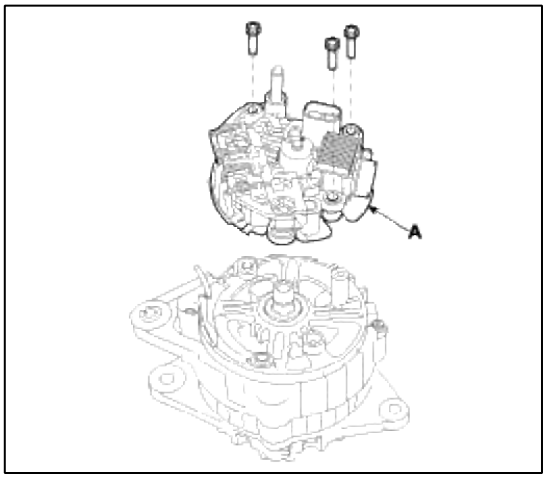
2. Unsolder the 4 stator leads(A) to the main diodes on the rectifier(B).

CAUTION

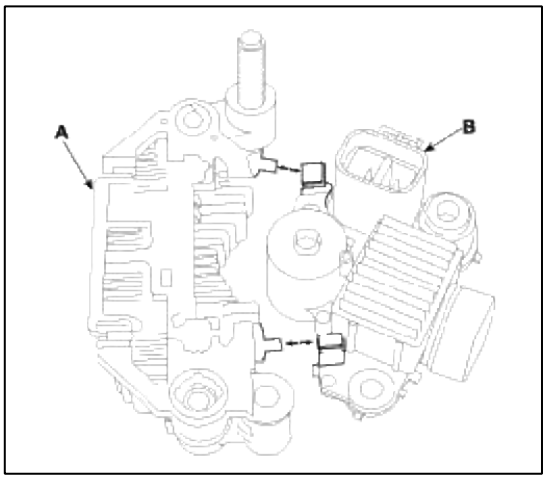
- When soldering or unsoldering, be careful not to heat the diodes for too long.
- Be careful that excesive force is not exerted on the leads of the diodes.



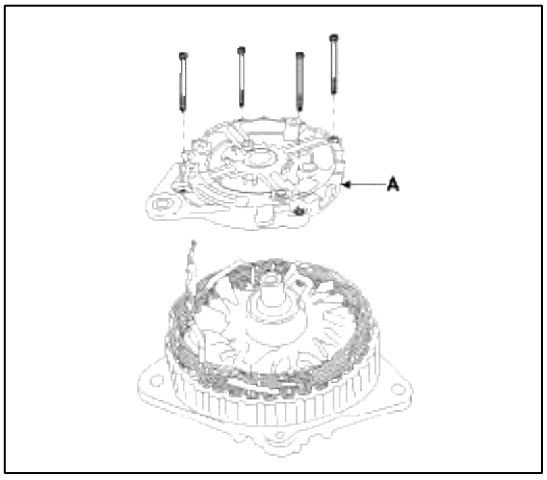
3. Remove the rectifier assembly(A).



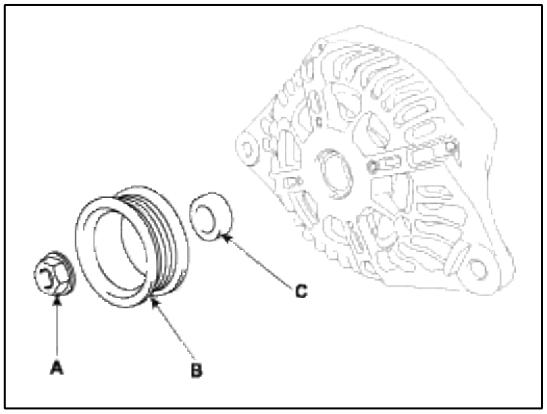
4. Unsolder between rectifier(A) and brush holder(B).



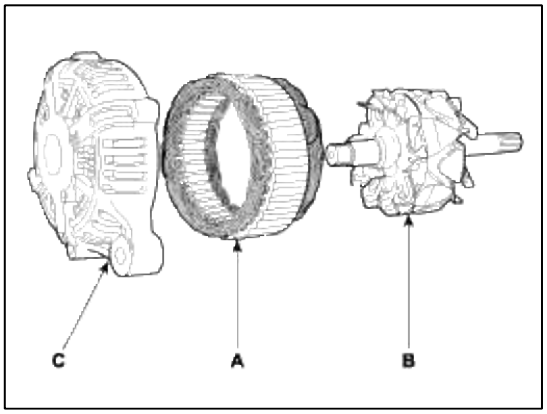
5. Remove the rear bracket(A).



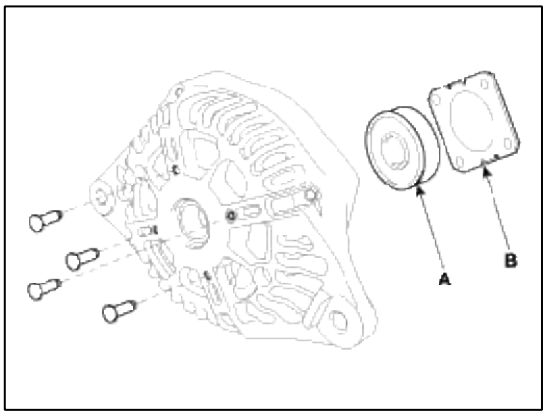
6. Remove the nut(A), pulley(B) and spacer(C).



7. Disconnect the stator(A), rotor(B) and front bracket(C).



8. Remove the rear bearing(A) and cover(B).

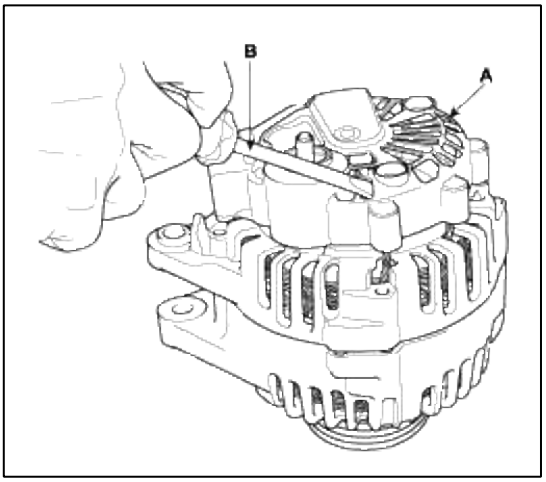


9. Reassembly is the reverse or disassembly.

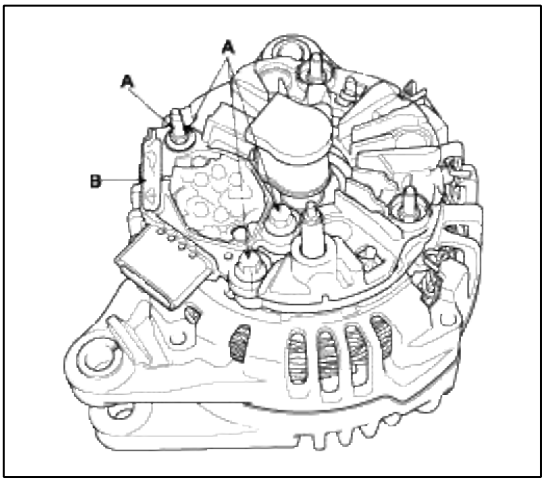
> NOTE
>
> Before the rotor is attached to the rear bracket, insert a wire through the small hole in the rear bracket to lock the brush. After the rotor has been installed, the wire can be removed.

GASOLINE (2.7)

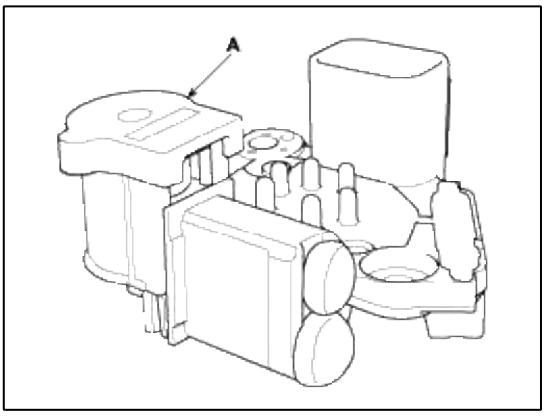
1. Remove the alternator cover(A) using a screw driver(B).



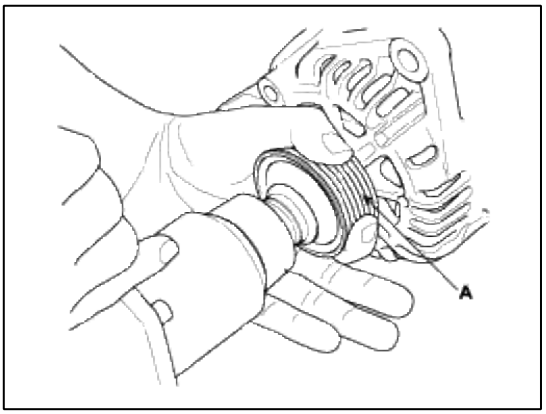
2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



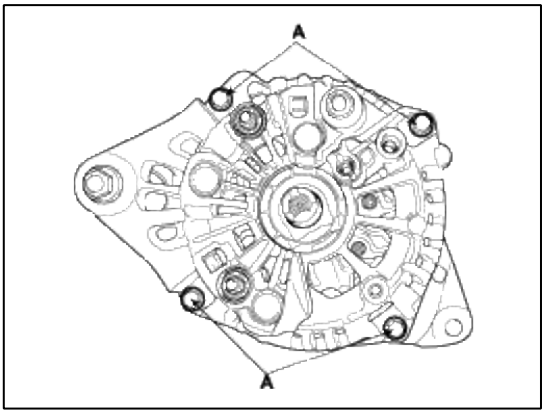
3. Remove the slip ring guide(A).



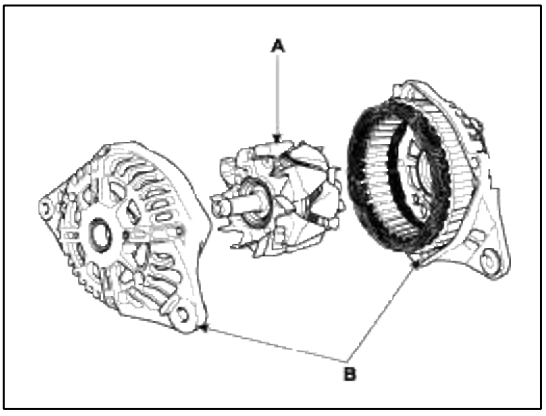
4. Remvoe the nut, pully(A) and spacer.



5. Loosen the 4 through bolts(A).



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

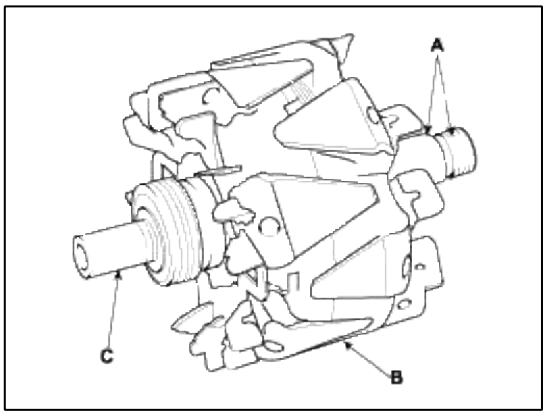


7. Reassembly is the reverse of disassembly.

INSPECTION

INSPECT ROTOR

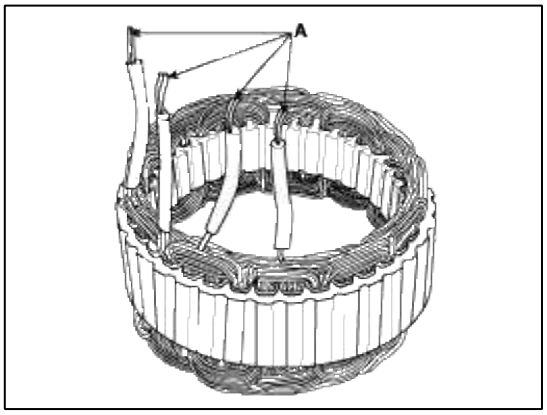
1. Check that there is continuity between the slip rings(A).



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).



2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the generator.

ALTERNATOR BELT INSPECTION AND ADJUSTMENT (GASOLINE 2.0)

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 values for the used belt after running engine for five minutes.

Deflection method :

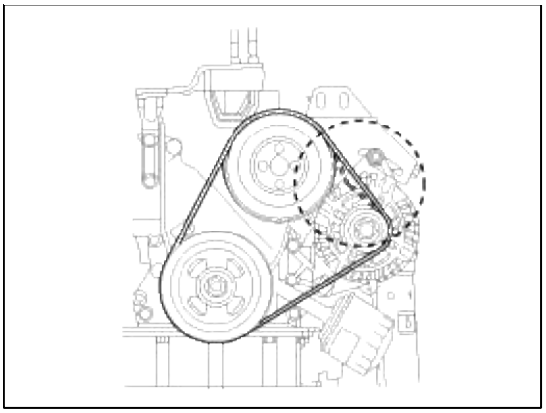
Apply a force of 98N (10 kgf, 22 lbf), and measure the deflection between the alternator and crankshaft pulley.

Deflection

Used Belt : 5.0 ~ 6.0 mm (0.20 ~ 0.23 in)
New Belt : 4.0 ~ 5.0 mm (0.16 ~ 0.20 in)

NOTE

If the belt is worn or damaged, replace it.

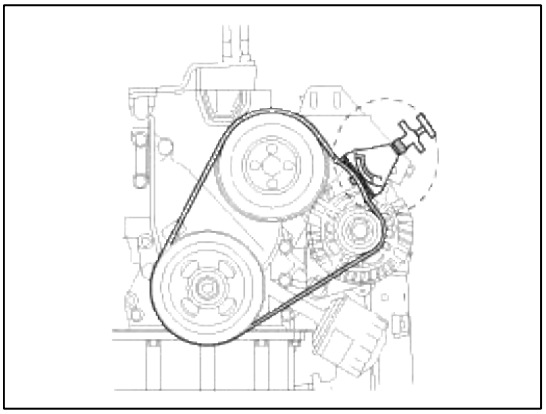


Belt tension gauge method :
Attach the belt tension gauge to the belt and measure the tension. Follow the gauge manufacturer's instructions.

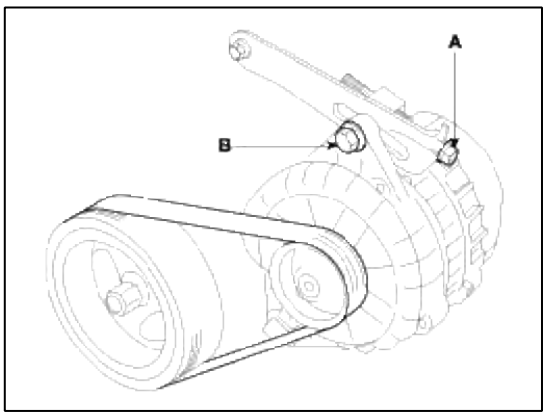
Tension
Used Belt : 340~490 N (35~50 kgf, 77~110 lbf)
New Belt : 540~640 N (55~65 kgf, 121~143 lbf)

NOTE

If the belt is worn or damaged, replace it.



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

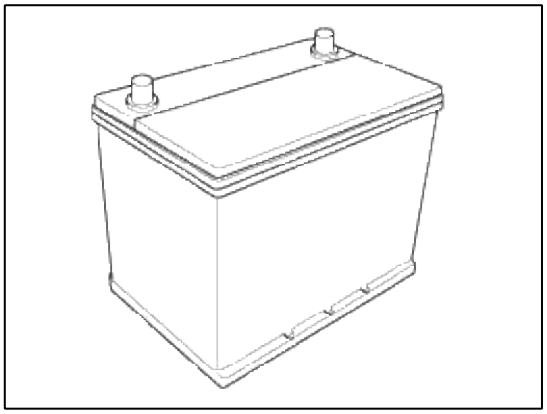


3. Recheck the deflection or tension of the belt.

Engine Electrical System > Charging System > Battery > Description and Operation

DESCRIPTION

1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.

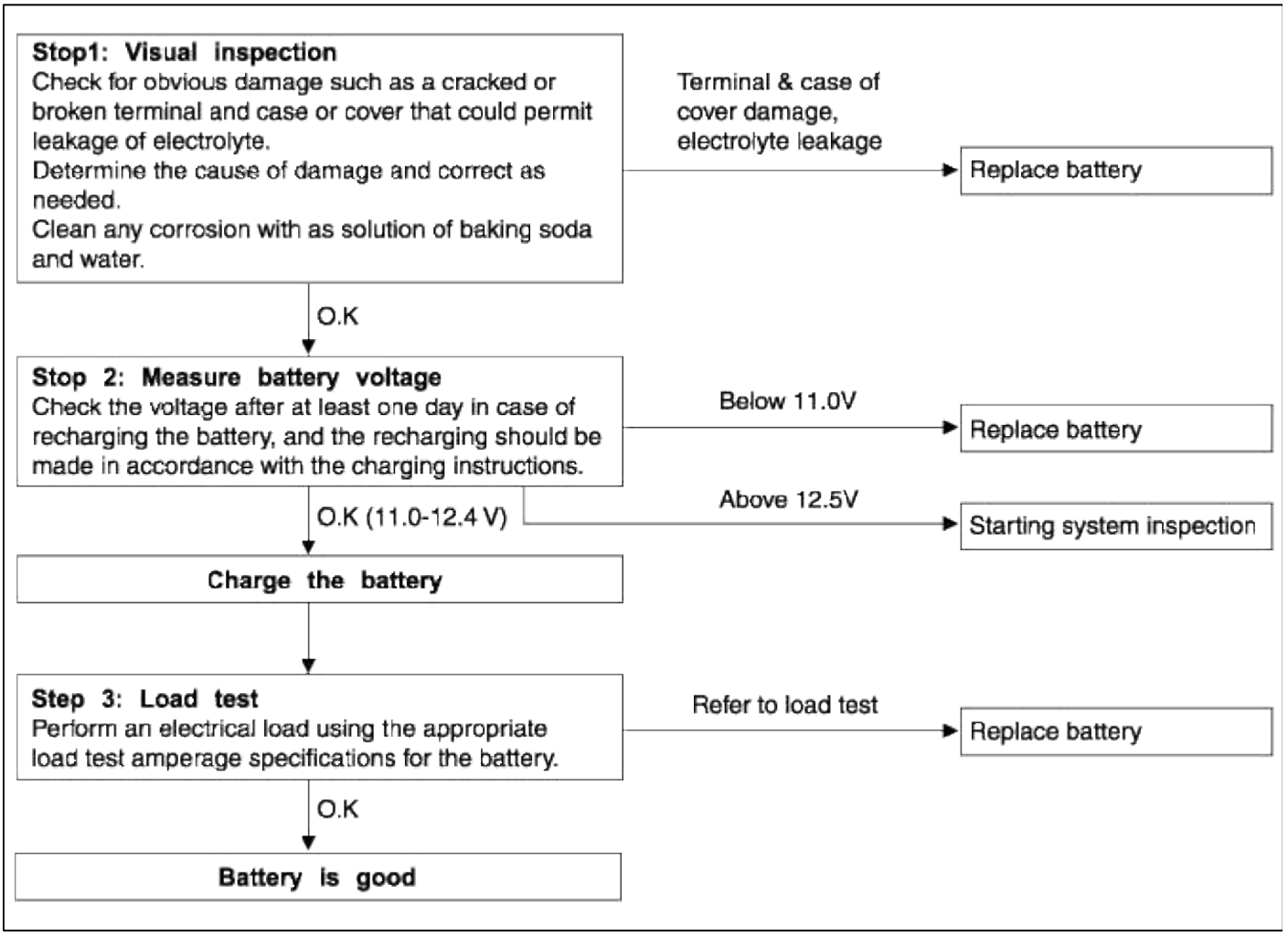


Engine Electrical System > Charging System > Battery > Repair procedures

INSPECTION

BATTERY DIAGNOSTIC TEST (1)

1. CHECKING FLOW



2. CHECKING SHEET

Inspection Items & contents	Judgment criteria	Remarks
1. Acid Leakage * Type of acid leakage - Leakage on the fusion part for joining the case and cover. - Leakage on the terminal part - Leakage on the other parts * Clean the wet part or wash it, then dry it before checking with naked eyes. * Determine a part where leakage might have occurred ; check it by tipping the battery, if the leakage takes place again. * Conduct a visual inspection for breakage, deformation, or cracks.	1. Damage in the case or cover due to outside impact.	
	2. Acid leakage on the molding part of the case or cover. (weld line or gate hole)	
	3. Damage on the terminal or cracks in the cover.	
	4. Acid leakage due to the tipped battery or slant storage.	
	5. Acid leakage due to poor welding of the cover. (with no damage)	
2. Outside damage and breakage * Check with naked eyes.	1. Outside damage due to causes without damage due to mistreatment.	
	2. Outside damage due to mistreatment.	
	3. Damage due to a spark between terminals.	
	4. Damage and breakage due to heat.	
3. Measure the voltage for the battery ; but wait at least one day before measuring in case of recharging, and recharging should be made in accordance with the charging instructions.	1. 12.0V	Refer to load test
	2. 11.0V< battery voltage<12.0V due to over-discharge.	Refer to load test
	3. Below 11.0V due to charge condition failure.	Refer to load test
	4. Below 11.0V due to discharged for a long period.	Refer to load test
	5. Below 11.0V due to internal short circuit.	Refer to load test
4. Load test ; For 15 seconds with a half of the CCA electric current value, but the voltage on the dischaarging stage should be above 9.6V (27±5°C) - Conduct the test with a battery tester. (Refer to the tester manual)	1. Load test result: below 9.5V	
	2. Load test result: above 9.6V	Mfg. Defect usable

3. 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 :
   A. If the battery has been on charge, remove the surface charge by connect a 300 ampere load for 15 seconds.
   B. Connect the voltmeter and apply the specified load.
   C. Read the voltage after the load has been applied for 15 seconds.
   D. Disconnect the load.
   E. 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
9.6	20°C (70°F) and above
9.5	16 °C (60 °F)
9.4	10 °C (50 °F)
9.3	4 °C (40 °F)
9.1	-1 °C (30 °F)
8.9	-7 °C (20 °F)
8.7	-12 °C (10 °F)
8.5	-18 °C (0 °F)

NOTE

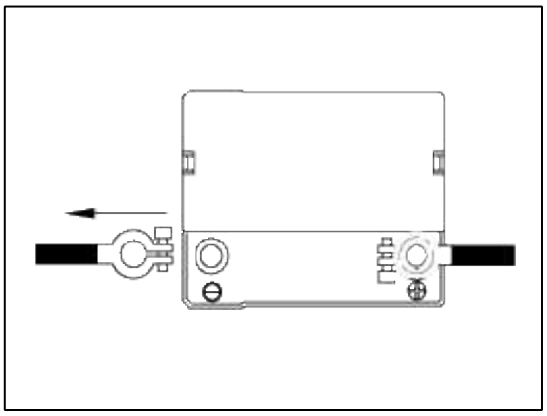
- If the voltage is less than shown in the table, the battery is good.
- If the voltage is greater than shown in the table, replace the battery.

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

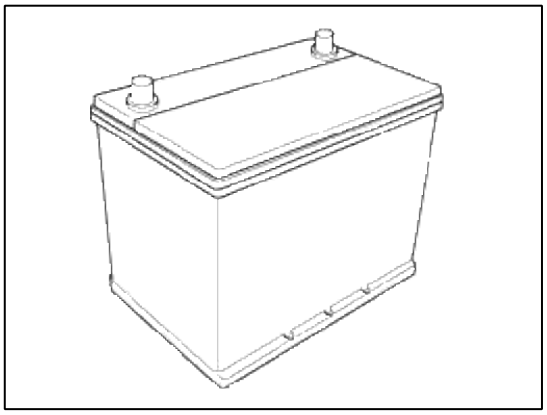
Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Heavy rubber gloves (not the household type) should be worn when removing the battery.



4. Inspect the battery carrier 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 in Step(3).
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 the 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.

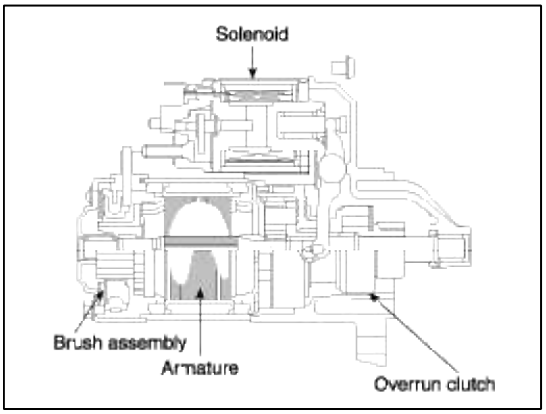
> CAUTION
>
> When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuits at the terminals of batteries being charged. A spark will occur when the circuit is broken. Keep open flames away from the battery.



Engine Electrical System > Starting System > Description and Operation

DESCRIPTION

The starting system includes the battery, starter motor, 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.



Engine Electrical System > Starting System > Repair procedures

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.

INSPECTION

START TEST

NOTE

The air temperature must be between 59 and 100°F (15 and 38°C) before testing.

Recommended procedure :

- Use a starter system tester.
- Connect and operate the equipment in accordance with the manufacturer's instructions.
- Test and troubleshoot as described.

Alternate Procedure :

- Use the following equipment :
  - Ammeter, 0~400A
  - Voltmeter, 0~20V (accurate within 0.1 volt)
  - Tachometer, 0~1,200 rpm
- Hook up a voltmeter and ammeter as shown.

NOTE

After this test, or any subsequent repair, reset the ECM/PCM to clear any codes.

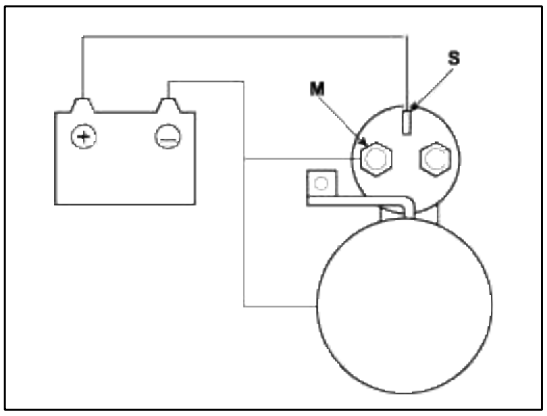
Check the Starter Engagement :

1. Remove the ECM(B+) fuse from the fuse/relay box.
2. Turn the ignition switch to START (III) with the shift lever in N or P position (A/T) or with the clutch pedal depressed (M/T). The starter should crank the engine.
   A. If the starter does not crank the engine, go to step 3.
   B. If it cranks the engine erratically or too slowly, go to "Check for Wear and Damage" on the next page.
3. Check the battery, battery positive cable, ground, starter cut relay, and the wire connections for looseness and corrosion. Test again.
   If the starter still does not crank the engine, go to step 4.
4. Unplug the connector from the starter.
5. Connect a jumper wire from the battery positive (+) terminal to the solenoid terminal.
   The starter should crank the engine.
   A. If the starter still does not crank the engine, remove it, and diagnose its internal problem.
   B. If the starter cranks the engine, go to step 6.
6. Check the ignition switch.
7. Check the starter relay (see page EE-54).
8. Check the A/T gear position switch (A/T) or the clutch interlock switch (M/T).
9. Check for an open in the wire between the ignition switch and starter.

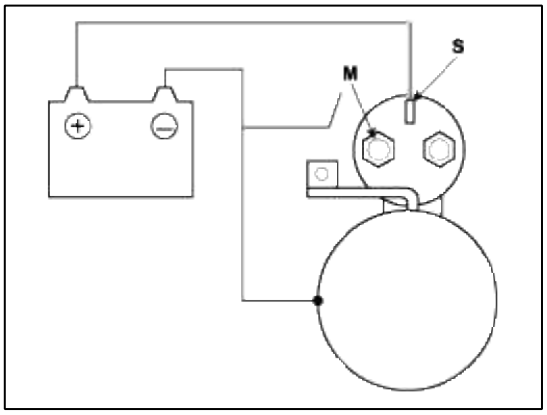
STARTER SOLENOID TEST

1. Disconnect the wires from the Sterminal and the M terminal.

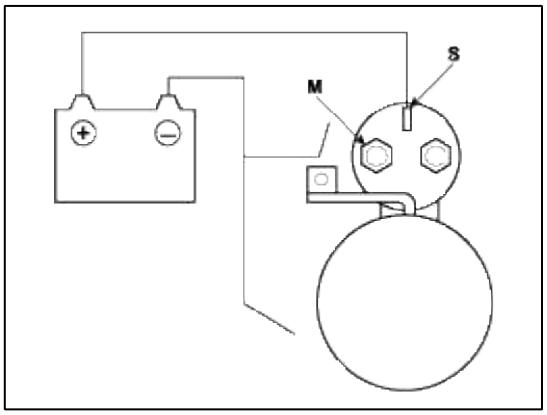
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly.
   To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



FREE RUNNING TEST

1. Place the starter motor in a vise equipped with soft jaws and connecta fully-charged 12-volt battery to starter motor as follows :
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostatas shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11 volts.

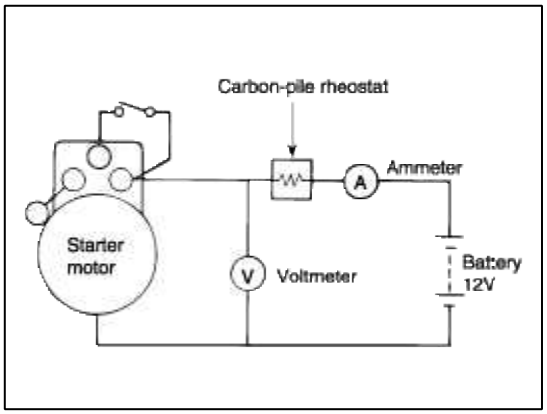
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely :

2.7

: Max. 90 Amps
: Min. 2,800 rpm

2.0

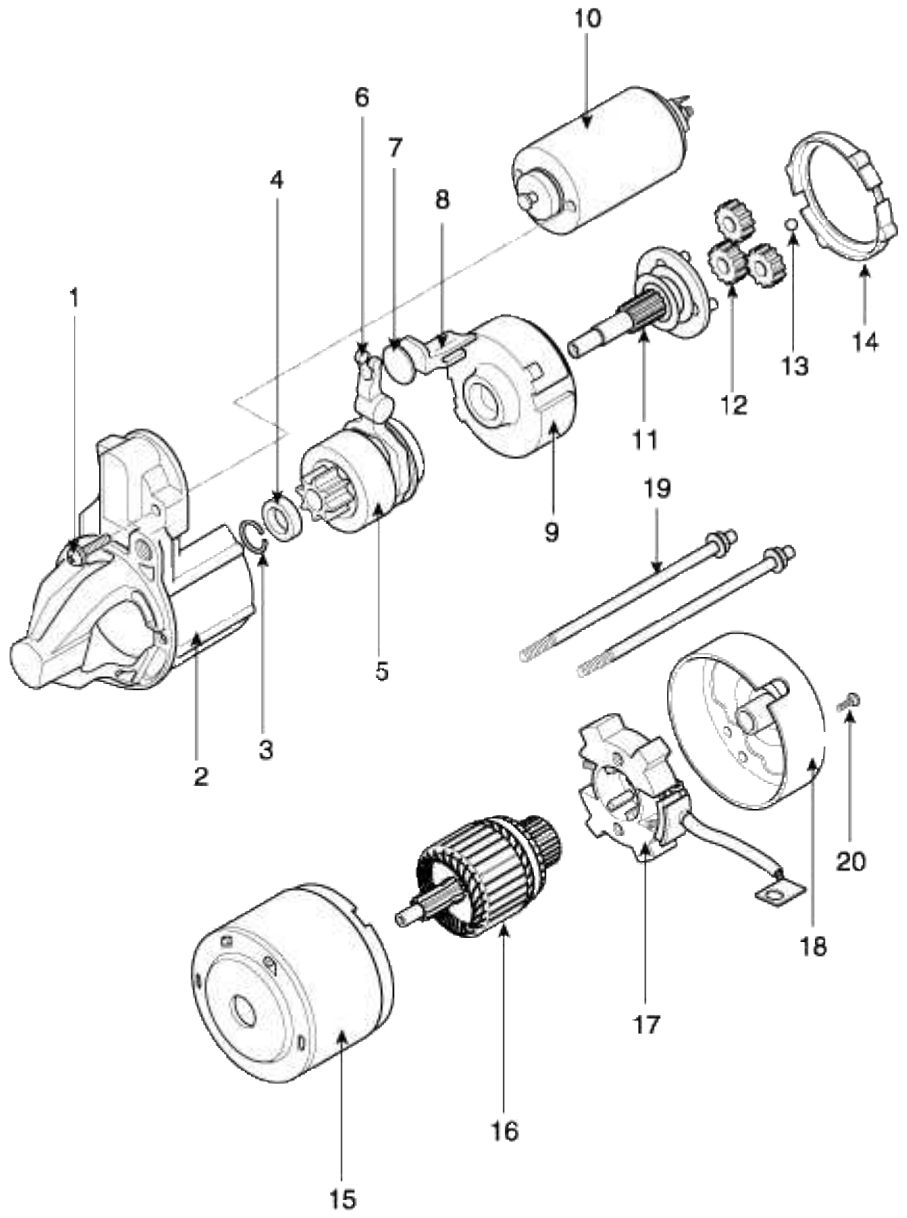
: Max. 90 Amps
: Min. 3,000 rpm



Engine Electrical System > Starting System > Starter > Components and Components Location

COMPONENTS

GASOLINE



1. Screw flange
2. Front bracket assembly
3. Stop ring
4. Stopper
5. Overrun clutch assembly
6. Lever
7. Plate
8. Lever packing
9. Internal gear assembly
10. Magnet switch assembly
11. Planet shaft assembly
12. Planetary gear assembly
13. Steel ball
14. Packing
15. Yoke assembly
16. Armature assembly
17. Brush holder assembly
18. Rear bracket
19. Through bolt
20. Screw flange

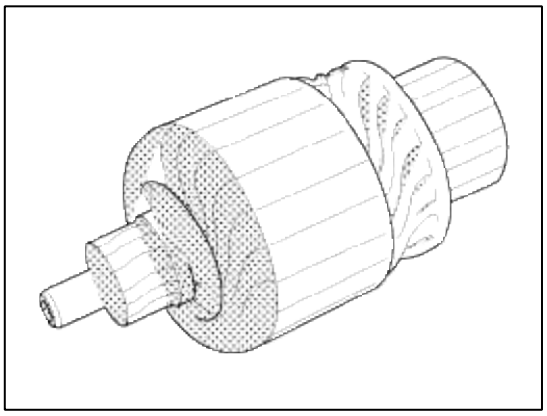
Engine Electrical System > Starting System > Starter > Repair procedures

INSPECTION

ARMATURE INSPECTION AND TEST

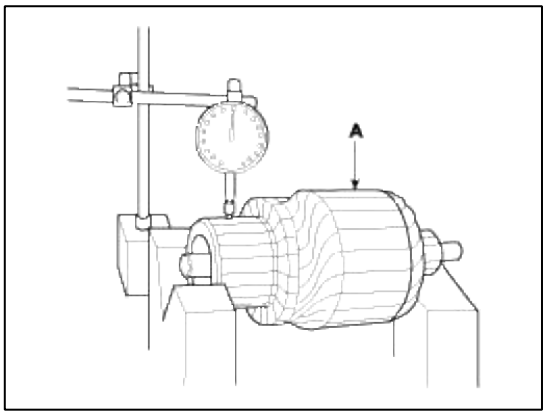
1. Remove the starter (see page EE-47).
2. Disassemble the starter as shown at the beginning of this procedure.

3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.

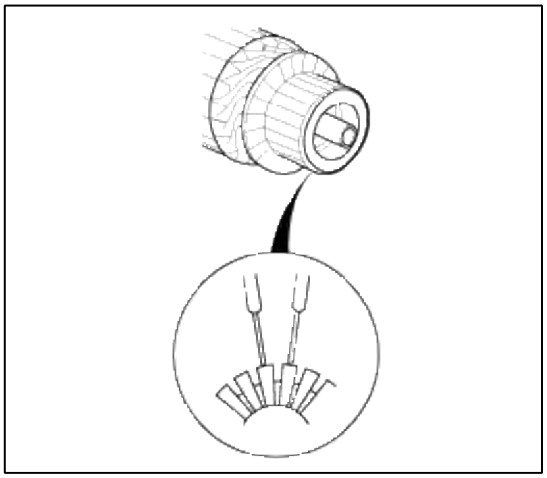


4. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator runout is not within the service limit, replace the armature.

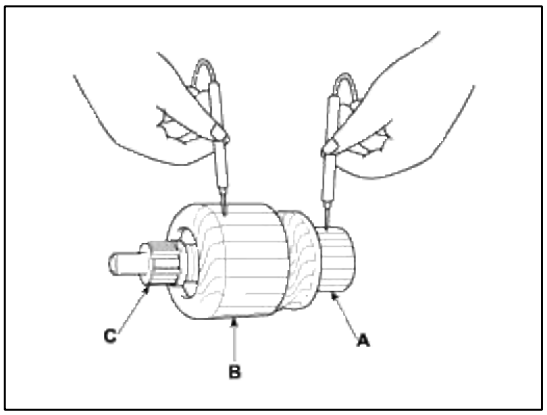
Commutator Runout
Standard (New) : 0.02mm (0.001 in.) max.
Service limit : 0.05mm (0.002 in.)



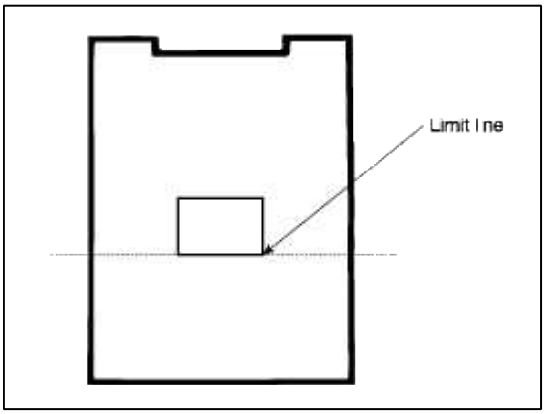
5. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



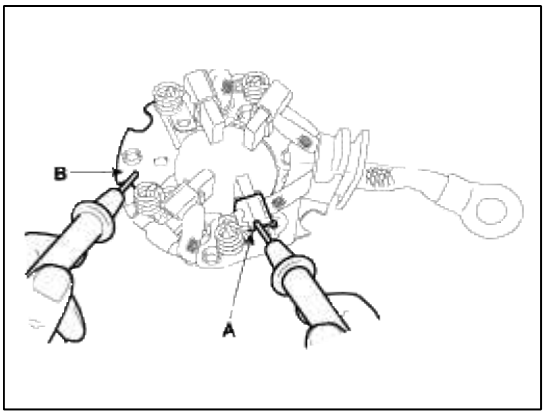
6. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



INSPECT STARTER BRUSH



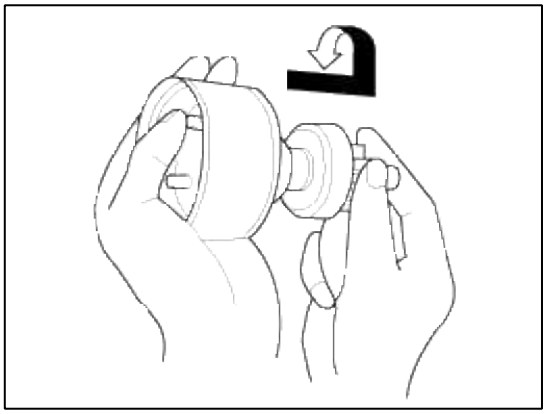
STARTER BRUSH HOLDER TEST



INSPECT OVERRUNNING CLUTCH

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.

2. Rotate the overrunning clutch (A) both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.

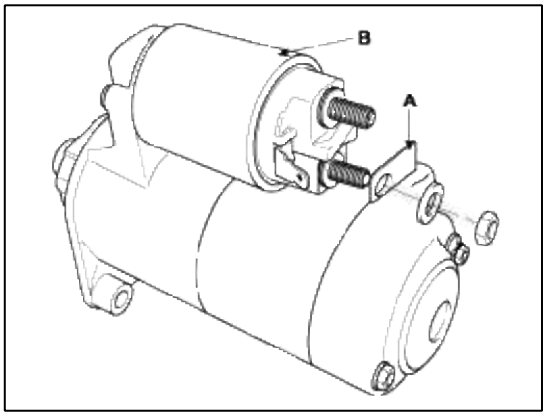


3. If the starter driver gear (B) is worn or damaged, replace the overrunning clutch assembly: the gear is not available separately.
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

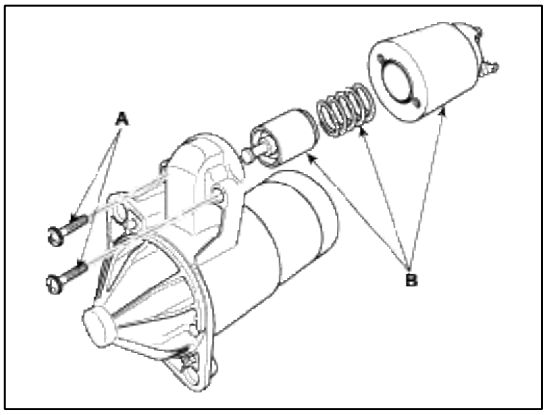
DISASSEMBLY

GASOLINE

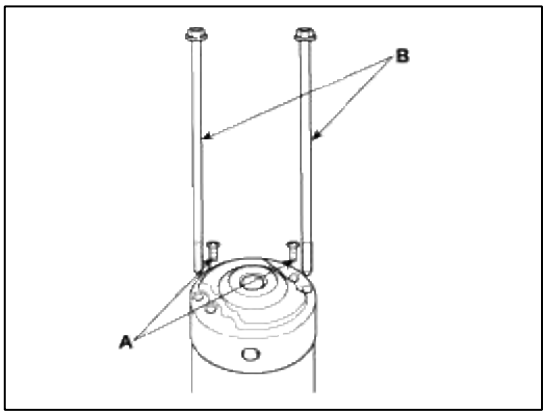
1. Disconnect the M-terminal(A) on the magnet switch assembly(B).



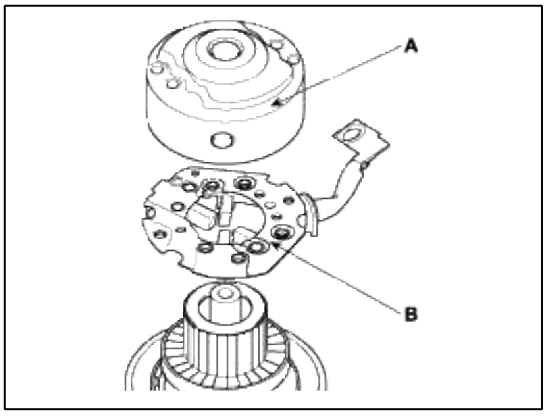
2. After loosening the 2 screws(A), detach the magnet switch assembly(B).



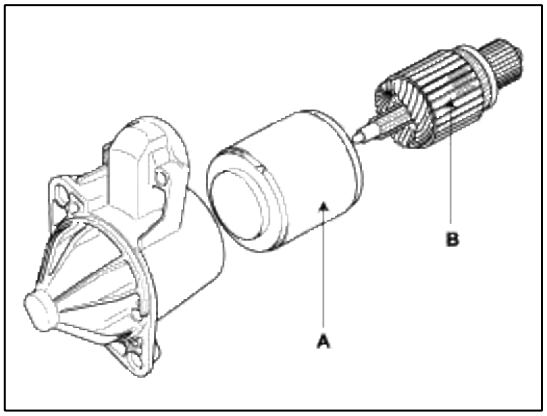
3. Loosen the brush holder mounting screws(A) and through bolts(B).



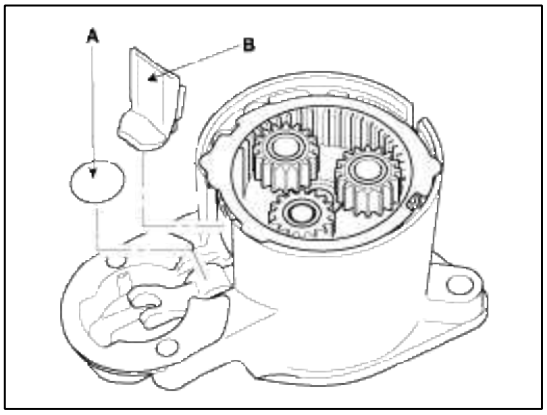
4. Remove the rear bracket(A) and brush holder assembly(B).



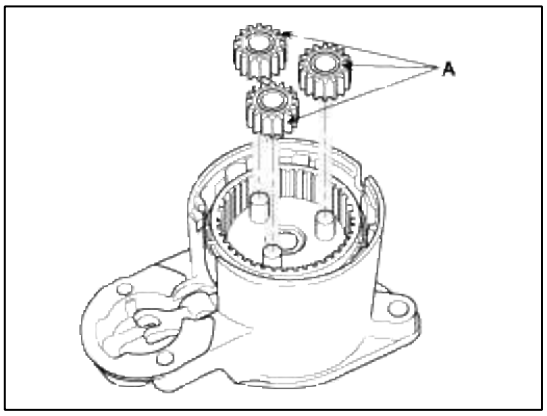
5. Remove the yoke(A) and armature(B).



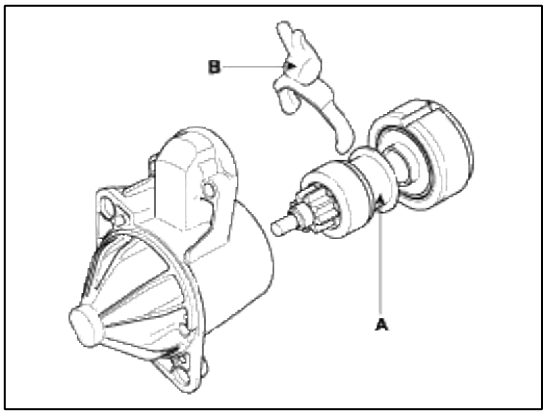
6. Remove the, lever plate(A) and planet shaft packing(B).



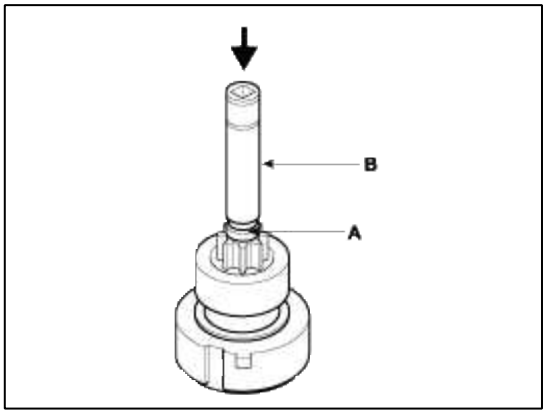
7. Disconnect the planet gear(A).



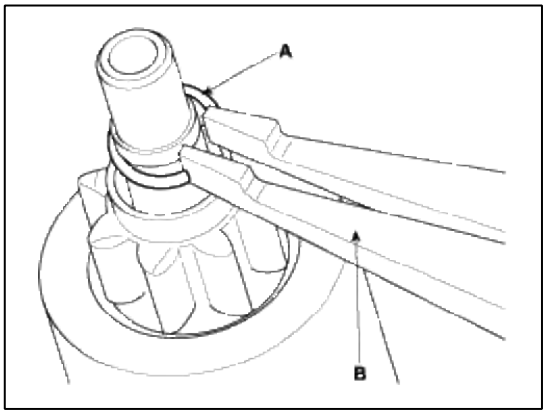
8. Disconnect the planet shaft assembly(A) and lever(B).



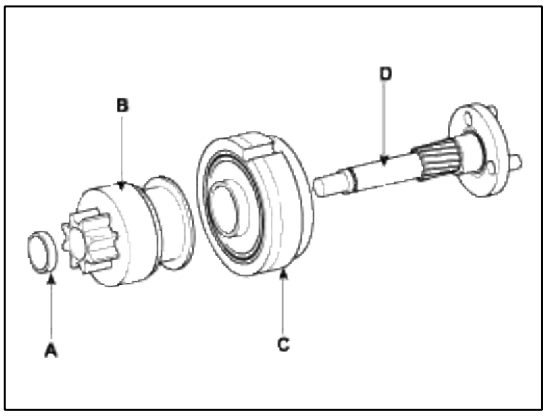
9. Press the stop ring(A) using a socket(B).



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



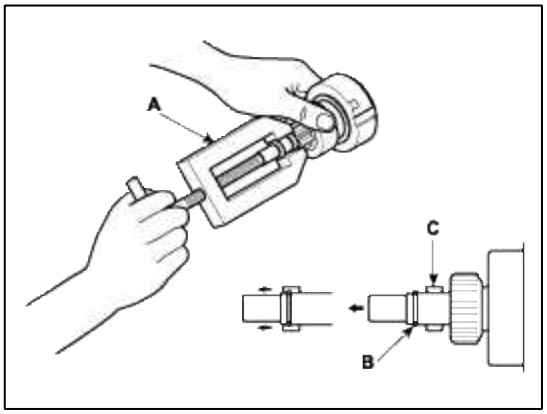
11. Disconnect the stop ring(A), overrunning clutch(B), internal gear(C) andplanet shaft(D).



12. Reassembly is the reverse of disassembly.

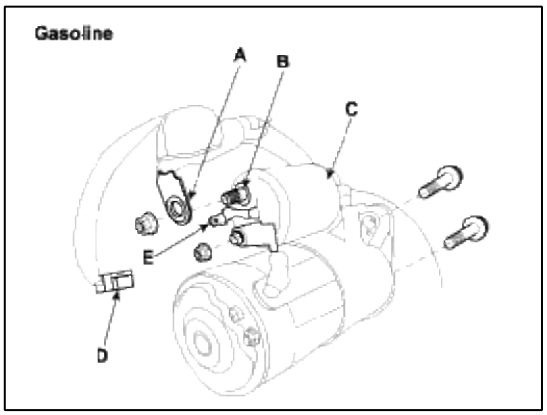
NOTE

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



REPLACEMENT

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



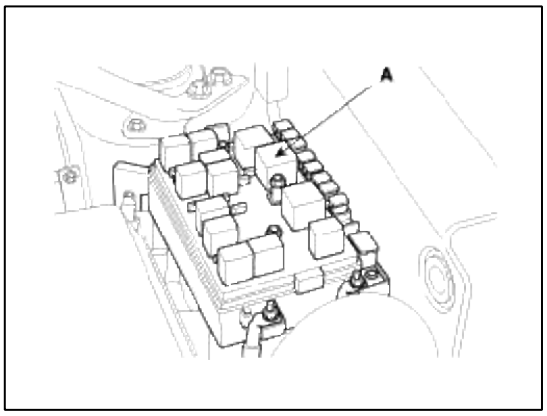
3. Remove the 2 bolts holding the starter, then remove the starter.
4. Installation is the reverse of removal.
5. Connect the battery positive cable and negative cable to the battery.

Engine Electrical System > Starting System > Starter Relay > Repair procedures

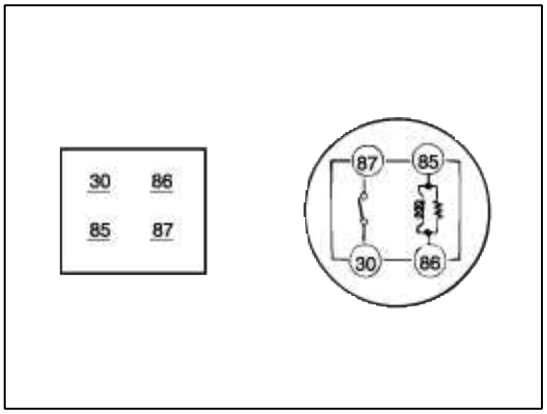
INSPECTION

1. Remove the fuse box cover.

2. Remove the starter relay(A).



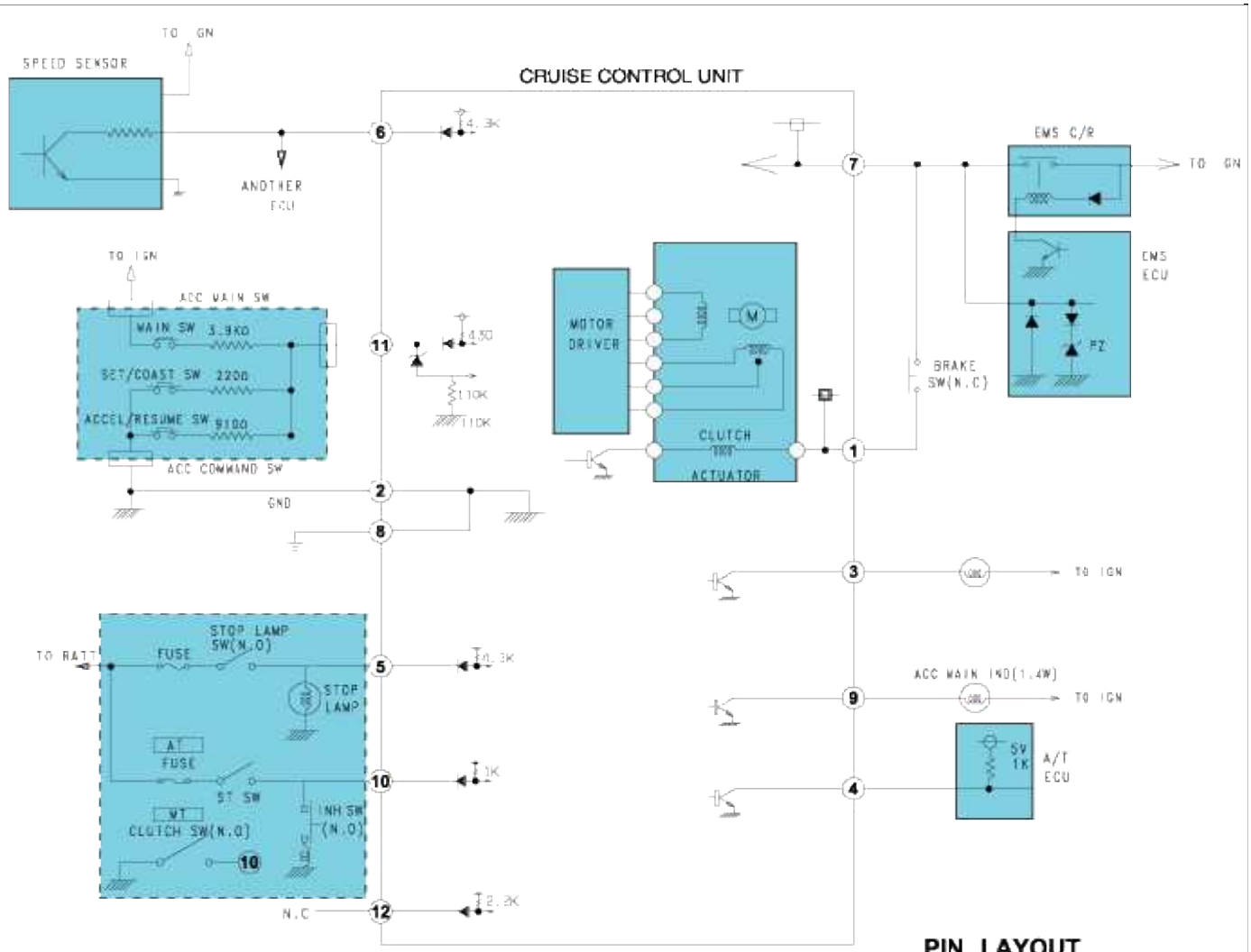
3. Inspect the relay continuity.
   A. Using an ohmmeter, check that there is continuity between terminals 85 and 86.
      If there is no continuity, replace the relay.
   B. Check that there is no continuity between terminals 30 and 87.
      If there is continuity, replace the relay.
4. Inspect the relay operation.
   A. Apply battery positive voltage across terminals 85 and 86.
   B. Using an ohmmeter, check that there is continuity between terminals 30 and 87.
      If there is no continuity, replace the relay.



5. Install the starter relay.
6. Install the fuse box cover.

Engine Electrical System > Cruise Control System > Schematic Diagrams

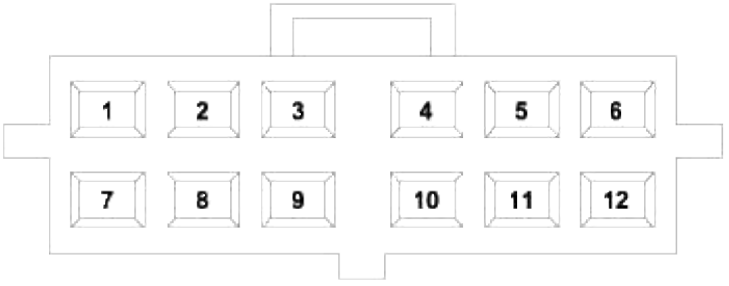
CIRCUIT DIAGRAM FOR CRUISE CONTROL SYSTEM



PIN LAYOUT

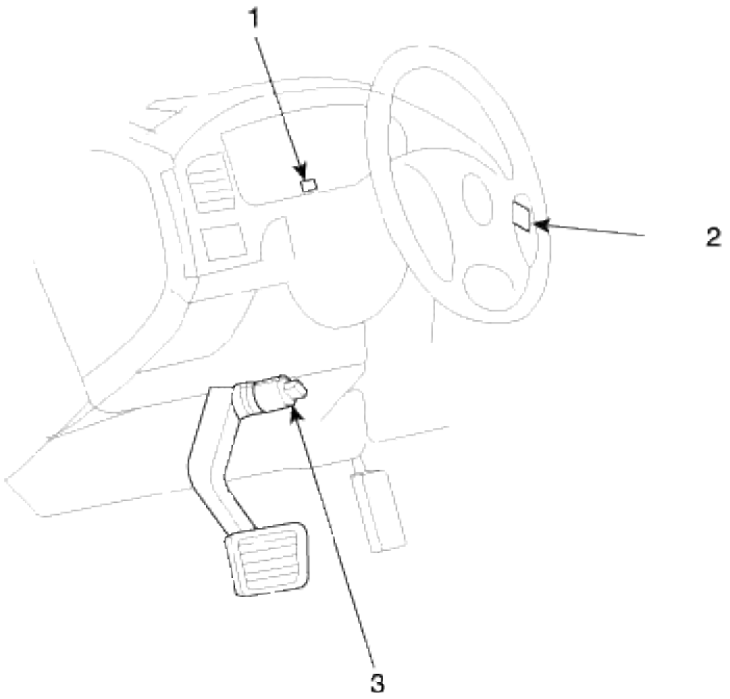
No	Name	Note
1	BRK	AUTUATOR CLUTCH
2	GND	GND
3	NC	NO CONNECTION
4	AT	OD CONTROL
5	STOP	STOP LAMP SW
6	SPD	SPEED SENSOR
7	IGN1	POWER SOURCE
8	GND	GND
9	MAIN	MAIN INDICATOR
10	CLU	INH./CLUTCH SW
11	COM	MAIN/COMMAND SW
12	NC	NO CONNECTION

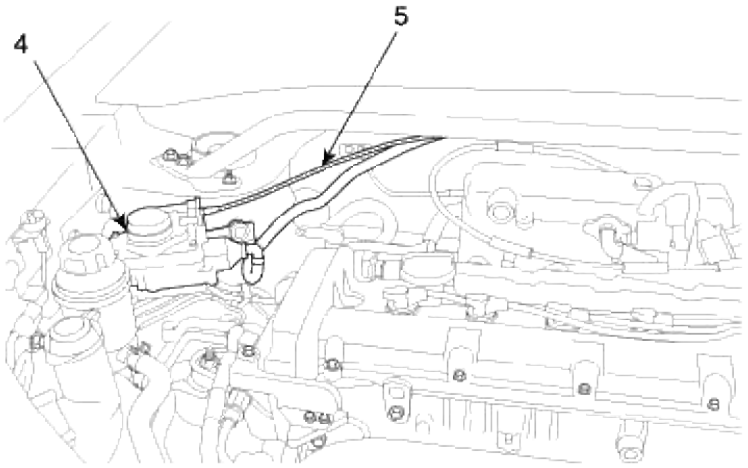
CONNECTOR NO.



Engine Electrical System > Cruise Control System > Components and Components Location

COMPONENTS LOCATION





1. Cruise control indicator
2. Main switch
3. Brake switch
4. Actuator & unit assembly
5. Actuator cable

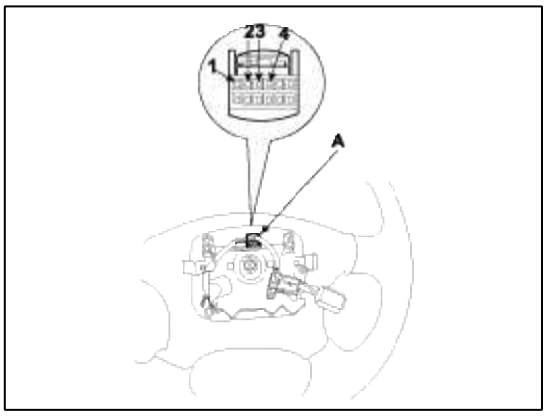
Engine Electrical System > Cruise Control System > Repair procedures

INSPECTION

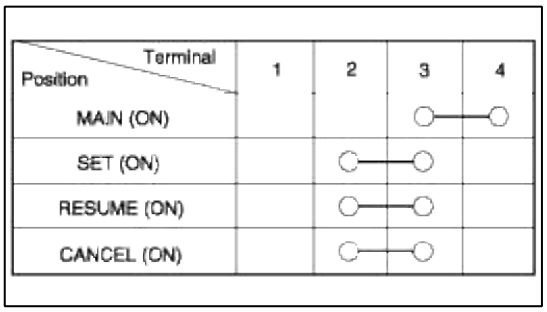
CRUISE REMOCON SWITCH TEST

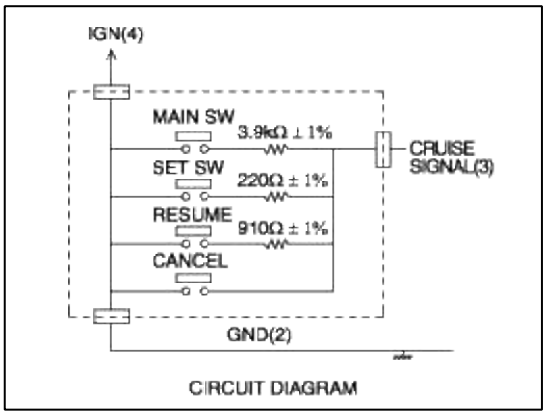
1. Disconnect the battery negative cable, then disconnect the positive cable, and wait at least three minutes.
2. Remove the driver's airbag (See page RT group-air bag module).

3. Disconnect the remocon switch connector(A).



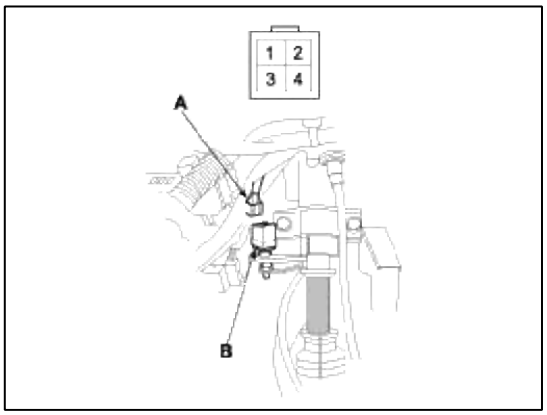
4. Check the continuity between the terminals of the connector in each switch position according to the table.
   A. If there is continuity, and it matches the table, the switch is O.K.
   B. If there is no continuity, replace the remocon switch.



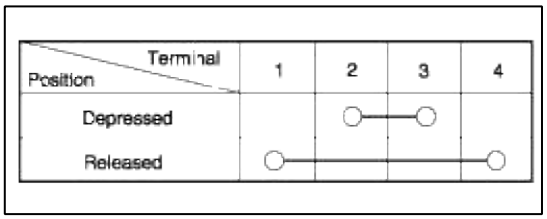


BRAKE SWITCH TEST

1. Disconnect the connector(A) from the brake switch.
2. Remove the brake switch(B).



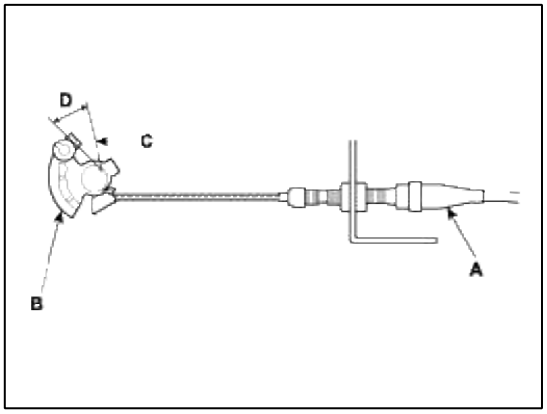
3. Check for continuity between the terminals according to the table.



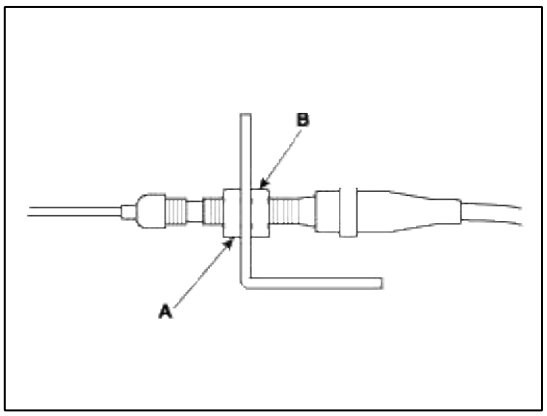
4. If necessary, replace the switch or adjust the pedal height.

ACTUATOR CABLE ADJUSTMENT

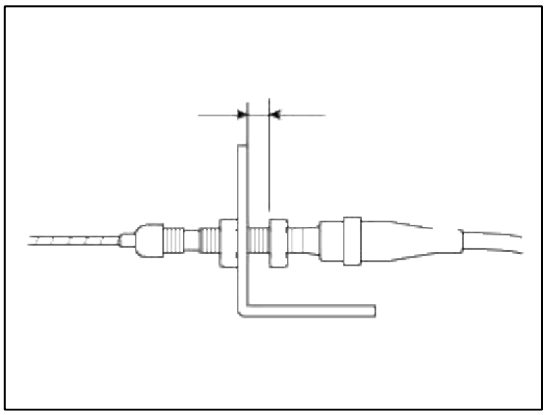
1. Check that the actuator cable (A) moves smoothly with no binding or sticking.



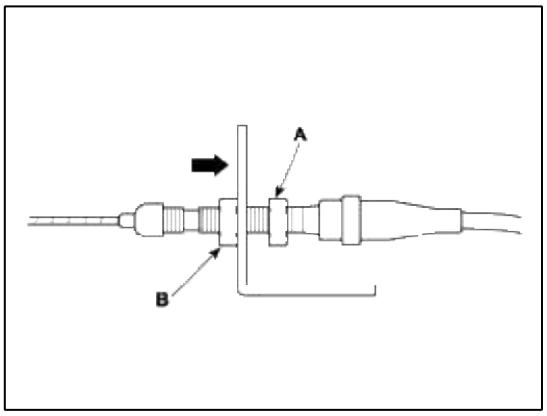
2. position, M/T in neutral) until the radiator fan comes on, then let it idle.
3. Measure the amount of movement of the output linkage (B) until the engine speed starts to increase.
   At first, the output linkage should be located at the fully closed position (C). The free play (D) should be 3.75±0.5 mm (0.15±0.02 in.)
4. If the free play is not within specs, move the cable to the point where the engine speed starts to increase, and tighten the locknut (A) and adjusting nut (B).



5. Turn the adjusting nut (A) until it is 3.75±0.5 mm (0.15±0.02 in.) away from the bracket (B).



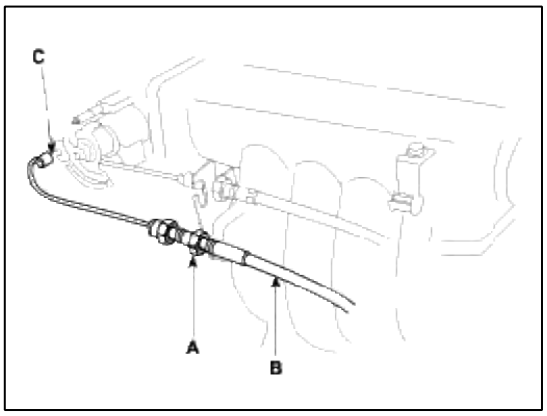
6. Pull the cable so that the adjusting nut (A) touches the bracket, and tighten the locknut (B).



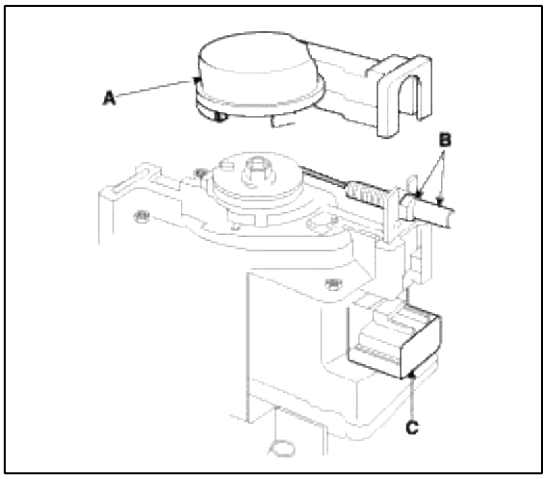
REPLACEMENT

CRUISE CONTROL UNIT AND CABLE

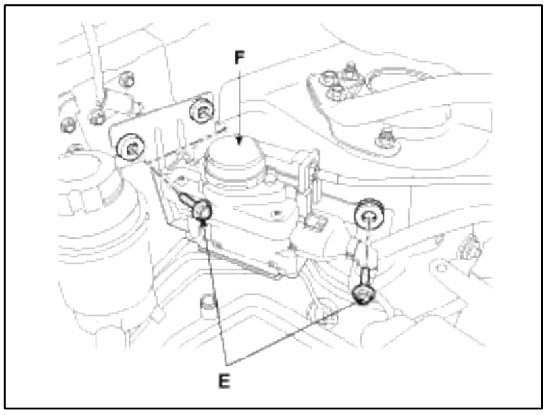
1. Loosen the locknuts(A) and disconnect the actuator cable (B) from the throttle linkage(C).



2. Disconnect the cover, actuator cable and connector.



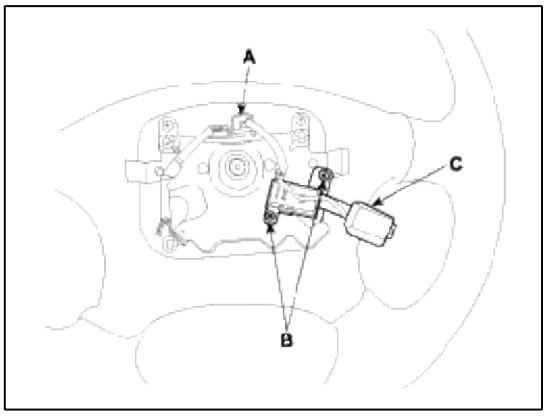
3. Loosen the three mounting bolts(E), and remove the actuator(F) with the bracket.



4. Installation is the reverse of removal.

CRUISE REMOCON SWITCH REPLACEMENT

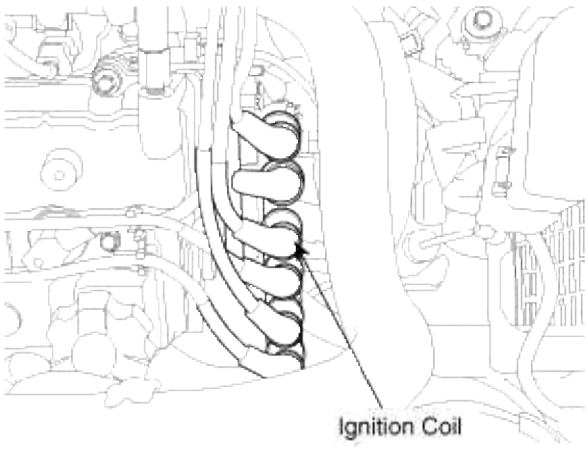
1. Disconnect the battery negative cable, them disconnect the positive cable, and wait at least three minutes.
2. Remove the driver's airbg (See page RT group-air bag module).
3. Disconnect the remocon switch connector(A).
4. Loosen the two mounting screws(B), and remove the cruise remocon switch(C).



5. Installation is the reverse of removal.
6. Connect the battery positive cable and negative cable to the battery.

Engine Electrical System > Troubleshooting > P0300

COMPONENT LOCATION



GENERAL DESCRIPTION

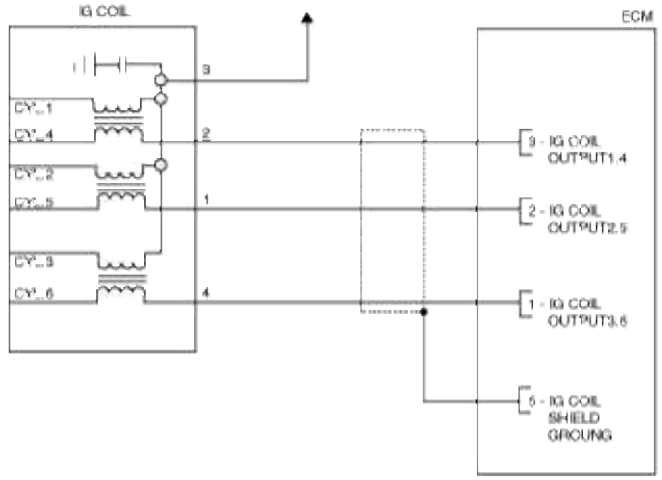
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Immediate (Catalyst converter damage has occurred) or 2 Driving Cycles (Emission thresholds are exceedes)	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



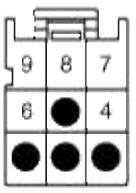
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

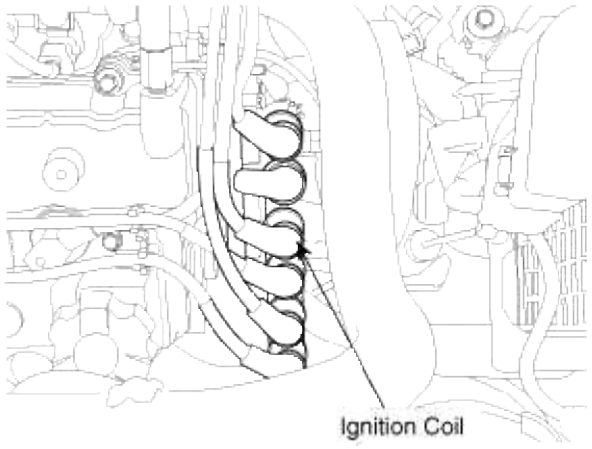
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0301

COMPONENT LOCATION



GENERAL DESCRIPTION

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

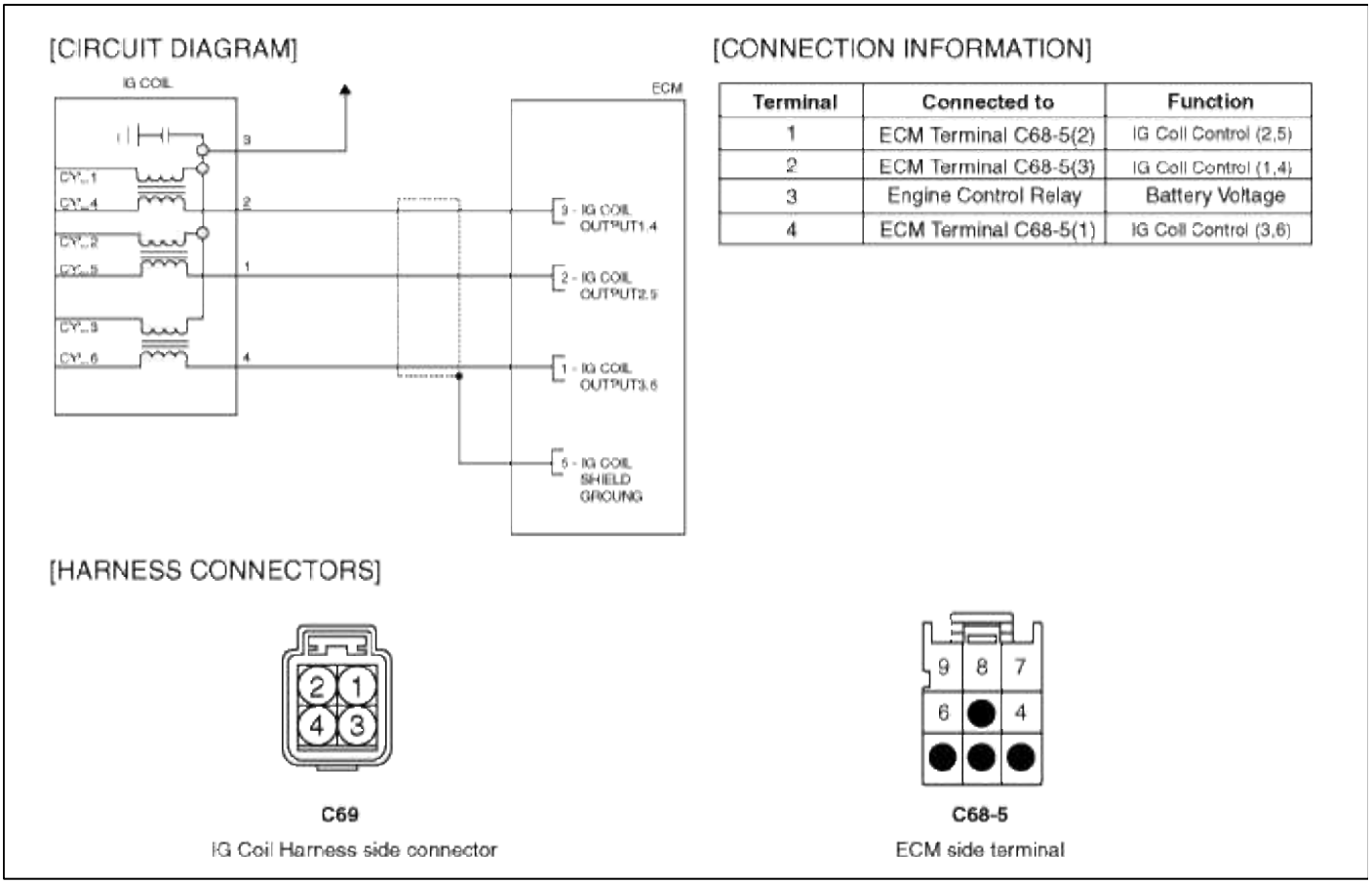
DTC DESCRIPTION

The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate. With a more than two cylinder misfire detection, the ECM sets P0300.

DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case 2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM



AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

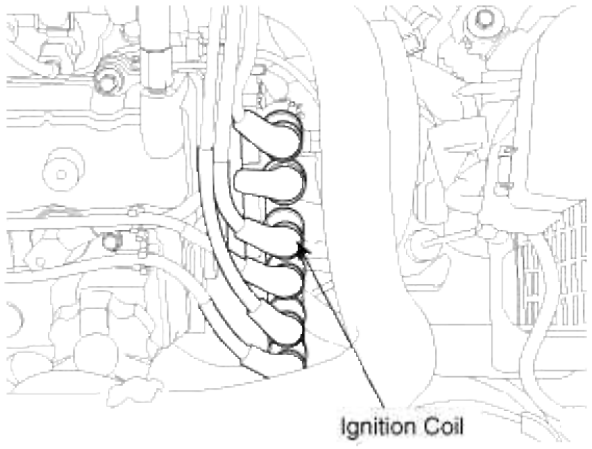
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0302

COMPONENT LOCATION



GENERAL DESCRIPTION

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION

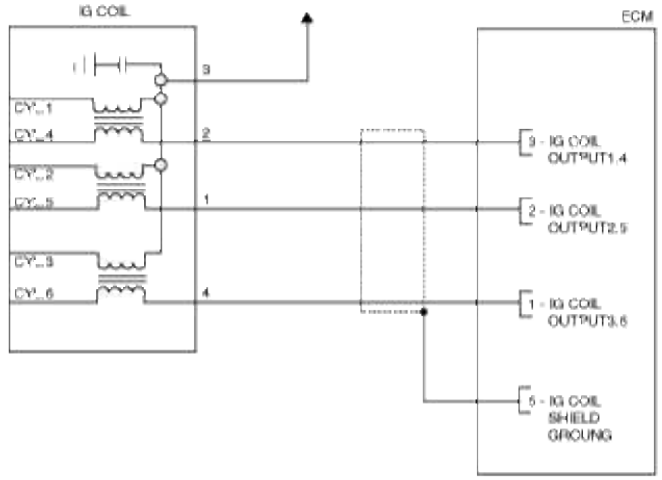
The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



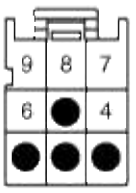
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

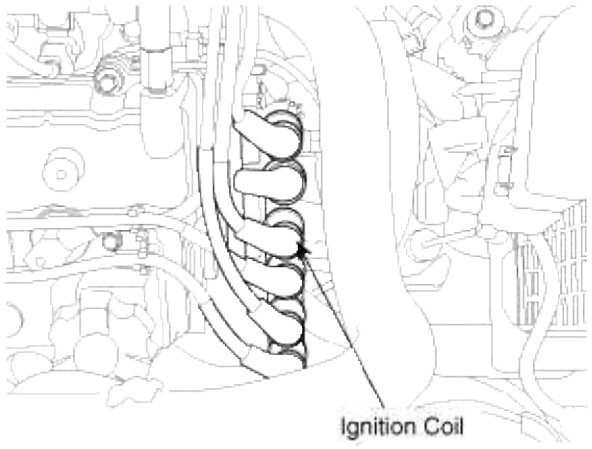
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0303

COMPONENT LOCATION



GENERAL DESCRIPTION

DTC DESCRIPTION

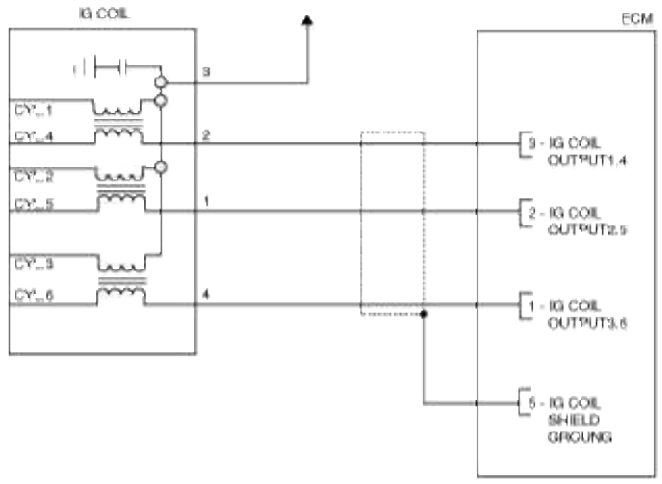
DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	

Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	• Leakage between cooling system and cylinder
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



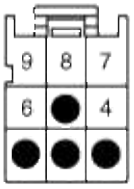
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

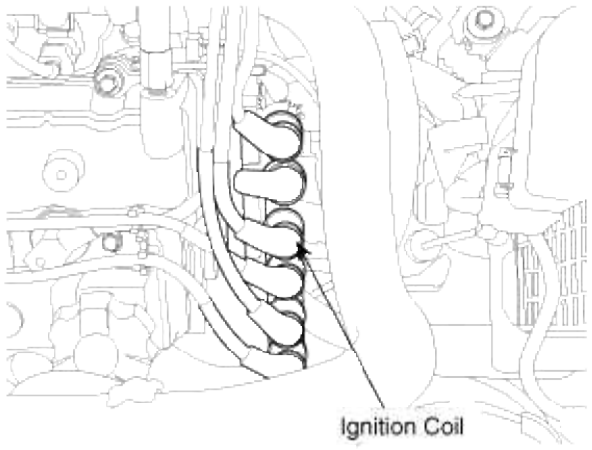
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0304

COMPONENT LOCATION



GENERAL DESCRIPTION

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION

The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

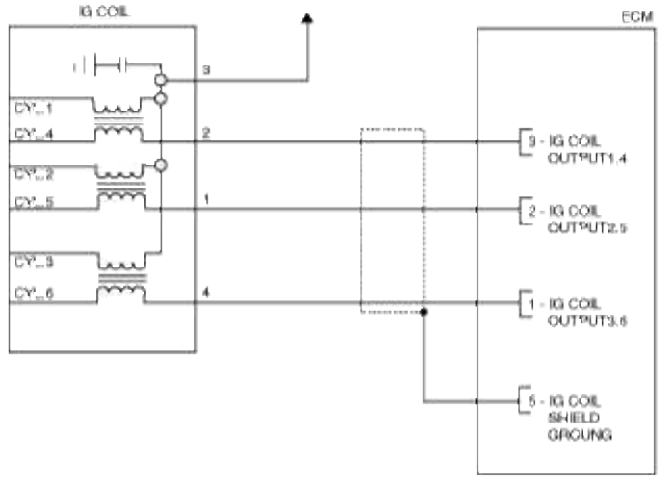
DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage
Enable Conditions	• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	

Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	• Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



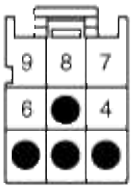
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage

2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

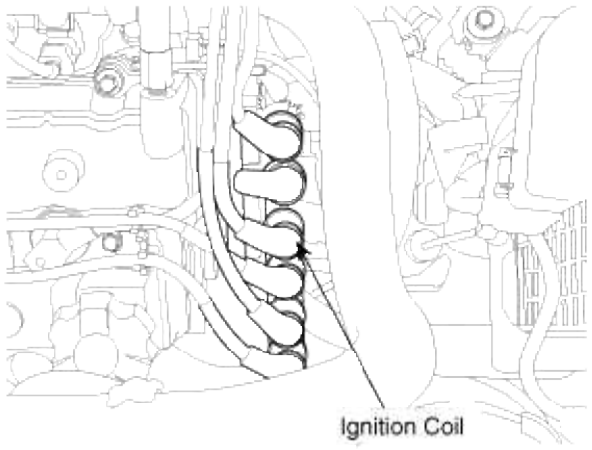
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0305

COMPONENT LOCATION



GENERAL DESCRIPTION

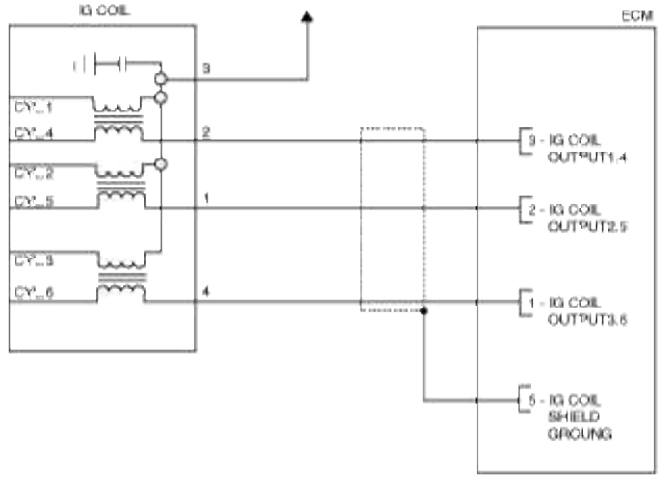
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



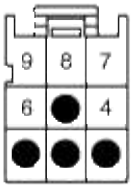
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. isually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

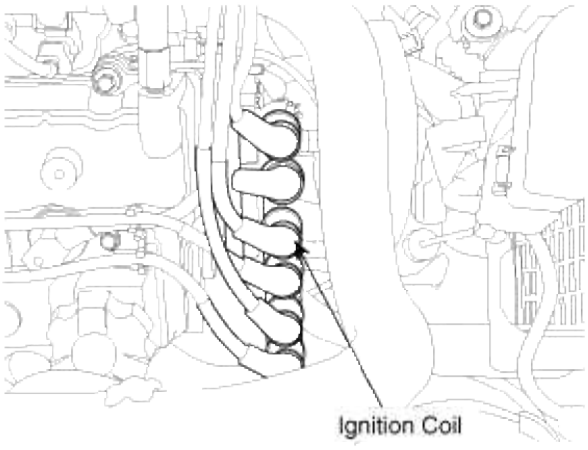
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0306

COMPONENT LOCATION



GENERAL DESCRIPTION

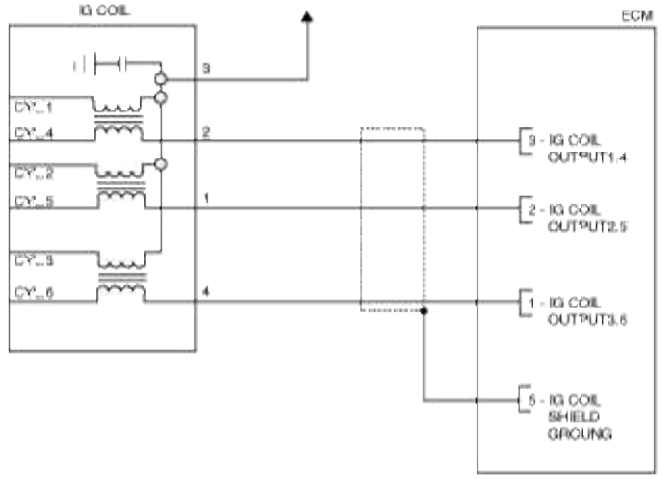
DTC DESCRIPTION

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">ITEM</th><th>DETECTING CONDITION</th><th>POSSIBLE CAUSE</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Calculation of engine roughness</td><td rowspan="6">• Faulty spark plugs, hightension lead, or Ignition coil
• Incorrect valve timing
• Uneven compression
• Air leakage
• Improper Fuel pressure or dirty fuel.
• Blocked/Leaking injectors
• Leakage between cooling system and cylinder</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• After starting
• Mass air flow >Approx. 0
• 550< Engine speed(RPM)< 6500
• Intake air mass gradient is in predetermined range
• Throttle Angle gradient is in predetermined range
• No injector shut off
• No rough road</td></tr>
<tr><td rowspan="2">Case 1)</td><td>Threshold Value</td><td>• Misfire= 6~17 within 200 rev.</td></tr>
<tr><td>Diagnosis Time</td><td>• 200 revolution: 3*200 revolution</td></tr>
<tr><td rowspan="2">Case2)</td><td>Threshold Value</td><td>• First 1000 rev.: Misfire>2%
• After first 1000 rev.: Misfire >2%</td></tr>
<tr><td>Diagnosis Time</td><td>• 1000 revolution: 4*1000 revolution</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• Case1) Immediate
• Case2) 2 Driving Cycles</td></tr>
</table>

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



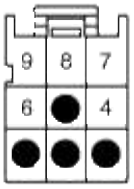
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

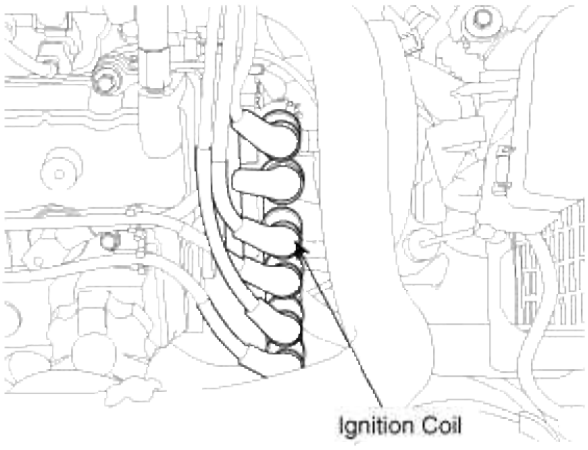
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0350

COMPONENT LOCATION



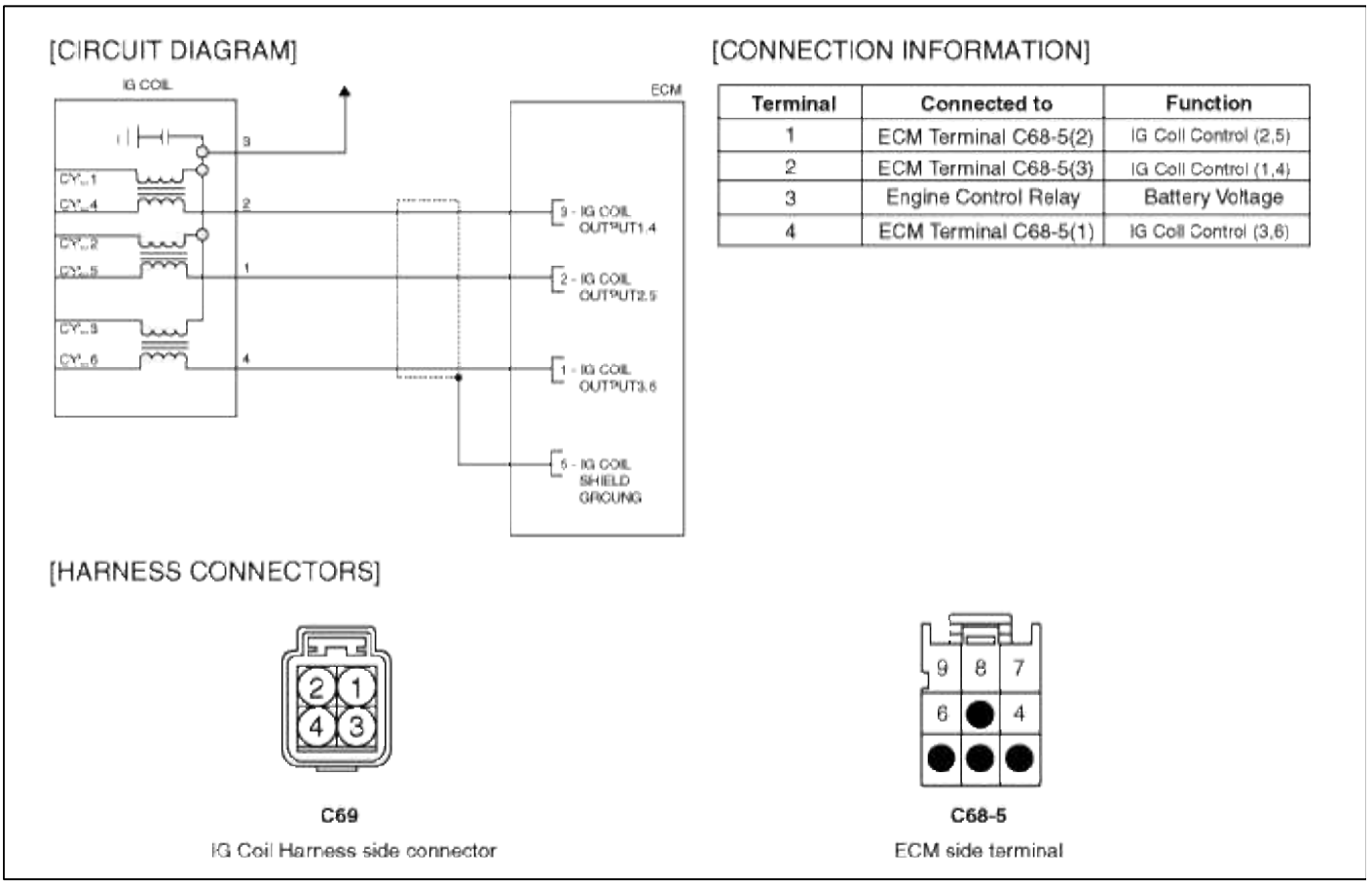
GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
Enable Conditions	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Threshold Value	• Coolant temperature >75°C(167°F)	
Threshold Value	• Failure on 3 cylinder or more	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

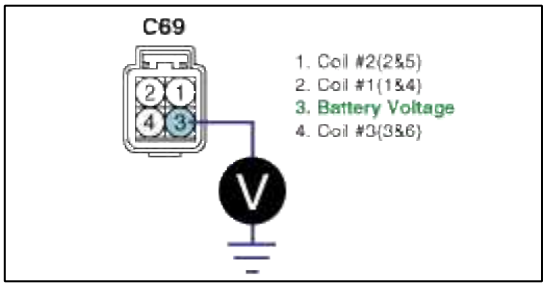
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

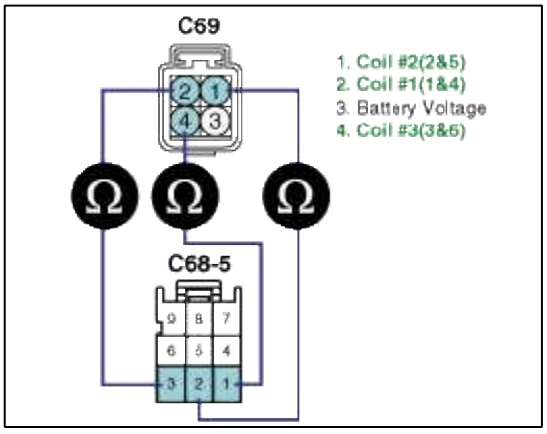
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance from each ignition coil control circuit to ECM.

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

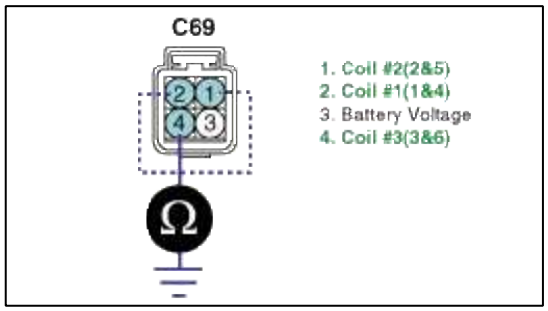
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance from each ignition coil control circuit (4/C14, 1/C14, 2/C14) to chassis ground.

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

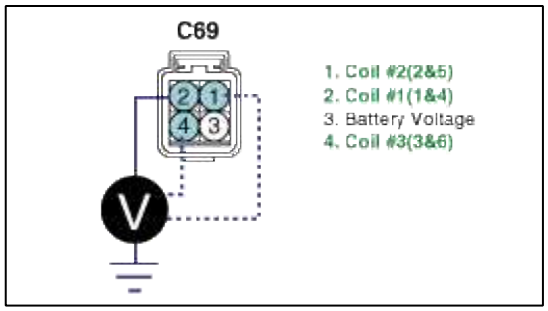
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage from each ignition coil control circuit (4/C14, 1/C14, 2/C14) to chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure.

   NO

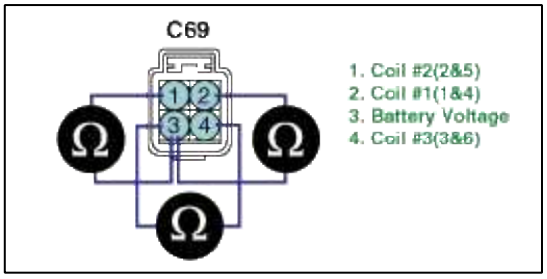
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.

4. Measure the resistance in each primary coil, referring to specification.(Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)
- No.1 & 4 cyl. : terminals 3 & 2
- No.2 & 5 cyl. : terminals 3 & 1
- No.3 & 6 cyl. : terminals 3 & 4

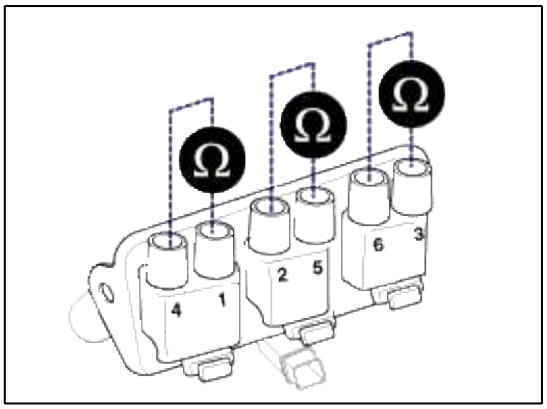


5. Measure the secondary coil resistance.
Measure the resistance between the high-voltage terminal for the No. 3 and No. 6 cylinders, between the high-voltage terminals for the No. 1 and No. 4 cylinders and between the high-voltage terminals for the No.2 and No.5 cylinders.

CAUTION

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

Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

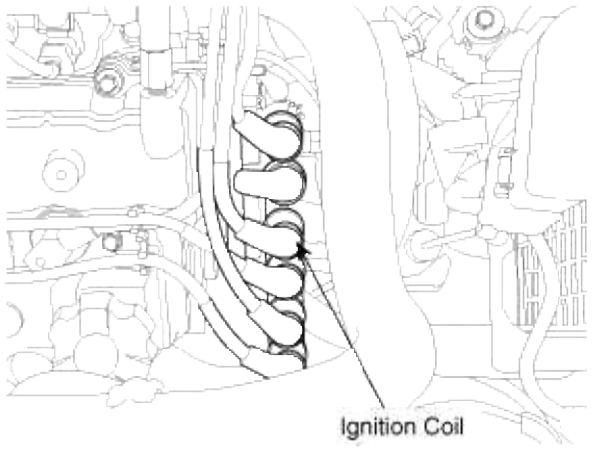
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Engine Electrical System > Troubleshooting > P0351

COMPONENT LOCATION



GENERAL DESCRIPTION

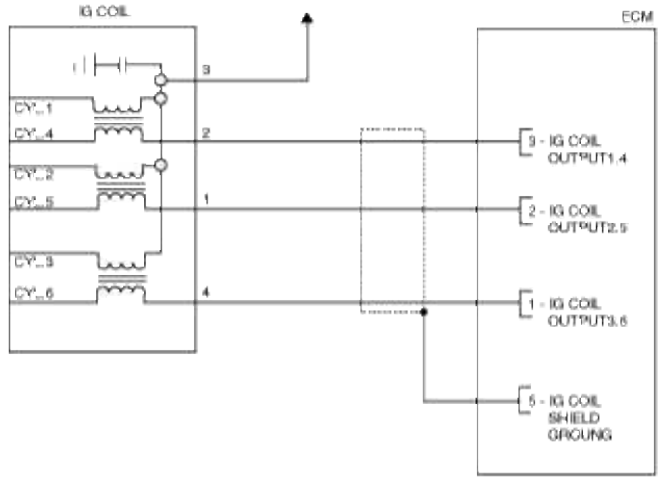
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
Enable Conditions	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Threshold Value	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



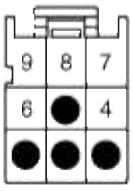
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

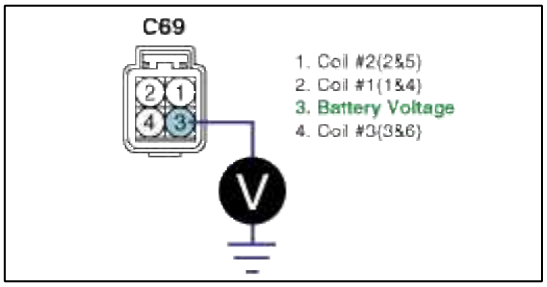
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

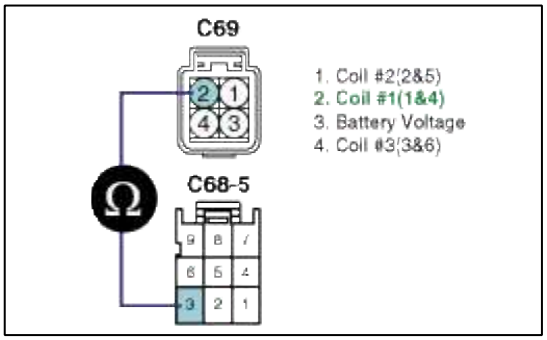
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the coil harness connector and 3 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

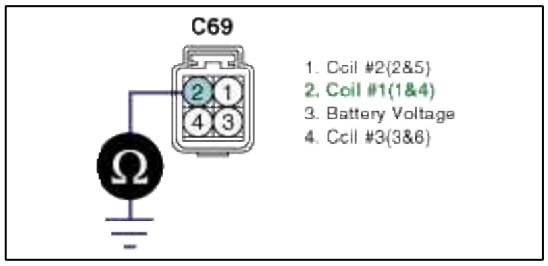
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 2 of the coil harness connector and chassis ground.

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

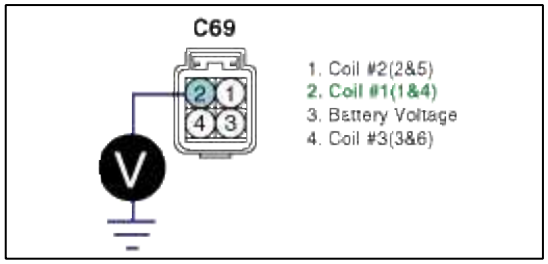
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 2 of the coil harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to next step as below.

   NO

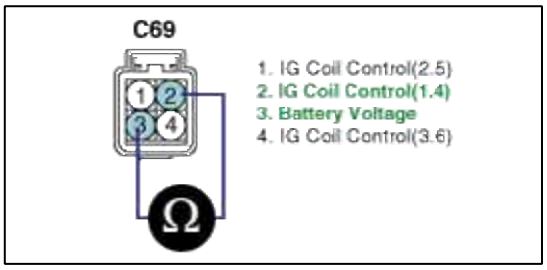
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.

4. Measure the resistance between terminals 2 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)

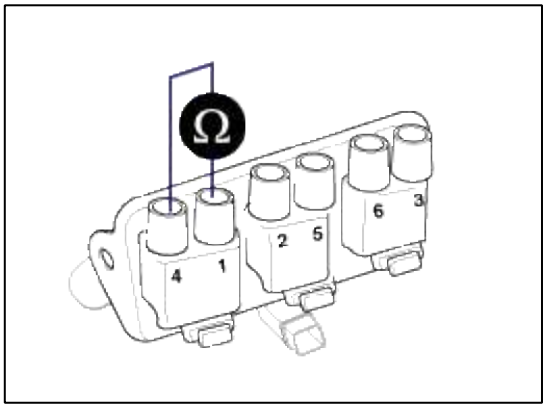


5. Measure the secondary coil resistance.
Measure the resistance between the high-voltage terminal to following diagram.

CAUTION

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

Specification : Approx. 13.3 ± 1.9 (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

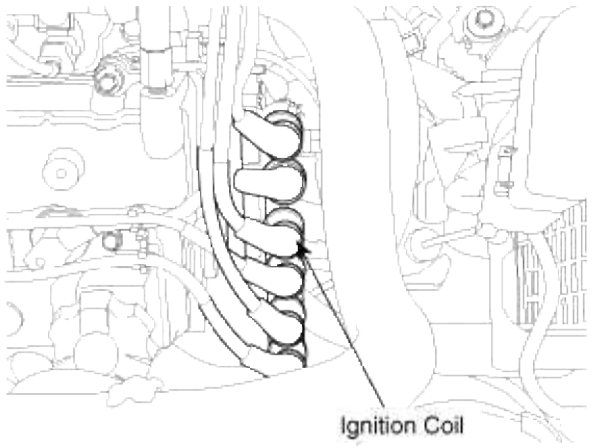
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Engine Electrical System > Troubleshooting > P0352

COMPONENT LOCATION



GENERAL DESCRIPTION

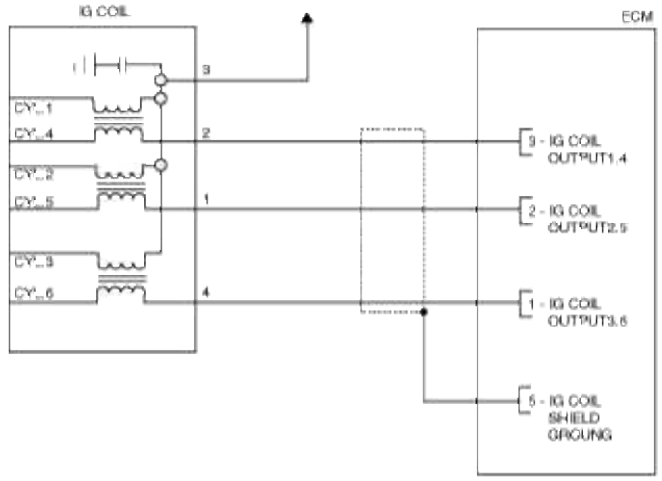
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
Enable Conditions	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Threshold Value	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



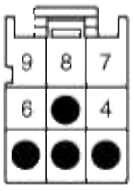
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

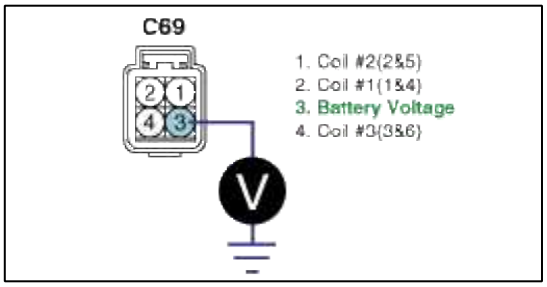
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

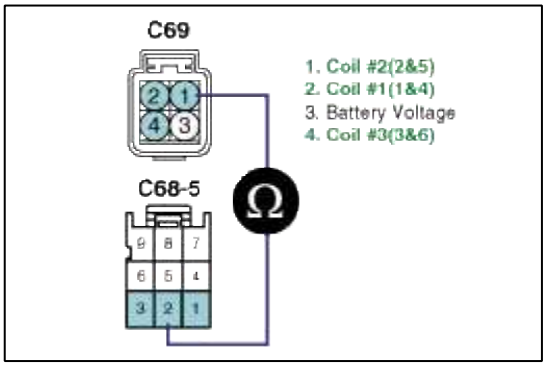
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 1 of the coil harness connector and 2 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

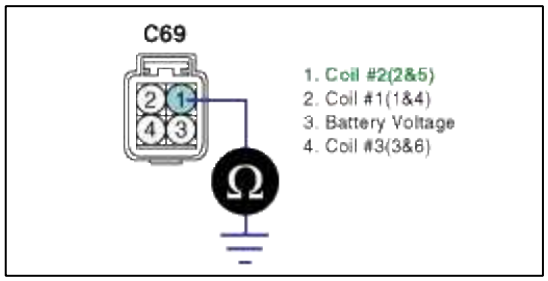
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 1 of the coil harness connector and chassis ground.

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

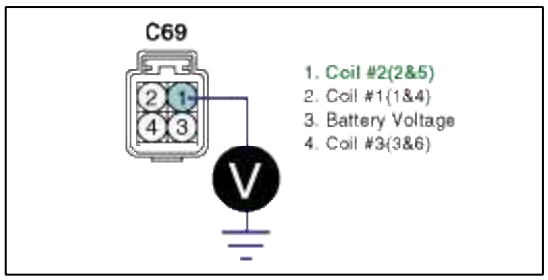
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 1 of the coil harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure.

   NO

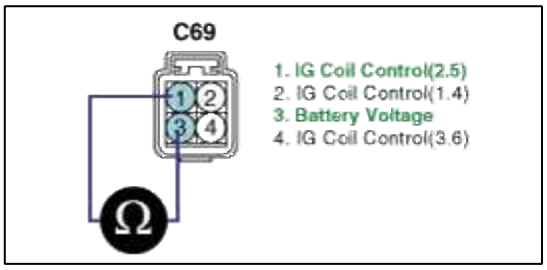
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.

4. Measure the resistance between terminals 1 and 3 of the primary ignition coil.(Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)

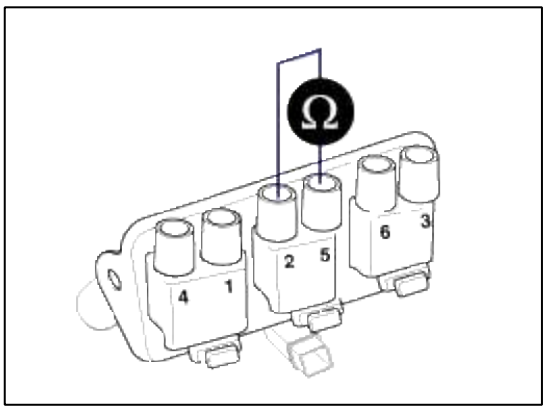


5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 13.3 ± 1.9 (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

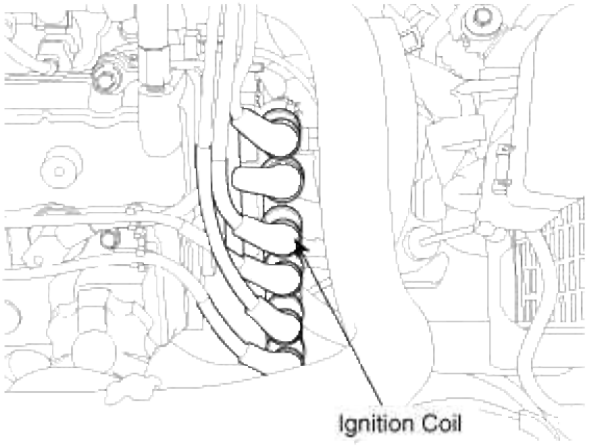
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx.12.5 ± 15% (kΩ)

Engine Electrical System > Troubleshooting > P0353

COMPONENT LOCATION



GENERAL DESCRIPTION

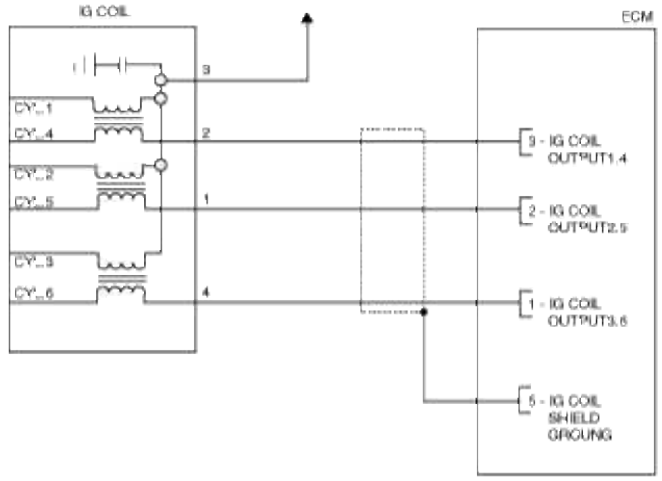
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Enable Conditions	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



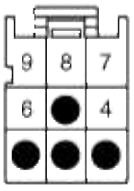
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

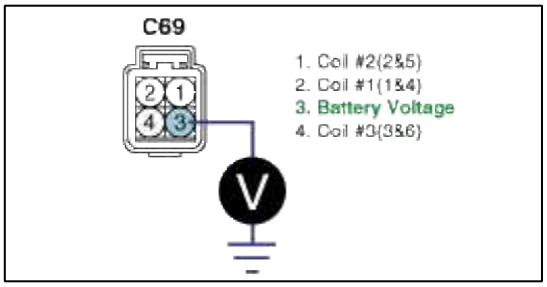
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

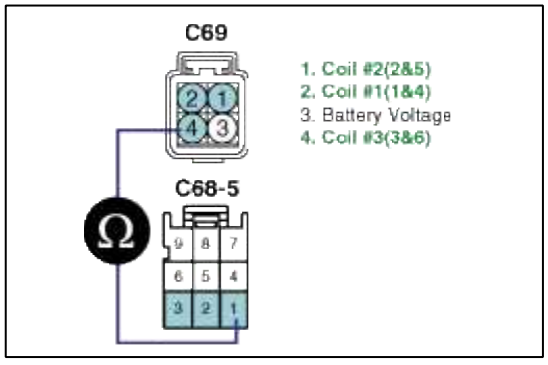
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 4 of the coil harness connector and 1 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

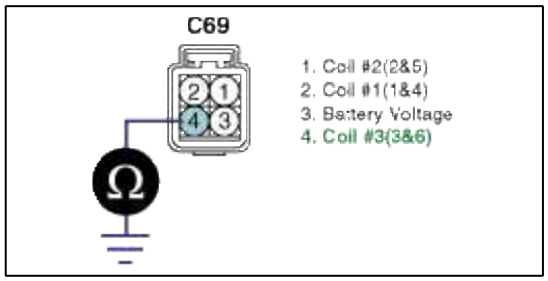
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 4 of the coil harness connector and chassis ground.

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

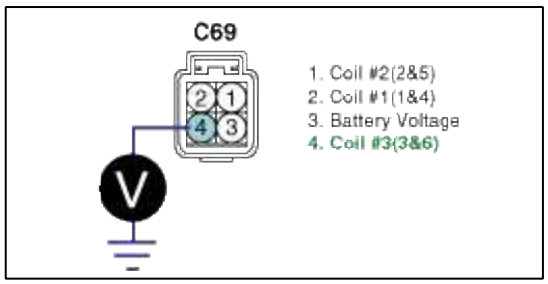
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 4 of the coil harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to next step as below.

   NO

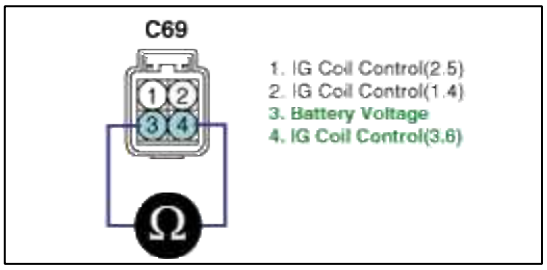
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.

4. Measure the resistance between terminals 4 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)

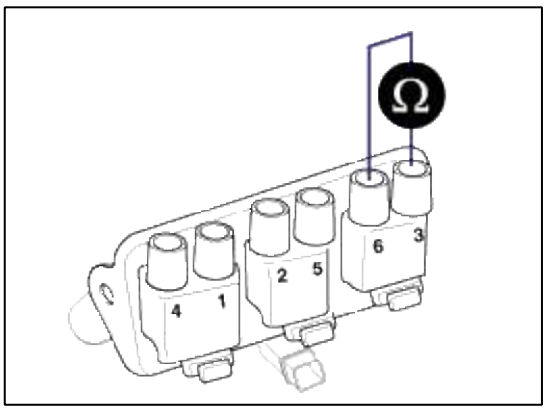


5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

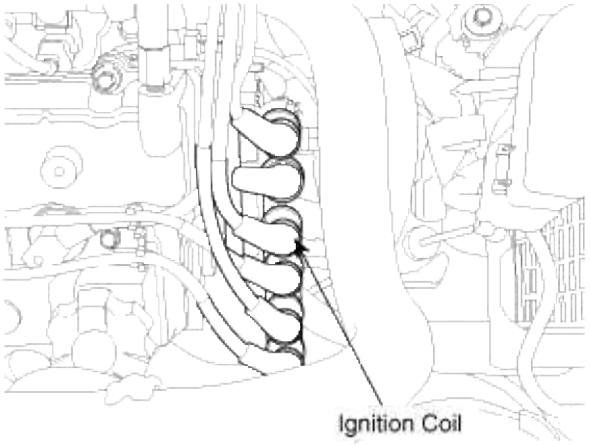
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Engine Electrical System > Troubleshooting > P0354

COMPONENT LOCATION



GENERAL DESCRIPTION

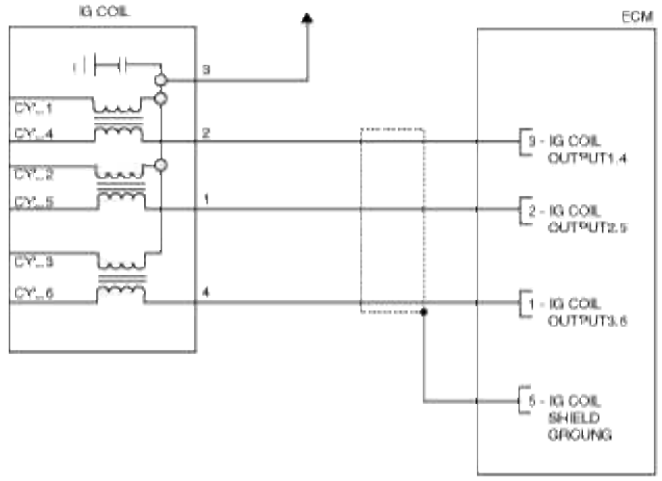
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Enable Conditions	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



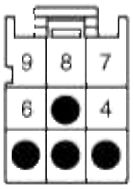
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

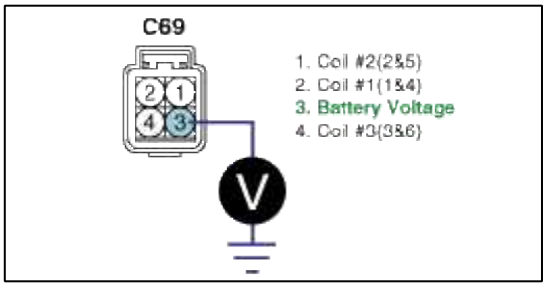
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

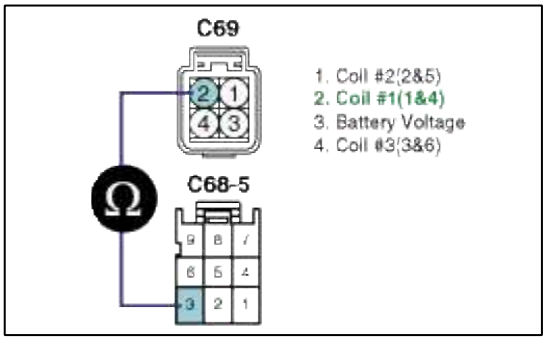
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the coil harness connector and 3 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

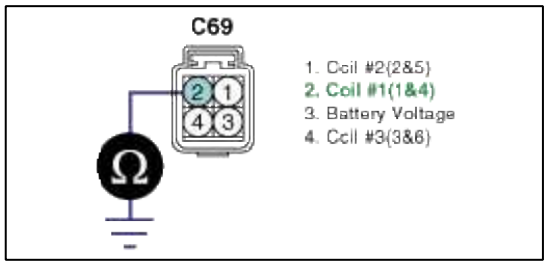
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 2 of the coil harness connector and chassis ground.

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

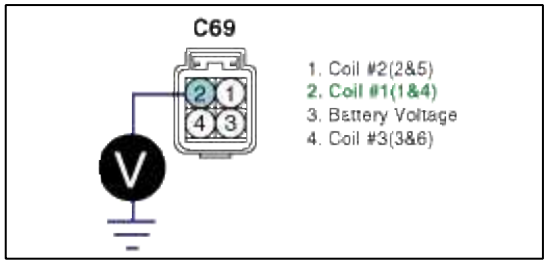
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 2 of the coil harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to next step as below.

   NO

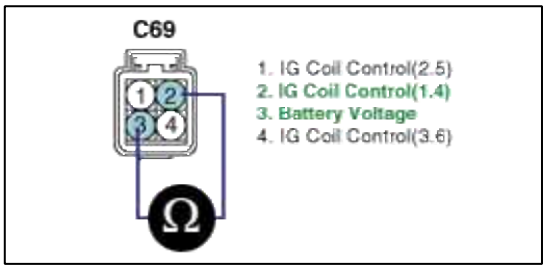
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.

4. Measure the resistance between terminals 2 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)

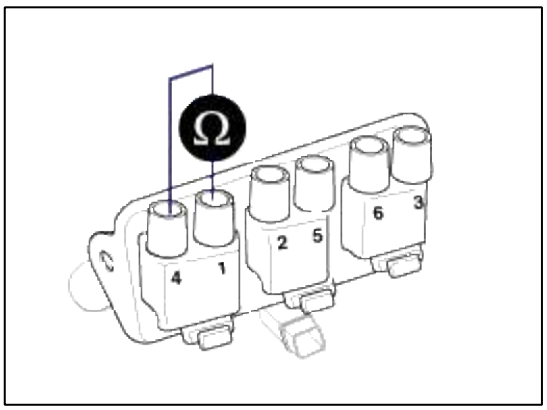


5. Measure the secondary coil resistance.
Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

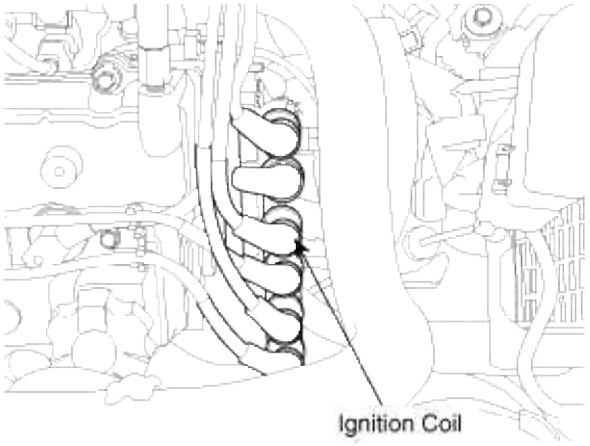
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Engine Electrical System > Troubleshooting > P0355

COMPONENT LOCATION



GENERAL DESCRIPTION

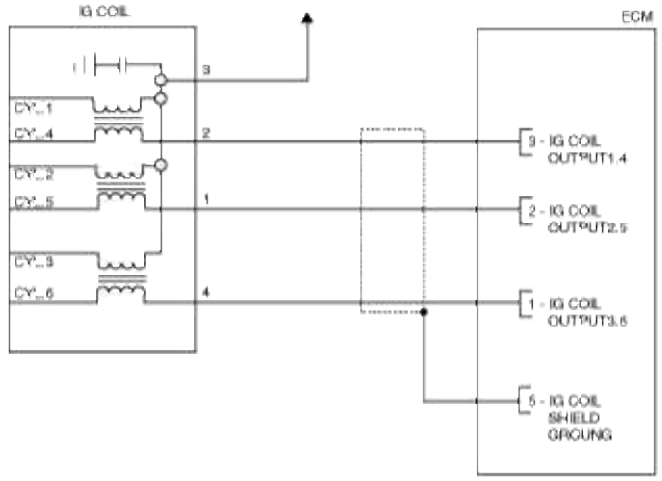
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Enable Conditions	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



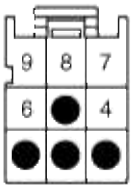
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

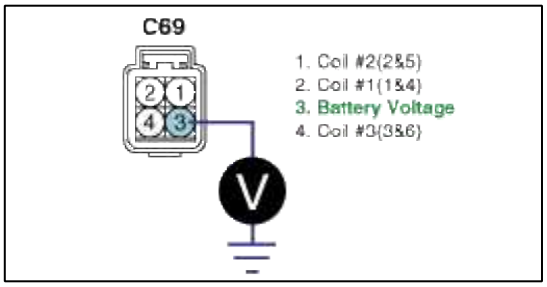
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

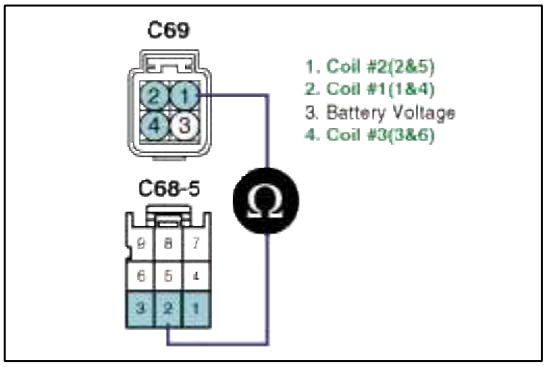
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 1 of the coil harness connector and 2 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

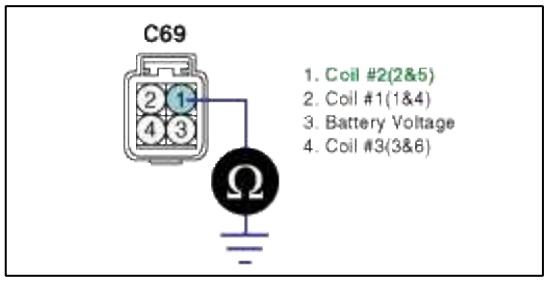
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 1 of the coil harness connector and chassis ground.

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

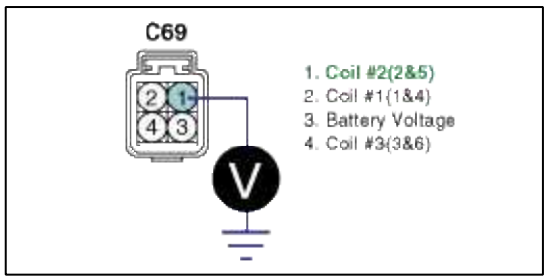
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 1 of the coil harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to next step as below.

   NO

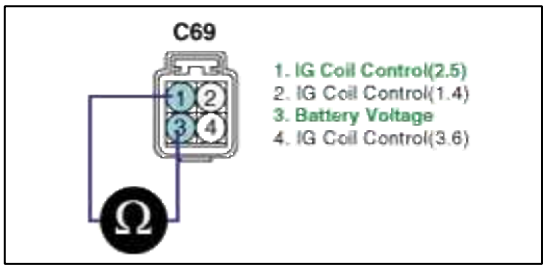
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.

4. Measure the resistance between terminals 1 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)

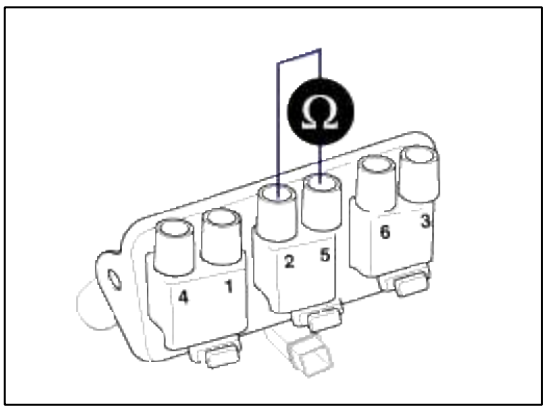


5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

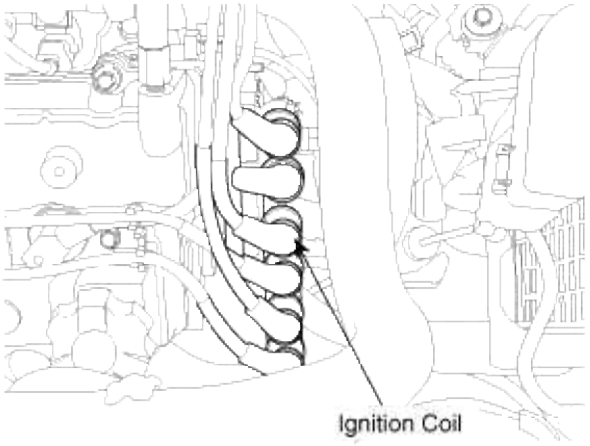
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Engine Electrical System > Troubleshooting > P0356

COMPONENT LOCATION



GENERAL DESCRIPTION

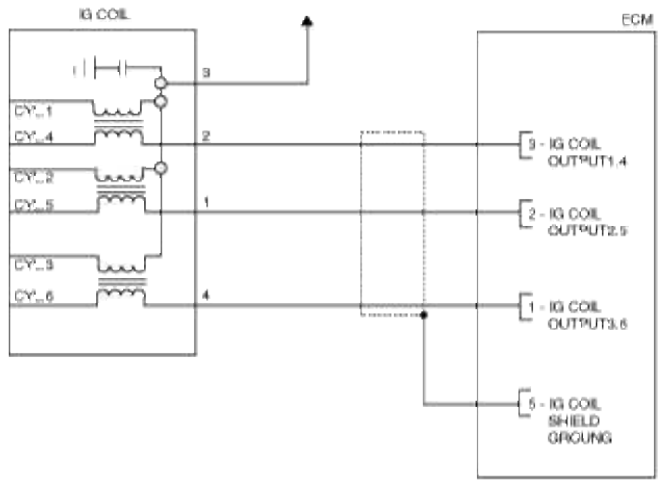
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Enable Conditions	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



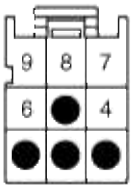
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

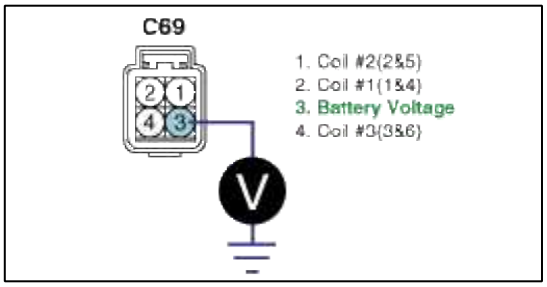
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

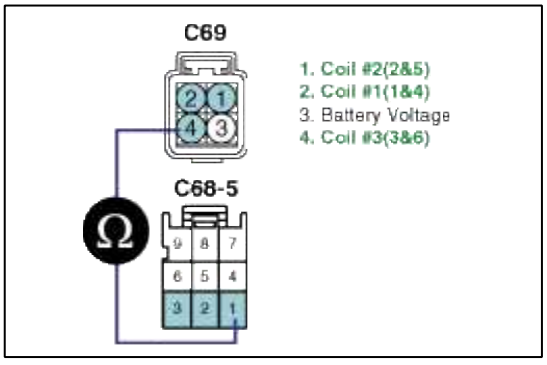
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 4 of the coil harness connector and 1 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

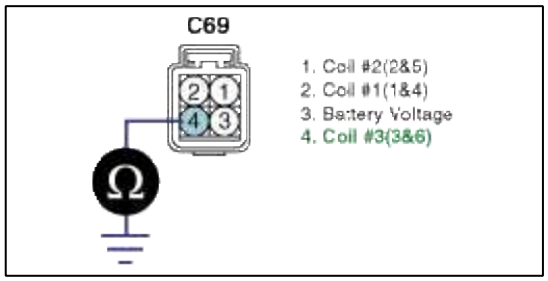
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 4 of the coil harness connector and chassis ground.

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

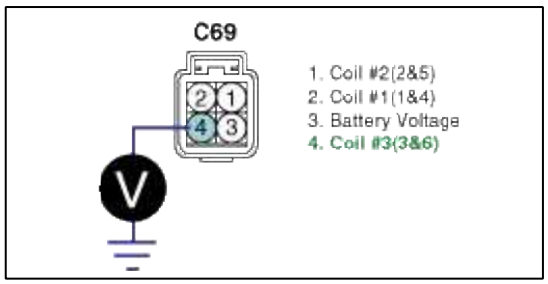
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 4 of the coil harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to next step as below.

   NO

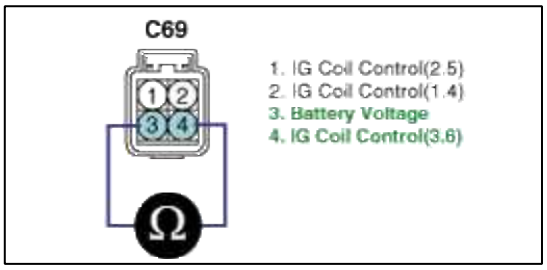
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.

4. Measure the resistance between terminals 4 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)

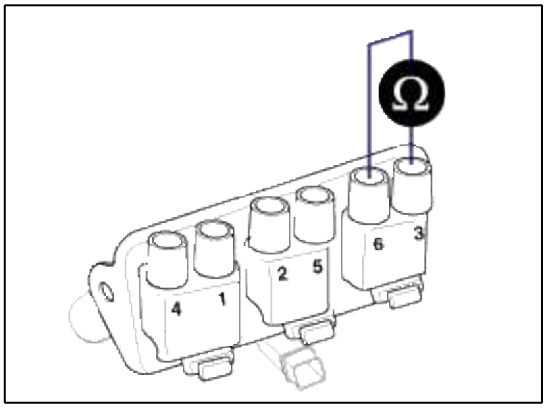


5. Measure the secondary coil resistance.
Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

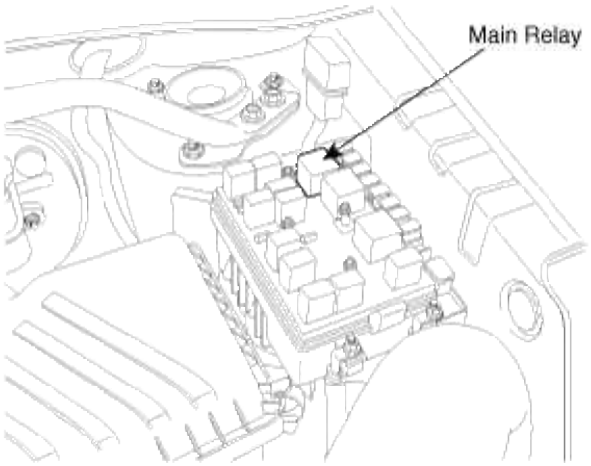
Go to the applicable troubleshooting procedure.

SPECIFICATION

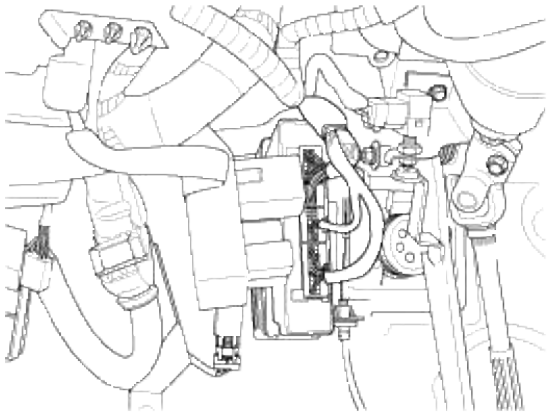
Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Engine Electrical System > Troubleshooting > P0560

COMPONENT LOCATION



COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

GENERAL DESCRIPTION

TCM(PCM) saves "LEARNING VALUE" and keeps it at certain value. Through this process, the "LEARNING VALUE" is protected from being erased at disconnecting Battery cable and maintaining related components.

DTC DESCRIPTION

The ECM measures the voltage from ignition key and from main relay respectively and compares two voltages. This comparison will watch if the Main Relay has switched and remains on after ignition Key-On and if it has switched off after the ignition Key-Off. The ECM sets DTC P0560 if the voltage after Main Relay is lower than a predetermined threshold after ignition key-on or higher than a predetermined threshold after ignition key-off.

DTC DESCRIPTION

The TCM(PCM) is detected an unexpected communication error with "EEPROM", the TCM(PCM) sets this code.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of battery voltage and voltage after	• Open or short circuit • Contact resistance in connectors
Enable Conditions	• Battery voltage >10V • Ignition ON	
Threshold Value	• Voltage after main relay when ON < 6V	
Diagnostic Time	• 0.1 sec.	
MIL On Condition	• -	

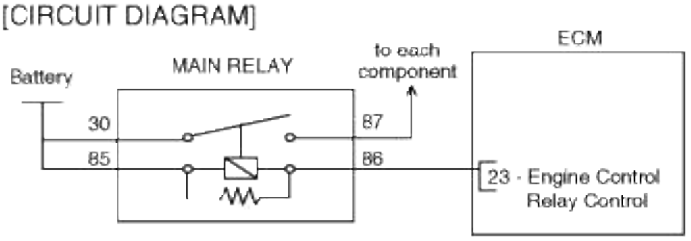
DTC DETECTING CONDITION

[2.7 GSL]

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check Voltage range	• Faulty TCM(PCM) • Fault in harness
Enable Conditions	• Engine speed is normal • Engine speed ≥ 400rpm • Vb(Backup-line) ≥ 9V	
Threshold value	• Backup-line ≥ 7 Volt	
Diagnostic Time	• 10 Sec	
Fail Safe		

SCHEMATIC DIAGRAM

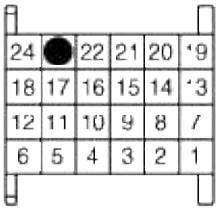
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Supply
85	Battery	Battery Supply
86	ECM Terminal C68-2(23)	Main Relay Control
87	-	Supply B+

[HARNESS CONNECTORS]



C68-2
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

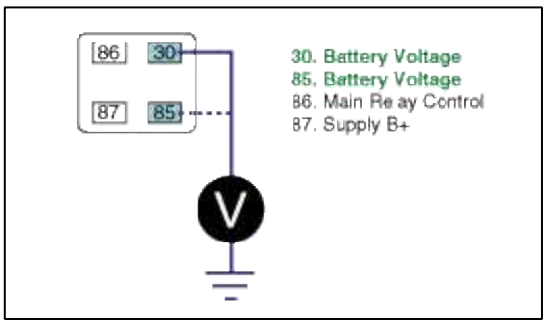
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Remove the main relay.
2. Ignition "ON" & Engine "OFF".
3. Measure the voltage between terminal 30 of the main relay harness connector(E07) and chassis ground.
4. Measure the voltage between terminal 85 of the main relay harness connector(E07) and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection"

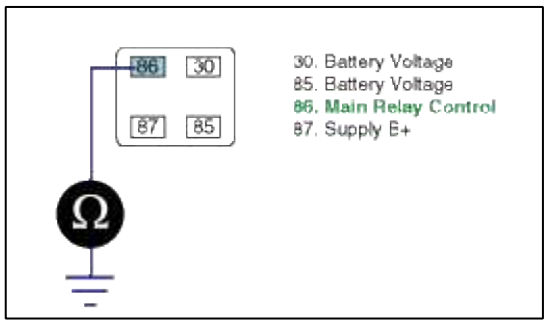
NO

Check for an open or short to ground in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect Relay harness connector.
   (3) Measure resistance between terminal 86 of the relay harness connector and chassis ground.

   Specification : Infinite



   (4) Is resistance within the specification?

   YES

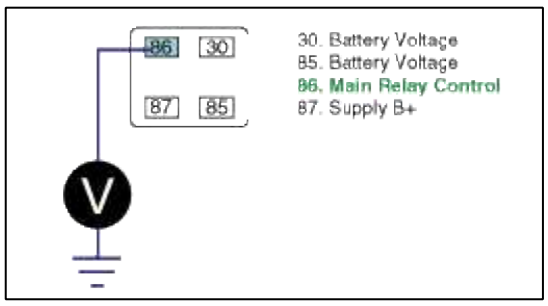
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect relay and ECM connectors.
   (3) Ignition "ON" and Engine "OFF".
   (4) Measure voltage between terminal 86 of the relay harness connector and chassis ground.

   Specification : Approx 0V



   (5) Is voltage within the specification?

   YES

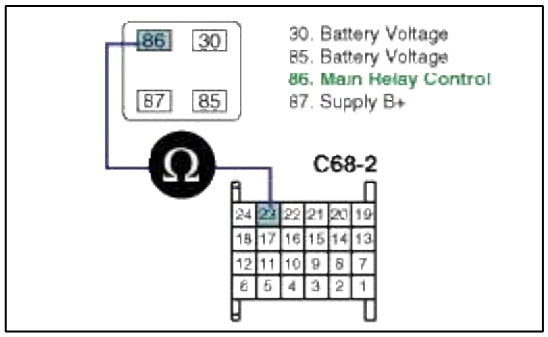
   Go to next step as below

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for open in control harness.
   (1) Ignition "OFF".
   (2) Disconnect relay and ECM connectors.
   (3) Measure resistance between terminals 86 of the relay harness connector and 23 of the ECM harness connector(C68-2).

   Specification : Approx 0Ω



   (4) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

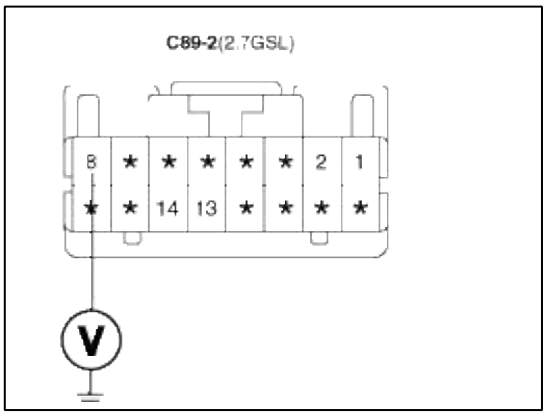
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disonnect the "C89-2" of TCM(PCM) connector.
3. Measure the voltage between terminal "8" of the "C89-2" of TCM(PCM) harness connector and chassis ground.

   Specification : Approx. B+



4. Is voltage 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. And Go to Component Inspection procedure.

   NO

   Check the Fuse 37-10A is installed or not blown.
   Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove the main relay.
3. Apply 12V and a ground to 85 and 86 terminals of the main relay.
4. Check if the main relay works well when it is energized. (If the main relay works normally, a clicking sound can be heard.)
5. Does the main relay operate normally?

YES

Go to next step as below.

NO

Replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Connect scantool to data link connector.
2. Ignition "ON" & Engine "OFF".
3. Monitor the "DTC".
4. Is DTC Re-displayed?

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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

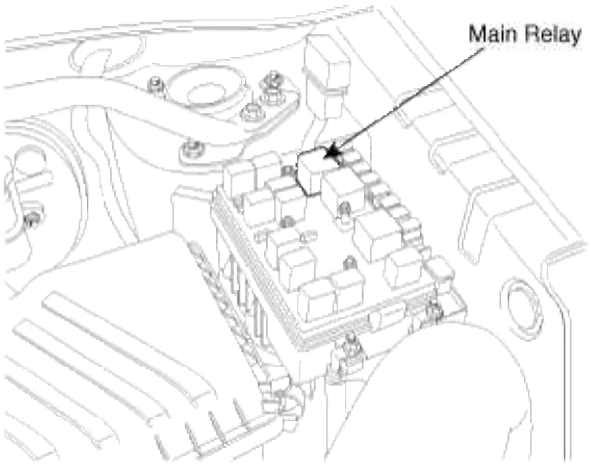
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0562

COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION

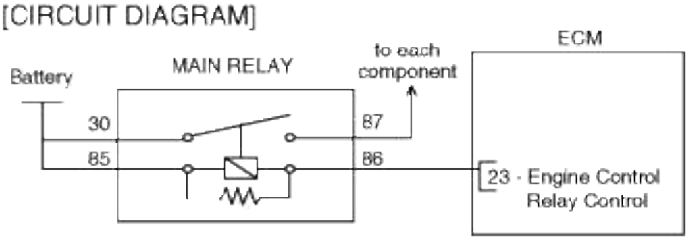
ECM sets DTC P0562 if the ECM detects system voltage lower than the possible range of battery voltage.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check system voltage.	• Contact resistance in connectors • Faulty charging system
Enable Conditions	• Vehicle speed > 19km/h(12mph)	
Threshold Value	• Voltage after main relay when ON < 6V	
Diagnostic Time	• 240 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

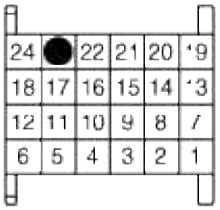
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Supply
85	Battery	Battery Supply
86	ECM Terminal C68-2(23)	Main Relay Control
87	-	Supply B+

[HARNESS CONNECTORS]



C68-2
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Charging System Inspection" procedure.

CHARGING SYSTEM INSPECTION

1. Check battery condition and Generator output
2. Are battery conditions and Generator output both okay?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

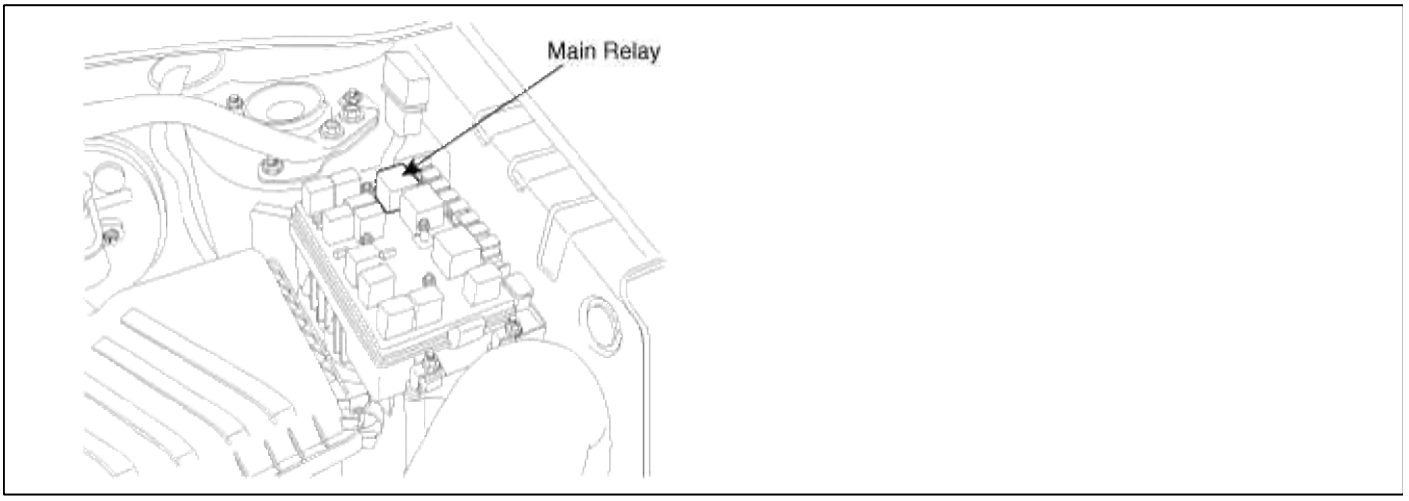
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Engine Electrical System > Troubleshooting > P0563

COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION

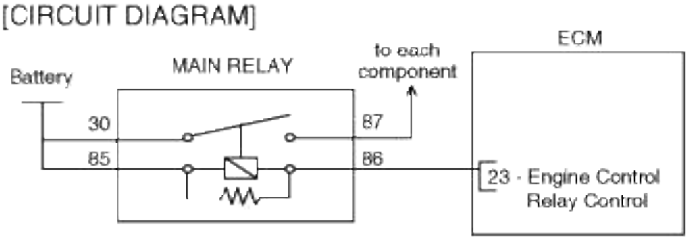
ECM sets DTC P0563 if the ECM detects system voltage lower than the possible range of battery voltage.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check system voltage.	• Contact resistance in connectors • Faulty charging system
Enable Conditions	• Vehicle speed > 19km/h(12mph)	
Threshold Value	• Voltage after main relay when ON >16V	
Diagnostic Time	• 240 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

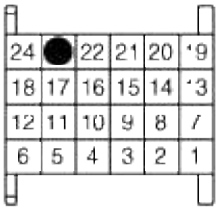
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Supply
85	Battery	Battery Supply
86	ECM Terminal C68-2(23)	Main Relay Control
87	-	Supply B+

[HARNESS CONNECTORS]



C68-2
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Charging System Inspection" procedure.

CHARGING SYSTEM INSPECTION

1. Check battery condition and Generator output
2. Are battery conditions and Generator output both okay?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Engine Mechanical System

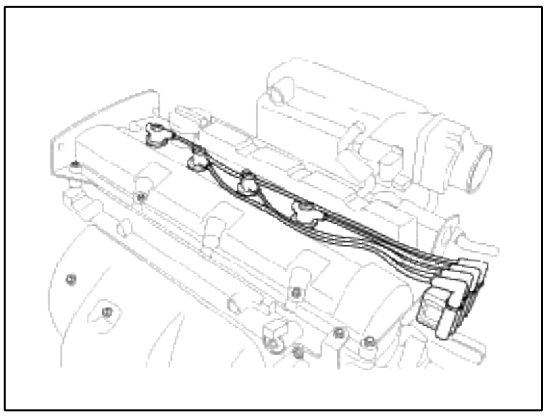
Engine Mechanical System > General Information > General Information

COMPRESSION PRESSURE INSPECTION

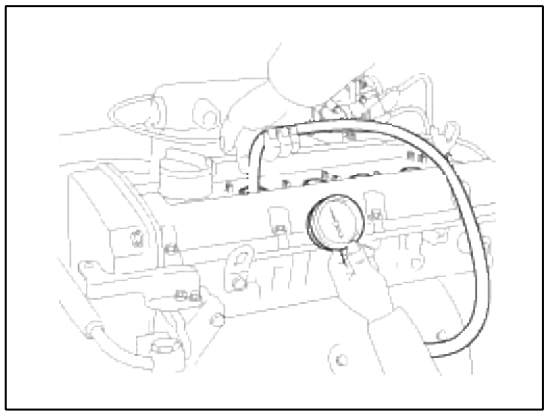
NOTE

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

1. Start the engine and allow to warm up to operating temperature (about five minutes). Stop the engine.
2. Disconnect the ignition coil connectors and the spark plug cables.



3. Remove the four spark plugs using a 16mm spark plug wrench.
4. Check the cylinder compression pressure.
   (1) Insert a compression gauge into the spark plug hole.



   (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.

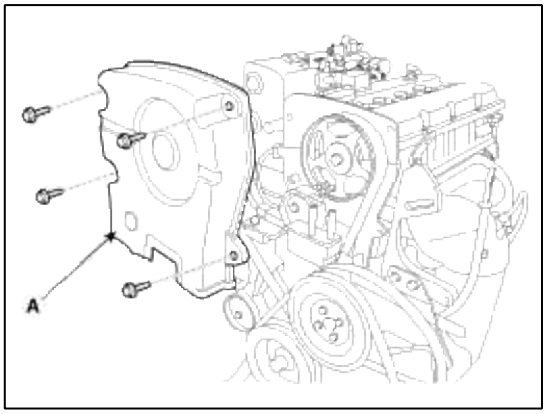
Compression pressure :
1,422kPa (14.5kg/cm², 206psi) (250~400 rpm)
Minimum pressure :
1,275kPa (13.0kg/cm², 185psi)
Difference between each cylinder :
98kPa (1.0kg/cm², 14psi) or less

(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.
A. If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
B. If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. Reinstall the spark plugs.
6. Connect the ignition coil connectors and the spark plug cables.

TIMING BELT TENSION ADJUSTMENT

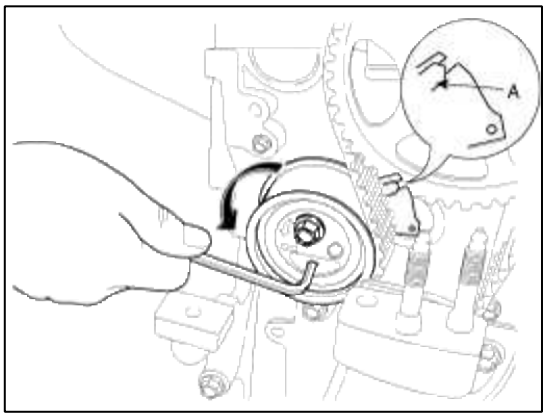
1. Remove RH front wheel.
2. Remove the 4bolts and timing belt upper cover (A).



3. Slacker the tensioner bolt.

> NOTE
>
> When check the timing belt tension or install the timing belt tensioner, must it the engine oil temperature is between 15°C(59°F) and 25°C(77°F)

4. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm(A) located at the center of the base notch.



CAUTION

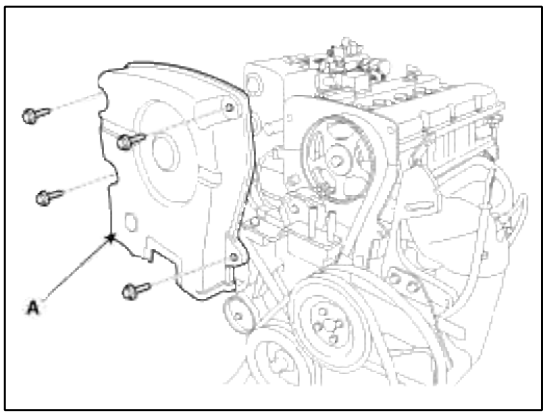
Do not rotate the adjuster clockwise.
It will result in auto tensioner's functional problem.

5. Tightening tensioner bolt with fixing the indicator not to move.

Tightening torque
Tensioner bolt :
22.6 ~ 28.4Nm (2.3 ~ 2.9kgf.m, 16.6 ~ 21.0lb-ft)

6. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
7. If the indicator is not located at the center of base, slacken the bolt and repeat the above procedure.
8. Install the timing belt upper cover (A).

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



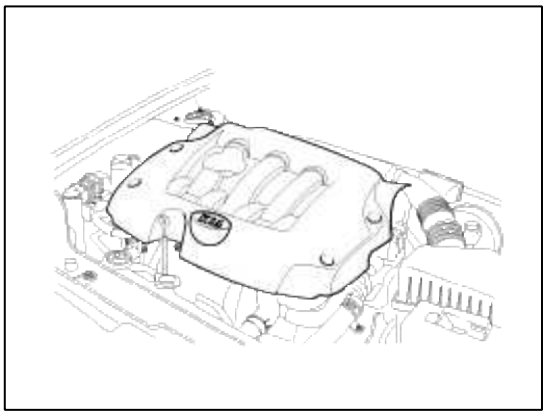
9. Install RH front wheel.

VALVE CLEARANCE INSPECTION AND ADJUSTMENT
MLA(MECHNICAL LASH ADJUSTER)

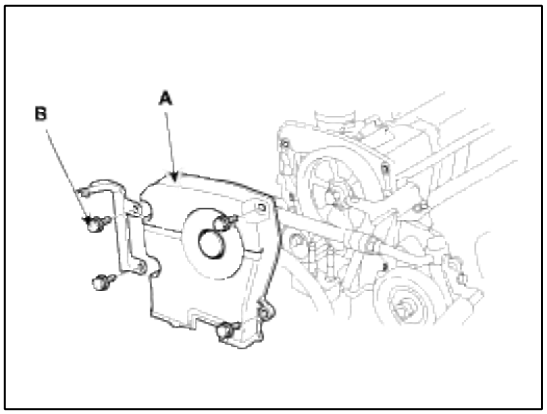
NOTE

Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : (20°C ± 5°C [68°F ± 9°F]) and cylinder head is installed on cylinder block.

1. Remove the engine cover.

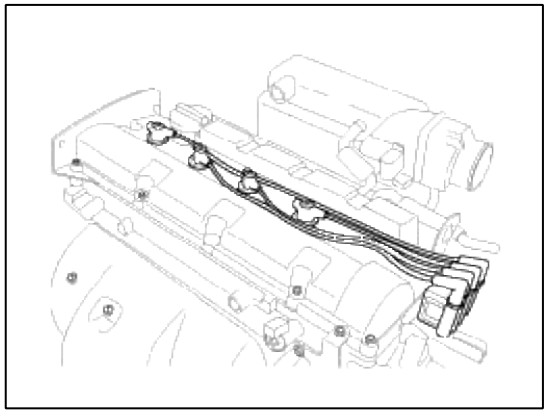


2. Remove the bolts(B) and timing belt upper cover(A).

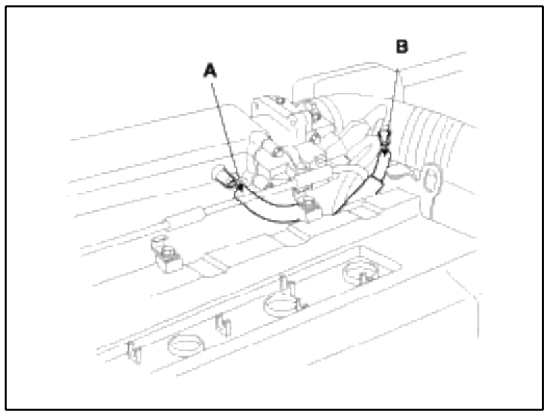


3. Remove the cylinder head cover.
   (1) Disconnect the spark plug cables and do not pull on the cable by force.

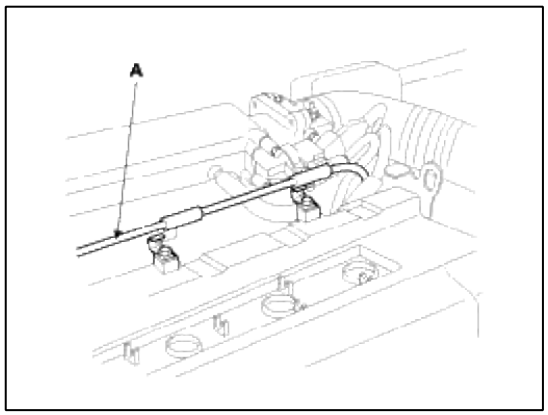
> NOTE
>
> Pulling on or bending the cables may damage the conductor inside.



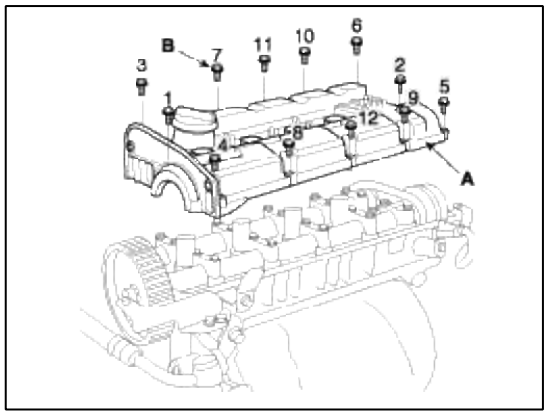
(2) Remove the PCV (Positive Crankcase Ventilation) hose(A) and the breather hose(B) from the cylinder head cover.



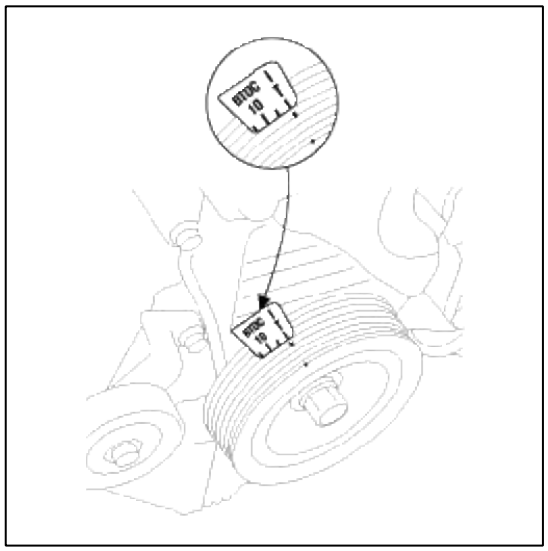
(3) Remove the accelerator cable(A) from the cylinder head cover.



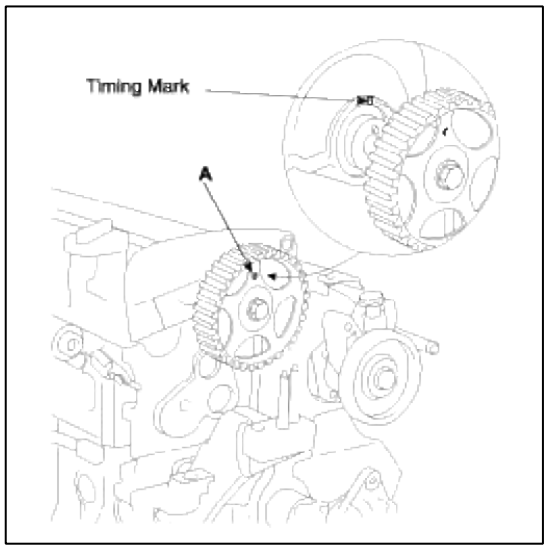
(4) Loosen the cylinder head cover bolts(B) and then remove the cover(A) and gasket.



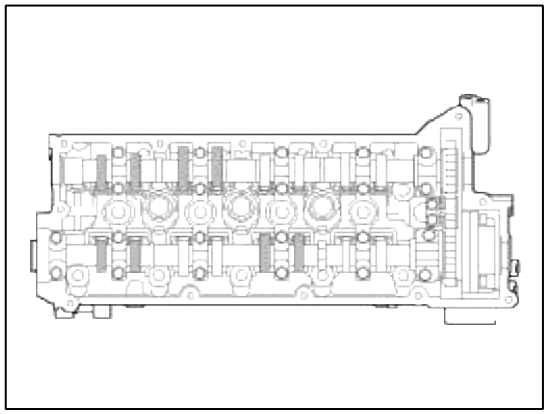
4. Set No. 1 cylinder to TDC/compression.
   (1) Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing belt cover.



   (2) Check that the hole of the camshaft timing pulley(A) is aligned with the timing mark of the bearing cap. If not, turn the crankshaft one revolution (360°).



5. Inspect the valve clearance.
   (1) Check only the valve indicated as shown. [No. 1 cylinder : TDC/compression]. Measure the valve clearance.

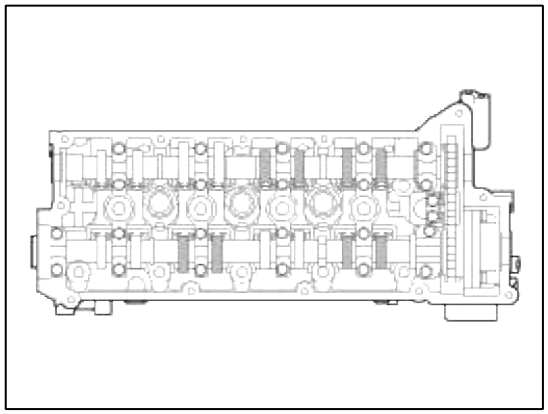


   A. Using a thickness gauge, measure the clearance between the tappet shim and the base circle of camshaft.
   B. Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance
[Specification]
Engine coolant temperature : (20°C ± 5°C[68°F ± 9°F])
Intake : 0.20mm (0.0079in)
Exhaust : 0.28mm (0.0110in)
[Limit]
Intake : 0.12 ~ 0.28mm (0.0047 ~ 0.0110in)
Exhaust : 0.20 ~ 0.38mm (0.0079 ~ 0.0150in)

(2) Turn the crankshaft pulley one revolution (360°) and align the groove with the timing mark "T" of lower timing belt cover.

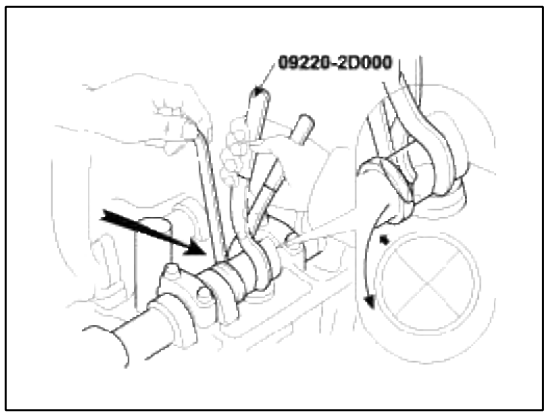
(3) Check only valves indicated as shown. [No. 4 cylinder : TDC/compression]. Measure the valve clearance. (See procedure step (1))



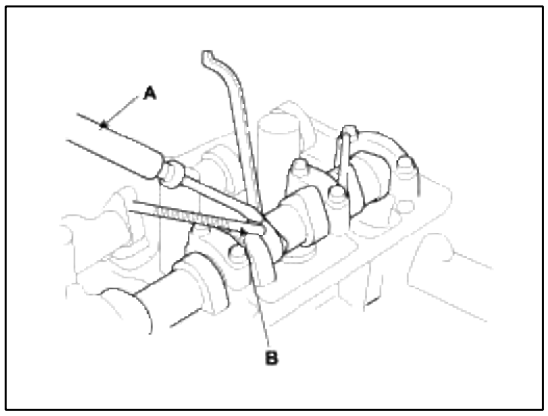
6. Adjust the intake and exhaust valve clearance.

(1) Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.

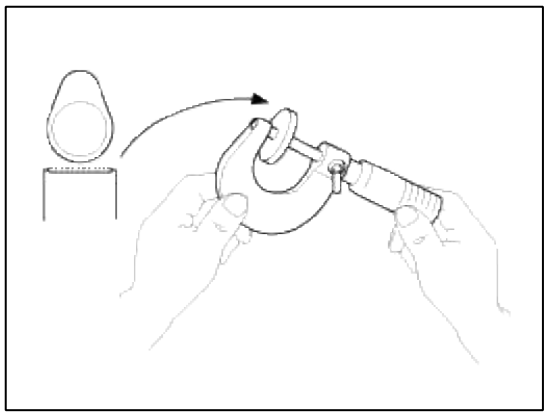
(2) Using the SST(09220 - 2D000), press down the valve lifter and place the stopper between the camshaft and v lifter and remove the special tool.



(3) Remove the adjusting shim with a small screw driver(A) and magnet(B).



(4) Measure the thickness of the removed shim using a micrometer.



(5) Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

Valve clearance
(Engine coolant temperature : 20°C ± 5°C[68°F ± 9°F])
T : Thickness of removed shim
A : Measured valve clearance
N : Thickness of new shim
Intake : N = T + [A - 0.20mm(0.0079in)]
Exhaust : N = T + [A - 0.28mm(0.0110in)]

(6) Select a new shim with a thickness as close as possible to the calculated value. (Refer to the Adjusting shim se chart)

NOTE

Shims are available in 20 size increments of 0.04mm (0.0016in) from 2.00mm (0.0787in) to 2.76mm (0.1087in)

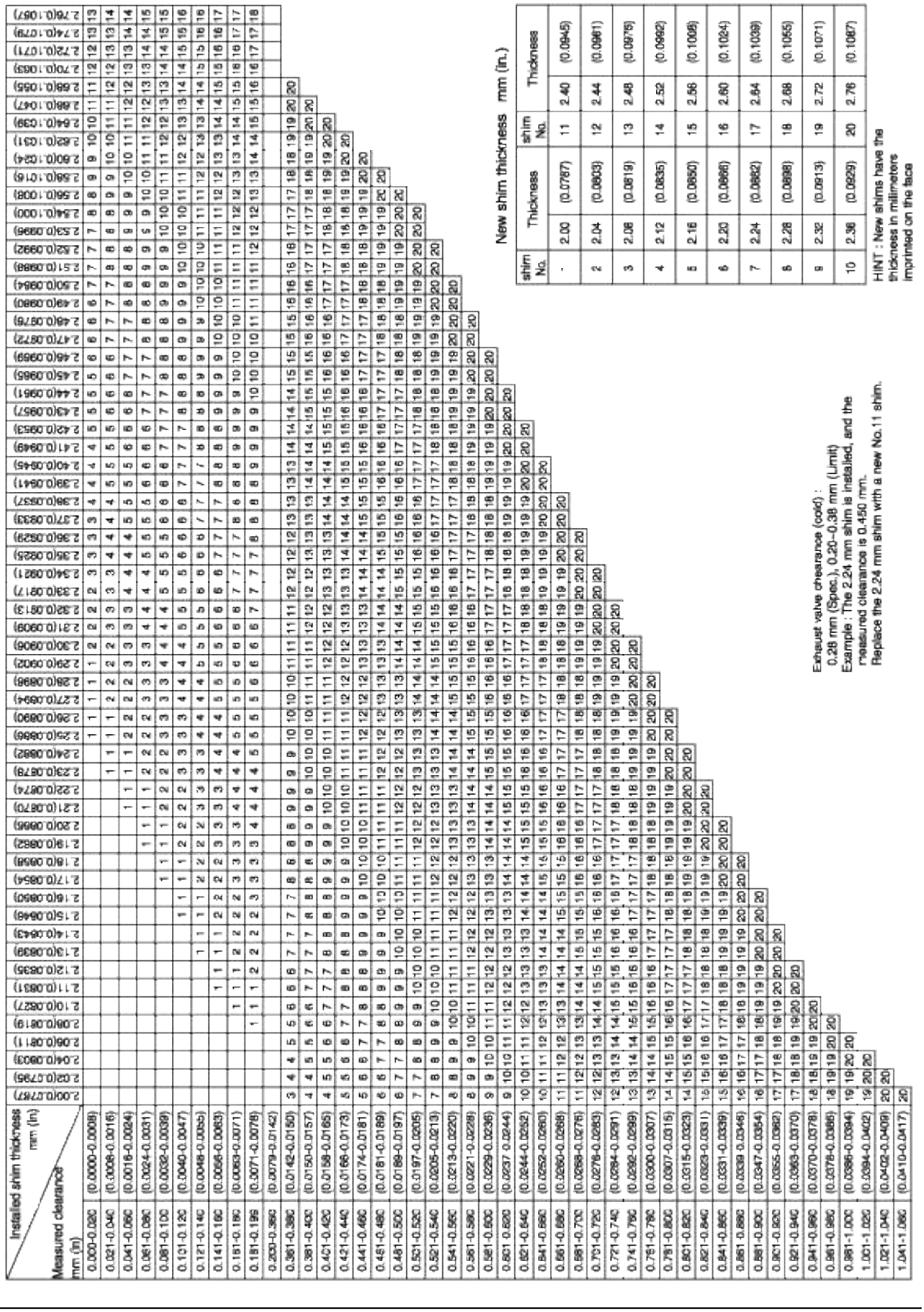
(7) Place a new adjusting shim on the valve lifter.

(8) Using the SST(09220 - 2D000), press down the valve lifter and remove the stopper.

(9) Recheck the valve clearance.

Valve clearance
(Engine coolant temperature : 20°C ± 5°C[68°F ± 9°F])
[Specification]
Intake : 0.20mm (0.0079in)
Exhaust : 0.28mm (0.0110in)
[Limit] (After adjusting valve clearance)
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0091in)
Exhaust : 0.25 ~ 0.31mm (0.0098 ~ 0.0122in)

Adjusting Shim Selection Chart (Exhaust)

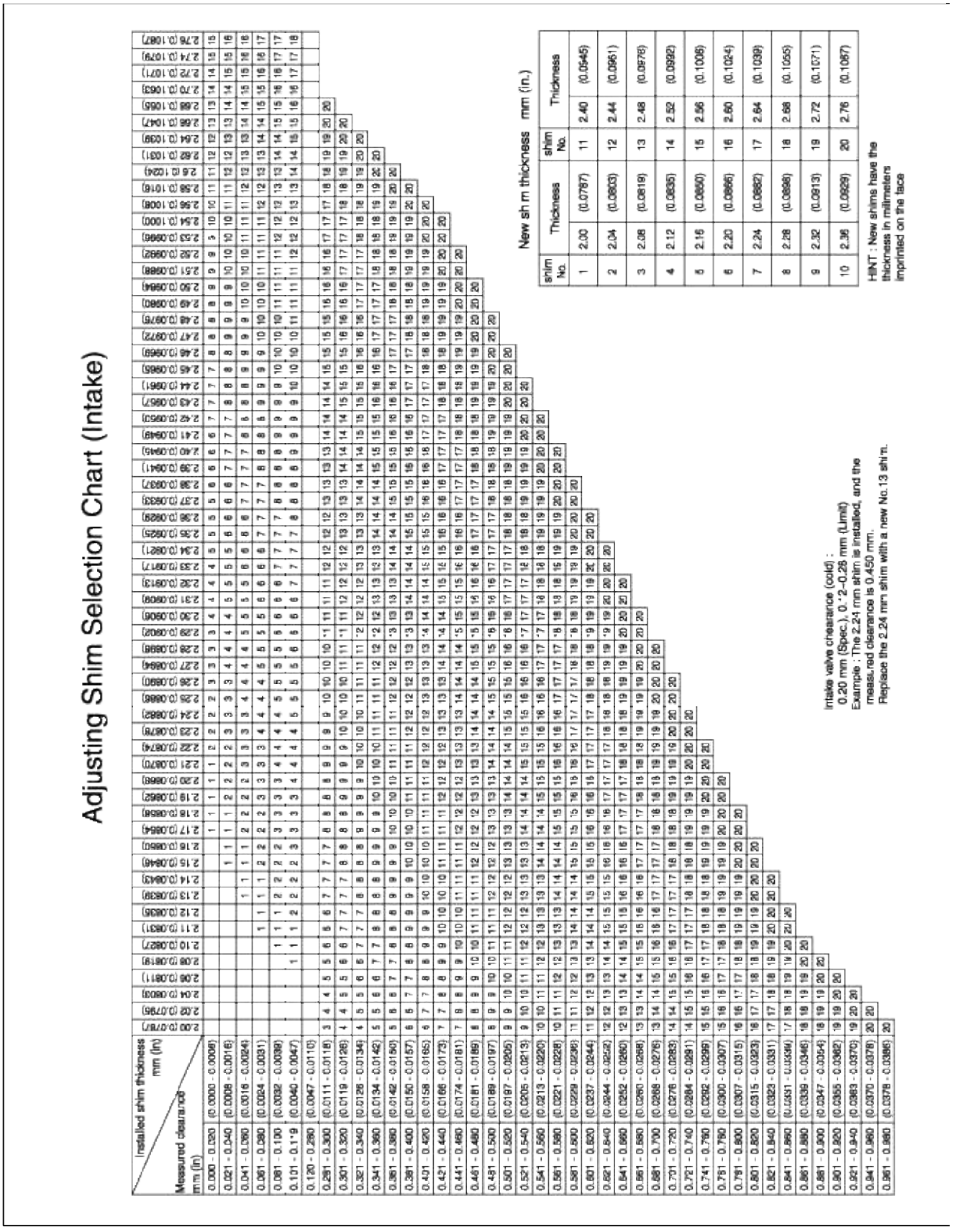


New shim thickness mm (in.)

shim No.	Thickness	shim No.	Thickness
-	2.00 (0.0787)	11	2.40 (0.0945)
2	2.04 (0.0803)	12	2.44 (0.0961)
3	2.08 (0.0819)	13	2.48 (0.0976)
4	2.12 (0.0835)	14	2.52 (0.0992)
5	2.16 (0.0850)	15	2.56 (0.1008)
6	2.20 (0.0866)	16	2.60 (0.1024)
7	2.24 (0.0882)	17	2.64 (0.1039)
8	2.28 (0.0898)	18	2.68 (0.1055)
9	2.32 (0.0913)	19	2.72 (0.1071)
10	2.36 (0.0929)	20	2.76 (0.1087)

Exhaust valve clearance (cold) : 0.28 mm (Spec.), 0.20–0.38 mm (Limit)
Example : The 2.24 mm shim is installed, and the measured clearance is 0.450 mm.
Replace the 2.24 mm shim with a new No.11 shim.

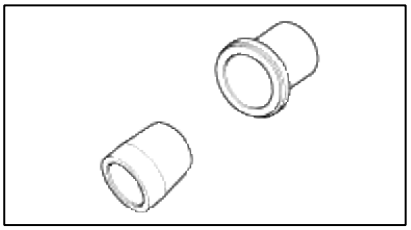
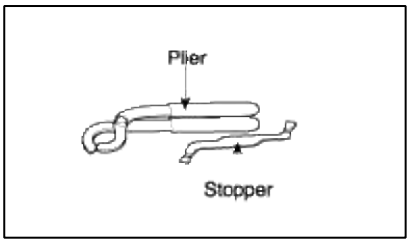
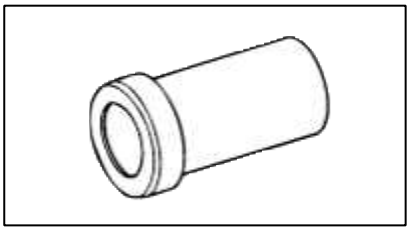
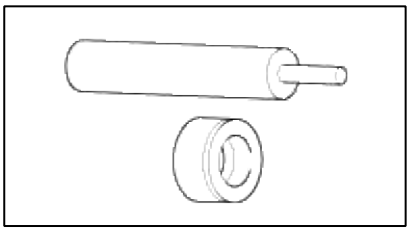
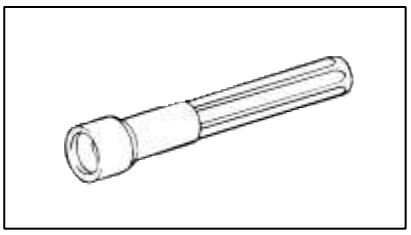
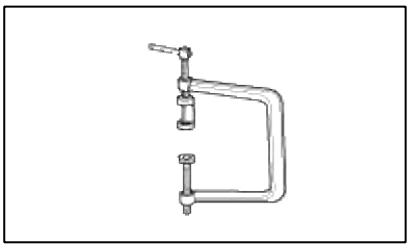
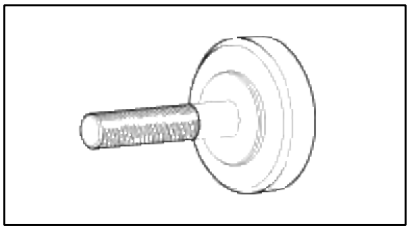
HINT : New shims have the thickness in millimeters imprinted on the face



shim No.	Thickness	shim No.	Thickness
1	2.00 (0.0787)	11	2.40 (0.0945)
2	2.04 (0.0803)	12	2.44 (0.0961)
3	2.08 (0.0819)	13	2.48 (0.0976)
4	2.12 (0.0835)	14	2.52 (0.0992)
5	2.16 (0.0850)	15	2.56 (0.1008)
6	2.20 (0.0866)	16	2.60 (0.1024)
7	2.24 (0.0882)	17	2.64 (0.1039)
8	2.28 (0.0898)	18	2.68 (0.1055)
9	2.32 (0.0913)	19	2.72 (0.1071)
10	2.36 (0.0929)	20	2.76 (0.1087)

Engine Mechanical System > General Information > Special Service Tools

SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231-23100)		Installation of the front oil seal
Valve clearance adjust tool set (09220-2D000)		Removal and installation of the tappet shim
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide installer (09221-3F100A/B)		Removal and installation of the valve guide
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor (09222-28000) Valve spring compressor adaptor (09222-28100)		Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-23200, 09231-H1100)		Installation of the crankshaft rear oil seal

Engine Mechanical System > General Information > Troubleshooting

TROUBLESHOOTING

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings.	Replace the crankshaft and bearings as required.
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem can cause the valve not to close properly.)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and 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)	Inspect 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. Refill with 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.

Lower engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace damaged components as required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	Inspect the oil pan. Inspect the oil pump screen. Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	Inspect the oil pump screen. Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	Inspect the piston and cylinder bore. Repair as required.
	Excessive piston pin-to-bore clearance.	Inspect the piston, piston pin and the connecting rod. Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation.	Verify the piston pins and connecting rods are installed correctly. Repair as required.
Engine noise under load.	Low oil pressure.	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals. • The cylinder block crankshaft bearing bore.
Engine will not crank. (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.

Engine Mechanical System > General Information > Specifications

GENERAL

SPECIFICATIONS

Description		Specifications (2.0 DOHC)	Limit
General			
Type		In-line, DOHC	
Number of cylinders		4	
Bore		82mm (3.2283in)	
Stroke		93.5mm (3.6811in)	
Total displacement		1,975 cc (120.5 cu.in)	
Compression ratio		10.1 : 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens	ATDC 11° ~ BTDC 29°	
	Closes	ABDC 59° ~ 19°	
Exhaust valve	Opens	BBDC 42°	
	Closes	ATDC 6°	
Cylinder head			
Flatness of gasket surface		Less than 0.03mm (0.0012in)	0.06mm (0.0024in)
Flatness of manifold mounting surface	Intake	Less than 0.15mm (0.0059in)	0.30mm (0.0118in)
	Exhaust	Less than 0.15mm (0.0059in)	0.30mm (0.0118in)
	STD	11.000 ~ 11.018mm (0.4331 ~ 0.4338in)	

Valve guide hole diameter (Intake, Exhaut)	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	33.000 ~ 33.025mm (1.2992 ~ 1.3002in)	
	0.3 OS	33.300 ~ 33.325mm (1.3110 ~ 1.3120in)	
	0.6 OS	33.600 ~ 33.625mm (1.3228 ~ 1.3238in)	
Exhaust valve seat ring hole diameter	STD	28.500 ~ 28.521mm (1.1220 ~ 1.1229in)	
	0.3 OS	28.800 ~ 28.821mm (1.1339 ~ 1.1347in)	
	0.6 OS	29.100 ~ 29.121mm (1.1457 ~ 1.1465in)	
Camshaft			
Cam height (With CVVT)	Intake	44.518 ~ 44.718mm (1.7527 ~ 1.7605in)	
	Exhaust	44.418 ~ 44.618mm (1.7487 ~ 1.7566in)	
Cam height (Without CVVT)	Intake	44.720mm ~ 44.920mm (1.7606 ~ 1.7685in)	
	Exhaust	44.620mm ~ 44.820mm (1.7567 ~ 1.7646in)	
Journal outer Diameter (Intake, Exhaust)		27.964 ~ 27.980mm (1.1009 ~ 1.1016in)	
Bearing 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	114.34mm (4.5016in)	
	Exhaust	116.8mm (4.5984in)	
Stem outer diameter	Intake	5.965 ~ 5.980mm (0.2348 ~ 0.2354in)	
	Exhaust	5.950 ~ 5.965mm (0.2343 ~ 0.2348in)	
Face angle		45° ~ 45° 30'	
Thickness of Valve head (margin)	Intake	1.15mm (0.0453in)	0.8mm (0.0315in)
	Exhaust	1.35mm (0.0531in)	1.0mm (0.0394in)

Valve stem to Valve guide clearance	Intake	0.020 ~ 0.050mm (0.0008 ~ 0.0020in)	0.10mm (0.0039in)
	Exhaust	0.035 ~ 0.065mm (0.0014 ~ 0.0026in)	0.13mm (0.0051in)
Valve guide			
Length	Intake	45.8 ~ 46.2mm (1.8031 ~ 1.8189in)	
	Exhaust	54.3 ~ 54.6mm (2.1378 ~ 2.1496in)	
Valve seat			
Width of seat contact	Intake	1.1 ~ 1.5mm (0.0433 ~ 0.0591in)	
	Exhaust	1.3 ~ 1.7mm (0.0512 ~ 0.0669in)	
Seat angle	Intake	45° ~ 45° 30'	
	Exhaust	45° ~ 45° 30'	
Valve spring			
Free length		48.86mm (1.9236in)	
Load		18.8±0.9kg/39.0mm(41.4±2.0 lb/1.5354in)	
		41.0±1.5kg/30.5mm(90.4±3.3 lb/1.2008in)	
Out of squareness		Less than 1.5°	3°
Valve clearance			
Cold (20°C ± 5°C) (68°F ± 9°F)	Intake	0.20mm (0.0079in)	0.12~0.28mm (0.0047~0.0110in)
	Exhaust	0.28mm (0.0110in)	0.20~0.38mm (0.0079~0.0150in)
Cylinder block			
Cylinder bore		82.00 ~ 82.03mm (3.2283 ~ 3.2295in)	
Flatness of gasket surface		Total : Less than 0.05mm (0.0020in) Bore to bore : Less than 0.03mm (0.0012in)	
Piston			
Piston outer diameter		81.970 ~ 82.000mm (3.2272 ~ 3.2283in)	
Piston to cylinder clearance		0.020 ~ 0.040mm (0.0008 ~ 0.0016in)	
Ring groove width	No. 1 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in)	
	No. 2 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in)	
	Oil ring groove	2.51 ~ 2.53mm (0.0988 ~ 0.0996in)	
Piston ring			

Side clearance	No. 1 ring	0.04 ~ 0.08mm (0.0016 ~ 0.0031in)	0.1mm (0.0039in)
	No. 2 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0028in)	0.1mm (0.0039in)
	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in)	0.2mm (0.0079in)
End gap	No. 1 ring	0..23 ~ 0.38mm (0.0091 ~ 0.0150in)	1.0mm (0.0394in)
	No. 2 ring	0.33 ~ 0.48mm (0.0130 ~ 0.0189in)	1.0mm (0.0394in)
	Oil ring	0.20 ~ 0.60mm (0.0079 ~ 0.0236in)	1.0mm (0.0394in)
Piston pin			
Piston pin outer diameter		20.001 ~ 20.006mm (0.7874 ~ 0.7876in)	
Piston pin hole inner diameter		20.016 ~ 20.021mm (0.7880 ~ 0.7882in)	
Piston pin hole clearance		0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end hole inner diameter		19.974 ~ 19.985mm (0.7864 ~ 0.7868in)	
Connecting rod small end hole clearance		-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)	
Piston pin press-in load		350~1,350 kg (772~2,976 lb)	
Connecting rod			
Connecting rod big end inner diameter		48.000 ~ 48.018mm (1.8898 ~ 1.8905in)	
Connecting rod bearing oil clearance		0.024 ~ 0.044mm (0.0009 ~ 0.0017in)	
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)	0.4mm (0.0157in)
Crankshaft			
Main journal outer diameter		56.942 ~ 56.962mm (2.2418 ~ 2.2426in)	
Pin journal outer diameter		44.946 ~ 44.966mm (1.7695 ~ 1.7703in)	
Main bearing oil clearance		0.028 ~ 0.048mm (0.0011 ~ 0.0019in)	0.1mm (0.0039in)
End play		0.06 ~ 0.260mm (0.0024 ~ 0.0102in)	0.3mm (0.0118in)
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		0.120 ~ 0.185mm (0.0047 ~ 0.0073in)	
Relief valve opening pressure		490±49.0kpa (5±0.5kg/cm², 71±7.1psi)	
Relief spring	Free length	43.8mm (1.7244in)	
	Load	3.7±0.4kg/40.1mm (8.2±0.9 lb/1.5787in) 9.7±0.4kg/34.3mm (21.4±0.9 lb/1.3504in)	
Engine oil			
Oil quantity (Total)		4.0 L (4.23 US qt, 3.52 lmp qt)	
Oil quantity (Oil pan)		3.7 L (3.91 US qt, 3.26 lmp qt)	
Oil quantity (Oil filter)		0.3 L (0.32 US qt, 0.26 lmp qt)	
Oil quality		Above SL, SJ	
Oil pressure (Idle)		156.9kpa (1.6kg/cm², 22.8psi)	
Cooling system			
Cooling method		Forced circulation with cooling fan	
Coolant quantity		6.0 L (6.34 US qt, 5.28 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	Quantity	Tightening torque		
		N.m	kgf.m	lbf.ft
Cylinder block				
Engine support (front) bracket bolt	3	34.3 ~ 49.0	3.5 ~ 5.0	25.3 ~ 36.2

Engine support (rear) bracket bolt	2	34.3 ~ 49.0	3.5 ~ 5.0	25.3 ~ 36.2
Engine support bracket stay plate bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Engine mounting				
Engine mounting bracket and body fixing bolt	3	49.0 ~63.7	5.0 ~6.5	36.2.9 ~47.0
Engine mounting insulator and engine mounting support bracket fixing nut	1	58.8 ~78.5	6.0 ~8.0	43.4 ~57.9
Engine mounting support bracket and engine support bracket fixing bolt	1	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Engine mounting support bracket and engine support bracket fixing nut	2	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Transaxle mounting bracket and body fixing bolt	4	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Transaxle mounting insulator	1	88.3 ~107.9	9.0 ~11.0	65.1 ~79.6

and transaxle support bracket fixing bolt				
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	49.0 ~52.0	5.0 ~5.3	36.2 ~38.3
Crankshaft main bearing cap bolt	10	27.5~31.4+60°~64°	2.8~3.2+60°~64°	20.3~23.1+60°~64°
Flywheel bolt (M/T)	6	117.7 ~127.5	12.0 ~13.0	86.8 ~94.0
Drive plate bolt (A/T)	6	117.7 ~127.5	12.0 ~13.0	86.8 ~94.0
Timing belt				

Timing belt upper cover bolt	4	7.8 ~9.8	0.8 ~1.0	5.8 ~7.2
Timing belt lower cover bolt	5	7.8 ~9.8	0.8 ~1.0	5.8 ~7.2
Timing belt under cover bolt	3	9.8 ~11.8	1.0 ~1.2	7.2 ~8.7
Crankshaft pulley bolt	1	166.7 ~176.5	17.0 ~18.0	123.0 ~130.2
Camshaft sprocket bolt	1	98.1 ~117.7	10.0 ~12.0	72.3 ~86.8
Timing belt auto tensioner bolt	1	22.6 ~28.4	2.3 ~2.9	16.6 ~21.0
Timing belt idler bolt	1	42.2 ~53.9	4.3 ~5.5	31.1 ~39.8
Cylinder head				
Engine cover bolt	5	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	22	13.7 ~14.7	1.4 ~1.5	10.1 ~10.8
Exhaust camshaft and CVVT assembly fixing bolt	1	64.7 ~76.5	6.6 ~7.8	47.7 ~56.4
Timing chain auto tensioner bolt	2	7.8 ~9.8	0.8 ~1.0	5.8 ~7.2
OCV(oil control valve) bolt	1	9.8 ~11.8	1.0 ~1.2	7.2 ~8.7
OCV(oil control valve) filter	1	40.2 ~ 50.0	4.1 ~ 5.1	29.7 ~ 36.9

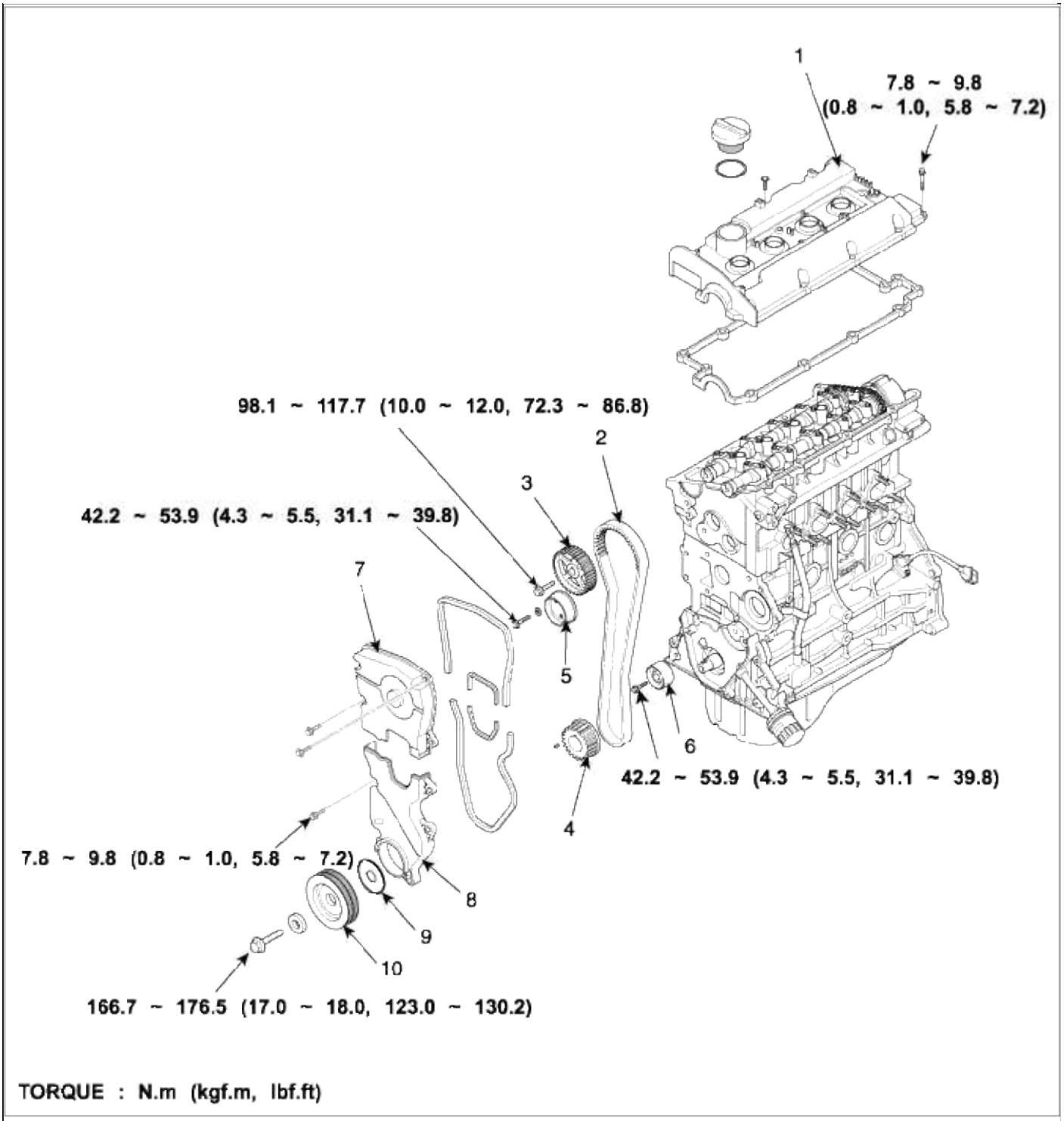
Cylinder head bolt (10 X 99)	8	22.6~26.5+60°~65°+60°~65°	2.3~2.7+60°~65°+60°~65°	16.6~19.5+60°~65°+60°~6
Cylinder head bolt (12 X 151)	2	27.5~31.4+60°~65°+60°~65°	2.8~3.2+60°~65°+60°~65°	20.3~23.1+60°~65°+60°~6
Cooling system				
Water pump pulley bolt	4	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water pump bolt (8 X 20)	1	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Water pump bolt (8 X 35)	2	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Water pump and alternator brace fixing bolt (8 X 45)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Alternator brace and cylinder block fixing bolt	2	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Thermostat housing bolt	1	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Thermostat housing nut	1	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Water temperature sensor	1	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Water inlet fitting nut	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Front case bolt (8 X 20)	4	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Front case bolt (8 X 25)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5

Front case bolt (8 X 38)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Front case bolt (8 X 45)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pan bolt (6 X 16)	15	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan bolt (6 X 50)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan bolt (6 X 118)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan and transaxle fixing bolt	3	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Oil pan drain bolt (Aluminum)	1	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Oil pan drain bolt (Steel)	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 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
Intake and exhaust system				
Intake manifold and cylinder head fixing nut	9	15.7 ~ 22.6	1.6 ~ 2.3	11.6 ~ 16.6
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	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
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	4	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
Air cleaner assembly fixing bolt	3	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Throttle body and surge tank fixing bolt	4	18.6 ~ 27.5	1.9 ~ 2.8	13.7 ~ 20.3
Exhaust manifold and front muffler fixing bolt	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Front muffler fixing clip bolt	1	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front muffler and center muffler fixing nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Center muffler and main muffler fixing nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4

Engine Mechanical System > Timing System > Timing Belt > Components and Components Location

COMPONENT



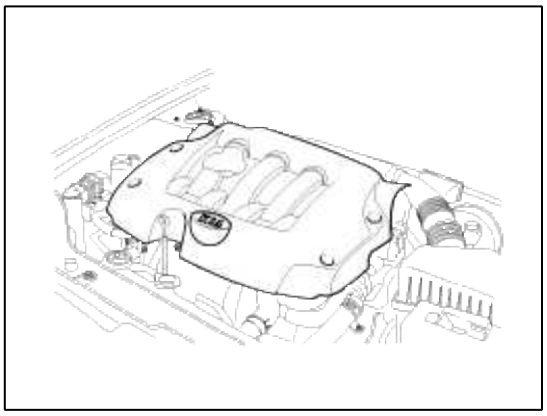
1. Cylinder cover
2. Timing belt
3. Cam shaft sprocket
4. Crank shaft sprocket
5. Tensioner
6. Idler
7. Timing belt upper cover
8. Timing belt lower cover
9. Flange
10. Crank shaft pulley

Engine Mechanical System > Timing System > Timing Belt > Repair procedures

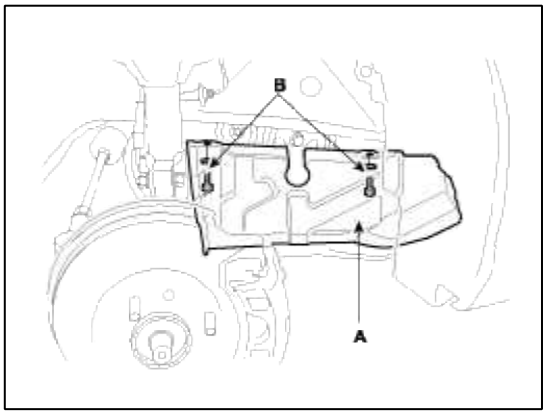
REMOVAL

Engine removal is not required for this procedure.

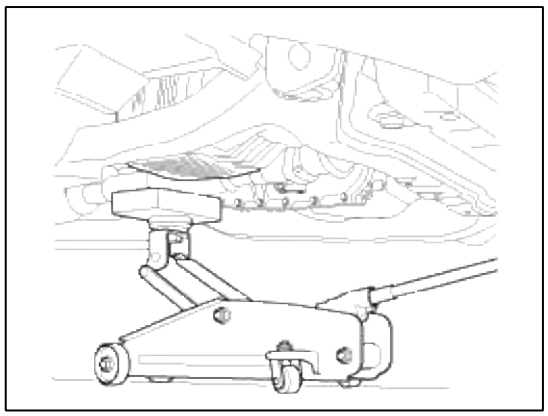
1. Remove the engine cover.



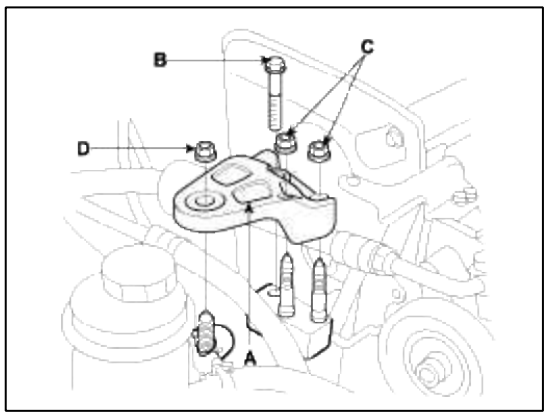
2. Remove the RH front wheel.
3. Remove the 2 bolts(B) and RH side cover(A).



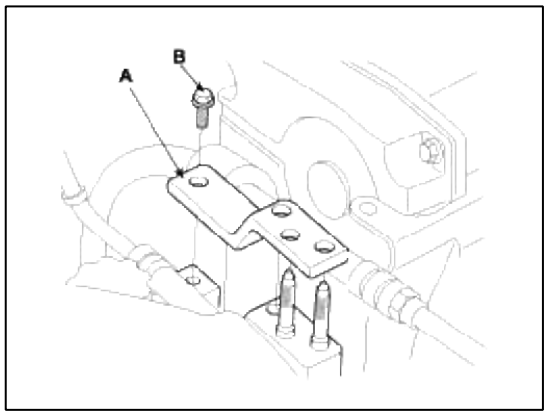
4. Remove the engine mounting support bracket.
   (1) Set the jack to the engine oil pan.



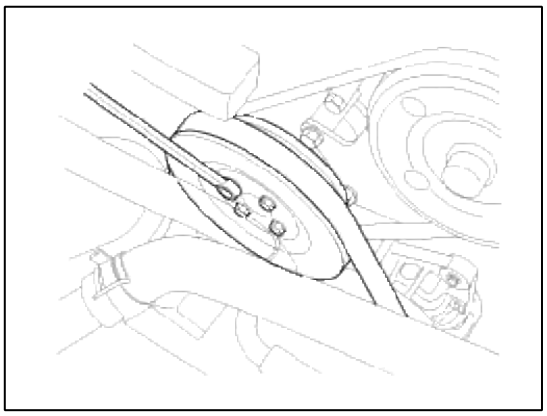
   (2) Remove the bolt(B), nuts(C,D) and engine mounting support bracket(A).



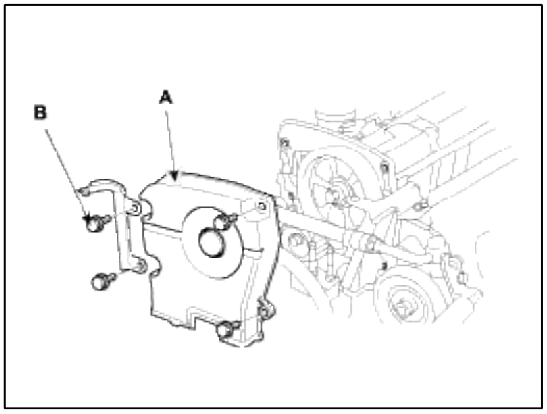
(3) Remove the bolt(B) and engine support bracket stay plate(A).



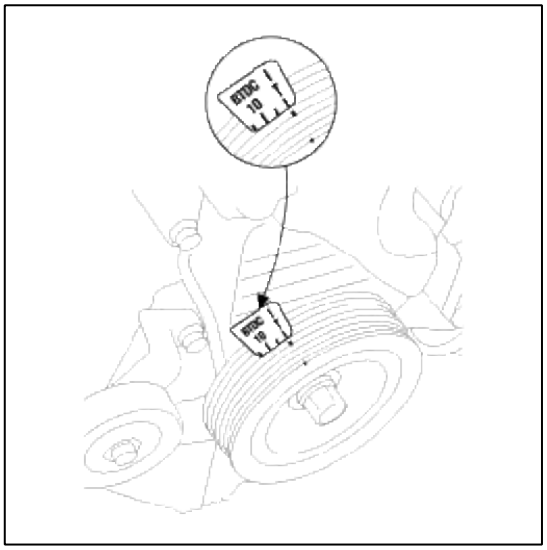
5. Temporarily loosen the water pump pulley bolts.

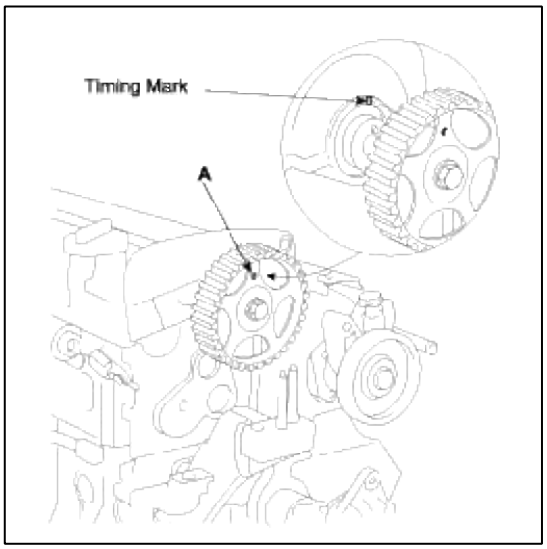


6. Remove the alternator drive belt. (See EE group - alternator)
7. Remove the air conditioner compressor drive belt. (See HA group - air conditioner compressor)
8. Remove the power steering pump drive belt. (See ST group - power steering pump)
9. Remove the 4 bolts and water pump pulley.
10. Remove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

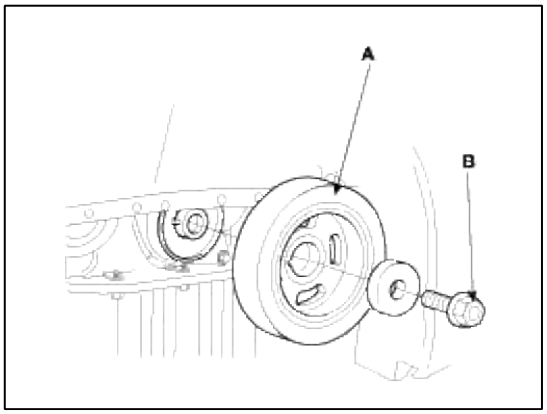


11. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. Check that the timing mark of camshaft sprocket is aligned with the timing mark of cylinder head cover. (No.1 cylinder compression TDC position)

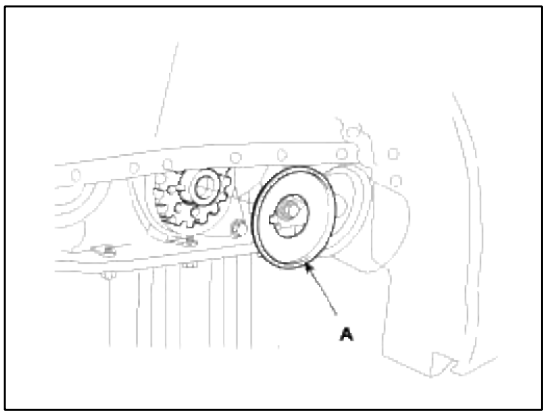




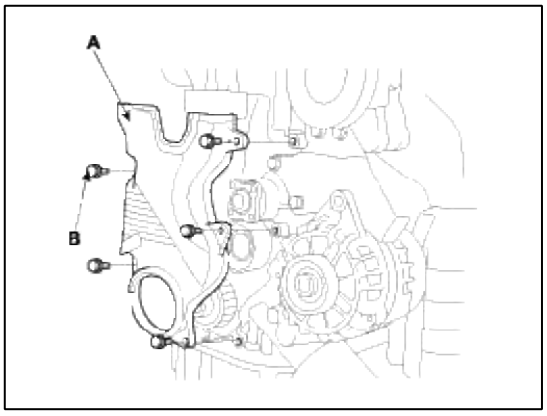
12. Remove the crankshaft pulley bolt(B) and crankshaft pulley(A).



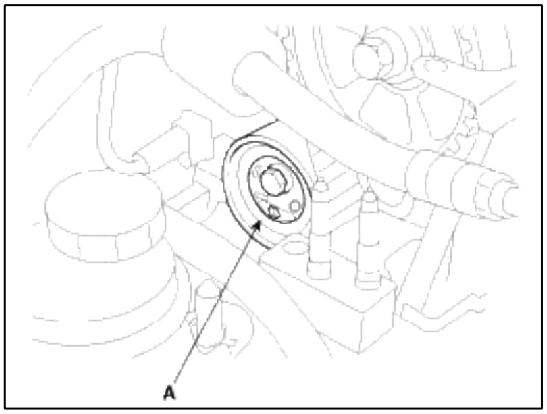
13. Remove the crankshaft flange(A).

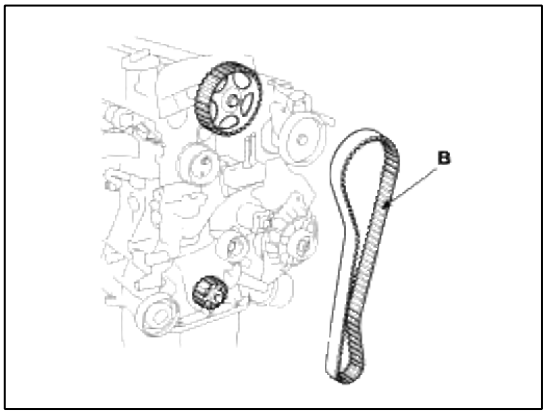


14. Remove the 5 bolts(B) and timing belt lower cover(A)



15. Remove the timing belt tensioner(A) and timing belt(B).

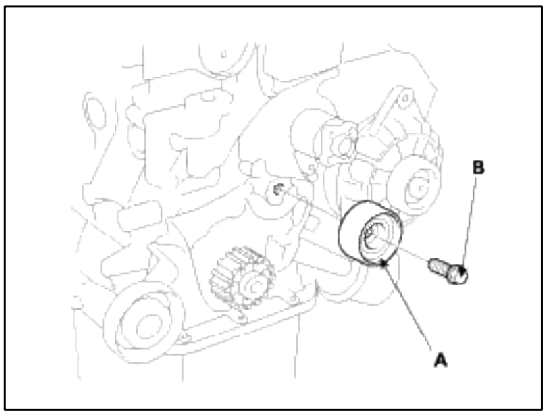




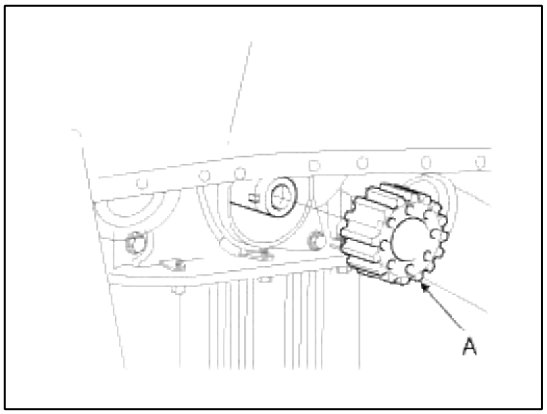
NOTE

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

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



17. Remove the crankshaft sprocket(A).

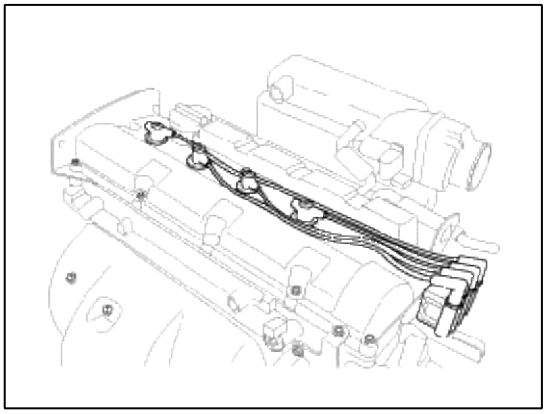


18. Remove the cylinder head cover.

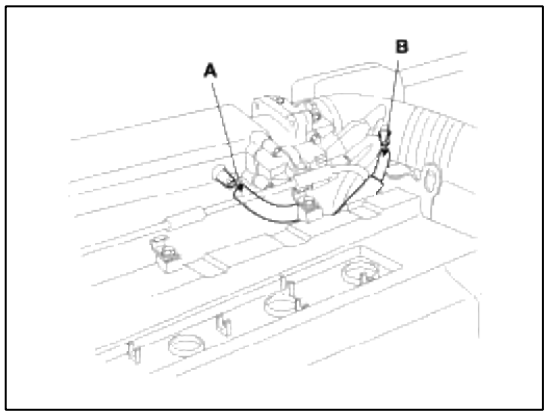
(1) Disconnect the spark plug cables and do not pull on the cable by force.

NOTE

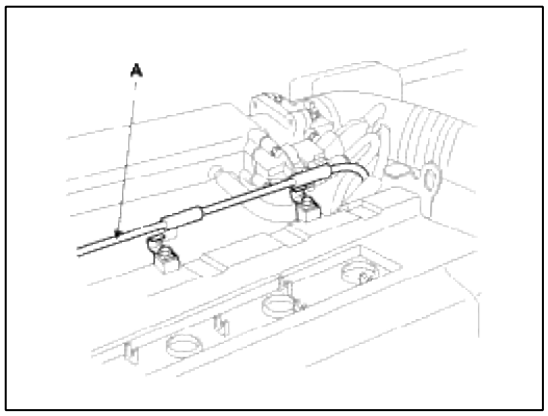
Pulling on or bending the cables may damage the conductor inside.



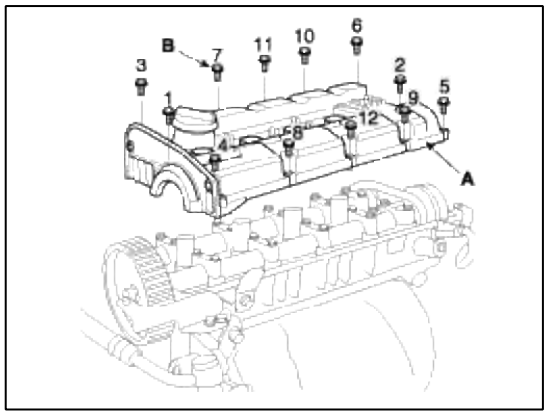
(2) Remove the PCV (Positive Crankcase Ventilation) hose(A) and the breather hose(B) from the cylinder head cover.



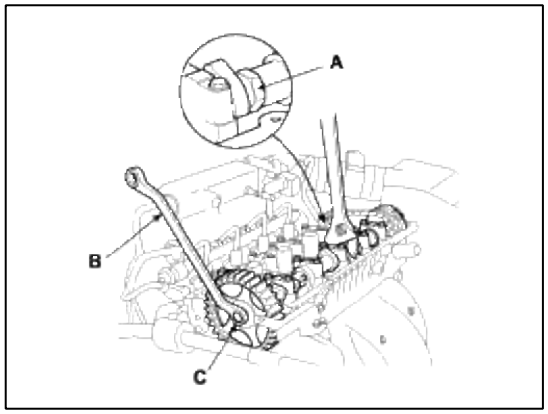
(3) Remove the accelerator cable(A) from the cylinder head cover.



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



19. 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.



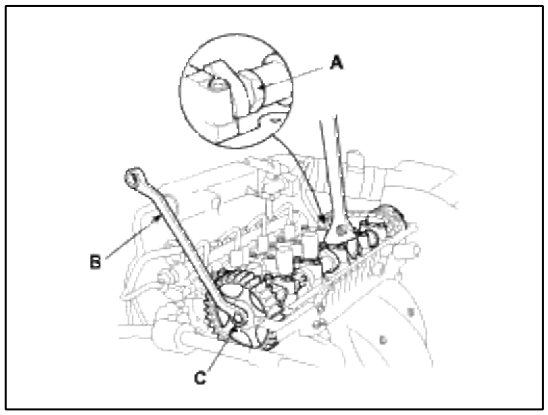
CAUTION

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

INSTALLATION

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) .

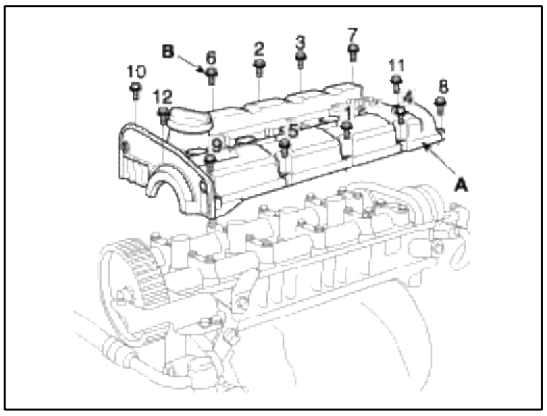
Tightening torque :
98.1 ~ 117.7N.m (10 ~ 12kgf.m, 72.3 ~ 86.8lbf.ft)



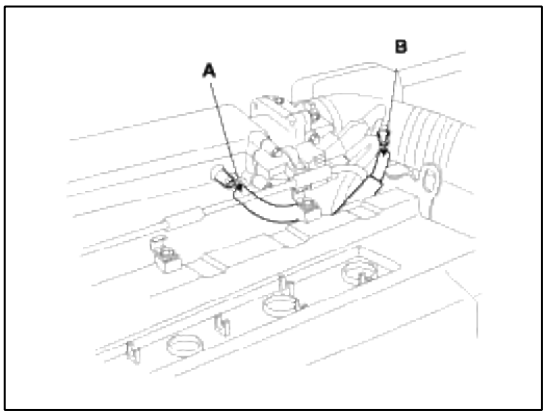
2. Install the cylinder head cover.

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

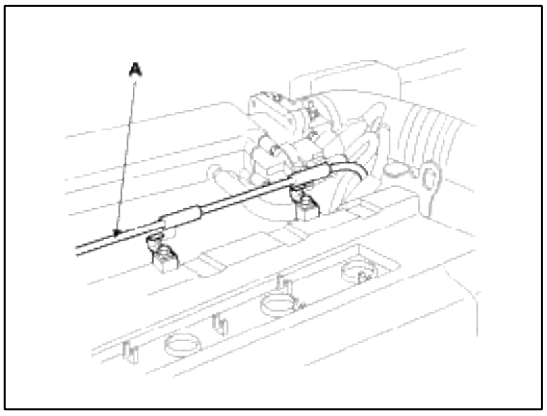
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lbf.ft)



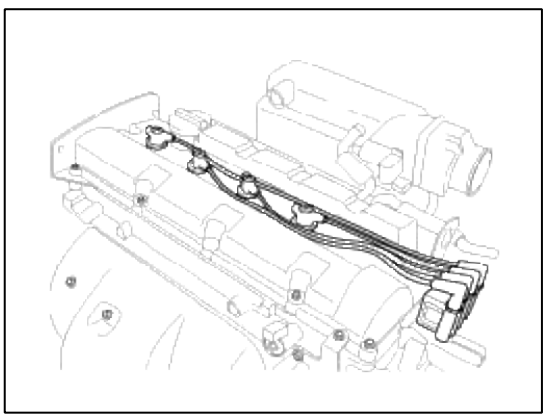
(2) Install the PCV(Positive Crankcase Ventilation) hose(A) and breather hose(B) to the cylinder head cover.



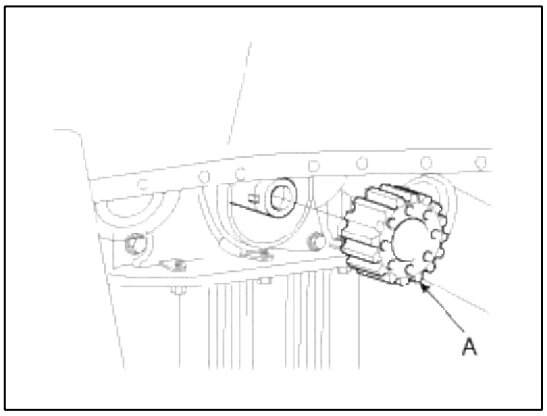
(3) Install the accelerator cable(A) to the cylinder head cover.



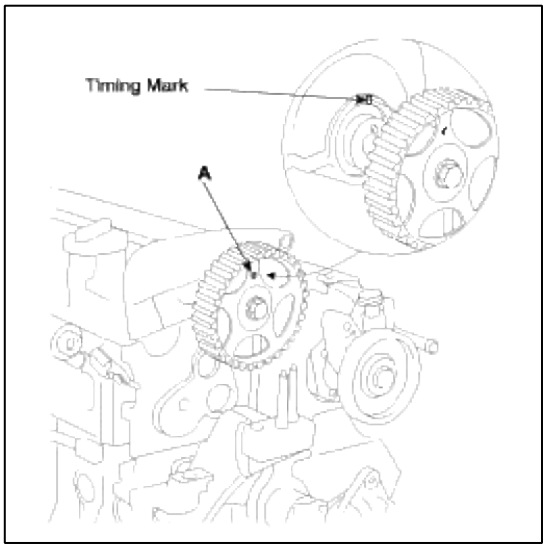
(4) Install the spark plug cables.

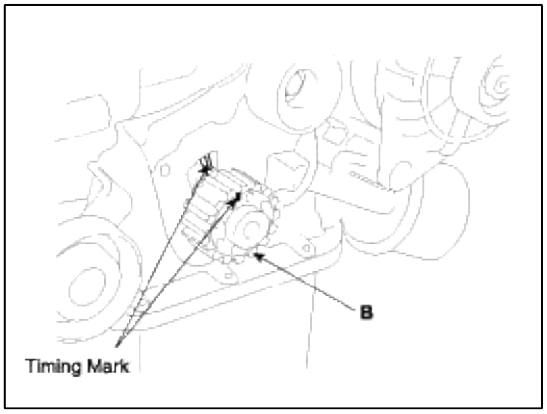


3. Install the crankshaft sprocket(A).



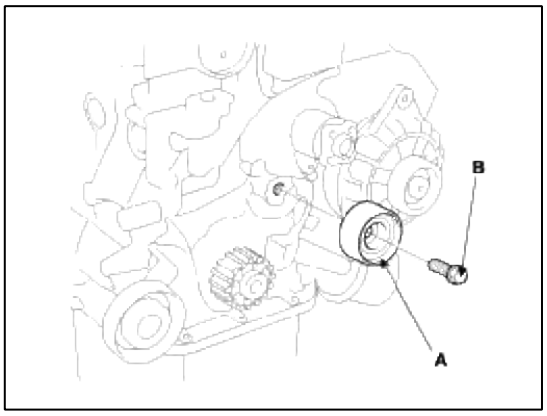
4. Align the timing marks of the camshaft sprocket(A) and crankshaft sprocket(B) with the No. 1 piston placed at top dead center and its compression stroke.



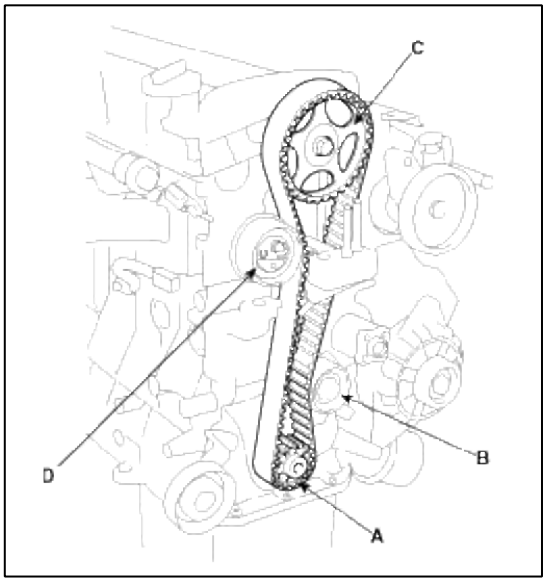


5. Install the idler pulley(A) and tighten the bolt(B) to the specified torque.

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

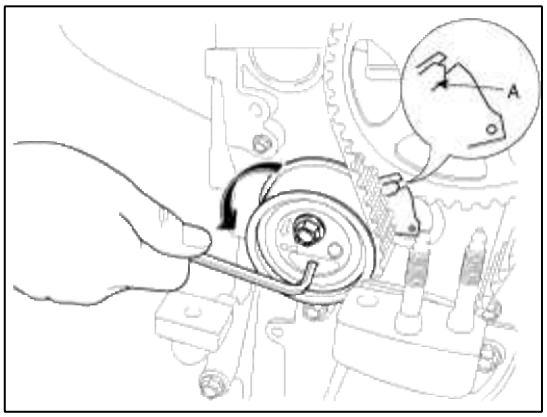


6. Install the timing belt tensioner loosely enough for the adjuster to rotate. Make sure that the stopper of base is leaning against the lowering sealing cap on the cylinder head.
7. Belt so as not give slack at each center of shaft. Do as following procedures when installing timing belt.
   Crankshaft sprocket (A) → Idler pulley (B) → Camshaft sprocket (C) → timing belt tensioner (D).
   (The tensioner can be installed after the timing belt.)



8. Check the alignment of the timing marks on each sprocket.
9. Remove the pin fixing the tensioner arm.

10. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm(A) located at the center of the base notch.



CAUTION

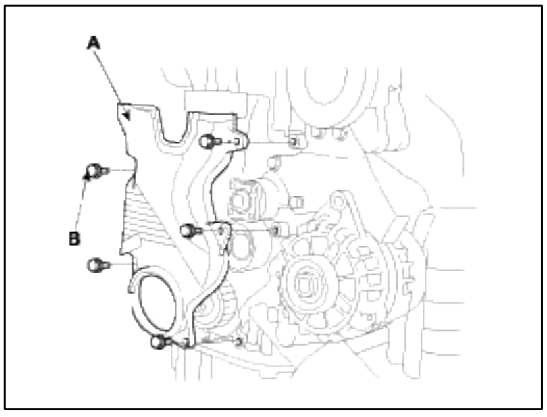
Do not rotate the adjuster clockwise.
It will result in auto tensioner's functional problem.

11. Tightening tensioner bolt with fixing the indicator not to move.

Tightening torque
Tensioner bolt :
22.6 ~ 28.4Nm (2.3 ~ 2.9kgf.m, 16.6 ~ 21.0lb-ft)

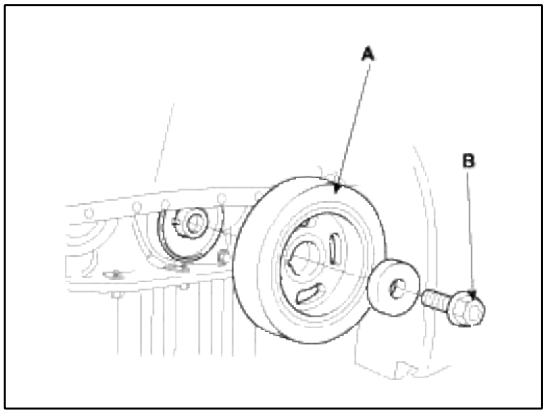
12. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
13. If the indicator is not located at the center of base, slacken the bolt and repeat the abore procedure.
14. Install the timing belt lower cover(A) with 5bolts(B).

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



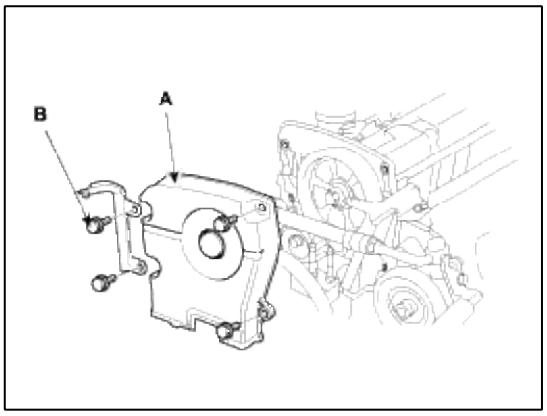
15. Install the flange and crankshaft pulley(A), and then tighten crankshaft pulley bolt(B).
    Make sure that the crankshaft sprocket pin fits into the small hole in the pulley.

    Tightening torque :
    166.7 ~ 176.5N.m (17 ~ 18kgf.m, 123.0 ~ 130.2lbf.ft)



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

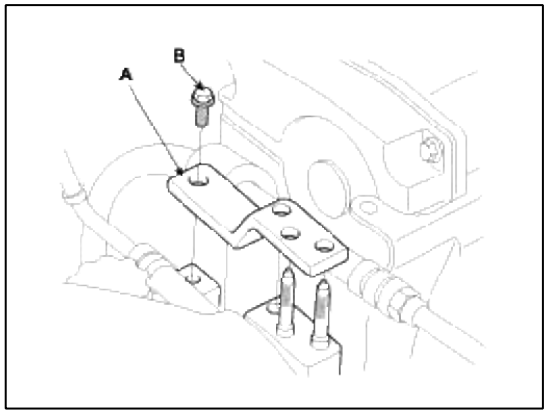
    Tightening torque :
    7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lbf.ft)



17. Install the water pump pulley and 4 bolts.
18. Install the power steering pump drive belt. (See ST group - power steering pump)
19. Install the air conditioner compressor drive belt. (See HA group - air conditioner compressor)
20. Install the alternator drive belt. (See EE group - alternator)
21. Tighten the bolts of water pump pulley.

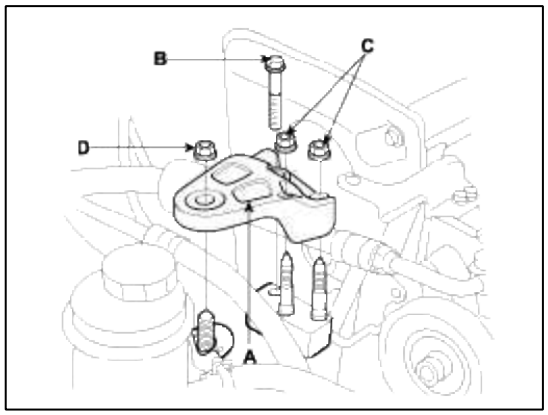
22. Install the engine mounting support bracket.
(1) Install the engine mounting support bracket stay plate(A) with bolt(B).

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

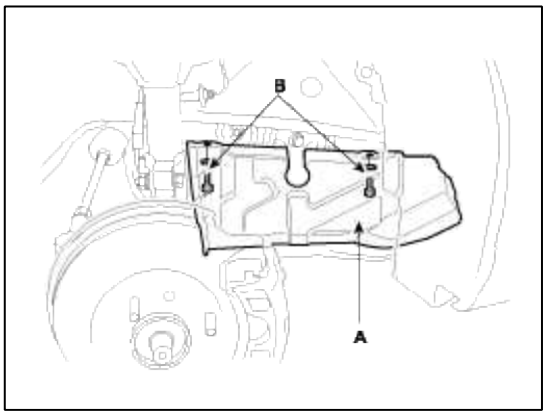


(2) Install the engine mounting support bracket(A) with nuts(C,D) and bolt(B).

Tightening torque :
Nut(D) : 58.8 ~ 78.5N.m (6.0 ~ 8.0kgf.m, 43.4 ~ 57.9lbf.ft)
Nut(C) and bolt(B) : 49.0 ~ 63.7N.m
(5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lbf.ft)



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

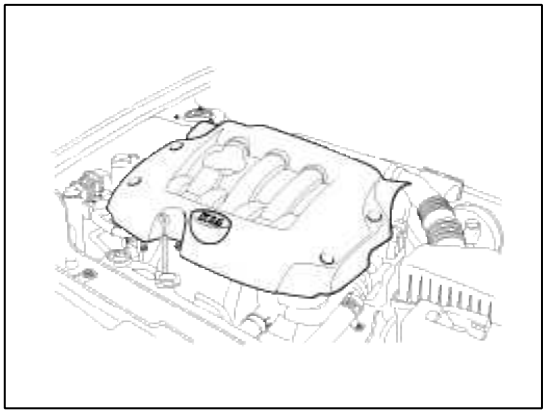


24. Install the RH front wheel.

Tightening torque :
88.3 ~ 98.N.m (9.0 ~ 10.0kgf.m, 65.1 ~ 72.3lbf.ft)

25. Install the engine cover with bolts.

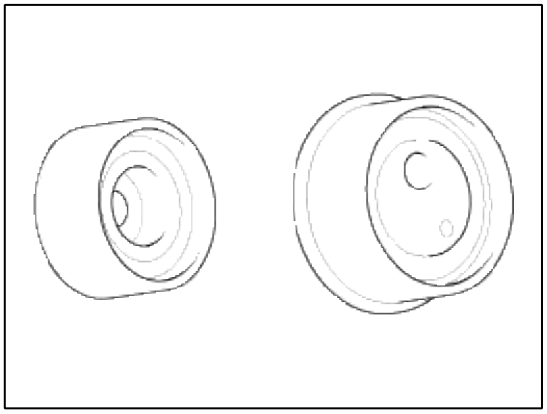
Tightening torque :
3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lbf.ft)



INSPECTION

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.



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

TIMING BELT

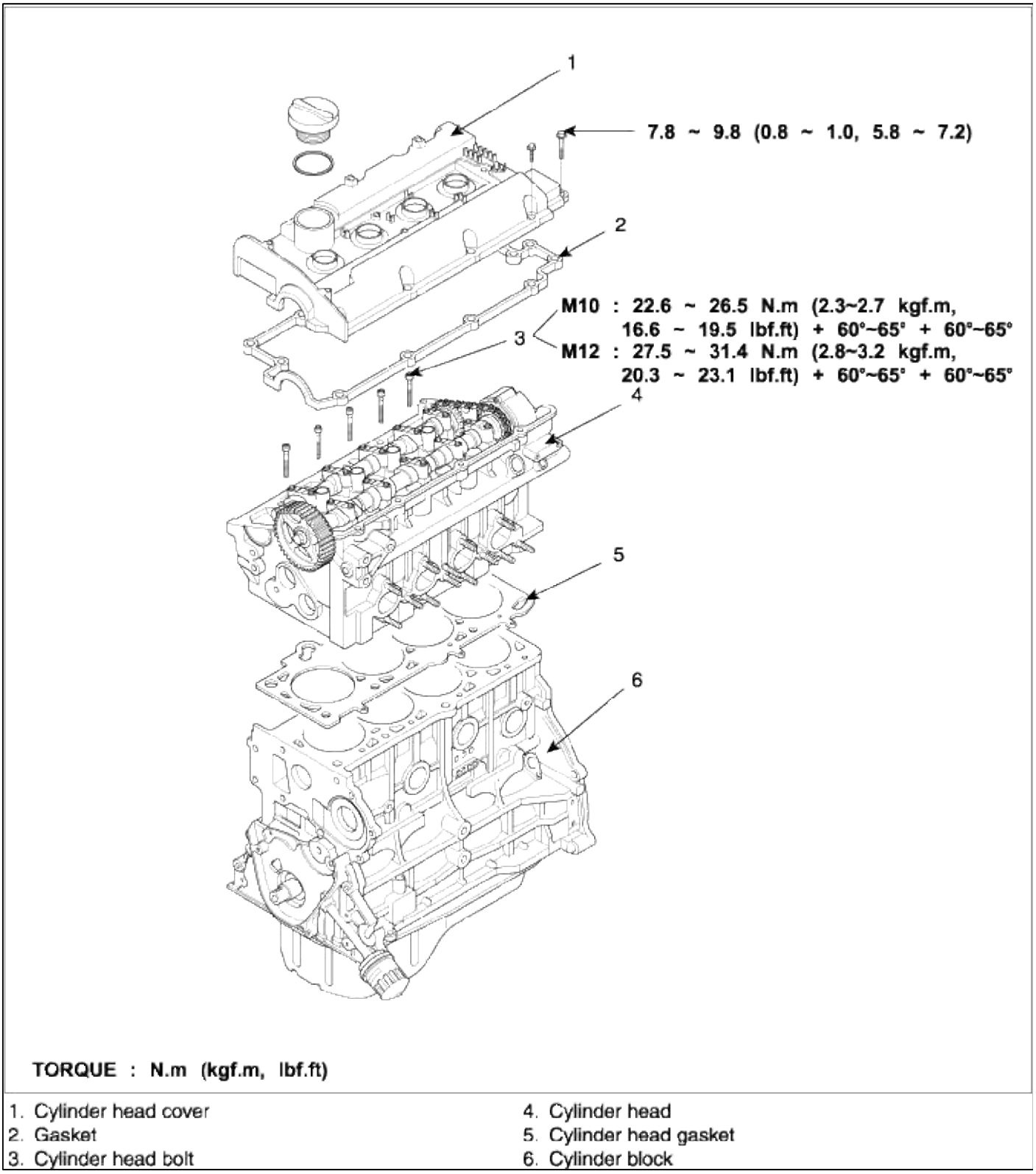
1. Check the belt for oil or dust deposits.
   Replace, if necessary.
   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the carefully. If any damage is found, replace the belt.

NOTE

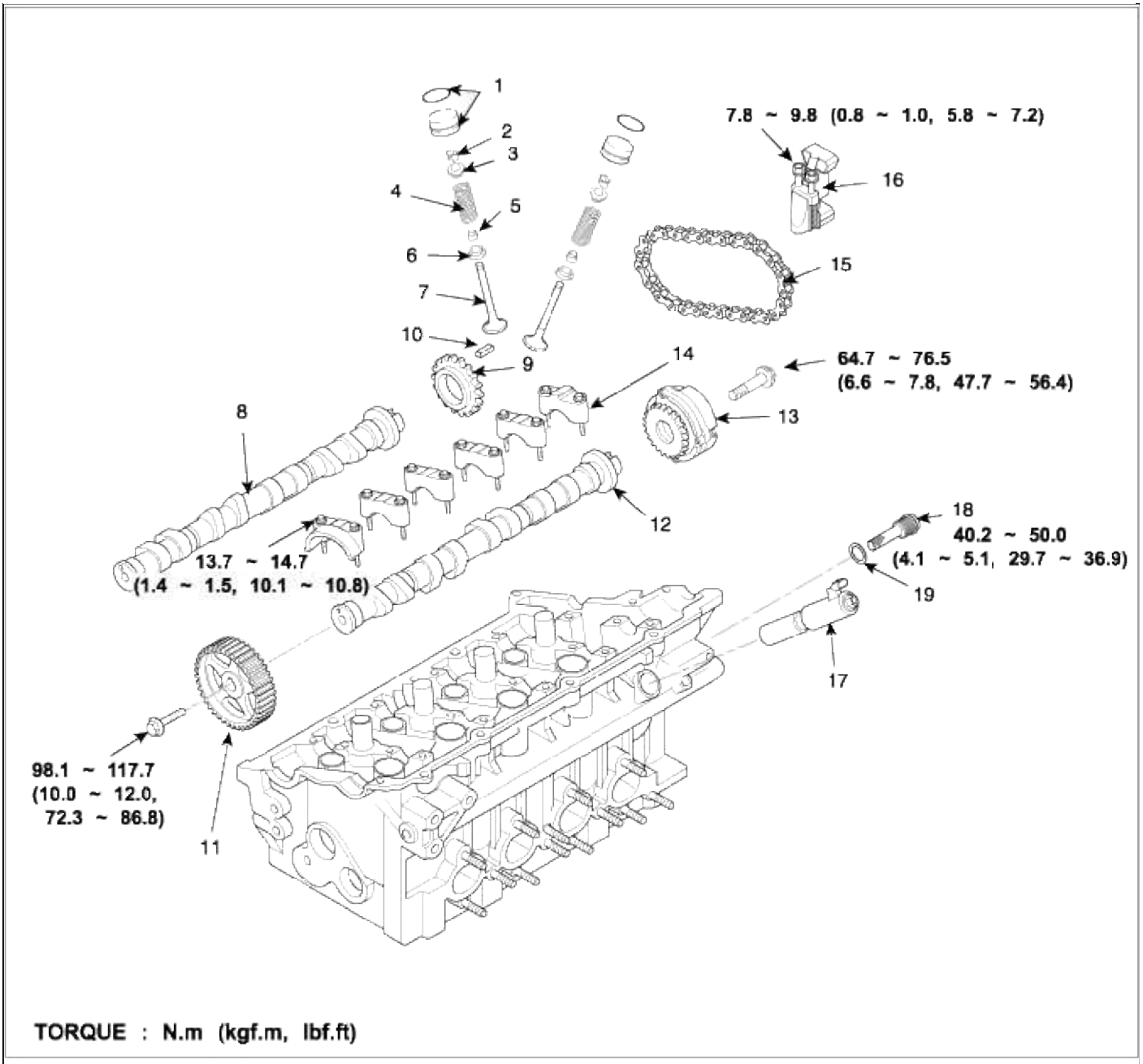
- Do not bend, twist or turn the timing belt inside out.
- Do not allow timing belt to come into contact with oil, water and steam.

Engine Mechanical System > Cylinder Head Assembly > Components and Components Location

COMPONENT



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



1. MLA (Mechanical Lash Adjuster)
2. Retainer lock
3. Retainer
4. Valve spring
5. Stem seal
6. Spring seat
7. Valve
8. Intake camshaft
9. Chain sprocket
10. Key
11. Camshaft sprocket
12. Exhaust camshaft
13. CVVT (Continuously Variable Valve Timing) assembly
14. Camshaft bearing cap
15. Timing chain
16. Auto tentioner
17. OCV (Oil Control Valve)
18. OCV (Oil Control Valve) filter
19. Washer

Engine Mechanical System > Cylinder Head Assembly > Repair procedures

REMOVAL

Engine removal is not required for this procedure.

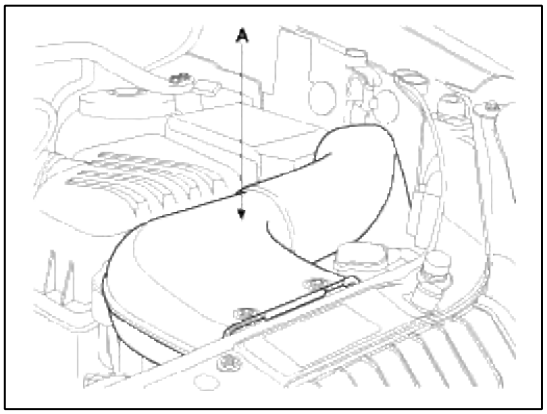
CAUTION

- Use Fender cover to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

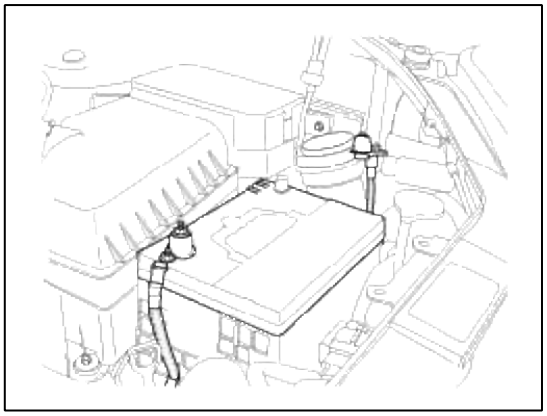
NOTE

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

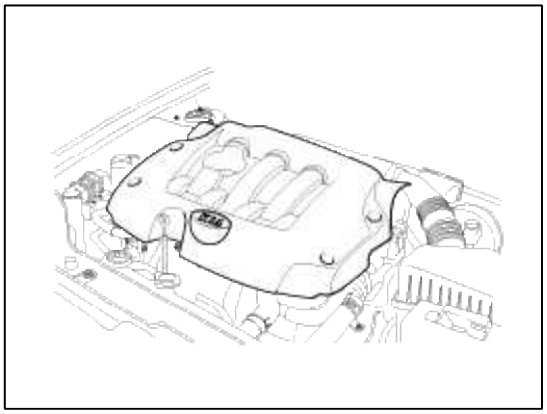
1. Remove the air duct(A).



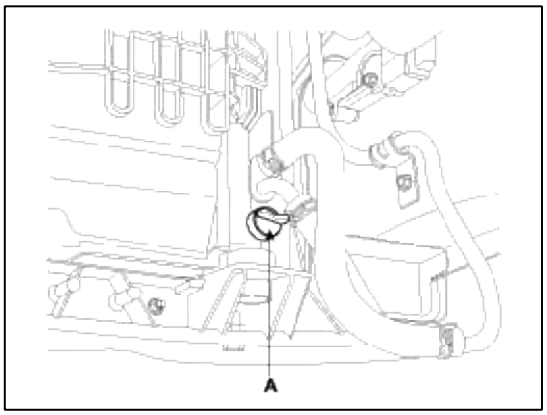
2. Disconnect the terminals(A) from battery.



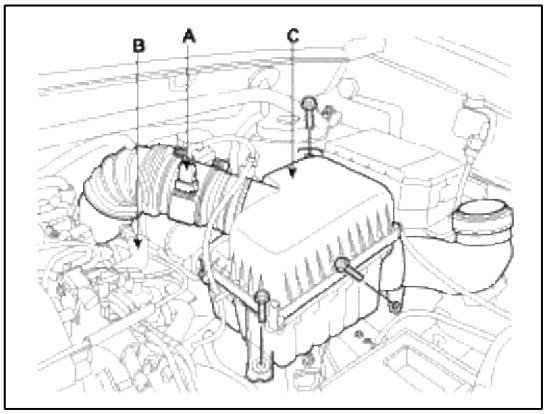
3. Remove the engine cover.



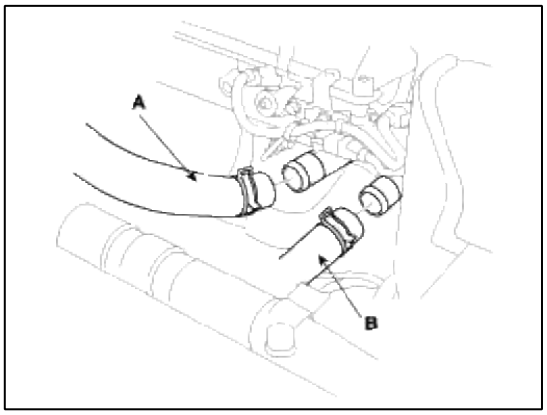
4. Drain the engine coolant. (Refer to EMA-90)
   Remove the radiator cap to speed draining.



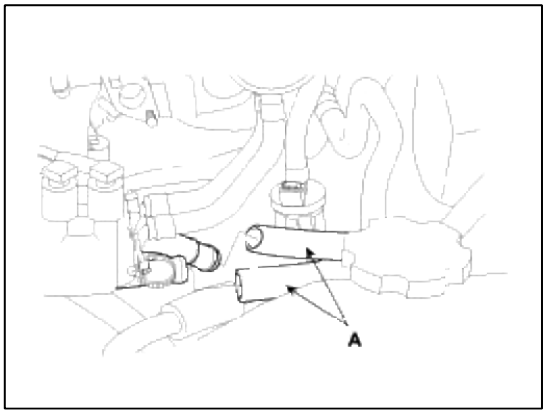
5. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the AFS(Air Flow Sensor) connector(A).
   (2) Disconnect the breather hose(B) from intake air hose.
   (3) Remove the intake air hose and air cleaner assembly(C).



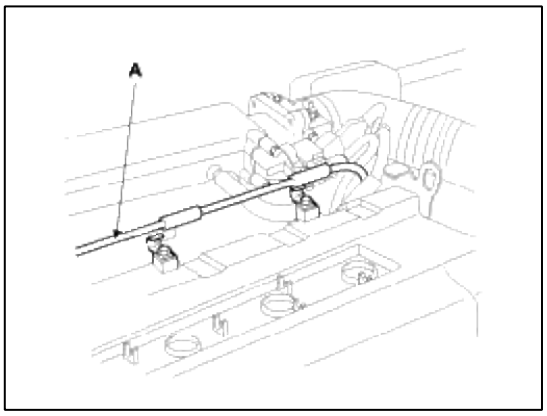
6. Remove the upper radiator hose(A) and lower radiator hose(B).



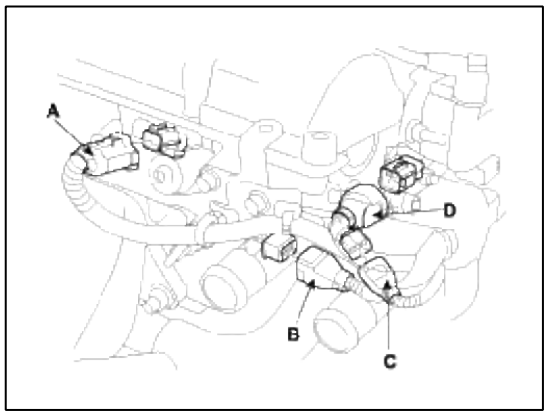
7. Remove the heater hoses(A).



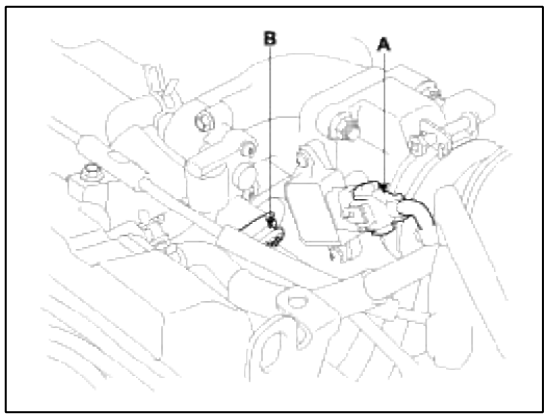
8. Remove the accelerator cable(A) by loosening the lock-nut, then slip the cable end out of the throttle linkage.



9. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.
   (1) Disconnect the OCV (Oil Control Valve) connector(A).
   (2) Disconnect the oil temperature sensor connector(B).
   (3) Disconnect the ECT (Engine Coolant Temperature) sensor connector(C).
   (4) Disconnect the ignition coil connector(D).

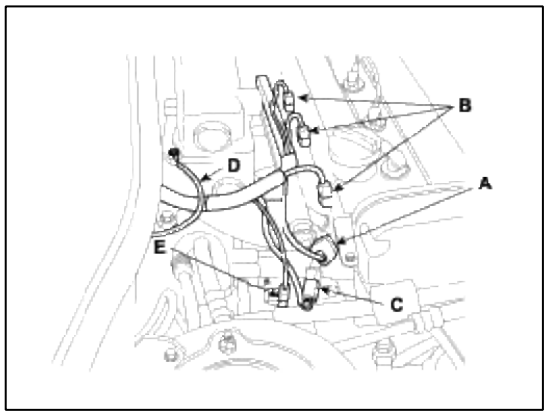


   (5) Disconnect the TPS (Throttle Position Sensor) connector(A).
   (6) Disconnect the ISA (Idle Speed Actuator) connector(B).



   (7) Disconnect the CMP (Camshaft Position Sensor) connector(A).
   (8) Disconnect the four injector connectors(B).
   (9) Disconnect the knock sensor connector(C).
   (10) Disconnect the ground cables (D) from the intake manifold.

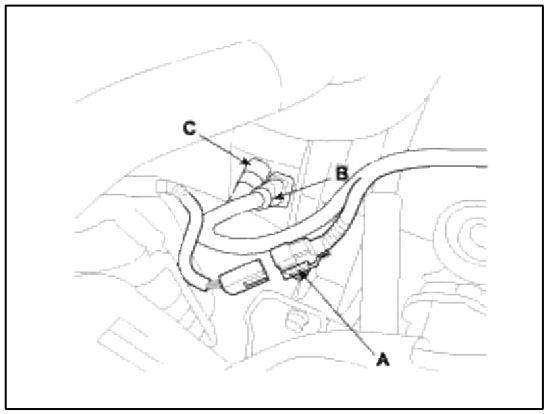
(11) Disconnect the air conditioner compressor switch connector(E).



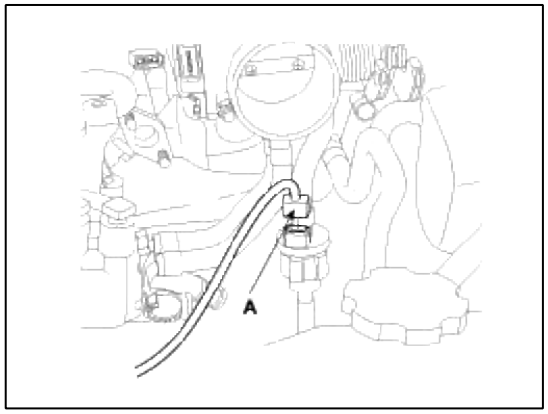
(12) Disconnect the front heated oxygen sensor connector(A).

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

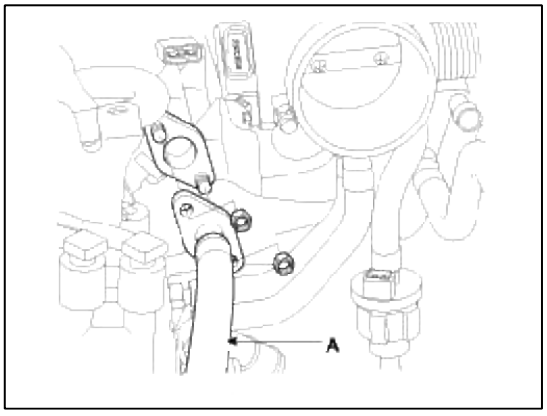
(14) Disconnect the oil pressure switch connector(C).



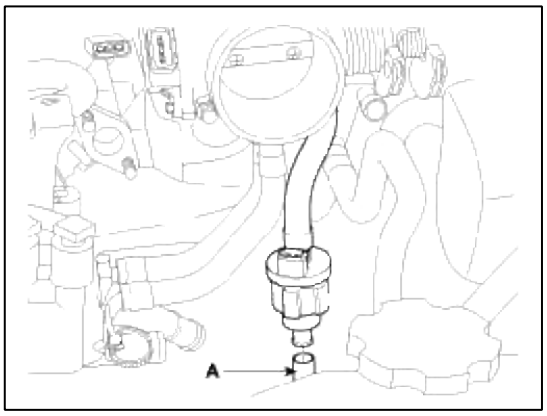
(15) Disconnect the PCSV (Purge Control Solenoid Valve) connector(A).



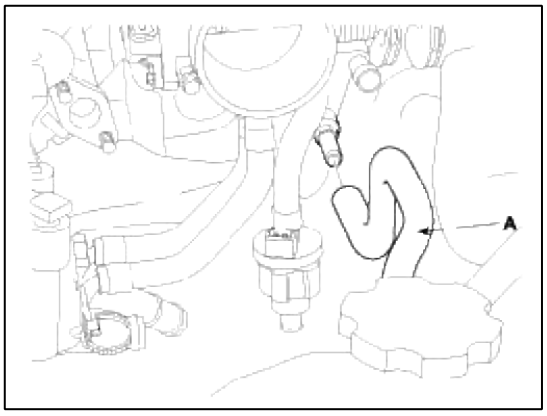
10. Disconnect the fuel inlet hose(A) of the delivery pipe side.



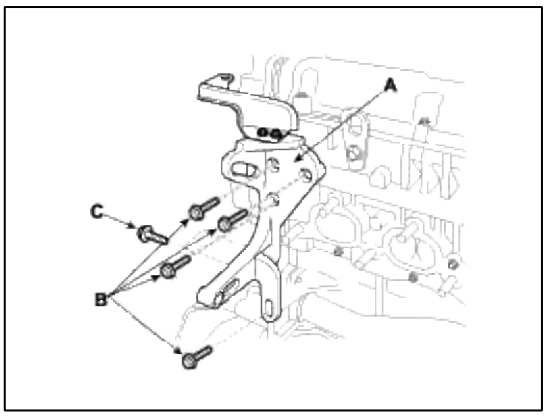
11. Disconnect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.



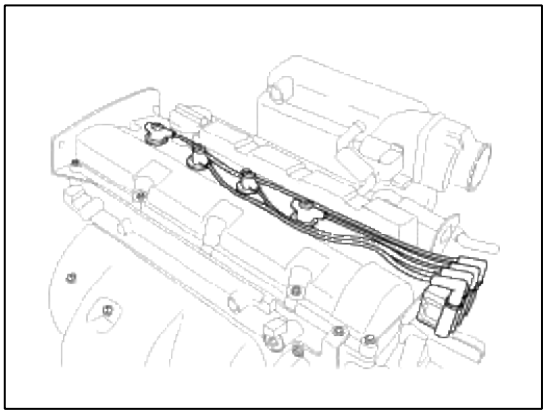
12. Remove the brake booster vacuum hose(A).



13. Remove the power steering pump drive belt.
14. Remove the power steering pump and use a wire to secure the pump to the vehicle so that it is out of the way.
15. Remove the bolts(B, C) and power steering pump bracket(A).

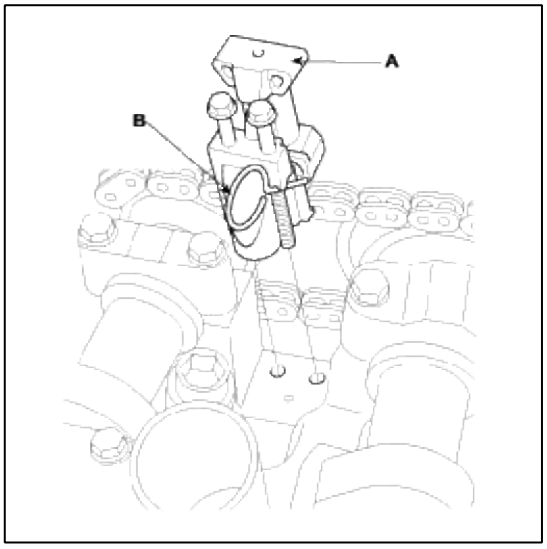


16. Remove the spark plug cables.

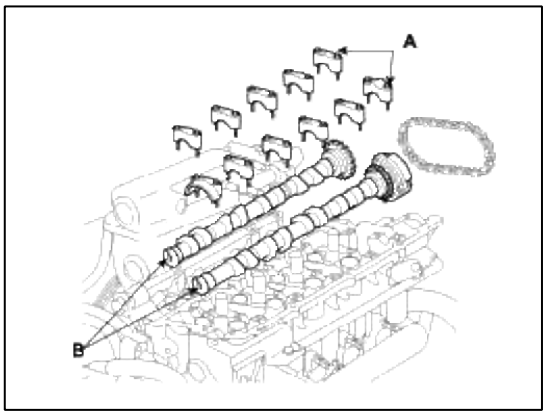


17. Remove the exhaust manifold. (Refer to EMA-113)
18. Remove the intake manifold. (Refer to EMA-110)
19. Remove the timing belt. (Refer to EMA-27 ~ 29, step 2 ~ 15)

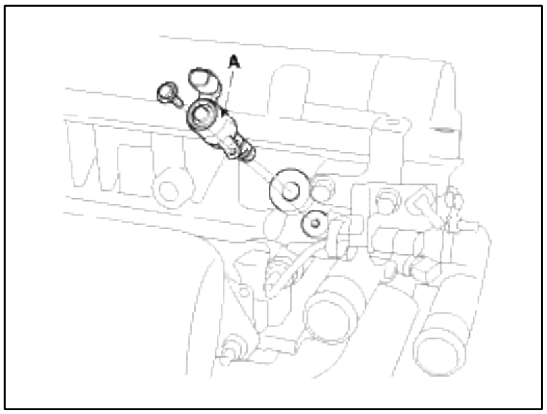
20. Remove the PCV(Positive Crankcase Ventilation) hose.
21. Remove the cylinder head cover. (Refer to EMA-30, step 18)
22. Remove the camshaft sprocket. (Refer to EMA-31, step 19)
23. Insert a stopper pin or other device into timing chain auto tensioner and remove the auto tensioner.



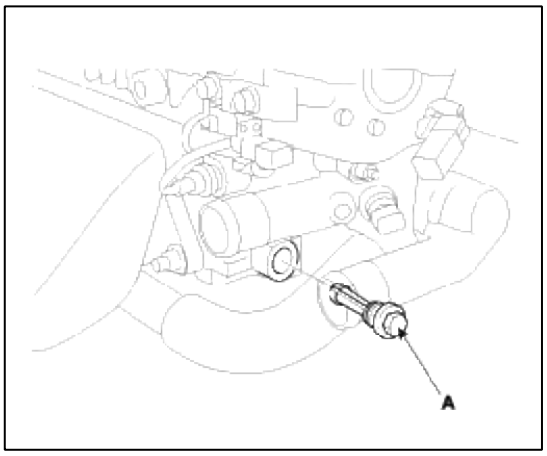
24. Remove the camshaft bearing caps(A) and camshafts(B).



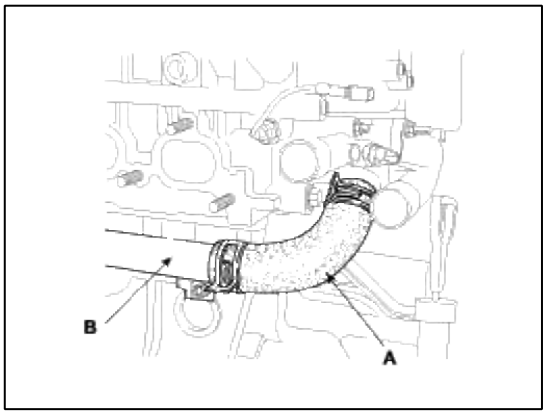
25. Remove the OCV(Oil Control Valve)(A).



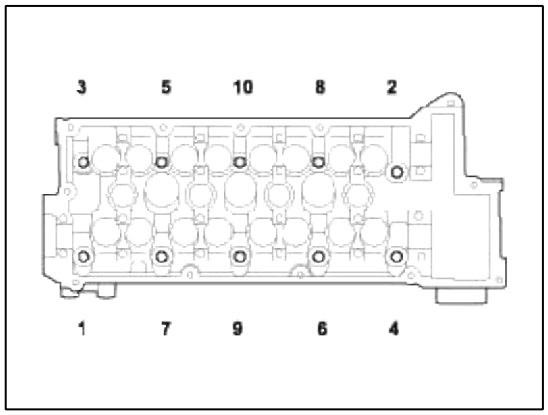
26. Remove the OCV(Oil Control Valve) filter(A).



27. Remove the water hose(A) from water pipe(B).



28. Remove the cylinder head bolts, then remove the cylinder head.
    (1) Using 8mm and 10mm hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.
    Remove the 10 cylinder head bolts and plate washers.



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

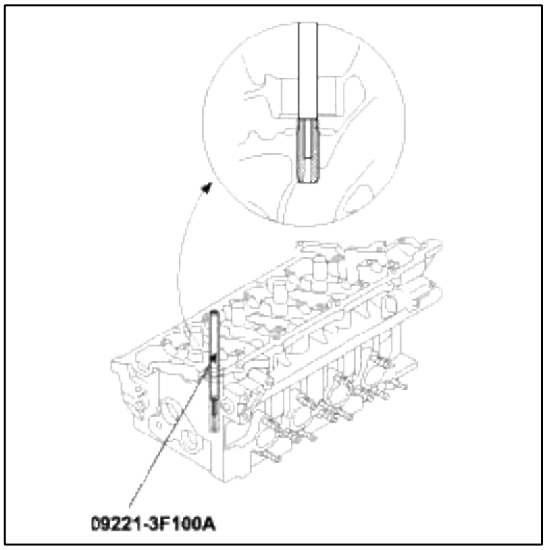
    (2) Lift the cylinder head from the dowels on the cylinder block and replace the cylinder head on wooden blocks on a bench.

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

REPLACEMENT

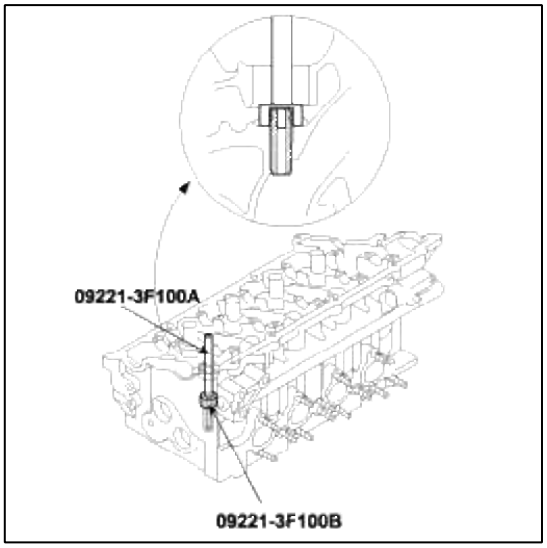
VALVE GUIDE

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



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 - 3F100 A/B), 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 : 45.8 ~ 46.2mm (1.8031 ~ 1.8189in)
Exhaust : 54.3 ~ 54.7mm (2.1378 ~ 2.1535in)



NOTE

Before the valve guide is press-fitted using the SST (09221-3F100A/B), remove the valve spring seat to install the valve guide correctly.

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

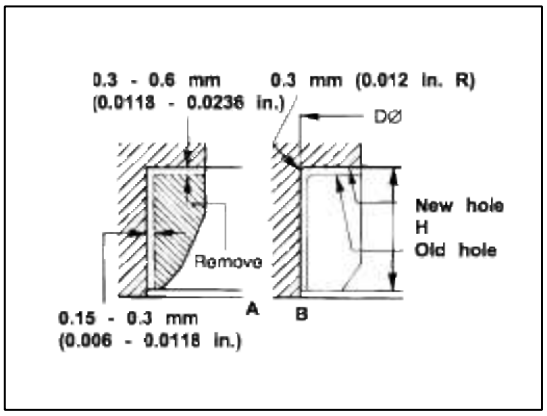
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

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)	11.040 ~ 11.050 (0.4346 ~ 0.4350)	14.000 (0.5512)
	0.05 (0.002) OS	5	11.050 ~ 11.068 (0.4350 ~ 0.4357)	11.090 ~ 11.100 (0.4366 ~ 0.4370)	
	0.25 (0.010) OS	25	11.250 ~ 11.268 (0.4429 ~ 0.4436)	11.290 ~ 11.300 (0.4445 ~ 0.4449)	
	0.50 (0.020) OS	50	11.500 ~ 11.518 (0.4528 ~ 0.4535)	11.540 ~ 11.550 (0.4543 ~ 0.4547)	

VALVE SEAT RING

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



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°C(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	-	33.000 ~ 33.025 (1.2992 ~ 1.3002)	33.090 ~ 33.105 (1.3028 ~ 1.3033)	7.200 ~ 7.400 (0.2835 ~ 0.2913)
	0.3(0.012) OS	30	33.300 ~ 33.325 (1.3110 ~ 1.3120)	33.390 ~ 33.405 (1.3146 ~ 1.3152)	7.500 ~ 7.700 (0.2953 ~ 0.3031)
	0.6(0.024) OS	60	33.600 ~ 33.625 (1.3228 ~ 1.3238)	33.690 ~ 33.705 (1.3264 ~ 1.3270)	7.800 ~ 8.000 (0.3071 ~ 0.3150)
Exhaust valve seat ring	STD	-	28.500 ~ 28.521 (1.1220 ~ 1.1229)	28.590 ~ 28.605 (1.1256 ~ 1.1262)	7.600 ~ 7.800 (0.3110 ~ 0.3189)
	0.3(0.012) OS	30	28.800 ~ 28.821 (1.1339 ~ 1.1347)	28.890 ~ 28.905 (1.1374 ~ 1.1380)	7.900 ~ 8.100 (0.3110 ~ 0.3189)
	0.6(0.024) OS	60	29.100 ~ 29.121 (1.1457 ~ 1.1465)	29.190 ~ 29.205 (1.1492 ~ 1.1498)	8.200 ~ 8.400 (0.3228 ~ 0.3307)

INSTALLATION

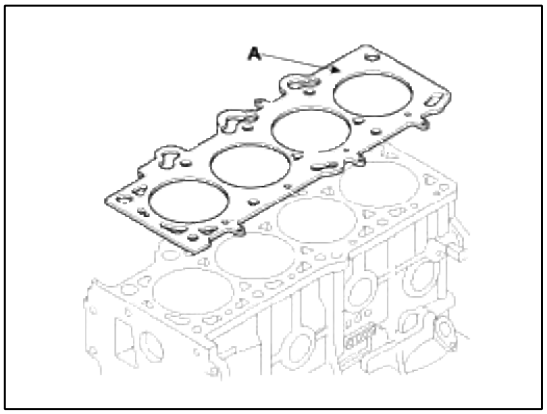
NOTE

- Thoroughly clean all parts to be assembled.
- Always use a new cylinder head and manifold gasket.
- 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.

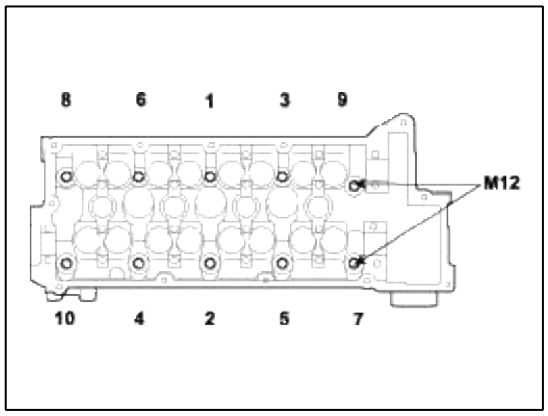
NOTE

Be careful of the installation direction.



2. Place the cylinder head onto the block carefully in order to prevent damaging the gasket. If the gasket is damaged, fluid leakage could occur.
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 :
M10: 22.6~26.5N.m (2.3~2.7kgf.m, 16.6~19.5lbf.ft)+60°~65° + 60°~65°
M12: 27.5~31.4N.m (2.8~3.2kgf.m, 20.3~23.1lbf.ft)+60°~65° + 60°~65°

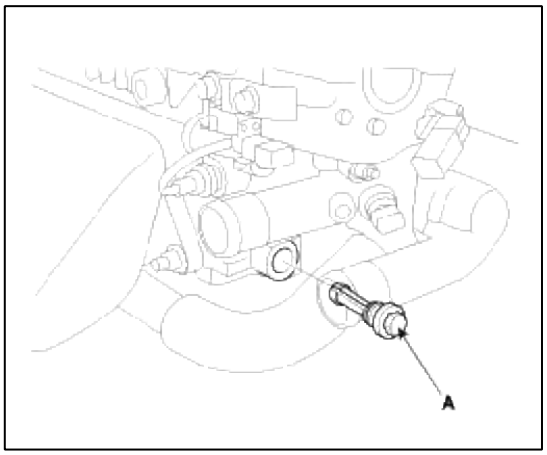


NOTE

Always use a new cylinder head bolts.

4. Install the OCV(Oil Control Valve) filter(A).

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

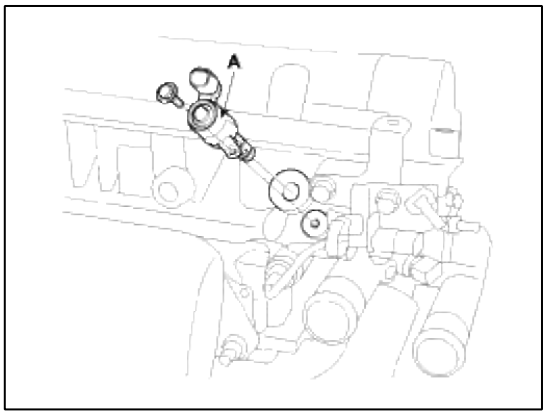


NOTE

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

5. Install the OCV(Oil Control Valve)(A).

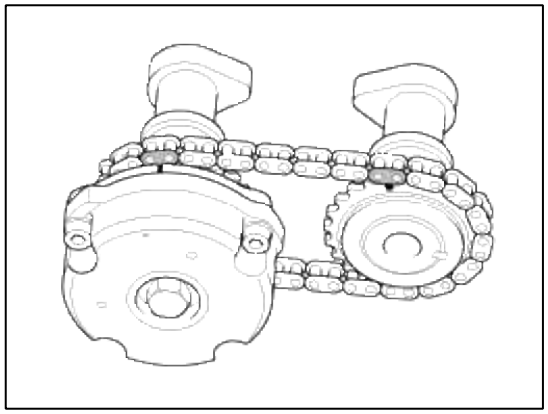
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lbf.ft)



CAUTION

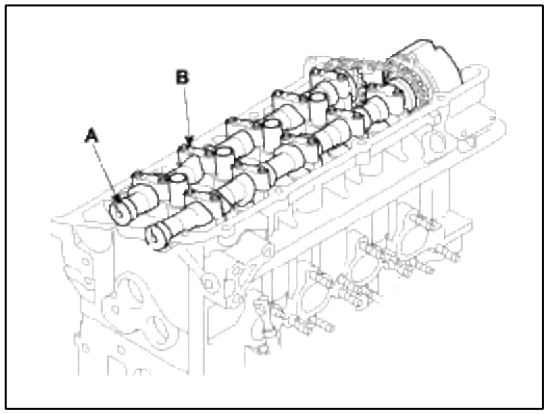
- Do not reuse the OCV(Oil Control Valve) when dropped.
- Keep the OCV clean.
- Do not hold the OCV(Oil Control Valve) sleeve during servicing.
- When the OCV is installed on the engine, be careful not to rotate the engine while holding the yoke.

6. Install the camshafts.
   (1) Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.



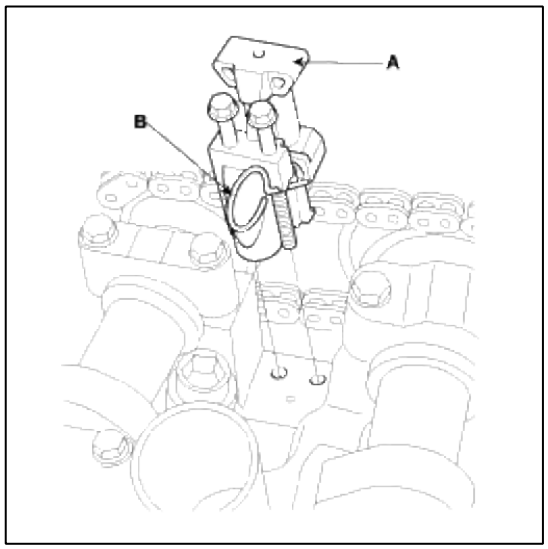
   (2) Install the camshaft(A) and bearing caps(B).

Tightening torque :
13.7 ~ 14.7N.m (1.4 ~ 1.5kgf.m, 10.1 ~ 10.8lbf.ft)



   (3) Install the timing chain auto tentioner(A).

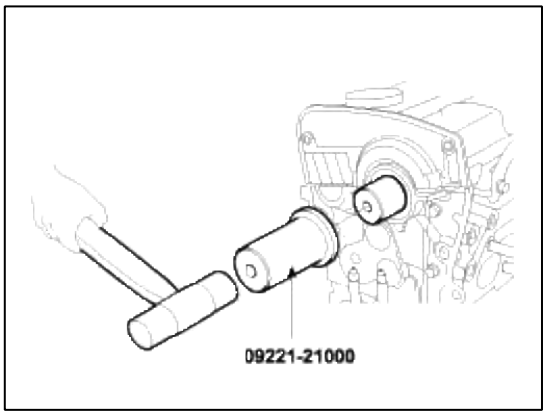
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lbf.ft)



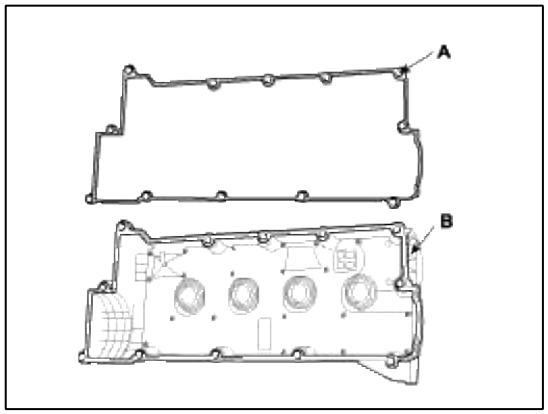
   (4) Remove the auto tentioner stopper pin(B).

7. Check and adjust valve clearance. (Refer to EMA-14 ~ 19)

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



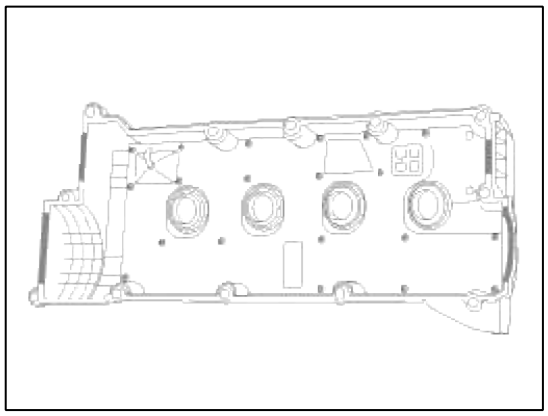
9. Install the camshaft sprocket. (Refer to EMA-32, step 1)
10. Install the cylinder head cover.
    (1) Install the cylinder head cover gasket(A) in the groove of the cylinder head cover(B).



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.

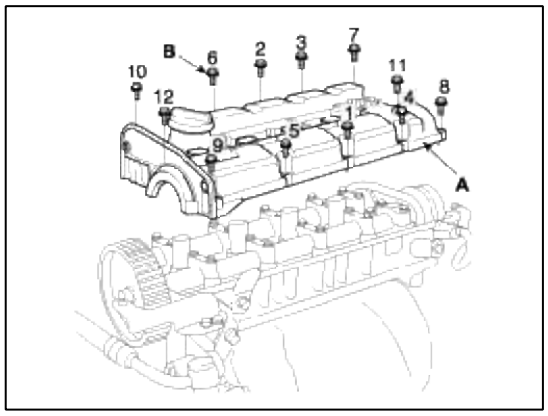


NOTE

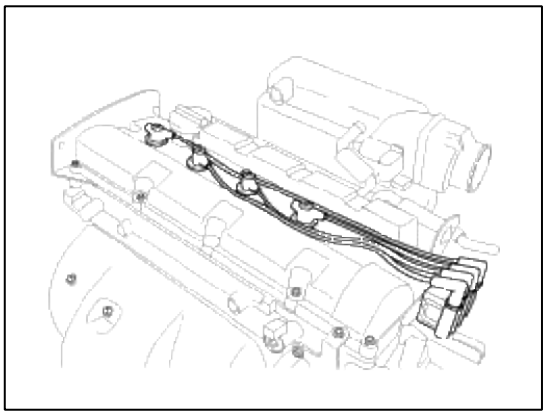
- Use liquid gasket, loctite No. 5999.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- After assembly, wait at least 30 minutes before filling the engine with oil.

(3) Install the cylinder head cover(A) with the 12 bolts(B). Uniformly tighten the bolts in several passes.

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

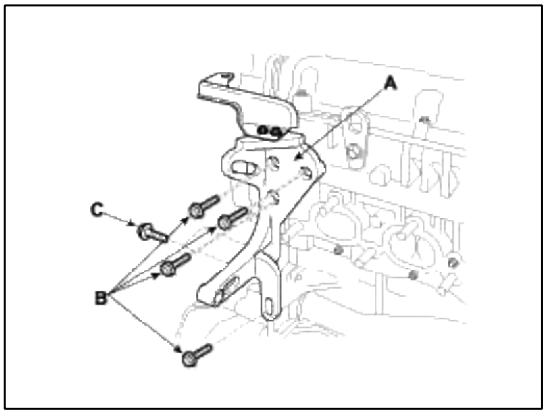


11. Install the PCV(Positive Crankcase Ventilation) hose. (Refer to EMA-33, step 2))
12. Install the timing belt. (Refer to EMA-33 ~ 37, step 4 ~ 21)
13. Install the intake manifold. (Refer to EMA-110)
14. Install the exhaust manifold. (Refer to EMA-113)
15. Install the spark plug cables.



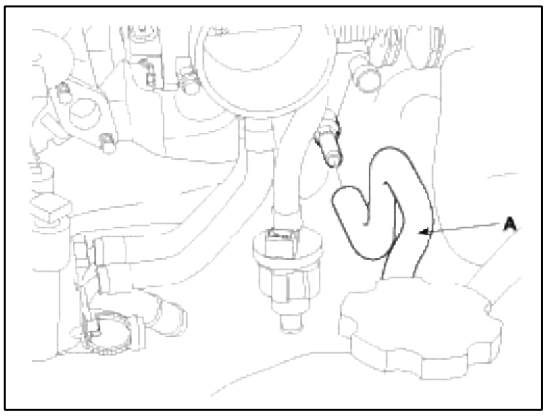
16. Install the power steering pump bracket(A) and bolts(B, C).

Tightening torque :
Bolt (B) : 34.3 ~ 49.0N.m (3.5~ 5.0kgf.m, 25.3 ~ 36.2lbf.ft)
Bolt (C) : 11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lbf.ft)

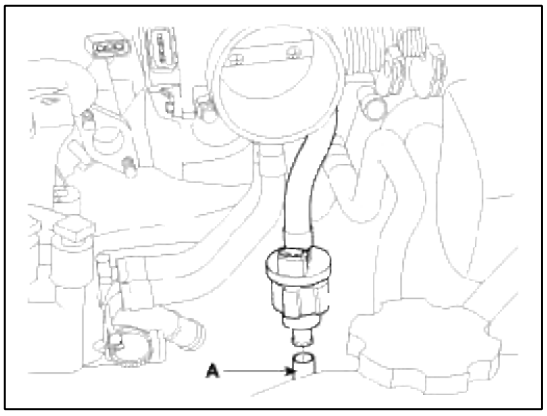


17. Install the power steering pump. (See ST group - power steering pump)
18. Install the accelerator cable.

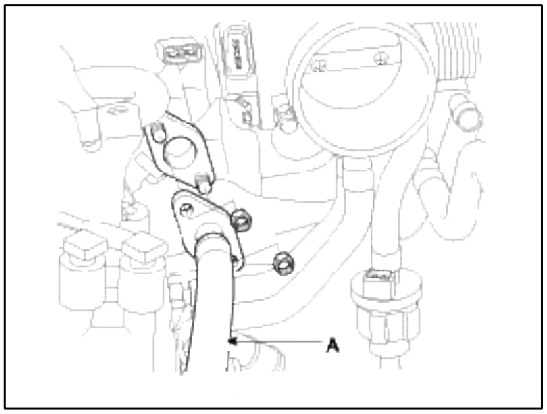
19. Install the brake booster hose(A).



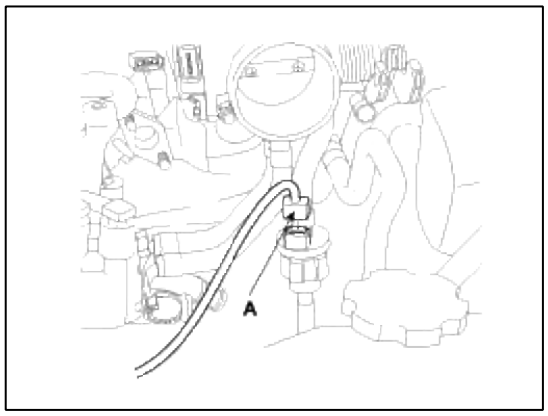
20. Connect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.



21. Connect the fuel inlet hose(A) of the delivery pipe side.



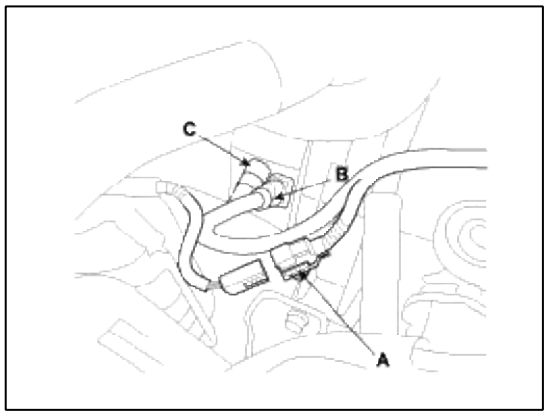
22. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
    (1) Connect the PCSV(Purge Control Solenoid Valve) connector(A).



    (2) Connect the front heated oxygen sensor connector (A).

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

(4) Connect the oil pressure switch connector(C).



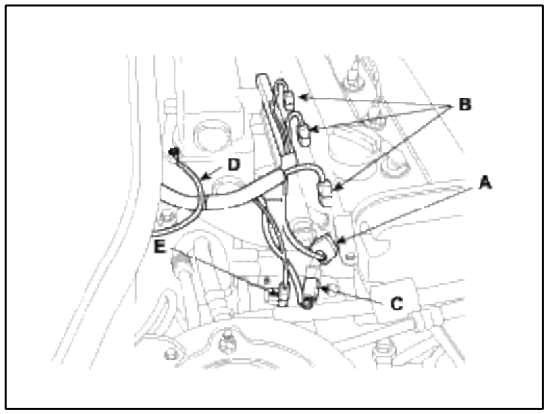
(5) Connect the air conditioner compressor switch connector(E).

(6) Connect the ground cables(D) to intake manifold.

(7) Connect the knock sensor connector(C).

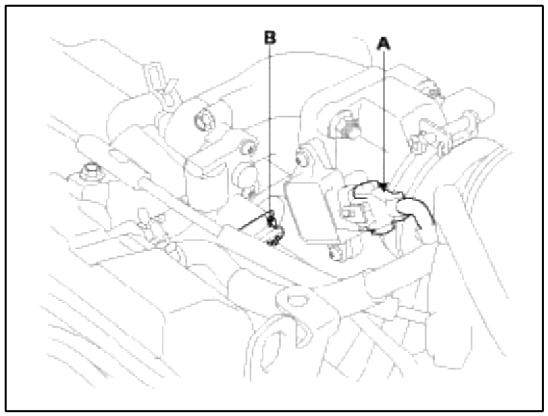
(8) Connect the fuel injector connectors(B).

(9) Connect the CMP(Camshaft position sensor) connector(A).



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

(11) Connect the TPS (Throttle Position Sensor) connector (A).

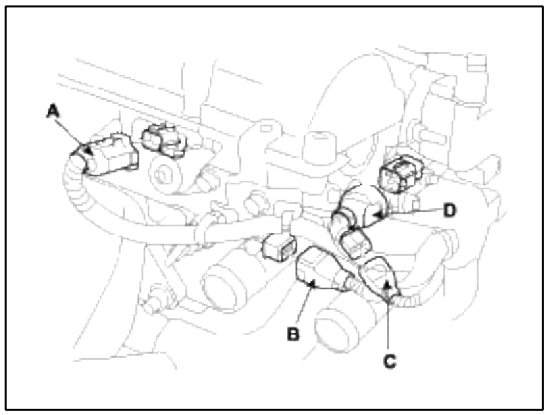


(12) Connect the ignition coil connector(D).

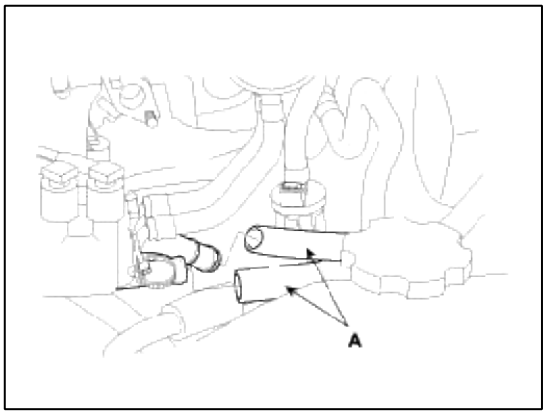
(13) Connect the ECT (Engine Coolant Temperature) connector(C).

(14) Connect the oil temperature sensor connector(B).

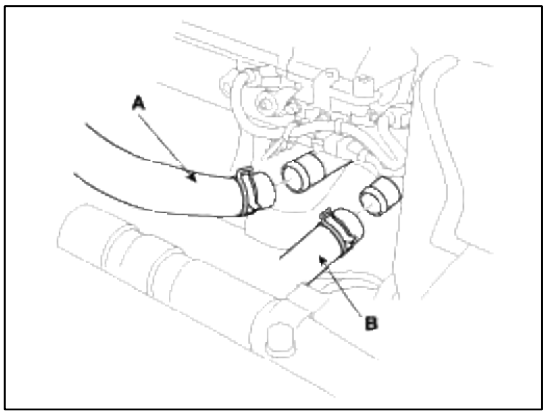
(15) Connect the OCV(Oil Control Valve) connector(A).



23. Install the heater hose(A).



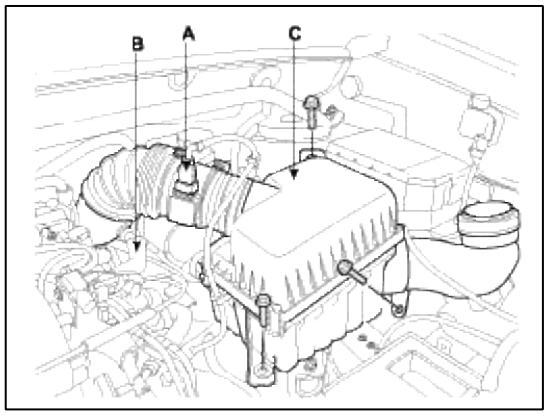
24. Install the upper radiator hose(A) and lower radiator hose(B).



25. Install the intake air hose and air cleaner assembly.
    (1) Install the intake air hose, air cleaner assembly(C) and bolts.

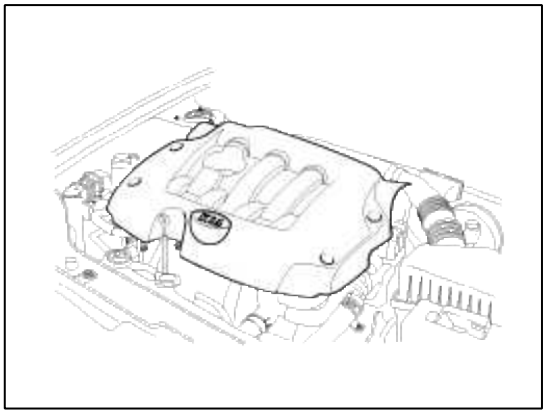
    Tightening torque :
    7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lbf.ft)

    (2) Install the breather hose(B) to intake air hose.
    (3) Connect the AFS(Air Flow Sensor) connector(A).

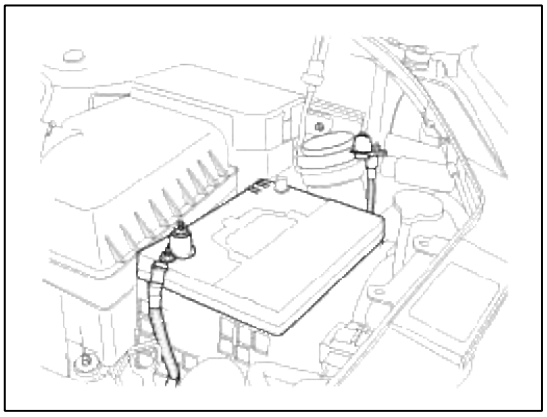


26. Install the engine cover.

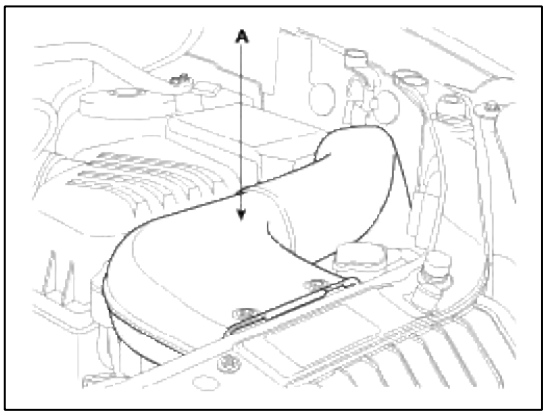
    Tightening torque :
    3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lbf.ft)



27. Reconnect the battery terminals(A).



28. Install the air duct(A).



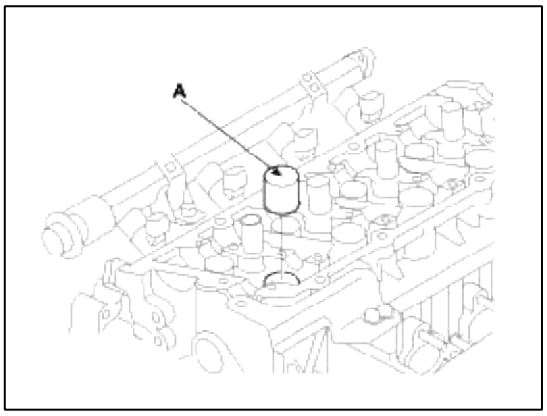
29. Fill with engine coolant.
30. Start the engine and check for leaks.
31. Recheck engine coolant level and oil level.

DISASSEMBLY

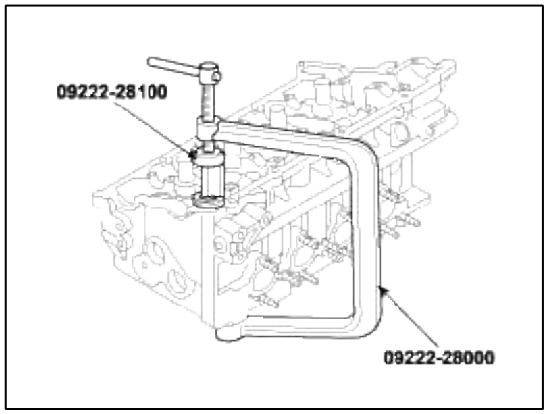
NOTE

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

1. Remove the MLAs(A).



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



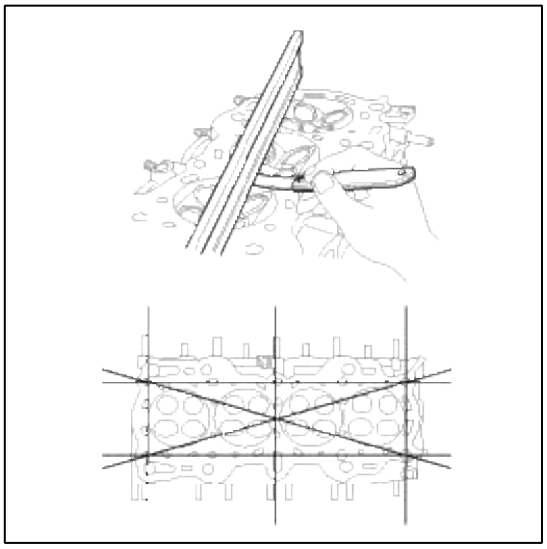
   (2) Remove the spring retainer.
   (3) Remove the valve spring.
   (4) Remove the valve.
   (5) Using a needle-nose pliers, remove the oil seal.
   (6) Using a magnetic finger, remove the spring seat.

INSPECTION

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 : 0.30mm (0.0118in)

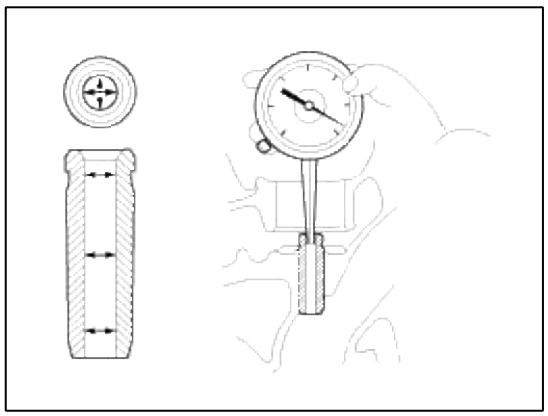


2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

VALVE AND VALVE SPRING

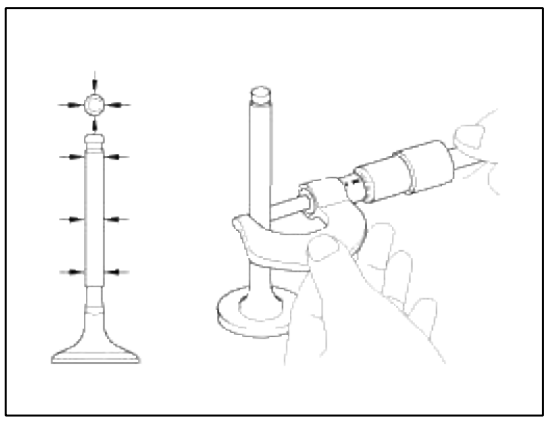
1. Inspect the valve stems and valve guides.
   (1) Using a caliper gauge, measure the innner diameter of valve guide.

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



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

Valve stem outer diameter
Intake : 5.965 ~ 5.980mm (0.2348 ~ 0.2354in)
Exhaust : 5.950 ~ 5.965mm (0.2343 ~ 0.2348in)



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

Valve stem- to-guide clearance
Standard
Intake : 0.020 ~ 0.050mm (0.0008 ~ 0.0020in)
Exhaust : 0.035 ~ 0.065mm (0.0014 ~ 0.0026in)
Limit
Intake : 0.10mm (0.0039in)
Exhaust : 0.13mm (0.0051in)

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

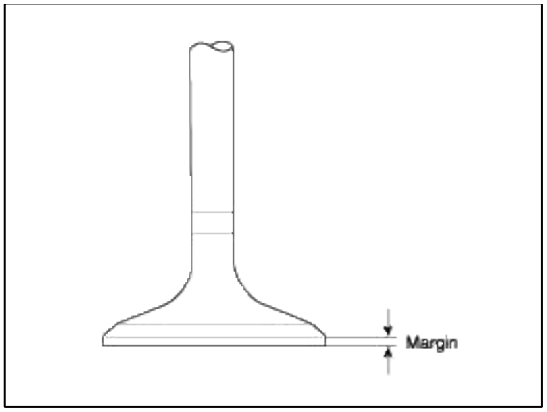
2. Inspect the valves.

(1) Check the valve is ground to the correct valve face angle.

(2) Check the surface of the valve face for damage or wear.
If the valve face is damaged or 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 : 1.15mm (0.0453in)
Exhaust : 1.35mm (0.0531in)
Limit
Intake : 0.8mm (0.0315in)
Exhaust : 1.0mm (0.0394in)



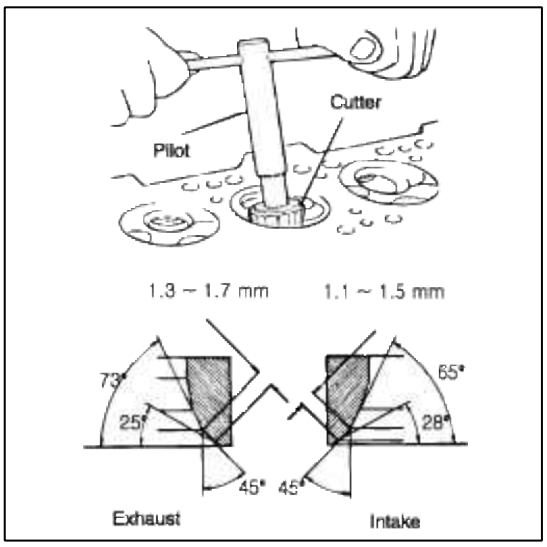
(4) Check the surface of valve stem tip for wear.
If the valve stem tip is worn, replace the valve.

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.

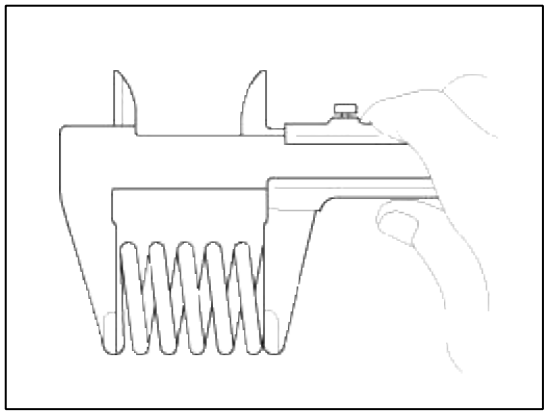
(2) Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat.

(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.



4. Inspect the valve springs.
   (1) Using a steel square, measure the out-of-square of valve spring.
   (2) Using vernier calipers, measure the free length of valve spring.

Valve spring
Standard
Free height : 48.86mm (1.9236in)
Load : 18.8±0.9kg/39.0mm (41.4±2.0lb/1.5354in)
41.0±1.5kg/30.5mm (90.4±3.3lb/1.2008in)
Out of square : Less than 1.5°
Limit
Out of square : 3°

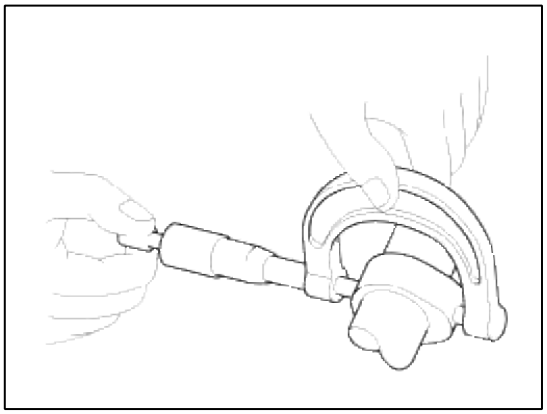


If the loads is not as specified, replace the valve spring.

CAMSHAFT

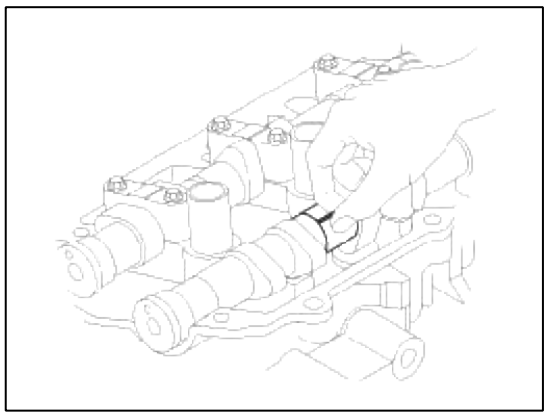
1. Inspect the cam lobes.
   Using a micrometer, measure the cam lobe height.

Cam height
Intake : 44.518 ~ 44.718mm (1.7527 ~ 1.7605in)
Exhaust : 44.418 ~ 44.618mm (1.7487 ~ 1.7566in)



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

2. Inspect the camshaft journal clearance.
   (1) Clean the bearing caps and camshaft journals.
   (2) Place the camshafts on the cylinder head.
   (3) Lay a strip of plastigage across each of the camshaft journal.

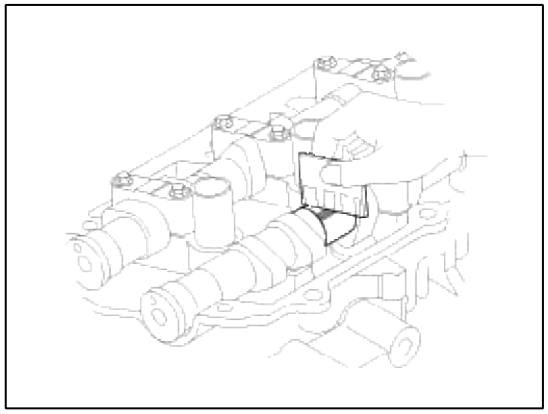


   (4) Install the bearing caps and tighten the bolts with specified torque. (Refer to EMA-55, step 6)

> CAUTION
>
> Do not turn the camshaft.

   (5) Remove the bearing caps.
   (6) Measure the plastigage at its widest point.

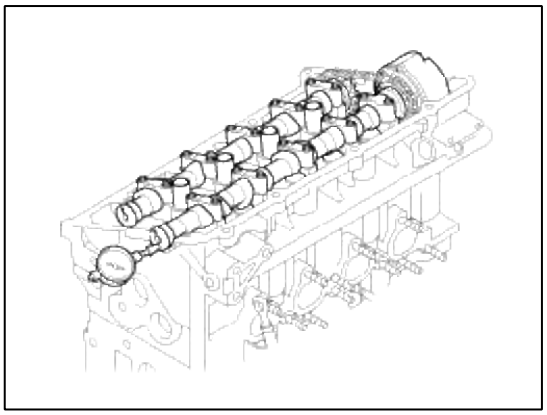
Bearing oil clearance
Standard : 0.020 ~ 0.061mm (0.0008 ~ 0.0024in)
Limit : 0.1mm (0.0039in)



   If the oil clearance is greater than maximum, 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 EMA-55, step 6)
   (2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

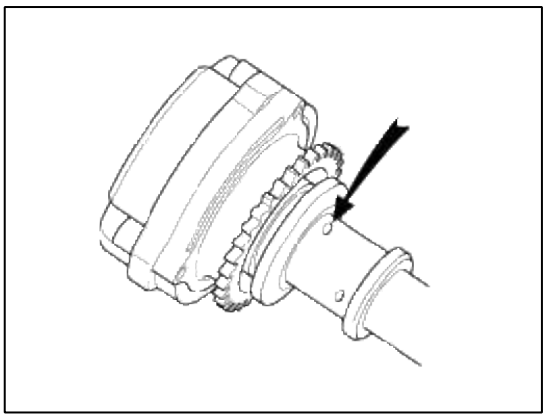
   Camshaft end play
   Standard : 0.1 ~ 0.2mm (0.0039 ~ 0.0079in)



   If the end play is greater than maximum, 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. 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.

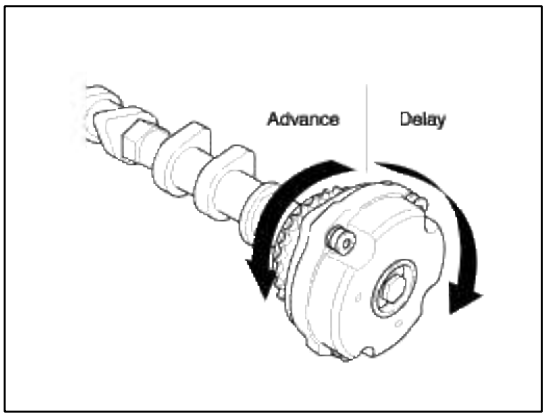


   (3) To release the CVVT lock pin, wrap some tape around the tip of an air pressure adapter and apply low air pressure(about 14 psi) to the exposed camshaft port.

   NOTE

   Wrap a shop towel or rag around the CVVT because residual oil may leak out of the unit when applying air pressure.

(4) With low air pressure applied, turn the CVVT to the ADVANCE direction as indicated in the illustration.
A. With the low air pressure applied, the CVVT should turn to the ADVANCE side.
B. If too much air leaks when applying the low air pressure, the CVVT lock pin may not release and the CVVT may not turn.



(5) Allow the CVVT assembly to move in the ADVANCE and DELAY directions to ensure there is no binding and that it moves freely.

Standard : Movable smoothly in the range about 20°

(6) Turn the CVVT by hand and make sure it locks in the maximum delay angle position.

REASSEMBLY

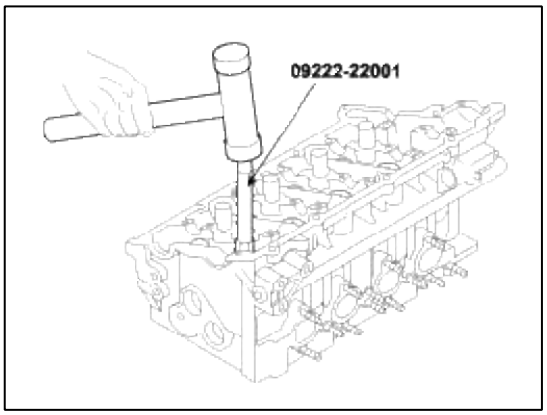
NOTE

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surface.
- Replace oil seals with new ones.

1. Install the valves.
(1) Install the spring seats.
(2) Using the SST (09222 - 22001), push in a new oil seal.

NOTE

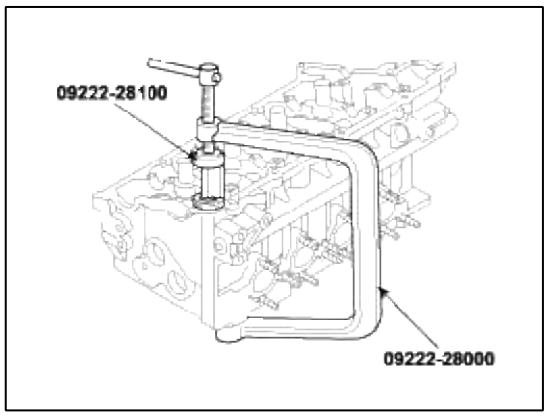
Do not reuse old valve stem oil seals.
Incorrect installation of the seal could result in oil leakage past the valve guides.



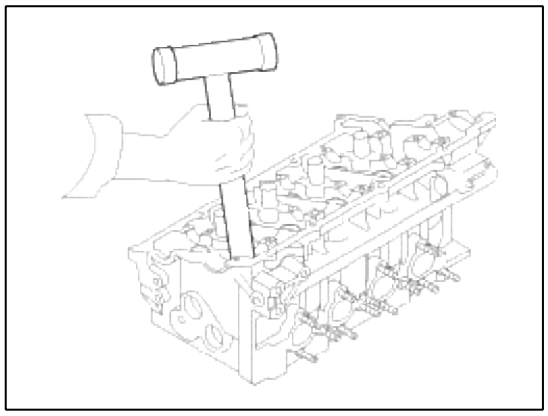
(3) Install the valve, valve spring and spring retainer.

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

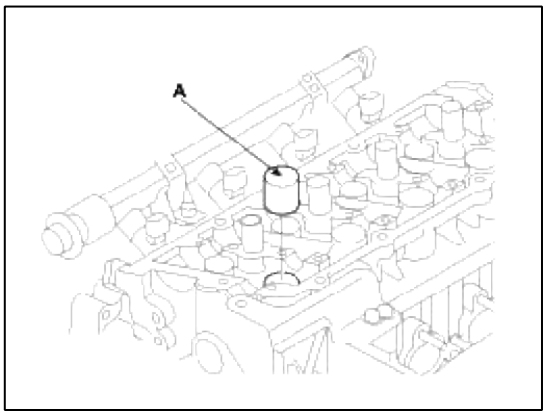
(4) Using the SST(09222 - 28000, 09222 - 28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



(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.

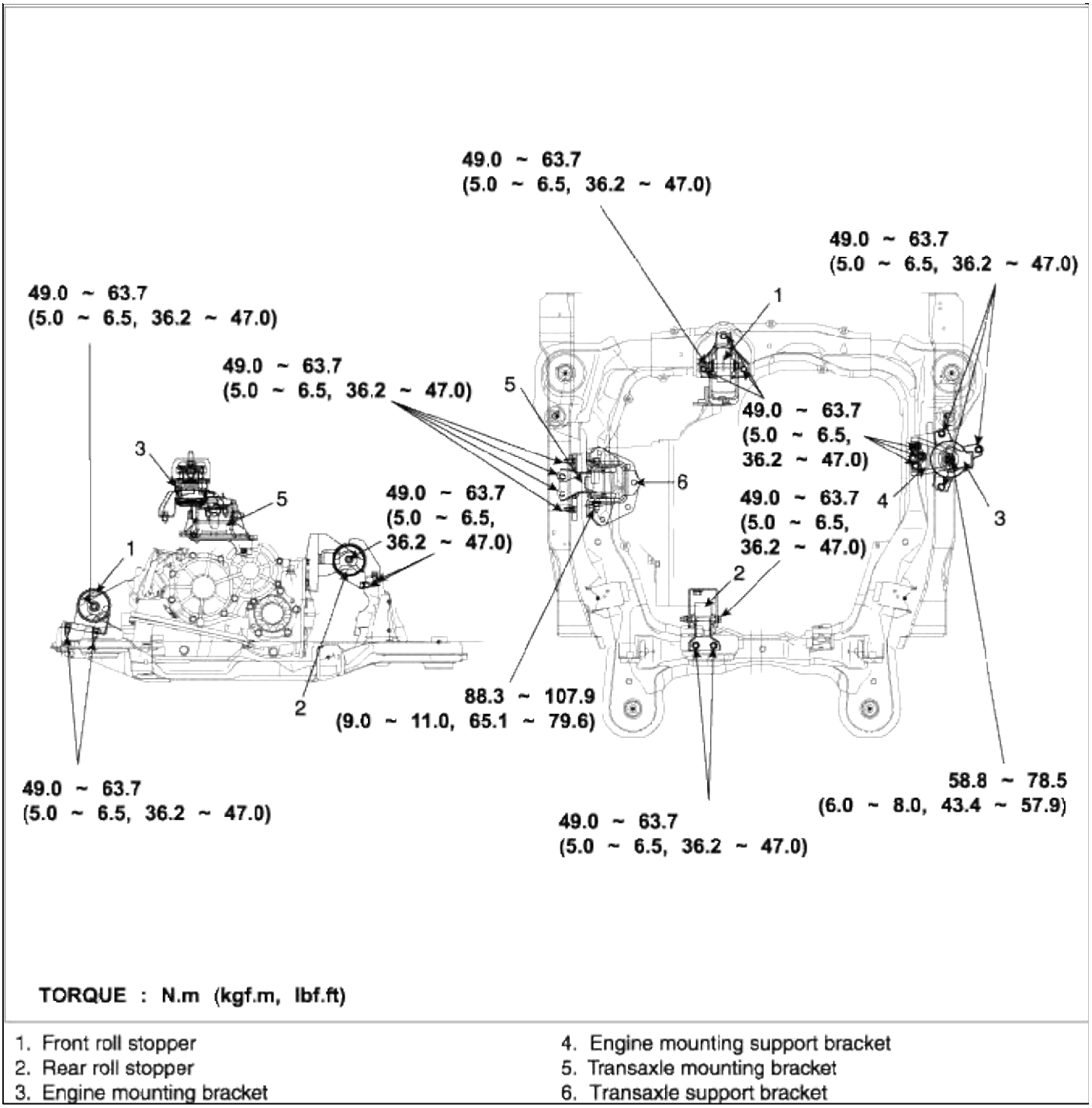


2. Install the MLA(Mechanical Lash Adjuster)s.
Check that the MLA rotates smoothly by hand.



Engine Mechanical System > Engine And Transaxle Assembly > Components and Components Location

COMPONENT



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

Engine Mechanical System > Engine And Transaxle Assembly > Repair procedures

REMOVAL

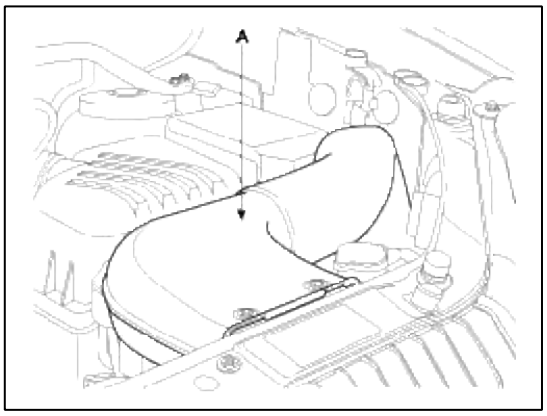
CAUTION

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

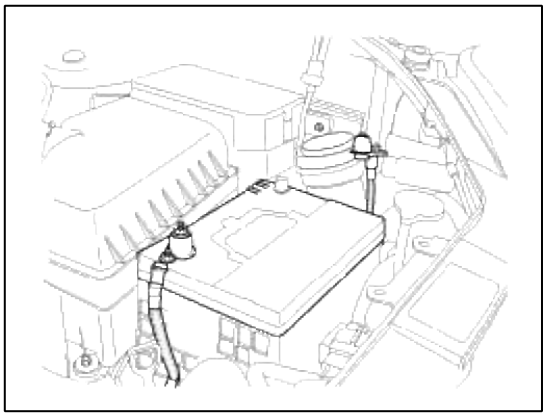
NOTE

- Mark all wiring and hoses to avoid misconnection.

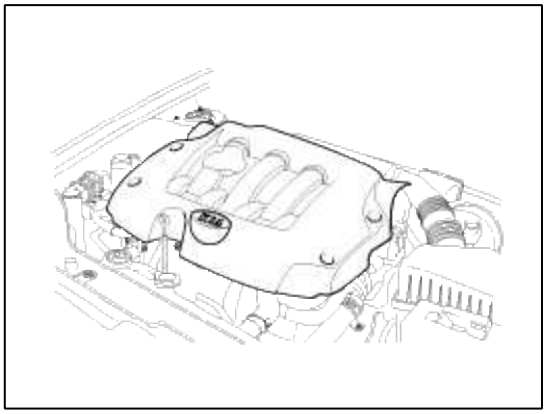
1. Remove the air duct(A).



2. Disconnect the battery terminals(A) and remove the battery.

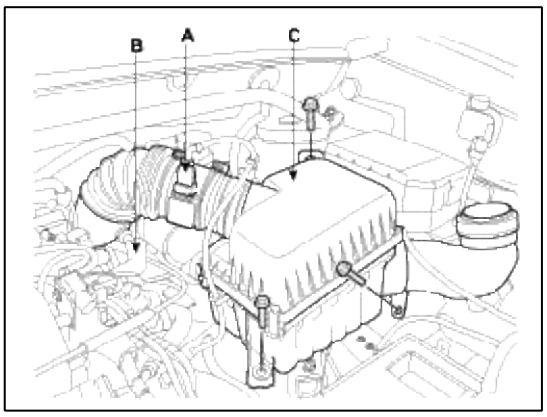


3. Remove the engine cover.

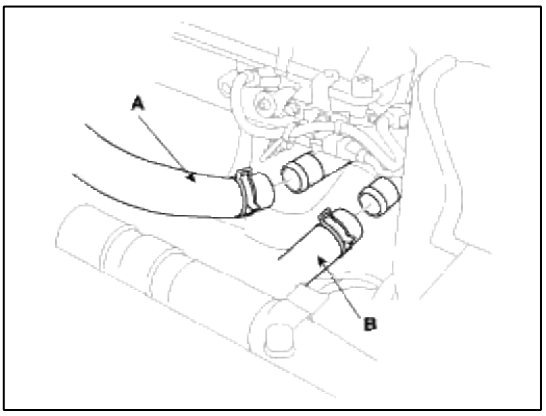


4. Drain the engine coolant. (Refer to EMA-90)
   Remove the radiator cap to speed draining.

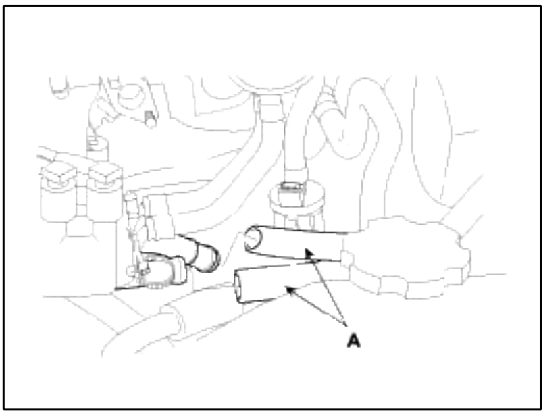
5. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the AFS(Air Flow Sensor) connector(A).
   (2) Disconnect the breather hose(B) from intake air hose.
   (3) Remove the intake air hose and air cleaner assembly(C).



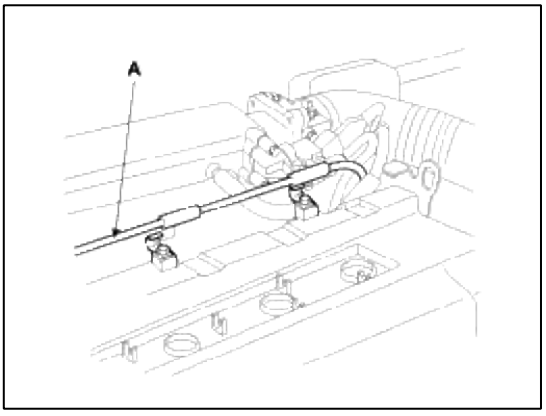
6. Remove the upper radiator hose(A) and lower radiator hose(B).



7. Remove the heater hose(A).



8. Remove the accelerator cable(A).



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

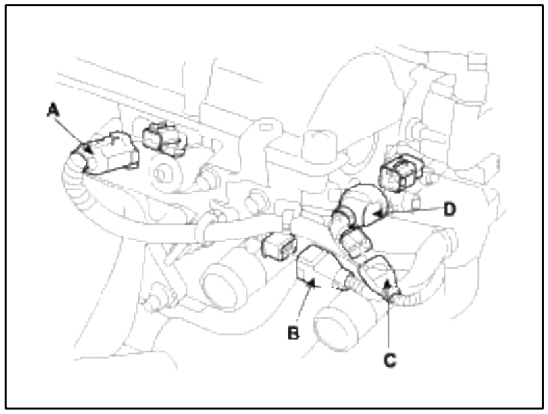
manifold.

(1) Disconnect the OCV(Oil Control Valve) connector(A).

(2) Disconnect the oil temperature sensor connector(B).

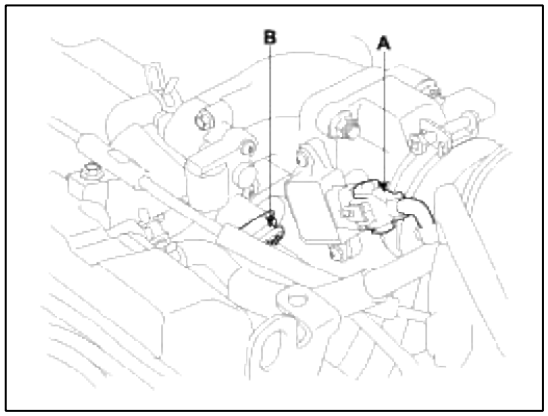
(3) Disconnect the ECT(Engine Coolant Temperature) sensor connector(C).

(4) Disconnect the ignition coil connector(D).



(5) Disconnect the TPS(Throttle Position Sensor) Connector(A).

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



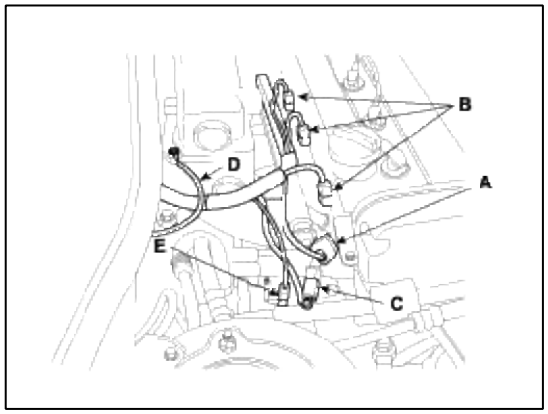
(7) Disconnect the CMP(Camshaft Position Sensor) connector(A).

(8) Disconnect the four fuel injector connectors(B).

(9) Disconnect the knock sensor connector(C).

(10) Disconnect the ground cables(D) from the intake manifold and vehicle's body.

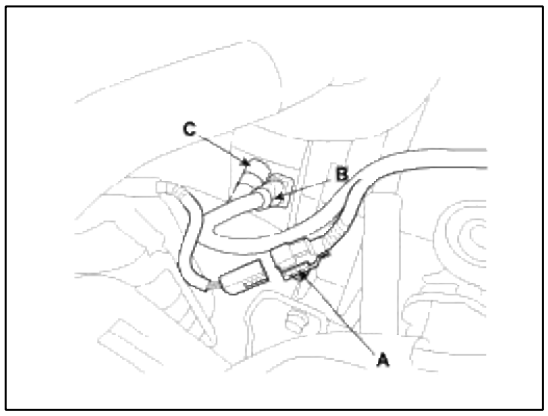
(11) Disconnect the air conditioner compressor switch(E).



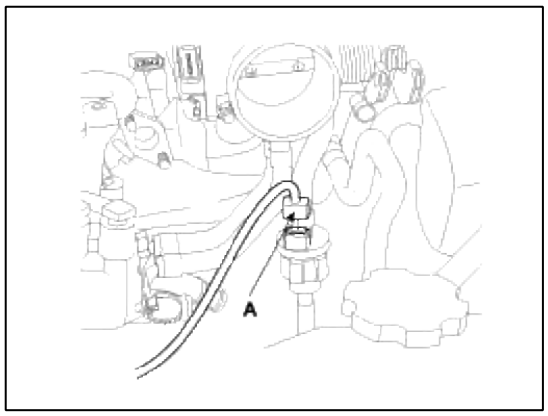
(12) Disconnect the front heated oxygen sensor connector(A).

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

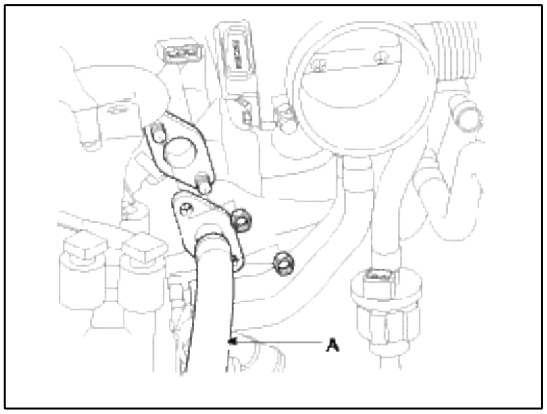
(14) Disconnect the oil pressure switch connector(C).



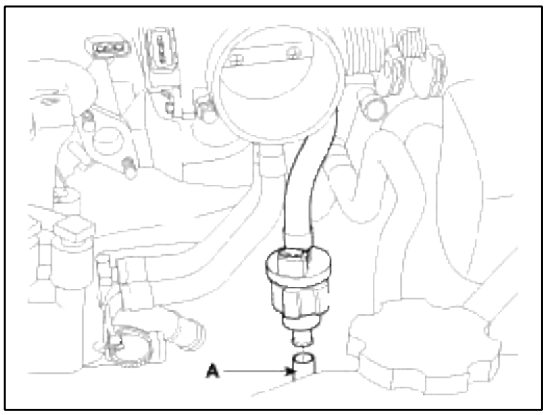
(15) Disconnect the PCSV (Purge Control Solenoid Valve) connector(A).



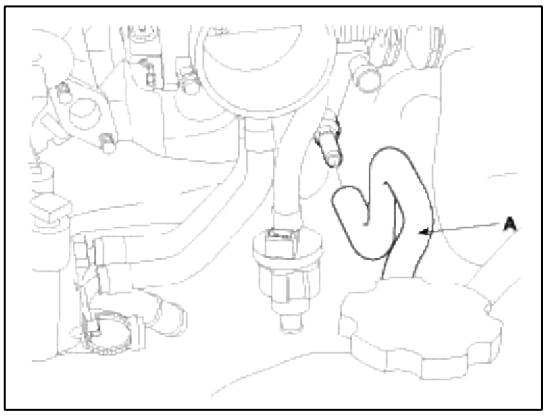
10. Disconnect the fuel inlet hose(A) of the delivery pipe side.



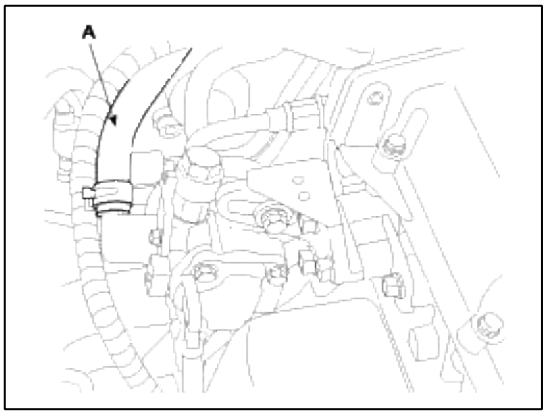
11. Disconnect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.



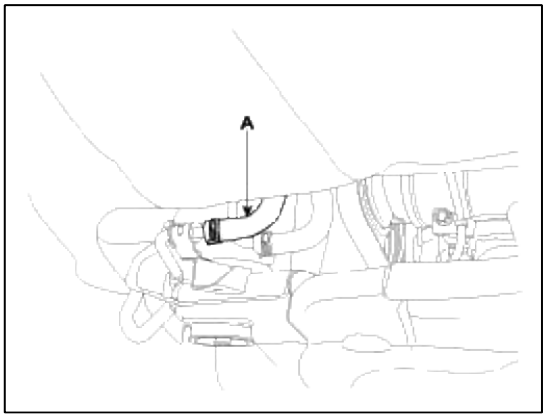
12. Remove the brake booster vacuum hose(A).



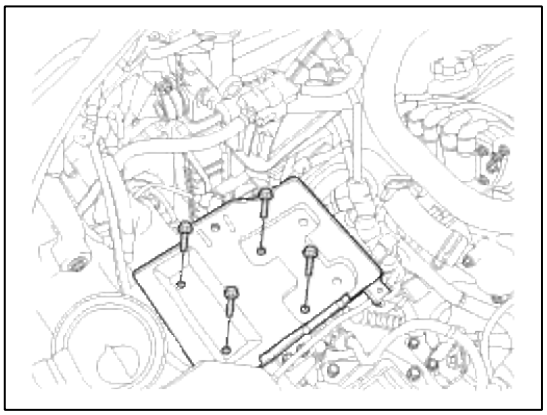
13. Remove the power steering oil hose(A) from the power steering pump.

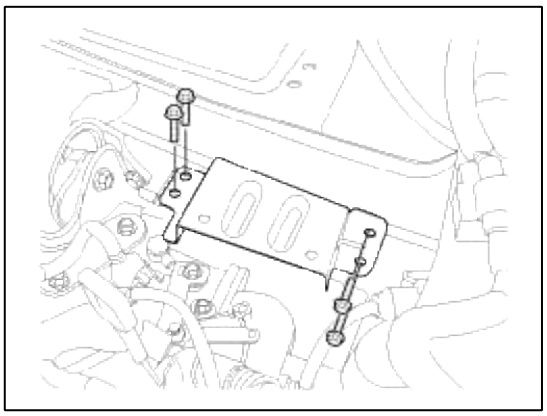


14. Remove the power steering lower oil hose(A).

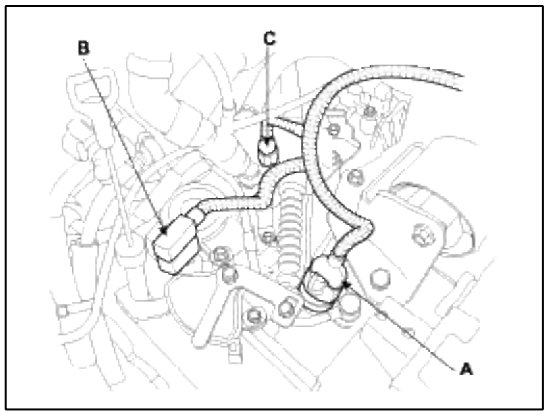


15. Remove the battery tray bracket.

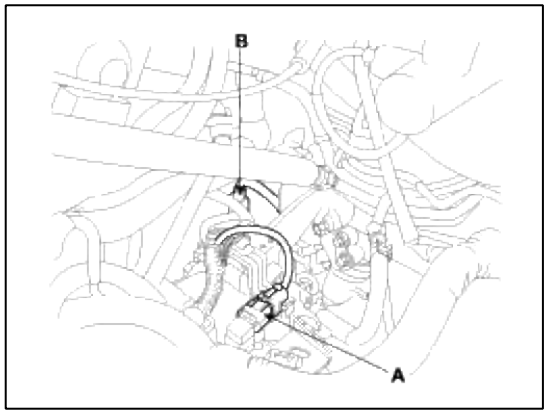




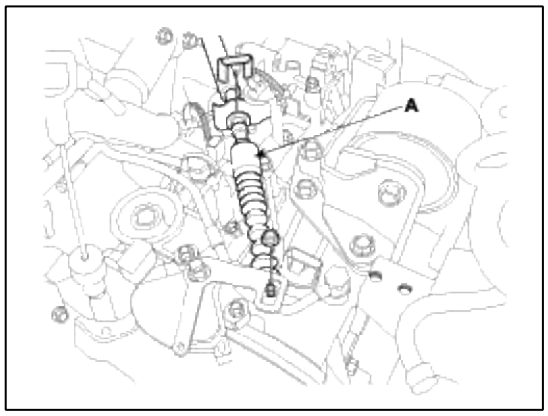
16. Remove the transaxle wire harness connectors and control cable from transaxle(A/T).
    (1) Disconnect the solenoid valve connector(A).
    (2) Disconnect the transaxle range switch connector(B).
    (3) Disconnect the input shaft speed sensor connector(C).



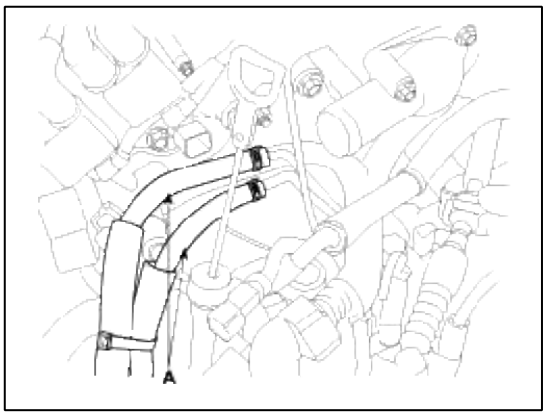
    (4) Disconnect the output shaft speed sensor connector(A).
    (5) Disconnect the vehicle speed sensor connector(B).



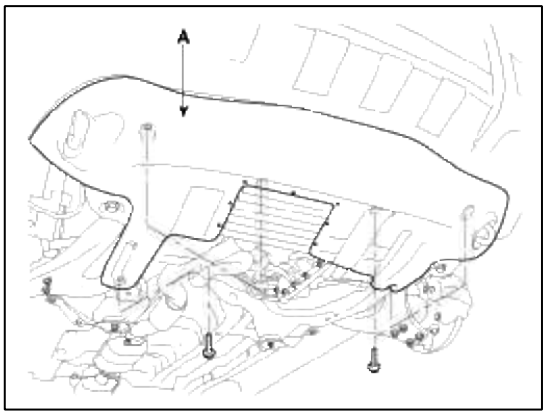
(6) Remove the control cable(A).



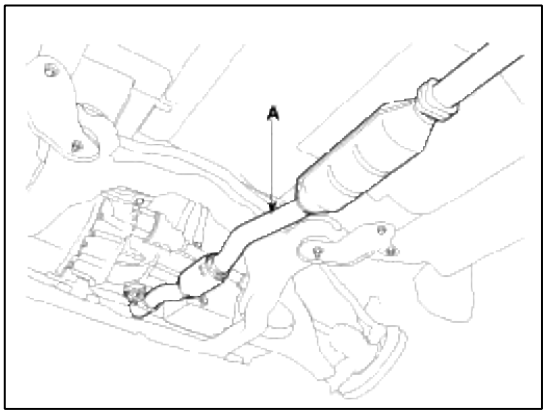
17. Remove the transaxle oil cooler hose(A) (A/T).



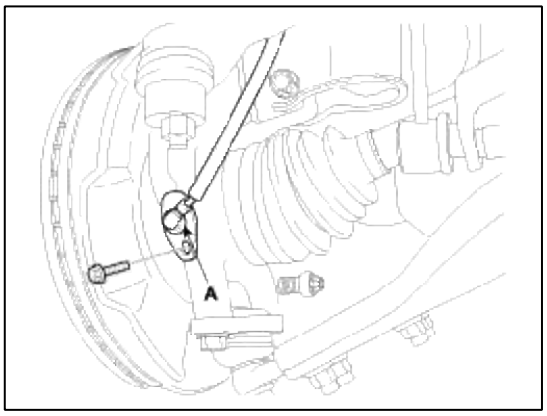
18. Remove the under cover(A).



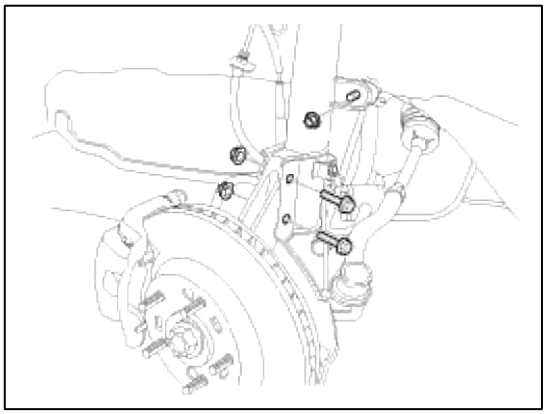
19. Remove the front exhaust pipe(A).



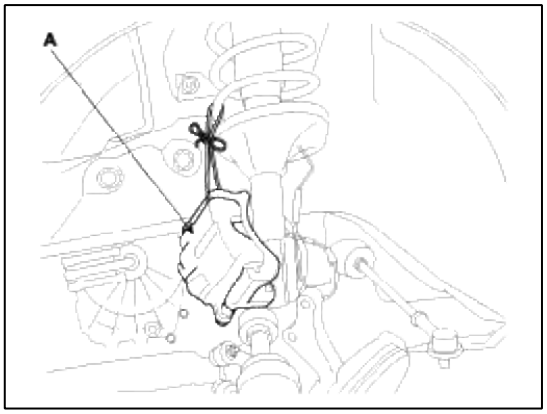
20. Disconnect the ABS wheel speed sensor(A) from both front knuckle. (See DS group - front axle)



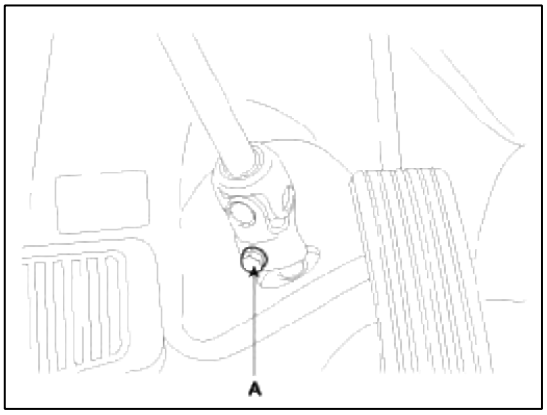
21. Remove the front strut lower mounting bolts and nuts.
(See SS griup - front strut)



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



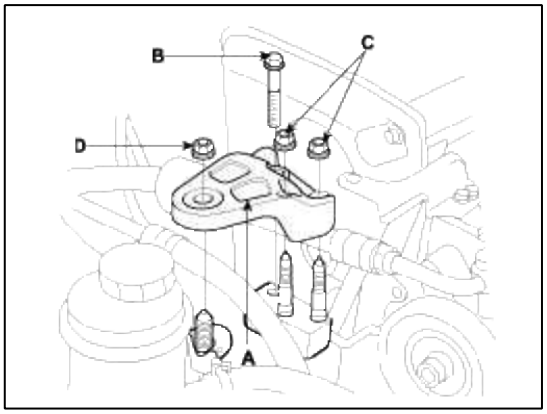
23. Remove the steering u-joint mounting bolt(A). (See ST group - steering)



24. Install the jack for supporting engine and transaxle assembly.

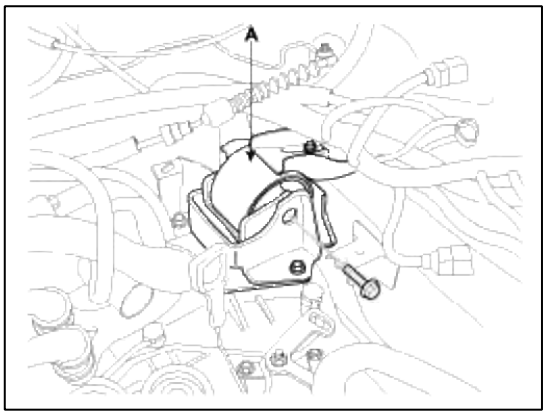
25. Remove the engine mounting bracket(A).

Tightening torque
Nut(D) : 58.8 ~ 78.5N.m (6.0 ~ 8.0 kgf.m, 43.4 ~ 57.9lbf.ft)
Bolt(B), Nut(C) : 49.0 ~ 63.7N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0lbf.ft)



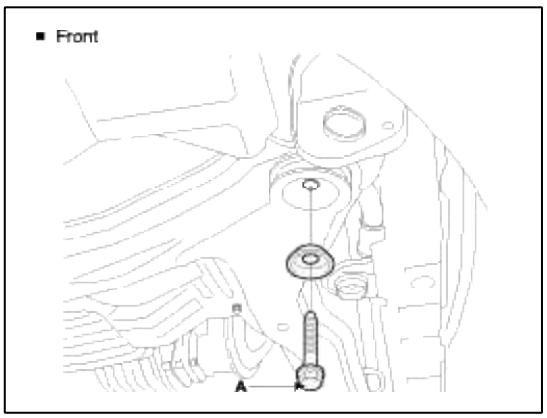
26. Remove the transaxle mounting bracket(A).

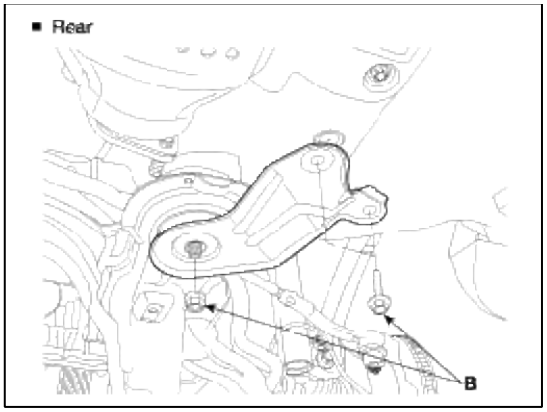
Tightening torque
Bolt(B) : 88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.61lbf.ft)

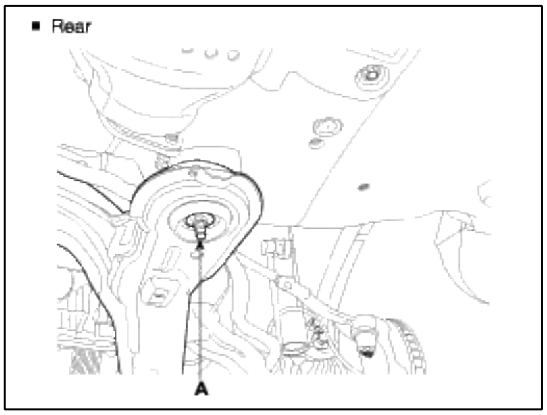


27. Remove the sub frame mounting bolts and nuts.

Tightening torque
Bolt(A) : 156.9 ~ 176.5N.m (16.0 ~ 18.0 kgf.m, 115.7 ~ 130.2 lbf.ft)
Bolt, Nut(B) : 68.6 ~ 88.3N.m (7.0 ~ 9.0 kgf.m, 50.6 ~ 65.1lbf.ft)







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

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

INSTALLATION

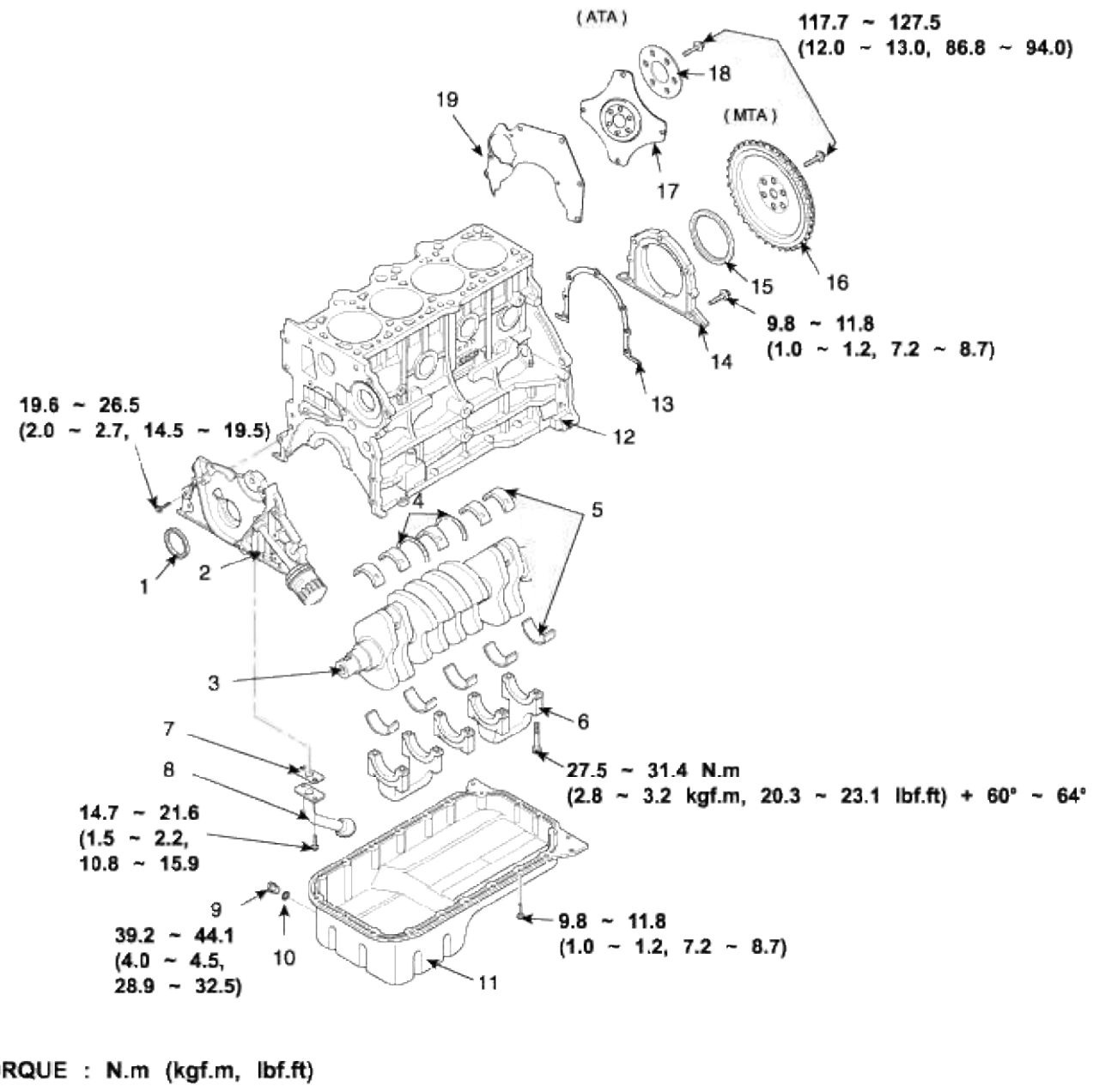
Installation is in the reverse order of removal.

Perform the following :

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator and reservoir tank with engine coolant.
- Place the heater control knob on "HOT" positon.
- 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.

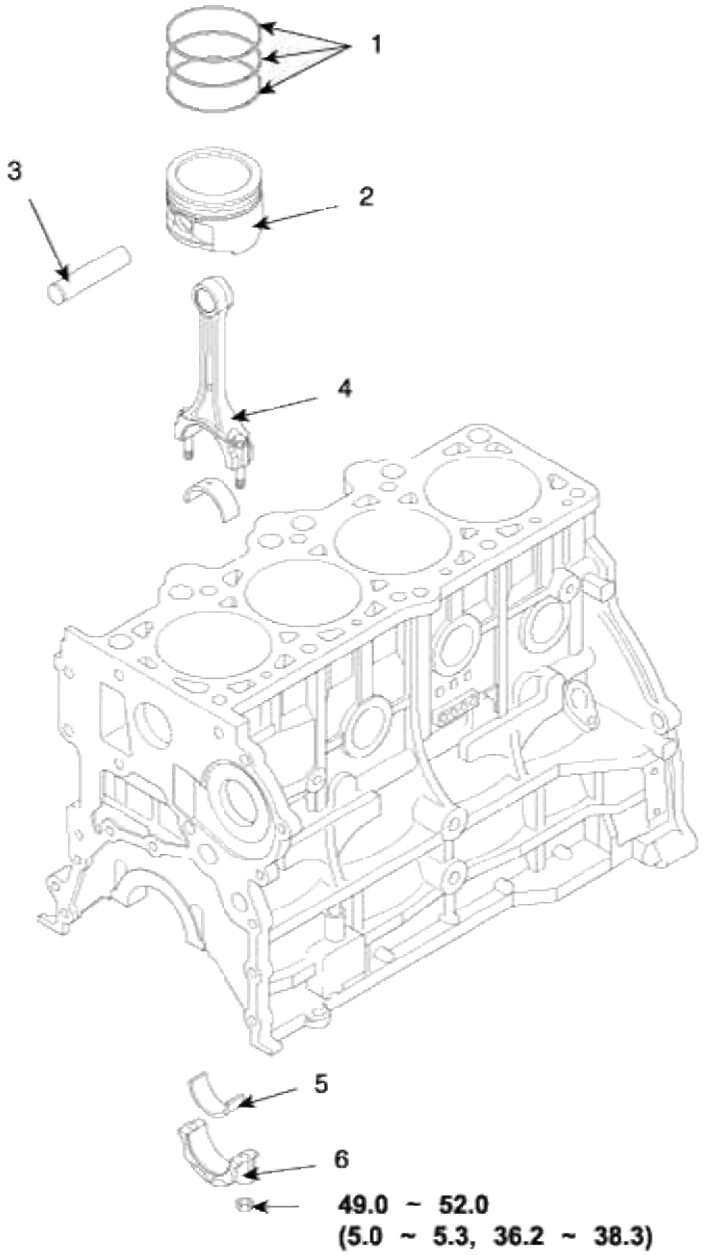
Engine Mechanical System > Cylinder Block > Components and Components Location

COMPONENT



TORQUE : N.m (kgf.m, lbf.ft)

1. Oil seal
2. Front case
3. Crank shaft
4. Thrust bearing
5. Main bearing
6. main bearing cap
7. Gasket
8. Oil screen
9. Drain plug
10. Gasket
11. Oil pan
12. Cylinder block
13. Gasket
14. Rear oil seal case
15. Oil seal
16. Fly wheel
17. Drive plate
18. Washer
19. Rear plate



TORQUE : N.m (kgf.m, lbf.ft)

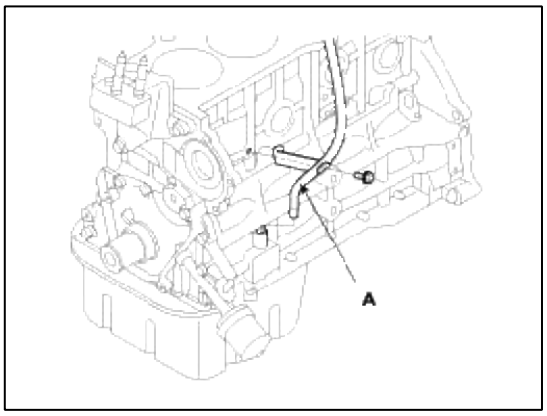
1. Piston ring
2. Piston
3. Piston pin
4. Connecting rod
5. Connecting rod bearing
6. Connecting rod bearing cap

Engine Mechanical System > Cylinder Block > Repair procedures

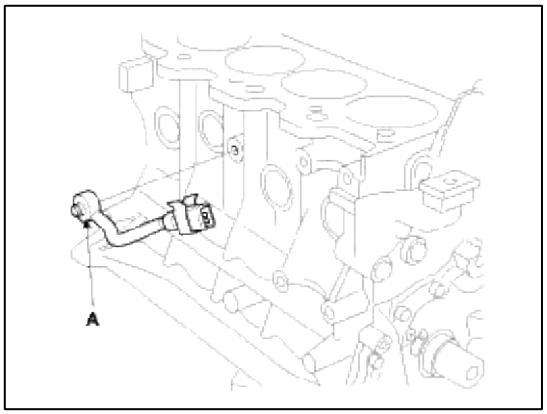
DISASSEMBLY

1. M/T : Remove the fly wheel.
2. A/T : Remove the drive plate.
3. Install the engine block onto an engine stand for disassembly.
4. Remove the timing belt. (Refer to EMA-27)
5. Remove the cylinder head. (Refer to EMA-40)

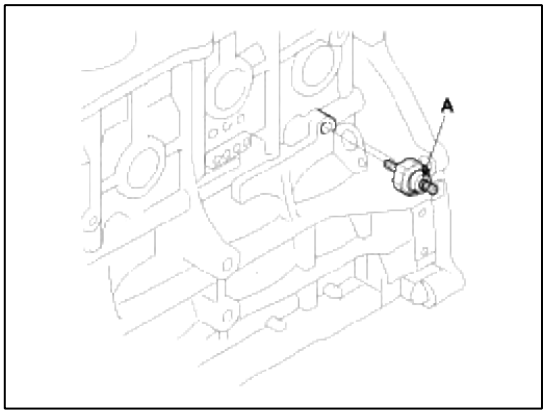
6. Remove the oil level gauge tube(A).



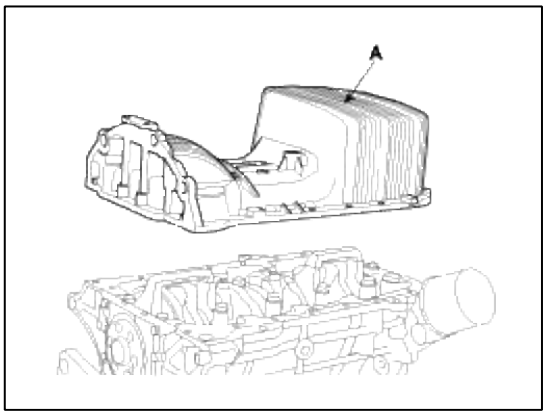
7. Remove the knock sensor(A).



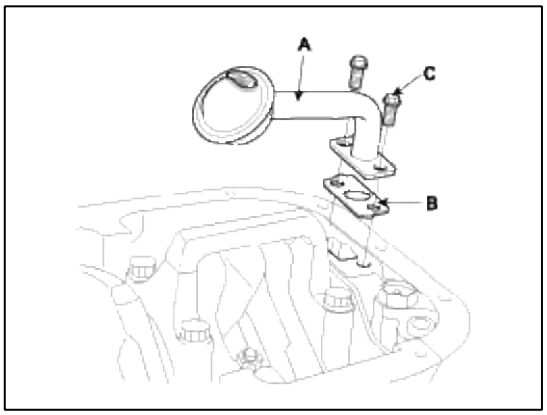
8. Remove the oil pressure switch(A).



9. Remove the water pump. (Refer to EMA-92)
10. Remove the oil pan(A).



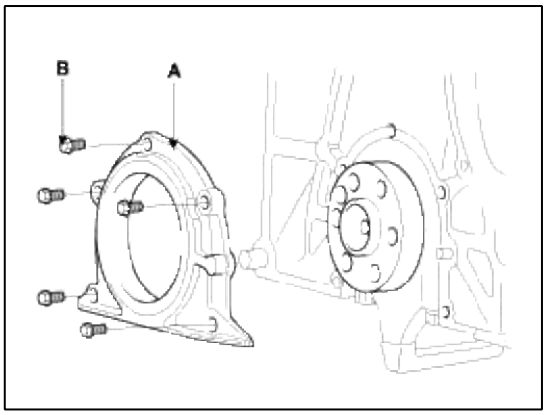
11. Remove the oil screen.
    Remove the 2bolts(C), oil screen(A) and gasket(B).



12. Check the connecting rod end play. (Refer to EMA-74, step 1)
13. Remove the connecting rod caps and check oil clearance. (Refer to EMA-74, step 2)
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.

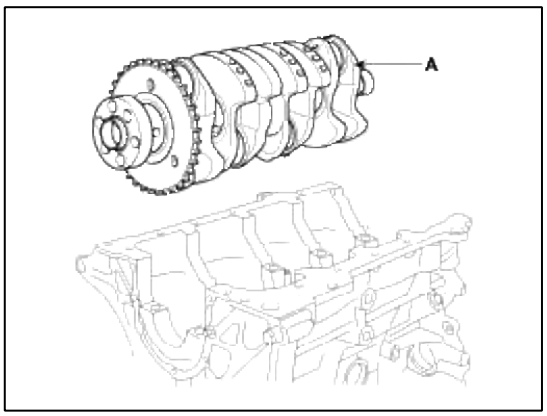
15. Remove the front case. (Refer to EMA-104, step 8 ~ 9)
16. Remove the rear oil seal case.
    Remove the 5bolts(B) and rear oil seal case(A).



17. Remove the crankshaft bearing cap and check oil clearance. (Refer to EMA-76, step 4)
18. Check the crankshaft end play. (Refer to EMA-78, step 5)

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.



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.

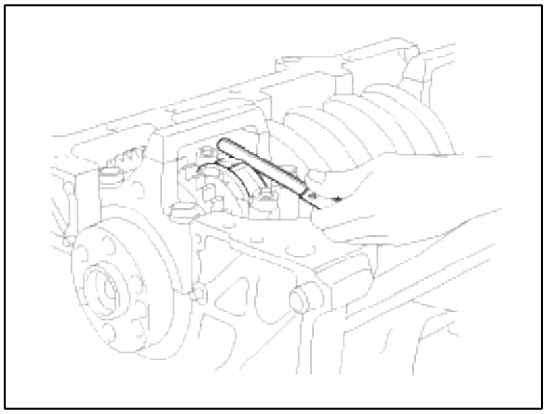
22. Remove the connecting rod from the piston.
    Using a press, remove the piston pin from piston.
    (Press-in load : 350 ~ 1,350kg(772~2,976lb)

INSPECTION

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)



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

B. If still out-of-tolerance, replace the crankshaft.

2. Check the connecting rod bearing oil clearance.

(1) Check the match marks on the connecting rod and cap are aligned to ensure correct reassembly.

(2) Remove the 2 connecting rod cap 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 :
49.0 ~ 52.0N.m (5.0 ~ 5.3kgf.m, 36.2 ~ 38.3lbf.ft)

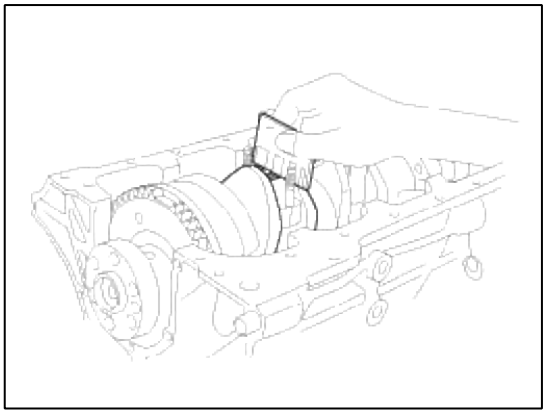
NOTE

Do not turn the crankshaft.
Always use a new connecting rod cap nuts.

(7) Remove the 2nuts, connecting rod cap and lower bearing.

(8) Measure the plastigage at its widest point.

Standard oil clearance
0.024 ~ 0.044mm (0.0009 ~ 0.0017in)



(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 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 connecting rod bearing selection table)
Recheck the oil clearance.

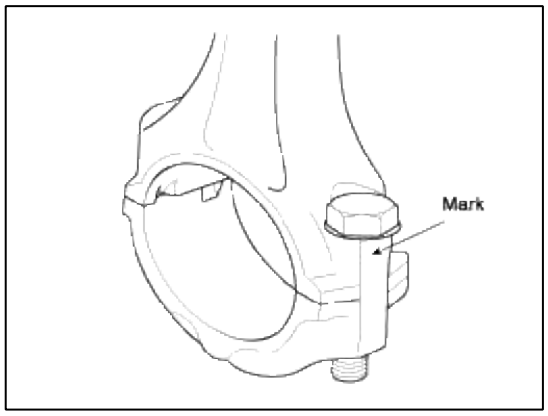
NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the alignment marks are unreadable because of an accumulation of grease or grime, don't clean with a wire or abrasive cleaner. Clean only with correct cleaning solvent or detergent.

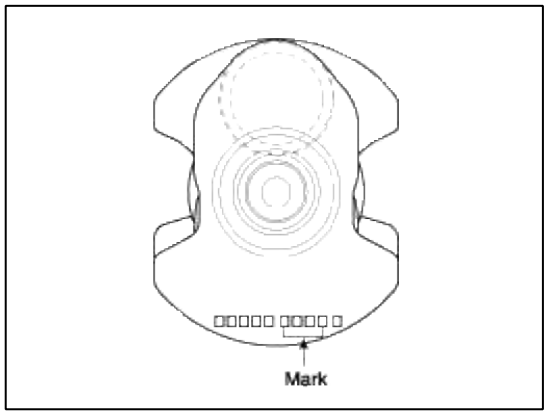
Connecting rod mark location



Discrimination of connecting rod

Mark	Connecting rod big-end inner diameter
A	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)

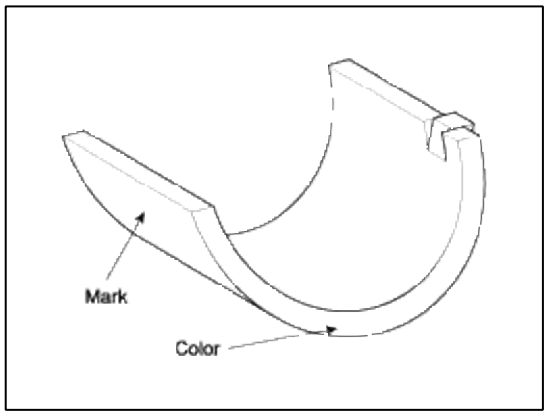
Crankshaft pin journal mark location



Discrimination of crankshaft pin journal

Mark	Crankshaft pin journalouter diameter
1	44.960 ~ 44.966mm (1.7701 ~ 1.7703in)
2	44.952 ~ 44.960mm (1.7698 ~ 1.7701in)
3	44.946 ~ 44.952mm (1.7695 ~ 1.7698in)

Connecting rod bearing mark location



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		
		A (White)	B (None)	C (Yellow)
Crank shaft pin journal mark	1 (Yellow)	D (Yellow)	C (Green)	B (None)
	2 (None)	C (Green)	B (None)	A (Black)
	3 (White)	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.

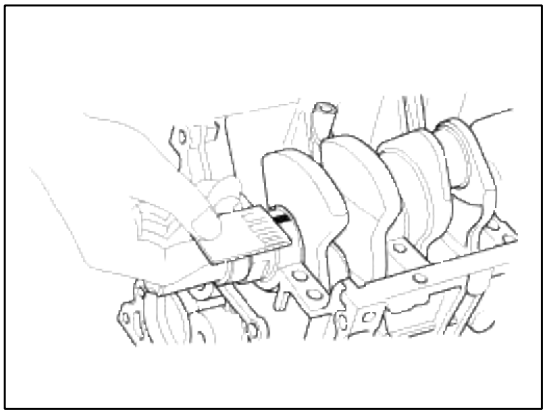
   Tightening torque : 27.5 ~ 31.4N.m
   (2.8 ~3.2kgf.m, 20.3 ~ 23.1lbf.ft)+60°~ 64°

   NOTE

   Do not turn the crankshaft.
   Always use a new main bearing cap bolts.

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

   Standard oil clearance :
   0.028 ~ 0.048mm (0.0011 ~ 0.0019in)



(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 EMA-78, step 8))
Recheck the oil clearance.

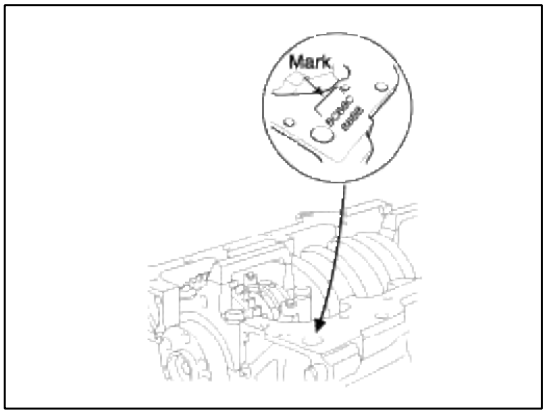
> CAUTION
>
> Do not file, shim, or scrape the bearings or the cap to adjust clearance.

(7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing.
(Refer to EMA-78, step 8))
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 alignment marks are unreadable because of accumulation of grease or grime, don't clean with a wire or abrasive cleaner. Clean only with correct cleaning solvent or detergent.

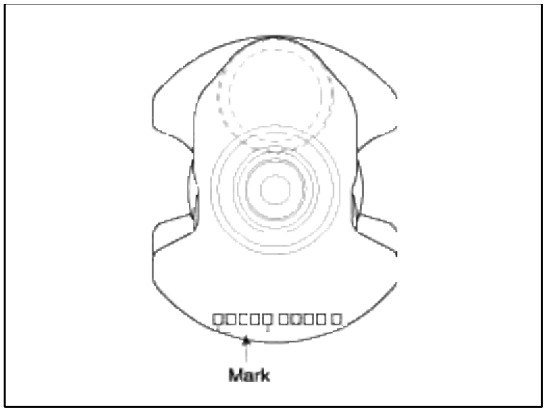
Cylinder block crankshaft journal bore mark location
Letters have been stamped on the end of the block as a mark for the size of each of the 5 main journal bores. Use them, and the numbers or letters stamped on the crank (marks for main journal size), to choose the correct bearings.

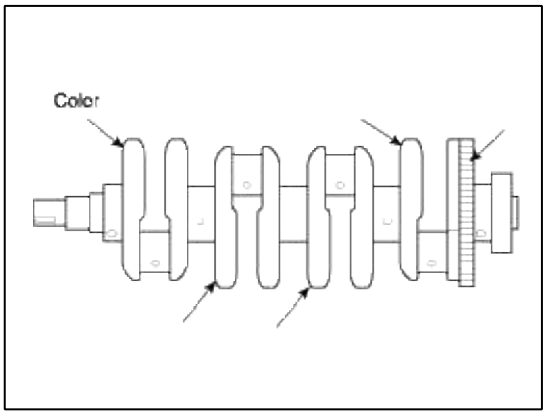


Discrimination of cylinder block crankshaft journal bore

Mark	Cylinder block crankshaft journal boreinner diameter
A	61.000 ~ 61.006mm (2.4016 ~ 2.4018in)
B	61.006 ~ 61.012mm (2.4018 ~ 2.4020in)
C	61.012 ~ 61.018mm (2.4020 ~ 2.4023in)

Crankshaft main journal mark location

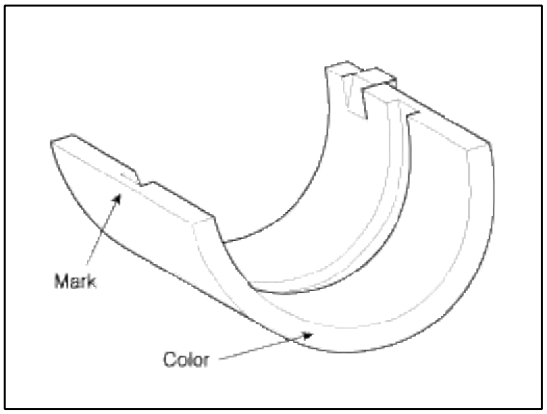




Discrimination of crankshaft main journal

Mark	Color	Crankshaft main journal outer diameter
1	Yellow	56.956 ~ 56.962mm (2.2424 ~ 2.2426in)
2	None	56.948 ~ 56.956mm (2.2420 ~ 2.2424in)
3	White	56.942 ~ 56.948mm (2.2418 ~ 2.2420in)

Crankshaft main bearing mark location



Discrimination of crankshaft main bearing

Mark	Color	Crankshaft main bearing thickness
AA	Blue	2.014 ~ 2.017mm (0.0793 ~ 0.0794in)
A	Black	2.011 ~ 2.014mm (0.0792 ~ 0.0793in)
B	None	2.008 ~ 2.011mm (0.0791 ~ 0.0792in)
C	Green	2.005 ~ 2.008mm (0.0789 ~ 0.0791in)
D	Yellow	2.002 ~ 2.005mm (0.0788 ~ 0.0789in)

(8) Select the bearing by using selection table.

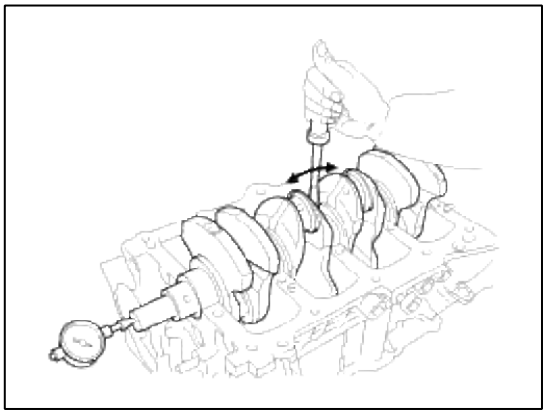
Crankshaft main bearing selection table

		Cylinder block crankshaft journal bore mark		
		A	B	C
Crank shaft main journal mark	1 (Yellow)	D (Yellow)	C (Green)	B (None)
	2 (None)	C (Green)	B (None)	A (Black)
	3 (White)	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: 0.06 ~ 0.26mm (0.0024 ~ 0.0102in)
Limit : 0.30mm (0.0118in)

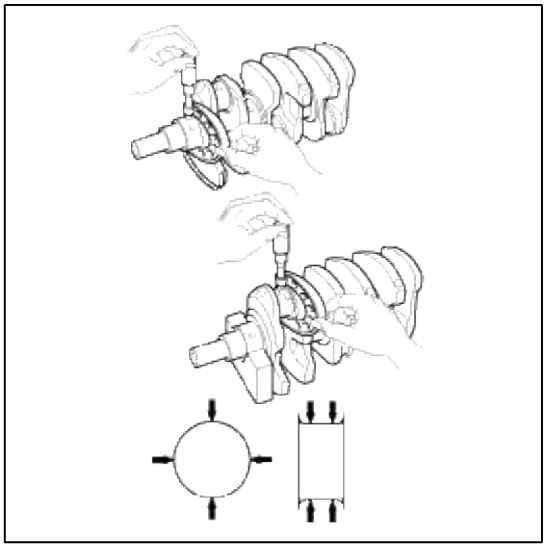


If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness :
2.44 ~ 2.77mm (0.0961 ~ 0.0972in)

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

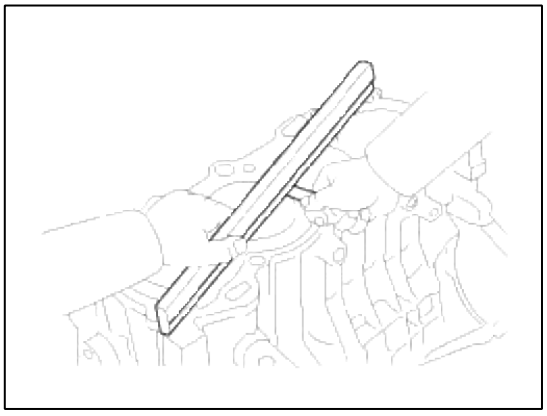
Main journal diameter :
56.942 ~ 56.962mm (2.2418 ~ 2.2426in)
Pin journal diameter :
44.946 ~ 44.966mm (1.7695 ~ 1.7703in)



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.

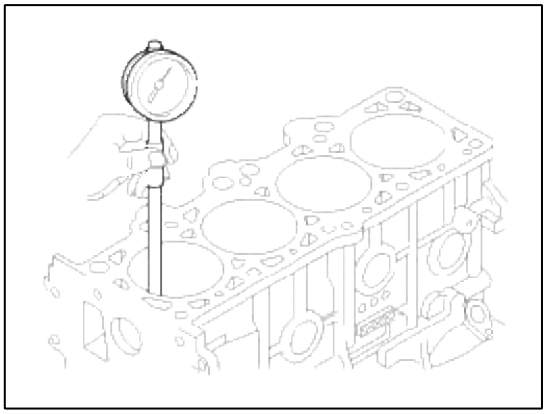
Flatness of cylinder block gasket surface
Total : Less than 0.05mm (0.0020in)
Bore to bore : Less than 0.03mm (0.0012in)



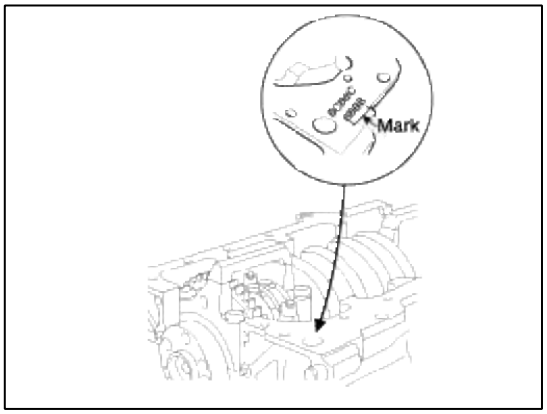
4. Inspect the cylinder bore.
   Visually check the cylinder for vertical scratchs.
   If deep scratchs are present, replace the cylinder block.

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 :
   82.00 ~ 82.03mm (3.2283 ~ 3.2295in)



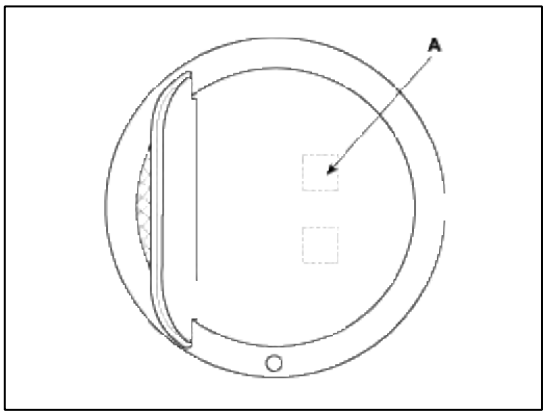
6. Check the cylinder bore size code on the cylinder block bottom face.



Discrimination of cylinder bore size

Mark	Cylinder bore inner diameter
A	82.00 ~ 82.01mm (3.2283 ~ 3.2287in)
B	82.01 ~ 82.02mm (3.2287 ~ 3.2291in)
C	82.02 ~ 82.03mm (3.2291 ~ 3.2295in)

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



Discrimination of piston outer diameter

Mark	Piston outer diameter
A	81.97 ~ 81.98mm (3.2272 ~ 3.2276in)
None	81.98 ~ 81.99mm (3.2276 ~ 3.2279in)
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in)

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.

PISTON AND PISTON RINGS

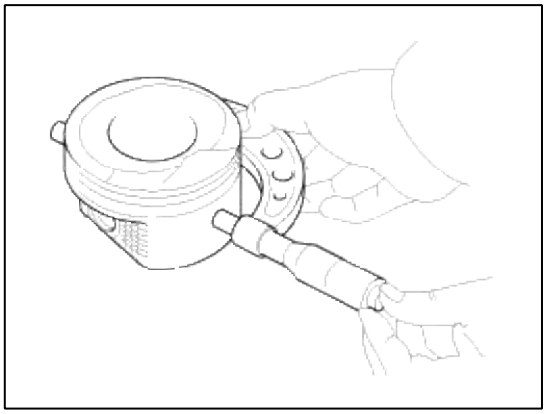
1. Clean the piston.
   (1) Using a gasket scraper, remove the carbon from the piston top.
   (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
   (3) Using solvent and a brush, thoroughly clean the piston.

NOTE

Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 47mm (1.85in) from top land of the piston.

Standard diameter :
81.97 ~ 82.00mm (3.2272 ~ 3.2283in)

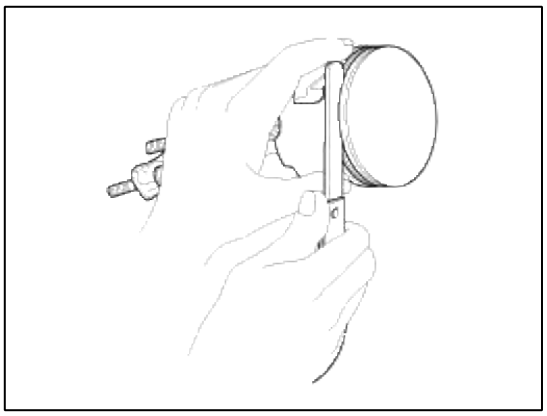


3. Calculate the difference between the cylinder bore inner diameter and the piston outer diameter.

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

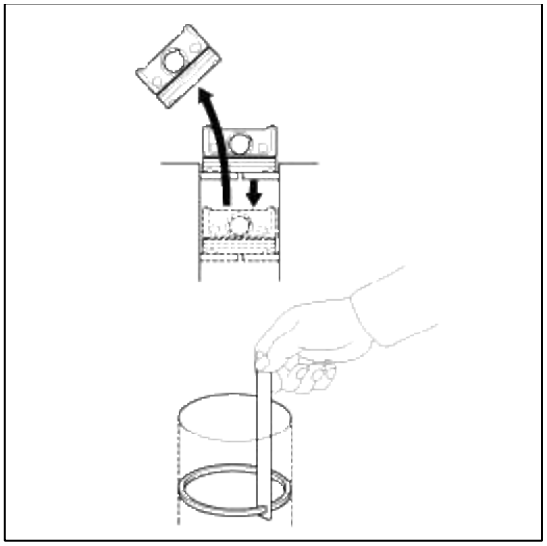
4. Inspect the piston ring side clearance.
   Using a feeler gauge, measure the clearance between new piston ring and the wall of ring groove.

   Piston ring side clearance
   No.1 : 0.04 ~ 0.08mm (0.0016 ~ 0.0031in)
   No. 2 : 0.03 ~ 0.07mm (0.0012 ~ 0.0028in)
   Oil ring : 0.06 ~ 0.15mm (0.0024 ~ 0.0059in)
   Limit
   No.1 : 0.1mm (0.0039in)
   No.2 : 0.1mm (0.0039in)
   Oil ring : 0.2mm (0.0079in)

   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 EMA-80)

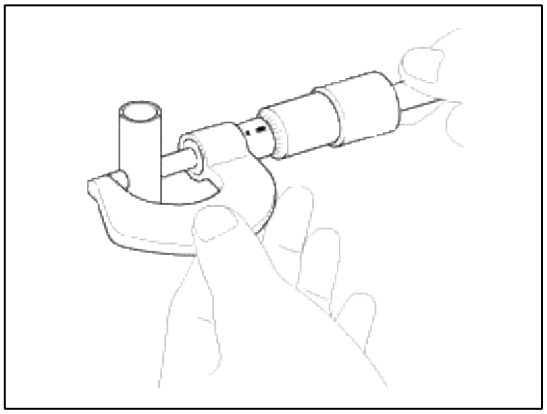
   Piston ring end gap
   Standard
   No.1 : 0.23 ~ 0.38mm (0.0091 ~ 0.0150in)
   No.2 : 0.33 ~ 0.48mm (0.0130 ~ 0.0189in)
   Oil ring : 0.20 ~ 0.60mm(0.0079 ~ 0.0236in)
   Limit
   No.1, 2, oil ring : 1.0mm(0.039in)



PISTON PINS

1. Measure the outer diameter of piston pin.

Piston pin diameter :
20.001 ~ 20.006mm (0.7874 ~ 0.7876in)



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

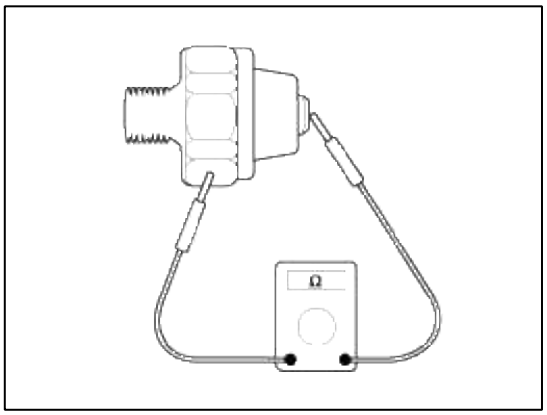
Piston pin-to-piston clearance :
0.01 ~ 0.02mm (0.0004 ~ 0.0008in)

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

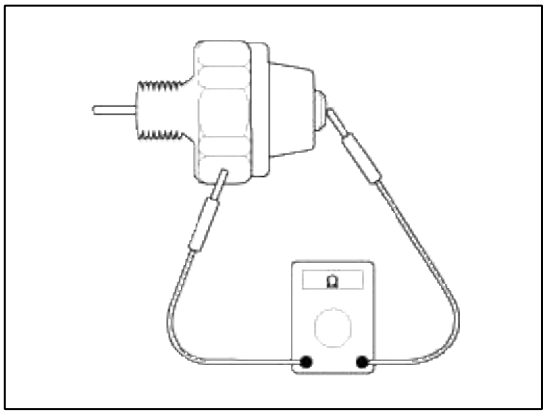
Piston pin-to-connecting rod interference :
-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)

OIL PRESSURE SWITCH

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



2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.



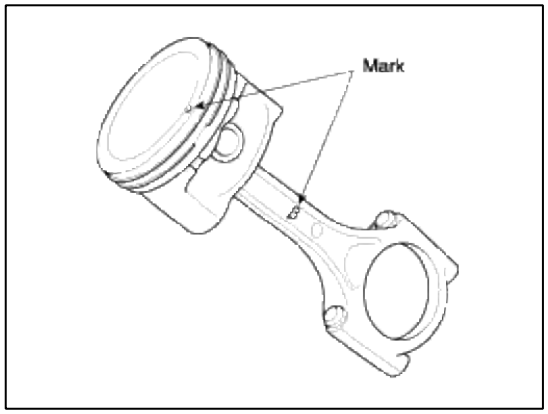
3. If there is no continuity when a 49.0kpa (0.5kg/cm², 7.1psi) is applied through the oil hole, the switch is operating properly.
   Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

REASSEMBLY

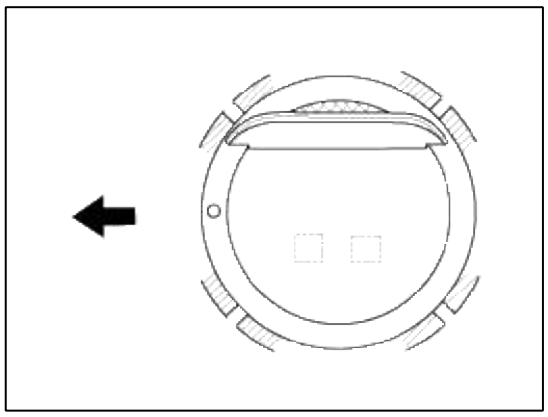
NOTE

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

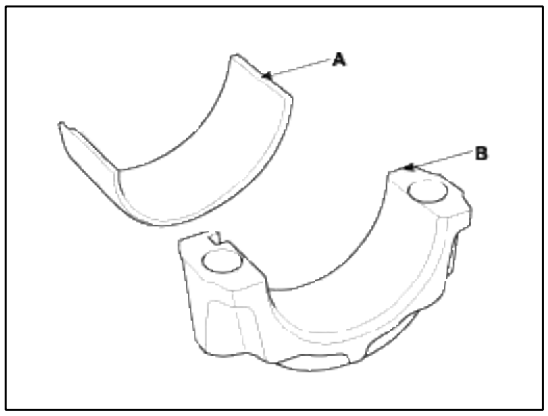
1. Assemble the piston and connecting rod.
   (1) Use a hydraulic press for installation
   (2) The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



2. Install the piston rings.
   (1) Install the oil ring spacer and 2 side rails by hand.
   (2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
   (3) Position the piston rings so that the ring ends are as shown.



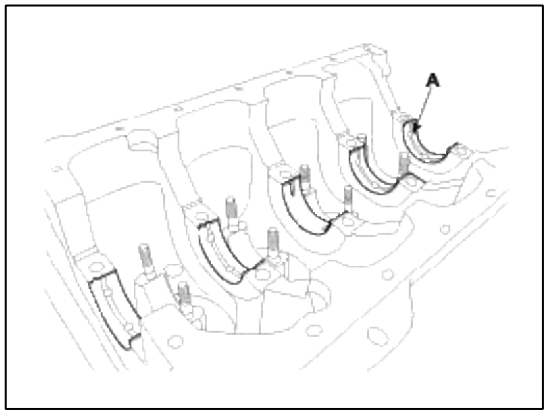
3. Install the connecting rod bearings.
   (1) Align the bearing claw with the groove of the connecting rod or connecting rod cap.
   (2) Install the bearings(A) in the connecting rod and connecting rod cap(B).



4. Install the crankshaft main bearings.

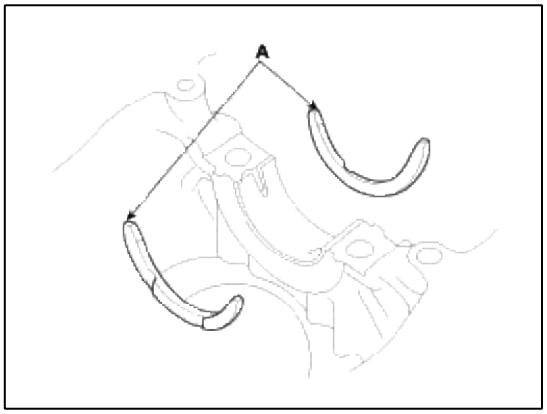
> NOTE
>
> Upper 1, 2, 4, 5 bearings have an oil groove of oil holes ; Lower bearings do not.

   (1) Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings(A).



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

5. Install the thrust bearings.
   Install the 2 thrust bearings(A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.



6. Place the crankshaft on the cylinder block.
7. Place the main bearing caps on the cylinder block.
8. Install the main bearing cap bolts.

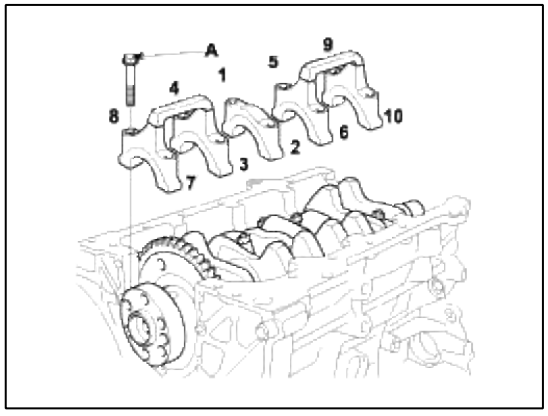
NOTE

- The main bearing cap bolts are tightened in 2 progressive steps.
- If any of the bearing cap bolts in broken or deformed, replace it.

(1) Apply a light coat of engine oil on the threads and under the bearing cap bolts.

(2) Install and uniformly tighten the 10 bearing cap bolts(A), in several passes, in the sequence shown.

Tightening torque : 27.5 ~ 31.4N.m
(2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lbf.ft) + 60°~ 64°



(3) Check that the crankshaft turns smoothly.

9. Check the crankshaft end play. (Refer to EMA-78, step 5)

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

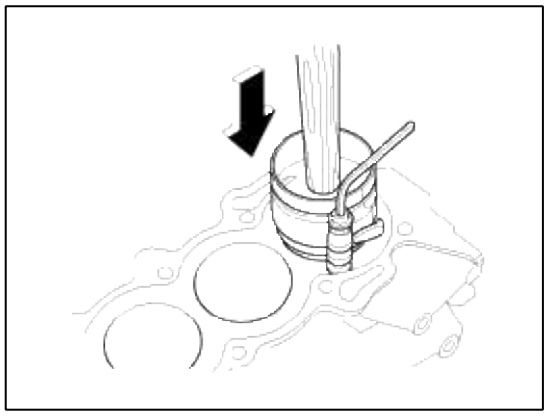
(2) Install the ring compressor, check that the rings are securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.

(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.

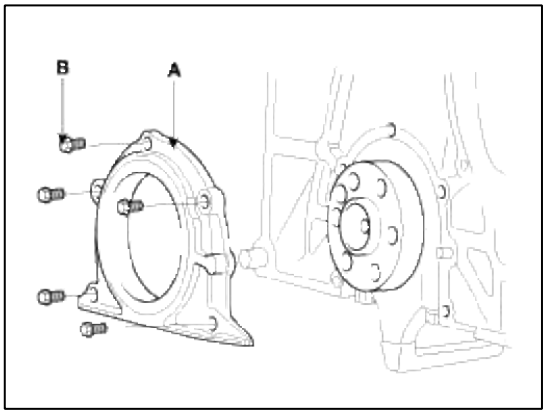
Tightening torque :
49.0 ~ 52.0N.m (5.0 ~ 5.3kgf.m, 36.2 ~ 38.3lbf.ft)

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



11. Install a new gasket and rear oil seal case(A) with 5 bolts(B).

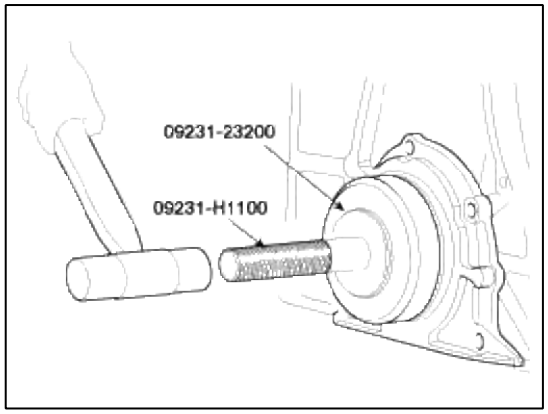
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lbf.ft)



NOTE

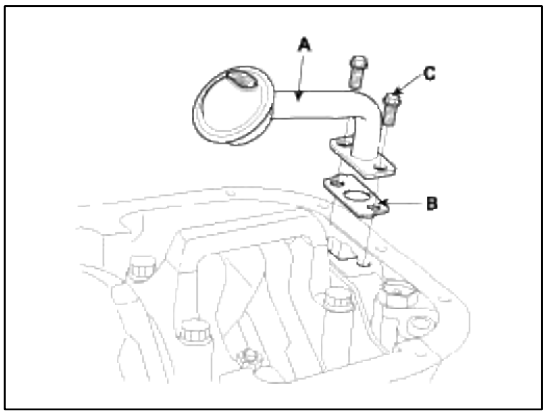
Check that the mating surfaces are clean and dry.

12. Install the rear oil seal.
    (1) Apply engine oil to a new oil seal lip.
    (2) Using the SST(09231-23200, 09231-H1100) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



13. Install the front case. (Refer to EMA-106, step 1 ~ 5)
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 ~ 15.9lbf.ft)



15. Install the oil pan.
    (1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

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

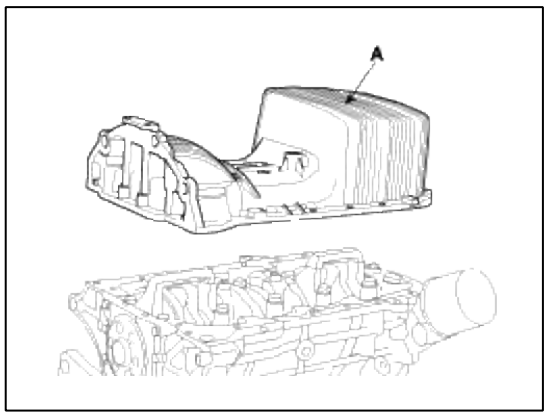
    (2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.

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 ~ 8.7lbf.ft)



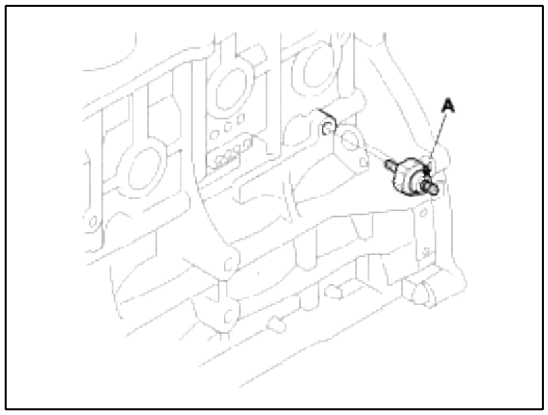
16. Install the water pump. (Refer to EMA-96)

17. Install the oil pressure switch.
    (1) Apply adhesive to 2 or 3 threads.

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

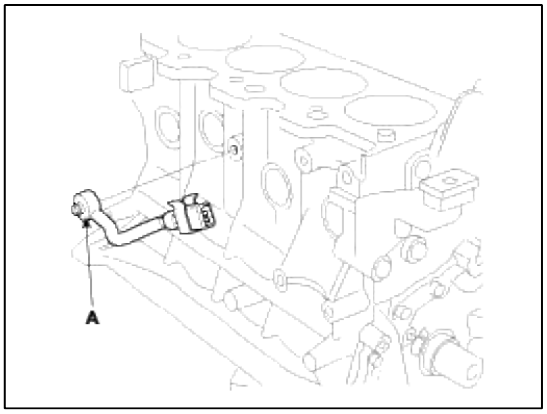
    (2) Install the oil pressure switch(A).

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



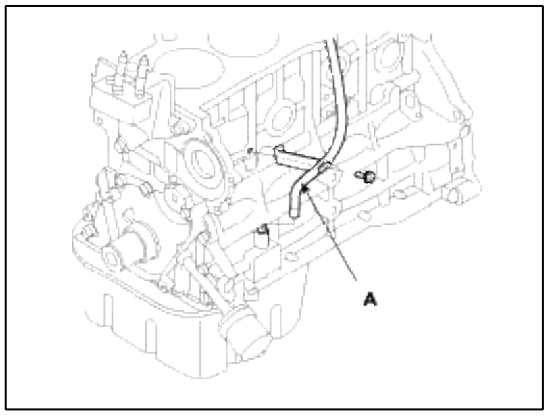
18. Install the knock sensor(A).

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



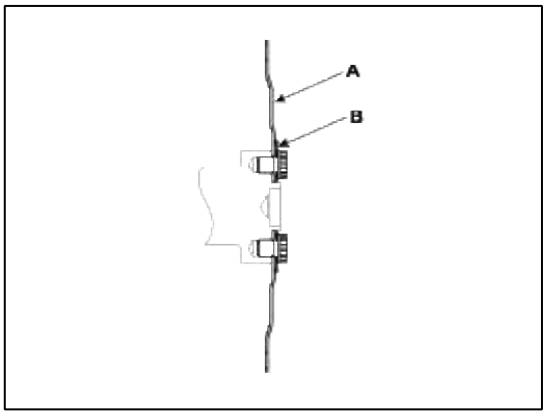
19. Install the oil level gauge tube(A).
    (1) Install a new O-ring on the oil level gauge tube.
    (2) Apply engine oil on the O-ring.
    (3) Install the oil level gauge tube(A) with the bolt.

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



20. Install the cylinder head. (Refer to EMA-54)
21. Install the timing belt. (Refer to EMA-32)
22. Remove the engine stand.
23. A/T : install the drive plate(A) and washer(B).

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



24. M/T : install the fly wheel.

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

Engine Mechanical System > Cooling System > General Information

ENGINE COOLANT REFILLING AND BLEEDING

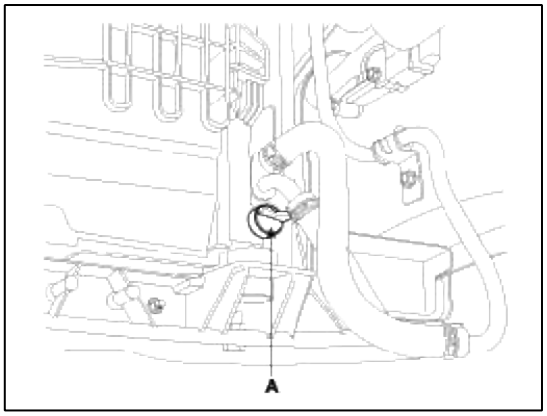
WARNING

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

CAUTION

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

1. Slide the the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap.
3. Loosen the drain plug, and drain the coolant.



4. Tighten the radiator drain plug(A) securely.
5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Fill fluid mixture with coolant and water slowly through the radiator cap. Gently squeeze the upper/lower hoses of the radiator so as to bleed air easily.

NOTE

- Use only genuine antifreeze/coolant.
- For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant Coolant concentrations less than 50% may not provide sufficient protection against corrosion or 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 anti-rust products; they may not be compatible with the coolant.

7. Start tart the engine and allow coolant to circulates.
   When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
8. Repeat 7 until the cooling fan 3 ~ 5times 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.

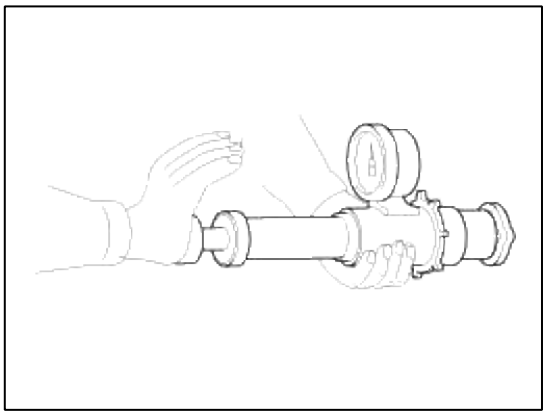
NOTE

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

Coolant capacity : 6.0 liters (6.34 US qt, 5.28 lmp qt)

RADIATOR CAP TESTING

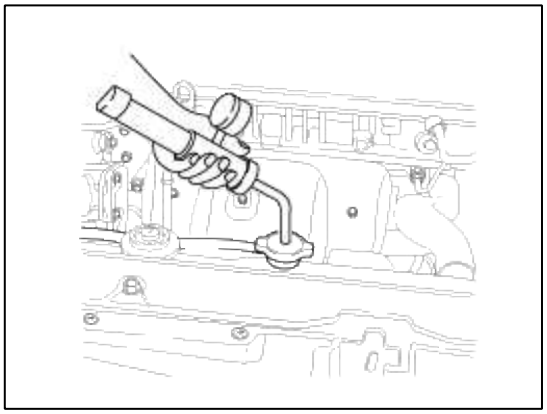
1. Remove the radiator cap, wet its seal with engine coolant, then install it on pressure tester.



2. Apply a pressure of 93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi).
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

RADIATOR LEAKAGE TEST

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.
2. Apply a pressure tester to the radiator and apply a pressure of 93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi).



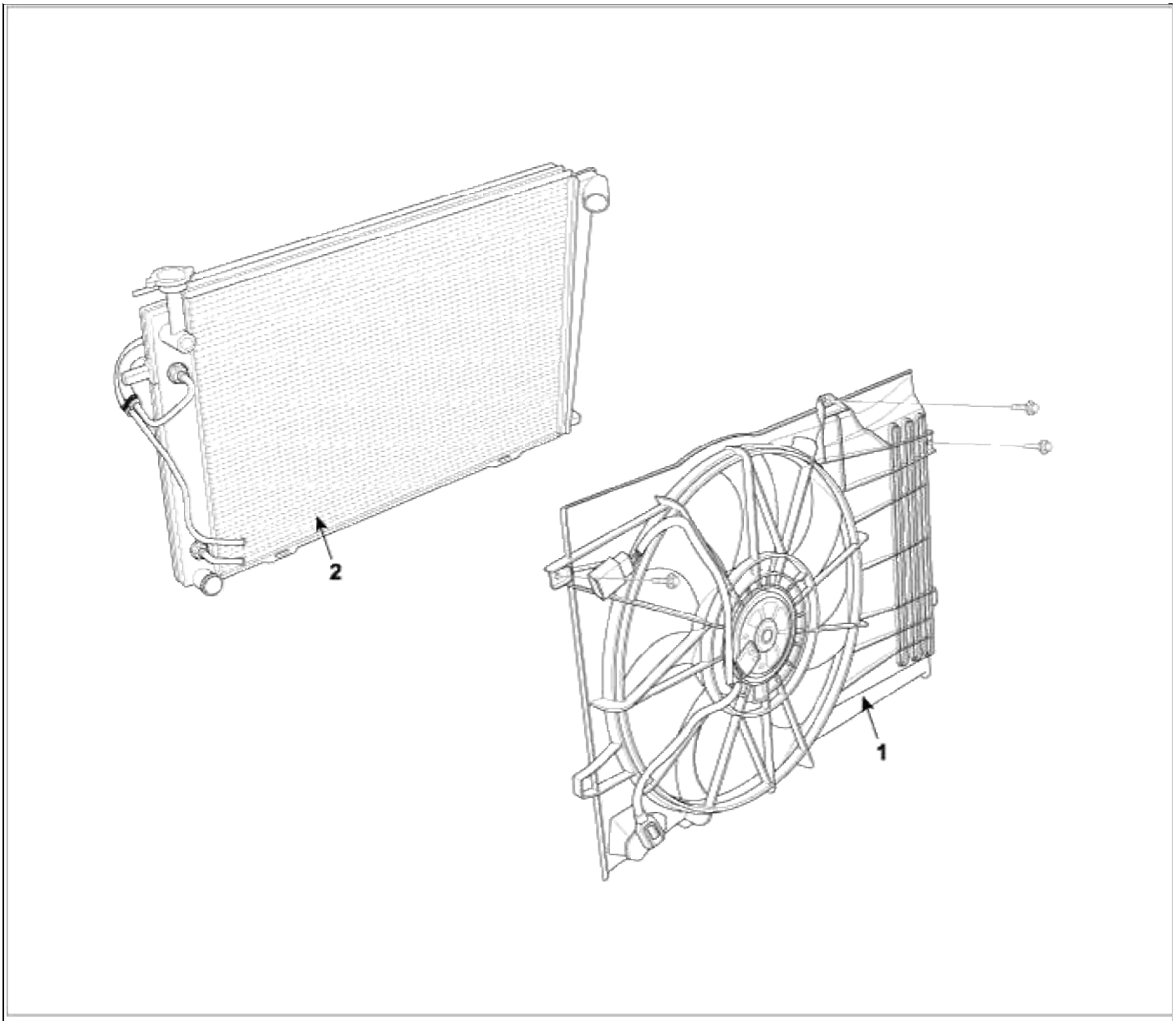
3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

NOTE

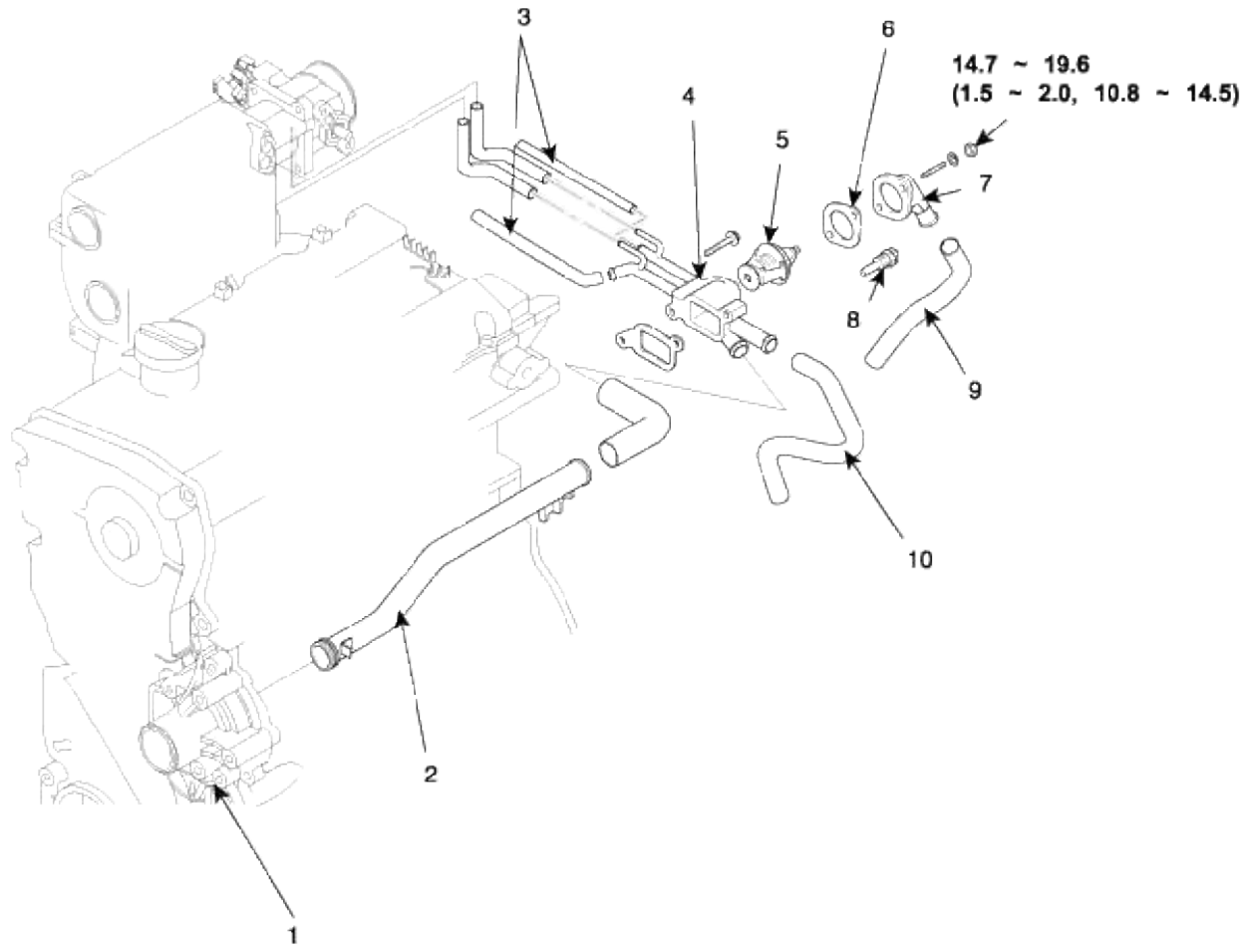
Check for engine oil in the coolant and/or coolant in the engine oil.

Engine Mechanical System > Cooling System > Components and Components Location

COMPONENT



1. Cooling fan & Condenser fan assembly
2. Radiator



TORQUE : N.m (kgf.m, lbf.ft)

1. Water pump
2. Water inlet pipe
3. Heater hoses
4. Thermostat housing
5. Thermostat
6. Gasket
7. Water inlet fitting
8. Water temperature sensor
9. Radiator lower hose
10. Radiator upper hose

Engine Mechanical System > Cooling System > Repair procedures

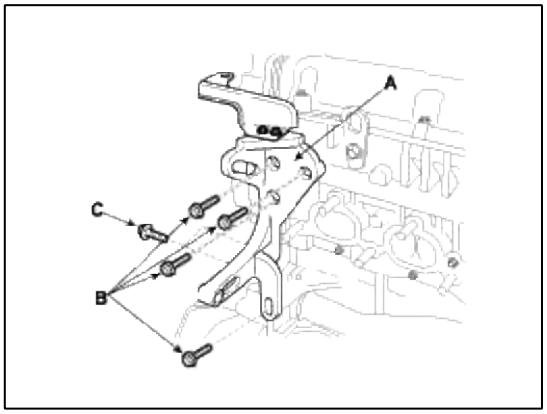
REMOVAL

WATER PUMP

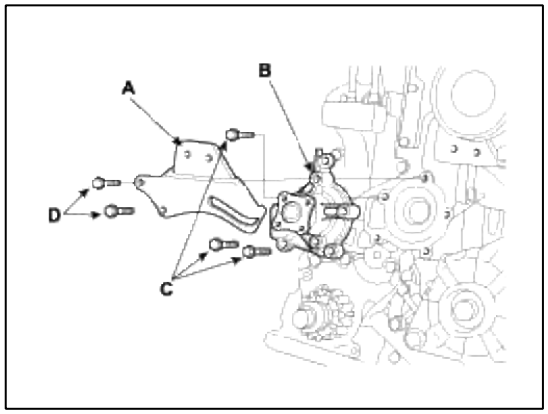
1. Drain the engine coolant.

> 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. Remove the drive belts.
3. Remove the timing belt. (Refer to EMA-27)
4. Remove the timing belt idler.
5. Remove the power steering pump and use a wire to secure the pump to the vehicle so that it is out of the way.
6. Remove the bolts(B, C) and power steering pump bracket(A).



7. Remove the alternator. (See EE group - alternator)
8. Remove the water pump.
   (1) Remove the 2 bolts(D) and alternator brace(A).
   (2) Remove the 3 bolts(C) and remove the water pump(B) and gasket.

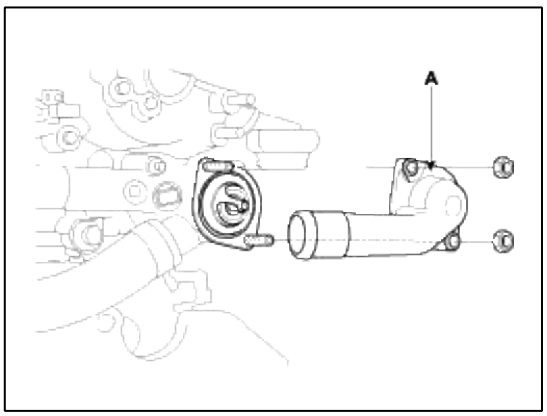


THERMOSTAT

NOTE

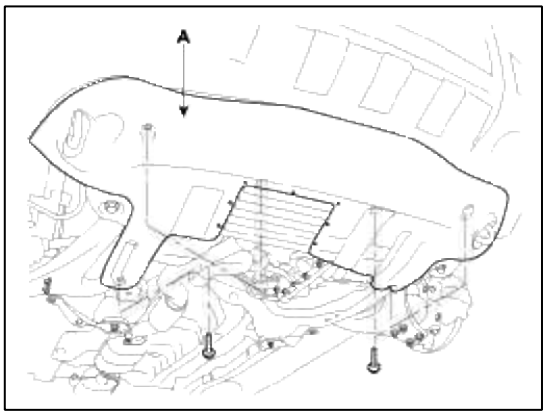
Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

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

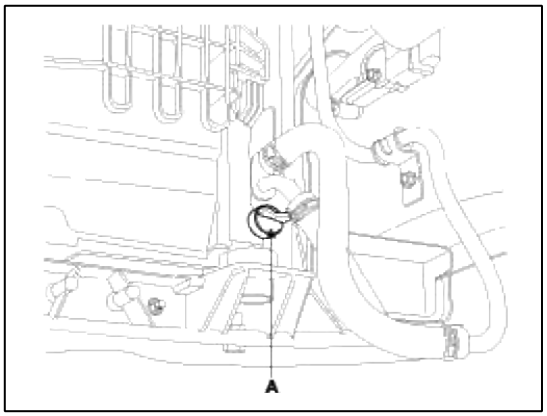


RADIATOR

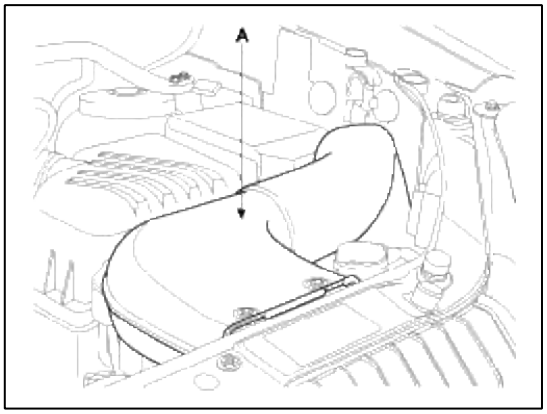
1. Remove the under cover(A).



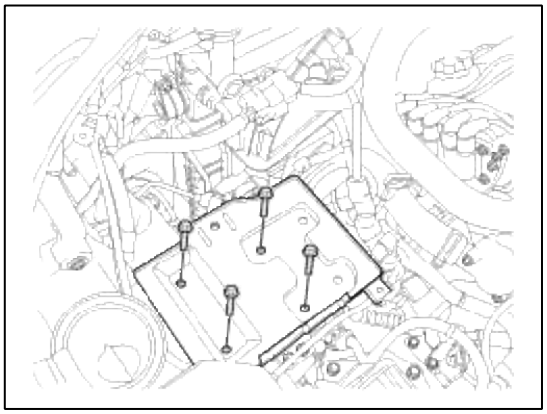
2. Drain the engine coolant. Remove the radiator cap to speed draining.



3. Remove the air duct(A).

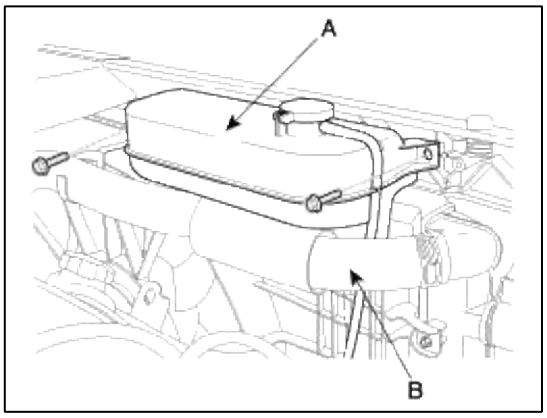


4. Remove the battery and tray.

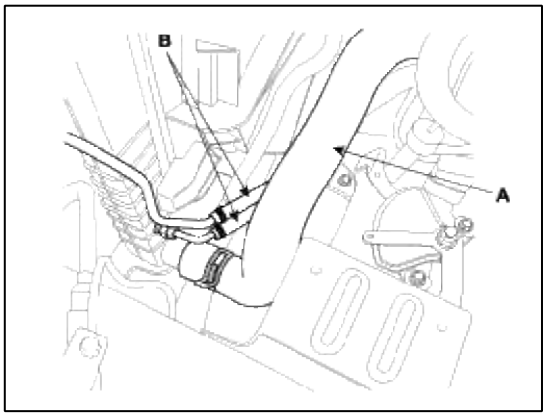


5. Remove the coolant reservoir tank(A).

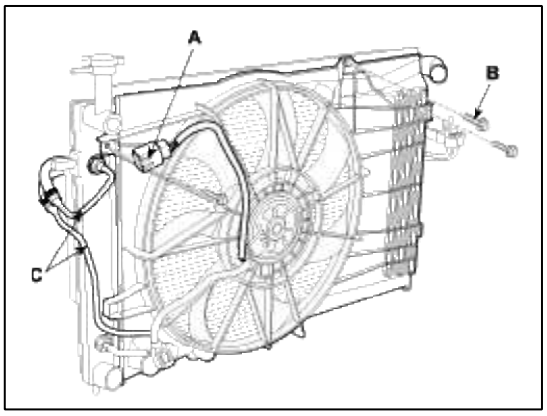
6. Remove the radiator upper hose(B).



7. Remove the radiator lower hose(A).
8. Remove the ATF oil cooler hose(B).

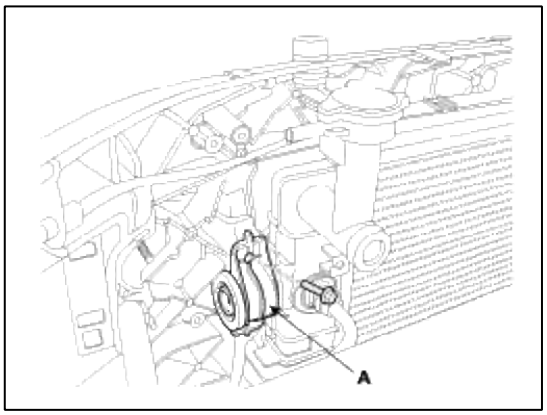


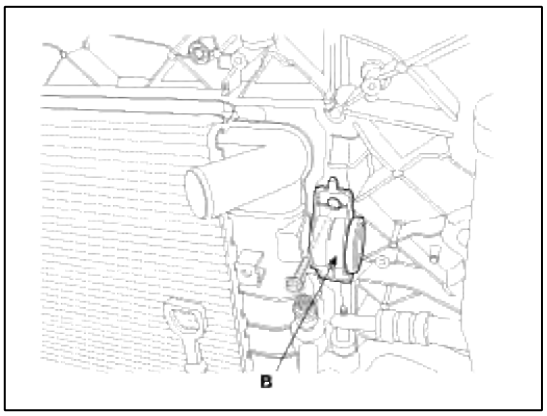
9. Remove the cooling fan motor connector(A).
10. Remove the cooling fan motor assembly mounting bolt(B).
11. Remove the ATF oil cooler pipe(C).



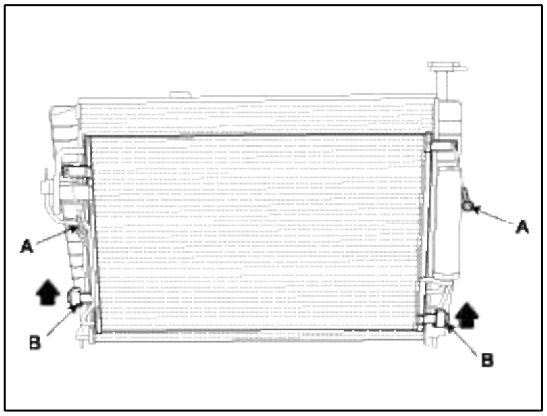
12. Remove the cooling fan motor assembly with pulling it from the radiator.

13. Remove the radiator bracket(A, B).





14. Remove the condenser mounting bolt(A).
15. Remove the condenser bracket(B) with pulling the condenser from the radiator.



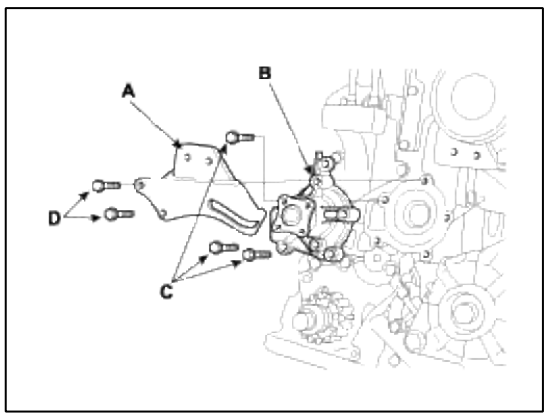
16. Remove the radiator from engine room.

INSTALLATION

WATER PUMP

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

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

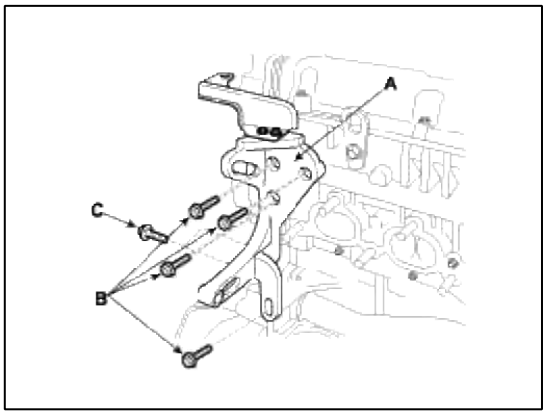


   (2) Install the alternator brace(A) with the 2 bolts(D).

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

2. Install the power steering pump bracket(A) and bolts(B, C).

   Tightening torque :
   Bolts(B) : 34.3 ~ 49.0N.m (3.5 ~ 5.0kgf.m, 25.3 ~ 36.2lbf.ft)
   Bolts(C) : 14.7 ~ 19.6N.m (1.5 ~ 2.0kgf.m, 10.8 ~ 14.5lbf.ft)



3. Install the alternator. (See EE group - alternator)
4. Install the power steering pump. (See ST group - power steering pump)
5. Install the timing belt idler.
6. Install the timing belt. (Refer to EMA-32)
7. Install the water pump pulley.
8. Install the drive belts.
9. Tighten the water pump pulley bolts.

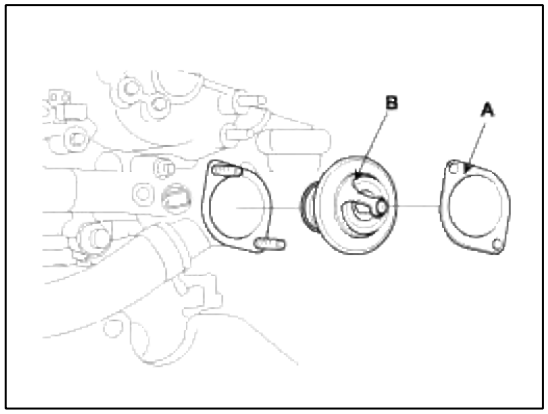
   Tightening torque :
   7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lbf.ft)

10. Fill with engine coolant.

11. Start engine and check for leaks.
12. Recheck engine coolant level.

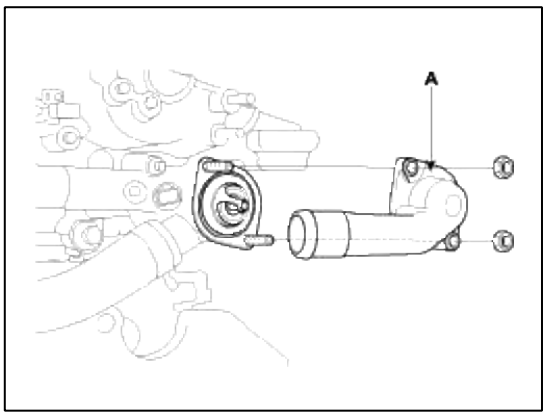
THERMOSTAT

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 ~ 14.5lbf.ft)



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

RADIATOR

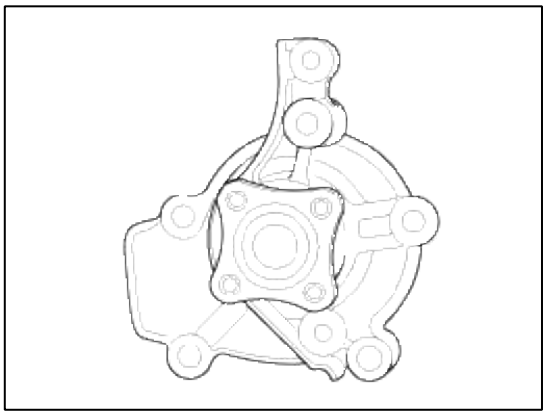
1. Install the cooling fan onto the radiator.
2. Install the radiator onto the air conditioner condenser on the vehicle.
   The next installation procedures are in the reverse order of radiator removal.
3. Connect the fan motor connector.
4. Install the upper and lower radiator hoses, and ATF cooler hoses.
5. Fill with engine coolant.
6. Start engine and check for leaks.

INSPECTION

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.

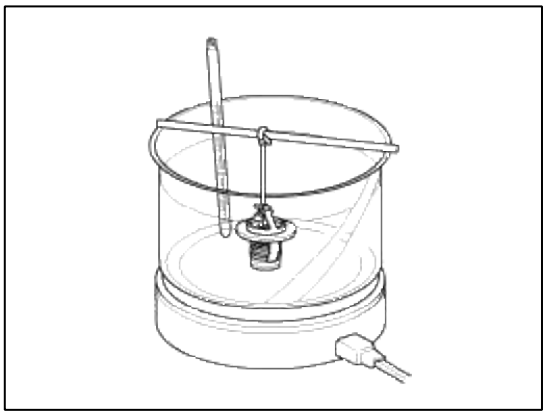


3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

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

THERMOSTAT

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



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.

Engine Mechanical System > Lubrication System > General Information

OIL AND FILTER REPLACEMENT

CAUTION

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.

1. Drain the engine oil.
   (1) Remove the oil filler cap.
   (2) Remove the oil drain plug, and drain the oil into a container.
2. Replace the oil filter.
   (1) Remove the oil filter.
   (2) Check and clean the oil filter installation surface.
   (3) Check the part number of the new oil filter is as same as old one.
   (4) Apply clean engine oil to the gasket of a new oil filter.
   (5) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
   (6) Tighten it an additional 3/4 turn.
3. Refill with engine oil.
   (1) Clean and install the oil drain plug with a new gasket.

   Tightening torque :
   Aluminum : 39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)
   Steel : 34.3 ~ 44.1N.m (3.5 ~ 4.5kgf.m, 25.3 ~ 32.5lb-ft)

   (2) Fill with fresh engine oil.

   Oil Capacity
   Total : 4.0 L (4.23 US qt, 3.52 lmp qt)
   Oil pan : 3.7 L (3.91 US qt, 3.26 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.

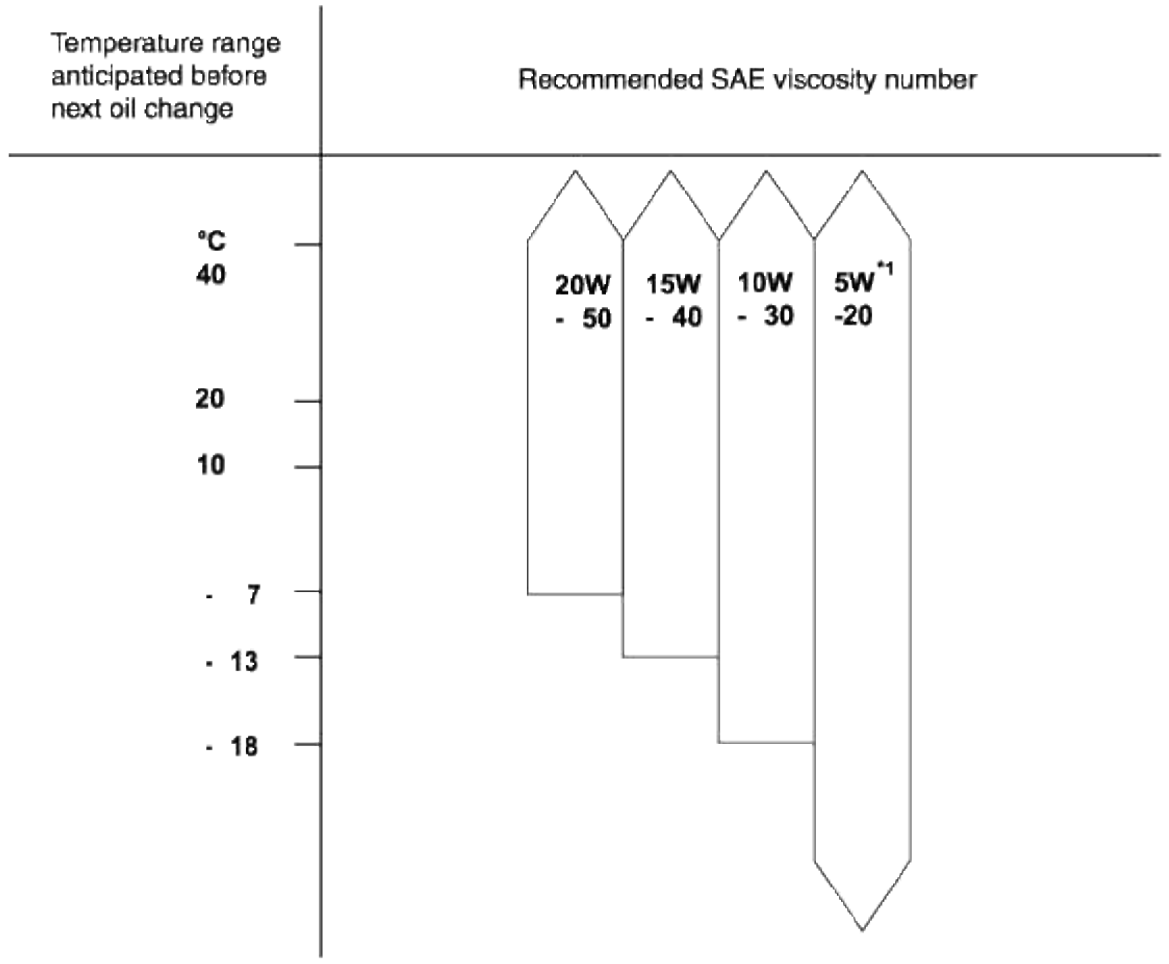
INSPECTION

1. Check the engine oil quality.
   Check for oil deterioration, entry of water, discoloring of thinning.
   If the quality is visibly poor, replace the oil.

2. Check the engine oil level.
   After warming up the engine for five minutes, stop the engine and check the oil leverl. The level should be between the "L" and "F" marks on the dipstick.
   If low, check for oil leakage and add oil up to the "F" mark on the dipstick.

> NOTE
>
> Do not fill with engine oil above the "F" mark.

SELECTION OF ENGINE OIL
Recommended ILSAC classification : GF-3 OR ABOVE
Recommended API classification : SL(SJ) OR ABOVE
Recommended SAE viscosity grades :

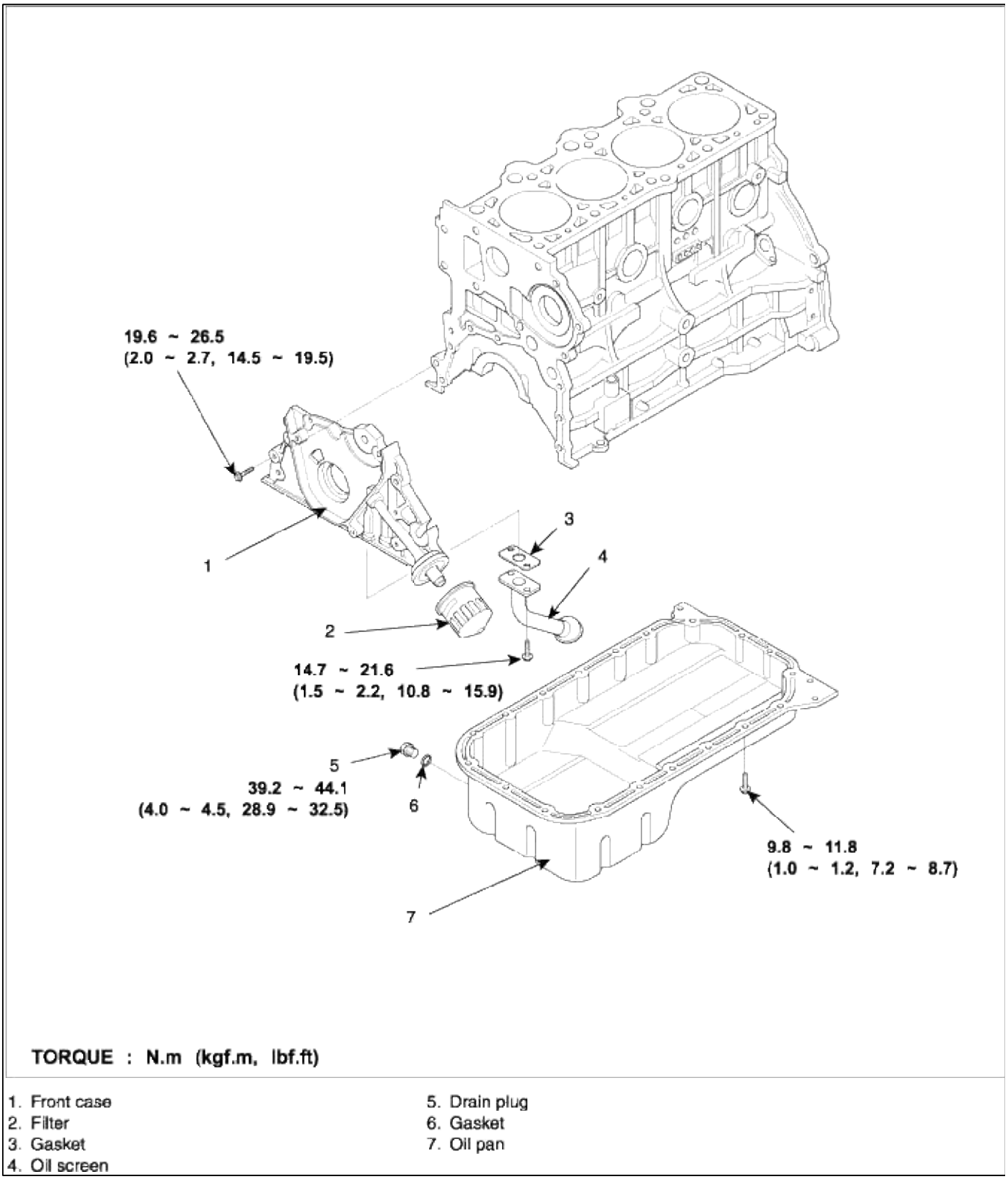


*1 : Recommended regardless of environment.
If not available, refer to the recommended SAE viscosity numbers.

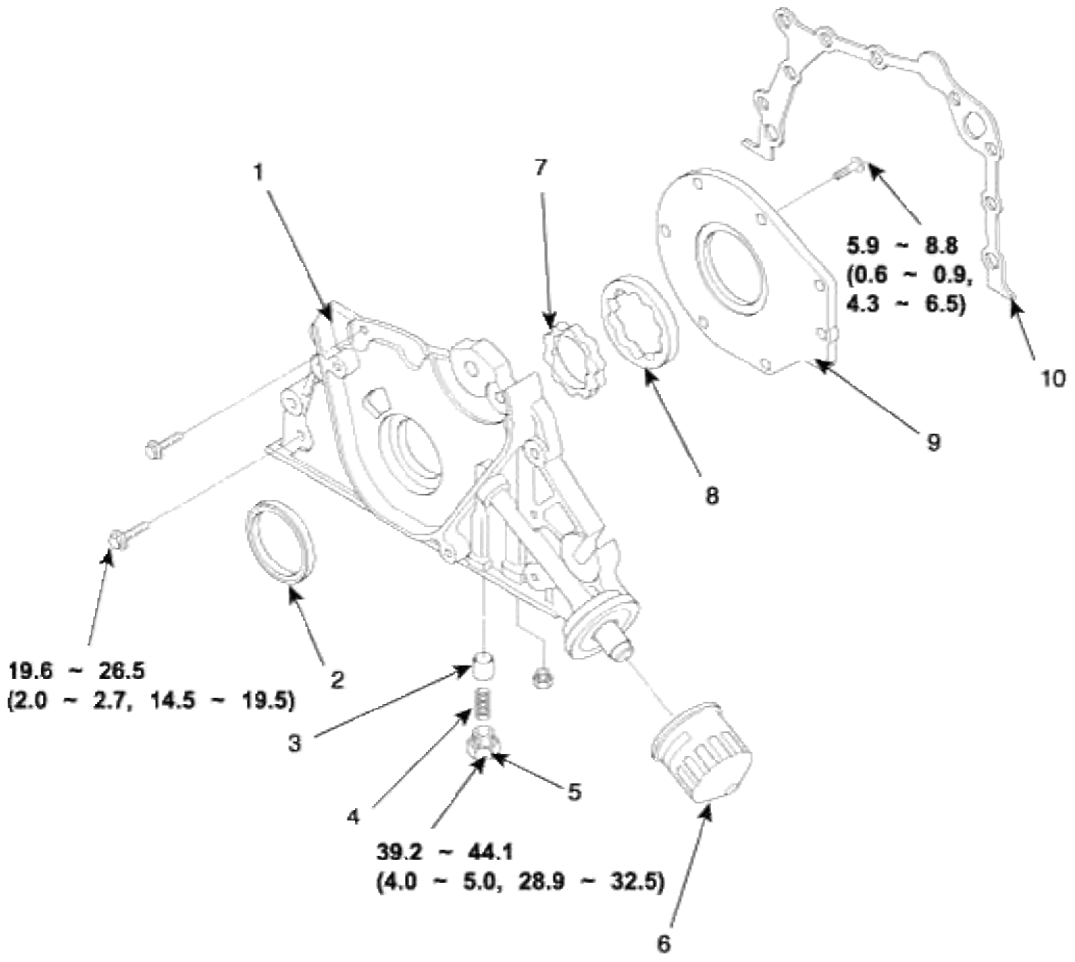
> NOTE
>
For best performance and maximum protection of all types of operation, select only those lubricants which :
1. Satisfy the requirement of the API classification.
2. Have proper SAE grade number for expected ambient temperature range.
3. Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

Engine Mechanical System > Lubrication System > Components and Components Location

COMPONENT



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



TORQUE : N.m (kgf.m, lbf.ft)

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

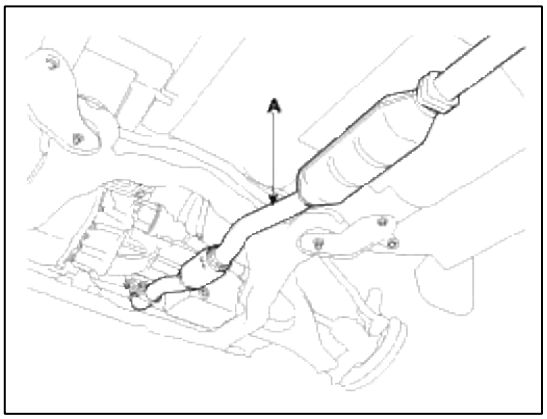
Engine Mechanical System > Lubrication System > Repair procedures

REMOVAL

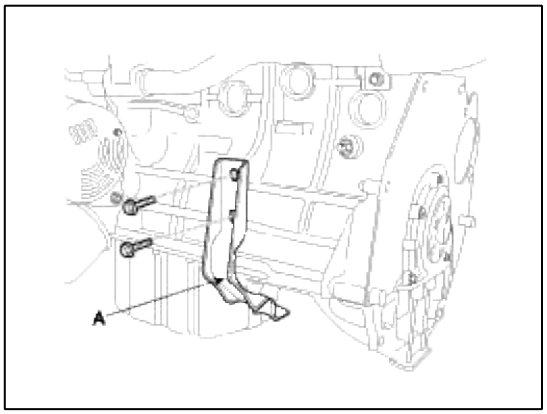
OIL PAN

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

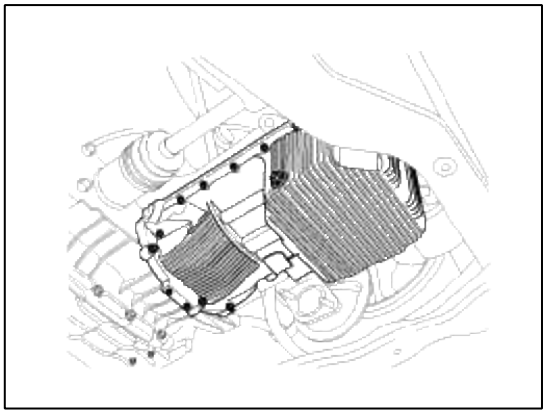
3. Remove the front muffler(A).



4. Remove the exhaust manifold. (Refer to EMA-113)
5. Remove the front muffler bracket(A).



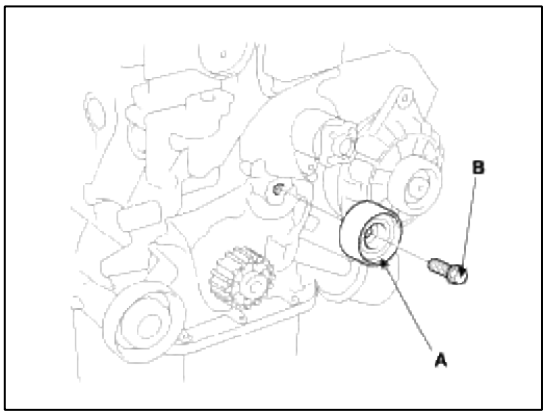
6. Remove the oil pan.



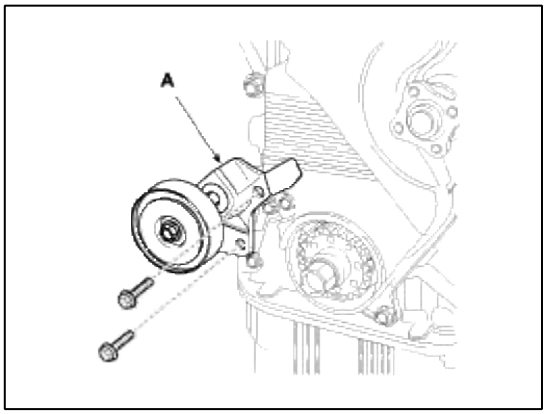
OIL PUMP

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 EMA-27)

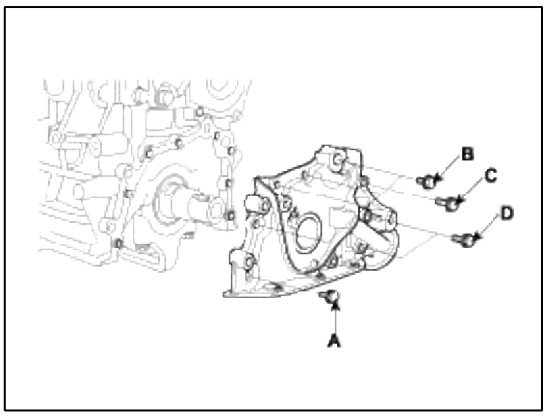
5. Remove the bolt(B) and timing belt idler(A).



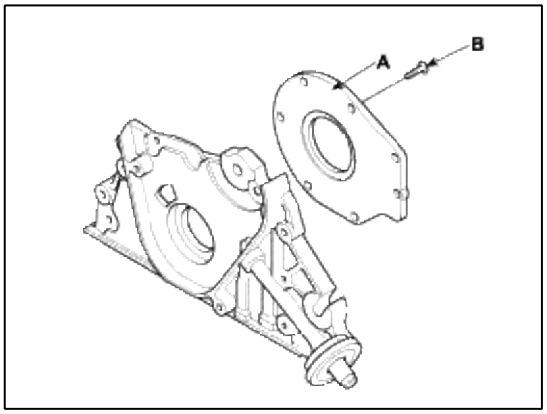
6. Remove the oil pan and oil screen.
7. Remove the alternator. (Sed EE group - alternator)
8. Remove the air conditioner compressor tensioner bracket(A).



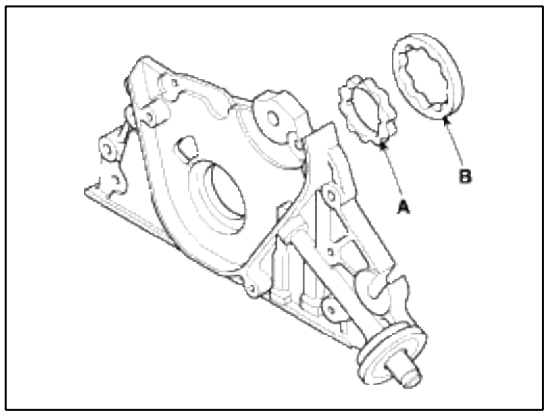
9. Remove the bolts(A, B, C, D) and front case.



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



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

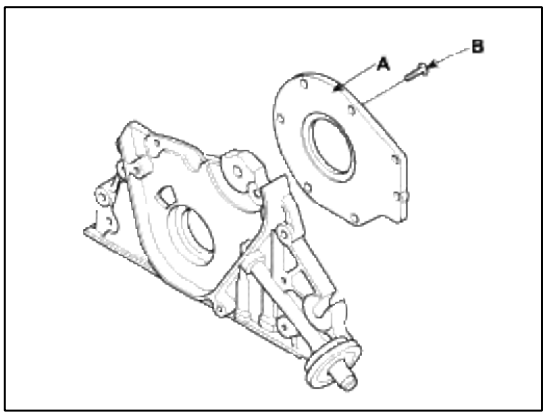


INSTALLATION

OIL PUMP

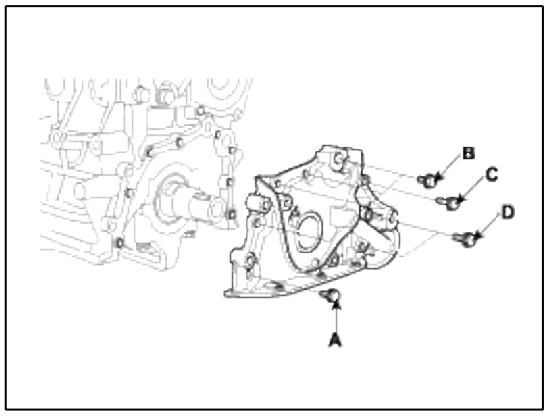
1. Install the oil pump.
   (1) Place the inner and outer rotors into front case with the marks facing the oil pump cover side.
   (2) Install the oil pump cover(A) to front case with the 7 screws(B).

Tightening torque :
5.9 ~ 8.8N.m (0.6 ~ 0.9kgf.m, 4.3 ~ 6.5lbf.ft)



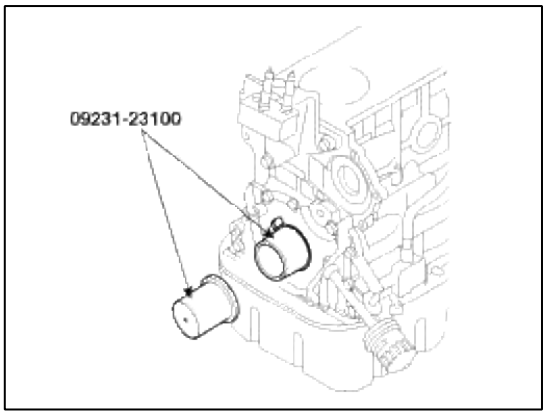
2. Check that the oil pump turns freely.

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.

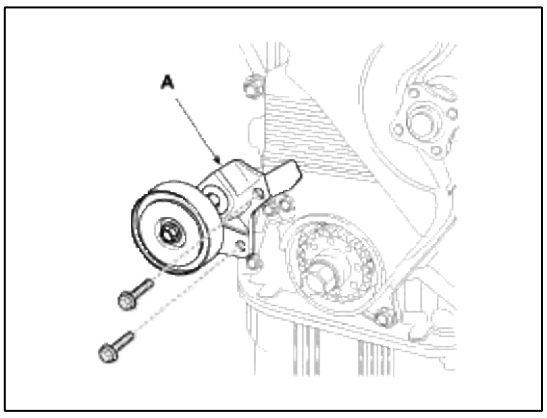


Bolt length
(A) : 25mm (0.984in), (B) : 30mm (1.181in)
(C) : 38mm (1.496in), (D) : 45mm (1.772in)
Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lbf.ft)

4. Apply a light coat of oil to the front case oil seal lip.
5. Using the SST(09231-23100), install the front case oil seal.



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



7. Install the alternator. (See EE group - alternator)

8. Install the oil screen.

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

9. Install the oil pan.

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

NOTE

Clean the oil pan gasket mating surfaces.

10. Install the timing belt idler.

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

11. Install the timing belt (Refer to EMA-32)
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.

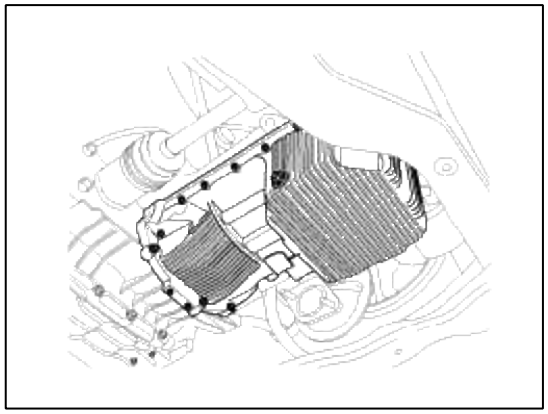
Liquid gasket : MS 721-40A or equivalent

NOTE

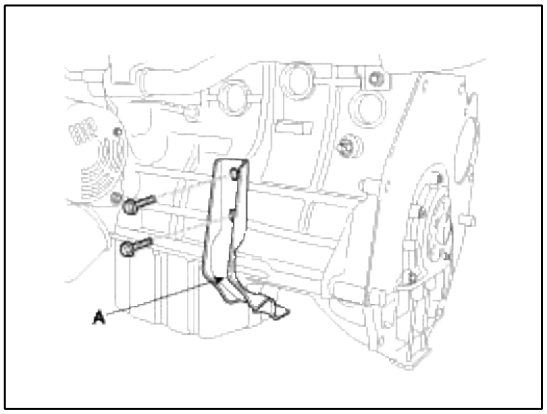
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

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

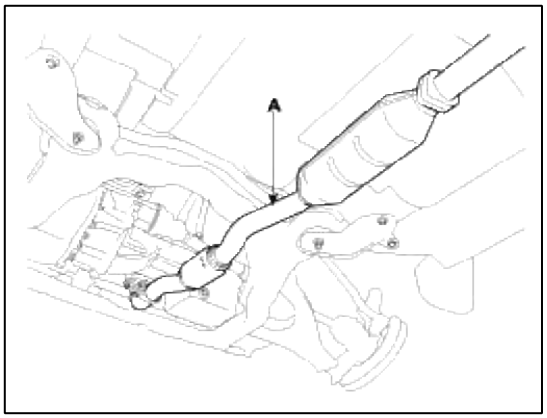
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lbf.ft)



2. Install the front muffler bracket(A).



3. Install the exhaust manifold. (Refer to EMA-113)
4. Install the front muffler(A).

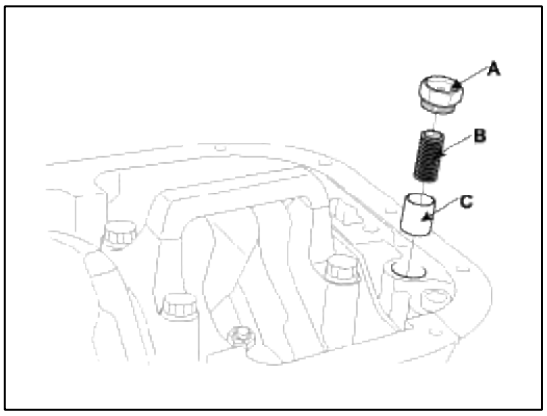


5. Connect the rear oxygen sensor connector.
6. Fill with engine oil

DISASSEMBLY

RELIEF PLUNGER

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



INSPECTION

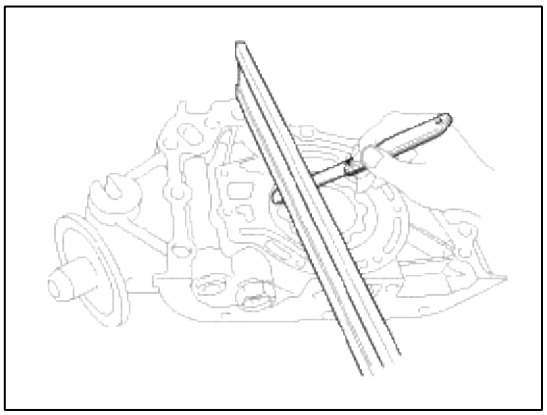
1. Inspect the relief plunger.
   Coat the plunger with engine oil and check that it falls smoothly into the plunger hole by its own weight.
   If it does not, replace the relief plunger. If necessary, replace the front case.
2. Inspect the relief valve spring.
   Inspect for distorted or broken relief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

Standard value
Free height : 43.8mm (1.724in)
Load : 3.7±0.4kg/40.1mm (8.2±0.9 lb/1.579in)
9.7±0.4kg/34.3mm (21.4±0.9 lb/1.350in)

---

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

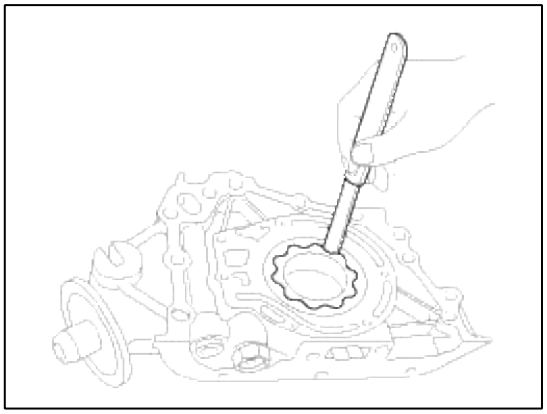
Side clearance	Outer rotor	0.04 ~ 0.09mm (0.0016 ~ 0.0035in)
	Inner rotor	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)



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

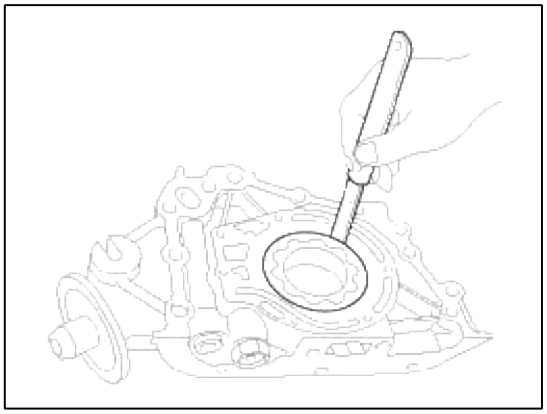
4. Inspect the rotor tip clearance.
   Using a feeler gauge, measure the tip clearance between the inner and outer rotor tips.

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



   If the tip clearance is greater than maximum, 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
   0.120 ~ 0.185mm (0.0047 ~ 0.0073in)



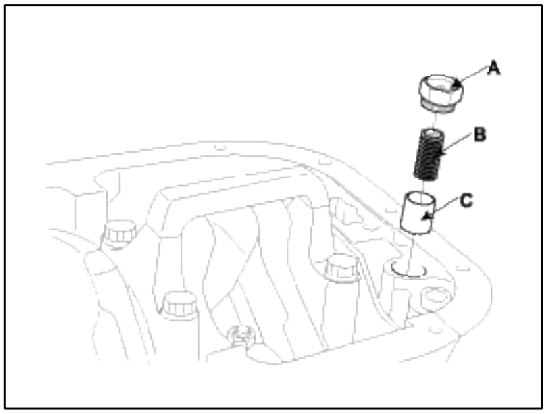
   If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

REASSEMBLY

RELIEF PLUNGER

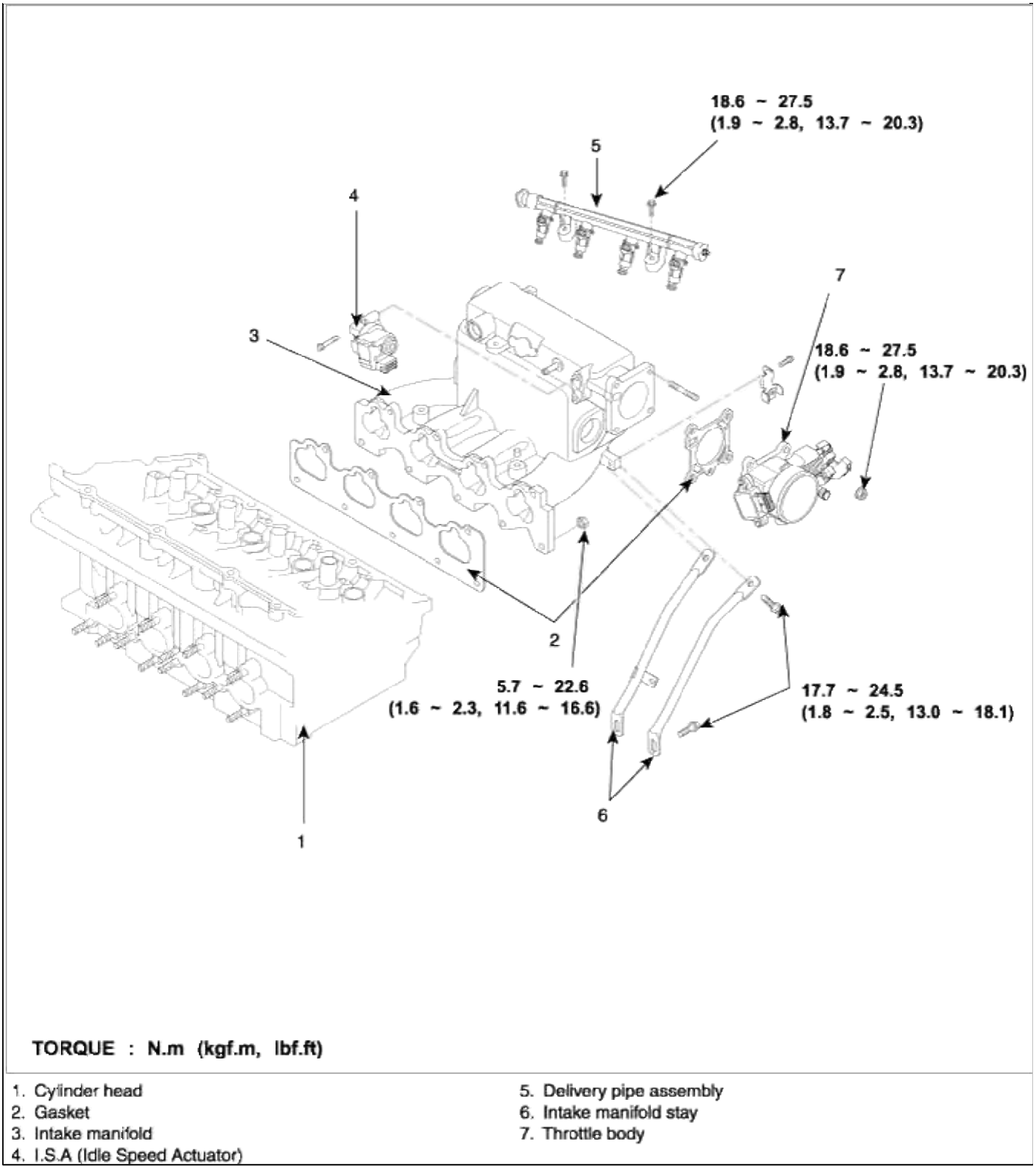
1. Install the relief plunger.
   Install relief plunger(C) and spring(B) into the front case hole, and install the plug(A).

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



Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Components and Components Location

COMPONENT

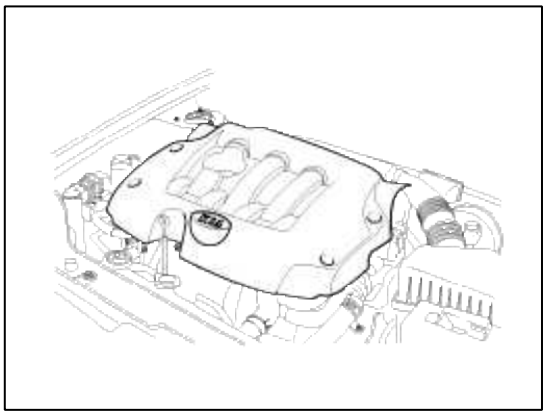


1. Cylinder head
2. Gasket
3. Intake manifold
4. I.S.A (Idle Speed Actuator)
5. Delivery pipe assembly
6. Intake manifold stay
7. Throttle body

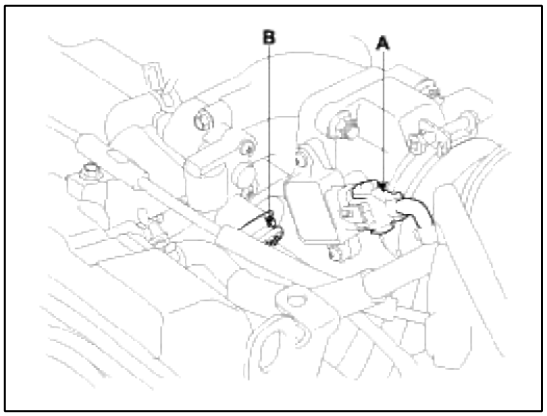
Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Repair procedures

REMOVAL

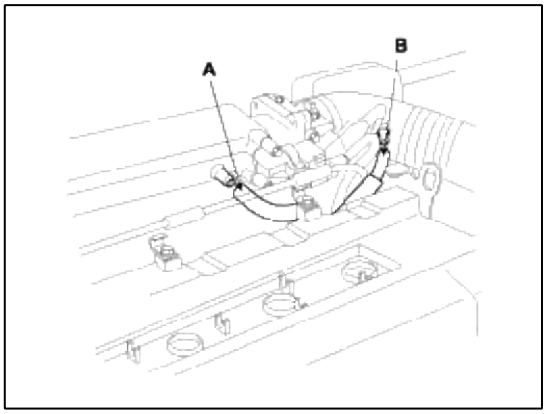
1. Remove the engine cover.



2. Disconnect the TPS(Throttle Position Sensor) connector(A) and ISA(Idle Speed Actuator) connector(B).

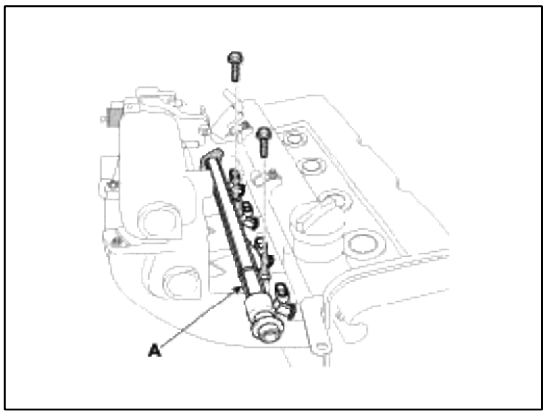


3. Disconnect the PCV(Positive Crankcase Ventilation) hose(A) and breather hose(B).

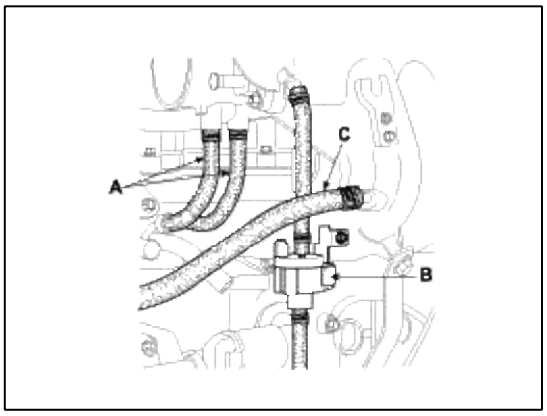


4. Remove the accelerator cable.
5. Remove the delivery pipe(A).

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

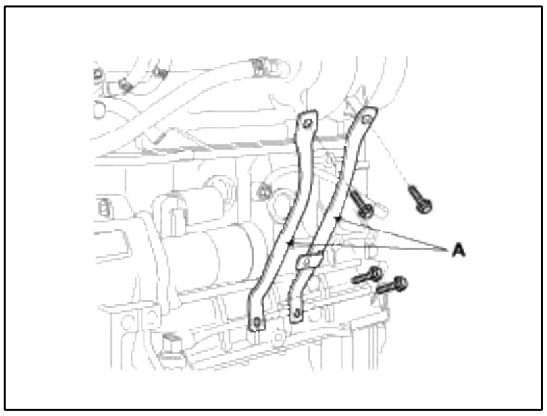


6. Remove the heater hose(A), PCSV(Purge Control Solenoid Valve)(B) and the brake vacuum hose(C) from throttle body and intake manifold.



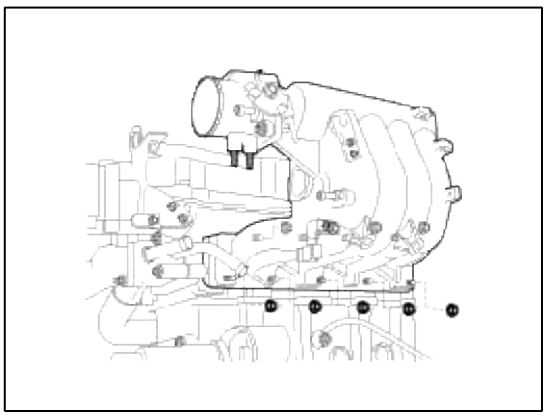
7. Remove the air conditioner compressor. (Refer to HA Gr.)
8. Remove the intake manifold stay(A).

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



9. Remove the intake manifold.

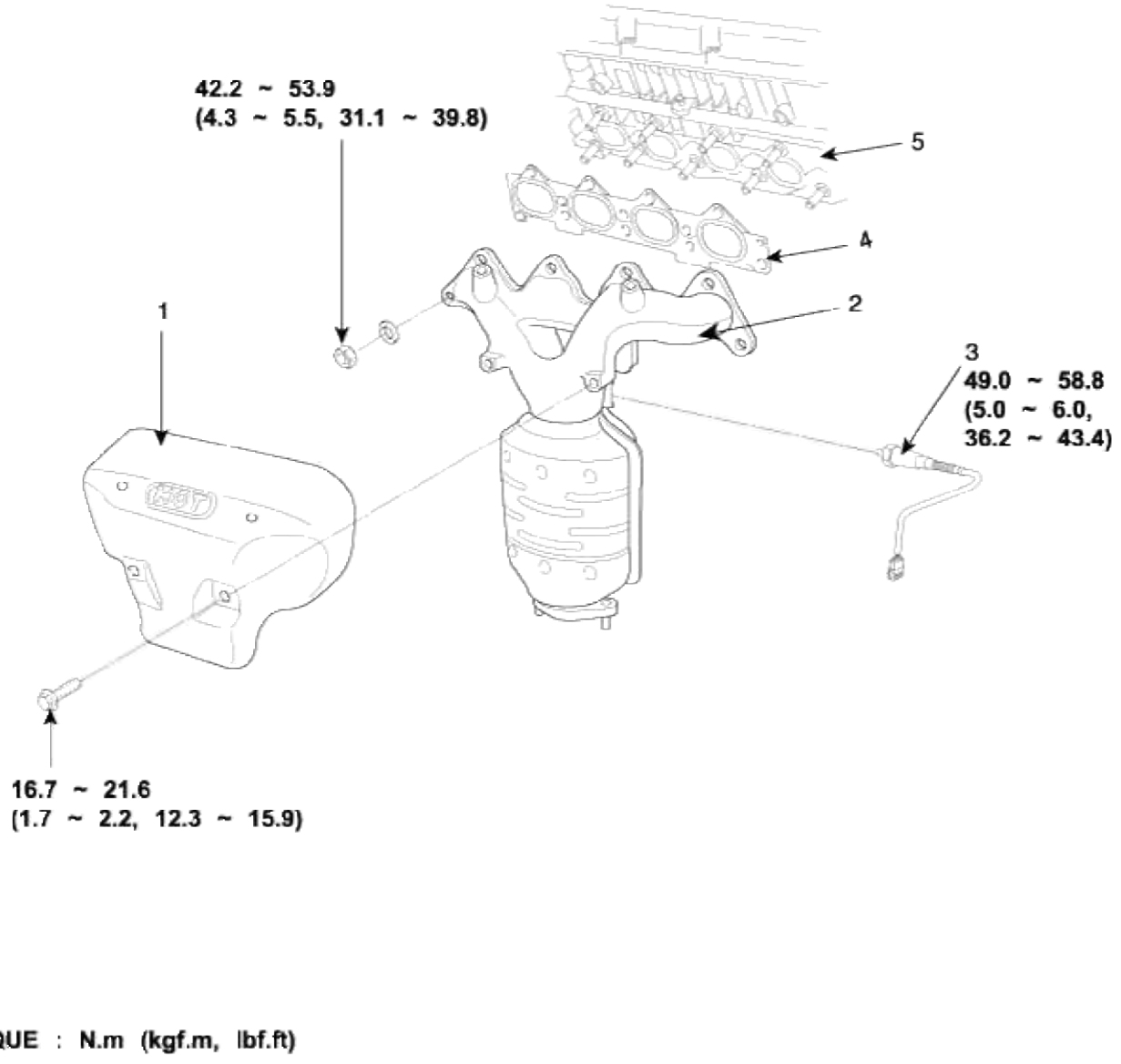
Tightening torque :
15.7 ~ 22.6N-m (1.6 ~ 2.3kg-m, 11.6 ~ 16.6lb-ft)



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

Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Components and Components Location

COMPONENT



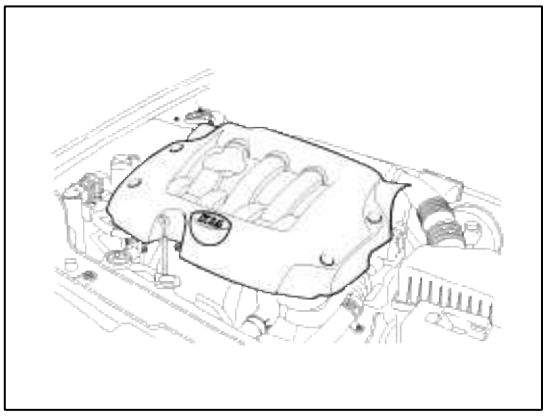
TORQUE : N.m (kgf.m, lbf.ft)

1. Heat protector
2. Exhaust manifold
3. Front oxygen sensor
4. Gasket
5. Cylinder head

Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Repair procedures

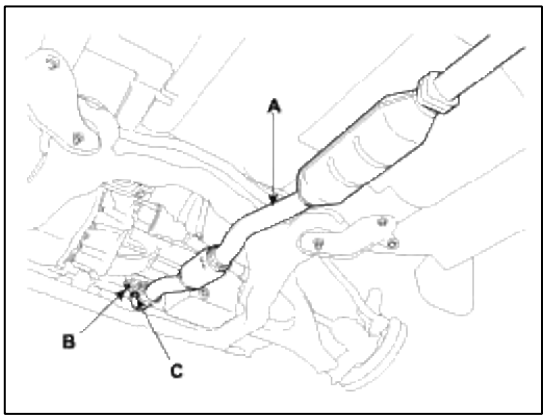
REMOVAL

1. Remove the engine cover.



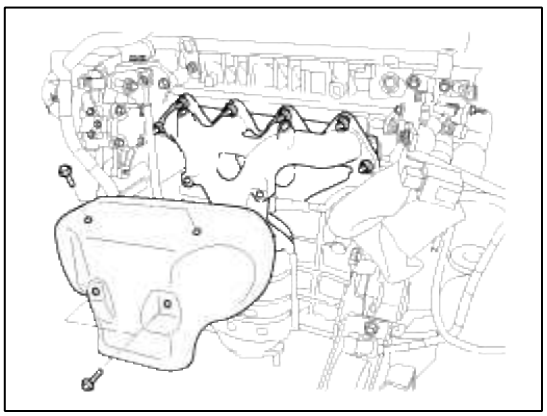
2. Disconnect the front oxygen sensor connector.
3. Remove the front muffler(A).

Tightening torque :
Nut (B) : 39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lbf.ft)
Bolt (C) : 29.4 ~ 39.2N.m (3.0 ~ 4.0kgf.m, 21.7 ~ 28.9lbf.ft)



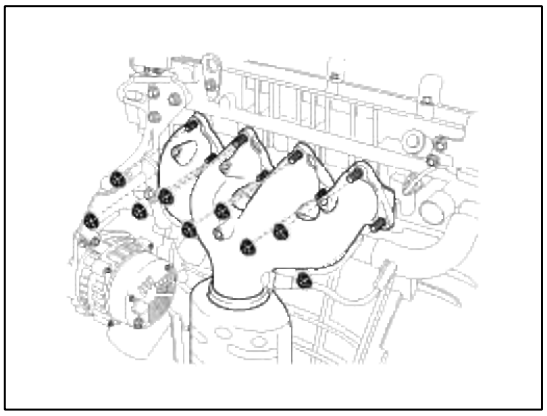
4. Remove the heat protector.

Tightening torque :
16.7 ~ 21.6N.m (1.7 ~ 2.2kgf.m, 12.3 ~ 15.9lbf.ft)



5. Remove the exhaust manifold and catalytic converter assembly.

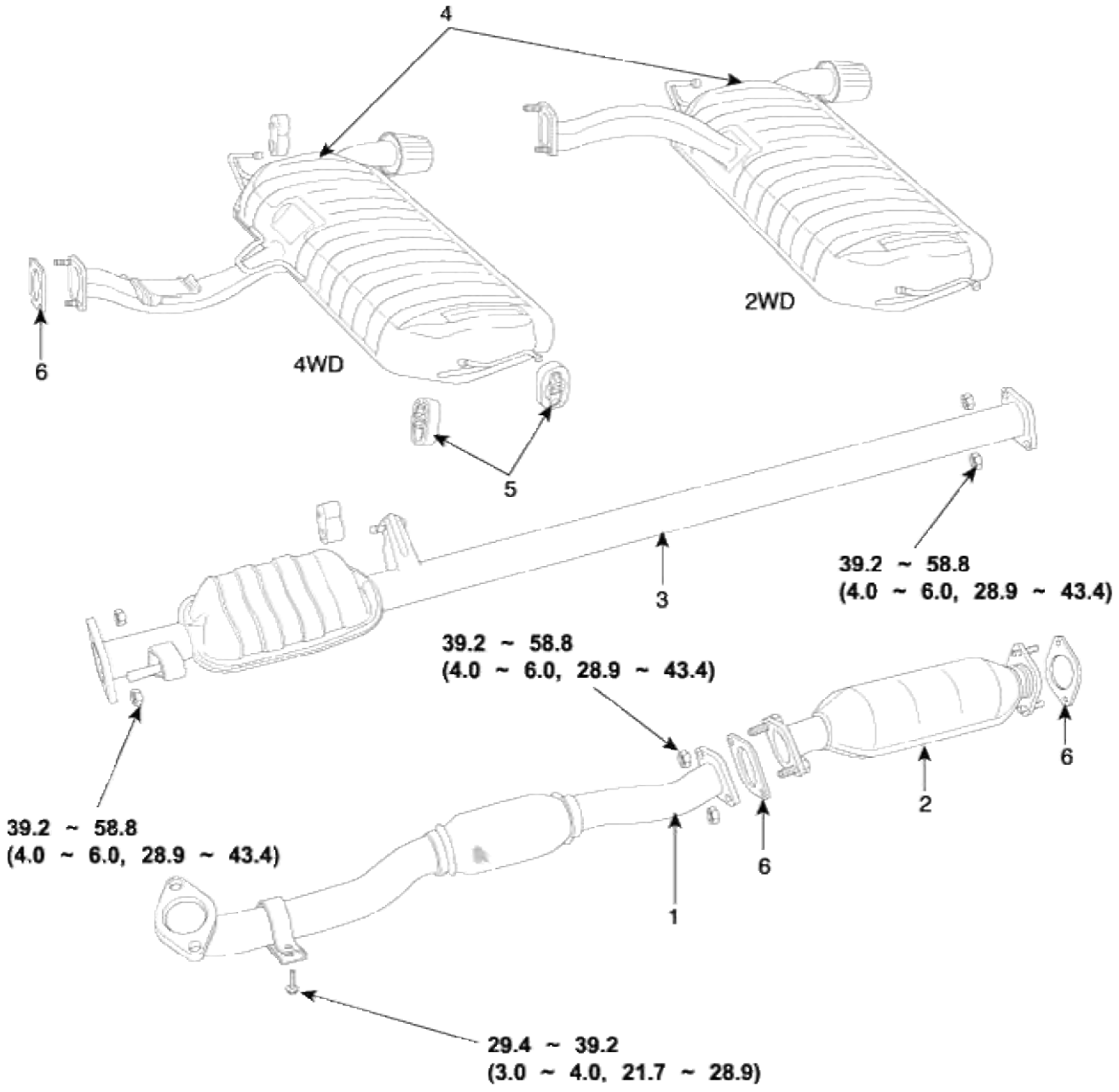
Tightening torque :
42.2 ~ 53.9N.m (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lbf.ft)



6. Installation is in the reverse order of removal

Engine Mechanical System > Intake And Exhaust System > Front Exhsust Pipe > Components and Components Location

COMPONENT

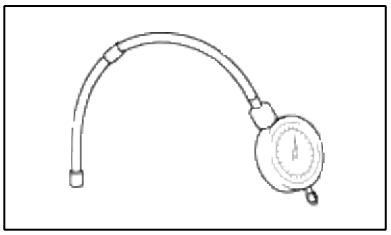
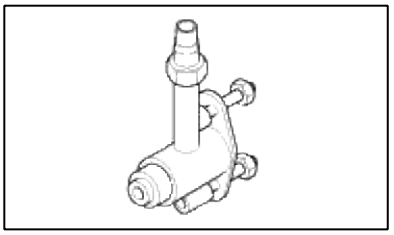
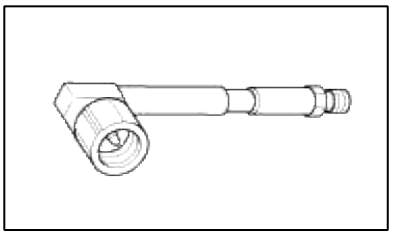


1. Front muffler
2. Catalytic converter
3. Center muffler
4. Main muffler
5. Rubber hanger
6. Gasket

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Fuel System

Fuel System > General Information > Special Service Tools

SPECIAL SERVICE TOOLS

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

Fuel System > General Information > Troubleshooting

BASIC TROUBLESHOOTING

BASIC TROUBLESHOOTING GUIDE

1	**Bring Vehicle to Workshop**
2	**Analyze Customer's Problem**
	• Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).
3	**Verify Symptom, and then Check DTC and Freeze Frame Data**
	• Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC). • Record the DTC and freeze frame data. ***NOTE*** *To erase DTC and freeze frame data, refer to Step 5.*
4	**Confirm the Inspection Procedure for the System or Part**
	• Using the SYMPTOM TROJBLESHOOTING 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(dc) 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	**Confirm test**
14	**END**

CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLE INFORMATION

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

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 check (Pre-check)	□ Normal □ DTC (_____) □ Freeze Frame Data
	Check mode	□ Normal □ DTC (_____) □ Freeze Frame Data

BASIC INSPECTION PROCEDURE

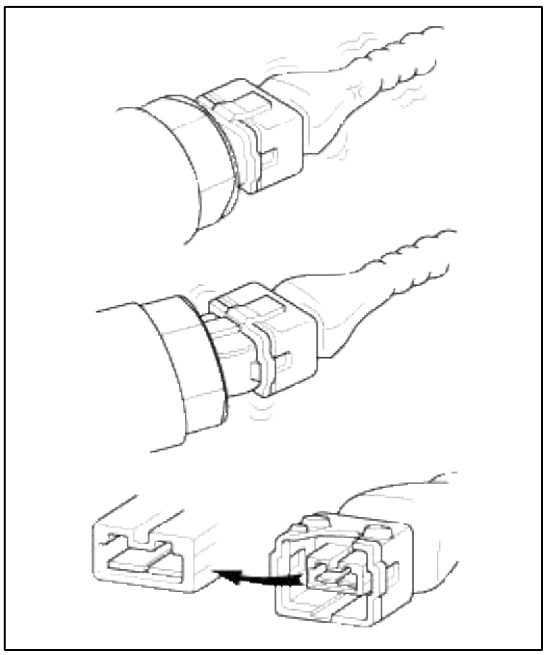
The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20°C, 68°F), unless there is any notice.

NOTE

The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.

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.



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

1) Sensors and Actuators

: Slightly vibrate sensors, actuators or relays with finger.

WARNING

Strong vibration may break sensors, actuators or relays

2) Connectors and Harness

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

● SIMULATING HEAT

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

WARNING

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

● SIMULATING WATER SPRINKLING

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

> WARNING
>
> DO NOT sprinkle water directly into the engine compartment or electronic components.

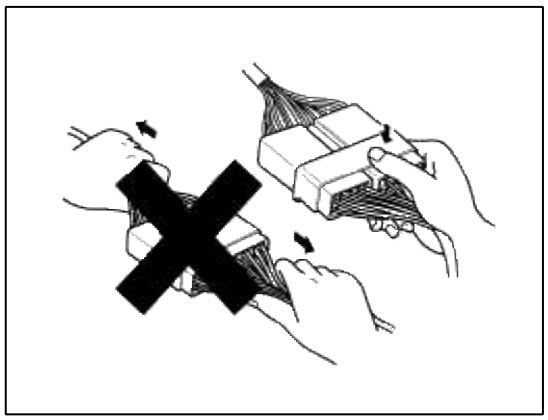
● SIMULATING ELECTRICAL LOAD

1) Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, etc.).

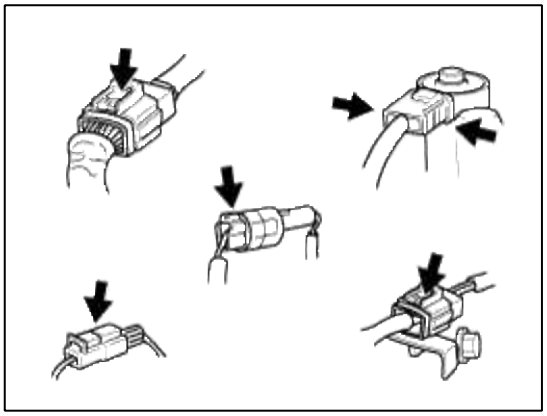
CONNECTOR INSPECTION PROCEDURE

1. Handling of Connector

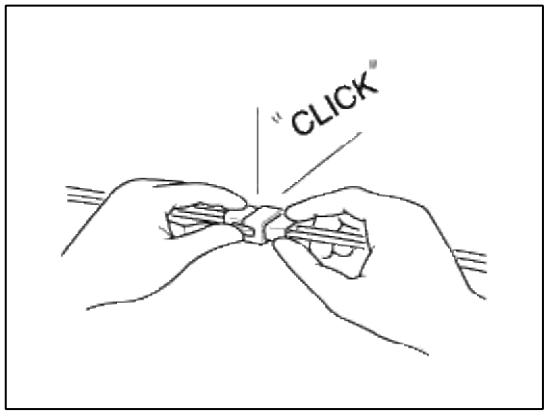
A. Never pull on the wiring harness when disconnecting connectors.



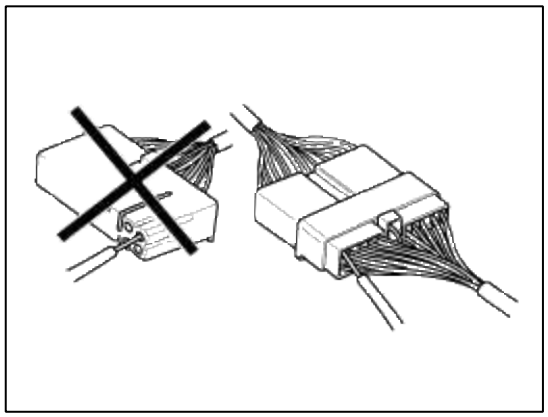
B. When removing the connector with a lock, press or pull locking lever.



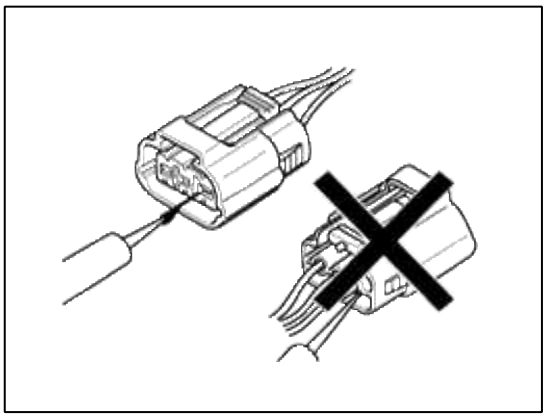
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



D. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



E. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



NOTE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

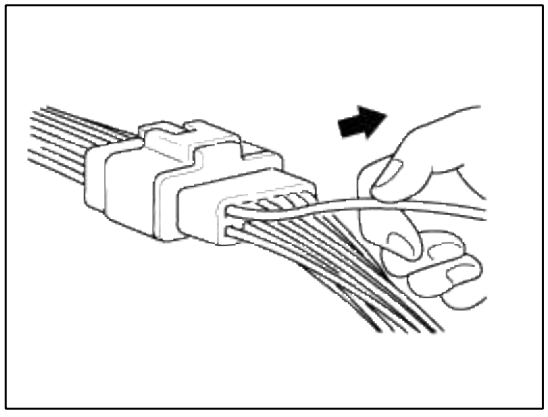
2. Checking Point for Connector

A. While the connector is connected:
Hold the connector, check connecting condition and locking efficiency.

B. When the connector is disconnected:
Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.
Visually check for rust, contamination, deformation and bend.

C. Check terminal tightening condition:
Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

D. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



3. Repair Method of Connector Terminal
   A. Clean the contact points using air gun and/or shop rag.

> NOTE
>
> Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

   B. In case of abnormal contact pressure, replace the female terminal.

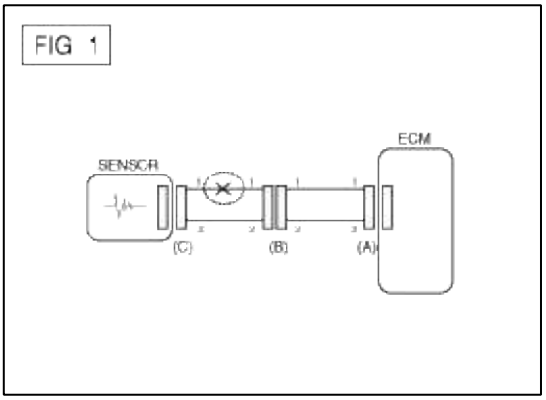
WIRE HARNESS INSPECTION PROCEDURE

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

ELECTRICAL CIRCUIT INSPECTION PROCEDURE

1. Procedures for Open Circuit
   A. Continuity Check
   B. Voltage Check
   If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1

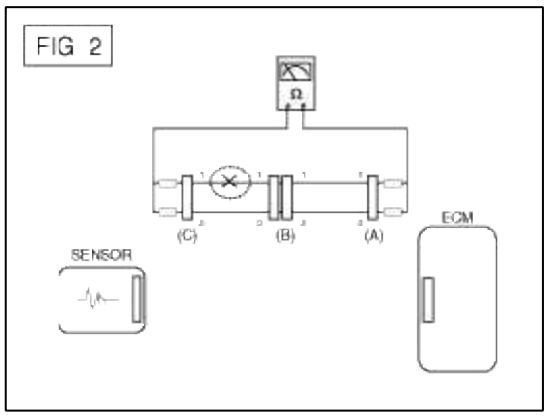


2. Continuity Check Method

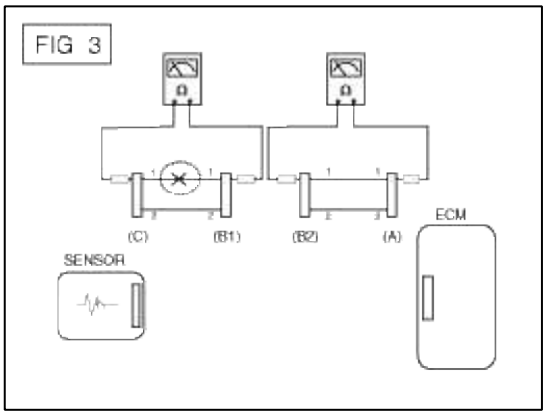
> NOTE
>
> When measuring for resistance, lightly shake the wire harness above and below or from side to side.

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.

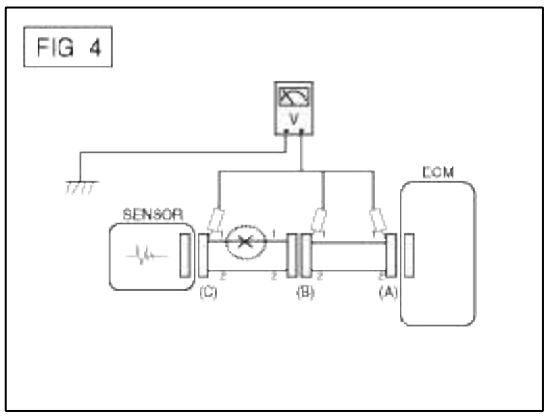


B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).



3. Voltage Check Method

A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].
The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

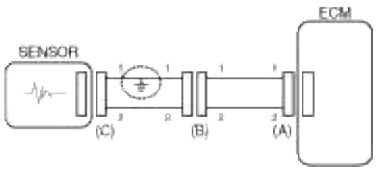


4. Test Method for Short to Ground Circuit

A. Continuity Check with Chassis Ground

If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing below Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5



5. Continuity Check Method (with Chassis Ground)

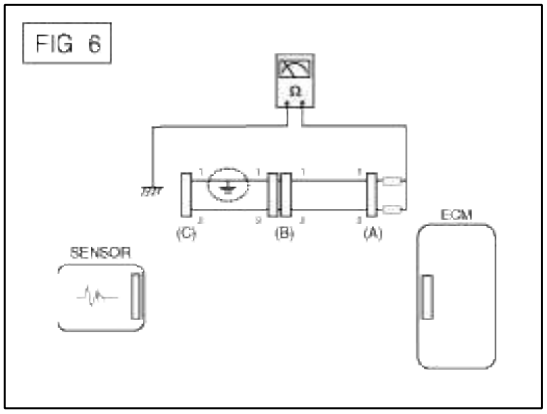
NOTE

Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

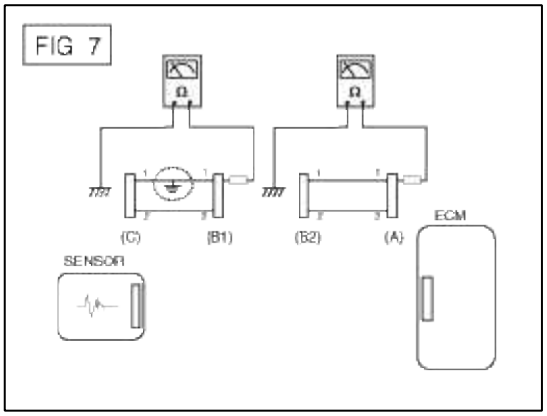
Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

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



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).



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
[illegible]	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit	• DTC • Low compression

Poor driving (Surge)	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)	• Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving 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. Test the canister close valve 2. Inspect the fuel filler hose/pipe • Pinched, kinked or blocked? • Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

Fuel System > General Information > Specifications

SPECIFICATIONS

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	65 L
Fuel Retrun System	Type	Returnless
Fuel Filter	Type	High pressure type (built in Fuel Pump Assembly)
Fuel Pressure Regulator	Type	Built in fuel pump assembly
	Regulated Fuel Pressure	343 kpa (3.5 kg/cm², 49.8 psi)
Fuel Pump	Type	Electrical, in-tank type

ENGINE MANAGEMENT SYSTEM

SENSORS	Mass Air Flow Sensor (MAFS)	Type	Hot film type
		Output Voltage	Idle: about 0.5V
			3000 rpm: about 1.0V

	Intake Air Temperature Sensor (IATS)	Type	Thermistor type	
		Resistance	-40°C(-40°F)	45.3 kΩ
			-10°C(14°F)	9.2 kΩ
			20°C(68°F)	2.5 kΩ
			80°C(176°F)	0.33 kΩ
			130°C(256°F)	0.09 kΩ
	Engine Coolant Temperature Sensor (ECTS)	Type	Thermistor type	
		Resistance	-40°C(-40°F)	48.14 kΩ
			-20°C(-4°F)	14.13 ~ 16.83 kΩ
			0°C(32°F)	5.79 kΩ
			20°C(68°F)	2.31 ~ 2.59 kΩ
			40°C(104°F)	1.15 kΩ
			60°C(140°F)	0.59 kΩ
			80°C(176°F)	0.32 kΩ
	Throttle Position Sensor (TPS)	Type	Variable Resistor Type	
		Resistance	1.6 ~ 2.4 kΩ	
		Output Voltage	C.T	0.25 ~ 0.8V
			W.O.T	4.25 ~ 4.7V
SENSORS	Heated Oxygen Sensor (HO2S)	Type	Zirconia Sensor (including Heater)	
		Output Voltage	0 ~ 1V	
		Heater Resistance	3.0 ~ 4.0Ω at 23±5°C	
	Knock Sensor	Type	Piezo-electric type	
		Capacitance	0.8 ~1.6 nF	
	Camshaft Position Sensor (CMPS)	Type	Hall Effect Sensor	
		Output Voltage	0 ~ 5.0V	
	Crankshaft Position Sensor (CKPS)	Type	Hall Effect Sensor	
		Output Voltage	0 ~ 5.0V	
	Fuel Tank Pressure Sensor (FTPS)	Type	Piezo - Resistavity Type	
		Output Voltage	Approx. 2.5 V at idle	
	Fuel Level Sensor (FLS)	Type	Variable Resistor Type	
ACTUATORS	Injector	Type	Electromagnetic Type	
		Number	6	
		Coil Resistance	13.8 ~ 15.2 Ω at 20°C	

	Purge Control Solenoid Valve (PCSV)	Type	Duty Control Type	
		Coil Resistance	24.5 ~ 27.5 Ω at 20°C	
	Canister Close Valve (CCV)	Type	ON/OFF Control Type	
		Coil Resistance	23.0 ~ 26.0 Ω at 20°C (68°F)	
	Idle Speed Control Actuator (ISCA)	Type	Double Coil Type	
		Coil Resistance	CLOSE	17.0 ~ 18.2 Ω (at 20°C)
			OPEN	14.9 ~ 16.1 Ω (at 20°C)
ACTUATORS	Intake Manifold Tuning Valve #1 (Surge Tank Side)	Coil Resistance	29.0 ~ 35.0 Ω at 20°C	
	Intake Manifold Tuning Valve #2 (Intake Manifold Side)	Coil Resistance	29.0 ~ 35.0 Ω at 20°C	
	Ignition Coil	Type	Mold Coil type	
		Primary Coil	0.74±10% Ω	
		Secondary Coil	13.3±15% kΩ	

TIGHTENING TORQUES

ENGINE CONTROL SYSTEM

Items	N·m	kgf·m	lbf·ft
ECM bracket installation bolt/nut	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Mass air flow sensor clamp installation	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6
Crankshaft position sensor installation bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Crankshaft position sensor connector bracket installation bolt	19.6 ~ 21.6	2.0 ~ 2.2	14.5 ~ 15.9
Crankshaft position sensor wheel installation screw	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
Knock sensor installation bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Knock sensor connector bracket installation bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Engine coolant temperature sensor installation	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Heated Oxygen Sensor (Bank 1, Sensor 1)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Heated Oxygen Sensor (Bank 1, Sensor 2)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Heated Oxygen Sensor (Bank 2, Sensor 1)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2

Heated Oxygen Sensor (Bank 2, Sensor 2)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Camshaft position sensor connector bracket installation bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Oil pressure switch installation	14.7 ~ 21.6	1.5 ~ 2.2	10.9 ~ 15.9
Intake air temperature sensor installation	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
Throttle position sensor installation screws	1.0 ~ 2.5	0.15 ~ 0.25	0.7 ~ 1.8
Idle speed control actuator installation bolts	5.9 ~ 7.8	0.6 ~ 0.8	4.3 ~ 5.8

FUEL DELIVERY SYSTEM

Items	N·m	kgf·m	lbf·ft
Delivery pipe installation bolts	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.9
Throttle body installation bolt/nut	14.7 ~ 19.6	1.5 ~ 2.0	10.9 ~ 14.5
Accelerator pedal installation bolt	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Fuel tank mounting nut	39.2 ~ 54.0	4.0 ~ 5.5	28.9 ~ 39.8

SEALANTS

Engine Coolant Temperature Sensor (ECTS) assemby	LOCTITE 962T or equivalent

SERVICE STANDARD

Basic Idle rpm (After warm up)	**A/C OFF**	**700±100 rpm**
	A/C ON	**750±100 rpm**
Ignition Timing(After warm up, at idle)	BTDC 12°±5°	

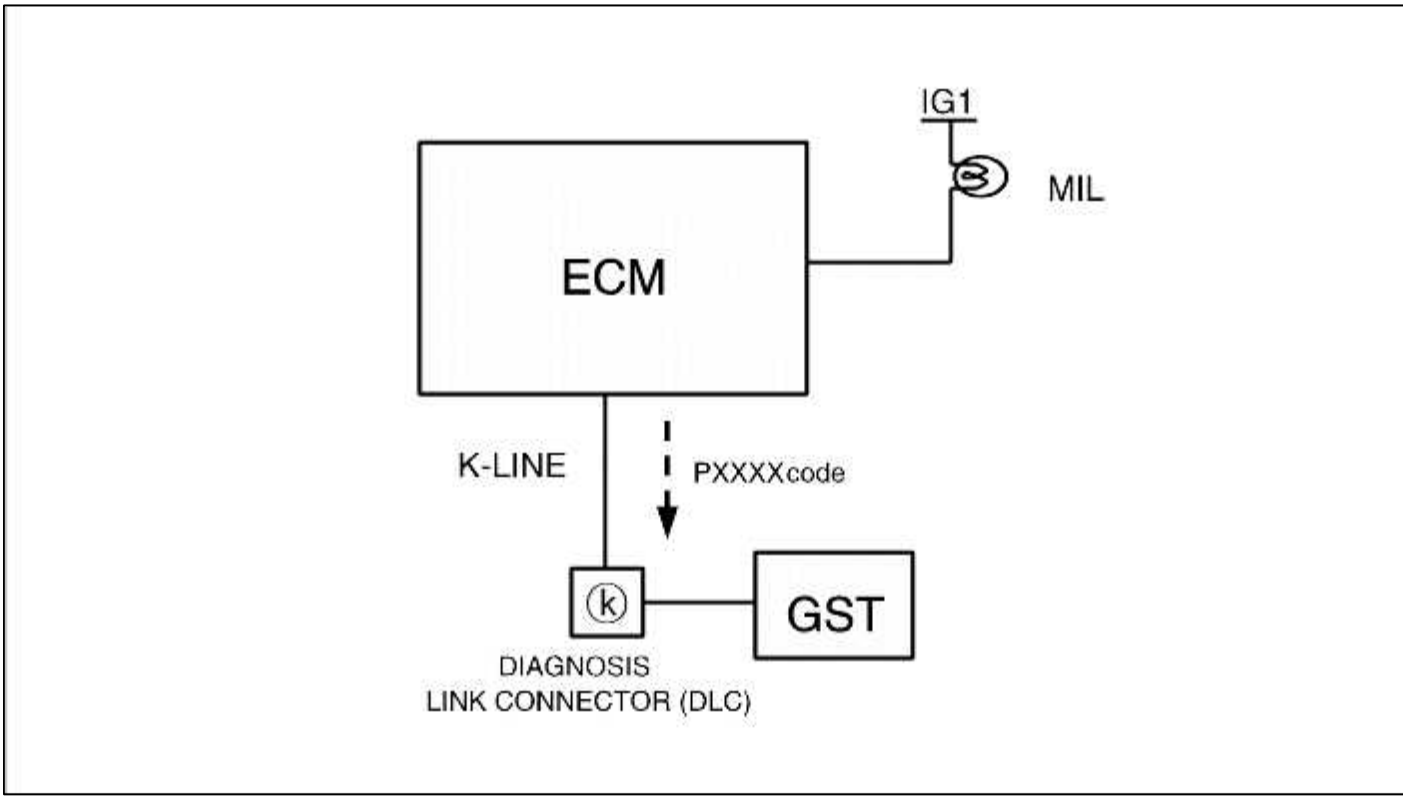
Fuel System > Engine Control System > Description and Operation

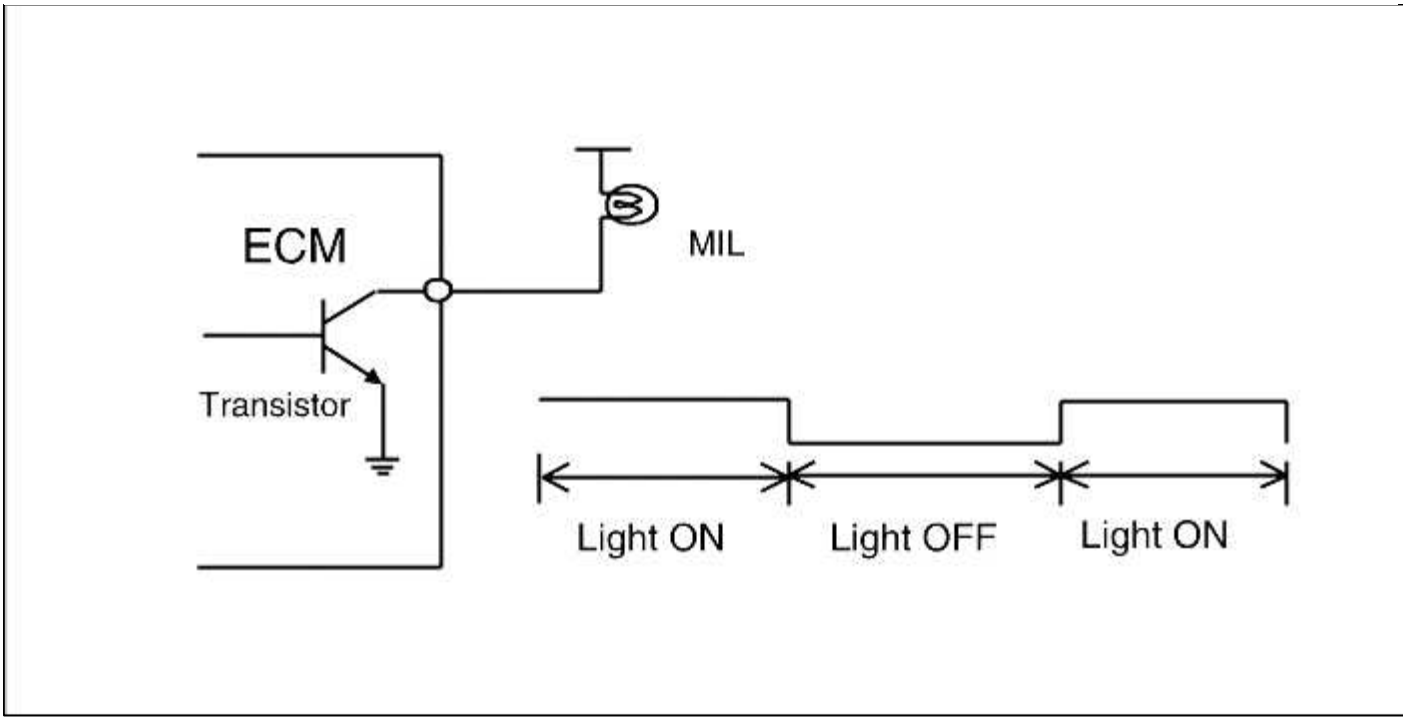
OBD-II REVIEW

1. OVERVIEW

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in california beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, Exhust Gas Recirculation (EGR) system and additional emission related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the fault and the need for repair of the emission control system. Associated with the MIL was a fault code or Diagnostic Trouble Code (DTC) idenfying the specific area of the fault.

The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations will be followed until 1999 when the federal regulations will be used.
The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.
The diagnostic executive is computer program in the Engine Control Module (ECM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeeze frame data and scan tool interface.
Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM, load and warm status at the point the first fault is detected. Previously stored conditions will be replace only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.
The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM).
The ECM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random acess memory, and others), the ECM generates output signals to control various relays, solenoids and actuators.
2. CONFIGURATION OF HARDWARE AND RELATED TERMS





The Malfunction Indicator Lamp (MIL) is connected between ECM-terminal Malfunction Indicator Lamp and battery supply (open collector amplifier).
In most of car, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit.
Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.

At ignition ON and engine revolution (RPM) < MIN. RPM, the MIL is switched ON for an optical check by the driver.
When the ECM detects a malfunction related emission during the first driving cycle, the DTC and engine data are stored in the freeze frame memory. The MIL is illuminated only when the ECM detects the same malfunction related the DTC in two consecutive driving cycles.
● Misfire and Fuel System Malfunctions:
For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.
● All Other Malfunctions:
For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.
The diagnostic system may erase a fault code if the same fault is not re-registered in at least 40 engine warm-up cycles, and the MIL is not illuminated for that fault code.

- Bidirectional line
- K-Line is defined as the line which provides information in a serial digital form from ECM to the diagnostic tester. K-Line is used bidirectionally, in which case it may carry commands or data from the diagnostic tester to the ECM. K-Line is also used to initialize the serial communication.

A driving cycle consists of engine start up, and engine shut off.
A warm-up cycle means sufficient vehicle operation such that the engine coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit.
A trip means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system except catalyst efficiency or

evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.

- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.

The letter of the beginning of the DTC identifies the function of the monitored device that has failed. A "P" indicates a powertrain device, "C" indicates a chassis device. "B" is for body device and "U" indicates a network or data link code. The first number indicates if the code generic (common to all manufacturers) or if it is manufacturer specific. A "0" & "2" indicates generic, "1" indicates manufacturer-specific. The second number indicates the system that is affected with a number between 1 and 7.
The following is a list showing what numbers are assign to each system.
1) Fuel and air metering
2) Fuel and air metering(injector circuit malfunction only)
3) Ignition system or misfire
4) Auxiliary emission controls
5) Vehicle speed controls and idle control system
6) Computer output circuits
7) Transmission
The last two numbers of the DTC indicates the component or section of the system where the fault is located.
When a freeze frame event is triggered by an emission related DTC, the ECM stores various vehicle information as it existed the moment the fault ocurred. The DTC number along with the engine data can be useful in aiding a technician in locating the cause of the fault. Once the data from the 1st driving cycle DTC ocurrence is stored in the freeze frame memory, it will remain there even when the fault ocurrs again (2nd driving cycle) and the MIL is illuminated.

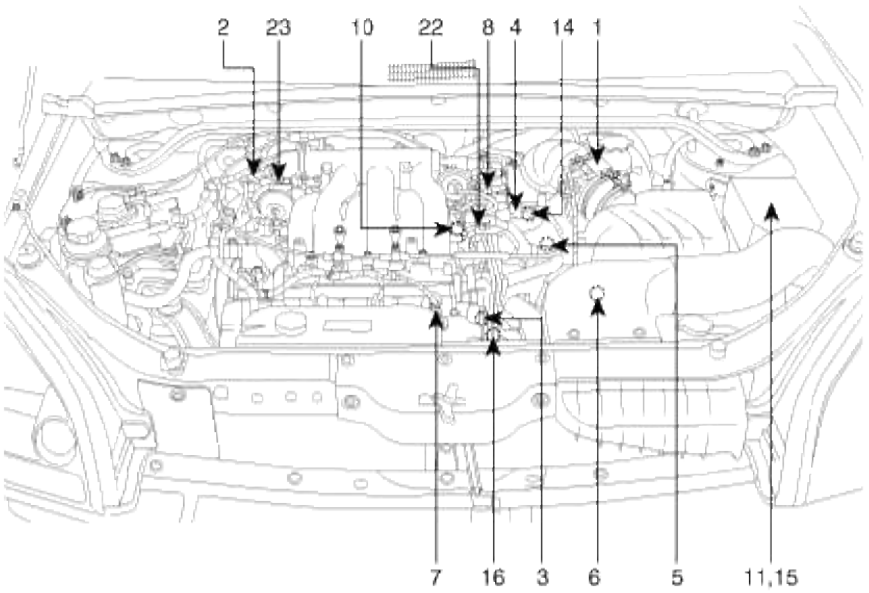
- Freeze Frame List
  1) Calculated Load Value
  2) Engine RPM
  3) Fuel Trim
  4) Fuel Pressure (if available)
  5) Vehicle Speed (if available)
  6) Coolant Temperature
  7) Intake Manifold Pressure (if available)
  8) Closed-or Open-loop operation
  9) Fault code

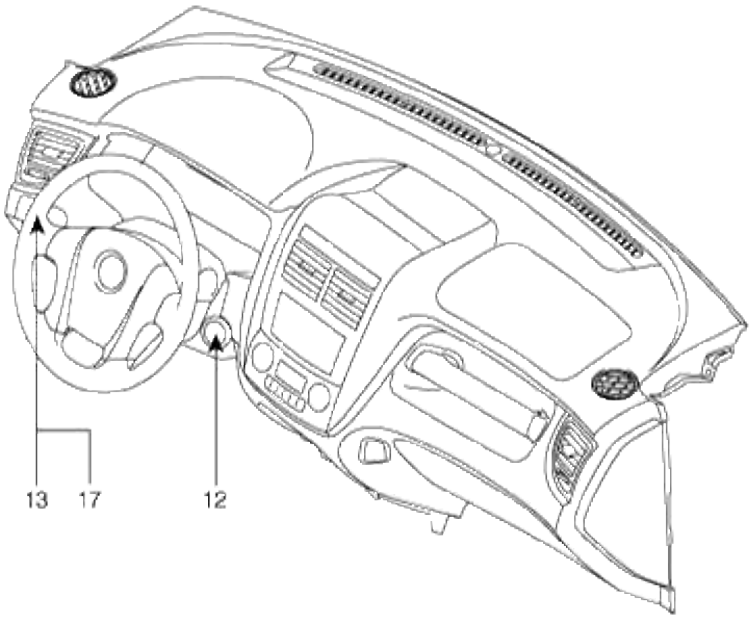
3. OBD-II SYSTEM READINESS TESTS
The catalyst efficiency monitor is a self-test strategy within the ECM that uses the downstream Heated Oxygen Sensor (HO2S) to determine when a catalyst has fallen below the minimum level of effectiveness in its ability to control exhaust emission.
Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering, or poor compression. Any combustion that does not occur within the cylinder at the proper time is also a misfire. The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalyst from permanent damage and to alert the customer of an emission failure or an inspection maintenance failure by illuminating the MIL . When a misfire is detected, special software called freeze frame data enabled. The freeze frame data captures the operational state of the vehicle when a fault is detected from misfire detection monitor strategy.
The fuel system monitor is a self-test strategy within the PCM that monitors the adaptive fuel table The fuel control system uses the adaptive fuel table to compensate for normal variability of the fuel system components caused by wear or aging. During normal vehicle operation, if the fuel system appears biased lean or rich, the adaptive value table will shift the fuel delivery calculations to remove bias.

The cooling system monitoring is a self-test strategy within the ECM that monitors ECTS (Engine Coolant Temperature Sensor) and thermostat about circuit continuity, output range, rationality faults.
OBD-II regulations require monitoring of the upstream Heated O2 Sensor (H2OS) to detect if the deterioration of the sensor has exceeded thresholds. An additional HO2S is located downstream of the Warm-Up Three Way Catalytic Converter (WU-TWC) to determine the efficiency of the catalyst.
Although the downstream H2OS is similar to the type used for fuel control, it functions differently. The downstream HO2S is monitored to determine if a voltage is generated. That voltage is compared to a calibrated acceptable range.
The EVAP. monitoring is a self-test strategy within the ECM that tests the integrity of the EVAP. system. The complete evaporative system detects a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.040 inch and 0.020 inch diameter orifice.
The A/C system monitoring is a self-test strategy within the ECM that monitors malfunction of all A/C system component at A/C ON.
The comprehensive components monitoring is a self-test strategy within the ECM that detects fault of any electronic powertrain components or system that provides input to the ECM and is not exclusively an input to any other OBD-II monitor.

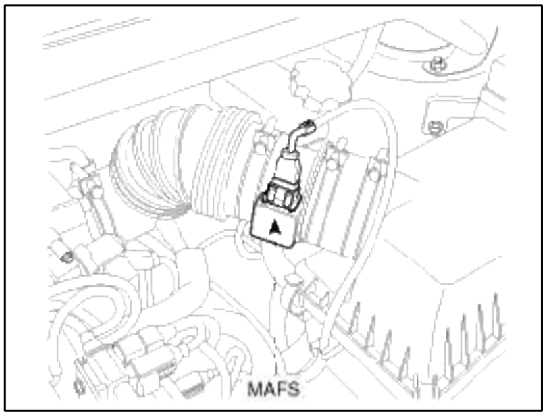
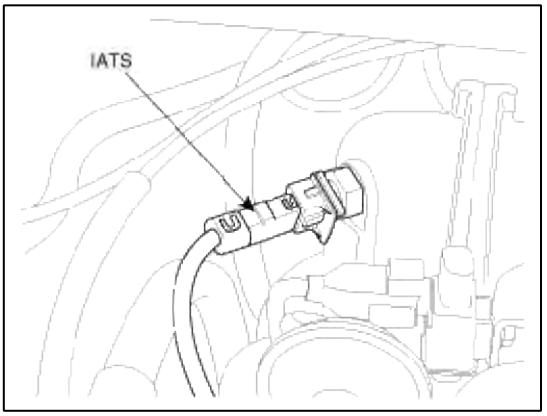
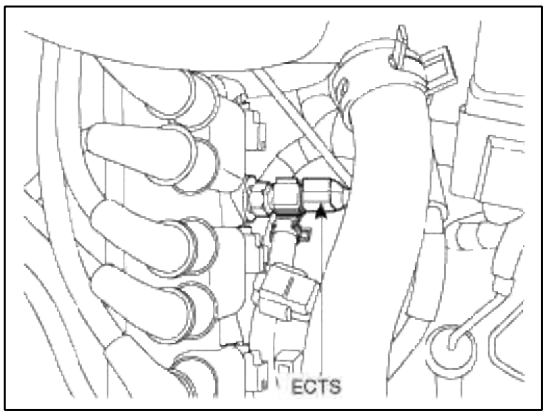
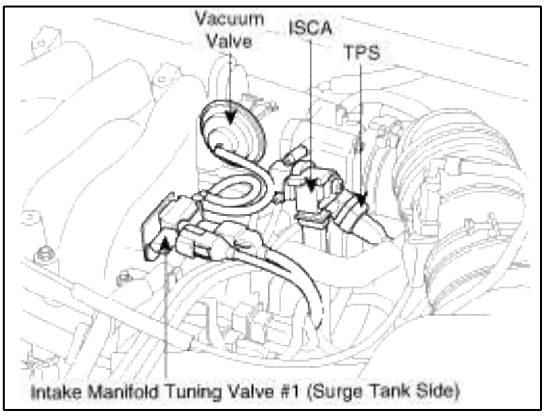
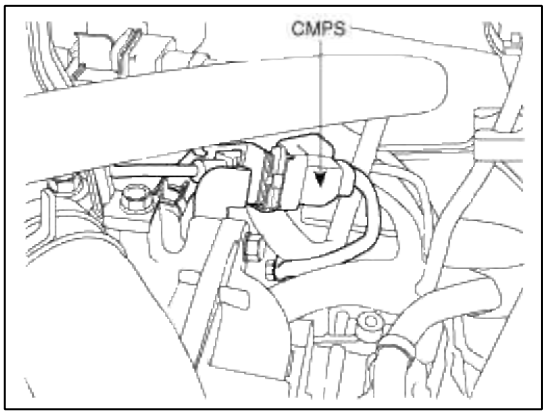
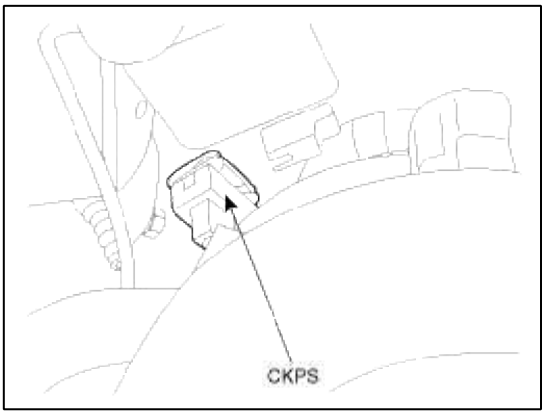
Fuel System > Engine Control System > Components and Components Location

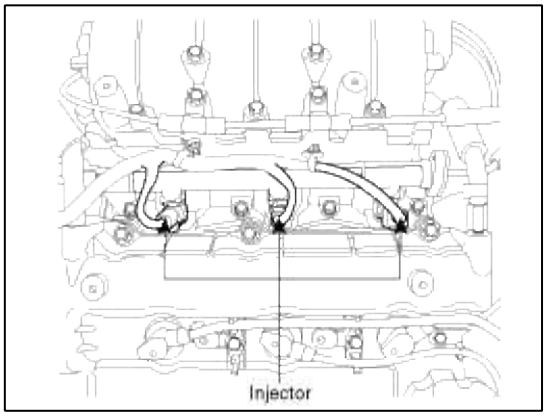
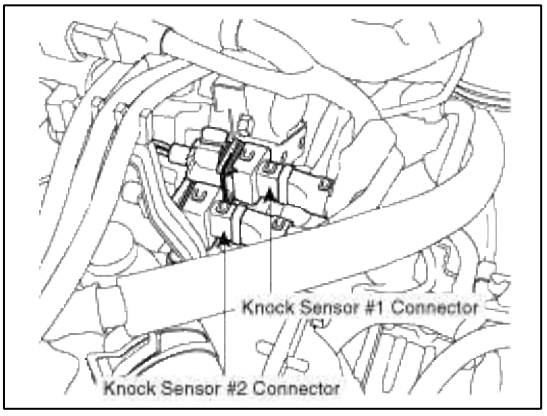
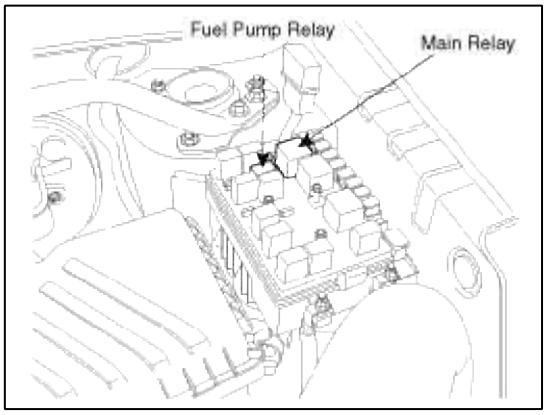
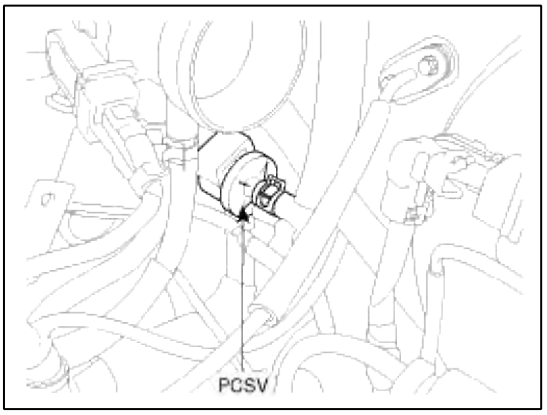
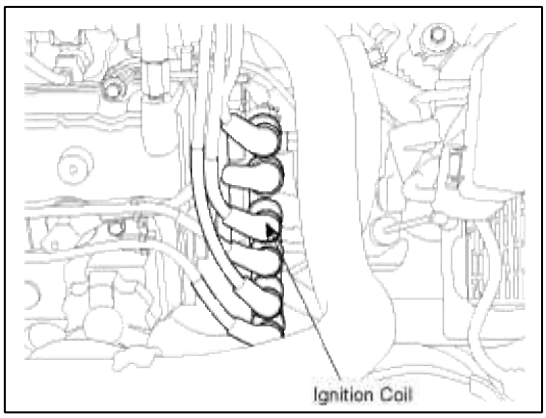
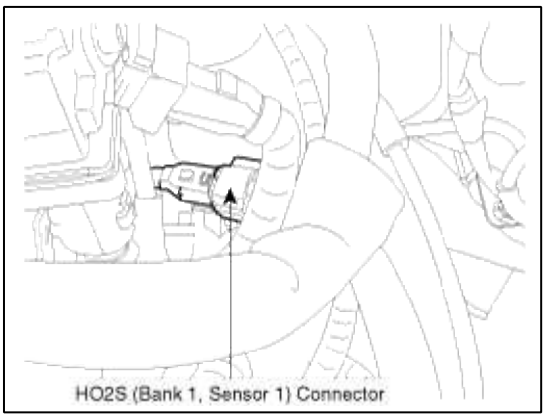
COMPONENTS LOCATION



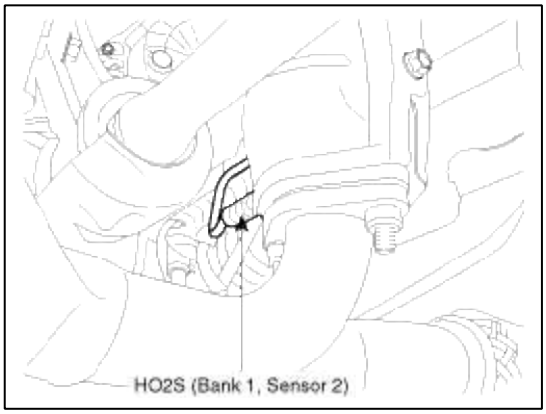


1. Mass Air Flow Sensor (MAFS)
2. Intake Air Temperature Sensor (IATS)
3. Engine Coolant Temperature Sensor (ECTS)
4. Throttle Position Sensor (TPS)
5. Camshaft Position Sensor (CMPS)
6. Crankshaft Position Sensor (CKPS)
7. Injector
8. Idle Speed Control Actuator (ISCA)
9. Vehicle Speed Sensor (VSS)
10. Knock Sensor
11. Fuel Pump Relay
12. Ignition Switch
13. ECM
14. Purge Control Solenoid Valve (PCSV)
15. Main Relay
16. Ignition Coil
17. DLC (Diagnostic Link Connector)
18. Heated Oxygen Sensor (Bank1, Sensor1)
19. Heated Oxygen seneor (Bank1, Sensor2)
20. Heated Oxygen seneor (Bank2, Sensor1)
21. Heated Oxygen seneor (Bank2, Sensor2)
22. Intake Manifold Tuning Valve #1 (Surge Tank Side)
23. Intake Manifold Tuning Valve #1 (Intake Manifold Side)
24. Fuel Tank Pressure Sensor (FTPS)
25. Canister Close Valve (CCV)

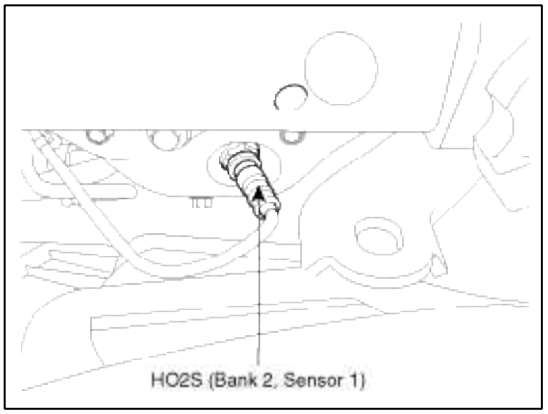
1. Mass Air Flow Sensor (MAFS)	2. Intake Air Temperature Sensor (IATS)
	
3. Engine Coolant Temperature Sensor (ECTS)	4. Throttle Position Sensor (TPS) 8. Idle Speed Contorl Actuator (ISCA) 22. Intake Manifold Tuning Valve #1 (Surge Tank Side)
	
5. Camshaft Position Sensor (CMPS)	6. Crankshaft Position Sensor (CKPS)
	

7.Injector	10. Knock Sensor
	
11. Fuel Pump Relay 15. Main Relay	14. Purge Control Solenoid Valve (PCSV)
	
16. Ignition Coil	18. Heated Oxygen Sensor (Bank 1, Sensor 1)
	

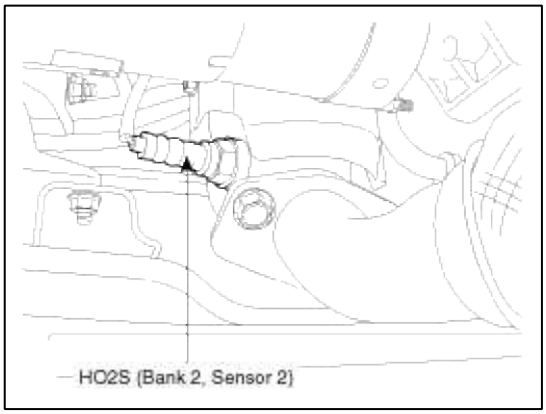
19. Heated Oxygen Sensor (Bank 1, Sensor 2)



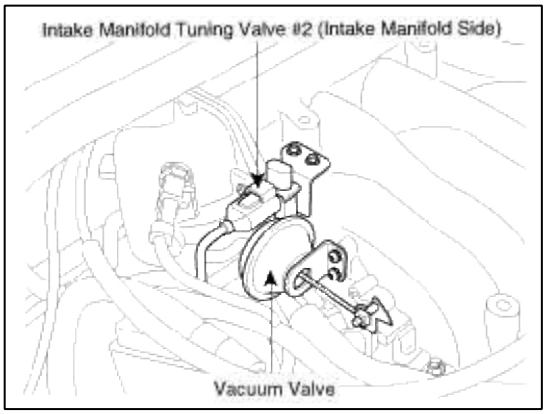
20. Heated Oxygen Sensor (Bank 2, Sensor 1)



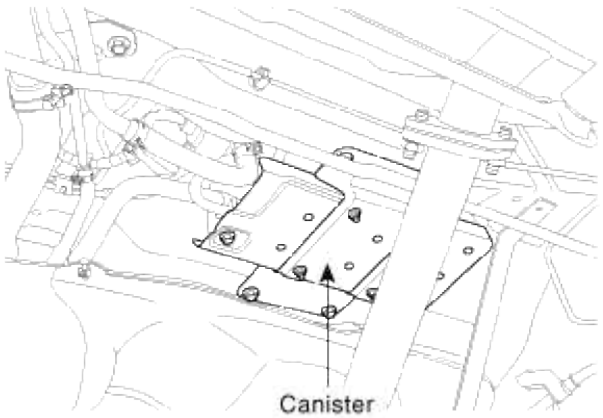
21. Heated Oxygen Sensor (Bank 2, Sensor 2)

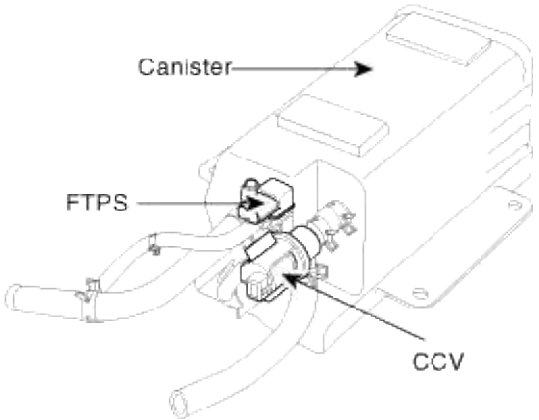


23. Intake Manifold Tuning Valve #2 (Intake Manifold Side)



24. Fuel Tank Pressure Sensor (FTPS)
25. Canister Close Valve (CCV)





Fuel System > Engine Control System > Engine Control Module (ECM) > Repair procedures

ECM PROBLEM INSPECTION PROCEDURE

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 terminals 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 again. If the vehicle operates normally then the problem was likely with the ECM.
4. RE-TEST THE ORIGINAL ECM : Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

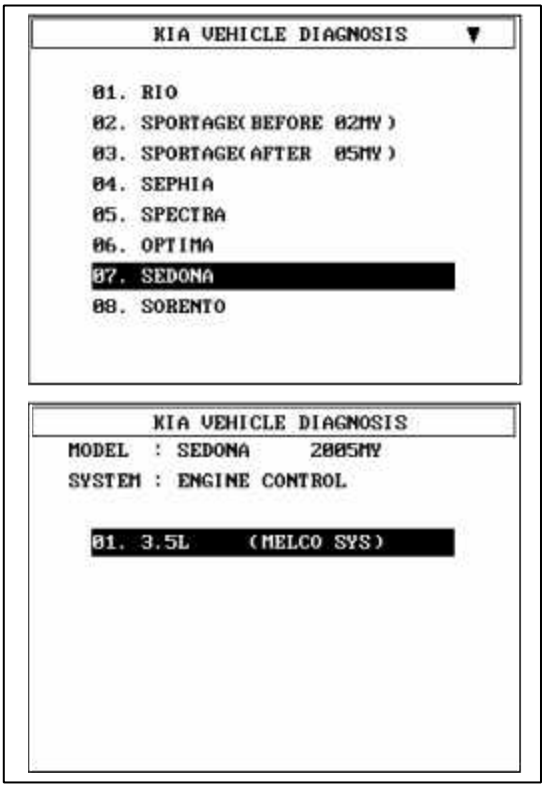
VIN PROGRAMMING PROCEDURE

VIN (Vehicle Identification Number) is a number that has the vehicle's information (Maker, Vehicle Type, Vehicle Line/Series, Body Type, Engine Type, Transmission Type, Model Year, Plant Location and so forth. For more information, please refer to the group "GI" in this SERVICE MANUAL). When replacing an ECM, the VIN must be programmed in the ECM. If there is no VIN in ECM memory, the fault code (DTC P0630) is set.

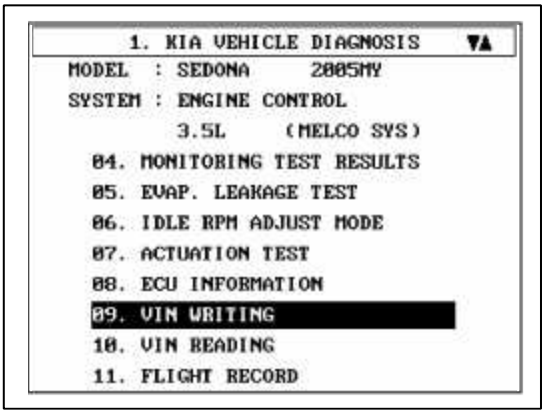
CAUTION

The programmed VIN cannot be changed. When writing the VIN, confirm the VIN carefully

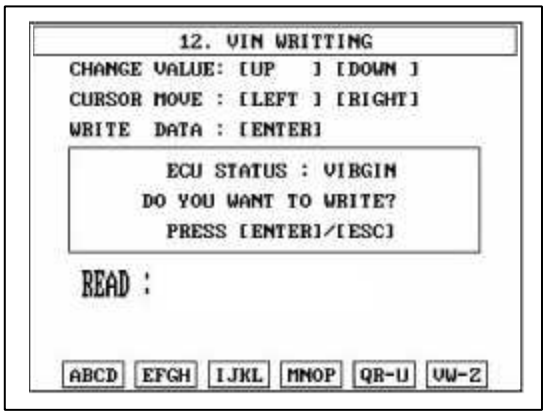
1. Select "Vehicle" and "Engine" (For example, SEDONA 3.5L V6).



2. Select "VIN WRITING".



3. Check the ECM status.



NOTE

- VIRGIN: VIN is not programmed
- LEARNT: VIN has been already programmed

Is the ECM status "VIRGIN"?

YES

Go to next step 4.

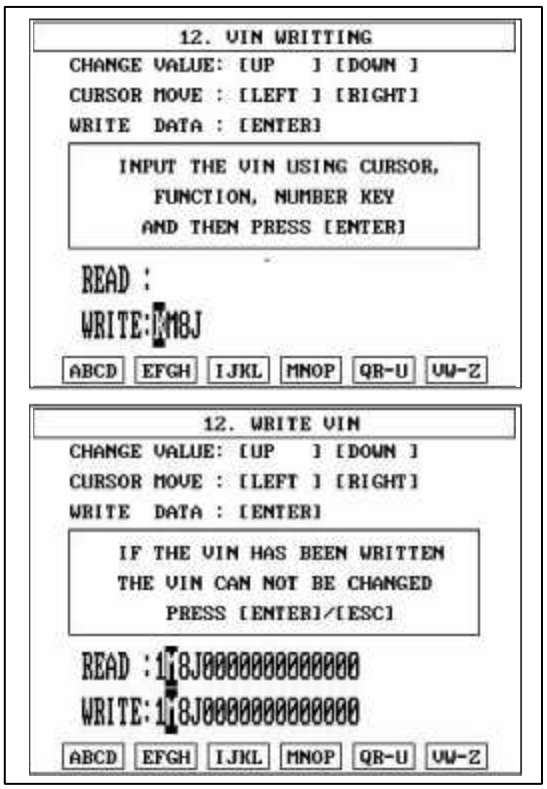
NO

END

4. Write the VIN with cursor, function and number keys.

WARNING

Before pressing the "ENTER" key, confirm the VIN again because the programmed VIN cannot be changed.



5. After verifying the written VIN, press the "ENTER" key.

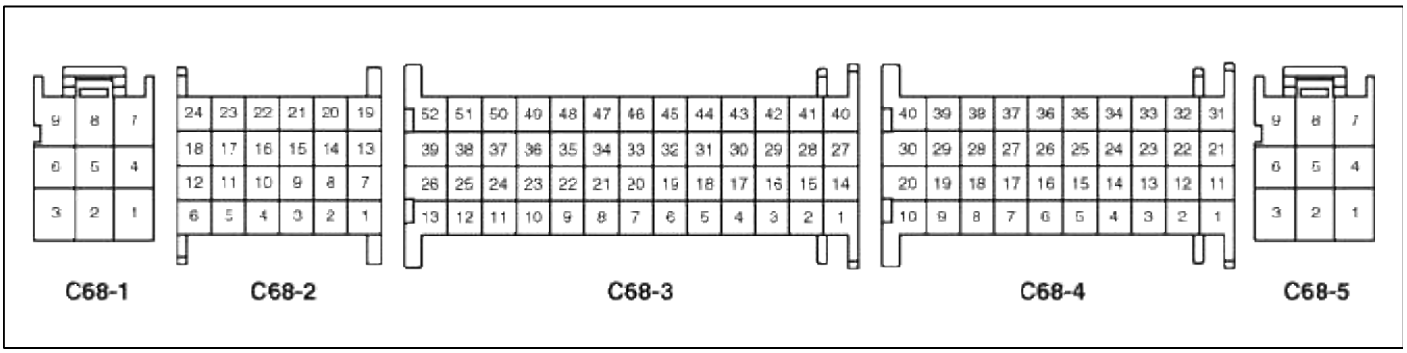
6. Turn the ignition switch OFF, and then turn ON.

7. Verify the programmed VIN in the ECM memory.

Fuel System > Engine Control System > Engine Control Module (ECM) > Specifications

ENGINE CONTROL MODULE (ECM)

1. ECM HARNESS CONNECTOR



2. ECM TERMINAL FUNCTION

CONNECTOR [C68-1]

Pin No.	Description	Connected to	Remark
1	Ignition switch signal input	Ignition Switch	
2	Not connected		
3	Diagnostic Data Line (k-Line)	Data Link Connector (DLC)	
4	ECM ground	Chassis ground	
5	Power stage ground	Chassis ground	
6	Power stage ground	Chassis ground	
7	Battery voltage supply	Battery	
8	Battery Voltage Supply after Main Relay	Main Relay	
9	Battery Voltage Supply after Main Relay	Main Relay	

CONNECTOR [C68-2]

Pin No.	Description	Connected to	Remark
1	Heated Oxygen Sensor Heater (B1/S1) control	Heated Oxygen Sensor (B1/S1)	
2	Not connected		
3	Not connected		
4	Not connected		
5	Not connected		
6	Not connected		
7	Heated Oxygen Sensor (B1/S2) Heater control	Heated Oxygen Sensor (B1/S2)	
8	Not connected		
9	Not connected		
10	Not connected		
11	Not connected		
12	Not connected		
13	Heated Oxygen Sensor (B2/S1) Heater control	Heated Oxygen Sensor (B2/S1)	
14	Heated Oxygen Sensor (B1/S1) signal input	Heated Oxygen Sensor (B1/S1)	
15	Heated Oxygen Sensor (B2/S1) signal input	Heated Oxygen Sensor (B2/S1)	
16	Heated Oxygen Sensor (B1/S2) signal input	Heated Oxygen Sensor (B1/S2)	
17	Fuel Consumption signal output	Trip Computer	
18	Heated Oxygen Sensor (B2/S2) signal input	Heated Oxygen Sensor (B2/S2)	
19	Heated Oxygen Sensor (B2/S2) Heater control	Heated Oxygen Sensor (B2/S2)	
20	Heated Oxygen Sensor (B1/S1) ground	Heated Oxygen Sensor (B1/S1)	
21	Heated Oxygen Sensor (B2/S1) ground	Heated Oxygen Sensor (B2/S1)	
22	Heated Oxygen Sensor (B1/S2) ground	Heated Oxygen Sensor (B1/S2)	
23	Main Relay control output	Main Relay	
24	Heated Oxygen Sensor (B2/S2) ground	Heated Oxygen Sensor (B2/S2)	

CONNECTOR [C68-3]

Pin No.	Description	Connected to	Remark

1	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)	
2	Not connected		
3	Not connected		
4	Not connected		
5	Not connected		
6	Not connected		
7	Not connected		
8	Crankshaft Position Sensor signal input	Crankshaft Position Sensor (CKPS)	
9	Not connected		
10	Throttle Position Sensor supply	Throttle Position Sensor (TPS)	
11	Not connected		
12	Not connected		
13	Not connected		
14	Not connected		
15	Not connected		
16	Not connected		
17	Mass Air Flow Sensor ground	Mass Air Flow Sensor (MAFS)	
18	Not connected		
19	Throttle Position Sensor signal input	Throttle Position Sensor (TPS)	
20	Throttle Position Sensor ground	Throttle Position Sensor (TPS)	
21	Crankshaft Position Sensor ground	Crankshaft Position Sensor (CKPS)	
22	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)	
23	Intake Air Temperature Sensor ground	Intake Air Temperature Sensor (IATS)	
24	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)	
25	Engine Coolant Temperature Sensor ground	Engine Coolant Temperature Sensor (ECTS)	
26	Power Steering Load input	Power Steering Switch	
27	Not connected		
28	Not connected		
29	Knock Sensor #1 (Cyl. #1, 3, 5) signal input	Knock Sensor (KS) #1	
30	Knock Sensor #1 (Cyl. #1, 3, 5) ground	Knock Sensor (KS) #1	
31	Knock Sensor #2 (Cyl. #2, 4, 6) signal input	Knock Sensor (KS) #2	
32	Knock Sensor #2 (Cyl. #2, 4, 6) signal input	Knock Sensor (KS) #2	

33	Injector (Cyl. 1) control output	Injector (Cyl. 1)	
34	Injector (Cyl. 2) control output	Injector (Cyl. 2)	
35	Injector (Cyl. 3) control output	Injector (Cyl. 3)	
36	Injector (Cyl. 4) control output	Injector (Cyl. 4)	
37	Injector (Cyl. 5) control output	Injector (Cyl. 5)	
38	Injector (Cyl. 6) control output	Injector (Cyl. 6)	
39	Not connected		
40	Not connected		
41	Not connected		
42	Purge Control Solenoid Valve PWM output	Purge Control Solenoid Valve (PCSV)	
43	Not connected		
44	Not connected		
45	Intake Manifold Tuning Valve #1 (Surge Tank Side) control output	Intake Manifold Tuning Valve #1 (Surge Tank Side)	
46	Idle Speed Control Actuator PWM output 2 (OPEN)	Idle Speed Control Actuator (ISCA)	
47	Idle Speed Control Actuator PWM output 1 (CLOSE)	Idle Speed Control Actuator (ISCA)	
48	Knock Sensor Shield	Knock Sensor (KS)	
49	Not connected		
50	Not connected		
51	Not connected		
52	Intake Manifold Tuning Valve #2 (In-mani Side) control output	Intake Manifold Tuning Valve #2 (In-mani Side)]	

CONNECTOR [C68-4]

Pin No.	Description	Connected to	Remark
1	Not connected		
2	Not connected		
3	Not connected		
4	Fuel Tank Pressure Sensor Supply	Fuel Tank Pressure Sensor (FTPS)	
5	Fuel Level Sensor Supply Input	Fuel Level Sensor (FLS)	
6	Not connected		
7	Camshaft Position Sensor signal input	Camshaft Position Sensor (CMPS)	
8	Camshaft Position Sensor ground	Camshaft Position Sensor (CMPS)	

9	Not connected		
10	Fuel Pump Relay control output	Fuel Pump Relay	
11	Not connected		
12	Not connected		
13	Throttle Position PWM output	Other control modules	
14	Fuel Tank Pressure Sensor ground	Fuel Tank Pressure Sensor (FTPS)	
15	Fuel Level Sensor ground	Fuel Level Sensor (FLS)	
16	Not connected		
17	Engine Speed signal output	Tachometer	
18	Cooling Fan Relay [Low] control output	Cooling Fan Relay	
19	Not connected		
20	Malfunction Indicating Lamp (MIL) output	Malfunction Indicating Lamp (MIL)	
21	Not connected		
22	Vehicle speed signal input	ABS Control Module	- With ABS
23	Air conditioner switch [Low/High] signal input	Triple Switch	
24	Air conditioner switch signal input	Air Conditioner Switch	
25	Air conditioner switch [Middle] signal input	Triple Switch	
26	Not connected		
27	Not connected		
28	Not connected		
29	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay	
30	Canister Close Valve Control Output	Canister Close Valve (CCV)	
31	Not connected		
32	Not connected		
33	Not connected		
34	Fuel Tank Pressure Sensor Signal Input	Fuel Tank Pressure Sensor (FTPS)	
35	Not connected		
36	CAN [HIGH]	Other control modules (TCM, ABS, etc.)	
37	CAN [LOW]	Other control modules (TCM, ABS, etc.)	
38	Wheel Speed Sensor (WSS) ground	Wheel Speed Sensor (WSS)	- Wthout ABS
39	Wheel Speed Sensor (WSS) signal input	Wheel Speed Sensor (WSS)	

40	Cooling Fan Relay [High] control output	Cooling Fan Relay	

CONNECTOR [C68-5]

Pin No.	Description	Connected to	Remark
1	Ignition coil #3 (Cyl. #3,6) control output	Ignition coil #3 (Cyl. #3,6)	
2	Ignition coil #2 (Cyl. #2,5) control output	Ignition coil #2 (Cyl. #2,5)	
3	Ignition coil #1 (Cyl. #1,4) control output	Ignition coil #1 (Cyl. #1,4)	
4	Not connected		
5	Ignition Coil shield	Ignition Coil and Chassis ground	
6	Not connected		
7	Not connected		
8	Not connected		
9	Not connected		

3. ECM TERMINAL INPUT/OUTPUT SIGNAL

CONNECTOR [C68-1]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Ignition switch signal input	DC	IG OFF	Max. 0.5 V	14.69V
			IG ON	Vbatt	0V
2	Not connected				
3	Diagnostic Data Line (k-Line)	Pulse	When transmitting	Hi: Min. Vbatt×80% Lo: Max. Vbatt×20%	High: 10.687V Low: 0.125V Vbatt: 14V
			When receiving	Hi: Min. Vbatt×70% Lo: Max. Vbatt×30%	
4	ECM ground	DC	Idle	Max. 50 mV	-
5	Power stage ground	DC	Idle	Max. 50 mV	-
6	Power stage ground	DC	Idle	Max. 50 mV	-
7	Battery voltage supply	DC	Always	Vbatt	14.625V
8	Battery Voltage Supply after Main Relay	DC	IG OFF	Max. 1.0 V	14.3V
			IG ON	Vbatt	0.0625V
9	Battery Voltage Supply after Main Relay	DC	IG OFF	Max. 1.0 V	14.3V
			IG ON	Vbatt	0.0625V

CONNECTOR [C68-2]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Heated Oxygen Sensor Heater (B1/S1) control	Pulse	Engine Run	High: Vbatt	14.687V
				Low: Max. 1.0V	0.25V
				Freguency: 10Hz	
2	Not connected				
3	Not connected				
4	Not connected				
5	Not connected				
6	Not connected				
7	Heated Oxygen Sensor (B1/S2) Heater control	Pulse	Engine Run	High: Vbatt	14.5V
				Low: Max. 1.0V	0.313V
				Freguency: 10Hz	
8	Not connected				
9	Not connected				
10	Not connected				
11	Not connected				
12	Not connected				
13	Heated Oxygen Sensor (B2/S1) Heater control	Pulse	Engine Run	High: Vbatt	14.562V
				Low: Max. 1.0V	0.25V
				Freguency: 10Hz	
14	Heated Oxygen Sensor (B1/S1) signal input	DC	When racing	Rich: 0.6 ~ 1.0V	0.83V
				Lean: 0 ~ 0.4V	0.37V
15	Heated Oxygen Sensor (B2/S1) signal input	DC	When racing	Rich: 0.6 ~ 1.0V	0.86V
				Lean: 0 ~ 0.4V	0.46V
16	Heated Oxygen Sensor (B1/S2) signal input	DC	When racing	Rich: 0.6 ~ 1.0V	0.95V
				Lean: 0 ~ 0.4V	0.16V
17	Fuel Consumption signal output	Pulse	Idle	High: Vbatt or Vcc	13.812V
				Low: Max. 0.5V	0V
				Freguency: 4Hz	
18	Heated Oxygen Sensor (B2/S2) signal input	DC	When racing	Rich: 0.6 ~ 1.0V	0.952V
				Lean: 0 ~ 0.4V	0.166V
19	Heated Oxygen Sensor (B2/S2) Heater control	Pulse	Engine Run	High: Vbatt	14.562V
				Low: Max. 1.0V	0.375V
				Freguency: 10Hz	
20	Heated Oxygen Sensor (B1/S1) ground	DC	Idle	Max. 50mV	15.573mV

21	Heated Oxygen Sensor (B2/S1) ground	DC	Idle	Max. 50mV	15.662mV
22	Heated Oxygen Sensor (B1/S2) ground	DC	Idle	Max. 50mV	15.525mV
23	Main Relay control output	DC	Relay ON	Max. 1.0V	0.75V
			Relay OFF	Vbatt	12.5V
24	Heated Oxygen Sensor (B2/S2) ground	DC	Idle	Max. 50mV	15.245mV

CONNECTOR [C68-3]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Mass Air Flow Sensor signal input	Analog	Idle	0 ~ 2.0V	0.788V
			3000 rpm	1.0 ~ 4.5V	1.942V
2	Not connected				
3	Not connected				
4	Not connected				
5	Not connected				
6	Not connected				
7	Not connected				
8	Crankshaft Position Sensor signal input	Pulse	Idle	High: Vcc or Vbatt	4.988V
				Low: Max. 1.0V	0.188V
				Frequency: 524Hz	
9	Not connected				
10	Throttle Position Sensor supply	DC	IG OFF	Max. 0.5V	0V
			IG ON	4.9 ~ 5.1V	5.0375V
11	Not connected				
12	Not connected				
13	Not connected				
14	Not connected				
15	Not connected				
16	Not connected				
17	Mass Air Flow Sensor ground	DC	Idle	Max. 50 mV	31.43mV
18	Not connected				
19	Throttle Position Sensor signal input	Analog	C.T	0.25 ~ 0.9V	0.35V
			W.O.T	Min. 4.0V	4.18V
20	Throttle Position Sensor ground	DC	Idle	Max. 50 mV	21.14mV
21	Crankshaft Position Sensor ground	DC	Idle	Max. 50 mV	11.85mV

22	Intake Air Temperature Sensor signal input	Analog	Idle	0 ~ 5V	1.525V at 78°C
23	Intake Air Temperature Sensor ground	DC	Idle	Max. 50 mV	11.93mV
24	Engine Coolant Temperature Sensor signal input	Analog	Idle	0.5 ~ 4.5V	1.09V at 93°C
25	Engine Coolant Temperature Sensor ground	DC	Idle	Max. 50 mV	12.27mV
26	Power Steering Load input	DC	S/W ON	Max. 0.5V	0V
			S/W OFF	Vbatt	11.5V
27	Not connected				
28	Not connected				
29	Knock Sensor #1 (Cyl. #1, 3, 5) signal input	Frequency	Knocking	-0.3 ~ 0.3 V	
			Normal	0 V	
30	Knock Sensor #1 (Cyl. #1, 3, 5) ground				
31	Knock Sensor #2 (Cyl. #2, 4, 6) signal input	Frequency	Knocking	-0.3 ~ 0.3 V	
			Normal	0 V	
32	Knock Sensor #2 (Cyl. #2, 4, 6) ground				
33	Injector (Cyl. 1) control output	Pulse	Idle	High: Vbatt	14V
34	Injector (Cyl. 2) control output			Low: Max . 1.0V	0.25V
35	Injector (Cyl. 3) control output			Vpeak : Max. 70V	48.625V
36	Injector (Cyl. 4) control output			Frequency: 5.5Hz	
37	Injector (Cyl. 5) control output				
38	Injector (Cyl. 6) control output				
39	Not connected				
40	Not connected				
41	Not connected				
42	Purge Control Solenoid Valve PWM output	Pulse	Inactive Active	High: Vbatt	14.312V
				Low: Max. 1.0V	0.125V
				Vpeak: Max. 70V	48.375V
				Frequency: 20Hz	
43	Not connected				
44	Not connected				
45	Intake Manifold Tuning Valve #1 (Surge Tank Side) control output	DC (20Hz)	Inactive	Max. 1.0 V	0.0625V
			Active	Vbatt	15.125V

46	Idle Speed Control Actuator PWM output 2 (OPEN)	Pulse	Idle	High: Vbatt	15.125V
				Low: Max . 1.0V	0.125V
				Frequency: 100Hz	
47	Idle Speed Control Actuator PWM output 1 (CLOSE)	Pulse	Idle	High: Vbatt	15.187V
				Low: Max . 1.0V	0.0625V
				Frequency: 100Hz	
48	Knock Sensor Shield	DC	Idle	Max. 50 mV	11.63mV
49	Not connected				
50	Not connected				
51	Not connected				
52	Intake Manifold Tuning Valve #2 (In-mani Side) control output	DC (20Hz)	Inactive	Max. 1.0 V	0V
			Active	Vbatt	15.125V

CONNECTOR [C68-4]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Not connected				
2	Not connected				
3	Not connected				
4	Fuel Tank Pressure Sensor supply	DC	IG OFF	Max. 0.5V	0V
			IG ON	4.9 ~ 5.1V	5.05V
5	Fuel Level Sensor signal input	DC	IG ON	0V ~ Vbatt	2.93V
6	Not connected				
7	Camshaft Position Sensor signal input	Pulse	Idle	High: Vcc or Vbatt	5V
				Low: Max . 1.0V	0.625V
				Frequency: 10.99Hz	
8	Camshaft Position Sensor ground	DC	Idle	Max. 50 mV	-
9	Not connected				
10	Fuel Pump Relay control output	DC	Relay OFF	Vbatt	12.38V
			Relay ON	Max. 1.0V	0.125V
11	Not connected				
12	Not connected				
13	Throttle Position PWM output	Pulse	Idle	High: Vbatt	11.75V
				Low: Max. 0.5V	0V
				Frequency: 100Hz	
14	Fuel Tank Pressure Sensor ground	DC	Idle	Max. 50 mV	23.78V
15	Fuel Level Sensor ground	DC	Idle	Max. 50 mV	14.92V
16	Not connected				

17	Engine Speed signal output	Pulse	Idle	High: Vbatt	14.25V
				Low: Max. 0.5V	0V
				Frequency: 38.76Hz	
18	Cooling Fan Relay [Low] control output	DC	Relay OFF	Vbatt	14.312V
			Relay ON	Max. 1.0V	0.25V
19	Not connected				
20	Malfunction Indicating Lamp (MIL) output	DC	Lamp OFF	Vbatt	13.812V
			Lamp ON	Max. 1.0VVbatt	0.0625V
21	Not connected				
22	Vehicle speed signal input	Pulse	Vehicle Run	High: Min. 5.0V Low: Max. 0.5V Frequency: 250Hz	252Hz
23	Air conditioner switch [Low/High] signal input	DC	A/C OFF	Max. 0.5V	0V
			A/C ON	Vbatt	13.812V
24	Air conditioner switch signal input	DC	A/C OFF	Max. 1.0V	0V
			A/C ON	Vbatt	12.937V
25	Air conditioner switch [Middle] signal input	DC	MID OFF	Max. 0.5V	12.625V
			MID ON	Vbatt	0.0625V
26	Not connected				
27	Not connected				
28	Not connected				
29	Air Conditioner Compressor Relay control output	DC	A/C OFF	Vbatt	14.125V
			A/C ON	Max. 1.0V	0.125V
30	Canister Close Valve control output	DC	Active Inactive	High: Vbatt	14.125V
				Low: Max. 1.0V	0.125V
				Frequency: 10Hz	
31	Not connected				
32	Not connected				
33	Not connected				
34	Fuel Tank Pressure Sensor signal input	DC	Idle	0.4 ~ 4.6V	2.501V
35	Not connected				
36	CAN [HIGH]	Pulse	Recessive	2.0 ~ 3.0 V	2.275V
			Dominant	2.75~4.5 V	2.953V
37	CAN [LOW]	Pulse	Recessive	2.0 ~ 3.0 V	2.254V
			Dominant	0.5~2.25 V	1.552V
38	Wheel Speed Sensor (WSS) ground	DC	Idle	Max. 50 mV	40.83mV

39	Wheel Speed Sensor (WSS) signal input	Sine Wave	Vehicle Run	Vp-p: Min.0.2V Frequency: 100Hz	2.625V (10 mile)
40	Cooling Fan Relay - High control output	DC	Relay OFF	Vbatt	14.625V
			Relay ON	Max. 1.0V	0.188V

CONNECTOR [C68-5]

Pin	Description	Type	Vehicle State	Level	Test Result
1	Ignition coil #3 (Cyl. #3,6) control output	Pulse	Idle	1st Voltage: 300~400V	362V
				ON Voltage: Max. 2.0V	1.5V
2	Ignition coil #2 (Cyl. #2,5) control output	Pulse	Idle	1st Voltage: 300~400V	363.25V
				ON Voltage: Max. 2.0V	1.5V
3	Ignition coil #1 (Cyl. #1,4) control output	Pulse	Idle	1st Voltage: 300~400V	361.75V
				ON Voltage: Max. 2.0V	1.5V
4	Not connected				
5	Ignition Coil shield	DC	Idle	Max. 50 mV	-12.575mV
6	Not connected				
7	Not connected				
8	Not connected				
9	Not connected				

Fuel System > Troubleshooting > Troubleshooting

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)

DTC	Description	MIL	PAGE
U0101	Serial Communication Problem with TCM (Timeout)	●	
P0030	HO2S Heater Control Circuit (Bank 1 / Sensor 1)	●	
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)	●	
P0050	HO2S Heater Control Circuit (Bank 2 / Sensor 1)	●	
P0051	HO2S Heater Circuit Low (Bank 2 / Sensor 1)	●	

P0052	HO2S Heater Circuit High (Bank 2 / Sensor 1)	●	
P0056	HO2S Heater Control Circuit (Bank 2 / Sensor 2)	●	
P0057	HO2S Heater Circuit Low (Bank 2 / Sensor 2)	●	
P0058	HO2S Heater Circuit High (Bank 2 / Sensor 2)	●	
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	●	
P0111	Intake Air Temperature Sensor1 Circuit Range/Performance	●	
P0112	Intake Air Temperature Sensor1 Circuit Low Input	●	
P0113	Intake Air Temperature Sensor1 Circuit High Input	●	
P0116	Engine Coolant Temperature Circuit Range/Performance	●	
P0117	Engine Coolant Temperature Circuit Low Input	●	
P0118	Engine Coolant Temperature Circuit High Input	●	
P0119	Engine Coolant Temperature Circuit Intermittent	●	
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	●	
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	●	
P0128	Coolant Thermostat (Coolant Temp. below Thermostat Regulating Temp.)	●	
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)	●	
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)	●	
P0150	HO2S Circuit (Bank 2/ Sensor 1)	●	
P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)	●	
P0152	HO2S Circuit High Voltage (Bank 2 / Sensor 1)	●	
P0153	HO2S Circuit Slow Response (Bank 2 / Sensor 1)	●	
P0154	HO2S Circuit No Activity Detected (Bank 2 / Sensor 1)	●	
P0156	HO2S Circuit (Bank 2 / Sensor 2)	●	

P0157	HO2S Circuit Low Voltage (Bank 2 / Sensor 2)	●	
P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)	●	
P0159	HO2S Circuit Slow Response (Bank 2 / Sensor 2)	●	
P0160	HO2S Circuit No Activity Detected (Bank 2 / Sensor 2)	●	
P0170	Fuel Trim (Bank 1)	●	
P0171	System Too Lean (Bank 1)	●	
P0172	System Too Rich (Bank 1)	●	
P0173	Fuel Trim (Bank 2)	●	
P0174	System Too Lean (Bank 2)	●	
P0175	System Too Rich (Bank 2)	●	
P0230	Fuel Pump Primary 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	●	
P0273	Cylinder 5-Injector Circuit Low	●	
P0274	Cylinder 5-Injector Circuit High	●	
P0276	Cylinder 6-Injector Circuit Low	●	
P0277	Cylinder 6-Injector Circuit High	●	
P0300	Random/Multiple Cylinder Misfire Detected	●	
P0301	Cylinder 1-Misfire detected	●	
P0302	Cylinder 2-Misfire detected	●	
P0303	Cylinder 3-Misfire detected	●	
P0304	Cylinder 4-Misfire detected	●	
P0305	Cylinder 5-Misfire detected	●	
P0306	Cylinder 6-Misfire detected	●	
P0315	Segment Time Acquisition Incorrect	▲	
P0325	Knock Sensor 1 Circuit	▲	
P0330	Knock Sensor 2 Circuit	▲	
P0335	Crankshaft Position Sensor A Circuit	●	
P0340	Camshaft Position Sensor A Circuit Malfunction(Single Sensor)	●	
P0350	Ignition Coil Primary / Secondary Circuit	▲	

P0351	Ignition Coil 'A' Primary / Secondary Circuit	▲	
P0352	Ignition Coil 'B' Primary / Secondary Circuit	▲	
P0353	Ignition Coil 'C' Primary / Secondary Circuit	▲	
P0354	Ignition Coil 'D' Primary / Secondary Circuit	▲	
P0355	Ignition Coil 'E' Primary / Secondary Circuit	▲	
P0356	Ignition Coil 'F' Primary / Secondary Circuit	▲	
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●	
P0430	Catalyst System Efficiency below Threshold (Bank 2)	●	
P0441	Evap. Emission System Incorrect Purge Flow	●	
P0442	Evap. Emission System-Leak detected (small leak)	●	
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●	
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●	
P0447	Evap. Emission System-Vent Control Circuit Open	●	
P0448	Evap. Emission System-Vent Control Circuit Shorted	●	
P0449	Evap. Emission System-Vent valve / Solenoid circuit	●	
P0451	Evap. Emission System-Pressure Sensor Range / Performance	●	
P0452	Evap. Emission System-Pressure Sensor Low Input	●	
P0453	Evap. Emission System-Pressure Sensor High Input	●	
P0454	Evap. Emission System-Pressure Sensor Intermittent	●	
P0455	Evap. Emission System-Leak detected (Large leak)	●	
P0456	Evap. Emission System-Leak detected (Very small leak)	●	
P0461	Fuel Level Sensor "A" Circuit Range/Performance	▲	
P0462	Fuel Level Sensor "A" Circuit Low Input	▲	
P0463	Fuel Level Sensor "A" Circuit High Input	▲	
P0464	Fuel Level Sensor "A" Circuit Intermittent	▲	
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	●	
P0551	Power Steering Pressure Sensor/Switch Circuit Range/Performance	▲	
P0560	System Voltage	▲	
P0562	System Voltage Low	●	
P0563	System Voltage High	●	
P0605	Internal Control Module Read Only Memory(ROM) Error	●	
P0630	VIN not Programmed or Incompatible-ECM/PCM	●	
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲	
P0661	Intake Manifold Tuning Valve Control Circuit Low (Bank 1)	▲	

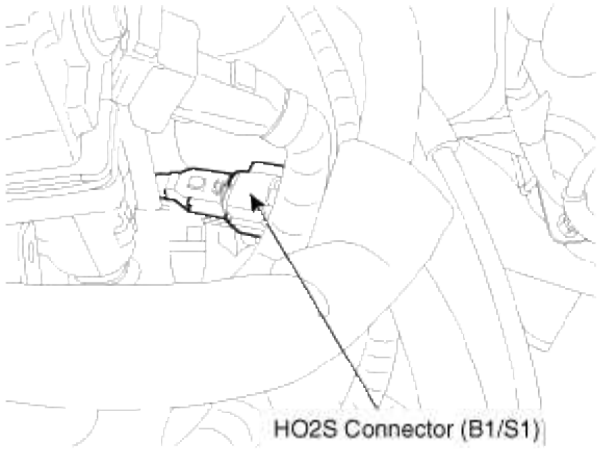
P0662	Intake Manifold Tuning Valve Control Circuit High (Bank 1)	▲	
P0664	Intake Manifold Tuning Valve Control Circuit Low (Bank 2)	▲	
P0665	Intake Manifold Tuning Valve Control Circuit High (Bank 2)	▲	
P0700	TCM Request for MIL On	●	
P1505	Idle Charge Actuator Signal Low of Coil #1	●	
P1506	Idle Charge Actuator Signal High of Coil #1	●	
P1507	Idle Charge Actuator Signal Low of Coil #2	●	
P1508	Idle Charge Actuator Signal High of Coil #2	●	
P1642	Non-Immobilizer-EMS connected to an Immobilizer	▲	

NOTE

●: MIL ON & FAULT CODE MEMORY
▲: MIL OFF & FAULT CODE MEMORY

Fuel System > Troubleshooting > P0030

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

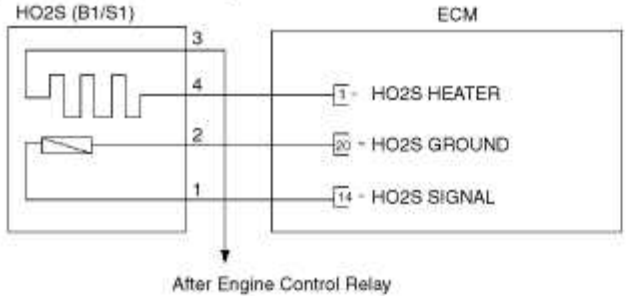
The ECM determines if a front HO2S heater fault has occurred and sets DTC P0030 if the front HO2S heater control driver inside the ECM fails, if HO2S is not operational (after an elapse of predetermined time) since engine start, or when the front HO2S tip temperature is out of normal working range. The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Evaluate O2 sensor element temperature via measuring element resistance	• Related fuse blown or missing • Heater control circuit open or short • Power supply circuit open or short • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Sensor preheating and full heating phases finished • Time after start elapsed: 240 sec. • 11V<Battery voltage<16V • 1%<Heater power<99% • Exhaust gas temp.model<610°C(1,130°F)	
Threshold Value	• O2 sensor element resistance >1100Ω	
Diagnostic Time	• 5 min.	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



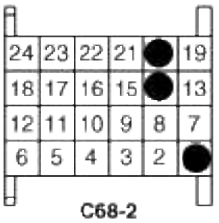
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(14)	Signal
2	ECM Terminal C68-2(20)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2 (1)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



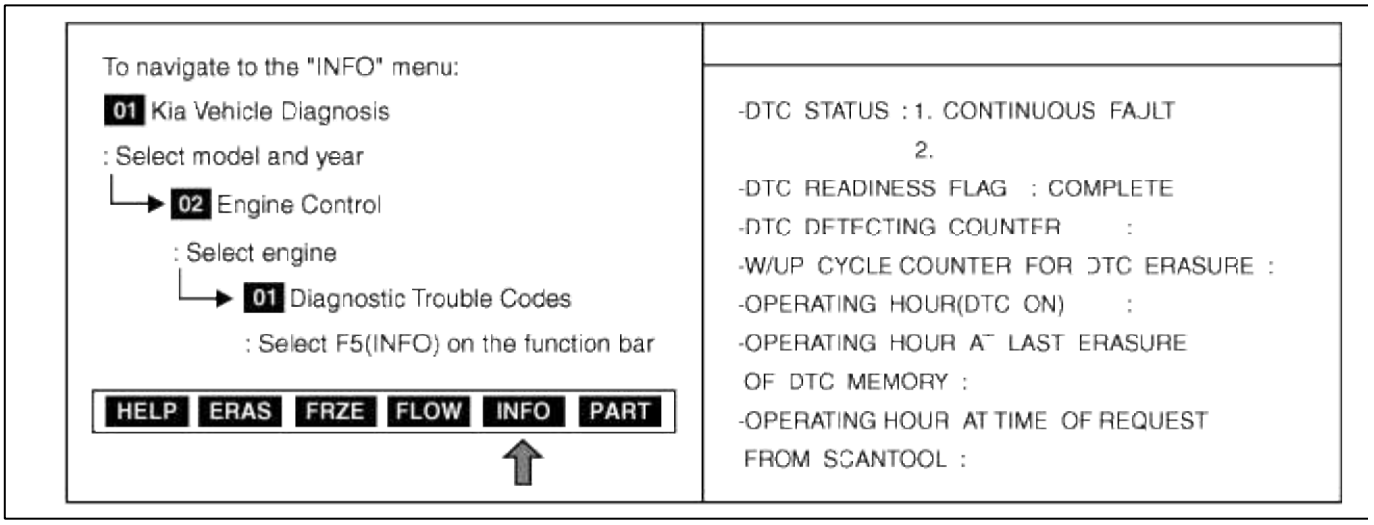
C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

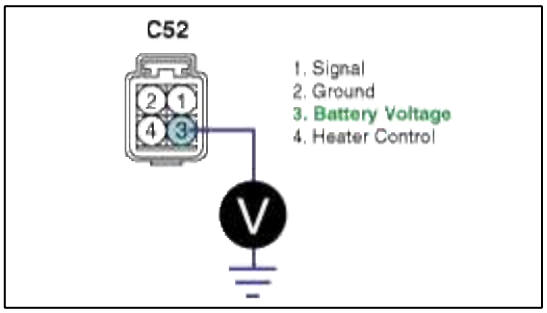
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

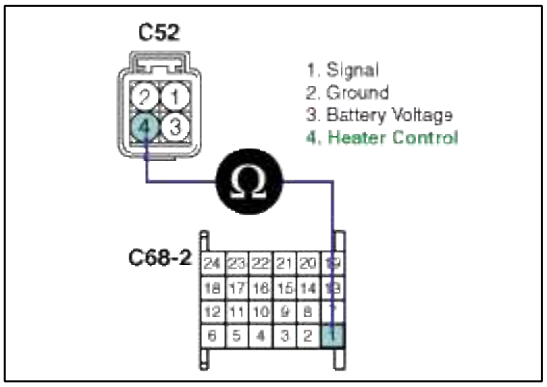
NO

Check for an open in the power supply circuit between the main relay and the Injector.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness
   (1) Ignition "OFF".
   (2) Disconnect ECM connector
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 1 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



   (4) Is resistance within the specification?

YES

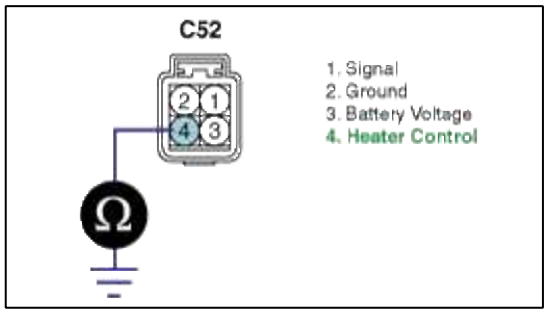
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit.
   (1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : infinite



   (2) Is resistance within the specification?

   YES

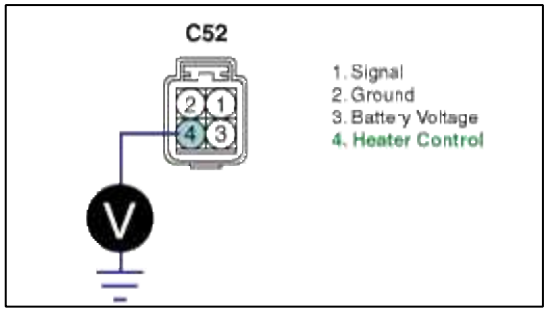
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in control circuit.
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure

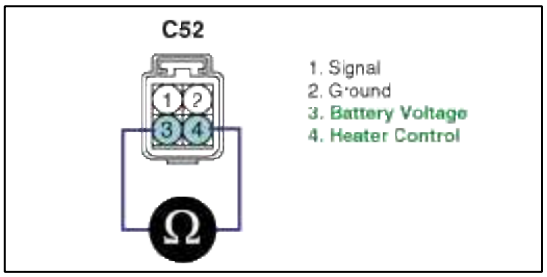
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω[at 20°C(68°F)]



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

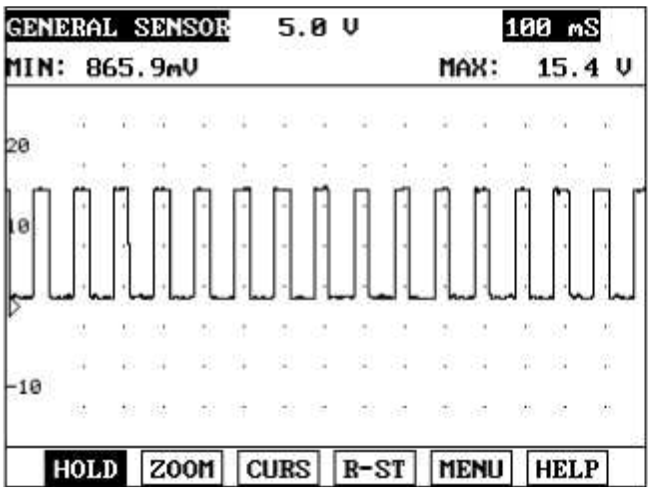
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



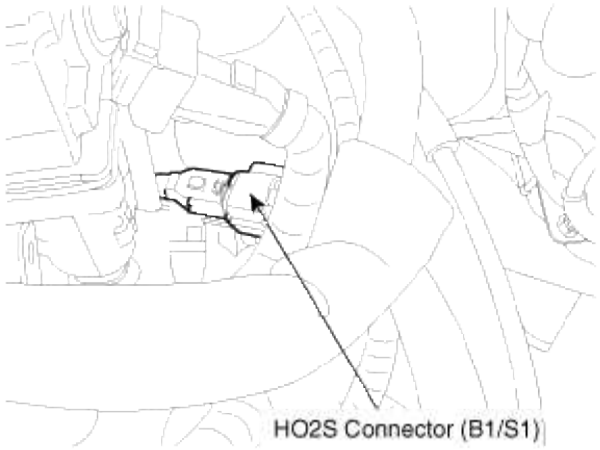
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0031

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The

ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

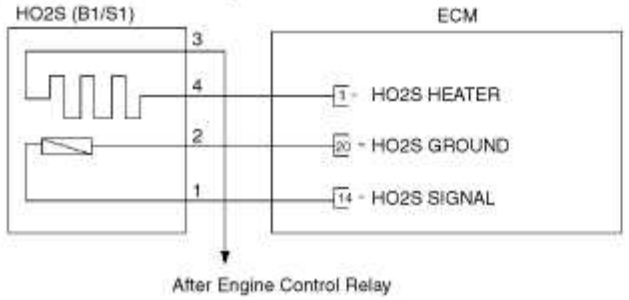
ECM sets DTC P0031 if the ECM detects that the front HO2S heater control circuit is short to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check short circuit to ground on front HO2S heater line	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage>10V • 1% <Heater power<99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



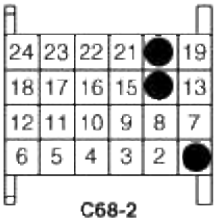
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(14)	Signal
2	ECM Terminal C68-2(20)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2 (1)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



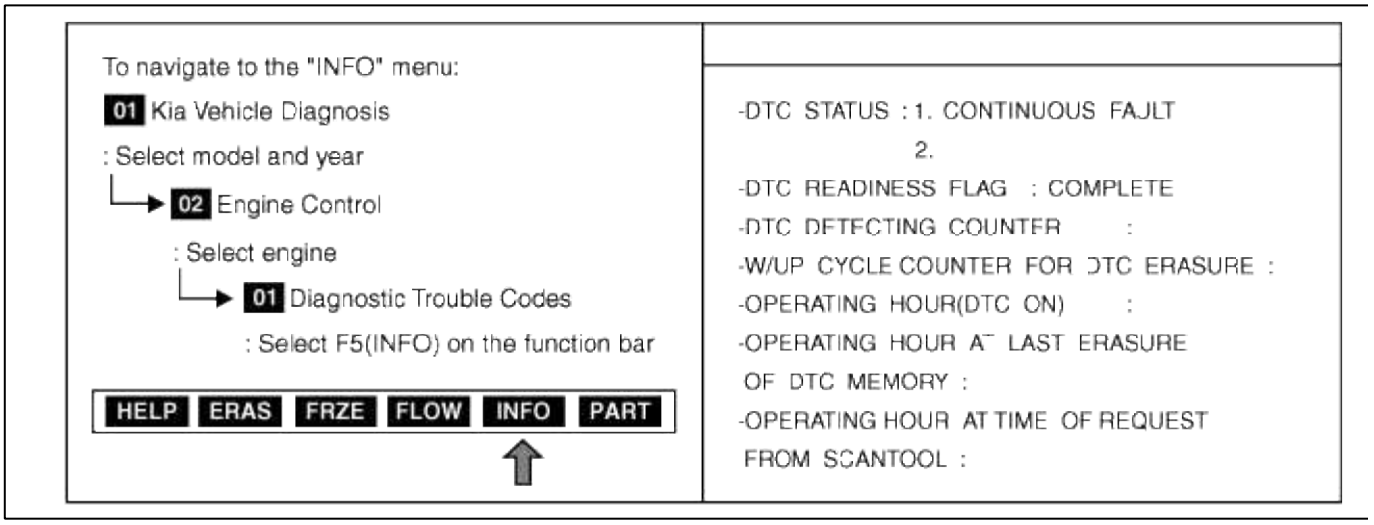
C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

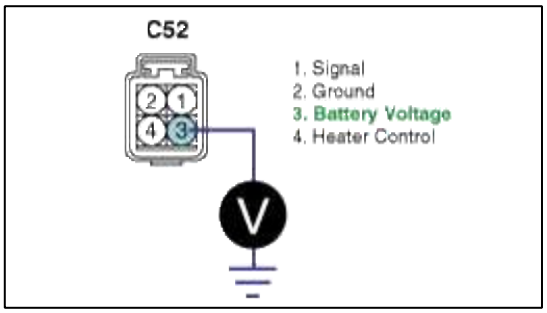
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

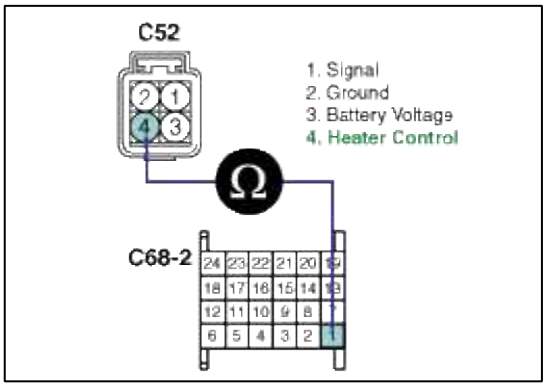
NO

Check for an open in the power supply circuit between the main relay and the Injector.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness
   (1) Ignition "OFF".
   (2) Disconnect ECM connector
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 1 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



   (4) Is resistance within the specification?

YES

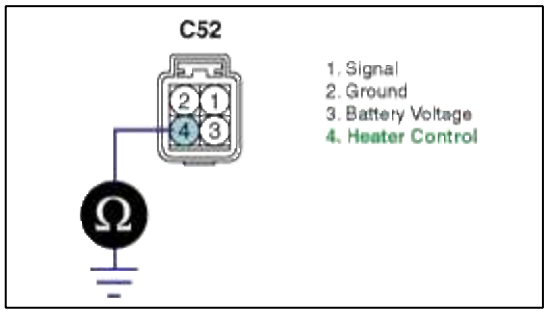
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit.
   (1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : infinite



   (2) Is resistance within the specification?

   YES

   Go to "Component Inspection" procedure.

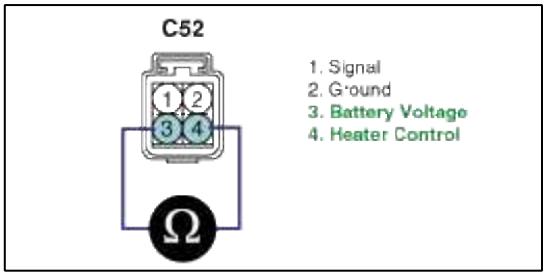
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

   Specification : 3~4Ω[at 20°C(68°F)]



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

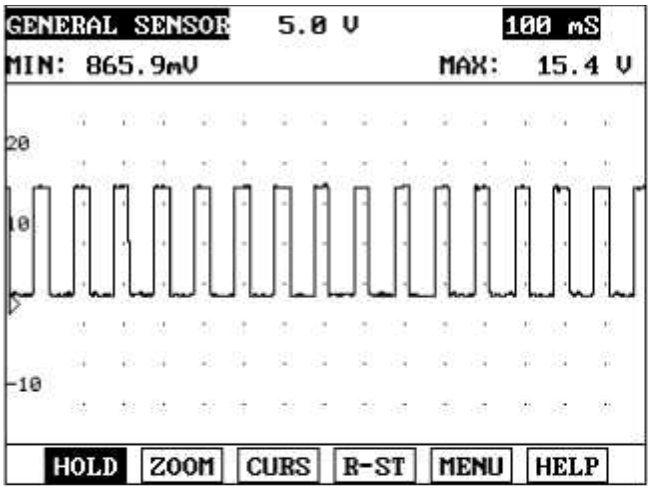
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



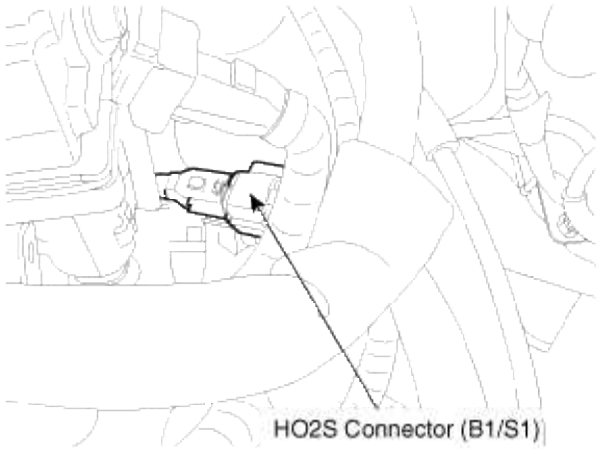
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0032

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

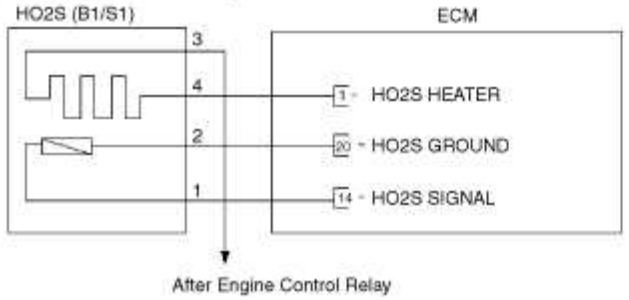
ECM sets DTC P0032 if the ECM detects that the front HO2S heater control line is open or short to battery circuit.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check open or short circuit to battery line on front HO2S heater line	• Open or short to battery in control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage>10V • 1%<Heater power<99%	
Threshold Value	• Open or short to Battery	
Diagnostic Time	• 20 sec.	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



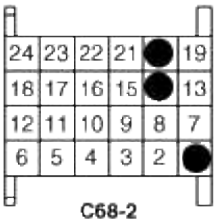
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(14)	Signal
2	ECM Terminal C68-2(20)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2 (1)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

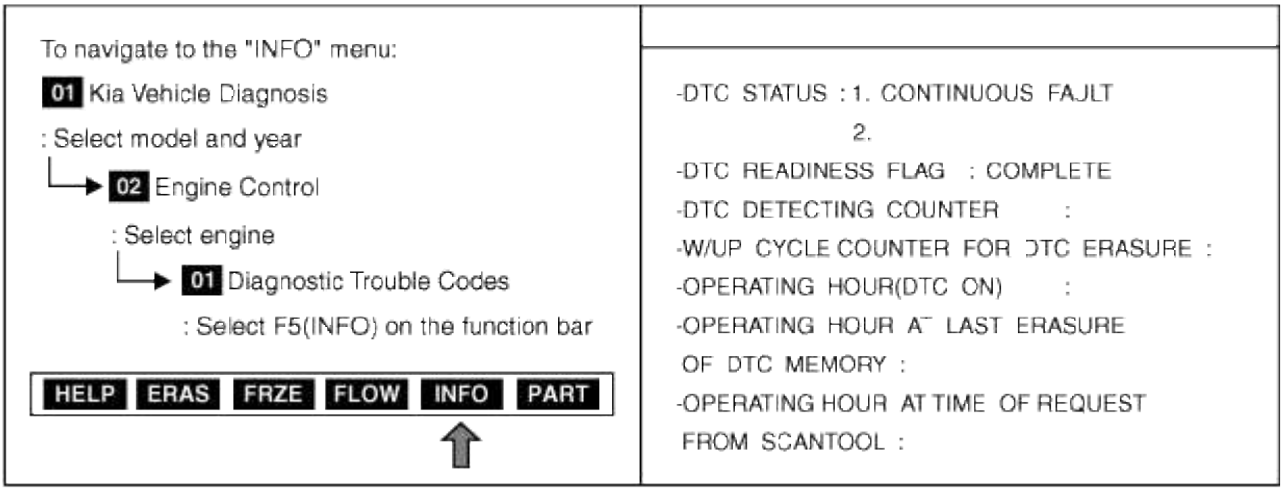


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

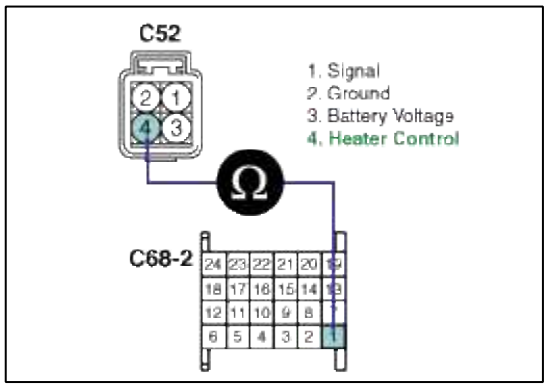
NO

Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness
   (1) Ignition "OFF".
   (2) Disconnect HO2S and ECM connectors.
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 1 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



   (4) Is resistance within the specification?

YES

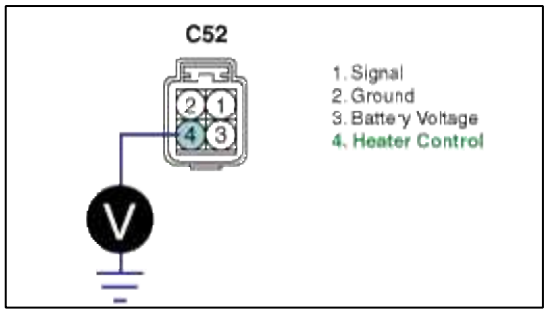
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in control circuit.
   (1) Reconnect the ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

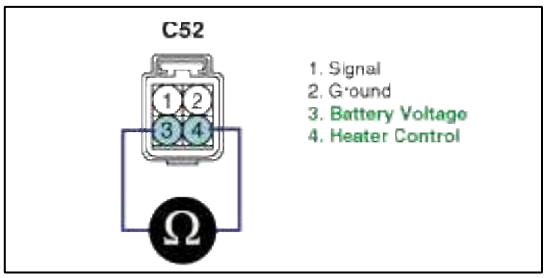
   YES
   Go to "Component Inspection" procedure.

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

   Specification : 3~4Ω[at 20°C(68°F)]



3. Is resistance within the specification?

   YES
   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO
   Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

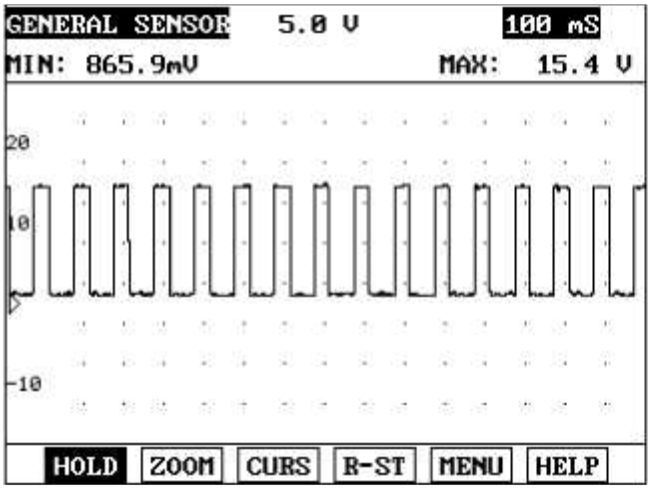
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



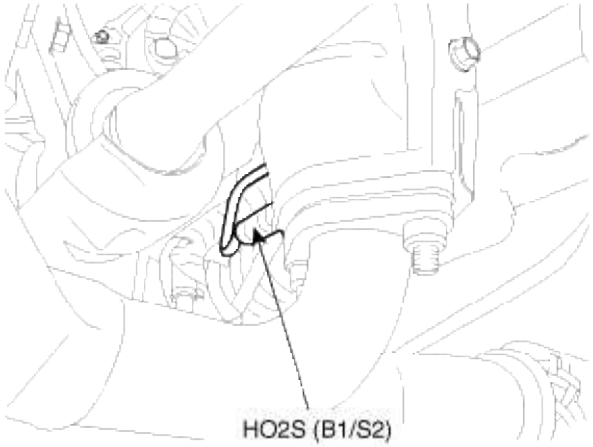
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0036

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

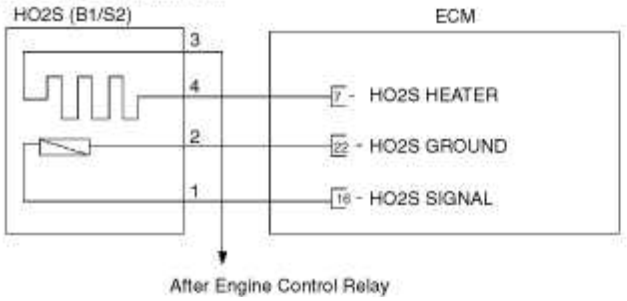
The ECM determines rear HO2S heater fault and sets DTC P0036 if measured rear HO2S resistance is lower than the predetermined threshold. The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Evaluate O2 sensor element temperature via measuring element resistance	• Related fuse blown or missing • Heater control circuit open or short • Power supply circuit open or short • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Sensor preheating and full heating phases finished • Time after start elapsed:180 sec. • 11V< Battery voltage<16V • 1%< Heater power< 99% • Exhaust gas temp.model<710°C(1,310°F)	
Threshold Value	• O2 sensor element resistance >2000Ω	
Diagnostic Time	• 5 min.	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



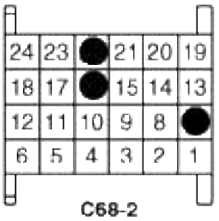
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(16)	Signal
2	ECM Terminal C68-2(22)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(7)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

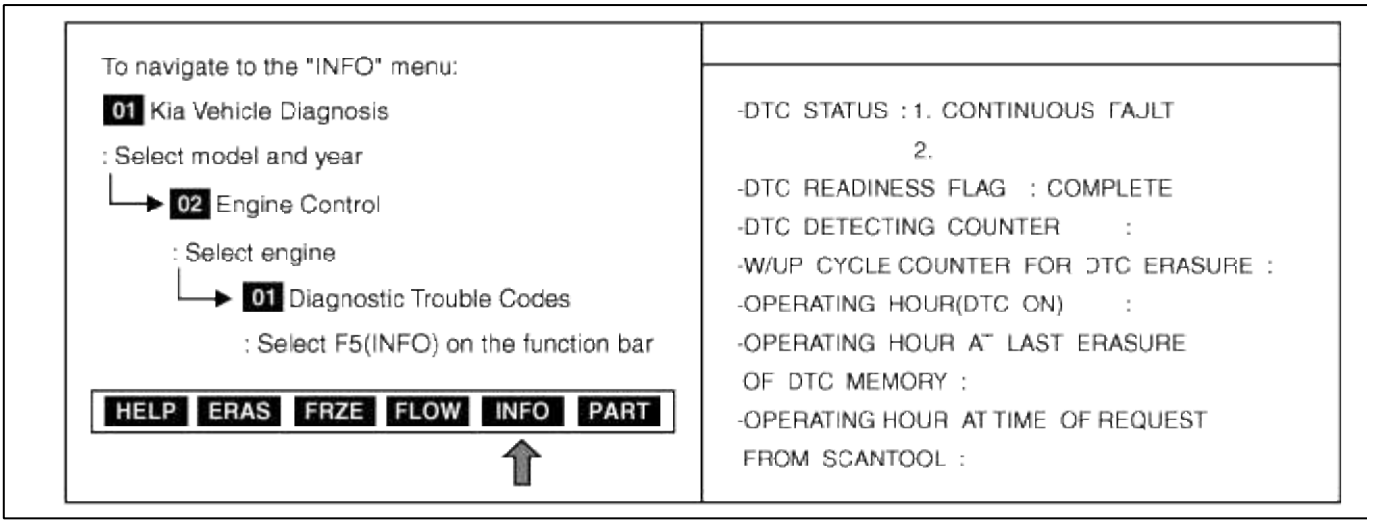


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

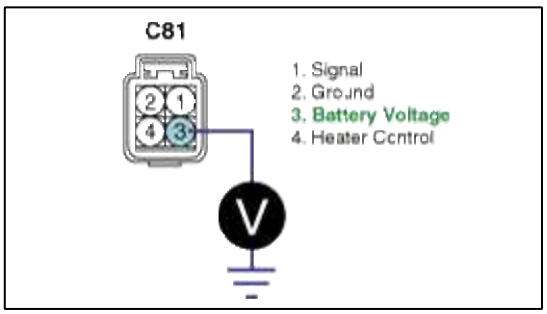
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

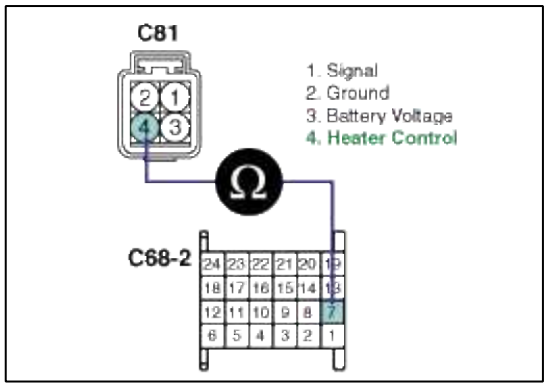
NO

Check for an open in the power supply circuit between the main relay and the HO2S.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 4 of the HO2S heater harness connector and 7 of the ECM harness connector(C68-2).

   Specification : Approx. 0Ω



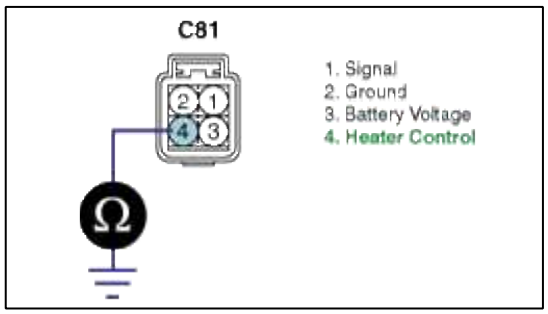
   (3) Is resistance within the specification?

   YES
   Go to next step as below.

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit.
   (1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : infinite



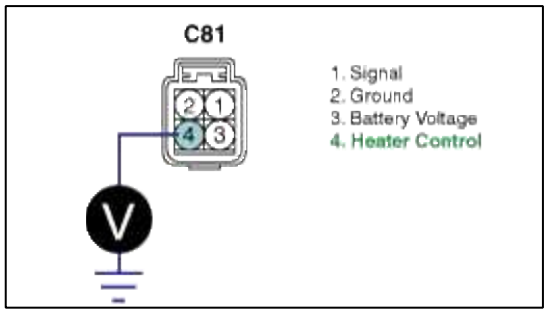
   (2) Is resistance within the specification?

   YES
   Go to next step as below.

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in control circuit.
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure

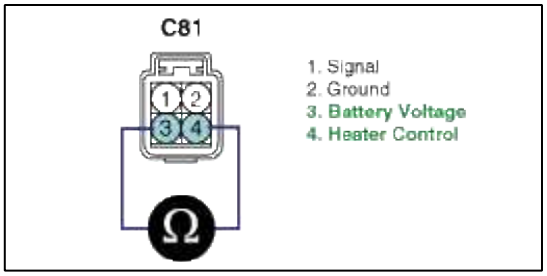
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

   Specification : 3~4Ω[at 20°C(68°F)]



2. Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

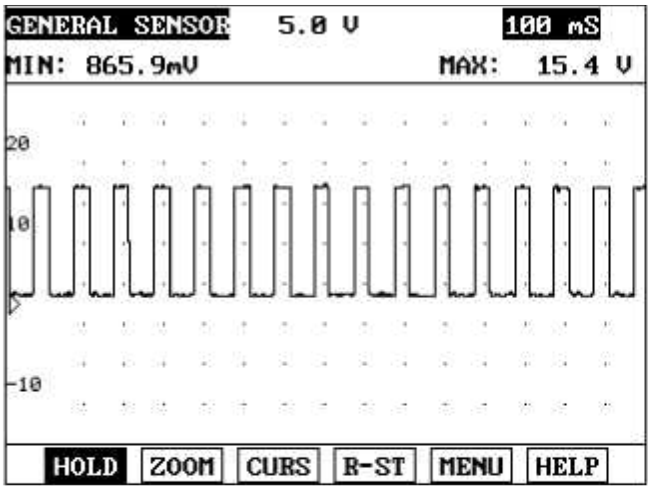
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



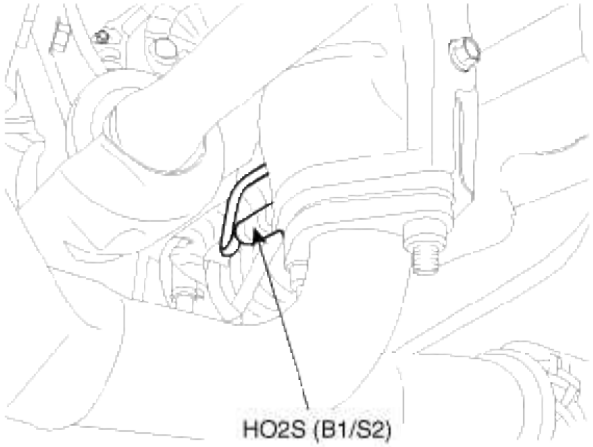
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0037

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

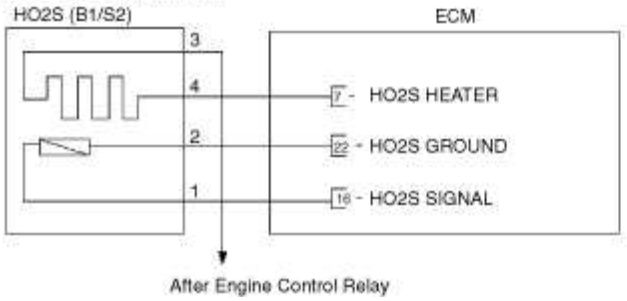
ECM sets DTC P0037 if the ECM detects that the rear HO2S heater control line is short to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check short circuit to ground on front HO2S heater line	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage>10V • 1%<Heater power<99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec.	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



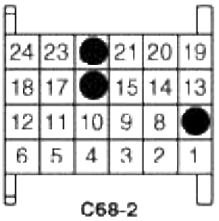
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(16)	Signal
2	ECM Terminal C68-2(22)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(7)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

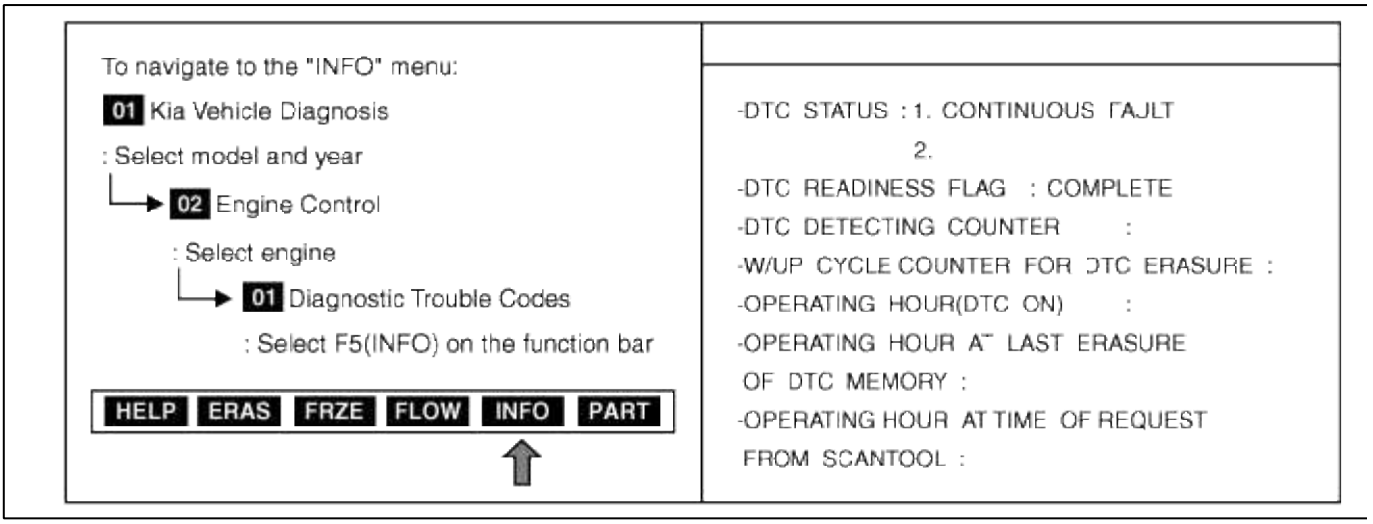


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

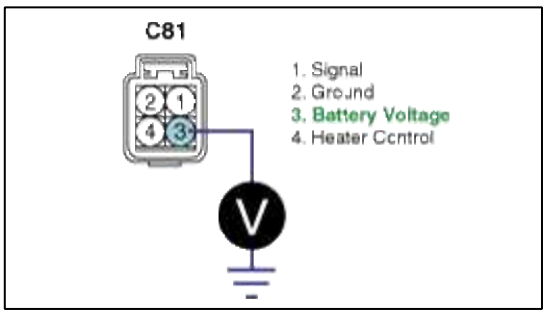
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

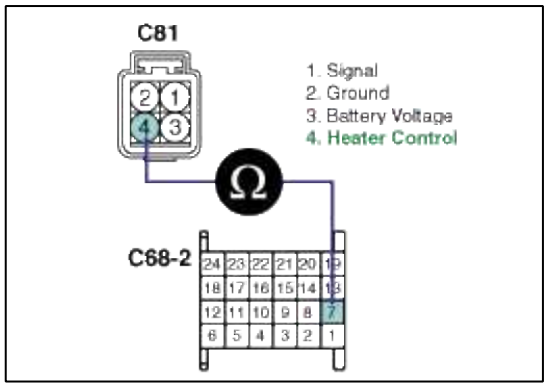
NO

Check for an open in the power supply circuit between the main relay and the Injector.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 4 of the HO2S heater harness connector and 7 of the ECM harness connector(C68-2).

   Specification : Approx. 0Ω



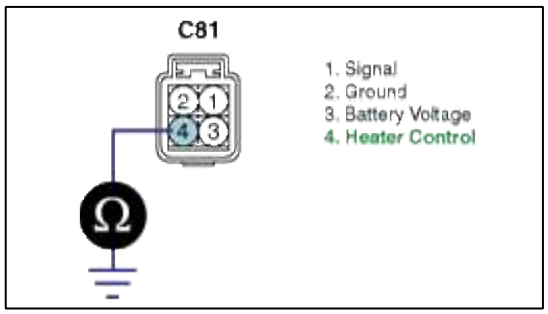
   (3) Is resistance within the specification?

   YES
   Go to next step as below.

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit.
   (1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : infinite



   (2) Is resistance within the specification?

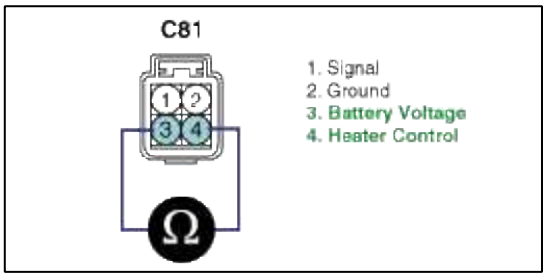
   YES
   Go to "Component Inspection" procedure.

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω[at 20°C(68°F)]



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

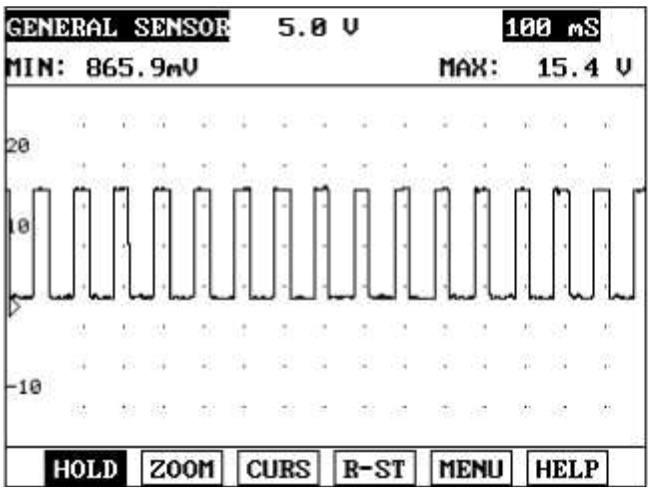
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



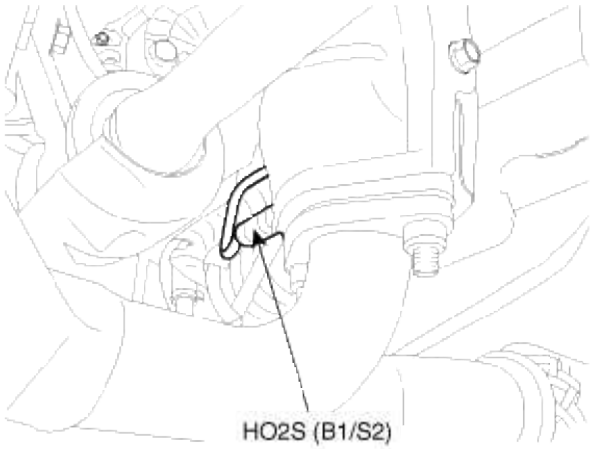
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0038

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM

provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, the temperature in the resistor of the sensor rises, the current drops gradually.

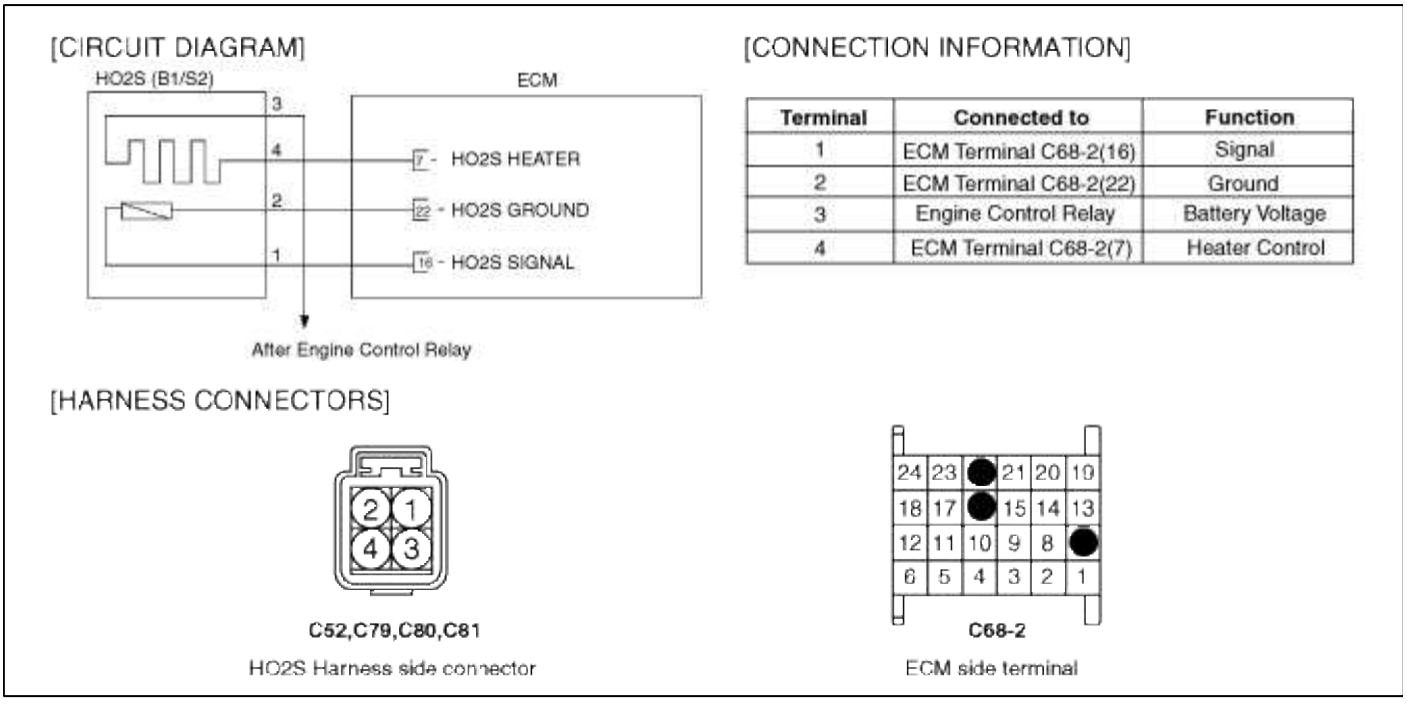
DTC DESCRIPTION

ECM sets DTC P0038 if the ECM detects that the rear HO2S heater control line is open or short to battery line.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check open or short circuit to battery line on front HO2S heater line	• Open or short to battery in control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage>10V • 1%<Heater power<99%	
Threshold Value	• Open or short to Battery	
Diagnostic Time	• 20 sec.	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

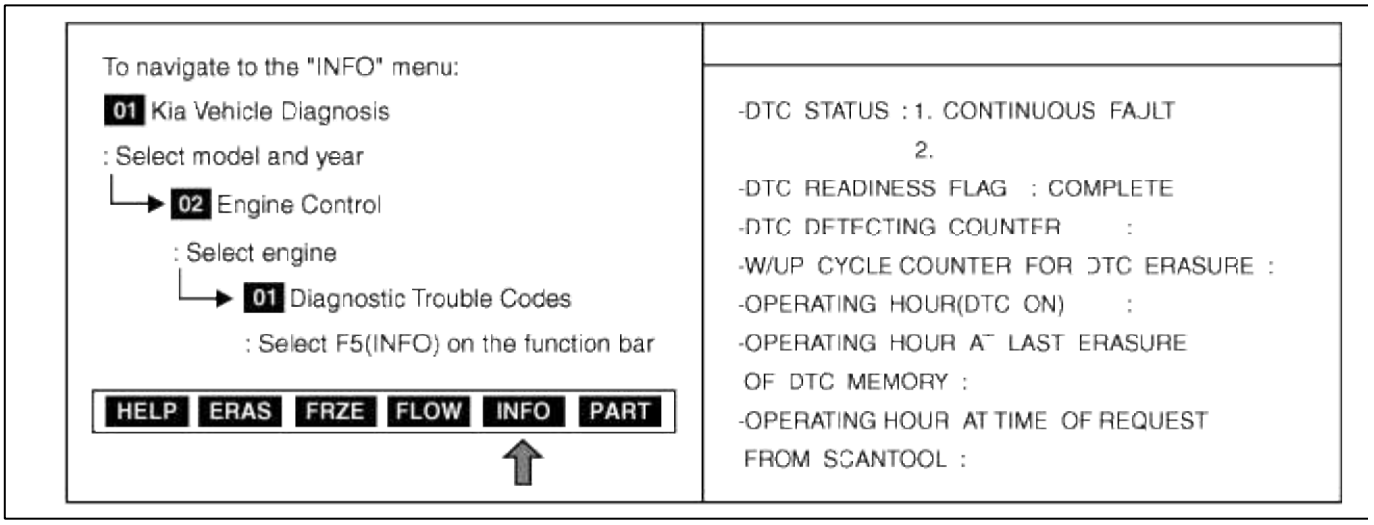
SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

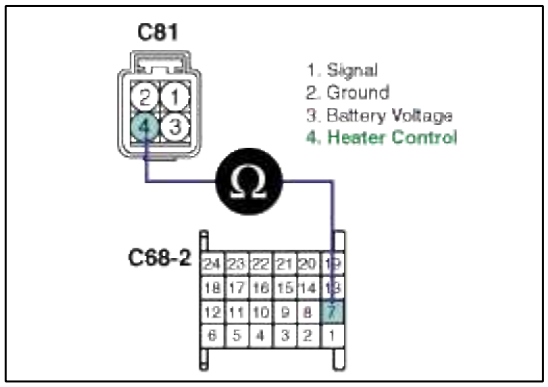
NO

Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness
   (1) Ignition "OFF".
   (2) Disconnect HO2S and ECM connectors.
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 7 of the ECM harness connector(C68-2).

   Specification : Approx. 0Ω



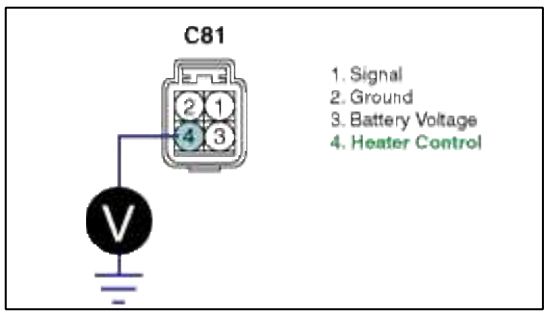
   (4) Is resistance within the specification?

   YES
   Go to next step as below.

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit.
   (1) Reconnect the ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES
   Go to "Component Inspection" procedure.

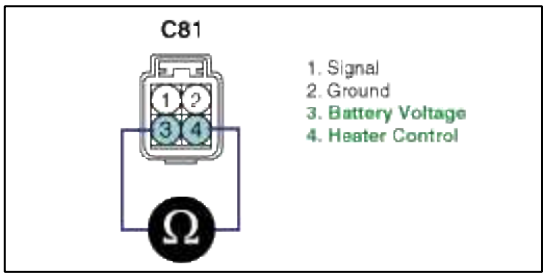
   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".

2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω[at 20°C(68°F)]



3. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

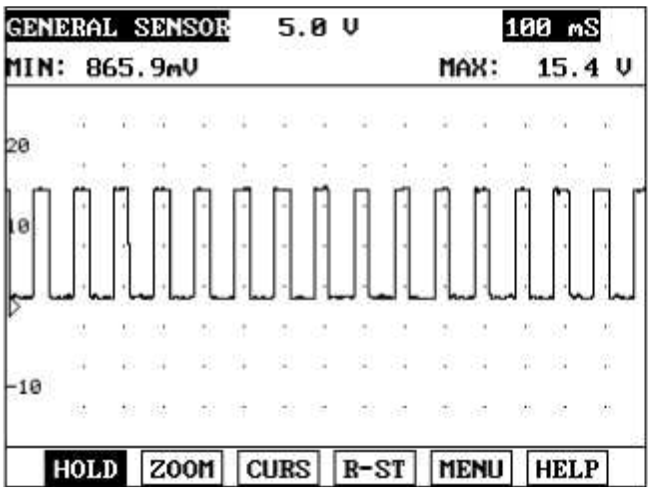
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



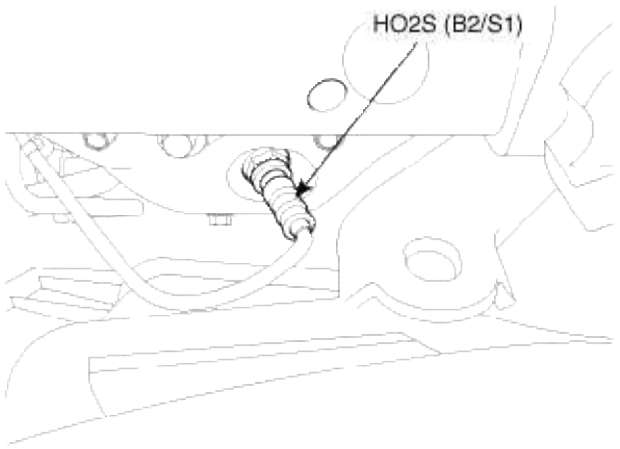
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0050

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The

ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

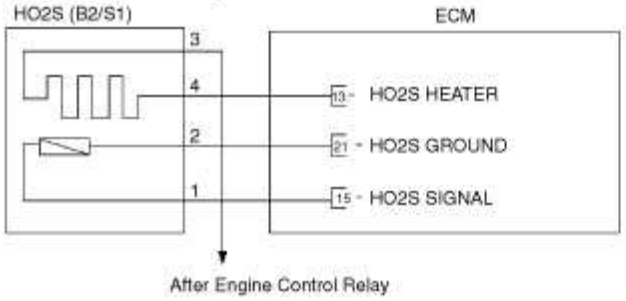
The ECM determines if a front HO2S heater fault has occurred and sets DTC P0050 if the front HO2S heater control driver inside the ECM fails, if HO2S is not operational (after an elapse of predetermined time) since engine start, or when the front HO2S tip temperature is out of normal working range. The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.

DTC DETECTING CONDITION

Item	Detecting condition	Possible Cause
DTC Strategy	• Evaluate O2 sensor element temperature via measuring element resistance	• Related fuse blown or missing • Heater control circuit open or short • Power supply circuit open or short • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Sensor preheating and full heating phases finished • Time after start elapsed:240 sec. • 11V<Battery voltage<16V • 1%<Heater power<99% • Exhaust gas temp.model<610°C(1,130°F)	
Threshold Value	• O2 sensor element resistance >1500Ω	
Diagnostic Time	• 5 min	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



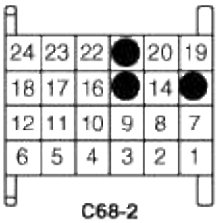
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(15)	Signal
2	ECM Terminal C68-2(21)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(13)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

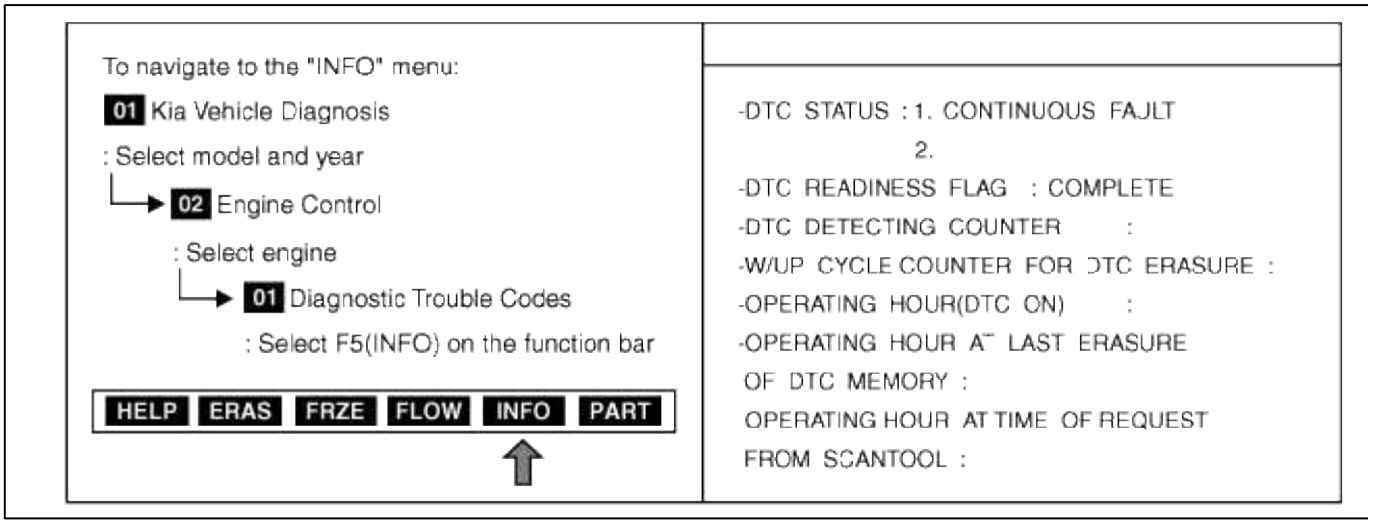


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

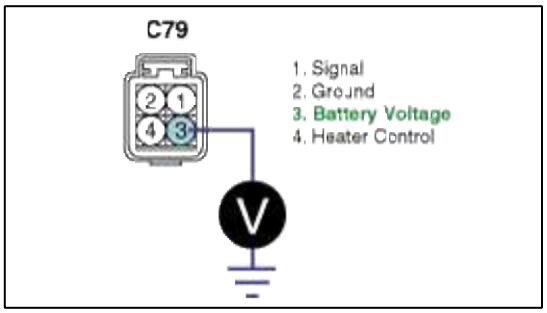
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

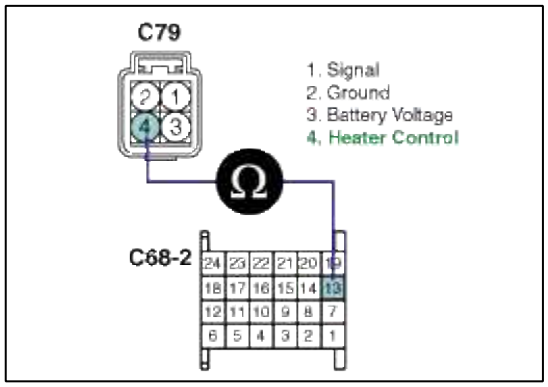
NO

Check for an open in the power supply circuit between the main relay and the HO2S.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness.
   (1) Ignition "OFF".
   (2) Disconnect ECM connectors.
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 13 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



   (4) Is resistance within the specification?

YES

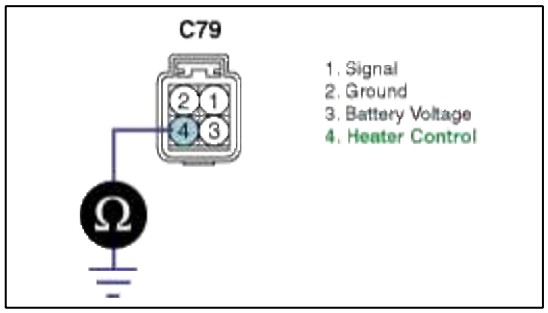
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit .
   (1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : infinite



   (2) Is resistance within the specification?

   YES

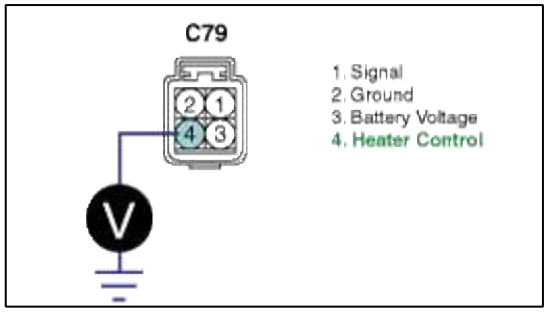
   Go to "Component Inspection" procedure .

   NO

   Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in control circuit.
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure

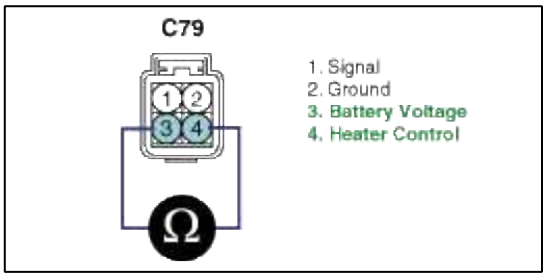
   NO

   Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure

COMPONENT INSPECTION

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω[at 20°C(68°F)]



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

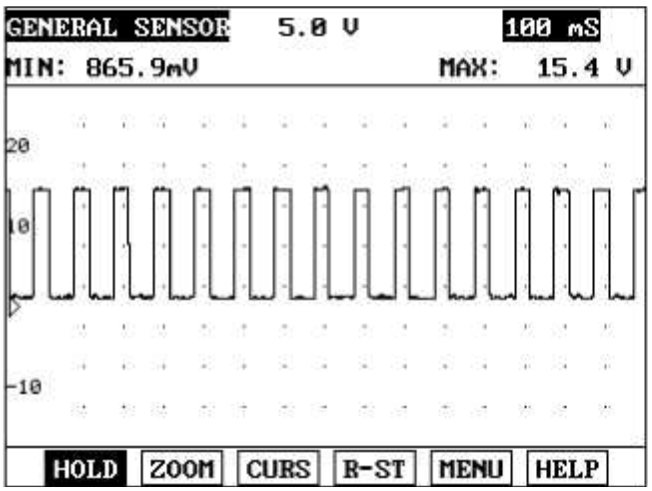
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



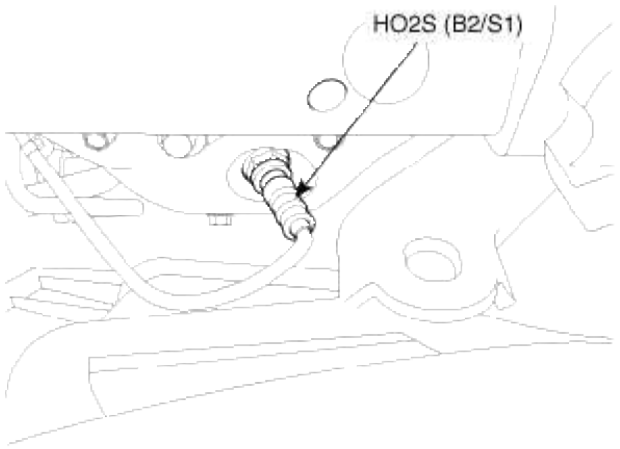
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0051

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The

ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

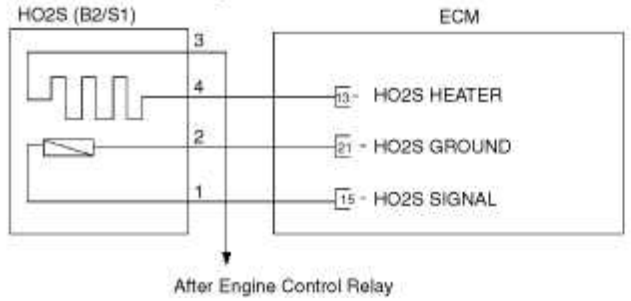
ECM sets DTC P0051 if the ECM detects that the front HO2S heater control line is short to ground.

DTC DETECTING CONDITION

Item	Detecting condition	Possible Cause
DTC Strategy	• Check short circuit to ground on front HO2S heater line	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage > 10V • 1%< Heater power < 99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



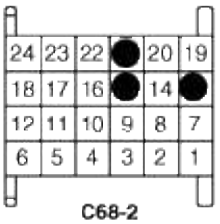
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(15)	Signal
2	ECM Terminal C68-2(21)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(13)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



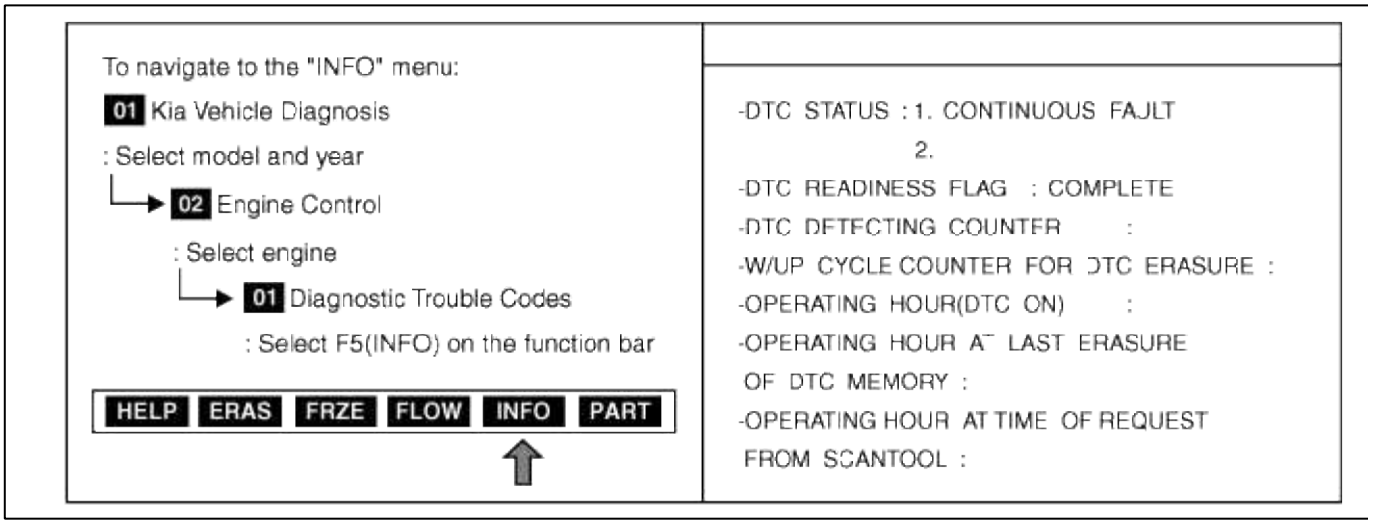
C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

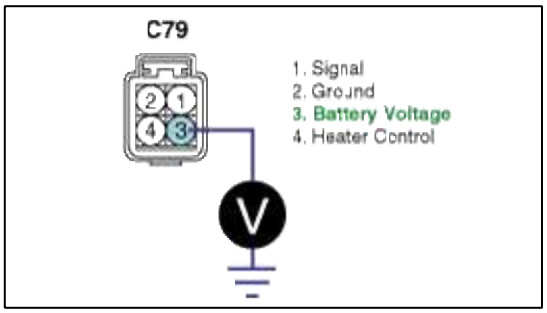
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

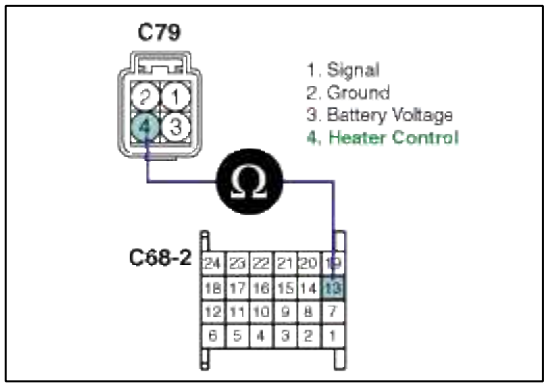
NO

Check for an open in the power supply circuit between the main relay and the HO2S.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness.
   (1) Ignition "OFF".
   (2) Disconnect ECM and HO2S connectors.
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 13 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



   (4) Is resistance within the specification?

YES

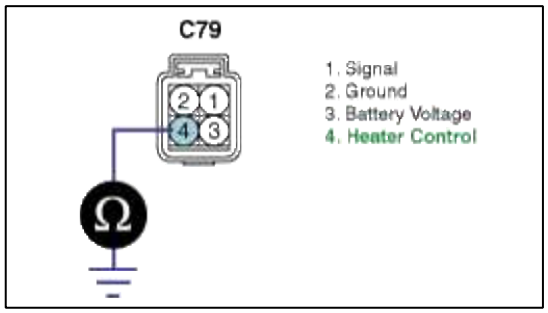
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit .
   (1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : infinite



   (2) Is resistance within the specification?

   YES

   Go to "Component Inspection" procedure .

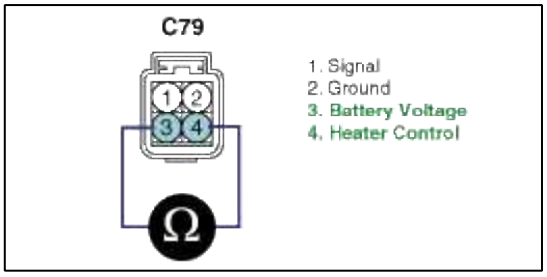
   NO

   Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

   Specification : 3~4Ω[at 20°C(68°F)]



2. Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

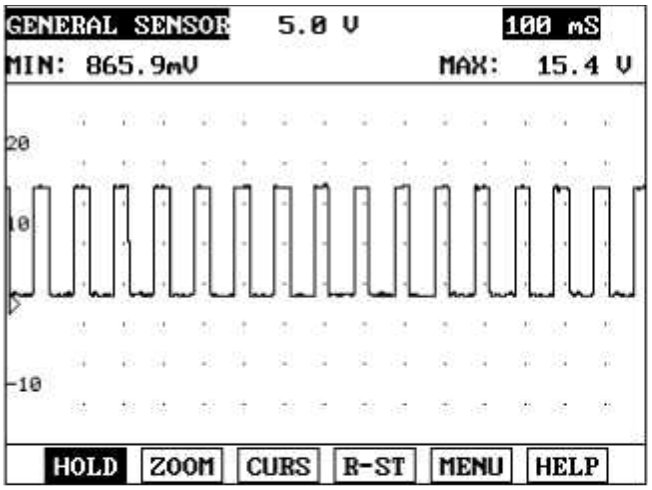
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



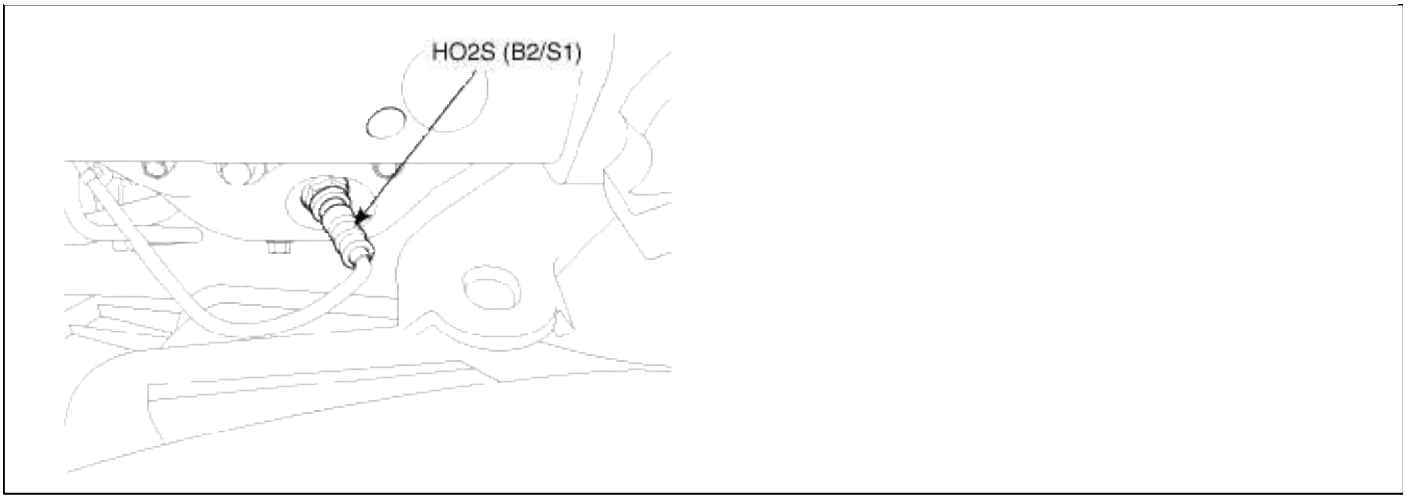
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0052

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

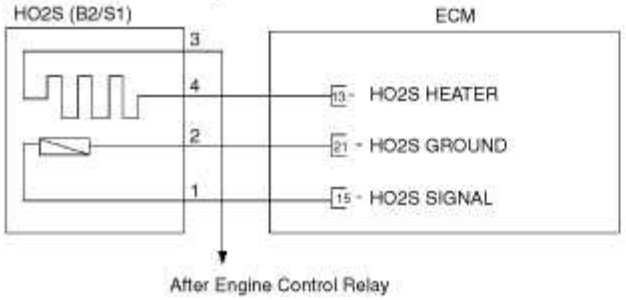
ECM sets DTC P0052 if the ECM detects that the front HO2S heater control line is open or short to battery line.

DTC DETECTING CONDITION

Item	Detecting condition	Possible Cause
DTC Strategy	• Check open or short circuit to battery line on front HO2S heater line.	• Open or short to battery in control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage > 10V • 1%< Heater power < 99%	
Threshold Value	• Short to Battery or line break	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



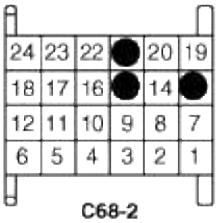
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(15)	Signal
2	ECM Terminal C68-2(21)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(13)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

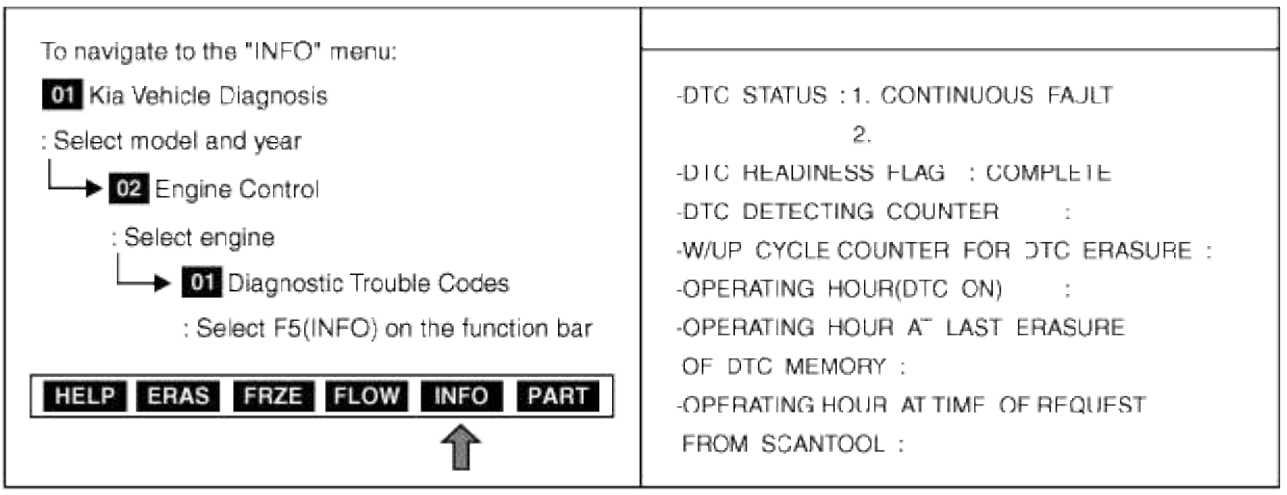


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

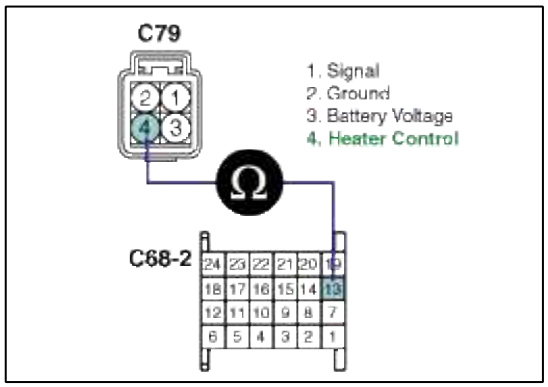
NO

Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness.
   (1) Ignition "OFF".
   (2) Disconnect HO2S and ECM connectors.
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 13 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



   (4) Is resistance within the specification?

YES

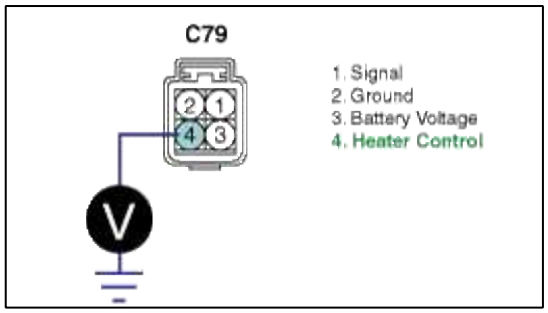
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit
   (1) Reconnect the ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

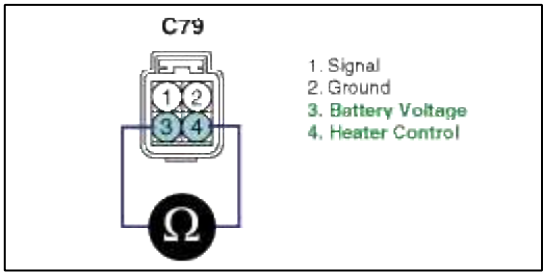
   YES
   Go to "Component Inspection" procedure.

   NO
   Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

   Specification : 3~4Ω[at 20°C(68°F)]



3. Is resistance within the specification?

   YES
   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO
   Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .

3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

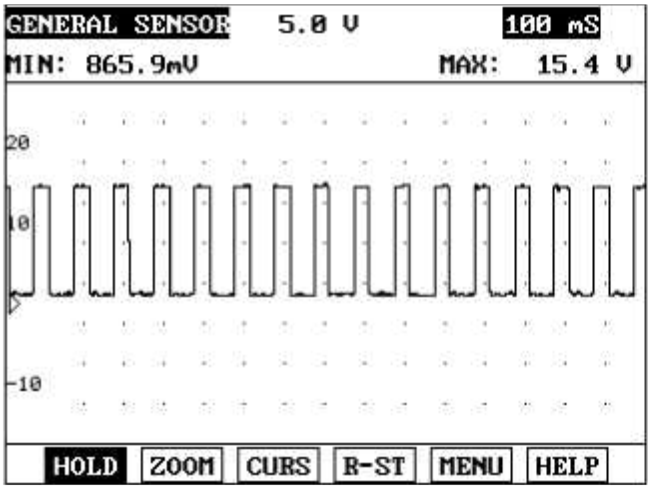
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



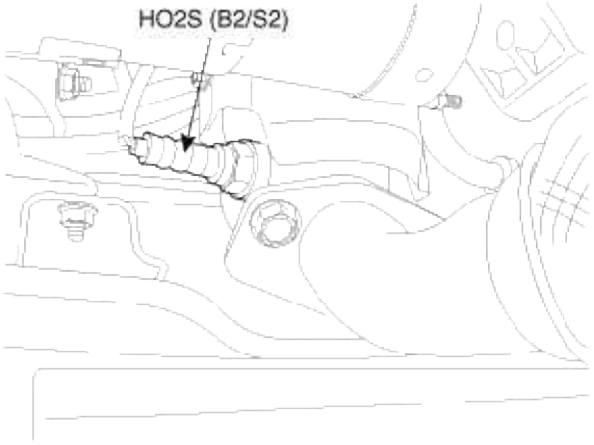
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0056

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

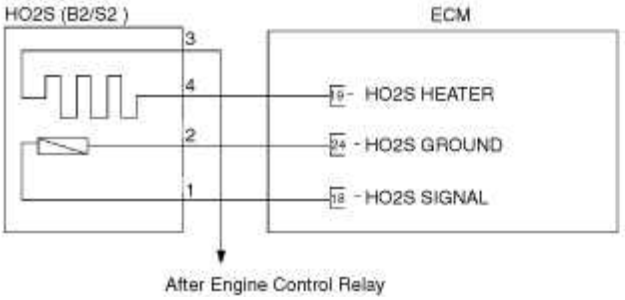
The ECM determines when a rear HO2S heater fault occurs and sets DTC P0056 if measured rear HO2S resistance is lower than the predetermined threshold.
The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.

DTC DETECTING CONDITION

Item	Detecting condition	Possible Cause
DTC Strategy	• Evaluate O2 sensor element temperature via measuring element resistance	• Related fuse blown or missing • Heater control circuit open or short • Power supply circuit open or short • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Sensor preheating and full heating phases finished • Time after start elapsed:180 sec. • 11V<Battery voltage<16V • 1%<Heater power<99% • Exhaust gas temp.model<710°C(1,310°F)	
Threshold Value	• O2 sensor element resistance >3000Ω	
Diagnostic Time	• 5 min	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



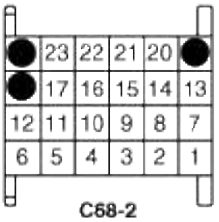
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(18)	Signal
2	ECM Terminal C68-2(24)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(19)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

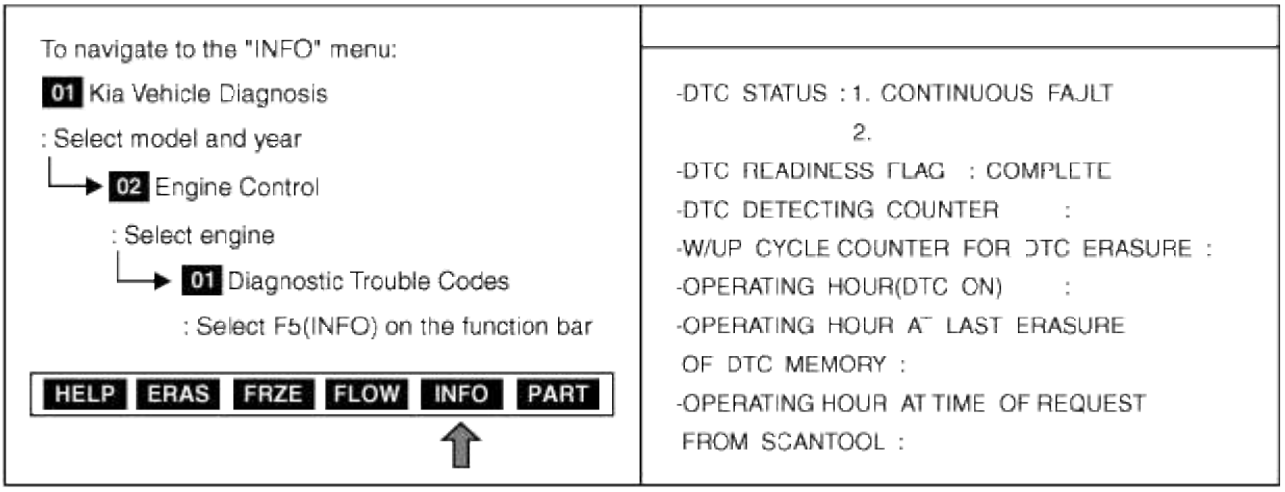


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

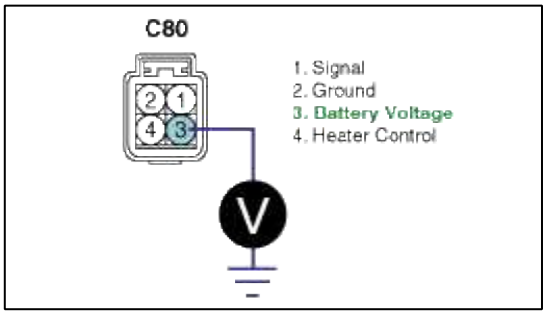
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

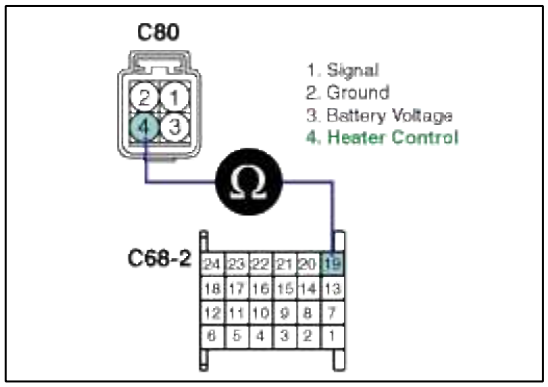
NO

Check for an open in the power supply circuit between the main relay and the HO2S.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness.
   (1) Ignition "OFF".
   (2) Disconnect ECM connectors.
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 19 of the ECM harness connector(C68-2).

   Specification : Approx. 0Ω



   (4) Is resistance within the specification?

   YES

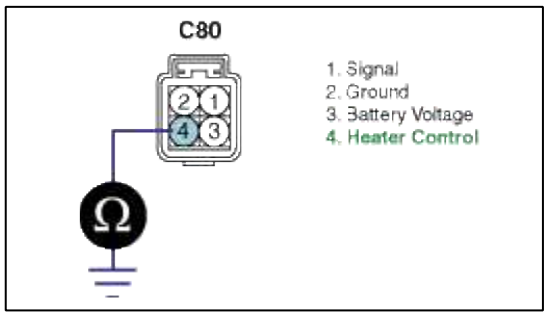
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit .
   (1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : infinite



   (2) Is resistance within the specification?

   YES

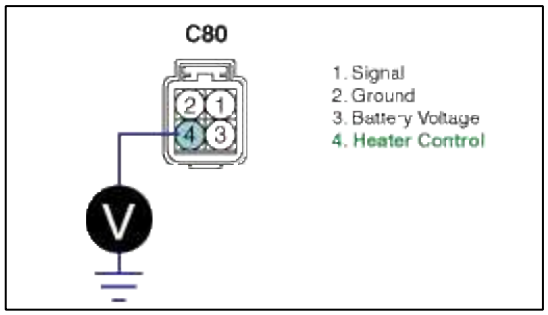
   Go to "Component Inspection" procedure .

   NO

   Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in control circuit.
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure

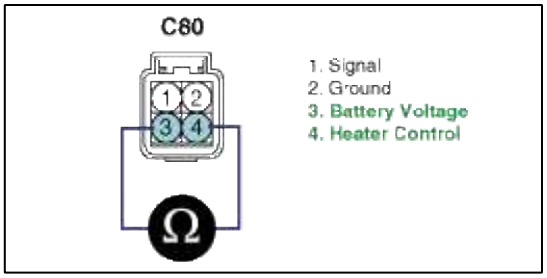
   NO

   Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure

COMPONENT INSPECTION

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

   Specification : 3~4Ω[at 20°C(68°F)]



2. Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

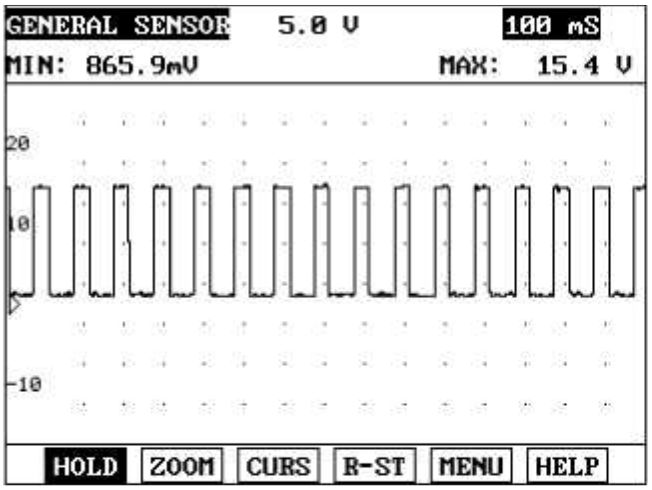
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



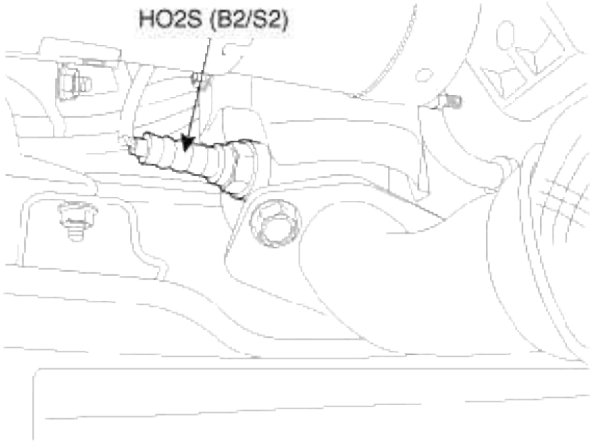
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0057

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

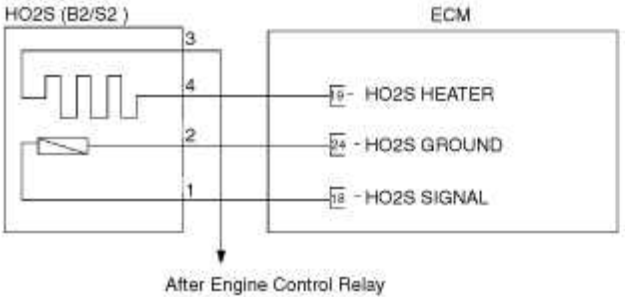
ECM sets DTC P0057 if the ECM detects that the rear HO2S heater control line is short to ground.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check short circuit to ground on rear HO2S heater line	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage > 10V • 1%< Heater power < 99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



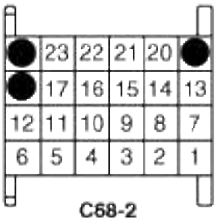
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(18)	Signal
2	ECM Terminal C68-2(24)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(19)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

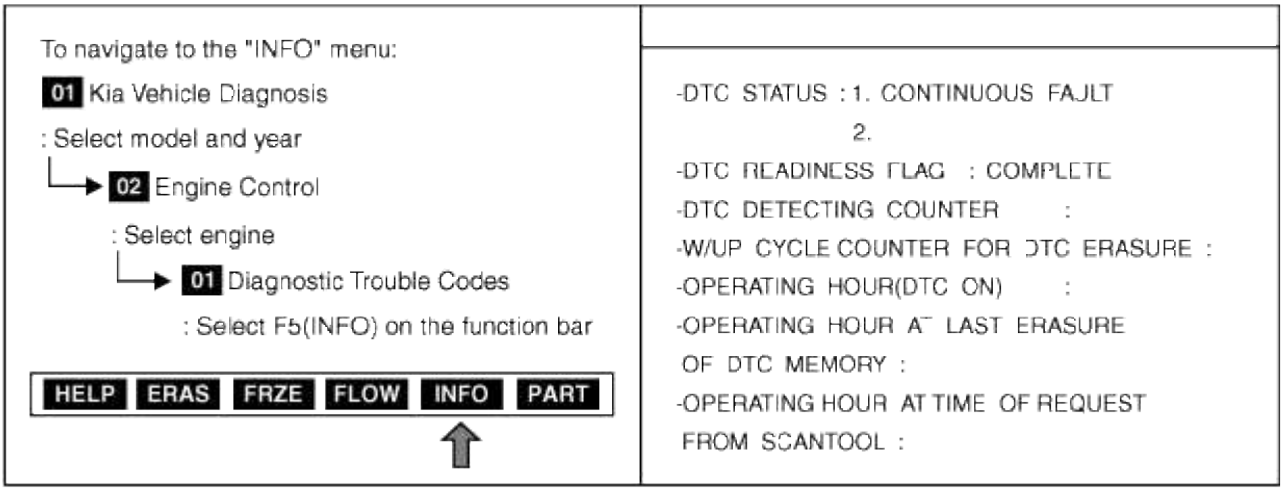


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

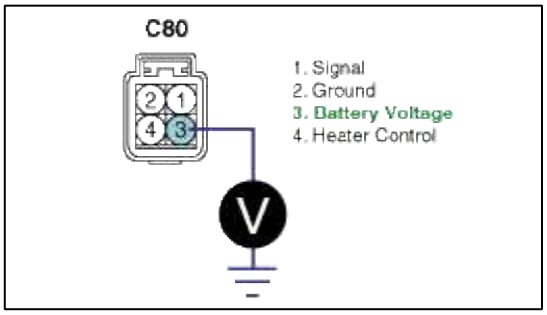
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the HO2S heater harness connector and chassis ground.

Specification : B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

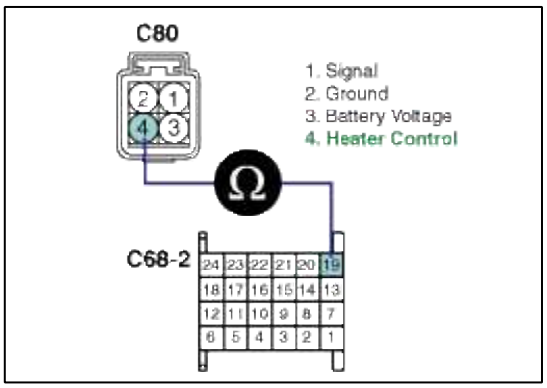
NO

Check for an open in the power supply circuit between the main relay and the HO2S.
Especially check for "10A O2 Sensor fuse" is installed and not blown.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness.
   (1) Ignition "OFF".
   (2) Disconnect ECM connector.
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 19 of the ECM harness connector(C68-2).

   Specification : Approx. 0Ω



   (1) Is resistance within the specification?

   YES

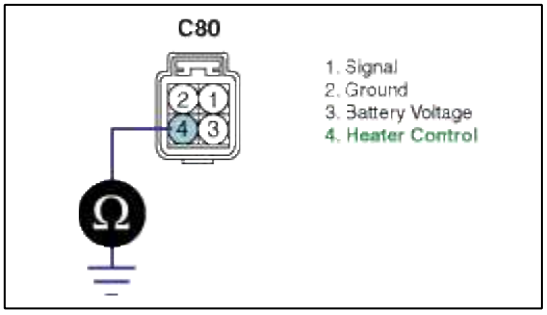
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in control circuit .
   (1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : infinite



   (2) Is resistance within the specification?

   YES

   Go to "Component Inspection" procedure .

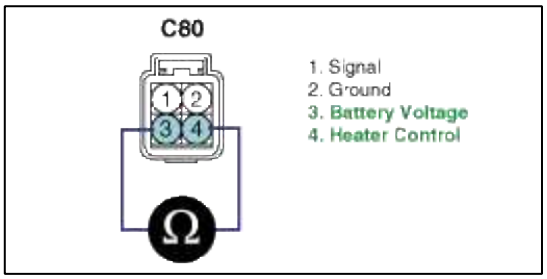
   NO

   Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω[at 20°C(68°F)]



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

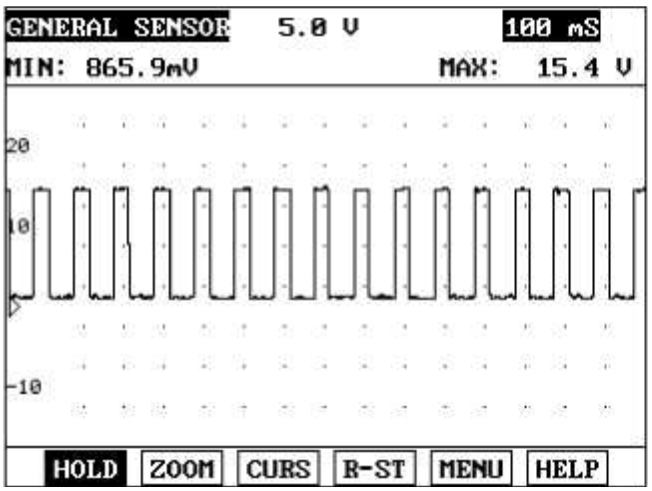
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



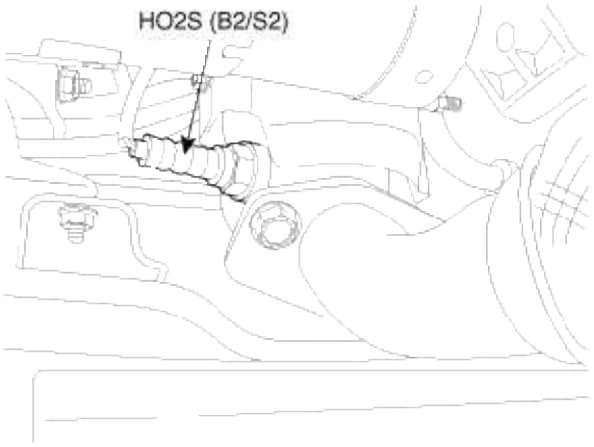
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0058

COMPONENT LOCATION



GENERAL DESCRIPTION

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The

ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION

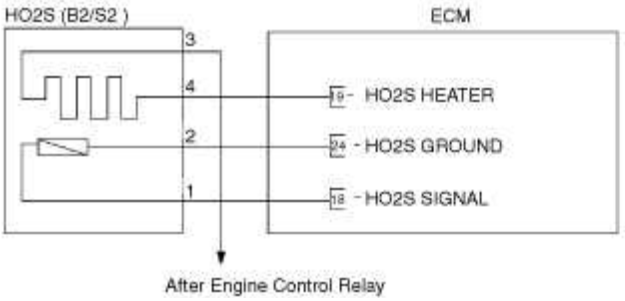
ECM sets DTC P0058 if the ECM detects that the rear HO2S heater control line is open or short to battery line.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check short circuit to ground on rear HO2S heater line	• Open or short to battery in control harness • Contact resistance in connectors • Faulty HO2S
Enable Conditions	• Battery voltage > 10V • 1%< Heater power < 99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 20 sec	
Fail Safe	• Heater open loop control	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



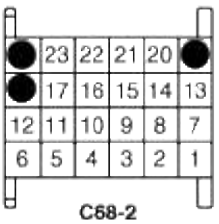
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(18)	Signal
2	ECM Terminal C68-2(24)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(19)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



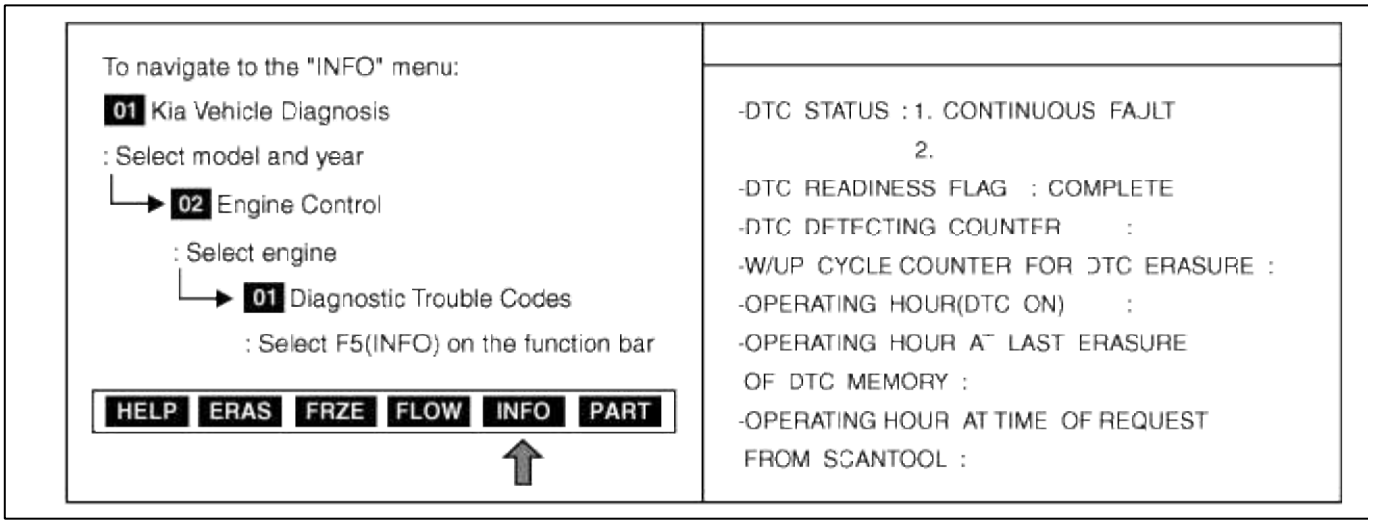
C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

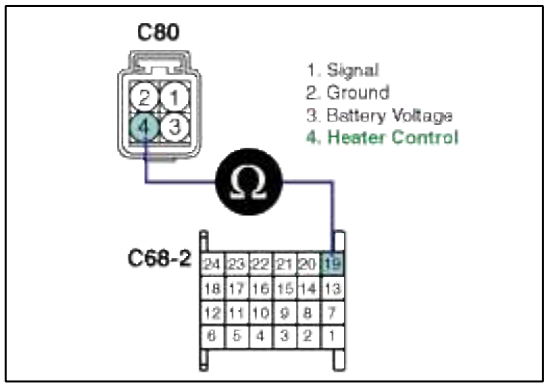
NO

Go to "Control Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in control harness.
   (1) Ignition "OFF".
   (2) Disconnect HO2S and ECM connectors.
   (3) Measure resistance between terminals 4 of the HO2S heater harness connector and 19 of the ECM harness connector(C68-2).

   Specification : Approx. 0Ω



   (4) Is resistance within the specification?

   YES

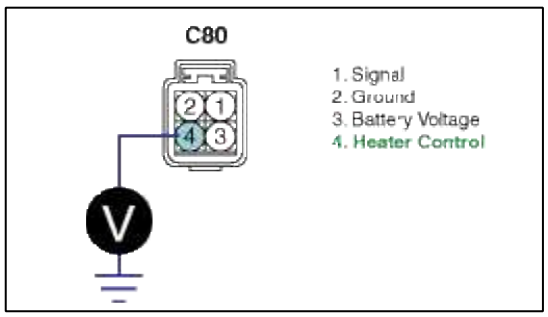
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit
   (1) Reconnect the ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure.

   NO

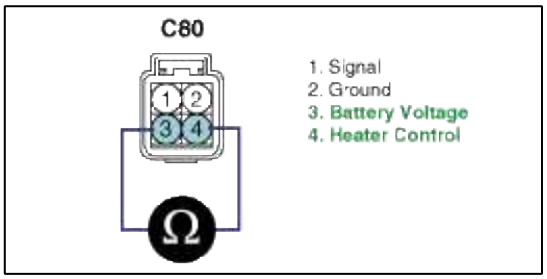
   Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".

2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification : 3~4Ω[at 20°C(68°F)]



3. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

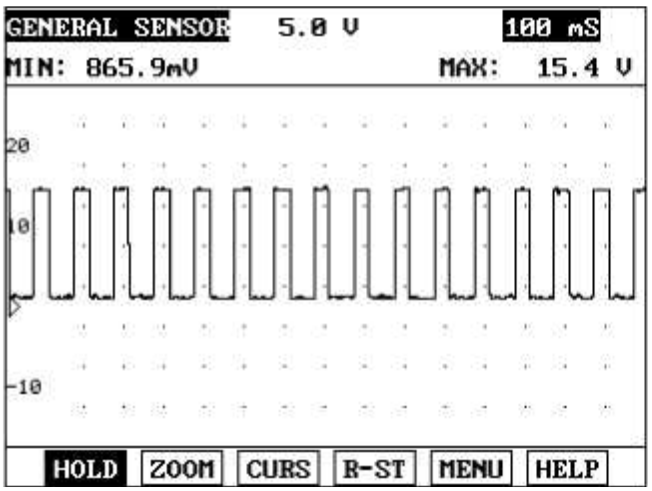
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



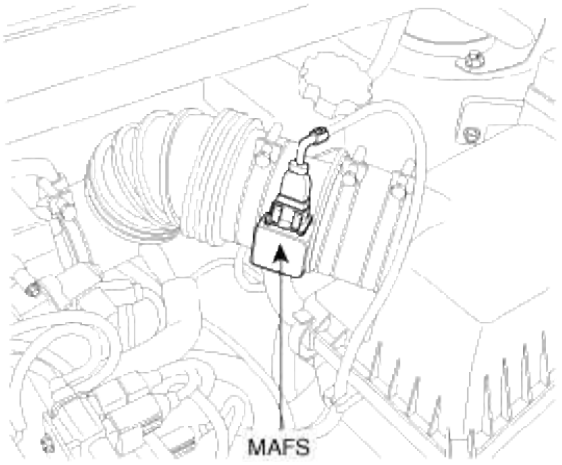
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The HO2S heater should be always ON after engine start. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater. The illustration is the signal waveform at idle after HO2S heater completes warming-up.

SPECIFICATION

HO2S Heater	Normal Parameter
	20°C (68°F)
Heater Resistance	Approx. 3~4Ω

Fuel System > Troubleshooting > P0101

COMPONENT LOCATION



GENERAL DESCRIPTION

The Mass Air Flow Sensor (MAFS) is located between the air cleaner assembly and the throttle body. The MAFS uses a hot film type sensing element to measure the mass of intake air entering the engine. This hot film type air flow

sensor consists of a hot film sensor, housing and metering ducts. Mass air flow rate is measured by detection of heat transfer from a hot film probe. The change in air flow rate causes change in the amount of heat being transferred from the hot film probe surface to the air. A large amount of intake air represents acceleration or high load conditions while a small amount of intake air represents deceleration or idle. The mass of intake air should increase at acceleration and be stable during constant engine speed. The ECM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

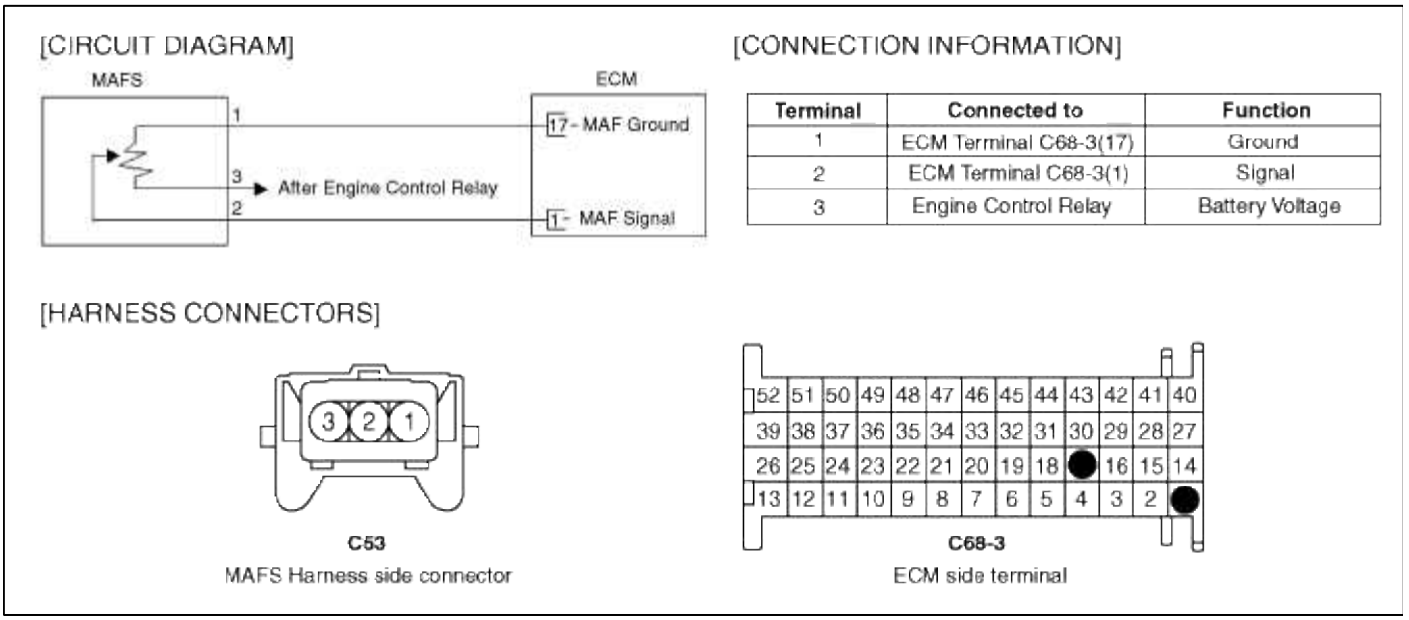
DTC DESCRIPTION

The ECM compares the actual measured Mass Air Flow signal to the modeled Mass Air Flow value and sets the DTC P0101 when the difference between these two value is too high or too low with lambda deviation in opposite direction.
The modeled Mass Air Flow value is determined by engine speed, throttle angle and ICA valve duty.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Compare calculated MAF with MAF signal	• Dirty air cleaner. • Oil Cap or Dipstick missing or not installed correctly. • Air leak in intake system • Contact resistance in connectors. • Faulty MAFS or TPS
Enable Conditions	• 1500< Engine speed(RPM)< 3500 • 150< Measured Mass Air Flow(mg/stk) <350 • Coolant temperature > 60°C(140°F)	
Threshold Value	• Measured MAF/Calculated MAF <0.5 or >1.3	
Diagnostic Time	• 110 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

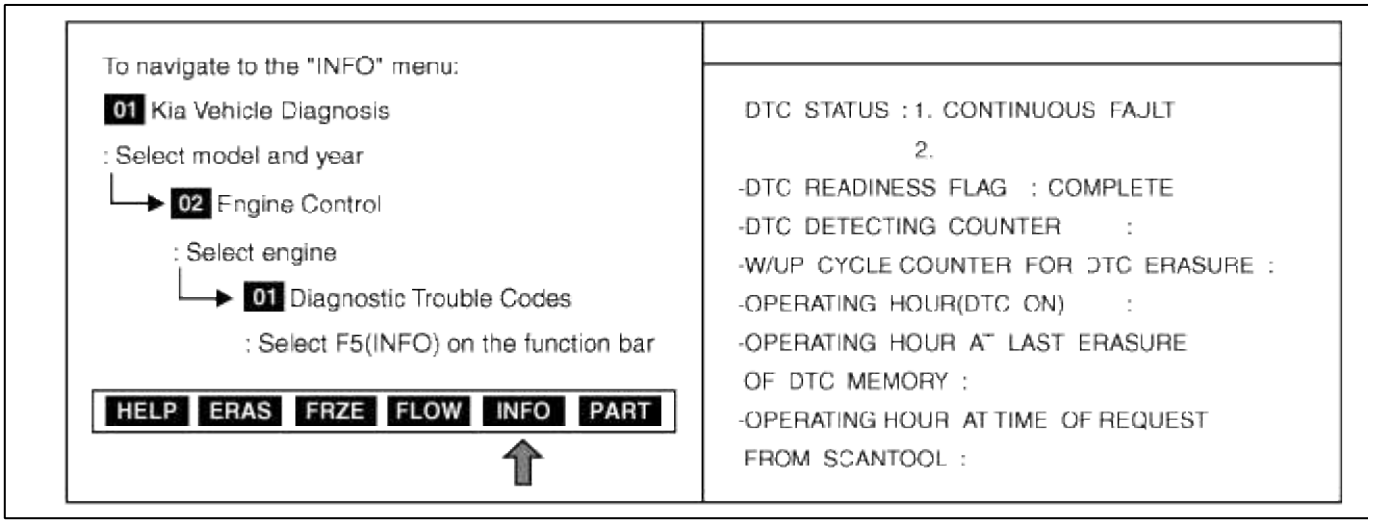


MONITOR DTC STATUS

NOTE

If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

AIR CLEANER INSPECTION

1. Check air cleaner condition. Is air cleaner clogged with dirt?

YES

Replace air cleaner and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Air Leakage Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

Go to "Conponent Inspection" procedure.

AIR LEAKAGE INSPECTION

1. Check intake tube, breather hose and MAFS for source of any air leaks. Are there any cracks in intake tube, MAFS or breather hose.
2. Verify oil cap and dipstick are properly installed and oil cap screwed on completely.
3. Has a problem been found?

YES

Repair or Replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "TPS Inspection" procedure.

TPS INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Connect Scantool and monitor the "THROTTLE P. SENSOR(V)" parameter on the Scantool data list.

Specification : Approx. 0.5V(Closed throttle Valve) / Approx 4.25~4.7V(Wide Open Throttle)

3. Is "THROTTLE P. SENSOR(V)" within specification?

YES

Go to "Terminal and Connector Inspection" procedure.

NO

Inspect TP sensor and W/harness and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Engine "ON".
2. Connect Scantool and monitor the "MASS AIR FLOW(V)" parameter on the Scantool data list.
3. Monitor the "MASS AIR FLOW(V)" parameter on the Scantool.

Specification :
Approx. 0.6 ~ 1.0V at idle & No load
Approx. 1.0 ~ 1.3V at idle & A/C "ON"

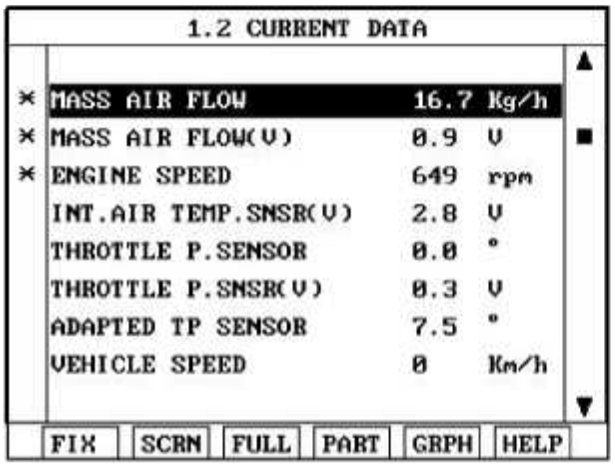


Fig. 1

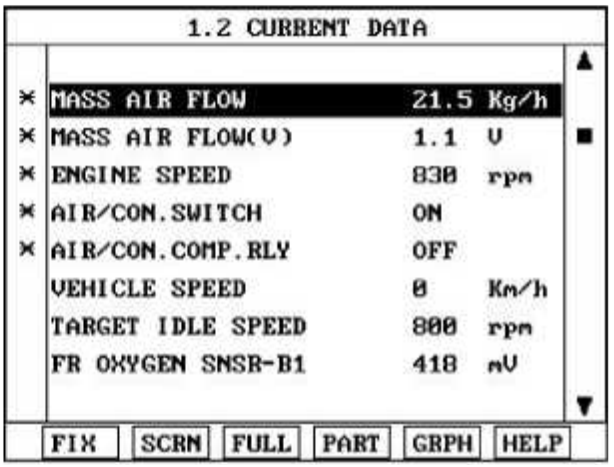


Fig. 2

Fig 1) Test Condition : id e after warm up
Specification : The MAFS is between 0.6~1.0V(11~20kg/h)
Fig 2) Test Condition : id e after warm up & A/C "ON"
Specification : The MAFS increase proportinally with engine load

4. Is MAF sensor voltage within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check MAFS for contamination, deterioration, or damage. Substitute with a known-good MAFS and check for proper operation. If the problem is corrected, replace MAFS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

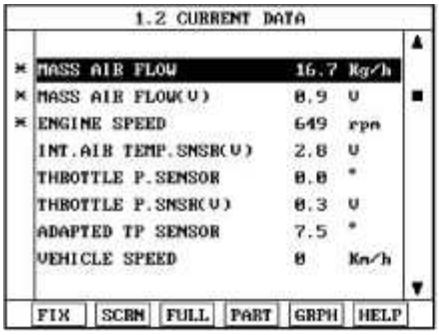


Fig. 1

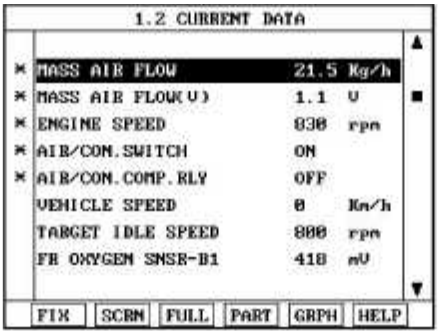


Fig. 2

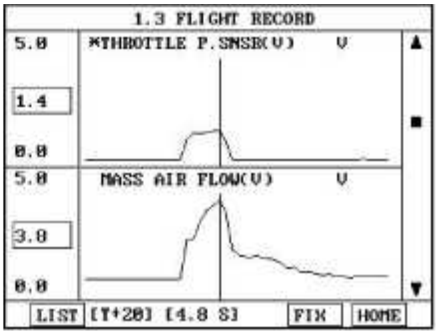


Fig. 3

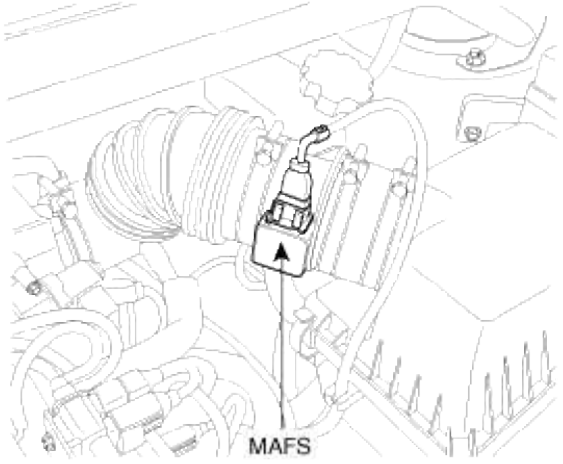
Fig 1) Normal value with idle after warm up : Approx. 0.7~1.0V
Fig 2) Normal value with idle after warm up and A/C "ON" : Signal increases proportionaly with engine load
Fig 3) Normal value with accelerating and decelerating : The MAFS and TPS signals increase at the same time with accelerating and decrease with releasing accelerator pedal

SPECIFICATION

Test Condition	MAF DATA		TPS DATA	
	Output Voltage (V)	Mass Air Flow (kg/h)	Output Voltage (V)	Resistance (kΩ)
Idle	0.6~1.0	11~20	0.25~0.80	0.71~1.38
Idle & A/C "ON"	1.0~1.3	20~30	-	-
W.O.T	-	-	4.25~4.7	0.2~3.4

Fuel System > Troubleshooting > P0102

COMPONENT LOCATION



GENERAL DESCRIPTION

The Mass Air Flow Sensor (MAFS) is located between the air cleaner assembly and the throttle body. The MAFS uses a hot film type sensing element to measure the mass of intake air entering the engine. This hot film type air flow sensor consists of a hot film sensor, housing and metering ducts. Mass air flow rate is measured by detection of heat transfer from a hot film probe. The change in air flow rate causes change in the amount of heat being transferred from the hot film probe surface to the air. A large amount of intake air represents acceleration or high load

conditions while a small amount of intake air represents deceleration or idle. The mass of intake air should increase at acceleration and be stable during constant engine speed. The ECM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

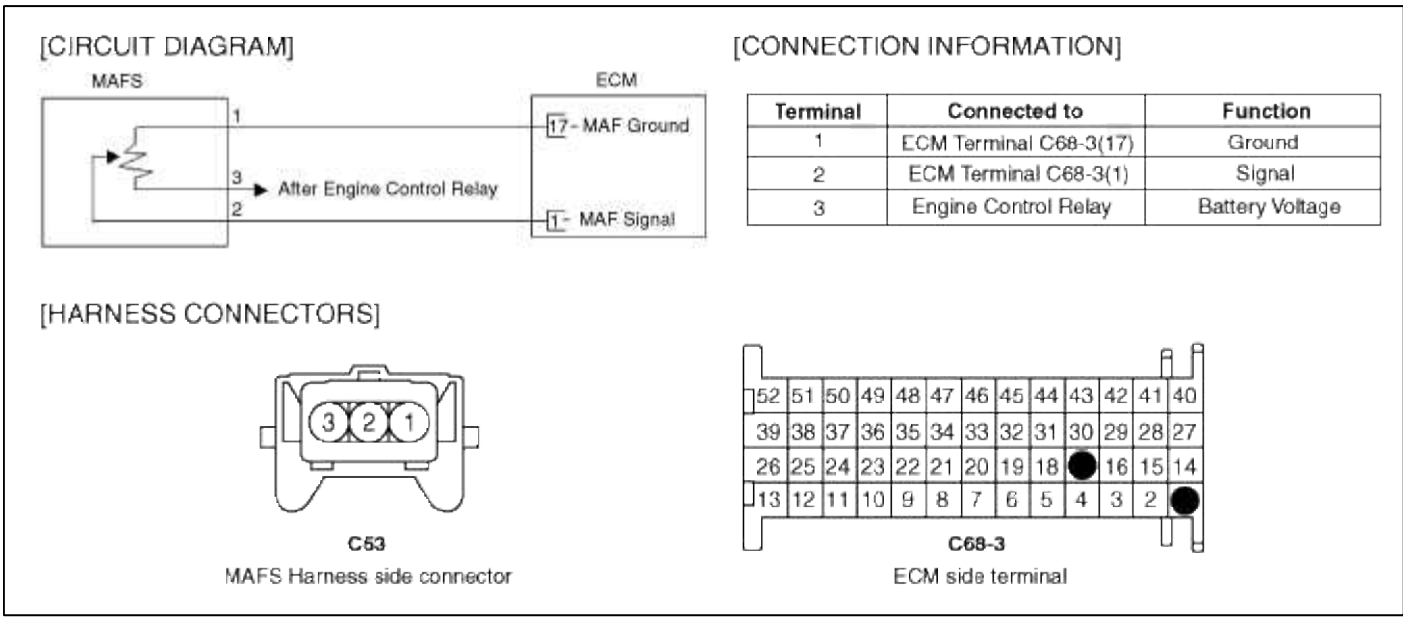
DTC DESCRIPTION

ECM sets DTC P0102 if the ECM detects signal voltage lower than the possible range of a properly operating MAF sensor.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Open or short to ground in signal circuit • Open in power supply circuit • Contact resistance in connections. • Faulty MAF sensor
Enable Conditions	• 1500< Engine speed(RPM)< 3500 • 150< Measured Mass Air Flow(mg/stk) <350 • Coolant temperature > 60°C(140°F)	
Threshold Value	• Measured MAF<2kg/h	
Diagnostic Time	• 200 sec.	
MIL On Condition	• 2 Driving Cycles	

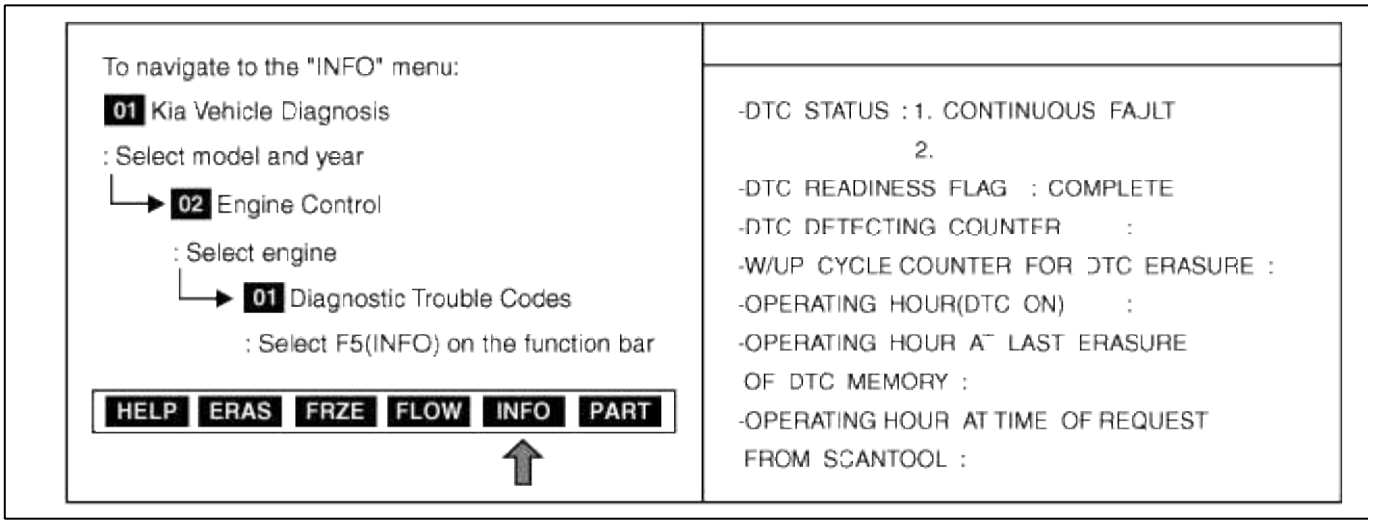
SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

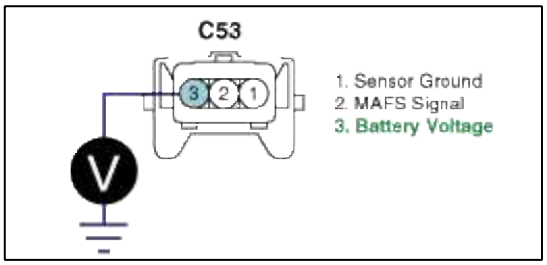
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect MAF connector.
3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal 3 of the MAF sensor heater harness connector and chassis ground.

Specification : B+



5. Is voltage within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

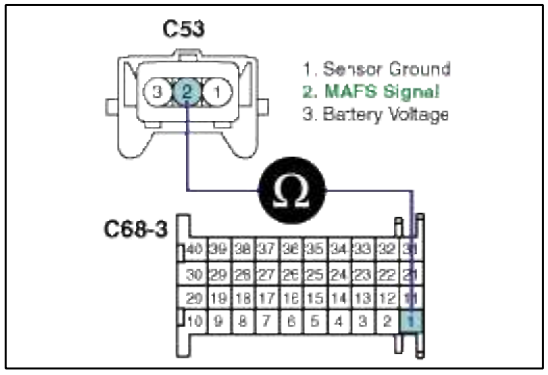
NO

Check for an open or short to ground in the power supply circuit between the MAF sensor and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Disconnect ECM connector.
   (3) Measure resistance between terminals 2 of the MAF sensor harness connector and 1 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



   (4) Is resistance within the specification?

YES

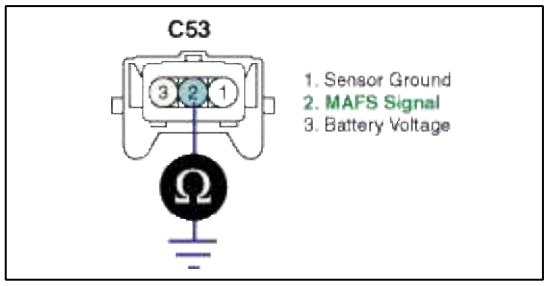
Go to next step as below.

NO

Check for an open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 2 of the MAF sensor harness connector and chassis ground.

Specification : infinite



   (3) Is resistance within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Engine "ON".
2. Connect Scantool and monitor the "MASS AIR FLOW(V)" parameter on the Scantool data list.
3. Monitor the "MASS AIR FLOW(V)" parameter on the Scantool.

Specification :
Approx. 0.6 ~ 1.0V at idle & No load
Approx. 1.0 ~ 1.3V at idle & A/C "ON"

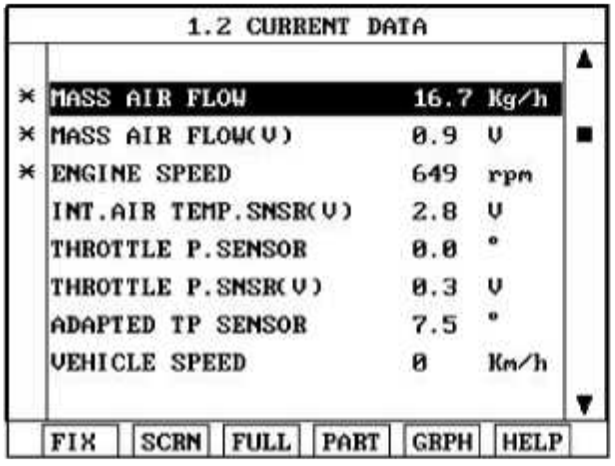


Fig. 1

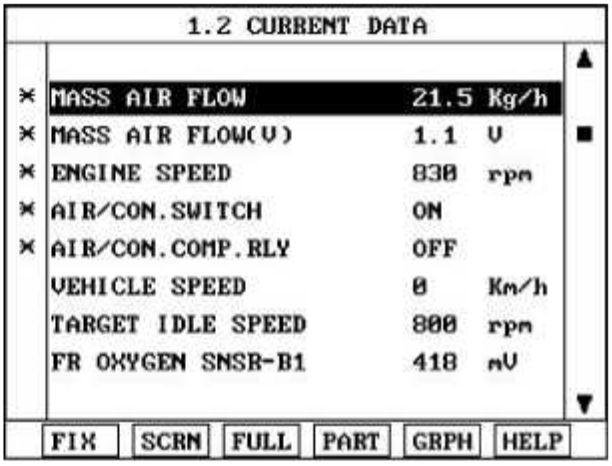


Fig. 2

Fig 1) Test Condition : id e after warm up
Specification : The MAFS is between 0.6~1.0V(11~20kg/h)
Fig 2) Test Condition : id e after warm up & A/C "ON"
Specification : The MAFS increase proportinally with engine load

4. Is MAF sensor voltage within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check MAFS for contamination, deterioration, or damage. Substitute with a known-good MAFS and check for proper operation. If the problem is corrected, replace MAFS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

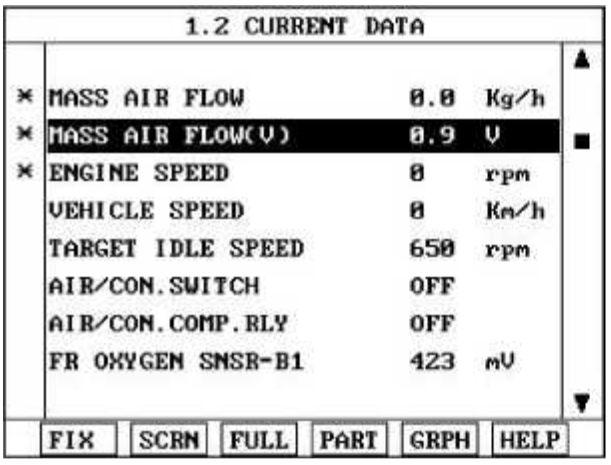


Fig. 1

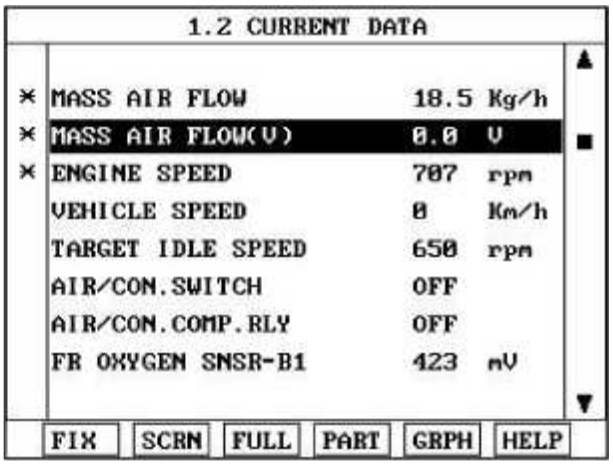


Fig. 2

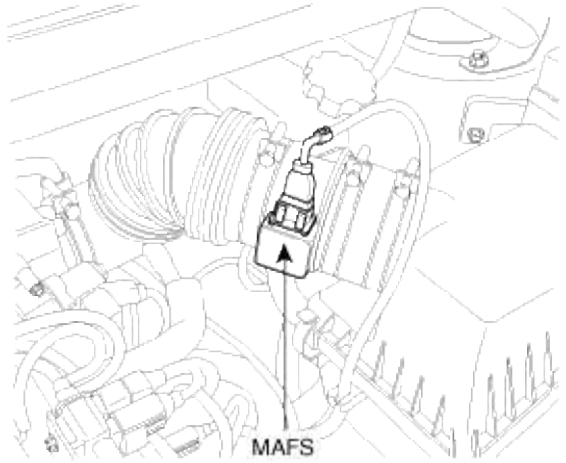
Fig 1) Normal value with ignition ON and engine OFF : Approx. 0.6~1.0V
Fig 2) Open in signal or power supply circuit/Short to ground in signal or power supply circuit : Approx. 0V

SPECIFICATION

Test Condition	MAF DATA		TPS DATA	
	Output Voltage (V)	Mass Air Flow (kg/h)	Output Voltage (V)	Resistance (kΩ)
Idle	0.6~1.0	11~20	0.25~0.80	0.71~1.38
Idle & A/C "ON"	1.0~1.3	20~30	-	-
W.O.T	-	-	4.25~4.7	0.2~3.4

Fuel System > Troubleshooting > P0103

COMPONENT LOCATION



GENERAL DESCRIPTION

The Mass Air Flow Sensor (MAFS) is located between the air cleaner assembly and the throttle body. The MAFS uses a hot film type sensing element to measure the mass of intake air entering the engine. This hot film type air flow sensor consists of a hot film sensor, housing and metering ducts. Mass air flow rate is measured by detection of heat transfer from a hot film probe. The change in air flow rate causes change in the amount of heat being transferred from the hot film probe surface to the air. A large amount of intake air represents acceleration or high load conditions while a small amount of intake air represents deceleration or idle. The mass of intake air should increase at acceleration and be stable during constant engine speed. The ECM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION

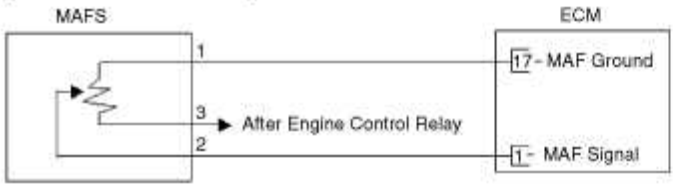
ECM sets DTC P0103 if the ECM detects signal voltage higher than the possible range of a properly operating MAF sensor.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Open in ground harness • Short to battery in signal harness • Contact resistance in connections. • Faulty MAF sensor
Enable Conditions	• 500< Engine speed(RPM)< 3500 • 150< Measured Mass Air Flow(mg/stk) <350 • Coolant temperature > 60°C(140°F)	
Threshold Value	• Measured MAF > 700 kg/h	
Diagnostic Time	• 200 mSec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

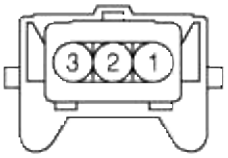
[CIRCUIT DIAGRAM]



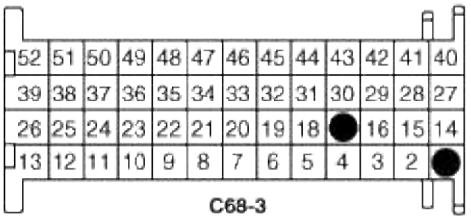
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-3(17)	Ground
2	ECM Terminal C68-3(1)	Signal
3	Engine Control Relay	Battery Voltage

[HARNESS CONNECTORS]



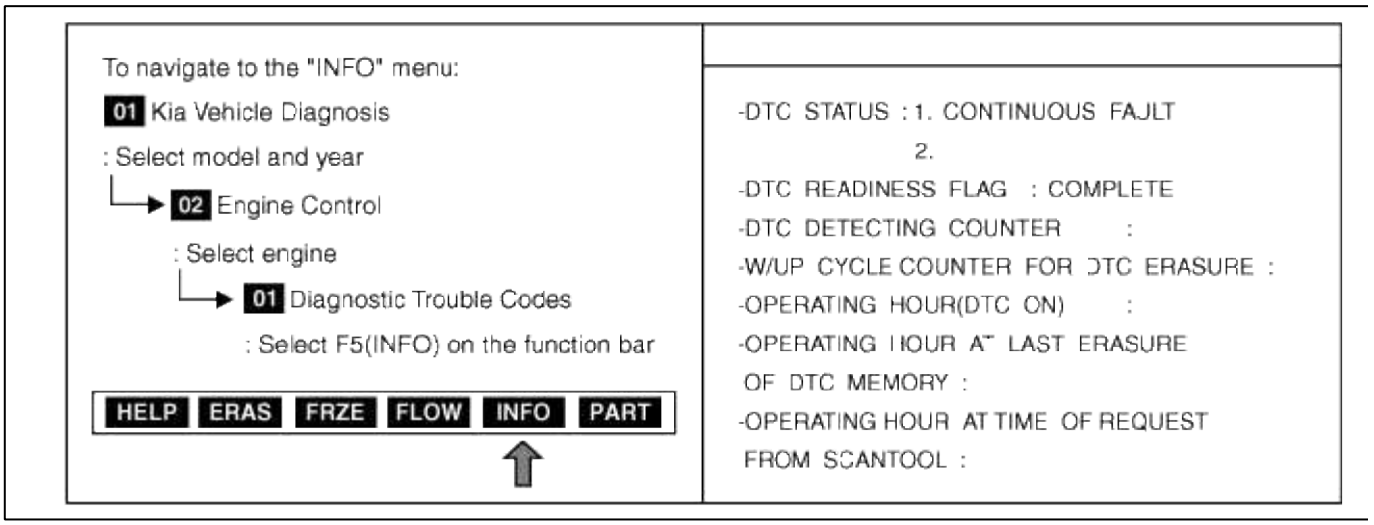
C53
MAFS Harness side connector



C68-3
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

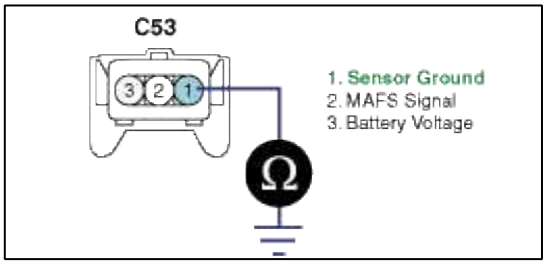
NO

Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect MAF sensor connector.
3. Measure resistance between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

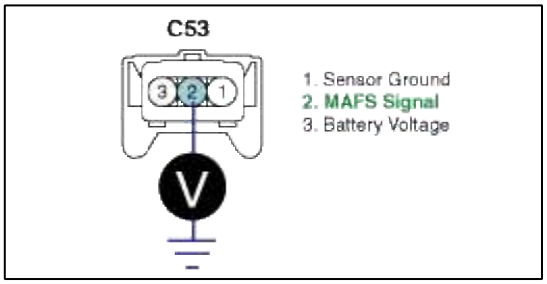
NO

Check for an open or short to battery in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 2 of the MAF sensor harness connector and chassis ground.

Specification : Approx. 0V



3. Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Engine "ON".
2. Connect Scantool and monitor the "MASS AIR FLOW(V)" parameter on the Scantool data list.
3. Monitor the "MASS AIR FLOW(V)" parameter on the Scantool.

Specification :
Approx. 0.6 ~ 1.0V at idle & No load
Approx. 1.0 ~ 1.3V at idle & A/C "ON"

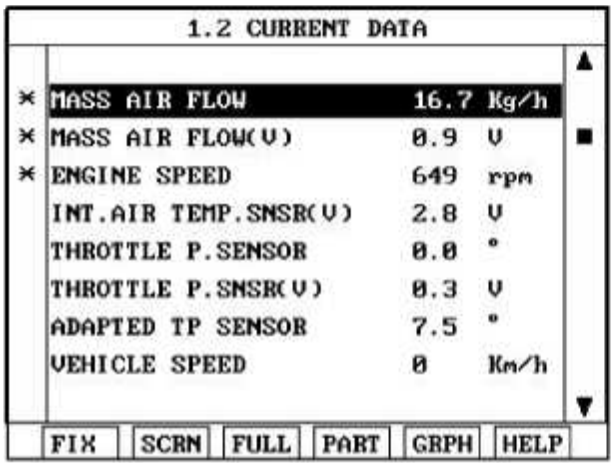


Fig. 1

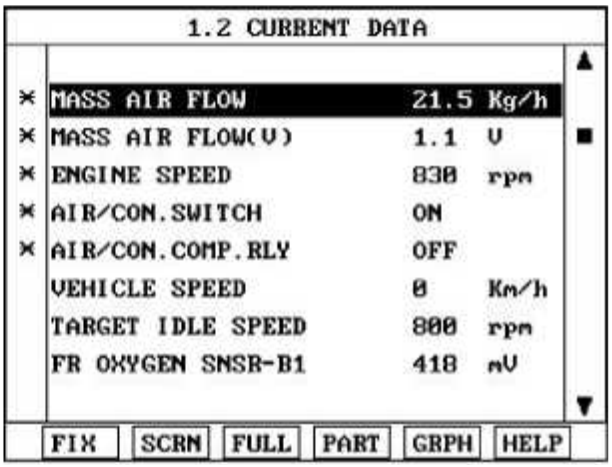


Fig. 2

Fig 1) Test Condition : idle after warm up
Specification : The MAFS is between 0.6~1.0V(11~20kg/h)
Fig 2) Test Condition : idle after warm up & A/C "ON"
Specification : The MAFS increase proportinally with engine load

4. Is MAF sensor voltage within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check MAFS for contamination, deterioration, or damage. Substitute with a known-good MAFS and check for proper operation. If the problem is corrected, replace MAFS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

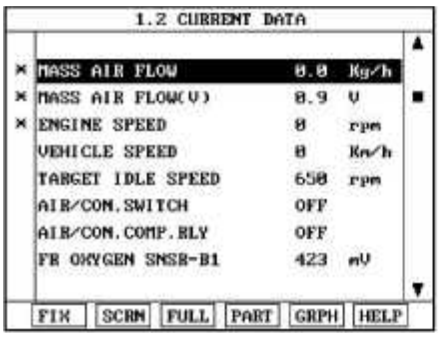


Fig. 1

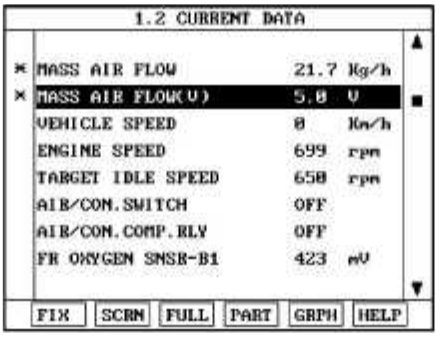


Fig. 2

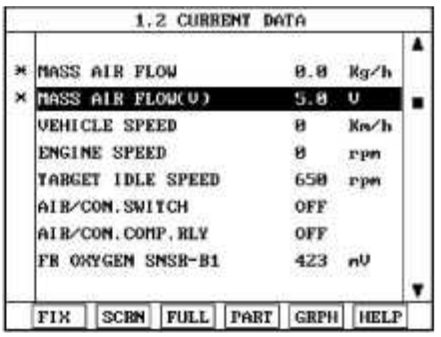


Fig. 3

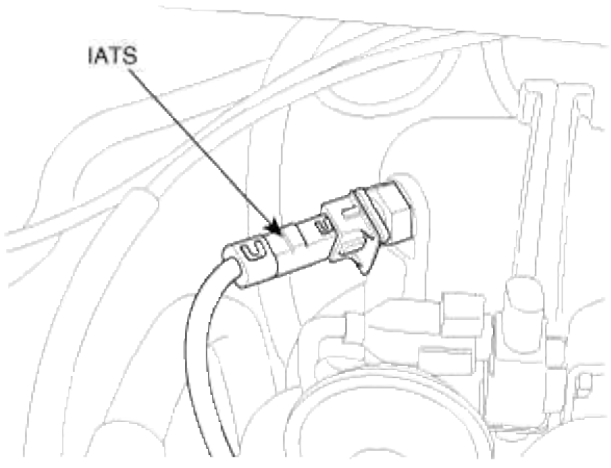
Fig 1) Normal value with ignition ON and engine OFF : Approx. 0.6~1.0V
Fig 2) Open in ground circuit with ignition ON and engine OFF : Approx 5V
Fig 3) Short to battery in signal circuit with ignition ON and engine OFF : Approx. 5V

SPECIFICATION

Test Condition	MAF DATA		TPS DATA	
	Output Voltage (V)	Mass Air Flow (kg/h)	Output Voltage (V)	Resistance (kΩ)
Idle	0.6~1.0	11~20	0.25~0.80	0.71~1.38
Idle & A/C "ON"	1.0~1.3	20~30	-	-
W.O.T	-	-	4.25~4.7	0.2~3.4

Fuel System > Troubleshooting > P0111

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature Sensor (IATS) is installed into the Mass Air Flow Sensor (MAFS). The IATS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the IATS decreases as the temperature increases, and increases as the temperature decreases. The 5 V power source in the ECM is supplied to the IATS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the IATS are connected in series. When the resistance value of the thermistor in IATS changes according to the intake air temperature, the

signal voltage also changes. Using this signal, the information of the intake air temperature, the ECM corrects basic fuel injection duration and ignition timing.

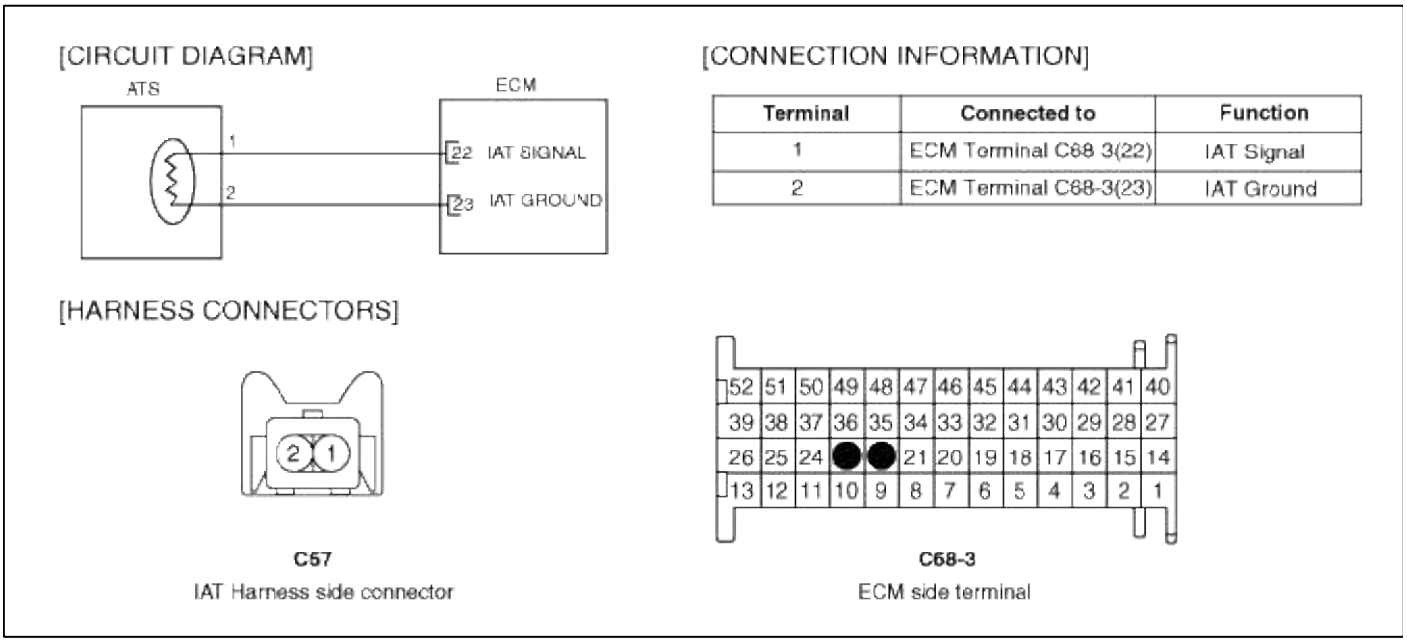
DTC DESCRIPTION

The purpose of this diagnosis is to detect a stuck air temperature signal. The diagnostic function checks whether after a variation of the calculated air temperature also a variation of the measured air temperature is detected. ECM sets DTC P0111 when the variation of measured intake air temperature is smaller than threshold while variation of calculated intake air temperature by ECM is greater than threshold.

DTC DETECTING CONDITION

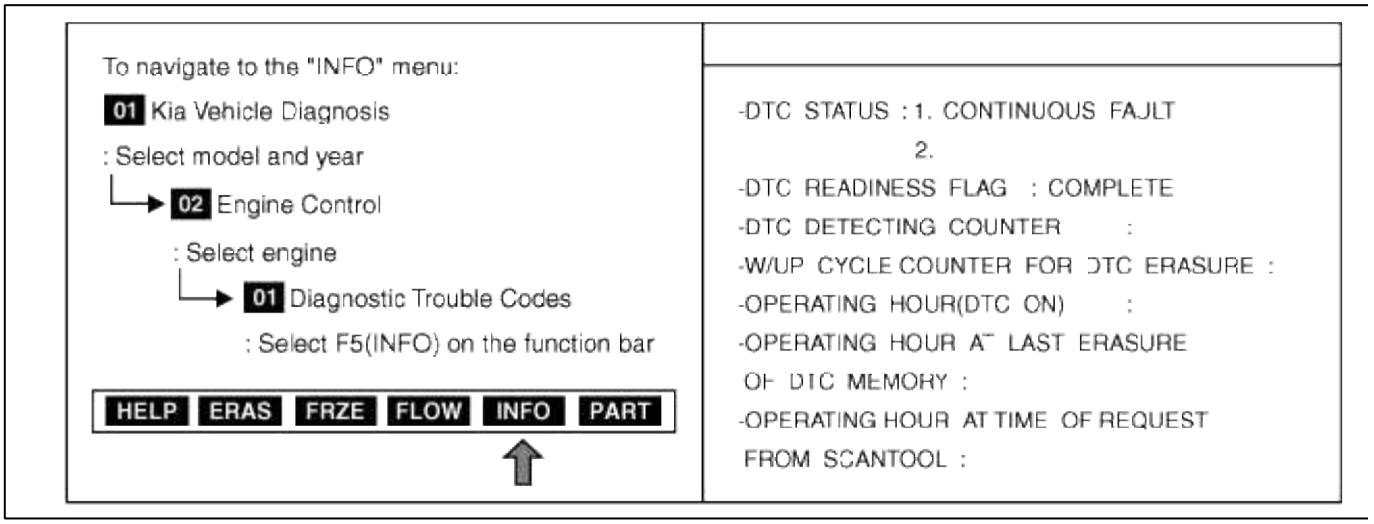
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Contact resistance in connections. • Faulty IAT sensor
Enable Conditions	• Time after Start > 300 sec. • Coolant temperature > 75°C(167°F) • Coolant temperature increase after Start > 40°C(104°F)	
Threshold Value	• Air temp. at present time - air temp. at engine start < 5.25°C(41.5°F) • Minimum air temp. - air temp. at engine start < 1.5°C(34.7°F) • Maximum air temp. - air temp. at engine start < 1.5°C(34.7°F)	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

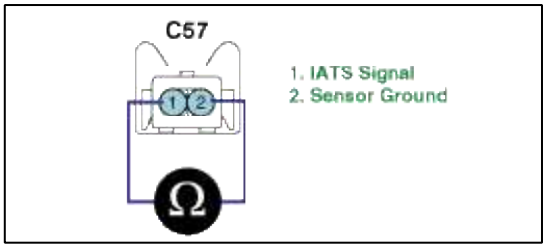
NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Temperature	Resistance (kΩ)
-20°C (-4°F)	Approx. 14.26~16.02
20°C (68°F)	Approx. 2.35~2.54
80°C (176°F)	Approx. 0.31~0.32



2. Is IAT sensor data within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check IAT sensor for contamination, deterioration, or damage. Substitute with a known-good IAT sensor and check for proper operation. If the problem is corrected, replace IAT sensor 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

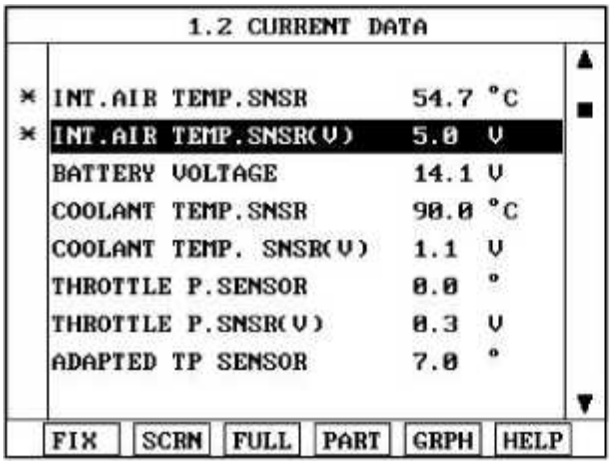
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

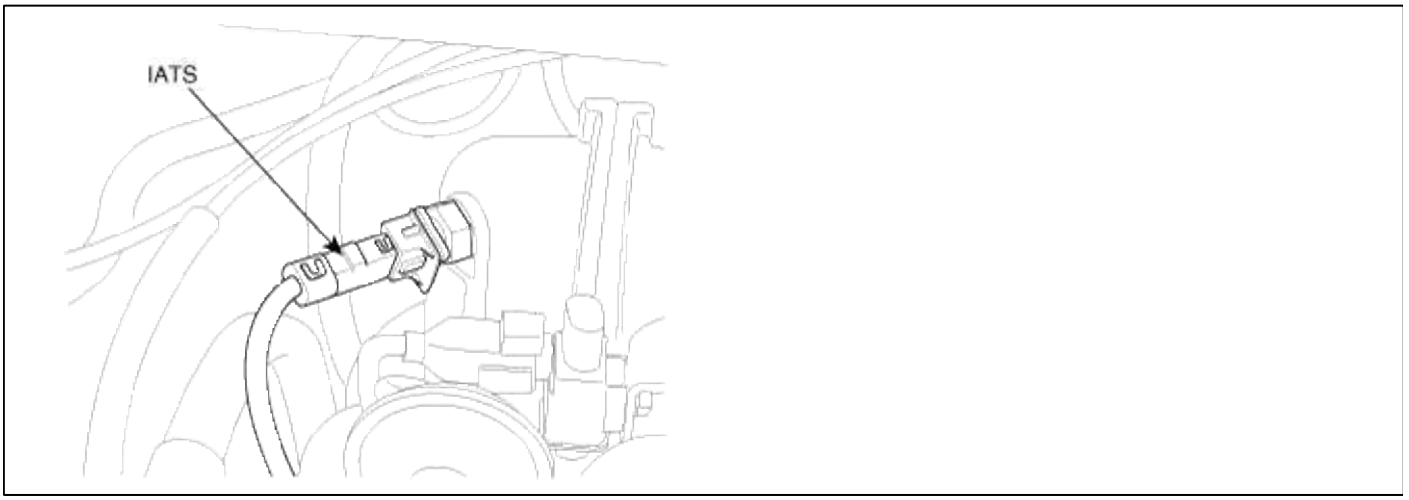


SPECIFICATION

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(°C)	(°F)		(°C)	(°F)	
-20	-4	14.26~16.02	40	104	1.11~1.19
0	32	5.50~6.05	60	140	0.57~0.60
20	68	2.35~2.54	80	176	0.31~0.32

Fuel System > Troubleshooting > P0112

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature Sensor (IATS) is installed into the Mass Air Flow Sensor (MAFS). The IATS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the IATS decreases as the temperature increases, and increases as the temperature decreases. The 5 V power source in the ECM is supplied to the IATS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the IATS are connected in series. When the resistance value of the thermistor in IATS changes according to the intake air temperature, the signal voltage also changes. Using this signal, the information of the intake air temperature, the ECM corrects basic fuel injection duration and ignition timing.

DTC DESCRIPTION

ECM sets DTC P0112 if the ECM detects signal voltage lower than the possible range of a properly operating IATS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Contact resistance in connections. • Faulty IAT sensor
Enable Conditions	• 6< Battery voltage(V) <16 • After 250 seconds from engine start	
Threshold Value	• Measured intake air temperature > 118°C(244°F)	
Diagnostic Time	• 50 sec.	
MIL On Condition	• 2 Driving Cycles	

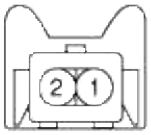
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

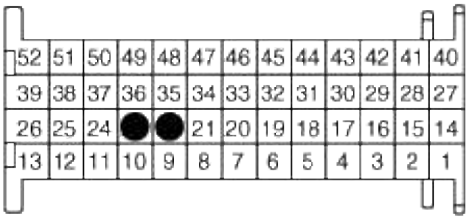
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-3(22)	IAT Signal
2	ECM Terminal C68-3(23)	IAT Ground

[HARNESS CONNECTORS]



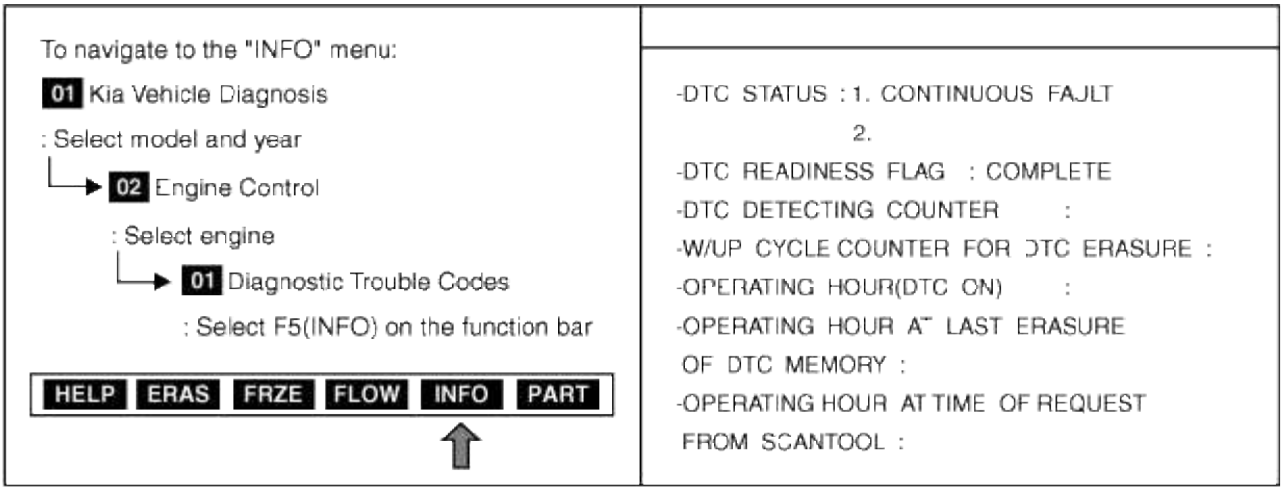
C57
IAT Harness side connector



C68-3
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

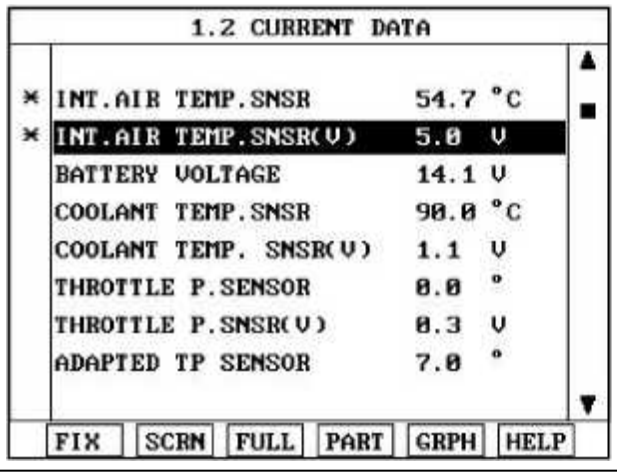
NO

Go to "Monitor Scantool Data" procedure.

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Disconnect IAT sensor connector.
3. Connect Scantool and monitor the "INT.AIR TEMP. SNSR(V)" parameter on the Scantool data list.

Specification : Approx. 5V



4. Is displayed IAT data within the specification?

YES

Possibility of sensor malfunction. Go to "Component Inspection" procedure.

NO

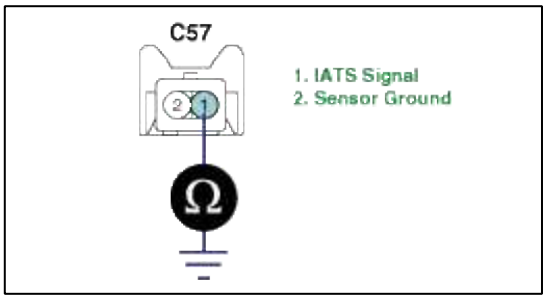
Possibility of signal circuit short to ground. Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect IAT sensor connector.

3. Measure resistance between terminal 1 of the IAT sensor harness connector and chassis ground.

Specification : Infinite



4. Is resistance within the specification?

YES

Go to "Terminal and Connector Inspection" procedure.

NO

Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

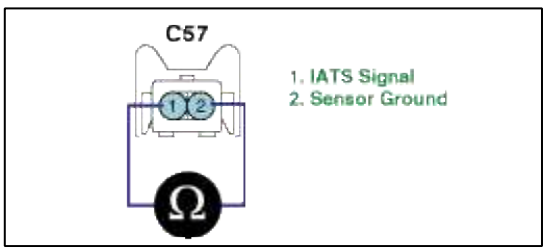
NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Temperature	Resistance (kΩ)
-20°C (-4°F)	Approx. 14.26~16.02
20°C (68°F)	Approx. 2.31~2.59
80°C (176°F)	Approx. 0.31~0.32



2. Is IAT sensor data within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check IAT sensor for contamination, deterioration, or damage. Substitute with a known-good IAT sensor and check for proper operation. If the problem is corrected, replace IAT sensor 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

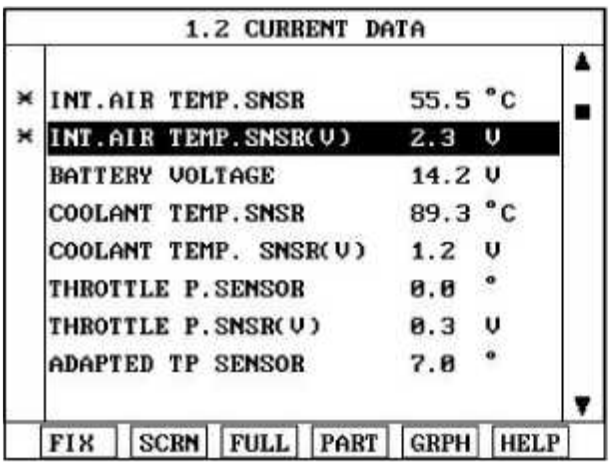


Fig. 1

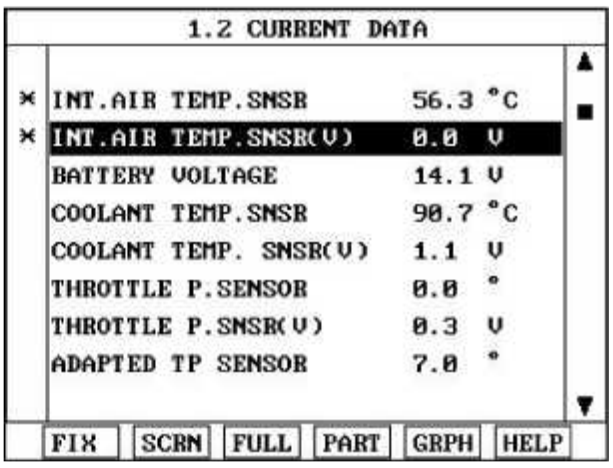


Fig. 2

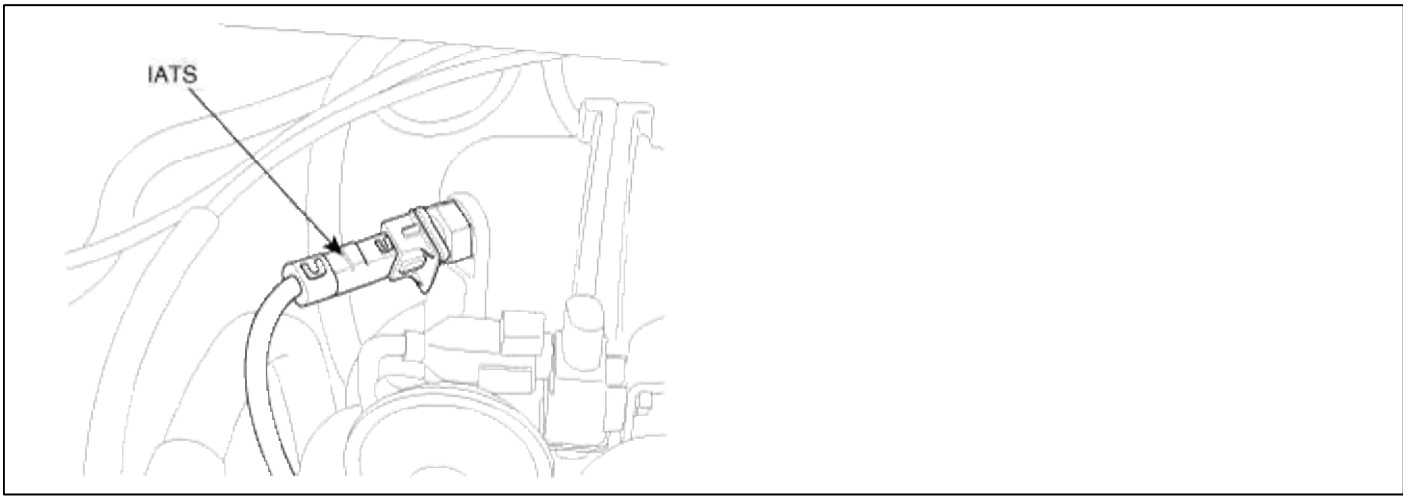
Fig 1) Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature : Approx. 2.3V at 55.5℃(132℉)
Fig 2) Short to ground in signal circuit : Approx. 0V

SPECIFICATION

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(℃)	(℉)		(℃)	(℉)	
-20	-4	14.26~16.02	40	104	1.11~1.19
0	32	5.50~6.05	60	140	0.57~0.60
20	68	2.31~2.59	80	176	0.31~0.32

Fuel System > Troubleshooting > P0113

COMPONENT LOCATION



GENERAL DESCRIPTION

The Intake Air Temperature Sensor (IATS) is installed into the Mass Air Flow Sensor (MAFS). The IATS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the IATS decreases as the temperature increases, and increases as the temperature decreases. The 5 V power source in the ECM is supplied to the IATS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the IATS are connected in series. When the resistance value of the thermistor in IATS changes according to the intake air temperature, the signal voltage also changes. Using this signal, the information of the intake air temperature, the ECM corrects basic fuel injection duration and ignition timing.

DTC DESCRIPTION

ECM sets DTC P0113 if the ECM detects signal voltage higher than the possible range of a properly operating IATS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to battery in signal harness • Open in signal or ground circuit • Contact resistance in connections. • Faulty IAT sensor
Enable Conditions	• 6< Battery voltage(V) <16 • After 250 seconds from engine start	
Threshold Value	• Measured intake air temperature > -38°C(-36°F)	
Diagnostic Time	• 50 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

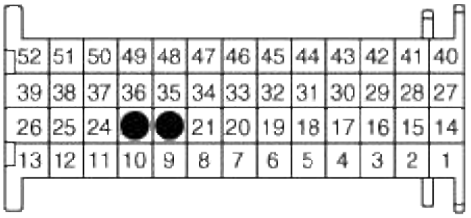
[CIRCUIT DIAGRAM]

[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-3(22)	IAT Signal
2	ECM Terminal C68-3(23)	IAT Ground

[HARNESS CONNECTORS]

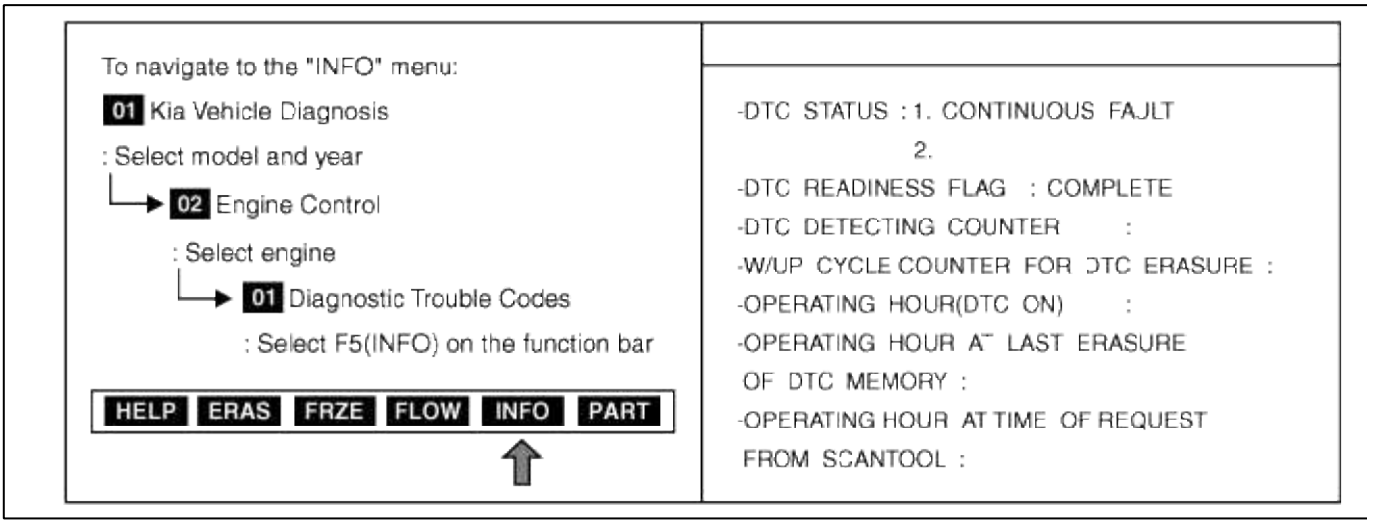
C57
IAT Harness side connector



C68-3
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

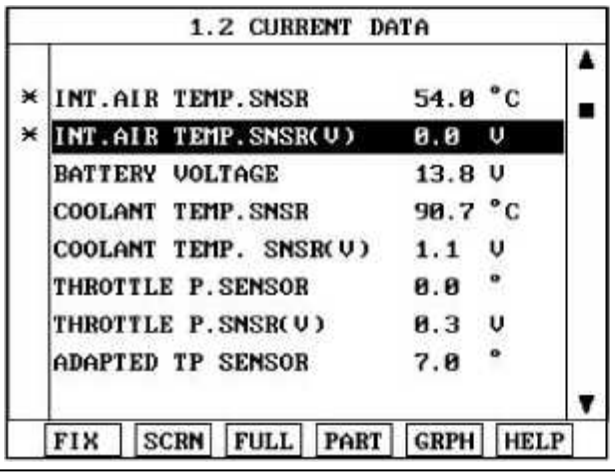
NO

Go to "Monitor Scantool Data" procedure.

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Disconnect IATS sensor connector.
3. Connect Scantool and monitor the "INT.AIR TEMP. SNSR(V)" parameter on the Scantool data list.
4. Jumper the terminals 1 and 2 of the IAT sensor harness connector together.

Specification : Approx. 0v



5. Is IAT data within the specification?

YES

Possibility of sensor malfunction. Go to "Component Inspection" procedure.

NO

Go to next step as below.

6. Jumper the terminal 1 of the IAT sensor harness connector to chassis ground.
7. Observe the "IAT SENSOR" parameter on the Scantool.

Specification : Approx. 0V

8. Is IAT data within the specification?

YES

Possibility of open in IAT ground circuit Go to "Ground circuit inspection" procedure.

NO

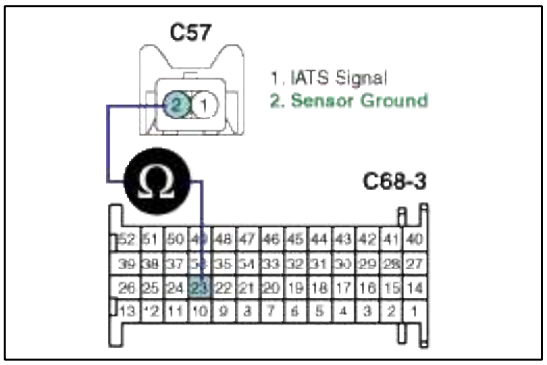
Possibility of open or short to battery in IAT signal circuit. Go to "Signal Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.

3. Measure resistance between terminal 2 of the IATsensor harness connector and 23 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Terminal and Connetor Inspection" procedure.

NO

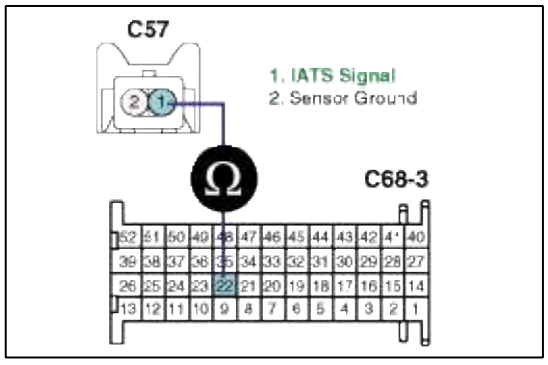
Repair open circuit and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION

1. Check for open in signal circuit

(1) Measure resistance between terminals 1 of the IAT sensor harness connector and 22 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



(2) Is resistance within the specification?

YES

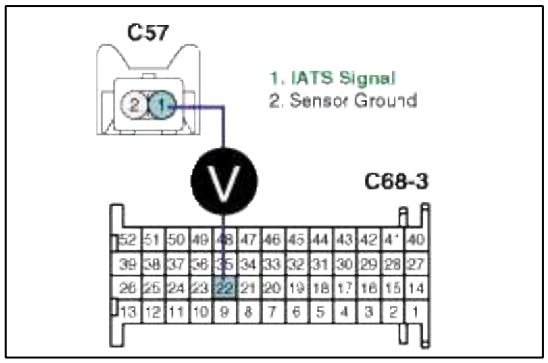
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in signal circuit.
   (1) Ignition "ON" & Engine "OFF".
   (2) With IATS and ECM connector still disconnected, measure voltage between terminals 1 of the IAT sensor harness connector and 22 of the ECM harness connector(C68-3).

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Go to "Terminal and Connector Inspection" procedure.

   NO

   Repair open circuit and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

Go to "Component Inspection" procedure.

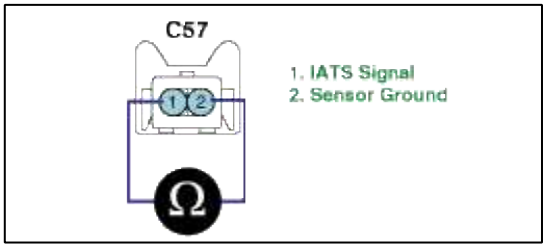
COMPONENT INSPECTION

1. Ignition "OFF"

2. Measure resistance between terminals 1 and 2 of the IAT sensor connector(Component side).

Specification : (at 20°C (68°F))

Temperature	Resistance (kΩ)
-20°C (-4°F)	Approx. 14.26~16.02
20°C (68°F)	Approx. 2.31~2.59
80°C (176°F)	Approx. 0.31~0.32



3. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check IAT sensor for contamination, deterioration, or damage. Substitute with a known-good IAT sensor and check for proper operation. If the problem is corrected, replace IAT sensor 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

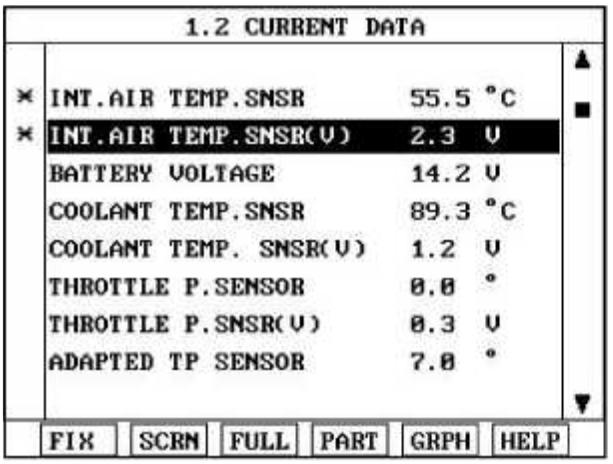


Fig. 1

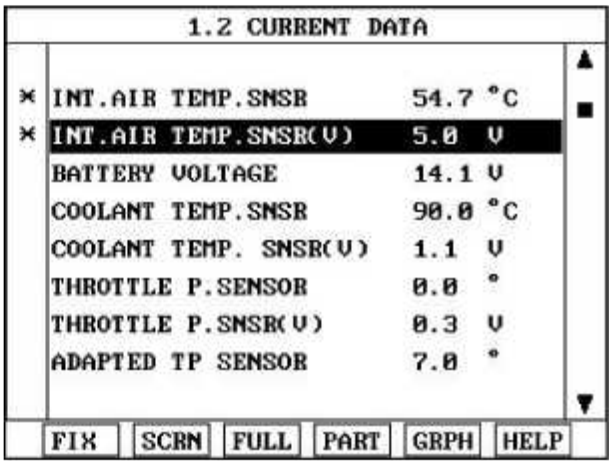


Fig. 2

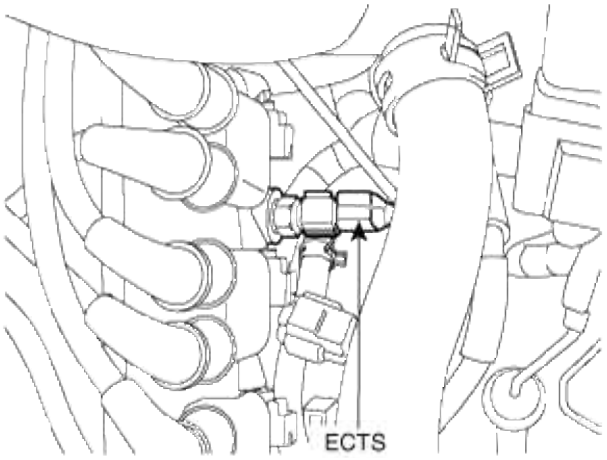
Fig 1) Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature : Approx. 2.3V at 55.5℃(132°F)
Fig 2) Short to battery in signal circuit : Approx. 5V

SPECIFICATION

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(°C)	(°F)		(°C)	(°F)	
-20	-4	14.26~16.02	40	104	1.11~1.19
0	32	5.50~6.05	60	140	0.57~0.60
20	68	2.31~2.59	80	176	0.31~0.32

Fuel System > Troubleshooting > P0116

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the

temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

DTC DESCRIPTION

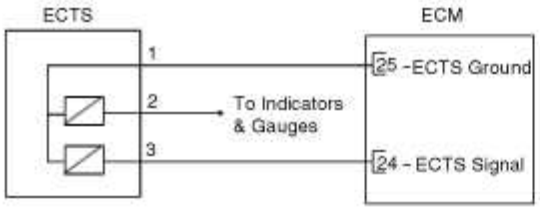
The purpose of this diagnosis is to detect a stuck coolant temperature signal. The diagnostic function checks whether after a variation of the calculated coolant temperature also a variation of the measured coolant temperature is detected.ECM sets DTC P0116 when the variation of measured engine coolant temperature from engine start is smaller than threshold while variation of calculated coolant temperature by ECM is greater than threshold.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check coolant temperature signal stuck.	• Contact resistance in connections. • Faulty ECT sensor
Enable Conditions	• Engine coolant >20°C (68°F) • After 100~1000 seconds from engine start	
Threshold Value	• TCOmodel increase > Threshold But TCO measuring increase <Threshold(Threshold depends on Coolant start temp.)	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

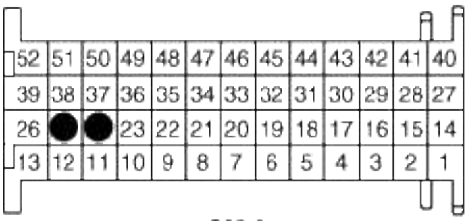


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM terminal C68-3(25)	ECTS Ground
2	Indicators & Gauges	-
3	ECM terminal C68-3(24)	ECTS Signal

[HARNESS CONNECTORS]

C94
ECTS Harness side connector



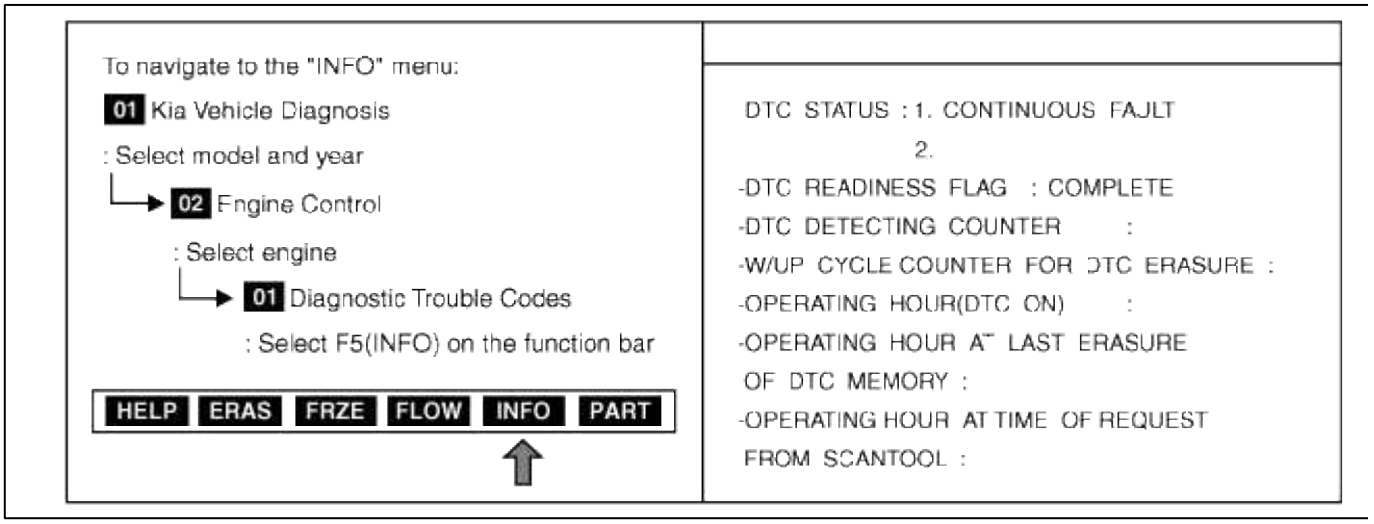
C68-3
ECM side terminal

MONITOR DTC STATUS

NOTE

If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

Go to "Component Inspection" procedure.

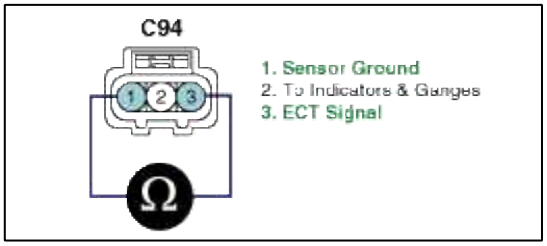
COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect ECTS connector

3. Measure resistance between terminals 1 and 3 of the ECT sensor connector (Component side)

Specification :

Temperature	Resistance (kΩ)
-20°C (-4°F)	Approx. 14.13~16.83
20°C (68°F)	Approx. 2.31~2.59
80°C (176°F)	Approx. 0.32



4. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ECT sensor for contamination, deterioration, or damage. Substitute with a known-good ECT sensor and check for proper operation. If the problem is corrected, replace ECT sensor 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

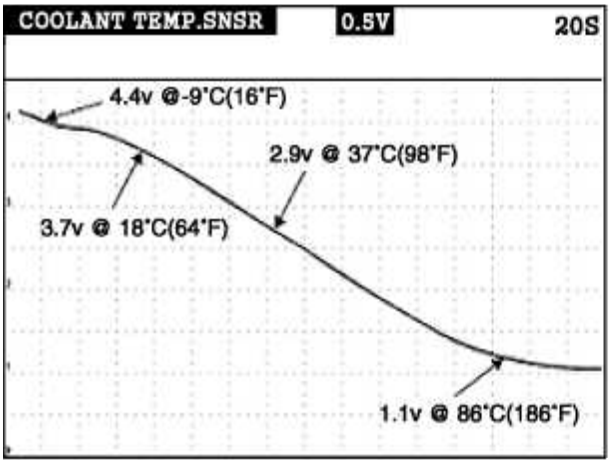
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



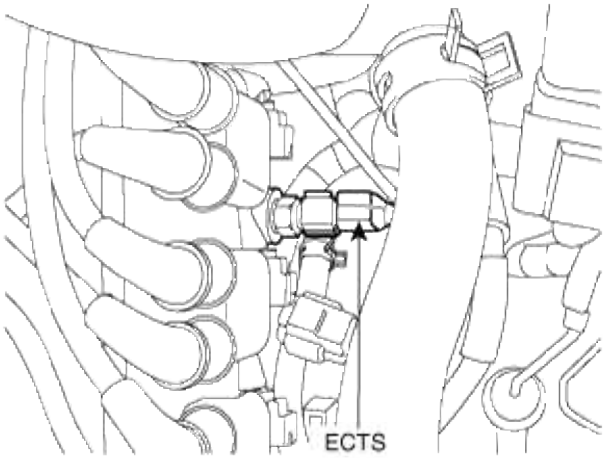
Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature

SPECIFICATION

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(°C)	(°F)		(°C)	(°F)	
-20	-4	14.13~16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31~2.59	80	176	0.32

Fuel System > Troubleshooting > P0117

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes.

During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

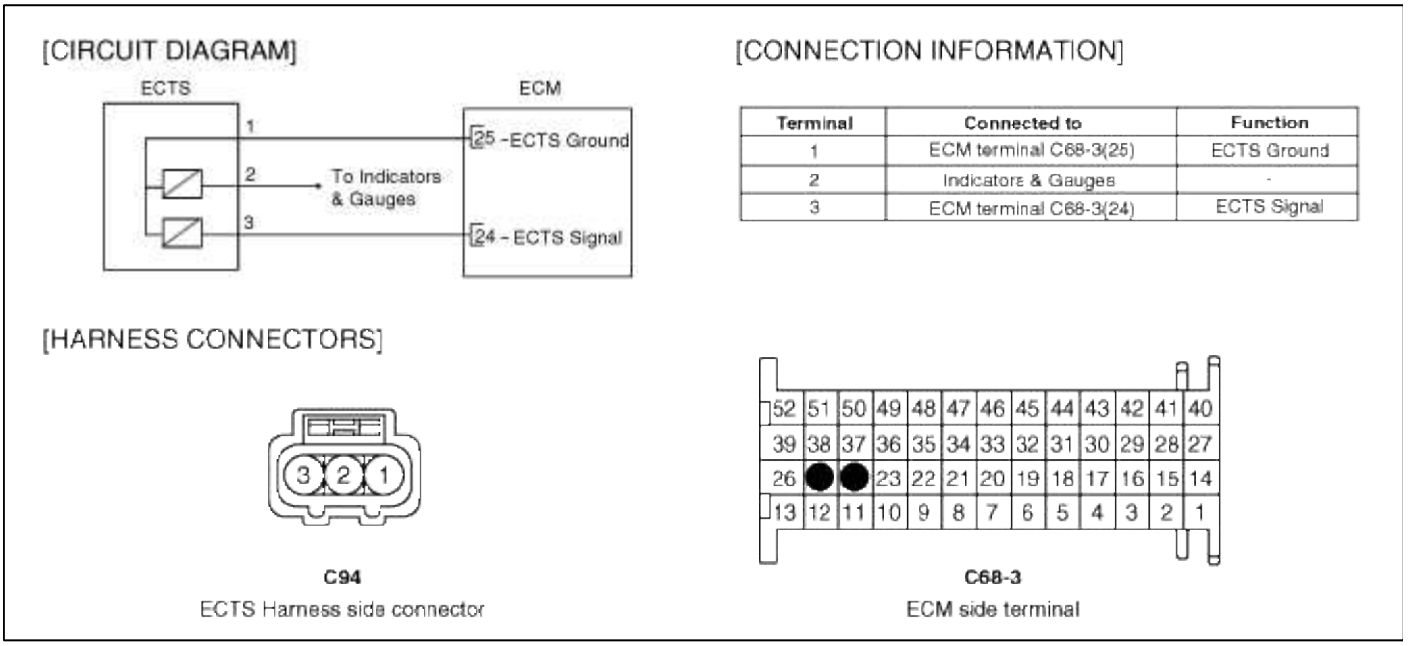
DTC DESCRIPTION

ECM sets DTC P0117 if the ECM detects signal voltage lower than the possible range of a properly operating ECTS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Contact resistance in connections. • Faulty ECT sensor
Enable Conditions	• Engine coolant >20°C (68°F) • After 100~1000 seconds from engine start	
Threshold Value	• Measured coolant temperature > 138°C(280°F).	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

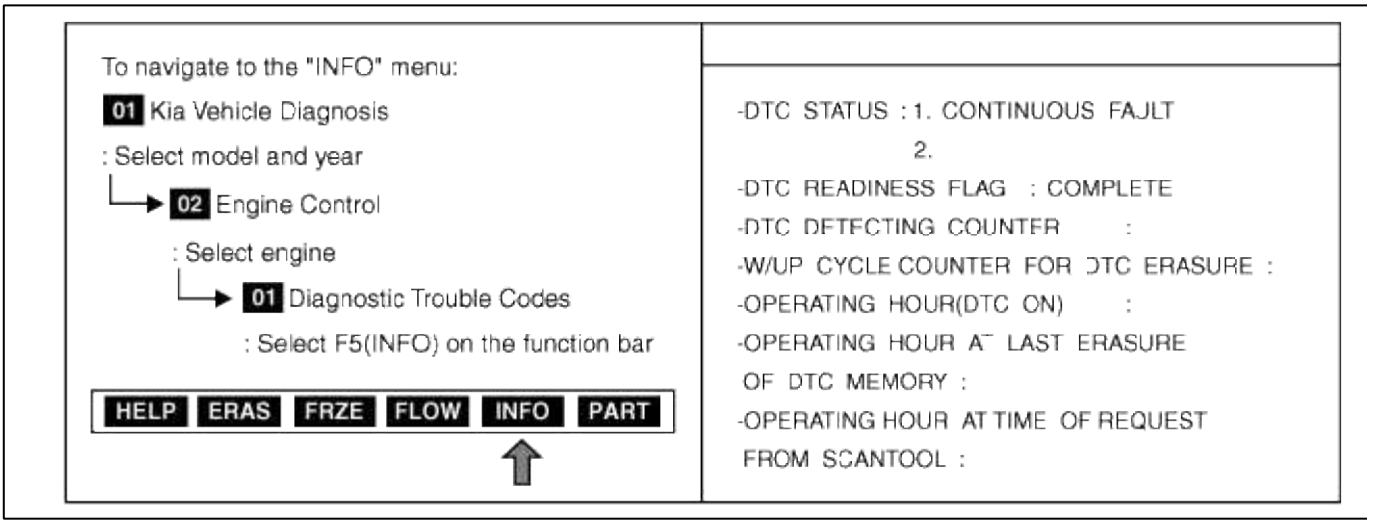
SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

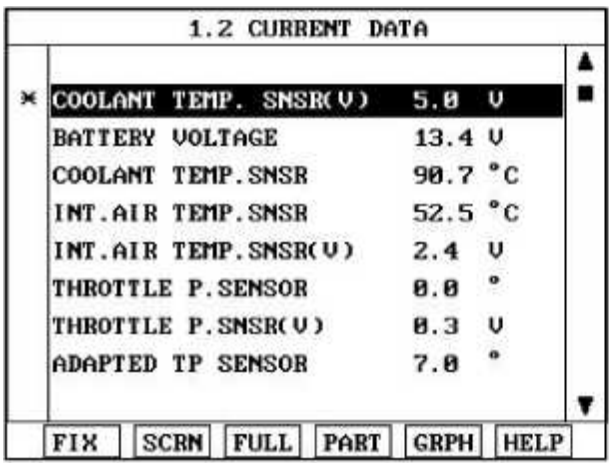
NO

Go to "Monitor Scantool Data" procedure.

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF".
2. Disconnect ECTS connector.
3. Connect Scantool and monitor the "COOLANT TEMP. SNSR(V)" parameter on the Scantool data list.

Specification : Approx. 5V



4. Is ECTS parameter within the specification?

YES

Possibility of sensor malfunction. Go to "Component Inspection" procedure.

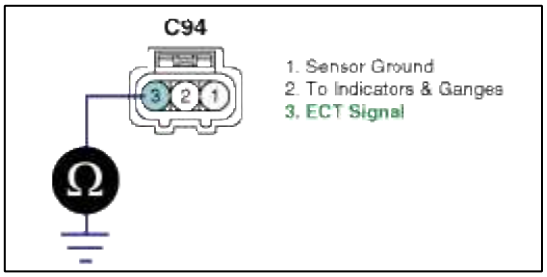
NO

Possibility of signal circuit short to ground. Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Measure resistance between terminal 3 of the ECT sensor harness connector and chassis ground.

Specification : Infinite



3. Is resistance within the specification?

YES

Go to "Terminal and Connector Inspection" procedure.

NO

Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

Go to "Component Inspection" procedure.

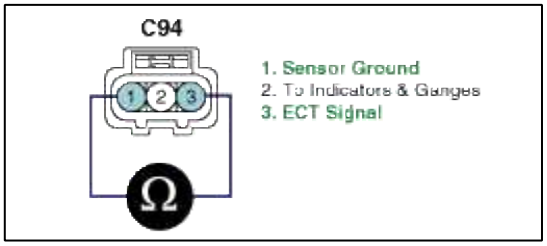
COMPONENT INSPECTION

1. Disconnect ECTS connector

2. Measure resistance between terminals 1 and 3 of the ECT sensor connector (Component side)

Specification :

Temperature	Resistance (kΩ)
-20°C (-4°F)	Approx. 14.13~16.83
20°C (68°F)	Approx. 2.31~2.59
80°C (176°F)	Approx. 0.32



3. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ECTS for contamination, deterioration, or damage. Substitute with a known-good ECTS and check for proper operation. If the problem is corrected, replace ECTS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

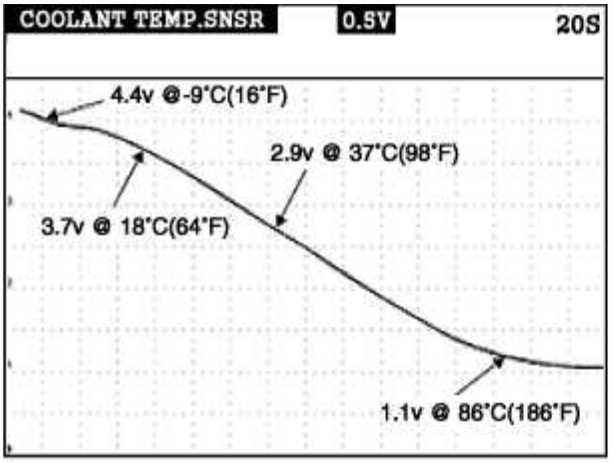


Fig. 1

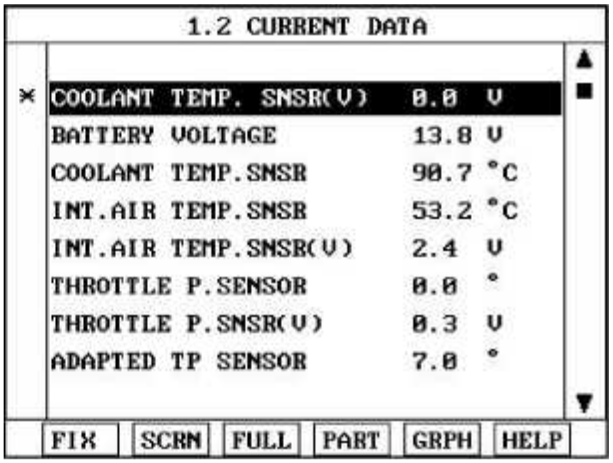


Fig. 2

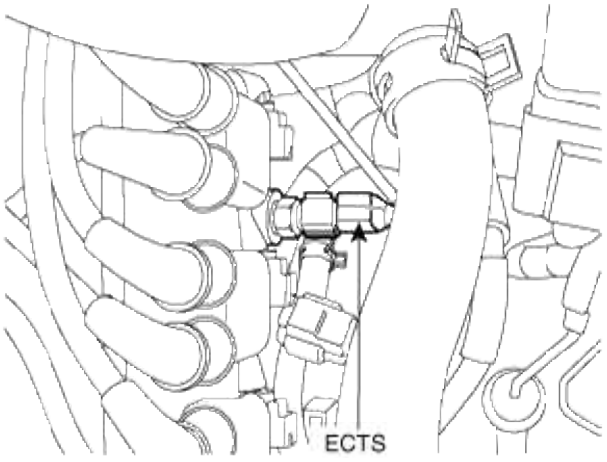
Fig 1) Signal decreases with increasing sensor temperature and increases with decreasign sensor temperature.
Fig 2) Short to ground in signal circuit : Approx. 0V

SPECIFICATION

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(°C)	(°F)		(°C)	(°F)	
-20	-4	14.13~16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31~2.59	80	176	0.32

Fuel System > Troubleshooting > P0118

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is,

the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

DTC DESCRIPTION

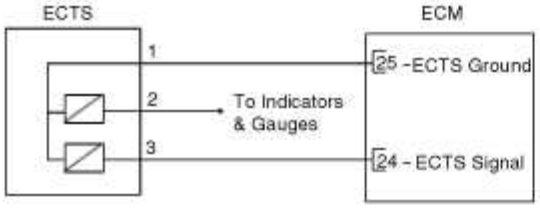
ECM sets DTC P0118 if the ECM detects signal voltage higher than the possible range of a properly operating ECTS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to battery in signal harness • Open in signal or ground circuit • Contact resistance in connections. • Faulty ECT sensor
Enable Conditions	• Engine coolant >20°C (68°F) • After 100~1000 seconds from engine start	
Threshold Value	• Measured coolant temperature < -38°C(-36°F).	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

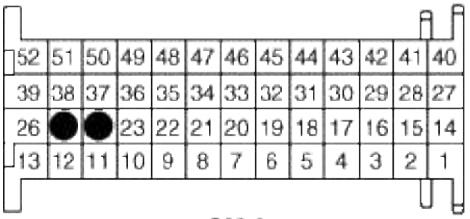


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM terminal C68-3(25)	ECTS Ground
2	Indicators & Gauges	-
3	ECM terminal C68-3(24)	ECTS Signal

[HARNESS CONNECTORS]

C94
ECTS Harness side connector

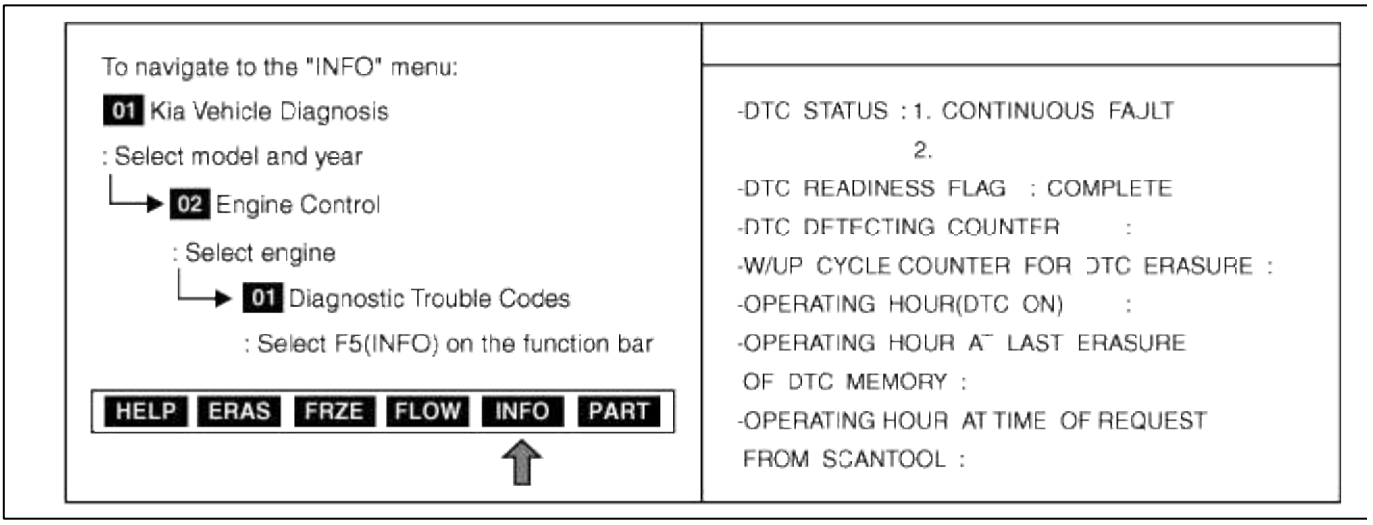


C68-3
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

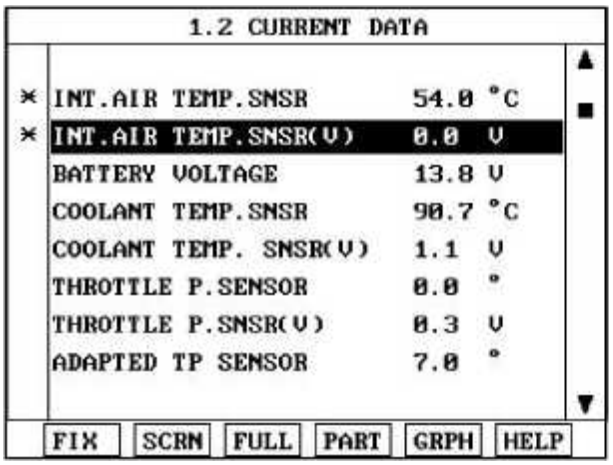
NO

Go to "Monitor Scantool Data" procedure.

MONITOR SCANTOOL DATA

1. Ignition "ON" & Engine "OFF"
2. Disconnect ECTS connector
3. Connect Scantool and monitor the "COOLANT TEMP. SNSR(V)" parameter on the Scantool data list.
4. Jumper the terminals 1 and 2 of the ECTS harness connector together.

Specification : Approx. 0V



5. Is ECTS parameter within the specification?

YES

Possibility of sensor malfunction. Go to "Component Inspection" procedure.

NO

Go to next step as below.

6. Jumper the terminal 3 of the ECT sensor harness connector to chassis ground.
7. Observe the "ECT SENSOR" parameter on the Scantool.

Specification : Approx. 0V

---

8. Is ECT data within the specification?

YES

Possibility of open in ECTS ground circuit. Go to "Ground Circuit Inspection" procedure.

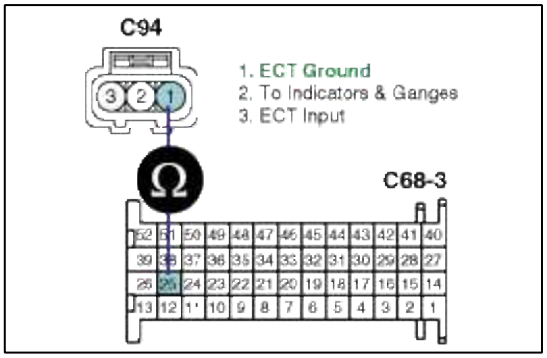
NO

Possibility of open or short to battery in ECTS signal circuit. Go to "Signal Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminals 1 of the ECT sensor harness connector and 25 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Terminal and connector Inspection" procedure.

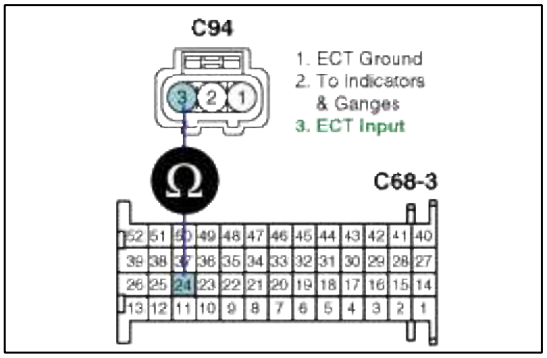
NO

Repair open circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in signal circuit.
   (1) Measure resistance between terminals 3 of the ECT sensor harness connector and 24 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (2) Is resistance within the specification?

   YES

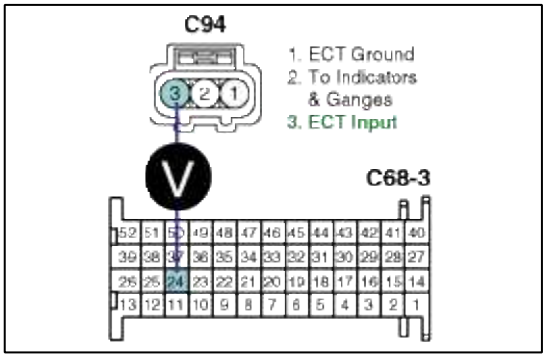
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in signal circuit.
   (1) Ignition "ON" & Engine "OFF".
   (2) Measure voltage between terminals 3 of the ECT sensor harness connector and 24 of the ECM harness connector(C68-3).

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Go to "Terminal and Connector Inspection" procedure

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

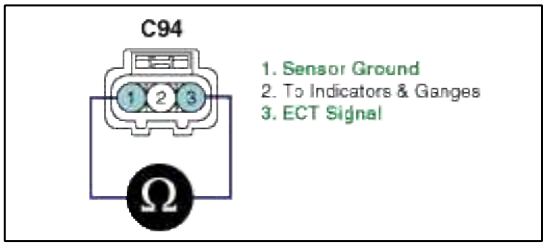
Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Measure resistance between terminals 1 and 3 of the ECT sensor connector (Component side)

Specification :

Temperature	Resistance (kΩ)
-20°C (-4°F)	Approx. 14.13~16.83
20°C (68°F)	Approx. 2.31~2.59
80°C (176°F)	Approx. 0.32



3. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ECTS for contamination, deterioration, or damage. Substitute with a known-good ECTS and check for proper operation. If the problem is corrected, replace ECTS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

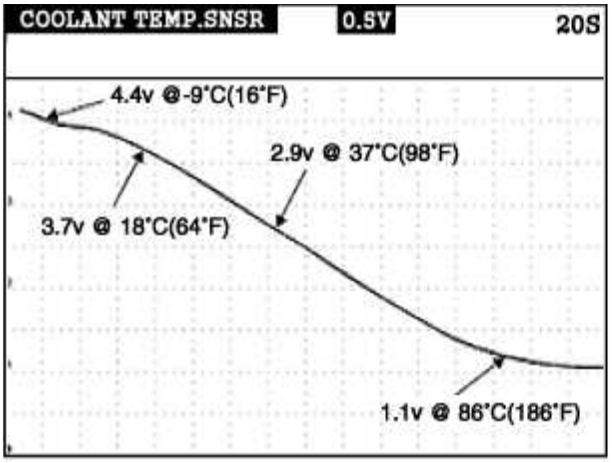


Fig. 1

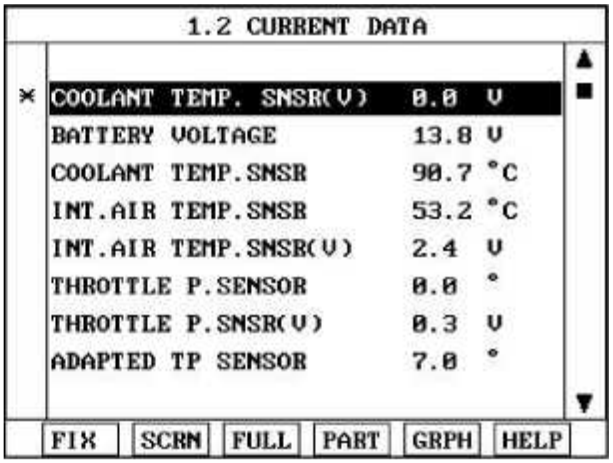


Fig. 2

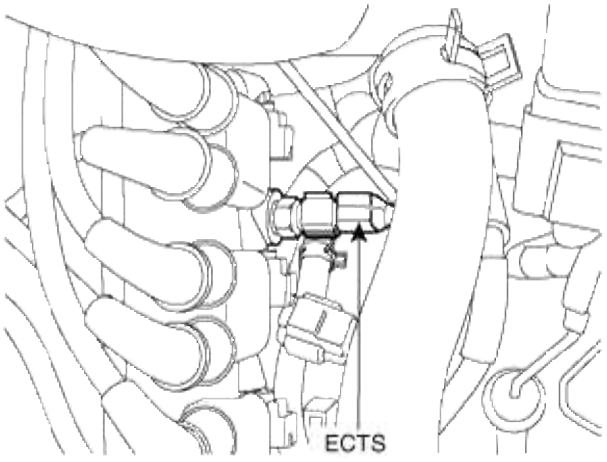
Fig 1) Signal decreases with increasing sensor temperature and increases with decreasign sensor temperature.
Fig 2) Short to ground in signal circuit : Approx. 0V

SPECIFICATION

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(°C)	(°F)		(°C)	(°F)	
-20	-4	14.13~16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31~2.59	80	176	0.32

Fuel System > Troubleshooting > P0119

COMPONENT LOCATION



GENERAL DESCRIPTION

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is,

the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

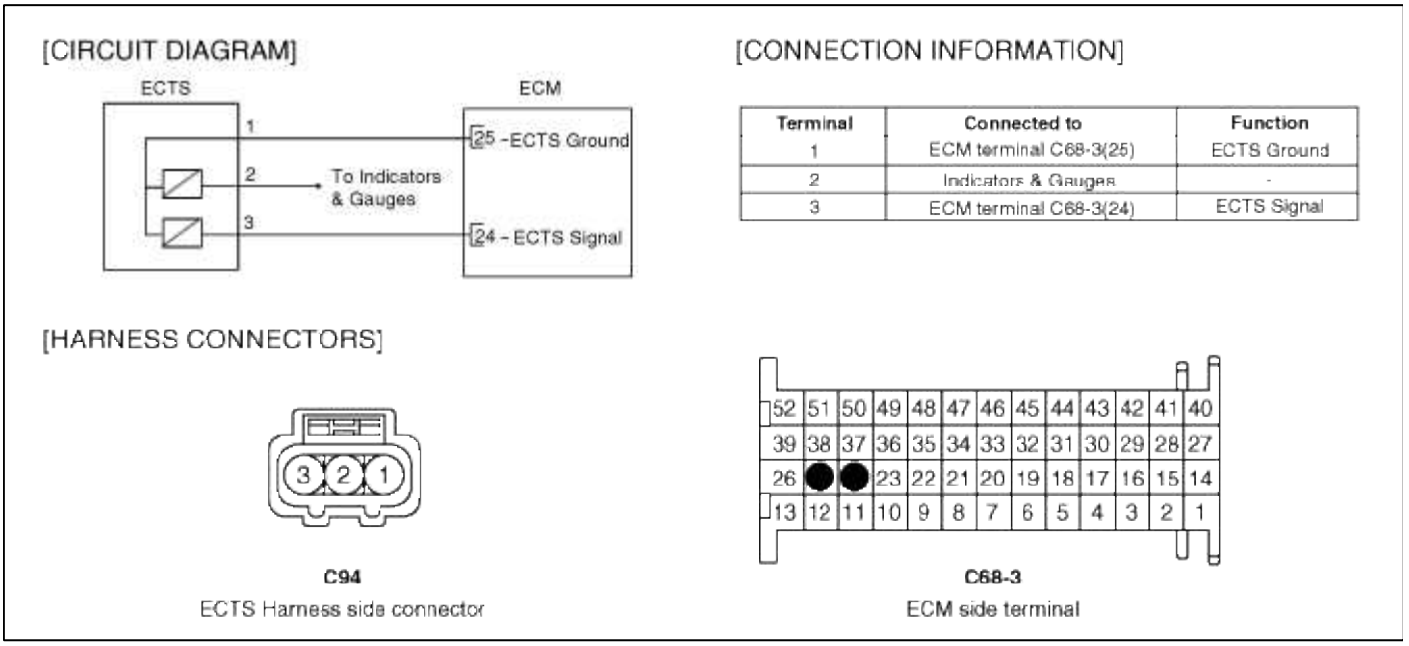
DTC DESCRIPTION

ECM sets DTC P0119 when the gradient of engine coolant temperature is abnomal.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitor the gradient of coolant temperature	• Contact resistance in connections. • Faulty ECT sensor
Enable Conditions	• Engine coolant >20°C (68°F) • After 100~1000 seconds from engine start	
Threshold Value	• TCO Gradient < 10°C(50°F) / 0.5 sec.	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

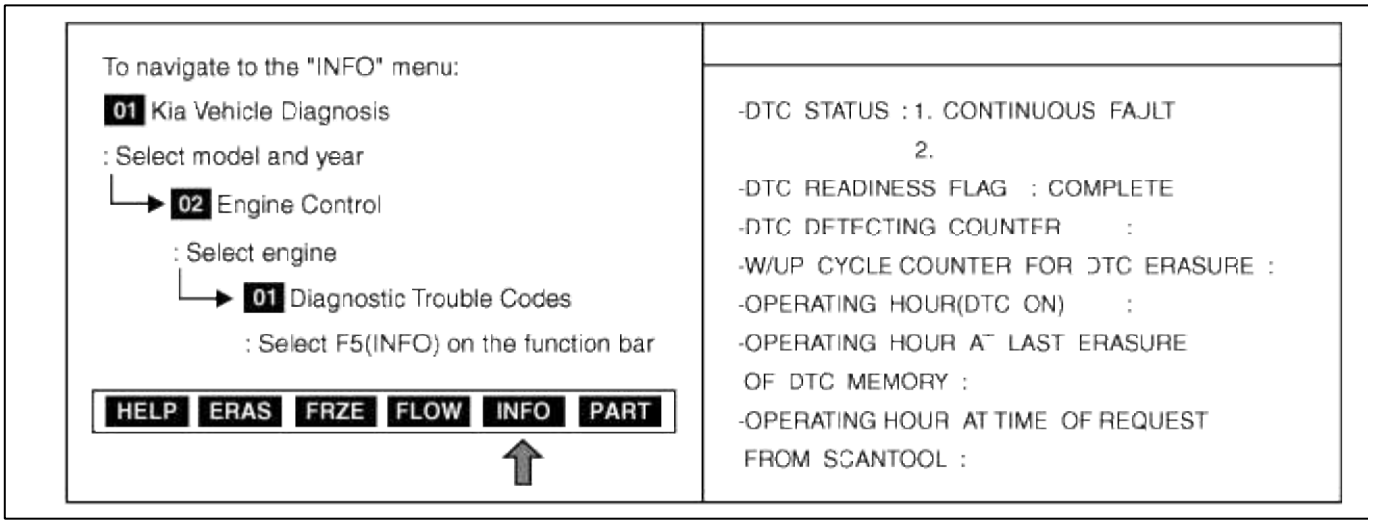
SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

Go to "Component Inspection" procedure.

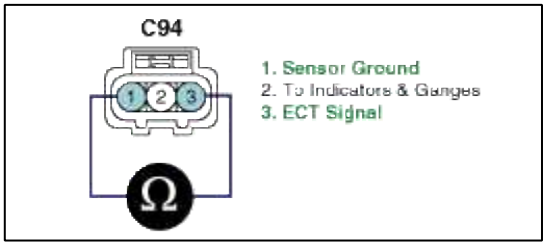
COMPONENT INSPECTION

1. Ignition "OFF"
2. Disconnect ECTS connector.

3. Measure resistance between terminals 1 and 3 of the ECT sensor connector (Component side)

Specification :

Temperature	Resistance (kΩ)
-20°C (-4°F)	Approx. 14.13~16.83
20°C (68°F)	Approx. 2.31~2.59
80°C (176°F)	Approx. 0.32



4. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ECTS for contamination, deterioration, or damage. Substitute with a known-good ECTS and check for proper operation. If the problem is corrected, replace ECTS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

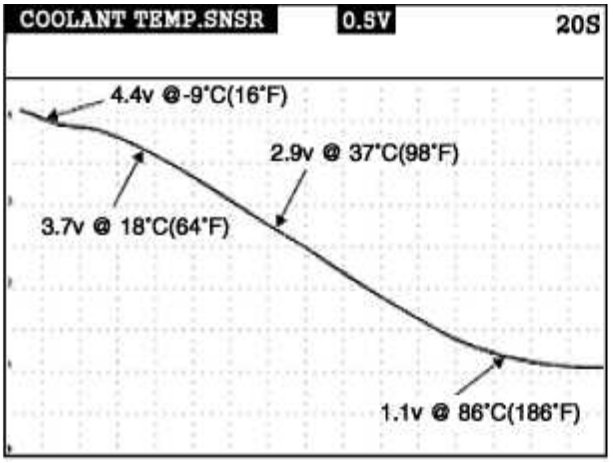


Fig. 1

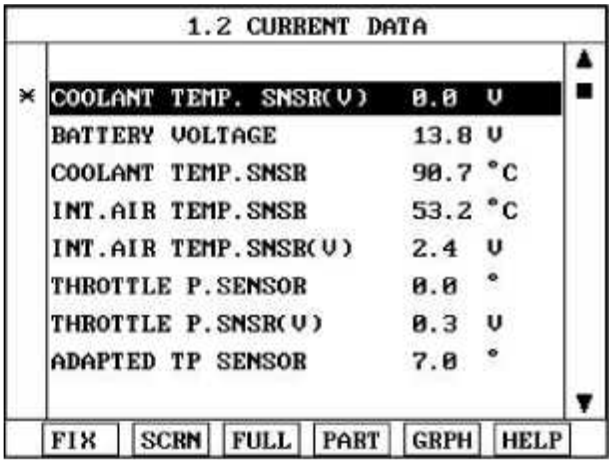


Fig. 2

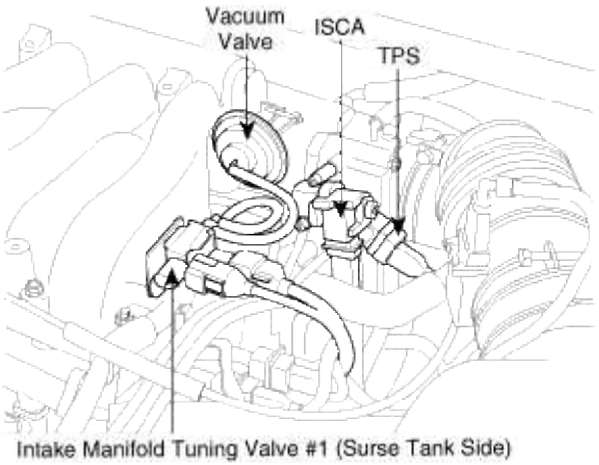
Fig 1) Signal decreases with increasing sensor temperature and increases with decreasign sensor temperature.
Fig 2) Short to ground in signal circuit : Approx. 0V

SPECIFICATION

Temperature		Resistance (kΩ)	Temperature		Resistance (kΩ)
(°C)	(°F)		(°C)	(°F)	
-20	-4	14.13~16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31~2.59	80	176	0.32

Fuel System > Troubleshooting > P0121

COMPONENT LOCATION



GENERAL DESCRIPTION

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) 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) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

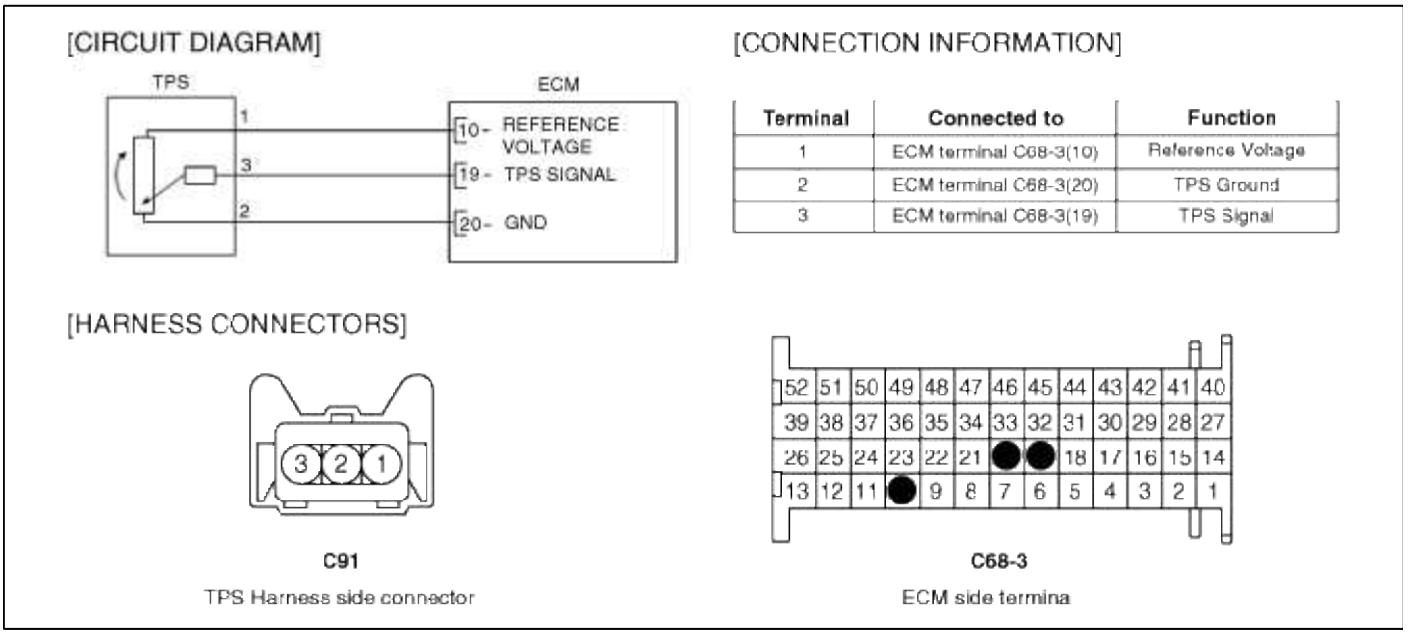
DTC DESCRIPTION

The ECM compares the actual measured Mass Air Flow signal with the modeled Mass Air Flow value to detect implausible TPS signal. Because throttle position is one of key parameters in determining the modeled MAF. The modeled Mass Air Flow value is determined by engine speed, throttle angle and ISCA duty. The DTC P0121 is set when the difference between these two value is too high or too low with lambda deviation in same direction for a certain time.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Compare calculated MAF with MAF signa	• Contact resistance in connectors • Faulty TP Sensor(TPS)
Enable Conditions	• 1500< Engine speed(RPM) < 3500 • 150< Measured mass air flow(mg/stk) <350 • Coolant temp. >60°C(140°F)	
Threshold Value	• Measured MAF/Calculated MAF < 0.5 or > 1.3	
Diagnostic Time	• 110 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

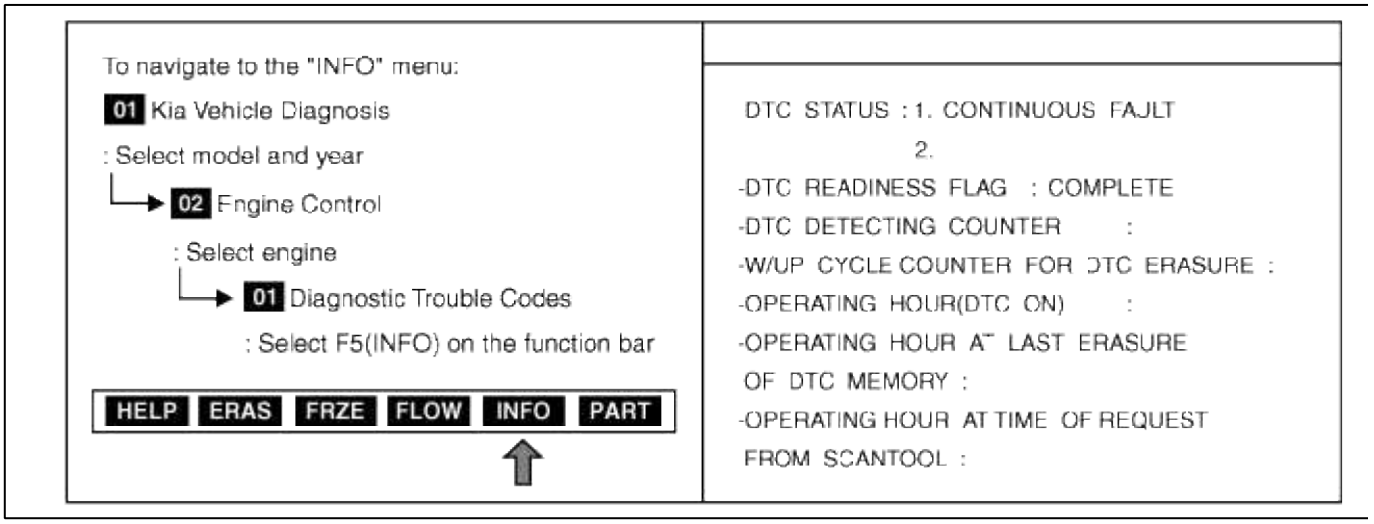


MONITOR DTC STATUS

NOTE

If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Air Leakage Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

NO

Go to "Component Inspection" procedure.

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the following items:
   A. Vacuum hoses for splits, kinks and improper connections.
   B. EVAP system for leakage.
   C. PCV hose for proper installation.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

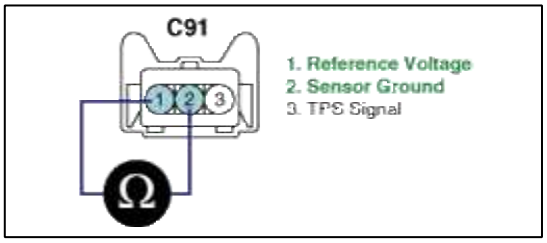
NO

Go to next step as below.

COMPONENT INSPECTION

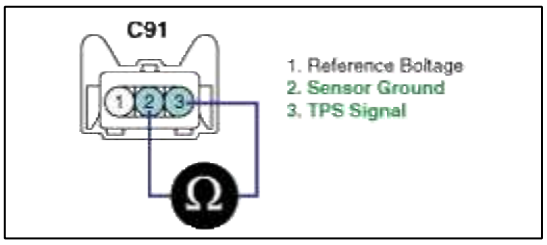
1. Ignition "OFF".
2. Disconnect TPS connector.
3. Measure resistance between terminals 1 and 2 of the TPS connector(Component side).

Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position



4. With still TPS connector disconnected, measure resistance between terminals 2 and 3 of the sensor connector(Component side)
5. Operate the throttle valve slowly from the idle position to the full open position and check the resistance changes smoothly in proportion with the throttle valve opening angle.

Specification : 0.71 ~ 1.38 kΩ at closed throttle valve, 2.7 kΩ at wide open throttle



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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.

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. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

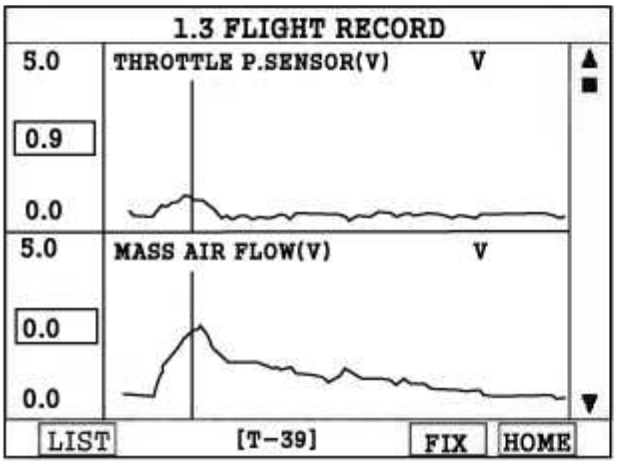


Fig. 1

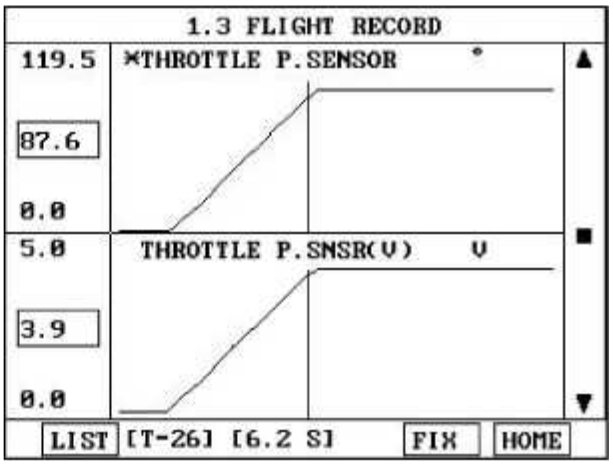


Fig. 2

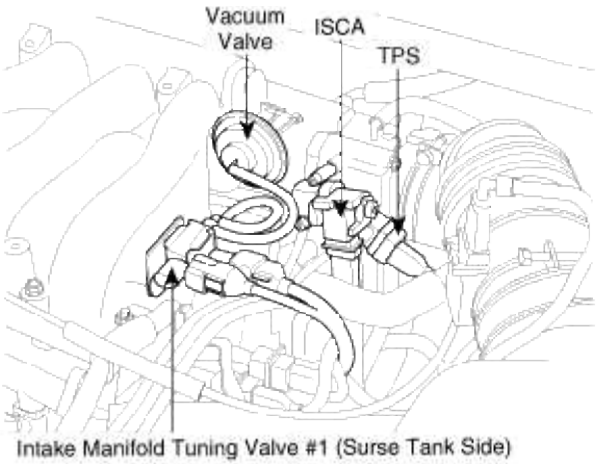
Fig 1) Normal value with accelerating and decelerating : The MAFS and TPS signals increase at the same time with accelerating and decrease with releasing accelerator pedal
Fig 2) Signal increases proportionally with throttle opening angle

SPECIFICATION

TPS		Normal parameter	
		C.T (Idle)	W.O.T
Throttle Angle (°)		0~0.5°	Approx. 85°
Signal Voltage (V)		0.25~0.8V	4.25~4.7V
Resistance (kΩ)	Terminal 2 and 3	0.71~1.38 kΩ at all temperature	2.7 kΩ at all temperature
	Terminal 1 and 2	1.6~2.4 kΩ at all throttle position	

Fuel System > Troubleshooting > P0122

COMPONENT LOCATION



GENERAL DESCRIPTION

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) 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) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC DESCRIPTION

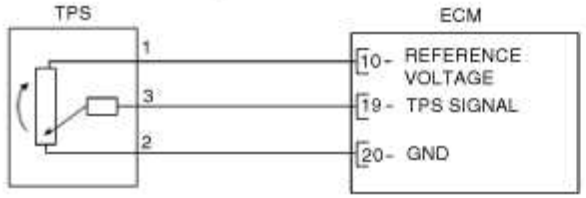
ECM sets DTC P0122 if the ECM detects signal voltage lower than the possible range of a properly operating TPS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Open in power supply harness • Short to ground in power supply or signal harness • Contact resistance in connectors • Faulty TP sensor
Enable Conditions	• 6 ≤ Battery voltage ≤ 16V	
Threshold Value	• Voltage <0.14V	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



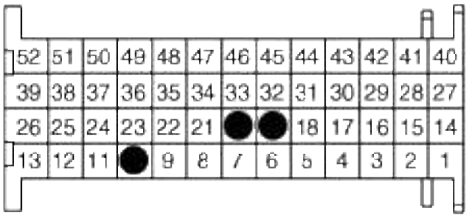
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM terminal C68-3(10)	Reference Voltage
2	ECM terminal C68 3(20)	TPS Ground
3	ECM terminal C68-3(19)	TPS Signal

[HARNESS CONNECTORS]

C91

TPS Harness side connector

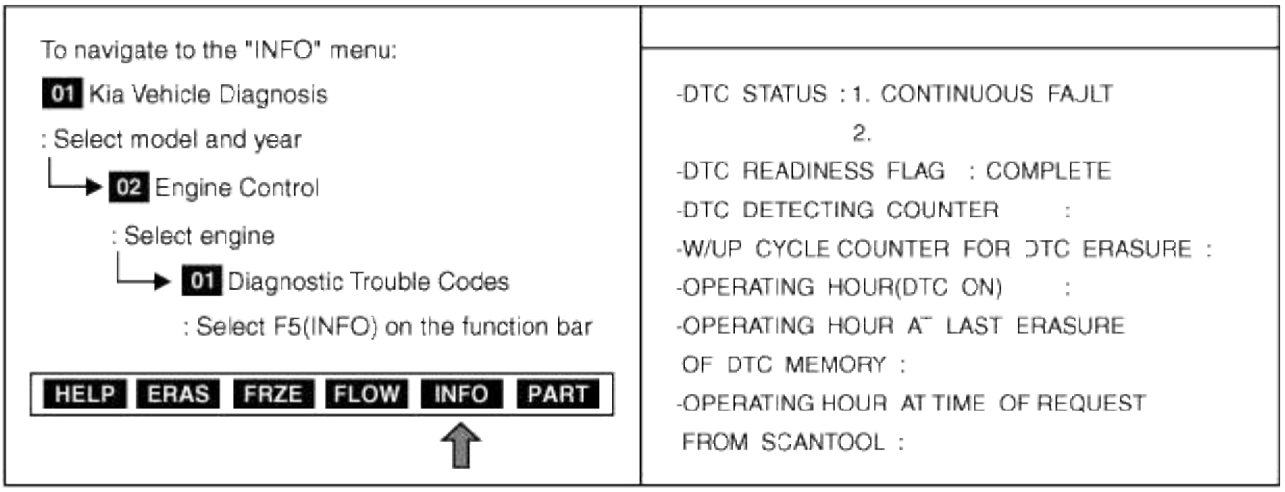


C68-3

ECM side termina

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

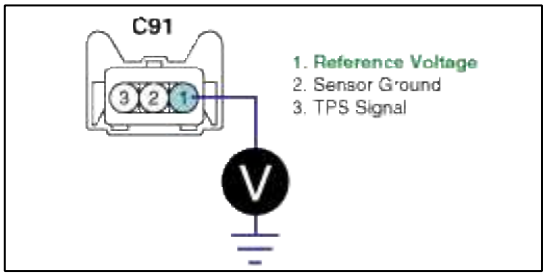
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : Approx. 5V



5. Is voltage within the specification?

YES

Go to "Signal Circuit inspection" procedure.

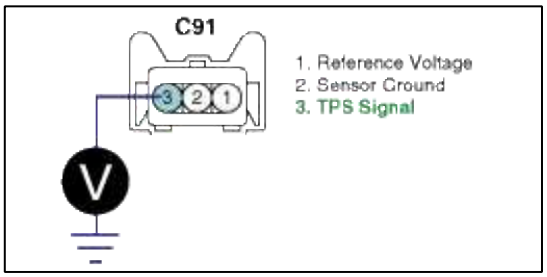
NO

Possibility of open or short to ground in 5V reference circuit.
Repair as necessary. Go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

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

Specification : Approx. 5V



3. Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

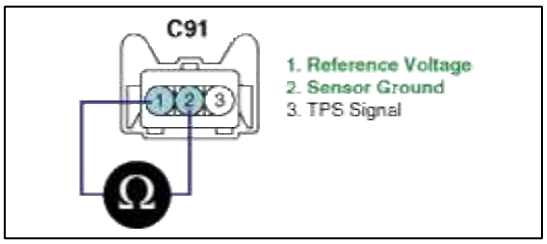
NO

Check the short to ground in signal circuit.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

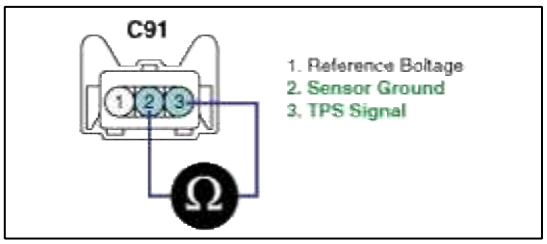
1. Ignition "OFF".
2. Disconnect TPS connector.
3. Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position



4. With still TPS connector disconnected, measure resistance between terminals 2 and 3 of the sensor connector(Component side)
5. Operate the throttle valve slowly from the idle position to the full open position and check the resistance changes smoothly in proportion with the throttle valve opening angle.

Test Condition : Ignition "OFF"
Specification : 0.71 ~ 1.38 kΩ at closed throttle valve, 2.7 kΩ at wide open throttle



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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.

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. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .

3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

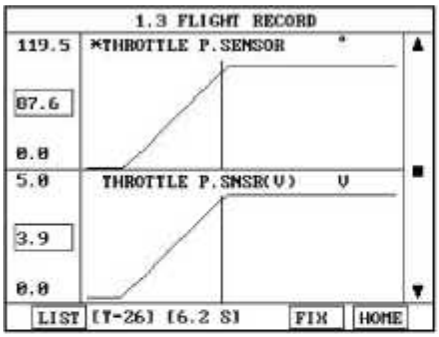


Fig. 1

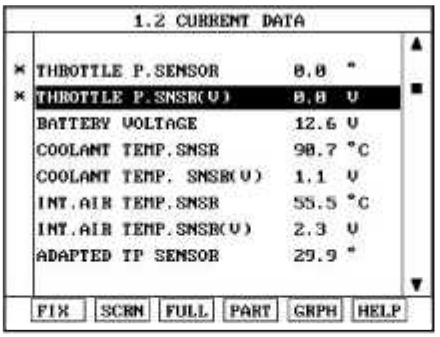


Fig. 2

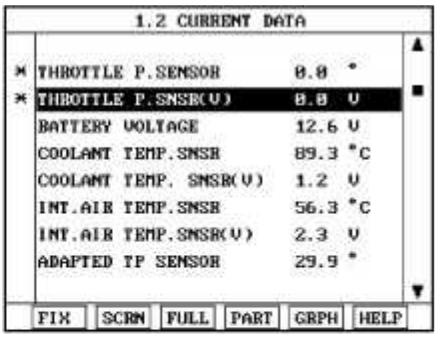


Fig. 3

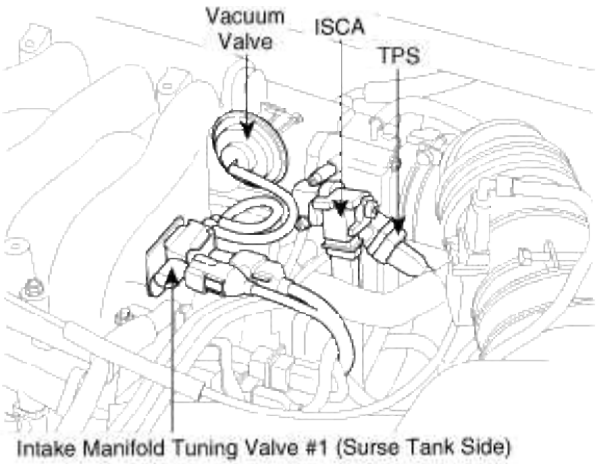
Fig 1) Signal increases proportionally with throttle opening angle
Fig 2) Short to ground in signal circuit/Open in power supply circuit : Approx. 0V
Fig 3) Short to ground in power supply circuit : Approx. 0V

SPECIFICATION

TPS		Normal parameter	
		C.T (Idle)	W.O.T
Throttle Angle (°)		0~0.5°	Approx. 85°
Signal Voltage (V)		0.25~0.8V	4.25~4.7V
Resistance (kΩ)	Terminal 2 and 3	0.71~1.38 kΩ at all temperature	2.7 kΩ at all temperature
	Terminal 1 and 2	1.6~2.4 kΩ at all throttle position	

Fuel System > Troubleshooting > P0123

COMPONENT LOCATION



GENERAL DESCRIPTION

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) 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) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC DESCRIPTION

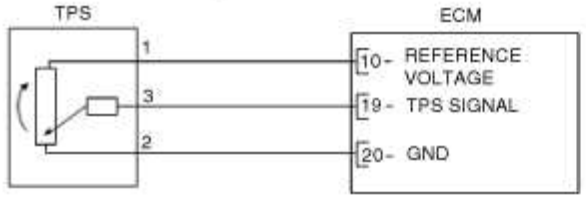
ECM sets DTC P0123 if the ECM detects signal voltage higher than the possible range of a properly operating TPS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Open in signal or ground circuit • Short to battery in signal circuit • Contact resistance in connectors • Faulty TP sensor
Enable Conditions	• 6 ≤ Battery voltage(V) ≤ 16	
Threshold Value	• Voltage > 4.86V	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



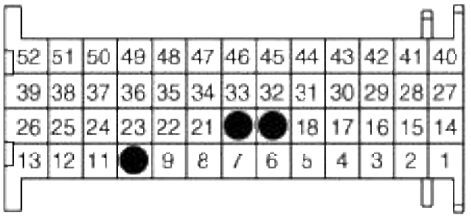
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM terminal C68-3(10)	Reference Voltage
2	ECM terminal C68 3(20)	TPS Ground
3	ECM terminal C68-3(19)	TPS Signal

[HARNESS CONNECTORS]

C91

TPS Harness side connector

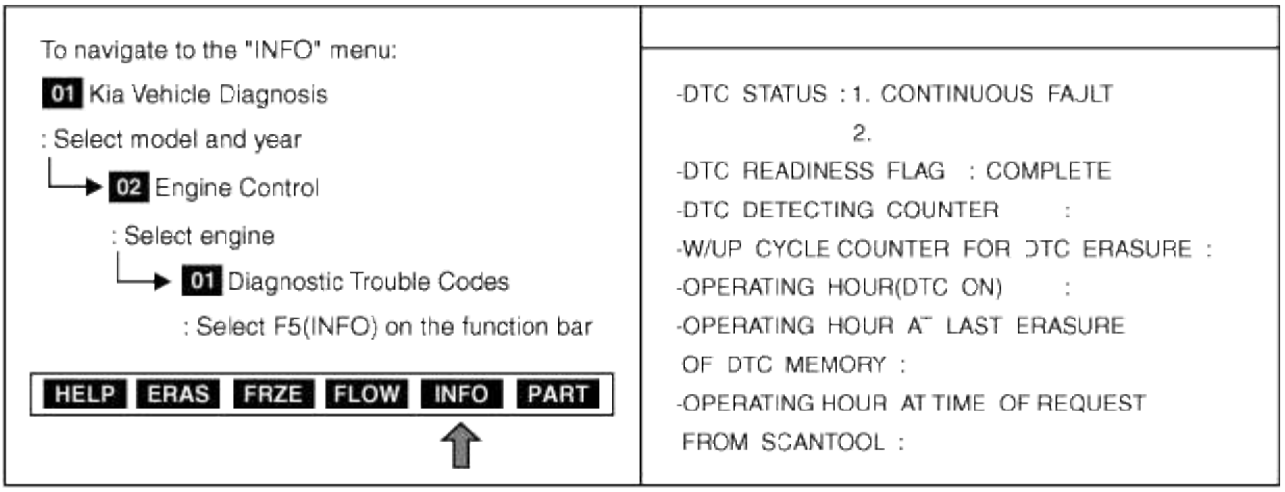


C68-3

ECM side termina

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure .

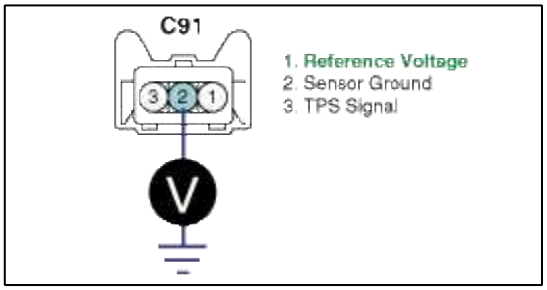
NO

Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect TPS connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification : Approx. 0V



5. Is voltage within the specification?

YES

Go to step "Signal Circuit Inspection" procedure.

NO

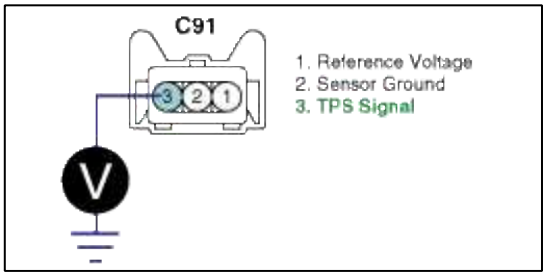
Check the ground circuit for an open.

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. With sensor connector still disconnected, measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : Approx. 5V



2. Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

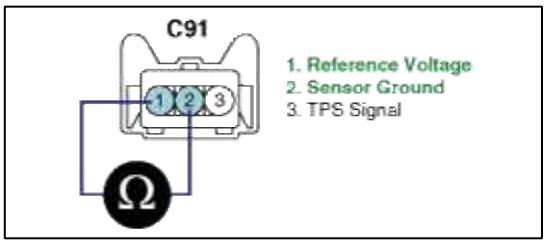
NO

Possibility of open or short to power in signal circuit.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

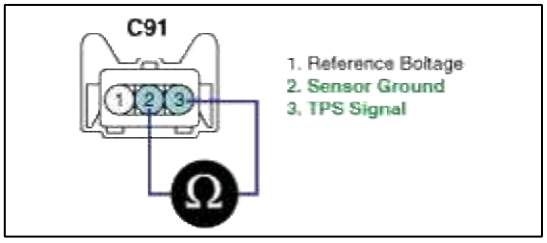
1. Ignition "OFF".
2. Disconnect TPS connector.
3. Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position



4. With still TPS connector disconnected, measure resistance between terminals 2 and 3 of the sensor connector(Component side)
5. Operate the throttle valve slowly from the idle position to the full open position and check the resistance changes smoothly in proportion with the throttle valve opening angle.

Specification : 0.71 ~ 1.38 kΩ at closed throttle valve, 2.7 kΩ at wide open throttle



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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.

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. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

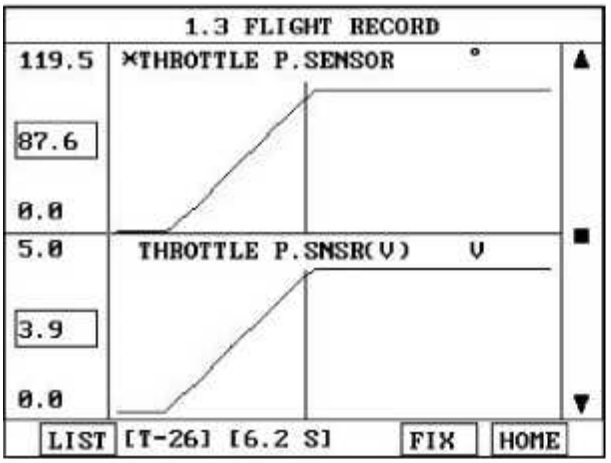


Fig. 1

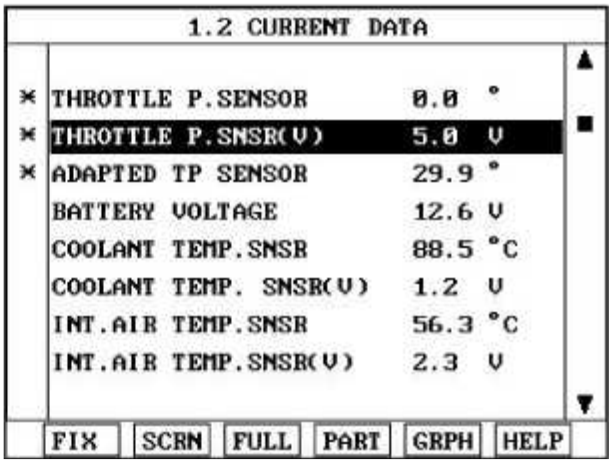


Fig. 2

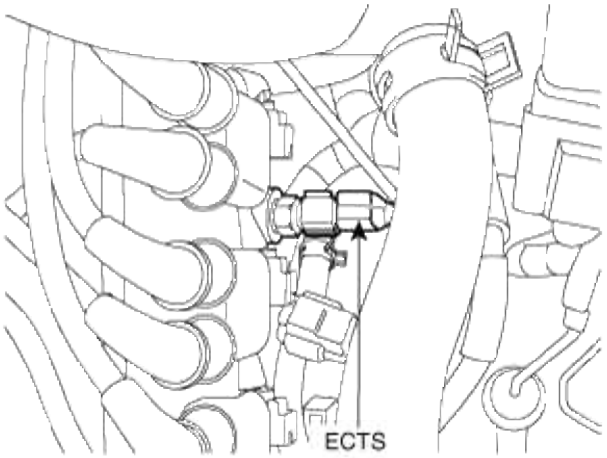
Fig 1) Signal increases proportinally with throttle opening angle
Fig 2) Open in signal or ground circuit : Approx. 5V

SPECIFICATION

TPS		Normal parameter	
		C.T (Idle)	W.O.T
Throttle Angle (°)		0~0.5°	Approx. 85°
Signal Voltage (V)		0.25~0.8V	4.25~4.7V
Resistance (kΩ)	Terminal 2 and 3	0.71~1.38 kΩ at all temperature	2.7 kΩ at all temperature
	Terminal 1 and 2	1.6~2.4 kΩ at all throttle position	

Fuel System > Troubleshooting > P0125

COMPONENT LOCATION



GENERAL DESCTIPTION

An Engine Coolant Temperature Sensor (ECTS) monitors the temperature of the coolant. This input is used by the ECM for engine control and as an enabling criteria for related diagnostics. The air flow coming into the engine is accumulated and used to determine if the engine has been driven within conditions that would allow the engine coolant to heat up normally to the thermostat regulating temperature. If the coolant temperature does not reach regulating temperature of the thermostat, diagnostics that use engine coolant temperature as enabling criteria, may not run when expected.This DTC will set when there has been excessive time to reach a minimum coolant temperature required for closed loop fuel control.

DTC DESCRIPTION

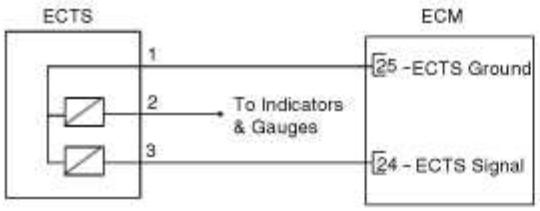
The purpose of this diagnosis is to monitor the minimum coolant temperature that enables lambda closed loop control after start. Minimum coolant temperature to run lambda control must be reached before the threshold time predetermined according to intake air temperature at start. If the lambda control is not active because of low engine coolant temperature within predetermined minimum time after start, the ECM sets DTC P0125.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check time to closed loop control start with coolant temperature model.	• Contact resistance in connectors. • Faulty cooling system. • Faulty thermostat. • Faulty ECT sensor.
Enable Conditions	• Engine coolant > 20°C(68°F) • After 100~1000 seconds from engine start	
Threshold value	• Measured coolant temperature< threshold When modeled coolant temperature > threshold	
Diagonostic Time	• 0.5 sec.	
Fall Safe	• Calculated engine coolant temperature is used for engine control. • Cooling/Condenser fan is active with MAX speed. • EVAP. emission control function is controlled in minimum operation mode.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



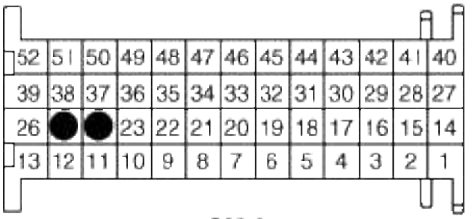
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM terminal C68-3(25)	ECTS Ground
2	Indicators & Gauges	-
3	ECM terminal C68-3(24)	ECTS Signal

[HARNESS CONNECTORS]

C94

ECTS Harness side connector



C68-3

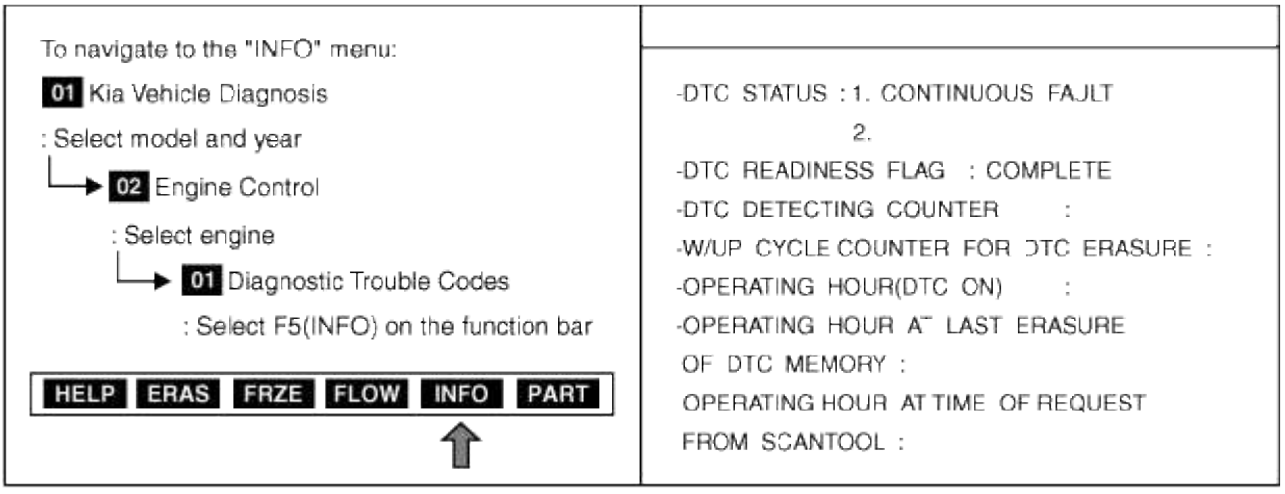
ECM side terminal

MONITOR DTC STATUS

NOTE

If any codes relating to ECTs are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

Cooling system inspection

1. Check cooling system coolant level and fill if low.
2. Check for a proper cooling system operation. Especially check that cooling and condenser fan working normally.
3. Remove the thermostat and check the following items:
   A. Stuck or damaged
   B. Verify the temperature at which the valve begins to open.
      Valve opening temperature : 80~84°C(176~183.2°F)
      Valve opening temperature : 95°C(203°F)
4. Is a problem found?

YES

5. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

6. Go to next step as below.

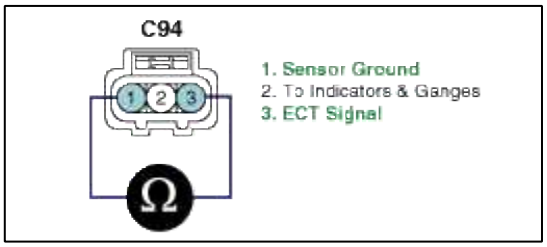
COMPONENT INSPECTION

1. Ignition "OFF" .
2. Disconnect ECTS connector.

3. Measure resistance between terminals 1 and 3 of the sensor connector(Component side).
Specification

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	14.13~16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31~2.59	80	176	0.32

4. Is resistance within the specification?



YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ECTS for contamination, deterioration, or damage. Substitute with a known-good ECTS and check for proper operation. If the problem is corrected, replace ECTS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter
4. Is parameter displayed "History(Not Present) fault"?

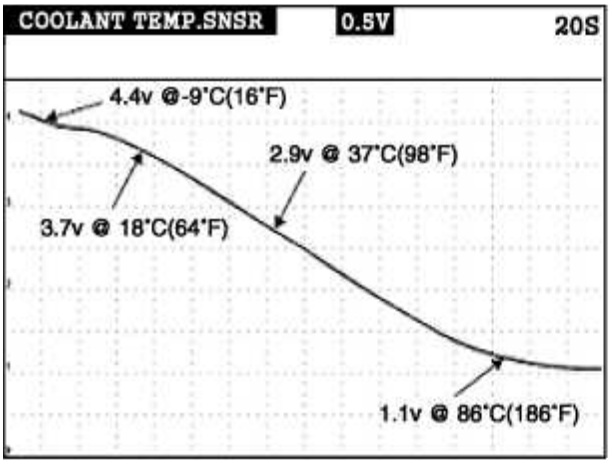
YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature

SPECIFICATION

[ECTS]

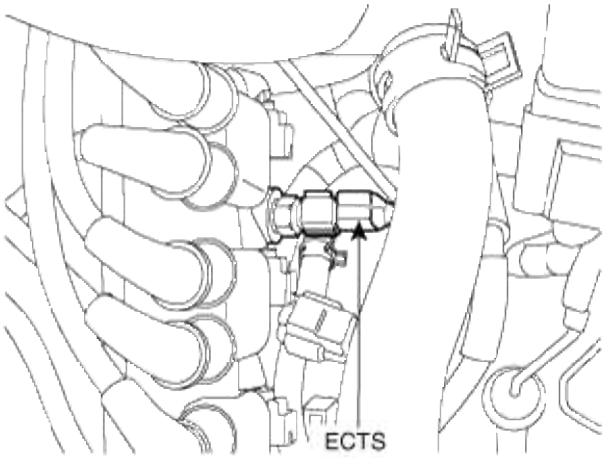
Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

[THERMOSTAT]

Thermostat	Normal Parameter
Valve Opening Temp.	80~84°C(176~183°F)
Valve Closing Temp.	77°C(170.6°F)
Full Open Lift	Above 10mm at 95°C(203°F)

Fuel System > Troubleshooting > P0128

COMPONENT LOCATION



GENERAL DESCTIPTION

An Engine Coolant Temperature Sensor (ECTS) monitors the temperature of the coolant. This input is used by the ECM for engine control and as an enabling criteria for same diagnostics. The air flow coming into the engine is accumulated and used to determine if the engine has been driven within conditions that would allow the engine coolant to heat up normally to the thermostat regulating temperature. If the coolant temperature does not reach regulating temperature of the thermostat, diagnostics that use engine coolant temperature as enabling criteria, may not run when expected.This DTC will set when there has been excessive time to reach a minimum coolant temperature required for closed loop fuel control.

DTC DESCRIPTION

An open stuck thermostat means an increase of the engine warm up time and can cause emission increase as well. To detect open stuck thermostat, the ECM checks measured coolant temperature as soon as calculated coolant temperature reaches threshold (85°C) and sets DTC P0128 when measured coolant temperature is lower than threshold. If same code is set again in the next driving cycle, MIL is illuminated.

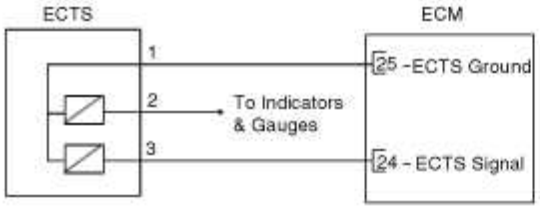
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Coolant temp.not reached warm up state	• Contact resistance in connectors • Faulty cooling system • Faulty thermostat
Enable Conditions	• Percentage of fuel-cut off phase<20% • Percentage of low load phase <50% • Intake air temperature decreases compared to start Intake air temp. > -9°C(16°F) • Percentage of low vehicle speed <78% • Percentage of high vehicle speed <90% • Coolant temperature at start >-9°C(16°F) • Intake air temperature at start >-9°C(16°F)	
Threshold value	• Measured coolant temp.< 75°C(167°F) When modelled coolant temp. > 85°C(185°F)	
Diagonostic Time	• 7~30 min. depending on coolant temperature at start and driving pattern	
Fall Safe	• Catalyst monitoring is inhibited • Post catalyst fuel trim system monitoring is inhibited	

MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

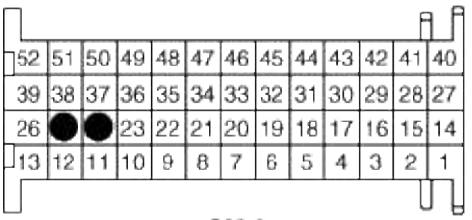


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM terminal C68-3(25)	ECTS Ground
2	Indicators & Gauges	-
3	ECM terminal C68-3(24)	ECTS Signal

[HARNESS CONNECTORS]

C94
ECTS Harness side connector



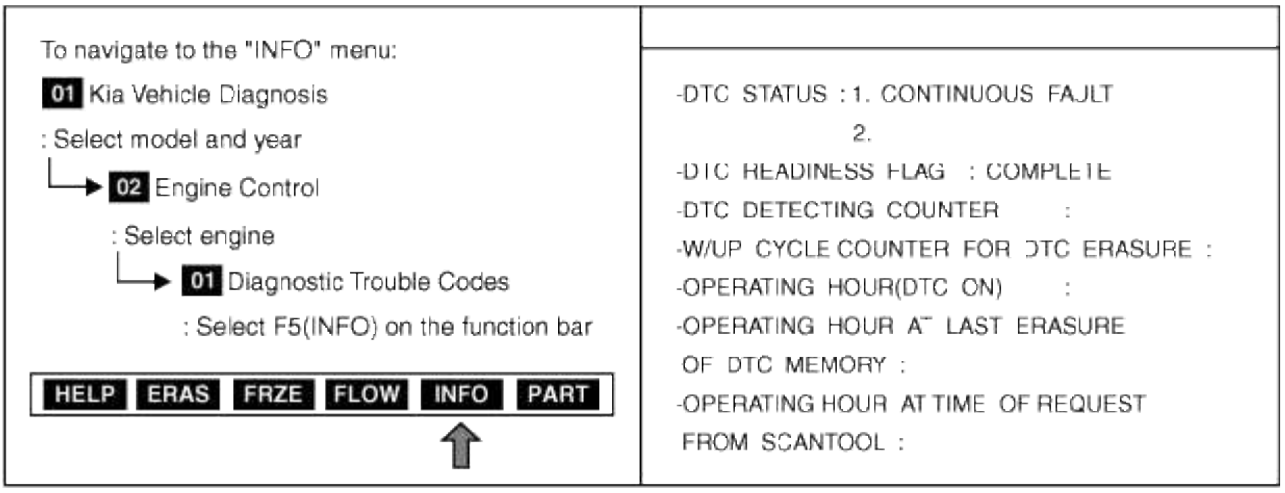
C68-3
ECM side terminal

MONITOR DTC STATUS

NOTE

If any codes relating to ECTs are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Cooling system inspection

1. Check cooling system coolant level and fill if low.
2. Check for a proper cooling system operation. Especially check that cooling and condenser fan working normally.
3. Remove the thermostat and check the following items:
   A. Stuck or damaged
   B. Verify the temperature at which the valve begins to open.
      Valve opening temperature : 80~84°C(176~183.2°F)
      Valve opening temperature : 95°C(203°F)
4. Is a problem found?

YES

5. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

6. Go to next step as below.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
3. Read "DTC Status" parameter

4. Is parameter displayed "History(Not Present) fault"?

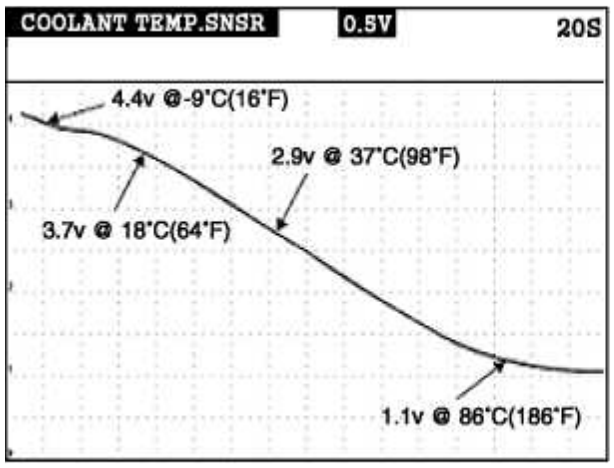
YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



Signal decreases with increasing sensor temperature and increases with decreasing sensor temperature

SPECIFICATION

[ECTS]

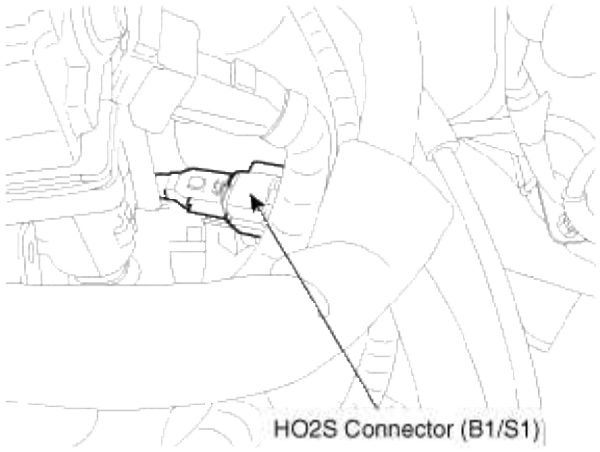
Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

[THERMOSTAT]

Thermostat	Normal Parameter
Valve Opening Temp.	80~84°C(176~183°F)
Valve Closing Temp.	77°C(170.6°F)
Full Open Lift	Above 10mm at 95°C(203°F)

Fuel System > Troubleshooting > P0130

COMPONENT LOCATION



GENERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

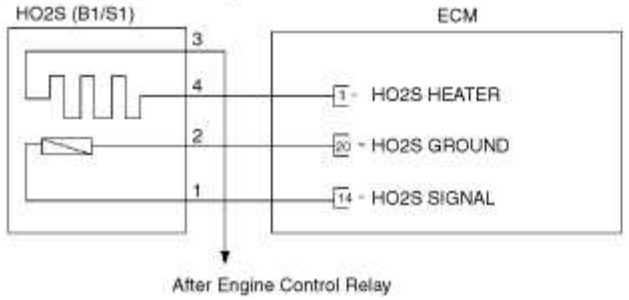
ECM sets DTC P0130 if the ECM detects that the front HO2S signal circuit is open.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check open circuit on rear HO2S	• Open in signal harness • Open in ground harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Condition	• Sensor preheating and full heating phases finished • Battery voltage >10V • Lambda control active	
Threshold Value	• 0.4V < Sensor voltage <0.5V	
Diagnostic Time	• 10 Seconds	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



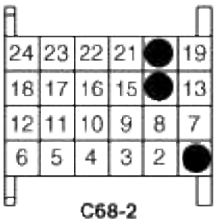
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(14)	Signal
2	ECM Terminal C68-2(20)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2 (1)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

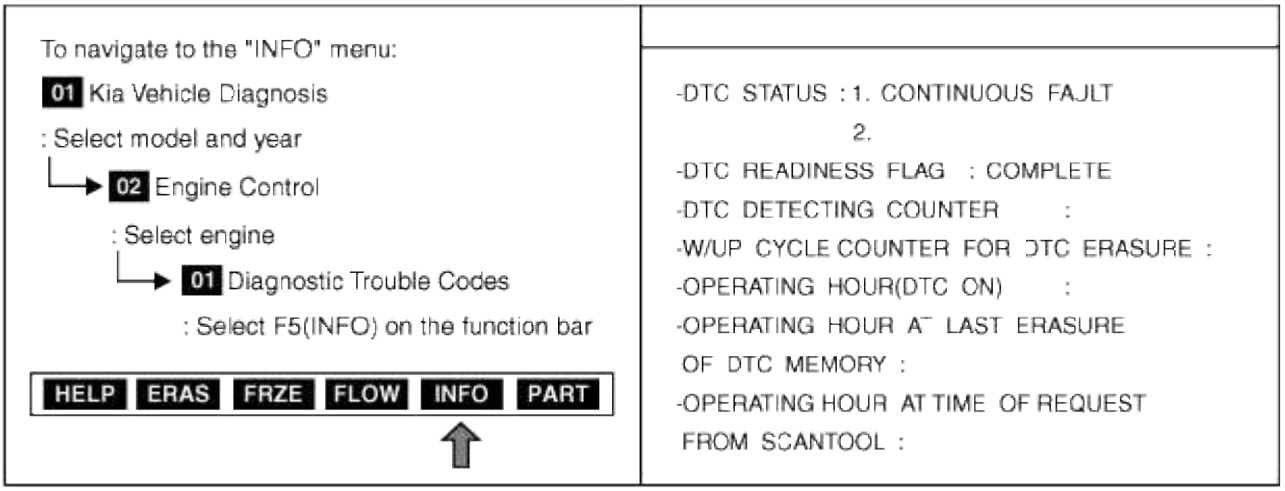


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

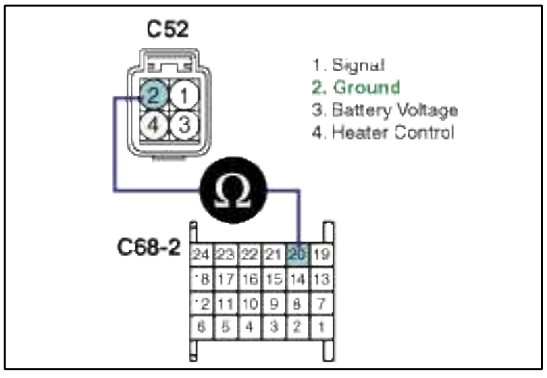
NO

Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminals 2 of the HO2S harness connector and 20 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Signal circuit inspection" procedure.

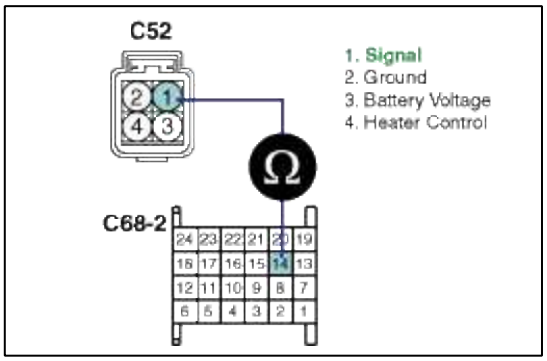
NO

Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION

1. Measure resistance between terminals 1 of the HO2S harness connector and 14 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



Is resistance within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B1" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

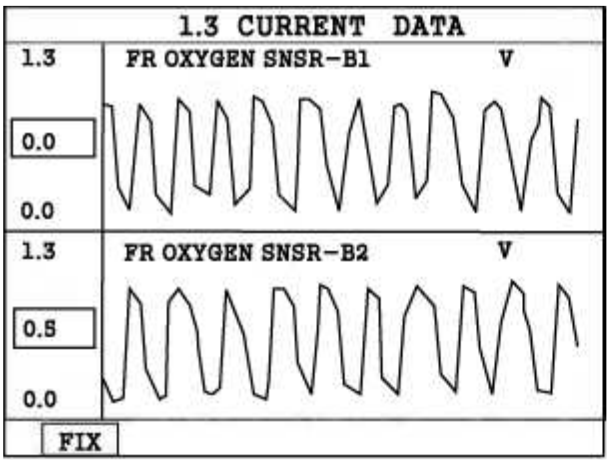


Fig. 1

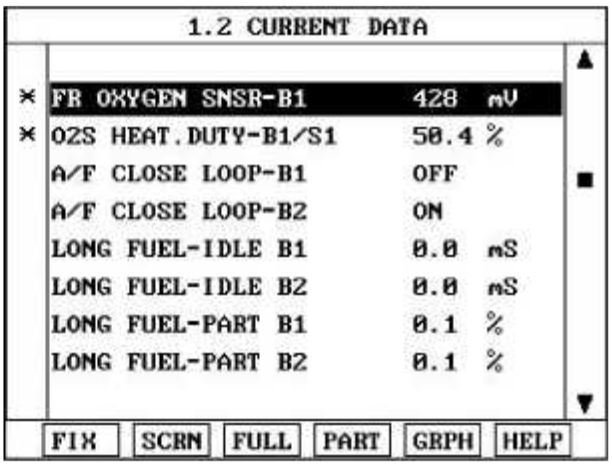


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

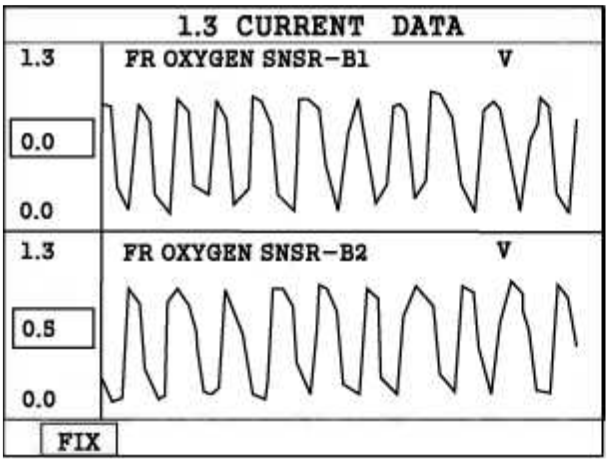


Fig. 1

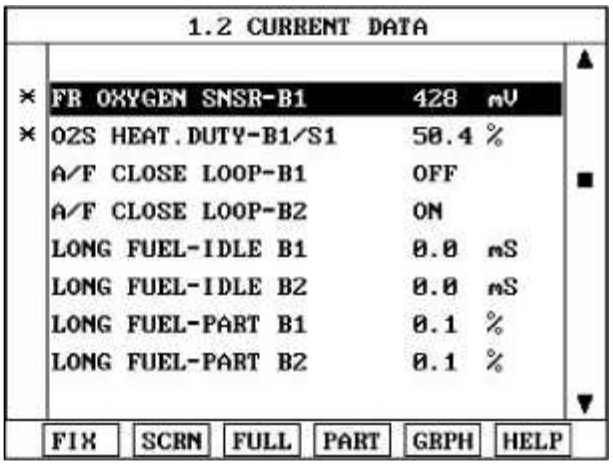


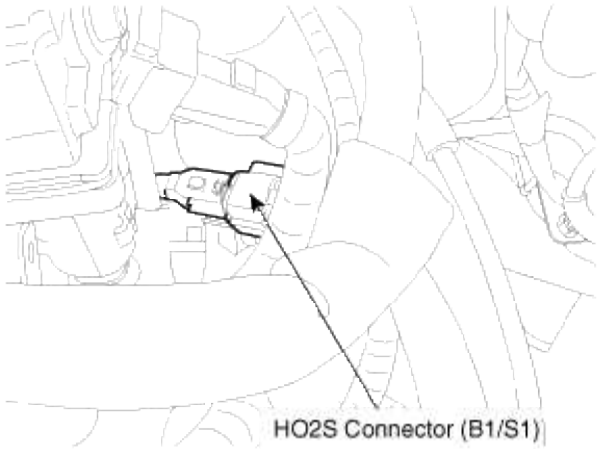
Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds

Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0131

COMPONENT LOCATION



GERNERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

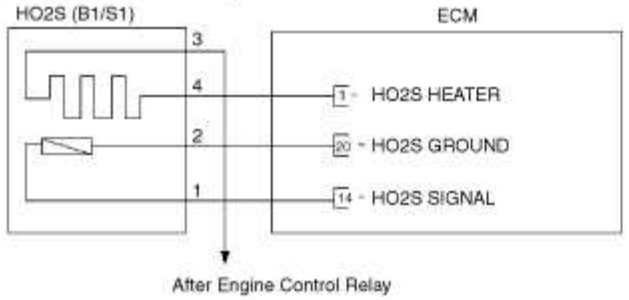
The control unit of the linear oxygen sensor built inside the ECM monitors short circuit errors on all front Heated Oxygen Sensor (HO2S) control lines and the ECM sets P0131 with short circuit to ground.

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage low	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage >10V	
Threshold Value	• Sensor voltage <0.02V and element resistance <10Ω	
Diagnostic Time	• 60 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



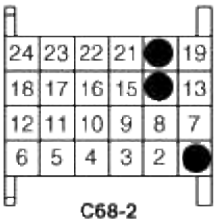
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(14)	Signal
2	ECM Terminal C68-2(20)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2 (1)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

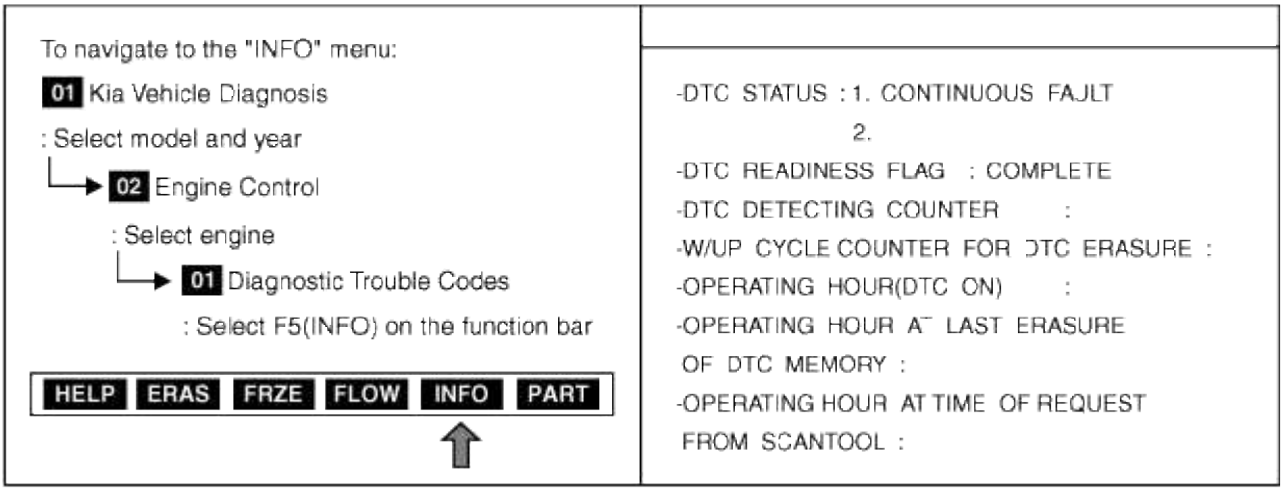


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

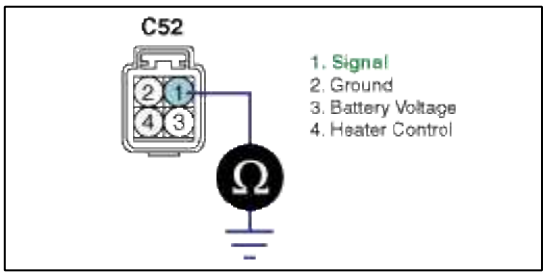
NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Infinite



4. Is resistance within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.

3. Connect Scantool and monitor the "FR OXYGEN SNSR-B1" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

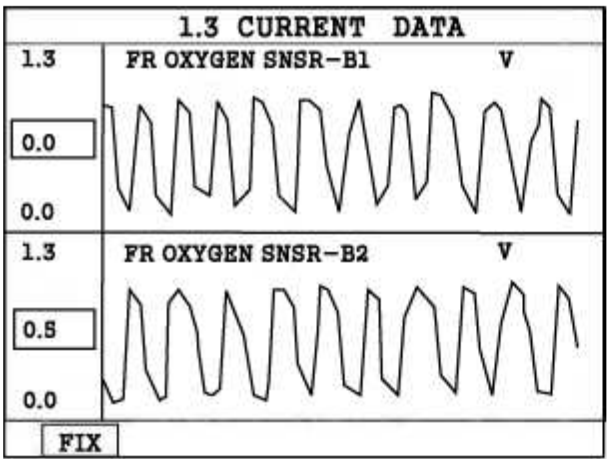


Fig. 1

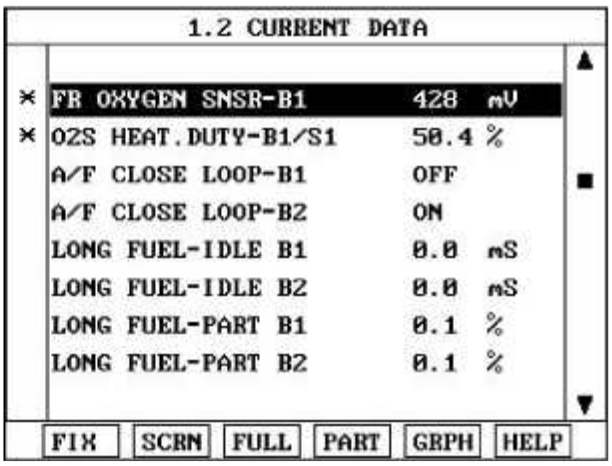


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

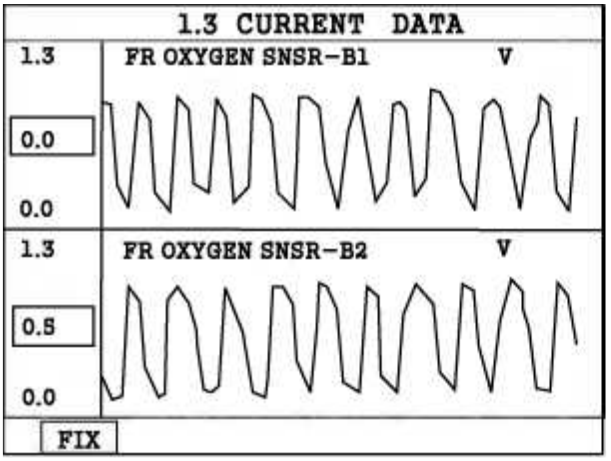


Fig. 1

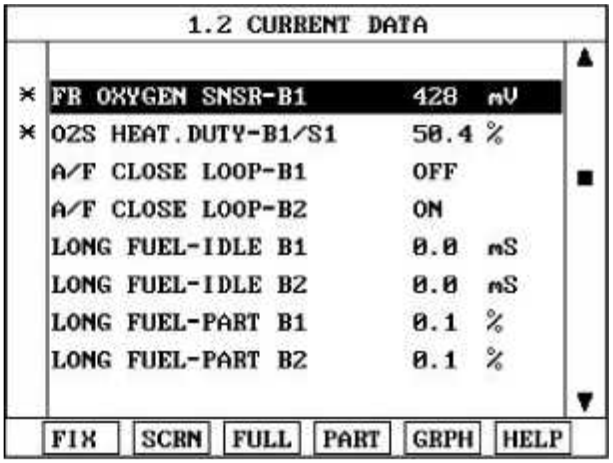
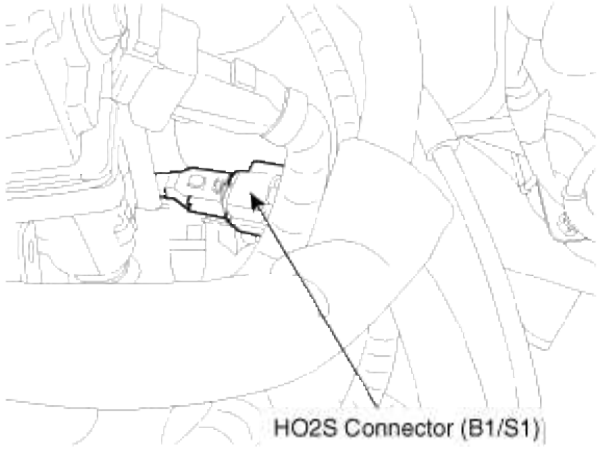


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0132

COMPONENT LOCATION



GERNERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

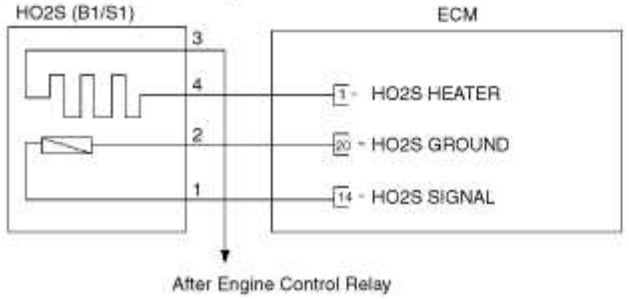
The control unit of the linear oxygen sensor built inside the ECM monitors short circuit errors on all front Heated Oxygen Sensor (HO2S) control lines and the ECM sets P0132 with short circuit to battery.

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage high	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage >10V	
Threshold Value	• Sensor voltage >1.3V	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DAIGRAM

[CIRCUIT DIAGRAM]



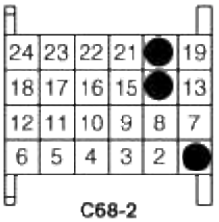
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(14)	Signal
2	ECM Terminal C68-2(20)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2 (1)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



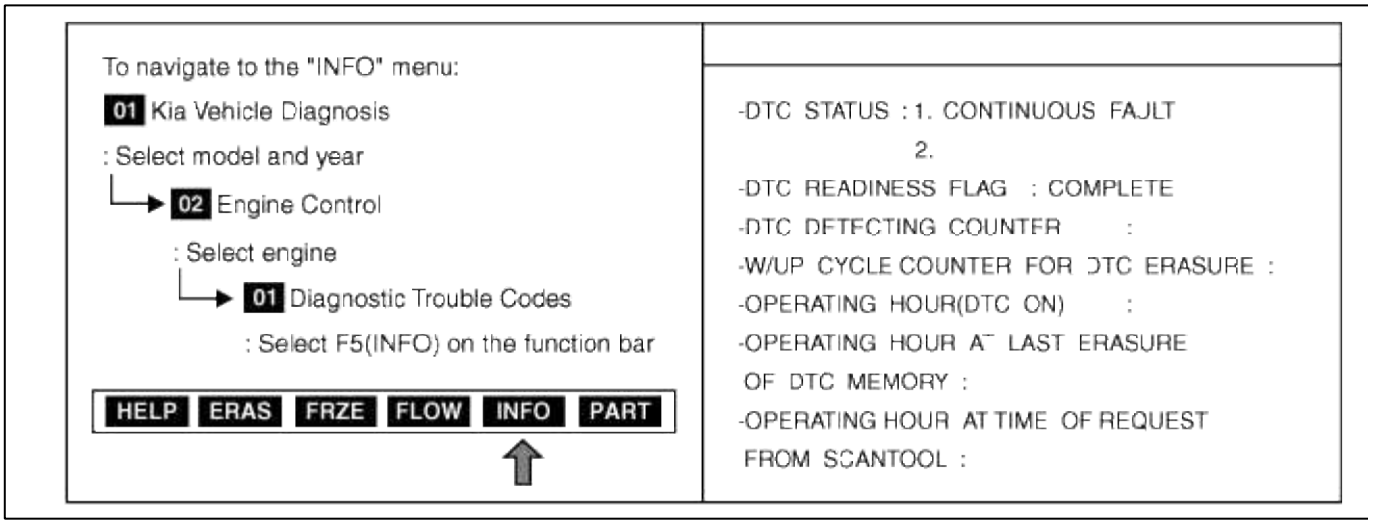
C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

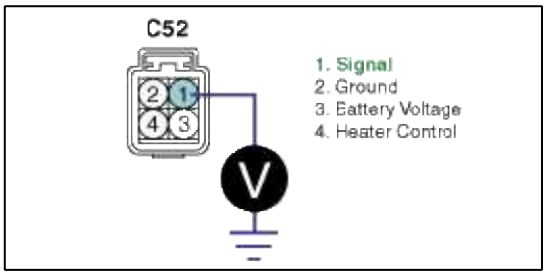
Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".

4. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Approx. 0V



5. Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B1" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

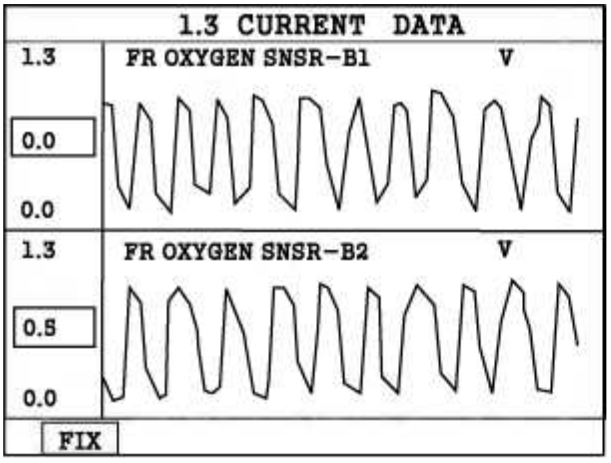


Fig. 1

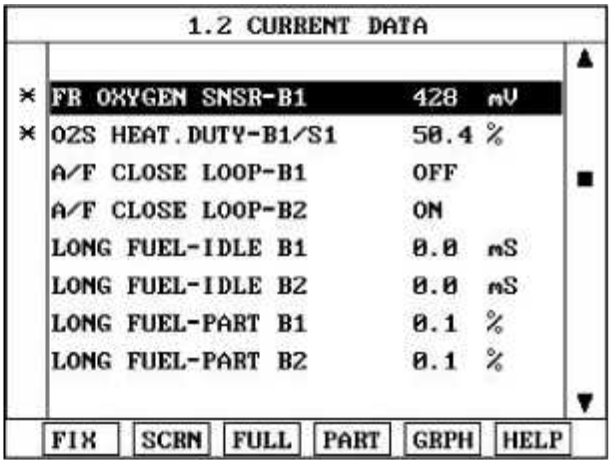


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.
If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

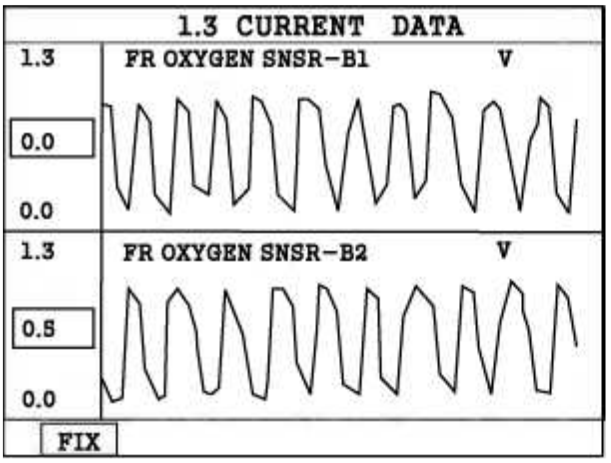


Fig. 1

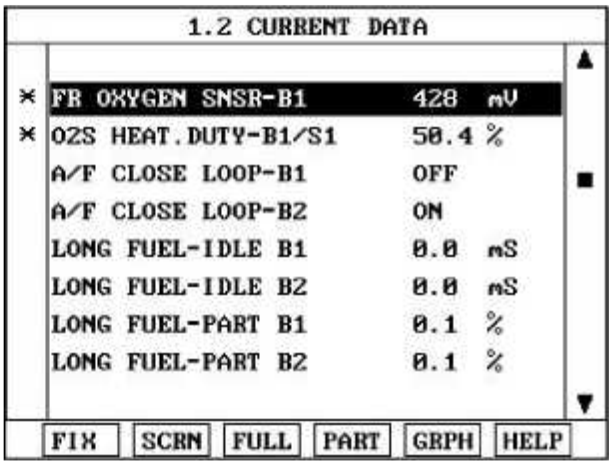
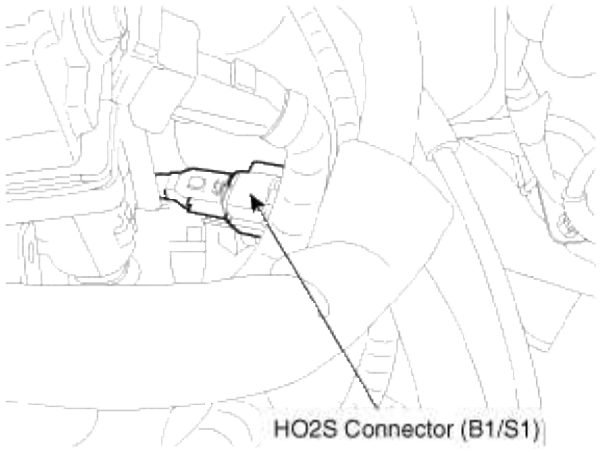


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0133

COMPONENT LOCATION



GERNERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

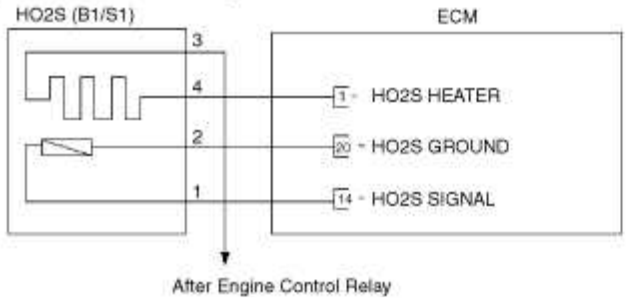
The ECM monitors front oxygen sensor amplitude level and compares it to predetermined minimum amplitude value which could increase emission or disturb lambda control by the effect of aging on the oxygen sensor. The ECM sets DTC P0133 when the amplitude of oxygen sensor is equal to or less than minimum amplitude threshold.

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of O2 sensor lean/rich period with calculated period	• Leak in intake or exhaust system • Faulty fuel system. • Front and rear HO2S connections reversed. • Contact resistance in connectors • HO2S contamination
Enable Conditions	• 400°C(752°F)< Catalyst Temp.Model <600°C(1112°F) • Coolant temp. >70°C(158°F) • 800 <Engine speed(RPM) <2500 • Mass air flow <250 mg/stk • No misfire detected • Not transient condition	
Threshold Value	• Sum of O2 sensor lean/rich period > calculated period	
Diagnostic Time	• 80 lambda controller cycles.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



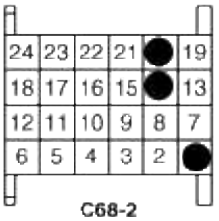
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(14)	Signal
2	ECM Terminal C68-2(20)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2 (1)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

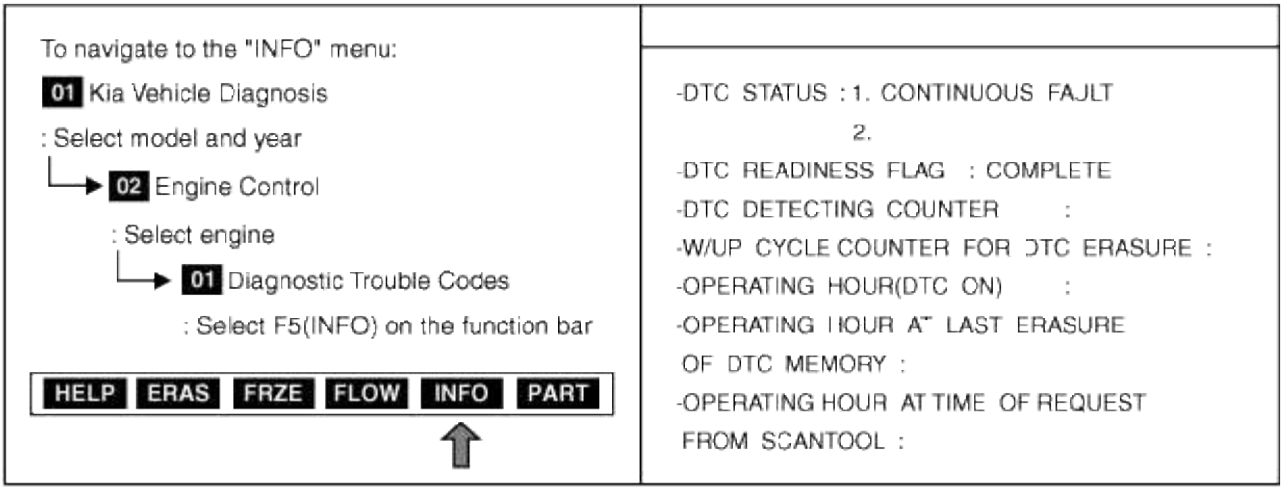
ECM side terminal

MONITOR DTC STATUS

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

VISUAL/PHYSICAL INSPECTION

1. Visually/physically inspect the following items:
   A. Ensure that the HO2S is securely installed.
   B. Check for corrosion on terminals.
   C. Check for terminal tension (at the HO2S and at the ECM).
   D. Check for damaged wiring.
   E. Check the HO2S ground circuit for a good connection.
2. Check front and rear HO2S for connections being reversed. If HO2S connections reversed, switch connections properly.
3. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "Air Leakage Inspection" procedure

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the following items:
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Exhaust system between HO2S and Three way catalyst for air leakage.
   C. EVAP system for leakage.
   D. PCV hose for proper installation.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "Fuel Pressure Inspection" procedure.

FUEL PRESSURE INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Inspect fuel pressure with engine idling at normal operating temperature.

Test Condition : Engine "ON" & Vacuum hose disconnected at Idle.
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

4. Is the fuel pressure within the specified value?

YES

Go to "Fuel Injector Inspection" procedure as below.

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator.
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECOTR INSPECTION

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B1" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

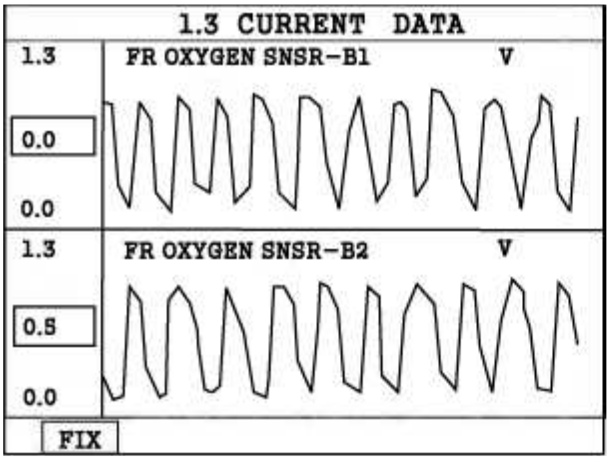


Fig. 1

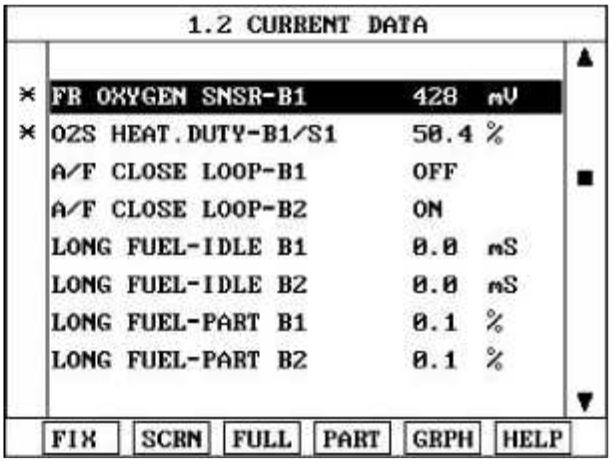


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.
If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

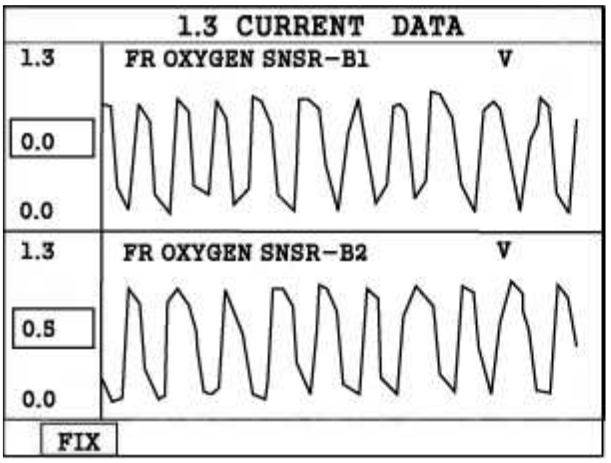


Fig. 1

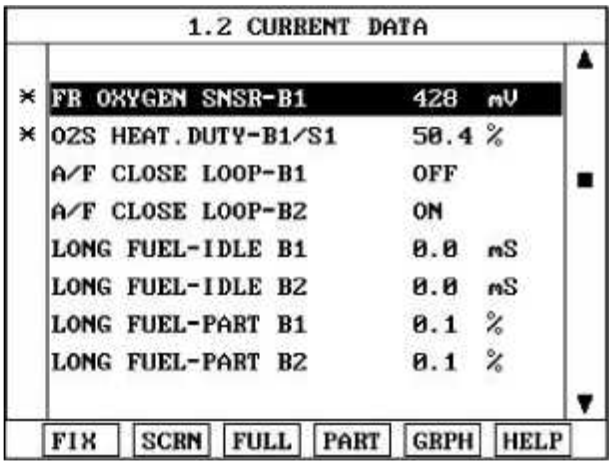
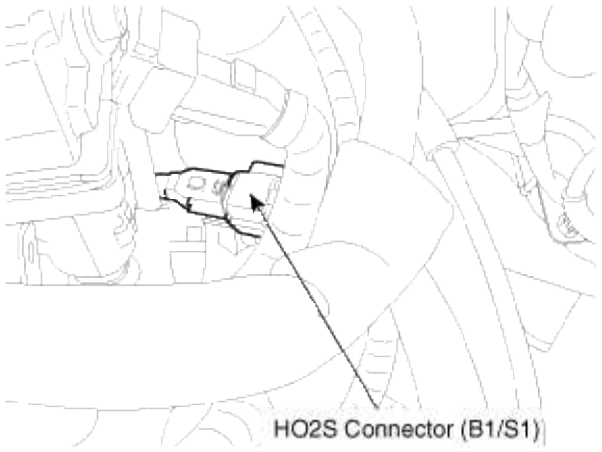


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0134

COMPONENT LOCATION



GERNERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

Due to possible oxygen sensor defects (e.g. reference air poisoning) or faults in the injection system (e.g. leaking fuel injector), the rear oxygen sensor may not provide the expected lean or rich signal level during fuel cut-off or full load condition. Hence, the oxygen sensor signal is checked for plausibility during this engine operating states.

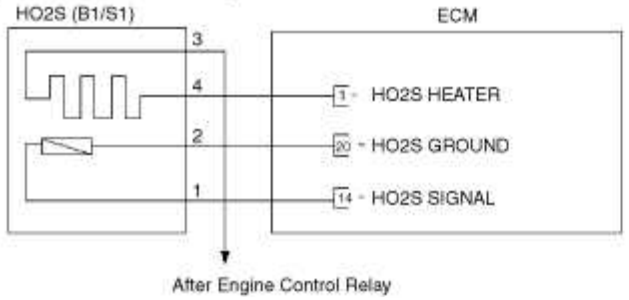
DTC DETECTING CONDITION

ITEM		DETECING CONDITION	POSSIBLE CAUSE
Case1)	DTC Strategy	• Signal plausibility during fuel cut off	• Related fuse blown or missing • Contact resistance in connectors • HO2S contamination
	Enable Conditions	• Sensor preheating and full heating phases finished • Fuel Cut Off active • Integrated Mass Air Flow since begin fuel cut-off > 20g • Battery voltage > 10V	
	Threshold Value	• Voltage with fuel cut off > 0.2V	
	Diagnostic Time	• 5 Sec.	
	DTC Strategy	• Signal stroke plausibility	
		• Sensor preheating and full heating phases finished	

Case2)	Enable Conditions	• 5 Cycles of A/F Closed Loop passed after lambda control active. • Lambda controller is not on the limit • Battery voltage > 10V	
	Threshold Value	• Sensor voltage < 0.25V	
	Diagnostic Time	• 2 min.	
MIL On Condition		• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



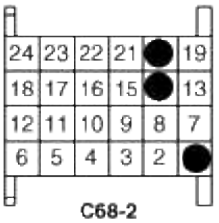
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(14)	Signal
2	ECM Terminal C68-2(20)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2 (1)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

ECM side terminal

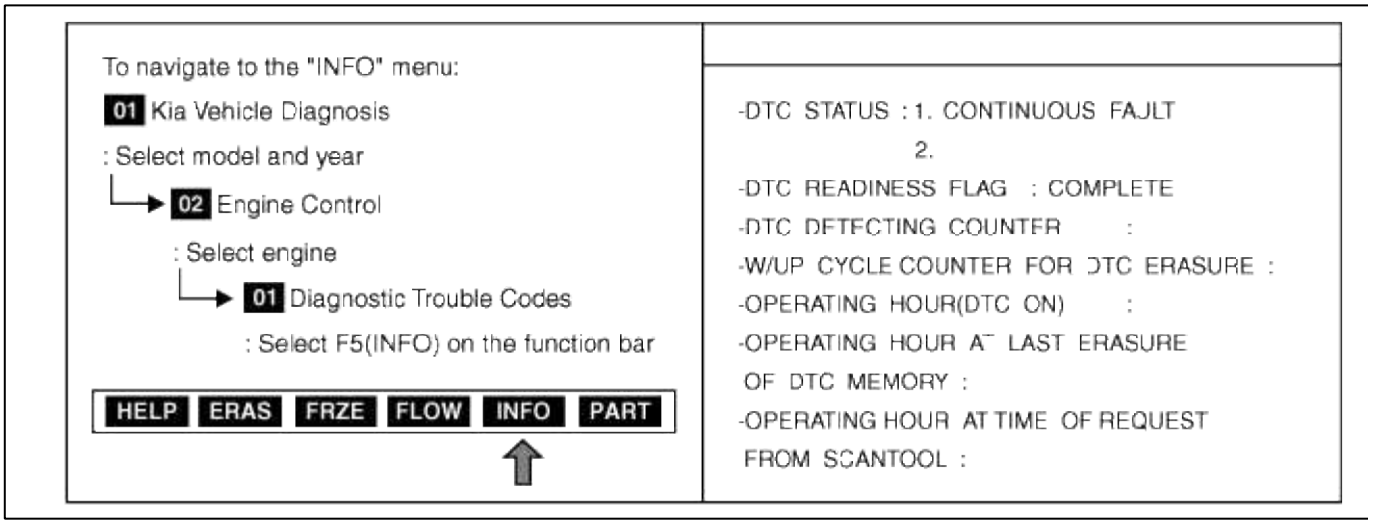
MONITOR DTC STATUS

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

Go to "HO2S Fuse Inspection" procedure

HO2S FUSE INSPECTION

1. Ignition "OFF" & Engine "OFF"
2. Verify "10A Sensor fuse" is installed and not blown.
3. If OK, go to "Component Inspection" procedure.
   If NG, replace fuse and repair any shorts as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.

3. Connect Scantool and monitor the "O2 SNSR VOLT.(B1/S1)" parameter on the Scantool data list.

Test Condition : Engine "ON"
Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

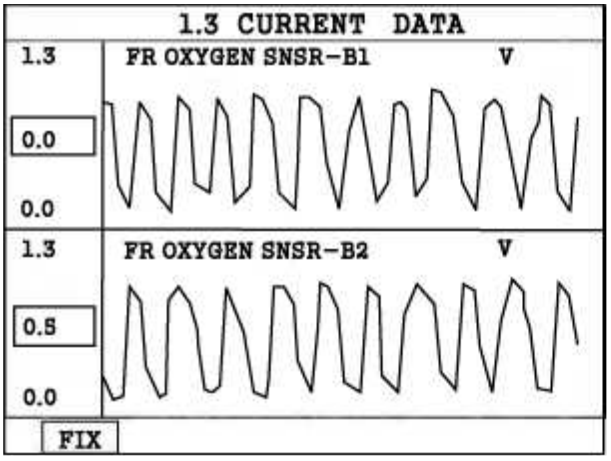


Fig. 1

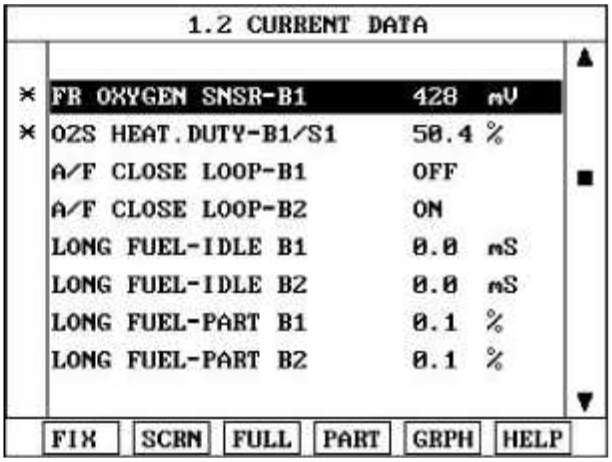


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

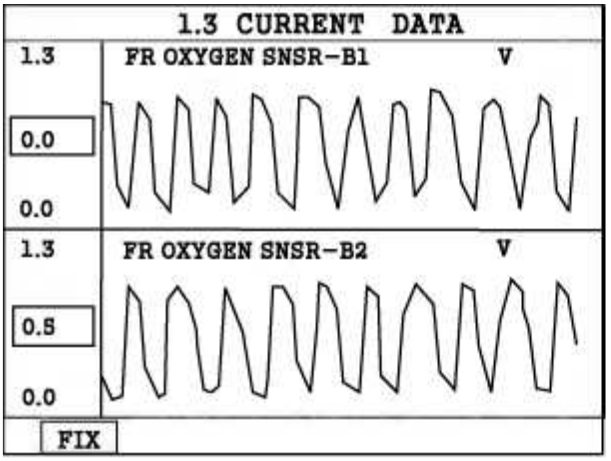


Fig. 1

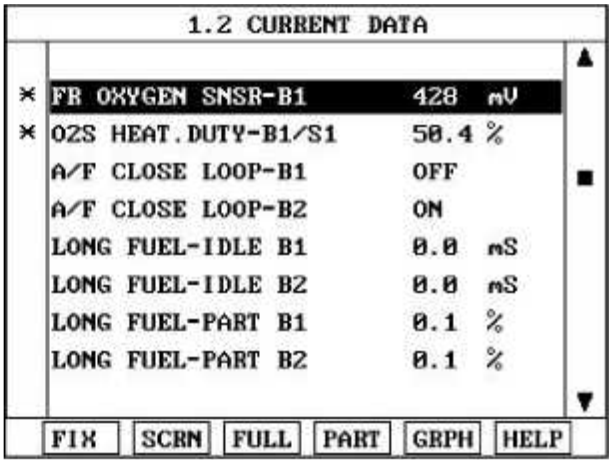
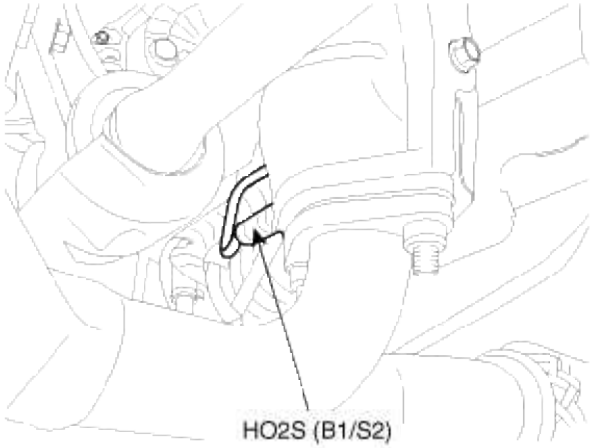


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0136

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which detects the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

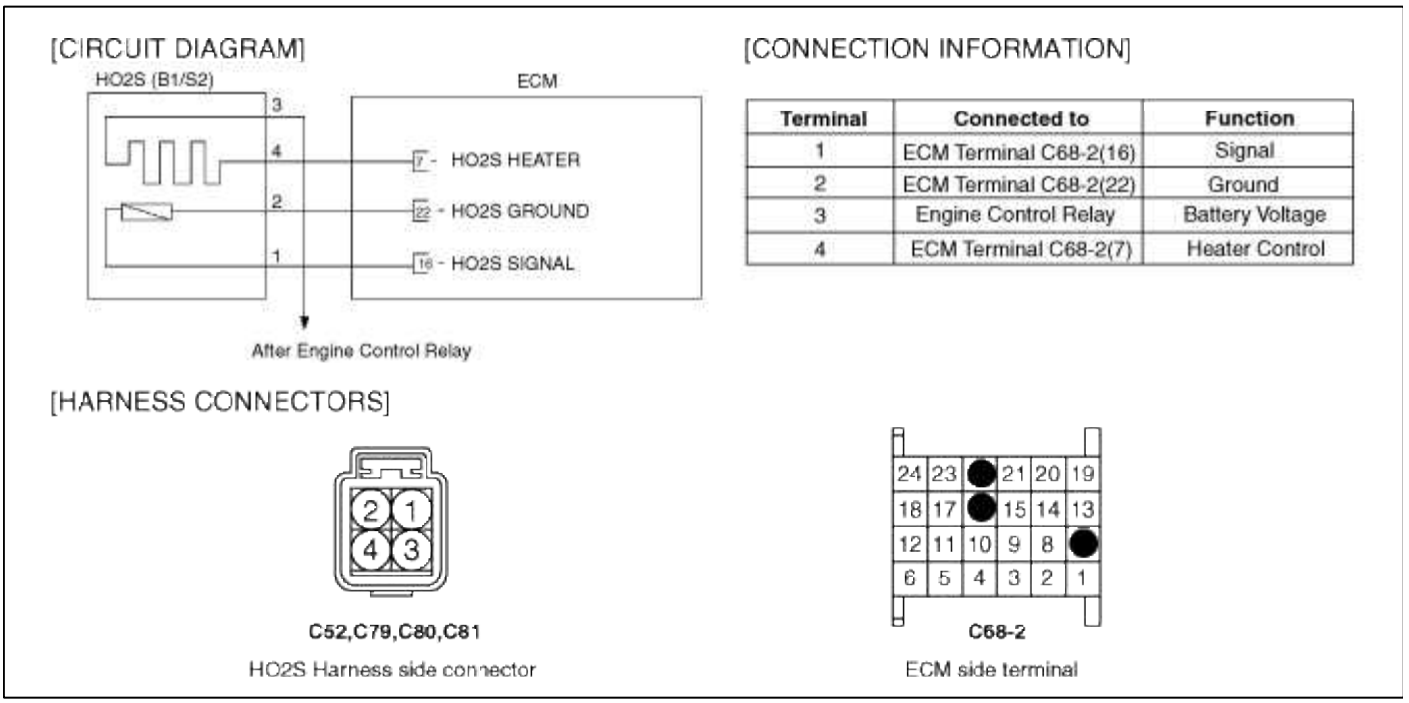
ECM sets DTC P0136 if the ECM detects that the rear HO2S signal circuit is open.

DTC DETECTING CONDITION

tomsn048@gmail.com

ITEM	DETECTING CONDITION	POSSIBL ECAUSE
DTC Strategy	• Check open circuit on rear HO2S	• Open in signal harness • Open in ground harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Condition	• Sensor preheating and full heating phases finished • No relevant failure • 10<Battery voltage(V) <16	
Threshold Value	• Sensor element resistance > 60kΩ	
Diagnostic Time	• 30 sec.	
MIL On Condition	• 2 Driving Cycles	

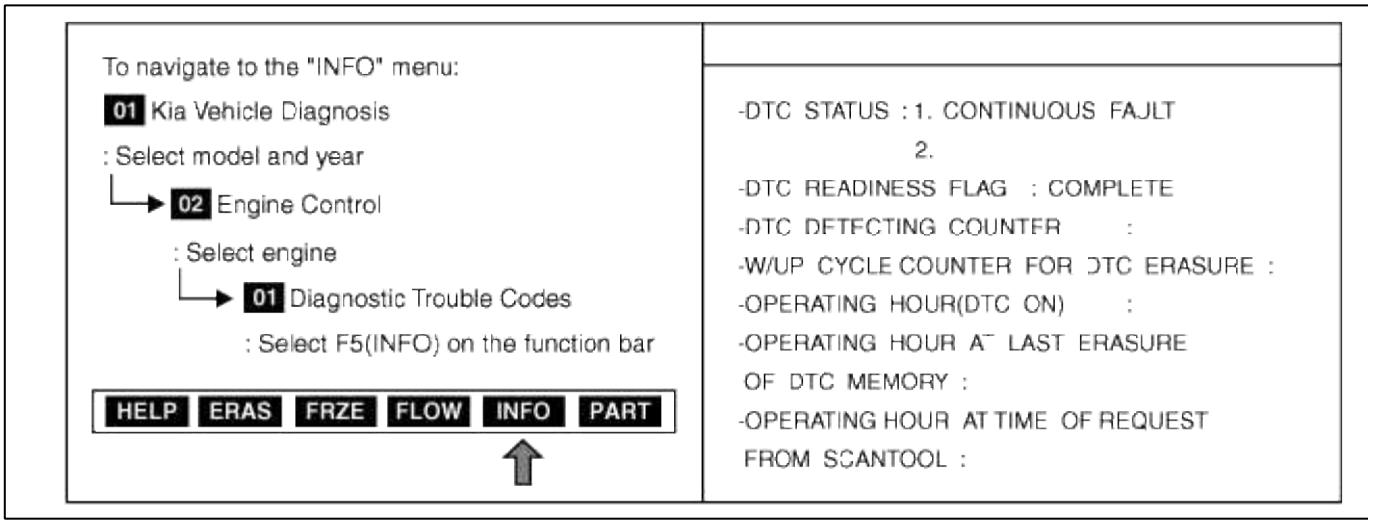
SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.

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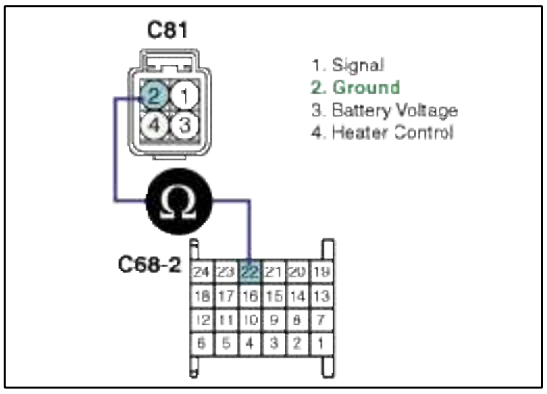
3. Measure resistance between terminals 2 of the HO2S harness connector and 22 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Signal circuit inspection" procedure.

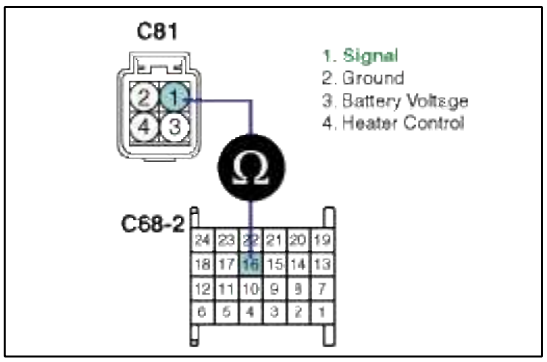
NO

Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION

1. Measure resistance between terminals 1 of the HO2S harness connector and 16 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



Is resistance within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.

2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

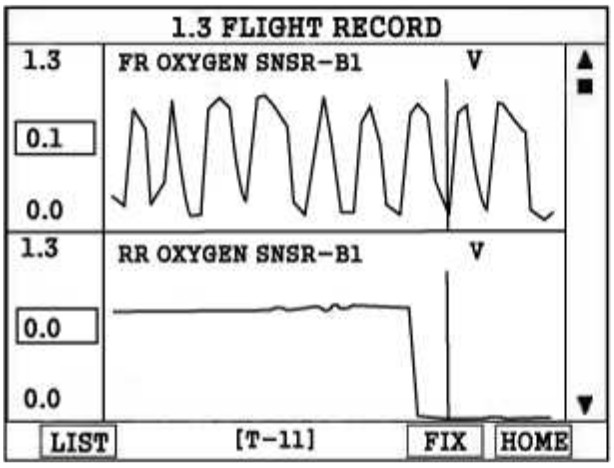


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3. Is "RR OXYGEN SNSR-B1" sensor data near the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

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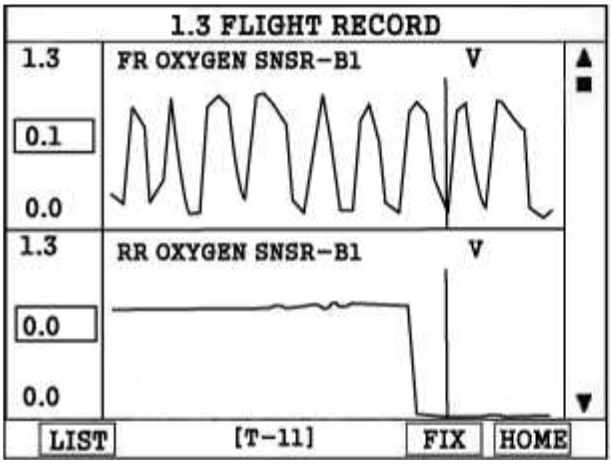
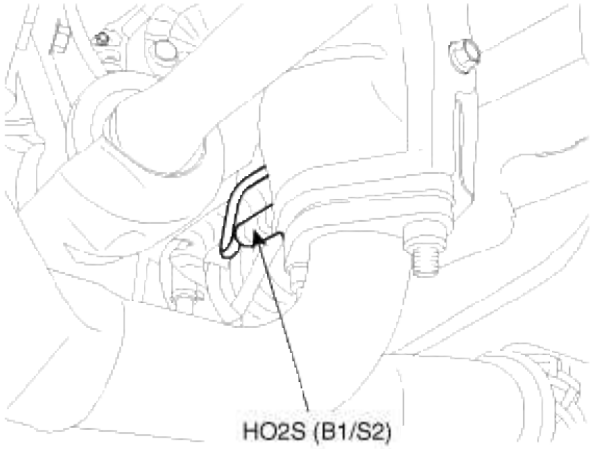


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0137

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

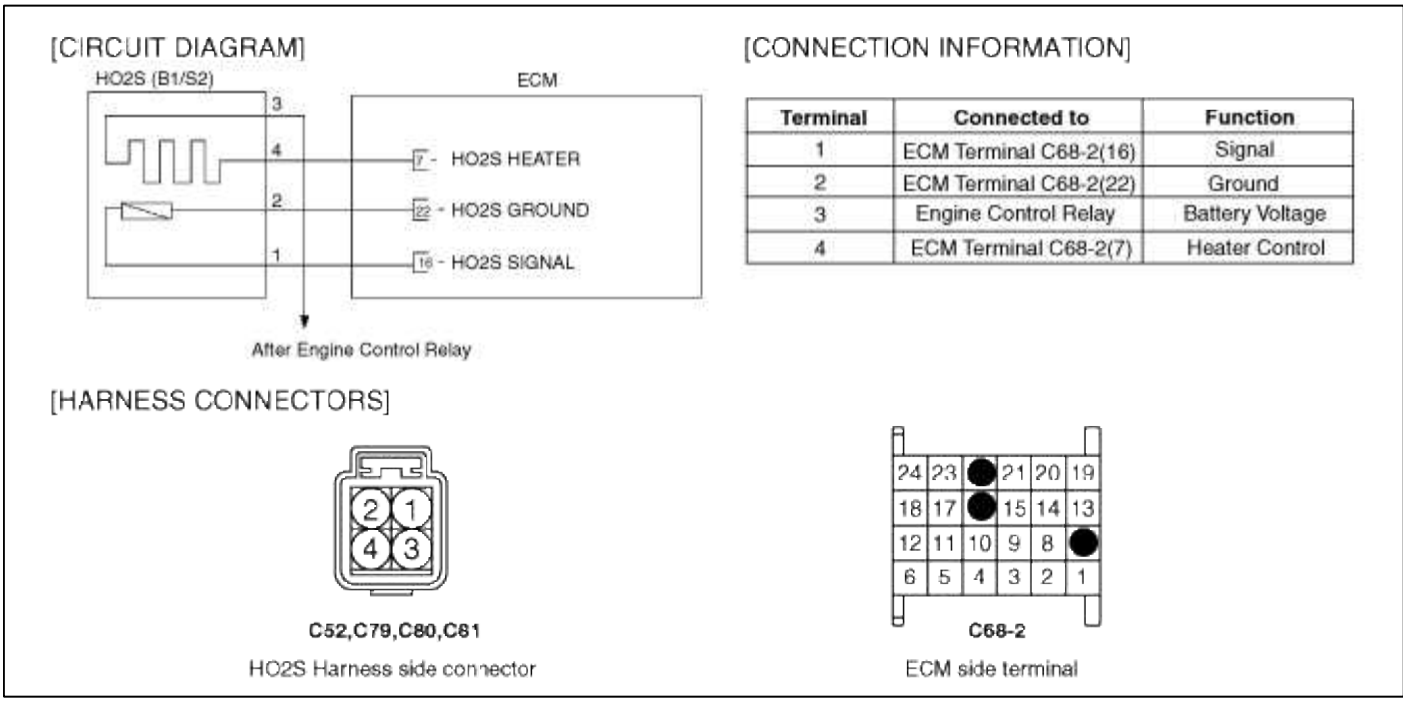
DTC DESCRIPTION

ECM sets DTC P0137 if the ECM detects signal voltage lower than the possible range of a properly operating rear heated oxygen sensor (HO2S).

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage low	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage >10V	
Threshold Value	• Sensor voltage <0.02V and element resistance <10Ω	
Diagnostic Time	• 30 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

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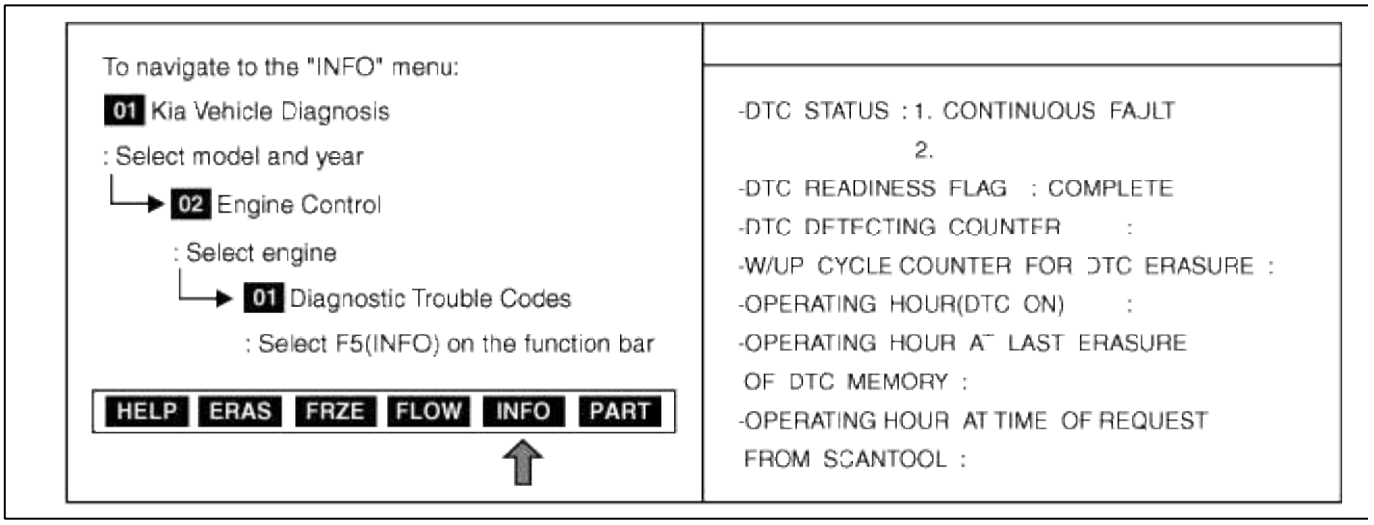
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

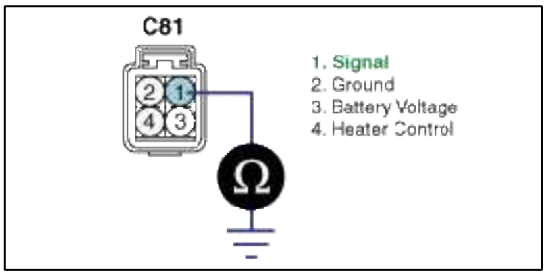
Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.

3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Infinite



4. Is resistance within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Install Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

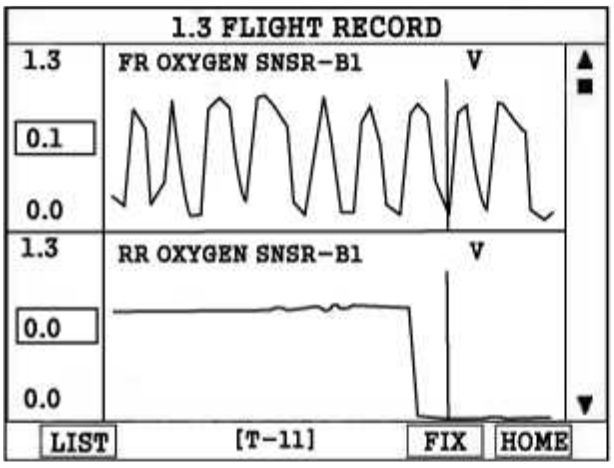


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3. Is "RR OXYGEN SNSR-B1" sensor data within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure

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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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

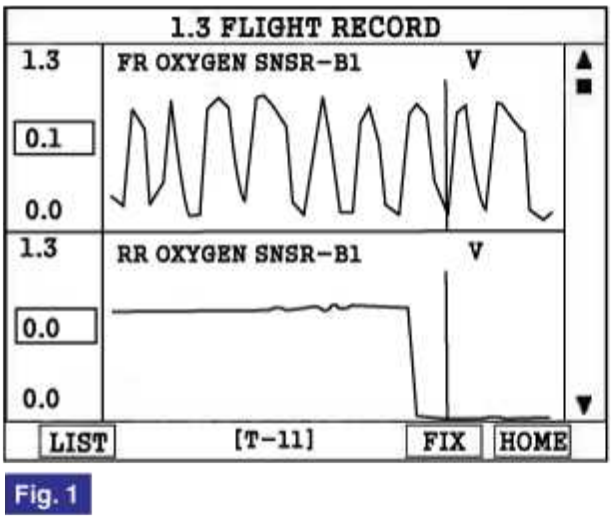
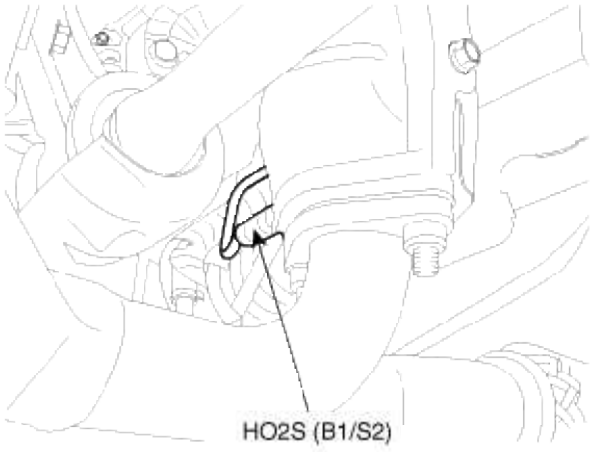


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0138

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

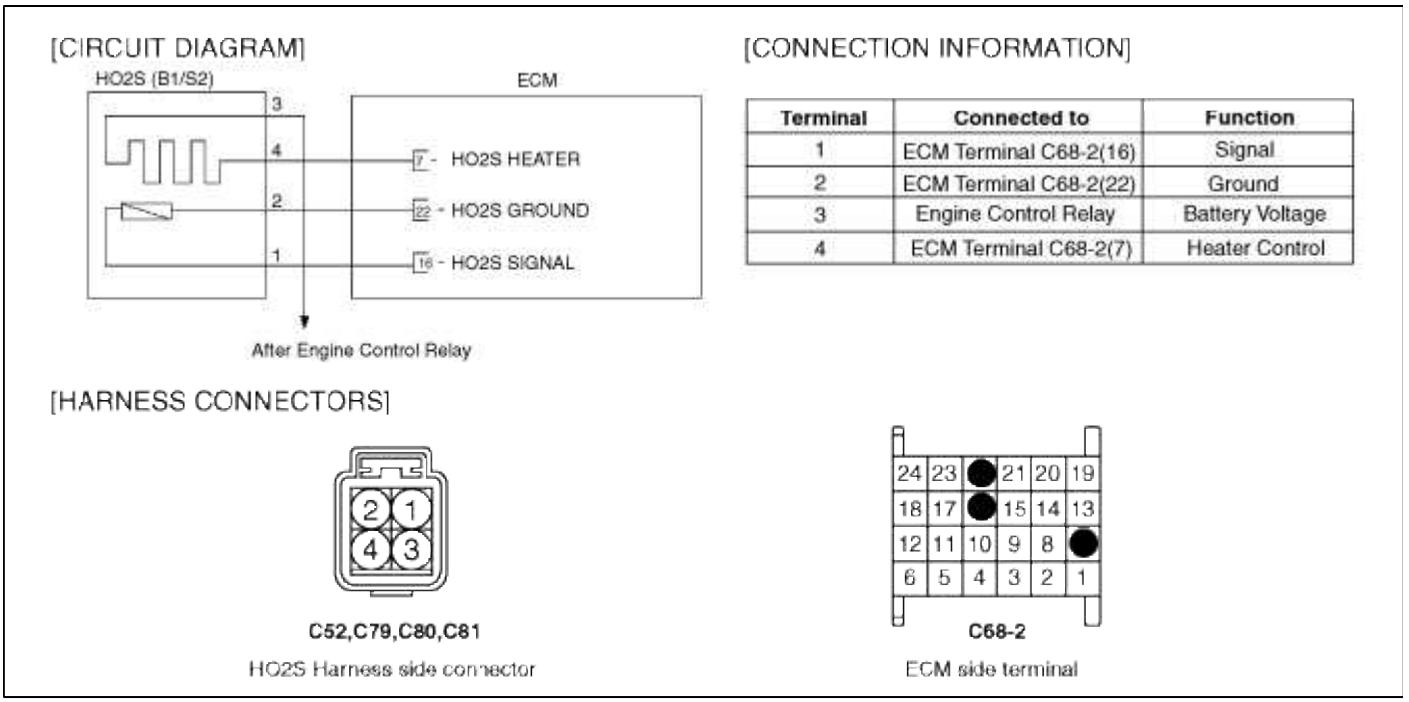
DTC DESCRIPTION

ECM sets DTC P0138 if the ECM detects signal voltage higher than the possible range of a properly operating rear heated oxygen sensor (HO2S).

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage high	• Short to Battery in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage >10V	
Threshold Value	• Sensor voltage >1.3V	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

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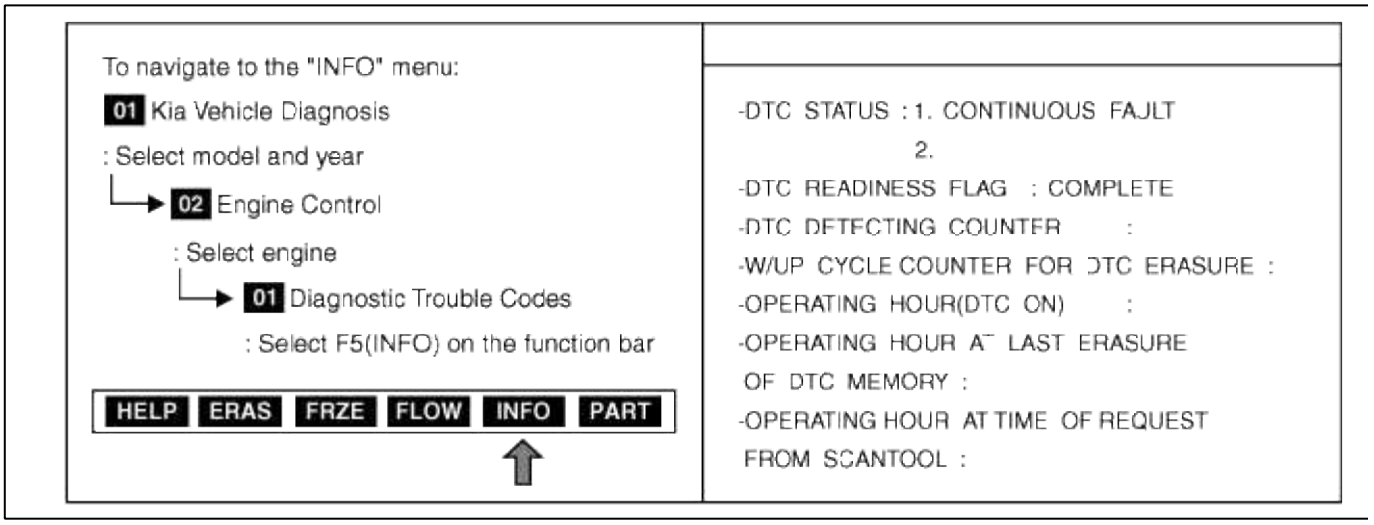
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

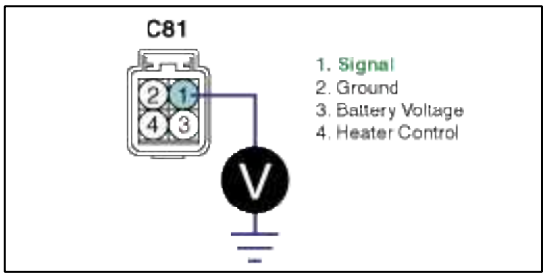
Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Approx. 0V



5. Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

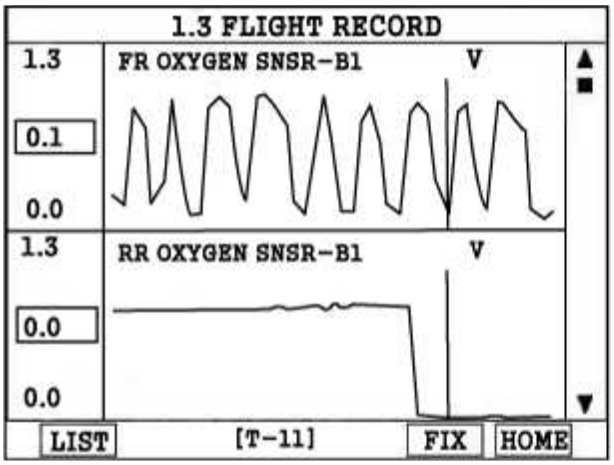


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3. Is sensor display within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

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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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

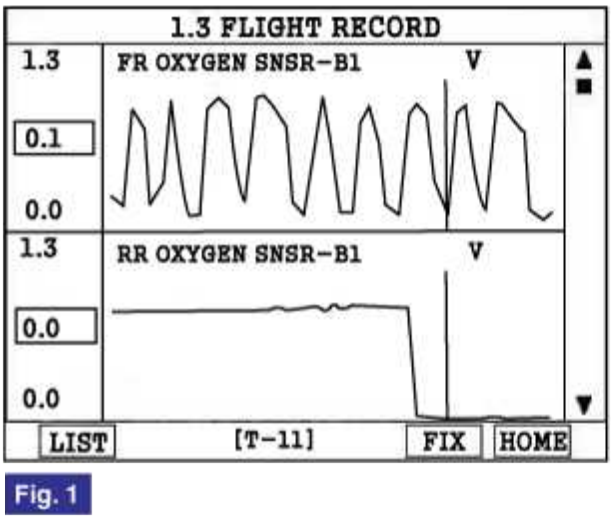
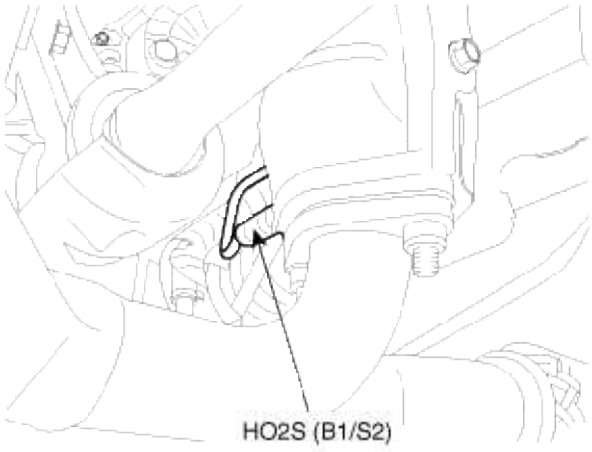


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0139

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

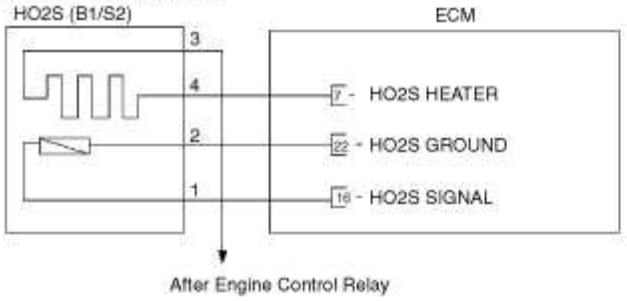
The ECM monitors rich-lean switching time of rear heated oxygen sensor (HO2S) after fuel cut-off to validate dynamic behaviour of rear heated oxygen sensor (HO2S). After detection of fuel cut-off engine operating state, the ECM measures rich-lean switching time of the rear heated oxygen sensor (HO2S) signal and compares it to the predetermined limit value. DTC P0139 is set when the switching time is bigger than the limit value. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Slow response(Switching time check at entry in fuel cut off)	• Leak in intake or exhaust system • Faulty fuel system. • Front and rear HO2S connections reversed. • Contact resistance in connectors • HO2S contamination
Enable Condition	• Fuel cut-off phase • Sensor preheating and full phase finished • Catalyst temp.model >350°C(662°F) • Coolant temp>70°C(158°F)	
Threshold Value	• Average ratio(between measured and maximum allowed switching time at entry in fuel cut-off) > 1	
Diagnostic Time	• 5 fuel cut-off phases	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



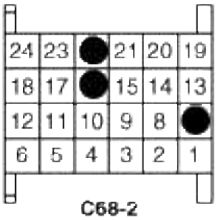
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(16)	Signal
2	ECM Terminal C68-2(22)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(7)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

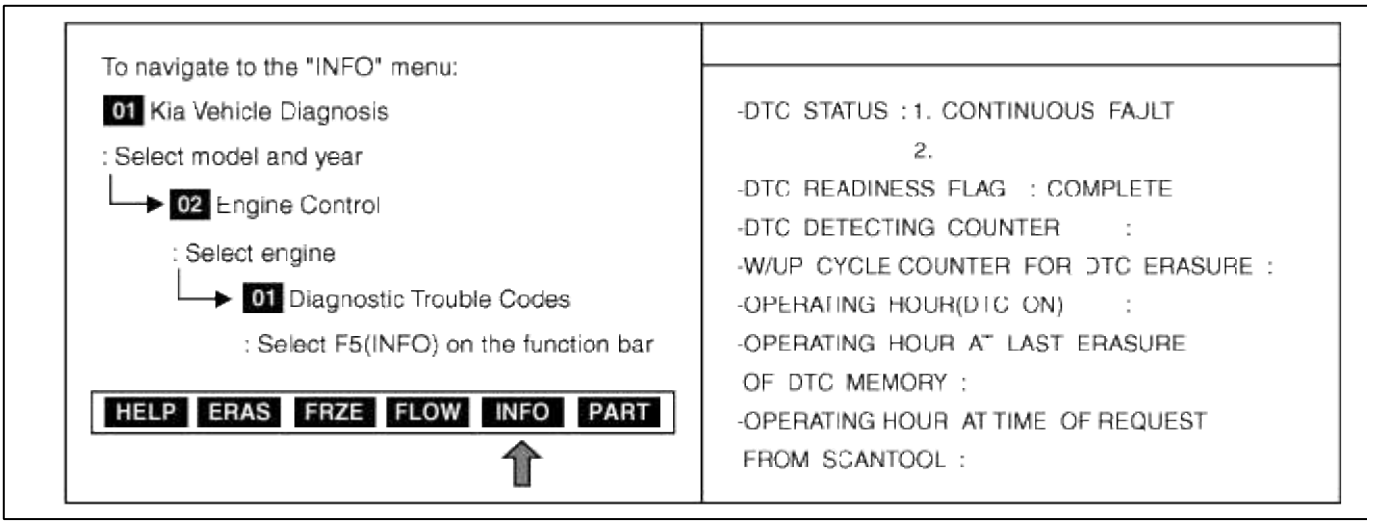
ECM side terminal

MONITOR DTC STATUS

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

1) History (Not Present) fault : DTC occurred but has been cleared.
2) Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

VISUAL / PHYSICAL INSPECTION

1. Visually/physically inspect the following items:
   A. Ensure that the HO2S is securely installed.
   B. Check for corrosion on terminals
   C. Check for terminal tension (at the HO2S and at the ECM)
   D. Check for damaged wiring
   E. Check the HO2S ground circuit for a good connection
2. Check front and rear HO2S for connections being reversed. If HO2S connections reversed, switch connections properly.

3. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Exhaust System Inspection" procedure.

EXHAUST SYSTEM INSPECTION

1. Check the exhaust system for an exhaust leak near the engine.
2. Was an exhaust leak found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Air Leakage Inspection " procedure.

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the following items:
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Exhaust system between HO2S and Three way catalyst for air leakage
   C. EVAP system for leakage
   D. PCV hose for proper installation
2. Was a problem found in any of the above areas?

YES

'Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "Fuel Pressure Inspection" procedure.

FUEL PRESSURE INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage
3. Inspect fuel pressure with engine idling at normal operating temperature.

Test Condition : Ignition "ON" & Engine "ON" & Vacuum hose disconnected at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is the fuel pressure within the specified value?

YES

Go to "Fuel Injector Inspection" procedure as below.

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator.
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECTOR INSPECTION

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Ensure that the sensor is securely installed.
   B. Check for corrosion on terminals.
   C. Check for damaged wiring.
   Repair as necessary and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "O2 SNSR VOLT.(B1/S2)" parameter on the Scantool data list.

Test Condition : Ignition "ON" & Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

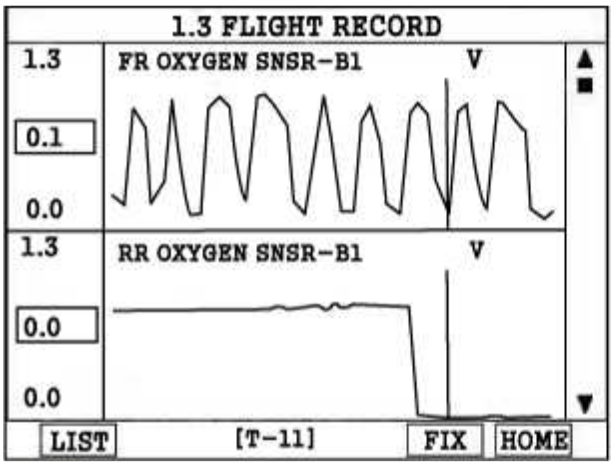


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

4. Is sensor data near the specified value?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

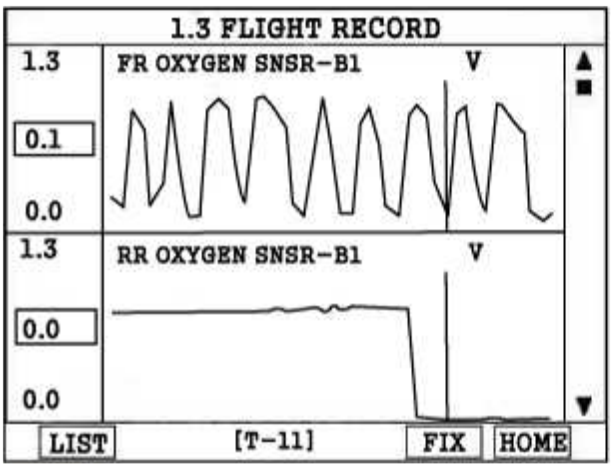
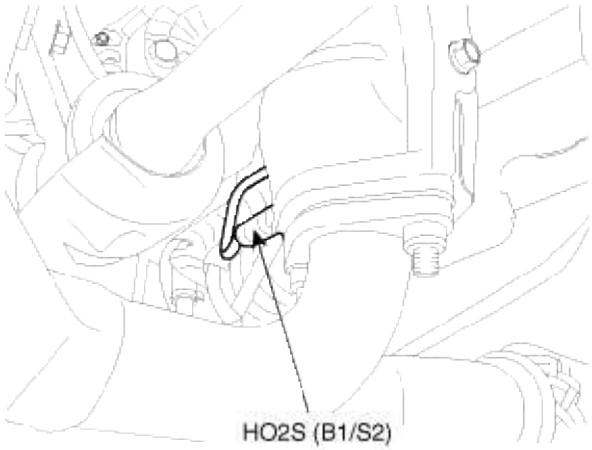


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0140

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

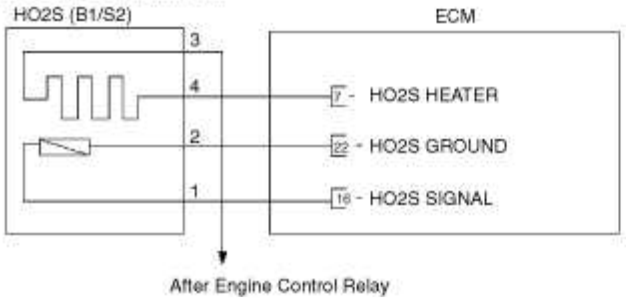
Due to possible oxygen sensor defects (e.g. reference air poisoning) or faults in the injection system (e.g. leaking fuel injector), the rear oxygen sensor may not provide the expected lean or rich signal level during fuel cut-off or full load condition. Hence, the oxygen sensor signal is checked for plausibility during this engine operating states.
There are 3 cases which DTC P0140 sets.
(I) Signal monitoring during fuel cut-off: The ECM monitors rear O2 sensor signal level during fuel cut-off which normally shows near 0V and sets DTC P0140 when signal level is too high.
(II) Signal monitoring after fuel cut-off: The ECM monitors rear O2 sensor signal level for a certain time after leaving fuel cut-off and sets DTC P0140 when signal variation during checked period is too small.
(III) Signal monitoring during full load: The ECM monitors rear O2 sensor signal during full load which applies rich air-fuel mixture and sets DTC P0140 when rear O2 sensor signal is too low.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTP DETDCING CONDITION

ITEM		DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Sensor voltage excursion for Lean and Rich mixture	• Related fuse blown or missing • Contact resistance in connectors • HO2S contamination
Case1)	Enable Conditions	• Sensor preheating and full heating phases finished • Full Phase finished • Integrated MAF in Fuel cut-Off>18g • Integrated MAF after Fuel cut-Off>40g	
	Threshold Value	• Signal increase < 30mV	
	Diagnostic Time	• 0.3 sec.	
Case2)	Enable Conditions	• Sensor preheating and full heating phases finished • Fuel cut-off phase • Integrated MAF after starting fuel cut-off>20g	
	Threshold Value	• Voltage with fuel cut off > 0.2V	
	Diagnostic Time	• 5 after fuel cut off phase	
MIL On Condition		• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



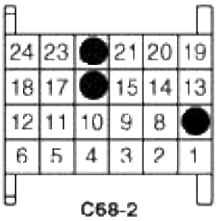
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(16)	Signal
2	ECM Terminal C68-2(22)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(7)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

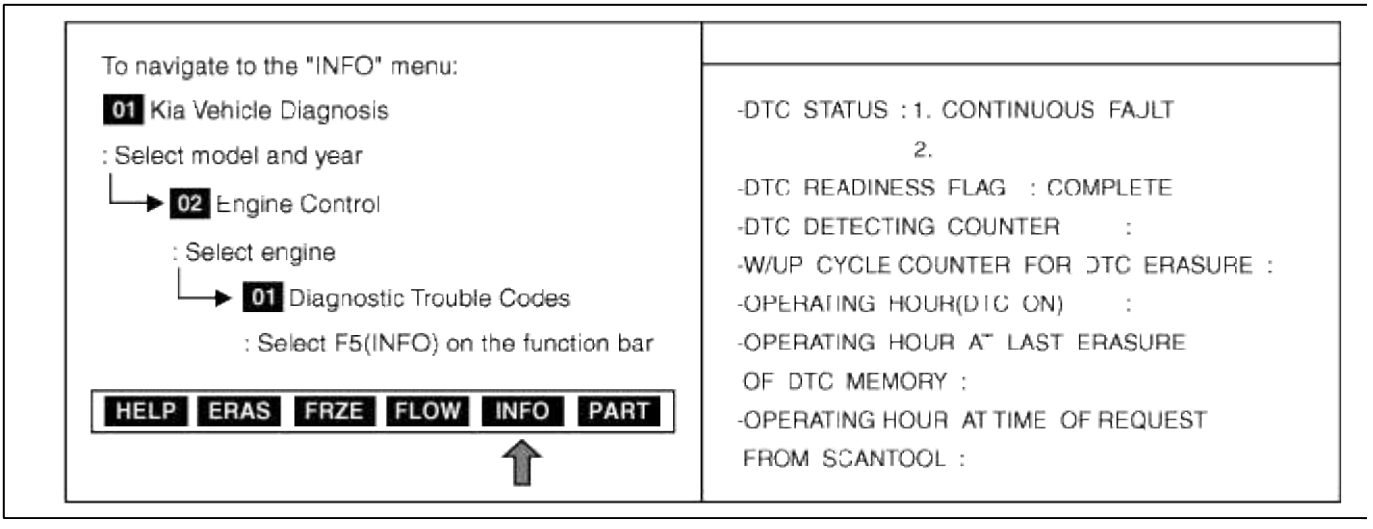
ECM side terminal

MONITOR DTC STATUS

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

1) History (Not Present) fault : DTC occurred but has been cleared.
2) Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "HO2S Fuse Inspection" procedure.

HO2S FUSE INSPECTION

1. Ignition "OFF" & Engine "OFF".
2. Verify "10A Sensor fuse" is installed and not blown.
3. If OK, go to "Component Inspection" procedure.
   If NG, replace fuse and repair any shorts as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Ignition "ON" & Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

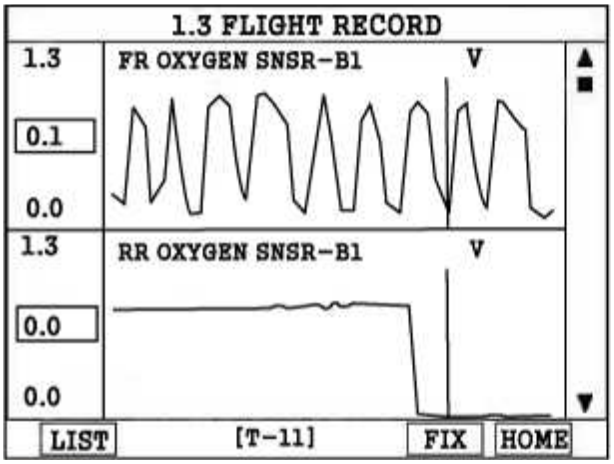


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3. Is sensor display within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

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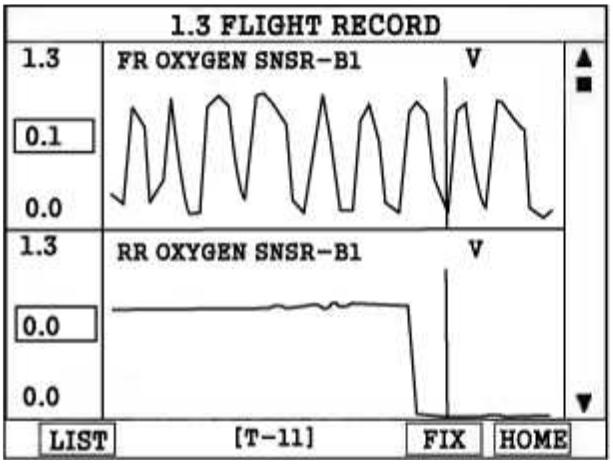
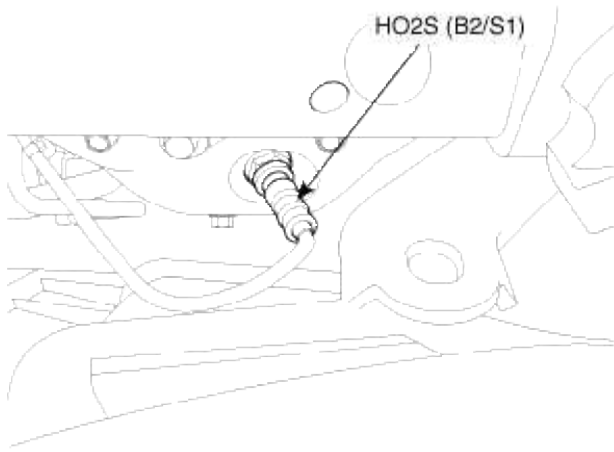


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0150

COMPONENT LOCATION



GENERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

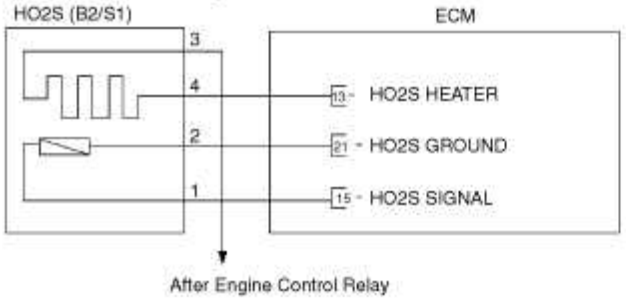
ECM sets DTC P0150 if the ECM detects that the front HO2S signal circuit is open.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check open circuit on front HO2S	• Open in signal harness • Open in ground harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Condition	• Sensor preheating and full heating phases finished • Battery voltage >10V • Lambda control active	
Threshold Value	• 0.4V < Sensor voltage <0.5V	
Diagnostic Time	• 10 Seconds	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



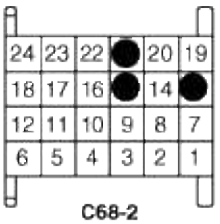
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(15)	Signal
2	ECM Terminal C68-2(21)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(13)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

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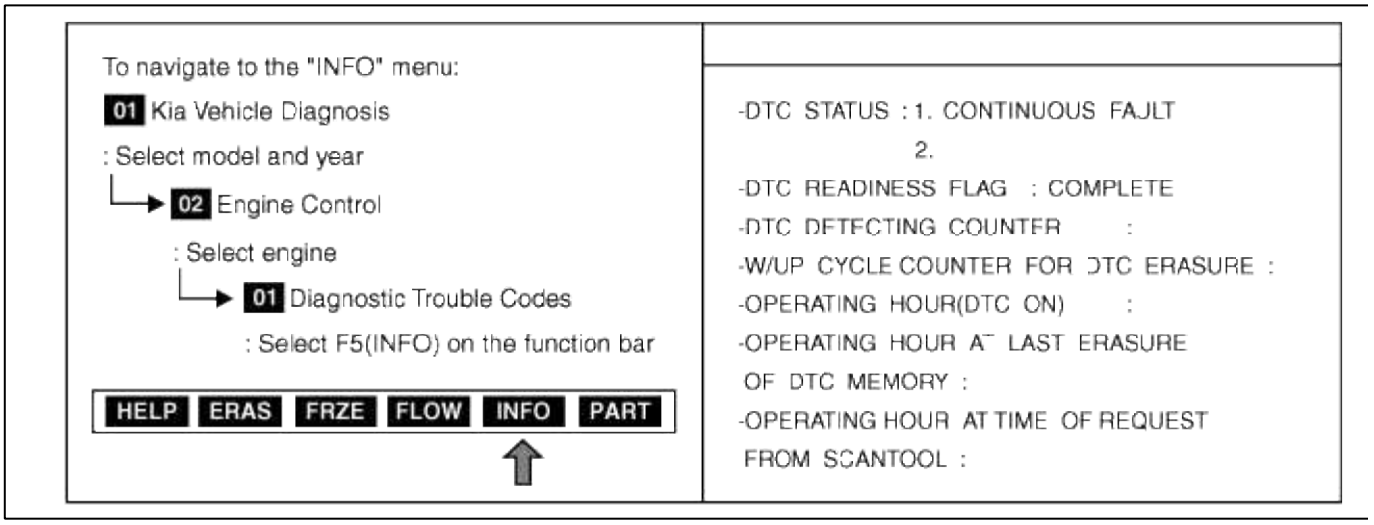
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

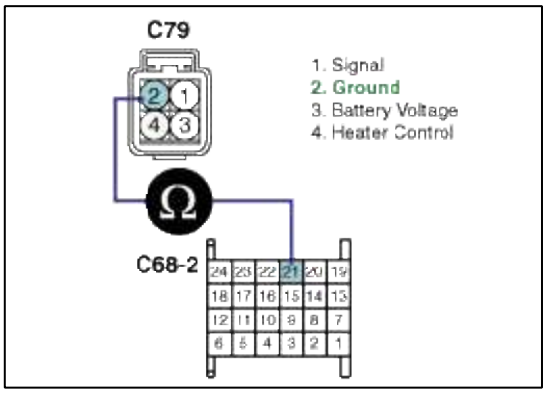
Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S and ECM connectors.

3. Measure resistance between terminal 2 of the HO2S harness connector and 21 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Signal circuit inspection" procedure.

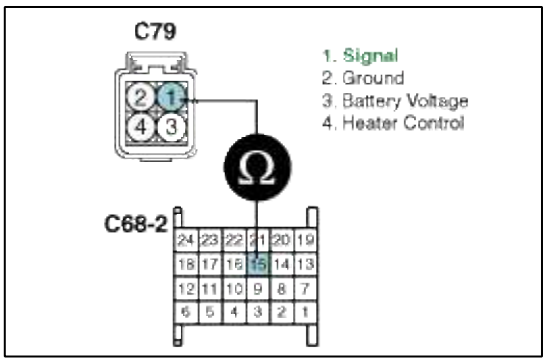
NO

Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Measure resistance between terminals 1 of the HO2S harness connector and 15 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



2. Is resistance within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.

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3. Connect Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

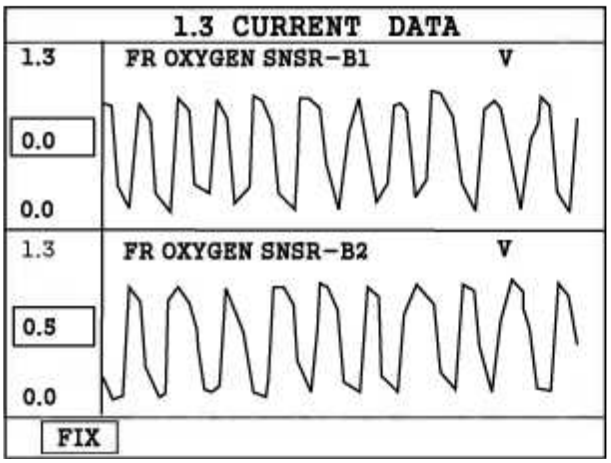


Fig. 1

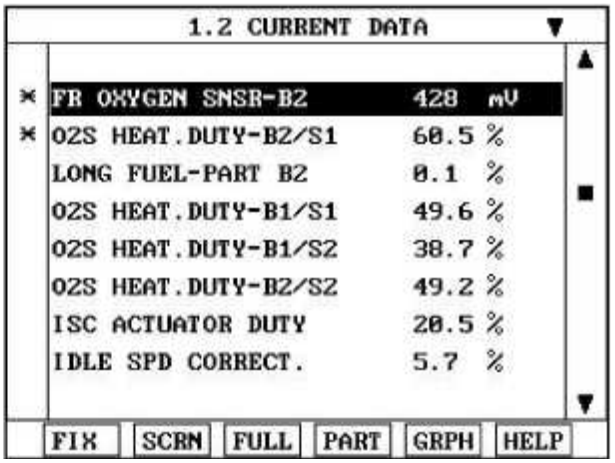


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fig 1) Normal value with idle after warm up : Signal is switching form rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10

Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

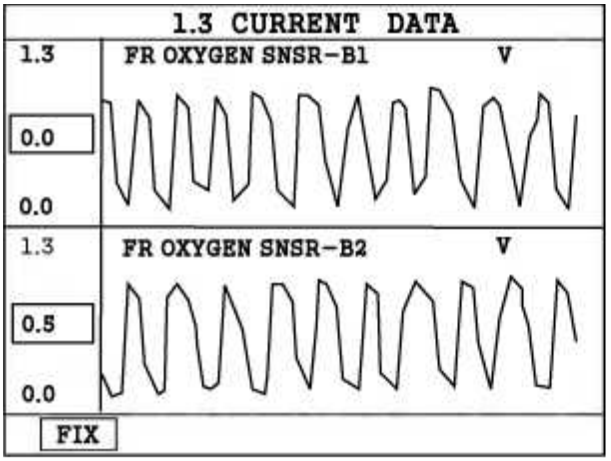


Fig. 1

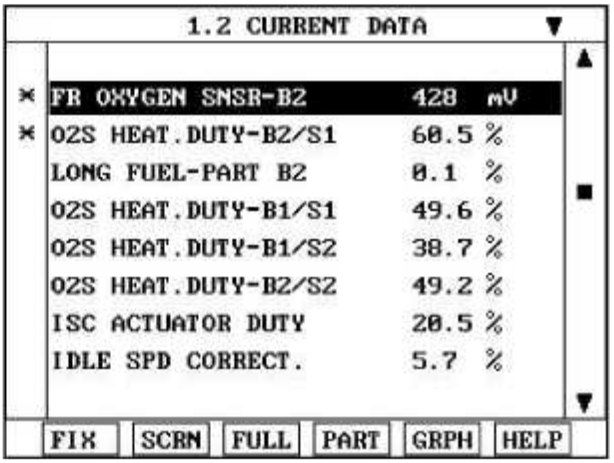
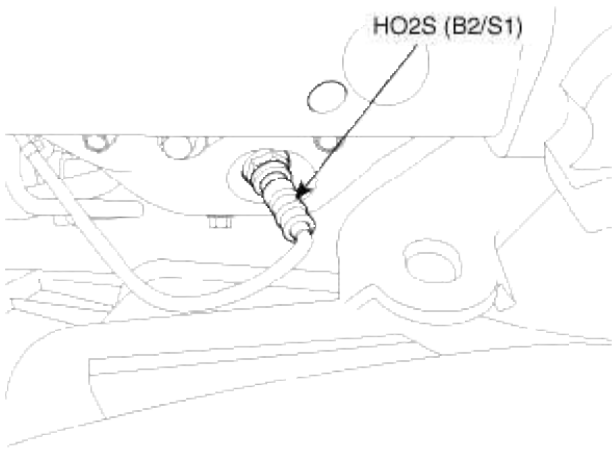


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0151

COMPONENT LOCATION



GERNERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

The control unit of the linear oxygen sensor built inside the ECM monitors short circuit error on all front Heated Oxygen Sensor (HO2S) control lines and ECM sets P0151 with short circuit to ground.

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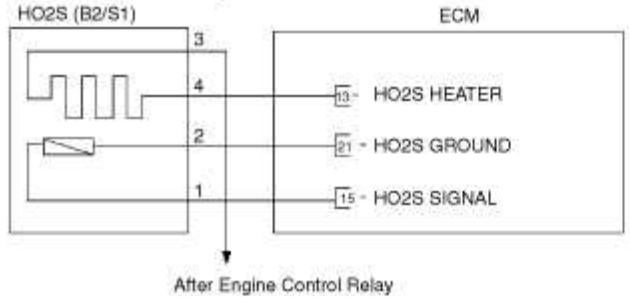
DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage low	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage >10V	
Threshold Value	• Sensor voltage <0.02V and element resistance <10Ω	
Diagnostic Time	• 60 sec.	
Fail Safe	• Reset lambda adaptation and fuel trim adaptation. • Front HO2S heater is controlled in open loop control. • EVAP. Emission control function is controlled in minimum operation mode.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



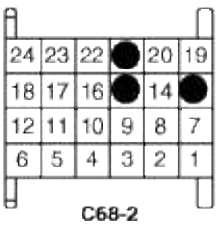
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(15)	Signal
2	ECM Terminal C68-2(21)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(13)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



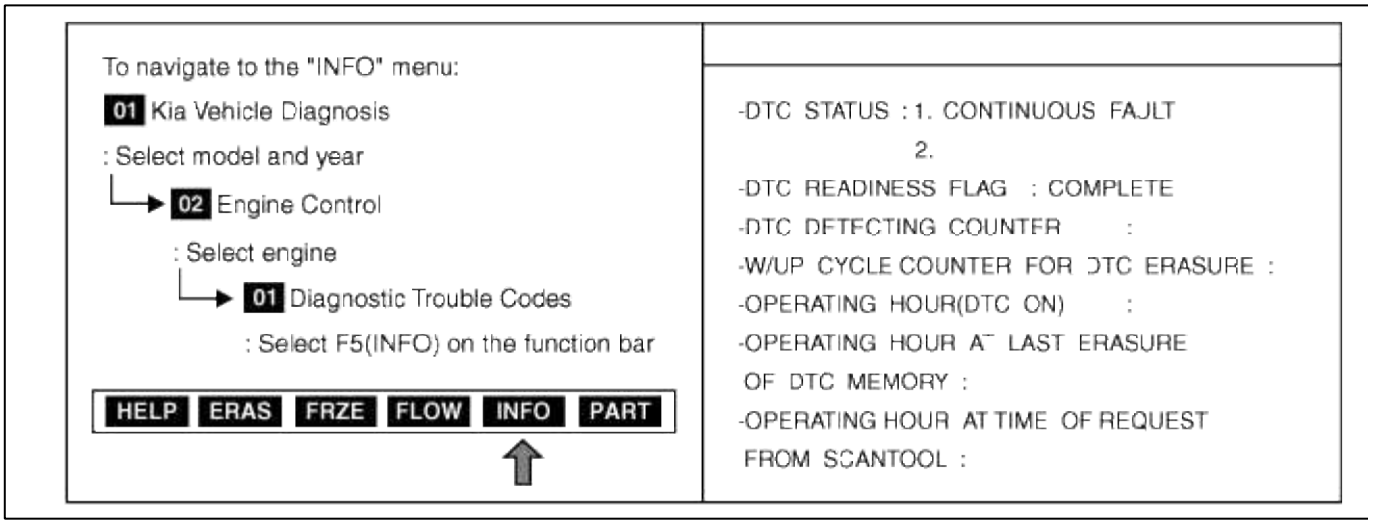
C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.

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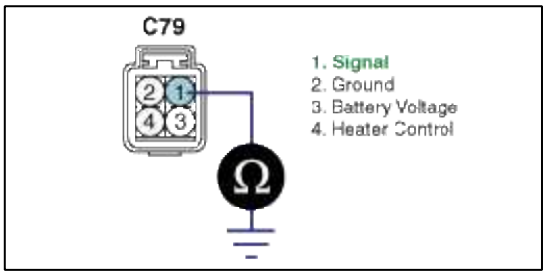
3. Measure resistance between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Infinite



4. Is resistance within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

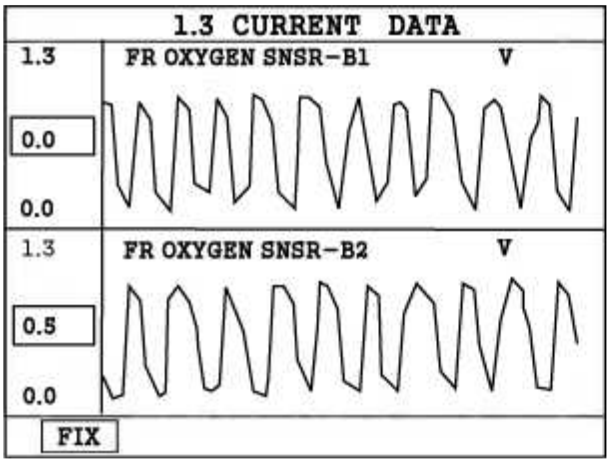


Fig. 1

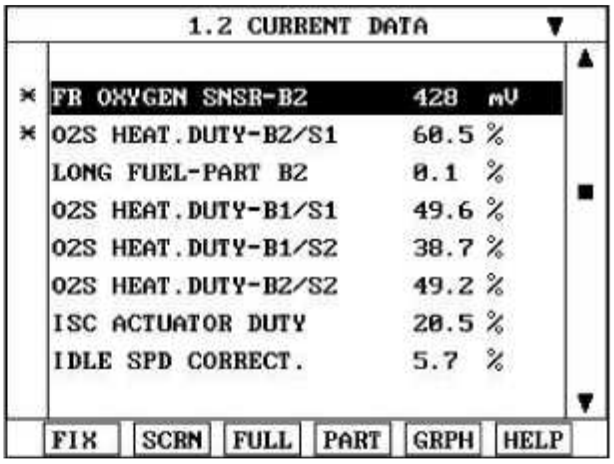


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

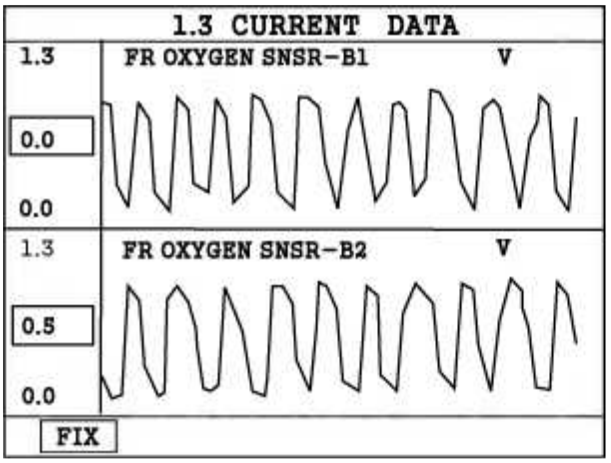


Fig. 1

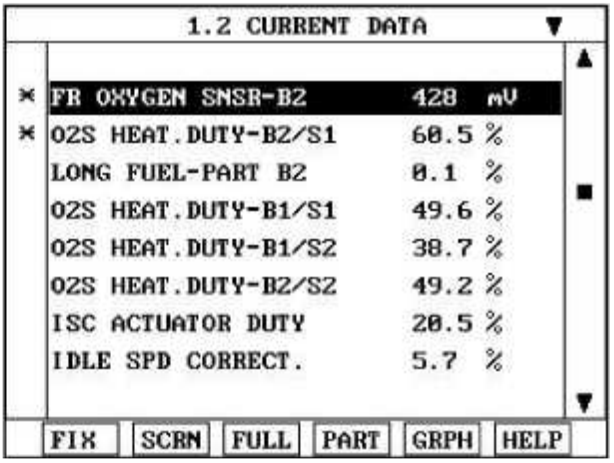


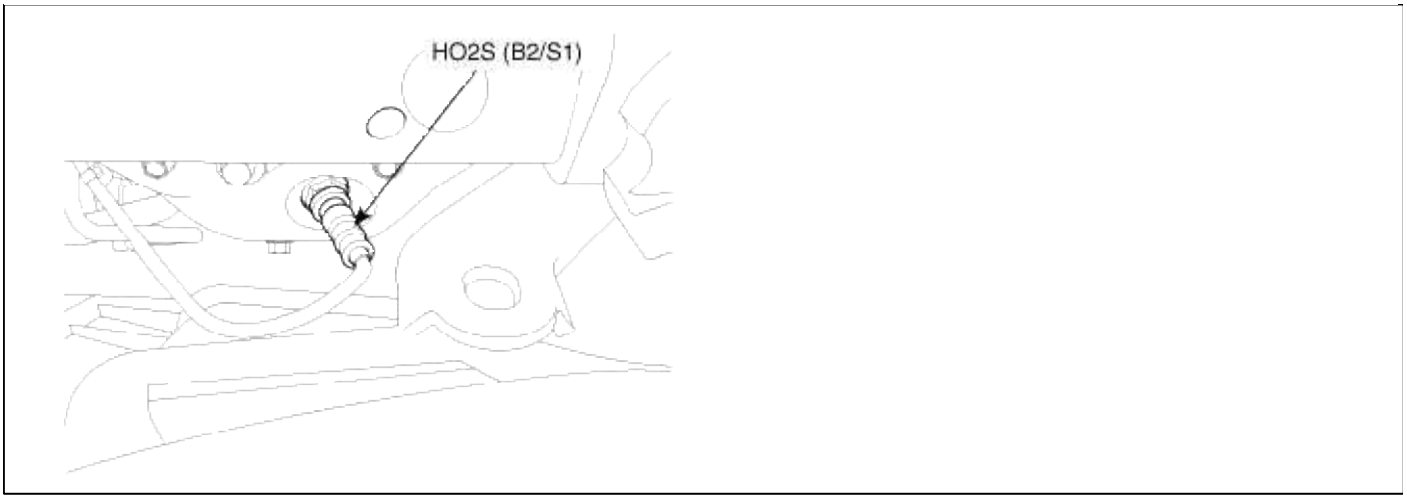
Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0152

COMPONENT LOCATION

tomsn048@gmail.com



GERNERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

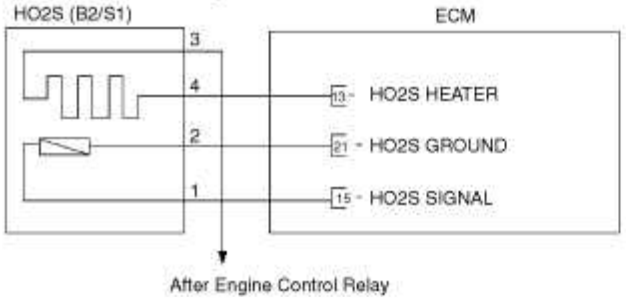
The control unit of the linear oxygen sensor built inside the ECM monitors short circuit error on all front Heated Oxygen Sensor (HO2S) control lines and ECM sets P0152 with short circuit to battery.

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor voltage high	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor.(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage >10V	
Threshold Value	• Sensor voltage >1.3V	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



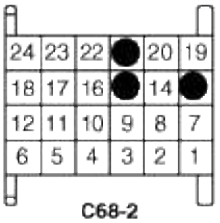
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(15)	Signal
2	ECM Terminal C68-2(21)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(13)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector

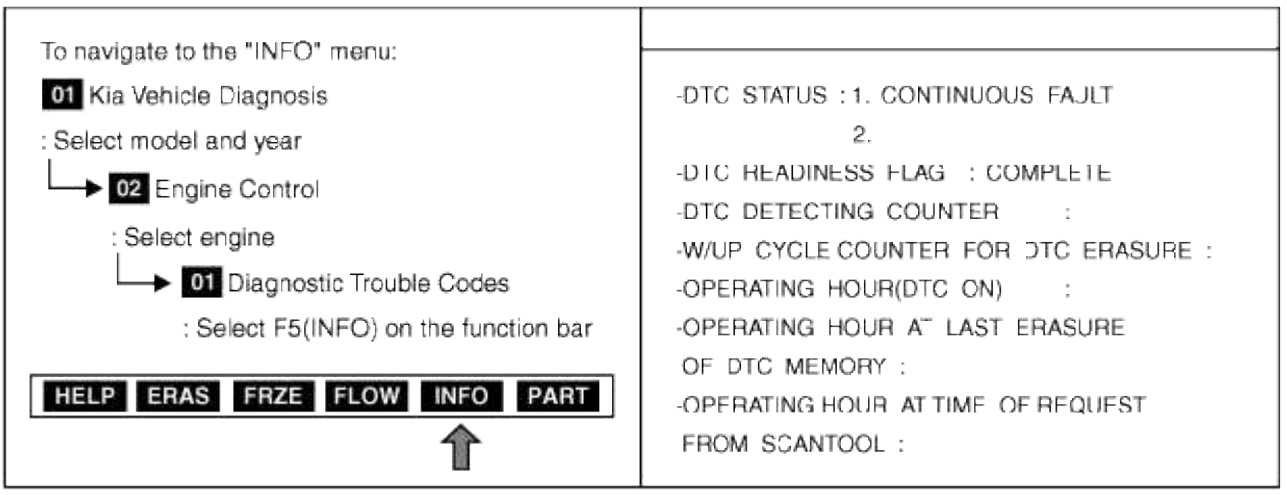


C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



tomsn048@gmail.com

5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

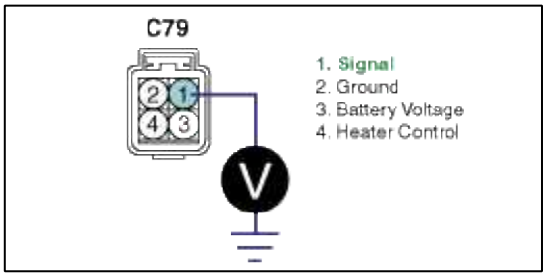
NO

Go to " Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the HO2S harness connector and chassis ground.

Specification : Approx. 0V



5. Is voltage within the specification?

YES

Go to "Component Circuit Inspection" procedure.

NO

Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   If contamination is evident on the HO2S, replace contaminated sensor and go to next step.

2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Connect Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

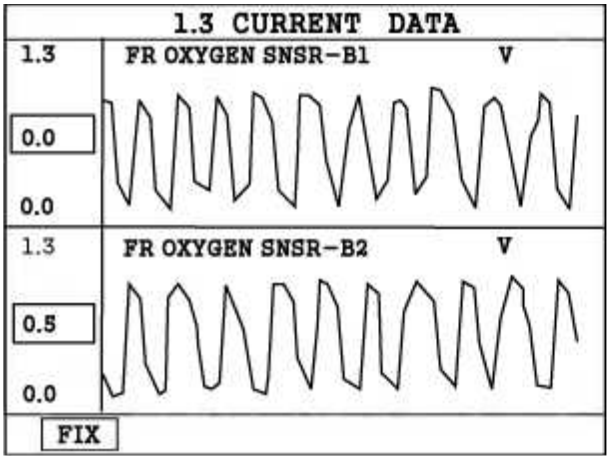


Fig. 1

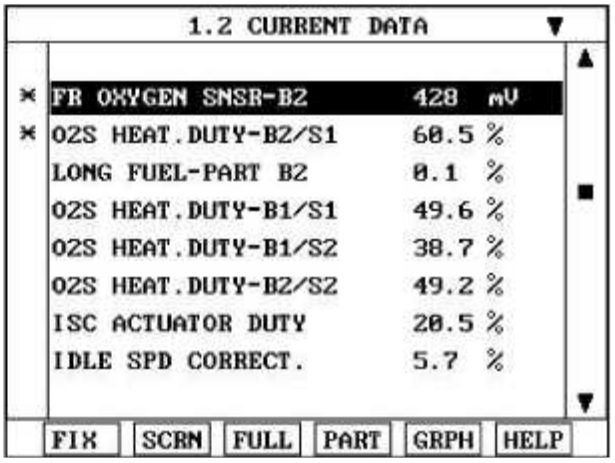


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

tomsn048@gmail.com

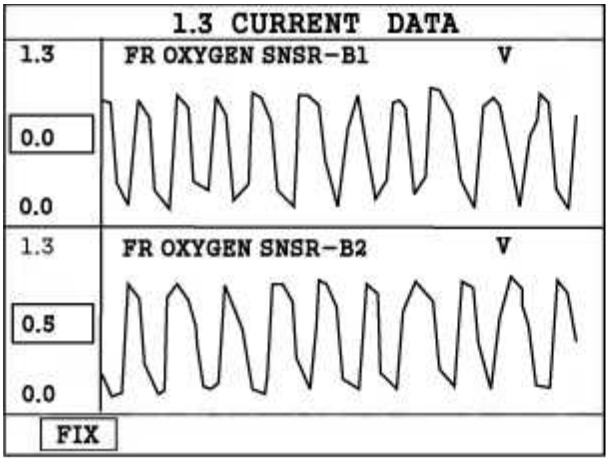


Fig. 1

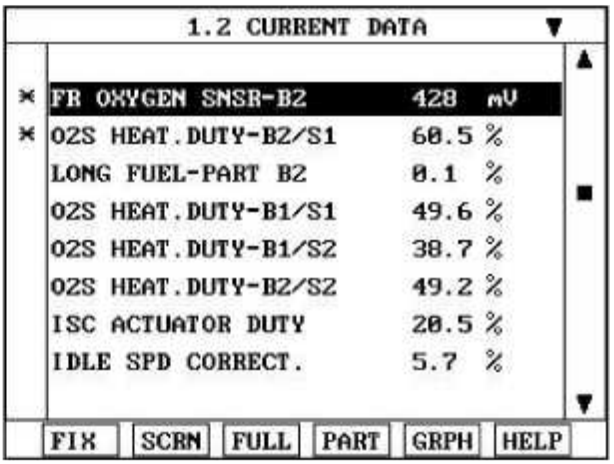
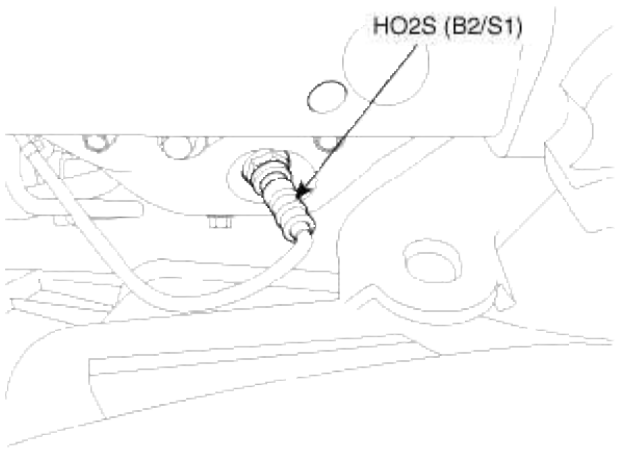


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0153

COMPONENT LOCATION



GERNERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

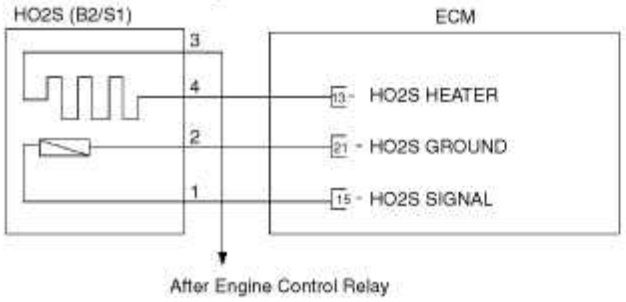
The ECM monitors front oxygen sensor amplitude level and compares it to predetermined minimum amplitude value which could increase emission or disturb lambda control by the effect of aging on the oxygen sensor. The ECM sets DTC P0153 when the amplitude of oxygen sensor is equal to or less than minimum amplitude threshold.

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of O2 sensor lean/rich period with calculated period	• Leak in intake or exhaust system • Faulty fuel system. • Front and rear HO2S connections reversed. • Contact resistance in connectors • HO2S contamination
Enable Conditions	• 400°C(752°F)< Catalyst Temp.Model <600°C(1112°F) • Coolant temp. >70°C(158°F) • 800 <Engine speed(RPM) <2500 • Mass air flow <250 mg/stk • No misfire detected • Not transient condition	
Threshold Value	• Sum of O2 sensor lean/rich period > calculated period	
Diagnostic Time	• 80 lambda controller cycles	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



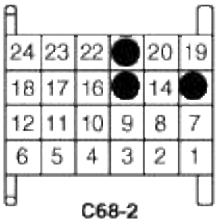
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(15)	Signal
2	ECM Terminal C68-2(21)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(13)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

ECM side terminal

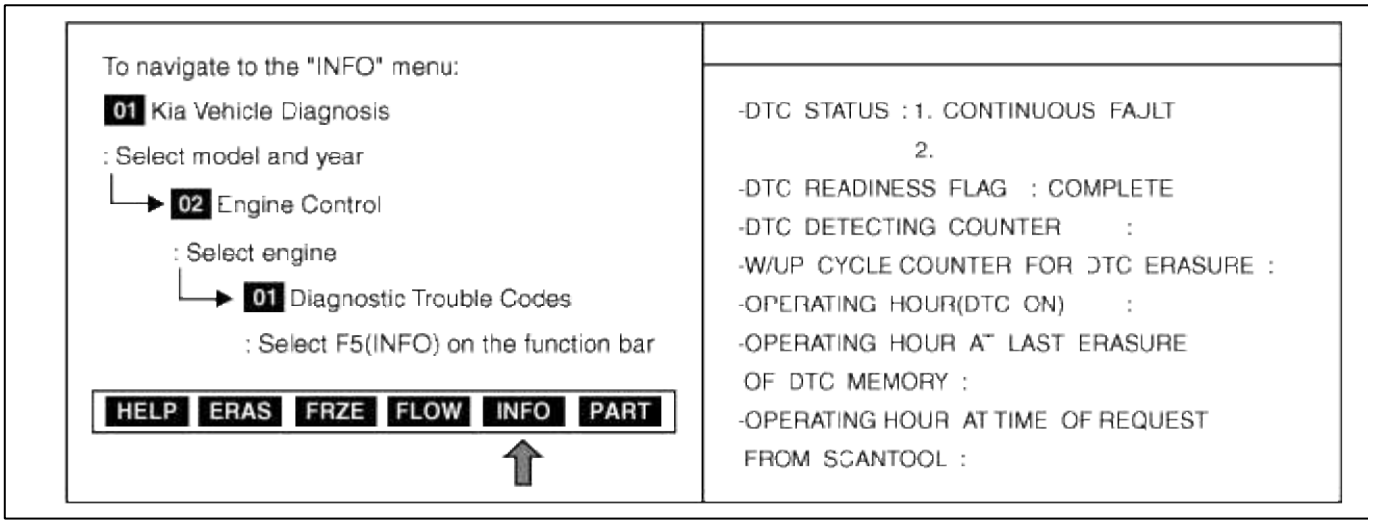
MONITOR DTC STATUS

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.

3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

VISUAL/PHYSICAL INSPECTION

1. Visually/physically inspect the following items:
   A. Ensure that the HO2S is securely installed.
   B. Check for corrosion on terminals.
   C. Check for terminal tension (at the HO2S and at the ECM).
   D. Check for damaged wiring.
   E. Check the HO2S ground circuit for a good connection.
2. Check front and rear HO2S for connections being reversed. If HO2S connections reversed, switch connections properly.
3. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "Exhaust System Inspection" procedure.

EXHAUST SYSTEM INSPECTION

1. Check the exhaust system for an exhaust leak near the engine.

2. Was an exhaust leak found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Air Leakage Inspection " procedure.

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the following items:
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Exhaust system between HO2S and Three way catalyst for air leakage.
   C. EVAP system for leakage.
   D. PCV hose for proper installation.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "Fuel Pressure Inspection" procedure

FUEL PRESSURE INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Inspect fuel pressure with engine idling at normal operating temperature.

Test Condition : Engine "ON" & Vacuum hose disconnected at Idle.
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

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4. Is the fuel pressure within the specified value?

YES

Go to "Fuel Injector Inspection" procedure as below.

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator.
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECOTR INSPECTION

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. If contamination is evident on the HO2S, replace contaminated sensor and go to next step.

2. Warm up the engine to normal operating temperature and check that HO2S signal is active.
3. Install Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Ignition "ON" & Engine "ON"
Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

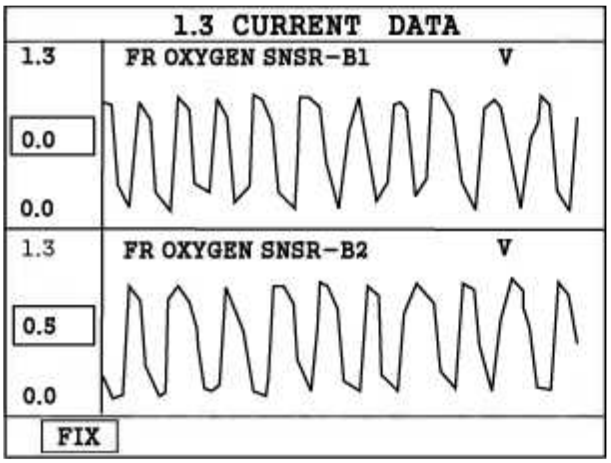


Fig. 1

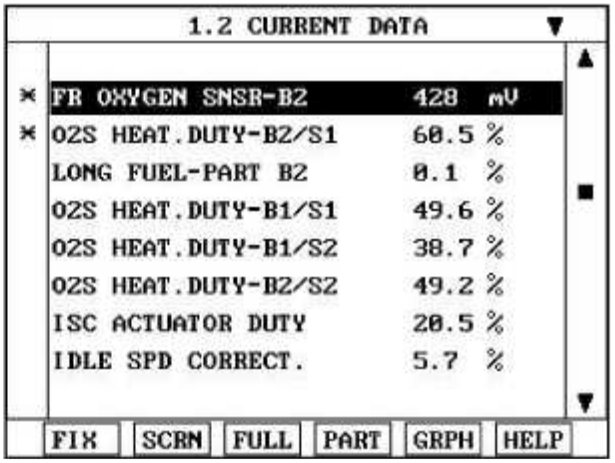


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.
If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

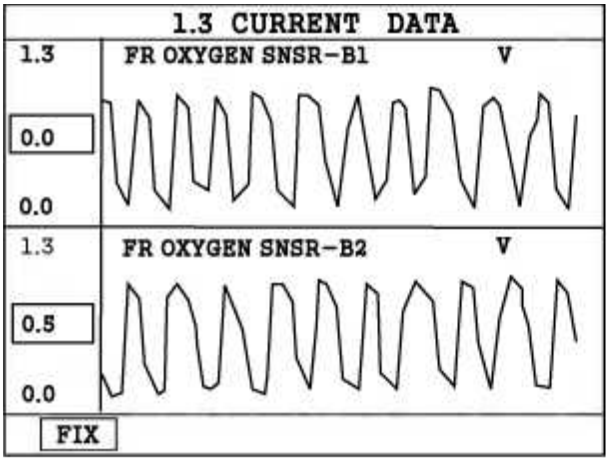


Fig. 1

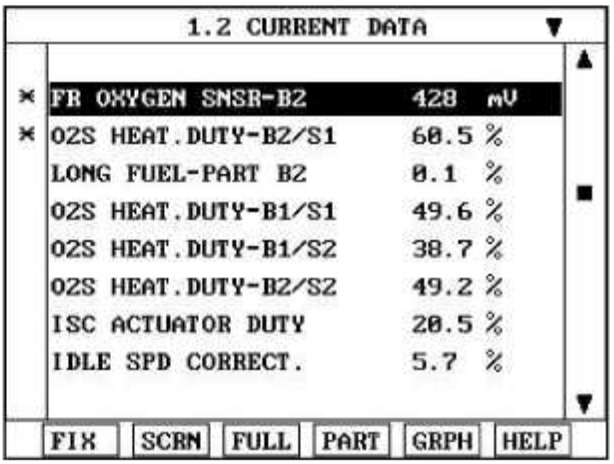
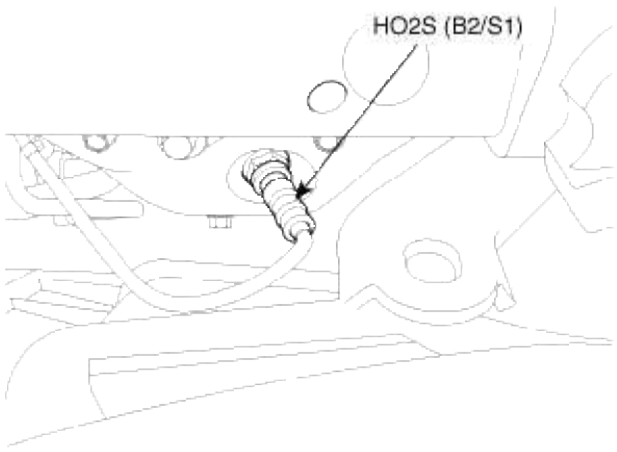


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0154

COMPONENT LOCATION



GERNERAL DESCRIPTION

The HO2S is used to supply the ECM with information regarding the composition of the air/fuel mixture. The HO2S is positioned in the exhaust pipe ahead of the TWC. To measure the oxygen content, the HO2S requires a supply of ambient air as a reference. Since this is supplied through the wiring, the lead must not be clamped or damaged in any other way. The HO2S produces a voltage that varies between 0.1V and 0.9V under normal operating conditions. The Engine Control Module (ECM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the ECM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The ECM constantly monitors the HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary.

DTC DESCRIPTION

Due to possible oxygen sensor defects (e.g. reference air poisoning) or faults in the injection system (e.g. leaking fuel injector), the rear oxygen sensor may not provide the expected lean or rich signal level during fuel cut-off or full load condition. Hence, the oxygen sensor signal is checked for plausibility during this engine operating states.

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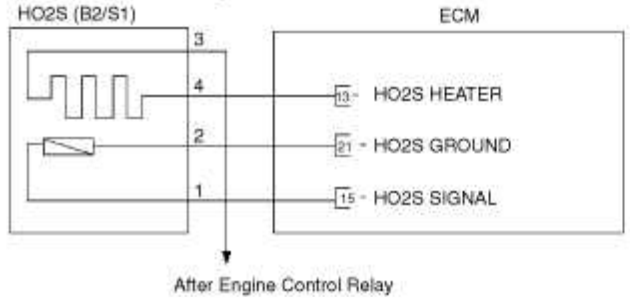
DTC DETECTING CONDITION

ITEM		DETECING CONDITION	POSSIBLE CAUSE
Case1)	DTC Strategy	• Signal plausibility during fuel cut off	• Related fuse blown or missing • Contact resistance in connectors • HO2S contamination
	Enable Conditions	• Sensor preheating and full heating phases finished • Fuel Cut Off active • Integrated Mass Air Flow since begin fuel cut-off >20g • Battery voltage >10V	
	Threshold Value	• Voltage with fuel cut off > 0.2V	
	Diagnostic Time	• 5 Sec.	
Case2)	DTC Strategy	• Signal stroke plausibility	
	Enable Conditions	• Sensor preheating and full heating phases finished • 5 Cycles of A/F Closed Loop passed after lambda control active. • Lambda controller is not on the limit • Battery voltage > 10V	
	Threshold Value	• Sensor voltage < 0.25V	
	Diagnostic Time	• 2 min.	
MIL On Condition		• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



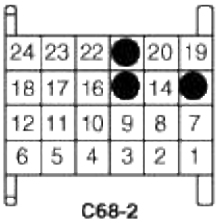
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(15)	Signal
2	ECM Terminal C68-2(21)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(13)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

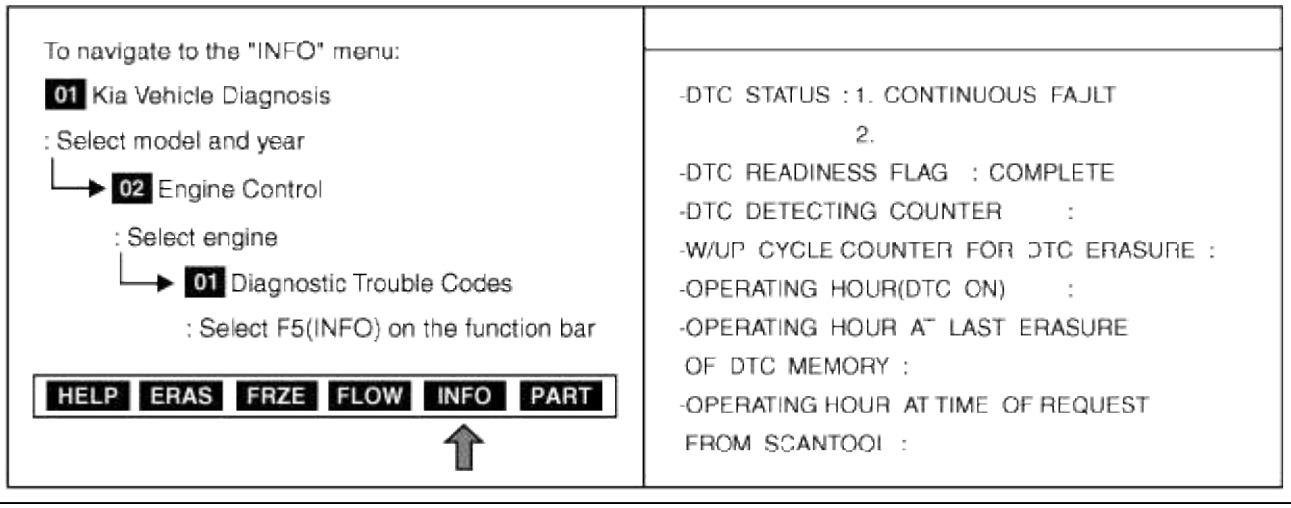
ECM side terminal

MONITOR DTC STATUS

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

Go to "HO2S Fuse Inspection" procedure

HO2S FUSE INSPECTION

1. Ignition "OFF" & Engine "OFF"
2. Verify "10A Sensor fuse" is installed and not blown.
3. If OK, go to "Component Inspection" procedure.
   If NG, replace fuse and repair any shorts as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Visually/physically inspect following items:
   A. Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. If contamination is evident on the HO2S, replace contaminated sensor and go to next step.
2. Warm up the engine to normal operating temperature and check that HO2S signal is active.

3. Install Scantool and monitor the "FR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Ignition "ON" & Engine "ON"
Specification : Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).

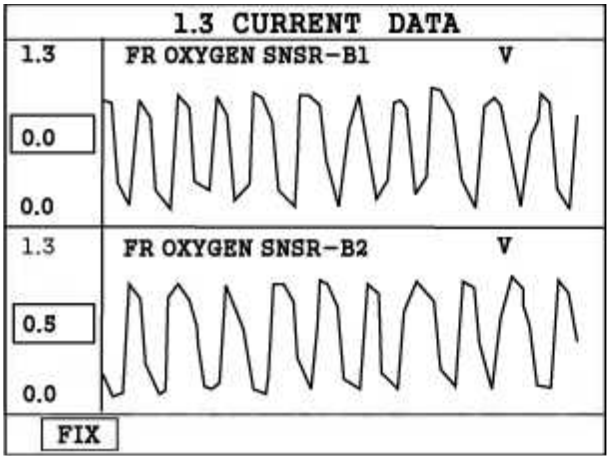


Fig. 1

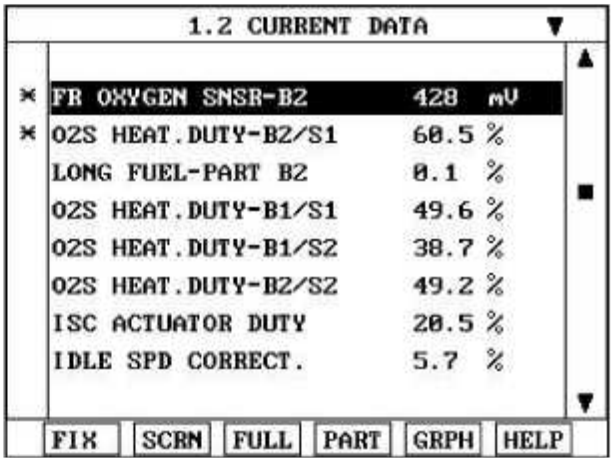


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

4. Is sensor switching properly?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.
If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

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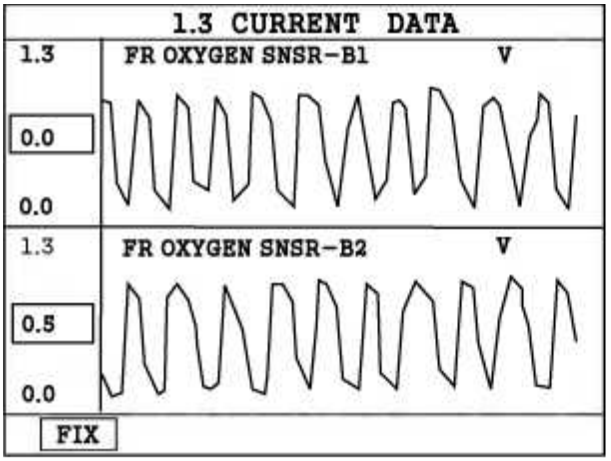


Fig. 1

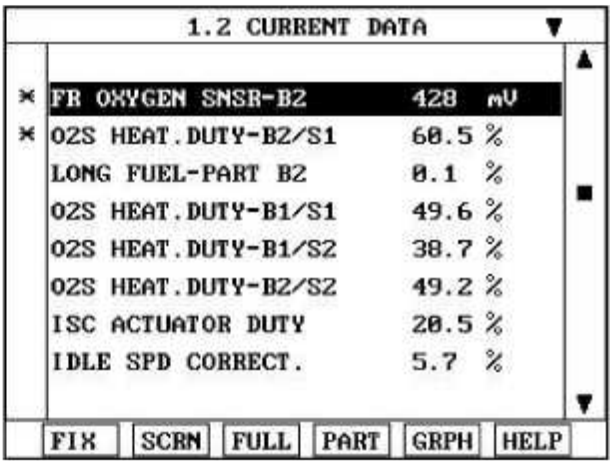
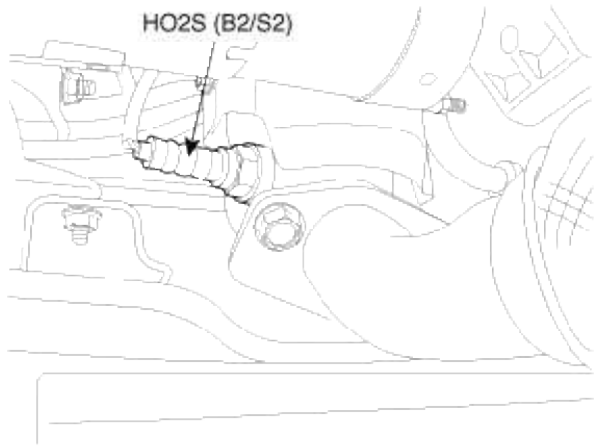


Fig. 2

Fig 1) Normal value with idle after warm up : Signal is switching from rich (above 0.45V) to lean (below 0.45V) a minimum of 3 times in 10 seconds.
Fig 2) Open in signal circuit with ignition ON : Approx. 0.4~0.5V

Fuel System > Troubleshooting > P0156

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which detects the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

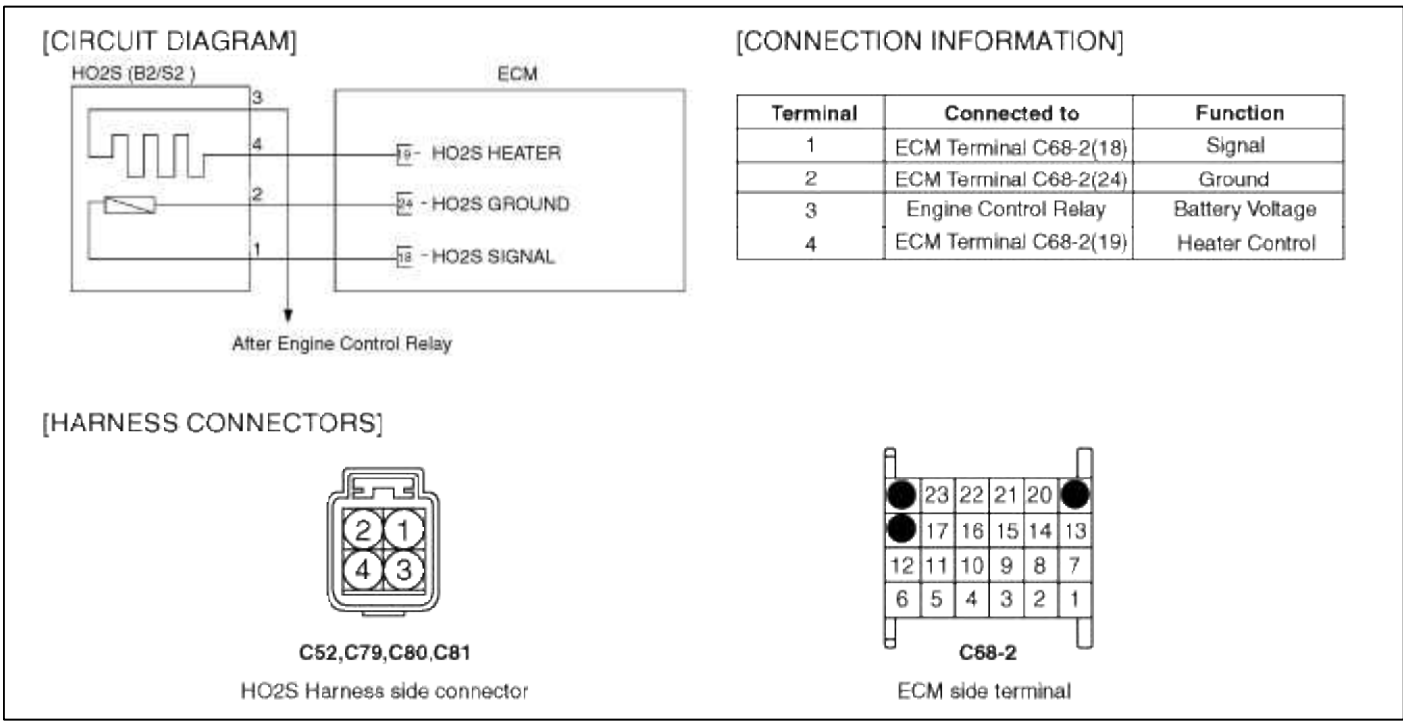
DTC DESCRIPTION

ECM sets DTC P0136 if the ECM detects that the rear HO2S signal circuit is open.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBL ECAUSE
DTC Strategy	• Check open circuit on rear HO2S	• Open in signal harness • Open in ground harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Condition	• Sensor preheating and full heating phases finished • No relevant failure • Battery voltage > 10V	
Threshold Value	• Sensor element resistance > 60 kΩ	
Diagnostic Time	• 30 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

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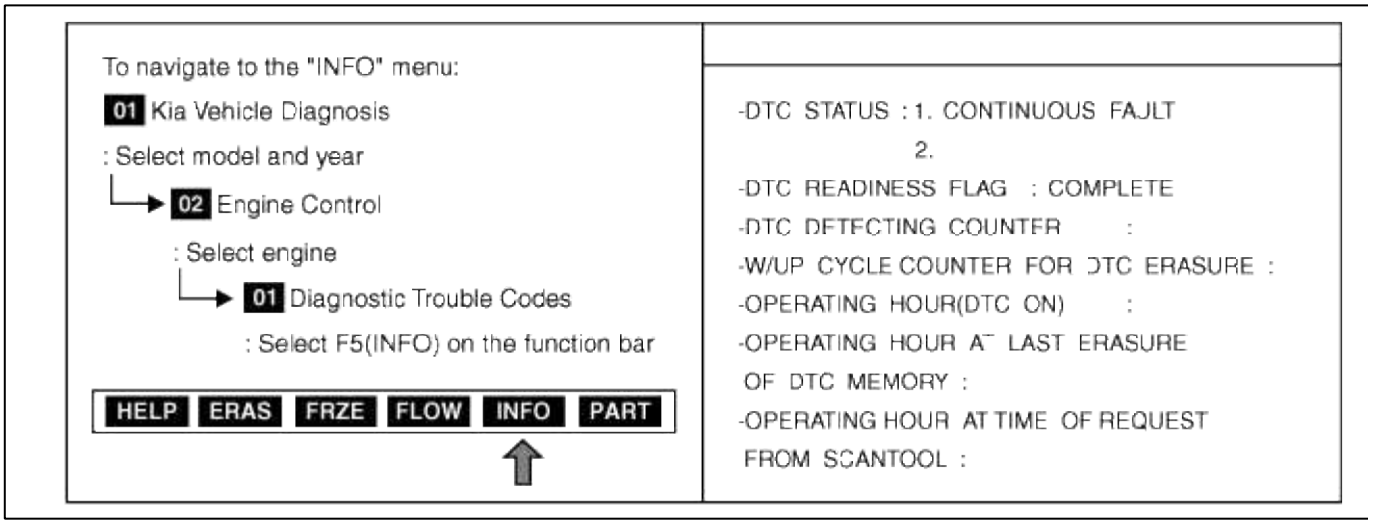
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

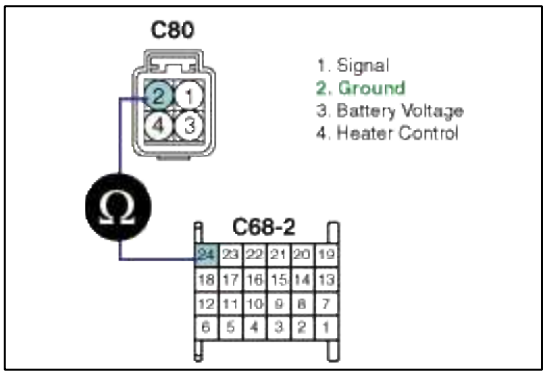
Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S and ECM connectors.

3. Measure resistance between terminal 2 of the sensor harness connector and 24 of the ECM harness connector.

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Signal circuit inspection" procedure.

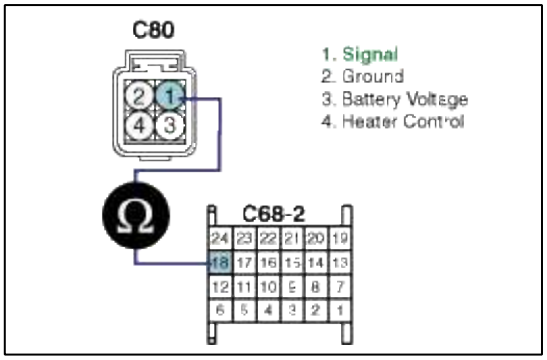
NO

Repair open in the signal circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Measure resistance between terminals 1 of the HO2S harness connector and 18 of the ECM harness connector(C68-2).

Specification : Approx. 0Ω



2. Is resistance within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.

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2. Connect Scantool and monitor the "RR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition.
Specification : Above 0.6V.

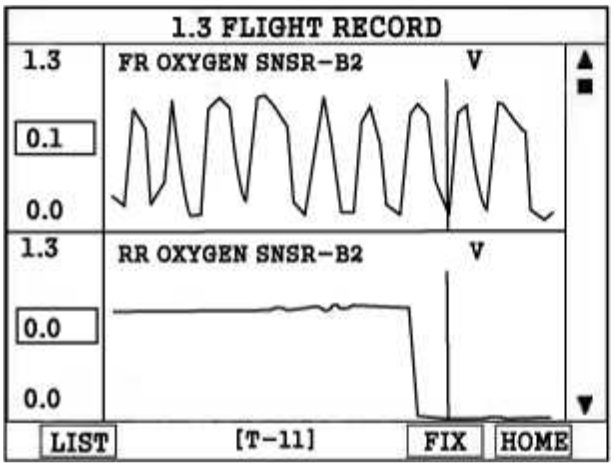


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3. Is sensor data within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

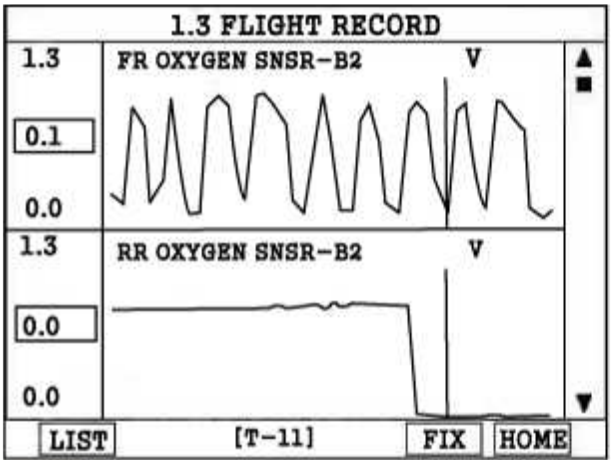
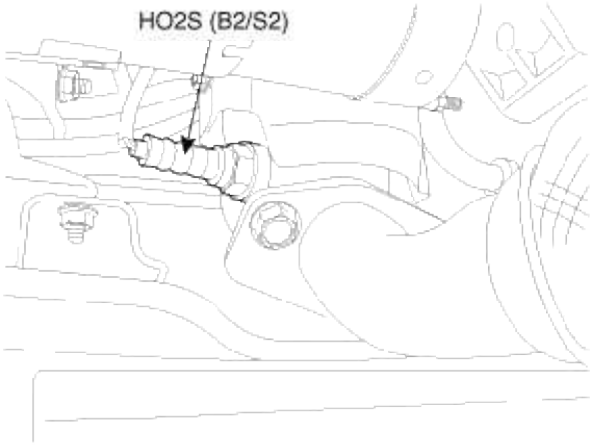


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0157

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

ECM sets DTC P0157 if the ECM detects signal voltage lower than the possible range of a properly operating rear heated oxygen sensor (HO2S).

DTC DETECTING CONDITION

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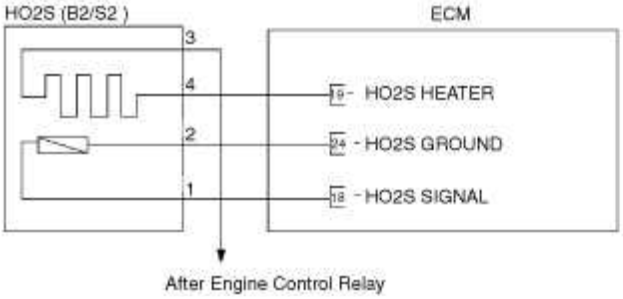
ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor Voltage Low	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage >10V	
Threshold Value	• Sensor voltage <0.02V and element resistance <10Ω	
Diagnostic Time	• 30 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



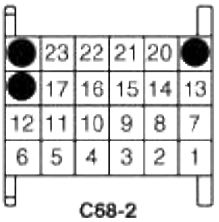
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(18)	Signal
2	ECM Terminal C68 2(24)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(19)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



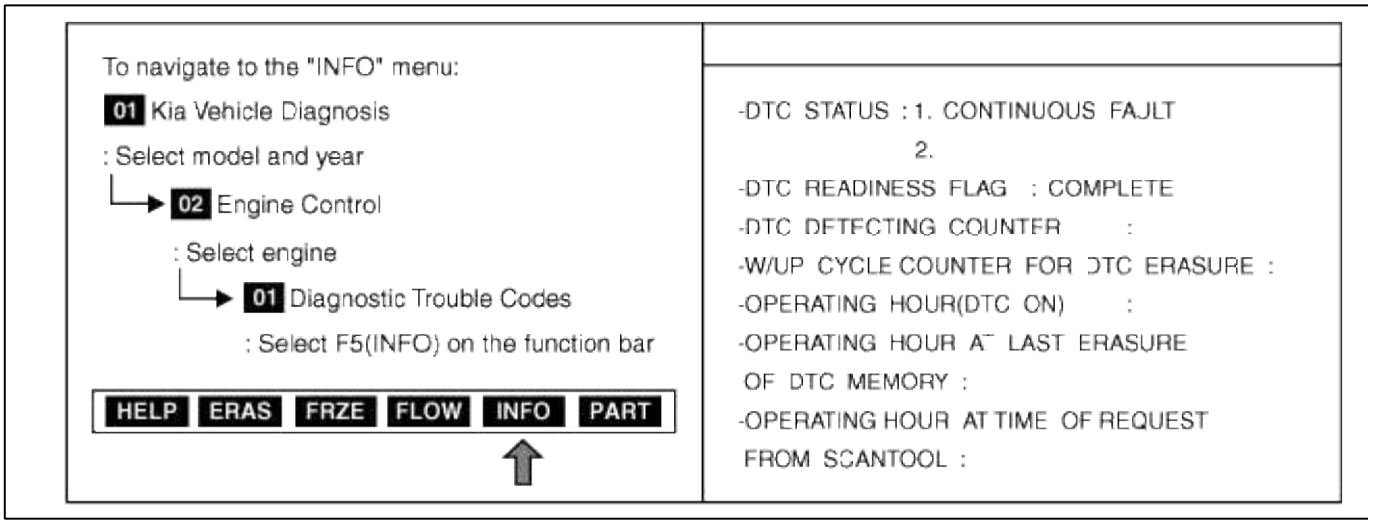
C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect HO2S connector.

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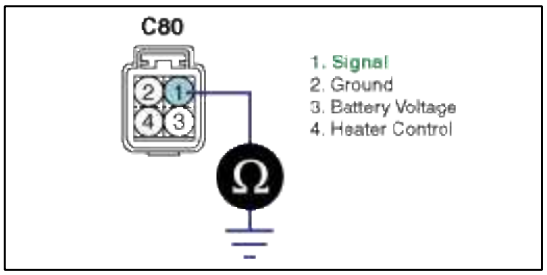
3. Measure resistance between terminal 1 of the sensor harness connector and chassis ground.

Specification : Infinite



4. Is resistance within the specification?

YES

Go to "Component Inspection" procedure

NO

Repair open or short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Install Scantool and monitor the "RR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition.
Specification : Above 0.6V.

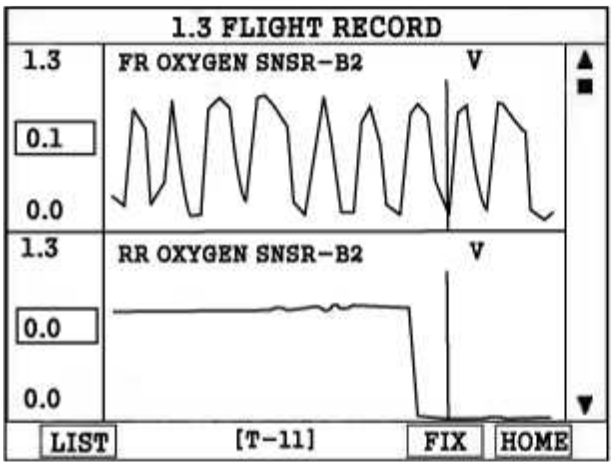


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3. Is sensor data within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

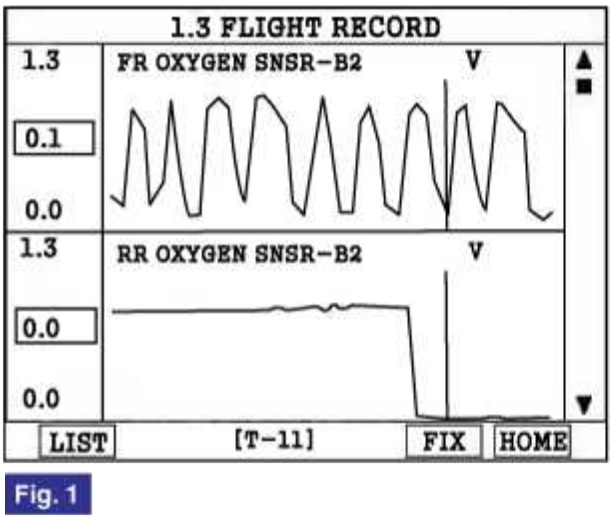
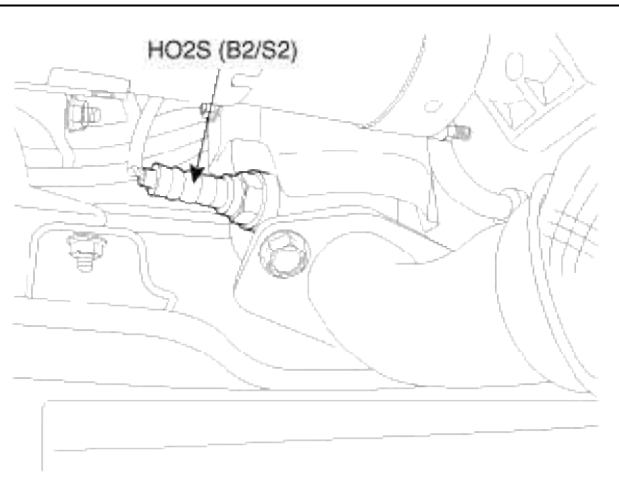


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0158

COMPONENT LOCATION



GERNERAL DESCRIPTION

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The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect the catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

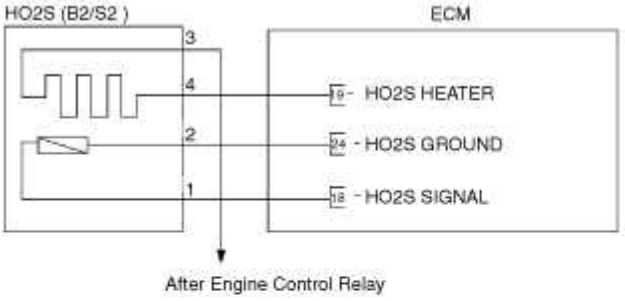
ECM sets DTC P0158 if the ECM detects signal voltage lower than the possible range of a properly operating rear heated oxygen sensor (HO2S).

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor Voltage High	• Short to ground in signal harness • Contact resistance in connectors • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	• Sensor preheating and full heating phases finished • Battery voltage >10V	
Threshold Value	• Sensor voltage >1.3V	
Diagnostic Time	• 1 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



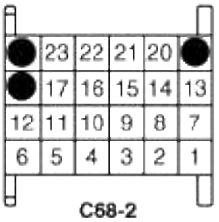
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(18)	Signal
2	ECM Terminal C68-2(24)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(19)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



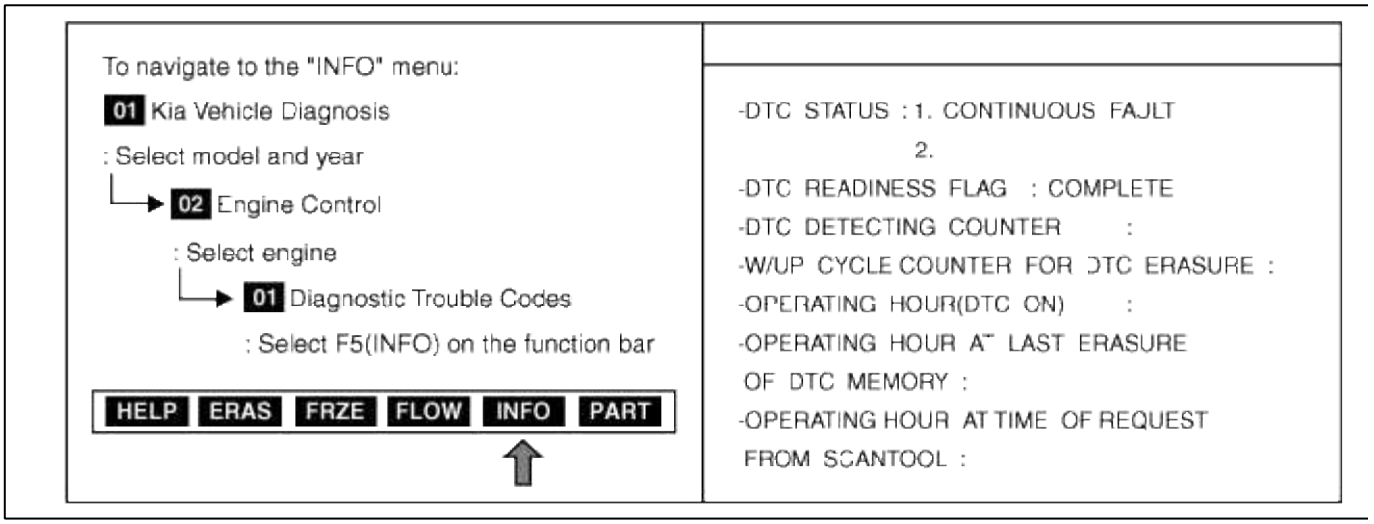
C68-2

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.

3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect HO2S connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. 0V

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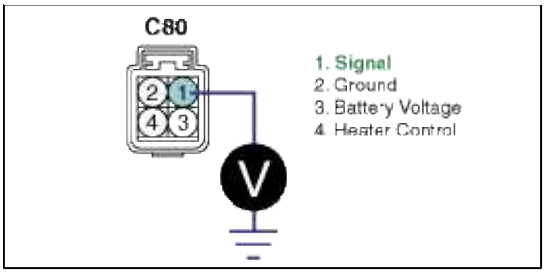


1. Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Install Scantool and monitor the "RR OXYGEN SNSR-B2" parameter on the Scantool data list.

Test Condition : Engine "ON" & In Idle("Closed Loop")condition.
Specification : Above 0.6V.

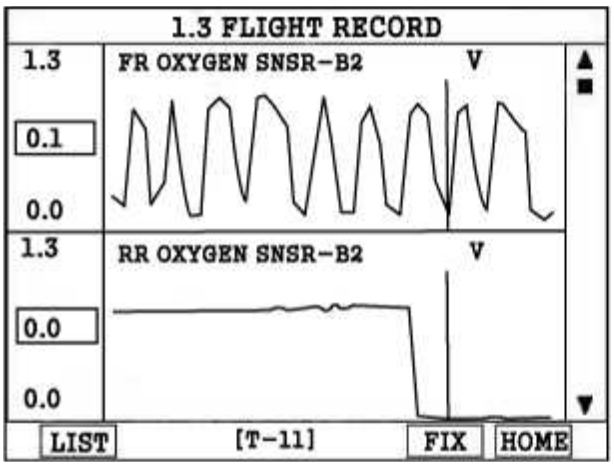


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3.

4. Is sensor data within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation.. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

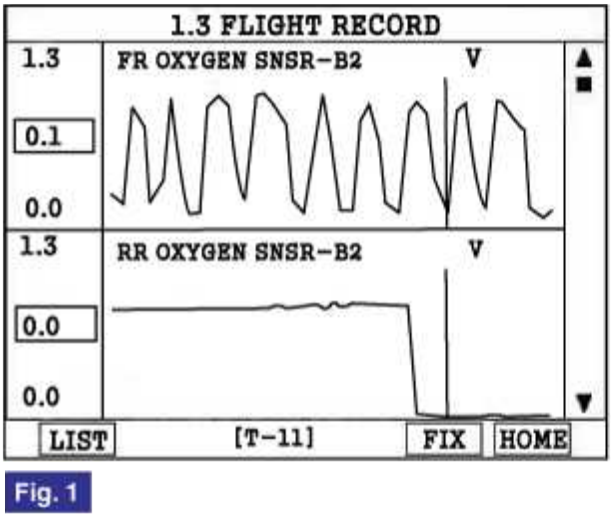
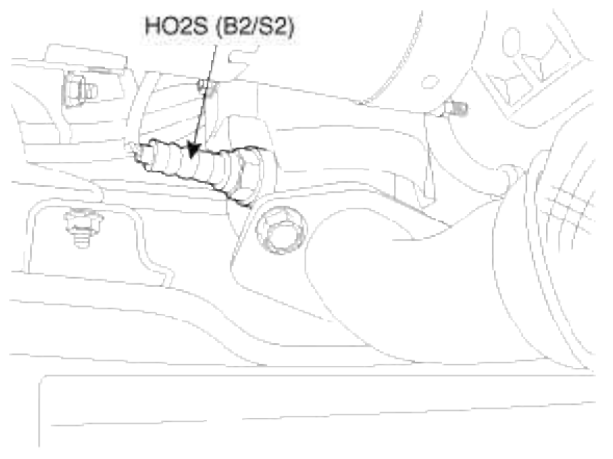


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0159

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S)

produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

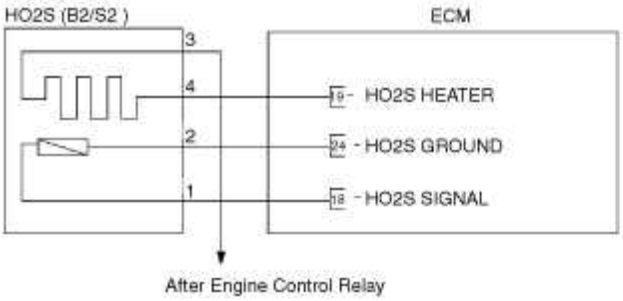
The ECM monitors rich-lean switching time of rear heated oxygen sensor (HO2S) after fuel cut-off to validate dynamic behaviour of rear heated oxygen sensor (HO2S). After detection of fuel cut-off engine operating state, the ECM measures rich-lean switching time of the rear heated oxygen sensor (HO2S) signal and compares it to the predetermined limit value. DTC P0159 is set when the switching time is bigger than the limit value. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Slow response(Switching time check at entry in fuel cut off)	• Leak in intake or exhaust system • Faulty fuel system. • Front and rear HO2S connections reversed. • Contact resistance in connectors • HO2S contamination
Enable Conditions	• Fuel cut-off phase • Sensor preheating and full phase finished • Catalyst temp.model >350°C(662°F) • Coolant temp >70°C(158°F)	
Threshold Value	• Average ratio(between measured and maximum allowed switching time at entry in fuel cut-off) > 1	
Diagnostic Time	• 5 fuel cut-off phases	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



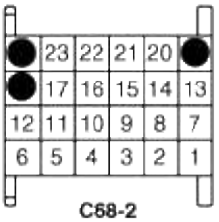
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(18)	Signal
2	ECM Terminal C68-2(24)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(19)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

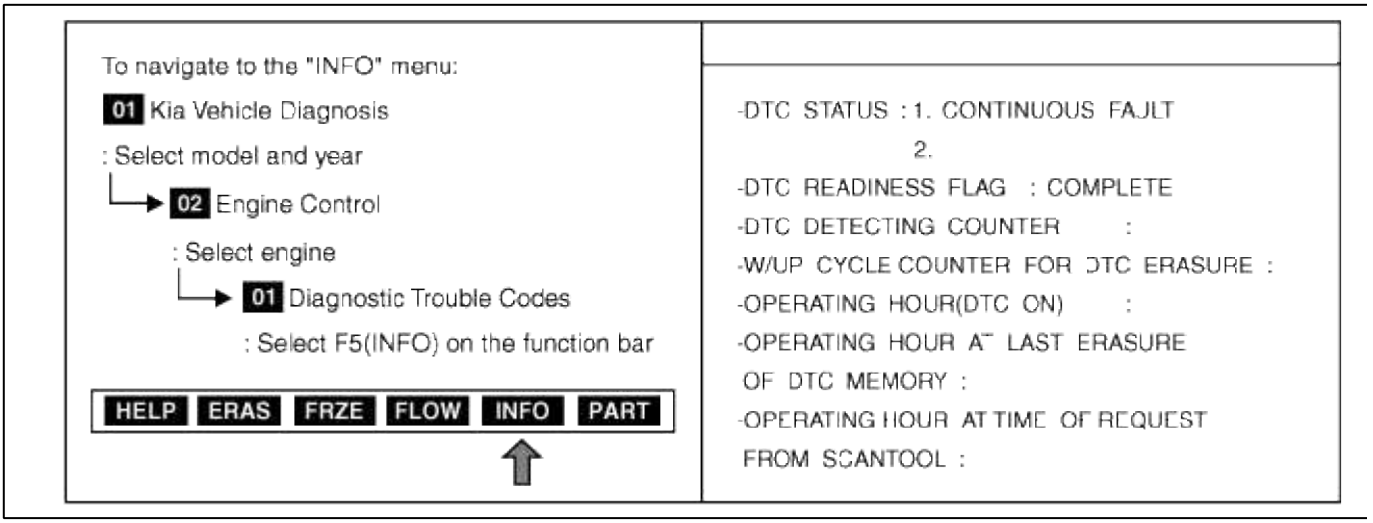
ECM side terminal

MONITOR DTC STATUS

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

VISUAL / PHYSICAL INSPECTION

1. Visually/physically inspect the following items:
   A. Ensure that the HO2S is securely installed.
   B. Check for corrosion on terminals
   C. Check for terminal tension (at the HO2S and at the ECM)
   D. Check for damaged wiring
   E. Check the HO2S ground circuit for a good connection
2. Check front and rear HO2S for connections being reversed. If HO2S connections reversed, switch connections properly.

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3. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Exhaust System Inspection" procedure.

EXHAUST SYSTEM INSPECTION

1. Check the exhaust system for an exhaust leak near the engine.
2. Was an exhaust leak found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Air Leakage Inspection " procedure.

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the following items:
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Exhaust system between HO2S and Three way catalyst for air leakage
   C. EVAP system for leakage
   D. PCV hose for proper installation
2. Was a problem found in any of the above areas?

YES

'Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "Fuel Pressure Inspection" procedure.

FUEL PRESSURE INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage
3. Inspect fuel pressure with engine idling at normal operating temperature.

Test Condition : Ignition "ON" & Engine "ON" & Vacuum hose disconnected at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is the fuel pressure within the specified value?

YES

Go to "Fuel Injector Inspection" procedure as below.

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator.
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECTOR INSPECTION

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Ignition "ON" & Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

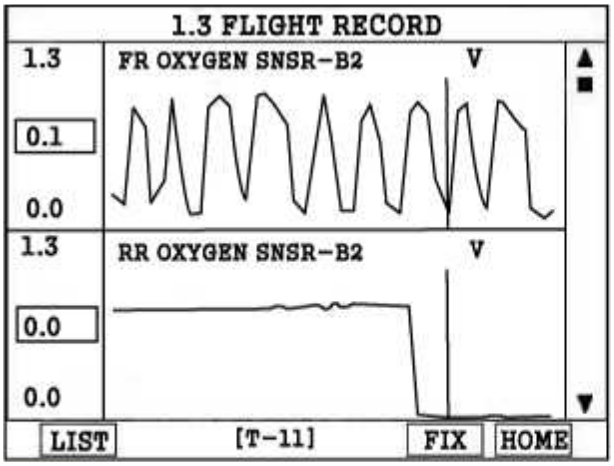

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3. Is sensor data near the specified value?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

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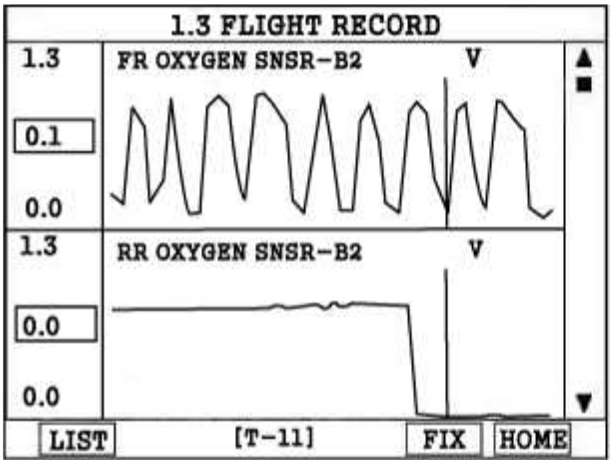
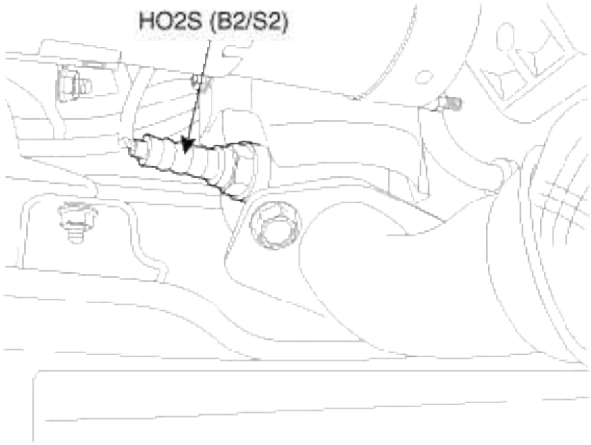


Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0160

COMPONENT LOCATION



GERNERAL DESCRIPTION

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION

Due to possible oxygen sensor defects (e.g. reference air poisoning) or faults in the injection system (e.g. leaking fuel injector), the rear oxygen sensor may not provide the expected lean or rich signal level during fuel cut-off or full load condition. Hence, the oxygen sensor signal is checked for plausibility during this engine operating states.
There are 3 cases which DTC P0160 sets.
(I) Signal monitoring during fuel cut-off: The ECM monitors rear O2 sensor signal level during fuel cut-off which normally shows near 0V and sets DTC P0160 when signal level is too high.

(II) Signal monitoring after fuel cut-off: The ECM monitors rear O2 sensor signal level for a certain time after leaving fuel cut-off and sets DTC P0160 when signal variation during checked period is too small.
(III) Signal monitoring during full load: The ECM monitors rear O2 sensor signal during full load which applies rich air-fuel mixture and sets DTC P0160 when rear O2 sensor signal is too low.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTP DETDCING CONDITION

<table>
<tr><th colspan="2">ITEM</th><th>DETECING CONDITION</th><th>POSSIBLE CAUSE</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Sensor voltage excursion for Lean and Rich mixture</td><td rowspan="8">• Related fuse blown or missing
• Contact resistance in connectors
• HO2S contamination</td></tr>
<tr><td rowspan="3">Case1)</td><td>Enable Conditions</td><td>• Sensor preheating and full heating phases finished
• Full Phase finished
• Integrated MAF in Fuel cut-Off>18g
• Integrated MAF after Fuel cut-Off>40g</td></tr>
<tr><td>Threshold Value</td><td>• Signal increase < 30mV</td></tr>
<tr><td>Diagnostic Time</td><td>• 0.3 sec.</td></tr>
<tr><td rowspan="3">Case2)</td><td>Enable Conditions</td><td>• Sensor preheating and full heating phases finished
• Fuel cut-off phase
• Integrated MAF after starting fuel cut-off>20g</td></tr>
<tr><td>Threshold Value</td><td>• Voltage with fuel cut off > 0.2V</td></tr>
<tr><td>Diagnostic Time</td><td>• 5 after fuel cut off phase</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• 2 Driving Cycles</td></tr>
</table>

SCHEMATIC DIAGRAM

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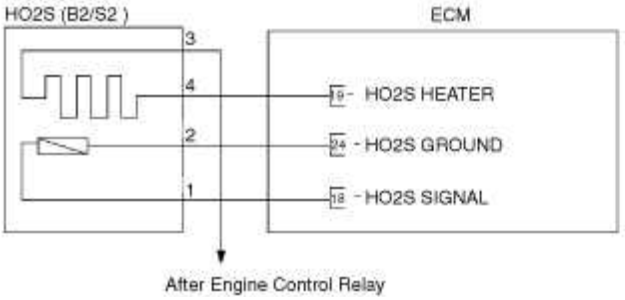
[CIRCUIT DIAGRAM]



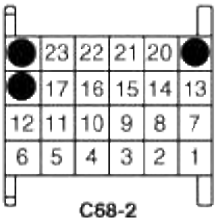
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-2(18)	Signal
2	ECM Terminal C68-2(24)	Ground
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-2(19)	Heater Control

[HARNESS CONNECTORS]

C52,C79,C80,C81

HO2S Harness side connector



C68-2

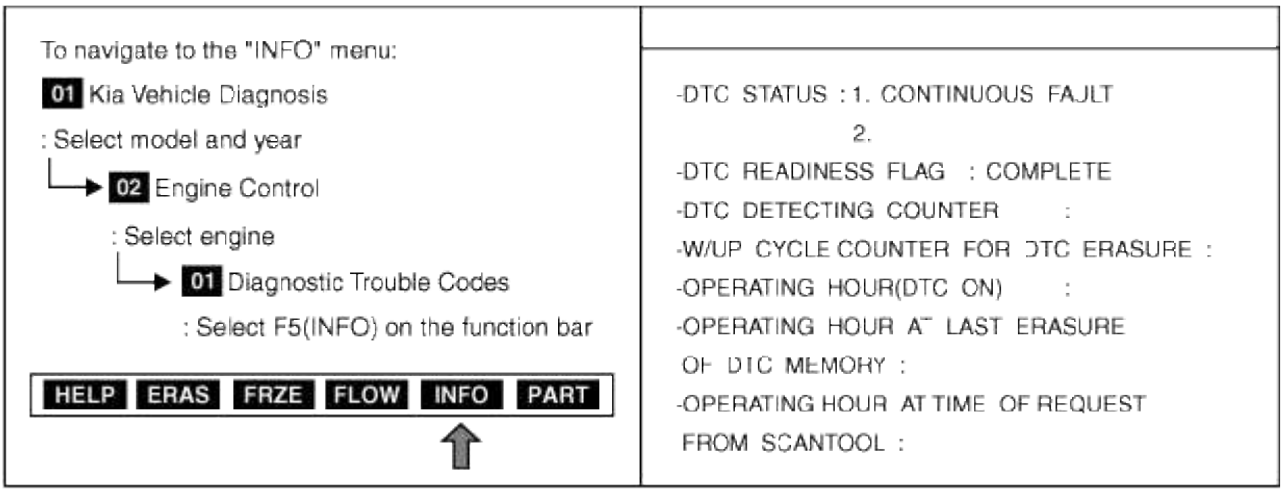
ECM side terminal

MONITOR DTC STATUS

NOTE

If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

1) History (Not Present) fault : DTC occurred but has been cleared.
2) Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL & CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "HO2S Fuse Inspection" procedure.

HO2S FUSE INSPECTION

1. Ignition "OFF" & Engine "OFF".
2. Verify "10A Sensor fuse" is installed and not blown.
3. If OK, go to "Component Inspection" procedure.
   If NG, replace fuse and repair any shorts as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Warm up the engine to normal operating temperature and check that HO2S signal is active.
2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition : Ignition "ON" & Engine "ON" & In Idle("Closed Loop")condition
Specification : Above 0.6V

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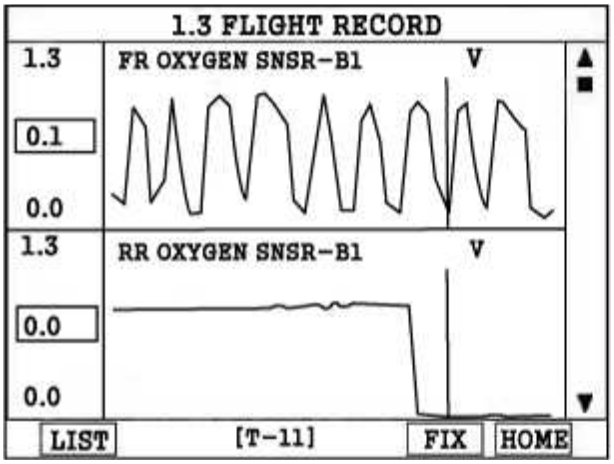

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

3. Is sensor display within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

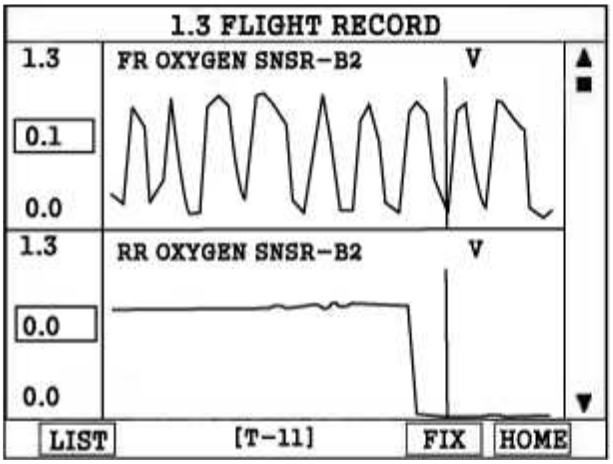

Fig. 1

Fig 1) Normal value with idle after warm up : Above 0.6V
Open in signal circuit : Approx. 0V

Fuel System > Troubleshooting > P0170

COMPONENT LOCATION

GENERAL DESCRIPTION

The Lambda closed-loop control system is included in the engine' s control system. The control system regulates the lambda upstream with the HO2S signal. Rich mixtures generate high concentrations of CO, H2, and HC. Lean mixtures generate the high concentrations of NOx, and free oxygen.

DTC DESCRIPTION

If the lambda controller reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The ECM sets DTC P0170 if no proportional fuel adaptation occurs for a defined time after the lambda controller has reached its minimum or maximum threshold.

DTC DETECTING CONDITION

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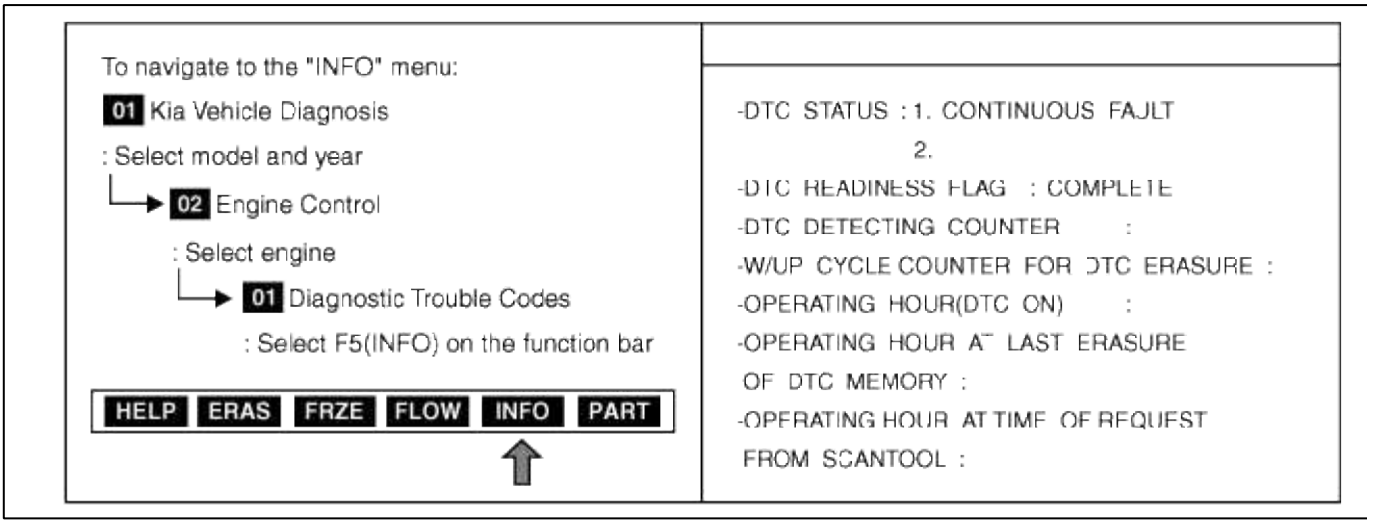
Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of lambda controller	• Air leakage or restriction in intake or exhaust system • Dirty engine oil or oil level too high • Front HO2S or MAFS contamination • Fuel system • EVAP system • Faulty sensor signals
Enable Conditions	• Canister purge solenoid closed • Coolant temperature>60°C(140°F)	
Threshold Value	• Lambda controller = +/-32%	
Diagnostic Time	• 2 min	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to fuel system, injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST

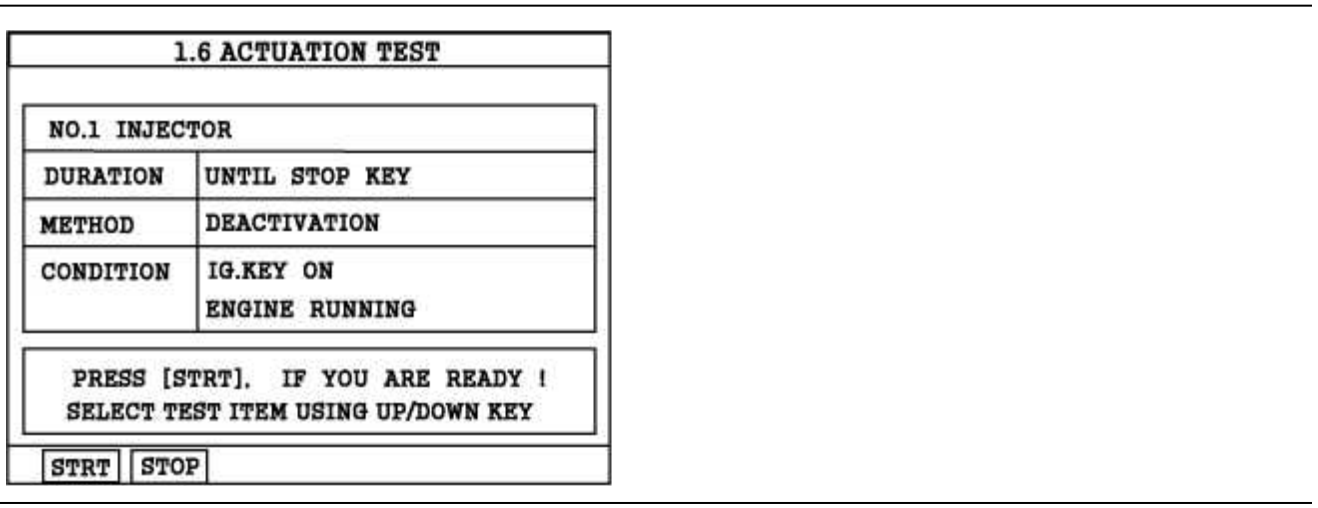
The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



5. Was each cylinder's rpm drop within the same value?

YES

Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

CHECK INTAKE/EXHAUST SYSTEM FOR RESTRICTION OR LEAKAGE

1. Visually/physically inspect the air leakage in intake/exhaust system as following items.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket.
   C. Gasket between intake manifold and cylinder head.
   D. Seals between intake manifold and fuel injectors.
   E. Exhaust system between HO2S and Three way catalyst for air leakage.
2. Visually/physically inspect the restriction in intake/exhaust system as following items.
   A. Air cleaner filter element for excessive dirt or for any foreign objects.
   B. Throttle body inlet for damage or for any foreign objects.
   C. Throttle bore, throttle plate and the IAC passages for chocking and for any foreign objects.
   D. Restricted exhaust system.

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3. Was a problem found in any of the above areas?

YES

Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to " Check the engine oil contamination " procedure.

CHECK THE ENGINE OIL CONTAMINATION

1. Check the engine oil level. The oil level should be between the min. and max. marking. Fill to the correct oil level.
2. Warm up the engine to normal operating temperature
3. Connect Scantool and note the "SHORT TERM FUEL-B1" parameter on the Scantool data list.
4. Disconnect and plug the positive crankcase ventilation.
5. Monitor the "SHORT TERM FUEL-B1" parameter on the Scantool data list once again.

Specification : The value should remain more or less unchanged

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6. Is the displayed value within the specified value?

YES

Go to "Sensor Contamination Inspection" procedure.

NO

The engine oil is diluted with fuel. Chang the oil and oil filter and go to "Verification of Vehicle Repair" procedure.

SENSOR CONTAMINATION INSPECTION

1. Visually/physically inspect following items:
   A. Remove and inspect the HO2S(B1S1) for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal
   B. Check MAFS for contamination, deterioration, or damage.
   C. If contamination is evident on the HO2S or MAFS, replace contaminated sensor and go to next step.

CHECK FOR LEAKAGE IN EVAP SYSTEM

1. Check the EVAP. EM system for possible over.
   (1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (3) Does the valve hold vacuum?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gage.
4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

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5. Is fuel pressure within the specification?

YES

Go to "Fuel Injector Inspection" procedure as below

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.(Inspection Note)

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   A. Test Condition : Ignition "OFF".
   B. Specification : No clogging and restriction.
2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. 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.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0171

COMPONENT LOCATION

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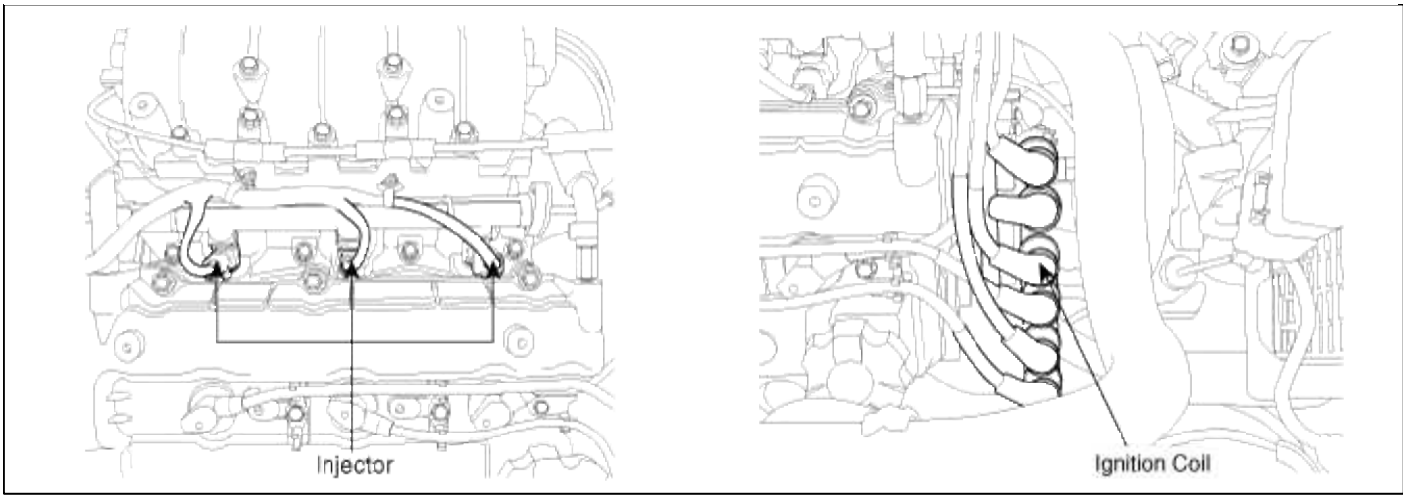


GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

Breaking lambda adaptation and lambda controller limits for a an extended period, which initially may have been caused by failures in the fuel or intake system, will involve emission rise, and therefore shall be diagnosed by fuel system monitoring.If same error code is set in the next driving cycle, the ECM illuminates the MIL. The lambda controller deviations, including adaptive terms, are used for fuel system monitoring. The time counter is increased if lambda controller deviations exceed a specific threshold and the ECM will then set DTC P0171 or P0172 respectively depending on the direction of the deviation. P0171 is set with positive deviation and P0172 is set with negative deviation.

DTC DETECTING CONDITION

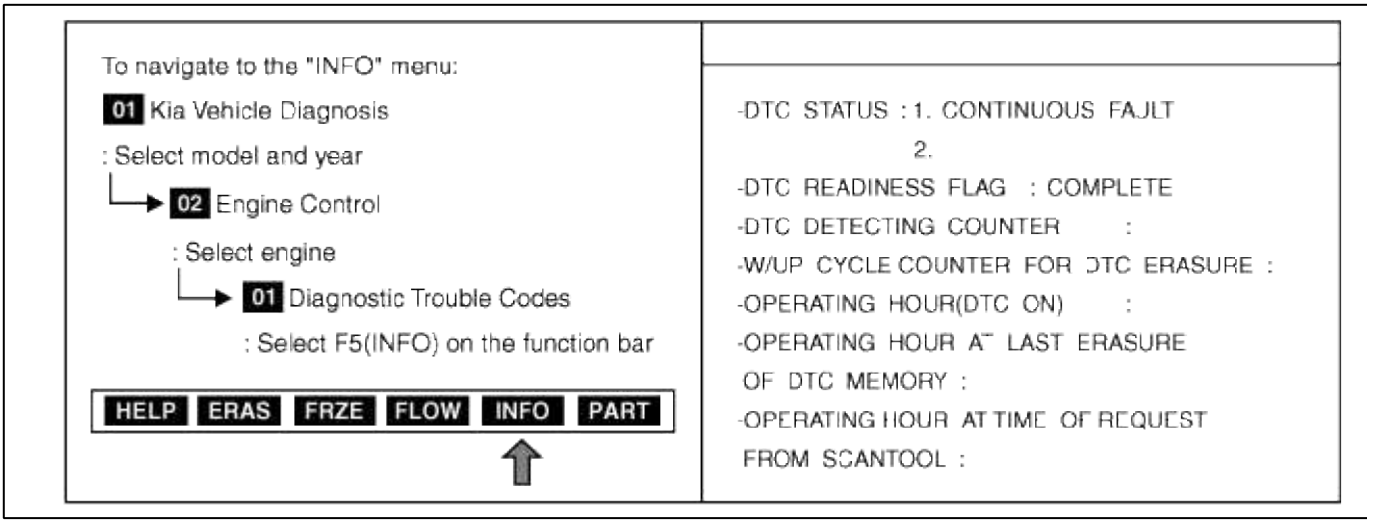
Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of fuel control	• Air leakage • Leaking EVAP system • Low fuel pressure • Faulty sensor signals
Enable Conditions	• Estimated canister loading >-11% • Estimated altitude < 8000ft • Coolant temp.>60°C (140°F) • Fueling adaptation >14.5%	
Threshold Value	• Lambda controller +Trim value > 17%(lean A/F ratio) • Lean A/F ratio: 400sec.	
Diagnostic Time	• 900 sec.	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.

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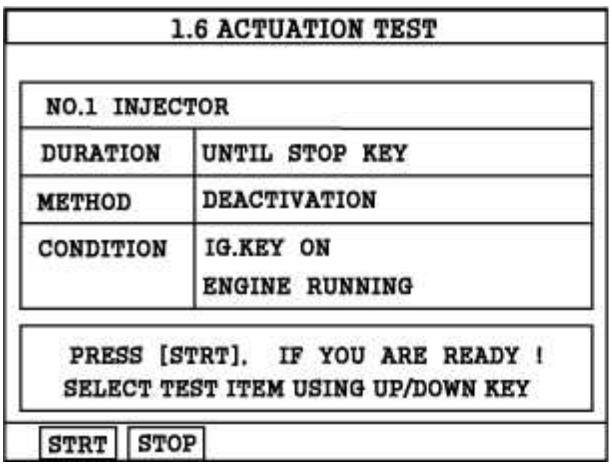
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



5. Was each cylinder's rpm drop within the same value?

YES

Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step.
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Check for air leakage in EVAP. Purge control valve.
   (1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (3) Does the valve hold vacuum?

   YES

   Go to "Fuel System Inspection" procedure.

   NO

   Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gauge.

4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

5. Is fuel pressure within the specification?

YES

Go to "Fuel Injector Inspection" procedure as below

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.(Inspection Note)

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECTOR INSPECTION

1. Check the fuel injector's for clogging or any restrictions.
2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. 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.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   A. Test Condition : Ignition "OFF".
   B. Specification : No clogging and restriction.
2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. 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.

VERIFICATION OF VEHICLE REPAIR

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

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1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

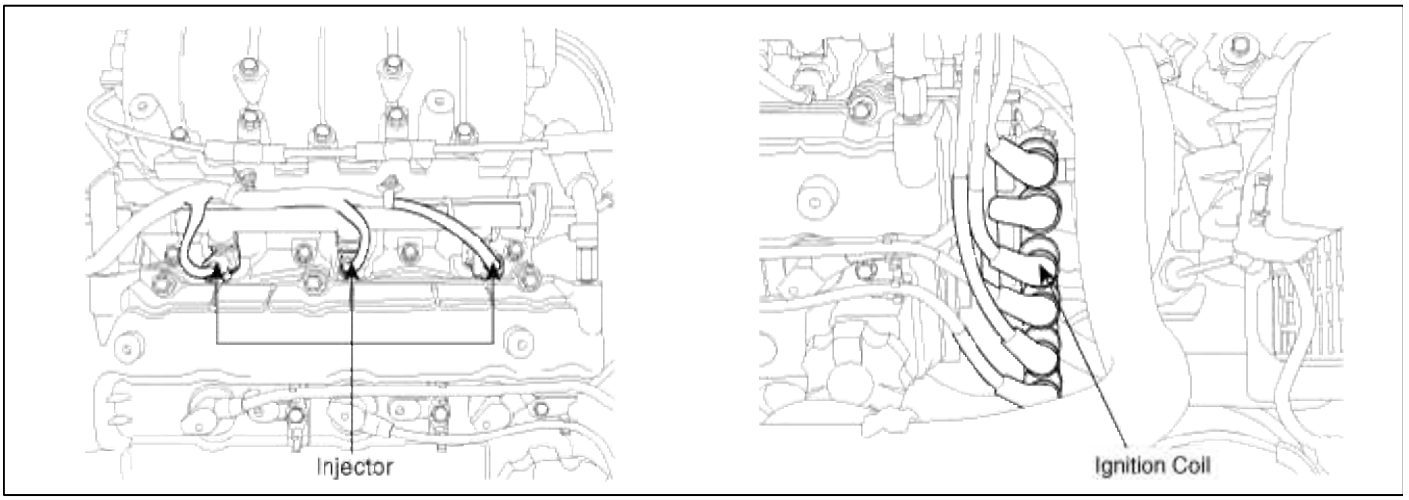
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0172

COMPONENT LOCATION



GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

Breaking lambda adaptation and lambda controller limits for a an extended period, which initially may have been caused by failures in the fuel or intake system, will involve emission rise, and therefore shall be diagnosed by fuel system monitoring.

If same error code is set in the next driving cycle, the ECM illuminates the MIL. The lambda controller deviations, including adaptive terms, are used for fuel system monitoring. The time counter is increased if lambda controller deviations exceed a specific threshold and the ECM will then set DTC P0171 or P0172 respectively depending on the direction of the deviation. P0171 is set with positive deviation and P0172 is set with negative deviation.

DTC DETECTING CONDITION

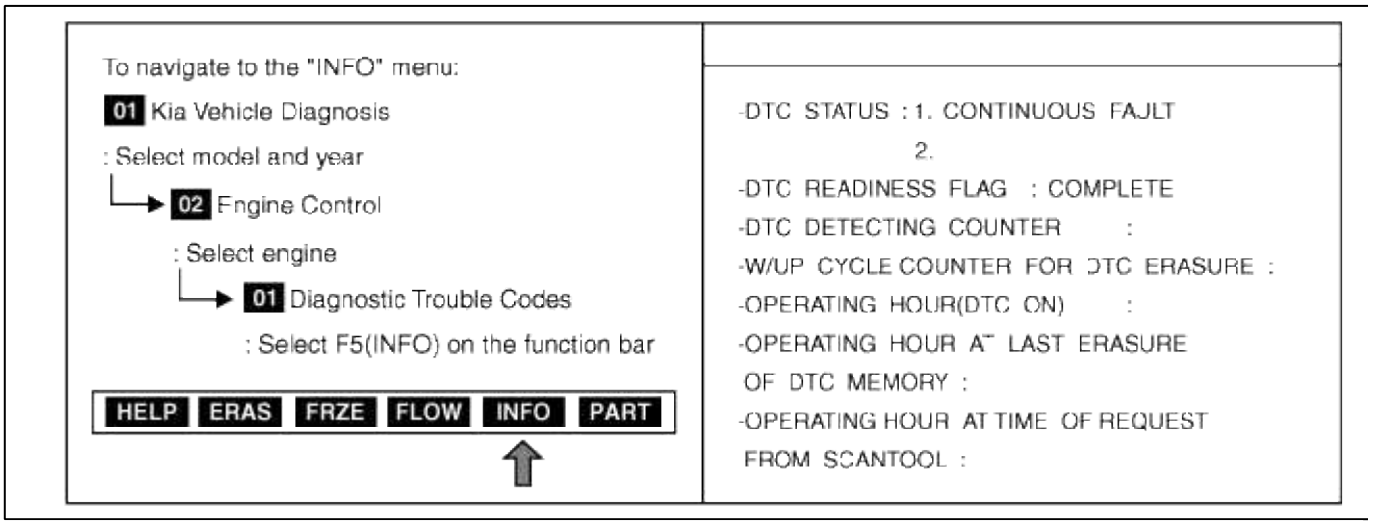
Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of lambda fuel control	• Restricted intake or exhaust system • Dirty engine oil or oil level too high • Front HO2S or MAFS contamination • Over purging of the EVAP system • High fuel pressure • Faulty sensor signals
Enable Conditions	• Estimated canister loading >-11% • Estimated altitude < 8000ft • Coolant temp.>60°C (140°F) • Fueling adaptation >14.5%	
Threshold Value	• Lambda controller + Trim value <-27%(Rich A/F ratio) • Rich A/F ratio: 300sec.	
Diagnostic Time	• 900 sec.	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to fuel system, injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



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5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST

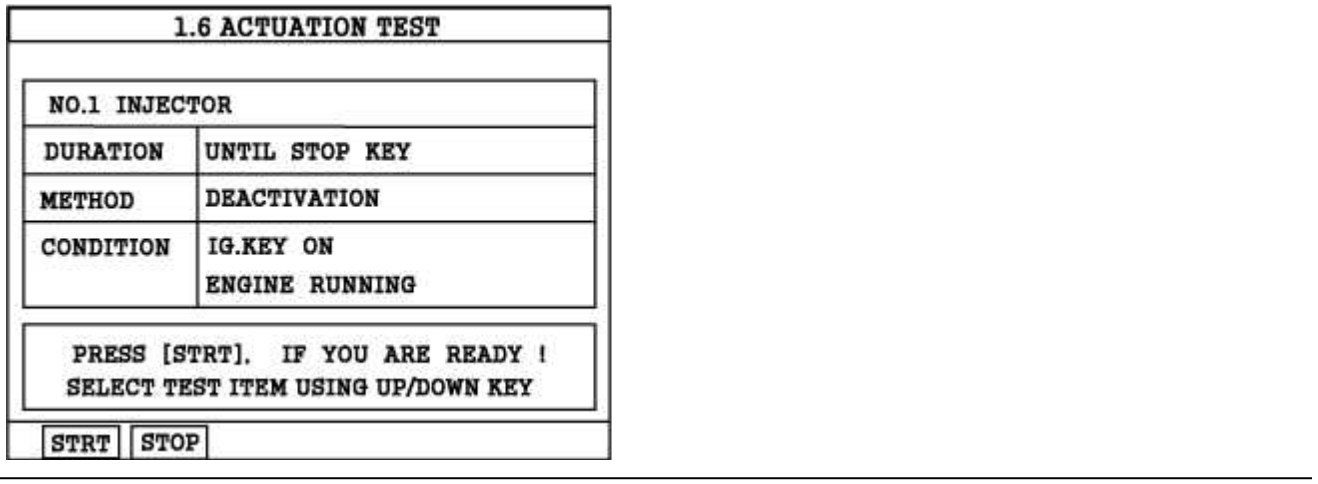
The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



5. Was each cylinder's rpm drop within the same value?

YES

Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

CHECK FOR RESTRICTED INTAKE OR EXHAUST SYSTEM

1. Visually/physically inspect the following items:
   A. Air cleaner filter element for excessive dirt or for any foreign objects
   B. Throttle body inlet for damage or for any foreign objects
   C. Throttle bore, throttle plate and the ICA passages for chocking and for any foreign objects
   D. Restricted exhaust system
2. Was a problem found in any of the above areas?

YES

Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Engine oil contamination Inspection" procedure.

ENGINE OIL CONTAMINATION INSPECTION

1. Check the engine oil level. The oil level should be between the min. and max. marking. Fill to the correct oil level.
2. Warm up the engine to normal operating temperature.
3. Connect Scantool and note the "SHORT TERM FUEL-B1" parameter on the Scantool data list.
4. Disconnect and plug the positive crankcase ventilation
5. Monitor the "SHORT TERM FUEL-B1" parameter on the Scantool data list once again.

Specification : The value should remain more or less unchanged

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6. Is the displayed value within the specification?

YES

Go to "Sensor Contamination Inspection" procedure.

NO

The engine oil is diluted with fuel. Change the oil and oil filter and go to "Verification of Vehicle Repair" procedure.

SENSOR CONTAMINATION INSPECTION

1. Visually/physically inspect following items:
   A. Remove and inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. Check MAFS for contamination, deterioration, or damage.
   C. If contamination is evident on the HO2S or MAFS, replace contaminated sensor and go to next step.

OVER PURGING OF THE EVAP SYSTEM

1. Check the EVAP. EM system for possible over.
   (1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (3) Does the valve hold vacuum?

YES

Go to "Fuel System Inspection" procedure.

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gage.

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4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

5. Is fuel pressure within the specification?

YES

Go to "Fuel Injector Inspection" procedure as below

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.(Inspection Note)

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   A. Test Condition : Ignition "OFF".
   B. Specification : No clogging and restriction.
2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. 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.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   A. Test Condition : Ignition "OFF".
   B. Specification : No clogging and restriction.
2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. 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.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

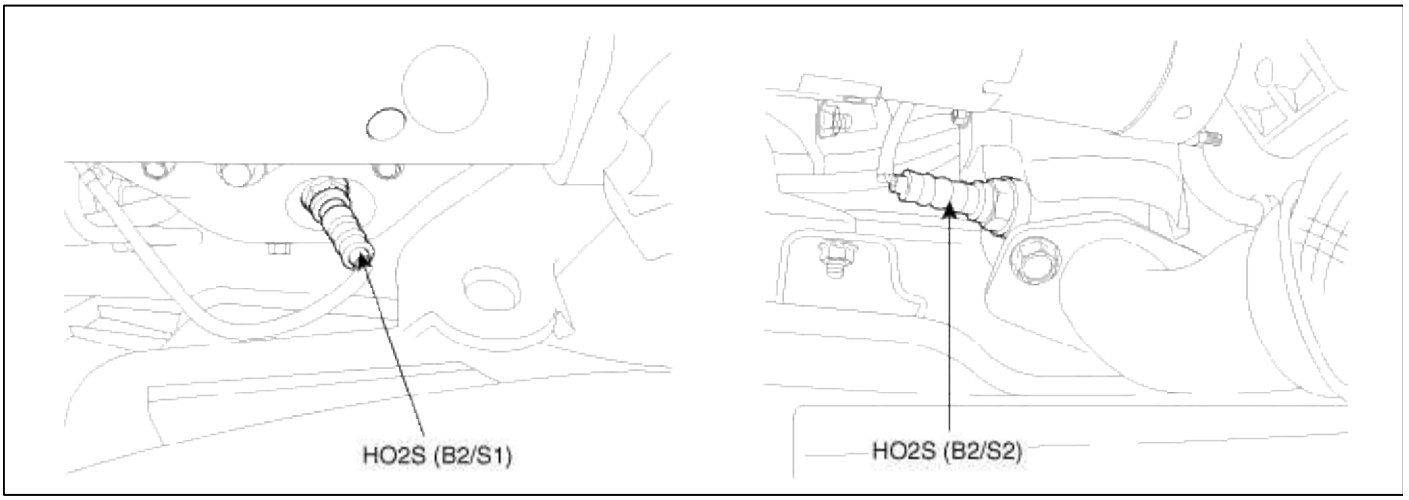
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0173

COMPONENT LOCATION



GENERAL DESCRIPTION

The Lambda closed-loop control system is included in the engine’ s control system. The control system regulates the lambda upstream with the HO2S signal. Rich mixtures generate high concentrations of CO, H2, and HC. Lean mixtures generate the high concentrations of NOx, and free oxygen.

DTC DESCRIPTION

If the lambda controller reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The ECM sets DTC P0173 if no proportional fuel adaptation occurs for a defined time after the lambda controller has reached its minimum or maximum threshold.

DTC DETECTING CONDITION

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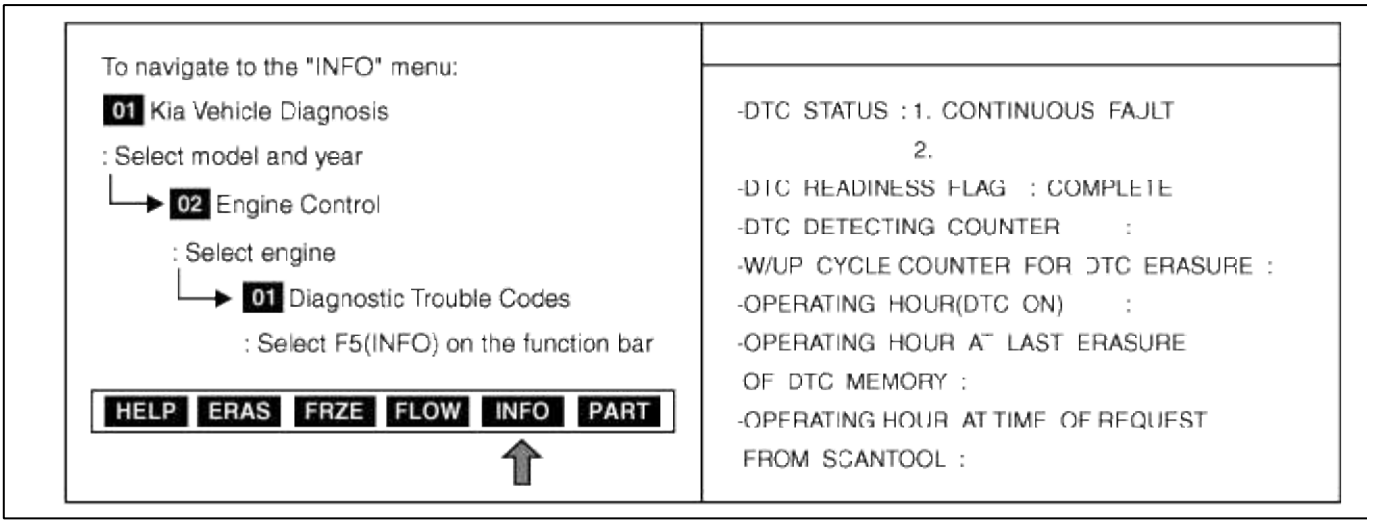
Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of lambda controller	• Air leakage or restriction in intake or exhaust system • Dirty engine oil or oil level too high • Front HO2S or MAFS contamination • Fuel system • EVAP system • Faulty sensor signals
Enable Conditions	• Canister purge solenoid closed • Coolant temperature>60°C(140°F)	
Threshold Value	• Lambda controller = +/-32%	
Diagnostic Time	• 2 min	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to fuel system, injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST

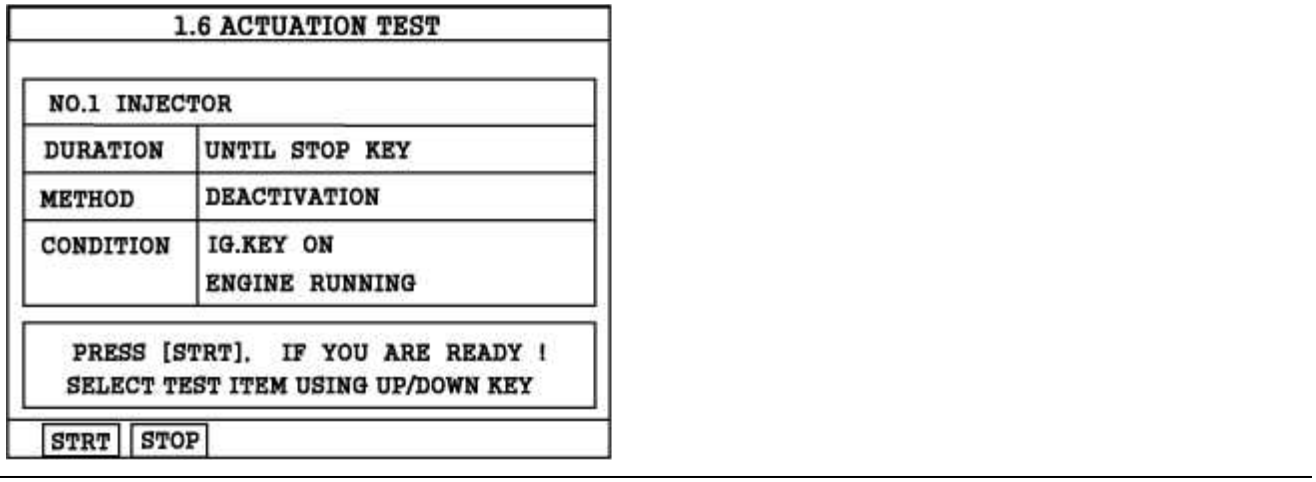
The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



5. Was each cylinder's rpm drop within the same value?

YES

Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

CHECK INTAKE/EXHAUST SYSTEM FOR RESTRICTION OR LEAKAGE

1. Visually/physically inspect the air leakage in intake/exhaust system as following items.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket.
   C. Gasket between intake manifold and cylinder head.
   D. Seals between intake manifold and fuel injectors.
   E. Exhaust system between HO2S and Three way catalyst for air leakage.
2. Visually/physically inspect the restriction in intake/exhaust system as following items.
   A. Air cleaner filter element for excessive dirt or for any foreign objects.
   B. Throttle body inlet for damage or for any foreign objects.
   C. Throttle bore, throttle plate and the IAC passages for chocking and for any foreign objects.
   D. Restricted exhaust system.

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3. Was a problem found in any of the above areas?

YES

Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to " Check the engine oil contamination " procedure.

CHECK THE ENGINE OIL CONTAMINATION

1. Check the engine oil level. The oil level should be between the min. and max. marking. Fill to the correct oil level.
2. Warm up the engine to normal operating temperature
3. Connect Scantool and note the "SHORT TERM FUEL-B2" parameter on the Scantool data list.
4. Disconnect and plug the positive crankcase ventilation.
5. Monitor the "SHORT TERM FUEL-B2" parameter on the Scantool data list once again.

Specification : The value should remain more or less unchanged

---

6. Is the displayed value within the specified value?

YES

Go to "Sensor Contamination Inspection" procedure.

NO

The engine oil is diluted with fuel. Chang the oil and oil filter and go to "Verification of Vehicle Repair" procedure.

SENSOR CONTAMINATION INSPECTION

1. Visually/physically inspect following items:
   A. Remove and inspect the HO2S(B1S1) for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. Check MAFS for contamination, deterioration, or damage.
   C. If contamination is evident on the HO2S or MAFS, replace contaminated sensor and go to next step.

CHECK FOR LEAKAGE IN EVAP SYSTEM

1. Check the EVAP. EM system for possible over.
   (1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (3) Does the valve hold vacuum?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gage.
4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

5. Is fuel pressure within the specification?

YES

Go to "Fuel Injector Inspection" procedure as below

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.(Inspection Note)

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
   A. Test Condition : Ignition "OFF".
   B. Specification : No clogging and restriction.
2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. 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.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

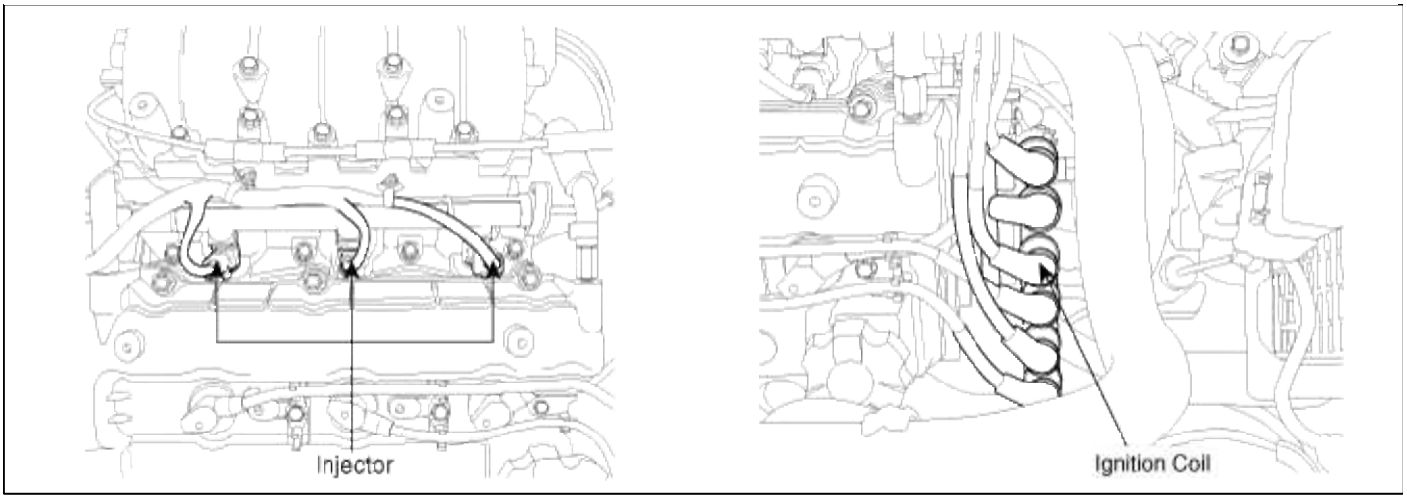
NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0174

COMPONENT LOCATION

tomsn048@gmail.com



GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

Breaking lambda adaptation and lambda controller limits for a an extended period, which initially may have been caused by failures in the fuel or intake system, will involve emission rise, and therefore shall be diagnosed by fuel system monitoring.If same error code is set in the next driving cycle, the ECM illuminates the MIL. The lambda controller deviations, including adaptive terms, are used for fuel system monitoring. The time counter is increased if lambda controller deviations exceed a specific threshold and the ECM will then set DTC P0174 or P0175 respectively depending on the direction of the deviation. P0174 is set with positive deviation and P0172 is set with negative deviation.

DTC DETECTING CONDITION

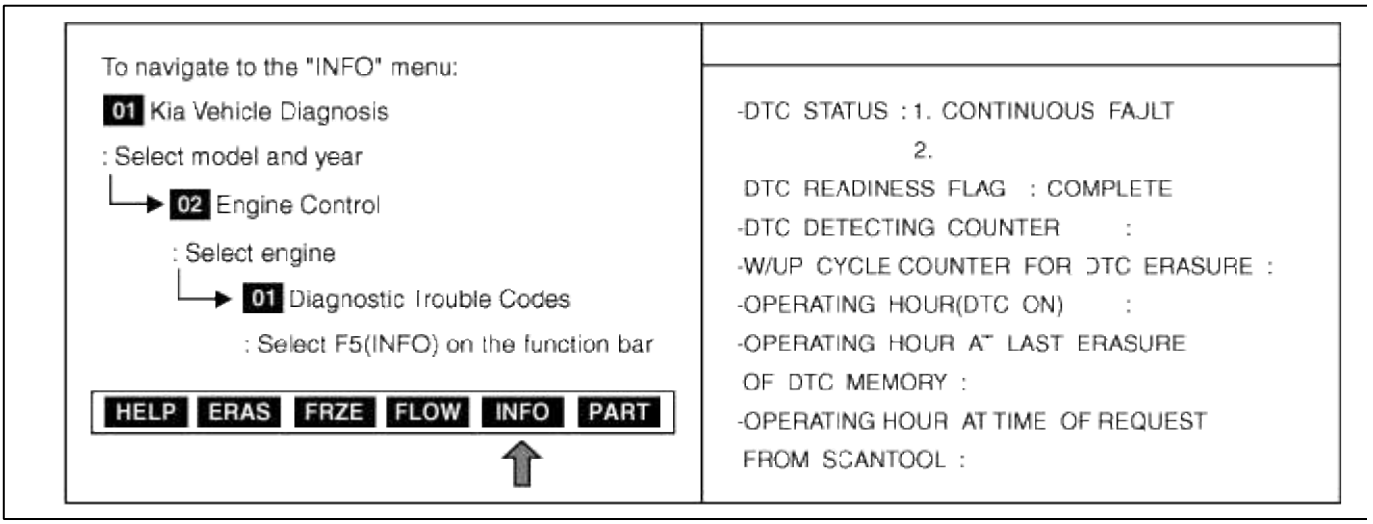
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring deviation of fuel centrol	• Air leakage • Leaking EVAP system • Low fuel pressure • Faulty sensor signals
Enable Conditions	• Estimated canister loading >-11% • Estimated altitude < 8000ft • Coolant temp.>60°C (140°F) • Fueling adaptation >14.5%	
Threshold Value	• Lambda controller + Trim value > 17% (lean A/F ratio) • Lean A/F ratio : 400 sec	
Diagnostic Time	• 900 sec	
Fail Safe	• EVAP. Emission control function is controlled in minimum operation mode	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.

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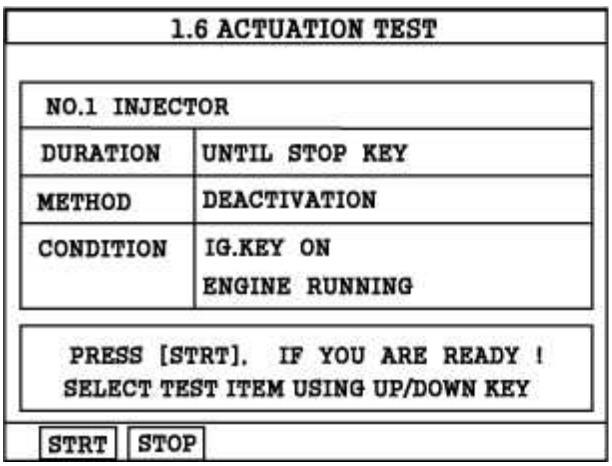
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



5. Was each cylinder's rpm drop within the same value?

YES

Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step.
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Check for air leakage in EVAP. Purge control valve.
   (1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (3) Does the valve hold vacuum?

   YES

   Go to "Fuel System Inspection" procedure.

   NO

   Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gauge.

4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

5. Is fuel pressure within the specification?

YES

Go to "Fuel Injector Inspection" procedure as below

NO

Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator.
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.
2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. 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.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0175

COMPONENT LOCATION

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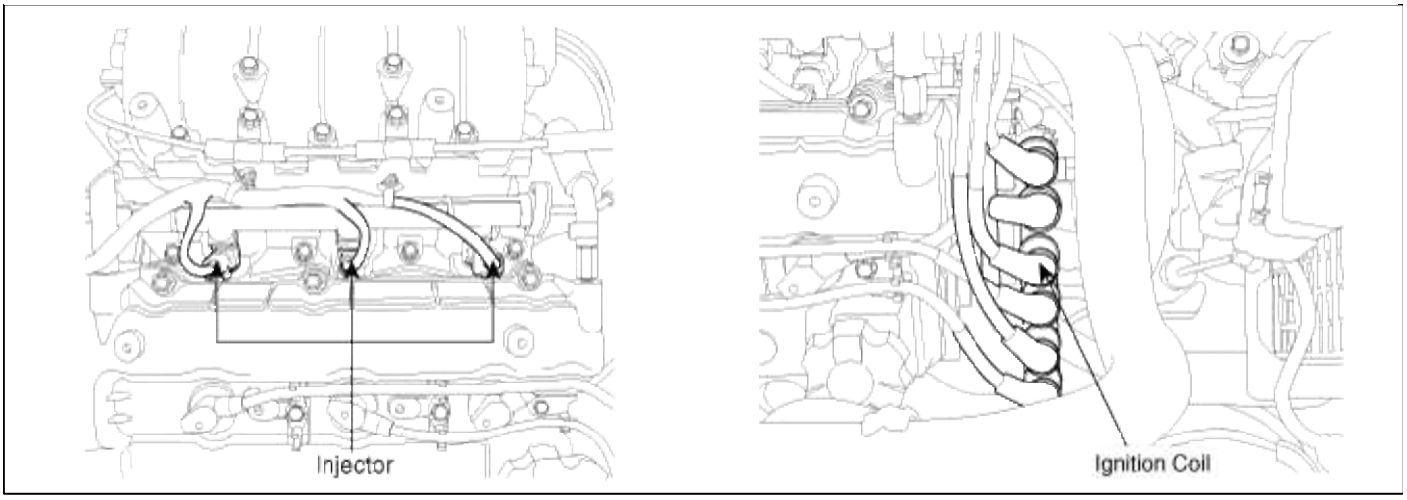


GENERAL DESCRIPTION

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION

Breaking lambda adaptation and lambda controller limits for a an extended period, which initially may have been caused by failures in the fuel or intake system, will involve emission rise, and therefore shall be diagnosed by fuel system monitoring.If same error code is set in the next driving cycle, the ECM illuminates the MIL. The lambda controller deviations, including adaptive terms, are used for fuel system monitoring. The time counter is increased if lambda controller deviations exceed a specific threshold and the ECM will then set DTC P0174 or P0175 respectively depending on the direction of the deviation. P0174 is set with positive deviation and P0175 is set with negative deviation.

DTC DETECTING CONDITION

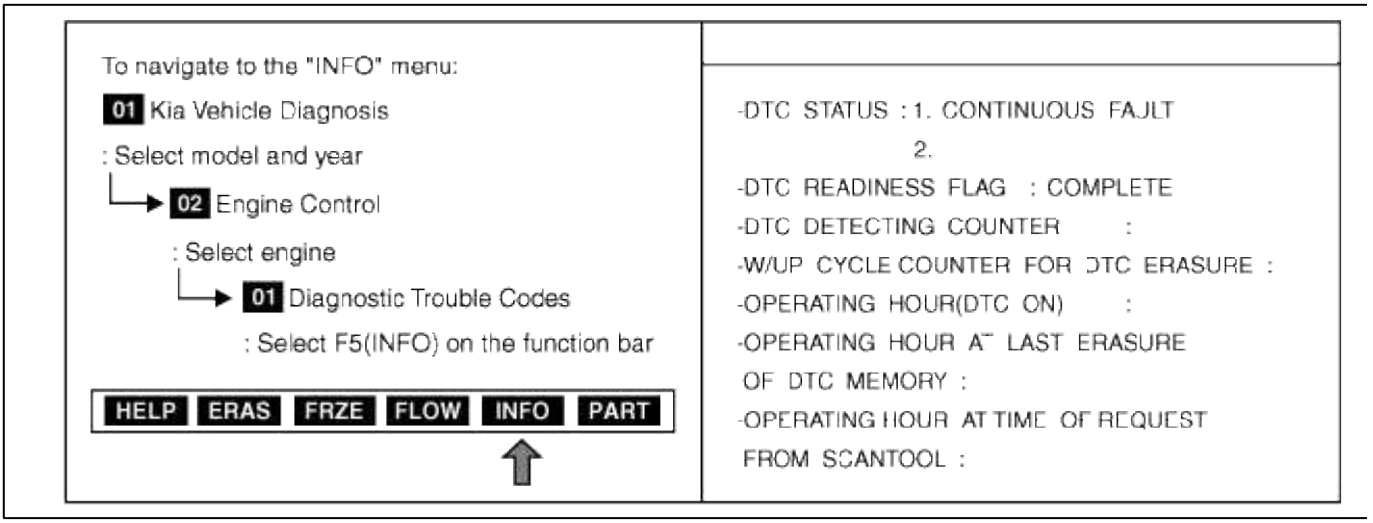
Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of fuel control	• Restricted intake or exhaust system • Dirty engine oil or oil level too high • Front HO2S or MAFS contamination • Over purging of the EVAP system • High fuel pressure • Faulty sensor signals
Enable Conditions	• Estimated canister loading >-11% • Estimated altitude < 8000ft • Coolant temp.>60°C (140°F) • Fueling adaptation >14.5%	
Threshold Value	• Lambda controller +Trim value > -27%(Rich A/F ratio) • Rich A/F ratio: 300sec.	
Diagnostic Time	• 900 sec.	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to fuel system, injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Monitor Actuation Test" procedure.

MONITOR ACTUATION TEST

The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible.

CAUTION

Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

1. Warm up the engine to normal operating temperature and let it idle.
2. Using a Scan Tool and select "INJECTOR #1" parameter on the Actuation Test mode shown in the figure.
3. Monitor engine rpm and shut off the injector #1 by pressing "STRT(F1)" key.

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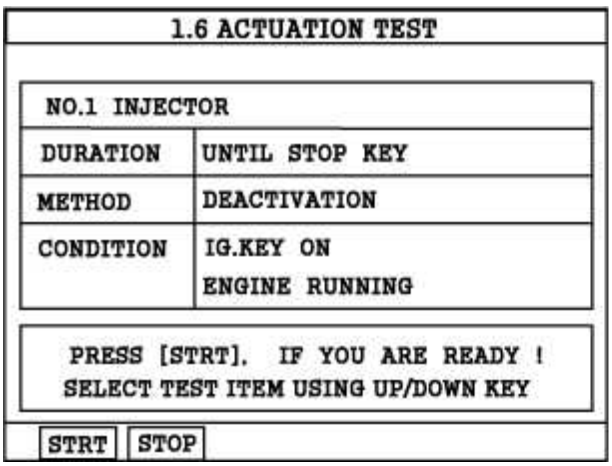
4. Repeat procedure on all injectors and record the engine rpm.

Specification : All cylinders should show an even RPM drop.



5. Was each cylinder's rpm drop within the same value?

YES

Go to " Check intake/exhaust system for restriction or leakage " procedure.

NO

Cylinders with the least amount of RPM drop are not contributing their share of power. Go to "Fuel Injector Inspection" procedure and check the suspect cylindersNote) If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

CHECK FOR RESTRICTED INTAKE OR EXHAUST SYSTEM

1. Visually/physically inspect the following items:
   A. Air cleaner filter element for excessive dirt or for any foreign objects
   B. Throttle body inlet for damage or for any foreign objects
   C. Throttle bore, throttle plate and the ICA passages for chocking and for any foreign objects
   D. Restricted exhaust system
2. Was a problem found in any of the above areas?

YES

Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Engine oil contamination Inspection" procedure.

Engine oil contamination Inspection

1. Check the engine oil level. The oil level should be between the min. and max. marking. Fill to the correct oil level.
2. Warm up the engine to normal operating temperature.
3. Connect Scantool and note the "LONG FUEL-PART B2" parameter on the Scantool data list.
4. Disconnect and plug the positive crankcase ventilation.
5. Monitor the "LONG FUEL-PART B2" parameter on the Scantool data list once again.

Specification : The value should remain more or less unchanged

6. Is the displayed value within the specified value?

YES

Go to "Sensor Contamination Inspection" procedure

NO

The engine oil is diluted with fuel. Chang the oil and oil filter and go to "Verification of Vehicle Repair" procedure.

SENSOR CONTAMINATION INSPECTION

1. Visually/physically inspect following items:
   A. Remove and inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating and this will result in a but false voltage signal.
   B. Check MAFS for contamination, deterioration, or damage.
   C. If contamination is evident on the HO2S or MAFS, replace contaminated sensor and go to next step.

OVER PURGING OF THE EVAP SYSTEM

1. Check the EVAP. EM system for possible over.
   (1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (3) Does the valve hold vacuum?

   YES

   Go to "Fuel System Inspection" procedure.

   NO

   Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. If any fuel is present in the vacuum hose, replace the fuel pressure regulator. Go to next step.
3. Install a fuel pressure gage.
4. Start engine and let it idle. With the vacuum hose from the fuel pressure regulator disconnected, inspect fuel pressure.

   Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

5. Is fuel pressure within the specification?

   YES

   Go to "Fuel Injector Inspection" procedure as below.

   NO

   Repair as necessary refer to inspection note as below and go to "Verification of Vehicle Repair" procedure.

> **NOTE**
>
> 1) Check if fuel line pressure decreases when accelerating quickly
>   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
> 2) If pressure quickly increases, check pressure regulator.
>   - If pressure quickly increases, check pressure regulator
>   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
> 3) If fuel pressure is higher than specification : Is fuel line clogged?
>   - If it is not, replace pressure regulator.
>   - If it is, replace it.

FUEL INJECTOR INSPECTION

1. Check the fuel injectors for clogging or any restrictions.

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2. Is the fuel injector OK?

YES

Visually/physically inspect the engine mechanical problem. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check injector for contamination, deterioration, or damage. 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.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

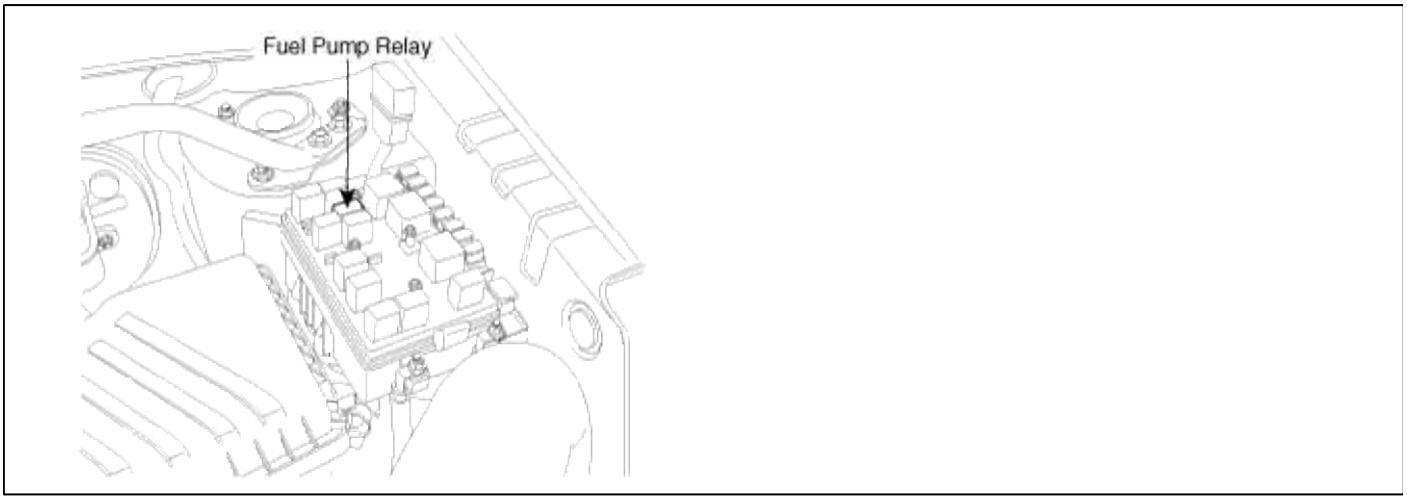
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0230

COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM 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 ECM monitors the control circuit between the fuel pump relay and the ECM. When the ignition switch is turned ON, the ECM energizes the fuel pump relay, which sends power to the fuel pump.

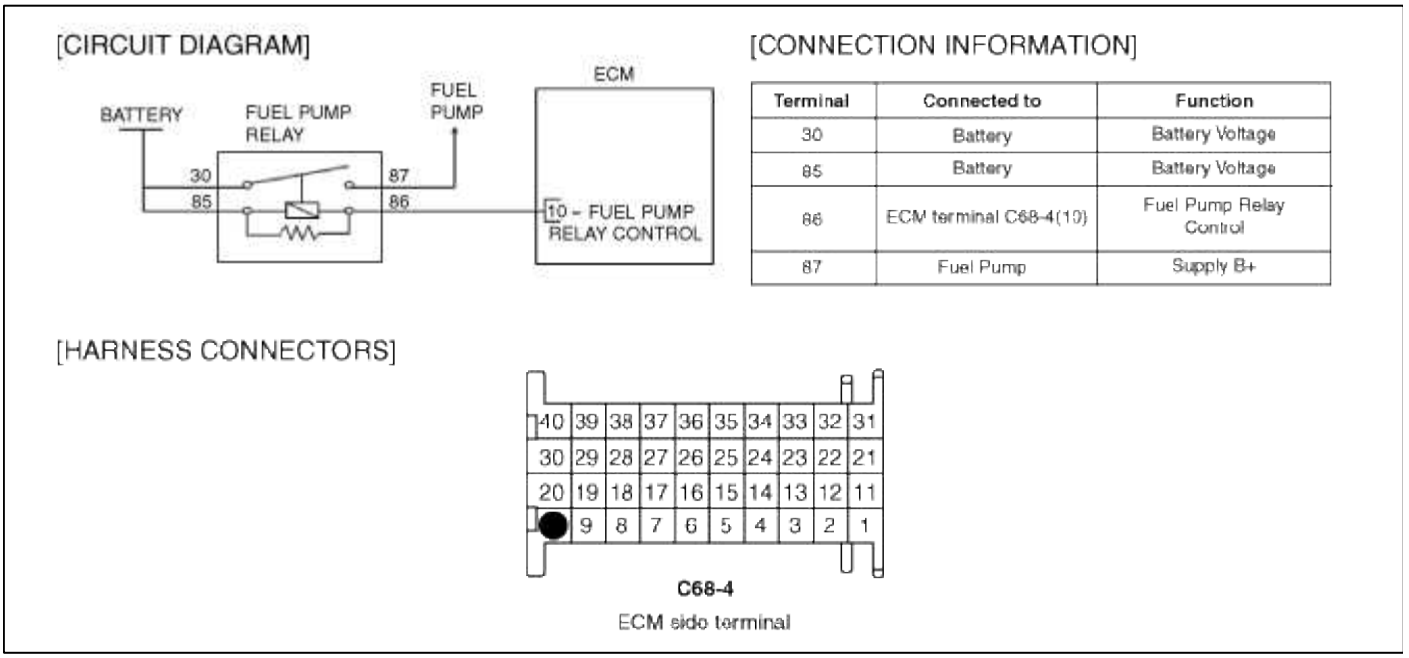
DTC DESCRIPTION

ECM sets DTC P0230 if the ECM detects the fuel pump relay control circuit is open, shorted to ground or battery.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check open or short to ground/battery in control circuit	• Open or short in harness • Contact resistance in connectors • Faulty relay
Enable Conditions	• Battery voltage>10V	
Threshold Value	• Short to ground, line break or short to battery	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• -	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Remove the fuel pump relay.
2. Ignition "ON" & Engine "OFF".
3. Measure the voltage between terminal 30 of the fuel pump relay harness connector and chassis ground.

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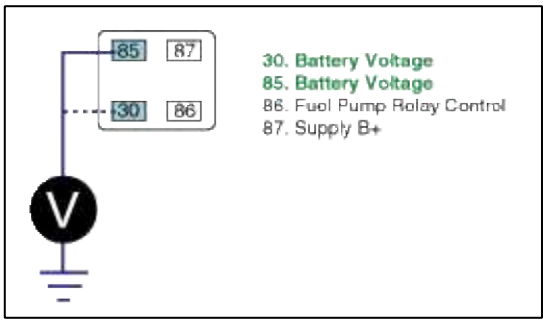
4. Measure the voltage between terminal 85 of the fuel pump relay harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

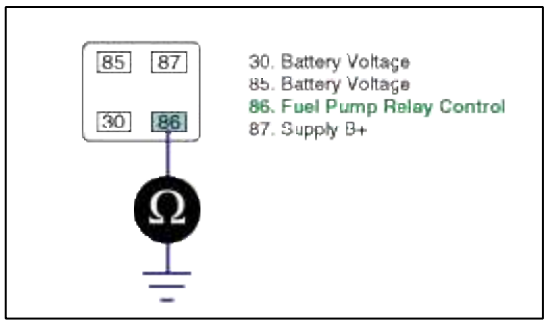
NO

Check for an open or short to ground in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF" & Relay connector : Disconnected.
   (2) Measure resistance between terminal 86 of the relay harness connector and chassis ground.

Specification : Infinite



   (3) Is resistance within the specification?

YES

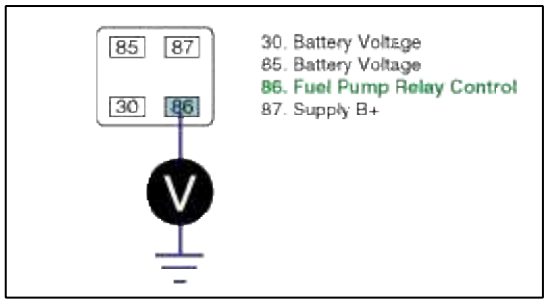
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" and Engine "OFF".
   (3) Measure voltage between terminal 86 of the relay harness connector and chassis ground.

   Specification : Approx 0V



   (4) Is voltage within the specification?

   YES

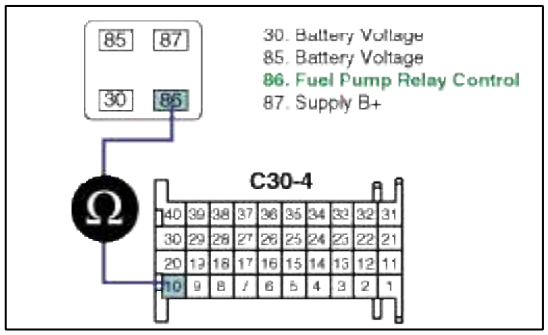
   Go to next step as below

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for open in control harness.
   (1) Measure resistance between terminals 86 of the relay harness connector and 10 of the ECM harness connector.

   Specification : Approx 0Ω



   (2) Is resistance within the specification?

   YES

   Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove the fuel pump relay.
3. Apply 12V and a ground to 85 and 86 terminals of the fuel pump relay. (Component side)
4. Check if the fuel pump relay works well when it is energized. (If the fuel pump relay works normally, a clicking sound can be heard.)

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5. Does the fuel pump relay operate normally?

YES

Go to next step as below.

NO

Check relay for contamination, deterioration, or damage. Substitute with a known-good relay and check for proper operation. If the problem is corrected, replace relay 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

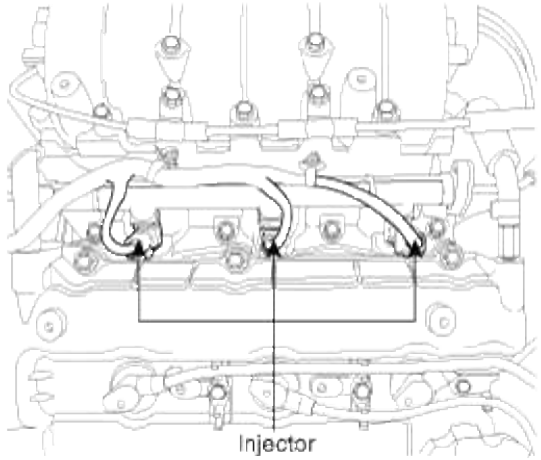
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0261

COMPONENT LOCATION



GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

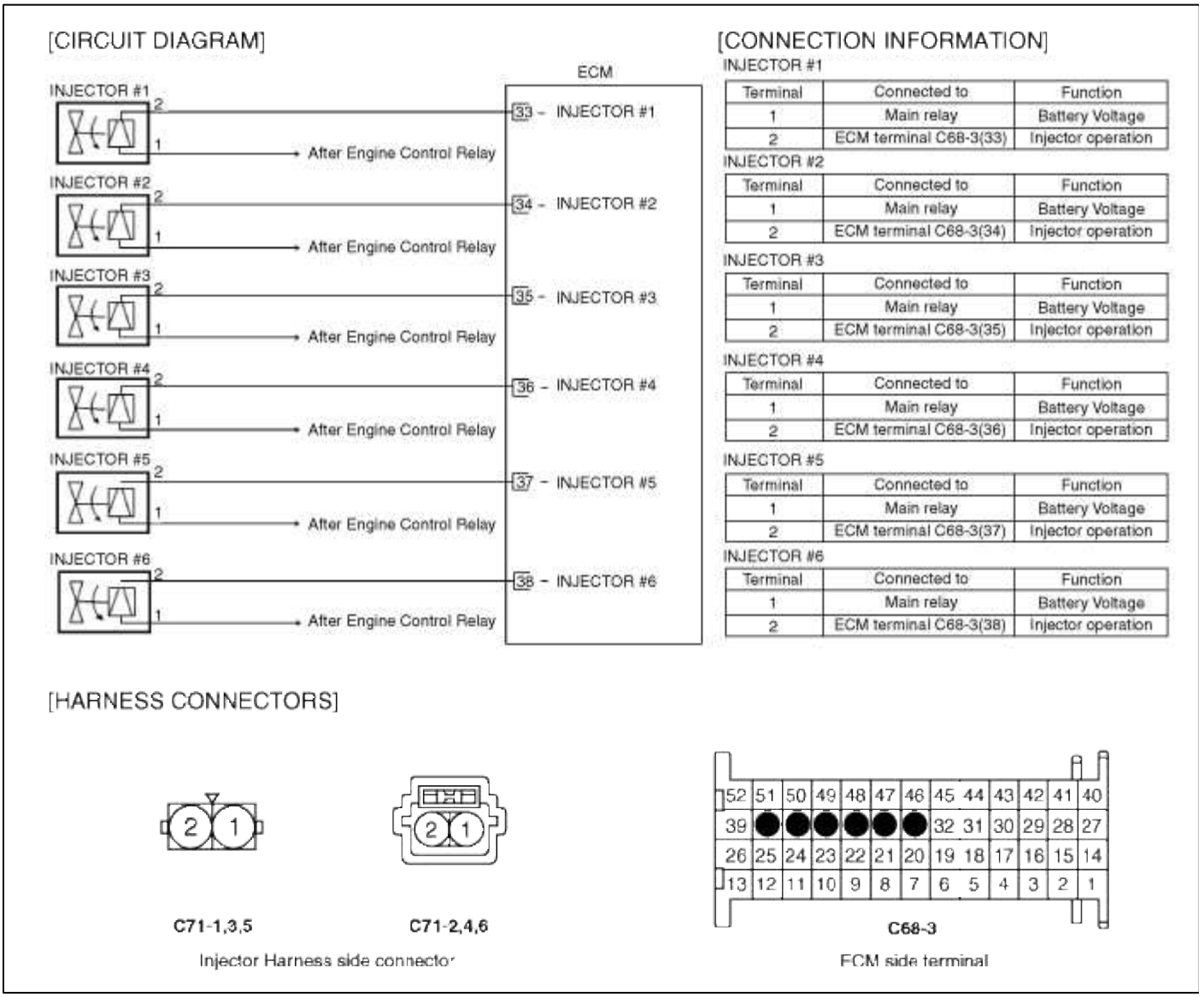
DTC DESCRIPTION

ECM sets DTC P0261 if the ECM detects that injector (Cylinder #1) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10< Battery voltage (V)<16 • Engine speed (rpm)>30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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.

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3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

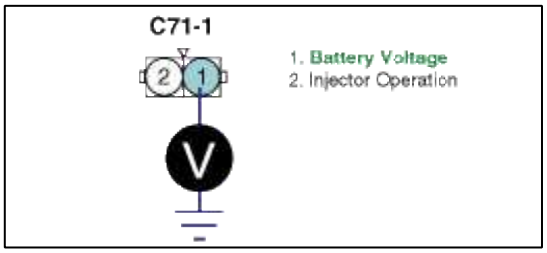
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

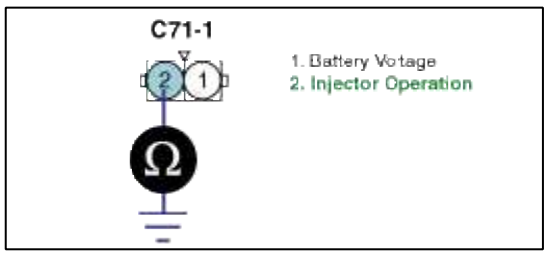
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF" & Relay connector : Disconnected.
   (2) Measure resistance between terminal 2 of the relay harness connector and chassis ground.

Specification : Infinite



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

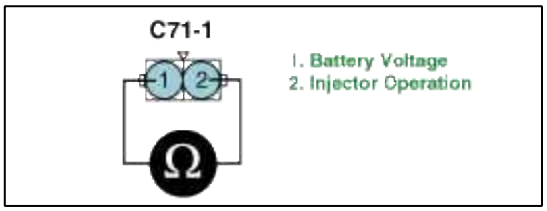
Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector

3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

CAUTION

Be careful not to damage wires or components during the test.
Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°F)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0262

COMPONENT LOCATION

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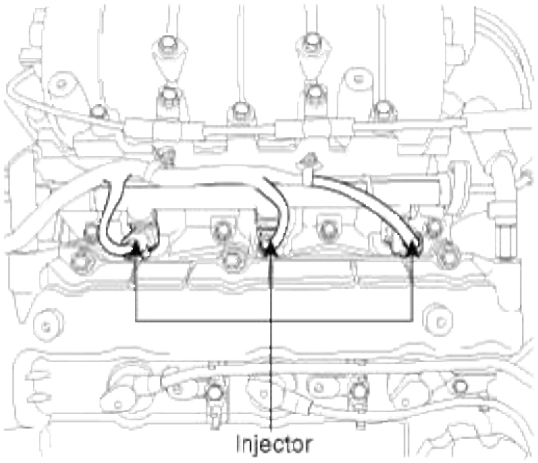


GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION

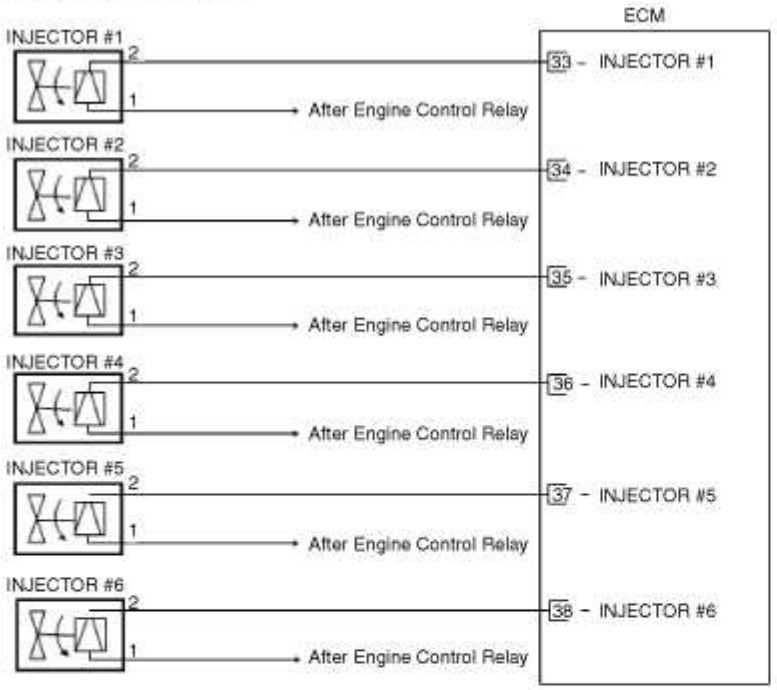
ECM sets DTC P0262 if the ECM detects that injector (Cylinder #1) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10< Battery voltage (V)<16 • Engine speed (rpm)>30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(33)	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(34)	Injector operation

INJECTOR #3

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(35)	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(36)	Injector operation

INJECTOR #5

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(37)	Injector operation

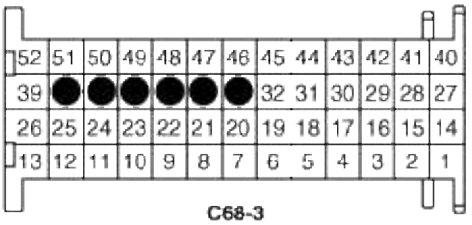
INJECTOR #6

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(38)	Injector operation

[HARNESS CONNECTORS]

C71-1,3,5 C71-2,4,6

Injector Harness side connector



C68-3

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".

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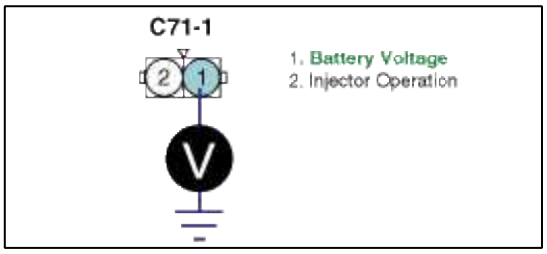
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

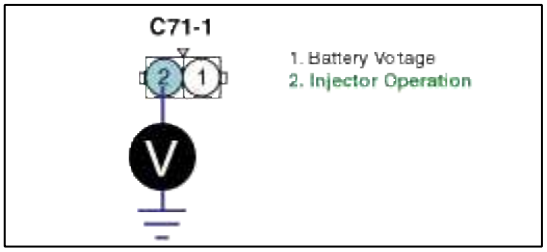
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to battery in control circuit.
   (1) Ignition "OFF"
   (2) Disconnect injector and ECM connectors.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

   Specification : Approx. 0V



   (5) Is voltage within the specification?

   YES

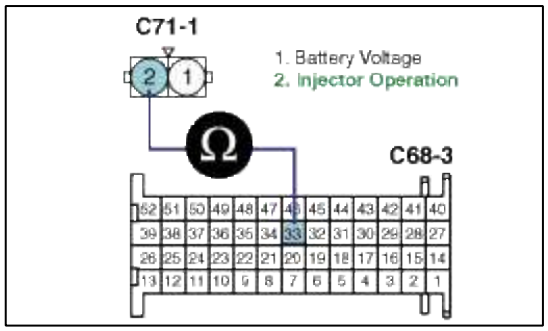
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the injector harness connector and 33 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

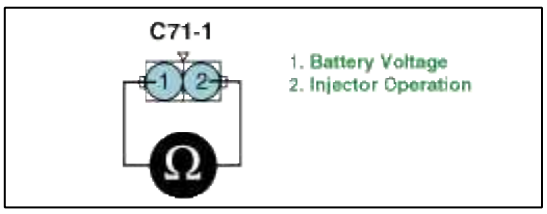
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

   Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

   YES

   Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

   CAUTION

   Be careful not to damage wires or components during the test.
   Repair as necessary and go to next step as below.

   NO

   Check Injector for contamination, deterioration, or damage. 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

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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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

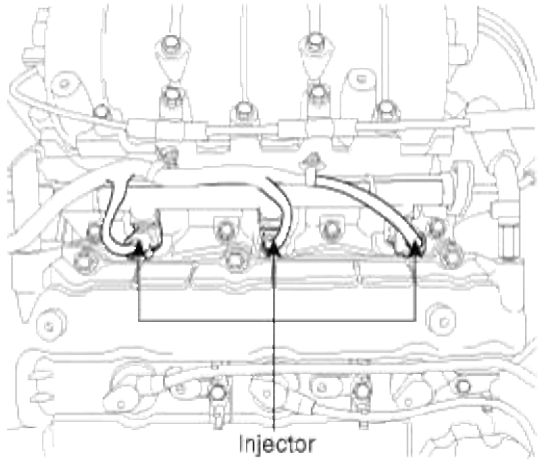
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°F)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0264

COMPONENT LOCATION



GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

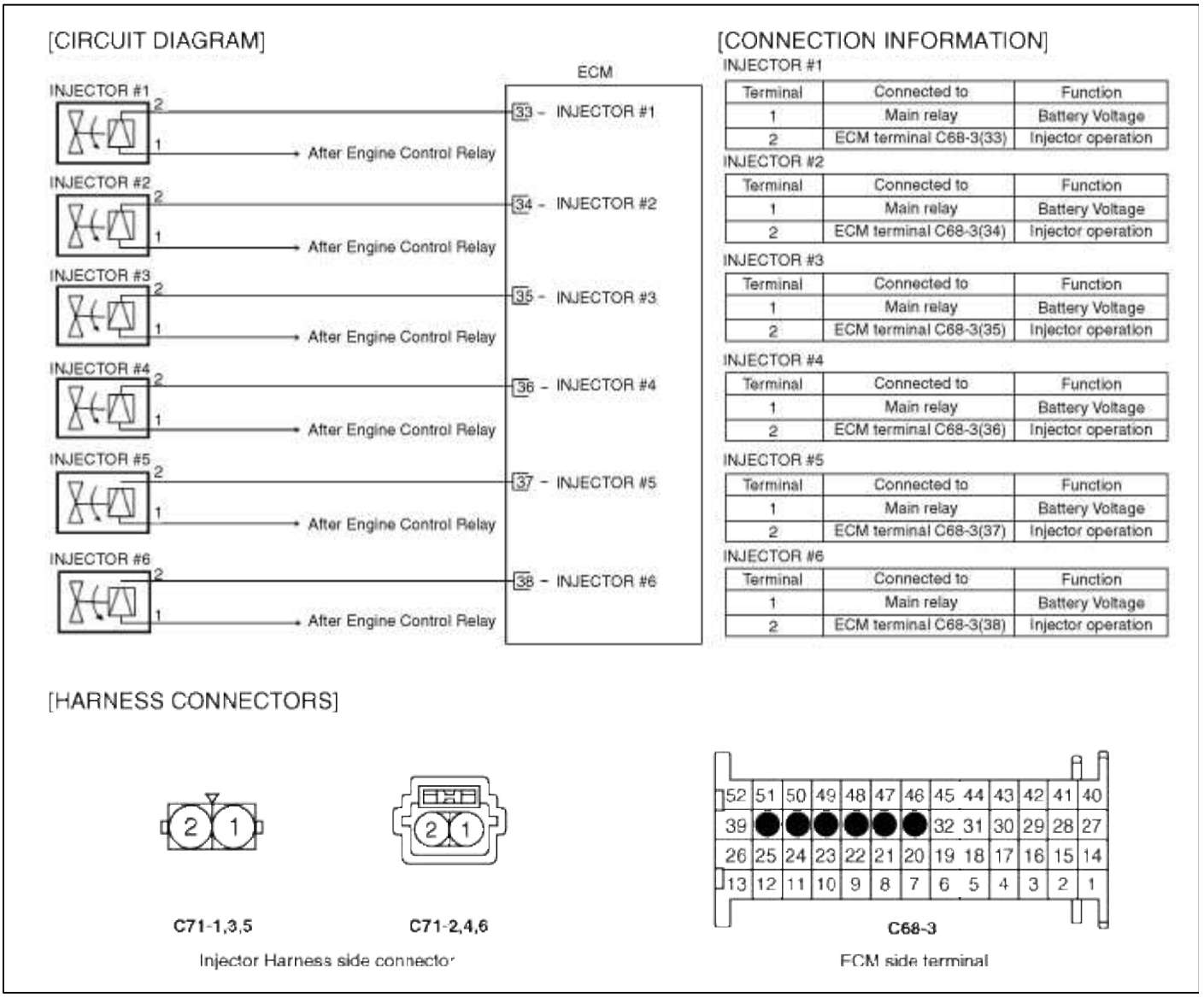
DTC DESCRIPTION

ECM sets DTC P0264 if the ECM detects that injector (Cylinder #2) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10< Battery voltage (V)<16 • Engine speed (rpm)>30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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.

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3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

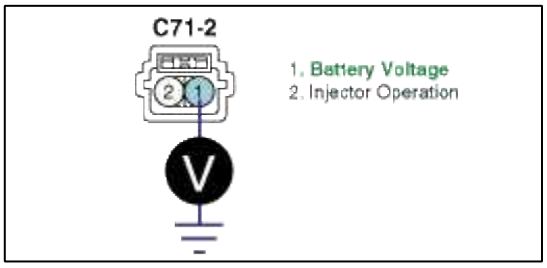
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

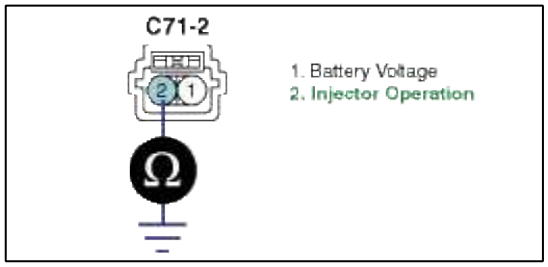
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 2 of the injector harness connector and chassis ground.

Specification : Infinite



   (3) Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

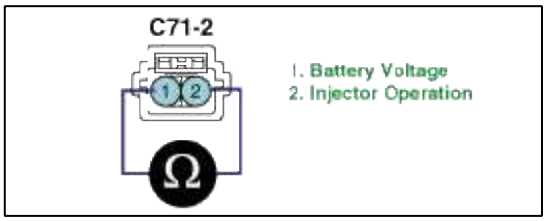
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".

2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

> **CAUTION**
>
> Be careful not to damage wires or components during the test.
> Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°F)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0265

COMPONENT LOCATION

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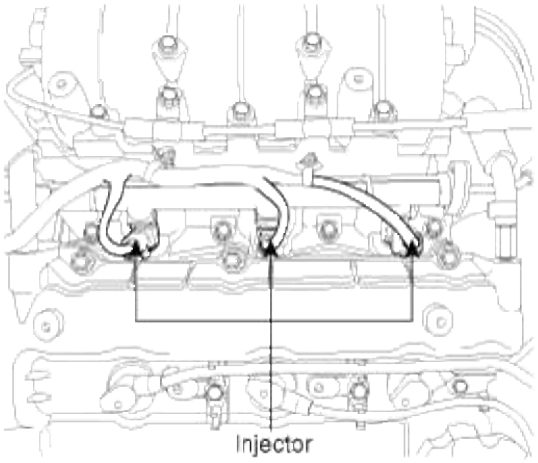


GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION

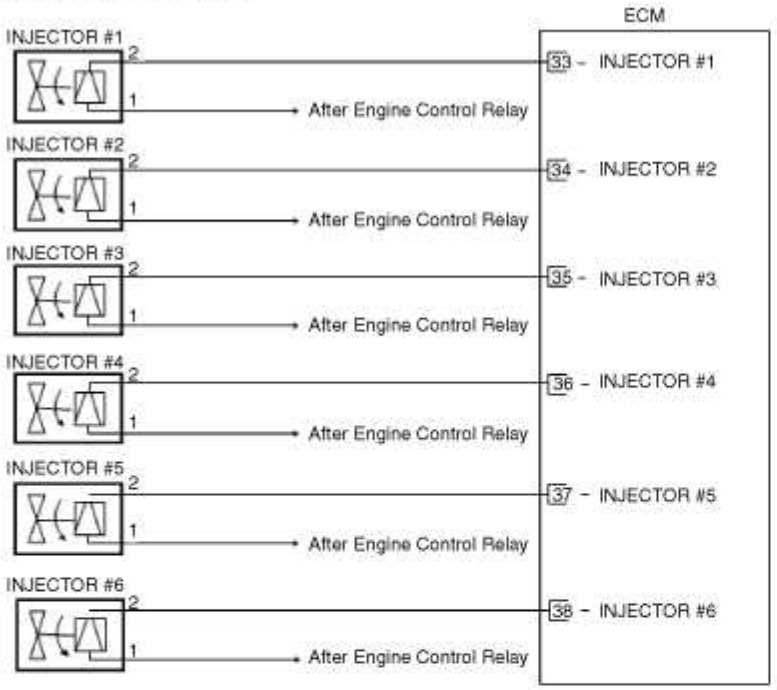
ECM sets DTC P0265 if the ECM detects that injector (Cylinder #2) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤ Battery voltage (V)≤16 • Engine speed (rpm)>30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(33)	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(34)	Injector operation

INJECTOR #3

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(35)	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(36)	Injector operation

INJECTOR #5

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(37)	Injector operation

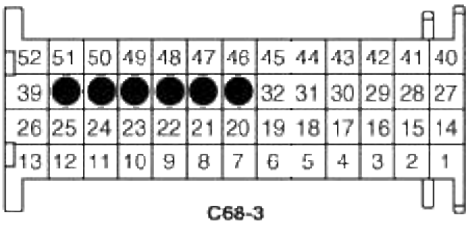
INJECTOR #6

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(38)	Injector operation

[HARNESS CONNECTORS]

C71-1,3,5 C71-2,4,6

Injector Harness side connector



C68-3

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".

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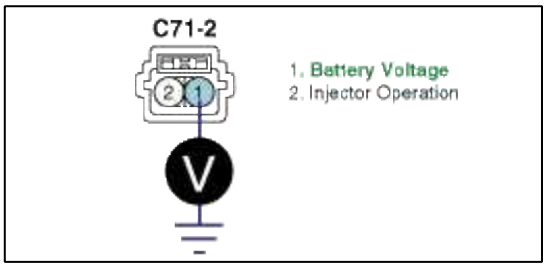
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

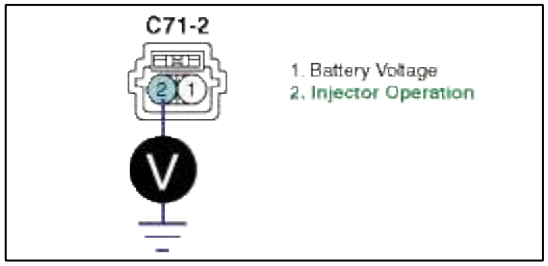
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to battery in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect injector and ECM connectors.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : Approx. 0V



   (5) Is voltage within the specification?

YES

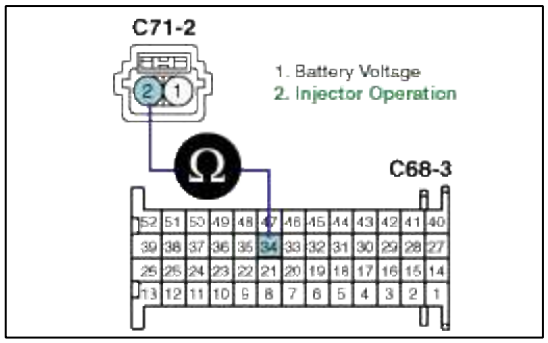
Go to next step as below

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the injector harness connector and 34 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

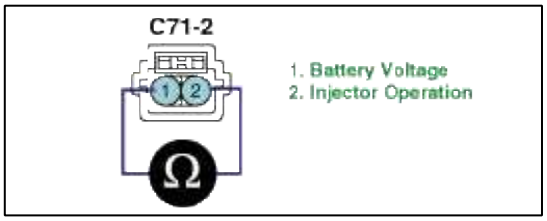
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

> **CAUTION**
>
> Be careful not to damage wires or components during the test.
> Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

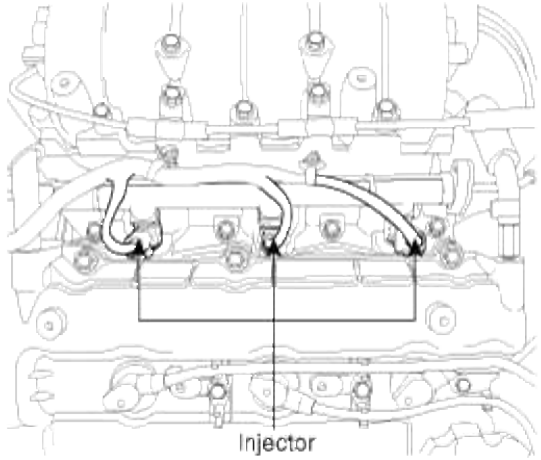
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°F)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0267

COMPONENT LOCATION



GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

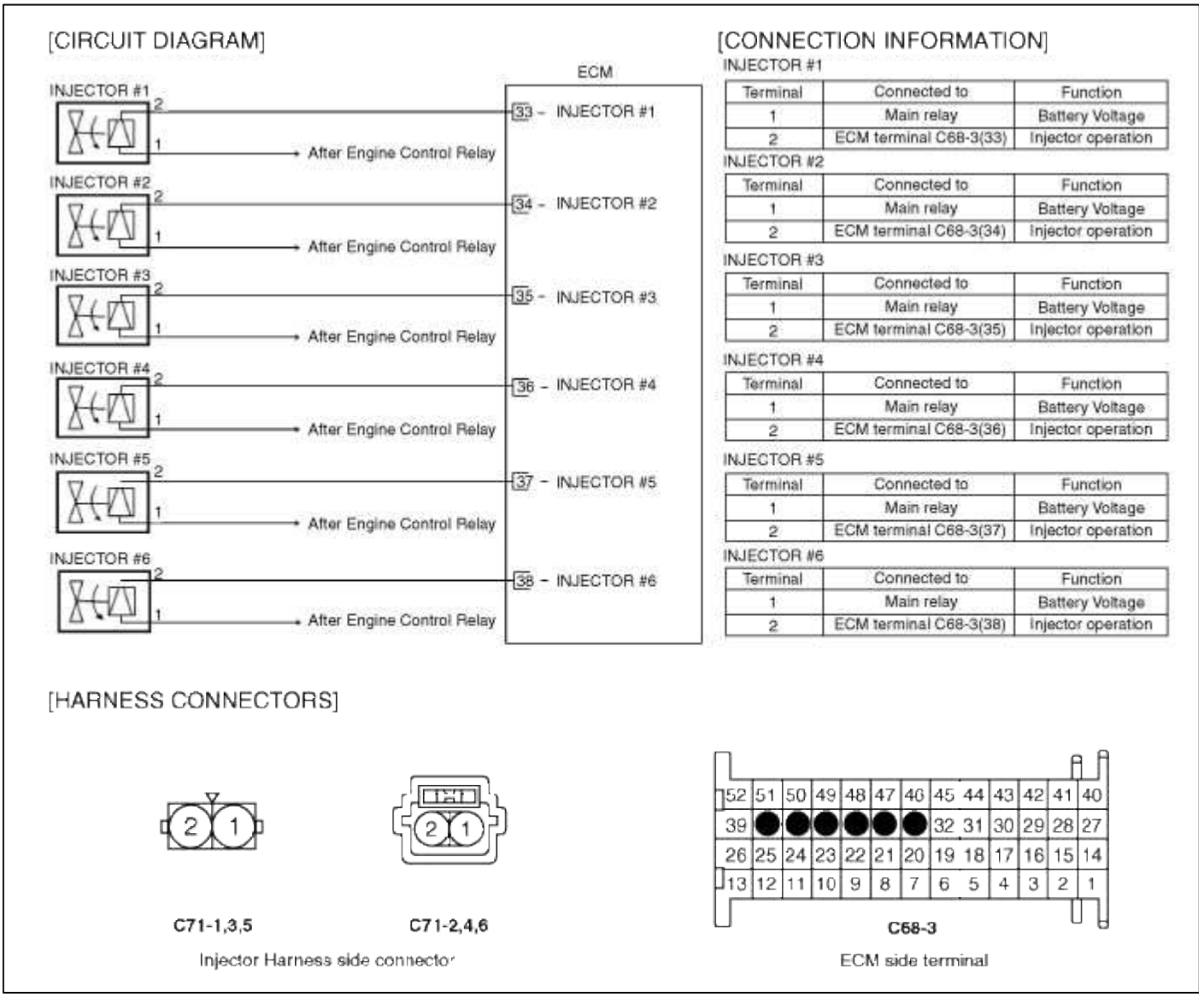
DTC DESCRIPTION

ECM sets DTC P0267 if the ECM detects that injector (Cylinder #3) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤ Battery voltage (V)≤16 • Engine speed (rpm)>30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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.

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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.

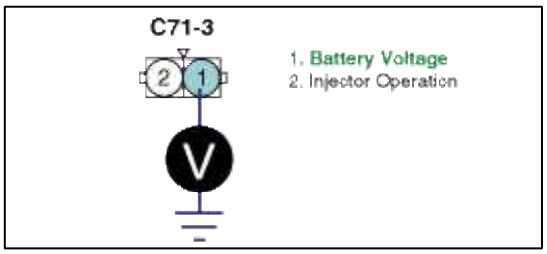
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

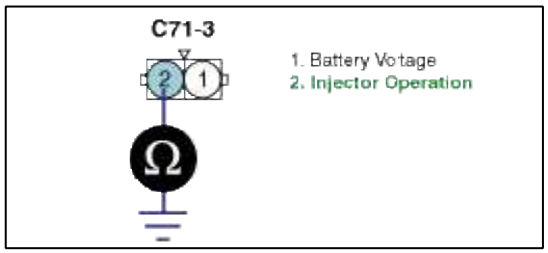
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 2 of the injector harness connector and chassis ground.

Specification : Infinite



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

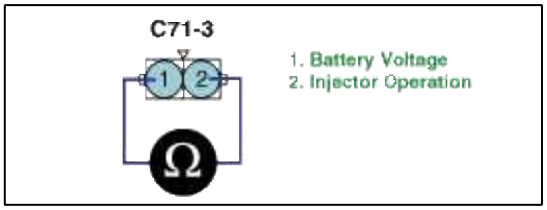
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

CAUTION

Be careful not to damage wires or components during the test.
Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°F)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0268

COMPONENT LOCATION

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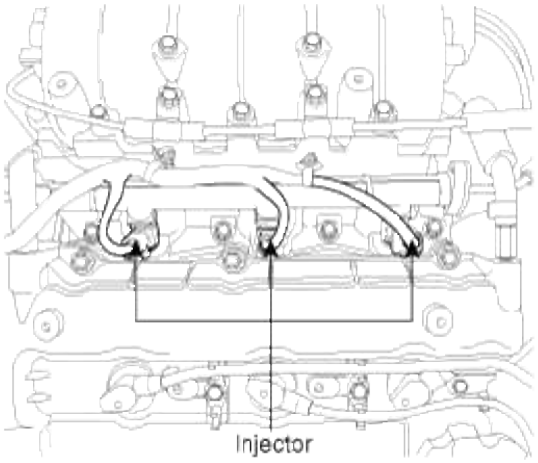


GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION

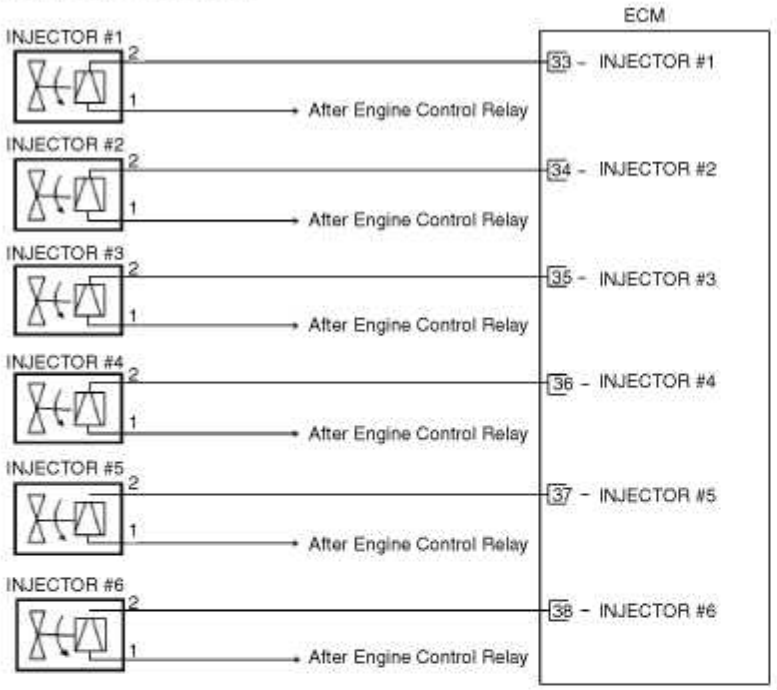
ECM sets DTC P0268 if the ECM detects that injector (Cylinder #3) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤ Battery voltage (V)≤16 • Engine speed (rpm)>30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(33)	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(34)	Injector operation

INJECTOR #3

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(35)	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(36)	Injector operation

INJECTOR #5

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(37)	Injector operation

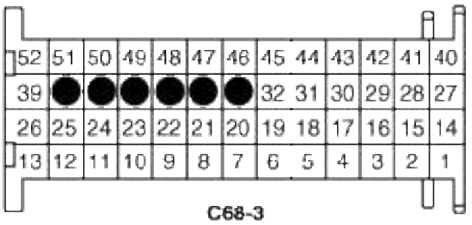
INJECTOR #6

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(38)	Injector operation

[HARNESS CONNECTORS]

C71-1,3,5 C71-2,4,6

Injector Harness side connector



C68-3

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".

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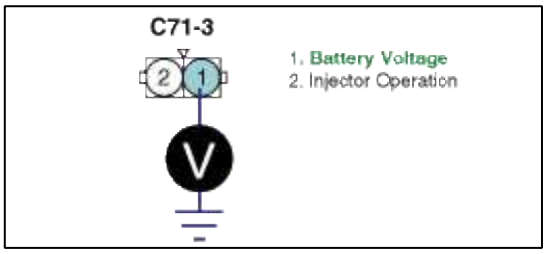
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

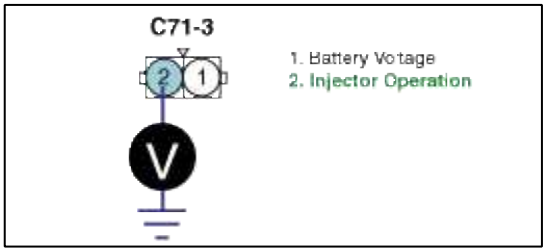
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to battery in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect injector and ECM connectors.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

   Specification : Approx. 0V



   (5) Is voltage within the specification?

   YES

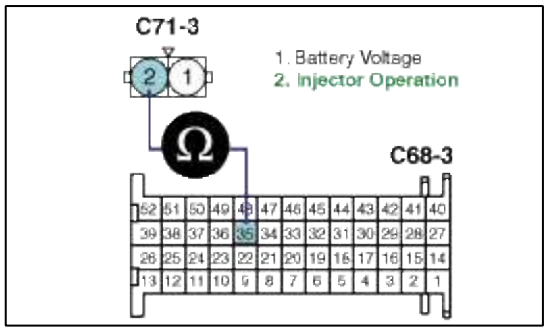
   Go to next step as below

   NO

2. Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

3. Check for open in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the injector harness connector and 35 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

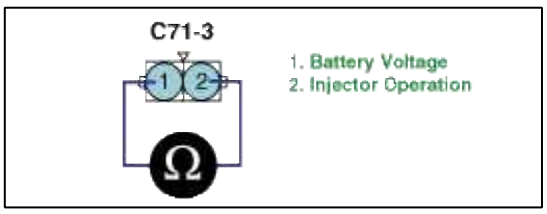
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

> **CAUTION**
>
> Be careful not to damage wires or components during the test.
> Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

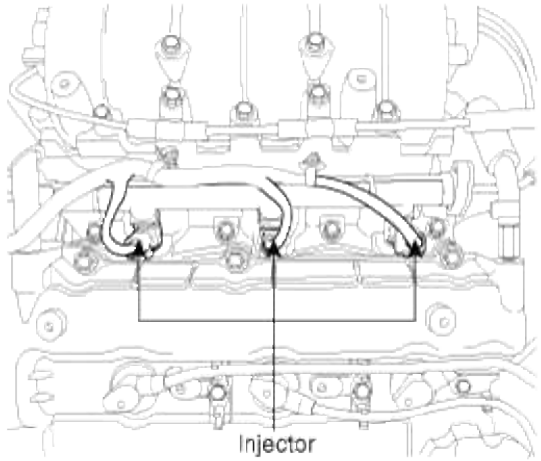
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°F)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0270

COMPONENT LOCATION



GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

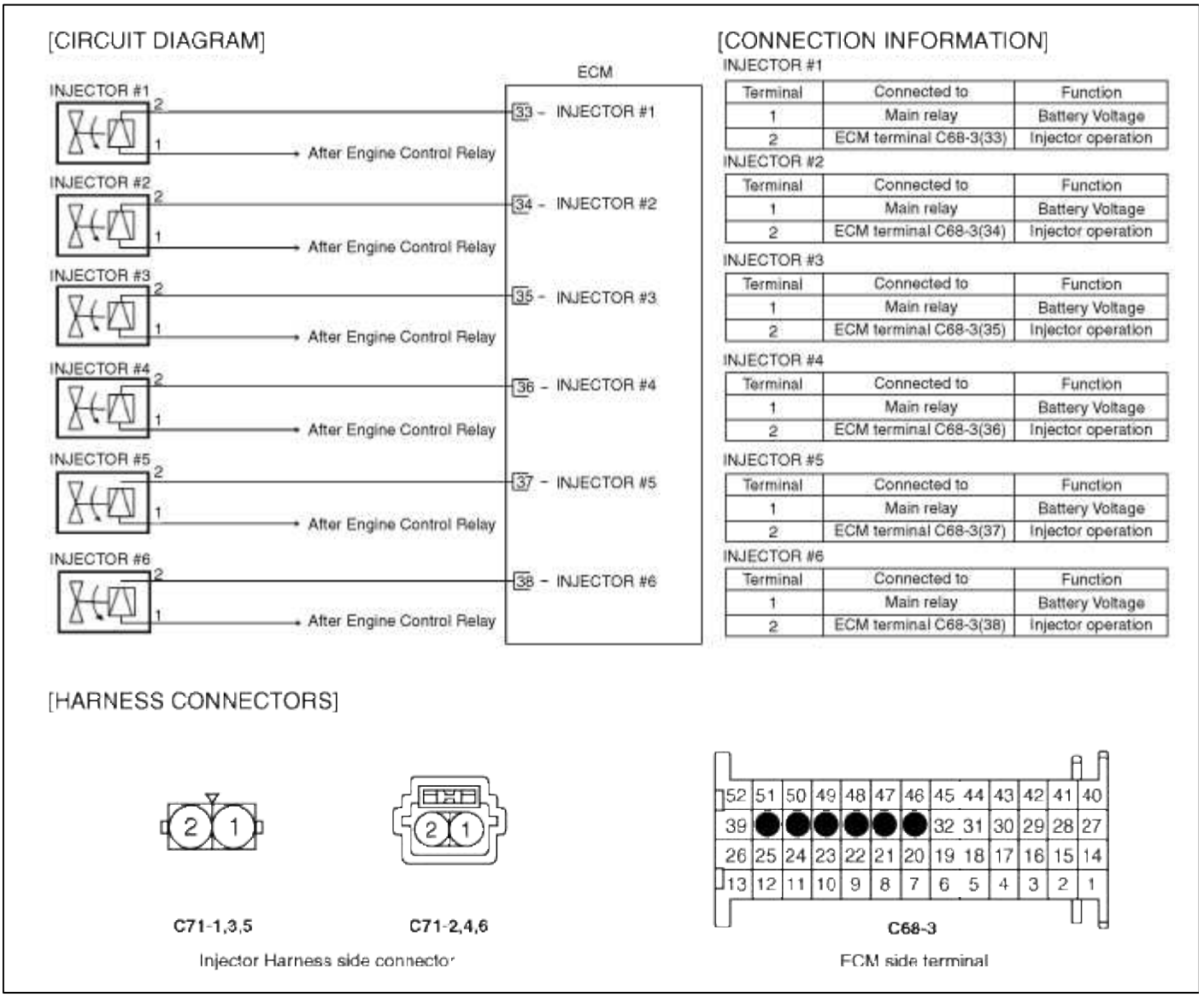
DTC DESCRIPTION

ECM sets DTC P0270 if the ECM detects that injector (Cylinder #4) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤ Battery voltage (V)≤16 • Engine speed (rpm)>30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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.

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3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

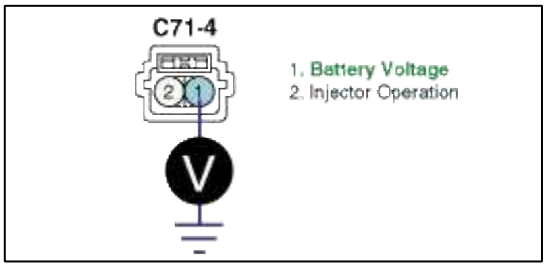
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

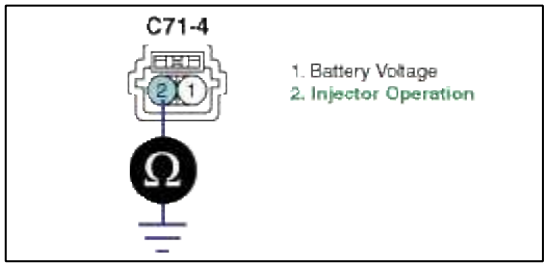
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 2 of the injector harness connector and chassis ground.

Specification : infinite



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

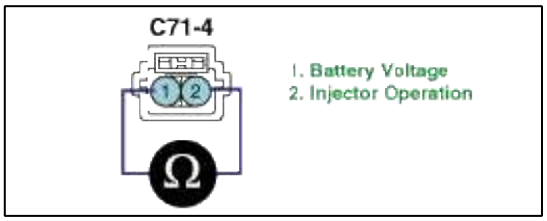
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".

2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

CAUTION

Be careful not to damage wires or components during the test.
Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

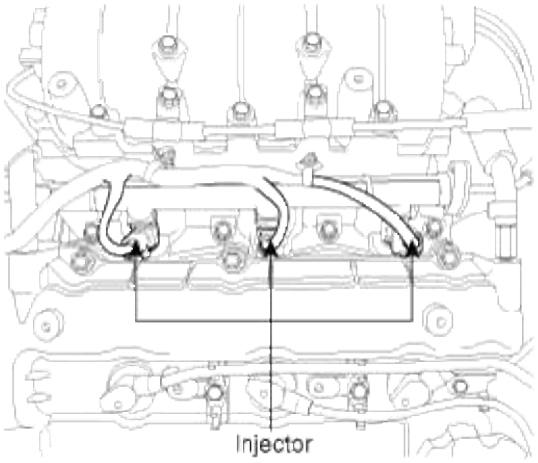
SPECIFICATION

Temperature		Resistance (Ω)
(°F)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0271

COMPONENT LOCATION

tomsn048@gmail.com



GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION

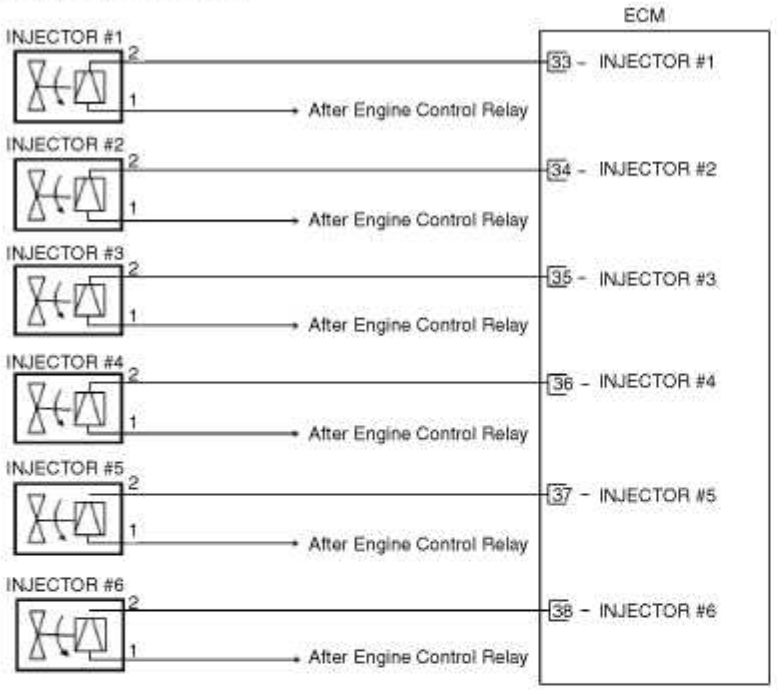
ECM sets DTC P0271 if the ECM detects that injector (Cylinder #4) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤Battery voltage (V)≤16 • Engine speed (rpm)>30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(33)	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(34)	Injector operation

INJECTOR #3

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(35)	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(36)	Injector operation

INJECTOR #5

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(37)	Injector operation

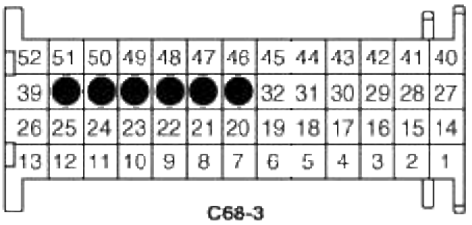
INJECTOR #6

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(38)	Injector operation

[HARNESS CONNECTORS]

C71-1,3,5 C71-2,4,6

Injector Harness side connector



C68-3

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".

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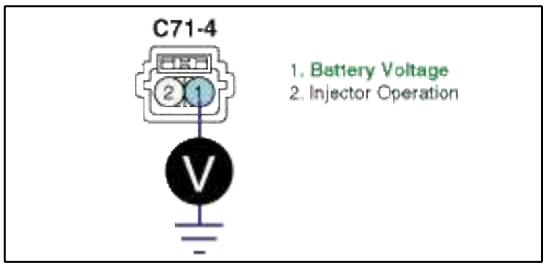
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

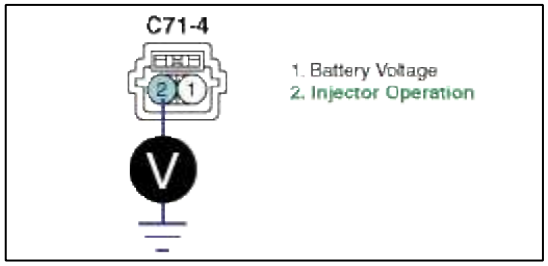
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to battery in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect injector and ECM connectors.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : Approx. 0V



   (5) Is voltage within the specification?

YES

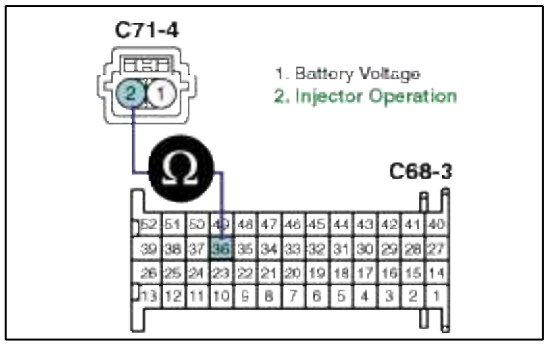
Go to next step as below

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the injector harness connector and 36 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

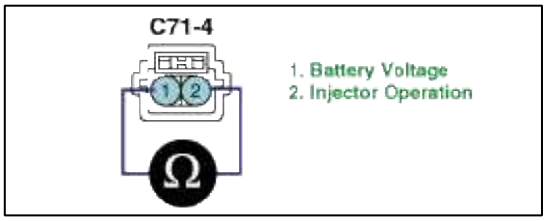
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

   Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

> **CAUTION**
>
> Be careful not to damage wires or components during the test.
> Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

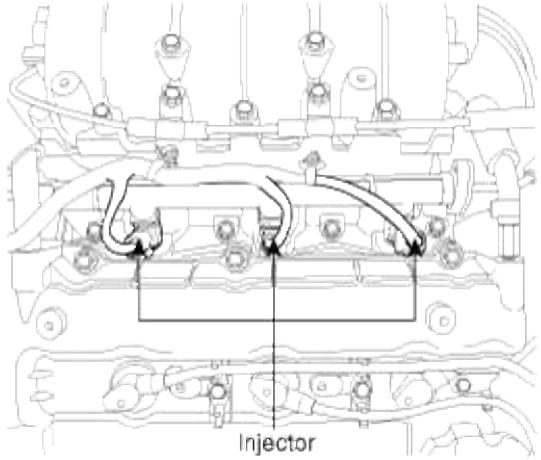
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0273

COMPONENT LOCATION



GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

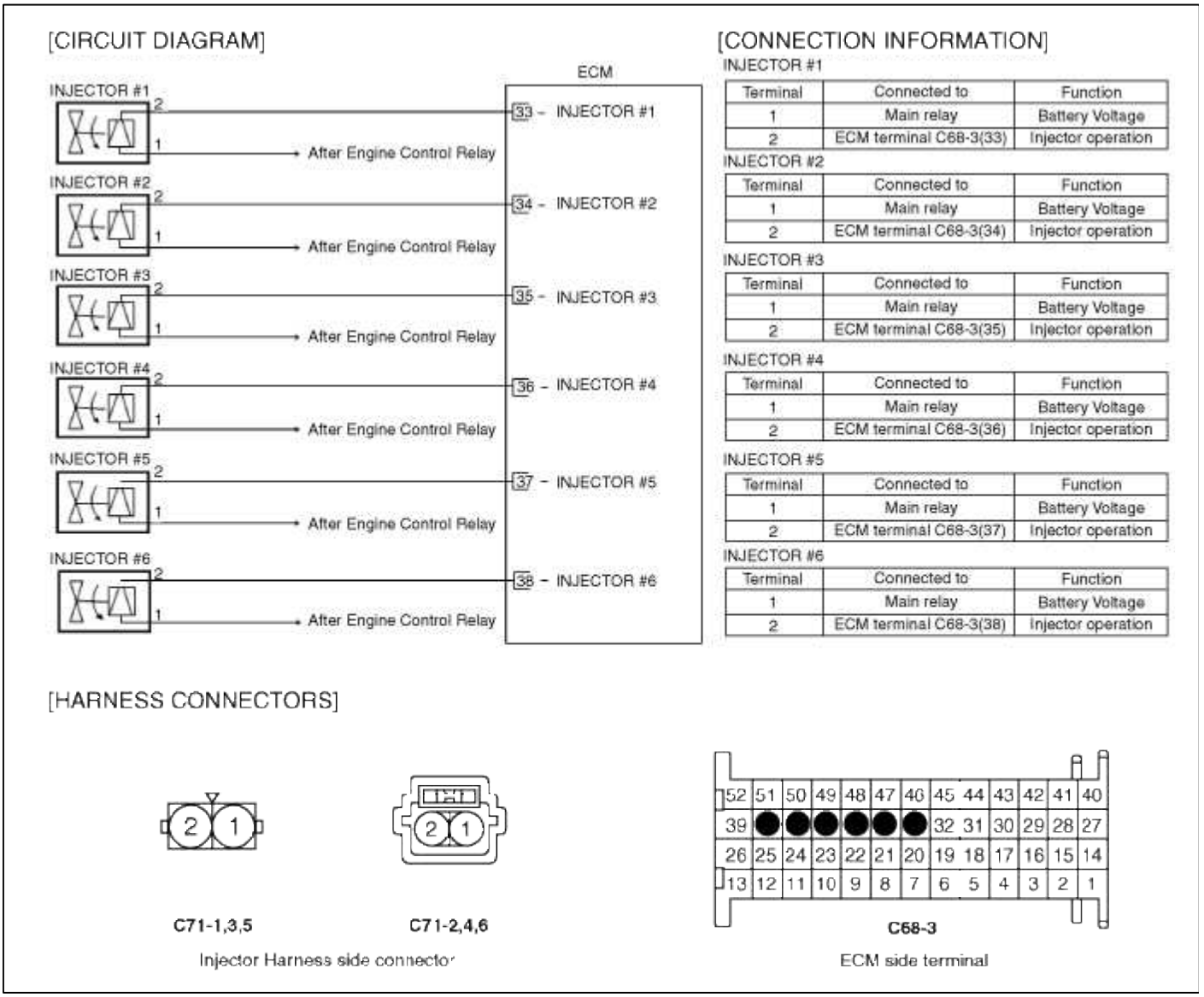
DTC DESCRIPTION

ECM sets DTC P0273 if the ECM detects that injector (Cylinder #5) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤ Battery voltage (V)≤16 • Engine speed (rpm)>30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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.

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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.

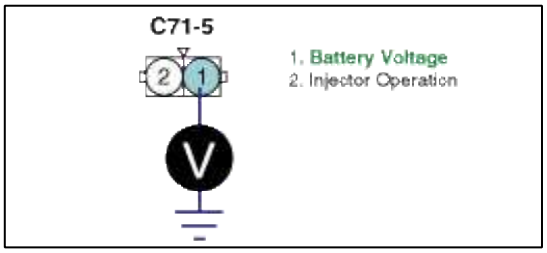
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

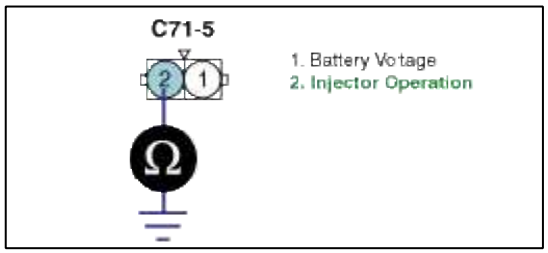
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 2 of the injector harness connector and chassis ground.

Specification : Infinite



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

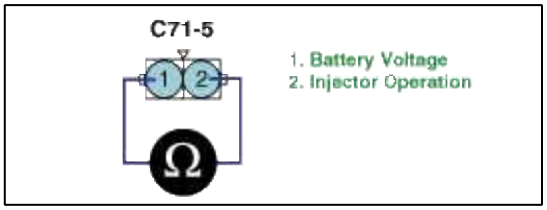
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

CAUTION

Be careful not to damage wires or components during the test.
Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0274

COMPONENT LOCATION

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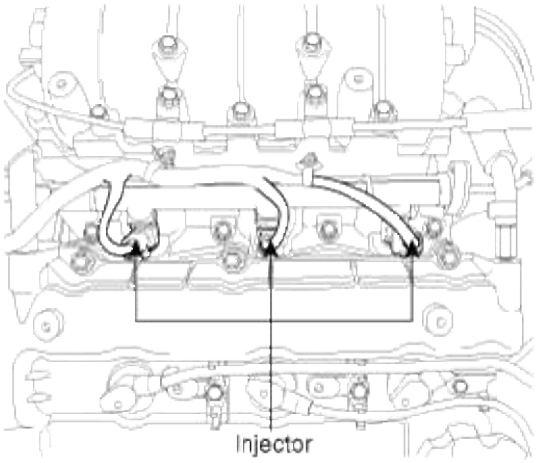


GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION

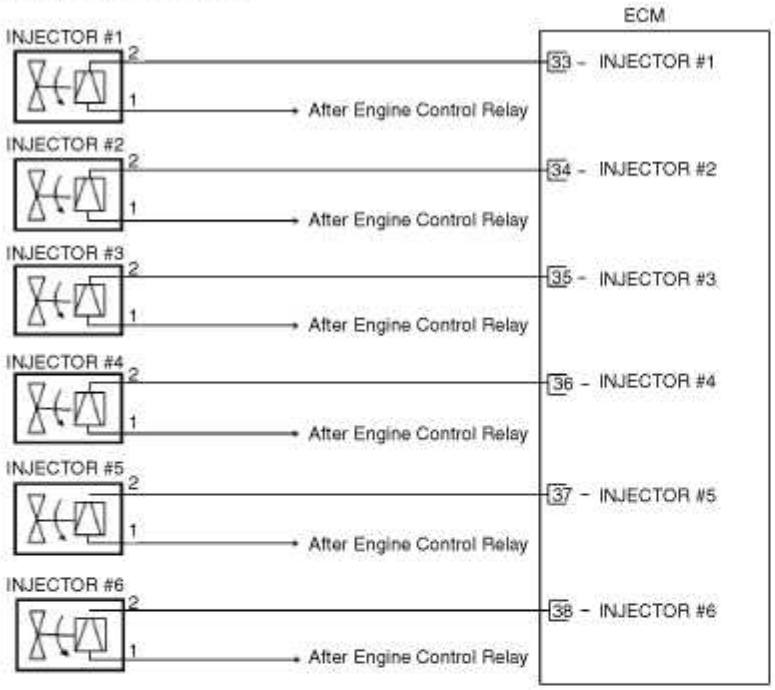
ECM sets DTC P0274 if the ECM detects that injector (Cylinder #5) control circuit is open or short to battery voltage.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤ Battery voltage (V)≤16 • Engine speed (rpm)>30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(33)	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(34)	Injector operation

INJECTOR #3

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(35)	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(36)	Injector operation

INJECTOR #5

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(37)	Injector operation

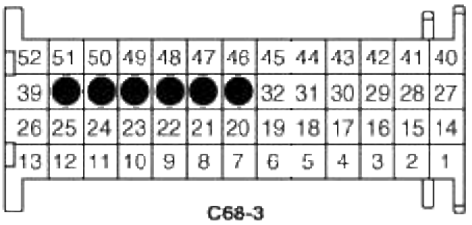
INJECTOR #6

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(38)	Injector operation

[HARNESS CONNECTORS]

C71-1,3,5 C71-2,4,6

Injector Harness side connector



C68-3

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".

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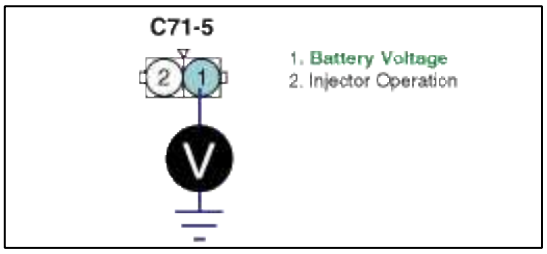
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

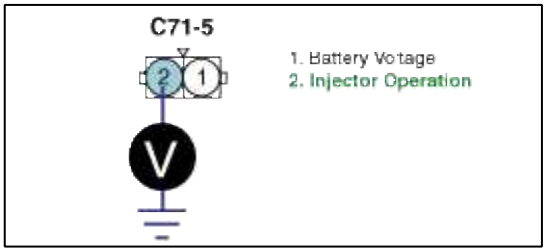
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to battery in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect injector and ECM connectors.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

   Specification : Approx. 0V



   (5) Is voltage within the specification?

   YES

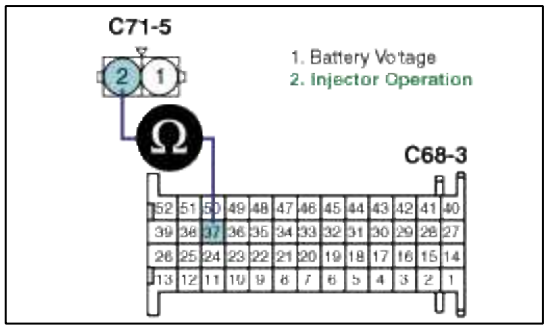
   Go to next step as below

   NO

   Repairas necessary and go to "Verfication of Vehicle Repair" procedure.

2. Check for open in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the injector harness connector and 37 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

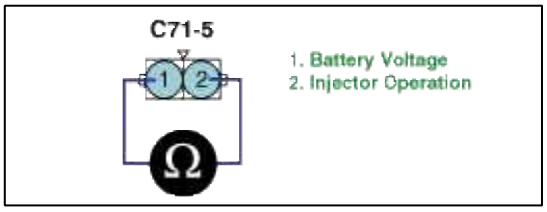
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

   Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

> **CAUTION**
>
> Be careful not to damage wires or components during the test.
> Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

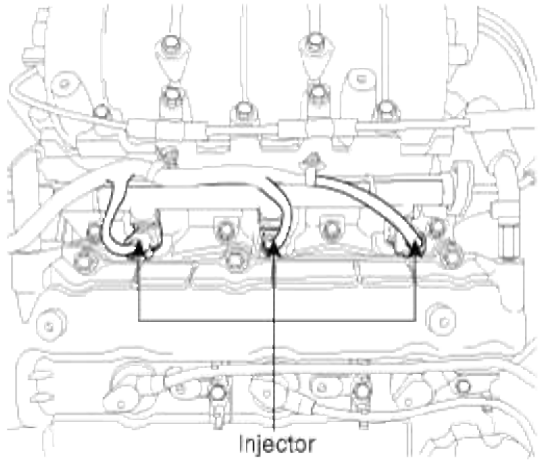
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0276

COMPONENT LOCATION



GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

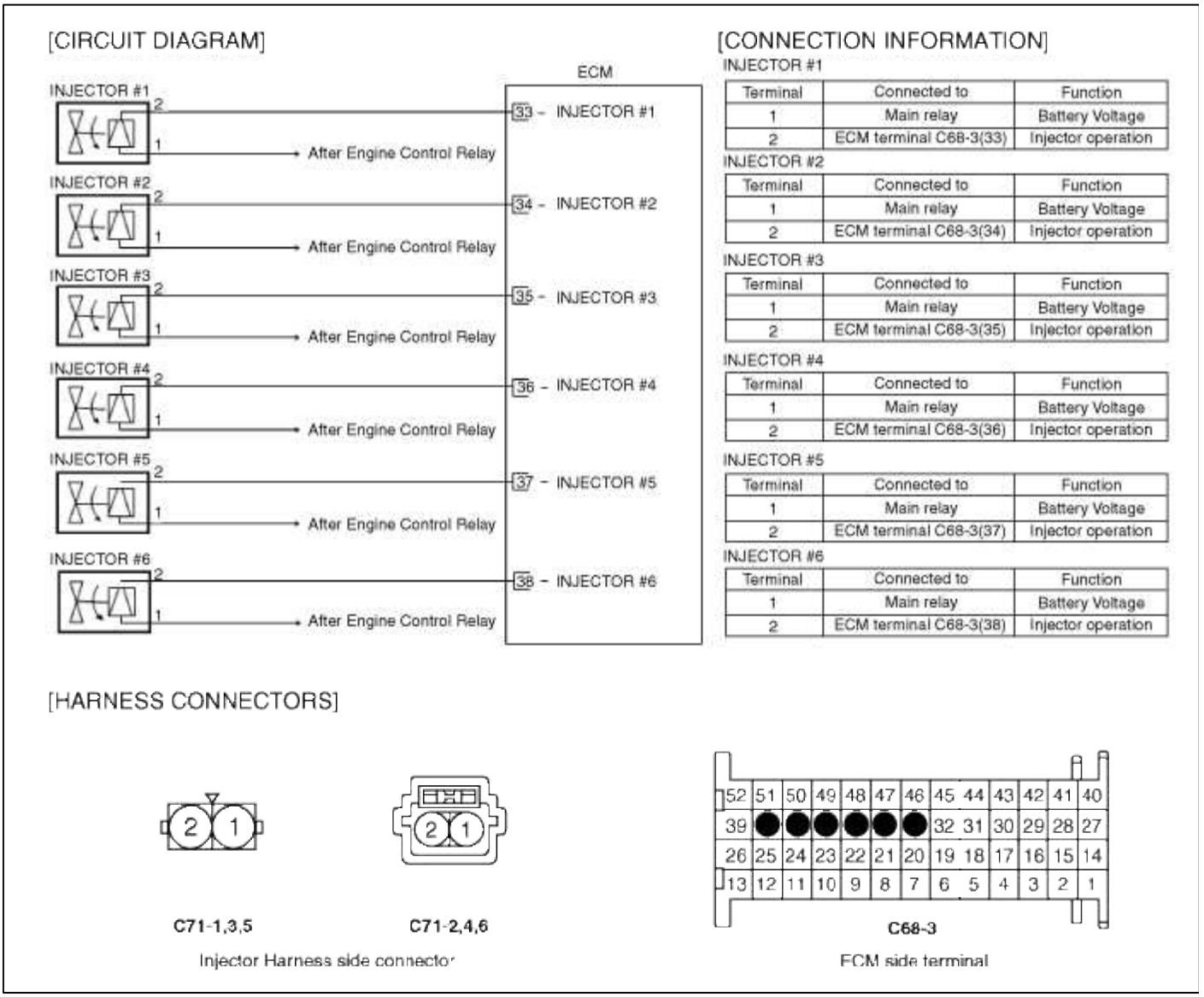
DTC DESCRIPTION

ECM sets DTC P0276 if the ECM detects that injector (Cylinder #6) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤ Battery voltage (V)≤16 • Engine speed (rpm)>30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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.

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3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

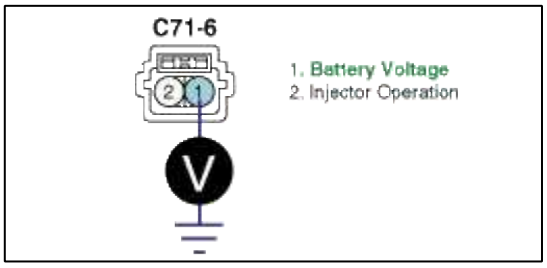
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

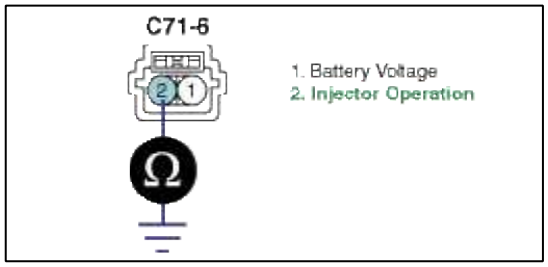
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 2 of the injector harness connector and chassis ground.

Specification : infinite



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

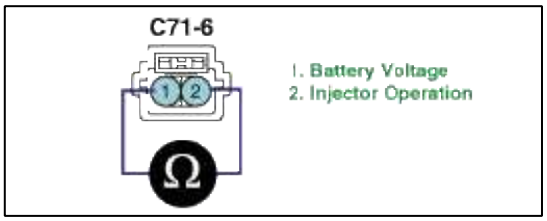
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".

2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

CAUTION

Be careful not to damage wires or components during the test.
Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0277

COMPONENT LOCATION

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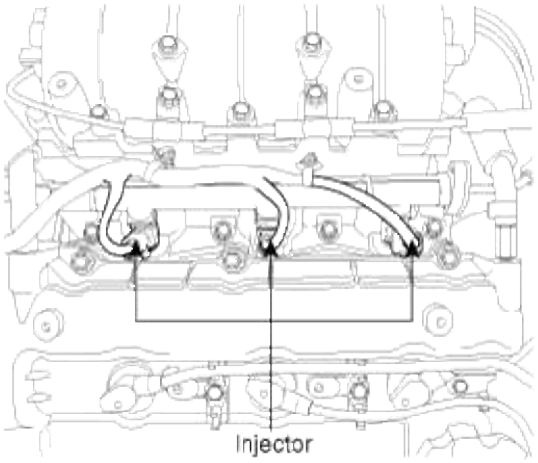


GENERAL DESCRIPTION

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION

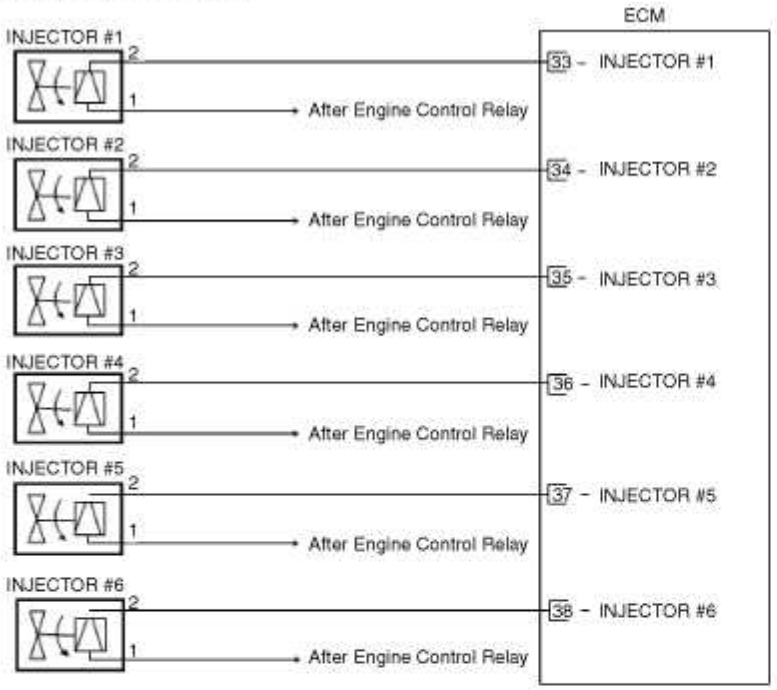
ECM sets DTC P0277 if the ECM detects that injector (Cylinder #6) control circuit is shorted to ground.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty injector
Enable Conditions	• 10≤ Battery voltage (V)≤6 • Engine speed (rpm)>30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

INJECTOR #1

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(33)	Injector operation

INJECTOR #2

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(34)	Injector operation

INJECTOR #3

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(35)	Injector operation

INJECTOR #4

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(36)	Injector operation

INJECTOR #5

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(37)	Injector operation

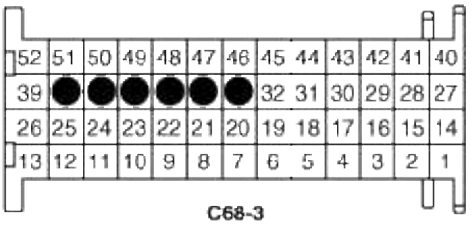
INJECTOR #6

Terminal	Connected to	Function
1	Main relay	Battery Voltage
2	ECM terminal C68-3(38)	Injector operation

[HARNESS CONNECTORS]

C71-1,3,5 C71-2,4,6

Injector Harness side connector



C68-3

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON".

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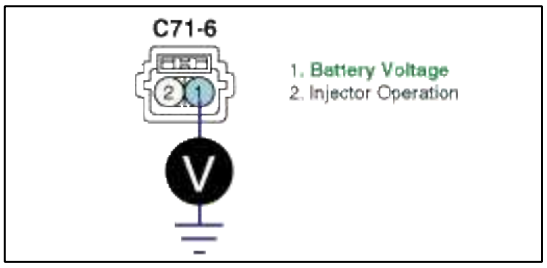
2. Measure voltage between terminal 1 of the injector harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

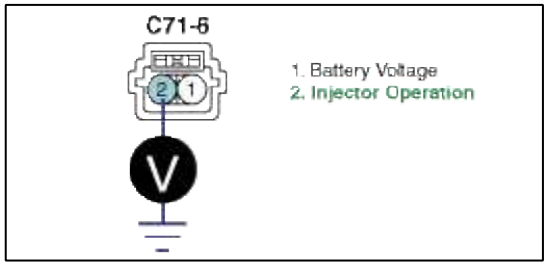
NO

Check for a open in the power supply circuit between the main relay and the Injector.
Check for open or blown 15A injector fuse.
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to battery in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect injector and ECM connectors.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 2 of the injector harness connector and chassis ground.

Specification : Approx. 0V



   (5) Is voltage within the specification?

YES

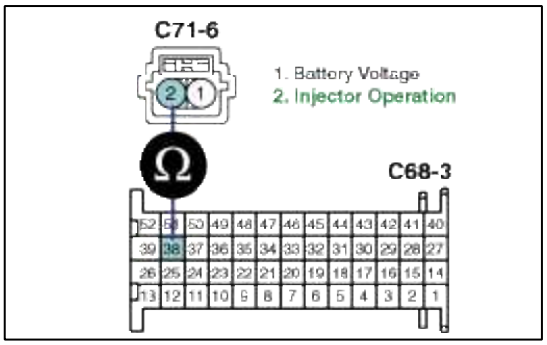
Go to next step as below

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the injector harness connector and 38 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

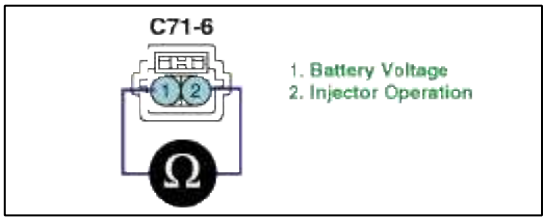
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect injector connector.
3. Measure resistance between terminals 1 and 2 of the injector connector(Component side).

   Specification : Approx. 13.8 ~ 15.2Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.

> **CAUTION**
>
> Be careful not to damage wires or components during the test.
> Repair as necessary and go to next step as below.

NO

Check Injector for contamination, deterioration, or damage. 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

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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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

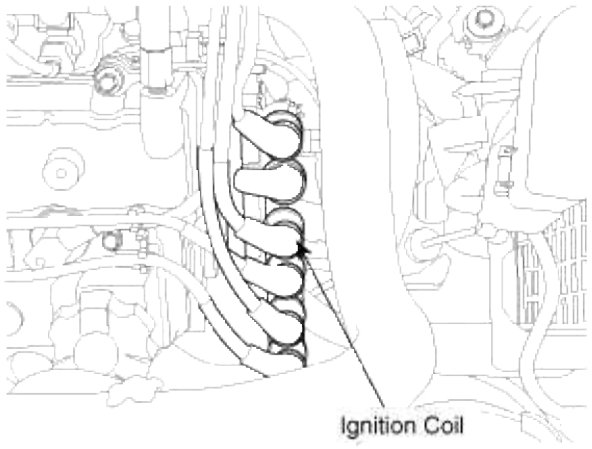
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	13.8 ~ 15.2

Fuel System > Troubleshooting > P0300

COMPONENT LOCATION



GENERAL DESCRIPTION

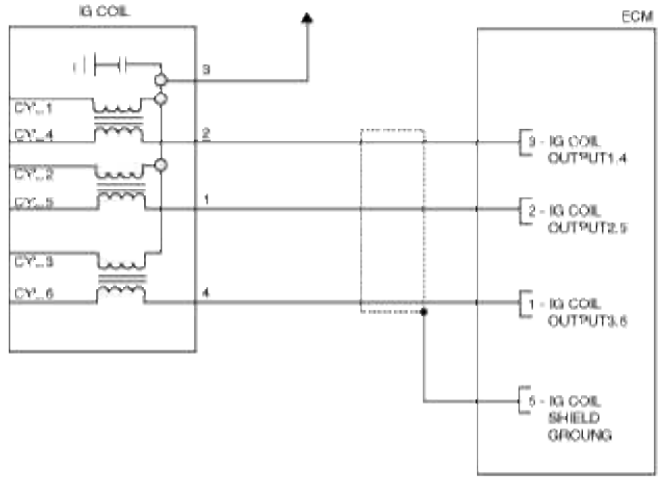
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Immediate (Catalyst converter damage has occurred) or 2 Driving Cycles (Emission thresholds are exceedes)	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



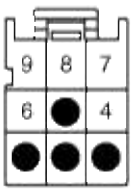
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

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AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

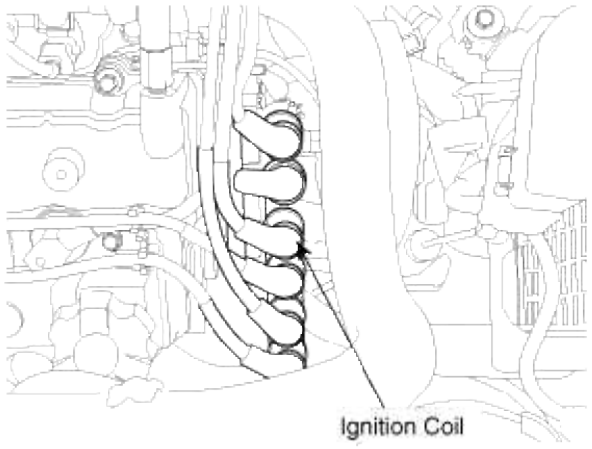
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0301

COMPONENT LOCATION



GENERAL DESCRIPTION

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION

The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate. With a more than two cylinder misfire detection, the ECM sets P0300.

DTC DETECTING CONDITION

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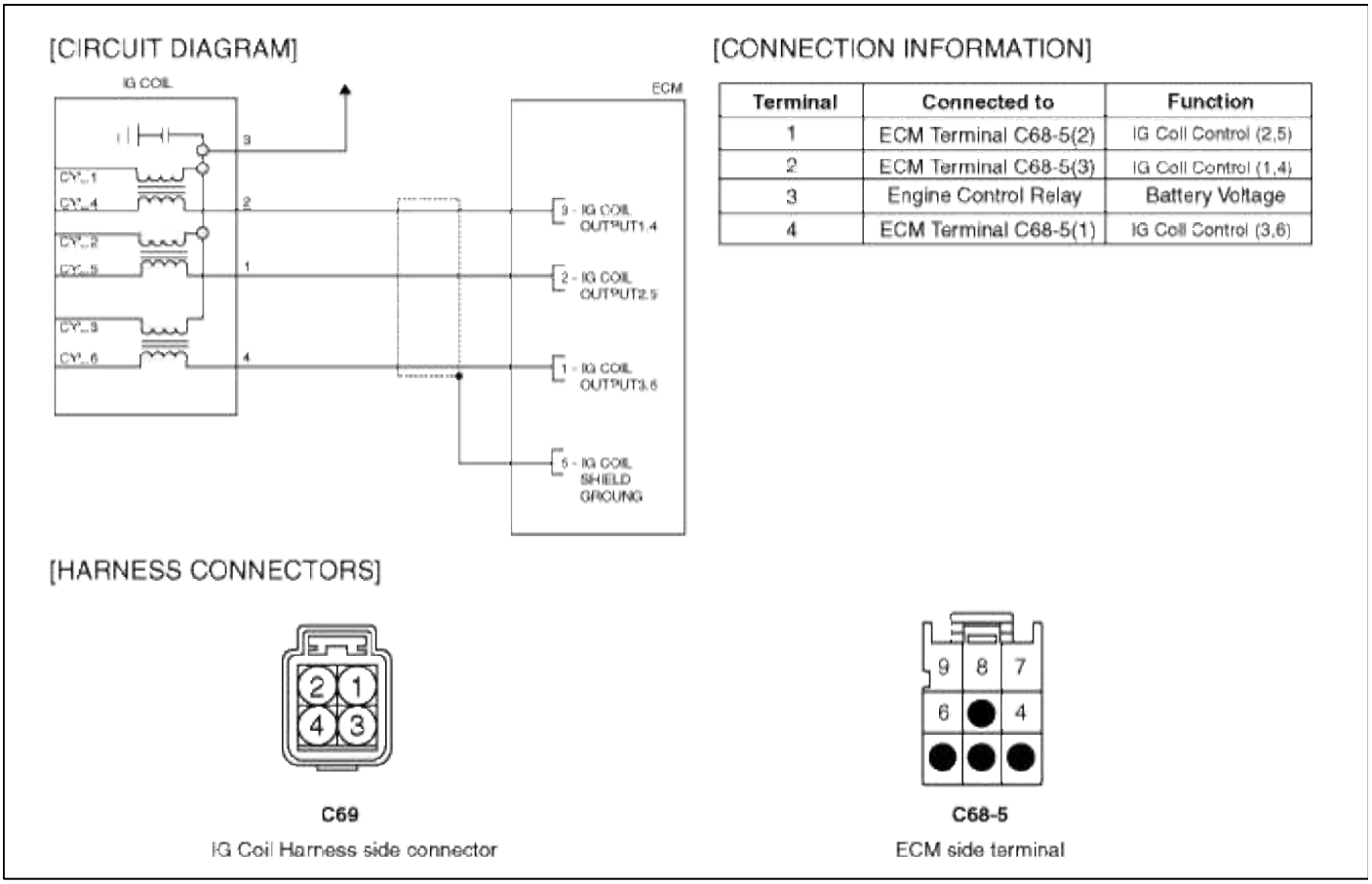
ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case 2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM



AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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.

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2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

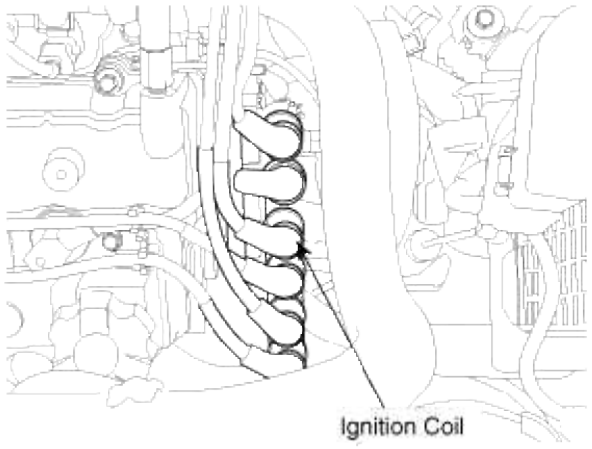
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0302

COMPONENT LOCATION



GENERAL DESCRIPTION

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION

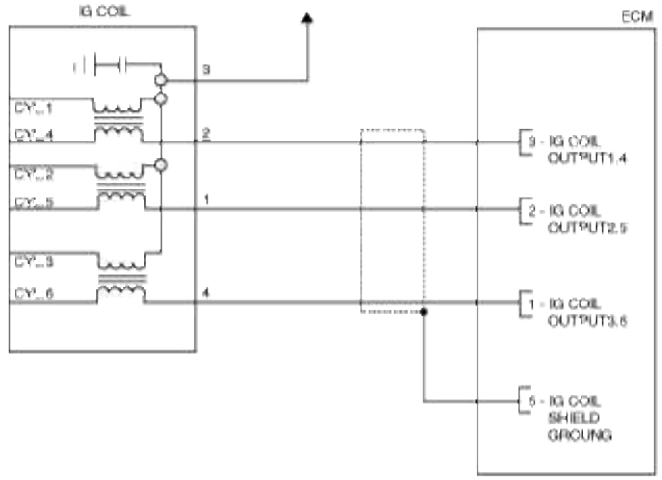
The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



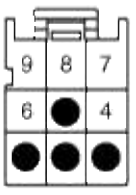
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

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AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

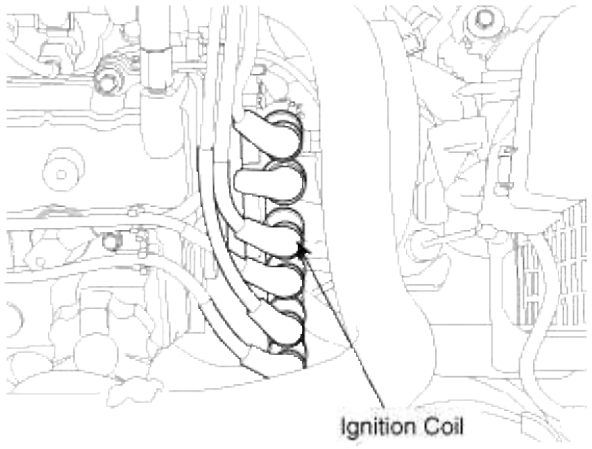
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0303

COMPONENT LOCATION



GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	

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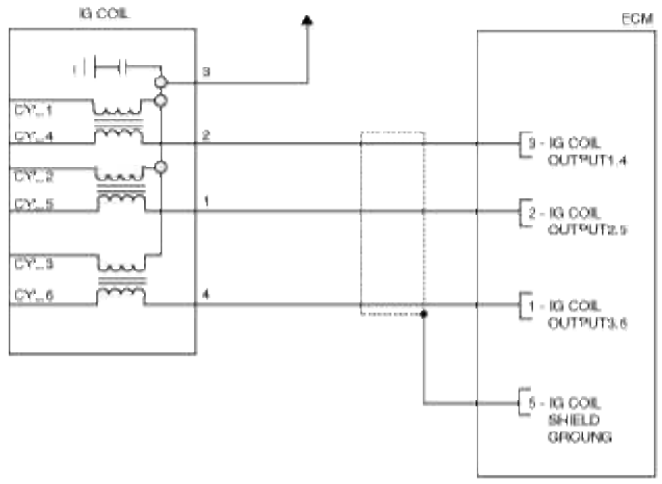
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	• Leakage between cooling system and cylinder
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



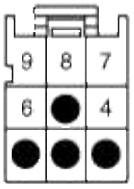
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

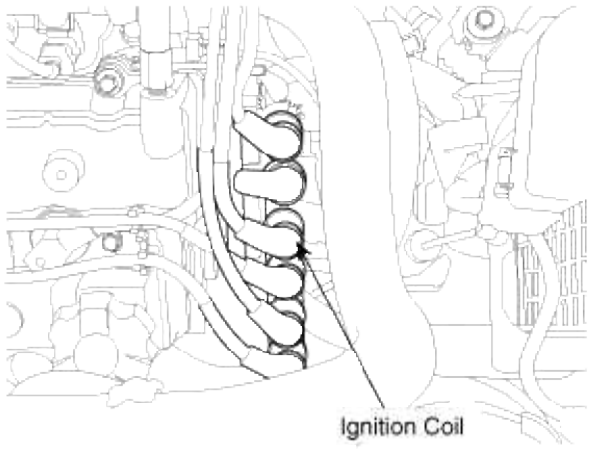
NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0304

COMPONENT LOCATION

tomsn048@gmail.com



GENERAL DESCRIPTION

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION

The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

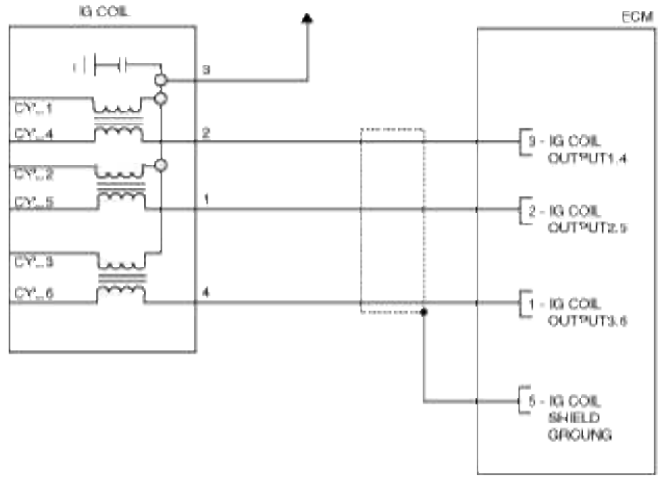
DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage
Enable Conditions	• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	

Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	• Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



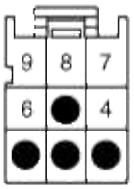
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage

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2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

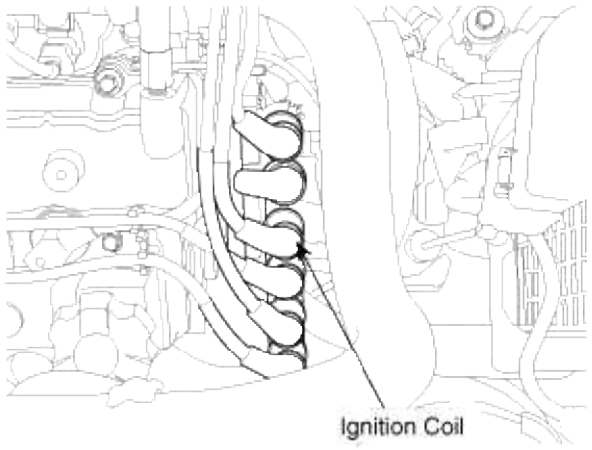
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0305

COMPONENT LOCATION



GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM		DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, hightension lead, or Ignition coil • Incorrect valve timing • Uneven compression • Air leakage • Improper Fuel pressure or dirty fuel. • Blocked/Leaking injectors • Leakage between cooling system and cylinder
Enable Conditions		• After starting • Mass air flow >Approx. 0 • 550< Engine speed(RPM)< 6500 • Intake air mass gradient is in predetermined range • Throttle Angle gradient is in predetermined range • No injector shut off • No rough road	
Case 1)	Threshold Value	• Misfire= 6~17 within 200 rev.	
	Diagnosis Time	• 200 revolution: 3*200 revolution	
Case2)	Threshold Value	• First 1000 rev.: Misfire>2% • After first 1000 rev.: Misfire >2%	
	Diagnosis Time	• 1000 revolution: 4*1000 revolution	
MIL On Condition		• Case1) Immediate • Case2) 2 Driving Cycles	

SCHEMATIC DIAGRAM

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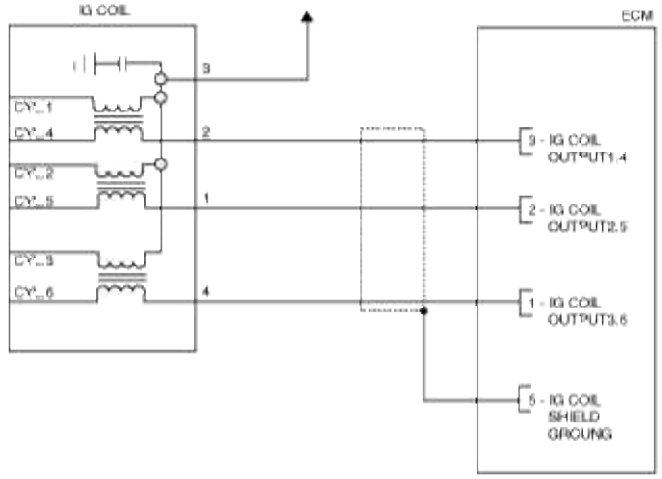
[CIRCUIT DIAGRAM]



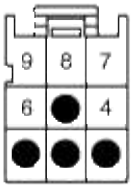
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. isually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

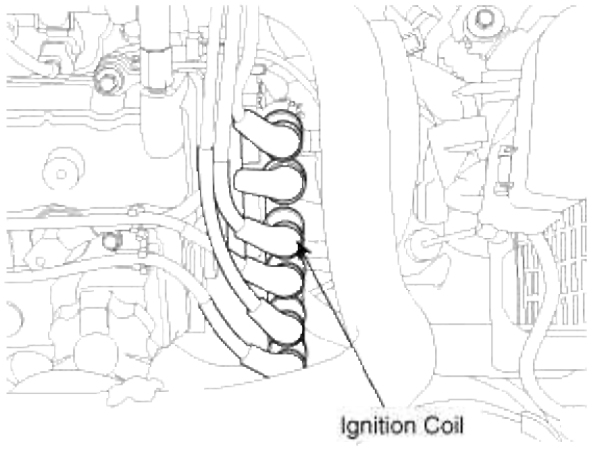
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0306

COMPONENT LOCATION



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GENERAL DESCRIPTION

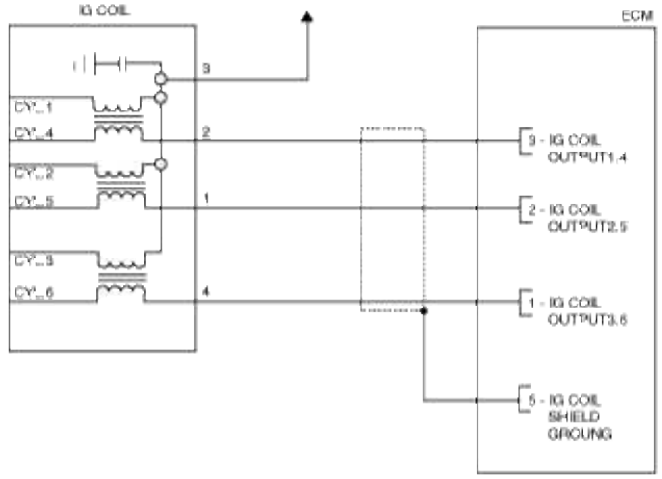
DTC DESCRIPTION

DTC DETECTING CONDITION

<table>
<tr><th colspan="2">ITEM</th><th>DETECTING CONDITION</th><th>POSSIBLE CAUSE</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Calculation of engine roughness</td><td rowspan="6">• Faulty spark plugs, hightension lead, or Ignition coil
• Incorrect valve timing
• Uneven compression
• Air leakage
• Improper Fuel pressure or dirty fuel.
• Blocked/Leaking injectors
• Leakage between cooling system and cylinder</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• After starting
• Mass air flow >Approx. 0
• 550< Engine speed(RPM)< 6500
• Intake air mass gradient is in predetermined range
• Throttle Angle gradient is in predetermined range
• No injector shut off
• No rough road</td></tr>
<tr><td rowspan="2">Case 1)</td><td>Threshold Value</td><td>• Misfire= 6~17 within 200 rev.</td></tr>
<tr><td>Diagnosis Time</td><td>• 200 revolution: 3*200 revolution</td></tr>
<tr><td rowspan="2">Case2)</td><td>Threshold Value</td><td>• First 1000 rev.: Misfire>2%
• After first 1000 rev.: Misfire >2%</td></tr>
<tr><td>Diagnosis Time</td><td>• 1000 revolution: 4*1000 revolution</td></tr>
<tr><td colspan="2">MIL On Condition</td><td>• Case1) Immediate
• Case2) 2 Driving Cycles</td></tr>
</table>

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



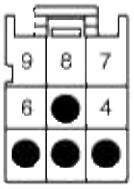
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket
   C. Gasket between intake manifold and cylinder head
   D. Seals between intake manifold and fuel injectors
   E. Exhaust system between HO2S and Three way catalyst for air leakage
2. Was a problem found in any of the above areas?

YES

Go to "Fuel System Inspection" procedure

NO

Repair air leakage and go to "Verification of Vehicle Repair" procedure.

FUEL SYSTEM INSPECTION

1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
2. Install a fuel pressure gage.
3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition : Engine "ON" at Idle
Specification : 343 kPa(3.5 kg/cm², 49.8 psi)

---

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4. Is fuel pressure within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure

NOTE

1) Check if fuel line pressure decreases when accelerating quickly.
   - If it does, check fuel pump maximum pressure. If pressure is OK, check fuel line and filter for clogging.
2) If fuel pressure is lower than specification : Check for fuel line pressure while pinching fuel return hose.
   - If pressure quickly increases, check pressure regulator
   - If pressure gradually increases, check for clogging between fuel pump and pressure regulator. If hose is not clogged, check fuel pump maximum pressure.
3) If fuel pressure is higher than specification : Is fuel line clogged?
   - If it is not, replace pressure regulator.
   - If it is, replace it.

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

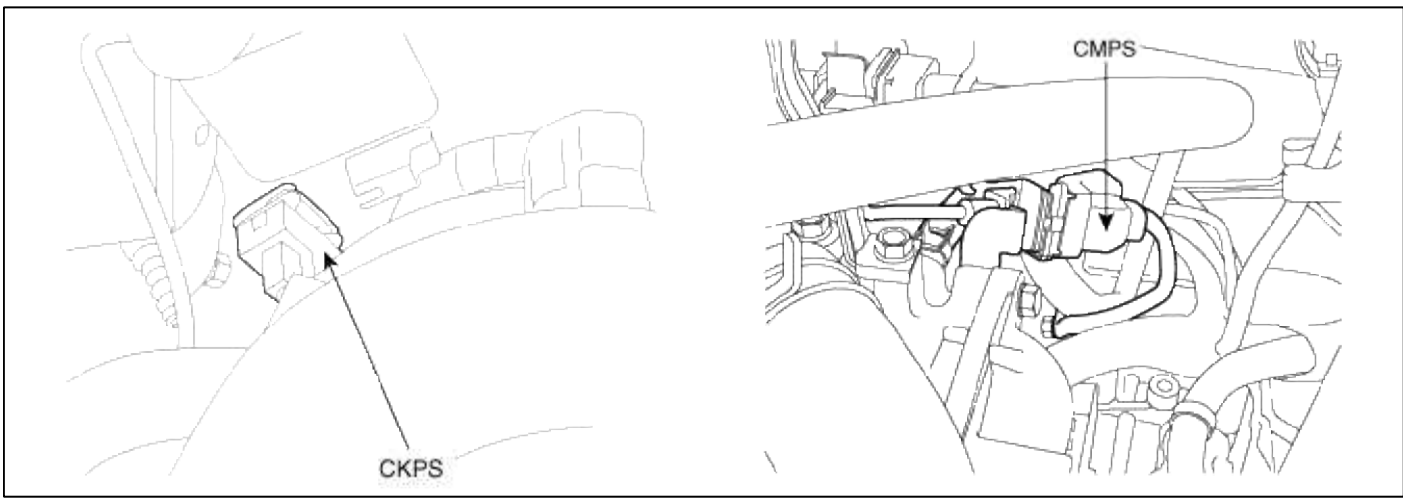
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0315

COMPONENT LOCATION



GENERAL DESCRIPTION

DTC DESCRIPTION

Because of the tolerance in mechanical machining and assembling process of the target wheel, the duration of each segment are not always same but differ from segment to segment on the same engine. And this irregular segment duration can disturb misfiring detection which is based on the difference of engine rotational speed between the firing and the misfiring cylinder. The ECM compares segment duration of 4 cylinders during fuel cut-off and deceleration period. With this comparison ECM perform segment adaptation to adapt the difference of each segment duration. The ECM sets DTC P0315 if any of segment adaptation value is on the limit.

DTC DETECTING CONDITION

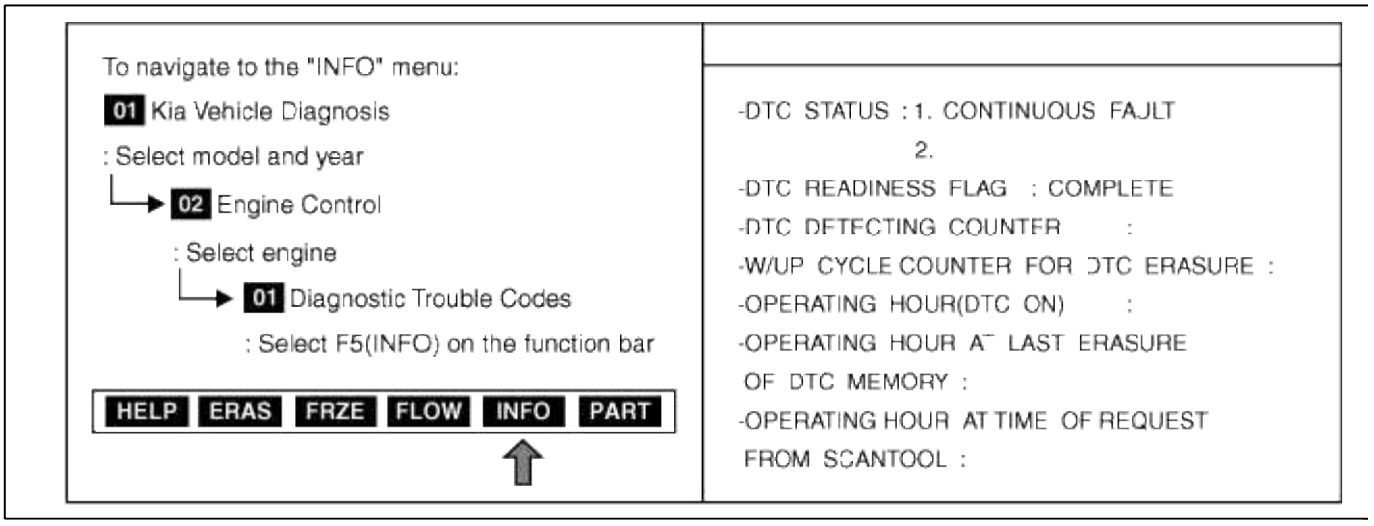
Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitor segment time adaptation	• Improperly installed target wheel • Contact resistance in connectors
Enable Conditions	• 11 ≤ Battery voltage(V) ≤ 16 • 2,000 < Engine speed < 3,000 • No failure on injector, MAFS, CKPS, CMPS and PCSV	
Threshold Value	• Segment adaptation value = 5/1000	
MIL On Condition	• -	

MONITOR DTC STATUS

NOTE

If any codes relating to CKPs are stored, do ALL REPAIRS associated with those codes before proceeding with troubleshooting.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



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5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

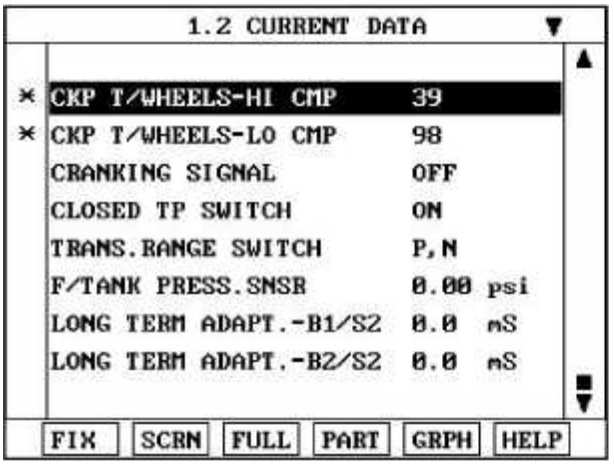
NO

Go to "Component Inspection" procedure.

COMPONENT INSPECTION

1. Start engine and let vehicle idle
2. Connect scantool and select "Current Data" mode.
3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification :
"CKP T/WHEELS-LO CMP" : 38 +/- 4 tooth
"CKP T/WHEELS-HI CMP" : 98 +/- 4 tooth



4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

YES

Thoroughly check connectors between CKPS and ECM for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

A. Remove CKP and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

NOTE

Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from hosing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A"

B. If failure to synchronize with CMP sensor, readjust timing system and go to next step.
Check CKP sensor for contamination, deterioration, or damage. Substitute with a known-good CKP sensor and check for proper operation. If the problem is corrected, replace CKP sensor 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

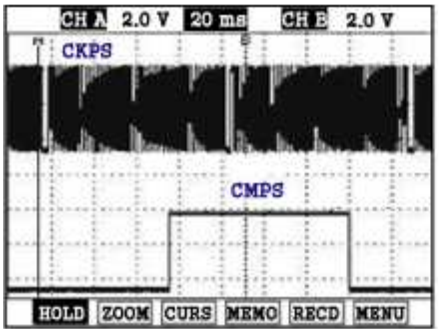


Fig. 1

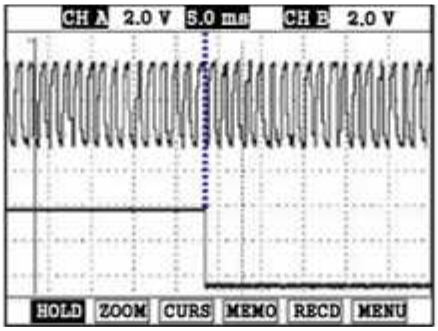


Fig. 2

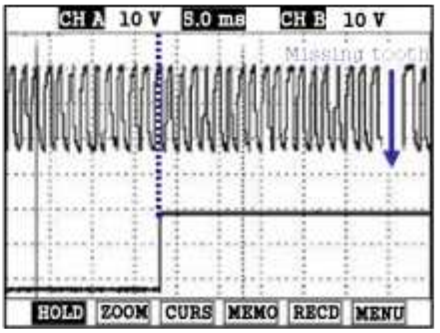
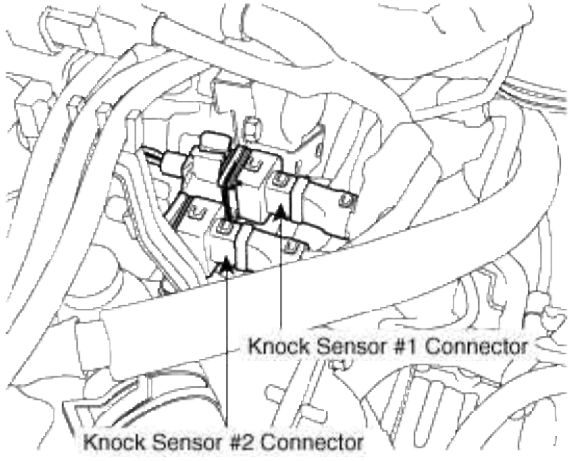


Fig. 3

Fig 1) Normal wave form with idle : The square wave signal should be smooth and without any distortion
Fig 2,3) Normal wave form with engine running : The CMP falling(rising) edge is coincided with 38+/-4 tooth of the CKP from one longer signal(missing tooth)

Fuel System > Troubleshooting > P0325

COMPONENT LOCATION



GENERAL DESCRIPTION

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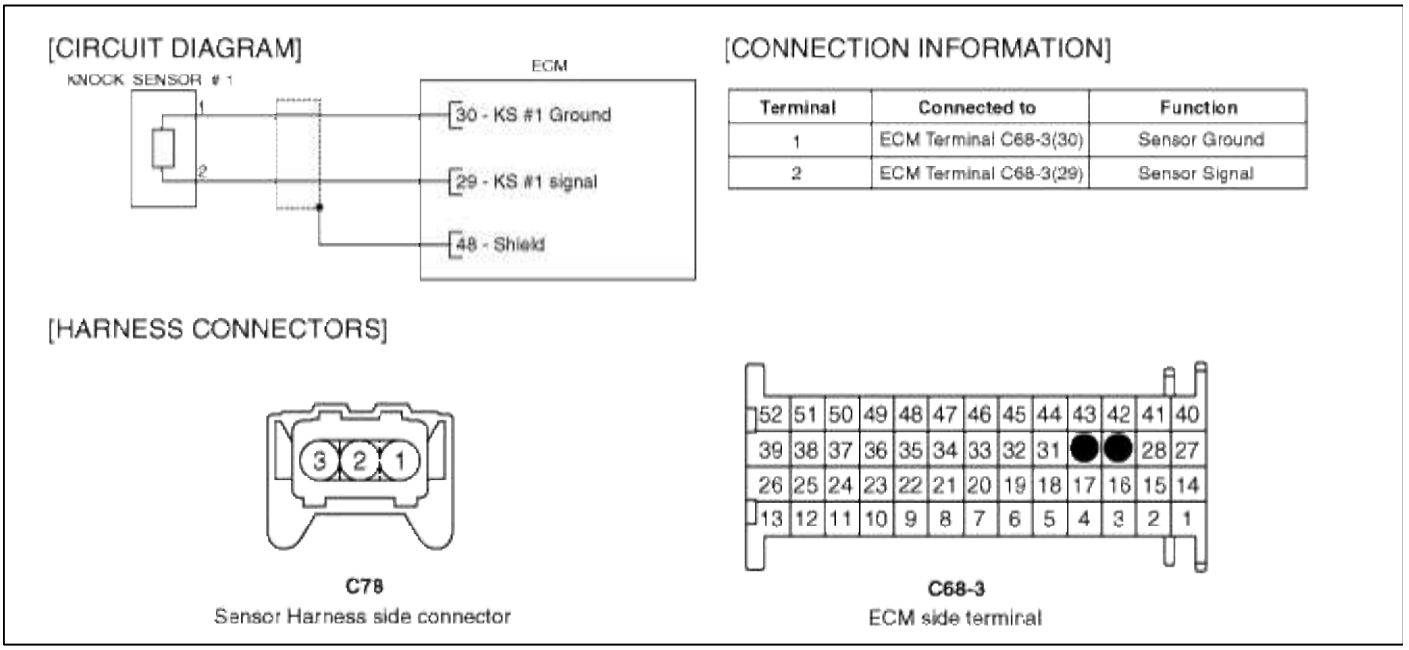
DTC DESCRIPTION

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range Check	• Open/short in signal or ground circuit • Contact resistance in connectors • Faulty knock sensor
Enable Conditions	• Knock control enabled • Engine speed >1800 rpm	
Threshold Value	• Mean value of sensor signal < 0.1V	
Diagnostic Time	• 10*720 crank angle	
MIL On Condition	• -	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

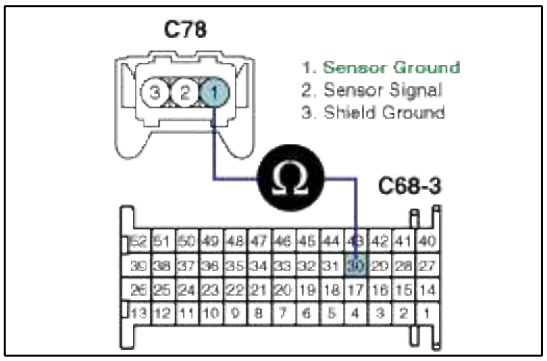
Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect Knock sensor connector.

3. Measure resistance between terminals 1 of the sensor harness connector and 30 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

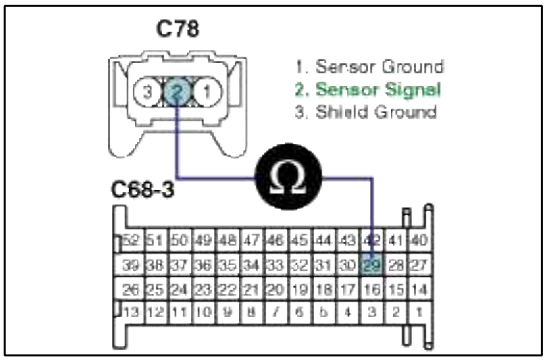
NO

Check for an open in the ground circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the sensor harness connector and 29 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

Go to next step as below

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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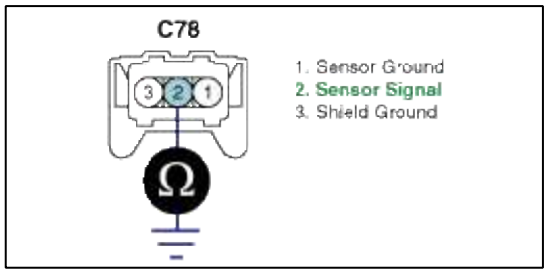
2. Check for short to ground in signal harness.
   (1) Ignition "OFF"
   (2) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

   Specification : Infinite



   (3) Is resistance within the specification?

   YES

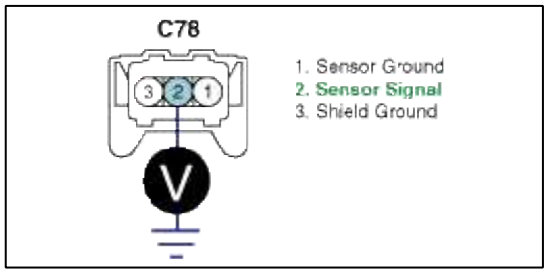
   Go to next step as below

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in signal harness.
   (1) Ignition "OFF"
   (2) Disconnect ECM connector
   (3) Ignition "ON" & Engine "OFF"
   (4) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

   Specification : Approx. 0V



   (5) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure

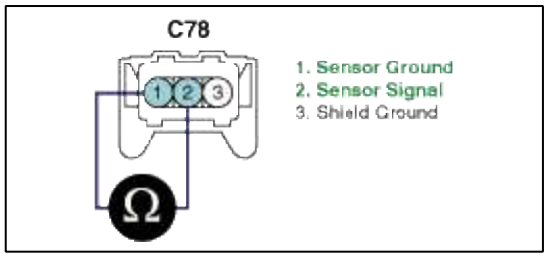
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Component resistance inspection.
   (1) Ignition "OFF"
   (2) Disconnect knock sensor connector
   (3) Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

   Specification : Approx. 5MΩ at 20°C(68°F)



2. Output signal inspection
   (1) Remove knock sensor from vehicle and secure (across mounting boss) in a shop vise.
   (2) Set up an oscilloscope as follows :
   Channel A (+): terminal 2 (-): terminal 1
   (3) Rap on vise with a ball peen hammer while monitoring oscilloscope screen (there should be a spike of less than 1 volt with each hammer strike).

   Specification : knock sensor send a voltage spike with hammer strikes

3. Installation torque inspection.
   (1) Check the installation torque of the knock sensor.

   Specification : 16.7 ~ 25.5 N·m(1.7 ~ 2.6 kgf·m, 12.3 ~ 18.8 lb·ft)

4. Has a problem been found?

YES

Check knock sensor for contamination, deterioration, or damage. Substitute with a known-good knock sensor and check for proper operation. If the problem is corrected, replace knock sensor and then go to "Verification of Vehicle Repair" procedure.

NO

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

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4. Is parameter displayed "History(Not Present) fault"?

YES

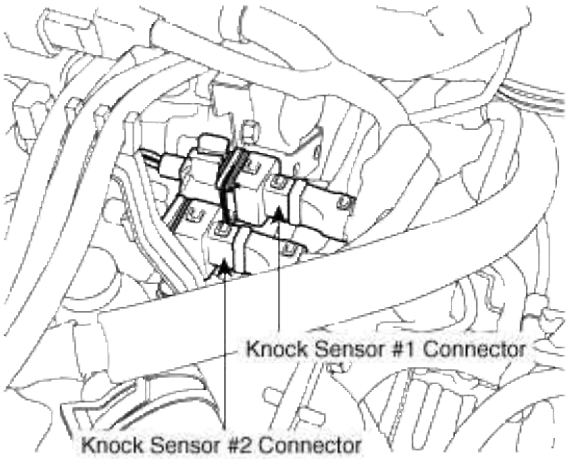
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0330

COMPONENT LOCATION



GENERAL DESCRIPTION

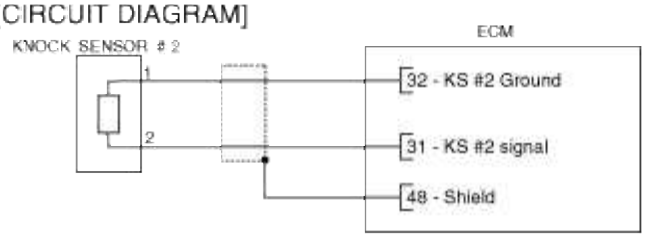
DTC DESCRIPTION

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range Check	• Open/short in signal or ground circuit • Contact resistance in connectors • Faulty knock sensor
Enable Conditions	• Knock control enabled • Engine speed >1800 rpm	
Threshold Value	• Mean value of sensor signal < 0.1V	
Diagnostic Time	• 10*720 crank angle	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

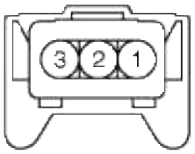
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

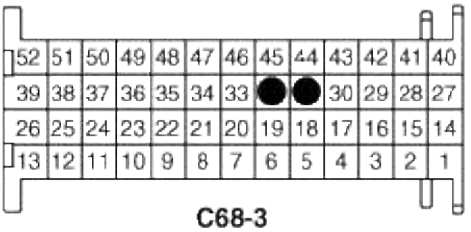
Terminal	Connected to	Function
1	ECM Terminal C68-3(32)	Sensor Ground
2	ECM Terminal C68-3(31)	Sensor Signal

[HARNESS CONNECTORS]



C77

IG Coil Harness side connector



C68-3

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

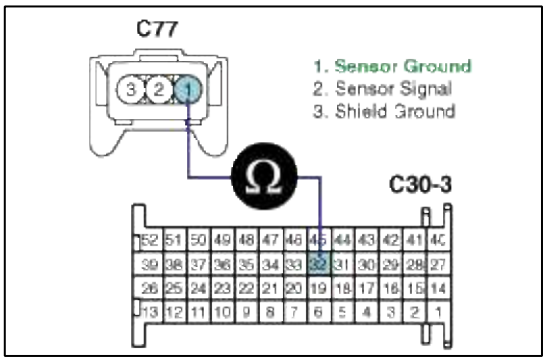
NO

Go to "Ground Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect Knock sensor connector.
3. Measure resistance between terminals 1 of the sensor harness connector and 32 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



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4. Is resistance within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Check for an open in the ground circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

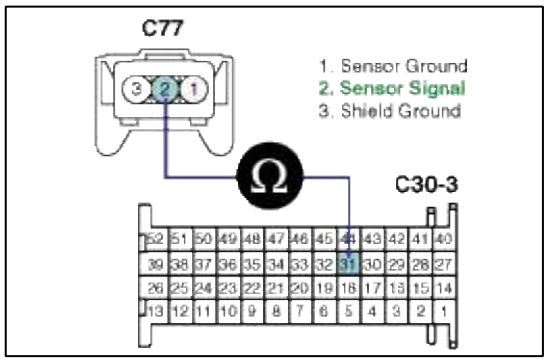
SIGNAL CIRCUIT INSPECTION

1. Check for open in signal harness.

(1) Ignition "OFF".

(2) Measure resistance between terminals 2 of the sensor harness connector and 31 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



(3) Is resistance within the specification?

YES

Go to next step as below

NO

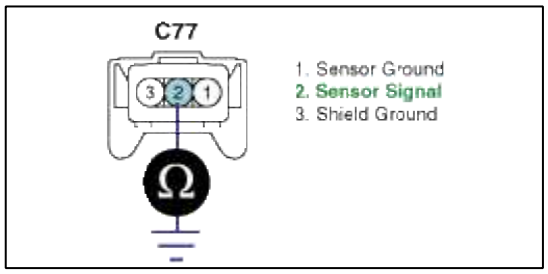
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

(1) Ignition "OFF"

(2) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

Specification : Infinite



(3) Is resistance within the specification?

YES

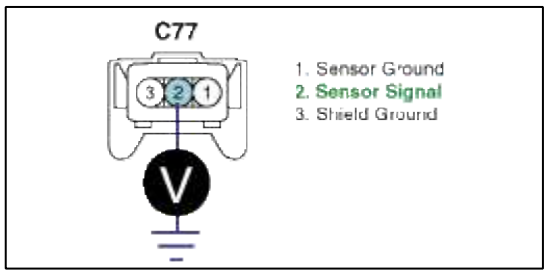
Go to next step as below

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in signal harness.
   (1) Ignition "OFF"
   (2) Disconnect ECM connector
   (3) Ignition "ON" & Engine "OFF"
   (4) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

   Specification : Approx. 0V



   (5) Is voltage within the specification?

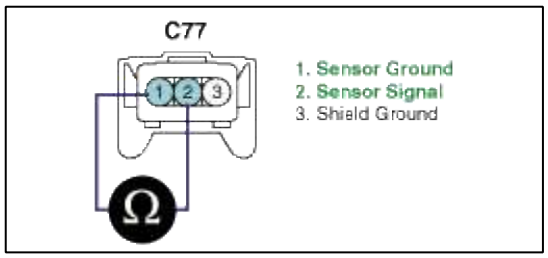
   YES
   Go to "Component Inspection" procedure

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Component resistance inspection.
   (1) Ignition "OFF"
   (2) Disconnect knock sensor connector
   (3) Measure resistance between terminals 1 and 2 of the sensor connector(Component side).

   Specification : Approx. 5MΩ at 20°C(68°F)



2. Output signal inspection
   (1) Remove knock sensor from vehicle and secure (across mounting boss) in a shop vise.
   (2) Set up an oscilloscope as follows :
   Channel A (+): terminal 2 (-): terminal 1
   (3) Rap on vise with a ball peen hammer while monitoring oscilloscope screen (there should be a spike of less than 1 volt with each hammer strike).

   Specification : knock sensor send a voltage spike with hammer strikes

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3. Installation torque inspection.
   (1) Check the installation torque of the knock sensor.

   Specification : Approx. 16.7 ~ 25.5 N·m(1.7 ~ 2.6 kgf·m, 12.3 ~ 18.8 lb·ft)

4. Has a problem been found?

YES

Check knock sensor for contamination, deterioration, or damage. Substitute with a known-good knock sensor and check for proper operation. If the problem is corrected, replace knock sensor and then go to "Verification of Vehicle Repair" procedure.

NO

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

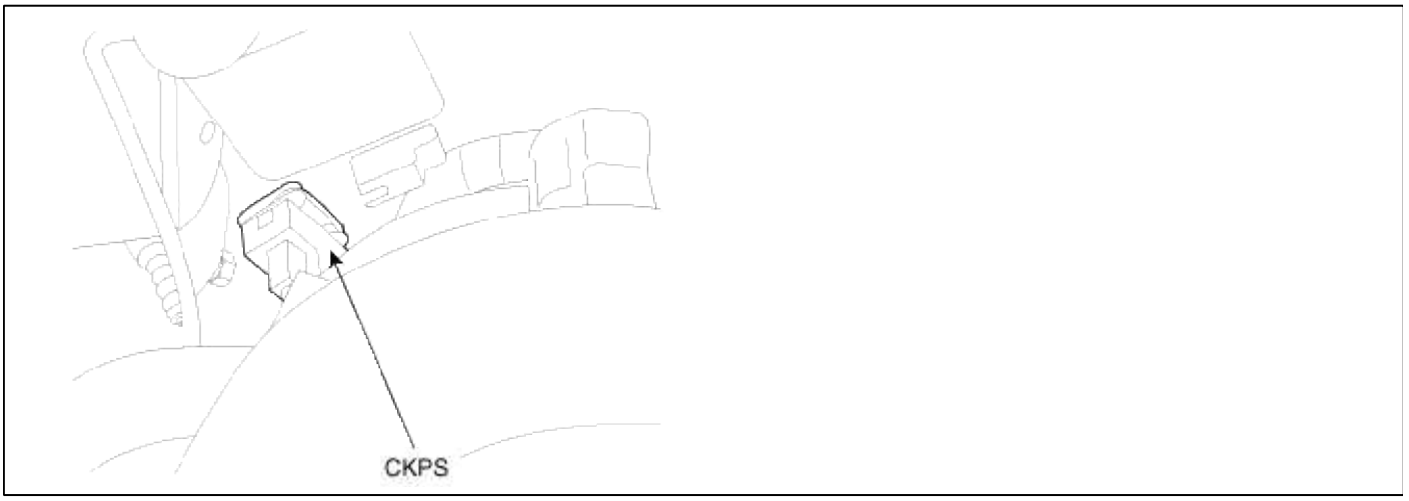
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0335

COMPONENT LOCATION



GENERAL DESCRIPTION

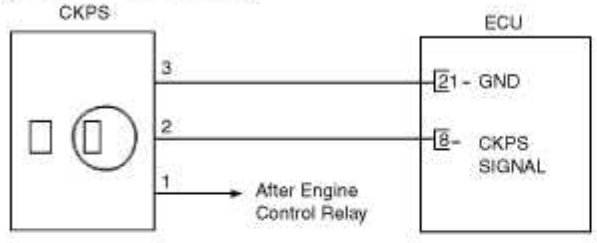
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION		POSSIBLE CAUSE
DTC Strategy	• Check Crankshaft Signal Switching		• Open or short in signal, ground or power supply circuit • Contact resistance in connectors • Damage to the connecting flange/flywheel • Misadjust crankshaft and camshaft pulley position • Faulty CKP sensor
Case 1	Enable Conditions	• Before Synchronization	
	Threshold Value	• Valid Crankshaft Teeth not yet detected with Camshaft Signal • Can not detect TDC with valid Crankshaft Teeth and Camshaft Signal	
	Diagnosis Time	• 4 revolutions	
Case2	Enable Conditions	• After Synchronization	
	Threshold Value	• Number of Crankshaft Tooth is not correct	
	Diagnosis Time	• 5 revolutions	
MIL On Condition		• 2 Driving Cycles	

SCHEMATIC DIAGRAM

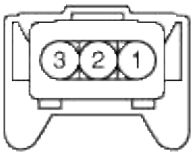
[CIRCUIT DIAGRAM]



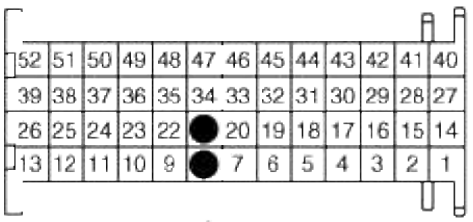
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Engine Control Relay	Battery Voltage
2	ECM Terminal C68-3(8)	CKPS signal
3	ECM Terminal C68-3(21)	Sensor ground

[HARNESS CONNECTORS]



C62
CKPS Harness side connector



C68-3
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions

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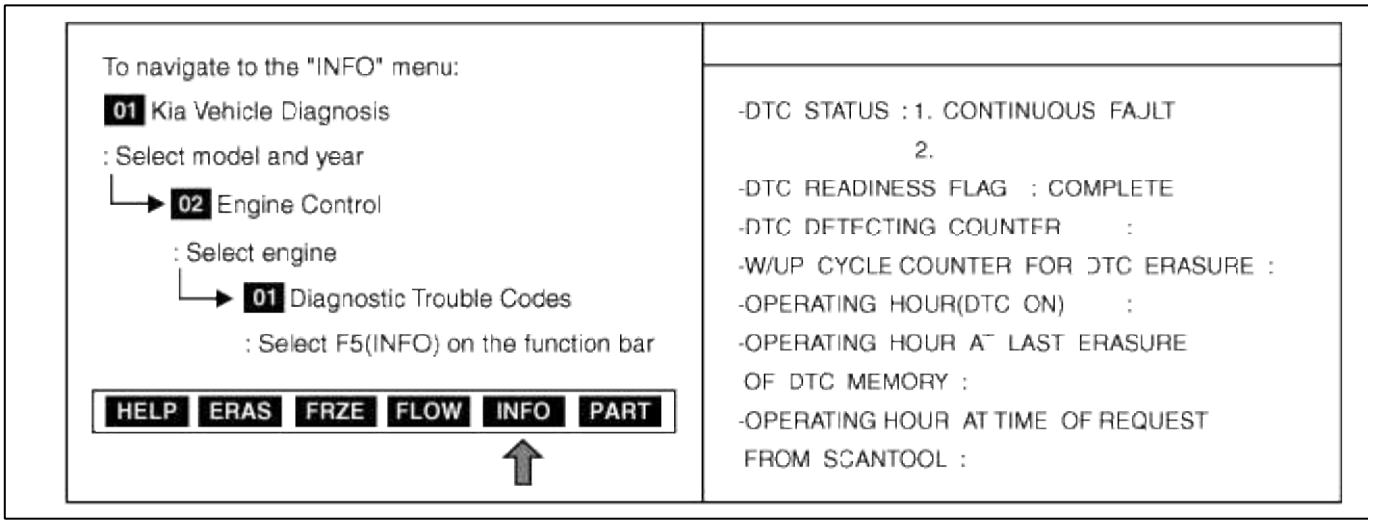
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

A. History (Not Present) fault : DTC occurred but has been cleared.

B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

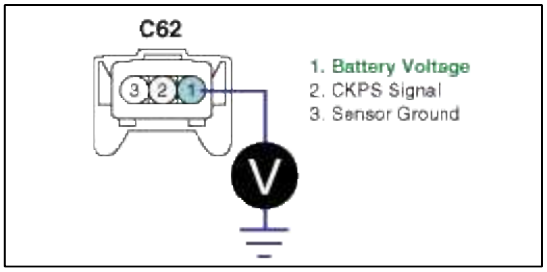
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect CKP sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Ground Circuit Inspection" procedure

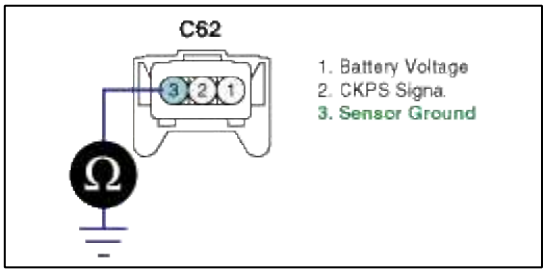
NO

Check for a open in the power supply circuit between the main relay and the crankshaft position sensor, Especially check for open or blown 10A sensor fuse refer to "Component Circuit".
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Measure resistance between terminals 3 of the sensor harness connector and chassis ground.

Specification : Approx. 0Ω



3. Is resistance within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

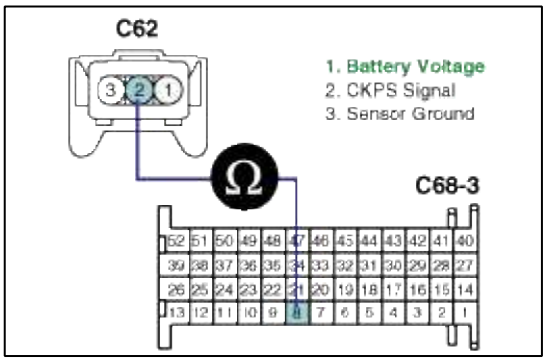
NO

Check for an open in the ground circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the sensor harness connector and 8 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

Go to next step as below

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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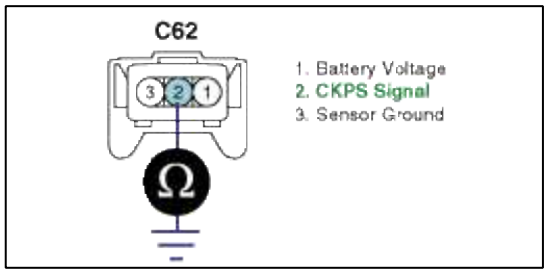
2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

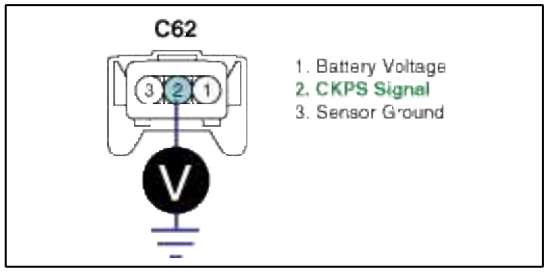
   Go to next step as below

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in signal harness.
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure

   NO

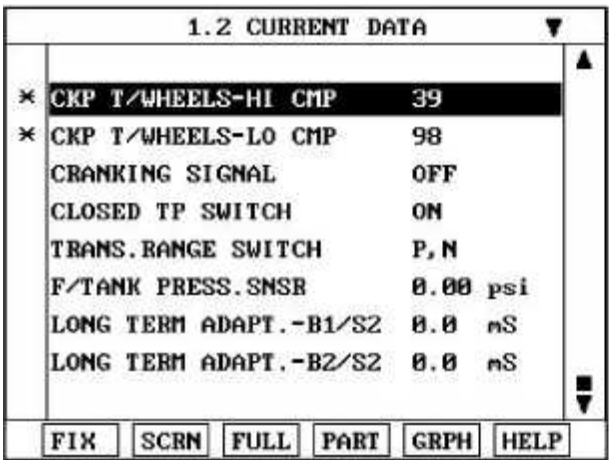
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Start engine and let vehicle idle
2. Connect scantool and select "Current Data" mode

3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification :
"CKP T/WHEELS-LO CMP" : 38 +/- 4 tooth
"CKP T/WHEELS-HI CMP" : 98 +/- 4 tooth



4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure .

NO

A. Remove CKP and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

NOTE

Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from hosing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A"

B. If fail to synchronize with CMP sensor, readjust timing system and go to next step.
Check CKP sensor for contamination, deterioration, or damage. Substitute with a known-good CKP sensor and check for proper operation. If the problem is corrected, replace CKP sensor 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

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SINGAL WAVEFORM

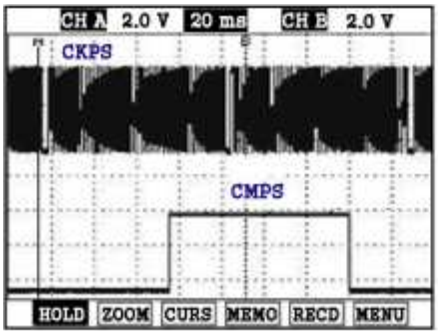


Fig. 1

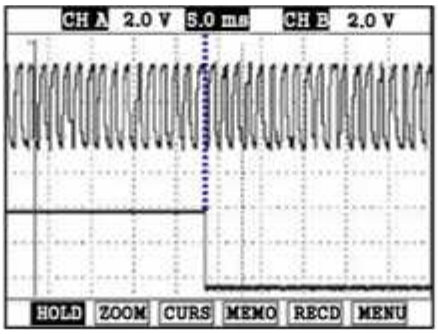


Fig. 2

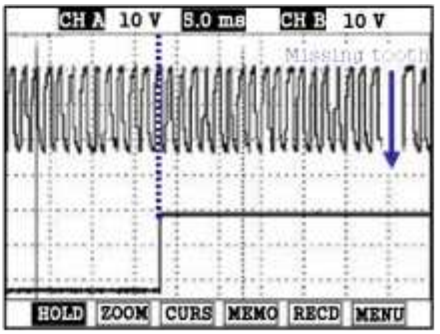
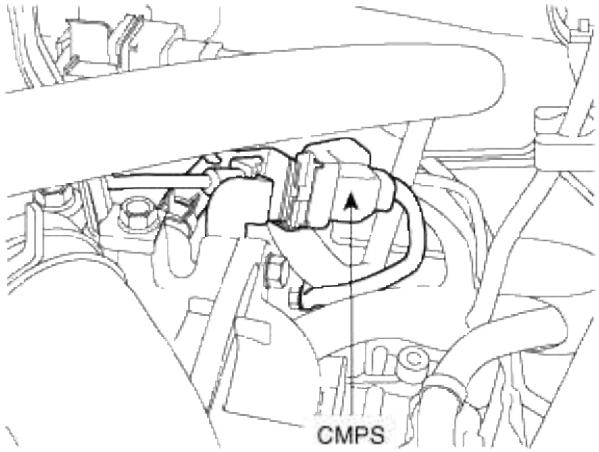


Fig. 3

Fig 1) Normal wave form with idle : The square wave signal should be smooth and without any distortion
Fig 2,3) Normal wave form with engine running : The CMP falling(rising) edge is coincided with 38+/-4 tooth of the CKP from one longer signal(missing tooth)

Fuel System > Troubleshooting > P0340

COMPONENT LOCATION



GENERAL DESCRIPTION

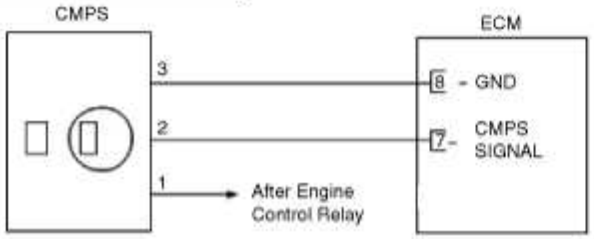
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check camshaft signal switching	• Open or short in signal, ground or power supply circuit • Contact resistance in connectors • Misadjust crankshaft and camshaft pulley position • Faulty CMP sensor
Enable Conditions	• No Crankshaft Position Sensor signal error	
Threshold Value	• No signal switching	
Diagnostic Time	• 80 revolutions	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

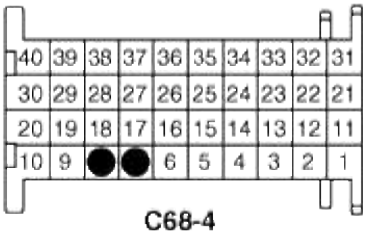


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Eng ne Control Relay	Battery Voltage
2	ECM Terminal C68-4(7)	CMPS signal
3	ECM Terminal C68-4(8)	Sensor ground

[HARNESS CONNECTORS]

C90
CMPS Harness side connector



C68-4
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.

To navigate to the "INFO" menu:

01 Kia Vehicle Diagnosis

: Select model and year

→ 02 Engine Control

: Select engine

→ 01 Diagnostic Trouble Codes

: Select F5(INFO) on the function bar

HELP ERAS FRZE FLOW INFO PART

-DTC STATUS : 1. CONTINUOUS FAJLT

2.

-DTC READINESS FLAG : COMPLETE

-DTC DETECTING COUNTER :

-W/UP CYCLE COUNTER FOR DTC ERASURE :

-OPERATING HOUR(DTC ON) :

-OPERATING HOUR A˜ LAST ERASURE OF DTC MEMORY :

-OPERATING HOUR AT TIME OF REQUEST FROM SCANTOOL :

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5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

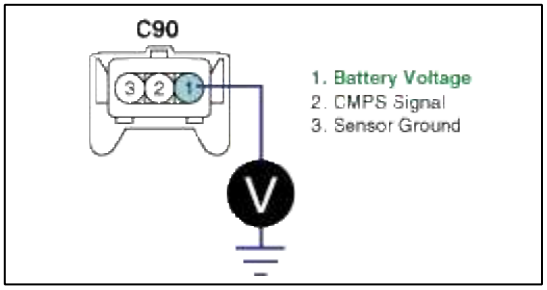
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect CMP sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 1 of the sensor harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Ground Circuit Inspection" procedure

NO

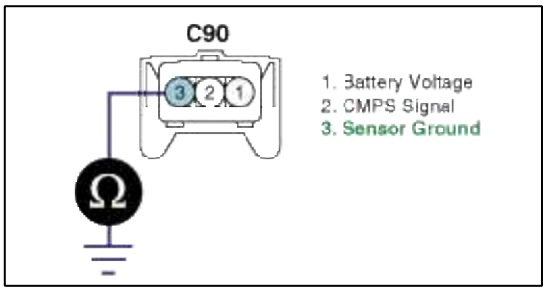
Check for a open in the power supply circuit between the main relay and the crankshaft position sensor, Especially check for open or blown 10A sensor fuse refer to "Component Circuit".
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".

2. Measure resistance between terminals 3 of the sensor harness connector and chassis ground.

Specification : Approx. 0Ω



3. Is resistance within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Check for an open or short to battery in the ground circuit.

Repair as necessary and go to "Verification of Vehicle Repair" procedure

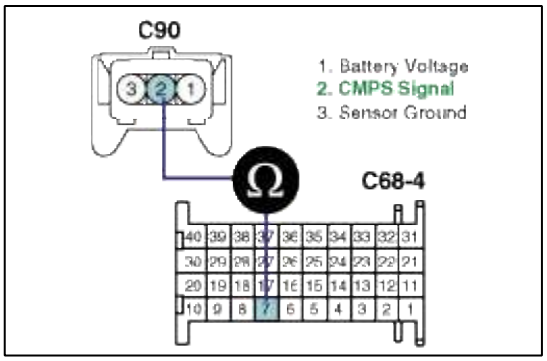
SIGNAL CIRCUIT INSPECTION

1. Check for open in signal harness.

(1) Disconnect ECM connector.

(2) Measure resistance between terminals 2 of the sensor harness connector and 7 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



(3) Is resistance within the specification?

YES

Go to next step as below

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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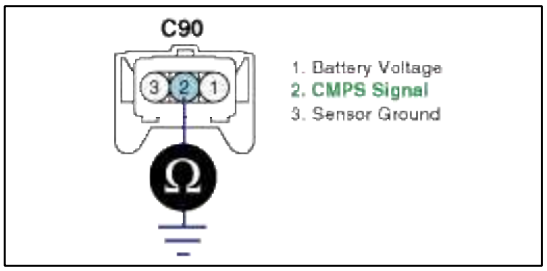
2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

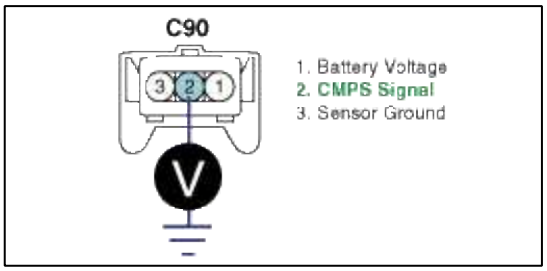
   Go to next step as below

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to power in signal harness.
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES

   Go to "Component Inspection" procedure

   NO

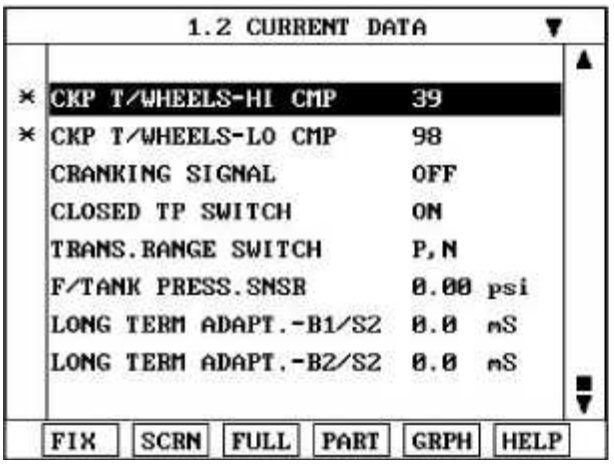
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Start engine and let vehicle idle
2. Connect scantool and select "Current Data" mode

3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification :
"CKP T/WHEELS-LO CMP" : 38 +/- 4 tooth
"CKP T/WHEELS-HI CMP" : 98 +/- 4 tooth



4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure .

NO

A. Remove CKP and calculate air gap.

B. If fail to synchronize with CMP sensor, readjust timing system and go to next step.

Check CMP sensor for contamination, deterioration, or damage. Substitute with a known-good CMP sensor and check for proper operation. If the problem is corrected, replace CMP sensor 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SINGAL WAVEFORM

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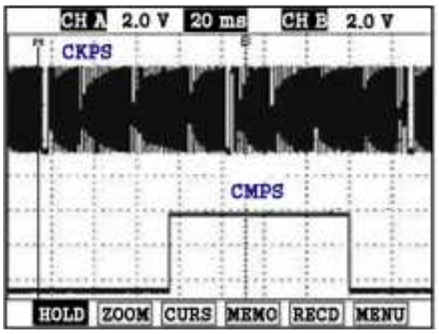


Fig. 1

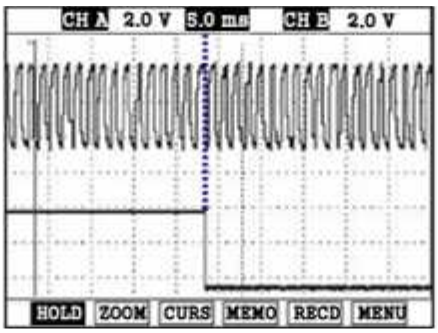


Fig. 2

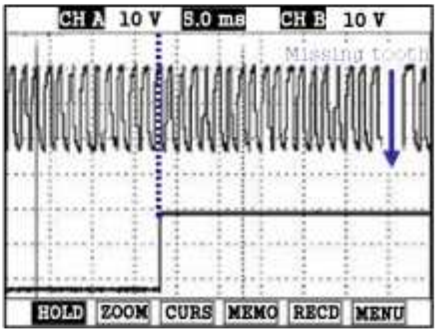
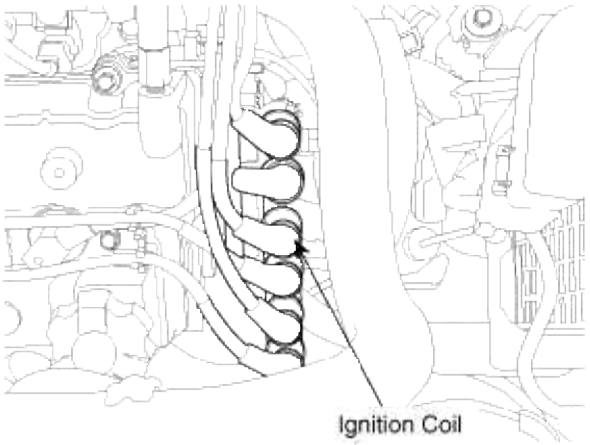


Fig. 3

Fig 1) Normal wave form with idle : The square wave signal should be smooth and without any distortion
Fig 2,3) Normal wave form with engine running : The CMP falling(rising) edge is coincided with 38+/-4 tooth of the CKP from one longer signal(missing tooth)

Fuel System > Troubleshooting > P0350

COMPONENT LOCATION



GENERAL DESCRIPTION

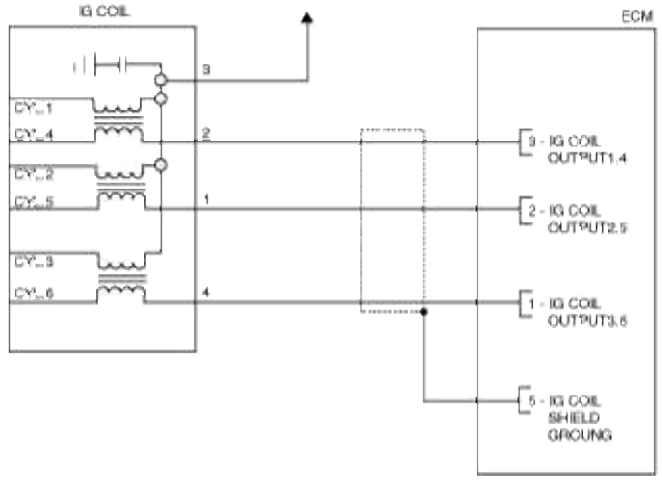
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
Enable Conditions	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Threshold Value	• Coolant temperature >75°C(167°F)	
Threshold Value	• Failure on 3 cylinder or more	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



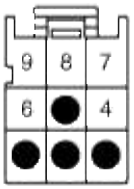
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

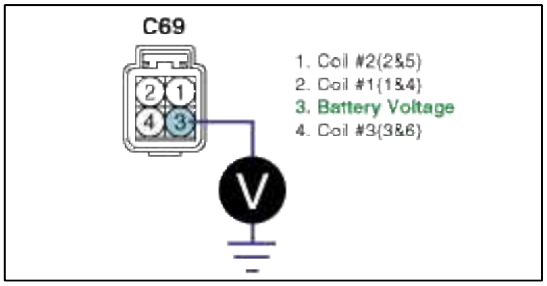
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+



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5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

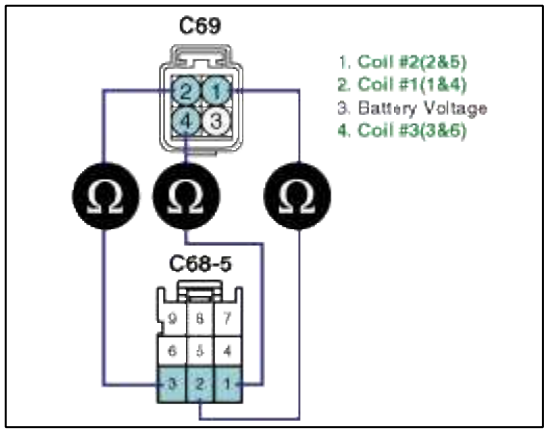
CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.

(1) Ignition "OFF".

(2) Measure resistance from each ignition coil control circuit to ECM.

Specification : Approx. 0Ω



(3) Is resistance within the specification?

YES

Go to next step as below.

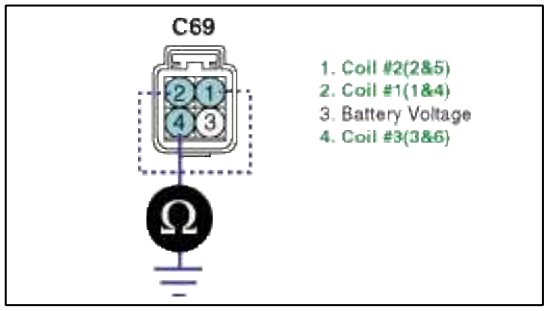
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

(1) Measure resistance from each ignition coil control circuit (4/C14, 1/C14, 2/C14) to chassis ground.

Specification : Infinite



(2) Is resistance within the specification?

YES

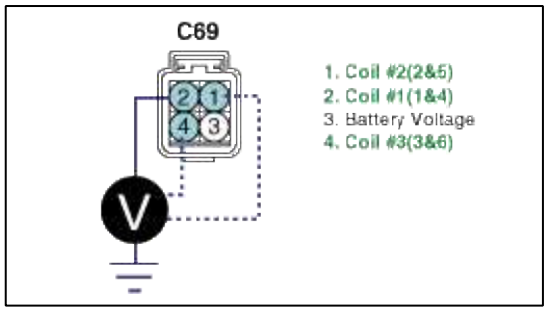
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage from each ignition coil control circuit (4/C14, 1/C14, 2/C14) to chassis ground.

Specification : Approx. 0V



   (4) Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

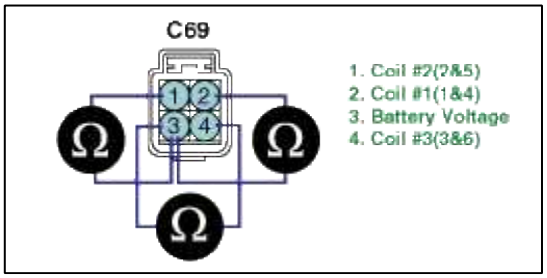
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.
4. Measure the resistance in each primary coil, referring to specification.(Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)
- No.1 & 4 cyl. : terminals 3 & 2
- No.2 & 5 cyl. : terminals 3 & 1
- No.3 & 6 cyl. : terminals 3 & 4



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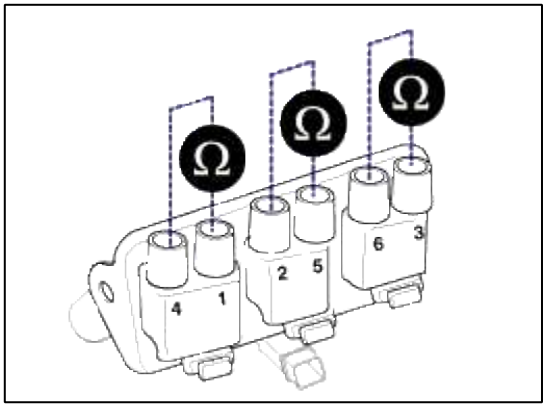
5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal for the No. 3 and No. 6 cylinders, between the high-voltage terminals for the No. 1 and No. 4 cylinders and between the high-voltage terminals for the No.2 and No.5 cylinders.

> CAUTION
>
> Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.
>
> Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

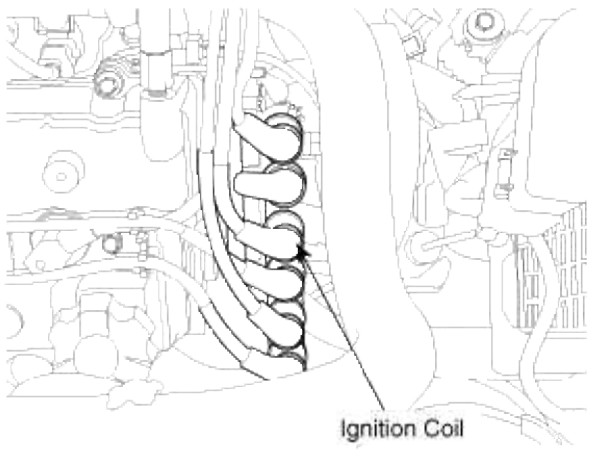
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Fuel System > Troubleshooting > P0351

COMPONENT LOCATION



GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
Enable Conditions	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Threshold Value	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

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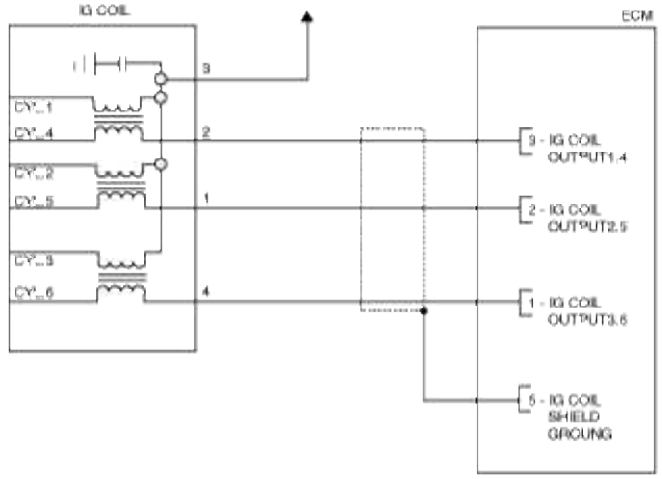
[CIRCUIT DIAGRAM]



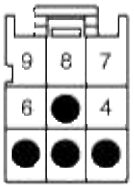
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

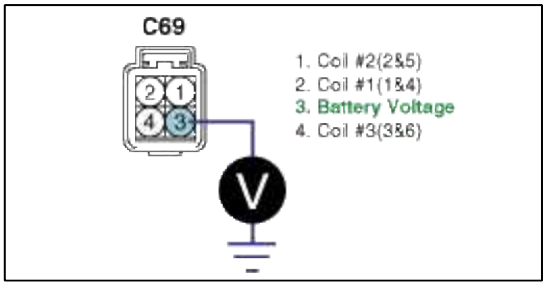
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

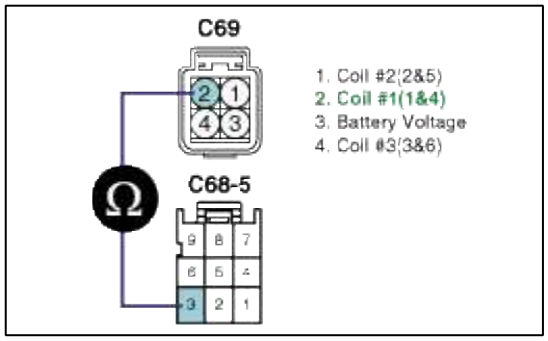
CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.

(1) Ignition "OFF".

(2) Measure resistance between terminals 2 of the coil harness connector and 3 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



(3) Is resistance within the specification?

YES

Go to next step as below.

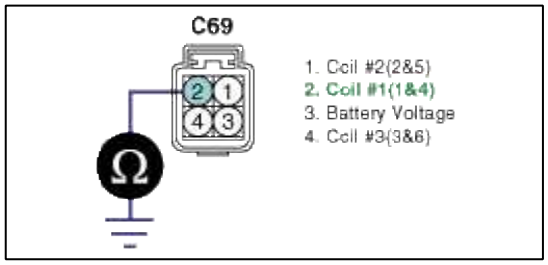
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

(1) Measure resistance between terminal 2 of the coil harness connector and chassis ground.

Specification : Infinite



(2) Is resistance within the specification?

YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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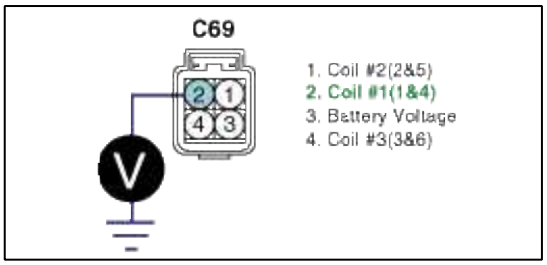
3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 2 of the coil harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is voltage within the specification?

YES

Go to next step as below.

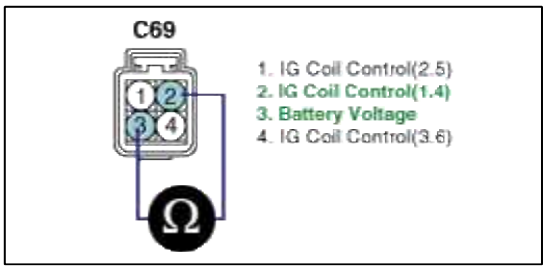
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

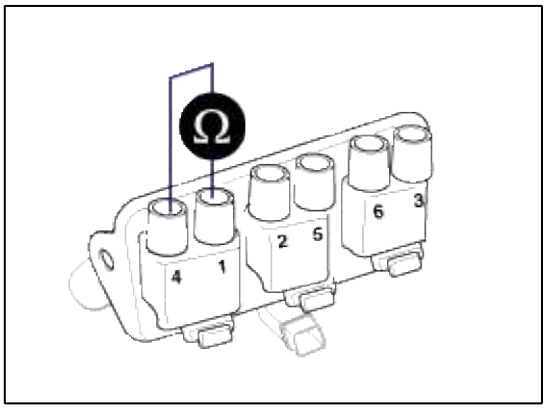
1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.
4. Measure the resistance between terminals 2 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)



5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal to following diagram.

> **CAUTION**
>
> Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.
>
> Specification : Approx. 13.3 ± 1.9 (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

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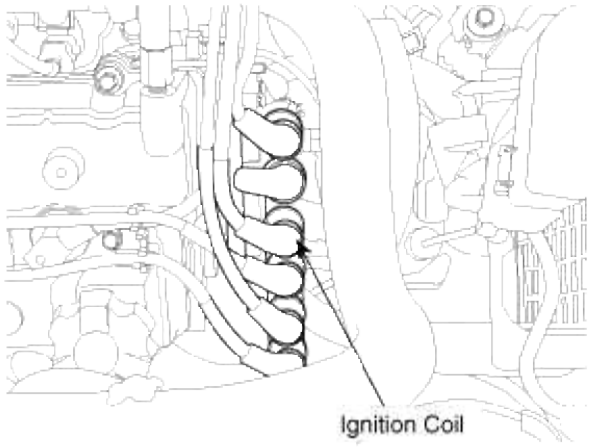
Fuel System > Troubleshooting > P0352

COMPONENT LOCATION



GENERAL DESCRIPTION

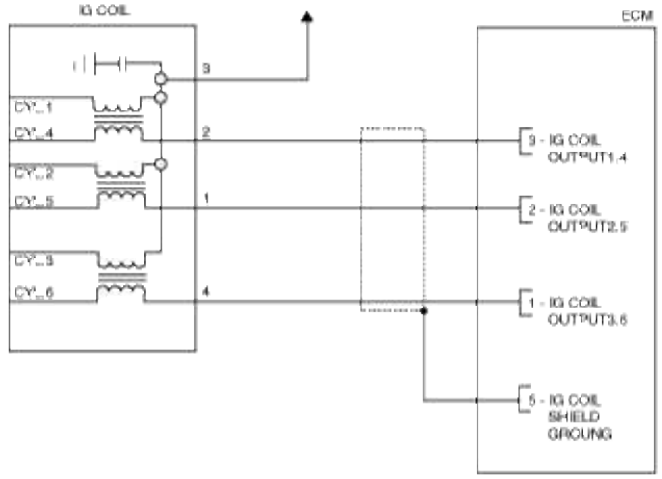
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
Enable Conditions	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Threshold Value	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



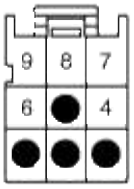
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

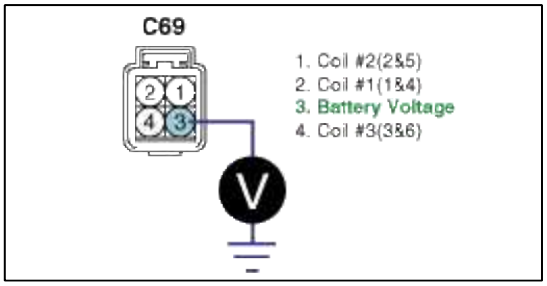
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the harness connector and chassis ground.

Specification : Approx. B+



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5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

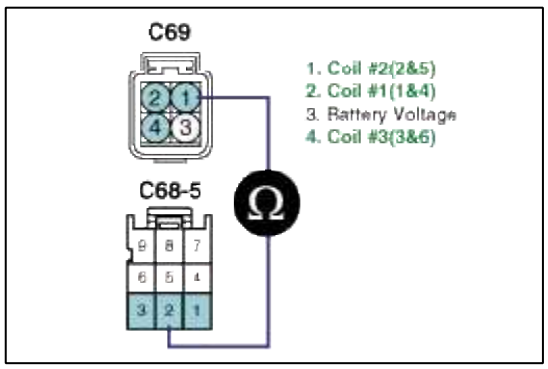
CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.

(1) Ignition "OFF".

(2) Measure resistance between terminals 1 of the coil harness connector and 2 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



(3) Is resistance within the specification?

YES

Go to next step as below.

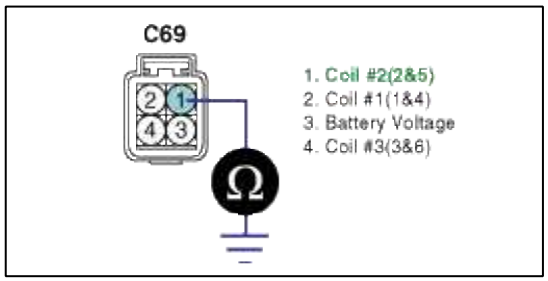
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

(1) Measure resistance between terminal 1 of the coil harness connector and chassis ground.

Specification : Infinite



(2) Is resistance within the specification?

YES

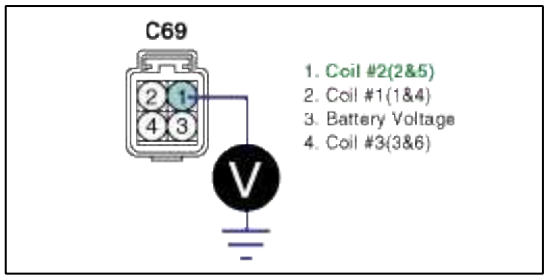
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 1 of the coil harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

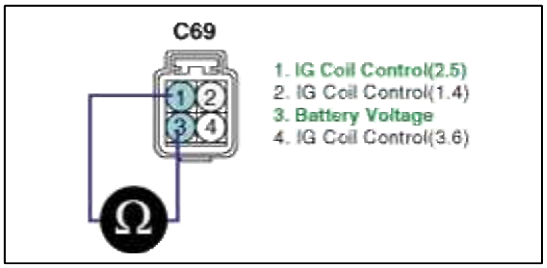
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.
4. Measure the resistance between terminals 1 and 3 of the primary ignition coil.(Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)



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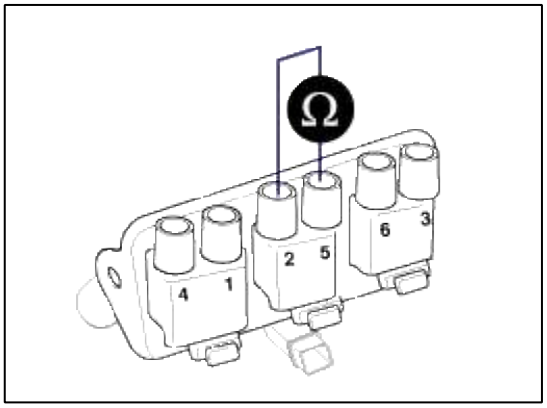
5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 13.3 ± 1.9 (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

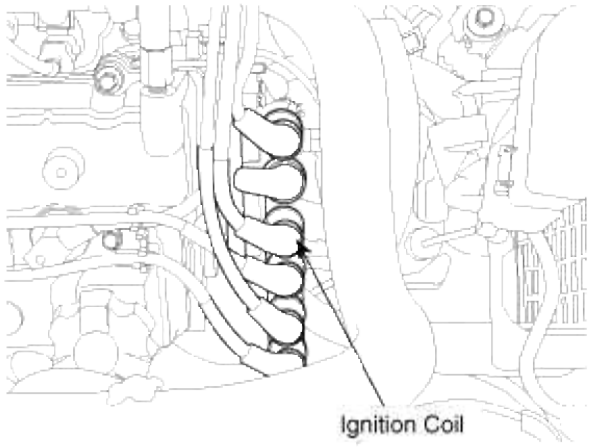
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx.12.5 ± 15% (kΩ)

Fuel System > Troubleshooting > P0353

COMPONENT LOCATION



GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Enable Conditions	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

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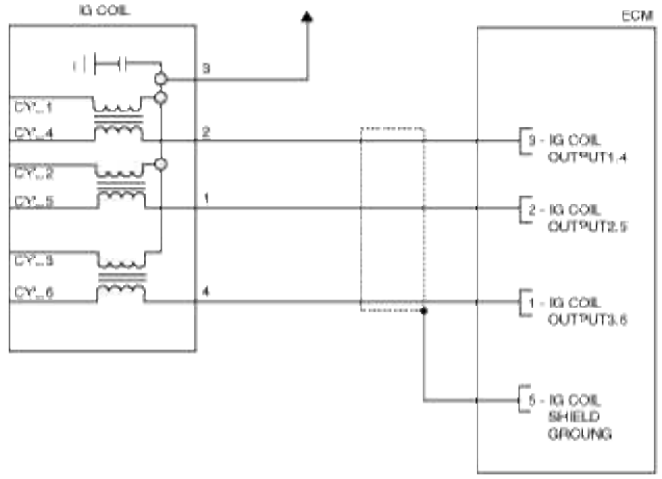
[CIRCUIT DIAGRAM]



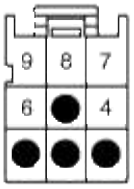
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

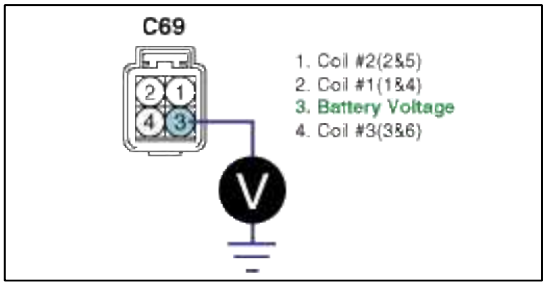
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the sensor harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

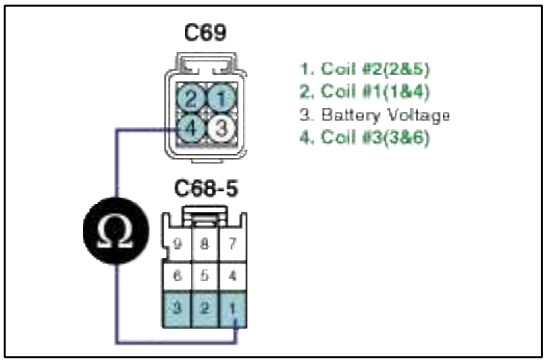
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 4 of the coil harness connector and 1 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

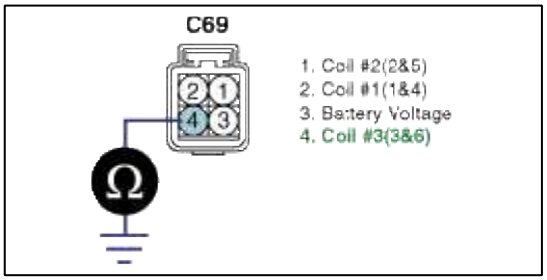
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 4 of the coil harness connector and chassis ground.

Specification : Infinite



   (2) Is resistance within the specification?

YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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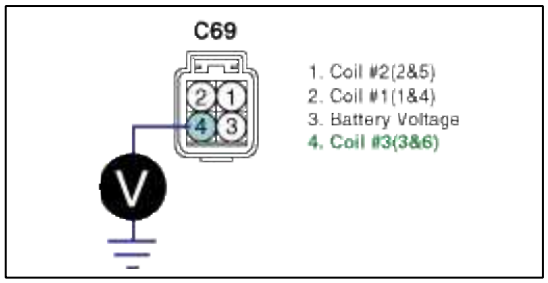
3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 4 of the coil harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

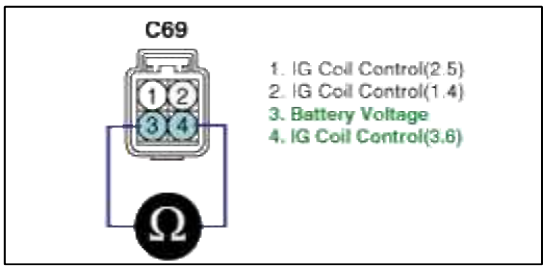
   YES
   Go to next step as below.

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.
4. Measure the resistance between terminals 4 and 3 of the primary ignition coil. (Component side)

   Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)

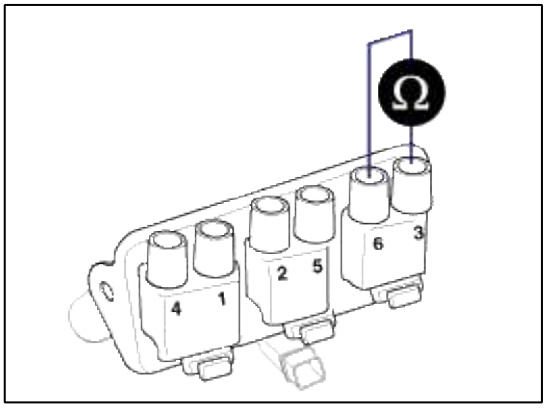


5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

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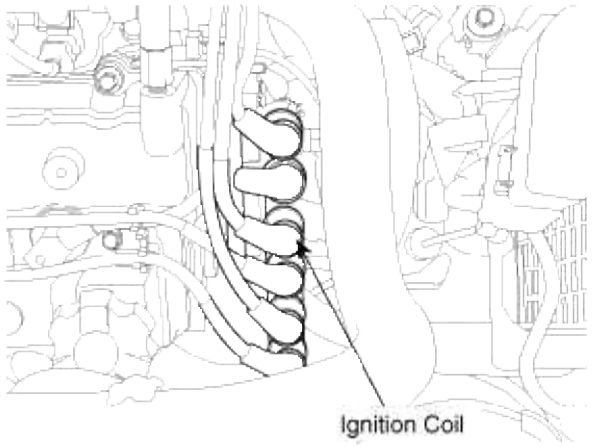
Fuel System > Troubleshooting > P0354

COMPONENT LOCATION



GENERAL DESCRIPTION

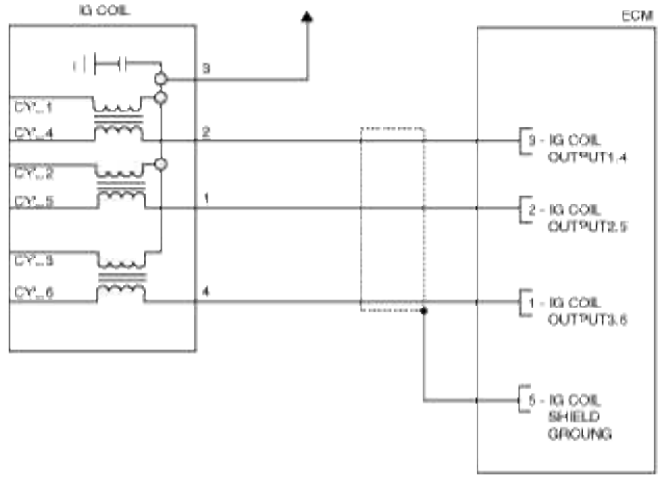
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Enable Conditions	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



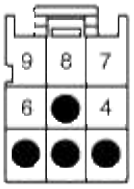
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

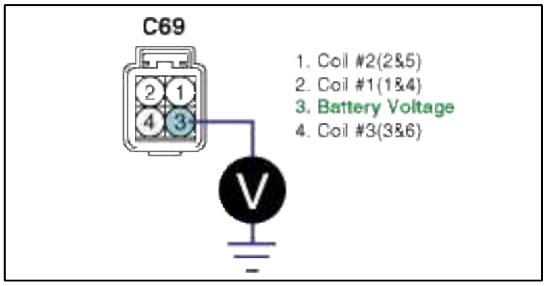
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+



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5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

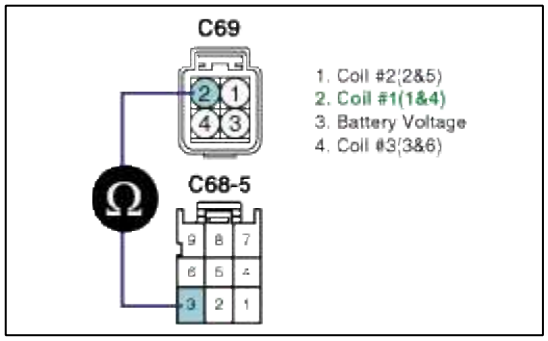
CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.

(1) Ignition "OFF".

(2) Measure resistance between terminals 2 of the coil harness connector and 3 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



(3) Is resistance within the specification?

YES

Go to next step as below.

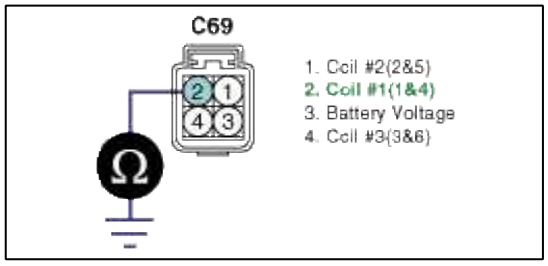
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

(1) Measure resistance between terminal 2 of the coil harness connector and chassis ground.

Specification : Infinite



(2) Is resistance within the specification?

YES

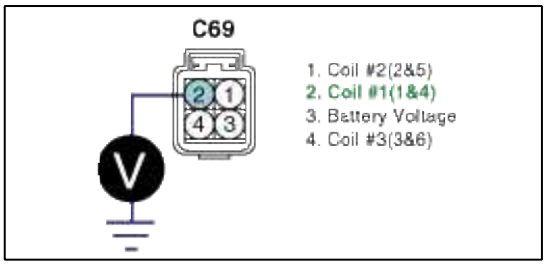
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 2 of the coil harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is voltage within the specification?

YES

Go to next step as below.

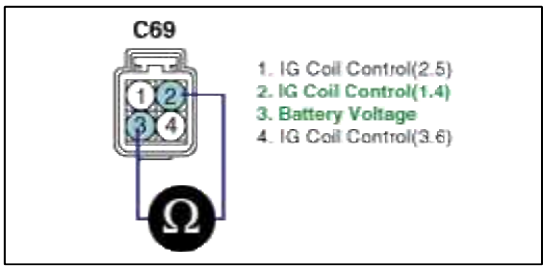
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.
4. Measure the resistance between terminals 2 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)



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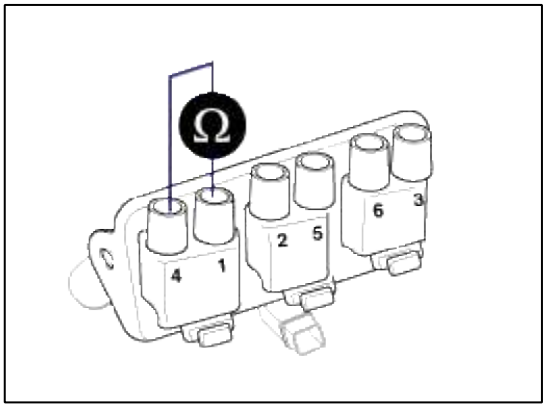
5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

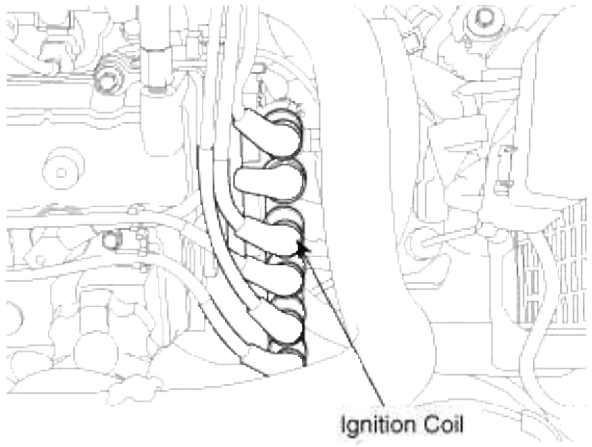
Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Fuel System > Troubleshooting > P0355

COMPONENT LOCATION



GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Enable Conditions	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

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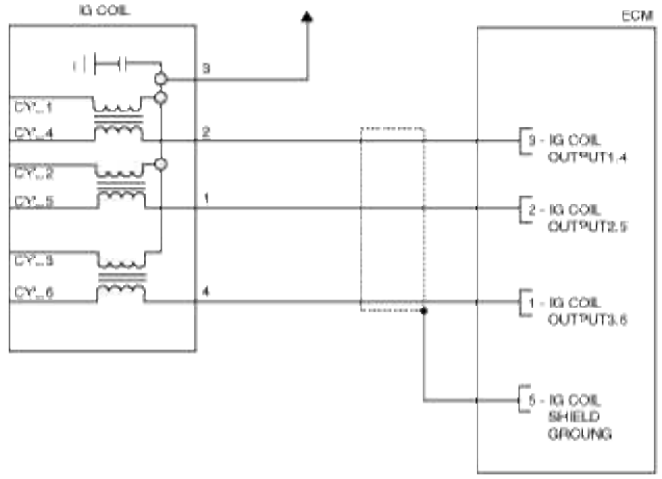
[CIRCUIT DIAGRAM]



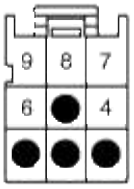
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

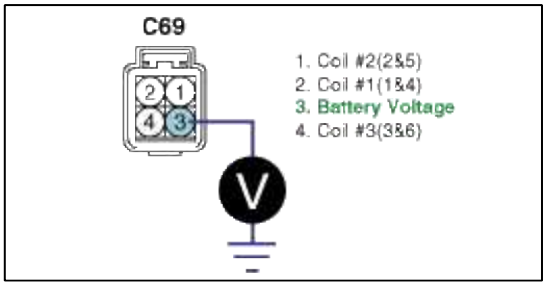
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

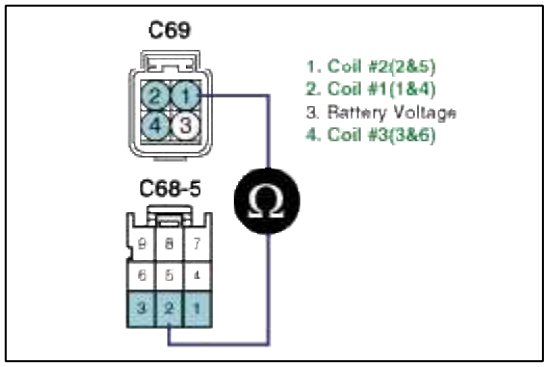
CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.

(1) Ignition "OFF".

(2) Measure resistance between terminals 1 of the coil harness connector and 2 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



(3) Is resistance within the specification?

YES

Go to next step as below.

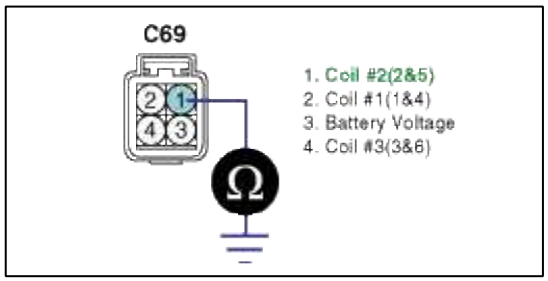
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.

(1) Measure resistance between terminal 1 of the coil harness connector and chassis ground.

Specification : Infinite



(2) Is resistance within the specification?

YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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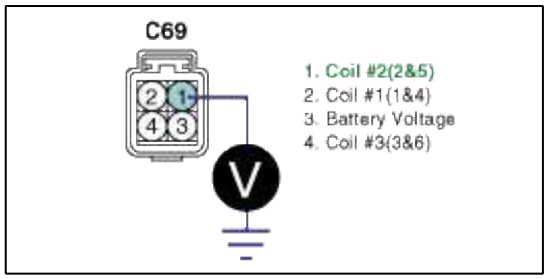
3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 1 of the coil harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is voltage within the specification?

YES

Go to next step as below.

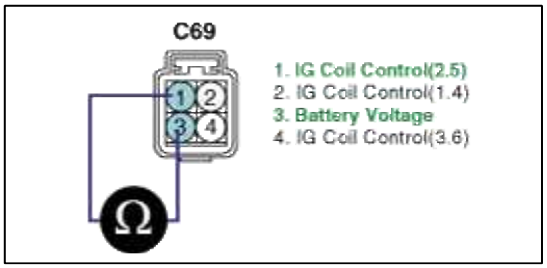
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.
4. Measure the resistance between terminals 1 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)

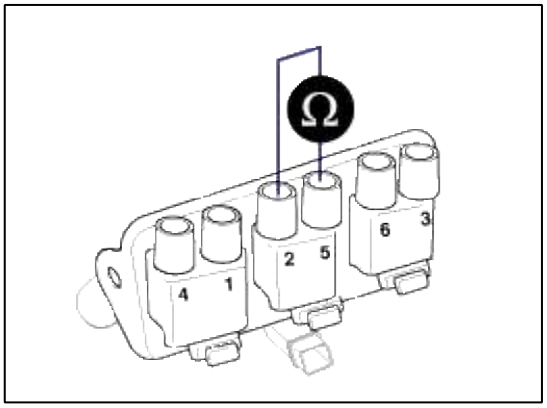


5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal referring to following diagram.

CAUTION

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

Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

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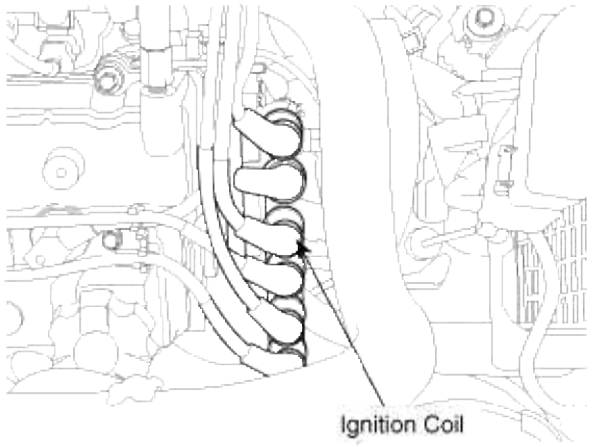
Fuel System > Troubleshooting > P0356

COMPONENT LOCATION



GENERAL DESCRIPTION

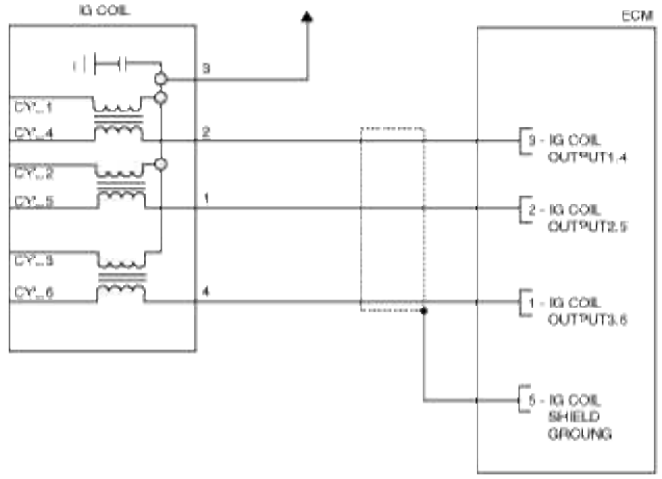
DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring ignition coil primary voltage	• Open or short in power supply circuit • Open or short in control circuit • Contact resistance in connectors • Faulty ignition coil
Enable Conditions	• Coolant temperature >75°C(167°F) • Over voltage duration depending on engine speed and air mass flow	
Threshold Value	• Over voltage duration = 0 • Over voltage duration < Threshold • Over voltage duration of each ignition output overlapping below 4500 rpm	
Diagnostic Time	• 255 revolutions	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



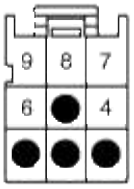
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-5(2)	IG Coil Control (2,5)
2	ECM Terminal C68-5(3)	IG Coil Control (1,4)
3	Engine Control Relay	Battery Voltage
4	ECM Terminal C68-5(1)	IG Coil Control (3,6)

[HARNESS CONNECTORS]

C69

IG Coil Harness side connector



C68-5

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

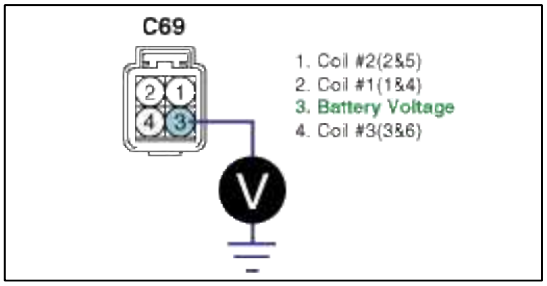
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification : Approx. B+



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5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure

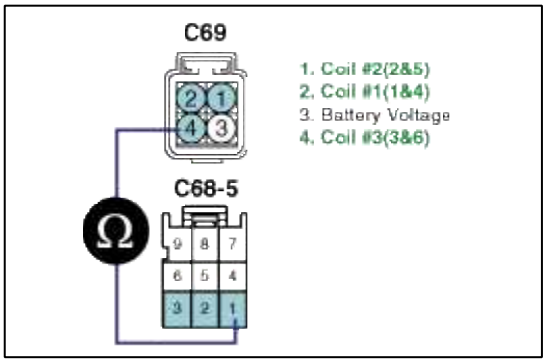
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for open in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 4 of the coil harness connector and 1 of the ECM harness connector(C68-5).

Specification : Approx. 0Ω



   (3) Is resistance within the specification?

YES

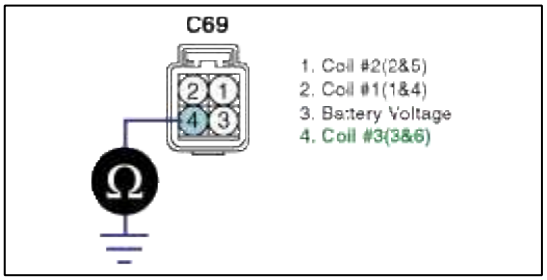
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal harness.
   (1) Measure resistance between terminal 4 of the coil harness connector and chassis ground.

Specification : Infinite



   (2) Is resistance within the specification?

YES

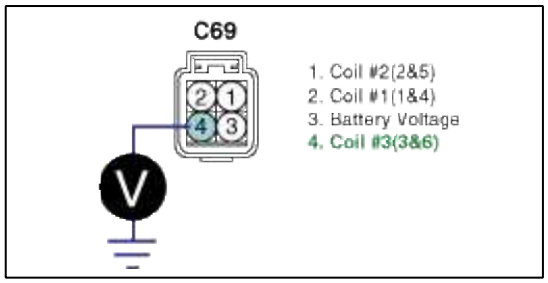
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in signal harness.
   (1) Disconnect ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 4 of the coil harness connector and chassis ground.

Specification : Approx. 0V



   (4) Is voltage within the specification?

YES

Go to next step as below.

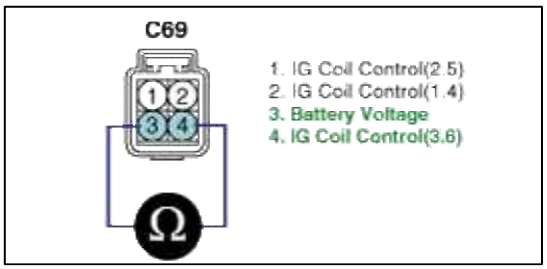
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

IGNITION COIL INSPECTION

1. Ignition "OFF".
2. Disconnect ignition coil connector.
3. Visually/physically inspect the following items:
   A. Damage, cracks and flashover.
4. Measure the resistance between terminals 4 and 3 of the primary ignition coil. (Component side)

Specification : Approx. 0.96 ± 10% (Ω) at 20°C(68°F)



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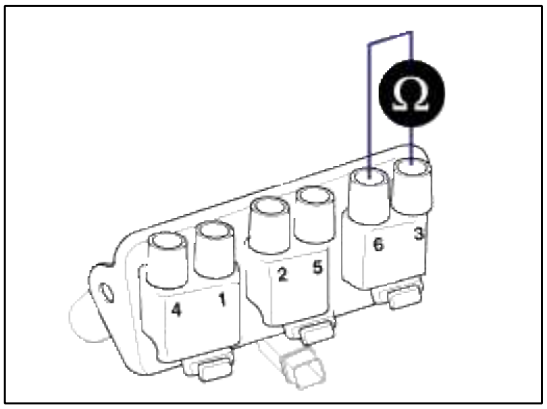
5. Measure the secondary coil resistance.
   Measure the resistance between the high-voltage terminal referring to following diagram.

> CAUTION
>
> Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.
>
> Specification : Approx. 12.5 ± 15% (kΩ) at 20°C(68°F)



6. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure.

NO

Check ignition coil for contamination, deterioration, or damage. Substitute with a known-good ignition coil and check for proper operation. If the problem is corrected, replace ignition coil 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Ignition Coil	Normal Parameter at 20°C (68°F)
Resistance (Primary)	Approx. 0.96 ± 10% (Ω)
Resistance (Secondary)	Approx. 12.5 ± 15% (kΩ)

Fuel System > Troubleshooting > P0420

COMPONENT LOCATION

GENERAL DESCRIPTION

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO2S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front. The output voltage of the rear HO2S copies the voltage of the front HO2S.To monitor the system, the lean-to-rich switches of the front HO2S to the rear HO2S is counted. The ratio of rear switches to front switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer rear switches than front switches, that is, a ratio closer to zero.

DTC DESCRIPTION

The ECM calculates oscillation size of rear HO2S signal which represents catalyst conversion properties. This oscillation size will determine if catalyst conversion is low due to aging or poisoning from leaded fuel or misfiring. The ECM sets P0420 if the average of calculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold.

DTC DETECTING CONDITION

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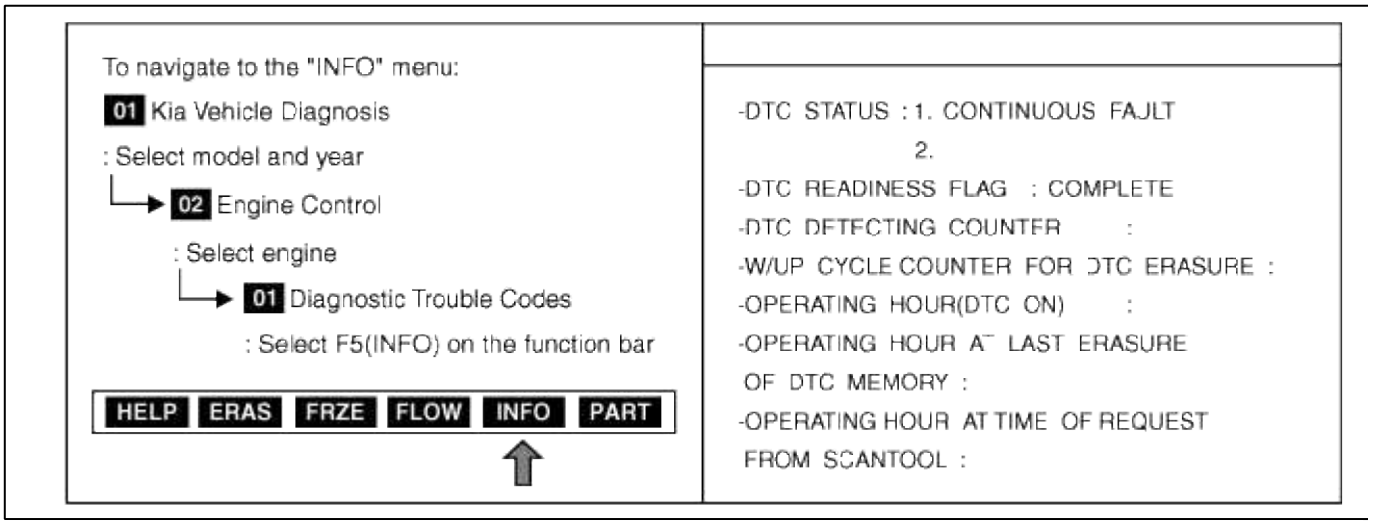
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of the signal ratio of upstream and downstream O2 sensor in a load and speed range	• Exhaust gas leaks • Rear HO2S malfunction • Three way catalyst converter malfunction
Enable Conditions	• 400(752°F)< Catalyst model temperature <600°C(1112°F) • Coolant temperature >70°C(158) • Lambda control within limit • 800rpm< Engine speed < 2500rpm • Air mass flow <250 mg/stk • No misfire is detected • Not transient condition	
Threshold Value	• Averaged malfunction index > 0.7	
Diagnostic Time	• 120 lambda controller cycles	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

EXHAUST SYSTEM INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   A. Exhaust system between HO2S and Three way catalyst for air leakage
   B. Damage, and for loose or missing hardware.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Rear HO2S Inspection " procedure.

REAR HO2S INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   A. Ensure that the HO2S is securely installed.(Pigtail and wiring harness not making contact with the exhaust pipe)
   B. Check for corrosion on terminals.
   C. Check for terminal tension. (at the HO2S and at the ECM)
   D. Any road damage.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "TWC Inspection " procedure

TWC INSPECTION

1. Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
   A. Severe discoloration caused by excessive temperature.
   B. Dents and holes.
   C. Internal rattle caused by a damaged catalyst.
2. Also, ensure that the TWC is a proper original equipment manufacturer part.
3. Was a problem found?

YES

Replace TWC and go to "Verification of Vehicle Repair" procedure.

NO

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

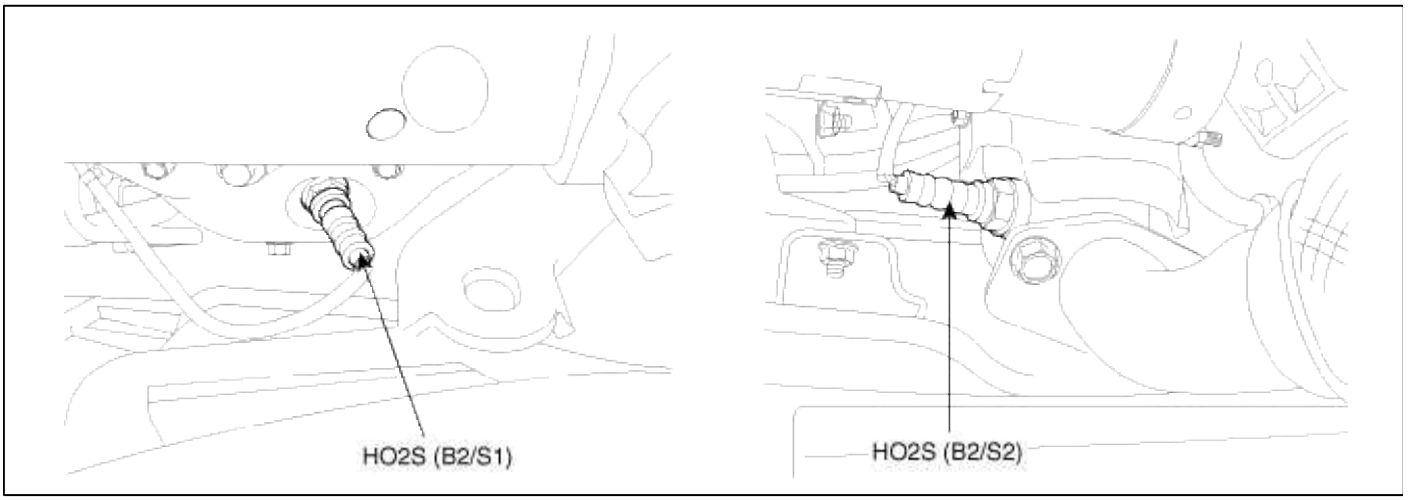
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0430

COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO2S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front. The output voltage of the rear HO2S copies the voltage of the front HO2S.To monitor the system, the lean-to-rich switches of the front HO2S to the rear HO2S is counted. The ratio of rear switches to front switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer rear switches than front switches, that is, a ratio closer to zero.

DTC DESCRIPTION

The ECM calculates oscillation size of rear HO2S signal which represents catalyst conversion properties. This oscillation size will determine if catalyst conversion is low due to aging or poisoning from leaded fuel or misfiring. The ECM sets P0430 if the average of calculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold.

DTC DETECTING CONDITION

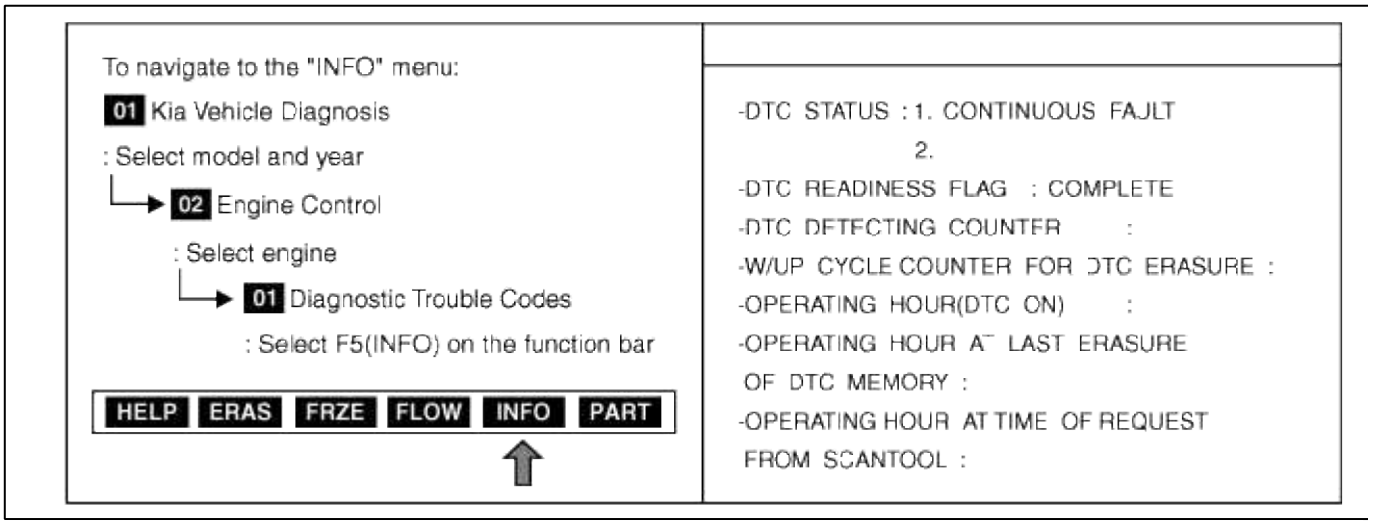
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of the signal ratio of upstream and downstream O2 sensor in a load and speed range	• Exhaust gas leaks • Rear HO2S malfunction • Three way catalyst converter malfunction
Enable Conditions	• 400(752°F)< Catalyst model temperature <600°C(1112°F) • Coolant temperature >70°C(158) • Lambda control within limit • 800rpm< Engine speed < 2500rpm • Air mass flow <250 mg/stk • No misfire is detected • Not transient condition	
Threshold Value	• Averaged malfunction index > 0.7	
Diagnostic Time	• 120 lambda controller cycles	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

NOTE

If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



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5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

EXHAUST SYSTEM INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   A. Exhaust system between HO2S and Three way catalyst for air leakage
   B. Damage, and for loose or missing hardware.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Rear HO2S Inspection " procedure.

REAR HO2S INSPECTION

1. Visually/physically inspect the rear HO2S for the following conditions:
   A. Ensure that the HO2S is securely installed.(Pigtail and wiring harness not making contact with the exhaust pipe)
   B. Check for corrosion on terminals.
   C. Check for terminal tension. (at the HO2S and at the ECM)
   D. Any road damage.
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "TWC Inspection " procedure

TWC INSPECTION

1. Visually/physically inspect the three-way catalyst(TWC) converter for the following damage:
   A. Severe discoloration caused by excessive temperature.
   B. Dents and holes.
   C. Internal rattle caused by a damaged catalyst.
2. Also, ensure that the TWC is a proper original equipment manufacturer part.
3. Was a problem found?

YES

Replace TWC and go to "Verification of Vehicle Repair" procedure.

NO

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

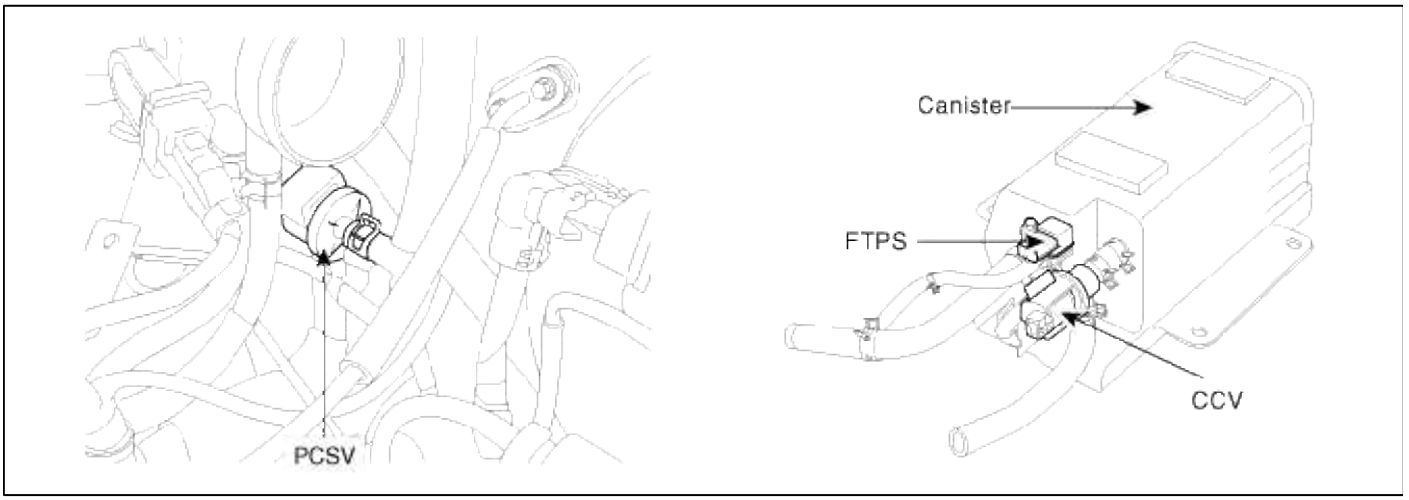
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0441

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustlon. This valve is actuated by the purge control signal from the ECM and controls fuel vapor from the canister to the intake manifold.

DTC DESCRIPTION

During "test of vapour generation" a new value from the tank pressure sensor is measured and compared with the start pressure at beginning of "test of vapour generation".
The ECM sets DTC P0441 if the pressure signal decrease occurs and the difference is below the predetermined threshold. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

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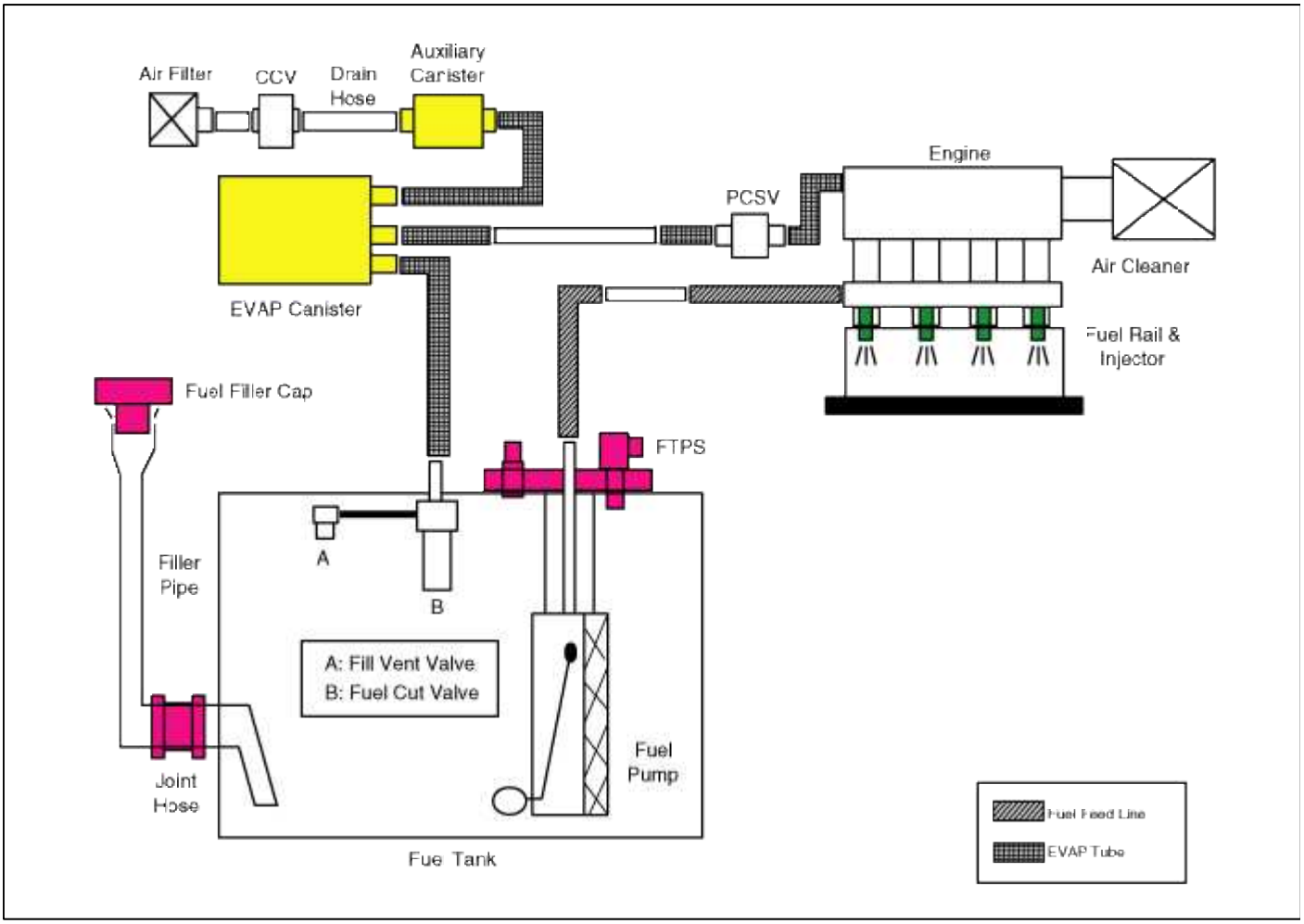
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor(DTP) signal with underpressure	• Leakage on hose to PCSV • Faulty PCSV
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Pressure fluctuation in fuel tank < -2hPa during vapor generation period	
Diagnostic Time	• 10 sec. In idle	
Fall Safe	• EVAP. System monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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. Check the following conditions:
   (1) Check for damaged harness and terminals: contact resistance, oxidation, bent or broken terminals.
   (2) Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks and poor terminal to wire connection.

> NOTE
>
> Using a suitable male pin to ensure that contact in sockets is good. The pin should remain in position when pulled gently.

   (3) Is a problem found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

> NOTE
>
> EVAP. Leakage Test enable conditions
> - Following conditions must be fulfilled to start the test.
>
> 1. Engine warm up at Idle Status
> 2. No relevant DTC
> 3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Fuel System > Troubleshooting > P0442

COMPONENT LOCATION

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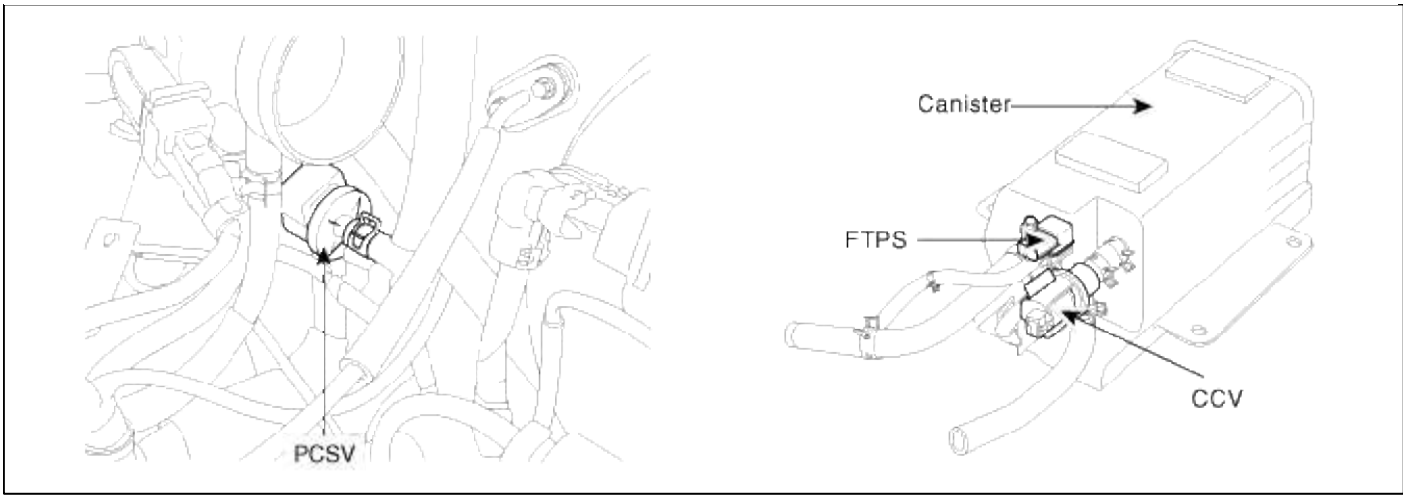


GENERAL DESCRIPTION

Due to the increasing ambient temperature of the fuel and the return of unused hot fuel from the engine, fuel vapors are generated in the tank. In order to control the release of these vapors to the atmosphere, the evaporative emissions control system is used. The evaporative emission control system reduces hydrocarbon (HC) emissions by trapping fuel tank vapors until they can be burned in the combustion process. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold. The evaporative emission control system is made up of a fuel tank that can be completely sealed from outside air, a Fuel Tank Pressure Sensor (FTPS), a Canister Close Valve (CCV) that seals the canister from the outside air, a canister filled with activated charcoal granules, a Purge Control Solenoid Valve (PCSV). The evaporative emission system can be checked for leaks by sealing the system off from the outside air, creating a vacuum, and monitoring if the system can hold that vacuum sufficiently for a set amount of time. If it cannot, a leak exists somewhere in the system.

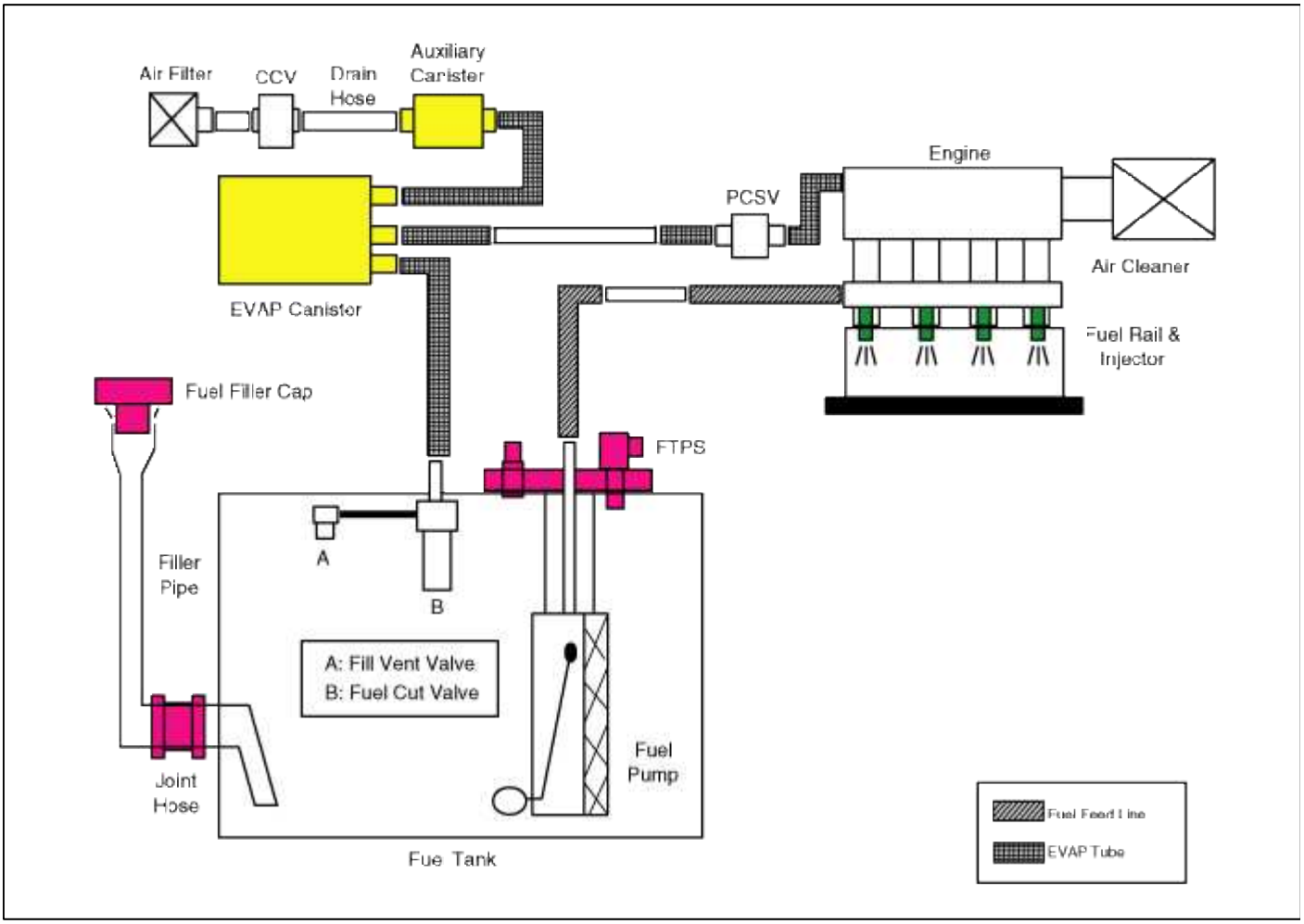
DTC DESCRIPTION

The ECM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. After vacuum generation, the ECM measures pressure differential curve in the fuel tank and sets DTC P0442 or P0456 if the vacuum generated within a monitoring period increases above a defined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor(DTP) signal with underpressure	• Fuel filler cap damage or missing • Faulty or damaged fuel filler pipe • Leaking, disconnected or plugged fuel vapor lines. • Fuel in lines due to faulty Rollover Valve • On-Board Refueling Vapor Recovery Valve (ORVR valve) or stuck closed CCV. • Improperly installed or stuck Purge Control Solenoid Valve (PCSV). • Faulty Fuel Tank Pressure Sensor (FTPS). • Leaking canister
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Pressure fluctuation in fuel tank < -2hPa during vapor generation period	
Diagnostic Time	• 26 sec. In idle	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

NOTE

EVAP. Leakage Test enable conditions
- Following conditions must be fulfilled to start the test.
  1. Engine warm up at Idle Status
  2. No relevant DTC
  3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

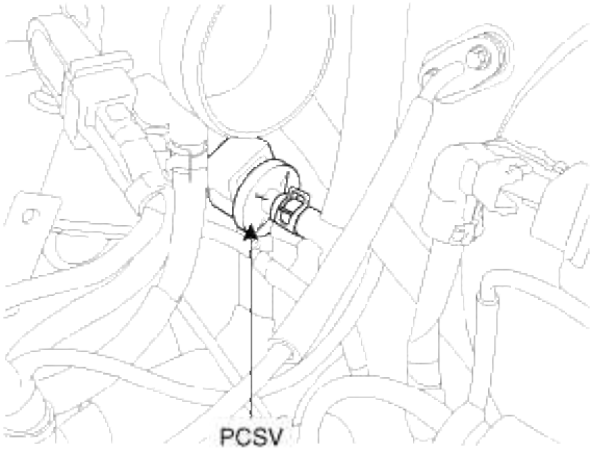
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Fuel System > Troubleshooting > P0444

COMPONENT LOCATION



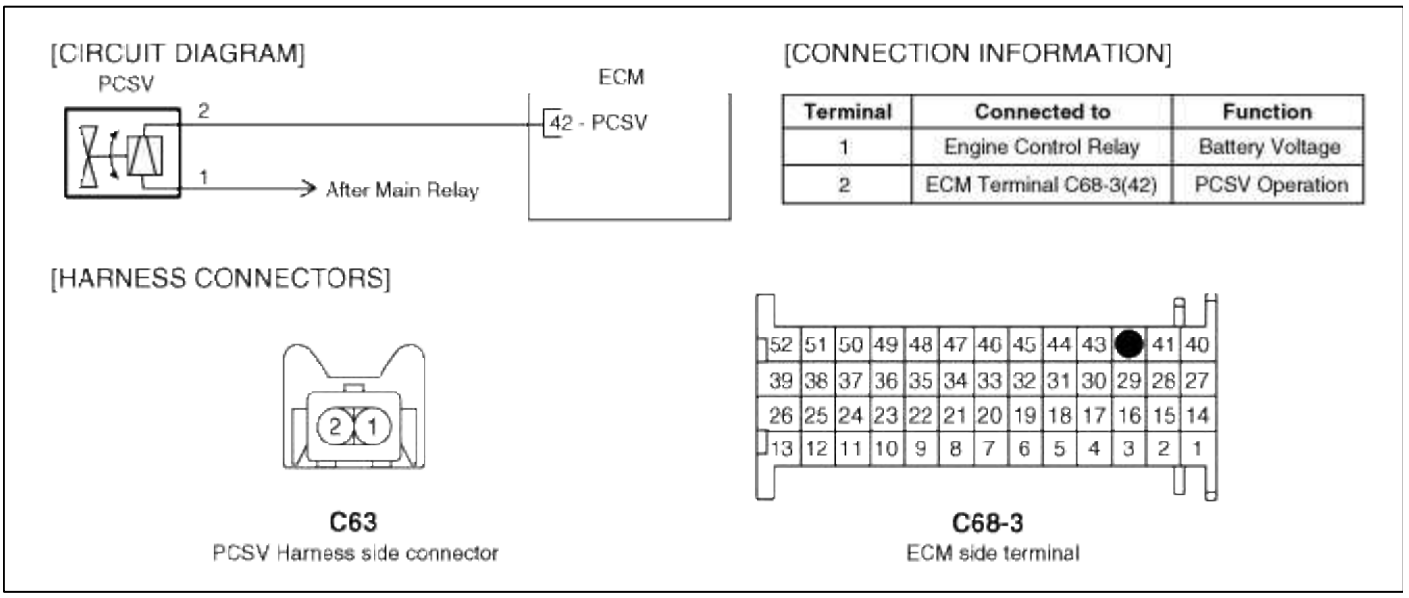
GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open in PCSV harness • Contact resistance in connectors • Faulty PCSV
Enable Conditions	• 10V< Battery voltage	
Threshold Value	• Open circuit	
Diagnostic Time	• 3 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

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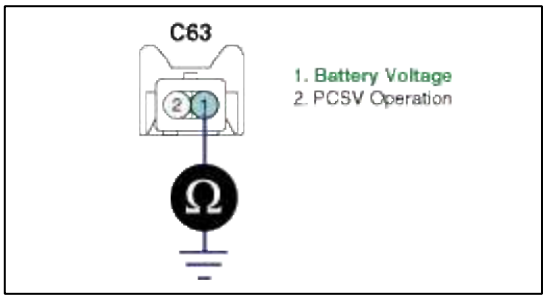
2. Measure voltage between terminal 1 of the PCSV harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

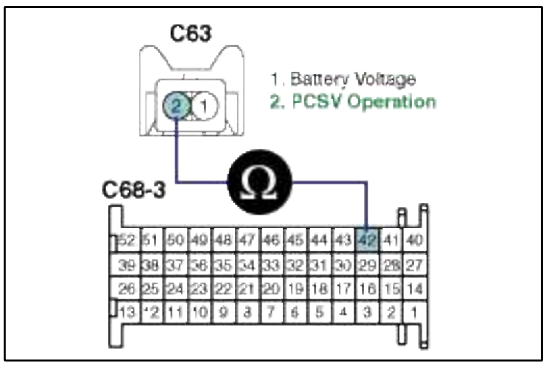
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminals 2 of the PCSV harness connector and 42 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

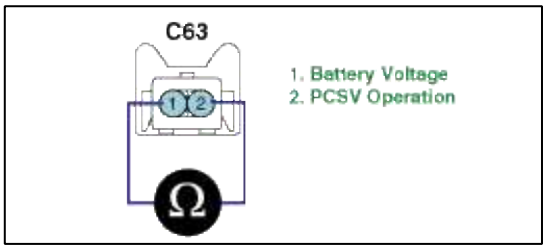
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect PCSV connector.

3. Measure resistance between terminals 1 and 2 of the PCSV connector(Component side).

Specification : Approx. 24.5~27.5Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check PCSV for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

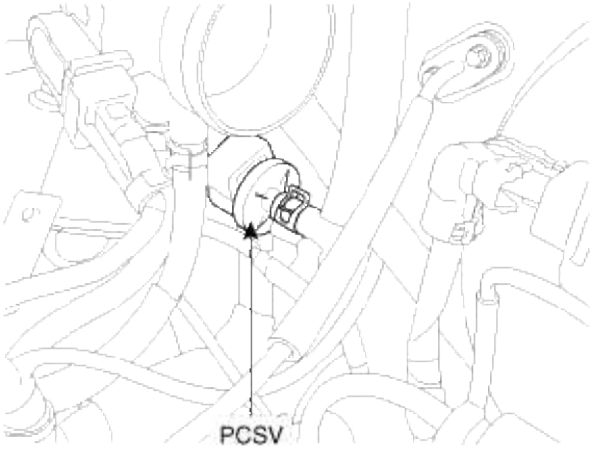
SPECIFICATION

Temperature		PCSV Resistance (Ω)
(°C)	(°F)	
20	68	24.5~27.5

Fuel System > Troubleshooting > P0445

COMPONENT LOCATION

tomsn048@gmail.com



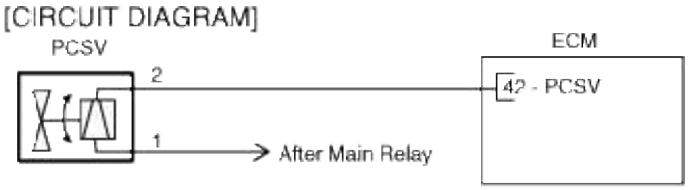
GENERAL DESCRIPTION

DTC DESCRIPTION

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short in PCSV harness • Contact Resistance in connectors • Faulty PCSV
Enable Conditions	• 10V< Battery voltage	
Threshold Value	• Short to ground or Short to Battery	
Diagnostic Time	• 3 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

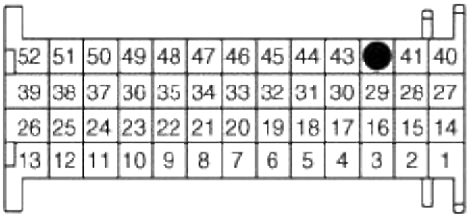


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Engine Control Relay	Battery Voltage
2	ECM Terminal C68-3(42)	PCSV Operation

[HARNESS CONNECTORS]

C63
PCSV Harness side connector



C68-3
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

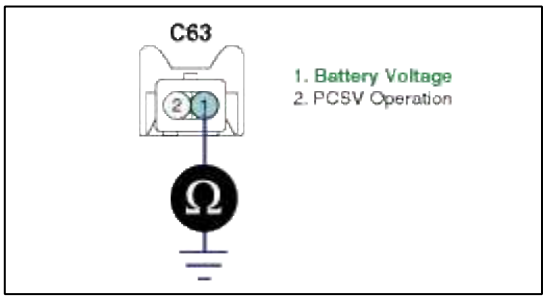
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the PCSV harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

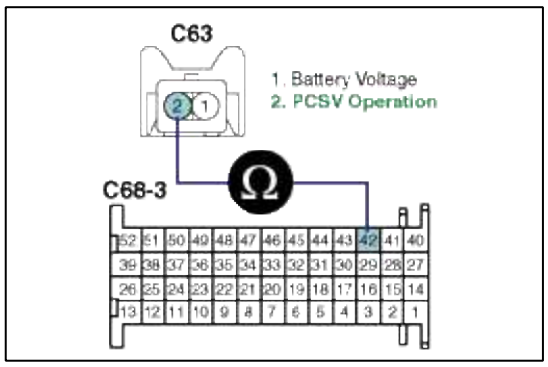
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect ECM connector.
   (3) Measure resistance between terminals 2 of the PCSV harness connector and 42 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



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(4) Is resistance within the specification?

YES

Go to next step as below.

NO

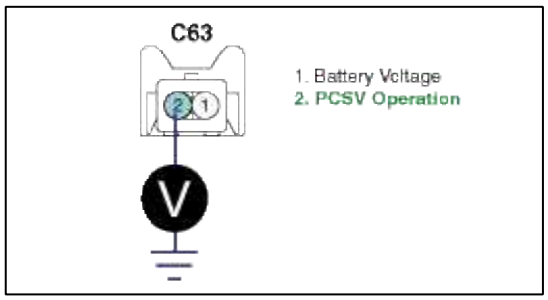
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in control circuit.

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

(2) Measure voltage between terminal 2 of the PCSV harness connector and chassis ground.

Specification : Approx. 0V



(3) Is voltage within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

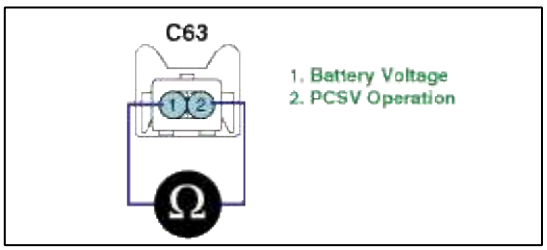
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect PCSV connector.
3. Measure resistance between terminals 1 and 2 of the PCSV connector(Component side).

Specification : Approx. 24.5~27.5Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check PCSV for contamination, deterioration, or damage. 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

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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

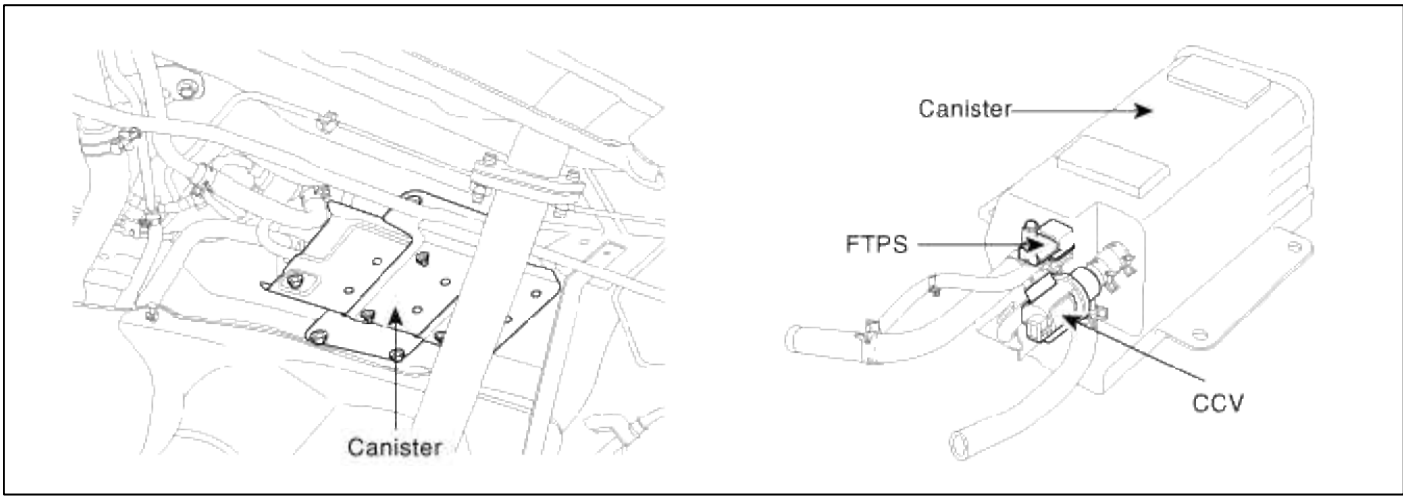
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		PCSV Resistance (Ω)
(°C)	(°F)	
20	68	24.5~27.5

Fuel System > Troubleshooting > P0447

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emissions system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

DTC DESCRIPTION

ECM sets DTC P0447 if the ECM detects that the CCV control line is open.

DTC DETECTING CONDITION

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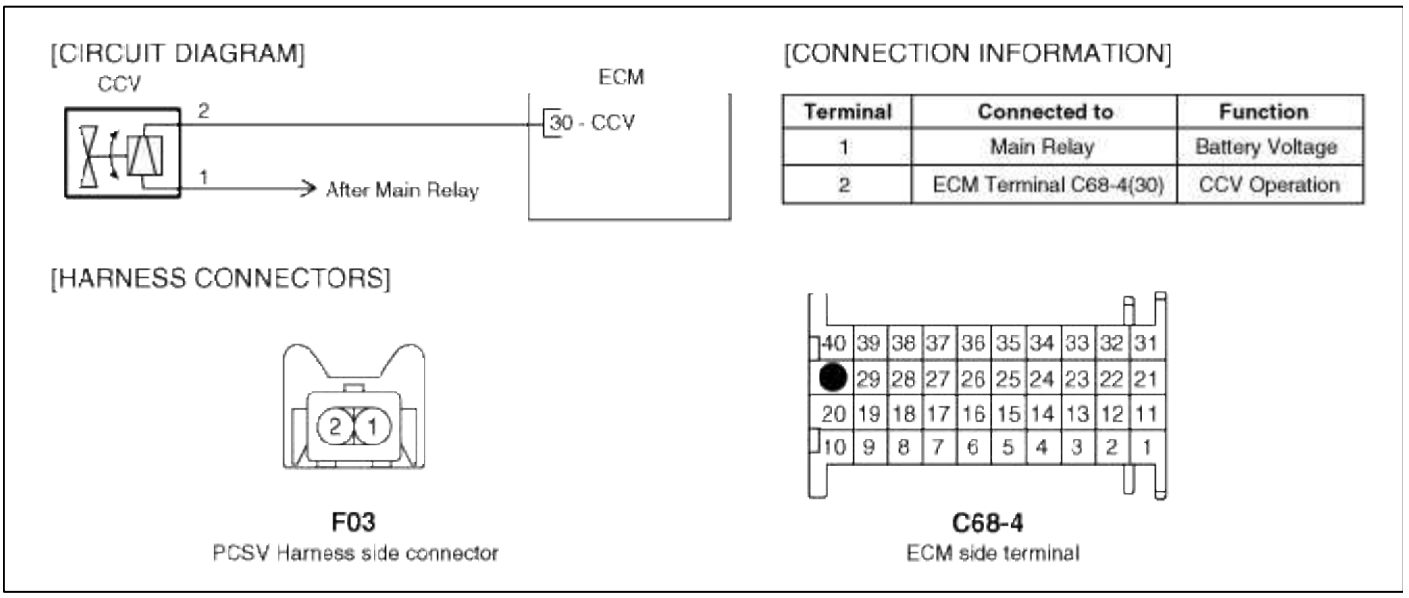
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open in CCV harness • Contact resistance in connectors • Faulty CCV.
Enable Conditions	• Battery voltage > 10V	
Threshold Value	• Line break	
Diagnostic Time	• 3 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

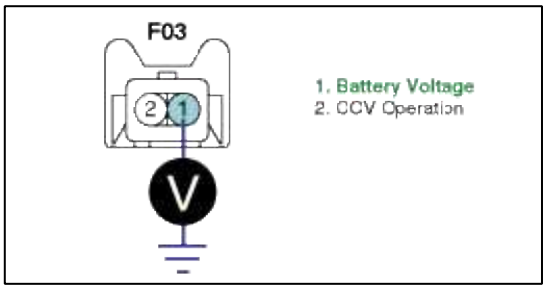
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

2. Measure voltage between terminal 1 of the CCV harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

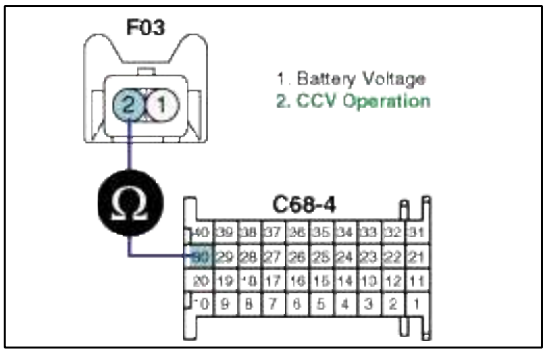
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminals 2 of the CCV harness connector and 30 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect CCV connector.

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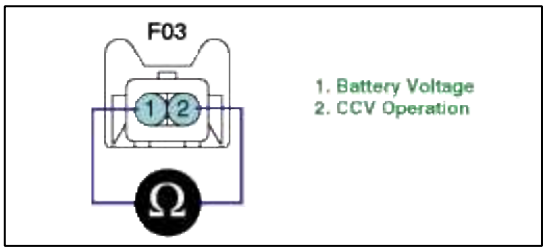
3. Measure resistance between terminals 1 and 2 of the CCV connector(Component side).

Specification : Approx. 23~26Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check CCV for contamination, deterioration, or damage. Substitute with a known-good CCV and check for proper operation. If the problem is corrected, replace CCV 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

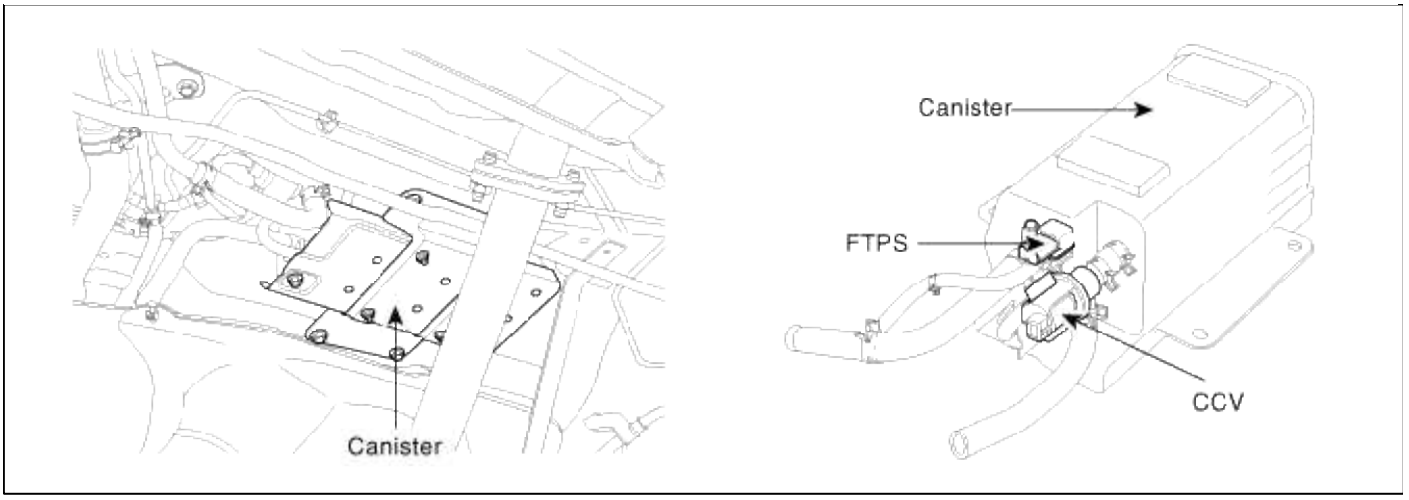
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temp.(°F)		CCV Resistance(Ω)
(°C)	(°F)	
20	68	23~26

Fuel System > Troubleshooting > P0448

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emissions system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

DTC DESCRIPTION

ECM sets DTC P0448 if the ECM detects that the CCV control line is short to ground or short to battery line.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short in CCV harness • Contact resistance in connectors • Faulty CCV
Enable Conditions	• Battery voltage > 10V	
Threshold Value	• Short to ground or Short to Battery	
Diagnostic Time	• 3 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

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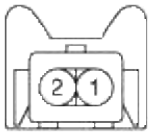
[CIRCUIT DIAGRAM]

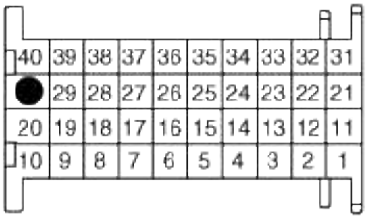
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal C68-4(30)	CCV Operation

[HARNESS CONNECTORS]



F03
PCSV Harness side connector



C68-4
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

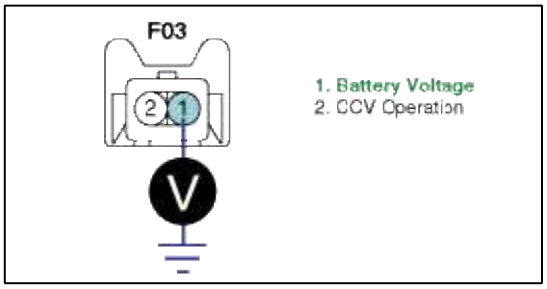
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the CCV harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection" procedure.

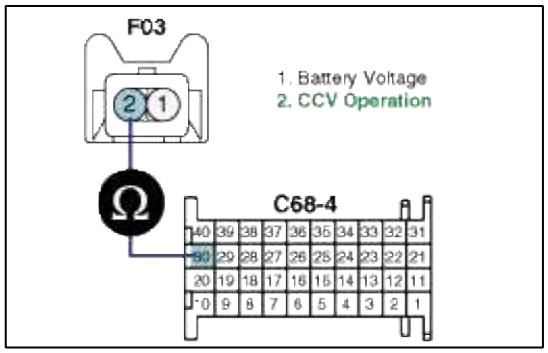
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect ECM connector.
   (3) Measure resistance between terminals 2 of the CCV harness connector and 30 of the ECM harness connector(C68-4).

   Specification : Approx. 0Ω



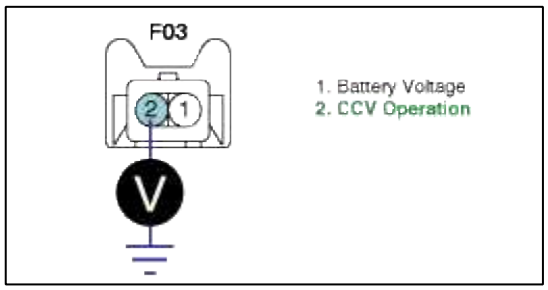
   (4) Is resistance within the specification?

   YES
   Go to "Control Circuit Inspection" procedure

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to battery in control circuit
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between terminal 2 of the CCV harness connector and chassis ground

   Specification : Approx. 0V



   (3) Is voltage within the specification?

   YES
   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect CCV connector.

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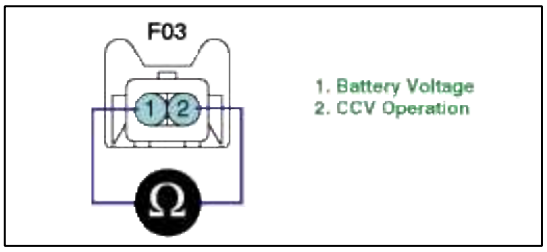
3. Measure resistance between terminals 1 and 2 of the CCV connector(Component side).

Specification : Approx. 23~26Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check CCV for contamination, deterioration, or damage. Substitute with a known-good CCV and check for proper operation. If the problem is corrected, replace CCV 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

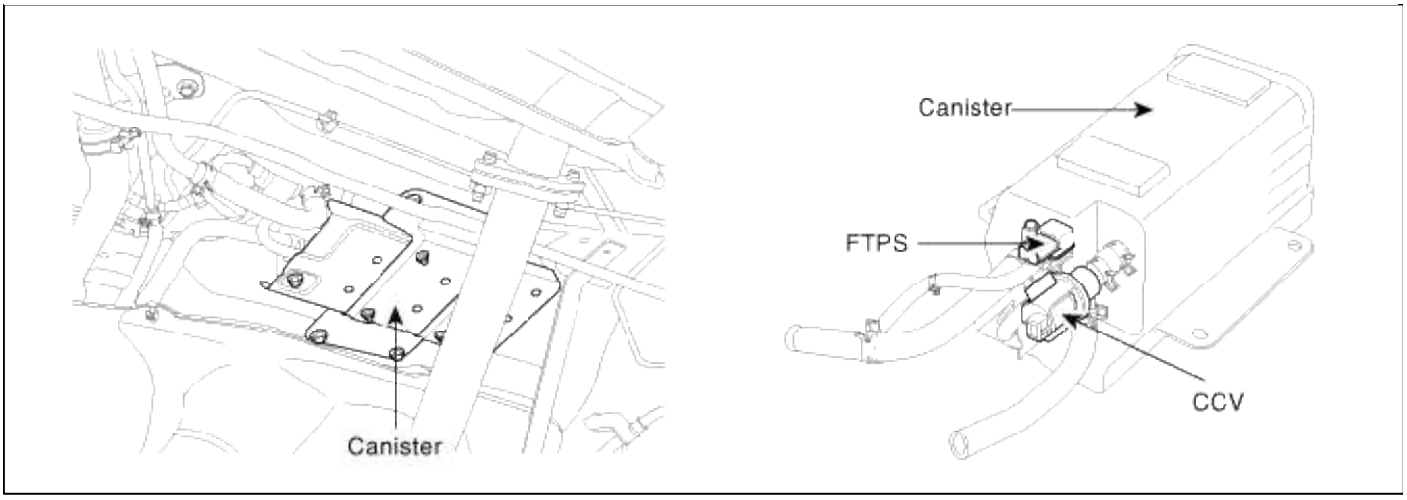
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temp.(°F)		CCV Resistance(Ω)
(°C)	(°F)	
20	68	23~26

Fuel System > Troubleshooting > P0449

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emissions system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

DTC DESCRIPTION

The ECM measures pressure in the fuel tank by means of tank pressure sensor during all engine operating states except engine stop and start. The DTC P0449 is set if pressure is lower than predetermined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor(DTP) signal with underpressure	• Canister Air-Filter contamination • Faulty CCV
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Voltage of differential fuel tank pressure <1.5V	
Diagnostic Time	• 200 sec.	
Fall Safe	• EVAP. emission control function is disabled • EVAP. System monitoring is inhibited • Fuel Tank Pressure Sensor monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

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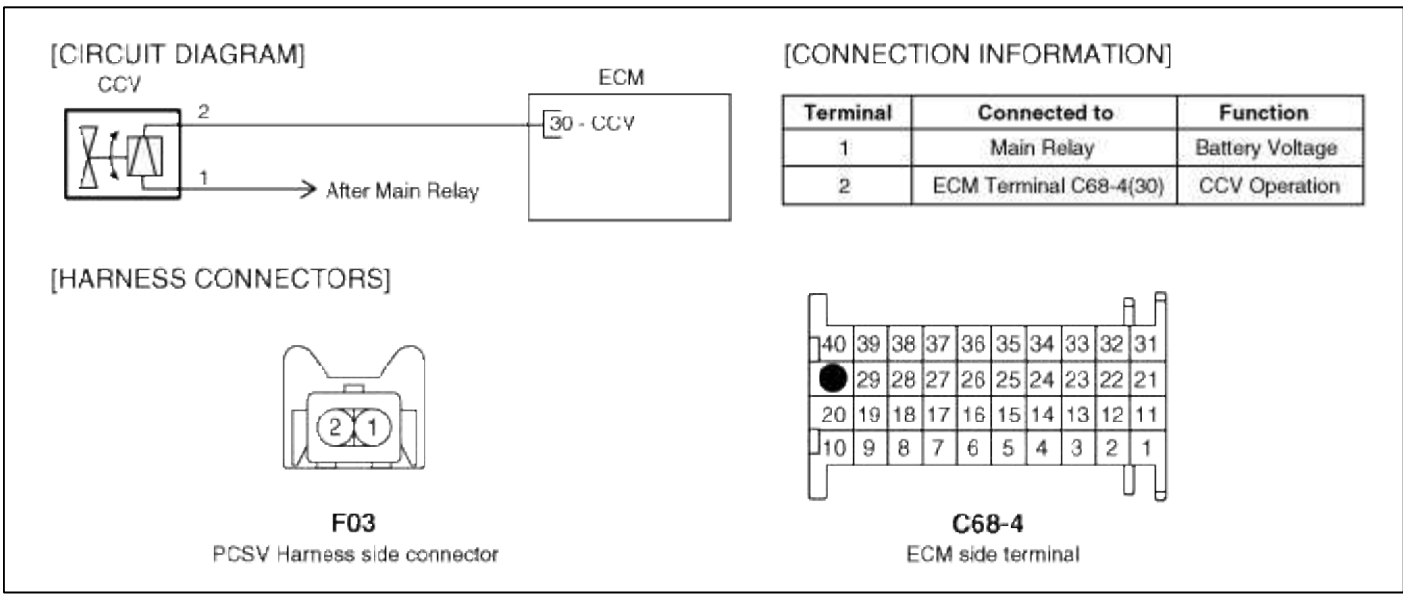
SCHEMATIC DIAGRAM



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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

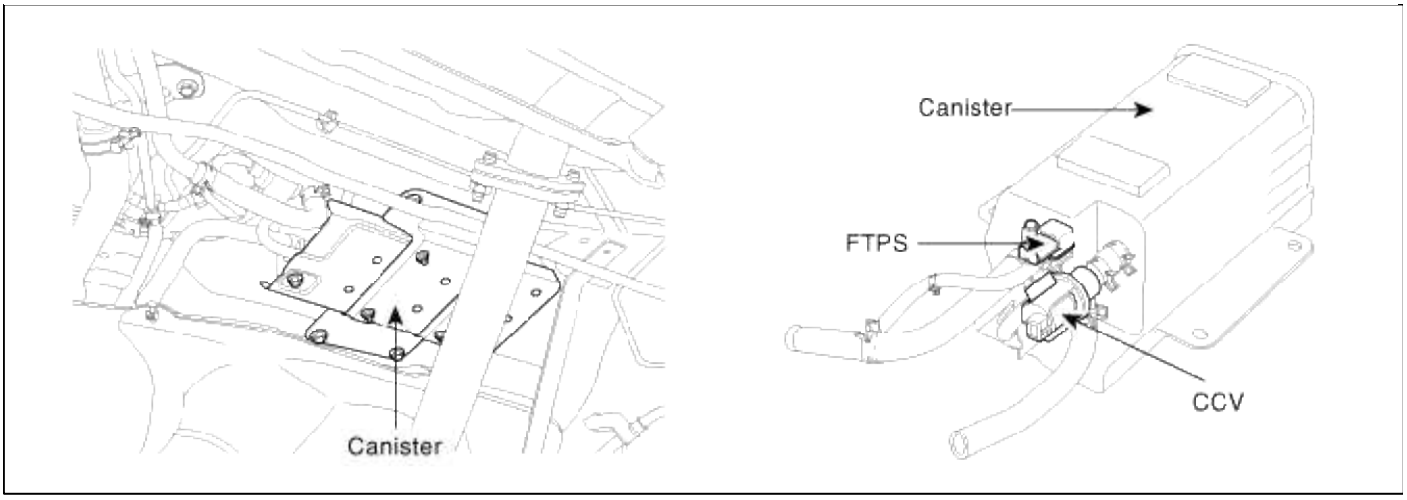
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temp.(°F)		CCV Resistance(Ω)
(°C)	(°F)	
20	68	23~26

Fuel System > Troubleshooting > P0451

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

DTC DESCRIPTION

The ECM monitors pressure in the fuel tank by means of Fuel Tank Pressure Sensor (FTPS) during purge control valve opening or closing phase. This monitoring will determine if pressure sensor signal is stuck. The ECM sets DTC P0451 if pressure variation is smaller than the predetermined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check signal oscillations	• Contact resistance in connectors • Faulty FTPS
Enable Conditions	• Minimum time in part load : 90 sec. • Vehicle speed once above threshold : 45km/h(28mph)	
Threshold Value	• Difference between max./min.voltage < 0.015V	
Diagnostic Time	• Immediate	
Fail Safe	• EVAP. System monitoring is inhibited • Fuel Tank Pressure Sensor monitoring is inhibited • Canister close valve monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

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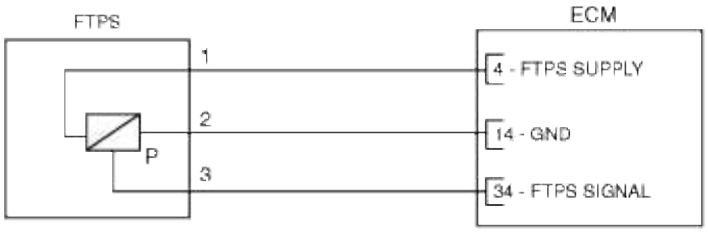
[CIRCUIT DIAGRAM]



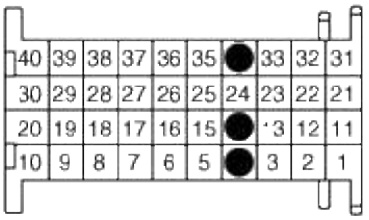
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-4(4)	Reference voltage
2	ECM Terminal C68-4(14)	Sensor ground
3	ECM Terminal C68-4(34)	FPTS Signal

[HARNESS CONNECTORS]

F14

ECTS Harness side connector



C68-4

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

Go to "Fuel Tank Pressure Sensor(FTPS) inspection" procedure

FUEL TANK PRESSURE SENSOR INSPECTION

1. Start engine and install scan tool.
2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification : Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed

A. Approx. 0~2 mmHg(2.5V) at Ig. On
B. Approx. 0 mmHg at 1400rpm
C. Approx. -2 mmHg at 4000rpm

3. Is signal value within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

A. Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.

B. Check for open or short in FTPS harness. Repair as necessary.
If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

NOTE

EVAP. Leakage Test enable conditions
- Following conditions must be fulfilled to start the test.
  1. Engine warm up at Idle Status
  2. No relevant DTC
  3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Fuel System > Troubleshooting > P0452

COMPONENT LOCATION

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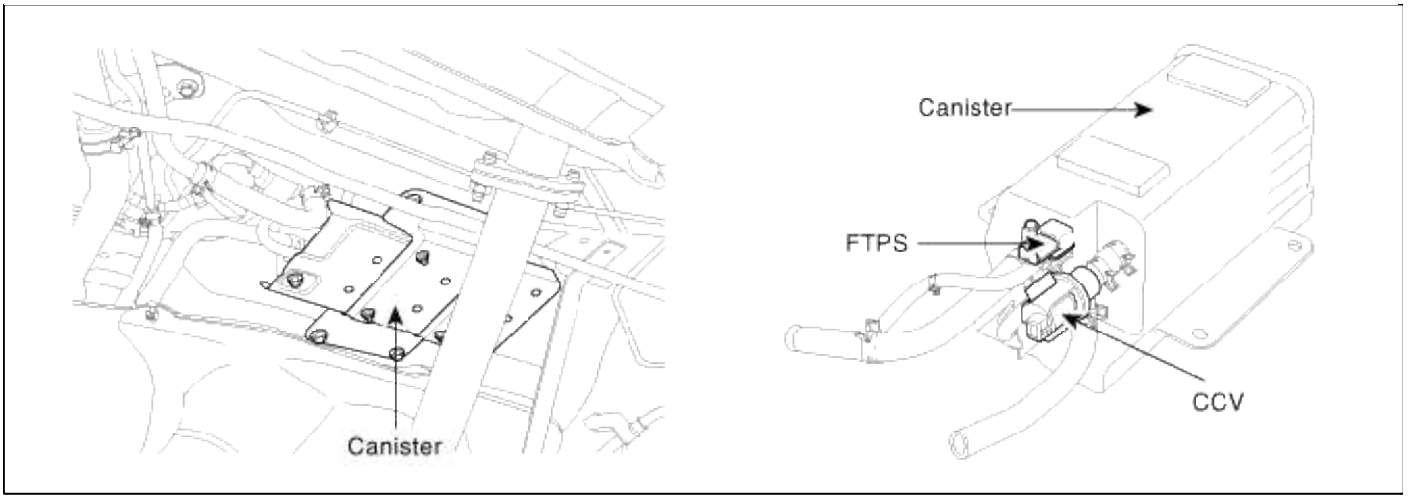


GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

DTC DESCRIPTION

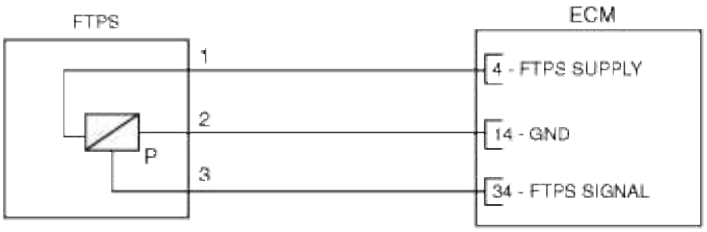
ECM sets DTC P0452 if the ECM detects signal voltage lower than the possible range of a properly operating FTPS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to ground in FTPS harness • Open in FTPS harness • Contact resistance in connectors • Faulty FTPS.
Enable Conditions	• Battery voltage > 11V	
Threshold Value	• Signal voltage <0.35V	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



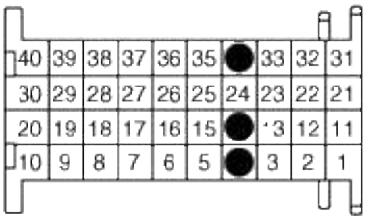
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-4(4)	Reference voltage
2	ECM Terminal C68-4(14)	Sensor ground
3	ECM Terminal C68-4(34)	FPTS Signal

[HARNESS CONNECTORS]

F14

ECTS Harness side connector



C68-4

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

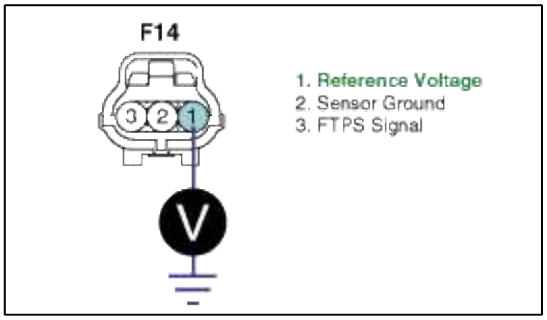
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect FTPS connector.
3. Ignition "ON" & Fngine "OFF".
4. Measure voltage between terminal 1 of the FTPS harness connector and chassis ground.

Specification : Approx. 5V



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5. Is voltage within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

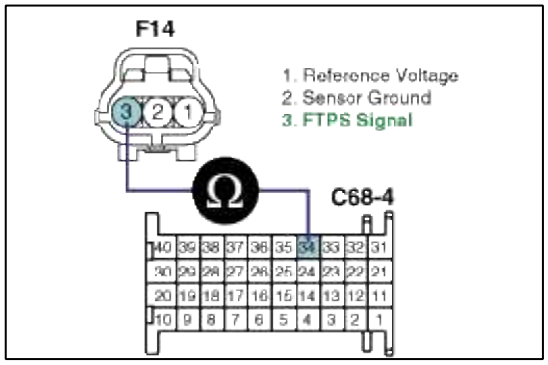
1. Check for open in signal circuit.

(1) Ignition "OFF".

(2) Disconnect ECM connector.

(3) Measure resistance between terminals 3 of the FTPS harness connector and 34 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



(4) Is resistance within the specification?

YES

Go to next step as below.

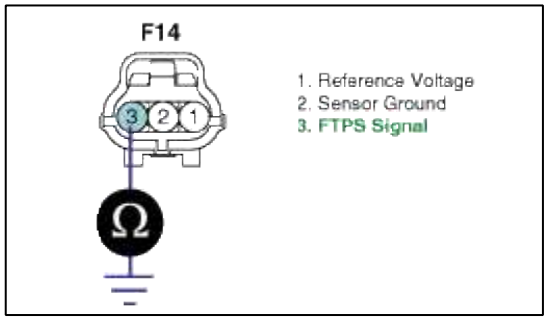
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal circuit

(1) Measure resistance between terminal 3 of the FTPS harness connector and chassis ground

Specification :Infinite



(2) Is resistance within the specification?

YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

FUEL TANK PRESSURE SENSOR INSPECTION

1. Start engine and install scan tool.
2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification : Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed

A. Approx. 0~2 mmHg(2.5V) at Ig. On
B. Approx. 0 mmHg at 1400rpm
C. Approx. -2 mmHg at 4000rpm

3. Is signal value within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

A. Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
B. Check for open or short in FTPS harness. Repair as necessary.
If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

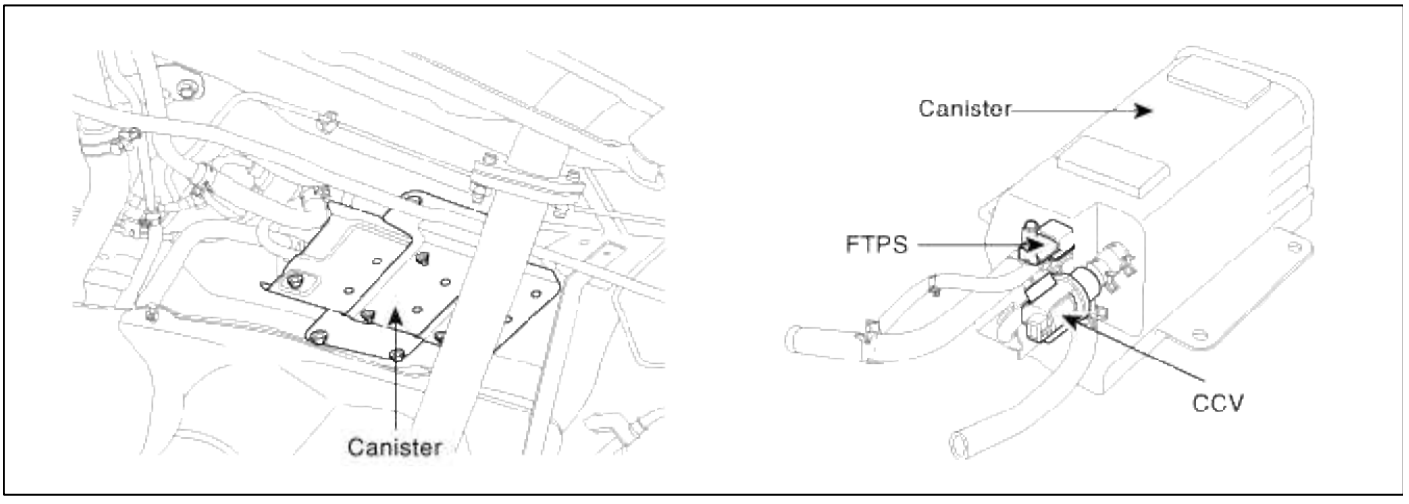
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0453

COMPONENT LOCATION



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GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

DTC DESCRIPTION

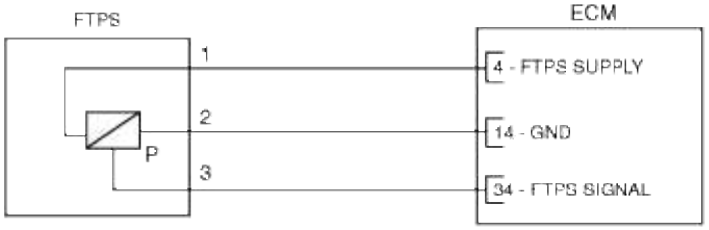
ECM sets DTC P0453 if the ECM detects signal voltage higher than the possible range of a properly operating FTPS.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to battery in FTPS harness • Contact resistance in connectors • Faulty FTPS
Enable Conditions	• Battery voltage > 11V	
Threshold Value	• Signal voltage < 4.78V	
Diagnostic Time	• 5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]



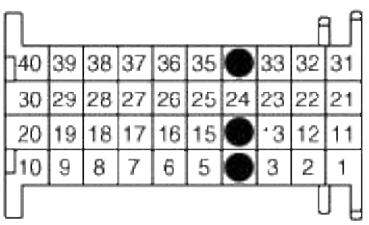
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-4(4)	Reference voltage
2	ECM Terminal C68-4(14)	Sensor ground
3	ECM Terminal C68-4(34)	FPTS Signal

[HARNESS CONNECTORS]

F14

ECTS Harness side connector



C68-4

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

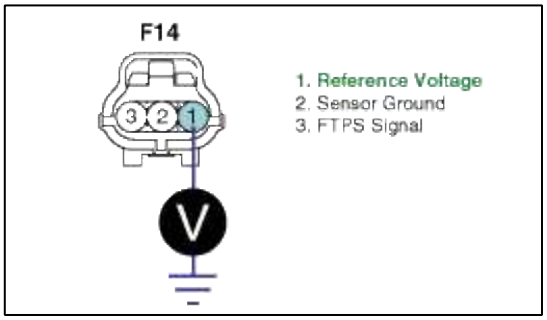
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : Approx. 5V



5. Is voltage within the specification?

YES

Go to "Ground Circuit Inspection" procedure.

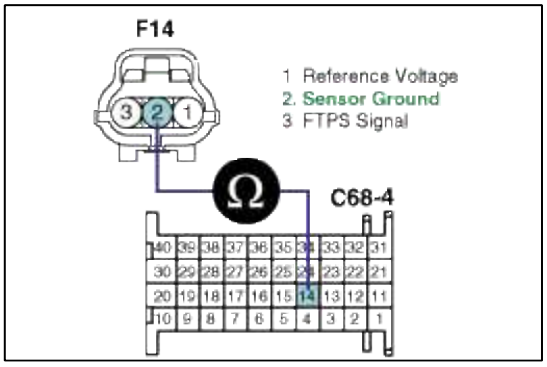
NO

Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Measure resistance between terminals 2 of the FTPS harness connector and 14 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



4. Is resistance within the specification?

YES

Go to "Signal Circuit Inspection" procedure

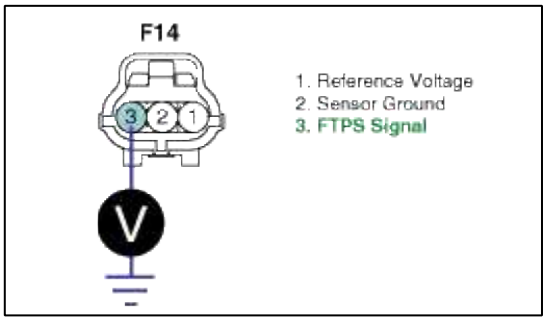
NO

Check for a open/short circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure

SIGNAL CIRCUIT INSPECTION

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

Specification : Approx. 0V



3. Is voltage within the specification?

(1) YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

FUEL TANK PRESSURE SENSOR INSPECTION

1. Start engine and install scan tool.
2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification : Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed

A. Approx. 0~2 mmHg(2.5V) at Ig. On
B. Approx. 0 mmHg at 1400rpm
C. Approx. -2 mmHg at 4000rpm

3. Is signal value within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

A. Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
B. Check for open or short in FTPS harness. Repair as necessary.
If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

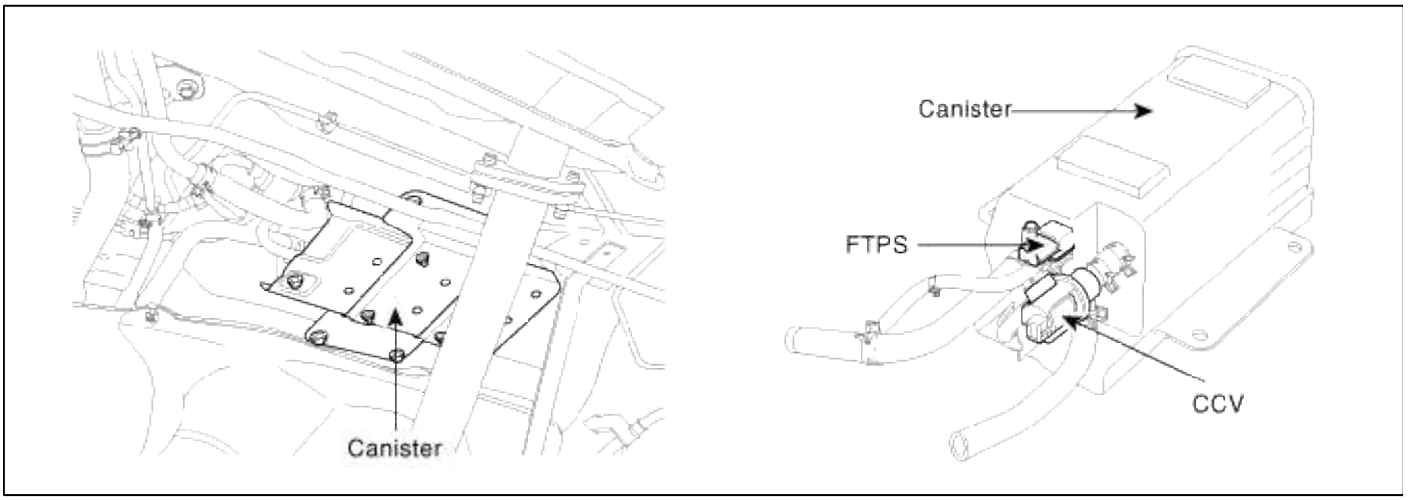
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0454

COMPONENT LOCATION



GENERAL DESCRIPTION

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

DTC DESCRIPTION

The ECM monitors pressure stability in the fuel tank by means of Fuel Tank Pressure Sensor (FTPS) for predetermined duration just before start the leakage monitoring to detect noise signal of pressure sensor. The ECM sets DTC P0454 if the pressure fluctuation is bigger than predetermined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

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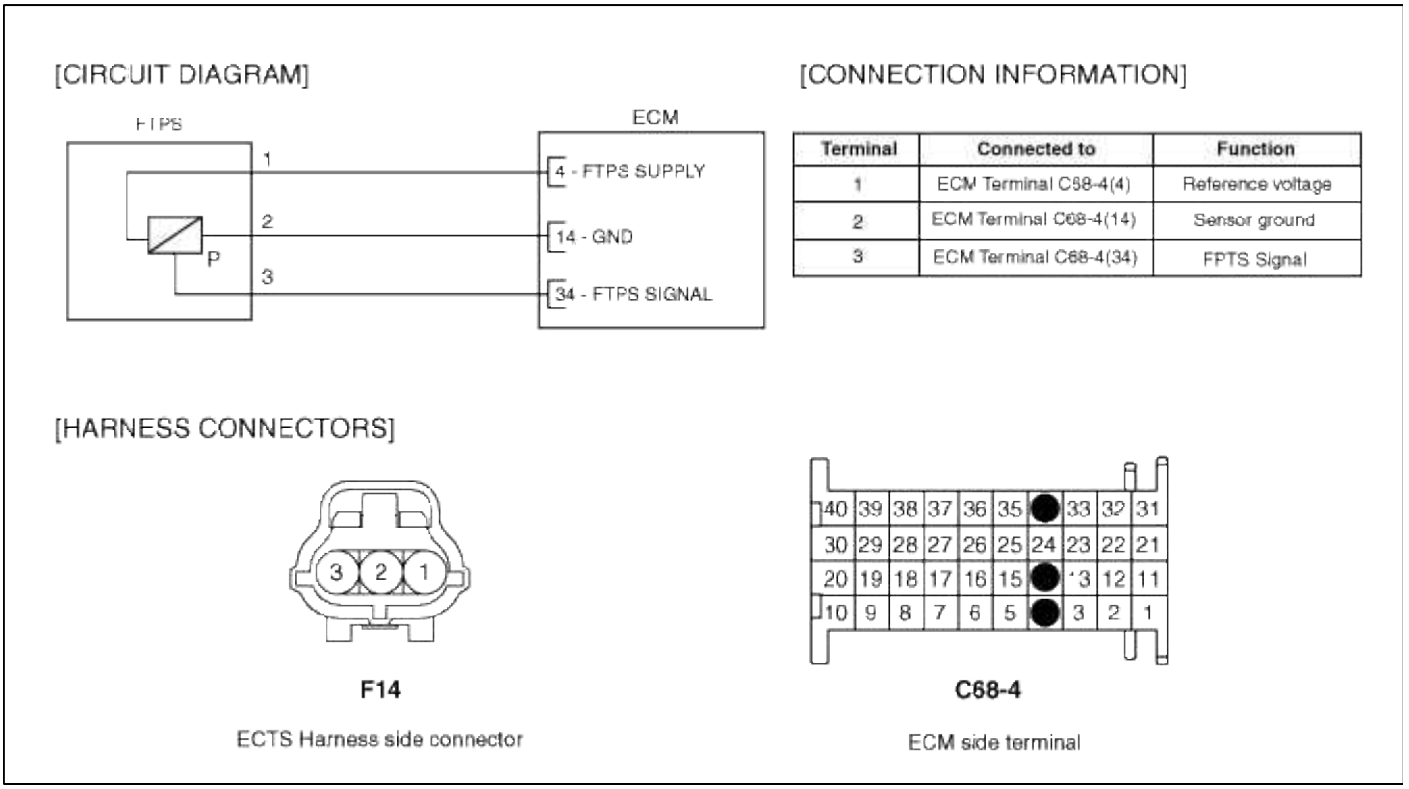
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Sensor signal noise check	• Contact resistance in connectors • Faulty FTPS
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Signal fluctuation > 0.5hPa	
Diagnostic Time	• Immediate	
Fail Safe	• EVAP. System monitoring is inhibited • Fuel Tank Pressure Sensor monitoring is inhibited • Canister close valve monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

Go to "Fuel Tank Pressure Sensor(FTPS) inspection" procedure

FUEL TANK PRESSURE SENSOR INSPECTION

1. Start engine and install scan tool.
2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification : Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed

A. Approx. 0~2 mmHg(2.5V) at Ig. On
B. Approx. 0 mmHg at 1400rpm
C. Approx. -2 mmHg at 4000rpm

3. Is signal value within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

A. Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
B. Check for open or short in FTPS harness. Repair as necessary.
If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

NOTE

EVAP. Leakage Test enable conditions
- Following conditions must be fulfilled to start the test.
  1. Engine warm up at Idle Status
  2. No relevant DTC
  3. Fuel level is below 80%

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5. Monitoring for (pending) DTC.Is the same DTC set?

YES

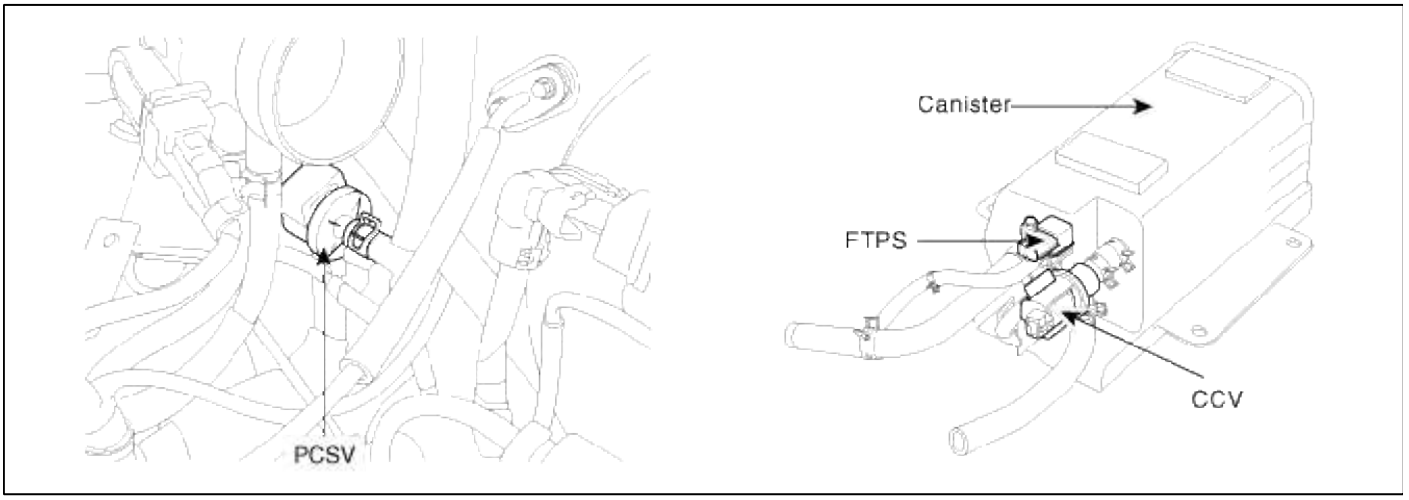
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Fuel System > Troubleshooting > P0455

COMPONENT LOCATION



GENERAL DESCRIPTION

Due to the increasing ambient temperature of the fuel and the return of unused hot fuel from the engine, fuel vapors are generated in the tank. In order to control the release of these vapors to the atmosphere, the evaporative emissions control system is used. The evaporative emission control system reduces hydrocarbon (HC) emissions by trapping fuel tank vapors until they can be burned in the combustion process. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold. The evaporative emission control system is made up of a fuel tank that can be completely sealed from outside air, a Fuel Tank Pressure Sensor (FTPS), a Canister Close Valve (CCV) that seals the canister from the outside air, a canister filled with activated charcoal granules, a Purge Control Solenoid Valve (PCSV). The evaporative emission system can be checked for leaks by sealing the system off from the outside air, creating a vacuum, and monitoring if the system can hold that vacuum sufficiently for a set amount of time. If it cannot, a leak exists somewhere in the system.

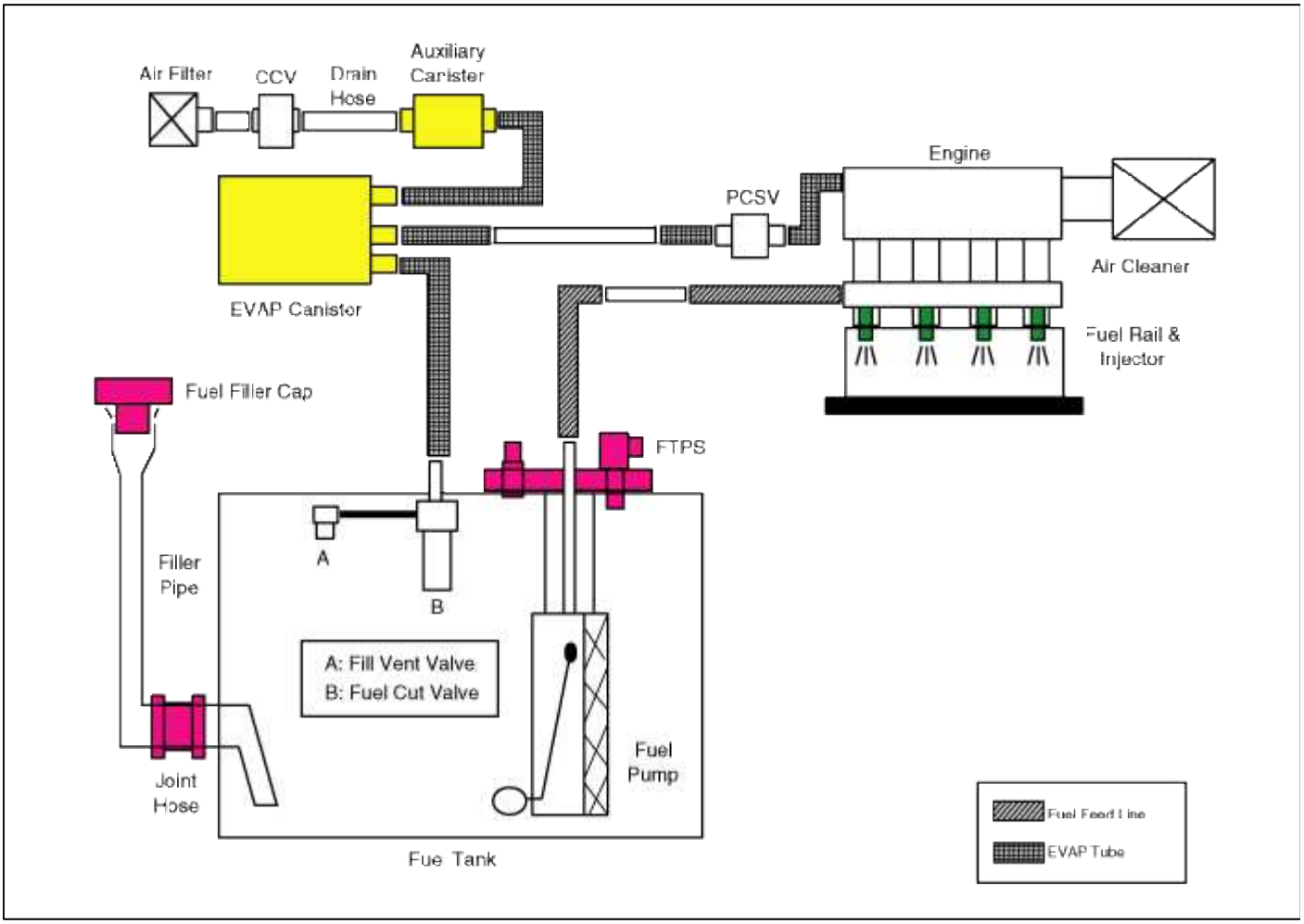
DTC DESCRIPTION

The ECM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. This vacumm generation phase will determine if there is a large leak like tank cap open or canister shut off valve (CCV) stuck open. The ECM sets DTC P0455 if the pressure in the fuel tank does not drop as low as predetermined threshold during predetermined maximum vacuum generation period.
If the same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor(DTP) signal with underpressure	• Leakage in EVAP. System
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• Pressure fluctuation in fuel tank >-12hPa for 13 seconds during underpressure period	
Diagnostic Time	• 24 sec. in idle	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

> NOTE
>
> EVAP. Leakage Test enable conditions
> - Following conditions must be fulfilled to start the test.
>
> 1. Engine warm up at Idle Status
> 2. No relevant DTC
> 3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

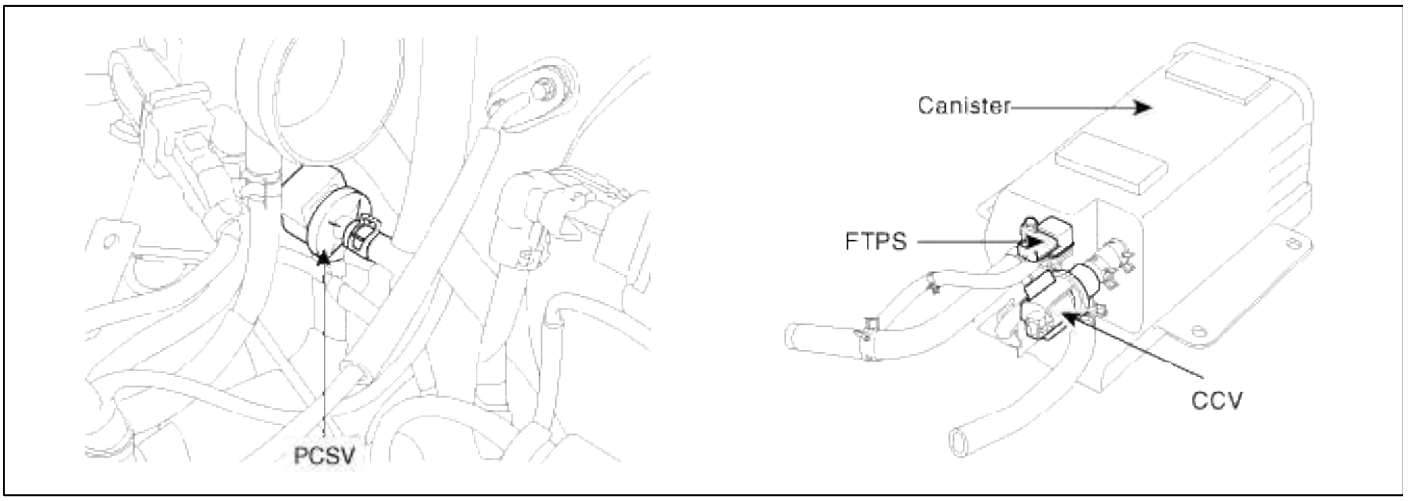
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Fuel System > Troubleshooting > P0456

COMPONENT LOCATION



GENERAL DESCRIPTION

Due to the increasing ambient temperature of the fuel and the return of unused hot fuel from the engine, fuel vapors are generated in the tank. In order to control the release of these vapors to the atmosphere, the evaporative emissions control system is used. The evaporative emission control system reduces hydrocarbon (HC) emissions by trapping fuel tank vapors until they can be burned in the combustion process. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold. The evaporative emission control system is made up of a fuel tank that can be completely sealed from outside air, a Fuel Tank Pressure Sensor (FTPS), a Canister Close Valve (CCV) that seals the canister from the outside air, a canister filled with activated charcoal granules, a Purge Control Solenoid Valve (PCSV). The evaporative emission system can be checked for leaks by sealing the system off from

the outside air, creating a vacuum, and monitoring if the system can hold that vacuum sufficiently for a set amount of time. If it cannot, a leak exists somewhere in the system.

DTC DESCRIPTION

The ECM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. After vacuum generation, the ECM measures pressure differential curve in the fuel tank and sets DTC P0442 or P0456 if the vacuum generated within a monitoring period increases above a defined threshold.
If same error code is set in the next driving cycle, the ECM illuminates the MIL.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Monitoring the tank pressure sensor (DTP) signal with underpressure	• Leakage in EVAP system line • Defective CCV,PCSV or FTPS
Enable Conditions	• Idle state • Minimum modeled ambient temperature >-10°C(14°F) • Coolant temperature >75°C(167°F) • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 5.5hPa • Limited canister saturation >-10% • Minimum purge time:100sec.	
Threshold Value	• 0.41mm < leak.diameter <0.8mm	
Diagnostic Time	• 39 sec. in idle	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

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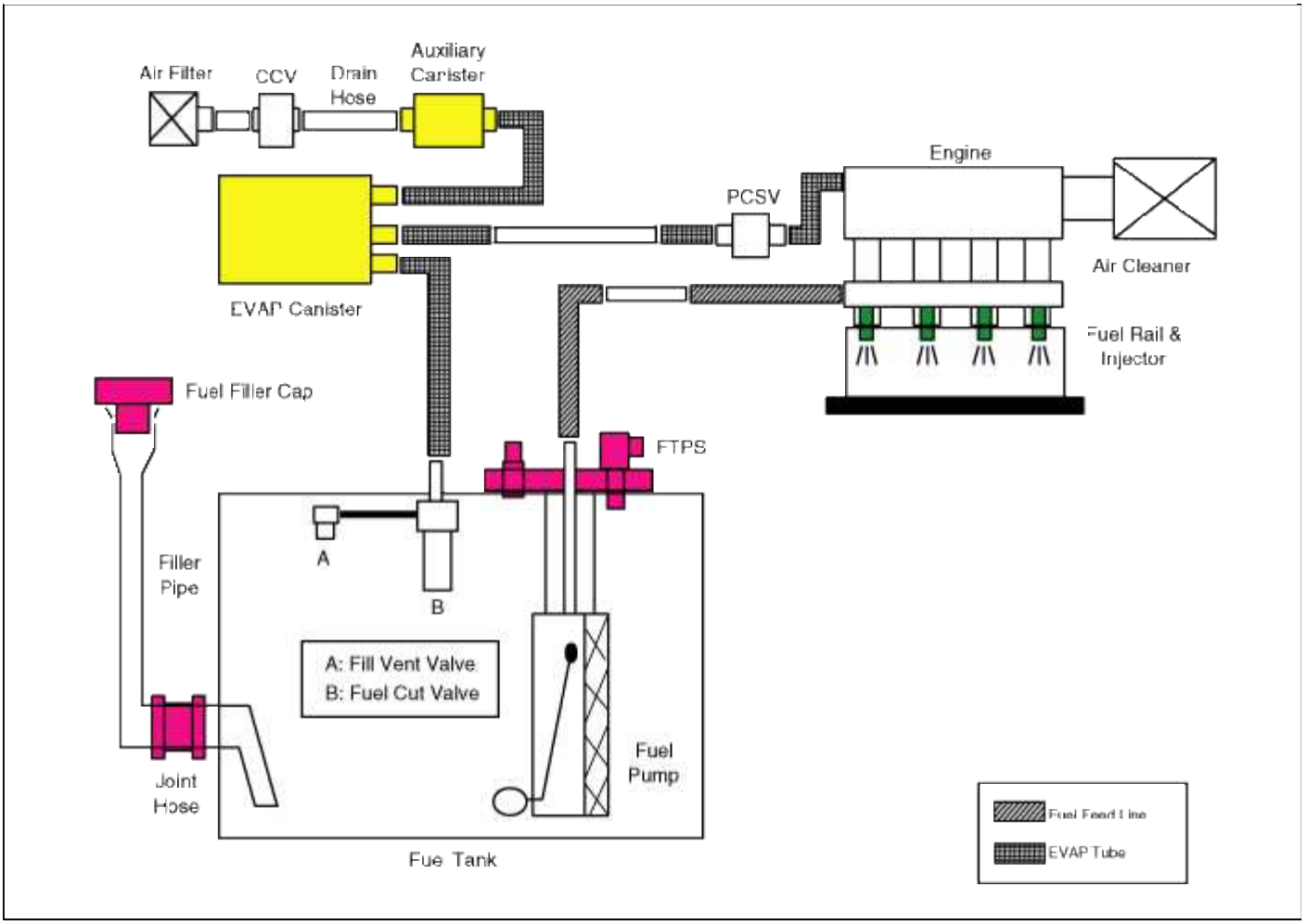


VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

> NOTE
>
> EVAP. Leakage Test enable conditions
> - Following conditions must be fulfilled to start the test.
>
> 1. Engine warm up at Idle Status
> 2. No relevant DTC
> 3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

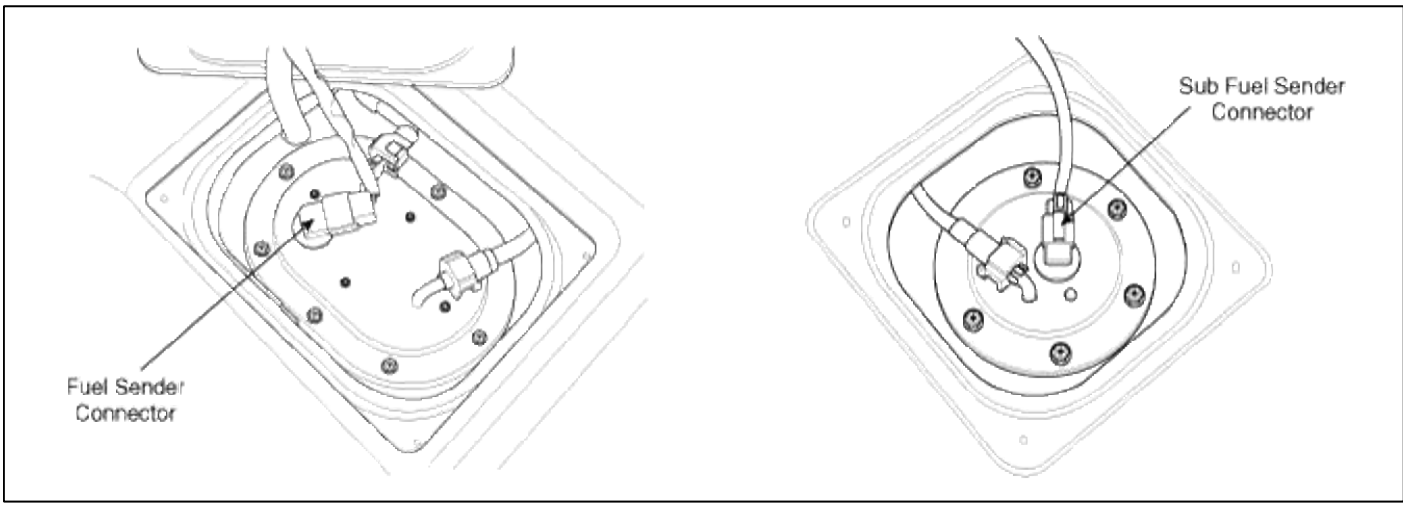
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Fuel System > Troubleshooting > P0461

COMPONENT LOCATION



GENERAL DESCRIPTION

The fuel level sensor measures the fuel level in fuel tank and its signal is used to determine if the fuel level is too high or too low to be able to accurately detect EVAP system failures.

DTC DESCRIPTION

The ECM sets DTC P0461 if ECM detects that fuel level change from maximum to minimum is less than the threshold value

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check signal stuck	• Contact resistance in connectors • Faulty FLS
Enable Conditions	• Minimum mileage:322km(200 mile)	
Threshold Value	• Difference between filtered max./min.value and initial value < 5%	
Diagnostic Time	• Immediate	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

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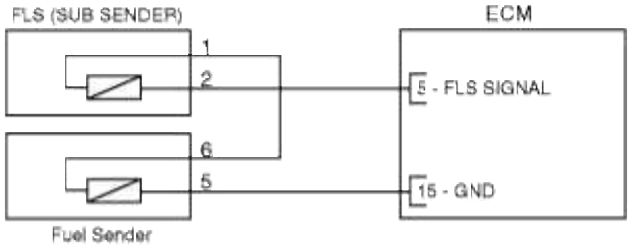
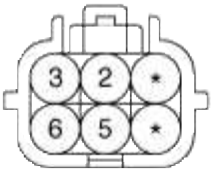
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

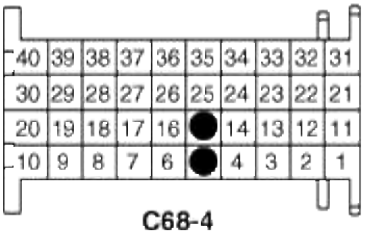
Terminal	Connected to	Function
1	ECM Terminal C68-4(15)	Sensor Ground
2	ECM Terminal C68-4(5)	Sensor Signal

[HARNESS CONNECTORS]



F18
Fuel Sender Harness side connector

F15
FLS Harness side connector



C68-4
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

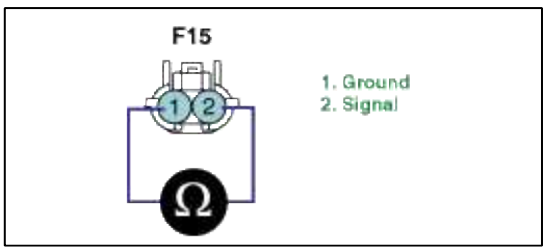
Go to next step as below

FUEL LEVEL SENSOR (FLS) INSPECTION

1. Ignition "OFF"
2. Disconnect FLS harness connector
3. Measure resistance between terminals 1 and 2 of the FLS connector(Component side).

Specification :

Fuel Level	Resistance (Ω)
E (Empty)	Approx. 94~96
1/2	Approx. 89~91
F (Full)	Approx. 3~4



4. Is resistance within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check FLS for contamination, deterioration, or damage. Substitute with a known-good FLS and check for proper operation. If the problem is corrected, replace FLS and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR

1. Return vehicle to original condition.
2. Start engine to normal operating temperature.

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install scan tool and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

NOTE

EVAP. Leakage Test enable conditions
- Following conditions must be fulfilled to start the test.
  1. Engine warm up at Idle Status
  2. No relevant DTC
  3. Fuel level is below 80%

5. Monitoring for (pending) DTC.Is the same DTC set?

YES

Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

SPECIFICATION

Fuel Level	Resistance (Ω)
E (Empty)	Approx. 94~96
1/2	Approx. 89~91
F (Full)	Approx. 3~4

Fuel System > Troubleshooting > P0462

COMPONENT LOCATION

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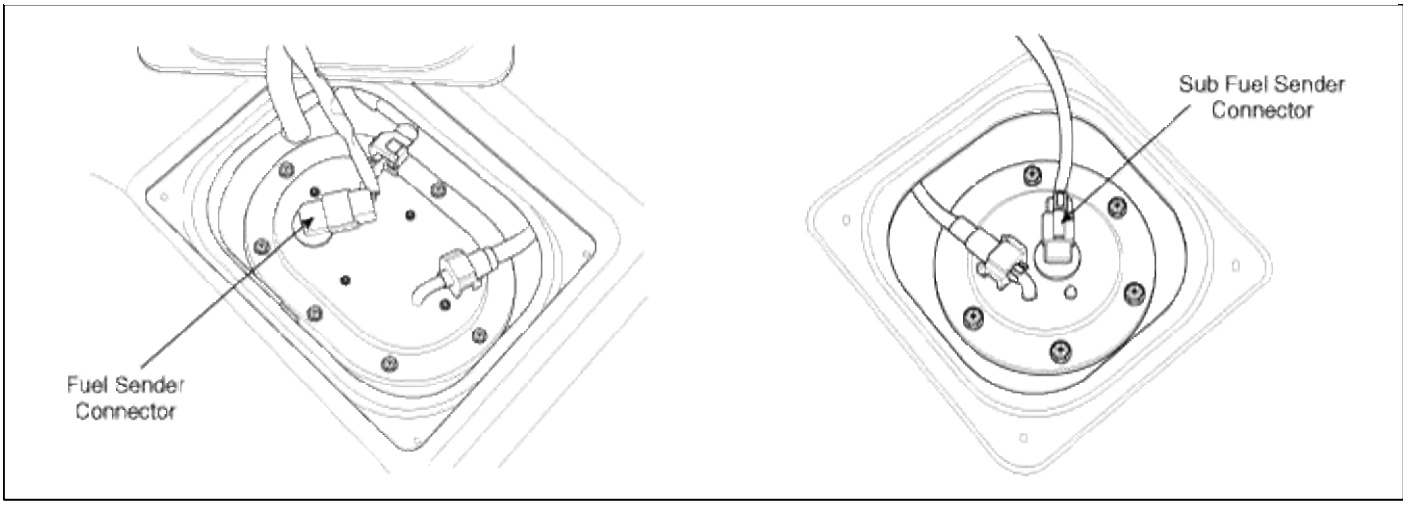


GENERAL DESCRIPTION

The fuel level sensor measures the fuel level in fuel tank and its signal is used to determine if the fuel level is too high or too low to be able to accurately detect EVAP system failures.

DTC DESCRIPTION

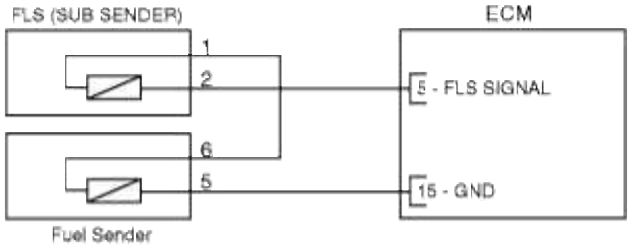
The ECM sets DTC P0462 if ECM detects that fuel level change from maximum to minimum is less than the threshold value

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Open in power supply harness • Contact resistance in connectors • Faulty FLS
Enable Conditions	• Battery voltage >11V • Minimum time >200 sec.	
Threshold Value	• Short to ground or Line Break(Voltage < 0.02)	
Diagnostic Time	• 20 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

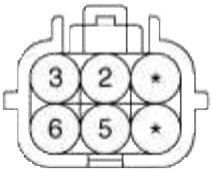
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

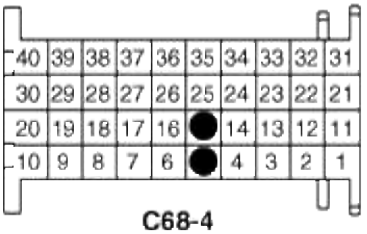
Terminal	Connected to	Function
1	ECM Terminal C68-4(15)	Sensor Ground
2	ECM Terminal C68-4(5)	Sensor Signal

[HARNESS CONNECTORS]



F18
Fuel Sender Harness side connector

F15
FLS Harness side connector



C68-4
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

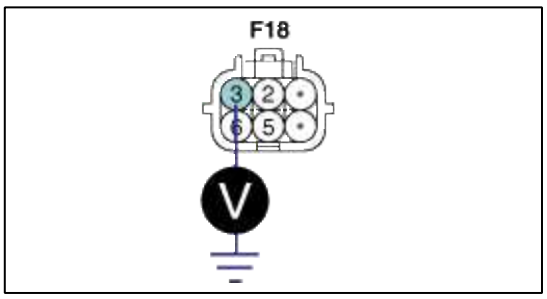
NO

Go to next step as below

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect Fuel Sender connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal 3 of the Fuel Sender harness connector and chassis ground.

Specification : Approx. B+



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5. Is voltage within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Check for a open/short in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

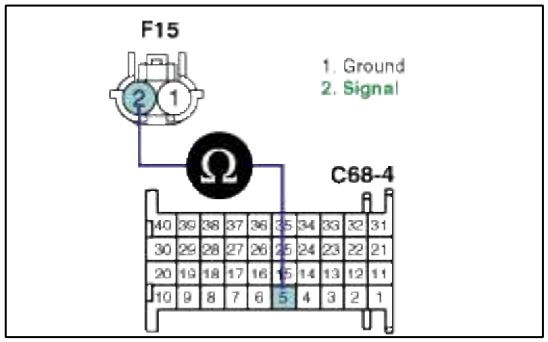
1. Check for open in signal circuit.

(1) Ignition "OFF".

(2) Disconnect FLS and ECM connector.

(3) Measure resistance between terminals 2 of the FLS harness connector and 5 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



(4) Is resistance within the specification?

YES

Go to next step as below.

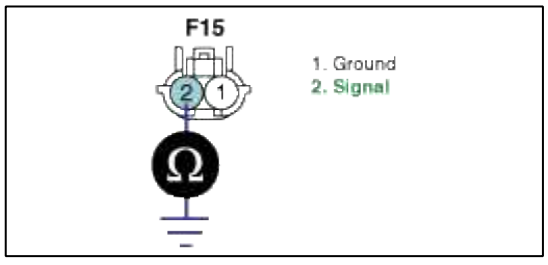
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in signal circuit

(1) Measure resistance between terminal 2 of the FTPS harness connector and chassis ground

Specification :Infinite



(2) Is resistance within the specification?

YES

Go to next step as below.

NO

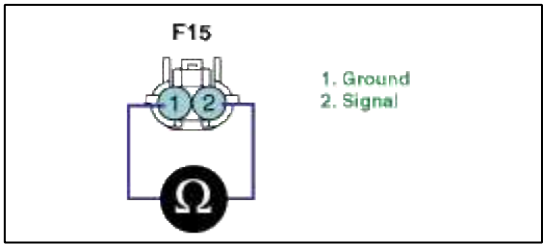
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

FUEL LEVEL SENSOR (FLS) INSPECTION

1. Measure resistance between terminals 1 and 2 of the FLS connector(Component side).

Specification :

Fuel Level	Resistance (Ω)
E (Empty)	Approx. 94~96
1/2	Approx. 89~91
F (Full)	Approx. 3~4



2. Is resistance within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check FLS for contamination, deterioration, or damage. Substitute with a known-good FLS and check for proper operation. If the problem is corrected, replace FLS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Fuel Level	Resistance (Ω)
E (Empty)	Approx. 94 ~ 96
1/2	Approx. 89 ~ 91
F (Full)	Approx. 3 ~ 4

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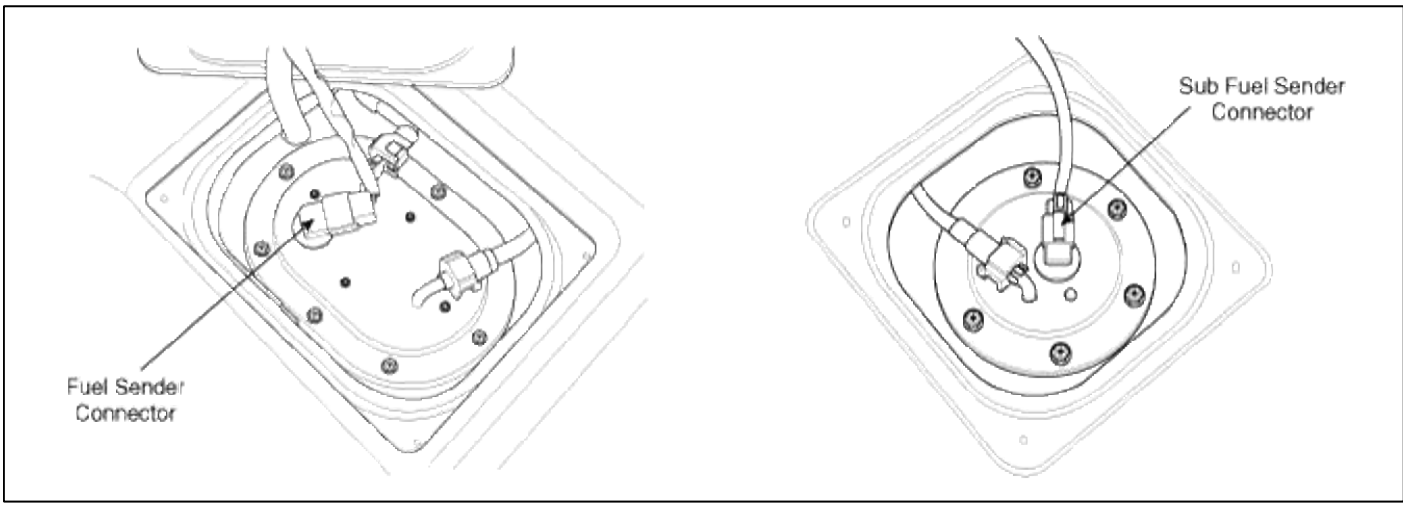
Fuel System > Troubleshooting > P0463

COMPONENT LOCATION



GENERAL DESCRIPTION

The fuel level sensor measures the fuel level in fuel tank and its signal is used to determine if the fuel level is too high or too low to be able to accurately detect EVAP system failures.

DTC DESCRIPTION

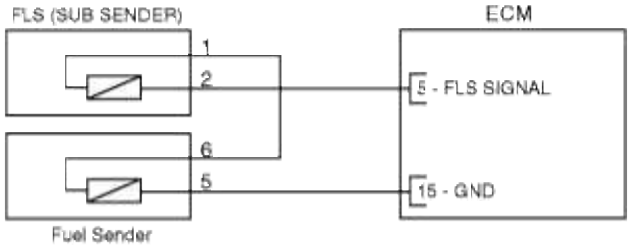
The ECM sets DTC P0463 if ECM detects that fuel level change from maximum to minimum is less than the threshold value

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Voltage range check	• Short to battery in signal harness • Open in power supply/ground harness • Contact resistance in connectors • Faulty FLS
Enable Conditions	• Battery voltage >11V • 200 seconds after starting	
Threshold Value	• Signal voltage >4.95V	
Diagnostic Time	• 10 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

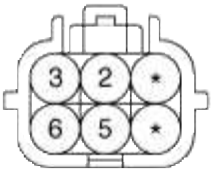
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

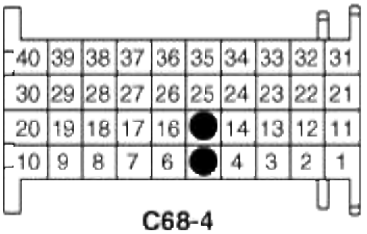
Terminal	Connected to	Function
1	ECM Terminal C68-4(15)	Sensor Ground
2	ECM Terminal C68-4(5)	Sensor Signal

[HARNESS CONNECTORS]



F18
Fuel Sender Harness side connector

F15
FLS Harness side connector



C68-4
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

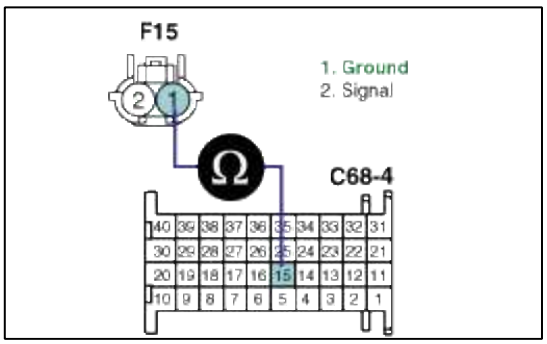
NO

Go to next step as below

GROUND CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect FLS and ECM connector
3. Measure resistance between terminals 1 of the FLS harness connector and 15 of the ECM harness connector(C68-4).

Specification : Approx. 0Ω



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4. Is resistance within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

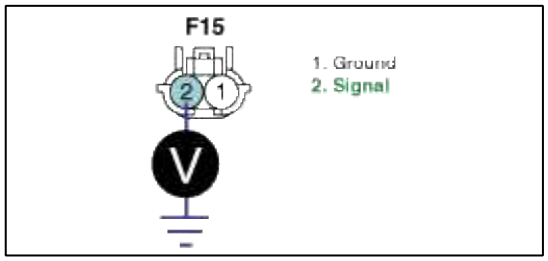
Check for a open/short circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 2 of the FLS harness connector and chassis ground.

(1)

Specification : Approx. 0V



3. Is resistance within the specification?

YES

Go to next step as below.

NO

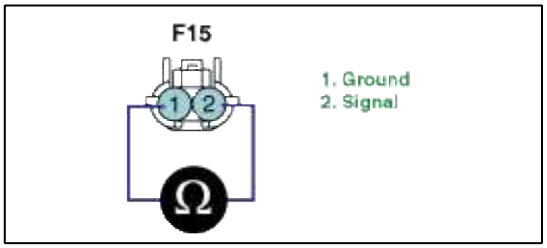
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

FUEL LEVEL SENSOR (FLS) INSPECTION

1. Measure resistance between terminals 1 and 2 of the FLS connector(Component side).

Specification :

Fuel Level	Resistance (Ω)
E (Empty)	Approx. 94~96
1/2	Approx. 89~91
F (Full)	Approx. 3~4



2. Is resistance within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check FLS for contamination, deterioration, or damage. Substitute with a known-good FLS and check for proper operation. If the problem is corrected, replace FLS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

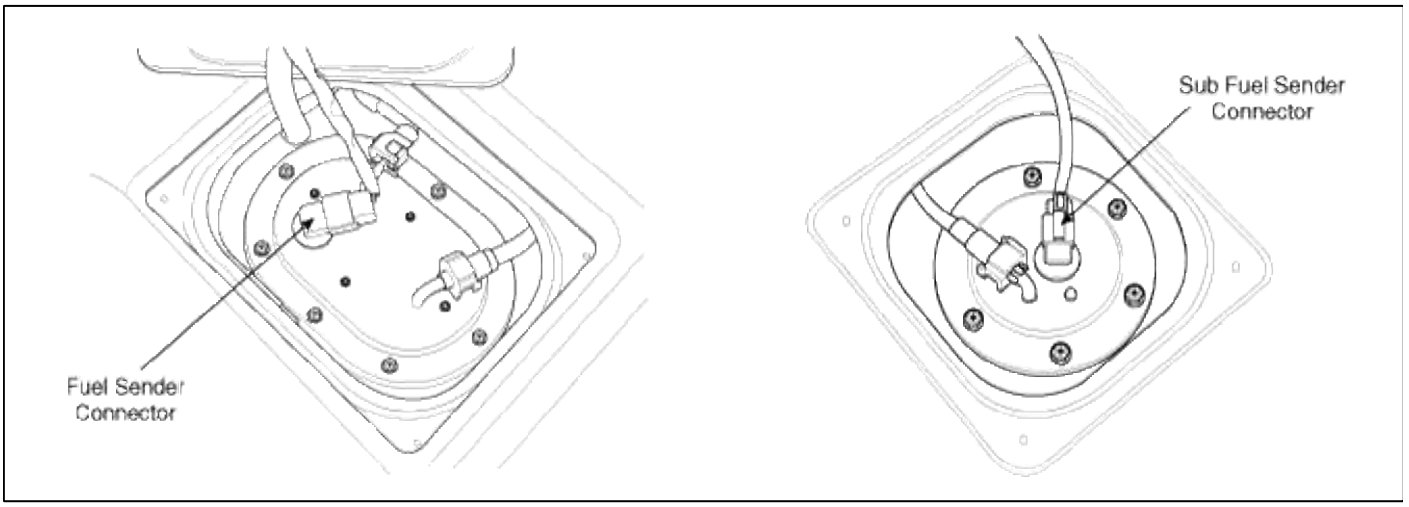
Go to the applicable troubleshooting procedure.

SPECIFICATION

Fuel Level	Resistance (Ω)
E (Empty)	Approx. 94 ~ 96
1/2	Approx. 89 ~ 91
F (Full)	Approx. 3 ~ 4

Fuel System > Troubleshooting > P0464

COMPONENT LOCATION



GENERAL DESCRIPTION

The fuel level sensor measures the fuel level in fuel tank and its signal is used to determine if the fuel level is too high or too low to be able to accurately detect EVAP system failures.

DTC DESCRIPTION

The ECM sets DTC P0463 if ECM detects that fuel level signal is higher than the threshold value.

DTC DETECTING CONDITION

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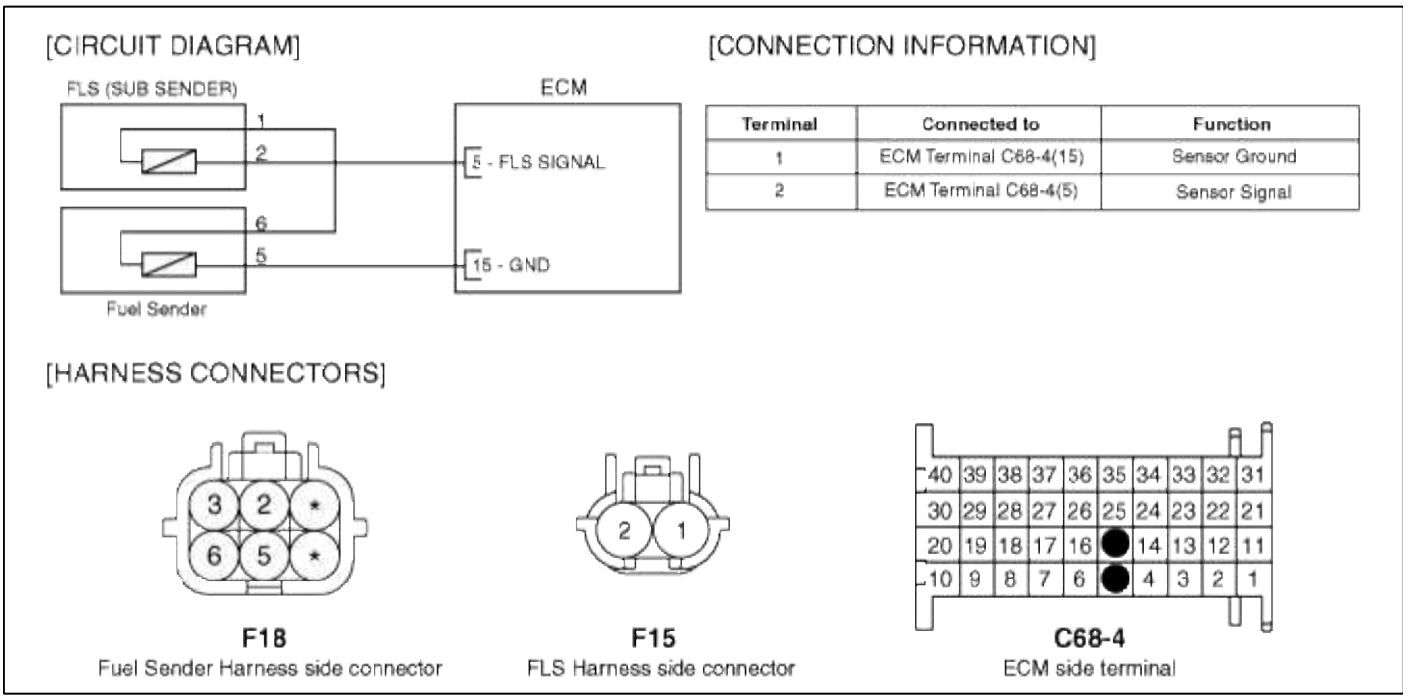
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check for signal fluctuation	• Contact resistance in connectors • Faulty FLS
Enable Conditions	• Engine state: part load • Minimum vehicle speed > 34km/h(21mph) • Wheel speed gradient < 0.18%	
Threshold Value	• Signal fluctuation > 50%	
Diagnostic Time	• 10 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

Go to next step as below

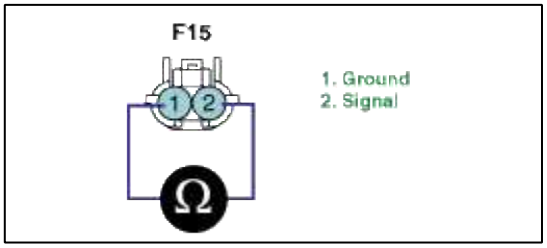
FUEL LEVEL SENSOR (FLS) INSPECTION

1. Ignition "OFF"
2. Disconnect FLS harness connector

3. Measure resistance between terminals 1 and 2 of the FLS connector(Component side).

Specification :

Fuel Level	Resistance (Ω)
E (Empty)	Approx. 94~96
1/2	Approx. 89~91
F (Full)	Approx. 3~4



4. Is resistance within specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check FLS for contamination, deterioration, or damage. Substitute with a known-good FLS and check for proper operation. If the problem is corrected, replace FLS 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Fuel Level	Resistance (Ω)
E (Empty)	Approx. 94 ~ 96
1/2	Approx. 89 ~ 91
F (Full)	Approx. 3 ~ 4

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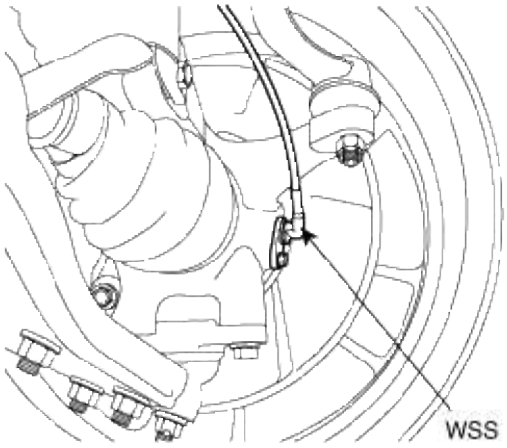
Fuel System > Troubleshooting > P0501

COMPONENT LOCATION



GENERAL DESCRIPTION

The Wheel Speed Sensor (WSS) generates a waveform with a frequency proportional to the speed of the vehicle. The signal generated by the WSS informs the ECM not only if the vehicle speed is low or high but also if the vehicle is or is not moving. The ECM uses this signal to control the fuel injection, ignition timing, transaxle shift scheduling and torque converter clutch scheduling. The WSS signal is also used to detect rough road conditions.

DTC DESCRIPTION

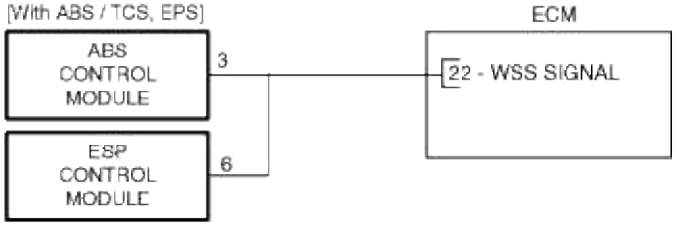
The ECM evaluates engine speed and mass air flow if there is no vehicle speed signal. This evaluation of both values will detect open circuit or short circuit errors on the wheel speed sensor. The ECM sets DTC P0501 if there is no vehicle speed signal from wheel speed sensor while both engine speed and mass air flow are higher than predetermined threshold during the predetermined time.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check vehicle speed signal	• Open or short in harness • Contact resistance in connectors • Faulty wheel speed sensor
Enable Conditions	• Engine speed >2016 rpm • Mass air flow >218mg/stk • Coolant temperature > 60°C(140°F) • No fuel shut-off	
Threshold Value	• Vehicle speed = 0 with high engine speed and high load	
Diagnostic Time	• 60 sec. (AT)/40 sec. (MT)	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

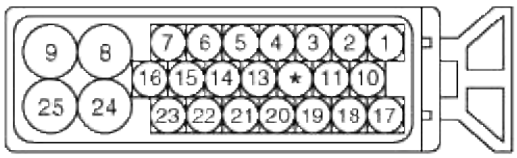
[CIRCUIT DIAGRAM]



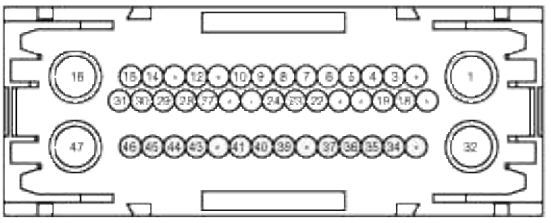
[CONNECTION INFORMATION]

Terminal	Connected to	Function
3	ECM Terminal C68-4(22)	WSS Signal
6	ECM Terminal C68-4(22)	WSS Signal

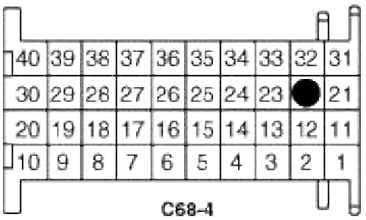
[HARNESS CONNECTORS]



E10
ABS

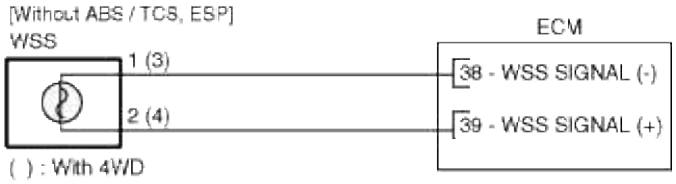


E11
ESP



C68-4
ECM side terminal

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

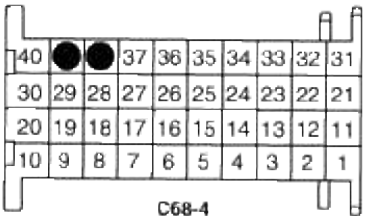
Terminal	Connected to	Function
1(3)	ECM Terminal C68-4(38)	WSS Signal (-)
2(4)	ECM Terminal C68-4(39)	WSS Signal (+)

( ) : With 4WD

[HARNESS CONNECTORS]

E26
WSS

E25
WSS (With 4WD)



C68-4
ECM side terminal

SIGNAL CIRCUIT INSPECTION

[With ABS]

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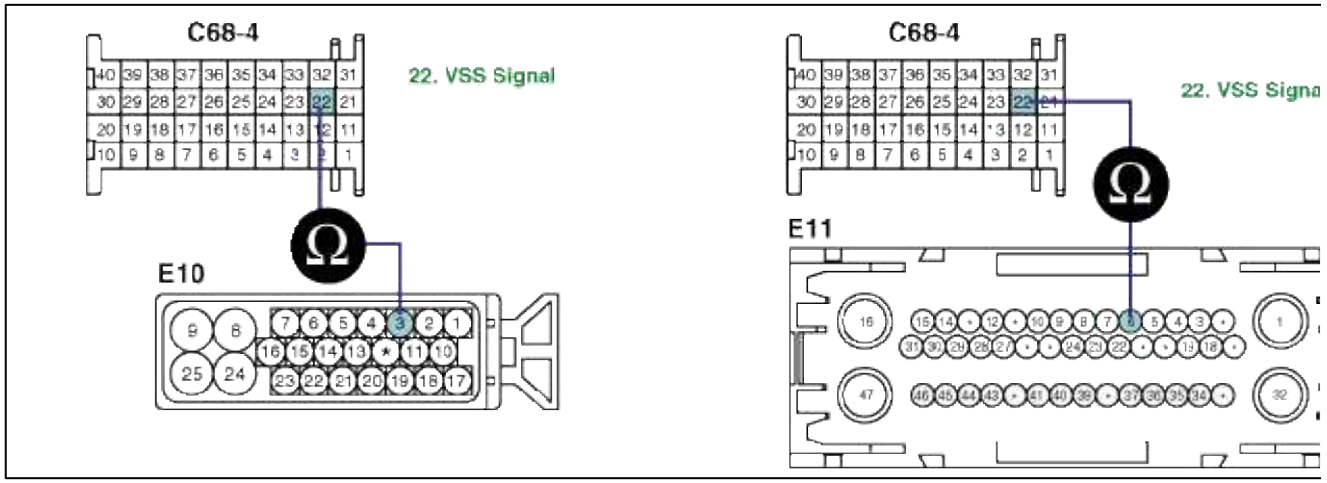
1. Check for open in circuit
   (1) Ignition "OFF".
   (2) Disconnect ECM and ABS or ESP Control Module connectors.
   (3) Measure resistance between terminals 22 of the ECM harness connector and 3 of the ABS Control Module h connector(W/ABS).
   Measure resistance between terminals 22 of the ECM harness connector and 6 of the ESP Control Module ha connector(W/ESP).

   Specification : Approx. 0Ω



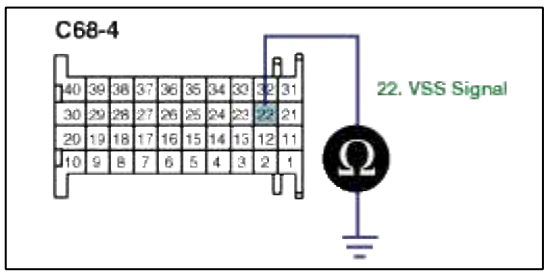
   (4) Is resistance within the specification?

   YES
   Go to next step as below

   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in circuit.
   (1) Measure resistance between terminal 22 of the ECM harness connector and chassis ground

   Specification : Infinite



   (2) Is resistance within the specification?

   YES
   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

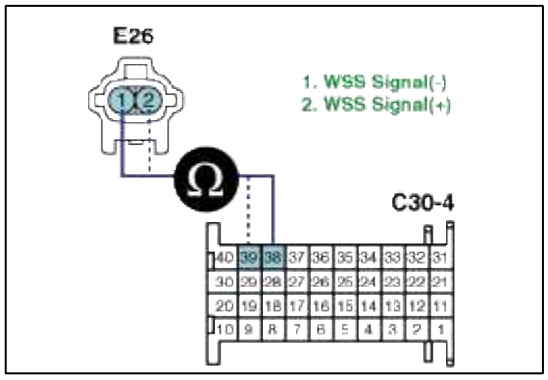
   NO
   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

[Without ABS]

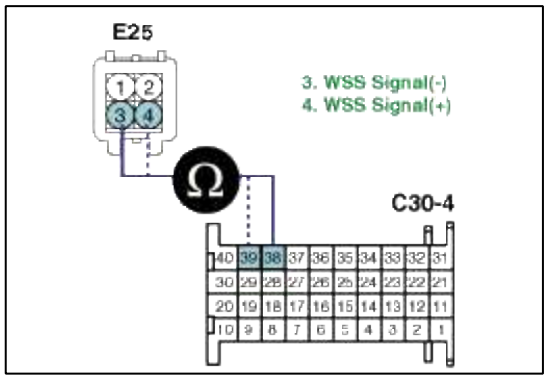
1. Check for open in circuit.
   (1) Ignition "OFF".
   (2) Disconnect ECM and wheel speed sensor(front right) harness connector.
   (3) Measure resistance between wheel speed sensor harness connector and ECM harness connector.

Specification : Approx. 0Ω

[W/O 4WD]
A. Terminal 1(sensor) & Terminal 38(ECM)
B. Terminal 2(sensor) & Terminal 39(ECM)



[With 4WD]
A. Terminal 3(sensor) & Terminal 38(ECM)
B. Terminal 4(sensor) & Terminal 39(ECM)



   (4) Is resistance within the specification?

YES

Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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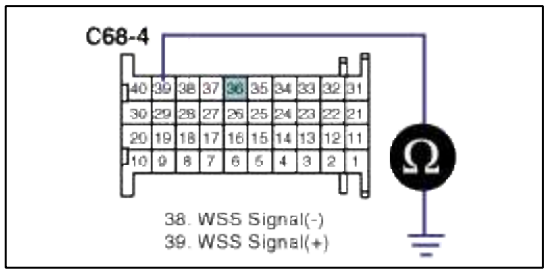
2. Check for short to ground in circuit.
   (1) Measure resistance between terminal 38 of the ECM harness connector and chassis ground.
   (2) Measure resistance between terminal 39 of the ECM harness connector and chassis ground.

   Specification : Infinite



   (3) Is resistance within the specification?

   YES

   Check wheel speed sensor(FR) as follow:

   A. Gap between ABS sensor and trigger wheel (Air gap : 0.3~1.1 mm(0.011 ~ 0.043 in))

   B. Trigger wheel condition

   C. Sensor resistance : Approx. 1,300~1,900Ω at 20°C(68°F)

   Replace wheel speed sensor as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

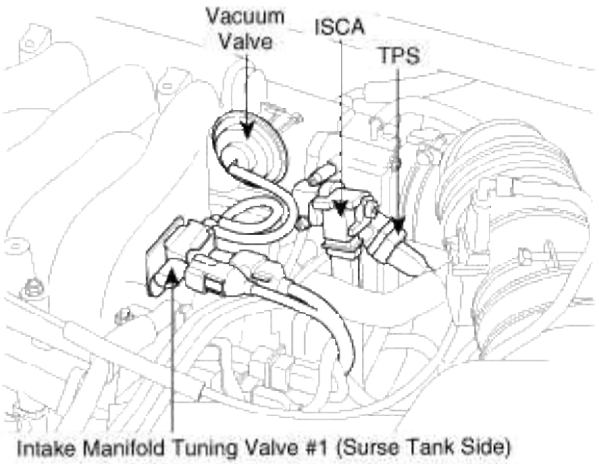
System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0505

COMPONENT LOCATION



GENERAL DESCRIPTION

When the TP sensor's signal indicates closed throttle position and the engine is idling, the PCM adjusts the idle speed control actuator so that the engine runs at the correct idling speed, regardless of coolant temperature, load and etc. When the additional load applied in the engine, the air flow through the idle speed control actuator is increased momentarily to raise the idling speed.

DTC DESCRIPTION

The temperature of catalyst has an effect on emissions. Also, the PCM estimates the temperature of catalyst by intake air mass. By the way, the intake air mass is controlled by ISCA during idling. So, if the Integral of intake air mass is below the threshold value, the PCM judges that ISCA doesn't work properly.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Plausibility check (MAF deviation monitoring under cold start)	• Restriction in intake or exhaust system • Carbonustment of the accelerator cable • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Catalyst heating active • Drive train positon : N or P • 12 seconds after engine start. • Estimated altitude > 820hPa • 11V < Battery voltage < 16V • Before Lambda controller activated • No relevant failure	
Threshold Value	• Integral of intake air mass is below the threshold value.	
Diagnostic Time	• 12 seconds	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

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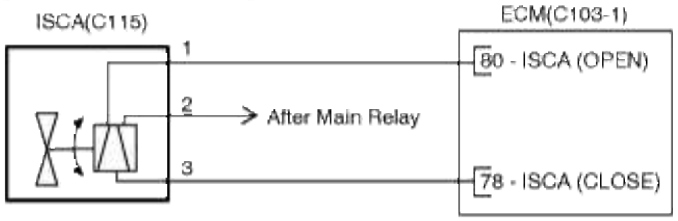
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C103-1(80)	ISCA (OPEN)
2	Main Relay	Battery Voltage
3	ECM Terminal C103-1(79)	ISCA (CLOSE)

[HARNESS CONNECTORS]

C115
ISCA

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	●	79	●	81	2	1

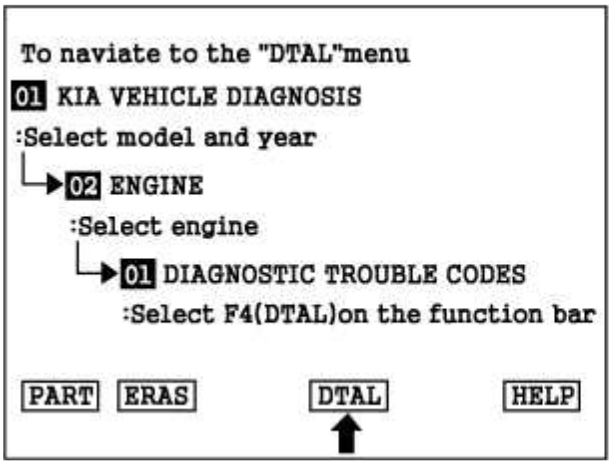
C130-1
ECM

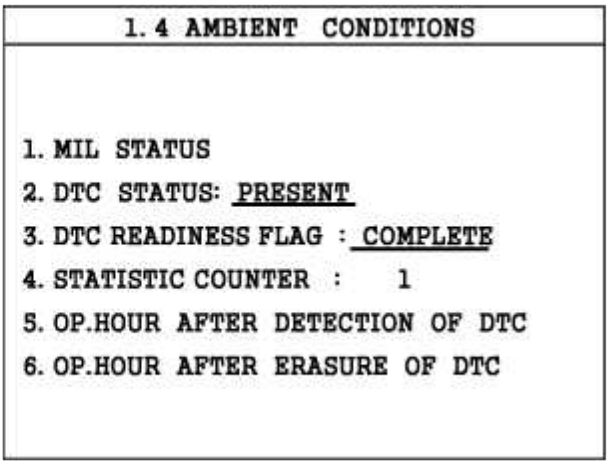
MONITOR DTC STATUS

NOTE

If any TPS, MAFS or ISCA Valve circuit codes are present, do ALL REPAIRS associated with them before proceeding with this troubleshooting tree.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.





5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

YES

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

NO

Go to "Check for restricted intake or exhaust system" procedure.

CHECK FOR RESTRICTED INTAKE OR EXHAUST SYSTEM

1. Visually/physically inspect the following items:
   A. Air cleaner filter element for excessive dirt or for any foreign objects
   B. Throttle body inlet for damage or for any foreign objects
   C. Restricted exhaust system
2. Was a problem found in any of the above areas?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to "W/harness Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Componment Inspection" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Remove ISCA from Throttle body and Check for throttle bore, throttle plate and the ISCA passages for chocking and for any foreign objects. Repair or clean as necessary
3. Ignition "ON" & Engine "OFF".
4. Connect scan tool and select "IDLE SPEED ACTUATOR" parameter on the "ACTUATION TEST" mode.
5. Activates ISCA by pressing "STAT" key
6. Check the ISCA for clicking sound and visually verifying valve closes and opens

NOTE

Repeat numerous times to ensure valve reliability

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7. Is ISCA OK?

YES

Check for poor connection between PCM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

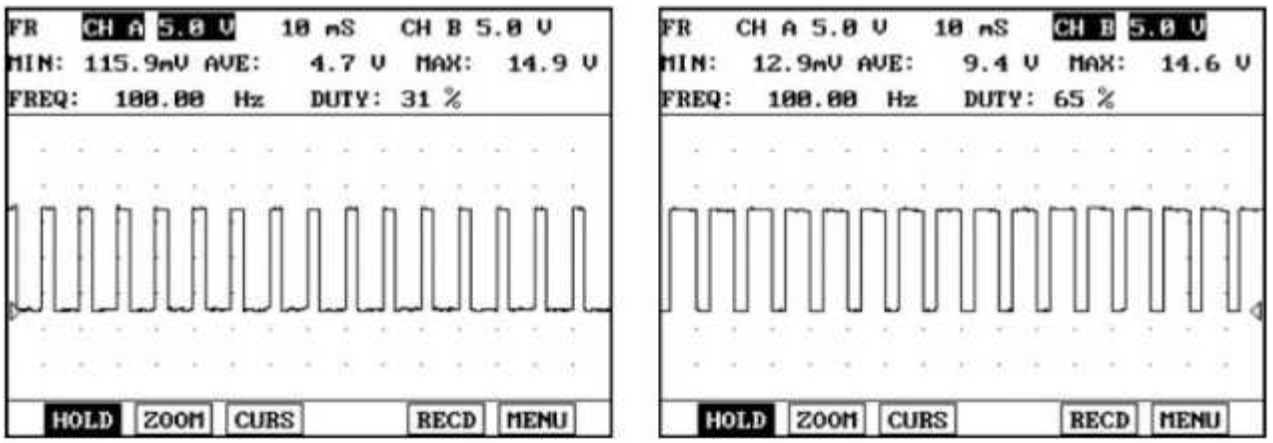
YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM



The above waveforms are the voltage signals generated when the ICA operates. This ICA is a duty type and the time opend determines the duty amount. The left side is the waveform of the ICA Opening coil during idle. The right side is the waveform of the ICA closing coil during idle.

SPECIFICATION

TPS

Throttle Position	Output Voltage
C.T (IDLE)	0.2 ~ 0.8 V
W.O.T	4.3 ~ 4.8 V

ICA COIL #1 (CLOSE)

Temp.(°C)	Temp.(°F)	ICA Coil #1 (CLOSE)(Ω)
-20	-4	12.1 ~ 13.7
-10	14	12.8 ~ 14.4
0	32	13.4 ~ 15.0
10	50	14.0 ~ 15.6
20	68	14.5 ~ 16.1
30	86	15.1 ~ 16.7
40	104	15.7 ~ 17.3
50	122	16.3 ~ 17.9
60	140	16.9 ~ 18.5
70	158	14.4 ~ 19.0
80	176	18.0 ~ 19.6
100	212	19.2 ~ 20.8

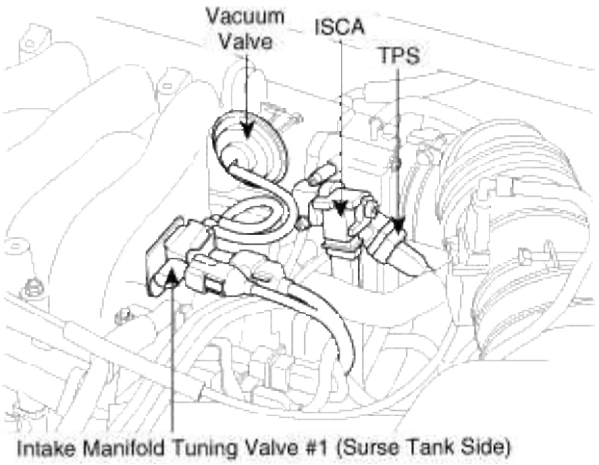
ICA COIL #2 (OPEN)

Temp.(°C)	Temp.(°F)	ICA Coil #1 (CLOSE)(Ω)
-20	-4	9.2 ~ 10.8
-10	14	9.7 ~ 11.3
0	32	10.2 ~ 11.8
10	50	10.6 ~ 12.2
20	68	11.1 ~ 12.7
30	86	11.5 ~ 13.1
40	104	12.0 ~ 13.6
50	122	12.4 ~ 14.0
60	140	12.9 ~ 14.5
70	158	13.4 ~ 15.0
80	176	13.8 ~ 15.4
100	212	14.7 ~ 16.3

Fuel System > Troubleshooting > P0506

COMPONENT LOCATION

tomsn048@gmail.com



GENERAL DESCRIPTION

When the TP sensor's signal indicates closed throttle position and the engine is idling, the ECM adjusts the idle speed control actuator so that the engine runs at the correct idling speed, regardless of coolant temperature, load and etc. When the additional load applied in the engine, the air flow through the idle speed control actuator is increased momentarily to raise the idling speed.

DTC DESCRIPTION

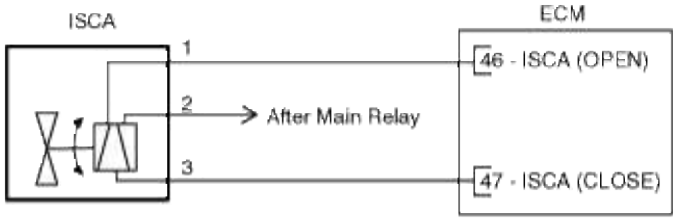
The ECM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the idle speed valve opening is stable. The ECM sets DTC P0506 if the difference to the target idle engine speed is lower than the predetermined threshold.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Compare engine speed and nominal idle speed in idle state	• Restriction in intake or exhaust system • Carbonustment of the accelerator cable • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Vehicle speed =0 • Coolant temperature>75°C(167°F) • Engine load <280 mg/stk • Throttle angle:closed • Minimum time after start:15sec. • Canister purge control <50%	
Threshold Value	• Target idle speed - Engine speed > 100rpm (Engine speed too low)	
Diagnostic Time	• 35 sec.	
Fail Safe	• Evaporative System monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

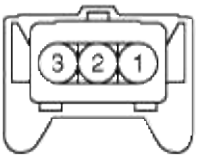
[CIRCUIT DIAGRAM]



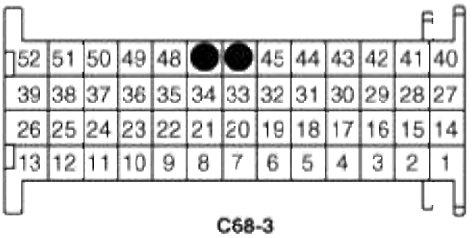
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-3(46)	ISCA (OPEN)
2	Main Relay	Battery Voltage
3	ECM Terminal C68-3(47)	ISCA (CLOSE)

[HARNESS CONNECTORS]



C72
ISCA Harness side connector



C68-3
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Componment Inspection" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Remove ISCA from Throttle body and Check for throttle bore, throttle plate and the ISCA passages for chocking and for any foreign objects. Repair or clean as necessary
3. Ignition "ON" & Engine "OFF".
4. Connect scan tool and select "IDLE SPEED ACTUATOR" parameter on the "ACTUATION TEST" mode.
5. Activates ISCA by pressing "STAT" key
6. Check the ISCA for clicking sound and visually verifying valve closes and opens

NOTE

Repeat numerous times to ensure valve reliability

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7. Is ISCA OK?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check ISCA valve for contamination, deterioration, or damage. Substitute with a known-good ISCA valve and check for proper operation. If the problem is corrected, replace ISCA valve 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

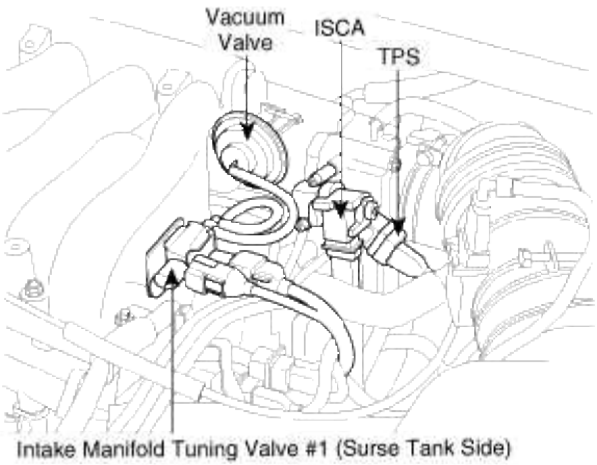
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0507

COMPONENT LOCATION



GENERAL DESCRIPTION

When the TP sensor's signal indicates closed throttle position and the engine is idling, the ECM adjusts the idle speed control actuator so that the engine runs at the correct idling speed, regardless of coolant temperature, load and etc. When the additional load applied in the engine, the air flow through the idle speed control actuator is increased momentarily to raise the idling speed.

DTC DESCRIPTION

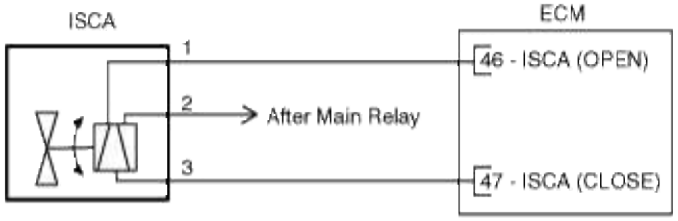
The ECM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the idle speed valve opening is stable. The ECM sets DTC P0507 if the difference to the target idle engine speed is lower than the predetermined threshold.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Compare engine speed and nominal idle speed in idle state	• A stuck or binding throttle plate • Misadjustment of the accelerator cable • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Vehicle speed =0 • Coolant temperature>75°C(167°F) • Engine load <280 mg/stk • Throttle angle:closed • Minimum time after start:15sec. • Canister purge control <50%	
Threshold Value	• Engine speed > (target RPM + 200)	
Diagnostic Time	• 35 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

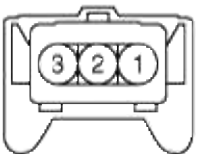
[CIRCUIT DIAGRAM]



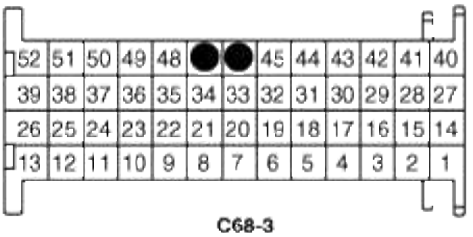
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-3(46)	ISCA (OPEN)
2	Main Relay	Battery Voltage
3	ECM Terminal C68-3(47)	ISCA (CLOSE)

[HARNESS CONNECTORS]



C72
ISCA Harness side connector



C68-3
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Componment Inspection" procedure.

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AIR LEAKAGE INSPECTION

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   If OK, go to next step.
   If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure.
   A. Vacuum hoses for splits, kinks and improper connections.
   B. Throttle body gasket.
   C. Gasket between intake manifold and cylinder head.
   D. Seals between intake manifold and fuel injectors.
   E. Exhaust system between HO2S and Three way catalyst for air leakage.
2. Check for air leakage in EVAP. Purge control valve
   (1) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (2) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve
   (3) Does the valve hold vacuum?

   YES

   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF"
2. Remove ISCA from Throttle body and Check for throttle bore, throttle plate and the ISCA passages for chocking and for any foreign objects. Repair or clean as necessary
3. Ignition "ON" & Engine "OFF".
4. Connect scan tool and select "IDLE SPEED ACTUATOR" parameter on the "ACTUATION TEST" mode.
5. Activates ISCA by pressing "STAT" key
6. Check the ISCA for clicking sound and visually verifying valve closes and opens

> **NOTE**
>
> Repeat numerous times to ensure valve reliability

7. Is ISCA OK?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check ISCA valve for contamination, deterioration, or damage. Substitute with a known-good ISCA valve and check for proper operation. If the problem is corrected, replace ISCA valve 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

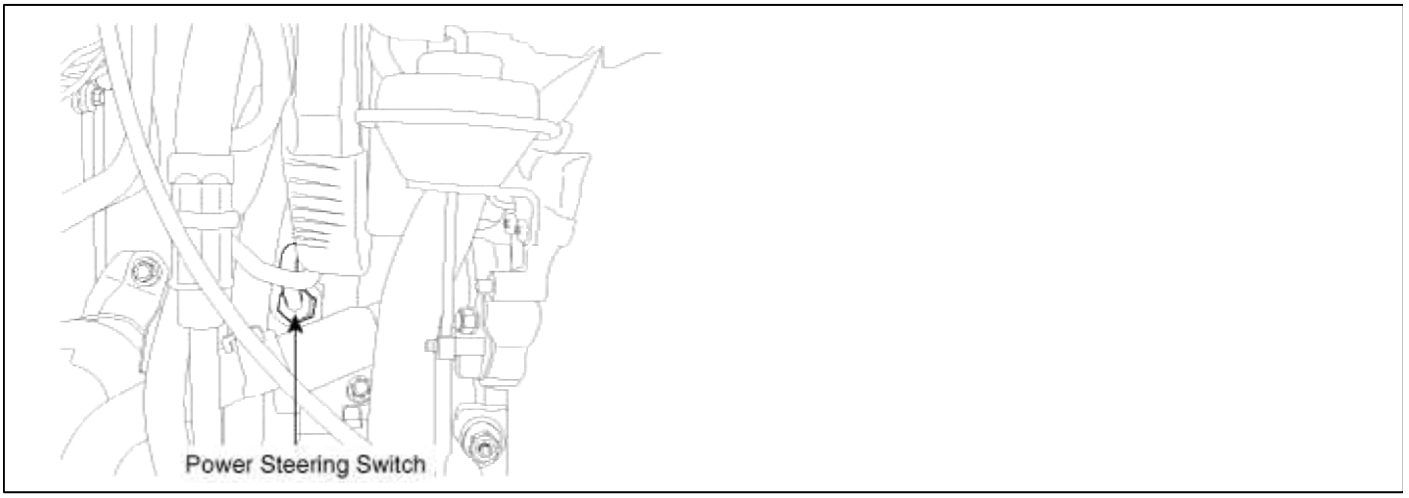
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0551

COMPONENT LOCATION



DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Power steering switch check	• Open or short circuit • Contact resistance in connectors • Faulty power steering switch
Enable Conditions	• No vehicle speed error • Coolant temperature>75°C(167°F) • Power steering switch is ON	
Threshold Value	• Power steering is ON with vehicle speed >100km/h & time > 25.5 sec.	
Diagnostic Time	• 0.1 sec.	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

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[CIRCUIT DIAGRAM]

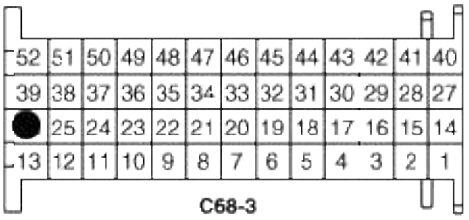
[CONNECTION INFORMATION]

Terminal	Connected to	Function
3	ECM Terminal C68-3(26)	Power Steering Switch Signal

[HARNESS CONNECTORS]

C86

HO2S Harness side connector



C68-3

ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

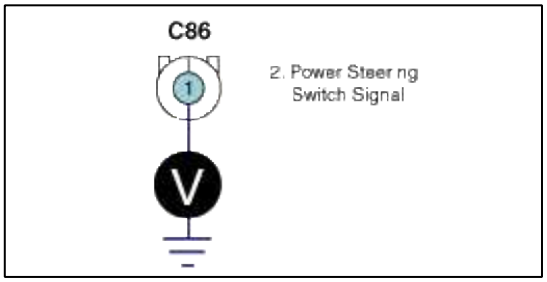
Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect P/S switch connector.
3. Start the engine, and measure voltage between P/S switch harness connector and chassis ground referring to specification.

Specification

Steering Wheel	Voltage
Straight ahead	Approx. B+
Turned	Approx. 0V



4. Is voltage within the specification?

YES

Go to "Component Inspection" procedure.

NO

Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect P/S switch connector.
3. Check continuity of the switch referring to specification.

Specification

Steering Wheel	Continuity
Straight ahead	No
Turned	Yes

4. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Check P/S switch for contamination, deterioration, or damage. Substitute with a known-good P/S switch and check for proper operation. If the problem is corrected, replace P/S switch 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

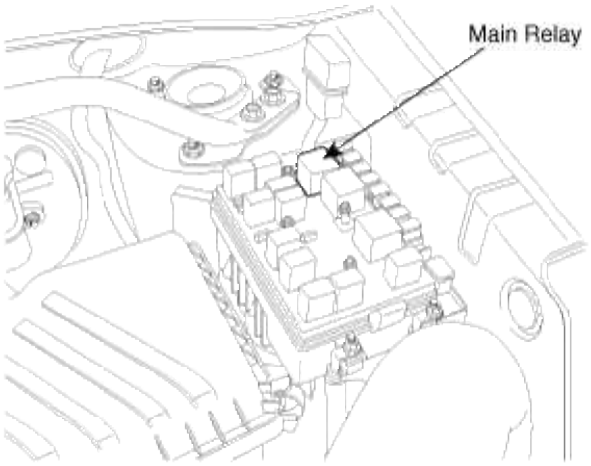
NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0560

COMPONENT LOCATION

tomsn048@gmail.com



GENERAL DESCRIPTION

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION

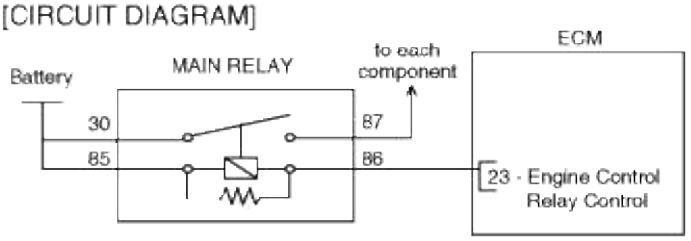
The ECM measures the voltage from ignition key and from main relay respectively and compares two voltages. This comparison will watch if the Main Relay has switched and remains on after ignition Key-On and if it has switched off after the ignition Key-Off. The ECM sets DTC P0560 if the voltage after Main Relay is lower than a predetermined threshold after ignition key-on or higher than a predetermined threshold after ignition key-off.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Comparison of battery voltage and voltage after	• Open or short circuit • Contact resistance in connectors
Enable Conditions	• Battery voltage >10V • Ignition ON	
Threshold Value	• Voltage after main relay when ON < 6V	
Diagnostic Time	• 0.1 sec.	
MIL On Condition	• -	

SCHEMATIC DIAGRAM

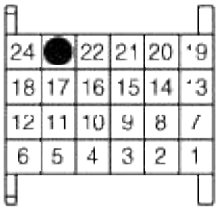
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Supply
85	Battery	Battery Supply
86	ECM Terminal C68-2(23)	Main Relay Control
87	-	Supply B+

[HARNESS CONNECTORS]



C68-2
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

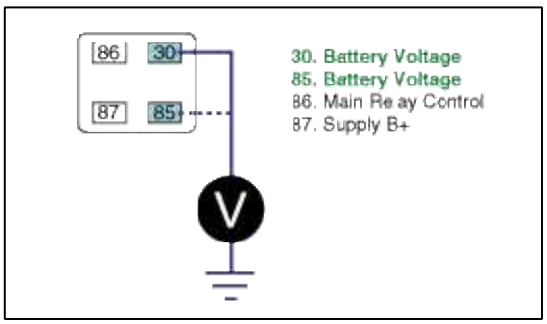
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Remove the main relay.
2. Ignition "ON" & Engine "OFF".
3. Measure the voltage between terminal 30 of the main relay harness connector(E07) and chassis ground.
4. Measure the voltage between terminal 85 of the main relay harness connector(E07) and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Control Circuit Inspection"

NO

Check for an open or short to ground in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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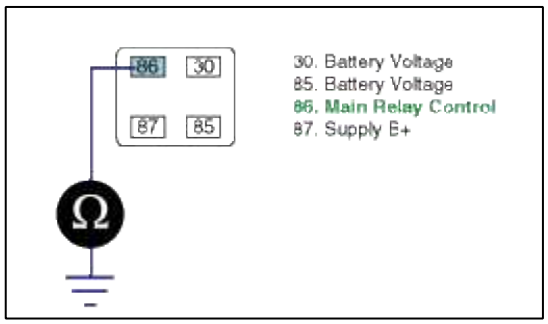
CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect Relay harness connector.
   (3) Measure resistance between terminal 86 of the relay harness connector and chassis ground.

   Specification : Infinite



   (4) Is resistance within the specification?

   YES

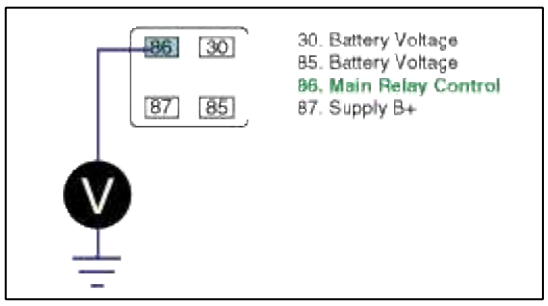
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect relay and ECM connectors.
   (3) Ignition "ON" and Engine "OFF".
   (4) Measure voltage between terminal 86 of the relay harness connector and chassis ground.

   Specification : Approx 0V



   (5) Is voltage within the specification?

   YES

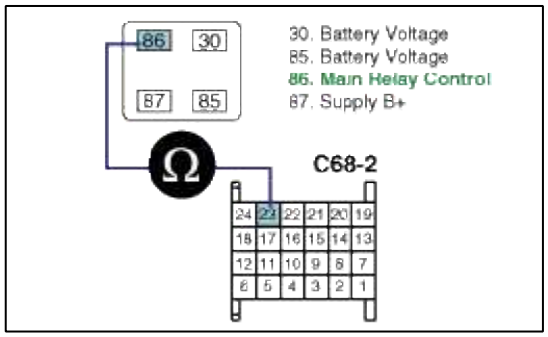
   Go to next step as below

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for open in control harness.
   (1) Ignition "OFF".
   (2) Disconnect relay and ECM connectors.
   (3) Measure resistance between terminals 86 of the relay harness connector and 23 of the ECM harness connector(C68-2).

   Specification : Approx 0Ω



   (4) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove the main relay.
3. Apply 12V and a ground to 85 and 86 terminals of the main relay.
4. Check if the main relay works well when it is energized. (If the main relay works normally, a clicking sound can be heard.)
5. Does the main relay operate normally?

YES

Go to next step as below.

NO

Replace as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

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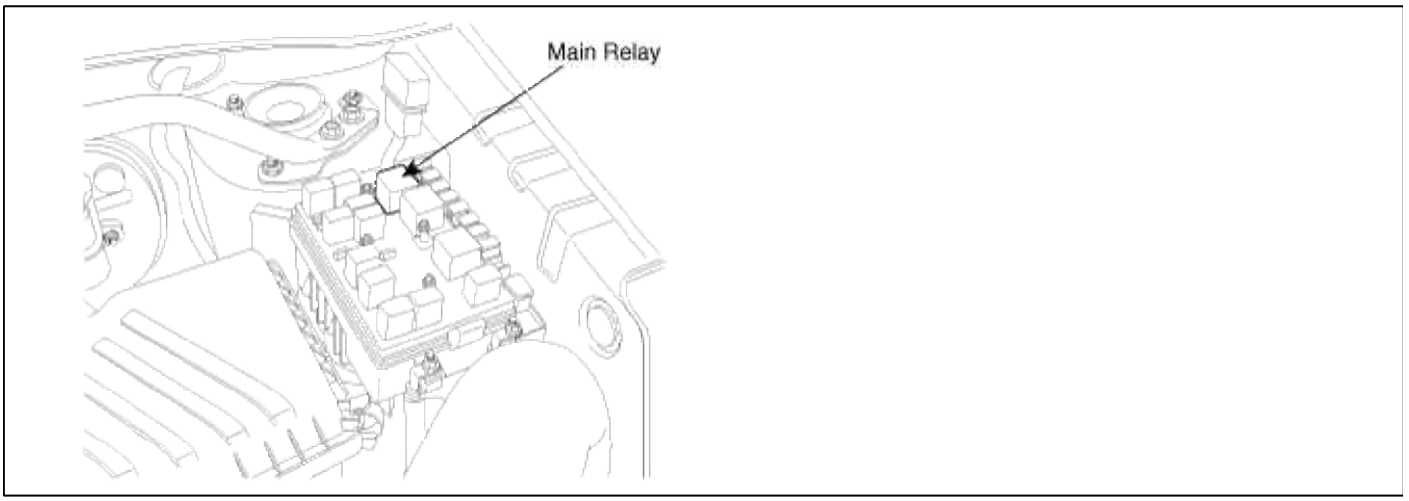
Fuel System > Troubleshooting > P0562

COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION

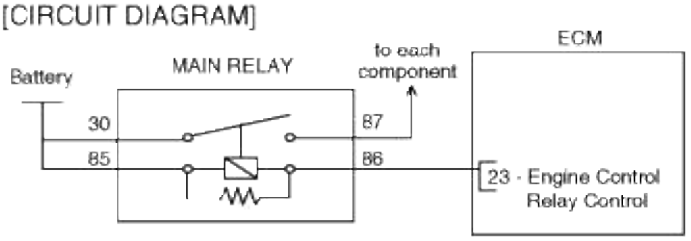
ECM sets DTC P0562 if the ECM detects system voltage lower than the possible range of battery voltage.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check system voltage.	• Contact resistance in connectors • Faulty charging system
Enable Conditions	• Vehicle speed > 19km/h(12mph)	
Threshold Value	• Voltage after main relay when ON < 6V	
Diagnostic Time	• 240 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

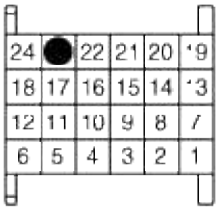
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Supply
85	Battery	Battery Supply
86	ECM Terminal C68-2(23)	Main Relay Control
87	-	Supply B+

[HARNESS CONNECTORS]



C68-2
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Charging System Inspection" procedure.

CHARGING SYSTEM INSPECTION

1. Check battery condition and Generator output
2. Are battery conditions and Generator output both okay?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

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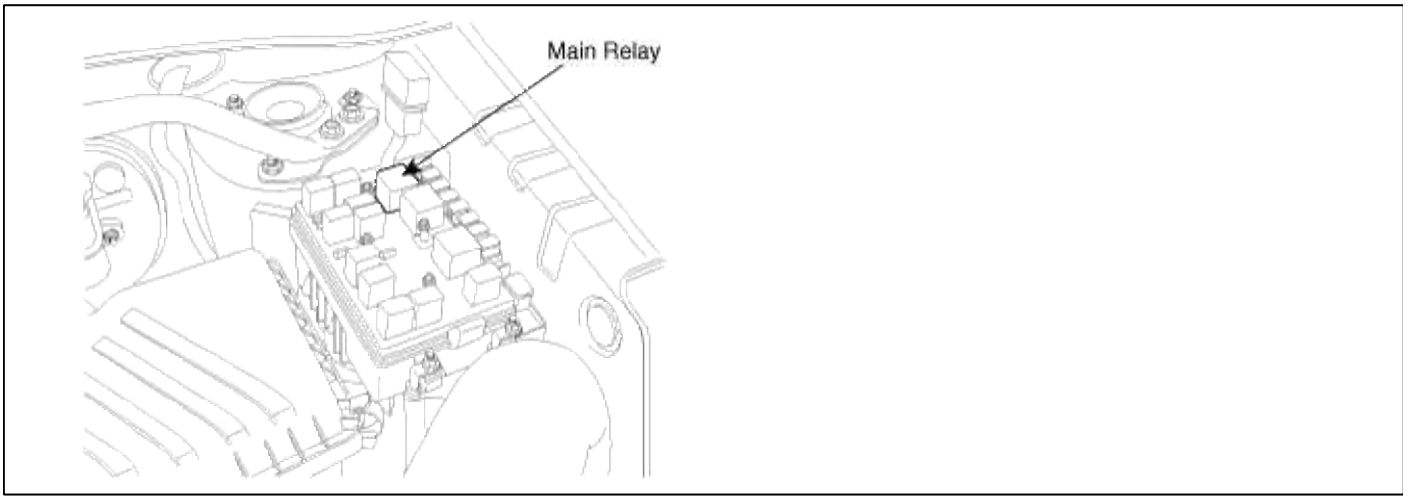
Fuel System > Troubleshooting > P0563

COMPONENT LOCATION



GENERAL DESCRIPTION

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION

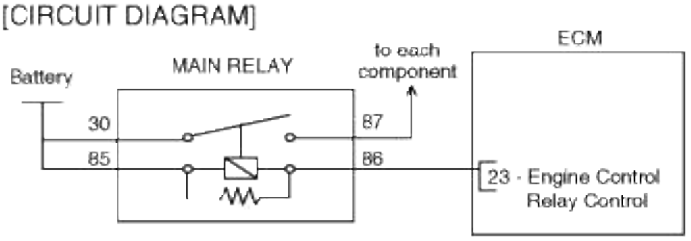
ECM sets DTC P0563 if the ECM detects system voltage lower than the possible range of battery voltage.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check system voltage.	• Contact resistance in connectors • Faulty charging system
Enable Conditions	• Vehicle speed > 19km/h(12mph)	
Threshold Value	• Voltage after main relay when ON >16V	
Diagnostic Time	• 240 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

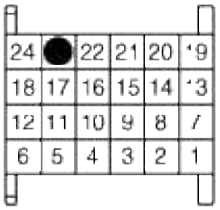
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
30	Battery	Battery Supply
85	Battery	Battery Supply
86	ECM Terminal C68-2(23)	Main Relay Control
87	-	Supply B+

[HARNESS CONNECTORS]



C68-2
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Charging System Inspection" procedure.

CHARGING SYSTEM INSPECTION

1. Check battery condition and Generator output
2. Are battery conditions and Generator output both okay?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

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Fuel System > Troubleshooting > P0605

GENERAL DESCRIPTION

A malfunction is detected by using a checksum technique for verifying data. The digital data is composed of zeros and ones. A checksum is the total of all ones in a string of data. By comparing the checksum value with a stored value, a malfunction can be detected.

DTC DESCRIPTION

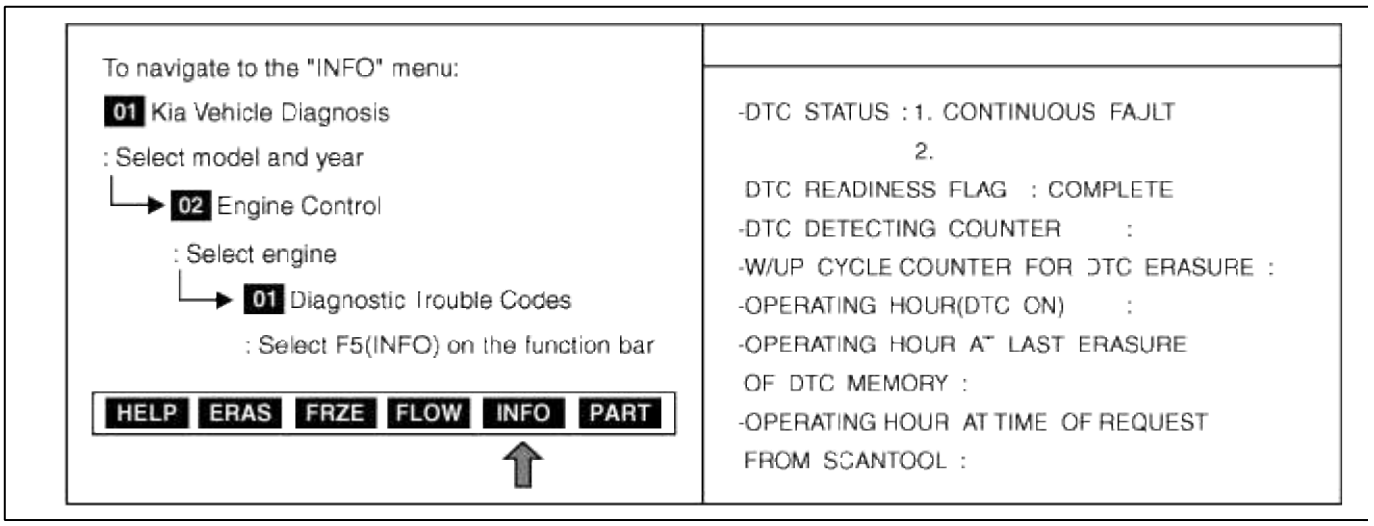
The ECM monitors RAM areas and communication connections between microcontroller and output drivers and sets DTC P0605 if failure is detected.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Check RAM Area / Communication connections	• Contact resistance in connectors • Faulty ECM
Enable Conditions	• Ignition ON	
Threshold Value	• Internal check	
Diagnostic Time	• 0.1 sec.	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

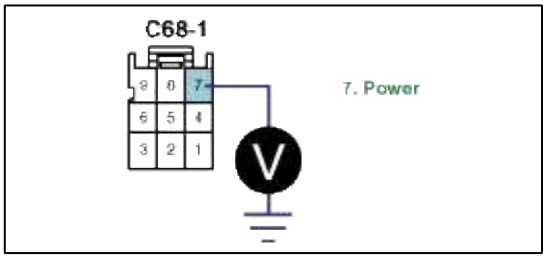
NO

Go to next step as below.

BACK VOLTAGE INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector.
3. Turn ignition "ON" and measure voltage between terminal 7 of the ECM harness connector (C68-1) and chassis ground

Specification : Remain stable at battery voltage



4. Are circuits remaining stable at battery voltage?

YES

Test with a new ECM and check for proper operation. If problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

If voltage fluctuates, check circuit Thoroughly for loose, bent or corroded terminals, Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0630

GENERAL DESCRIPTION

Regulations require that all 2005 and subsequent model year vehicles shall have the Vehicle Identification Number(VIN) available in a standardized format through the standardized data link connector in accordance with

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SAE J1979 specifications. Using a scan tool, PERFORM "VIN WRITING" procedure after replacing or reflashing a ECM.

DTC DESCRIPTION

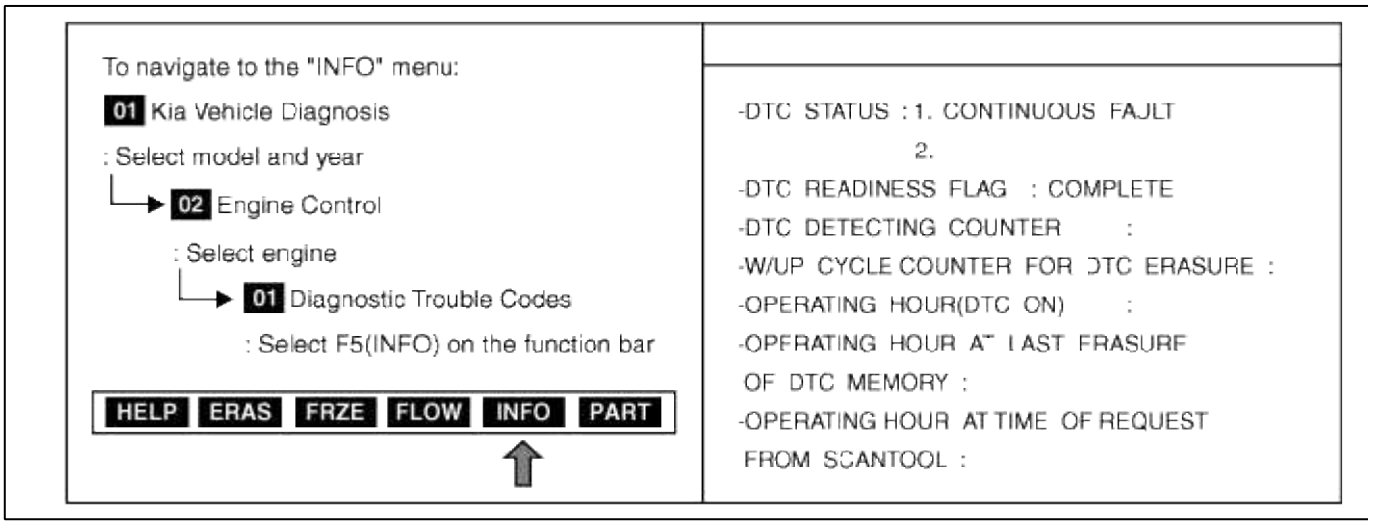
The ECM monitors ROM areas and sets DTC P0630 if there is no Vehicle Identification Number(VIN) information.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• ECM Internal Check.	• ECM is Virgin(not programmed) status
Enable Conditions	• Ignition ON	
Threshold Value	• VIN not exist in boot area	
Diagnostic Time	• Immediate.	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

A. History (Not Present) fault : DTC occurred but has been cleared.

B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next step as below.

SYSTEM INSPECTION

1. Was the ECM just replaced or reflashed?

YES

Using a scan tool, perform "VIN WRITING" procedure. Refer to the latest reference manual for scan tool and go to "Verification of Vehicle Repair" procedure

NO

Using a scan tool, read VIN information.

If there is no proper VIN information, perform "VIN WRITING" procedure.

If VIN information exists, substitute with a known-good ECM and check for proper operation. If the problem. 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

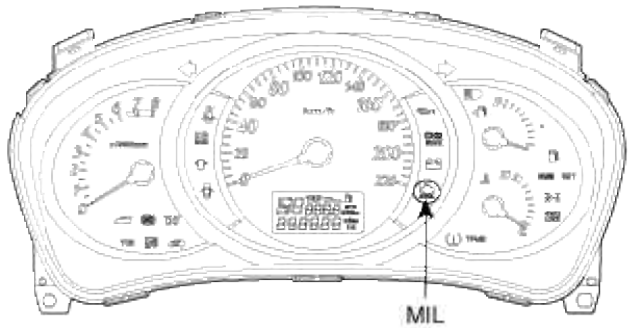
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0650

COMPONENT LOCATION



GENERAL DESCRIPTION

The Malfunction Indicator Lamp (MIL), which is located in the instrument cluster, comes on to notify the driver that there may be a problem with the vehicle and that service is needed. Immediately after the ignition switch turns on, the malfunction indicate that the MIL operates normally and goes off after starting.

DTC DESCRIPTION

ECM sets DTC P0650 if the ECM detects that the MIL control line is open or short circuit to ground or battery line.

DTC DETECTING CONDITION

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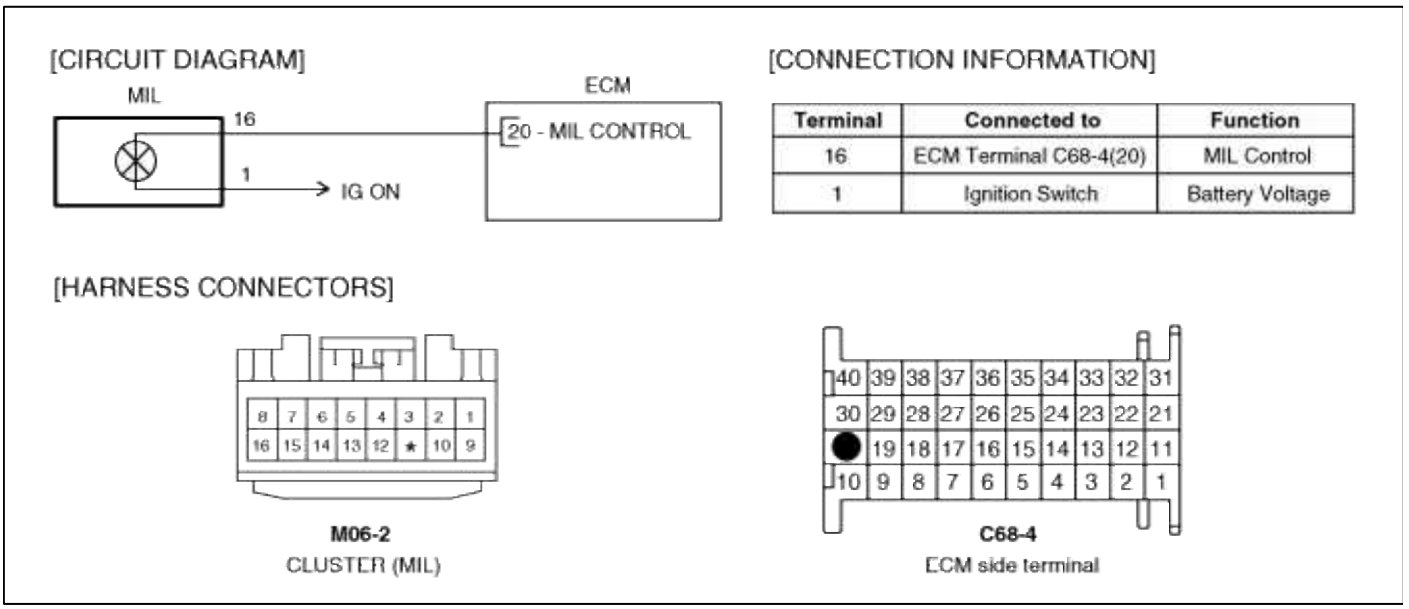
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open or short between MIL and ECM • Contact resistance in connectors • Burned out MIL bulb
Enable Conditions	• Battery voltage >10V	
Threshold Value	• Open, short to ground or battery	
Diagnostic Time	• 20 sec.	
MIL On Condition	• -	

SCHEMATIC DIAGRAM



CONTROL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ECM connector
3. Ignition "ON" & Engine "OFF"
4. Using a suitable wire, jumper the terminal 20 of ECM harness connector to chassis ground.
5. Is MIL bulb illuminated?

YES

Go to next step.

NO

Remove instrument cluster and inspect MIL bulb. If it is burned out, replace bulb. If bulb is okay, locate source of open between bulb and (20/C30-4) or between bulb and Meter Fuse. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

6. Remove wire from ECM harness connector.
7. Does MIL bulb go out?

YES

Thoroughly check for loose, bent, or corroded terminals in MIL circuit (including circuit board). Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Check for source of short to GND between bulb and ECM(20/C30-4). Repair as necessary. 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

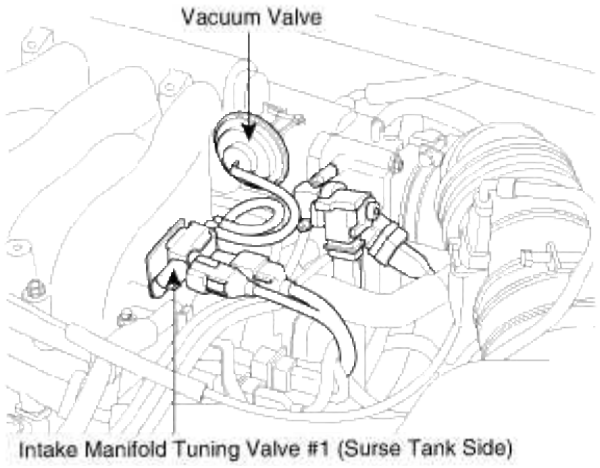
System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

Fuel System > Troubleshooting > P0661

COMPONENT LOCATION



GENERAL DESCRIPTION

Intake manifold tuning valve is used to increase torque at lower rpm and increase horsepower at higher rpm. This engine has two intake runners for each cylinder. The primary intake runner is a long, thin tube in which the intake air passes through. This allows a strong stream of air to blast into the cylinder, helping low-end torque. The secondary intake runner is a short, fat tube. This allows a large volume of air to be sucked into the engine, increasing high-end horsepower. At lower rpm range, the engine does not provide enough suction into the cylinders, starving the engine of much needed oxygen. The skinny tube helps blast the air into the cylinder for more oxygen. At higher rpm, the engine has plenty of suction but the intake runner is too small to provide the oxygen it needs. The short, fat tube allows plenty of oxygen to be sucked in. The ECM controls this function utilizing a intake manifold tuning valve. Based on engine RPM, the position of the shutter within the intake manifold is changed, thereby directing intake air through a longer path for low rpm range or a shorter path for high rpm range.

DTC DESCRIPTION

ECM sets DTC P0661 if the ECM detects that intake manifold tuning valve control circuit is shorted to ground.

DTC DETECTING CONDITION

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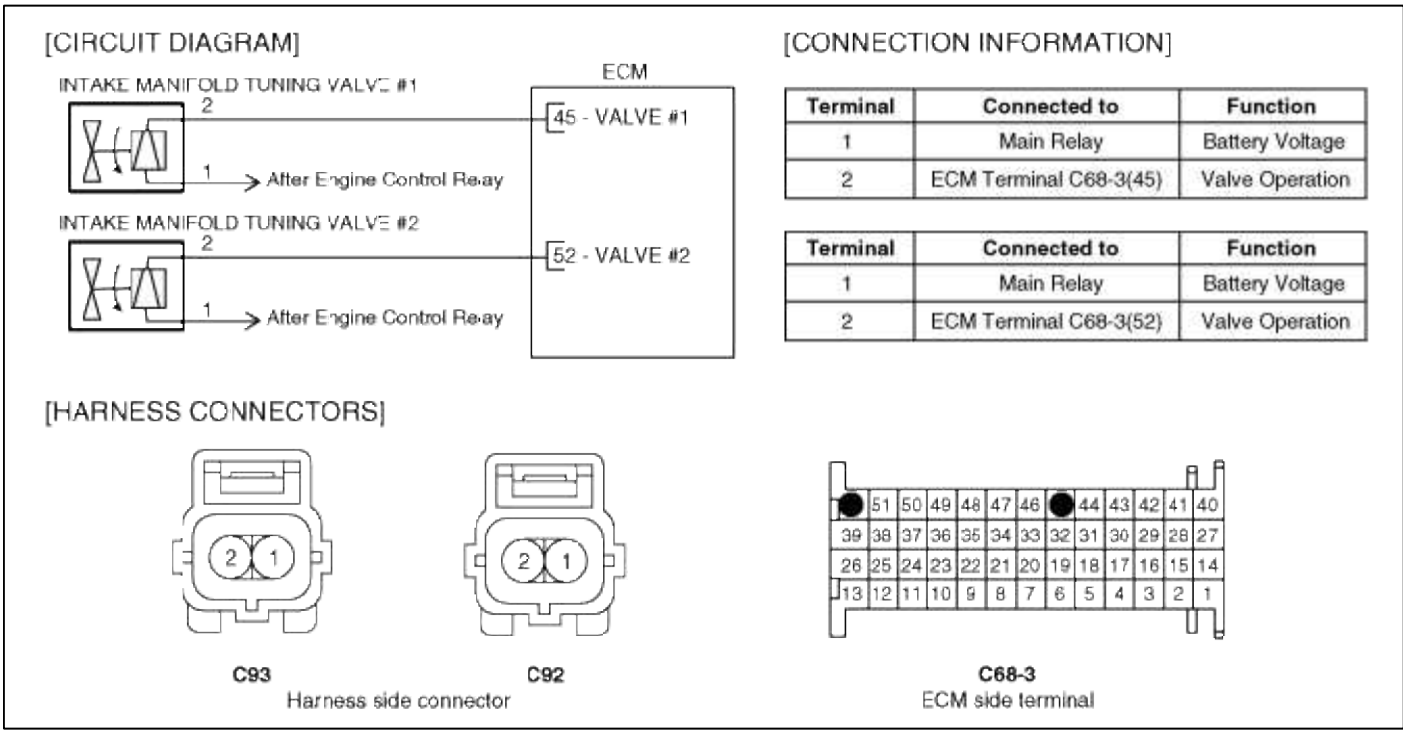
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty VICV
Enable Conditions	• 10 < Battery voltage(V) <16 • Engine speed(rpm) >30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

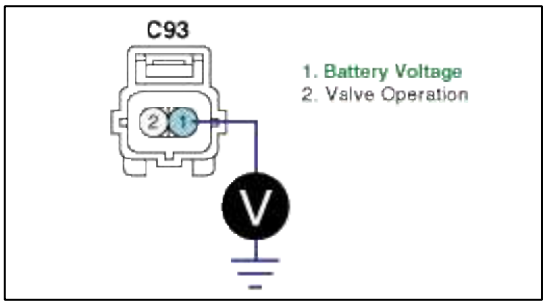
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

2. Measure voltage between terminal 1 of the valve harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection"

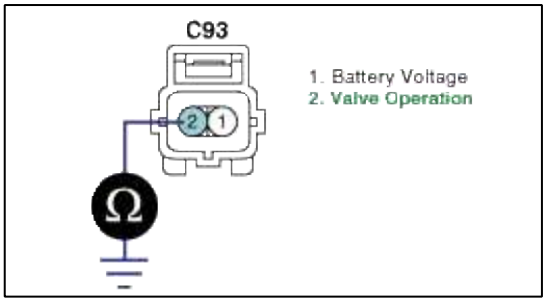
NO

Check for open or blown SNSR Fuse(2).
Repair as necessary and go to "Verification of Vehicle Repair" procedure

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 2 of the valve harness connector and chassis ground

Specification : Infinite



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure

NO

Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect valve connector.

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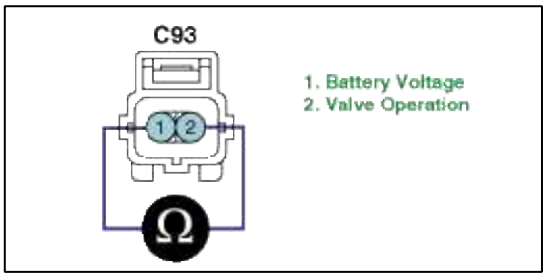
3. Measure resistance between terminals 1 and 2 of the valve connector(Component side).

Specification : Approx. 29~35Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check valve for contamination, deterioration, or damage. Substitute with a known-good valve and check for proper operation. If the problem is corrected, replace valve 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

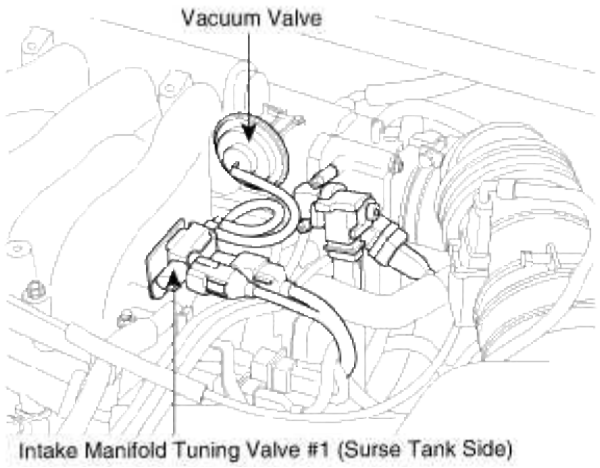
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	29~35

Fuel System > Troubleshooting > P0662

COMPONENT LOCATION



GENERAL DESCRIPTION

Intake manifold tuning valve is used to increase torque at lower rpm and increase horsepower at higher rpm. This engine has two intake runners for each cylinder. The primary intake runner is a long, thin tube in which the intake air passes through. This allows a strong stream of air to blast into the cylinder, helping low-end torque. The secondary intake runner is a short, fat tube. This allows a large volume of air to be sucked into the engine, increasing high-end horsepower. At lower rpm range, the engine does not provide enough suction into the cylinders, starving the engine of much needed oxygen. The skinny tube helps blast the air into the cylinder for more oxygen. At higher rpm, the engine has plenty of suction but the intake runner is too small to provide the oxygen it needs. The short, fat tube allows plenty of oxygen to be sucked in. The ECM controls this function utilizing a intake manifold tuning valve. Based on engine RPM, the position of the shutter within the intake manifold is changed, thereby directing intake air through a longer path for low rpm range or a shorter path for high rpm range.

DTC DESCRIPTION

ECM sets DTC P0662 if the ECM detects that intake manifold tuning valve control circuit is open or shorted to battery voltage.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty VICV
Enable Conditions	• 10 < Battery voltage(V) <16 • Engine speed(rpm) >30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

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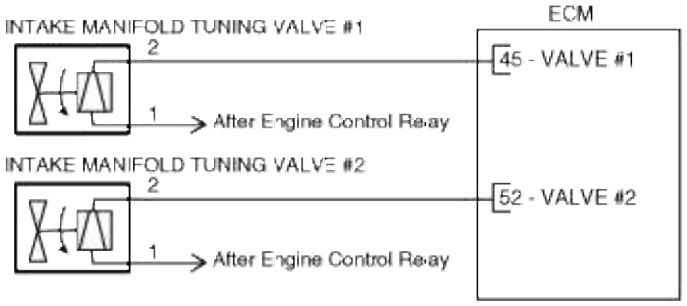
[CIRCUIT DIAGRAM]

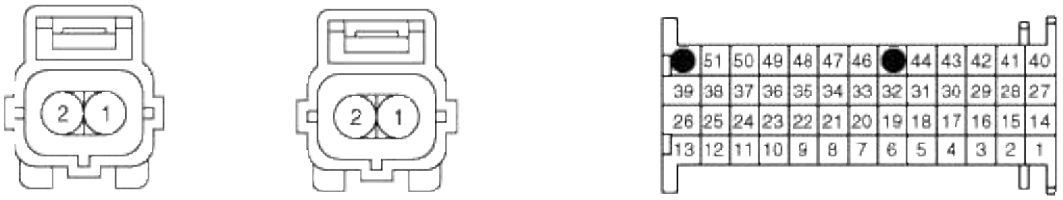


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal C68-3(45)	Valve Operation

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal C68-3(52)	Valve Operation

[HARNESS CONNECTORS]



C93 C92
Harness side connector

C68-3
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

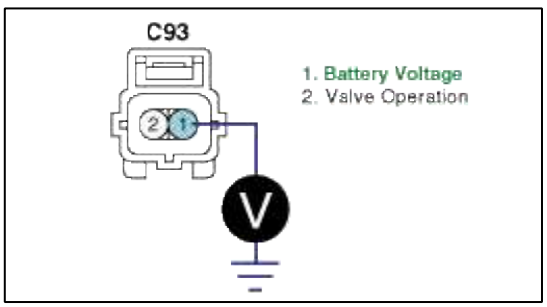
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the valve harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection"

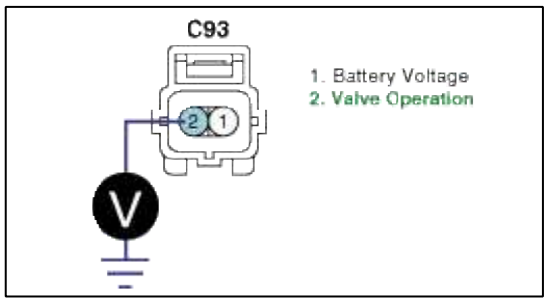
NO

Check for open or blown SNSR Fuse(2).
Repair as necessary and go to "Verification of Vehicle Repair" procedure

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect ECM connector.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 2 of the valve harness connector and chassis ground.

   Specification : Approx. 0V



   (5) Is voltage within the specification?

   YES

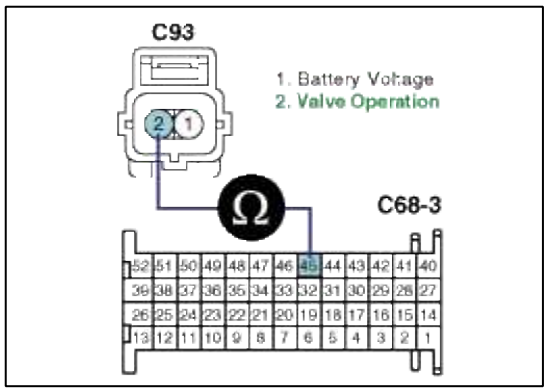
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for Open in Control Circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the valve harness connector and 45 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

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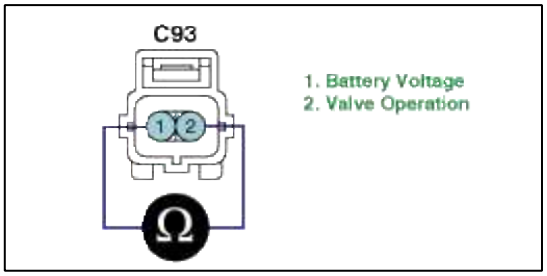
1. Ignition "OFF".
2. Disconnect valve connector.
3. Measure resistance between terminals 1 and 2 of the valve connector(Component side).

Specification : Approx. 29~35Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check valve for contamination, deterioration, or damage. Substitute with a known-good valve and check for proper operation. If the problem is corrected, replace valve 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

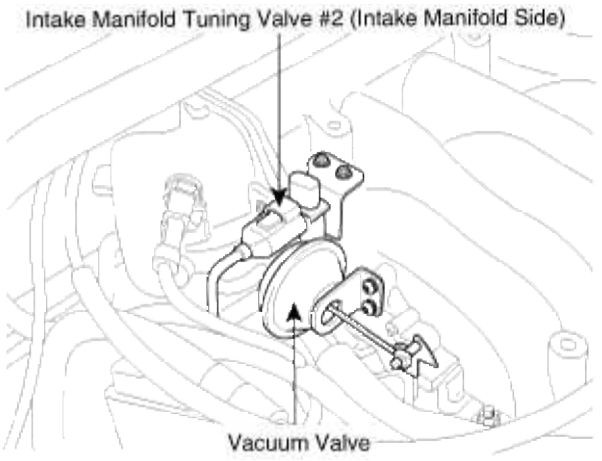
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	29~35

Fuel System > Troubleshooting > P0664

COMPONENT LOCATION



GENERAL DESCRIPTION

Intake manifold tuning valve is used to increase torque at lower rpm and increase horsepower at higher rpm. This engine has two intake runners for each cylinder. The primary intake runner is a long, thin tube in which the intake air passes through. This allows a strong stream of air to blast into the cylinder, helping low-end torque. The secondary intake runner is a short, fat tube. This allows a large volume of air to be sucked into the engine, increasing high-end horsepower. At lower rpm range, the engine does not provide enough suction into the cylinders, starving the engine of much needed oxygen. The skinny tube helps blast the air into the cylinder for more oxygen. At higher rpm, the engine has plenty of suction but the intake runner is too small to provide the oxygen it needs. The short, fat tube allows plenty of oxygen to be sucked in. The ECM controls this function utilizing a intake manifold tuning valve. Based on engine RPM, the position of the shutter within the intake manifold is changed, thereby directing intake air through a longer path for low rpm range or a shorter path for high rpm range.

DTC DESCRIPTION

ECM sets DTC P0664 if the ECM detects that intake manifold tuning valve control circuit is shorted to ground.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver Stage Check	• Open in power supply harness • Short to ground in control harness • Contact resistance in connectors • Faulty VICV
Enable Conditions	• 10 < Battery voltage(V) <16 • Engine speed(rpm) >30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

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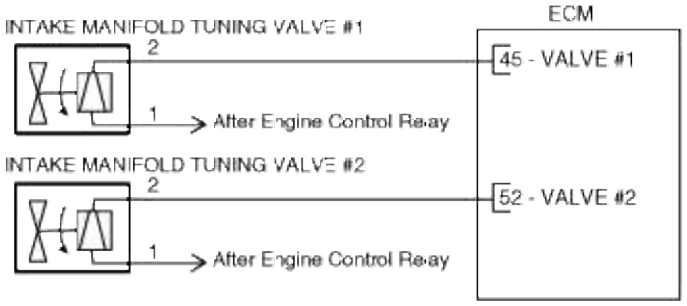
[CIRCUIT DIAGRAM]

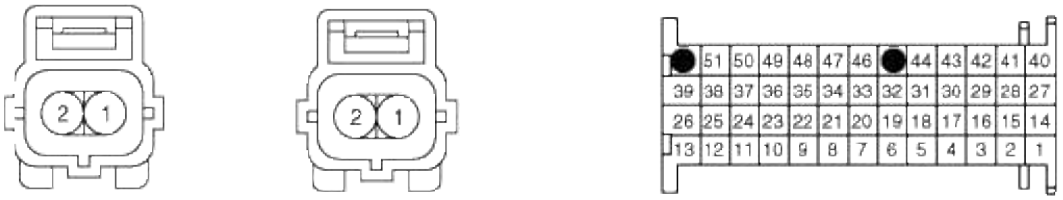


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal C68-3(45)	Valve Operation

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM Terminal C68-3(52)	Valve Operation

[HARNESS CONNECTORS]



C93 C92
Harness side connector

C68-3
ECM side terminal

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

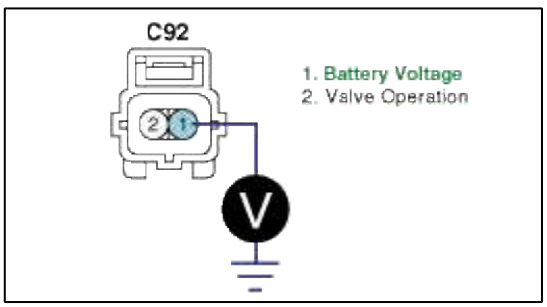
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the valve harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection"

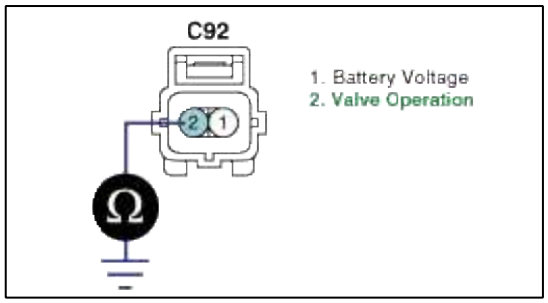
NO

Check for open or blown SNSR Fuse(2).
Repair as necessary and go to "Verification of Vehicle Repair" procedure

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 2 of the valve harness connector and chassis ground

Specification : Infinite



2. Is resistance within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure

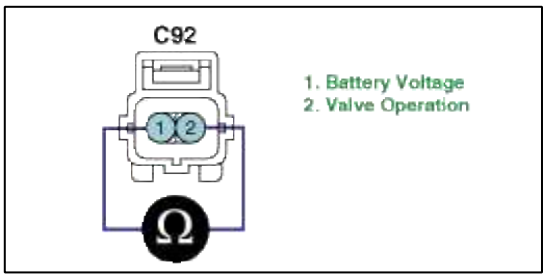
NO

Repair open or short to ground in control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect valve connector.
3. Measure resistance between terminals 1 and 2 of the valve connector(Component side).

Specification : Approx. 29~35Ω at 20°C(68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check valve for contamination, deterioration, or damage. Substitute with a known-good valve and check for proper operation. If the problem is corrected, replace valve 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

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3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

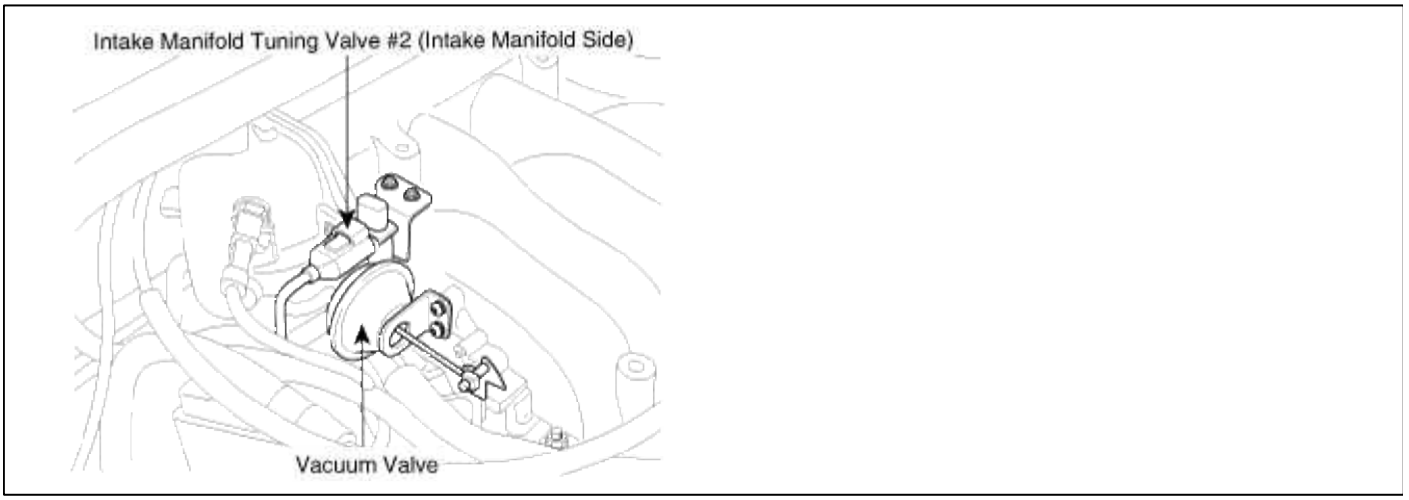
Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	29~35

Fuel System > Troubleshooting > P0665

COMPONENT LOCATION



GENERAL DESCRIPTION

Intake manifold tuning valve is used to increase torque at lower rpm and increase horsepower at higher rpm. This engine has two intake runners for each cylinder. The primary intake runner is a long, thin tube in which the intake air passes through. This allows a strong stream of air to blast into the cylinder, helping low-end torque. The secondary intake runner is a short, fat tube. This allows a large volume of air to be sucked into the engine, increasing high-end horsepower. At lower rpm range, the engine does not provide enough suction into the cylinders, starving the engine of much needed oxygen. The skinny tube helps blast the air into the cylinder for more oxygen. At higher rpm, the engine has plenty of suction but the intake runner is too small to provide the oxygen it needs. The short, fat tube allows plenty of oxygen to be sucked in. The ECM controls this function utilizing a intake manifold tuning valve. Based on engine RPM, the position of the shutter within the intake manifold is changed, thereby directing intake air through a longer path for low rpm range or a shorter path for high rpm range.

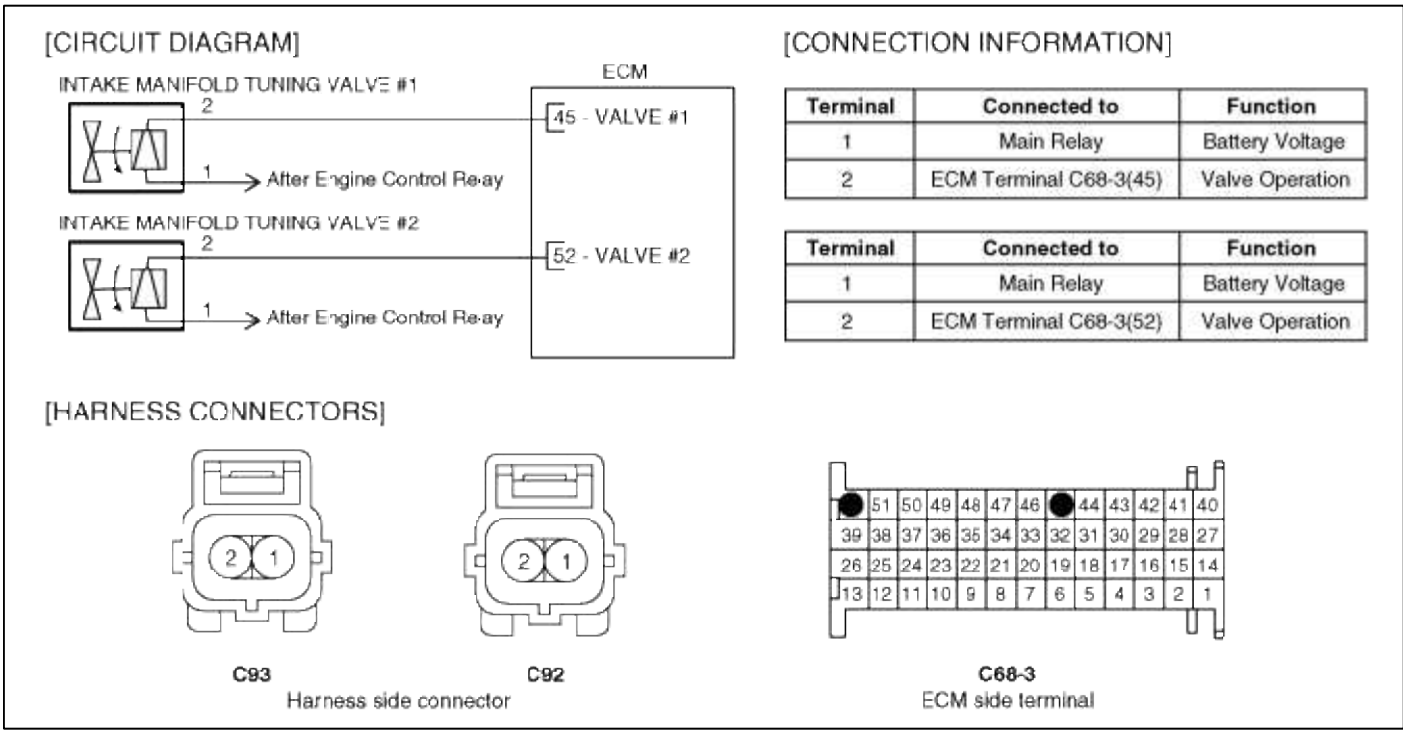
DTC DESCRIPTION

ECM sets DTC P0665 if the ECM detects that intake manifold tuning valve control circuit is open or shorted to battery voltage.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver Stage Check	• Open or short to battery in control harness. • Contact resistance in connectors • Faulty VICV
Enable Conditions	• 10 < Battery voltage(V) <16 • Engine speed(rpm) >30	
Threshold Value	• Open or short to battery	
Diagnostic Time	• 1.5 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM



TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

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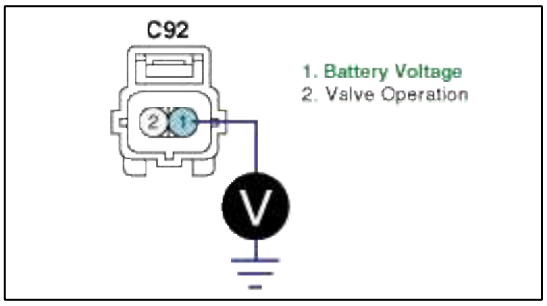
2. Measure voltage between terminal 1 of the valve harness connector and chassis ground.

Specification : Approx. B+



3. Is voltage within the specification?

YES

Go to "Control Circuit Inspection"

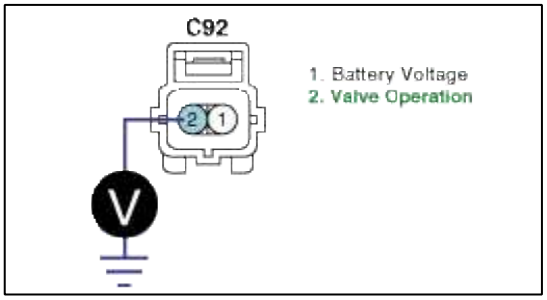
NO

Check for open or blown SNSR Fuse(2).
Repair as necessary and go to "Verification of Vehicle Repair" procedure

CONTROL CIRCUIT INSPECTION

1. Check for short to ground in control circuit.
   (1) Ignition "OFF".
   (2) Disconnect ECM connector.
   (3) Ignition "ON" & Engine "OFF".
   (4) Measure voltage between terminal 2 of the valve harness connector and chassis ground.

Specification : Approx. 0V



   (5) Is voltage within the specification?

YES

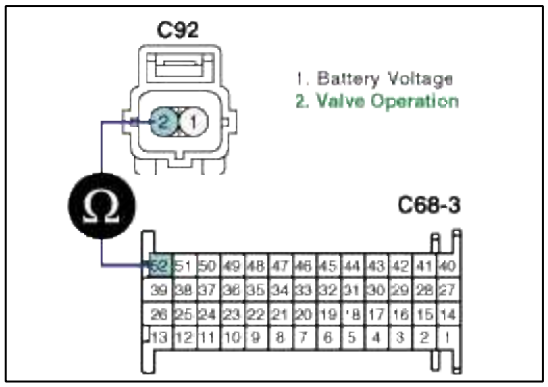
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for Open in Control Circuit.
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 2 of the valve harness connector and 52 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification Vehicle Repair" procedure

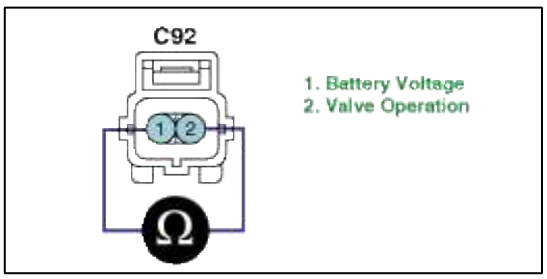
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect valve connector.
3. Measure resistance between terminals 1 and 2 of the valve connector(Component side).

   Specification : Approx. 29~35Ω at 20°C(68°F)



4. Is resistance within the specification?

   YES

   Go to next step as below.

   NO

   Check valve for contamination, deterioration, or damage. Substitute with a known-good valve and check for proper operation. If the problem is corrected, replace valve 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SPECIFICATION

Temperature		Resistance (Ω)
(°C)	(°F)	
20	68	29~35

Fuel System > Troubleshooting > P0700

GENERAL DESCRIPTION

The TCM can request activation of the MIL lamp Via a communication line to the ECM. This is only a request from TCM to ECM to turn the MIL on. The fault code is stored in the TCM. Select Transaxle system on the Scantool and monitor DTC related automatic transaxle system.
DO ALL REPAIRS associated malfunction with A/T.

DTC DETECTING CONDITION

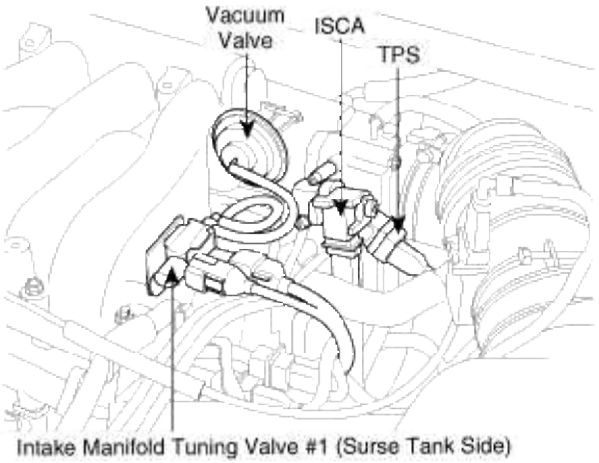
ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Freeze frame request via CAN	• Transaxle system
Enable Conditions	• Battery voltage(V) >10V • Engine speed(rpm) >256 rpm	
Threshold Value	• MIL is requested by TCM	
Diagnostic Time	• Immediate	
MIL On Condition	• Immediate	

MONITOR DTC STATUS

1. This is only a request from TCM to ECM to turn the MIL on. The fault code is stored in the TCM. The Freeze Frame Data is stored in the ECM under the P0700 request code. Be sure to retrieve freeze frame data before clearing code P0700 from ECM.
2. Check the transaxle system.

Fuel System > Troubleshooting > P1505

COMPONENT LOCATION



GENERAL DESCRIPTION

The Idle Speed Control Actuator (ISCA) is installed on the intake manifold and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle vlave is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditons, and also to provide additional air during starting. The ISCA vlave consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensor, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by pass airflow into the engine.

DTC DESCRIPTION

ECM sets DTC P1505 if the ECM detects that the ISCA(OPEN) control circuit is open or short to ground.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open or short to ground in harness • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Battery voltage >10V	
Threshold Value	• Open or short to ground	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

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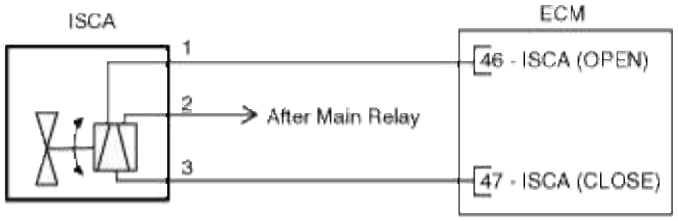
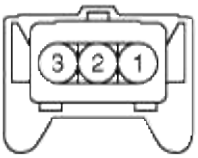
[CIRCUIT DIAGRAM]



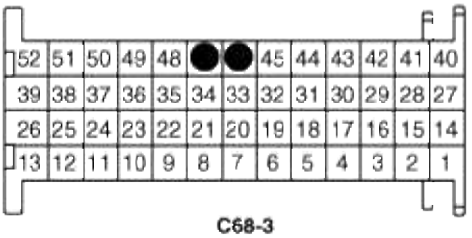
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-3(46)	ISCA (OPEN)
2	Main Relay	Battery Voltage
3	ECM Terminal C68-3(47)	ISCA (CLOSE)

[HARNESS CONNECTORS]



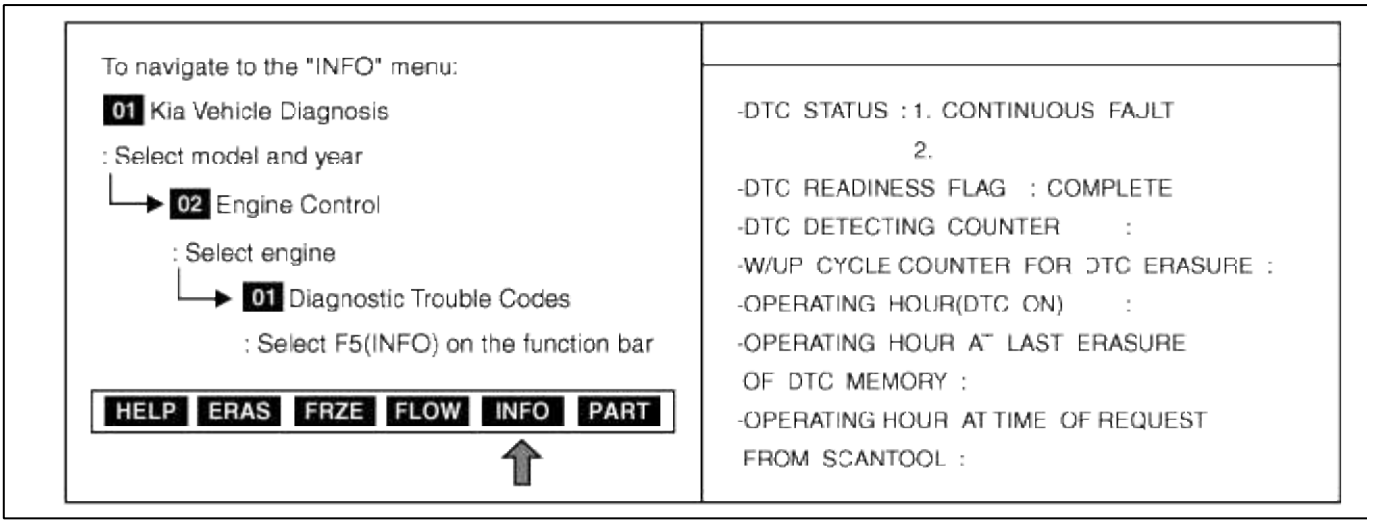
C72
ISCA Harness side connector



C68-3
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

A. History (Not Present) fault : DTC occurred but has been cleared.

B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

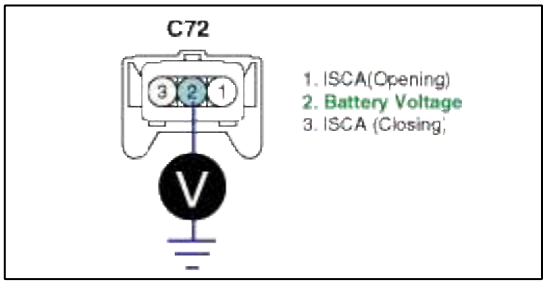
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

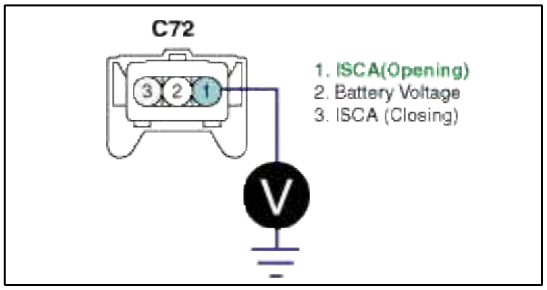
NO

Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal 1 of the ISCA harness connector and chassis ground.

Specification : Approx. 3~4V



3. Is voltage within the specification?

YES

Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to next step as below.

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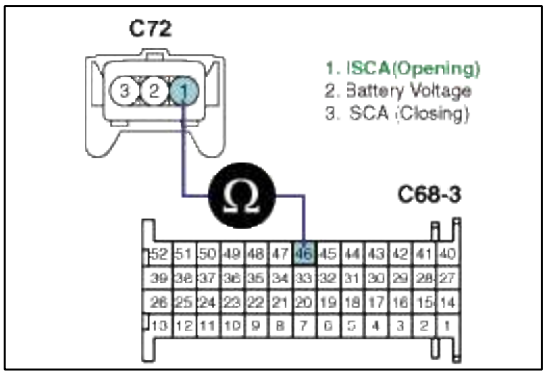
4. Check for open in signal harness
   (1) Ignition "OFF".
   (2) Measure resistance between terminals 1 of the ISCA harness connector and 46 of the ECM harness connector(C68-3).

   Specification : Approx. 0Ω



   (3) Is resistance within the specification?

   YES

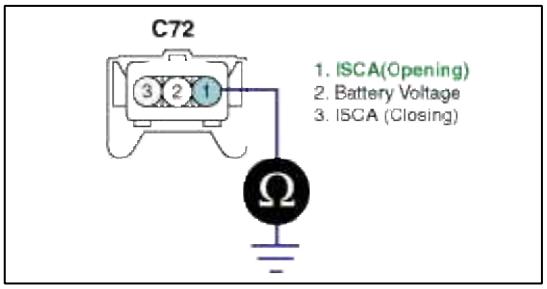
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

5. Check for short to ground in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 1 of the ISCA harness connector and chassis ground.

   Specification : Infinite



   (3) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

   NO

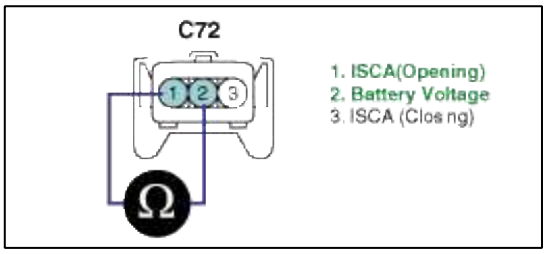
   Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect ISCA connector.

3. Measure resistance between terminals 1 and 2 of the actuator connector(Component side).

Specification : 14.9 ~ 16.1 Ω at 20°C (68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

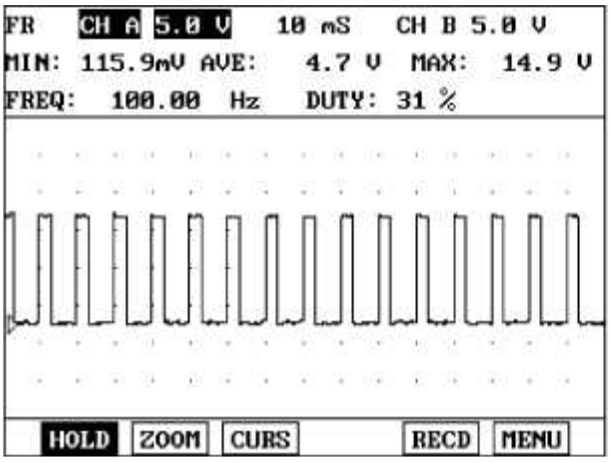


Fig. 1

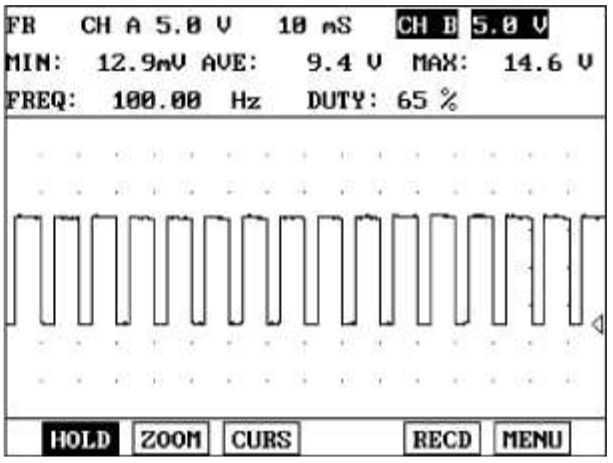


Fig. 2

The above waveforms are the voltage signals generated when the ISCA operates. This ISCA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ISCA opening coil during idle.
The right side is the waveform of the ISCA closing coil during idle.

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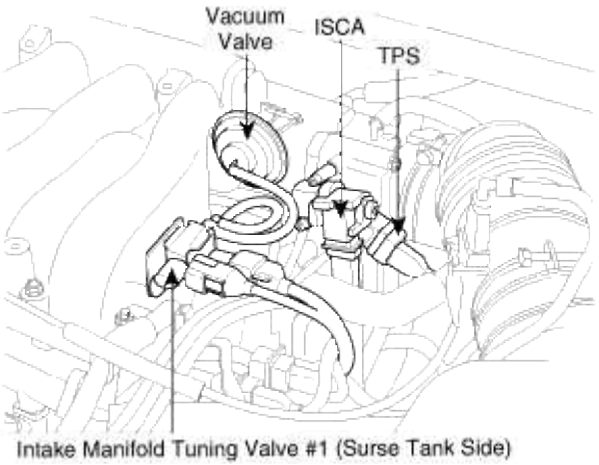
SPECIFICATION

SPECIFICATION	
Opening Coil	Closing Coil
14.9 ~ 16.1 Ω at 20°C (68°F)	17.0 ~ 18.2 Ω at 20°C (68°F)

Fuel System > Troubleshooting > P1506

COMPONENT LOCATION



GENERAL DESCRIPTION

The Idle Speed Control Actuator (ISCA) is installed on the intake manifold and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle vlave is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditons, and also to provide additional air during starting. The ISCA vlave consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensor, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by pass airflow into the engine.

DTC DESCRIPTION

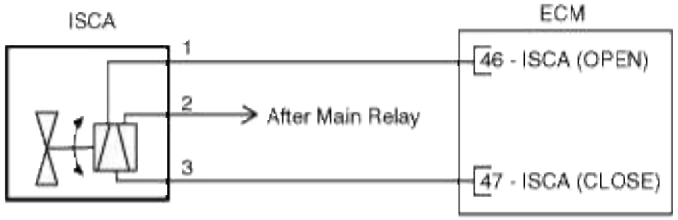
ECM sets DTC P1506 if the ECM detects that the ISCA(OPEN) control circuit is short to battery.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short to battery in harness • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Battery voltage >10V	
Threshold Value	• Short to battery	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

SCHEMATIC DIAGRAM

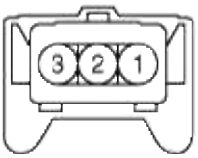
[CIRCUIT DIAGRAM]



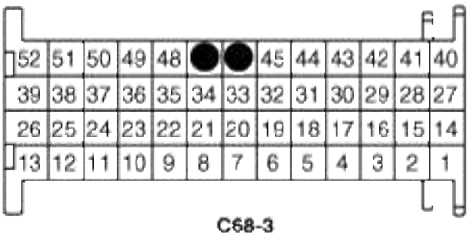
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-3(46)	ISCA (OPEN)
2	Main Relay	Battery Voltage
3	ECM Terminal C68-3(47)	ISCA (CLOSE)

[HARNESS CONNECTORS]



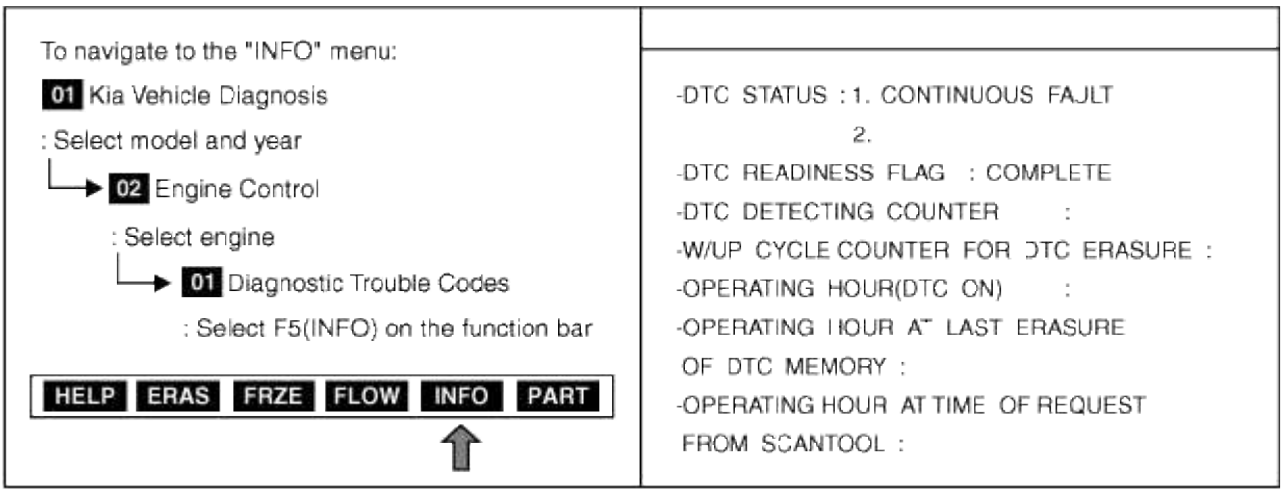
C72
ISCA Harness side connector



C68-3
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



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5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

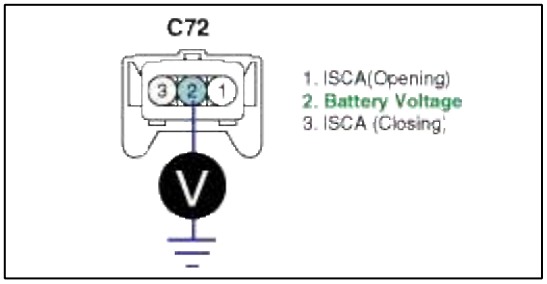
NO

Go to next step as below.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

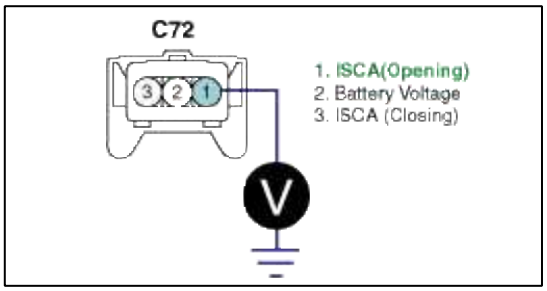
Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

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

2. Measure voltage between terminal 1 of the ISCA harness connector and chassis ground.

Specification : Approx. 3~4V



3. Is voltage within the specification?

YES

Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to next step as below.

4. Check for short to power in signal harness

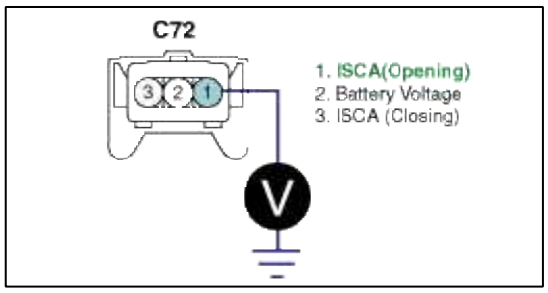
(1) Ignition "OFF".

(2) Disconnect ECM connector

(3) Ignition "ON"

(4) Measure voltage between terminal 1 of the ISCA harness connector and chassis ground

Specification : Approx. 0V



(5) Is voltage within the specification?

YES

Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

Repair short in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect ISCA connector.

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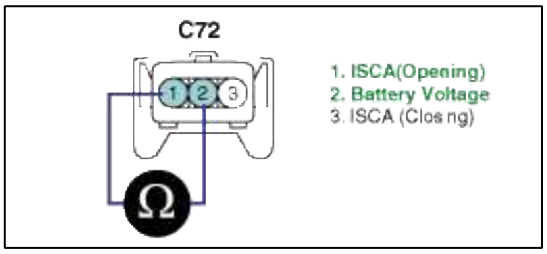
3. Measure resistance between terminals 1 and 2 of the actuator connector(Component side).

Specification : 14.9 ~ 16.1 Ω at 20°C (68°F)



4. Is resistance within the specification?

YES

Go to next step as below.

NO

Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

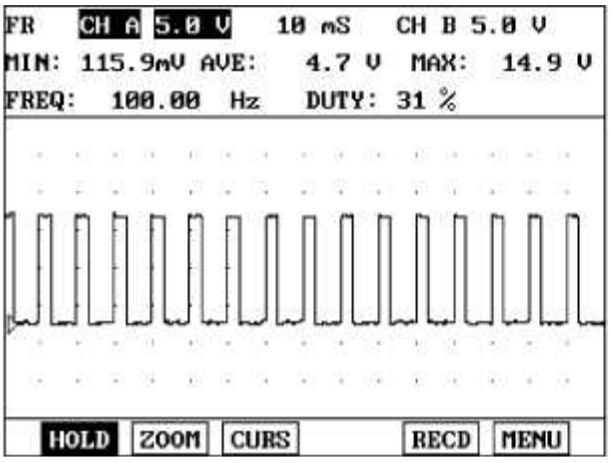


Fig. 1

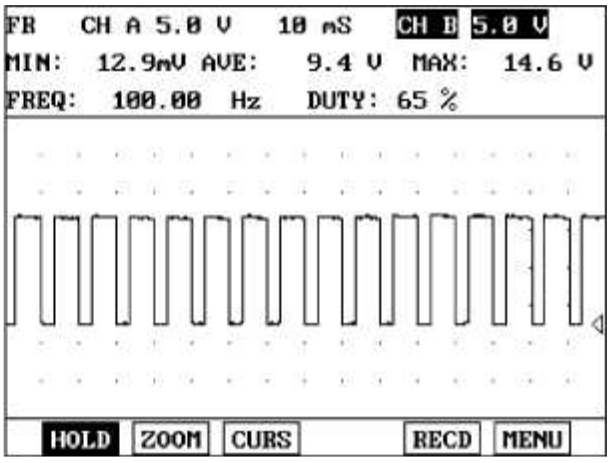


Fig. 2

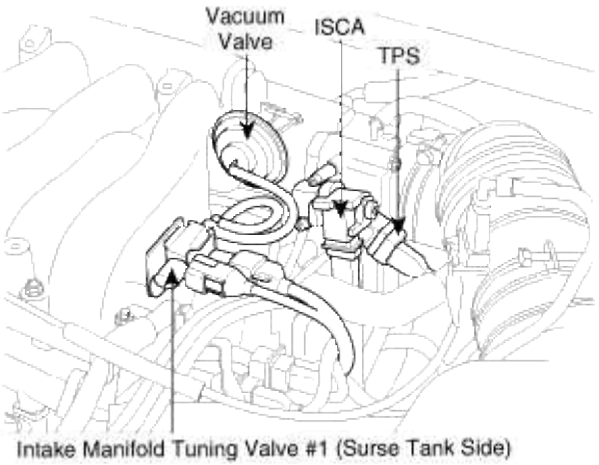
The above waveforms are the voltage signals generated when the ISCA operates. This ISCA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ISCA opening coil during idle.
The right side is the waveform of the ISCA closing coil during idle.

SPECIFICATION

SPECIFICATION	
Opening Coil	Closing Coil
14.9 ~ 16.1 Ω at 20°C (68°F)	17.0 ~ 18.2 Ω at 20°C (68°F)

Fuel System > Troubleshooting > P1507

COMPONENT LOCATION



GENERAL DESCRIPTION

The Idle Speed Control Actuator (ISCA) is installed on the intake manifold and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle vlave is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditons, and also to provide additional air during starting. The ISCA vlave consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensor, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by pass airflow into the engine.

DTC DESCRIPTION

ECM sets DTC P1507 if the ECM detects that the ISCA(OPEN) control circuit is open or short to ground.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Open or short to ground in harness • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Battery voltage >10V	
Threshold Value	• Open or short to ground	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

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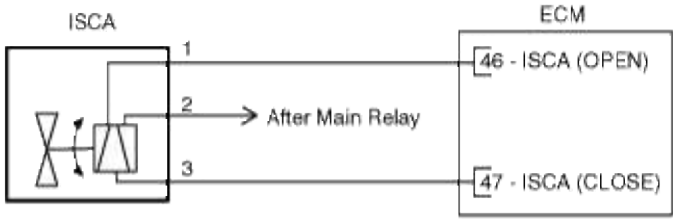
SCHEMATIC DIAGRAM

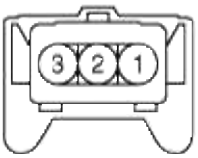
[CIRCUIT DIAGRAM]



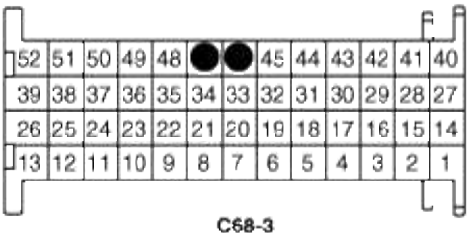
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM Terminal C68-3(46)	ISCA (OPEN)
2	Main Relay	Battery Voltage
3	ECM Terminal C68-3(47)	ISCA (CLOSE)

[HARNESS CONNECTORS]



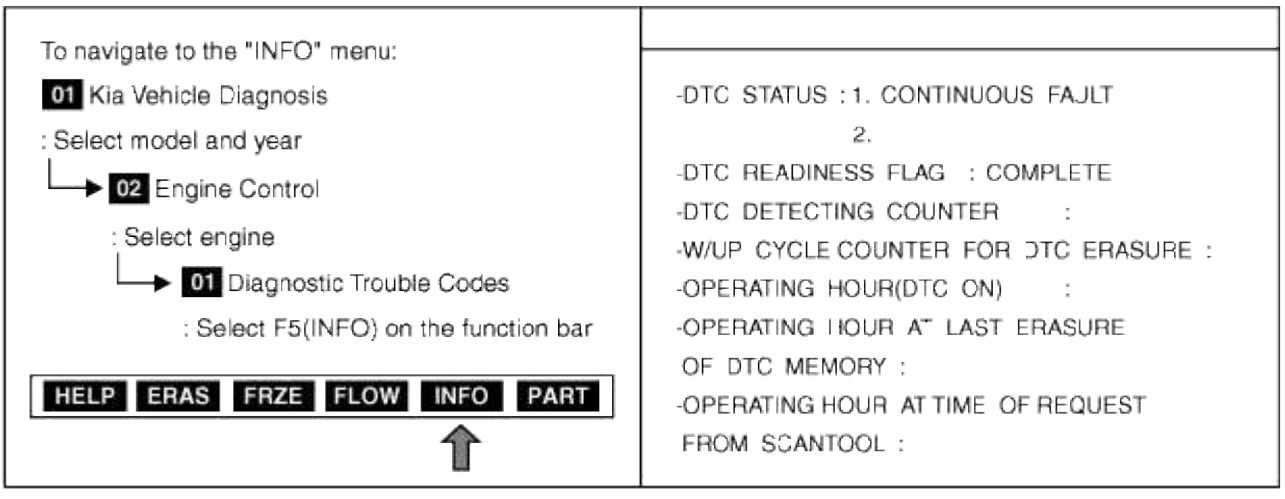
C72
ISCA Harness side connector



C68-3
ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

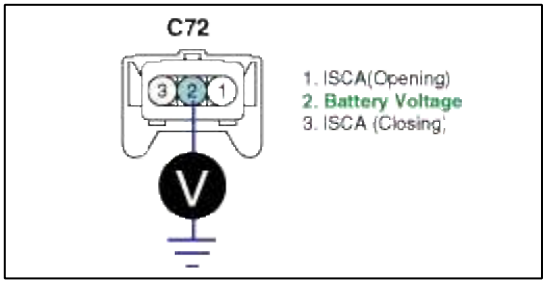
NO

Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

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

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

NO

Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

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

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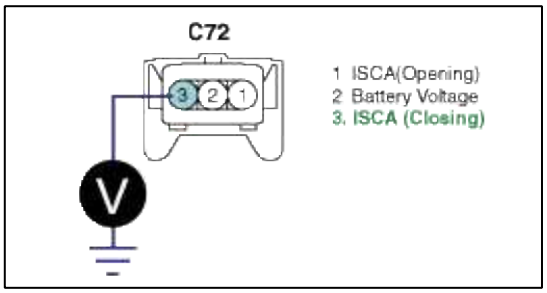
2. Measure voltage between terminal 3 of the ISCA harness connector and chassis ground.

Specification : Approx. 0.5~0.6V



3. Is voltage within the specification?

YES

Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

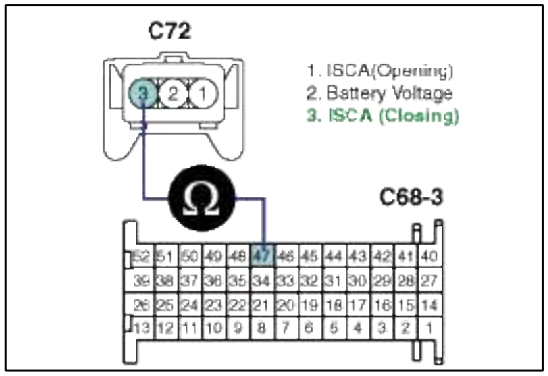
Go to next step as below.

4. Check for open in signal harness

(1) Ignition "OFF".

(2) Measure resistance between terminals 3 of the ISCA harness connector and 47 of the ECM harness connector(C68-3).

Specification : Approx. 0Ω



(3) Is resistance within the specification?

YES

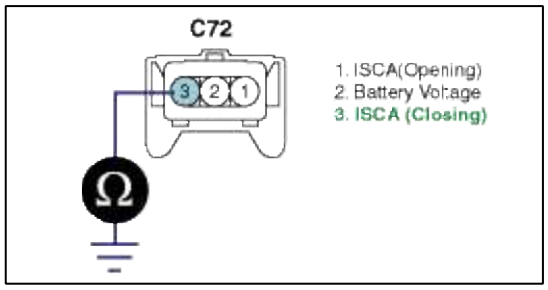
Go to next step as below.

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

5. Check for short to ground in signal harness.
   (1) Ignition "OFF".
   (2) Measure resistance between terminal 3 of the ISCA harness connector and chassis ground.

   Specification : Infinite



   (3) Is resistance within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

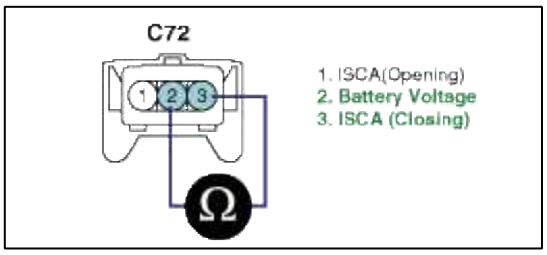
   NO

   Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Measure resistance between terminals 2 and 3 of the actuator connector(Component side).

   Specification : 17.0 ~ 18.2 Ω at 20°C (68°F)



4. Is resistance within the specification?

   YES

   Go to next step as below.

   NO

   Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

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4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

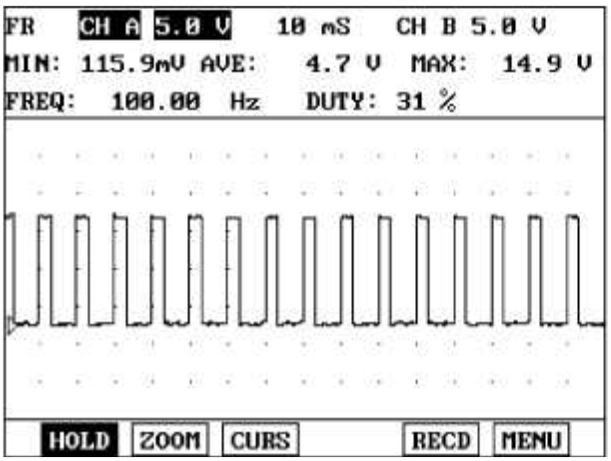


Fig. 1

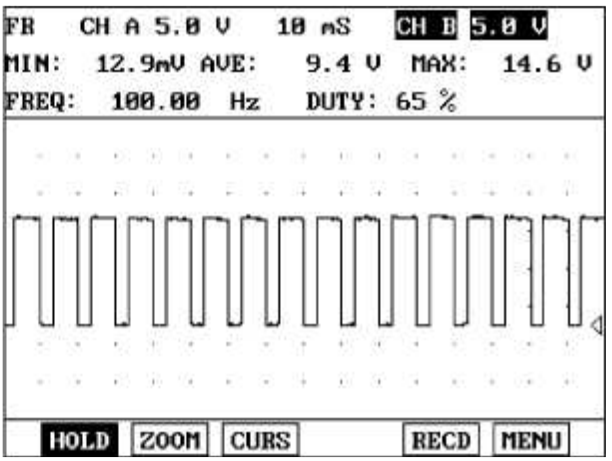


Fig. 2

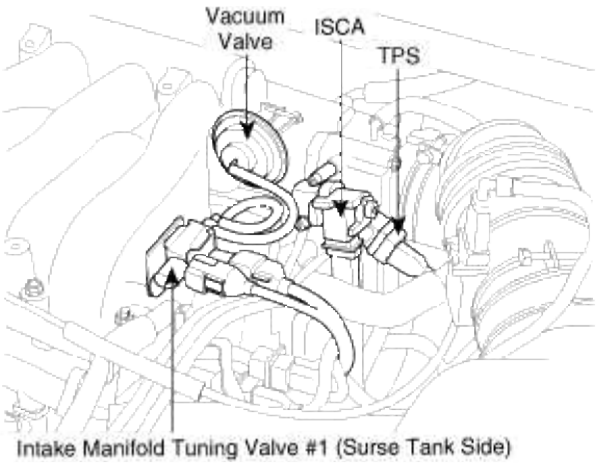
The above waveforms are the voltage signals generated when the ISCA operates. This ISCA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ISCA opening coil during idle.
The right side is the waveform of the ISCA closing coil during idle.

SPECIFICATION

SPECIFICATION	
Opening Coil	Closing Coil
14.9 ~ 16.1 Ω at 20°C (68°F)	17.0 ~ 18.2 Ω at 20°C (68°F)

Fuel System > Troubleshooting > P1508

COMPONENT LOCATION



GENERAL DESCRIPTION

The Idle Speed Control Actuator (ISCA) is installed on the intake manifold and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle vlave is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditons, and also to provide additional air during starting. The ISCA vlave consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensor, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by pass airflow into the engine.

DTC DESCRIPTION

ECM sets DTC P1508 if the ECM detects that the ISCA(CLOSE) control circuit is short to battery.

DTC DETECTING CONDITION

ITEM	DETECTING CONDITION	POSSIBLE CAUSE
DTC Strategy	• Driver stage check	• Short to battery in harness • Contact resistance in connectors • Faulty ISCA valve
Enable Conditions	• Battery voltage >10V	
Threshold Value	• Short to battery	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

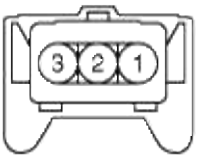
SCHEMATIC DIAGRAM

[CIRCUIT DIAGRAM]

[CONNECTION INFORMATION]

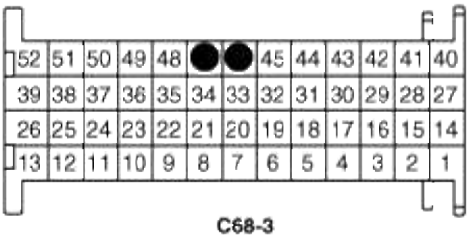
Terminal	Connected to	Function
1	ECM Terminal C68-3(46)	ISCA (OPEN)
2	Main Relay	Battery Voltage
3	ECM Terminal C68-3(47)	ISCA (CLOSE)

[HARNESS CONNECTORS]



C72

ISCA Harness side connector



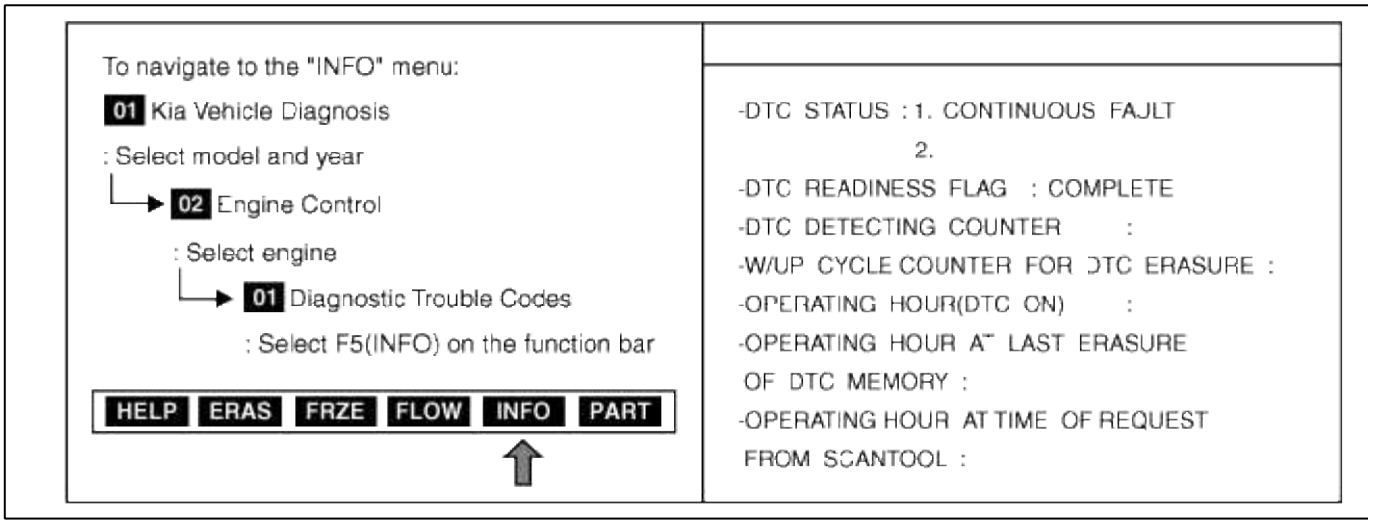
C68-3

ECM side terminal

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.

3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?
   A. History (Not Present) fault : DTC occurred but has been cleared.
   B. Present fault : DTC is occurring at present time.

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 loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure.

NO

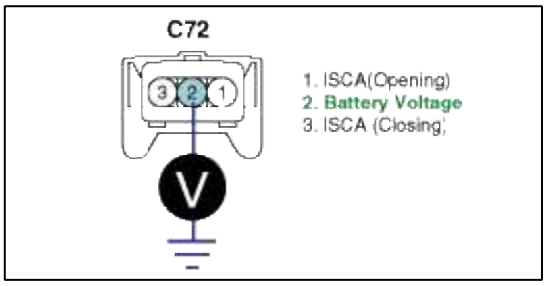
Go to "Power Supply Circuit Inspection" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal 2 of the ISCA harness connector and chassis ground.

Specification : Approx. B+



5. Is voltage within the specification?

YES

Go to "Signal Circuit Inspection" procedure.

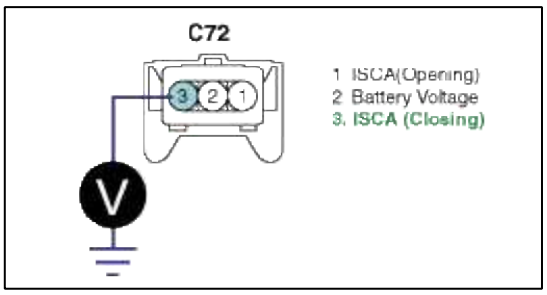
NO

Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

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

Specification : Approx. 0.5~0.6V



3. Is voltage within the specification?

YES

Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to next step as below.

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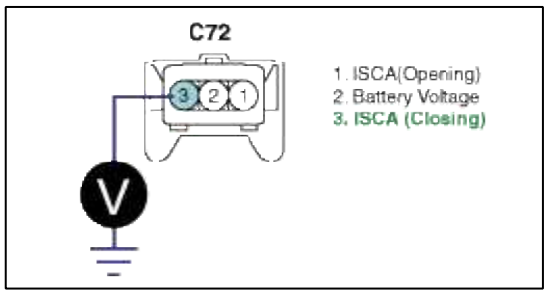
4. Check for short to power in signal harness
   (1) Ignition "OFF".
   (2) Disconnect ECM connector
   (3) Ignition "ON"
   (4) Measure voltage between terminal 3 of the ISCA harness connector and chassis ground

   Specification : Approx. 0V



   (5) Is voltage within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure

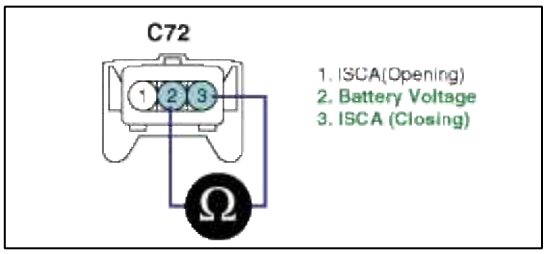
   NO

   Repair short in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Disconnect ISCA connector.
3. Measure resistance between terminals 2 and 3 of the actuator connector(Component side).

   Specification : 17.0 ~ 18.2 Ω at 20°C (68°F)



4. Is resistance within the specification?

   YES

   Go to next step as below.

   NO

   Check ISCA for contamination, deterioration, or damage. Substitute with a known-good ISCA and check for proper operation. If the problem is corrected, replace ISCA 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. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

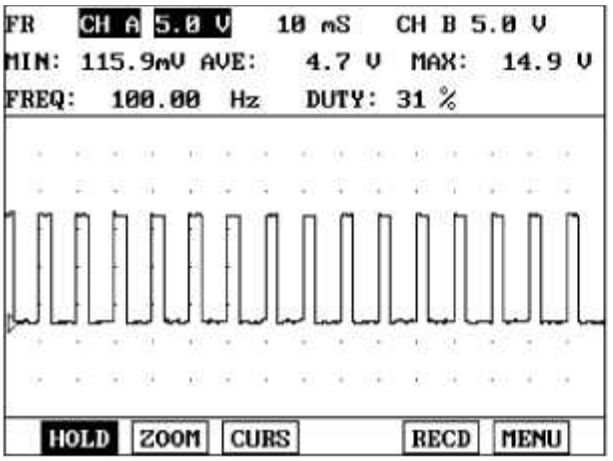


Fig. 1

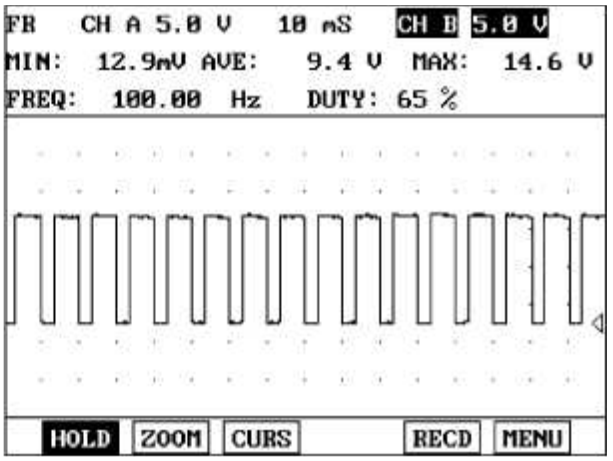


Fig. 2

The above waveforms are the voltage signals generated when the ISCA operates. This ISCA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ISCA opening coil during idle.
The right side is the waveform of the ISCA closing coil during idle.

SPECIFICATION

SPECIFICATION	
Opening Coil	Closing Coil
14.9 ~ 16.1 Ω at 20°C (68°F)	17.0 ~ 18.2 Ω at 20°C (68°F)

Fuel System > Troubleshooting > U0101

GENERAL DESCRIPTION

A communication line exists between the Engine Control Module(ECM) and the Transaxle Control Module(TCM). The communication is through a Control Area Network(CAN). Without CAN communication, an independent pin and wiring is needed to receive a sensor information from a ECM. The more information to be communicated, the more wirings is required. In case of CAN communication type, all the information need to be communicated among control modules such as ECM and TCM use CAN lines.

DTC DESCRIPTION

The ECM sets DTC U0101 if ECM detects that communication time via CAN exceeds threshold value.

DTC DETECTING CONDITION

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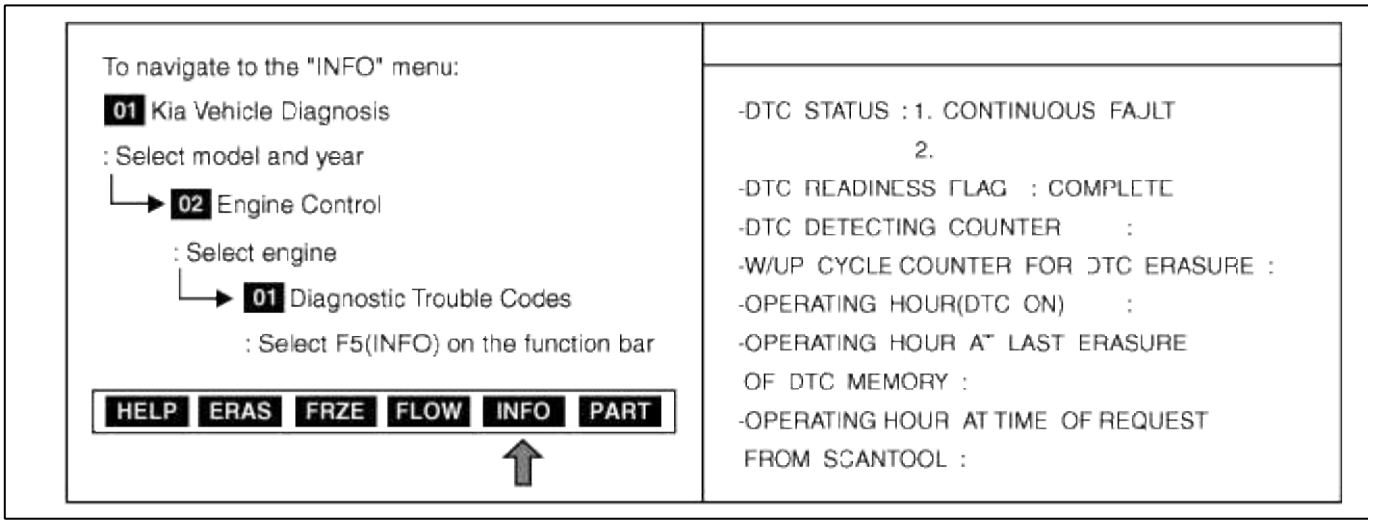
Item	Detecting Condition	Possible Cause
DTC Strategy	• Missing messages TCU	• Open or short in CAN line • Contact resistance in connectors
Enable Conditions	• Battery voltage >10V • Engine speed > Approx. 260 rpm	
Threshold Value	• Time exceeded without message = 0.5 sec.	
Diagnostic Time	• 1 sec.	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F5(INFO) to select DTC information from the DTCs menu.
3. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
4. Read "DTC Status" parameter.



5. Is parameter displayed "History(Not Present) fault"?

NOTE

- History (Not Present) fault : DTC occurred but has been cleared.
- Present fault : DTC is occurring at present time.

YES

Fault is intermittent caused by poor contact in the sensor(s) and/or the ECM's connector was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

Go to next step as below.

TERMINAL AND CONNECTOR INSPECTION

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 go to "Verification of Vehicle Repair" procedure

NO

Go to "CAN High line Inspection" procedure.

CAN HIGH LINE INSPECTION

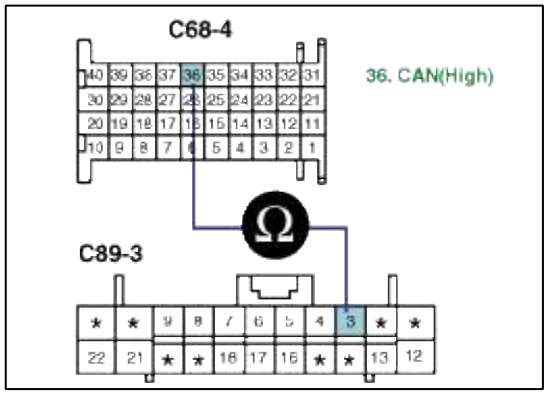
1. Check for Open in harness

(1) Ignition "OFF".

(2) Disconnect ECM and TCM connectors.

(3) Measure resistance between terminals 36 of the ECM harness connector and 3 of the TCM harness connector.

Specification : Approx. 0Ω



(4) Is resistance within the specification?

YES

Go to next step as below.

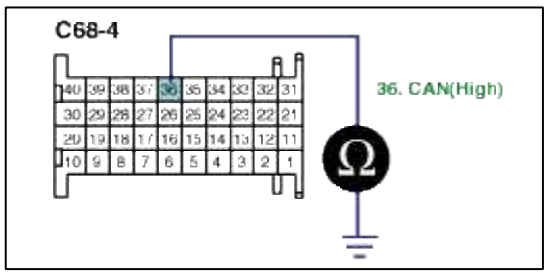
NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.

(1) Measure resistance between terminal 36 of the ECM harness connector and chassis ground.

Specification : Infinite



(2) Is resistance within the specification?

YES

Go to next step as below

NO

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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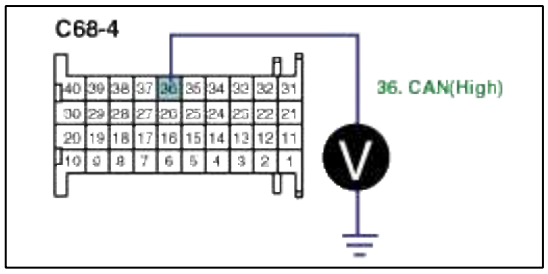
3. Check for short to battery in harness.
   (1) Reconnect the ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 36 of the ECM harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Go to "CAN Low Line Inspection" procedure

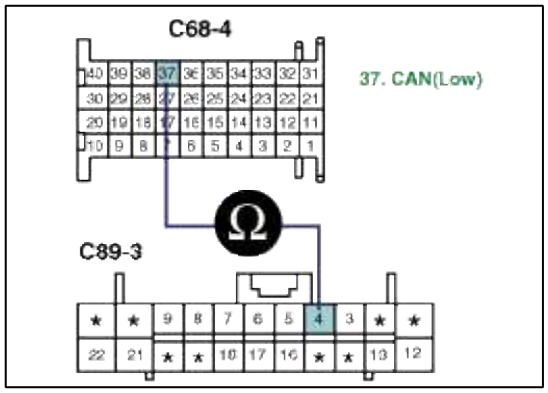
   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

CAN LOW LINE INSPECTION

1. Check for Open in harness.
   (1) Ignition "OFF".
   (2) Disconnect ECM and TCM connectors.
   (3) Measure resistance between terminals 37 of the ECM harness connector and 4 of the TCM harness connector.

   Specification : Approx. 0Ω



   (4) Is resistance within the specification?

   YES

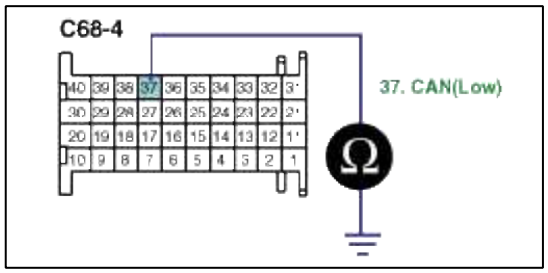
   Go to next step as below.

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to ground in harness.
   (1) Measure resistance between terminal 37 of the ECM harness connector and chassis ground.

   Specification : Infinite



   (2) Is resistance within the specification?

   YES

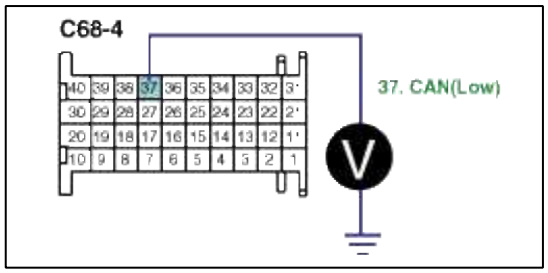
   Go to next step as below

   NO

   Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check for short to battery in harness.
   (1) Reconnect the ECM connector.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal 37 of the ECM harness connector and chassis ground.

   Specification : Approx. 0V



   (4) Is voltage within the specification?

   YES

   Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   Repair as necessary 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. Press F5(INFO) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

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4. Is parameter displayed "History(Not Present) fault"?

YES

System performing to specification at this time. Clear the DTC.

NO

Go to the applicable troubleshooting procedure.

SIGNAL WAVEFORM

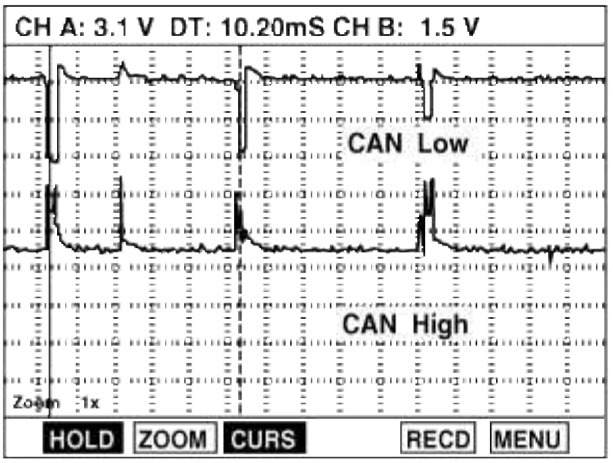
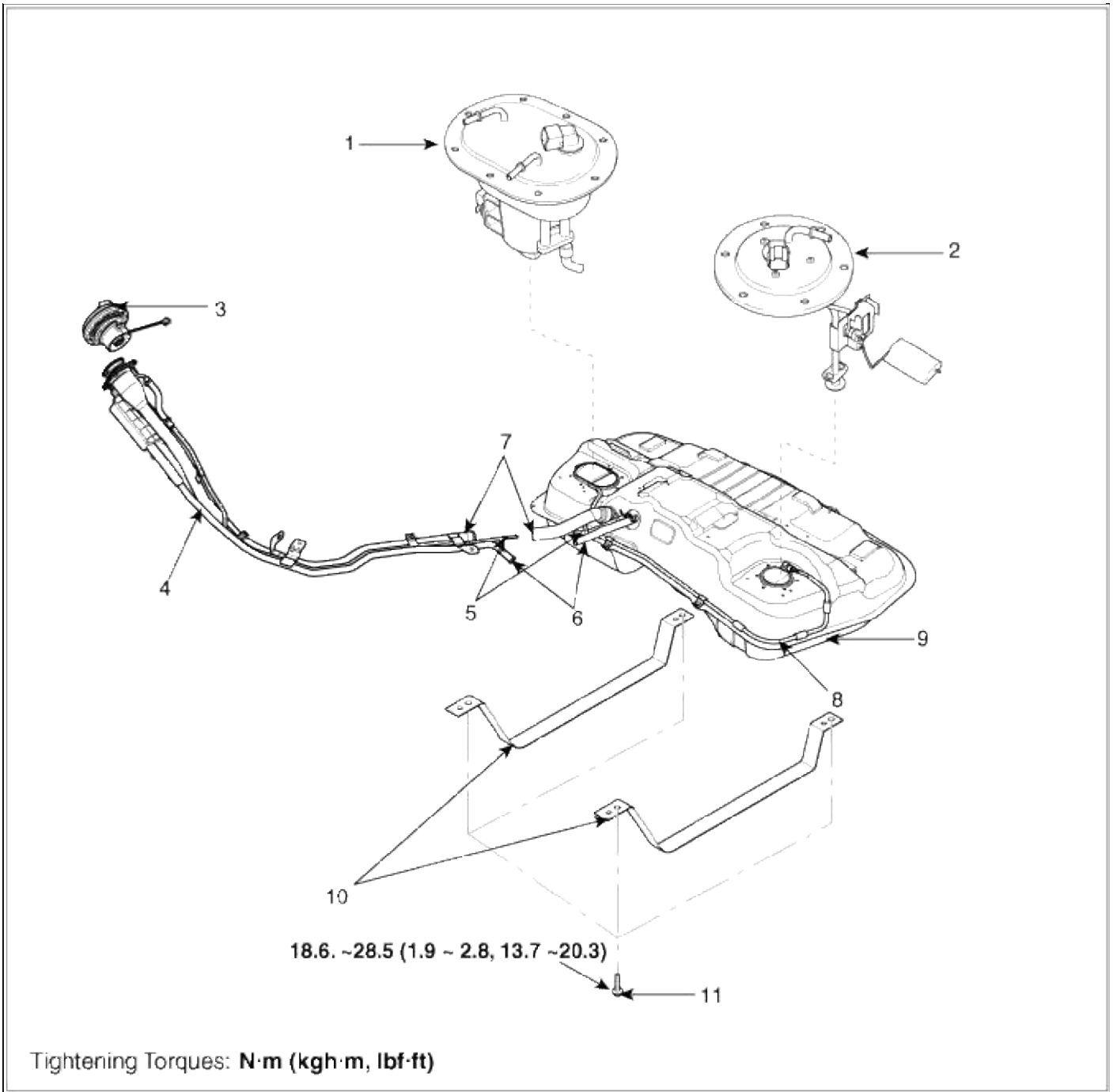


Fig. 1

Fig 1) Normal wave form with ignition ON

Fuel System > Fuel Delivery System > Components and Components Location

COMPONENTS LOCATION



1. Fuel Pump Assembly (Including Fuel Filter and Fuel Pressure Regulator)
2. Fuel Sender (Sub)
3. Fuel Filler Cap
4. Fuel Filler Neck assembly
5. Leveling Hose
6. Ventilation Hose
7. Fuel Filler Hose
8. Suction Hose
9. Fuel Tank
10. Fuel Tank Band
11. Mounting Bolts - Fuel Tank Band

Fuel System > Fuel Delivery System > Repair procedures

FUEL PRESSURE TEST

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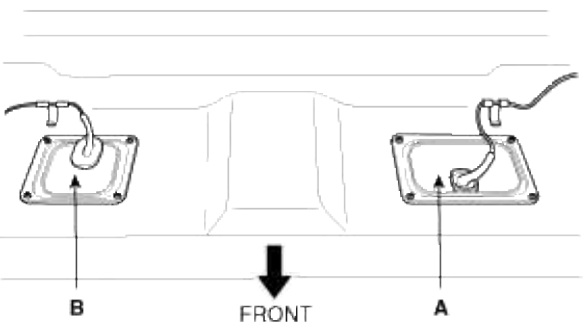
1. PREPARING

1. Remove the rear seat (Refer to ""BD"" group in this WORKSHOP MANUAL).
2. Open the service cover (A) under the rear seat.

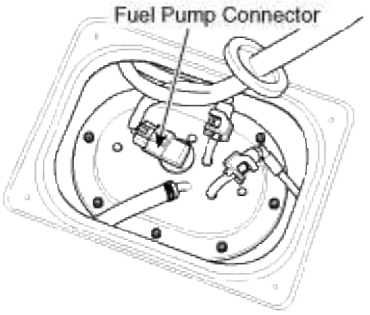


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector.
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, tum 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.



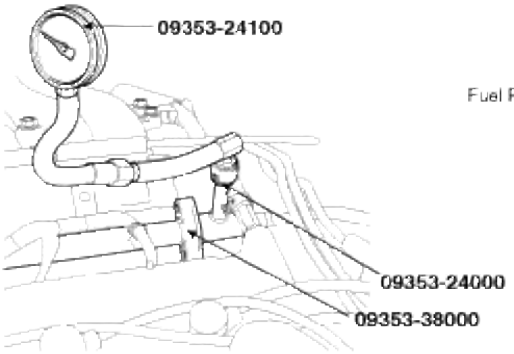
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

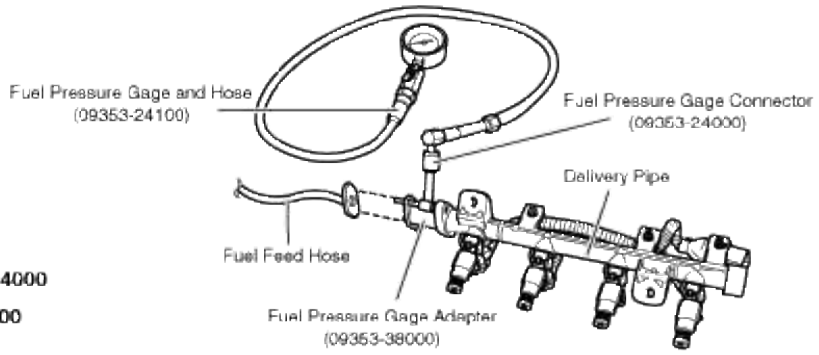
1. Disconnect the fuel feed hose from the delivery pipe.

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).





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 kg/cm^2, 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

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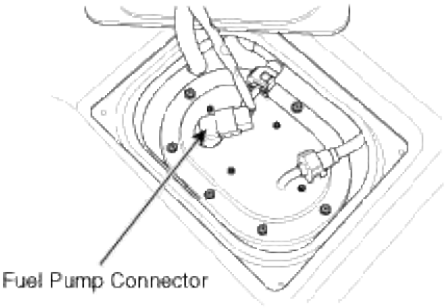
6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector.
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

8. INSPECT FUEL LEAKAGE ON CONNECTION

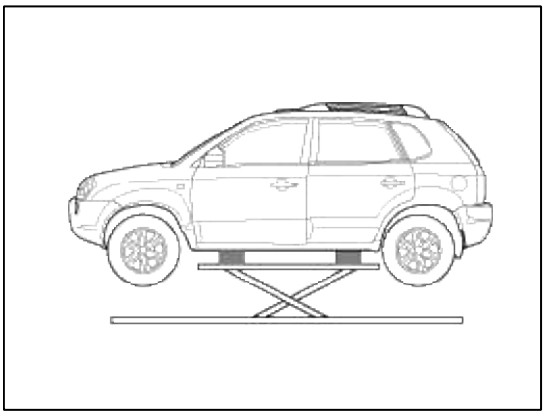
1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

Fuel System > Fuel Delivery System > Fuel Tank > Repair procedures

REMOVAL

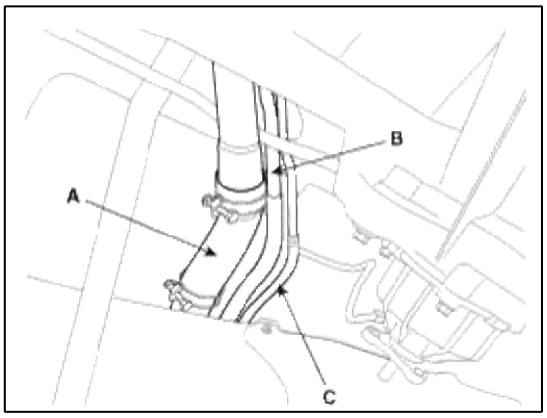
WARNING

When lifting up or down vehicle, be sure to place blocks between vehicle and lifter to prevent fuel tank from being damaged.

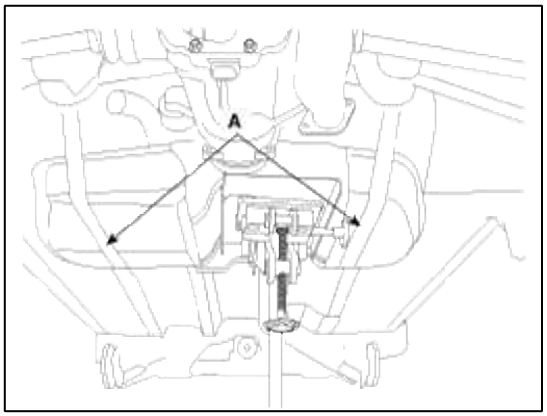


1. Remove the front and main muffler assembly (Refer to group “EM” in this Workshop Manual).
2. Remove the propeller-shaft (For 4WD only).

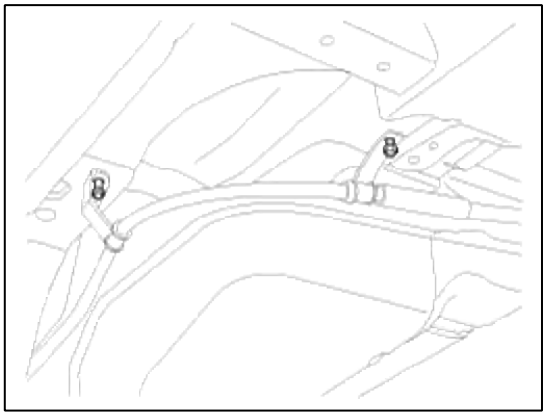
3. Disconnect the fuel filler hose (A), fuel leveling hose (B) and ventilation hose (C).



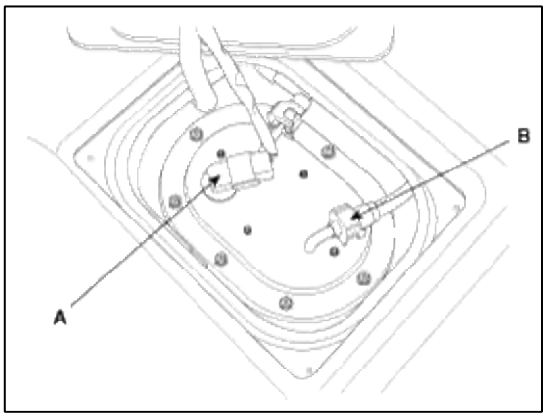
4. Lift the vehicle and support the fuel tank with a jack, and then remove the two fuel tank band.



5. Remove the four parking brake mounting bolts(A).



6. Down the fuel tank slowly until work space is made, and then disconnect the fuel pump connector (A) and fuel feed hose(B).



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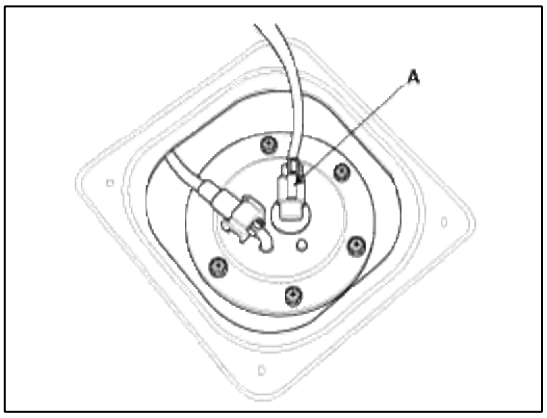
7. Disconnect the sub fuel sender connector (A).

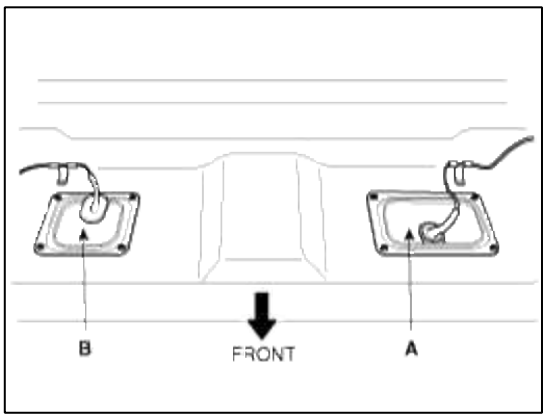


8. Remove the fuel tank.

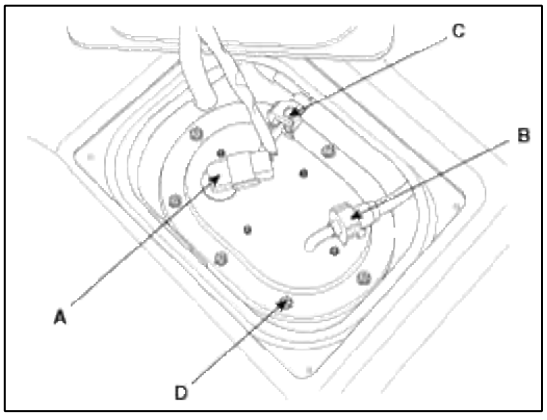
Fuel System > Fuel Delivery System > Fuel Pump > Repair procedures

REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR)

1. Turn ignition switch to “OFF” and disconnect the battery negative (-) terminal.
2. Remove the rear seat cushion flame hinge bolts, and then lift the cushion (Refer to group “BD” in this Service Manual).
3. Remove the service cover (A) under the carpet.

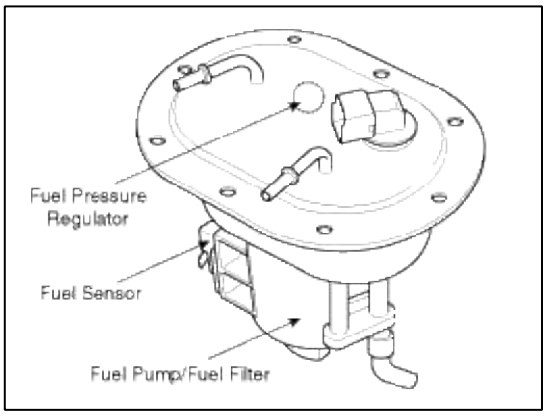


4. Disconnect the fuel pump wiring connector (A).



5. Remove the fuel feed hose (B) and suction hose (C).
6. Remove the fuel pump plate mounting bolts (D).

7. Remove the fuel pump assembly.

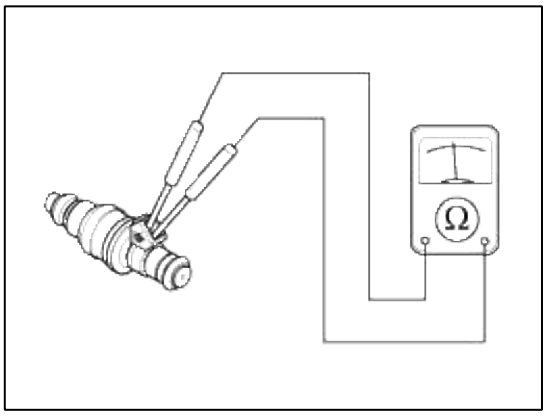


Fuel System > Fuel Delivery System > Injector > Repair procedures

INSPECTION

1. Measure resistance between the terminal 1 and 2 of the injector.

Injector Resistance: 13.8 ~ 15.2 Ω at 20°C (68°F)

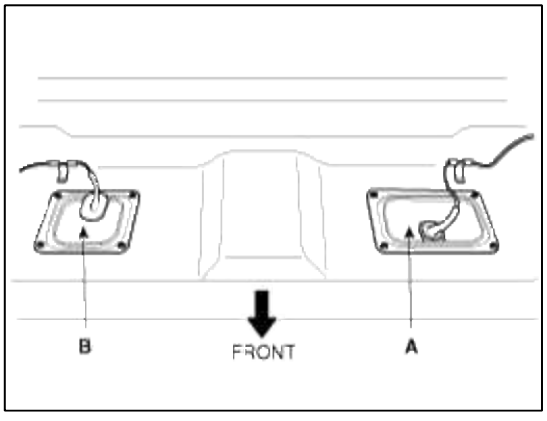


2. If the resistance is not within specification, replace the injector.

Fuel System > Fuel Delivery System > Sub Fuel Sender > Repair procedures

REMOVAL

1. Turn ignition switch to “OFF” and disconnect the battery negative (-) terminal.
2. Remove the rear seat cushion flame hinge bolts, and then lift the cushion (Refer to group “BD” in this Service Manual).
3. Remove the service cover (B) under the carpet.



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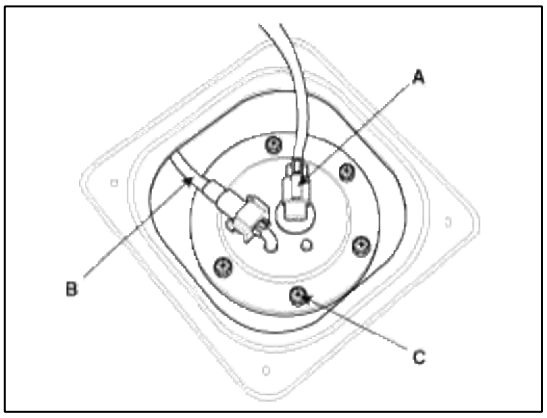
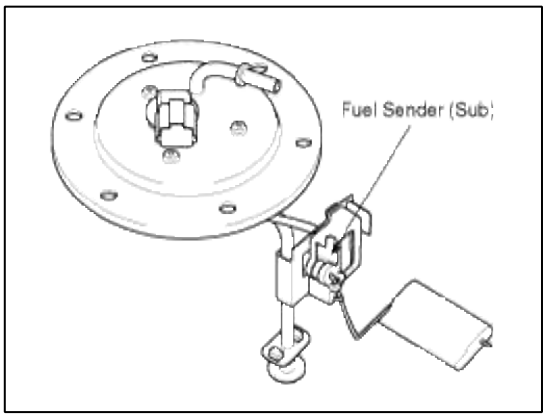
4. Disconnect the fuel sender (Sub) wiring connector (A).



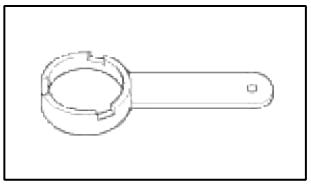
5. Disconnect the suction hose (B).
6. Remove the fuel sender (Sub) plate mounting bolt (C).
7. Remove the fuel sender (Sub) assembly.



SPORTAGE(KM) > 2007 > G 2.0 DOHC > Heating,Ventilation, Air Conditioning

Heating,Ventilation, Air Conditioning > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09977-29000 Dise & hub bolt remover		Removal and installation of disc & hub

Heating,Ventilation, Air Conditioning > General Information > Troubleshooting

TROUBLESHOOTING

PROBLEM SYMPTOMS TABLE

Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor.

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

After correcting the malfunction, check the complete system to ensure that performance is satisfactory.

STANDARD :

Symptom	Suspect Area	See page
No blower operation	1. Blower fuse	-
	2. Blower relay	HA - 65
	3. Blower motor	HA - 63
	4. Power mosfet	HA - 67
	5. Blower speed control switch	HA - 72, 79
	6. Wire harness	-
No air temperature control	1. Engine coolant capacity	-
	2. Heater control assembly	HA - 72, 79
No compressor operation	1. Refrigerant capacity	HA - 3
	2. A/C Fuse	-
	3. Magnetic clutch	HA - 25
	4. Compressor	HA - 23
	5. Triple pressure switch	HA - 31
	6. A/C switch	-
	7. Evaporator temperature sensor	HA - 35
	8. Wire harness	-
No cool comes out	1. Refrigerant capacity	HA - 3

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	2. Refrigerant pressure	HA - 3, 13
	3. Drive belt	HA - 21
	4. Magnetic clutch	HA - 25
	5. Compressor	HA - 23
	6. Triple pressure switch	HA - 31
	7. Evaporator temperature sensor	HA - 35
	8. A/C switch	-
	9. Heater control assembly	HA - 72, 79
	10. Wire harness	-
Insufficient cooling	1. Refrigerant capacity	HA - 3
	2. Drive belt	HA - 21
	3. Magnetic clutch	HA - 25
	4. Compressor	HA - 23
	5. Condenser	HA - 28
	6. Expansion valve	HA - 54
	7. Evaporator	HA - 52
	8. Refrigerant lines	HA - 33
	9. Triple pressure switch	HA - 31
	10. Heater control assembly	HA - 72, 79
No engine idle-up when A/C switch ON	1. Engine ECU	-
	2. Wire harness	-
No air inlet control	1. Heater control assembly	HA - 72, 79
No mode control	1. Heater control assembly	HA - 72, 79
	2. Mode actuator	HA - 58
No cooling fan operation	1. Cooling fan fuse	-
	2. Fan motor	-
	3. Engine ECU	-
	4. Wire harness	-

Heating,Ventilation, Air Conditioning > General Information > Specifications

SPECIFICATION

AIR CONDITIONER

Item		Specification	
		β engine (2.0L)	δ engine (2.7L)
Compressor	Type	10PA15C (Swash plate)	10PA17C (Swash plate)
	Oil type & Capacity	ND-OIL8 (PAG), 120 ~ 135cc	ND-OIL8 (PAG), 200 ~ 215cc
	Pulley type	4PK-TYPE	6PK-TYPE
	Displacement	155.3cc/rev	177.7cc/rev
Condenser	Heat rejection	13,500 ± 5% kcal/hr	
Triple switch	High [psi(kg/cm²)]	ON : 370 ± 2.8 (26.0 ± 0.2) OFF : 455 ± 2.8 (32.0 ± 0.2)	
	Low ([psi(kg/cm²)]	ON : 28.6 ~ 36.3 (2.00 ~ 2.55) OFF : 28.4 ± 2.8 (2.0 ± 0.2)	
	Medium [psi(kg/cm²)]	ON : 220 ± 11.4 (15.5 ± 0.8) OFF : 164 ± 17.1 (11.5 ± 1.2)	
Expansion valve	Type	Block	
Refrigerant	Type	R-134a	
	Capacity [oz.(g)]	18.0 ± 0.88 (510 ± 25)	

BLOWER UNIT

Item		Specification
Fresh and recirculation	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	Auto + 8 speed (Automatic), 9 speed (Manual)
	Speed control	Power mosfet
Air filter	Type	Particle filter

HEATER AND EVAPORATOR UNIT

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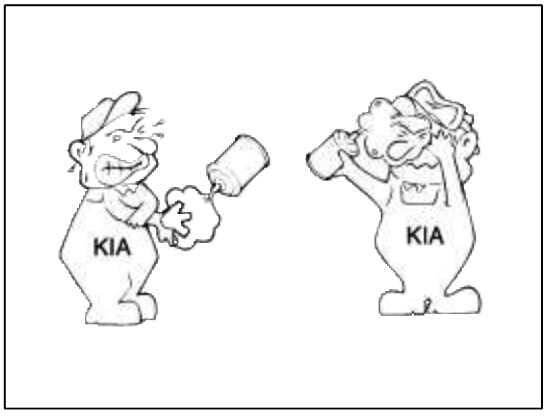
Item		Specification
Heater	Type	Pin & Tube type
	Heating capacity	4,500 ± 5% kcal/hr
	Mode operating method	Actuator
	Temperature operating method	Actuator
Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [°C(°F)]	OFF : 0.5 ± 0.5(32.9 ± 32.9), ON : 2.5 ± 0.5(36.5 ± 32.9)

Heating,Ventilation, Air Conditioning > Air conditioning System > General Information

INSTRUCTIONS

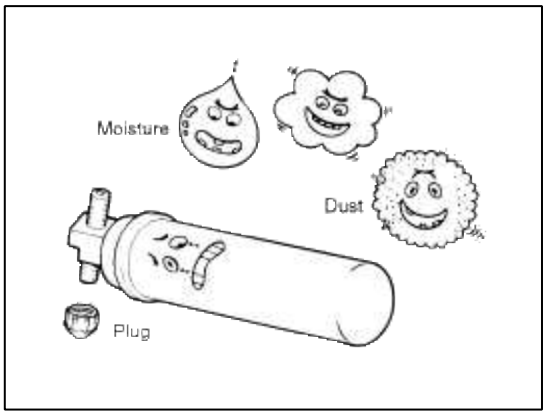
WHEN HANDLING REFRIGERANT

1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. 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 :
   A. When removing refrigerant components from a vehicle, cap immediately the components to prevent from the entry of moisture.
   B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   D. Use the recommended lubricant from a sealed container only.
7. If an accidental discharge in the system occurs, ventilate the work area before resuming service.



WHEN REPLACING PARTS ON A/C SYSTEM

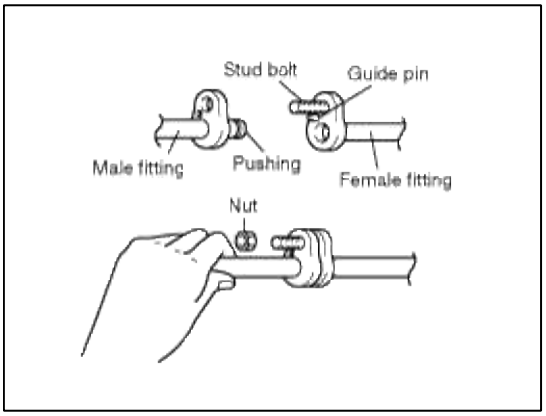
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



WHEN INSTALLING CONNECTING PARTS

FLANGE WITH GUIDE PIN

Check the new O-ring for damage (use only the specified) and lubricate it using compressor oil. Tighten the nut to specified torque.



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)

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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

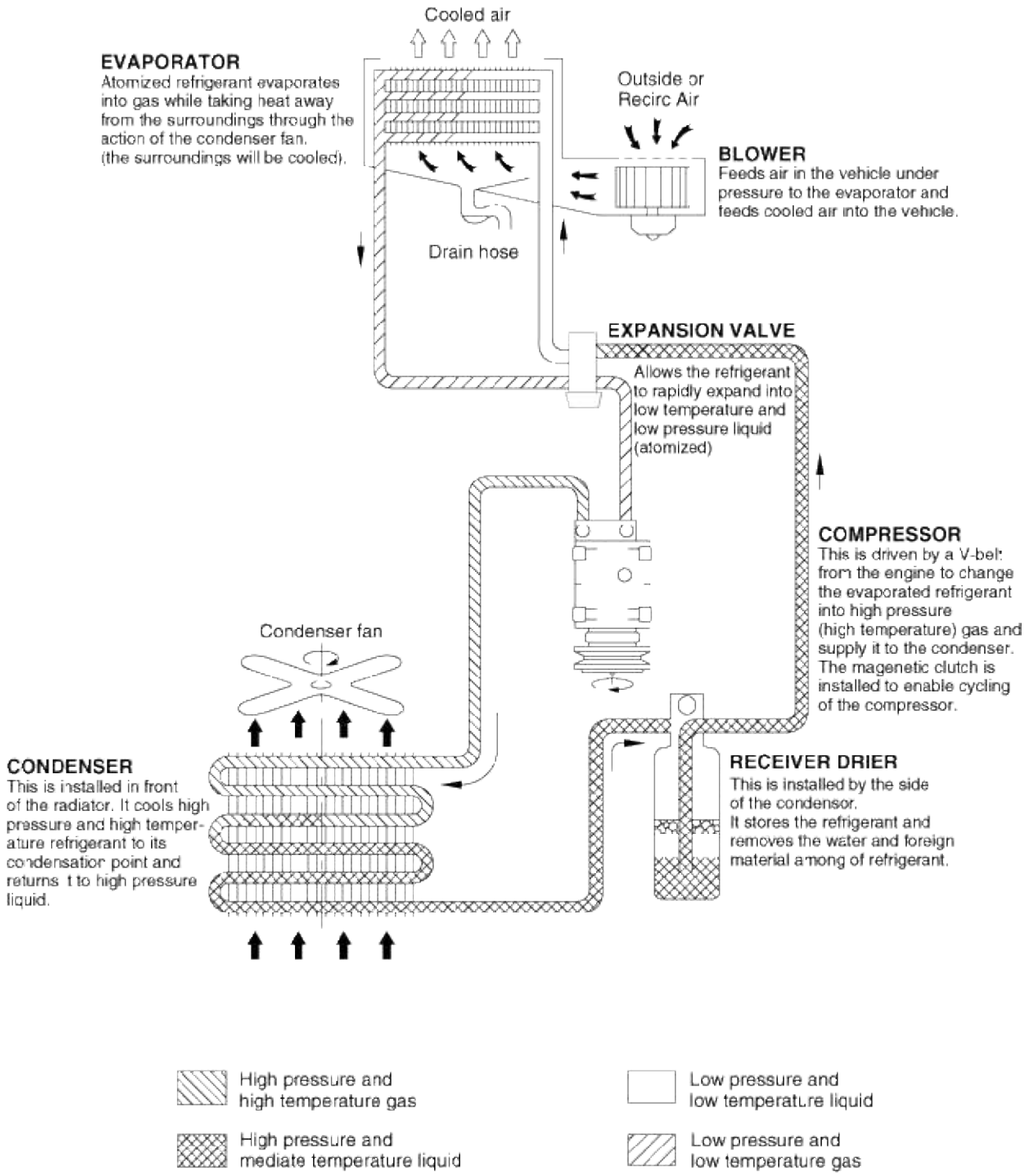
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

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.

Heating,Ventilation, Air Conditioning > Air conditioning System > Description and Operation

REFRIGERATION CYCLE



Heating,Ventilation, Air Conditioning > Air conditioning System > Components and Components Location

COMPONENT LOCATION INDEX

ENGINE ROOM

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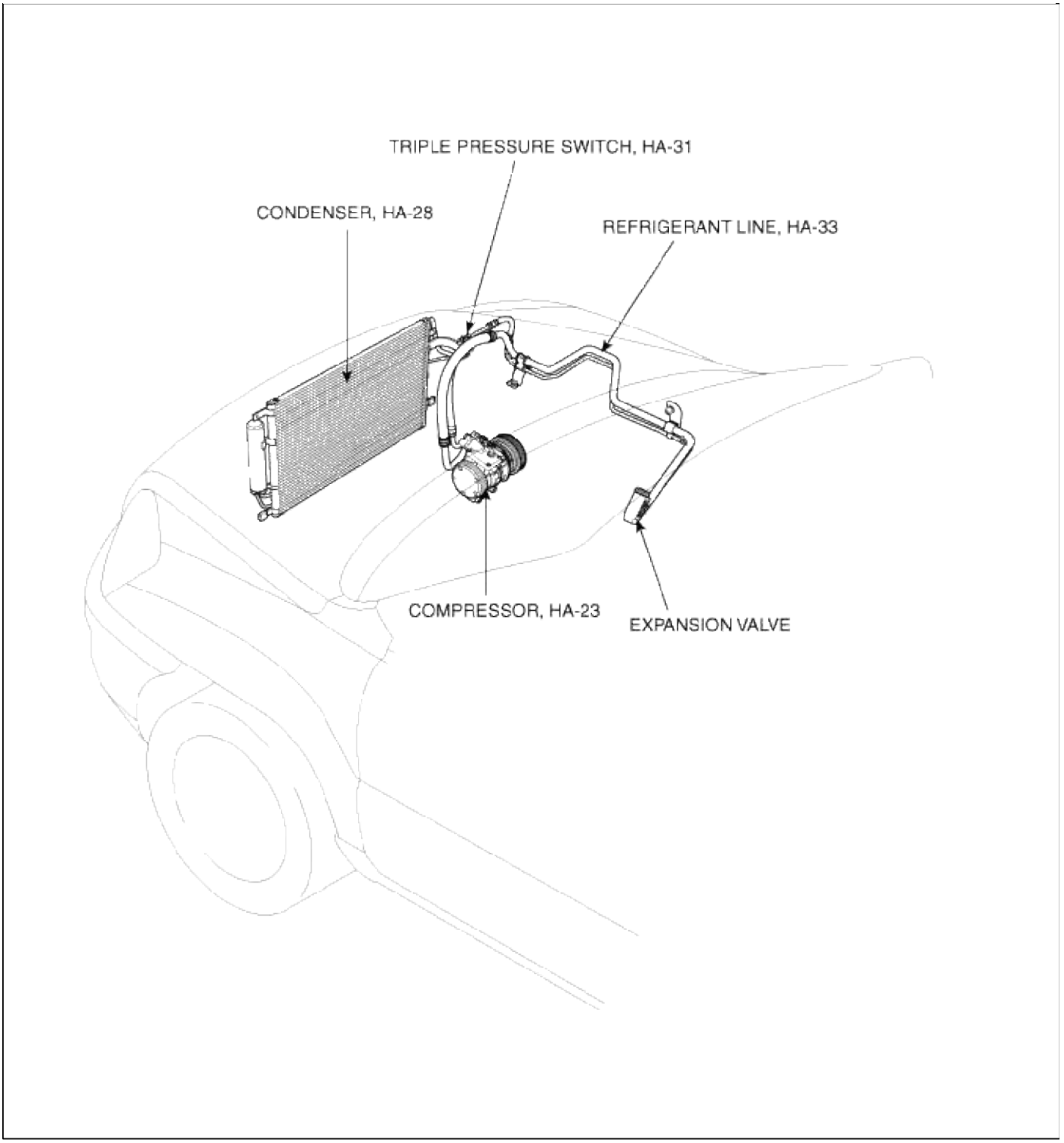
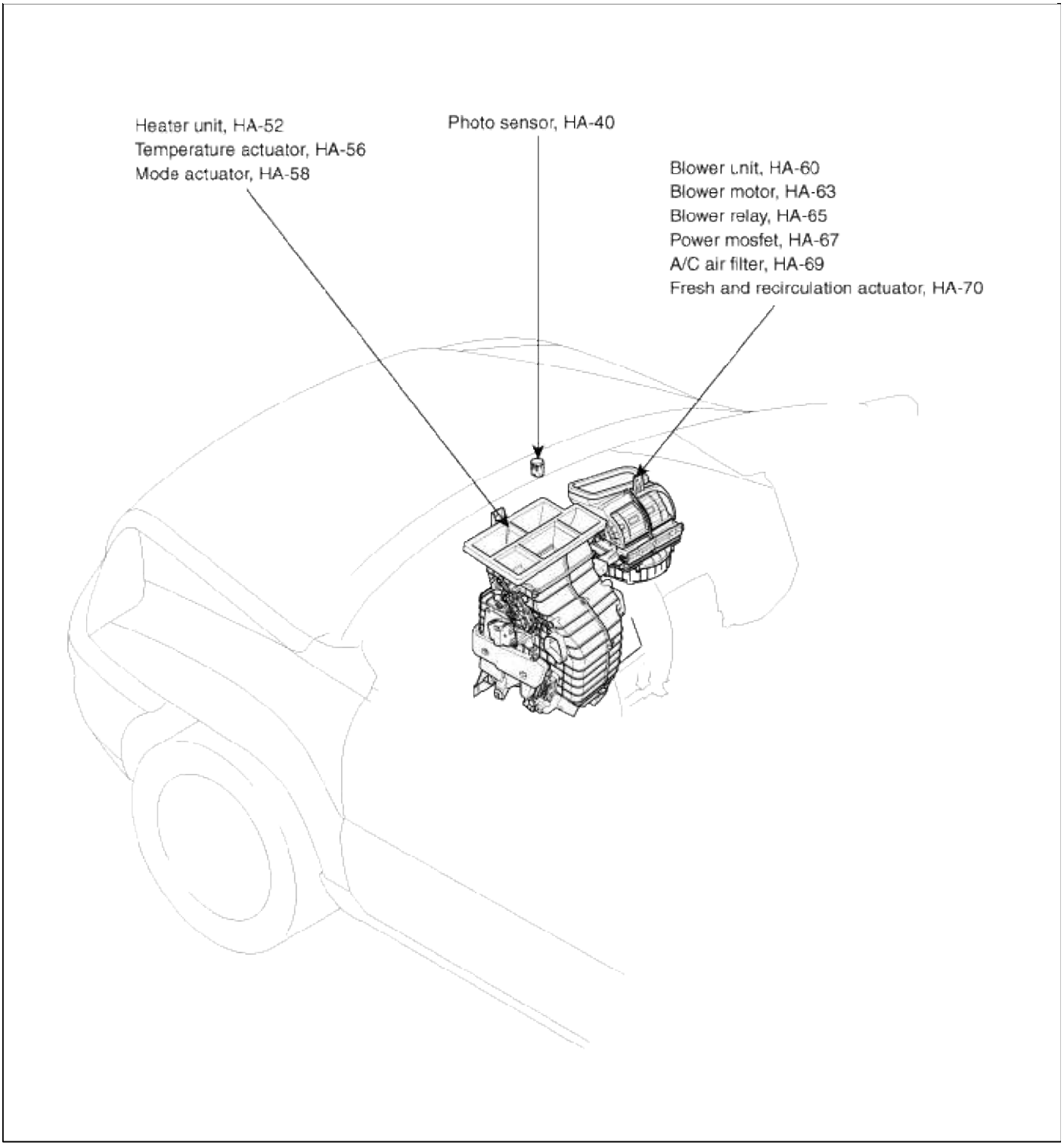

TRIPLE PRESSURE SWITCH, HA-31
CONDENSER, HA-28
REFRIGERANT LINE, HA-33
COMPRESSOR, HA-23
EXPANSION VALVE

INTERIOR



Heating,Ventilation, Air Conditioning > Air conditioning System > Troubleshooting

ON-VEHICLE INSPECTION

This is a method in which the trouble is located by using a gauge set. Read the gauge pressure when these conditions are established.

TEST CONDITIONS

- Temperature at the air inlet with the switch set at recirculation is 30~35°C (86~95°F).
- Engine running at 1,500rpm.
- Blower speed control knob on "4" position.
- Temperature control knob on "COOL" position.

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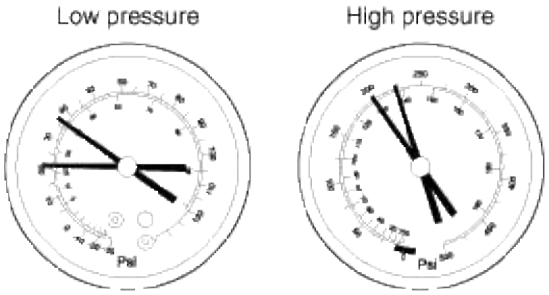
NOTE

It should be noted that the gauge indications may vary slightly due to ambient temperature conditions.

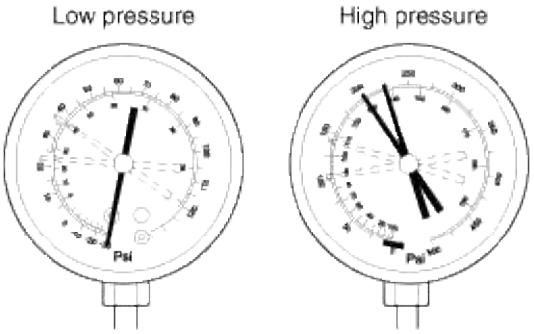
1. Normally functioning refrigeration system.
   Gauge reading :

Low pressure side : 0.15~0.25MPa (1.5~2.5 kg/cm^2, 21.8~36.3psi)
High pressure side : 1.37~1.57MPa (14~16 kg/cm^2, 200~228psi)



2. Moisture present in refrigeration system.

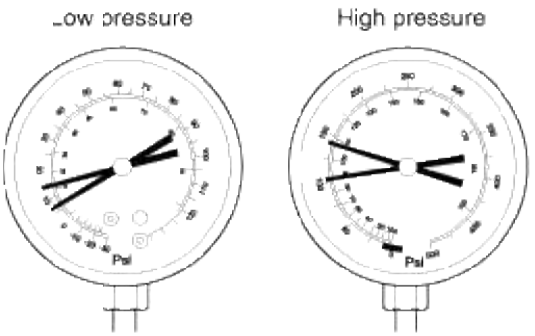
Condition : Periodically cools and then fails to cool



Symptom seen in refrigeration system	Probable cause	Diagnosis	Remedy
During operation, pressure on low pressure side sometimes becomes a vacuum and sometimes normal	Moisture entered in refrigeration system freezes at expansion valve orifice and temporarily stops cycle, but normal state is restored after a time when the ice melts	- Drier in over saturated state - Moisture in refrigeration system freezes at expansion valve orifice and blocks circulation of refrigerant	- Replace drier - Remove moisture in cycle through repeated evacuating the system - Evacuate the system a charge new refrigerant to specified amount

3. Insufficient cooling

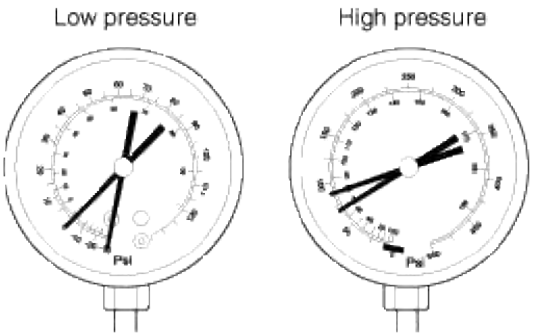
Condition : Insufficient cooling



Symptom seen in refrigeration system	Probable cause	Diagnosis	Remedy
- Pressure low on both low and high pressure sides - Insufficient cooling performance	Gas leakage at some place in refrigeration system	- Insufficient refrigerant in system - Refrigerant leaking	- Check for gas leakage with gas leak detector and repair if necessary - Evacuate the system a charge new refrigerant to specified amount - If indicated pressure value is near 0 when connected to gauge, create the vacuum afte inspecting and repairin the location of the leak

4. Poor circulation of refrigerant

Condition : Insufficient cooling



Symptom seen in refrigeration system	Probable cause	Diagnosis	Remedy
- Pressure low in both low and high pressure sides - Frost on tube from receiver to unit	Refrigerant flow obstructed by dirt in drier	Condenser clogged	Replace drier

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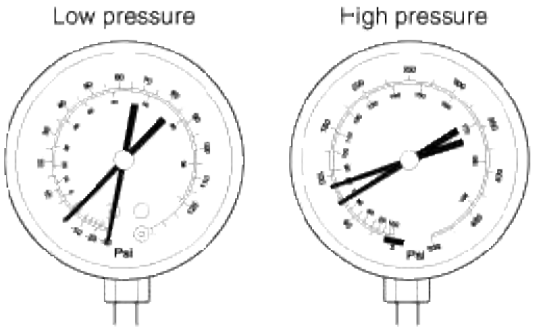
5. Refrigerant does not circulate

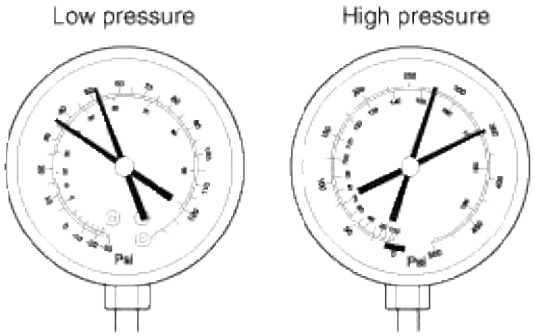
Condition : Does not cool (Cools from time to time in some cases)



Symptom seen in refrigeration system	Probable cause	Diagnosis	Remedy
- Vacuum indicated on low pressure side, very low pressure indicated on high pressure side - Frost or dew seen on piping before and after receiver/drier or expansion valve	- Refrigerant flow obstructed by moisture or dirt in refrigeration system - Refrigerant flow obstructed by gas leakage from expansion valve	Refrigerant does not circulate	- Check expansion valv - Clean out dirt in expansion valve by blowing with air - Replace drier - Evacuate the system a charge new refrigerant to specified amount - For gas leakage from expansion valve, repla expansion valve

6. Refrigerant overcharged or insufficient cooling of condenser

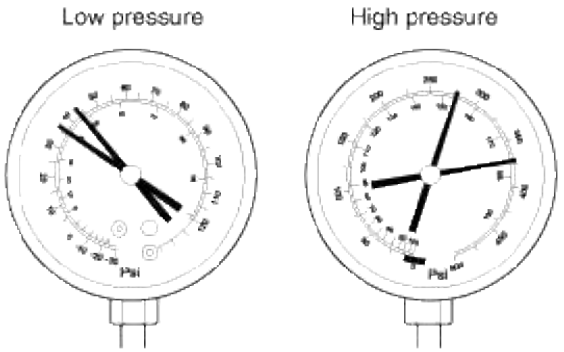
Condition : Insufficient cooling



Symptom seen in refrigeration system	Probable cause	Diagnosis	Remedy
Pressure too high on both low and high pressure sides	- Unable to develop sufficient performance due to excessive refrigerant - Insufficient cooling of condenser	- Excessive refrigerant in cycle → refrigerant overcharged - Condenser cooling → condenser fins clogged or condenser fan faulty	- (1) Clean condenser - (2) Check cooling fan with fluid coupling operation - (3) If (1) and (2) are in normal state, check amount of refrigerant Evacuate the system a charge new refrigerant to specified amount

7. Air present in refrigeration system

Condition : Insufficient cooling



Symptom seen in refrigeration system	Probable cause	Diagnosis	Remedy
- Pressure too high on both low and high pressure sides - The low pressure piping hot to the touch	Air entered in refrigeration system	- Air present in refrigeration system - Insufficient vacuum purging	- Check compressor oil to see if it is dirty or insufficient - Evacuate the system a charge new refrigerant to specified amount

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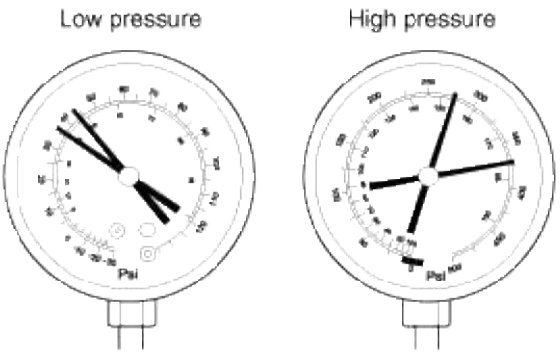
8. Expansion valve functions improperly

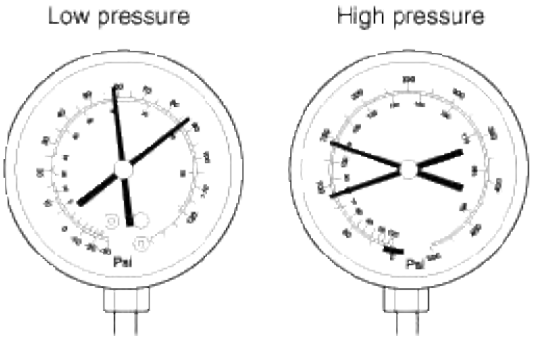
Condition : Insufficient cooling



Symptom seen in refrigeration system	Probable cause	Diagnosis	Remedy
- Pressure too high on both low and high pressure sides - Frost or large amount of dew on piping on low pressure side	Trouble in expansion valve	- Excessive refrigerant in low pressure piping - Expansion valve opened too wide	- Check expansion valv - Replace if defective

9. Defective compression compressor

Condition : Does not cool



Symptom seen in refrigeration system	Probable cause	Diagnosis	Remedy
- Pressure too low on high pressure side - Pressure too high on low pressure side	Internal leak in compressor	- Compression defective - Valve leaking or broken sliding parts	Repair or replace compressor

Heating,Ventilation, Air Conditioning > Air conditioning System > Repair procedures

REFRIGERANT SYSTEM SERVICE BASICS

REFRIGERANT RECOVERY

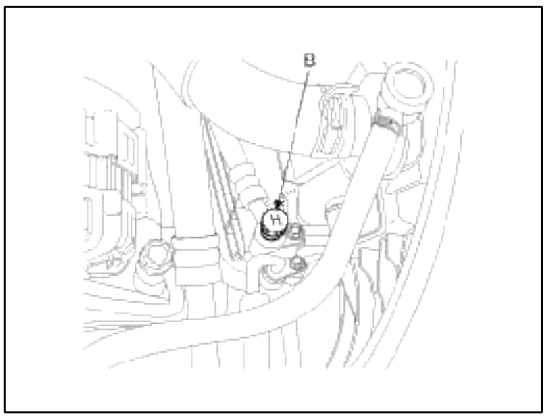
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

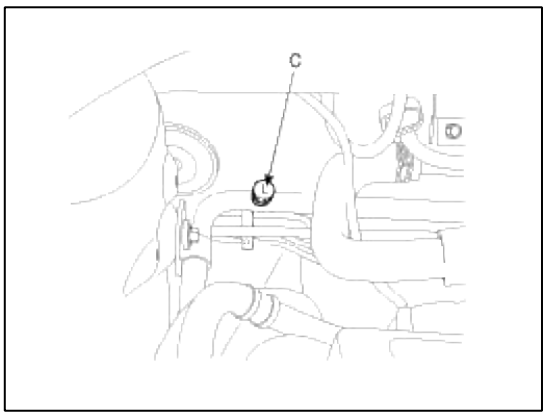
CAUTION

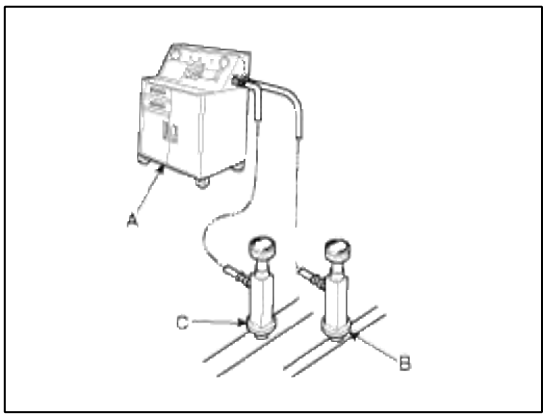
- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

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 a R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.







2. Measure the amount of refrigerant oil removed from the A/C system after the recovery process is completed. Be sure to install the same amount of new refrigerant oil back into the A/C system before charging.

SYSTEM EVACUATION

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

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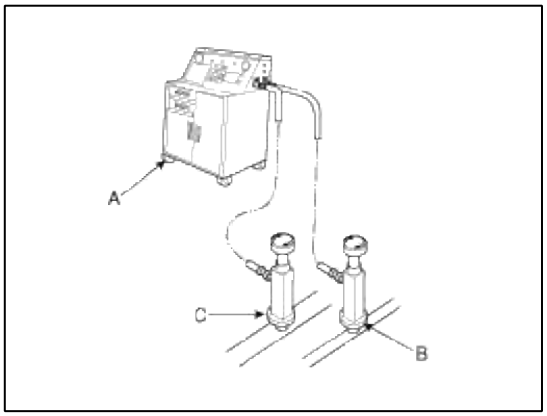
CAUTION

- 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 a 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 a R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



3. If the low-pressure does not reach more than 93.3 kPa (700 mmHg, 27.6 in.Hg) in 10 minutes, there is probably a leak in the system. Partially charge the system, and check for leaks (see Leak Test.)
4. Remove the low pressure valve from the low-pressure service port.

SYSTEM CHARGING

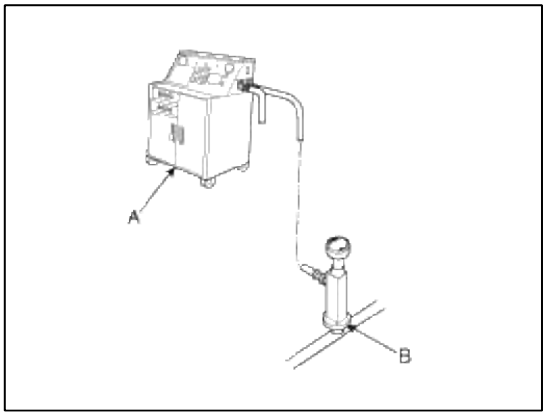
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

CAUTION

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect a R-134a refrigerant.
   Recovery/Recycling/Charging System (A) to the high-pressure service port (B) as shown, following the equipment manufacturer's instructions.



2. Add the same amount of new refrigerant oil to system that was removed during recovery. Use only Specified refrigerant oil. Charge the system with 18.0 ± 0.88 oz. (510 ± 25g) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

REFRIGERANT LEAK TEST

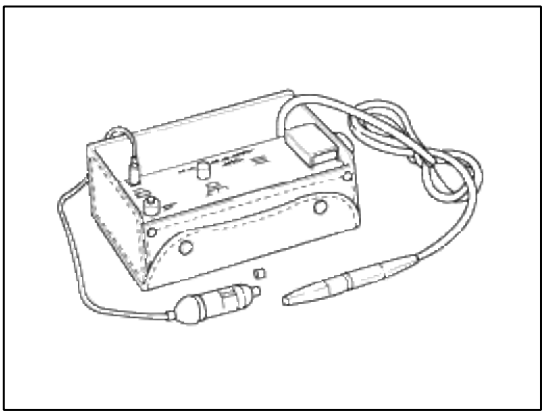
Always conduct a leak test with an electronic leak detector whenever leakage of refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

NOTE

In order to use the leak detector properly, read the manual supplied by the manufacturer.

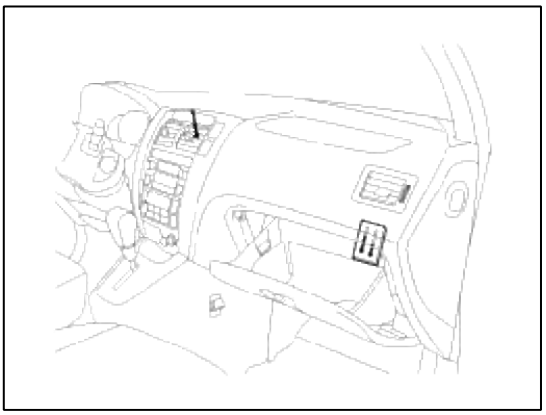
If a gas leak is detected, proceed as follows:

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.
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.



A/C SYSTEM PERFORMANCE TESTS

1. Connect a R-134a refrigerant.
   Recovery/Recycling/Charging System to the high-pressure service port and the low-pressure service port, following the equipment manufacturer's instructions.
2. Determine the relative humidity and air temperature.
3. Remove the glove box stopper and tension code and let the glove box hang down.
4. Insert a thermometer in the cool air outlet.
5. Place a thermometer near the blower unit inlet.



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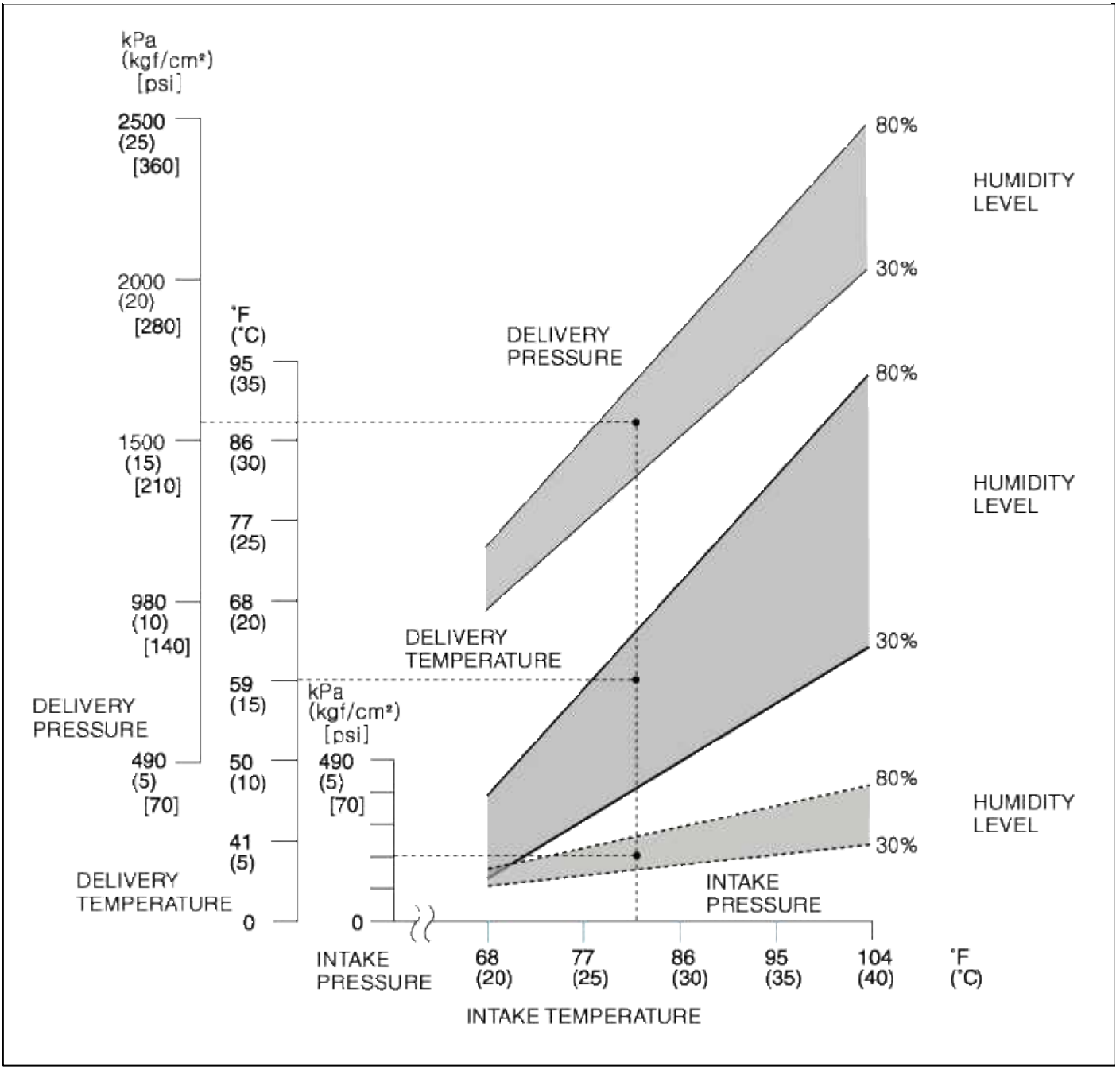
6. Test condition
   A. Avoid direct sunlight.
   B. Open hood.
   C. Open front doors.
   D. Set the temperature control dial to Max cool, the mode control switch to Vent, and the recirculation control switch to Recirculation.
   E. Turn the A/C switch in and the fan switch to Max.
   F. Run the engine at 1,500 rpm.
   G. No driver or passenger in vehicle.
7. After running the air conditioning for 10 minutes under the above test conditions, read the delivery temperature from the thermometer in the cool air outlet, the intake temperature near the blower unit inlet, and the high and low system pressure from the A/C gauges.
8. To complete the chart
   A. Mark the delivery temperature along the vertical line
   B. Mark the intake temperature along the bottom line
   C. Draw a line straight up from the air temperature to the humidity
   D. Mark a point 10% above and 10% below the humidity level
   E. From each point
   F. Draw a horizontal line across the delivery temperature
   G. The delivery temperature should fall between the two lines
   H. Complete the low side pressure test and high side pressure test in the same way
   I. Any measurements outside the line may indicate the near for more further inspection



Heating,Ventilation, Air Conditioning > Air conditioning System > Drive belt > Repair procedures

INSPECTION

1. Only Beta engine (2.0L). 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.

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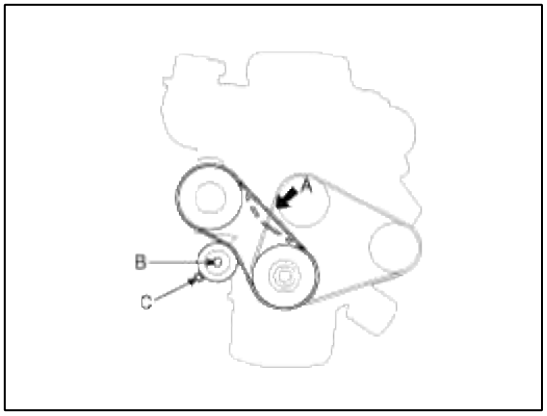
2. Apply a force of 98N(10kgf, 22lbf), and measure the deflection at the mid point (A) between the air condition compressor and crankshaft pulley.

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 (0.236 ~ 0.276 in.)	36 ± 5 kg (79 ± 11 lb)
Check after operation	8 mm (0.315 in.)	25 ~ 50 kg (55 ~ 110 lb)



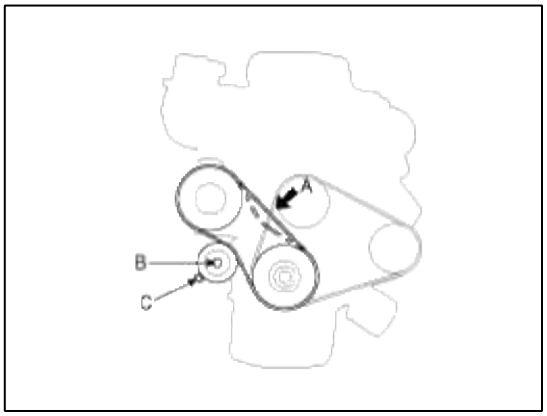
NOTE

These items when adjusting belt tension :

A. If there are cracks or any damage evident on the belt, replace it with a new one.
B. "Used belt" means a belt which has been used for five minutes or more.
C. "New belt" means a belt which has been used for less than five minutes.

ADJUSTMENT

1. Loosen the tension mounting bolt(B).
2. Turn the adjusting bolt(C) to obtain the proper belt tension, then retighten the mounting bolt(B).
3. Recheck the deflection of the A/C compressor belt.

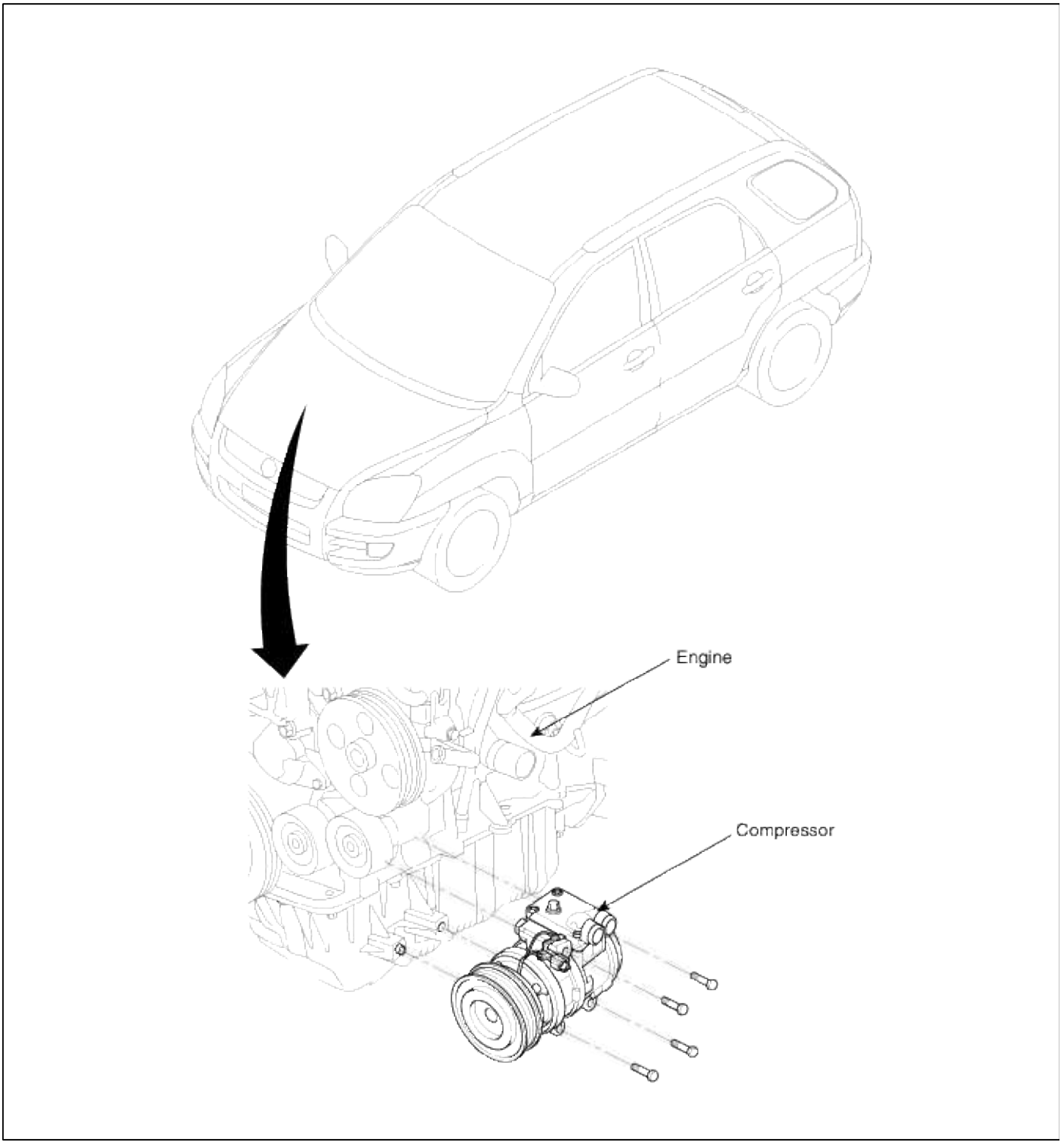


NOTE

Delta engine (2.7L) refer to the engine group.

Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Components and Components Location

COMPONENT



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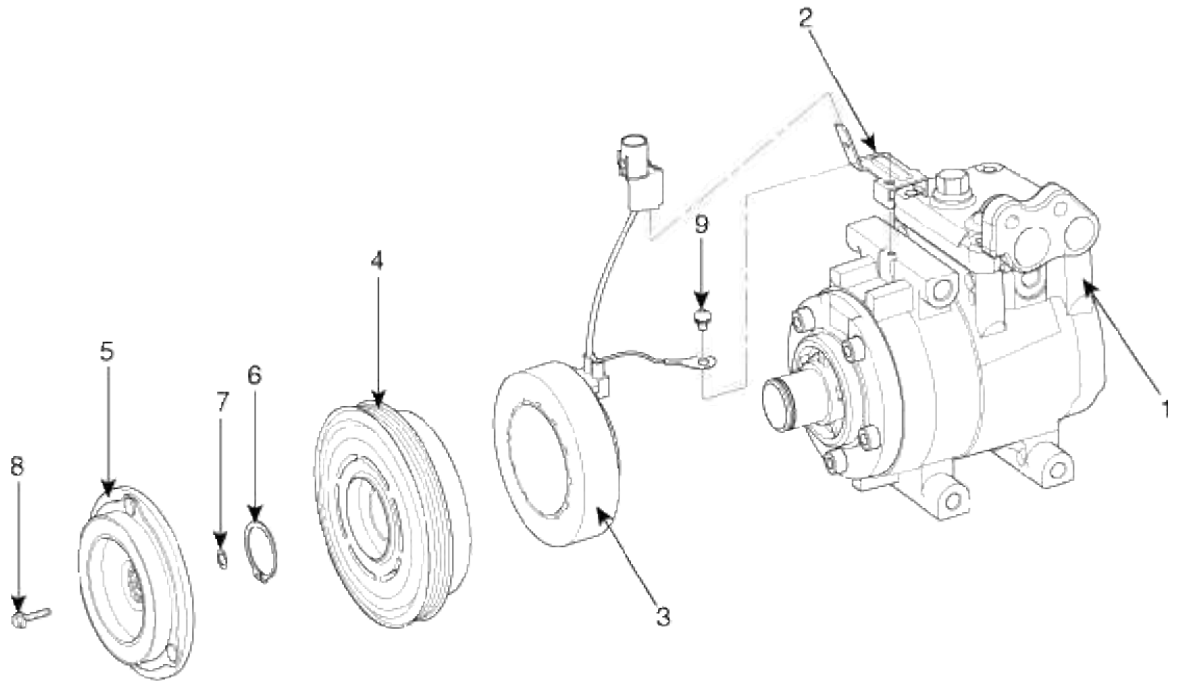
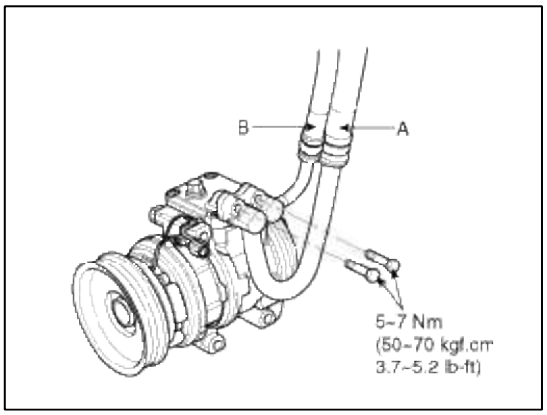


1. Compressor assembly
2. Connector bracket
3. Field coil
4. Pulley
5. Disc & hub
6. Retainer ring
7. Shim
8. Bolt
9. Screw

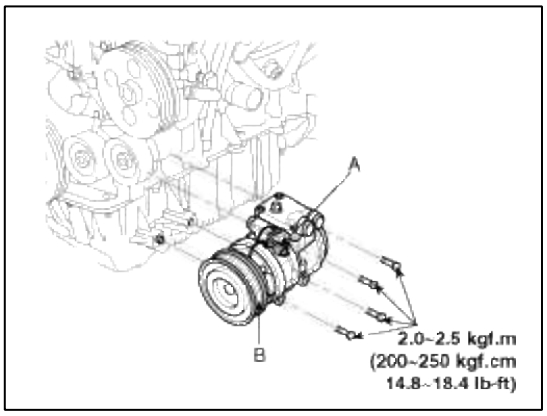
Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor > Repair procedures

REMOVAL

1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station (See page HA-9).
4. Loosen the drive belt (See page HA-21).
5. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



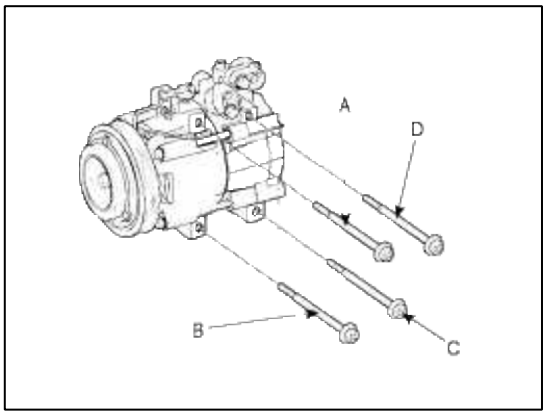
6. Disconnect the compressor clutch connector (A), then remove the mounting bolts and the compressor (B).



INSTALLATION

1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.

Bolt	β Engine (2.0L)	δ Engine (2.7L)
A	118mm (4.65in.)	118mm (4.65in.)
B	102mm (4.02in.)	118mm (4.65in.)
C	102mm (4.02in.)	118mm (4.65in.)
D	126mm (4.96in.)	94mm (3.70in.)



2. Install in the reverse order of removal, and note these items.
   A. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume, Subtract the volume of drained oil from 120cc(4.20 oz.) the result is the amount of oil you should drain from the new compressor (through the suction fitting).
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
   D. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
   E. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.
   F. Adjust the drive belt (See page HA-21).
   G. Charge the system and test its performance.

INSPECTION

1. Check the plated parts of the disc & hub for color changes, peeling or other damage. If there is damage, replace the clutch set.

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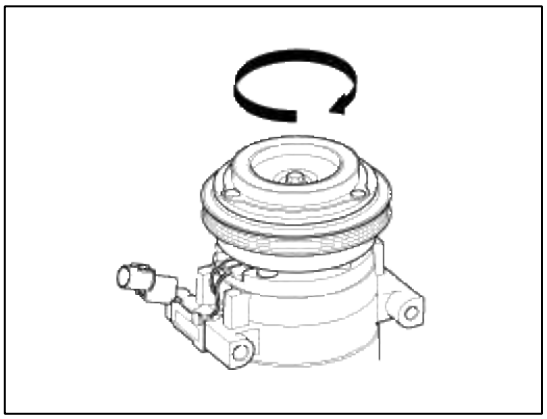
2. Check the pulley bearing play and drag by rotating the pulley by hand. Replace the clutch set with a new one if it is noisy or has excessive play/drag.

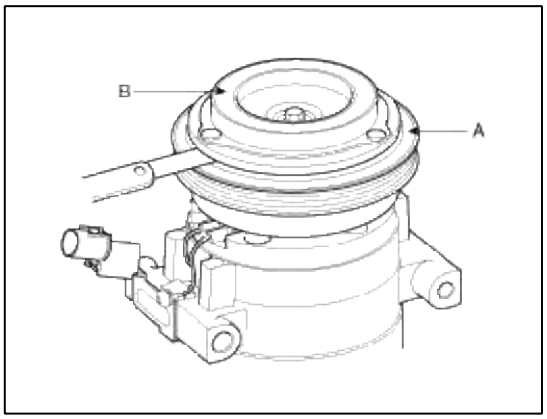


3. Measure the clearance between the pulley (A) and the disc & hub (B) all the way around. If the clearance is not within specified limits, remove the disc & hub (See page HA-27) and add or remove shims as needed to increase or decrease clearance.

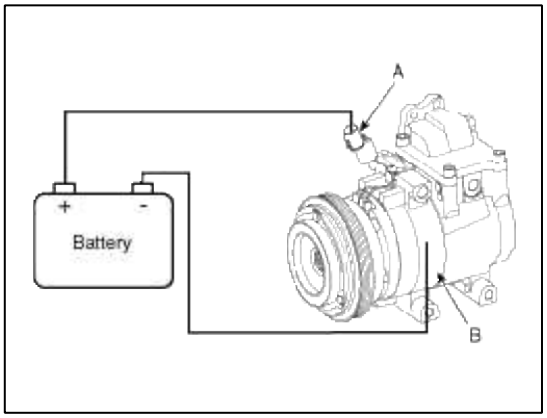
Clearance : 0.5 ± 0.15mm (0.020 ± 0.006 in.)

NOTE

The shims are available in seven thicknesses : 0.7mm, 0.8mm, 0.9mm, 1.0mm, 1.1mm, 1.2mm and 1.3mm.

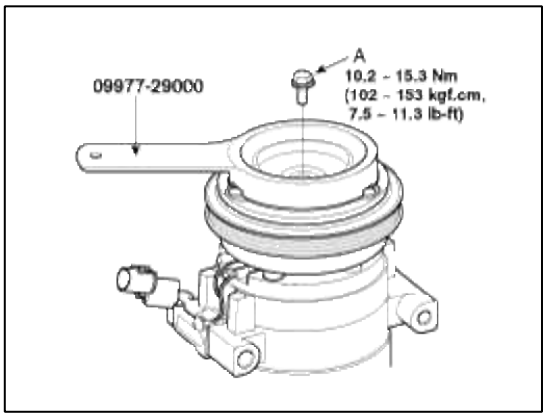


4. Check operation of the magnetic clutch.
   Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body.
   Check the magnetic clutch operating noise to determine the condition.

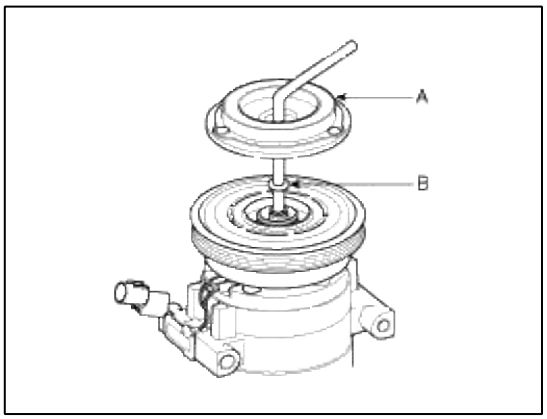


DISASSEMBLY

1. Remove the center bolt (A) while holding the disc & hub with a commercially available disc & hub bolt remover; Special tool number 09977-29000.



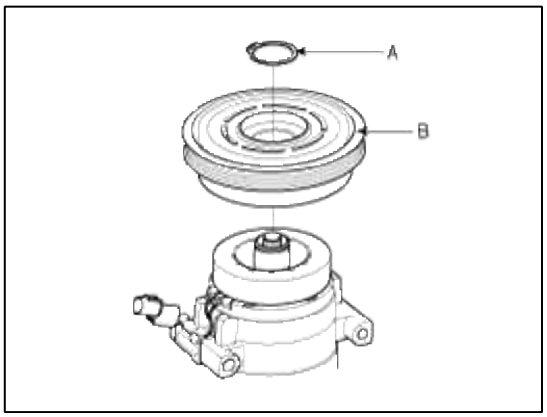
2. Remove the disc & hub (A) and shim (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub, and recheck its clearance (See page HA-25).



3. If you removal the field coil, remove snap ring (A) with snap ring pliers.

NOTE

- Be careful not to damage the pulley (B) and compressor during removal/installation.
- Once snap ring (A) is removed, replace it with a new one.



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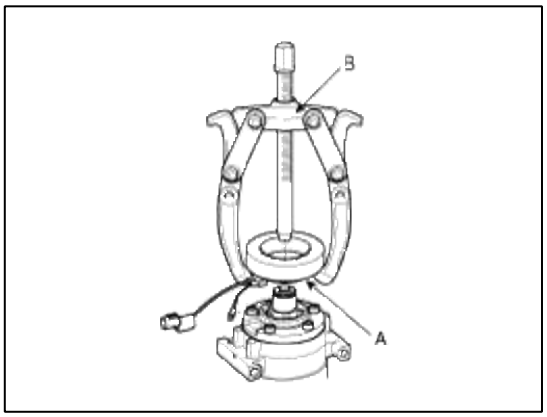
4. Remove the screw from the field coil ground terminal.
   Remove the field coil (A) from the shaft with a puller (B). Be careful not to damage the coil and compressor.



5. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
   A. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
   B. Install new snap rings, and make sure they are fully seated in the groove.
   C. Make sure that the pulley turns smoothly after it's reassembled.

Heating,Ventilation, Air Conditioning > Air conditioning System > Compressor oil > Repair procedures

OIL SPECIFICATION

- The HFC-134a system requires a synthetic (PAG) compressor oil whereas the R-12 system requires mineral compressor oil. The two oils must never be mixed.
- Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

HANDLING OF OIL

- The oil should be free from moisture, dust, metal powder, etc.
- Do not mix with other oil.
- 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.)
- 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 :
120~135cc (4.05~4.56 fl.oz) - β engine (2.0L)
200~215cc (6.76~7.27 fl.oz) - δ engine (2.7L)

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 oz.)
Condenser	30 cc (1.02 oz.)
Receiver/dryer	30 cc (1.02 oz.)
Refrigerant line (One piece)	10 cc (0.34 oz.)

For compressor replacement, subtract the volume of oil drained from the removed compressor from the specified volume, and drain the calculated volume of oil from the new compressor :
The specified volume - volume of removed compressor = volume to drain from the new compressor.

NOTE

Even if no oil is drained from the removed compressor, don't drain more than 50cc from new compressor.

Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Components and Components Location

COMPONENT

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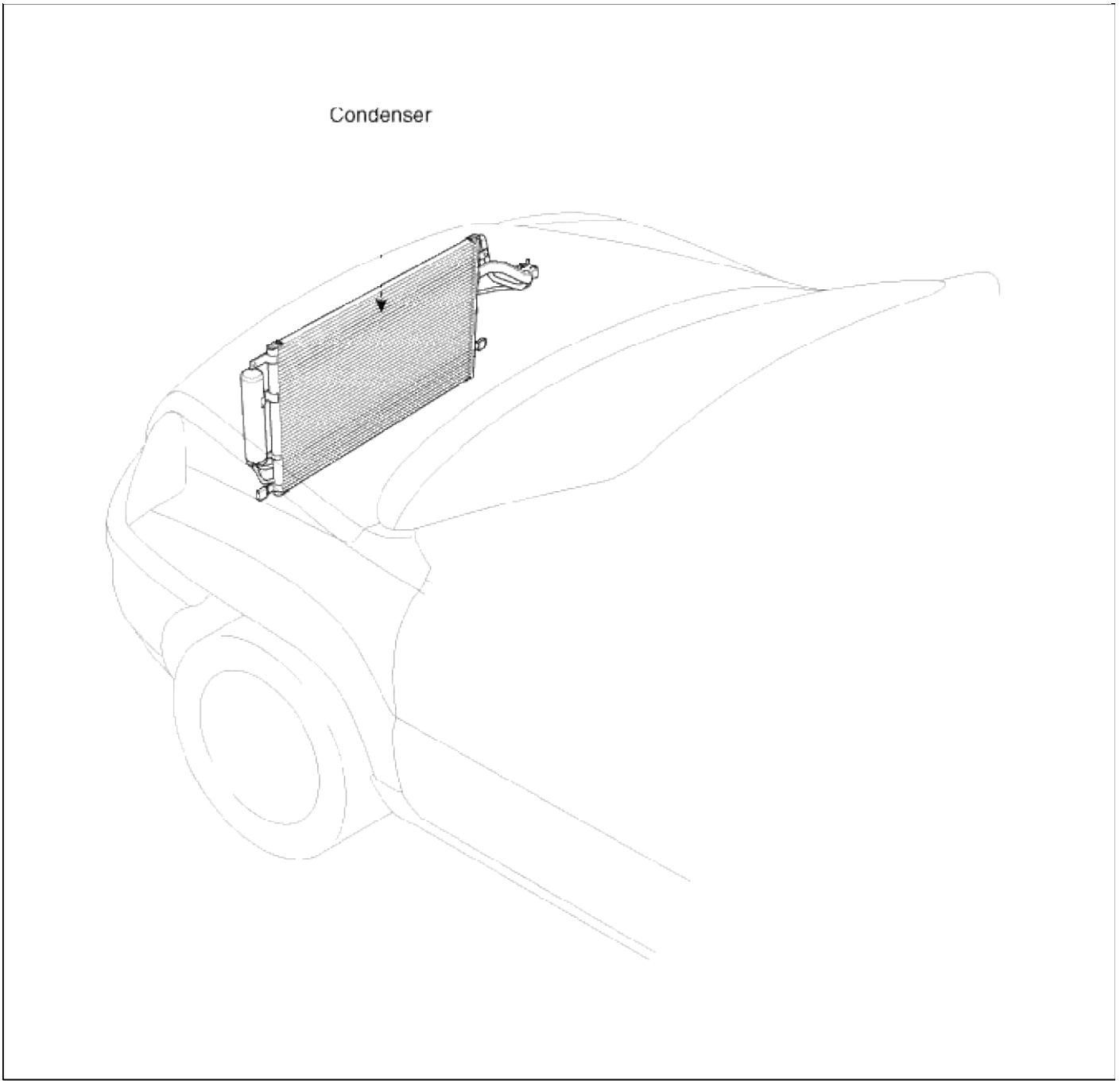


Heating,Ventilation, Air Conditioning > Air conditioning System > Condenser > Repair procedures

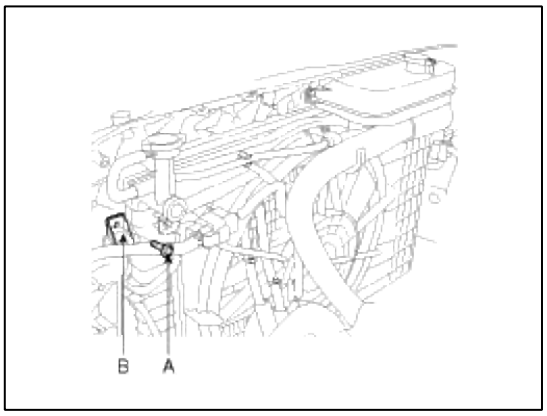
INSPECTION

1. Check the condenser fins for clogging and damage. If clogged, clean them with water, and blow them with compressed air. If bent, gently bend them using a screwdriver or pliers.
2. Check the condenser connections for leakage, and repair or replace it, if required.

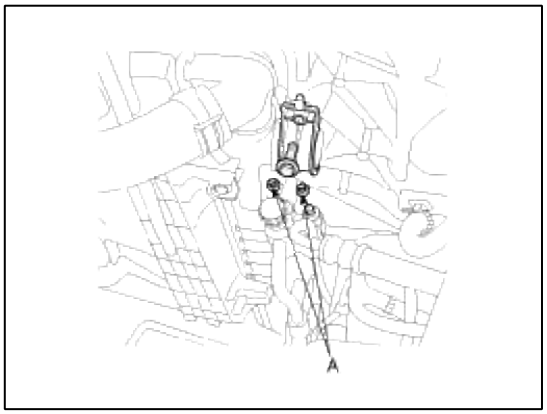
REPLACEMENT

1. Recover the refrigerant with a recovery/recycling/charging station (See page HA-9).
2. Remove the coolant reservoir, but do not disconnect the reservoir hose from the coolant reservoir and the radiator.

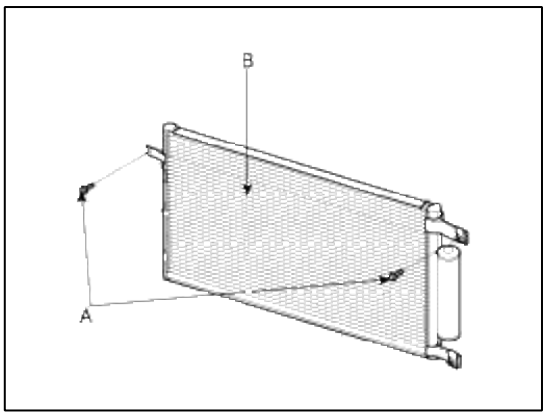
3. Remove the bolt(A), then remove the radiator bracket(B) from the radiator.



4. Remove the nuts (A), then disconnect the discharge line and condenser line from the condenser.
   Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



5. Remove the bolts (A), then remove the condenser (B) by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser.



6. Install in the reverse order of removal, and note these items:
   A. If you're installing a new condenser, add refrigerant oil ND-OIL8.
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. Be careful not to damage the radiator and condenser fins when installing the condenser.
   D. Be sure to install the lower mount cushions of condenser securely into the holes.
   E. Charge the system, and test its performance.

Heating,Ventilation, Air Conditioning > Air conditioning System > Receiver/Drier > Repair procedures

REPLACEMENT

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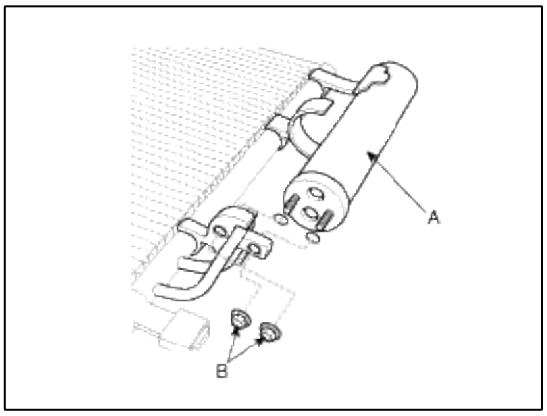
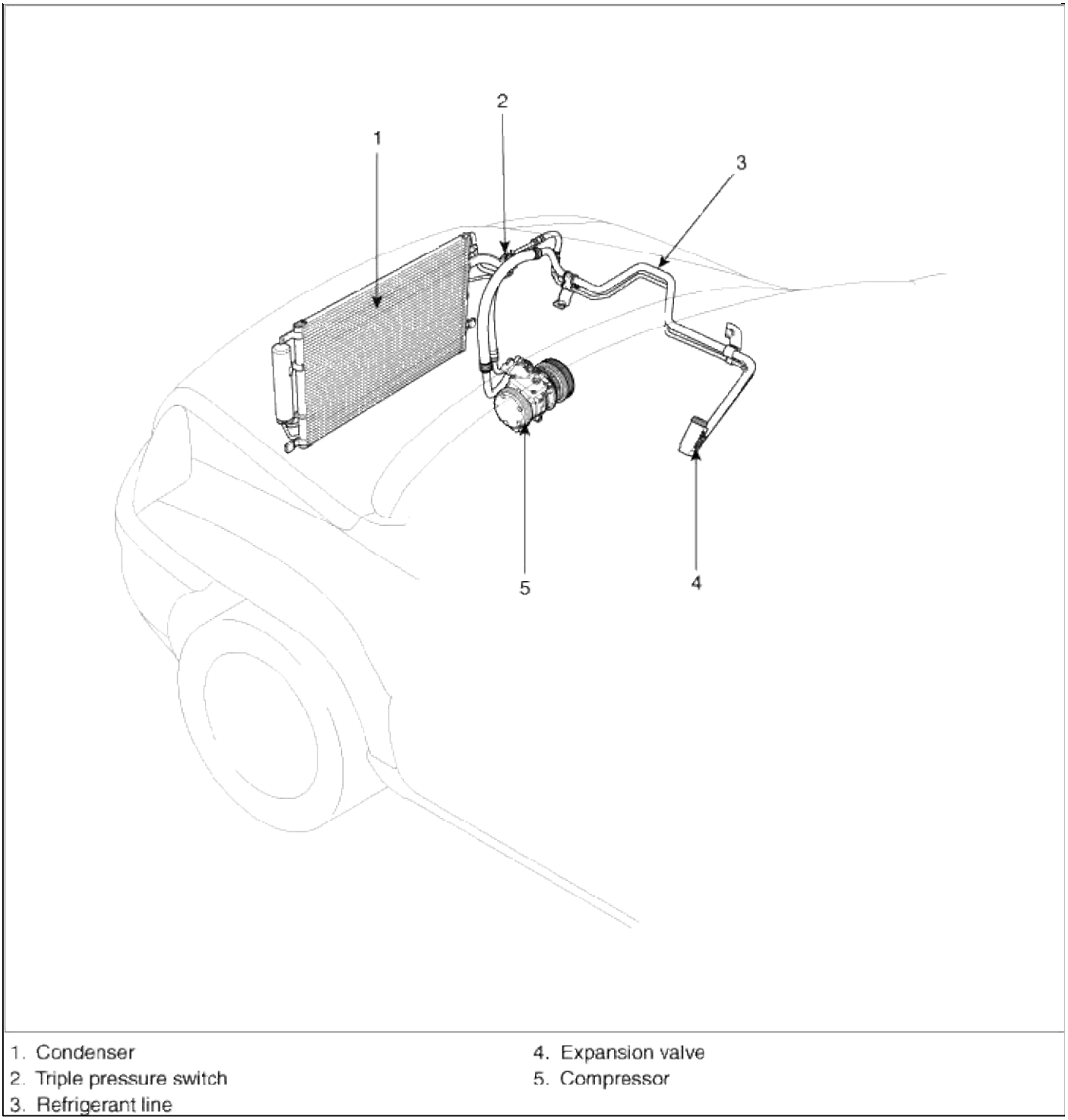
1. Remove the condenser, and then remove the receiver/drier after loosening the nuts (B) at the lower receiver/drier (A).



2. Install in the reverse order of removal, and note these items :
   A. If you're installing a new receiver/drier, add refrigerant oil ND-OIL8.
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. Be careful not to damage the radiator and condenser fins when installing the condenser.
   D. Be sure to install the lower mount cushions of condenser securely into the holes.
   E. Charge the system, and test its performance.

Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Components and Components Location

COMPONENT LOCATION



1. Condenser
2. Triple pressure switch
3. Refrigerant line
4. Expansion valve
5. Compressor

Heating,Ventilation, Air Conditioning > Air conditioning System > Refrigerant line > Repair procedures

REPLACEMENT

1. Discharge refrigerant from refrigeration system (see page HA-9).
2. Replace faulty tube or hose.

> **CAUTION**
>
> Cap the open fittings immediately to keep moisture or dirt out of the system.

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3. Tighten joint of bolt or nut to specified torque.

> CAUTION
>
> Connections should not be torque tighter than the specified torque.

4. Evacuate air in refrigeration system and charge system with refrigerant (see page HA-9).

Specified amount : 510 ± 25g (18.0 ± 0.88 oz.)

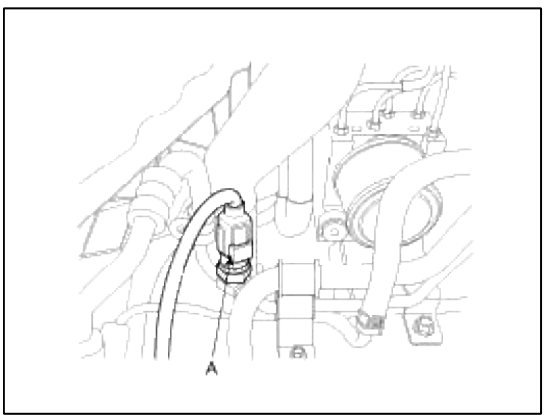
5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant (see page HA-11).
6. Inspect A/C operation.

Part tightened	N.m	kg.cm	lb-ft
Condenser x Discharge hose	5 ~ 7	50 ~ 70	3.7 ~ 5.2
Condenser x Liquid tube	5 ~ 7	50 ~ 70	3.7 ~ 5.2
Compressor x Discharge hose	10 ~ 15	100 ~ 150	7.2 ~ 10.8
Compressor x Suction hose	10 ~ 15	100 ~ 150	7.2 ~ 10.8
Expansion valve x Evaporator	8 ~ 12	80 ~ 120	5.8 ~ 8.7

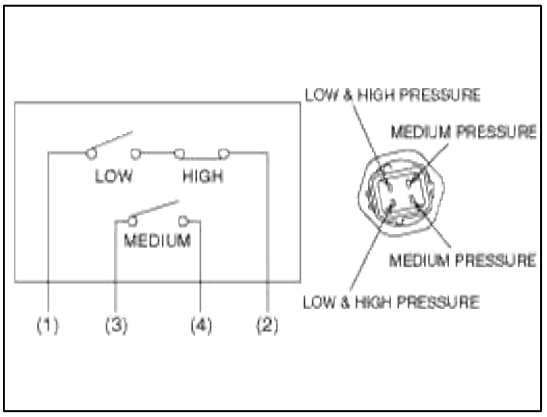
Heating,Ventilation, Air Conditioning > Air conditioning System > Triple pressure switch > Description and Operation

DESCRIPTION

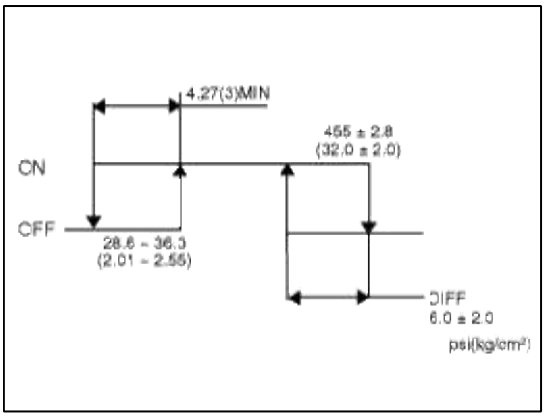
The triple switch is a combination of a medium switch as well as conventional low pressure and high pressure switches. The low pressure switch will be turned off to stop compressor operation if refrigerant pressure is low. The high pressure switch will be turned off to stop compressor operation if refrigerant pressure is too high. The medium switch will be turned on at medium level pressure to cool the A/C system operating radiator fan and condenser fan at high speed.



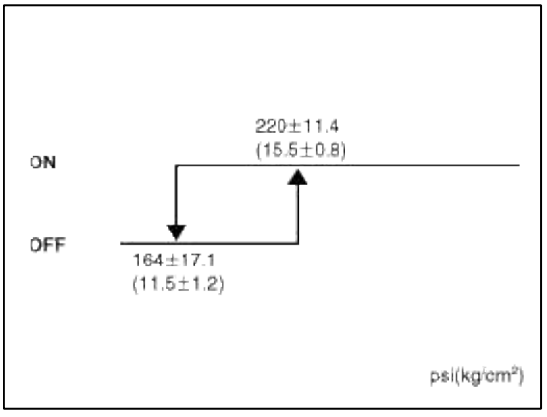
Pressure	ON	OFF
High [psi (kg/cm²)]	370 ± 2.8 (26.0 ± 2.0)	455 ± 2.8 (32.0 ± 2.0)
Low [psi (kg/cm²)]	28.6 ~ 36.3 (2.01 ~ 2.55)	28.4 ± 2.8 (2.0 ± 0.2)
Medium [psi (kg/cm²)]	220 ± 11.4 (15.5 ± 0.8)	164 ± 17.1 (11.5 ± 1.2)



LOW & HIGH PRESSURE



MEDIUM PRESSURE



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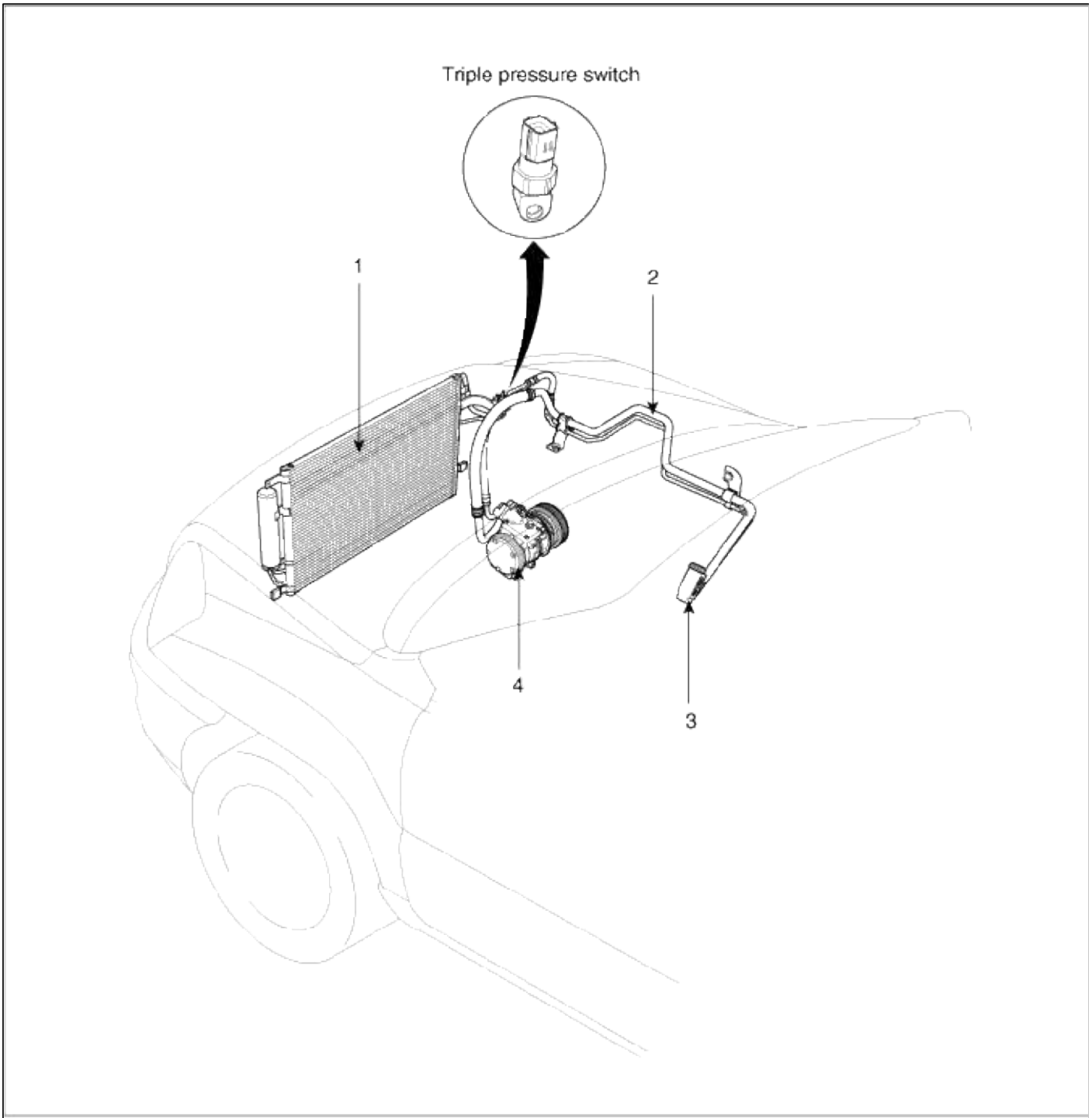
Heating,Ventilation, Air Conditioning > Air conditioning System > Triple pressure switch > Components and Components Location

COMPONENT

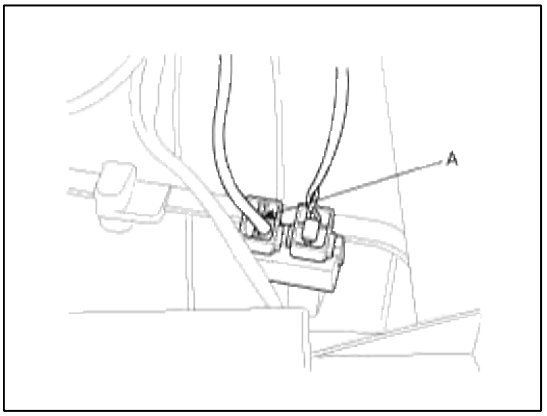


1. Condenser
2. Refrigerant line
3. Expansion valve
4. Compressor

Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Description and Operation

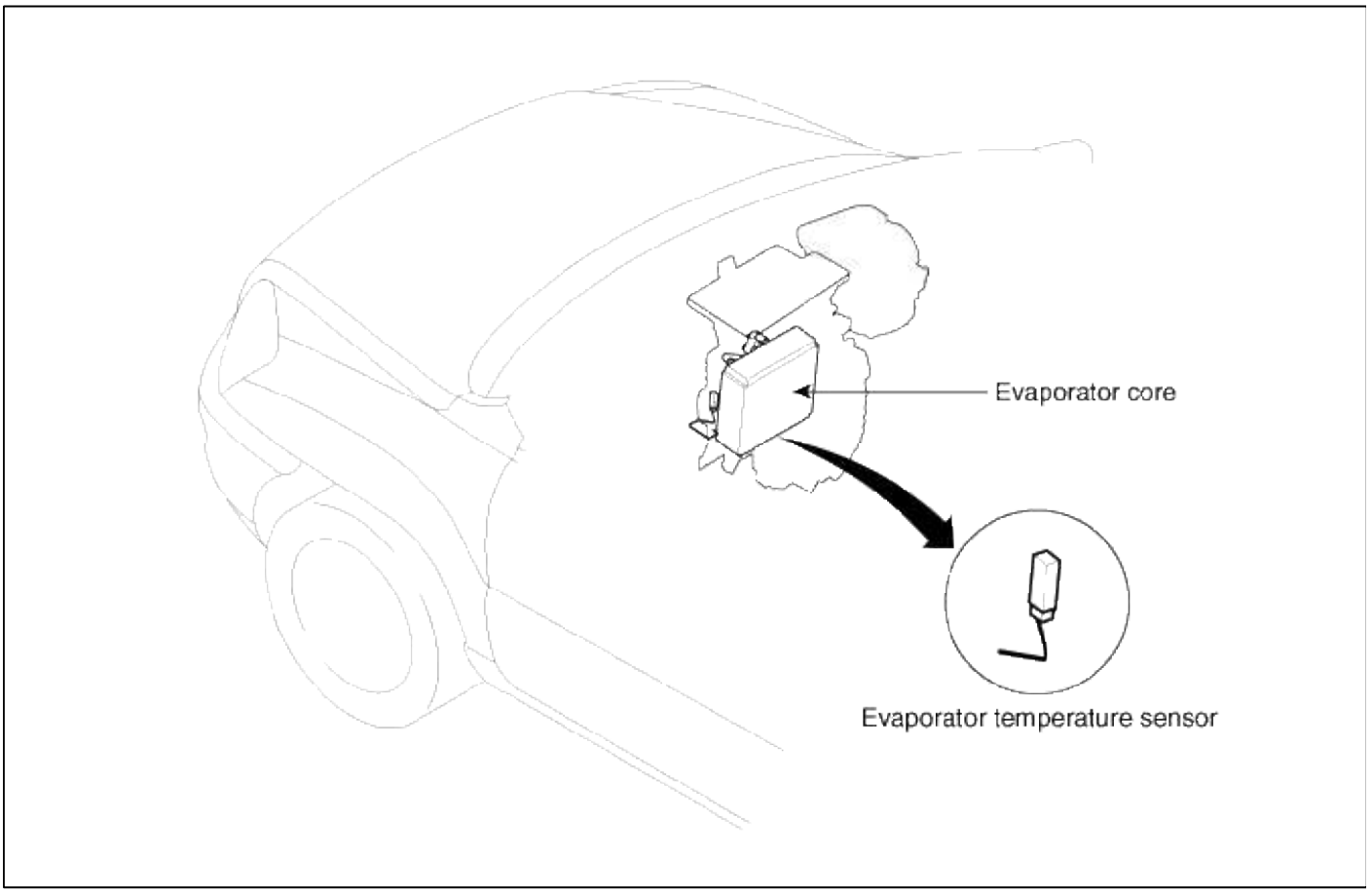
DESCRIPTION

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.



Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Components and Components Location

COMPONENT



Heating,Ventilation, Air Conditioning > Air conditioning System > Evaporator temperature sensor > Repair procedures

INSPECTION

1. Ignition "OFF"
2. Disconnect evaporator temperature sensor.

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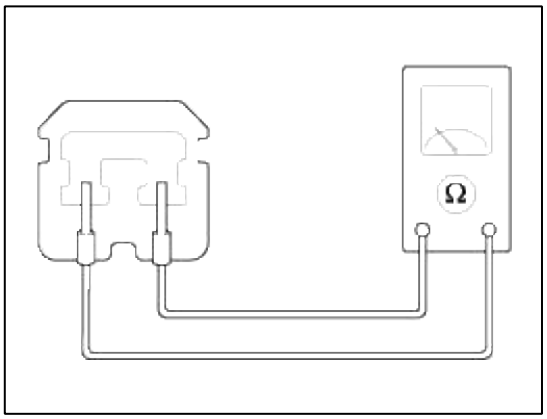
3. Using the multi-tester, Measure resistance between terminal "1" and "2" of evaporator temperature sensor.



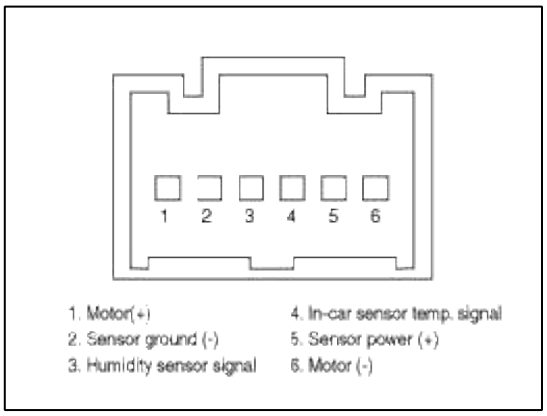
Specification

Evaporator core temperature [°C(°F)]	Resistance [KΩ]
-10(14)	13.6
0(32)	8.0
10(50)	4.9
15(59)	3.9
30(86)	2.0
40(104)	1.3
50(122)	0.9

Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Description and Operation

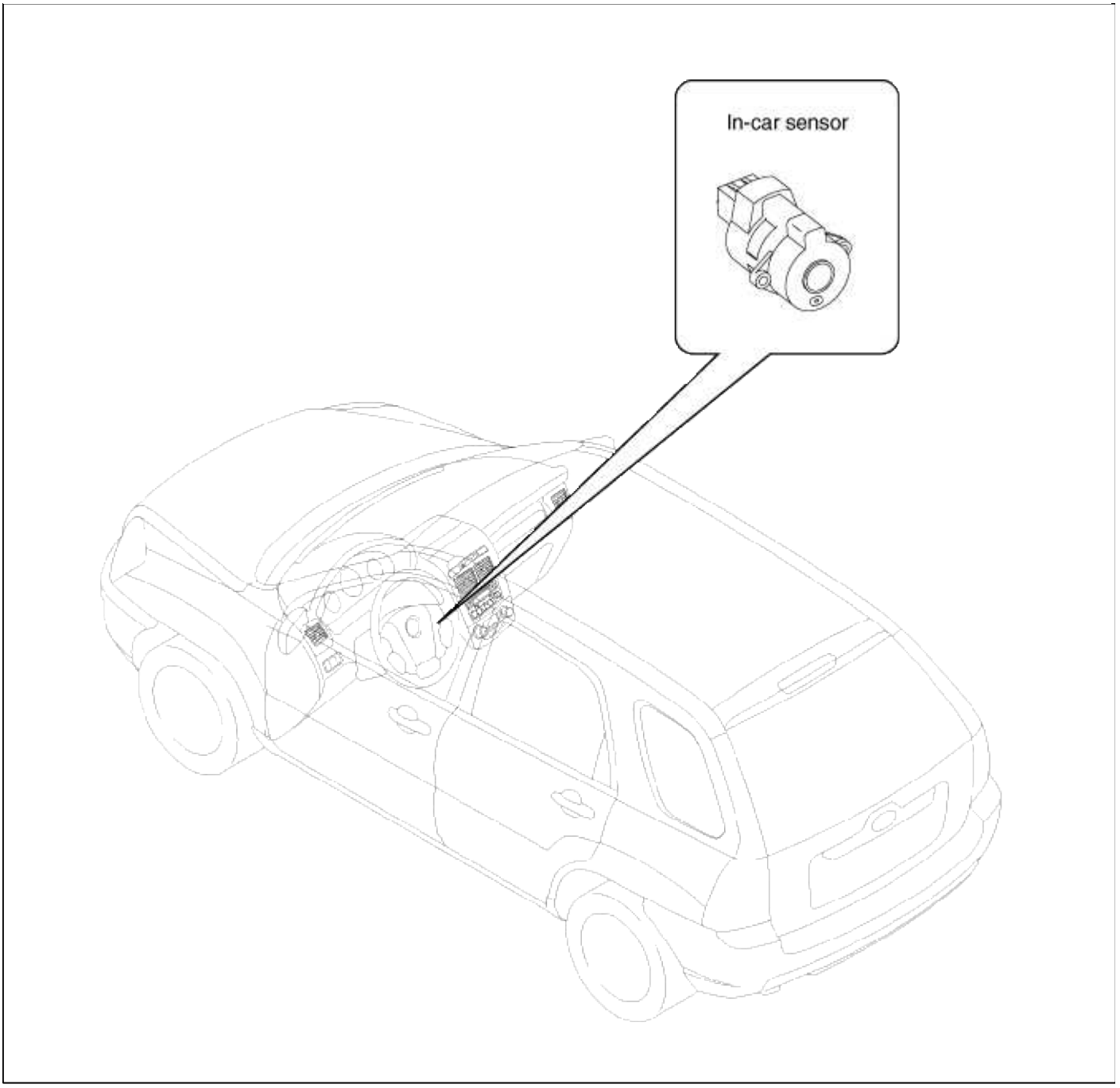
DESCRIPTION

1. In-car air temperature sensor is located at the lower crush pad.
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.



Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Components and Components Location

COMPONENT



Heating,Ventilation, Air Conditioning > Air conditioning System > In-car sensor > Repair procedures

INSPECTION

1. Ignition "OFF"
2. Disconnect in-car temperature sensor.

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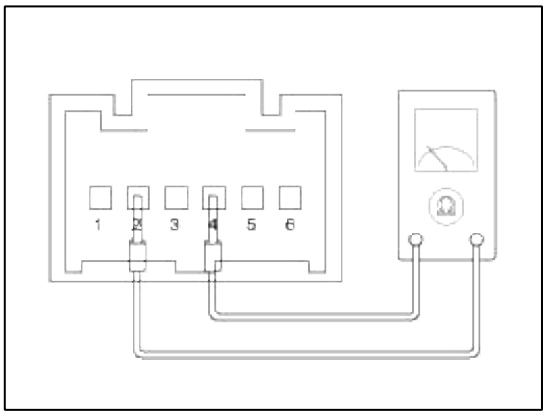
3. Using the multi-tester, Measure resistance between terminal "2" and "4" of in-car sensor.

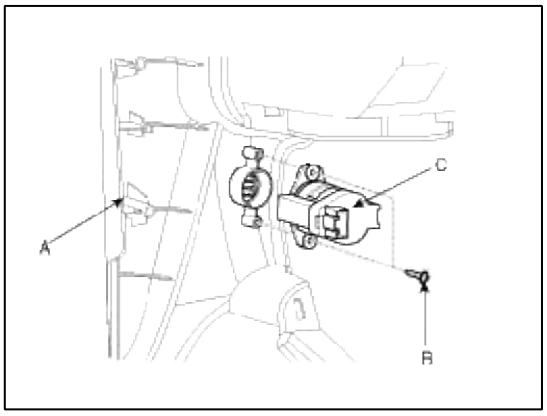


Specification

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%

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crush panel (A) (Refer to the Body group).
3. Disconnect the connector of in-car sensor.
4. Loosen the mounting screws (B) and then remove the in-car sensor (C).



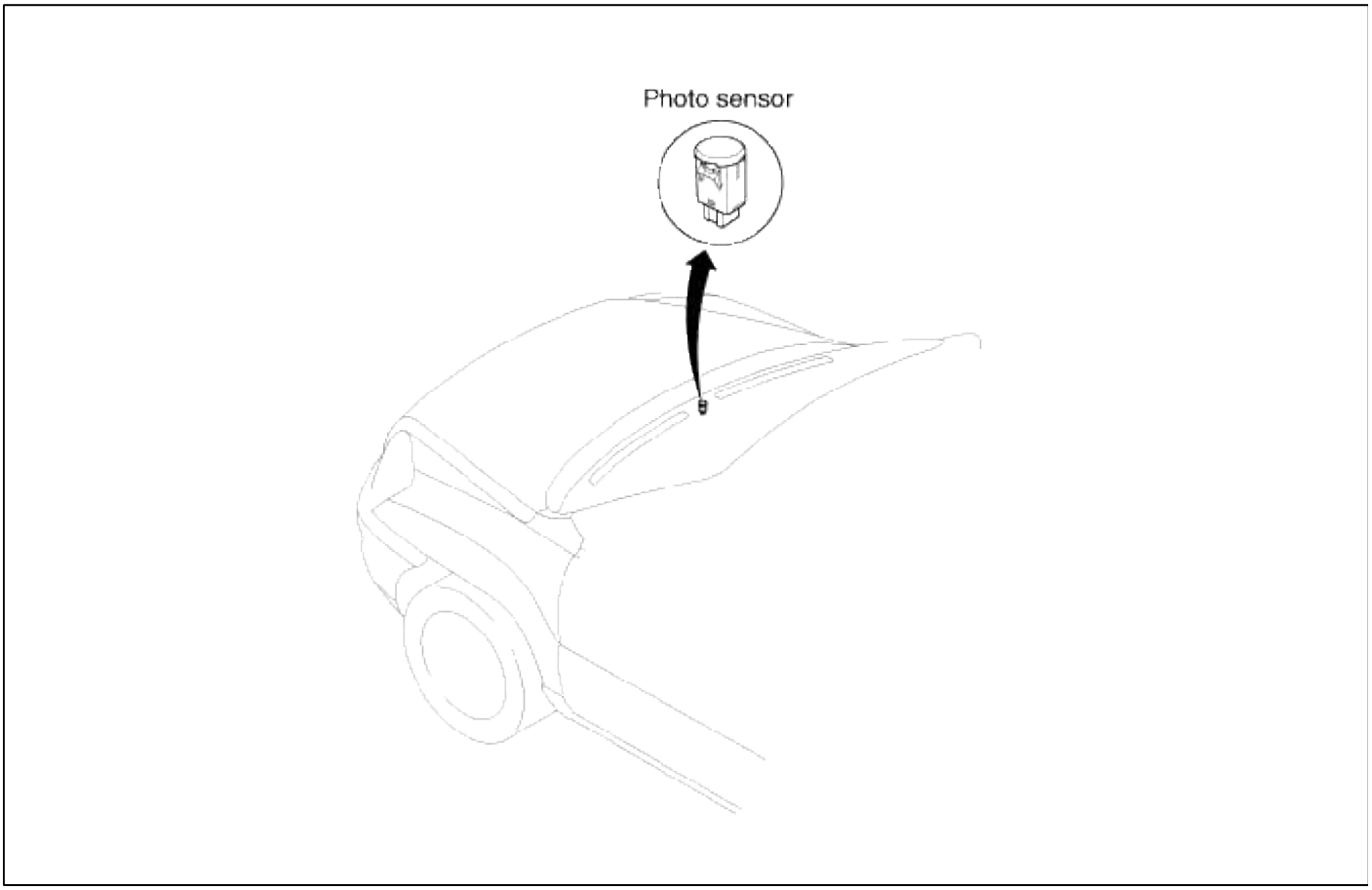
Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Description and Operation

DESCRIPTION

1. The photo sensor 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.

Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Components and Components Location

COMPONENT



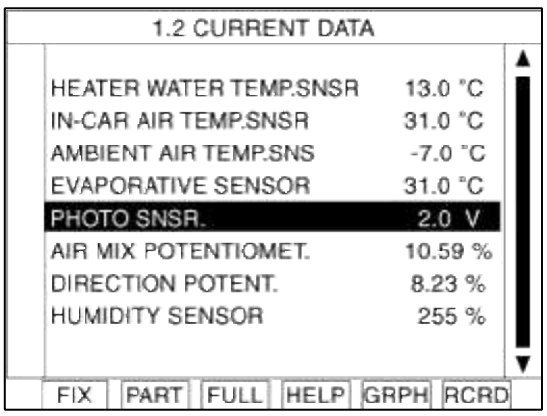
Heating,Ventilation, Air Conditioning > Air conditioning System > Photo sensor > Repair procedures

INSPECTION

1. Ignition "ON"
2. Using the scan tool.
3. Emit intensive light toward photo sensor using sunshine, and check the output absolute voltage change.
4. The absolute voltage will rise with higher intensive light and reduce with lower intensive light.

NOTE

When checking photo sensor, select a place where sun shines directly on it.



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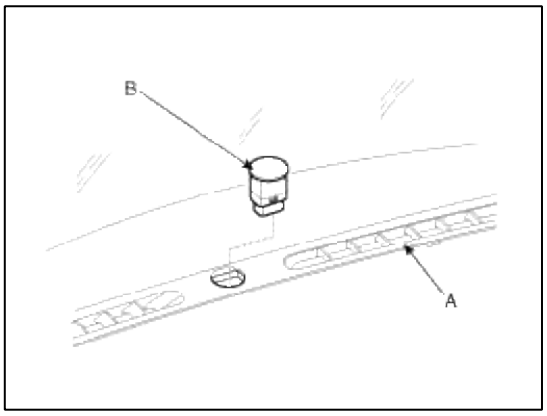
REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Using the (-) driver, Remove the photo sensor (B) from the center of defrost nozzle (A).

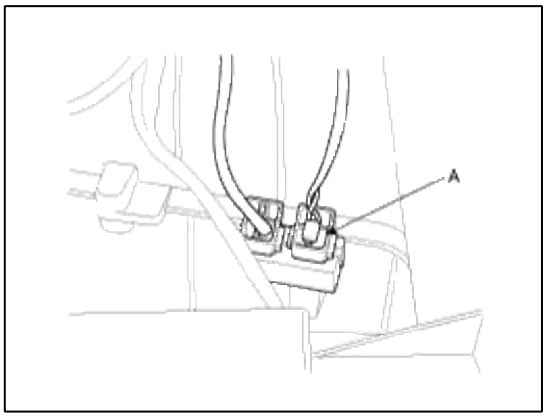


3. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Description and Operation

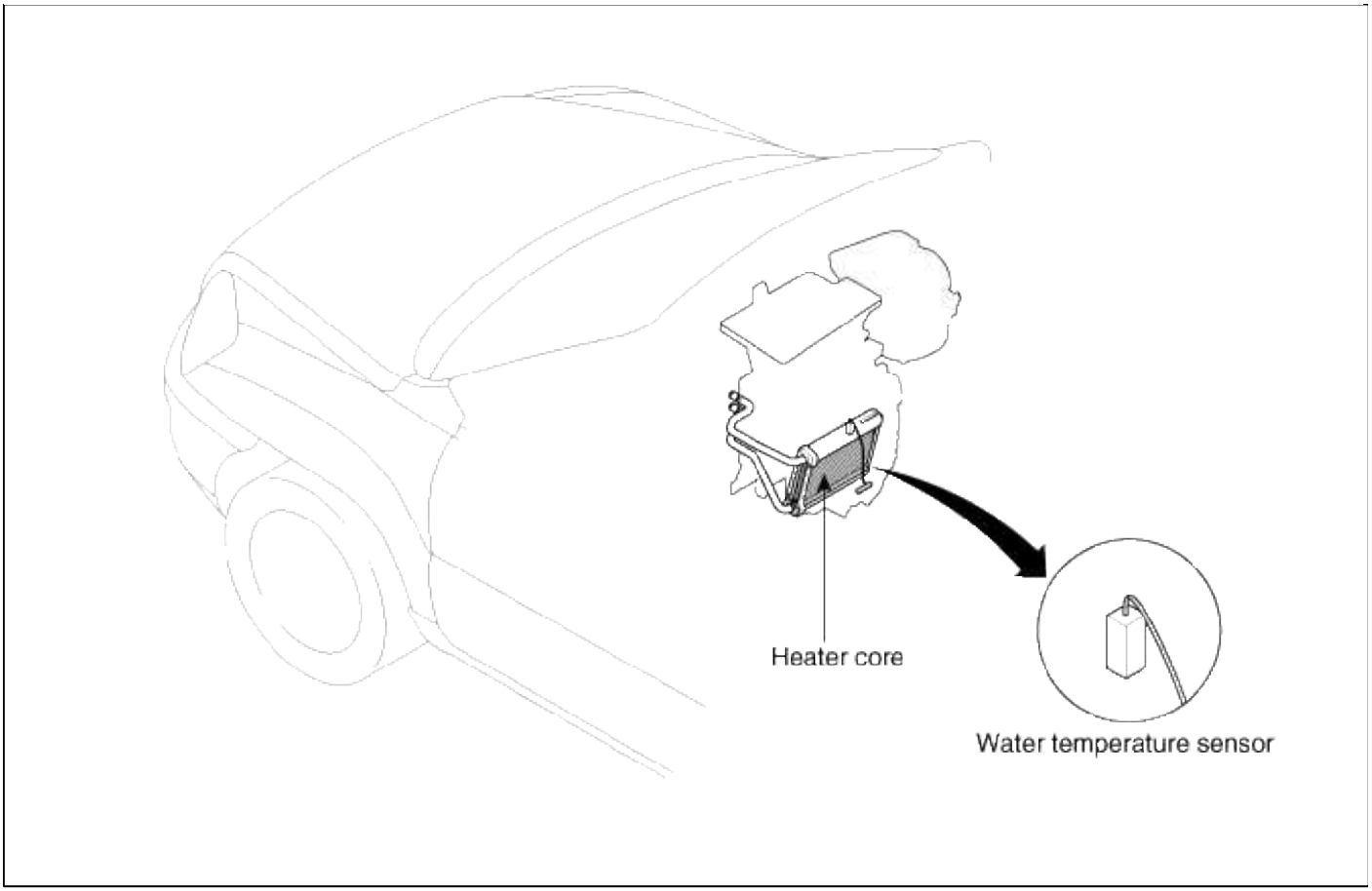
DESCRIPTION

1. Water temperature sensor(A) 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.



Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Components and Components Location

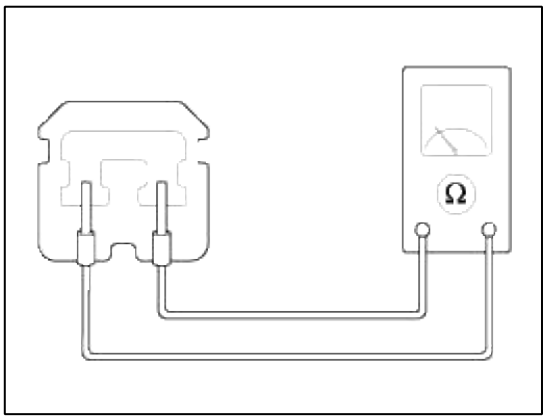
COMPONENT



Heating,Ventilation, Air Conditioning > Air conditioning System > Water temperature sensor > Repair procedures

INSPECTION

1. Ignition "OFF"
2. Disconnect water temperature sensor.
3. Using the multi-tester, Measure resistance between terminal "1" and "2" of water temperature sensor.



Specification

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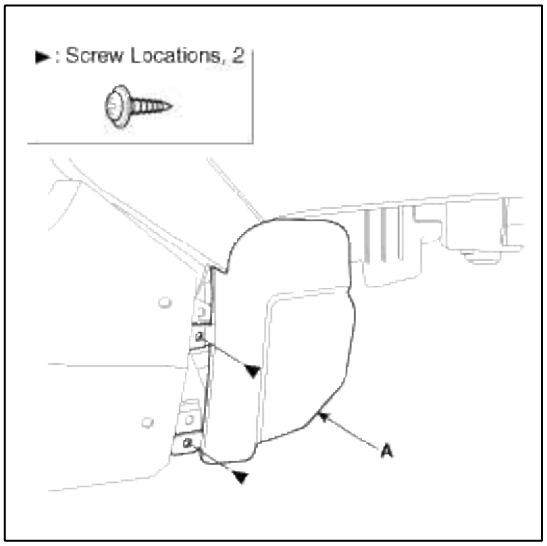
Coolant temperature [°C(°F)]	Resistance between terminals 1and 2 (KΩ)
-15 (5)	73.6 ± 3%
0 (32)	32.9 ± 3%
15 (59)	15.8 ± 3%
25 (77)	10.0 ± 3%
35 (95)	6.0 ± 3%
60 (140)	2.5 ± 3%

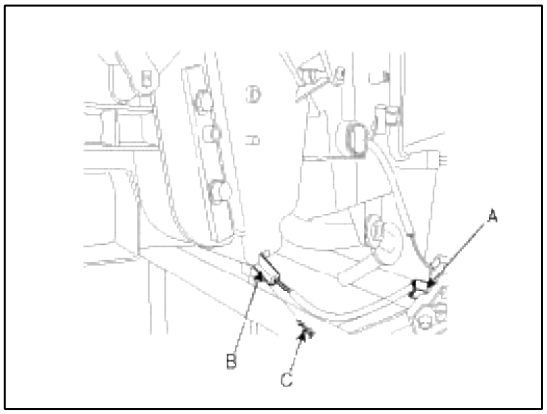
4. If the measured resistance is not specification, substitute with a known-good water temperature sensor and check for proper operation.
5. If the problem is corrected, replace the water temperature sensor.

REPLACEMENT

1. Disconnect the negative(-) battery terminal.
2. Remove the passenger's center lower side cover(A) (Refer to the Body group).



3. Disconnect the connector(A) of water temperature sensor.
4. Remove the caulk of water temperature sensor by using the scraper.
5. Pull the water temperature sensor out at the heater unit with the clamp(C).



NOTE

Take care that wire of water temperature sensor is not to be damaged

6. Install in the reverse order of removal.

NOTE

- Apply caulk to the water temperature sensor.
- Make sure that there is no air leakage.

Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Description and Operation

DESCRIPTION

1. The ambient temperature sensor is located at the front 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.

Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Components and Components Location

COMPONENT

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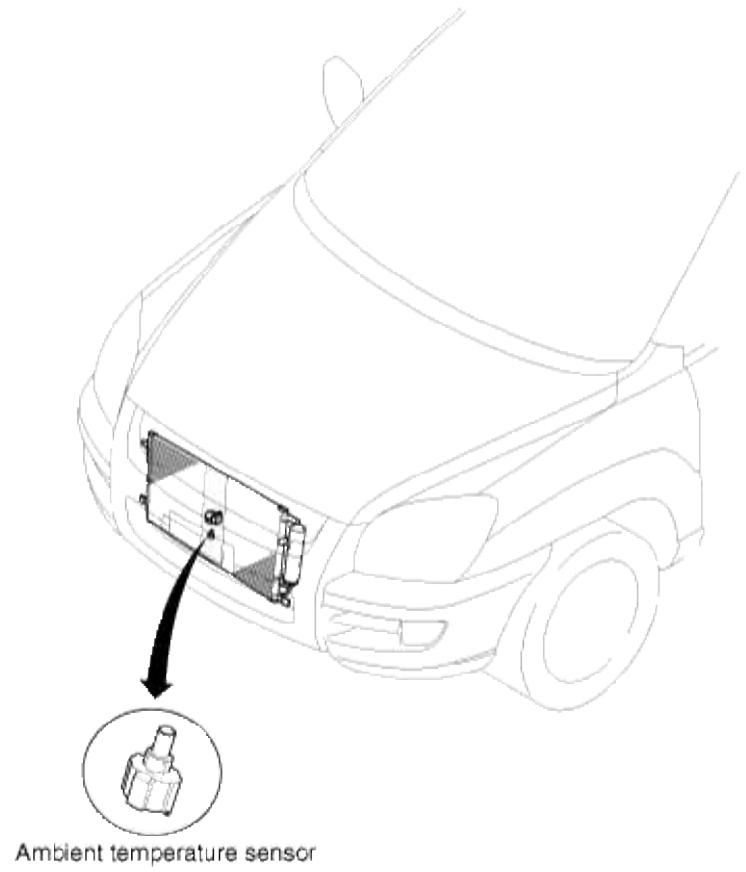


Heating,Ventilation, Air Conditioning > Air conditioning System > Ambient sensor > Repair procedures

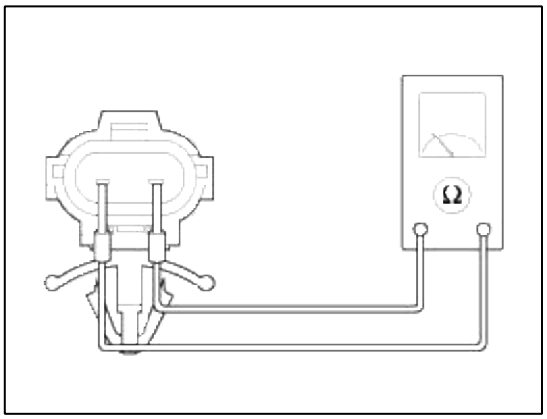
INSPECTION

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 temperature of the ambient temperature sensor.
   Specification

Ambient temperature[°C(°F)]	Resistance between terminals 1and 2 (kΩ)
-15 (5)	215.3±3%
0 (32)	97.5±3%
15 (59)	59.6±3%
25 (77)	30.0±3%
35 (95)	24.2±3%
60 (140)	16±3%

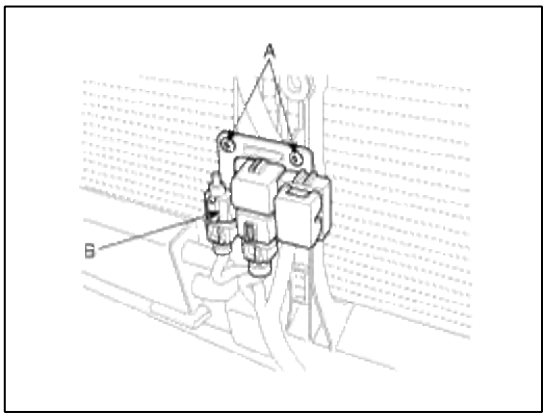
4. If the measured resistance is not specification, substitute with a known-good ambient temperature sensor and check for proper operation.

5. If the problem is corrected, replace the ambient temperature sensor.



REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper (Refer to the Body group).
3. Remove the ambient temperature sensor (B) after loosening the mounting screws(A).



4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Description and Operation

DESCRIPTION

1. A.Q.S is located at center support in front of the engine radiator, and detects hazardous elements in ambient air providing output signal to control.
2. It will detect sulfurous acid gas, carbon dioxide, carbon monoxide, hydrocarbon and allergen.

Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Components and Components Location

COMPONENT

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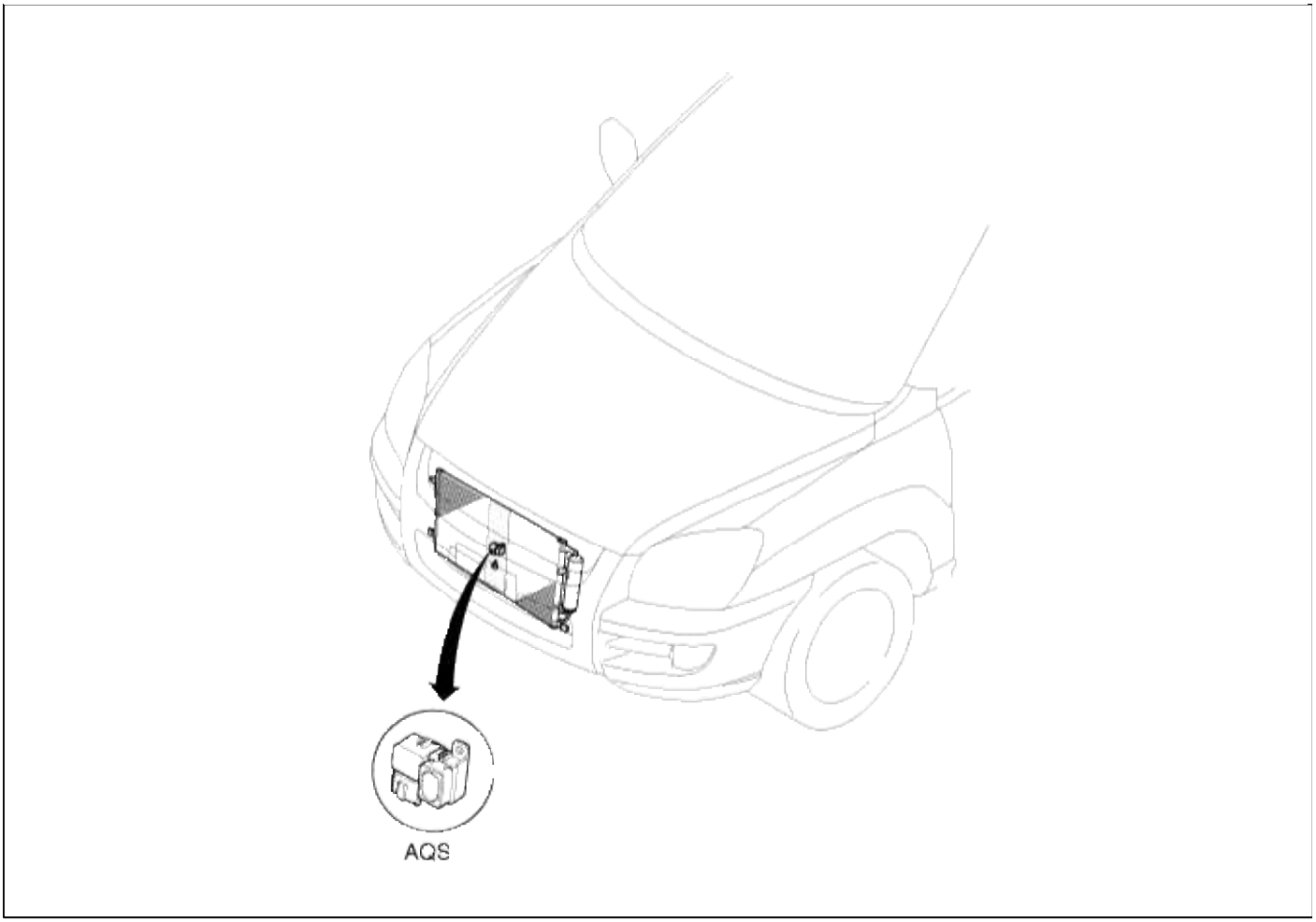


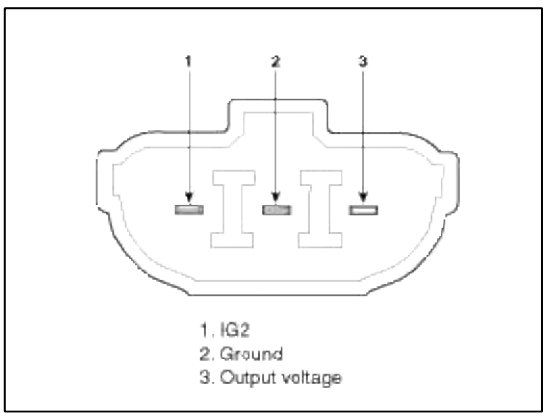
Heating,Ventilation, Air Conditioning > Air conditioning System > A.Q.S (Air Quality Sensor) > Repair procedures

INSPECTION

1. Ignition "ON"
2. Using the scan tool.
3. Check the output voltage of AQS between terminals 2 and 3.

Specification

Condition	Output signal	Fresh/recirculation
Normal condition	4 ~ 5V	Fresh
Hazardous gas detection	0 ~ 1V	Recirculation

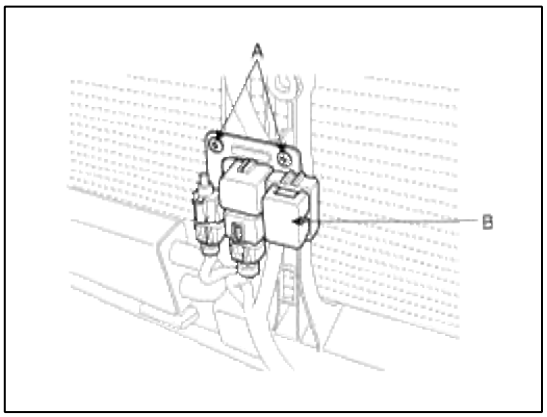


4. AQS diagnosis and fail safe.
   Open signal detection period : 7 seconds (AQS switch OFF, IGN ON).
   2.5V detected for ≥ 3.5 seconds during 7 second initialization period.
   Fail safe: AQS function inoperative (AQS cannot be selected). Intake mode selection may be accomplished manually.

> NOTE
>
> When IG is turned ON, AQS sensor heats for 34±5 seconds, it will output below 1.0 voltage during this time.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper (Refer to the Body group).
3. Remove the AQS (B) after loosening the mounting screws (A).

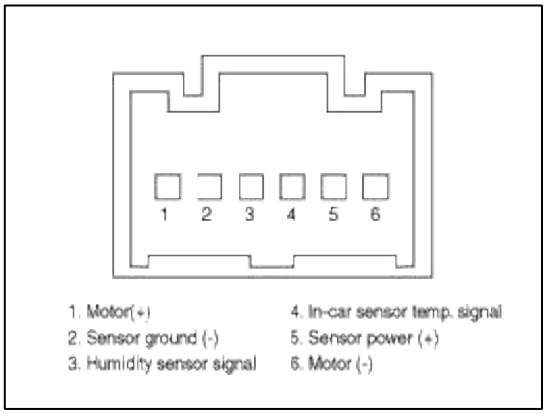


4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Description and Operation

DESCRIPTION

1. Humidity sensor is located at the lower crush pad and detects 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.



Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Components and Components Location

COMPONENT

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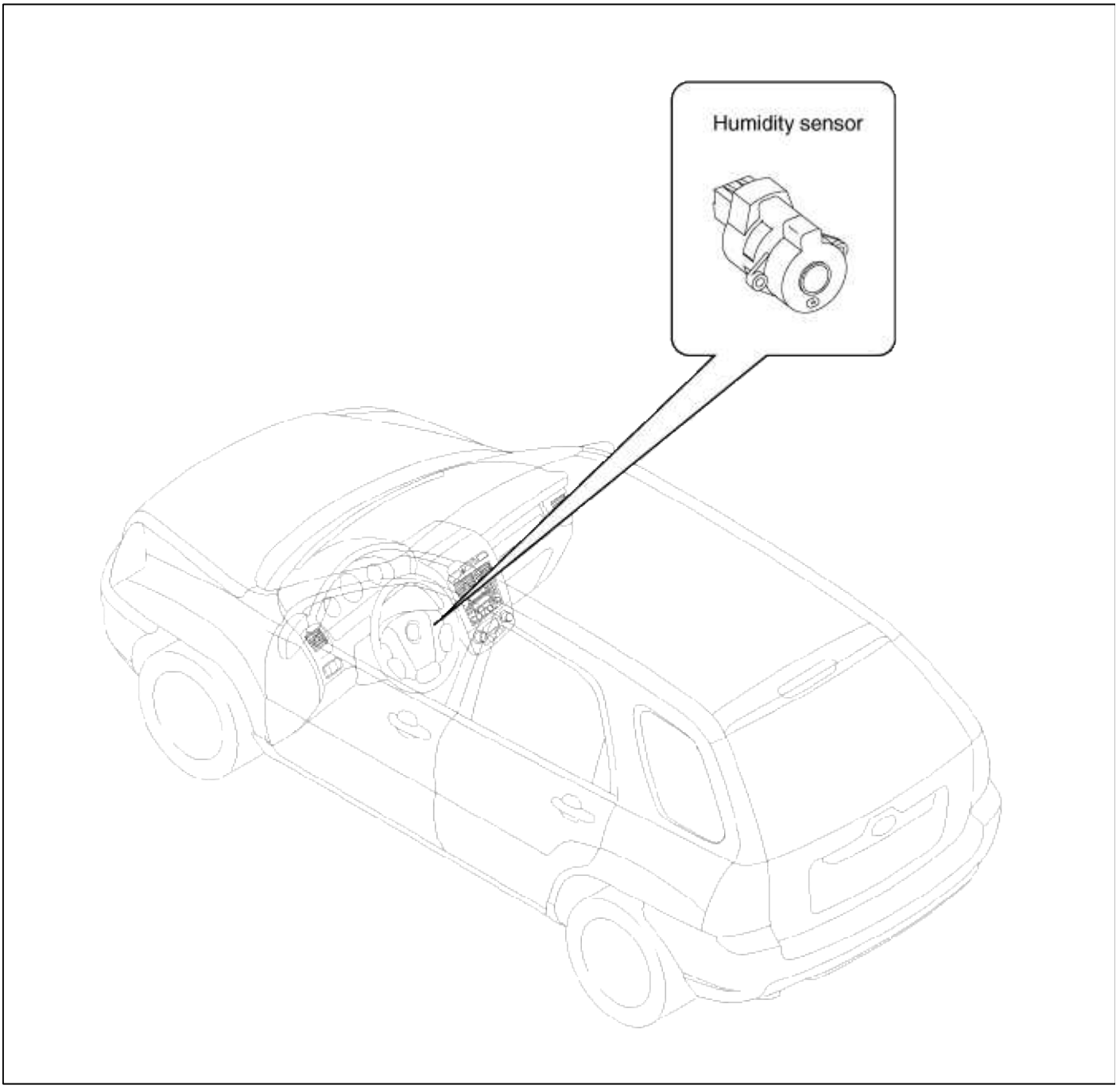


Heating,Ventilation, Air Conditioning > Air conditioning System > Humidity Sensor > Repair procedures

INSPECTION

1. Ignition "ON"
2. Using the scan tool.

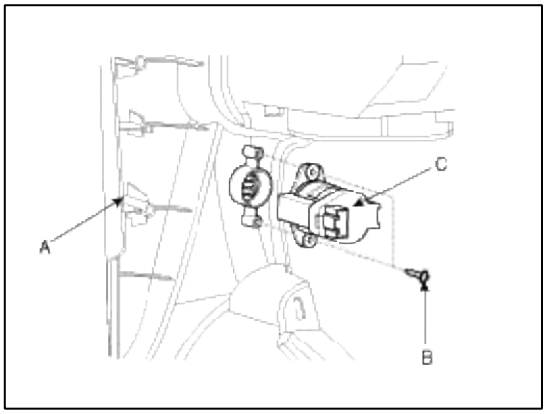
3. Check the frequency of humidity sensor between terminals 2 and 3.

Humidity (%)	Frequency between terminals 2and 3(Hz)
30	6976 ± 5%
50	6728 ± 5%
60	6600 ± 5%
70	6468 ± 5%
80	6330 ± 5%
100	6033 ± 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

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crush panel (A) (Refer to the Body group).
3. Disconnect the connector of humidity sensor.
4. Loosen the mounting screws (B) and then remove the humidity sensor (C).



5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Components and Components Location

COMPONENT LOCATION

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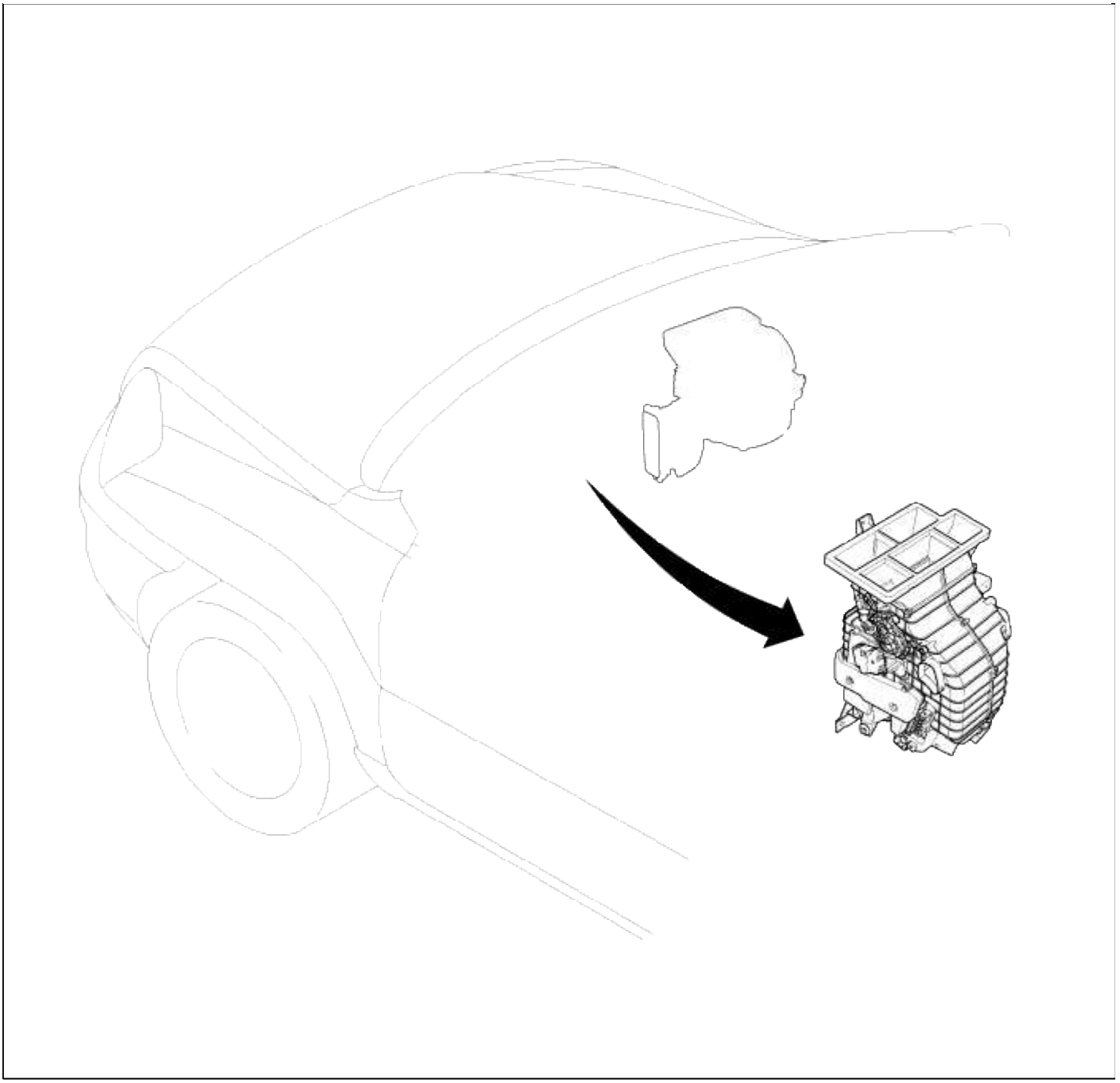
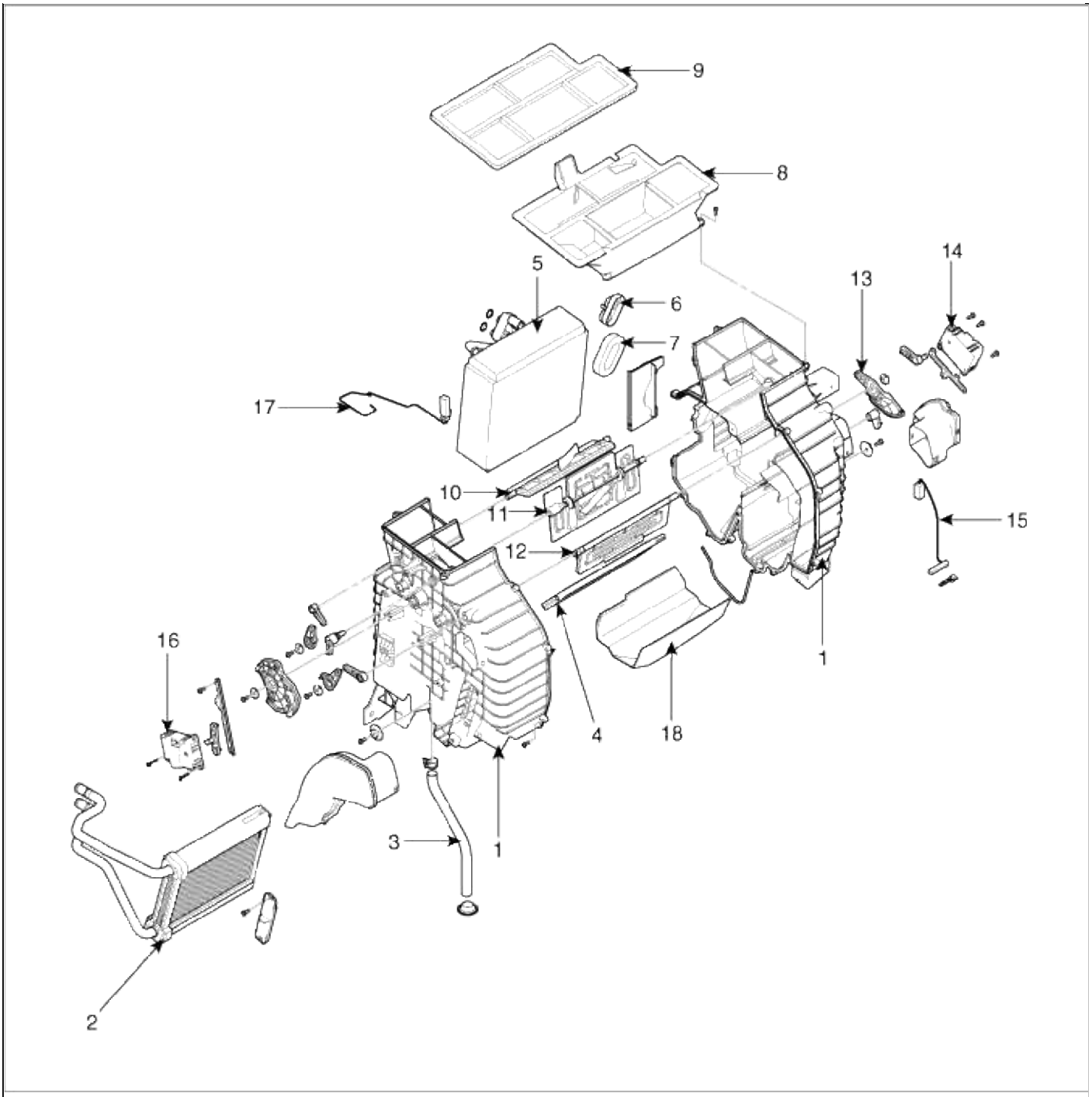


COMPONENTS



1. Heater & evaporator case	7. Seal	13. Cam
2. Heater core	8. Heater & evaporator upper case	14. Temp. control actuator
3. Drain hose	9. Upper case seal	15. Water temp. sensor (Full auto)
4. Temp. door	10. Defrost door	16. Mode control actuator
5. Evaporator core	11. Vent door	17. Evaporator temp. sensor
6. Bracket	12. Floor door	18. Insulation

Heating,Ventilation, Air Conditioning > Heater > Heater Unit > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/recycling/charging station.
3. 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.

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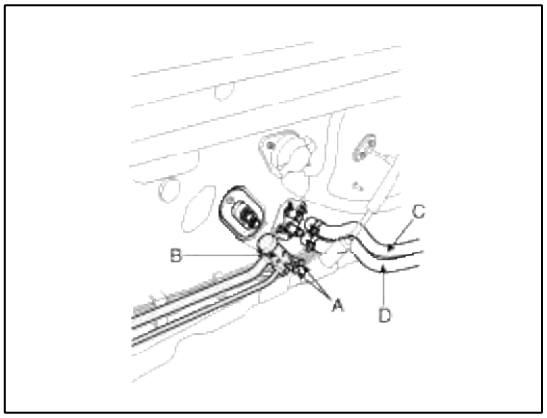
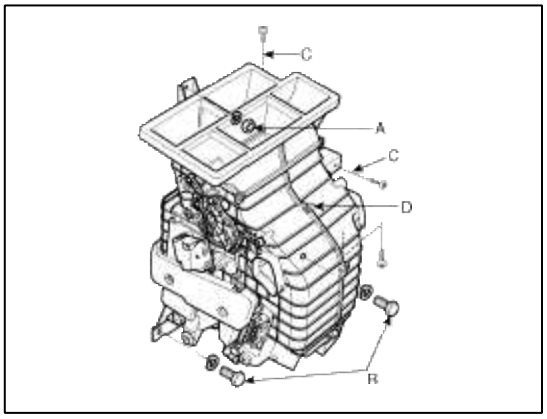
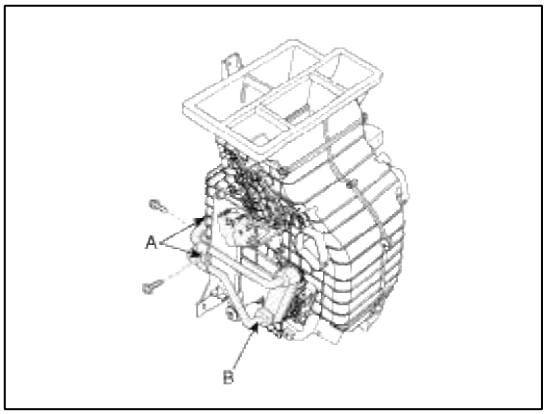
4. When the engine is cool, disconnect the inlet (D) and outlet (C) heater hoses from the heater unit.
   Engine coolant will run out when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.



5. Remove the crash pad (Refer to the Body group).
6. Remove the cross member.
7. Disconnect the connectors from the temperature control actuator, the mode control actuator and the evaporator temperature sensor, then remove the mounting nut (A) and the mounting bolts (B).
8. Remove the heater & evaporator unit after loosening the mounting screws (C).



9. Remove the self-tapping screws and the side bracket (A).
10. Be careful not to bend the inlet and outlet pipes during heater core (A) removal, and pull out the heater core.



11. Install the heater core in the reverse order of removal.

12. Install in the reverse order of removal, and note these items :
    A. If you're installing a new evaporator, add refrigerant oil (ND-OIL8).
    B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
    C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    D. Do not spill the refrigerant oil on the vehicle ; it may damage the paint ; if the refrigerant oil contacts the paint, wash it off immediately.
    E. Apply sealant to the grommets.
    F. Make sure that there is no air leakage.
    G. Charge the system and test its performance.
    H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    I. Refill the cooling system with engine coolant.

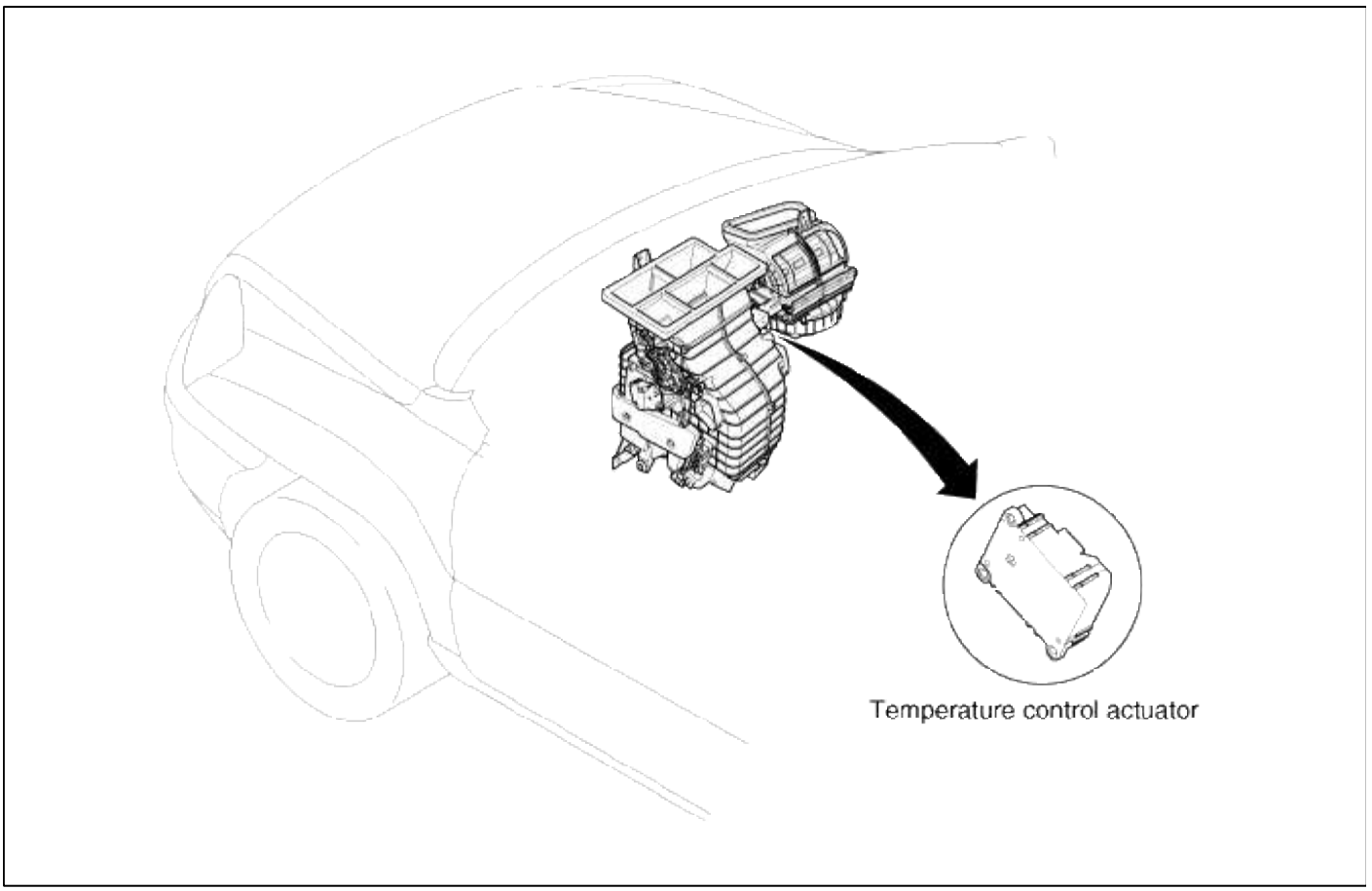
Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Description and Operation

DESCRIPTION

1. Heater unit includes mode control actuator and temperature control actuator.
2. Temperature control actuator is located at the heater unit. 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 determined by position of temperature door.

Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Components and Components Location

COMPONENT



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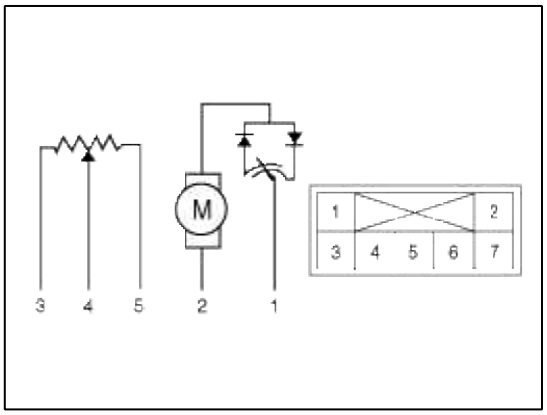
Heating,Ventilation, Air Conditioning > Heater > Temperature Control Actuator > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect the connector of temperature control actuator.
3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 1 and grounding terminal 2.
4. Verify that the temperature control actuator operates to the cool position when the connections are reversed.



5. Check the voltage between terminals 3 and 4.

Specification

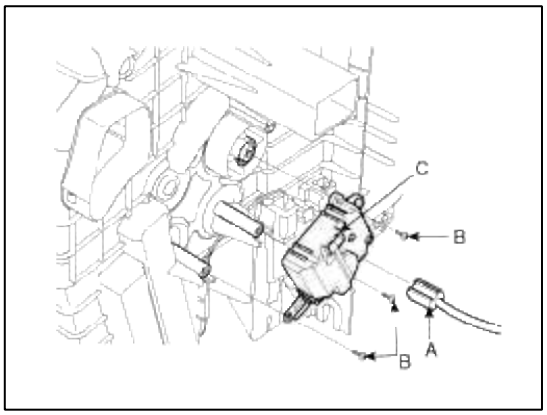
Door position	Voltage (3-4)	Error detecting
Max. cooling	0.3 ± 0.15V	Low voltage : 0.08V or less
Max. heating	4.7 ± 0.15V	High voltage : 4.9V or more

It will feed back current position of actuator to controls.

6. If the measured voltage is not within specification, substitute with a known-good temperature control actuator and check for proper operation.
7. If the problem is corrected, replace the temperature control actuator.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the side cover (Refer to the Body group).
3. Disconnect the connector (A) of temperature control actuator after removing the air duct.
4. Loosen the mounting screw (B) and then remove the temperature control actuator (C).



5. Install in the reverse order of removal.

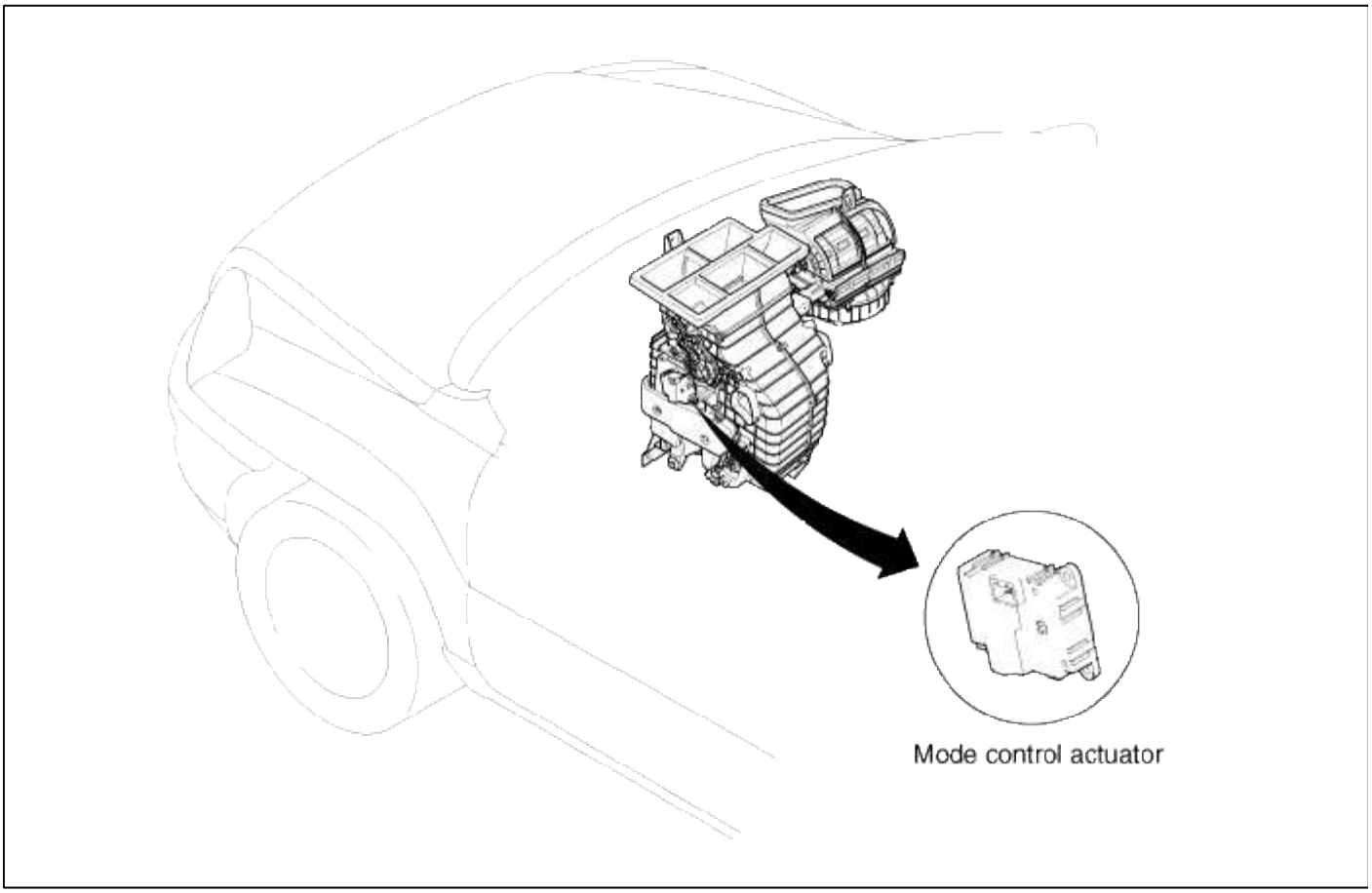
Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Description and Operation

DESCRIPTION

The mode control actuator is located at the heater unit.
It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Components and Components Location

COMPONENT



Heating,Ventilation, Air Conditioning > Heater > Mode Control Actuator > Repair procedures

INSPECTION

1. Ignition "OFF"
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the vent position when connecting 12V to the terminal 1 and grounding terminal 2.

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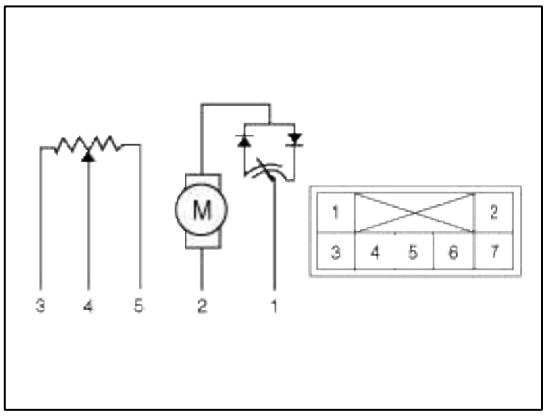
4. Verify that the mode control actuator operates to the defrost position when the connections are reversed.



5. Check the voltage between terminals 4 and 5.

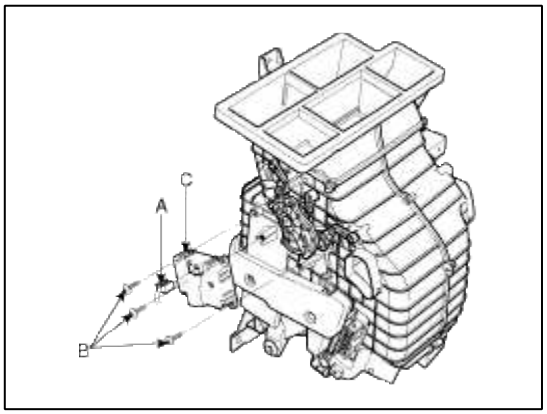
Door position	Voltage (4-5)	Error detecting
Vent	0.3 ± 0.15V	Low voltage : 0.08V or less
Defrost	4.7 ± 0.15V	High voltage : 4.9V or more

It will feed back current position of actuator to controls.

6. If the measured voltage is not within 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

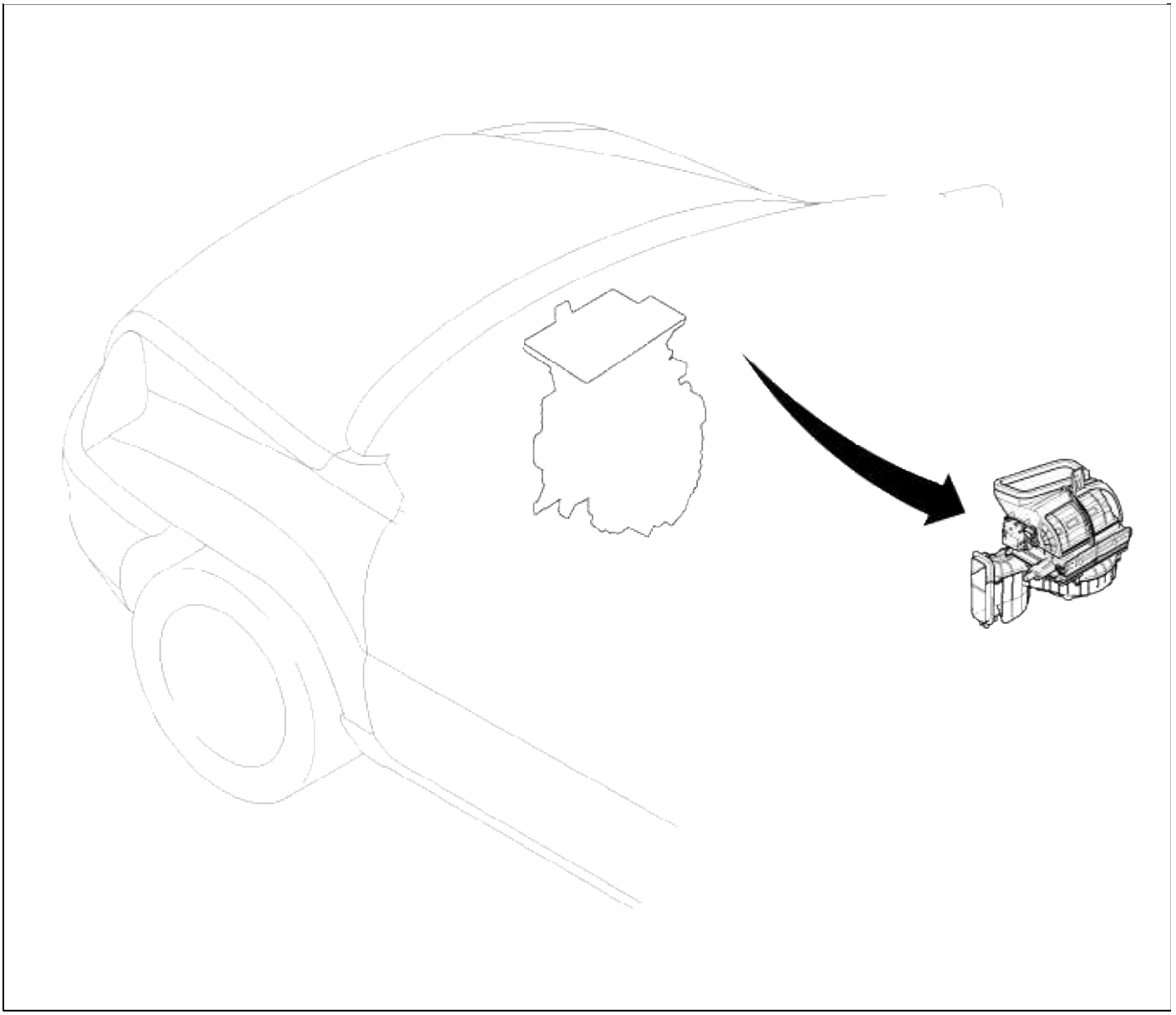
1. Disconnect the negative (-) battery terminal.
2. Remove the lower crush panel (Refer to the Body group).
3. Disconnect the connector (A) of mode control actuator after removing the air duct.
4. Loosen the mounting screws (B) and then remove the mode control actuator (C).



5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Components and Components Location

COMPONENT LOCATION



COMPONENTS

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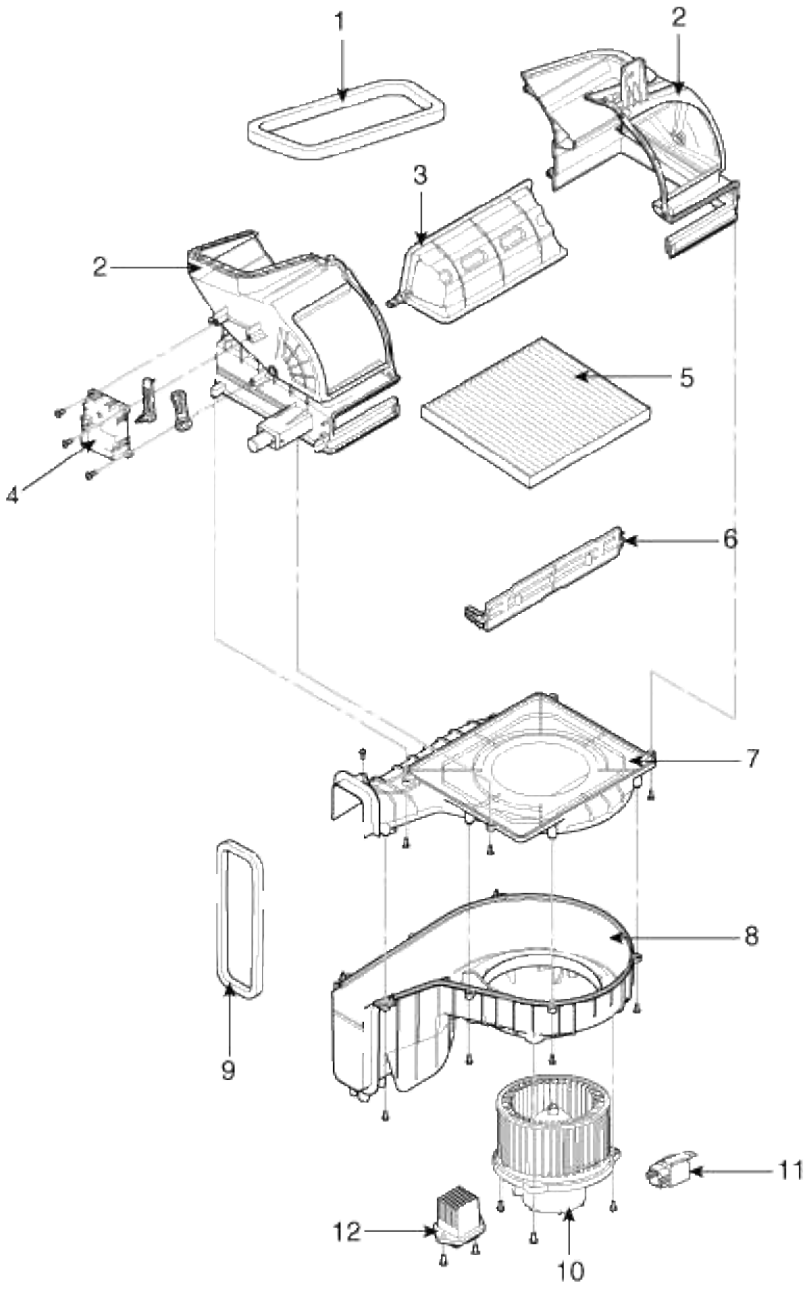


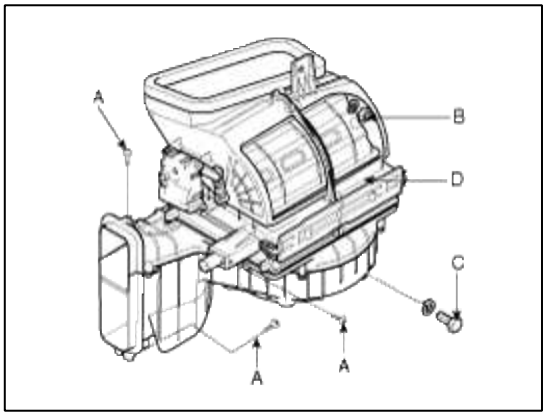
1. Outlet duct seal
2. Inlet duct case
3. Inlet door
4. Fresh and recirculation actuator
5. Air filter if equipped
6. Air filter cover
7. Blower upper case
8. Blower lower case
9. Blower seal
10. Blower motor
11. Blower relay
12. Power mosfet

Heating,Ventilation, Air Conditioning > Blower > Blower Unit > Repair procedures

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the heater unit (See page HA-20)

3. Disconnect the connectors from the fresh and recirculation actuator, the blower relay, the blower motor and power mosfet.
   Remove the self-tapping screws (A), the mounting nut (B), the mounting bolt (C) and the blower unit (D).



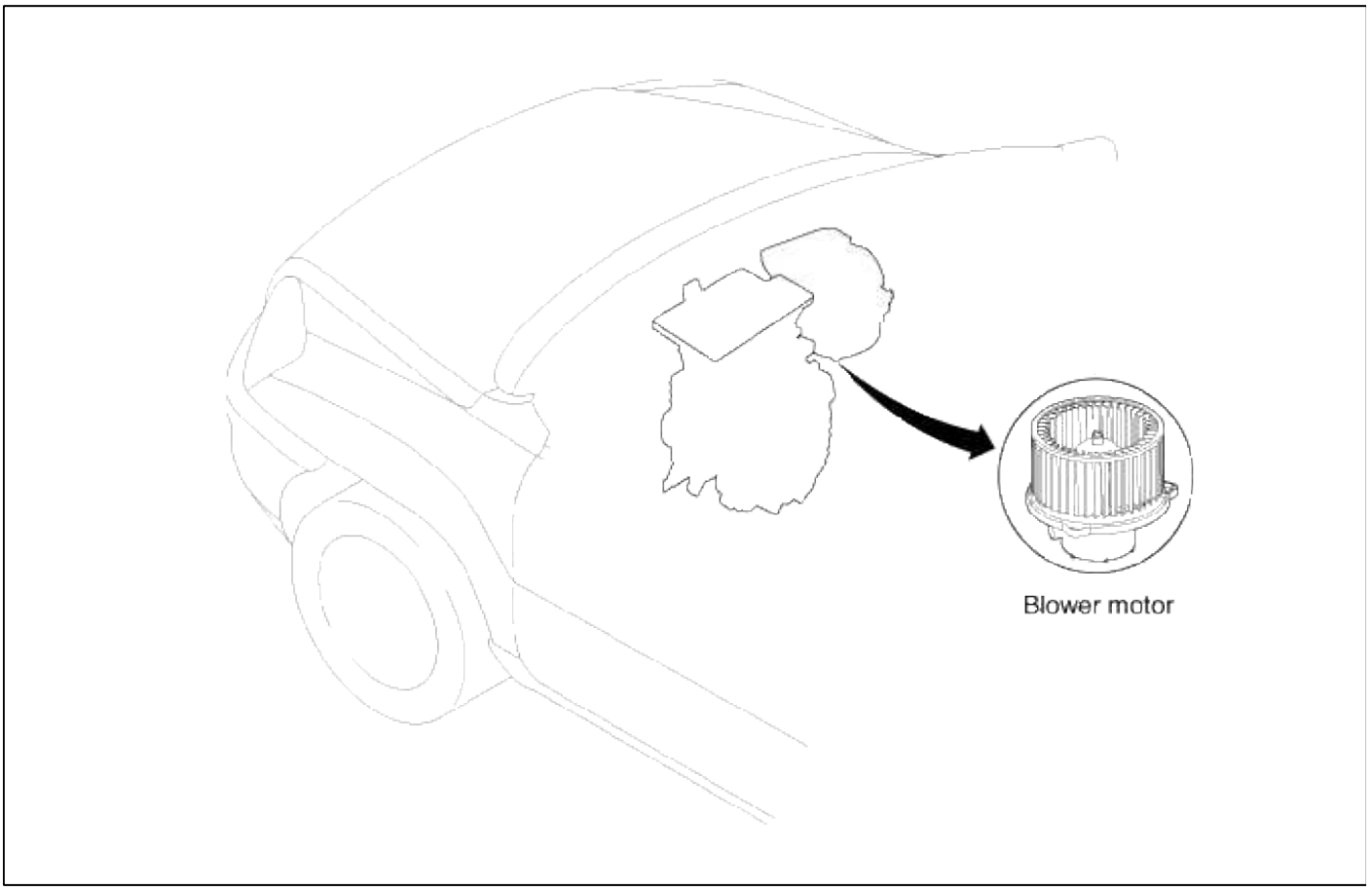
NOTE

Make sure that there is no air leaking out of the blower and duct joints.

4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Components and Components Location

COMPONENTS



Heating,Ventilation, Air Conditioning > Blower > Blower Motor > Repair procedures

INSPECTION

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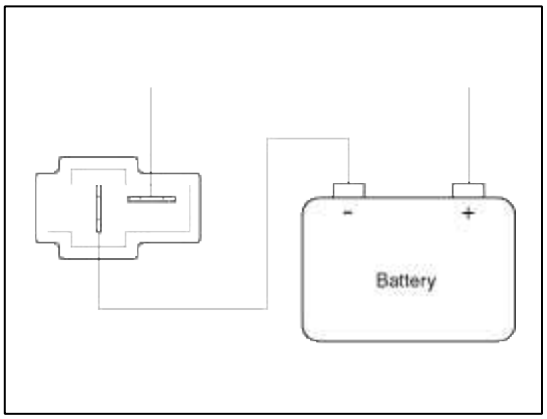
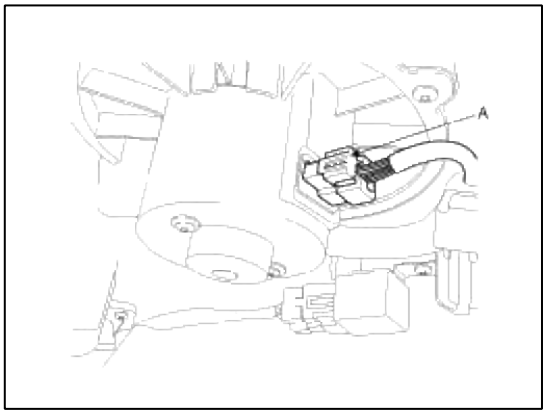
1. Connect the battery voltage and check the blower motor rotation.



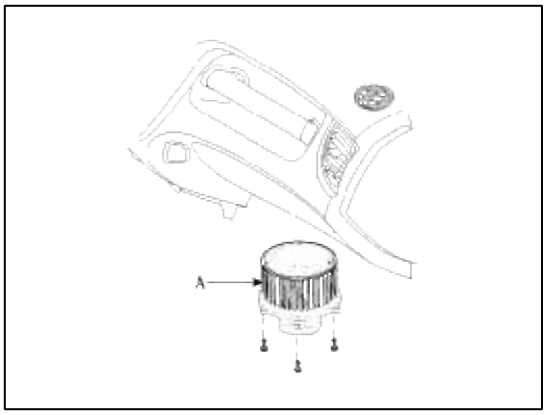
2. If the blower motor does not operate properly, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector (A) of the blower motor.



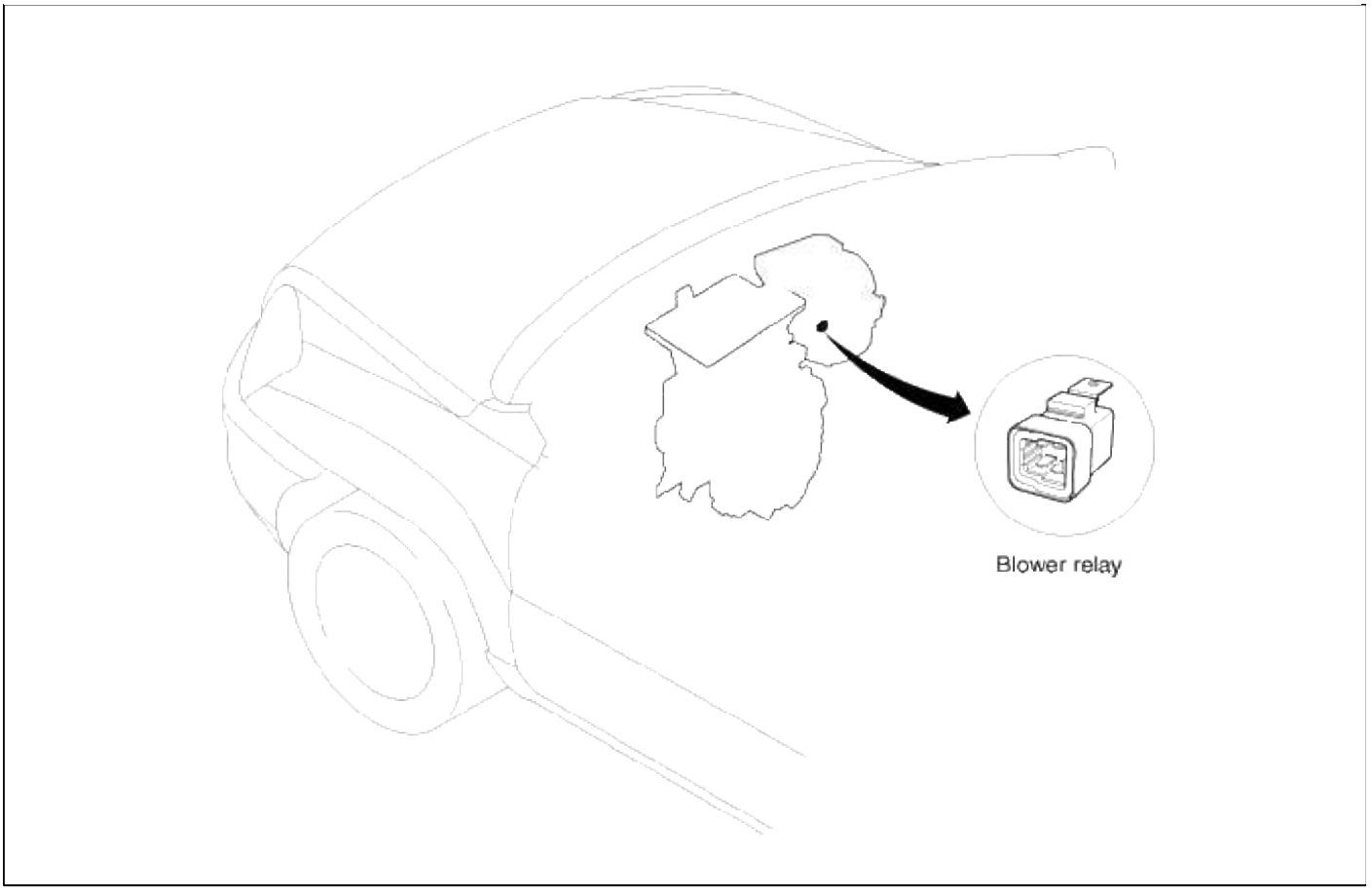
3. Remove the blower motor (A) after loosening the mounting screws.



4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Blower Relay > Components and Components Location

COMPONENT

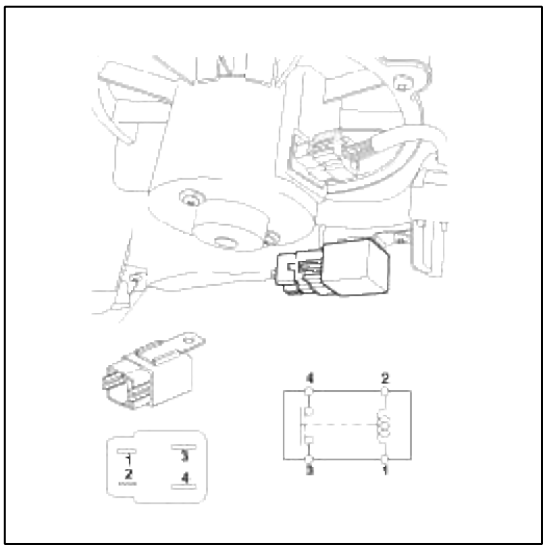


Heating,Ventilation, Air Conditioning > Blower > Blower Relay > Repair procedures

INSPECTION

Check for continuity between the terminals.

1. There should be continuity between the No.3 and No.4 terminals when power and ground are connected to the No.1 and No.2 terminals.
2. There should be no continuity between the No.3 and No.4 terminals when power is disconnected.



Terminal / Position	3	4	1	2
Power OFF			○	○
Power ON	○	○	⊕	⊖

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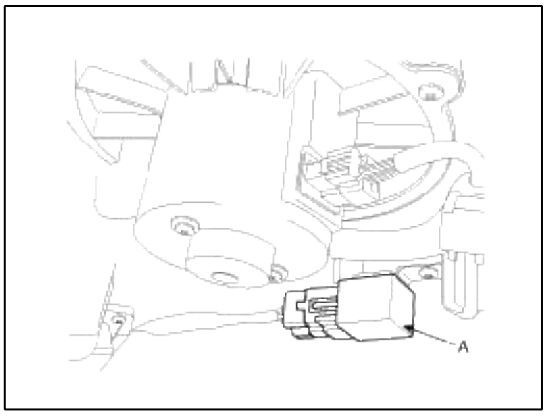
3. If the blower relay does not operate properly, substitute with a known-good blower relay and check for proper operation.
4. If the problem is corrected, replace the blower relay.

REPLACEMENT

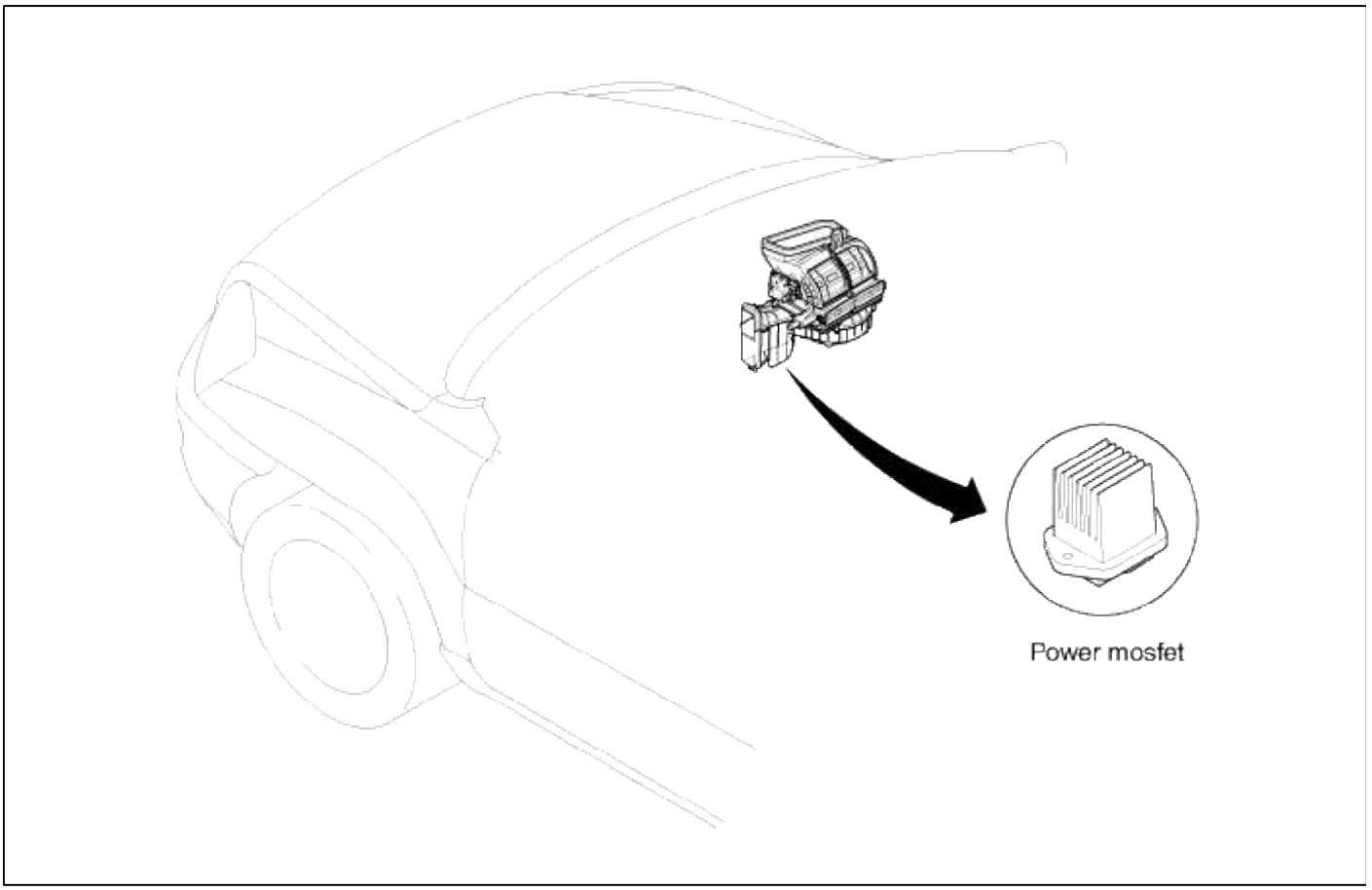
1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector of the blower relay at the below blower unit.
3. Remove the blower relay (A) after loosening the mounting screw.



4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Components and Components Location

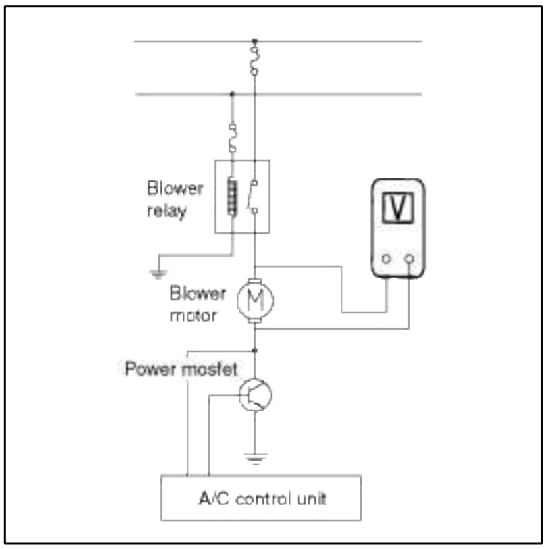
COMPONENT



Heating,Ventilation, Air Conditioning > Blower > Power Mosfet > Repair procedures

INSPECTION

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.



Specification

Fan	Motor Voltage	
	Manual	**Automatic**
First speed	3.8 ±0.5V	3.8 ±0.5V
Second speed	4.8 ±0.5V	5.0 ±0.5V
Third speed	5.8 ±0.5V	6.2 ±0.5V
Fourth speed	6.8 ±0.5V	7.4 ±0.5V
Fifth speed	7.9 ±0.5V	8.6 ±0.5V
Sixth speed	8.9 ±0.5V	9.8 ±0.5V
Seventh speed	9.9 ±0.5V	11.0 ±0.5V
eighth speed	11.0 ±0.5V	Battery(+)
Ninth speed	Battery(+)	-

4. If the measured voltage is not within specification, substitute with a known-good power mosfet and check for proper operation.
5. If the problem is corrected, replace the power mosfet.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.

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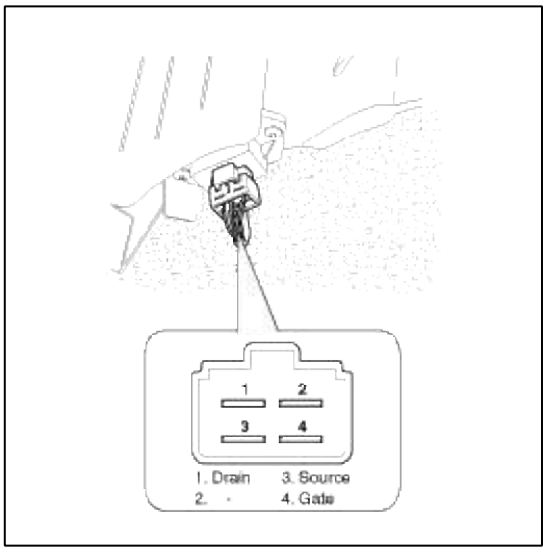
2. Disconnect the connector (A) of the power mosfet at the below blower unit.



3. Remove the power mosfet after loosening the mounting screws.
4. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > A/C Air Filter > Description and Operation

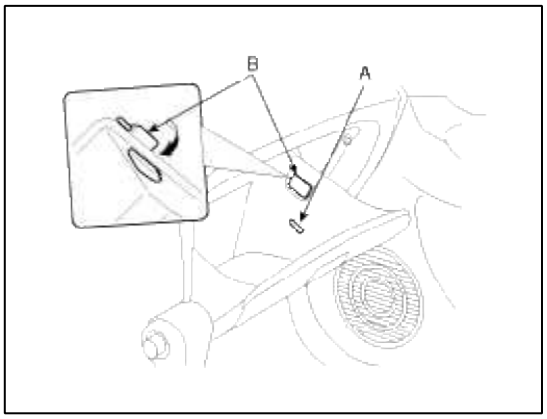
DESCRIPTION

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.

Heating,Ventilation, Air Conditioning > Blower > A/C Air Filter > Repair procedures

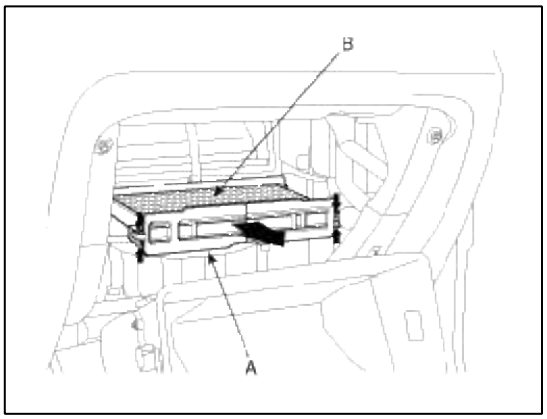
REPLACEMENT

1. Open the glove box. Lower the glove box down completely by removing the tension cord (A) and the glove box stopper (B) to the glove box.



2. Remove the filter cover (A) with pushing the knob.

3. Replace the air filter (B).



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)

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Description and Operation

DESCRIPTION

1. The fresh and recirculation actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Components and Components Location

COMPONENT

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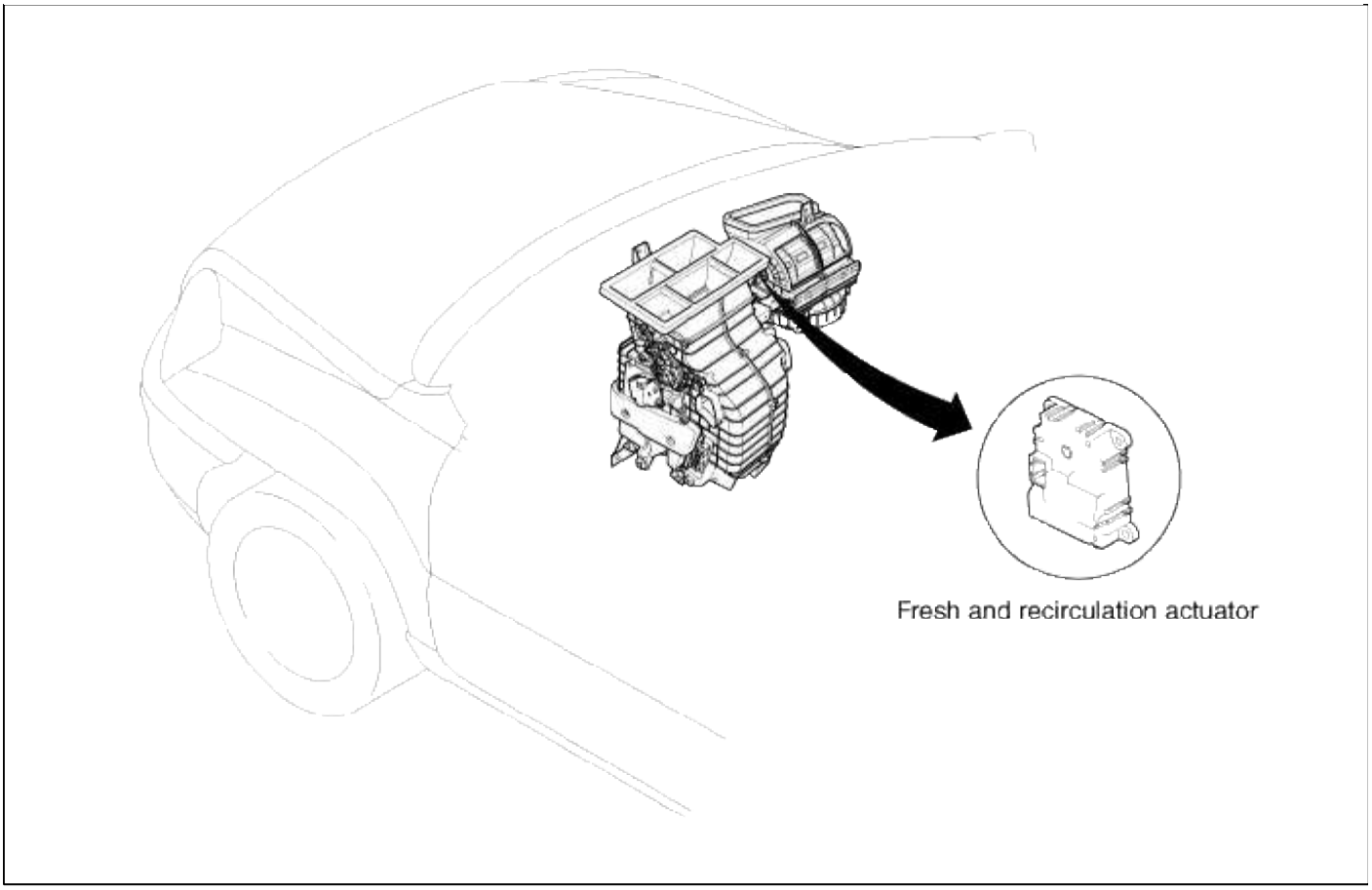
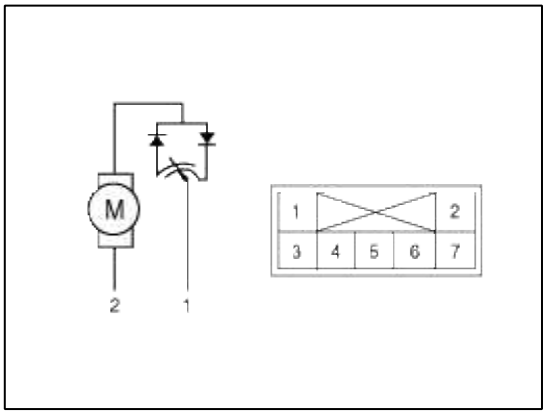


Heating,Ventilation, Air Conditioning > Blower > Intake Actuator > Repair procedures

INSPECTION

1. Ignition "OFF".
2. Disconnect the connector of fresh and recirculation actuator.
3. Verify that the fresh and recirculation actuator operates to the fresh position when connecting 12V to the terminal 1 and grounding terminal 2.
4. Verify that the fresh and recirculation actuator operates to the recirculation position when the connections are reversed.

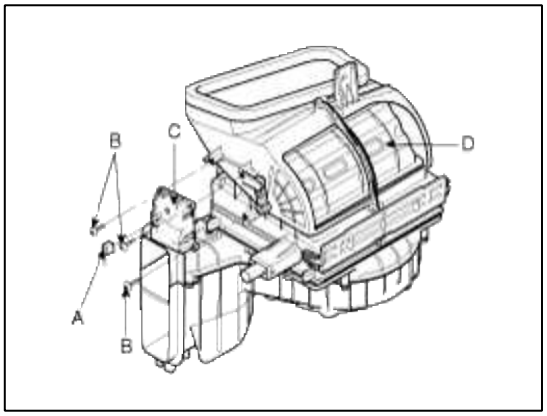


5. If the fresh and recirculation actuator does not operate properly, substitute with a known-good fresh and recirculation actuator and check for proper operation.
6. If the problem is corrected, replace the fresh and recirculation actuator.

REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the glove box (Refer to the Body group).

3. Disconnect the connector (A) of fresh and recirculation actuator.
4. Loosen the mounting screw (B) and then remove the fresh and recirculation actuator (C) from the blower unit (D).



5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Blower > Control Panel > Schematic Diagrams

CIRCUIT DIAGRAM

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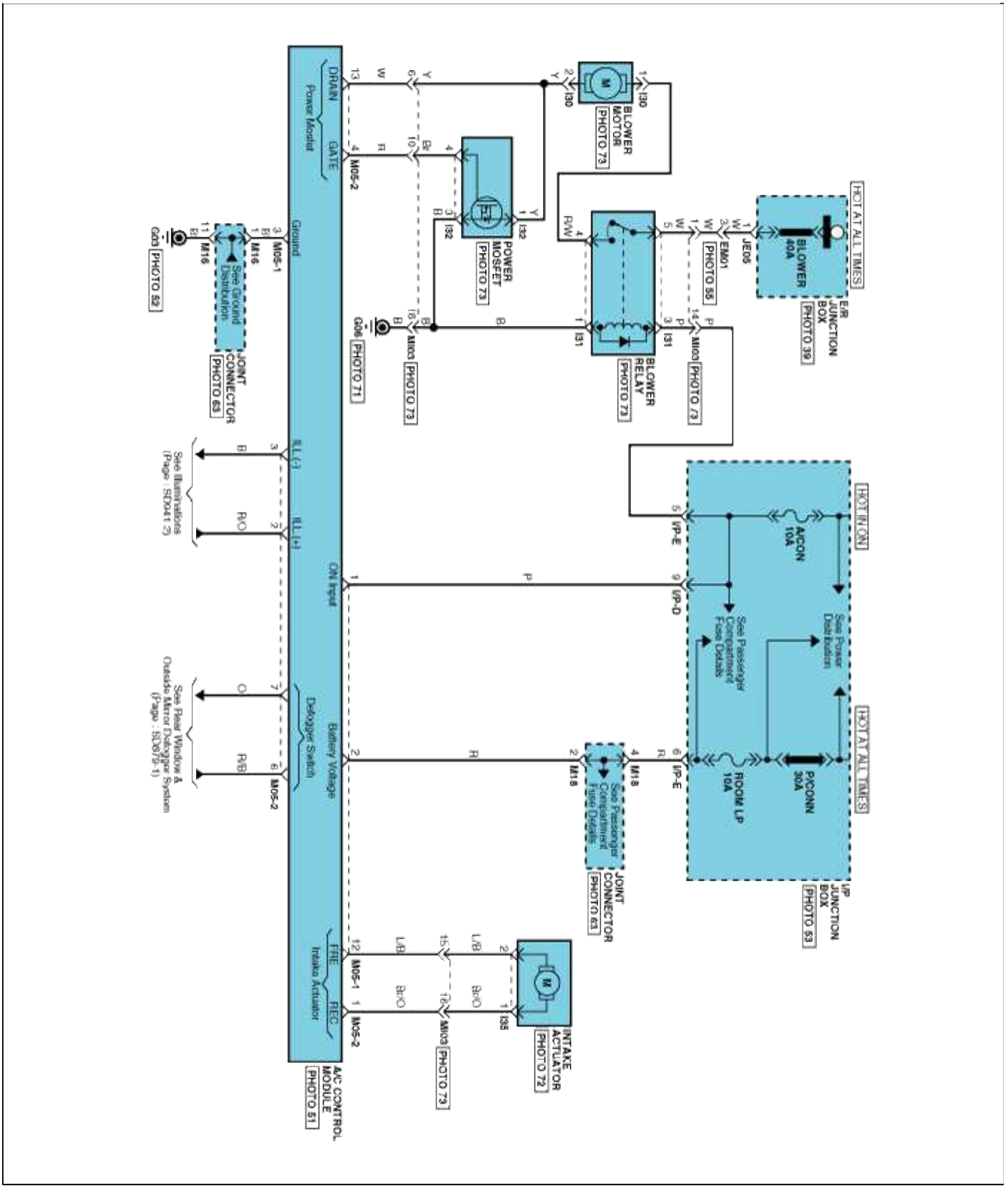
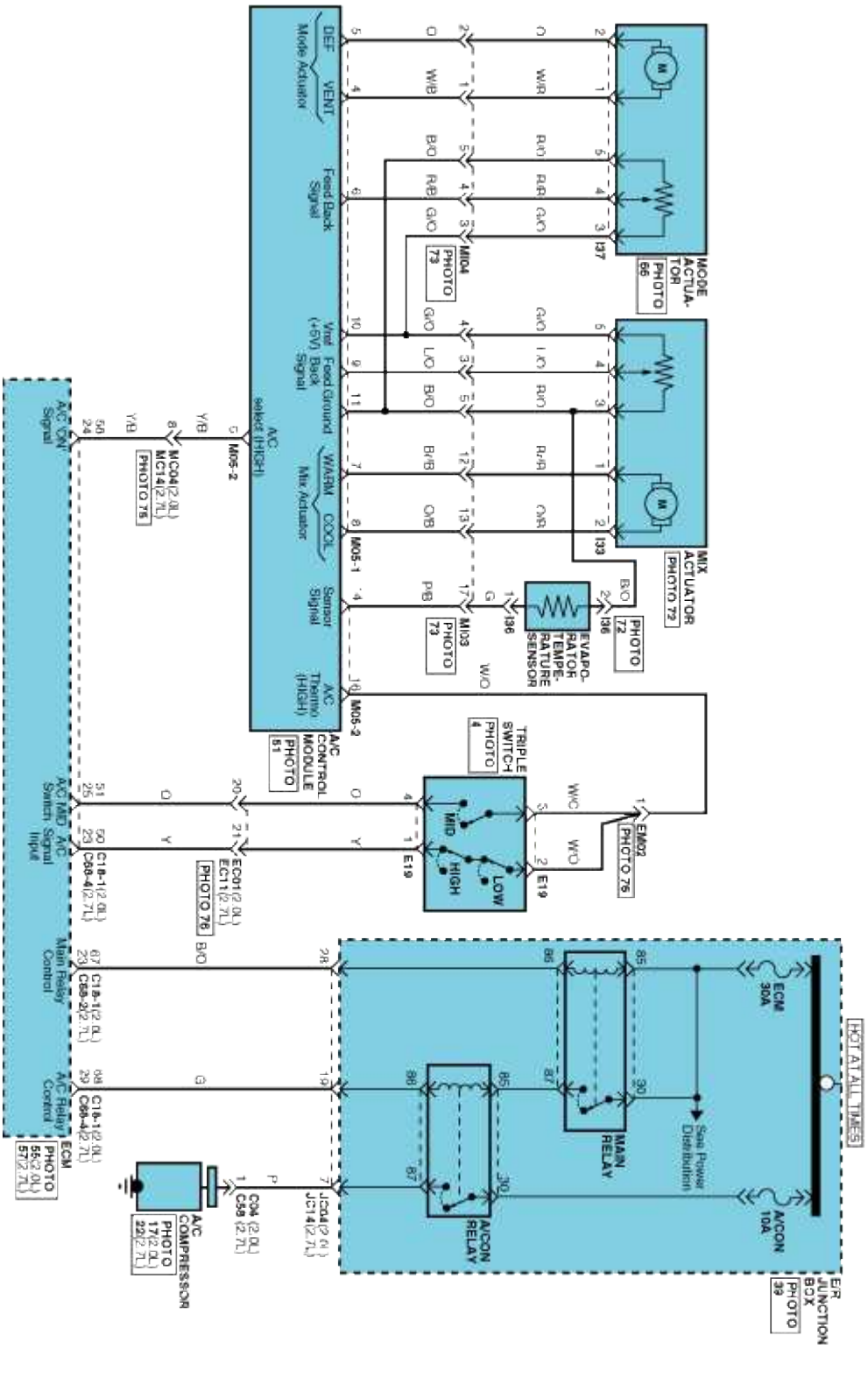
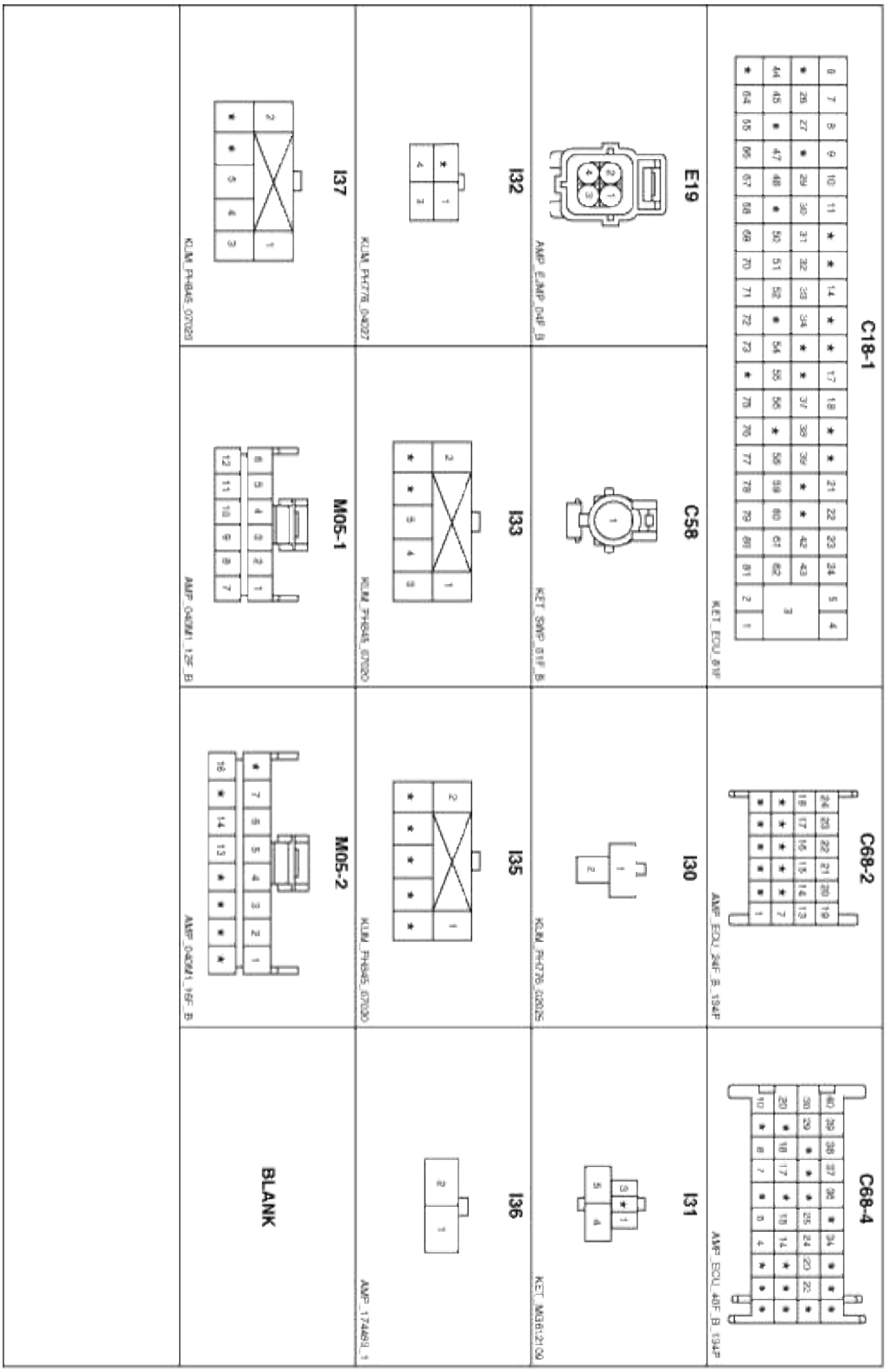
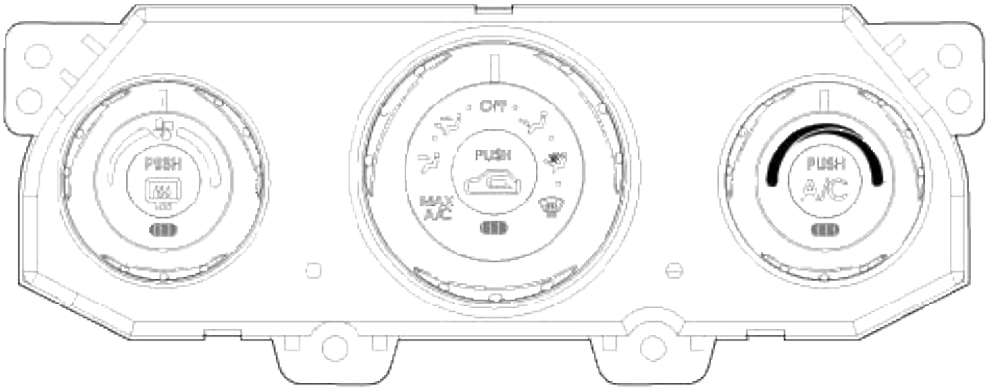

HOT AT ALL TIMES
E/R JUNCTION BOX
PHOTO 39
BLOWER 40A
JE05
EM01
PHOTO 55
BLOWER MOTOR
PHOTO 73
POWER MOSFET
PHOTO 73
BLOWER RELAY
PHOTO 73
PHOTO 73
PHOTO 73
PHOTO 71
G06
DRAIN
GATE
Power Mosfet
Ground
M05-1
M05-2
M16
M16
See Ground Distribution
JOINT CONNECTOR
PHOTO 63
G03
PHOTO 52
HOT IN ON
HOT AT ALL TIMES
A/CON 10A
P/CONN 30A
ROOM LP 10A
See Power Distribution
See Passenger Compartment Fuse Details
I/P-E
I/P-D
I/P-E
I/P JUNCTION BOX
PHOTO 53
See Passenger Compartment Fuse Details
JOINT CONNECTOR
PHOTO 63
ON Input
Battery Voltage
Defogger Switch
ILL (-)
ILL (+)
See Illuminations
See Rear Window & Outside Mirror Defogger System
FRE
REC
Intake Actuator
INTAKE ACTUATOR
PHOTO 72
PHOTO 73
A/C CONTROL MODULE
PHOTO 51

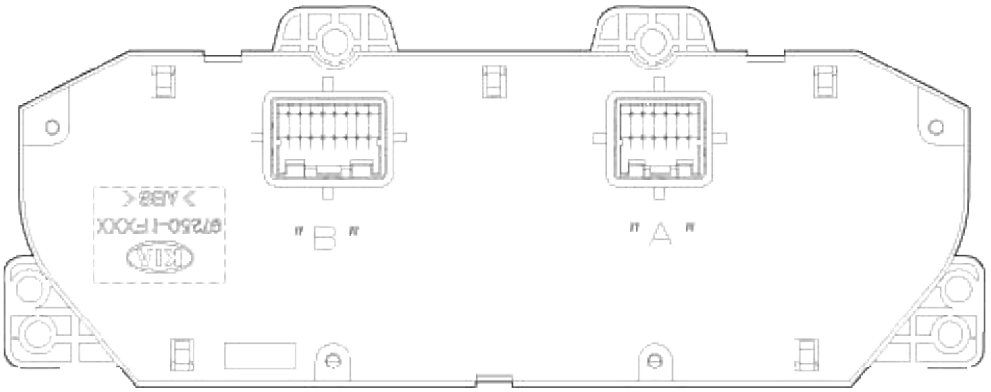

MODE ACTUATOR PHOTO 66
MIX ACTUATOR PHOTO 72
EVAPORATOR TEMPERATURE SENSOR
PHOTO 72
PHOTO 73
A/C CONTROL MODULE PHOTO 51
TRIPLE SWITCH PHOTO 4
PHOTO 76
ECM 30A
A/CON 10A
MAIN RELAY
A/CON RELAY
Sea Power Distribution
HOT AT ALL TIMES
E/R JUNCTION BOX PHOTO 39
A/C COMPRESSOR PHOTO 17 22
ECM PHOTO 55 57
DEF
VENT
Mode Actuator
Feed Back Signal
Vref (+5V)
Feed Back Signal
Ground
WARM
COOL
Mix Actuator
Sensor Signal
A/C Thermi (HIGH)
A/C select (HIGH)
A/C ON Signal
A/C MID Switch Signal
A/C Switch Input
Main Relay Control
A/C Relay Control
MID
HIGH
LOW



Heating,Ventilation, Air Conditioning > Blower > Control Panel > Components and Components Location

COMPONENT





A1	A2	A3	A4	A5	A6
A7	A8	A9	A10	A11	A12

B1	B2	B3	B4	B5	B6	B7	B8
B9	B10	B11	B12	B13	B14	B15	B16

CONNECTOR PIN FUNCTION

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CONNECTOR	PIN	FUNCTION	CONNECTOR	PIN	FUNCTION
Connector(A)	1	IG2	Connector (B)	1	Intake (Recirculation)
	2	Battery		2	Tail lamp(+)
	3	Ground		3	Rheostat
	4	Mode vent		4	Power mosfet (Gate)
	5	Mode defrost		5	A/C select
	6	Mode feedback		6	Rear defogger indicator
	7	Mix warm		7	Rear defogger switch
	8	Mix cool		8	-
	9	Mix feedback		9	-
	10	Sensor voltage(5V)		10	-
	11	Sensor ground		11	-
	12	Intake (Fresh)		12	-
				13	Power mosfet (Drain)
				14	Evaporator temperature sensor
				15	Blower select
				16	A/C output

Heating,Ventilation, Air Conditioning > Blower > Control Panel > Repair procedures

CONTROL LOGICS

1. Dissolution & reinstatement of logic

Specification	Control factor	Mix, Defrost	Floor	KEY ON	KEY OFF	Blower OFF	Blower ON	MAX A/C
Initial (Reinstatement)	A/C	ON (*2)	Previous	Previous	OFF	OFF	Previous	ON(*2)
	Intake	Fresh (*1)	Fresh	Fresh	Fresh	Fresh(Defrost)	Fresh	Recirculati (*2)
Dissolution	A/C	Previous (*1)	Previous	Previous	OFF	OFF	Previous	ON(*2)
	Intake	Previous (*1)	Previous	Previous	Previous	Previous	Previous	Recirculati (*2)

*1 : User is able to select, *2 : User is not able to select.

NOTE

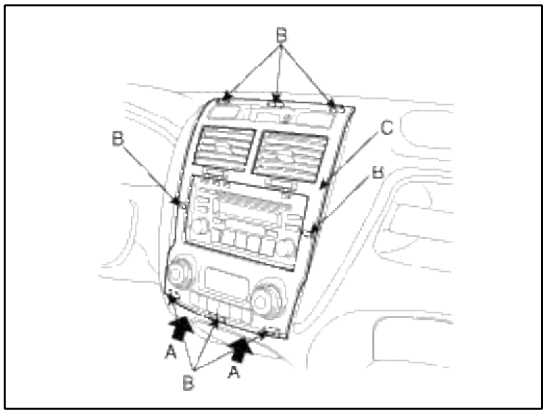
- When selecting MAX A/C: A/C is ON and vent mode is selected.
- When selecting other modes from MAX A/C: It goes back in previously selected condition.

2. Dissolution & reinstatement of logic procedure
   (1) Ignition "ON".
   (2) Turn off the blower switch.
   (3) Move to defrost mode.
   (4) Press the intake button more than 5 times within 3 seconds.
   (5) Indicator of intake button is flashed 3 times.
   (6) Dissolution & reinstatement of logic is completed.
   (7) A/C and intake status is initialized to "A/C off" and "fresh status"

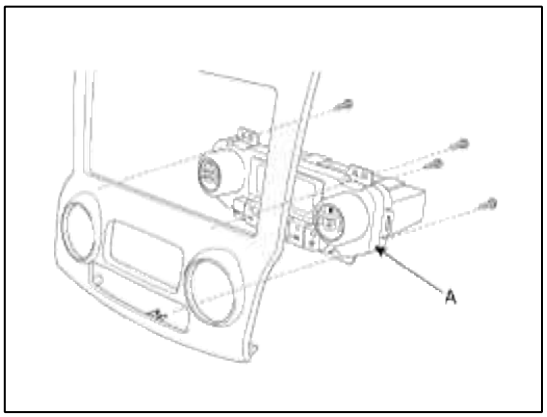
> NOTE
>
> When the battery happens to be disconnected or discharged, the logic is reinstated.

CONTROL UNIT REPLACEMENT

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel (C) after pulling it by using a screw driver (-) at part (A). Take care of fixing clips (B).



3. Disconnect the connectors from the center facia.
4. Remove the blower and A/C control unit (A).



5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Schematic Diagrams

CIRCUIT DIAGRAM

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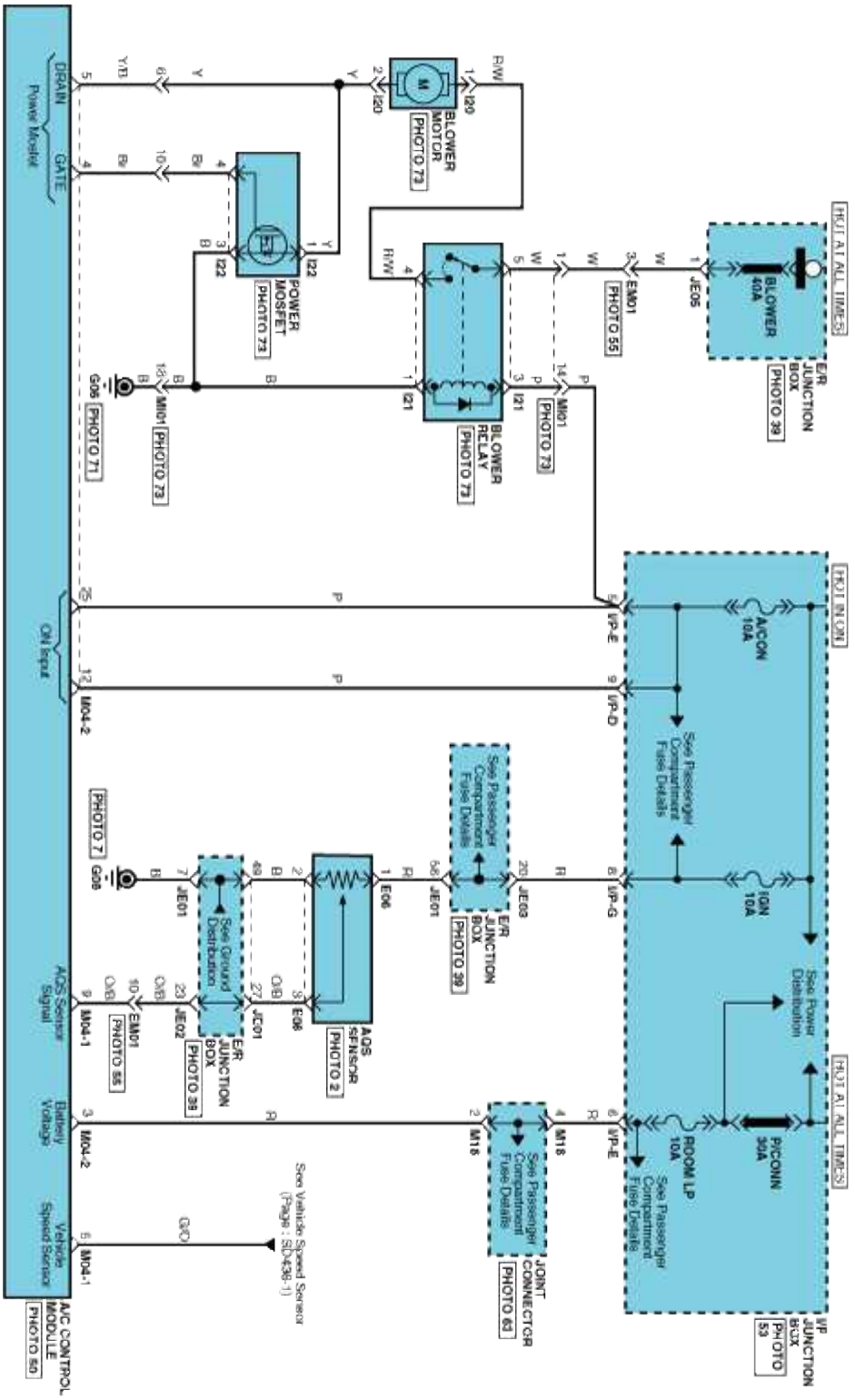
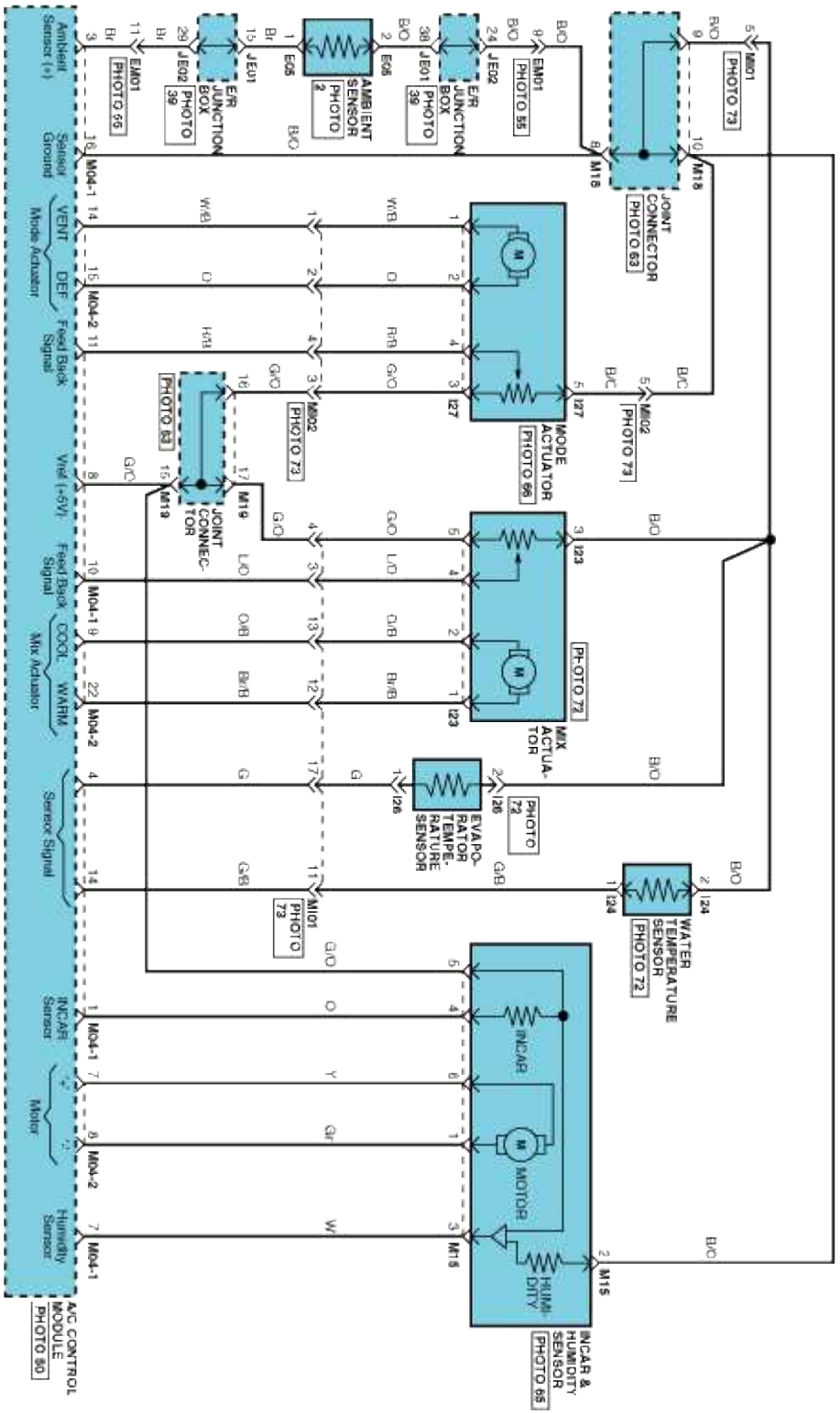
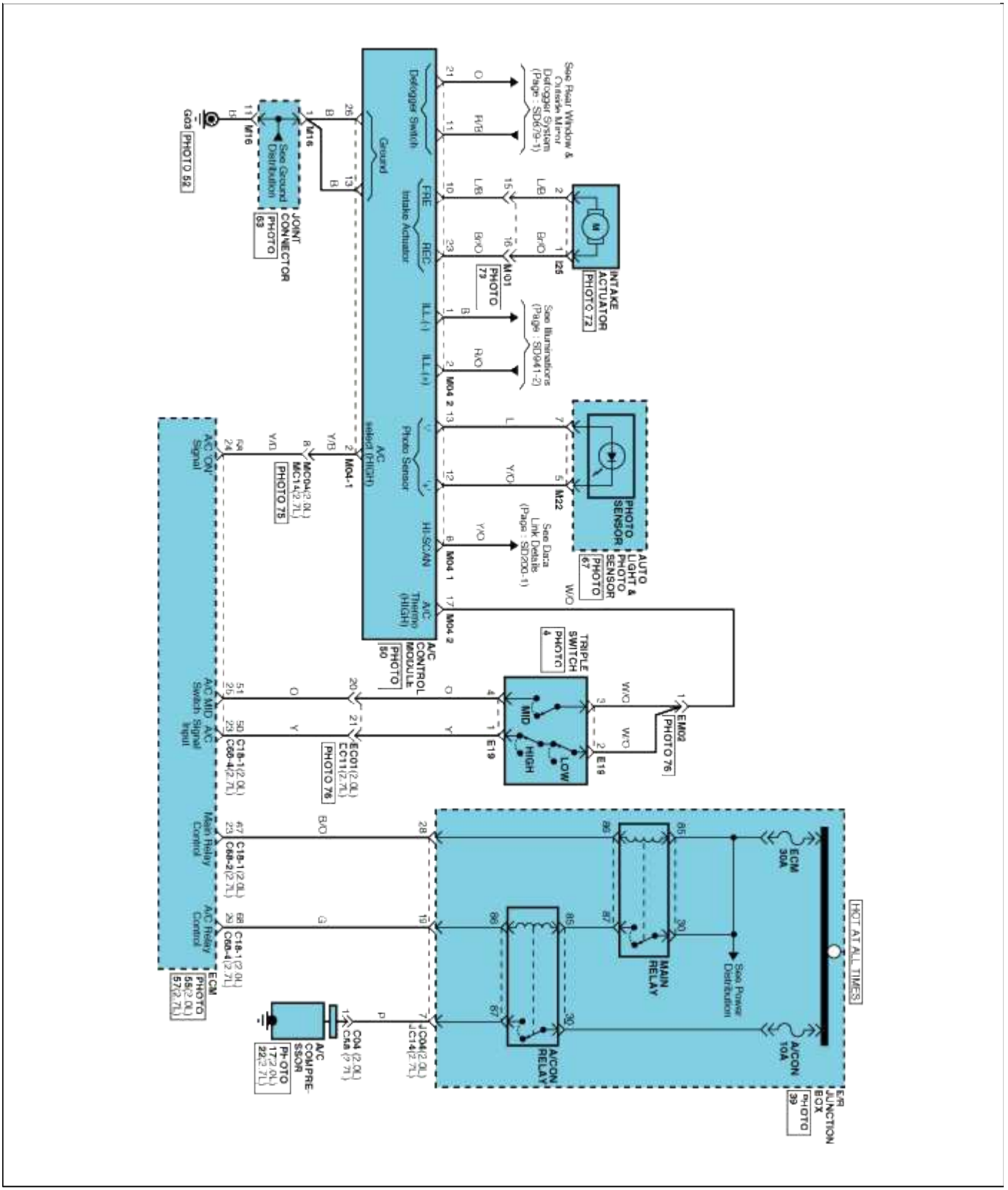
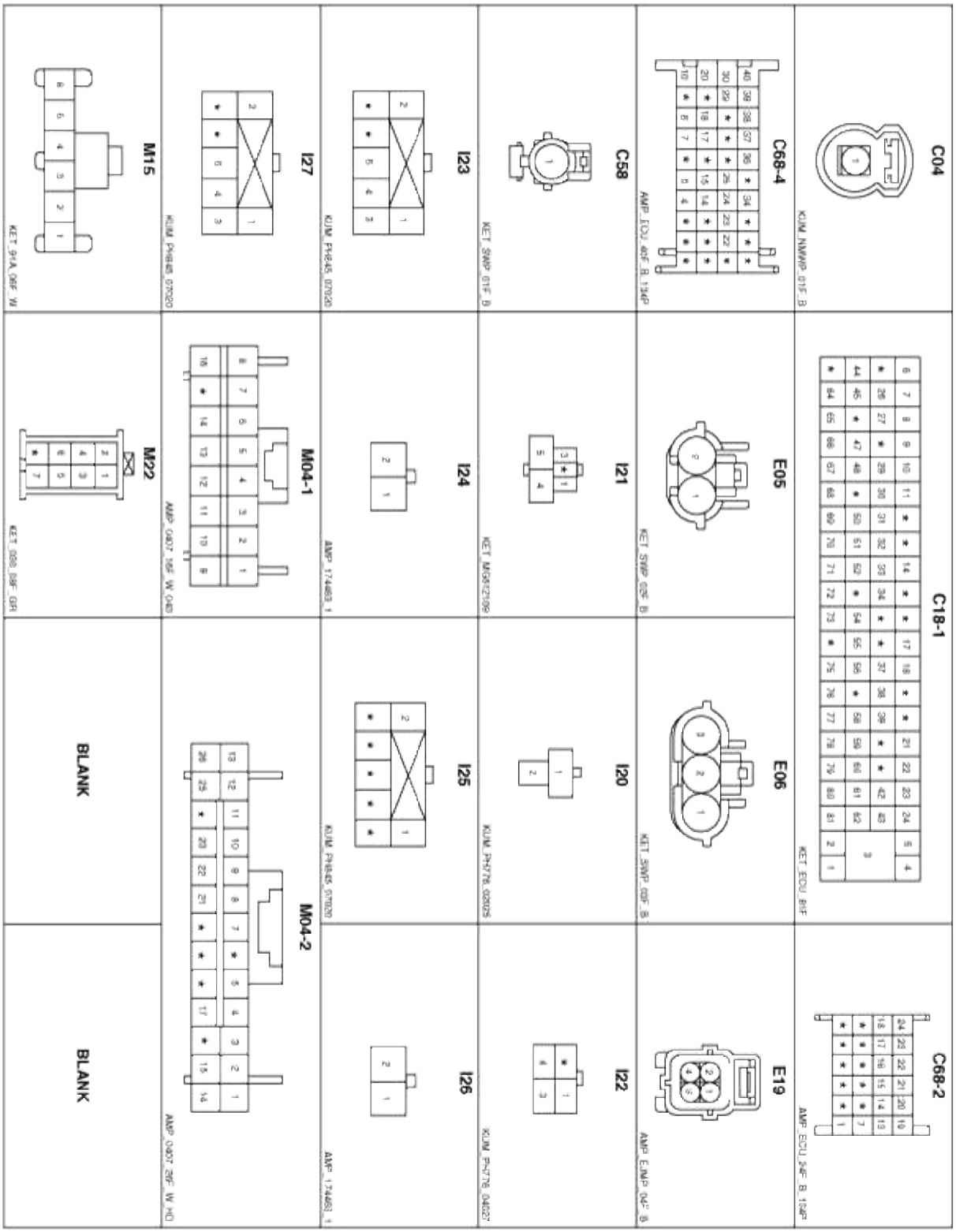

HOT AT ALL TIMES
BLOWER 40A
E/R JUNCTION BOX
PHOTO 39
JE05
EM01
PHOTO 55
BLOWER MOTOR
PHOTO 73
POWER MOSFET
PHOTO 73
BLOWER RELAY
PHOTO 73
MI01
PHOTO 73
G06
PHOTO 71
DRAIN
GATE
Power Mosfet
ON Input
M04-2
HOT IN ON
A/CON 10A
IGN 10A
See Passenger Compartment Fuse Details
See Power Distribution
HOT AT ALL TIMES
P/CONN 30A
ROOM LP 10A
I/P JUNCTION BOX
PHOTO 53
VP-E
VP-D
VP-G
JE03
E/R JUNCTION BOX
PHOTO 39
JE01
E06
AQS SENSOR
PHOTO 2
See Ground Distribution
JE02
E/R JUNCTION BOX
PHOTO 39
PHOTO 7
G05
AQS Sensor Signal
M04-1
EM01
PHOTO 55
Battery Voltage
M04-2
M18
JOINT CONNECTOR
PHOTO 63
See Vehicle Speed Sensor (Page : SD436-1)
Vehicle Speed Sensor
M04-1
A/C CONTROL MODULE
PHOTO 50


M01
PHOTO 73
JOINT CONNECTOR
PHOTO 63
M18
EM01
PHOTO 55
E/R JUNCTION BOX
PHOTO 39
JE02
JE01
AMBIENT SENSOR
PHOTO 2
E26
E25
EM01
PHOTO 55
E/R JUNCTION BOX
PHOTO 39
JE02
JE01
M02
PHOTO 73
I27
MODE ACTUATOR
PHOTO 66
I23
MIX ACTUATOR
PHOTO 72
I26
EVAPORATOR TEMPERATURE SENSOR
PHOTO 72
I24
WATER TEMPERATURE SENSOR
PHOTO 72
M19
JOINT CONNECTOR
PHOTO 63
M02
PHOTO 73
M101
PHOTO 73
INCAR & HUMIDITY SENSOR
PHOTO 65
INCAR
MOTOR
HUMIDITY
M15
A/C CONTROL MODULE
PHOTO 60
M04-1
M04-2
Sensor Ground
VENT
DEF
Mode Actuator
Feed Back Signal
Vref (+5V)
Feed Back Signal
COOL
WARM
Mix Actuator
Sensor Signal
INCAR Sensor
Motor
Humidity Sensor
Ambient Sensor (+)


HOT AT ALL TIMES
E/R JUNCTION BOX
PHOTO 39
ECM 30A
A/CON 10A
MAIN RELAY
A/CON RELAY
See Power Distribution
A/C COMPRESSOR
PHOTO 17(2.0L) 22(2.7L)
ECM
PHOTO 55(2.0L) 57(2.7L)
A/C ON Signal
A/C MID Switch Signal Input
A/C Switch
Main Relay Control
A/C Relay Control
A/C CONTROL MODULE
PHOTO 50
TRIPLE SWITCH
PHOTO 4
MID
HIGH
LOW
PHOTO SENSOR
AUTO LIGHT & PHOTO SENSOR
PHOTO 67
See Data Link Details (Page : SD200-1)
See Illuminations (Page : SD941-2)
See Rear Window & Outside Mirror Defogger System (Page : SD679-1)
Defogger Switch
Intake Actuator
Ground
Photo Sensor
A/C select (HIGH)
A/C Therm (HIGH)
HI-SCAN
INTAKE ACTUATOR
PHOTO 72
JOINT CONNECTOR
PHOTO 63
See Ground Distribution
G03
PHOTO 52
PHOTO 75
PHOTO 76
PHOTO 78



Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Components and Components Location

COMPONENT

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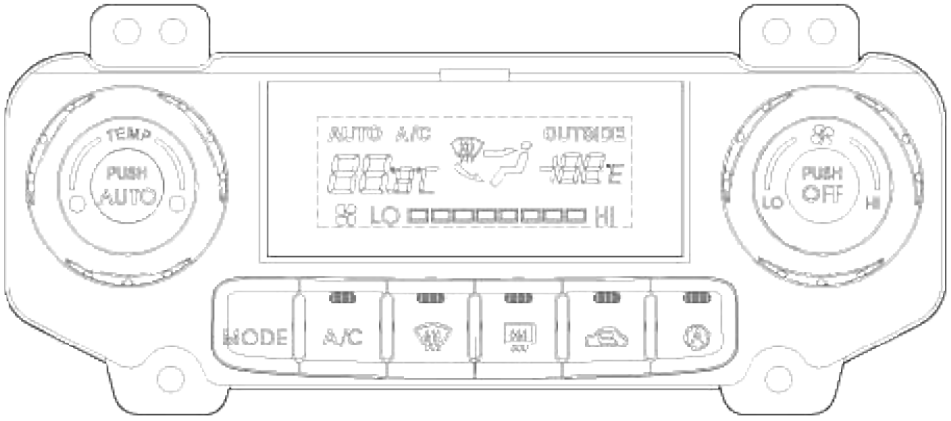

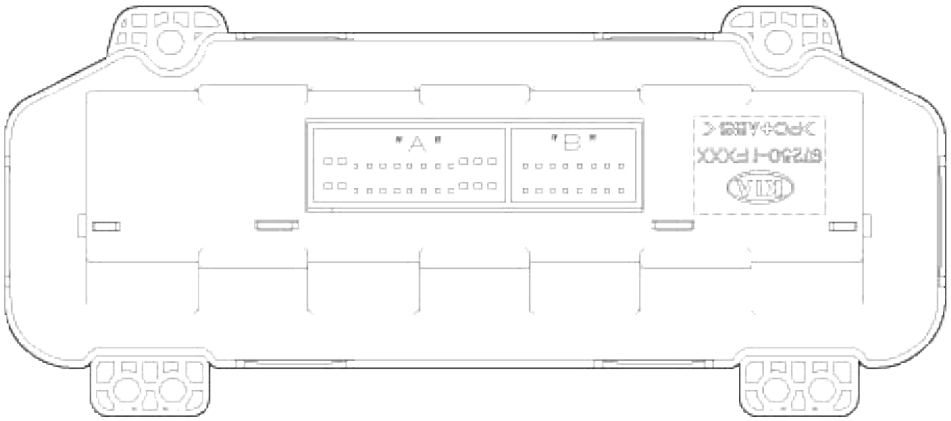

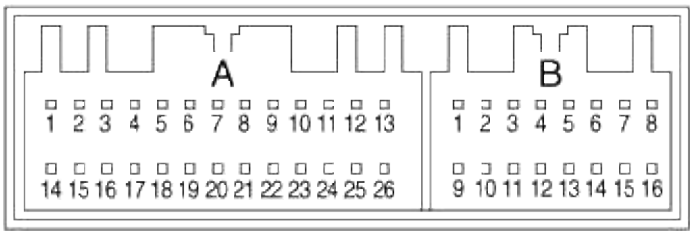

CONNECTOR PIN FUNCTION

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	-		6	Diagnostic tool
	7	In car sensor motor (+)		7	Humidity sensor
	8	In car sensor motor (-)		8	Sensor voltage (5V)
	9	Mix cool		9	AQS
	10	Intake fresh		10	Mix feedback
	11	Rear defogger indicator		11	Mode feedback
	12	IG2		12	Photo sensor (+)
	13	Ground		13	Photo sensor ground
	14	Mode vent		14	Water temperature output
	15	Mode defrost		15	-
	16	-		16	Sensor ground
	17	A/C output			
	18	-			
	19	-			
	20	-			
	21	Rear defogger switch			
	22	Mix warm			
	23	Intake recirculation			
	24	Blower select signal			
	25	IG2			
	26	Ground			

Heating,Ventilation, Air Conditioning > Controller > Manual Controller > Repair procedures

CONTROL LOGIC

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1. Intake & A/C control logic

Mode	Intake		A/C	
	IG "ON"	System "ON"	IG "ON"	System "ON"
Vent, Bi-level	Memory	Previous	Memory	Previous
Floor	Fresh (*1)	Fresh (*1)	Memory	Previous
Mix, Defrost	Fresh (*1)	Fresh (*1)	ON (*2)	Previous

NOTE

*1: User is able to select, *2 : User is not able to select.

2. Dissolution & reinstatement of defrost logic

Specification	Control factor	Mix, Defrost	KEY ON	KEY OFF
Initial (Reinstatement)	A/C	ON	Previous	OFF
	Intake	Fresh	Fresh	Fresh
Dissolution	A/C	Previous	Previous	OFF
	Intake	Previous	Previous	Previous

3. Dissolution & reinstatement of defrost logic procedure

(1) Ignition "ON".

(2) Move to defrost mode.

(3) Press intake button more than 5 times within 3 seconds while holding A/C switch down.

(4) Graphics of the entire LCD display switch on and off 3 times with an interval of 0.5 seconds.

(5) Dissolution & reinstatement of logic is completed.

(6) A/C and intake status is initialized to "A/C off" and "fresh status".

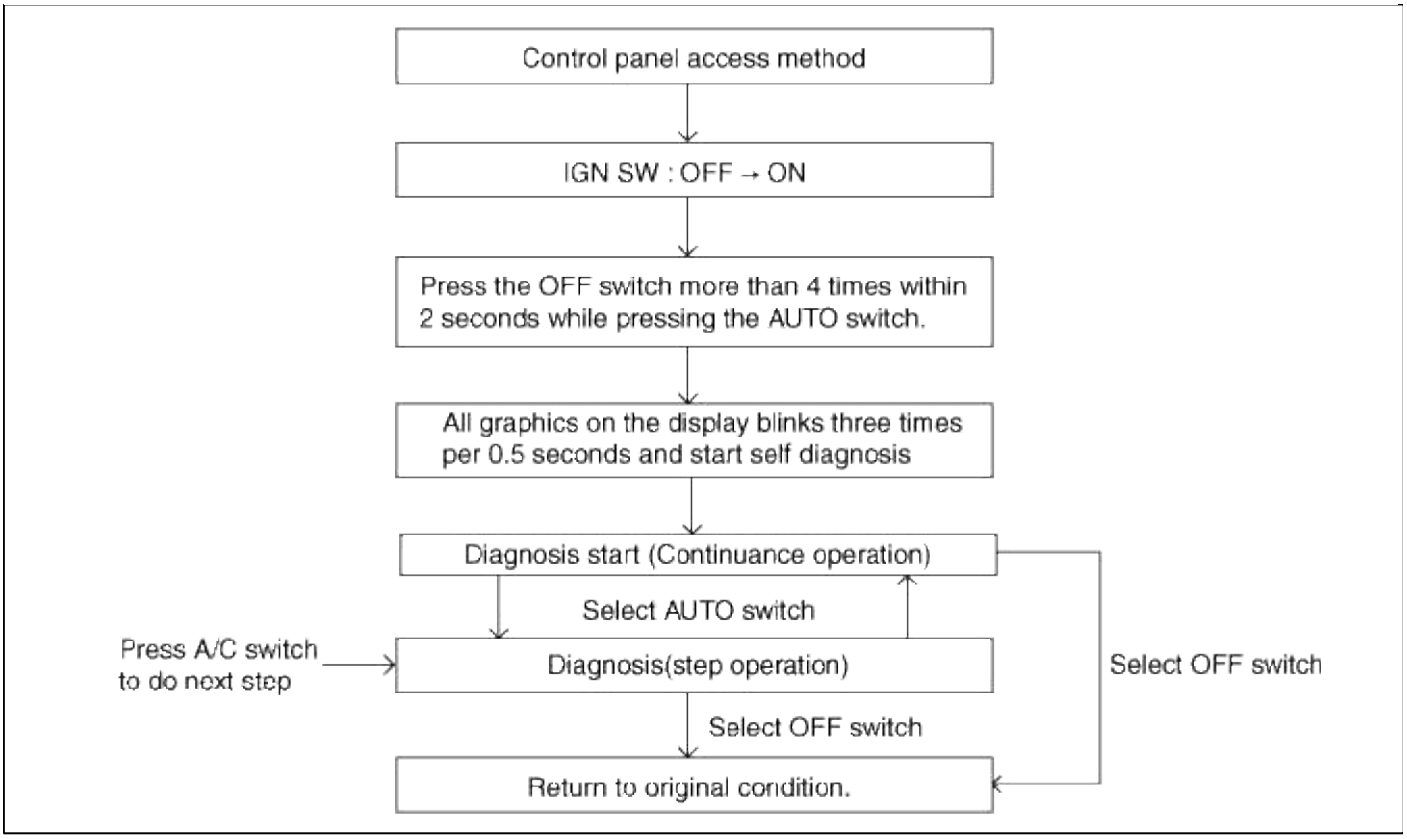
NOTE

When the battery happens to be disconnected or discharged, the logic is reinstated.

SELF-DIAGNOSIS

Self-diagnosis process

The F.A.T.C. module self test feature will detect electrical malfunction and provide error codes for system components with suspected failures.

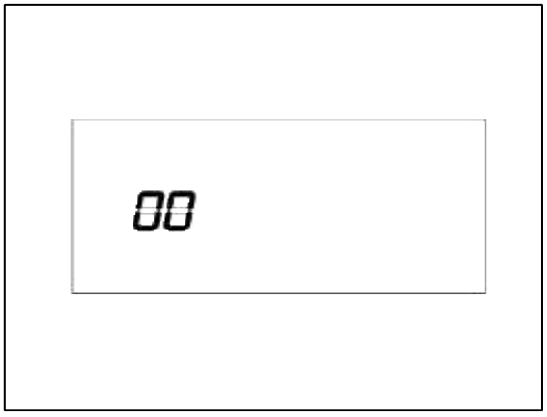


NOTE

DTC data can be retrieved from the control panel directly or from the DLC using the Hi-Scan Pro.

HOW TO READ SELF-DIAGNOSTIC CODE

1. 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.
   DTC's are displayed in numerical format.



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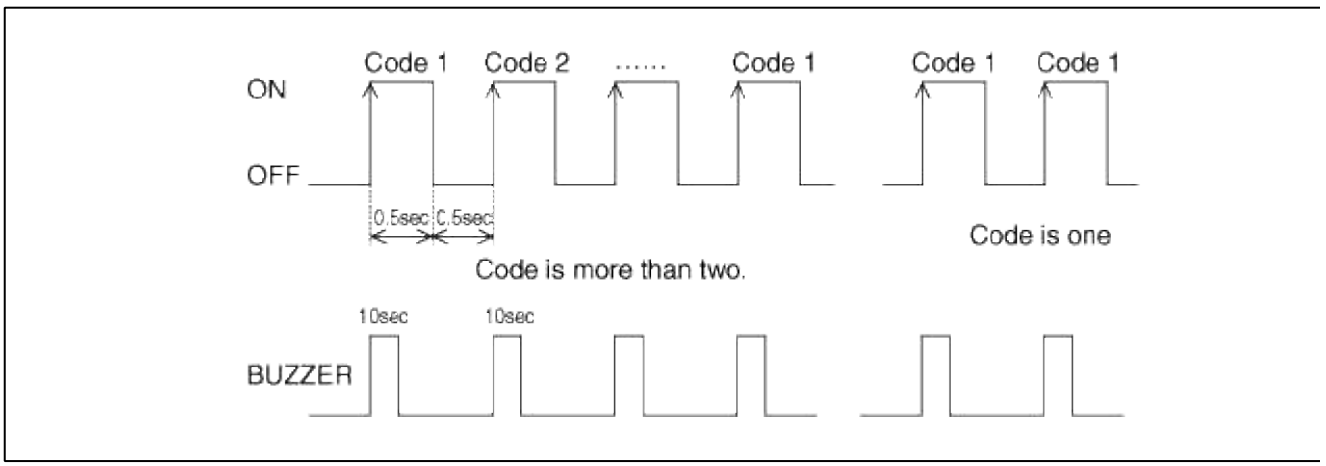
2. Fault code

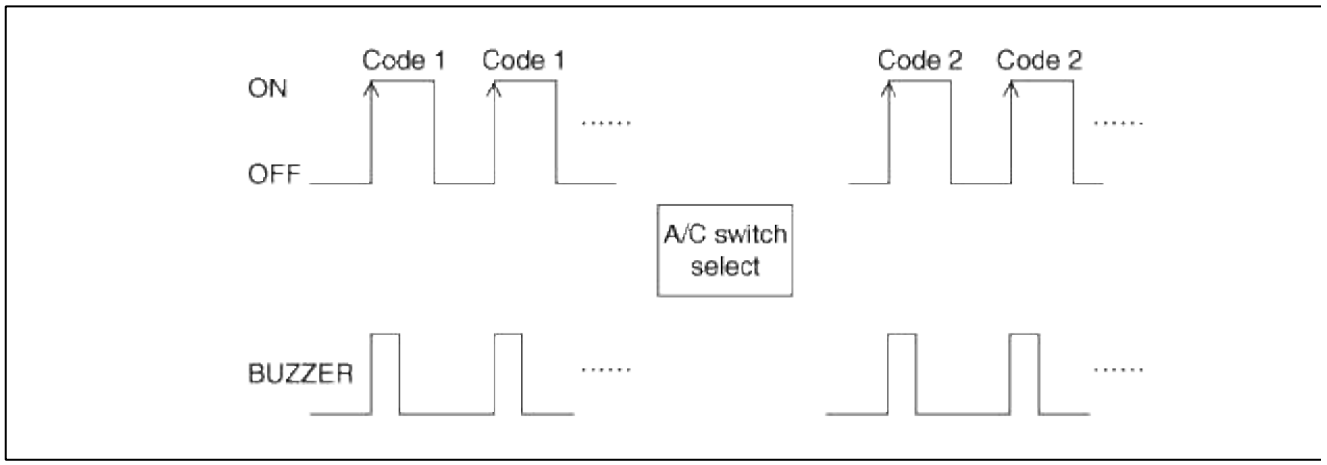
Fault code		Fail description
Control unit	Scan tool (DTC)	
00	-	Normal
11	B1234	In-car temperature sensor open (High)
12	B1233	In-car temperature sensor short (Low)
13	B1238	Ambient temperature sensor open (High)
14	B1237	Ambient temperature sensor short (Low)
15	B1202	Water temperature sensor open (High)
16	B1203	Water temperature sensor short (Low)
17	B1242	Evaporator temperature sensor open (High)
18	B1241	Evaporator temperature sensor short (Low)
19	B1245	Air mix potentiometer open (Low) - Driver
19	B1246	Air mix potentiometer short (High) - Driver
20	B2406	Air mix motor (Driver)
21	B1249	Direction potentiometer open (Low) - Driver
21	B1250	Direction potentiometer short (High) - Driver
22	B2409	Direction control motor (Driver)
23	B1200	Humidity sensor open (High)
24	B1201	Humidity sensor short (Low)

3. Fault code display

(1) Continuance operation



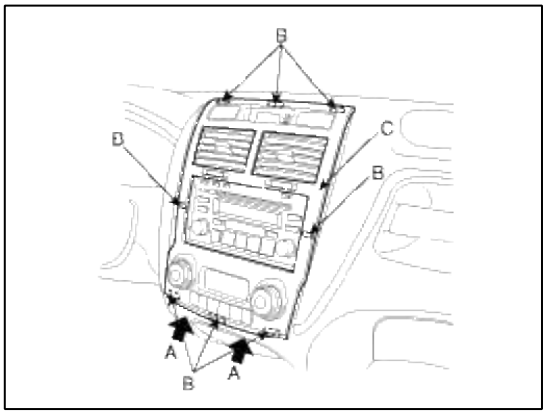
(2) Step operation



4. If a fault code is displayed during the DTC check, Inspect a malfunction cause by referring to the DTC code.
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: Control with the value of 10%
   (5) Photo sensor: None
   (6) Temperature control actuator (Air mix potentiometer):
   If temperature setting 17°C-24.5°C, fix at maximum cooling position.
   If temperature setting 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

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel (C) after pulling it by using a screw driver (-) at part (A).
   Take care of fixing clips (B).



3. Disconnect the connectors from the center facia.

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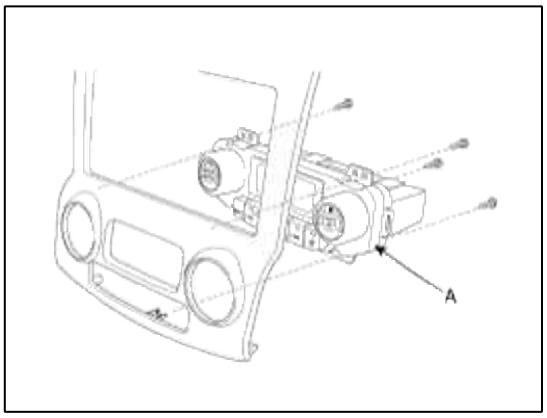
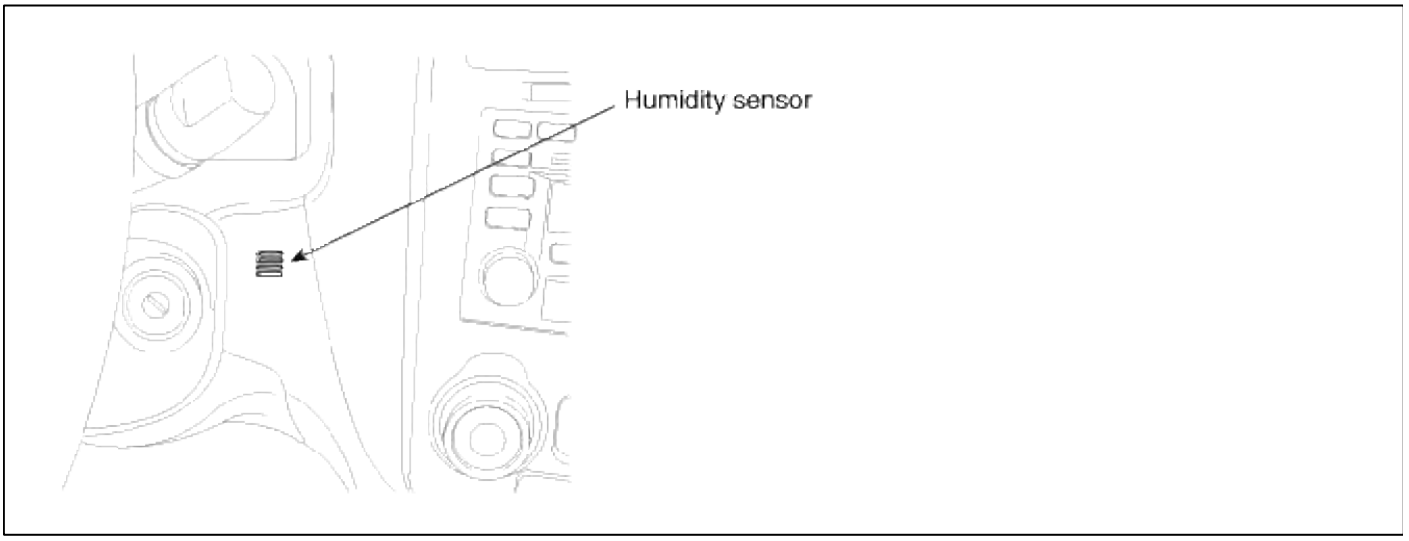
4. Remove the blower And A/C control unit (A).



5. Install in the reverse order of removal.

Heating,Ventilation, Air Conditioning > Troubleshooting > B1200

COMPONENT LOCATION



GENERAL DESCRIPTION

Humidity sensor located at crush pad, 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.

DTC DESCRIPTION

The A/C controller sets DTC B1200 if there is an open circuit in humidity sensor signal harness or the measured frequency value of sensor is more than threshold value(about 7,224Hz)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Frequency check	• Open Circuit in harness • Faulty Humidity Sensor • Faulty A/C control unit
Threshold value	• > 7,224 Hz	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 10%	

MONITOR SCANTOOL DATA

1. Connect scantool to data dink connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool while drying the humidity sensor with a hair drier or hea gun adjusted to a low heat setting.

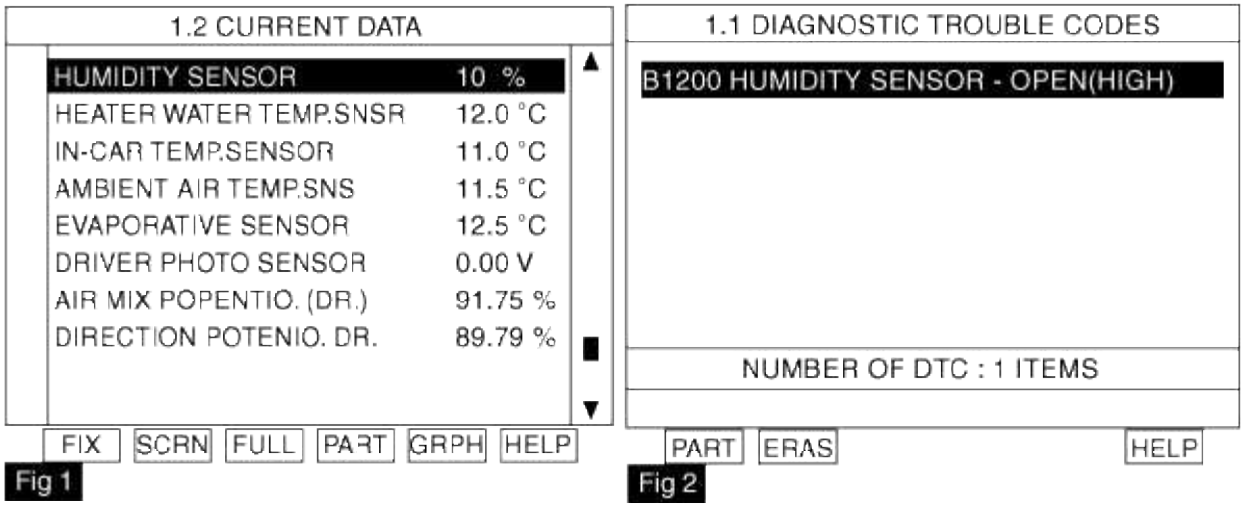


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1200.

4. Are the DTC B1200 present and is parameter of "Humidity Sensor" fixed?
   Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

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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

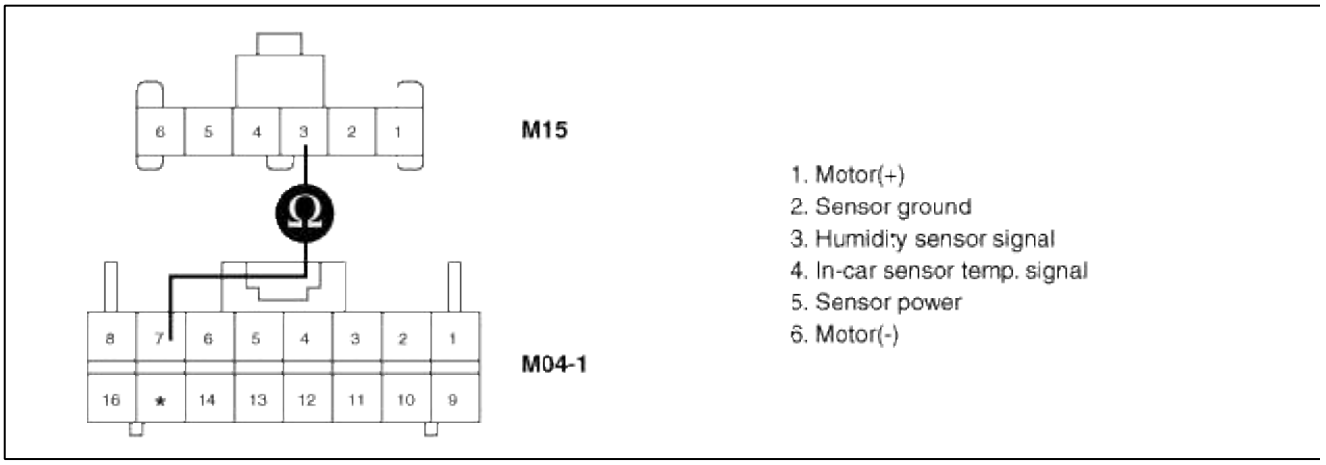
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Humidity Sensor.

(3) Measure resistance between terminal "3" of Humidity Sensor and terminal "7" of A/C Control Unit.

Specification : Approx. 0 Ω



(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

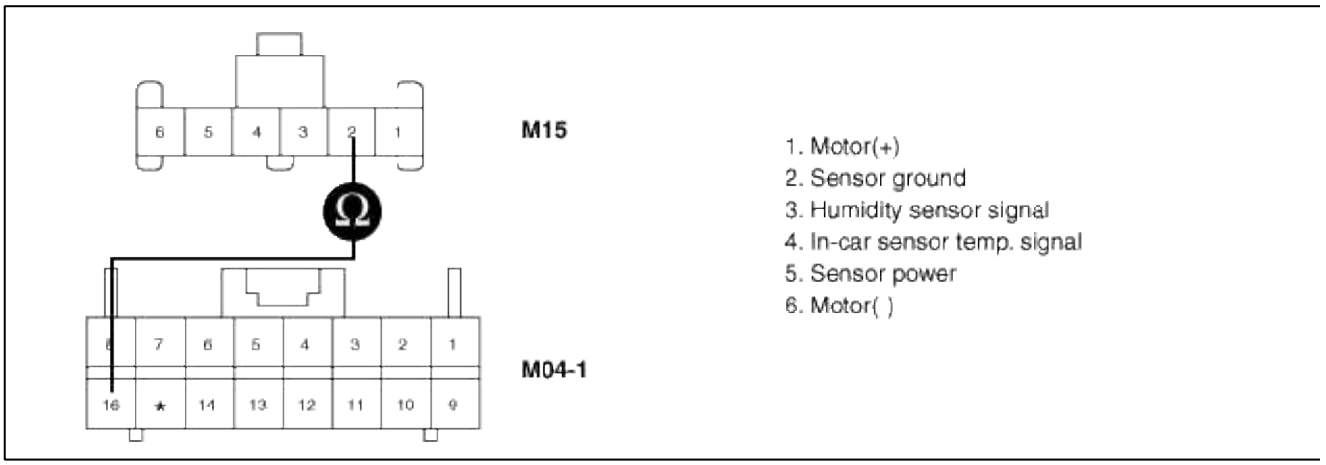
1. Check for open in ground harness.

(1) Ignition "OFF"

(2) Disconnect Humidity Sensor.

(3) Measure resistance between terminal "2" of Humidity Sensor and terminal "16" of A/C Control Unit.

Specification :Approx. 0 Ω



(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

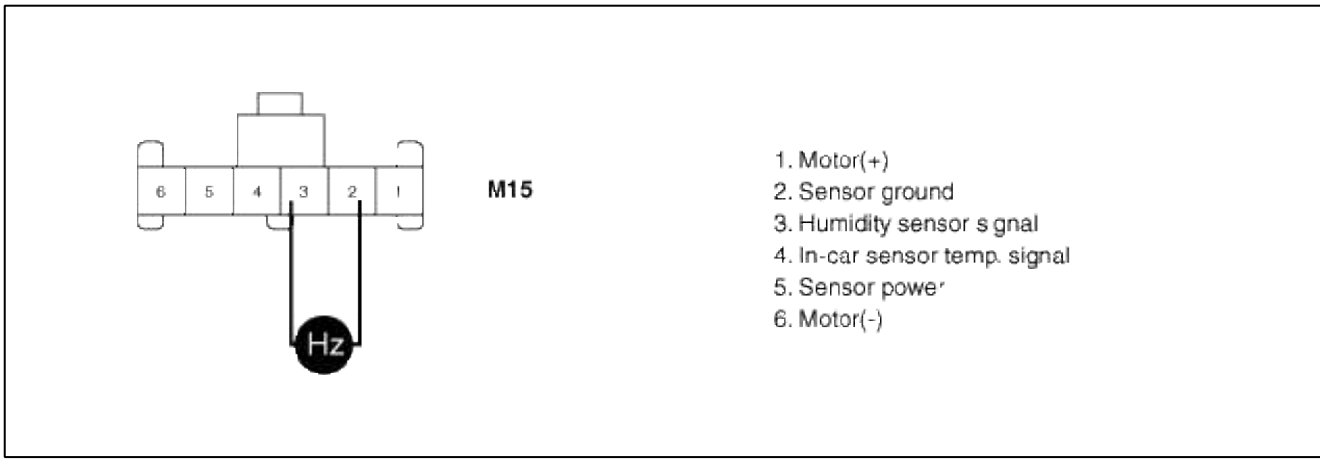
1. Check Humidity Sensor.

(1) Engine "ON"

(2) Connect Humidity Sensor.

(3) Measure Frequency between terminal "3" and "2" of Humidity sensor while increasing humidity.

Specification : Refer the specifications in fig 5.



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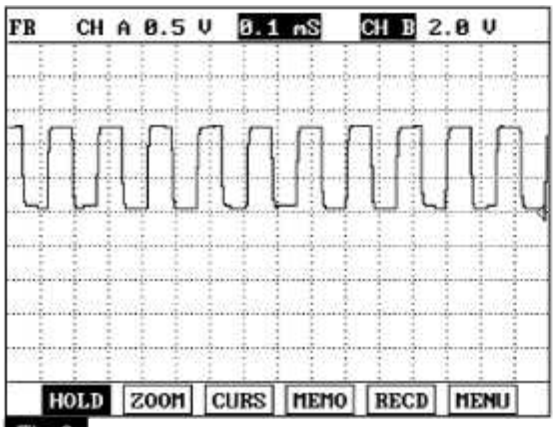


Fig 3

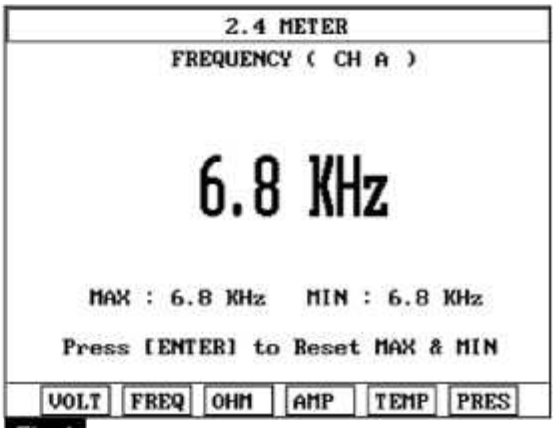


Fig 4

Fig 3 : Signal waveform of Humidity sensor.
Fig 4 : Frequency of Humidity sensor Measured by scantool.

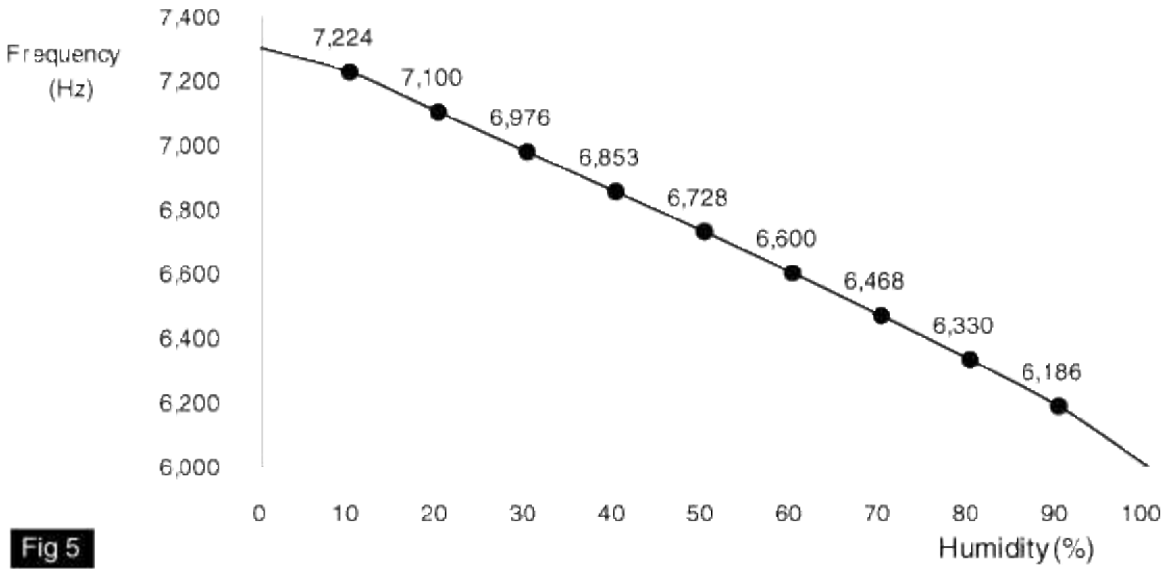


Fig 5

Fig 5) Specifications : Frequency value of humidity sensor as a function of Relative humidity.

(4) Is the measured frequency within specifications in fig 5? (tolerance limits ± 5%)

YES

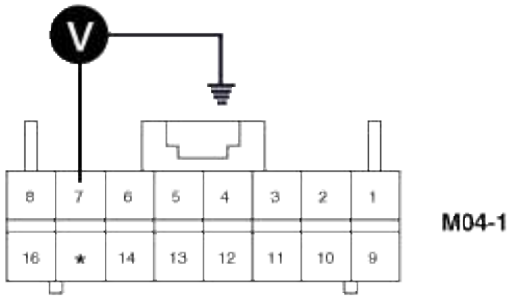
Go to "Check A/C Control Unit" procedure.

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 A/C Control Unit
   (1) Engine "ON"
   (2) Disconnect Humidity Sensor.
   (3) Measure voltage value between terminal "7" of A/C control unit and chassis ground.

Specification : 5V



7. Humidity sensor signal

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

SPECIFICATION

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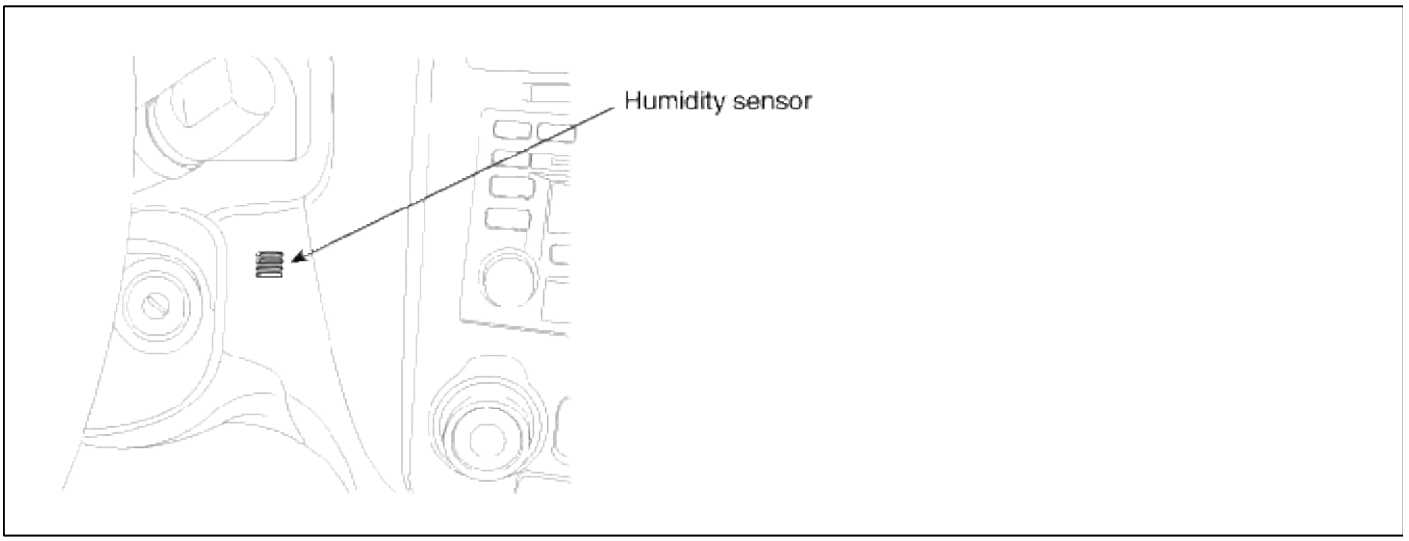
Relative humidity(%)	Frequency(Hz)	Relative humidity(%)	Frequency(Hz)
10	7,224	55	6,664
15	7,162	60	6,600
20	7,100	65	6,534
25	7,038	70	6,468
30	6,976	75	6,399
35	6,915	80	6,330
40	6,853	85	6,258
45	6,791	90	6,186
50	6,728	95	6,110

Heating,Ventilation, Air Conditioning > Troubleshooting > B1201

COMPONENT LOCATION



GENERAL DESCRIPTION

Humidity sensor located at crush pad, 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.

DTC DESCRIPTION

The A/C controller sets DTC B1201 if there is a short circuit in humidity sensor signal harness or the measured frequency value of sensor is less than threshold value(about 6,100Hz)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Frequency check	• Open Circuit in power harness • Short Circuit in signal harnes • Faulty Humidity Sensor • Faulty A/C control unit
Threshold value	• < 6,100 Hz	
Detecting time	• 10msec	
FAIL SAFE	• Control with the value of 10%	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Humidity Sensor" Parameter on the Scantool while drying the humidity sensor with a hair drier or hea gun adjusted to a low heat setting.

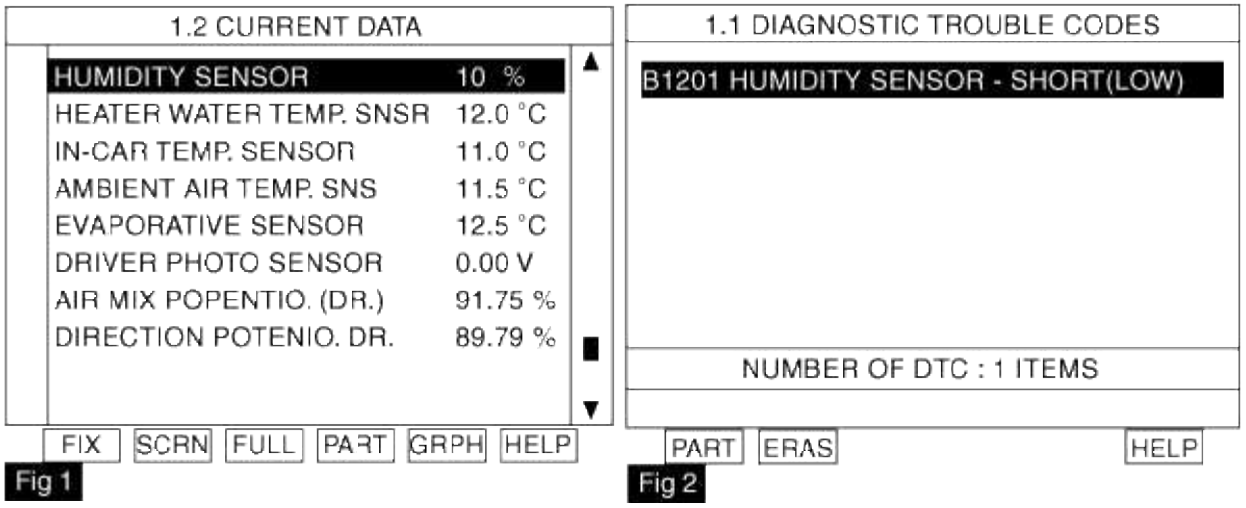


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1201.

4. Are the DTC B1201 present and is parameter of "Humidity Sensor" fixed?
   Parameter of "Humidity Sensor" will be fixed at 10%, if there is any fault in Humidity Sensor.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

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3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

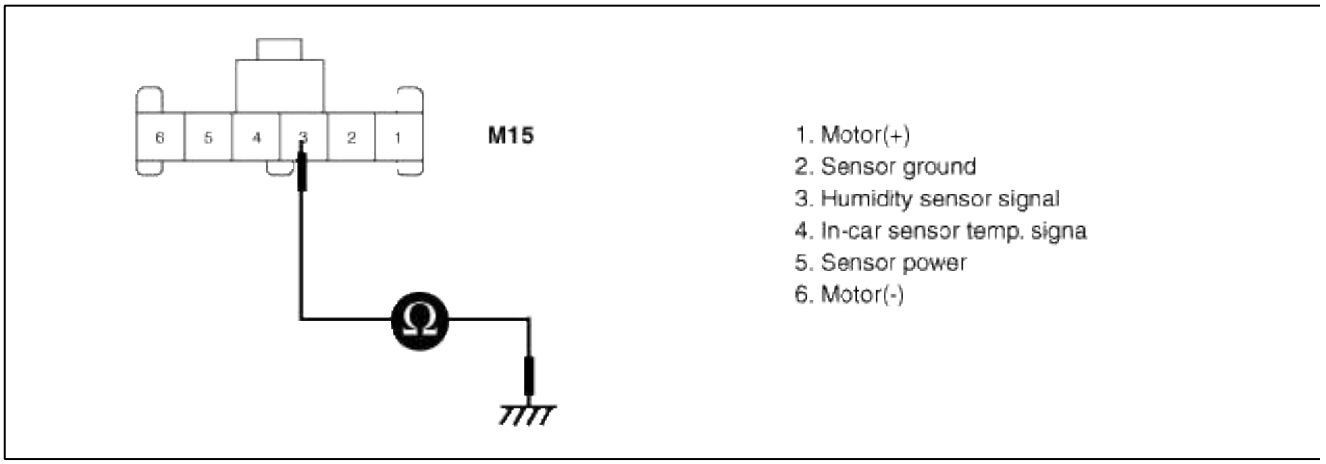
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect Humidity Sensor.
   (3) Measure resistance between terminal "3" of Humidity Sensor and chassis ground.

Specification : Approx. ∞ Ω



   (4) Is the measured resistance within specifications?

YES

Go to "Power circuit Inspection " procedure.

NO

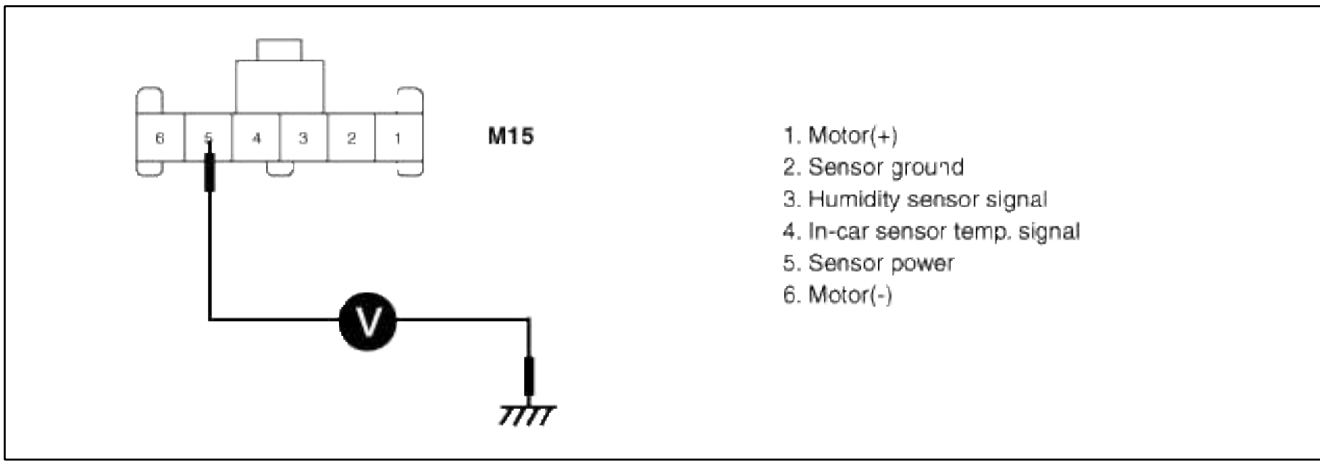
Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedu

POWER SUPPLY CIRCUIT INSPECTION

1. Check for open in power harness.
   (1) Ignition "ON"
   (2) Disconnect Humidity Sensor.

(3) Measure voltage value between terminal "5" of Humidity Sensor and chassis ground.

Specification : 5V



(4) Is the measured voltage within specifications?

YES

Go to "Component Inspection " procedure.

NO

Check for open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

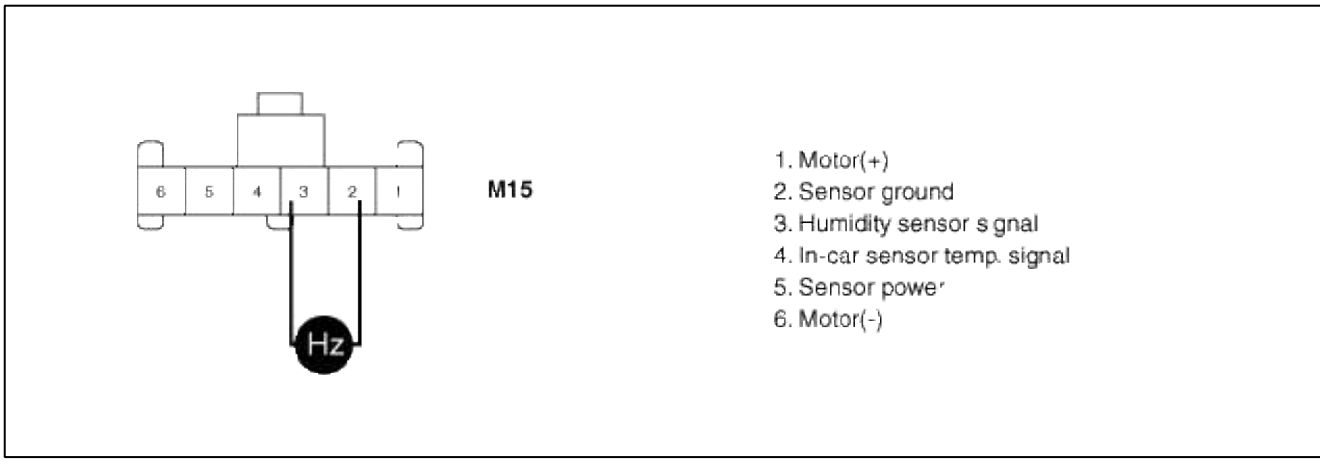
1. Check Humidity Sensor.

(1) Engine "ON"

(2) Connect Humidity Sensor.

(3) Measure Frequency between terminal "3" and "2" of Humidity sensor while increasing humidity.

Specification : Refer the specifications in fig 5.



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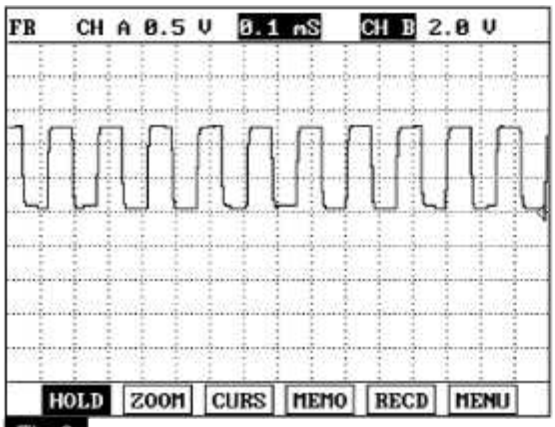


Fig 3

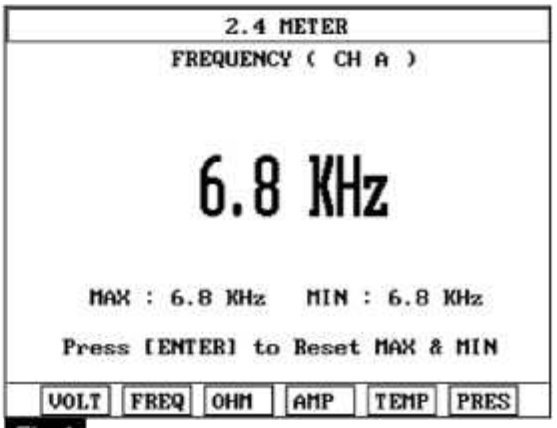


Fig 4

Fig 3 : Signal waveform of Humidity sensor.
Fig 4 : Frequency of Humidity sensor Measured by scantool.

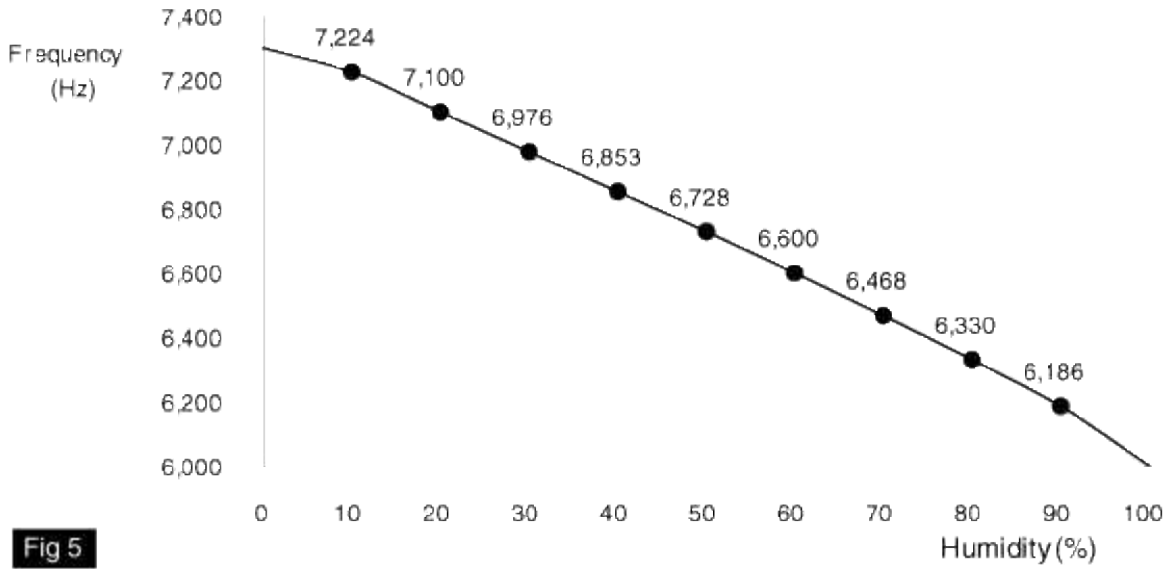


Fig 5

Fig 5) Specifications : Frequency value of humidity sensor as a function of Relative humidity.

(4) Is the measured frequency within specifications in fig 5? (tolerance limits ± 5%)

YES

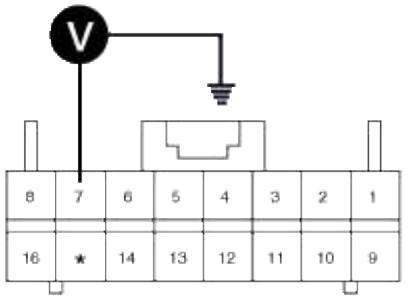
Go to "Check A/C Control Unit" procedure.

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 A/C Control Unit
   (1) Engine "ON"
   (2) Disconnect Humidity Sensor.
   (3) Measure voltage value between terminal "7" of A/C control unit and chassis ground.

Specification : 5V



YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

SPECIFICATION

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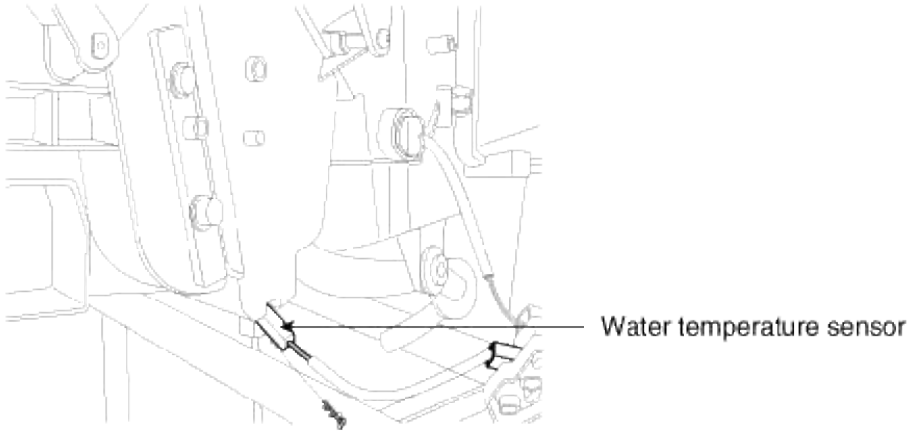
Relative humidity(%)	Frequency(Hz)	Relative humidity(%)	Frequency(Hz)
10	7,224	55	6,664
15	7,162	60	6,600
20	7,100	65	6,534
25	7,038	70	6,468
30	6,976	75	6,399
35	6,915	80	6,330
40	6,853	85	6,258
45	6,791	90	6,186
50	6,728	95	6,110

Heating,Ventilation, Air Conditioning > Troubleshooting > B1202

COMPONENT LOCATION



GENERAL DESCRIPTION

A 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.

DTC DESCRIPTION

The A/C controller sets DTC B1202 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 176.3kΩ)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Open Circuit in harness • Faulty water temp. Sensor • Faulty A/C control unit
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 20°C(68°F)	

MONITOR SCANTOOL DATA

1. Connect scantool to data dink connector(DLC).
2. Engine "ON"
3. Monitor the "WATER TEMP. SENSOR" Parameter on the Scantool.

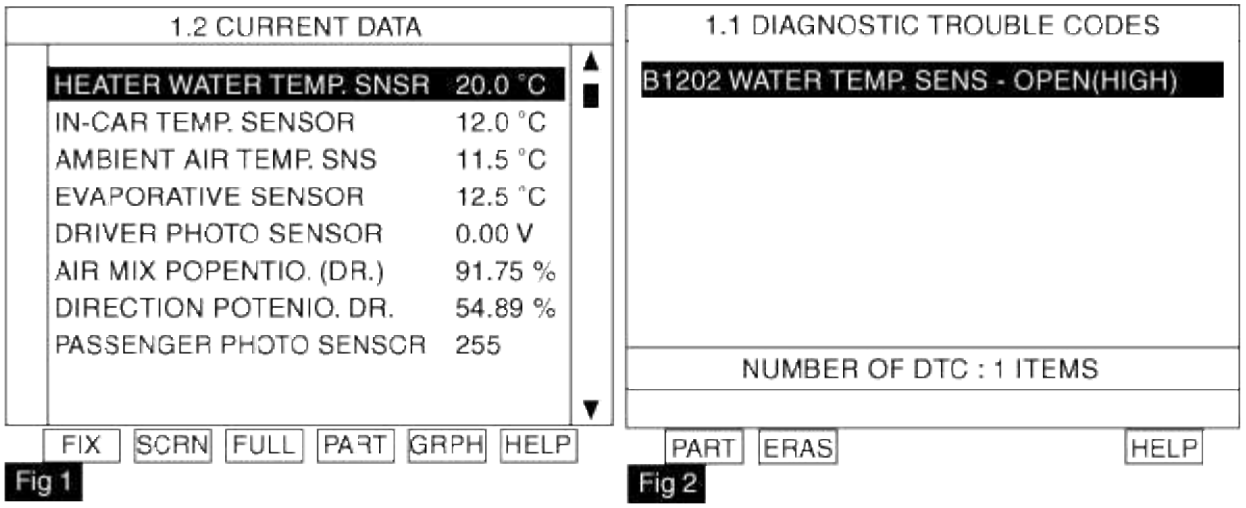


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1202.

4. Are the DTC B1202 present and is parameter of "WATER TEMP. SENSOR" fixed?
   Parameter of "WATER TEMP. SENSOR" will be fixed at 20°C, if there is any fault in WATER TEMP. SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

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3. Has a problem been found?

YES

Repair as necessary and go to "Verification of Vehicle Repair" procedure.

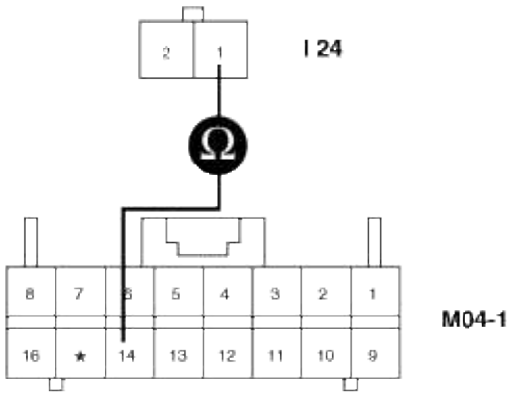
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   (1) Ignition "OFF"
   (2) Disconnect water temp. sensor.
   (3) Measure resistance between terminal "1" of water temp. sensor and terminal "14" of A/C Control Unit.

Specification : Approx. 0 Ω



1. Water temp. sensor signal
2. Sensor ground

   (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.

(3) Measure resistance between terminal "2" of water temp. sensor and chassis ground.

Specification : Approx. 0 Ω

1. Water temp. sensor signal
2. Sensor ground

(4) Is the measured resistance within specifications?

YES

Go to "Component Inspection " procedure.

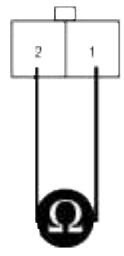
NO

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.
   (3) Measure resistance between terminal "1" and "2" of water temp. sensor.

Specification : Refer the specifications in fig 3.



1. Water temp. sensor signal
2. Sensor ground

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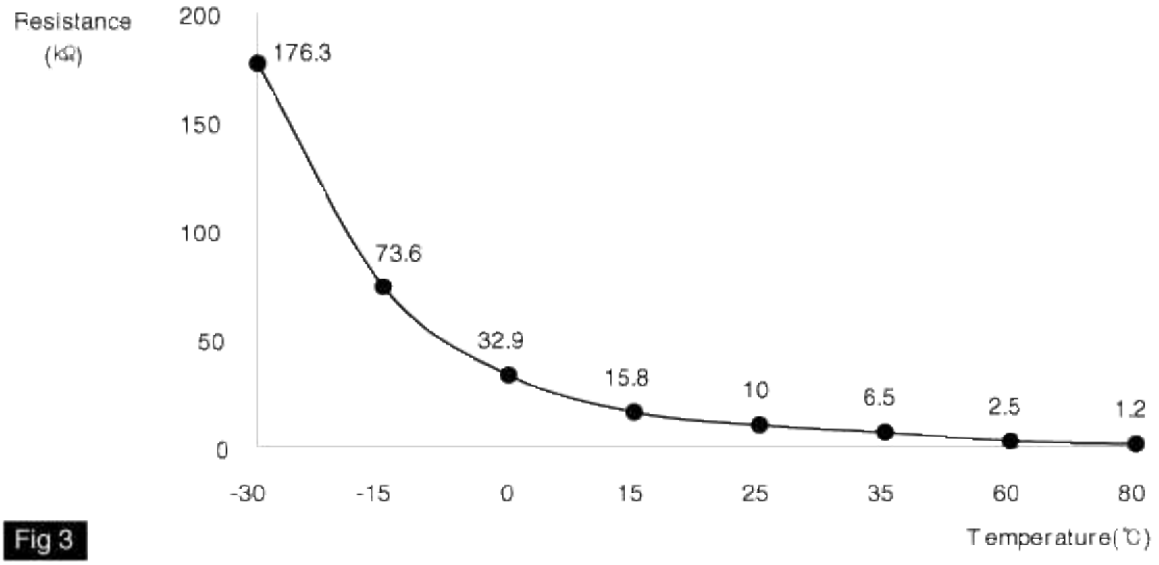


Fig 3

Fig 3) Specifications : Resistance value of water temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig 3)? (tolerance limits ± 3%)

YES

Go to "Check A/C Control Unit" 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" proced

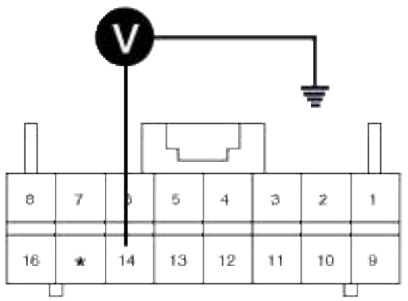
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect water temp. sensor.

(3) Measure Voltage between terminal "14" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



M04-1

14. Water temp. sensor signal

(4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

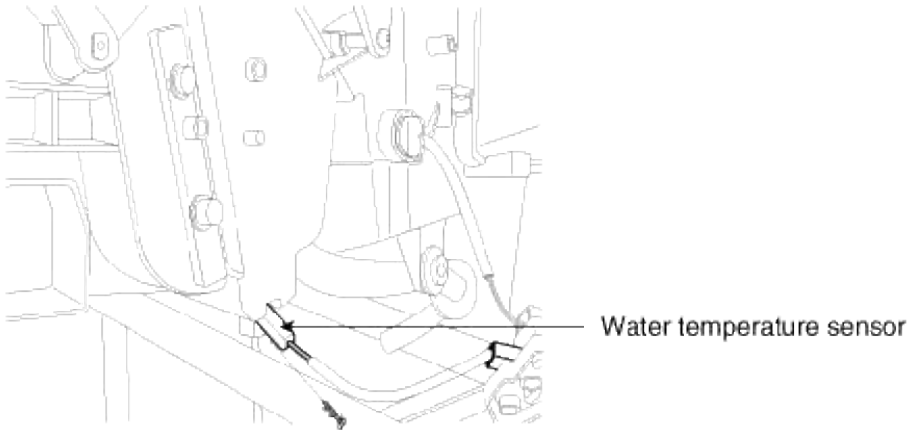
System is performing to specification at this time.

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)	1.2

Heating,Ventilation, Air Conditioning > Troubleshooting > B1203

COMPONENT LOCATION



GENERAL DESCRIPTION

A 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.

DTC DESCRIPTION

The A/C controller sets DTC B1203 if there is a short circuit in water temp. sensor signal harness or the measured resistance value of sensor is less than threshold value(about 1.2kΩ)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Short circuit in harness • Faulty water temp. Sensor • Faulty A/C control unit
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 20°C(68°F)	

MONITOR SCANTOOL DATA

1. Connect scantool to data dink connector(DLC).
2. Engine "ON"
3. Monitor the "WATER TEMP. SENSOR" Parameter on the Scantool.

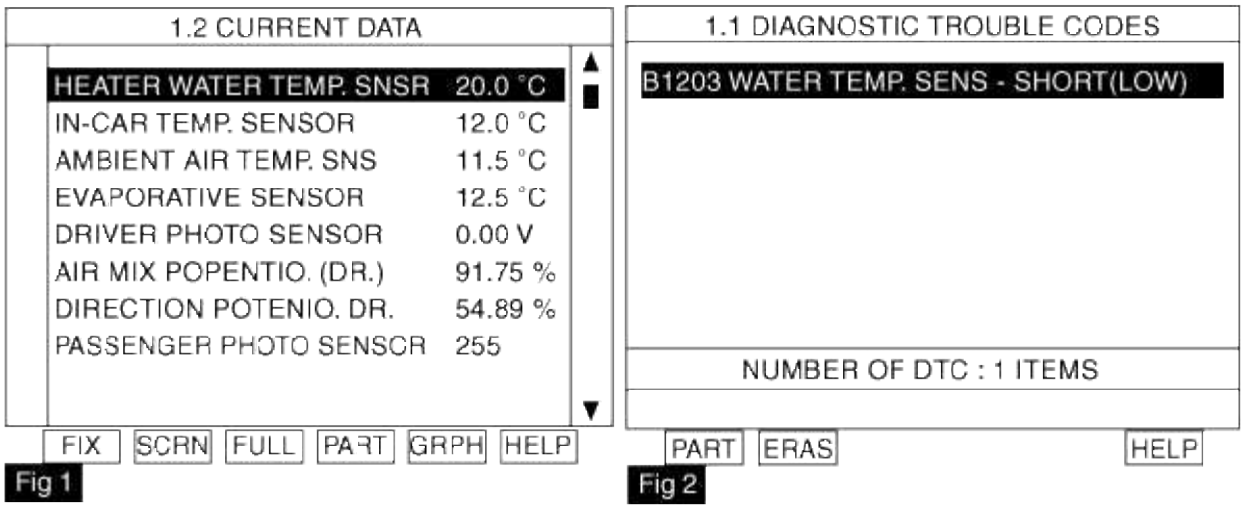


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1203.

4. Are the DTC B1203 present and is parameter of "WATER TEMP. SENSOR" fixed?
   Parameter of "WATER TEMP. SENSOR" will be fixed at 20°C, if there is any fault in WATER TEMP. SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

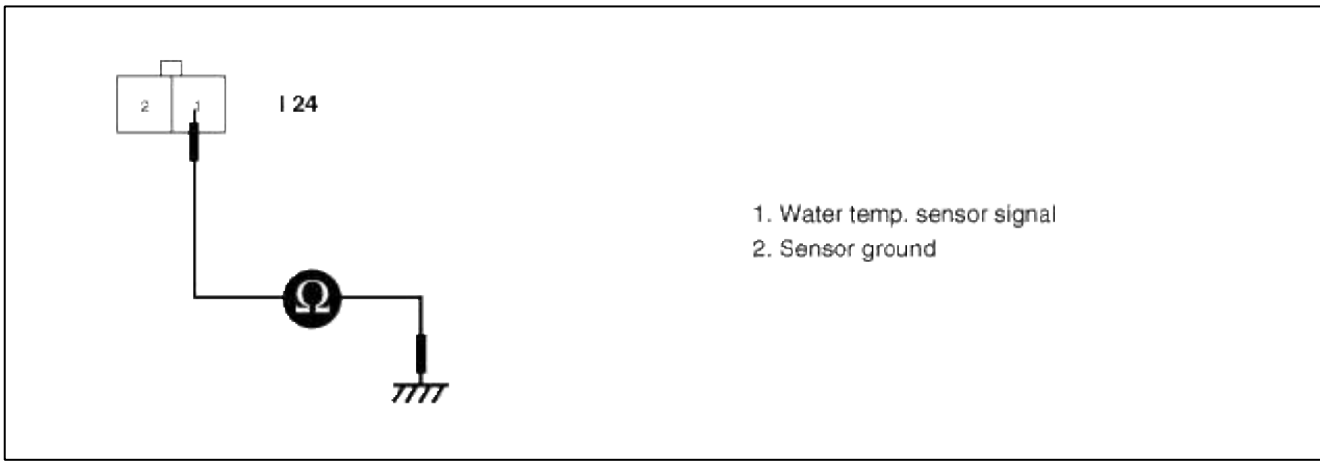
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect water temp. sensor.
   (3) Measure resistance between terminal "1" of water temp. sensor and chassis ground.

Specification : Approx. ∞Ω



   (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" procedu

COMPONENT INSPECTION

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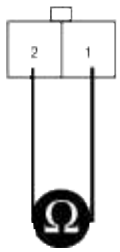
1. Check water temp. sensor.
   (1) Ignition "OFF"
   (2) Disconnect water temp. sensor.
   (3) Measure resistance between terminal "1" and "2" of water temp. sensor.

Specification : Refer the specifications in fig 3.



I 24

1. Water temp. sensor signal
2. Sensor ground

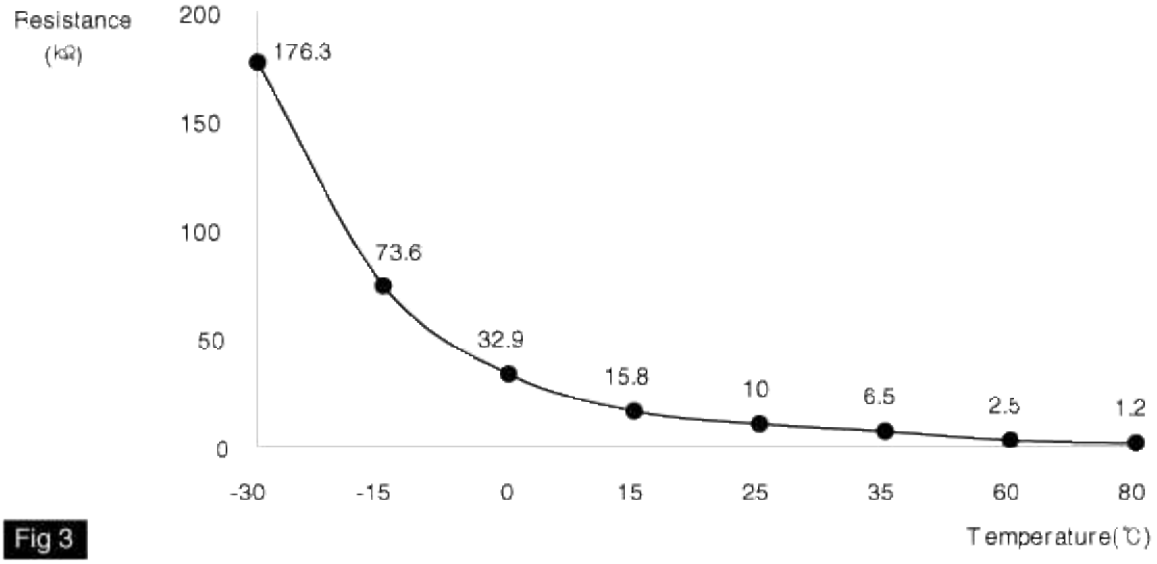


Fig 3

Fig 3) Specifications : Resistance value of water temp. sensor as a function of temperature.

   (4) Is the measured resistance within specifications in fig 3)? (tolerance limits ± 3%)

YES

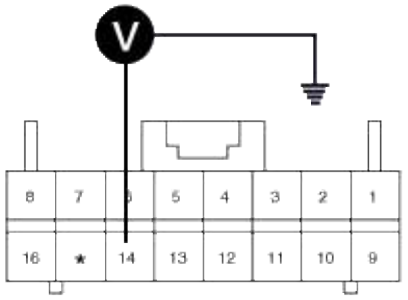
Go to "Check A/C Control Unit" procedure.

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" proced

2. Check A/C Control Unit
   (1) Engine "ON"
   (2) Disconnect water temp. sensor.
   (3) Measure Voltage between terminal "14" of A/C Control Unit and chassis ground.

   Specification : Approx. 5V



14. Water temp. sensor signal

   (4) Is the measured voltage within specifications?

   YES

   Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
   Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good A/C Control Unit and check for proper operation.
   If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

   YES

   Go to the applicable troubleshooting procedure.

   NO

   System is performing to specification at this time.

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)	1.2

Heating,Ventilation, Air Conditioning > Troubleshooting > B1233

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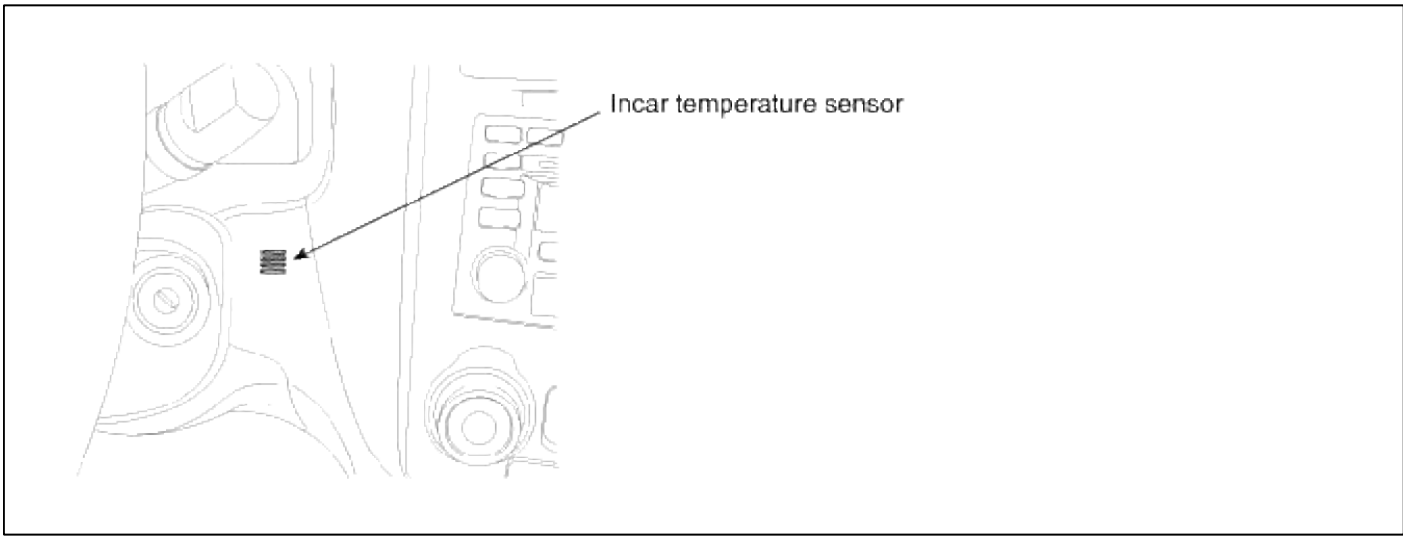
COMPONENT LOCATION



GENERAL DESCRIPTION

The incar temperature sensor located at crush pad, control unit 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.

DTC DESCRIPTION

The A/C controller sets DTC B1233 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)

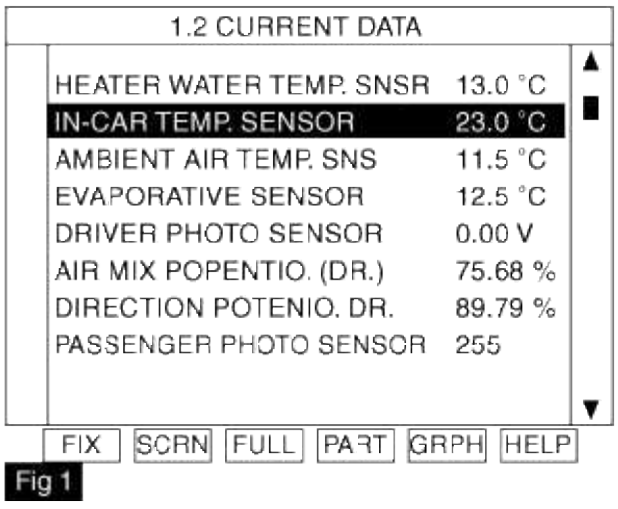
DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Short circuit in harness • Faulty incar temp. Sensor • Faulty A/C control unit
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 23°C(73°F)	

MONITOR SCANTOOL DATA

1. Connect scantool to data dink connector(DLC).
2. Engine "ON"

3. Monitor the "INCAR TEMP. SENSOR" Parameter on the Scantool.



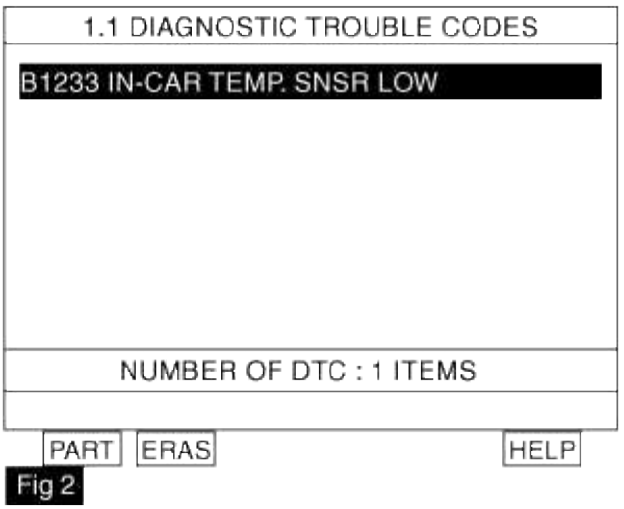


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1233.

4. Are the DTC B1233 present and is parameter of "INCAR TEMP. SENSOR" fixed?
   Parameter of "INCAR TEMP. SENSOR" will be fixed at 23°C(73°F), if there is any fault in INCAR TEMP. SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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

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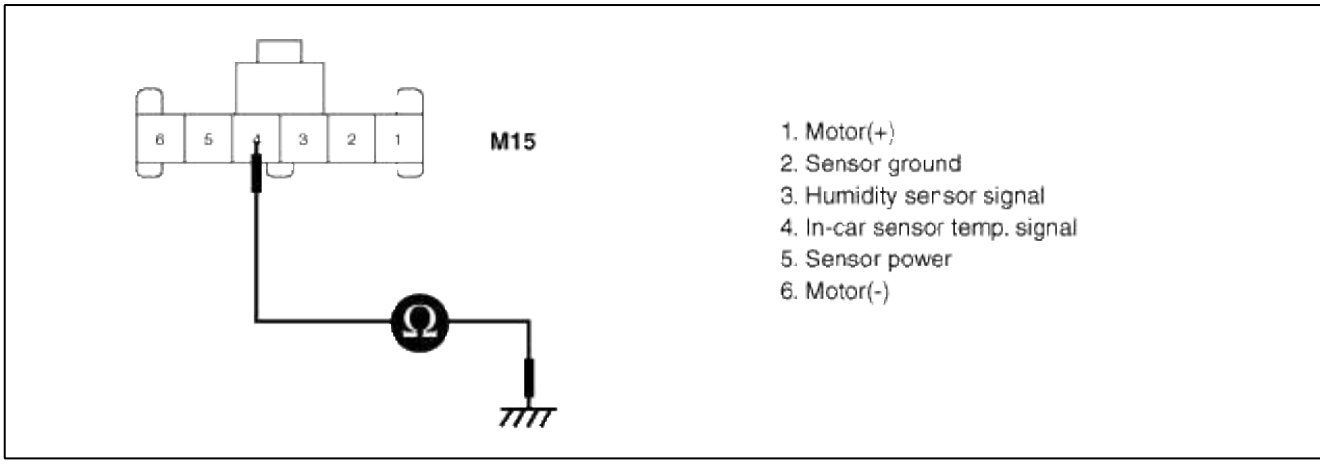
1. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect incar sensor.
   (3) Measure resistance between terminal "4" of incar sensor and chassis ground.

   Specification : Approx. ∞Ω



   (4) Is the measured resistance within specifications?

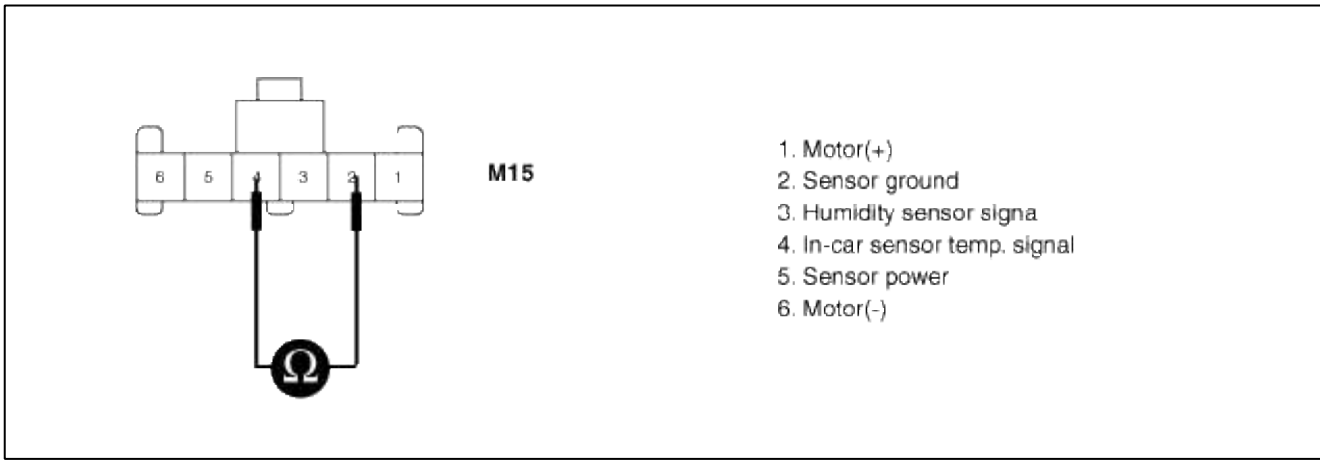
   YES
   Go to "Component Inspection" procedure.

   NO
   Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedu

COMPONENT INSPECTION

1. Check incar temp. sensor.
   (1) Ignition "OFF"
   (2) Disconnect incar sensor.
   (3) Measure resistance between terminal "4" and "2" of incar sensor.

   Specification : Refer the specifications in fig 3.



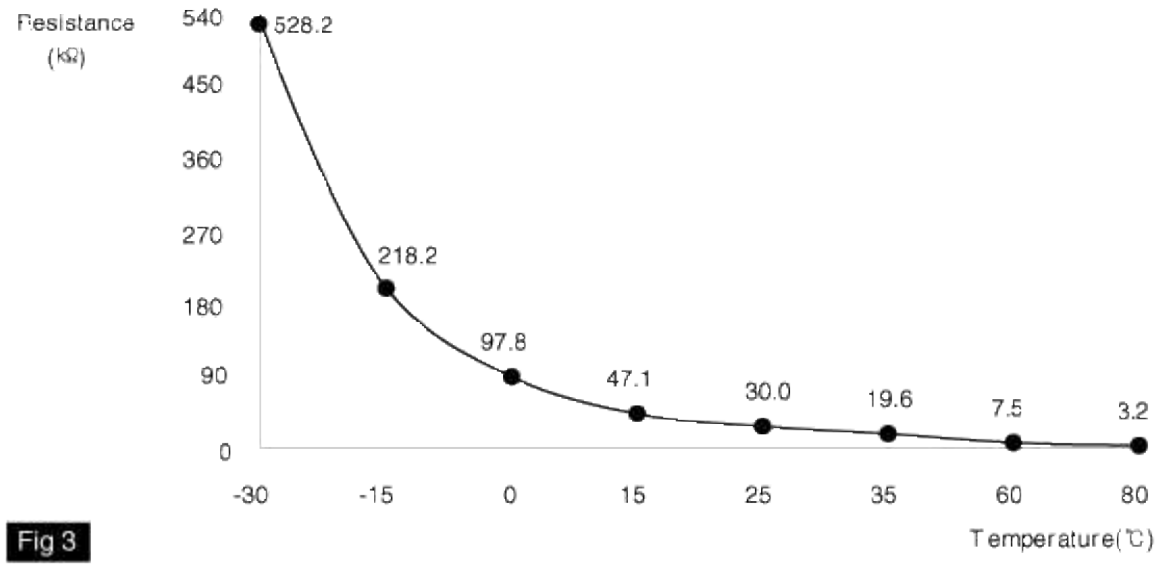


Fig 3

Fig 3) Specifications : Resistance value of incar temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits ± 3%)

YES

Go to "Check A/C Control Unit" 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.

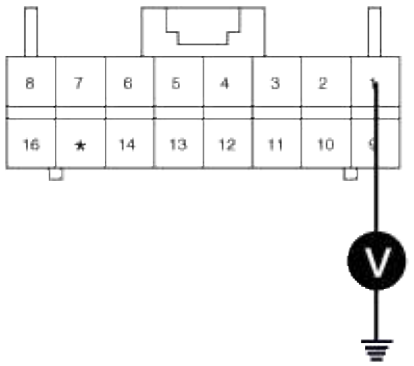
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect incar sensor.

(3) Measure Voltage between terminal "1" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



M04-1

1. Incar sensor temp. signal

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(4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

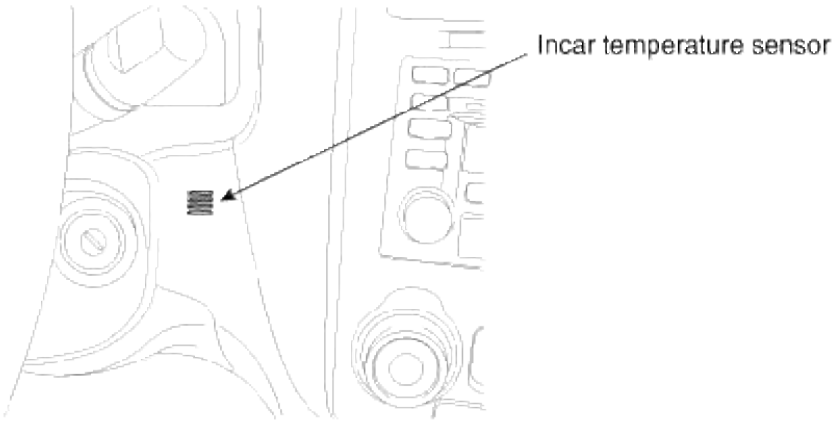
System is performing to specification at this time.

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

Heating,Ventilation, Air Conditioning > Troubleshooting > B1234

COMPONENT LOCATION



GENERAL DESCRIPTION

The incar temperature sensor located at crush pad, control unit 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.

DTC DESCRIPTION

The A/C controller sets DTC B1234 if there is an open circuit in incar temp. sensor signal harness or the measured resistance value of sensor is more than threshold value(about 528kΩ)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Open Circuit in harness • Faulty incar temp. Sensor • Faulty A/C control unit
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 23°C(73°F)	

MONITOR SCANTOOL DATA

1. Connect scantool to data dink connector(DLC).
2. Engine "ON"
3. Monitor the "INCAR TEMP. SENSOR" Parameter on the Scantool.

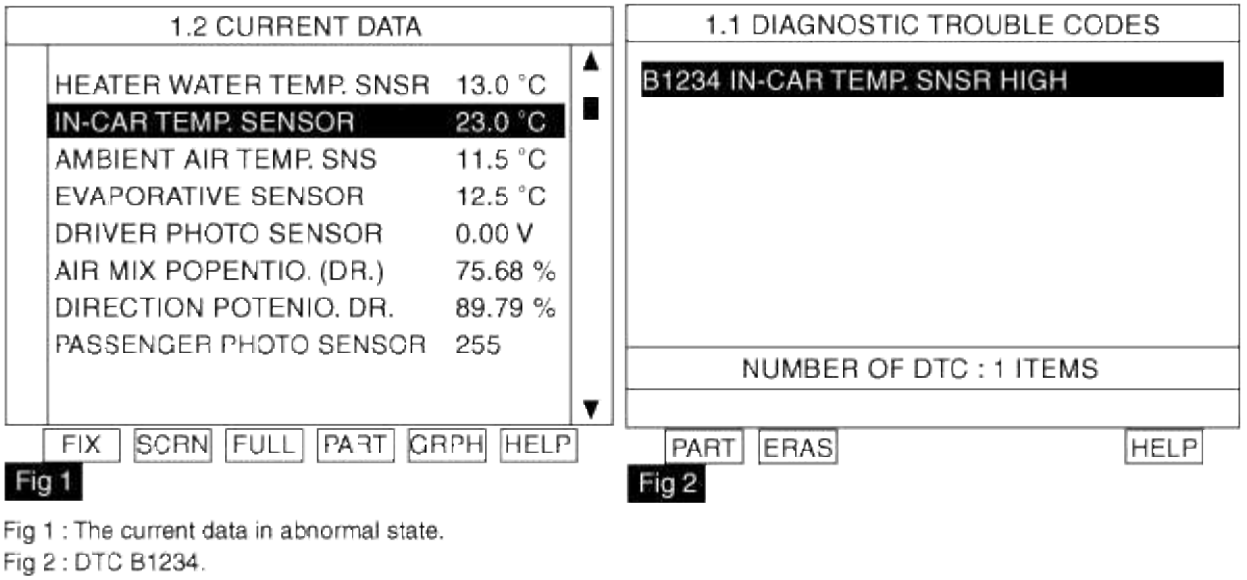


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1234.

4. Are the DTC B1234 present and is parameter of "INCAR TEMP. SENSOR" fixed?
   Parameter of "INCAR TEMP. SENSOR" will be fixed at 23°C(73°F), if there is any fault in INCAR TEMP. SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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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.

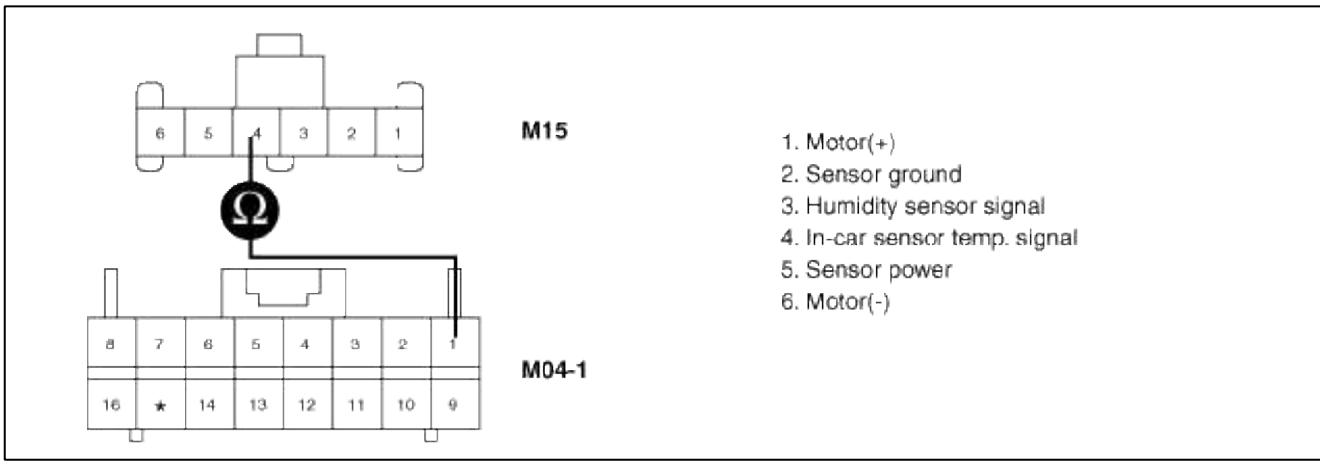
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   (1) Ignition "OFF"
   (2) Disconnect incar temp. sensor.
   (3) Measure resistance between terminal "4" of incar temp. sensor and terminal "1" of A/C Control Unit..

Specification : Approx. 0 Ω



   (4) Is the measured resistance within specifications?

YES

Go to "Ground circuit Inspection " procedure.

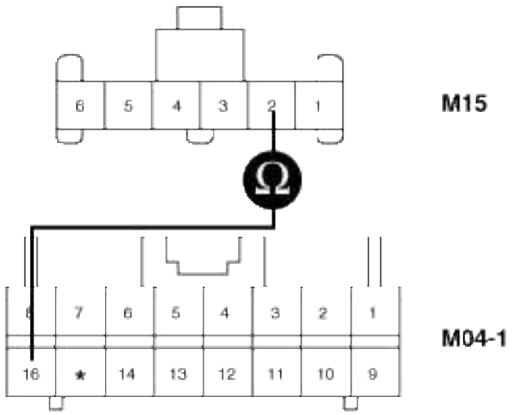
NO

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.
   (3) Measure resistance between terminal "2" of incar temp. sensor and terminal "16" of A/C Control Unit.

   Specification : Approx. 0 Ω



1. Motor(+)
2. Sensor ground
3. Humidity sensor signal
4. In-car sensor temp. signal
5. Sensor power
6. Motor(-)

   (4) Is the measured resistance within specifications?

   YES

   Go to "Component Inspection " procedure.

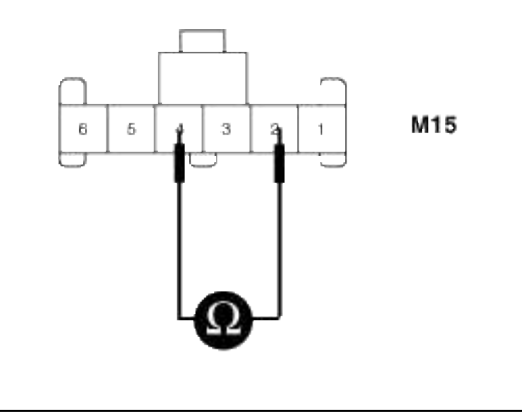
   NO

   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.
   (3) Measure resistance between terminal "4" and "2" of incar sensor.

   Specification : Refer the specifications in fig 3.



1. Motor(+)
2. Sensor ground
3. Humidity sensor signa
4. In-car sensor temp. signal
5. Sensor power
6. Motor(-)

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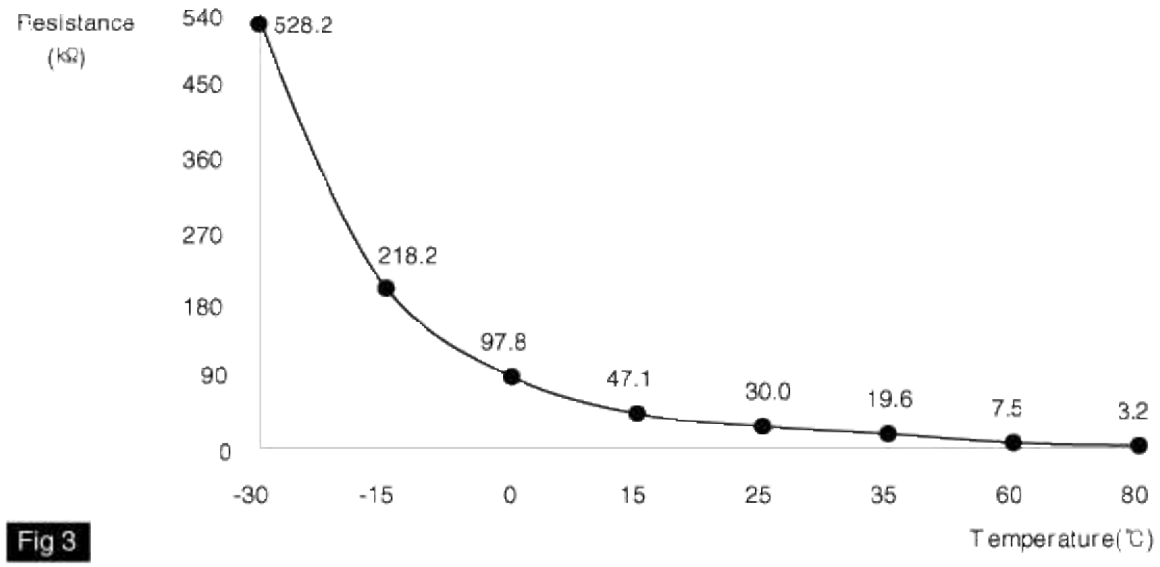


Fig 3

Fig 3) Specifications : Resistance value of incar temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits ± 3%)

YES

Go to "Check A/C Control Unit" 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.

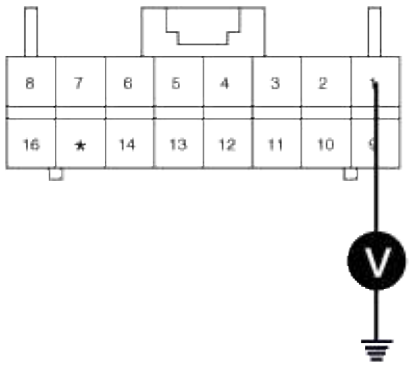
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect incar sensor.

(3) Measure Voltage between terminal "1" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



M04-1

1. Incar sensor temp. signal

(4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

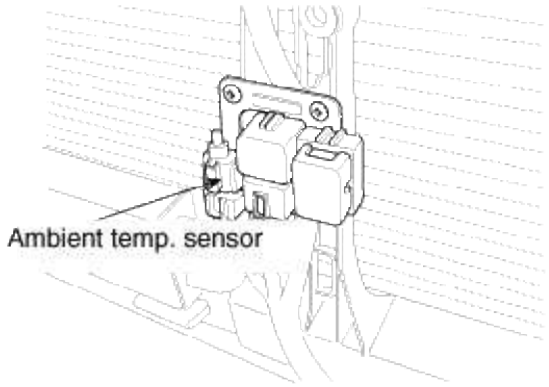
System is performing to specification at this time.

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

Heating,Ventilation, Air Conditioning > Troubleshooting > B1237

COMPONENT LOCATION



GENERAL DESCRIPTION

The ambient temperature senor located at the center stay 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.

DTC DESCRIPTION

The A/C controller sets DTC B1237 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 10.8kΩ)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Short circuit in harness • Faulty ambient temp. Sensor • Faulty A/C control unit
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 20°C(68°F)	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "AMBIENT TEMP. SENSOR" Parameter on the Scantool.

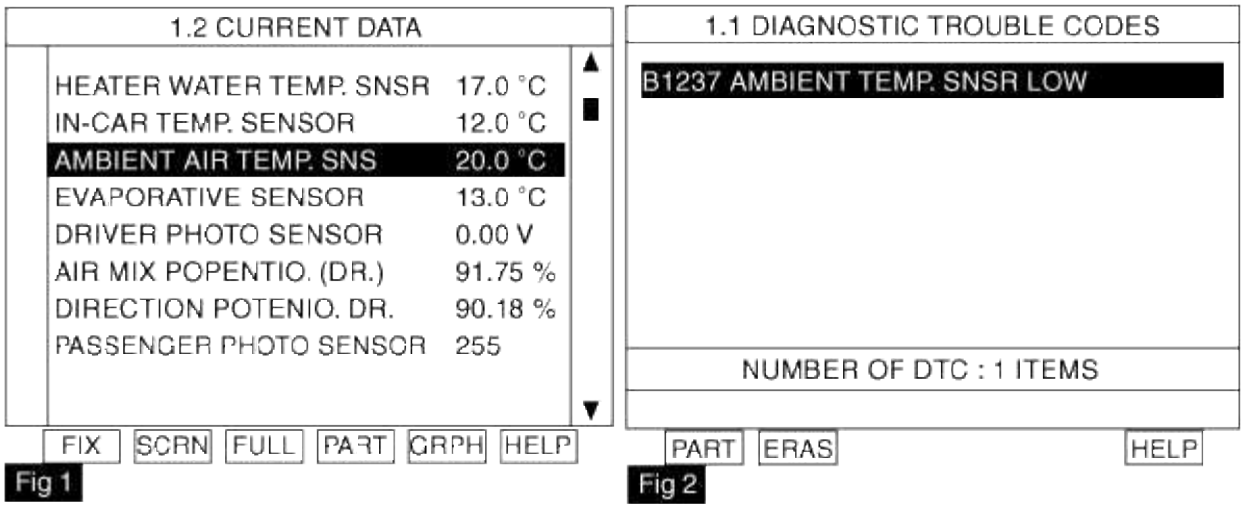


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1237.

4. Are the DTC B1237 present and is parameter of "AMBIENT TEMP. SENSOR" fixed?

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

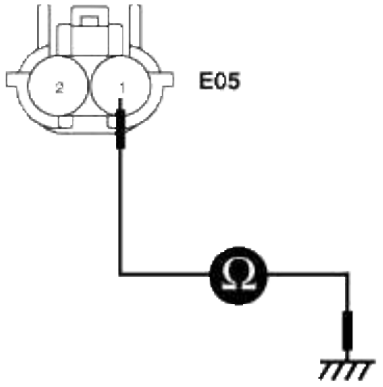
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect ambient temp. sensor.
   (3) Measure resistance between terminal "1" of ambient temp. sensor and chassis ground.

Specification : Approx. ∞Ω



1. Ambient temp. sensor signal
2. Ambient temp. sensor ground

   (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" procedu

COMPONENT INSPECTION

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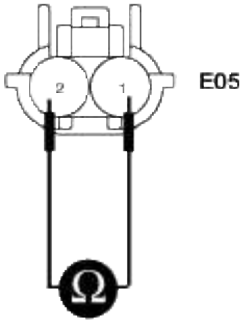
1. Check Ambient temp. sensor.
   (1) Ignition "OFF"
   (2) Disconnect ambient temp. sensor.
   (3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.

Specification : Refer the specifications in fig 3.



1. Ambient temp. sensor signal
2. Ambient temp. sensor ground

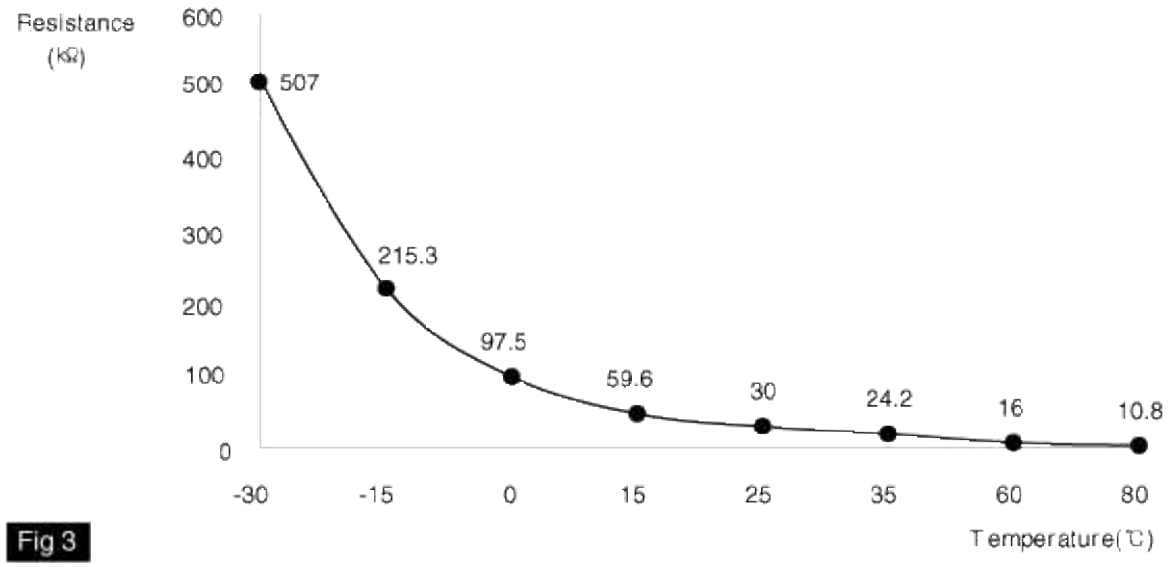


Fig 3

Fig 3) Specifications : Resistance value of ambient temp. sensor as a function of temperature.

   (4) Is the measured resistance within specifications in fig3? (tolerance limits ±3%)

YES

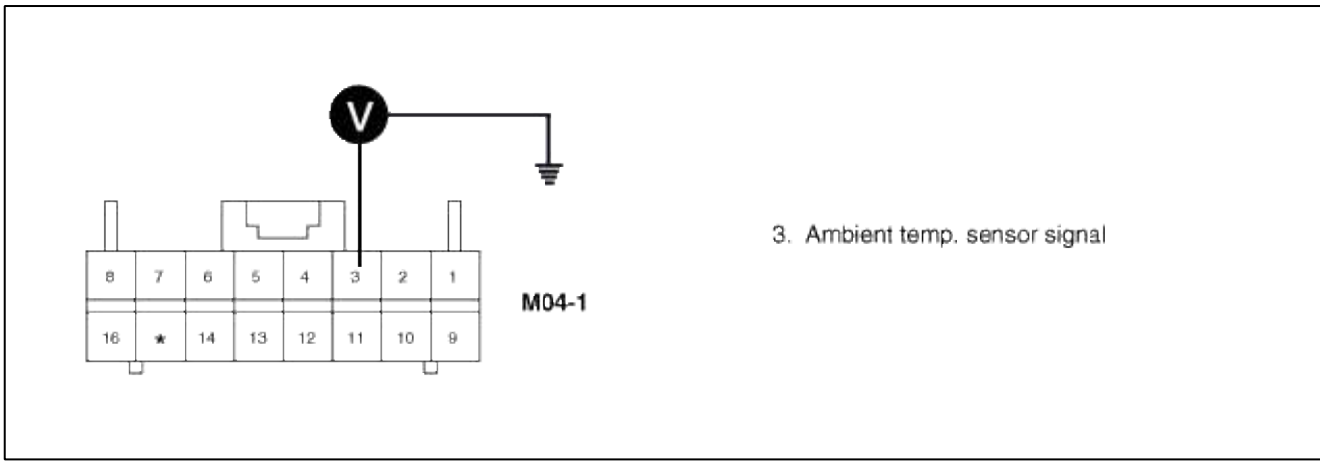
Go to "Check A/C Control Unit" procedure.

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" proc

2. Check A/C Control Unit
   (1) Engine "ON"
   (2) Disconnect ambient temp. sensor.
   (3) Measure voltage between terminal "3" of A/C Control Unit and chassis ground.

   Specification : Approx. 5V



   (4) Is the measured voltage within specifications?

   YES

   Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
   Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good A/C Control Unit and check for proper operation.
   If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

   YES

   Go to the applicable troubleshooting procedure.

   NO

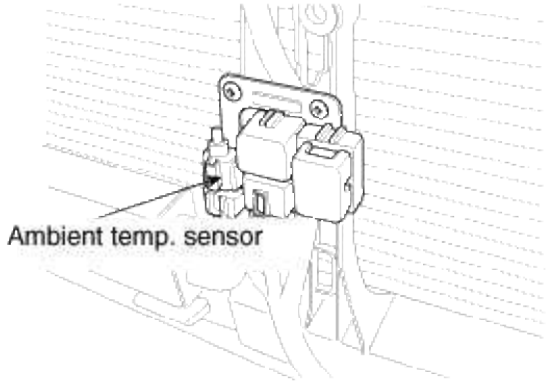
   System is performing to specification at this time.

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	507	25(77)	30
-15(5)	215.3	35(95)	24.2
0(32)	97.5	60(140)	16
15(59)	59.6	80(176)	10.8

tomsn048@gmail.com

COMPONENT LOCATION



GENERAL DESCRIPTION

The ambient temperature senor located at the center stay 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.

DTC DESCRIPTION

The A/C controller sets DTC B1238 if there is an open circuit in ambient temp. sensor signal harness or the measured resistance value of sensor is more than threshold value(about 507kΩ)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Open Circuit in harness • Faulty ambient temp. Sensor • Faulty A/C control unit
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of 20°C(68°F)	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"

3. Monitor the "AMBIENT TEMP. SENSOR" Parameter on the Scantool.
   Parameter of "AMBIENT TEMP. SENSOR" will be fixed at 20°C(67°F), if there is any fault in AMBIENT TEMP. SENSOR.

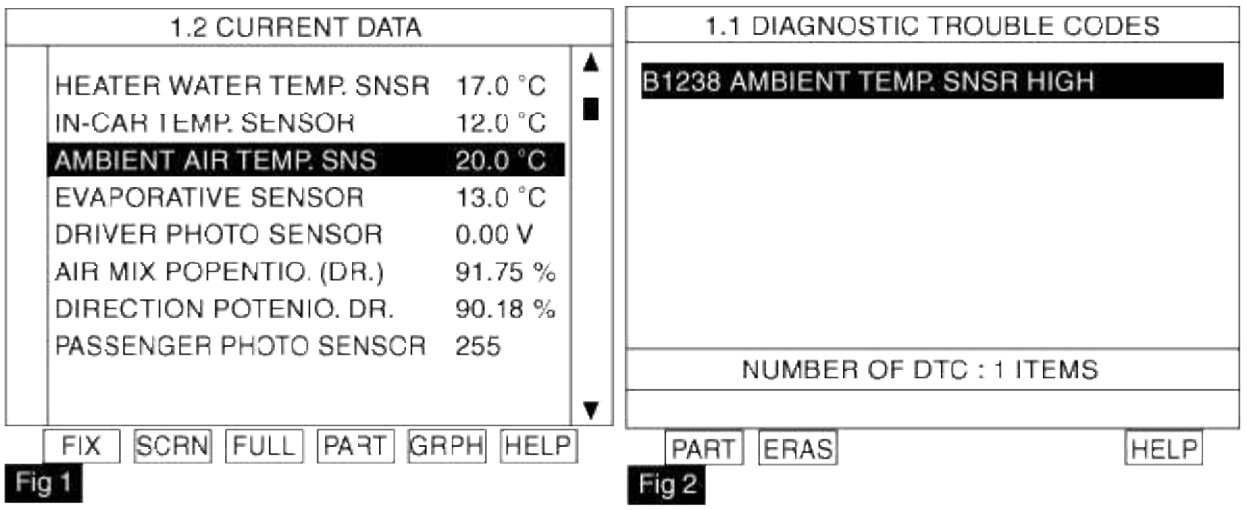


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1238.

4. Are the DTC B1238 present and is parameter of "AMBIENT TEMP. SENSOR" fixed?

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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

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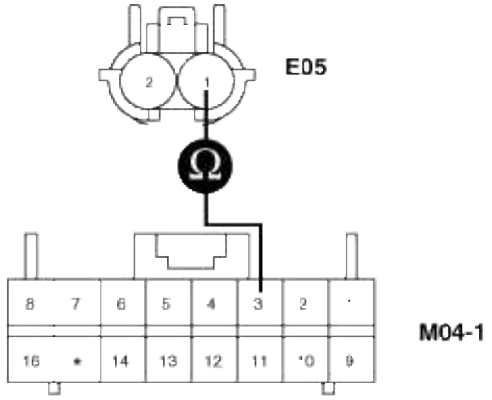
1. Check for open in harness.
   (1) Ignition "OFF"
   (2) Disconnect ambient temp. sensor.
   (3) Measure resistance between terminal "1" of ambient temp. sensor and terminal "3" of A/C Control Unit.

   Specification : Approx. 0 Ω



1. Ambient temp. sensor signal
2. Ambient temp. sensor ground

   (4) Is the measured resistance within specifications?

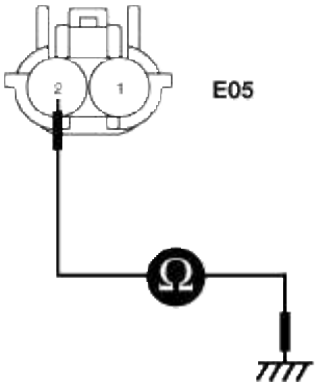
   YES
   Go to "Ground circuit Inspection " procedure.

   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



1. Ambient temp. sensor signal
2. Ambient temp. sensor ground

(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

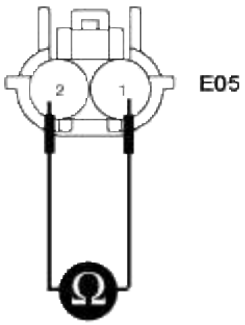
1. Check Ambient temp. sensor.

(1) Ignition "OFF"

(2) Disconnect ambient temp. sensor.

(3) Measure resistance between terminal "1" and "2" of ambient temp. sensor.

Specification : Refer the specifications in fig 3.



1. Ambient temp. sensor signal
2. Ambient temp. sensor ground

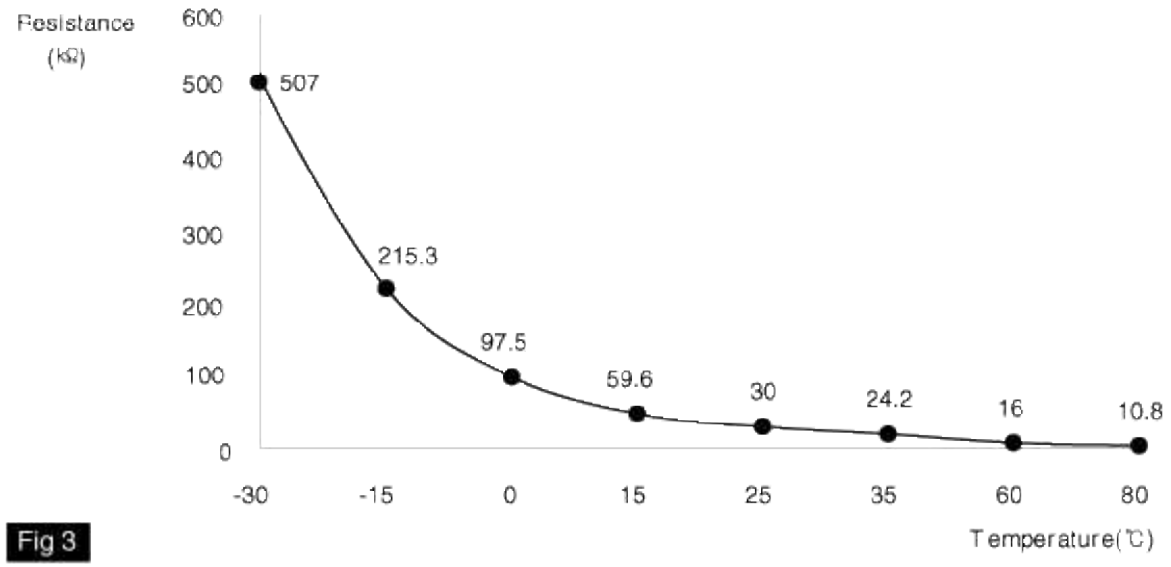


Fig 3

Fig 3) Specifications : Resistance value of ambient temp. sensor as a function of temperature.

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(4) Is the measured resistance within specifications in fig3? (tolerance limits ±3%)

YES

Go to "Check A/C Control Unit" 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" proc

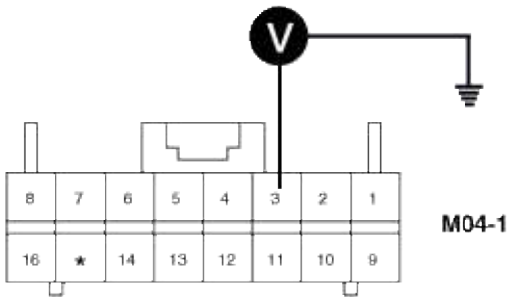
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect ambient temp. sensor.

(3) Measure voltage between terminal "3" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



3. Ambient temp. sensor signal

(4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

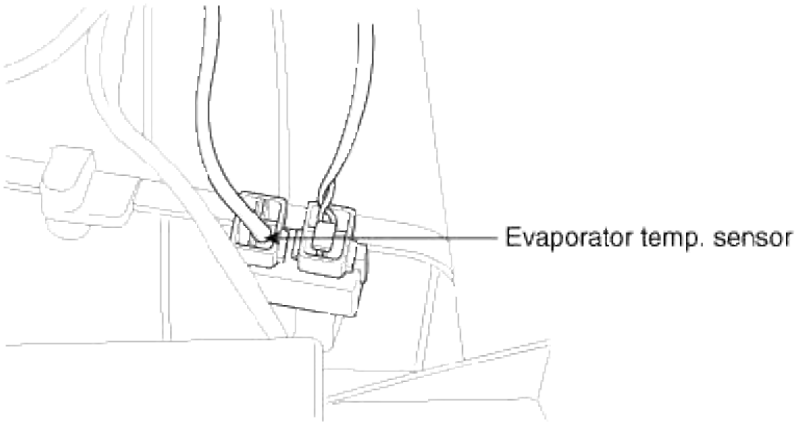
System is performing to specification at this time.

SPECIFICATION

Temperature[°C(°F)]	Resistance(kΩ)	Temperature[°C(°F)]	Resistance(kΩ)
-30(-22)	507	25(77)	30
-15(5)	215.3	35(95)	24.2
0(32)	97.5	60(140)	16
15(59)	59.6	80(176)	10.8

Heating,Ventilation, Air Conditioning > Troubleshooting > B1241

COMPONENT LOCATION



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.

DTC DESCRIPTION

The A/C controller sets DTC B1241 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 0.9kΩ)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Short circuit in harness • Faulty Evaporator temp. Sensor • Faulty A/C control unit
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

MONITOR SCANTOOL DATA

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1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

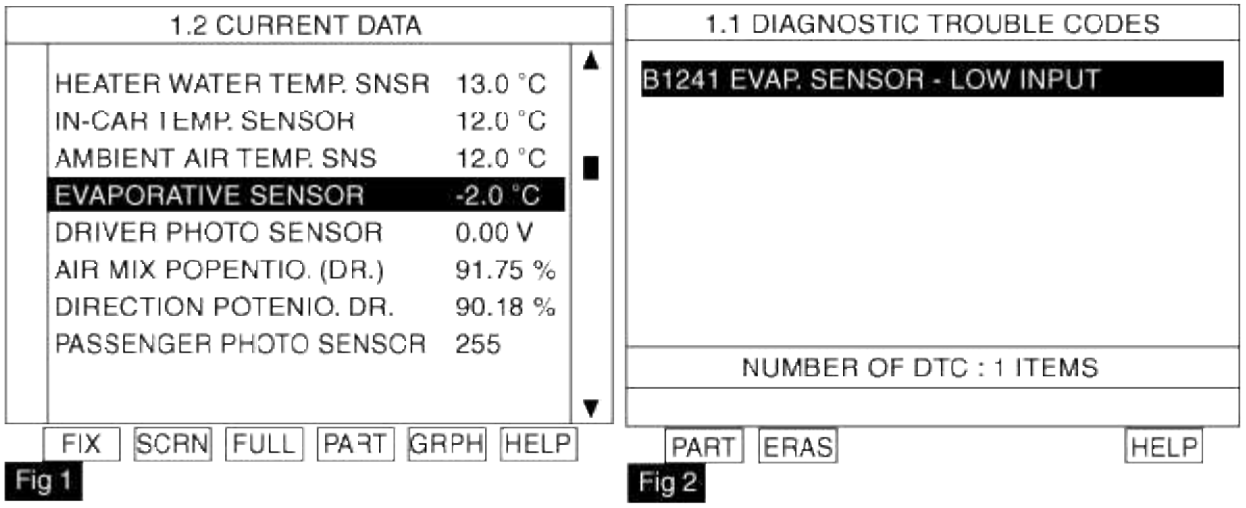


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1241.

4. Are the DTC B1241 present and is parameter of "EVAPORATIVE SENSOR" fixed?
   Parameter of "EVAPORATIVE SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in EVAPORATIVE SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

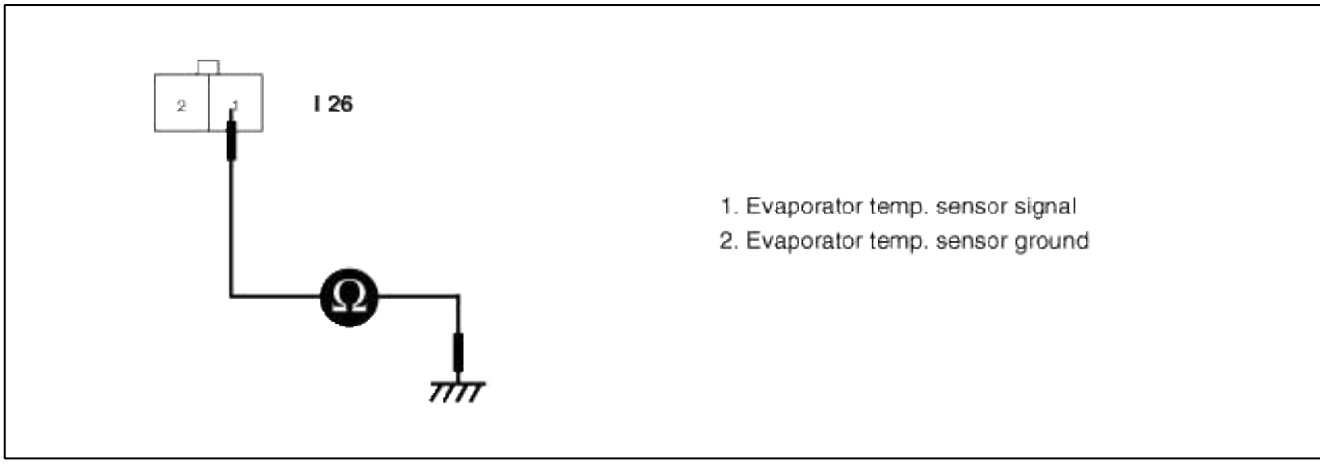
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect evaporator temp. sensor.
   (3) Measure resistance between terminal "1" of evaporator temp. sensor and chassis ground.

   Specification : Approx. ∞Ω



   (4) Is the measured resistance within specifications?

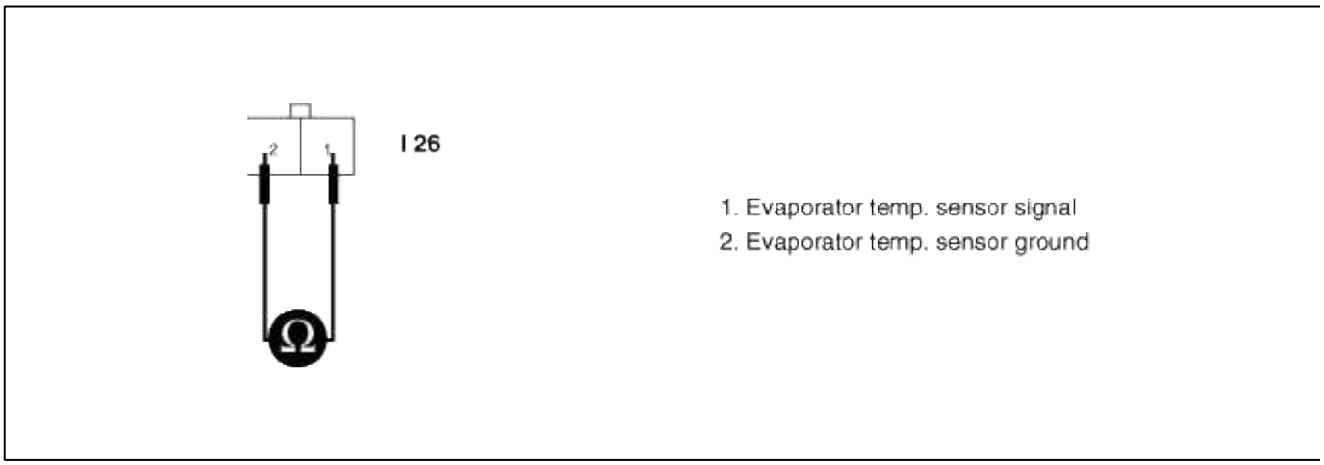
   YES
   Go to "Component Inspection" procedure.

   NO
   Check for short to ground in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedu

COMPONENT INSPECTION

1. Check evaporator temp. sensor.
   (1) Ignition "OFF"
   (2) Disconnect evaporator temp. sensor.
   (3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.

   Specification : Refer the specifications in fig 3.



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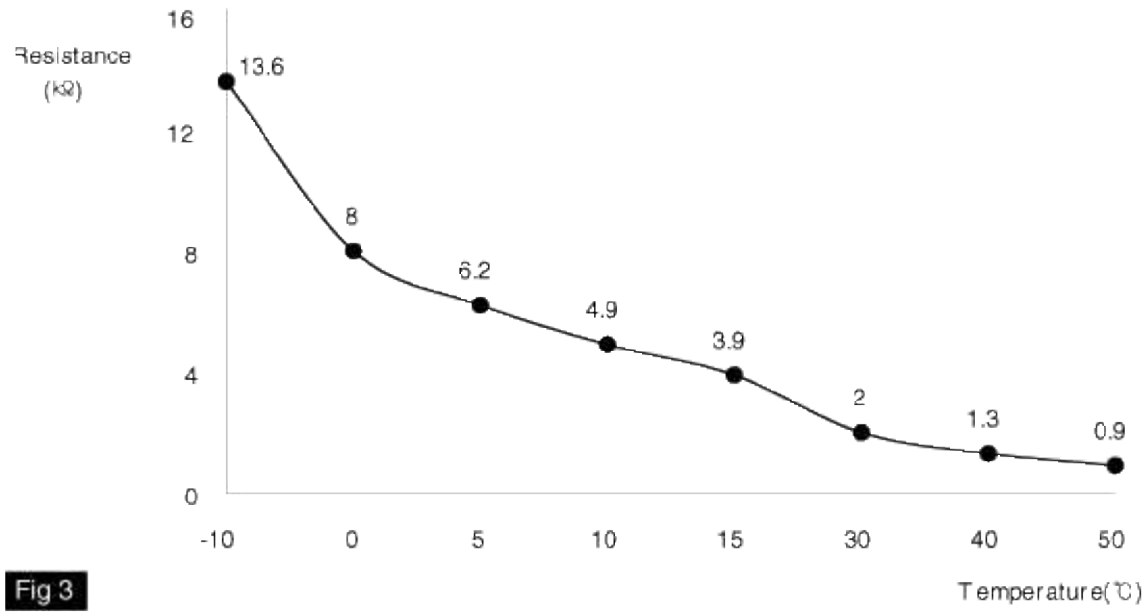


Fig 3

Fig 3) Specifications : Resistance value of evaporator temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits ±3%)

YES

Go to "Check A/C Control Unit" 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.

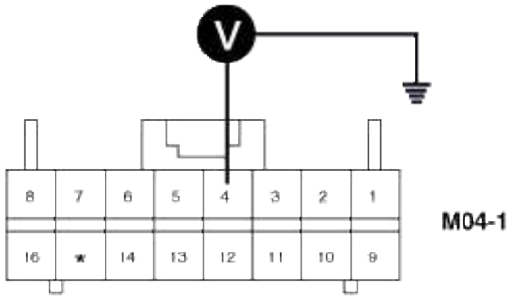
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect evaporator temp. sensor.

(3) Measure voltage between terminal "4" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



4. Evaporator temp. sensor signal

(4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

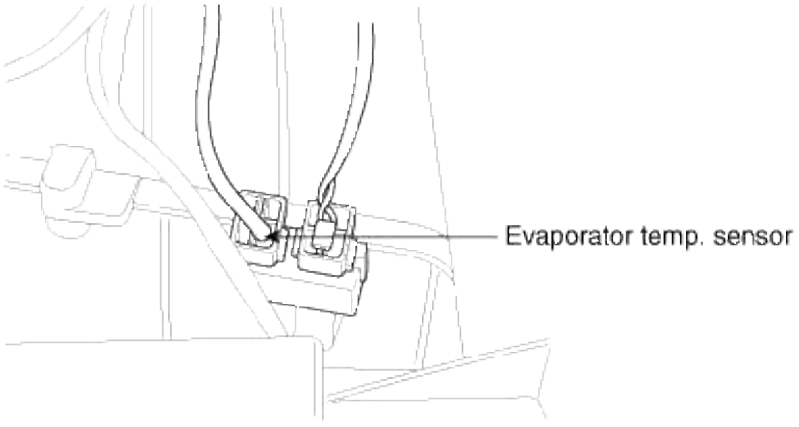
System is performing to specification at this time.

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

Heating,Ventilation, Air Conditioning > Troubleshooting > B1242

COMPONENT LOCATION



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.

DTC DESCRIPTION

The A/C controller sets DTC B1242 if there is an open circuit in evaporator temp. sensor signal harness or the measured resistance value of sensor is more than threshold value(about 13.6kΩ)

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Open Circuit in harness • Faulty Evaporator temp. Sensor • Faulty A/C control unit
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Control with the value of -2°C(28.4°F)	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "EVAPORATIVE SENSOR" Parameter on the Scantool.

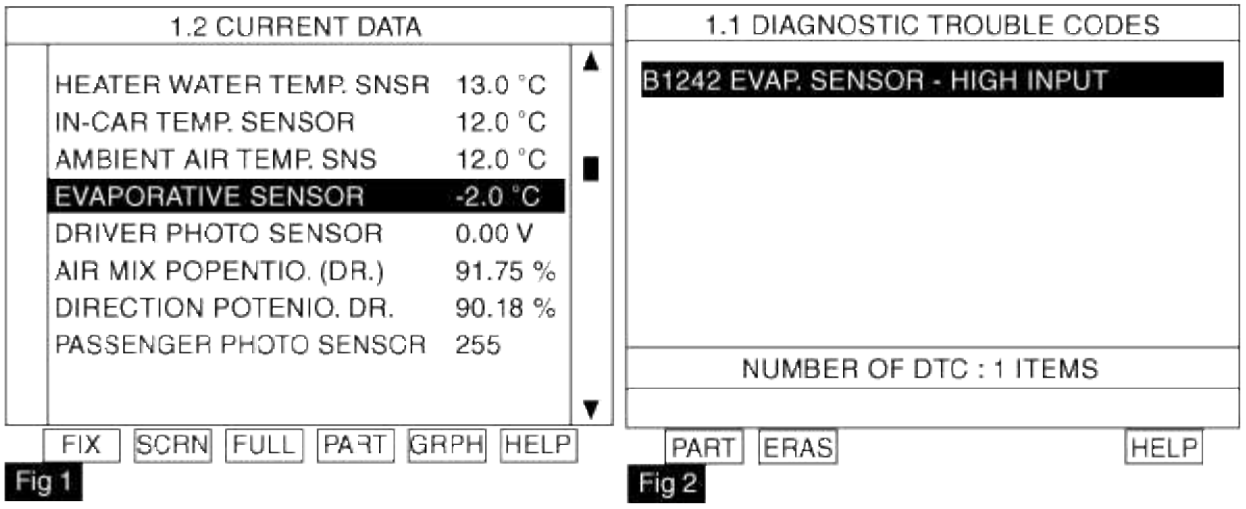


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1242.

4. Are the DTC B1242 present and is parameter of "EVAPORATIVE SENSOR" fixed?
   Parameter of "EVAPORATIVE SENSOR" will be fixed at -2°C(28.4°F), if there is any fault in EVAPORATIVE SENSOR.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

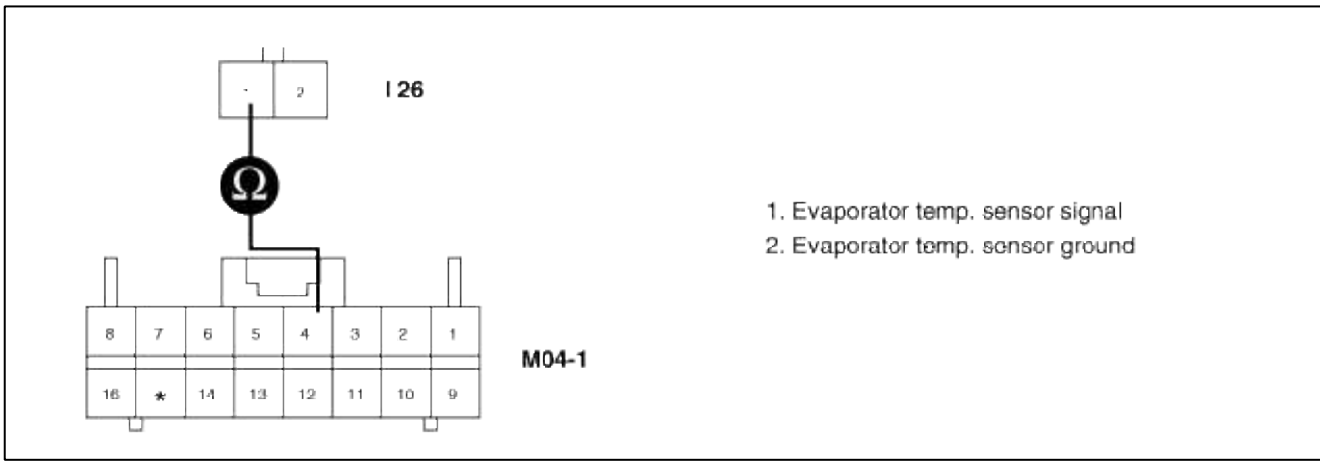
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   (1) Ignition "OFF"
   (2) Disconnect evaporator temp. sensor.
   (3) Measure resistance between terminal "1" of evaporator temp. sensor and terminal "4" of A/C Control Unit.

Specification : Approx. 0 Ω



   (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

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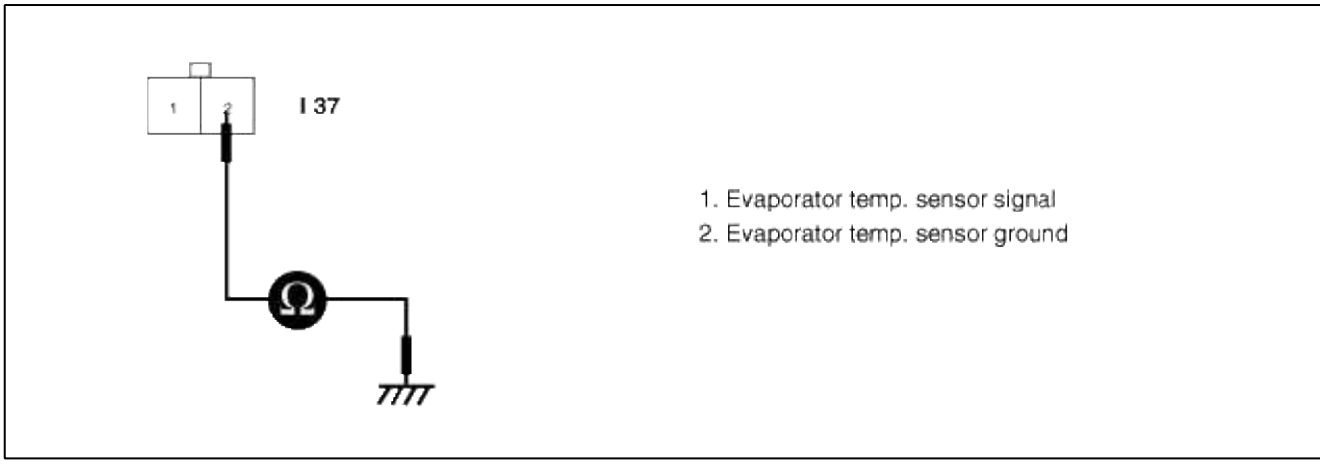
1. Check for open in ground harness.
   (1) Ignition "OFF"
   (2) Disconnect evaporator temp. sensor.
   (3) Measure resistance between terminal "2" of evaporator temp. sensor and chassis ground.

   Specification : Approx. 0 Ω



   (4) Is the measured resistance within specifications?

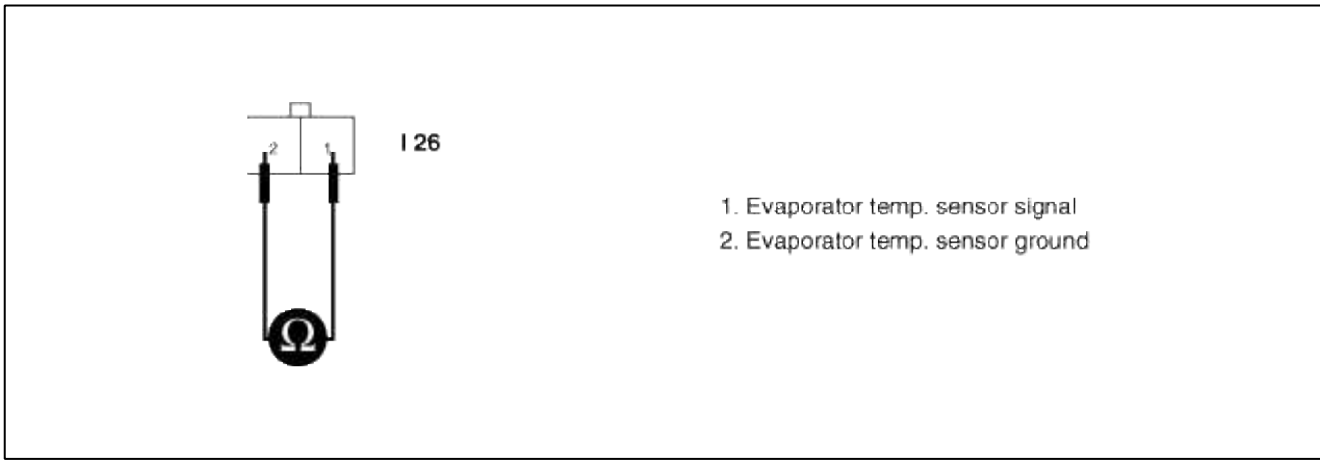
   YES
   Go to "Ground circuit Inspection " procedure.

   NO
   Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check evaporator temp. sensor.
   (1) Ignition "OFF"
   (2) Disconnect evaporator temp. sensor.
   (3) Measure resistance between terminal "1" and "2" of evaporator temp. sensor.

   Specification : Refer the specifications in fig 3.



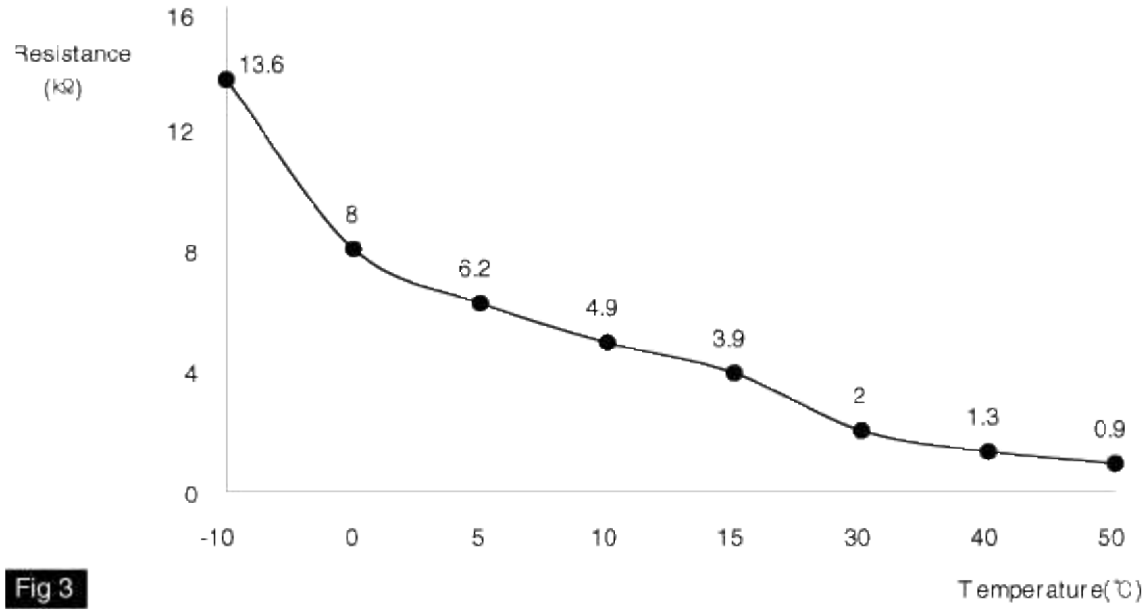


Fig 3

Fig 3) Specifications : Resistance value of evaporator temp. sensor as a function of temperature.

(4) Is the measured resistance within specifications in fig3? (tolerance limits ±3%)

YES

Go to "Check A/C Control Unit" 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.

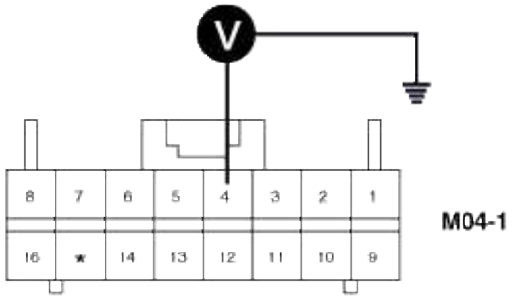
2. Check A/C Control Unit

(1) Engine "ON"

(2) Disconnect evaporator temp. sensor.

(3) Measure voltage between terminal "4" of A/C Control Unit and chassis ground.

Specification : Approx. 5V



4. Evaporator temp. sensor signal

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(4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

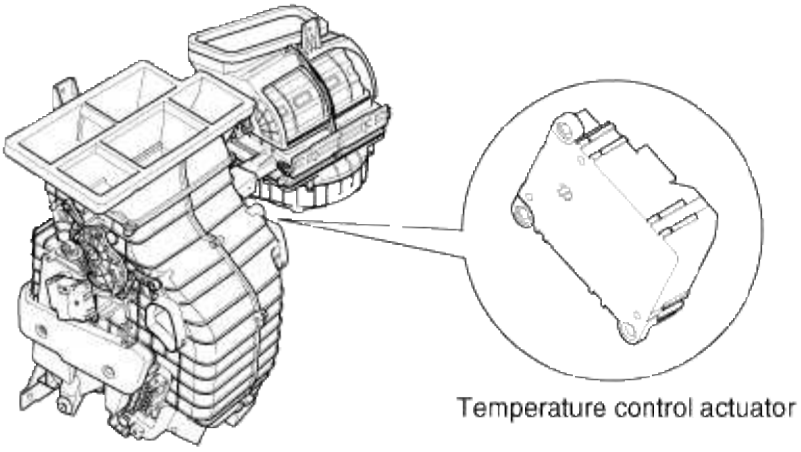
System is performing to specification at this time.

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

Heating,Ventilation, Air Conditioning > Troubleshooting > B1245

COMPONENT LOCATION



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.

DTC DESCRIPTION

The A/C controller sets DTC B1245 if there is an open circuit or poor connection in the air mix potentiometer.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC 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	
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.	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Driver Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

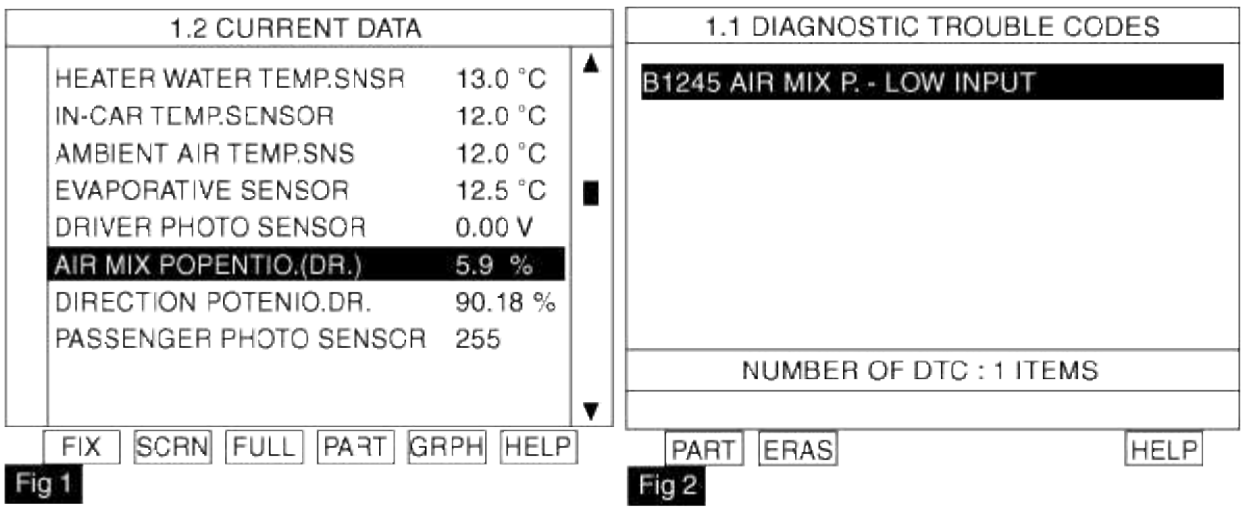


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1245.

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4. Are the DTC B1245 present and is parameter of "Driver Air Mix Potentiometer" fixed?
   Parameter of "Driver Air Mix Potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Air Mix potentiometer.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

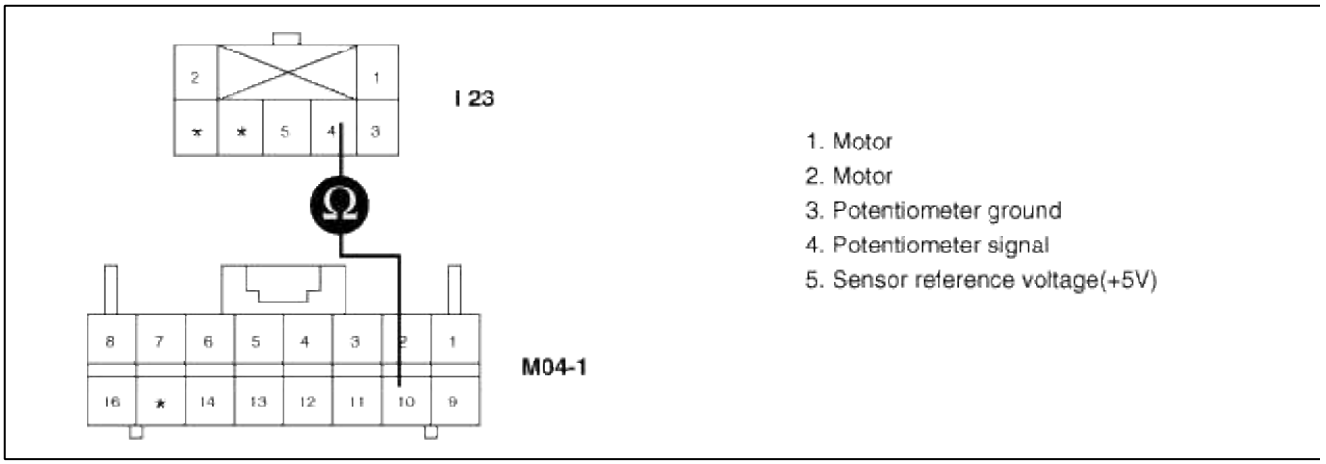
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   (1) Ignition "OFF"
   (2) Disconnect Driver Air Mix potentiometer.
   (3) Measure resistance between terminal "4" of Driver Air Mix Potentiometer and terminal "10" of A/C control un

Specification : Approx. 0 Ω



   (4) Is the measured resistance within specifications?

YES

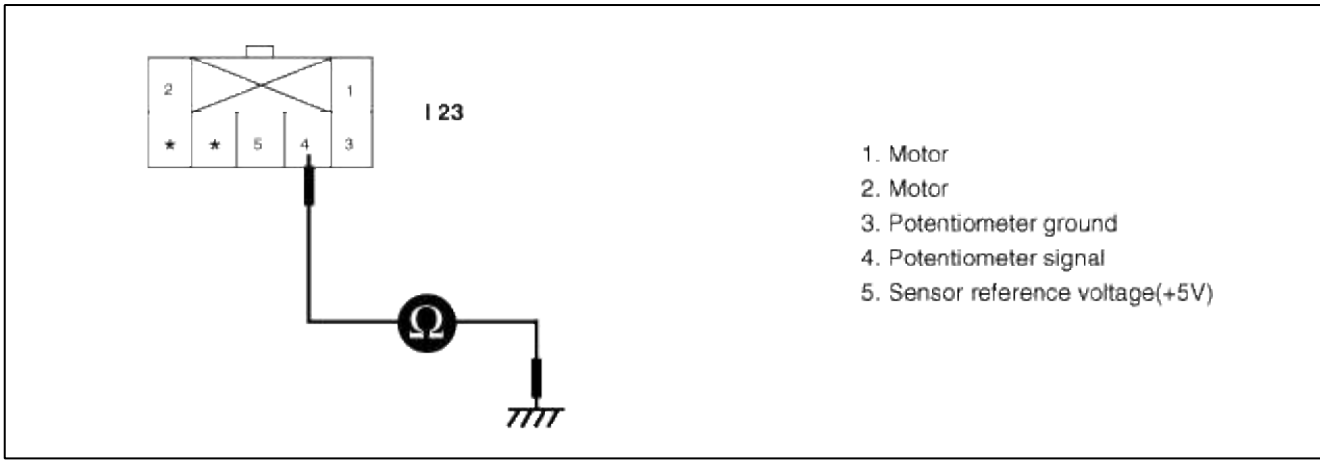
Go to "Check for short to ground in harness" procedure.

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.
   (3) Measure resistance between terminal "4" of Driver Air Mix Potentiometer and chassis ground.

   Specification : Approx. ∞ Ω



   (4) Is the measured resistance within specifications?

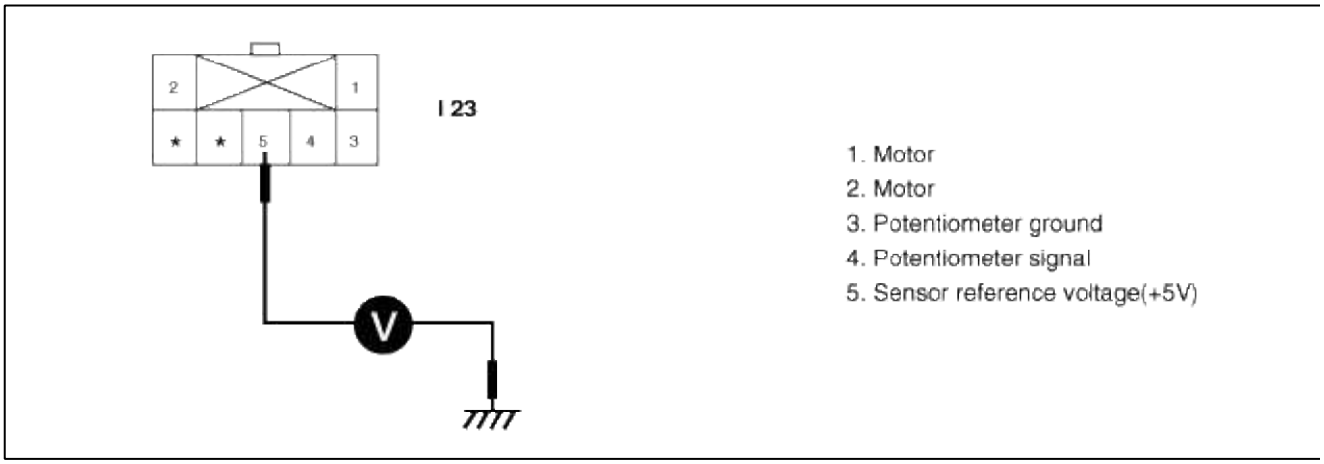
   YES
   Go to "Power circuit Inspection" procedure.

   NO
   Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. Check for short or open in harness.
   (1) Ignition "ON"
   (2) Connect Driver Air Mix Potentiometer.
   (3) Measure voltage between terminal "5" of Driver Air Mix Potentiometer and chassis ground.

   Specification : Approx. 5V



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(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

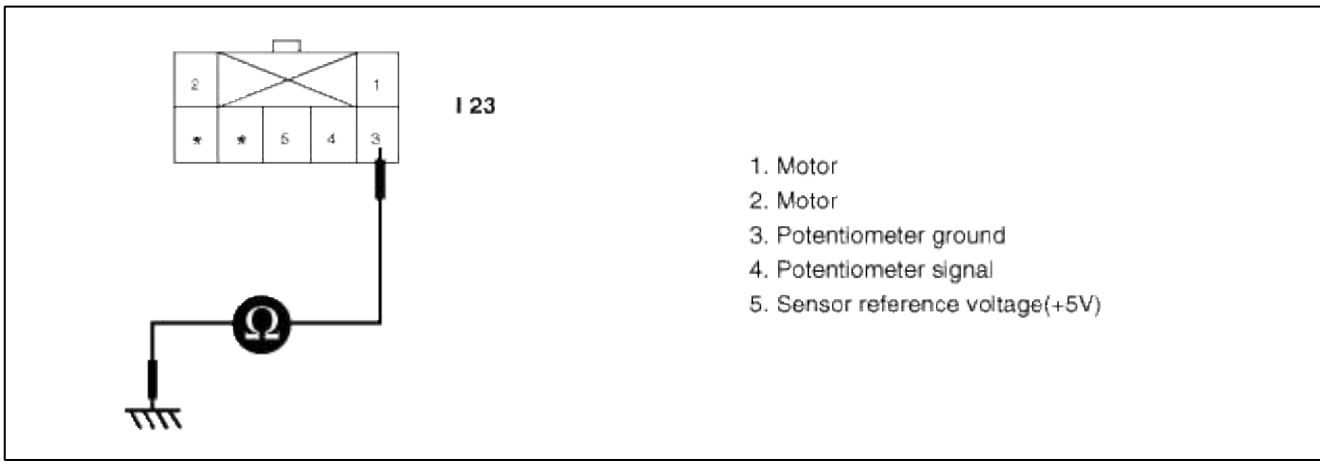
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Driver Air Mix Potentiometer.

(3) Measure resistance between terminal "3" of Driver Air Mix Potentiometer and chassis ground.

Specification : Approx. 0 Ω



(4) Is the measured resistance within specifications?

YES

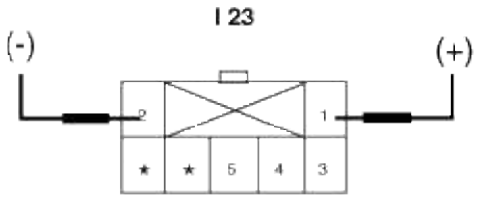
Go to "Component Inspection" procedure.

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.
   (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.



1. Motor
2. Motor
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

   (5) Dose the actuator work properly?

   YES

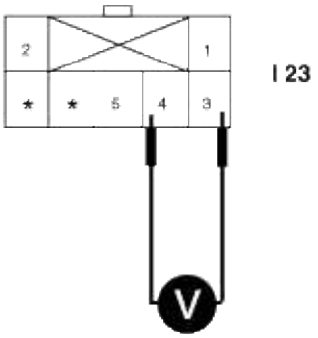
   Go to "Check potentiometer" procedure.

   NO

   Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

2. Check potentiometer
   (1) Ignition "ON"
   (2) Connect Driver Air Mix potentiometer.
   (3) Measure voltage between terminal "3" and "4" of Driver Air Mix potentiometer while operating the temp. swit

Specification : Refer the specifications in fig 3)



I 23

1. Motor
2. Motor
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

Door position	Voltage (3-4)	Error detecting
MAX. Cooling	0.3 ± 0.15V	Low voltage : 0.08V or les
MAX. Heating	4.7 ± 0.15V	High voltage : 4.9V or mo

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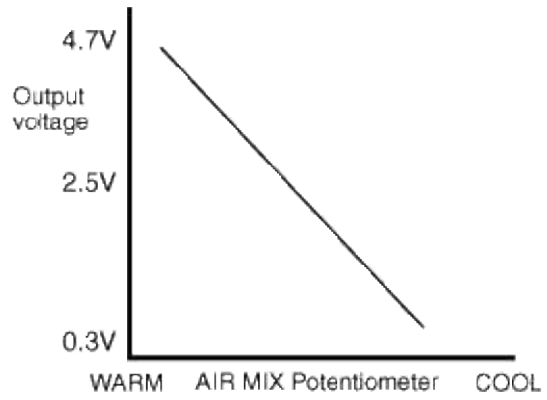


Fig 3

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of temperatur door.

(4) Is the measured voltage within specifications in fig3?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag 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 a 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. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

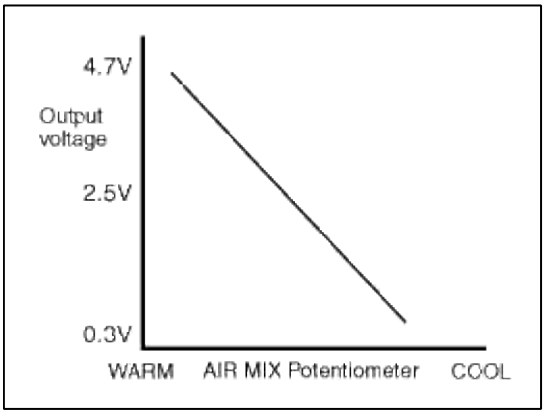
YES

Go to the applicable troubleshooting procedure.

NO

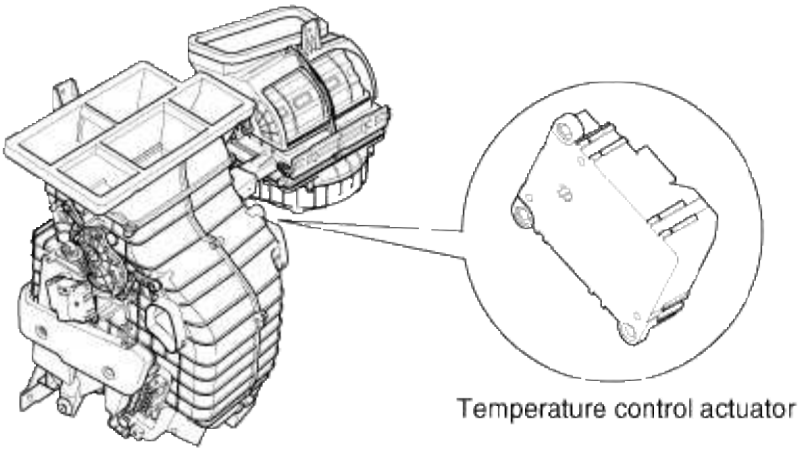
System is performing to specification at this time.

SPECIFICATION



Heating,Ventilation, Air Conditioning > Troubleshooting > B1246

COMPONENT LOCATION



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.

DTC DESCRIPTION

The A/C controller sets DTC B1246 if there is a short to power in the air mix potentiometer.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Short circuit in harness • Faulty driver Air Mix potentiometer
Threshold value	• > 4.9V	
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.	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"

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3. Monitor the "Driver Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

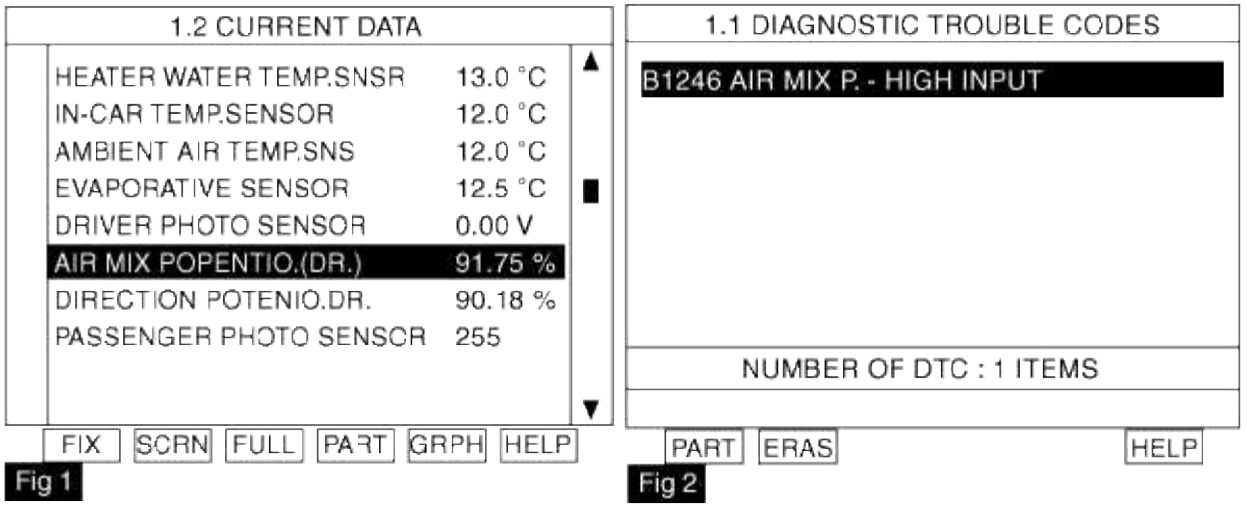


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1246.

4. Are the DTC B1246 present and is parameter of "Driver Air Mix potentiometer" fixed?
   Parameter of "Driver Air Mix potentiometer" will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Air Mix potentiometer.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

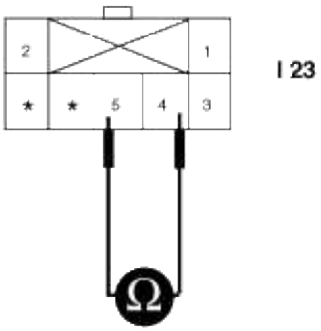
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for short in harness.
   (1) Ignition "OFF"
   (2) Disconnect Driver Air Mix potentiometer.
   (3) Measure resistance between terminal "5" and "4" of Driver Air Mix potentiometer.

   Specification : Approx. ∞ Ω



I 23

1. Motor
2. Motor
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

   (4) Is the measured resistance within specifications?

   YES

   Go to "Ground circuit Inspection" procedure.

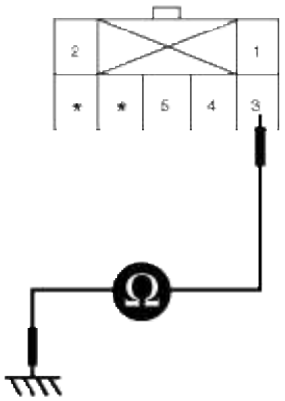
   NO

   Check for short to power harness in signal harness. Repair as necessary and go to "Verification of Vehicle Rep procedure.

GROUND CIRCUIT INSPECTION

1. Check for open in harness.
   (1) Ignition "OFF"
   (2) Disconnect Driver Air Mix Potentiometer.
   (3) Measure resistance between terminal "3" of Driver Air Mix Potentiometer and chassis ground.

   Specification : Approx. 0 Ω



I 23

1. Motor
2. Motor
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

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(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

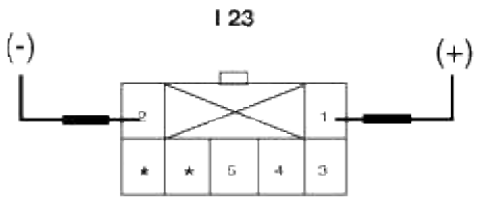
1. Check actuator motor.

(1) Ignition "OFF"

(2) Disconnect Driver Air Mix Potentiometer.

(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.



1. Motor
2. Motor
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

(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 a and then go to "Verification of Vehicle Repair" procedure.

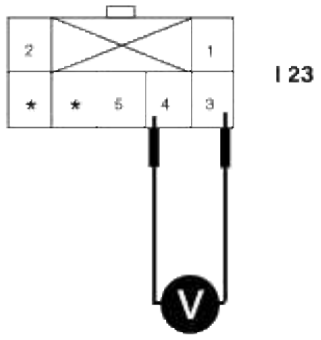
2. Check potentiometer

(1) Ignition "ON"

(2) Connect Driver Air Mix potentiometer.

(3) Measure voltage between terminal "3" and "4" of Driver Air Mix potentiometer while operating the temp. swit

Specification : Refer the specifications in fig 3)



I 23

1. Motor
2. Motor
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

Door position	Voltage (3-4)	Error detecting
MAX. Cooling	0.3 ± 0.15V	Low voltage : 0.08V or les
MAX. Heating	4.7 ± 0.15V	High voltage : 4.9V or mo

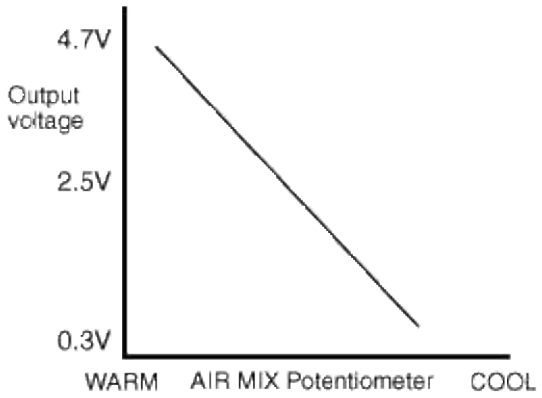


Fig 3

Fig 3) Specifications : Voltage value of air mix potentiometer as a function of position of temperatur door.

(4) Is the measured voltage within specifications in fig3?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
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 a
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. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.

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3. Are any DTCs present?

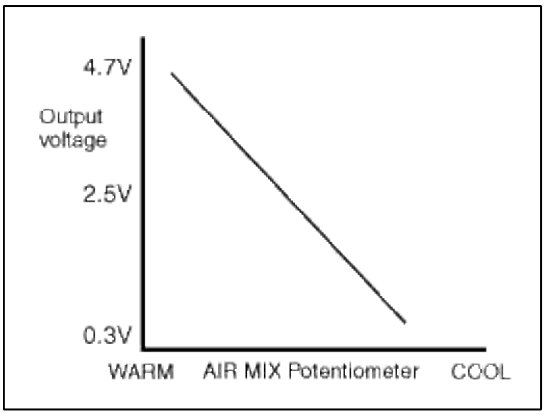
YES

Go to the applicable troubleshooting procedure.

NO

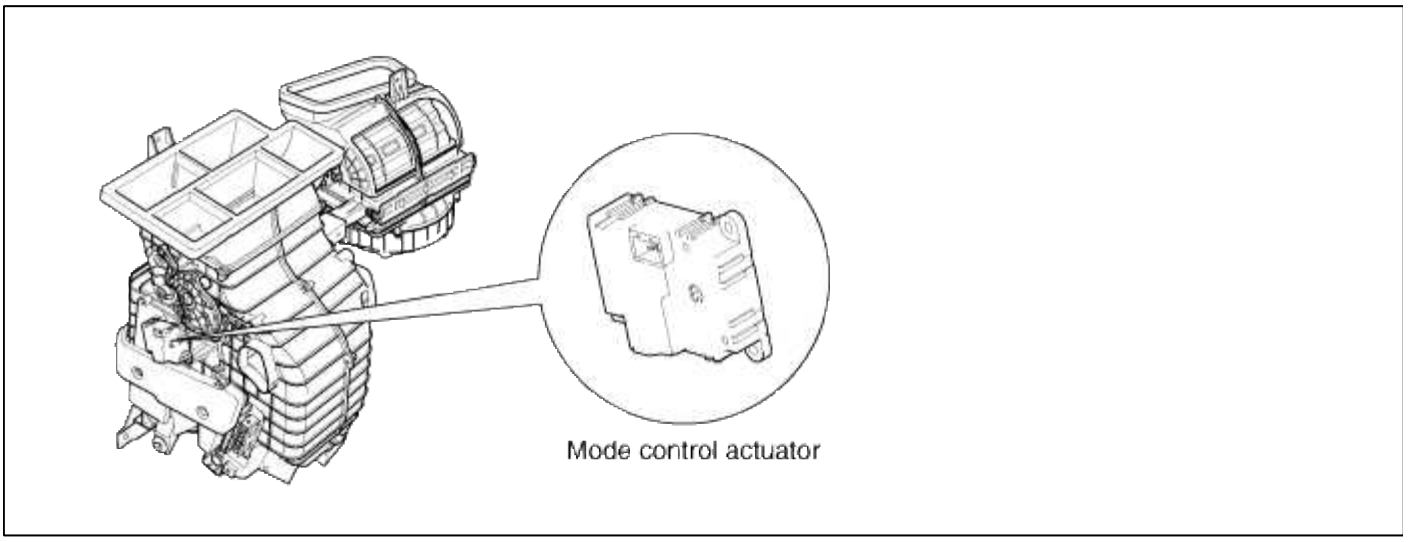
System is performing to specification at this time.

SPECIFICATION



Heating,Ventilation, Air Conditioning > Troubleshooting > B1249

COMPONENT LOCATION



GENERAL DESCRIPTION

The mode control actuator mounted on heater unit, adjusts position of mode door by operating Direction Motor 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.

DTC DESCRIPTION

The A/C controller sets DTC B1249 if there is an open circuit or poor connection in the Direction potentiometer.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Poor connection of connected part • Open circuit in harness • Short circuit in harness • Faulty driver direction potentiometer
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Fix vent position, while selecting vent mode. • Fix defrost position while selecting except vent mode.	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR. DIRECTION POTENTIO." parameter on the scantool while operating mode switch.

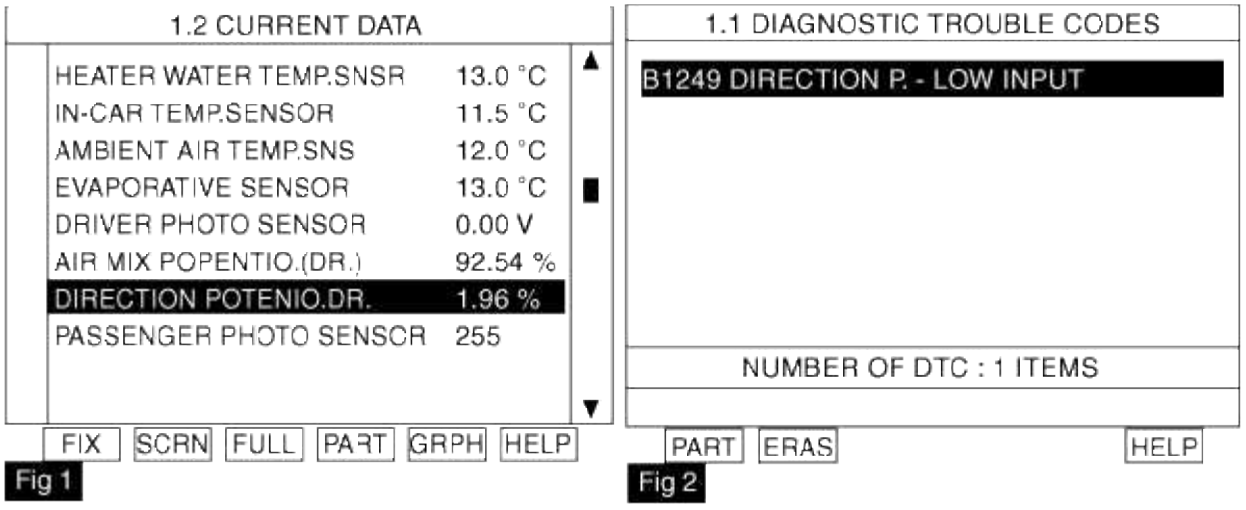


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1249.

4. Are the DTC B1249 present and is parameter of "DR. DIRECTION POTENTIO." fixed?
   Parameter of "DR. DIRECTION POTENTIO." will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Direction potentiometer.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

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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

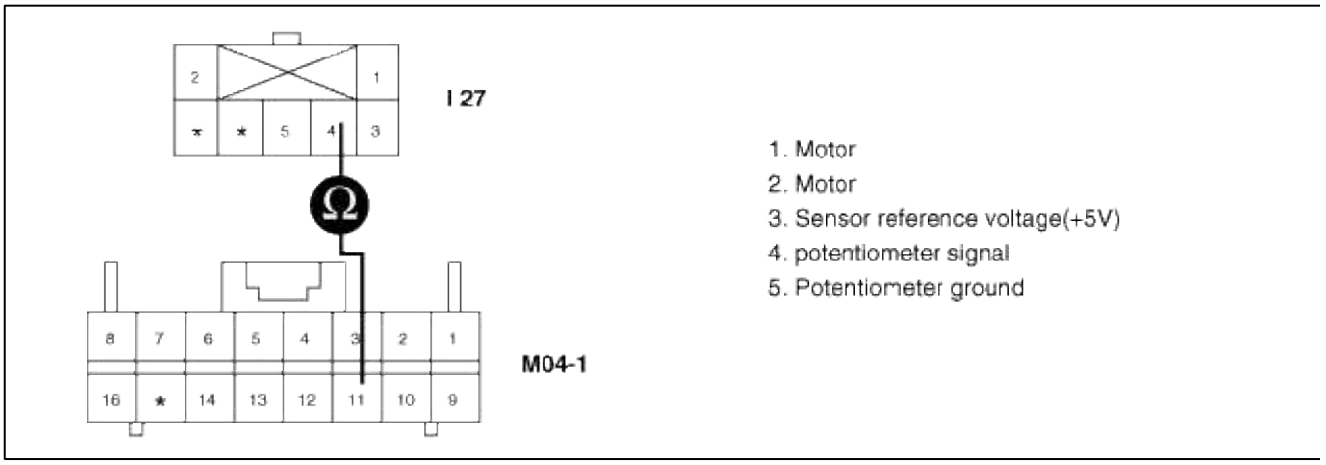
1. Check for open in harness.

(1) Ignition "OFF"

(2) Disconnect Driver mode Actuator.

(3) Measure resistance between terminal "4" of Driver Direction potentiometer and terminal "11" of A/C control u

Specification : Approx. 0 Ω



(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.

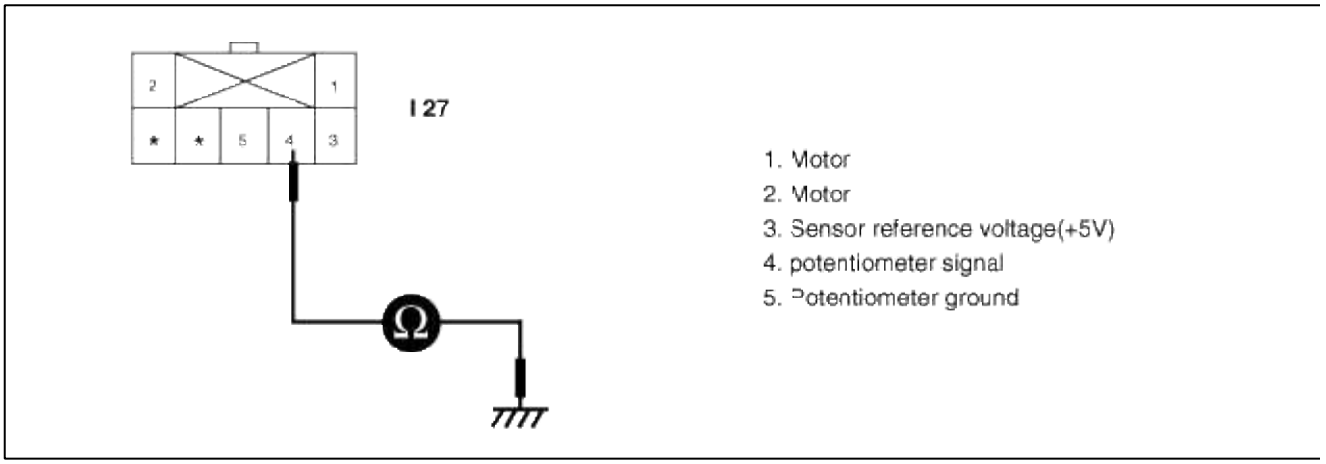
2. Check for short to ground in harness.

(1) Ignition "OFF"

(2) Disconnect Driver mode Actuator.

(3) Measure resistance between terminal "4" of Driver Direction potentiometer and chassis ground.

Specification : Approx. ∞ Ω



(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.

POWER SUPPLY CIRCUIT INSPECTION

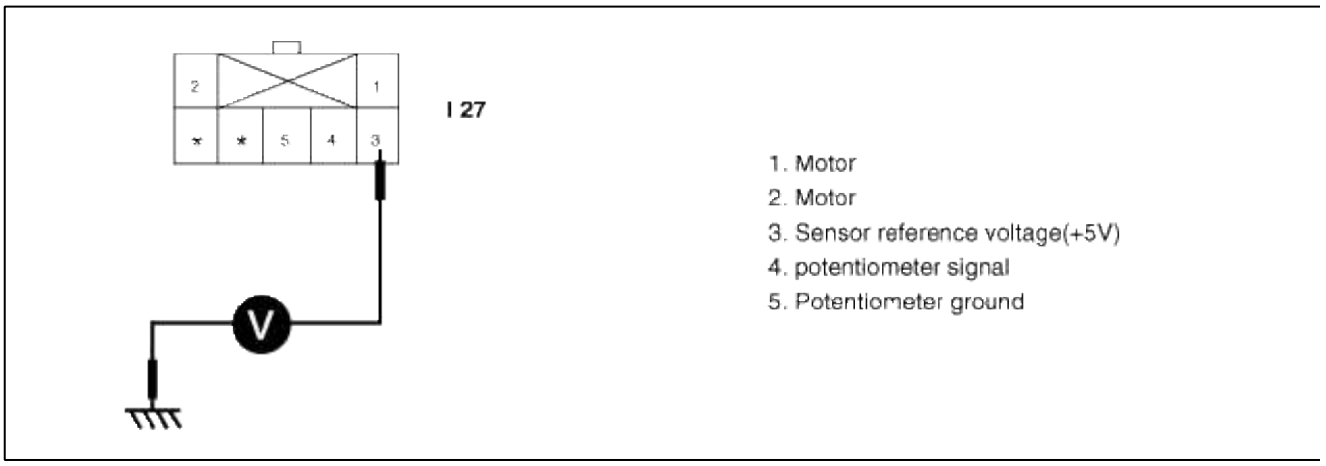
1. Check for short or open in harness.

(1) Ignition "ON"

(2) Connect Driver Direction potentiometer.

(3) Measure voltage between terminal "3" of Driver Direction potentiometer and chassis ground.

Specification : Approx. 5V



(4) Is the measured voltage within specifications?

YES

Go to "Component Inspection" procedure.

NO

Check for short or open in power harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

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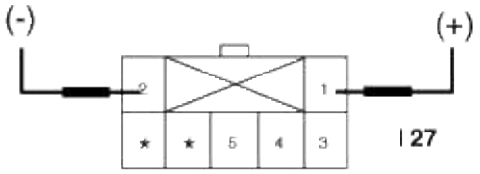
1. Check actuator.
   (1) Ignition "OFF"
   (2) Disconnect Driver Direction potentiometer.
   (3) Verify that the mode actuator operates to the vent mode when connecting 12V to the terminal 1 and grounding terminal 2.
   (4) Verify that the mode actuator operates to the def mode when the connections are reversed.



1. Motor
2. Motor
3. Sensor reference voltage(+5V)
4. potentiometer signal
5. Potentiometer ground

   (5) Dose the actuator work properly?

   YES

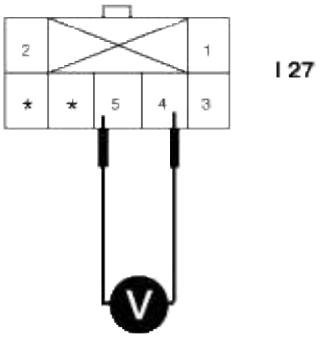
   Go to "Check potentiometer" procedure.

   NO

   Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

2. Check potentiometer
   (1) Ignition "ON"
   (2) Connect Driver Direction potentiometer.
   (3) Measure voltage between terminal "4" and "5" of Driver Direction potentiometer as the mode switch is operat

Specification : Refer the specifications in fig 3



1. Motor
2. Motor
3. Sensor reference voltage(+5V)
4. potentiometer signal
5. Potentiometer ground

Door position	Voltage (3-4)	Error detecting
VENT	0.3 ± 0.15V	Under voltage : 0.08V or le Over voltage : 4.92V or mo
BI-LEVEL(1)	1.35 ± 0.4V	
BI-LEVEL(2)	2.25 ± 0.4V	
FLOOR	3.0 ± 0.4V	
MIX	3.6 ± 0.4V	
DEF	4.7 ± 0.15V	

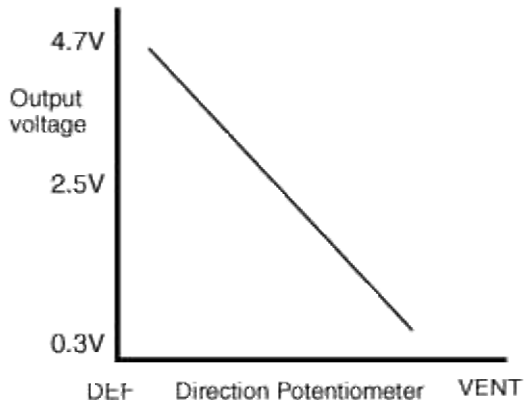


Fig 3

Fig 3) Specifications : Voltage value as a function of position of direction potentiometer.

(4) Is the measured voltage within specifications in fig3?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
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 a
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. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

SPECIFICATION

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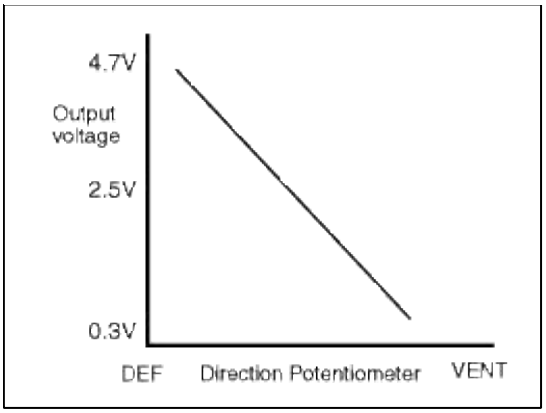
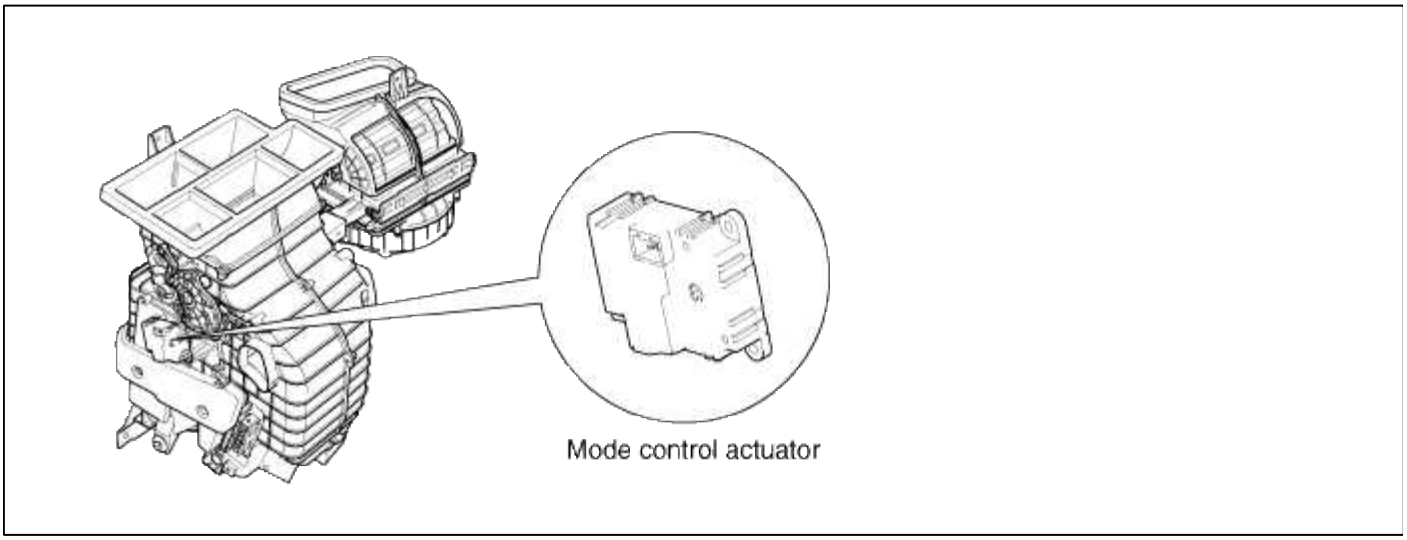


Heating,Ventilation, Air Conditioning > Troubleshooting > B1250

COMPONENT LOCATION



GENERAL DESCRIPTION

The mode control actuator mounted on heater unit, adjusts position of mode door by operating Direction Motor 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.

DTC DESCRIPTION

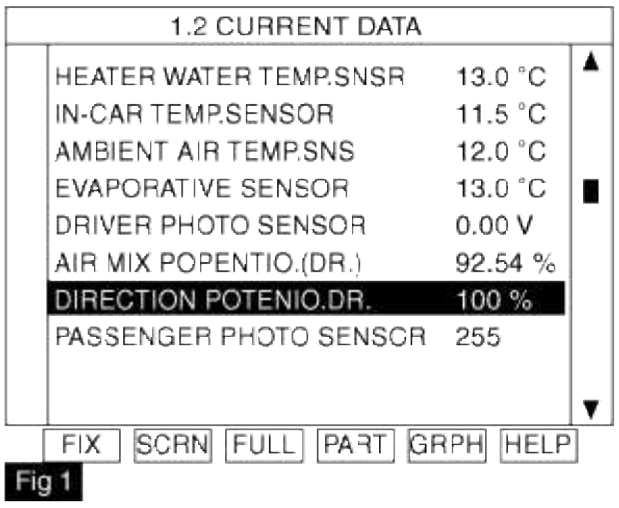
The A/C controller sets DTC B1250 if there is a short to power in the Direction potentiometer.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Short circuit in harness • Faulty driver direction potentiometer
Threshold value	• > 4.9V	
Detecting time	• 0.3 sec	
FAIL SAFE	• Fix vent position, while selecting vent mode. • Fix defrost position while selecting except vent mode.	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "DR. DIRECTION POTENTIO." parameter on the scantool while operating mode switch.



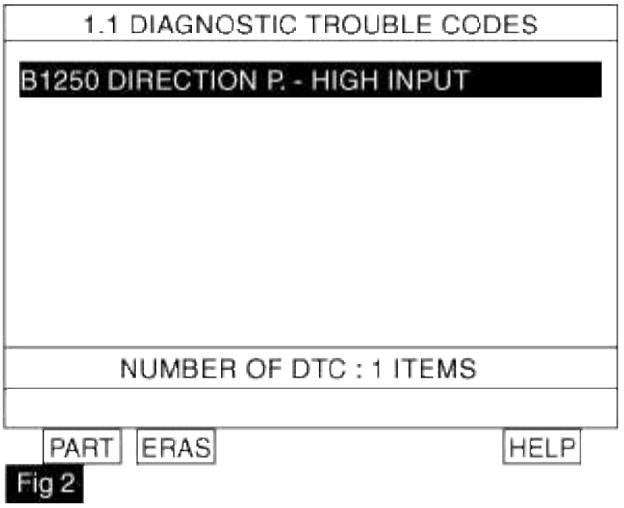


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B1250.

4. Are the DTC B1250 present and is parameter of "DR. DIRECTION POTENTIO." fixed?
   Parameter of "DR. DIRECTION POTENTIO." will be fixed at 100%(or any value above 90%), or 0% (or any value below 10%), if there is any fault in Driver Direction potentiometer.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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

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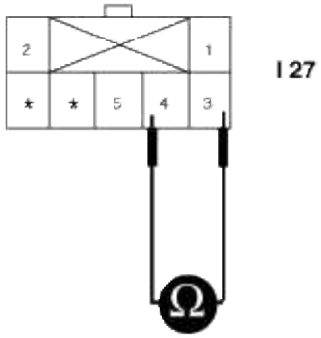
1. Check for short in harness.
   (1) Ignition "OFF"
   (2) Disconnect Driver mode Actuator.
   (3) Measure resistance between terminal "3" and "4"of Driver Direction potentiometer.

   Specification : Approx. ∞ Ω



I 27

1. Motor
2. Motor
3. Sensor reference voltage(+5V)
4. potentiometer signal
5. Potentiometer ground

   (4) Is the measured resistance within specifications?

   YES

   Go to "Check for short to ground in harness" procedure.

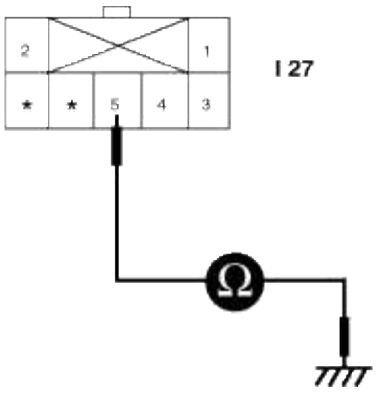
   NO

   Check for open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. Check for open in ground harneS.
   (1) Ignition "OFF"
   (2) Disconnect Driver mode Actuator.
   (3) Measure resistance between terminal "5" of evaporator sensor and chassis ground.

   Specification :Approx. 0 Ω



I 27

1. Motor
2. Motor
3. Sensor REF +5V
4. Potentiometer signal
5. Potentiometer GND

(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

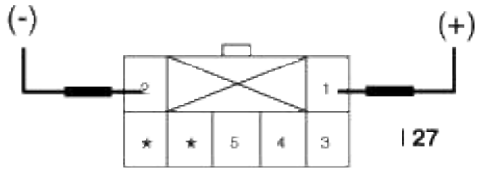
1. Check actuator.

(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 the connections are reversed.



1. Motor
2. Motor
3. Sensor reference voltage(+5V)
4. potentiometer signal
5. Potentiometer ground

(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 a and then go to "Verification of Vehicle Repair" procedure.

2. Check potentiometer

(1) Ignition "ON"

(2) Connect Driver Direction potentiometer.

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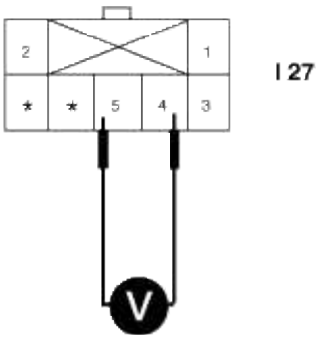
(3) Measure voltage between terminal "4" and "5" of Driver Direction potentiometer as the mode switch is operat

Specification : Refer the specifications in fig 3



I 27

1. Motor
2. Motor
3. Sensor reference voltage(+5V)
4. potentiometer signal
5. Potentiometer ground

Door position	Voltage (3-4)	Error detecting
VENT	0.3 ± 0.15V	Under voltage : 0.08V or le Over voltage : 4.92V or mo
BI-LEVEL(1)	1.35 ± 0.4V	
BI-LEVEL(2)	2.25 ± 0.4V	
FLOOR	3.0 ± 0.4V	
MIX	3.6 ± 0.4V	
DEF	4.7 ± 0.15V	

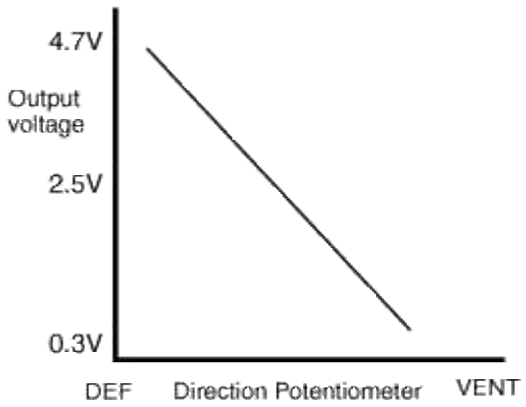


Fig 3

Fig 3) Specifications : Voltage value as a function of position of direction potentiometer.

(4) Is the measured voltage within specifications in fig3?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
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 a
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. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

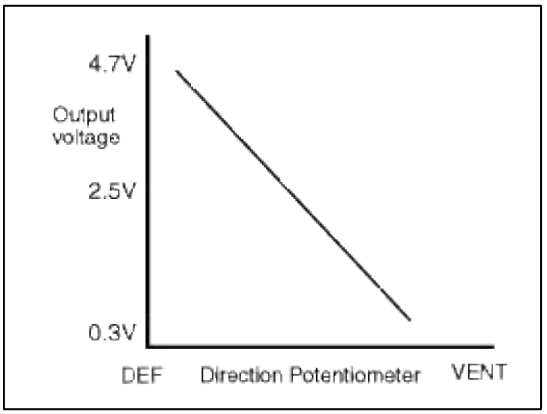
YES

Go to the applicable troubleshooting procedure.

NO

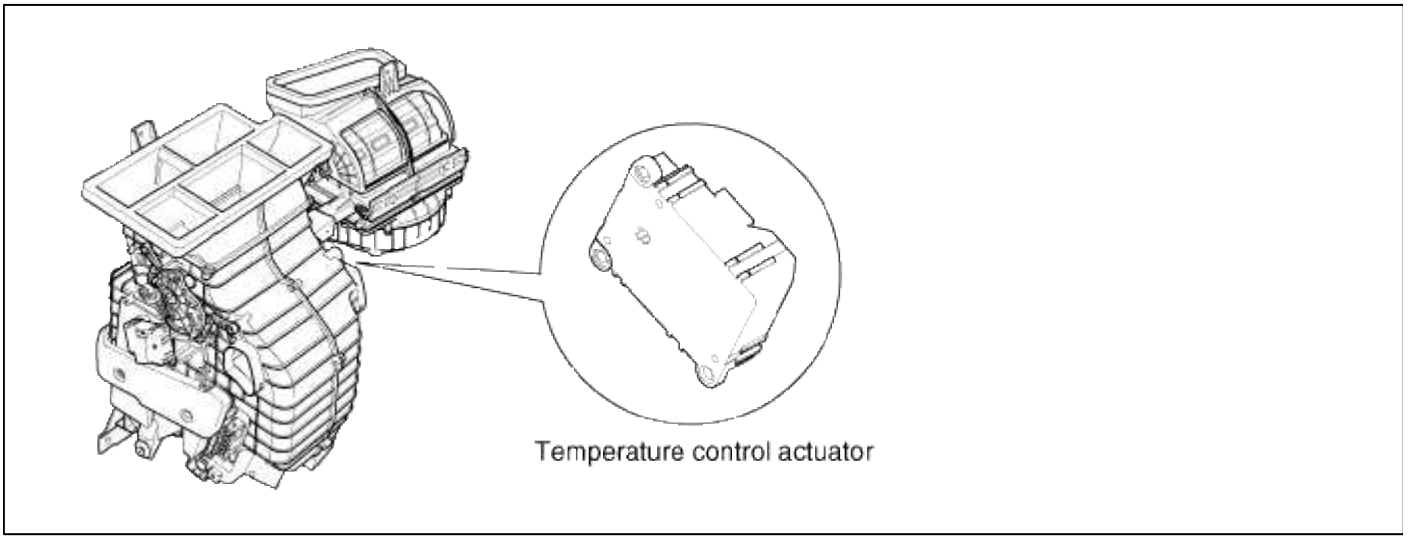
System is performing to specification at this time.

SPECIFICATION



Heating,Ventilation, Air Conditioning > Troubleshooting > B2406

COMPONENT LOCATION



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. then temperature will be regulated by the hot/cold air ratio decided by position of temp. door.

DTC DESCRIPTION

The A/C controller sets DTC B2406 if the air mix actuator doesn't move to intended position within 40sec (In this

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case, A/C controller try to move temp. door for 2sec. 3 times, every 20 sec. before setting DTC).

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Poor connection of connected part • Open circuit in harness • Short circuit in harness • Faulty driver Air Mix potentiometer • Fault A/C Control Unit
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Driver Air Mix Potentiometer" Parameter on the Scantool while operating temp. switch.

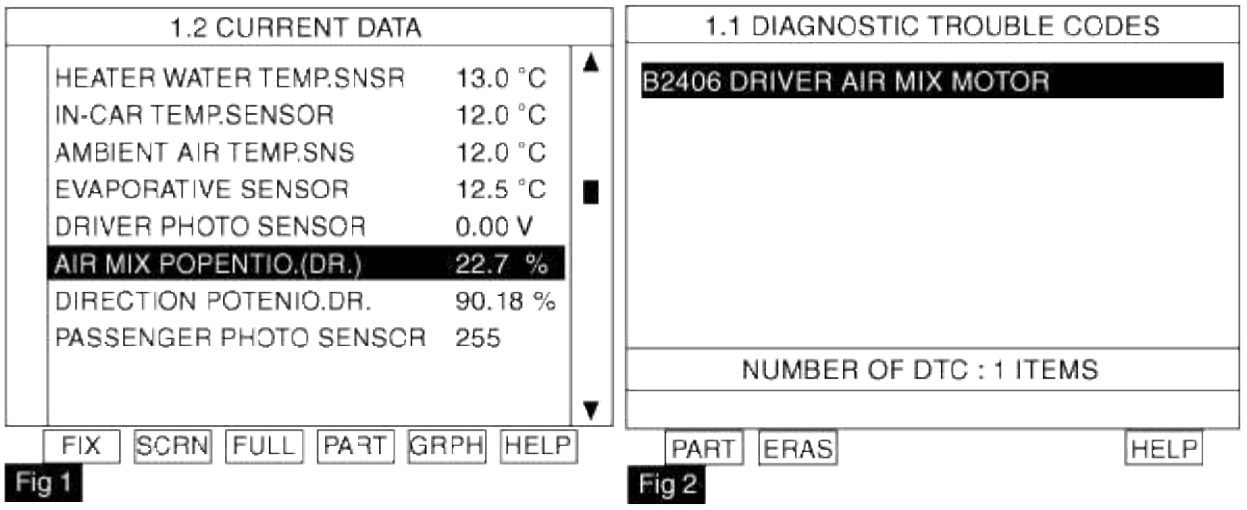


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B2406.

4. Are the DTC B2406 present and is parameter of "Driver AIR MIX Potentiometer" fixed?

There is any fault in Driver AIR MIX Motor. If the parameter of "Driver AIR MIX DOOR" is 30% or less when the actuator operates to the hot position, or If the parameter is 60% and more when the actuator operates to the cold position.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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.

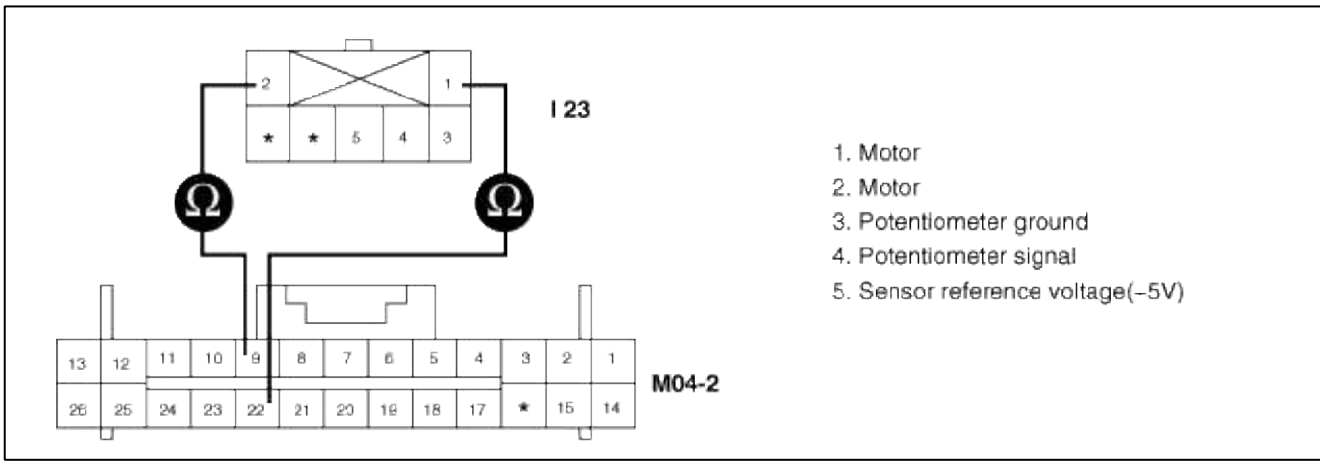
NO

Go to "Component Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

1. Check for open in harness.
   (1) Ignition "OFF"
   (2) Disconnect Driver Air Mix potentiometer.
   (3) Measure resistance between terminal "1,2" of Driver Air Mix Motor and terminal "9,22" of A/C control unit.

Specification : Approx. 0 Ω



   (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.

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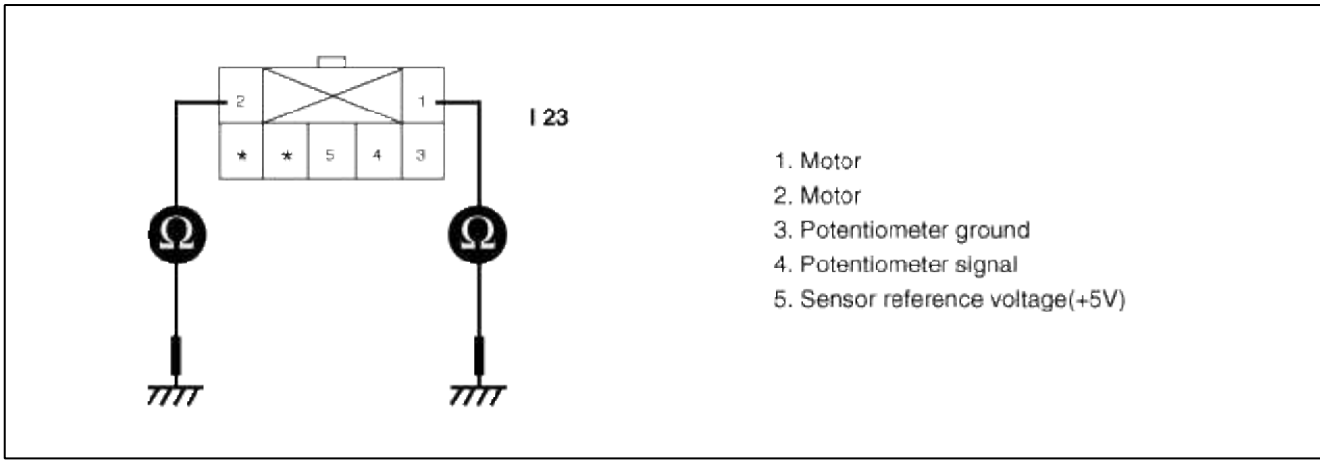
2. Check for short to ground in harness.
   (1) Ignition "OFF"
   (2) Disconnect Driver Air Mix Actuator.
   (3) Measure resistance between terminal "1,2" of Driver Air Mix Motor and chassis ground.

   Specification : Approx. ∞ Ω



   (4) Is the measured resistance within specifications?

   YES

   Go to "Visual/Physical Inspection " procedure.

   NO

   Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VISUAL/PHYSICAL INSPECTION

1. Check actuator.

   Check if Driver Air Mix Actuator works properly through ACTUATION TEST.

   (1) Ignition : ON
   (2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

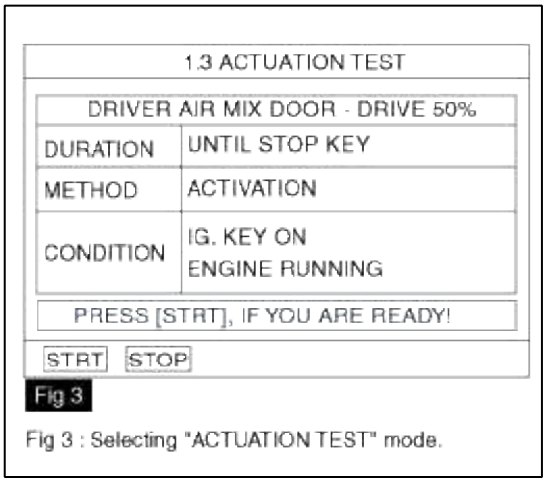


Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Dose Driver Air Mix Actuator work properly?

YES

Go to "Component Inspection" procedure.

NO

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.

COMPONENT INSPECTION

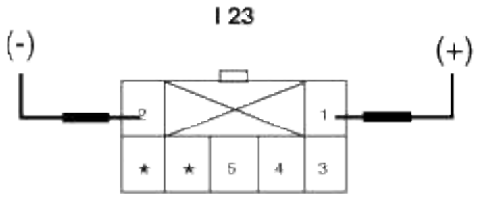
1. Check actuator motor.

(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.



1. Motor
2. Motor
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

(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 a and then go to "Verification of Vehicle Repair" procedure.

2. Check potentiometer

(1) Ignition "ON"

(2) Connect Driver Air Mix potentiometer.

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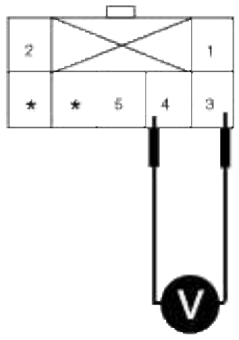
(3) Measure voltage between terminal "3" and "4" of Driver Air Mix potentiometer while operating the temp. swit

Specification : Refer the specifications in fig 3)



I 23

1. Motor
2. Motor
3. Potentiometer ground
4. Potentiometer signal
5. Sensor reference voltage(+5V)

Door position	Voltage (3-4)	Error detecting
MAX. Cooling	0.3 ± 0.15V	Low voltage : 0.08V or les
MAX. Heating	4.7 ± 0.15V	High voltage : 4.9V or mo

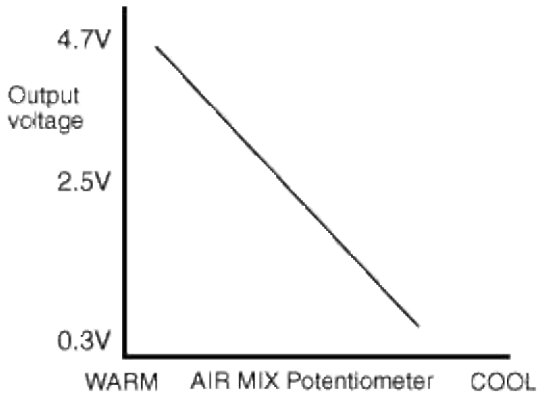


Fig 4

Fig 4) Specifications : Voltage value of air mix potentiometer as a function of position of temperatur door.

(4) Is the measured voltage within specifications in fig4?

YES

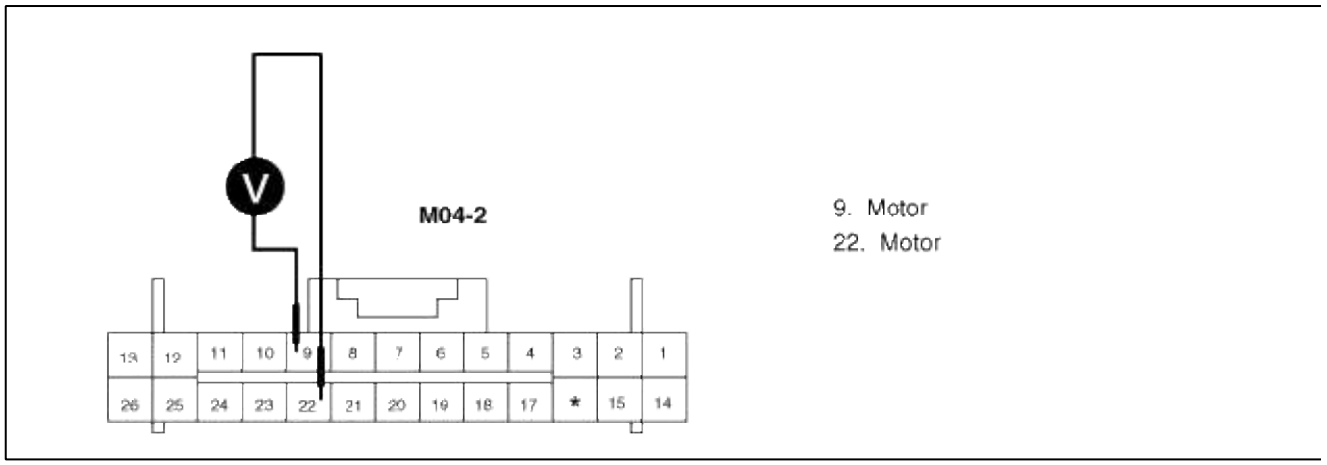
Go to "check A/C control unit" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

3. Check A/C Control Unit.
   (1) Engine "ON"
   (2) Connect A/C Control Unit.
   (3) Measure voltage between terminal "9" and "22" of A/C Control Unit while operating the temp. switch.

   Specification :Approx. 12V



   (4) Is the measured voltage within specifications?

   YES

   Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag
   Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   NO

   Substitute with a known-good A/C Control Unit and check for proper operation.
   If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

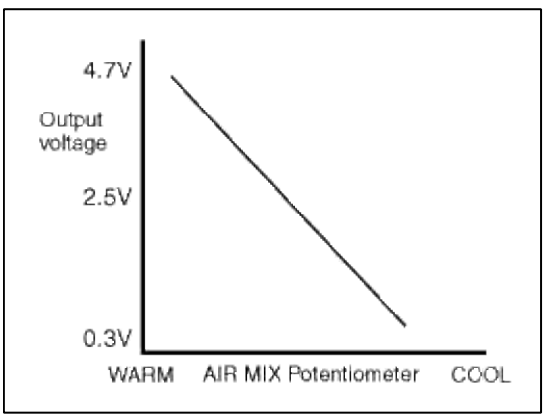
   YES

   Go to the applicable troubleshooting procedure.

   NO

   System is performing to specification at this time.

SPECIFICATION



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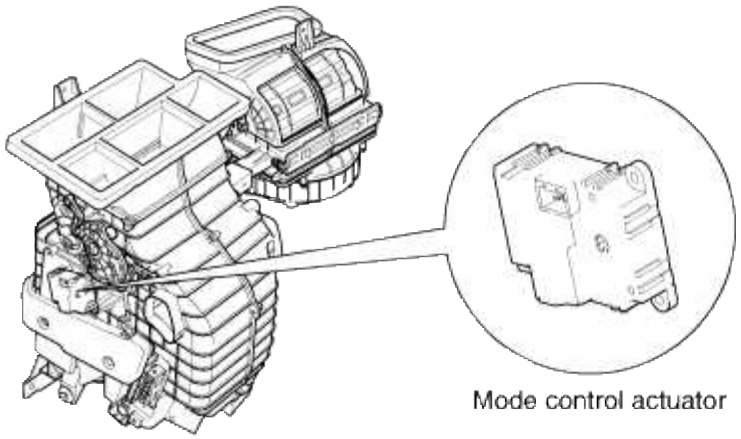
Heating,Ventilation, Air Conditioning > Troubleshooting > B2409

COMPONENT LOCATION



GENERAL DESCRIPTION

The mode control actuator mounted on heater unit, adjusts position of mode door by operating Direction Motor in accordance with signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

DTC DESCRIPTION

The A/C controller sets DTC B2409 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 DTC).

DTC DETECTING CONDITION

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage check	• Poor connection of connected part • Open circuit in harness • Short circuit in harness • Faulty driver direction potentiometer • Fault A/C Control Unit.
Threshold value	• < 0.1V	
Detecting time	• 0.3 sec	
FAIL SAFE	-	

MONITOR SCANTOOL DATA

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"

3. Monitor the "DR DIRECTION POTENTIO" parameter on the scantool while operating mode switch.

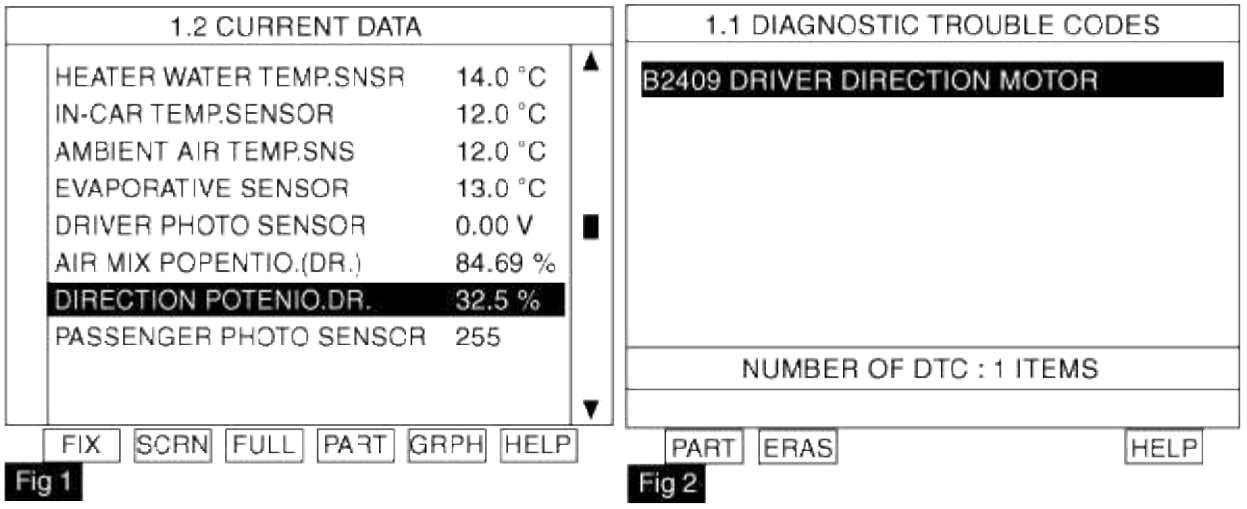


Fig 1 : The current data in abnormal state.
Fig 2 : DTC B2409.

4. Are the DTC B2409 present and is parameter of "Driver DIRECTION POTENTIO." fixed?

There is any fault in Driver Direction Motor. If the parameter of "Driver DIRECTION POTENTIO." is 10% or less on "VENT" mode, or If the parameter is 90% or more on "DEF" mode.

YES

Go to "Inspection" procedure.

NO

Fault is intermittent caused by poor contact in the sensor's and/or A/C controller's connector or was repaired and A/C controller 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.

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

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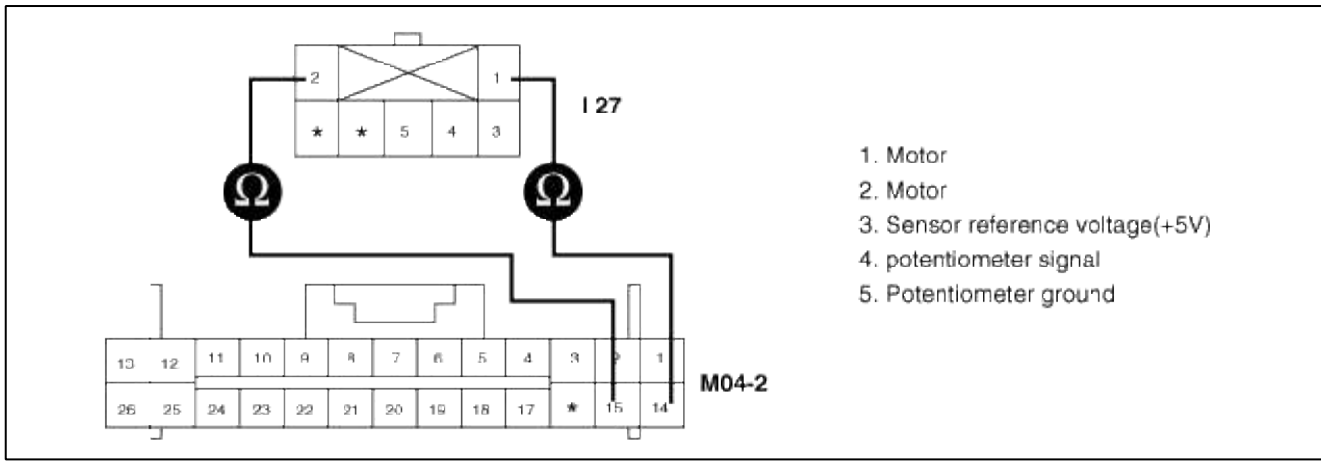
1. Check for open in harness.
   (1) Ignition "OFF"
   (2) Disconnect Driver mode Actuator.
   (3) Measure resistance between terminal "1,2" of Driver Direction Motor and terminal "14,15" of A/C control unit

   Specification : Approx. 0 Ω



   (4) Is the measured resistance within specifications?

   YES

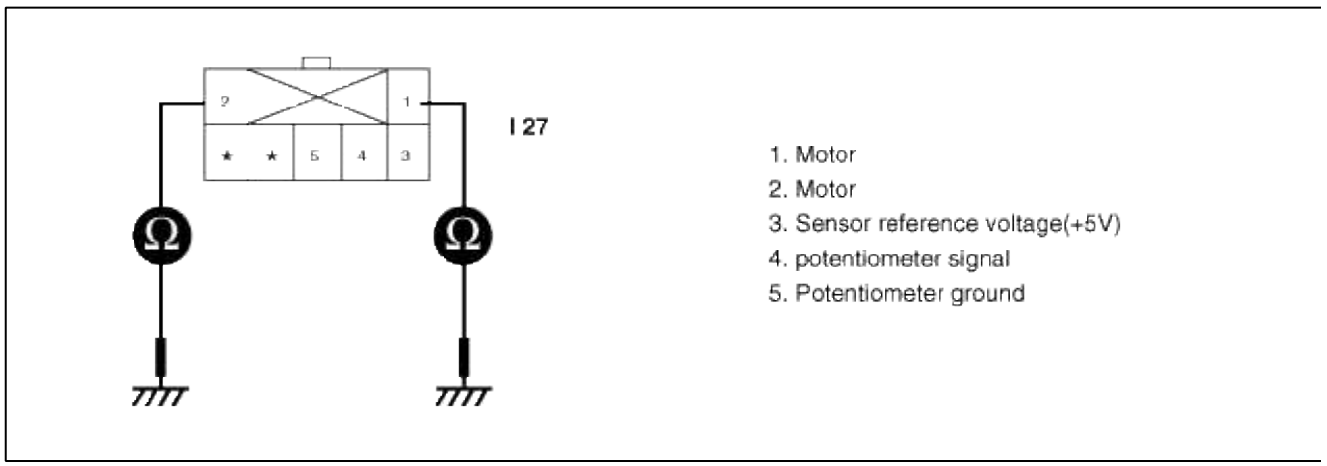
   Go to "Check for short to ground in harness" procedure.

   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.
   (3) Measure resistance between terminal "1,2" of Driver Direction Motor and chassis ground.

   Specification : Approx. ∞ Ω



   (4) Is the measured resistance within specifications?

   YES

   Go to "Visual/Physical Inspection " procedure.

   NO

   Check for short to ground in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

VISUAL/PHYSICAL INSPECTION

1. Check actuator.

Check if Driver Direction Actuator works properly through ACTUATION TEST.

(1) Ignition : ON

(2) Connect Scantool and select " ACTUATION TEST" mode and press [F1]

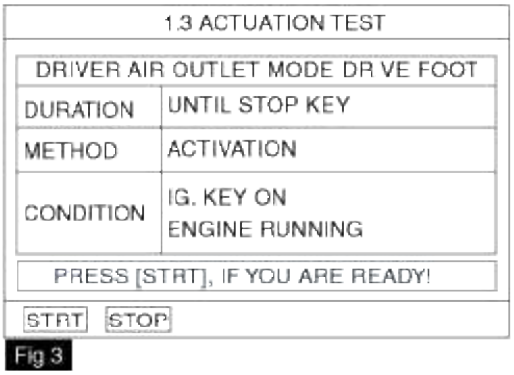


Fig 3 : Selecting "ACTUATION TEST" mode.

(3) Dose Driver Direction Actuator work properly?

YES

Go to "Component Inspection" procedure.

NO

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.

COMPONENT INSPECTION

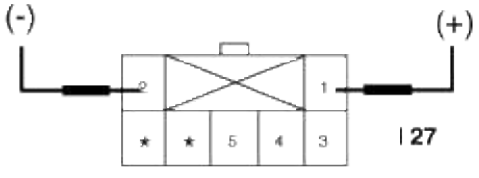
1. Check actuator.

(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.



1. Motor
2. Motor
3. Sensor reference voltage(+5V)
4. potentiometer signal
5. Potentiometer ground

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(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 a and then go to "Verification of Vehicle Repair" procedure.

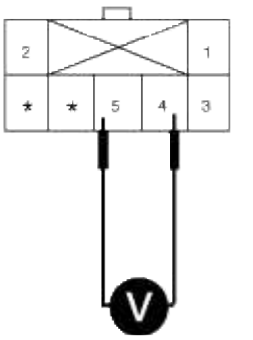
2. Check potentiometer

(1) Ignition "ON"

(2) Connect Driver Direction potentiometer.

(3) Measure voltage between terminal "4" and "5" of Driver Direction potentiometer as the mode switch is operat

Specification : Refer the specifications in fig 3)



I 27

1. Motor
2. Motor
3. Sensor reference voltage(+5V)
4. potentiometer signal
5. Potentiometer ground

Door position	Voltage (3-4)	Error detecting
VENT	0.3 ± 0.15V	Under voltage : 0.08V or le Over voltage : 4.92V or mo
BI-LEVEL(1)	1.35 ± 0.4V	
BI-LEVEL(2)	2.25 ± 0.4V	
FLOOR	3.0 ± 0.4V	
MIX	3.6 ± 0.4V	
DEF	4.7 ± 0.15V	

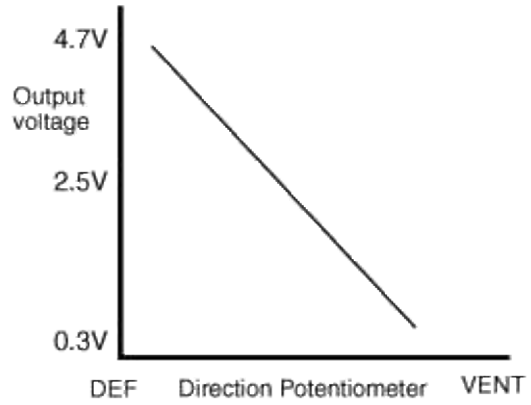


Fig 4

Fig 4) Specifications : Voltage value as a function of position of direction potentiometer.

(4) Is the measured voltage within specifications in fig4?

YES

Go to "Check A/C control unit" procedure.

NO

Substitute with a known-good actuator and check for proper operation. If the problem is corrected, replace a and then go to "Verification of Vehicle Repair" procedure.

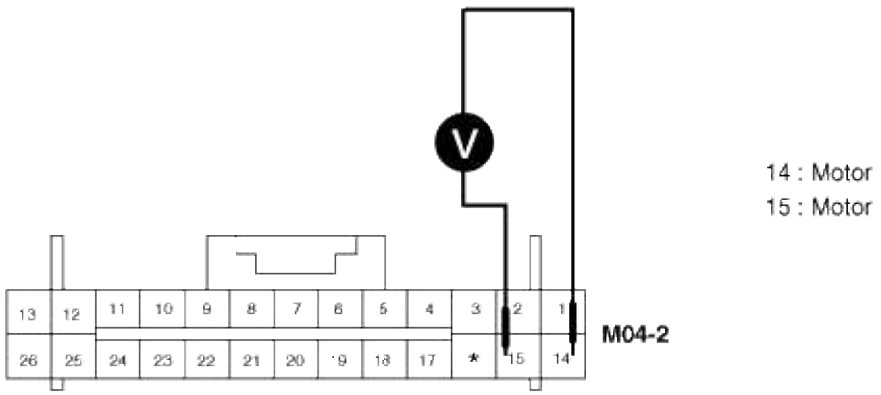
3. Check A/C Control Unit.

(1) Engine : "ON"

(2) Connect A/C Control Unit.

(3) Measure voltage between terminal "14" and "15" of A/C Control Unit while operating the mode switch.

Specification :Approx. 12V



(4) Is the measured voltage within specifications?

YES

Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damag Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good A/C Control Unit and check for proper operation.
If the problem is corrected, replace A/C Control Unit and then go to "Verification of Vehicle Repair" procedu

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

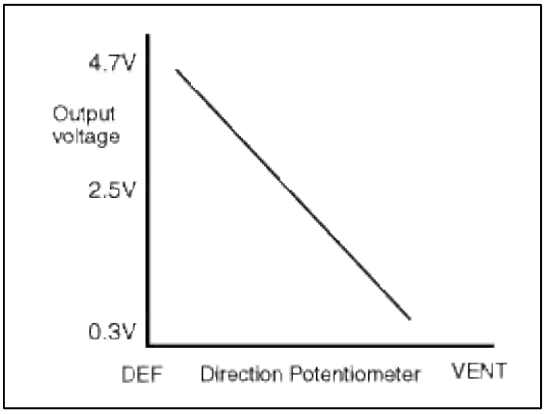
YES

Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

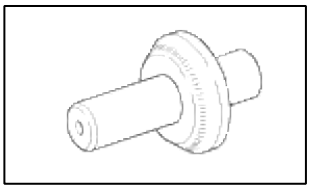
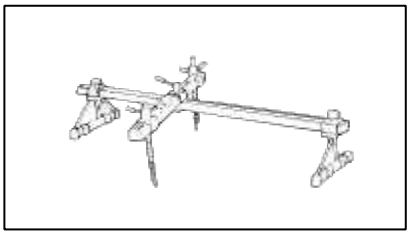
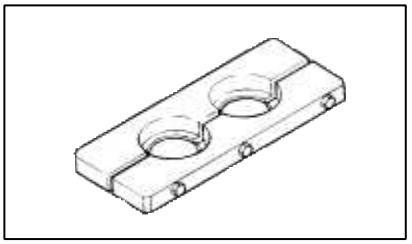
SPECIFICATION



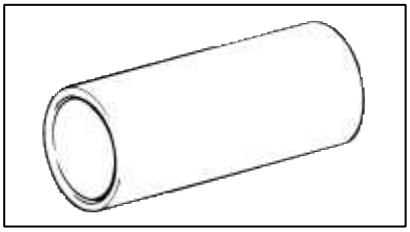
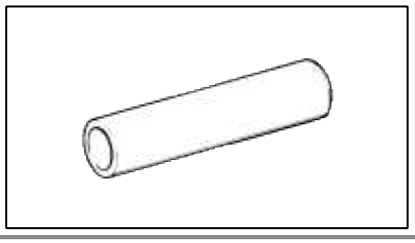
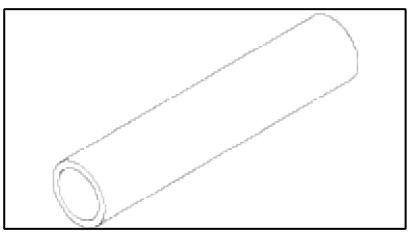
SPORTAGE(KM) > 2007 > G 2.0 DOHC > Manual Transaxle System

Manual Transaxle System > General Information > Special Service Tools (M5GF1)

SPECIAL TOOLS

TOOL number and name)	Illustration	Use
09431 - 39000 Oil seal installer		Installation of differential oil seal Use with (09500 - 11000)
09200 - 38001 Engine support fixture		Removal and installation of transaxle.
09432 - 33200 Bearing removing plate		• Removal of 4WD coupling flange oil seal • Removal of input shaft's gear and ball bearing

SPECIAL SERVEICE TOOLS

Tool (Number and Name)	Illustration	Use
09432-22000 Oil seal installer		Installation of output shaft's gear and sleeve
09432-33100 Bearing installer		Installation of input shaft bearing
09455-21100 Bearing installer		Installation of differential bearing

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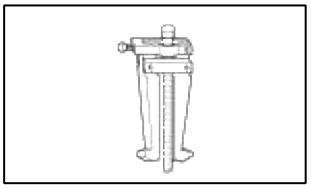
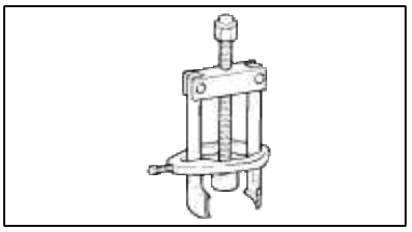
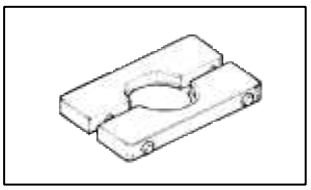
09455-32200/0K011190 008 Oil weal puller		Removal of differential bearing spacer
09495-33000 Bearing and gear puller		Removal of ball bearing and gear
09433 -21000 Removal plate		Removal of differential ball bearing

Manual Transaxle System > General Information > Troubleshooting (M5GF1)

TROUBLESHOOTING

Symptom	Suspect area	Remedy
Vibration, noise	Loose or damaged transaxle and engine mounts	Tighten or replace mounts
	Inadequate shaft end play	Correct end play
	Worn or damaged gears	Replace gear
	Inadequate grade of oil	Replace with specified oil
	Low oil level	Replenish
	Inadequate engine idle speed	Adjust idle speed
Oil leakage	Broken or damaged, oil seal or O-ring	Replace oil seal or O-ring
Hard shift	Faulty control cable	Replace control cable
	Poor contact or wear of synchronizer ring and gear cone	Correct or replace
	Weakened synchronizer spring	Replace synchronizer spring
	Inadequate grade of oil	Replace with specified oil
	Grease in flywheel	Inspect and replace flywheel
Jumps out of gear	Worn gear shift fork or broken poppet spring	Replace shift fork or poppet spring
	Synchronizer hub to sleeve spline clearance too large	Replace synchronizer hub and sleeve
Rear wheel lock at starting with steering wheel full-turn		

Rear wheel lock at starting with half-pressing clutch and acceleration pedal	4WD ECM malfunction	Replace 4WD ECM

Manual Transaxle System > General Information > Specifications (M5GF1)

SPECIFICATION

ITEM		M5GF1
TYPE		Forward 5 speed Reverse 1 speed
ENGINE		2.0L GSL
GEAR RATIO	1st	3.636
	2nd	2.056
	3rd	1.333
	4th	1.061
	5th	0.821
	Reverse	3.455
Final Reduction Gear Ratio		4.533

SERVICE STANDARD

Items	mm (in)
Differential side bearing end play	0.05T ~ 0.10T (0.0019T ~ 0.0039T)
Gear backlash in differential	0.025L ~ 0.150L (0.00095L ~ 0.0057L)
Input front bearing snap ring end play	0.01L ~ 0.12L (0.00038L ~ 0.0045L)
Input rear bearing snap ring end play	0.01L ~ 0.12L (0.00038L ~ 0.0045L)
Output front bearing snap ring end play	0.01L ~ 0.12L (0.00038L ~ 0.0045L)
Output rear bearing snap ring end play	0.01L ~ 0.09L (0.00038L ~ 0.00342L)
5th input gear snap ring end play	0.01L ~ 0.05L (0.00038L ~ 0.0019L)
3rd output gear snap ring end play	0.01L ~ 0.05L (0.00038L ~ 0.0019L)

TIGHTENING TORQUE

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Item	Nm	kgf.cm	lb-ft
Select lever knob	4.5~7.5	45~75	3.3~5.4
Console upper cover	9~14	90~140	6.4~10.1
Facia bracket mounting	9~14	90~140	6.5~10.1
Facia bracket mounting 2	7~11	70~110	5.1~7.9
Shift cable	8~12	80~120	5.7~8.67
Transaxle support bracket	60~80	600~800	43.4~57.9
Input speed sensor	10~12	100~120	7.2~8.7
Output speed sensor	10~12	100~120	7.2~8.7
Shift lever switch	10~12	100~120	7.2~8.7
Shift arm	20~27	200~270	14.5~19.6
Select lever	20~27	200~270	14.5~19.6
Reamer bolt	43~55	430~550	31.1~39.8
Side cover bolt	10~12	100~120	7.2~8.7
Release bearing sleeve mounting	6~8	60~80	4.3~5.8
Differential drive gear bolt(4WD)	130~140	1300~1400	94.1~101.2
Differential drive gear bolt(LSD)	130~140	1300~1400	94.1~101.2
Release fork shaft lever mounting	27~40	270~400	19.5~28.9
Transmission hanger mounting	15~22	150~220	10.8~15.9
Cylinder & hose assy	15~22	150~220	10.8~15.9
1st gear switch	13	130	9.4
Back-up lamp switch	30~35	300~350	21.7~25.3
Transmission stud mounting	15~20	150~200	10.8~14.5
Oil drain plug	30~35	300~350	21.7~25.3
Filler plug	35~45	350~450	25.3~32.5

LUBRICANTS

Item	Lubricant	Quantity
Transmission Oil	HYUNDAI GENUINE PARTS MTF SAE 75W/85(API-GL4)	2.1L (2.2US qt, 1.8mp qt.)
Transaxle input shaft spline	CASMOLY-L9508	as required
Clutch release fork shaft bushing	CASMOLY-L9508	1g
Rear axle oil	SAE 80W/90(API-GL5)-SHELL SPIRAX OR equivalent	0.75ℓ (0.79 US qt, 0.66 lmp qt)
Transfer case	SAE 80W/90(API-GL5)-SHELL SPIRAX OR equivalent	0.8ℓ (0.85 US qt, 0.7 lmp qt)

Manual Transaxle System > Manual Transaxle System > Troubleshooting (M5GF1)

SERVICE ADJUSTMENT PROCEDURE

TRANSAXLE GEAL OIL

INSPECTION

Inpect each component for evidence of leakage.

Check the gear oil level by removing the filler plug.

If the oil is contaminated, it is necessary to replace it with new oil.

1. Remove oil filler plug and check level with finger.
2. Oil level must be up to fill the hole, add oil until it runs over.Then reinstall plug.
3. Replace the oil so that the transaxle gear oil is not dirty, and so that it is of suitable viscosity.

REPLACEMENT

1. With the vehicle parked on a level surface, remove the drain plug and drain the transaxle oil.
2. Replace the gasket with a new one and install the drain plug.

TORQUE :
30 ~ 35 Nm(300 ~ 350 kgf.cm, 21.7 ~ 25.3 lb-ft)

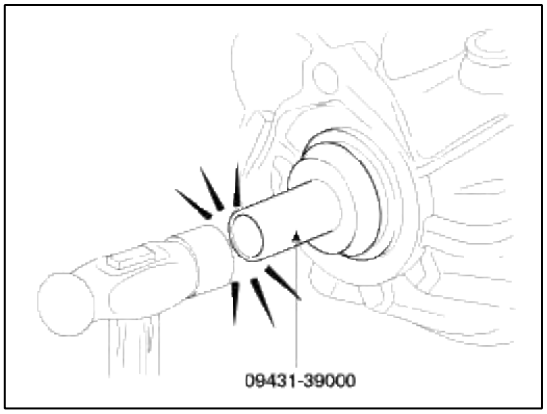
3. Add new oil through the filler plug and, fill it to just below the plug opening.

TORQUE :
35 ~ 45 Nm(350 ~ 450 kgf.cm, 25.3 ~ 32.5 lb-ft)

Standard value
Transaxle oil total capacity :
2.1 lit (2.2 U.S.qts., 1.8 limp.qts)

DRIVE SHAFT OIL SEAL REPLACEMENT

1. Disconnect the drive shaft from the transaxle (Refer to "DS" group).
2. Using a flat-tip screwdriver, remove the oil seal.
3. Apply a coating of gear oil to the oil seal.
   Transaxle gear oil : HYUNDAI GENUINE PARTS MTF 75W/85 API GL-4
4. Using the special tool (09431-39000), tap the drive shaft oil seal into the transaxle.



Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Components and Components Location (M5GF1)

COMPONENTS

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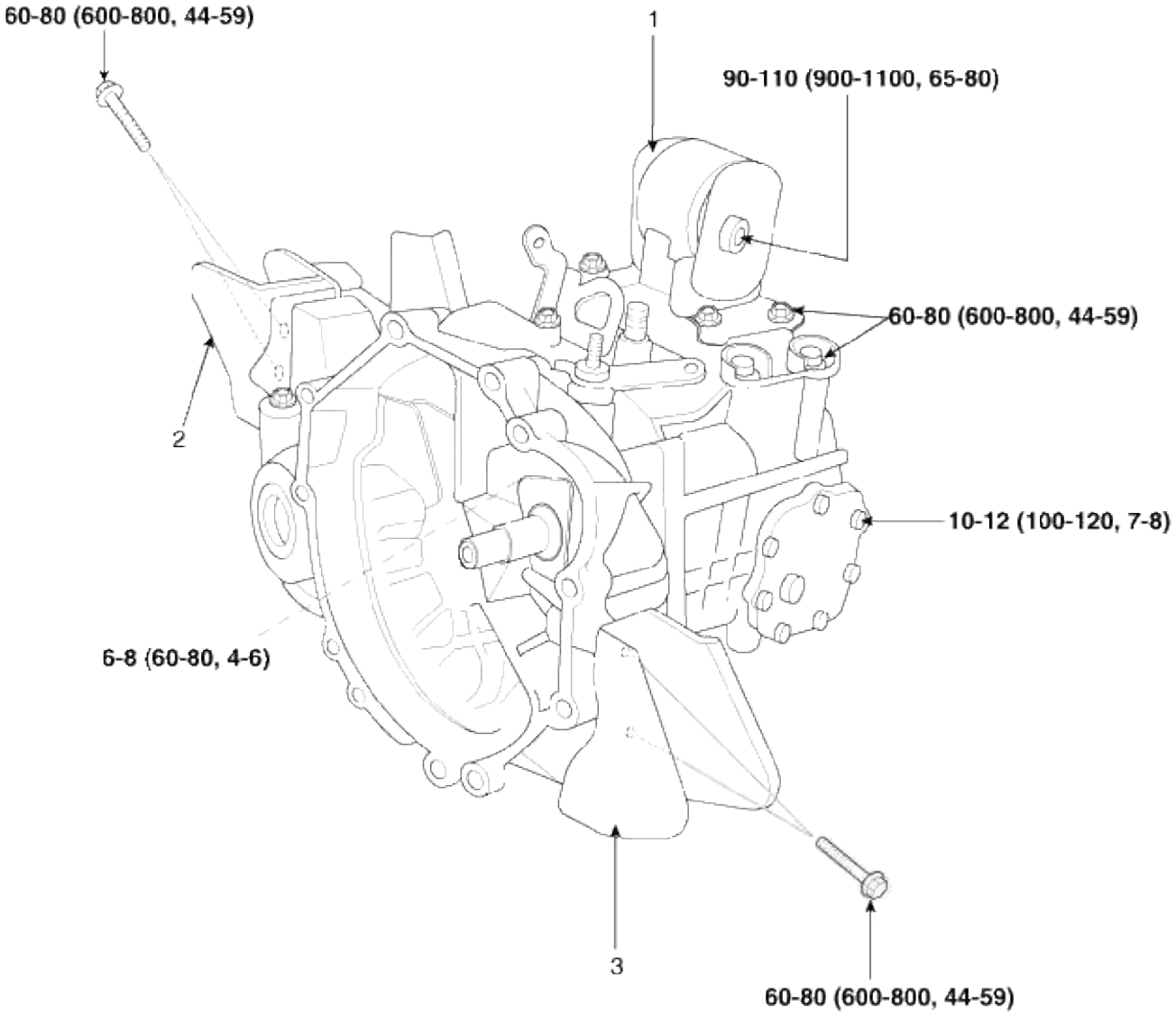
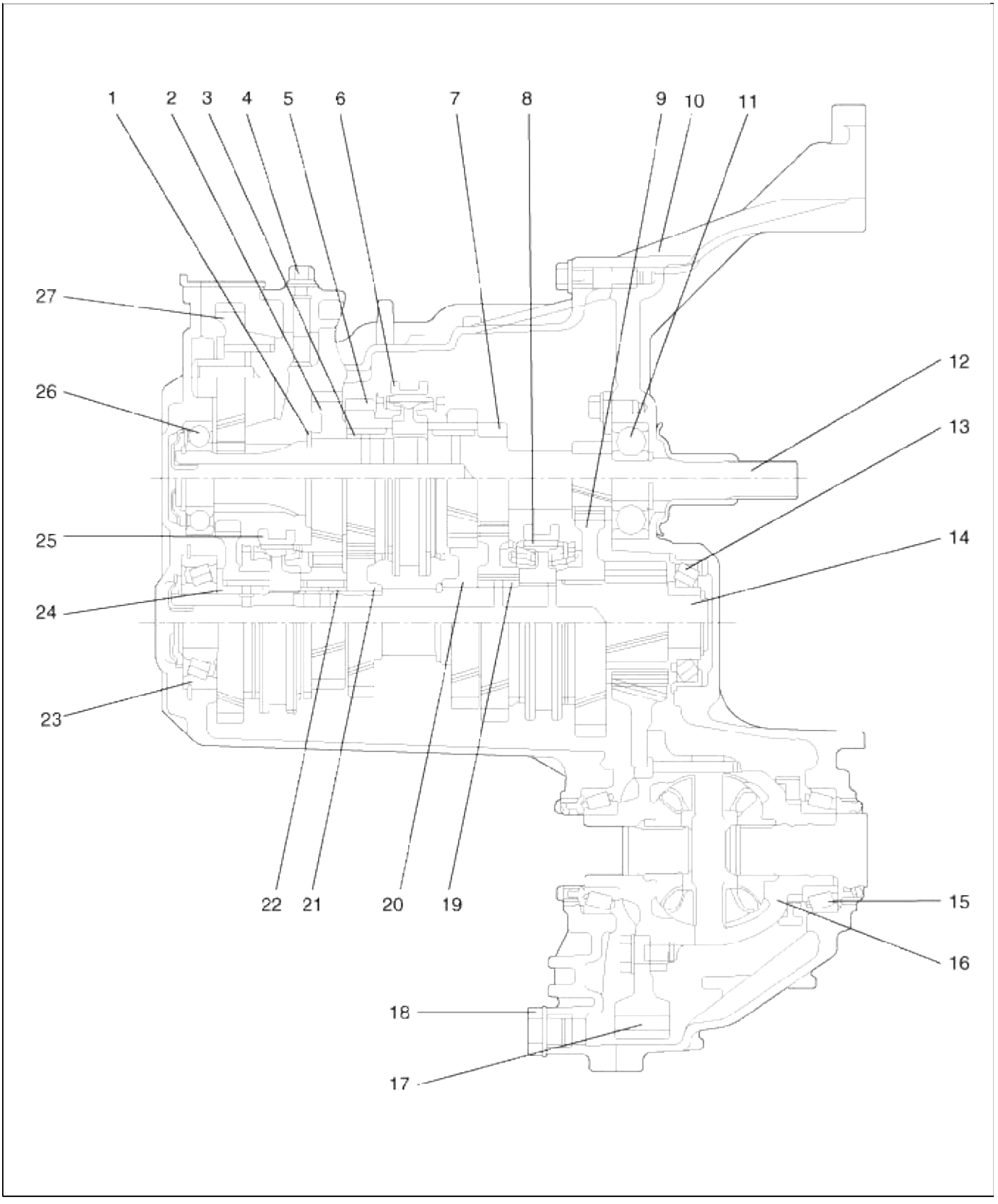


TORQUE : Nm (kg.cm, lb-ft)

1. Transmission mounting bracket
2. Rear roll stopper bracket
3. Front roll stopper bracket



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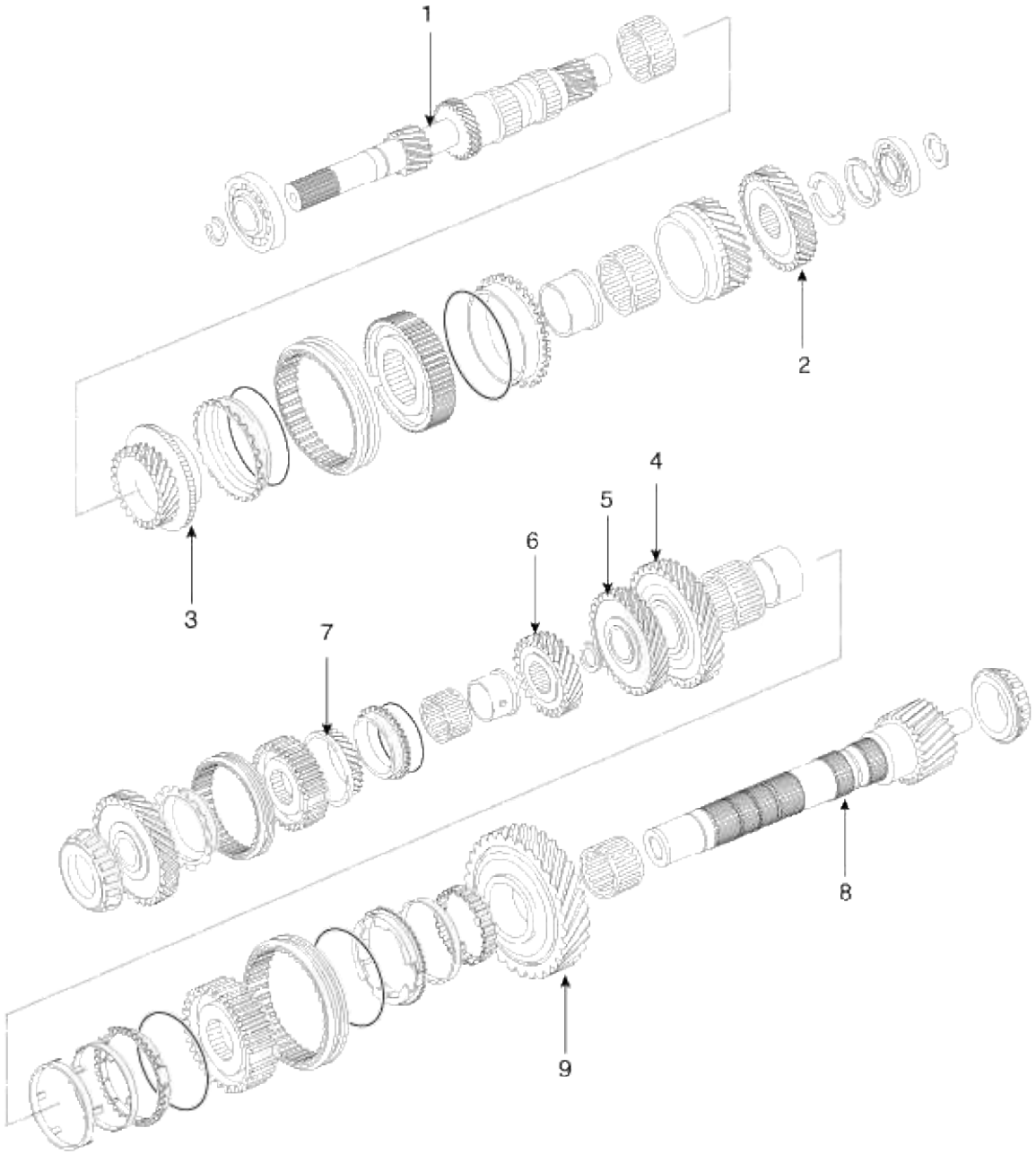
1. Snap ring
2. 5th speed gear
3. 4th speed gear sleeve
4. Reverse idler bolt
5. 4th speed gear
6. 3rd&4th synchronizer hub and sleeve
7. 3rd speed gear
8. 1st&2nd synchronizer hub and sleeve
9. 1st speed gear
10. Clutch housing
11. Front input shaft ball bearing
12. Input shaft
13. Front output shaft taper roller bearing
14. Output shaft
15. Differential taper roller bearing
16. Differential
17. Differential drive gear
18. Drain plug
19. 2nd speed gear sleeve
20. 3rd speed output gear
21. 4th speed output gear
22. 5th speed gear sleeve
23. Rear output shaft taper roller bearing
24. Reverse driven gear sleeve
25. 5th&REV synchronizer hub and sleeve
26. Rear front shaft taper roller bearing
27. Reverse idler gear

COMPONENTS



1. Input shaft
2. 4th speed gear
3. 3rd speed gear
4. 2nd speed gear
5. 3rd speed gear
6. 4th speed gear
7. 5th speed gear
8. Output shaft
9. 1st speed gear

Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Repair procedures (M5GF1)

REMOVAL

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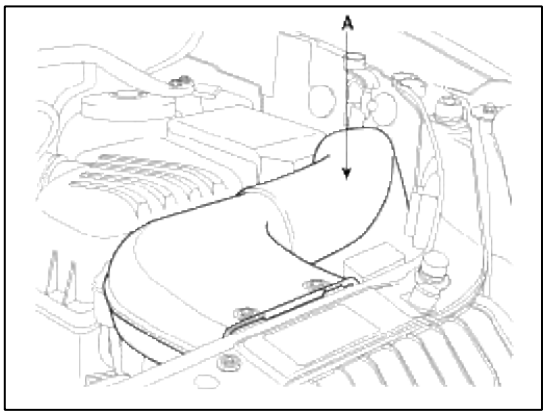
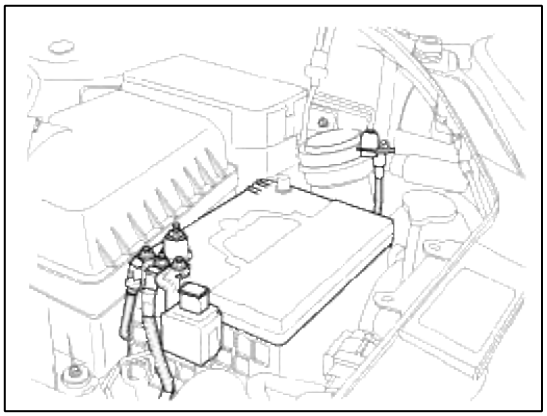
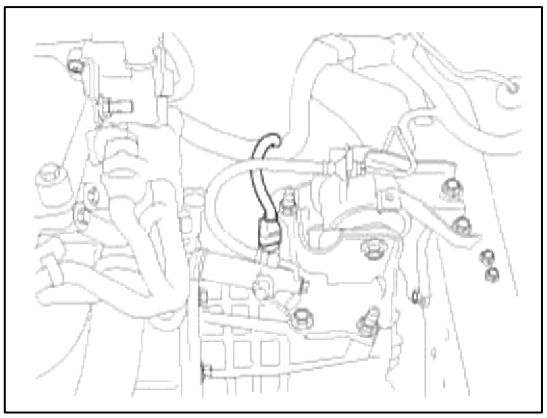
1. Remove the air duct(A) and hose assembly.



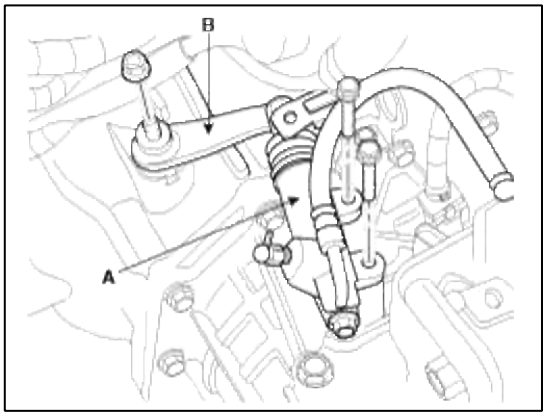
2. Remove the battery and battery tray.



3. Remove the air cleaner assembly and air flow sensor.
4. Remove the back-up lamp connector and the vehicle speed sensor.

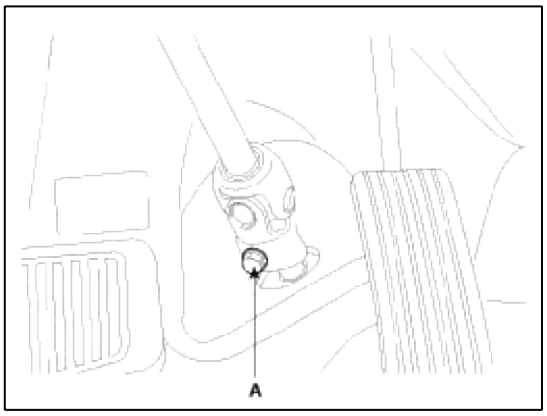


5. Disconnect the connectors and the terminals.
6. Remove the clutch release cylinder(A) and lever(B).

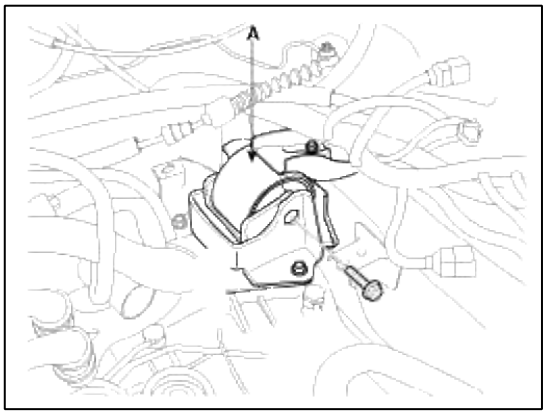


7. Separate the transaxle cable from the transaxle assembly.

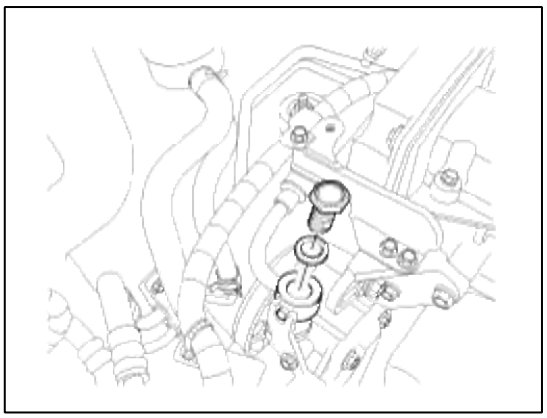
8. Disconnect the steering column shaft from the universal joint in the gear box(See 'ST' group).



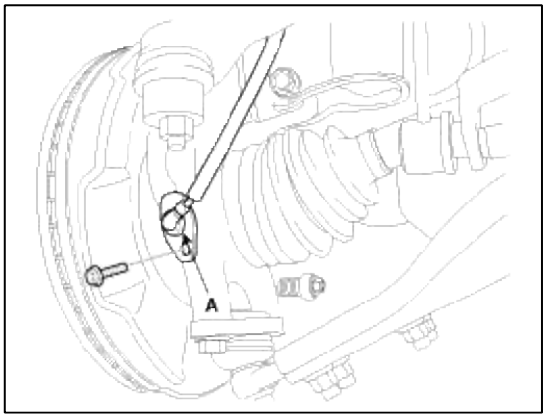
9. Remove the transaxle clutch housing upper mounting bolts.
10. Remove the transaxle mounting brackets. (front, rear, left(A))



11. Using SST(09200-38001), support the engine assembly.
12. Disconnect the power steering oil pressure tube from the pump. Afterwards, stuff the hole with papers.



13. Remove the wheel and tire.
14. Disconnect the strut assembly, tie rod and stabilizer bar link from the knuckle.
15. Remove the wheel speed sensor.



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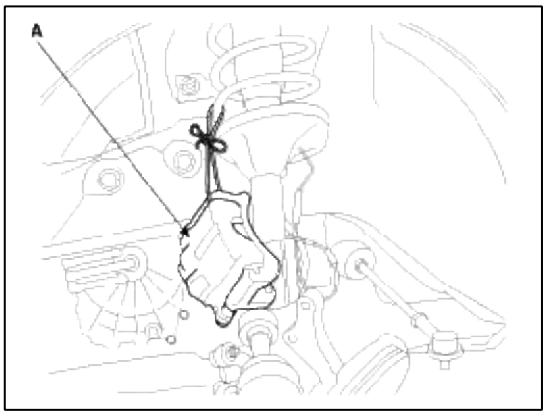
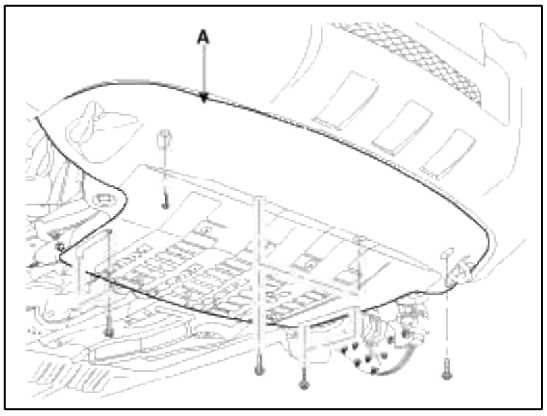
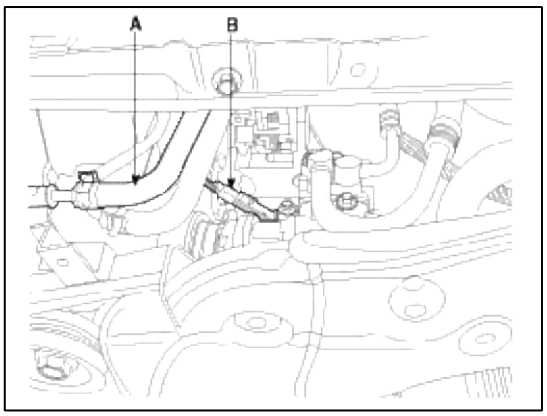
16. Remove the brake caliper(A) and suspend it with a string.



17. Lift up the vehicle and remove the undercover(A).

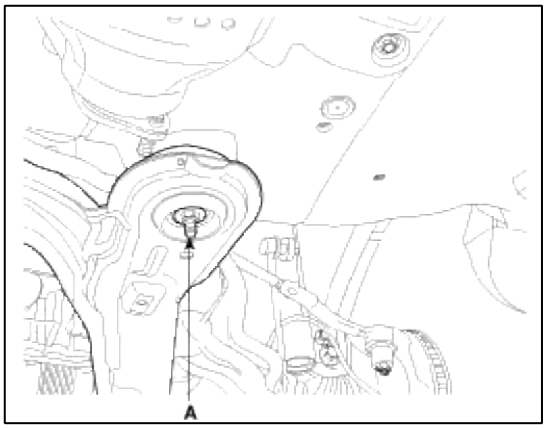


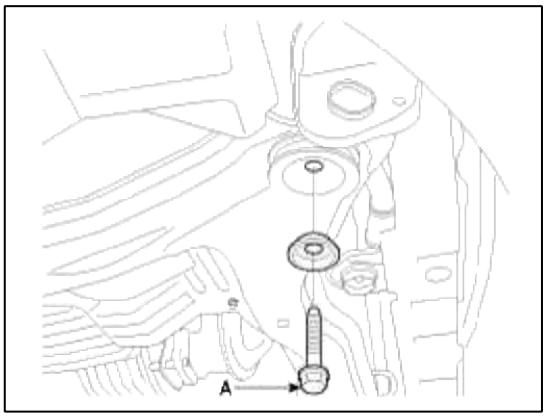
18. Remove the oil drain plug and drain the fluid.
19. Remove the front muffler.
20. Disconnect the steering tube (A)on the cross member(sub-frame) and air condition switch(B).



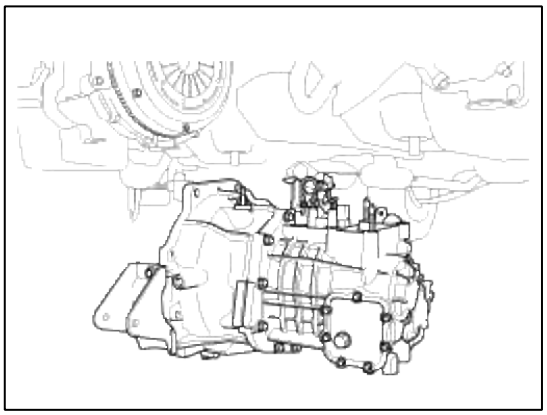
21. Install a jack for the removal of a cross member(sub-frame).

22. After removing the cross member mounting bolts and nuts, remove the cross member with the steering gear box and the stabilizer bar.





23. Install a jack for the removal of the transaxle.
24. Remove the front and the rear roll stopper.
25. Remove the engine and the transaxle mounting bolts.
26. Lowering the jack slowly, remove the transaxle.



INSTALLATION

Installation is in the reverse order of removal.

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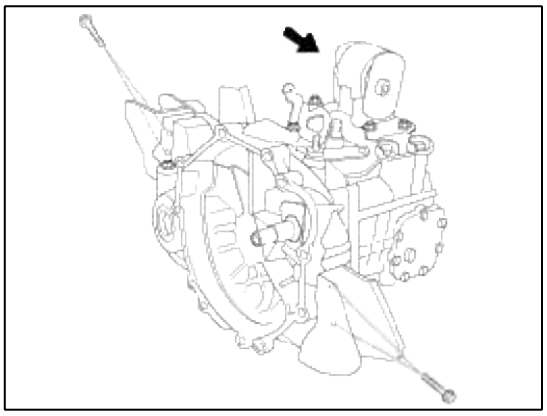
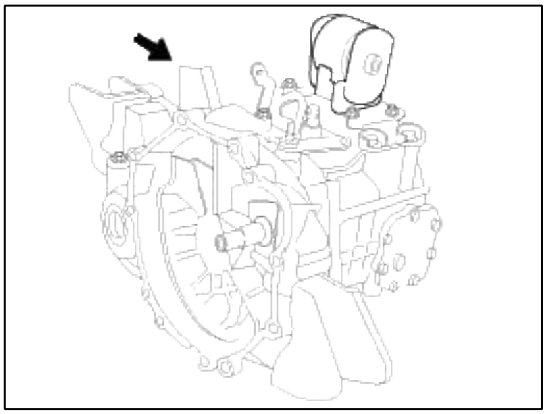
DISASSEMBLY

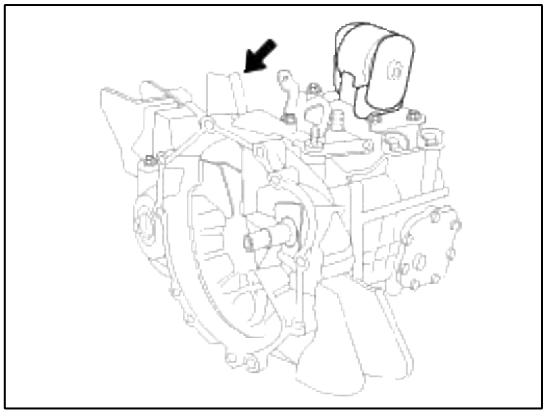
1. Remove the T/M mounting bracket.



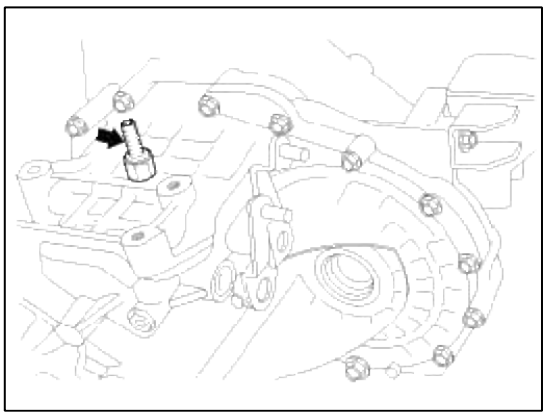
2. Remove the shift control cable bracket.



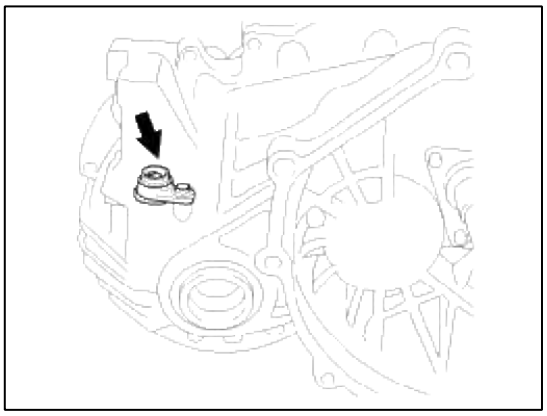
3. Remove the clutch release cylinder.



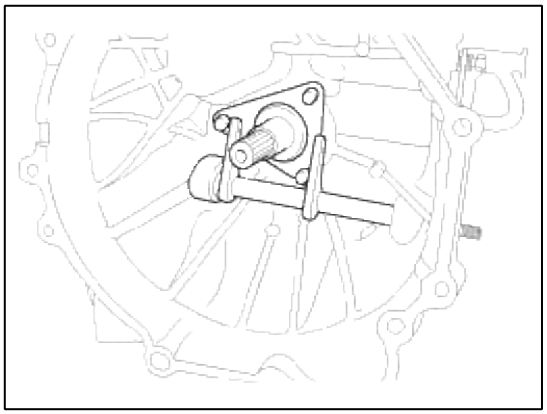
4. Remove the backup lamp switch.



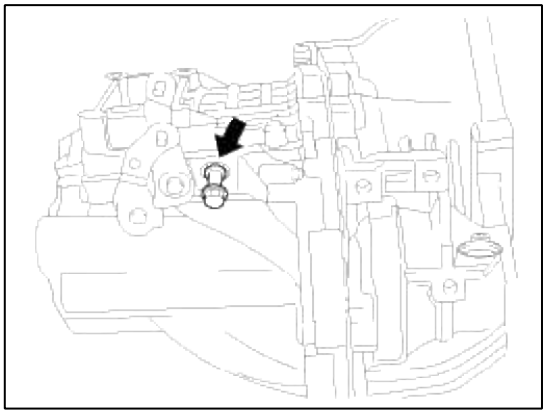
5. Remove the speedometer driven gear.



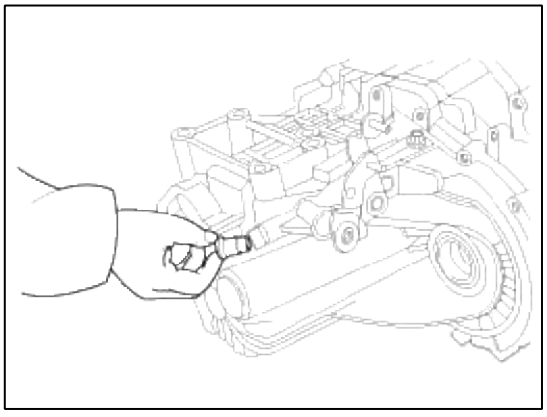
6. Remove the clutch release fork shaft and the release bearing sleeve.



7. Remove the reamer bolt.



8. Remove the poppet ball assembly.



9. Remove the side cover and the reverse idler gear assembly.

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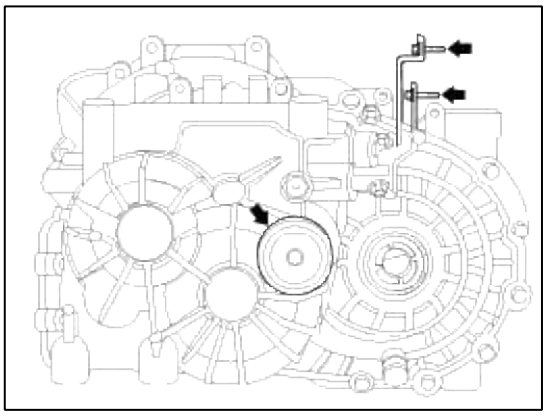
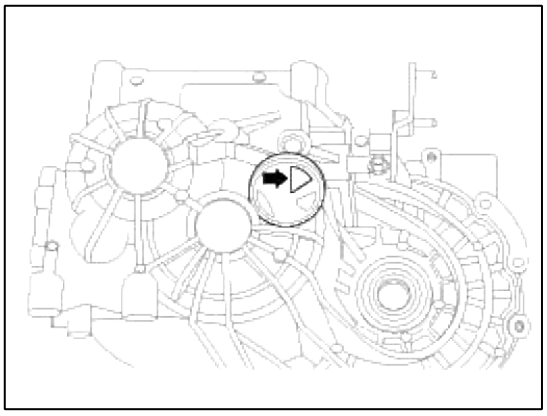
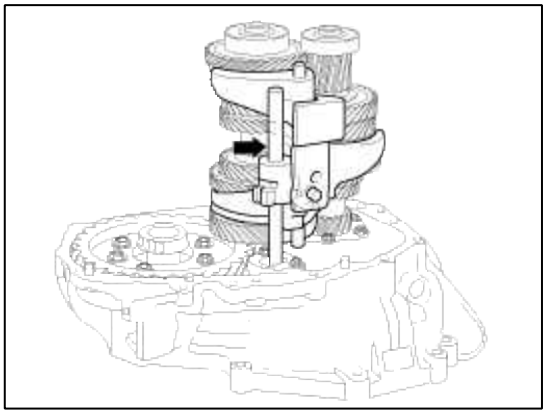
10. Remove the select lever, the shift lever and sealing cap.



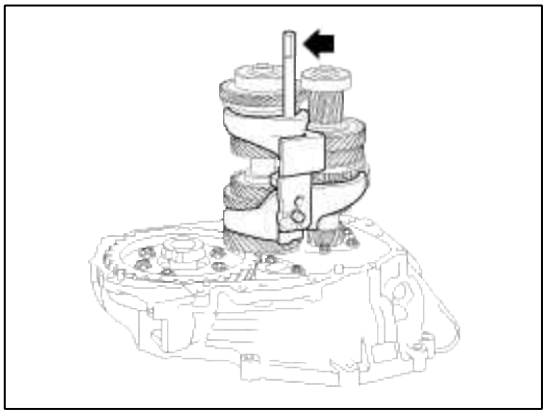
11. Remove the clutch housing from the transmission case with the snap ring extended.



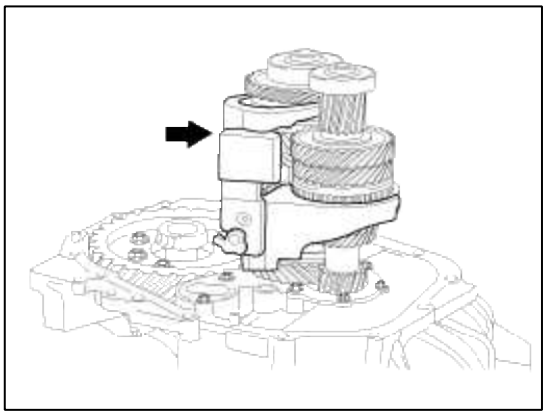
12. Remove the interlock body and the control shaft.



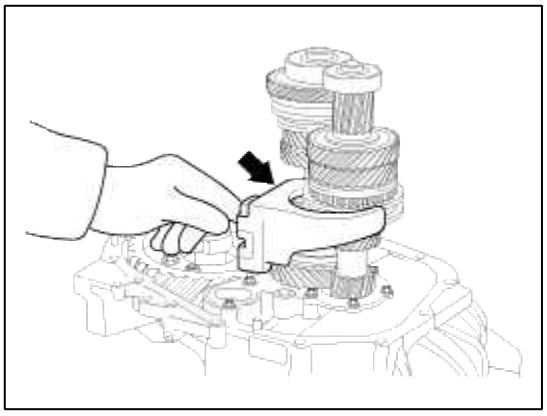
13. Remove the shift rail.



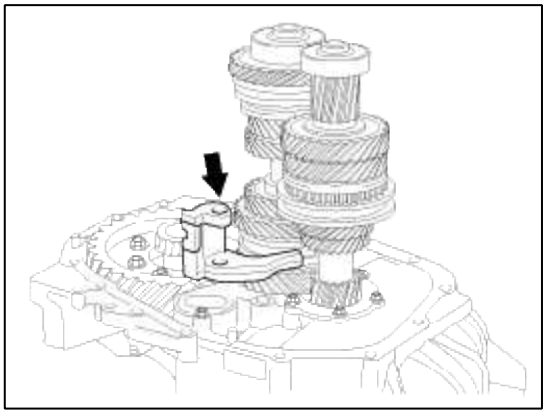
14. Remove the fork shift (5th & Rev).



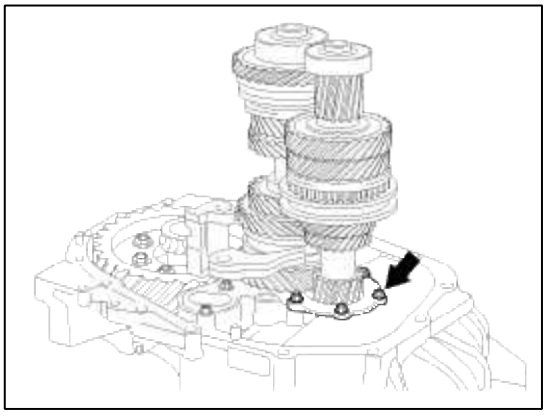
15. Remove the fork shift (3rd & 4th).



16. Remove the fork shift (1st &2nd).



17. Remove the bearing retainer.



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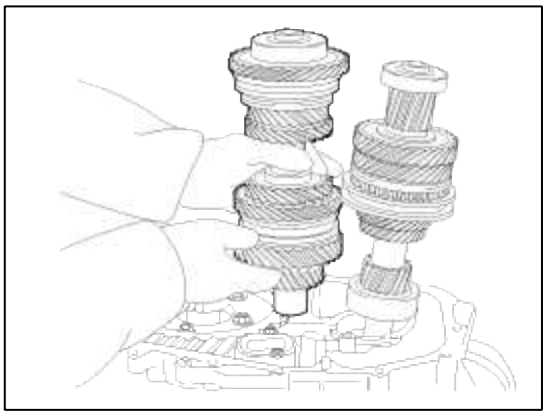
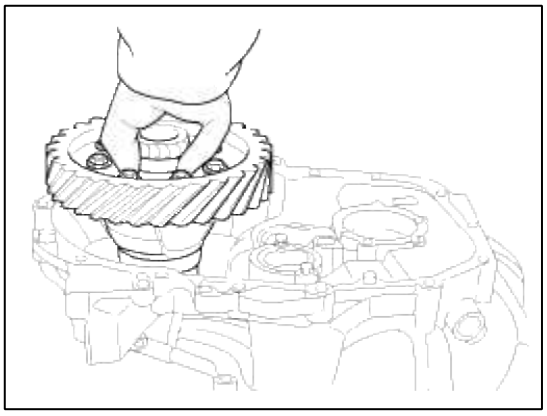
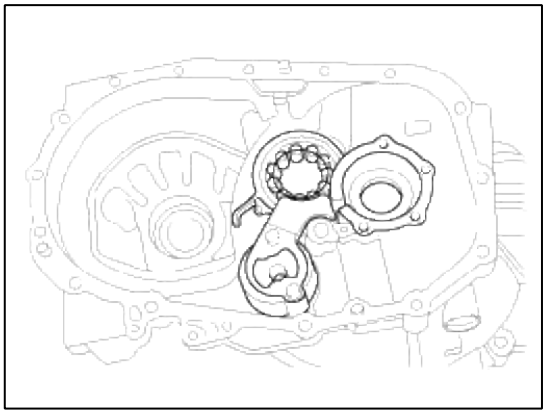
18. Remove the output shaft assembly and the input shaft assembly.



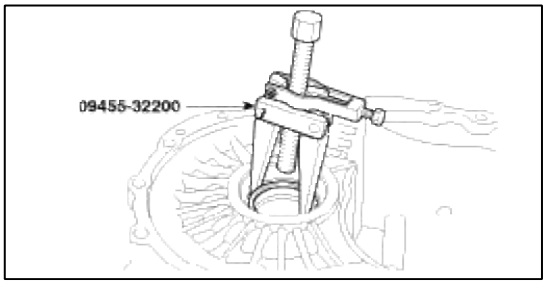
19. Remove the differential assembly.



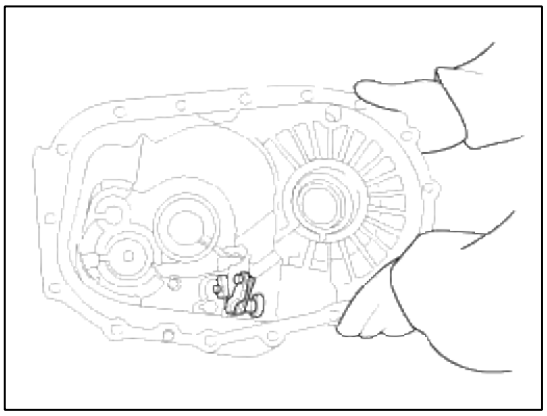
20. Remove the detent body cover and the roller bearing.



21. Remove the differential bearing outer spacer using special tool (09455-32200) and the drive shaft oil seal.



22. Remove the shift arm and the select arm from the transmission case.

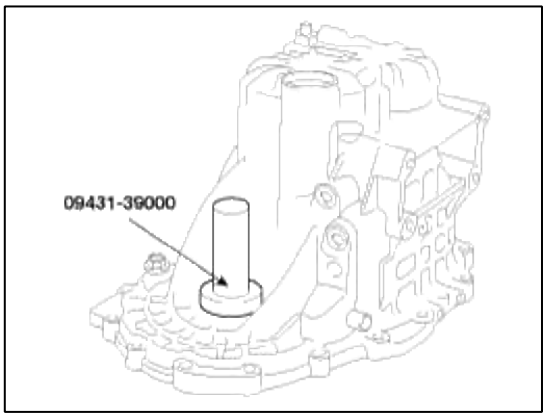


REASSEMBLY

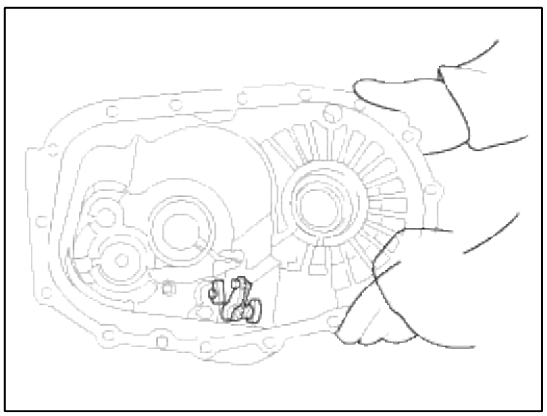
1. Install the drive shaft oil seal using the special tool (09431-39000).

NOTE

Insert the oil seal straightly.



2. Install the shift arm and the select arm in the transmission case.



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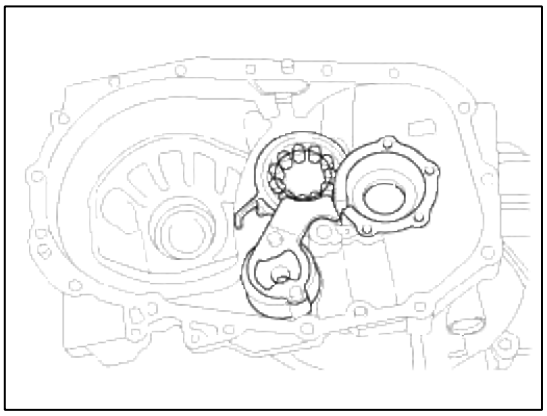
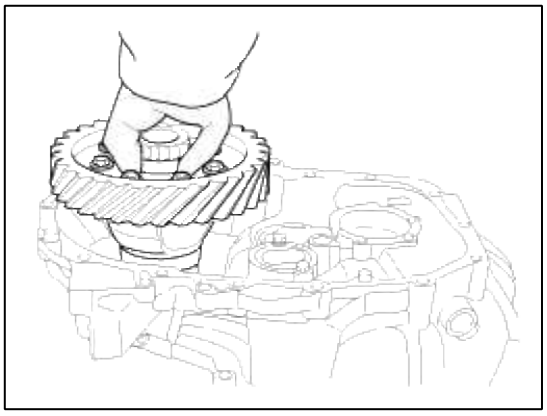
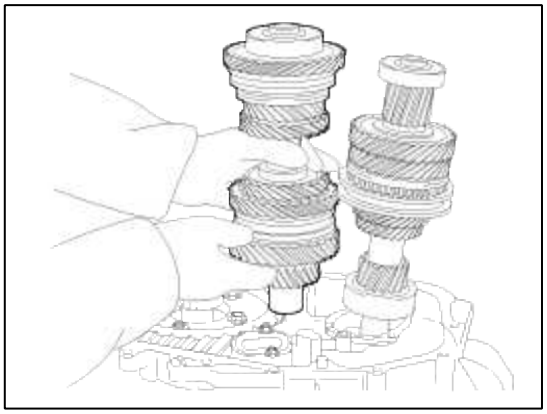
3. Install the detent body cover and the roller bearing.



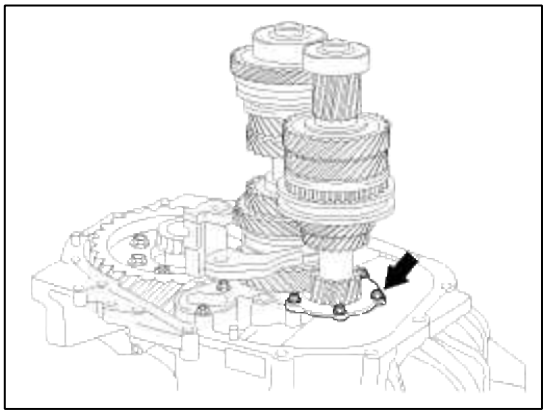
4. Install the differential assembly.



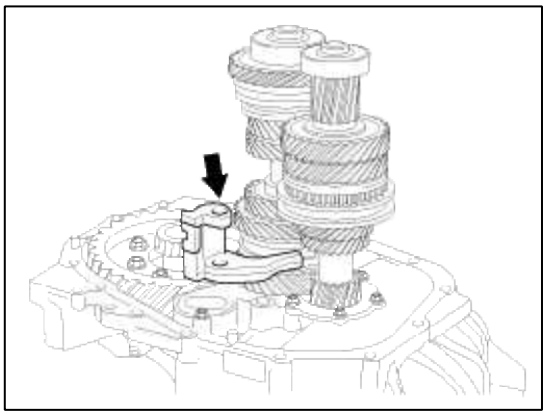
5. Install the output shaft assembly and the input shaft assembly.



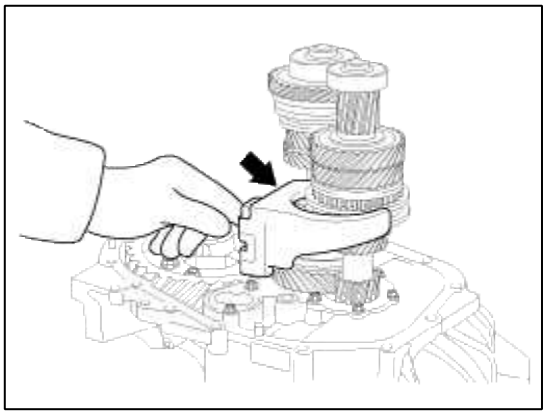
6. Install the retainer bearing.



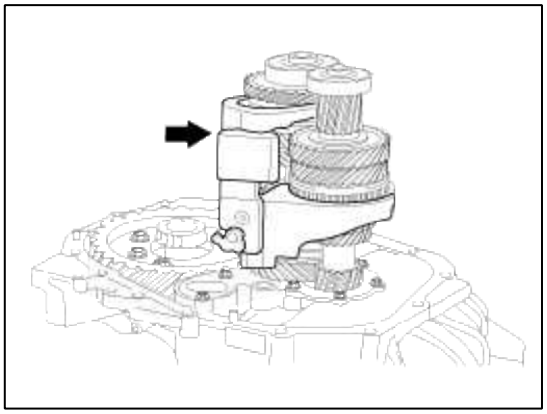
7. Install the fork shift (1st & 2nd).



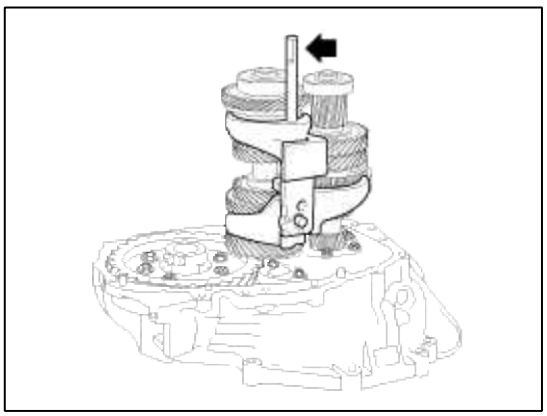
8. Install the fork shift (3rd & 4th).



9. Install the fork shift (5th & Rev).



10. Install the shift rail.



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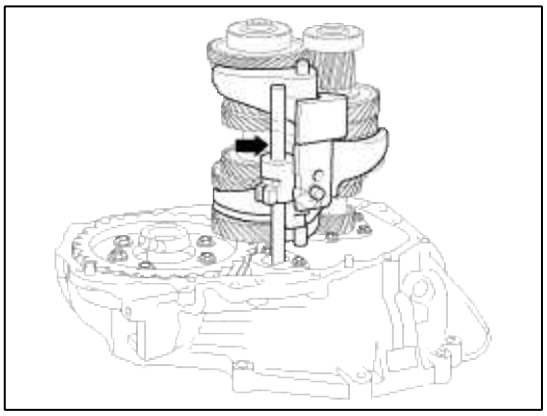
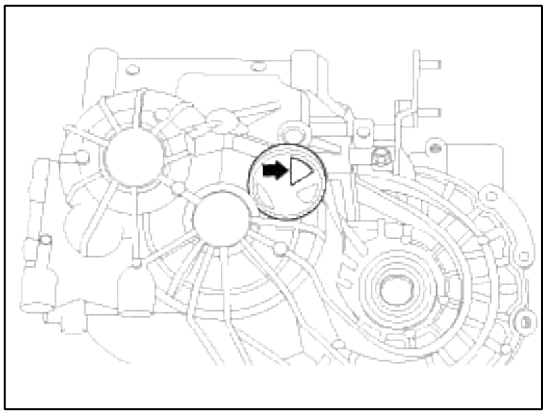
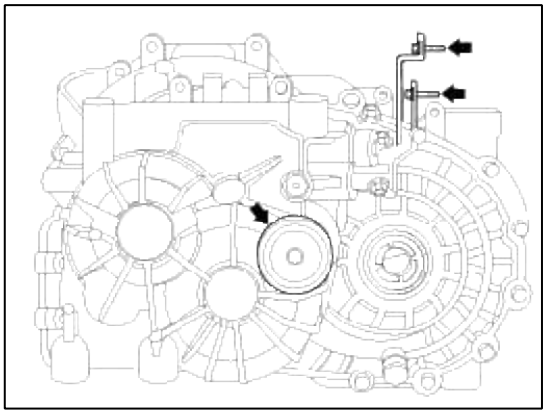
11. Install the interlock body and the control shaft.



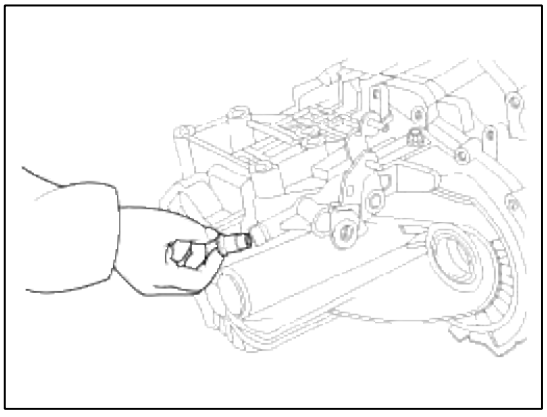
12. Assemble the clutch housing and the transmission case with the snap ring extended.



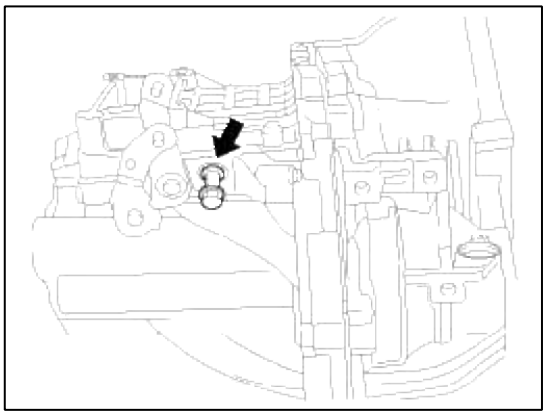
13. Install the select lever, the shift lever and the sealing cap.



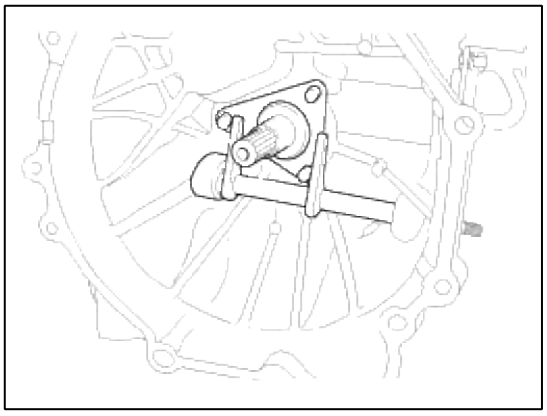
14. Install the side cover and the reverse idler gear assembly.
15. Install the poppet ball assembly.



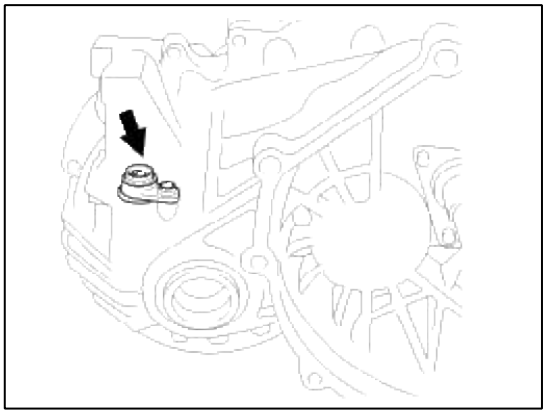
16. Install the reamer bolt.



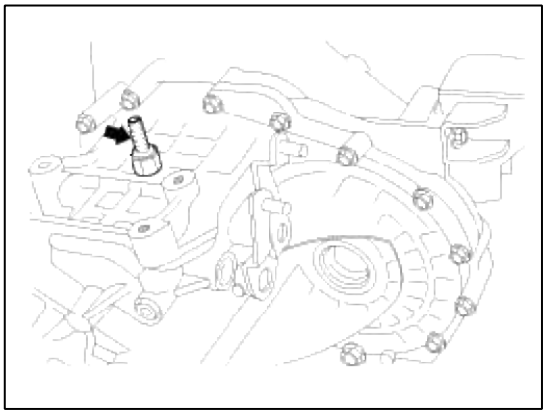
17. Install the clutch release fork shaft and the release bearing sleeve.



18. Install the speedometer driven gear.



19. Install the backup lamp.



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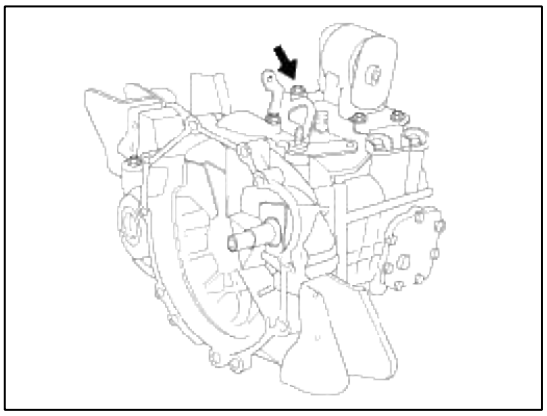
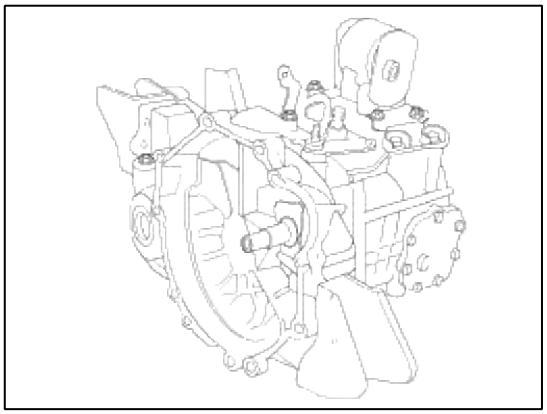
20. Install the clutch release cylinder mounting bracket.

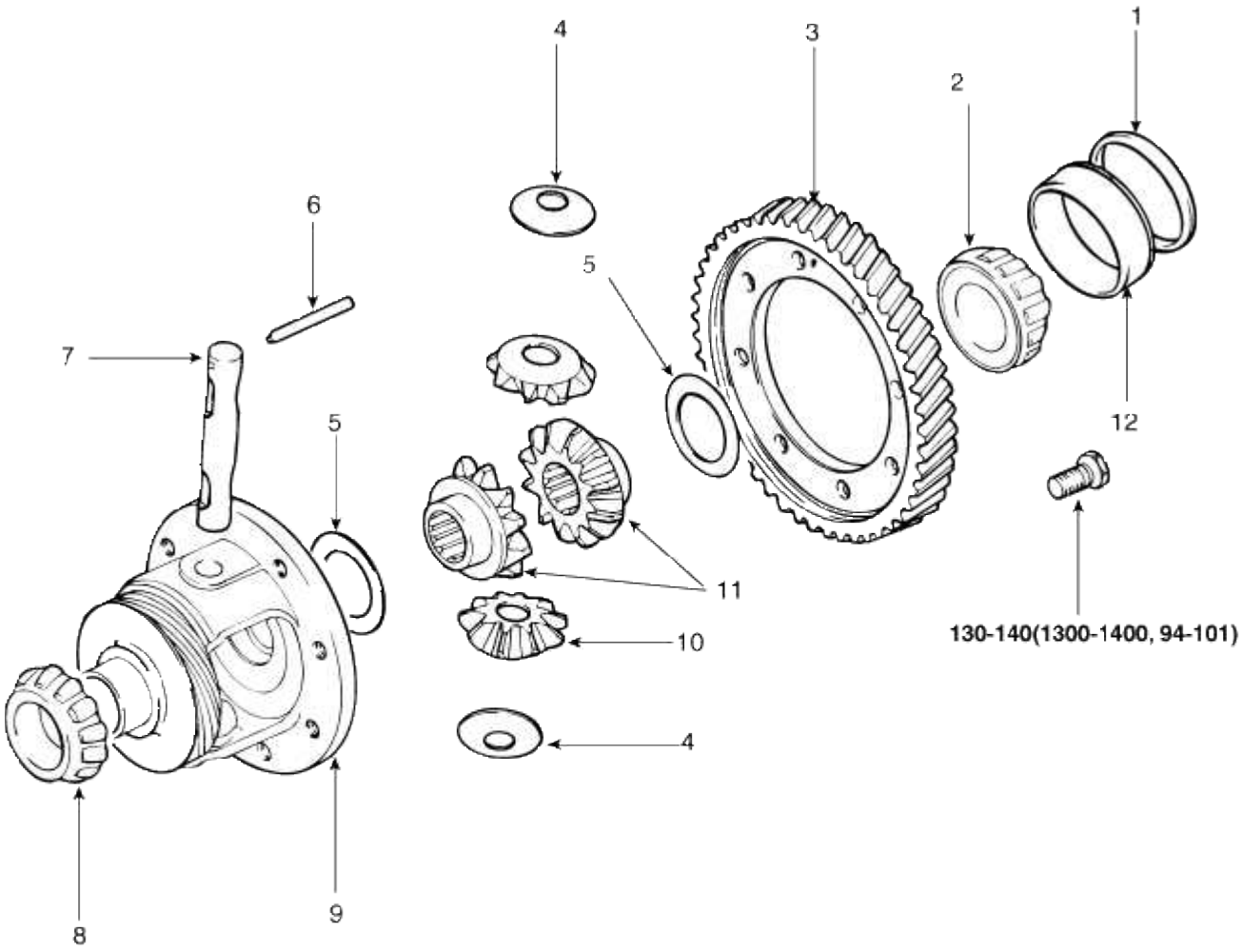


21. Install the shift control mounting bracket.
22. Install the mounting bracket.



Manual Transaxle System > Manual Transaxle Gear System > Differential > Components and Components Location (M5GF1)

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

1. Spacer
2. Taper roller bearing
3. Differential drive gear
4. Washer
5. Spacer
6. Lock pin
7. Pinion shaft
8. Taper roller bearing
9. Differential case
10. Pinion gear
11. Side gear
12. Outer race

Manual Transaxle System > Manual Transaxle Gear System > Differential > Repair procedures (M5GF1)

DISASSEMBLY

1. Clamp the differential case in a vise.

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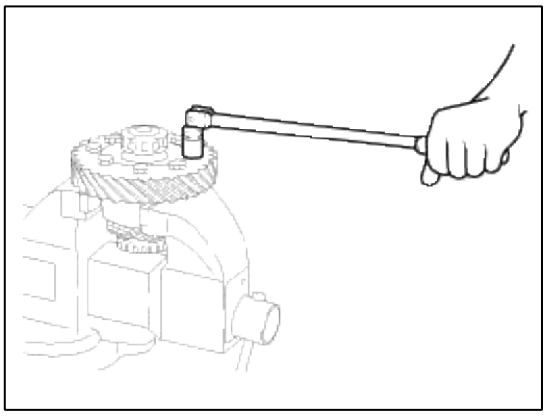
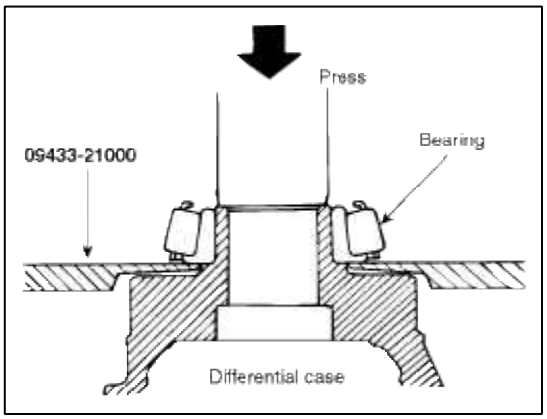
2. Remove the differential drive gear retaining bolts and remove the differential drive gear from the case.

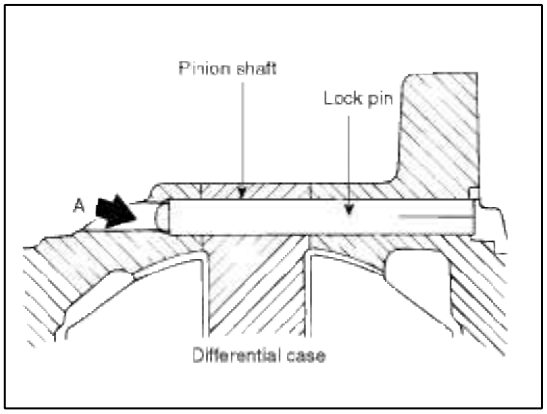


3. Remove the taper roller bearing using the special tool (09433-21000).

> **CAUTION**
>
> Do not reuse the old bearing removed from the shaft.



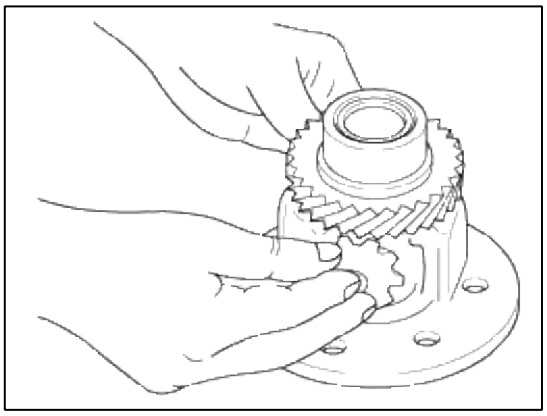
4. Drive out the lock pin from the hole using a punch.



5. Drive out the pinion shaft.
6. Remove the pinion gears, washers, side gear and spacers.

REASSEMBLY

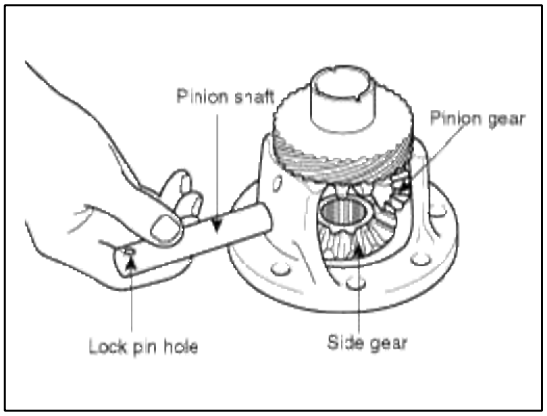
1. Insert the spacer on the back of the side gear and then install the gear in the differential case.



CAUTION

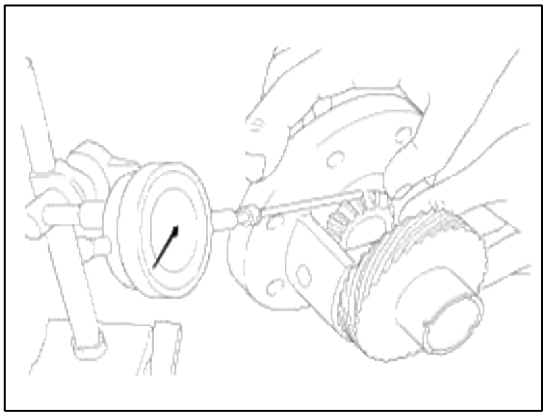
- When installing a new side gear, use a spacer of medium thickness [0.83-0.92 mm (0.033-0.036 in.)].
- Do not reuse the old lock pin.
- The lock pin head must be sunk below the flange of the differential case.

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.



4. Measure the backlash between the side gears and pinions.

Standard value : 0.025-0.150 mm (0.00095-0.0057 in.)



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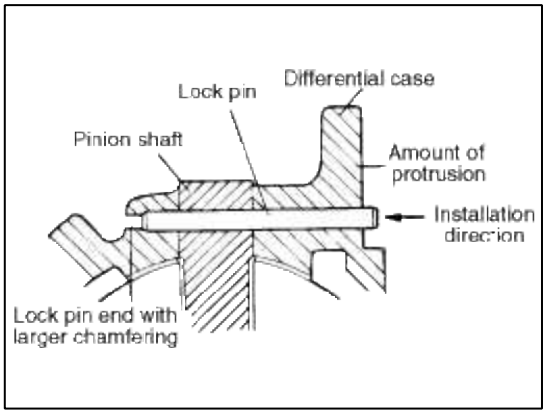
5. If the backlash is out of specifications, disassemble and install the correct spacer, reassemble and remeasure.

> CAUTION
>
> Adjust the backlash of both side gears to the same specification.

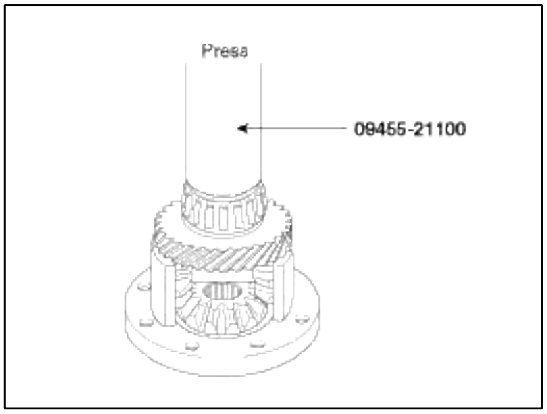
6. Align the pinion shaft lock pin hole with the case lock pin hole and insert the lock pin.



> CAUTION
>
> • Do not reuse the lock pin.
> • The lock pin head must not protrude more than 3 mm(0.118 in.).

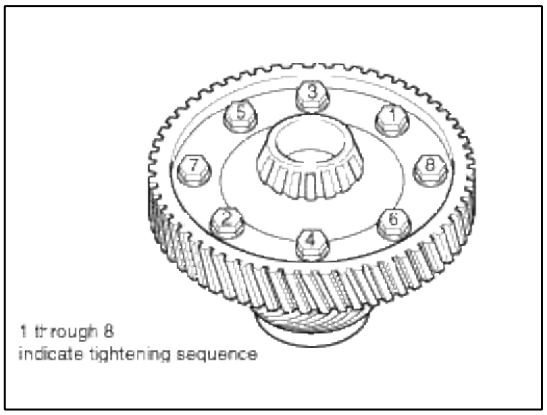
7. Install the tapered roller bearings on both sides of the differental case using the speacial tool (09455-21100).

> CAUTION
>
> When press-fitting the bearing, press on the inner race only.



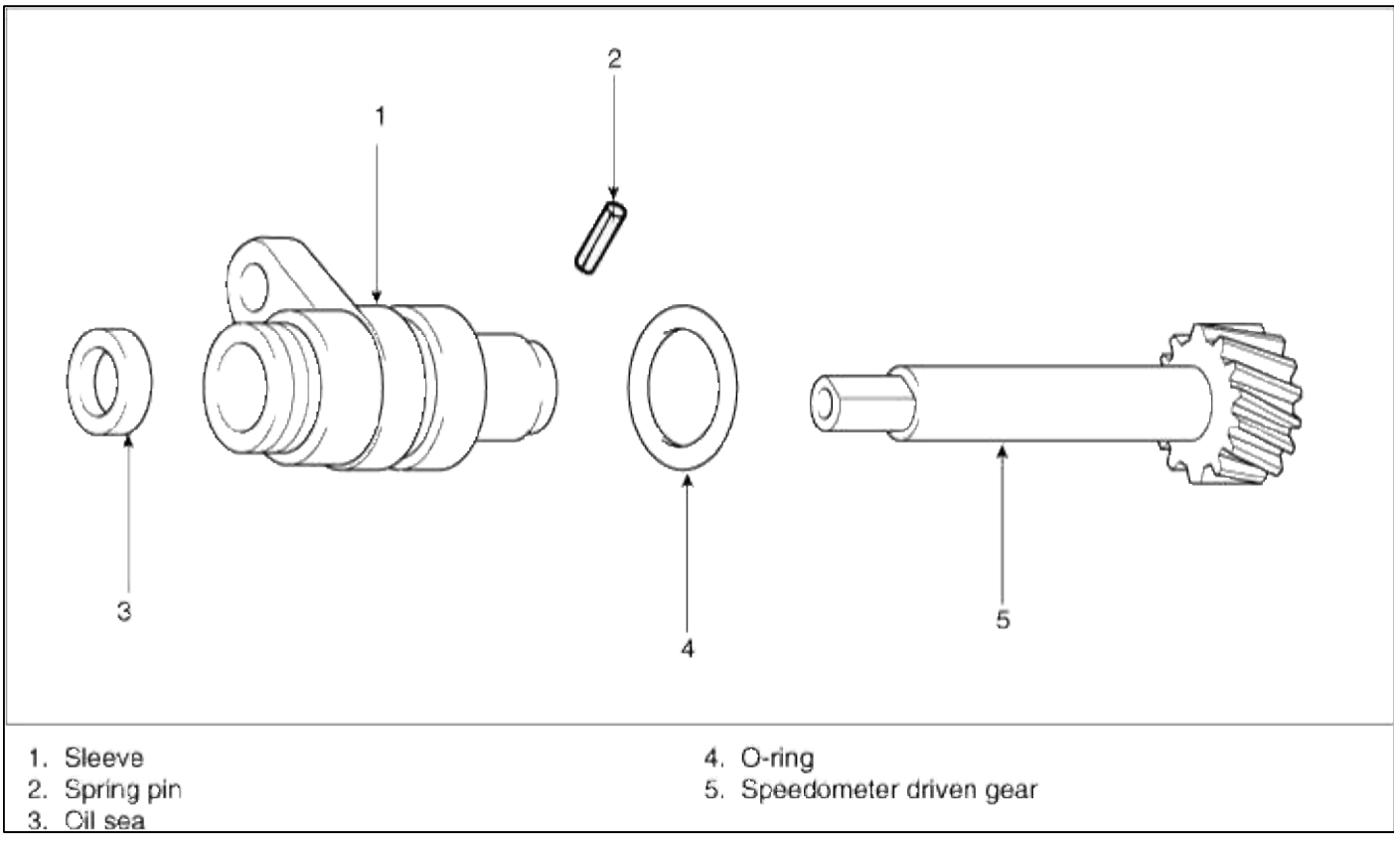
8. Apply specified sealant to the entire threads of the bolts. Tighten to specifications using the sequence shown in the illustration.
   Specified sealant : Three bond 2471

> **CAUTION**
>
> If a bolt is reused, remove the old sealant from the threads.



Manual Transaxle System > Manual Transaxle Gear System > Speedometer Driven Gear Assembly > Components and Components Location (M5GF1)

COMPONENTS



1. Sleeve
2. Spring pin
3. Oil sea
4. O-ring
5. Speedometer driven gear

Manual Transaxle System > Manual Transaxle Gear System > Speedometer Driven Gear Assembly > Repair procedures (M5GF1)

REASSEMBLY

1. Apply gear oil sparingly to the speedometer driven gear shaft and insert the shaft.

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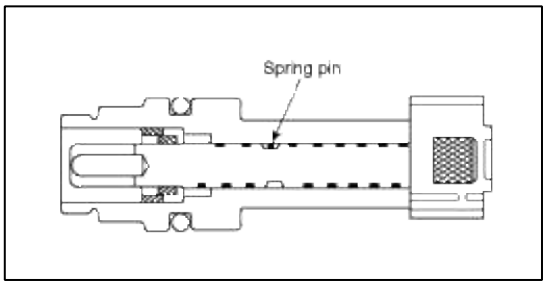
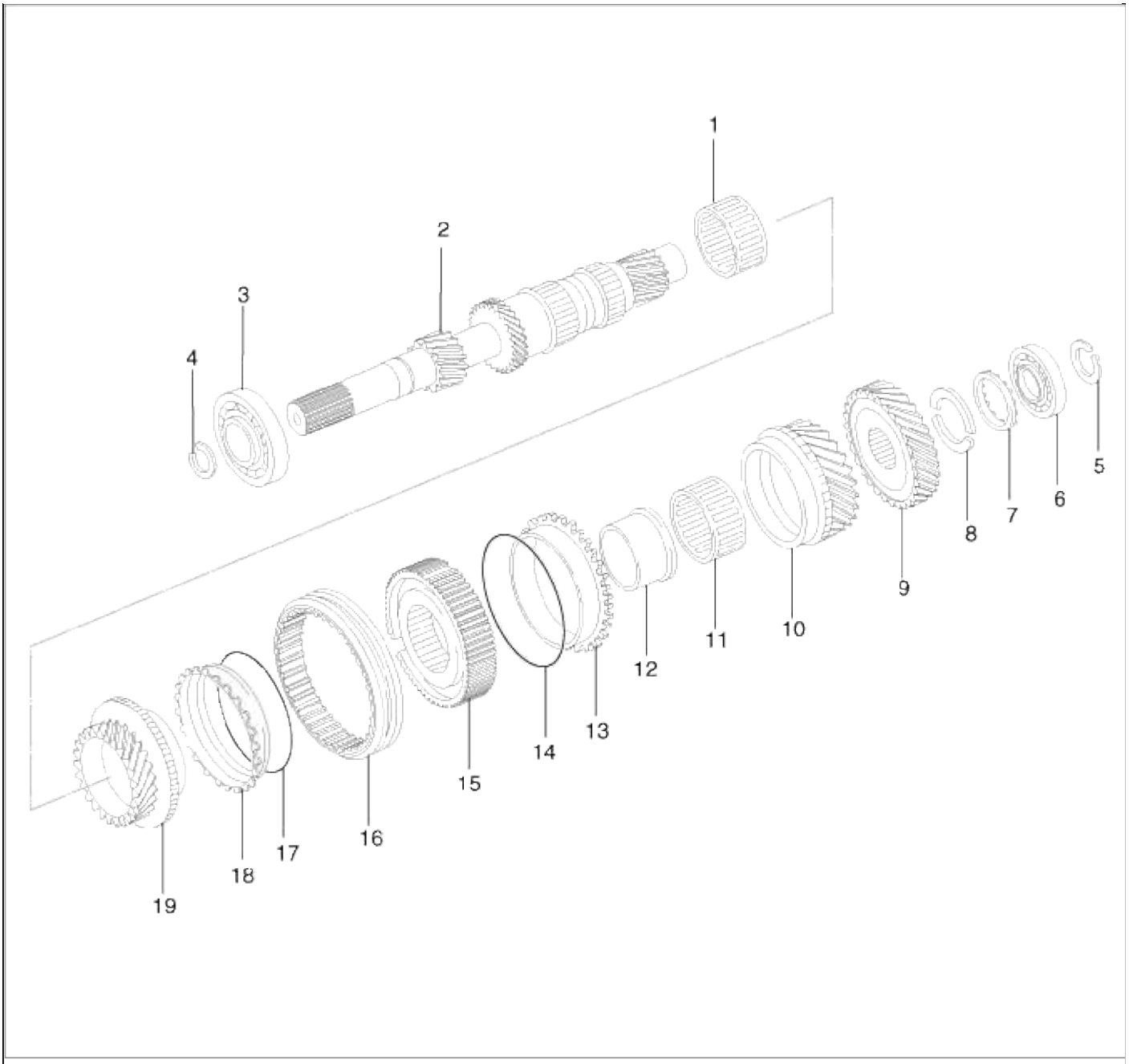
2. Insert carefully the speedometer driven gear into the clutch housing not to disassemble the speedometer driven gear shaft.



Manual Transaxle System > Manual Transaxle Gear System > Input Shaft > Components and Components Location (M5GF1)

COMPONENETS



1. Needle bearing
2. Input shaft
3. Ball bearing
4. Snap ring
5. Snap ring
6. Ball bearing
7. Stopper snap ring
8. Snap ring
9. 5th speed gear
10. 4th speed gear sleeve
11. Needle bearing
12. 4th speed gear sleeve
13. Synchronizer ring
14. Synchronizer spring
15. Synchronizer hub
16. Synchronizer sleeve
17. Synchronizer spring
18. Synchronizer ring
19. 3rd speed gear

Manual Transaxle System > Manual Transaxle Gear System > Input Shaft > Repair procedures (M5GF1)

DISASSEMBLY

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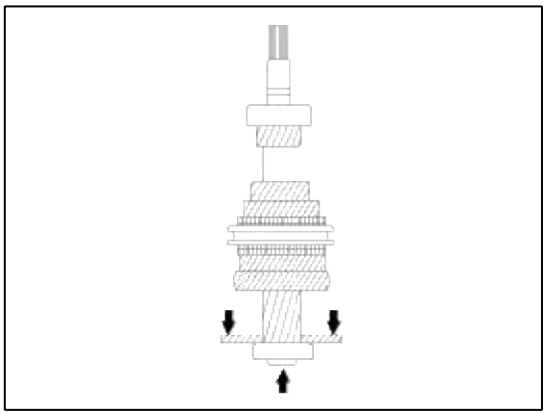
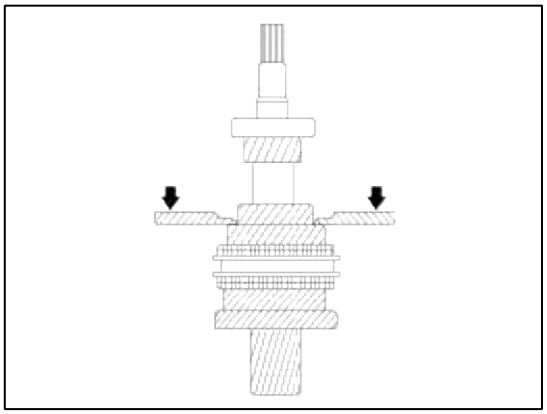
1. Remove the snap ring and the ball bearing using the special tool (09432-21300).



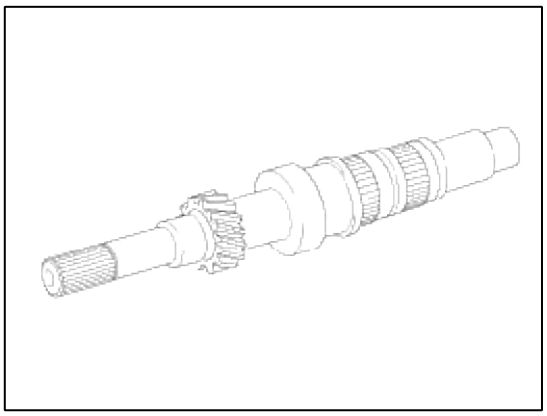
2. Remove the stopper snap ring, snap ring, 5th and 4th speed gear, needle roller bearing, 4th speed gear sleeve, synchronizer ring (3rd 4th), synchronizer spring (1st, 2nd, 3rd, 4th), synchronizer sleeve (3rd 4th), 3rd speed gear and needle roller bearing.



INSPECTION

INPUT SHAFT

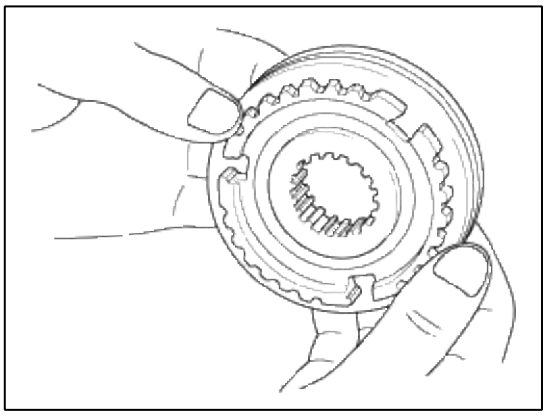
1. Check the outer surface of the input shaft where the needle bearing is mounting for damage or abnormal wear.



2. Check the splines for damage or wear.

SYNCHRONIZER SLEEVE AND HUB

1. Install the synchronizer sleeve on the hub and check that it slides smoothly.

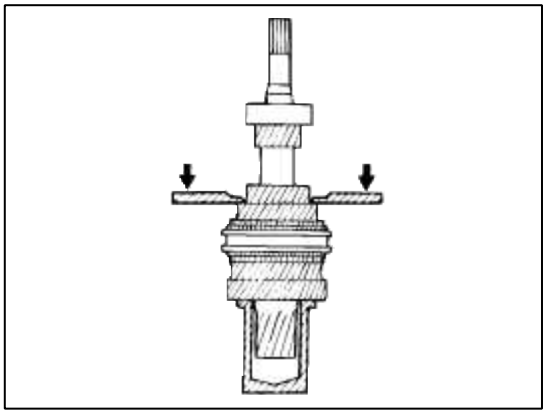


2. Check that the sleeve is free from damage.
3. Check for wear of the hub end surfaces (in contact with each gear).

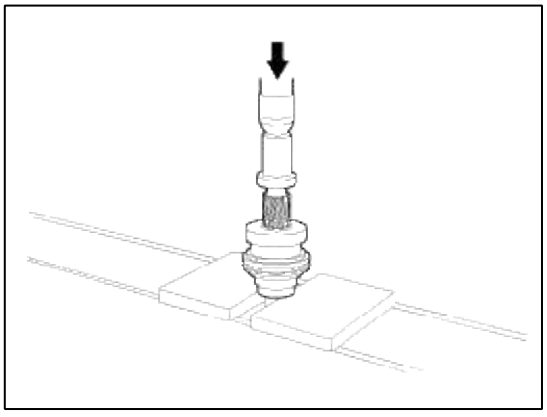
> CAUTION
>
> Replace the synchronizer hub and sleeve as a set.

REASSEMBLY

1. Install the needle roller bearing, 3rd speed gear, synchronizer sleeve (3rd 4th), synchronizer spring (1st, 2nd, 3rd, 4th), synchronizer ring (3rd 4th), 4th speed gear sleeve, needle roller bearing, 5th and 4th speed gar, snap ring and the stopper snap ring using the special tool (09432-33200).



2. Install the snap ring and the ball bearing using special tool (09495-33100).



Manual Transaxle System > Manual Transaxle Gear System > Output Shaft > Components and Components Location (M5GF1)

COMPONENTS

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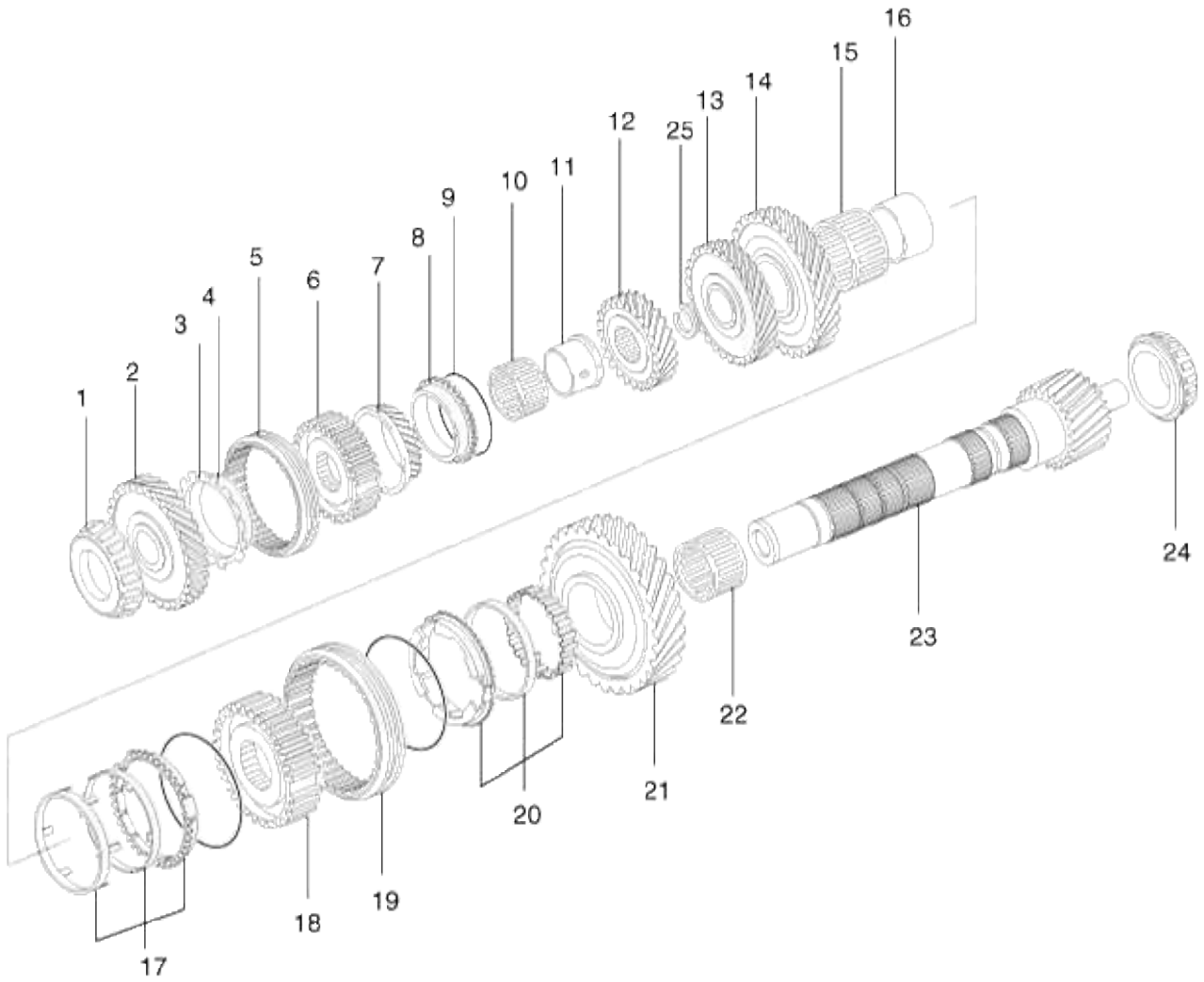
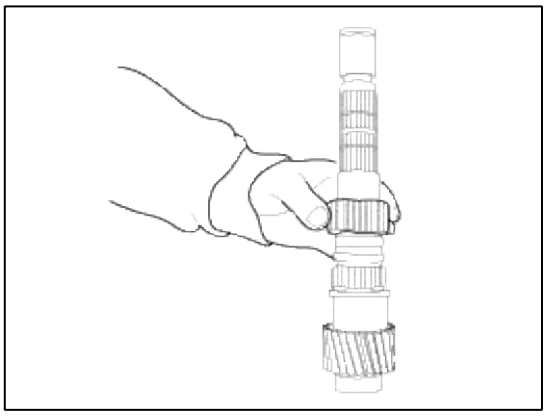


1. Taper roller bearing
2. Reverse speed gear
3. Synchronizer ring
4. Synchronizer spring
5. Synchronizer sleeve
6. Synchronizer hub
7. 5th speed gear
8. Synchronizer ring
9. Needle bearing
10. 5th speed gear sleeve
11. 5th speed gear
12. 4th speed gear
13. 3rd speed gear
14. 2nd speed gear
15. Needle bearing
16. 2nd speed gear sleeve
17. Triple cone synchronizer ring
18. Synchronizer hub
19. Synchronizer sleeve
20. Triple cone synchronizer ring
21. 1st speed gear
22. Needle bearing
23. Output shaft
24. Front taper roller bearing

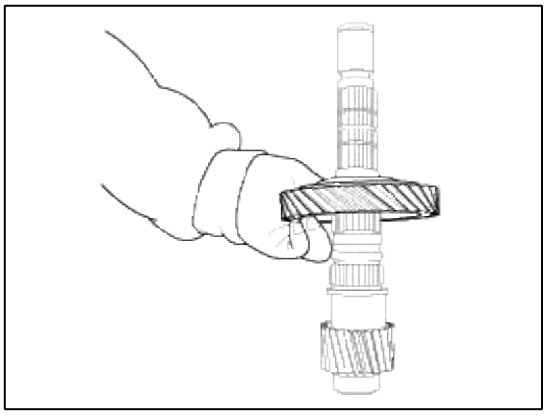
Manual Transaxle System > Manual Transaxle Gear System > Output Shaft > Repair procedures (M5GF1)

REASSEMBLY

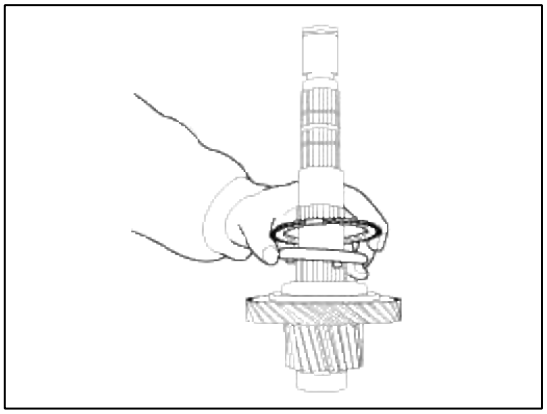
1. Install the needle roller bearing.



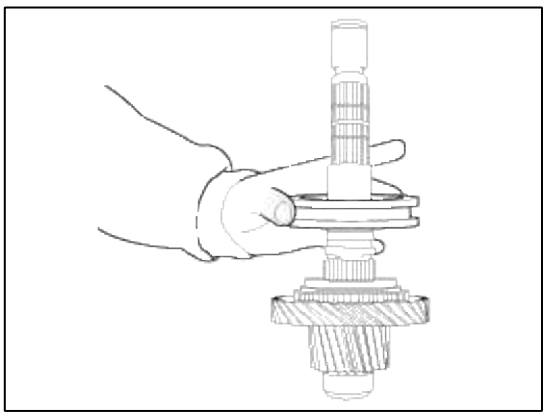
2. Install the 1st speed gear.



3. Install the triple cone assembly.



4. Install the synchronizer sleeve and hub.



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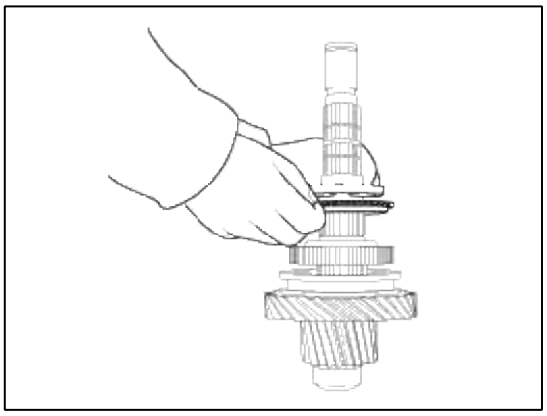
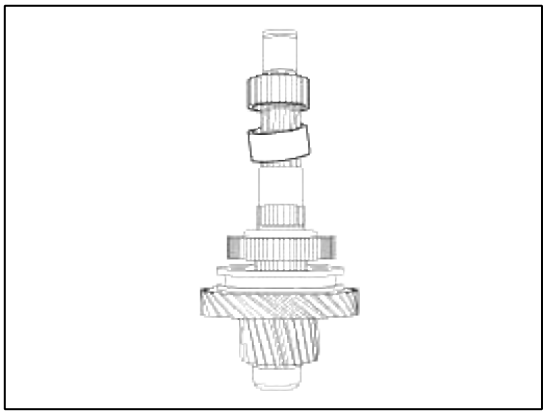
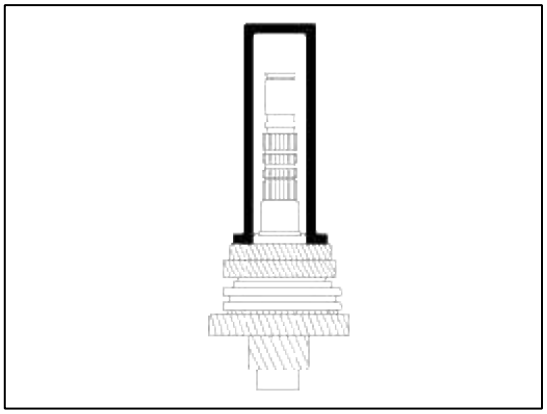
5. Install the triple cone assembly.



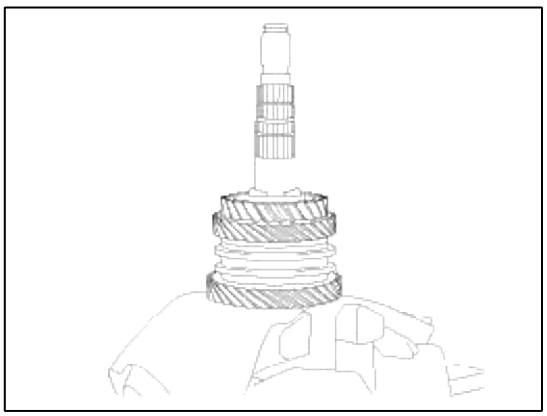
6. Install the 2nd speed sleeve and the needle roller bearing.



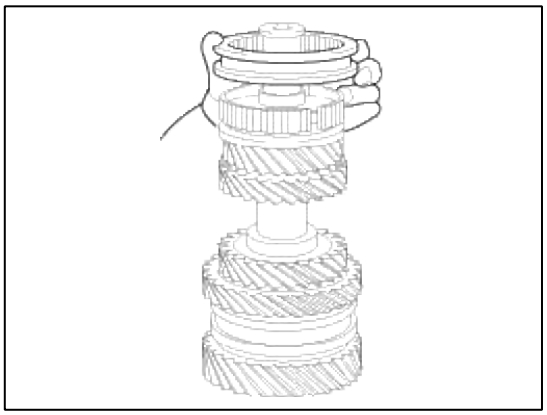
7. Install the 2nd and 3rd speed gear with all together above mentioned using the special tool (09432-H1000).



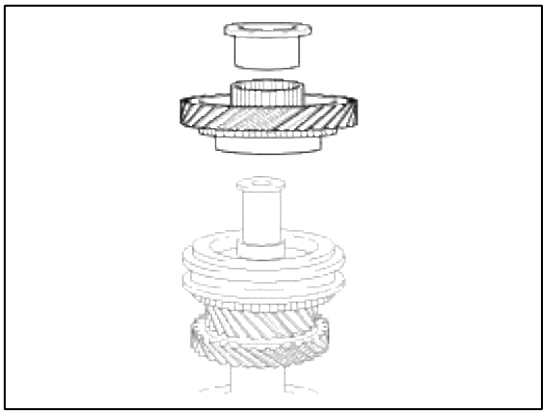
8. Install the snap ring.



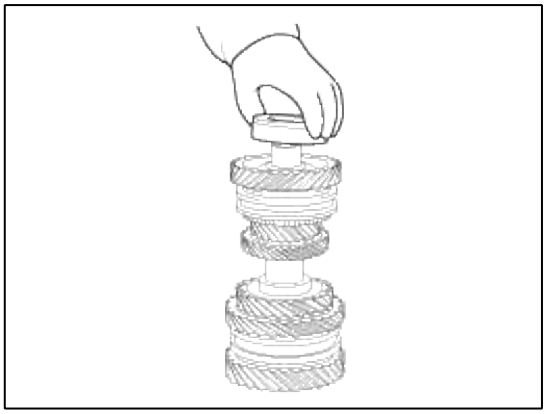
9. Install the 4th speed gear, the 5th speed gear sleeve, the needle roller bearing, the 5th speed gear, the synchronizer ring (5th), the synchronizer hub and the sleeve (5 & R).



10. Install the needle roller bearing, the reverse gear assembly and the reverse driven gear sleeve.

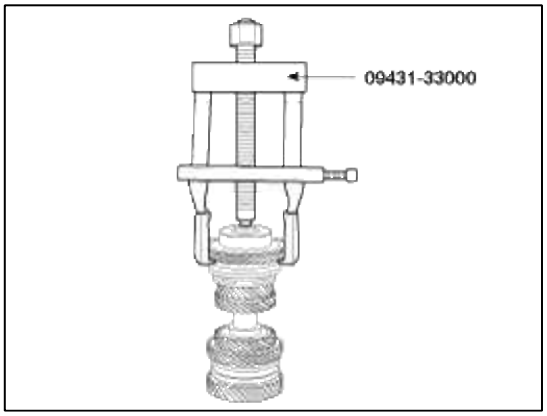


11. Install the rear taper roller bearing with all together above mentioned using the special tool (09432-22000).



DISASSEMBLY

1. Remove the taper roller bearing and the reverse gear using the special tool (03495-33000).



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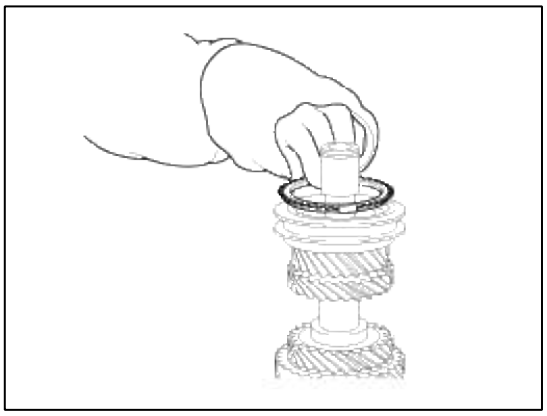
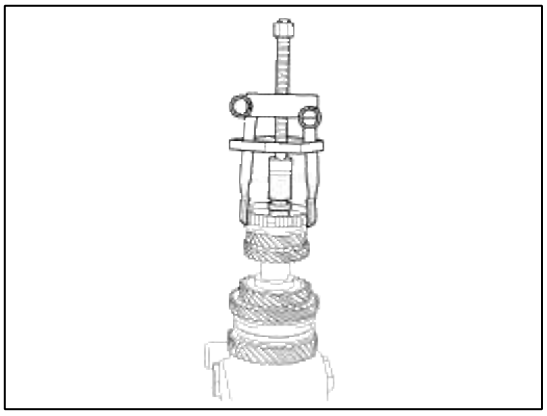
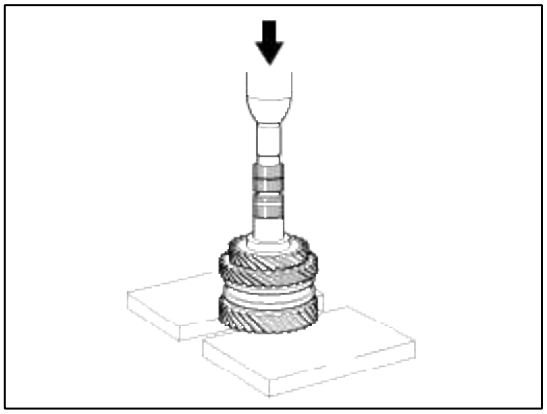
2. Remove the synchronizer ring, synchronizer spring (5th & Rev), sleeve (5th & Rev).



3. Remove the synchronizer hub and the 5th gear using the special tool (03495-33000).



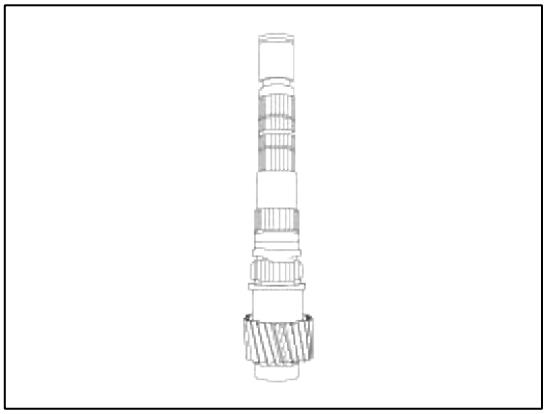
4. Remove the 4th, 3rd, 2nd, 1st gear all together the special tool (09432-33200).



INSPECTION

OUTPUT SHAFT

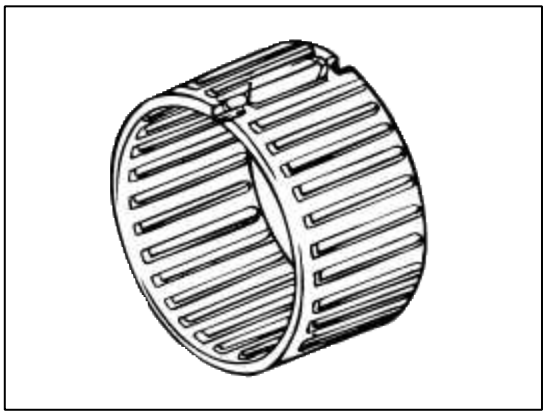
1. Check the outer surface of where the needle bearing is mounted for damage or abnormal wear.



2. Check the splines for damage or wear.

NEEDLE BEARING

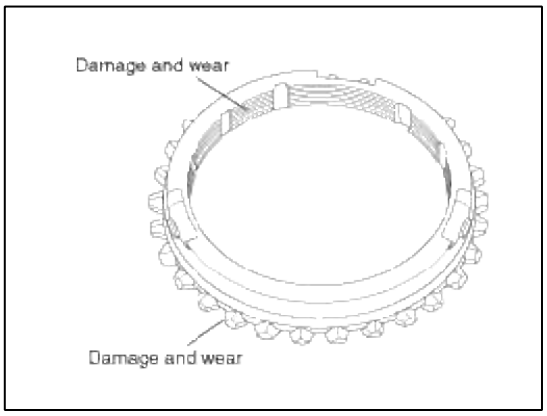
1. Install the needle bearing on the shaft with the bearing sleeve and gear. Check that it rotates smoothly without abnormal noise or play.



2. Check the needle bearing cage for distortion.

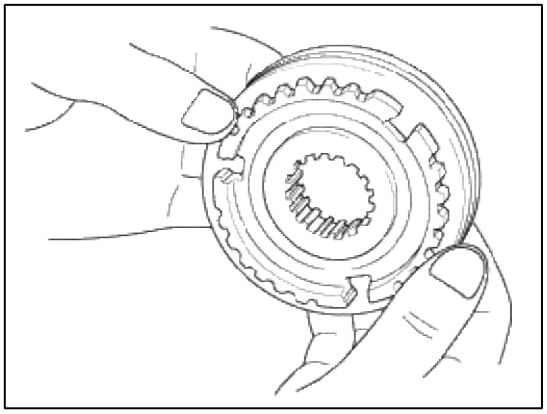
SYNCHRONIZER RING

1. Check the clutch gear teeth for damage.
2. Check internal surface for damage, wear or broken grooves.



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.

GEARS

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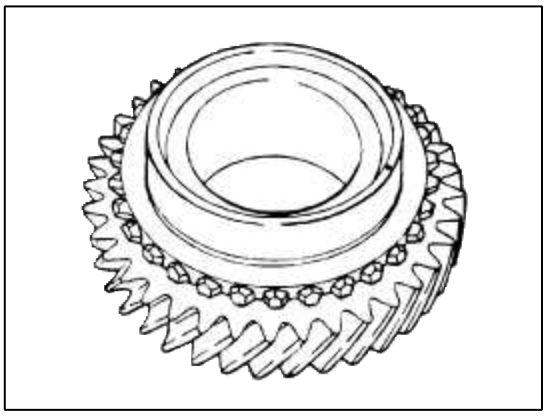
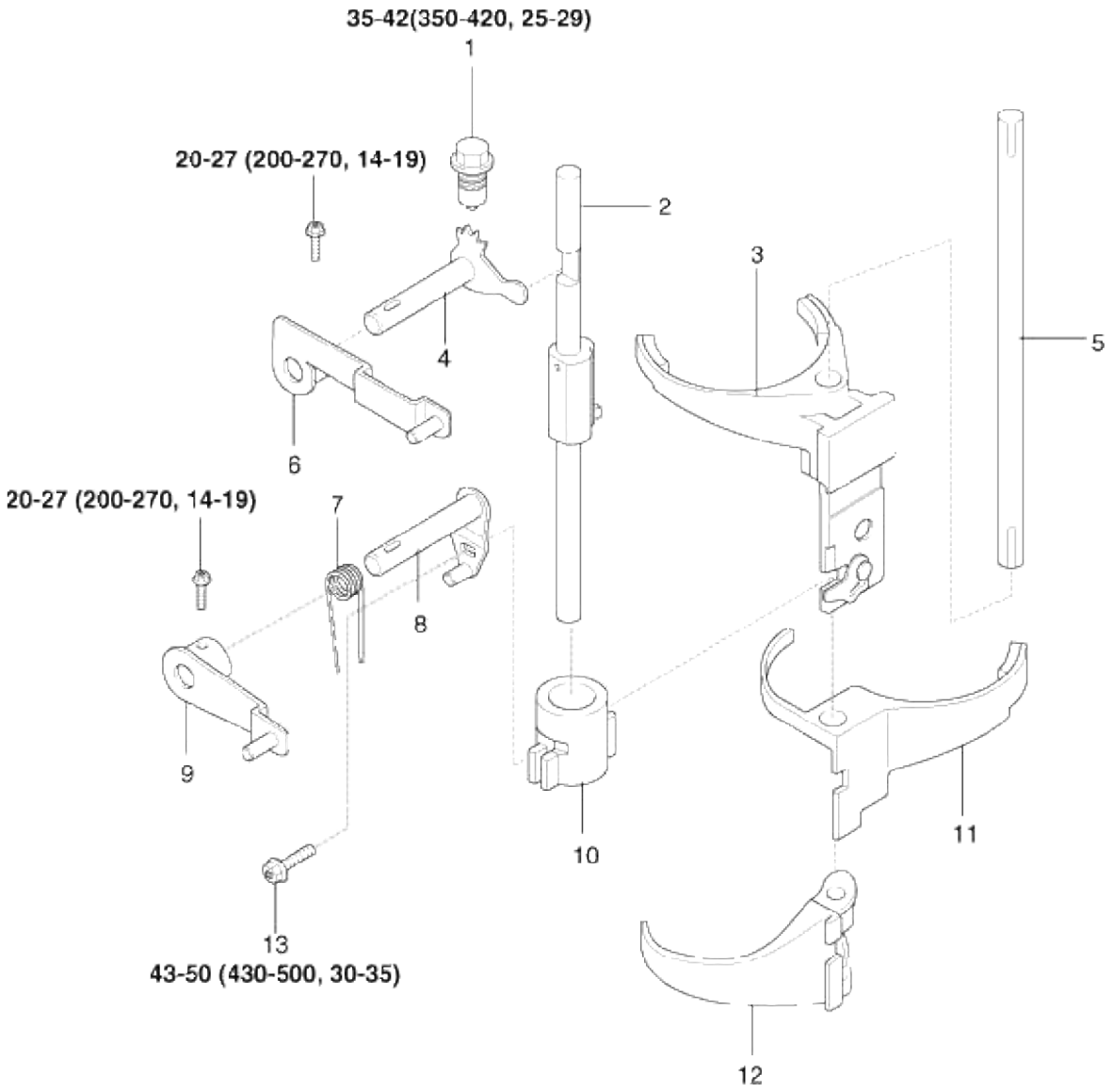
1. Check the helical gear and clutch gear teeth for damage or wear.



2. Check the gear cone for rough surfaces, damage or wear.
3. Check the gear bore for damage or wear.

Manual Transaxle System > Manual Transaxle Control System > Shift Fork > Components and Components Location (M5GF1)

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

1. Poppet ball
2. Control shaft
3. Shift fork (5th & Rev)
4. Shift arm
5. Shift rail
6. Shift lever
7. Return spring
8. Select arm
9. Select lever
10. Interlock body
11. Shift fork (3rd & 4th)
12. Shift fork (1st & 2nd)
13. Interlock body bolt

Manual Transaxle System > Manual Transaxle Control System > Manual Transaxle Shift Control > Components and Components Location (M5GF1)

COMPONENTS

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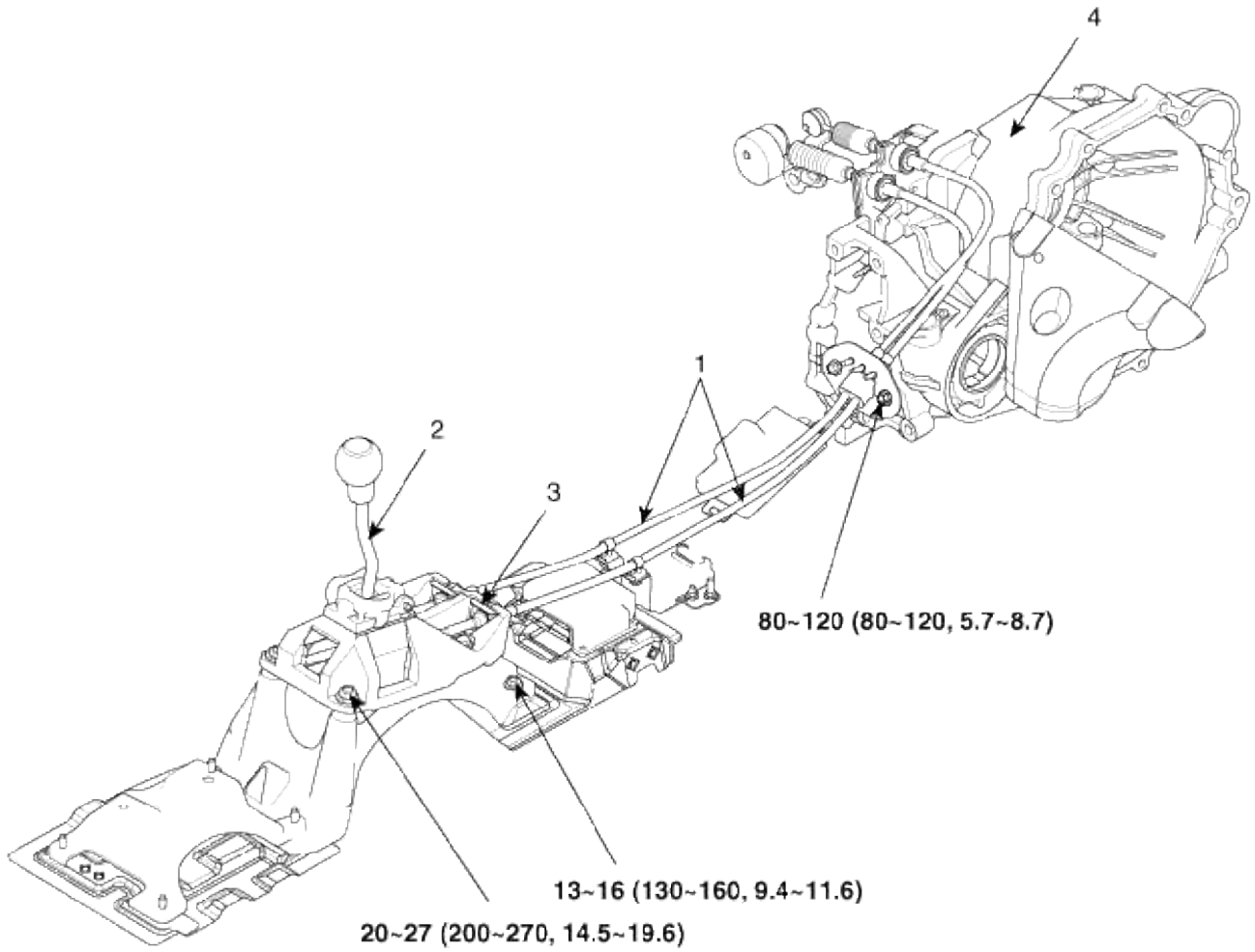


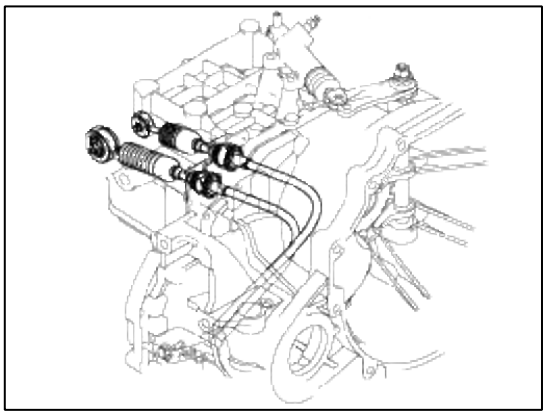
1. Cable assembly
2. Shift lever
3. Fixing Pin
4. Transaxle

Manual Transaxle System > Manual Transaxle Control System > Manual Transaxle Shift Control > Repair procedures (M5GF1)

REMOVAL

1. Remove the console assembly.
2. Remove the cotter pins and clips (shift lever side).
3. Remove the shift lever assembly.
4. Remove the retainer and bolts.
5. Remove the cotter pins and clips (Transaxle side).

6. Remove the shift cable and select cable.



INSTALLATION

1. Install the shift lever assembly.
2. Install the shift lever and select cable.

INSPECTION

1. Check the select cable for proper operation and for damage.
2. Check the shift cable for porper operation and for damage.
3. Check the boot for damage.
4. Check each bushing for wear, abrasion, sticking, restricted movement or damage.
5. Check for a weak or damaged return spring.

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SPORTAGE(KM) > 2007 > G 2.0 DOHC > Restraint

Restraint > General Information > General Safety Information and Caution

Precautions

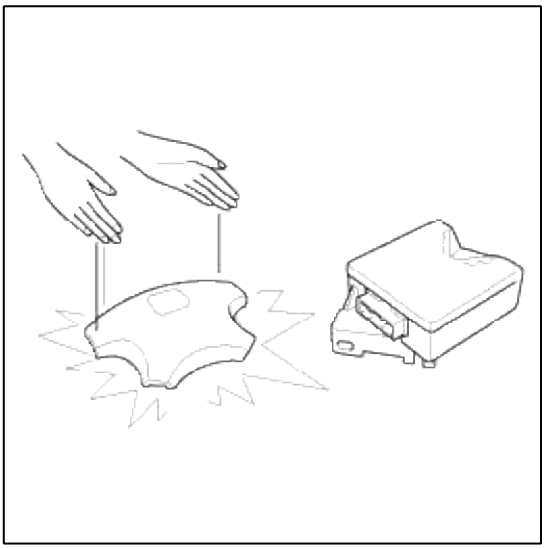
General Precautions

Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

> NOTE
>
> The contents in the memory is not erased even if the ignition switch is turned OFF or the battery cables are disconnectedfrom the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality.
  Do not install used SRS parts from another vehicle.
  Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it.
  Do not install any part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.



- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

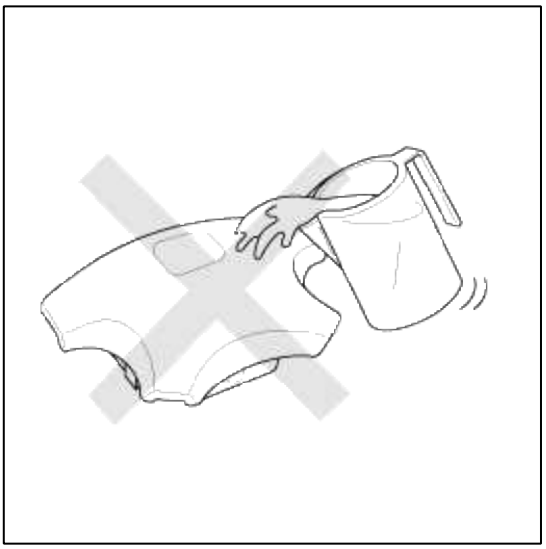
Airbag Handling and Storage

Do not disassemble the airbags; it has no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.

For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.

- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.



- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85°C/185°F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRS unit or the side impact sensors 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 104°F/40°C) 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.

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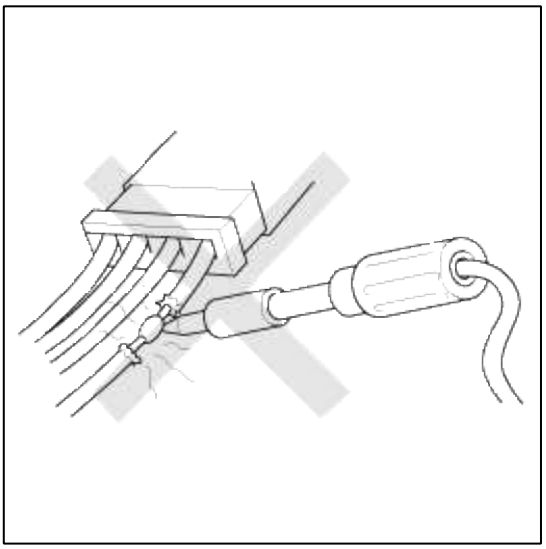
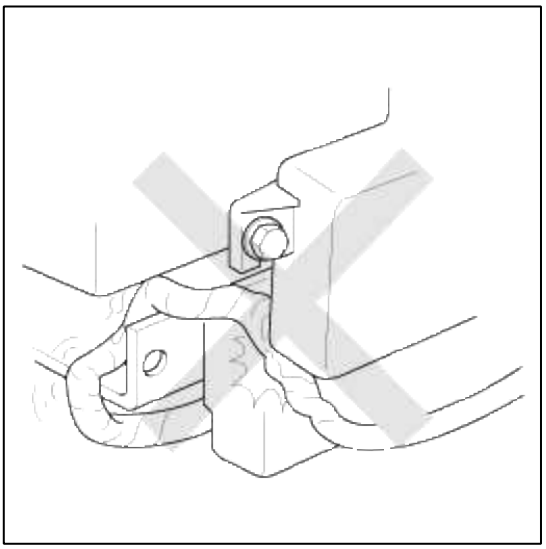
- Never attempt to modify, splice, or repair SRS wiring.
  If there is an open or damage in SRS wiring, replace the harness.



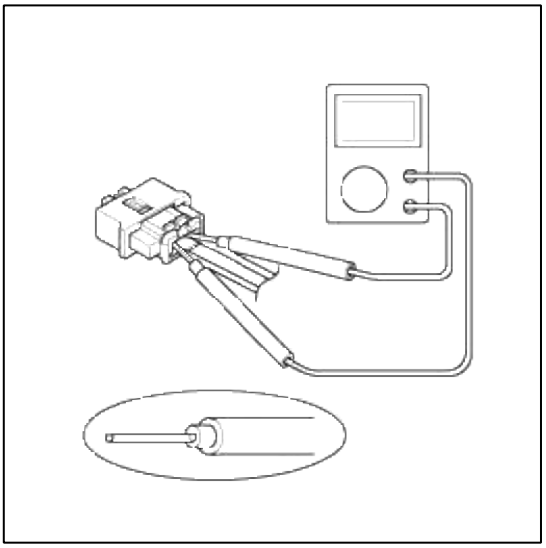
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- Make sure all SRS ground locations are clean, and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

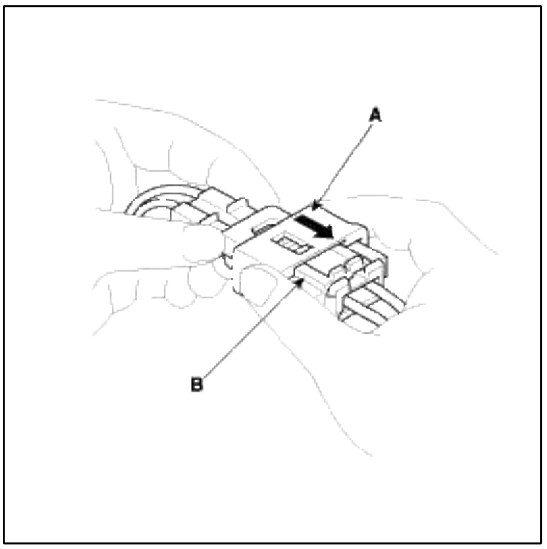
Precautions for Electrical Inspections

- When using electrical test equipment, insert the probe of the tester into the wire side of the connector.
  Do not insert the probe of the tester into the terminal side of the connector, and do not tamper with the connector.



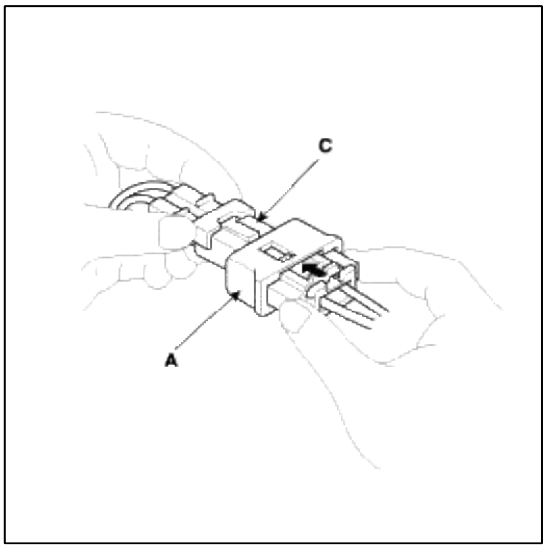
- Use a u-shaped probe. Do not insert the probe forcibly.
- Use specificed service connectors for troubleshooting.
  Using improper tools could cause an error in inspection due to poor metal contact.

Spring-loaded Lock Connector
Airbag Connector(I)



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 connectpr halves are pressed together, the sleeve (A) is pushed back by the pawl (C). Do not touch the sleeve.



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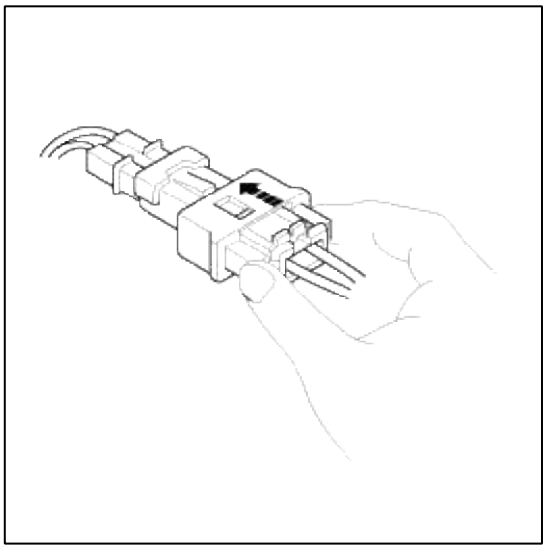
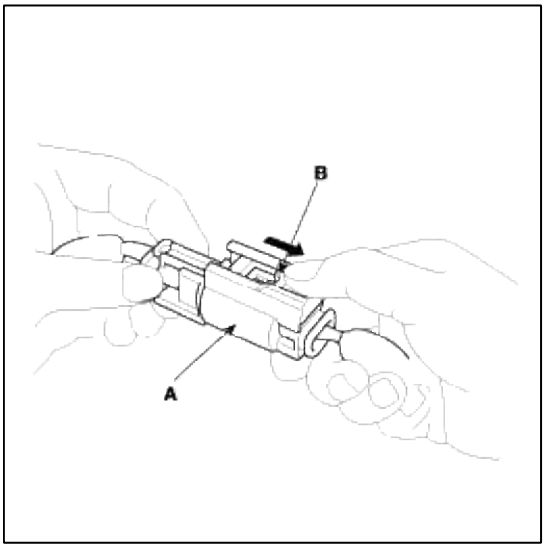
2. When the connector halves are completely connected, the pawl is released, and the spring-loaded sleeve locks the connector.

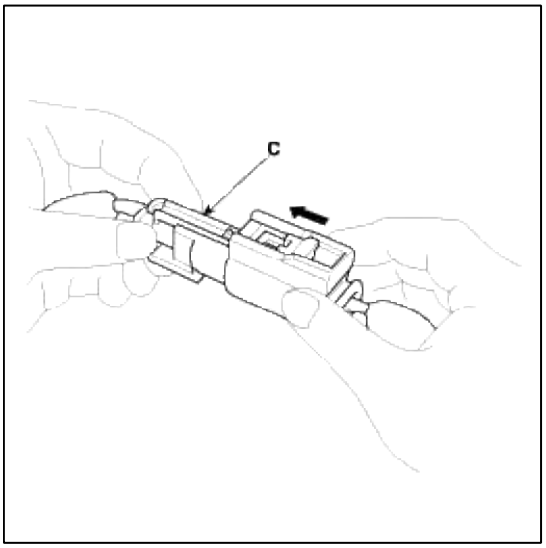


Airbag Connector(II)



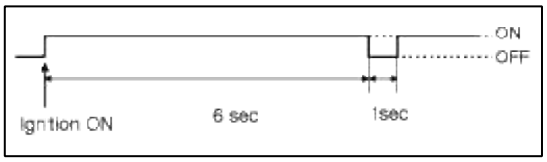
Connecting

Hold both connector halves and press firmly until the projection (C) of the sleeve-side connector clicks to lock.

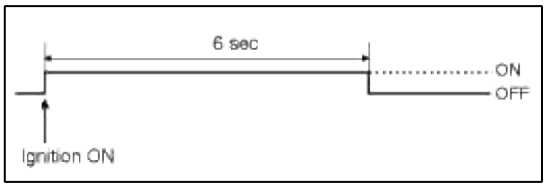


WARNING LAMP ACTIVATION

1. Active fault or historical fault counter is greater or equal to 10



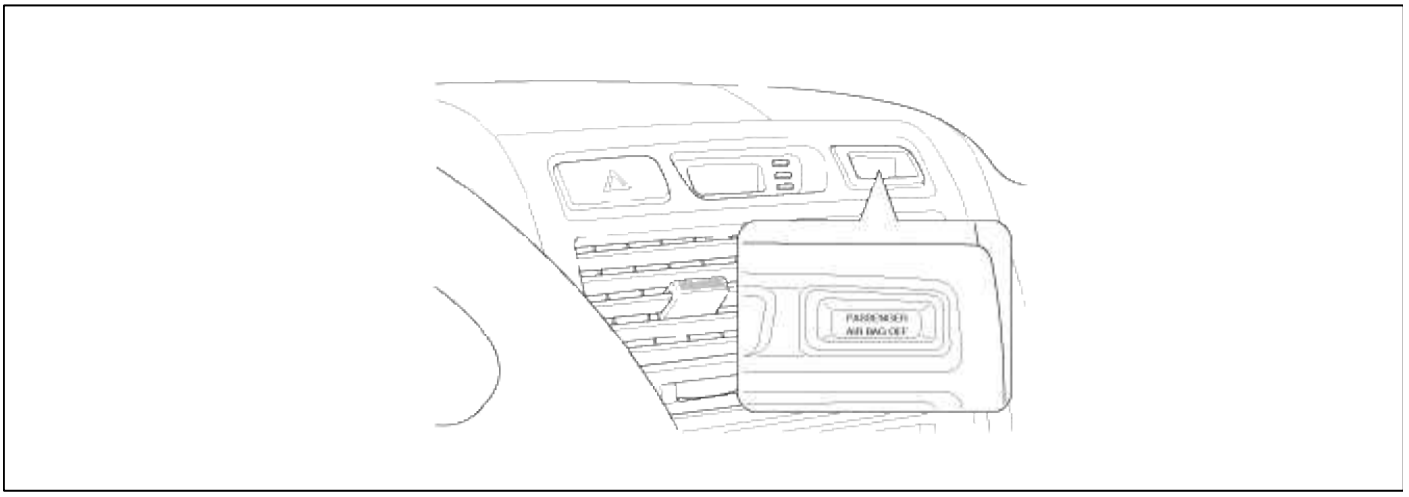
2. Normal or historical fault counter is less than 10



3. Loss of battery supply to the SRSCM : warning lamp turned on continuously.
4. Loss of internal operating voltage : warning lamp turned on continuously.
5. Loss of SRSCM operation : warning lamp turned on continuously.
6. SRSCM not connected : warning lamp turned on continuously through the shorting bar.
7. Reset by the Watchdog Trigger failure : warning lamp flashed or turned on continuously.

TELLTALE LAMP ACTIVATION

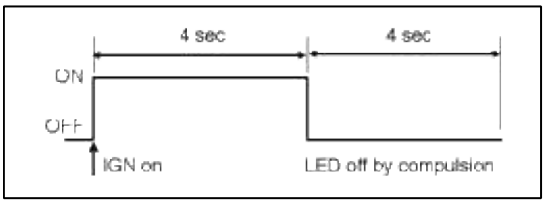
DESCRIPTION



The Telltale Lamp indicates the Passenger Airbag(PAB) enable disable status based on occupant status of passenger seat. If the passenger seat is occupied with child (or child seat), the Passenger Airbag is disabled and the Telltale Lamp is turned ON to inform the driver that the PAB is disabled. As soon as operating voltage is applied to the SRSCM ignition input, the SRSCM activates telltale lamp prove out. OCS will send an indeterminate status to the SRSCM as a default setting for passenger airbag deployment during the prove out period. After crash if OCS gets reset and sends the indeterminate status, the telltale lamp will be ON as long as the occupant status is in the indeterminate status. Occupant status information and telltale ststus are as below table.

Occupant Status	Telltale Status Indicator	Passenger Airbag
Empty(buckled)	ON	Disable
Empty*unbuckled)	OFF	Disable
Small	ON	Disable
Large	OFF	Available
Indeterminate	ON	Disable

After ignition on, telltale lamp will turn on for 4 seconds and turn off for 3 seconds during the initialization phase and be turned off afterward until receive first valid suppression message from OCS system.



Restraint > General Information > General Information

Description

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 pre-tensioner in certain frontal or side collisions.

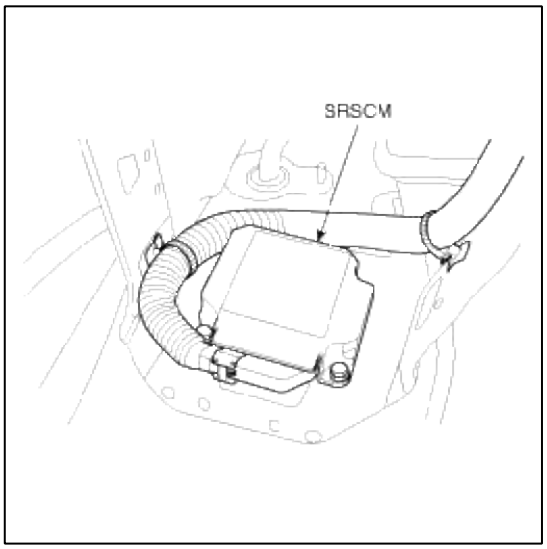
The SRS (Airbag) consists of : a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad containsthe folded cushion assembled with inflator unit ; side airbag 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 Passenger Occupant classification System (OCS) utilizes bladder placed between the passenger seat cushion and suspension to measure the occupant's loading force on the vehicle seat. Seat Track Position Sensor (STPS) located in driver and passenger seat interfaces with SRSCM and will help in determining whether to suppress either stage of a multi-stage airbag system. SRSCM is located under the center console. 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.

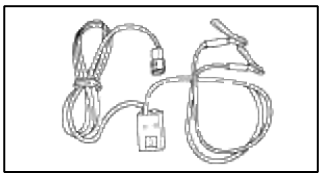
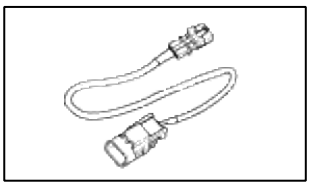
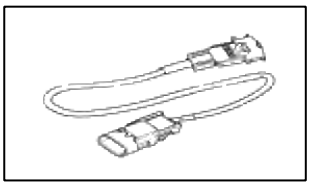
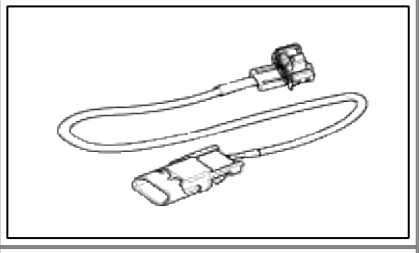
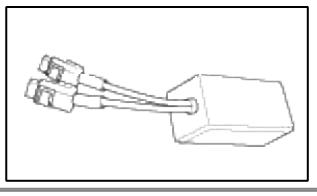
1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provide ignition voltage for 2 front airbag ignition circuits and the internal operation voltage of the SRSCM. If the internal operation voltage is below critical value setting, it will perform resetting.
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.



Restraint > General Information > Special Service Tools

SPECIAL SERVICE TOOLS

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-38100		Use with deployment tool.(PAB,SAB)
Deployment adapter 0957A-38500		Use with deployment tool.(DAB,CAB,BPT)
Deployment adapter 0957A-2E210		Use with deployment tool.(BUPT)
Dummy 0957A-38200		Simulator to check the resistance of each wiring harness

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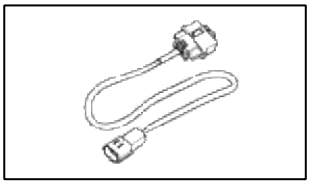
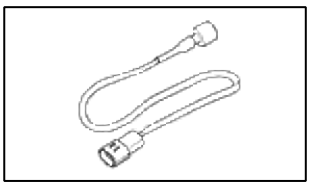
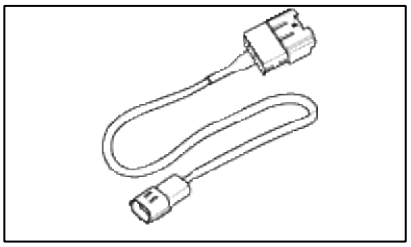
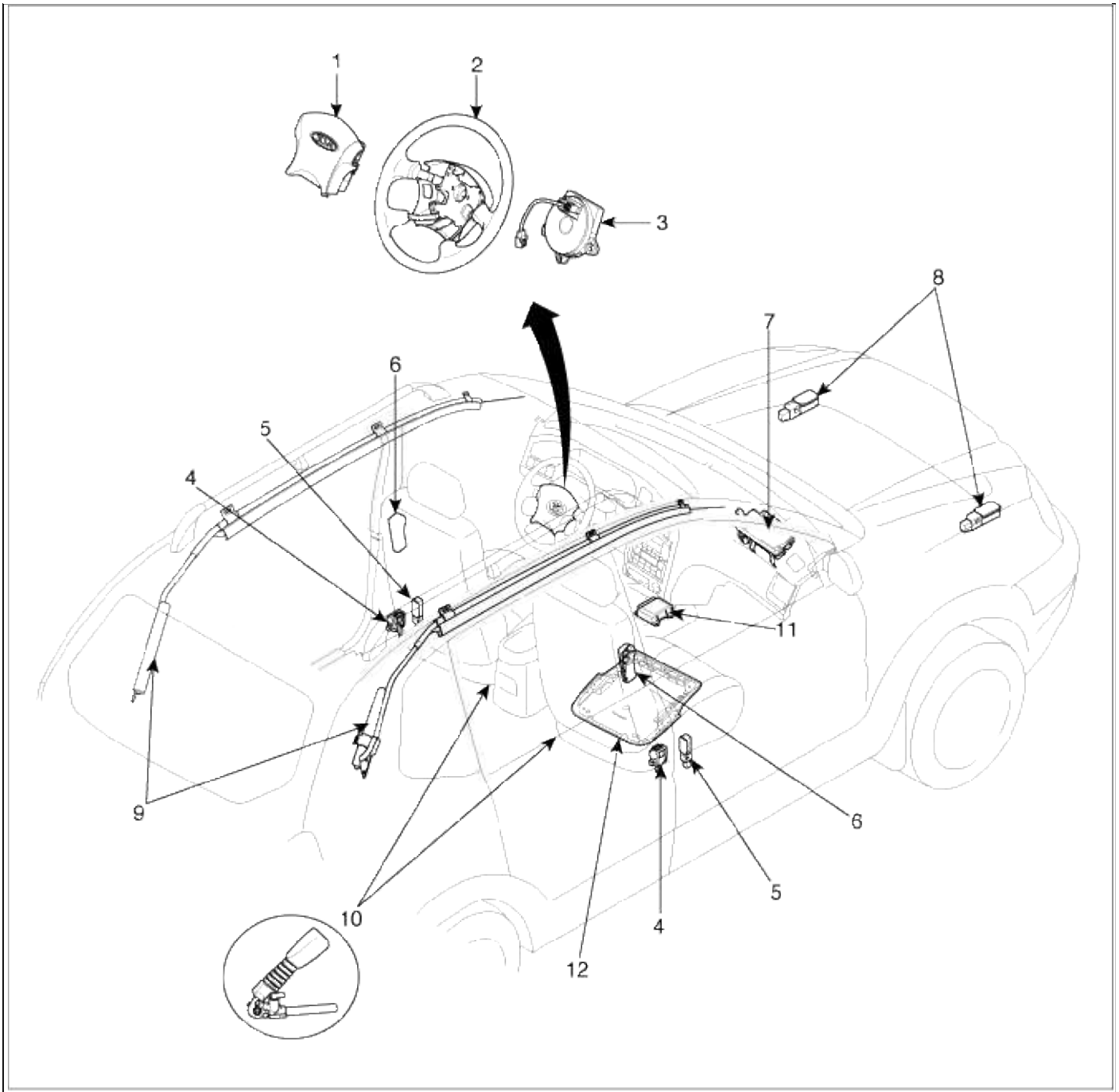
Dummy adapter 0957A-38300		Use with dummy(PAB,SAB)
Dummy adapter 0957A-1C000		Use with dummy(DAB,CAB,BPT)
Dummy adapter 0957A-2E200		Use with dummy(BUPT)

DAB : Driver Airbag
PAB : Passenger Airbag
SAB : Side Airbag
CAB : Curtain Airbag
BPT : Belt Pretensioner
BUPT: Buckle Pretensioner

Restraint > General Information > Components and Components Location

airbag system

components



1. Driver Airbag (DAB)
2. Steering Wheel
3. Clock Spring
4. Seat Belt Pretensioner (BPT)
5. Side Impact Sensor (SIS)
6. Side Airbag (SAB)
7. Passenger Airbag (PAB)
8. Front Impact Sensor (FIS)
9. Curtain Airbag (CAB)
10. Buckle Pretensioner (BUPT)
11. Airbag Control Module (SRSCM)
12. Occupant Classification Sensor(OCS)

COMPONENTS LOCATION
DRIVER AIRBAG (DAB) /PASSENGER AIRBAG (PAB)

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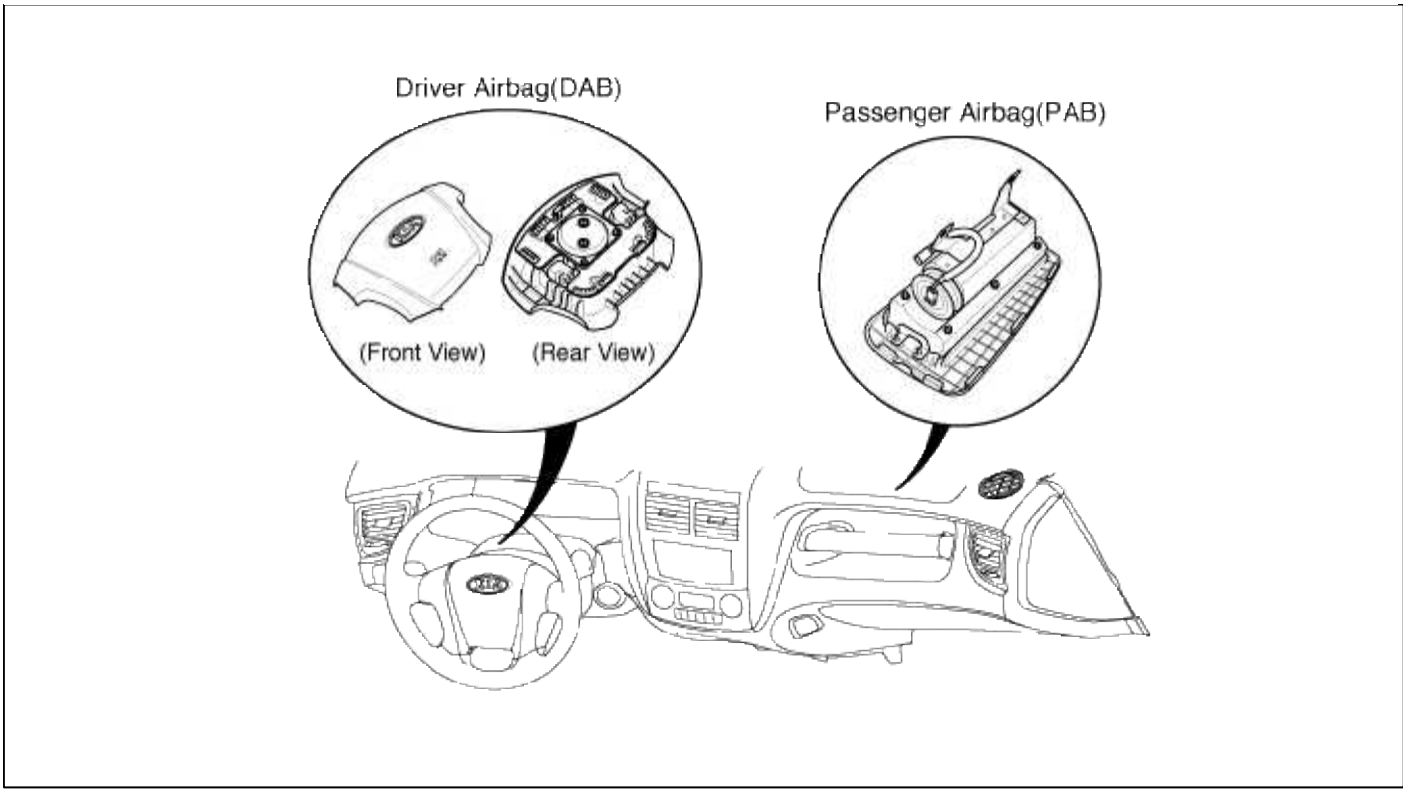
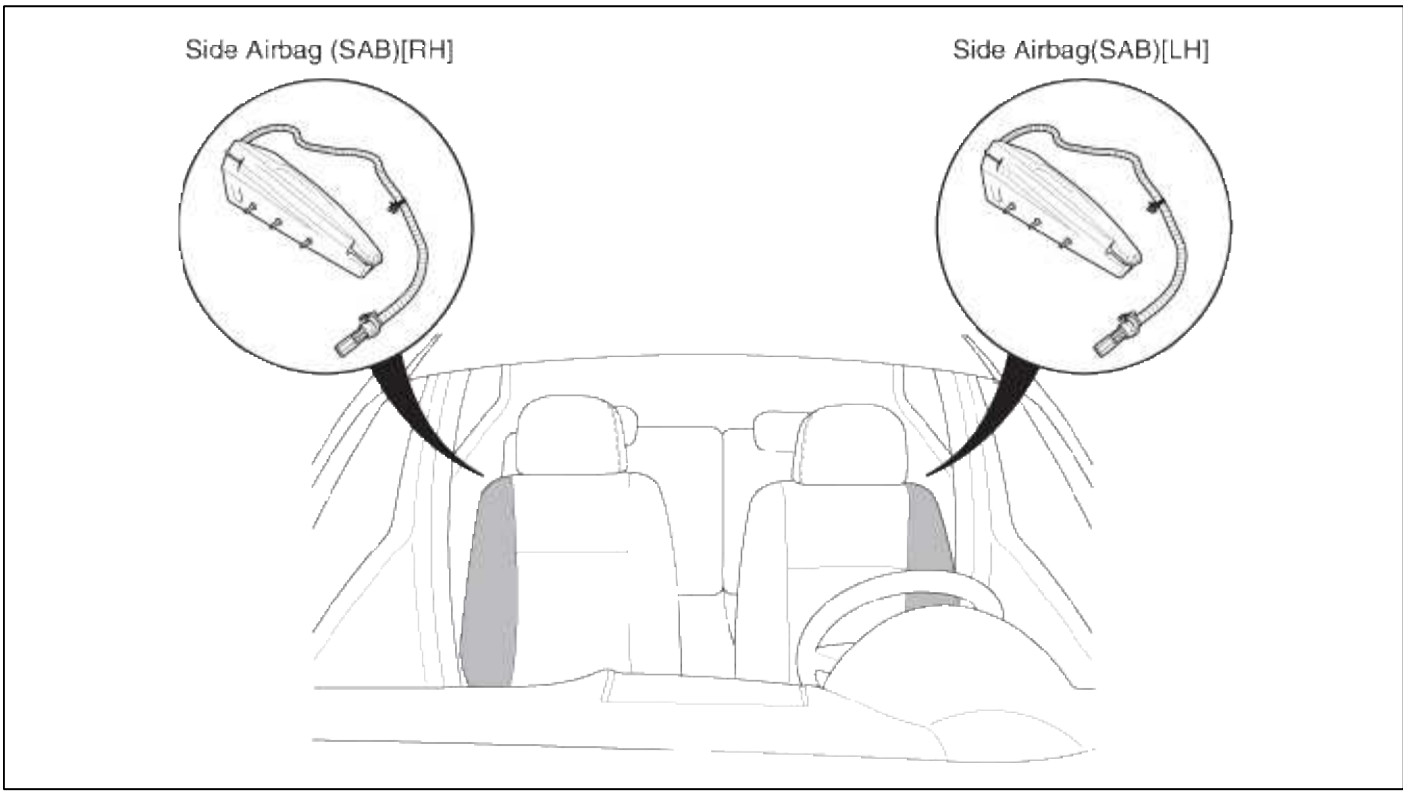
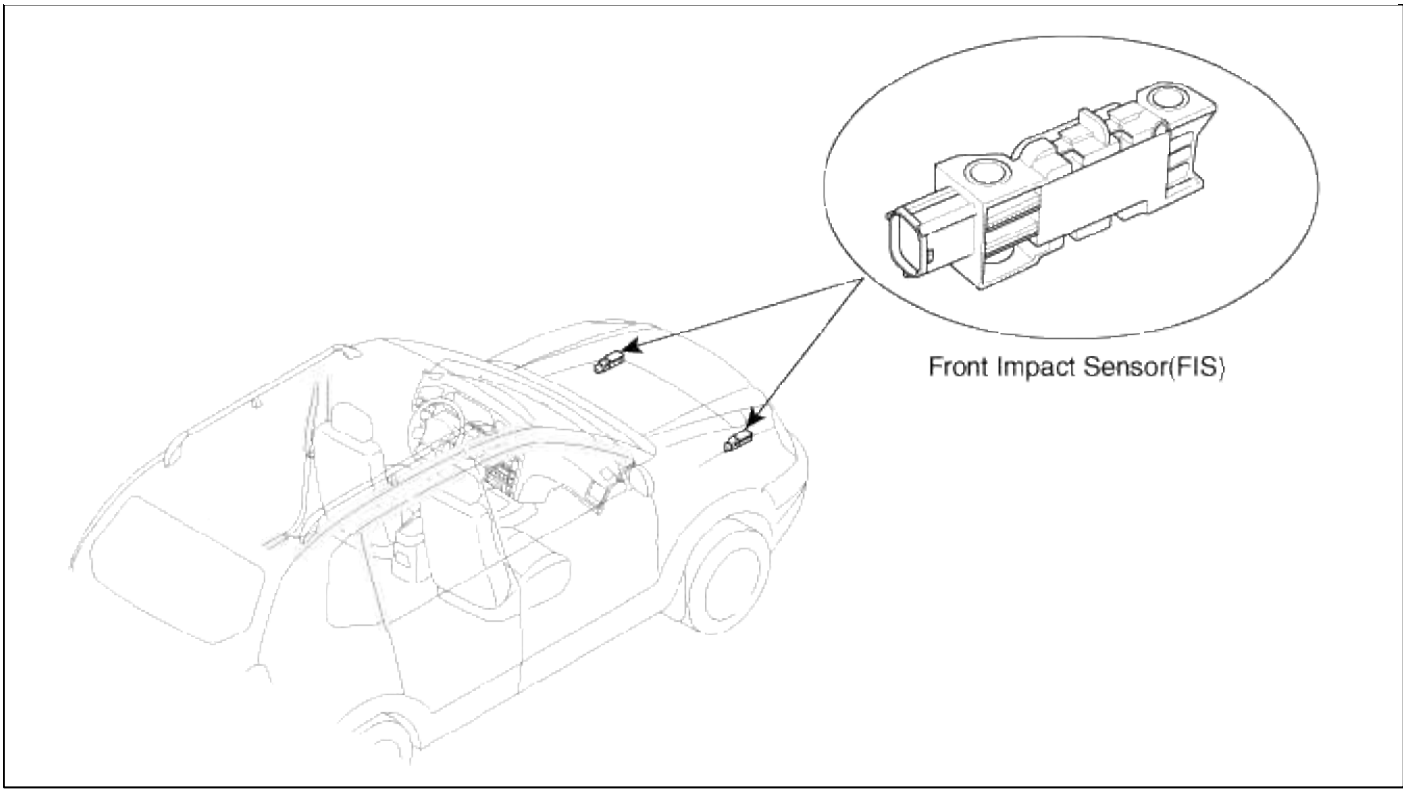


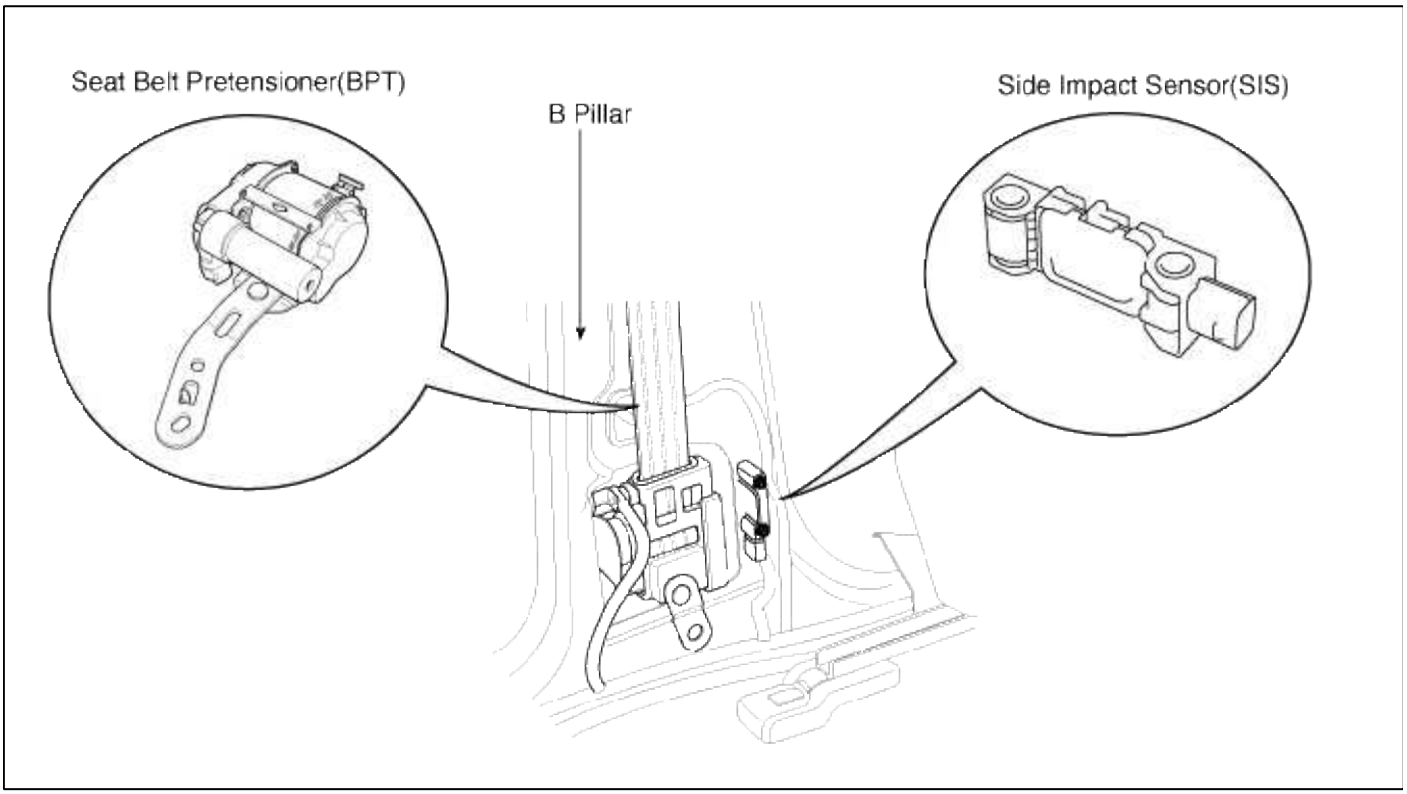
SIDE AIRBAG (SAB)



FRONT IMPACT SENSOR (FIS)



SEAT BELT PRETENSIONER (BPT) / SIDE IMPACT SENSOR (SIS)



SRSCM

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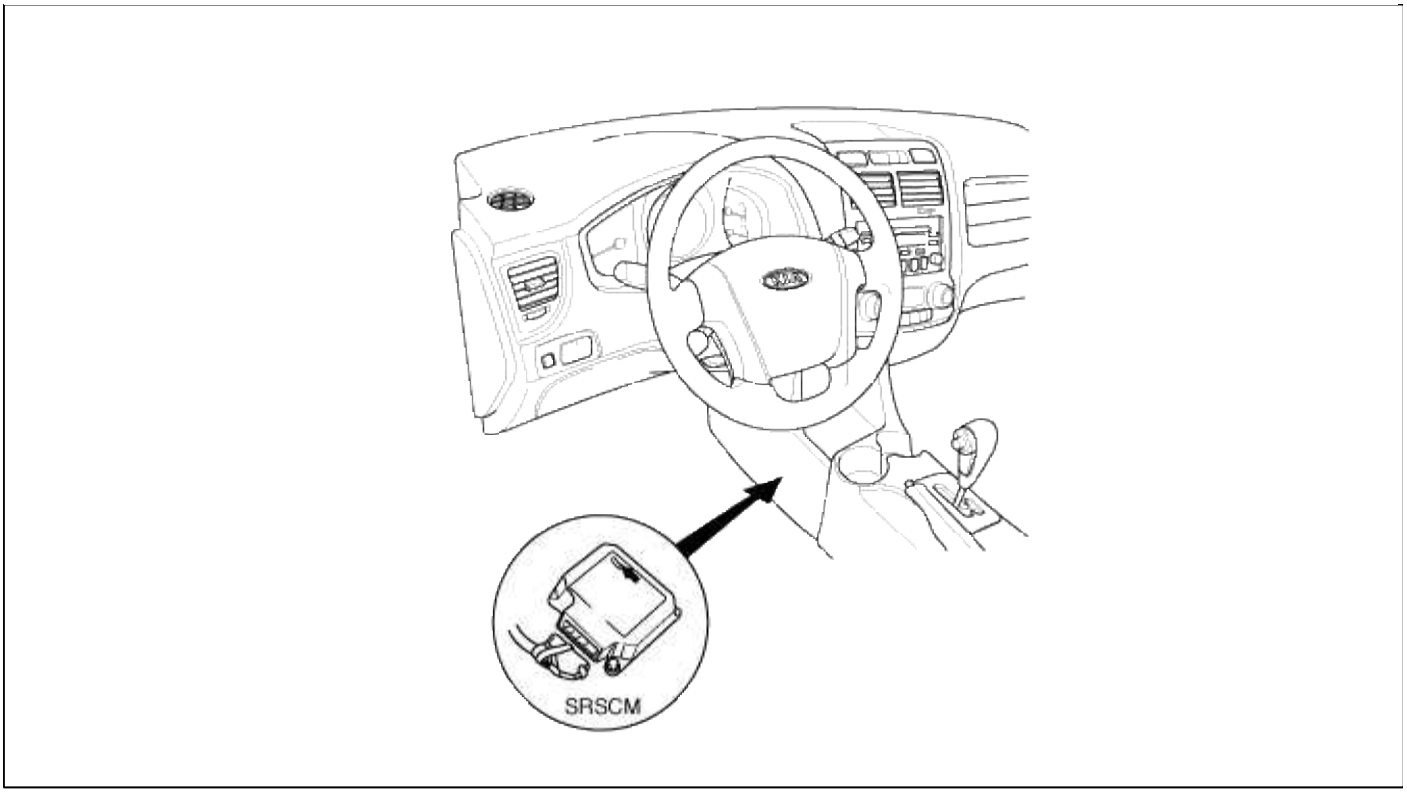

Restraint > General Information > Specifications

SPECIFICATION

ITEM	SPECIFICATION	
Driver Airbag (DAB)	Resistance (Ω)	1.5 ~ 5.7 Ω
Passenger Airbag (PAB)	Resistance (Ω)	1.5 ~ 5.7 Ω
Side Airbag (SAB)	Resistance (Ω)	1.5 ~ 5.7 Ω
Curtain Airbag (CAB)	Resistance (Ω)	1.5 ~ 5.7 Ω
Seat Belt Pretensioner (BPT)	Resistance (Ω)	1.5 ~ 5.7 Ω
Buckle Pretensioner (BUPT)	Resistance (Ω)	1.5 ~ 5.7 Ω

TIGHTENING TORQUES

ITEM	kgf.m	N.m	lb.ft
Driver Airbag (DAB)	0.8 ~ 1.1	7.8 ~ 10.8	5.8 ~ 8.0
Passenger Airbag (PAB)	1.9 ~ 2.7	18.6 ~ 26.5	13.7 ~ 19.5
Side Airbag (SAB)	0.6 ~ 1	5.9 ~ 9.8	4.3 ~ 7.2
Curtain Airbag (CAB)	0.7 ~ 0.9	6.9 ~ 8.8	5.1 ~ 6.5
Seat Belt Lower Anchor bolt (BPT)	4.0 ~ 5.5	39 ~ 54	29 ~ 40
SRSCM Mounting Bolt	0.7 ~ 0.9	6.9 ~ 8.8	5.1 ~ 6.5
Front Impact Sensor (FIS) Mounting Bolt	0.9 ~ 1.1	8.8 ~ 10.8	6.5 ~ 8.0
Side Impact Sensor (SIS) Mounting Bolt	0.9 ~ 1.1	8.8 ~ 10.8	6.5 ~ 8.0

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Schematic Diagrams

SYSTEM BLOCK DIAGRAM

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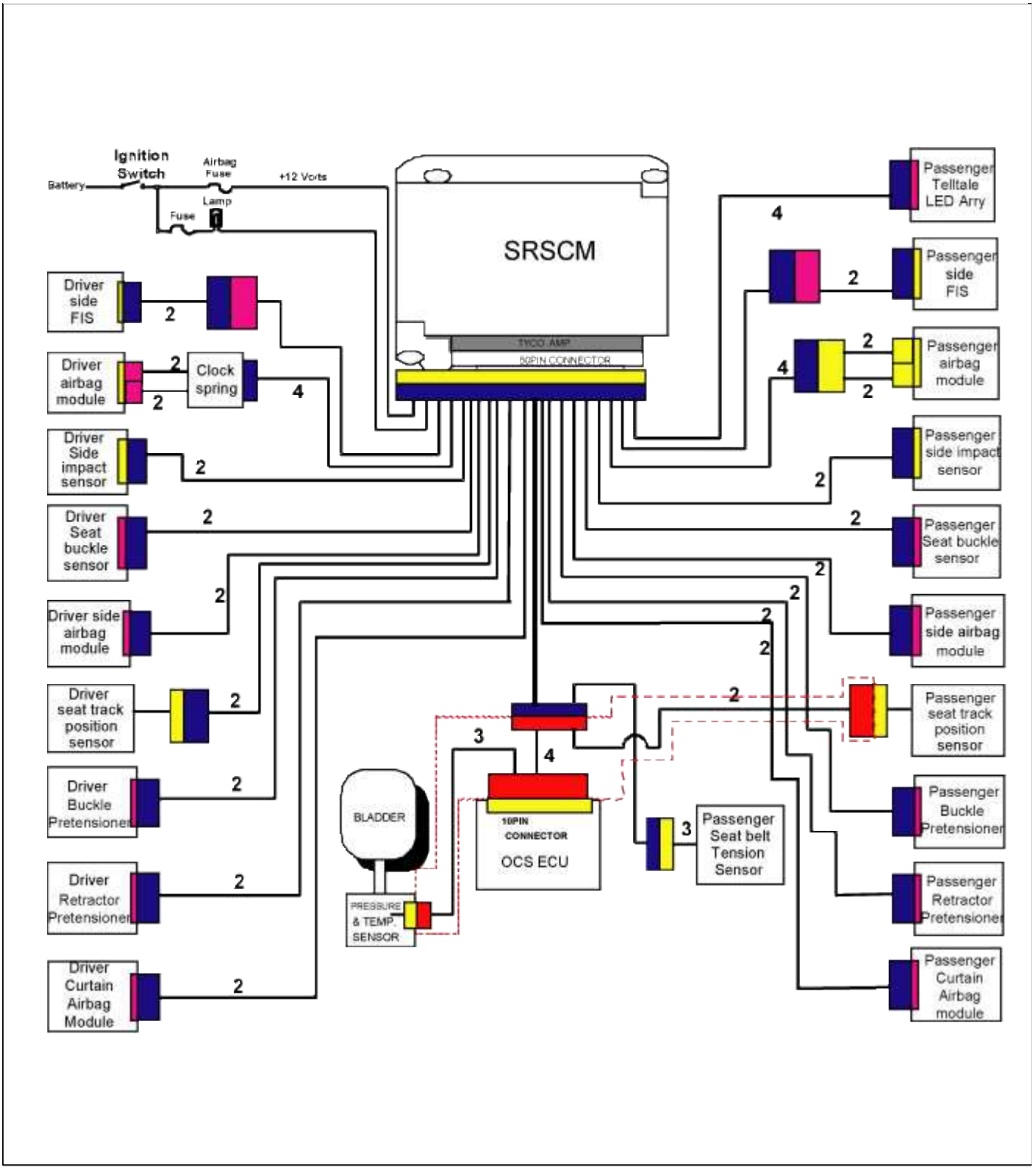
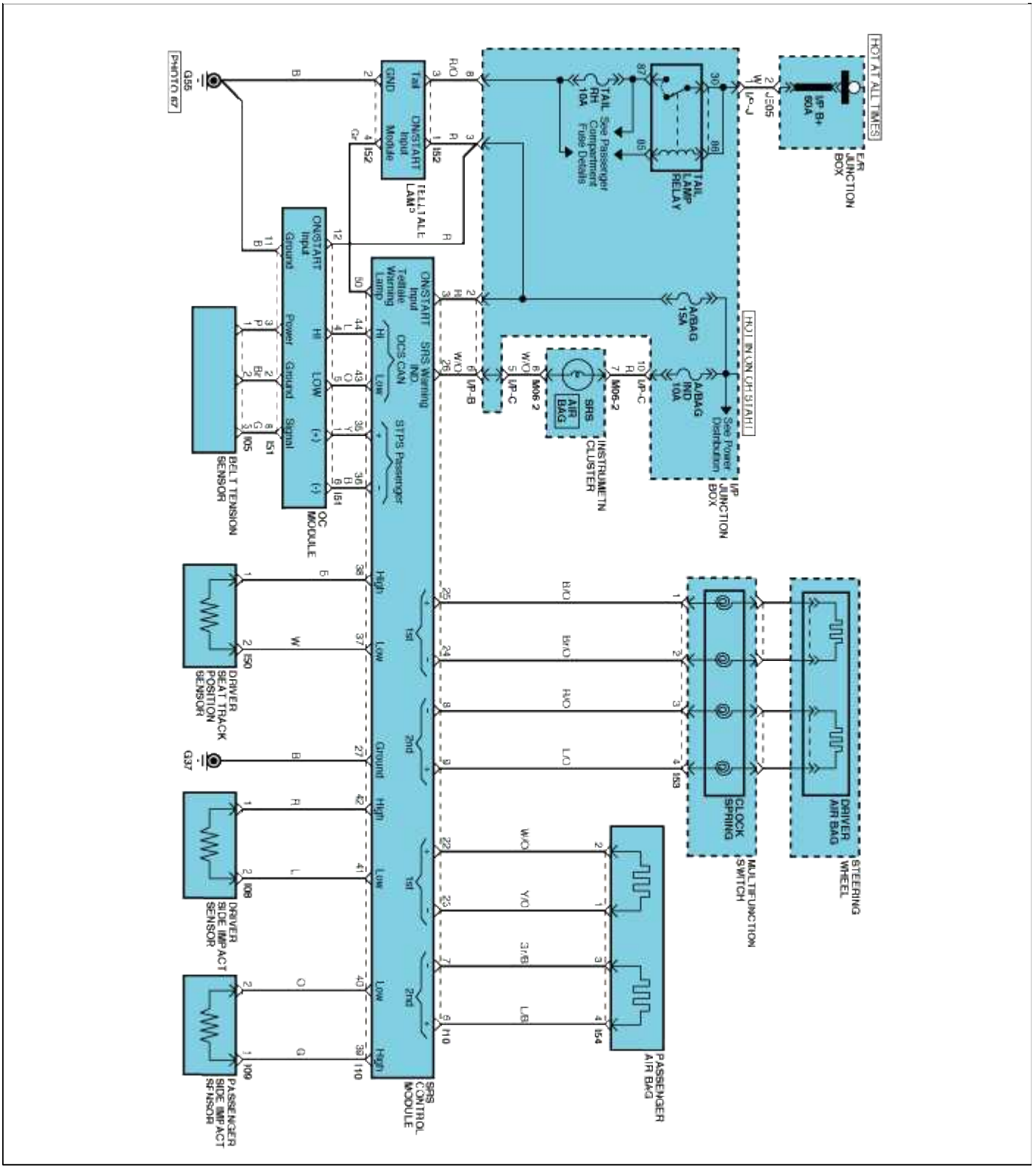


CIRCUIT DIAGRAM(1)



CIRCUIT DIAGRAM(2)

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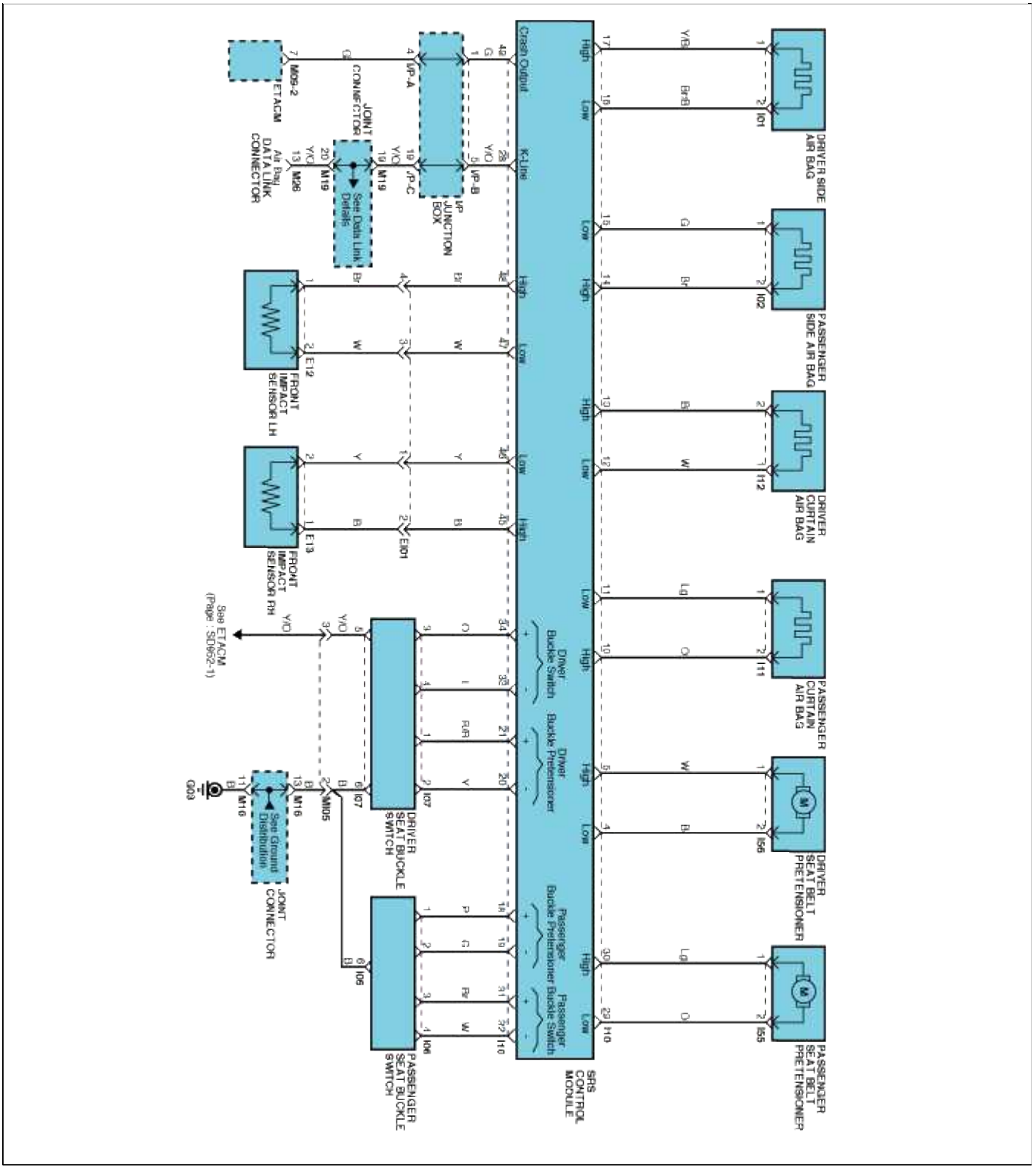
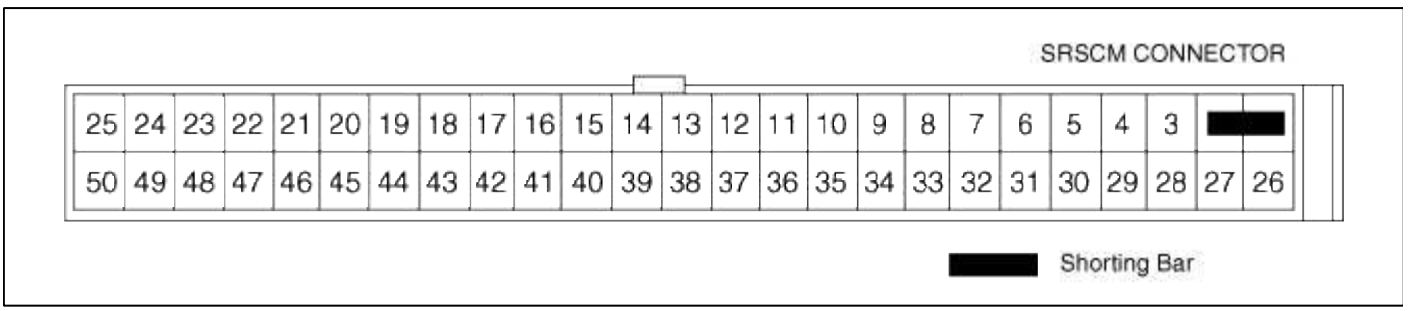


SRSCM CONNECTOR TERMINAL



PIN	Function	PIN	Function
1	Shorting Bar	26	Warning Lamp
2	Shorting Bar	27	Battery Ground
3	Battery Supply(Vbat)	28	K-Line Diagnostic
4	Seat Belt Pretensioner [Front-Driver] Low	29	Seat Belt Pretensioner [Front-Passenger] Low
5	Seat Belt Pretensioner [Front-Driver] High	30	Seat Belt Pretensioner [Front-Passenger] High
6	(2nd Stage) Passenger Airbag High	31	Buckle Switch [Front-Passenger] High
7	(2nd Stage) Passenger Airbag Low	32	Buckle Switch [Front-Passenger] Low
8	(2nd Stage) Driver Airbag Low	33	Buckle Switch [Driver] Low
9	(2nd Stage) Driver Airbag High	34	Buckle Switch [Driver] High
10	Curtain Airbag [Passenger] High	35	Seat Track Position Sensor [Passenger] High
11	Curtain Airbag [Passenger] Low	36	Seat Track Position Sensor [Passenger] Low
12	Curtain Airbag [Driver] Low	37	Seat Track Position Sensor [Driver] Low
13	Curtain Airbag [Driver] High	38	Seat Track Position Sensor [Driver] High
14	Side Airbag [Front-Passenger] High	39	Side Impact Sensor [Passenger] High
15	Side Airbag [Front-Passenger] Low	40	Side Impact Sensor [Passenger] Low
16	Side Airbag [Front-Driver] Low	41	Side Impact Sensor [Driver] Low
17	Side Airbag [Front-Driver] High	42	Side Impact Sensor [Driver] High
18	Buckle Pretensioner [Front-Passenger] High	43	Occupant Classification (OC) Sensor CAN Low
19	Buckle Pretensioner [Front-Passenger] Low	44	Occupant Classification (OC) Sensor CAN High
20	Buckle Pretensioner [Driver] Low	45	Front Impact Sensor [Passenger] High
21	Buckle Pretensioner [Driver] High	46	Front Impact Sensor [Passenger] Low
22	(1st Stage) Passenger Airbag High	47	Front Impact Sensor [Driver] Low
23	(1st Stage) Passenger Airbag Low	48	Front Impact Sensor [Driver] High
24	(1st Stage) Driver Airbag Low	49	Crash Output
25	(1st Stage) Driver Airbag High	50	Telltale Warning Lamp

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Troubleshooting

Hi-Scan check

1. Turn the ignition switch off.
2. Connect the Hi-Scan Pro connector to the datalink connector located under the crash pad.
3. Connect the Hi-Scan Pro power cable.

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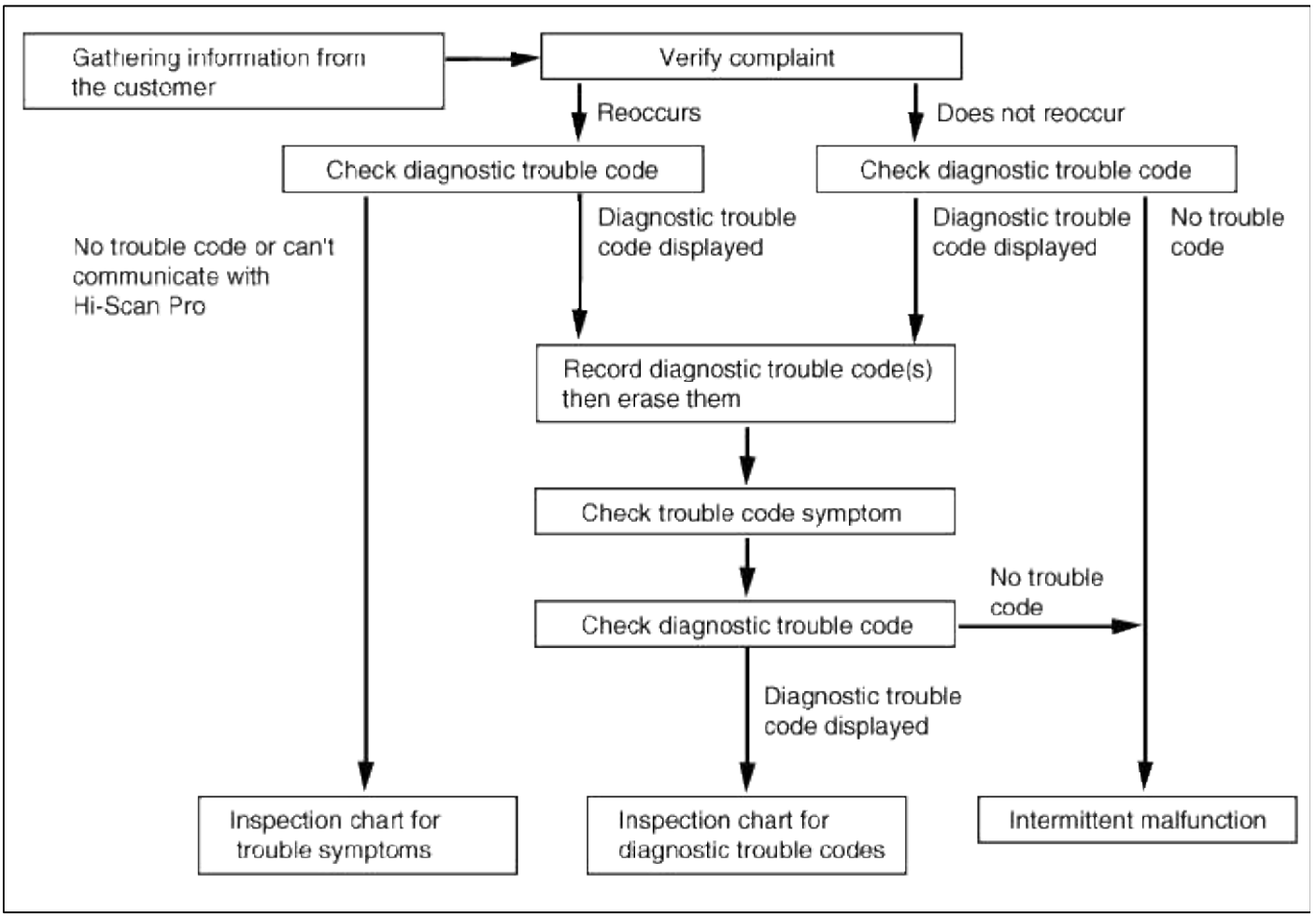
4. Turn the ignition switch on and power on the Hi-Scan Pro.
5. Read DTCs.
6. Find and repair the trouble, and clear the DTCs using Hi-Scan Pro.
7. Disconnect the Hi-Scan Pro.

DIAGNOSTIC TROUBLESHOOTING FLOW



DIAGNOSTIC TROUBLE CODES (DTC)

CODE	FAULT DESCRIPTION
B1101	Battery Voltage too High
B1102	Battery Voltage too Low

B1326	Front Impact Sensor [Driver] Short to Ground
B1327	Front Impact Sensor [Driver] Short to Battery
B1328	Front Impact Sensor [Driver] Defect
B1329	Front Impact Sensor [Driver] Communication Error
B1330	Front Impact Sensor [Driver] Wrong ID
B1331	Front Impact Sensor [Passenger] Short to Ground
B1332	Front Impact Sensor [Passenger] Short to Battery
B1333	Front Impact Sensor [Passenger] Defect
B1334	Front Impact Sensor [Passenger] Communication Error
B1335	Front Impact Sensor [Passenger] Wrong ID
B1346	(1st Stage) Driver Airbag Resistance Too High
B1347	(1st Stage) Driver Airbag Resistance Too Low
B1348	(1st Stage) Driver Airbag Circuit Short to Ground
B1349	(1st Stage) Driver Airbag Circuit Short to Battery
B1352	(1st Stage) Passenger Airbag Resistance Too High
B1353	(1st Stage) Passenger Airbag Resistance Too Low
B1354	(1st Stage) Passenger Airbag Circuit Short to Ground
B1355	(1st Stage) Passenger Airbag Circuit Short to Battery
B1361	Seat Belt Pretensioner [Front-Driver] Resistance Too High
B1362	Seat Belt Pretensioner [Front-Driver] Resistance Too Low
B1363	Seat Belt Pretensioner [Front-Driver] Circuit Short to Ground
B1364	Seat Belt Pretensioner [Front-Driver] Circuit Short to Battery
B1367	Seat Belt Pretensioner [Front-Passenger] Resistance Too High
B1368	Seat Belt Pretensioner [Front-Passenger] Resistance Too Low
B1369	Seat Belt Pretensioner [Front-Passenger] Circuit Short to Ground
B1370	Seat Belt Pretensioner [Front-Passenger] Circuit Short to Battery
B1378	Side Airbag [Front-Driver] Resistance Too High
B1379	Side Airbag [Front-Driver] Resistance Too Low
B1380	Side Airbag [Front-Driver] Circuit Short to Ground
B1381	Side Airbag [Front-Driver] Circuit Short to Battery
B1382	Side Airbag [Front-Passenger] Resistance Too High
B1383	Side Airbag [Front-Passenger] Resistance Too Low
B1384	Side Airbag [Front-Passenger] Circuit Short to Ground
B1385	Side Airbag [Front-Passenger] Circuit Short to Battery
B1396	Seat Track Position Sensor [Driver] Open or Short to Ground
B1397	Seat Track Position Sensor [Driver] Short or Short to Battery

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B1398	Seat Track Position Sensor [Passenger] Open or Short to Ground
B1399	Seat Track Position Sensor [Passenger] Short or Short to Battery
B1400	Side Impact Sensor [Front-Driver] Defect
B1401	Side Impact Sensor [Front-Driver] Short to Ground
B1402	Side Impact Sensor [Front-Driver] Short to Battery
B1403	Side Impact Sensor [Front-Passenger] Defect
B1404	Side Impact Sensor [Front-Passenger] Short to Ground
B1405	Side Impact Sensor [Front-Passenger] Short to Battery
B1409	Side Impact Sensor [Front-Driver] Communication Error
B1410	Side Impact Sensor [Front-Passenger] Communication Error
B1414	Side Impact Sensor [Front-Driver] Wrong ID
B1415	Side Impact Sensor [Front-Passenger] Wrong ID
B1473	Side Curtain Airbag [Driver] Resistance Too High
B1474	Side Curtain Airbag [Driver] Resistance Too Low
B1475	Side Curtain Airbag [Driver] Circuit Short to Ground
B1476	Side Curtain Airbag [Driver] Circuit Short to Battery
B1477	Side Curtain Airbag [Passenger] Resistance Too High
B1478	Side Curtain Airbag [Passenger] Resistance Too Low
B1479	Side Curtain Airbag [Passenger] Circuit Short to Ground
B1480	Side Curtain Airbag [Passenger] Circuit Short to Battery
B1481	(2nd Stage) Driver Airbag Resistance Too High
B1482	(2nd Stage) Driver Airbag Resistance Too Low
B1483	(2nd Stage) Driver Airbag Circuit Short to Ground
B1484	(2nd Stage) Driver Airbag Circuit Short to Battery
B1485	(2nd Stage) Passenger Airbag Resistance Too High
B1486	(2nd Stage) Passenger Airbag Resistance Too Low
B1487	(2nd Stage) Passenger Airbag Circuit Short to Ground
B1488	(2nd Stage) Passenger Airbag Circuit Short to Battery
B1489	Passenger Occupant Classification (OC) ECU failure
B1490	Passenger Occupant Classification (OC) Sensor(Bladder) failure
B1493	Passenger Occupant Classification (OC) Communication Error
B1494	Passenger Occupant Classification (OC) Wrong ID
B1495	Belt Tension Sensor failure
B1521	Seat Belt Buckle Switch [Driver] Short or Short to Battery
B1522	Seat Belt Buckle Switch [Driver] Open or Short to Ground

B1523	Seat Belt Buckle Switch [Front-Passenger] Short or Short to Battery
B1524	Seat Belt Buckle Switch [Front-Passenger] Open or Short to Ground
B1620	Airbag control unit Internal Fault (Replace airbag control unit)
B1650	Crash Recored in 1st Stage only (Frontal-Replace airbag control unit)
B1651	Crash Recorded Driver Side (Replace airbag control unit)
B1652	Crash Recorded Passenger Side (Replace airbag control unit)
B1657	Crash Recorded - Belt Pretensioner Only
B1658	Belt Pretensioner 6 times Deployment (Replace airbag control unit)
B1670	Crash Recorded in Full Stage (Frontal - Replace airbag control unit)
B1701	Buckle Pretensioner [Driver] Resistance Too High
B1702	Buckle Pretensioner [Driver] Resistance Too Low
B1703	Buckle Pretensioner [Driver] Circuit Short to Ground
B1704	Buckle Pretensioner [Driver] Circuit Short to Battery
B1706	Buckle Pretensioner [Front-Passenger] Resistance Too High
B1707	Buckle Pretensioner [Front-Passenger] Resistance Too Low
B1708	Buckle Pretensioner [Front-Passenger] Circuit Short to Ground
B1709	Buckle Pretensioner [Front-Passenger] Circuit Short to Battery
B2500	Warning Lamp Fault
B2502	Telltale Lamp Fault

Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Description and Operation

DESCRIPTION

COMPONENTS

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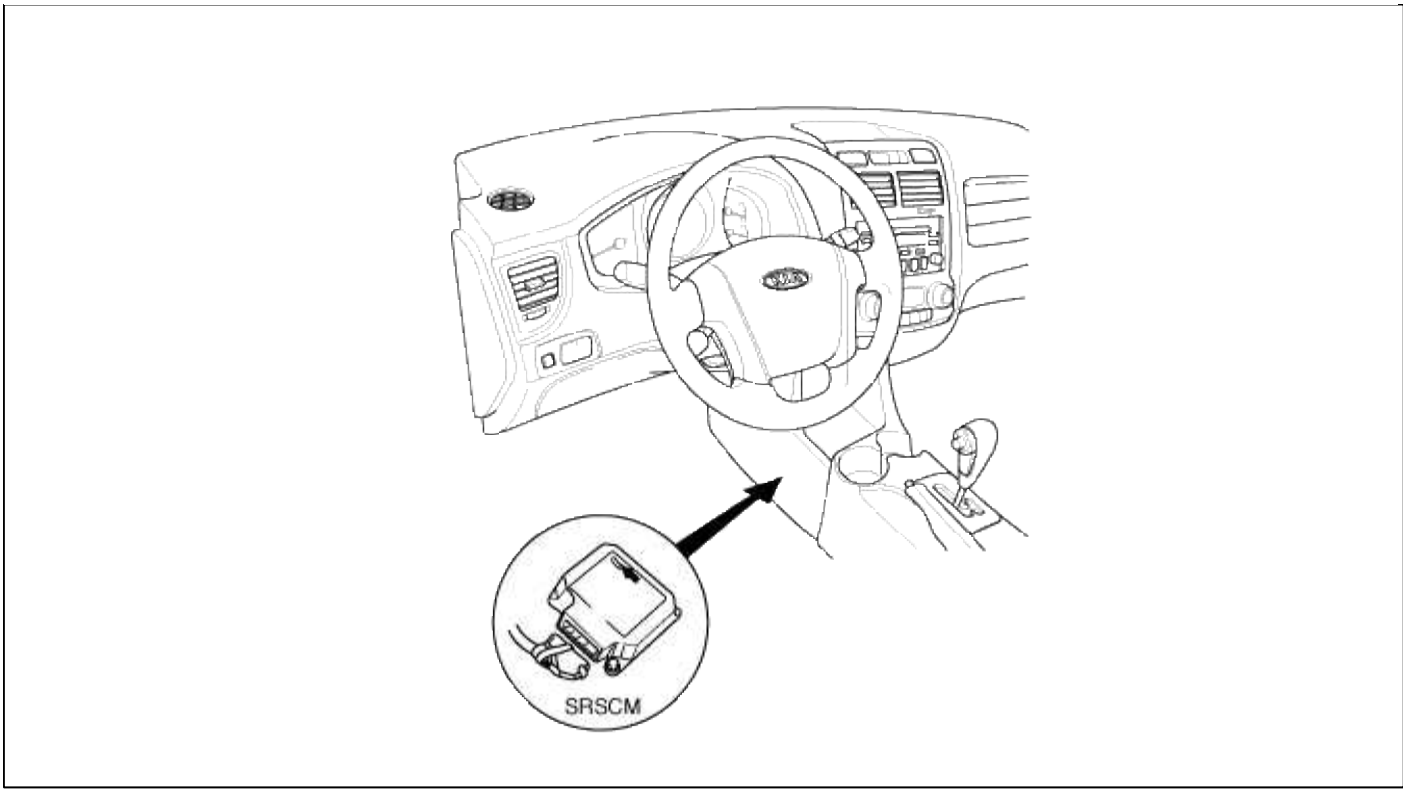
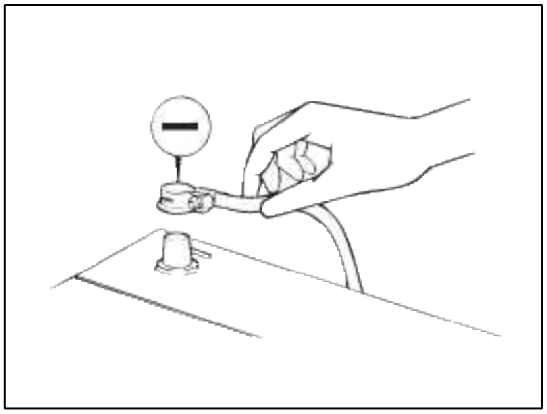


Restraint > Supplemental Restraint System Control Module (SRnodeM) > SRS Control Module (SRnodeM) > Repair procedures

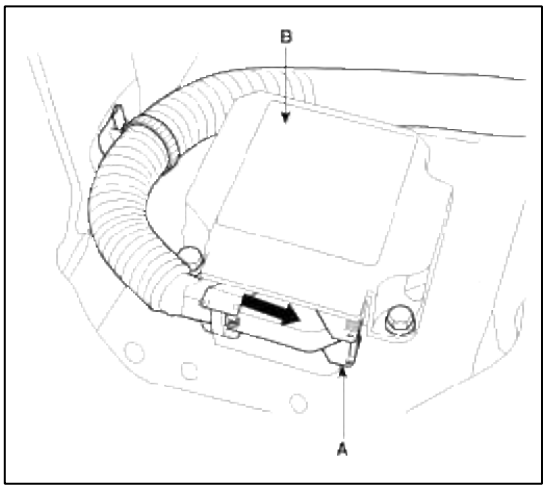
REMOVAL

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 center console (Refer to BD group in the Service Manual).

5. Disconnect the SRSCM harness connector(A) from the SRSCM(B).



6. Remove the SRSCM mounting bolts from the SRSCM then remove the SRSCM.

INSTALLATION

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)
: 6.9 ~ 8.8 N·m (5.1 ~ 6.5 lb·ft)

4. Connect the SRSCM harness connector.
5. Install the center console.
6. Connect the DAB, PAB, SAB, CAB and BPT connectors.
7. After installing the SRSCM, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Description and Operation

DESCRIPTION

The release system for the front airbag consists of a SRSCM installed in the middle of the vehicle and two front impact sensors (FIS) which are located in front of the vehicle. Only the SRSCM is capable of releasing the airbags or the seat-belt pretensioner system in the vehicle. In the dialog between the SRSCM and the front impact sensor it is the SRSCM which takes the release decision. The SRSCM is supported in connection with the front airbag function by the two front impact sensors, which act as intelligent acceleration sensors and as such back up the central airbag controller. Both the front impact sensors continuously report the current system status of the vehicle to the SRSCM.
If one of the two front impact sensor reports an acceleration level, the SRSCM must verify the acceleration signal internally by means of a suitable plausibility check. The SRSCM does not release the appropriate airbag unless the result of this verification is positive.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Components and Components Location

COMPONENTS

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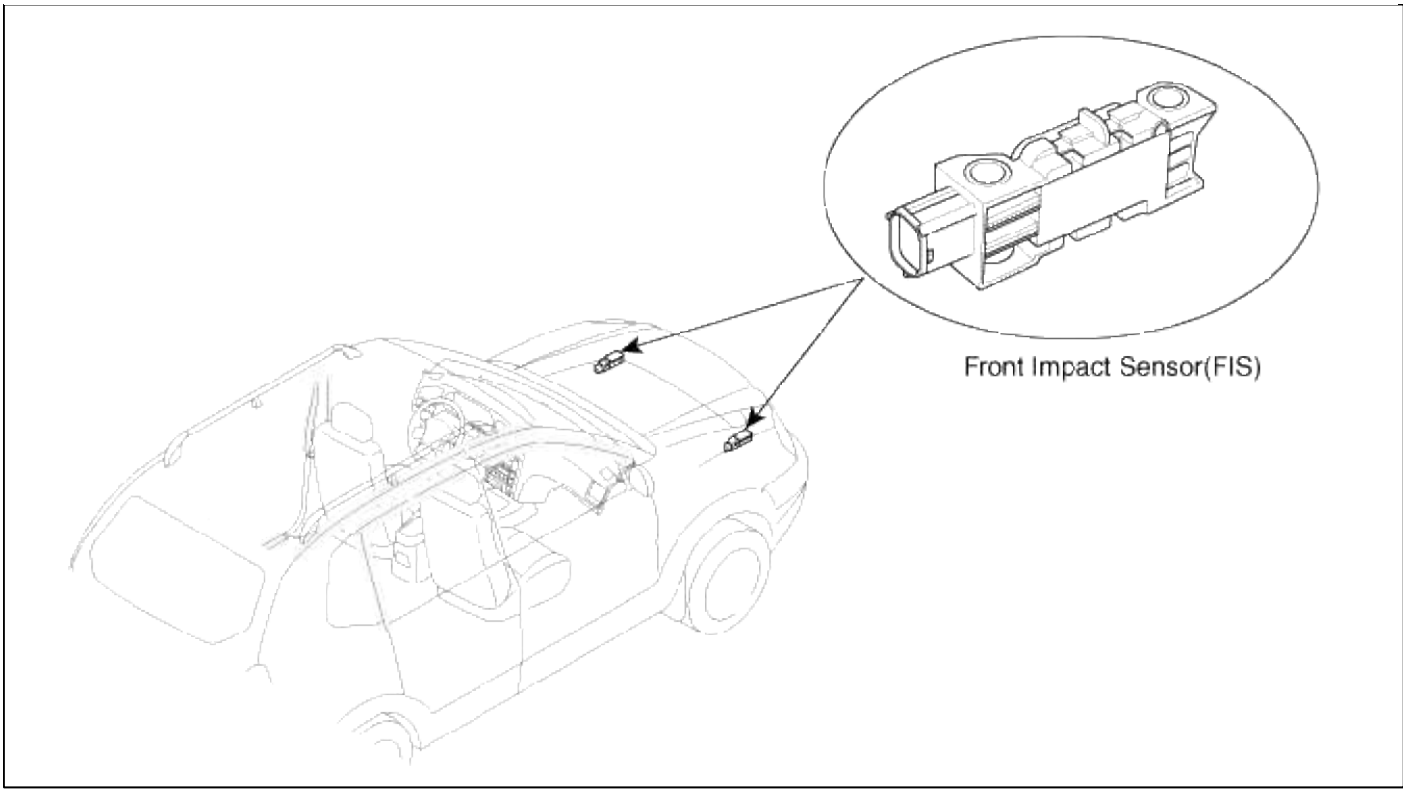


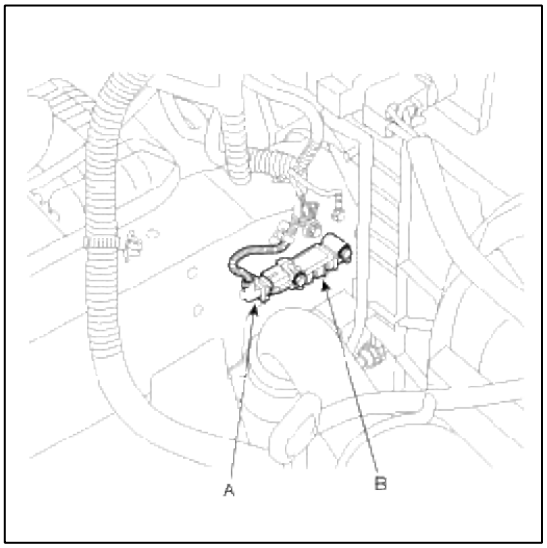
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Front Impact Sensor (FIS) > Repair procedures

removal

CAUTION

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the negative battery cable, and wait at least three minutes before beginning work.
2. Remove the radiator guard (Refer to BD group).
3. Remove the bolt then remove the front impact sensor.
4. Disconnect the SRS harness connector (A) from the front impact sensor (B).



INSTALLATION

CAUTION

- Be sure to install the harness wire so that they are not 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
: 8.8 ~ 10.8 N·m(6.5 ~ 8.0 lb·ft)

2. Install the radiator guard.
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.

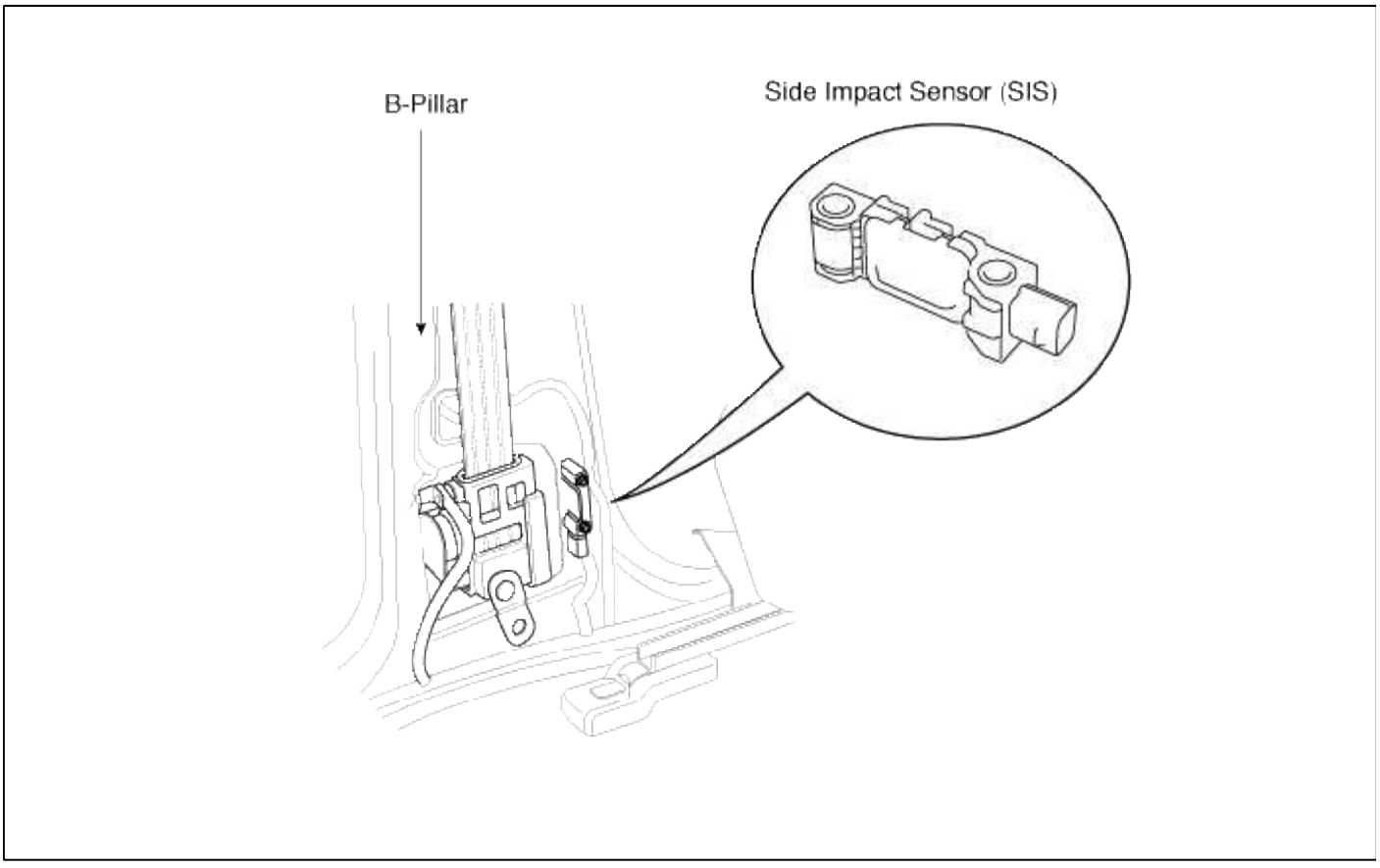
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Description and Operation

DESCRIPTION

The release system for the front airbag consists of a SRSCM installed in the middle of the vehicle and two side impact sensors (SIS) which are located inside the B-Pillar. They are remote sensor 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 ImpactSensor (SIS) sends acceleration data to the SRSCM.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Components and Components Location

COMPONENTS



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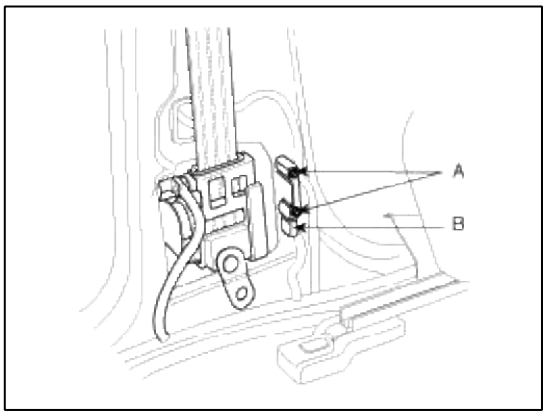
Restraint > Supplemental Restraint System Control Module (SRnodeM) > Side Impact Sensor (SIS) > Repair procedures

removal

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 negative battery cable, and wait at least three minutes before beginning work.
2. Remove the seat assembly (Refer to BD group).
3. Remove the front door sill trim.
4. Remove the center pillar trim.
5. Remove the lower anchor bolt.
6. Remove the belt pretensioner.
7. Remove the two bolts(A) then remove the side impact sensor(B).



8. Disconnect the SRS harness connector(B) from the side impact sensor.

Installation

CAUTION

- Be sure to install the harness wires so that they are not pinched or interfere 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 two bolts then connect the SRS harness connector to the side impact sensor.

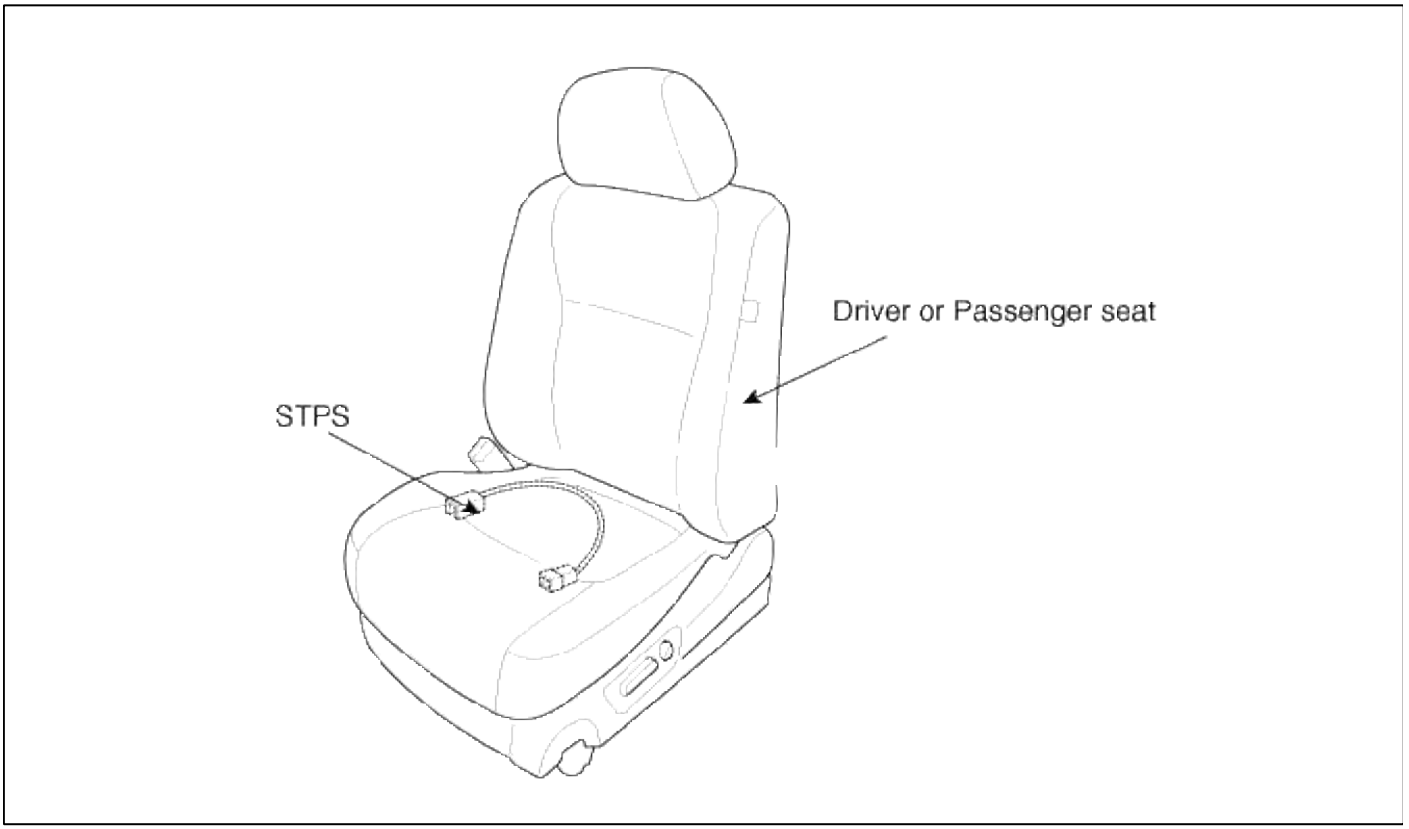
Tightening torque
: 8.8 ~ 10.8 N·m(6.5 ~ 8.0 lb·ft)

2. Reinstall belt pretensioner.
3. Reconnect the negative battery cable.
4. 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.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Track Position Sensor (STPS) > Description and Operation

DESCRIPTION

COMPONENTS



Restraint > Supplemental Restraint System Control Module (SRnodeM) > Seat Belt Buckle Switch (BS) > Description and Operation

DESCRIPTION

COMPONENTS

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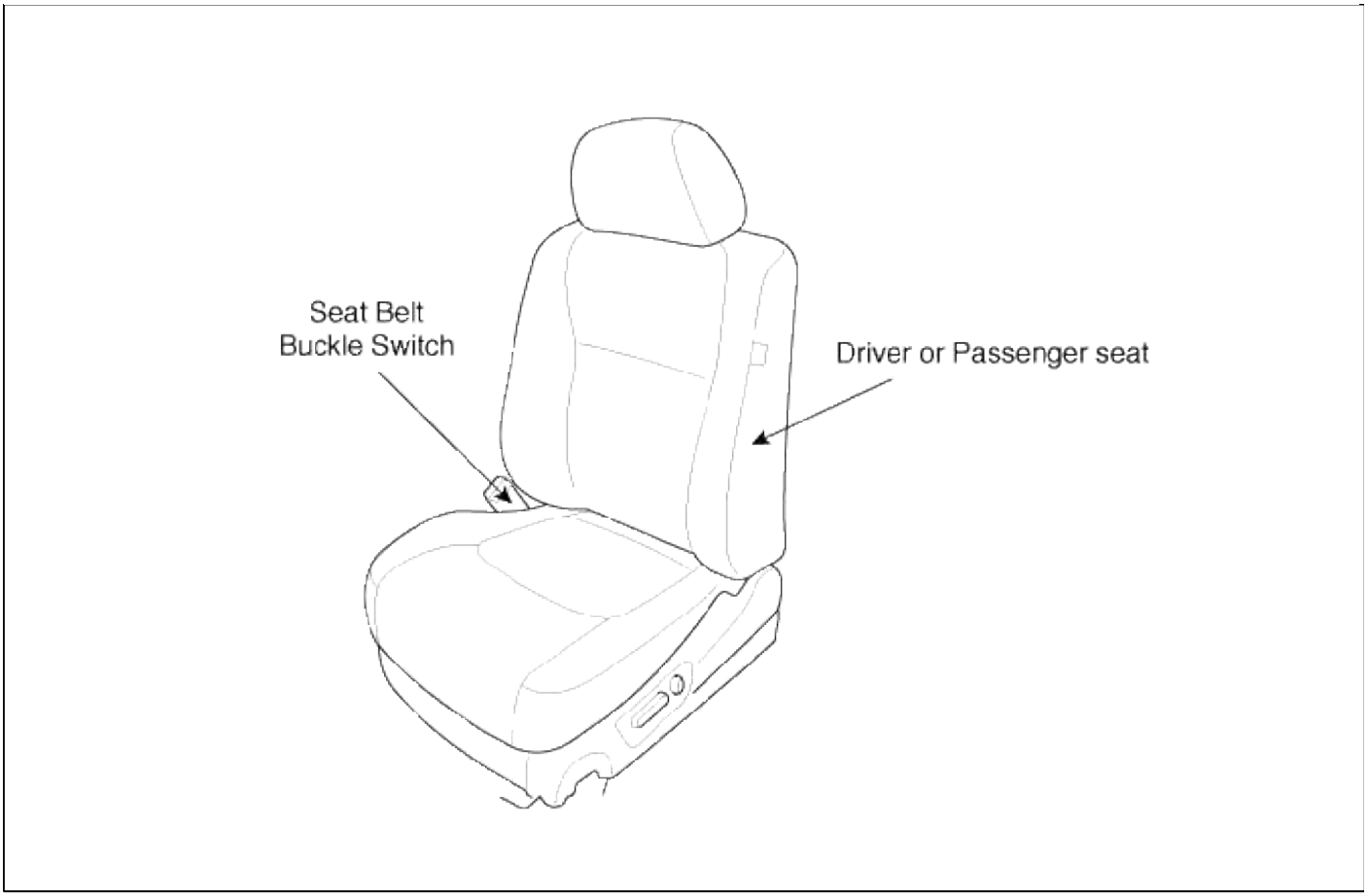


Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Description and Operation

DESCRIPTION

The system is intended to classify the occupancy status of the front passenger seat in a motor vehicle based upon the measured force on the bottom seat cushion.

The system also communicates to the SRSCM whether to allow or inhibit the deployment of the passenger airbags and/or pretensioner based upon this status.

The System also measured dynamic responses of the occupant. This information is used to idenitify when a child seat is cinched down tightly with the seat belt, and to also determine if the seat is unoccupied.

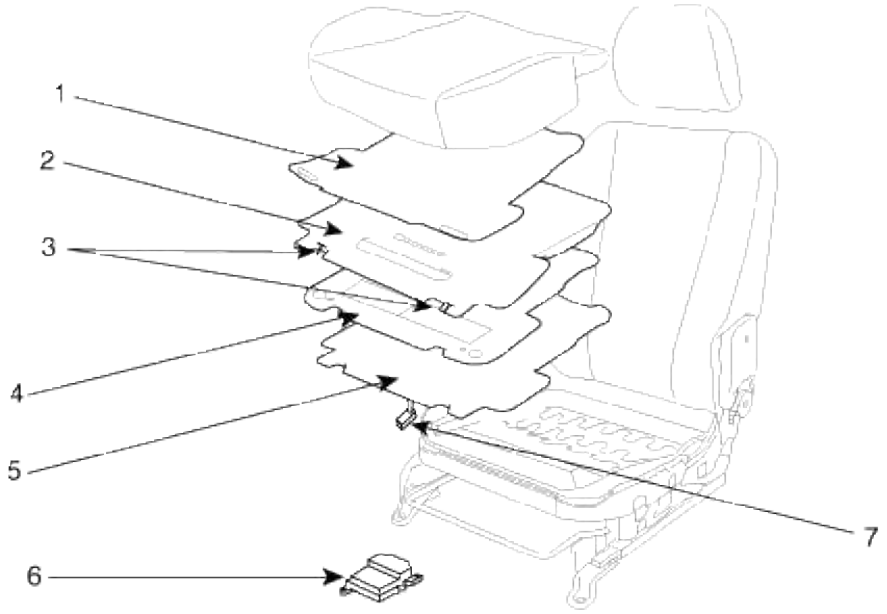
However, the dynamic measurements are not intended, nor capable of monitoring the seating position of the occupant, nor can they determine the proximity of the occupant to the inflator modules.

The system should not be confused with an occupant position recognition system, or any other occupant proximity sensor.

The Passenger Occupant Detecting System (PODS) utilizes bladder placed between the passenger seat cushion and suspension to measure the occupant's loading force on the vehicle seat. The bladder is connected to pressure sensor and ultimately to an electronic control unit (ECU), both of which are mounted under the seat pan. The quantitative force determined by the system is compared to a given threshold for determination of passenger airbag suppression.

Restraint > Supplemental Restraint System Control Module (SRnodeM) > Occupant Classification Sensor (OCS) > Components and Components Location

COMPONENTS



1. Topper Board : Provide stable and smooth reaction surface for Bladder, together with Felt Pad.
2. Bladder : Sense occupant weight and provide fluid pressure input to Pressure Sensor.
3. Push pins : Use to secure the Bladder assembly on the seat pan and maintain the correct Bladder position during seat assembly.
4. Backer Board : Provide stable and smooth reaction surface for Bladder, together with Felt Pad.
5. Felt Pad : Provide stable reaction surface for Bladder, together with Backer Board, and protect Bladder Assembly from the seat frame environment.
6. ECU : Utilizing data from the Pressure Sensor, BTS (Belt Tension sensor), and Compensation Tables, determine if PAB (Passenger Airbag) will be suppressed.
7. Pressure Sensor : Sense pressure input from Bladder and convert the pressure input to a voltage signal for ECU

Restraint > Airbag Module > Description and Operation

AIRBAG DISPOSAL

Special Tool Required

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 a 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 are securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.

Driver's Airbag AND BPT :

1. Remove the driver's airbag and the install the SST(0957A-38500).
2. Install the driver's airbag on the steering wheel.

Front Passenger's Airbag :

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1. Remove the glove box, then disconnect the 4P connector between the front passenger's airbag and SRS main harness.
2. Install the SST(0957A-38100).

Buckle Pretensioner

1. Disconnect the 6p connect between the buckle pretensioner and buckle pretensioner wire Harness.
2. Install the SST(0957A - 2E210)

Side Airbag, CURTAIN AIRBAG:

1. Disconnect the 2P connector between the side airbag and side wire harness.
2. Install the SST (0957A-38100 : SAB, 0957A-38500 : CAB).
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. Repeat for 2nd circuit if deploying DAB or PAB. (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.

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 tool is functioning properly by following the check procedure on this page.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

Disposal of Damaged Airbag

1. If installed in a vehicle, follow the removal procedure of driver's airbag, front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation

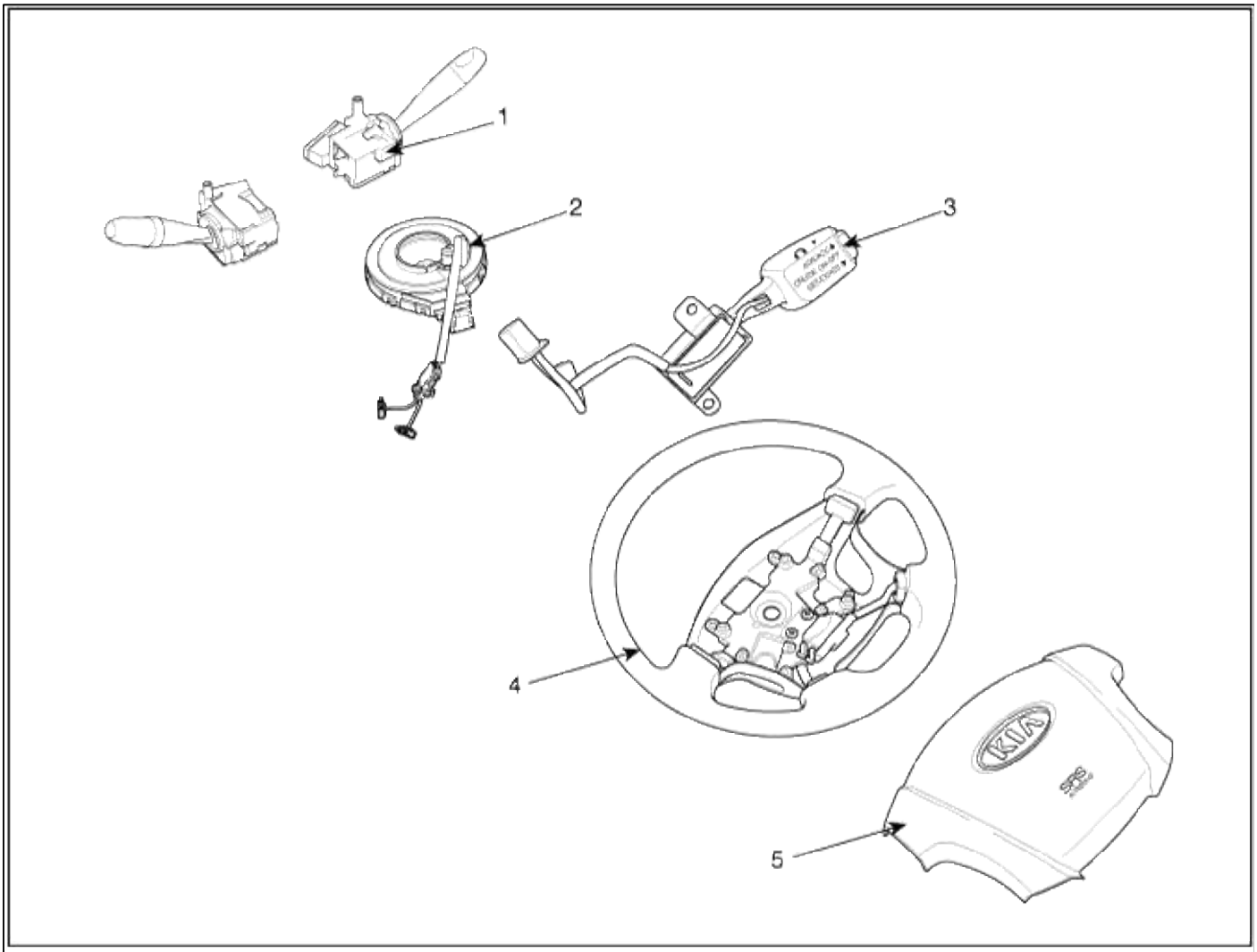
DESCRIPTION

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Components and Components Location

COMPONENTS



1. Multi-Function Switch
2. Clock Spring
3. Auto Cruise Switch
4. Steering Wheel
5. Driver Airbag(DAB)

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

REMOVAL

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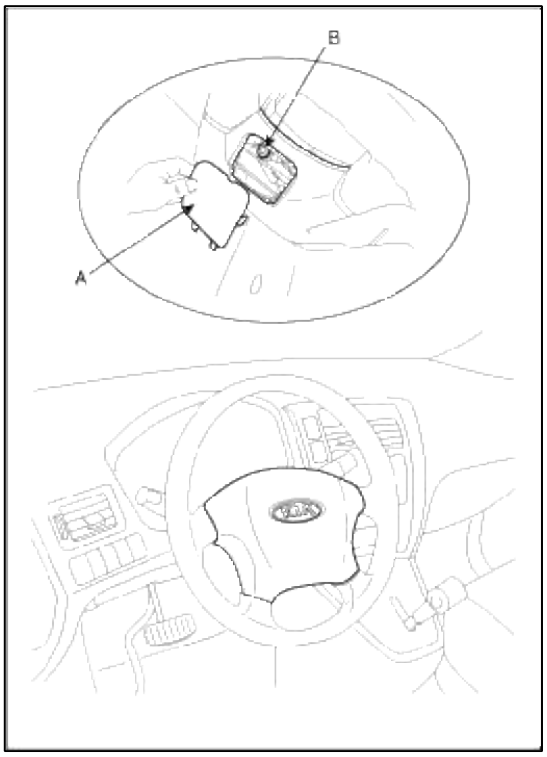
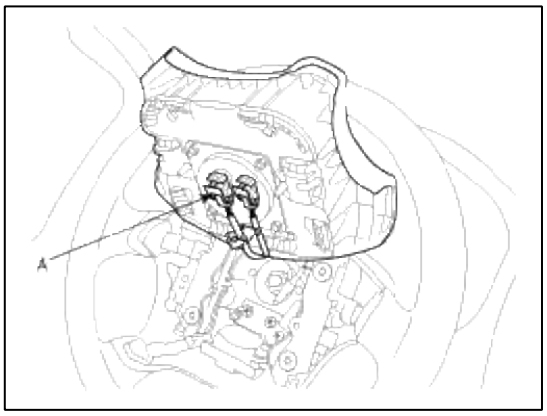
CAUTION

- Turn the front wheel to the straight-ahead position when removing/installing the Driver Airbag or Clokspring.
- Prior to installing the clock spring, set the colockspring on "NEUTRAL" position Refer to "clockspring" section), and after turning the front wheels to the straight-ahead position, install the clock spring to the column switch. If the mating mark of the clock spring is not properly aligned, the steering wheel may not completely rotate during a turn, or the flat cable within the clock spring may be broken obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver.
- Never attempt to disassemble or repair the air bag module or clock spring. If faulty, replace it.
- Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace if a dent, crack, deformation or rust is detected.
- The air bag module should be stored on a flat surface and placed so that the pad surface is facing upward. Do not place anything on top of it.
- Do not expose the air bag module to temperatures over 85°C(185°F).
- After deployment of an air bag, replace the clock spring with a new one.
- Wear gloves and safety glasses when handing an air bag that has been deployed.
- An undeployed air bag module should only be disposed of in accordance with the procedures mentioned in the restraints section.
- When you disconnect the air bag module-clock spring connector, take care not to apply excessive force.
- The removed air bag module should be stored in a clean, dry place.

1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. After removing the cover(A), then loosen the two airbag module mounting bolts(B).



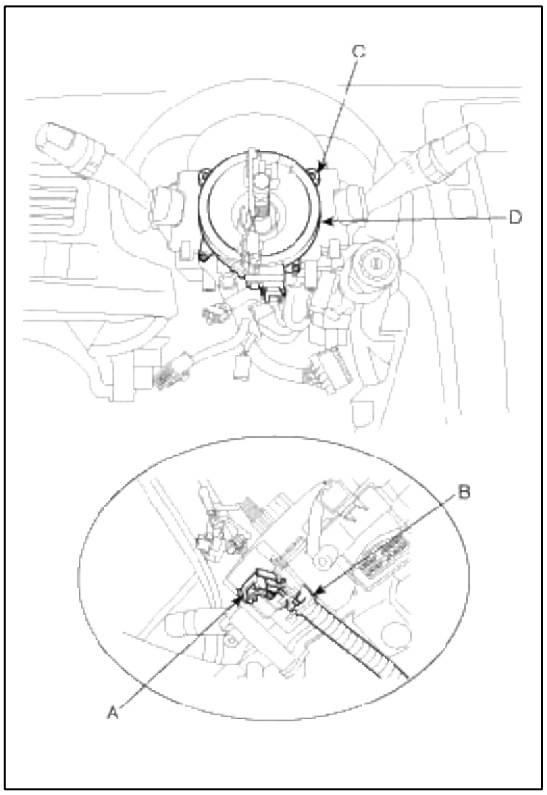
3. Remove the driver's airbag from the steering wheel, then disconnect the driver's airbag connectors.



CAUTION

The removed airbag module should be stored in a clean, dry place with the pad cover face up.

4. Remove the steering wheel(Refer to ST group in the Service Manual).
5. After disconnecting the lock pin(A), disconnect the connector(B).
6. Loosen the mounting screw(C), then remove the clock spring(D).



INSTALLATION

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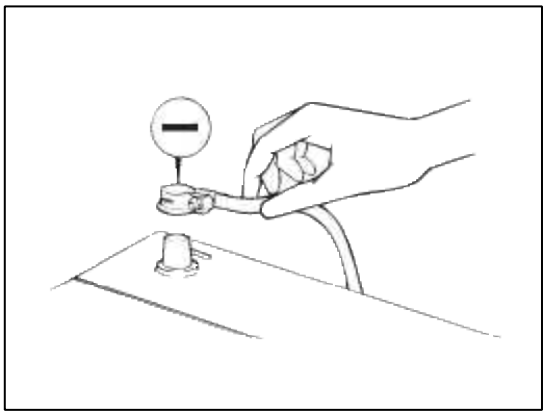
1. Disconnect the negative (-) cable from battery and wait for at least three minutes.



2. Remove ignition key from the vehicle.
3. Connect the Driver Airbag (DAB) harness connectors, then install a Driver Airbag (DAB) module on the steering wheel.
4. Secure the Driver Airbag (DAB) with the new mounting bolts.

Tightening Torque (DAB Mounting Bolt)
: 7.8 ~ 10.8 N·m (5.8 ~ 8.0 lb·ft)

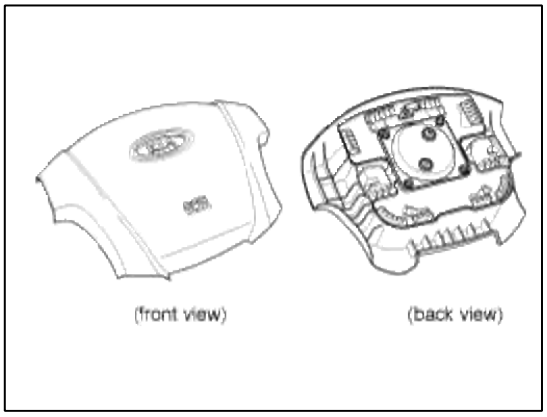
5. Connect the battery negative cable.
6. After installing the airbag, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
   B. Make sure both horn buttons work.

INSPECTION

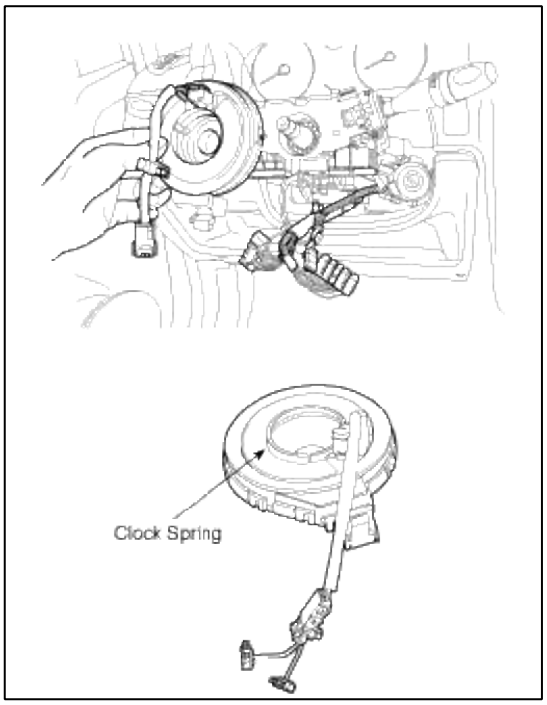
CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.



5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.
   A. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
   B. Check connectors and protective tube for damage, and terminals for deformities.



Restraint > Airbag Module > Passenger Airbag (PAB) Module > Description and Operation

DESCRIPTION

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Components and Components Location

COMPONENTS

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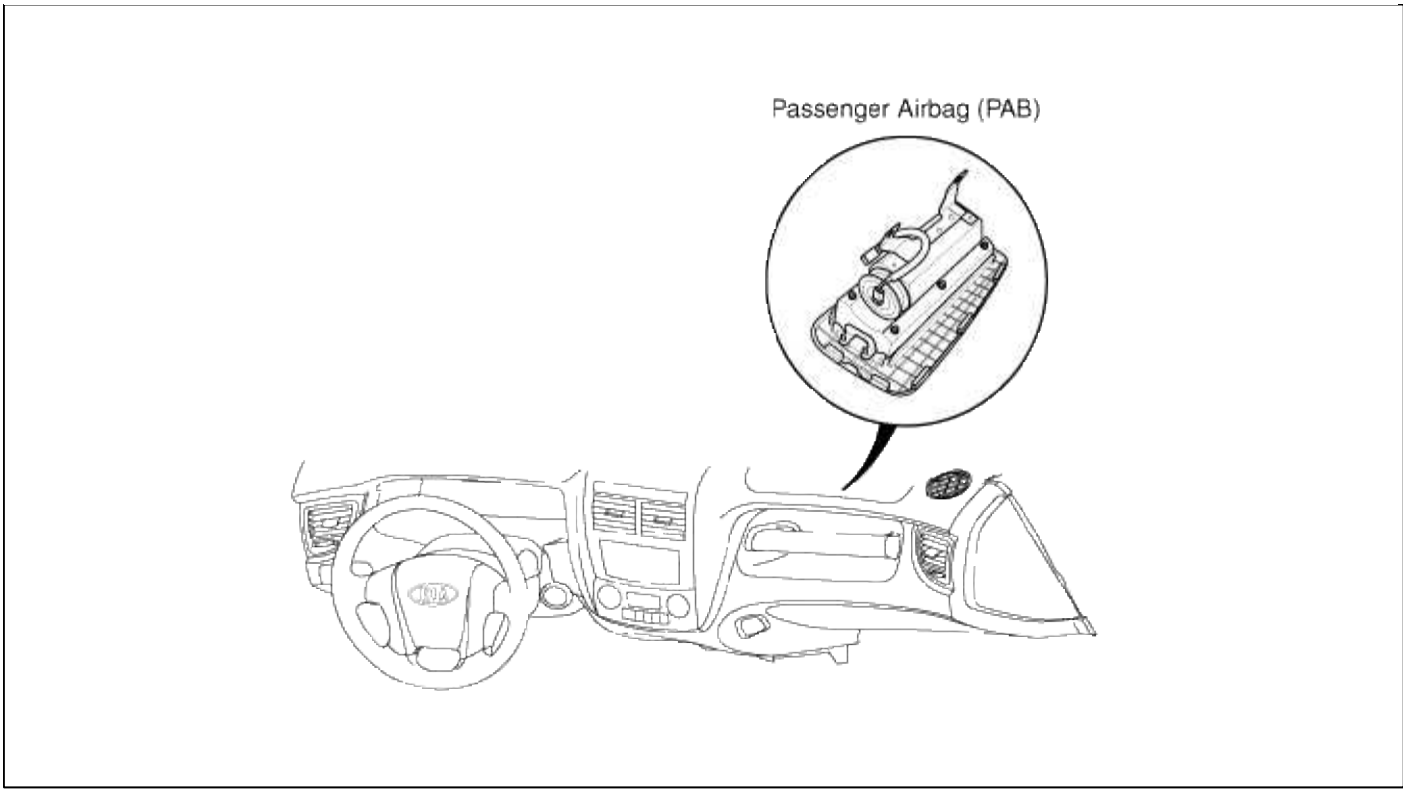


Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

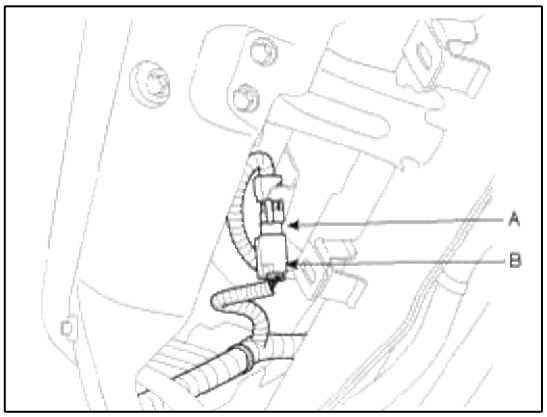
REMOVAL

CAUTION

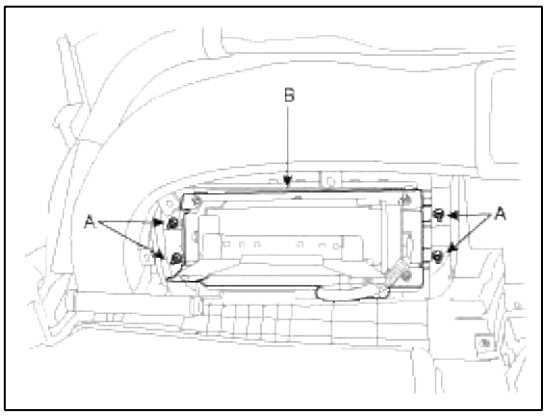
- Never attempt to disassemble or repair the airbag module.
- Do not drop the airbag module or allow contact with water, grease or oil. Replace it if a dent, crack, deformation or rust is detected.
- The airbag module should be stored on a flat surface and placed so that the pad surface is facing upward. Do not place anything on top of it.
- Do not expose the airbag module to temperature over 85°C(185°F).
- An undeployed airbag module should only be disposed in accordance with the procedures.
- 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.
- Whenever the PAB is deployed it should be replaced with a new one assembled with an extension wire. The squib is melt down if the PAB is deployed making the extension wire useless.

1. Disconnect the battery negative cable and wait at least three minutes before beginning work.

2. Remove the glove box (Refer to BD group - glove box), then disconnect the connector between the SRS main harness connector (A) and front passenger's airbag connector(B).



3. Remove the crash pad. (Refer to BD group - crash pad)
4. Remove the mounting nuts (A) from the crash pad. Then remove the passenger's airbag (B).

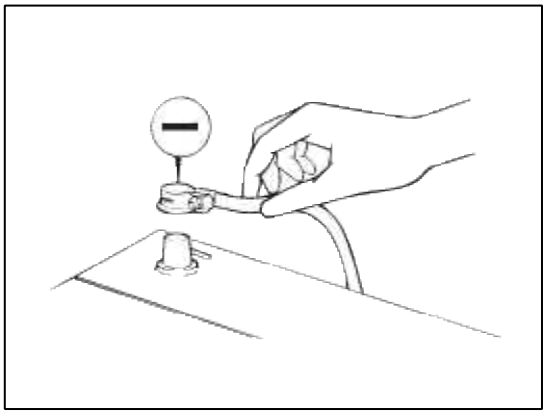


5. Installation is the reverse of removal.

> **NOTE**
>
> After installing the clock spring, confirm proper system operation; Turn the ignition switch ON: the SRS indicator light should be turned on for about 6 seconds and then go off.

INSTALLATION

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 instrument panel and tighten the Passenger Airbag (PAB) mounting nuts.

Tightening Torque
: 18.6 ~ 26.5 N·m(13.7 ~ 19.5 lb·ft)

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4. Install the instrument panel (Refer to BD group in this Service Manual).
5. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
   Attach the Passenger Airbag (PAB) connector to the connector holder, then reinstall the glove box.
6. Reconnect the battery negative cable.
7. After installing the Passenger Airbag (PAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Side Airbag (SAB) Module > Description and Operation

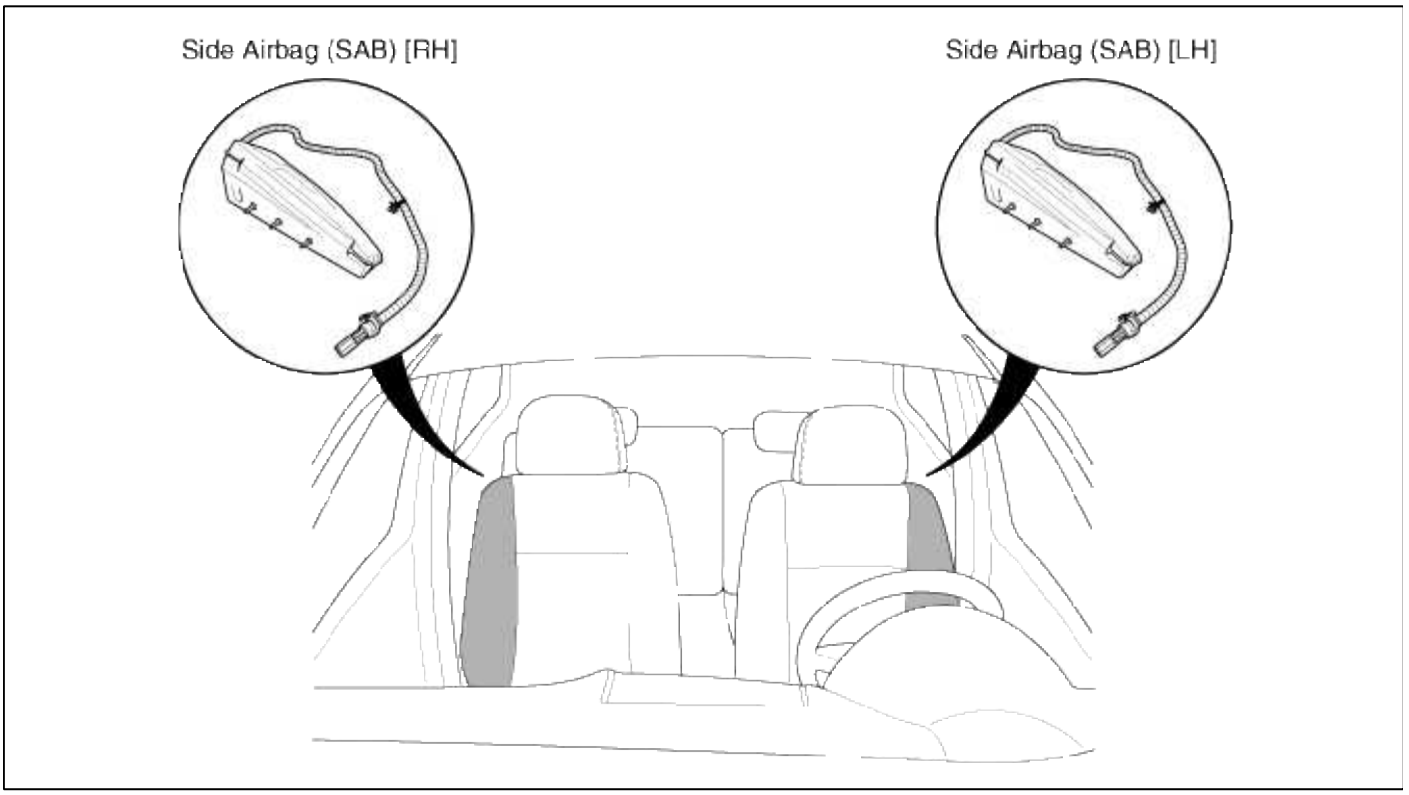
DESCRIPTION

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Side Airbag (SAB) Module > Components and Components Location

COMPONENTS



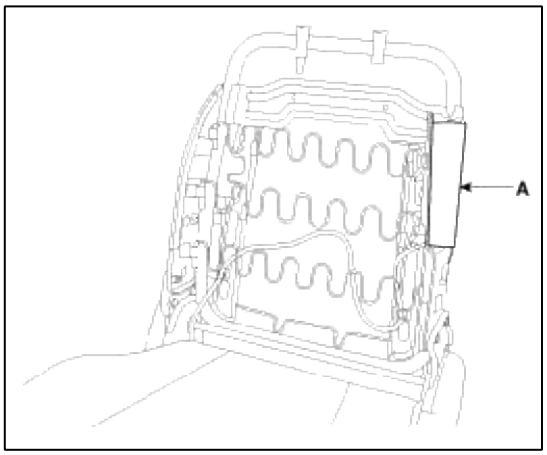
Restraint > Airbag Module > Side Airbag (SAB) Module > Repair procedures

REMOVAL

CAUTION

- Never attempt to disassemble or repair the airbag module.
- Do not drop the airbag module or allow contact with water, grease or oil. Replace it if a dent, crack, deformation or rust is detected.
- The airbag module should be stored on a flat surface and placed so that the pad surface is facing upward. Do not place anything on top of it.
- Do not expose the airbag module to temperature over 93°C(200°F).
- An undeployed airbag module should only be disposed in accordance with the procedures.
- 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.
- Whenever the SAB is deployed it should be replaced with a new one assembled with an extension wire. The squib is melt down if the SAB is deployed making the extension wire useless.

1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. Remove the front seat assambly.(Refer to BD group)
3. Remove the seat-back cover.
4. Loosen the nuts and remove the SAB(A) module.



NOTE

After installing the side 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.

INSTALLATION

CAUTION

Be sure to install the harness wires so that they are not pinched or interfering 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 negative (-) cable from battery and wait for at least three minutes.
2. Remove ignition key from the vehicle.

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3. Place a Side Airbag (SAB) on the seat back-frame and tighten the side airbag mounting nuts.

Tightening torque
: 5.9 ~ 9.8 N·m(4.3 ~ 7.2 lb·ft)

4. Install the new seat-back cover.
5. Install the seat assembly, then connect the Side Airbag (SAB) harness connector.
6. Reconnect the battery negative cable.
7. After installing the Side Airbag (SAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
8. Recline and slide the front seat forward fully, make sure the harness wires are not pinched or interfering with other parts.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Description and Operation

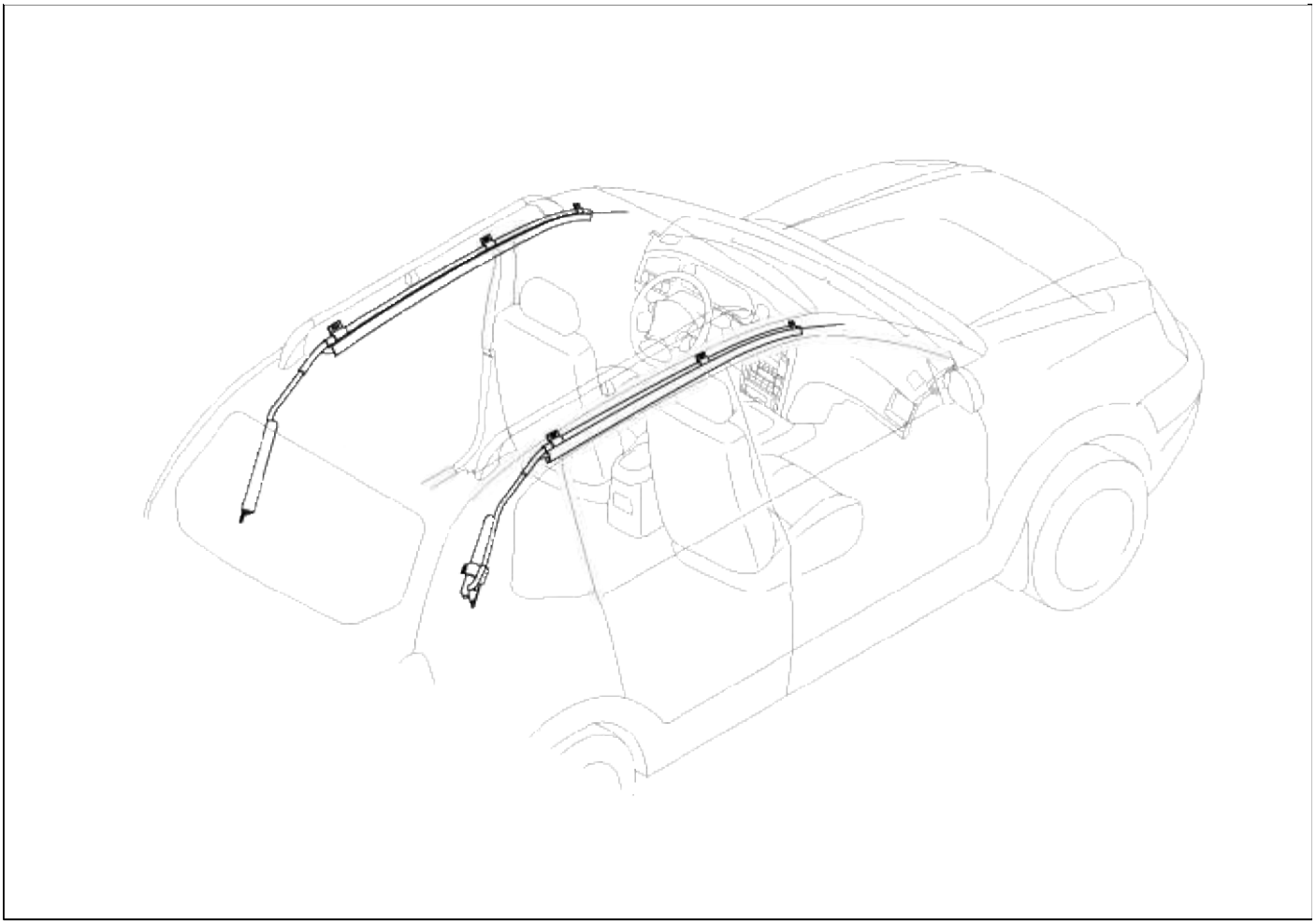
DESCRIPTION

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Components and Components Location

COMPONENTS



Restraint > Airbag Module > Curtain Airbag (CAB) Module > Repair procedures

removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the following parts (Refer to BD group).
   A. Front and rear seat
   B. Interior trim
   C. Trunk trim
   D. Headlining
3. Disconnect the connector (A).

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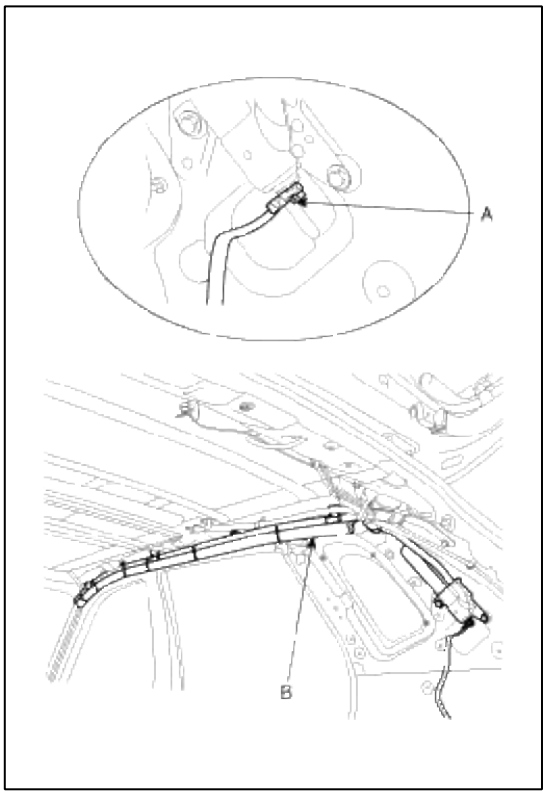
4. After loosening the mounting bolts, remove the curtain airbag (B).



NOTE

After installing the curtain airbag, confirm proper system operation: Turn the ignition switch ON; the SRS indicator light should be turned on for about seconds and then go off.

INSTALLATION

CAUTION

- Be sure to install the harness wires so that they are not pinched or interfering 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)
: 6.9 ~ 8.8 N·m (5.1 ~ 6.5 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:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Description and Operation

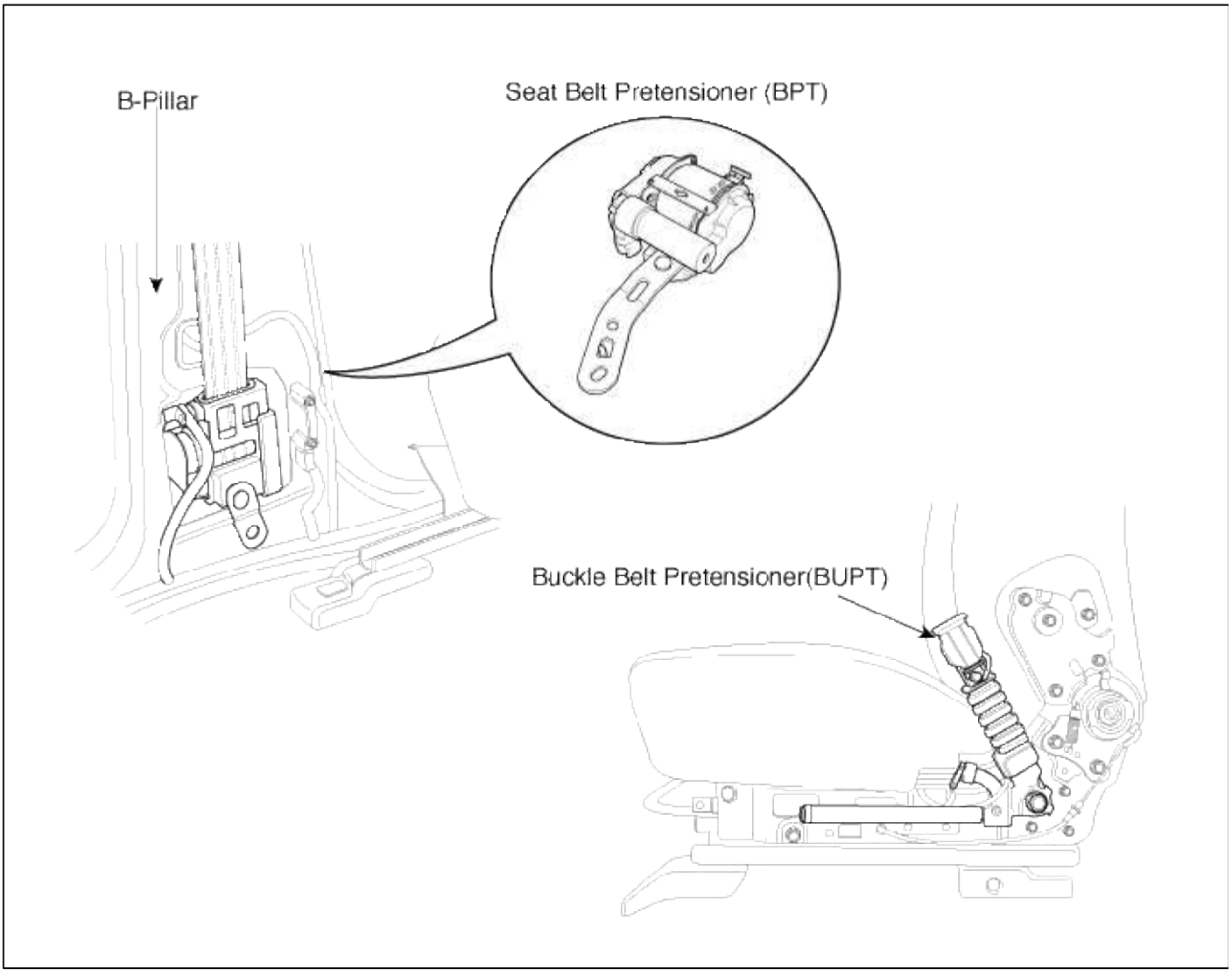
DESCRIPTION

CAUTION

Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) and Buckle Belt Pretensioner (BUPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Components and Components Location

COMPONENTS



Restraint > Seat Belt Pretensioner > Seat Belt Retractor Pretensioner (BPT) > Repair procedures

REMOVAL

1. Disconnect the battery negative cable, and wait at least three minutes before beginning work.
2. Remove the seat assembly (Refer to BD group)
3. Remove the front door scuff trim.
4. Remove the center pillar trim.

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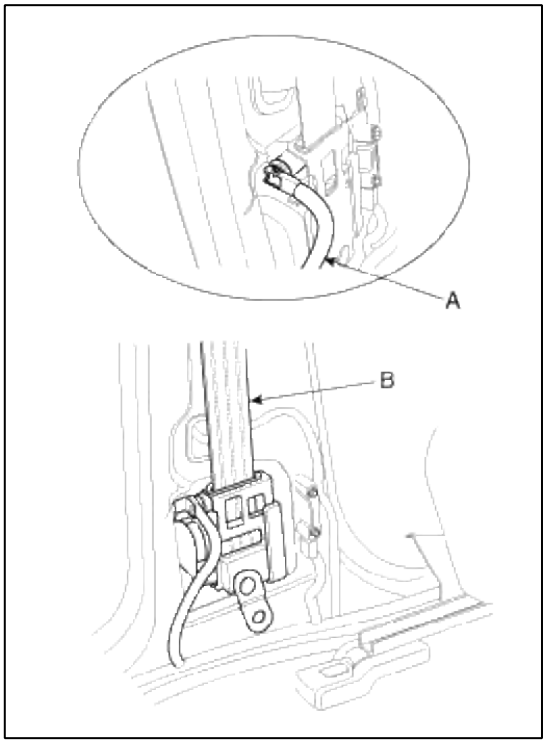
5. Remove the lower anchor bolt.
6. Remove the upper anchor bolt.
7. Disconnect the connector (A).
8. Lossen the mounting bolt.
   Remove the pretensioner (B).



INSTALLATION

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 anchor bolt.

Tightening Torque (Seat Belt Upper Anchor Bolt)
: 39 ~ 54 N·m (29 ~ 40 lb·ft)

5. Install the lower anchor bolt.

Tightening Torque (Seat Belt Lower Anchor Bolt)
: 39 ~ 54 N·m (29 ~ 40 lb·ft)

6. Install the center pillar trim.
7. Install the front door scuff trim.
8. Install the seat assembly.
9. Reconnect the negative battery cable.
10. After installing the Seat Belt Pretensioner (BPT), confirm proper system operation:
    A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Troubleshooting > B1101

DTC Description

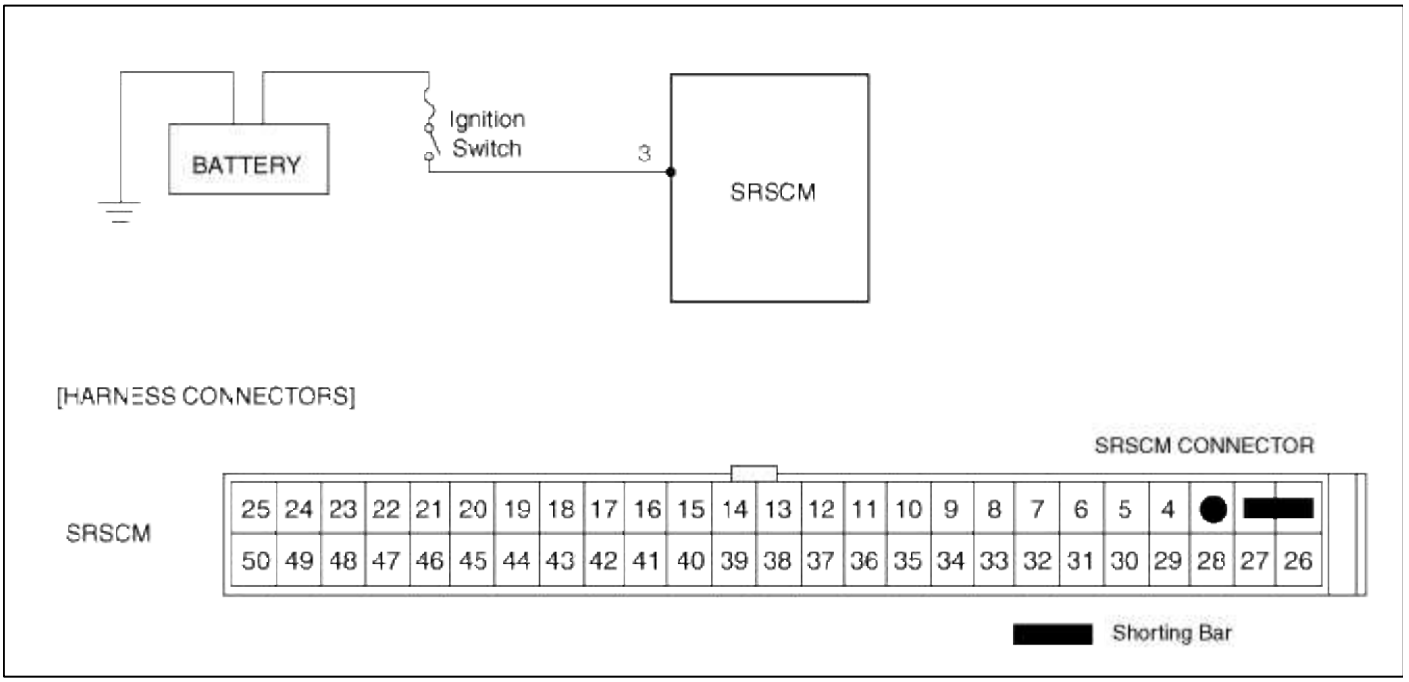
The SRSCM sets above DTC(s) if it detects that the battery voltage of restraints system is too high or too low.

When the voltage returns to normal, the SRS warning light automatically goes off and a malfunction is no longer indicated.

DTC Detecting Condition

DTC	Condition	Probable cause
B1101	Battery Voltage > 16.5 V for 10 seconds after IG ON	• Battery • Alternator • Wiring Harness • SRSCM
B1102	Battery Voltage < 9.0 V for 10 seconds after IG ON	

Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

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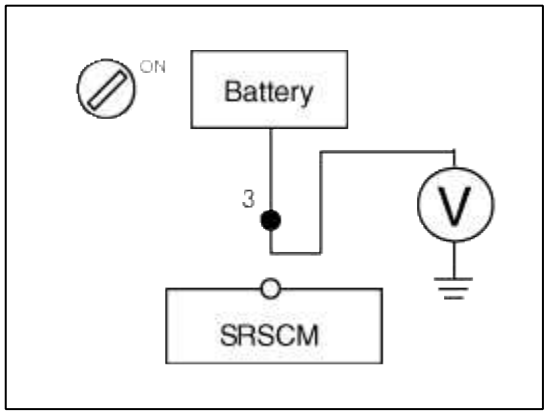
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SOURCE VOLTAGE
   (1) Turn the ignition switch to ON.
   (2) Measure voltage between the terminal 3 of SRSCM harness connector and chassis ground.

   specification(voltage) : 9.0 ≤ V ≤ 16.5 V



   (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 (-) terminal 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, BUPT, FIS and SIS.
(4) Connect the SRSCM connector.
(5) Connect the negative (-) terminal 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.

Specification

Voltage : $9.0 \leq V \leq 16.5$ V

Restraint > Troubleshooting > B1102

DTC Description

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

DTC	Condition	Probable cause
B1101	Battery Voltage > 16.5 V for 10 seconds after IG ON	• Battery • Alternator • Wiring Harness • SRSCM
B1102	Battery Voltage < 9.0 V for 10 seconds after IG ON	

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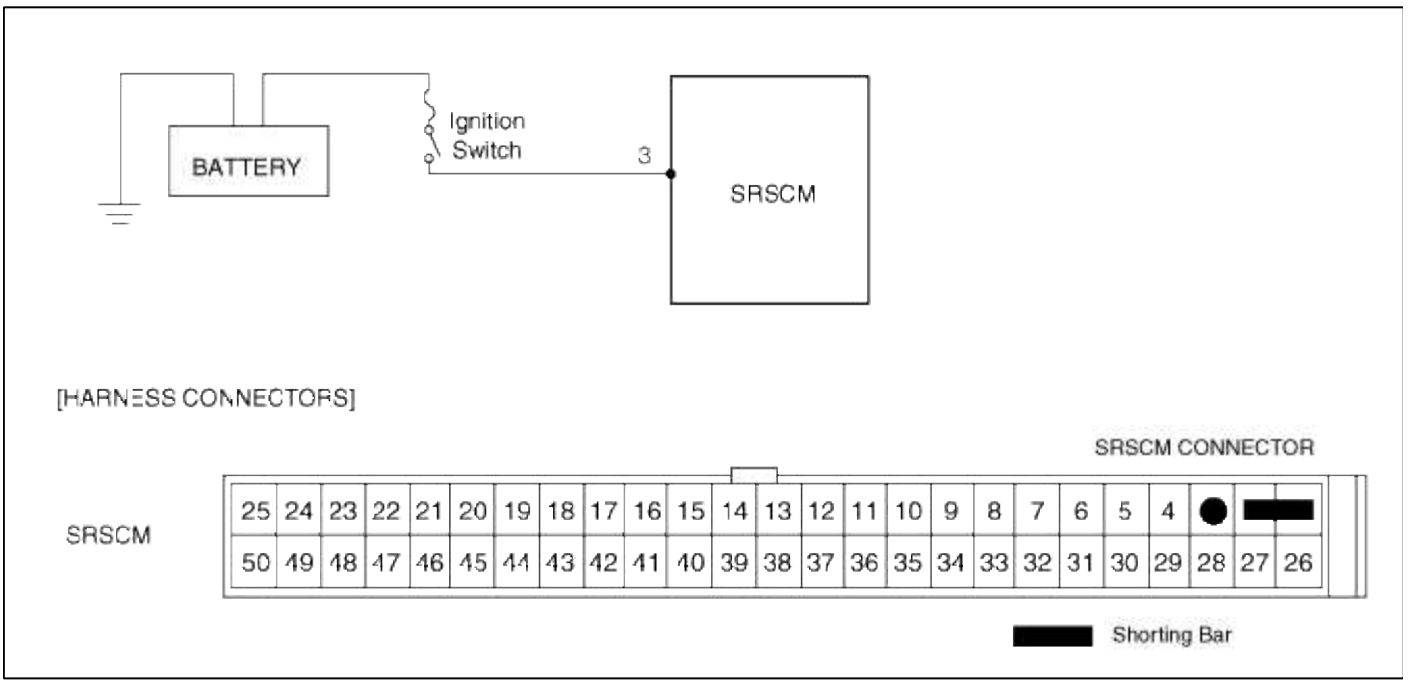
Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

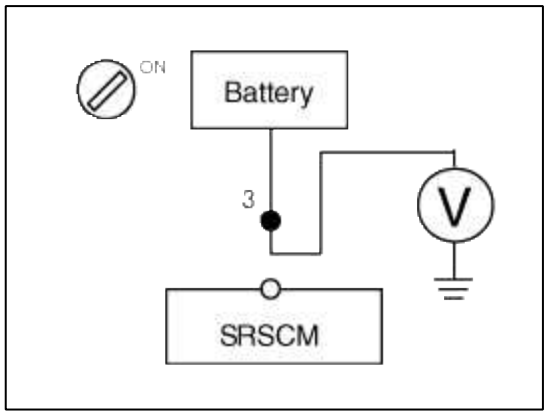
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SOURCE VOLTAGE

(1) Turn the ignition switch to ON.

(2) Measure voltage between the terminal 3 of SRSCM harness connector and chassis ground.

specification(voltage) : 9.0 ≤ V ≤ 16.5 V



(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.

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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 (-) terminal 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

Specification

Voltage : 9.0 ≤ V ≤ 16.5 V

Restraint > Troubleshooting > B1326

DTC Description

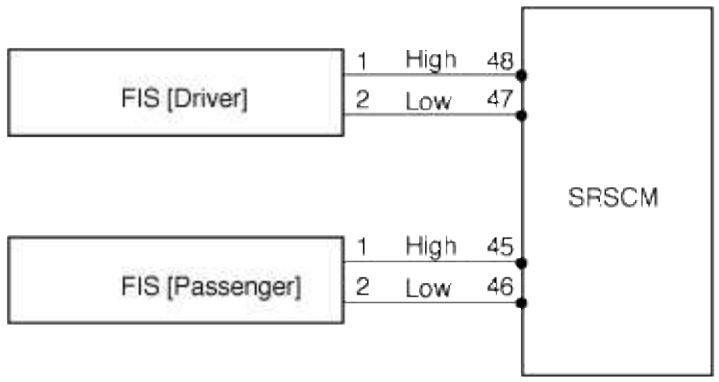
The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1326 B1331	• Short to ground between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Short to ground on Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

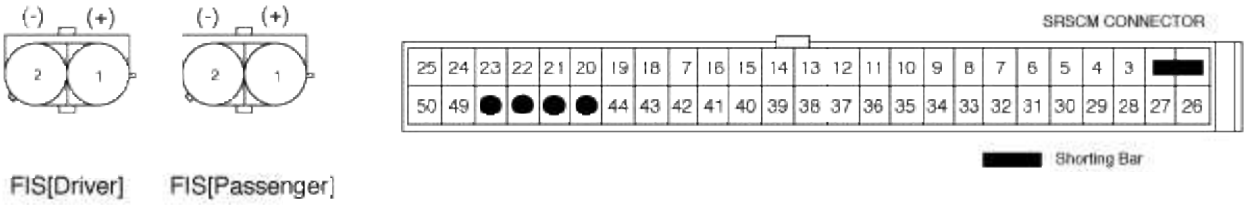
FIS [Driver]

Pin	Connected to	Function
1	SRSCM terminal 48	FIS High
2	SRSCM terminal 47	FIS Low

FIS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 45	FIS High
2	SRSCM terminal 46	FIS Low

[HARNESS CONNECTORS]



FIS[Driver] FIS[Passenger]

Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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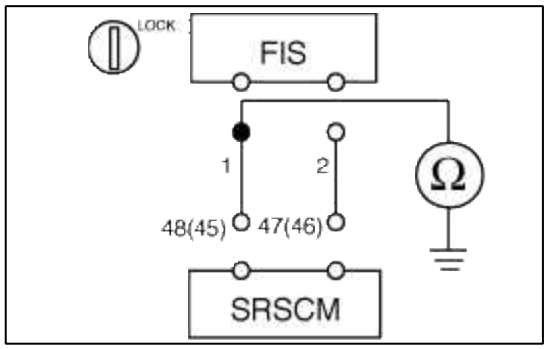
2. CHECK FIS CIRCUIT

(1) Measure resistance between the terminal 1 of FIS harness connector and chassis ground(-).

specification(resistance) : ∞ Ω



(2) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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. 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 (-) terminal 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,BUPT,FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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

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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1327

DTC Description

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

DTC	Condition	Probable cause
B1327 B1332	• Short to battery line between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Short to battery line on Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram

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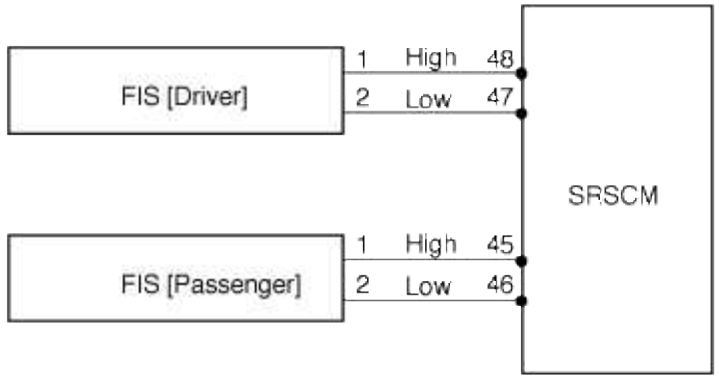
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

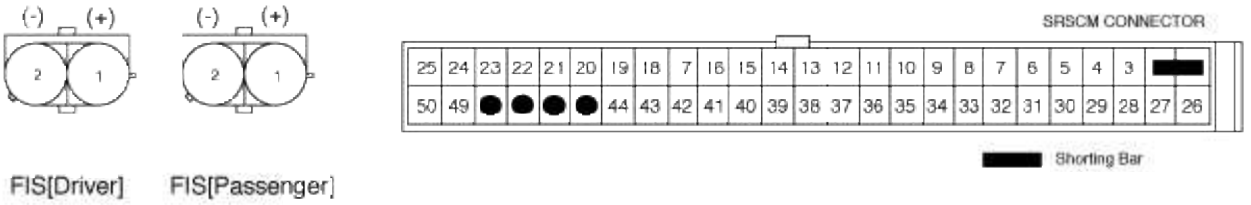
FIS [Driver]

Pin	Connected to	Function
1	SRSCM terminal 48	FIS High
2	SRSCM terminal 47	FIS Low

FIS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 45	FIS High
2	SRSCM terminal 46	FIS Low

[HARNESS CONNECTORS]



FIS[Driver] FIS[Passenger]

Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

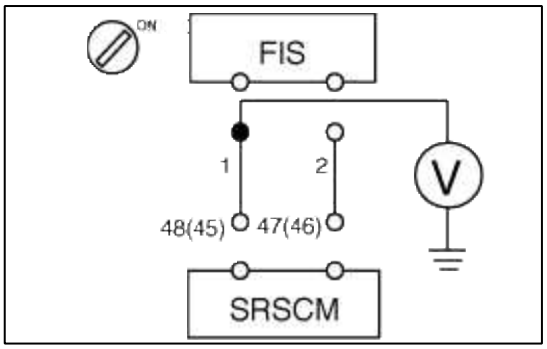
2. CHECK FIS CIRCUIT

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of FIS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check Front Impact Sensor.

NO

Repair the short to battery line circuit on 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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).

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4. 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 (-) terminal 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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

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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1328

DTC Description

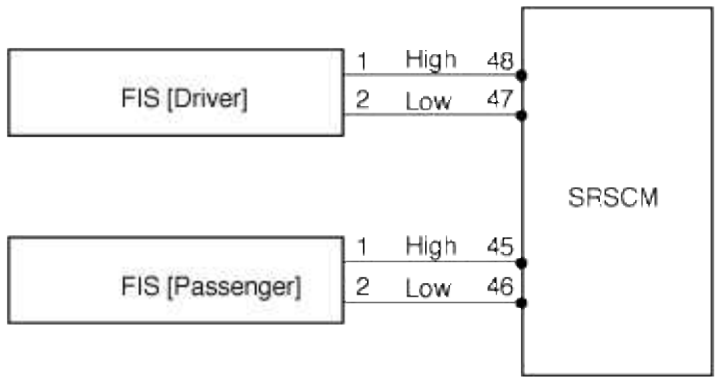
The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

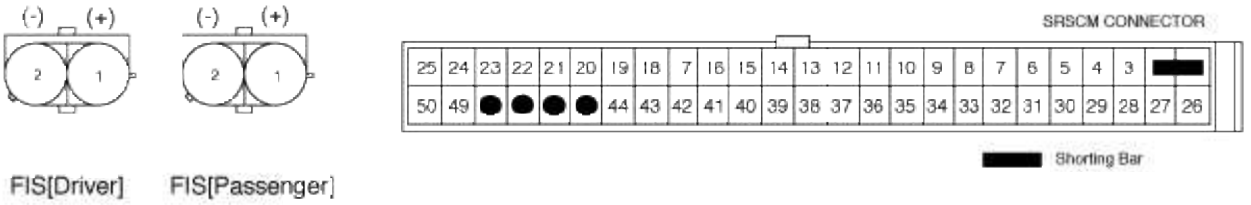
FIS [Driver]

Pin	Connected to	Function
1	SRSCM terminal 48	FIS High
2	SRSCM terminal 47	FIS Low

FIS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 45	FIS High
2	SRSCM terminal 46	FIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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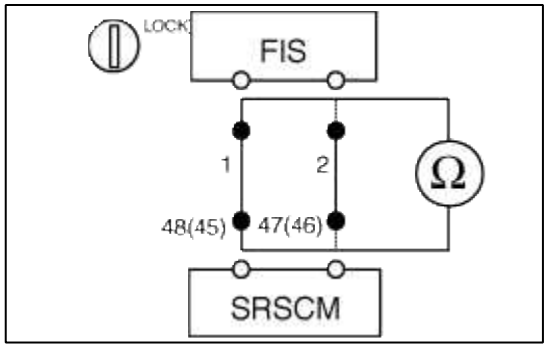
2. CHECK FIS CIRCUIT

(1) Measure resistance between the terminal 1 of FIS harness connector and the terminal 48(45) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of FIS harness connector and the terminal 47(46) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
   (1) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (2) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (3) Turn the ignition switch to ON and wait for at least 30 seconds.
   (4) 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1329

DTC Description

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

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

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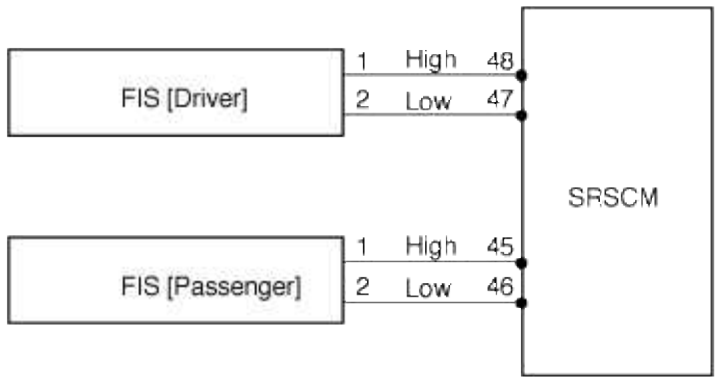
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

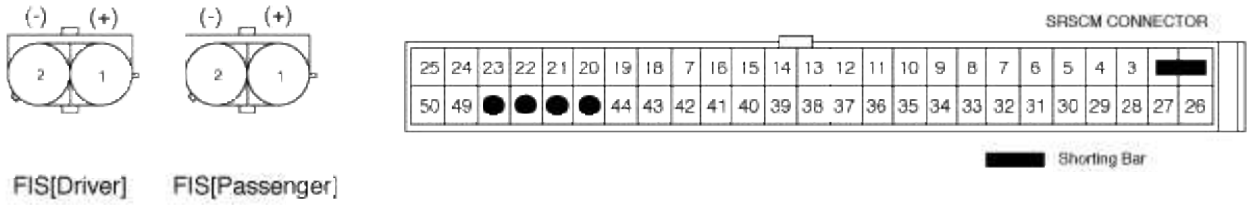
FIS [Driver]

Pin	Connected to	Function
1	SRSCM terminal 48	FIS High
2	SRSCM terminal 47	FIS Low

FIS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 45	FIS High
2	SRSCM terminal 46	FIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

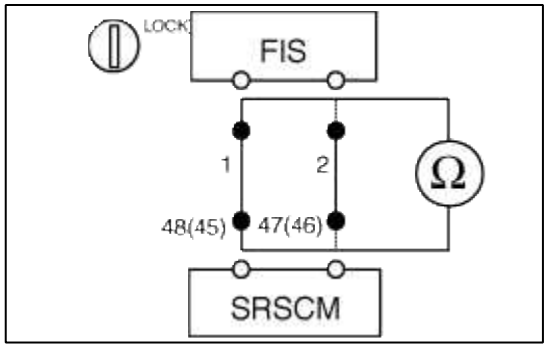
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK FIS CIRCUIT

(1) Measure resistance between the terminal 1 of FIS harness connector and the terminal 48(45) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of FIS harness connector and the terminal 47(46) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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).

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
(2) Turn the ignition switch to LOCK and wait for at least 30 seconds.
(3) Turn the ignition switch to ON and wait for at least 30 seconds.
(4) 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1330

DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS).

Inspection Procedure

If above DTC is detected , replace two Front Impact Sensors(FIS).

Restraint > Troubleshooting > B1331

DTC Description

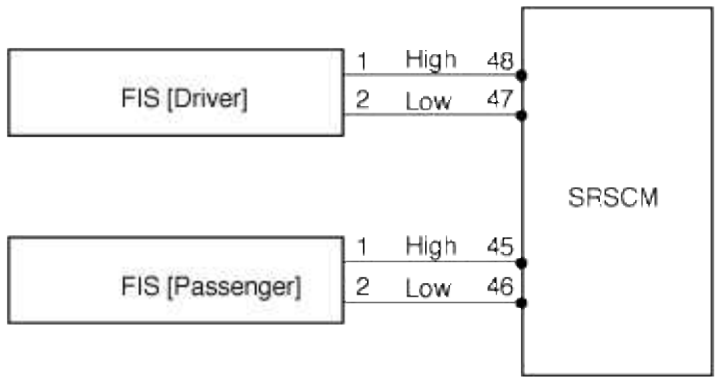
The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

DTC	Condition	Probable cause
B1326 B1331	• Short to ground between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Short to ground on Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

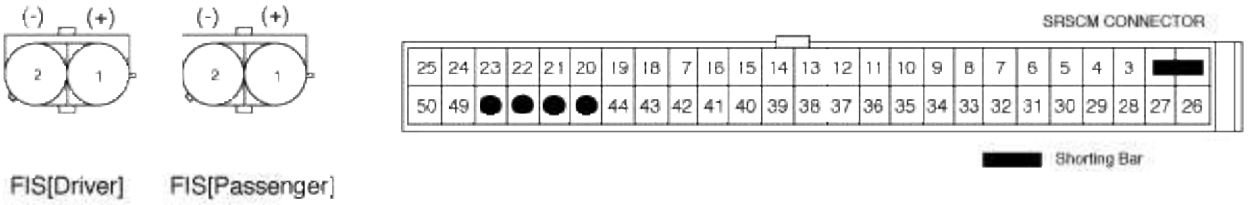
FIS [Driver]

Pin	Connected to	Function
1	SRSCM terminal 48	FIS High
2	SRSCM terminal 47	FIS Low

FIS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 45	FIS High
2	SRSCM terminal 46	FIS Low

[HARNESS CONNECTORS]



FIS[Driver] FIS[Passenger]

Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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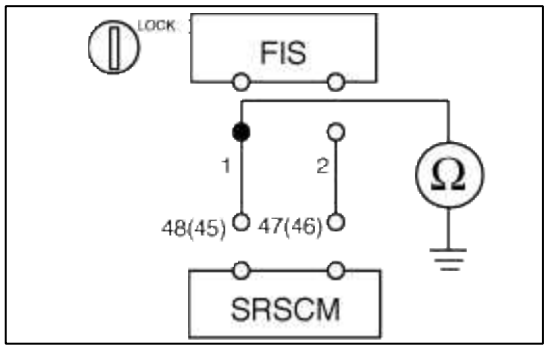
2. CHECK FIS CIRCUIT

(1) Measure resistance between the terminal 1 of FIS harness connector and chassis ground(-).

specification(resistance) : ∞ Ω



(2) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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. 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 (-) terminal 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,BUPT,FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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

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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1332

DTC Description

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

DTC	Condition	Probable cause
B1327 B1332	• Short to battery line between FIS and SRSCM • Front Impact Sensor(FIS) Malfunction • SRSCM Malfunction	• Short to battery line on Wiring Harness • Front Impact Sensor(FIS) squib • SRSCM

Schematic Diagram

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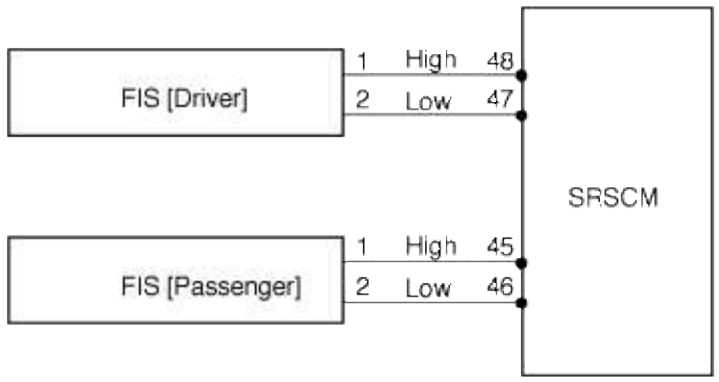
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

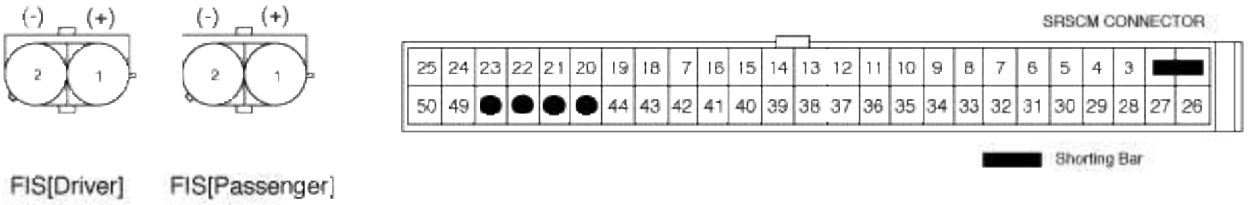
FIS [Driver]

Pin	Connected to	Function
1	SRSCM terminal 48	FIS High
2	SRSCM terminal 47	FIS Low

FIS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 45	FIS High
2	SRSCM terminal 46	FIS Low

[HARNESS CONNECTORS]



FIS[Driver] FIS[Passenger]

Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

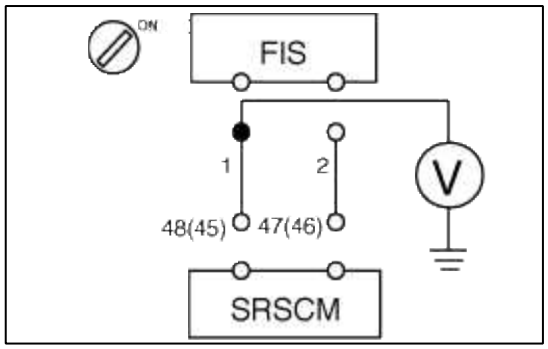
2. CHECK FIS CIRCUIT

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of FIS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check Front Impact Sensor.

NO

Repair the short to battery line circuit on 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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).

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4. 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 (-) terminal 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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

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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1333

DTC Description

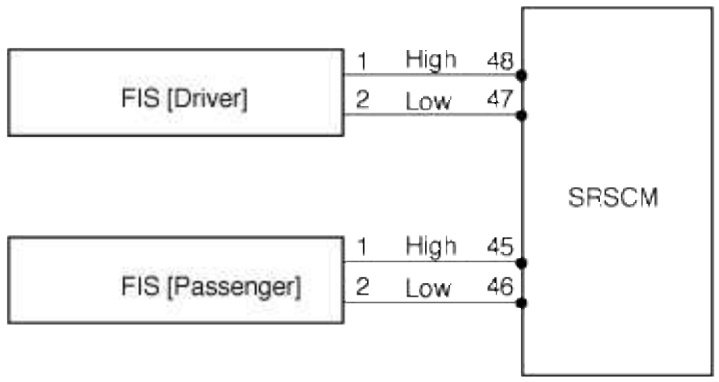
The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS). The SRSCM sets above DTC(s) if it detects that any FIS is defective or there is communication error between any FIS and the SRSCM.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

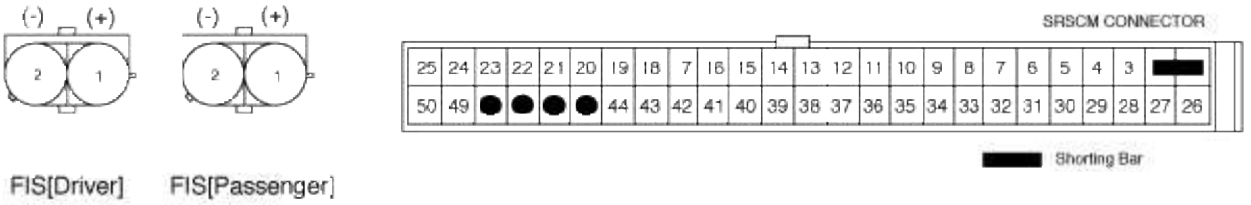
FIS [Driver]

Pin	Connected to	Function
1	SRSCM terminal 48	FIS High
2	SRSCM terminal 47	FIS Low

FIS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 45	FIS High
2	SRSCM terminal 46	FIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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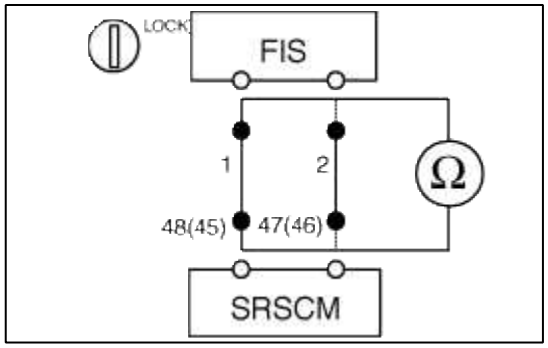
2. CHECK FIS CIRCUIT

(1) Measure resistance between the terminal 1 of FIS harness connector and the terminal 48(45) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of FIS harness connector and the terminal 47(46) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
   (1) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (2) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (3) Turn the ignition switch to ON and wait for at least 30 seconds.
   (4) 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1334

DTC Description

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

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

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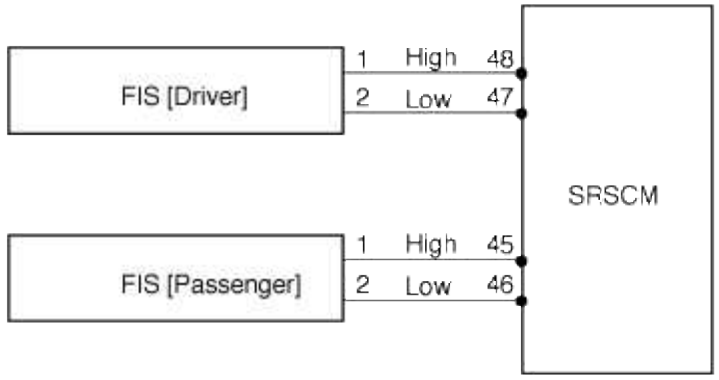
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

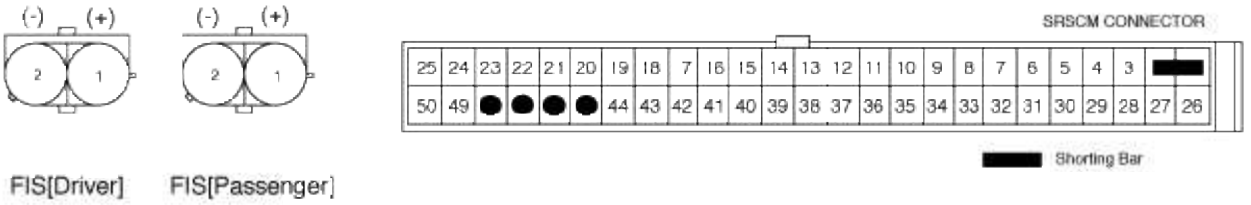
FIS [Driver]

Pin	Connected to	Function
1	SRSCM terminal 48	FIS High
2	SRSCM terminal 47	FIS Low

FIS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 45	FIS High
2	SRSCM terminal 46	FIS Low

[HARNESS CONNECTORS]



FIS[Driver] FIS[Passenger]

Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

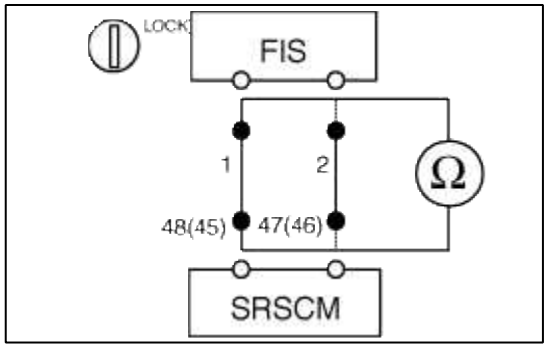
(5) Disconnect the SRSCM connector.

2. CHECK FIS CIRCUIT

(1) Measure resistance between the terminal 1 of FIS harness connector and the terminal 48(45) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of FIS harness connector and the terminal 47(46) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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).

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Clear the DTC stored in the SRSCM memory with the Hi-Scan(Pro).
   (2) Turn the ignition switch to LOCK and wait for at least 30 seconds.
   (3) Turn the ignition switch to ON and wait for at least 30 seconds.
   (4) 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1335

DTC Description

The detecting system for front crash consists of the SRSCM and two Front Impact Sensors (FIS).

Inspection Procedure

If above DTC is detected , replace two Front Impact Sensors(FIS).

Restraint > Troubleshooting > B1346

DTC Description

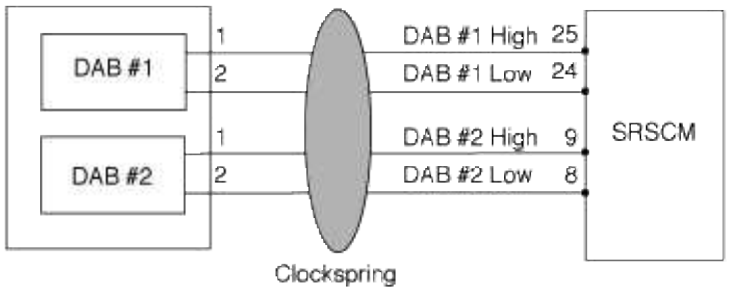
The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

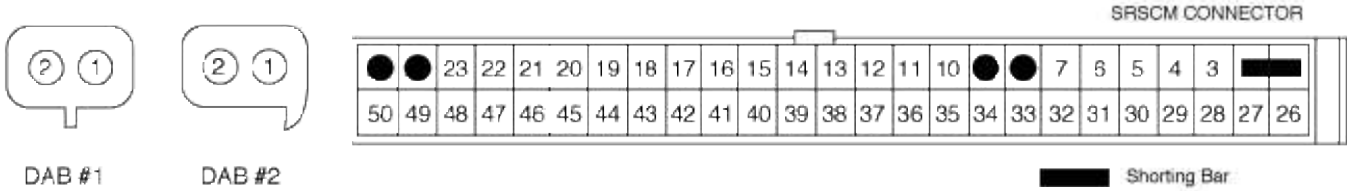
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 25	DAB #1 High
2	SRSCM terminal 24	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9	DAB #2 High
2	SRSCM terminal 8	DAB #2 Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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2. CHECK DAB RESISTANCE

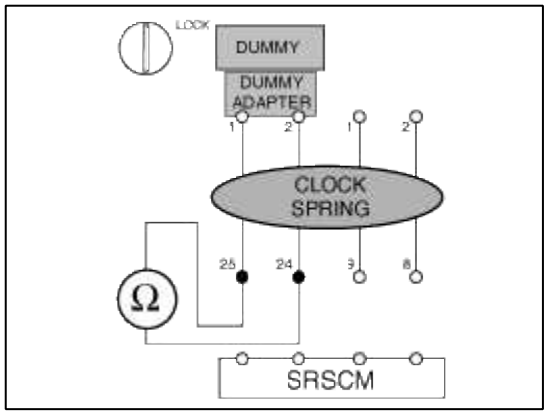
CAUTION

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 24 and 25 of SRSCM harness connector.

DAB resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

NO

Check open circuit.

YES

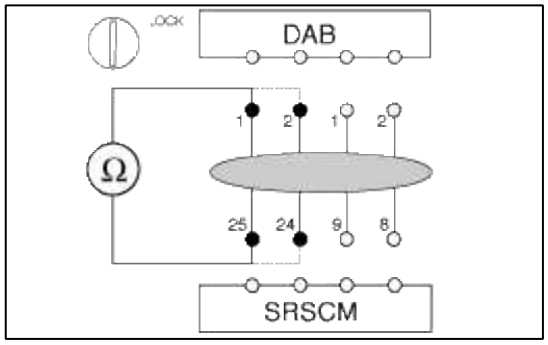
Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of DAB harness connector and the terminal 25 of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of DAB harness connector and the terminal 24 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

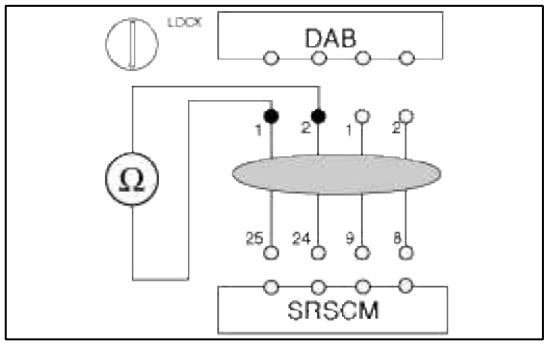
NO

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



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

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DAB resistance : 1.5 ≤ R ≤ 5.7 Ω

Restraint > Troubleshooting > B1347

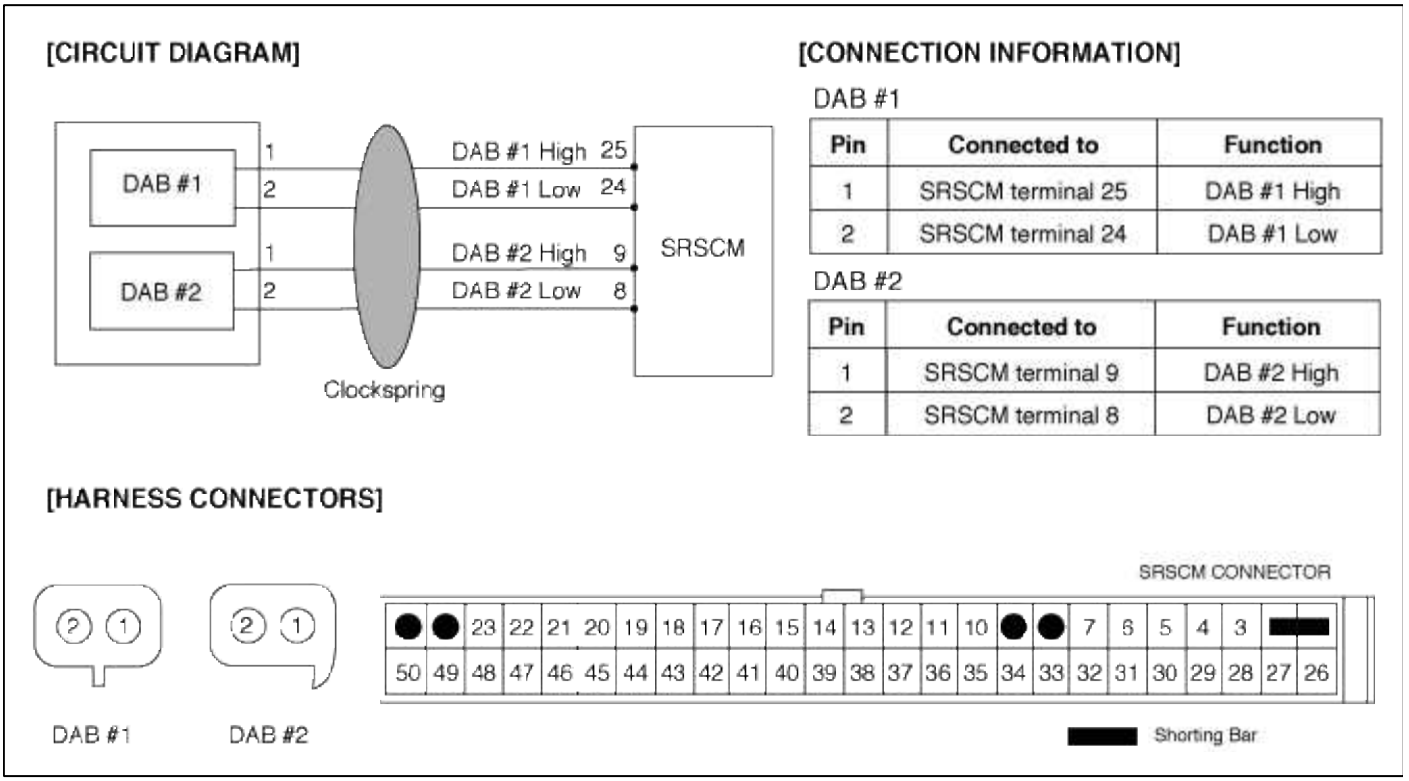
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

DTC Detecting Condition

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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK DAB RESISTANCE

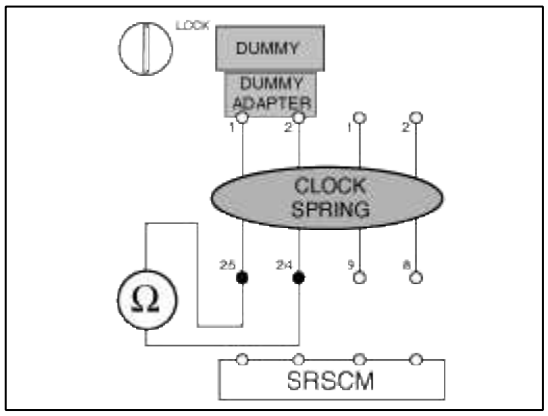
> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 24 and 25 of SRSCM harness connector.

DAB resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

NO

Check open circuit.

YES

Replace the Driver Airbag(DAB) module.

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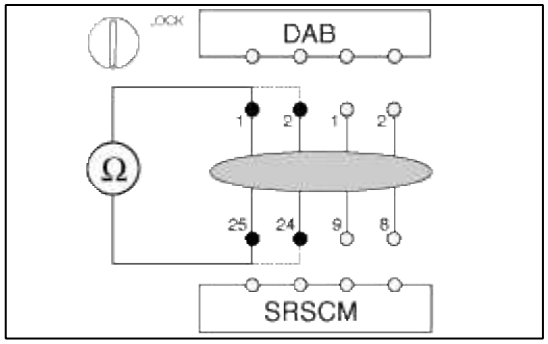
3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of DAB harness connector and the terminal 25 of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of DAB harness connector and the terminal 24 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

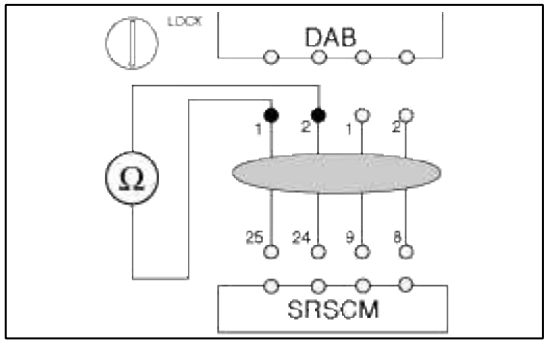
NO

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



(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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

DAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1348

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1348 B1483	• 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

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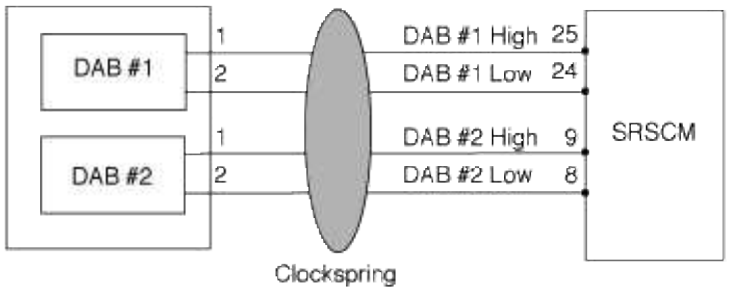
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

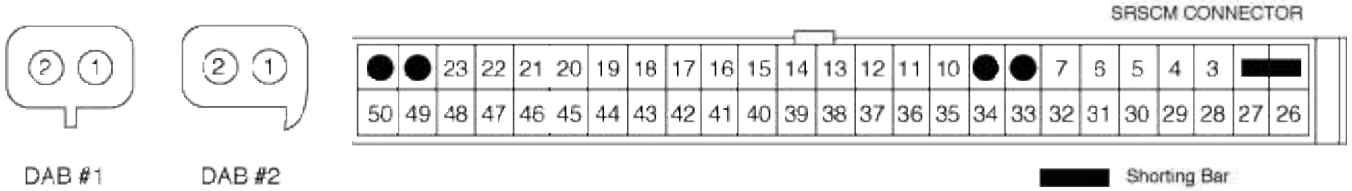
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 25	DAB #1 High
2	SRSCM terminal 24	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9	DAB #2 High
2	SRSCM terminal 8	DAB #2 Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

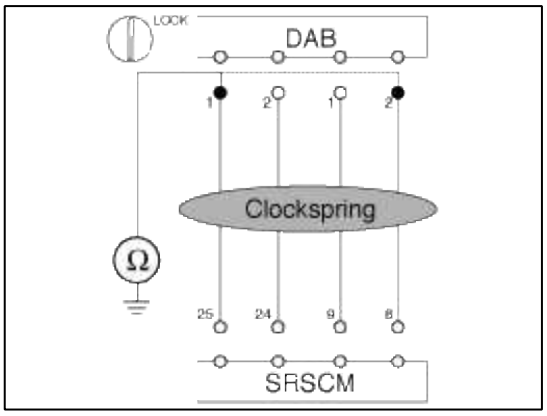
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of DAB harness connector and chassis ground (DAB Stage 1).

(2) Measure resistance between the terminal 2 of DAB harness connector and chassis ground (DAB Stage 2).

specification(resistance) : infinite



(3) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1349

DTC Description

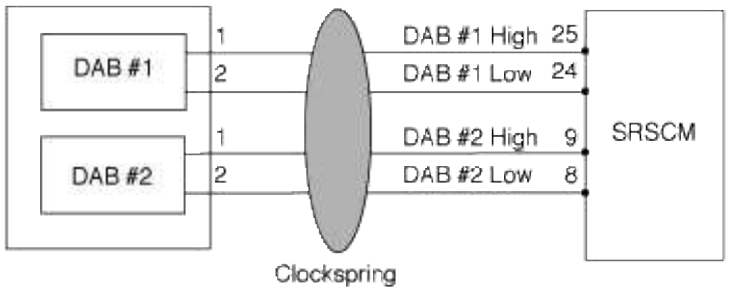
The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1349 B1484	• 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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

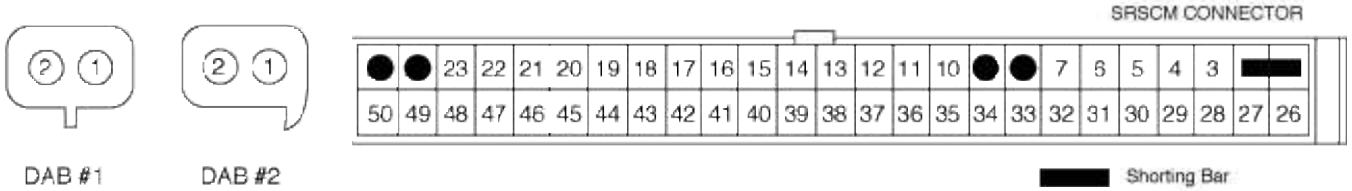
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 25	DAB #1 High
2	SRSCM terminal 24	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9	DAB #2 High
2	SRSCM terminal 8	DAB #2 Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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2. CHECK SHORT TO BATTERY LINE

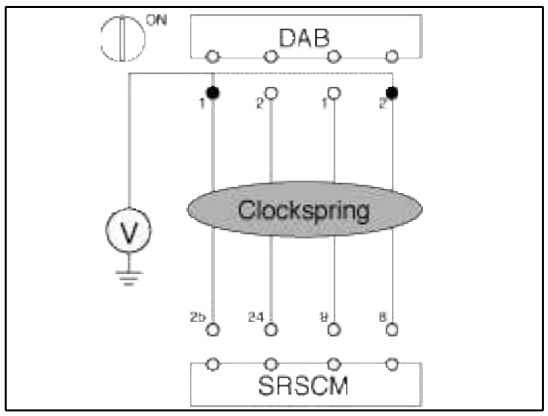
(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of DAB harness connector and chassis ground(-) (DAB Stage 1).

(4) Measure voltage between the terminal 2 of DAB harness connector and chassis ground(-) (DAB Stage 2).

specification(voltage) : Approximately 0 V



(5) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1352

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

DTC Detecting Condition

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

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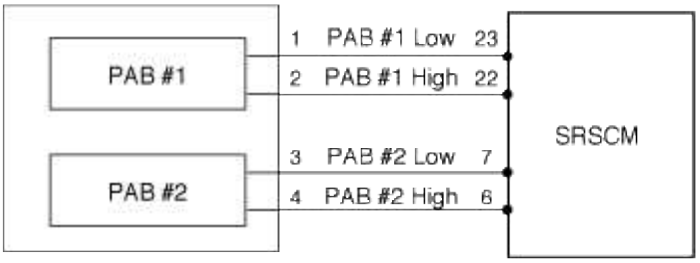
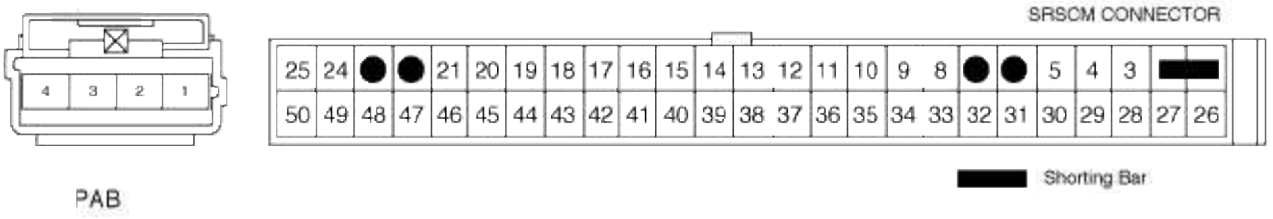
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Pin	Connected to	Function
1	SRSCM terminal 23	PAB #1 Low
2	SRSCM terminal 22	PAB #1 High
3	SRSCM terminal 7	PAB #2 Low
4	SRSCM terminal 6	PAB #2 High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

1. Check all the connectors related to the DTC for contact condition visually.
2. Check the connector and the terminal.
   (1) Check the connector for connection securely.
   (2) Check the terminal for contact condition,deterioration,erosion and elasticity.

> **CAUTION**
>
> Do not deform the connector for revising contact.

Are confirmed trouble on the connector and the terminal?

NO

Go to next step.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK PAB RESISTANCE

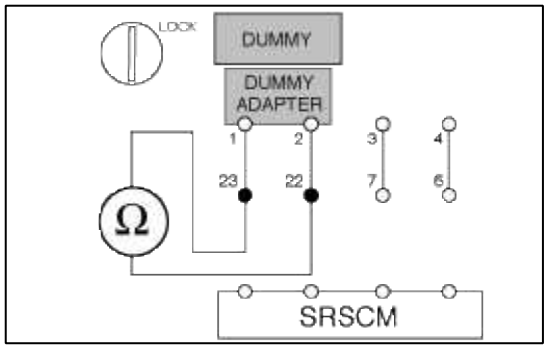
CAUTION

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 22 and 23 of SRSCM harness connector.

PAB resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Passenger Airbag(PAB) module.

NO

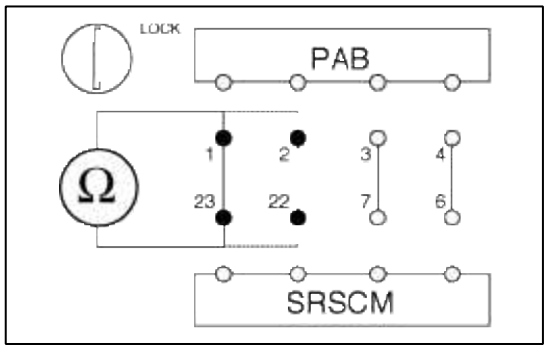
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of PAB harness connector and the terminal 23 of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of PAB harness connector and the terminal 22 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

NO

Repair or replace the wiring harness between the PAB and the SRSCM.

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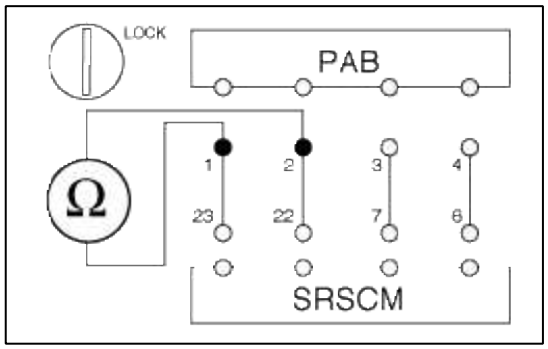
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of PAB harness connector.

specification(resistance) : infinite



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

PAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1353

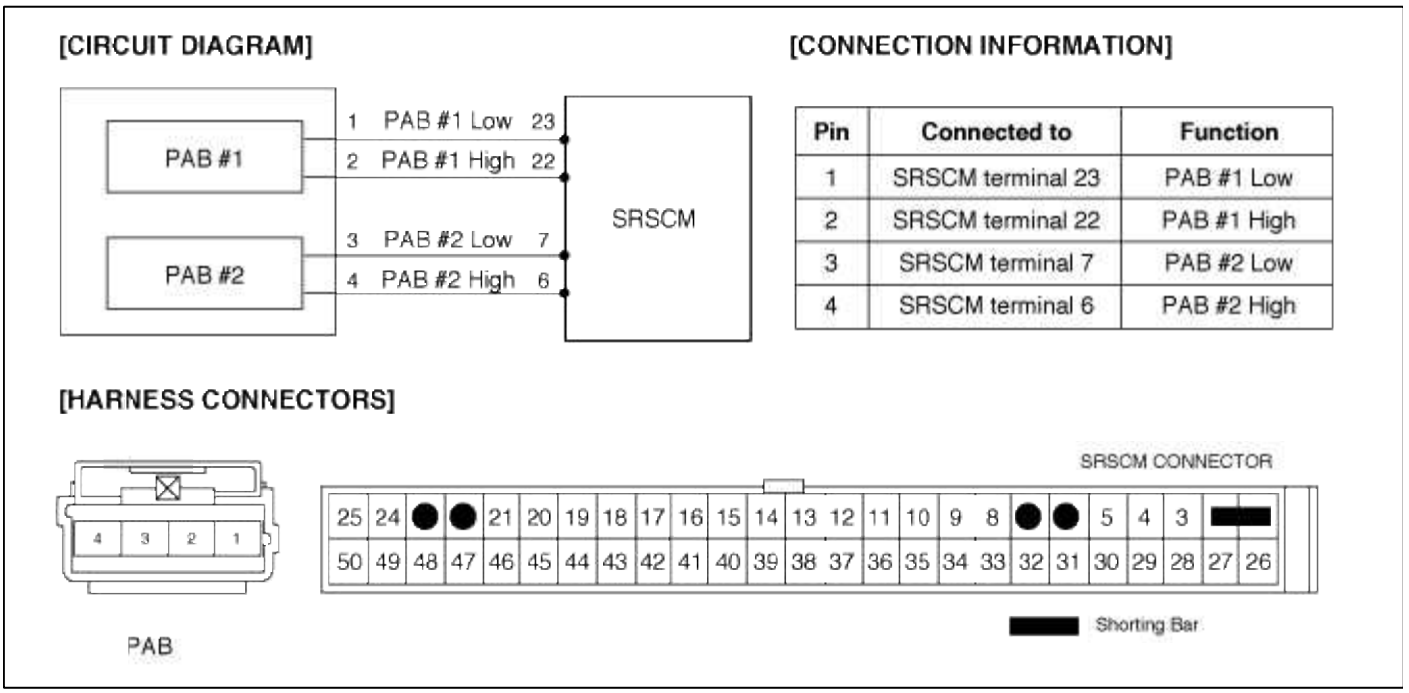
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

DTC Detecting Condition

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



Terminal & Connector Inspection

1. Check all the connectors related to the DTC for contact condition visually.
2. Check the connector and the terminal.
   (1) Check the connector for connection securely.
   (2) Check the terminal for contact condition,deterioration,erosion and elasticity.

> CAUTION
>
> Do not deform the connector for revising contact.

Are confirmed trouble on the connector and the terminal?

NO

Go to next step.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

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1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK PAB RESISTANCE

CAUTION

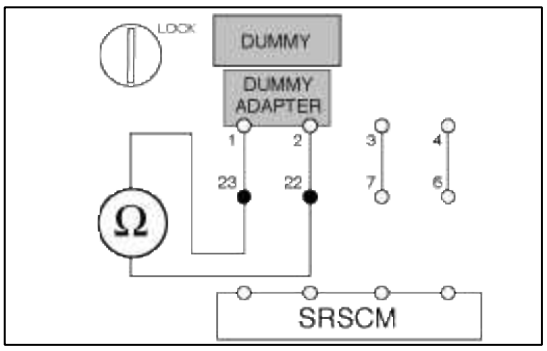
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 22 and 23 of SRSCM harness connector.

PAB resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

YES

Replace the Passenger Airbag(PAB) module.

NO

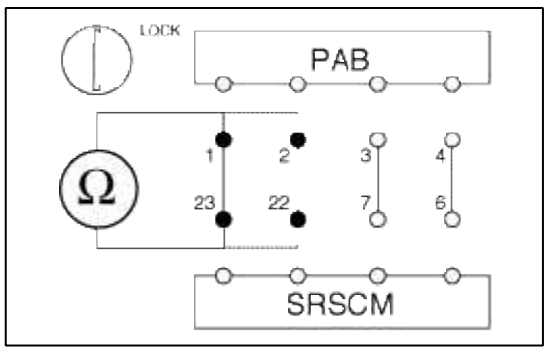
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of PAB harness connector and the terminal 23 of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of PAB harness connector and the terminal 22 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

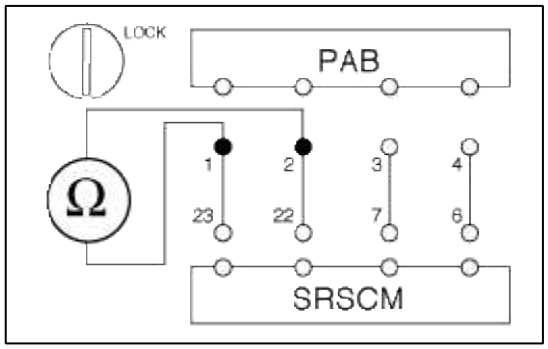
NO

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



(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.

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5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

PAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1354

DTC Description

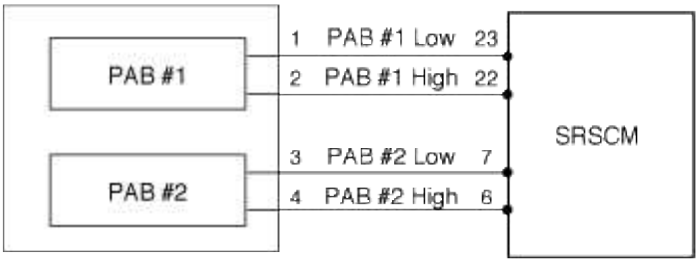
The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1354 B1487	• 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

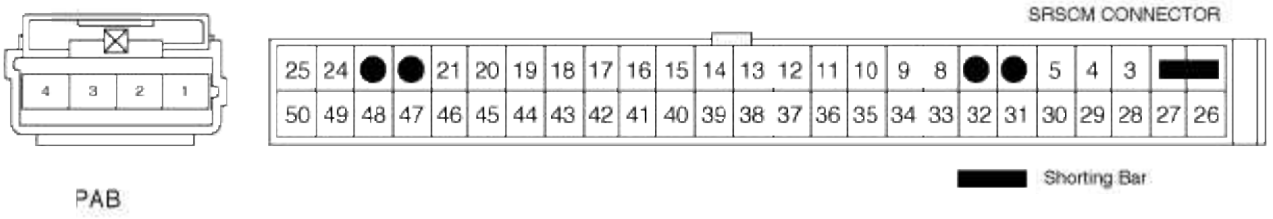
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Pin	Connected to	Function
1	SRSCM terminal 23	PAB #1 Low
2	SRSCM terminal 22	PAB #1 High
3	SRSCM terminal 7	PAB #2 Low
4	SRSCM terminal 6	PAB #2 High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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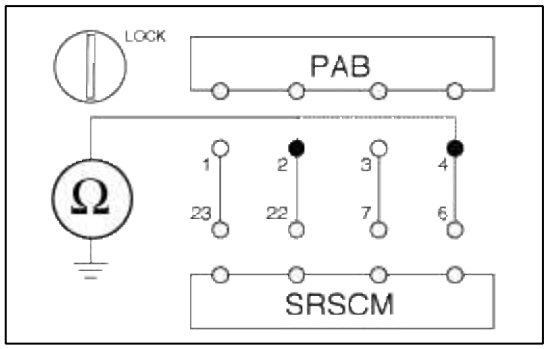
2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 2 of PAB harness connector and chassis ground(PAB Stage 1).

(2) Measure resistance between the terminal 4 of PAB harness connector and chassis ground(PAB Stage 2).

specification(resistance) : infinite



(3) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1355

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits.The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1355 B1488	• 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

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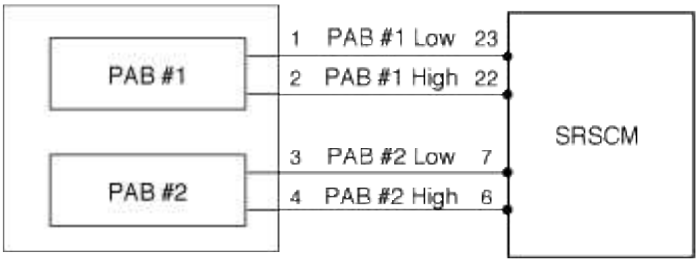
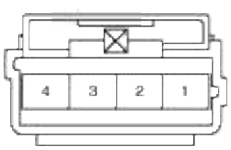
[CIRCUIT DIAGRAM]



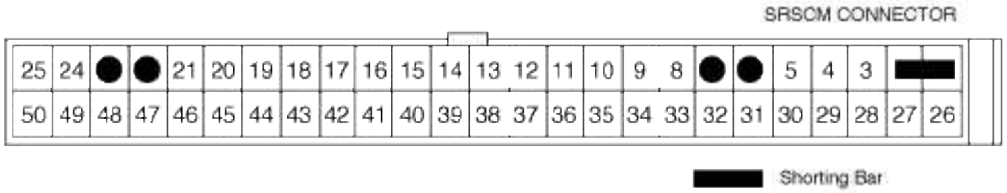
[CONNECTION INFORMATION]

Pin	Connected to	Function
1	SRSCM terminal 23	PAB #1 Low
2	SRSCM terminal 22	PAB #1 High
3	SRSCM terminal 7	PAB #2 Low
4	SRSCM terminal 6	PAB #2 High

[HARNESS CONNECTORS]



PAB



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE

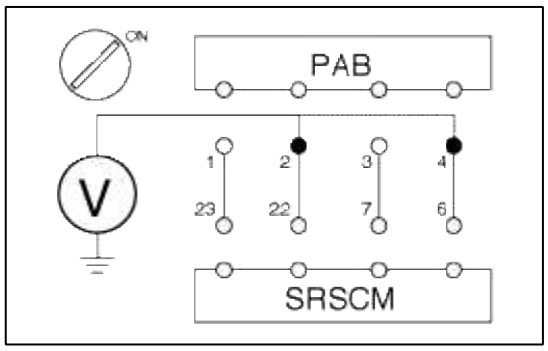
(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 2 of PAB harness connector and chassis ground(-) (PAB Stage 1).

(4) Measure voltage between the terminal 4 of PAB harness connector and chassis ground(-) (PAB Stage 2).

specification(voltage) : Approximately 0 V



(5) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1361

DTC Description

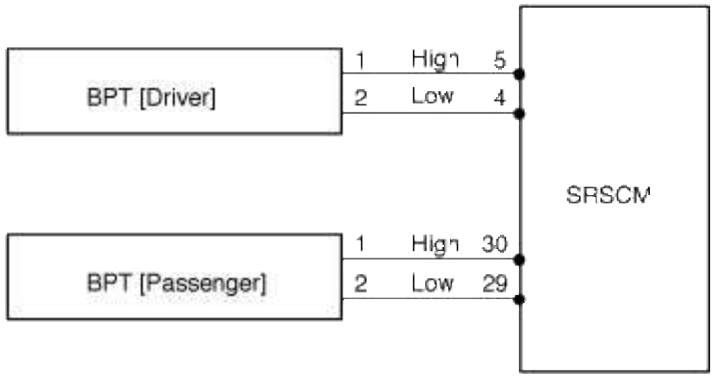
The Seat Belt Pretensioner circuit consists of the SRSCM and two Seat Belt Pretensioners (BPT).
The SRSCM sets above DTC(s) if it detects that the resistance of BPT squib is too high or low.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

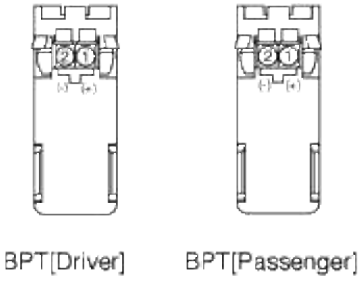
BPT [Driver]

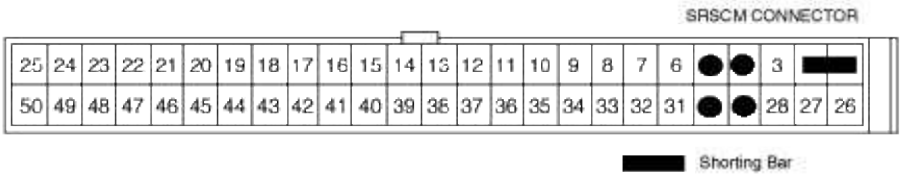
Pin	Connected to	Function
1	SRSCM Terminal 5	BPT High
2	SRSCM Terminal 4	BPT Low

BPT [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 30	BPT High
2	SRSCM Terminal 29	BPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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2. CHECK BPT RESISTANCE

CAUTION

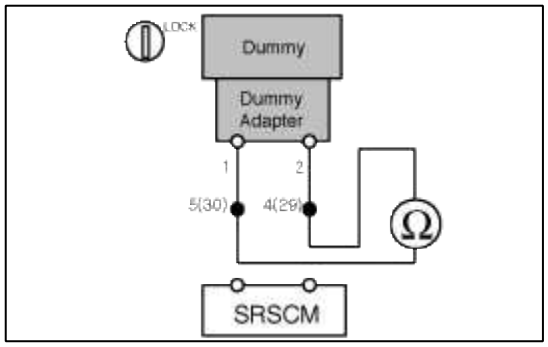
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 5(30) and 4(29) of SRSCM harness connector.

BPT resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

YES

Replace the Seat Belt Pretensioner(BPT) module.

NO

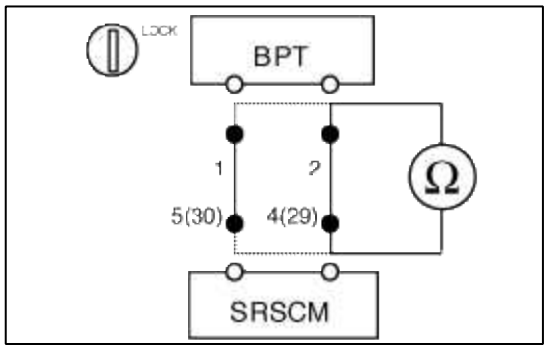
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 5(30) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(29) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

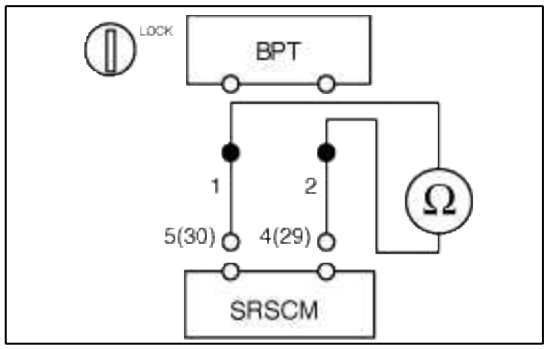
NO

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



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BPT resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1362

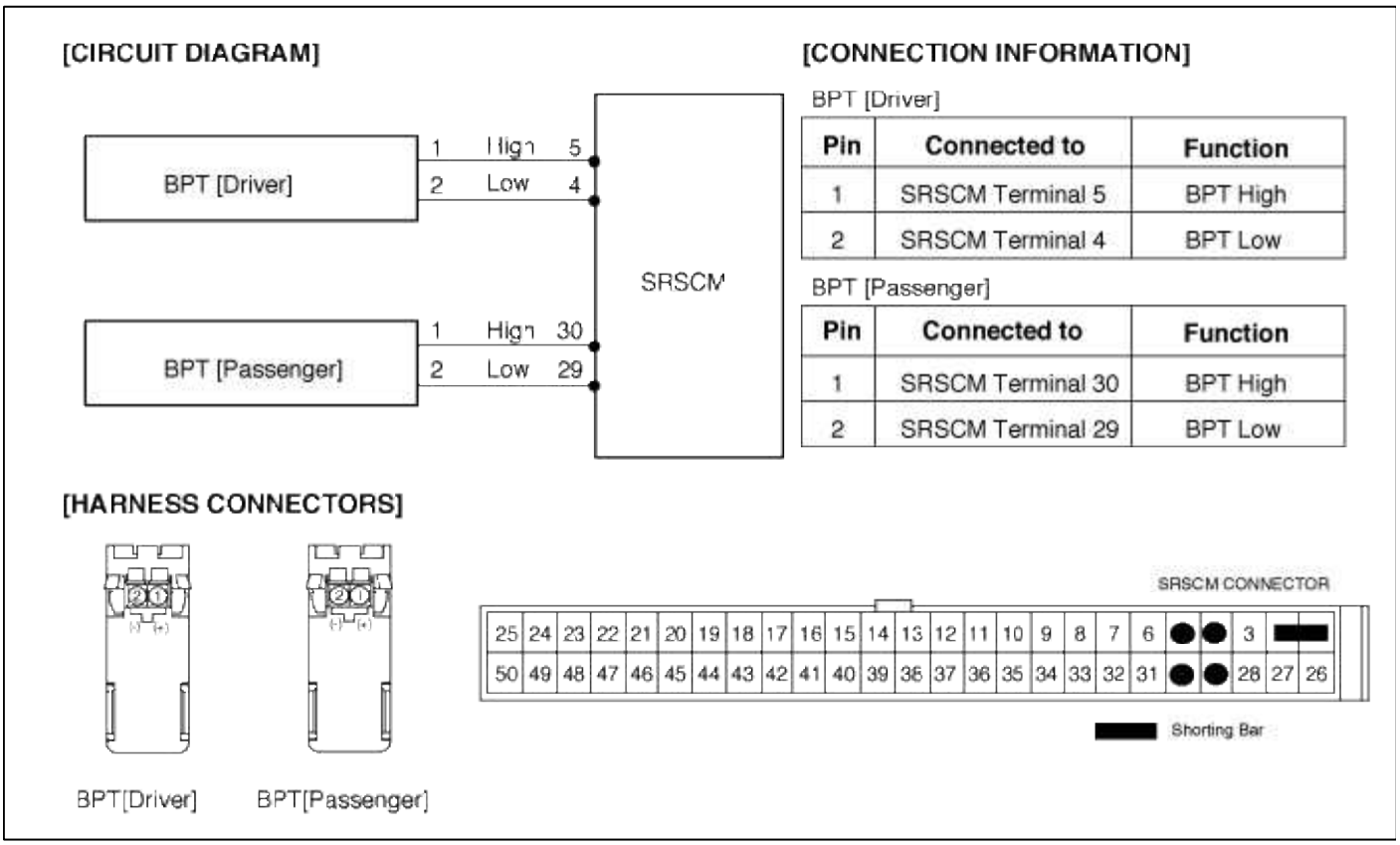
DTC Description

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

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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK BPT RESISTANCE

CAUTION

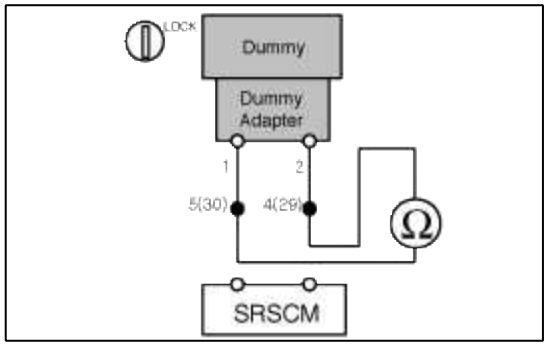
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 5(30) and 4(29) of SRSCM harness connector.

BPT resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

YES

Replace the Seat Belt Pretensioner(BPT) module.

NO

Check open circuit.

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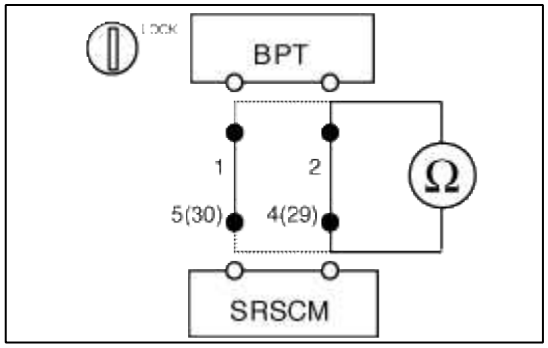
3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 5(30) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(29) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

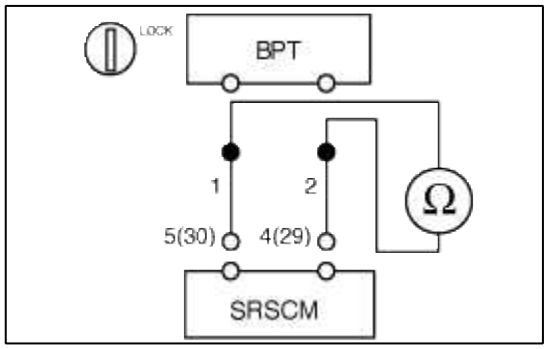
NO

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



(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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BPT resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1363

DTC Description

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

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

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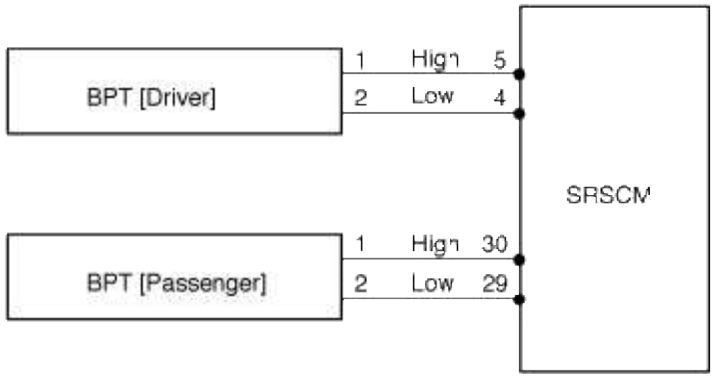
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

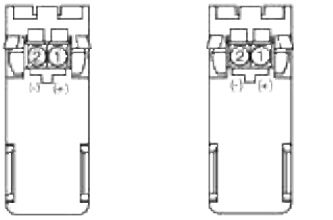
BPT [Driver]

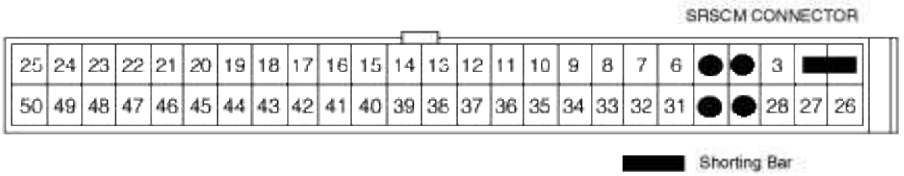
Pin	Connected to	Function
1	SRSCM Terminal 5	BPT High
2	SRSCM Terminal 4	BPT Low

BPT [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 30	BPT High
2	SRSCM Terminal 29	BPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

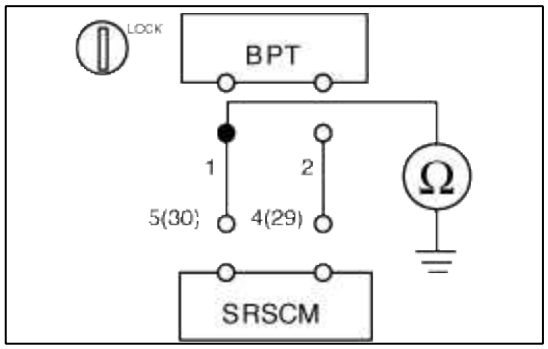
(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of BPT harness connector and chassis ground.

specification(resistance) : infinite



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1364

DTC Description

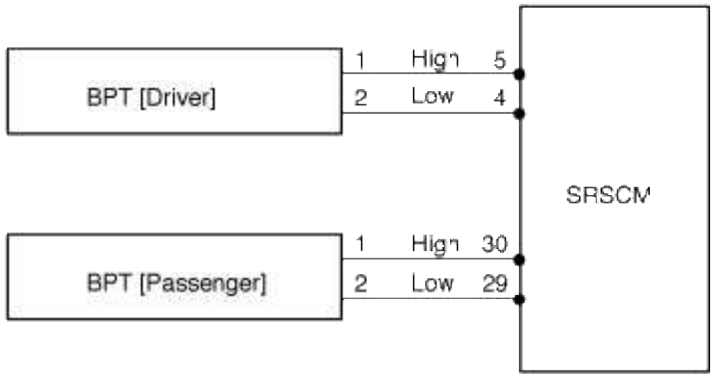
The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects short to battery line on the BPT circuit.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

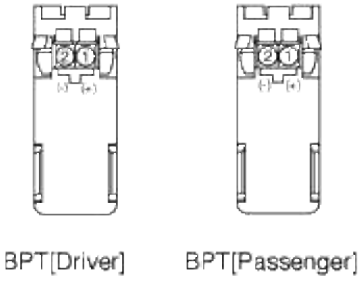
BPT [Driver]

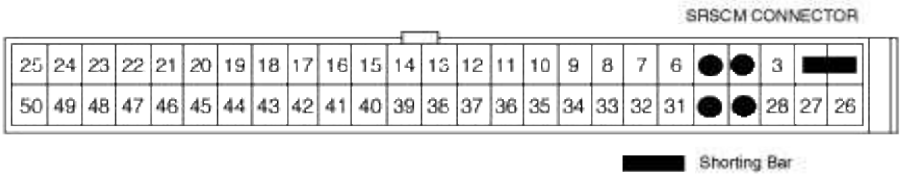
Pin	Connected to	Function
1	SRSCM Terminal 5	BPT High
2	SRSCM Terminal 4	BPT Low

BPT [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 30	BPT High
2	SRSCM Terminal 29	BPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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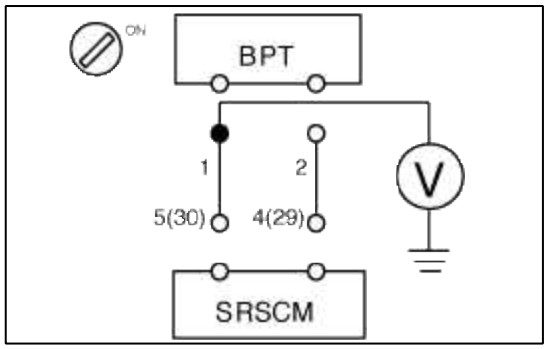
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal 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



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1367

DTC Description

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

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

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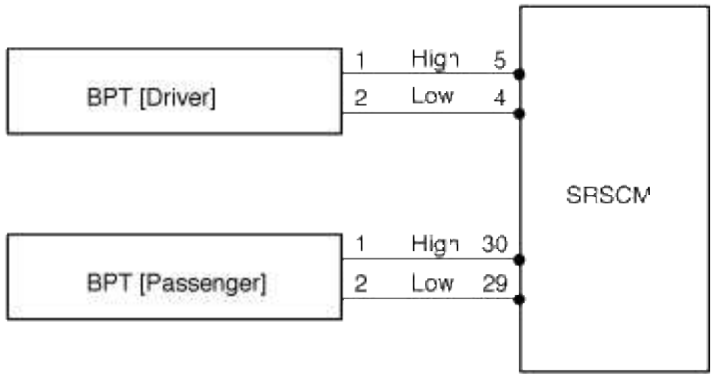
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

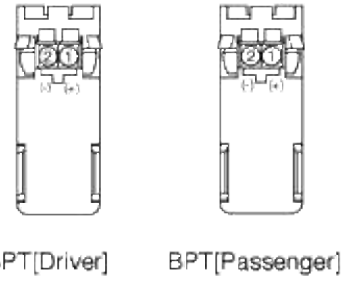
BPT [Driver]

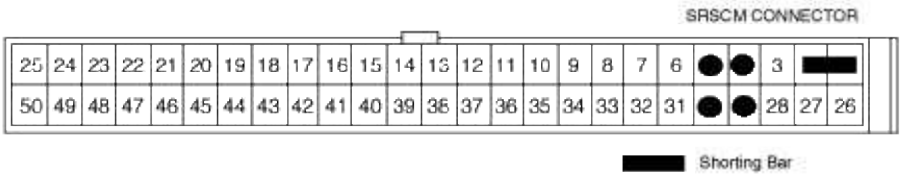
Pin	Connected to	Function
1	SRSCM Terminal 5	BPT High
2	SRSCM Terminal 4	BPT Low

BPT [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 30	BPT High
2	SRSCM Terminal 29	BPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK BPT RESISTANCE

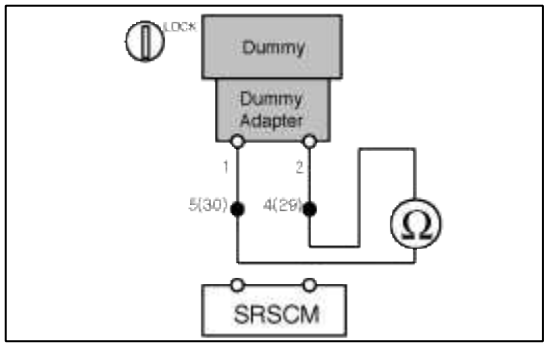
CAUTION

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 5(30) and 4(29) of SRSCM harness connector.

BPT resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Seat Belt Pretensioner(BPT) module.

NO

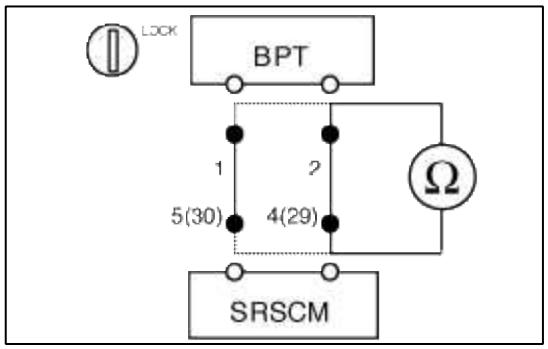
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 5(30) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(29) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

NO

Repair or replace the wiring harness between the BPT and the SRSCM.

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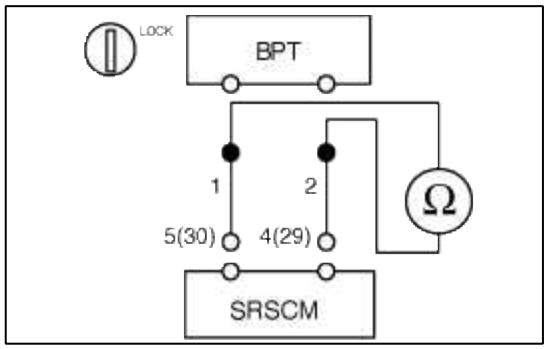
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BPT harness connector.

specification(resistance) : infinite



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BPT resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1368

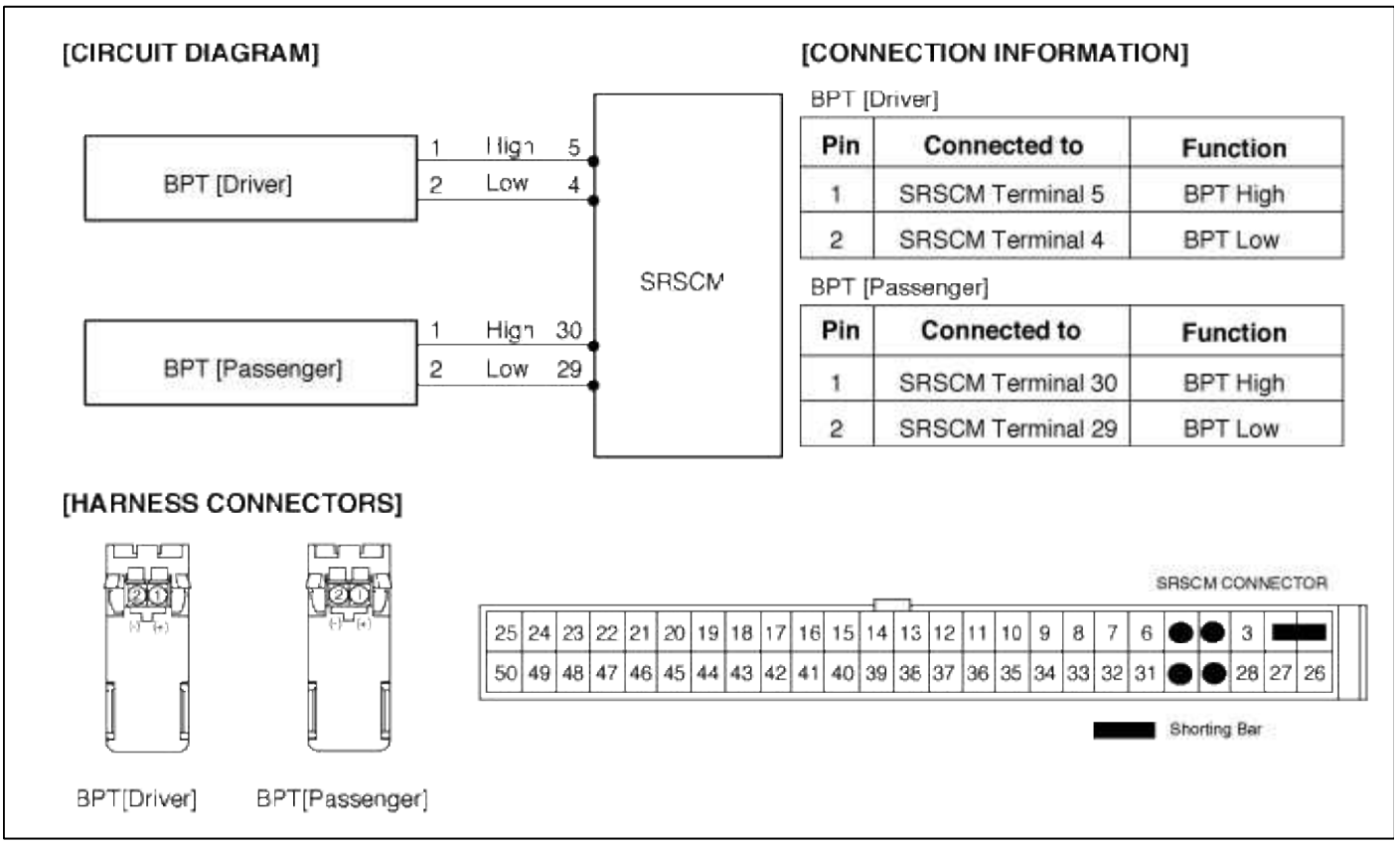
DTC Description

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

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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

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Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK BPT RESISTANCE

CAUTION

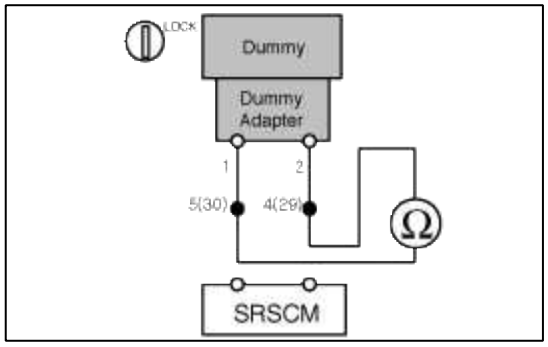
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 5(30) and 4(29) of SRSCM harness connector.

BPT resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

YES

Replace the Seat Belt Pretensioner(BPT) module.

NO

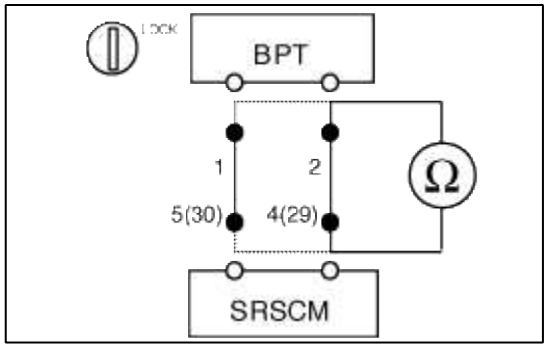
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BPT harness connector and the terminal 5(30) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of BPT harness connector and the terminal 4(29) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

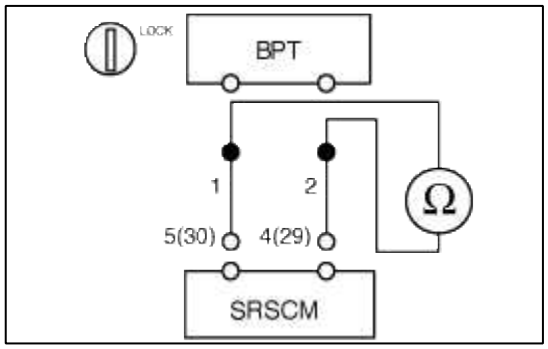
NO

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



(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.

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5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BPT resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1369

DTC Description

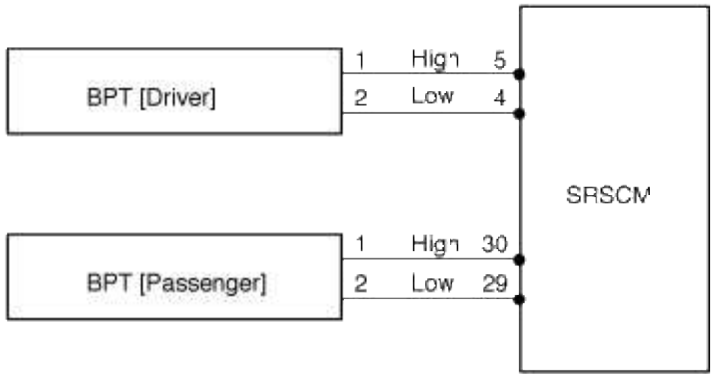
The Seat Belt Pretensioner consists of the SRSCM and two Seat Belt Pretensioners (BPT). The SRSCM sets above DTC(s) if it detects short to ground on the BPT circuit.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

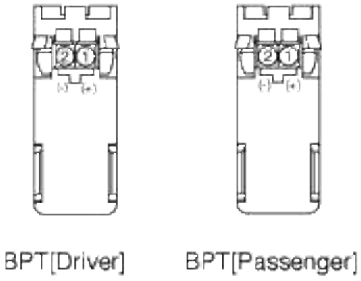
BPT [Driver]

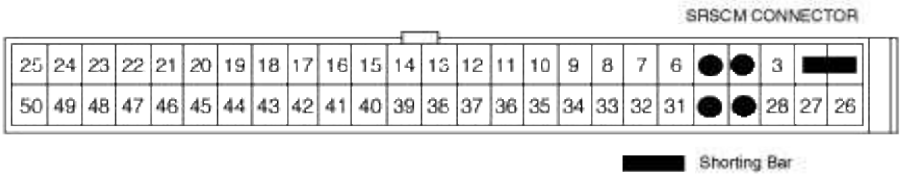
Pin	Connected to	Function
1	SRSCM Terminal 5	BPT High
2	SRSCM Terminal 4	BPT Low

BPT [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 30	BPT High
2	SRSCM Terminal 29	BPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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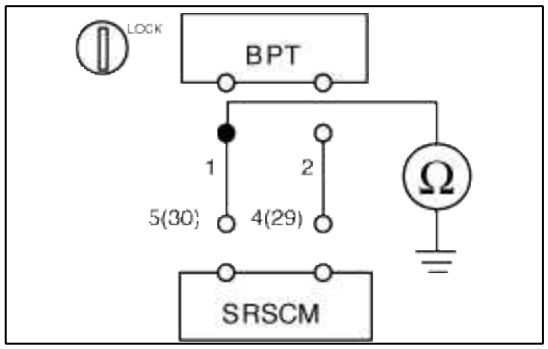
2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of BPT harness connector and chassis ground.

specification(resistance) : infinite



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1370

DTC Description

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

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

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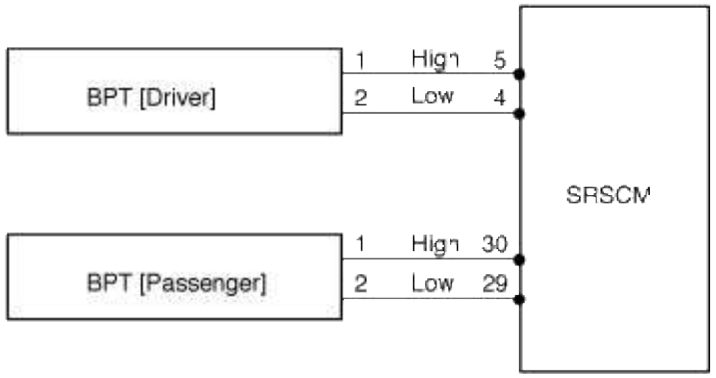
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

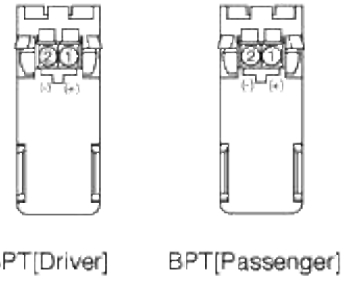
BPT [Driver]

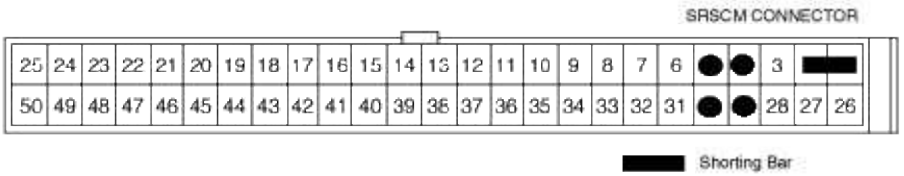
Pin	Connected to	Function
1	SRSCM Terminal 5	BPT High
2	SRSCM Terminal 4	BPT Low

BPT [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 30	BPT High
2	SRSCM Terminal 29	BPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

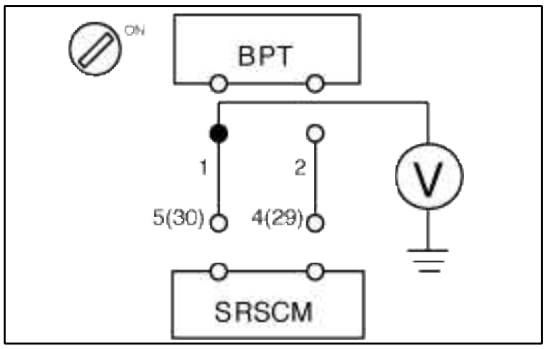
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal 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



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1373

DTC Description

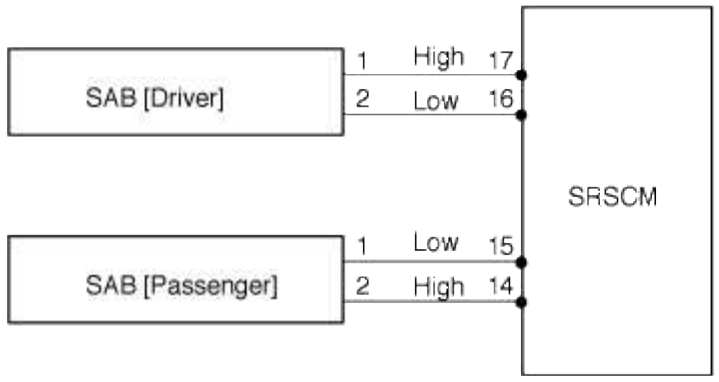
The Side Airbag circuit consists of the SRSCM and two Side Airbags (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

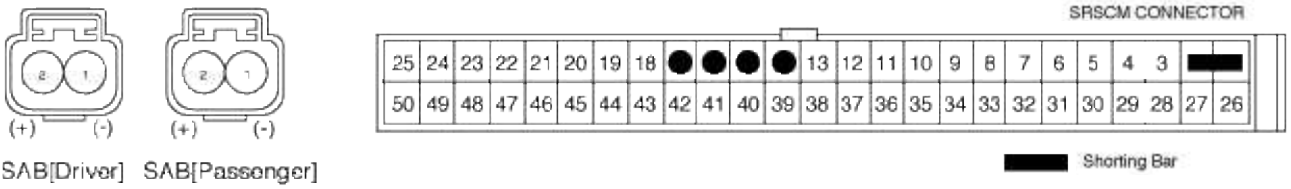
SAB [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 17	SAB High
2	SRSCM Terminal 16	SAB Low

SAB [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 15	SAB Low
2	SRSCM Terminal 14	SAB High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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2. CHECK SAB RESISTANCE

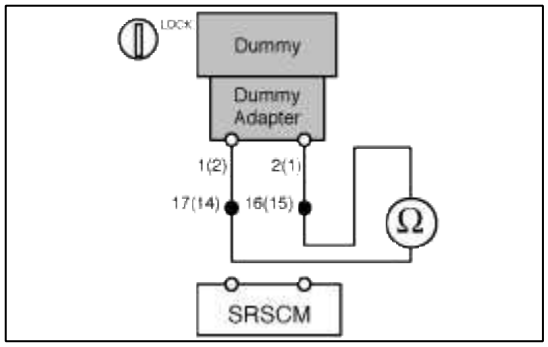
CAUTION

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 17(14) and 16(15) of SRSCM harness connector.

SAB resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

YES

Replace the Side Airbag(SAB) module.

NO

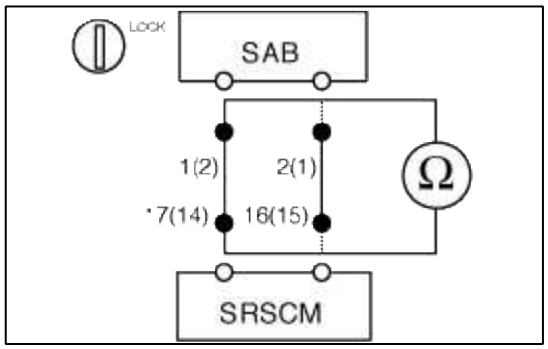
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1(2) of SAB harness connector and the terminal 17(14) of SRSCM harness connector.

(2) Measure resistance between the terminal 2(1) of SAB harness connector and the terminal 16(15) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

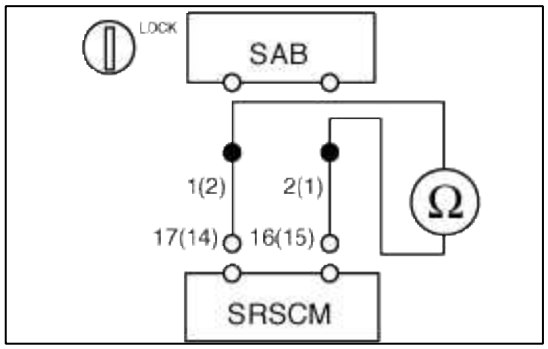
NO

Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1(2) and 2(1) of SAB harness connector.

specification(resistance) : infinite



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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

SAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1378

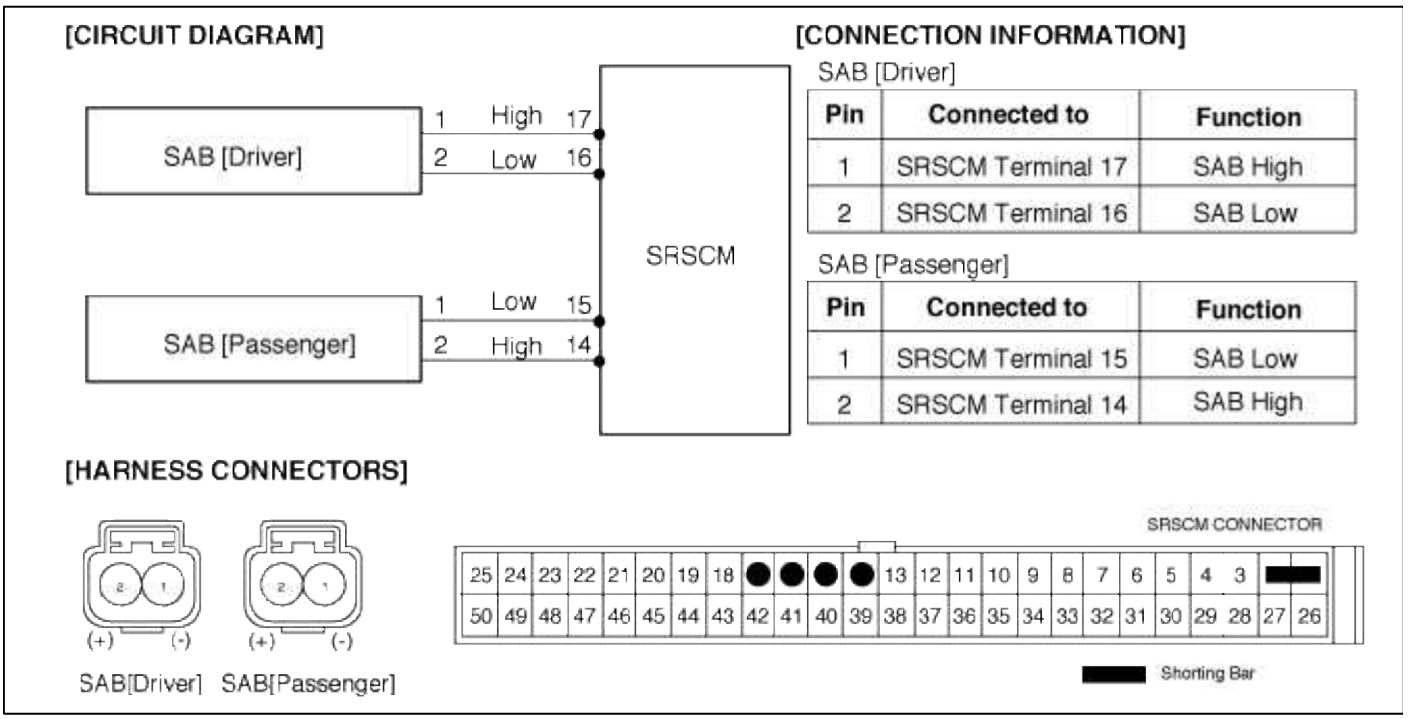
DTC Description

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

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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SAB RESISTANCE

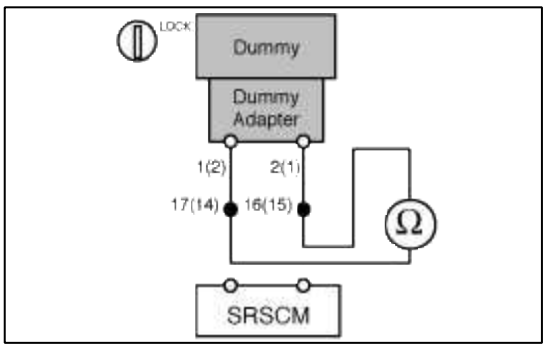
> **CAUTION**
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 17(14) and 16(15) of SRSCM harness connector.

SAB resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

YES

Replace the Side Airbag(SAB) module.

NO

Check open circuit.

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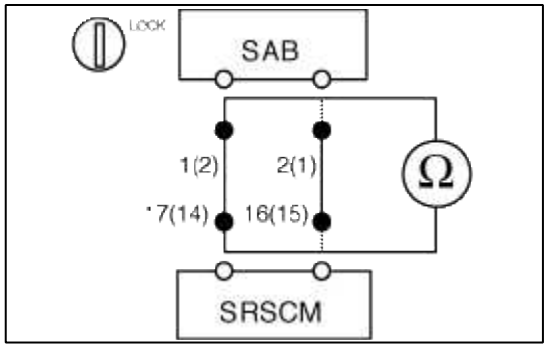
3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1(2) of SAB harness connector and the terminal 17(14) of SRSCM harness connector.

(2) Measure resistance between the terminal 2(1) of SAB harness connector and the terminal 16(15) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

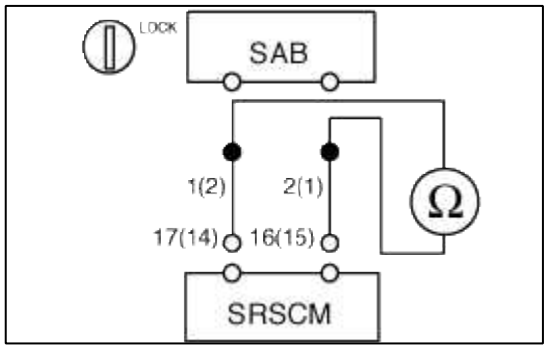
NO

Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1(2) and 2(1) of SAB harness connector.

specification(resistance) : infinite



(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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

SAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1379

DTC Description

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

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

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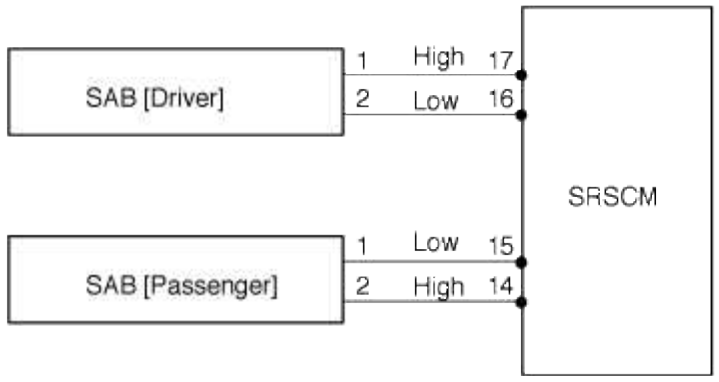
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

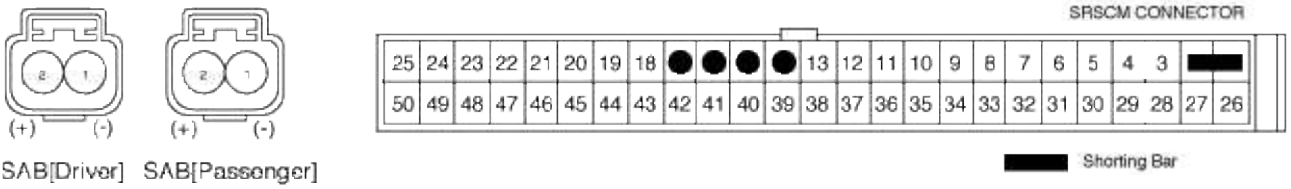
SAB [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 17	SAB High
2	SRSCM Terminal 16	SAB Low

SAB [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 15	SAB Low
2	SRSCM Terminal 14	SAB High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SAB RESISTANCE

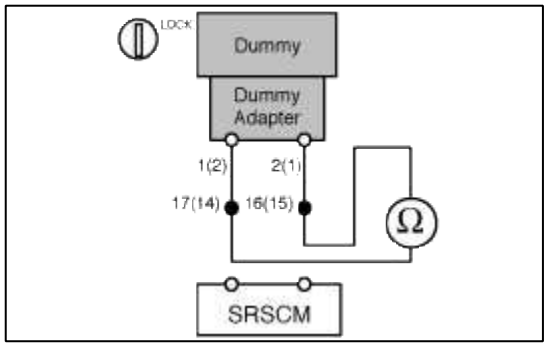
CAUTION

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 17(14) and 16(15) of SRSCM harness connector.

SAB resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

YES
Replace the Side Airbag(SAB) module.

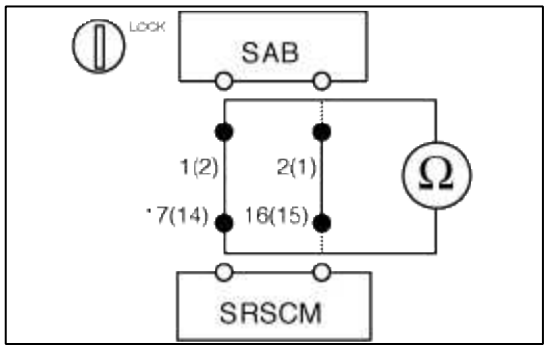
NO
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1(2) of SAB harness connector and the terminal 17(14) of SRSCM harness connector.

(2) Measure resistance between the terminal 2(1) of SAB harness connector and the terminal 16(15) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES
Check short circuit.

NO
Repair or replace the wiring harness between the SAB nd the SRSCM.

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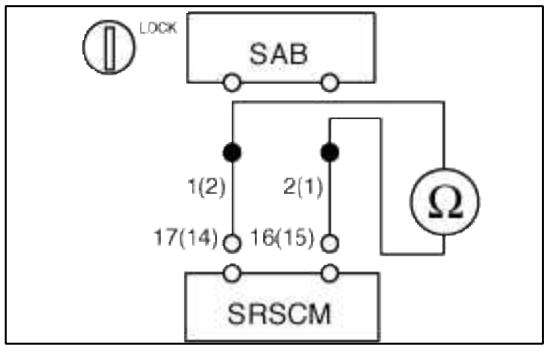
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1(2) and 2(1) of SAB harness connector.

specification(resistance) : infinite



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

SAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1380

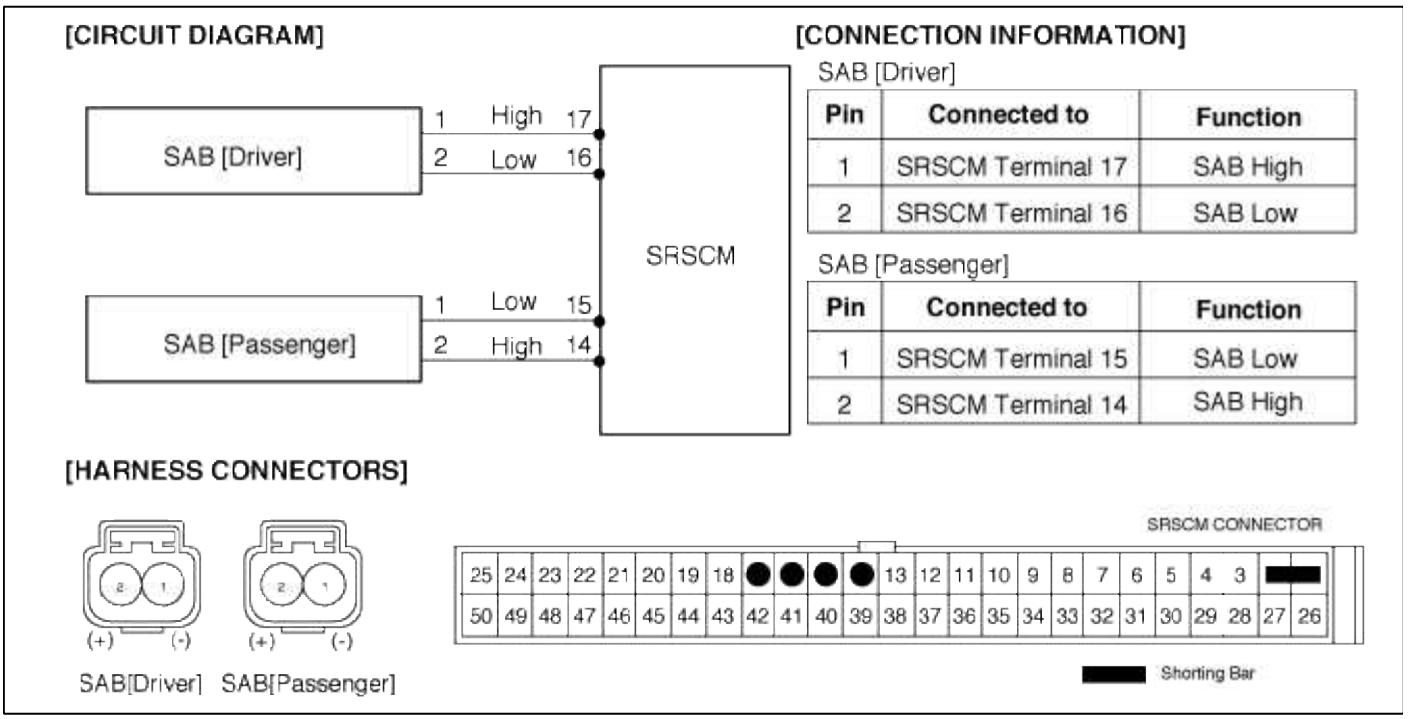
DTC Description

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

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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

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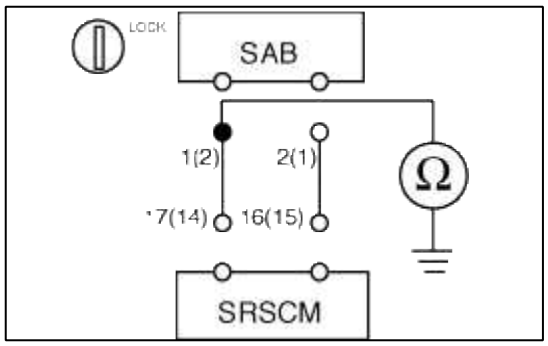
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1(2) of SAB harness connector and chassis ground.

   specification(resistance) : infinite



   (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, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) onnect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1381

DTC Description

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

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

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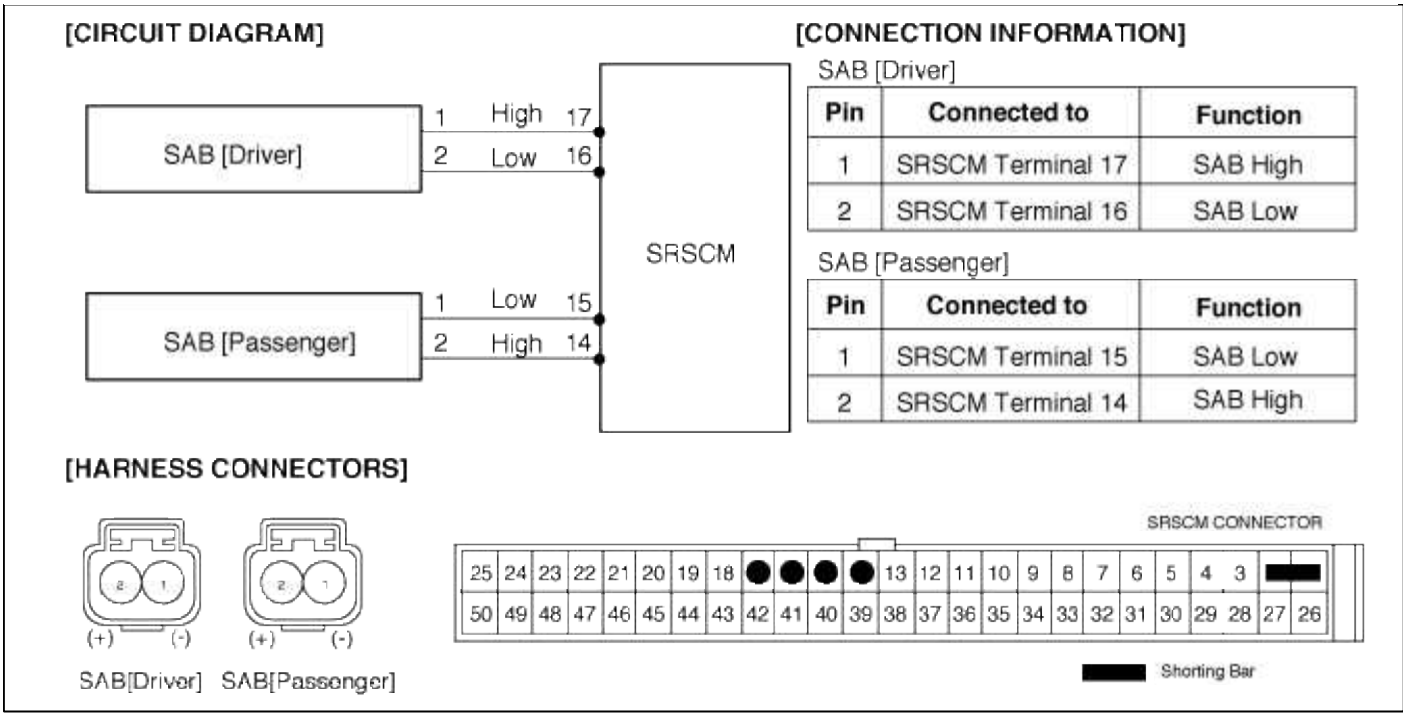


Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

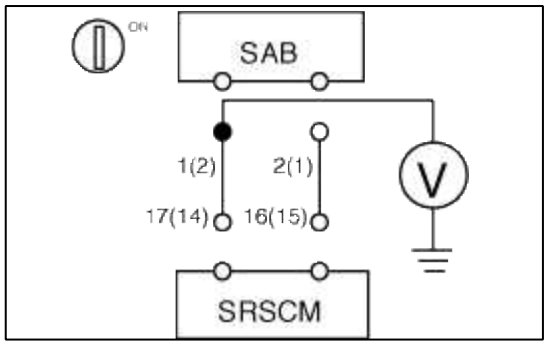
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1(2) of SAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1382

DTC Description

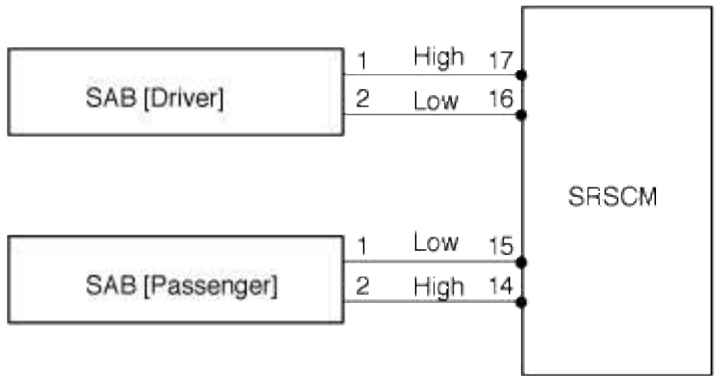
The Side Airbag circuit consists of the SRSCM and two Side Airbags (SAB). The SRSCM sets above DTC(s) if it detects that the resistance of SAB squib is too high or low.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

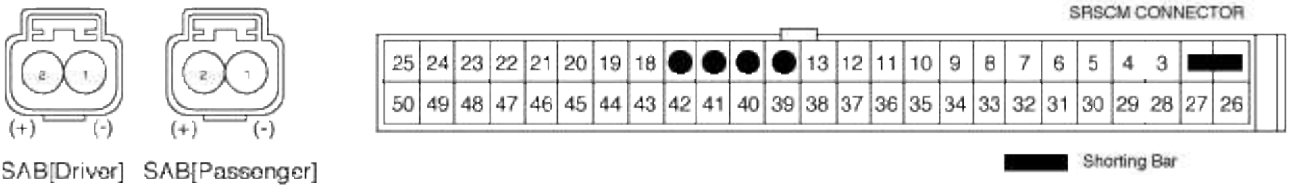
SAB [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 17	SAB High
2	SRSCM Terminal 16	SAB Low

SAB [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 15	SAB Low
2	SRSCM Terminal 14	SAB High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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2. CHECK SAB RESISTANCE

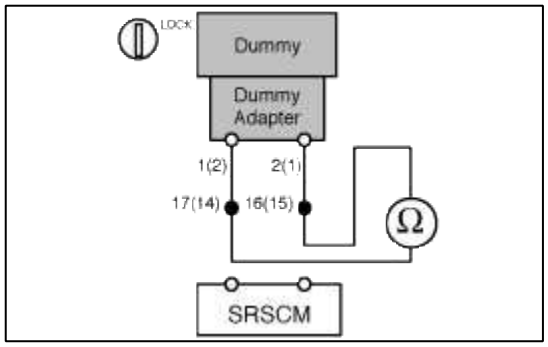
CAUTION

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 17(14) and 16(15) of SRSCM harness connector.

SAB resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Side Airbag(SAB) module.

NO

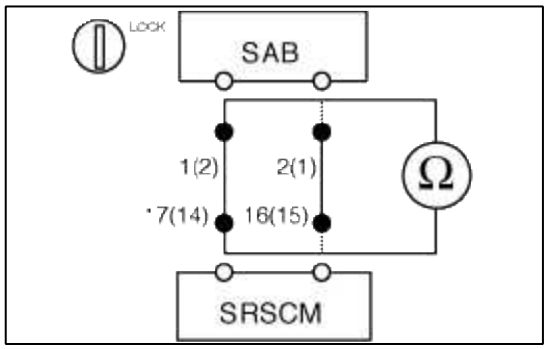
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1(2) of SAB harness connector and the terminal 17(14) of SRSCM harness connector.

(2) Measure resistance between the terminal 2(1) of SAB harness connector and the terminal 16(15) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

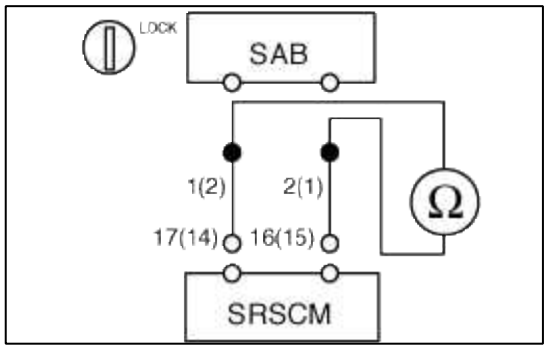
NO

Repair or replace the wiring harness between the SAB nd the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1(2) and 2(1) of SAB harness connector.

specification(resistance) : infinite



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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

SAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1384

DTC Description

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.

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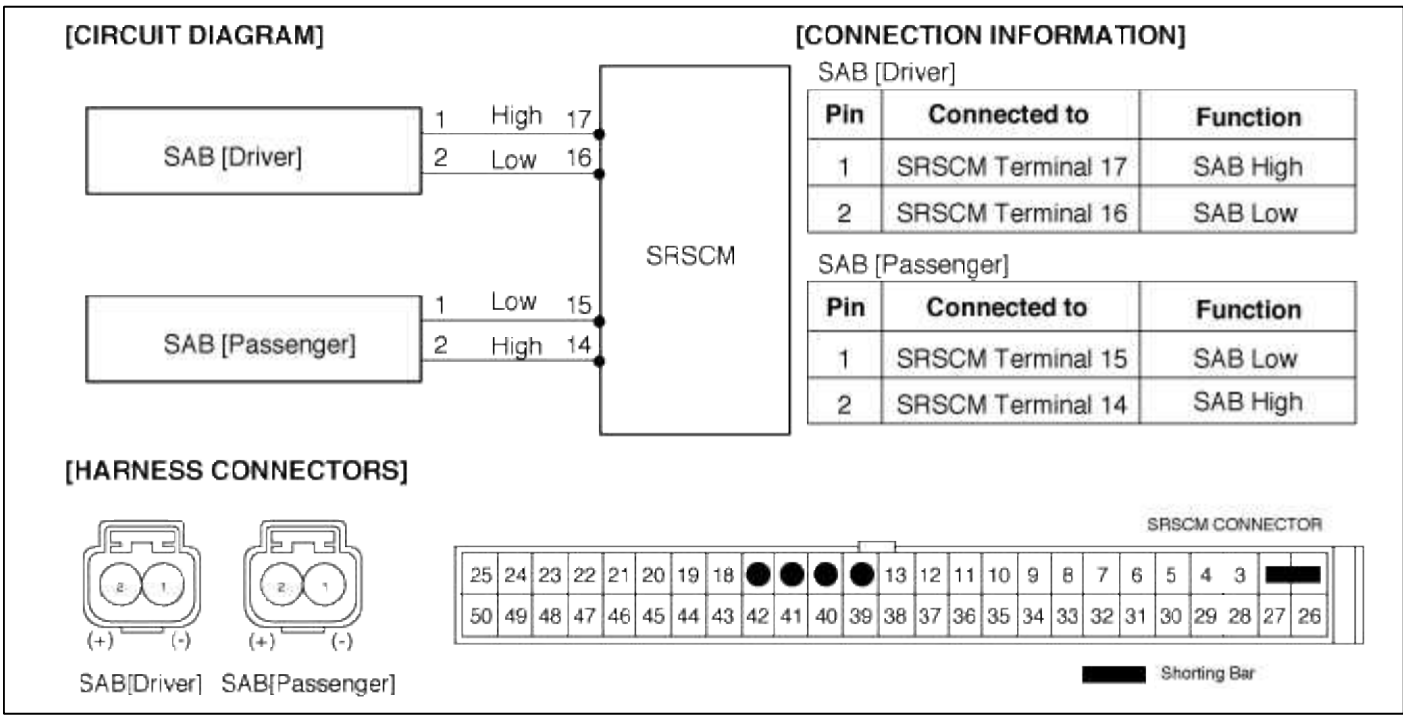
DTC Detecting Condition

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



Terminal & Connector Inspection

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.

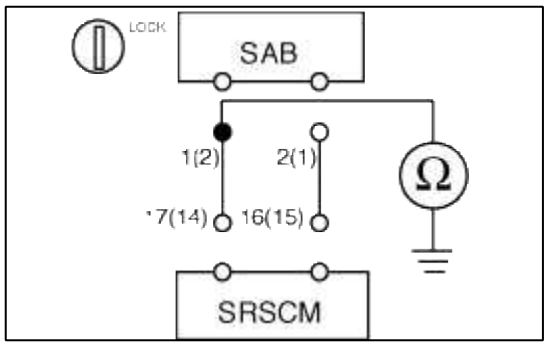
YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1(2) of SAB harness connector and chassis ground.

   specification(resistance) : infinite



   (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, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) onnect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1385

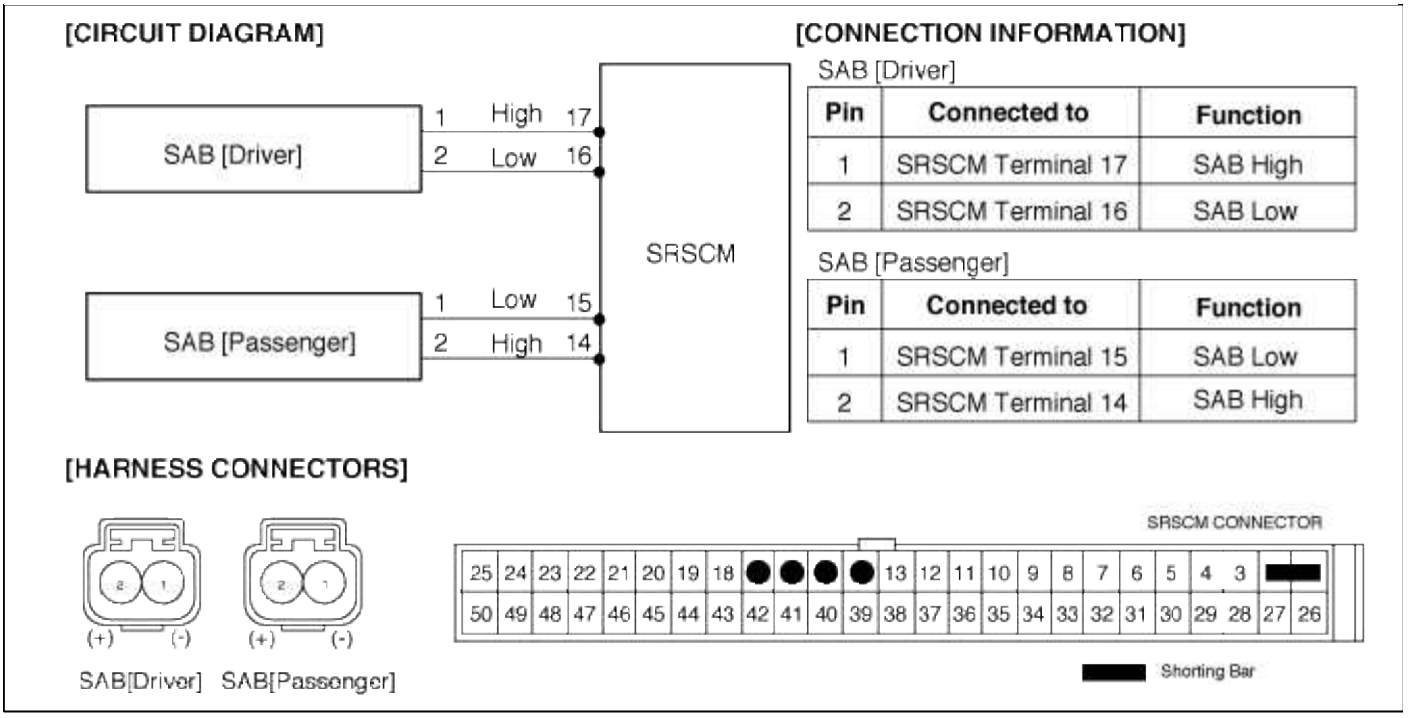
DTC Description

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

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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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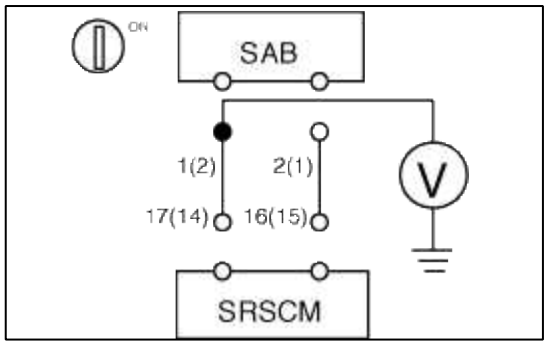
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1(2) of SAB harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1396

DTC Description

The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects open or short to ground on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

DTC	Condition	Probable cause
B1396 B1398	• Open between STPS and SRSCM • Short to ground between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Open or short to ground circuit on wiring harness • STPS • SRSCM

Schematic Diagram

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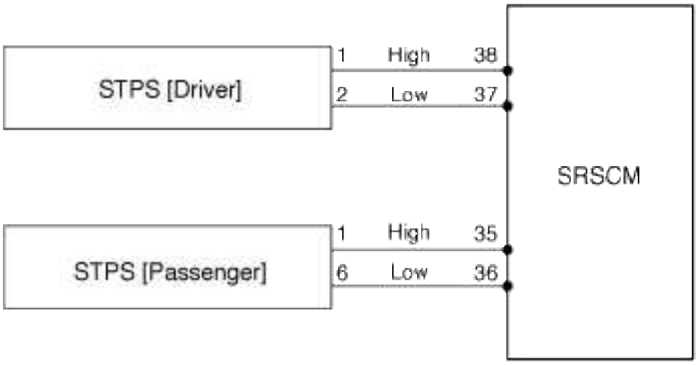
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

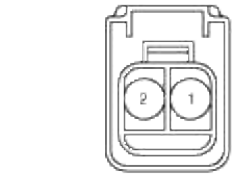
STPS [Driver]

Pin	Connected to	Function
3	SRSCM terminal 38	STPS High
4	SRSCM terminal 37	STPS Low

STPS [Passenger]

Pin	Connected to	Function
1	SRSCM terminal 35	STPS High
6	SRSCM terminal 36	STPS Low

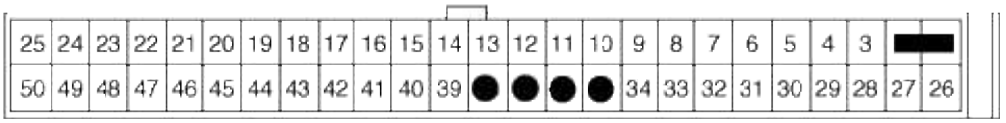
[HARNESS CONNECTORS]



STPS[Driver]

STPS[Passenger]

SRSCM CONNECTOR



Shorting Bar

Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

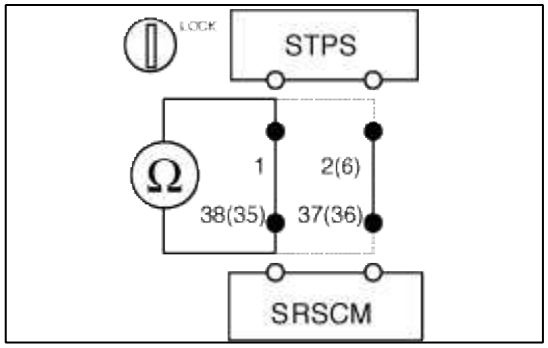
(5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of STPS harness connector and the terminal 38(35) of SRSCM harness connector.

(2) Measure resistance between the terminal 2(6) of STPS harness connector and the terminal 37(36) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short to ground.

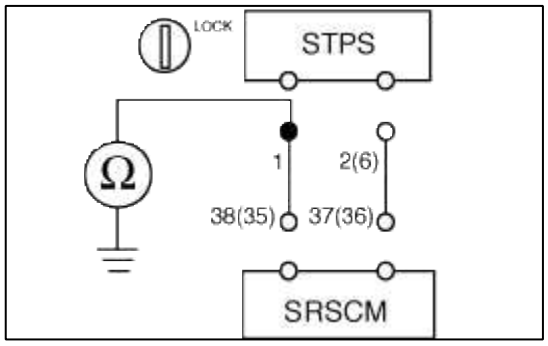
NO

Repair the open circuit on wiring harness between the STPS and the SRSCM.

3. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of STPS harness connector and chassis ground.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Check the STPS.

NO

Repair or replace the wiring harness between the STPS and the SRSCM.

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4. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
(1) Measure current between the terminal 1 of STPS and 38(35) of SRSCM.

Specification(current) : 12 ~ 17 mA (Reward status, 4 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

Goto next stop.

NO

Replace the STPS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

STPS Satus	Resistance(R) or Current (mA)	Related DTC(s)
Short to ground	R < 70Ω (low line, STPS Reward)	B1396, B1398
"SEAT FORWARD" status	4 < I < 7 mA	
"SEAT REWARD" status	12 < I < 17 mA	
Short to battery	R < 600Ω (low line, STPS Forward)	B1397, B1399

Restraint > Troubleshooting > B1397

DTC Description

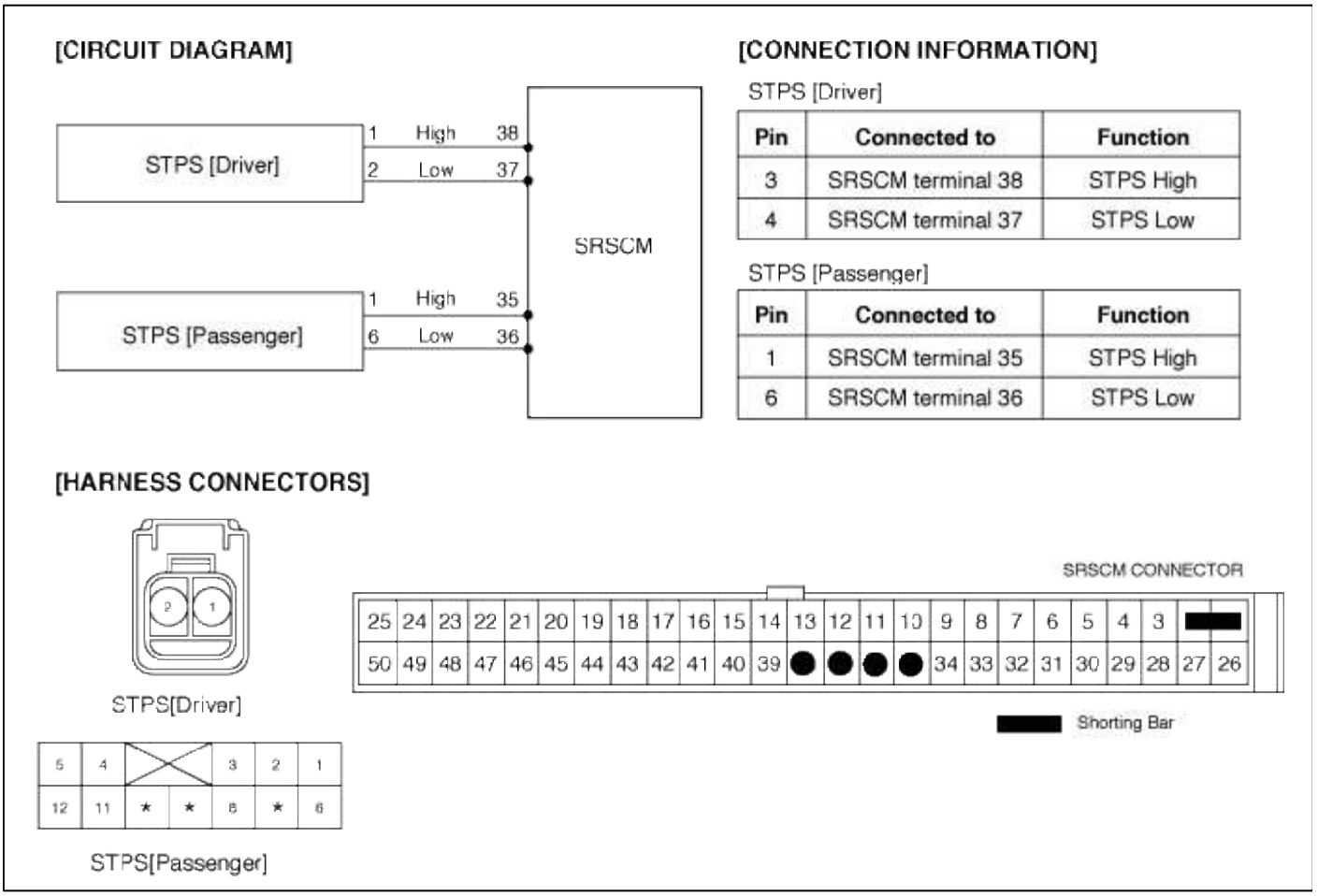
The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects short or short to battery line on the STPS circuit. The "Seat Forward" status currently represents

a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

DTC	Condition	Probable cause
B1397 B1399	• Short between STPS and SRSCM • Short to battery line between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Short or short to battery line circuit on wiring harness • STPS • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

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3. Are any problems found?

NO

Go to next step.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

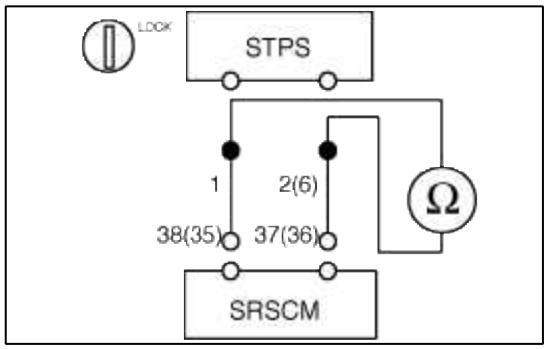
(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2(6) of STPS harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Go to next step.

NO

Repair or replace the wiring harness between the STPS and the SRSCM.

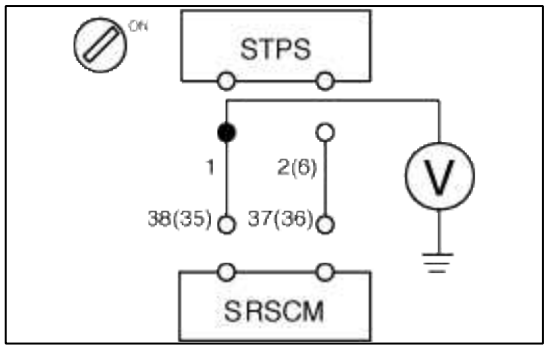
3. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of STPS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check the STPS.

NO

Repair the short to battery line circuit on wiring harness between the STPS and the SRSCM.

4. CHECK THE SEAT TRACK POSITION SENSOR (STPS)

(1) Measure current between the terminal 1 of STPS and 38(35) of SRSCM.

Specification(current) : 12 ~ 17 mA (Reward status), 4 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

Goto next stop.

NO

Replace the STPS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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.

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(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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

STPS Satus	Resistance(R) or Current (mA)	Related DTC(s)
Short to ground	R < 70Ω (low line, STPS Reward)	B1396, B1398
"SEAT FORWARD" status	4 < I < 7 mA	
"SEAT REWARD" status	12 < I < 17 mA	
Short to battery	R < 600Ω (low line, STPS Foward)	B1397, B1399

Restraint > Troubleshooting > B1398

DTC Description

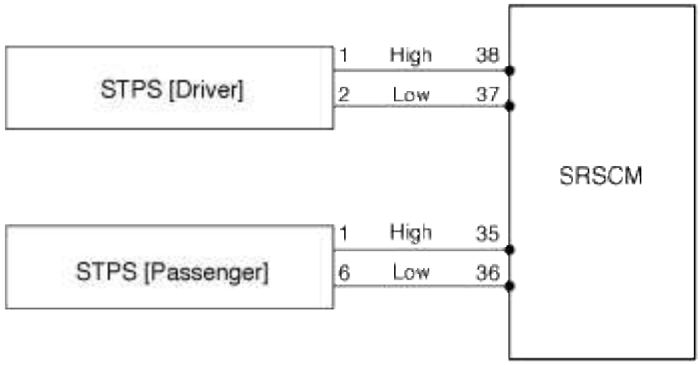
The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects open or short to ground on the STPS circuit. The "Seat Forward" status currently represents a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

DTC	Condition	Probable cause
B1396 B1398	• Open between STPS and SRSCM • Short to ground between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Open or short to ground circuit on wiring harness • STPS • SRSCM

Schematic Diagram

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

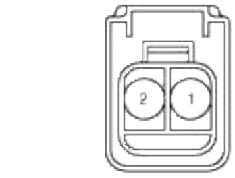
STPS [Driver]

Pin	Connected to	Function
3	SRSCM terminal 38	STPS High
4	SRSCM terminal 37	STPS Low

STPS [Passenger]

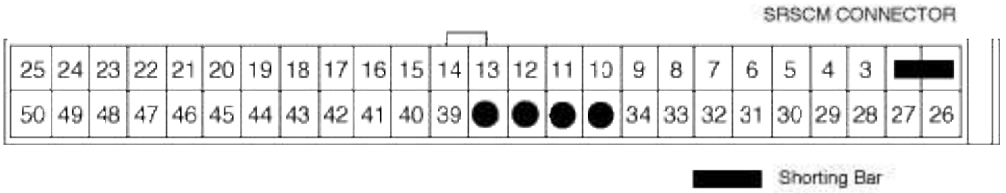
Pin	Connected to	Function
1	SRSCM terminal 35	STPS High
6	SRSCM terminal 36	STPS Low

[HARNESS CONNECTORS]



STPS[Driver]

STPS[Passenger]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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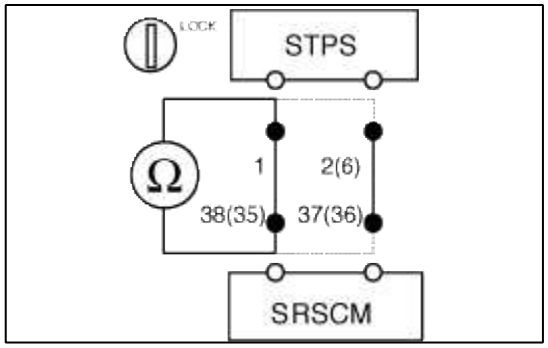
2. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of STPS harness connector and the terminal 38(35) of SRSCM harness connector.

(2) Measure resistance between the terminal 2(6) of STPS harness connector and the terminal 37(36) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short to ground.

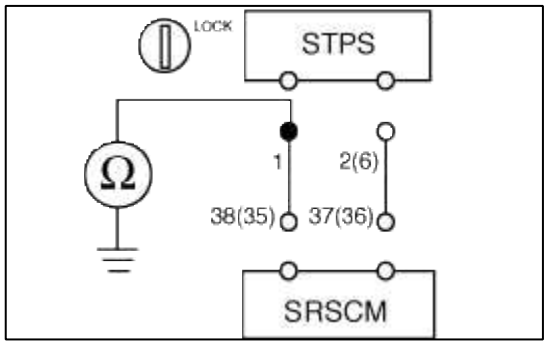
NO

Repair the open circuit on wiring harness between the STPS and the SRSCM.

3. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of STPS harness connector and chassis ground.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Check the STPS.

NO

Repair or replace the wiring harness between the STPS and the SRSCM.

4. CHECK THE SEAT TRACK POSITION SENSOR (STPS)
(1) Measure current between the terminal 1 of STPS and 38(35) of SRSCM.

Specification(current) : 12 ~ 17 mA (Reward status, 4 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

Goto next stop.

NO

Replace the STPS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

STPS Satus	Resistance(R) or Current (mA)	Related DTC(s)
Short to ground	R < 70Ω (low line, STPS Reward)	B1396, B1398
"SEAT FORWARD" status	4 < I < 7 mA	
"SEAT REWARD" status	12 < I < 17 mA	
Short to battery	R < 600Ω (low line, STPS Forward)	B1397, B1399

Restraint > Troubleshooting > B1399

DTC Description

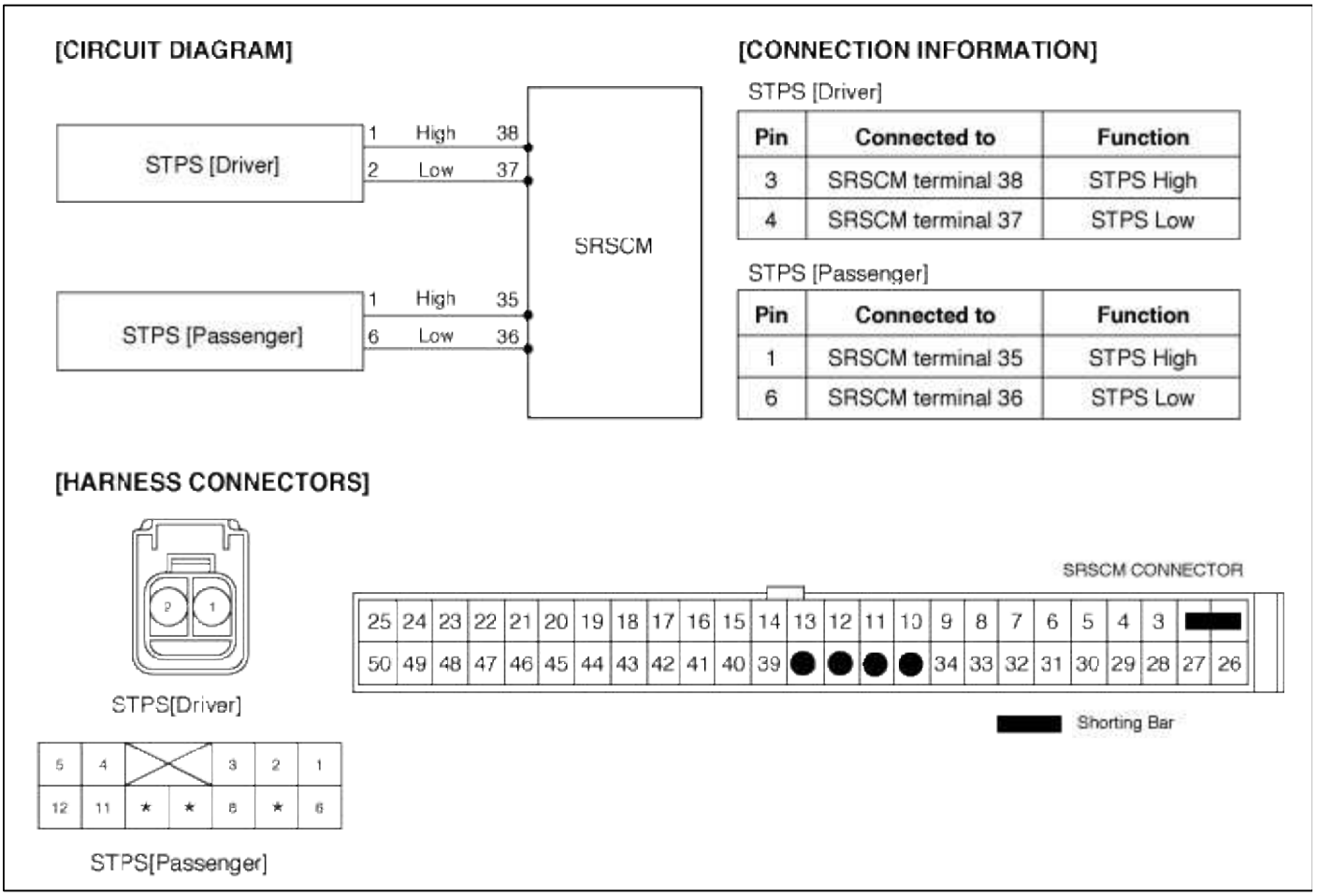
The Seat Track Position Sensor (STPS) circuit consists of the SRSCM and two STPS. The SRSCM sets above DTC(s) if it detects short or short to battery line on the STPS circuit. The "Seat Forward" status currently represents

a seat position in which the deployment of the second stage airbag is prohibited.

DTC Detecting Condition

DTC	Condition	Probable cause
B1397 B1399	• Short between STPS and SRSCM • Short to battery line between STPS and SRSCM • STPS Malfunction • SRSCM Malfunction	• Short or short to battery line circuit on wiring harness • STPS • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

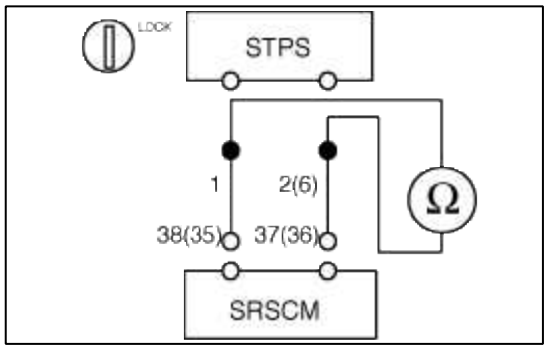
(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2(6) of STPS harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Go to next step.

NO

Repair or replace the wiring harness between the STPS and the SRSCM.

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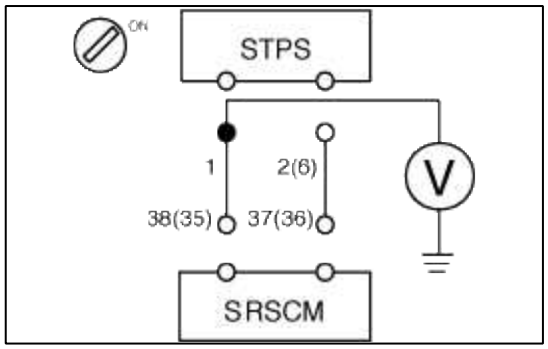
3. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of STPS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check the STPS.

NO

Repair the short to battery line circuit on wiring harness between the STPS and the SRSCM.

4. CHECK THE SEAT TRACK POSITION SENSOR (STPS)

(1) Measure current between the terminal 1 of STPS and 38(35) of SRSCM.

Specification(current) : 12 ~ 17 mA (Reward status), 4 ~ 7 mA (Forward status)

(2) Is the measured current within specification?

YES

Goto next stop.

NO

Replace the STPS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

STPS Satus	Resistance(R) or Current (mA)	Related DTC(s)
Short to ground	R < 70Ω (low line, STPS Reward)	B1396, B1398
"SEAT FORWARD" status	4 < I < 7 mA	
"SEAT REWARD" status	12 < I < 17 mA	
Short to battery	R < 600Ω (low line, STPS Foward)	B1397, B1399

Restraint > Troubleshooting > B1400

DTC Description

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 front SIS and the SRSCM.

DTC Detecting Condition

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

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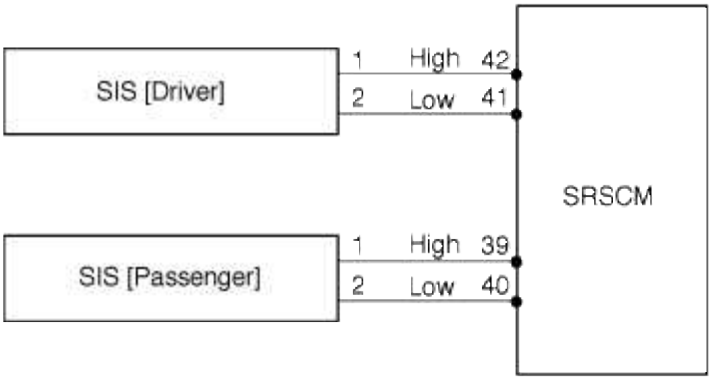
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

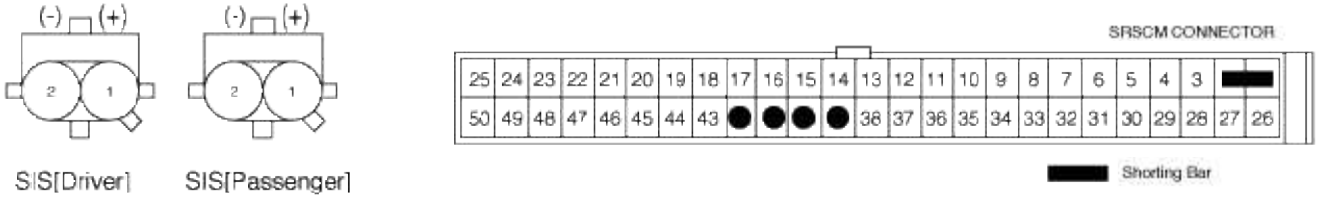
SIS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 42	SIS High
2	SRSCM Terminal 41	SIS Low

SIS [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 39	SIS High
2	SRSCM Terminal 40	SIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

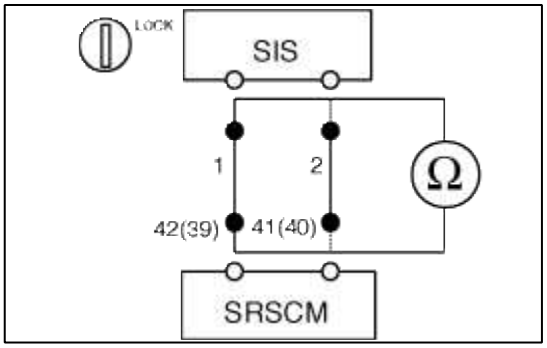
(5) Disconnect the SRSCM connector.

2. CHECK SIS CIRCUIT

(1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 42(39) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 41(40) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1401

DTC Description

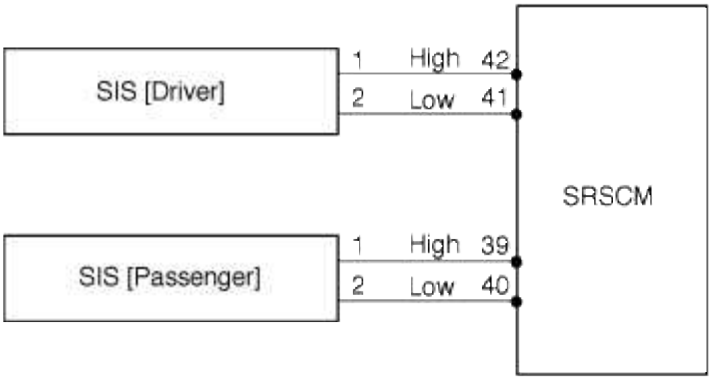
The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects short to ground on the SIS circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1401 B1404	• Short to ground between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

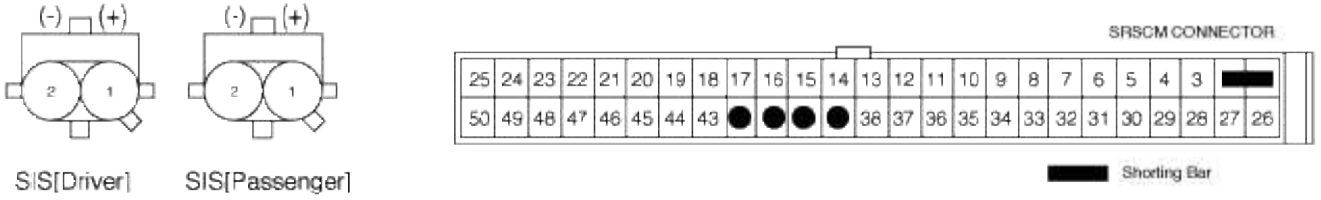
SIS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 42	SIS High
2	SRSCM Terminal 41	SIS Low

SIS [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 39	SIS High
2	SRSCM Terminal 40	SIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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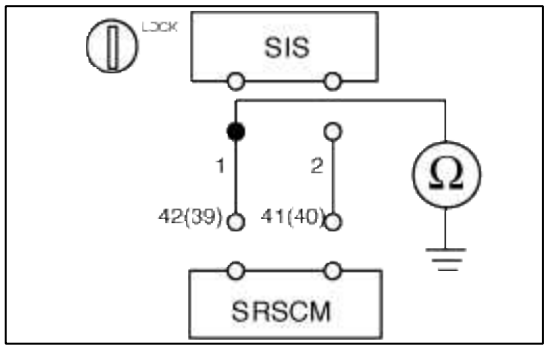
2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of SIS harness connector and chassis ground.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Check the SIS.

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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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 module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1402

DTC Description

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 short to battery line on the SIS circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1402 B1405	• Short to battery line between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram

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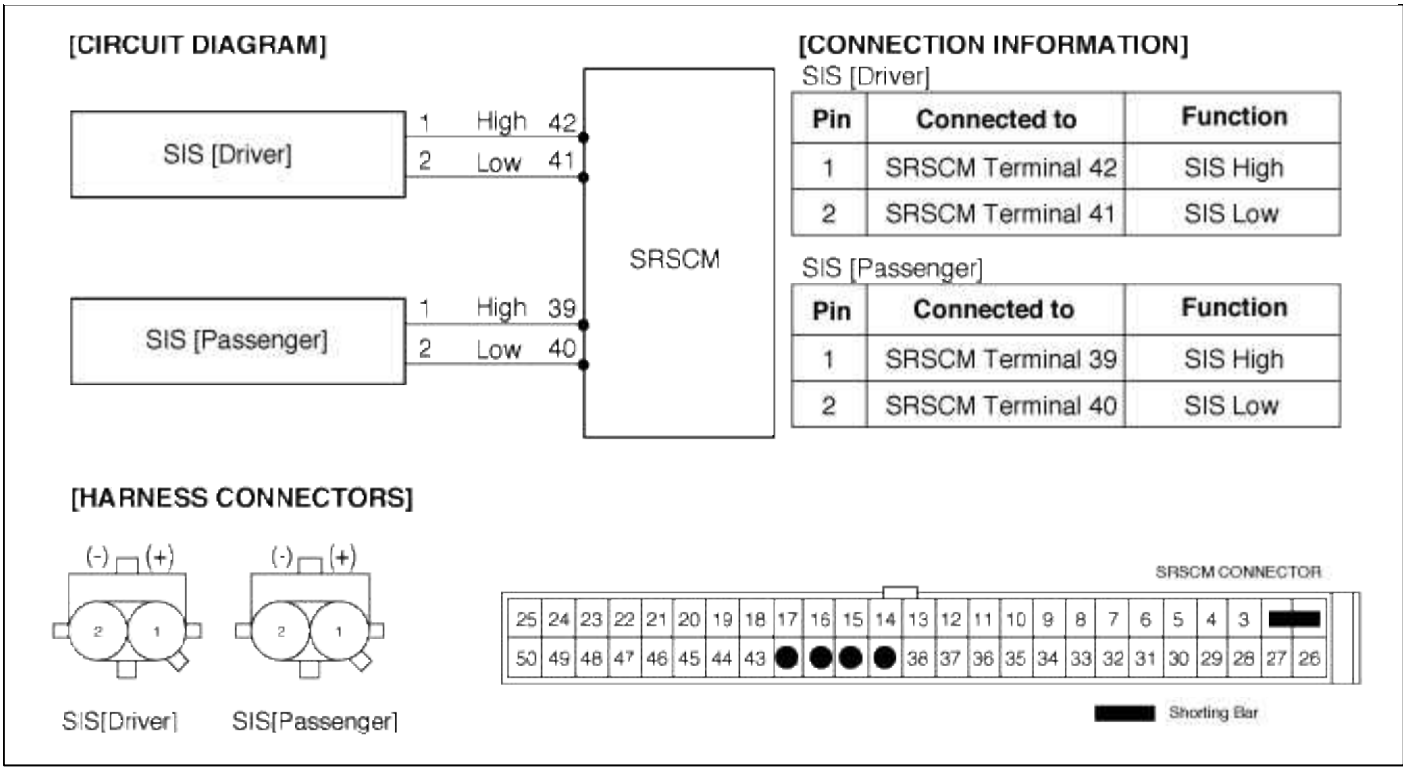


Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

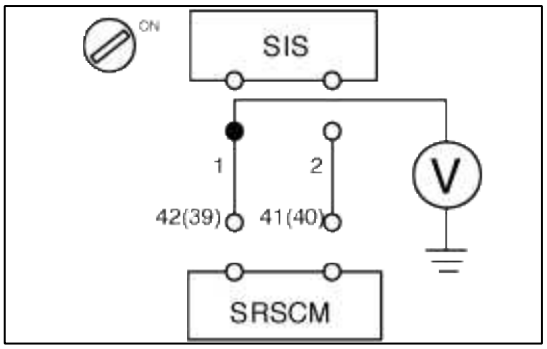
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of SIS harness connector and chassis ground(-).

specification(voltage) : Approximately 0V



(4) Is the measured voltage within specification?

YES

Check the SIS Module.

NO

Repair the short to battery line circuit on wiring harness between the SIS and the SRSCM.

3. CHECK THE SIS MODULE

(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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 module.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1403

DTC Description

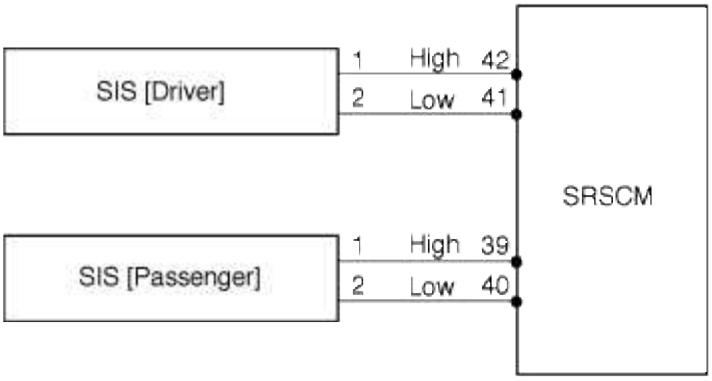
The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

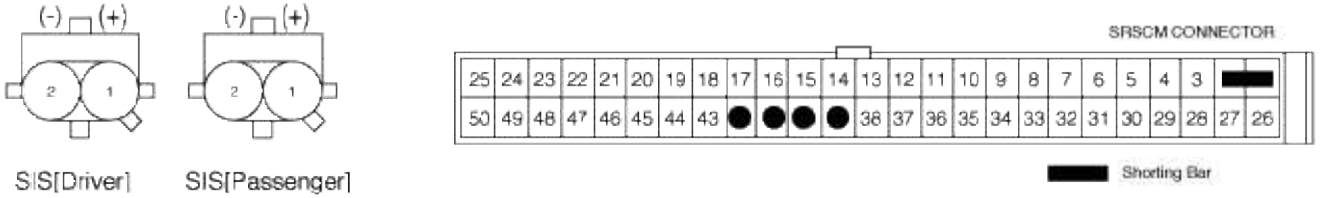
SIS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 42	SIS High
2	SRSCM Terminal 41	SIS Low

SIS [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 39	SIS High
2	SRSCM Terminal 40	SIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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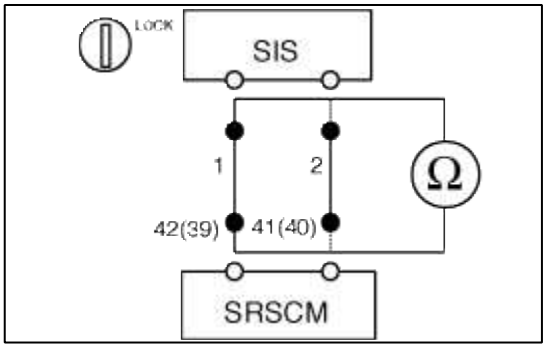
2. CHECK SIS CIRCUIT

(1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 42(39) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 41(40) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1404

DTC Description

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 short to ground on the SIS circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1401 B1404	• Short to ground between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram

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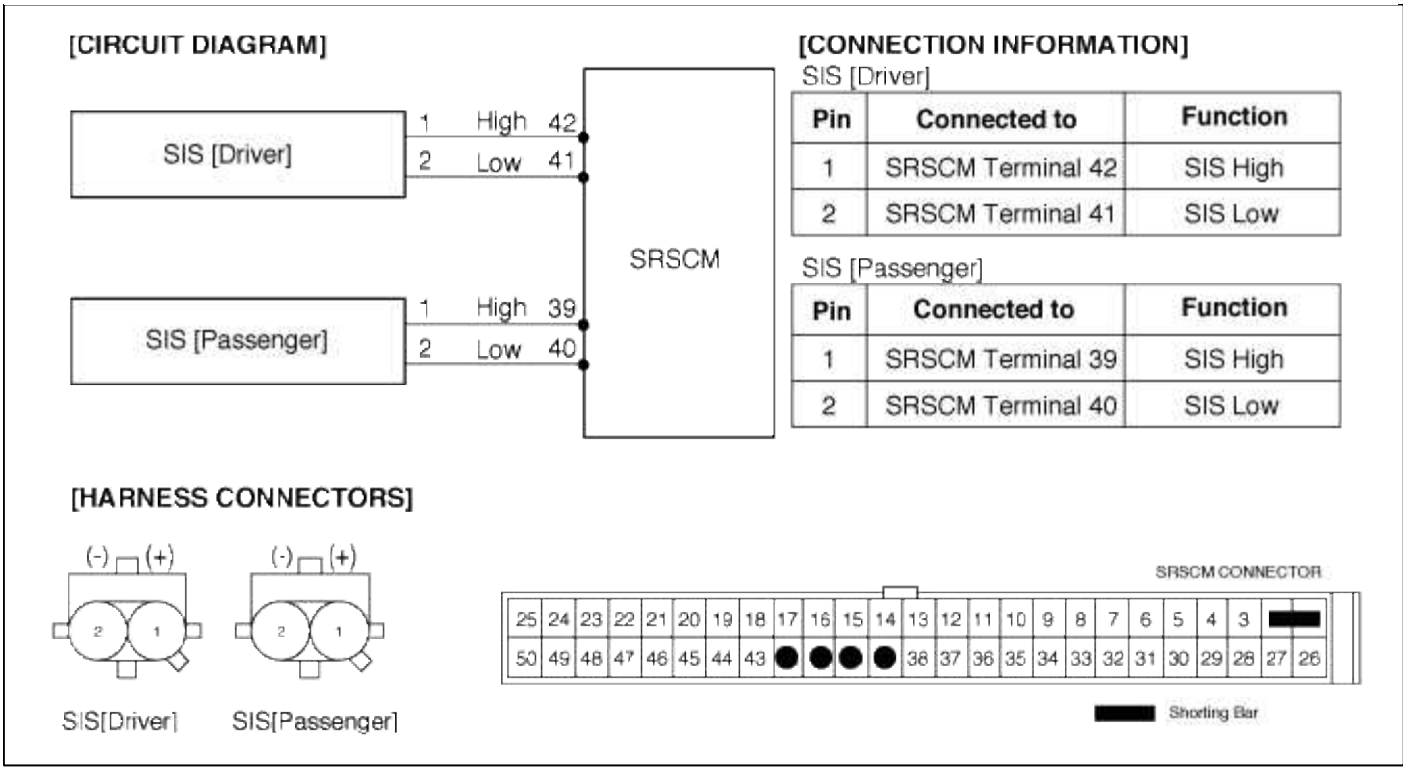


Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

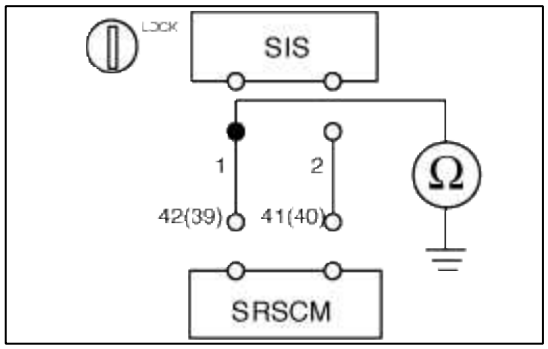
(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of SIS harness connector and chassis ground.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Check the SIS.

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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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 module.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1405

DTC Description

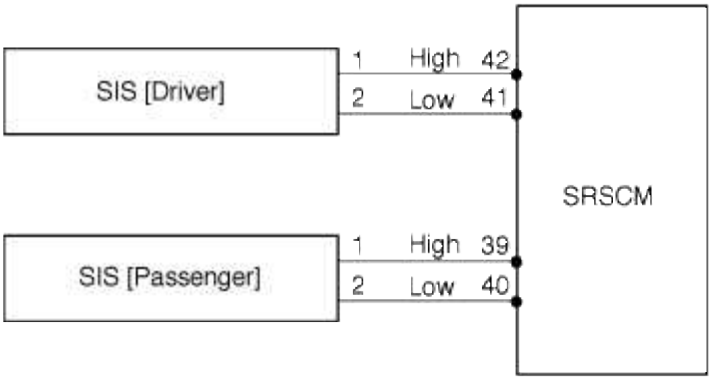
The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects short to battery line on the SIS circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1402 B1405	• Short to battery line between SIS and SRSCM • Side Impact Sensor (SIS) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring Harness • Side Impact Sensor (SIS) squib • SRSCM

Schematic Diagram

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

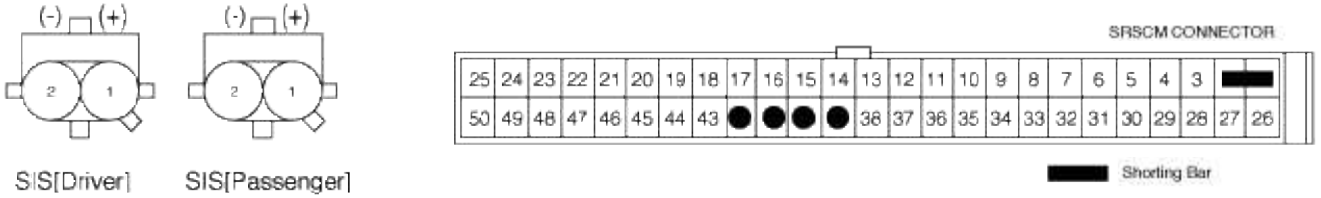
SIS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 42	SIS High
2	SRSCM Terminal 41	SIS Low

SIS [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 39	SIS High
2	SRSCM Terminal 40	SIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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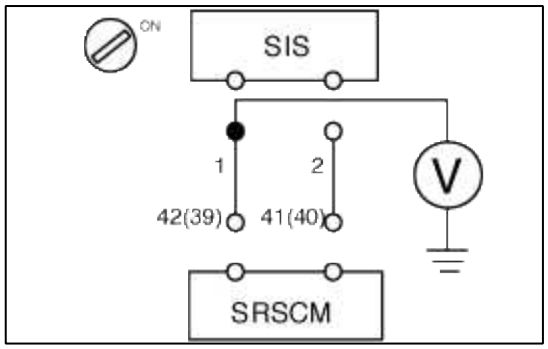
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of SIS harness connector and chassis ground(-).

specification(voltage) : Approximately 0V



(4) Is the measured voltage within specification?

YES

Check the SIS Module.

NO

Repair the short to battery line circuit on wiring harness between the SIS and the SRSCM.

3. CHECK THE SIS MODULE

(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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 module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1409

DTC Description

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 front SIS and the SRSCM.

DTC Detecting Condition

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

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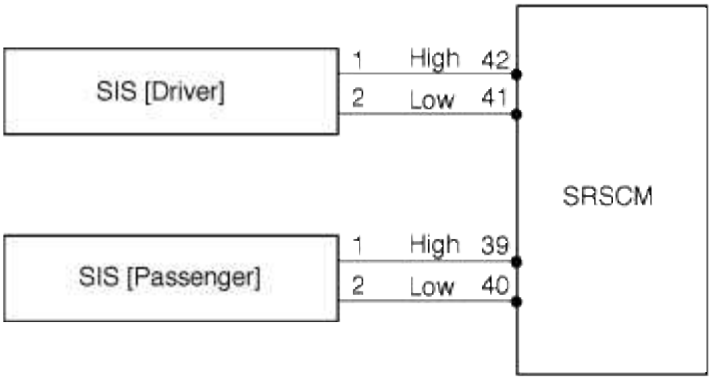
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

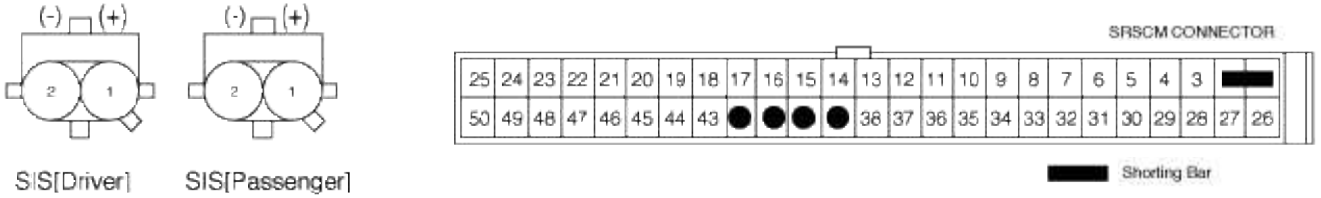
SIS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 42	SIS High
2	SRSCM Terminal 41	SIS Low

SIS [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 39	SIS High
2	SRSCM Terminal 40	SIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

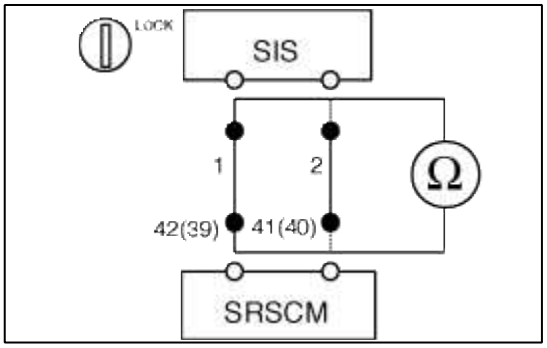
2. CHECK SIS CIRCUIT

(1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 42(39) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 41(40) of SRSCM harness connector.

---

specification(resistance) : below 1 Ω



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1410

DTC Description

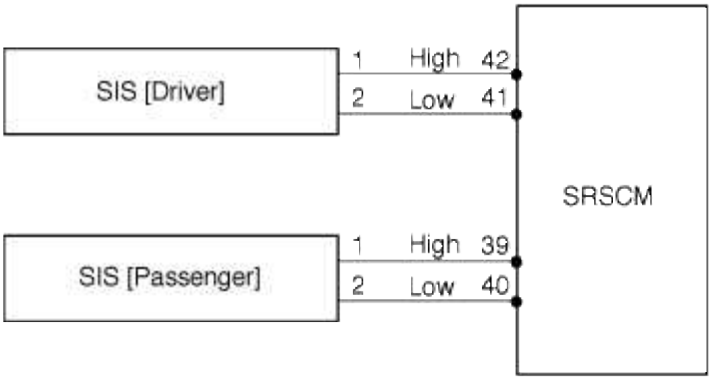
The detecting system for side crash consists of the SRSCM and two Side Impact Sensors (SIS). The SRSCM sets above DTC(s) if it detects that any SIS is defective or there is communication error between any front SIS and the SRSCM.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

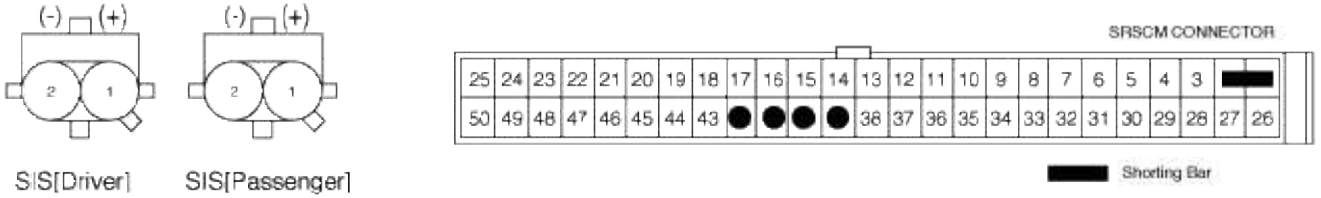
SIS [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 42	SIS High
2	SRSCM Terminal 41	SIS Low

SIS [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 39	SIS High
2	SRSCM Terminal 40	SIS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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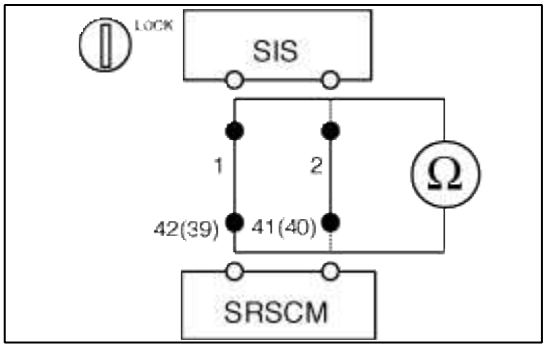
2. CHECK SIS CIRCUIT

(1) Measure resistance between the terminal 1 of SIS harness connector and the terminal 42(39) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of SIS harness connector and the terminal 41(40) of SRSCM harness connector.

---

specification(resistance) : below 1 Ω



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1414

DTC Description

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 SIS wrong ID.

Inspection Procedure

If above DTC is detected, replace Side Impact Sensors(SIS).

Restraint > Troubleshooting > B1415

DTC Description

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 SIS wrong ID.

Inspection Procedure

If above DTC is detected, replace Side Impact Sensors(SIS).

Restraint > Troubleshooting > B1473

DTC Description

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 the CAB resistance too high or low is detected in the CAB squib circuit.

DTC Detecting Condition

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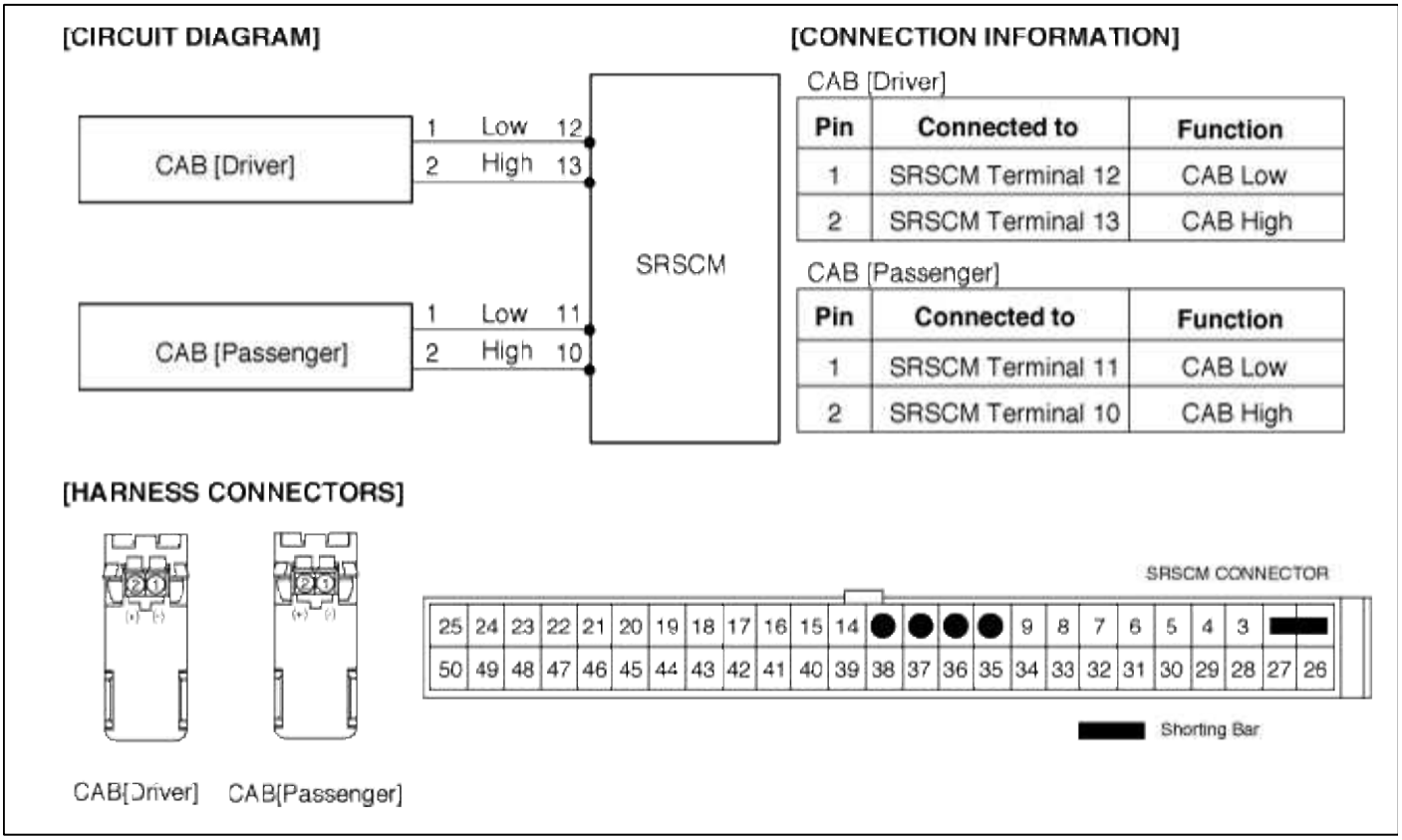
DTC	Condition	Probable cause
B1473 B1474 B1477 B1478	• Too high or low resistance between CAB high(+) and CAB low (-) • Curtain Airbag (CAB) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Curtain Airbag (CAB) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

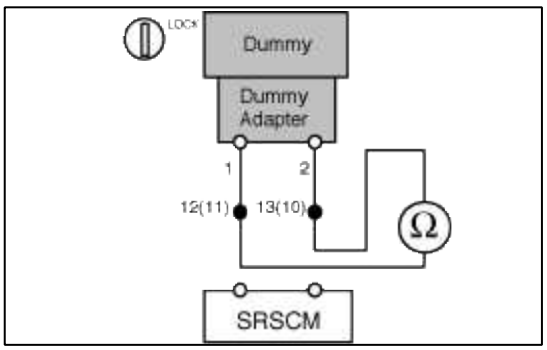
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
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 12(11) and 13(10) of SRSCM harness connector.

   CAB resistance : $1.5 \leq R \leq 5.7\ \Omega$



   (3) Is the measured resistance within specification?

   YES
   Replace the Curtain Airbag(CAB) module.

   NO
   Check open circuit.

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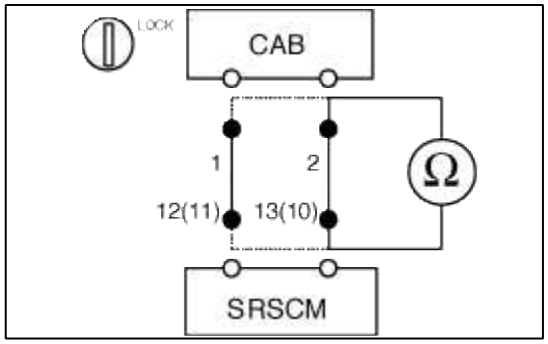
3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 13(10) of SRSCM harness connector.

(2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 12(11) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

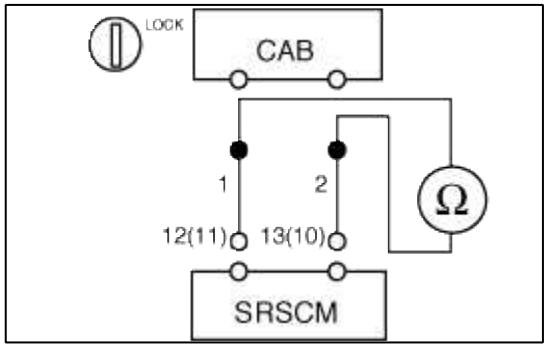
NO

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



(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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

CAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1474

DTC Description

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 the CAB resistance too high or low is detected in the CAB squib circuit.

DTC Detecting Condition

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

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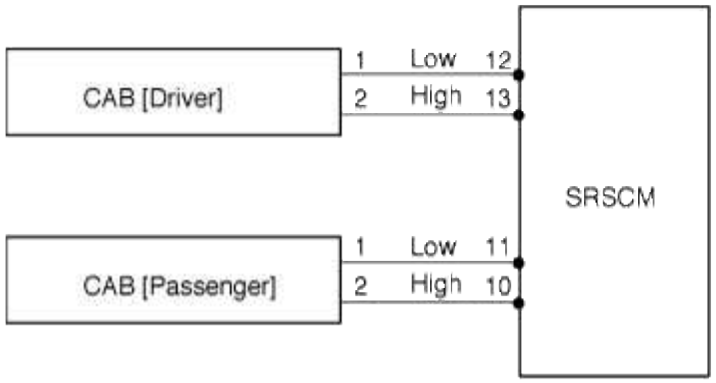
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

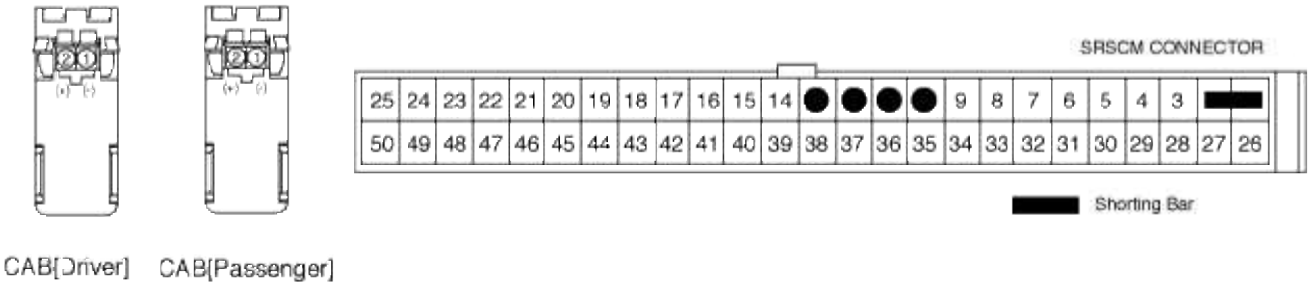
CAB [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 12	CAB Low
2	SRSCM Terminal 13	CAB High

CAB [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 11	CAB Low
2	SRSCM Terminal 10	CAB High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK CAB RESISTANCE

CAUTION

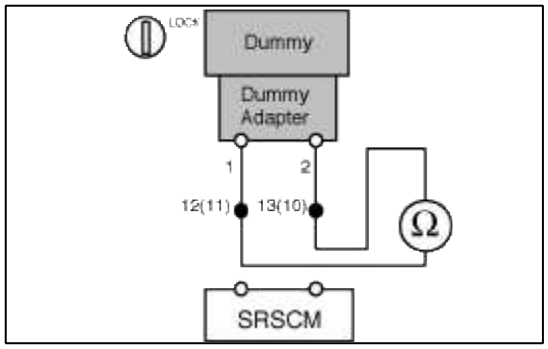
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 12(11) and 13(10) of SRSCM harness connector.

CAB resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Curtain Airbag(CAB) module.

NO

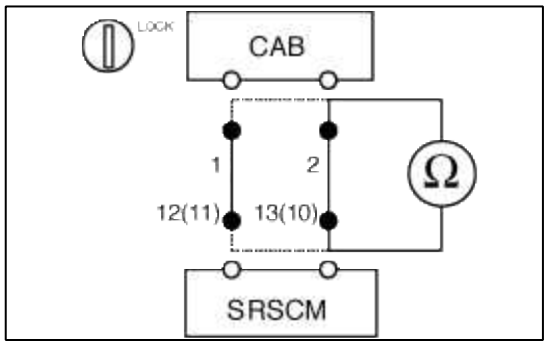
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 13(10) of SRSCM harness connector.

(2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 12(11) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

NO

Repair or replace the wiring harness between the CAB and the SRSCM.

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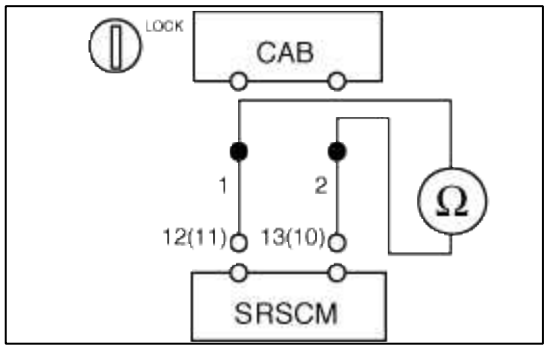
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of CAB harness connector.

specification(resistance) : infinite



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

CAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1475

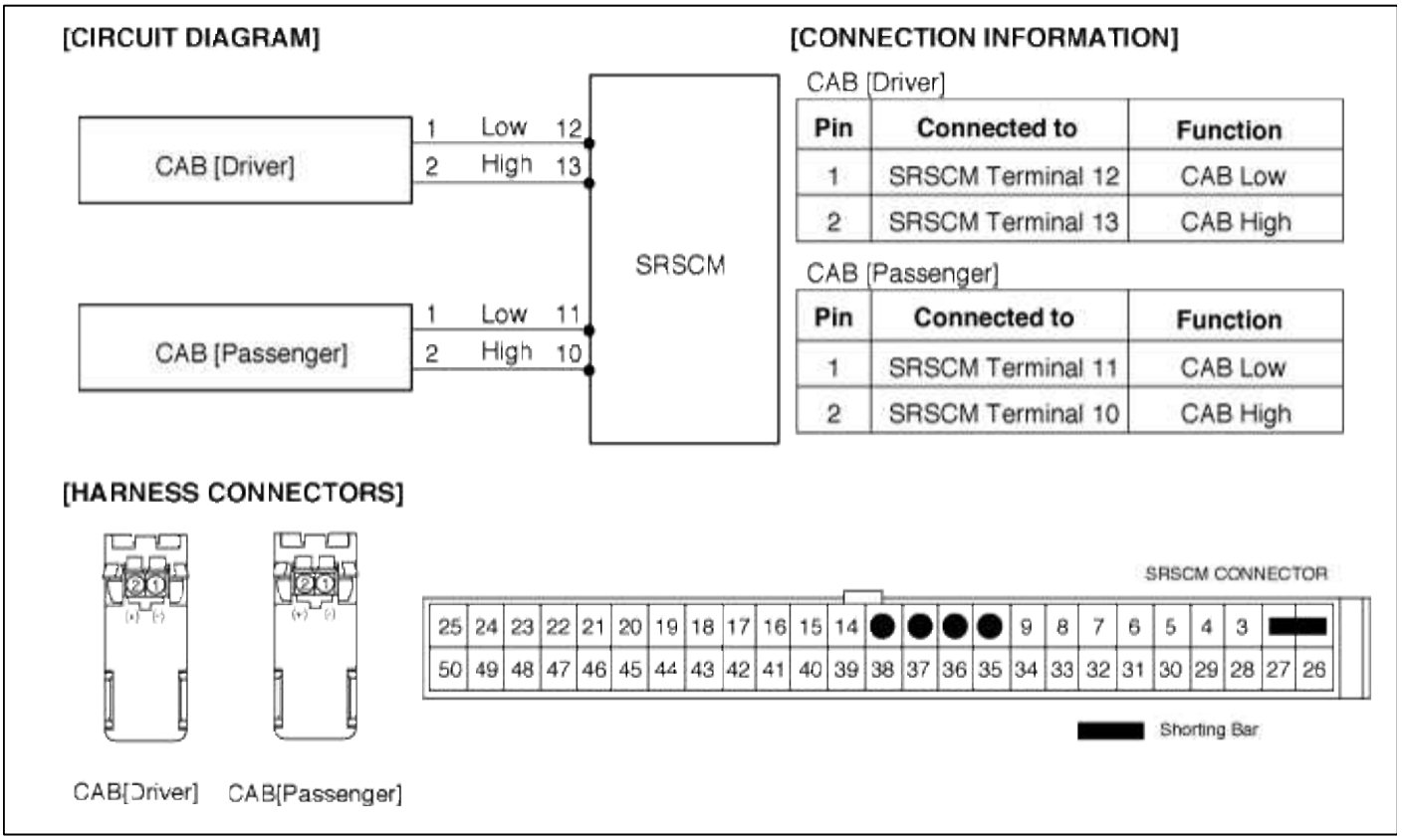
DTC Description

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

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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

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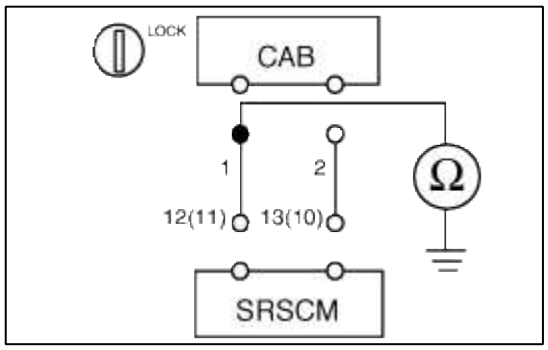
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of CAB harness connector and chassis ground.

   specification(resistance) : infinite



   (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, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 LOCK 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1476

DTC Description

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

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

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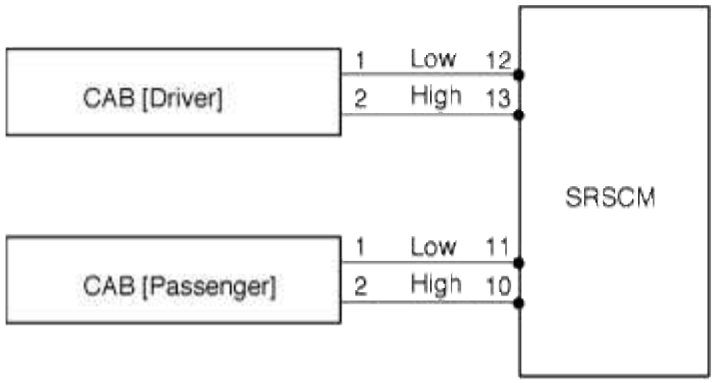
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

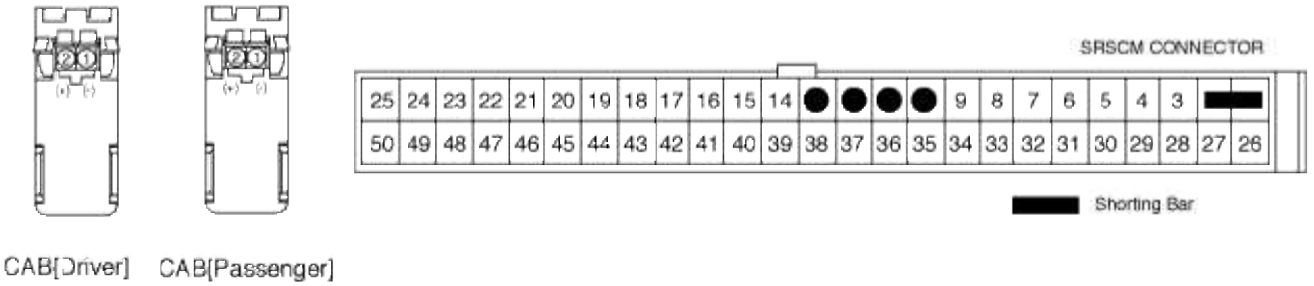
CAB [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 12	CAB Low
2	SRSCM Terminal 13	CAB High

CAB [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 11	CAB Low
2	SRSCM Terminal 10	CAB High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

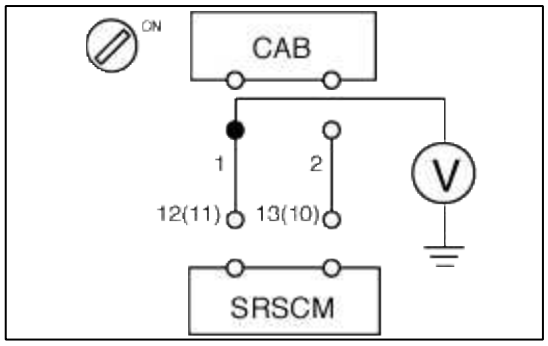
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal 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 0V



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1477

DTC Description

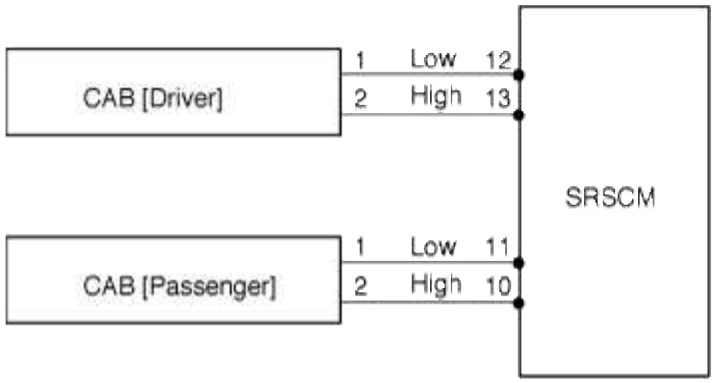
The CAB squib circuit consists of the SRSCM and CAB. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when the CAB resistance too high or low is detected in the CAB squib circuit.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

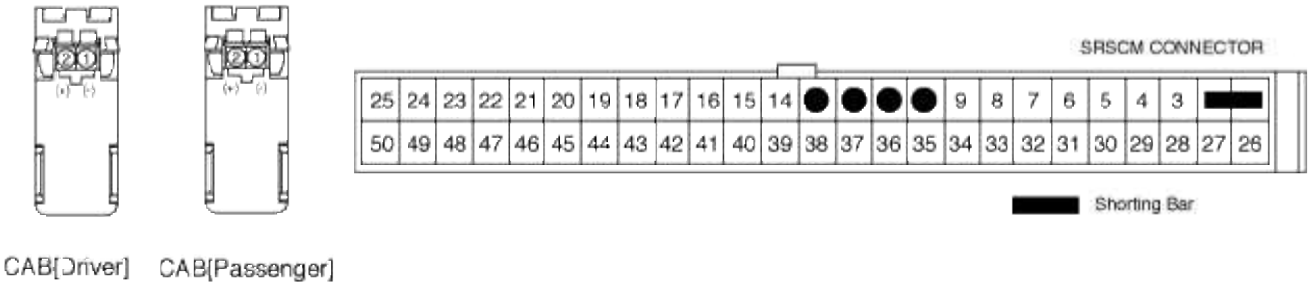
CAB [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 12	CAB Low
2	SRSCM Terminal 13	CAB High

CAB [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 11	CAB Low
2	SRSCM Terminal 10	CAB High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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2. CHECK CAB RESISTANCE

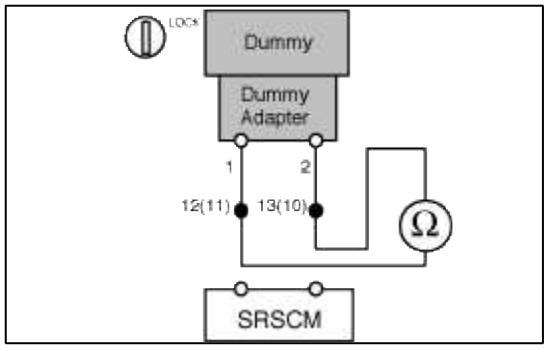
CAUTION

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 12(11) and 13(10) of SRSCM harness connector.

CAB resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Curtain Airbag(CAB) module.

NO

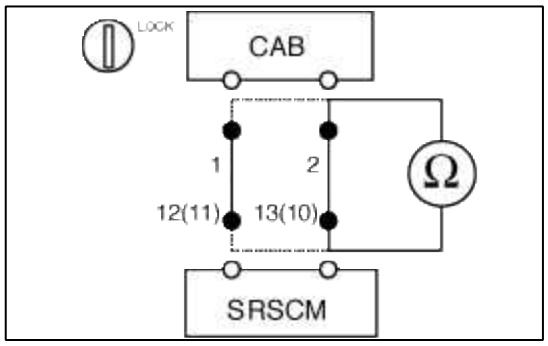
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 13(10) of SRSCM harness connector.

(2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 12(11) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

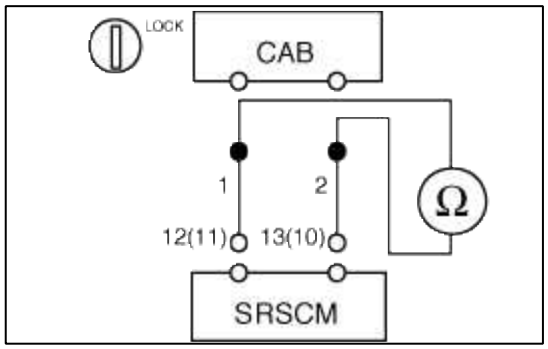
NO

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



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

CAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1478

DTC Description

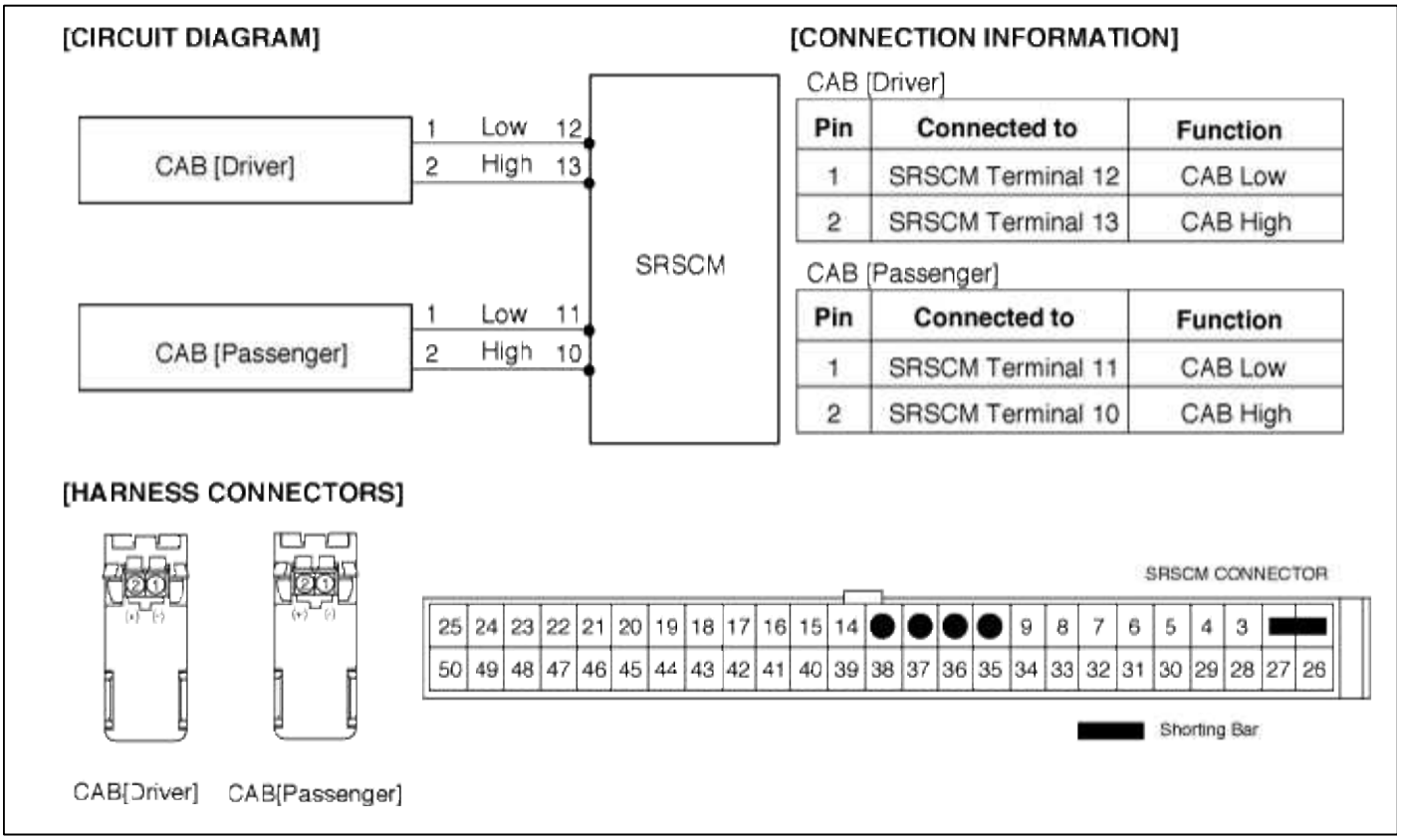
The CAB squib circuit consists of the SRSCM and CAB. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when the CAB resistance too high or low is detected in the

CAB squib circuit.

DTC Detecting Condition

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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK CAB RESISTANCE

CAUTION

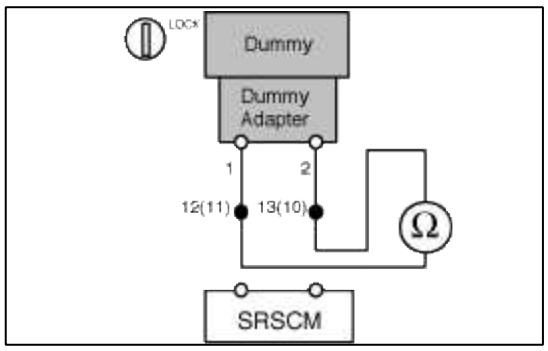
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 12(11) and 13(10) of SRSCM harness connector.

CAB resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

YES

Replace the Curtain Airbag(CAB) module.

NO

Check open circuit.

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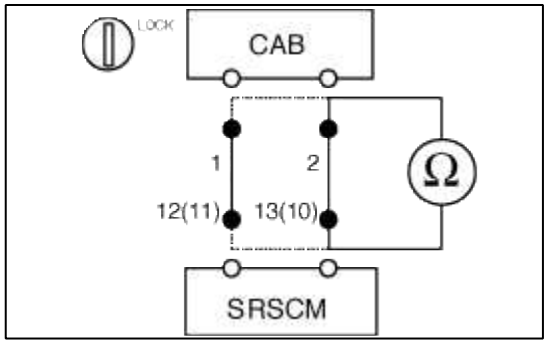
3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 2 of CAB harness connector and the terminal 13(10) of SRSCM harness connector.

(2) Measure resistance between the terminal 1 of CAB harness connector and the terminal 12(11) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

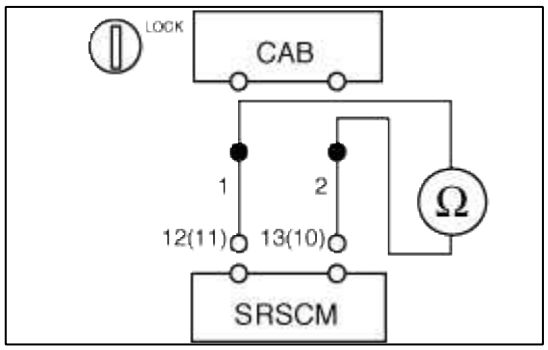
NO

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



(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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

CAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1479

DTC Description

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

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

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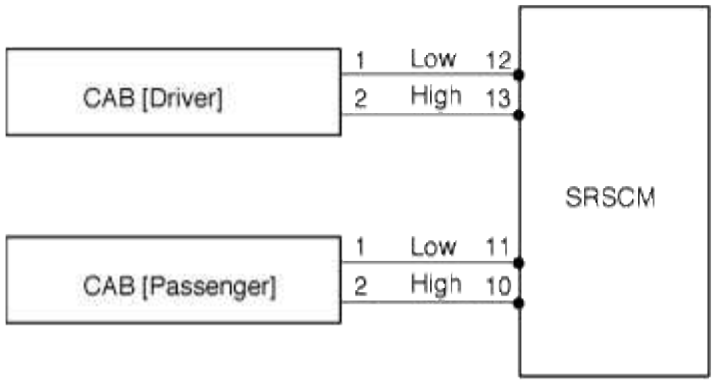
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

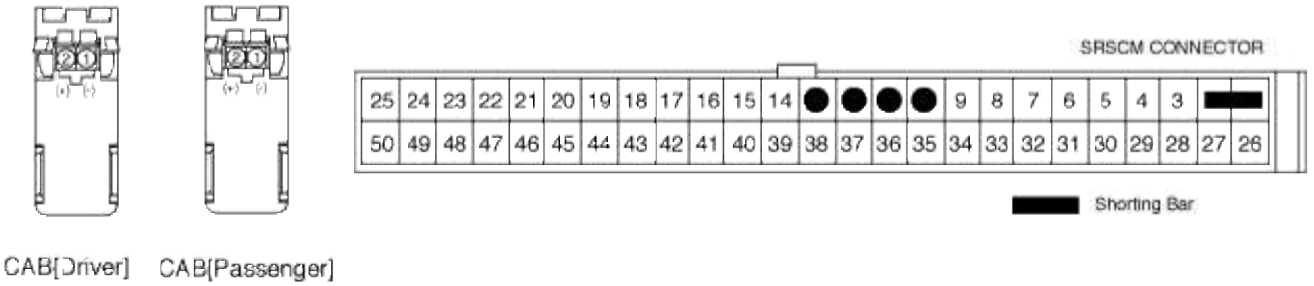
CAB [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 12	CAB Low
2	SRSCM Terminal 13	CAB High

CAB [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 11	CAB Low
2	SRSCM Terminal 10	CAB High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

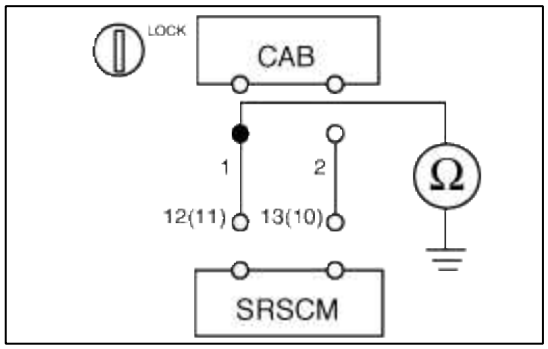
(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of CAB harness connector and chassis ground.

specification(resistance) : infinite



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 LOCK 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1480

DTC Description

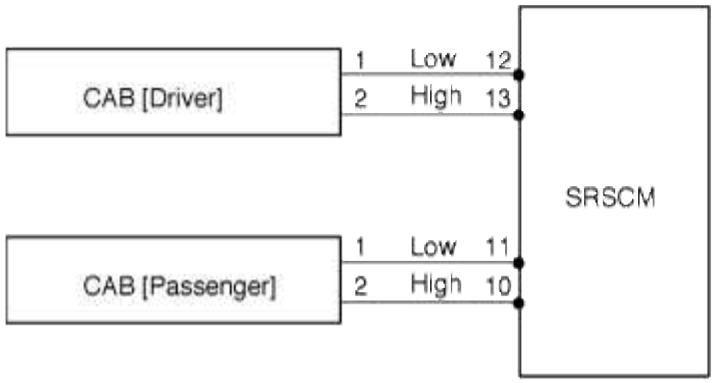
The CAB squib circuit consists of the SRSCM and CAB. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTC is recorded when short to battery is detected in the CAB squib circuit.

DTC Detecting Condition

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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

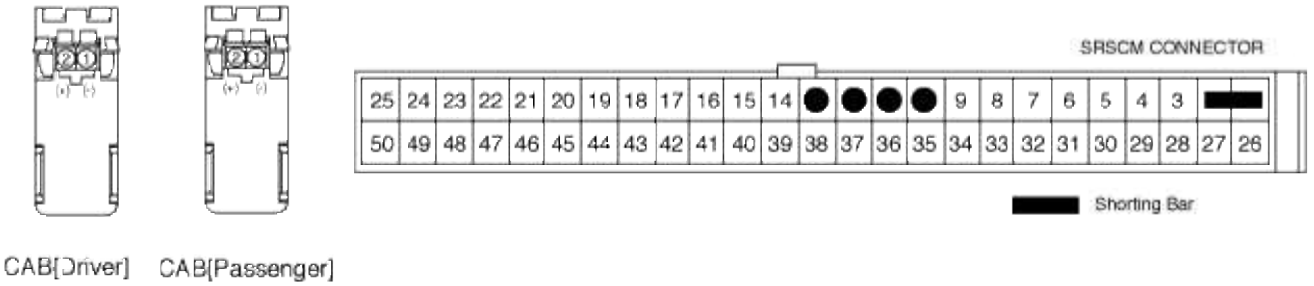
CAB [Driver]

Pin	Connected to	Function
1	SRSCM Terminal 12	CAB Low
2	SRSCM Terminal 13	CAB High

CAB [Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 11	CAB Low
2	SRSCM Terminal 10	CAB High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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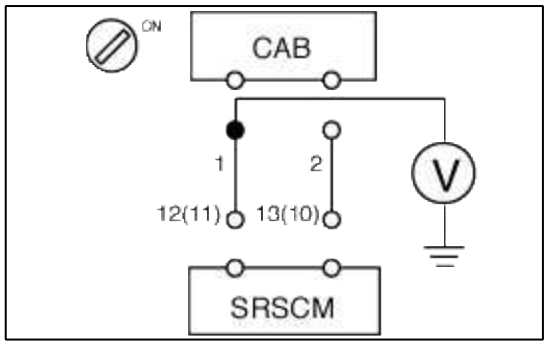
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal 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 0V



(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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1481

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

DTC Detecting Condition

DTC	Condition	Probable cause
B1481 B1482	• 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

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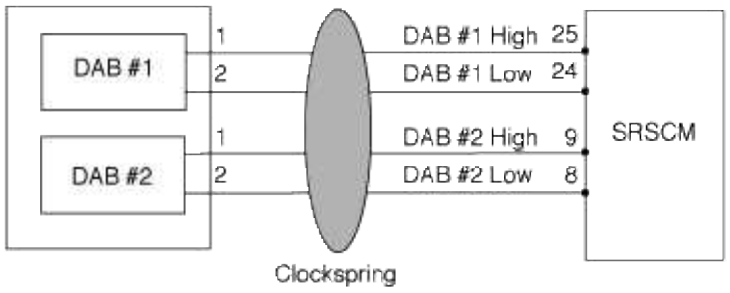
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

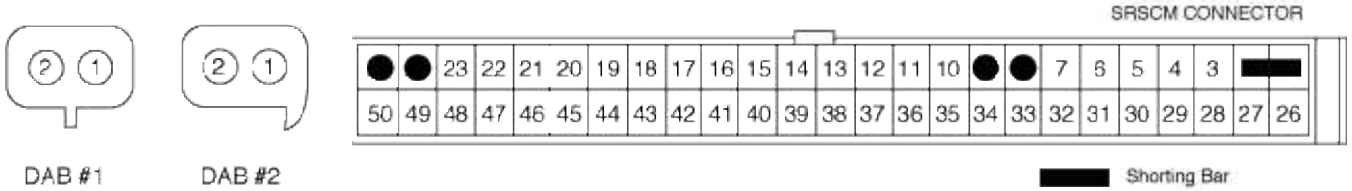
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 25	DAB #1 High
2	SRSCM terminal 24	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9	DAB #2 High
2	SRSCM terminal 8	DAB #2 Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK DAB RESISTANCE

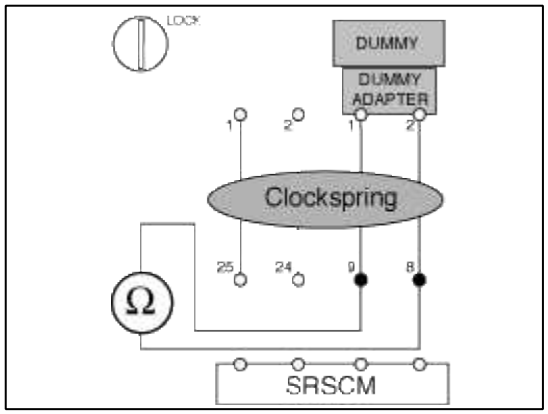
CAUTION

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 8 and 9 of SRSCM harness connector.

DAB resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

NO

Check open circuit.

YES

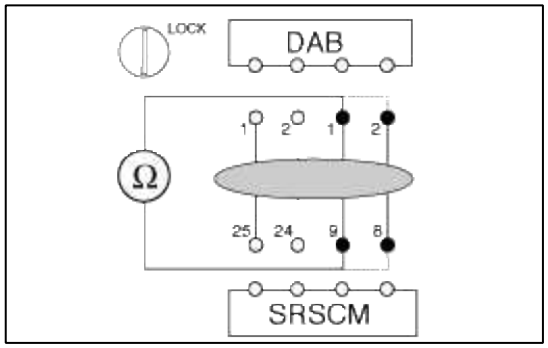
Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of DAB harness connector and the terminal 9 of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of DAB harness connector and the terminal 8 of SRSCM harness connector.

specification(resistance) : below 1 Ω



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(3) Is the measured resistance within specification?

YES

Check short circuit.

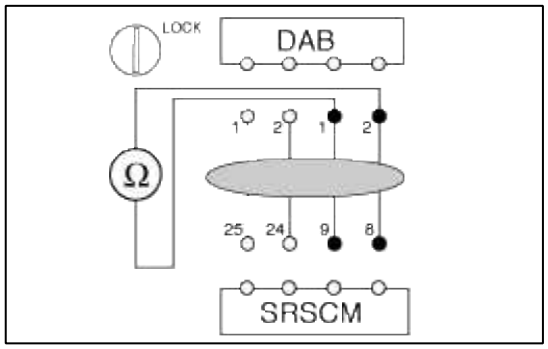
NO

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



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

DAB resistance : 1.5 ≤ R ≤ 5.7 Ω

Restraint > Troubleshooting > B1482

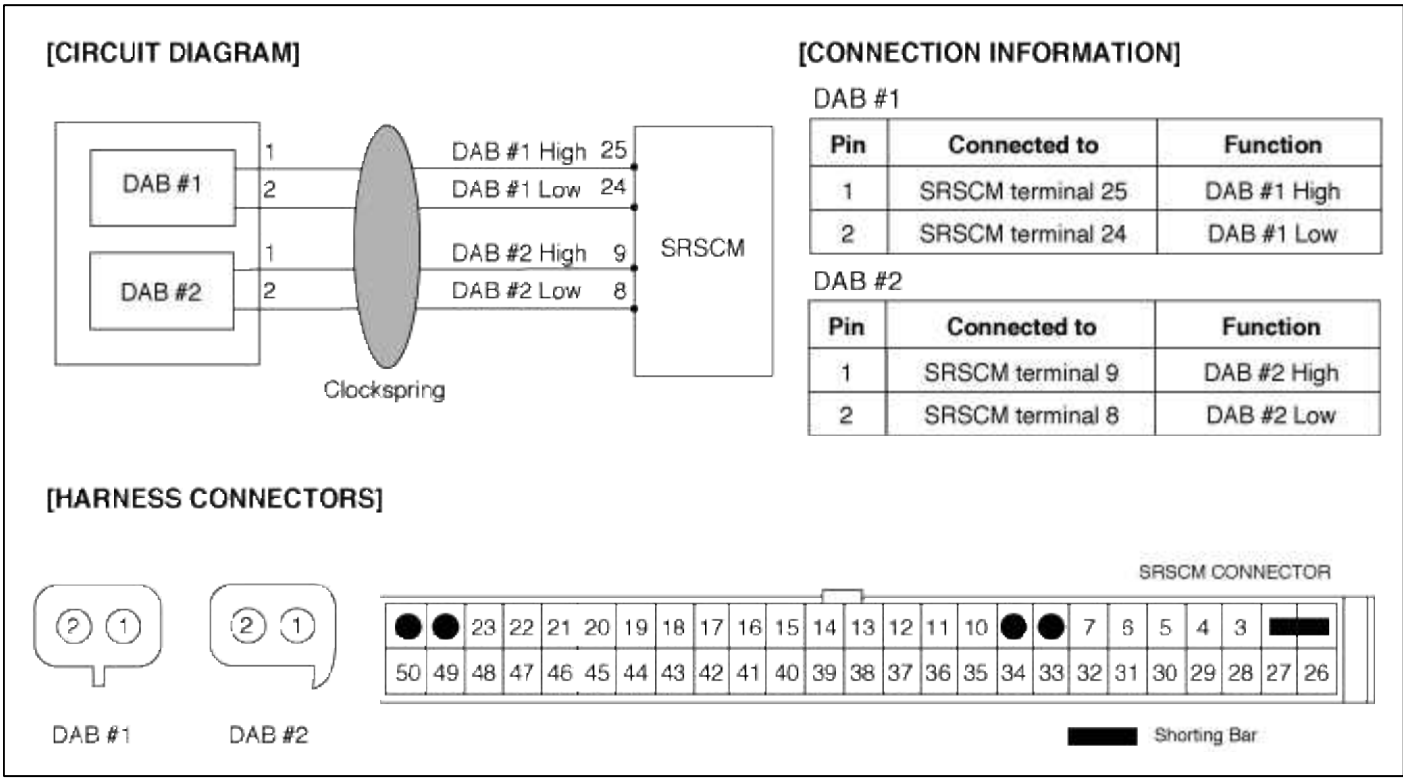
DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of DAB squib is too high or low.

DTC Detecting Condition

DTC	Condition	Probable cause
B1481 B1482	• 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



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.

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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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK DAB RESISTANCE

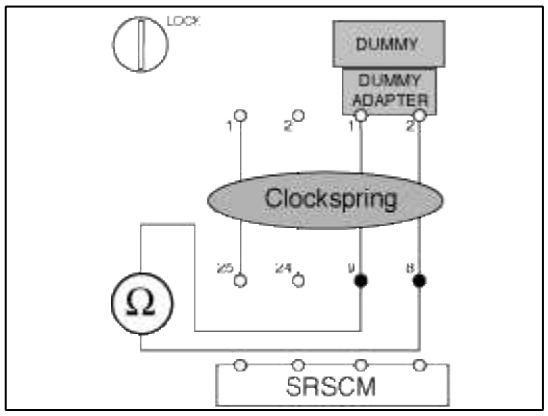
> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 8 and 9 of SRSCM harness connector.

DAB resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

NO

Check open circuit.

YES

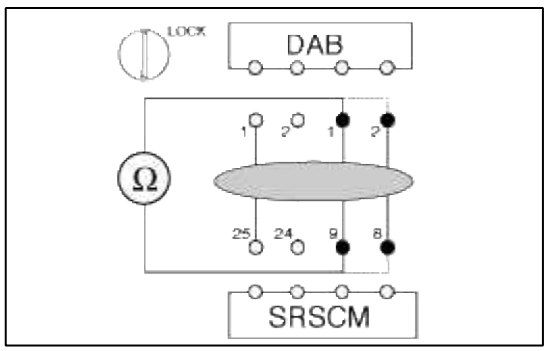
Replace the Driver Airbag(DAB) module.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of DAB harness connector and the terminal 9 of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of DAB harness connector and the terminal 8 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

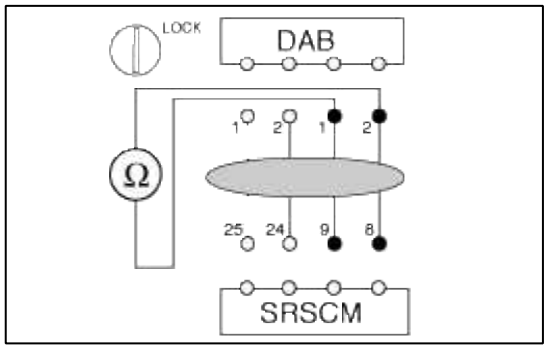
NO

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



(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.

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5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

DAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1483

DTC Description

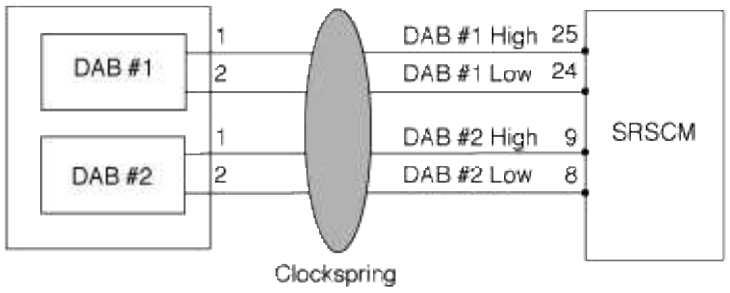
The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1348 B1483	• 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

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

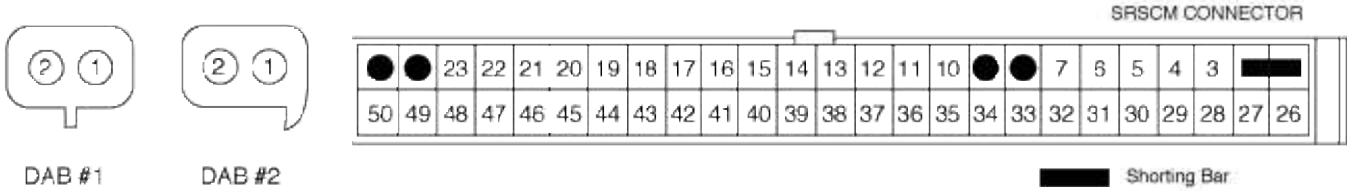
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 25	DAB #1 High
2	SRSCM terminal 24	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9	DAB #2 High
2	SRSCM terminal 8	DAB #2 Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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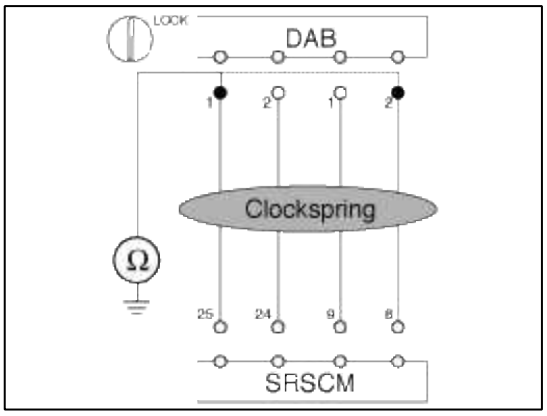
2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of DAB harness connector and chassis ground (DAB Stage 1).

(2) Measure resistance between the terminal 2 of DAB harness connector and chassis ground (DAB Stage 2).

specification(resistance) : infinite



(3) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1484

DTC Description

The Driver Airbag circuit consists of the SRSCM, Clockspring and the Driver Airbag (DAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to battery line on the DAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1349 B1484	• 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

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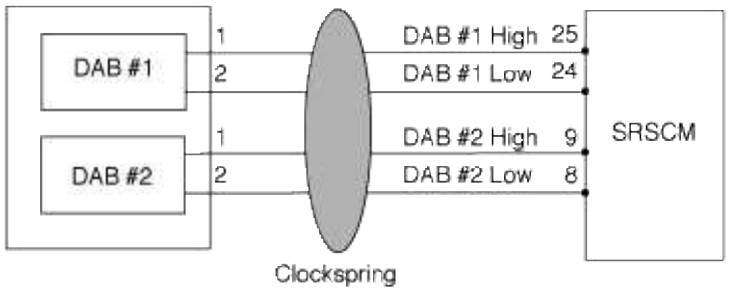
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

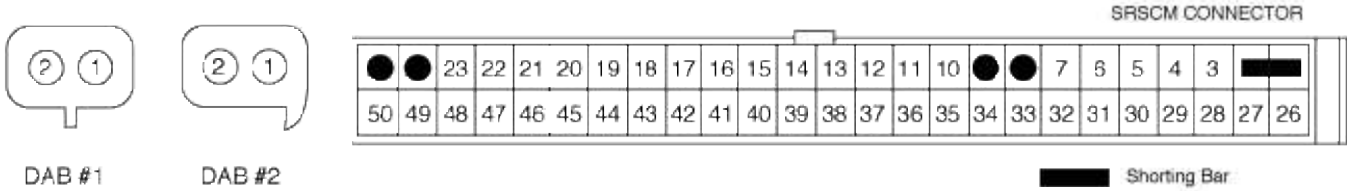
DAB #1

Pin	Connected to	Function
1	SRSCM terminal 25	DAB #1 High
2	SRSCM terminal 24	DAB #1 Low

DAB #2

Pin	Connected to	Function
1	SRSCM terminal 9	DAB #2 High
2	SRSCM terminal 8	DAB #2 Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO BATTERY LINE

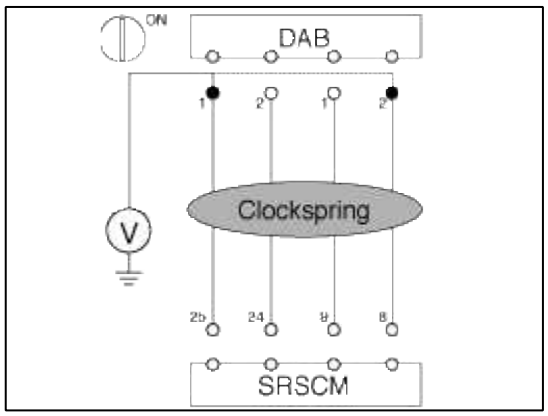
(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of DAB harness connector and chassis ground(-) (DAB Stage 1).

(4) Measure voltage between the terminal 2 of DAB harness connector and chassis ground(-) (DAB Stage 2).

specification(voltage) : Approximately 0 V



(5) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1485

DTC Description

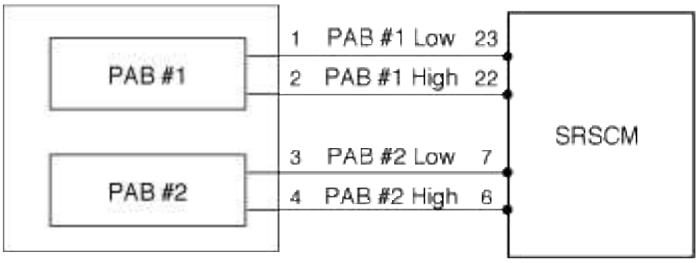
The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

DTC Detecting Condition

DTC	Condition	Probable cause
B1485 B1486	• 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

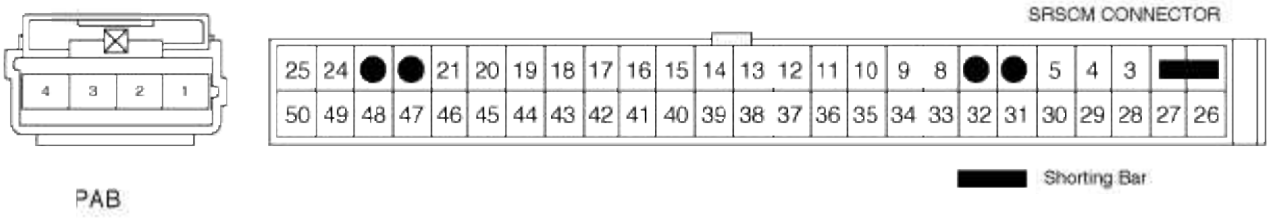
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Pin	Connected to	Function
1	SRSCM terminal 23	PAB #1 Low
2	SRSCM terminal 22	PAB #1 High
3	SRSCM terminal 7	PAB #2 Low
4	SRSCM terminal 6	PAB #2 High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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2. CHECK PAB RESISTANCE

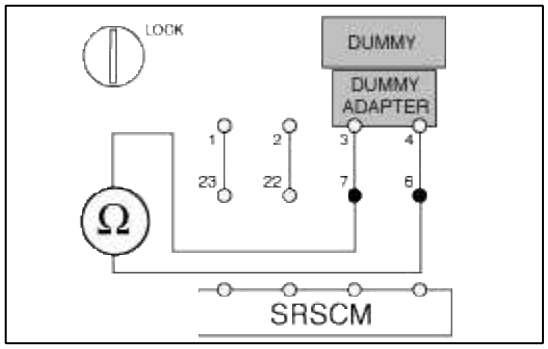
CAUTION

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 6 and 7 of SRSCM harness connector.

PAB resistance : 1.5 ≤ R ≤ 5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Passenger Airbag(PAB) module.

NO

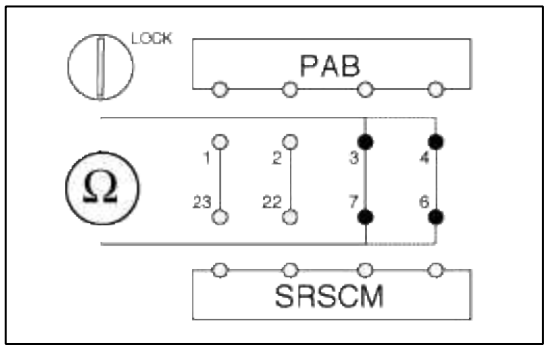
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 3 of PAB harness connector and the terminal 7 of SRSCM harness connector.

(2) Measure resistance between the terminal 4 of PAB harness connector and the terminal 6 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

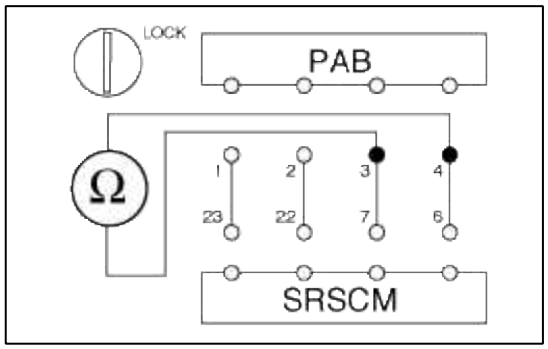
NO

Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 3 and 4 of PAB harness connector.

specification(resistance) : infinite



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

PAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1486

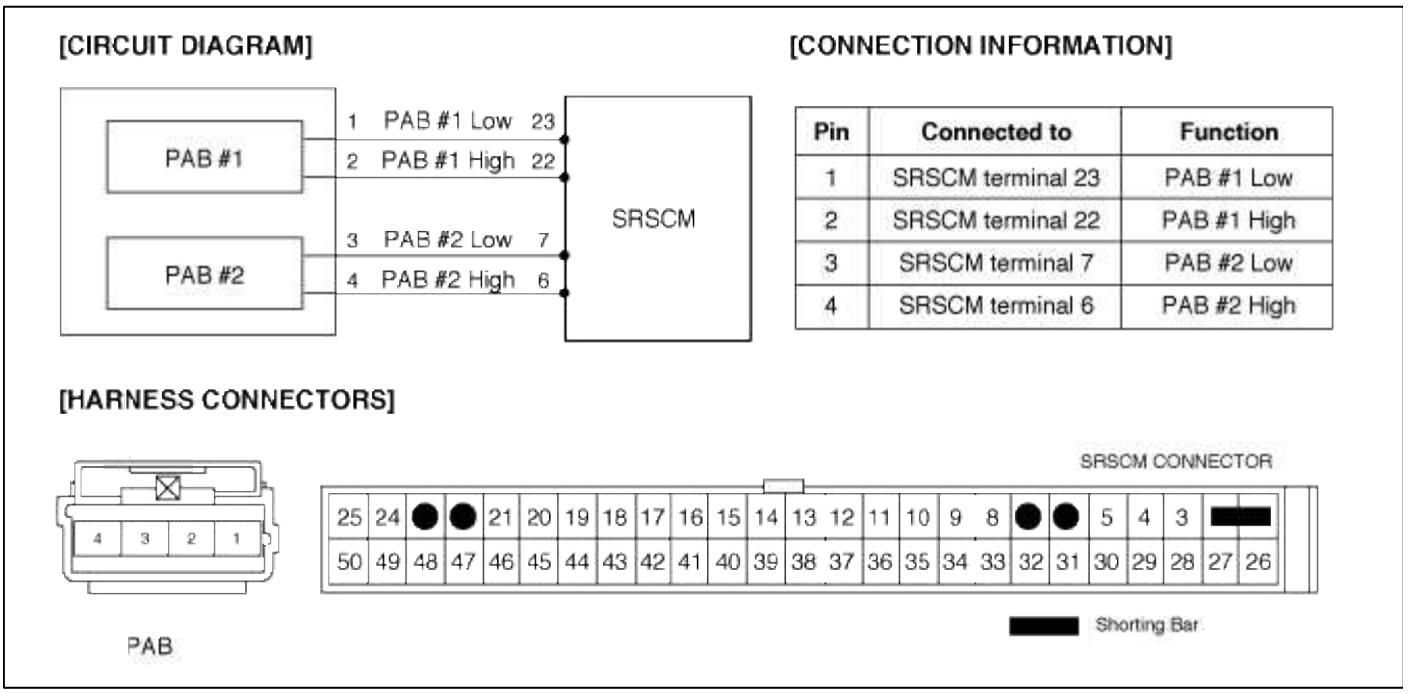
DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects that the resistance of PAB squib is too high or low.

DTC Detecting Condition

DTC	Condition	Probable cause
B1485 B1486	• 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



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK PAB RESISTANCE

CAUTION

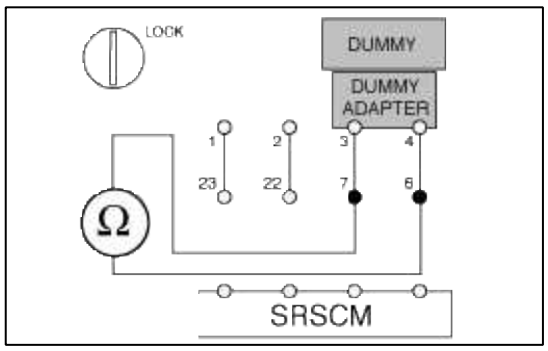
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(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 6 and 7 of SRSCM harness connector.

PAB resistance : $1.5 \leq R \leq 5.7\ \Omega$



(3) Is the measured resistance within specification?

YES

Replace the Passenger Airbag(PAB) module.

NO

Check open circuit.

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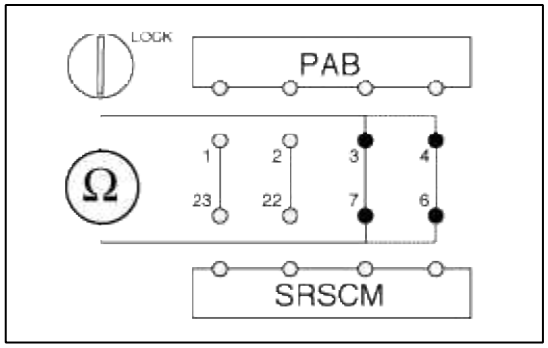
3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 3 of PAB harness connector and the terminal 7 of SRSCM harness connector.

(2) Measure resistance between the terminal 4 of PAB harness connector and the terminal 6 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

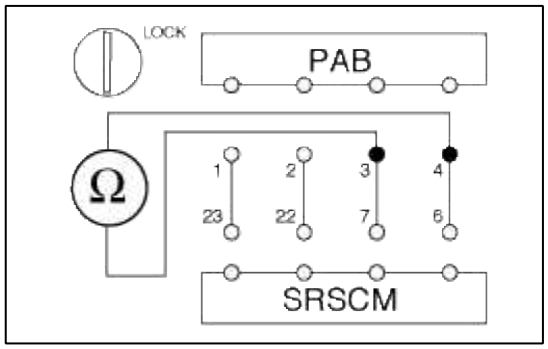
NO

Repair or replace the wiring harness between the PAB and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 3 and 4 of PAB harness connector.

specification(resistance) : infinite



(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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

PAB resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1487

DTC Description

The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits. The SRSCM sets above DTC(s) if it detects short to ground on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1354 B1487	• 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

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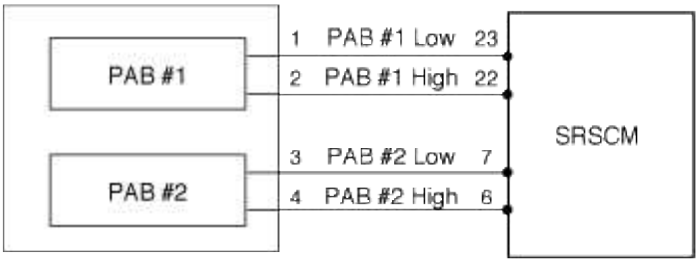
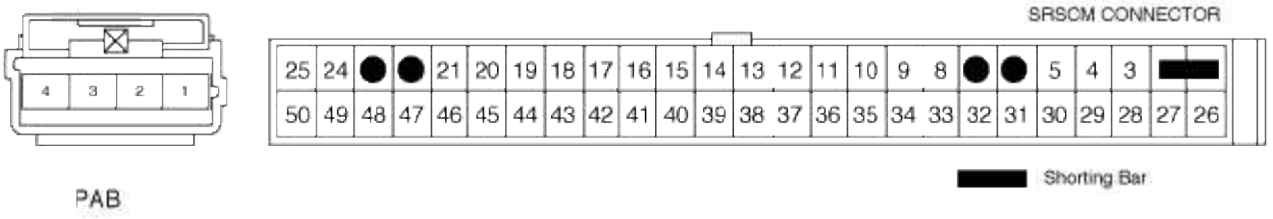
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Pin	Connected to	Function
1	SRSCM terminal 23	PAB #1 Low
2	SRSCM terminal 22	PAB #1 High
3	SRSCM terminal 7	PAB #2 Low
4	SRSCM terminal 6	PAB #2 High

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

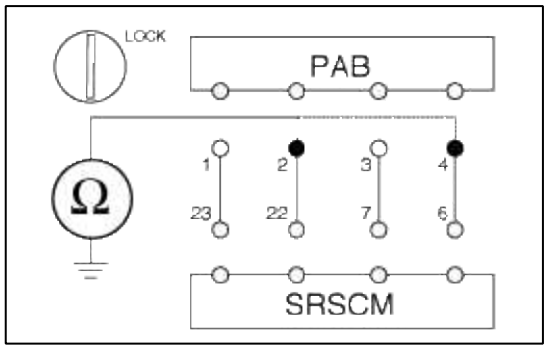
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 2 of PAB harness connector and chassis ground(PAB Stage 1).

(2) Measure resistance between the terminal 4 of PAB harness connector and chassis ground(PAB Stage 2).

specification(resistance) : infinite



(3) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1488

DTC Description

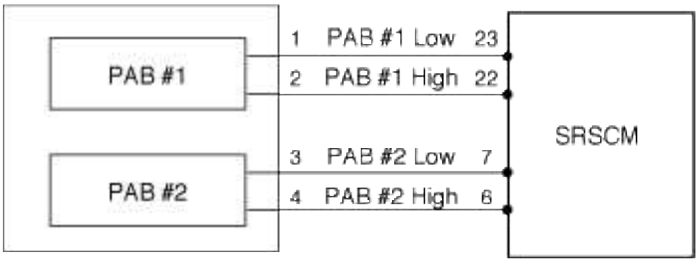
The Passenger Airbag circuit consists of the SRSCM and the Passenger Airbag (PAB) which has two squib circuits.The SRSCM sets above DTC(s) if it detects short to battery line on the PAB circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1355 B1488	• 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

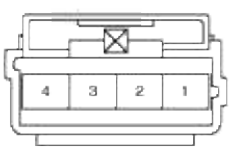
[CIRCUIT DIAGRAM]



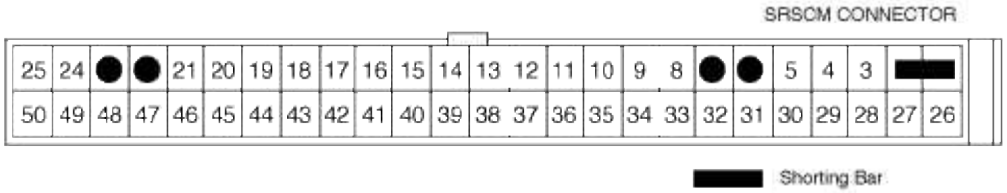
[CONNECTION INFORMATION]

Pin	Connected to	Function
1	SRSCM terminal 23	PAB #1 Low
2	SRSCM terminal 22	PAB #1 High
3	SRSCM terminal 7	PAB #2 Low
4	SRSCM terminal 6	PAB #2 High

[HARNESS CONNECTORS]



PAB



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

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2. CHECK SHORT TO BATTERY LINE

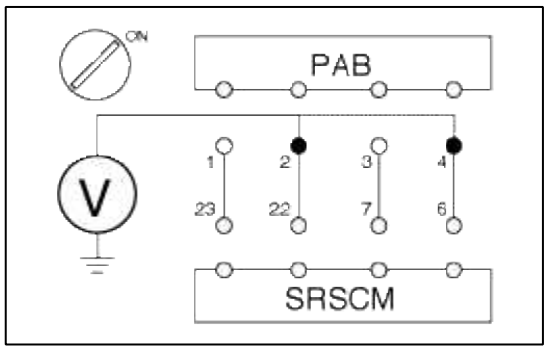
(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 2 of PAB harness connector and chassis ground(-) (PAB Stage 1).

(4) Measure voltage between the terminal 4 of PAB harness connector and chassis ground(-) (PAB Stage 2).

specification(voltage) : Approximately 0 V



(5) 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1489

DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1489 B1490 B1493 B1494	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram

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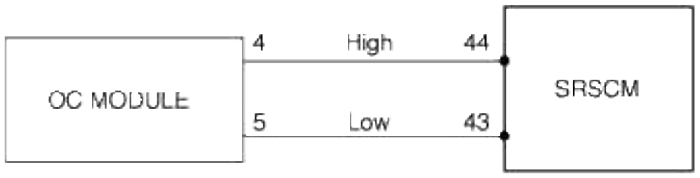
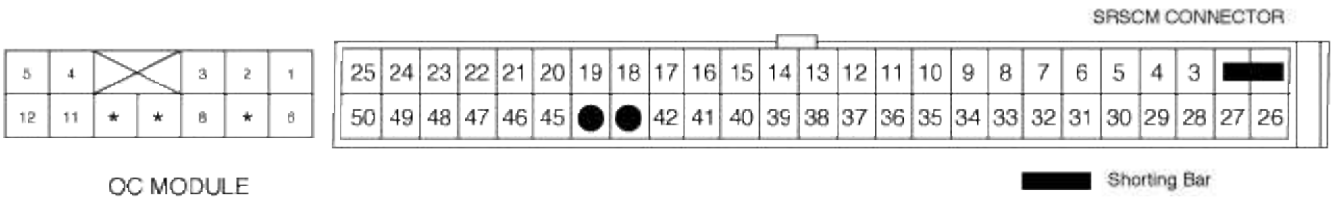
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Pin	Connected to	Function
4	SRSCM terminal 44	OC CAN High
5	SRSCM terminal 43	OC CAN Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

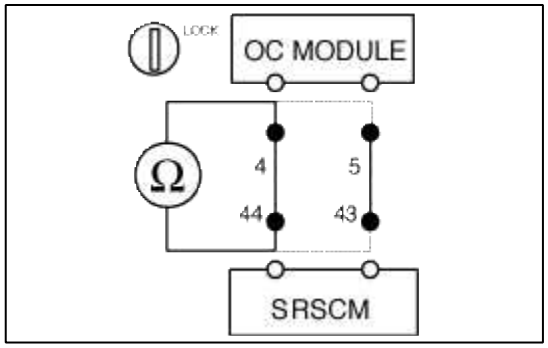
1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.
   (3) Remove the DAB module and disconnect the DAB connector.
   (4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 4 of OC module harness connector and the terminal 44 of SRSCM harness connector.

(2) Measure resistance between the terminal 5 of OC module harness connector and the terminal 43 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short to ground.

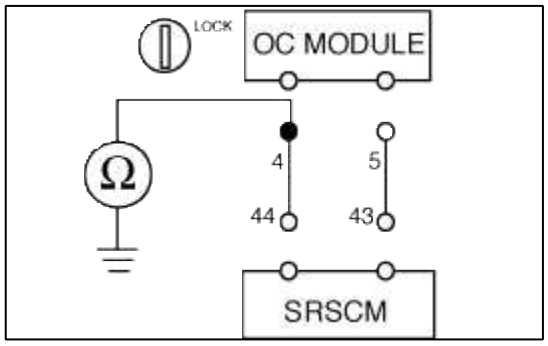
NO

Repair the open circuit on wiring harness between the OC module and the SRSCM.

3. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 4 of OC module harness connector and chassis ground.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Check short circuit.

NO

Repair or replace the wiring harness between the OC module and the SRSCM.

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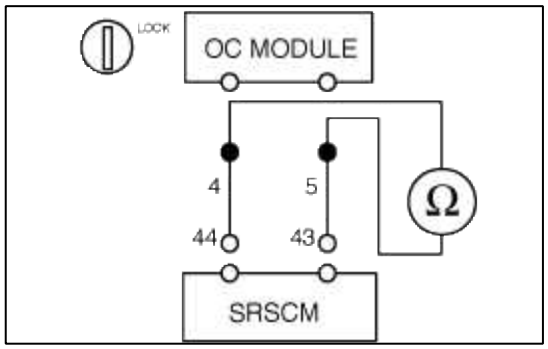
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 4 and 5 OC module harness connector.

Specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Goto next stop.

NO

Repair or replace the wiring harness between the OC module and the SRSCM.

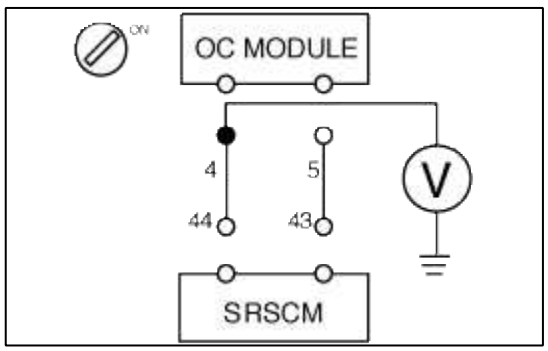
5. CHECK SHORT TO BATTERY LINE

(1) Connect the negative(-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 4 of OC module harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check the OC module.

NO

Repair the short to battery line on the wiring harness between the OC module and the SRSCM.

6. CHECK THE OC MODULE
(1) Replace the OC module with a new one.
● Refer to OCS section in this SERVICE MANUAL.
(2) Turn the ignition switch to LOCK.
(3) Connect the OC module connector.
(4) Connect the SRSCM connector.
(5) Connect the negative(-) terminal to the battery.
(6) Connect 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 OC module?
YES
Go to next step.
NO
Replace OC module.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1490

DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

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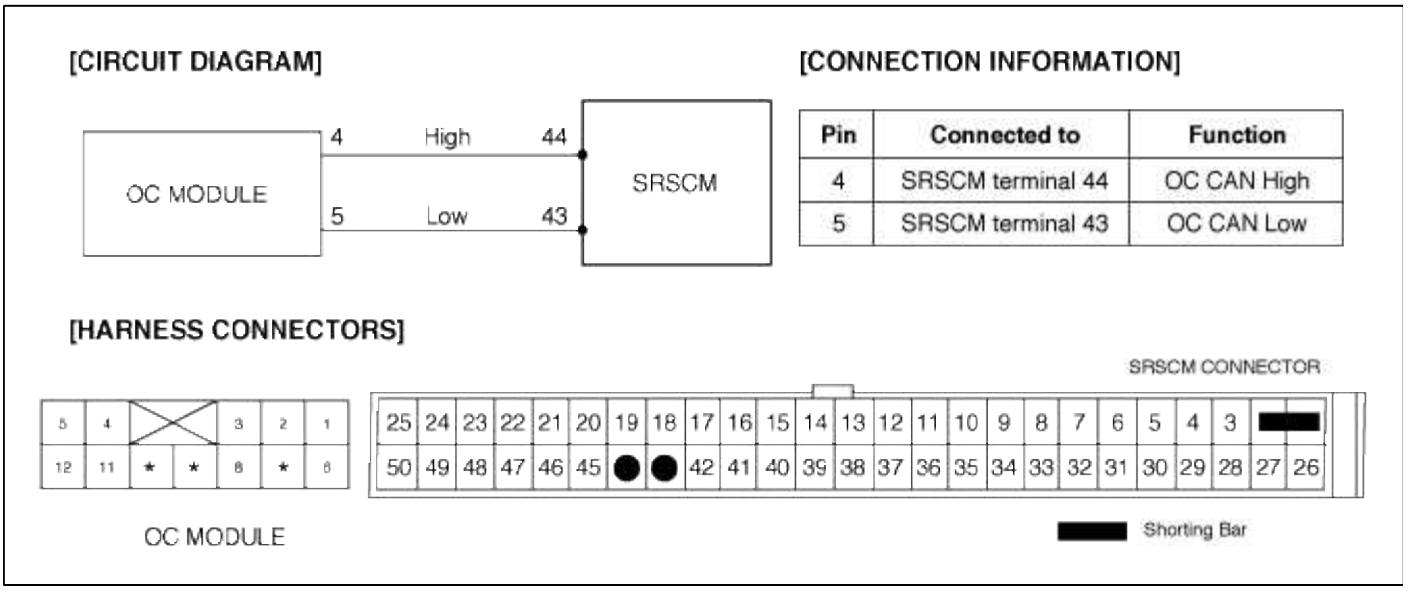
DTC	Condition	Probable cause
B1489 B1490 B1493 B1494	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

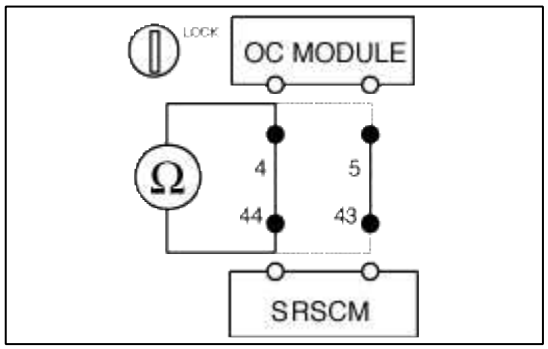
YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of OC module harness connector and the terminal 44 of SRSCM harness connector.
   (2) Measure resistance between the terminal 5 of OC module harness connector and the terminal 43 of SRSCM harness connector.

   specification(resistance) : below 1 Ω



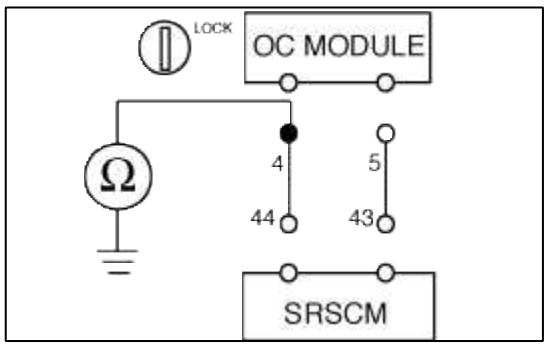
   (3) Is the measured resistance within specification?

   YES
   Check short to ground.

   NO
   Repair the open circuit on wiring harness between the OC module and the SRSCM.

3. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 4 of OC module harness connector and chassis ground.

   specification(resistance) : infinite



   (2) Is the measured resistance within specification?

   YES
   Check short circuit.

   NO
   Repair or replace the wiring harness between the OC module and the SRSCM.

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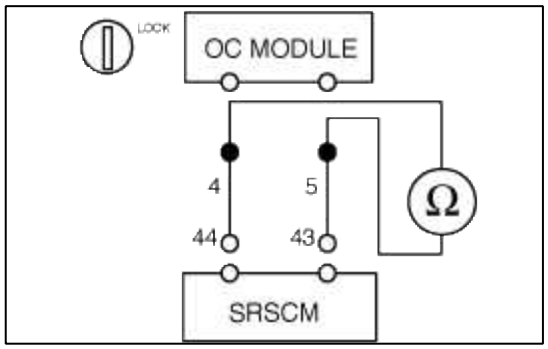
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 4 and 5 OC module harness connector.

Specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Goto next stop.

NO

Repair or replace the wiring harness between the OC module and the SRSCM.

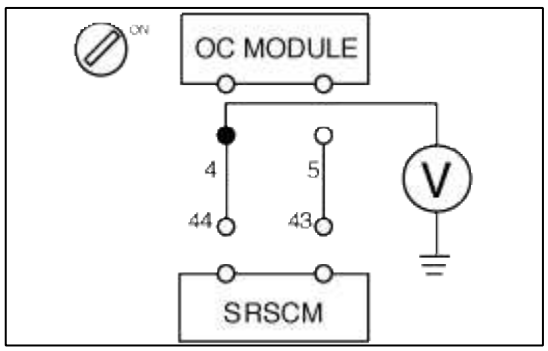
5. CHECK SHORT TO BATTERY LINE

(1) Connect the negative(-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 4 of OC module harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check the OC module.

NO

Repair the short to battery line on the wiring harness between the OC module and the SRSCM.

6. CHECK THE OC MODULE
(1) Replace the OC module with a new one.
● Refer to OCS section in this SERVICE MANUAL.
(2) Turn the ignition switch to LOCK.
(3) Connect the OC module connector.
(4) Connect the SRSCM connector.
(5) Connect the negative(-) terminal to the battery.
(6) Connect 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 OC module?
YES
Go to next step.
NO
Replace OC module.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1493

DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

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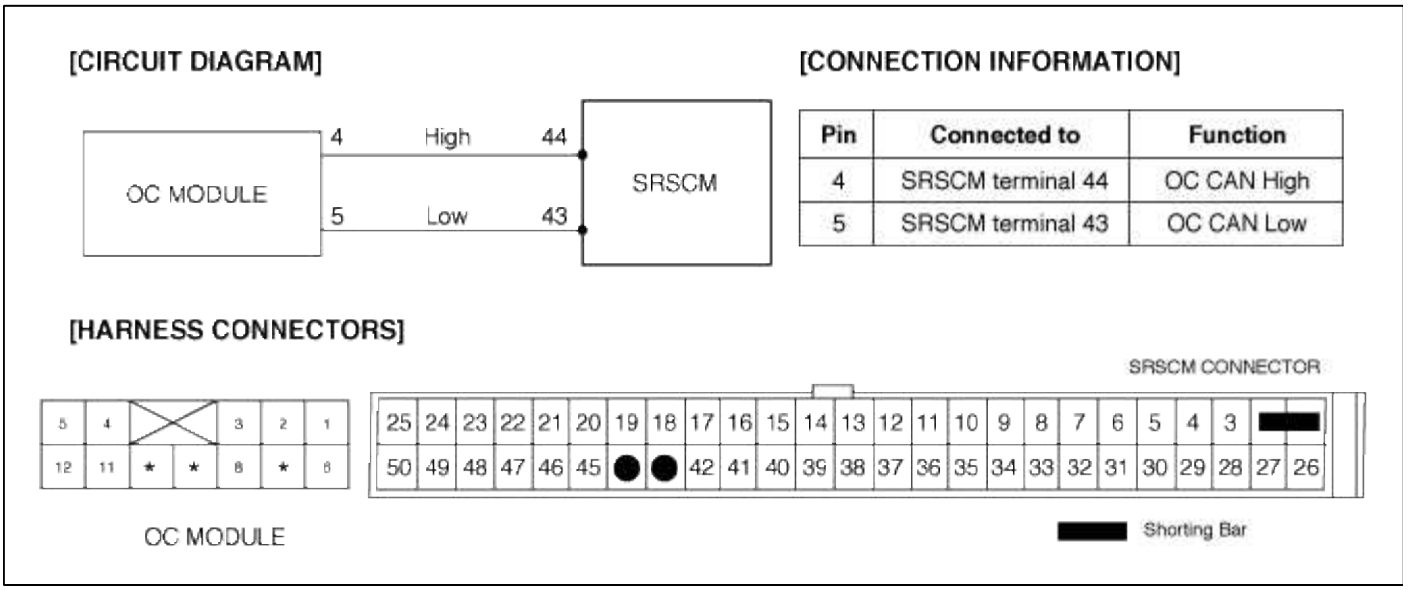
DTC	Condition	Probable cause
B1489 B1490 B1493 B1494	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

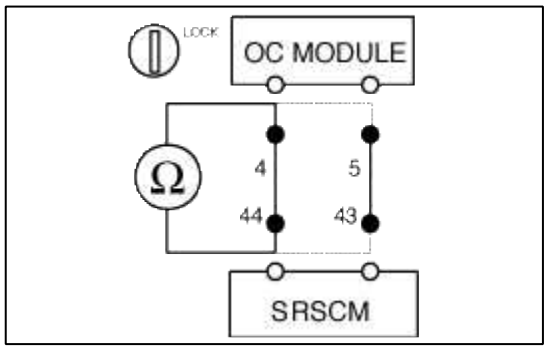
YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of OC module harness connector and the terminal 44 of SRSCM harness connector.
   (2) Measure resistance between the terminal 5 of OC module harness connector and the terminal 43 of SRSCM harness connector.

   specification(resistance) : below 1 Ω



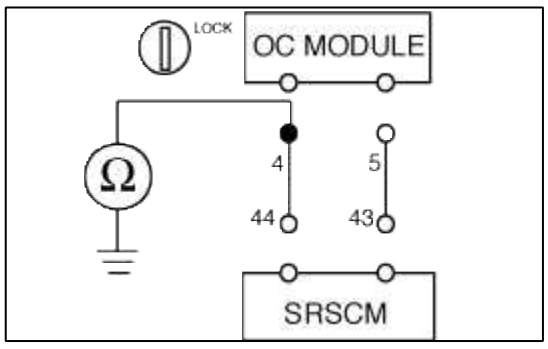
   (3) Is the measured resistance within specification?

   YES
   Check short to ground.

   NO
   Repair the open circuit on wiring harness between the OC module and the SRSCM.

3. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 4 of OC module harness connector and chassis ground.

   specification(resistance) : infinite



   (2) Is the measured resistance within specification?

   YES
   Check short circuit.

   NO
   Repair or replace the wiring harness between the OC module and the SRSCM.

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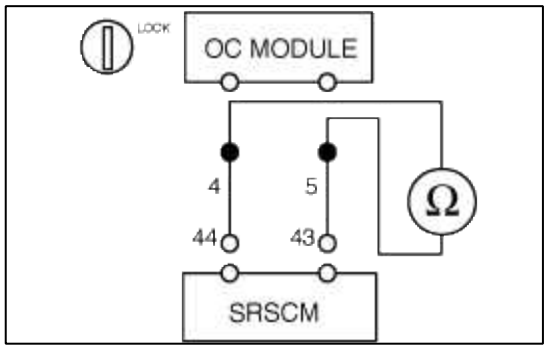
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 4 and 5 OC module harness connector.

Specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Goto next stop.

NO

Repair or replace the wiring harness between the OC module and the SRSCM.

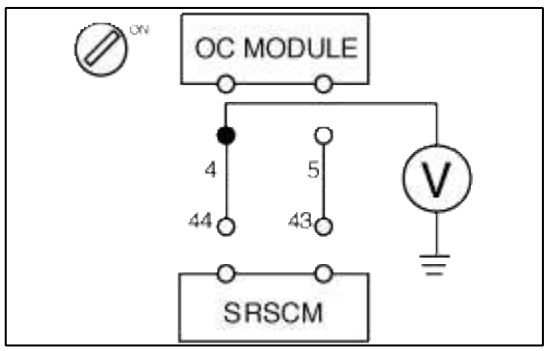
5. CHECK SHORT TO BATTERY LINE

(1) Connect the negative(-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 4 of OC module harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check the OC module.

NO

Repair the short to battery line on the wiring harness between the OC module and the SRSCM.

6. CHECK THE OC MODULE
(1) Replace the OC module with a new one.
● Refer to OCS section in this SERVICE MANUAL.
(2) Turn the ignition switch to LOCK.
(3) Connect the OC module connector.
(4) Connect the SRSCM connector.
(5) Connect the negative(-) terminal to the battery.
(6) Connect 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 OC module?
YES
Go to next step.
NO
Replace OC module.

7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1494

DTC Description

The passenger occupant classification system consists of the SRSCM and the OC module. The above DTC is recorded when a defect or communication error of the OC module is detected in the OC module circuit.

DTC Detecting Condition

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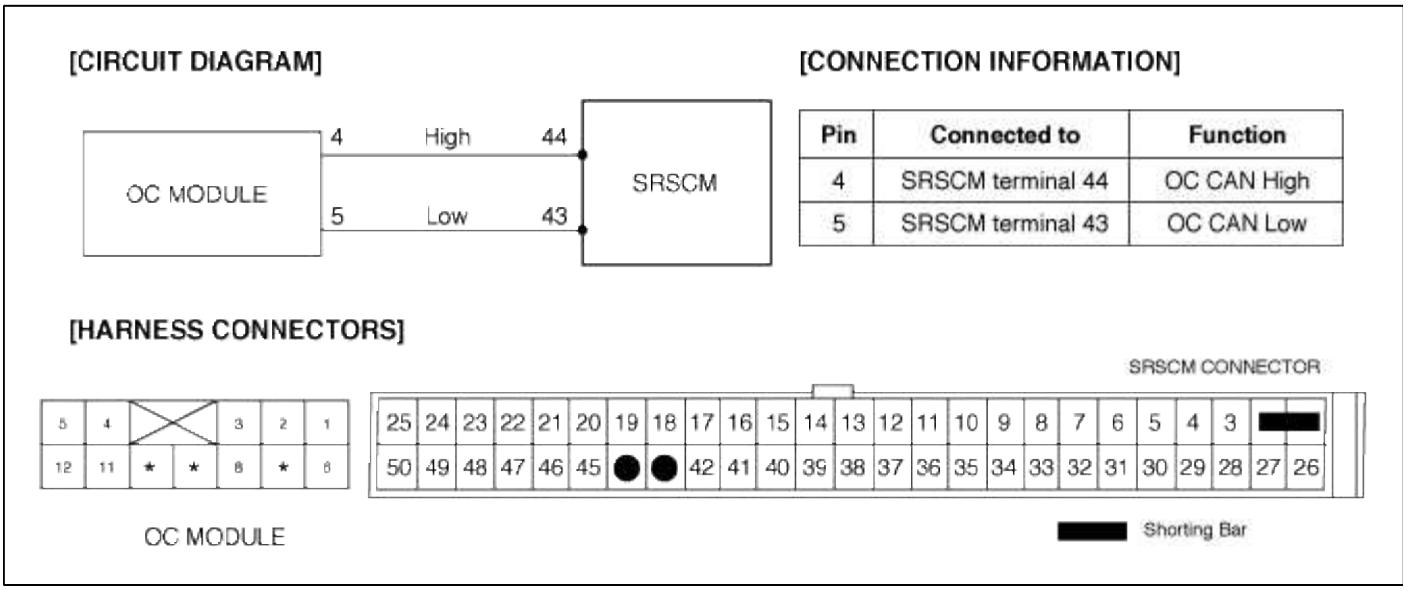
DTC	Condition	Probable cause
B1489 B1490 B1493 B1494	• OC module Malfunction • SRSCM Malfunction	• Wiring Harness • OC module • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

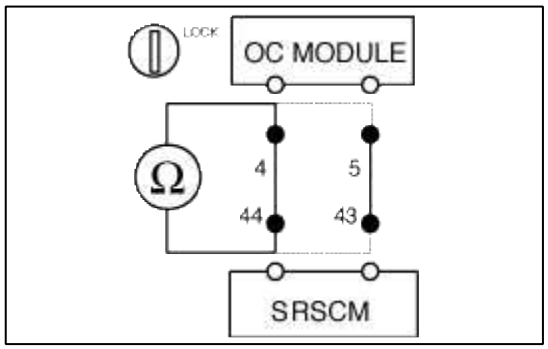
YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 4 of OC module harness connector and the terminal 44 of SRSCM harness connector.
   (2) Measure resistance between the terminal 5 of OC module harness connector and the terminal 43 of SRSCM harness connector.

   specification(resistance) : below 1 Ω



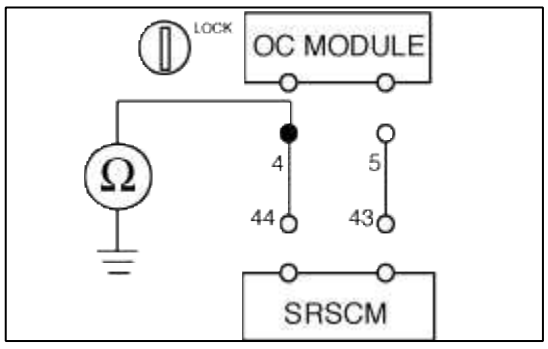
   (3) Is the measured resistance within specification?

   YES
   Check short to ground.

   NO
   Repair the open circuit on wiring harness between the OC module and the SRSCM.

3. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 4 of OC module harness connector and chassis ground.

   specification(resistance) : infinite



   (2) Is the measured resistance within specification?

   YES
   Check short circuit.

   NO
   Repair or replace the wiring harness between the OC module and the SRSCM.

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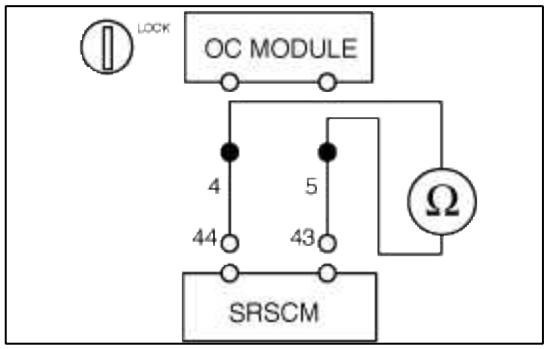
4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 4 and 5 OC module harness connector.

Specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Goto next stop.

NO

Repair or replace the wiring harness between the OC module and the SRSCM.

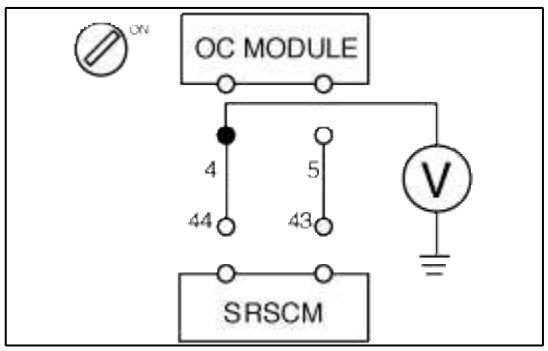
5. CHECK SHORT TO BATTERY LINE

(1) Connect the negative(-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 4 of OC module harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check the OC module.

NO

Repair the short to battery line on the wiring harness between the OC module and the SRSCM.

6. CHECK THE OC MODULE
   (1) Replace the OC module with a new one.
      ● Refer to OCS section in this SERVICE MANUAL.
   (2) Turn the ignition switch to LOCK.
   (3) Connect the OC module connector.
   (4) Connect the SRSCM connector.
   (5) Connect the negative(-) terminal to the battery.
   (6) Connect 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 OC module?
      YES
         Go to next step.
      NO
         Replace OC module.
7. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1495

DTC Description

The passenger detecting system consists of the SRSCM and the OC module. The SRSCM sets above DTCs if it detects short to battery line or short to ground between BTS and OC module.

DTC Detecting Condition

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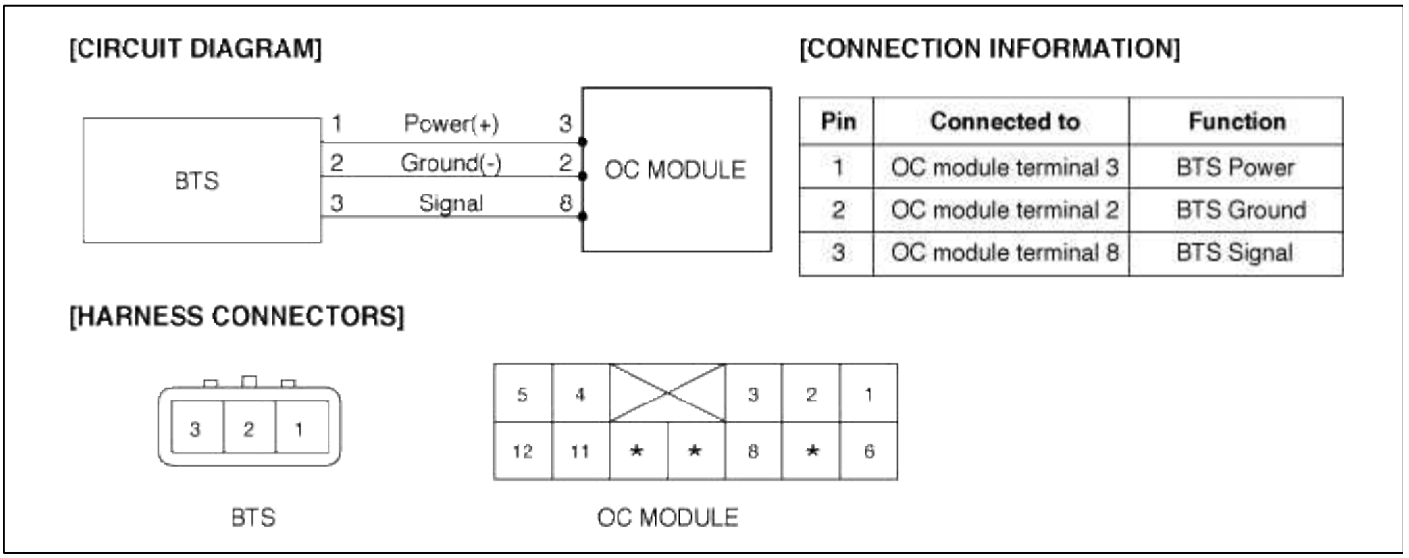
DTC	Condition	Probable cause
B1495	• Short to battery or ground between BTS and OC module • Open between BTS and OC module • BTS Malfunction • OC module Malfunction	• Short to battery or ground circuit on wiring harness • Open circuit on wiring harness • BTS • OC module

Schematic Diagram



Terminal & Connector Inspection

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.

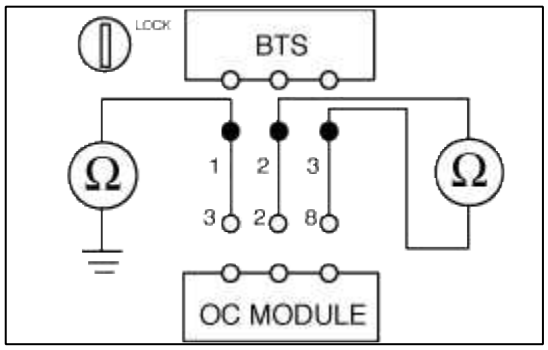
YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 1 of BTS harness connector and chassis ground.
   (2) Measure resistance between the terminal 2 and 3 of BTS harness connector.

   specification(resistance) : infinite



   (3) Is the measured resistance within specification?

   YES

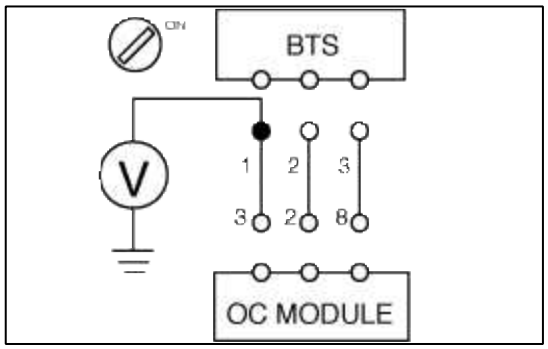
   Go to next step.

   NO

   Repair or replace the wiring harness between the BTS and the OC module.

3. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative(-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of BTS harness connector and chassis ground(-).

   Specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

   YES

   Go to next stop.

   NO

   Repair the short to battery line circuit on wiring harness between the BTS and the OC module.

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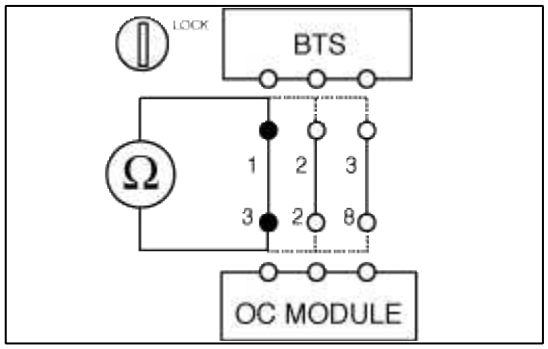
4. CHECK BTS CIRCUIT

(1) Disconnect the negative(-) terminal from the battery and wait for at least 3 minutes.

(2) Measure resistance between the terminal 1 of BTS harness connector and the terminal 3 of OC module harness connector.

(3) Measure resistance between the terminal 2 of BTS harness connector and the terminal 2 of OC module harness connector.

specification(resistanve) : below 1 Ω



(4) Is the measured resistance within specification?

YES

Check Belt Tension Sensor.

NO

Repair or replace the wiring harness between the BTS and the OC module.

5. CHECK THE BELT TENSION SENSOR

(1) Replace the Belt Tension Sensor with a new one.

(2) Connect the BTS connector.

(3) Connect the OC module connector.

(4) Connect the SRSCM connector.

(5) Connect the negative(-) terminal to the battery.

(6) Connect 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 Tension Sensor(BTS)?

YES

Go to next step.

NO

Replace BTS.

6. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1521

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects short or short to battery line on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

DTC Detecting Condition

DTC	Condition	Probable cause
B1521 B1523	• Short between BS and SRSCM • Short to battery line between BS and SRSCM • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Short or short to battery line circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Schematic Diagram

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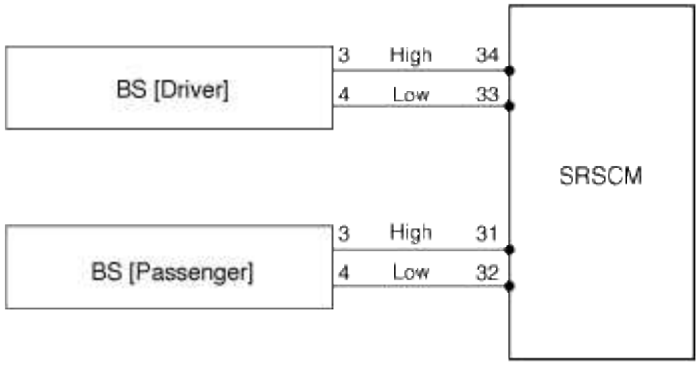
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

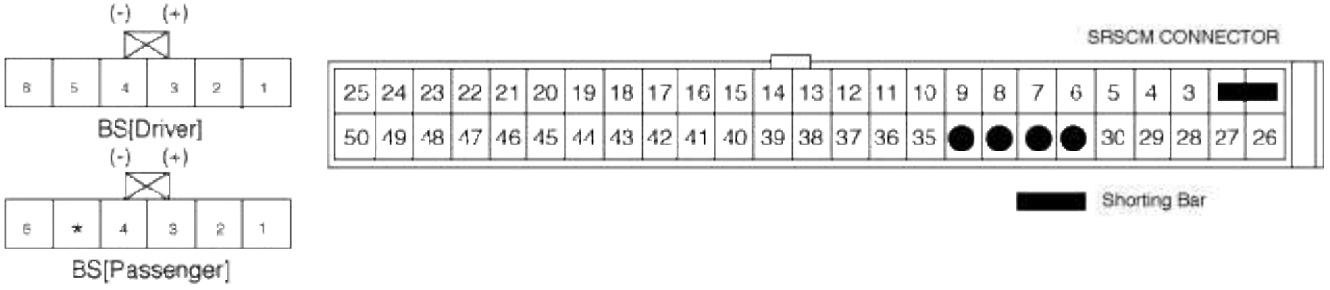
BS [Driver]

Pin	Connected to	Function
3	SRSCM terminal 34	BS High
4	SRSCM terminal 33	BS Low

BS [Passenger]

Pin	Connected to	Function
3	SRSCM terminal 31	BS High
4	SRSCM terminal 32	BS Low

[HARNESS CONNECTORS]



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

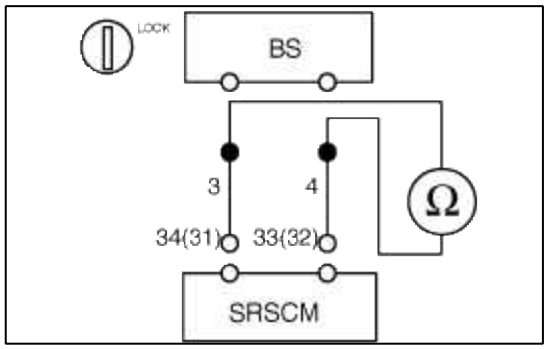
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 3 and 4 of BS harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Go to next step.

NO

Repair or replace the wiring harness between the BS and the SRSCM.

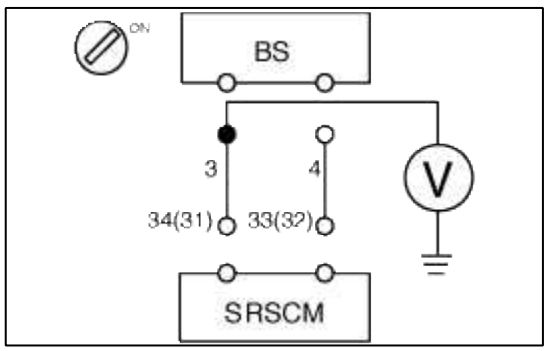
3. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 3 of BS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check the BS.

NO

Repair the short to battery line circuit on wiring harness between the BS and the SRSCM.

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4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
(1) Measure current between the terminal 3 of BS and 34(31) of SRSCM.

Specification(current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

YES
Goto next stop.

NO
Replace the BS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BS Satus	Resistance(R) or Current (mA)	Related DTC(s)
Short to ground	R < 70Ω (low line, BS Buckled)	B1522, B1524
"UNBUCKLED" status	4 < I < 7mA	
"BUCKLED" status	12 < I < 17mA	
Short to battery	R < 600Ω (low line, BS Unbuckled)	B1521, B1523

Restraint > Troubleshooting > B1522

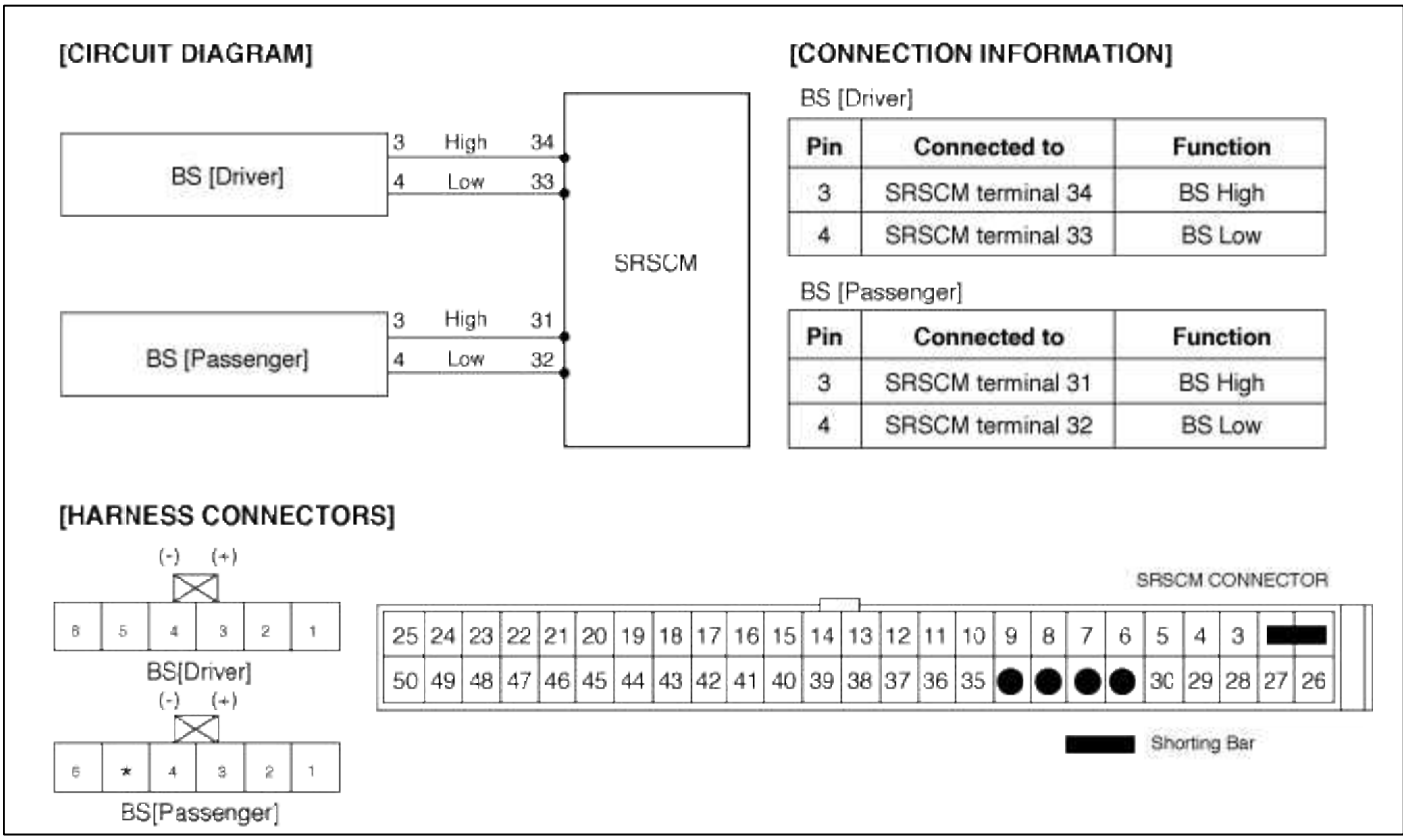
DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects open or short to ground on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

DTC Detecting Condition

DTC	Condition	Probable cause
B1522 B1524	• Open between BS and SRSCM • Short to ground between BS and SRSCM • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Open or short to ground circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

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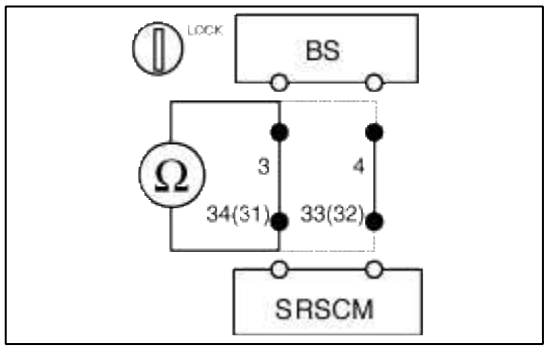
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 3 of BPT harness connector and the terminal 34(31) of SRSCM harness connector.
   (2) Measure resistance between the terminal 4 of BPT harness connector and the terminal 33(32) of SRSCM harness connector.

   specification(resistance) : below 1 Ω



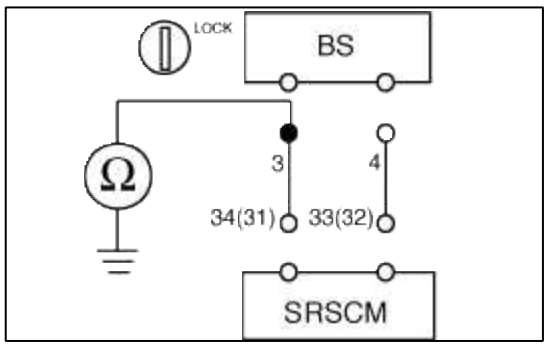
   (3) Is the measured resistance within specification?

   YES
   Check short to ground.

   NO
   Repair the open circuit on wiring harness between the BS and the SRSCM.

3. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 3 of BS harness connector and chassis ground.

   specification(resistance) : infinite



   (2) Is the measured resistance within specification?

   YES
   Check the BS.

   NO
   Repair or replace the wiring harness between the BS and the SRSCM.

4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)

(1) Measure current between the terminal 3 of BS and 34(31) of SRSCM.

Specification(current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

YES

Go to next stop.

NO

Replace the BS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BS Satus	Resistance(R) or Current (mA)	Related DTC(s)
Short to ground	R < 70Ω (low line, BS Buckled)	B1522, B1524
"UNBUCKLED" status	4 < I < 7 mA	
"BUCKLED" status	12 < I < 17 mA	
Short to battery	R < 600Ω (low line, BS Unbuckled)	B1521, B1523

Restraint > Troubleshooting > B1523

DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects short or short to battery line on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

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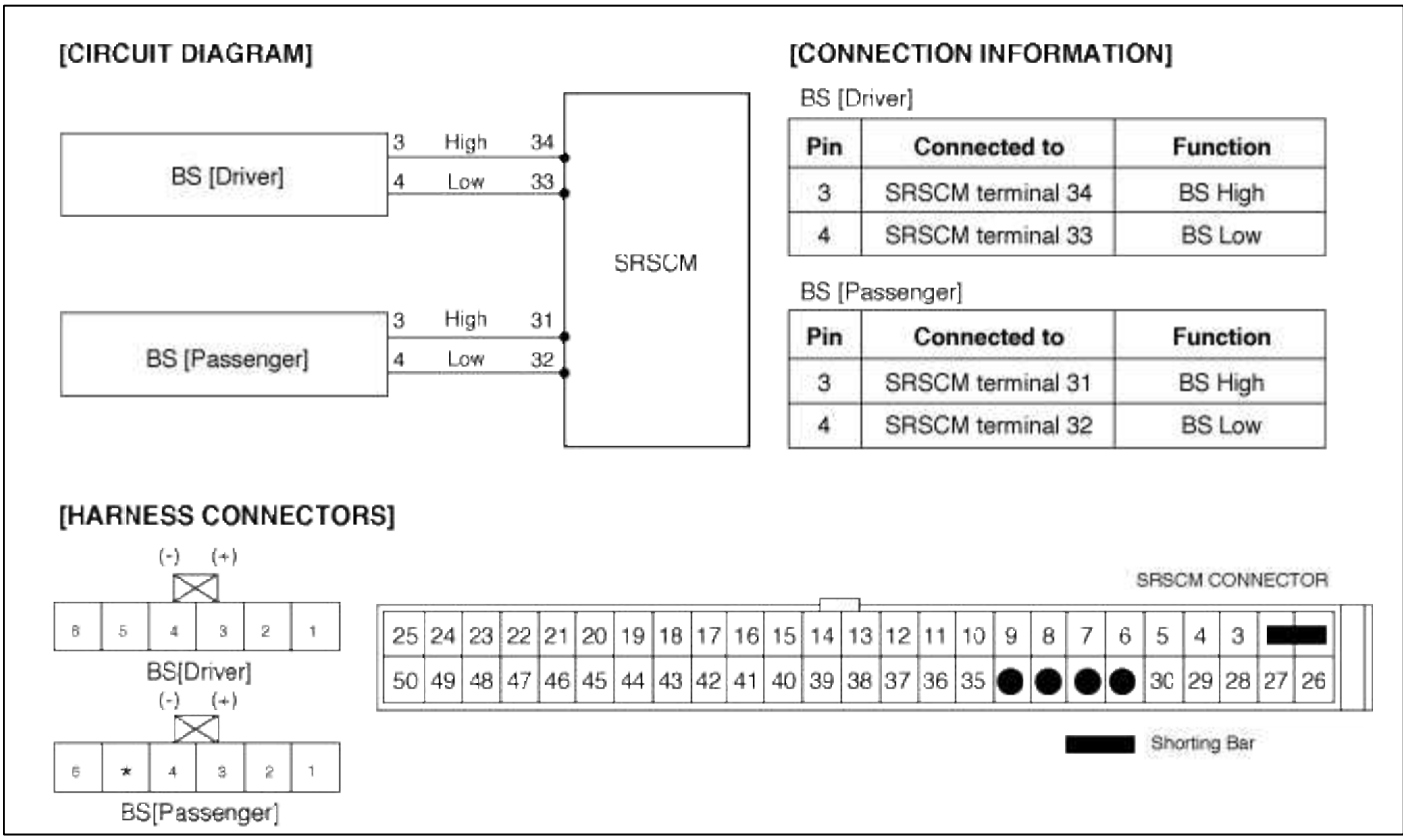
DTC Detecting Condition

DTC	Condition	Probable cause
B1521 B1523	• Short between BS and SRSCM • Short to battery line between BS and SRSCM • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Short or short to battery line circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

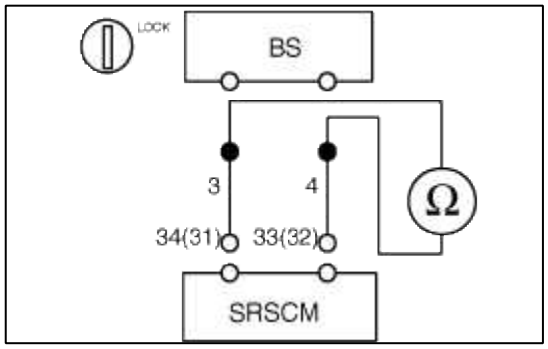
YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT CIRCUIT
   (1) Measure resistance between the terminal 3 and 4 of BS harness connector.

specification(resistance) : infinite



   (2) Is the measured resistance within specification?

YES

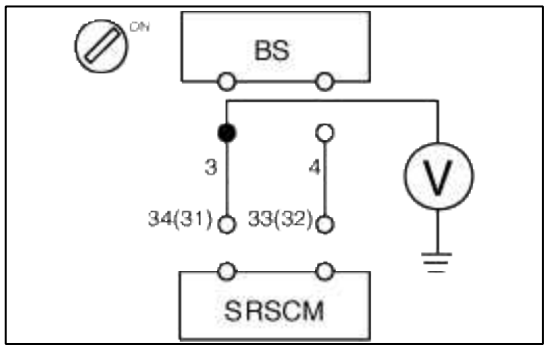
Go to next step.

NO

Repair or replace the wiring harness between the BS and the SRSCM.

3. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 3 of BS harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

YES

Check the BS.

NO

Repair the short to battery line circuit on wiring harness between the BS and the SRSCM.

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4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
(1) Measure current between the terminal 3 of BS and 34(31) of SRSCM.

Specification(current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

YES

Goto next stop.

NO

Replace the BS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BS Satus	Resistance(R) or Current (mA)	Related DTC(s)
Short to ground	R < 70Ω (low line, BS Buckled)	B1522, B1524
"UNBUCKLED" status	4 < I < 7mA	
"BUCKLED" status	12 < I < 17mA	
Short to battery	R < 600Ω (low line, BS Unbuckled)	B1521, B1523

Restraint > Troubleshooting > B1524

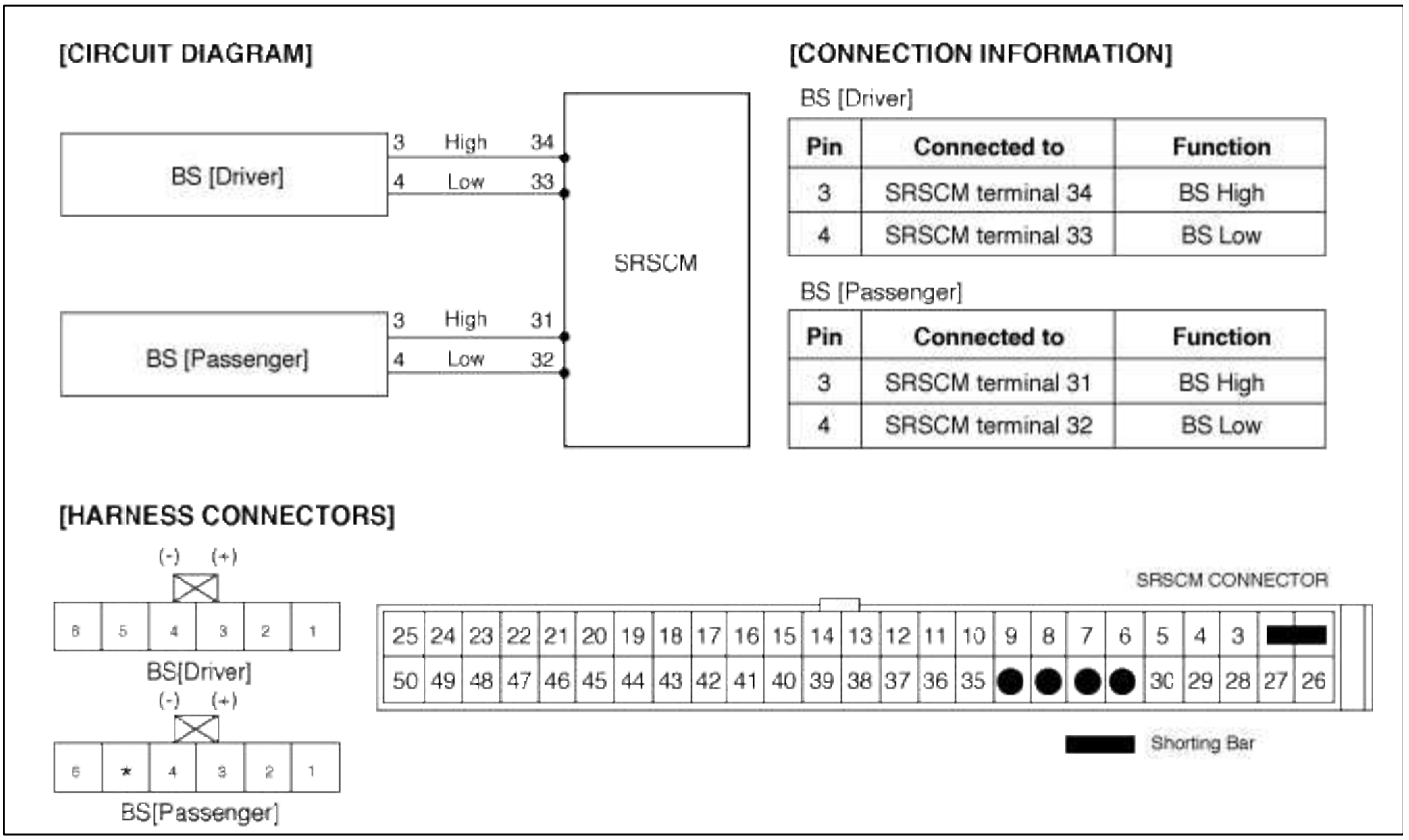
DTC Description

The Seat Belt Buckle Switch (BS) circuit consists of the SRSCM and two BS. The SRSCM sets above DTC(s) if it detects open or short to ground on the BS circuit. This system decides whether the driver or passenger seat belt is locked or not.

DTC Detecting Condition

DTC	Condition	Probable cause
B1522 B1524	• Open between BS and SRSCM • Short to ground between BS and SRSCM • Seat Belt Buckle Switch (BS) Malfunction • SRSCM Malfunction	• Open or short to ground circuit on wiring harness • Seat Belt Buckle Switch (BS) • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

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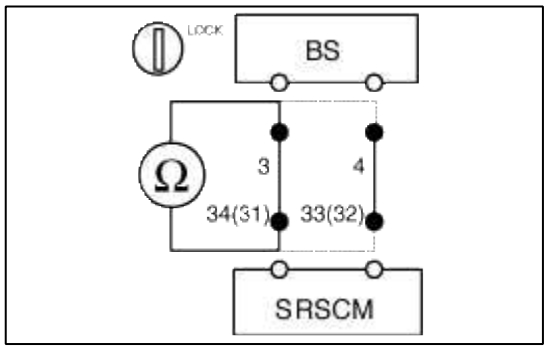
Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK OPEN CIRCUIT
   (1) Measure resistance between the terminal 3 of BPT harness connector and the terminal 34(31) of SRSCM harness connector.
   (2) Measure resistance between the terminal 4 of BPT harness connector and the terminal 33(32) of SRSCM harness connector.

   specification(resistance) : below 1 Ω



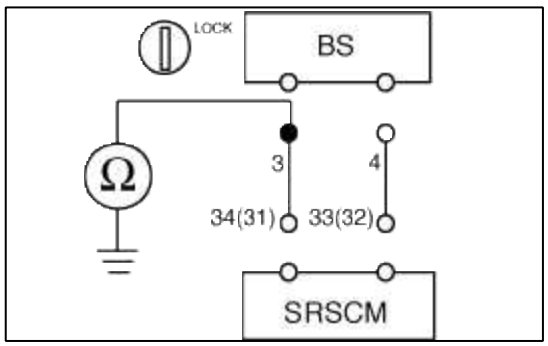
   (3) Is the measured resistance within specification?

   YES
   Check short to ground.

   NO
   Repair the open circuit on wiring harness between the BS and the SRSCM.

3. CHECK SHORT TO GROUND
   (1) Measure resistance between the terminal 3 of BS harness connector and chassis ground.

   specification(resistance) : infinite



   (2) Is the measured resistance within specification?

   YES
   Check the BS.

   NO
   Repair or replace the wiring harness between the BS and the SRSCM.

4. CHECK THE SEAT BELT BUCKLE SWITCH (BS)
(1) Measure current between the terminal 3 of BS and 34(31) of SRSCM.

Specification(current) : 12 ~ 17 mA (Buckled status), 4 ~ 7 mA (Unbuckled status)

(2) Is the measured current within specification?

YES

Go to next stop.

NO

Replace the BS.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BS Satus	Resistance(R) or Current (mA)	Related DTC(s)
Short to ground	R < 70Ω (low line, BS Buckled)	B1522, B1524
"UNBUCKLED" status	4 < I < 7 mA	
"BUCKLED" status	12 < I < 17 mA	
Short to battery	R < 600Ω (low line, BS Unbuckled)	B1521, B1523

Restraint > Troubleshooting > B1620

DTC Description

The SRSCM shall also cyclically monitor the following :
1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.

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3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

Inspection Procedure

The SRSCM must be replaced once the fault codes except B1657 mentioned above are confirmed. Be able to reuse SRSCM 5 times, when B1657 is only monitored.

Restraint > Troubleshooting > B1650

DTC Description

The SRSCM shall also cyclically monitor the following :
1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

Inspection Procedure

The SRSCM must be replaced once the fault codes except B1657 mentioned above are confirmed. Be able to reuse SRSCM 5 times, when B1657 is only monitored.

Restraint > Troubleshooting > B1651

DTC Description

The SRSCM shall also cyclically monitor the following :
1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

Inspection Procedure

The SRSCM must be replaced once the fault codes except B1657 mentioned above are confirmed. Be able to reuse SRSCM 5 times, when B1657 is only monitored.

Restraint > Troubleshooting > B1652

DTC Description

The SRSCM shall also cyclically monitor the following :
1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

Inspection Procedure

The SRSCM must be replaced once the fault codes except B1657 mentioned above are confirmed. Be able to reuse SRSCM 5 times, when B1657 is only monitored.

Restraint > Troubleshooting > B1657

DTC Description

The SRSCM shall also cyclically monitor the following :
1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

Inspection Procedure

The SRSCM must be replaced once the fault codes except B1657 mentioned above are confirmed. Be able to reuse SRSCM 5 times, when B1657 is only monitored.

Restraint > Troubleshooting > B1658

DTC Description

The SRSCM shall also cyclically monitor the following :
1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

Inspection Procedure

The SRSCM must be replaced once the fault codes except B1657 mentioned above are confirmed. Be able to reuse SRSCM 5 times, when B1657 is only monitored.

Restraint > Troubleshooting > B1670

DTC Description

The SRSCM shall also cyclically monitor the following :
1. Functional readliness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safing sensor integtity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of SRSCM components.

Inspection Procedure

The SRSCM must be replaced once the fault codes except B1657 mentioned above are confirmed. Be able to reuse SRSCM 5 times, when B1657 is only monitored.

Restraint > Troubleshooting > B1701

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioners (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

DTC Detecting Condition

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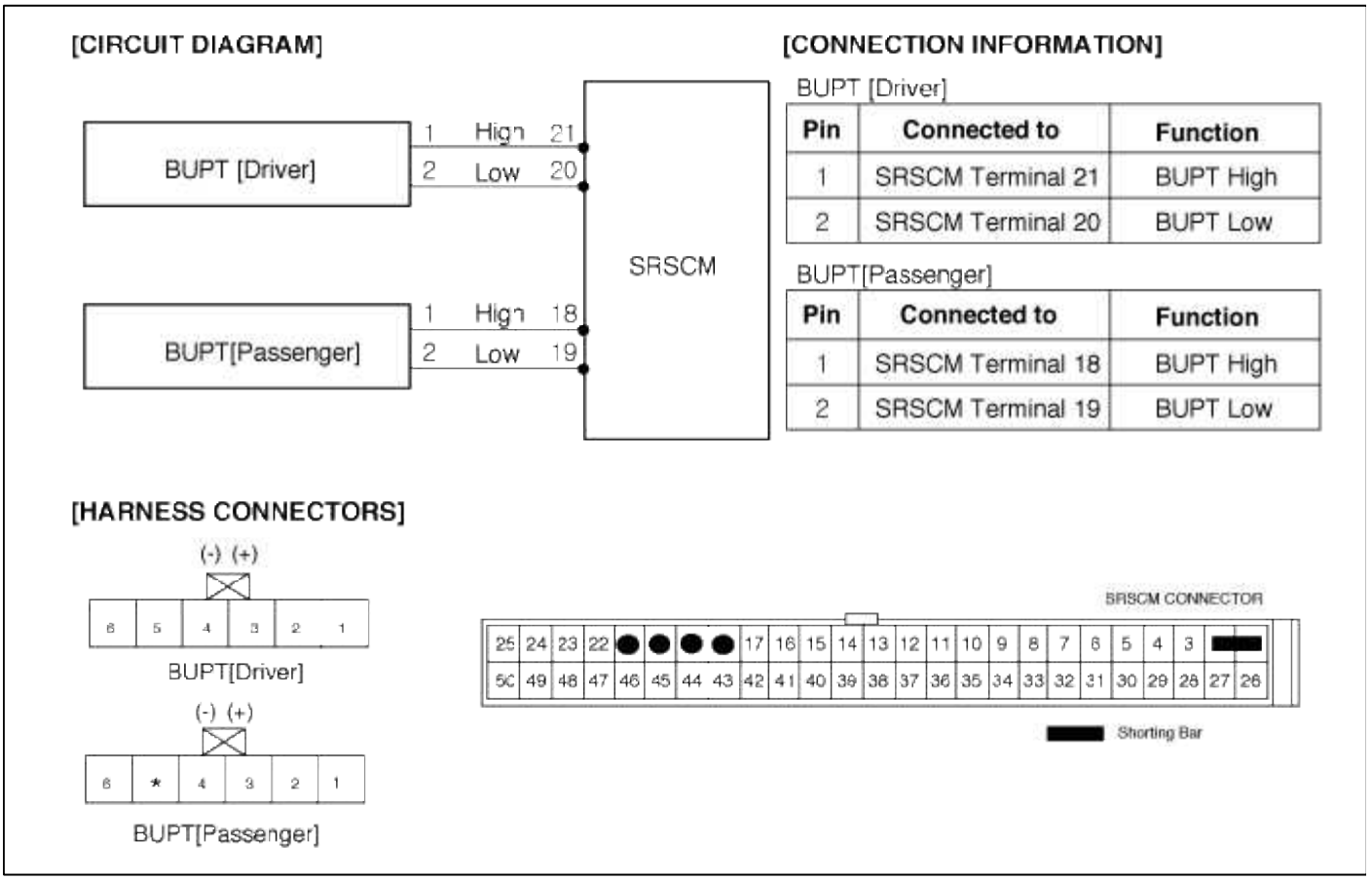
DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK BUPT RESISTANCE

CAUTION

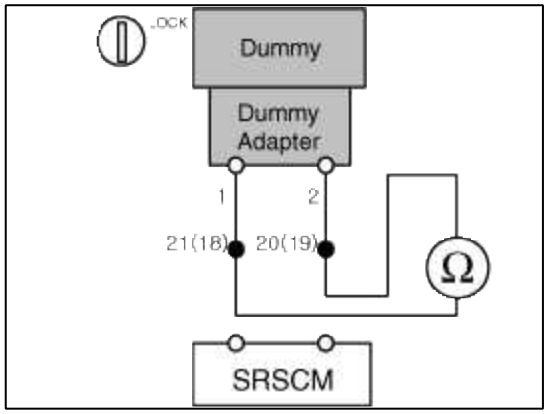
Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT 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 21(18) and 20(19) of SRSCM harness connector.

BUPT resistance : 1.5≤R≤5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Buckle Pretensioner(BUPT) module.

NO

Check open circuit.

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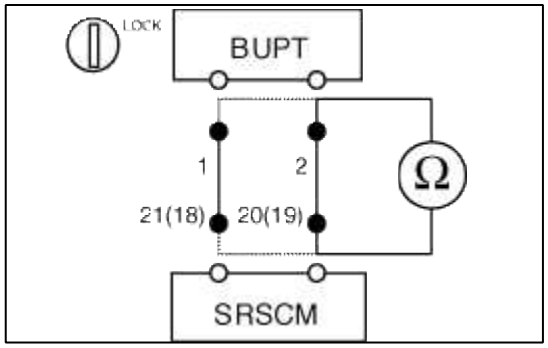
3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 21(18) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(19) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

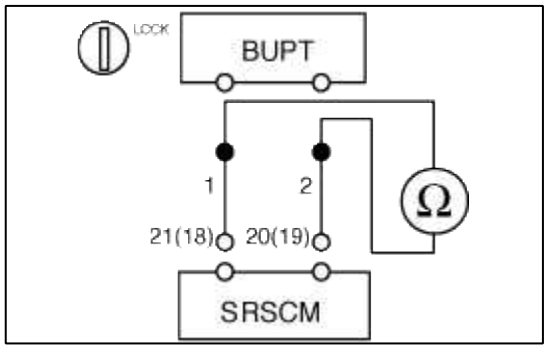
NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Go to next step.

NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BUPT resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1702

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioners (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram

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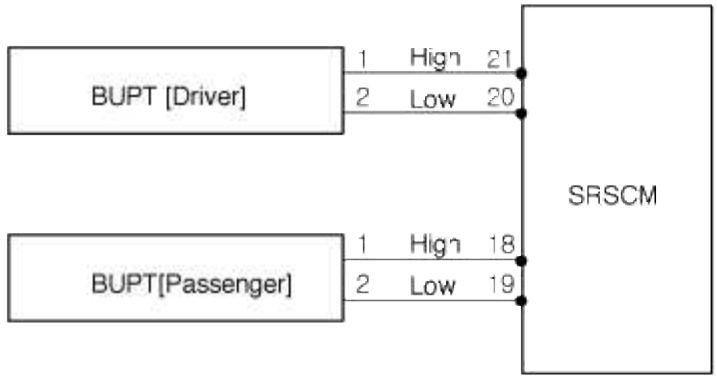
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

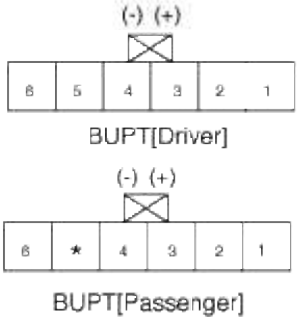
BUPT [Driver]

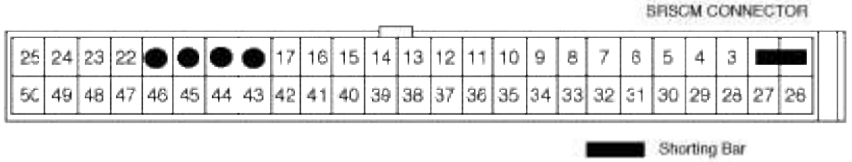
Pin	Connected to	Function
1	SRSCM Terminal 21	BUPT High
2	SRSCM Terminal 20	BUPT Low

BUPT[Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 18	BUPT High
2	SRSCM Terminal 19	BUPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK BUPT RESISTANCE

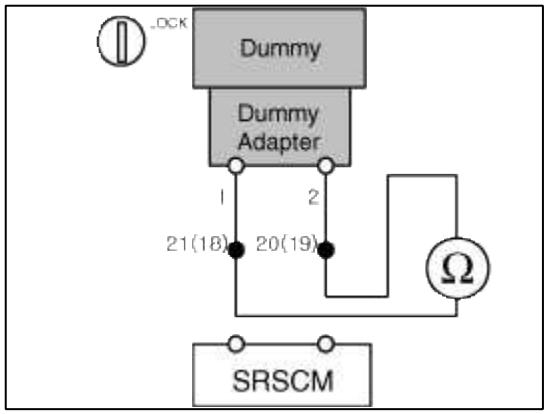
CAUTION

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 BUPT 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 21(18) and 20(19) of SRSCM harness connector.

BUPT resistance : 1.5≤R≤5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Buckle Pretensioner(BUPT) module.

NO

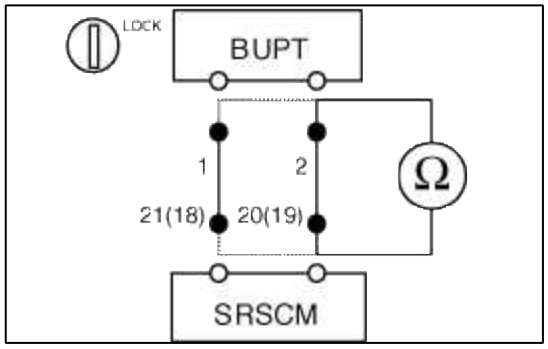
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 21(18) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(19) of SRSCM harness connector.

specification(resistance) : below 1 Ω



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(3) Is the measured resistance within specification?

YES

Check short circuit.

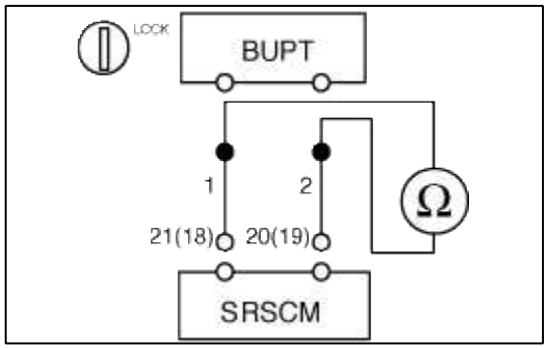
NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Go to next step.

NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BUPT resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1703

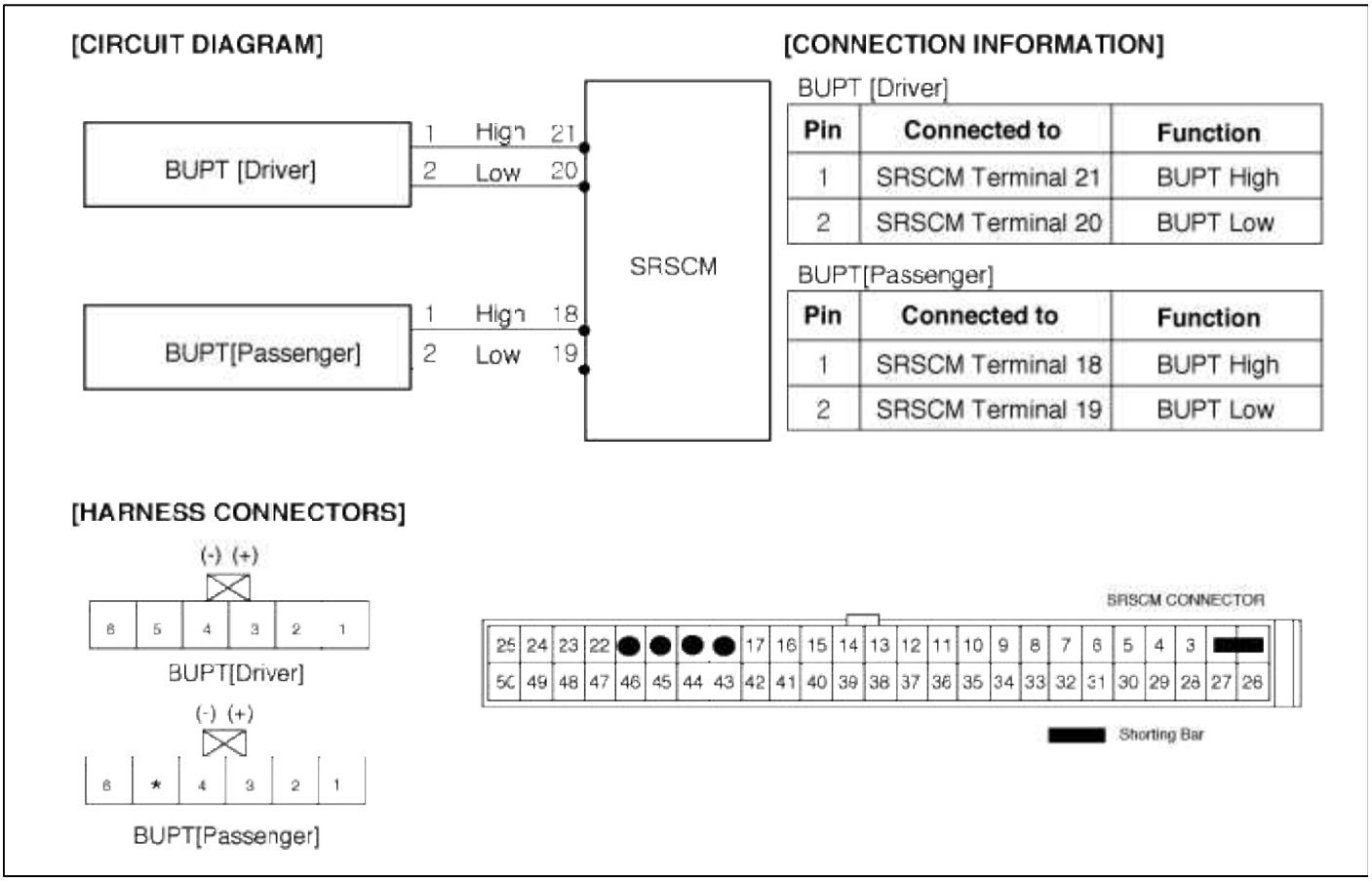
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioners (BUPT). The SRSCM sets above DTC(s) if it detects short to ground on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1703 B1708	• Short to ground between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

1. Visually inspect all connectors related to the affected circuit for damage and secure connection.

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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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

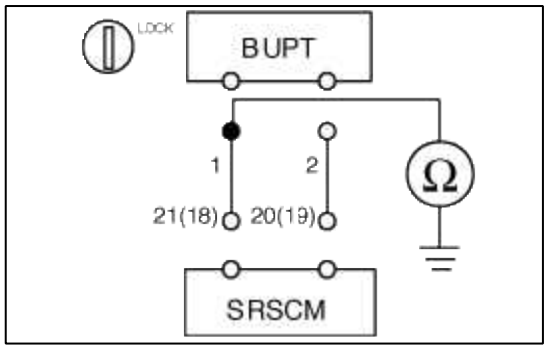
(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of BUPT harness connector and chassis ground.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Check the BUPT Module.

NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE

(1) Replace the Buckle Pretensioner(BUPT) with a new one.

● Refer to "Buckle Pretensioner(BUPT)" 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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 Buckle Pretensioner(BUPT)?

YES

Go to next step.

NO

Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1704

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioners (BUPT). The SRSCM sets above DTC(s) if it detects short to battery on the BUPT circuit.

DTC Detecting Condition

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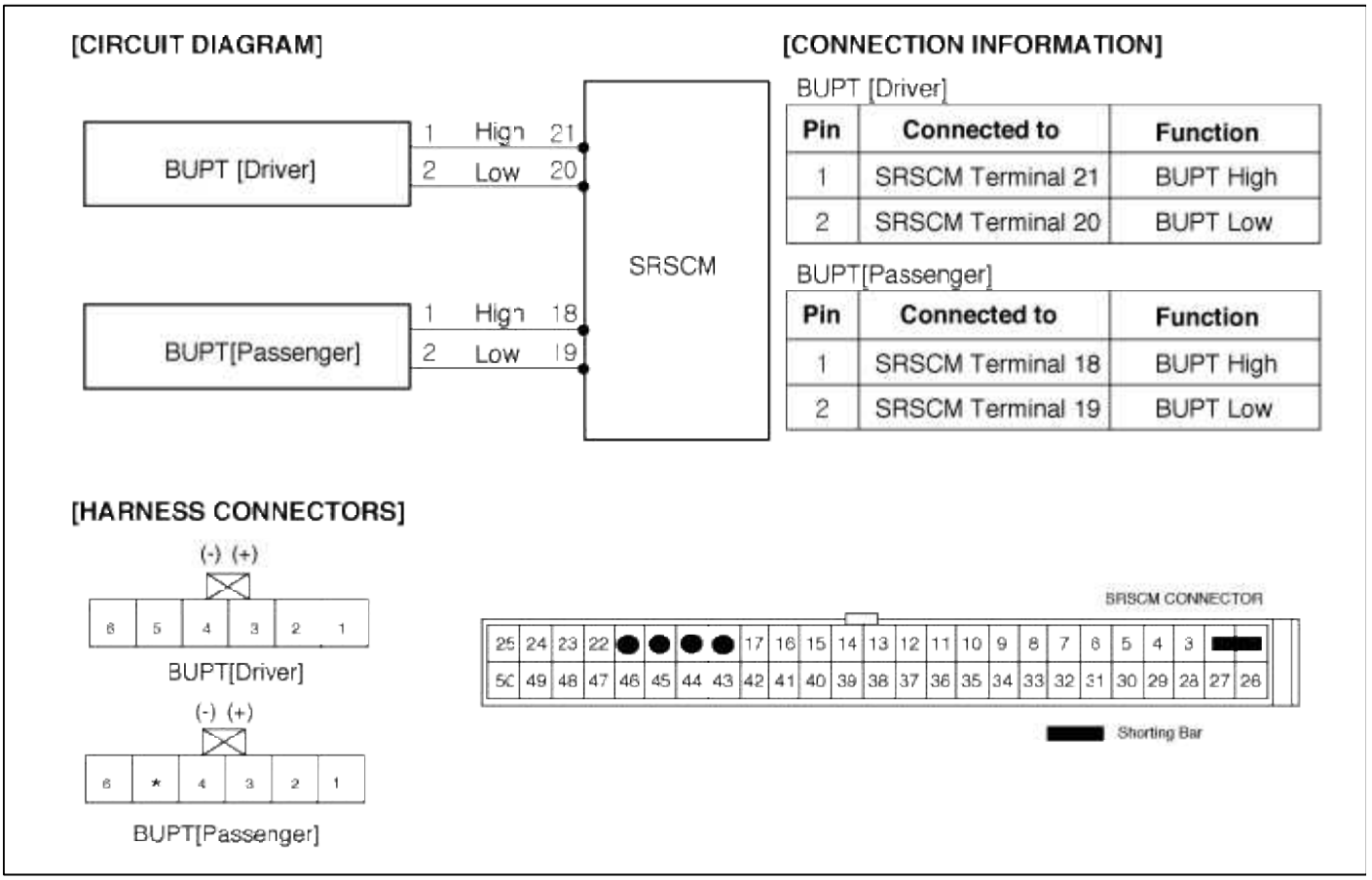
DTC	Condition	Probable cause
B1704 B1709	• Short to battery between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Buckle Pretensioner(BUPT) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

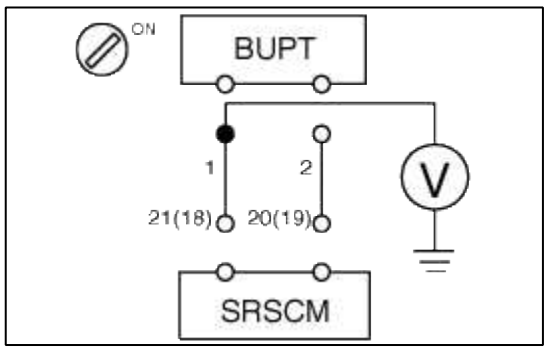
YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK SHORT TO BATTERY LINE
   (1) Connect the negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of BUPT harness connector and chassis ground(-).

   specification(voltage) : Approximately 0 V



   (4) Is the measured voltage within specification?

   YES

   Check the BUPT Module.

   NO

   Repair the short to battery line circuit on wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE
   (1) Replace the Buckle Pretensioner(BUPT) with a new one.
   - Refer to "Buckle Pretensioner(BUPT)" 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, BUPT, FIS and SIS.
   (4) Connect the SRSCM connector.
   (5) Connect the negative (-) terminal to the battery.
   (6) Connect a Hi-Scan(Pro) to the data link connector.
   (7) Connect a Hi-Scan(Pro) to the data link connector.
   Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

   YES

   Go to next step.

   NO

   Replace BUPT module.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1706

DTC Description

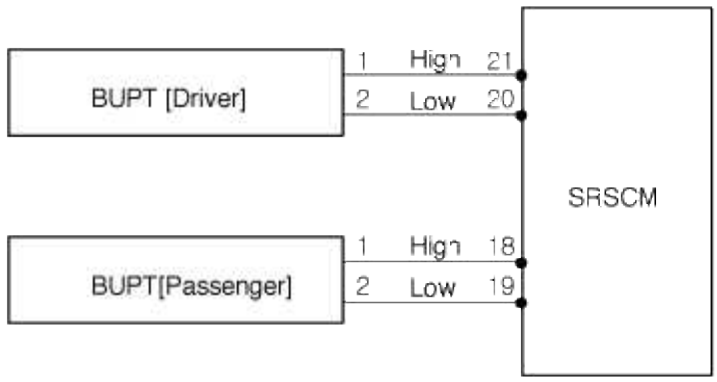
The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioners (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

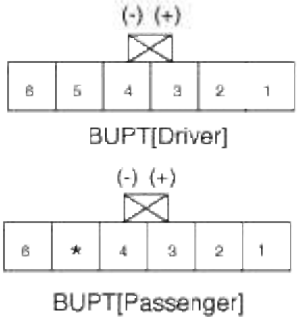
BUPT [Driver]

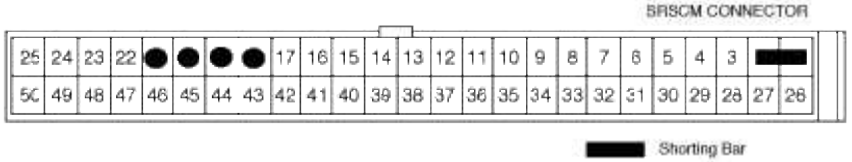
Pin	Connected to	Function
1	SRSCM Terminal 21	BUPT High
2	SRSCM Terminal 20	BUPT Low

BUPT[Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 18	BUPT High
2	SRSCM Terminal 19	BUPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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2. CHECK BUPT RESISTANCE

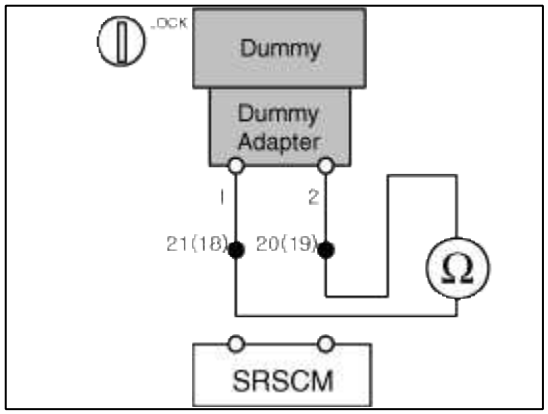
CAUTION

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 BUPT 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 21(18) and 20(19) of SRSCM harness connector.

BUPT resistance : 1.5≤R≤5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Buckle Pretensioner(BUPT) module.

NO

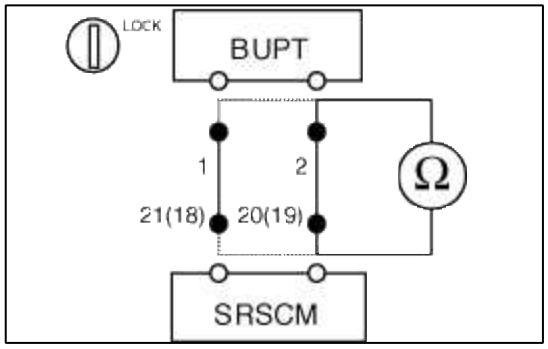
Check open circuit.

3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 21(18) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(19) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

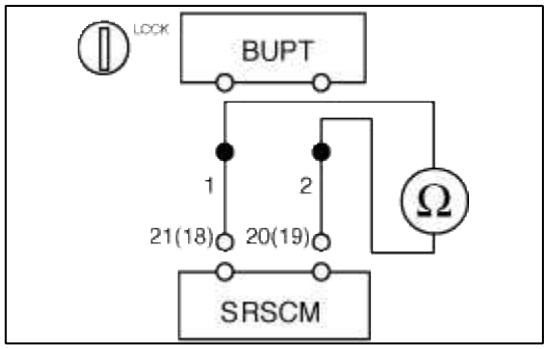
NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Go to next step.

NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BUPT resistance : $1.5 \leq R \leq 5.7\ \Omega$

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Restraint > Troubleshooting > B1707

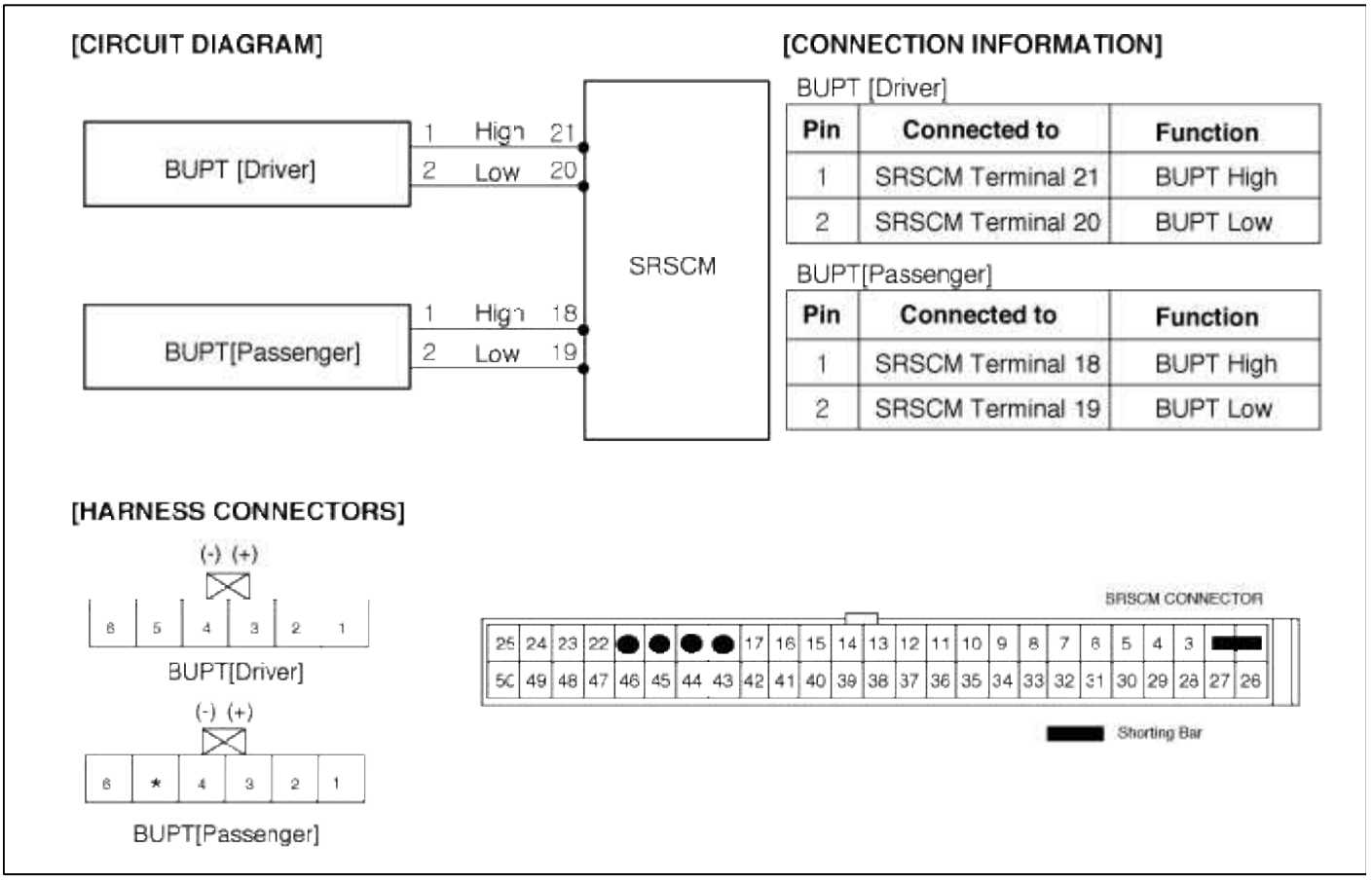
DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioners (BUPT). The SRSCM sets above DTC(s) if it detects that the resistance of BUPT squib is too high or low.

DTC Detecting Condition

DTC	Condition	Probable cause
B1701 B1702 B1706 B1707	• Too high or low resistance between BUPT high(+) and BUPT low (-) • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Open or short circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK BUPT RESISTANCE

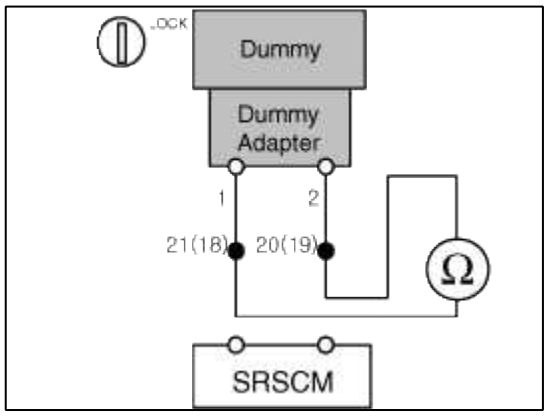
> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module(squib) even if you are using the specified tester.

(1) Connect the Dummy and the Dummy Adapter on BUPT 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 21(18) and 20(19) of SRSCM harness connector.

BUPT resistance : 1.5≤R≤5.7 Ω



(3) Is the measured resistance within specification?

YES

Replace the Buckle Pretensioner(BUPT) module.

NO

Check open circuit.

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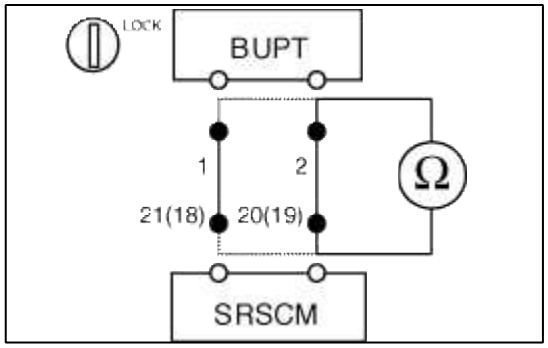
3. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 1 of BUPT harness connector and the terminal 21(18) of SRSCM harness connector.

(2) Measure resistance between the terminal 2 of BUPT harness connector and the terminal 20(19) of SRSCM harness connector.

specification(resistance) : below 1 Ω



(3) Is the measured resistance within specification?

YES

Check short circuit.

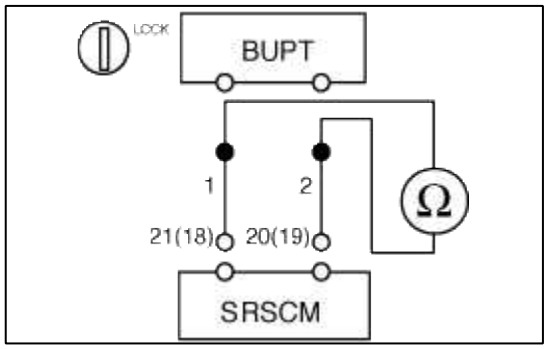
NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

4. CHECK SHORT CIRCUIT

(1) Measure resistance between the terminal 1 and 2 of BUPT harness connector.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Go to next step.

NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

5. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Specification

BUPT resistance : $1.5 \leq R \leq 5.7\ \Omega$

Restraint > Troubleshooting > B1708

DTC Description

The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioners (BUPT). The SRSCM sets above DTC(s) if it detects short to ground on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1703 B1708	• Short to ground between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to ground circuit on wiring harness • Seat Buckle Pretensioner (BUPT) squib • SRSCM

Schematic Diagram

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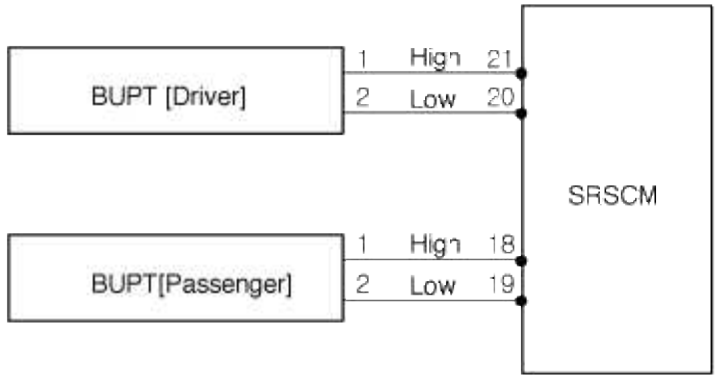
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

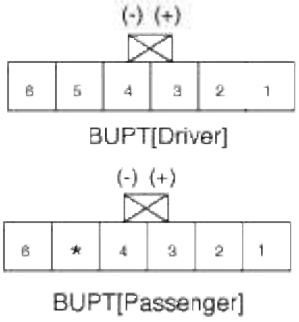
BUPT [Driver]

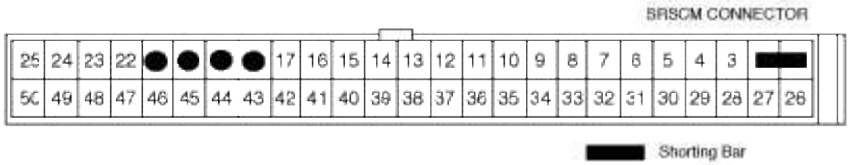
Pin	Connected to	Function
1	SRSCM Terminal 21	BUPT High
2	SRSCM Terminal 20	BUPT Low

BUPT[Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 18	BUPT High
2	SRSCM Terminal 19	BUPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal from the battery and wait for at least 3 minutes.

(3) Remove the DAB module and disconnect the DAB connector.

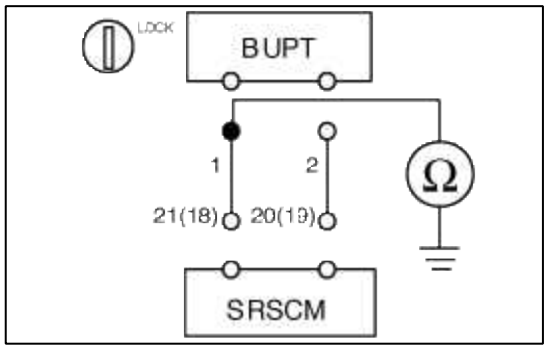
(4) Disconnect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

2. CHECK SHORT TO GROUND

(1) Measure resistance between the terminal 1 of BUPT harness connector and chassis ground.

specification(resistance) : infinite



(2) Is the measured resistance within specification?

YES

Check the BUPT Module.

NO

Repair or replace the wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE

(1) Replace the Buckle Pretensioner(BUPT) with a new one.

● Refer to "Buckle Pretensioner(BUPT)" 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal 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 Buckle Pretensioner(BUPT)?

YES

Go to next step.

NO

Replace BUPT module.

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4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
(1) Install the DAB module and connect the DAB connector.
(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
(3) Connect the SRSCM connector.
(4) Connect the negative (-) terminal 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 vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B1709

DTC Description

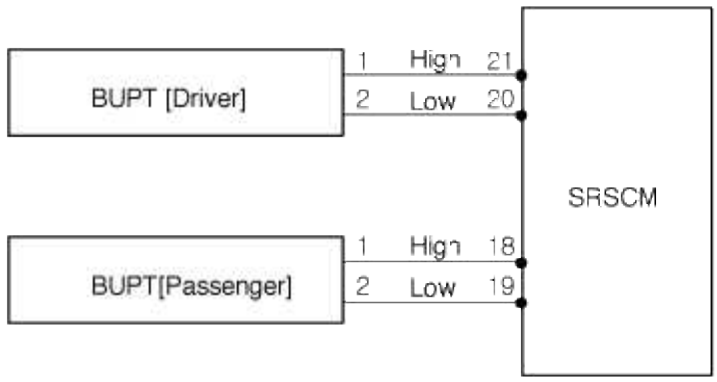
The Buckle Pretensioner circuit consists of the SRSCM and two Buckle Pretensioners (BUPT). The SRSCM sets above DTC(s) if it detects short to battery on the BUPT circuit.

DTC Detecting Condition

DTC	Condition	Probable cause
B1704 B1709	• Short to battery between BUPT and SRSCM • Seat Buckle Pretensioner (BUPT) Malfunction • SRSCM Malfunction	• Short to battery line circuit on wiring harness • Buckle Pretensioner(BUPT) squib • SRSCM

Schematic Diagram

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

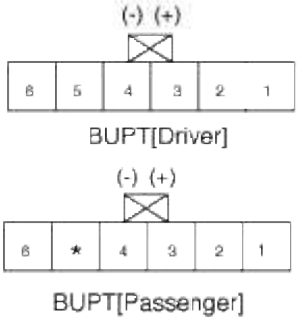
BUPT [Driver]

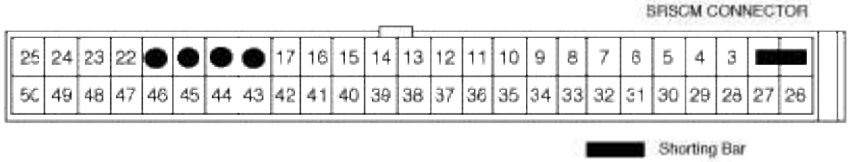
Pin	Connected to	Function
1	SRSCM Terminal 21	BUPT High
2	SRSCM Terminal 20	BUPT Low

BUPT[Passenger]

Pin	Connected to	Function
1	SRSCM Terminal 18	BUPT High
2	SRSCM Terminal 19	BUPT Low

[HARNESS CONNECTORS]





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION

(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.

(5) Disconnect the SRSCM connector.

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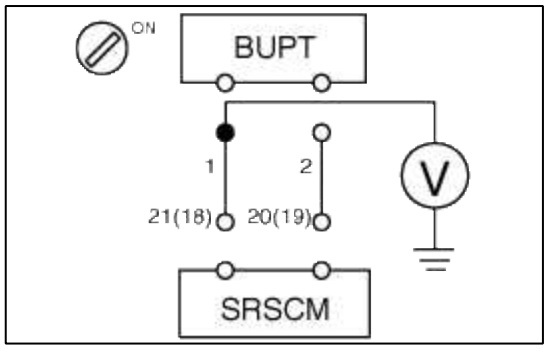
2. CHECK SHORT TO BATTERY LINE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 1 of BUPT harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(4) Is the measured voltage within specification?

YES

Check the BUPT Module.

NO

Repair the short to battery line circuit on wiring harness between the BUPT and the SRSCM.

3. CHECK THE BUPT MODULE

(1) Replace the Buckle Pretensioner(BUPT) with a new one.

- Refer to "Buckle Pretensioner(BUPT)" 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, BUPT, FIS and SIS.

(4) Connect the SRSCM connector.

(5) Connect the negative (-) terminal to the battery.

(6) Connect a Hi-Scan(Pro) to the data link connector.

(7) Connect a Hi-Scan(Pro) to the data link connector.
Does Hi-Scan (Pro) indicate any DTC related to Buckle Pretensioner(BUPT)?

YES

Go to next step.

NO

Replace BUPT module.

4. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN
   (1) Install the DAB module and connect the DAB connector.
   (2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.
   (3) Connect the SRSCM connector.
   (4) Connect the negative (-) terminal 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 vehiclenormally operates with a new SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B2500

DTC Description

The SRS warning lamp is located in the cluster. When the airbag system is normal, the SRS warning lamp flashes for approx. 6 seconds after the ignition switch is turned 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

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

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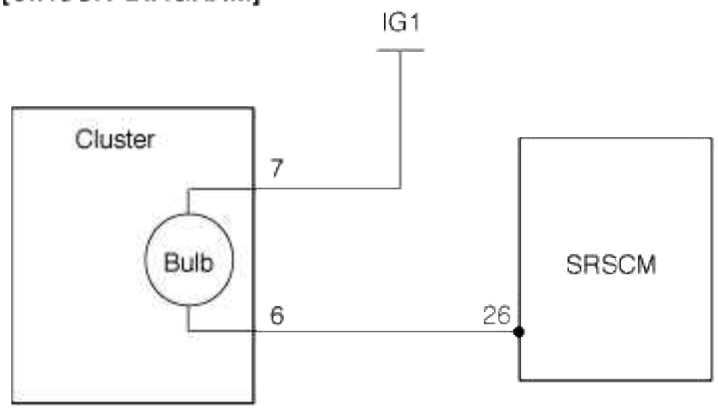
[CIRCUIT DIAGRAM]

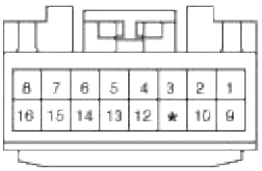


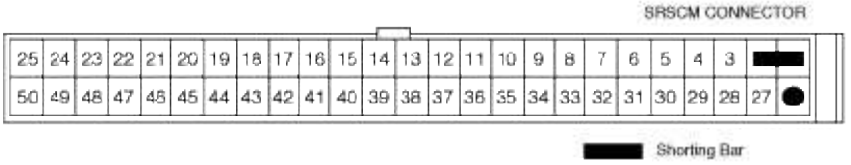
[CONNECTION INFORMATION]

Pin	Connected to	Function
6	SRSCM Terminal 26	Lamp Control
7	IG1	Battery Voltage

[HARNESS CONNECTORS]

Cluster Connector(M06-2)





Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.

2. CHECK THE FUSE

(1) Remove the airbag fuse and the airbag warning lamp fuse from junction block.

(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.

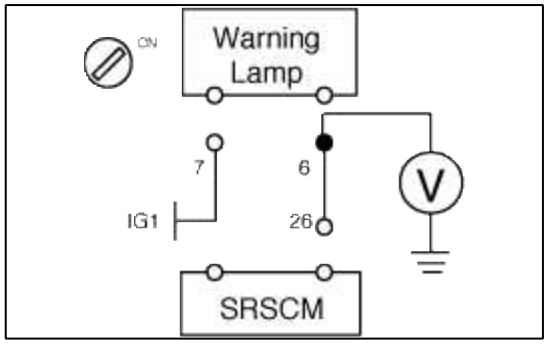
4. CHECK SOURCE VOLTAGE

(1) Connect the negative (-) terminal to the battery.

(2) Turn the ignition switch to ON.

(3) Measure voltage between the terminal 7 of the instrument Cluster harness connector (M06-2) and chassis ground(-).

specification(voltage) : 9 ~ 16.5 V



(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.

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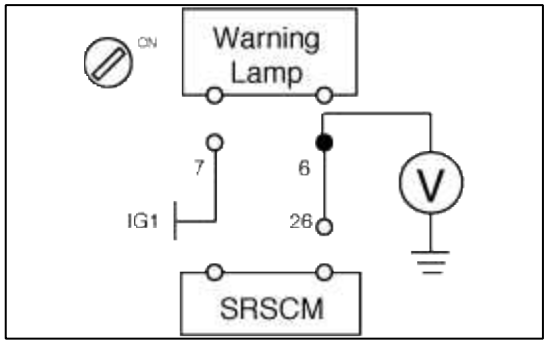
5. CHECK SHORT TO BATTERY LINE

(1) Measure voltage between the terminal 6 of the instrument Cluster harness connector (M06-2) and chassis ground(-).

specification(voltage) : Approximately 0 V



(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

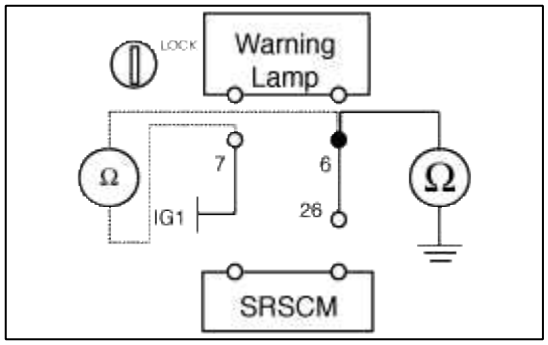
(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative(-) terminal from the battery.

(3) Measure resistance between the terminal 6 of the instrument cluster harness connector (M06-2) and chassis ground.

(4) Measure resistance between the terminal 6 and 7 of the Instrument Cluster harness connector (M06-2).

specification(resistance) : infinite



(5) Is the measured resistance within specification?

YES

Check open circuit.

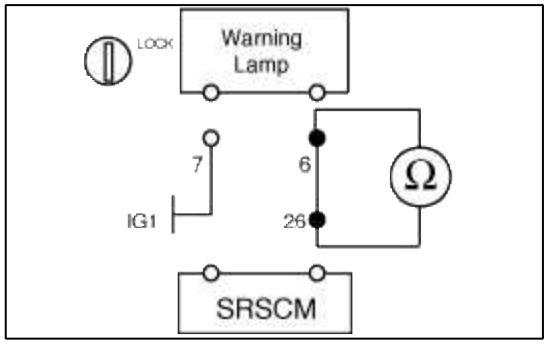
NO

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 6 of the Instrument Cluster connector (M06-2) and the terminal 26 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(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

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

Restraint > Troubleshooting > B2502

DTC Description

The Telltale Lamp circuit consisits of the Telltale Lamp and the SRSCM. SRSCM set the above DTC that the Telltale Lamp failure is detected.

DTC Detecting Condition

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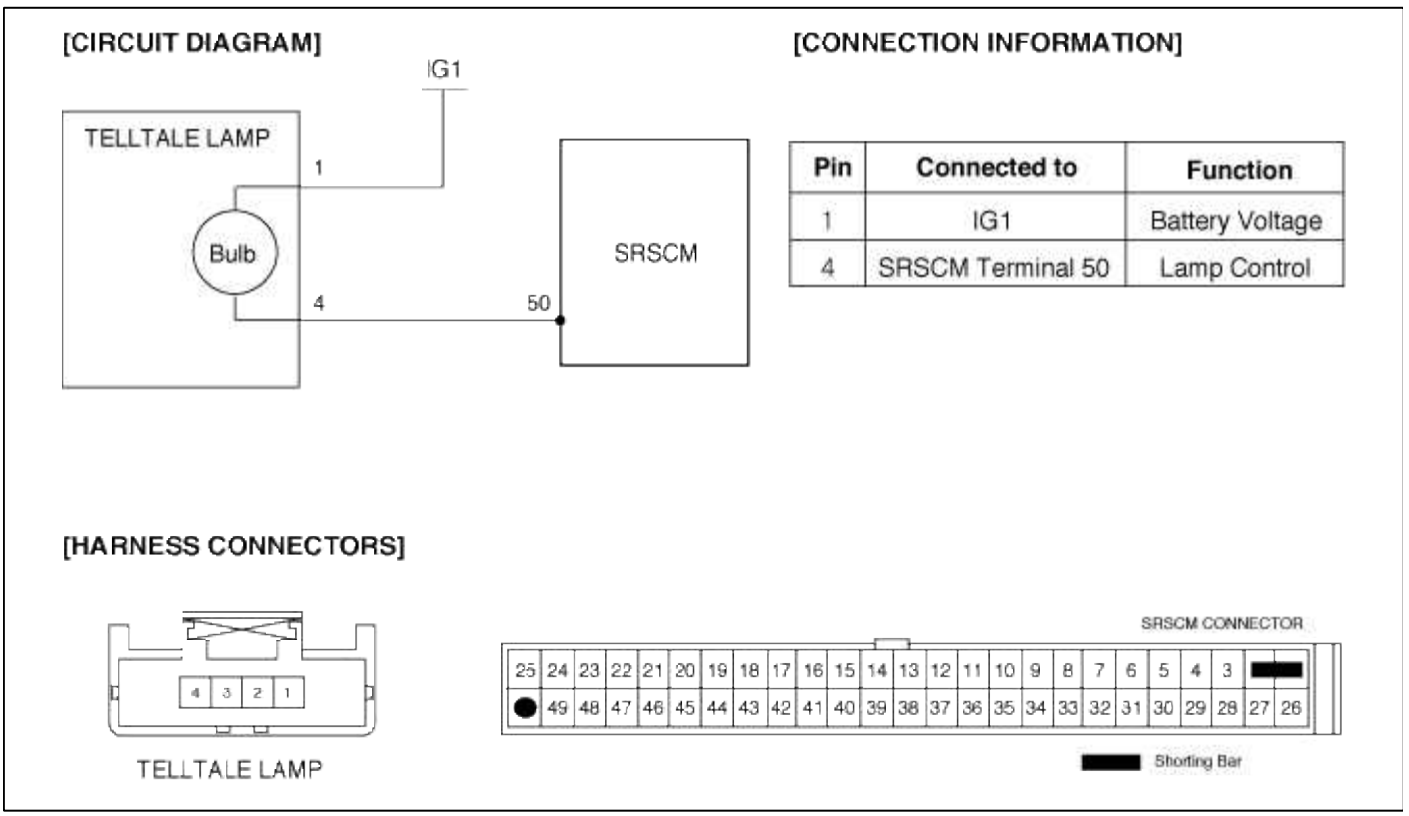
DTC	Condition	Probable cause
B2502	• Airbag fuse • Telltale Lamp Bulb • Open between Telltale Lamp and SRSCM • Short to ground or battery line between the Telltale Lamp and SRSCM • SRSCM Malfunction	• Fuse • Telltale Lamp Bulb • Wiring Harness • SRSCM

Schematic Diagram



Terminal & Connector Inspection

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.

YES

After repairing the trouble part, check whether DTC occurs or not.

Inspection Procedure

1. PREPARATION
   (1) Turn the ignition switch to LOCK.
   (2) Disconnect the negative (-) terminal 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, BUPT, FIS and SIS.
   (5) Disconnect the SRSCM connector.
2. CHECK THE FUSE
   (1) Remove the airbag fuse and the airbag telltale lamp fuse from junction block.
   (2) Inspect the fuses. Are the fuses normal?

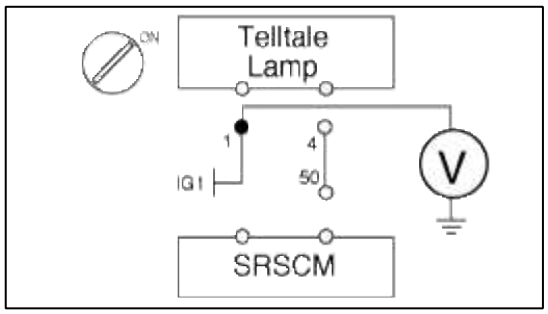
   YES
   Check the telltale lamp bulb.

   NO
   Repair or replace the fuses.
3. CHECK THE TELLTALE 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 negative (-) terminal to the battery.
   (2) Turn the ignition switch to ON.
   (3) Measure voltage between the terminal 1 of the Telltale Lamp harness connector and chassis ground(-).

   specification(voltage) : 9 ~ 16.5 V



   (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 Telltale Lamp.

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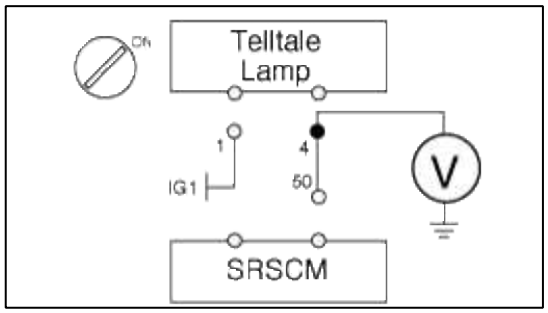
5. CHECK SHORT TO BATTERY LINE

(1) Measure voltage between the terminal 4 of the Telltale Lamp harness connector and chassis ground(-).

specification(voltage) : Approximately 0 V



(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 Telltale Lamp.

6. CHECK SHORT OR SHORT TO GROUND

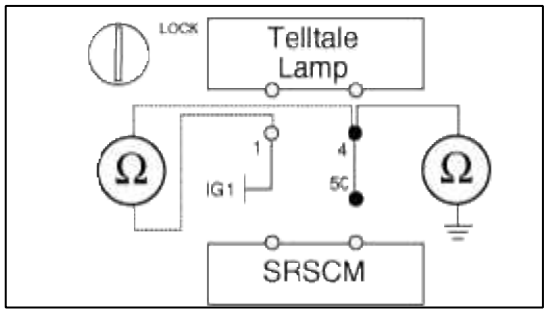
(1) Turn the ignition switch to LOCK.

(2) Disconnect the negative(-) terminal from the battery.

(3) Measure resistance between the terminal 4 of the Telltale Lamp harness connector and chassis ground.

(4) Measure resistance between the terminal 1 and 4 of the Telltale Lamp harness connector.

specification(resistance) : infinite



(5) Is the measured resistance within specification?

YES

Check open circuit.

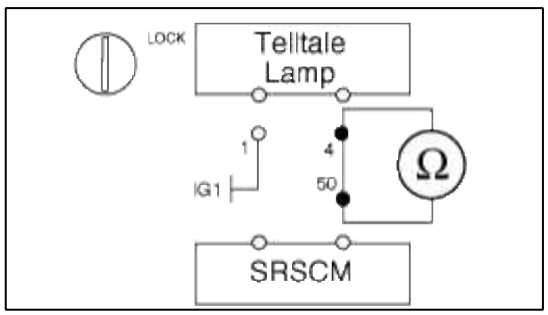
NO

Repair the short or short to ground circuit on wiring harness between the SRSCM and the Telltale Lamp.

7. CHECK OPEN CIRCUIT

(1) Measure resistance between the terminal 4 of the Telltale Lamp harness connector and the terminal 50 of SRSCM harness connector.

specification(resistance) : below 1 Ω



(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 Telltale Lamp.

8. CLEAR THE DTC AND CHECK THE VEHICLE AGAIN

(1) Install the DAB module and connect the DAB connector.

(2) Connect the connectors of the PAB, SAB, CAB, BPT, BUPT, FIS and SIS.

(3) Connect the SRSCM connector.

(4) Connect the negative (-) terminal 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 SRSCM, the fault may be the SRSCM(Replace SRSCM).

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SPORTAGE(KM) > 2007 > G 2.0 DOHC > Steering System

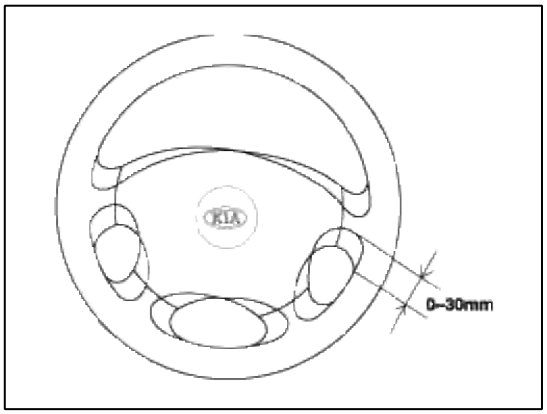
Steering System > General Information > General Information

GENERAL

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 :
Steering wheel free play : 0 ~ 30 mm (0 ~ 1.1 in)

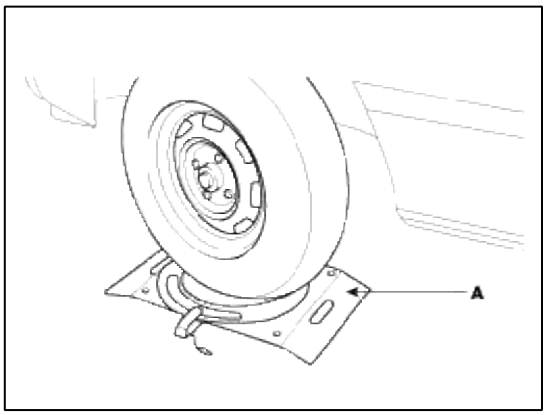


3. If the play exceeds the standard value, inspect the connection between the steering shaft and tie rod ends.

CHECKING STEERING ANGLE

1. Place the front wheel on a turning radius gauge and measure the steering angle.

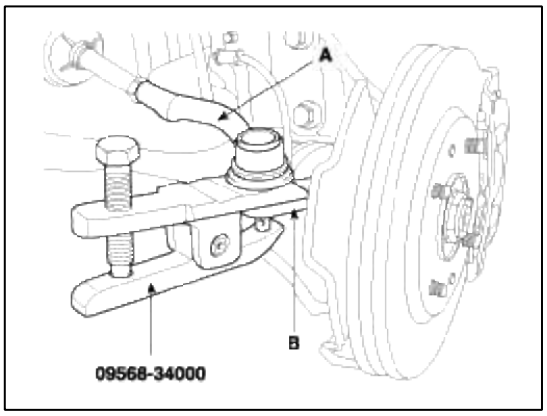
Standard value :
Wheel angle
Inner wheel : 36.77° ± 1°30'
Outer wheel : 31.8°



2. If the measured value is not within the standard value, adjust the linkage.

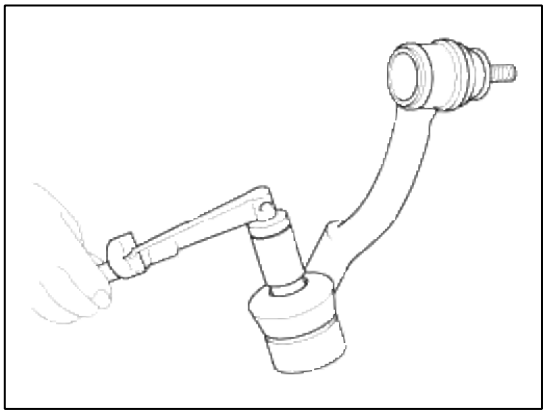
CHECKING THE TIE ROD END BALL JOINT STARTING TORQUE

1. Disconnect the tie rod(A) and knuckle(B) by using the special tool (09568-34000).



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, 0.36~1.78 lb-ft)



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 nece ssary.

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).

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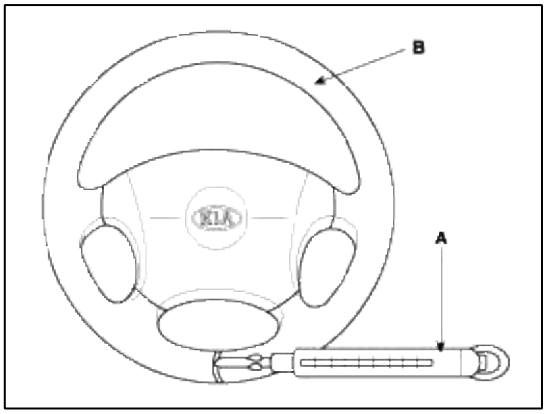
3. Measure the turning force with a spring scale(A) by turning the steering wheel(B) clockwise and counterclockwise one and a quarter turns.

Standard value :
Stationary steering effort :
29 N (3.0 kg, 6.5lbs) or less



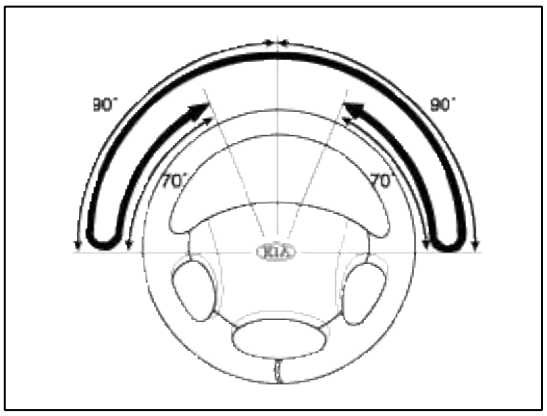
4. Check that there is no sudden change of force while turning the steering wheel.
5. If the stationary steering effort is excessive, check and adjust the following points.
   (1) Damage or cracks on the dust cover of the lower arm ball joint and tie rod end.
   (2) Pinion preload of the steering gear 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 the steering wheel and the wheel return 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 70° or more.

NOTE

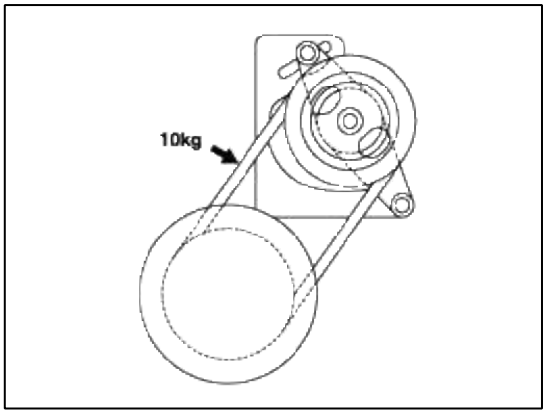
If the steering wheel is turned very quickly, steering may be momentarily difficult. This is not a malfunction because the oil pump output will be somewhatdecreased.



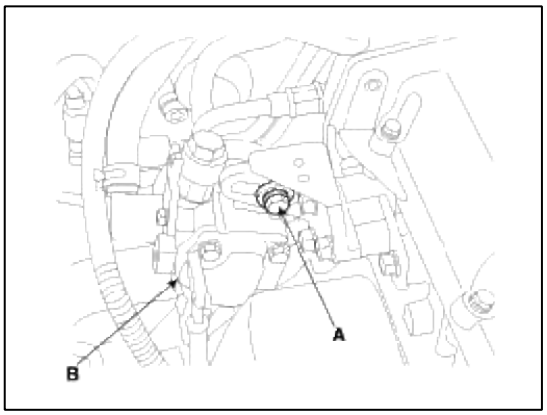
CHECKING POWER STEERING BELT TENSION

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 standardvalue.

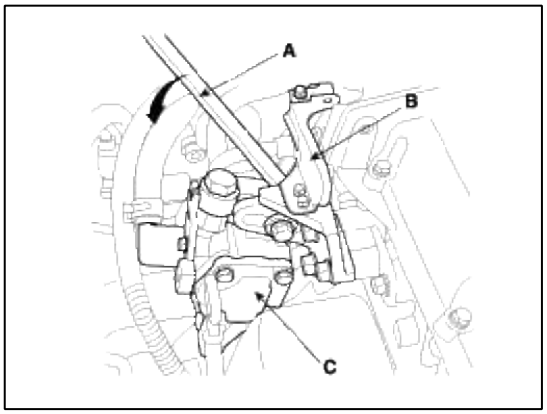
Standard value :
New belt : 8.8 ~ 11.0 mm
Used belt : 12.5 ~ 14.3 mm



2. If the belt deflection is beyond the standard value, adjust the belt tension as follows.
   (1) Loosen the adjusting bolt(A) and the bolt hinged(B).



   (2) Put a bar(A) or equivalent, between the bracket(B) and the oil pump(C) and adjust the tension so that the belt deflection is within the standard value.



   (3) Tighten the adjusting bolt(A) and the bolt hinged(B).

Tightening torque :
35 ~ 50 Nm (3.5 ~ 5.0 kgf·m, 25.3 ~ 37 lb-ft)

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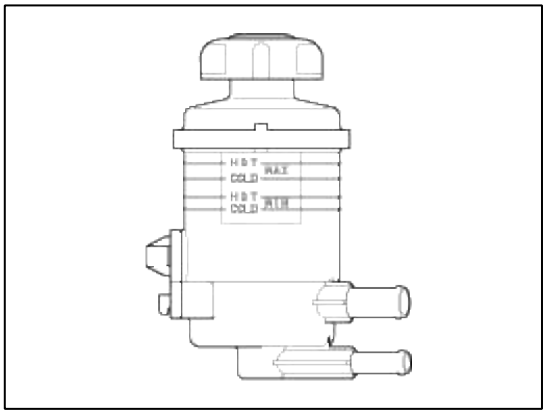
(4) Check the belt deflection and adjust it again if necessary.

> CAUTION
>
> After turning the V belt in the no rmal rotation direction more than once, recheck the belt deflection.

CHECKING POWER STEERING FLUID LEVEL

1. Position the vehicle on a level surface.
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.



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 cl ip.
6. Fill the power steering fluid reservoir with the specified fluid.

PSF-3 : 0.8~0.9 lit.

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.

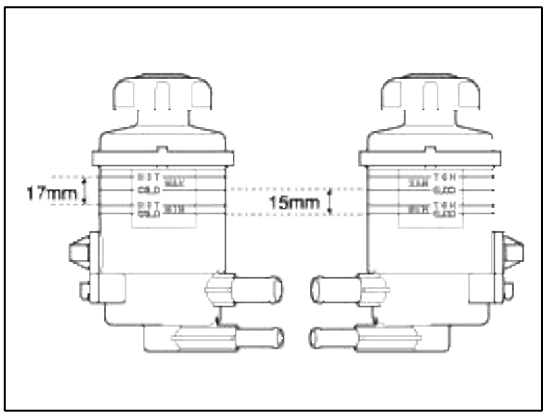
> NOTE
>
> 1. When bleeding fluid, replenish with the fluid so that the level does not fall below the bottom of the filter.
> 2. Perform air bleeding only while cranking to avoid excessive fluid aeration.

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 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.



OIL PUMP PRESSURE TEST

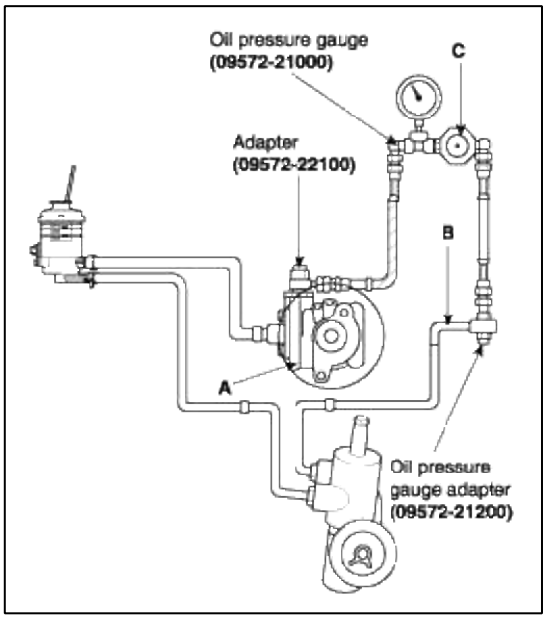
1. Disconnect the pressure hose(B) from the pump(A). Connect the special tool between the pump and the pressure hose as illustrated.
2. Bleed the air, and then start the engine and turn the steering wheel several times, measure the fluid temperature by Temperature gauge so that the fluid temperature 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 :
2.0(I4), 2.7(V6) :
8.6 ~ 9.1 MPa (88 ~ 93 kg.cm², 1251 ~ 1322 psi)

> CAUTION
>
> Do not keep the shut-off valve on the pressure gauge closed for more than ten seconds.

5. Remove the special tools, and tighten the pressure hose(B) against the oil pump (A) using the specified torque.

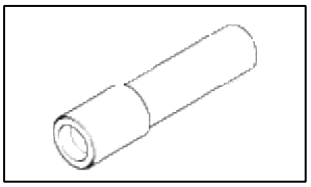
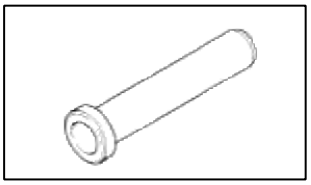
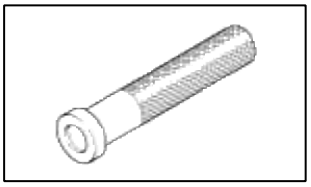
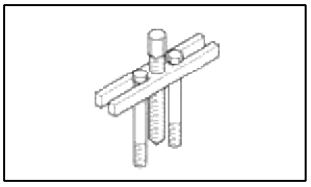
Tightening torque :
55 ~ 65 Nm (5.5 ~ 6.5 kgf·m, 39.7 ~ 47 lb-ft)

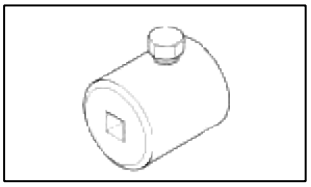
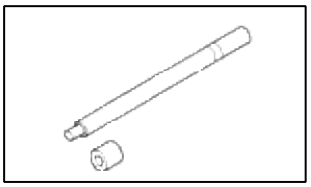
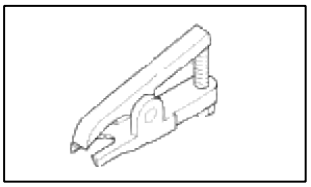
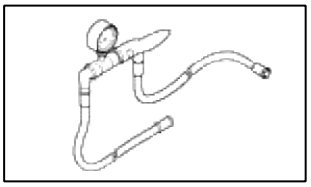
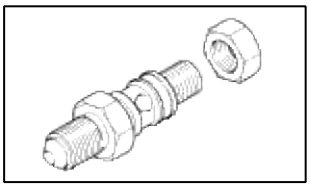
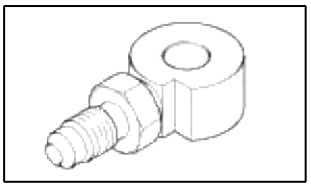
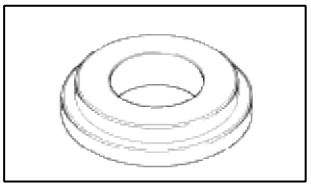
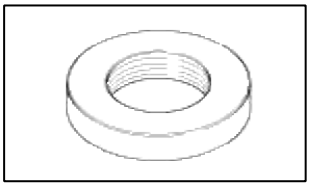
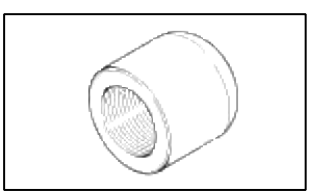


6. Air bleed the system. (see page ST-10)

Steering System > General Information > Special Service Tools

SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
09222-32100 Valve stem oil seal installer		Installing the pinion gear bearing
09432-21600 Bearing installer		Installing the pinion gear bearing
09434-14200 Counter shaft bearing installer		Installing the gear box oil seal.
09561-11002 Steering wheel puller		Removing the steering wheel.

09565-11100 Prelo ad socket		Measuring the mainshaft preload.
09555-21000 Bar		Removing & installing the oil seal.
09568-34000 Ball joint puller		Separating the tie rod end ball joint.
09572-21000 Oil pressure gauge		Measuring the power steering oil pressure (use with 09572-21200, 09572-22100)
09572-21200 Oil pressure gauge adapter		Measuring the power steering oil pressure (use with 09572-21000, 09572-22100)
09572-22100 Oil pressure gauge adapter		Measuring the power steering oil pressure (use with 09572-21000, 09572-21200)
09573-21000 Oil seal installer gauge		Installing the back-up washer and oil seal. (use with 09573-21100, 09573-21200, 09517-11000, 09555-21000)
09573-21100 Oil seal installer		Installing the back-up washer and oil seal. (use with 09573-21000, 09573-21200, 09555-21000)
09573-21200 Oil seal guide		1. Removing the gear box oil seal and back washer (use with 09573-21000) 2. Installing the gear box oil seal and back washer (use with 09555-21000, 09573-21000)

Steering System > General Information > Troubleshooting

TROUBLESHOOTING

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Symptom	Probable cause	Remedy
Excessive play in steering	Loose yoke plug Loose steering gear mounting bolts Loose or worn tie rod end	Retighten Retighten Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	V-belt slippage Damaged V-belt Low fluid level Air in the fluid Twisted or damaged hoses Insufficient oil pump pressure Sticky flow control valve Excessive internal oil pump leakage Excessive oil leaks from rack and pinion in gear box Distorted or damaged gear box or valve body seals	 Readjust Replace Replenish Bleed air Correct the routing or replace Repair or replace the oil pump Replace Replace the damaged parts Replace the damaged parts Replace
Steering wheel does not return properly	Ex cessive turning resistance of tierod end Yoke plug excessively tight Tie rod and/or ball joint cannot turn smoothly Loose mounting of gear box mounting bracket Worn steering shaft joint and/or body grommet Distorted rack Damaged pinion bearing Twisted or damaged hoses Damaged oil pressure control valve Damaged oil pump input shaft bearing	Replace Adjust Replace Retighten Correct or replace Replace Replace Reposition or replace Replace 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 Loose gear box bracket Loose tie rod end and/or ball joint Worn tie rod and/or ball joint	Reposition Retighten Retighten Replace
Noise in the oil pump	Low fluid level Air in the fluid Loose pump mounting bolts	Replenish Bleed air Retighten

Steering System > General Information > Specifications

SPECIFICATIONS

Items	Specifications
Steering gear type	Rack and pinion
Rack stroke	140 ± 1 mm (lock to lock : 3.06 turns)
Power steering pump type	Vane type
Oil pump displacement	
2.0(I4)	9.6cc/rev. MAX. (0.59 in³/rev. MAX)
2.7(V6)	10.5cc/rev. MAX. (0.64 in³/rev. MAX)

SERVICE STANDARD

Items	Specifications
Steering wheel free play	0 ~ 30 mm (0 ~ 1.1 in)
Steering angle	36.77° ± 1°30′
Inner wheel	31.8°
Outer wheel	29 N (3.0 kg, 6.5 lbs) or less
Stationary steering effort	
Belt deflection [under 98N (10kg, 22lb) force]	8.8 ~ 11.0 mm
New belt	12.5 ~ 14.3 mm
Used belt	
Oil pump relief pressure	8.6 ~ 9.1 MPa (88 ~ 93 kg/cm², 1251 ~ 1322 psi)
2.0 (I4), 2.7 (V6)	0.6 ~ 1.3 Nm (0.06 ~ 0.13 kgf·m, 5.2 ~ 11.3 lb-in)
Total pinion preload	2 ~ 5 Nm (0.2 ~ 0.5 kgf·m, 1.4 ~ 3.6 lb-ft)
Tie rod swing resistance	0.5 ~ 2.5 Nm (0.05 ~ 0.25 kgf·m, 0.36 ~ 1.78 lb-ft)
Ball joint starting torque	

TIGHTENING TORQUE

Item	Nm	kgf·m	lb-ft
Power steering column and shaft			
Steering column and shaft mounting bolt	13 ~ 18	1.3 ~ 1.8	9.6 ~ 13.3
Power steering wheel lock nut	40 ~ 50	4.0 ~ 5.0	28.9 ~ 36.1
Pinion gear and joint assembly	15 ~ 20	1.5 ~ 2	10.8 ~ 14.8
Steering column shaft and universal joint assembly	15 ~ 20	1.5 ~ 2	10.8 ~ 14.8
Power steering gear box			
Gear box mounting bolt	60 ~ 80	6 ~ 8	44 ~ 59
Tie rod end ball joint and knuckle arm mounting nut	45 ~ 60	4.5 ~ 6	32.5 ~ 43.4
Feed tube to gear box	10 ~ 16	1 ~ 1.6	7.4 ~ 11.8
Gear box to valve body	20 ~ 30	2 ~ 3	14.8 ~ 21.7
Yoke plug lock nut	50 ~ 70	5 ~ 7	37 ~ 50
Power steering oil pump			
Pressure hose to oil pump	55 ~ 65	5.5 ~ 6.5	39.7 ~ 47
Oil pump adjusting bolt	35 ~ 50	3.5 ~ 5	25.3 ~ 37

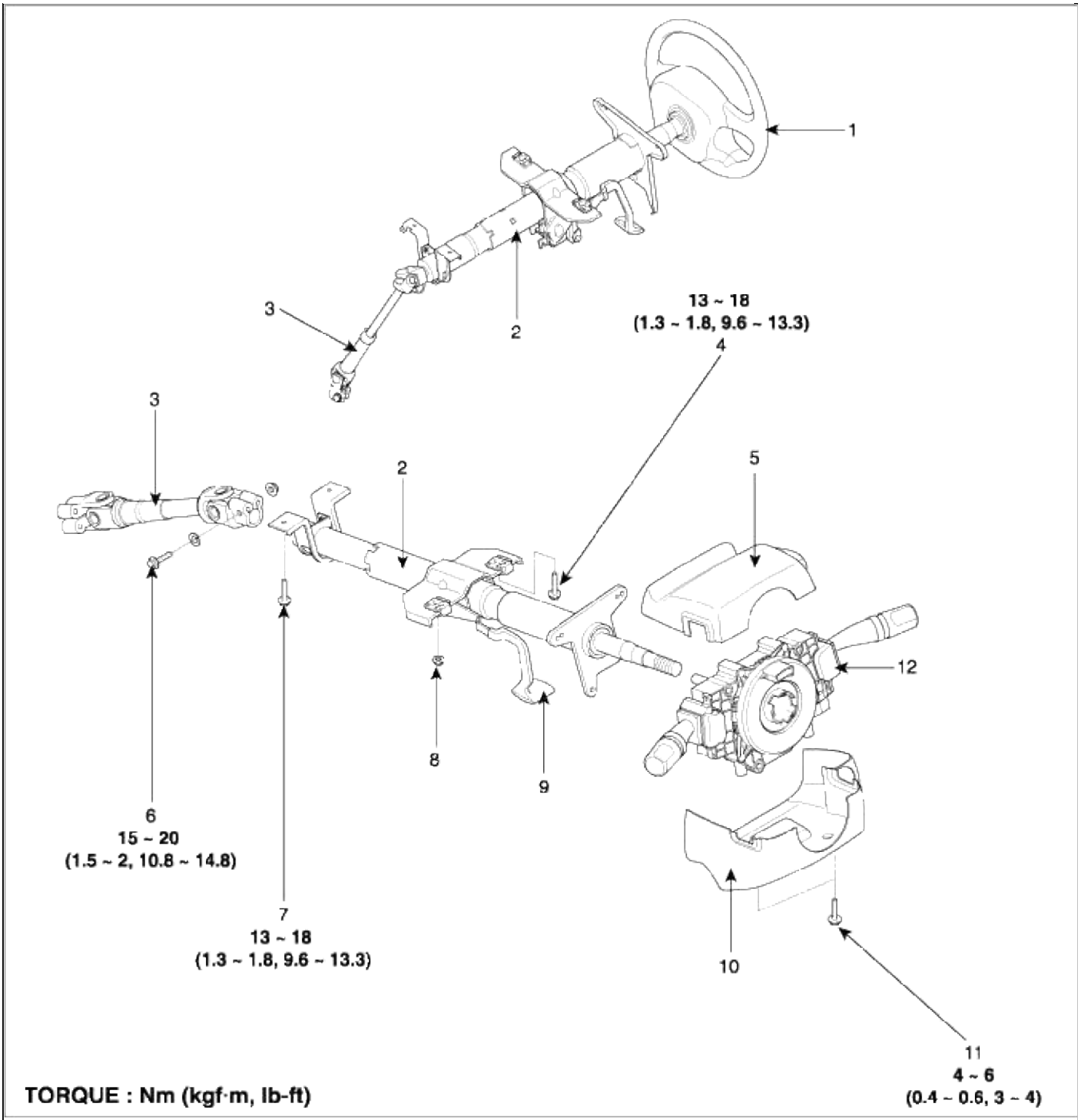
Oil pump mounting bolt 2.0 (I4), 2.7 (V6) Oil pump bracket mounting bolt	 35 ~ 50 35 ~ 50	 3.5 ~ 5 3.5 ~ 5	 25.8 ~ 37 25.8 ~ 37
Power steering hose Power steering reservoir mounting bolt Power steering hose mounting bolt Power steering tube mounting bolt	 17 ~ 26 7 ~ 11 7 ~ 11	 1.7 ~ 2.6 0.7 ~ 1.1 0.7 ~ 1.1	 12.3 ~ 18.8 5 ~ 7.9 5 ~ 7.9

LUBRICANTS

Item	Recommended lubricant	Quantity
Bearing of steering shaft	ALVANIA #2 OR #3 (KEUK DONG SHELL, KOREA)	As required
Ball joint of tie rod end	SHOWA SUNLIGHT MB-2 OR equivalent	4 g
Steering gear housing	ONE-LUBER RP GREASE (KYODOYUSHI, JAPAN)	As required
Inner ball joint of gear box	LONG TIME PD2 (OPTIMOL, GERMAN)	As required
Contact area of gear box bellows & tie rod	SILICON GREASE (SPEC NO : MS511-41)	As required
Power steering fluid	PSF-3	0.8 ~ 0.9 liter (0.84 ~ 0.95 qts.)

Steering System > Steering Column & Shaft > Steering Column/Shaft > Components and Components Location

COMPONENTS



1. Steering wheel
2. Steering column shaft assembly
3. Universal joint assembly
4. Steering column shaft mounting bolt
5. Steering column upper shroud
6. Universal joint mounting bolt
7. Steering column shaft mounting bolt
8. Steering column shaft mounting nut
9. Tilt lever
10. Steering column lower shoud
11. Steering column lower shroud mounting bolt
12. Multifunction switch

Steering System > Steering Column & Shaft > Steering Column/Shaft > Repair procedures

REMOVAL

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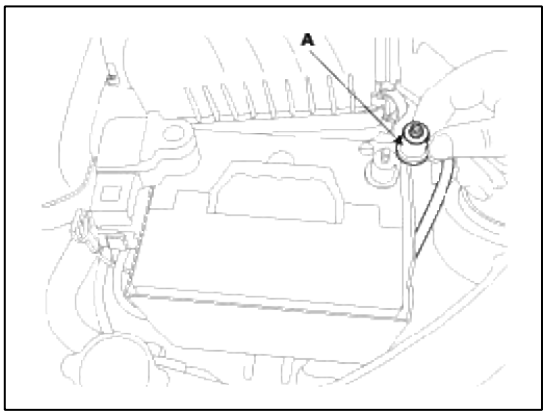
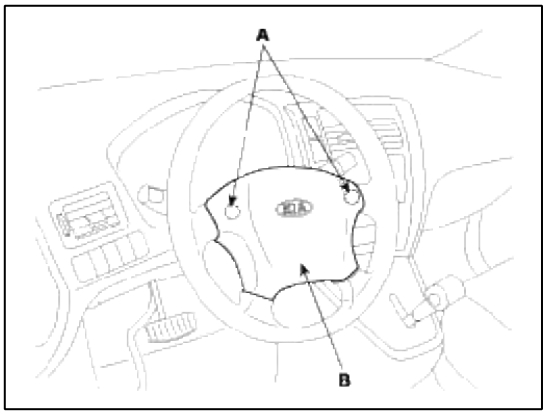
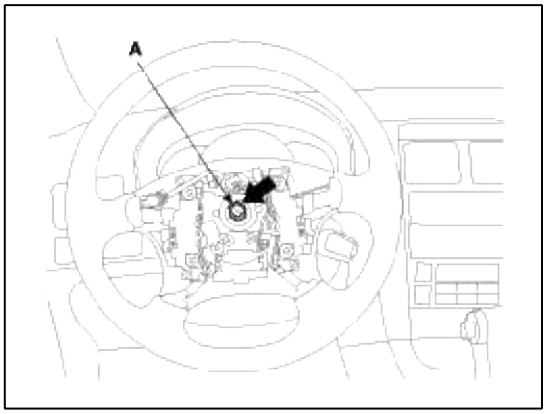
1. Disconnect the negative (-) terminal(A) from the battery.



2. Take away the bolts (A) in the illustration, and then remove the driver's airbag module(B).

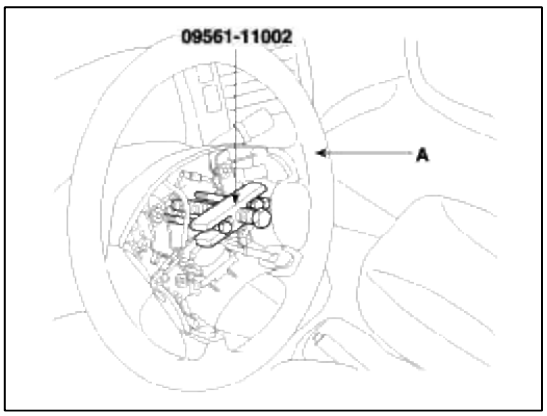


3. Remove the steering wheel lock nut(A).

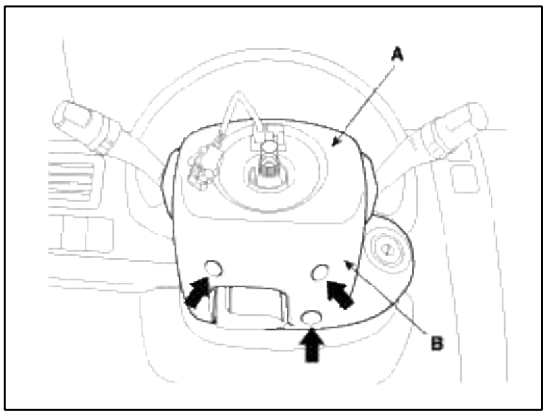


4. After aligning the marks on the steering shaft and wheel(A), remove the steering wheel using the special tool (09561-11002).

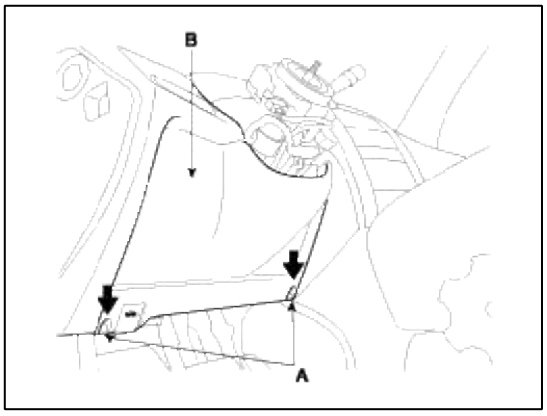
> NOTE
>
> Do not hammer on the steering wheel to remove it: it may damage the steering column.



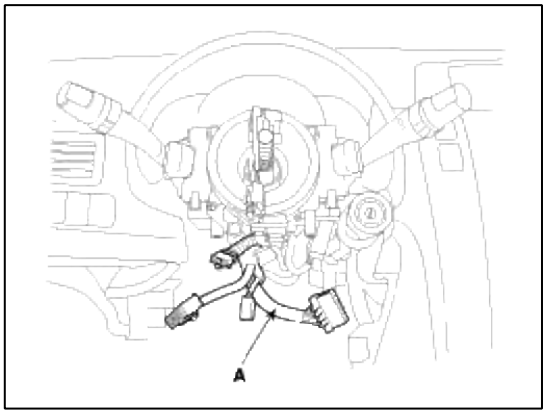
5. Remove the steering column upper(A) and lower shrouds(B).



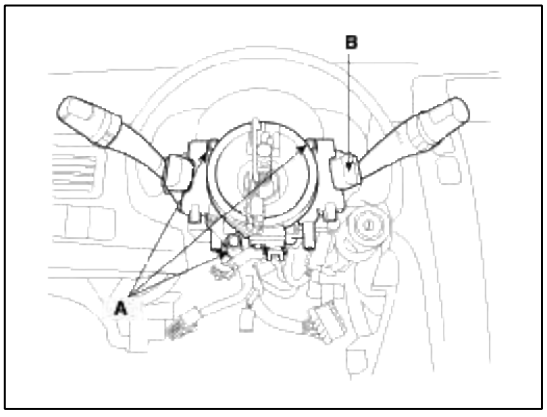
6. Disconnect two tightening bolt(A) and remove the lower crash pad(B).



7. Remove the connectors of the multifunction switch(A).



8. After removing three bolts(A) in the illustration, remove the multifunction switch assembly(B).



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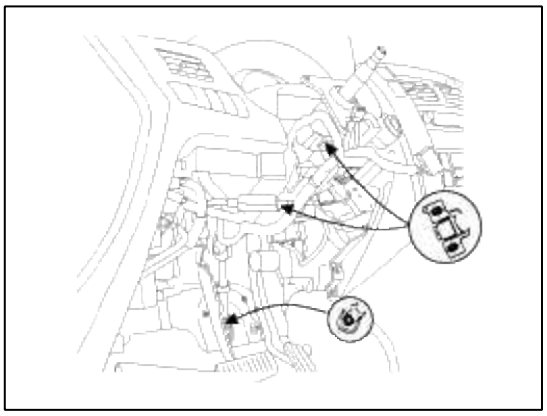
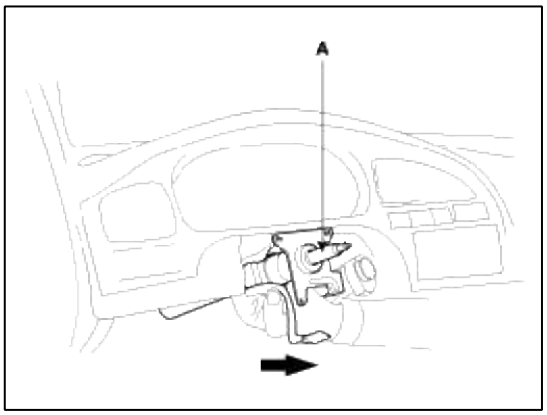
9. Remove the bolts connecting the steering column shaft(A) and the universal joint(B) as shown in the illustration.



CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

10. After removing the mounting bolts and nuts on the steering column and shaft assembly, remove the steering column and shaft assembly(A).



INSTALLATION

Assembly is the reverse of removal.

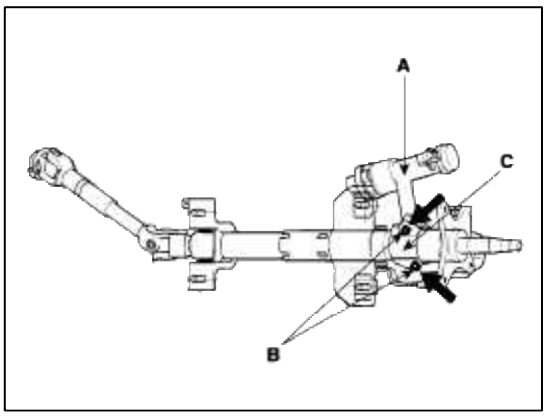
CAUTION

When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

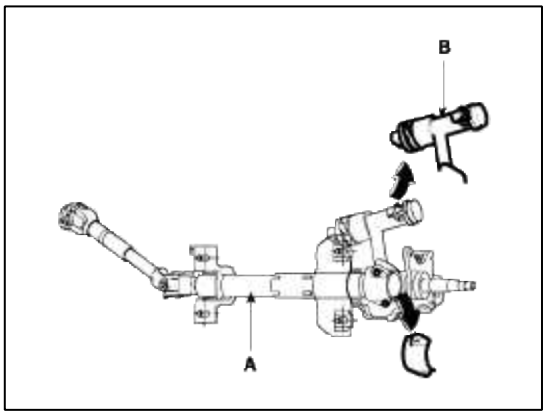
DISASSEMBLY AND REASSEMBLY

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 screwdriverto remove the key lock assembly mounting bracket(C).



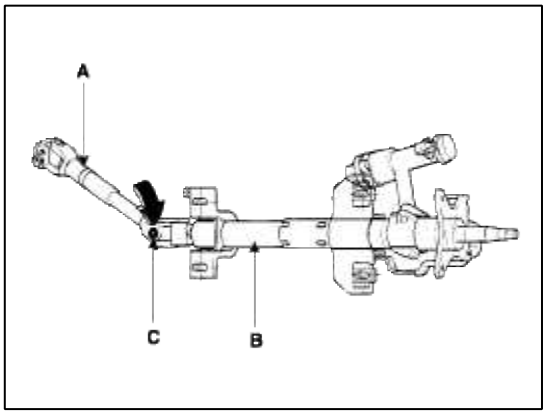
2. Disassemble the key lock assembly(A) from the steering column and shaft assembly(B).



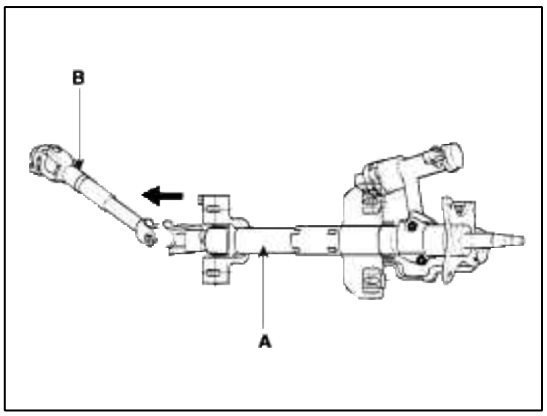
3. Reassembly is the reverse of disassembly.

UNIVERSAL JOINT ASSEMBLY

1. Remove the bolt(C) connecting the universal joint assembly(A) and the steering column and shaft assembly(B).



2. Remove the universal joint assembly(B) from the steering column and shaft assembly(A).



3. Reassembly is the reverse of disassembly.

INSPECTION

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.

Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Components and Components Location

COMPONENTS

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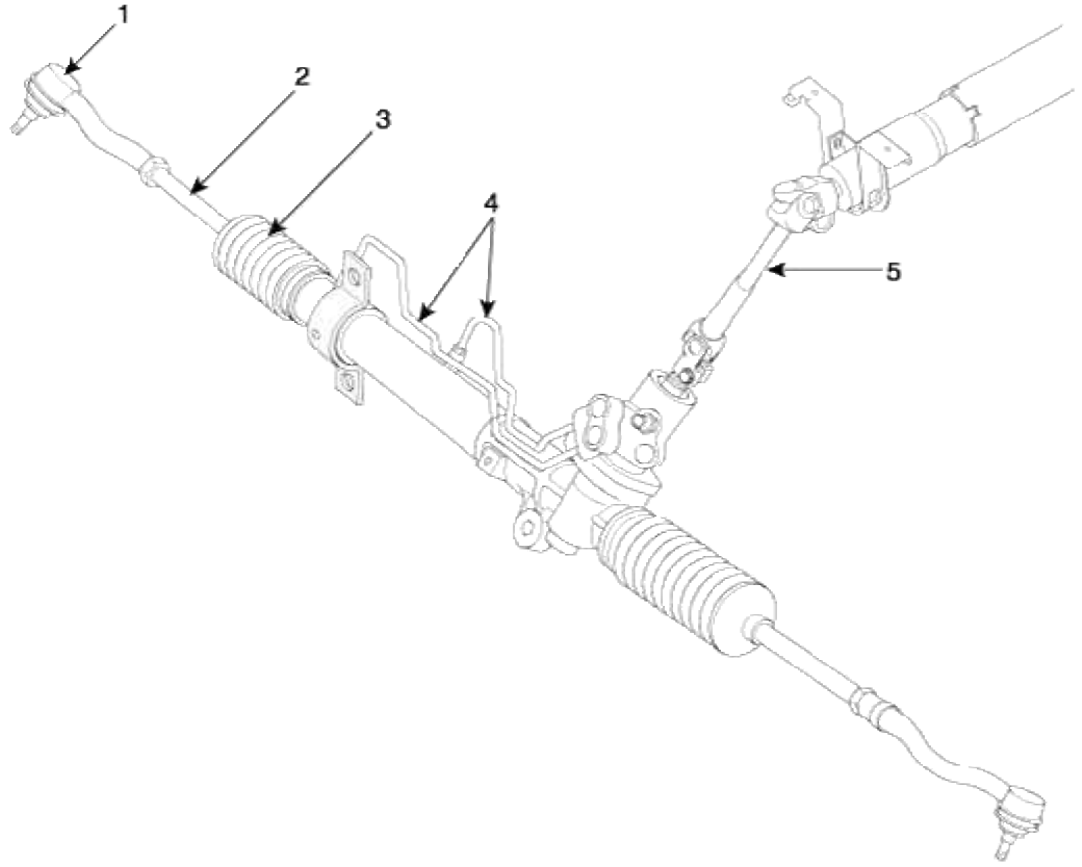
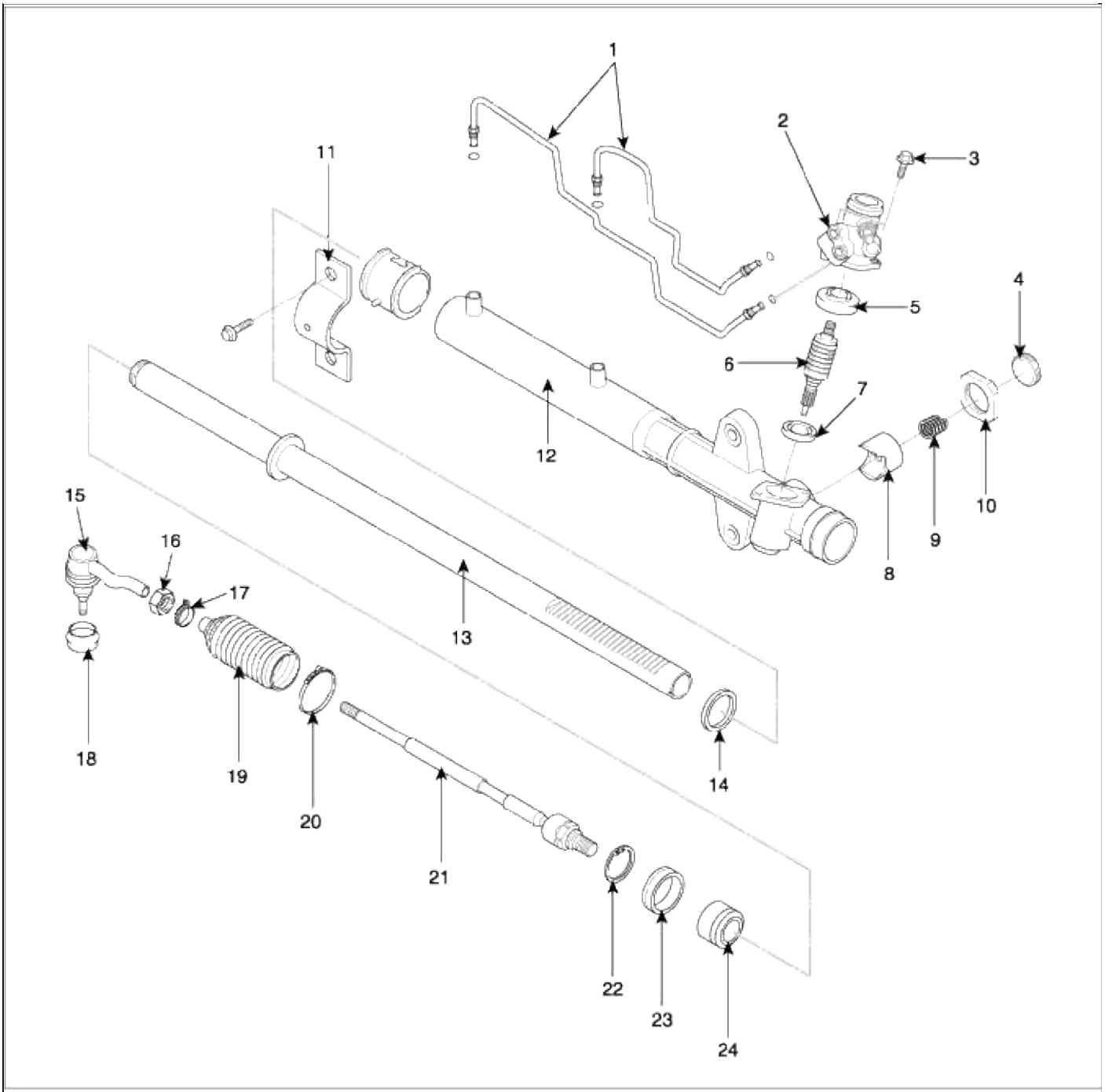


1. Tie rod end assembly
2. Tie rod assembly
3. Bellows
4. Feed tube
5. Joint assembly



1. Feed tube
2. Valve body housing
3. Bolt
4. Yoke plug
5. Oil seal
6. Pinion valve assembly
7. Oil seal
8. Rack support yoke
9. Rack support spring
10. Lock nut
11. Power steering gear box mounting clamp
12. Rack housing
13. Rack
14. Oil seal
15. Tie rod end
16. Lock nut
17. Bellows clip
18. Dust cover
19. Bellows
20. Bellows band
21. Tie rod
22. Circlip
23. Oil seal
24. Rack stopper

Steering System > Hydraulic Power Steering System > Power Steering Gear Box > Repair procedures

REMOVAL

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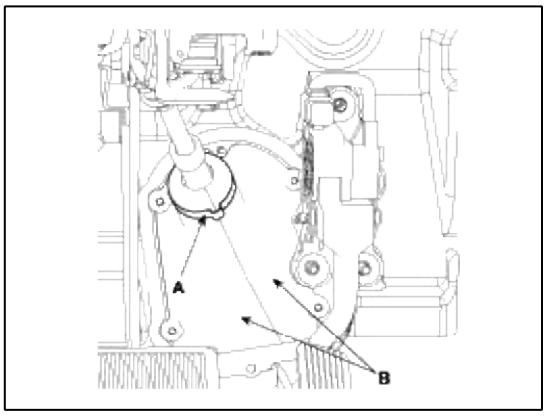
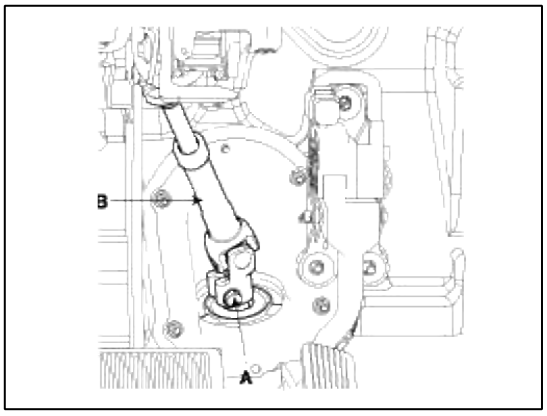
1. Disconnect the cover fixing clip(A) on the universal joint indoor driver inside, loosen the noise covers(B).



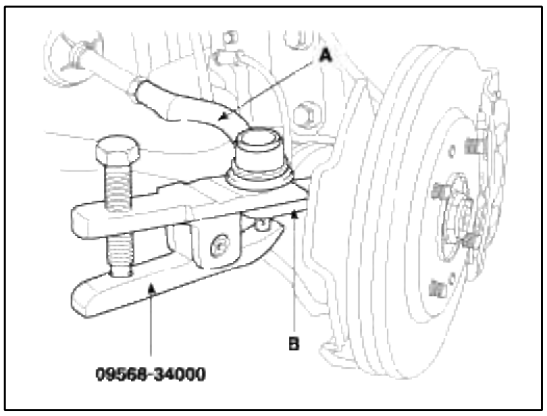
2. Loosen the universal joint and the gear box mounting bolt and disconnect the universal joint from the gear box.



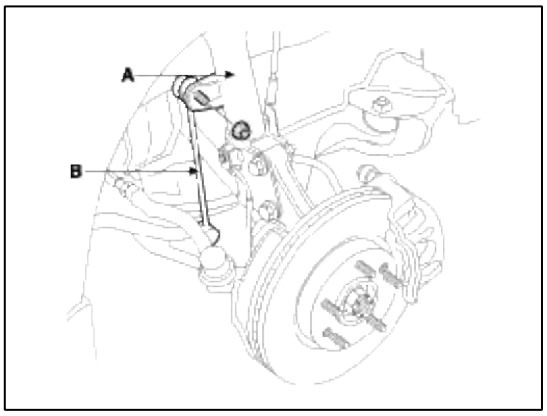
CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

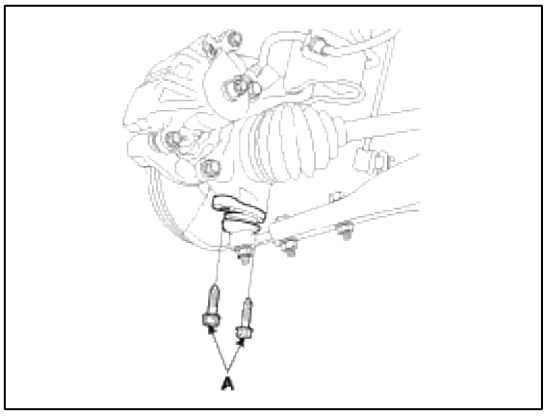
3. Lift up the vehicle.
4. Remove the front tires (RH/LH).
5. Remove the engine under cover.
6. After removing the split pin, disconnect the tie rod(A) from the knuckle(B) by using the special tool (09568-34000).



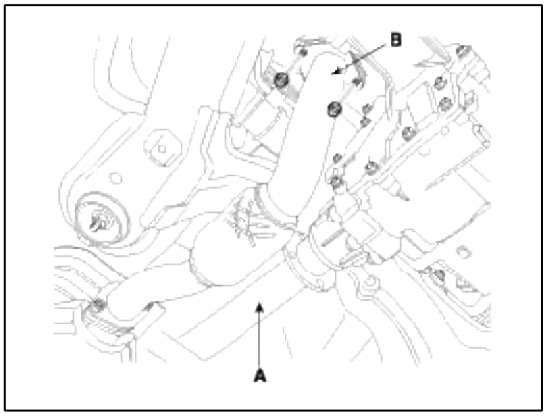
7. Remove the stabilizer link(B) from the strut assembly(A).



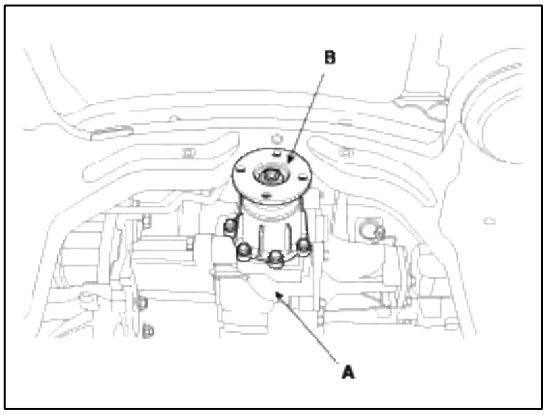
8. Remove the two bolts(A) for lower arm ball joint.



9. Remove the propeller shaft(A) and the front muffler assembly(B).



10. Drain oil from the transfer case(A). then remove the rear flange assembly(B).



11. Drain power steering oil.

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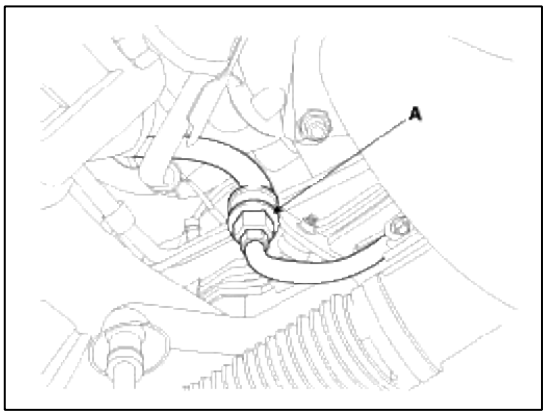
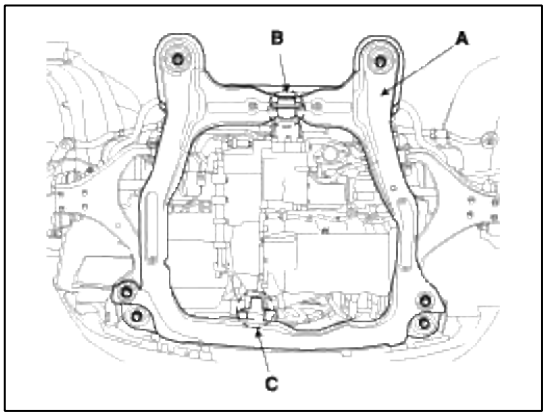
12. Remove the connecting bolt(A) for pressure tubes.

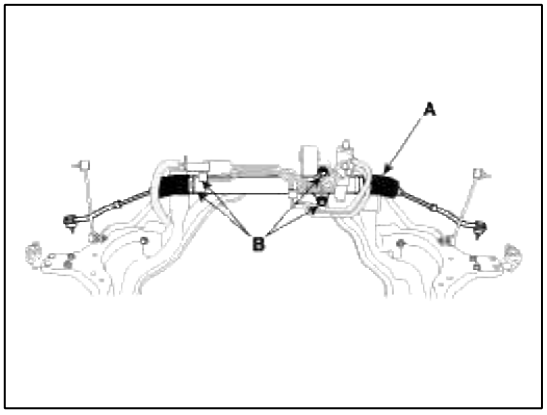


13. Remove two engline mounting bolts(B,C) and six subframe mounting bolts in order to remove the subframe(A).

Tightening torque :
engine mounting bolts
50 ~ 65 Nm (5 ~ 6.5 kgf·m, 37 ~ 47.8 lb-ft)



14. Remove the powersteering gearbox(A) after removing four mounting bolts(B) of the powersteering gearbox.

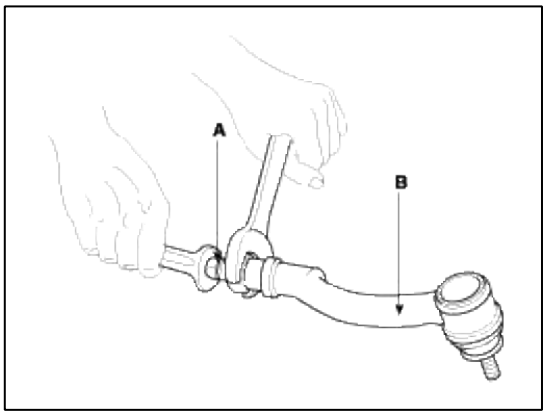


INSTALLATION

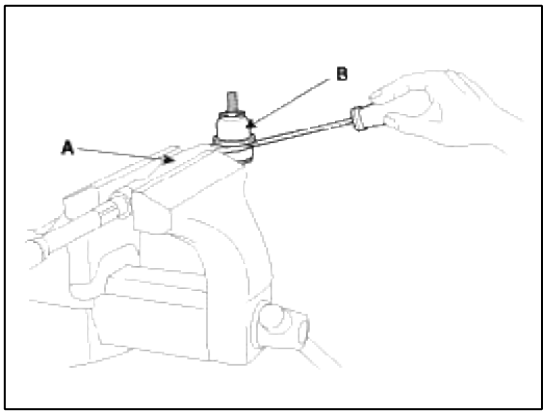
1. Installation is the reserve of removal.
2. Add power steering fluid.
3. Air bleed the system.

DISASSEMBLY

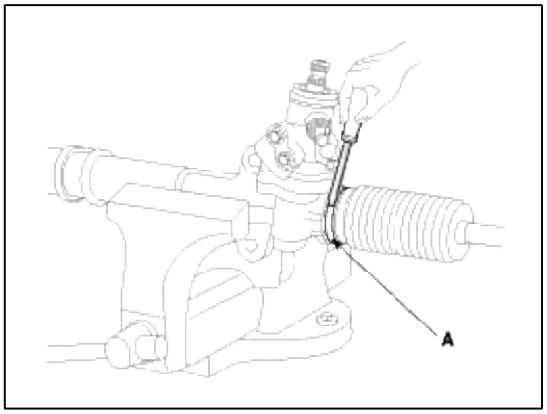
1. Remove the tie rod end(A) from the tie rod(B).



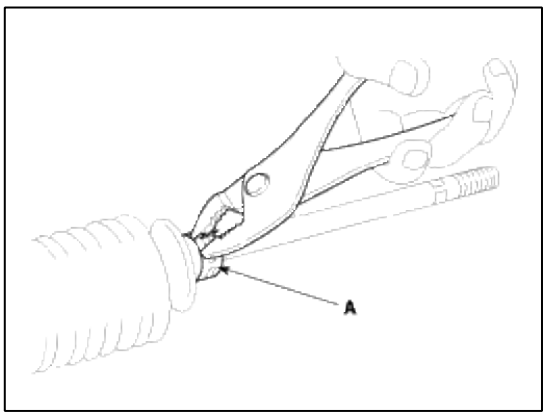
2. After mounting the tie rod end(A) in a vise, remove the dust cover(B) from the ball joint.



3. Remove the bellows band(A).



4. Remove the bellows clip(A).



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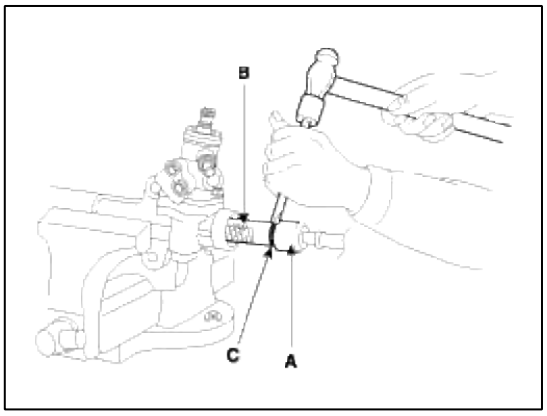
5. Pull the bellows out toward the tie rod.

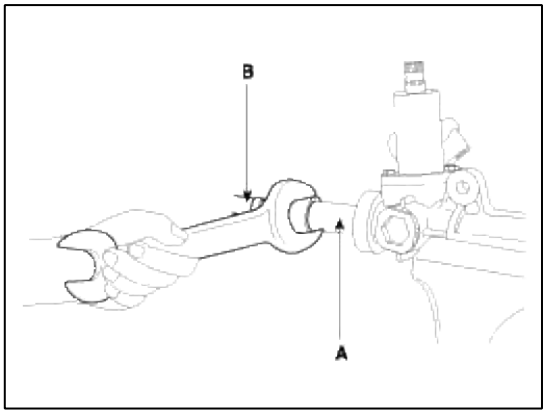
> NOTE
>
> Check for rust on the rack when the bellows are replaced.

6. Remove the feed tube from the rack housing.
7. While moving the rack slowly, drain the fluid from the rack housing.
8. Unstake the tab washer(C) which fixes the tie rod(A) and rack(B) with a chisel.

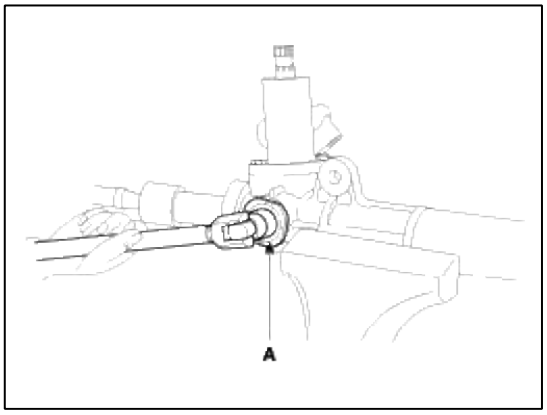


9. Remove the tie rod(B) from the rack(A).

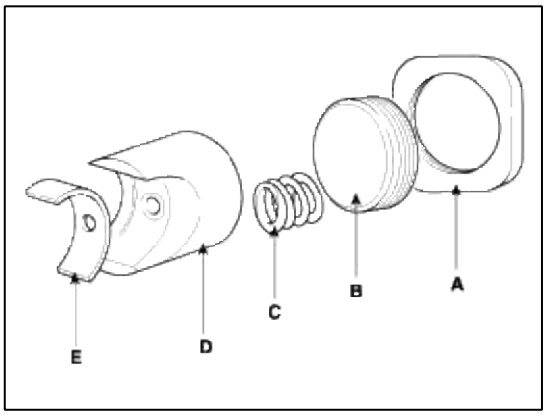
> CAUTION
>
> Remove the tie rod(B) from the rack(A), taking care not to twist the rack.



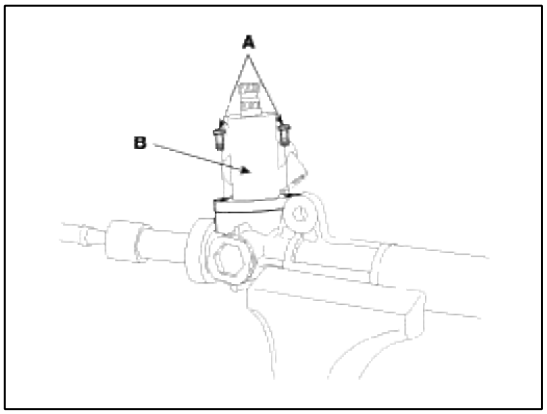
10. Remove the yoke plug locking nut(A), and then remove the yoke plug.



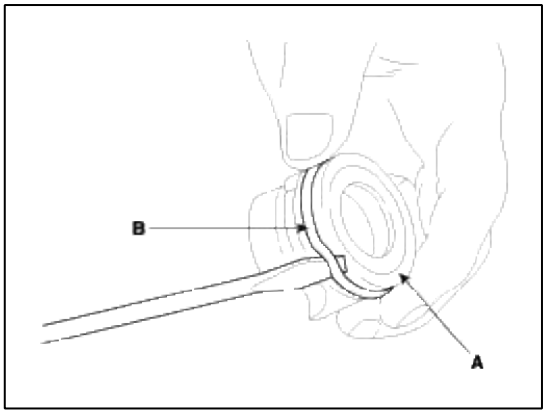
11. Remove the lock nut(A), yoke plug(B), rack support spring(C), rack support yoke(D) and bushing(E) from the gear box.



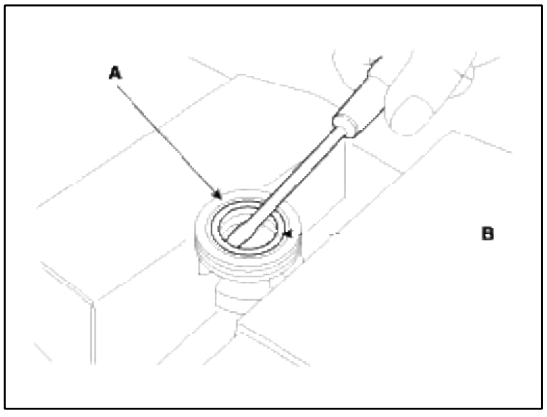
12. Remove the valve body housing(B) by loosening the two bolts(A).



13. Remove the rack bushing and the rack from the rack housing.
14. Remove the O-ring(A) from the rack bushing(B).



15. Remove the oil seal(B) from the rack bushing(A).



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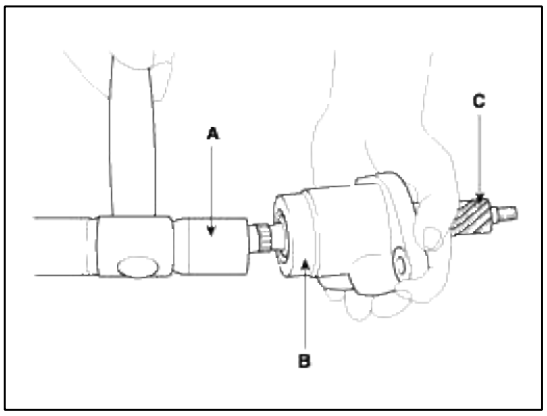
16. Remove the pinion vlave assembly(C) from the valve body housing(B) with a soft hammer(A).

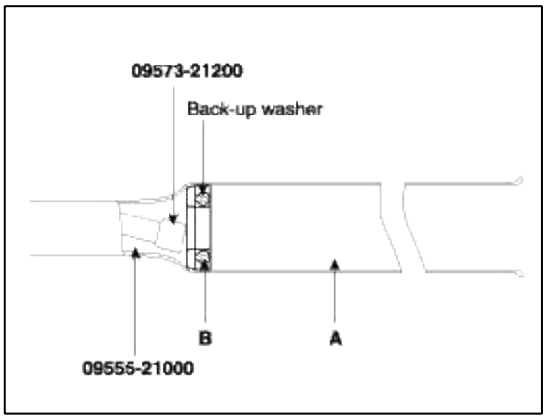


17. Using the special tool, remove the oil seal and ball bearing from the valve body housing.
18. Remove the oil seal and O-ring from the rack housing.

> CAUTION
>
> Be careful not to damage the pinion valve cylinder inside of the rack housing.

19. Using the special tool(06573-21200, 09555-21000), remove the oil seal(B) from the rack housing(A).

> CAUTION
>
> Be careful not to damage the rack cylinder inside of the rack housing.

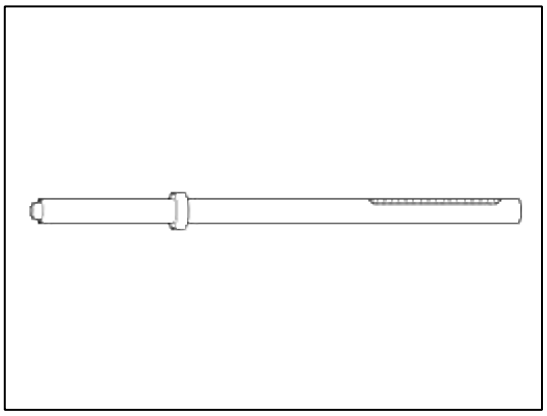


INSPECTION

Rack

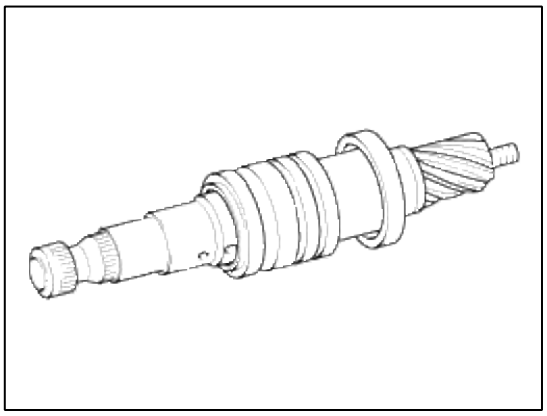
1. Check for rack tooth face damage or wear.
2. Check for oil seal contact surface damage.
3. Check for rack bending or twisting.
4. Check for oil seal ring damage or wear.

5. Check for oil seal damage or wear.



Pinion valve

1. Check for pini on 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.



Bearing

1. Check for seizure or abnormal noise during rotating a bearing.
2. Check for excessive play.
3. Check for missing needle bearing rollers.

Others

1. Check for damage of the rack housing cylinder bore.
2. Check for boot damage, cracking or aging.

REASSEMBLY

1. Apply the specified fluid to the entire surface of the rack oil seal.

Recommended fluid : PSF-3

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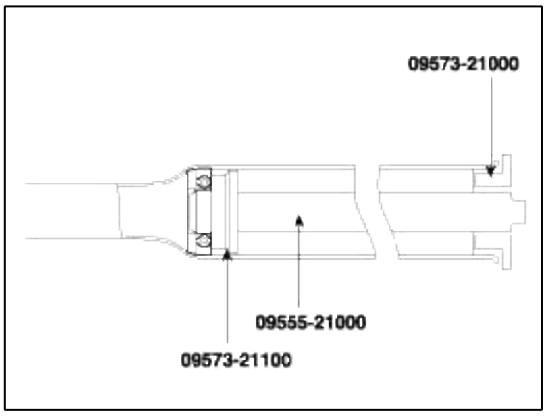
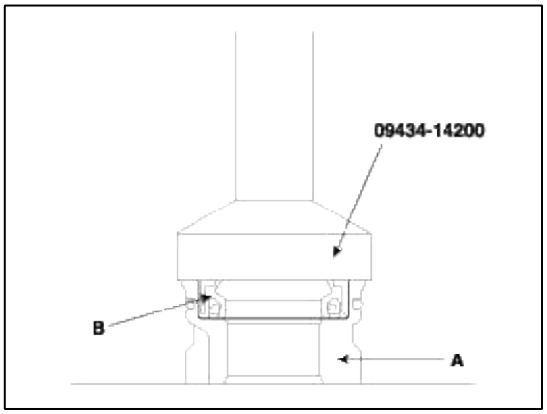
2. Install the oil seal(A) to the specified position in the rack housing.



3. Apply the specified fluid to the entire surface of the rack bushing oil seal .

Recommended fluid : PSF-3

4. Install the oil seal(B) in the rack bushing(A).

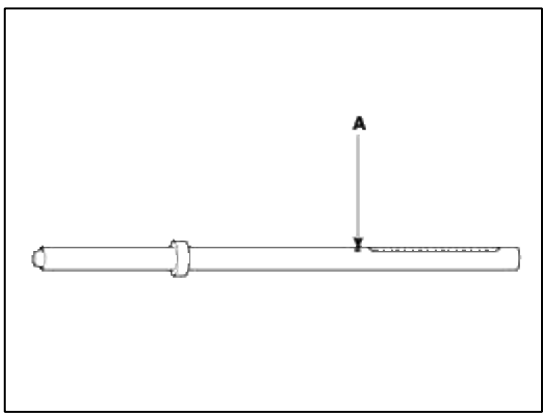


5. Apply the specified fluid to the entire surface of the O-ring and install it in the rack bushing.
6. Apply the specified grease to the rack teeth.

Recommended grease :
Multipurpose grease SAE J310, NLGI No.2

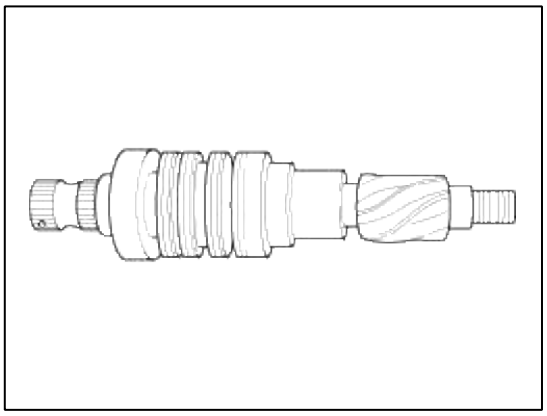
NOTE

Do not plug the vent hole(A) in the rack with grease.

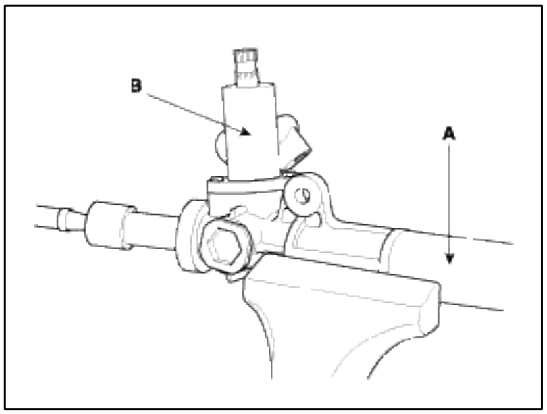


7. Insert the rack into the rack housing and install the rack bushing and rack stopper.
8. Install the oil seal and the ball bearing in the valve body.

9. After appling the specified fluid and grease to the pinion valve assembly(A), install it in the rack housing assembly.



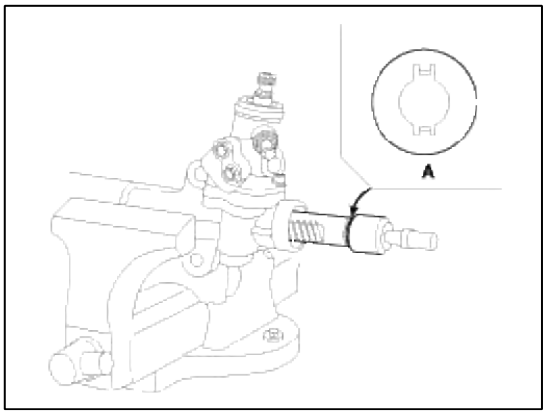
10. After applying the specified fluid to the oil seal, install it in the rack housing, and fix the valve body assembly(B) and O-ring in the gear box(A).



11. Install the tab washer and the tie rod and stake the tab washer(A) end at two points over the tie rod.

NOTE

1. Align the tab washer pawls with the rack grooves.
2. Always use a new tab washer.



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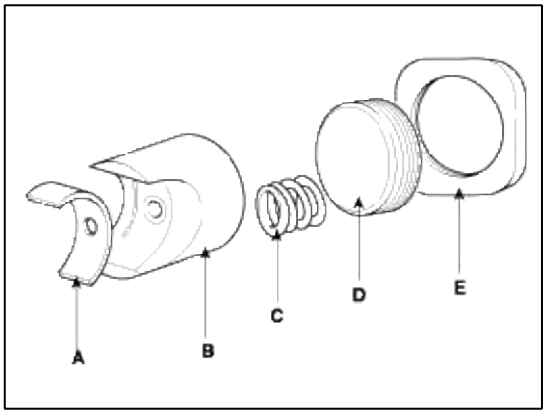
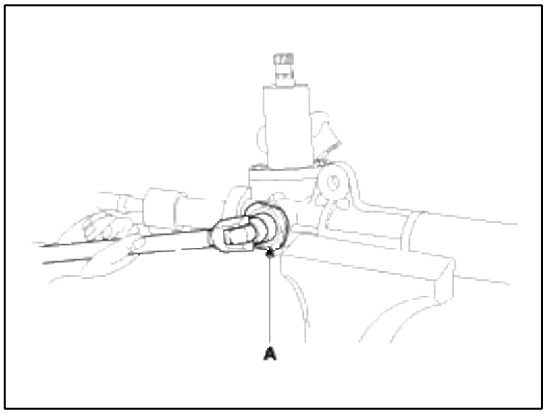
12. Install the bushing(A), rack support yoke(B), rack support spring(C), lock nut(E) and yoke plug(D) in the order shown in the illustration. Apply semi-drying sealantto to the threaded section of the yoke plu g before installation.



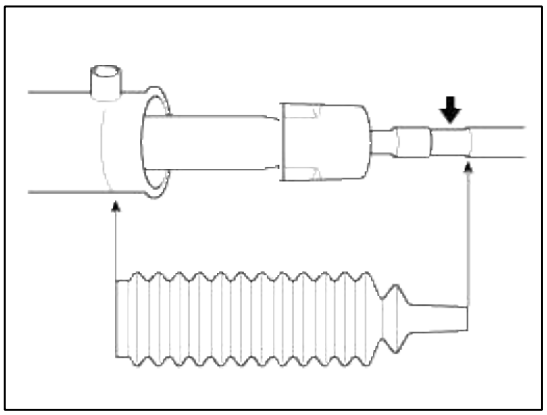
13. With the rack placed in the center position, attach the yoke plug to the rack housing. Tighten the yoke plug to 15 Nm (1.5 kgf·m, 11 lbf·ft). Loosen the yoke plug approximately from 30° to60° and tighten the locking nut to the specified torque.

Tightening torque :
50 ~ 70 Nm (5 ~ 7 kgf·m, 37 ~ 52 lb-ft)



14. Tighten the feed tube to the specified torque and install the mounting rubber using adhesive.
15. Apply the specified grease to the bellows mounting position (fitting groove) of the tie rod.

: Silicone grease

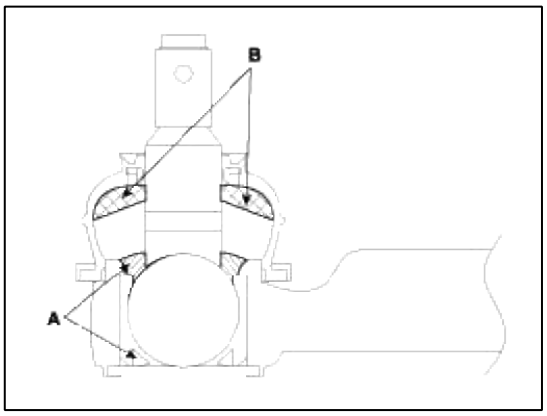


16. Install the new attaching band to the bellows.

> NOTE
>
> When the bellows are installed, a new band must be used.

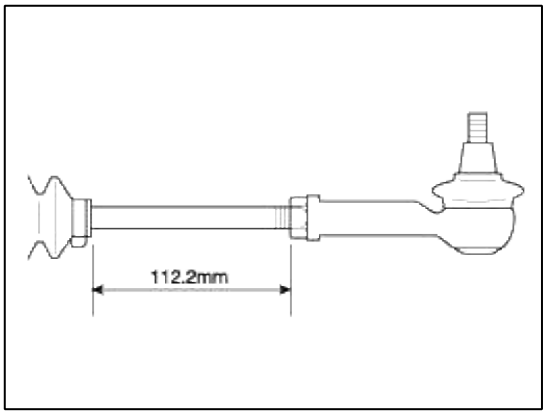
17. Install the bellows in position, taking care not to twist it.
18. Fill the dust cover inner side and lip with the specified grease, and fix the dust cover in position with the clip ring attached in the grooveof the tie rod end.

Recommended greas :
A : POLY LUB GLY 801K or equivalent
B : SHOWA SUNLIGHT MB2 or equivalent
Dust cover inner side and lip : THREE BOND



19. Install the tie rods so that the length of the left and right tie rods equals the standard value.

Standard value :
Tie rod free length : 112.2 mm



20. Check for total pinion preload.

Total pinion preload :
0.6 ~ 1.3 Nm (0.06 ~ 0.13 kgf·m, 5.2 ~ 11.3 lb-ft)

INSPECTION

Rack

1. Check for rack tooth face damage or wear.

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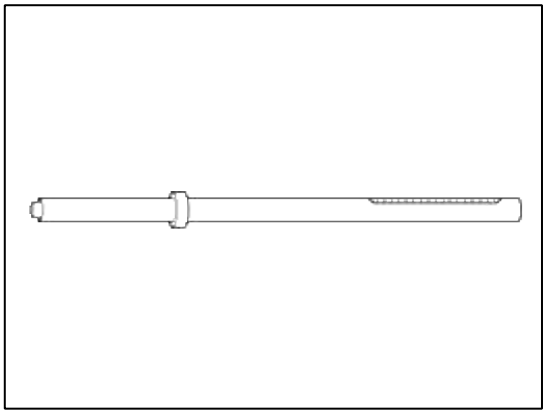
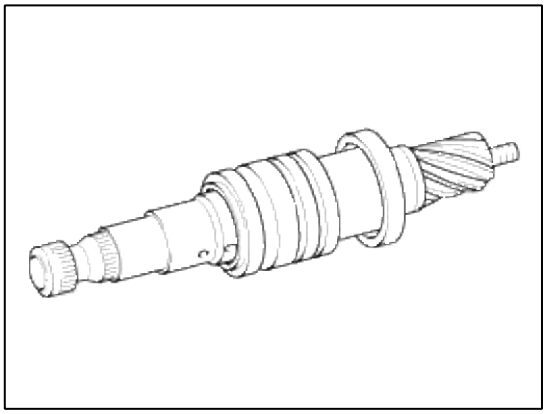
2. Check for oil seal contact surface damage.
3. Check for rack bending or twisting.
4. Check for oil seal ring damage or wear.
5. Check for oil seal damage or wear.



Pinion valve

1. Check for pini on 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.



Bearing

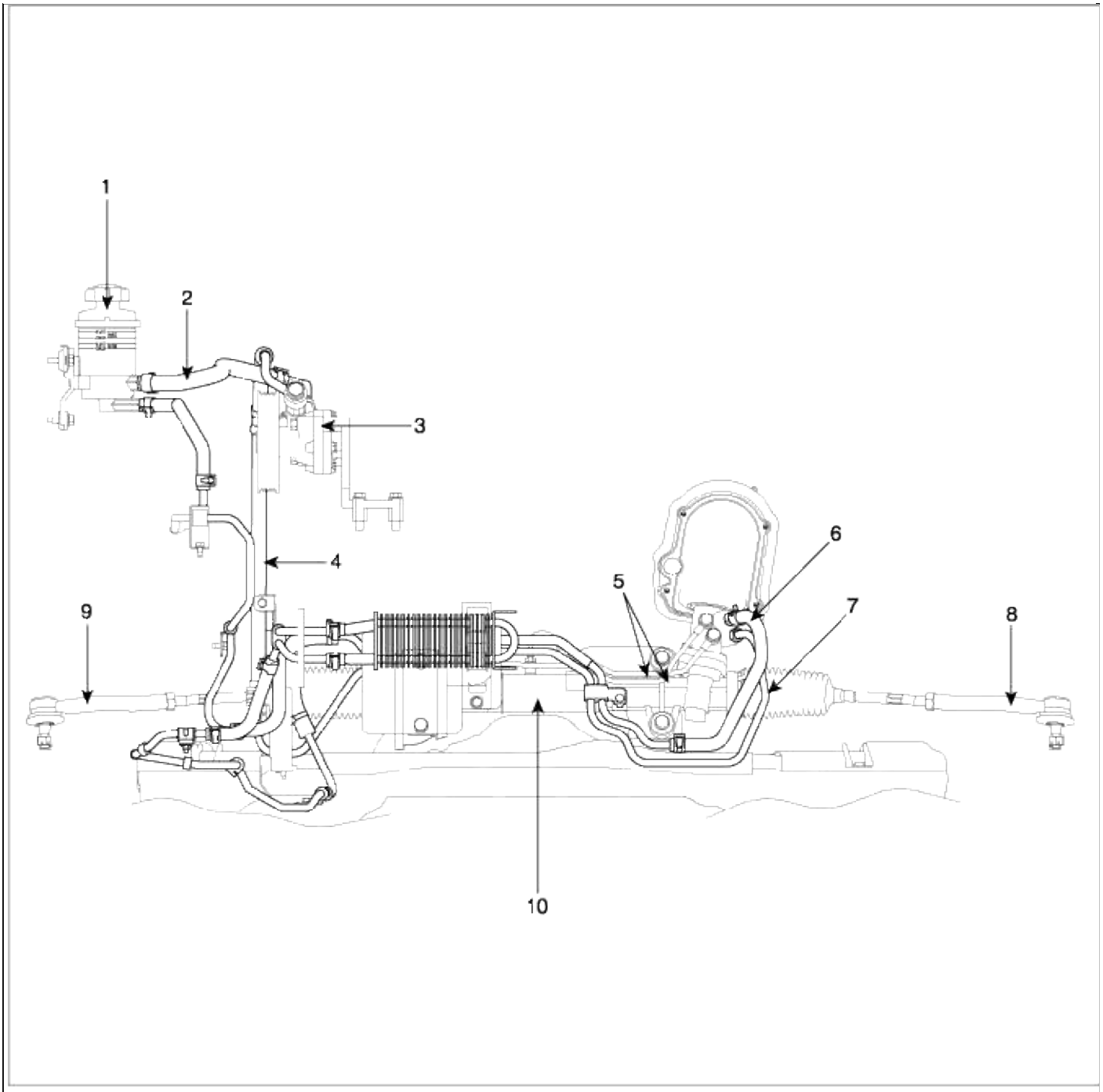
1. Check for seizure or abnormal noise during rotating a bearing.
2. Check for excessive play.
3. Check for missing needle bearing rollers.

Others

1. Check for damage of the rack housing cylinder bore.
2. Check for boot damage, cracking or aging.

Steering System > Hydraulic Power Steering System > Power Steering Hoses > Components and Components Location

COMPONENTS



1. Power steering oil reservoir
2. Suction hose
3. Power steering oil pump assembly
4. Pressure hose and tube assembly
5. Feed tube
6. Return hose
7. Pressure tube
8. Tie rod end
9. Tie rod end
10. Power steering gear box assembly

Steering System > Hydraulic Power Steering System > Power Steering Hoses > Repair procedures

REMOVAL

1. Drain the power steering oil.

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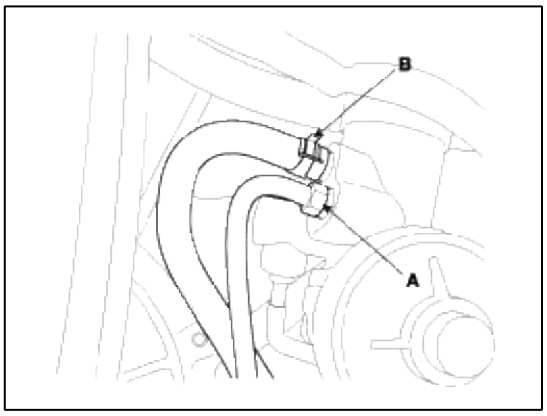
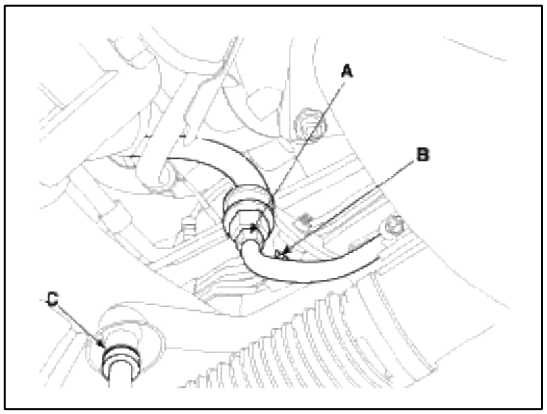
2. Remove both the pressure tube fitting(A) and the return hose clamp(B) from the gearbox, after lifting the vehicle.

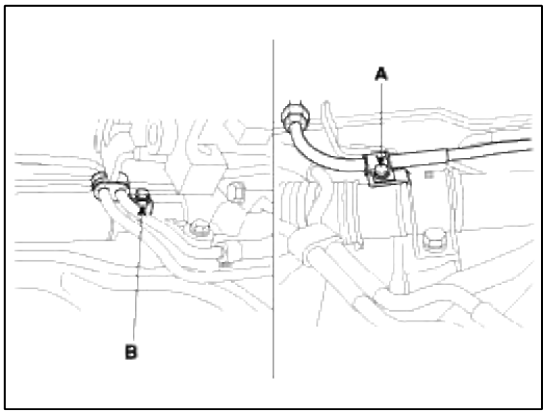


3. Remove the pressure tube connecting bolt(A) and the pressure hose mounting bolt(B), then remove the return hose clamp(C).

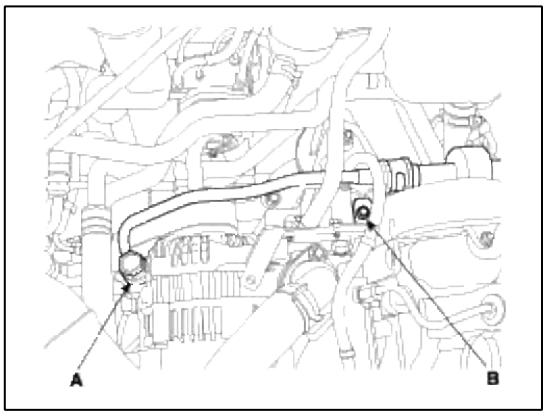


4. Remove the pressure tube mounting bolt(A) and the return tube mounting bolt(B).

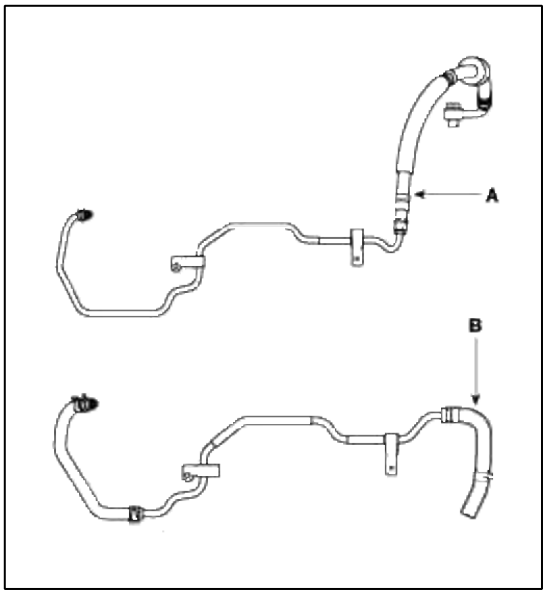
Tightening torque :
A: 90 ~ 100 Nm (9 ~ 10 kgf·m, 65 ~ 72 lb-ft)
B: 7 ~ 11 Nm (0.7 ~ 1.1 kgf·m, 5 ~ 7.9 lb-ft)



5. Remove the pressure tube bolt(A) and clamp(B), after lowering the vehicle.



6. Remove the pressure tube(A) and the return tube(B).

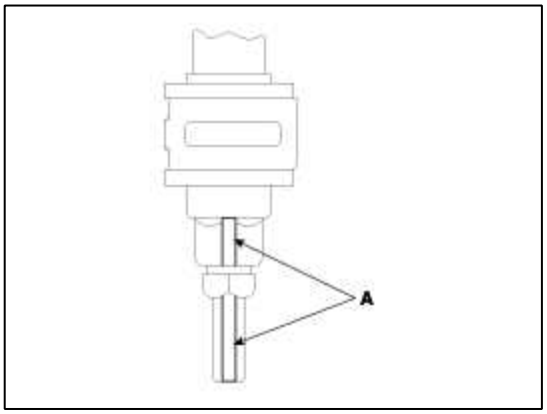


INSTALLATION

1. Installation is the reverse of removal.
2. Add power steering fluid.

CAUTION

- While installing the tube and hose assembly, be sure to align white marks(A) on each fitting.



- Install the pressure hose and tube so that they are not twisted and they do not come in contact with any other parts.
- After installation, air bleed the system.

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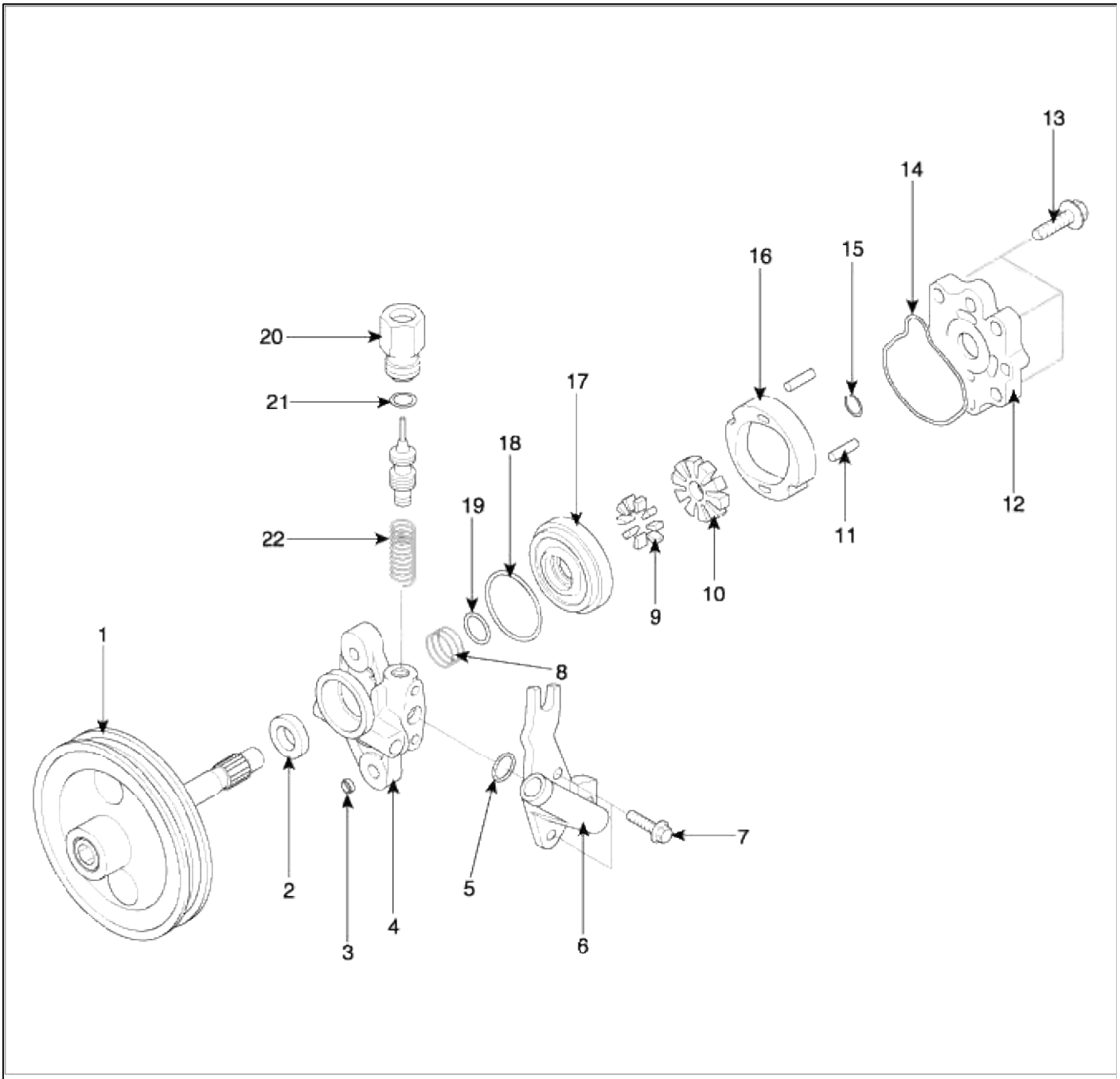
Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Components and Components Location

COMPONENTS

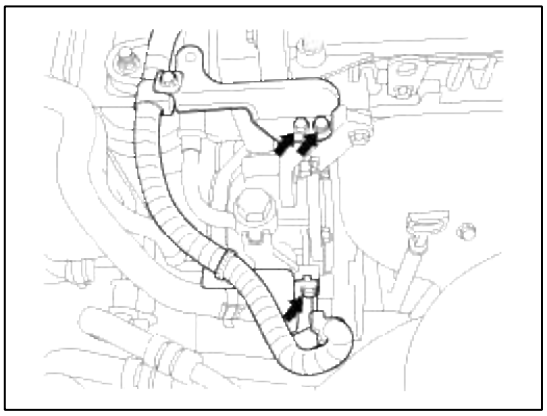


1. Pulley & driveshaft assembly
2. Oil seal
3. Bush
4. Front housing
5. O-ring
6. Suction pipe
7. Mounting bolt
8. Side plate spring
9. Vane
10. Rotor
11. Dowel pin
12. Oil pump cover assembly
13. Mounting bolt
14. O-ring
15. Snap ring
16. Cam ring
17. Oil pump side plate
18. O-ring (Outer)
19. O-ring (Inner)
20. Connector
21. O-ring
22. Spring

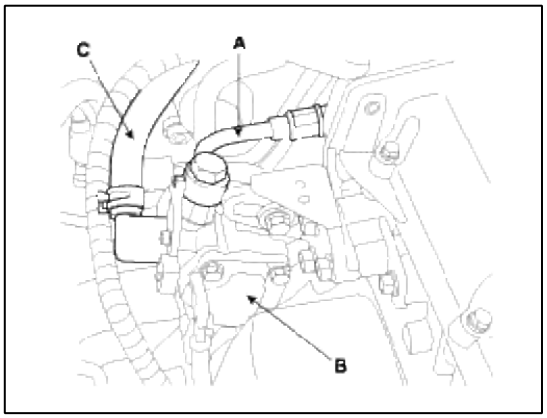
Steering System > Hydraulic Power Steering System > Power Steering Oil Pump > Repair procedures

REMOVAL

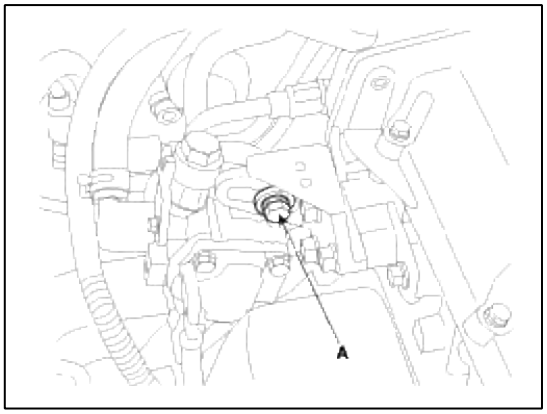
1. Loosen the bolt fixing the wiring bracket, and then move the wiring sideward.



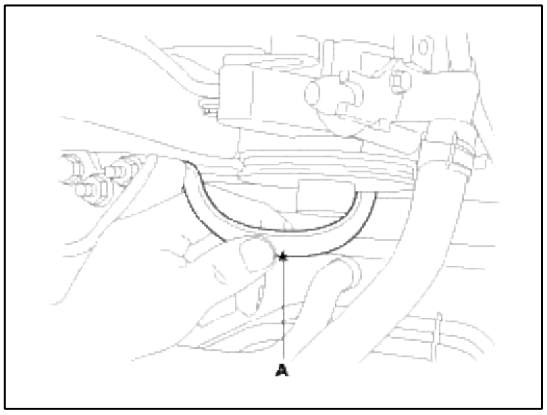
2. Remove the pressure hose(A) from the oil pump(B), and then disconnect the suction hose(C) from the suction connector and drain the fluid into a container. (see page ST-11)



3. Loosen the tension adjusting bolt(A) on the power steering "V" belt.



4. Remove the "V" belt(A) from the power steering oil pump pulley.



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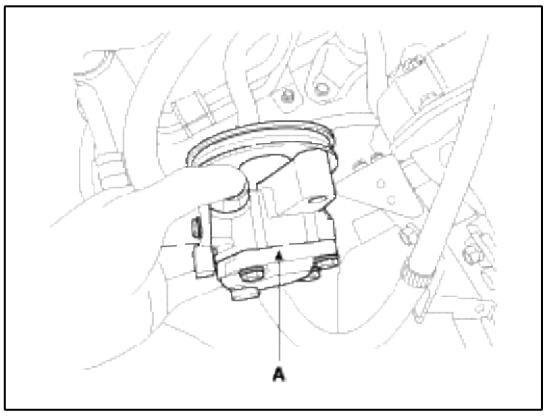
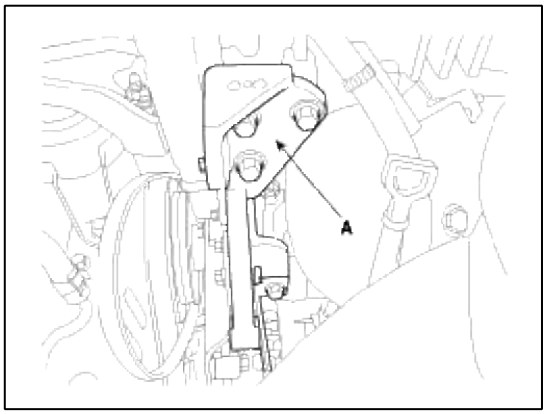
5. Loosen the power steering oil pump mounting bolt and the tension adjusting bolt, and then remove the steering oil pump assembly(A).

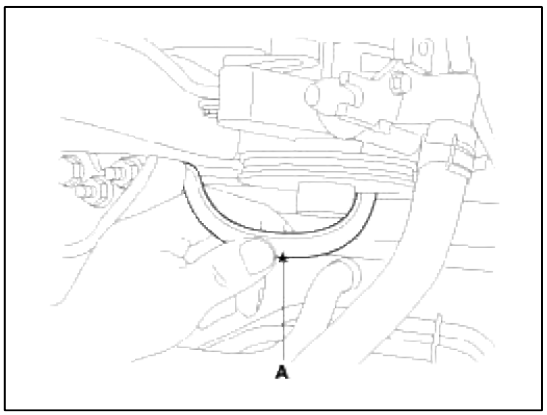


6. Remove the power steering oil pump mounting bracket(A).



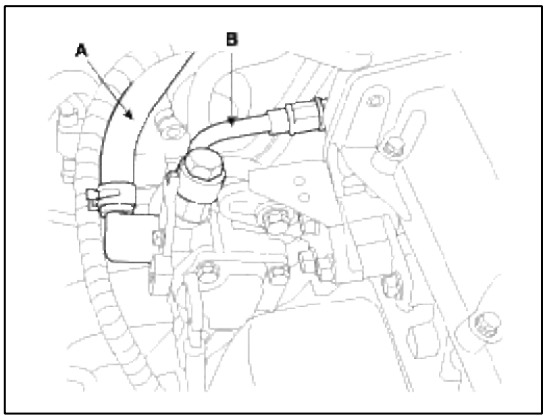
INSTALLATION

1. Install the oil pump(A) to the oil pump bracket.

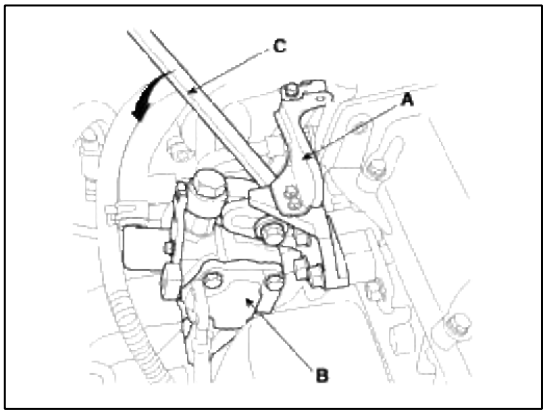


2. Hang the "V" belt on the oil pump and connect the suction hose(A) and the pressure hose(B).

> NOTE
>
> Install the hose being careful so that it does not twist and come in contact with other components.



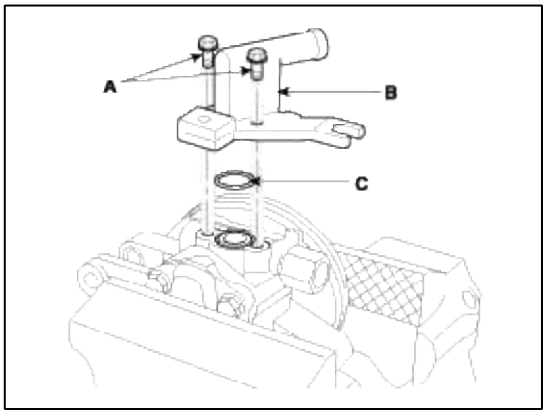
3. Insert a bar(C) or similar tod between the bracket(A) and the oil pump(B) to produce tension and confirm that belt deflection is within the standard value.



4. Add power steering fluid. (see page to ST-10)
5. Air bleed the system. (see page to ST-10)
6. Check the oil pump pressure. (see page to ST-11)

DISASSEMBLY

1. Remove two bolts(A) from the oil pump body, and then remove the suction pipe(B) and O-ring(C).



2. Loosen the four bolts and remove the oil pump cover assemb ly.
3. Remove the cam ring.
4. Remove the rotor and vanes.

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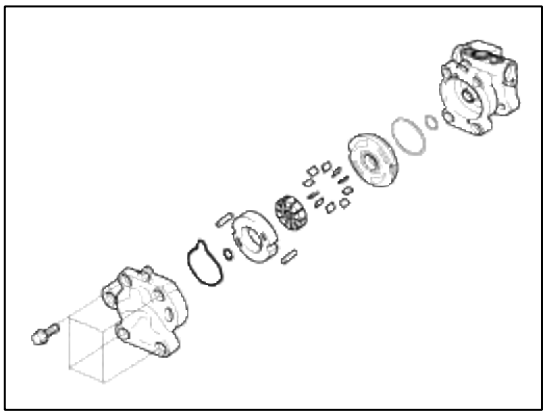
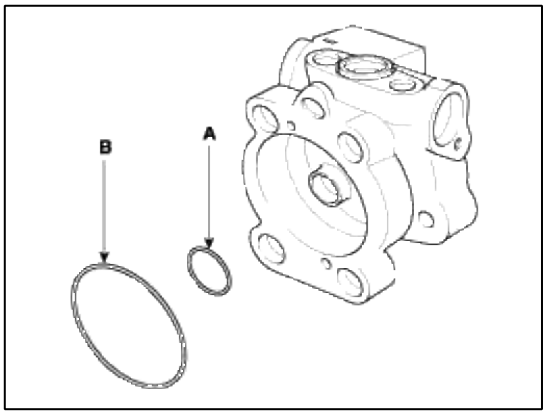
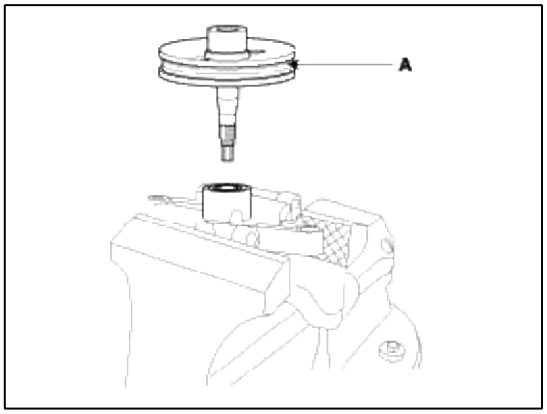
5. Remove the oil pump side plate.



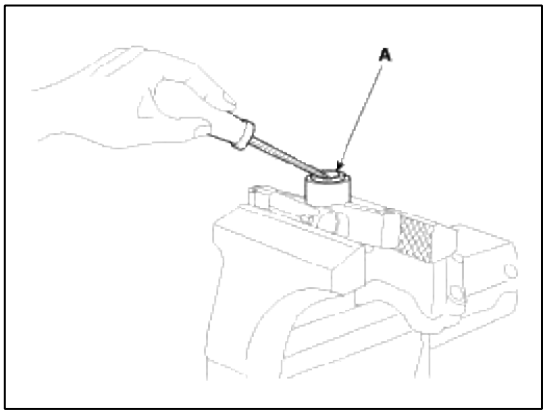
6. Remove the inner O-ring(A) and outer O-ring(B).



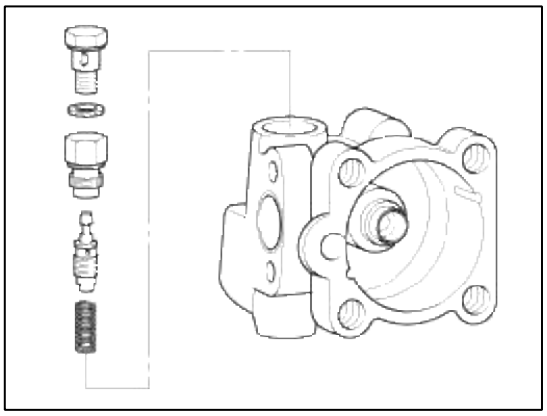
7. Remove the snap ring and take out the pulley and the drive shaft assembly(A).



8. Remove the oil seal(A) from the oil pump body.



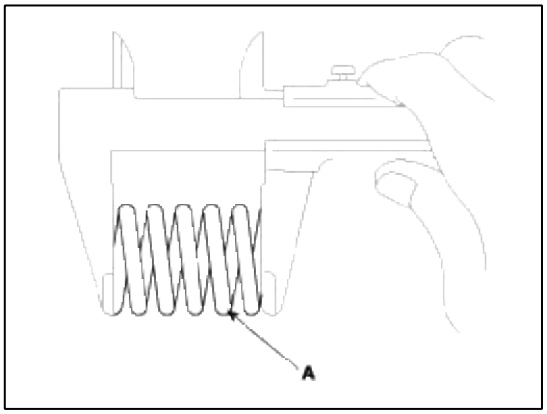
9. Remove the connector from the oil pump body, and take out the flow control valve and the flow control spring.



INSPECTION

1. Check the free length of the flow control spring.

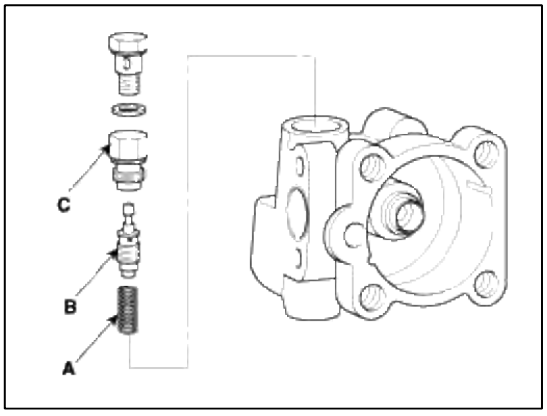
Free length of the flow control spring : 36.5mm



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

1. Install the flow control spring, the flow control valve and the connector into the pump body.



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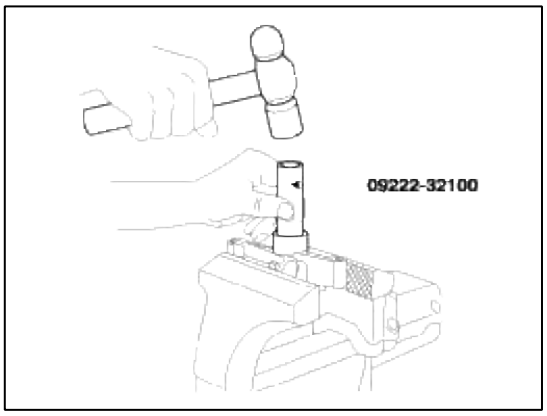
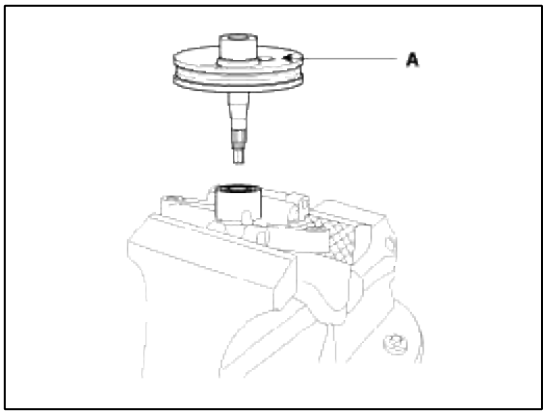
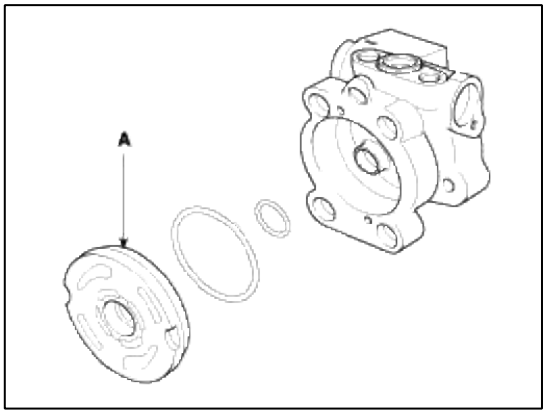
2. Install the oil seal in the pump body by using the special tool(09222-32100).



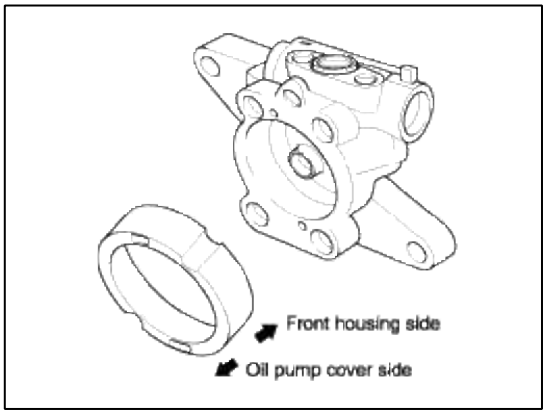
3. Install the pump pulley(A).



4. Assengle the inner O-ring and the outer O-ring and install the site plate(A).



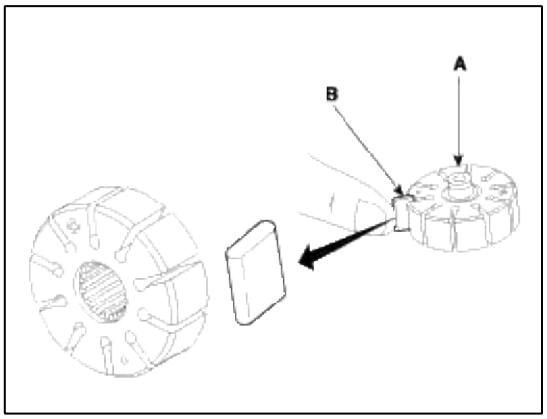
5. Install the cam ring attending to the groove and the direction of the front housing.



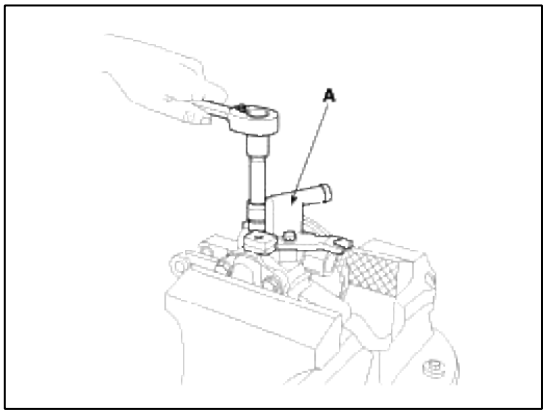
6. Install the rotor.

7. Install vanes(A) to the rotor(B).

> CAUTION
>
> Be sure to place vanes with a round side out.



8. Install the O-ring and the oil pump cover assembly.
9. Install the suction pipe(A) and O-ring.



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SPORTAGE(KM) > 2007 > G 2.0 DOHC > Suspension System

Suspension System > General Information > Specifications

SPECIFICATIONS

Items		Specifications	
Front suspension	**Model**	Macpherson strut type	
	Shock absorber Type Stroke mm(in) Identification color	 Gas type 160.7(6.33) Orange	
	Coil spring	GSL2.0 M/T, A/T	GSL2.7 A/T
	[2WD] Inside dia. mm(in) Outside dia. mm(in) Load rate Kgf/mm Free height mm(in) Identification color	 Ø137.8(5.42) Ø166.2±1.5(6.54±0.059) 2.8±0.14 346.8(13.65) BLUE	 Ø137.7(5.42) Ø166.3±1.5(6.54±0.059) 2.8±0.14 348.5(13.72) RED
	[4WD] Inside dia. mm(in) Outside dia. mm(in) Load rate Kgf/mm Free height mm(in)Identification color	 Ø137.5(5.42) Ø166.3±1.5(6.54±0.059) 2.9±0.15 34.16(13.44) WHITE-WHITE	 Ø137.6(5.41) Ø166.4±1.5(6.55±0.059) 2.9±0.15 348.5(13.72) RED-RED
Rear suspension	**Model**	Dual link	
	Shock absorber Type Stroke mm(in) Identification color	 Gas type 191.0(7.52) BLUE	
	Coil spring	2WD	4WD
	Inside dia. mm(in) Outside dia. mm(in) Load rate Kgf/mm Measurement range of rate mm(in) Free height mm(in) Identification color	Ø100 (3.94) Ø170 (6.69) 2.3±12 155~313(6.1~12.32) 356.3(14.38) BLUE-BLIE	Ø100 (3.94) Ø170 (6.69) 2.6±0.13 158~310(6.22~12.2) 360.1(14.17) GREEN
	Wheel alignment	**Front**	**Rear**
	Toe-in(Total) Camber Caster King pin	-2mm~2mm 0°±30' 3°36'±30' 12°46'±30'	4.6+3,-1 mm (=0.19°) -0°55'±30' - -

Wheel & Tire	**Wheel** Size Run out mm(in)	AL wheel 6.5JX16 Radial : 0.(0.01), Lateral : 0.3(0.1)
	Tire Size Inflation pressure kg/cm² (psi)	 P215/65R16, P235/60R16 2.1±0.07(30+1.0)

TIGHTENING TORQUE

Items	Nm	Kgf·m	lbf·ft
Front suspension			
Wheel nut	90~110	9~11	66.4~81.2
Strut upper mounting nut	45~60	4.5~6	33.2~44.3
Strut lower mounting nut	140~160	14~16	103.3~118.0
Strut mounting self-locking nut	60~70	6~7	44.3~51.6
Speed sensor cable mounting bolt	7~11	0.7~1.1	5.2~8.1
Lower arm mounting nut	80~90	8~9	59.0~66.4
Lower arm bush(A) mounting bolt	100~120	10~12	73.8~88.5
Lower arm bush(G) mounting bolt	140~160	14~16	103.3~118.0
Lower arm ball joint mounting bolt	100~120	10~12	73.8~88.5
Stabilizer bracket mounting bolt	45~55	4.5~5.5	33.2~40.6
Stabilizer link mounting nut	100~120	10~12	73.8~88.5
Tie rod end ball joint mounting nut	45~60	4.5~6	33.2~44.3
Tie rod toe adjustment nut	50~60	5~6	36.9~44.3
Stabilizer bar link mounting nut	100~120	10~12	73.8~88.5
Rear suspension			
Wheel nut	90~110	9~11	66.4~81.2
Strut upper mounting nut	30~40	3~4	22.1~29.5
Strut lower mounting nut	140~160	14~16	103.3~118.0
Strut mounting self-locking nut	52~70	5.2~7.0	37.6~50
Speed sensor cable mounting bolt	7~11	0.7~1.1	5.2~8.1
Stabilizer bracket mounting bolt	45~55	4.5~5.5	33.2~40.6
Stabilizer link mounting nut	100~120	10~12	73.8~88.5
Tie rod toe adjustment nut	50~60	5~6	36.9~44.3
Suspension arm mounting	160~180	16~18	118.0~132.8
bolt[2WD]	140~160	14~16	103.3~118.0
Suspension arm mounting	100~120	10~12	73.8~88.5
bolt[4WD]	100~120	10~12	73.8~88.5
Cross member mounting bolt	100~120	10~12	73.8~88.5
Trailing arm bracket mounting bolt	90~120	9~12	59.0~88.5
Trailing arm to carrier mounting bolt			
Differential mounting bolt			

CAUTION

Replace the self-locking nuts with new ones after removal.

LUBRICANTS

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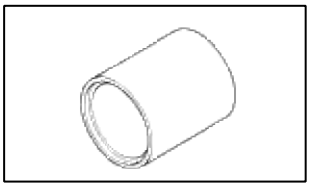
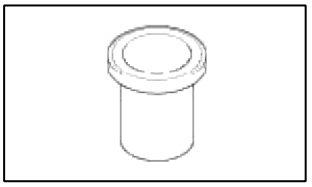
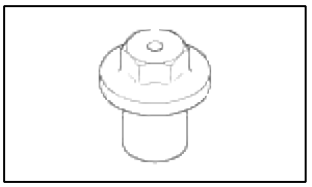
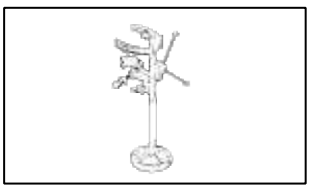
Item	Quantity
In insulator of strut	As required

Suspension System > General Information > Special Service Tools

SPECIAL TOOLS

Tool(Number and Name)	Illusstration	Use
09261-2100 Mount bushing remover and installer		Removal & installation of lower arm bushing(G)
09214-32000 Mount bushing remover and installer		Removal & installation of lower arm bushing(G)
09529-21000 Trailing arm bushing remover installer		Removal & installation of trailing arm bushing
09546-26000 Strut spring compressor		Compression of the coil spring

Suspension System > General Information > Troubleshooting

TROUBLESHOOTING

Trouble sysmptom	Probable cause	See page
Hard steering	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Flat tire No power assist	SS - 39 - - -
Poor return of steering wheel to center	Improper front wheel alignment	SS - 39
Poor ride quality	Improper front wheel alignment Damaged shock absorber Varied or dameged stabilizer Varied or dameged coil spring Worn lower arm bushing	SS - 39 SS - 7,22 SS - 17,36 SS - 9 SS - 14
Abnormal tire wear	Improper front wheel alignment Worn of shock absorber	SS - 39 SS - 7,22
Wandering	Improper front wheel alignment Poor turning resistance of lower arm ball joint Loose or worn lower arm bushing	SS - 39 - SS - 14
Vehicle pulls to one side	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Varied or dameged coil spring Bent lower arm Improper tire inflation pressure	SS - 39 - SS - 9,25 SS - 13 -
Steering wheel shimmy	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Varied or dameged stabilizer Worn lower arm bushing Worn of shock absorber Varied or dameged coil spring Improper front wheel alignment	SS - 39 - SS - 17 SS - 14 SS - 7 SS - 9 -
Bottoming	Broken or worn spring Malfunction of shock absorber	SS - 9,25 SS - 7,22

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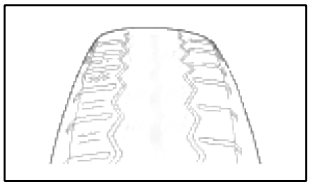
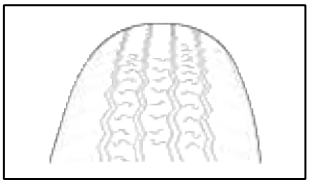
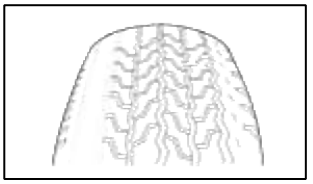
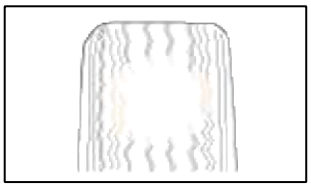
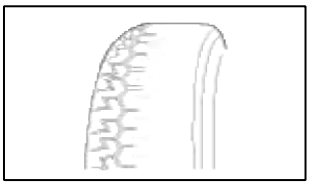
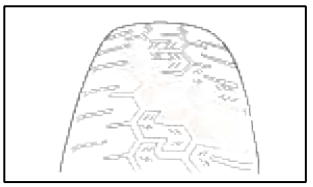
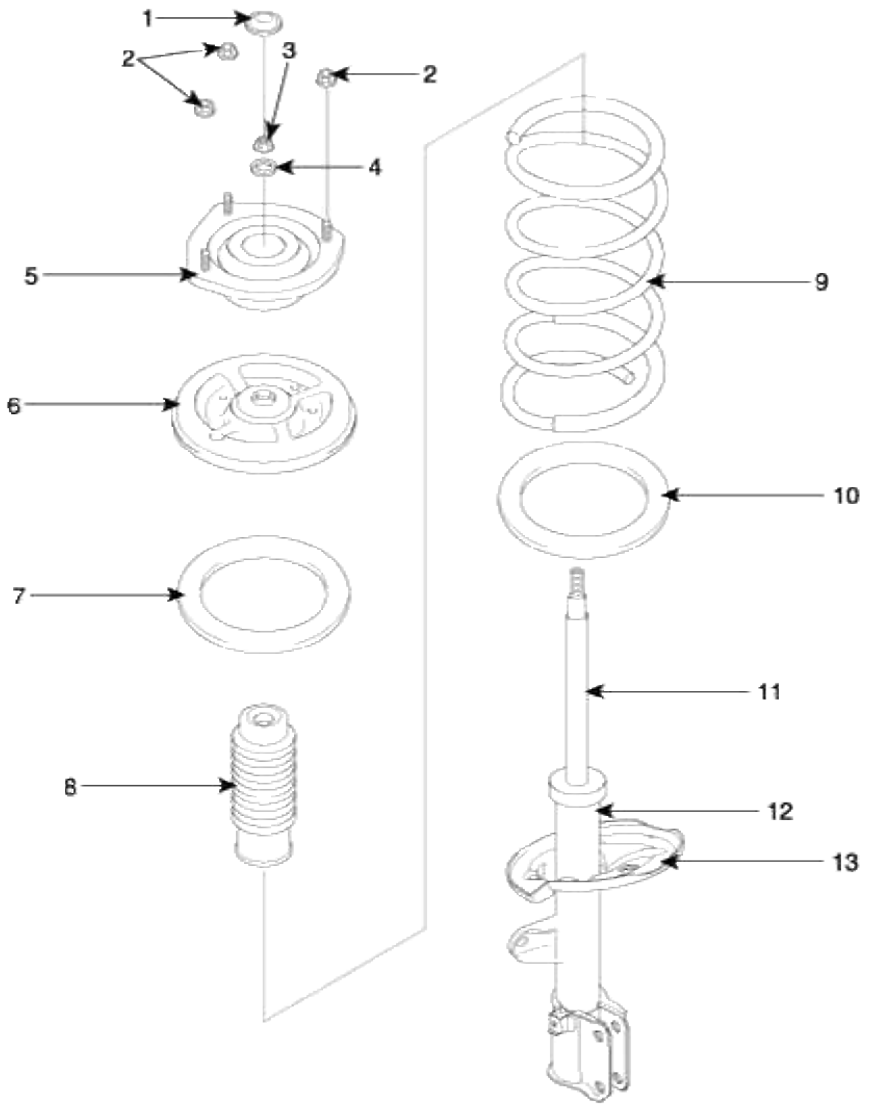
WHEEL AND TIRE DIAGNOSIS		
Radid wear at the center	Rapid wear at both shoulders	Wear at one shoulder
		
• Center-tread down to fabric due to excessive over inflated tires • Lack of rotation • Excessive toe on drive wheels • Heavy acceleration on drive	• Underinflated tires • Worn suspension components • Excessive cornering speeds • Lack of rotation	• Toe adjustment out of specification • Camber out of specification • Damaged strut • Damaged lower arm

WHEEL AND TIRE DIAGNOSIS		
Partial wear	Feathered edge	Wear pattern
		
• Cansed by irrequlat burrs on brak drums.	• Toe adjustment out of specification • Damaged or worn tie rods • Damaged knuckle	• Excessive toe on non-drive wheels • Lack of rotation

Suspension System > Front Suspension System > Front Strut Assembly > Components and Components Location

COMPONENTS



1. Insulator dust cover
2. Upper mounting nuts
3. Self-locking nut
4. Spacer
5. Insulator
6. Spring upper seat
7. Spring upper pad
8. Strut dust cover & bumper rubber
9. Coil spring
10. Spring lower pad
11. Piston rod
12. Strut assembly
13. Spring lower seat

Suspension System > Front Suspension System > Front Strut Assembly > Repair procedures

DISASSEMBLY

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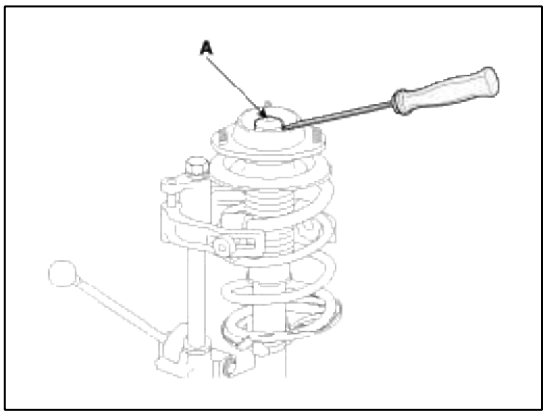
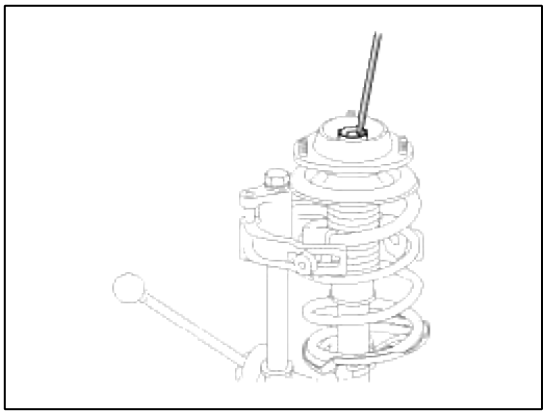
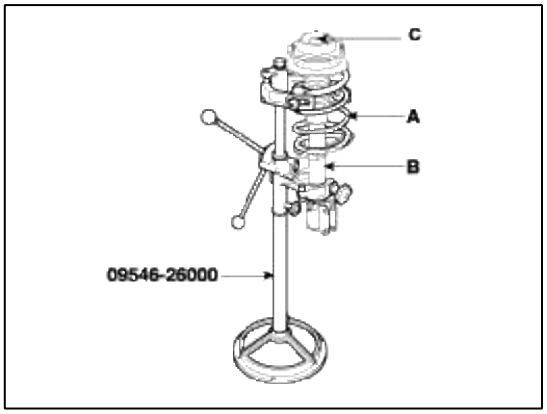
1. Remove the dust cover(A) with a flat-tipped (-) screw driver.



2. Open the dust cover and wipe off grease in the insulator.



3. Using the special tool (09546-26000), compress the coil spring(A) until there is only a little tension of the spring on the strut.

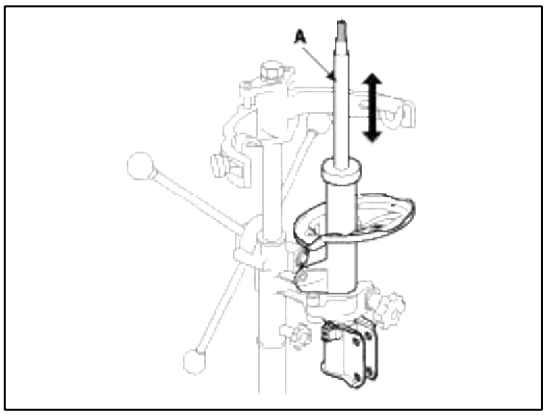


4. Remove the self-locking nut(C) from the strut assembly(B).
5. Remove the insulator, spring seat, coil spring and dust cover from the strut assembly.

INSPECTION

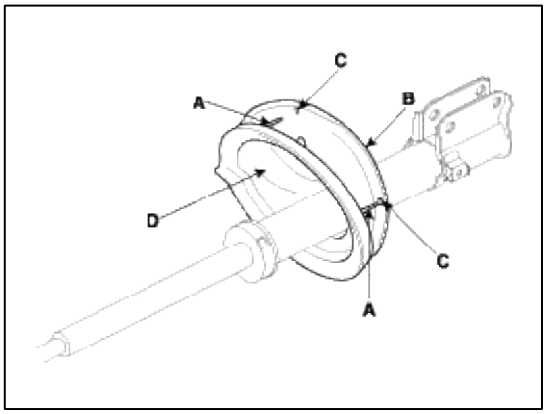
1. Check the strut insulator bearing for wear or damage.
2. Check rubber parts for damage or deterioration.

3. Compress and extend the piston rod(A) and check that there is no abnormal resistance or unusual sound during operation.



REASSEMBLY

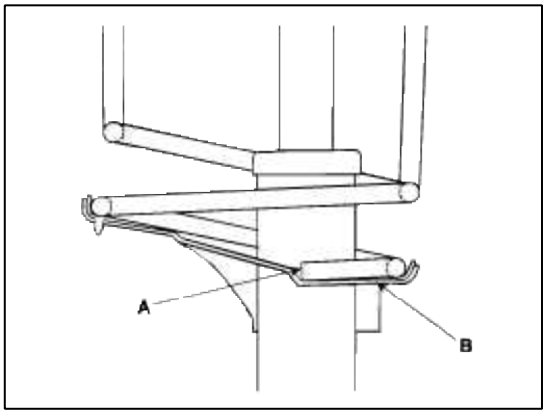
1. Install the spring lower pad(D) so that the protrusions(A) fit in the holes(C) in the spring lower seat(B).



2. Compress coil spring using special tool (09546-26000).
   Install compressed coil spring into shock absorber.

> NOTE
>
> 1) Indicated two identification color marks on the coil spring one follows model option (see page SS-2) the other follows load classification according to the below.
>   Pay attention to distiuguish between the two marks and then install them.
> 2) Install the coil spring wth the idenftification mark directed toward the knuckle.

3. After fully extending the piston rod, install the spring upper seat and insulator assembly.
4. After seating the upper and lower ends of the coil spring(A) in the upper and lower spring seat grooves(B) correctly, tighten new self-locking nut temporarily.



5. Remove the special tool(09546-26000).

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6. Tighten the self-locking nut to the specified torque.

Tightening torque :
60~70 Nm(6~7 kgf·m, 44.3~51.6 lb-ft)

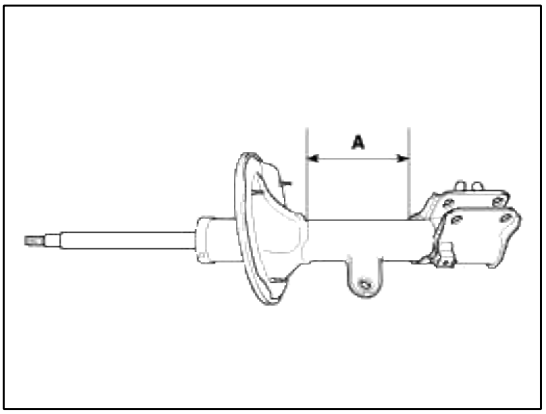
7. Apply grease to the strut upper bearing and install the insulator cap.

CAUTION

When applying the grease, be careful so that it isn't smeared on the insulator rubber.

DISPOSAL

1. Fully extend the piston rod.
2. Drill a hole on the A section to remove gas from the cylinder.

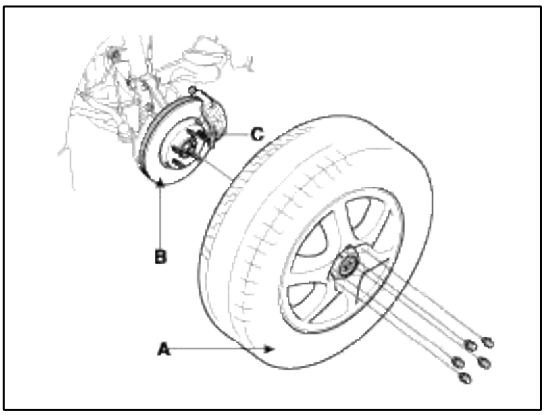


CAUTION

The gas coming out is harmless, but be careful of chips that may fly when drilling.

REMOVAL

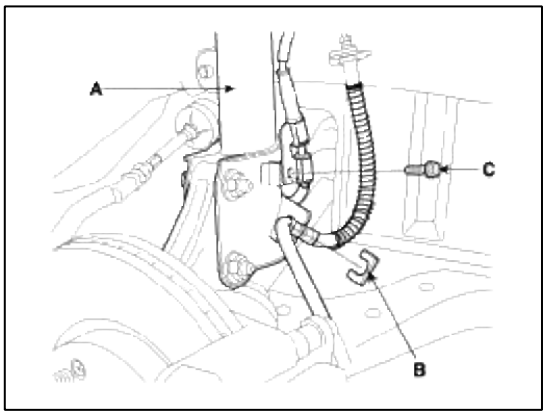
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire(A) from front hub(B).



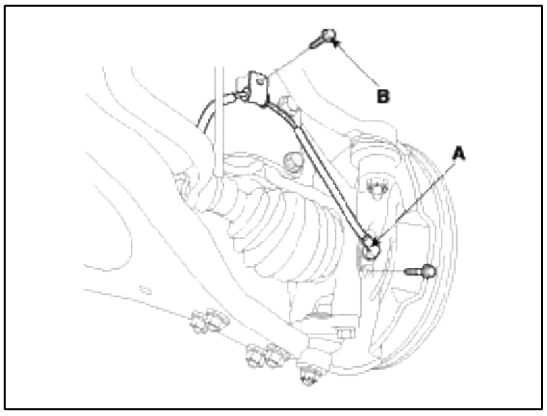
CAUTION

Bej careful not to damage the hub bolts(C) then remove the front wheel and tire(A).

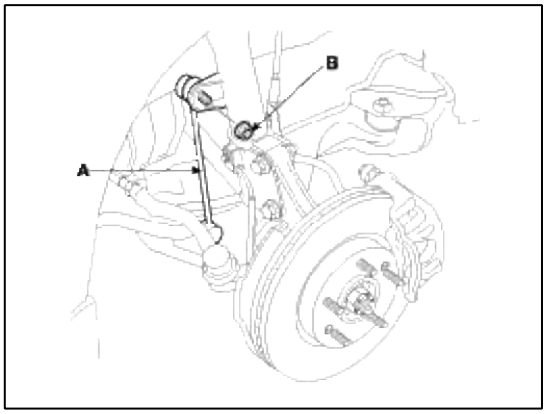
3. Remove the brake hose bracket(B) and speed sensor cable mounting bolt(C) from the strut assembly(A).



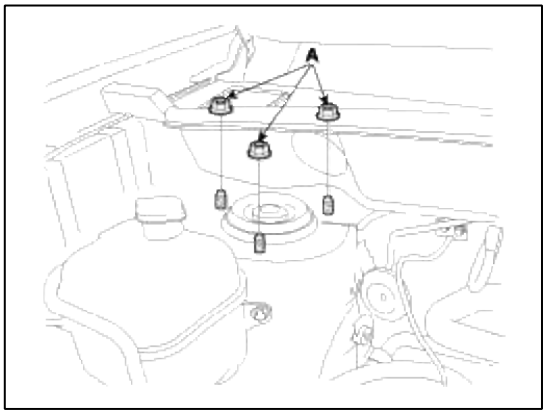
4. Remove the speed sensor cable mounting bolt(B) and speed sensor(A).



5. Remove the nut(B) from the stabilizer bar link(A).



6. Remove the strut upper mounting nuts(A).



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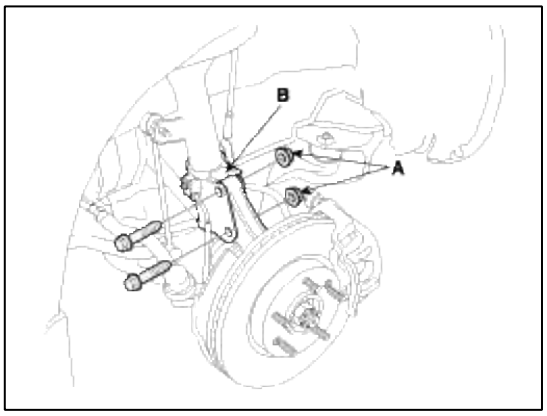
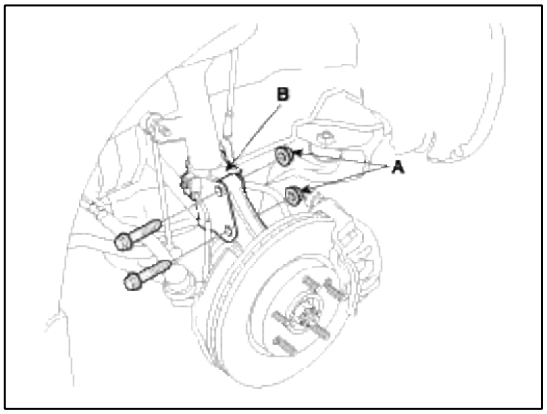
7. Remove the strut lower mounting bolts(A) and then remove the strut assembly(B).



INSTALLATION

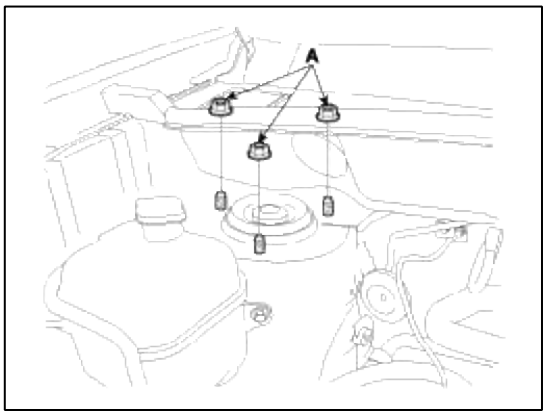
1. Install the strut assembly(B) and then install the strut lower mounting bolts(A).

Tightening torque :
140~160 Nm (14~16 Kgf·m, 103.3~118.0 lb-ft)



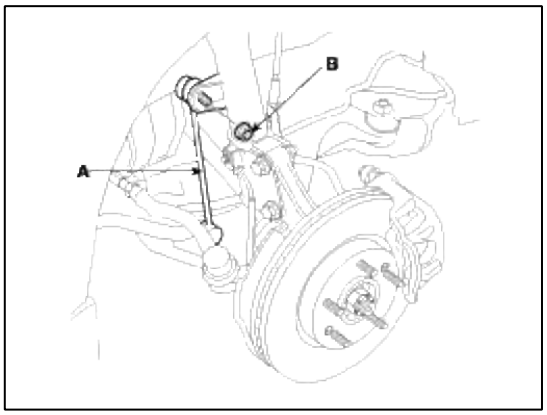
2. Install the strut upper mounting nuts(A).

Tightening torque :
45~60 Nm (4.5~6 Kgf·m, 33.2~44.3 lb-ft)



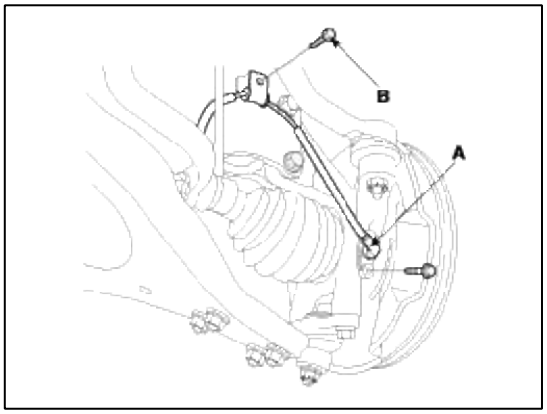
3. Install the nut(B) on the stabilizer bar link(A).

Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)



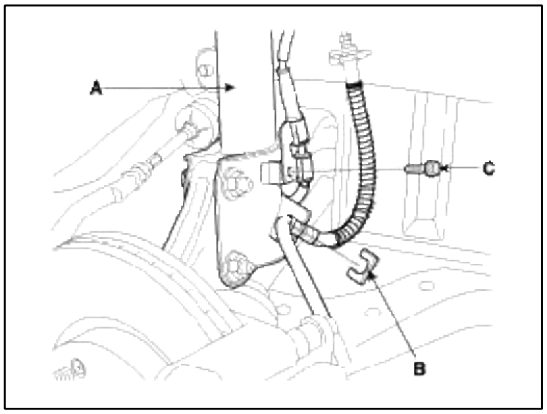
4. Install the speed sensor cable mounting bolt(B) and speed sensor(A).

Tightening torque :
7~11 Nm (7~1.1 Kgf·m, 5.2~8.1 lb-ft)



5. Install the brake hose bracket(B) and speed sensor cable mounting bolt(C) on the strut assembly(A).

Tightening torque :
7~11 Nm (7~11 Kgf·m, 5.2~8.1 lb-ft)



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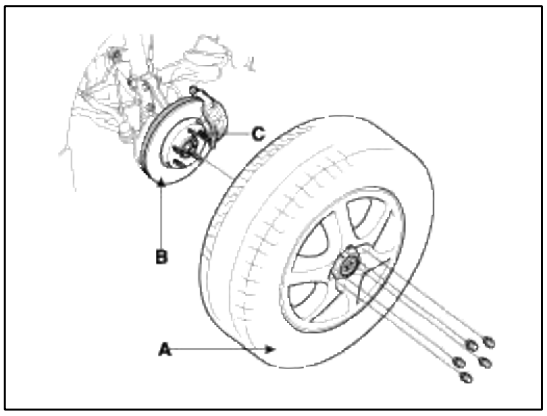
6. Install the front wheel and tire(A) on the front hub(B).

Tightening torque :
90~110 Nm (9~11 Kg·m, 66.4~81.2 lb-ft)

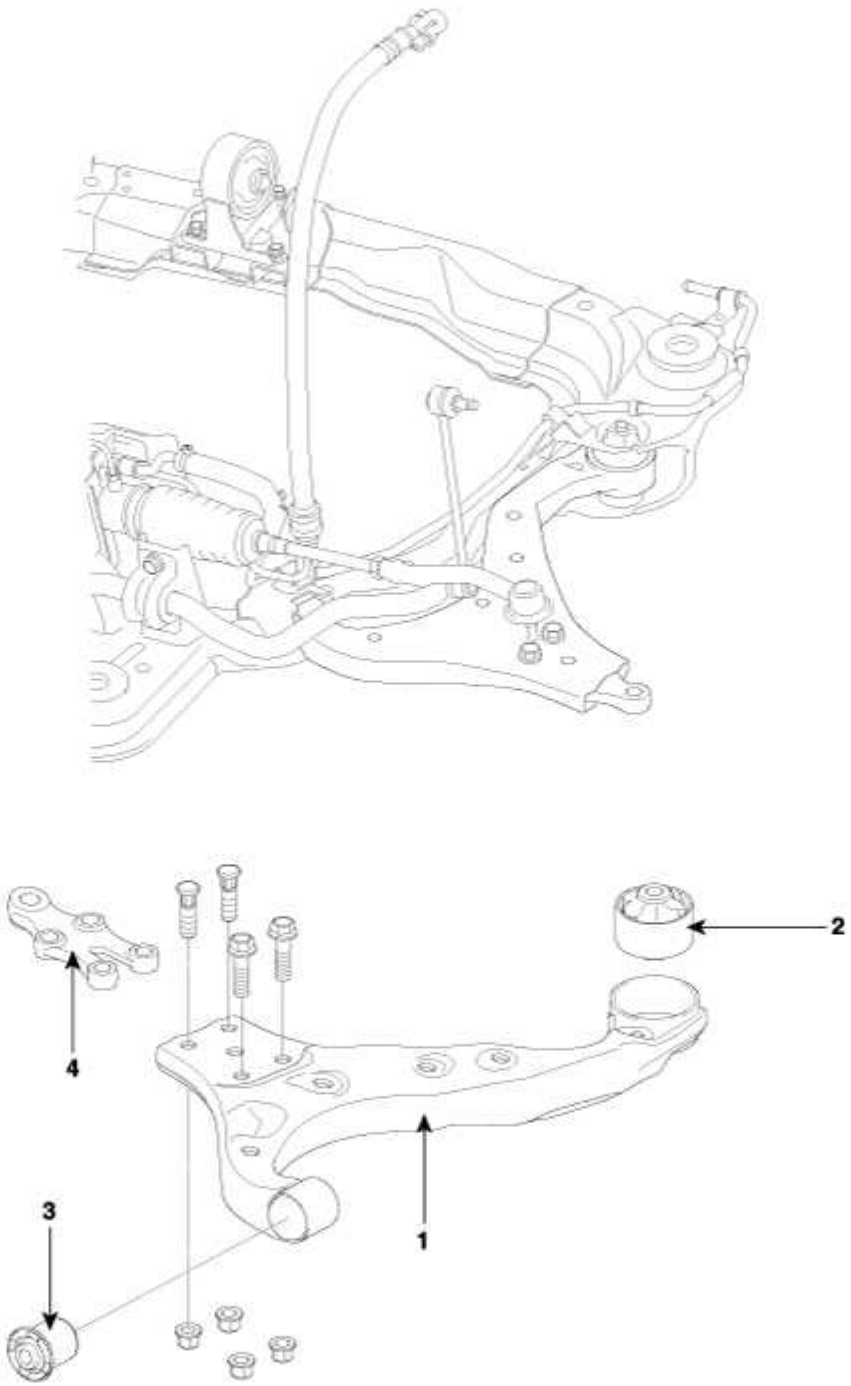


CAUTION

Be careful not to damage the hub bolts(C) then install the front wheel and tire(A).

Suspension System > Front Suspension System > Front Lower Arm > Components and Components Location

COMPONENTS



1. Lower arm
2. G bushing
3. A bushing
4. Connector

Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.

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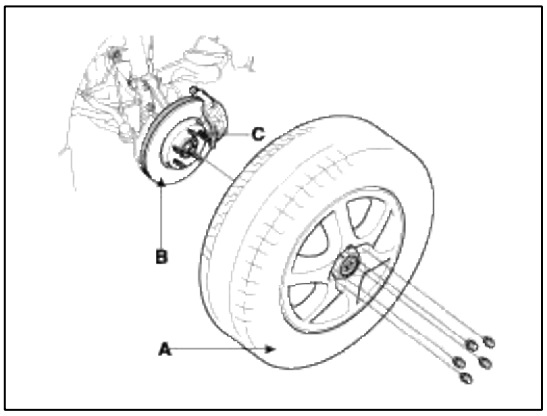
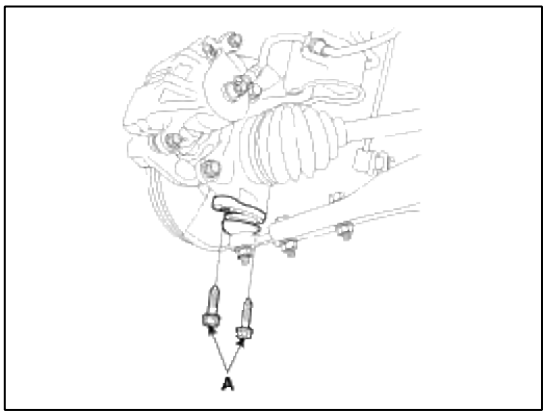
2. Remove the front wheel and tire(A) from front hub(B).



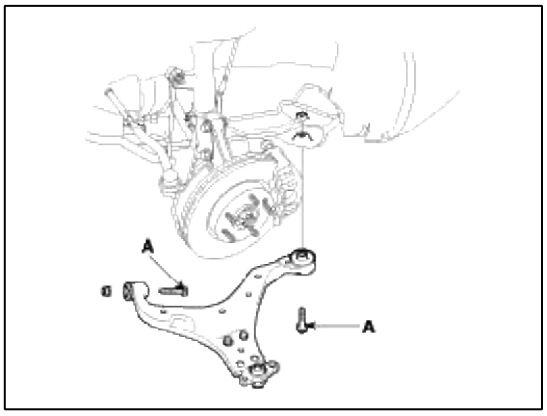
CAUTION

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).

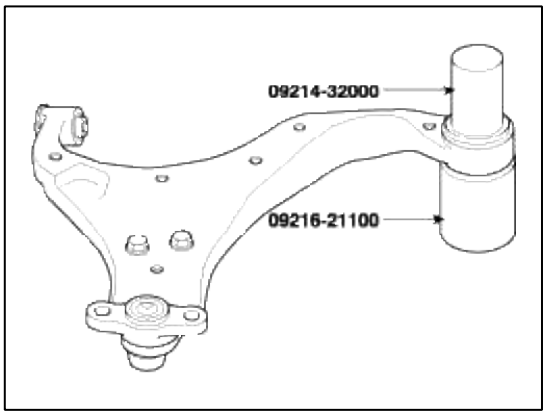


4. Remove the lower arm mounting bolts(A).

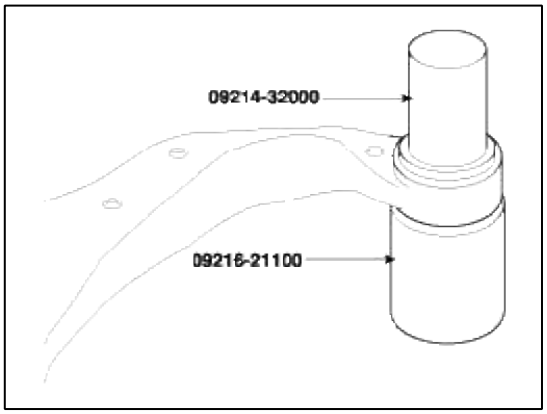


REPLACEMENT

1. Using the special tools(09214-32000 & 09216-211000), remove the bushing from the lower arm.



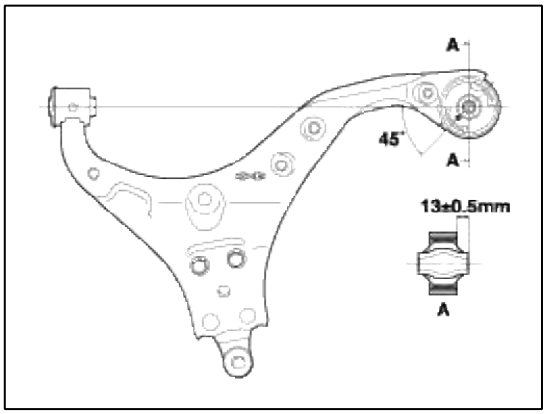
2. Apply soap solution to the following parts.
   A. Outer surface of the bushing.
   B. Inner surface of the lower bushing mounting part.
3. Using the special tools(09214-32000 & 09216-21100), install the busing on the lower arm.



CAUTION

Insert bushing in the direction as shown in the illustration.

Separation force is over 8000 N (800 Kgf, 1763 lbf)



INSTALLATION

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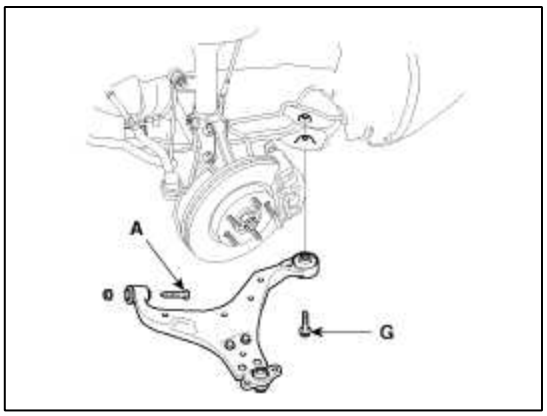
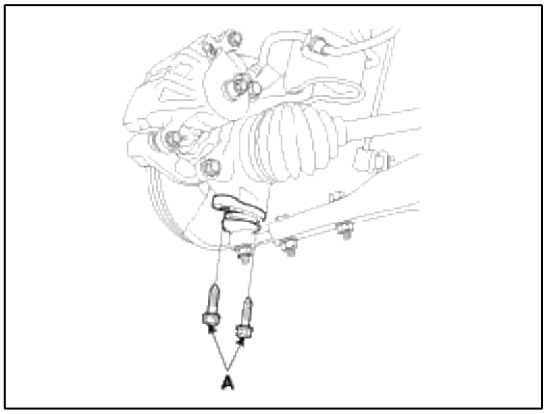
1. Install the lower arm mounting bolts(A).

Tightening torque :
A bushing :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)
G bushing :
140~160 Nm (14~16 Kgf·m, 103.3~118.0 lb-ft)



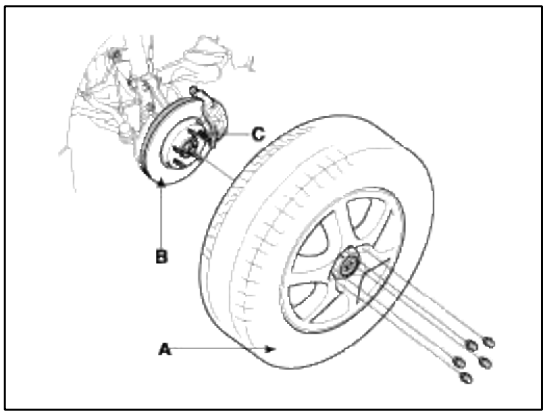
2. Install the lower arm ball joint mounting bolts(A).

Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)



3. Install the front wheel and tire(A) on the front hub(B).

Tightening torque :
90~110 Nm (9~11 Kgf·m, 66.4~81.2 lb-ft)

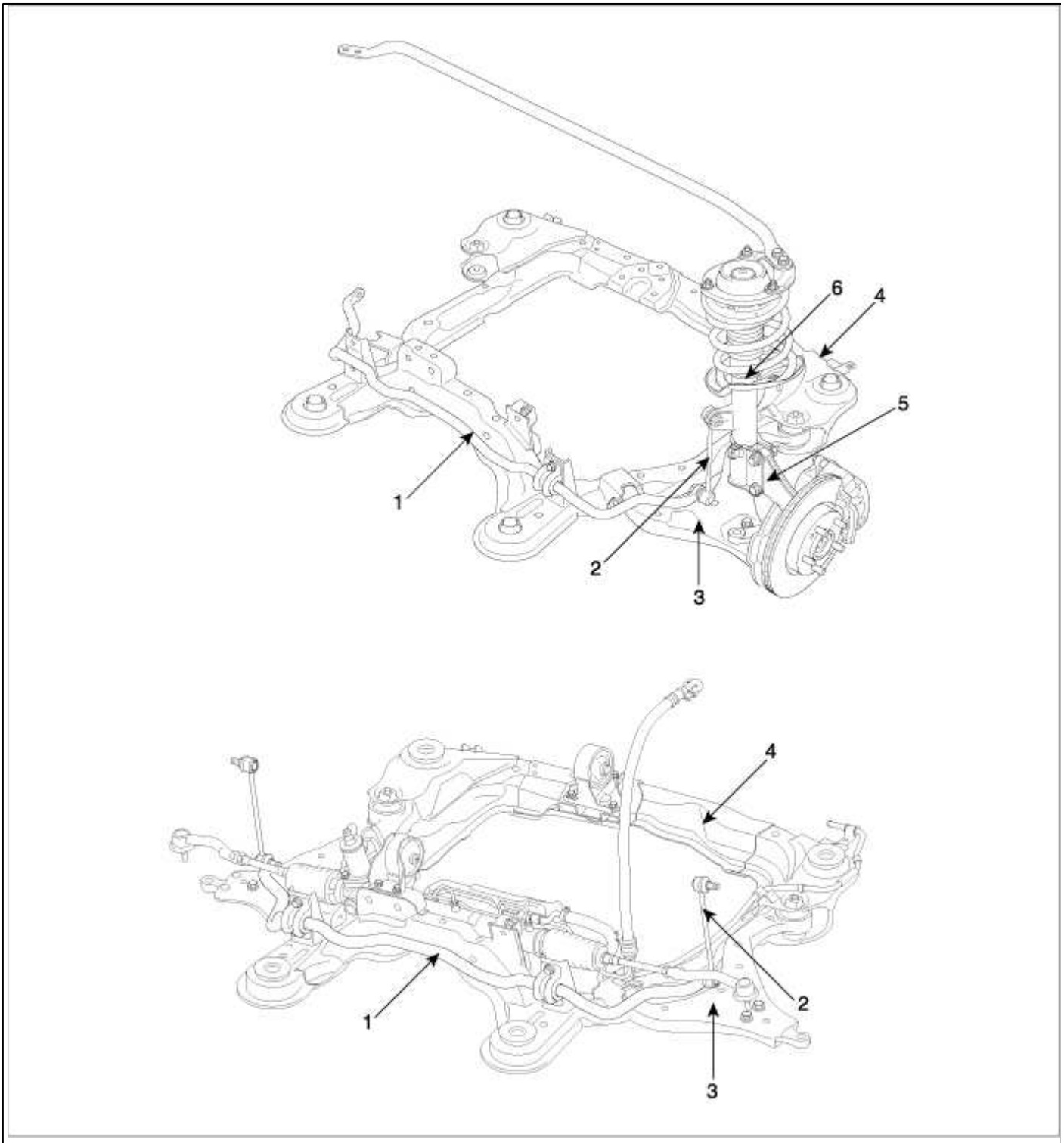


CAUTION

Be careful not to damage the hub bolts(C) then install the front wheel and tire(A).

Suspension System > Front Suspension System > Front Stabilizer Bar > Components and Components Location

COMPONENTS



1. Stabilizer bar
2. Stabilizer bar link
3. Lower arm
4. Sub-frame
5. Knuckle
6. Strut assembly

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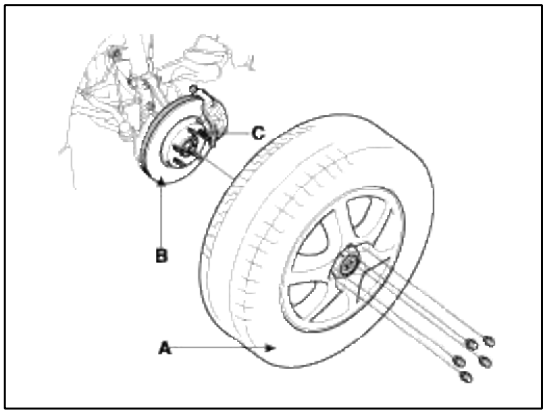
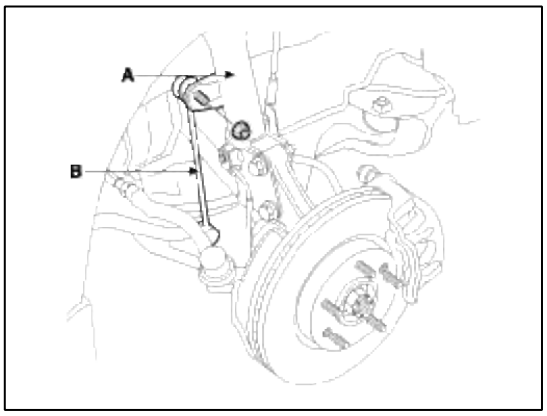
Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures

REMOVAL

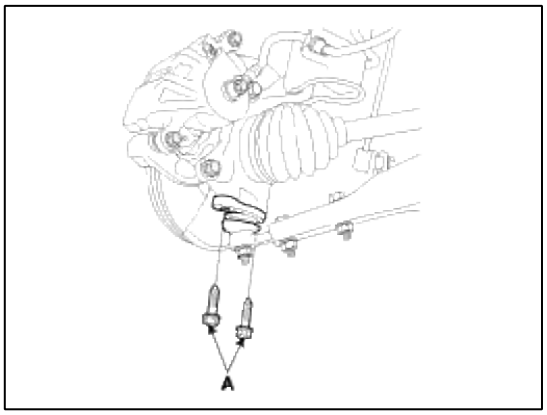
1. Loosen the wheel nuts slightly.
   Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire(A) from front hub(B).



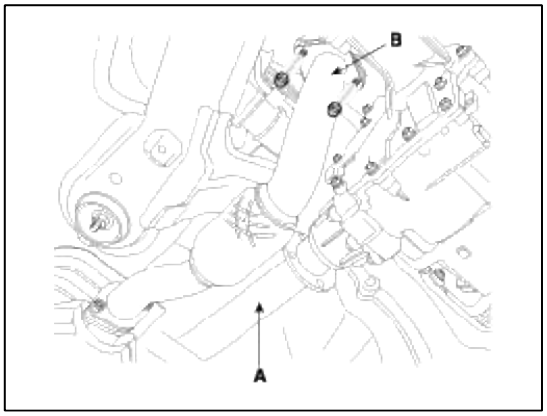
3. Remove the stabilizer bar link(B) from the strut assmembly(A).



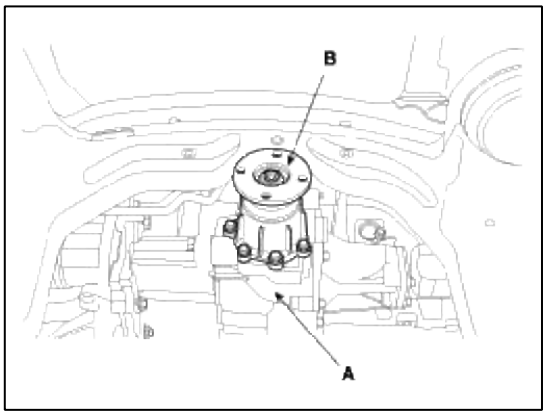
4. Remove the two bolts(A) for lower arm ball joint.



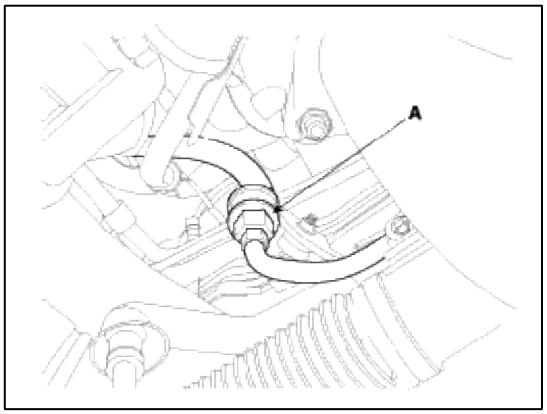
5. Remove the propeller shaft(A) and the front muffler assembly(B).



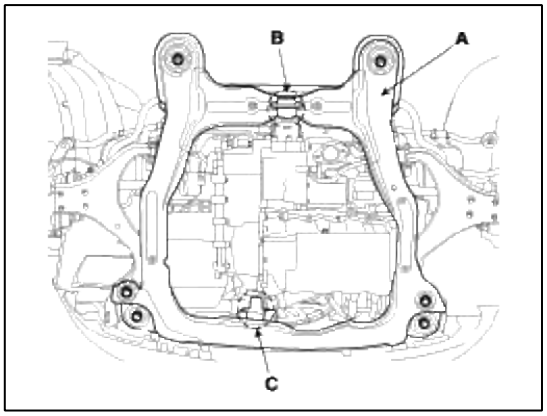
6. Drain oil from the transfer case(A). then remove the rear flange assmbly(B).



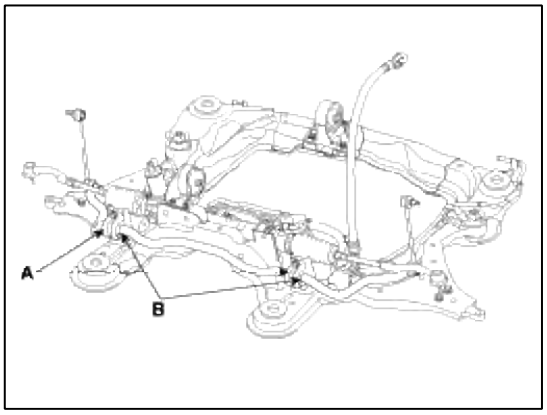
7. Drain power steering oil.
8. Remove the connecting bolt(A) for pressure tubes.



9. Remove two engine mounting bolts(B,C) and six subframe mounting bolts in order to remove the subframe(A).



10. Remove both two stabilizer brackets and two bushes respcetively.



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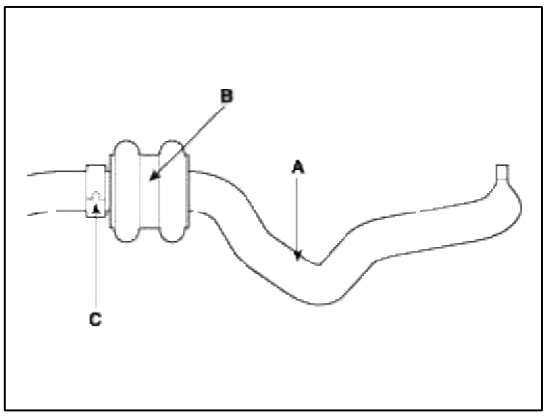
11. Remove the stabilizer bar.

> CAUTION
>
> Be careful not to do damage to pressure tubes.

INSTALLATION

1. Install the bushing(B) on the stabilizer bar(A).



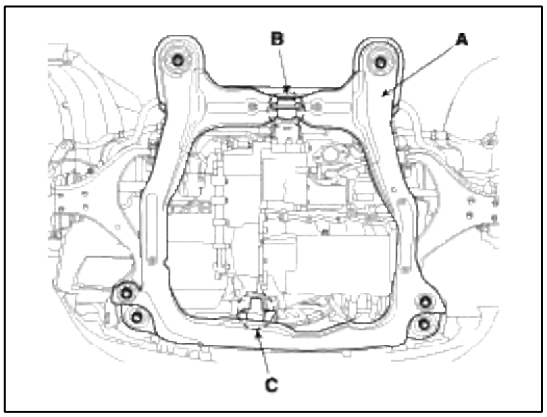
> NOTE
>
> Bring clamp(C) of stabilizer bar(A) into contact with bushing(B).

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.

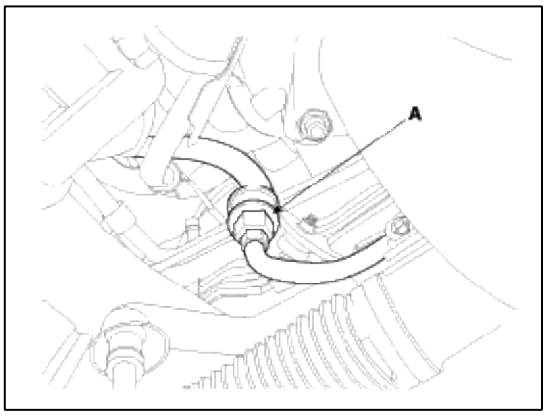
Tightening torque :
45~55 Nm (4.5~5.5 Kgf·m, 33.2~40.6 lb-ft)

4. Install the six subframe mounting bolts, then the two engine mounting bolts(B,C).

Tightening torque :
50~65 Nm (5~6.5 Kgf·m, 36.9~48.0 lb-ft)

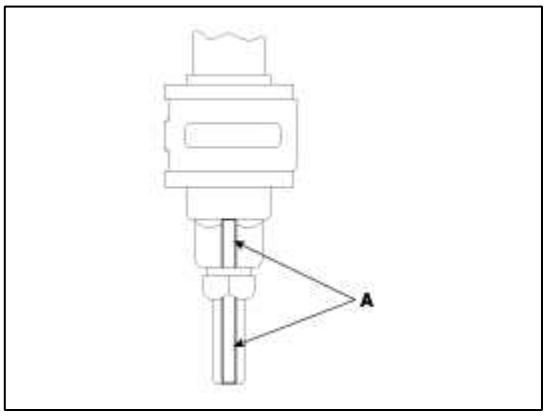


5. Install the connecting blot(A) for pressure tubes.

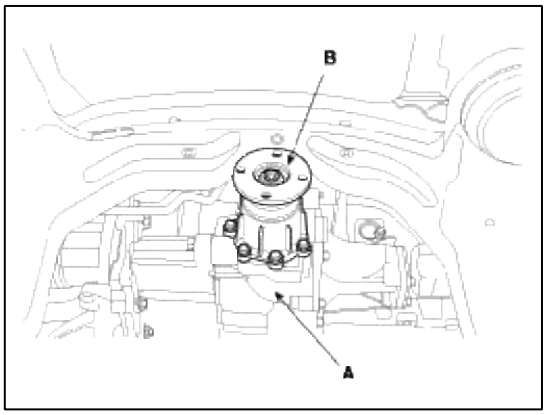


CAUTION

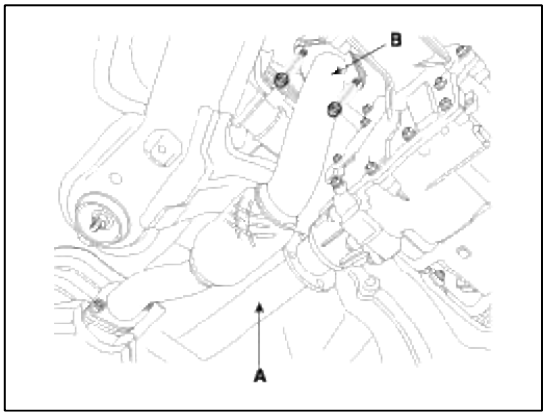
Be sure to align the white marks(A) on the tube and the hose.



6. Install the rear flange assembly(B) to the transfer case(A).



7. Install the propeller shaft(A), then the front mufler assembly(B).



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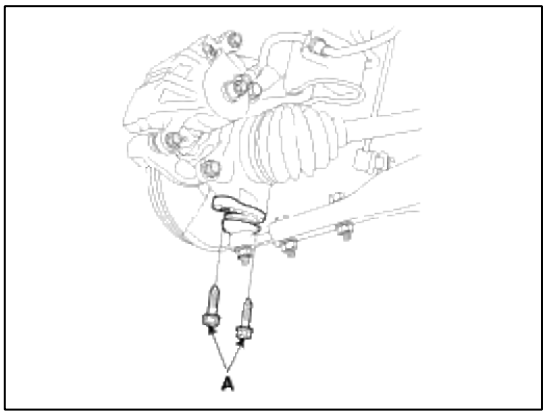
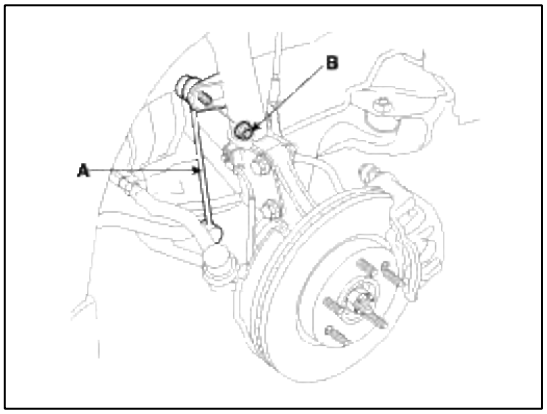
8. Install the two bolts(A) for the lower arm ball joint.

Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)



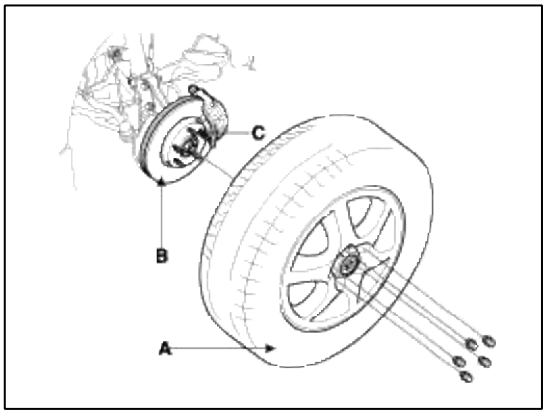
9. Install the nut(B) on the stabilizer bar link(A).

Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)



10. Install the front wheel and tire(A) on thr front hub(B).

Tightening torque :
90~110 Nm (9~11 Kgf·m, 66.4~81.2 lb-ft)



CAUTION

Be careful not to damage the hub bolts(C) then install the front wheel and tire(A).

INSPECTION

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.

Suspension System > Rear Suspension System > Rear Strut Assembly > Components and Components Location

COMPONENT LOCATION

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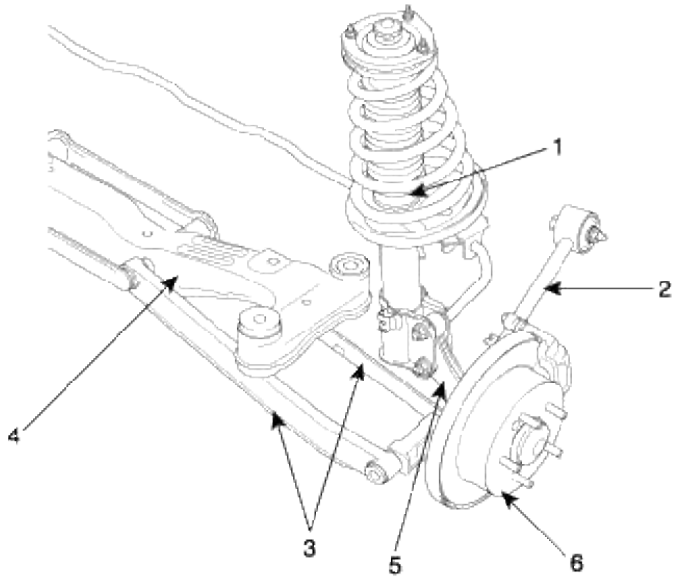
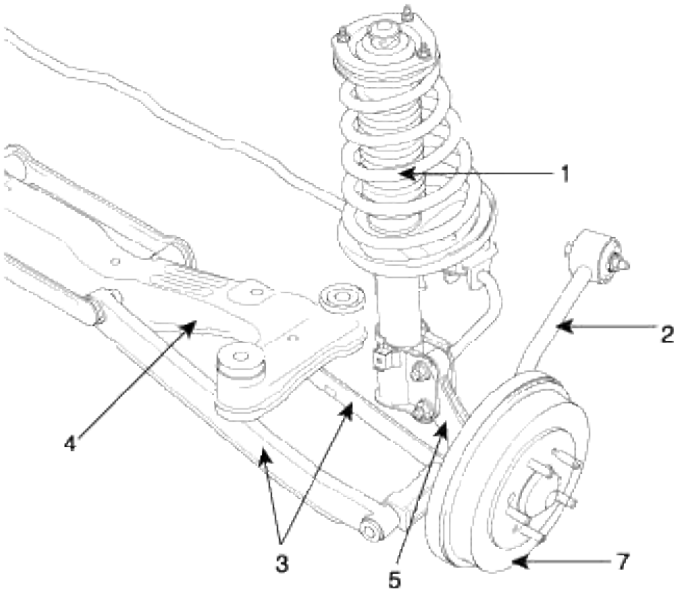
[2WD-DISC TYPE]

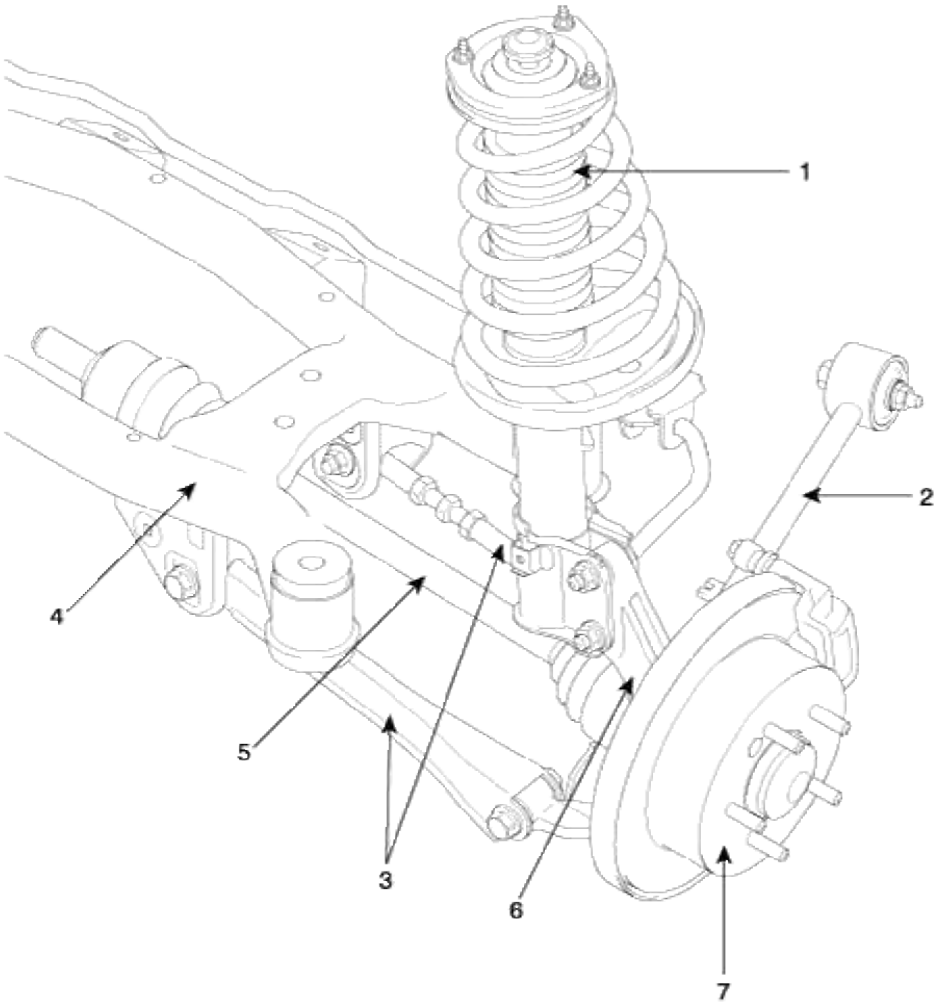


[2WD-DRUM TYPE]



1. Strut assembly
2. Trailing arm
3. Suspension arm
4. Cross member
5. Carrier
6. Disc brake assembly
7. Drum brake assembly

[4WD]



1. Strut assembly
2. Trailing arm
3. Suspension arm
4. Cross member
5. Drive shaft
6. Carrier
7. Disc brake assembly

COMPONENTS

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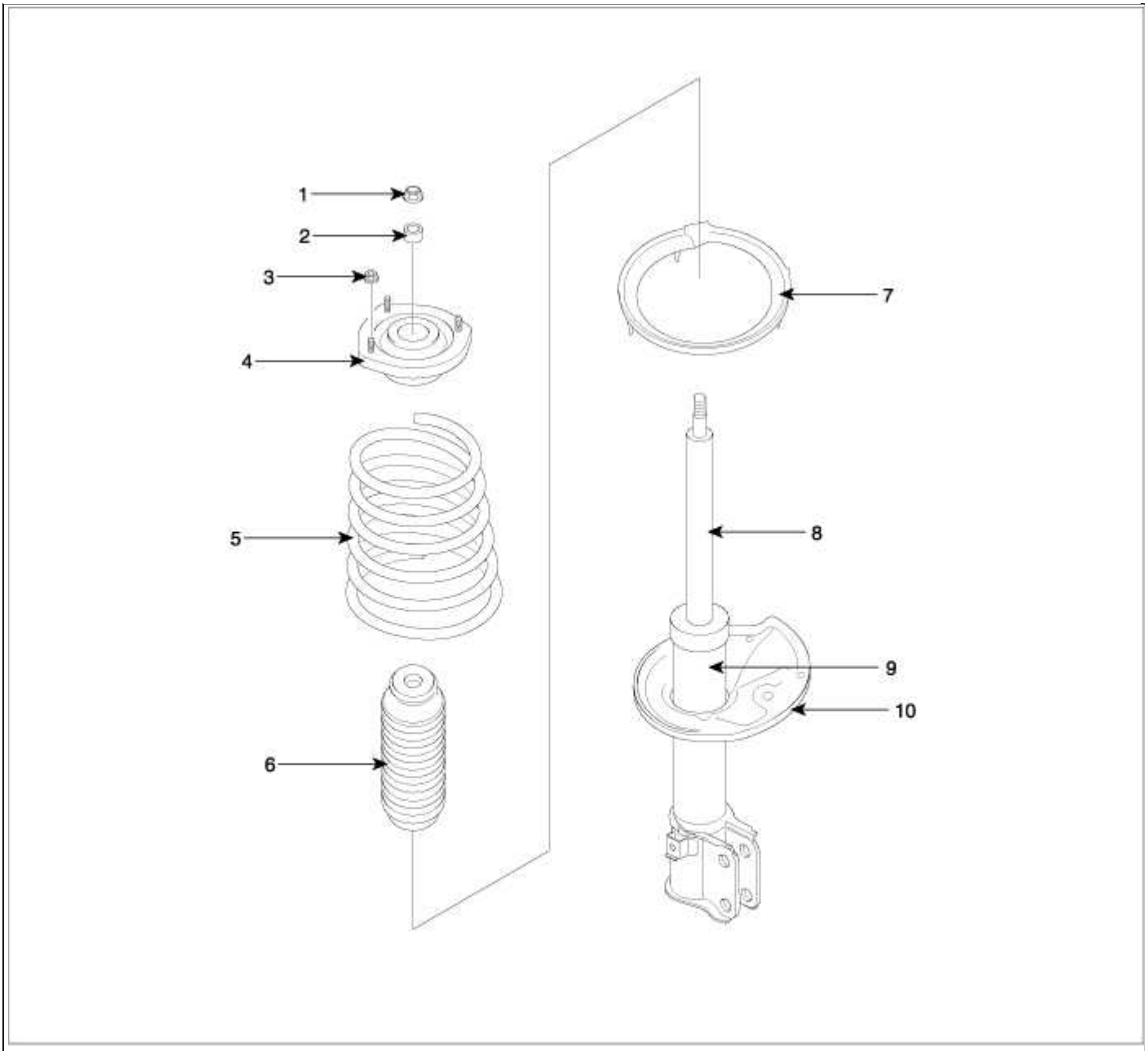


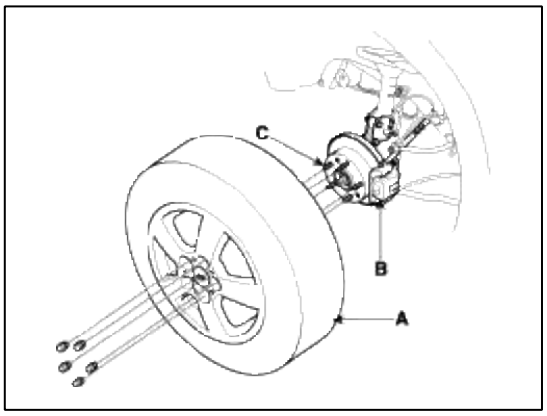
1. Self-locking nut
2. Spacer
3. Upper mounting nut
4. Insulator
5. Coil spring
6. Strut dust cover & bumper rubber
7. Spring lower pad
8. Piston rod
9. Strut assembly
10. Spring lower seat

Suspension System > Rear Suspension System > Rear Strut Assembly > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.

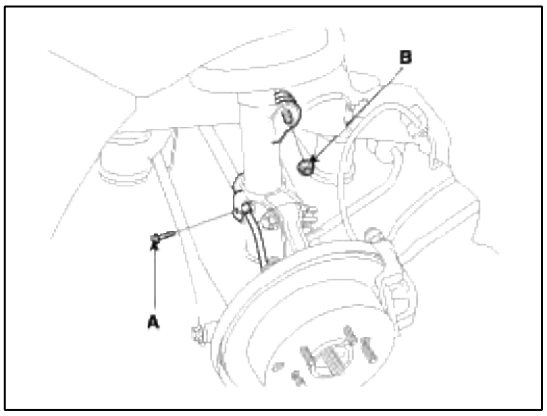
2. Remove the rear wheel and tire(A) from rear hub(B).



CAUTION

Be careful not to damage the hub bolts(C) then remove the rear wheel and tire(A).

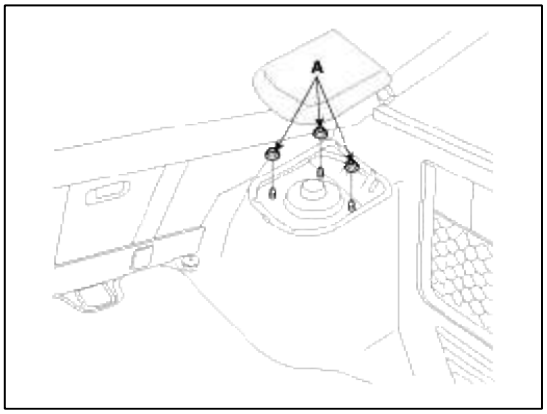
3. Remove the speed sensor cable monting bolt(A).



NOTE

Drum brake type :
Remove the speed sensor cable mounting bolts(2EA) and the brake hose bracket.
Disc brake type :
Remove the speed sensor cable mounting bolt(1EA)

4. Remove the stabilizer bar link nut(B).
5. Remove the strut upper mounting nut(A).



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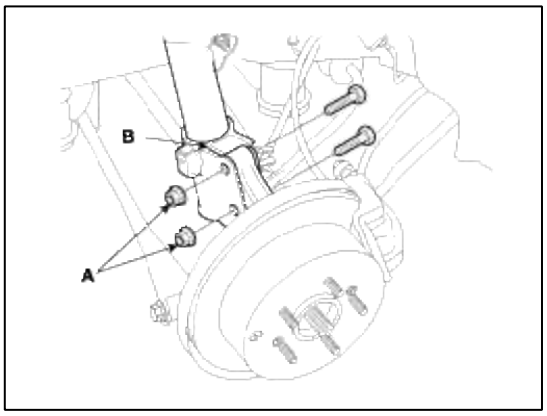
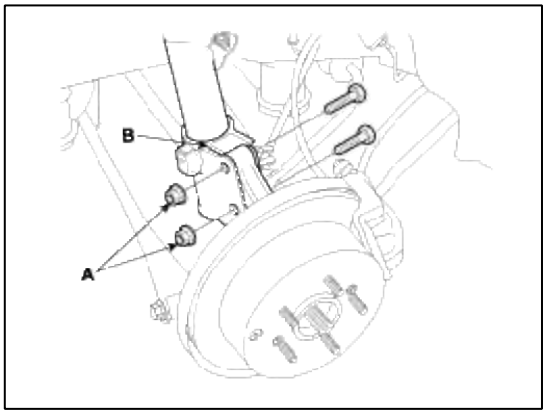
6. Remove the strut lower mounting bolts(A) and then remove the strut assembly(B).



INSTALLATION

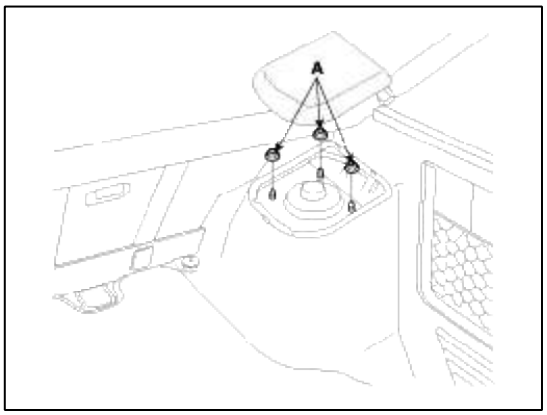
1. Install the strut assembly(B) and then install the strut lower mounting bolts(A).

Tightening torque :
140~160 Nm (14~16 Kgf·m, 103.3~118.0 lb-ft)



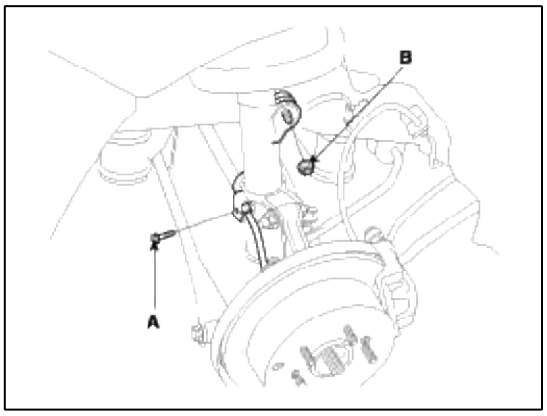
2. Install the strut upper mounting nuts(A).

Tightening torque :
30~40 Nm (3~4 Kgf·m, 22.1~29.5 lb-ft)



3. Install stabilizer bar link nut(B).

Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)



4. Install the speed sensor cable mounting bolt(A).

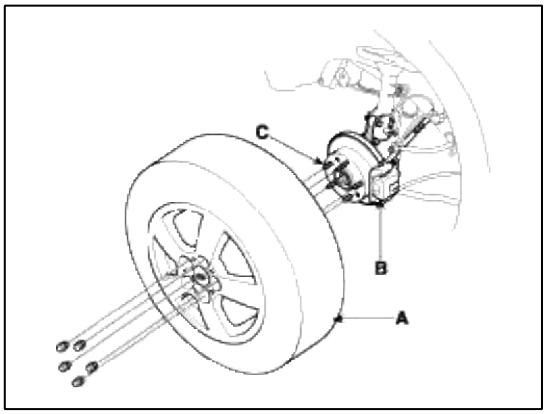
Tightening torque :
7~11 Nm (0.7~1.1 Kgf·m, 5.2~8.1 lb-ft)

NOTE

Drum brake type :
Install the speed sensor cable mounting bolts(2EA) and the brake hose bracket.
Disc brake tyep :
Install the speed sensor cable mounting bolt(1EA)

5. Install the rear wheel and tire(A) on the rear hub(B).

Tightening torque :
90~110 Nm (9~11 Kgf·m, 66.4~81.2 lb-ft)



CAUTION

Be careful not to damage the hub bolts(C) then install the rear wheel and tire(A).

DISASSEMBLY

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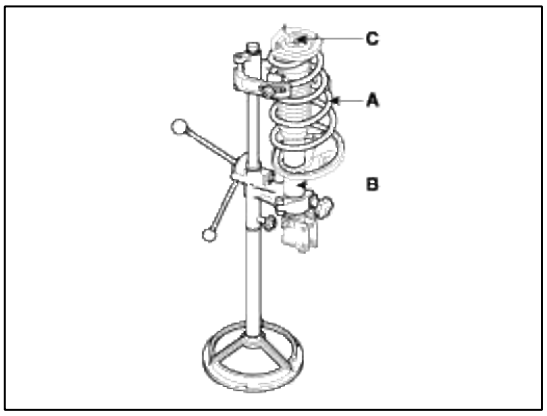
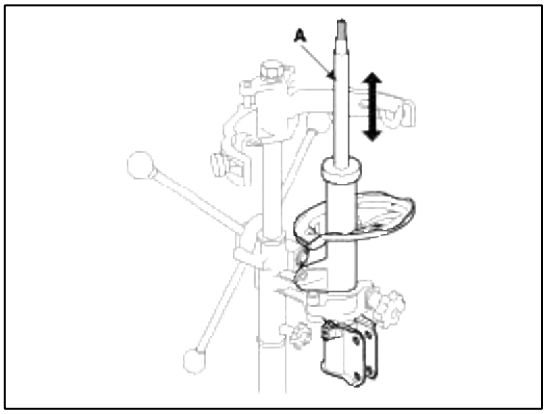
1. Using the special tool(09545-26000), compress the coil spring(A).



2. Remove the self-locking nut(C) from the strut(B).
3. Remove the pipe, insulator, spring seat, coil spring and dust cover from the strut(B).

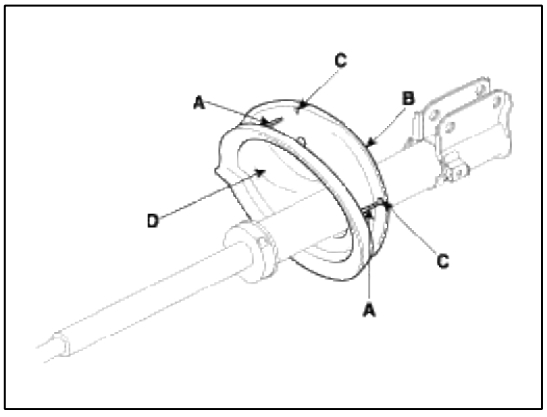
INSPECTION

1. Check the insulator 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 operating.



REASSEMBLY

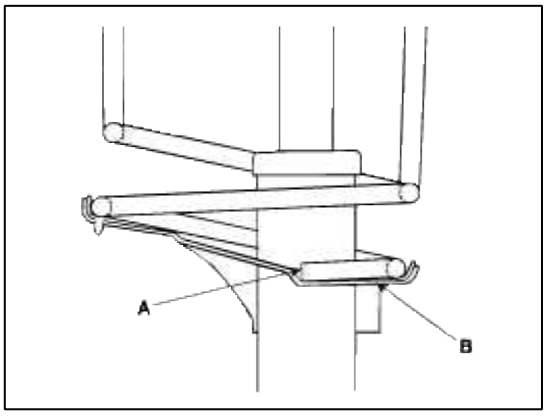
1. Install the spring lower pad(D) so that the protrusions(A) fit in the holes(C) in the spring lower seat(B).



2. Compress coil spring using special tool(09546-26000).
   Install compressed coil spring into shock absorber.

> NOTE
>
> 1) There are two color marks on the coil spring. One corresponds to model option (see page SS-2), and the other corresponds to load clssification. Ensure that the correct parts are being installed.
> 2) Install the coil spring with the identification mark directed toward the knuckle.

3. After fully extending the piston rod, install the spring upper seat and insulator assembly.
4. After seating the upper and lower ends of the coil spring(A) in the upper and lower spring seat grooves(B) correctly, tighten new self-locking nut temporarily.

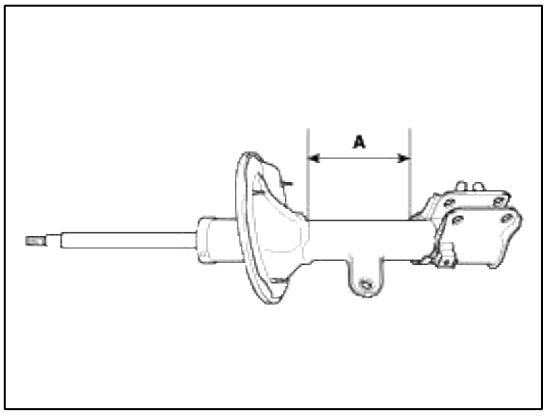


5. Remove the special tool(09546-26000).
6. Tighten the self-locking nut to the specified torque.

Tightening torque :
52~70 Nm (5.2~7.0 Kgf·m, 37.6~50 lb-ft)

DISPOSAL

1. Fully extend the piston rod.
2. Drill a hole on the A section to remove gas from the cylinder.



> CAUTION
>
> The gas coming out is harmless, but be careful of chips that may fly when drilling.

Suspension System > Rear Suspension System > Rear Suspension Arm > Components and Components Location

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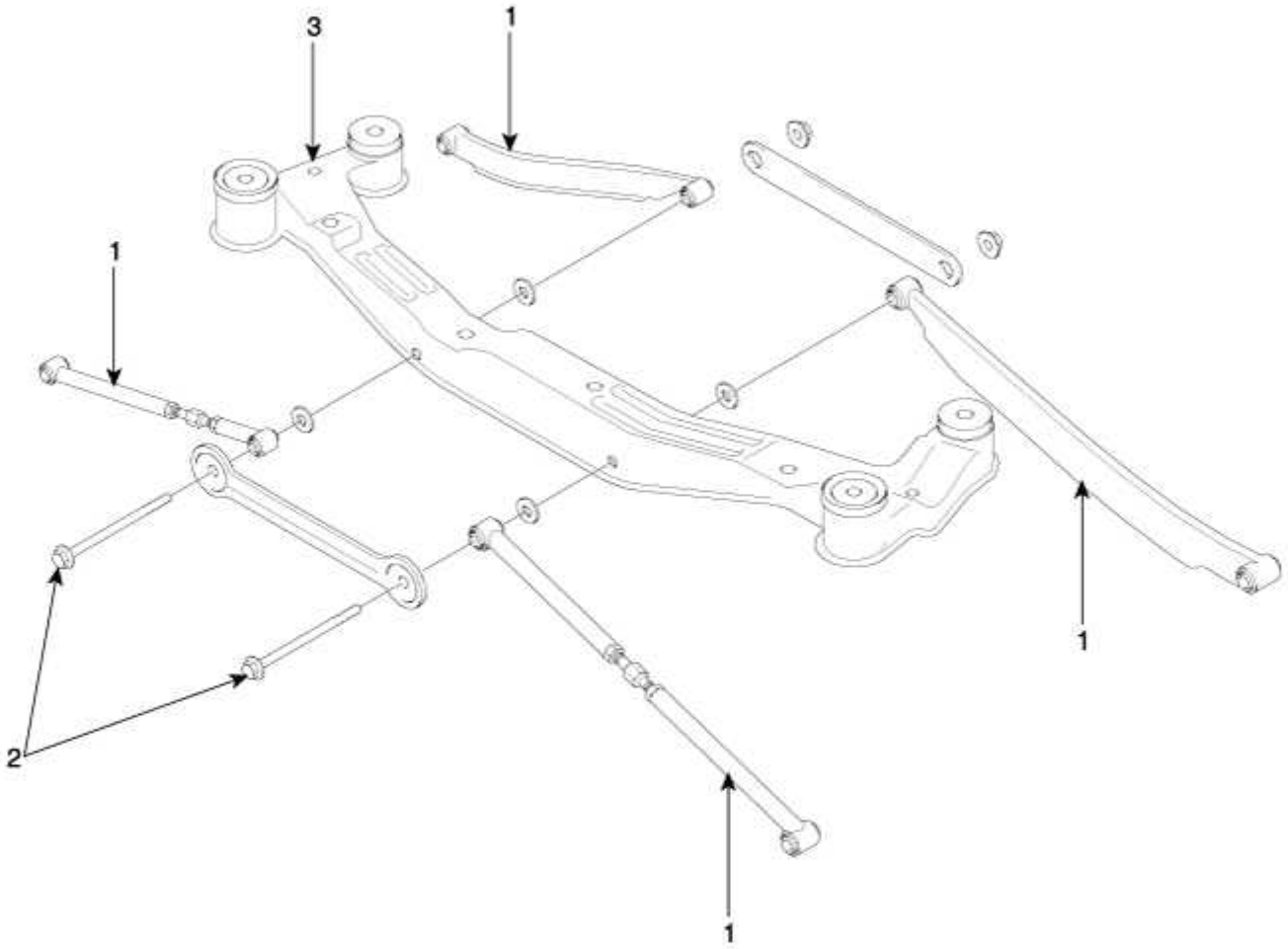
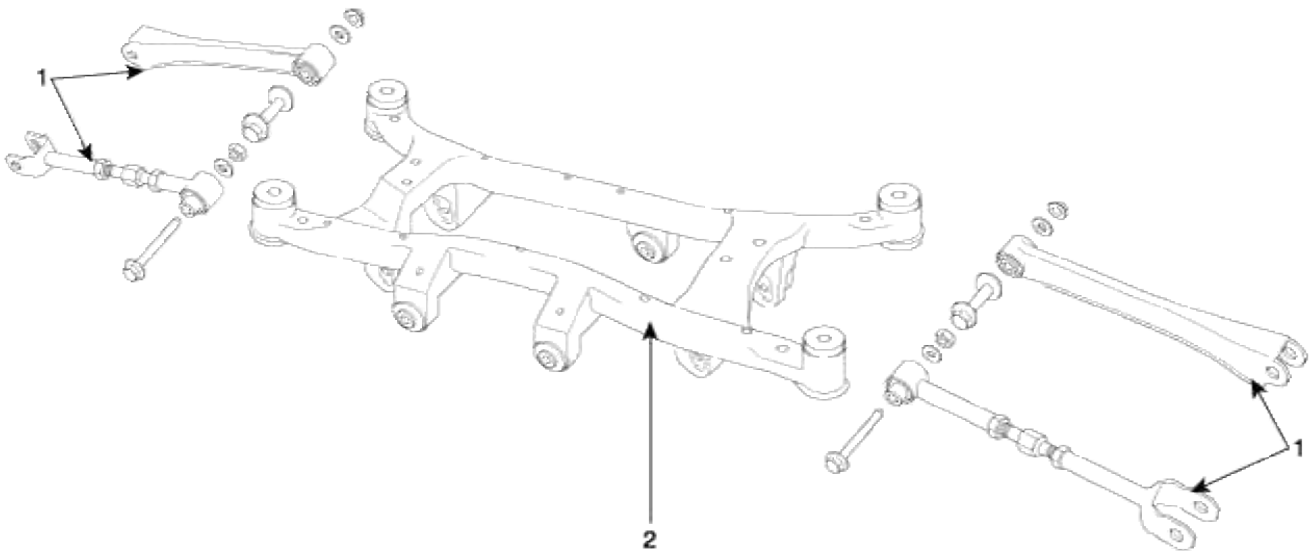
COMPONENTS

[2WD]



1. Suspension arm
2. Suspension arm bracket mounting bolt
3. Cross member

[4WD]



1. Suspension arm
2. Cross member

Suspension System > Rear Suspension System > Rear Suspension Arm > Repair procedures

REPLACEMENT

[2WD]

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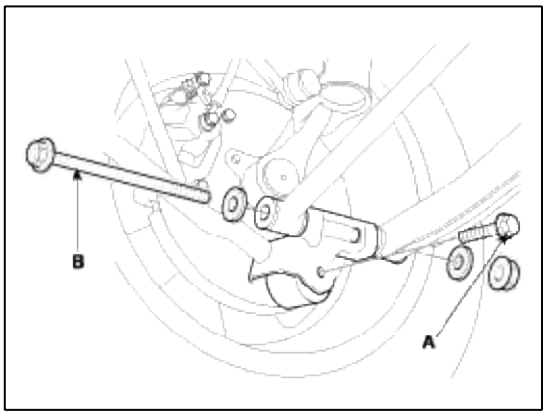
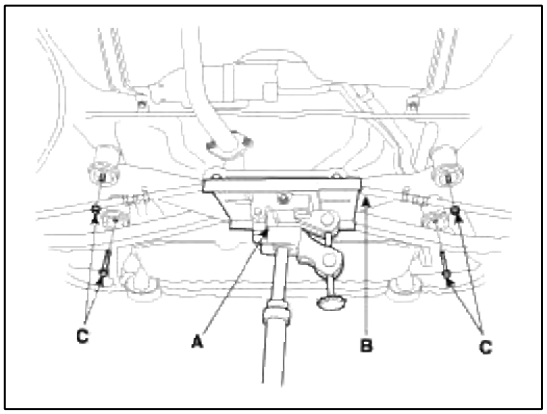
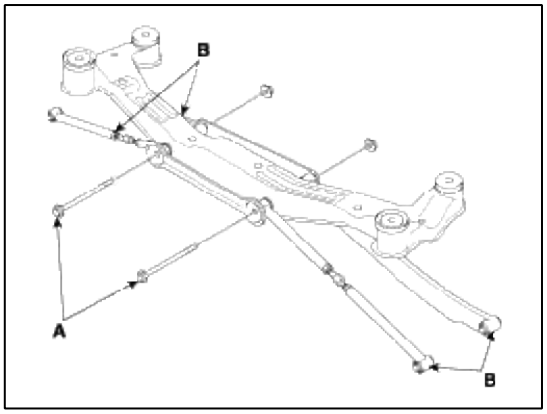
1. Remove the trailing arm mounting bolt(A) and suspension arm mounting bolt(B).



2. Remove the opposite side trailing arm mounting bolt and suspension arm mounting bolt.
3. After supporting the rear cross member assembly(B) with the jack(A), remove the cross member mounting bolts and nuts(C).



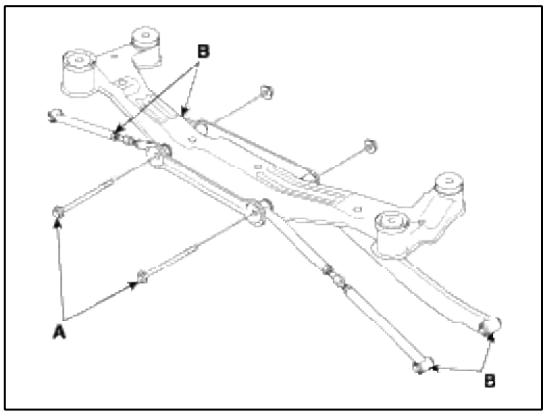
4. Remove the suspension arm bracket mounting bolts(A).



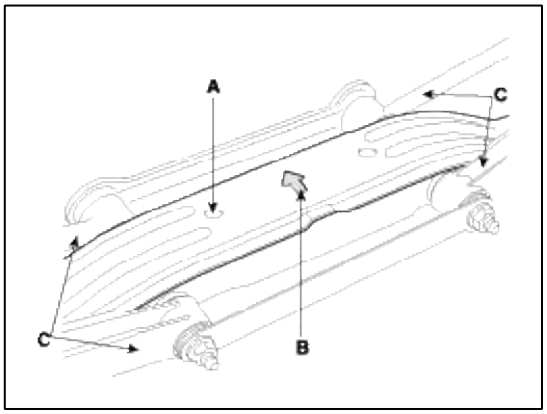
5. Remove the suspension arm(B).

6. Install the suspension arm bracket mounting bolts(A).

Tightening torque :
160~180 Nm (16~18 Kgf·m, 118.0~132.8 lb-ft)



7. Make sure that the arrow mark(B) on the rear cross member(A) should place the front face of the vehicle.

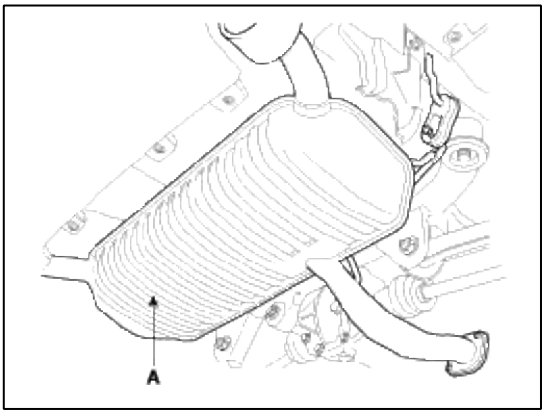


8. Rear suspension arm(C)-to-rear carrier bolts should be temporarily tightened, and then fully tightened with the vehicle on the ground in unloaded condition.

Tightening torque :
160~180 Nm (16~18 Kgf·m, 118.0~132.8 lb-ft)

[4WD]

1. Remove the muffler(A).



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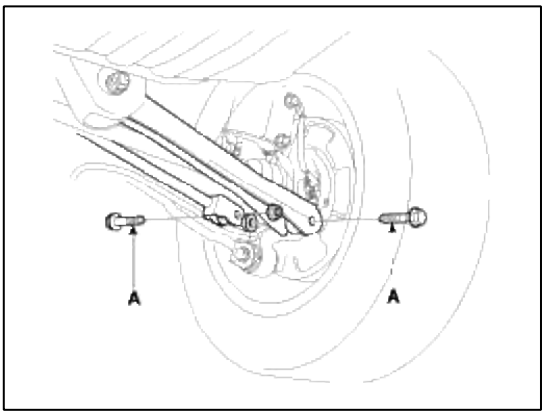
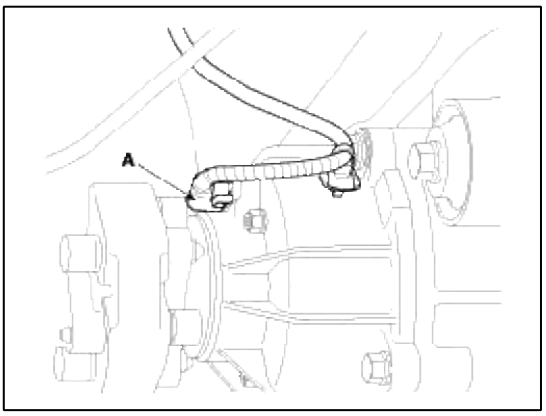
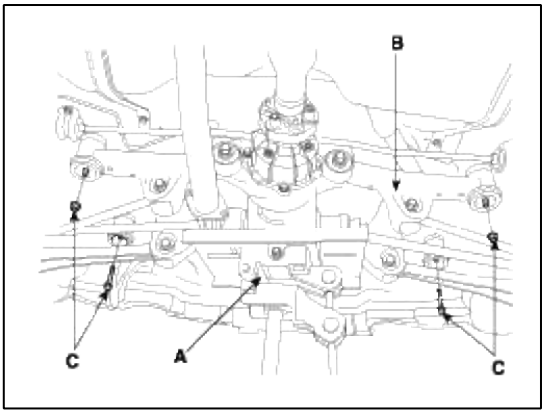
2. Remove the suspension arm mounting bolts(A).



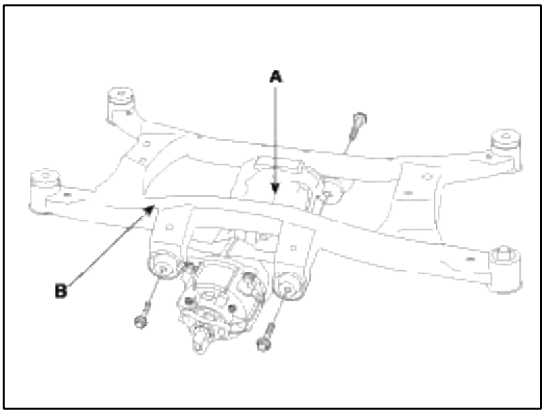
3. Remove the opposite side suspension mounting bolts.
4. Remove the coupling control connector(A).



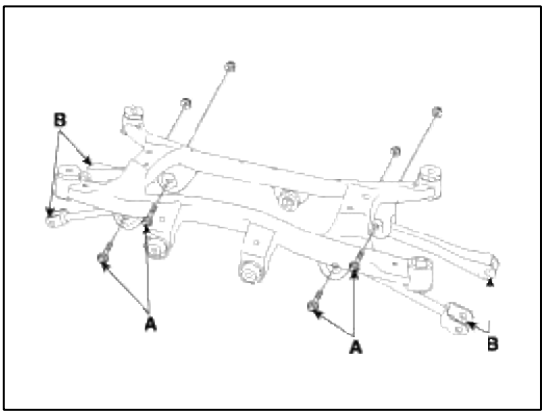
5. After supporting the rear cross member assembly(B) with a jack(A), remove the cross member mounting bolts and nuts(C).



6. Remove the propeller shaft. (see page DS-propeller shaft)
7. Remove the rear differential(A) from the cross member(B).

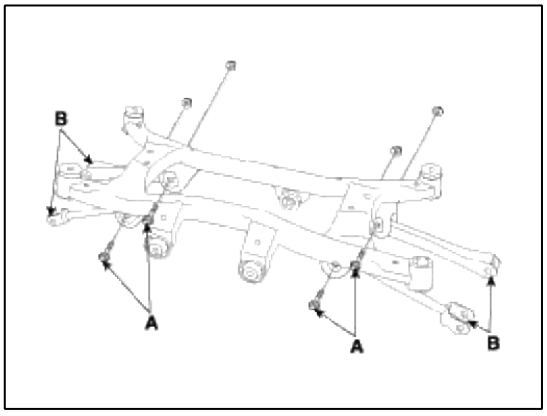


8. Remove the suspension arm bracket mounting bolts(A).



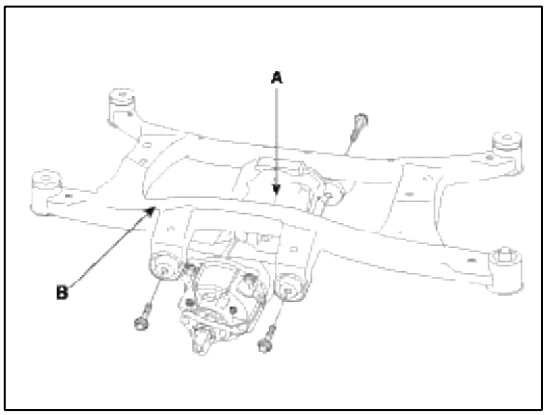
9. Remove the suspension arm(B).
10. Install the suspension arm bracket mounting bolts(A).

Tightening torque :
140~160 Nm (14~16 Kgf·m, 103.3~118.0 lb-ft)



11. Install the rear differential(A) on the cross member(B).

Tightening torque :
90~120 Nm (9~12 Kgf·m, 59.0~88.5 lb-ft)



12. Install the propeller shaft. (see page DS-propeller shaft)

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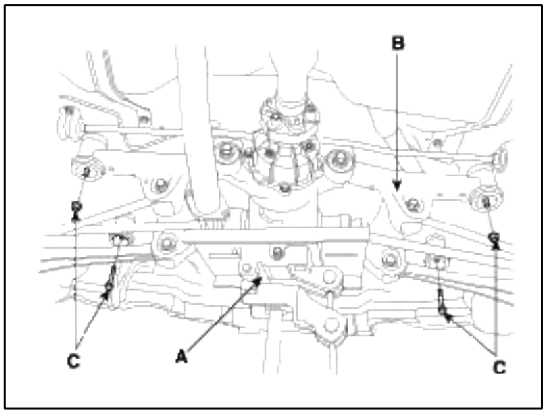
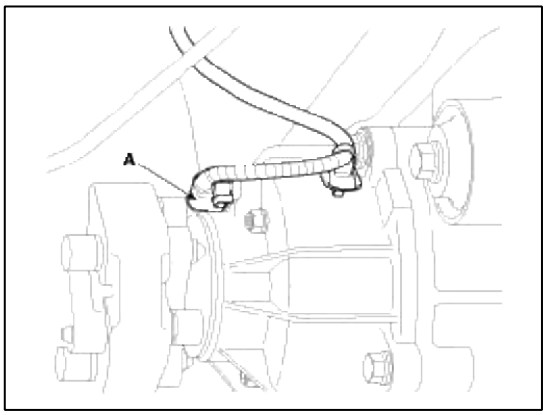
13. After supporting the rear cross member assembly(B) with the jack(A), install the cross member mounting bolts and nuts(C).

Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)

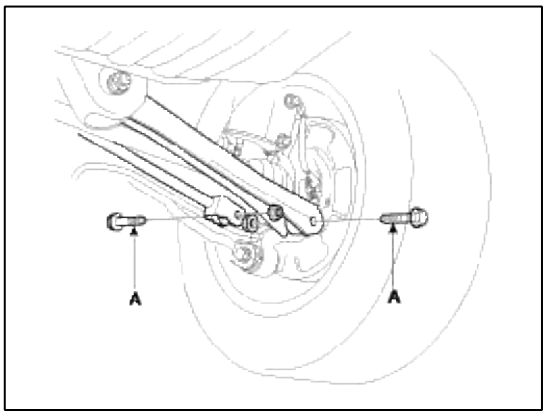


14. Install the coupling control connector(A).



15. Rear suspension arm-to-rear carrier bolts(A) should be temporarily tightened, and then fully tightened with the vehicle on the ground in unloaded condition.

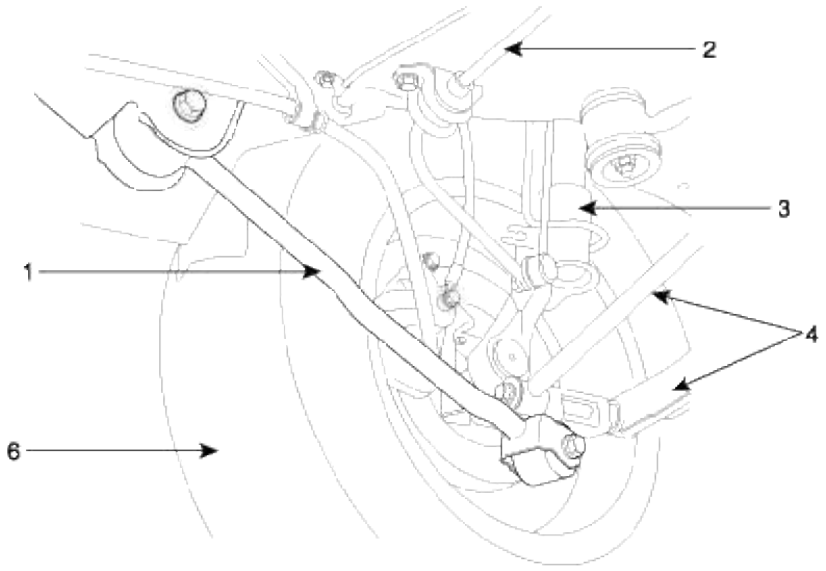
Tightening torque :
140~160 Nm (14~16 Kgf·m, 103.3~118.0 lb-ft)



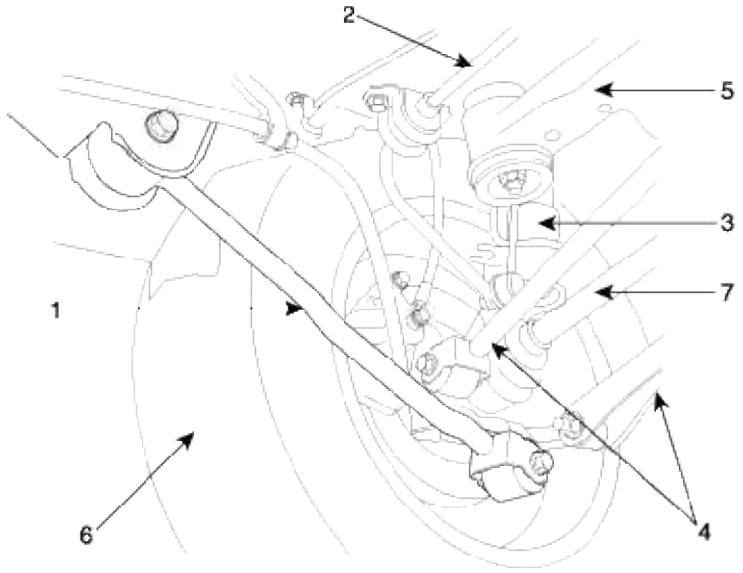
Suspension System > Rear Suspension System > Trailing Arm > Components and Components Location

COMPONENTS

[2WD]



[4WD]



1. Trailing arm
2. Stabilizer bar
3. Strut assembly
4. Suspension arm
5. Cross member
6. Tire
7. Drive shaft

Suspension System > Rear Suspension System > Trailing Arm > Repair procedures

REMOVAL

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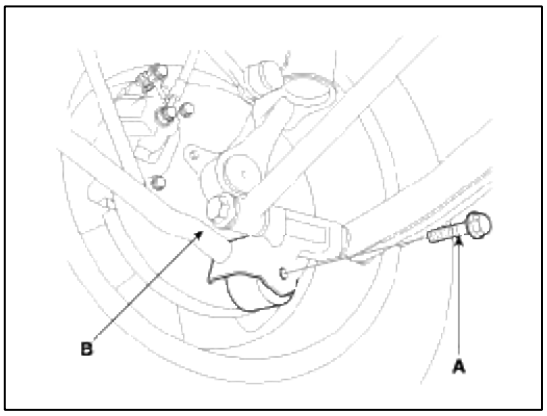
1. Remove the trailing arm mounting bolts(A).

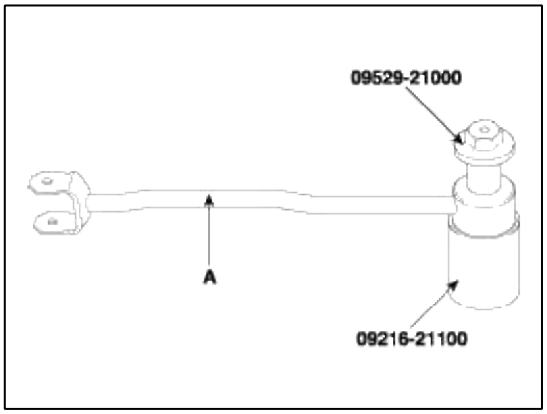


2. Remove the bracket mounting bolt, nut of the vehicle side.
3. Remove the trailing arm(B).

REPLACEMENT

TRAILING ARM BUSHING

1. Install the special tools(09529-21000 & 09216-21100) on the trailing arm(A).



2. Remove the bushing from the trailing arm(A).
3. Using the special tools(09529-21000 & 09216-21100), press-fit the rear trailing arm bushing.

Separation force is over 3000 N (300 Kgf, 661 lbf)

NOTE

Insert bush as to arrow direct toward trailing arm length.

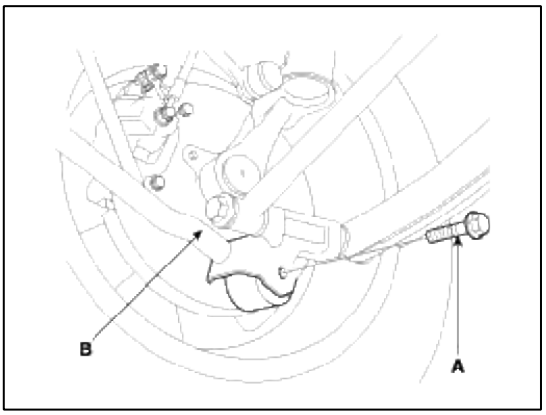
INSTALLATION

1) Install the trailing arm mounting bolt(A).

Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)

2) Install the trailing arm bracket mounting bolt, nut.

Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)



NOTE

The trailing arm mounting bolts, then fully tightened with the vehicle on the ground in unloaded condition.

Suspension System > Rear Suspension System > Rear Stabilizer Bar > Components and Components Location

COMPONENTS

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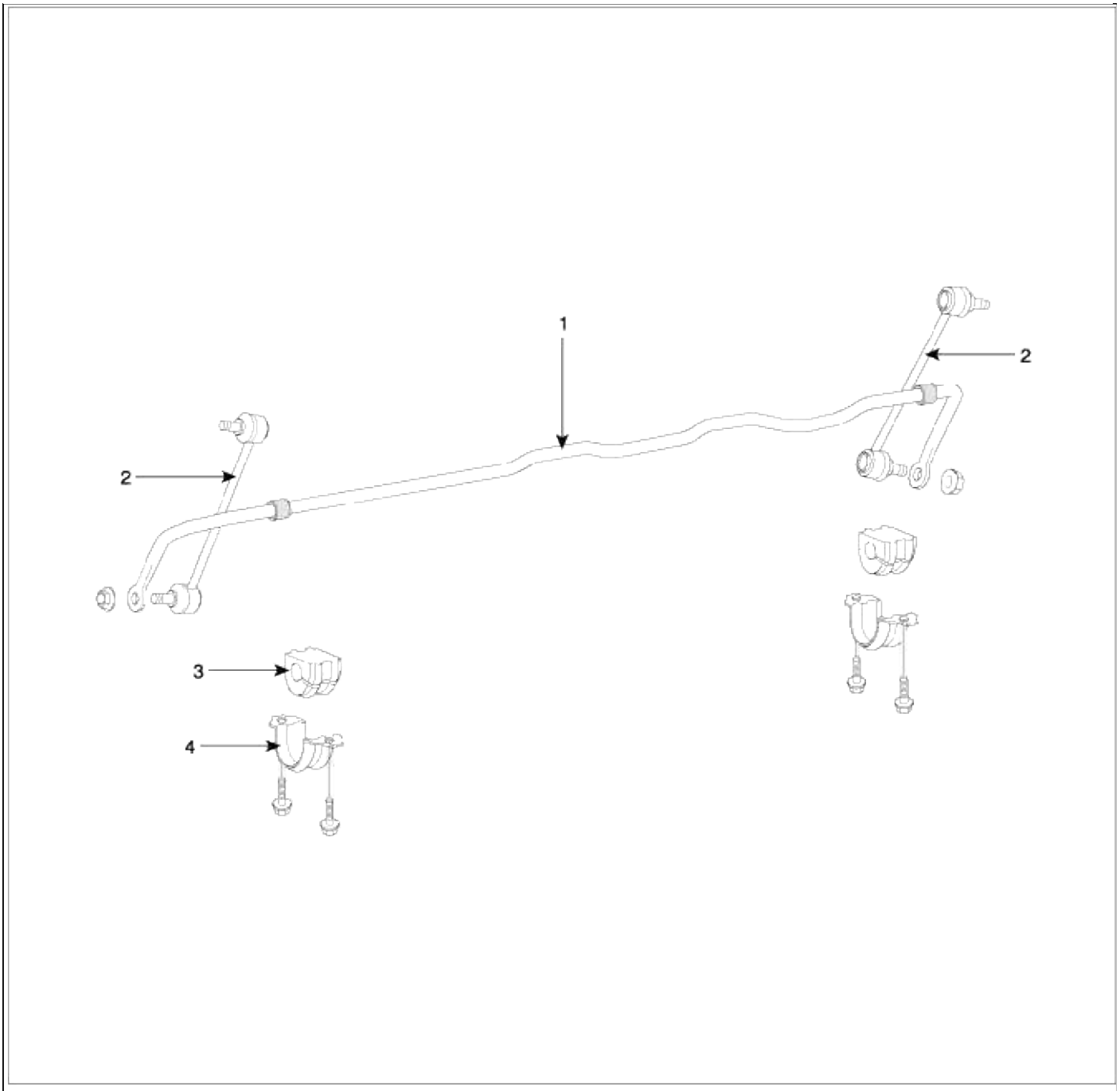


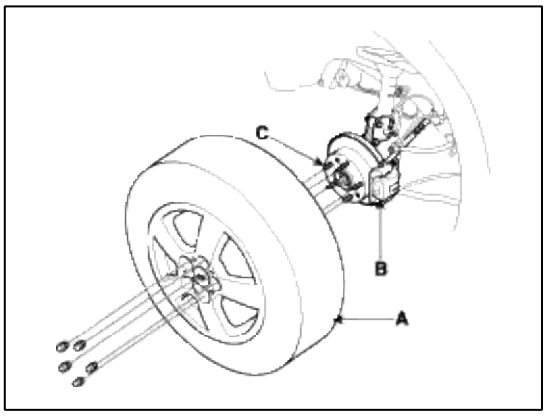
1. Stabilizer bar
2. Stabilizer bar link
3. Bushing
4. Bracket

Suspension System > Rear Suspension System > Rear Stabilizer Bar > Repair procedures

REMOVAL

1. Loosen the wheel nuts slightly.
   Raise the rear of the vehicle, and make sure it is securely supported.

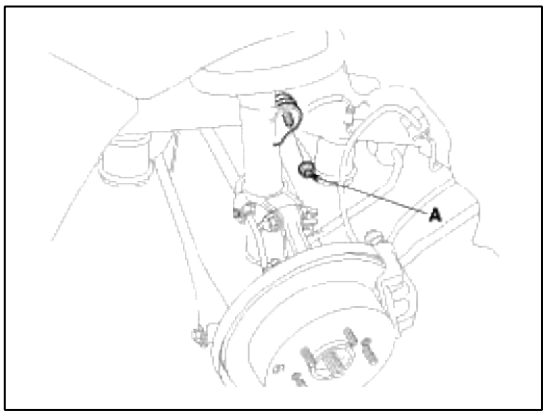
2. Remove the rear wheel and tire(A) from rear hub(B).



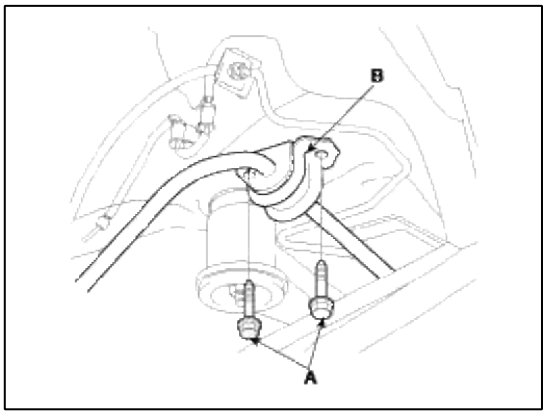
CAUTION

Be careful not to damage the hub bolts(C) then remove the rear wheel and tire(A).

3. Remove the stabilizer bar link mounting nut(A).



4. Remove the stabilizer bar mounting bolts(A) and then remove the stabilizer bracket(B).



5. Employ the same manner described above step 3 and 4 to the other side.
6. Remove the stabilizer bar.

INSTALLATION

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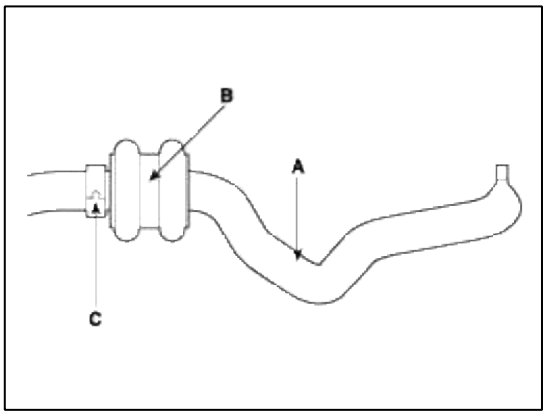
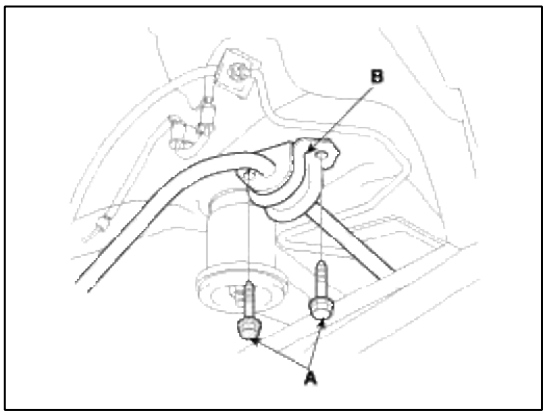
1. Install the bushing(B) on the stabilizer bar(A).



NOTE

Bring clamp(C) of stabilizer bar(A) into contact with bushing(B).

2. Install the stabilizer bracket(B) and then install the stabilizer bar mounting bolts(A).

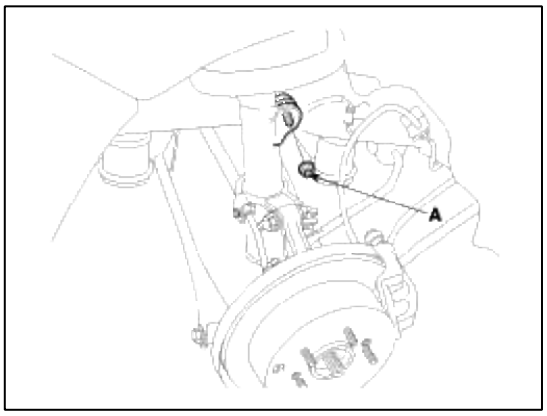


3. One side bracket should be temporarily tightened, and then install the bushing on the opposite side.

Tightening torque :
45~55 Nm (4.5~5.5 Kgf·m, 32.5~39.7 lb-ft)

4. Install the stabilizer bar link mounting nut(A).

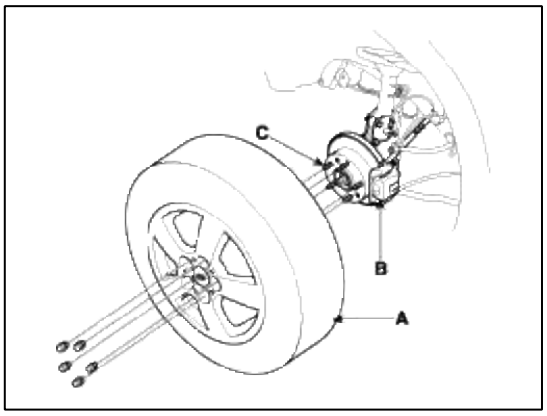
Tightening torque :
100~120 Nm (10~12 Kgf·m, 73.8~88.5 lb-ft)



5. Repeat step 3 and 4 for the other side.

6. Install the rear wheel and tire(A) on the rear hub(B).

Tightening torque :
90~110 Nm (9~11 Kgf·m, 66.4~81.2 lb-ft)



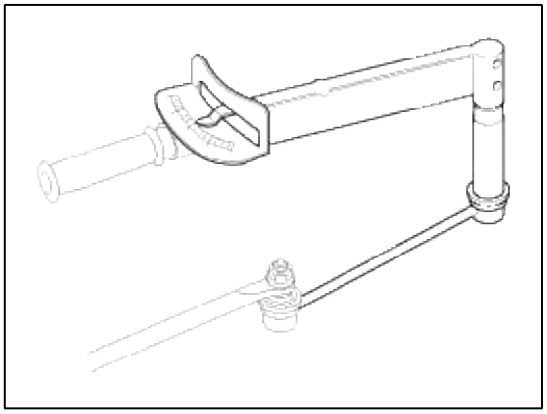
CAUTION

Be careful not to damage the hub bolts(C) then install the rear wheel and tire(A).

INSPECTION

1. If there is a crack and damage in the dust cover, replace the stabilizer bar link.
2. Mount the self-locking nut on the ball joint, and then measure the ball joint rotating torque.

Tightening torque :
0.7~2 Nm (0.07~0.2 Kgf·m, 05~1.4 lb-ft)



3. If the rotating torque is above the upper limit of the standard value, replace the stabilizer link.
4. If the rotating torque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.

Suspension System > Tires/Wheels > Alignment > Description and Operation

DESCRIPTION

WHEEL ALIGNMENT

TOE

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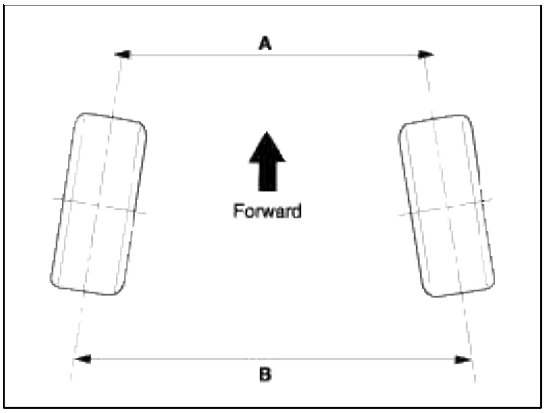


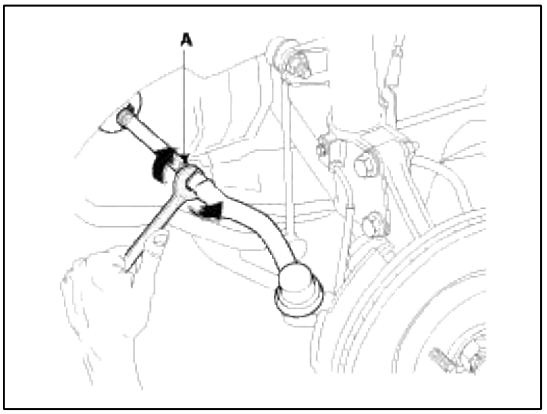
ITEM	Description
A-B<0	Positive (+) toe (toe in)
A-B>0	Negative (-) toe (toe out)

Standard value
Toe-in
Total : -2mm~2mm

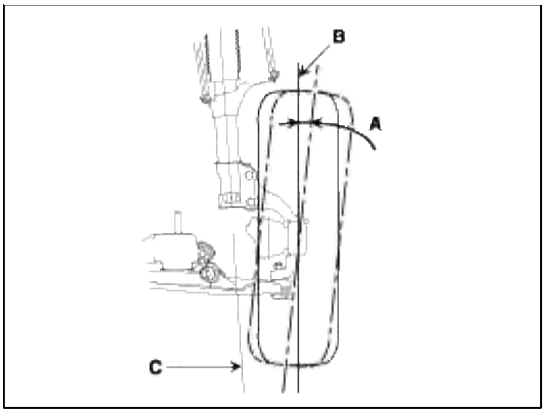
NOTE

- 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.

Tie rod end lock nuts(A) tightening torque :
50~60 Nm (5~6 Kgf·m, 36.9~44.3 lb-ft)



CAMBER



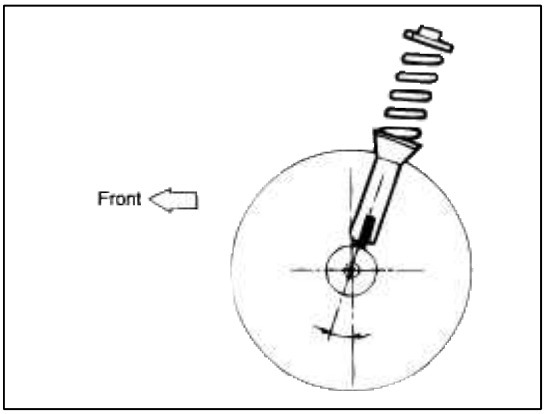
ITEM	Description
A	Positive camber angle
B	True vertical
C	Strut centerline

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.
If the camber in not within specification, inspect for damaged components and replace as needed.

Camber : 0°±30'

CASTER

Caster : 3°36'±30'



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°±0.5°.

DESCRIPTION

TOE-IN

Standard value

Toe-in

Total : 4.6+3,-1mm (=0.19°)

Left tie rod : Clockwise direction → toe-in

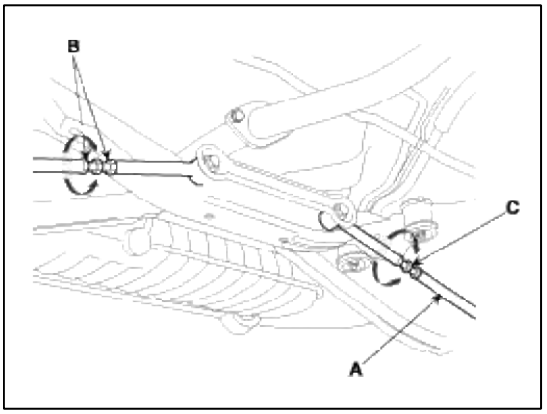
Right tie rod : Clockwise direction → toe-out

CAUTION

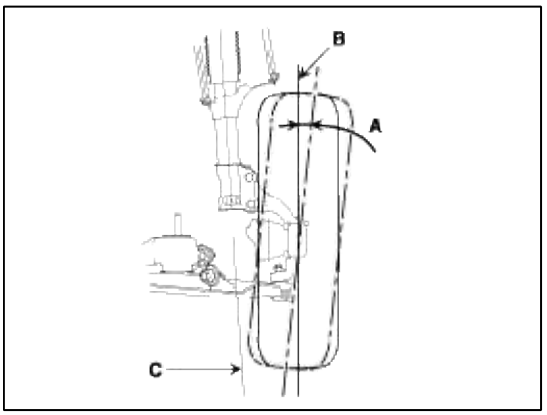
- Each of toe must be 2.8±1mm
- After adjusting the tie rod(C), tighten both nuts(B) to the specified torque.

Specified torque

50~60 Nm (5~6 kgf·m, 37~43 lb-ft)



CAMBER



ITEM	Description
A	Positive camber angle
B	True vertical
C	Pivot centerline

Camber : -0°55'±30'

NOTE

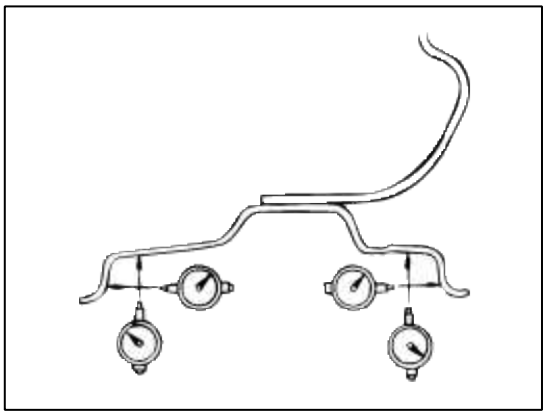
Camber is pre-set at the factory and doesn't need to be adjusted. If the camber is not within the standard value, replace the bent or damaged parts.

Suspension System > Tires/Wheels > Wheel Runout > Description and Operation

DESCRIPTION

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)	0.3(0.012)	0.3(0.012)



Suspension System > Tires/Wheels > Wheel Nut Tightening > Description and Operation

DESCRIPTION

1. Tightening torque.

Tightening torque :
90~110 Nm (9~11 Kgf·m, 66.4~81.2 lb-ft)

CAUTION

When using an impact gun, final tightening torque should be checked using a torque wrench.

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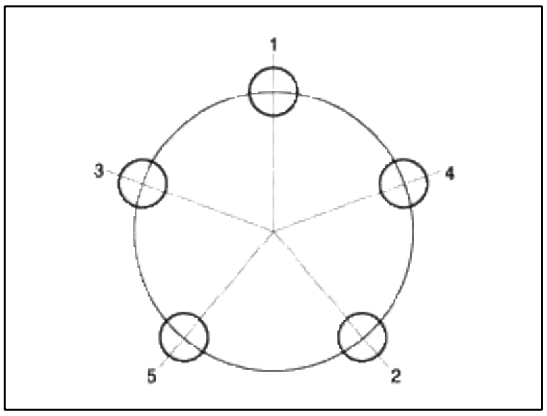
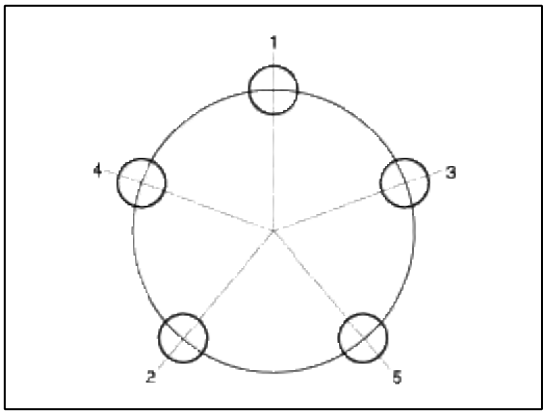
2. Tightening order.
   Check the torque again after tightening the wheel nuts diagonally.





Suspension System > Tires/Wheels > Tire Wear/Rotation > Description and Operation

DESCRIPTION

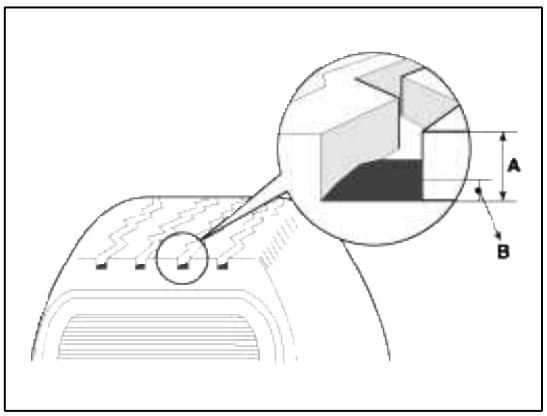
1. Measure the tread depth of the tires.

   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.

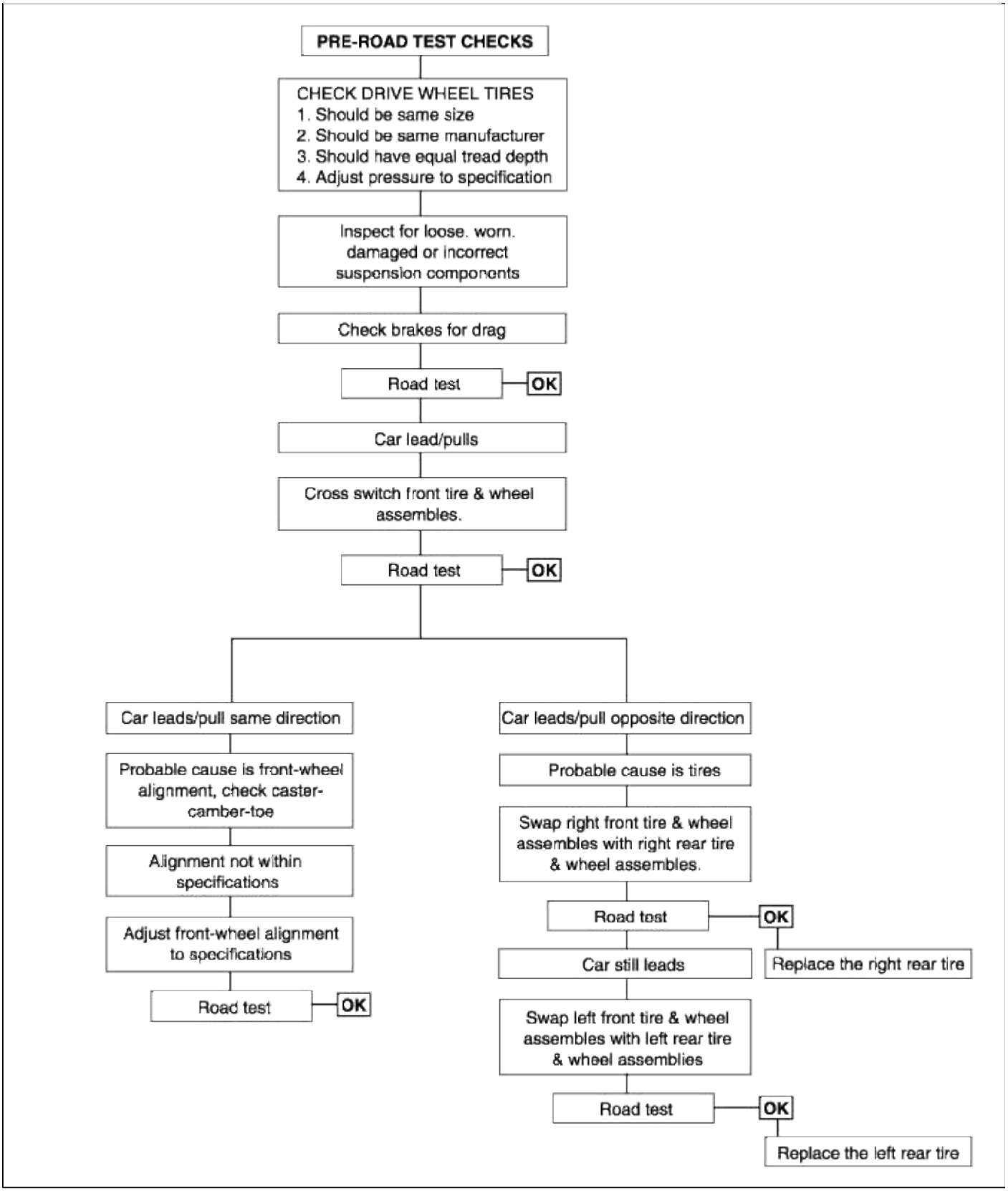
   NOTE

   When the tread depth of the tires is less than 1.6 mm (0.06 in.), the wear indicators(B) will appear.



DISCRIPTION

LEAD/PULL CORRECTION CHART



ROTATION

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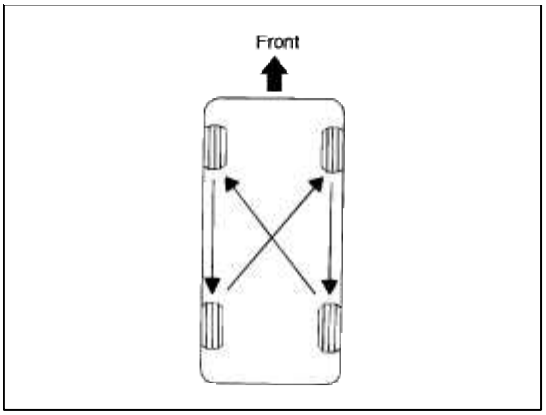
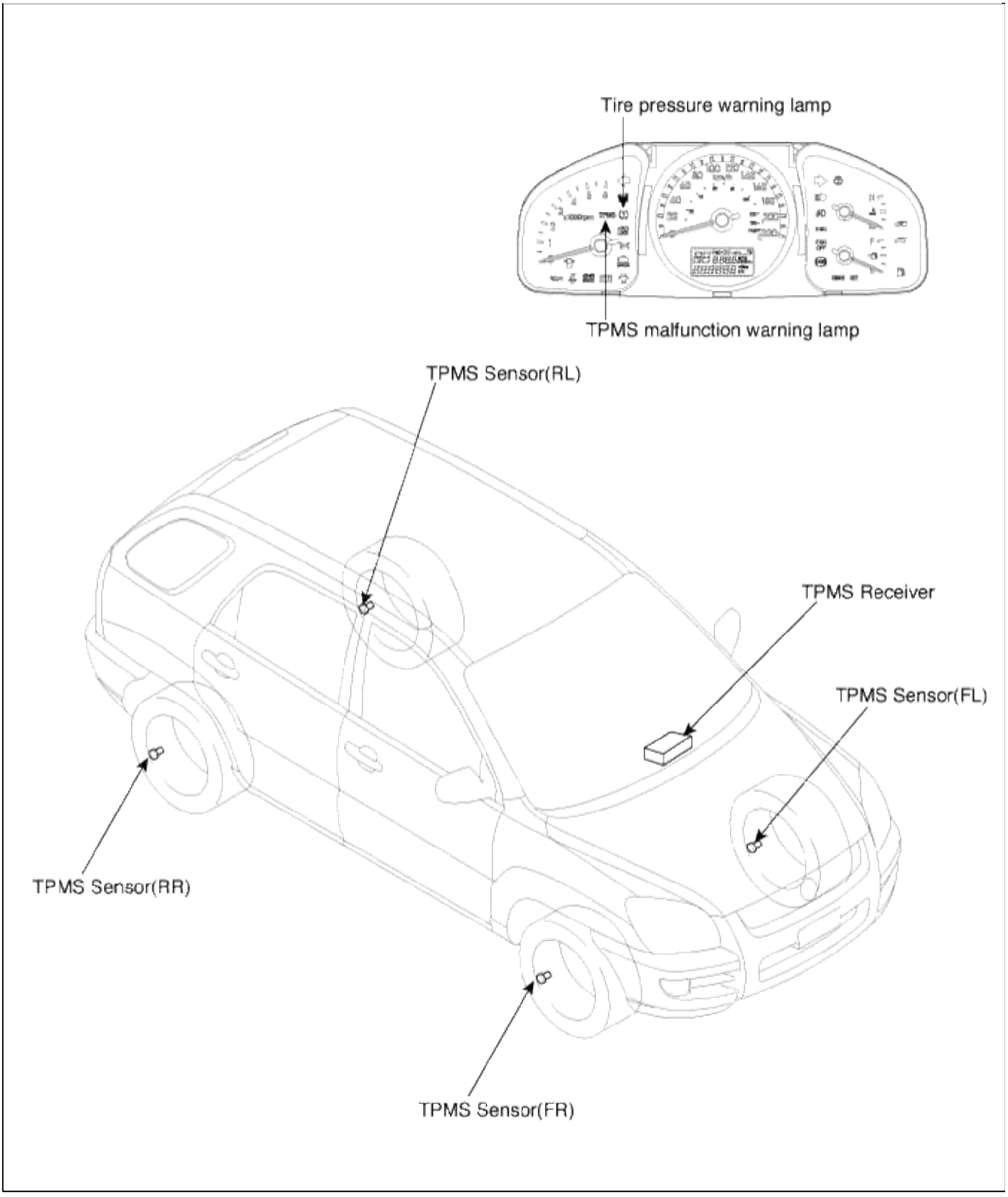


Suspension System > Tire Pressure Monitoring System > Components and Components Location

components



Suspension System > Tire Pressure Monitoring System > Schematic Diagrams

SCHEMATIC DIAGRAM

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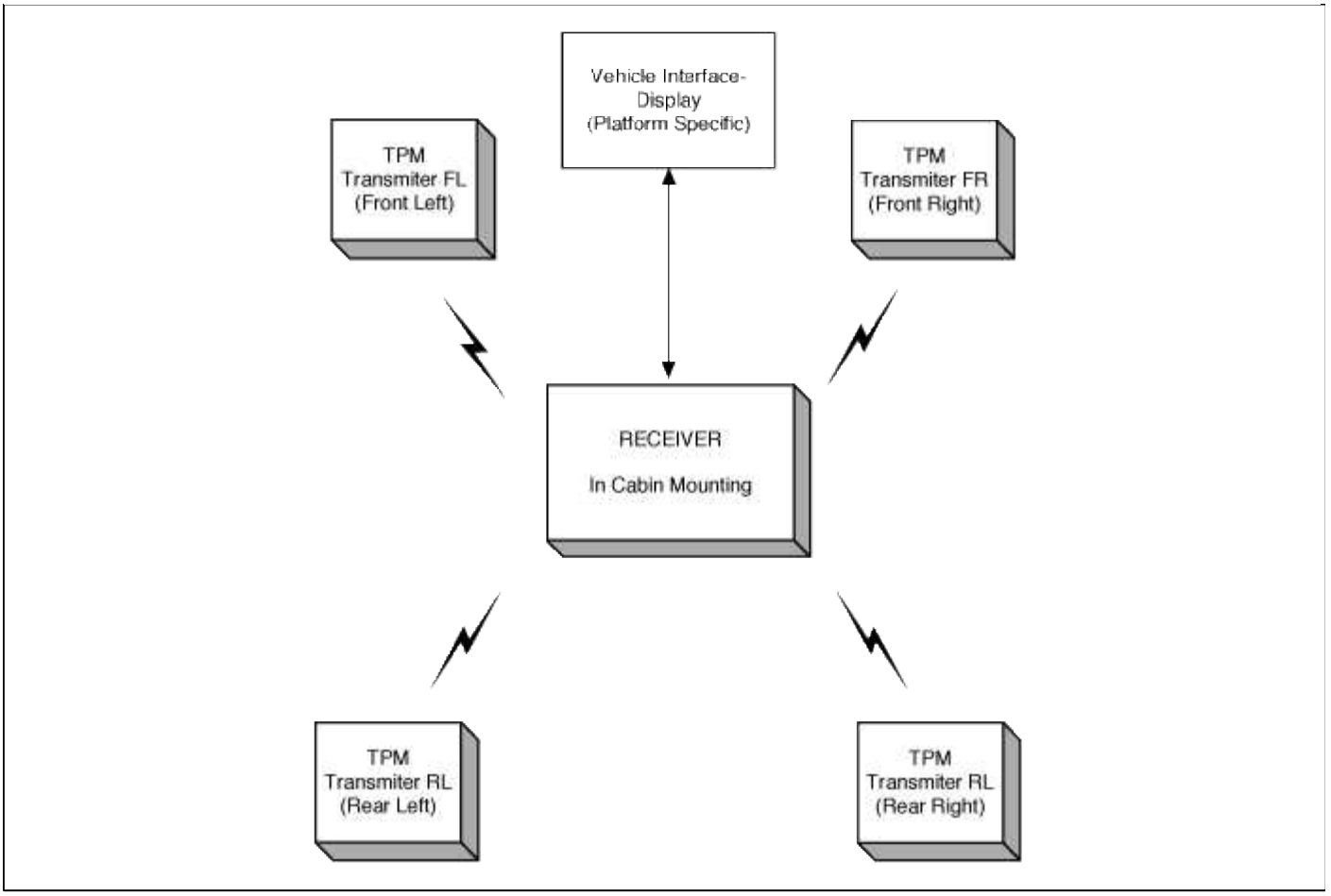
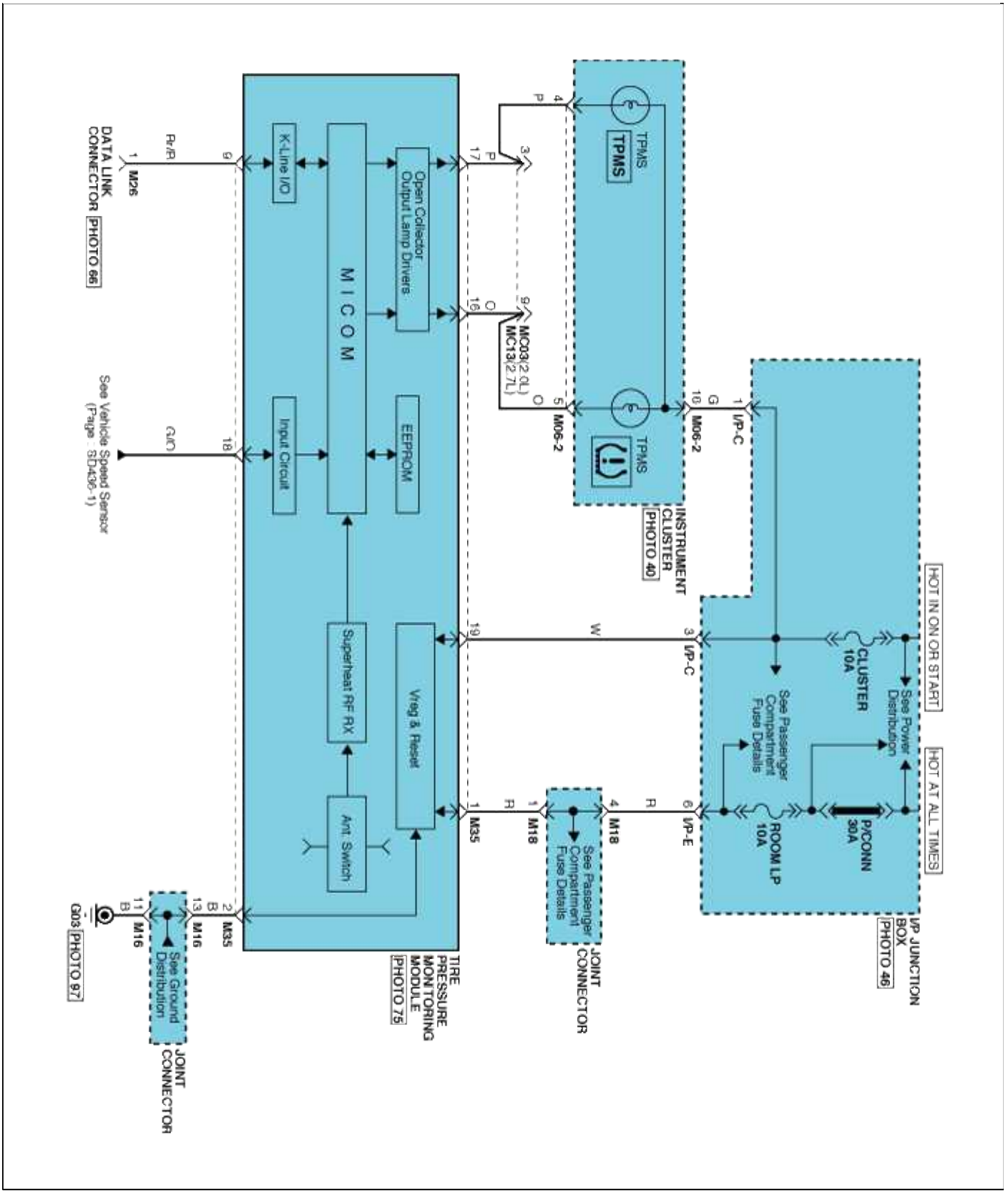


circuit diagram



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

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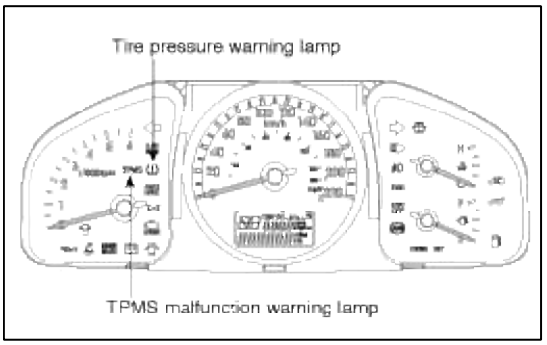
NO	PIN-OUT ASSIGNMENT	NO	PIN-OUT ASSIGNMENT
1	Battery	11	-
2	Ground(TPMS receiver)	12	-
3	-	13	-
4	-	14	-
5	-	15	-
6	-	16	TREAD lamp
7	-	17	Diagnostic lamp (TPMS)
8	-	18	Speed signal
9	K-LINE	19	Ignition 1(+)
10	-	20	-

Suspension System > Tire Pressure Monitoring System > Description and Operation

DESCRIPTION

WARNING LAMPS



TREAD Lamp

- Tire Under Inflation / Leak Warning.

1. Turn on condition
   A. When tire pressure is below allowed threshold
   B. When rapid leak is detected by the sensor.
   C. Indicates that tire needs to be re-inflated to placard pressure / repaired.
2. Turn off condition
   A. Under-inflation ; When tire pressure is above (warning threshold + hysteresis).
   B. Rapid Leak ; When tire pressure is above (leak warning threshold).

DTC Warning

TPMS

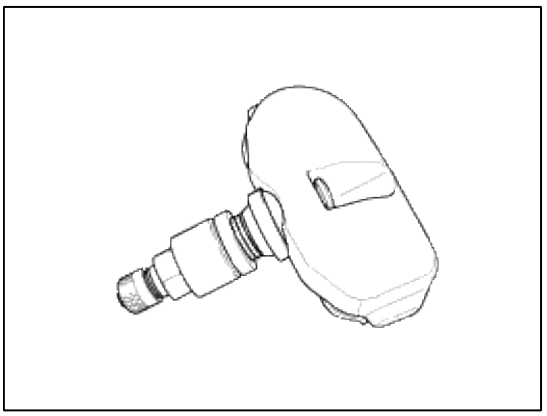
1. Turn on condition
   A. When the system detects a fault that is external to the receiver/ sensor.
   B. When the system detects a receiver fault.
   C. When the system detects a sensor fault.
2. Turn off condition
   A. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
   B. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

SYSTEM FAULT

1. General Function
   A. The system monitors a number of inputs across time in order to determine that a fault exists.
   B. Faults are prioritized according to which has the most likely cause.
   C. Maximum fault store is equal to 15.
   D. Certain faults are not covered through DTC. The main ones are:
      1) Speed input. This is important since it is required for Auto-Learn & DTC. Requires diagnostic check of speed while driving vehicle to diagnose.
      2) Sensor thermal shutdown (over 257°F/125°C).
      3) Control module Micro-controller lock up ; requires observation of lamps at Ignition ON to diagnose.
      4) Ignition Line stuck ; requires observation of lamps at Ignition ON to diagnose.

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Description and Operation

DESCRIPTION



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1. MODE
   (1) Configuration State
      A. All sensors should be in the Low Line (Base) state.
      B. In Low Line (Base) configuration, sensor transmissions occur every 3 minutes 20 seconds (nominal) and pressure is measured every 20 seconds.
   (2) Normal Fixed Base State
      A. Sensor transmissions continue at the Low Line (Base) configuration defined rates until the state is either changed by LF command or by the sensor detecting a condition that requires a temporary change to another state.
      B. The LF command to this state must contain the sensors ID.
   (3) Storage Base State:
      A. This state is a Low current consumption state.
      B. Sensors are in this state when they first arrive at the dealership (either on the vehicle or as replacement spares).
      C. In this state, the sensor does not measure pressure / temperature / battery level.
      D. The sensor will not transmit in this state unless requested to do so by the initiate command.
   (4) Alert State:
      A. The sensor automatically enters this state if the measured temperature exceeds 230 °F(110 °C) and over temperature shutdown is likely.
      B. In this state, pressure is measured every 4 seconds and RF data transmitted every 4 seconds.
      C. The state lasts for 1 minute if it is pressure triggered.
      D. After state is alse entered when a 3 psi change in pressure from the last RF transmission occurs.

Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Repair procedures

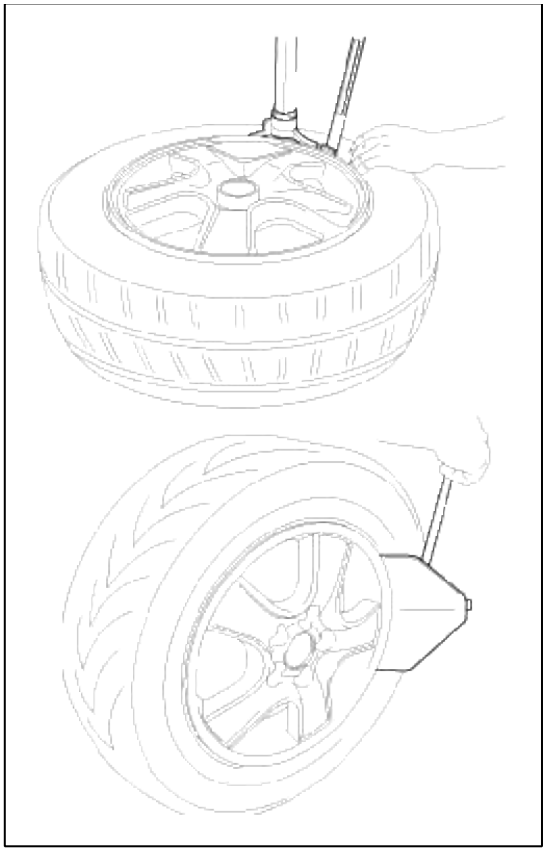
REMOVAL

Tire Removal

1. Deflate tire & remove balance weights.

CAUTION

- The tire bead should be broken approx. 180° from the valve side of the wheel. The bead breaker should not be set too deep.
- Avoid tire/tool contact with the valve on dismount.
- Dismount should end near the valve.

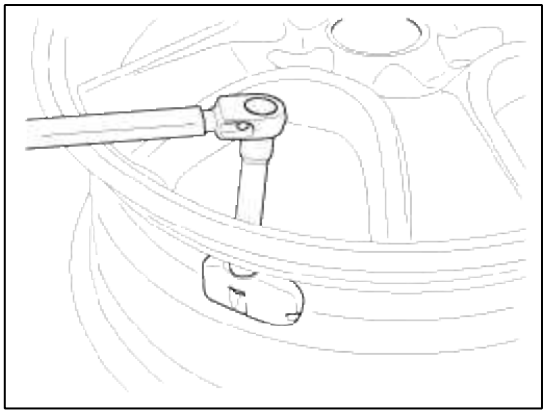


Sensor Removal

CAUTION

Handle the sensor with care.

1. Remove the valve nut.



CAUTION

The valve nut should not be re-used.

2. Discard the valve assembly.

INSTALLATION

Sensor Fit

CAUTION

- Handle the sensor with care.
- Avoid lubricant contact if possible.

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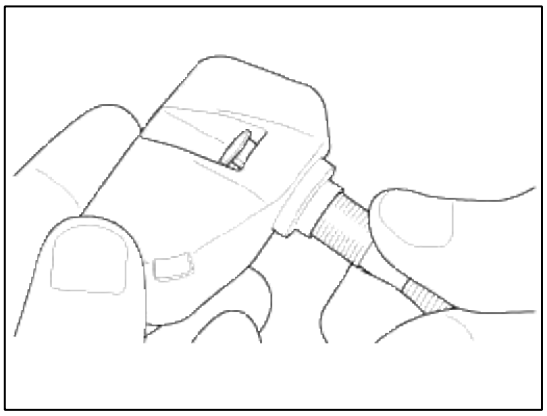
1. Assemble valve to sensor and turn valve 3 times with the square part of the screw in the slot.



CAUTION

- The fit should not be tight i.e. it should still be possible to easily adjust valve angle.
- Ensure that the wheel to be fitted is designed for sensor mount. There should normally be a mark to indicate this.
- Ensure that the valve hole and mating face of the wheel are clean.

2. Mount assembly to wheel.

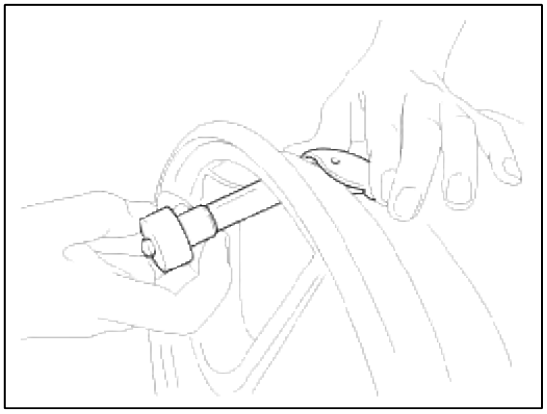
CAUTION

Ensure sensor feet are against the wheel throughout the remainder of the assembly process.

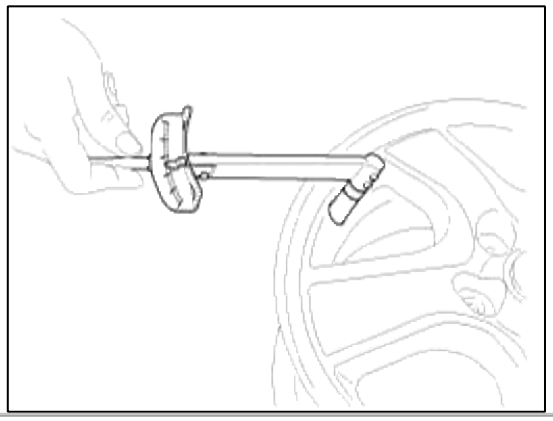
3. Tighten washer and nut by hand until the valve thread meets the nut built-in calibrated stop.

CAUTION

Ensure that the grommet remains in contact with the wheel.



4. Using a torque wrench, tighten the nut to 2.95±0.37 lb-ft (4.0±0.5 Nm) It is normal to feel a break as the 1.7 lb-ft (2.3Nm) calibrated stop in the nut snaps and the torque falls.



CAUTION

- Increase torque smoothly in order to achieve a clean break of the stop.
- Do not exceed allowed torque.
- Do not use electric or pneumatic tools.

Tire Fit

CAUTION

Only use wheels designed to accommodate the TPMS sensor.

1. Lubricate the tire bead not the rim. Excessive lubrication should not be applied.
2. Start tire mounting approx. 5.9 in(15 cm) from valve.
3. Move the mounting tool away from the valve.

CAUTION

Avoid tire / tool contact with the valve.

4. Finish with mounting tool near to valve.
5. Carry out inflation / pressure correction and then fit valve cap.

Sensor Initiating Procedure

NOTE

The sensor's default state will be Storage Auto (High Line).

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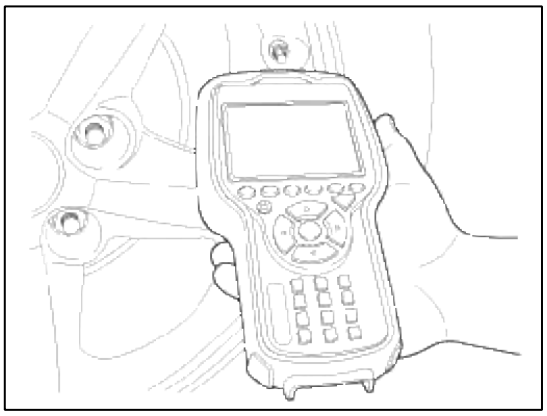
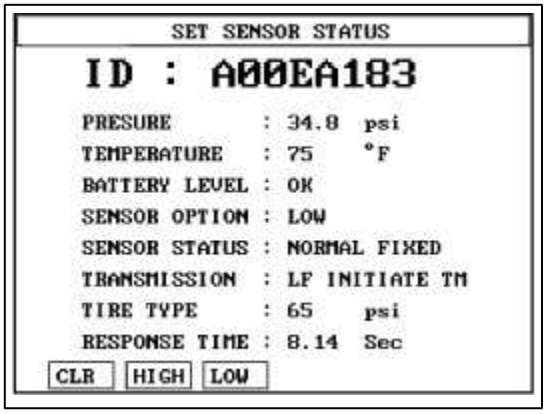
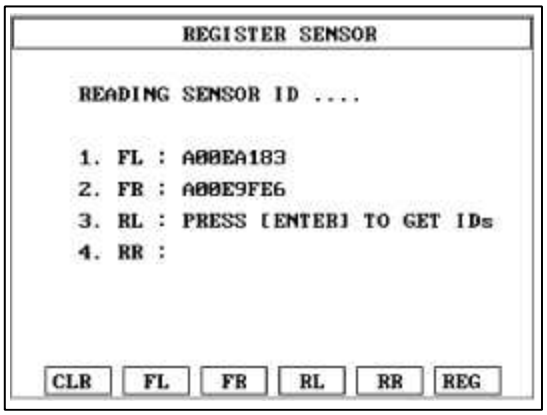
1. Change the sensor mode to Normal Fixed Base(Low Line) with the 'TPMS exciter'.



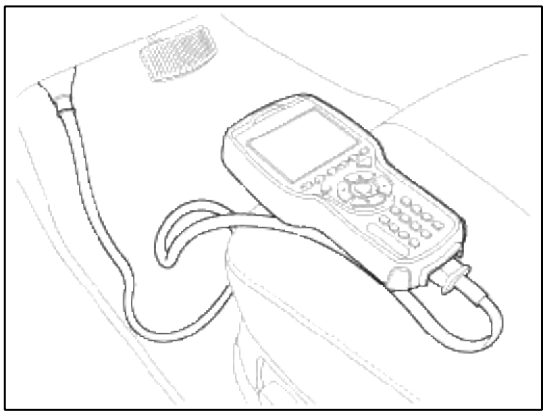


2. Read the four sensor's ids starting with sensor 1 (1 normally front left, 2 front right, 3 rear left, 4 rear right).

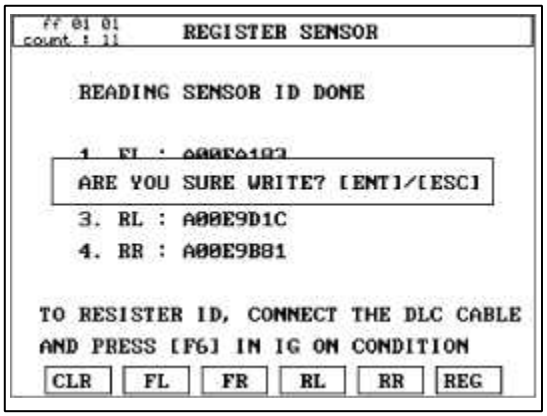
> NOTE
>
> Note that sensors which were already configured as Base (Low Line) will take longer to read.

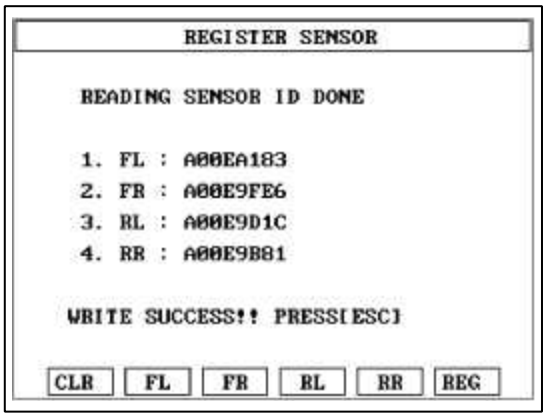


3. Connect 'TPMS exciter' to the diagnostic connector.



4. Register the four sensor's ids to the receiver.

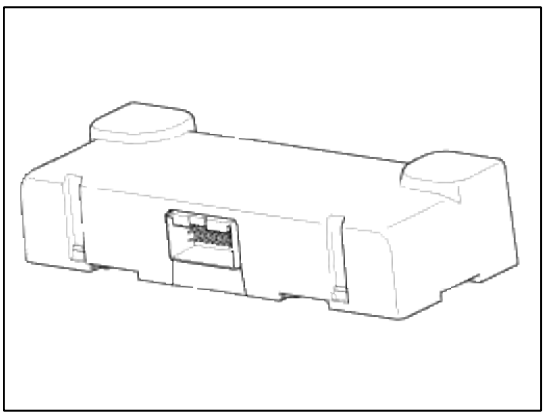




5. Cycle Ignition, wait 4 minutes and check that Normal Receiver State is now indicated (see SS-).

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Description and Operation

DESCRIPTION



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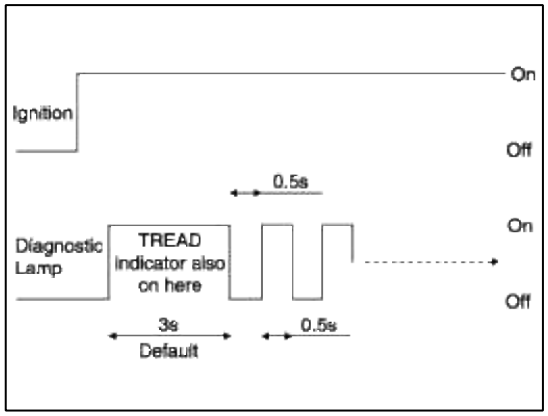
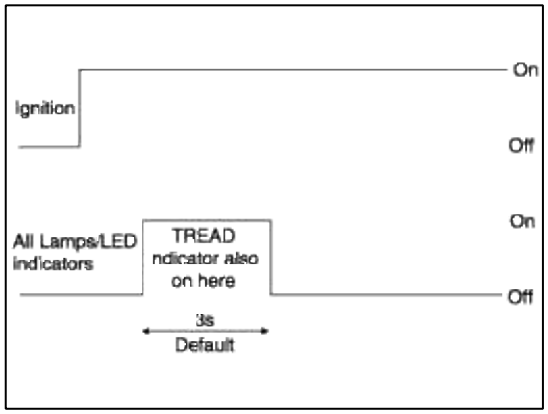
1. **Mode**
   (1) Virgin State
      A. The receiver as a sole part is shipped in this state. Replacement parts should therefore arrive in this state.
      B. In this state, there is no sensor monitoring and no DTC monitoring.
      C. The state indicates that platform specific parameters must be written to the receiver and that sensors are un-learned.



   (2) Normal State
      A. In order for tire inflation state and DTC monitoring to occur, the receiver must be in this state.
      B. In this state, automatic sensor learning is enabled.



2. **Overview**
   A. Receives RF data from sensor.
   B. Uses sensor data to decide whether to turn on TREAD Lamp.
   C. Uses sensor information, distance traveled, background noise levels, Auto-learn status, short circuit output status, vehicle battery level, internal receiver states to determine if there is a system or a vehicle fault.

OPERATION

1. General Function
   A. Auto-learn takes place only once per Ignition cycle.
   B. On successful completion, 4 road wheel sensor ID's are latched into memory for monitoring.
   C. Until Auto-learn completes, previously learned sensors are monitored for under inflation / leak warnings.
2. General Conditions to Learn New Sensors:
   A. Receiver must determine that it is confident that sensor is not temporary:
      1) Uses vehicle speed.
      2) Uses confidence reduction of previously learned sensors.
   B. Typical time at driving over 12.4 mph(20 kph) to learn a new sensor is up to 20 minutes.

3. General Conditions to Un-Learn a sensor that is removed:
   A. It takes less than 20 minutes at 12.4~18.6 mph(20~30kph).
   B. Confidence reduction is dependent on vehicle speed greater than or equal to 12.4 mph(12 kph).

Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Repair procedures

REPLACEMENT

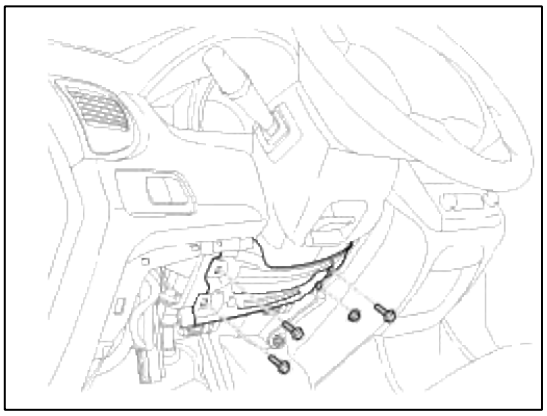
NOTE

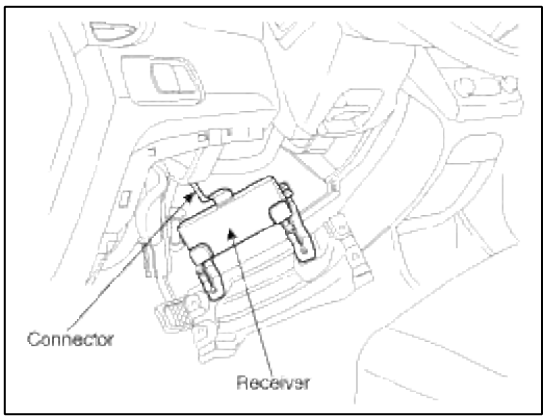
When the receiver first arrives for replacement:
1) It will be in Virgin State.
2) It will not be configured for any specific platform.
3) It will not have any sensor ID's memorized.

CAUTION

It is important to make sure that the correct receiver is used to replace the faulty part i.e. it must be Low Line (PN 95800-2E500) and not High Line (PN 95800-26000) in order to have the correct inflation warning thresholds set.

1. Disconnect vehicle battery.
2. Remove faulty part and fit bracket assembly to new part.





3. Secure new part to vehicle and fit connector.
4. Re-connect battery and turn Ignition on.
5. Check that DTC flash rate matches Virgin State indication (see SS-).

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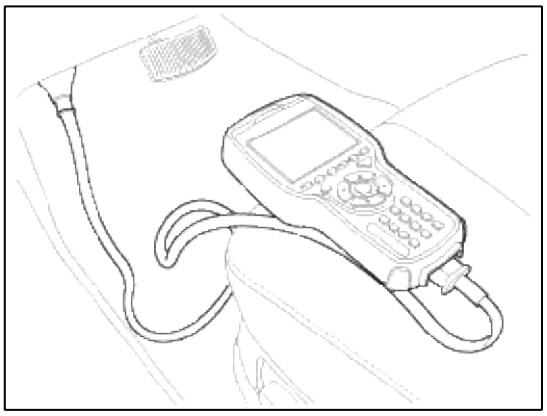
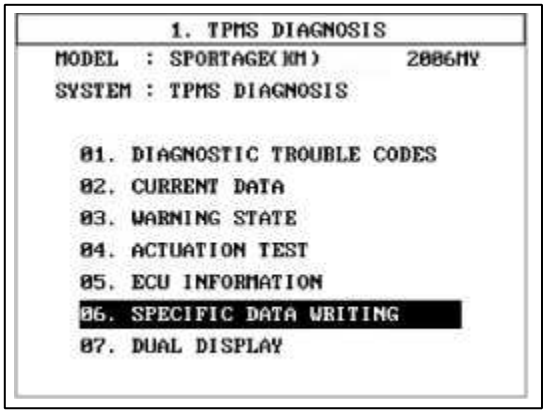
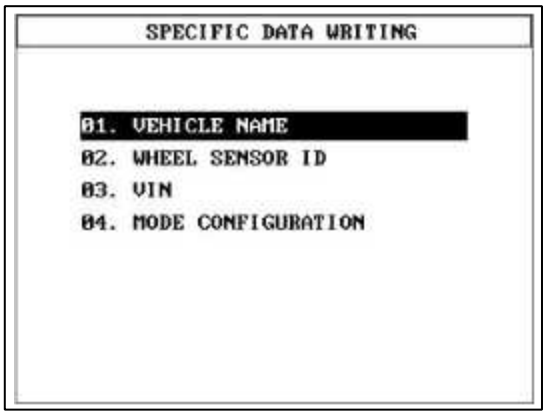
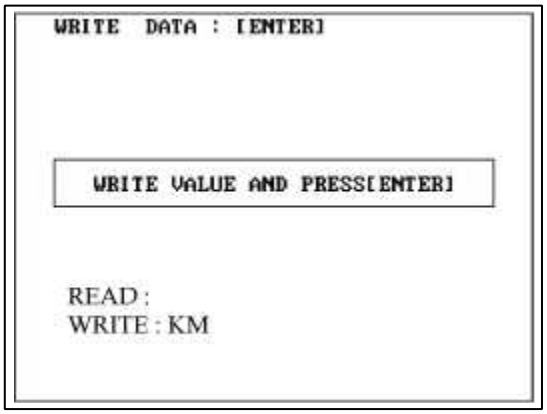
6. Connect 'TPMS exciter' to the diagnostic connector.





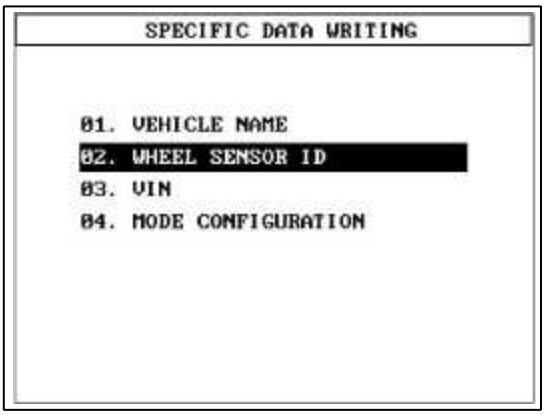
7. Write vehicle name to receiver. receiver will now automatically update monitoring parameters.

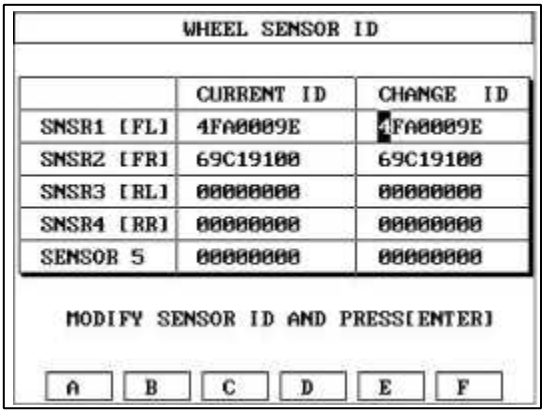




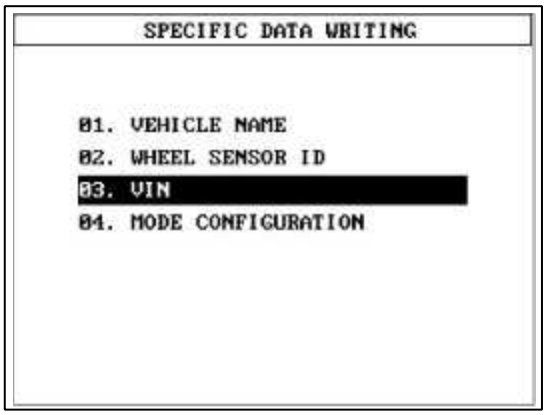
8. Read sensor's ids with the 'TPMS exciter'.
   (Refer to 'SENSOR INITIATING PROCEDURE')

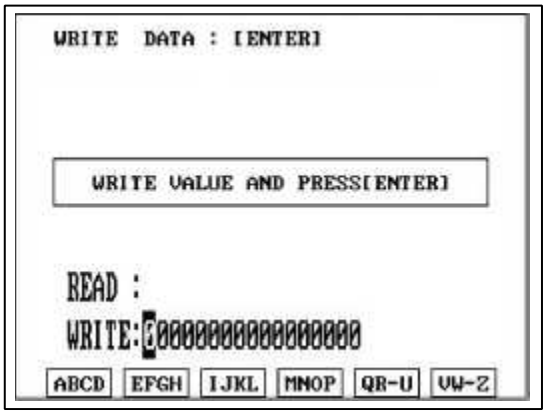
9. Register sensor's ids to receiver.





10. Register VIN number of the vehicle.(17 digits)





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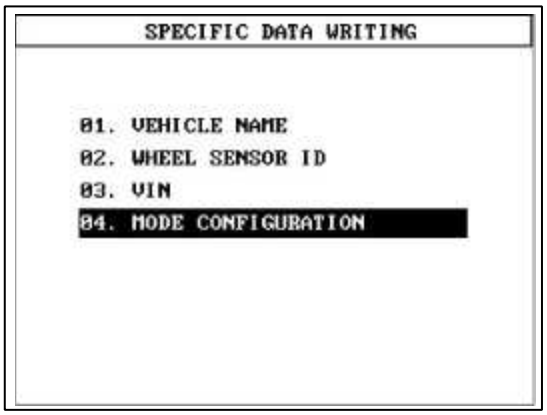
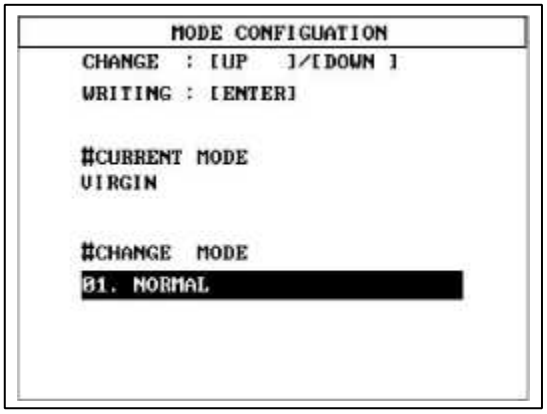
11. Change receiver state from Virgin to Normal.





12. Disconnect diagnostic link.
13. Turn ignition off for approximately 10 seconds then turn it back on and check that Normal State is now indicated (see SS-).

Suspension System > Tire Pressure Monitoring System > Troubleshooting

TROUBLESHOOTING

- the lamp check should occur and then all lamps / LED's should turn off.
- **If the lamp test does not occur:**
  - Check connectors and fuse/harnessing - open / short circuits.
  - Check DTC's.
  - If diagnostics cannot be entered, replace the receiver with a known good one (follow configuration & learning procedure).

TREAD warnings

- **Information to ascertain (TREAD Lamp):**
  - Was puncture repair fluid used (it should not be)?
    - This can cause the sensor pressure port to block and incorrect warning to occur.
  - What temperature were tires last inflated at?
    At what temperature did warnings occur?
    - Pressure change is approx. 1.5psi / 10°C increase.
  - Have the tires been checked / inflated since the lamp first came on?
- **If the TREAD Lamp is on:**

- Check for short circuits.
- Enter Diagnostics and read TREAD Warnings Local Identifier Data.
- Check to see if warning type is under inflation or leak.
- If the warning is for under inflation, then:
  a. Re-inflate the wheel with the matching sensor ID to it's desired Placard pressure.
  b. Check to make sure that the TREAD lamp turns off (this may take up to 4 minutes if the tire is not rapidly re-inflated).
- If the warning is for a leak, then:
  a. Fix any puncture and re-inflate the tire to the desired Placard pressure.
  b. Wait up to 4 minutes and make sure that the TREAD lamp turns off and the lamp does not turn on again.
  c. If lamp comes on again:
  d. Re-check pressure for signs of a puncture and Re-Check TREAD Warnings Local Identifier Data.

- **If the Placard pressure is OK and the TREAD lamp still does not turn off:**
  - Turn wheel a quarter turn and again wait 4 minutes (the sensor may be in an RF null).
  - If the lamp still does not turn off:
    check for loose receiver wiring and replace the receiver with a known good one if necessary (follow configuration & learning procedure).
    - If the problem still exists, replace sensor.
    - Ensure that all tires are inflated to their correct Placard pressures.
    - Clear TREAD warnings.
    - Test drive the vehicle and ensure that the TREAD lamp does not come back on.

DTC's

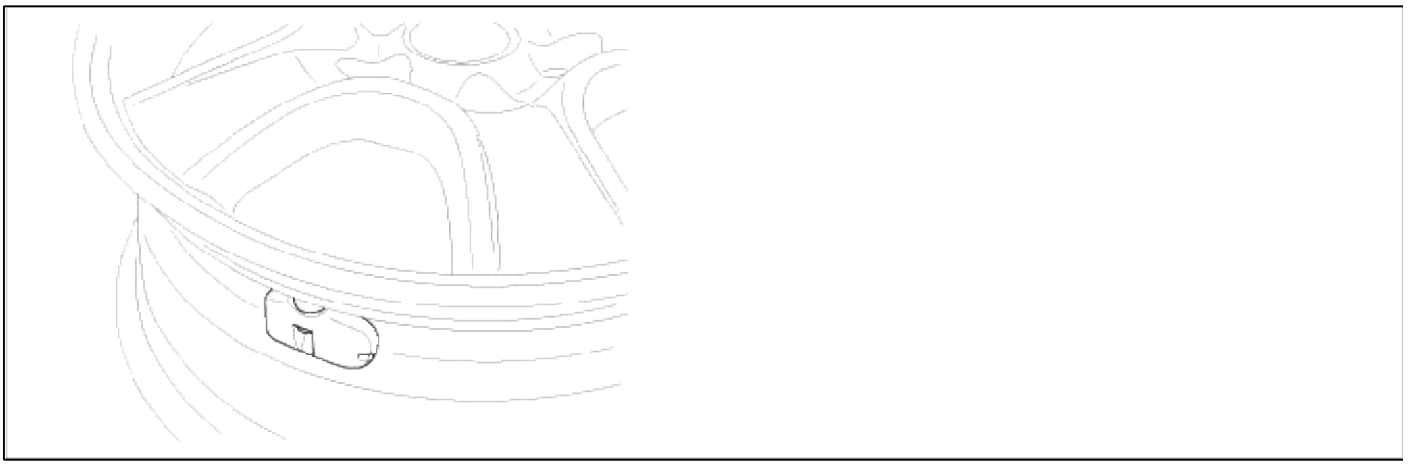
- Information to ascertain (DTC Lamp):
  - At what temperature did the DTC occur? Under certain conditions (approx.-40°C/F), a RF channel missing / hardware failure DTC may occur. This is due to the battery behavior.
- DTC's should be retrieved by using Hi-Scan diagnostic tool.
- The fault should then be diagnosed and rectified.
- DTC's should then be cleared.

DTC	Warning Type	Trouble Description	Diagnostic Lamp
C1121	Battery Level	Sensor 1 Battery Low.	Permanent during detection.
C1122		Sensor 2 Battery Low.	
C1123		Sensor 3 Battery Low.	
C1124		Sensor 4 Battery Low.	
C1126		Vehicle / TPMS receiver Battery Low.	
C1127		Vehicle / TPMS receiver Battery High.	
C1300	LF / RF External Interference	LF/RF Interference Failure.	Permanent during detection.
C1306	RF Internal Interference	Internal vehicle RF source e.g. scanner.	Permanent
C1312	Individual RF channel failure.	Sensor 1 / Front Left RF Failure.	Permanent
C1313		Sensor 2 / Front Right RF Failure.	
C1314		Sensor 3 / Rear Left RF Failure.	

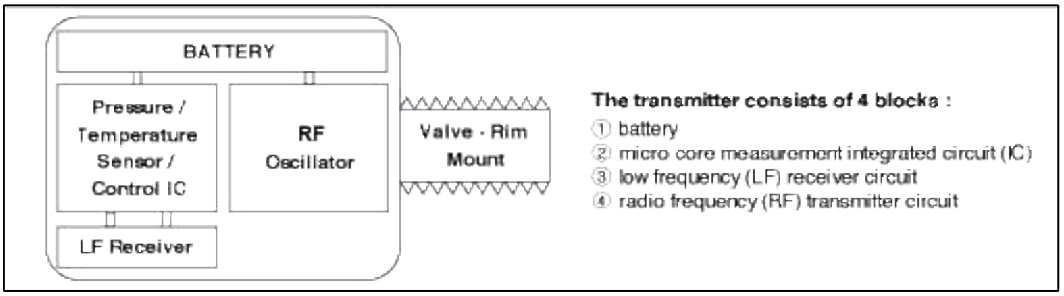
C1315		Sensor 4 / Rear Right RF Failure.	
C1322	Sensor over Temperature	Sensor 1 / Front Left Sensor over 230°F(110°C).	Permanent
C1323		Sensor 2 / Front Right Sensor over 230°F(110°C).	
C1324		Sensor 3 / Rear Left Sensor over 230°F(110°C).	
C1325		Sensor 4 / Rear Right Sensor over 230°F(110°C).	
C1332	Sensor Failure	Sensor 1 / Front Left Sensor Fault.	Permanent
C1333		Sensor 2 / Front Right Sensor Fault.	
C1334		Sensor 3 / Rear Left Sensor Fault.	
C1335		Sensor 4 / Rear Right Sensor Fault.	
C1660	System Hardware	TPMS receiver RF circuit.	Permanent
C1661	EEPROM Failure	TPMS receiver EEPROM Failure.	Permanent
C1668	Micro controller error	Repeated Watchdog Reset / Internal failure detection.	Permanent
C2510	Lamp Short Circuit	TREAD lamp short circuit to 12 V.	Permanent
C2511		Diagnostic lamp short circuit to 12 V.	Permanent

Suspension System > Troubleshooting > C1121

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere due to transmission. Wheel sensors shall support usage on steel or aluminum rims.
Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 248 °F(40 to 120 °C). Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 257 °F(125 °C). The accuracy of the sensor is 23 to 44.6 °F(-5 to 7 °C)at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 212 °F(100 °C). The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit..

Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 32 to 122 °F(0 to 50 °C) and ±17.5 kPa from -40 to 248 °F(-40 to 120°C) with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±37.4 °F(±3 °C) from -4 to 158 °F(-20 to 70 °C) and to ±41 °F(±5 °C) from -40 to 248 °F(40 to 120 °C)..

DTC Description

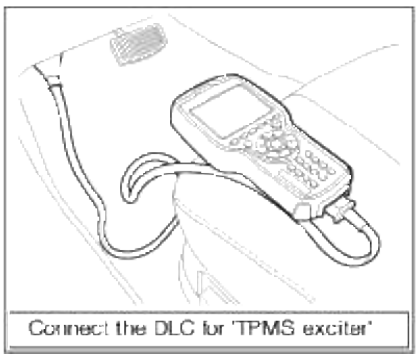
This DTC indicates that the sensor battery voltage level is Low. The most likely cause is battery passing it's expected life / excessively Low temperatures / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Sensor battery check	• Sensor temperature low • Sensor battery low • Faulty TPMS sensor
Enable conditions	• Latest Lowest sensor Temp. > -4 °F(-20 °C) • Distance travelled during 12 min. > 4 km	
Threshold value	• Sensor voltage <2.2 V	
Diagnosis time	• 12 ~13 minutes	

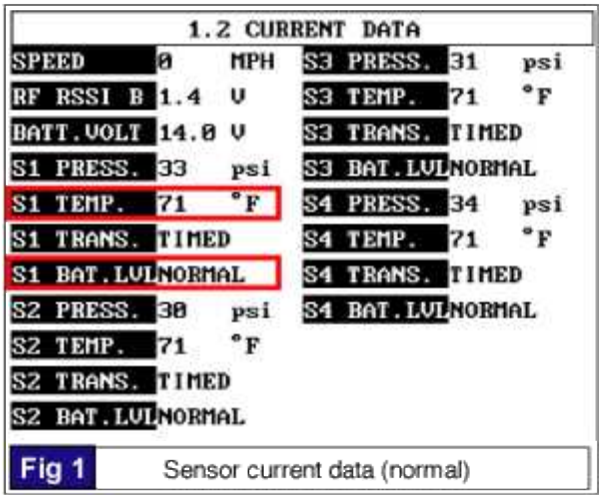
Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mod of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 13 minutes.

Specification : 'Sensor Temp.' is more than -68 °F(-20 °C)and 'Sensor battery value' is 'Normal'.



6. Is parameter within specifications?

YES

Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet.
Go to "Verification of vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.

3. Execute "SET SENSOR STATUS" of each wheel.

Specification : 'Sensor battery value' is 'Normal' and 'Sensor Temp.' is more than -68 °F(-20 °C).

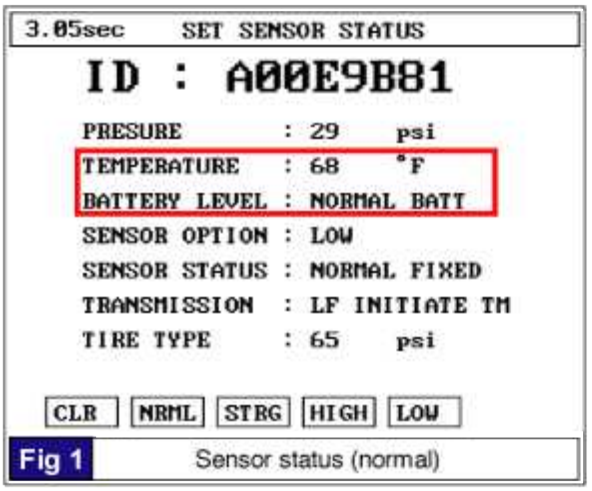
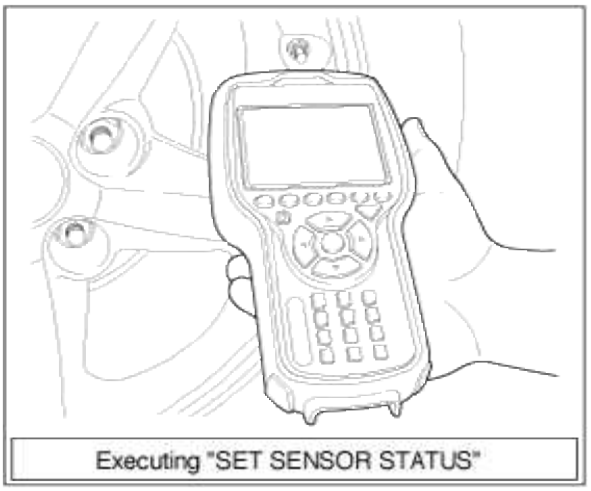


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

The sensor which displays data above the specification is SENSOR 1.

Check wheel / tire where abnormal sensor data was detected. Check for tire / wheel damage and overheated brake condition.

Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.

If it is OK, go to "Check wheel / tire" as follows.

NO

Check for sensor if unable to retrieve data with 'TPMS exciter'.

Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.

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

YES

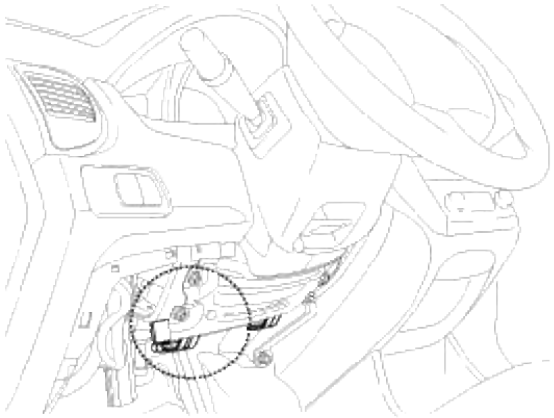
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C1126

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

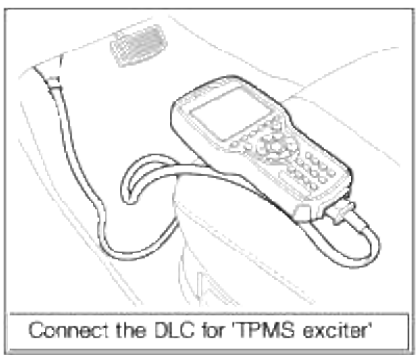
This indicates that the receiver battery level is Low. The most likely cause is battery / harness / receiver input / A-D failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Battery level check	• Faulty charging system • Vehicle battery low • Faulty TPMS Receiver
Enable conditions	• Battery voltage level low	
Threshold value	• Battery voltage < 9V	
Diagnosis time	• 2 sec.	

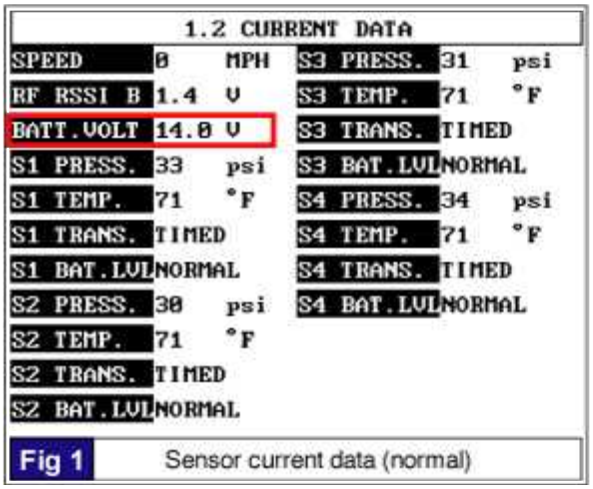
Monitor Scantool Data

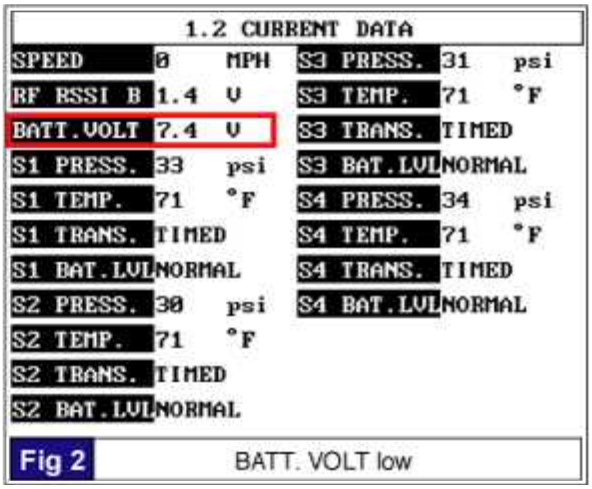
1. Start engine and turn headight and rear defroster.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.
6. Monitor the parameter of BATT. VOLT on the 'TPMS exciter' or scantool

Specification : 'BATT. VOLT' is more than 10 V





7. Is parameter normal?

YES

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
Go to "Verification of vehicle Repair" procedure.

NO

Go to "Inspection/Repair" procedure.

Terminal and Connector Inspection

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

YES

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

NO

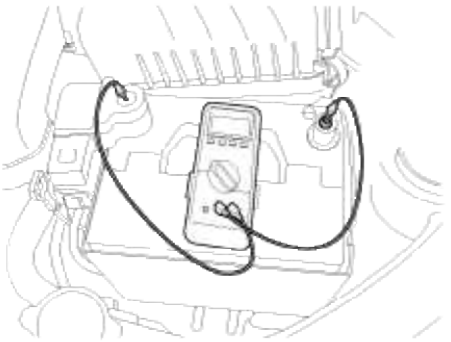
Go to "Charging System Inspection" procedure.

Charging System Inspection

1. Engine "ON".
2. headight and rear defroster "ON".

3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500 RPM(idle) over 2 minutes.

Specification : more than 10 V



4. Is the measured voltage within specifications?

YES

Substitute with a known-good TPM receiver and check for proper operation.
If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

Check for fault in charging system and check for tension of generator drive belt, ENG.idle rpm or open/short in harness from battery to generator.
Repair if necessary 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. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

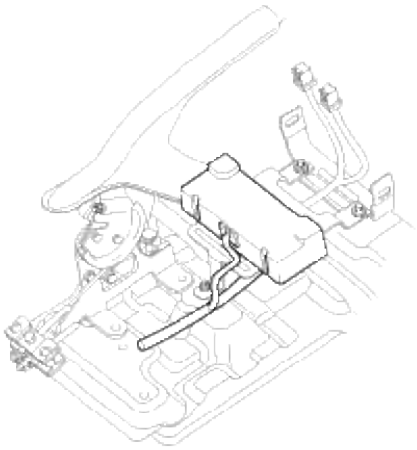
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C1127

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

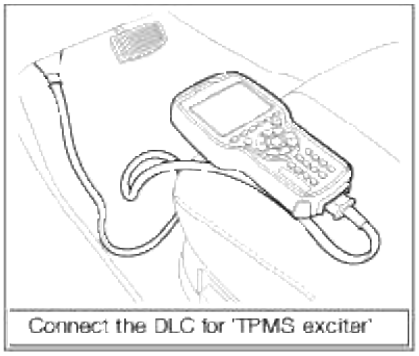
This indicates that the receiver battery level is High. The most likely cause is receiver input / A-D failure.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Battery level check	• Faulty charging system • Vehicle battery high • Faulty TPMS Receiver
Enable conditions	• Battery voltage level high	
Threshold value	• Battery voltage > 17.5 V	
Diagnosis time	• 2 sec.	

Monitor Scantool Data

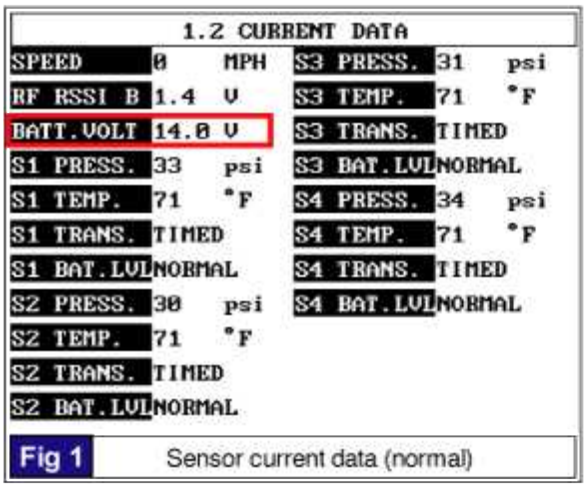
1. Start engine and turn headight and heatwire on.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).

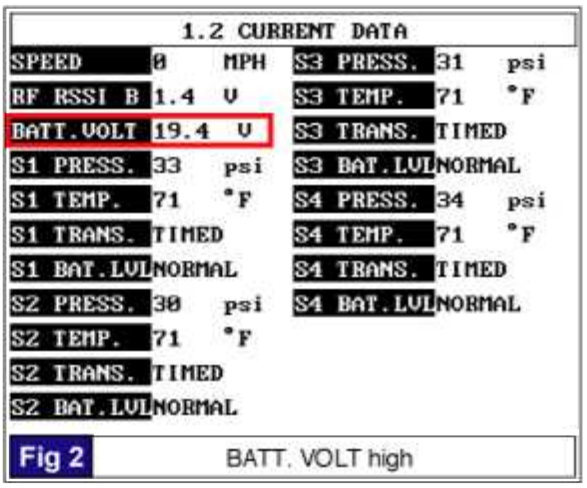

Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

6. Monitor the parameter of BATT. VOLT on the 'TPMS exciter' or scantool.

Specification : 'BATT. VOLT' is less than 16.5 V





7. Is parameter normal?

YES

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
Go to "Verification of vehicle Repair" procedure.

NO

Go to "Inspection/Repair" procedure.

Terminal and Connector Inspection

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

YES

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

NO

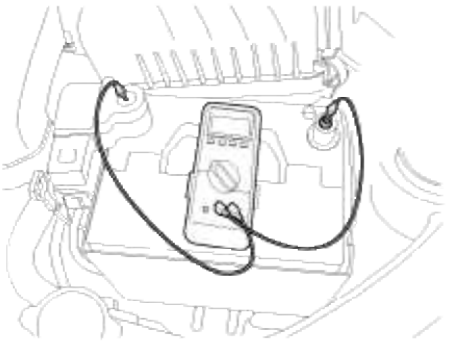
Go to "Charging System Inspection" procedure.

Charging System Inspection

1. Engine "ON".
2. headight and rear defroster "ON".

3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500 RPM(idle) over 2 minutes.

Specification : less than 16.5 V



4. Is the measured voltage within specifications?

YES

Substitute with a known-good TPM receiver and check for proper operation.
If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

Check for fault in charging system and thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
Repair or replace if necessary 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. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

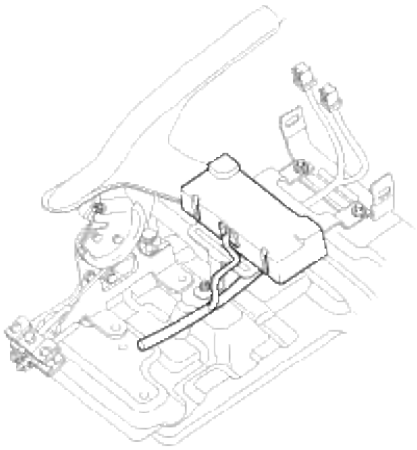
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C1300

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

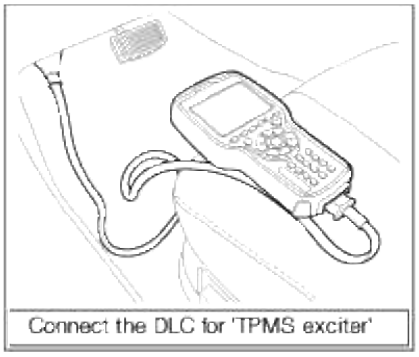
This DTC indicates that system is not functioning due to High interference levels from external sources.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• LF/RF check	• LF/RF Interference from external sources(unless C1306 also exists as historic. If this is the case then interference source is likely to be internal to the vehicle)
Enable conditions	• System not functioning due to High RF interference levels	
Threshold value	• No valid RF data for 8 min from any sensor • Distance travelled during 8 minutes ≤ 1.68 mile(2.7 km)	
Diagnosis time	• 8 - 9 minutes	

Monitor Scantool Data

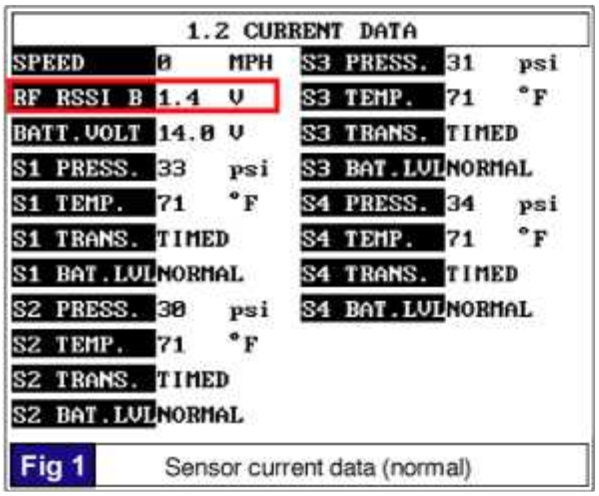
1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).


Connect the DLC for 'TPMS exciter'

3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.

5. Monitor the parameter of RF RSSI background on the 'TPMS exciter' or scantool after 9 minutes.

Specification : "RSSI background" is less than 1.9 V



6. Is parameter within specifications?

YES

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
Go to "Verification of vehicle Repair" procedure.

NO

Substitute with a known-good TPM receiver module and check for proper operation.
If the problem is corrected, replace TPM receiver module 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. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

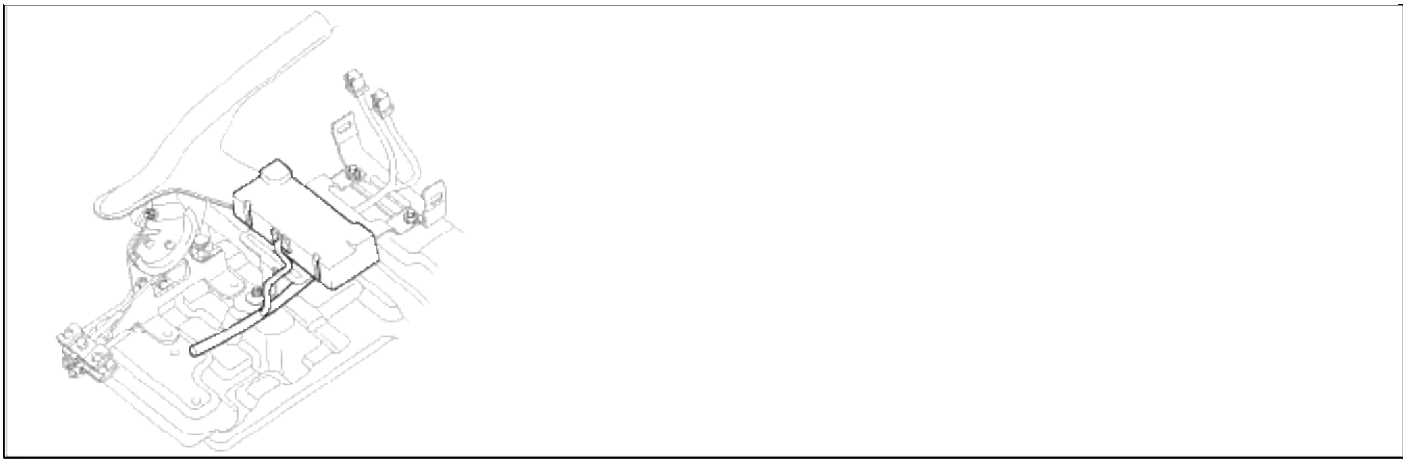
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C1306

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

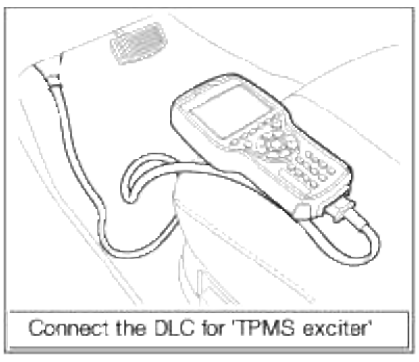
This DTC indicates that system is not functioning due to High interference levels, which are most likely being generated in the vehicle.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• LF/RF check	• Internal vehicle noise source
Enable conditions	• System not functioning due to High RF interference (Internal) levels	
Threshold value	• No valid RF data for 8 min from any sensor • Distance travelled during 8 minutes > 1.68 mile(2.7 km)	
Diagnosis time	• 8 - 9 minutes	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.

4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of RF RSSI background on the 'TPMS exciter' or scantool after 9 minutes..

Specification : "RSSI background" is less than 1.9V

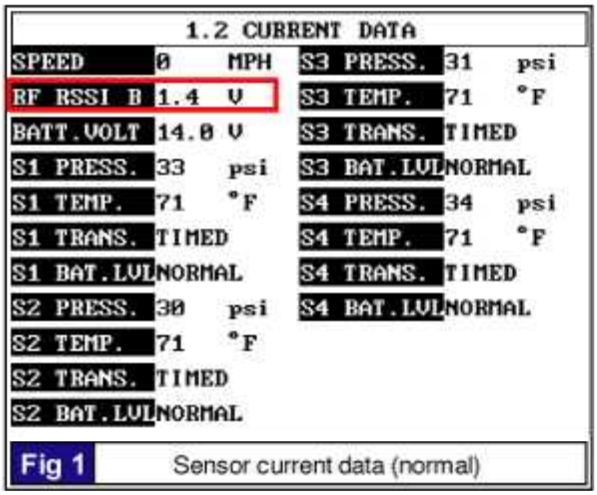


Fig 1 Sensor current data (normal)

6. Is parameter within specifications?

YES

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
Go to "Verification of vehicle Repair" procedure.

NO

Substitute with a known-good TPM receiver module and check for proper operation.
If the problem is corrected, replace TPM receiver module 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. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or 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.

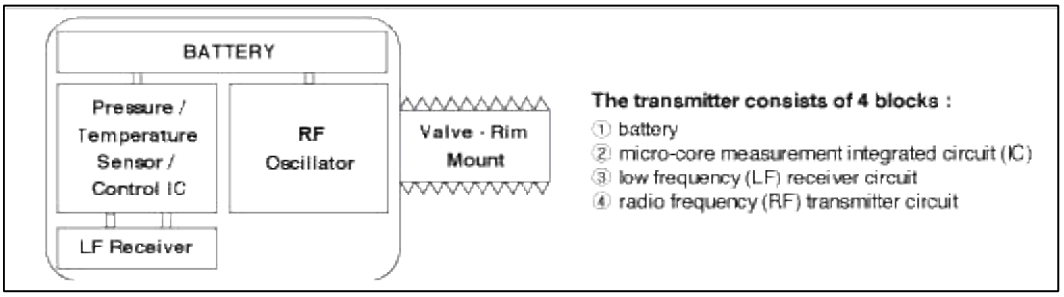
NO

System performing to specification at this time.

Suspension System > Troubleshooting > C1312

Component Location

General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

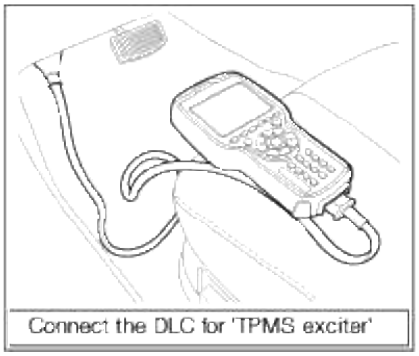
This DTC indicates that the sensor has either failed to learn OR has successfully learned and the receiver did not receive messages from the learned sensor for 12 minutes.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• RF message from sensor1 check	• Faulty TPMS sensor • Incorrectly configured TPMS sensor e.g.Low Line vehicle with High Line sensors. • Low Line vehicle sensors in storage state. • Wrong receiver type fitted e.g. Low Line receiver to a High Line vehicle. • Shielding in vehicle. • Un-approved wheels/tires i.e. a vehicle set up that has not been approved for good RF performance. • Incorrectly fitted sensor / receiver.
Enable conditions	• 2.48 mile < Distance travelled during 12 min. < 24.85 mile	
Threshold value	• Failure to Learn Sensors1 Correctly. • No RF message received from sensor1 over 12 min.	
Diagnosis time	• 12 ~ 20 minutes.	

Monitor Scantool Data

1. Connect "TPMS exciter' or scantool to Data Link Connector(DLC).



2. Select "TPMS DIAGNOSIS" mode.
3. Select the "FULL" mode of "CURRENT DATA" function.

4. Monitor the parameter of SENSOR 1 on the 'TPMS exciter' or scantool after 20 minutes.

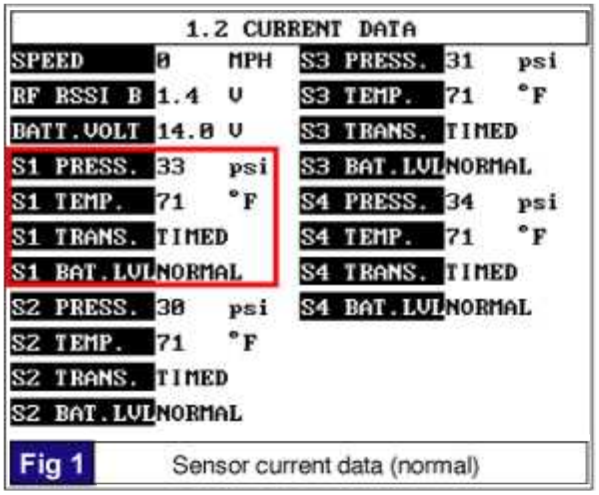


Fig 1 Sensor current data (normal)

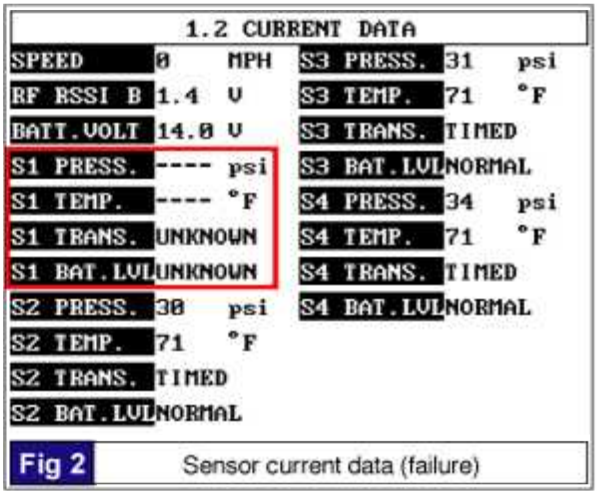


Fig 2 Sensor current data (failure)

5. Is parameter normal?

YES

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
Go to "Verification of vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.

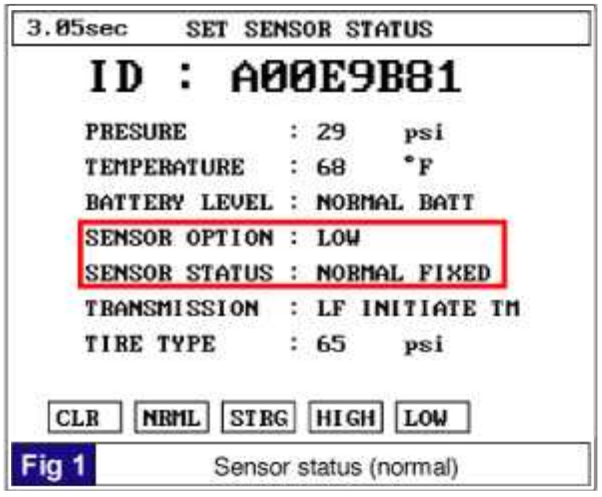
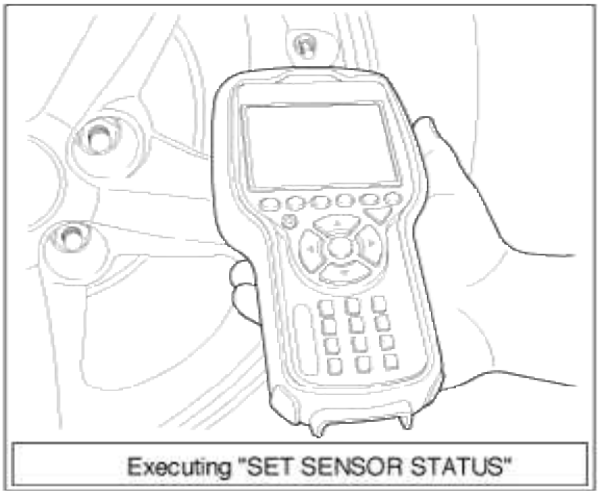


Fig 1 Sensor status (normal)



Executing "SET SENSOR STATUS"

4. Is data unable to be retrieved for any sensor?

YES

Replace affected TPM sensor and register sensor ID with 'TPMS exciter'.
Go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good TPM receiver module and check for proper operation.
If the problem is corrected, replace TPM receiver module 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. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode

2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

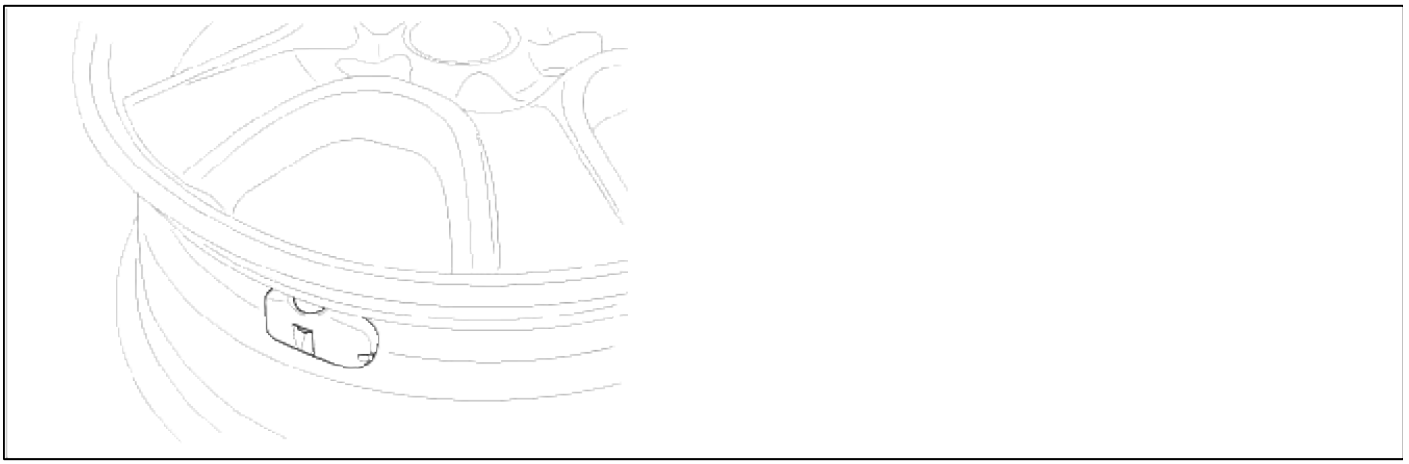
Go to the applicable troubleshooting procedure.

NO

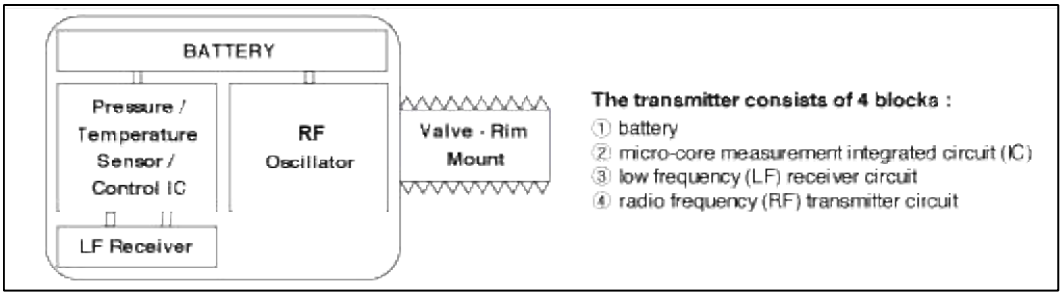
System performing to specification at this time.

Suspension System > Troubleshooting > C1322

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s

nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

This DTC indicates that the sensor has seen a temperature in excess of 110°C. At 125°C, the sensor will shut down and the warning is therefore so that the driver knows that there is a problem with the vehicle that may affect tire performance.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Temperature of sensor check	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable conditions	• 2 consecutive Alert State temperature > 230°F(110°C)	
Threshold value	• Sensor temperature > 230°F(110°C)	
Diagnosis time	• < 10 sec.	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).
3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor the parameter of SENSOR 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

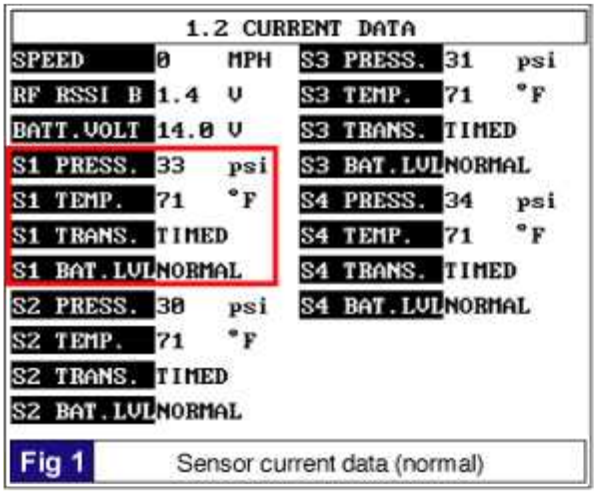
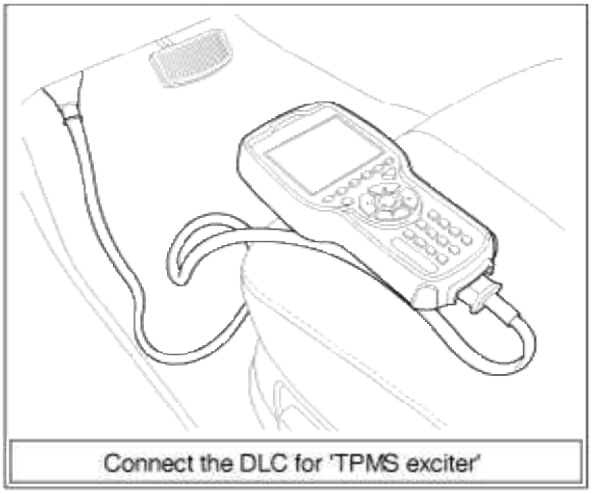


Fig 1 Sensor current data (normal)


Connect the DLC for 'TPMS exciter'

6. Is parameter within specifications?

YES

Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
Go to "Verification of vehicle Repair" procedure.

NO

Go to "Component Inspection" procedure.

Component Inspection

Check TPM SENSOR 1

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.
3. Monitor the parameter of each sensor temperature on the 'TPMS exciter'.

Specification : Less than 230 °F(110 °C)

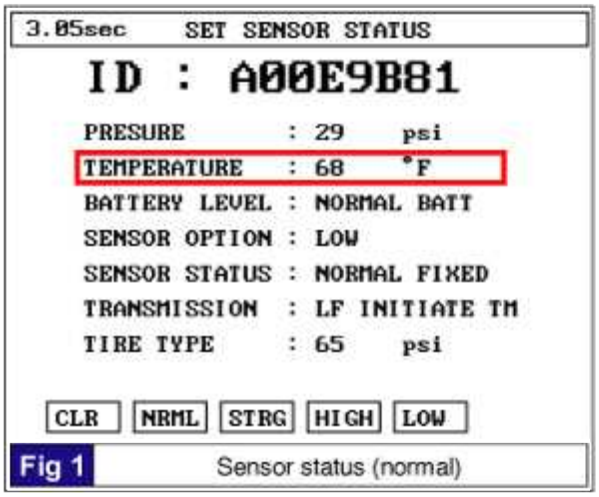
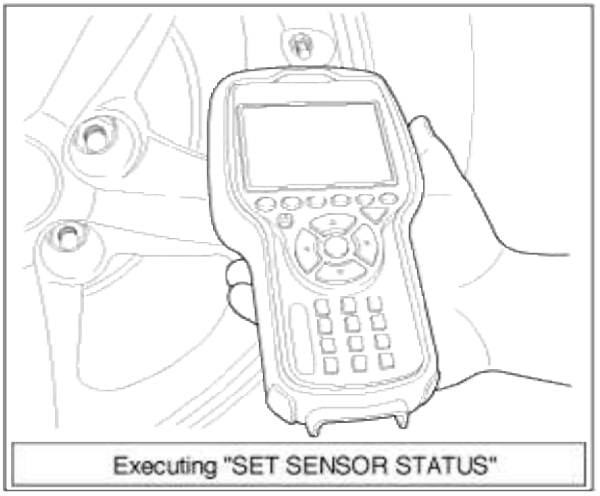


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

4. Is any sensor data outside specification?

YES

The sensor which displays data above the specification is SENSOR 1.
Check wheel / tire of SENSOR 1 if Damaged tire, Excessive braking, Driving while the parking brake is on is detected.
Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure.
If it is OK, go to "Check wheel / tire" as fellows.

NO

Substitute with a known-good TPMS receiver module and check proper operation.
If the problem is corrected, replace TPMS receiver module and go to "Verification of Vehicle Repair" procedure.

Check wheel / tire

1. Cool the heat of the SENSOR 1 wheel / tire.
2. IG OFF & IG ON.

3. Monitor the parameter of sensor 1 temperature on the 'TPMS exciter' or scantool after 4 minutes.

Specification : Less than 230 °F(110 °C)

YES

Fault can be because of temporary overheating.
Go to "Verification of vehicle Repair" procedure.

NO

Replace TPMS sensor and register sensor ID with 'TPMS exciter'.
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 TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

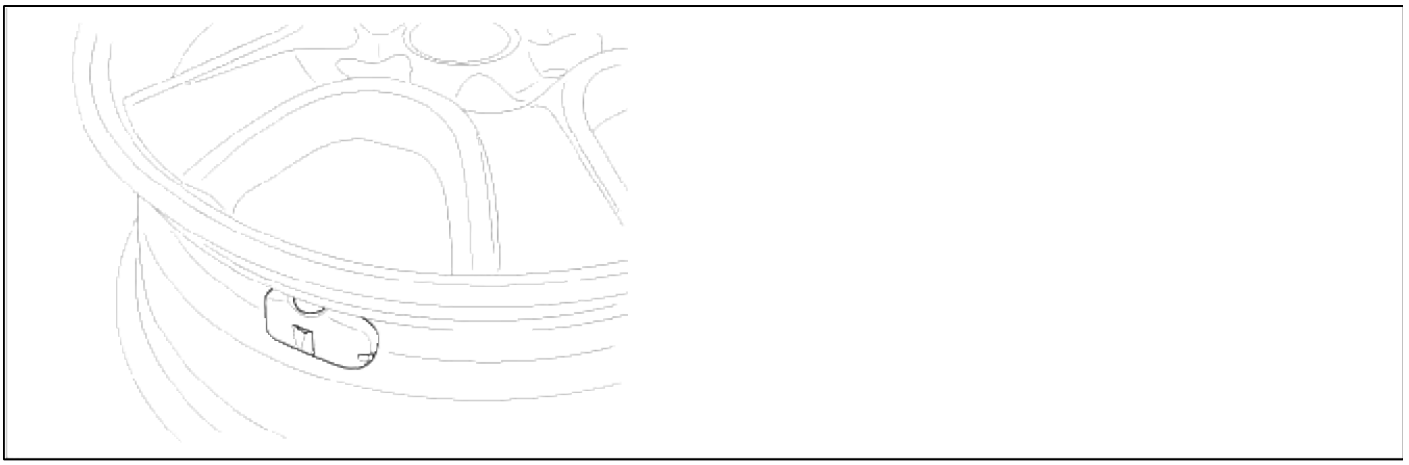
Go to the applicable troubleshooting procedure.

NO

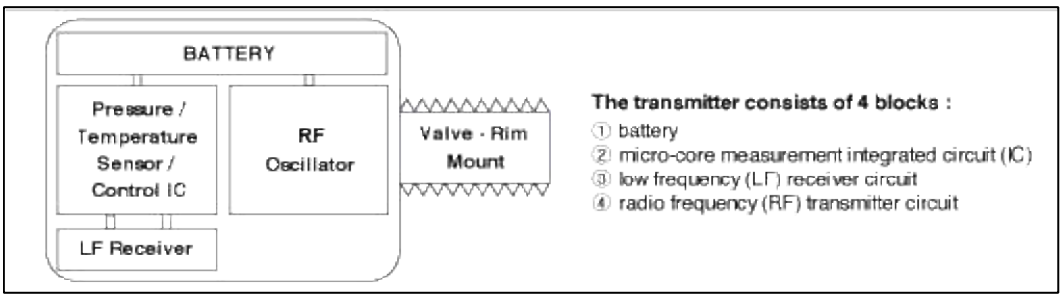
System performing to specification at this time.

Suspension System > Troubleshooting > C1332

Component Location



General Description



This transmitter is a transmitter device with tire valve, which is mounted in the valve hole of the wheel rim and transmits the pressure and temperature inside the tire, the battery voltage of the transmitter, and the tire identification

code (ID) at normal and abnormal condition with the radio wave (RF) that conforms to the used area. Also this device has a countermeasure function such as the random delay of transmission time so that the RF signal from each tire will not interfere such as due to the simultaneous transmission. Wheel sensors shall support usage on steel or aluminum rims.

Sensor transmissions continue when sensor status is 'Normal Fixed State'. Sensor transmissions stop when sensor status is 'Storage State' or the sensor battery runs out. The transmitter should transmit data at vehicle speeds between 0 mph (0 kph) and 186 mph (300 kph). Operating Temperature Range is -40 to 120 °C. Transmitter shall enter thermal shutdown once the measured temperature is greater than or equal to 125 °C. The accuracy of the sensor is ± 5°C at this temperature. The sensor shall exit thermal shutdown once the temperature is less than or equal to 100 °C. The transmitter shall have the capability to measure the internal battery voltage as an indicator of the end of life of the sensor. Since the unit is sealed, this parameter cannot be verified with a production unit.

Tire Pressure Monitoring

When 4 sensors have been learned as road wheels, it shall not be possible to learn new road wheel sensors on the same Ignition cycle. In normal mode low line, tire pressure and temperature shall be transmitted every 3 minutes 20 s nominally independent of vehicle operation. Monitoring shall be every 20 s. If sensor detects rapid deflation, then RF messages will be transmitted every 4 s for 1 minute duration. Communication from wheel sensors shall be via RF at a frequency of 315 MHz, 5 kBaud. Tire pressure measurement tolerance shall be ±7 kPa from 0 to 50 °C and ±17.5 kPa from -40 to 120°C with a range of 100 to 450 kPa. Tire temperature measurement tolerance shall be ±3 °C from -20 to 70 °C and to ±5 °C from -40 to 120 °C.

DTC Description

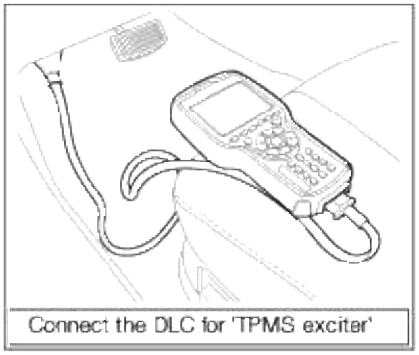
This DTC indicates that the sensor has detected that it has an internal fault. The most likely cause is sensor failure.

DTC Detecting Condition

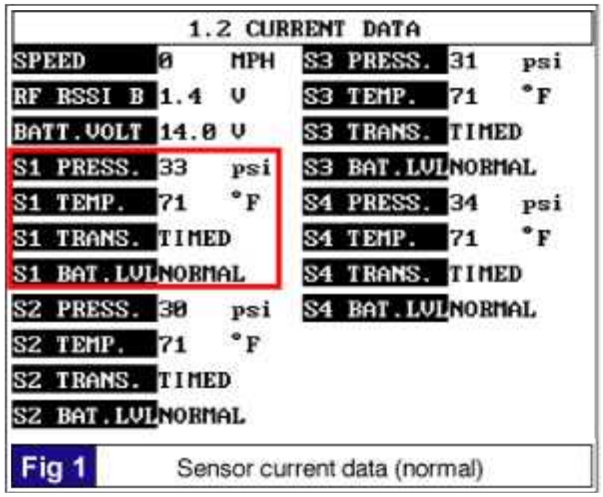
Item	Detecting Condition	Possible cause
DTC strategy	• Sensor check	• Damage to sensor • Faulty TPMS sensor
Enable conditions	• An internal fault in the TPMS sensor	
Threshold value	• TPMS sensor fault	
Diagnosis time	• < 9 minutes	

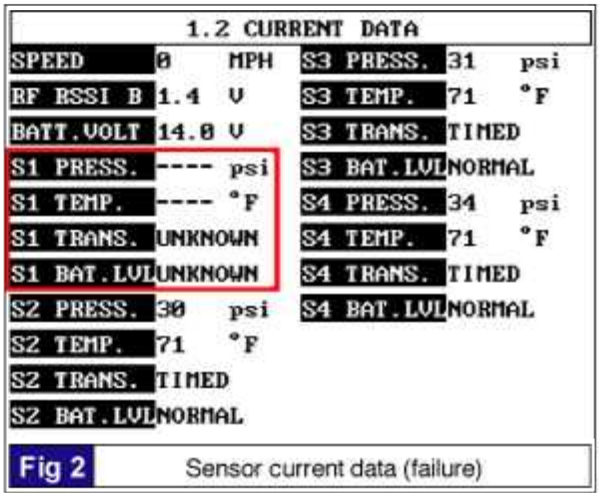
Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



3. Select "TPMS DIAGNOSIS" mode.
4. Select the "FULL" mode of "CURRENT DATA" function.
5. Monitor each sensor's temperature parameter on the 'TPMS exciter' or scantool after 9 minutes.





6. Is parameter normal?

YES

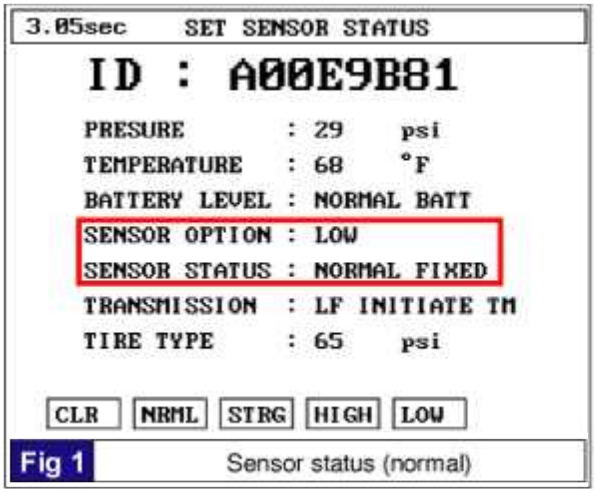
Fault is intermittent. It has been repaired and TPM receiver module memory is not cleared yet.
Go to "Verification of vehicle Repair" procedure.

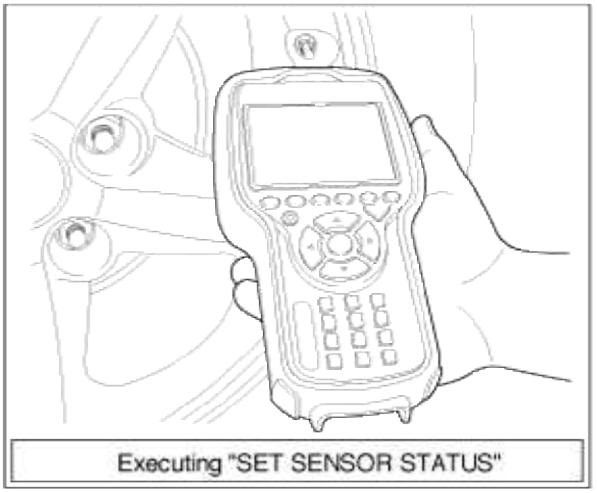
NO

Go to "Component Inspection" procedure.

Component Inspection

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
3. Execute "SET SENSOR STATUS" of each wheel.





4. Is data unable to be retrieved for any sensor?

YES

Check for damaged of TPMS sensor on affected wheel.
Replace TPMS sensor if necessary and register sensor ID with 'TPMS exciter'.
Go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good TPM receiver module and check for proper operation.
If the problem is corrected, replace TPM receiver module 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. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

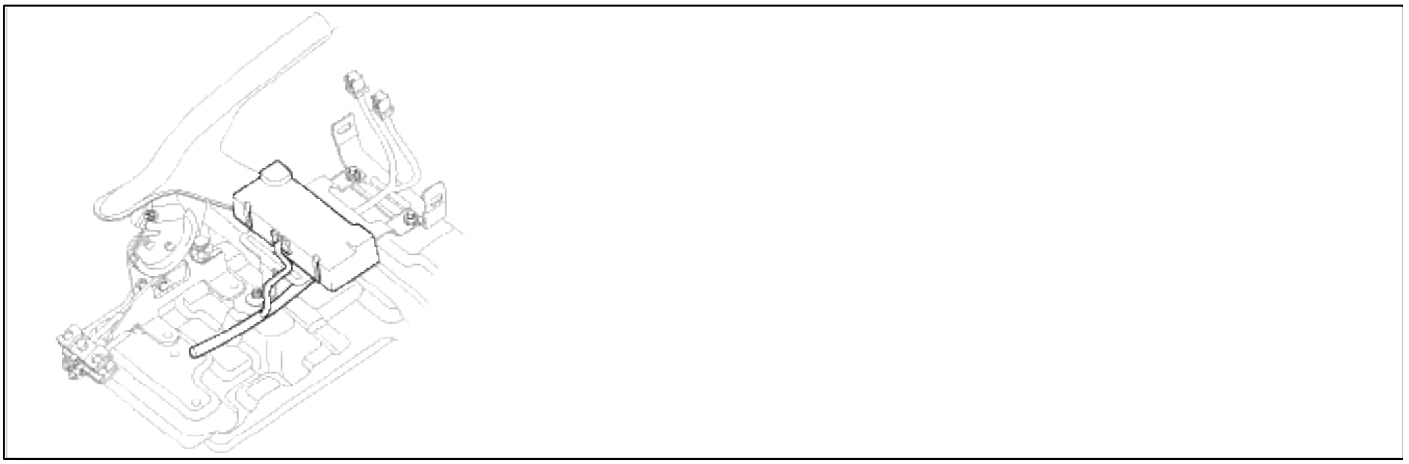
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C1660

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

This DTC indicates that the receiver has not received any RF messages. The most likely cause is receiver RF circuit failure / RF screening.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Internal RF circuit check of Receiver module	• Low Line - all sensors in storage state and no other RF transmissions received • Low Line - receiver RF shielding • Faulty TPMS Receiver module
Enable conditions	• No valid RF data for 12 min from any sensor • RF messages and the signal levels are unexpected	
Threshold value	• Internal RF circuit fault	
Diagnosis time	• 12 ~13 minutes	

Component Inspection

Check status of all TPM sensor

1. Turn ON 'TPMS exciter'.
2. Select "TIRE SNSR CONFIG(EXCITER)" mode.
   Execute "SET SENSOR STATUS" of each wheel.

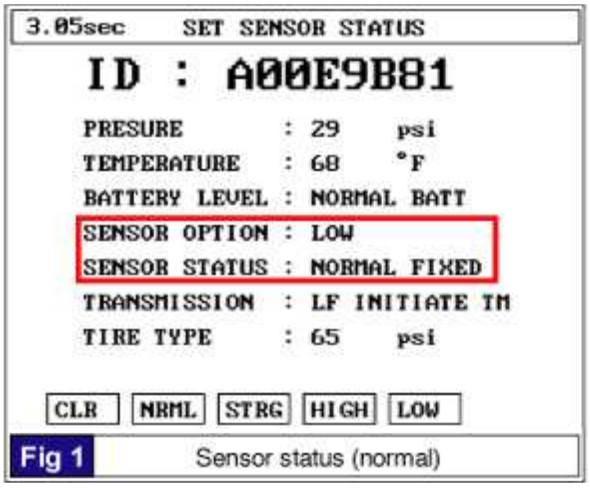
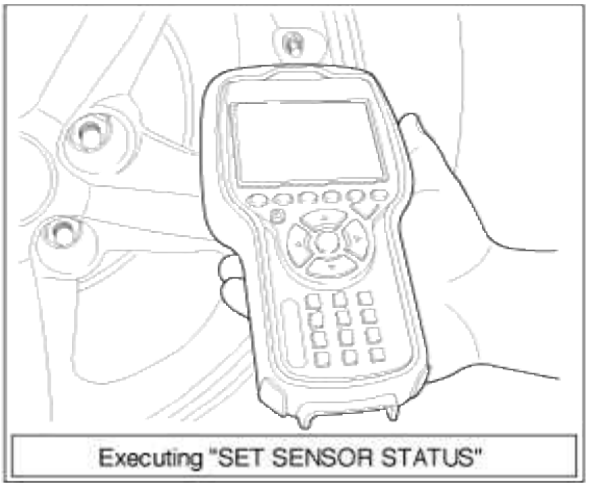


Fig 1 Sensor status (normal)


Executing "SET SENSOR STATUS"

3. Are status of all sensors "normal"?

YES

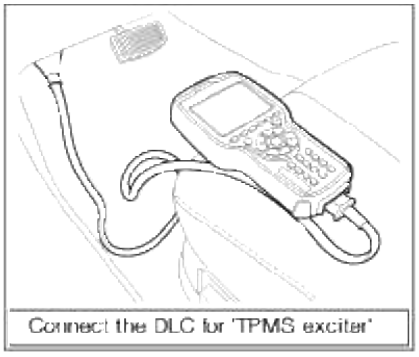
Check TPM receiver RF shielding.
If it is OK, go to "Check TPM receiver" as fellows.
Repair if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Change status of all TPM sensors into "normal" status with 'TPMS exciter'.
Go to "Verification of Vehicle Repair" procedure.

Check TPM receiver

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).


Connect the DLC for 'TPMS exciter'

2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1660' present ?

YES

Substitute with a known-good TPM Receiver module and check for proper operation.
If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

TPM receiver complete successful Auto-Learn.
System is OK.

Verification of Vehicle Repair

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

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

YES

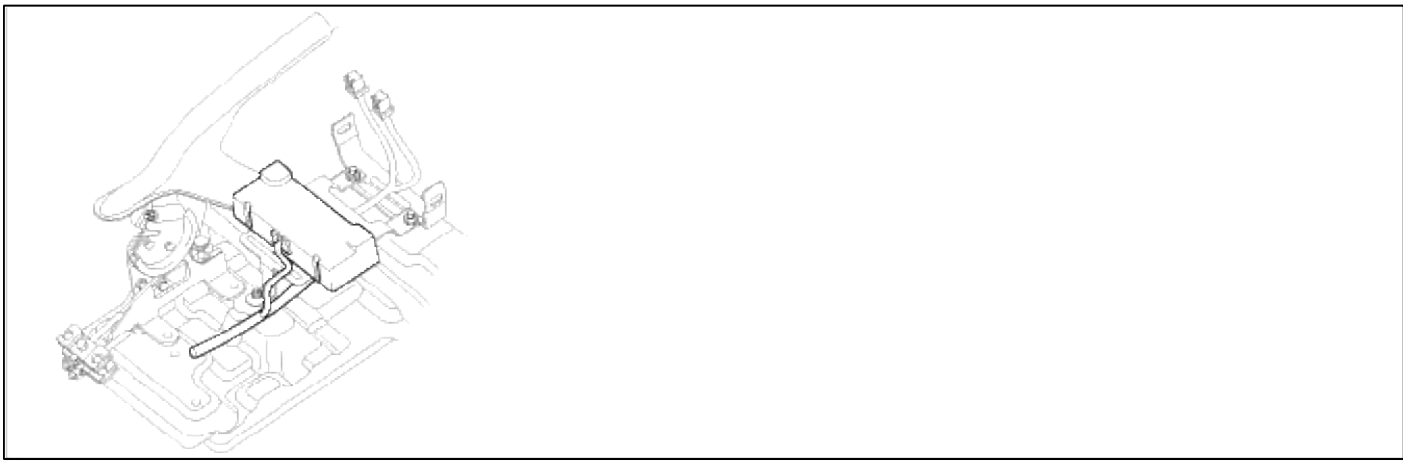
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C1661

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

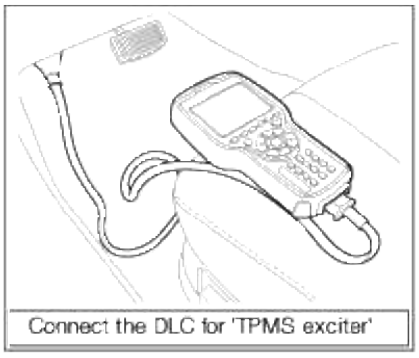
This DTC indicates that the receiver has a problem reading or writing to EEPROM.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Receiver module check	• Transient over voltage due to vehicle fault (fault would typically recover) • Faulty TPMS Receiver
Enable conditions	• Reading or writing problem to EEPROM	
Threshold value	• EEPROM in the receiver module fault	
Diagnosis time	• < 10 sec.	

Component Inspection

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1661' present ?

YES

Substitute with a known-good TPM Receiver module and check for proper operation.
If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

TPM receiver complete successful Auto-Learn.
System is OK.

Verification of Vehicle Repair

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

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

YES

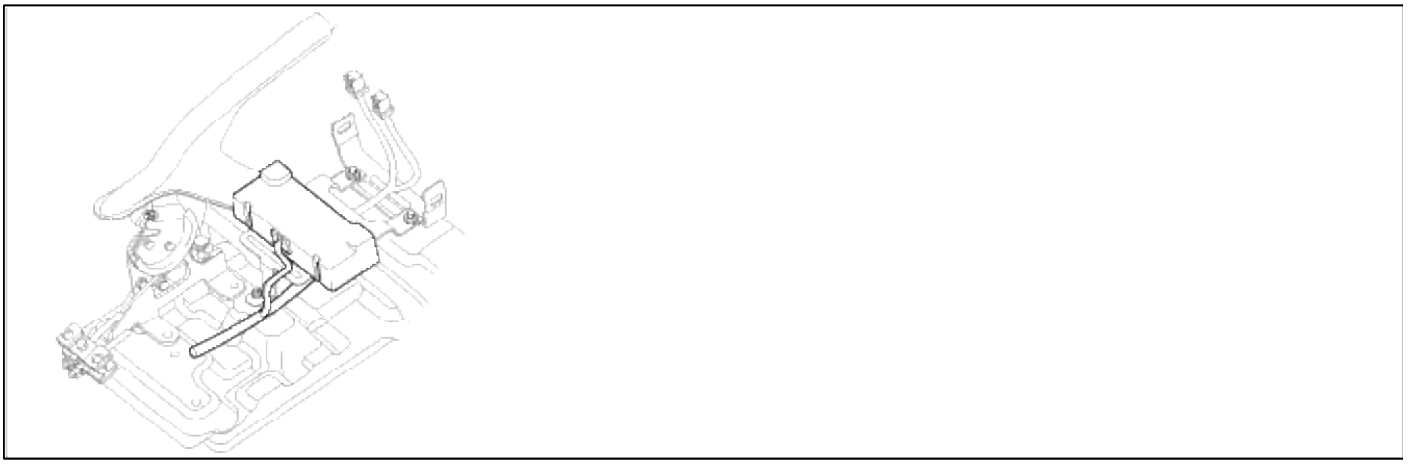
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C1668

Component Location



General Description

TPM Receiver is integrated with the TPM module installed at the bottom of the steering column. The operating battery of TPM module is supplied from the vehicle battery. Data such as Tire pressure, Tire Temperature, TPM sensor battery status and TPM sensor valve ID from TPM sensors are transmitted to TPM receiver in the form of RF signal. TPM module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

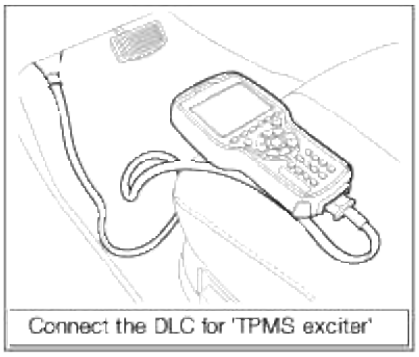
This DTC indicates that the receiver has detected an internal error.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Receiver module check	• Transient over voltage due to vehicle fault (fault would typically recover) • Faulty TPMS Receiver
Enable conditions	• An Internal error	
Threshold value	• TPMS Receiver module fault	
Diagnosis time	• < 3 sec. - Carried out once at Ignition ON	

Component Inspection

1. Connect 'TPMS exciter' or scantool to Data Link Connector(DLC).



2. Clear DTC.
3. IG OFF & IG ON. Wait 4 minutes.
4. Execute "Diagnostic Trouble Codes(DTCs)".
5. Is 'C1668' present ?

YES

Substitute with a known-good TPM Receiver module and check for proper operation.
If the problem is corrected, replace TPM Receiver module and go to "Verification of vehicle Repair" procedure.

NO

TPM receiver complete successful Auto-Learn.
System is OK.

Verification of Vehicle Repair

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

1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES

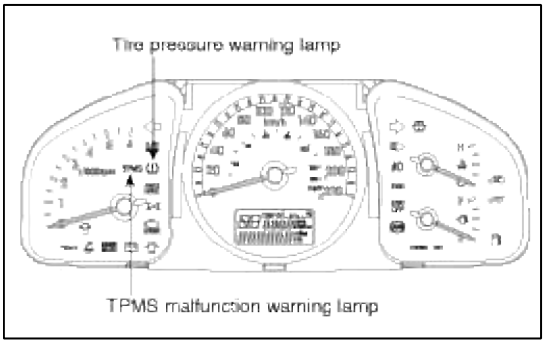
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C2510

Component Location



General Description

The TPMS receiver unit must provide two outputs continuously to drive the indicator lamps. One of the output turn the TREAD indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The other output turn the TPMS Warning indicator bulb on when the TPMS receiver unit has detected a system fault.

Turn the TREAD indicator lamp on

1. When tire pressure is below allowed threshold.
2. When rapid leak is detected by the sensor.
3. Indicates that tire needs to be re-inflated to placard pressure / repaired.

Turn the TREAD indicator lamp off

1. Under-inflation : When tire pressure is above (warning threshold + hysteresis).
2. Leak : When tire pressure is above (leak warning threshold) OR on Ignition cycle off to on.

DTC Description

This DTC indicates that the TREAD(Tire Under Inflation / Leak Warning) / DTC Warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness / instrument cluster / connector / receiver short circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp current check	• Short circuit to 12 V between lamp and TPMS receiver
Enable conditions	• TREAD / Diagnostic lamp circuit short to 12 V	
Threshold value	• TREAD / Diagnostic lamp - 200 mA allowed each (after in rush time). 50 mA margin built in.	
Diagnosis time	• < 3s	

Terminal and Connector Inspection

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

YES

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

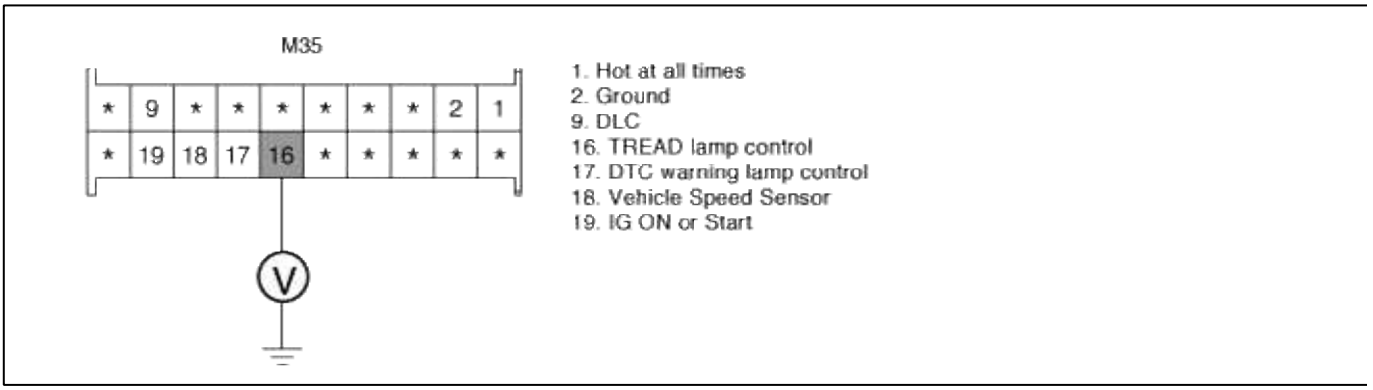
NO

Go to "Control Circuit Inspection" procedure.

Control Circuit Inspection

1. Engine "OFF".
2. Disconnect instrument cluster connector and TPM receiver connector.
3. Engine "ON".
4. Measure voltage between terminal "16" of TPMS receiver harness connector and chassis ground.

Specification : 0 V



5. Is the measured voltage within specifications?

YES

Substitute with a known-good TPM receiver and check for proper operation.
If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

Check for short to power in control harness.
Repair if necessary 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. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES

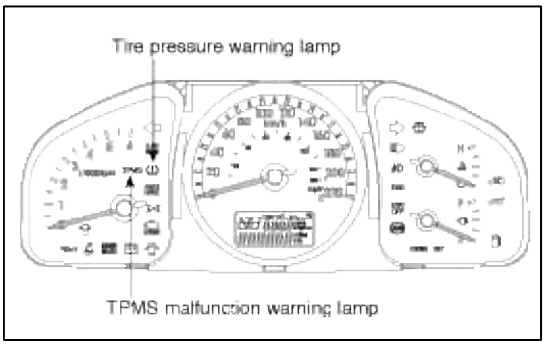
Go to the applicable troubleshooting procedure.

NO

System performing to specification at this time.

Suspension System > Troubleshooting > C2511

Component Location



General Description

The TPMS receiver unit must provide two outputs continuously to drive the indicator lamps. One of the output turn the TREAD indicator lamp on when pressure in one or more tires associated with the TPMS receiver unit have reported a pressure below the warning level threshold. The other output turn the TPMS Warning indicator bulb on when the TPMS receiver unit has detected a system fault.

Turn the TPMS DTC Warning indicator lamp on

1. When the system detects a fault that is external to the receiver / sensor.
2. When the system detects a receiver fault.
3. When the system detects a sensor fault.

Turn the TPMS DTC Warning indicator lamp off

1. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
2. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

DTC Description

This DTC indicates that the TREAD(Tire Under Inflation / Leak Warning) / DTC Warning lamp is short circuit and therefore cannot be turned on. The most likely failure is harness / instrument cluster / connector / receiver short circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC strategy	• Input lamp current check	• Short circuit to 12 V between lamp and TPMS receiver
Enable conditions	• TREAD / Diagnostic lamp circuit short to 12 V	
Threshold value	• TREAD / Diagnostic lamp - 200 mA allowed each (after in rush time). 50 mA margin built in.	
Diagnosis time	• < 3s	

Terminal and Connector Inspection

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

3. Has a problem been found?

YES

Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

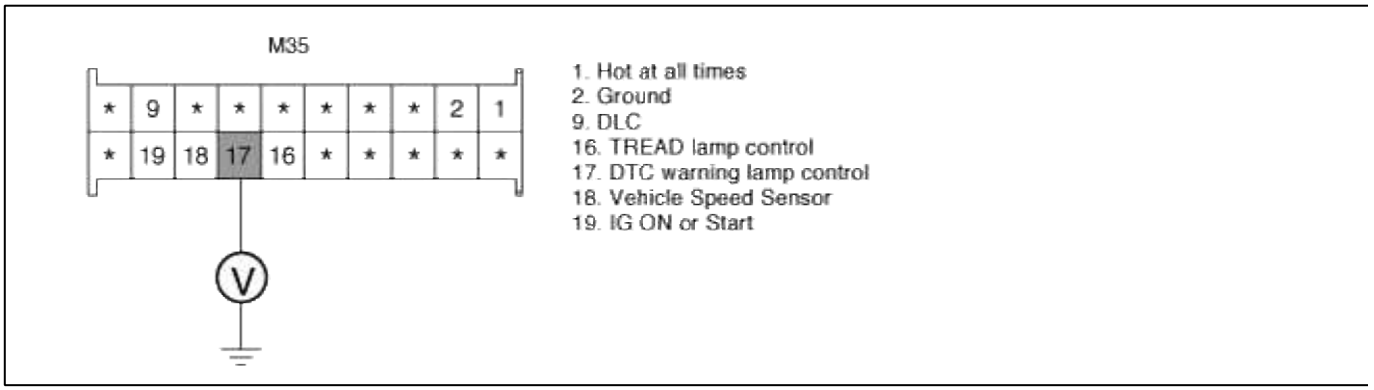
NO

Go to "Control Circuit Inspection" procedure.

Control Circuit Inspection

1. Engine "OFF".
2. Disconnect instrument cluster connector and TPM receiver connector.
3. Engine "ON".
4. Measure voltage between terminal "17" of TPMS receiver harness connector and chassis ground.

Specification : 0 V



5. Is the measured voltage within specifications?

YES

Substitute with a known-good TPM receiver and check for proper operation.
If the problem is corrected, replace TPM receiver and then go to "Verification of Vehicle Repair" procedure.

NO

Check for short to power in control harness.
Repair if necessary 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. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or 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

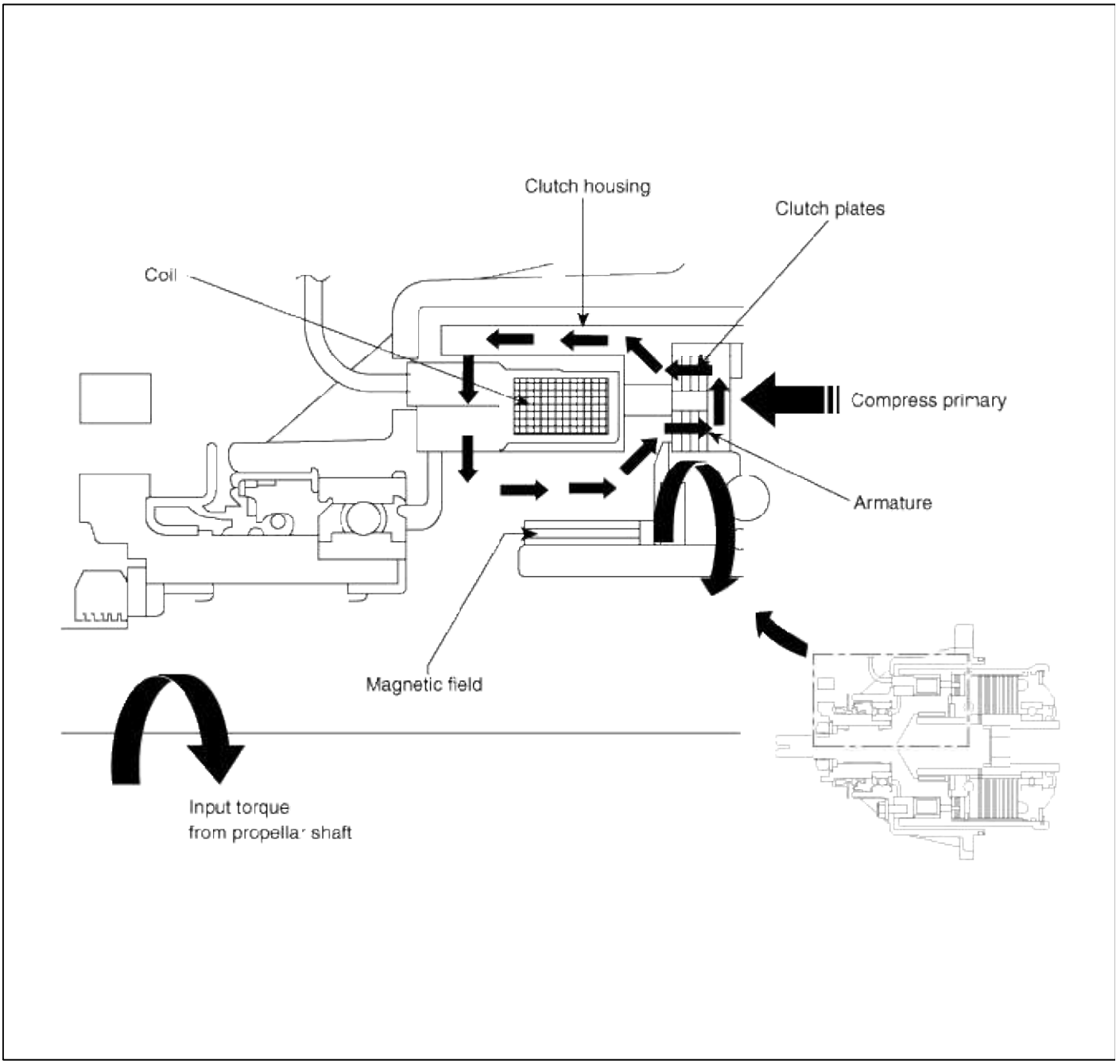
System performing to specification at this time.

SPORTAGE(KM) > 2007 > G 2.0 DOHC > Transfer System

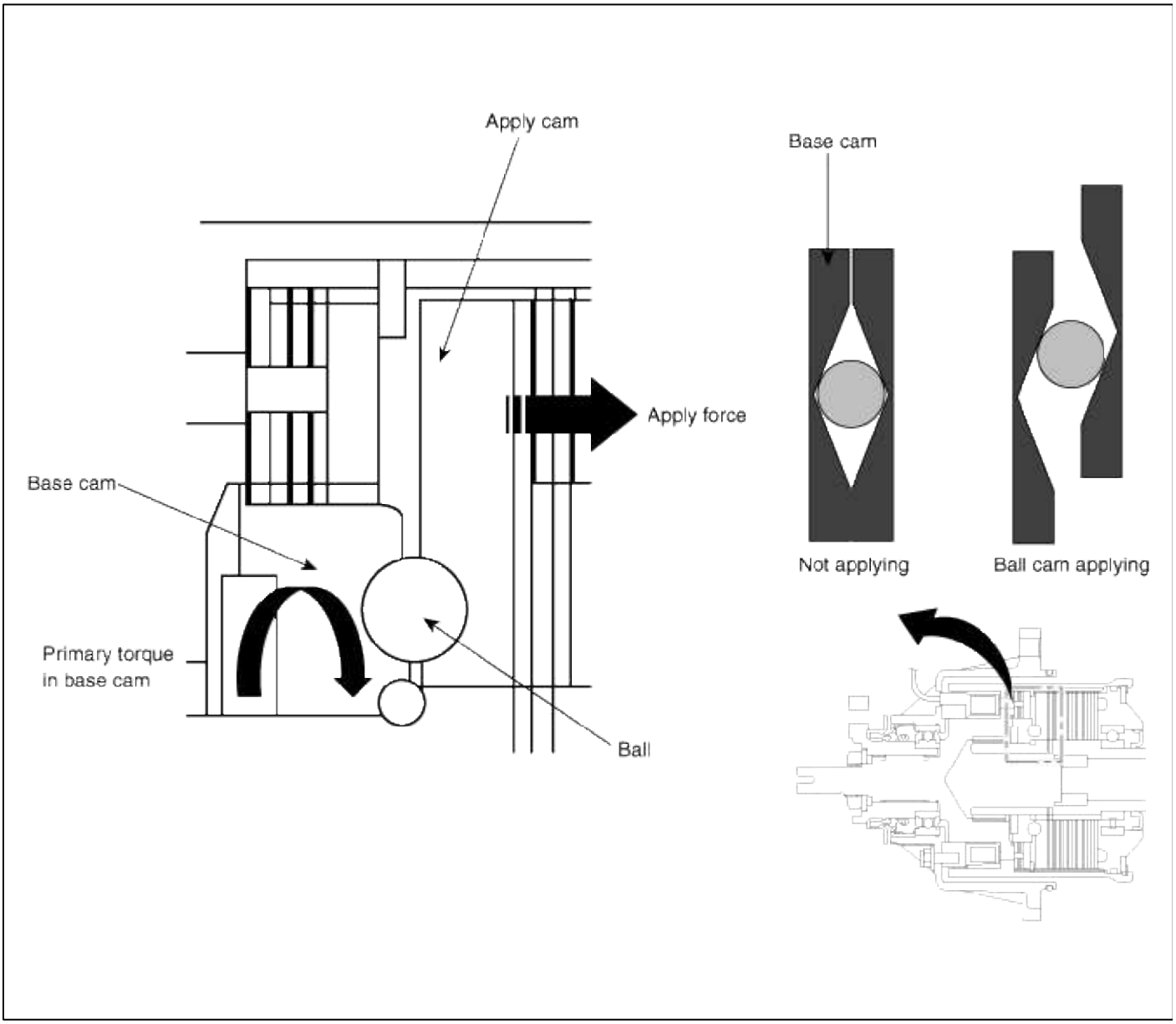
Transfer System > Transfer Case Assembly > Description and Operation (M5GF1)

POWER FLOW MECHANISM

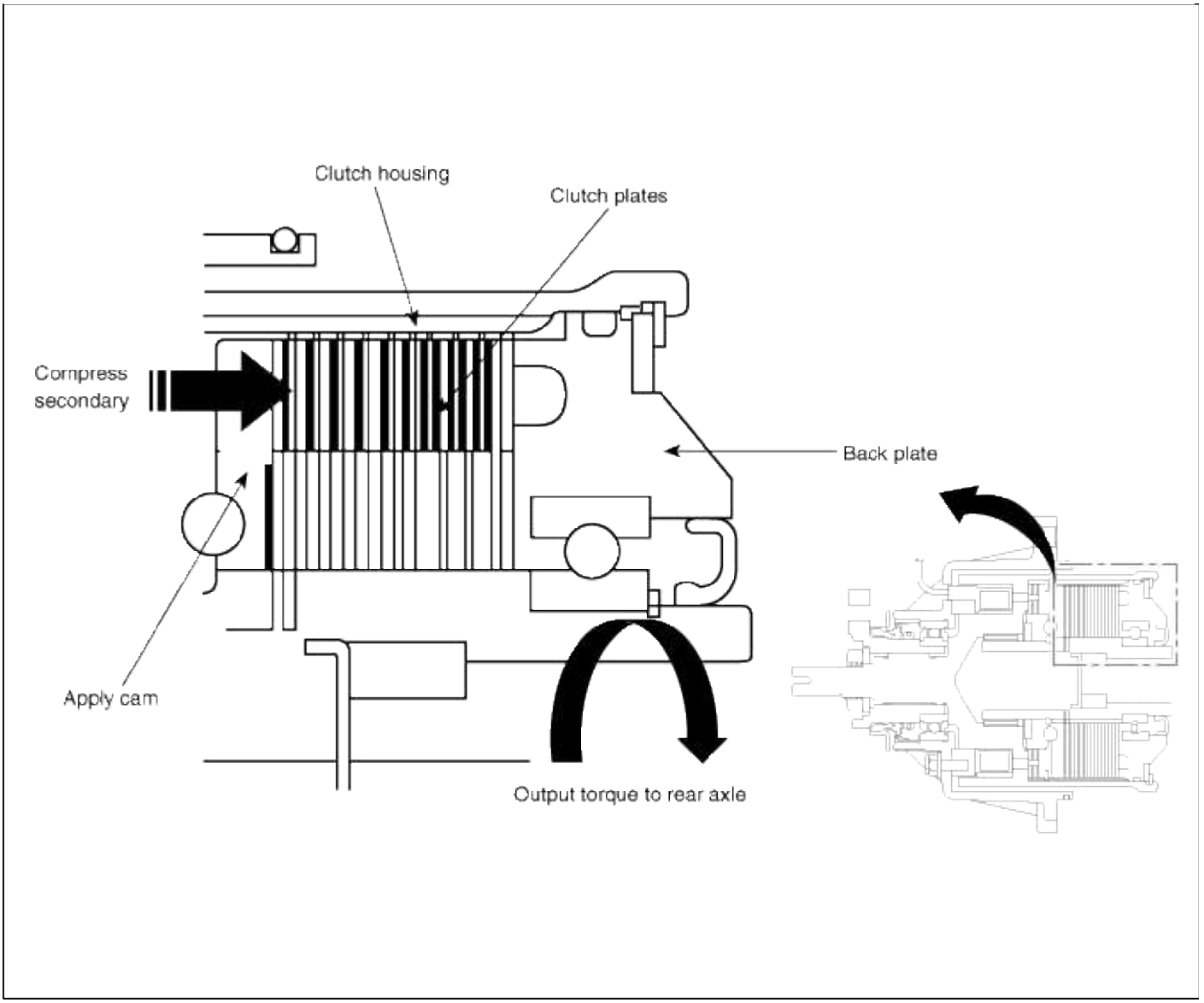
- Normal driving situation: 2WD base driving
- 4WD driving in driving situations (rapid activation, cornering etc.)
- Input the information from each sensor in vehicle
  - Input torque (Throttle position sensor)
  - Cornering situation (Steering angle sensor)
  - Vehicle speed and different wheel speed front & rear (Wheel speed sensor)
  - Braking situation (Brake signal and ABS signal)
- Distributed the required driving force after 4WD ECU operates.
- EMC (Electric Magnetic Clutch) operates the primary clutch.



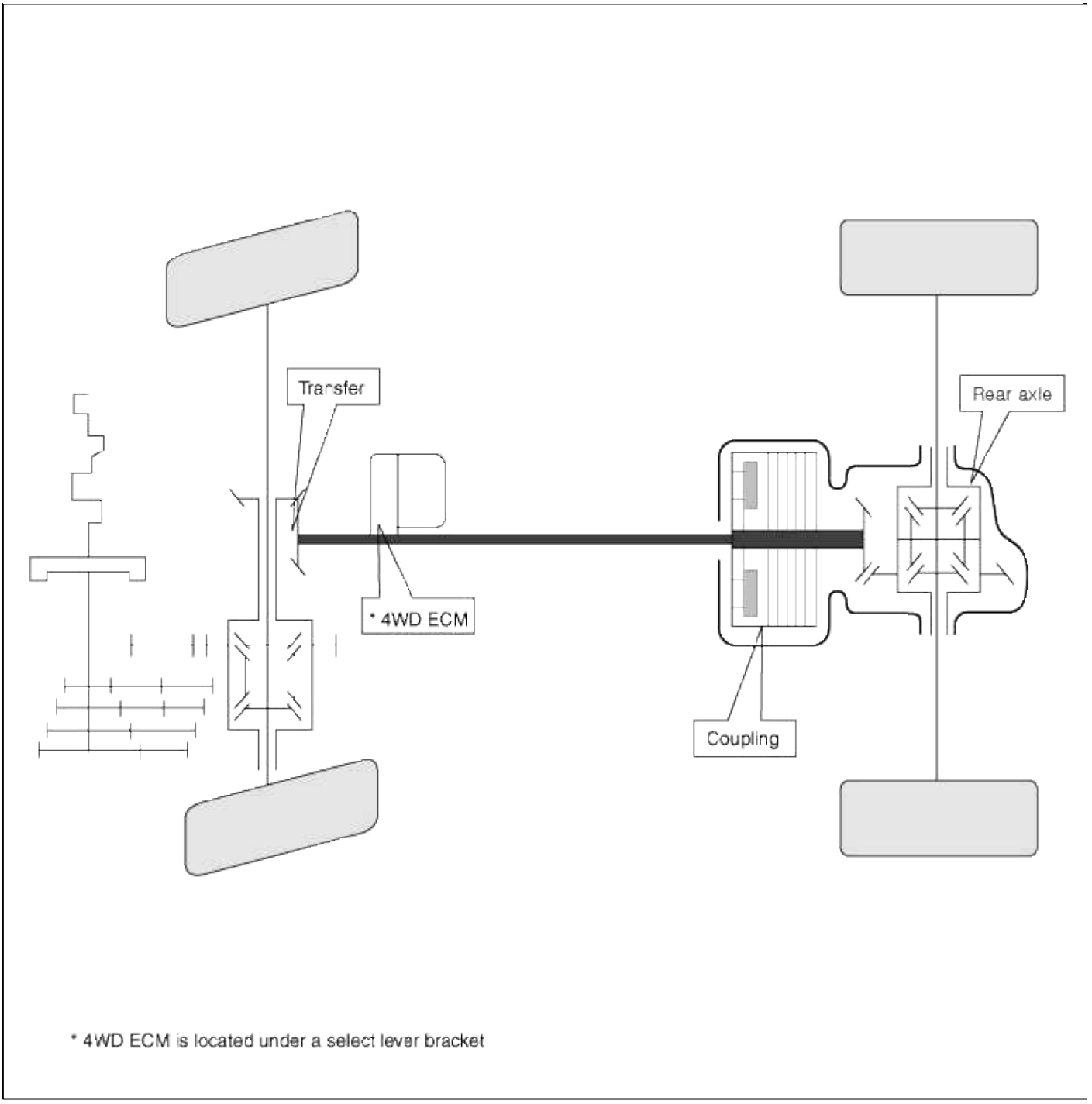
- Control the cam's opening gap by operation of primary clutch.



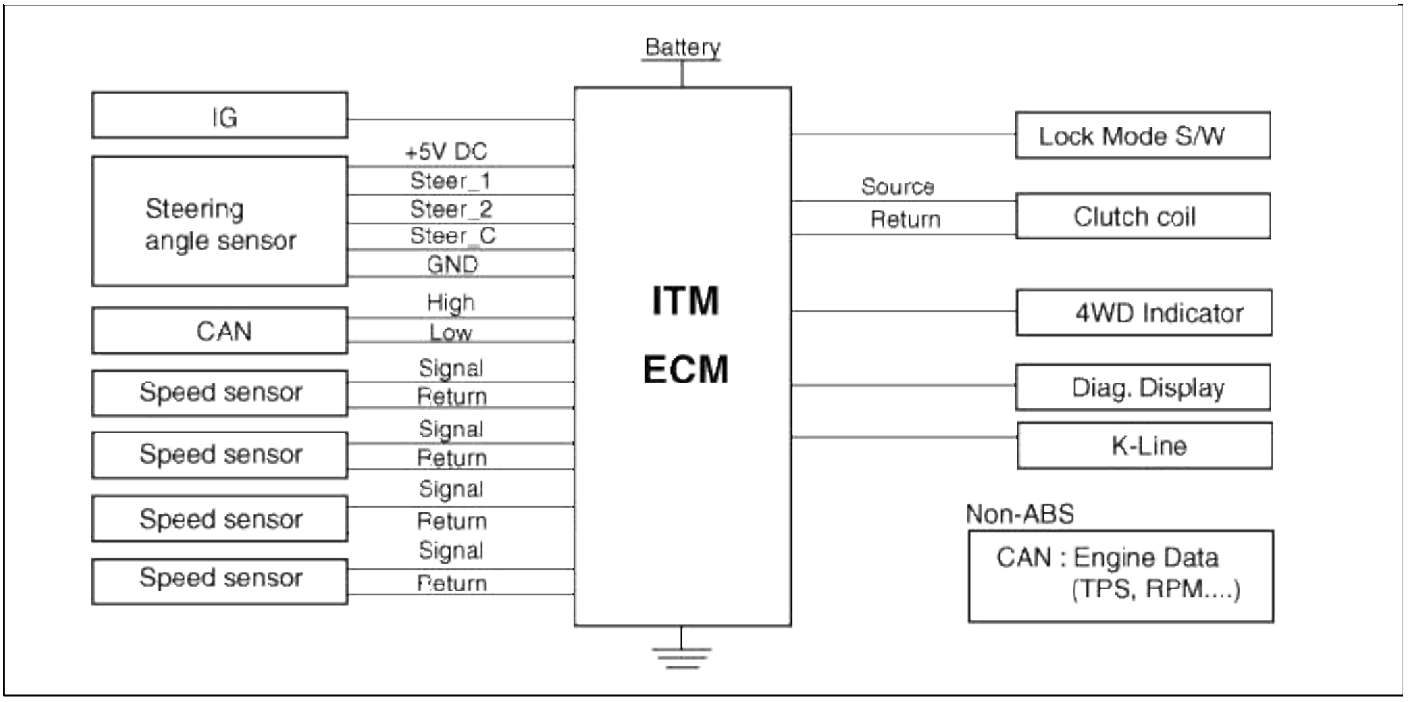
- Control the slip of inner & outer plate.
  Control variably the driving force distribution to optimize front & rear driving force.



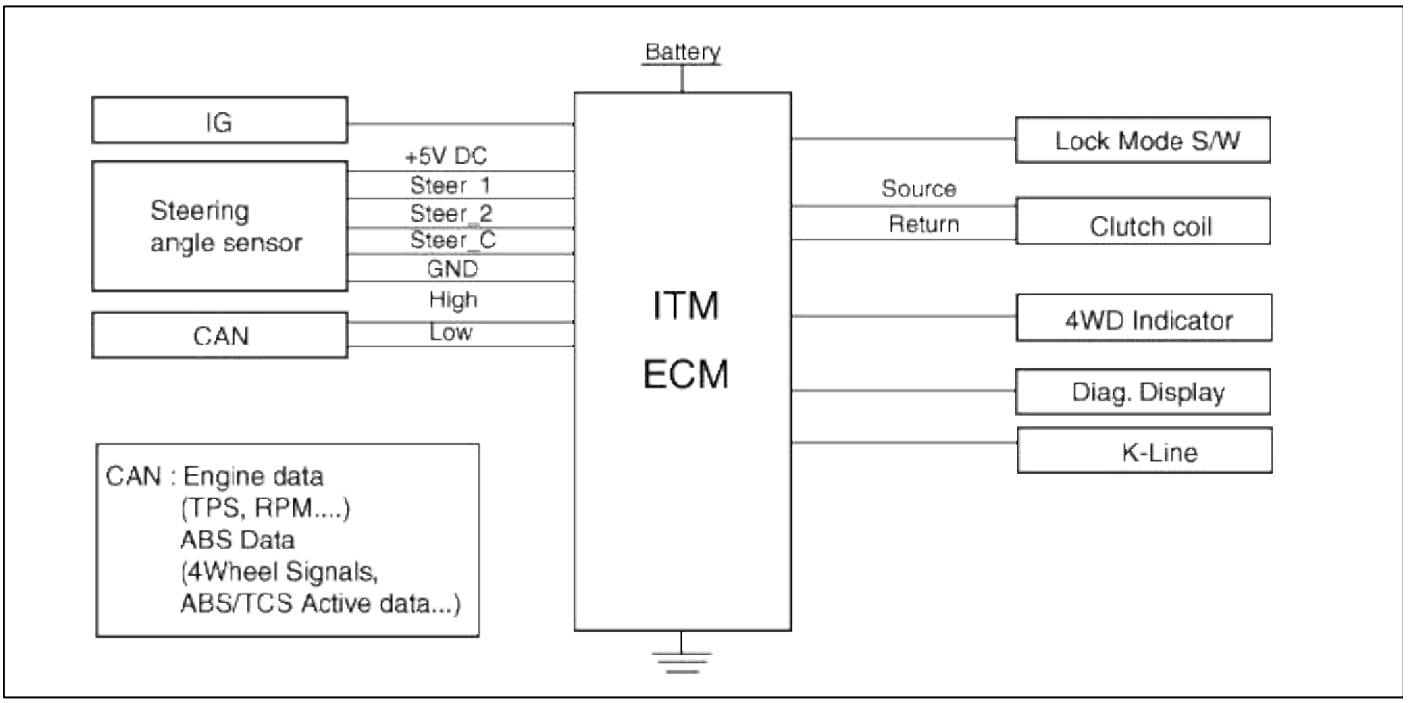
SYSTEM SCHEMATICS



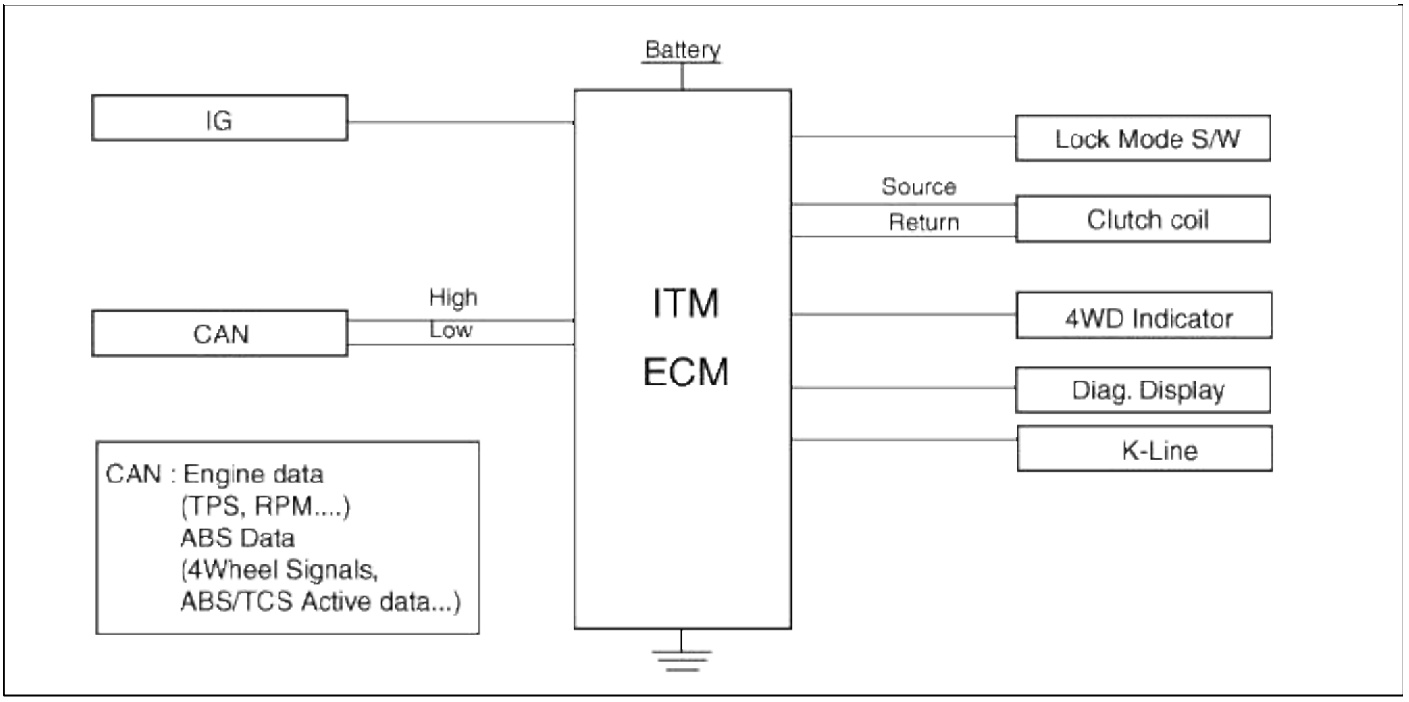
ITM confroller
1. NON-ABS controller



2. ABS/TCS controller

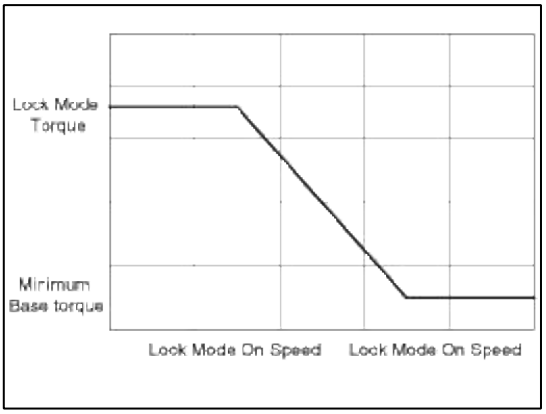


3. ESP controller



Lock Mode Description

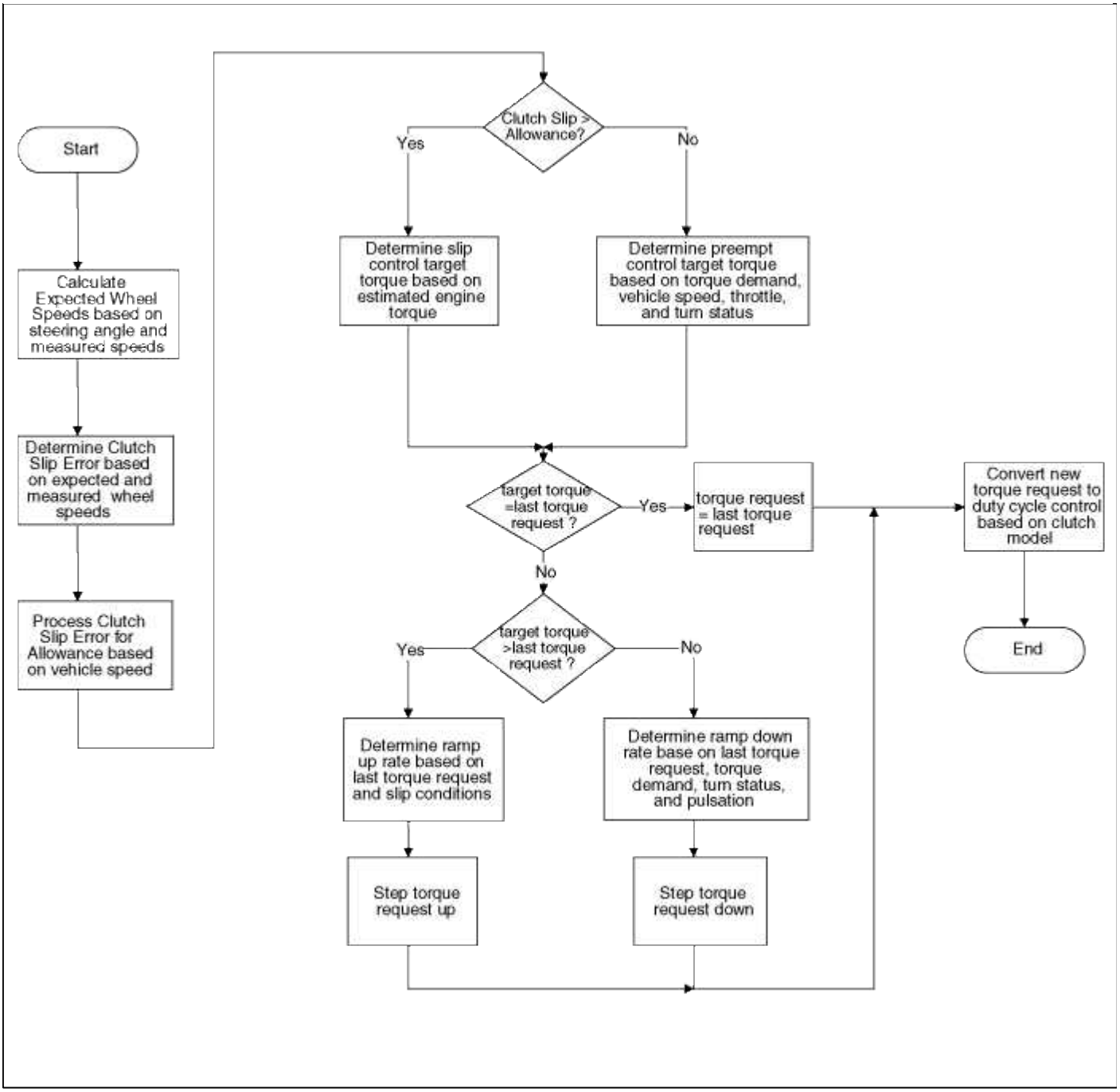
- Based on a driver request for lock mode, the system will supply a fixed torque to the ITM-I clutch.
- When the vehicle exceeds 30KPH the system will begin to disable lock mode by ramping down the ITM clutch torque. When the vehicle exceeds 40 KPH the ITM clutch is reduced to its minimum torque value. Lock mode is re-enabled following the same speed-to-torque map.
- Lock mode is activated based on part number.



- Lock mode will override all other system requests except for during an ABS event. During an ABS event the ITM clutch is turned off.
- If there is a speed sensor signal fault, the speeds are no longer considered reliable and lock mode will be disabled.

Control Algorithm Flow Chart

The base control algorithm of the ITM ECM is defined by the following flowchart:

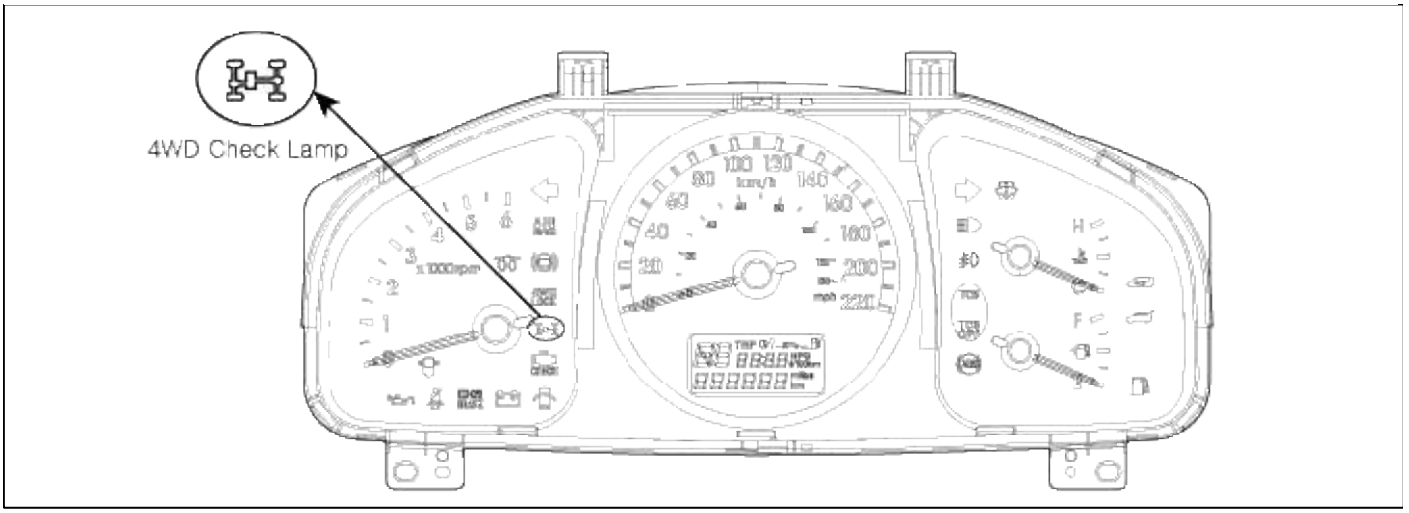


Transfer System > Transfer Case Assembly > Troubleshooting (M5GF1)

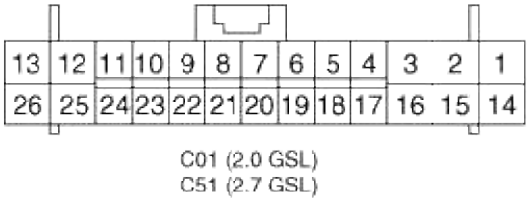
DTC TROUBLESHOOTING

4WD ECM DTC INDEX

DTC No.	DESCRIPTION	4WD MIL	SEE PAGE
P1716	STEERING WHEEL ANGLE SENSOR SIGNAL(CAN ERROR)	Whenever the DTCs relevant to 4WD ECM are set, 4WD MIL(*) will blink.	TR-22
P1717	STEERING WHEEL ANGLE SENSOR 1-INPUT SIGNAL		TR-26
P1718	STEERING WHEEL ANGLE SENSOR 2-INPUT SIGNAL		TR- 33
P1719	STEERING WHEEL ANGLE SENSOR C-INPUT SIGNAL		TR-39
P1726	THROTTLE POSITION SENSOR SIGNAL		TR -46
P1728	EMC OPEN/SHORTED to BATTERY		TR-50
P1729	EMC SHORTED to GROUND		TR-57
P1738	4WD ECU INVALID PART NUMBER		TR-61
P1750A	WHEEL SPEED SENSOR SIGNAL(FL)-with ABS		TR-64
P1750B	WHEEL SPEED SENSOR SIGNAL(FL)-without ABS		TR-69
P1751A	WHEEL SPEED SENSOR SIGNAL(FR)-with ABS		TR-77
P1751B	WHEEL SPEED SENSOR SIGNAL(FR)-without ABS		TR-80
P1752A	WHEEL SPEED SENSOR SIGNAL(RL)-with ABS		TR-86
P1752B	WHEEL SPEED SENSOR SIGNAL(RL)-without ABS		TR-89
P1753A	WHEEL SPEED SENSOR SIGNAL(RR)-with ABS		TR-95
P1753B	WHEEL SPEED SENSOR SIGNAL(RR)-without ABS		TR-98
P1764	ECU-ITM CAN ERROR		TR-104
P1765	TCS-ITM CAN ERROR		TR-109
P1766	CAN COMMUNICATIOM BUS OFF		TR-113
P1767	ABS ACTIVE SIGNAL (CAN ERROR)		TR-116



4WD ECM PIN DESCRIPITION

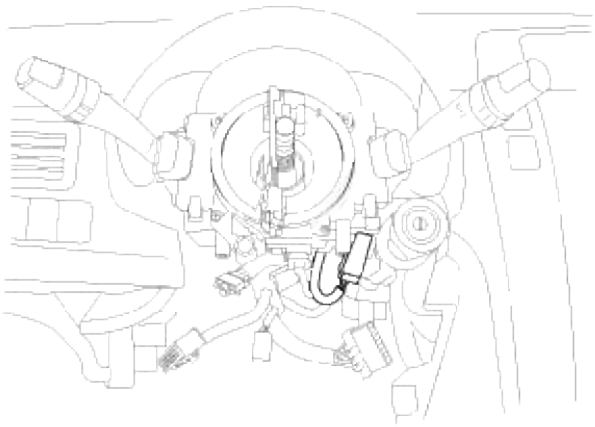


Terminal Number		Wire Color	Description
C01(2.0GSL) C51(2.7GSL)	1	R	BATTERY INPUT
	2	-	BRAKE INPUT
	3	B	ECU GROUND
	4	G	CAN L
	5	O	CAN H
	6	L	GND RTN 4
	7	Br	GND RTN 3
	8	L	GND RTN 2
	9	Br	GND RTN1
	10	R	LOCK SWITCH INPUT
	11	L/B	STEERING REF C
	12	B/O	STEERING REF RTN
	13	B	EMC RTN
	14	W	ISO9141 K LINE
	15	R/B	IGNITION INPUT
	16	Gr/O	4WHEEL DRIVE INDICATOR
	17	O	FRONT RIGHT SPEED SENSOR

18	R	FRONT LEFT SPEED SENSOR
19	R	REAR LEFT SPEED SENSOR
20	O	REAR RIGHT SPEED SENSOR
21	Y	DIAGNOSTIC OUT
22	-	TPS INPUT
23	Gr/O	STEERING 1 INPUT
24	L	STEERING 2 INPUT
25	Gr/B	STEERING REF 5V
26	R	EMC OUTPUT

Transfer System > Transfer Case Assembly > Troubleshooting > P1716

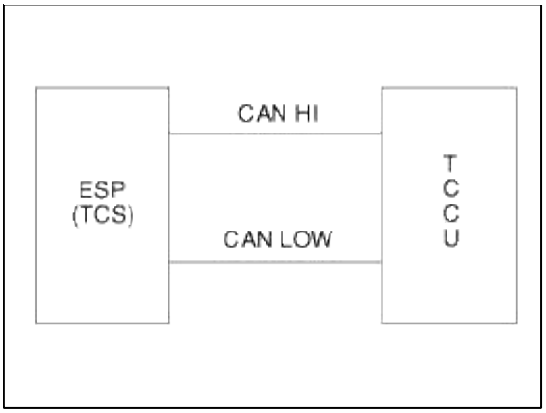
COMPONENT LOCATION



GERNERAL DESCRIPTION

Steering wheel sensor which is contactless and analog type measures the absolute pressure by using the "MR" effect. you must execute initialization by using SCAN TOOL after installing new or reinstalling old steering wheel angle sensor.

This signal which is a angle velocity of steering wheel is made use of sensing the rotating direction & neutrality of steering wheel. In case ESP system is applied to the vehicle steering angle sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



DTC DESCRIPTION

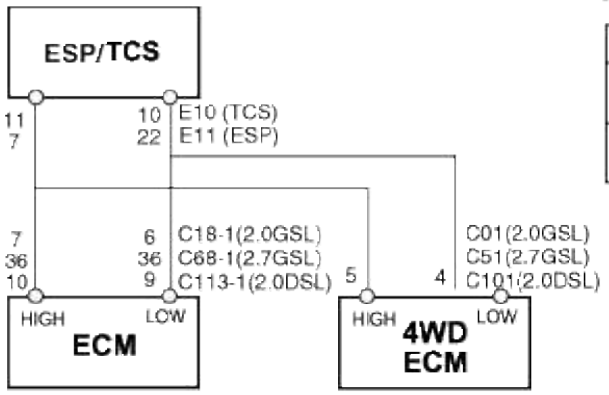
This failure code is related to the TCCU communication line of the ESP application system and is set if input signal to TCCU is in"Loss of signal out of range".

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• Steering Angle sensor,ESP, TCCU connector looseness and poor terminal to wire connection • open/short in CAN line. • Steering Angle sensor faulty. • Faulty ESP MODULE. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• FFFH	
Diagnostic Time		
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM

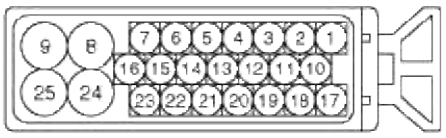
[Circuit Diagram]



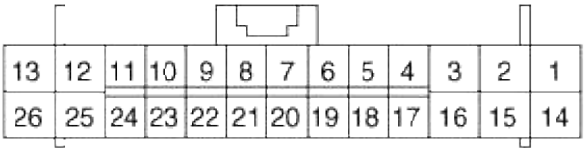
[Connection Information]

Terminal	Connection	Function
C01/C51/C101 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51/C101 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

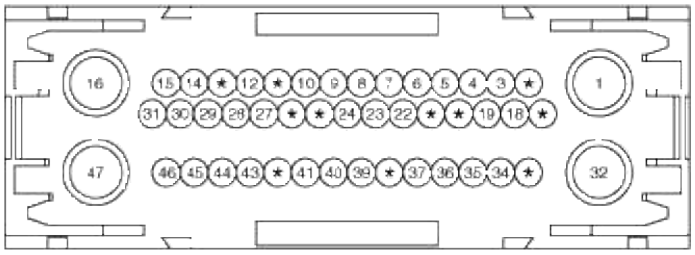
[Harness Connector]



E10(TCS)



C01(2.0GSL)
C51(2.7GSL)
C101(2.0DSL)



E11(ESP)

TERMINAL & 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

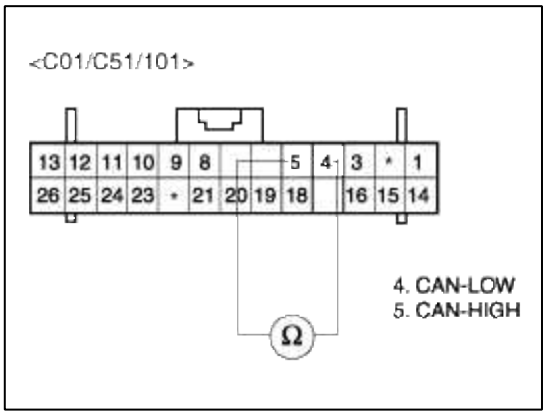
Go to "CAN(Signal Error) comm. Line Inspection " procedure.

CAN(Signal Error) comm. Line Inspection

1. Ignition "OFF".

2. Measure resistance between terminal "4" of the TCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value ?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for the signal or component of ESP control module.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

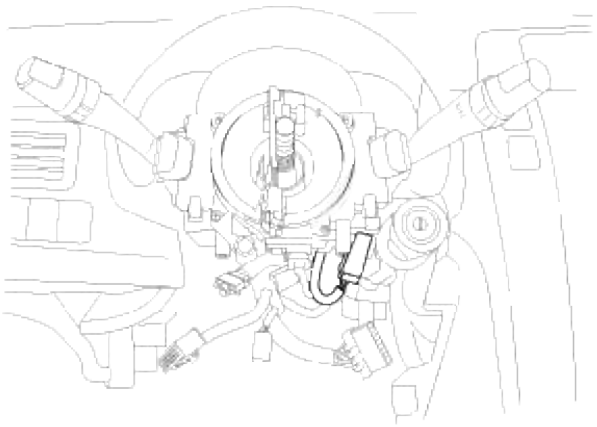
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

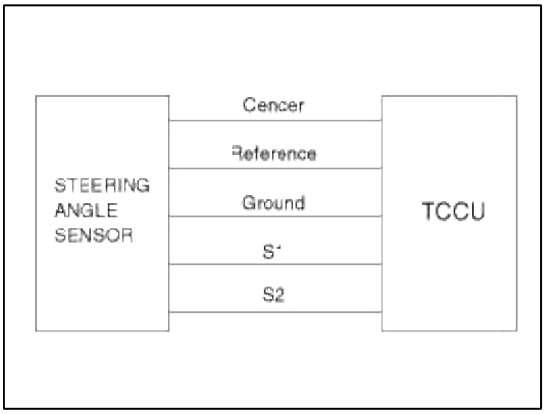
Transfer System > Transfer Case Assembly > Troubleshooting > P1717

COMPONENT LOCATION



GERNERAL DESCRIPTION

Steering wheel sensor which is contactless and analog type measures the absolute pressure by using the "MR" effect. you must execute initialization by using SCAN TOOL after installing new or reinstalling old steering wheel angle sensor.This signal which is a angle velocity of steering wheel is made use of sensing the rotating direction & neutrality of steering wheel. In case ESP system is applied to the vehicle steering angle sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



DTC DESCRIPTION

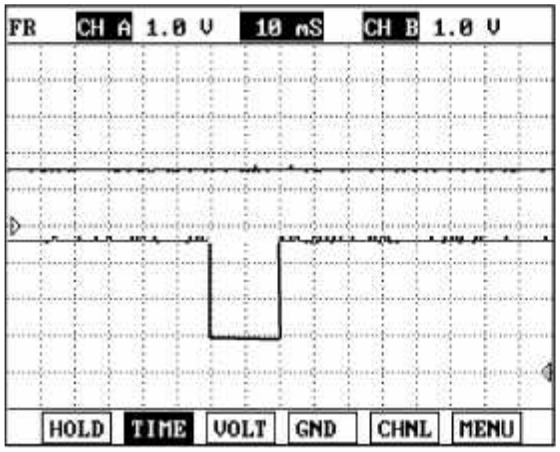
This failure code is related to the Steering angle sensor 1 and is set if input signal to TCCU is in"Loss of signal out of range".

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) application system and is set if input signal to TCCU is in"Loss of signal out of range".

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• Steering Angle sensor,ESP, TCCU connector looseness and poor terminal to wire connection. • Steering angle sensor circuit open/short. • Faulty Steering angle sensor. • Faulty TCCU.
Enable Conditions	• V<4.5 for 1.0 sec self clearing	
Threshold Value	• > 4.5VDC	
Diagnostic Time	• 1 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

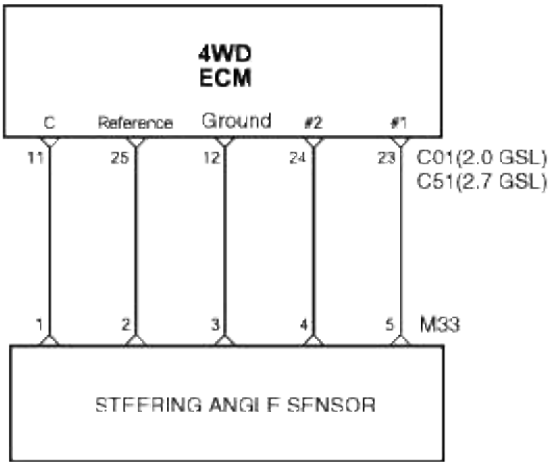
SIGNAL WAVEFROM



[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine conditions.

SCHEMATIC DIAGRAM

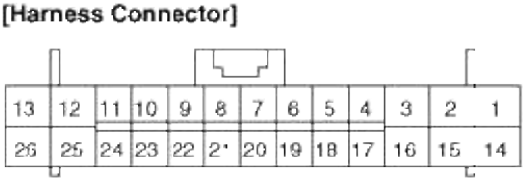
[Circuit Diagram]



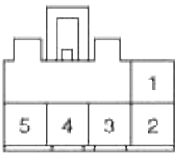
[Connection Information]

Terminal	Connection	Function
1	NO.11	Steering C signal
2	NO.25	5V source
3	NO.12	Ground
4	NO.24	Steering #2 signal
5	NO.23	Steering #1 signal

[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)



M33

TERMINAL & 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.

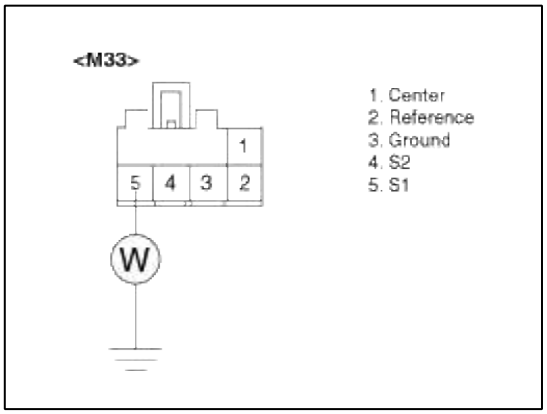
NO

Go to " Steering angle sensor 1 Signal Inspection " procedure.

Steering angle sensor 1 Signal Inspection

1. Engine "ON".
2. Connect TCCU, Steering angle sensor connector.
3. Monitor signal waveform between terminal 5 of Steering angle sensor harness connector M33 and chassis ground.
4. Turn steering Wheel to the right or left.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is Steering angle sensor 1 Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

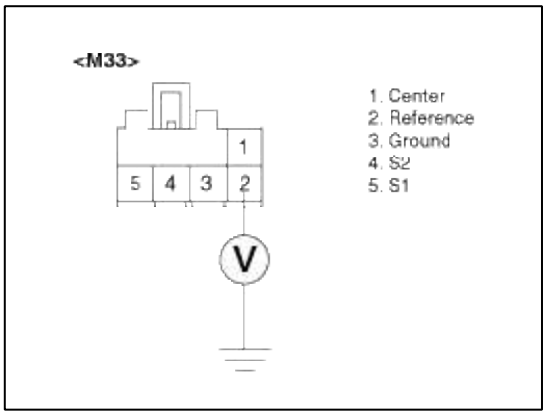
Go to " Steering angle sensor Reference voltage inspection " procedure.

Steering angle sensor Reference voltage inspection

1. Ignition "ON",Engine "OFF".
2. TCCU, Steering angle sensor connector : Connect.

3. Measure voltage between terminal 2 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 5V



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is voltage display near the specified value.

YES

Go to " Steering angle sensor ground harness open circuit inspection " procedure.

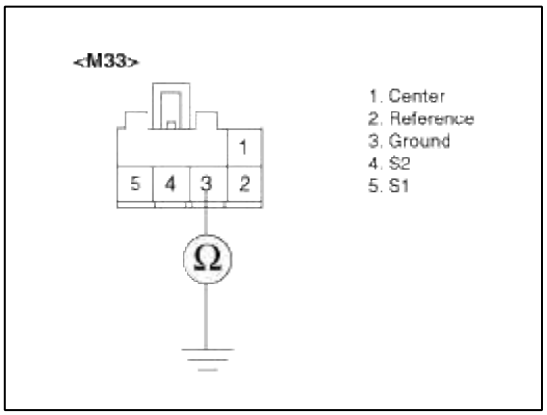
NO

Check for Steering angle sensor Reference harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor ground harness open circuit inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Connect.
3. Measure resistance between terminal 3 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor 1 ,short to signal line ground Inspection " procedure.

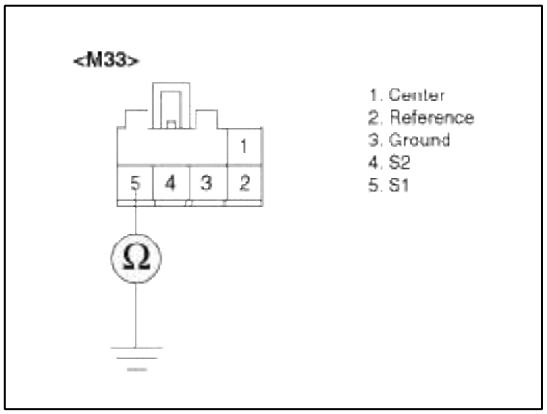
NO

Check for open circuit of Steering angle sensor ground harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor 1 ,short to signal line ground Inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Disconnect.
3. Measure resistance between terminal 5 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor #1 signal line open Inspection " procedure.

NO

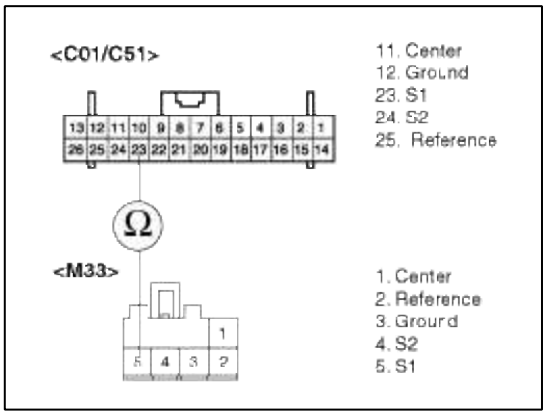
Check for short to ground circuit of Steering angle sensor #1Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure?

Steering angle sensor 1 signal line open Inspection

1. Ignition "ON",Engine "OFF".
2. TCCU, Steering angle sensor connector : Disconnect.

3. Measure resistance between terminal 5 of Steering angle sensor harness connector M33 and terminal 23 of TCCU harness connector.

Specification : Approx. 0Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good TCCU or Steering angle sensor and check for proper operation.
If the problem is corrected, replace TCCU and then go to "Verification of Vehicle Repair" procedure.

NO

Check for open circuit of Steering angle sensor #1 Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

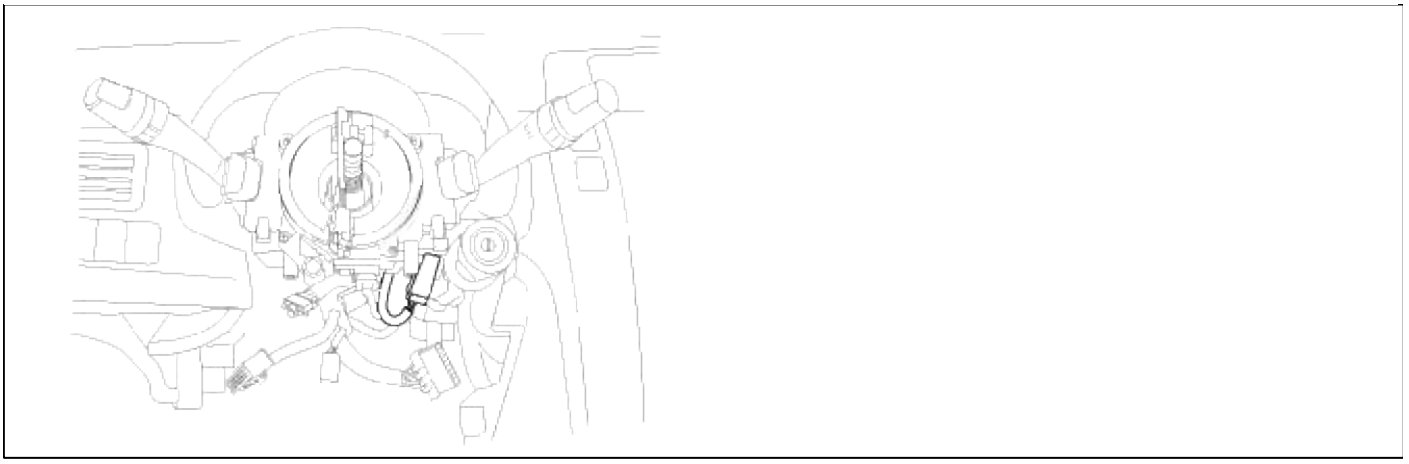
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Transfer System > Transfer Case Assembly > Troubleshooting > P1718

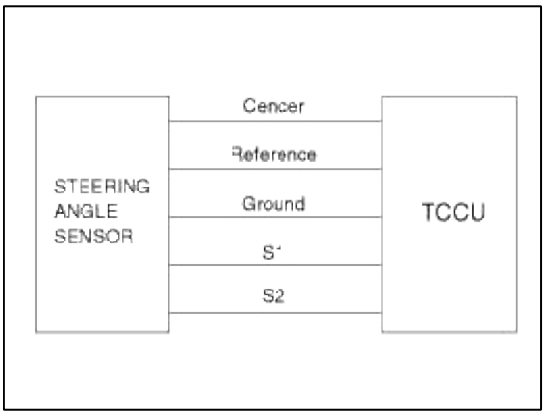
COMPONENT LOCATION



GERNERAL DESCRIPTION

Steering angle sensor is a hole plate between the photo-controller LED and the photo transistor. As the hole plate rotates during steering wheel rotation, an electrical signal will be generated depending on whether the LED light passes through the plate to the photo-transistor or not.

This signal which is a angle velocity of steering wheel is made use of sensing the rotating direction & neutrality of steering wheel. In case ABS(ESP) system is applied to the vehicle steering angle sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



DTC DESCRIPTION

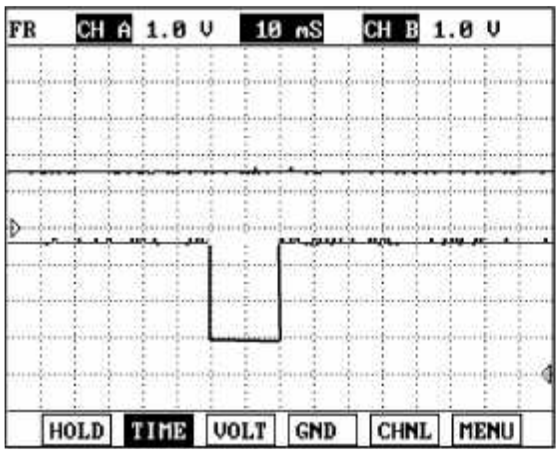
This failure code is related to the Steering angle sensor #2 and is set if input signal to TCCU is "Loss of signal out of range".

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) application system and is set if input signal to TCCU is in"Loss of signal out of range".

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• Steering Angle sensor, TCCU connector looseness and poor terminal to wire connection. • Steering angle sensor circuit open/short. • Faulty Steering angle sensor. • Faulty TCCU.
Enable Conditions	• V<4.5 for 1.0 sec self clearing	
Threshold Value	• > 4.5VDC	
Diagnostic Time	• 1 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

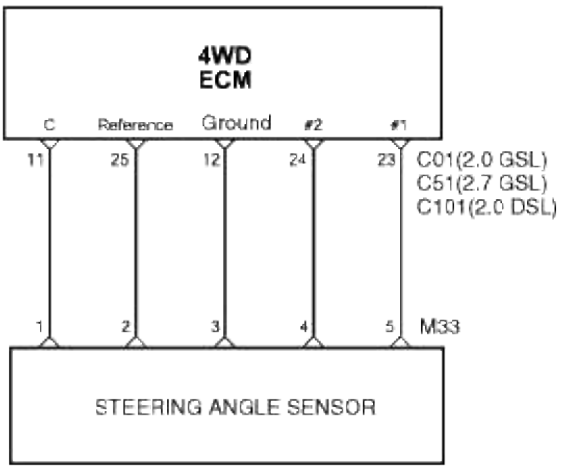
SIGNAL WAVEFROM



[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine conditions.

SCHEMATIC DIAGRAM

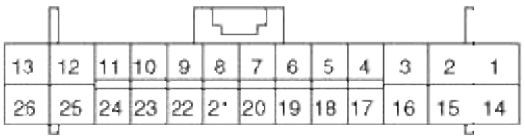
[Circuit Diagram]



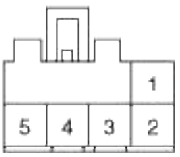
[Connection Information]

Terminal	Connection	Function
1	NO.11	Steering C signal
2	NO.25	5V source
3	NO.12	Ground
4	NO.24	Steering #2 signal
5	NO.23	Steering #1 signal

[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)
C101(2.0DSL)



M33

TERMINAL & 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.

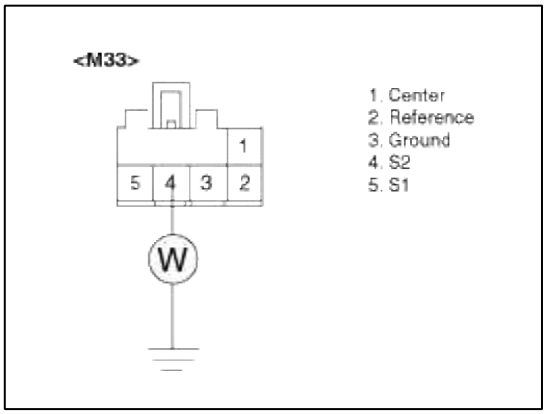
NO

Go to " Steering angle sensor 2 Signal Inspection " procedure.

Steering angle sensor 2 Signal Inspection

1. Engine "ON".
2. Connect TCCU, Steering angle sensor connector.
3. Monitor signal waveform between terminal 4 of Steering angle sensor harness connector M33 and chassis ground.
4. Turn steering Wheel to the right or left.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is Steering angle sensor 2 Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

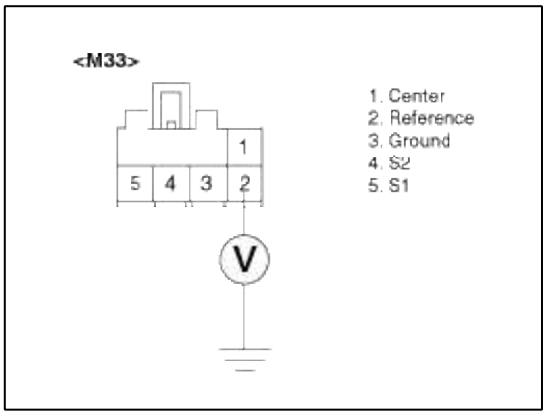
Go to " Steering angle sensor Reference voltage inspection " procedure.

Steering angle sensor Reference voltage inspection

1. Ignition "ON",Engine "OFF".
2. TCCU, Steering angle sensor connector : Connect.

3. Measure voltage between terminal 2 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 5V



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is voltage display near the specified value.

YES

Go to " Steering angle sensor ground harness open circuit inspection " procedure.

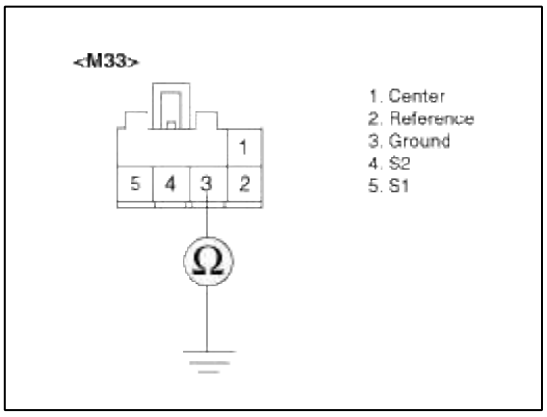
NO

Check for Steering angle sensor Reference harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor ground harness open circuit inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Connect.
3. Measure resistance between terminal 3 of Steering angle sensor harness connector M33 and chassis ground.

Specification : < 1 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor 2 ,short to signal line ground Inspection " procedure.

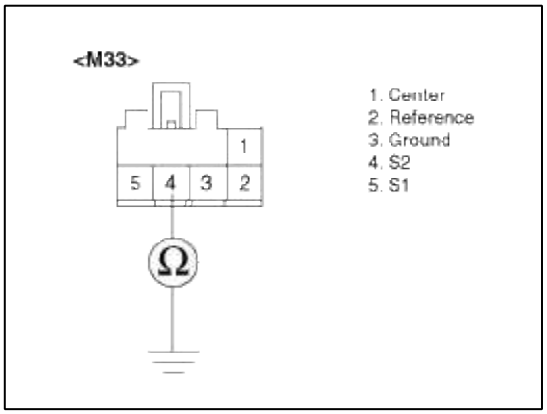
NO

Check for open circuit of Steering angle sensor ground harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor 2 ,short to signal line ground Inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Disconnect.
3. Measure resistance between terminal 4 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor #2 signal line open Inspection " procedure.

NO

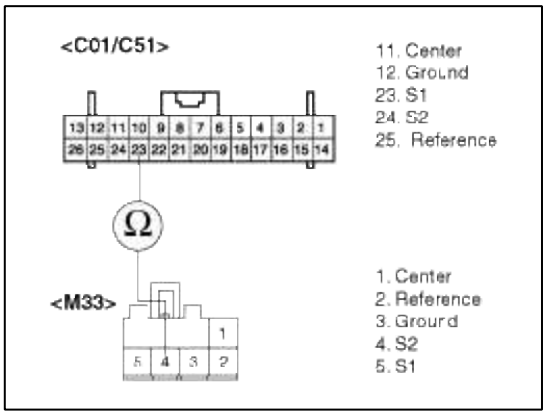
Check for short to ground circuit of Steering angle sensor #2 Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure?

Steering angle sensor #2 signal line open inspection

1. Ignition "OFF"
2. TCCU, Steering angle sensor connector : Disconnect.

3. Measure resistance between terminal 4 of Steering angle sensor harness connector M33 and terminal 24 of TCCU harness connector.

Specification : Approx. 0 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good TCCU or Steering angle sensor and check for proper operation. If the problem is corrected, replace TCCU and then go to "Verification of Vehicle Repair" procedure.

NO

Check for open circuit of Steering angle sensor #2 Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

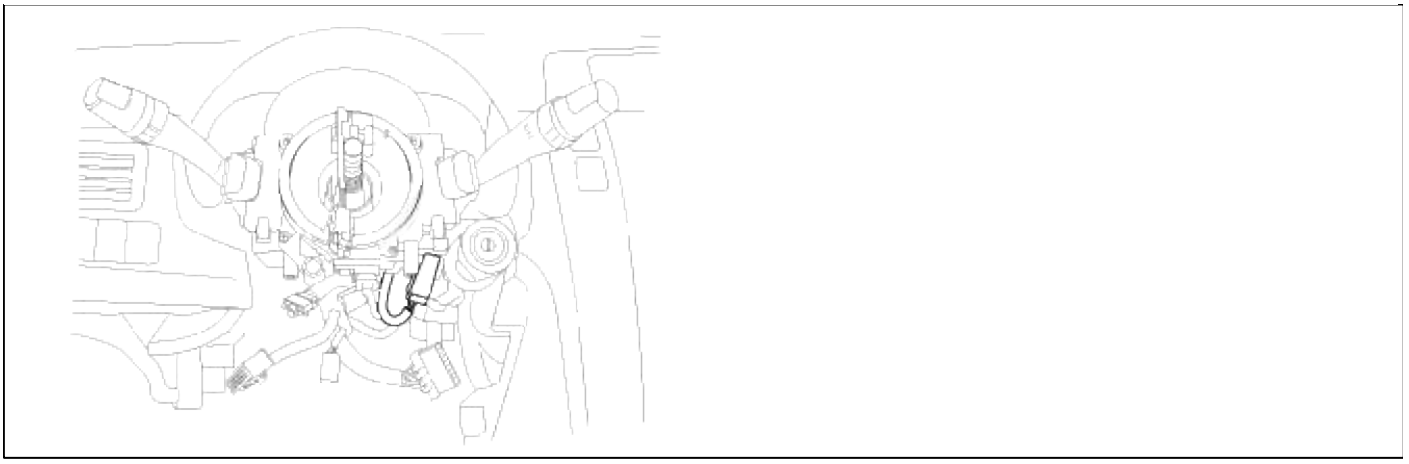
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

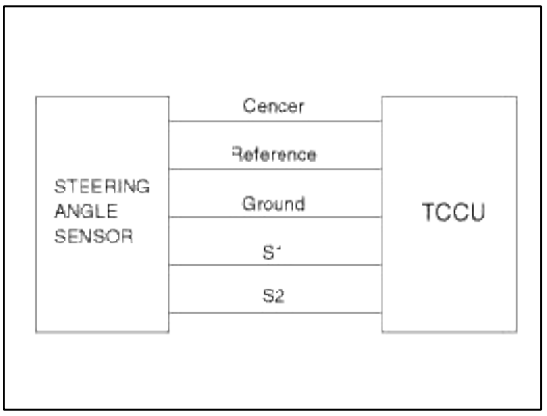
Transfer System > Transfer Case Assembly > Troubleshooting > P1719

COMPONENT LOCATION



GERNERAL DESCRIPTION

Steering angle sensor is a hole plate between the photo-controller LED and the photo transistor. As the hole plate rotates during steering wheel rotation, an electrical signal will be generated depending on whether the LED light passes through the plate to the photo-transistor or not.
This signal which is a angle velocity of steering wheel is made use of sensing the rotating direction & neutrality of steering wheel. In case ABS(ESP) system is applied to the vehicle steering angle sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



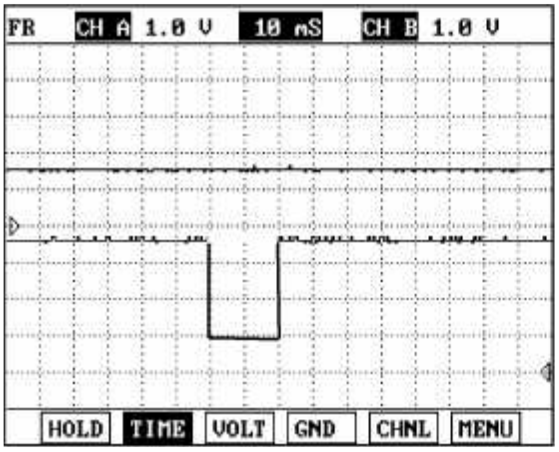
DTC DESCRIPTION

This failure code is related to the Steering angle sensor N and is set if input signal to TCCU is "Loss of signal out of range".
This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) application system and is set if input signal to TCCU is in"Loss of signal out of range".

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• Steering Angle sensor, TCCU connector looseness and poor terminal to wire connection. • Steering angle sensor circuit open/short. • Faulty Steering angle sensor. • Faulty TCCU.
Enable Conditions	• V<4.5 for 1.0 sec self clearing	
Threshold Value	• > 4.5VDC	
Diagnostic Time	• 1 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

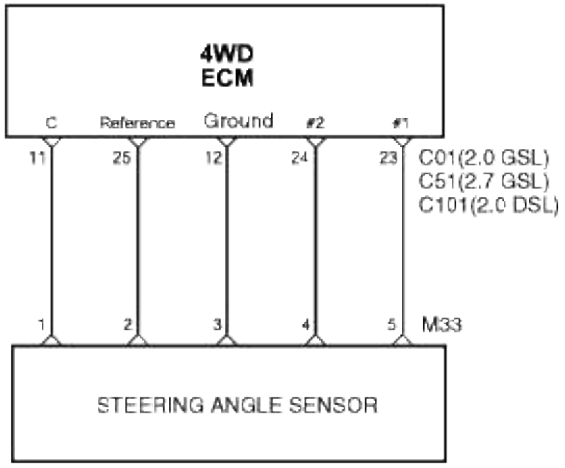
SIGNAL WAVEFROM



[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine conditions.

SCHEMATIC DIAGRAM

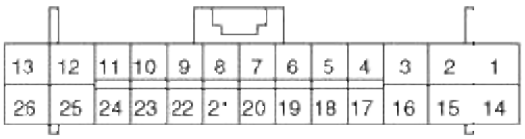
[Circuit Diagram]



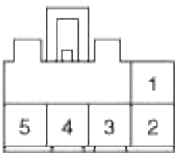
[Connection Information]

Terminal	Connection	Function
1	NO.11	Steering C signal
2	NO.25	5V source
3	NO.12	Ground
4	NO.24	Steering #2 signal
5	NO.23	Steering #1 signal

[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)
C101(2.0DSL)



M33

TERMINAL & 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.

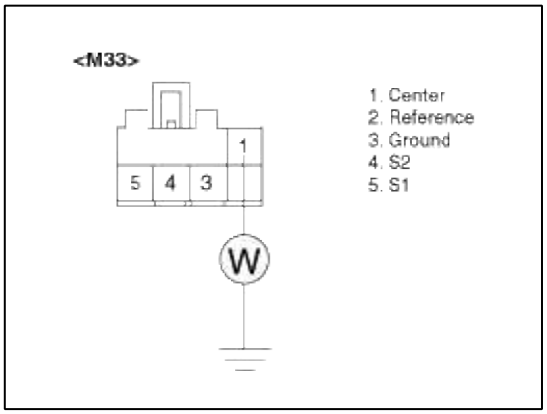
NO

Go to " Steering angle Neutral Signal Inspection " procedure.

Steering angle Neutral Signal Inspection

1. Engine "ON".
2. Connect TCCU, Steering angle sensor connector.
3. Monitor signal waveform between terminal 1 of Steering angle sensor harness connector M33 and chassis ground.
4. Turn steering Wheel to the right or left.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is Steering angle Neutral Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

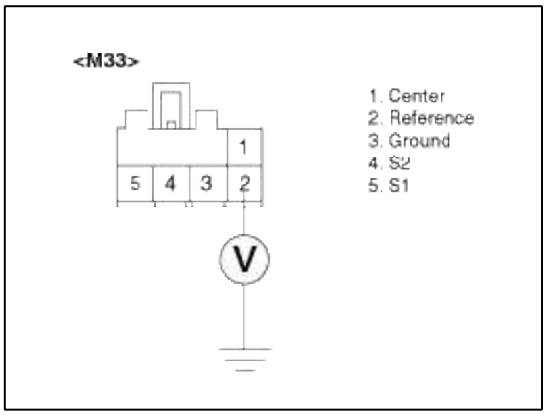
Go to " Steering angle sensor Reference voltage inspection " procedure.

Steering angle sensor Reference voltage inspection

1. Ignition "ON",Engine "OFF".
2. TCCU, Steering angle sensor connector : Connect.

3. Measure voltage between terminal 2 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 5V



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is voltage display near the specified value?

YES

Go to " Steering angle sensor ground harness open circuit inspection " procedure.

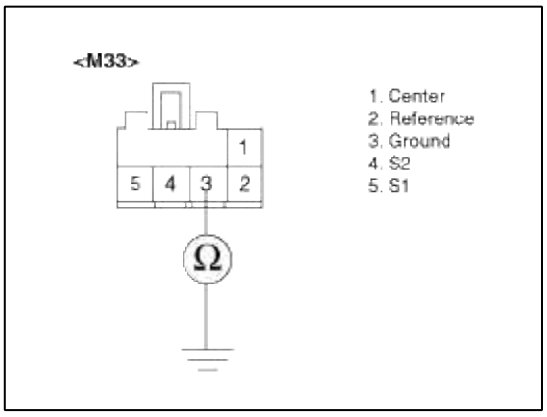
NO

Check for Steering angle sensor Reference harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle sensor ground harness open circuit inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Connect.
3. Measure resistance between terminal 3 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle sensor ground harness open circuit inspection " procedure.

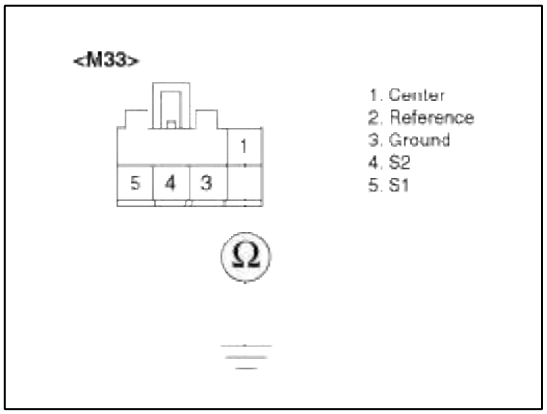
NO

Check for open circuit of Steering angle sensor ground harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle Neutral Signal ,short to signal line ground Inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Disconnect.
3. Measure resistance between terminal 1 of Steering angle sensor harness connector M33 and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " Steering angle Neutral signal line open Inspection " procedure.

NO

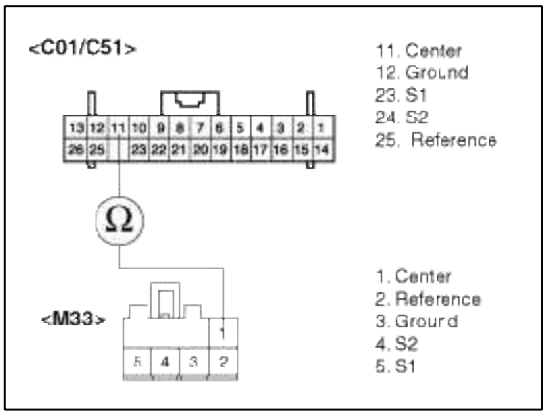
Check for short to ground circuit of Steering angle Neutral Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Steering angle Neutral signal open Inspection

1. Ignition OFF.
2. TCCU, Steering angle sensor connector : Disconnect.

3. Measure resistance between terminal 1 of Steering angle sensor harness connector M33 and terminal 11 of TCCU harness connector C.

Specification : Approx. 0 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good TCCU or Steering angle sensor and check for proper operation.
If the problem is corrected, replace TCCU and then go to "Verification of Vehicle Repair" procedure.

NO

Check for open circuit of Steering angle sensor Neutral Signal circuit.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

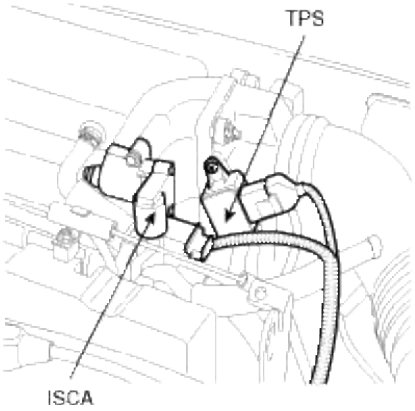
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

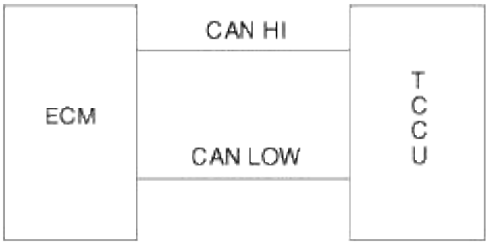
Transfer System > Transfer Case Assembly > Troubleshooting > P1726

COMPONENT LOCATION



GERNERAL DESCRIPTION

The TPS signal is transmitted to the 4WD ECU via CAN communication with the engine ECU. This signal is used as one of the criteria for determining the amount of torque distribution between the front and rear wheel.



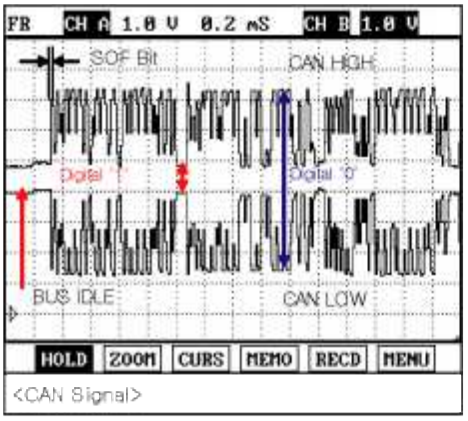
DTC DESCRIPTION

This DTC code is related to TPS and is set If there is no input signal to TCCU or the signal is out of specified range.

DTC DETECTING CONDITION

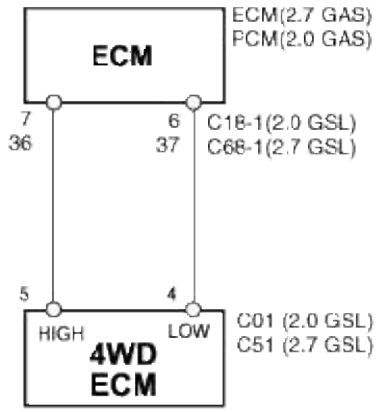
Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal out of range	• ECM,TCCU connector looseness and poor terminal to wire connection. • CAN HIGH/LOW circuit open/short. • APS(TPS) faulty. • Faulty ECM. • Faulty TCCU.
Enable Conditions	• Message present 1.0 sec self clearing	
Threshold Value	• Input CAN Message : FHH • Can Signal Lost : No Signal	
Diagnostic Time	• 1 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



SCHEMATIC DIAGRAM

[Circuit Diagram]



[Connection Information]

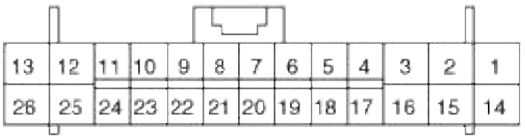
<2.0 GASOLINE>

Terminal	Connection	Furction
C18-1 NO 7	C01 NO.5	CAN (HIGH)
C18-1 NO 6	C01 NO.4	CAN (LOW)

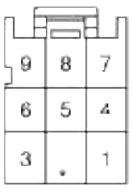
<2.7 GASOLINE>

Terminal	Connection	Function
C68-1 NO.36	C51 NO.5	CAN (HIGH)
C68-1 NO.37	C51 NO.4	CAN (LOW)

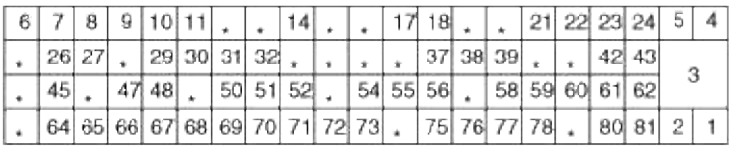
[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)



C68-1



C18-1

TERMINAL & 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.

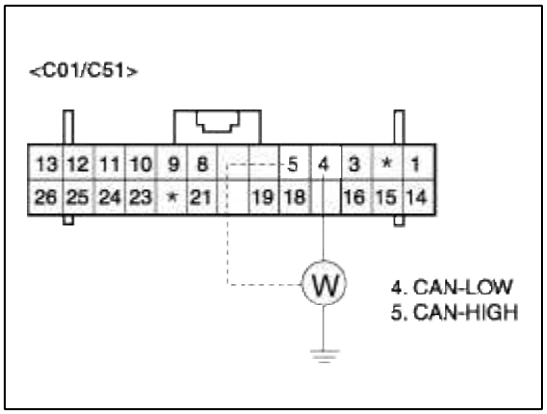
NO

Go to " CAN Signal Inspection " procedure.

CAN Signal Inspection

1. Ignition ON, Engine : OFF.
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 and 5 of TCCU harness connector and chassis ground.
4. Shift to N Range.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

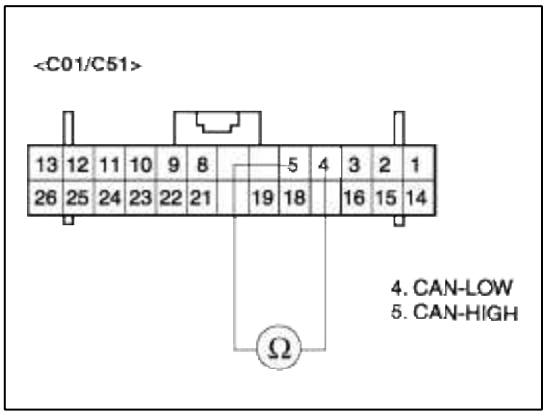
Go to "CAN comm. Line Inspection" procedure.

CAN comm. Line Inspection

1. Ignition "OFF".

2. Measure resistance between terminal "4" of the TCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of Engine control module.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

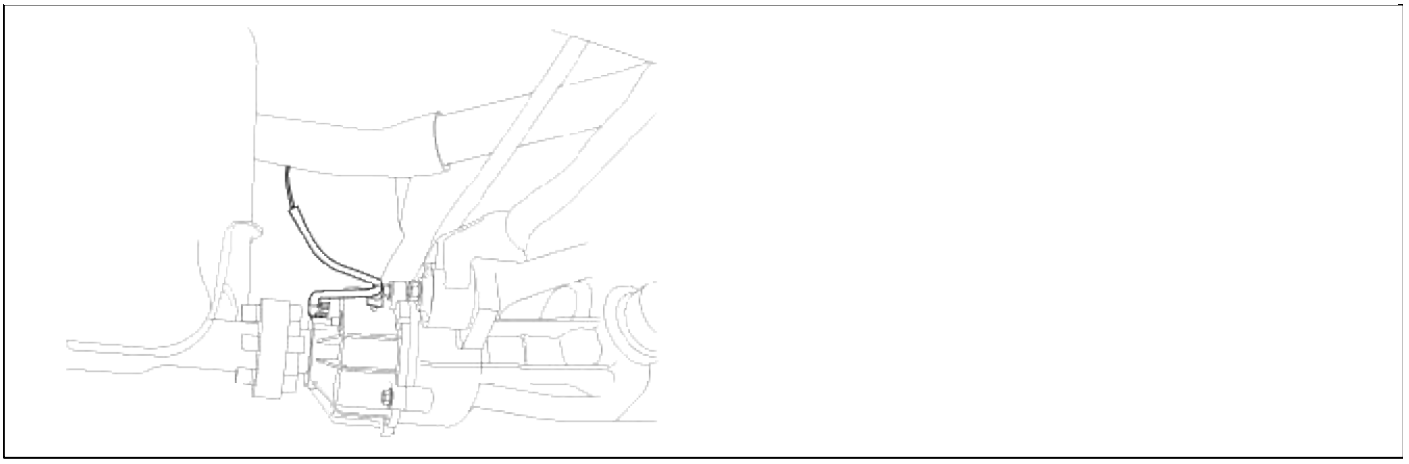
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

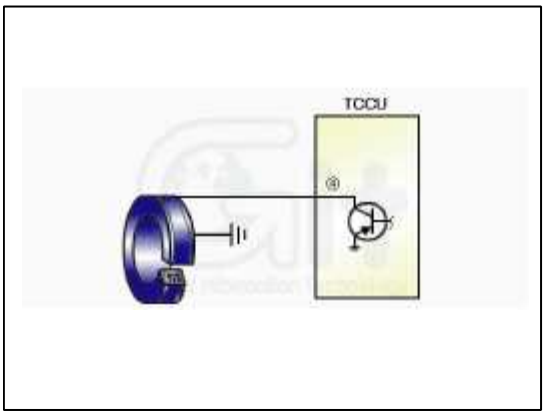
Transfer System > Transfer Case Assembly > Troubleshooting > P1728 EMC-Open or Short to Battery

COMPONENT LOCATION



GERNERAL DESCRIPTION

4WD ECM(TCCU) uses voltage to control EMC (Electric Magnet Clutch). EMC distributes suitable toque with slippage of multi-plate clutch.



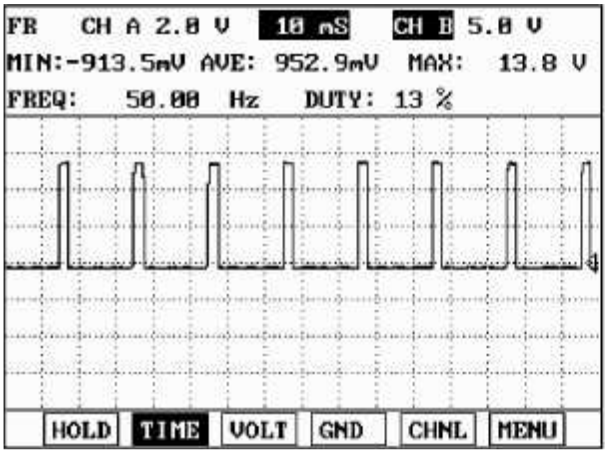
DTC DESCRIPTION

This DTC code is related to the EMC and is set If EMS harness has an open or short to battery source.

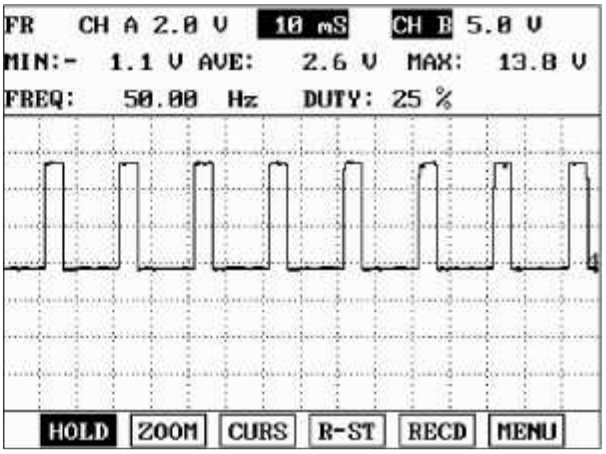
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Short/ Open to Battery	• Power supply malfunction. • .EMC,TCCU connector looseness and poor terminal to wire connection. • EMC circuit open or short to battery. • Faulty EMC motor. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• 25 occurances	
Diagnostic Time		
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



[Idling]

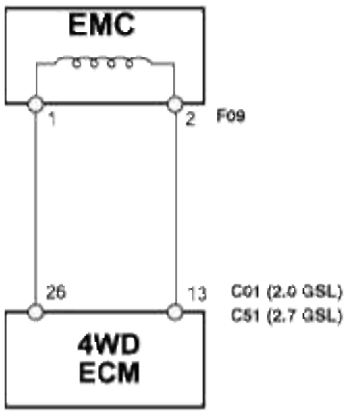


[Throttle Valve Open]

[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine condition.

SCHEMATIC DIAGRAM

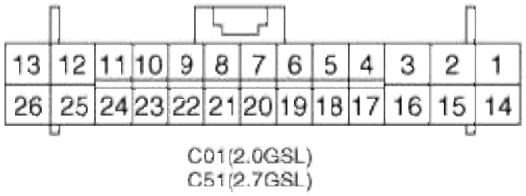
[Circuit Diagram]



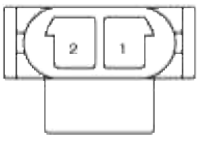
[Connection Information]

Terminal	Connection	Function
F09 No.1	C01/C51 No.26	EMC output
F09 No.2	C01/C51 No.13	EMC GND

[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)



F09

TERMINAL & 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.

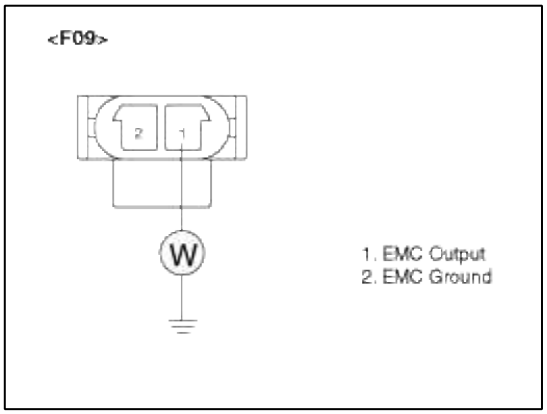
NO

Go to "EMC Signal Inspection " procedure.

EMC Signal Inspection

1. Engine : Idling.
2. EMC connector : Connect.
3. Monitor signal waveform between terminal 1 of F09 harness connector and chassis ground.
4. Shift to N Range.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is EMC Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

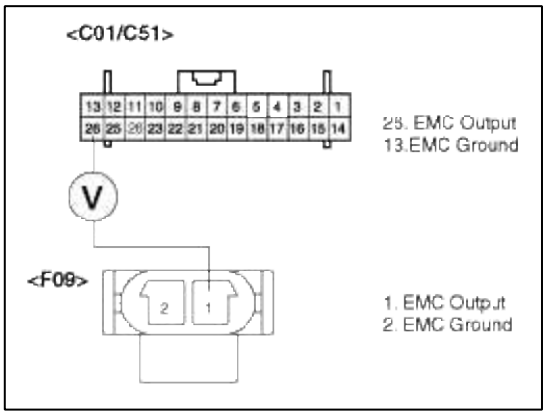
Go to " EMC wiring battery short Inspection " procedure.

EMC wiring battery short Inspection

1. Ignition "OFF".
2. Electric Magnet Valve Clutch,TCCU connector : Disconnect.
3. Ignition "ON"

4. Measure voltage between terminal 1 or 2 of Electric Magnet Valve Clutch harness connector F09 and terminal 26 or 13 of TCCU harness connector.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is resistance display near the specified value?

YES

Go to " EMC harness open Inspection " procedure.

NO

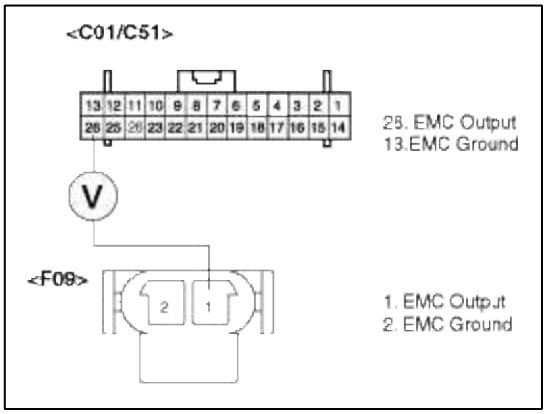
Check for short to battery in EMC harness.

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

EMC harness open Inspection

1. Ignition "OFF".
2. Electric Magnet Valve Clutch, TCCU connector : Disconnect.
3. Measure resistance between terminal 1 or 2 of Electric Magnet Valve Clutch harness connector F09 and terminal 26 or 13 of TCCU harness connector.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition

4. Is resistance display near the specified value?

YES

Go to " Component inspection " procedure

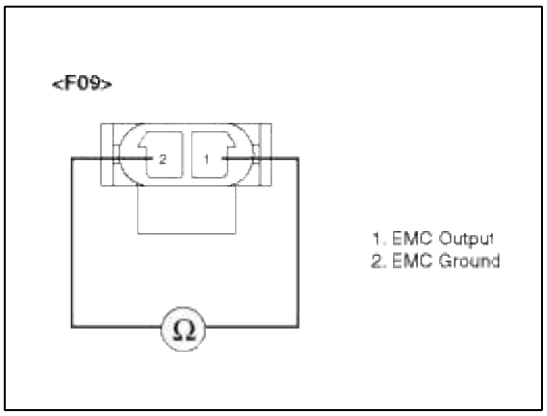
NO

Check for open in EMC harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition OFF.
2. F09 Electric Magnet Valve Clutch connector : Disconnect.
3. Measure resistance between 1 & 2

Specification : Approx. 1.8 ~ 2.2 Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "EMC coil" and check for proper operation.
If the problem is corrected, replace "EMC coil" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

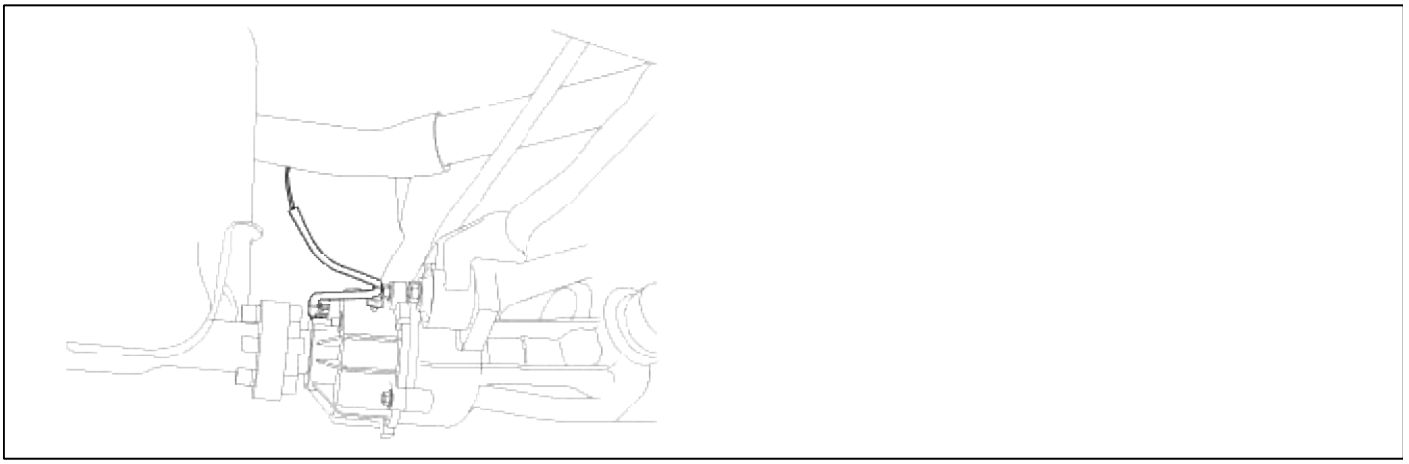
YES

Go to the applicable troubleshooting procedure.

NO

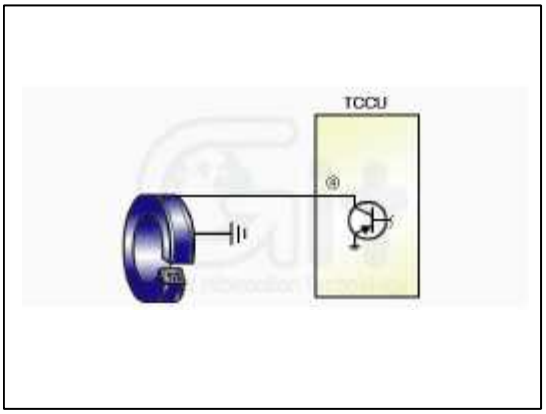
System is performing to specification at this time.

COMPONENT LOCATION



GERNERAL DESCRIPTION

4WD ECM(TCCU) uses voltage to control EMC (Electric Magnet Clutch). EMC distributes suitable toque with slippage of multi-plate clutch.



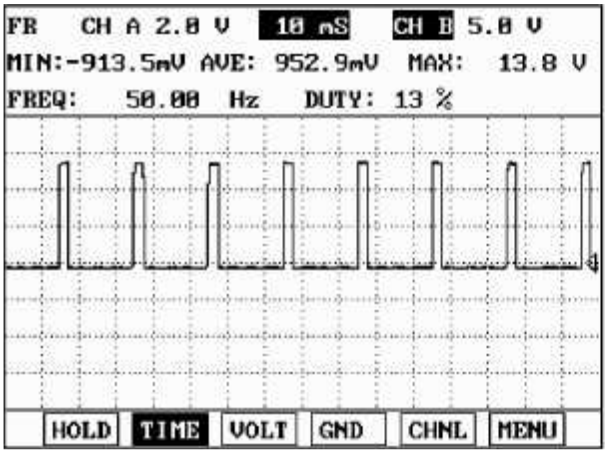
DTC DESCRIPTION

This DTC code is related to the EMC and is set If EMS harness has an short or short to ground.

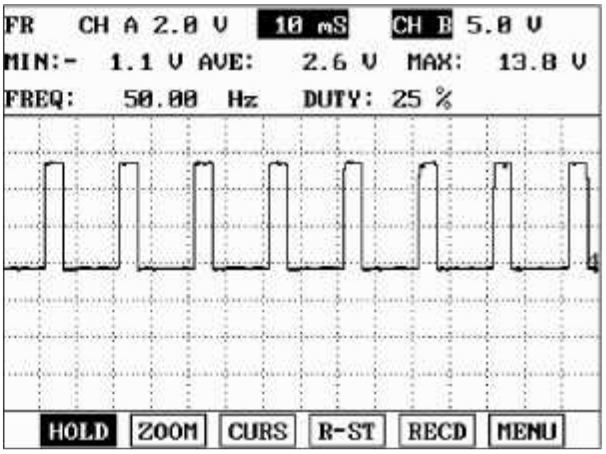
DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Short to Ground	• EMC,TCCU connector looseness and poor terminal to wire connection. • EMC circuit open or short to ground.. • Faulty EMC motor. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• 25 occurances	
Diagnostic Time		
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



[Idling]

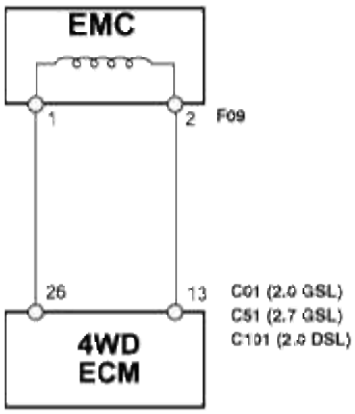


[Throttle Valve Open]

[CAUTION] The above value is just for reference. The actual value may differ from it according to various engine condition.

SCHEMATIC DIAGRAM

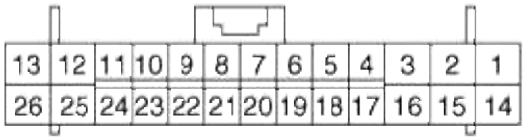
[Circuit Diagram]



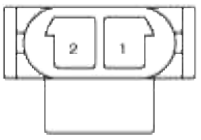
[Connection Information]

Terminal	Connection	Function
F09 No.1	C01/C51/C101 No.26	EMC output
F09 No.2	C01/C51/C101 No.13	EMC GND

[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)
C101(2.0DSL)



F09

TERMINAL & 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.

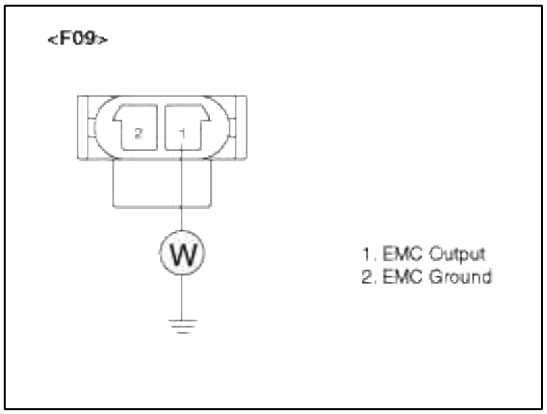
NO

Go to "EMC Signal Inspection " procedure.

EMC Signal Inspection

1. Engine : Idling.
2. EMC connector : Connect.
3. Monitor signal waveform between terminal 1 of F09 harness connector and chassis ground.
4. Shift to N Range.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is EMC Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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

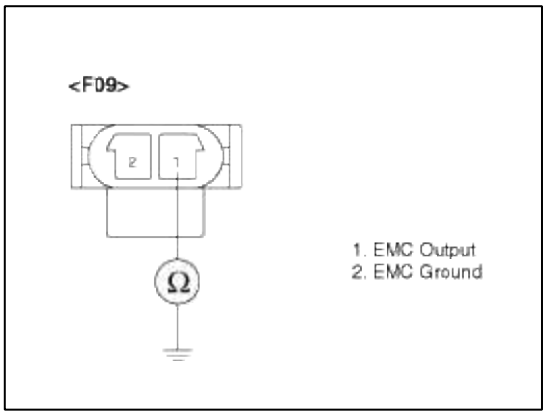
Go to " EMC wiring ground short Inspection " procedure.

EMC wiring ground short Inspection

1. Ignition "OFF".
2. Electric Magnet Valve Clutch connector : Disconnect.
3. Measure resistance between terminal 1 of Electric Magnet Valve Clutch harness connector F09 and chassis ground.

4. Repeat step 3 for the other pin.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is resistance display near the specified value?

YES

Go to " EMC wiring short Inspection " procedure.

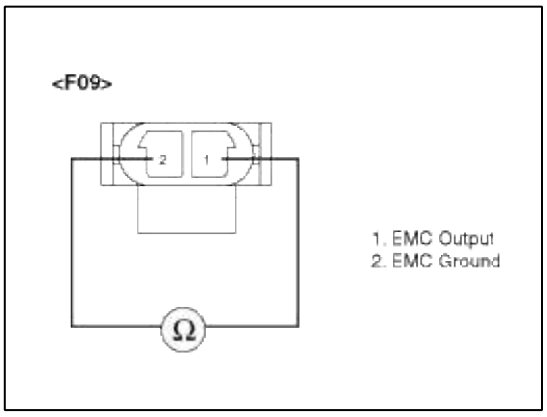
NO

Check for short to ground in EMC harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

EMC wiring short Inspection

1. Ignition "OFF".
2. Electric Magnet Valve Clutch, TCCU connector : Disconnect.
3. Measure resistance between 1 & 2.

Specification : ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition

4. Is resistance display near the specified value?

YES

Go to " Component inspection " procedure.

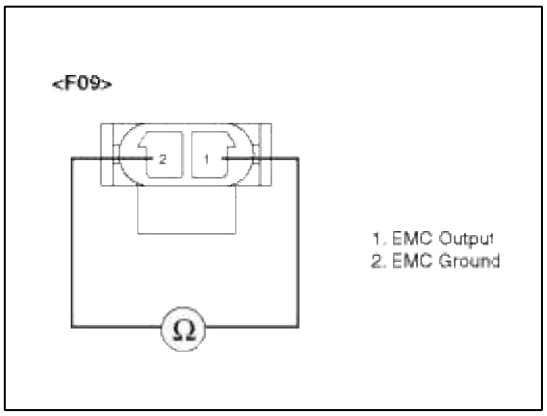
NO

Check for open in EMC harness.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Ignition OFF.
2. F09 Electric Magnet Valve Clutch connector : Disconnect.
3. Measure resistance between 1 & 2

Specification : Approx. 1.8 ~ 2.2 Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to "Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "EMC coil" and check for proper operation.
If the problem is corrected, replace "EMC coil" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

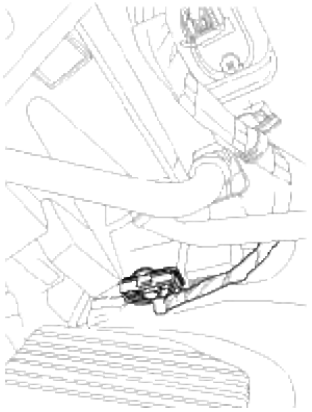
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

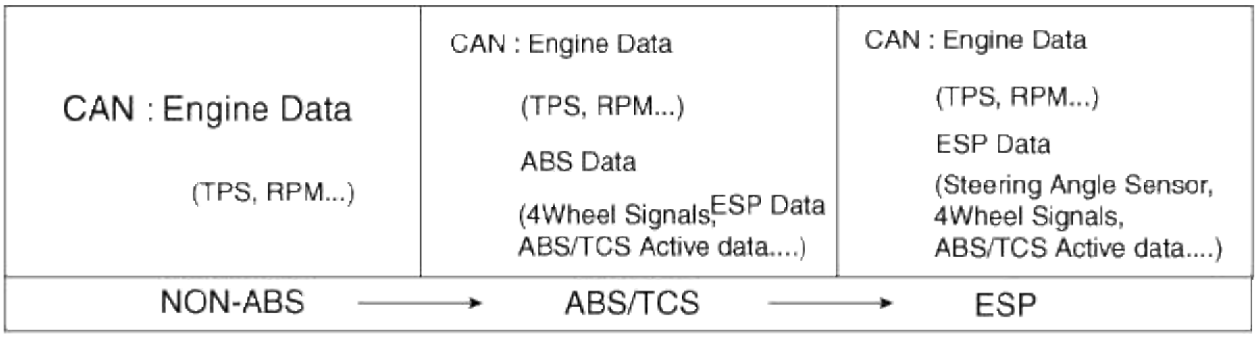
Transfer System > Transfer Case Assembly > Troubleshooting > P1738 Shift System Timeout

COMPONENT LOCATION



GERNERAL DESCRIPTION

The TPS signal is transmitted to the 4WD ECU via CAN communication with the engine ECU. This signal is used as one of the criteria for determining the amount of torque distribution between the front and rear wheel.



DTC DESCRIPTION

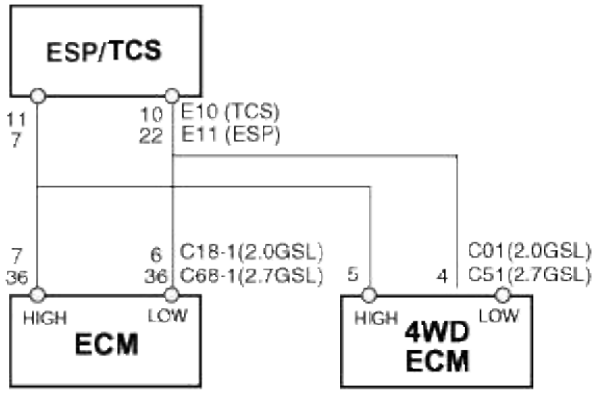
This failure code is set if CAN BUS ERROR that means wrong TCCU installation is continued for more than 1sec.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Invalid part number	• Part Number. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• 1 occurances	
Diagnostic Time	•	
MIL on condition	• 0.5 Sec	
Fail Safe		

SCHEMATIC DIAGRAM

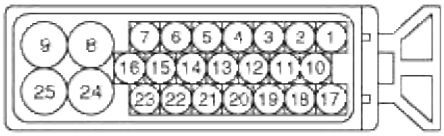
[Circuit Diagram]



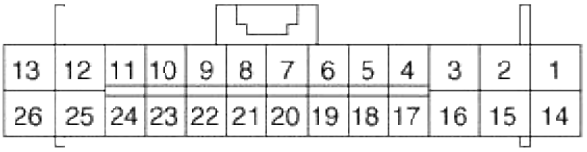
[Connection Information]

Terminal	Connection	Function
C01/C51/ NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51/ NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

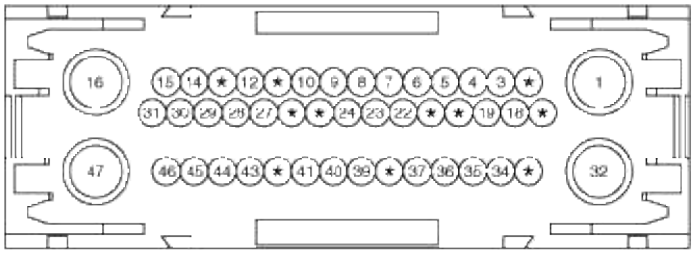
[Harness Connector]



E10(TCS)



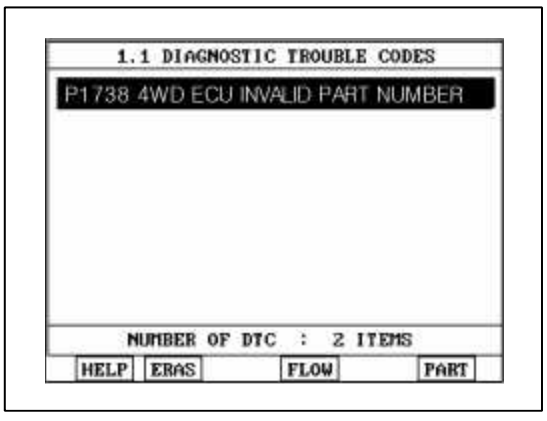
C01(2.0GSL)
C51(2.7GSL)



E11(ESP)

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Clean the 4WD DTC data.
4. Monitor DTC(Diagnostics Trouble Code) on the scantool.



5. Is the same DTC displayed again?

YES

Check if equipped option(ABS/TCS, ESP) and part number is qualified specification.
Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

Fault is intermittent caused by poor contact in the angle in the TCCU's connector or was repaired and TCCU 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.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

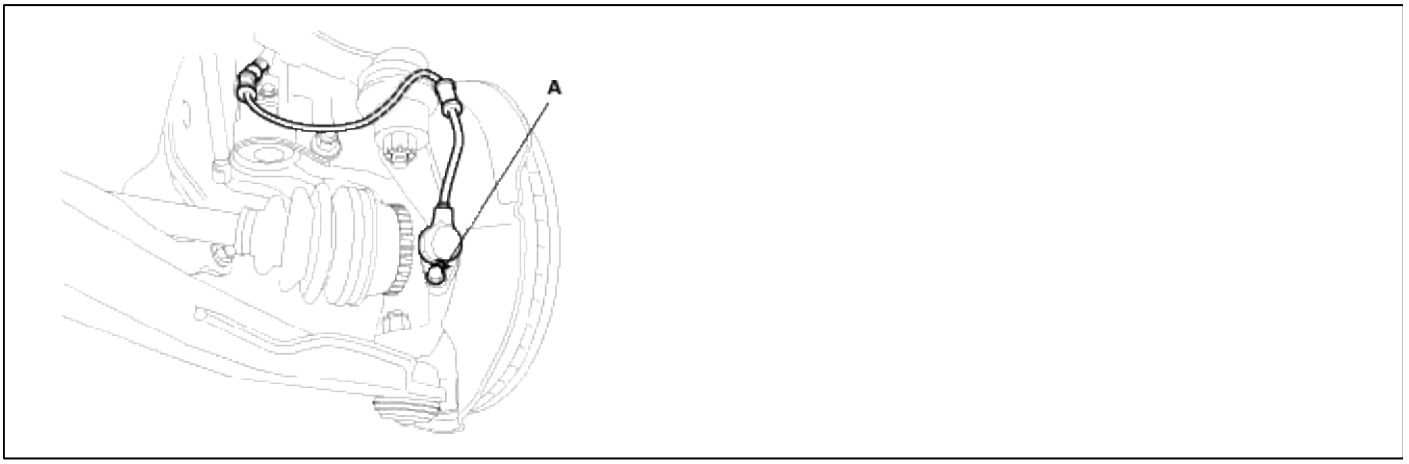
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

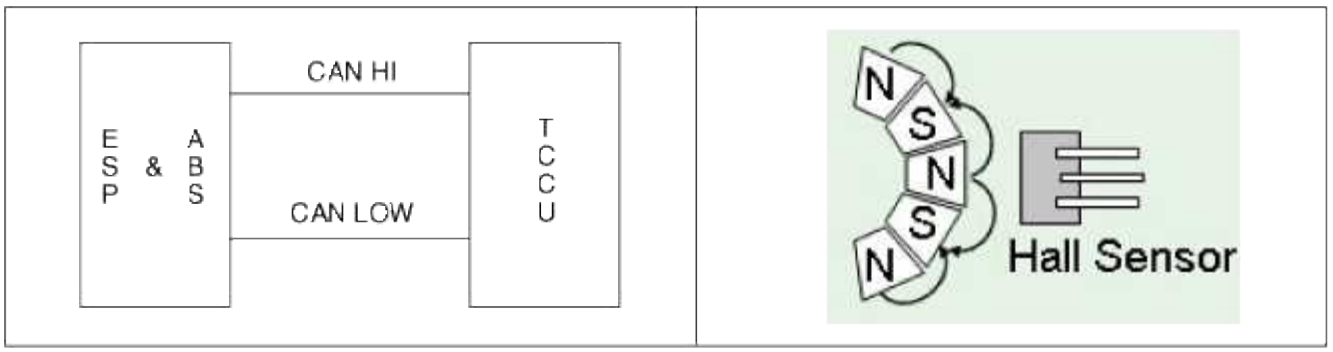
Transfer System > Transfer Case Assembly > Troubleshooting > P1750A

COMPONENT LOCATION



GERNERAL DESCRIPTION

Wheel speed sensor is active hall-sensor type. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.
In case ABS(or ESP) system is applied to the vehicle, wheel speed sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



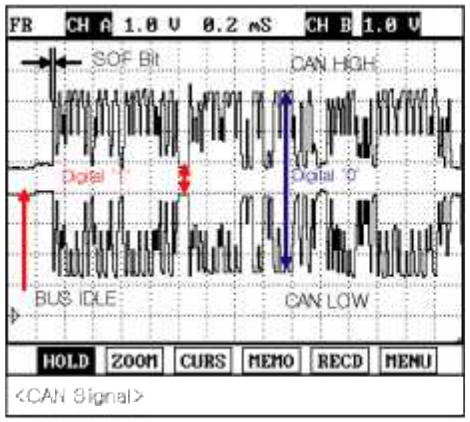
DTC DESCRIPTION

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

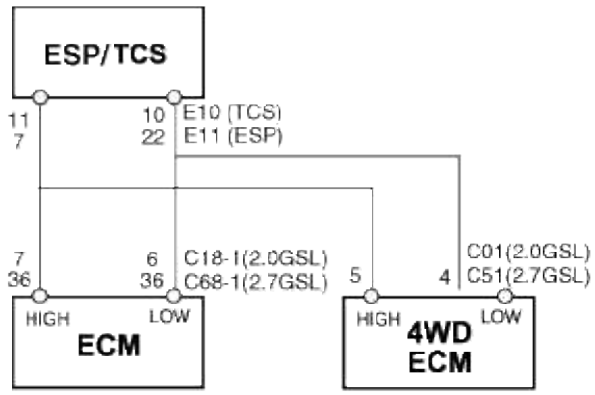
Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • Wheel sensor comm line circuit open/short. • Faulty Wheel sensor. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



SCHEMATIC DIAGRAM

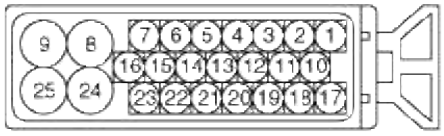
[Circuit Diagram]



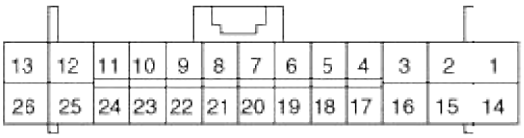
[Connection Information]

Terminal	Connection	Function
C01/C51 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

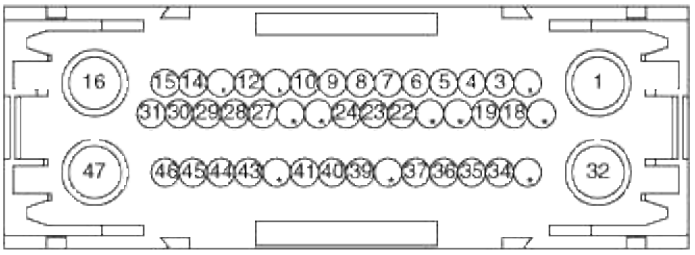
[Harness Connector]



E10(TCS)



C0*(2.0GSL)
C5*(2.7GSL)



E11(ESP)

TERMINAL & 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

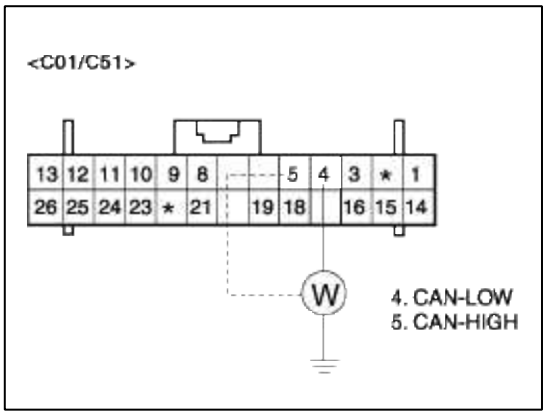
Go to " CAN(SPEED SENSOR)comm. Line Signal Inspection " procedure.

CAN(SPEED SENSOR)comm. Line Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(FLSS)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

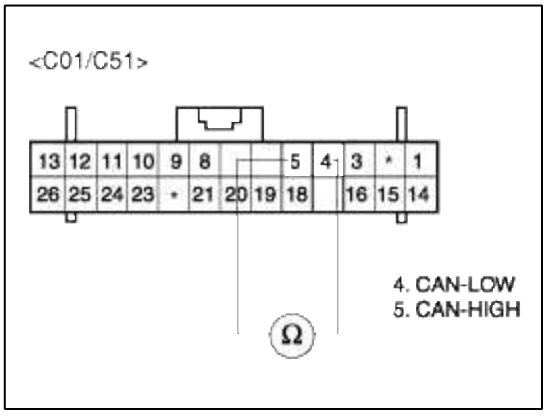
NO

Go to "CAN(SPEED SENSOR) comm. Line Inspection" procedure.

CAN(SPEED SENSOR) comm. Line Inspection

1. Ignition "OFF".
2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using 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

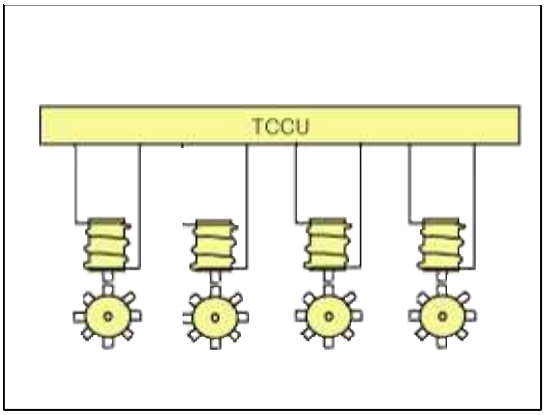
System is performing to specification at this time.

Transfer System > Transfer Case Assembly > Troubleshooting > P1750B

COMPONENT LOCATION

GERNERAL DESCRIPTION

When the tone wheel rotates, adjacent to the sensor pole component, an alternating current signal is generated in the coil with a frequency proportional to the wheel speed.
Wheel Speed Sensor generates a signal which is sent to TCCU.



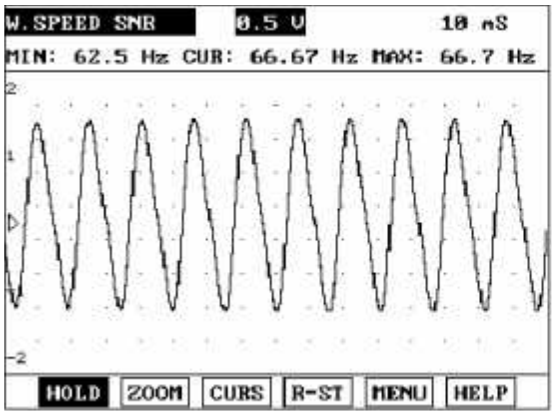
DTC DESCRIPTION

This failure code is related to the Wheel Speed Sensor and is set if no signal is received by TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• Wheel speed sensor,TCCU connector looseness and poor terminal to wire connection • wheel speed circuit open or short to battery • wheel speed sensor airgap • Faulty wheel speed. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

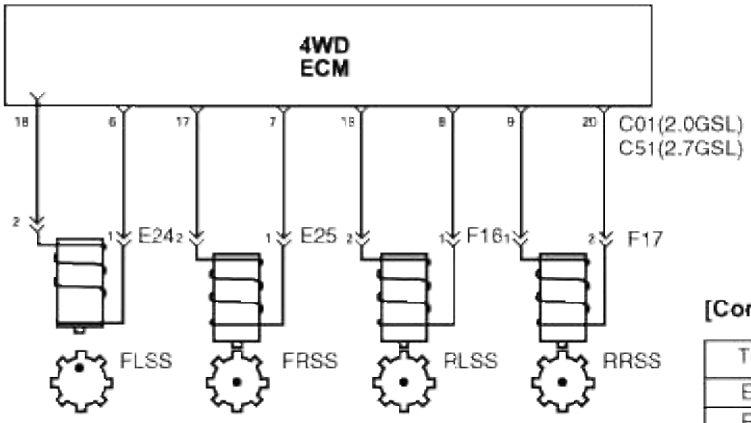
SIGNAL WAVEFROM



[CAUTION] he above value is just for reference. The actual value may differ from it according to various engine condition.

SCHEMATIC DIAGRAM

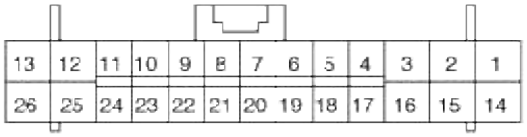
[Circuit Diagram]



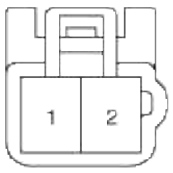
[Connection Information]

Terminal	Connection	Function
E16 No.1	C01/C51 No.8	Wheel speed input
E16 No.2	C01/C51 No.19	Wheel speed input
E17 No.1	C01/C51 No.9	Wheel speed input
E17No.2	C01/C51 No.20	Wheel speed input
E24 No.1	C01/C51 No.6	Wheel speed input
E24 No.2	C01/C51 No.18	Wheel speed input
E25 No.1	C01/C51 No.7	Wheel speed input
E25 No.2	C01/C51 No.17	Wheel speed input

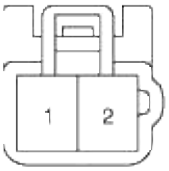
[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)

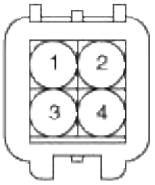


F16



F17

E24



E25

TERMINAL & 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

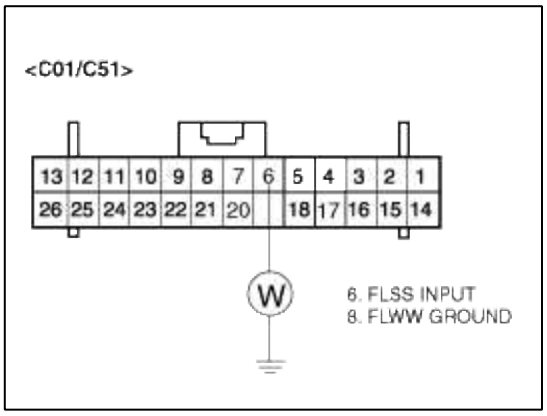
Go to " FLSS Signal Inspection" procedure.

FLSS Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 6 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is FLSS Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

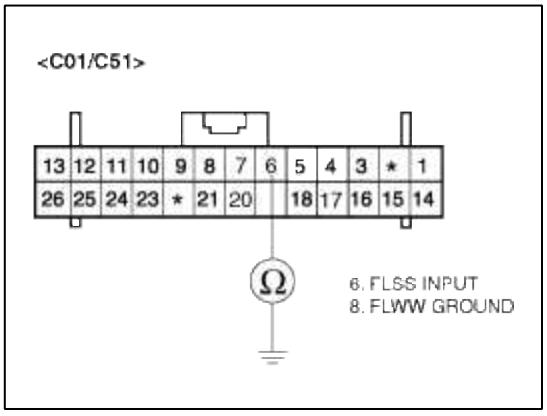
NO

Go to " FLSS input circuit line ground short inspection " procedure.

FLSS input circuit line ground short inspection

1. Ignition "OFF".
2. TCCU, FLSS connector : Disconnect.
3. Measure resistance between terminal 6 of TCCU harness connector and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " FLSS input circuit line open inspection " procedure.

NO

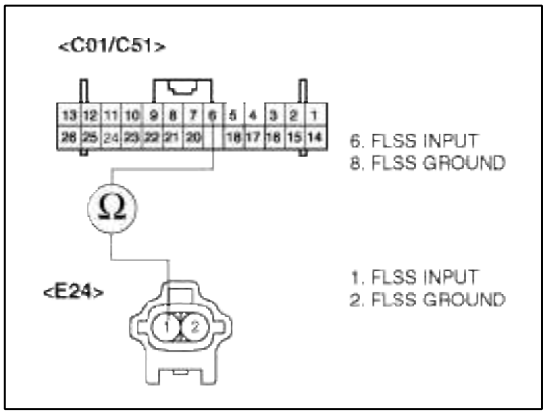
Check for ground to short circuit of FLSS circuit

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

FLSS input circuit line open inspection

1. Ignition OFF
2. TCCU, FLSS connector : Disconnect.
3. Measure resistance between terminal 6 of TCCU harness connector and terminal 1 of FLSS harness connector E24 .

Specification : Approx. 1Ω below



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " FLSS ground line open inspection " procedure.

NO

Check for open circuit of FLSS circuit.

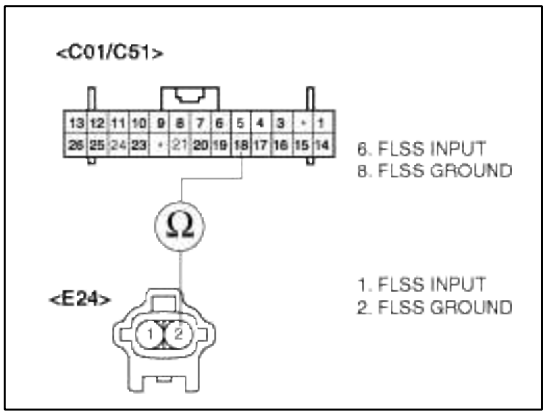
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

FLSS ground line open inspection

1. Ignition OFF
2. TCCU, FLSS connector : Disconnect.

3. Measure resistance between terminal 8 of TCCU harness connector and terminal 2 of FLSS harness connector E24.

Specification : Approx. 1Ω below



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to "Component inspection" procedure.

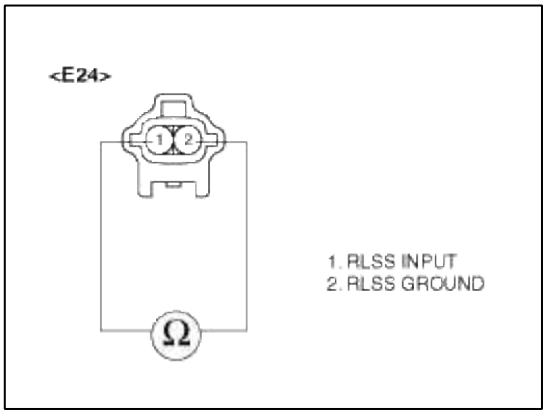
NO

FLSS ground circuit open checking.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition OFF
2. Speed Sensor,TCCU connector : Disconnect.
3. Measure resistance between terminal 1 and 2 of FLSS harness connector E24.

Specification : Approx. 1.1±0.05Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to"Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "Speed Sensor" and check for proper operation. If the problem is corrected, replace "Speed Sensor" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

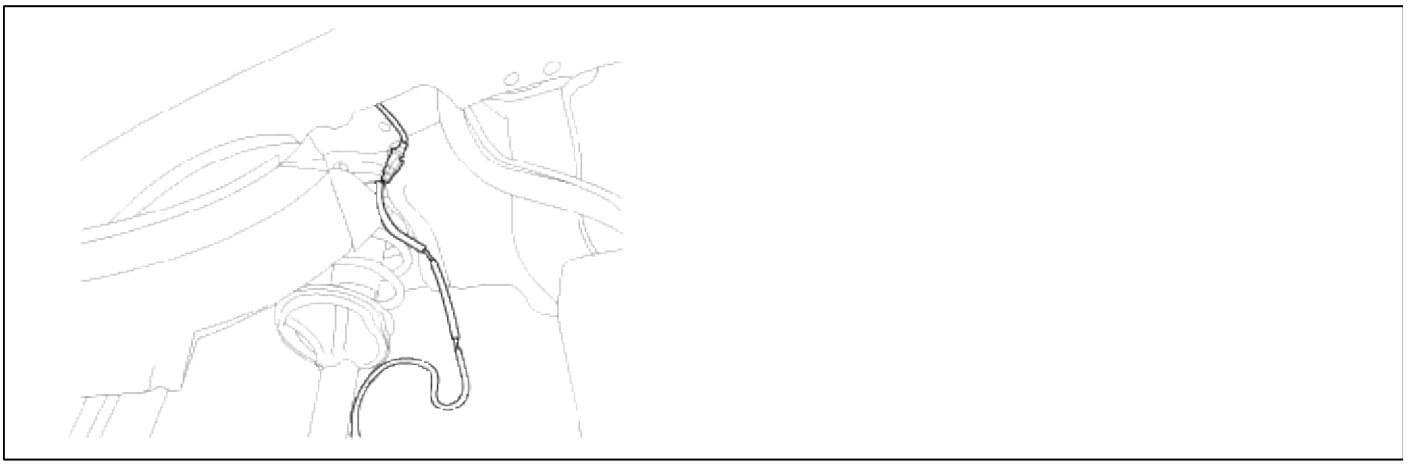
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Transfer System > Transfer Case Assembly > Troubleshooting > P1751A

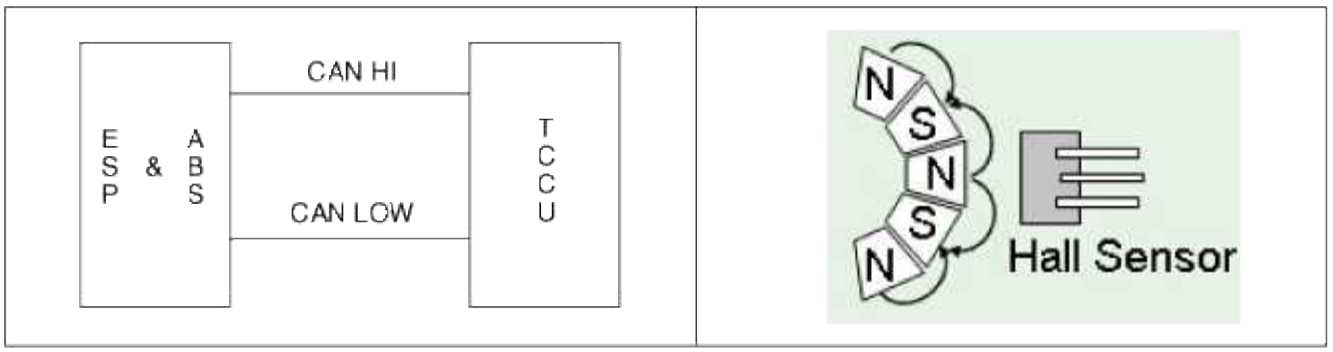
COMPONENT LOCATION



GERNERAL DESCRIPTION

Wheel speed sensor is active hall-sensor type and good at temperature and noise charateristic. 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.

In case ABS(or ESP) system is applied to the vehicle, wheel speed sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.



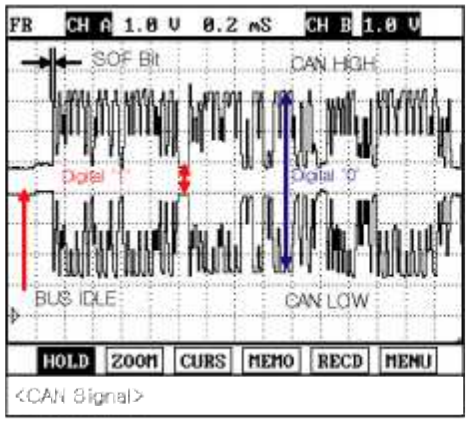
DTC DESCRIPTION

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

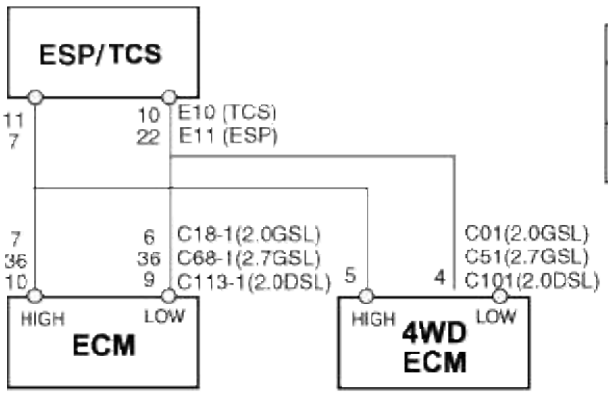
Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • Wheel sensor comm line circuit open/short. • Faulty Wheel sensor. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



SCHEMATIC DIAGRAM

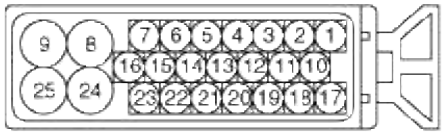
[Circuit Diagram]



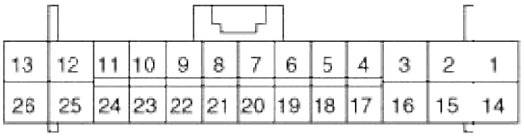
[Connection Information]

Terminal	Connection	Function
C01/C51/C101 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51/C101 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

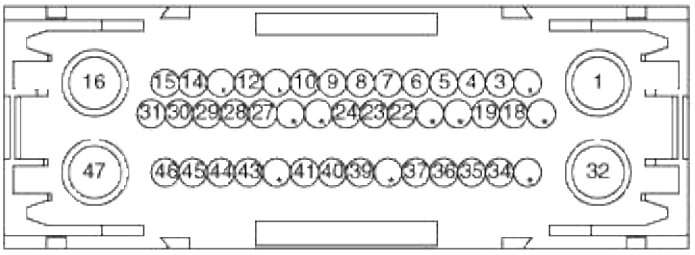
[Harness Connector]



E10(TCS)



C0*(2.0GSL)
C5*(2.7GSL)
C101(2.0DSL)



E11(ESP)

TERMINAL & 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

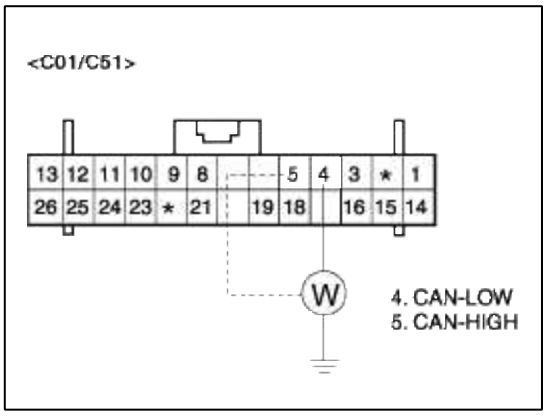
Go to " CAN(SPEED SENSOR)comm. Line Signal Inspection " procedure.

CAN(SPEED SENSOR)comm. Line Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(FRSS)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

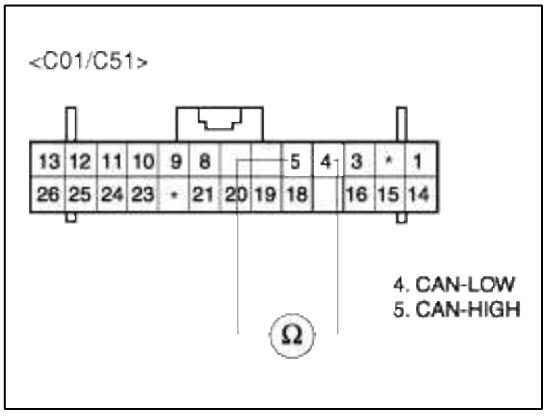
NO

Go to "CAN(SPEED SENSOR) comm. Line Inspection" procedure.

CAN(SPEED SENSOR) comm. Line Inspection

1. Ignition "OFF".
2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

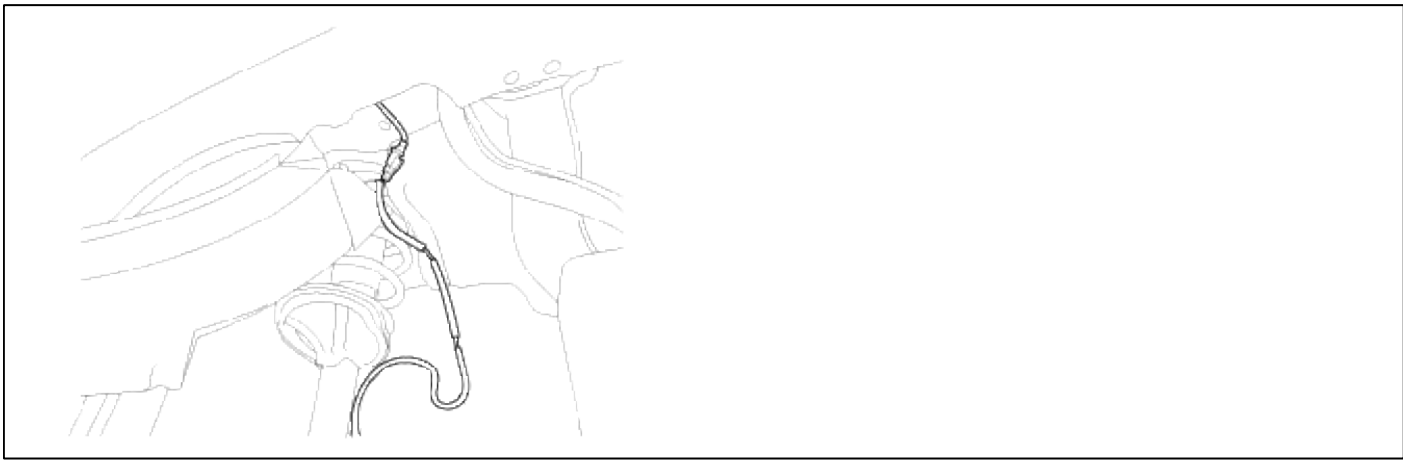
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

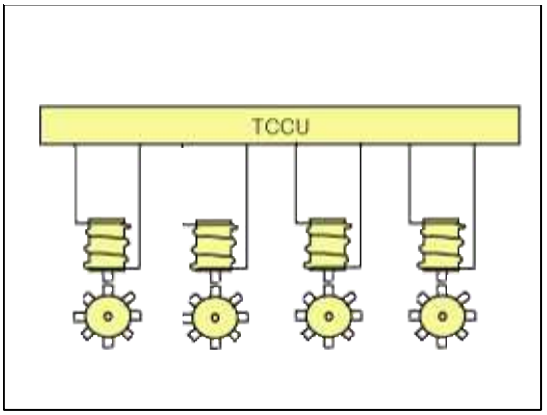
Transfer System > Transfer Case Assembly > Troubleshooting > P1751B

COMPONENT LOCATION



GERNERAL DESCRIPTION

When the tone wheel rotates, adjacent to the sensor pole component, an alternating current signal is generated in the coil with a frequency proportional to the wheel speed.
Wheel Speed Sensor generates a signal which is sent to TCCU.



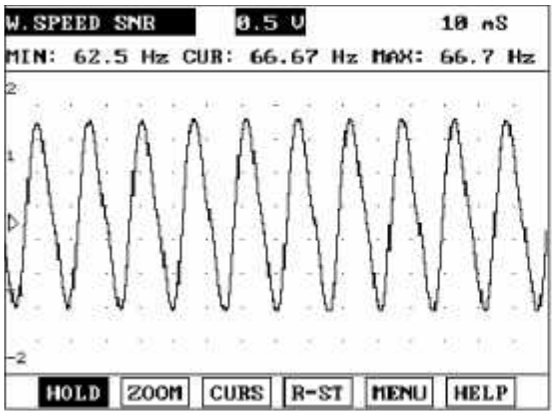
DTC DESCRIPTION

This failure code is related to the Wheel Speed Sensor and is set if no signal is received by TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• Wheel speed sensor,TCCU connector looseness and poor terminal to wire connection. • wheel speed circuit open or short to battery. • wheel speed sensor airgap • Faulty wheel speed. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

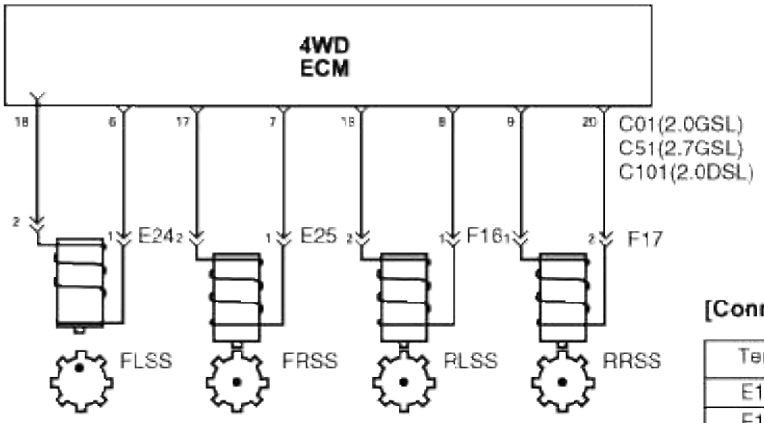
SIGNAL WAVEFROM



[CAUTION] he above value is just for reference. The actual value may differ from it according to various engine condition.

SCHEMATIC DIAGRAM

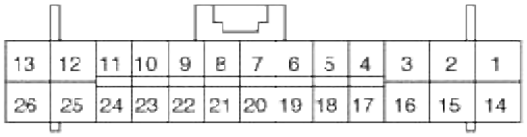
[Circuit Diagram]



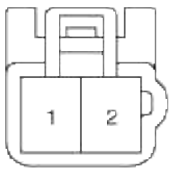
[Connection Information]

Terminal	Connection	Function
E16 No.1	C01/C51/C101 No.8	Wheel speed input
E16 No.2	C01/C51/C101 No.19	Wheel speed input
E17 No.1	C01/C51/C101 No.9	Wheel speed input
E17No.2	C01/C51/C101 No.20	Wheel speed input
E24 No.1	C01/C51/C101 No.6	Wheel speed input
E24 No.2	C01/C51/C101 No.18	Wheel speed input
E25 No.1	C01/C51/C101 No.7	Wheel speed input
E25 No.2	C01/C51/C101 No.17	Wheel speed input

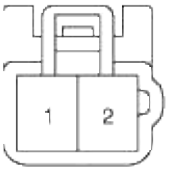
[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)
C101(2.0DSL)

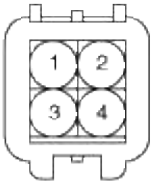


F16



F17

E24



E25

TERMINAL & 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

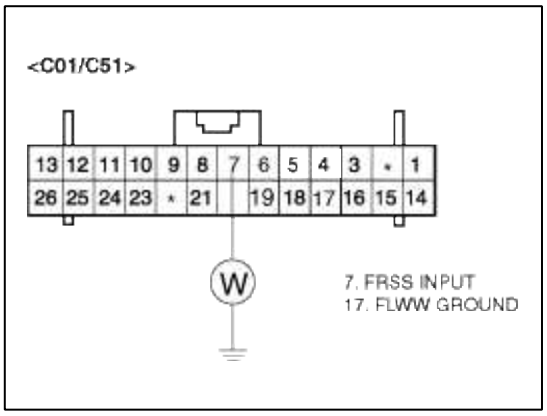
Go to " FRSS Signal Inspection" procedure.

FRSS Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 7 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is FRSS Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

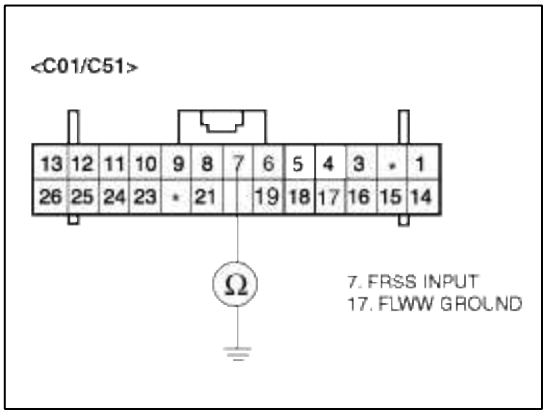
NO

Go to " FRSS input circuit line ground short inspection " procedure.

FRSS input circuit ground short inspection

1. Ignition "OFF".
2. TCCU, FRSS connector : Disconnect.
3. Measure resistance between terminal 7 of TCCU harness connector and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " FRSS input circuit line open inspection " procedure.

NO

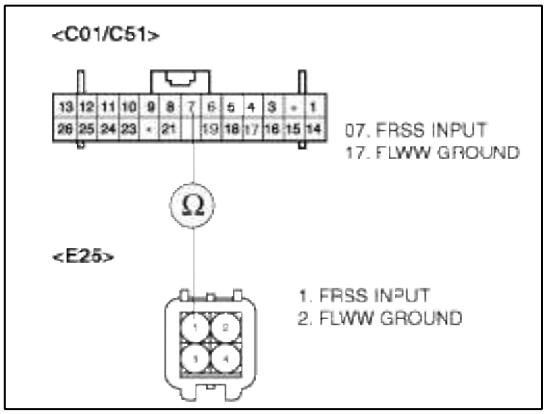
Check for ground to short circuit of FRSS circuit

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

FRSS input circuit open inspection

1. Ignition OFF
2. TCCU, FRSS connector : Disconnect.
3. Measure resistance between terminal 7 of TCCU harness connector and terminal 1 of FRSS harness connector E25.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " FRSS ground line open inspection " procedure.

NO

Check for open circuit of FRSS circuit.

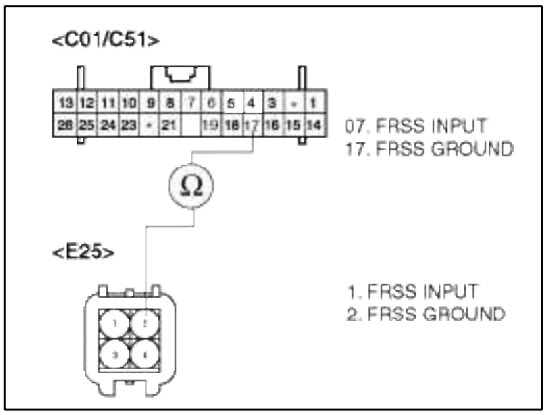
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

FRSS ground circuit open inspection

1. Ignition OFF
2. TCCU, FRSS connector : Disconnect.

3. Measure resistance between terminal 17 of TCCU harness connector and terminal 2 of FRSS harness connector E25.

Specification : Approx. 1Ω below



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to "Component inspection" procedure.

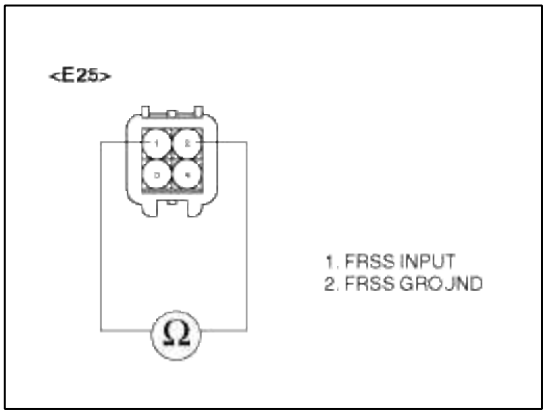
NO

FRSS ground circuit open checking.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition OFF
2. Speed Sensor,TCCU connector : Disconnect
3. Measure resistance between terminal 1& 2 of FRSS harness connector E25.

Specification : Approx. 1.1±0.05Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to"Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "Speed Sensor" and check for proper operation. If the problem is corrected, replace "Speed Sensor" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

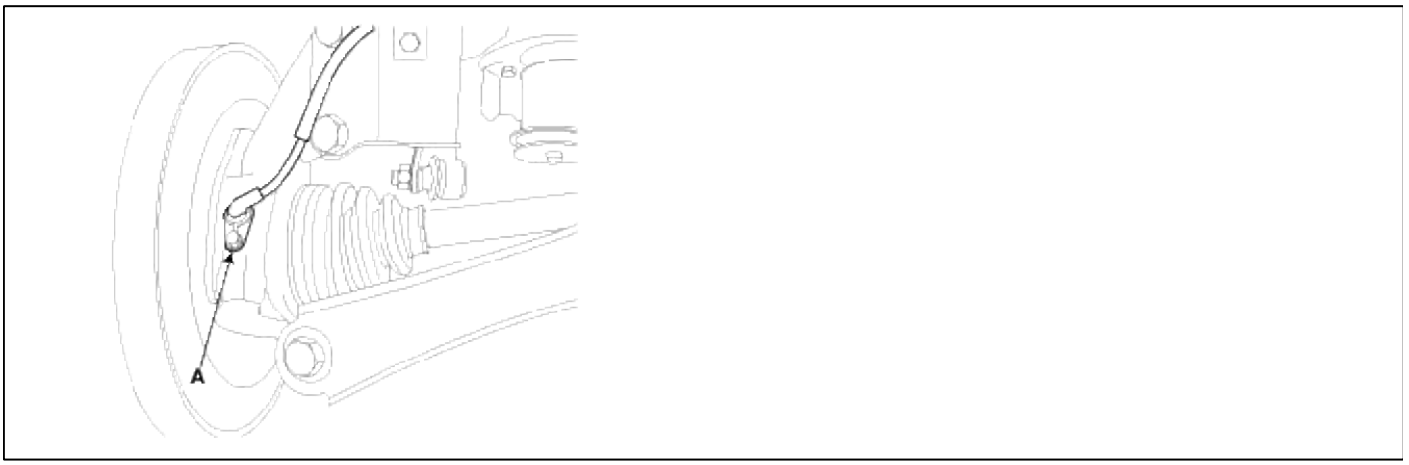
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

Transfer System > Transfer Case Assembly > Troubleshooting > P1752A

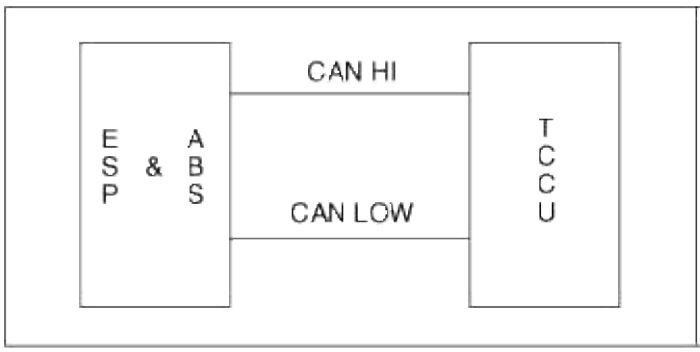
COMPONENT LOCATION

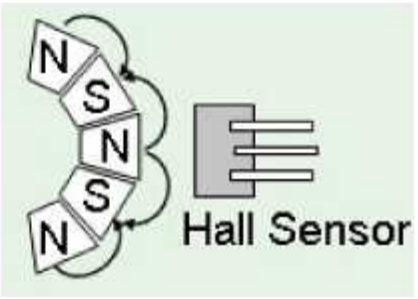


GERNERAL DESCRIPTION

Wheel speed sensor is active hall-sensor type and good at temperature and noise charateristic. 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.

In case ABS(or ESP) system is applied to the vehicle, wheel speed sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.





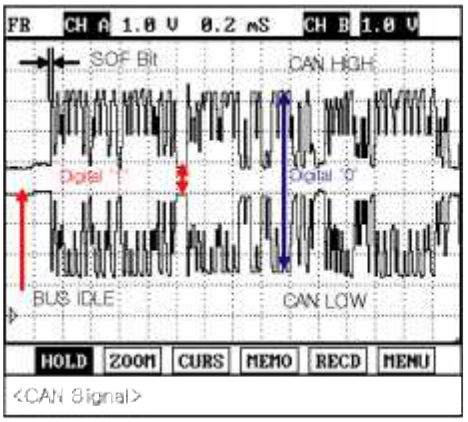
DTC DESCRIPTION

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

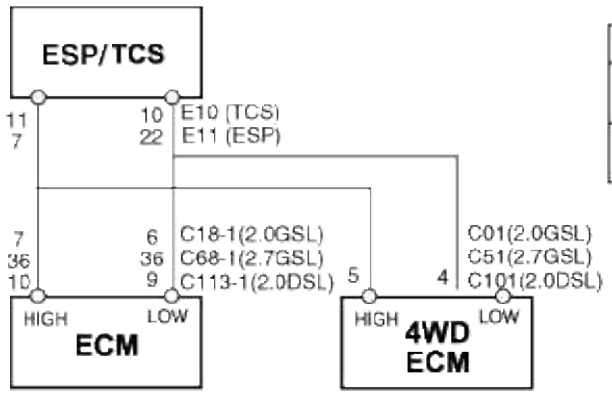
Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • Wheel sensor comm line circuit open/short. • Faulty Wheel sensor. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



SCHEMATIC DIAGRAM

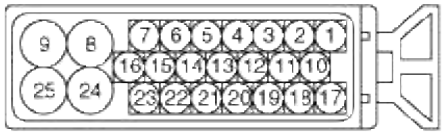
[Circuit Diagram]



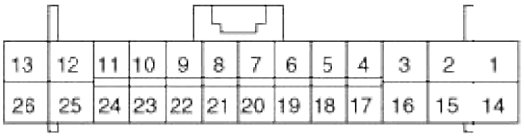
[Connection Information]

Terminal	Connection	Function
C01/C51/C101 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51/C101 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

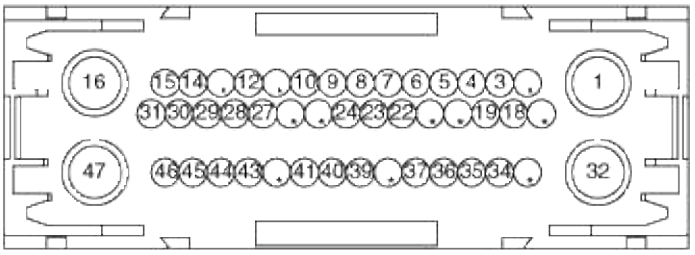
[Harness Connector]



E10(TCS)



C0*(2.0GSL)
C5*(2.7GSL)
C101(2.0DSL)



E11(ESP)

TERMINAL & 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

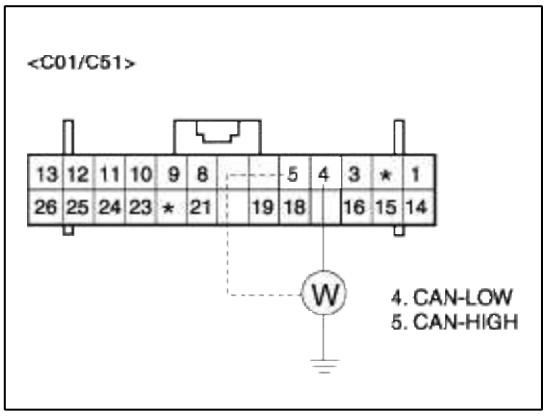
Go to " CAN(SPEED SENSOR)comm. Line Signal Inspection " procedure.

CAN(SPEED SENSOR)comm. Line Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(RLSS)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

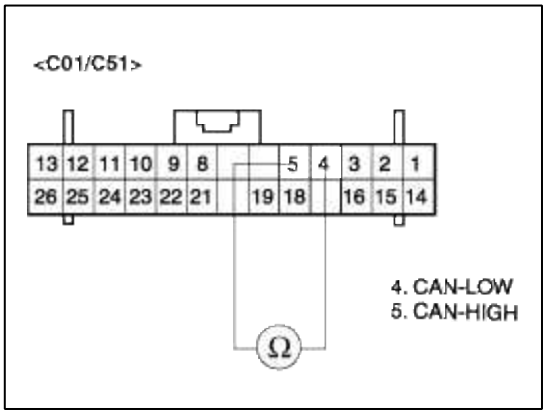
NO

Go to "CAN(SPEED SENSOR) comm. Line Inspection" procedure.

CAN(SPEED SENSOR) comm. Line Inspection

1. Ignition "OFF".
2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

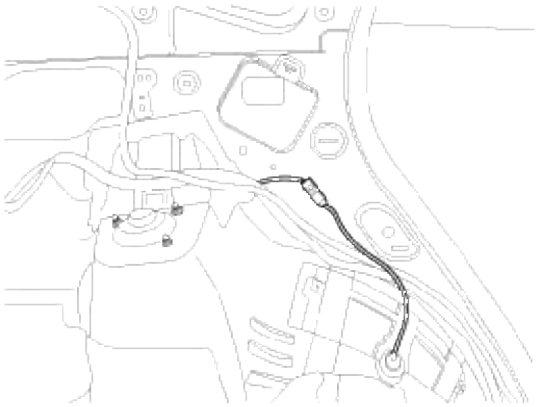
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

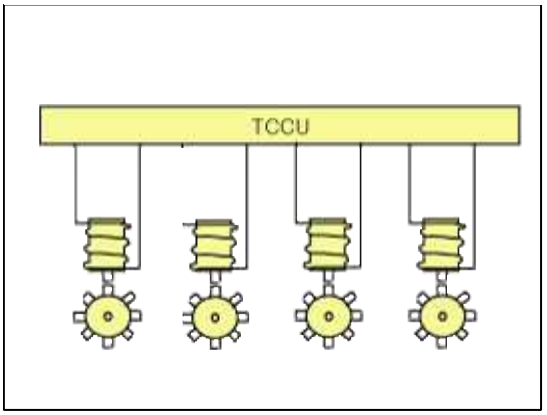
Transfer System > Transfer Case Assembly > Troubleshooting > P1752B

COMPONENT LOCATION



GERNERAL DESCRIPTION

When the tone wheel rotates, adjacent to the sensor pole component, an alternating current signal is generated in the coil with a frequency proportional to the wheel speed.
Wheel Speed Sensor generates a signal which is sent to TCCU.



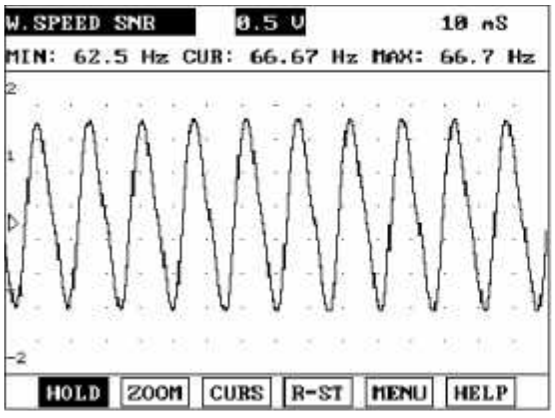
DTC DESCRIPTION

This failure code is related to the Wheel Speed Sensor and is set if no signal is received by TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• Wheel speed sensor,TCCU connector looseness and poor terminal to wire connection. • wheel speed circuit open or short to battery. • wheel speed sensor airgap • Faulty wheel speed. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

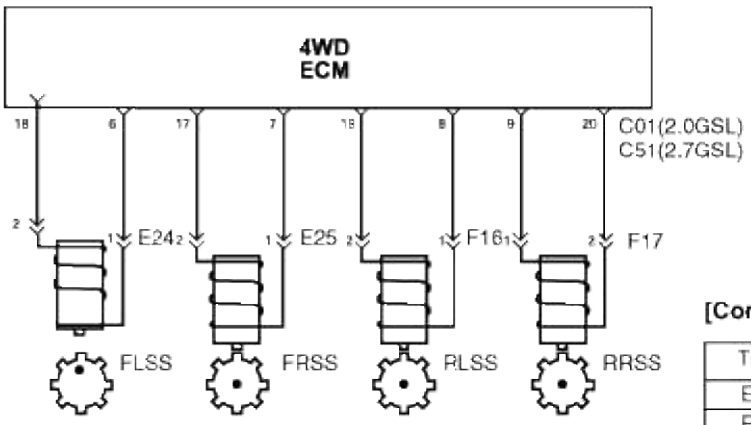
SIGNAL WAVEFROM



[CAUTION] he above value is just for reference. The actual value may differ from it according to various engine condition.

SCHEMATIC DIAGRAM

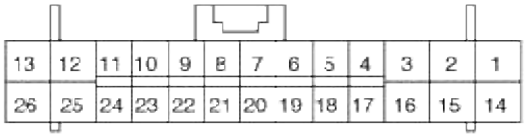
[Circuit Diagram]



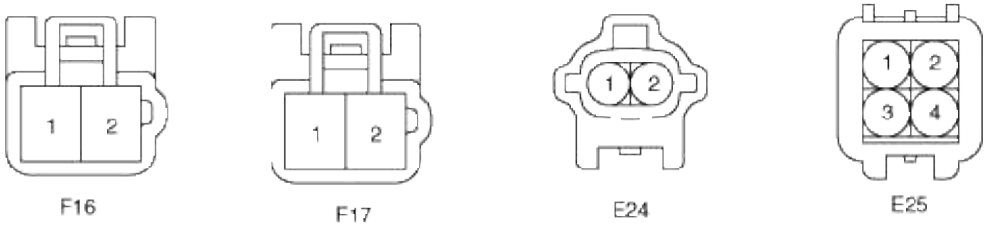
[Connection Information]

Terminal	Connection	Function
E16 No.1	C01/C51 No.8	Wheel speed input
E16 No.2	C01/C51 No.19	Wheel speed input
E17 No.1	C01/C51 No.9	Wheel speed input
E17No.2	C01/C51 No.20	Wheel speed input
E24 No.1	C01/C51 No.6	Wheel speed input
E24 No.2	C01/C51 No.18	Wheel speed input
E25 No.1	C01/C51 No.7	Wheel speed input
E25 No.2	C01/C51 No.17	Wheel speed input

[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)



TERMINAL & 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

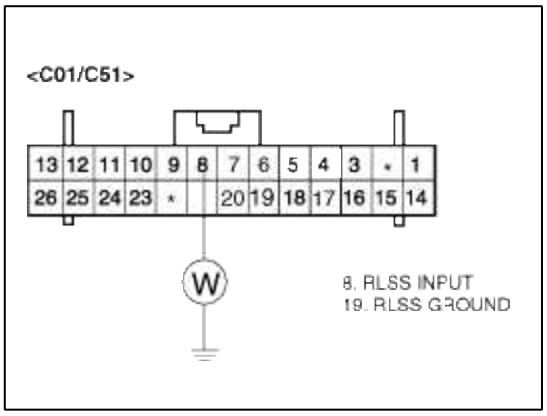
Go to " RLSS Signal Inspection" procedure.

RLSS Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 8 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is RLSS Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

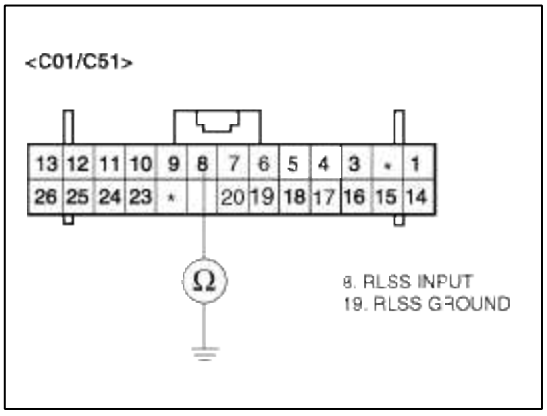
NO

Go to " RLSS input circuit line ground short inspection " procedure.

RLSS input circuit ground short inspection

1. Ignition "OFF".
2. TCCU, RLSS connector : Disconnect.
3. Measure resistance between terminal 8 of TCCU harness connector and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " RLSS input circuit line open inspection " procedure.

NO

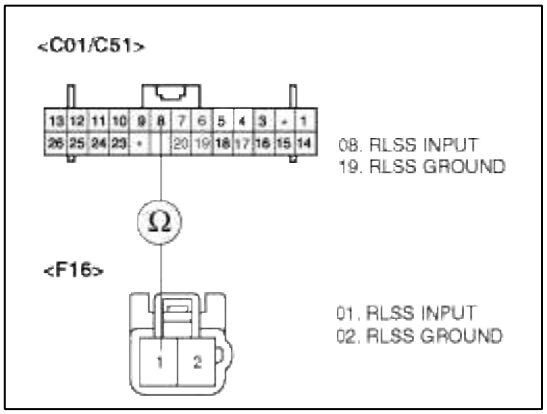
Check for ground to short circuit of RLSS circuit

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

RLSS input circuit line open inspection

1. Ignition OFF
2. TCCU, RLSS connector : Disconnect.
3. Measure resistance between terminal 8 of TCCU harness connector and terminal 1 of RLSS harness connector F16.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " RLSS ground line open inspection " procedure.

NO

Check for open circuit of RLSS circuit.

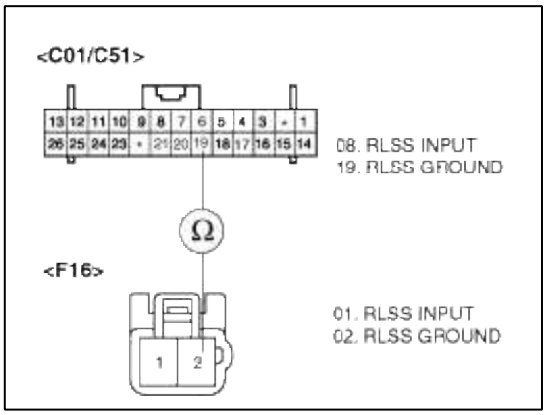
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

RLSS ground line open inspection

1. Ignition OFF
2. TCCU, RLSS connector : Disconnect.

3. Measure resistance between terminal 19 of TCCU harness connector and terminal 2 of RLSS harness connector F16.

Specification : Approx. 1Ω below



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to "Component inspection" procedure.

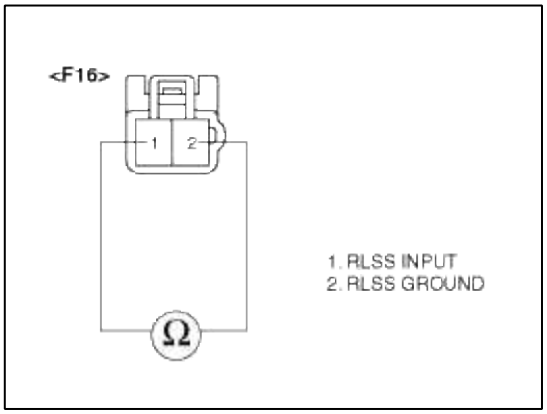
NO

RLSS ground circuit open checking.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition OFF
2. Speed Sensor,TCCU connector : Disconnect
3. Measure resistance between terminal 1& 2 of RLSS harness connector F16.

Specification : Approx. 1.1±0.05Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to"Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "Speed Sensor" and check for proper operation. If the problem is corrected, replace "Speed Sensor" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

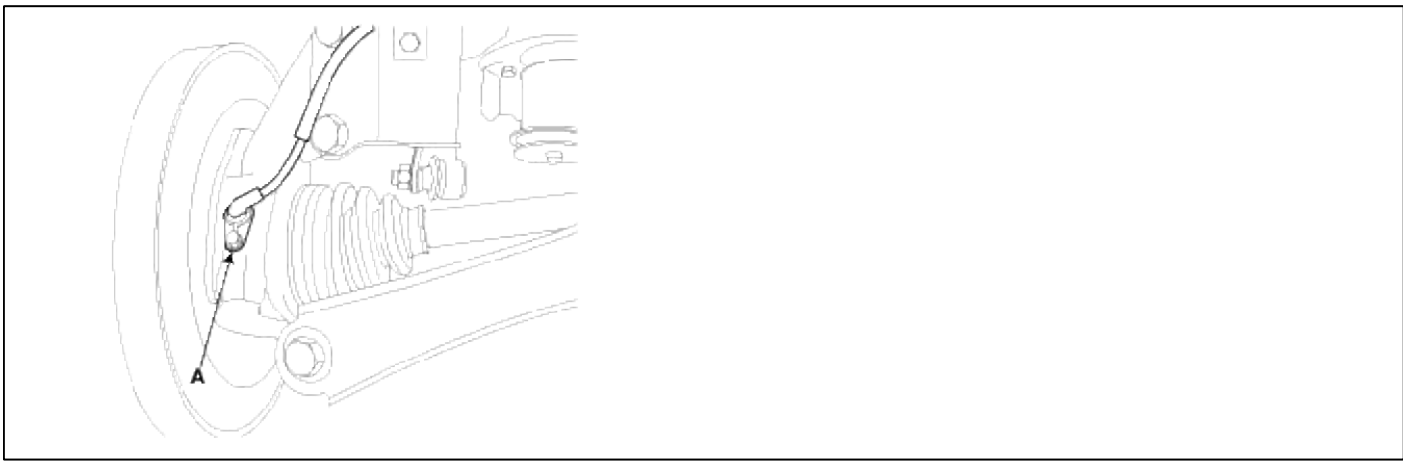
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

Transfer System > Transfer Case Assembly > Troubleshooting > P1753A

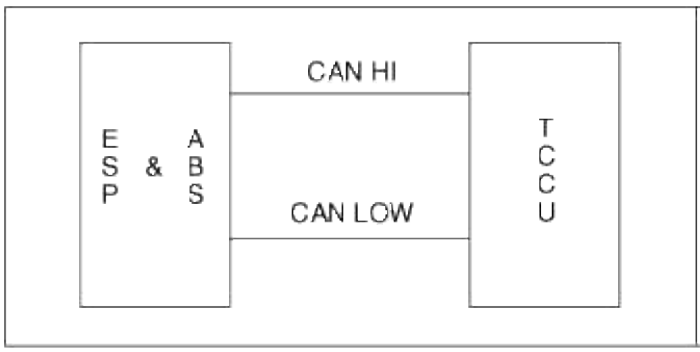
COMPONENT LOCATION

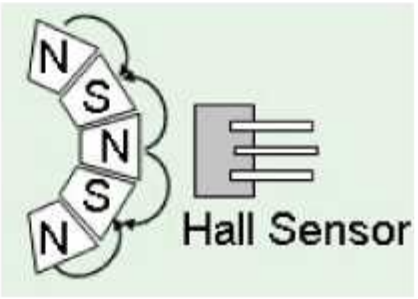


GERNERAL DESCRIPTION

Wheel speed sensor is active hall-sensor type and good at temperature and noise charateristic. 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.

In case ABS(or ESP) system is applied to the vehicle, wheel speed sensor signal is sent to 4WD-ECM(TCCU) by CAN communication.





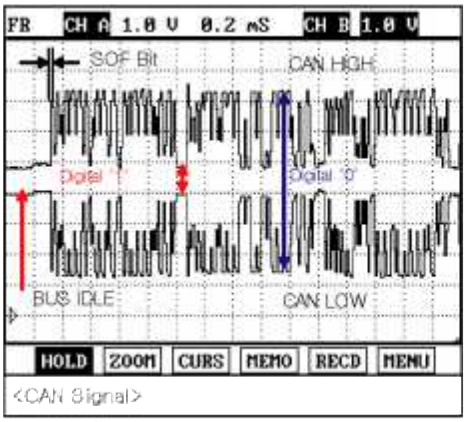
DTC DESCRIPTION

This failure code is related to the TCCU communication line of the ESP(ABS CONTROL MODULE) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

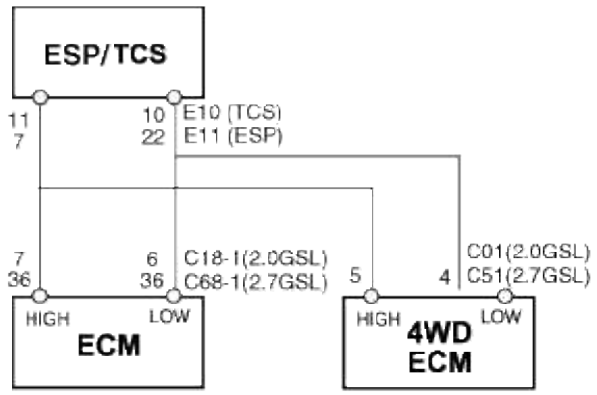
Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • Wheel sensor comm line circuit open/short. • Faulty Wheel sensor. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph(19mph)	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



SCHEMATIC DIAGRAM

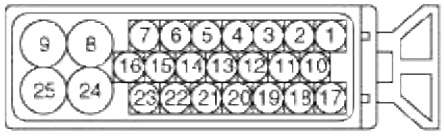
[Circuit Diagram]



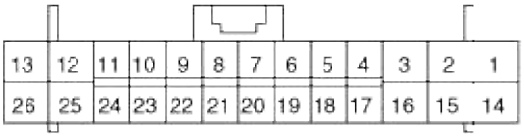
[Connection Information]

Terminal	Connection	Function
C01/C51 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

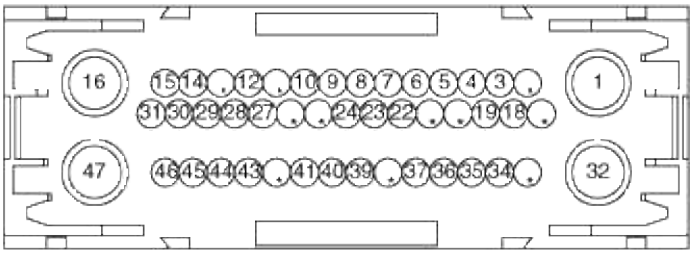
[Harness Connector]



E10(TCS)



C0*(2.0GSL)
C5*(2.7GSL)



E11(ESP)

TERMINAL & 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

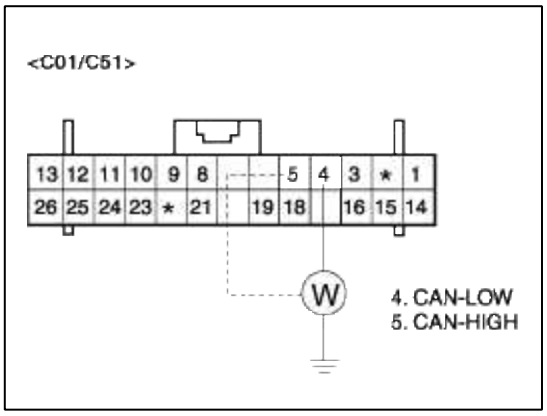
Go to " CAN(SPEED SENSOR)comm. Line Signal Inspection " procedure.

CAN(SPEED SENSOR)comm. Line Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(RRSS)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

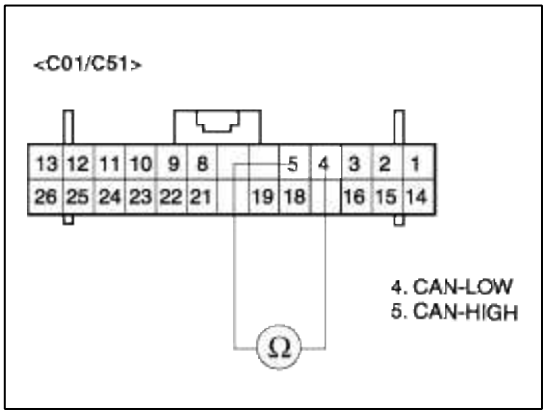
NO

Go to "CAN(SPEED SENSOR) comm. Line Inspection" procedure.

CAN(SPEED SENSOR) comm. Line Inspection

1. Ignition "OFF".
2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

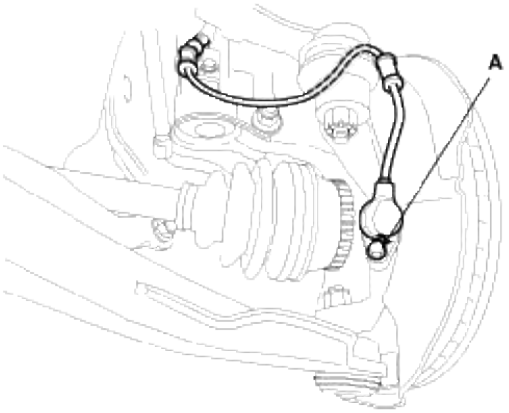
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time.

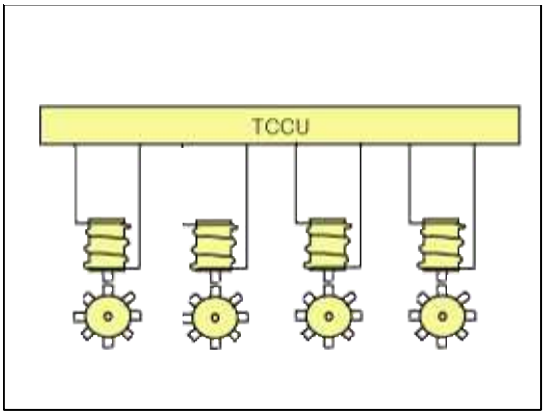
Transfer System > Transfer Case Assembly > Troubleshooting > P1753B

COMPONENT LOCATION



GERNERAL DESCRIPTION

When the tone wheel rotates, adjacent to the sensor pole component, an alternating current signal is generated in the coil with a frequency proportional to the wheel speed.
Wheel Speed Sensor generates a signal which is sent to TCCU.



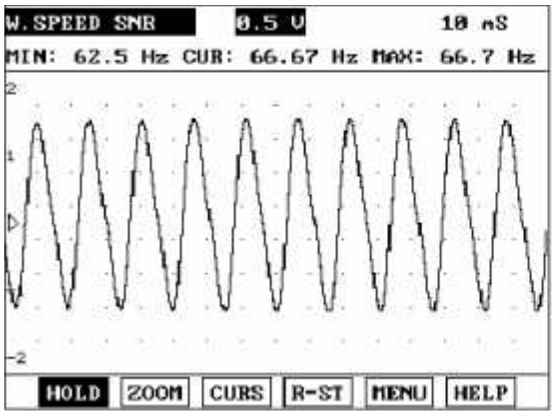
DTC DESCRIPTION

This failure code is related to the Wheel Speed Sensor and is set if no signal is received by TCCU.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of signal	• Wheel speed sensor,TCCU connector looseness and poor terminal to wire connection. • wheel speed circuit open or short to battery. • wheel speed sensor airgap • Faulty wheel speed. • Faulty TCCU.
Enable Conditions	• Fault cleared ignition cycle	
Threshold Value	• Speed defference 30kph(19mph)	
Diagnostic Time	• 30 Sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

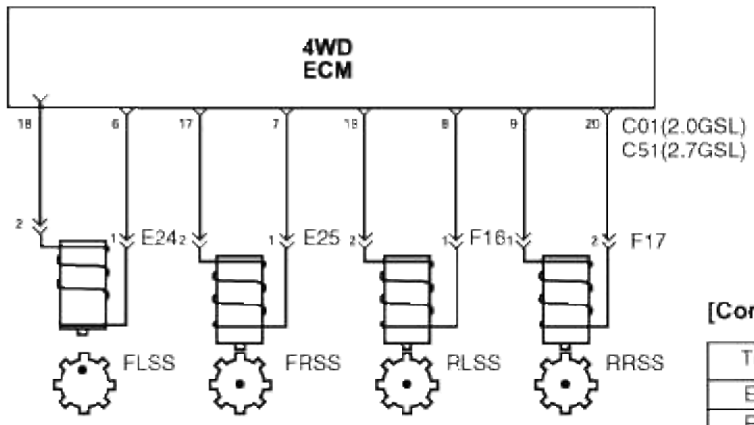
SIGNAL WAVEFROM



[CAUTION] he above value is just for reference. The actual value may differ from it according to various engine condition.

SCHEMATIC DIAGRAM

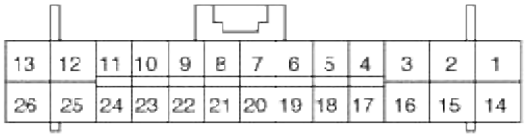
[Circuit Diagram]



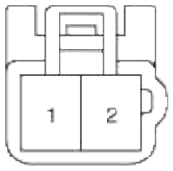
[Connection Information]

Terminal	Connection	Function
E16 No.1	C01/C51 No.8	Wheel speed input
E16 No.2	C01/C51 No.19	Wheel speed input
E17 No.1	C01/C51 No.9	Wheel speed input
E17No.2	C01/C51 No.20	Wheel speed input
E24 No.1	C01/C51 No.6	Wheel speed input
E24 No.2	C01/C51 No.18	Wheel speed input
E25 No.1	C01/C51 No.7	Wheel speed input
E25 No.2	C01/C51 No.17	Wheel speed input

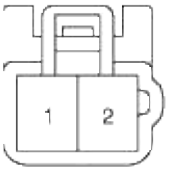
[Harness Connector]



C01(2.0GSL)
C51(2.7GSL)

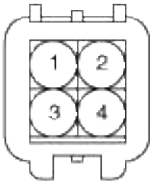


F16



F17

E24



E25

TERMINAL & 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

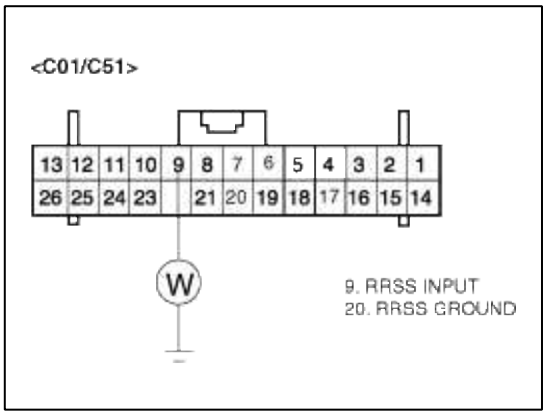
Go to " RRSS Signal Inspection" procedure.

RRSS Signal Inspection

1. Engine "ON".
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 9 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less).

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is RRSS Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

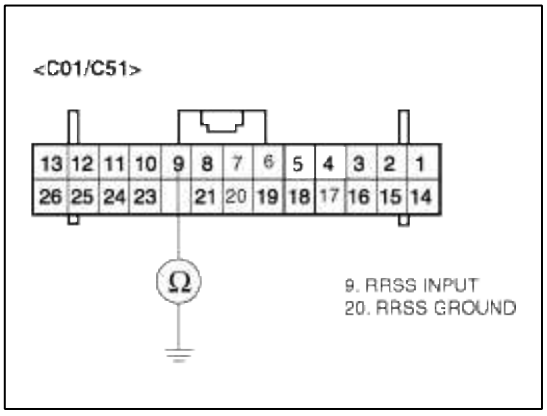
NO

Go to " RRSS input circuit line ground short inspection " procedure.

RRSS input circuit ground short inspection

1. Ignition "OFF".
2. TCCU, RRSS connector : Disconnect.
3. Measure resistance between terminal 9 of TCCU harness connector and chassis ground.

Specification : Approx. ∞ Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " RRSS input circuit line open inspection " procedure.

NO

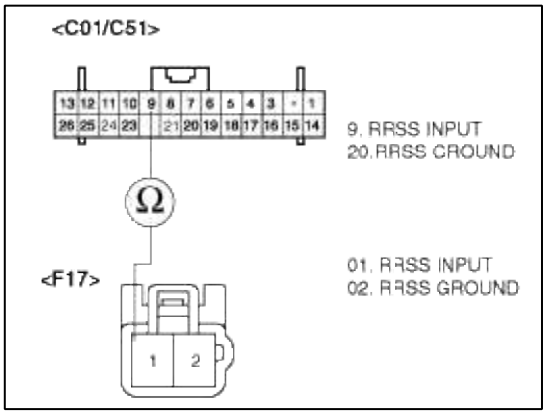
Check for ground to short circuit of RRSS circuit

Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

RRSS input circuit open inspection

1. Ignition OFF
2. TCCU, RRSS connector : Disconnect.
3. Measure resistance between terminal 9 of TCCU harness connector and terminal 1 of RRSS harness connector F17.

Specification : Approx. 1Ω below.



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to " RRSS ground line open inspection " procedure.

NO

Check for open circuit of RRSS circuit.

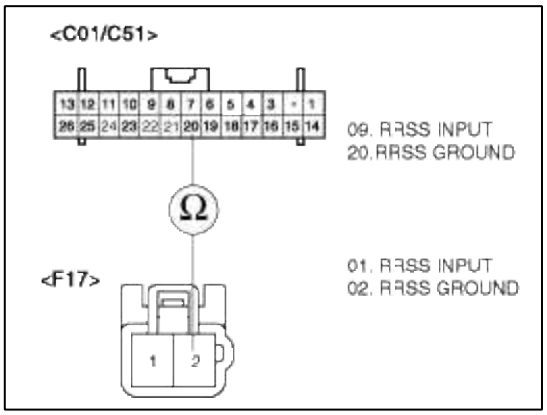
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

RRSS ground line open inspection

1. Ignition OFF
2. TCCU, RRSS connector : Disconnect.

3. Measure resistance between terminal 20 of TCCU harness connector and terminal 2 of RRSS harness connector F17.

Specification : Approx. 1Ω below



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Go to "Component inspection" procedure.

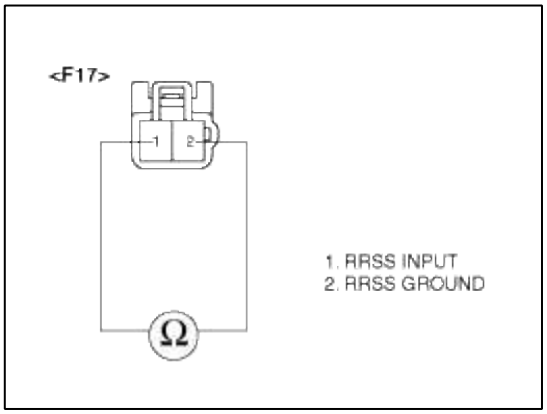
NO

RRSS ground circuit open checking.
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition OFF
2. Speed Sensor,TCCU connector : Disconnect
3. Measure resistance between terminal 1& 2 of RRSS harness connector F17.

Specification : Approx. 1.1±0.05Ω



CAUTION

The above value is just for reference. The actual value may differ from it according to various engine condition.

4. Is resistance display near the specified value?

YES

Substitute with a known-good "TCCU" and check for proper operation. If the problem is corrected, replace "TCCU" and then go to"Verification of Vehicle Repair" procedure.

NO

Substitute with a known-good "Speed Sensor" and check for proper operation. If the problem is corrected, replace "Speed Sensor" and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

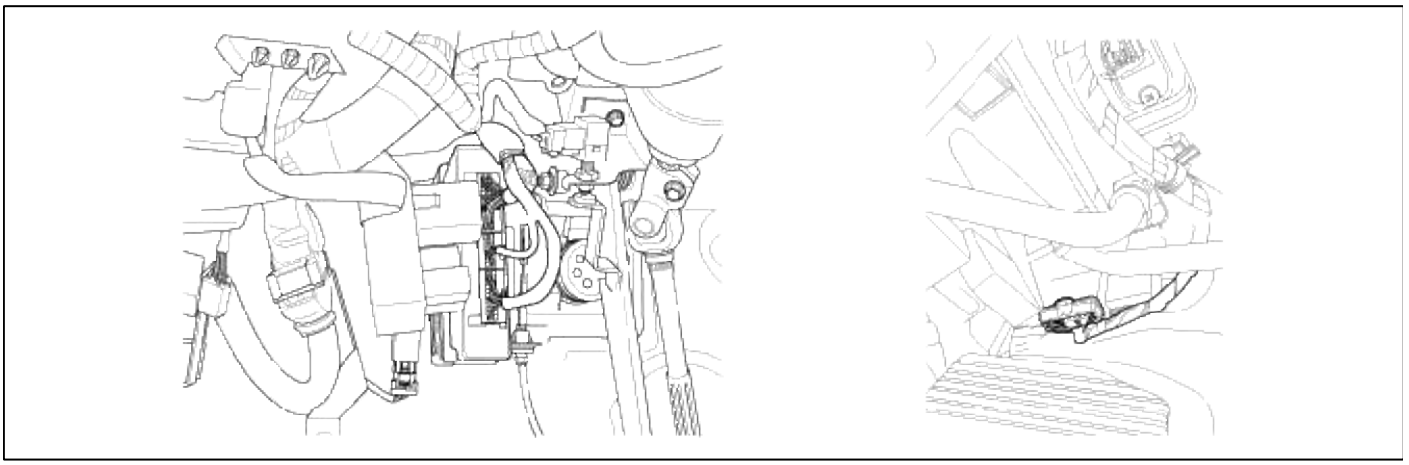
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

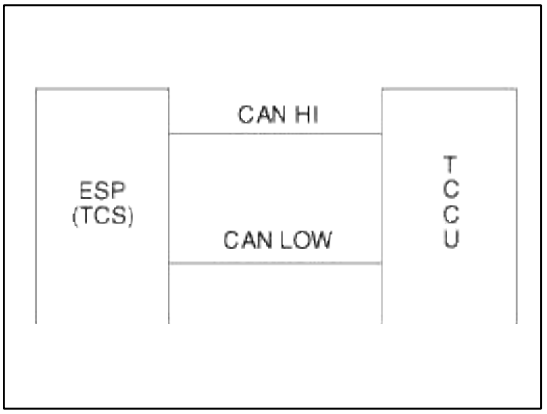
Transfer System > Transfer Case Assembly > Troubleshooting > P1764

COMPONENT LOCATION



GERNERAL DESCRIPTION

CAN communication is filled to permit the exchange of multiple signals between electronic control units through the use of two common data lines.



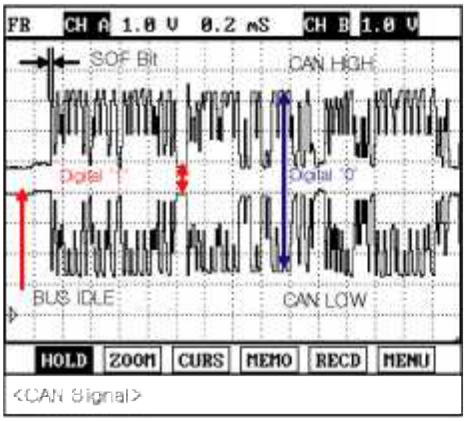
DTC DESCRIPTION

This failure code is related to the TCCU communication line between ECU and 4WD(ECU) and is set if there is no input signal to TCCU.

DTC DETECTING CONDITION

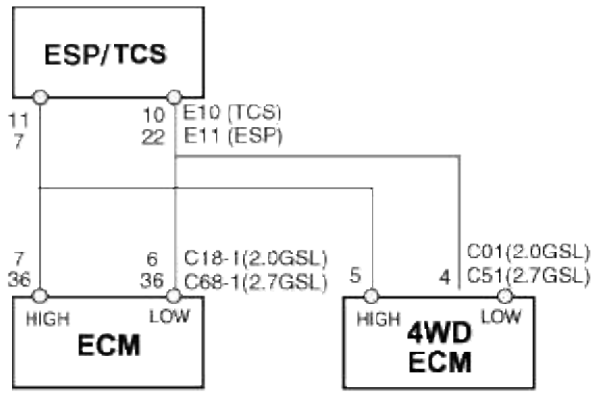
Item	Detecting Condition	Possible Cause
DTC Strategy	• ECU-ITM Communication Line, or ECU side malfunction	• ECM,TCCU connector looseness and poor terminal to wire connection. • CAN HIGH/LOW circuit open/short. • Faulty ECM. • Faulty TCCU.
Enable Conditions	• Message present 1.0 sec self clearing	
Threshold Value	• Loss of Signal	
Diagnostic Time	• 1 sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



SCHEMATIC DIAGRAM

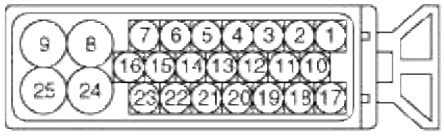
[Circuit Diagram]



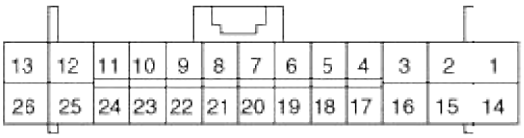
[Connection Information]

Terminal	Connection	Function
C01/C51 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

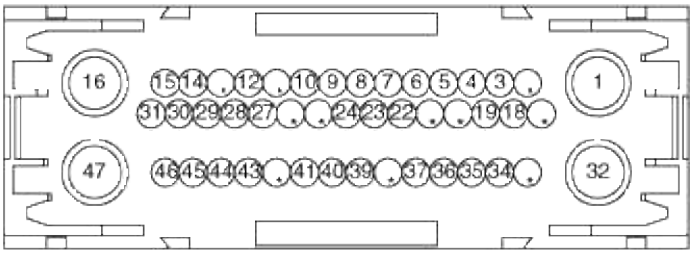
[Harness Connector]



E10(TCS)



C0*(2.0GSL)
C5*(2.7GSL)



E11(ESP)

TERMINAL & 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

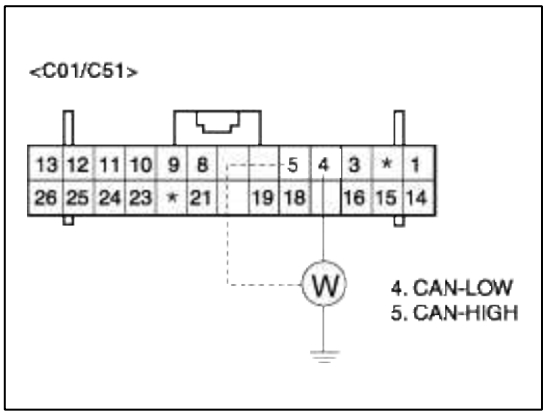
Go to " CAN(ECU-ITM)comm. Line Signal Inspection " procedure.

CAN(ECM-ITM)comm. Line Signal Inspection

1. Ignition ON, Engine : OFF
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.

4. Shift to N Range.

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

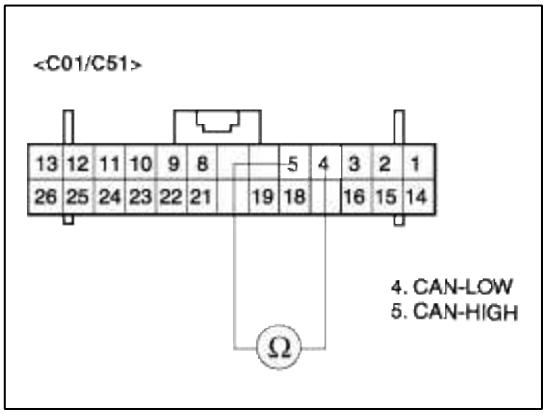
NO

Go to "CAN(ECM-ITM) comm. Line Inspection" procedure.

CAN(ECM-ITM) comm. Line Inspection

1. Ignition "OFF".
2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

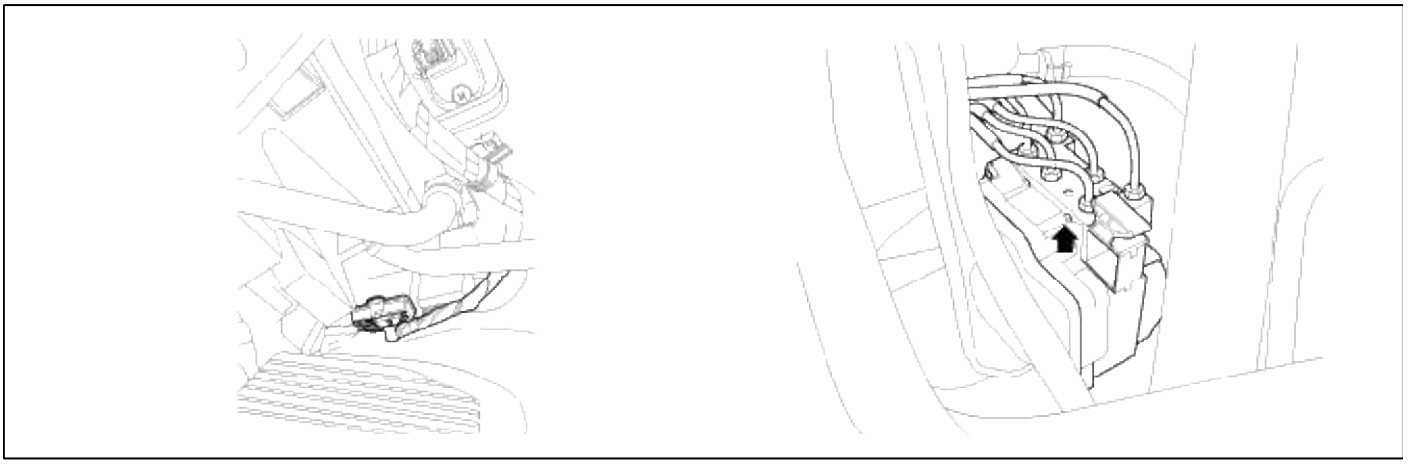
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

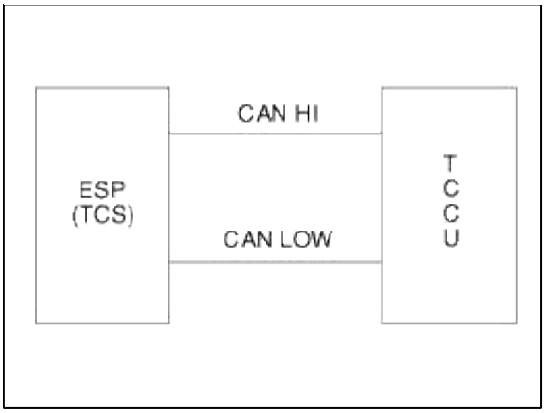
Transfer System > Transfer Case Assembly > Troubleshooting > P1765 -

COMPONENT LOCATION



GERNERAL DESCRIPTION

In case of the vehicle installed ESP & TCS(ABC CONTROL MODULE), ABS control module sends the wheel speed signal to 4WD(ECU) by CAN comunication after ABS control module recieves the wheel speed signal.



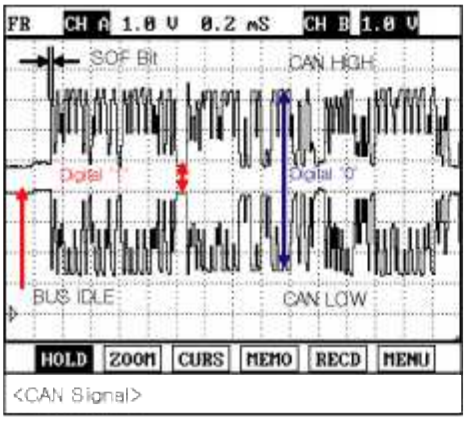
DTC DESCRIPTION

This failure code is related to the communication line between ESP(ABC CONTROL MODULE) and TCCU and is set if there is no CAN signal to TCCU.

DTC DETECTING CONDITION

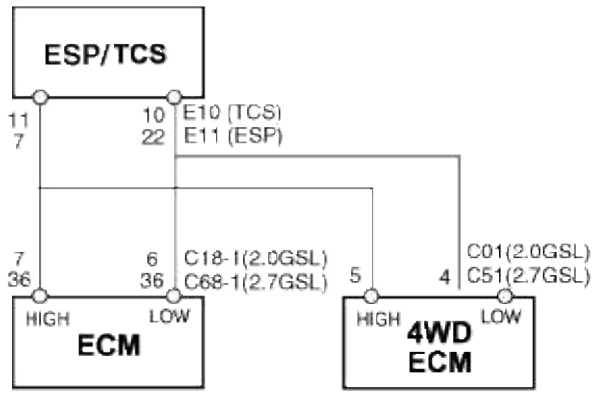
Item	Detecting Condition	Possible Cause
DTC Strategy	• ECU-ITM Communication Line, or ECU side malfunction	• ECM,TCCU connector looseness and poor terminal to wire connection. • CAN HIGH/LOW circuit open/short. • Faulty ECM. • Faulty TCCU.
Enable Conditions	• Message present 1.0 sec self clearing	
Threshold Value	• Loss of Signal	
Diagnostic Time	• 1 sec	
MIL on condition	• 0.5 Sec	
Fail Safe		

SIGNAL WAVEFROM



SCHEMATIC DIAGRAM

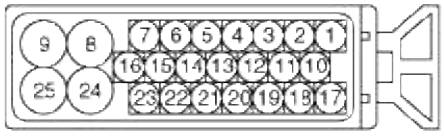
[Circuit Diagram]



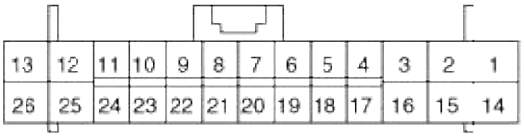
[Connection Information]

Terminal	Connection	Function
C01/C51 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

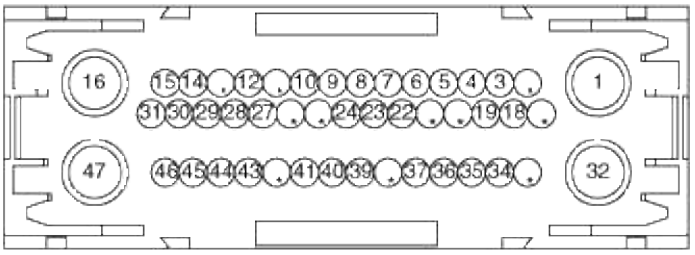
[Harness Connector]



E10(TCS)



C0*(2.0GSL)
C5*(2.7GSL)



E11(ESP)

TERMINAL & 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

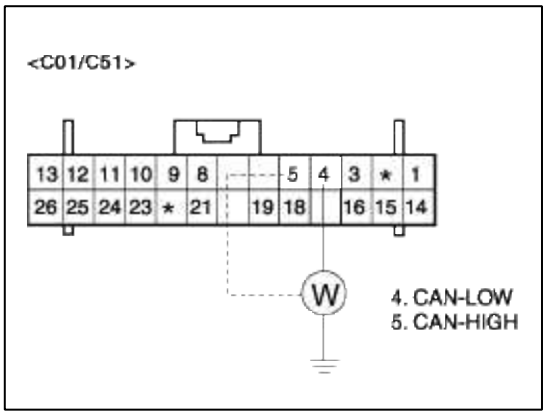
Go to " CAN(TCS-ITM)comm. Line Signal Inspection " procedure.

CAN(TCS-ITM)comm. Line Signal Inspection

1. Engine: ON
2. TCCU connector : Connect.
3. Monitor signal waveform between terminal 4 & 5 of TCCU harness connector and chassis ground.

4. Start and drive vehicle in gear and maintain vehicle speed approx. 10km/h or less(6mph or less)

Specification : Signal Waveform & Data



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

5. Is CAN(TCS-ITM)comm. Line Signal display near the specified value?

YES

Fault is intermittent caused by poor contact in the sensor's and/or TCCU's connector or was repaired and TCCU 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.

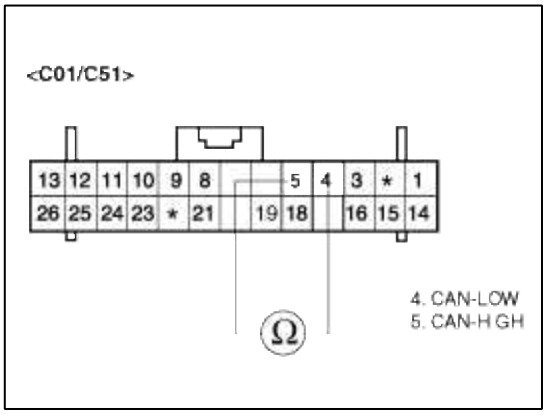
NO

Go to "CAN(TCS-ITM) comm. Line Inspection" procedure.

CAN(TCS-ITM) comm. Line Inspection

1. Ignition "OFF".
2. Measure resistance between terminal "4" of theTCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60 Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is resistance display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

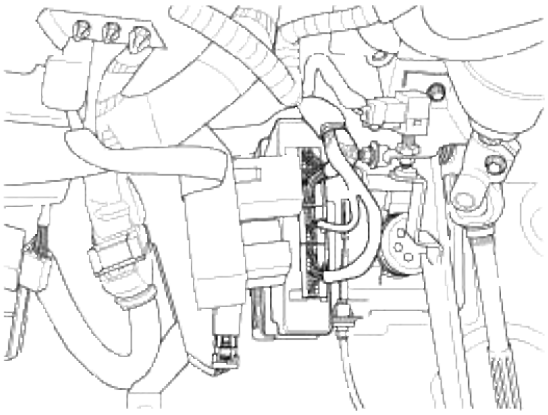
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

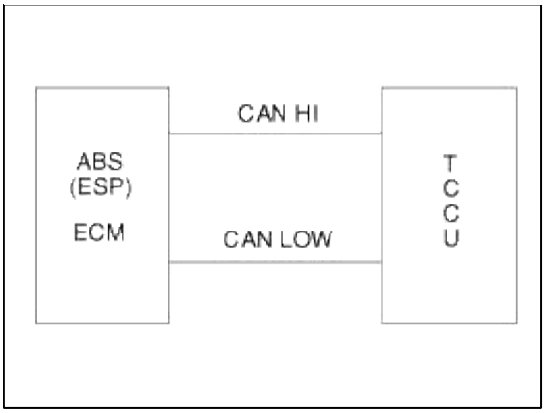
Transfer System > Transfer Case Assembly > Troubleshooting > P1766 -

COMPONENT LOCATION



GERNERAL DESCRIPTION

CAN communication is filled to permit the exchange of multiple signals between electronic control units through the use of two common data lines.



DTC DESCRIPTION

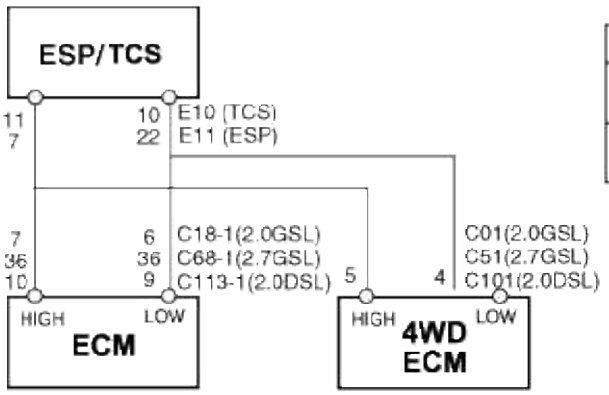
This failure code is set if CAN BUS ERROR on TCCU is continued for more than 1sec which is caused by poor contact on CAN BUS or the failure of ECM and ABS(ESP).

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Transmit error/loss of communication	• CAN Bus. • ABS MODULE,TCCU connector looseness and poor terminal to wire connection. • CAN comm line circuit open/short. • Faulty ECU. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• CAN transmit counter exceeds 255	
Diagnostic Time	•	
MIL on condition	•	
Fail Safe		

SCHEMATIC DIAGRAM

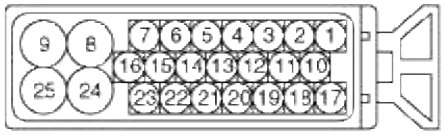
[Circuit Diagram]



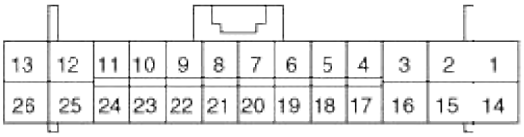
[Connection Information]

Terminal	Connection	Function
C01/C51/C101 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51/C101 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

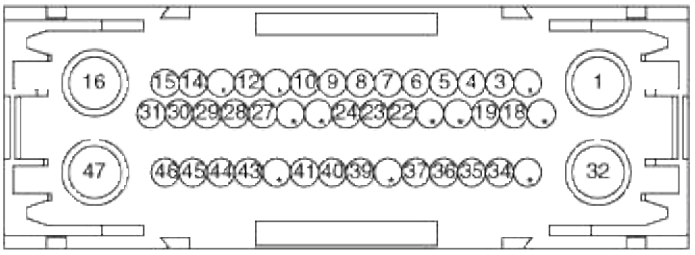
[Harness Connector]



E10(TCS)



C0*(2.0GSL)
C5*(2.7GSL)
C101(2.0DSL)



E11(ESP)

TERMINAL & 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

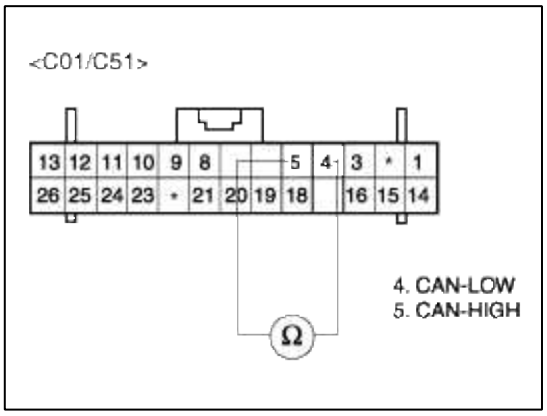
Go to " CANcomm. Line Inspection " procedure.

CAN(ECM-ITM)comm. Line Signal Inspection

1. Engine : ON.

2. Measure resistance between terminal "4" of the TCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is CAN(TCOMMUNICATIOM BUS OFF) Signal display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of Control module(ECU, ESP, ABS)
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

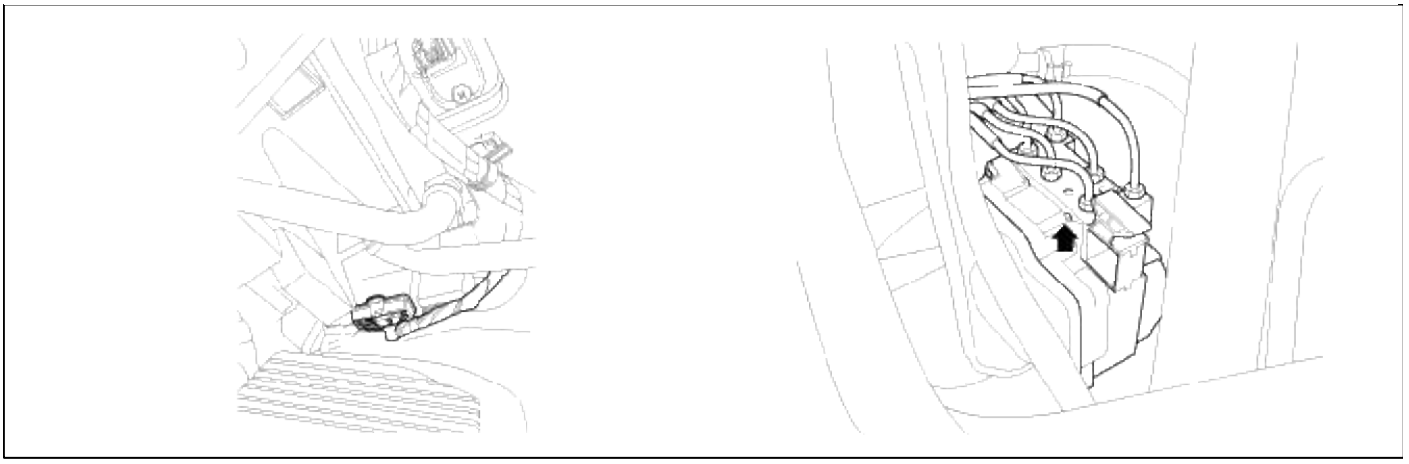
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

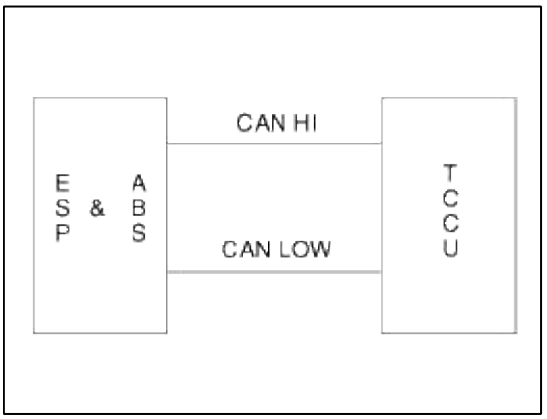
Transfer System > Transfer Case Assembly > Troubleshooting > P1767 -

COMPONENT LOCATION



GERNERAL DESCRIPTION

In case of the vehicle installed ESP & TCS(ABC CONTROL MODULE), ABS control module sends the wheel speed signal to 4WD(ECU) by CAN comunication after ABS control module recieves the wheel speed signal.



DTC DESCRIPTION

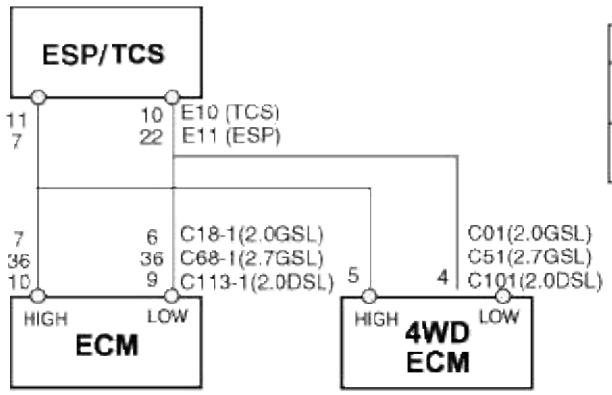
This failure code is related to the communication line between ESP(ABC CONTROL MODULE) and is set if CAN BUS ERROR that means wrong TCCU installation is continued for more than 1sec.

DTC DETECTING CONDITION

Item	Detecting Condition	Possible Cause
DTC Strategy	• Loss of Signal	• ABS Active. • ABS MODULE connector looseness and poor terminal to wire connection. • CAN comm line circuit open/short. • Faulty ABS MODULE. • Faulty TCCU.
Enable Conditions	• Ignition cycle required	
Threshold Value	• Loss of 0153H Message	
Diagnostic Time	•	
MIL on condition	• No Set	
Fail Safe		

SCHEMATIC DIAGRAM

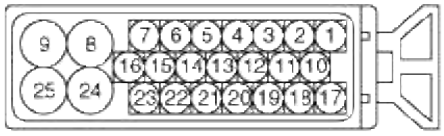
[Circuit Diagram]



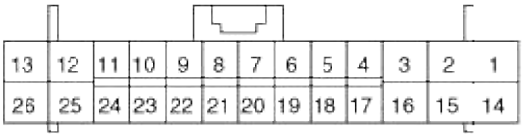
[Connection Information]

Terminal	Connection	Function
C01/C51/C101 NO.5	E10 NO.11	CAN Line(HIGH)
	E11 NO.7	
C01/C51/C101 NO.4	E10 NO.10	CAN Line(LOW)
	E11 NO.22	

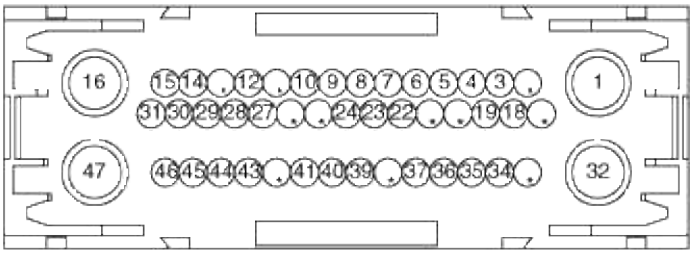
[Harness Connector]



E10(TCS)



C0*(2.0GSL)
C5*(2.7GSL)
C101(2.0DSL)



E11(ESP)

TERMINAL & 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

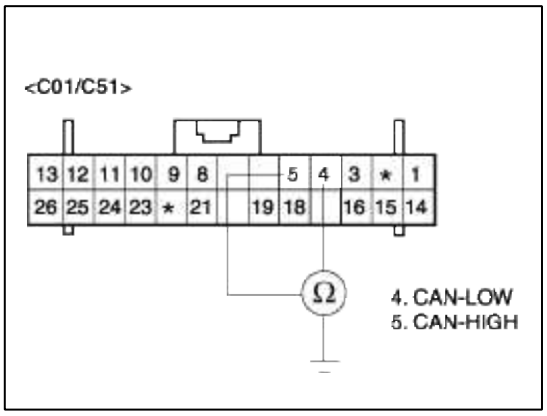
Go to " CAN(ABS ACTIVE SIGNAL)comm. Line Signal Inspection " procedure.

CAN(ABS ACTIVE SIGNAL)comm. Line Signal Inspection

1. Engine: ON

2. Measure resistance between terminal "4" of the TCCU harness connector and terminal "5" of the TCCU harness connector.

Specification : Approx. 60Ω



CAUTION

The above value is only for reference. The actual value may differ from it according to various engine condition.

3. Is CAN(ABS ACTIVE ERROR) Signal display near the specified value?

YES

Fault is intermittent caused by open or short in CAN signal harnessor was repaired and TCCU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

Check for open/short in CAN comunication line of TCCU circuit.
Check for the signal or component of ESP(ABS control module).
Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

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

YES

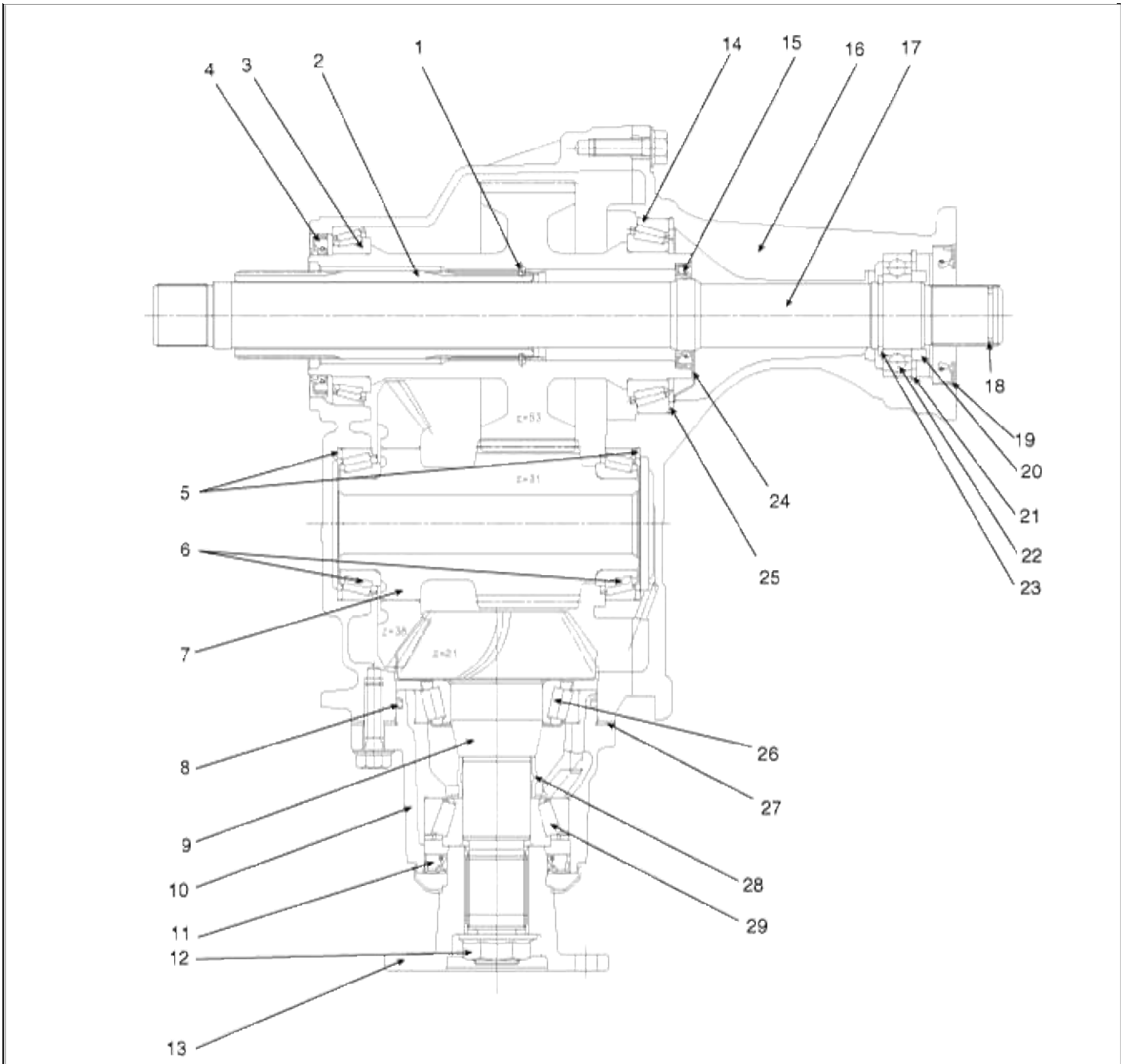
Go to the applicable troubleshooting procedure.

NO

System is performing to specification at this time .

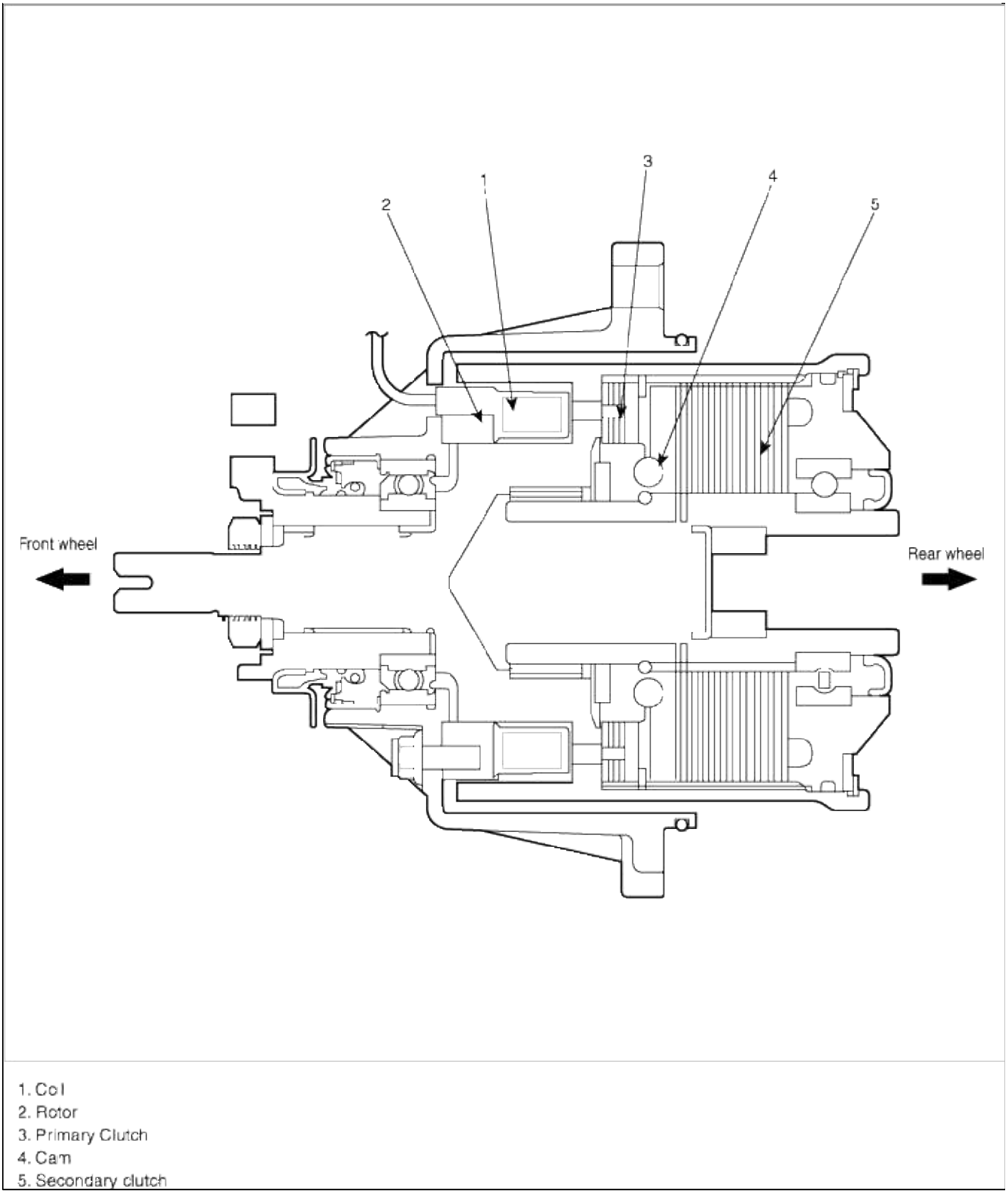
Transfer System > Transfer Case Assembly > Transfer Case > Components and Components Location (M5GF1)

COMPONENTS(1)



1. Circlp
2. Hollow shaft
3. Typer roller bearing
4. Oil seal
5. Spacer set
6. Typer roller bearing
7. Hypoid gear shaft asseembly
8. O-ring
9. Pinion shaft
10. Pinion case
11. Oil seal
12. Lock nut
13. Rear plange
14. Typer roller bearing
15. Oil seal
16. Transfer corver
17. Inner drive shaft
18. Circlip
19. Oil seal
20. Hoop ring
21. Snap ring
22. Ball bearing
23. Snap ring
24. Oil guide
25. Spacer set
26. Typer roller bearing
27. Spacer set
28. Collapsible spacer
29. Typer roller bearing

COMPONENTS(2)



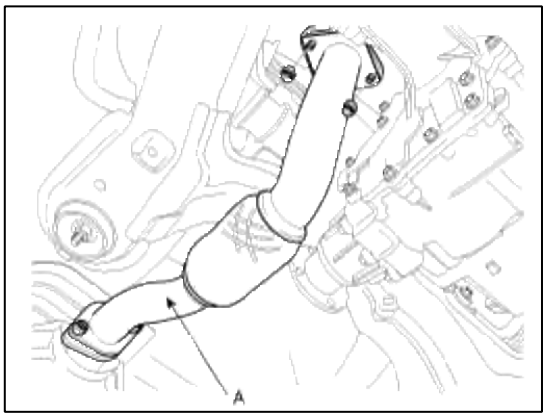
1. Coil
2. Rotor
3. Primary Clutch
4. Cam
5. Secondary clutch

Transfer System > Transfer Case Assembly > Transfer Case > Repair procedures (M5GF1)

REMOVAL

1. Remove the battery (-) terminal.
2. Lift up the vehicle.
3. Remove the propellar shaft (See 'DS' group-'PROPELLAR SHAFT')

4. Remove the front muffler(A).



5. Remove the RH driveshaft (See 'DS' group-'DRIVESHAFT').
6. Loosen the oil drain plug and drain the fluid.
7. After draining, re-tighten the oil drain plug.

Tightening torque:
39.2 ~ 58.8 Nm (400 ~ 600 kgf.cm, 28.9 ~ 43.4 lb-ft)

8. Support the transfer assembly with a jack.
9. Remove the transfer assembly by loosening the mounting bolts.

CAUTION

Remove the transfer bracket mounting bolts(2EA) together.

REPLACEMENT

TRANSFER OIL

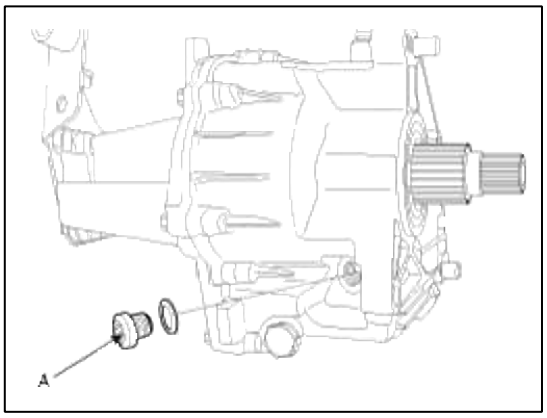
1. Replace the oil every 100,000km(62,137miles) in a general condition and every 40,000km(24,854miles) in severe usage conditions.

NOTE

1. Severe usage (marked '*') is defined as
1) Frequent driving on rough road (Bumpy road, gravel road, snowy road, unpaved road . Etc.)
2) Frequent driving on mountain road, ascent/descent.
3) Police, taxi, commercial type operation or trailer towing. Etc.)
2. Transfer & diff carrier lubricants should be changed anytime transfer & diff carrier have been submerged in water.

INSTALLATION

1. Remove the filler plug(A).



2. Refill the specification to the specified quantity.

Specification : SAE 80w/90
Quantity : 0.8L (0.8 US qt, 0.7 lmp qt)

3. Fix it in proper position with mounting bolts.

TRANSFER OIL

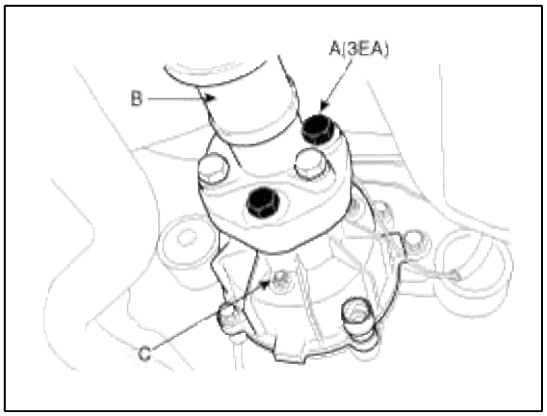
1. Check and replenish the transfer oil every 40,000km(24855 miles).

Transfer System > Transfer Case Assembly > Coupling Assembly > Repair procedures (M5GF1)

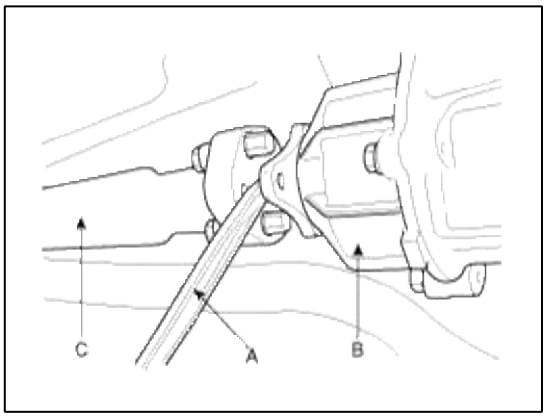
REMOVAL

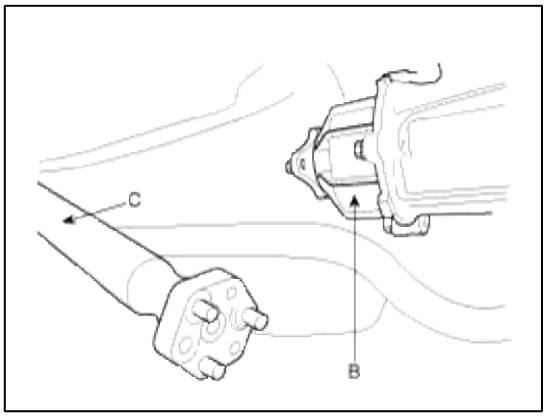
1. Remove the 4WD coupling bolts (A-3EA) mounted to the rear propellar shaft.

Tightening torque :
49.1~68.7N.m (5.0~7.0kgf.m, 36.2~50.6lb-ft)



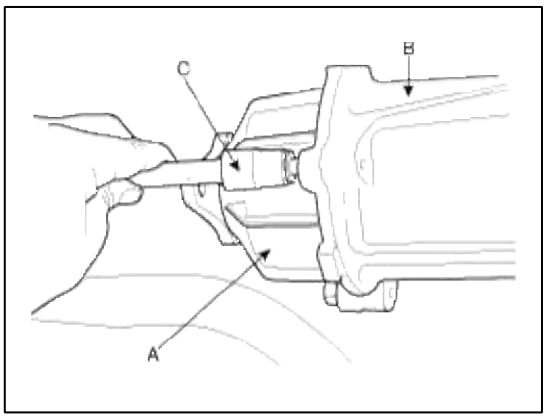
2. Using a flat tool(A), separate the propellar shaft(C) from 4WD coupling(B).



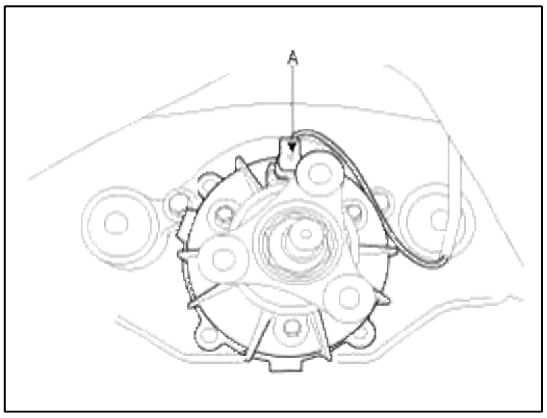


3. Remove the rear axle (B-Differential carrier) bolts mounted to the 4WD coupling(A) by a socket(C).

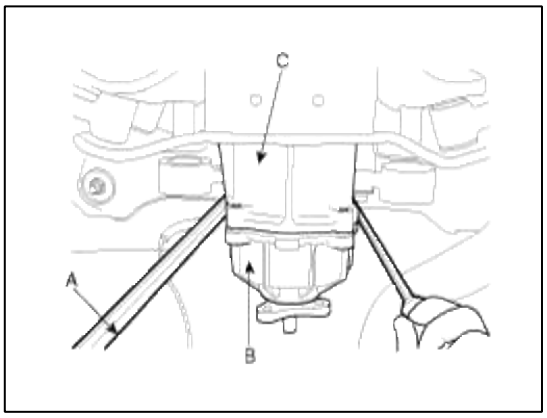
Tightening torque :
58.9~63.8N.m (6.0~6.5kgf.m, 43.4~47.0lb-ft)



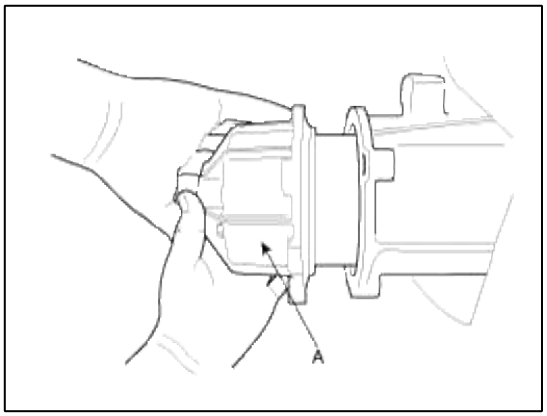
4. Remove the electric magnetic clutch connector(A).



5. Using a flat tool(A), separate the 4WD coupling assembly(B) from the rear differential carrier(C).



6. Remove the 4WD coupling assembly(A).



INSTALLATION

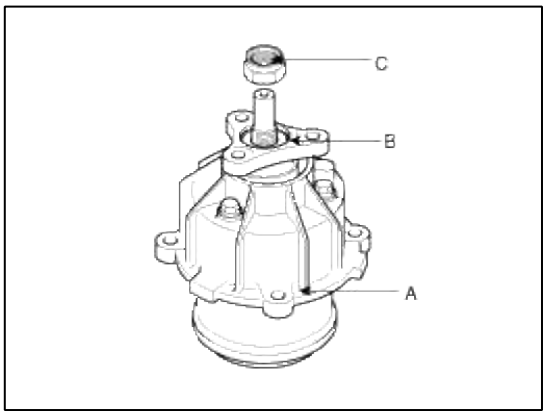
Installation is the reverse of the removal.

DISASSEMBLY

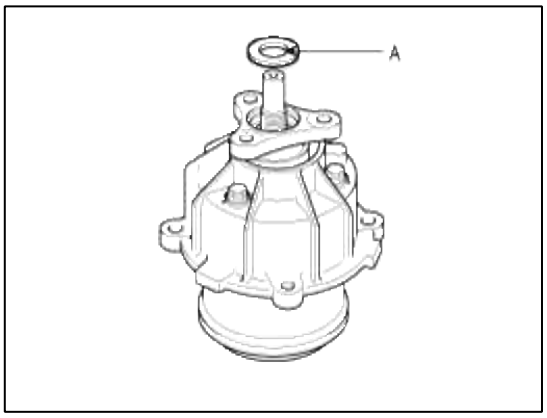
CAUTION

Don't disassemble the coupling assembly more than bleow procedure because its performance may get bad influence after disassembling.

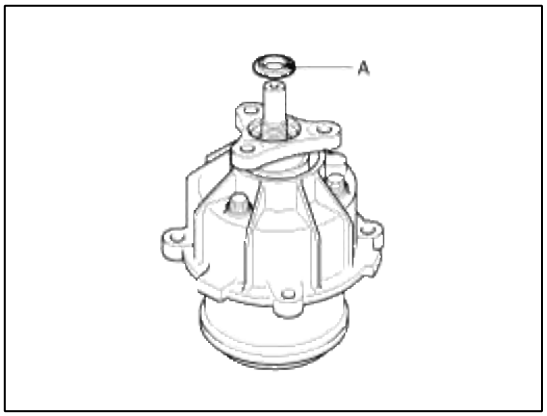
1. Remove the coupling(A) flange(B) mounting nut(C).



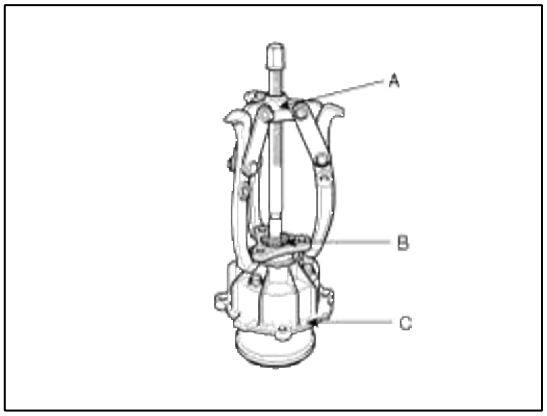
2. Remove the flange spacer(A).



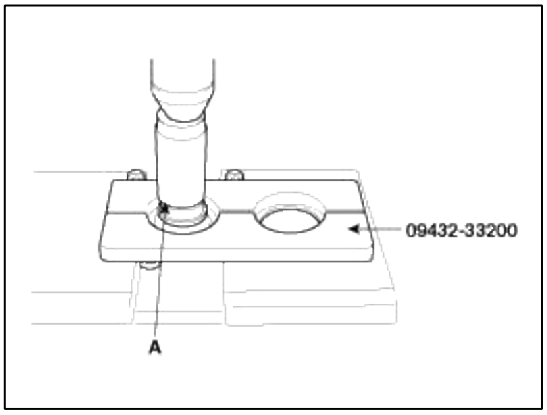
3. Remove the coupling flange oil seal(A).



4. Using a general tool, 3-way puller(A), remove the flange assembly(B) from the coupling(C).



5. Remove the flange oil seal(A) using special tool (09432-33200).



6. Remove the coupling case assembly(A).