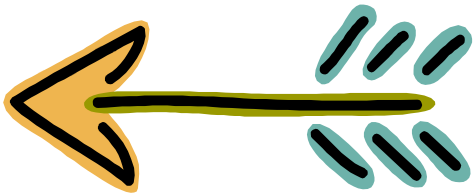
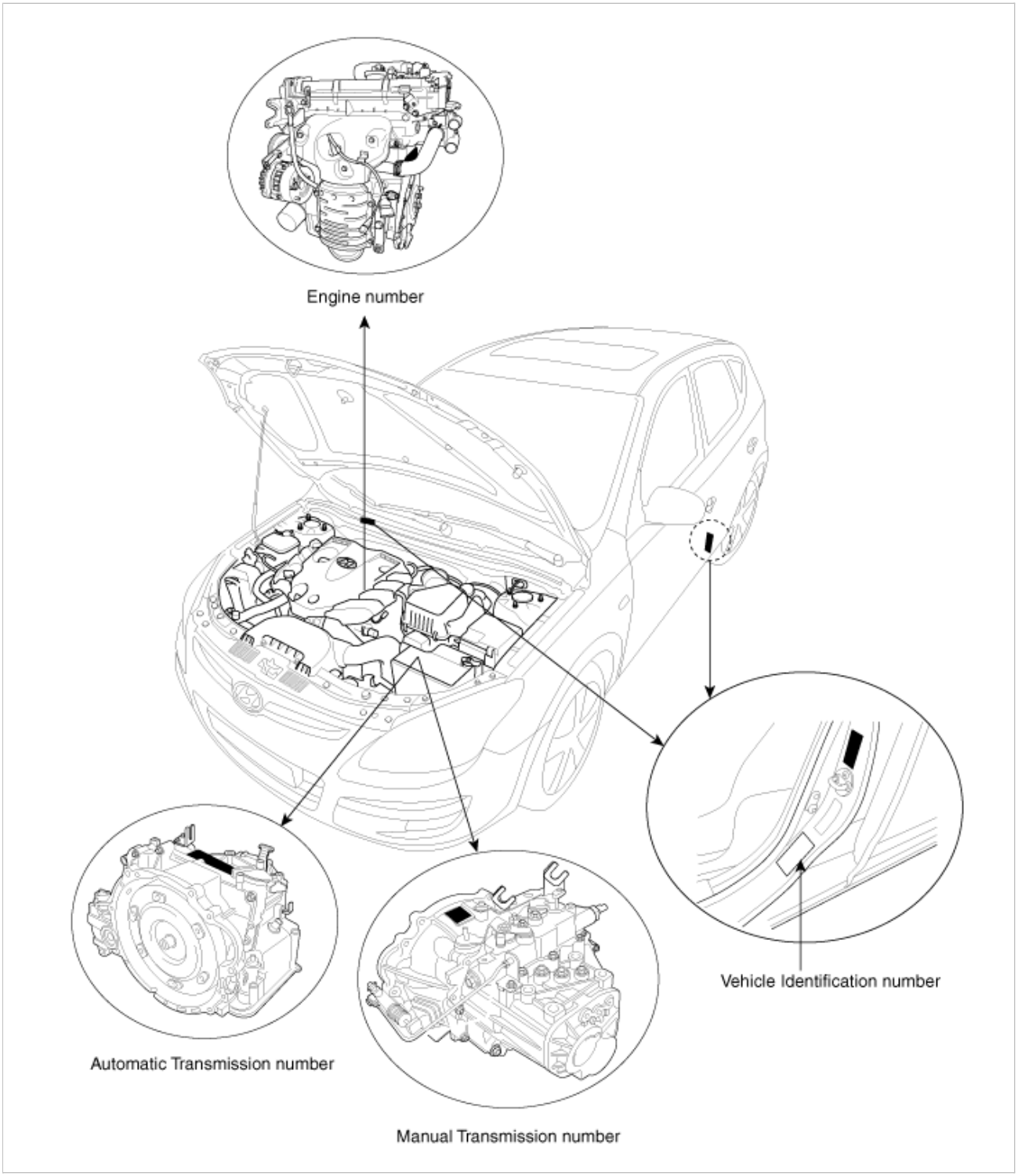
To open the menu
please click on the icon
near the top left
of this page.



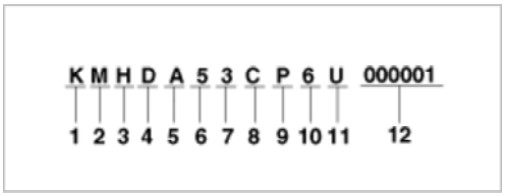
To find keywords
Enter the word in the “Find”
Or “Search” box at the top.

Identification Number Locations



Identification Number Description

Vehicle Identification Number



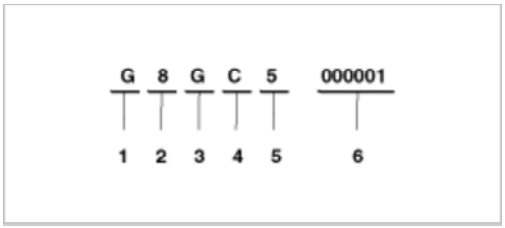
1. Geographic zone
   - K : Korea
2. Manufacturer
   - M : Hyundai motor company
3. Vehicle type
   - H : Passenger
4. Vehicle line
   - D : FD
5. Model & Series
   - A : STANDAD (L)
   - B : DELUXE (GL)
   - C : SUPER DELUXE (GLS)
6. Body type
   - 4 : Sedan, 4 Door
   - 5 : Sedan, 5 Door
   - 8 : Wagon
7. Restraint system
   - 3 : Drive Side : active belt & airbag,
   Passenger side : active belt or passive belt
   - 4 : Both Sides : active belt & airbag.
   - 5 : Depowered : airbag.
   - 6 : Advanced airbag or depowered airbag with suspension
8. Engine type
   - E : Gasoline 2.0 DOHC
9. Check digit
   - Check digit : 0 ~ 9, x
   - P : Left hand driver
   - R : Right hand driver
10. Production year
    - 7 : 2007, 8 : 2008, 9 : 2009
11. Plant of production
    - U : Ulsan (Korea)
12. Vehicle production sequence number
    - 000001 ~ 999999

Paint Code

Code	Color
7F	Crystal White
2R	Continental Silver
9A	Steel Gray
9D	Moonlight blue
JA	Shine Red
2X	Indigo Blue
9F	Stone Black
BV	Vivid Blue
KF (FA01)	Gold Metalic
ND (FA03)	Ember Red

QU (FA07)	Champagne Silver
WC (FA06)	Mocha Brown

Engine Identification Number



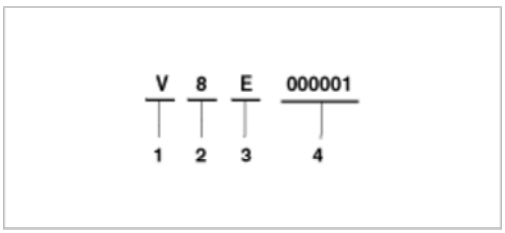
1. Engine fuel
   - G : Gasoline
2. Engine range
   - 4 : 4 cycle 4 cylinder

3 - 4. Engine development order and capacity
   - GC : β engine, 1975cc (Gasoline)

5. Production year
   - 6 : 2006, 7 : 2007, 8 : 2008, 9 : 2009
6. Engine production sequence number
   - 000001 ~ 999999

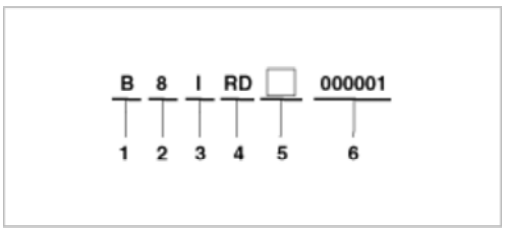
Transmission Identification Number

Manual



1. Model
   - V : M5CF2
2. Production year
   - 7 : 2007, 8 : 2008, 9 : 2009
3. Gear ratio
   - E : 4.188
4. Transaxle production sequence number
   - 000001 ~ 999999

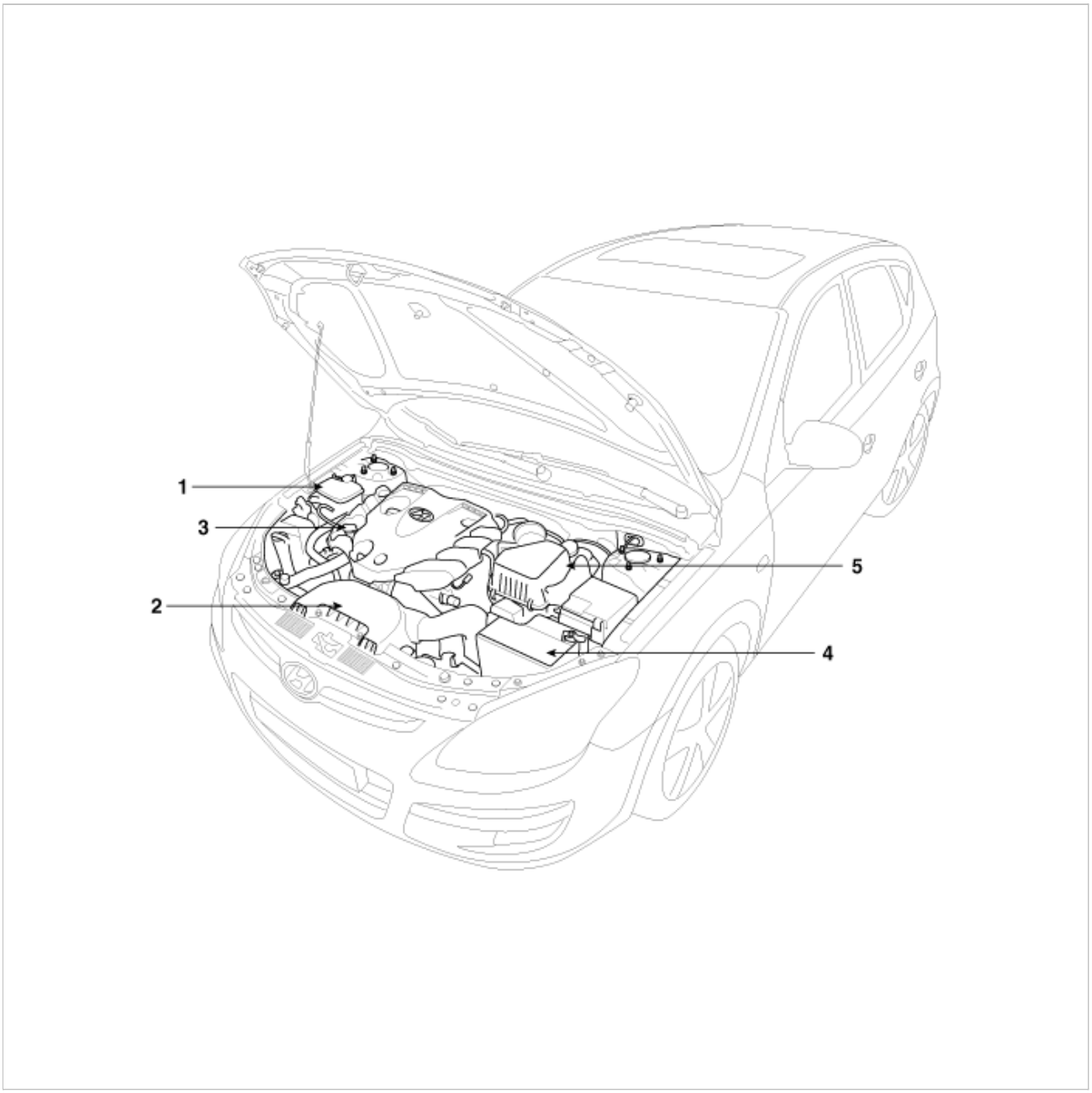
Automatic



1. Model
   - B : A4CF2
2. Production year
   - 7 : 2007, 8 : 2008, 9 : 2009
3. Gear ratio
   - I = 4.121
4. Detailed chassification
   - RU/RD : β - 2.0

5. Spare
6. Transaxle production sequence number
   - 000001 ~ 999999

Warning / Caution Label Locations



1. Coolant Level Caution 2. Fan Caution 3. Radiator Cap Caution	4. Battery Caution 5. Air Cleaner Caution

Battery Caution Label Describtion

Warning / Caution Label (Cont'd)

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

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

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

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

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

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

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

Handling And Storage The Battery

Battery Itself	• Batteries should be stored in cool, dry (27 degrees Celsius) places and out of direct sunlight. • MF batteries are tightly sealed to prevent acid leakage. However, tilting the battery to an angle of 45 degrees can cause acid to leak

	through the vents on the sides. Therefore, batteries should always be stored in their upright positions. Prevent placing any aqueous or solid (i.e. conductors) bodies on top of the battery. • It is extremely dangerous to use tools, such as hammers, on the battery terminals when connecting cables to the mounted battery.
Battery on Vehicle	• When storing the vehicle for long periods of time, make sure to remove the memory fuse at junction box to prevent natural discharging. • Also, run the engine for battery charging within 1 month if the memory fuse wasn't removed from the start of vehicle storing. If the memory fuse was removed, run the engine for battery charging within 3 months from the start of vehicle storing.

NOTE

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

Lift And Support Points

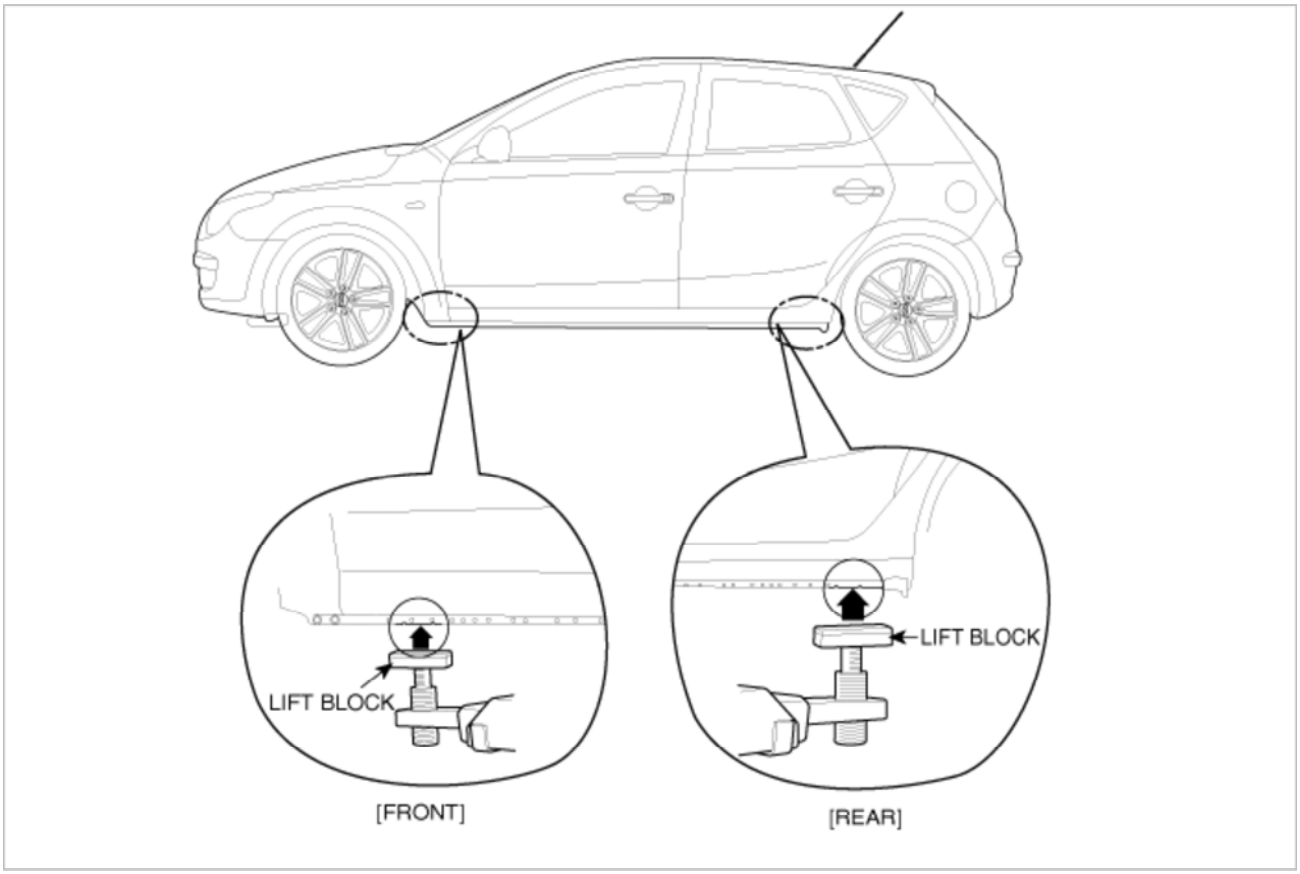
WARNING

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

NOTE

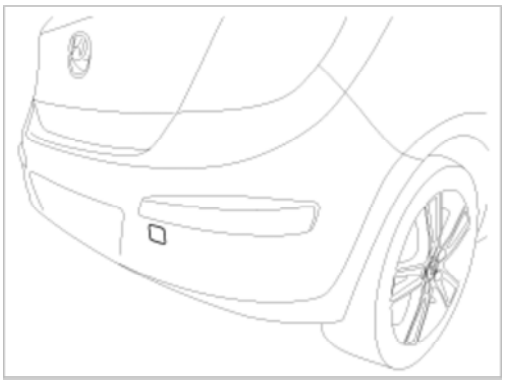
- Since each tire/wheel assembly weights approximately 30lbs (14kg), placing the front wheels in the luggage area can assist with the weight distribution.
- Use the same support points to support the vehicle on safety stands.

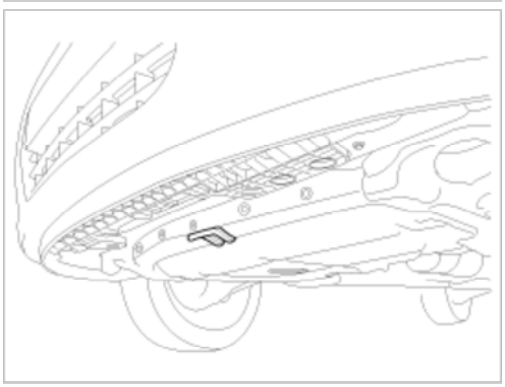
1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches (centimeters) and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height to inspect the lift points for secure support.



Towing

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





Emergency Towing

There are three popular methods of towing a vehicle :

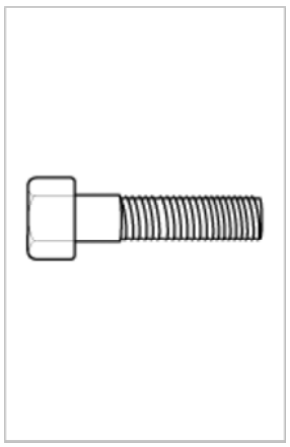
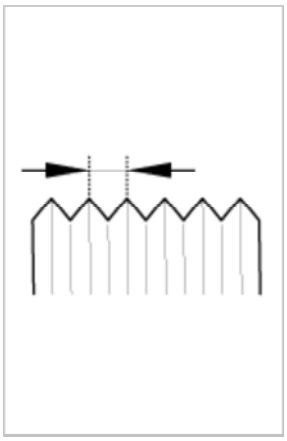
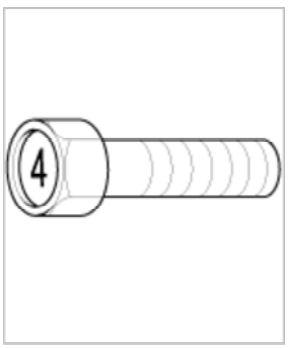
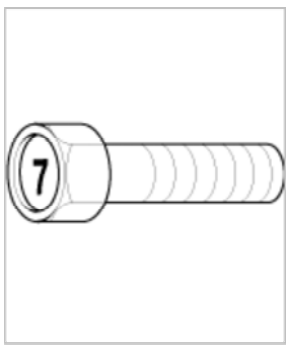
- The operator loads the vehicle on the back of truck. This is best way of transporting the vehicle.
- The tow truck uses two pivoting arms that go under the tires (front or rear) and lift them off the ground. The other two wheels remain on the ground.

- The tow truck uses metal cables with hooks on the ends. These hooks go around parts of the frame or suspension, and the cables lift that end of the vehicle off the ground. The vehicle's suspension and body can be seriously damaged if this method of towing is attempted.
If the vehicle cannot be transported by flat-bed, 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 the following :
Manual Transmission
  • Release the parking brake.
  • Shift the transmission to neutral
Automatic Transmission
  • Release the parking brake.
  • Start the engine.
  • Shift to [D] position, then [N] position.
  • Turn off the engine.

CAUTION

- Improper towing preparation will damage the transmission. Follow the above procedure exactly. If you cannot shift the transmission or start the engine(automatic transmission), your vehicle must be transported on a flatbed.
- It is the best to tow vehicle no farther than 19miles (30km), and keep the speed below 30mph (50km/h).
- Trying to lift or tow your vehicle by the bumpers will cause serious damage. The bumpers are not designed to support the vehicle's weight.

Tightening Torque Table Of Standartd Parts

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

		~ 240)	~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

NOTE

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

Lubricants

Recommended Lubricants

Parts		Oil & Grease Standard
Engine Oil	Gasoline 2.0 (G4GC)	Above API SJ or SL, Above ILSAC GF3
Transaxle	Manual (M5CF2)	SAE 75W/85 API GL-4 TGO-7(MS517-14) ZIC G-F TOP 75W/85 HD GEAR OIL XLS 75W/85
	Auto (A4CF2)	DIAMOND ATF SP-III, SK ATF SP-III
Brake fluid		DOT 3 or DOT 4

WARNING

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

Lubricants Capacities

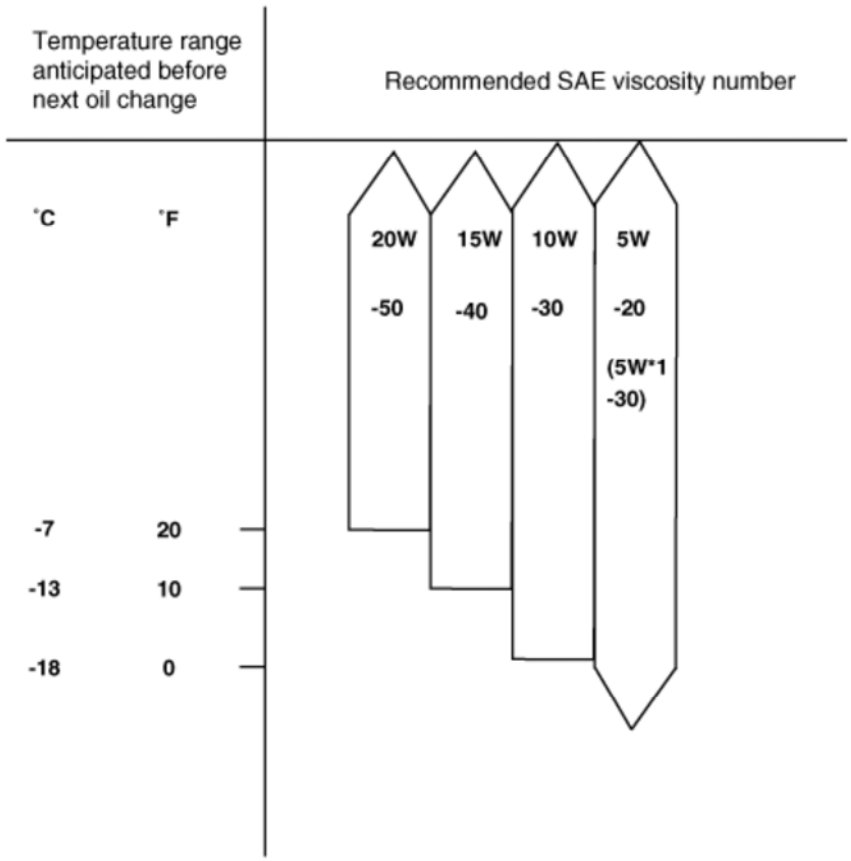
Description		2.0 (G4GC)
Engine oil	Total	4.1 (4.33, 3.60)
	Oil pan	3.7 (3.91, 3.26)
	Drain and refill including oil filter	4.0 (4.23, 3.52)
Cooling system		6.2~6.3 (6.55~6.66, 5.46~5.54)
Manual transaxle	M5CF2	2.0 (2.11, 1.76)
Automatic transaxle	A4CF2	6.6 (6.97, 5.81)

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

Selection Of Engine Oil

RECOMMENDED API CLASSIFICATION : SJ OR SL ABOVE - 2.0 (GASOLINE)

Recommended SAE viscosity grades :



*1 If 5W-20 GF3 engine oil is not available, 5W-30 GF3 or secondary recommended engine oil for corresponding temperature range can be used.

NOTE

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

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

Lubricants which do not have both an SAE grade number and an 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

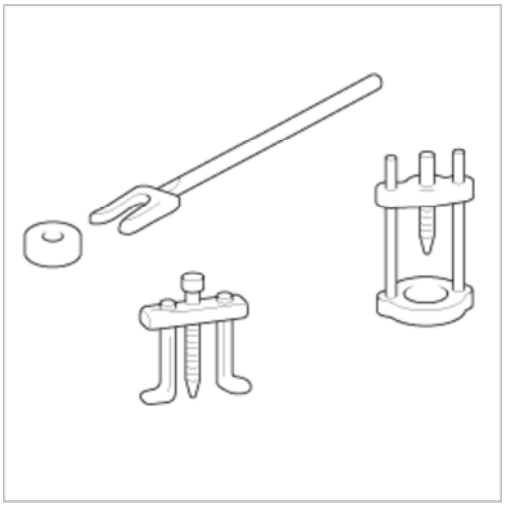
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched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

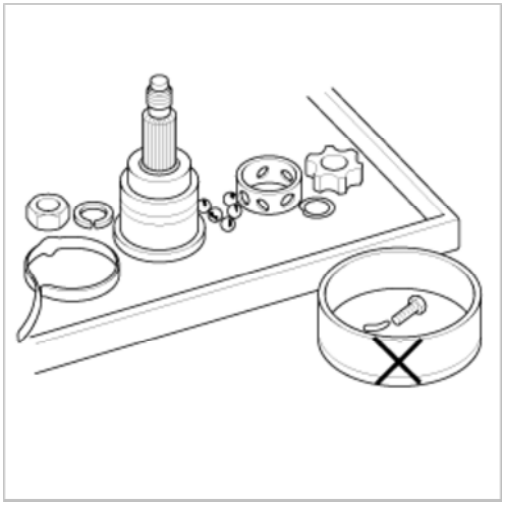
First find the cause of the problem and then determine whether removal or disassembly before starting the job.

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

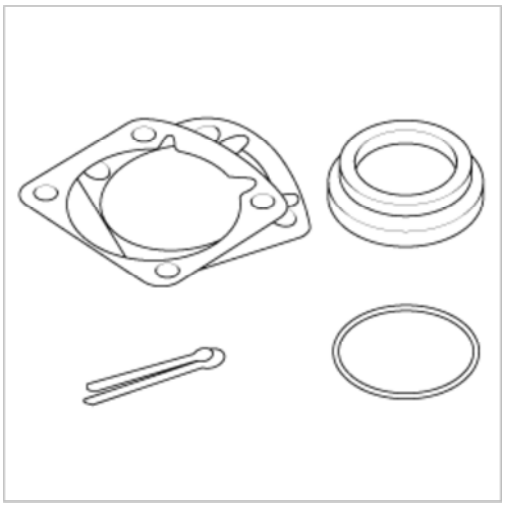
When replacing parts, use HYUNDAI genuine parts.

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.

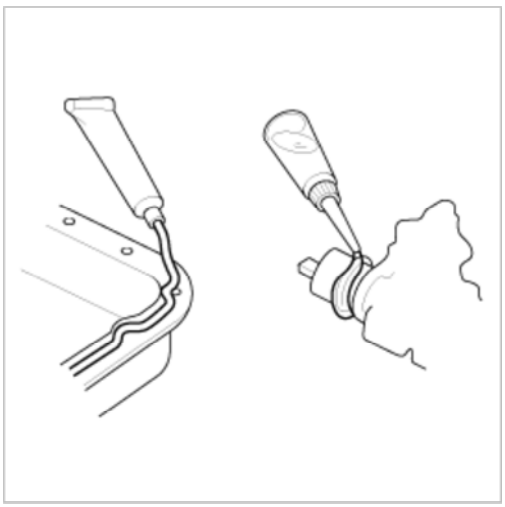
1. Oil seals
2. Gaskets

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.

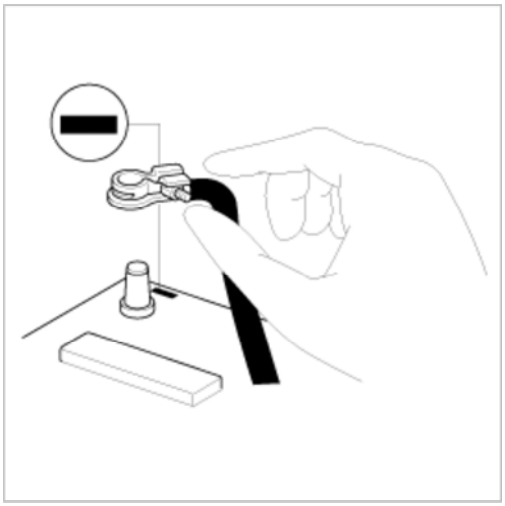


Adjustment

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.



Ruber Parts And Tubes

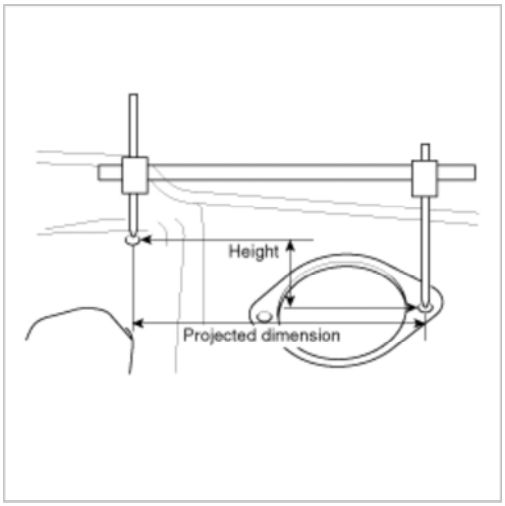
Always prevent gasoline or from touching rubber parts or tubing.

Measuring Body Dimensiongs

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

Dimensions Projected

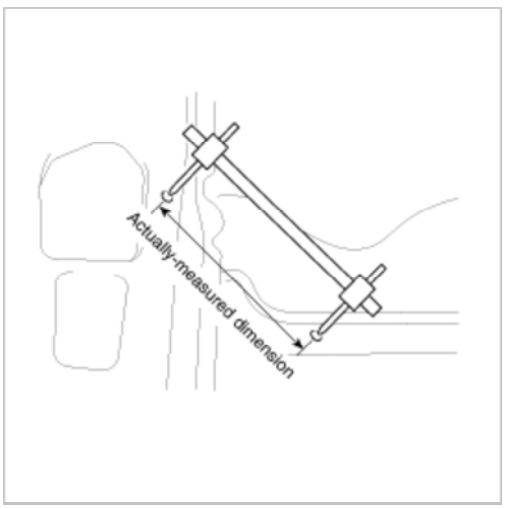
1. These are the dimensions measured when the measurement points are projected from the vehicle's surface, and are the reference dimensions used for used for body alterations.
2. If the length of the tracking gauge probes is adjustable, measure it by lengthening one of two probes as long as the different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



Measuring Actual Dimensions

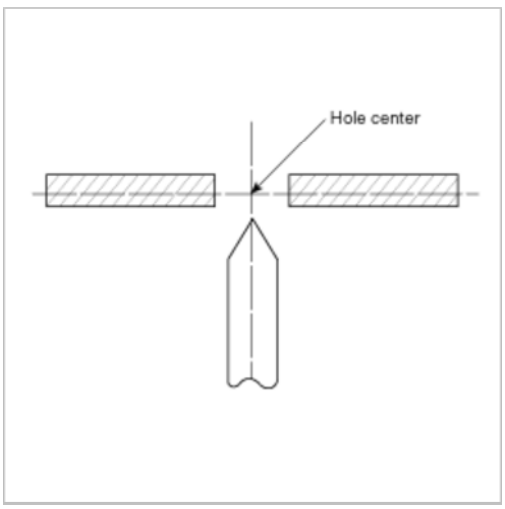
1. These dimensions indicate the actual linear distance between mesaurement points, and are used as the reference dimensions when a tracking gauge is used for measurement.
2. First adjust both probes to the same length (A=A') before measurement.

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



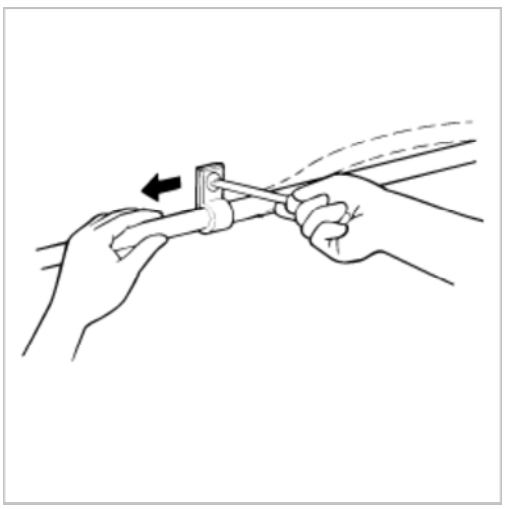
Measurement Point

Measurements should be taken at the center fo the hole.



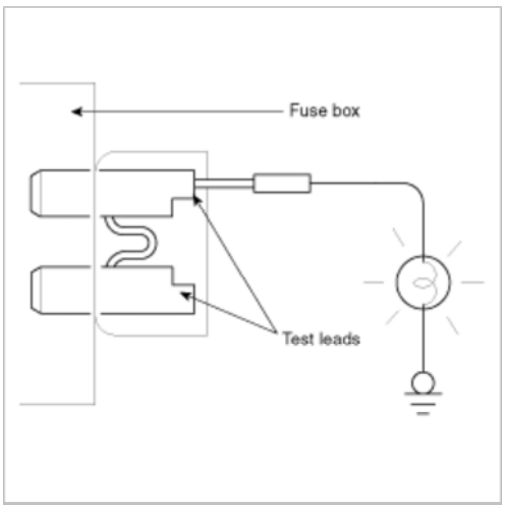
Checking Cables And Wires

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)

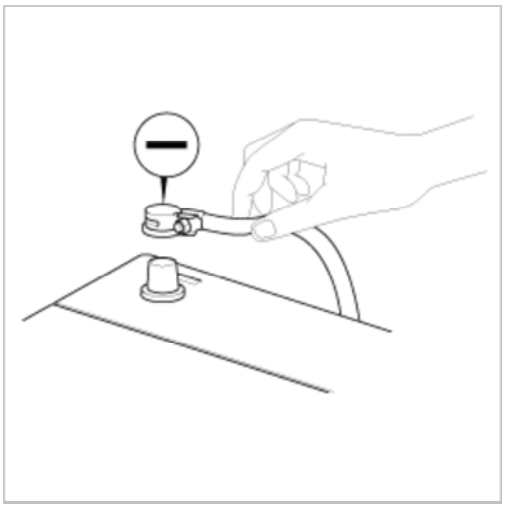


Serivicing The Electrical System

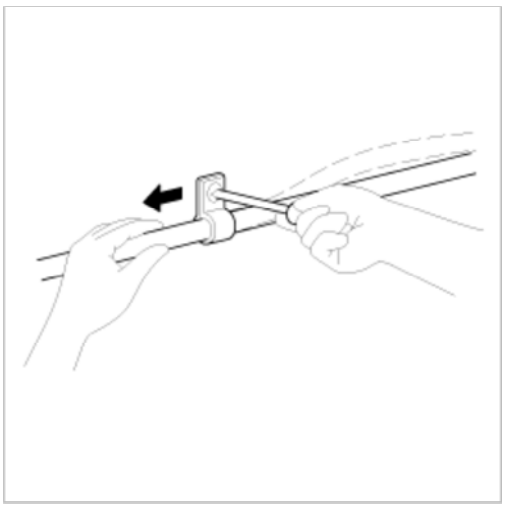
1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

> NOTE
>
> In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code

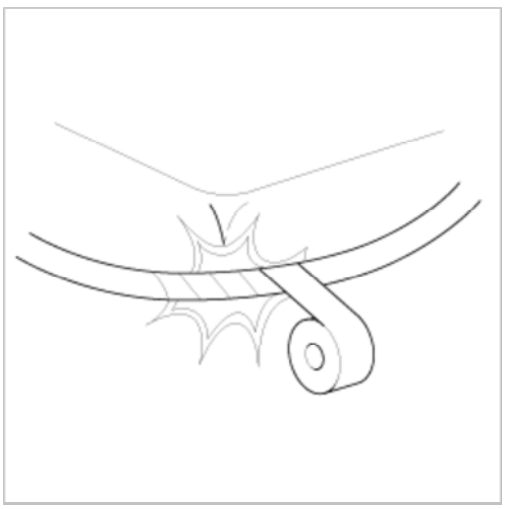
retained by the computer will be cleared. There fore, if necessary, record the diagnostic data before removing the battery cable.



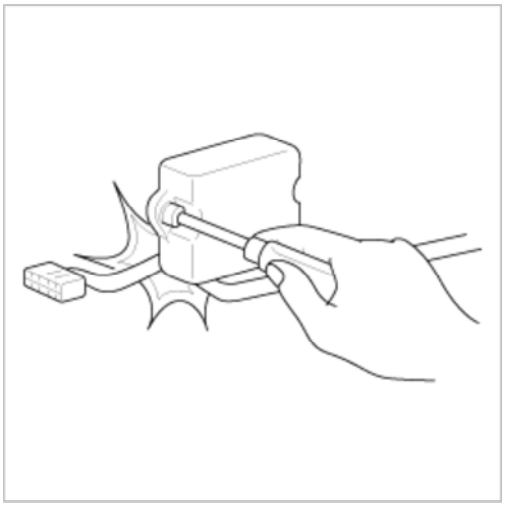
2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surronding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

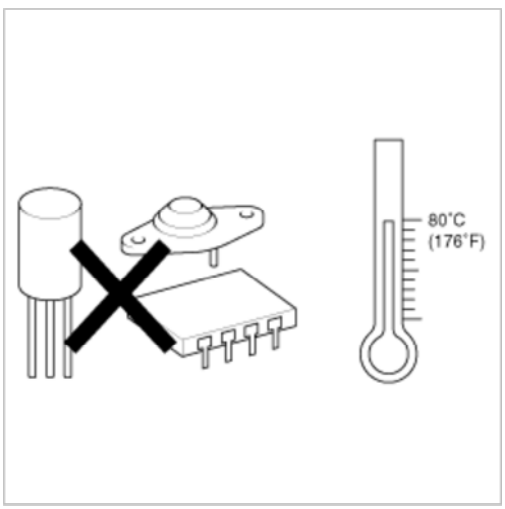


4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



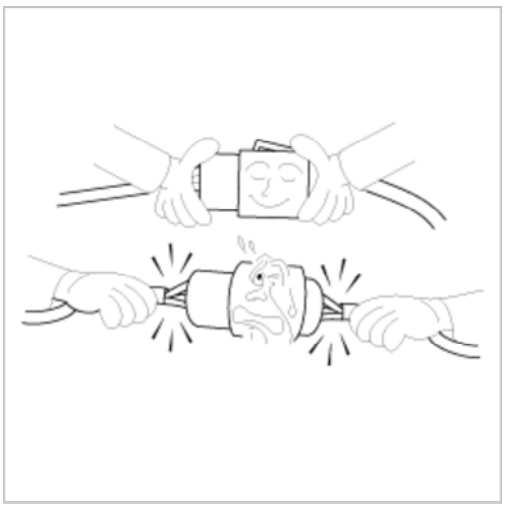
5. Never throw relays, sensors or electrical parts, or expose them to strong shock.

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.

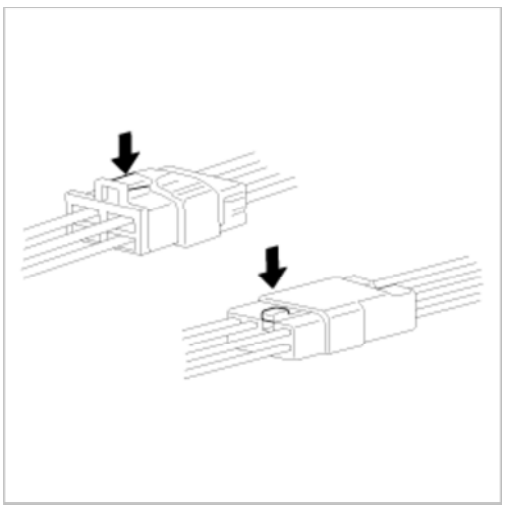


7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.

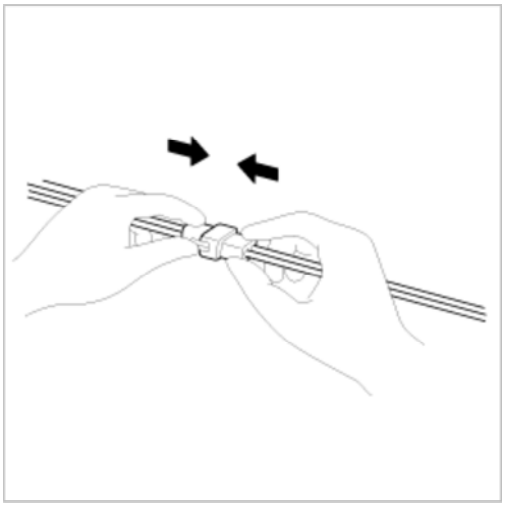
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



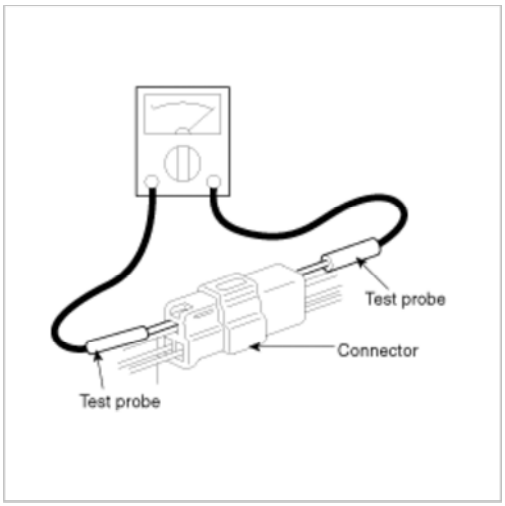
9. Disconnect connector which have catches by pressing in the direction of the arrows shown the illustration.



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

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

10minutes and idle speed for more than 20 minutes.

3. Do not measure engine compression for an extended time. Engine compression tests must be made as rapidly as possible. Remove the fuel pump relay before performing a compression test.
4. Do not dispose of used catalytic converter together with parts contaminated with gasoline or oil.

Specifications

Description		Specifications	Limit
General			
Type		In-line, Double Overhead Camshaft	
Number of cylinder		4	
Bore		82mm (3.228in)	
Stroke		93.5mm (3.681in)	
Total displacement		1975cc (120.52cu.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	Opens	BBDC 42°	
	Closes	ATDC 6°	
Valve			
Valve length	Intake	114.34mm (4.5016in)	
	Exhaust	116.8mm (4.598in)	
Stem outer diameter	Intake	5.965 ~ 5.98mm (0.2348 ~ 0.2354in)	
	Exhaust	5.950 ~ 5.965mm (0.2343 ~ 0.2348in)	
Face angle thickness of valve head (Margin)			
Intake		1.6±0.15mm (0.0630±0.0059in)	0.8mm (0.031in)
Exhaust		1.8±0.15mm (0.0709±0.0059in)	1.0mm (0.039in)
Valve stem to valve guide clearance			
Intake		0.02 ~ 0.05mm (0.0008 ~ 0.0019in)	0.10mm (0.0039in)
Exhaust		0.035 ~ 0.065mm (0.0014 ~ 0.0026in)	0.13mm(0.0051in)
Valve guide			
Installed dimension outer diameter	Intake	45.8~46.2mm (1.8031~1.8189in)	
	Exhaust	52.8~53.2mm (2.0787~2.0945in)	
Service oversize		0.05, 0.25, 0.50mm (0.002, 0.010, 0.020in) oversize	
Valve seat			
Width of seat contact	Intake	1.1 ~ 1.5mm (0.043 ~ 0.059in)	
	Exhaust	1.3 ~ 1.7mm (0.051 ~ 0.066in)	
Oversize		0.3, 0.6mm (0.012, 0.024in) oversize	
Valve spring			
Free length		48.86mm (1.9236in)	
Load		18.8k±0.9kg/39.0mm(41.4±2.0lb/1.5354in) 41.0±1.5kg/30.5mm(90.4±3.3lb/1.2008in)	
Squarences		1.5° or less	
Valve clearance			
Cold (20°C[68°F])	Intake	0.20mm (0.0079in)	0.17~0.23mm (0.0067~0.0091in)

	Exhaust	0.28mm (0.0110in)	0.25~0.31mm (0.0098~0.0122in)
Hot (80°C[176°F]) : only for reference	Intake	0.29mm (0.0114in)	
	Exhaust	0.34mm (0.0134in)	
Cylinder head			
Flatness of gasket surface		Max. 0.03mm (0.0012in)	0.06mm(0.0024in)
Flatness of manifold mounting surface		Max. 0.15mm (0.0059in)	0.03mm(0.0012in)
Oversize rework dimensions of valve seat hole			
Intake	0.3mm (0.012in) O.S.	33.300 ~ 33.325mm (1.3110 ~ 1.3120in)	
	0.6mm (0.024in) O.S.	33.600 ~ 33.625mm (1.3228 ~ 1.3238in)	
Exhaust	0.3mm (0.012in) O.S.	28.800 ~ 28.821mm (1.1338 ~ 1.1346in)	
	0.6mm (0.024in) O.S.	29.100 ~ 29.121mm (1.1456 ~ 1.1465in)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)			
0.05mm (0.002in) O.S		11.05 ~ 11.068mm (0.435 ~ 0.4357in)	
0.25mm (0.010in) O.S		11.25 ~ 11.268mm (0.443 ~ 0.4436in)	
0.50mm (0.020in) O.S		11.50 ~ 11.518mm (0.453 ~ 0.4535in)	
Cylinder block			
Cylinder bore		82.00 ~ 82.03mm (3.2283 ~ 3.2295in)	
Out-of-round and taper of cylinder bore		Less than 0.01mm (0.0004in)	
Clearance with piston (To set limits to new parts)		0.02 ~ 0.04mm (0.0008 ~ 0.0016in)	
Piston			
Outer diameter (To set limits to new parts)		81.97 ~ 82.00mm (3.2271 ~ 3.2283in)	
Service oversize		0.25, 0.50mm (0.010, 0.020in) oversize	
Piston ring			
Side clearance	No.1	0.04 ~ 0.08mm (0.0015 ~ 0.0031in)	0.1mm (0.004in)
	No.2	0.03 ~ 0.07mm (0.0012 ~ 0.0027in)	
End gap	No.1	0.20 ~ 0.35mm (0.0079 ~ 0.0138in)	1mm (0.039in)
	No.2	0.37 ~ 0.52mm (0.0146 ~ 0.0205in)	1mm (0.039in)
Oil ring side rail		0.20 ~ 0.60mm (0.0078 ~ 0.0236in)	1mm (0.039in)
Service oversize		0.25, 0.50mm (0.010, 0.020in.) oversize	
Piston pin			
Outer diameter		20.001 ~ 20.006mm (0.7874 ~ 0.7876in)	
Hole inner diameter		20.016 ~ 20.021mm (0.7880 ~ 0.7882in)	
Hole clearance		0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end inner diameter		19.974 ~ 19.985mm (0.7864 ~ 0.7868in)	
Connecting rod			
Bend		0.05mm (0.0020in) or less	
Twist		0.1mm (0.004in) or less	
Connecting rod big end to crankshaft side clearance		0.100 ~ 0.250mm (0.0039 ~ 0.010in)	0.4mm(0.0157in)
Connecting rod bearing			
Oil clearance (To seat limits to new parts)		0.024 ~ 0.042mm (0.0009 ~ 0.0017in)	
Undersize		0.25mm (0.01in)	

Camshaft			
Cam height	Intake	44.618mm (1.7566in)	44.518mm(1.7527in)
	Exhaust	44.518mm (1.7527in)	44.418mm (1.7487in)
Journal outer diameter		28mm (1.1023in)	
Bearing oil clearance		0.02 ~ 0.061mm (0.0008 ~ 0.0024in)	0.1mm(0.0039in)
End play		0.1 ~ 0.2mm (0.0040 ~ 0.0079in)	
Crankshaft			
Pin outer diameter		44.946 ~ 44.966mm (1.7695 ~ 1.7703in)	
Journal outer diameter		56.942 ~ 56.962mm (2.2418 ~ 2.2426in)	
Bend		0.03mm (0.0012in) or less	
Out-of-round, taper of journal and pin		0.01mm (0.0004in) or less	0.030mm (0.0012in)
End play		0.06 ~ 0.260mm (0.0023 ~ 0.010in)	
Undersize rework dimension of pin	0.25mm (0.010in)	44.725 ~ 44.740mm (1.7608 ~ 1.7614in)	
Undersize rework dimension of journal	0.25mm (0.010in)	56.727 ~ 56.742mm (2.2333 ~ 2.2339in)	
Crankshaft bearing			
Oil clearance		0.028 ~ 0.046mm (0.0011 ~ 0.0018in)	
Flywheel			
Runout		0.1mm (0.0039in)	0.13mm(0.0051in)
Cooling method		Water-cooled, pressurized. Forced circulation with electrical fan	
Coolant			
Quantity		6.2~6.3liter (6.55~6.66U.S qts, 5.46~5.54Imp.qts)	
Radiator			
Type		Pressurized corrugated fin type	
Radiator cap			
Main valve opening pressure		93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi)	
Vacuum valve opening pressure		MAX. 6.86 kpa(0.07kg/cm², 1.00 psi)	
Thermostat			
Type		Wax pellet type with jiggle valve	
Valve opening temperature		82°C (177°F)	
Valve closing temperature		77°C (170.6°F)	
Full-opening temperature		95°C (201°F)	
Coolant pump		Centrifugal type impeller	
Drive belt			
Type		V-ribbed belt	
Engine coolant temperature sensor			
Type		Heat-sensitive thermistor type	
Resistance		2.31 ~ 2.59kΩ at 20°C (68°F) 0.3222kΩ at 80°C (176°F)	
Oil pump			
Clearance between outer circumference and front case.		0.120 ~ 0.185mm (0.0049 ~ 0.0073in)	
Front case tip clearance		0.025 ~ 0.069mm (0.0009 ~ 0.0027in)	
Side clearance			

Inner gear		0.04 ~ 0.085mm (0.0016 ~ 0.0033in)	
Outer gear		0.04 ~ 0.09mm (0.0016 ~ 0.0035in)	
Engine oil pressure at 1500 RPM [Oil temperature is 90 to 110°C 194 to 230°F)]		245KPa (2.5kg/cm², 35.5psi)	
Engine oil			
Oil quantity(Total)		4.1L (4.33US qt, 3.60lmp.qt)	When replacing a short engine or block assembly
Oil quantity(Oil pan)		3.7L (3.91US qt, 3.26lmp.qt)	When replacing an oil pan only
Oil quantity(Drain and refill including oil filter)		4.0L (4.23US qt, 3.52lmp.qt)	
Oil quality	Except for Europe	Above API SJ or SL, Above ILSAC GF3	
	For Europe	Above API SL, Above ACEA A3	
Relief spring			
Free height		43.8mm (1.725in.)	
Load		3.7kg at 40.1mm (3.15lb/1.578in)	
Air cleaner			
Type		Dry type	
Element		Unwoven cloth type	
Exhaust pipe			
Muffler		Expansion resonance type	
Suspension system		Rubber hangers	

Service Standrds

Standard value	
Antifreeze	Maxture ratio of anti-freeze in coolant
Ethylene glycol base for aluminum	50%

Tightening Torques

Item	Nm	kgf.m	lb-ft
Cylinder Block			
Front engine support bracket bolt and nut	34.3 ~ 49.0	3.5 ~ 5.0	25.3 ~ 36.2
Front roll stopper bracket bolt	68.6 ~ 88.3	7.0 ~ 9.0	50.6 ~ 65.1
Rear roll stopper bracket bolt	68.6 ~ 88.3	7.0 ~ 9.0	50.6 ~ 65.1
Rear engine stopper bracket bolt	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Engine Mounting			
Right mounting insulator (large) nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Right mounting insulator (small) nut	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Right mounting bracket to engine nuts and bolts	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transmission mount insulator nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Transmission insulator bracket to side member bolt	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Rear roll stopper insulator nut	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Rear roll stopper bracket to center member bolts	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Front roll stopper insulator nut	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Front roll stopper bracket to center member bolts.	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Main Moving			

Connecting rod cap nut	49.0 ~ 52.0	5.0 ~ 5.3	36.2 ~ 38.3
Crankshaft bearing cap bolt	27.5~31.4 + (60°~64°)	2.8~3.2 + (60°~64°)	20.3~23.1 + (60°~64°)
Fly wheel M/T bolt	117.7 ~ 127.5	12.0 ~ 13.0	86.8 ~ 94.0
Drive plate A/T bolt	117.7 ~ 127.5	12.0 ~ 13.0	86.8 ~ 94.0
Engine cover	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Heat protector	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~14.5
Water pipe bracket bolts	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Cooling system			
Alternator support bolt and nut	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1
Alternator lock bolt	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Alternator brance mounting bolt	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Coolant pump pulley bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Coolant pump bolts	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Coolant temperature sensor	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Coolant inlet fitting nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Thermostat housing bolts and nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Lubrication system			
Oil filter	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Oil pan bolts	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug (Aluminum)	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Oil pan drain plug (Steel)	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Oil screen bolts	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~15.9
Oil pressure switch	12.7 ~ 14.7	1.3 ~ 1.5	9.4 ~10.8
Intake and Exhaust system			
Air cleaner body mounting bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Intake manifold to cylinder head nuts and bolts	15.7 ~ 22.6	1.6 ~ 2.3	11.6 ~ 16.6
Intake manifold stay to cylinder block bolts	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Throttle body to surge tank nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Exhaust manifold to cylinder head nuts	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Exhaust manifold cover to exhaust manifold bolts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Oxygen sensor to front muffler	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Oxygen sensor to exhaust manifold	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Front exhaust pipe to exhaust manifold nuts	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front exhaust pipe bracket bolts	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front exhaust pipe to catalytic converter bolts	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Main muffler hanger support bracket bolts	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.8
Cylinder head			
Cylinder head bolts - M10	22.6~26.5+(60°~65°)+ (60°~65°)	2.3~2.7 + (60°~65°)+ (60°~65°)	16.6~19.5+(60°~65°)+ (60°~65°)
Cylinder head bolts - M12	27.5~31.4+(60°~65°) + (60°~65°)	2.8~3.2 + (60°~65°)+ (60°~65°)	20.3~33.1+(60°~65°)+ (60°~65°)
Intake manifold nuts	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Exhaust manifold nuts	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Cylinder head cover bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Camshaft bearing cap bolts	13.7 ~ 14.7	1.4 ~ 1.5	10.1 ~ 10.8
Oil control valve bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7

OCV Filter	40.2 ~ 50.0	4.1 ~ 5.1	29.7 ~ 36.9
CVVT unit to exhaust camshaft bolt	64.7 ~ 76.5	6.6 ~ 7.8	47.7~ 56.4
Rear plate bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Timing Belt			
Crankshaft pulley bolt	156.9 ~ 166.7	16.0 ~ 17.0	115.7 ~ 123.0
Camshaft sprocket bolt	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Timing belt auto tensioner bolts	22.6 ~ 28.4	2.3 ~ 2.9	16.6 ~ 21.0
Timing belt cover bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Front case bolts	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Timing belt idler bolt	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8

Engine Mechanical System > General Information > Repair procedures

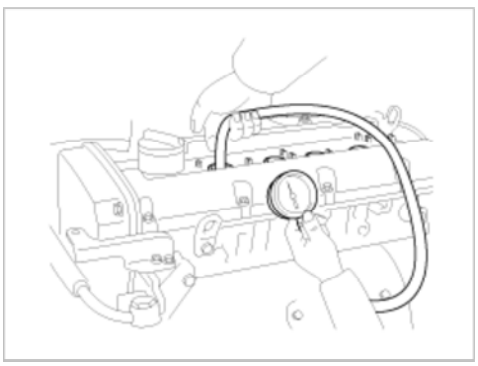
Inspection

Compression Pressure

NOTE

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

1. Warm up and stop engine.
   Allow the engine to warm up to normal operating temperature.
2. Remove ignition coils.
3. Remove spark plugs.
   Using a 16mm plug wrench, remove the 4 spark plugs.
4. Check cylinder compression pressure
   A. Insert a compression gauge into the spark plug hole.



   B. Fully open the throttle.
   C. while cranking the engine, measure the compression pressure.

NOTE

Always use a fully charged battery to obtain engine speed of 250 rpm or more.

   D. Repeat steps (a) through (c) for each cylinder.

NOTE

This measurement must be done in as short a time as possible.

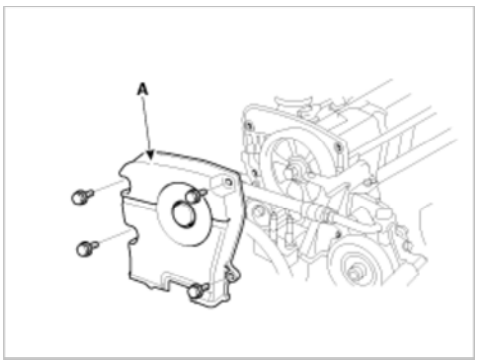
Compression pressure :
1421.96kPa (14.5kgf/cm², 206.24psi)
Minimum pressure :
1274.86kPa (13.0kgf/cm², 184.90psi)
Difference between each cylinder :
98.07kPa (1.0kgf/cm², 14.22psi) or less

E. 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 steps (a) through (c) for cylinders with low compression.
   - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
   - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. Reinstall spark plugs.
6. Install ignition coils.

Timing Belt Tension Adjustment

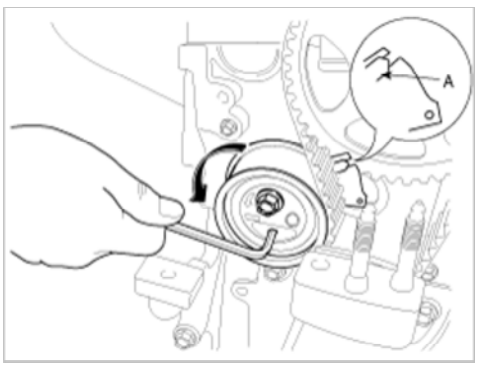
1. Remove the engine cover.
2. Remove RH front wheel.
3. Remove the 4bolts and timing belt upper cover (A).



4. 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)

5. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm(A) located at the center of the base notch.



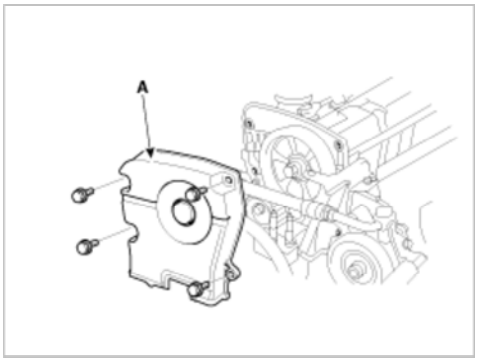
> CAUTION
>
> Do not rotate the adjuster clockwise.
> It will result in auto tensioner's functional problem.

6. 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)

7. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
8. If the indicator is not located at the center of base, slacken the bolt and repeat the above procedure.
9. Install the timing belt upper cover (A).

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



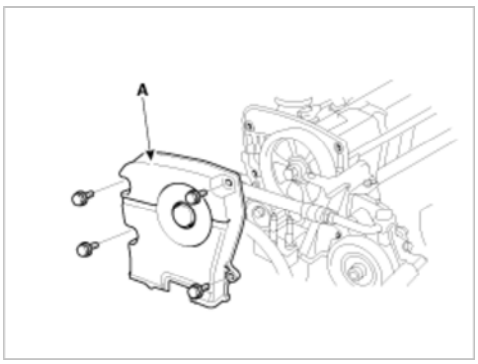
10. Install RH front wheel.
11. Install the engine cover.

Valve Clearance Inspection And Adjustment

MLA (Mechanical Lash Adjuster)

> NOTE
>
> Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C) and cylinder head is installed on the cylinder block.

1. Remove the engine cover.
2. Remove the upper timing belt cover (A).

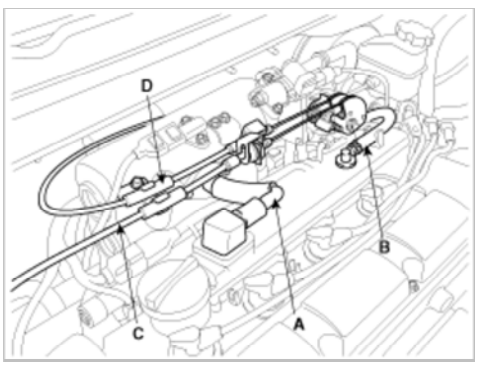


A. Loosen the upper timing cover bolts and then remove the cover.

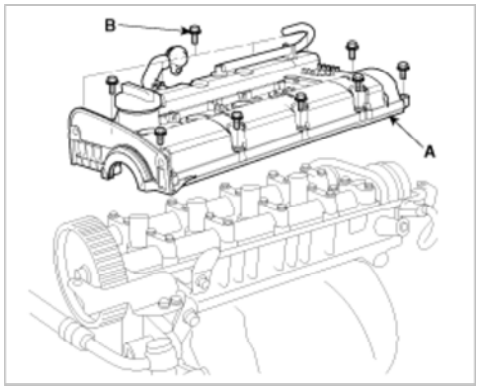
3. Remove the cylinder head cover.
   (1) Disconnect the spark plug cables and do not pull on the spark plug by force.

   > NOTE
   >
   > Pulling on or bending the cables may damage the connductor inside.

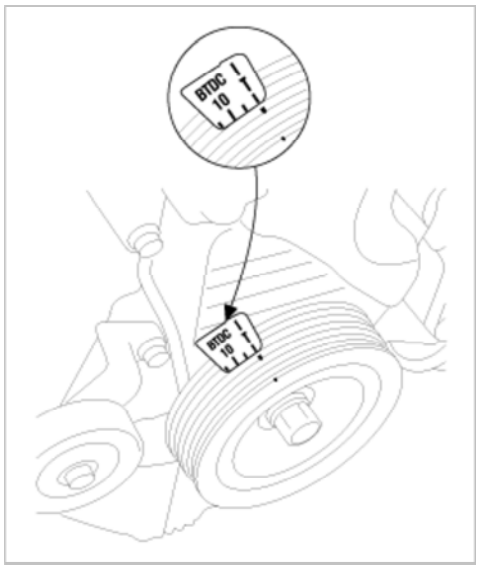
   (2) Disconnect the P.C.V hose (A) and the breather hose (B) from the cylinder head cover.
   (3) Disconnect the accelerater cable (C) and the auto-cruise cable(D) from the cylinder head cover.



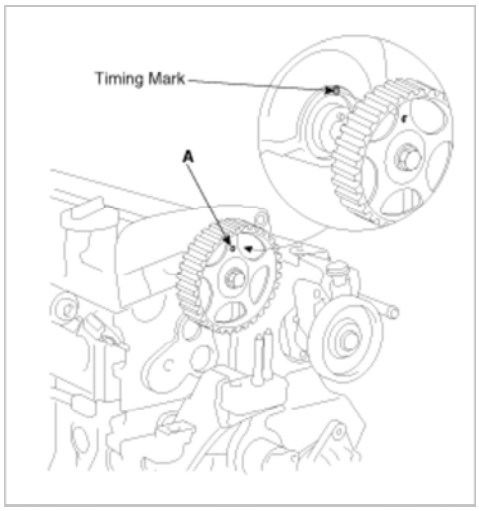
   (4) Loosen the cylinder head cover bolts (B) and then remove the cover (A) and gasket.



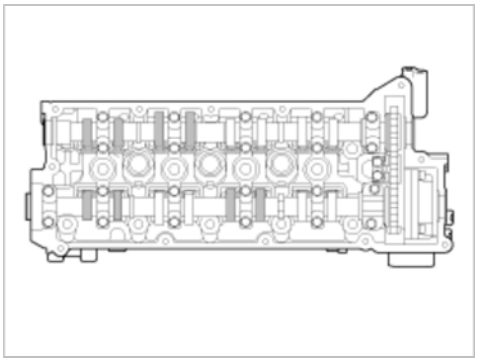
4. Set No. 1 cylinder to TDC/compression.
   (1) Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing belt cover.



   (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.



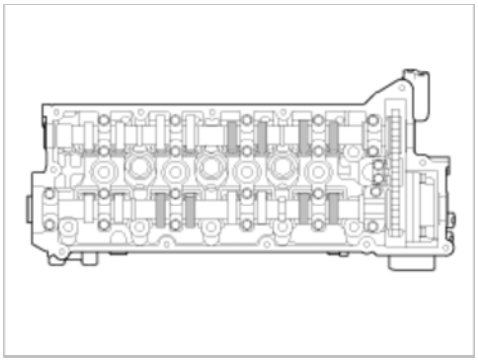
A. Using a thickness gauge, measure the clearance between the tappe shim and the base circle of camshaft.

B. Record the out-of-specification valve clearance measurements. They will be used later to determine the required replaement adjusing shim.

Valve clearance
Specitication
Engine coolant temperature : 20°C [68°F]
Intake : 0.20mm (0.0079in.)
Exhaust : 0.28mm (0.0110in.)
Engine coolant temperature : 80°C [176°F]
Intake : 0.29mm (0.0114in.)
Exhaust : 0.34mm (0.0134in.)
Limit
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.091in.)
Exhaust : 0.25 ~ 0.31mm (0.0098 ~ 0.0122in.)

(2) Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing belt cover.

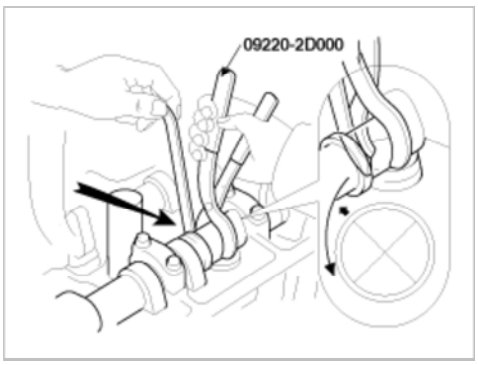
(3) Check only valves indicated as shown. [NO. 4 cylinder : TDC/compression]. Measure the valve clearance. (See procedure in step (6))



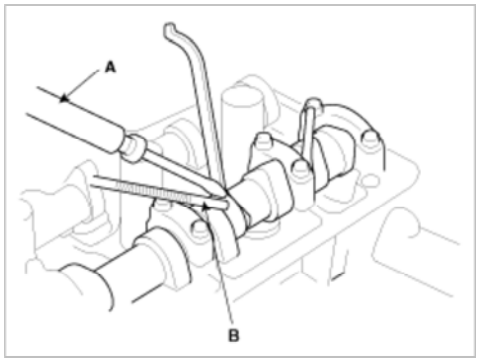
6. Adjust the intake and exhaust valve clearance.

(1) Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.

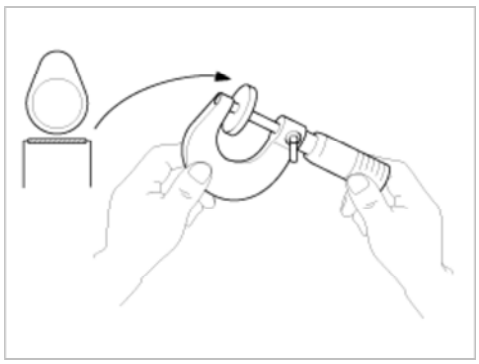
(2) Using the SST(09220 - 2D000), press down the valve lifter and place the stopper between the camshaft and valve lifter and remove the special tool.



(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 specificified value.

Valve clearance (Engine coolant temperature : 20°C)
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 caculated value. [Refer to the Adjusting shim selection chart]

NOTE

Shims are available in 20size increments of 0.04mm (0.0016in.) from 2.00mm (0.079in.) to 2.76mm (0.1087in.)

(7) Place a new adjusting shim on the valve lifter.

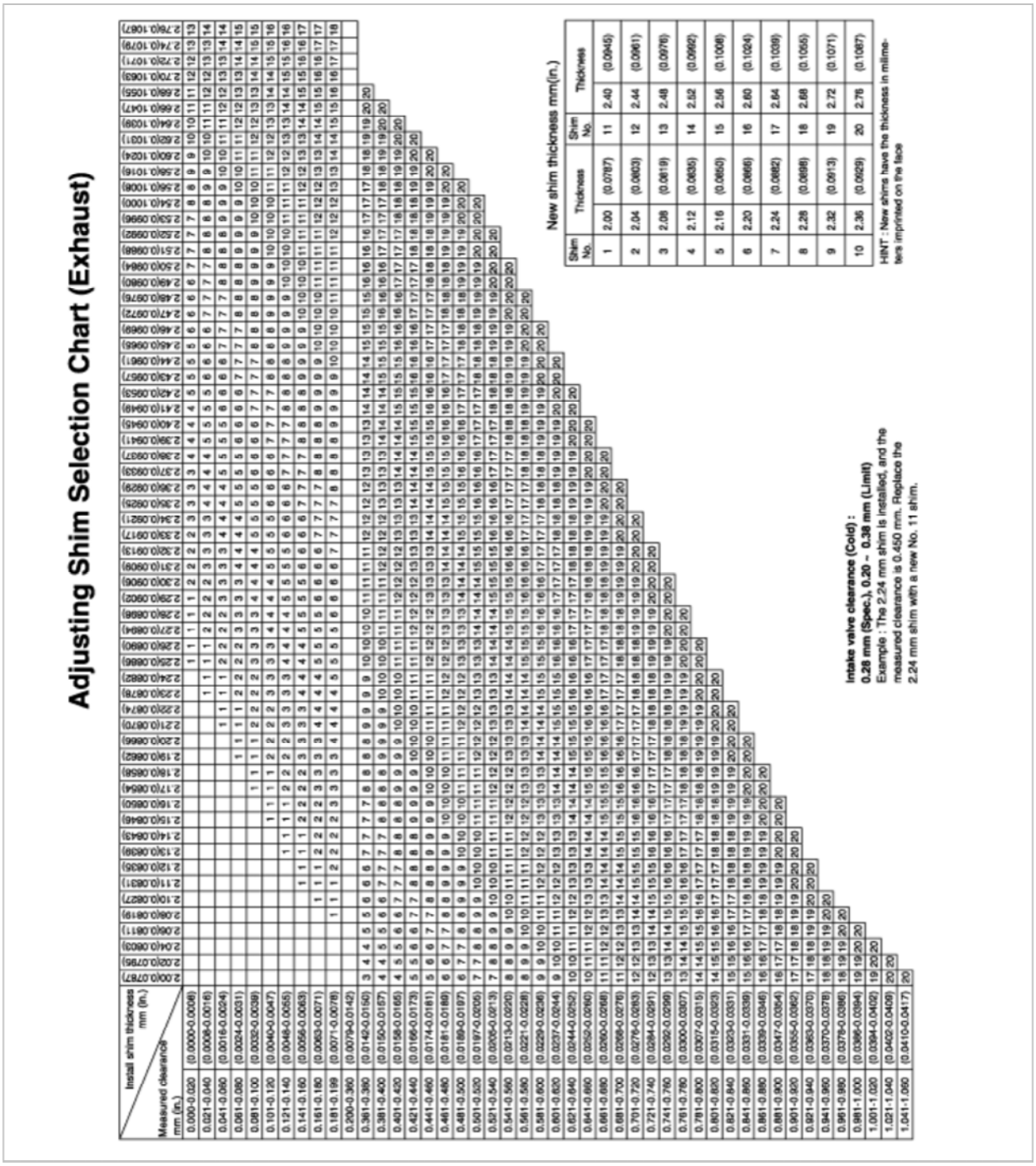
(8) Using the SST(09220 - 2D000), press down the valve lifter and remove the stopper.

(9) Recheck the valve clearance.

Valve clearance (Engine coolant temperature : 20°C)
[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 (Intake)

| Measured clearance mm (in.) \ Install shim thickness mm (in.) | 2.00 (0.0787) | 2.02 (0.0795) | 2.04 (0.0803) | 2.06 (0.0811) | 2.08 (0.0819) | 2.10 (0.0827) | 2.11 (0.0831) | 2.12 (0.0835) | 2.13 (0.0839) | 2.14 (0.0843) | 2.15 (0.0846) | 2.16 (0.0850) | 2.17 (0.0854) | 2.18 (0.0858) | 2.19 (0.0862) | 2.20 (0.0866) | 2.21 (0.0870) | 2.22 (0.0874) | 2.23 (0.0878) | 2.24 (0.0882) | 2.25 (0.0886) | 2.26 (0.0890) | 2.27 (0.0894) | 2.28 (0.0898) | 2.29 (0.0902) | 2.30 (0.0906) | 2.31 (0.0909) | 2.32 (0.0913) | 2.33 (0.0917) | 2.34 (0.0921) | 2.35 (0.0925) | 2.36 (0.0929) | 2.37 (0.0933) | 2.38 (0.0937) | 2.39 (0.0941) | 2.40 (0.0945) | 2.41 (0.0949) | 2.42 (0.0953) | 2.43 (0.0957) | 2.44 (0.0961) | 2.45 (0.0965) | 2.46 (0.0969) | 2.47 (0.0972) | 2.48 (0.0976) | 2.49 (0.0980) | 2.50 (0.0984) | 2.51 (0.0988) | 2.52 (0.0992) | 2.53 (0.0996) | 2.54 (0.1000) | 2.56 (0.1006) | 2.58 (0.1016) | 2.6 (0.1024) | 2.62 (0.1031) | 2.64 (0.1039) | 2.66 (0.1047) | 2.68 (0.1055) | 2.70 (0.1063) | 2.72 (0.1071) | 2.74 (0.1079) | 2.76 (0.1087) |
|---|---|---



Engine Mechanical System > General Information > Troubleshooting

Troubleshooting

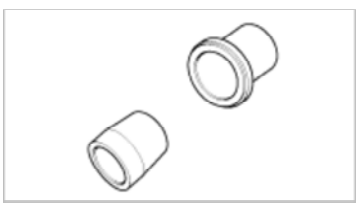
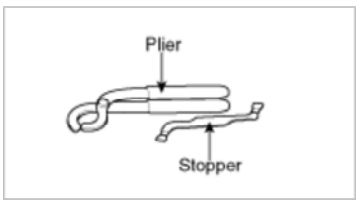
Symption	Suspect area	Remedy (See page)
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings (Oil cousnmption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss 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 buidup on the valve stem)	Repair or replace as required
		Replace the timing chain and sprocket as

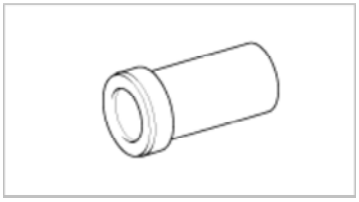
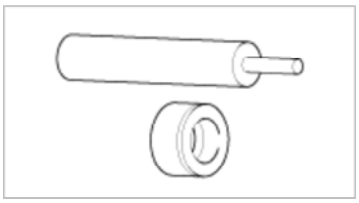
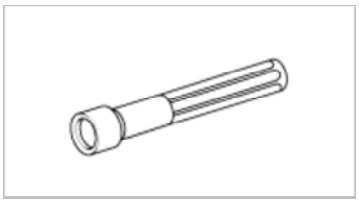
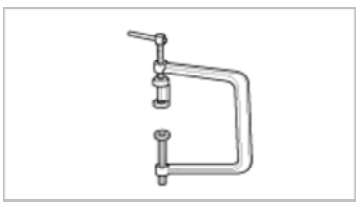
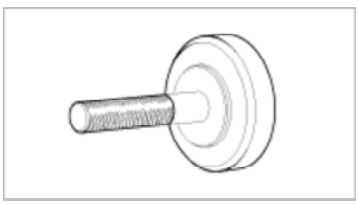
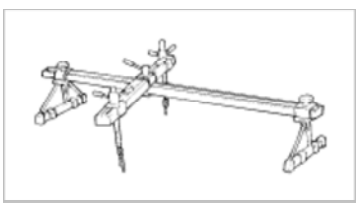
	Excessive worn or mis-aligned timing chain	required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant cousmption	• Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system. • Coolant consumption may or may 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, 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. • Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	• Inspect the thrust bearing and crankshaft. • Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure	Repair or repalce as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stetched 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 timing 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 oli pressure.	Repair or 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 restircted.	• Inspect the oil pump screen. • Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-clearance	• Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing rod clearance	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
		Inspect the following components, and

	Excessive crankshaft bearing clearance	repair as required. • The crankshaft bearing. • 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
Engine will not crank-crankkshaft will not rotate	Hydraulically cylinder • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder	1. Remove spark plugs and check for fluid. 2. Inspect for broken head gasket. 3. Inspect for cracked engine black or cylinder head. 4. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing belt and/or timing belt and/or timing belt gears.	1. Inspect timing belt and gears. 2. Repair as required.
	Material cylinder • Broken valve • Piston material • Foreign material	1. Inspect cylinder for damaged components and/or foreign materials. 2. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	1. Inspect crankshaft and connecting rod bearing. 2. Repair as required.
	Bent or broken connecting rod.	1. Inspect connecing rods. 2. Repair as required.
	Broken crankshaft	1. Inspect crankshaft. 2. Repair as required.

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)		Removeal and installation of the tappet shim

Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide installer (09221-3F100 A/B)		Remove and installation of the valve guide
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor & adaptor (09222-28000, 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 support fixture and adapter (09200-38001, 09200-1C000)		Engine fixing

Engine Mechanical System > Engine And Transaxle Assembly > Repair procedures

Removal

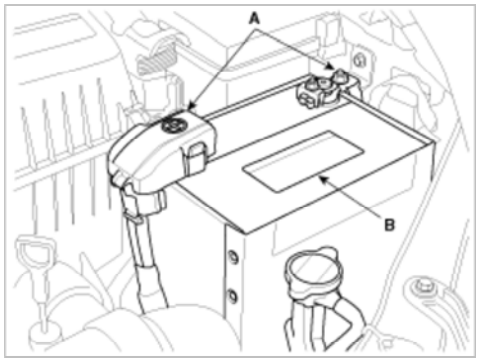
CAUTION

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

NOTE

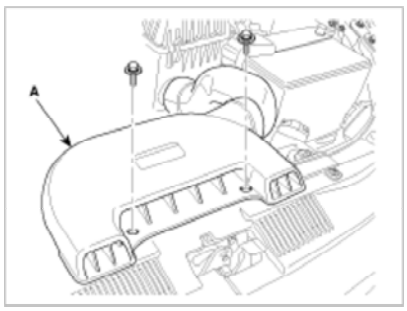
- Mark all wiring and hoses to avoid misconnection.
- Inspection the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

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



2. Remove the engine cover.
3. Remove the air duct (A).

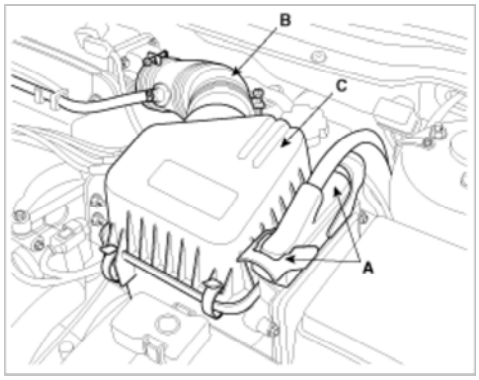
Tightening torque :
7.8 ~ 10.8N.m (0.8 ~ 1.1kgf.m, 5.8 ~ 8.0lb-ft)



4. Remove the radiator cap to speed daring.
5. Loosen the radiator drain plug (A) and drain engine coolant.

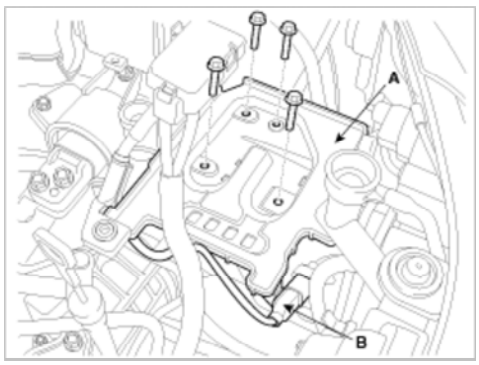
6. Remove the air cleaner assembly.
   (1) Disconnect the power train control module (PCM) connector (A).
   (2) Disconnect the intake hose (B).
   (3) Remove the air cleaner assembly (C).

Tightening torque :
Hose clamp :
2.9 ~ 4.9N.m (0.3 ~ 0.5kgf.m, 2.2 ~ 2.6lb-ft)
Mounting bolt :
7.8 ~ 10.8N.m (0.8 ~ 1.1kgf.m, 5.8 ~ 8.0lb-ft)

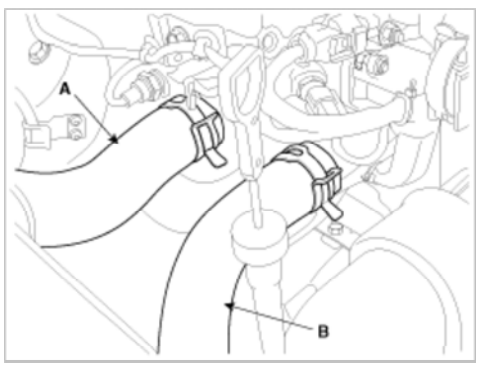


7. Remove the battery tray (A) and the front connector (B).

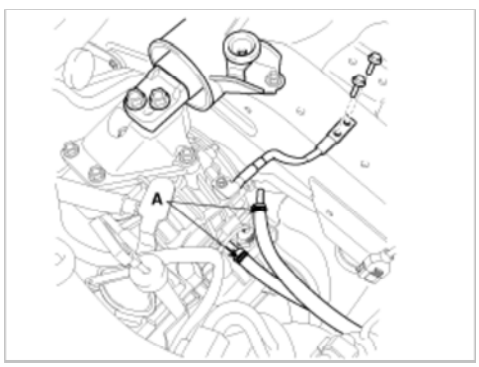
Tightening torque :
8.8 ~ 13.7N.m (0.9 ~ 1.4kgf.m, 6.5 ~ 10.1lb-ft)



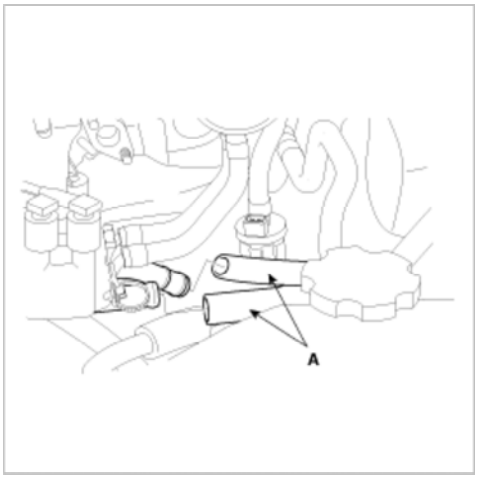
8. Remove the upper radiator hose (A) and lower radiator hose (B).



9. Disconnect the auto transaxle fluid (ATF) hose (A).

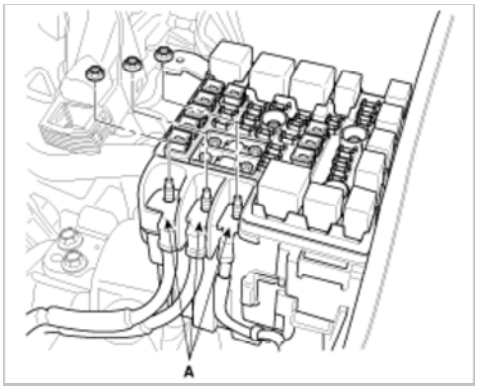


10. Remove the heater hose (A).



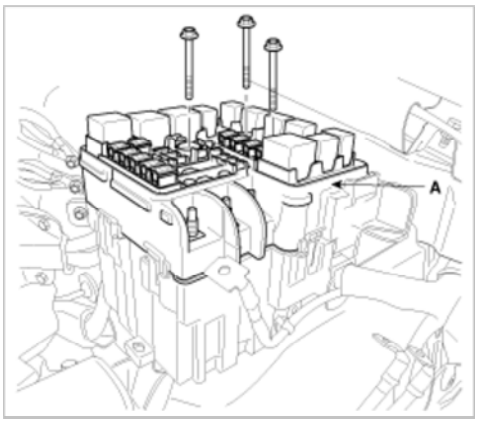
11. Remove the junction box cover.
12. Disconnect the terminals(A) from the fuse box.

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

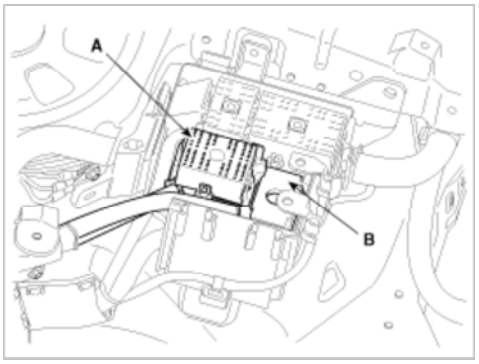


13. After removing the mounting bolts, remove the relay and fuse assembly(A).

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

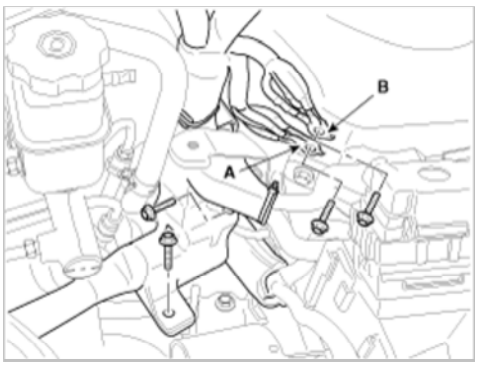


14. Remove the connector wiring(A) and the engine wiring(B).

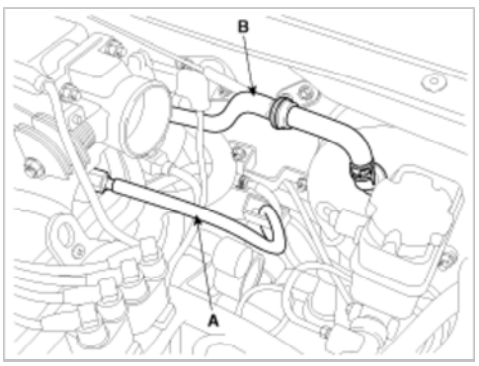


15. Remove the engine control side ground(A) and, the transaxle control side one(B).

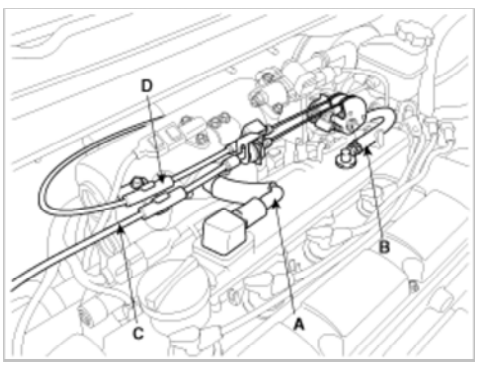
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



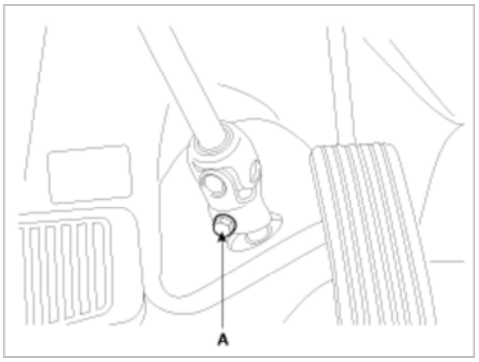
16. Remove the fuel inlet from delivery pipe (A) and brake booster vacuum hose (B).



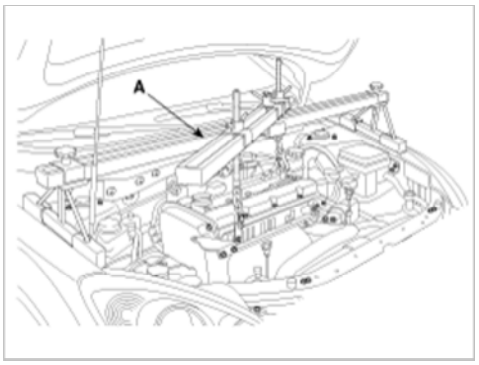
17. Disconnect the accelerator cable (C) and the auto-cruise cable(D) from the cylinder head cover.



18. Remove the transaxle wire and control cable. (Refer to Transaxle control system in MTA or ATA Group).
19. Remove the high & low pressure pipe. (Refer to Air conditioner compressor in HA Group).
20. Remove the steering u-joint mounting bolt(A).

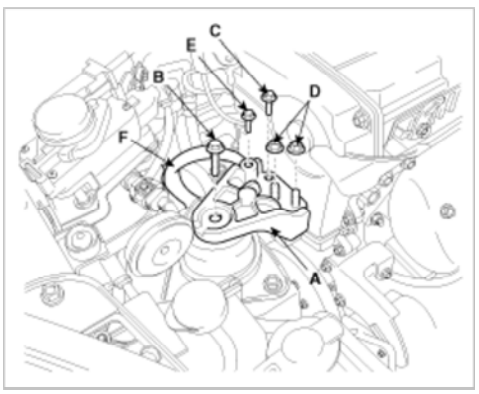


21. Install the SST (09200-38001, 09200-1C000), the engine support fixture and the adapter, on the engine and transaxle assembly.



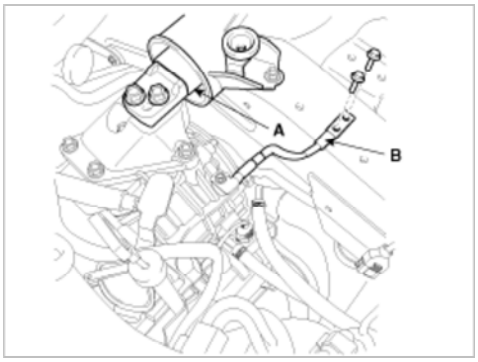
22. Remove the engine mounting bracket (A) by removing the bolts(B, C) and nuts(D) and ground line (F).

Tightening torque :
Bolt (B) :
63.7 ~ 83.3N.m (6.5 ~ 8.5kgf.m, 47.0 ~ 61.5lb-ft)
Bolt (C), Nuts (D) :
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lb-ft)
Bolt (E) :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

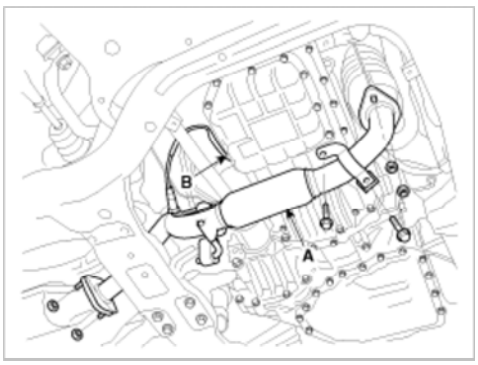


23. Remove the transaxle mounting bracket (A) and the ground line (B).

Tightening torque :
A : 88.2 ~ 107.8N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.5lb-ft)
B : 9.8 ~ 14.7N.m (1.0 ~ 1.5kgf.m, 7.2 ~ 10.8lb-ft)

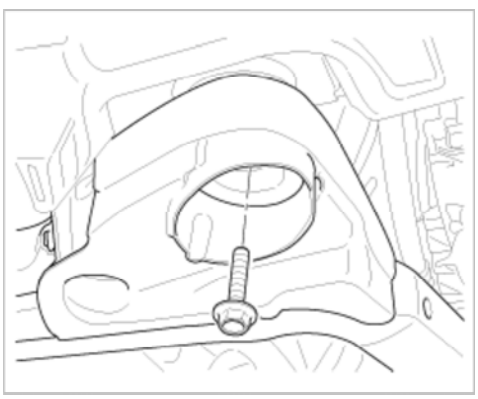


24. Remove the front tires.
25. Disconnect the stabilizer bar link and remove the mounting bolts from the lower arm and the front axles.
26. Remove the front muffler (A) and disconnect the rear oxygen sensor connector(B).



27. Remove the sub frame bolts (A).

Tightening torque :
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lb-ft)



28. Remove the engine support fixture and the adapter.
29. Jack up the vehicle.

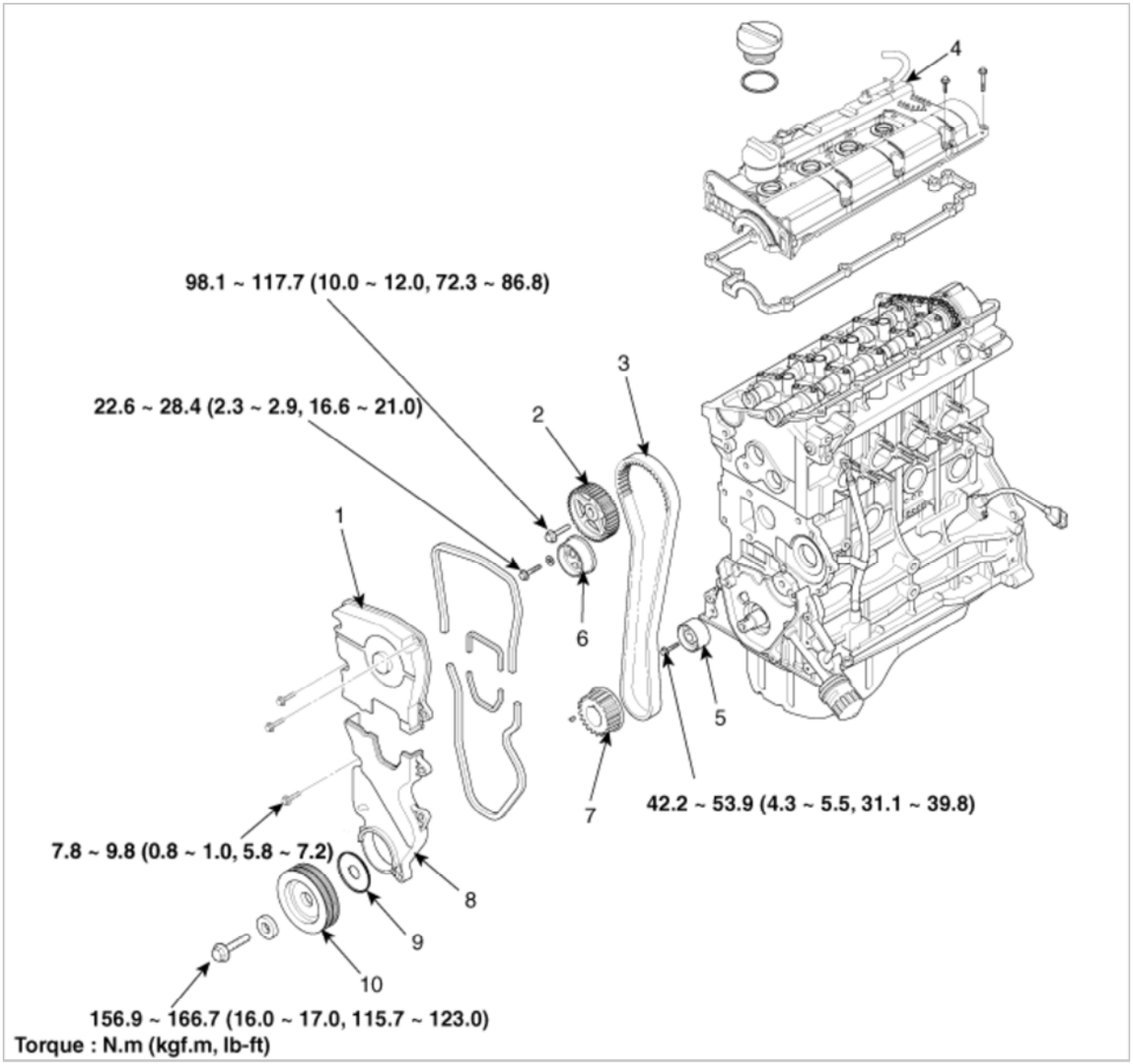
Installation

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

- Adjust shift cable.
- Adjust throttle cable.
- Refill engine with engine oil.
- Refill transaxle with fluid.
- Refill radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
  After assembling 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 pressureizes.
  Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

Engine Mechanical System > Timing System > Timing Belt > Components and Components Location

Components

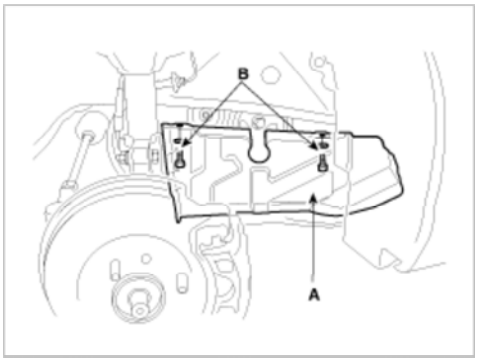


1. Timing belt upper cover	6. Tensioner
2. Camshaft sprocket	7. Crankshaft sprocket
3. Timing belt	8. Timing belt lower cover
4. Cylinder head cover	9. Flange
5. Idler	10. Crankshaft pulley

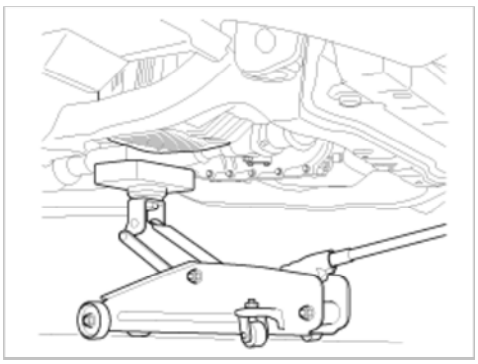
Removal

Engine removal is not required for this procedure.

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



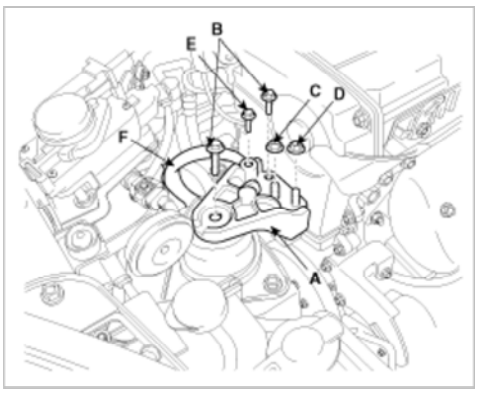
4. Remove the engine mount bracket.
   (1) Set the jack to the engine oil pan.



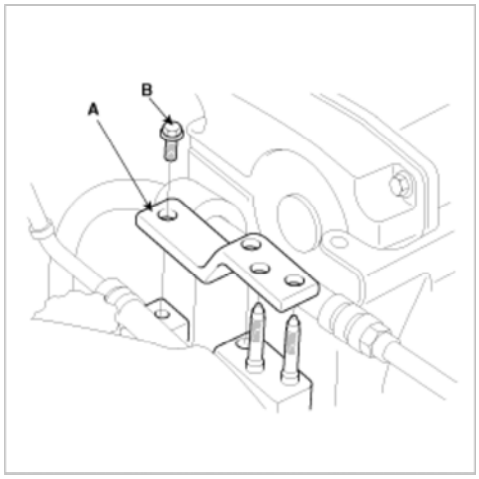
NOTE

Place wooden block between the jack and engine oil pan.

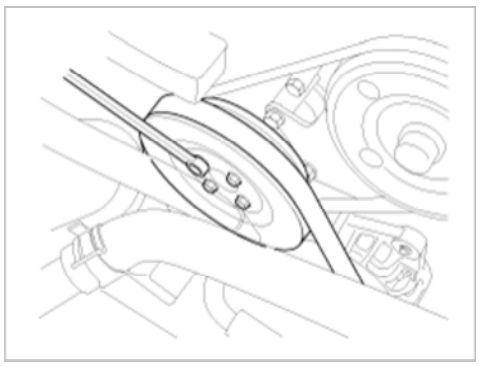
   (2) Remove the bolts(B), nuts(C, D) and engine mount bracket (A), and the groud line(F).



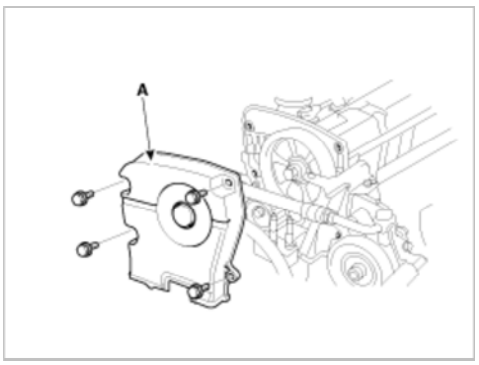
   (3) Remove the bolt (B) and stay plate (A).



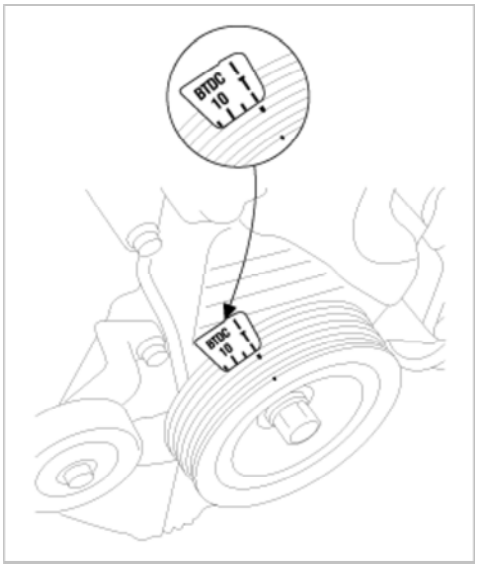
5. Temporarily loosen the water pump pulley bolts.



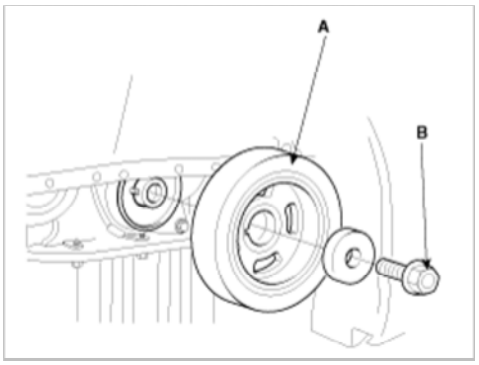
6. Remove alternator belt.
7. Remove air compressor belt.
8. Remove power steering belt.
9. Remove four bolts and water pump pulley.
10. Remove the timing belt upper cover (A).



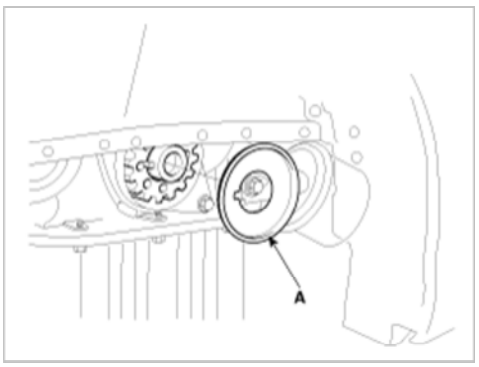
11. Turn the crankshaft pulley, and align its groove with timing mark “T”of the timing belt cover.



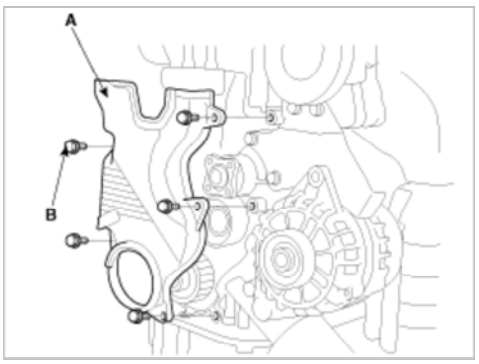
12. Remove the crankshaft pulley bolt (B) and crankshaft pulley (A).



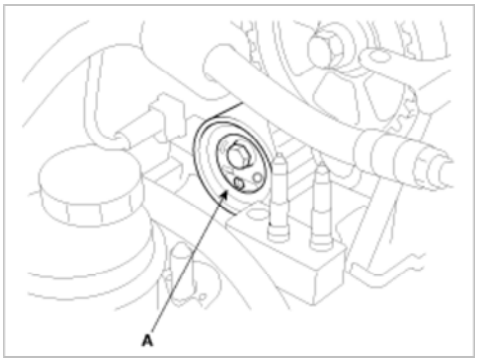
13. Remove the crankshaft flange (A).

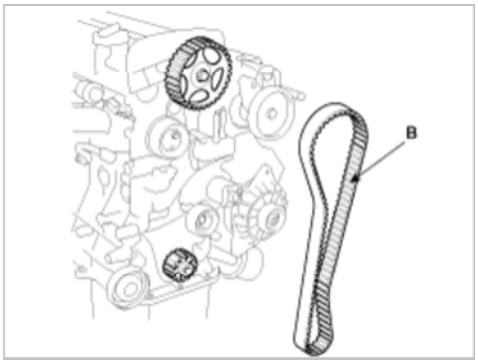


14. Remove the 5bolts (B) and timing belt lower cover (A).



15. Remove the timing belt tensioner (A) and timing belt (B).

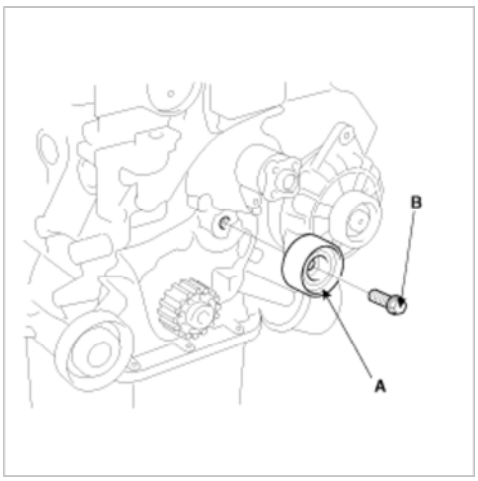




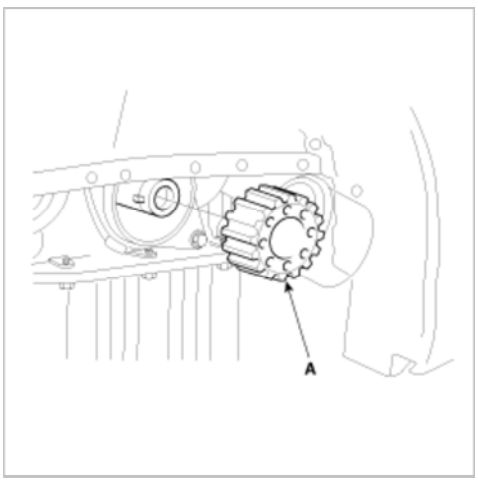
NOTE

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

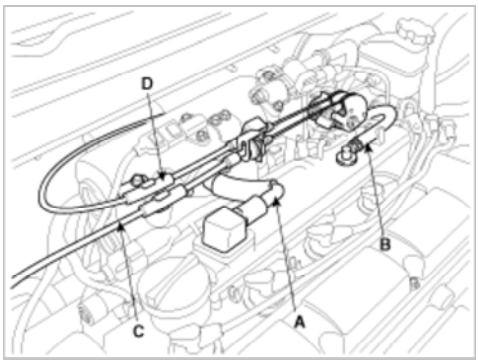
16. Remove the bolt (B) and timing belt idler (A).



17. Remove the crankshaft sprocket (A).

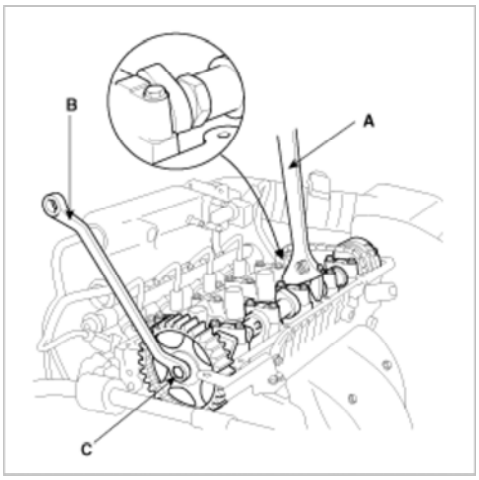


18. Remove the cylinder head cover.
    (1) Remove the spark plug cable.
    (2) Remove the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.
    (3) Remove the PCV(Positive Crankcase ventilation) hose (A) and breather hose (B).



    (4) Remove the bolts and cylinder head cover.

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

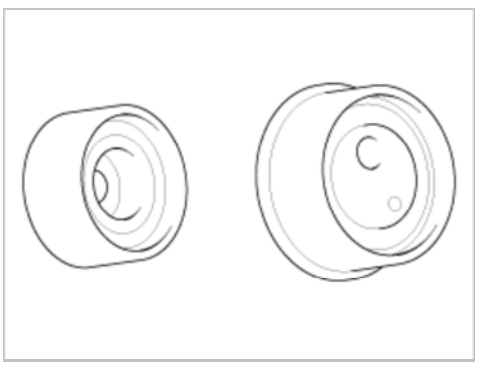


> **CAUTION**
>
> Be careful not to damage the cylinder head and valve lifter with the wrench.

Inspection

Sprockets, Tensioner, Idler

1. Check the camshaft sproket, 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

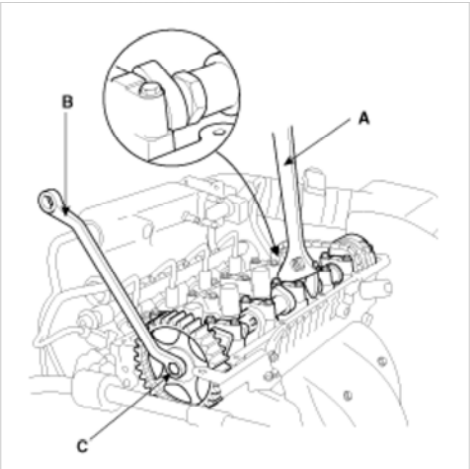
1. Check the belt for oil or dust deposits.
   Replace, if necessary.
   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any of the following flaws are evident, replace the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

> NOTE
>
> • Do not bend, twist or turn the timing belt inside out.
> • Do not allow the timing belt to come into contact with oil, water and stem.

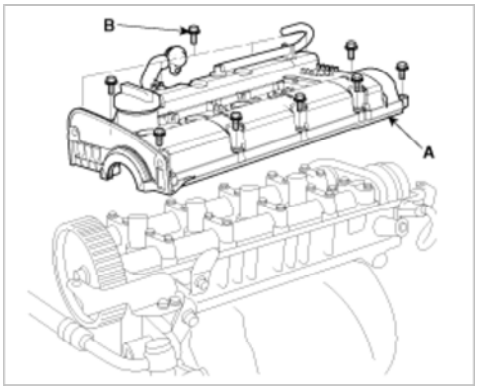
Installation

1. Install the camshaft sprocket and tighten the bolt to the specified torque.
   (1) Temporarily install the camshaft sprocket bolt.
   (2) Hold the hexagonal head wrench (A) portion of the camshaft with a wrench (B), and tighten the camshaft sprocket (C) bolt.

Tightening torque
Camshaft sprocket bolt :
98.1 ~ 117.7Nm (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)

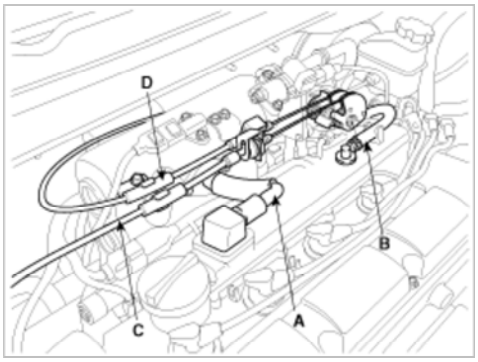


2. Install cylinder head cover.
   (1) Install cylinder head cover (A) and the twelve bolts (B).



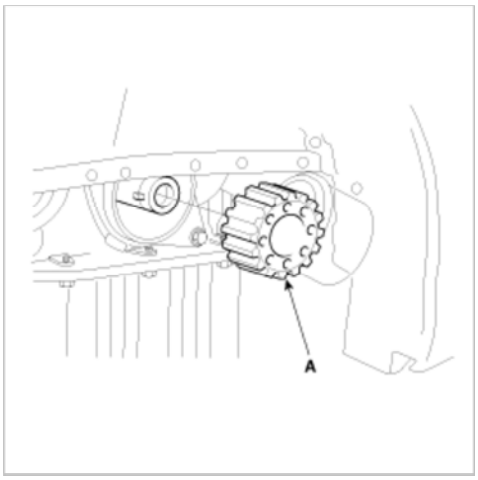
Tightening torque :
7.8 ~ 9.8Nm (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

   (2) Install the PCV hose (A) and breather hose (B).
   (3) Install the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.

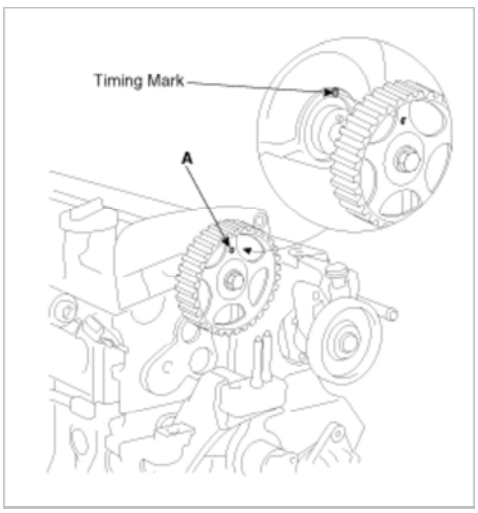


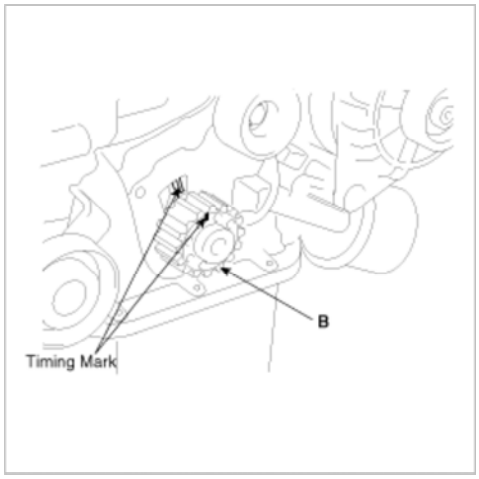
(4) Install the spark plug cable.

3. Install the crankshaft sprocket (A).



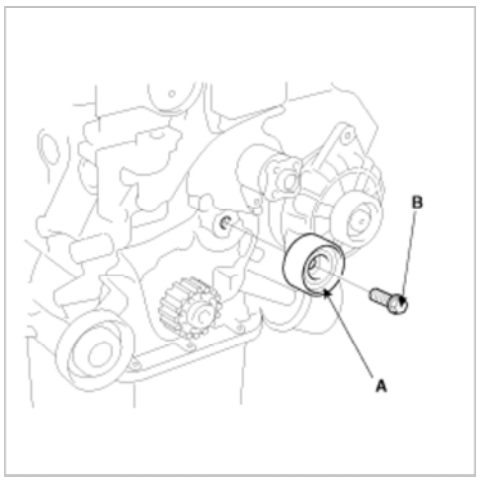
4. Align the timing marks of the camshaft sprocket (A) and crankshaft sprocket (B) with the No. 1 piston placed at top dead center and its compression stroke.



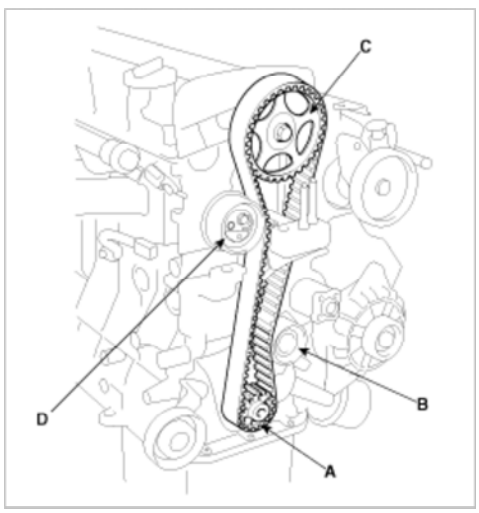


5. Install the idler pulley (A) and tighten the bolt (B) to the specified torque.

Tightening torque
Idler pulley bolt :
42.2 ~ 53.9Nm (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lb-ft)

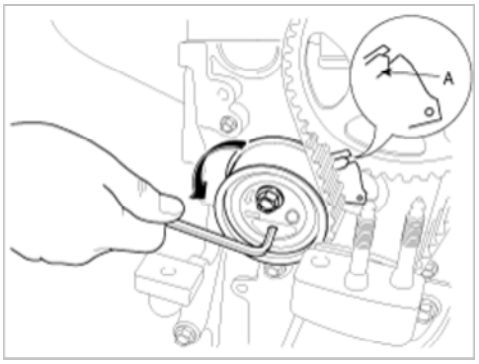


6. Install the timing belt tensioner loosely enough for the adjuster to rotate. Make sure that the stopper of base is leaning against the lowering sealing cap on the cylinder head.
7. Belt so as not give slack at each center of shaft. Do as following procedures when installing timing belt.
   Crankshaft 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

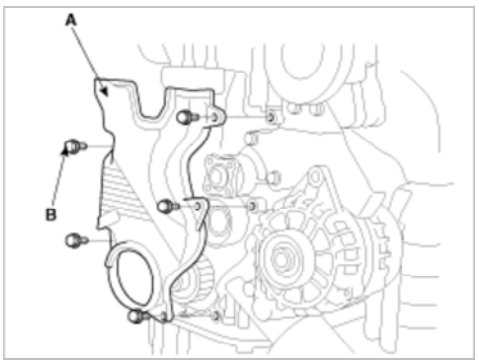
Do not rotate the adjuster clockwise.
It will result in auto tensioner's functional problem.

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)

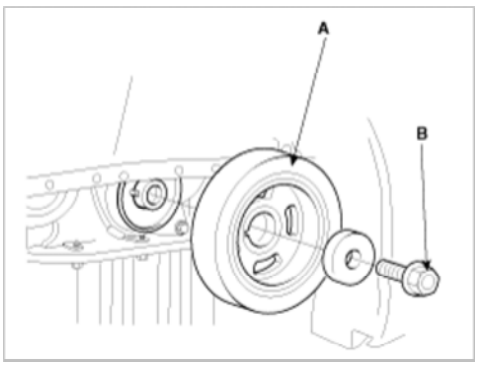
12. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
13. If the indicator is not located at the center of base, slacken the bolt and repeat the abore procedure.
14. Install the timing belt lower cover (A) with 5 bolts (B).

Tightening torque
Timing belt cover bolt :
7.8 ~ 9.8Nm (0.8 ~1.0kgf.m, 5.8 ~ 7.2lb-ft)



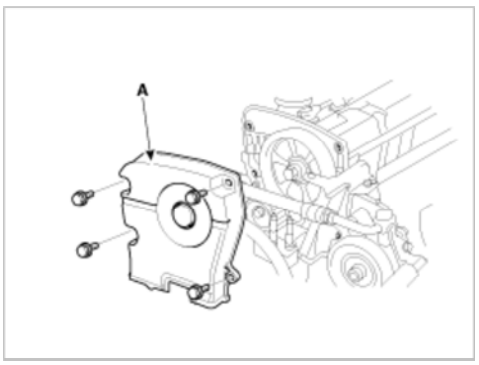
15. Install the flange and crankshaft pulley (A).
Make sure that crankshaft sprocket pin fits the small hole in the pulley.

Tightening torque
Crankshaft pulley bolt :
156.9 ~ 166.7N.m (16.0 ~ 17.0kgf.m, 115.7 ~ 123.0lb-ft)



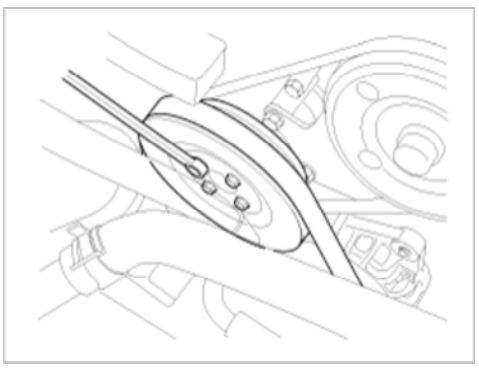
16. Install the timing belt upper cover (A).

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



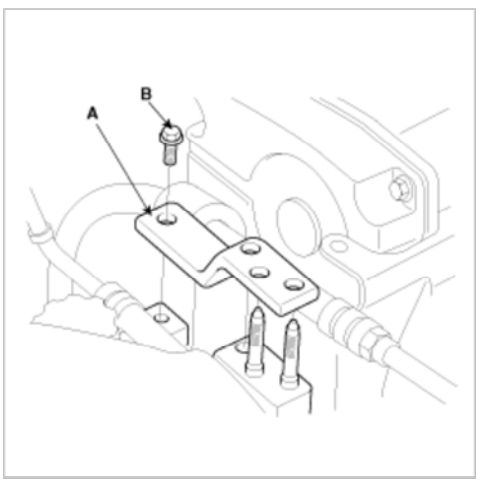
17. Install the coolant pump pulley with 4bolts.

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



18. Install power steering belt.
19. Install air compressor belt.
20. Install alternator belt.
21. Install the engine mount bracket
    (1) Install the stay plate (A) with bolt (B).

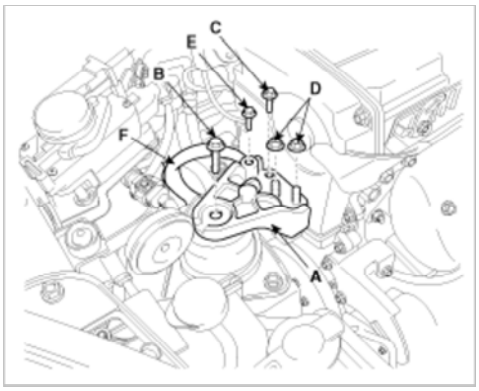
Tightening torque
Stay plate bolt :
42.2 ~ 53.9Nm (4.3 ~ 5.5kgf.m 31.1 ~ 39.8lb-ft)



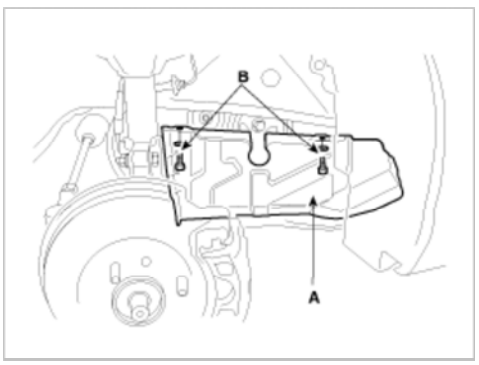
    (2) Install engine mount bracket(A) and ground line (F).

Tightening torque

Bolt (B) :
63.7 ~ 83.3N.m (6.5 ~ 8.5kgf.m, 47.0 ~ 61.5lb-ft)
Bolt (C), Nuts (D) :
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lb-ft)
Bolt (E) :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



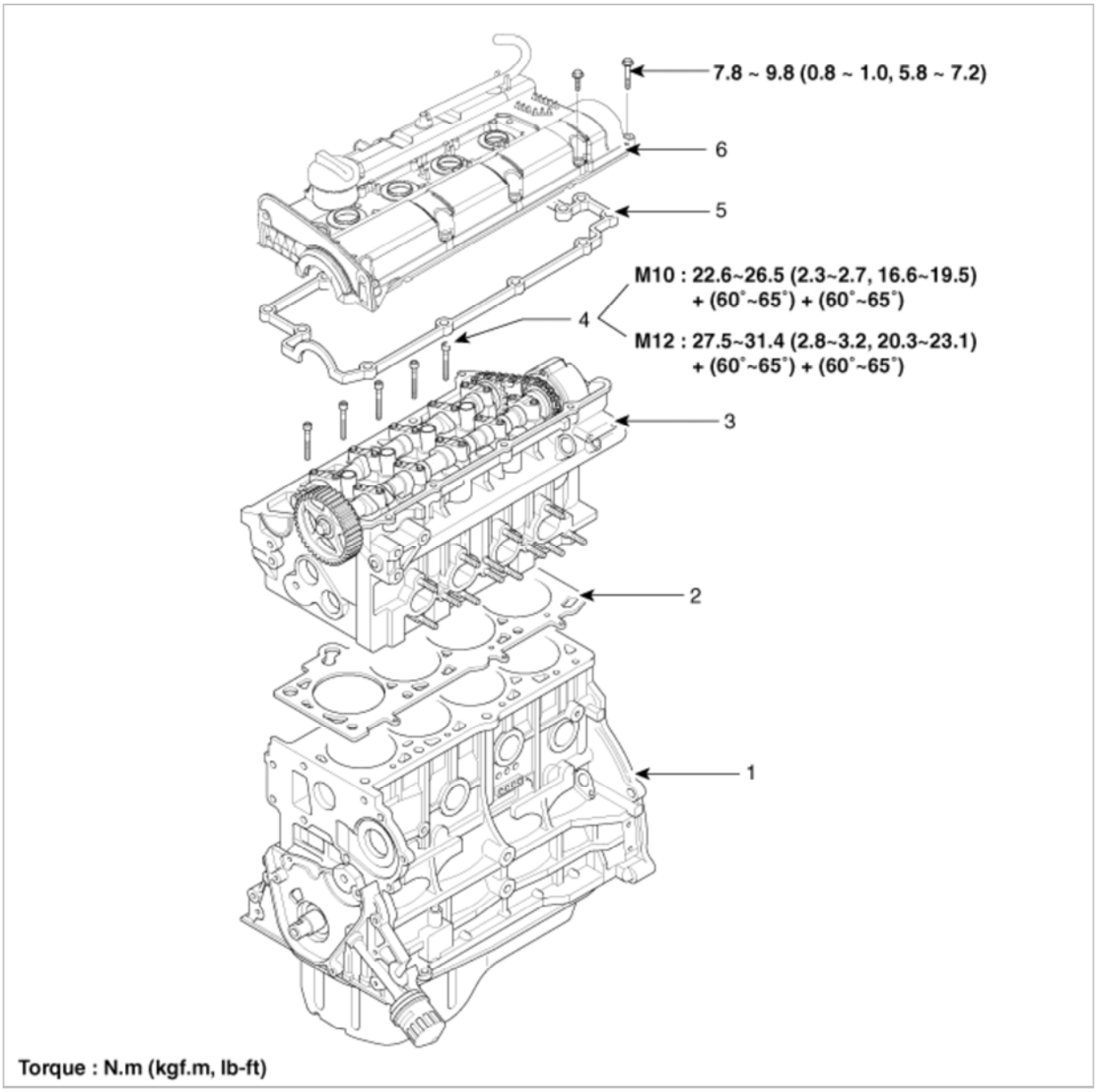
22. Install RH side cover (A) with 2bolts (B).



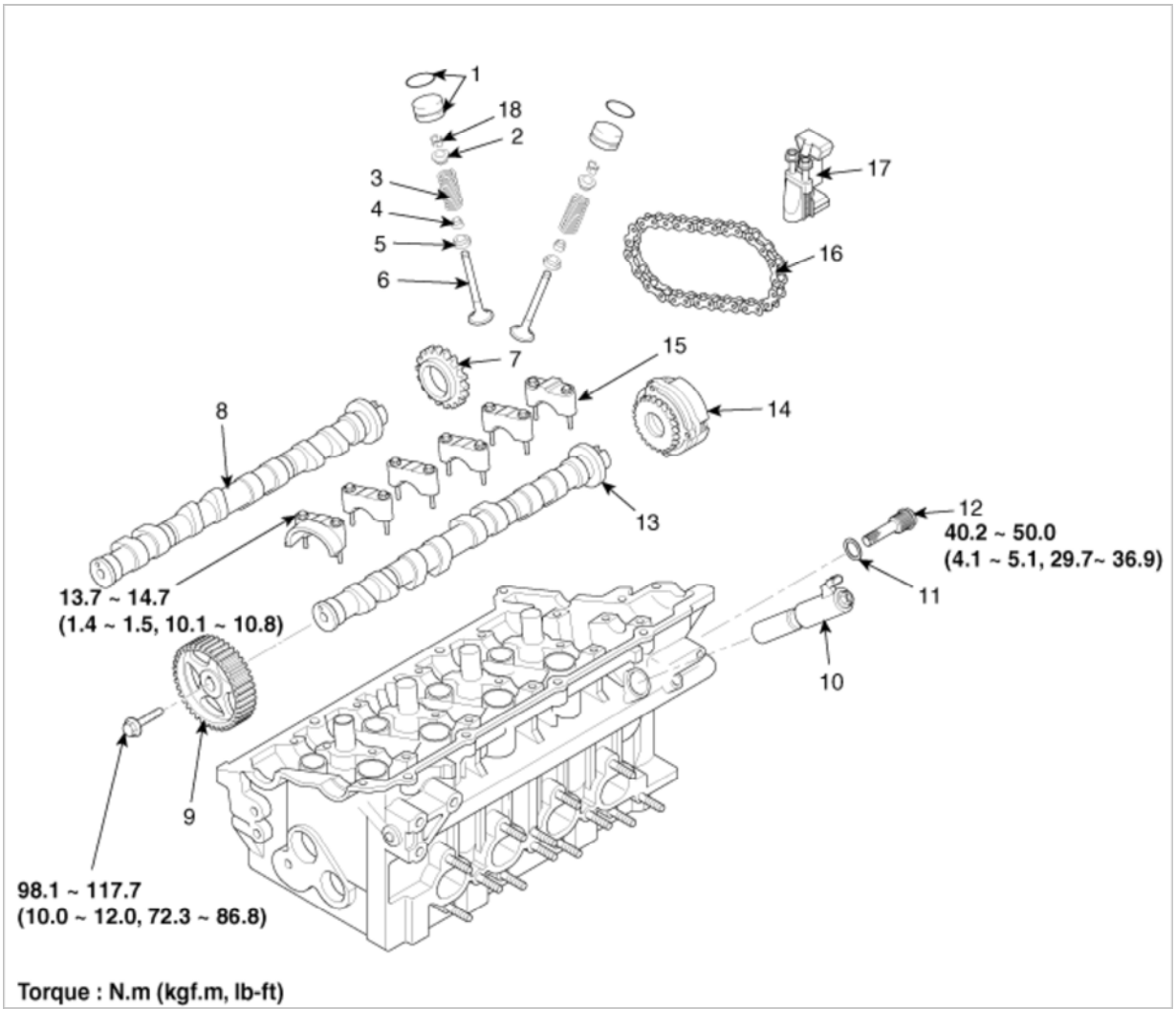
23. Install RH front wheel.
24. Install the engine cover.

Engine Mechanical System > Cylinder Head Assembly > Components and Components Location

Components



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



1. Mechanical lash adjuster(MLA)	7. Chain sprocket	13. Exhaust camshaft
2. Retainer	8. Intake camshaft	14. CVVT assembly
3. Valve spring	9. Camshaft sprocket	15. Camshaft bearing cap
4. Stem seal	10. Oil control valve(OCV)	16. Timing chain
5. Spring seat	11. Washer	17. Auto Tensioner
6. Valve	12. OCV filter	18. Retainer lock

Engine Mechanical System > Cylinder Head Assembly > Repair procedures

Removal

Engine removal is not required for this procedure.

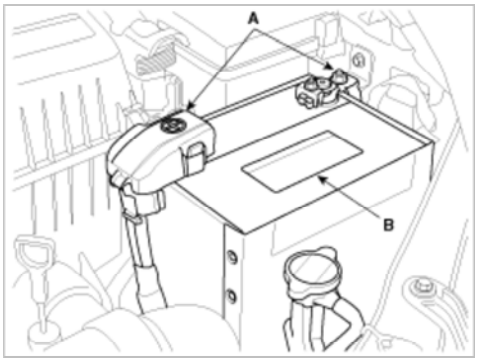
CAUTION

- Use fender covers 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.

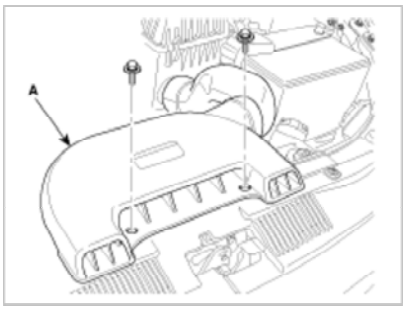
NOTE

- 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. Disconnect the terminals (A) and remove the battery (B).

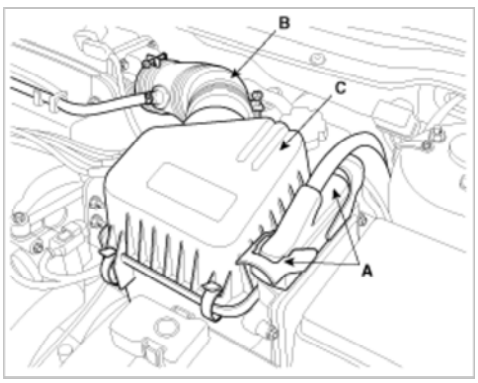


2. Remove the engine cover.
3. Remove the air duct(A).

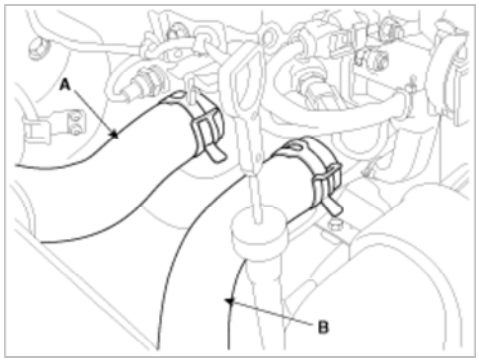


4. Remove the radiator cap to speed draing.
5. Loosen the radiator drain plug(A) and drain engine coolant.

6. Remove the intake air hose and air cleaner assembly.
   (1) Disconnect the PCM connectors (A).
   (2) Remove the intake air hose (B) and the air cleaner assembly (C).

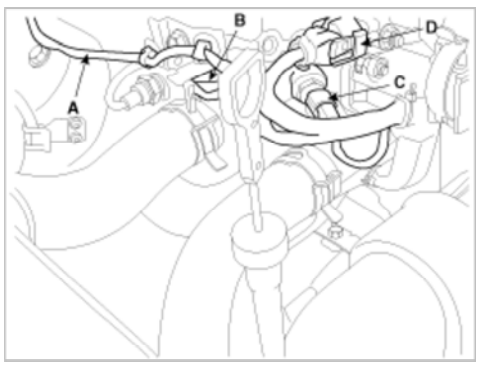


7. Remove the upper radiator hose(A) and lower radiator hose(B).

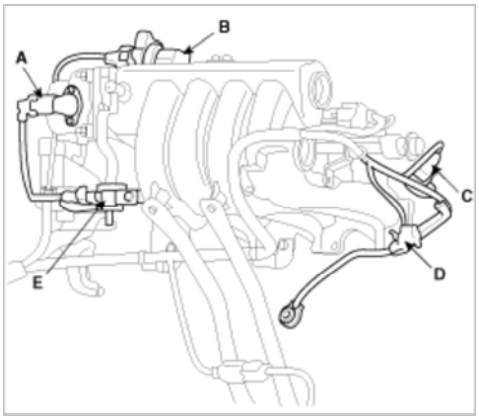


8. Remove the heater hoses (A).

9. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
   (1) OCV(Oil control Valve) connector (A).
   (2) Oil temperature sensor (OTS) connector (B).
   (3) Engine coolant temperature (ECT) sensor connector (C).
   (4) Ignition coil connector (D).

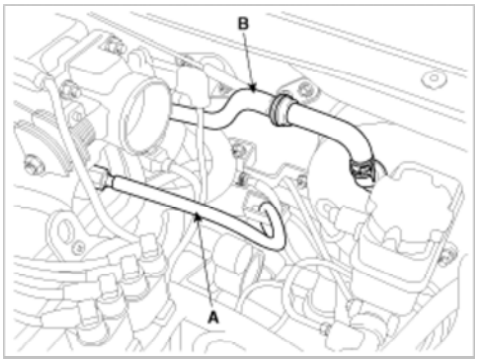


   (5) TPS(Throttle Position Sensor) connector (A).
   (6) ISA(Idle Speed Actuator) connector (B).
   (7) CMP(Camshaft Position Sensor) connector (C).
   (8) Four fuel injector connectors.
   (9) Knock sensor connector (D).
   (10) PCSV(Purge Control Solenoid Valve) connector (E).



(11) Front heated oxygen sensor connector.

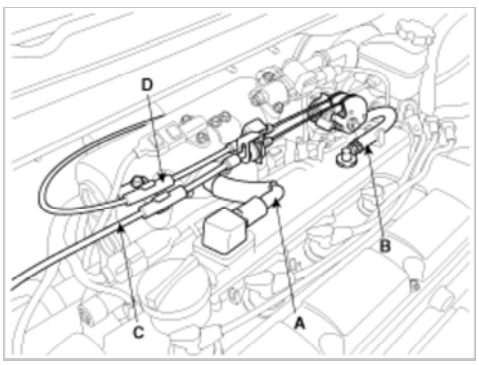
10. Remove the fuel inlet hose (A) from delivery pipe and brake booster vacuum hose(B).



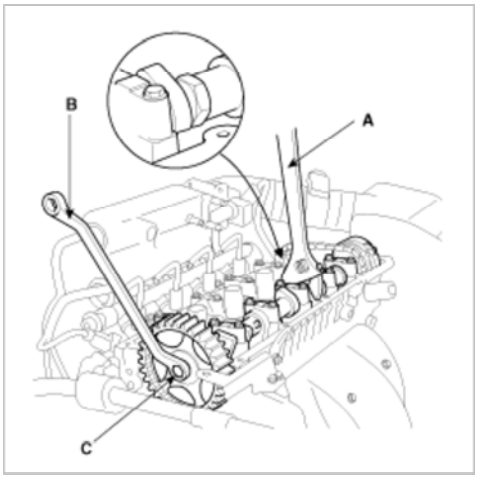
11. Remove the cylinder head cover.
    (1) Disconnect the spark plug cables and do not pull on the spark plug by force.

> NOTE
>
> Pulling on or bending the cables may damage the conductor inside.

    (2) Disconnect the positive crankcase ventilation (P.C.V) hose (A) and the breather hose (B) from the cylinder head cover.
    (3) Disconnect the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.



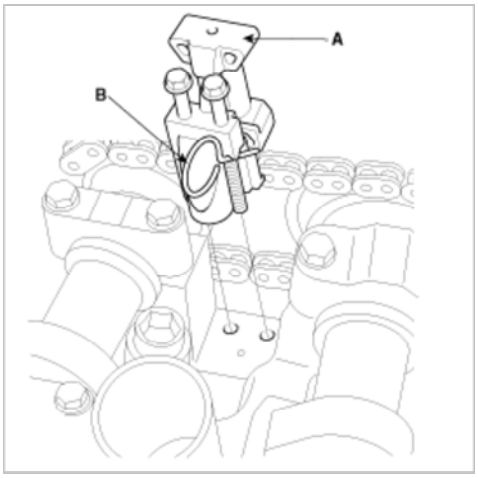
12. Remove the timing belt. (Refer to Timing system in this group)
13. Remove the exhaust manifold and intake manifold. (Refer to Intake and exhaust system in this group)
14. Remove camshaft sprocket.
    (1) Hold the hexagonal head wrench (A) portion of the camshaft with a wrench (B), and remove the bolt and camshaft sprocket (C).



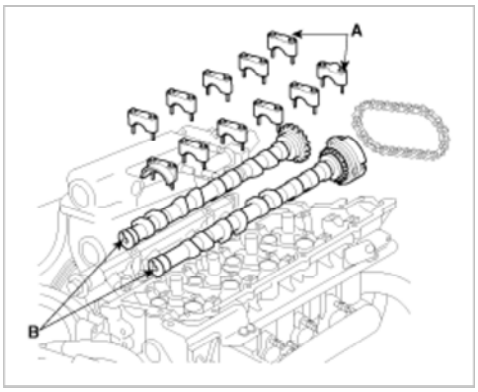
CAUTION

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

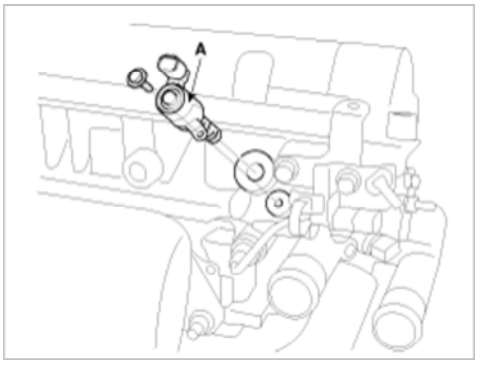
15. Remove the timing chain auto tensioner (A).



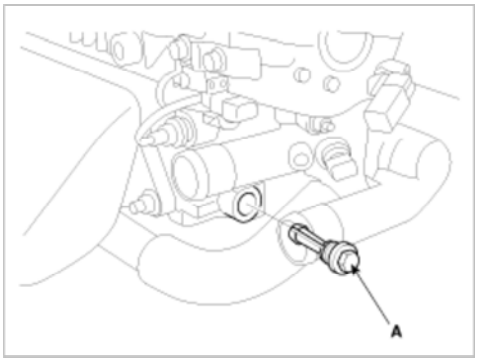
16. Remove the camshaft bearing caps (A) and camshafts (B).



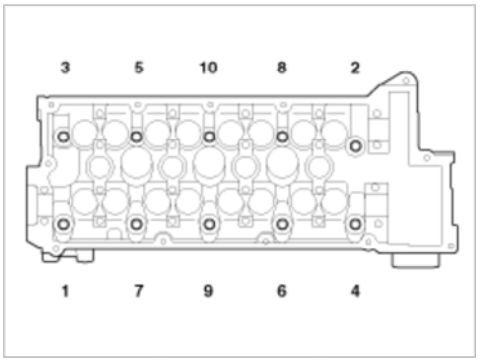
17. Remove the OCV(oil control valve) (A).



18. Remove the OCV(oil control valve) filter (A).



19. 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.

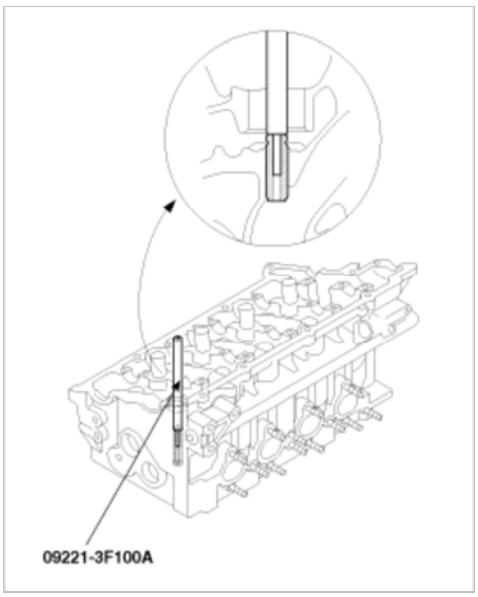
    (2) Lift the cylinder head from the dowels on the cylinder block and replace the cylinder head on wooden blocks on a bench.

> **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.

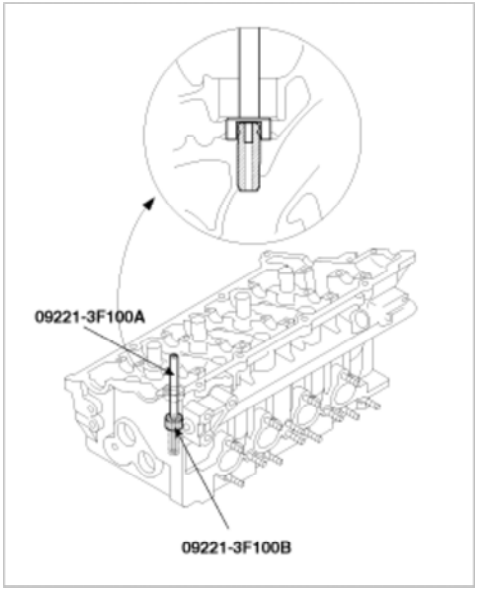


2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.

3. Using the SST(09221-3F100A/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.

Over size mm(in.)	Size mark	Oversize valve guide hole size mm(in.)
0.05 (0.002)	5	11.05 ~ 11.068 (0.4350 ~ 0.4357)
0.25 (0.010)	25	11.25 ~ 11.268 (0.4429 ~ 0.4436)
0.50 (0.020)	50	11.50 ~ 11.518 (0.4528 ~ 0.4535)

Valve guide length
Intake : 46mm (1.8in.)
Exhaust : 54.5mm (2.15in.)



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.

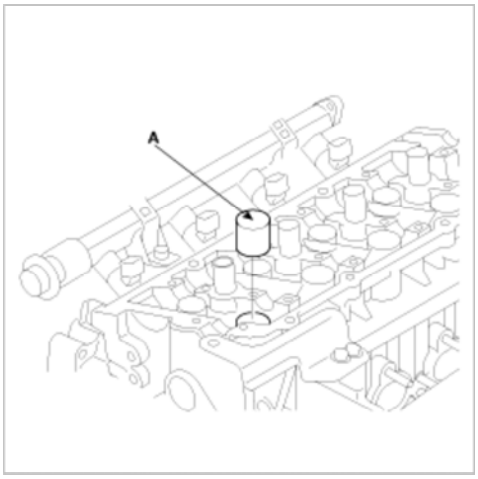
4. After the valve guide is press-fitted, insert a new valve and check for proper stem -to-guide clearance.
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

Disassembly

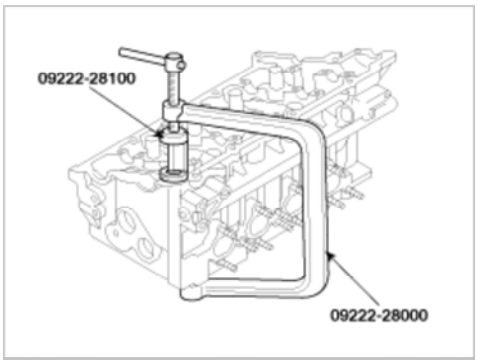
NOTE

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 MLAs (A).



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



   (2) Remove the spring retainer.

   (3) Remove the valve spring.

   (4) Remove the valve.

   (5) Remove the using needle-nose pliers, remove the oil seal.

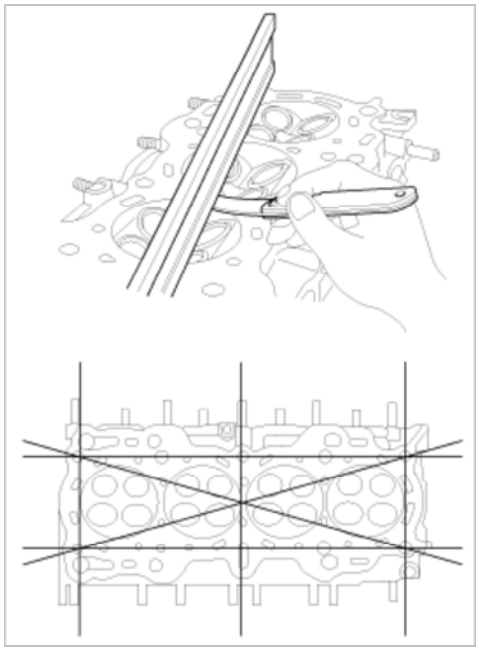
   (6) Using a magnetic finger, remove the spring seat.

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.

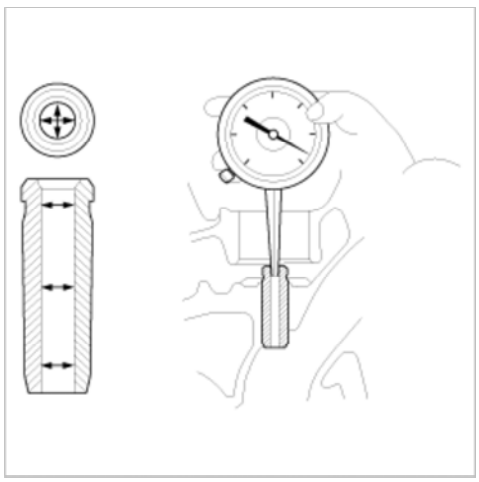
Flatness of cylinder head gasket surface
Standard : Less than 0.03mm(0.0012 in)
Limit : 0.06 mm (0.0024 in)



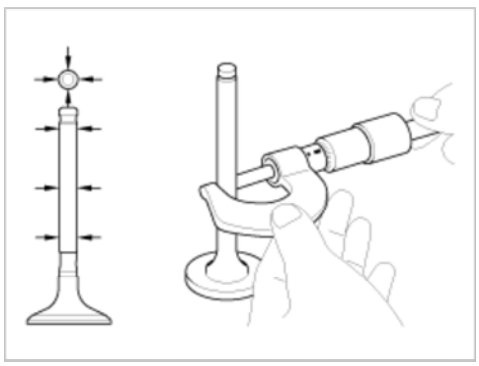
2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

Valve And Valve Spring

1. Inspect valve stems and valve guides.
   (1) Using a caliper gauge, measure the inside diameter or the valve guide.
   Valve guide inside.



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



   (3) Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.
   Valve stem-to-guide clearance

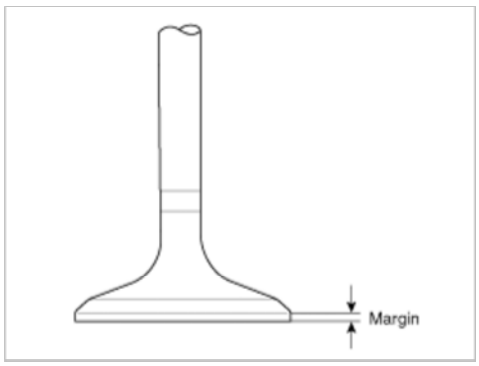
[Standard]

Intake : 0.02 ~ 0.05mm (0.0008 ~ 0.0020in)
Exhaust : 0.035 ~ 0.065mm (0.0014 ~ 0.0026in)
[Limit]
Intake : 0.1mm (0.0040in)
Exhaust : 0.13mm (0.0051in)

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

2. Inspect valves.
   (1) Check the valve is ground to the correct valve face angle.
   (2) Check that the surface of the valve for wear.
   If the valve face is worn, replace the valve.
   (3) Check the valve head margin thickness.
   If the margin thickness is less than minimum, replace the valve.

Margin
[Standard]
Intake : 1.6 mm(0.0630 in)
Exhaust : 1.8 mm(0.0709 in)
[Limit]
Intake : 1.45 mm(0.0571 in)
Exhaust : 1.65 mm(0.0650 in)

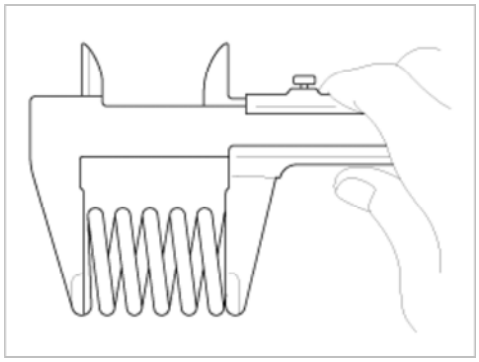


   (4) Check the surface of the valve stem tip for wear.
   If the valve stem tip is worn, replace the valve.

3. Inspect valve seats
   Check the valve seat for evidence of overheating and improper contact with the valve face.
   Replace the seat if necessary.
   Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat.
   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 valve springs.
   (1) Using a steel square, measure the out-of-square of the valve spring.
   (2) Using a vernier calipers, measure the free length of the valve spring.

Valve spring
[Standard]
Free height : 48.86mm (1.9236 in)
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 : 1.5°
[Limit]
Out-of-square : 3°

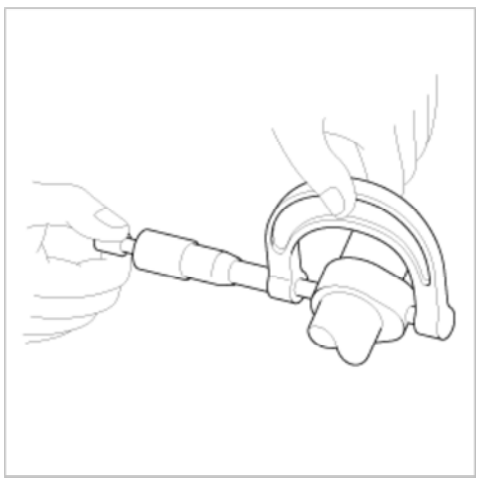


If the free length is not as specified, replace the valve spring.

Camshaft

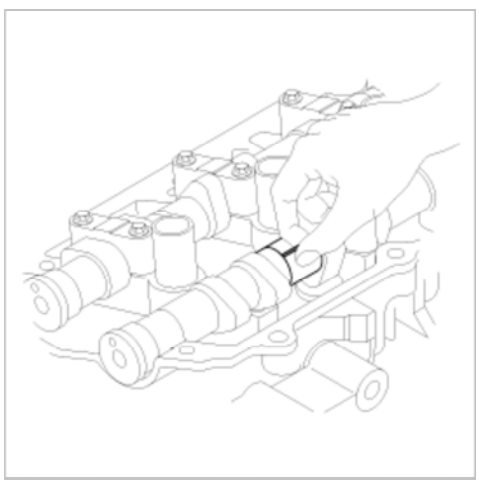
1. Inspect cam lobes.
   Using a micrometer, measure the cam lobe height.

Cam height
[Standard value]
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 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.

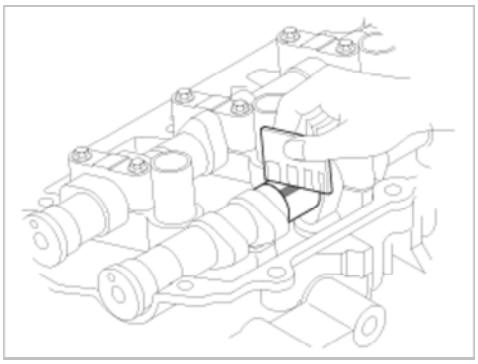
CAUTION

Do not turn the camshaft.

(5) Remove the bearing caps.

(6) Measure the plastigage at its widest point.

Bearing oil clearance :
[Standard value] : 0.02 ~ 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.

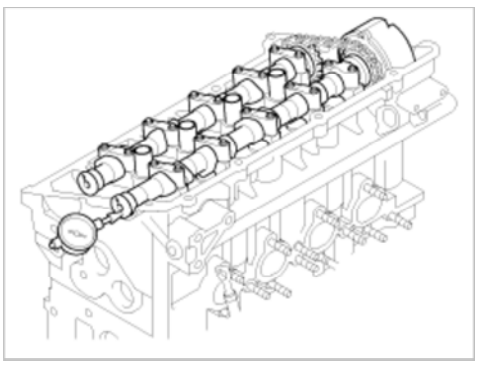
(8) Remove the camshafts.

3. Inspect camshaft end play.

(1) Install the camshafts.

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

Camshaft end play
[Standard value] : 0.1 ~ 0.15mm(0.0039 ~ 0.0059in)



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

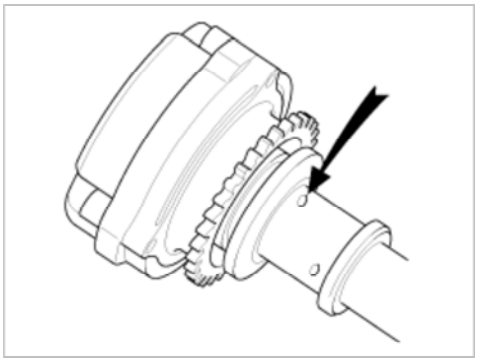
(3) Remove the camshafts.

CVVT Assembly

1. Inspect CVVT assembly.

(1) Check that the CVVT assembly will not turn.

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



(3) Wind tape around the tip of the air gun and apply air of approx. 100kpa(1kgf/cm², 14psi) to the port of the camshaft.
(Perform this order to release the lock pin for the maximum delay angle locking.)

> NOTE
>
> When the oil splashes, wipe it off with a shop rag and the likes.

(4) Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.
Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.

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

Standard: Movable smoothly in the range about 20°

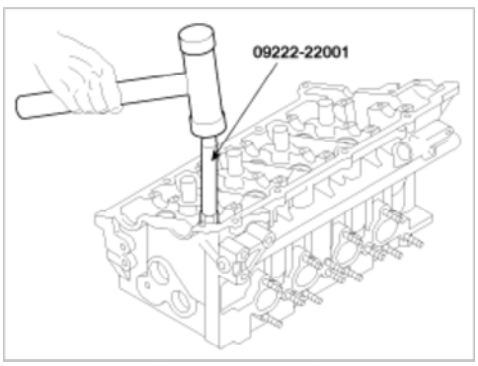
(6) Turn the CVVT assembly with your hand and lock it at the maximum delay angle position.

Reassembly

> NOTE
>
> Thoroughly clean all parts to be assembled.
> Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
> Replace oil seals with new ones.

1. Install valves.
(1) Install the spring seats.
(2) Using SST(09222-22001), push in a new oil seal.

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

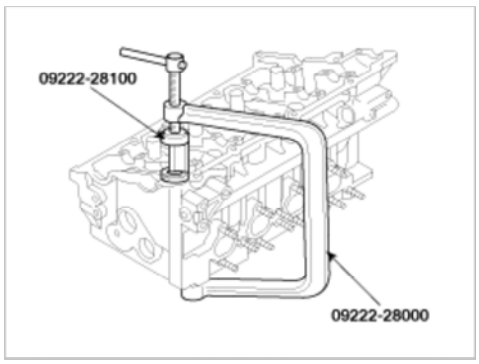


(3) Install the valve, valve spring and spring retainer.

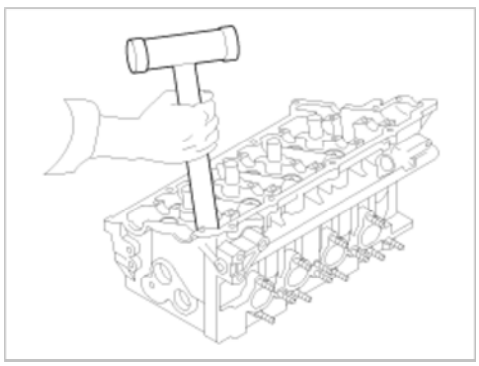
> NOTE
>
> Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the

retainer.

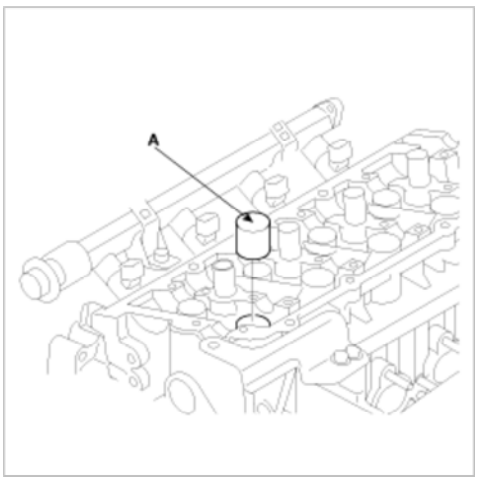
(4) Using the SST (09222-28000, 09222-28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



(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 MLAs.
Check that the MLA rotates smoothly by hand.

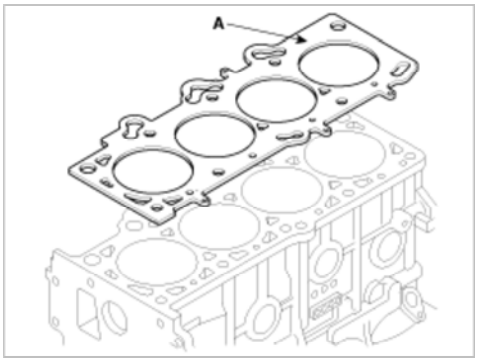


Installation

NOTE

- Thoroughly clean all parts to be assembled.
- Always use a new 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.

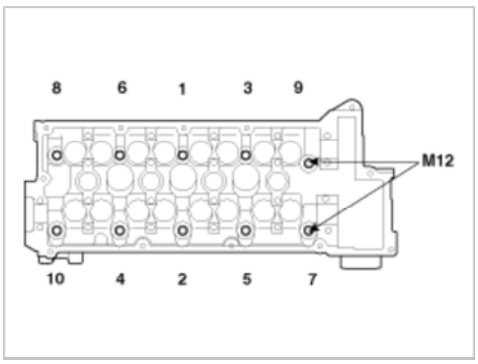


NOTE

Be careful of the installation direction.

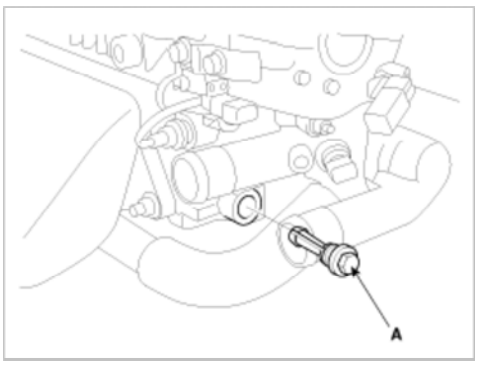
2. Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.
   (1) Apply a light coat if engine oil on the threads and under the heads of the cylinder head bolts.
   (2) Using 8mm and 10mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

Tightening torque
M10 :
22.6~26.5Nm (2.3~2.7kgf.m, 16.6~19.5lb-ft) + (60° ~ 65°) + (60° ~ 65°)
M12 :
27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.1lb-ft) + (60° ~ 65°) + (60° ~ 65°)



4. Install OCV filter (A).

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

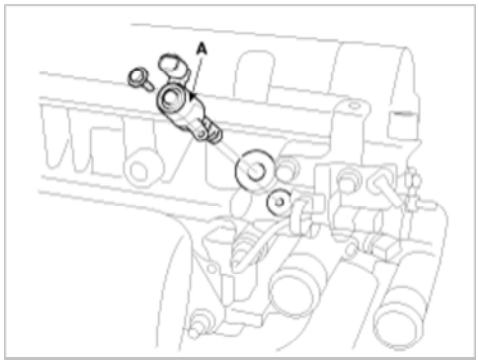


NOTE

Always use a new OCV filter gasket.
Keep clean the OCV filter.

5. Install OCV (A).

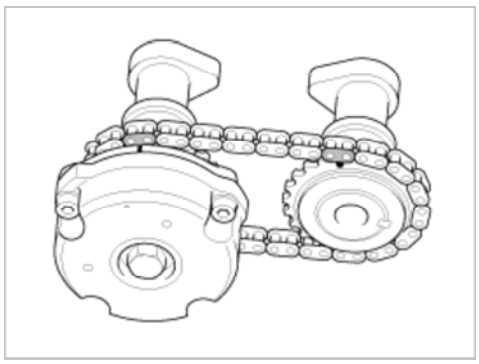
Tightening torque
9.8 ~ 11.8Nm(1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



CAUTION

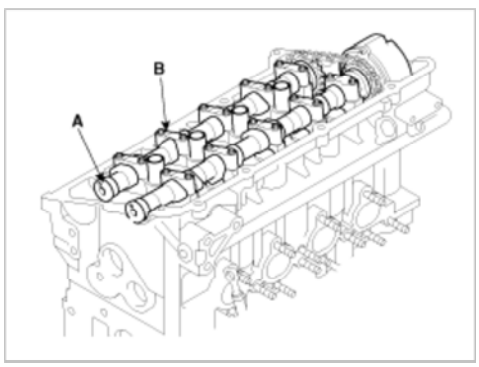
- Do not reuse the OCV when dropped.
- Keep clean the OCV.
- Do not hold the OCV sleeve during servicing.
- When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.

6. Install the camshafts.
   (1) Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.



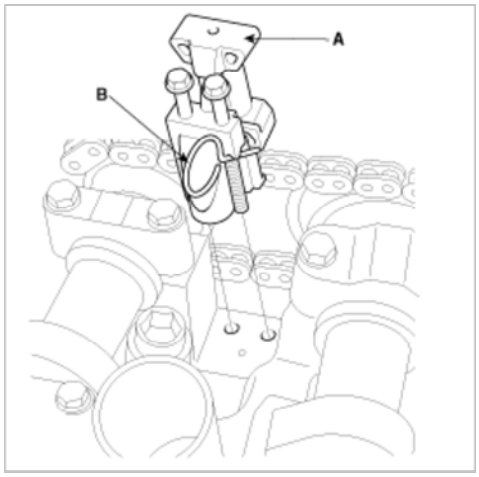
   (2) Install the camshafts (A) and bearing caps (B).

Tightening torque
13.7 ~ 14.7Nm (1.4 ~ 1.5kgf.m, 10.1 ~ 10.8lb-ft)



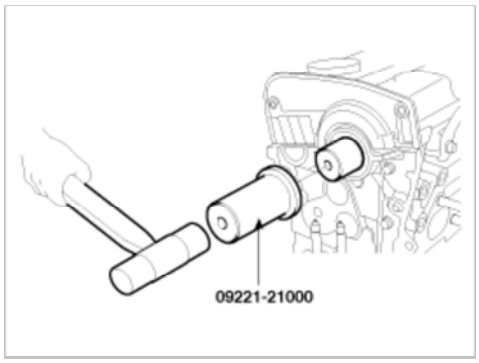
   (3) Install the timing chain auto tensioner (A).

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



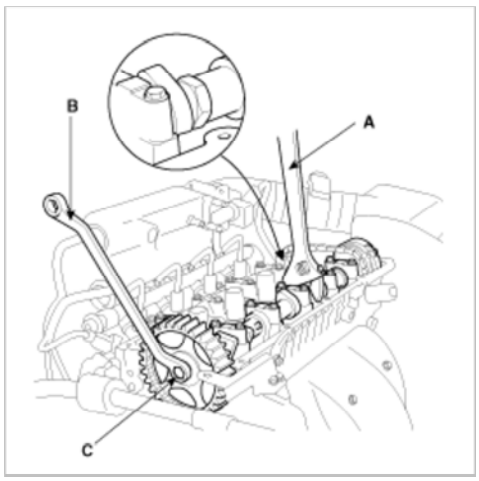
(4) Remove the auto tensioner stopper pin (B).

7. Check and adjust valve clearance.
8. Using the SST (09221-21000), install the camshaft bearing oil seal.

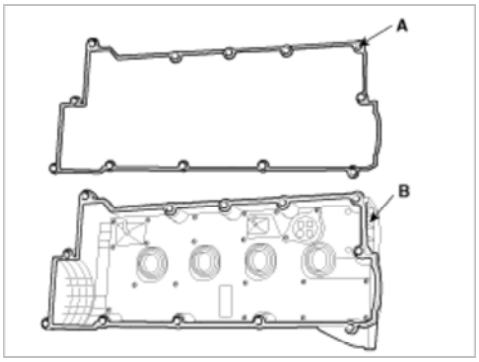


9. Install the camshaft sprocket and tighten the bolt to the specified torque.
   (1) Temporarily install the camshaft sprocket bolt.
   (2) Hold the hexagonal head wrench (A) portion of the camshaft with a wrench (B), and tighten the camshaft sprocket (C) bolt.

Tightening torque
Camshaft sprocket bolt :
98.1 ~ 117.7Nm (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



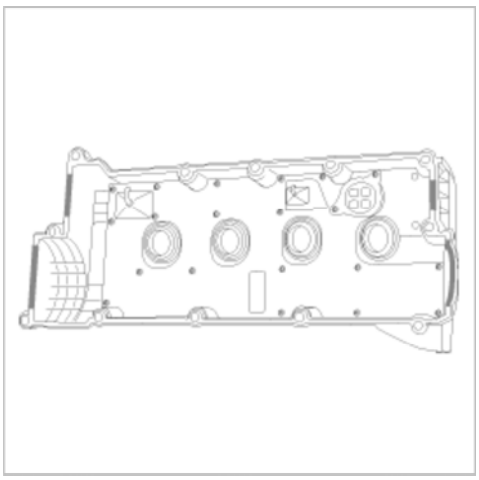
10. Install the timing belt. (Refer to Timing system in this group)
11. Install the cylinder head cover.
    (1) Install the cylinder head cover gasket (A) in the groove of the cylinder head cover(B).



NOTE

- Before installing the head cover gasket, thoroughly clean the head cover gasket and the groove.
- When installing, make sure the 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.

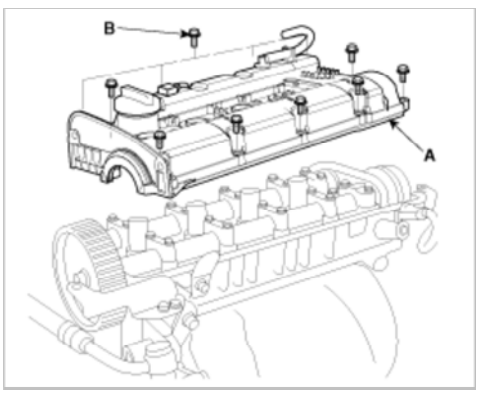


NOTE

- 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 12bolts(B). Uniformly tighten the bolts in several passes.

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



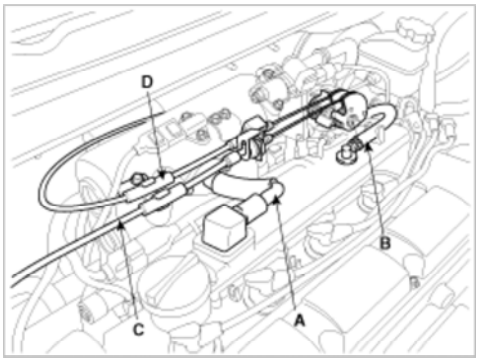
(4) Connect the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.

(5) Connect the positive crankcase ventilation (P.C.V) hose (A) and the breather hose (B) from the cylinder head cover.

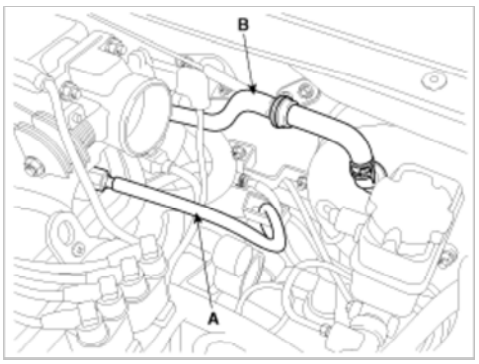
(6) Disconnect the spark plug cables and do not pull on the spark plug by force.

NOTE

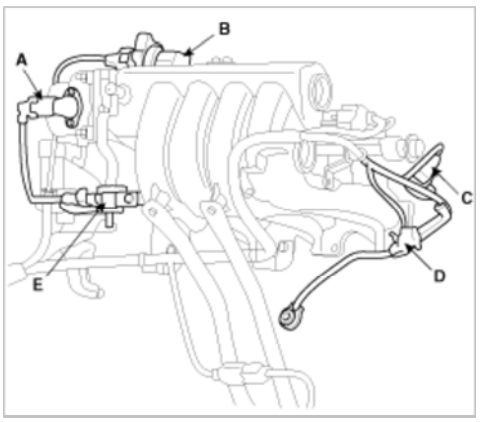
Pulling on or bending the calbes may damage the conductor inside.



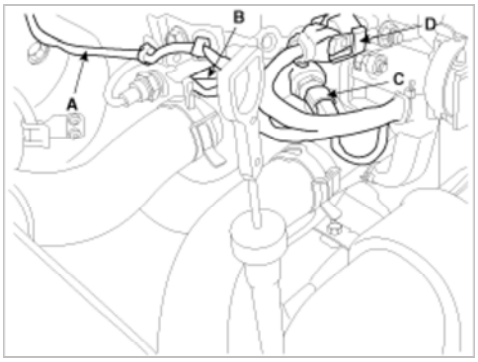
12. Install the intake manifold and exhaust manifold. (Refer to Intake and exhaust system in this group)
13. Install the fuel inlet hose (A).



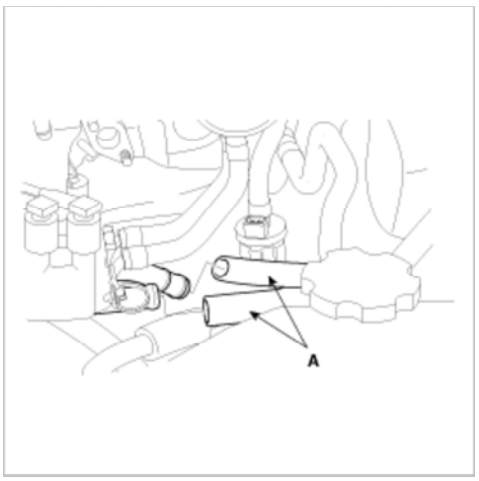
14. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
    (1) Front heated oxygen sensor connector.
    (2) Knock sensor connector (D).
    (3) Four fuel injector connectors.
    (4) CMP connector (C).
    (5) PCSV connector (E).
    (6) ISA connector (B).
    (7) TPS connector (A).



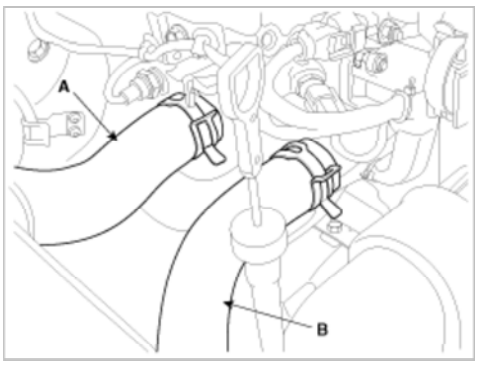
    (8) Ignition coil connector (D).
    (9) ECT sensor connector (C).
    (10) Oil temperature sensor connector (B).
    (11) OCV connector (A).



15. Install the heater hoses (A).



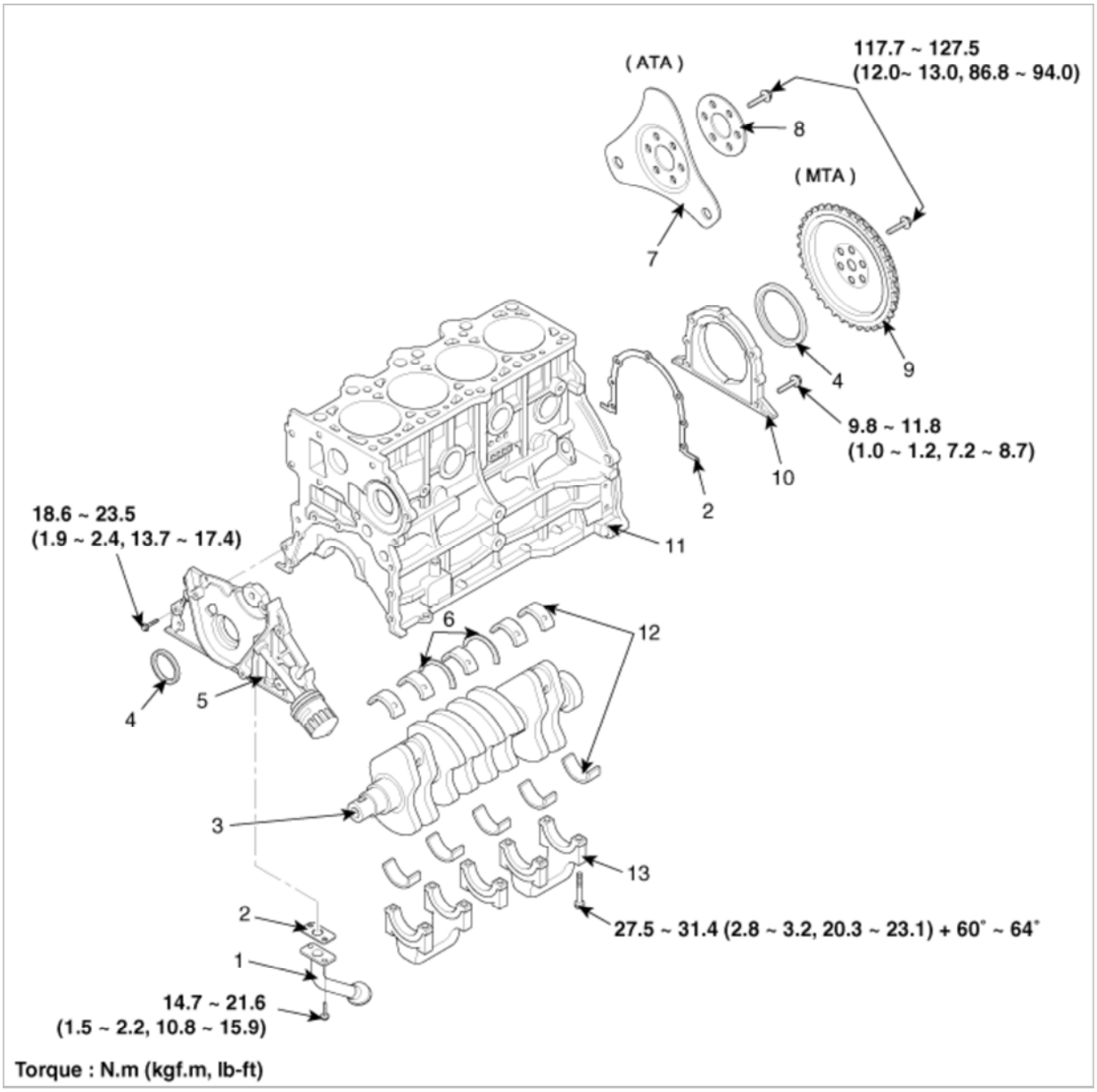
16. Install the upper radiator hose (A) and lower radiator hose (B).



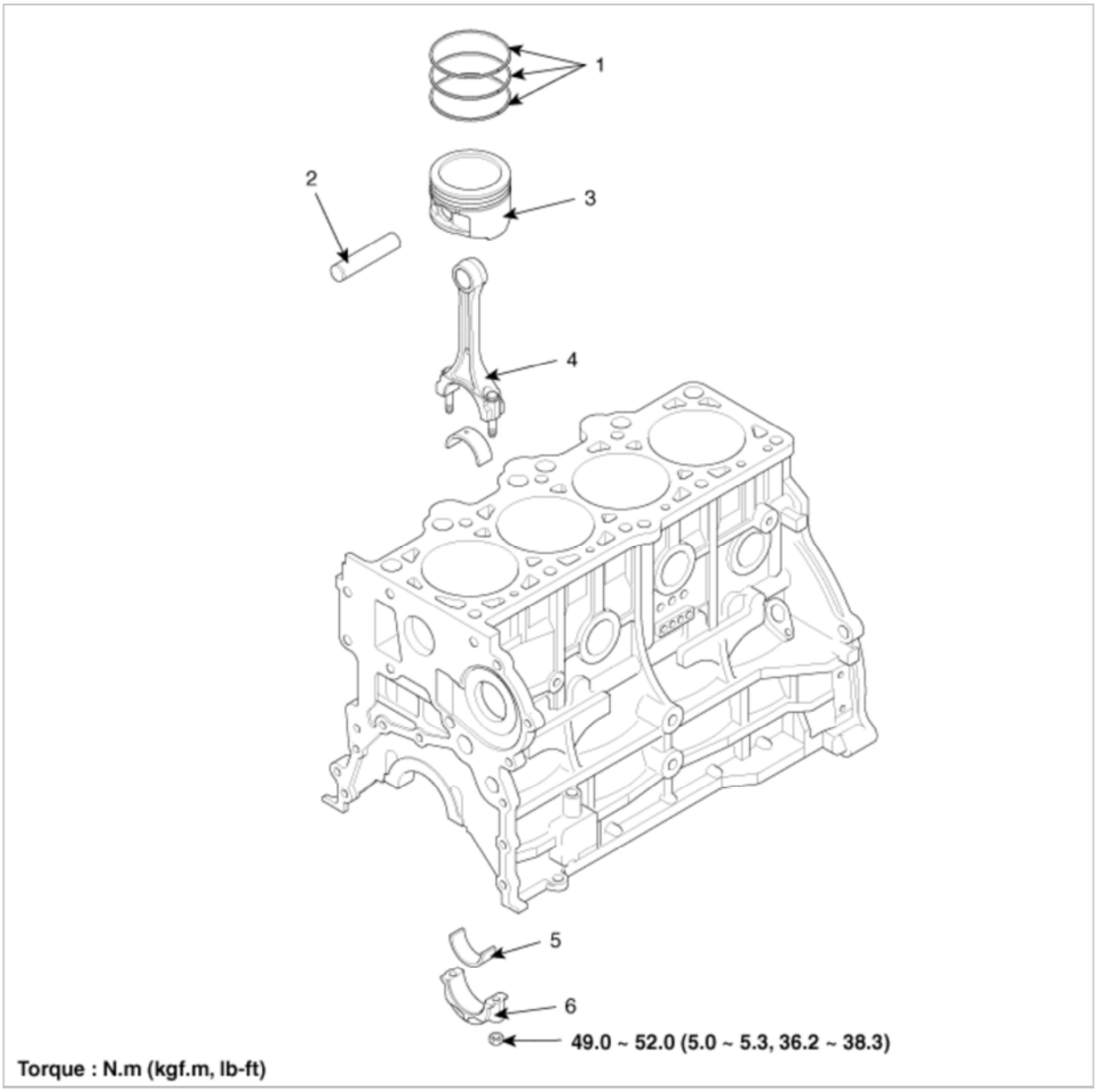
17. Install the intake air hose and air cleaner assembly.
18. Install the engine cover.
19. Install the battery and connect terminals.
20. Filll with engine coolant.
21. Start the engine and check for leaks.
22. Recheck engine coolant level and oil level.

Engine Mechanical System > Cylinder Block > Components and Components Location

Components



1. Oil screen 2. Gasket 3. Crankshaft 4. Oil seal 5. Front case	6. Thrust bearing 7. Drive plate 8. Washer 9. Adapter plate	10. Rear oil seal case 11. Cylinder block 12. Main bearing 13. Main bearing cap

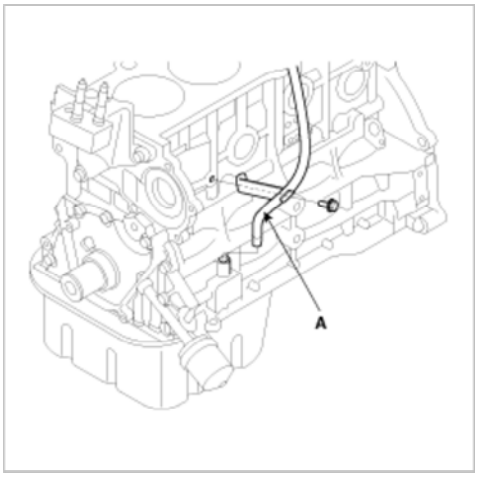


1. Piston ring 2. Piston pin 3. Piston	4. Connecting rod 5. Connecting rod bearing 6. Connecting rod bearing cap

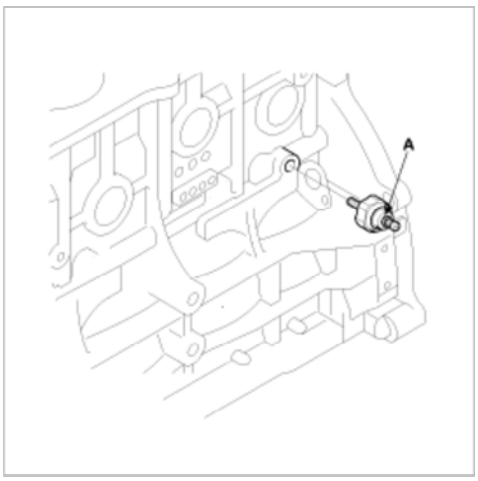
Engine Mechanical System > Cylinder Block > Repair procedures

Disassembly

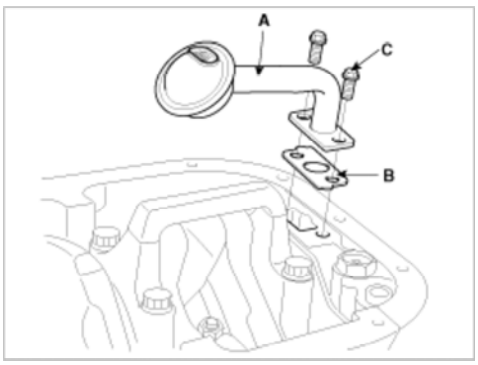
1. M/T : remove flywheel.
2. A/T : remove drive plate.
3. Install engine to engine stand for disassembly.
4. Remove timing belt. (Refer to Timing system in this group)
5. Remove cylinder head. (Refer to Cylinder head in this group)
6. Remove oil level gauge assembly (A).



7. Remove knock sensor.
8. Remove oil pressure sensor (A).



9. Remove water pump.
10. Remove oil pan.
11. Remove oil screen.
    Remove the 2bolts(C), oil screen (A) and gasket (B).

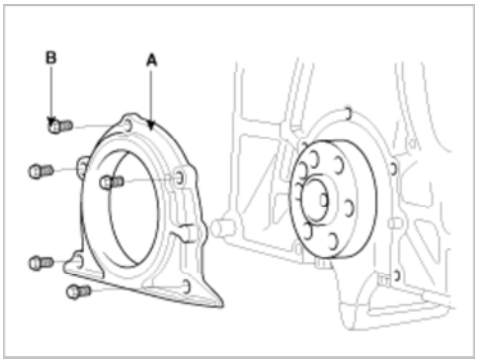


12. Check the connecting rod end play.
13. Remove the connecting rod caps and check oil clearance.
14. Remove piston and connecting rod assemblies.
    (1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
    (2) Push the piston, connecting rod assembly and upper bearing through 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.

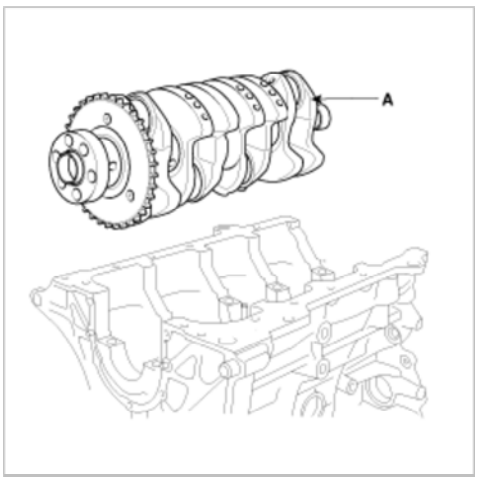
15. Remove front case.

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



17. Remove crankshaft bearing cap and check oil clearance.
18. Check the crankshaft end play.
19. Lift the crankshaft (A) out of the engine, being careful not to damage journals.

> NOTE
>
> Arrange the main bearings and trust washers 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 piston rings.
    (1) Using a piston ring expender, remove the 2 compression rings.
    (2) Remove the 2side rails and oil ring by hand.

> NOTE
>
> Arrange the piston rings in the correct order only.

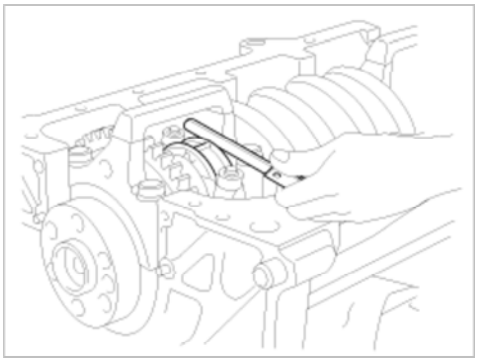
22. Disconnect connecting rod from piston.

Inspection

Connecting Rod And Crankshaft

1. Check the connecting rod end play.
   Using a feeler gauge, measure the end play while moving the connecting rod back and forth.

Standard end play : 0.1~ 0.25mm(0.004 ~ 0.010in)
Maximum end play : 0.4mm(0.016in)



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

B. If still out-of-tolerance, replace the crankshaft.

2. Check the connecting road bearing oil clearance.

(1) Check the matchmarks 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 bearing half.

(4) Clean the crank pin and bearing.

(5) Place plastigage across the crank pin.

(6) Reinstall the bearing half and cap, and torque the nuts.

Tightening torque
49.0 ~ 52.0 Nm (5.0 ~ 5.3kgf.m, 36.2 ~ 38.3lb-ft)

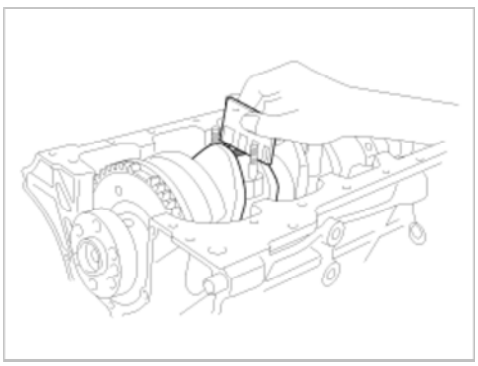
NOTE

Do not turn the crankshaft.

(7) Remove the 2 nuts, connecting rod cap and bearing half.

(8) Measure the plastigage at its widest point.

Standard oil clearance
0.024 ~ 0.042mm(0.0009 ~ 0.0017in)



(9) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION

Do not file, shim, or 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 (the color listed above or below that one), and check clearance again.

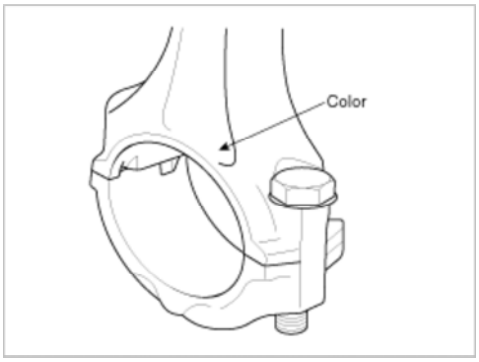
NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

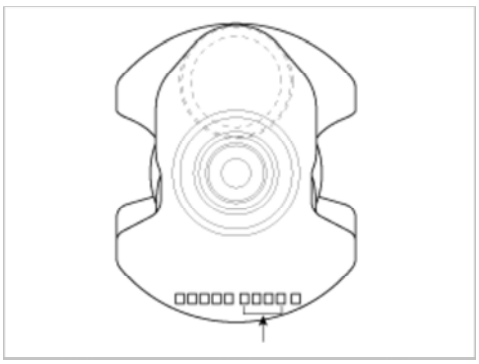
Connecting rod mark location

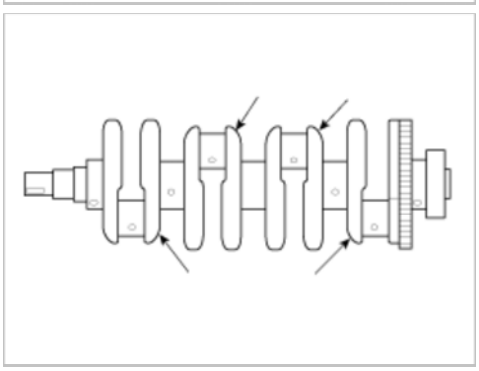


Discrimination Of Connecting Rod

Class	Mark	Inside Diameter
A	White	48.00 ~ 48.006mm (1.8896 ~ 1.8899in.)
B	None	48.006 ~ 48.012mm (1.8899 ~ 1.8902in.)
C	Yellow	48.012 ~ 48.018mm (1.8902 ~ 1.8904in.)

Crankshaft Pin Mark Location

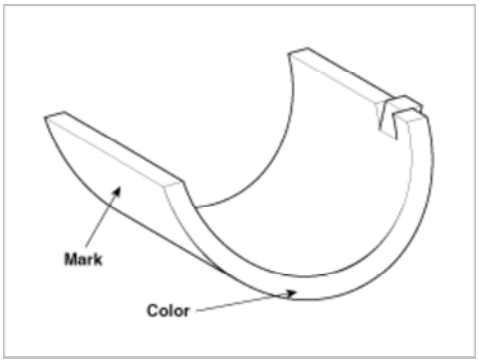




Discrimination Of Crankshaft

Clsass	Mark	Outside Diameter Of Pan
I	Yellow	44.960 ~ 44.966mm (1.7700 ~ 1.7703in.)
II	None	44.954 ~ 44.960mm (1.7698 ~ 1.7700in.)
III	White	44.948 ~ 44.954mm (1.7696 ~ 1.7698in.)

Place Of Identification Mark (Connecting Rod Bearing)



Discrimination Of Connecting Rod Bearing

Class	Mark	Thickness Of Bearing
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) Selection of connecting rod.

Crankshaft Indentification Mark	Connecting Rod Identification Mark	Assembing Classification Of Bearing
I (Yellow)	A (White)	D (Yellow)
	B (None)	C (Green)
	C (Yellow)	B (None)
II (None)	A (White)	C (Green)
	B (None)	B (None)
	C (Yellow)	A (Black)
III (White)	A (White)	B (None)
	B (None)	A (Black)
	C (Yellow)	AA (Blue)

3. Check the connecting rod.
   (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 (0.0020 in./3.94 in) or less
Allowable twist of connecting rod :
0.1mm / 100mm (0.0039 in./3.94 in) or less

4. Check the crankshaft bearing oil clearance.
   (1) To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.

(2) Clean each main journal and bearing half with a clean shop tower.

(3) Place one strip of plastigage across each main journal.

(4) Reinstall the bearings and caps, then torque the bolts.

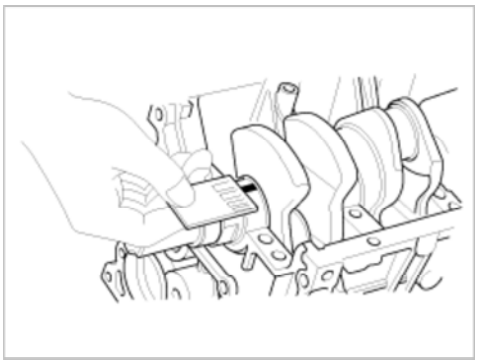
Tightening torque :
27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.11lb-ft) + 60° ~ 64°

NOTE

Do not turn the crankshaft.

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

Standard oil clearance :
0.028 ~ 0.046mm (0.0011 ~ 0.0018in)



(6) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION

Do not file, shim, or scrape the bearings or the caps to adjust clearance.

(7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

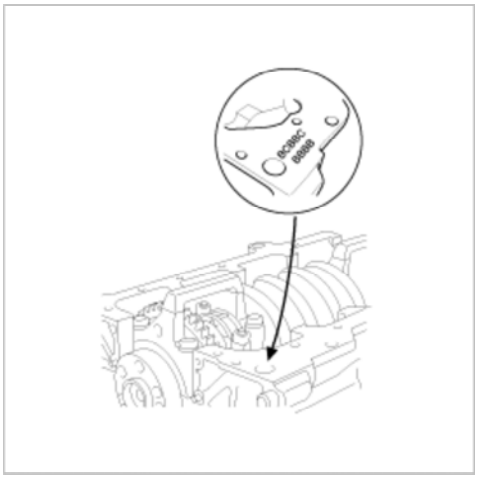
NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

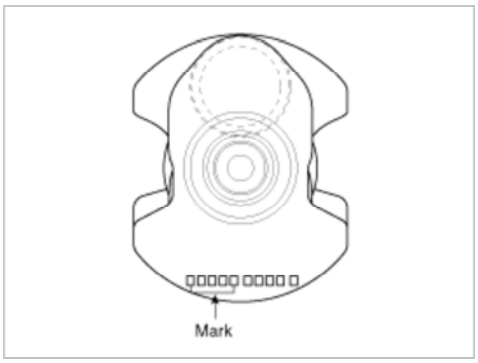
Crankshaft Bore Mark Location
Letters have been stamped on the end of the block as a mark for the size of each of the 5 main journal bores.
Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct bearings.

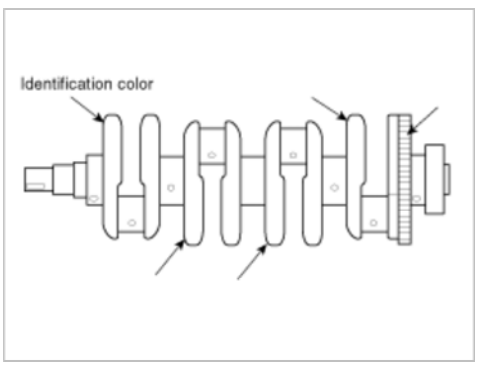


Discrimination Of Cylinder Block

Calss	Mark	Inside Diameter
a	A	59.000 ~ 59.006mm (2.3228 ~ 2.3230in.)
b	B	59.006 ~ 59.012mm (2.3230 ~ 2.3233in.)
c	C	59.012 ~ 59.018mm (2.3233 ~ 2.3235in.)

Crankshaft Journal Mark Location

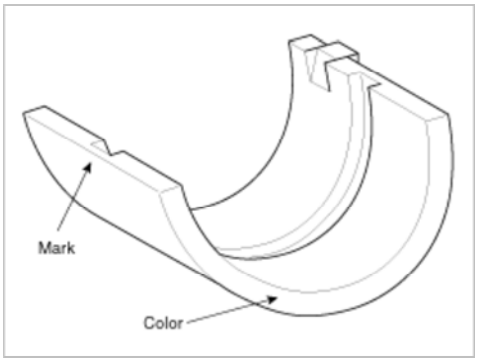




Discrimination Of Crankshaft

Class	Mark	Outside Diameter Of Journal
I	Yellow	54.956 ~ 54.962mm (2.1636 ~ 2.1638in.)
II	None	54.950 ~ 54.956mm (2.1633 ~ 2.1636in.)
III	White	54.944 ~ 54.950mm (2.1631 ~ 2.1633in.)

Place Of Identification Mark (Crankshaft Bearing)



Discrimination Of Crankshaft Bearing

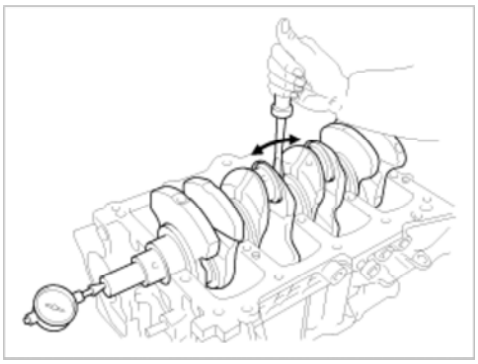
Class	Mark	Thickness Of Bearing
AA	Blue	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)
A	Black	2.011 ~ 2.014mm (0.0791 ~ 0.0793in.)
B	None	2.008 ~ 2.011mm (0.0790 ~ 0.0791in.)
C	Green	2.005 ~ 2.008mm (0.0789 ~ 0.790in.)
D	Yellow	2.002 ~ 2.005mm (0.0788 ~ 0.0789in.)

Selection

Crankshaft Identification Mark	Crankshaft Bore Identification Mark	Assembling Classification Of Bearing
I (Yellow)	a (A)	D (Yellow)
	b (B)	C (Green)
	c (C)	B (None)
II (None)	a (A)	C (Green)
	b (B)	B (None)
	c (C)	A (Black)
III (White)	a (A)	B (None)
	b (B)	A (Black)
	c (C)	AA (Blue)

5. Check crankshaft end play.
   Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard end play:
0.06 ~ 0.26mm (0.0023 ~ 0.010in)
Limit : 0.30mm (0.0118in)

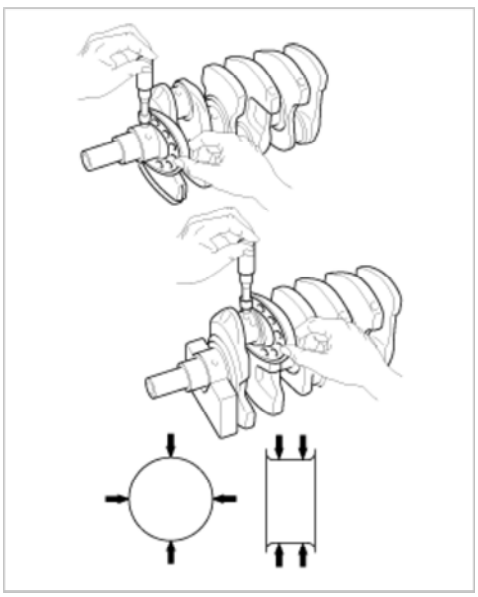


If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness :
2.44 ~ 2.47mm(0.096 ~ 0.097in)

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

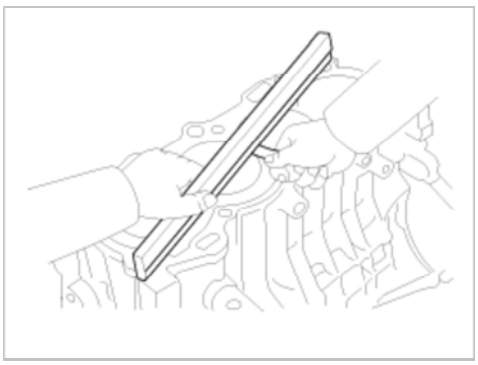
Main journal diameter :
56.942 ~ 56.962mm (2.2418~2.2426in)
Crank pin diameter :
44.946 ~ 44.966mm (1.7695 ~ 1.7703in)



Cylinder Block

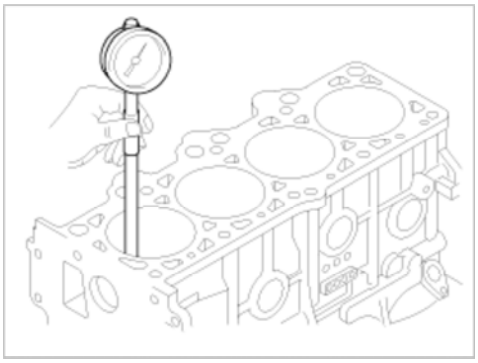
1. Remove gasket material.
   Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
2. Clean cylinder block
   Using a soft brush and solvent, thoroughly clean the cylinder block.
3. Inspect top surface of cylinder block for flatness.
   Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface
Standard : Less than 0.03mm(0.0012 in)
Limit : 0.05 mm (0.0020 in)

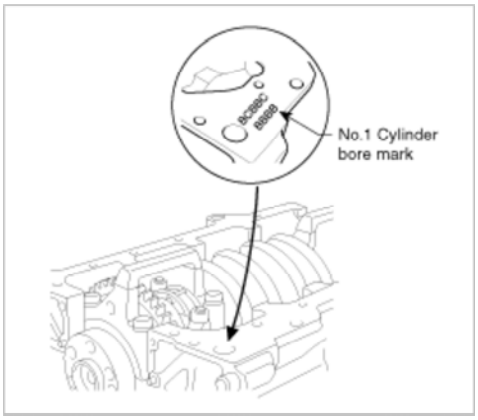


4. Inspect cylinder bore diameter
   Visually check the cylinder for vertical scratchs.
   If deep scratches are present, replace the cylinder block.
5. Inspect cylinder bore diameter
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial directions.

Standard diameter :
82.00 ~ 82.03mm (3.2283 ~ 3.2295in)

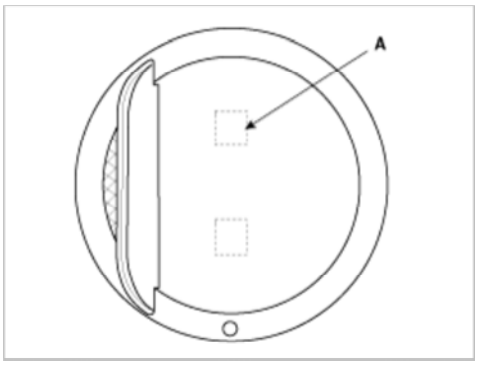


6. Check the cylinder bore size code on the cylinder block bottom face.



Class	Cylinder Bore Inner Diameter	Size code
A	82.00 ~ 82.01mm (3.228~ 3.2287in)	A
B	82.01 ~ 82.02mm (3.2287~ 3.2291in)	B
C	82.02 ~ 82.03mm (3.2291~ 3.2295in.)	C

7. Check the piston size code on the piston top face.



NOTE

Stamp the grade mark of basic diameter with rubber stamp.

Class	Piston Outer Diameter	Size Code
A	81.97 ~ 81.98mm (3.2271 ~ 3.2275in)	A

-	81.98 ~ 81.99mm (3.2275 ~ 3.2279in)	-
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in)	C

8. Select the piston related to cylinder borre class.

Clearance
0.02 ~ 0.04mm (0.00078 ~ 0.00157in.)

Boring Cylinder

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

Identification Mark	Size
0.25	0.25mm (0.010in)
0.50	0.50mm (0.020in)

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., calculate the new bore size.

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

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 Rings

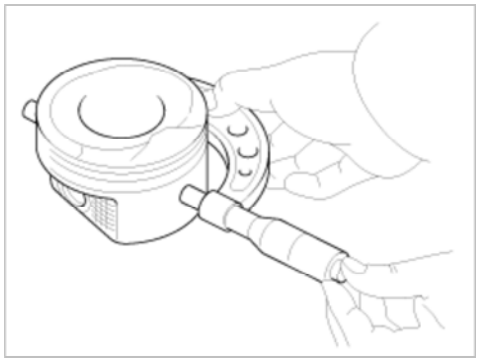
1. Clean piston
   (1) Using a gasket scraper, remove the carbon from the piston top.
   (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
   (3) Using solvent and a brush, thoroughly clean the piston.

NOTE

Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

Standard diameter
81.97 ~ 82.00mm (3.2272 ~ 3.2283in)

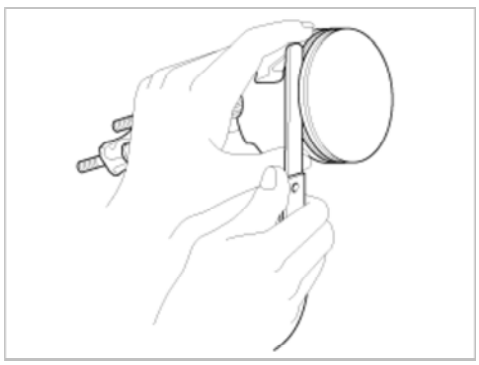


3. Calculate the difference between the cylinder bore diameter and the piston diameter.

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 the ring groove.

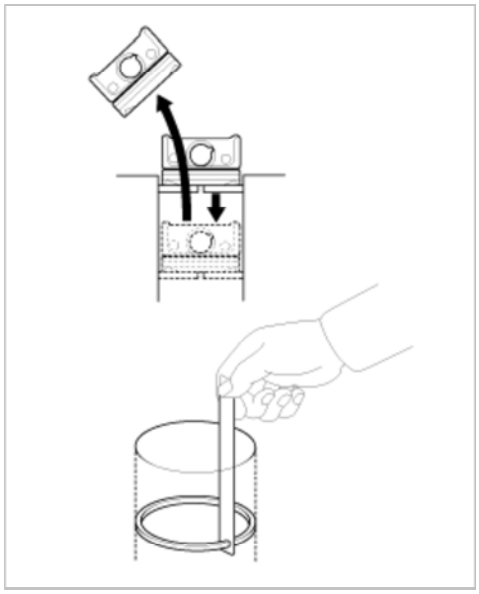
Piston ring side clearance
No. 1 : 0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in)
No. 2 : 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in)
Oil ring : 0.06 ~ 0.15 mm (0.0024 ~ 0.0059 in)
Limit
No. 1 : 0.1mm (0.004in)
No. 2 : 0.1mm (0.004in)
Oil ring : 0.2 mm (0.0079 in)



   If the clearance is greater than maximum, replace the piston.

5. Inspect 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 ring. If the gap is too large, recheck the cylinder bore diameter against the wear limits. If the bore is over the service limit, the cylinder block must be rebored.

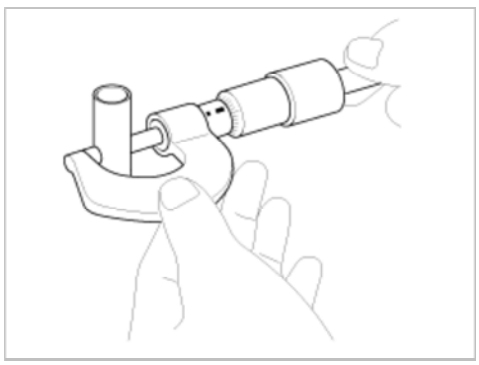
Piston ring end gap
Standard
No. 1 : 0.20 ~ 0.35mm (0.0079 ~ 0.0138 in)
No. 2 : 0.37 ~ 0.52mm (0.0146 ~ 0.0205 in)
Oil ring : 0.20 ~ 0.60 mm (0.0079 ~ 0.0236 in)
Limit
No. 1, 2, oil ring : 1.0mm (0.039in)



Piston Pins

1. Measure the diameter of the piston pin.

Piston pin diameter
20.001 ~ 20.006mm (0.7874 ~ 0.7876in)



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

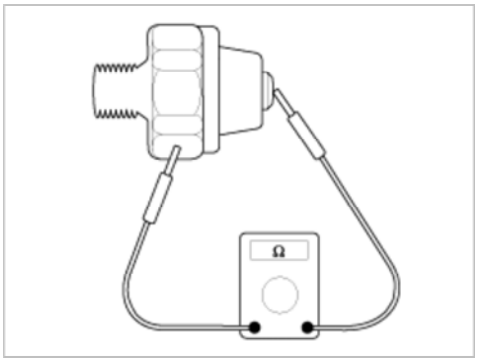
Piston pin-to-piston clearance
0.01 ~ 0.02mm (0.0004 ~ 0.0008in)

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

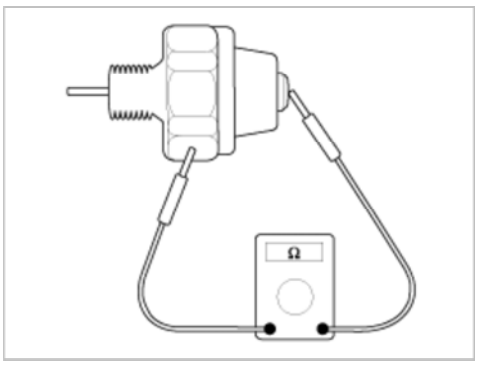
Piston pin-to-connecting rod interference
-0.032 ~ -0.016mm (-0.0013 ~ -0.00006in)

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 50kpa (7psi) is applied throgh the oil hole, the switch is operaing properly.
   Check for air leakage. If air leaks, the diahragm is broken. Replace it.

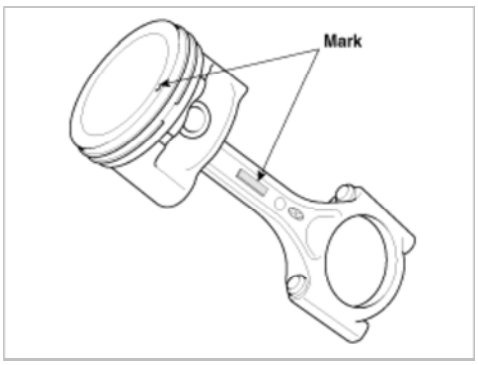


Reassembly

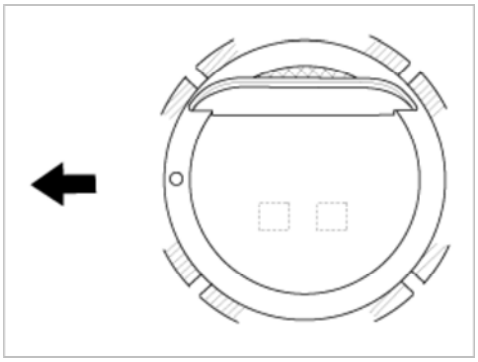
NOTE

- 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.

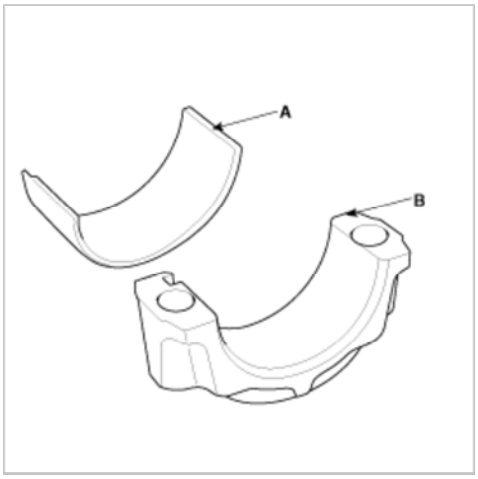
1. Assemble piston and connecting rod.
   (1) Use a hydraulic press for installation.
   (2) The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



2. Install piston rings.
   (1) Install the oil ring expander and 2 side rails by hand.
   (2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
   (3) Position the piston rings so that the ring ends are as shown.



3. Install 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).

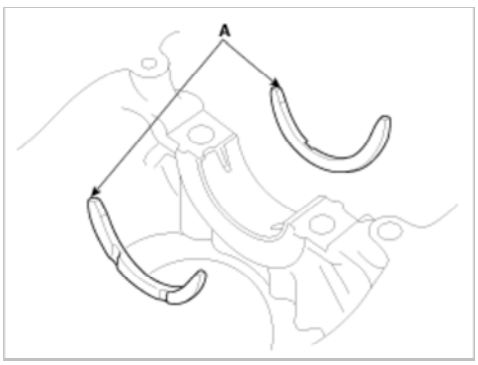


4. Install main bearings.

> 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 thrust bearings.
   Install the 2 thrust bearings under the No.3 journal position of the cylinder block with the oil grooves facing outward.



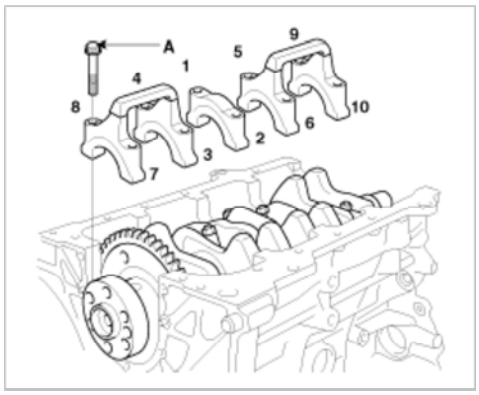
6. Place crankshaft on the cylinder block.
7. Place main bearing caps on cylinder block.
8. Install main bearing cap bolts.

> NOTE
>
> • The main bearing cap bolts are tightened in 2 progressive steps.
> • Always use new main bearing cap bolts.

(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 ~ 31.4Nm (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft) + 60 ~ 64°



(3) Check that the crankshaft turns smoothly.

9. Check crankshaft end play.

10. Install piston and connecting rod assemblies.

NOTE

Before installing the pistons, 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.

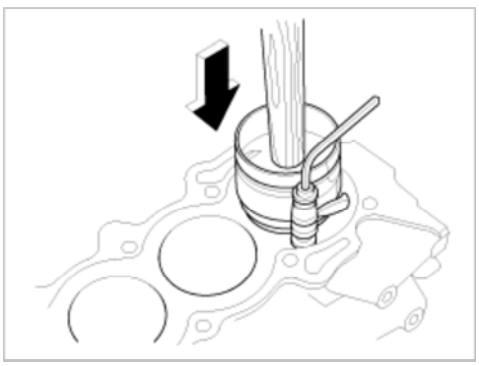
(2) Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.

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

(4) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the nuts : 49.0 ~ 52.0Nm (5.0 ~ 5.3kgf.m, 36.2 ~ 38.3lb-ft)

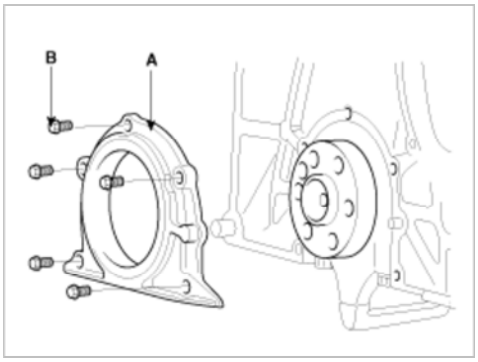
NOTE

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



11. Install a new gasket and rear oil seal case (A) with 5 bolts (B).

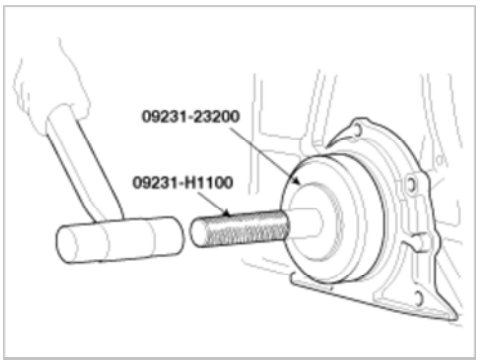
Tightening torque
9.8 ~ 11.8Nm (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



NOTE

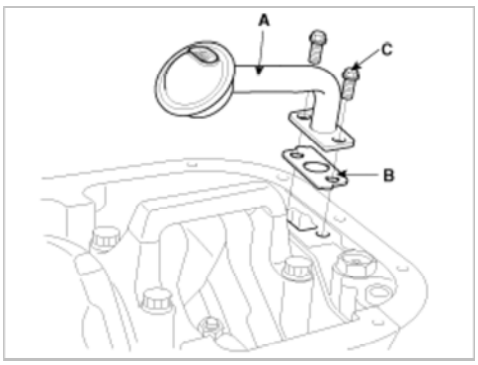
Check that the mating surfaces are clean and dry.

12. Install rear oil seal.
    (1) Apply engine oil to a new oil seal lip.
    (2) Using 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 front case.
14. Install oil screen.
    Install a new gasket (A) and oil screen (B) with 2 bolts(C).

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



15. Install 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 liqued gasket.

    (2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.
    Use liquid gasket 'TB 1217H' or equivalent.

NOTE

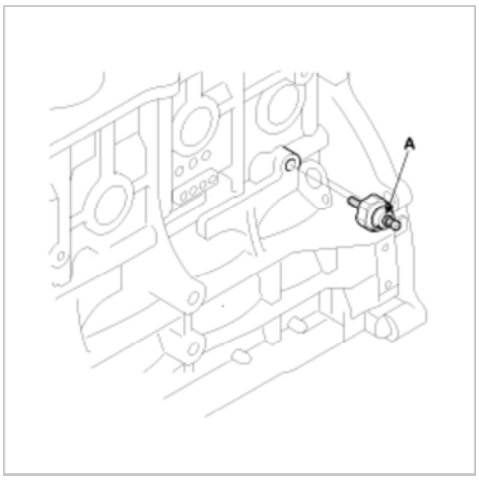
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

(3) Install the oil pan with the 19 bolts.
Uniformly tighten the bolts in several passes.

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

16. Install water pump. (Refer to Cooling system in this group)
17. Install oil pressure sensor.
    (1) Apply adhesive to 2 or 3 threads.
    Adhesive : Three bond 2310/2350 or equivalent.
    (2) Install the oil pressure sensor (A).

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

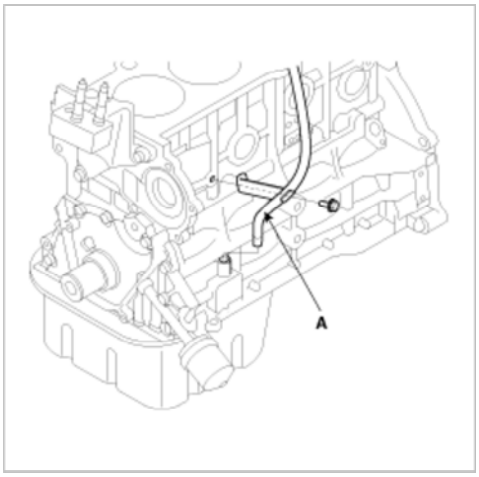


18. Install knock sensor.

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

19. Install oil level gauge assembly.
    (1) Install a new O-ring on the oil level gauge.
    (2) Apply engine oil on the O-ring.
    (3) Install the oil level gauge assembly (A) with the bolt.

Tightening torque
18.6 ~ 23.5Nm (1.9~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



20. Install cylinder head. (Refer to Cylinder head in this group)
21. Install timing belt. (Refer to Timing system in this group)
22. Remove engine stand.
23. A/T : Install drive plate.

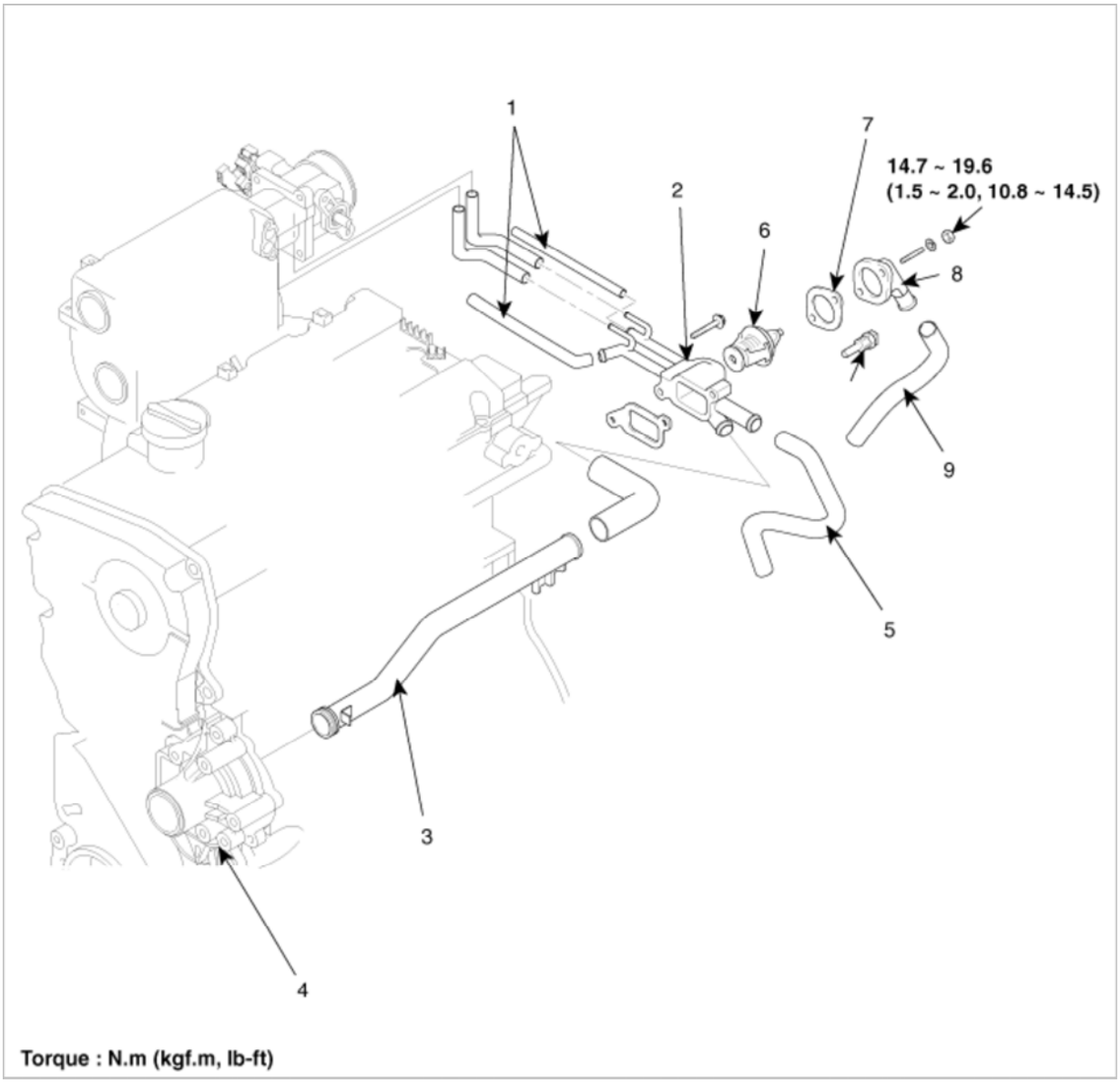
Tightening torque
117.7 ~ 127.5Nm (12.0 ~ 13.0kgf.m, 86.8 ~ 94.0lb-ft)

24. M/T : Install flywheel.

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

Engine Mechanical System > Cooling System > Components and Components Location

Components



1. Heater hoses 2. Thermostat housing 3. Coolant inlet pipe 4. Water pump 5. Radiator upper hose	6. Thermostat 7. Gasket 8. Coolant inlet fitting 9. Radiator lower hose

Engine Mechanical System > Cooling System > Repair procedures

Engine Coolant Refilling and Bleeding

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

3. Loosen the drain plug, and drain the coolant.
4. Tighten the radiator drain plug 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. Mix the recommended antifreeze with water at the ratio of five to five(coolant 5 : water 5) in a clean container.

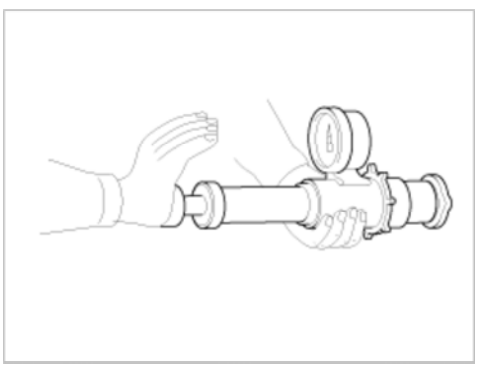
> NOTE
>
> • Use only genuine antifreese/coolant.
> • For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion or freezing.
> • Coolant concentrations greater then 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. Pour coolant into the radiator up to base of the filler neck, and install the radiator cap loosely.
8. Start the engine and let it run until it warms up (the radiator fan comes on at least twice).
9. Turn off the engine. Check the level in the radiator, add coolant if needed.
10. Put the radiatir cap on tightly, then run the engine again and check for leaks.

Cap Testing

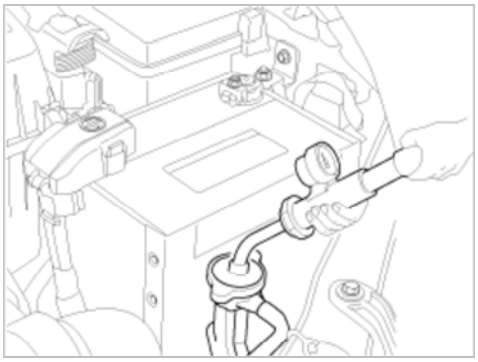
1. Remove the radiator cap, wet its seal with engine coolant, then install it no pressure tester.



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.

Testing

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.

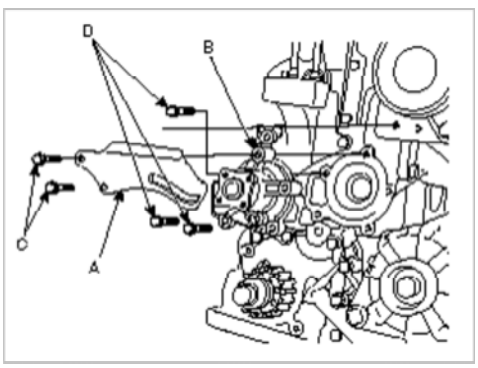
Removal

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.

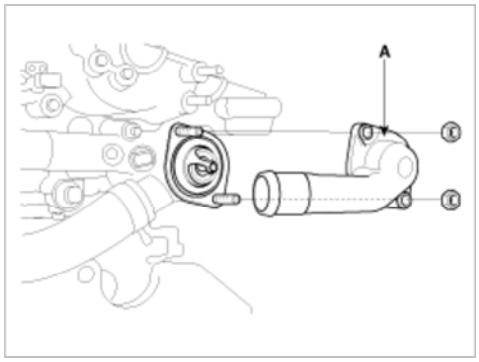
2. Remove drive belts.
3. Remove the timing belt and the timing belt idler. (Refer to Timing system in this group)
4. Remove the water pump.
   (1) Remove the 4 bolts and pump pulley.
   (2) Remove the 2 bolts(C), then remove the alternator brace (A).
   (3) Remove the water pump (B) and gasket.



Thermostat

> NOTE
>
> Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

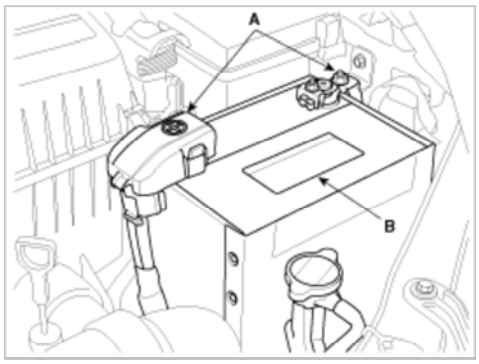
1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet (A), gasket and thermostat.



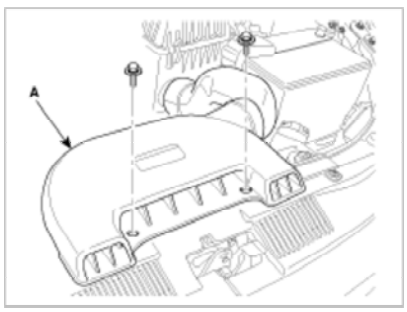
Radiator

1. Remove the radiator cap to speed draining.
2. Loosen the radiator drain plug (A) and drain engine coolant.

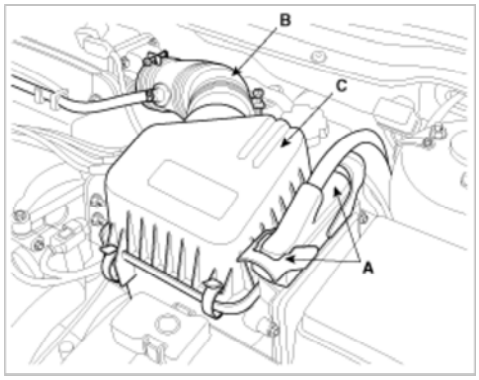
3. Disconnect the terminals(A) and remove the battery(B).



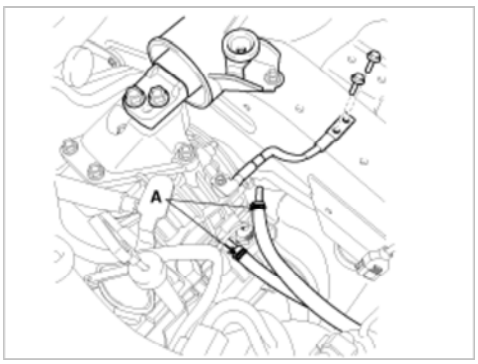
4. Remove the air duct (A).



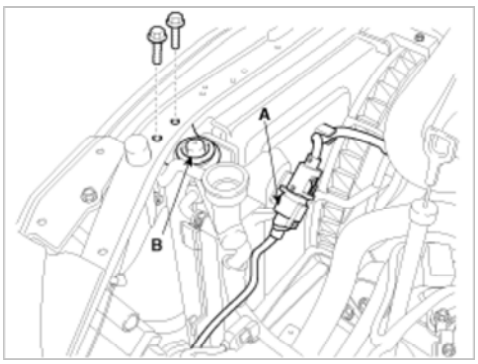
5. Remove the air cleaner assembly.
   (1) Disconnect the power train module (PCM) connector (A).
   (2) Disconnect the intake hose (B).
   (3) Remove the air cleaner assembly (C).



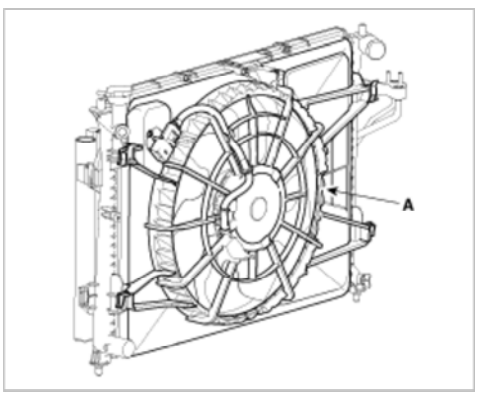
6. Disconnect the auto transaxle fluid (ATF) hose (A).



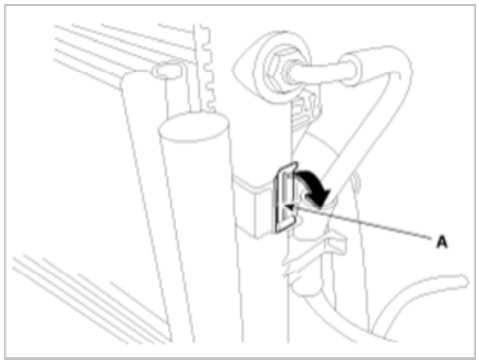
7. Disconnect the fan motor connector (A) and remove the radiator mounting bracket (B).



8. Remove the blower assembly(A).



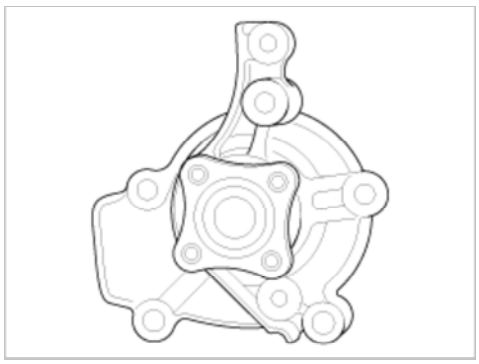
9. After pulling back the condenser fixing bracket(A), remove the radiator assembly.



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 abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.



3. Check for coolant leakage. If coolant leaks from hole, replace the coolant pump assembly.

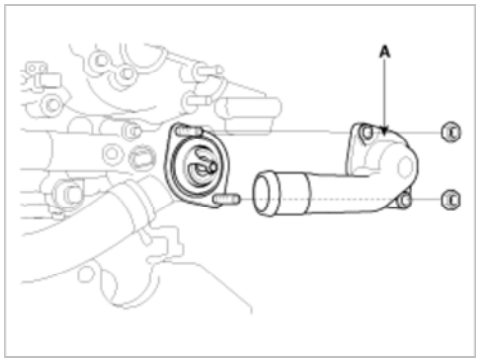
> NOTE
>
> A small amount of “weeping” from the bleed hole is normal.

Thermostat

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

2. Check the valve opening temperature.

Valve opening temperature : 82 °C(177 °F)
Full opening temperature : 95 °C(205 °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(205 °F)

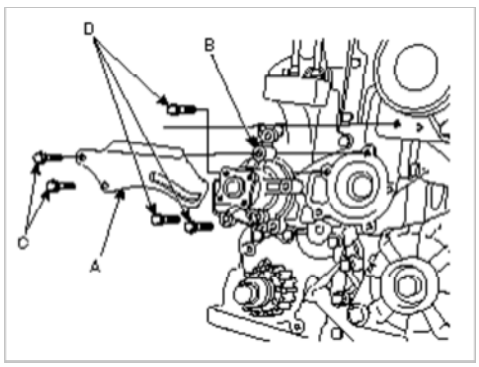
If the valve lift is not as specified, replace the thermostat.

Installation

Water Pump

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

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

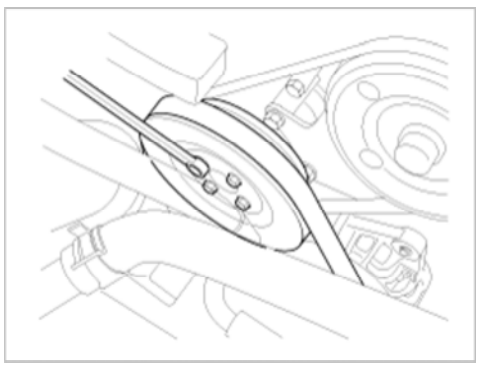


   (2) Install the alternator brace (A) with the 2 bolts (C).

Tightening torque
19.6 ~ 23.5Nm (2.0 ~ 2.4kgf.m, 14.5 ~ 17.4lb-ft)

   (3) Install the 4 bolts and pump pulley.

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

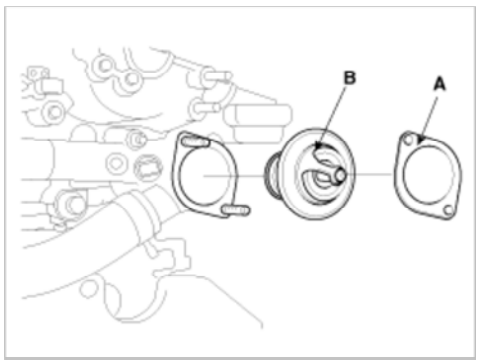


2. Install the timing belt idler and the timing belt. (Refer to Timing system in this group)

3. Install drive belts.
4. Fill with engine coolant.
5. Start engine and check for leaks.
6. Recheck engine coolant level.

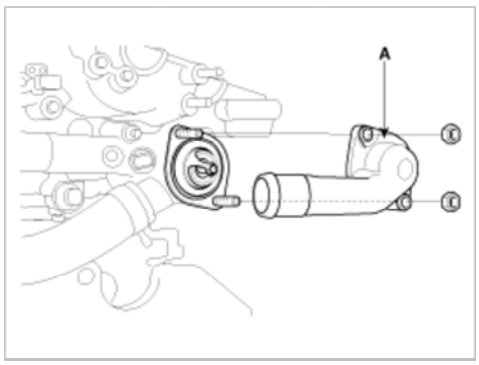
Thermostat

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



2. Install water inlet (A).

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

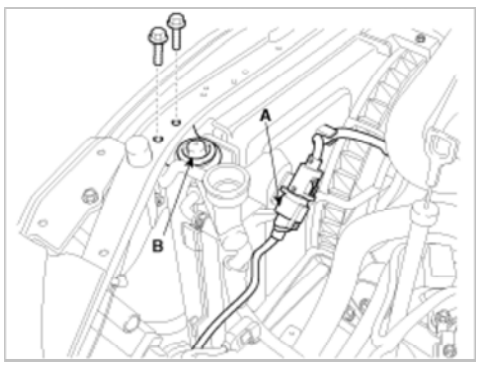


3. Fill with engine coolant.
4. Start engine and check for leaks.

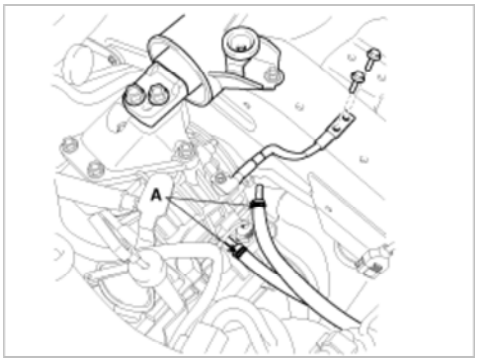
Radiator

1. Install the radiator.
2. Connect the fan motor connector (A) and install the radiator mounting bracket (B).

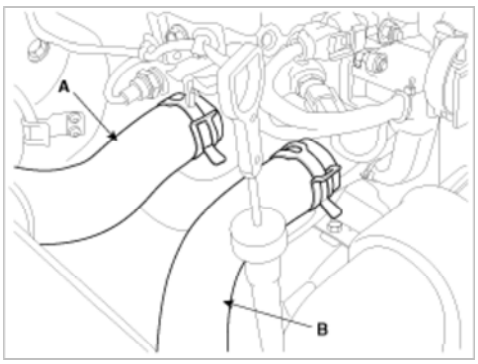
Tightening torque
8.8 ~ 10.8Nm (0.9 ~ 1.1kgf.m, 6.5 ~ 7.9lb-ft)



3. Connect the auto transaxle fluid (ATF) hoses (A).

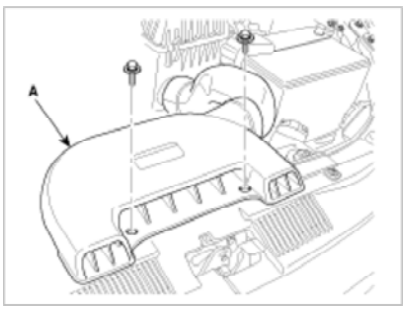


4. Install the upper radiator hose (A) and lower radiator hose (B).

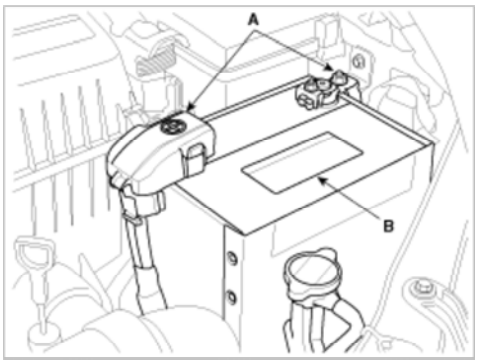


5. Install air cleaner assembly.
6. Install the air duct (A).

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



7. Install battery (B) and connect teminal (A).



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

Engine Mechanical System > Cooling System > Troubleshooting

Troubleshooting

Water Pump

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the bleed hole of the water pump	Visually check	• Check leaks after about ten-minute warming up.	• If coolant still leaks, replace a water pump.
				• If leakage stops, reuse the water pump (Do not replace the pump with a new one).
	• From gaskets or bolts		• Check the tightening of the water pump mounting bolts.	• Retighten the mounting bolts.
			• Check damage of gaskets or inflow of dust.	• Replace the gasket and clean dust off.
	• From outer surface of water pump		• Check the material or any cracks of the water pump.	• Poor material. If any crack found, replace the water pump.
Noise	• From bearings • From mechanical seals • Impeller interference	Inspection with a stethoscope	• After starting the engine, check noise with a stethoscope.	• If there is no noise, reuse the water pump (do not replace it).
				• If there is any noise from the water pump, remove the drive belt and recheck.
		Inspection after removing a drive belt	• After removing a water pump and a drive belt, check noise again.	• If there is noise, reuse the water pump. Check other drive line parts.
				• If there is no noise, replace the water pump with a new one.
		Inspection after removing a water pump	• After removing a water pump and a drive belt, check noise again.	• If there is any interference between them, replace the water pump with a new one.
Overheating	• Damaged impeller • Loosened impeller	Loosened impeller	• Corrosion of the impeller wing	• Check engine coolant. • Poor coolant quality / Maintenance check
			• Impeller seperation from the shaft	• Replace the water pump.

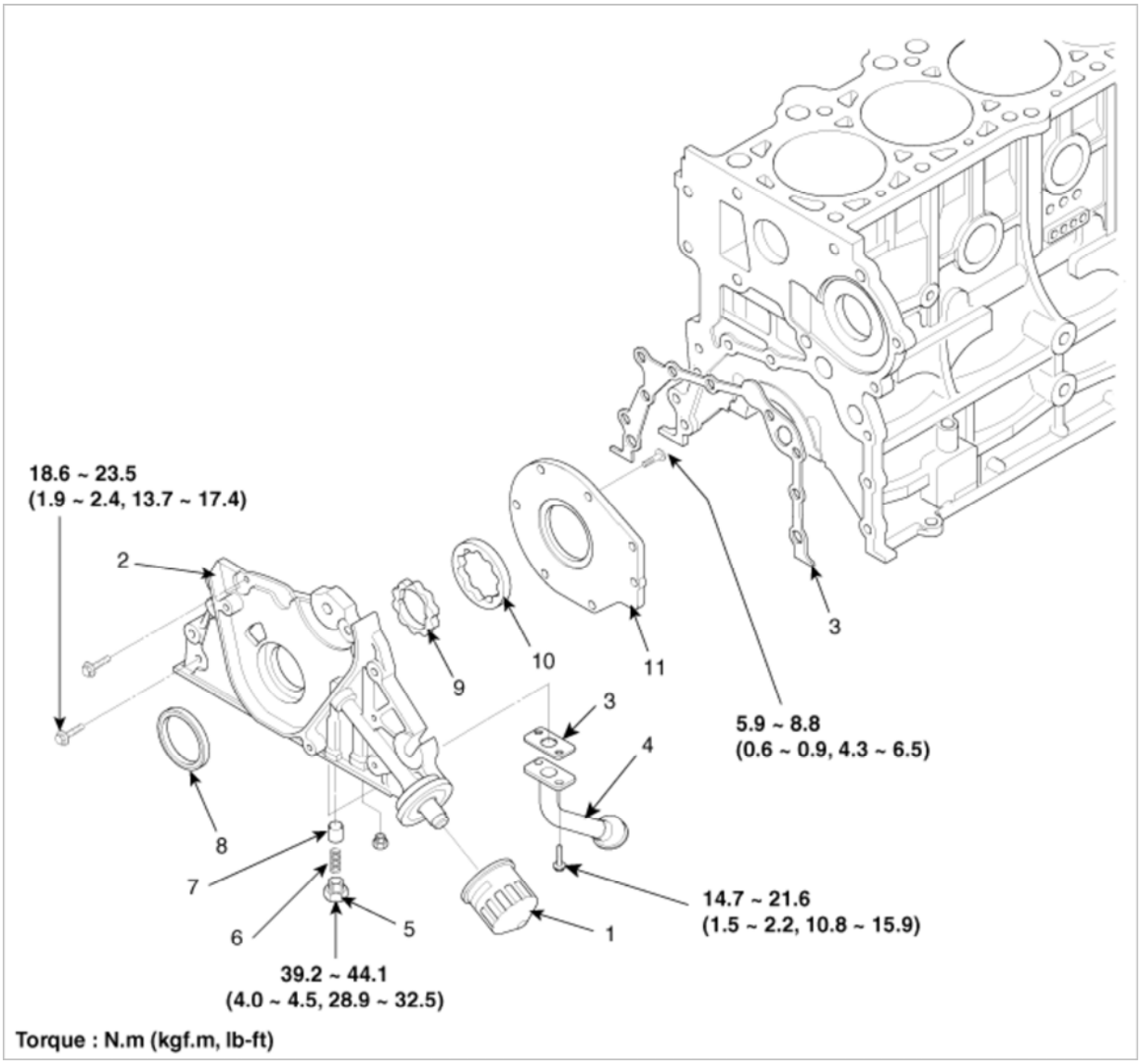
Thermostat

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the thermostat gasket	Check the mounting bolts	• Check the torque of the mounting bolts	• Retighten the bolts and check leakage again.
		Check the gasket for damage	• Check gasket or seal for damage	• Replace gaskets and reuse the thermostat.
Cooled excessively	• Low heater performance (cool air blowed-out) • Thermogauge indicates 'LOW'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage.	• After refilling coolant, recheck.
		GDS check&Starting engine	• Check DTCs • Check connection of the fan clutch or the fan motor. ※ If the fan clutch is always connected, there will be a noise at idle.	• Check the engine coolant sensor, wiring and connectors. • Replace the componants.
		Remove the		

		thermostat and inspect	• Check if there are dusts or chips in the thermostat valve. • Check adherence of the thermostat.	• Clean the thermostat valve and reuse the thermostat. • Replace the thermostat, if it doesn't work properly.
Heated excessively	• Engine overheated • Thermogauge indicates 'HI'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage. ※ Be careful when removing a radiator cap of the overheated vehicle. • Check air in cooling system.	• After refilling coolant, recheck. • Check the cylinder head gaskets for damage and the tightening torque of the mounting bolts.
		GDS check&Starting engine	• Check DTCs • Check the fan motor performance as temperature varies. • Check if the fan clutch slips. • Check the water pump adherence or impeller damaged.	• Check the engine coolant sensor, wiring and connectors. • Check the fan motor, the relay and the connector. • Replace the fan clutch, if it doesn't work properly. • Replace the water pump, if it doesn't work properly.
		Immerse the thermostat in boiling water and inspection.	• After removing the thermostat, check it works properly. ※ Check the thermostat opens at the valve opening temperature.	• Replace the thermostat, if it doesn't work properly.

Engine Mechanical System > Lubrication System > Components and Components Location

Components



1. Filter 2. Front case 3. Gasket 4. Oil screen 5. Plug 6. Relief spring	7. Relief plunger 8. Oil seal 9. Inner rotor 10. Outer rotor 11. Pump cover

Engine Mechanical System > Lubrication System > Repair procedures

Oil And Filter

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 engine oil.
   A. Remove the oil filler cap.
   B. Remove the oil drain plug, and drain the oil into a container.

2. Replace oil filter.
   A. Remove the oil filter.
   B. Check and clean the oil filter installation surface.
   C. Check the part number of the new oil filter is as same as old one.
   D. Apply clean engine oil to the gasket of a new oil filter.
   E. Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
   F. Tighten it an additional 3/4 turn.
3. Refill with engine oil filter.
   A. 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)

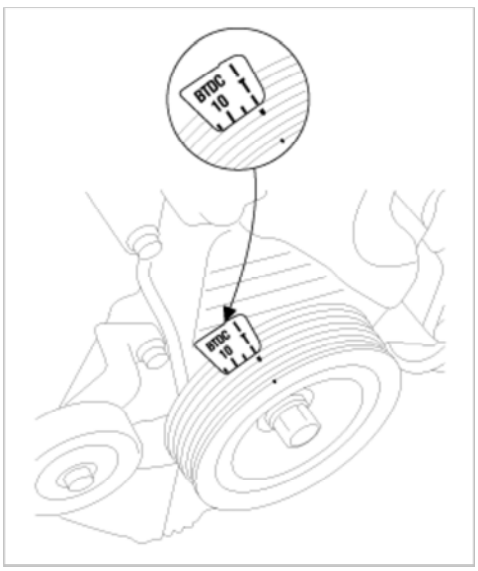
   B. Fill with fresh engine oil

   Capacity
   When replacing a short engine or a block assembly : 4.1L (4.33US qts, 3.60Imp qts)
   When replacing an oil pan :
   3.7L (3.91US qts, 3.26Imp qts)
   Drain and refill including oil filter :
   4.0L (4.23US qts, 3.25Imp qts)

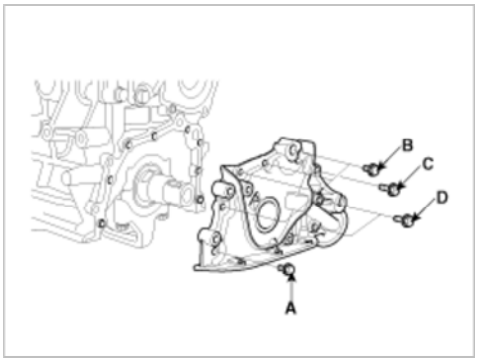
   C. Install the oil filter cap.
4. Start engine and check for oil leaks.
5. Recheck engine oil level.

Removal

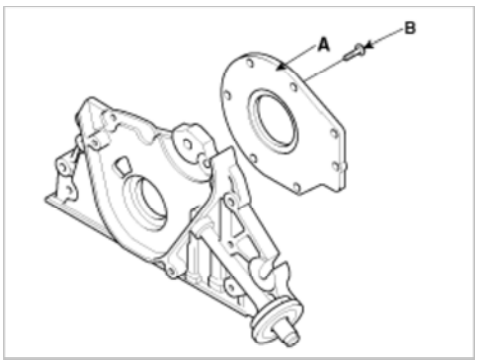
1. Drain engine oil.
2. Remove the drive belts.
3. Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the lower cover.



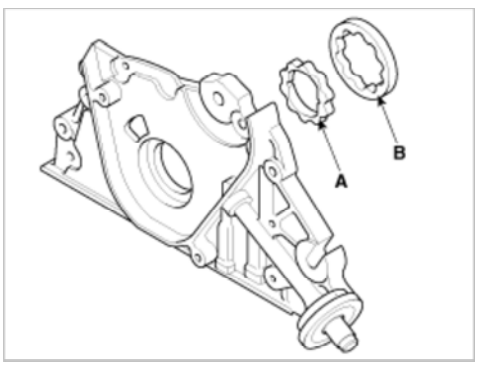
4. Remove the timing belt. (Refer to Timing system in this group)
5. Remove the oil pan and oil screen.
6. Remove the front case.



(1) Remove the screws (B) from the pump housing, then separate the housing and cover (A).

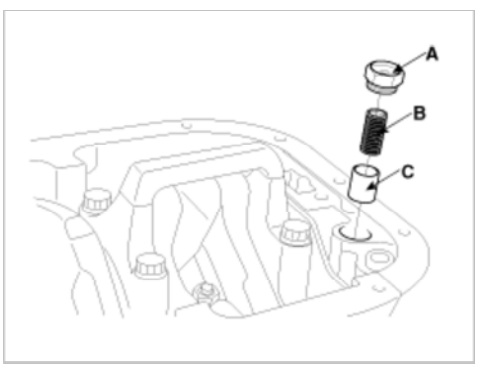


(2) Remove the inner (A) and outer (B) rotors.



Disassembly

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



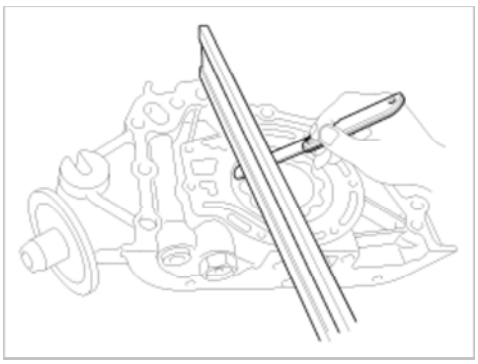
Inspection

1. Inspect relief plunger.
   Coat the valve 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 relief valve spring.
   Inspect for distorted or broken relief valve spring.

Standard value
Free height : 43.8mm (1.724 in.)
Load : 3.7kg/40.1mm (8.14 lb/1.579 in.)

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

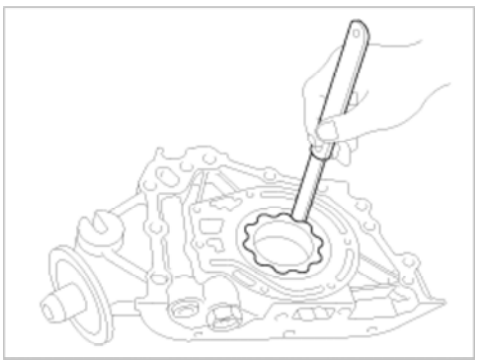
Side clearance	Outer gear	0.04 ~ 0.09mm (0.0016 ~ 0.0035in.)
	Inner gear	0.04 ~ 0.085mm (0.0016 ~ 0.0033in.)



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

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

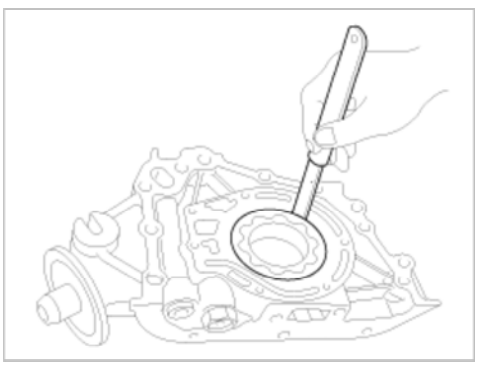
Tip clearance
0.025 ~ 0.069 mm(0.0010 ~ 0.0027 in.)



   If the tip clearance is greater than maximum, replace the rotor as a set.

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

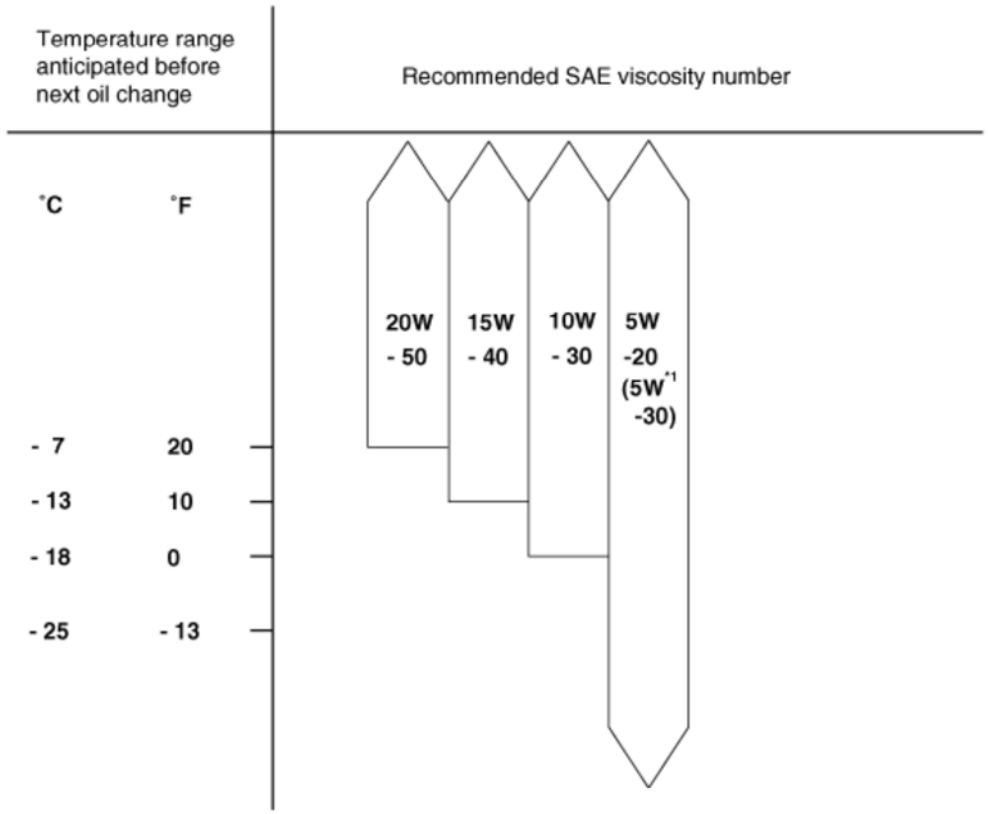
Body clearance
0.12 ~ 0.185 mm(0.0047 ~ 0.0073 in.)



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

Selection Of Engine Oil

Recommended ILSAC classification : Above GF3
Recommended API classification : Above SJ or SL
Recommended SAE viscosity grades :



*1 If 5W-20 / GF3 engine oil is not available, 5W-30/GF3 or secondary recommended engine oil for corresponding temperature range can be used.

NOTE

For best performance and maximum protection of all types of operation, select only those lubricants whitch :
1. Satisfy the requirement of the API classification.
2. Have proper SAE grade number for expected ambient temperature range.

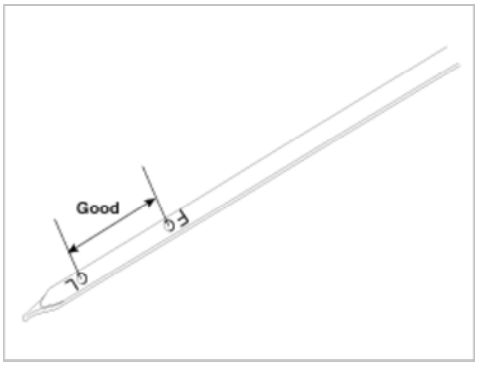
Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

Eneine Oil

1. Check engine oil quality.
   Check the oil for deterioration, entry of water, discoloring or thinning.
   If the quality is visibly poor, replace the oil.
2. Check engine oil level.
   After warming up the engine and then 5 minutes after the engine stop, oil level should be between the “L” and “F” marks on the dipstick.
   If low, check for leakage and add oil up to the “F” mark.

NOTE

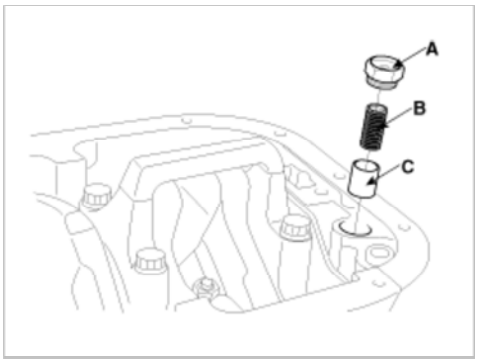
Do not fill with engine oil above the “F” mark.



Reassembly

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

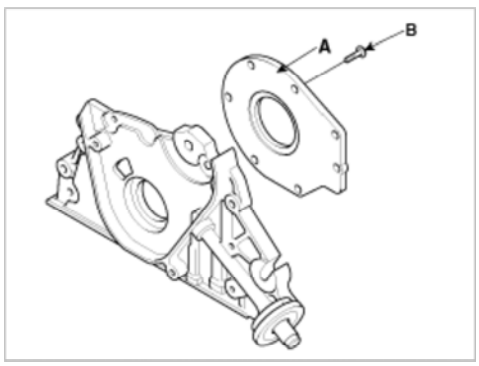
Tightening torque
39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)



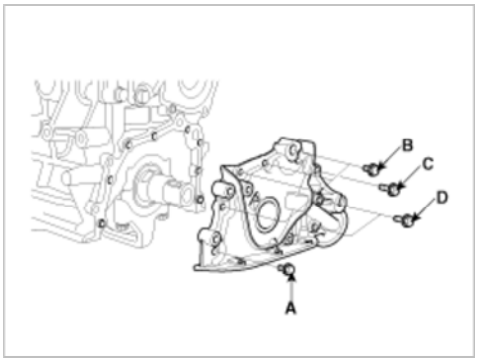
Installation

1. Install 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).

Tightenig torque
5.9 ~ 8.8N.m (0.6 ~ 0.9kgf.m, 4.3 ~ 6.5lb-ft)



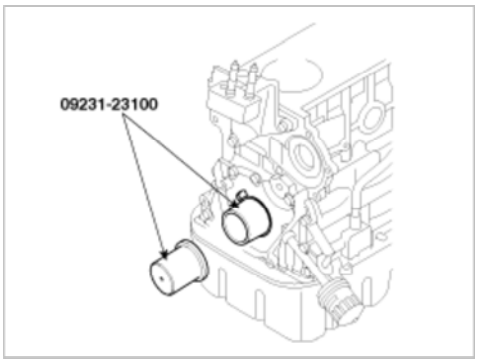
2. Check that the oil pump turns freely.
3. Install the oil pump on the cylinder block.
   Place a new front case gasket on the cylinder block. Apply engine oil to the lip of the oil pump seal. Then, install the oil pump onto the crankshaft. When the pump is in place, clean any excess grease off the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



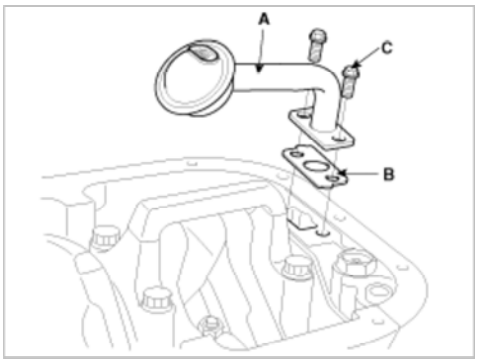
Bolt length
(A) : 0.98 in (25mm)
(B) : 0.787 in (20mm)
(C) : 1.496 in (38mm)
(D) : 1.771 in (45mm)

Tightening torque :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4 lb-ft)

4. Apply a light coat of oil to the seal lip.
5. Using the SST(09231-23100), install the oil seal.



6. Install the oil screen(A) with a new gasker (B).



7. Install 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 liqued gasket.

   (2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.
   Use liquid gasket 'TB 1217H' 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.

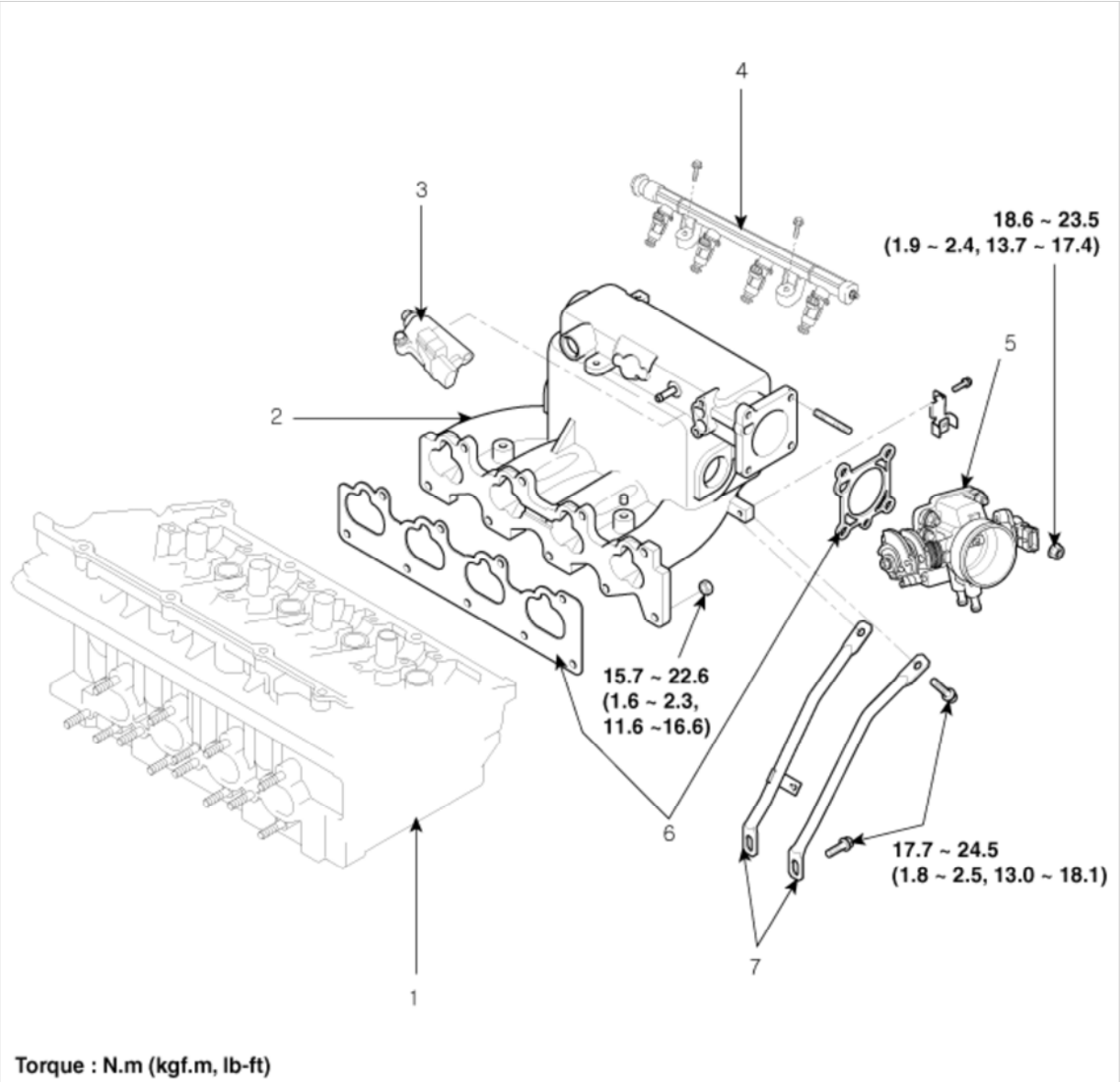
• After assembly, wait at least 30 minutes before filling the engine with oil.

(3) Install the oil pan with the 19 bolts.
Uniformly tighten the bolts in several passes.

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

Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Components and Components Location

Components



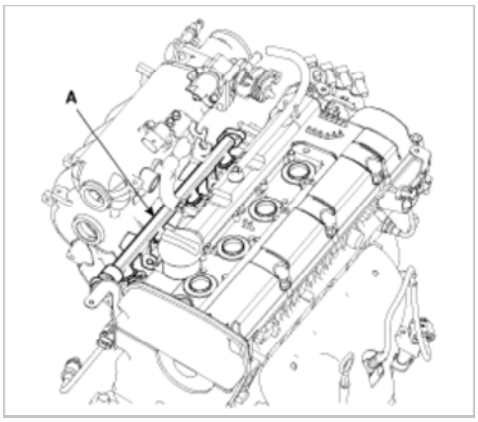
1. Cylinder head 2. Intake manifold 3. Idle speed actuator(ISA) 4. Delivery pipe assembly	5. Throttle body assembly 6. Gasket 7. Intake manifold stay

Engine Mechanical System > Intake And Exhaust System > Intake Manifold > Repair procedures

Removal

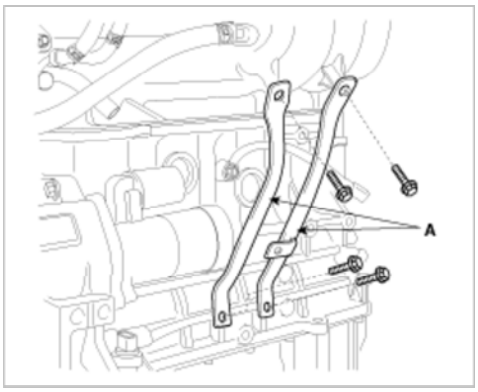
1. Removal the engine cover.
2. Disconnect the throttle position sensor(TPS) and the idle speed actuator(ISA) connectors.
3. Disconnect the positive crankcase ventilation(PCV) hose and the breather hose.
4. Disconnect the accelerator cable.
5. Remove the delivery pipe(A).

Tightening torque
18.6 ~ 23.5Nm (1.9 ~ 2.4kgf.m, 13.7 ~ 17.3lb-ft)



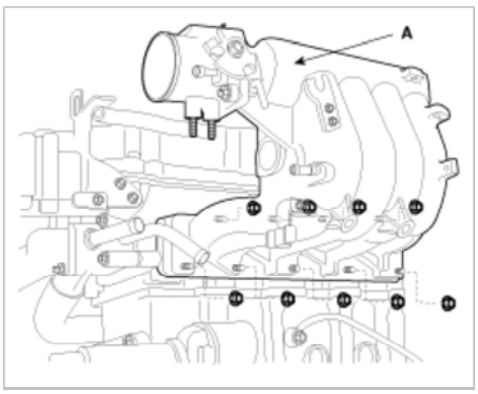
6. Disconnect the pulge control solenoid valve(PCSV) hose and the brake booster hose from the intake manifold and throttle body assembly.
7. Remove the intake manifold stay(A).

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



8. Remove the intake manifold assembly(A).

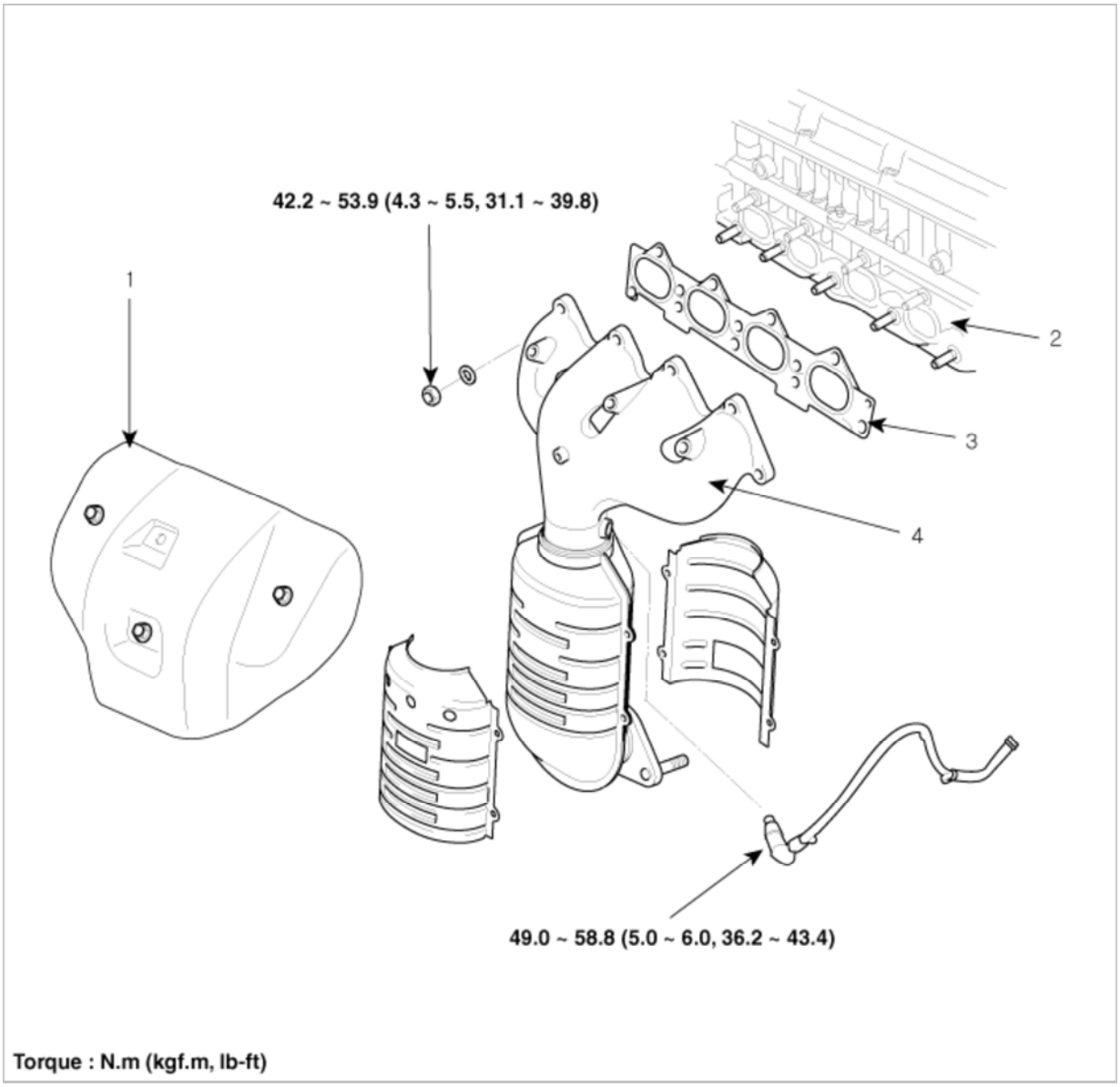
Tightening torque
15.7 ~ 22.6Nm (1.6 ~ 2.3kgf.m, 11.6 ~ 16.6lb-ft)



9. To install, reverse the removal procedure with new gaskets.

Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Components and Components Location

Components



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

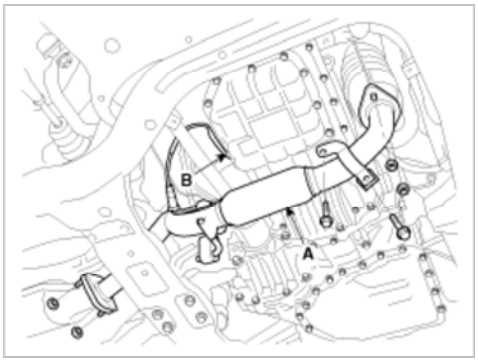
1. Heat protector 2. Cylinder Head 3. Gasket	4. Exhaust manifold 5. Front oxygen sensor

Engine Mechanical System > Intake And Exhaust System > Exhaust Manifold > Repair procedures

Removal

1. Remove the engine cover.
2. Disconnect the front oxygen sensor connector(B).
3. Remove the front muffler(A).

Tightening torque
39.8 ~ 58.8Nm (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)

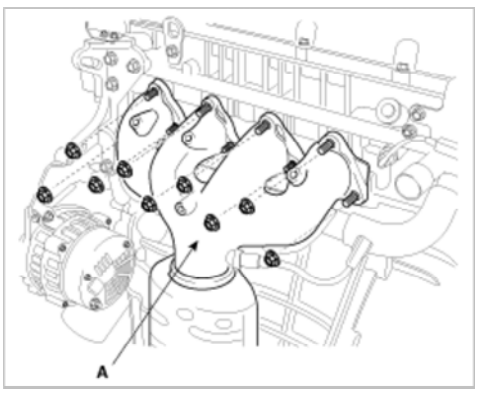


4. Remove the heat protector.

Tightening torque
16.7 ~ 21.5Nm (1.7 ~ 2.2kgf.m, 12.3 ~ 15.9lb-ft)

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

Tightening torque
42.1 ~ 53.9Nm (4.3 ~ 5.5kgf.m, 31.1 ~ 39.7lb-ft)



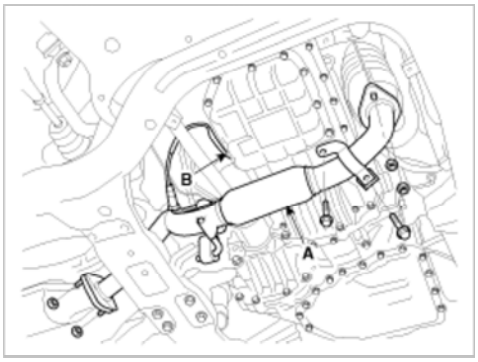
6. To install, reverse the removal procedure with new gasket.

Engine Mechanical System > Intake And Exhaust System > Front Exhaust Pipe > Repair procedures

Removal

1. Disconnect the front oxygen sensor connector(B).
2. Remove the front muffler(A).

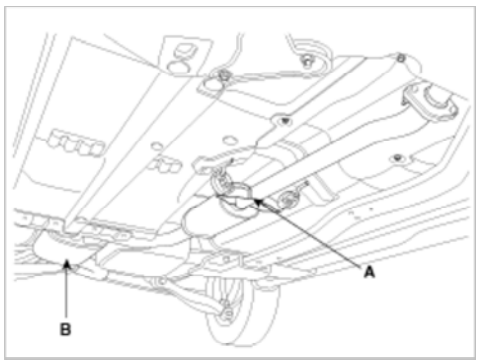
Tightening torque
39.8 ~ 58.8Nm (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



3. Remove the center muffler(A) and the main muffler(B).

Tightening torque

39.8 ~ 58.8Nm (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



Specification

Ignition System

Items			Specification
Ignition coil	Primary resistance		0.58 ± 10 % (Ω)
	Secondary resistance		8.8 ± 15 % (kΩ)
Spark plugs	Unleaded	NGK	BKR5ES-11
		CHAMPION	RC10YC4
		Gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)

Starting System

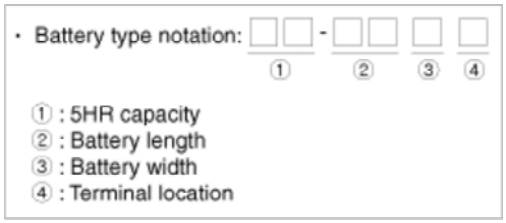
Items			Specification
Starter	Rated voltage		12 V, 1.2 kW
	No. of pinion teeth		8
	No-load characteristics	Voltage	11 V
		Ampere	90A, MAX
		Speed	2,800 rpm, MIN

Charging System

Items		Specification
Alternator	Rate voltage	13.5 V, 90A
	Speed in use	1,000 ~ 18,000 rpm
	Regulator setting voltage	14.55 ± 0.2 V
	Temperature compensation	-7 ± 3 mV / °C
Battery	Type	48-23GL
	Cold cranking amperage [at -18°C(-0.4°F)]	550 A
	Reserve capacity	92 min
	Specific gravity [at 20°C(68°F)]	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.
- RESERVE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80.1°F).



Auto Cruise Control System

Items	Specification
Actuator	

Rated voltage range	DC 12V
Operating voltage range	DC 11 ~ 16V
Operation temperature rnage	-30 ~ 100°C (22 ~ 212°F)
Cruise main switch	
Reted voltage	DC 5V
Operating temperature range	-30 ~80 °C (-22 ~ 176°F)

Tightening Torque

Items	Nm	kgf.m	lb-ft
Ignition coil monnting	18.6 ~ 26.5	1.9 ~ 2.7	13.7 ~ 19.5
Stater terminal mounting	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Stater mounting	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Alternator mounting A	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1
Alternator mounting B	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1

Engine Electrical System > General Information > Troubleshooting

Troubleshooting

Ignition System

Trouble condition	Probable cause	Remedy
Engine cranks, but will not start or is hard to start.	Ignition coil faulty	Replace ignition coil
	High tension cable faulty	Replace high tension cable
	Spark plugs faulty	Replace plugs
	Incorrect immobilizer system	Adjust
	Ignition wiring disconnected or broken	Inspect and replace
Rough idle or stalling	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Replace wiring
	Ingition coil faulty	Replace ignition coil
	High gension cord faulty	Relpace high tension cord
Engine hesitates/poor acceleration	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Replace wiring
Poor fuel	Spark plugs faulty	Replace plugs

Charging System

Trouble condition	Probable cause	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off	Fues blown	Check fuses
	Light burnde out	Replace light
	Wiring connection loose	Tighten loose connections
	Electronic voltage regulator faulty	Replace voltage regulator
Charging warning indicator does not go out with engine runing. (Battery requires fequent recharging)	Drive belt loose or worn	Adjust tension or replace cables
	Battery cables loose, corroded or worn	Repair or replace cables
	Fuse blown	Check fuses
	Fusible link blown	Replace fusible link

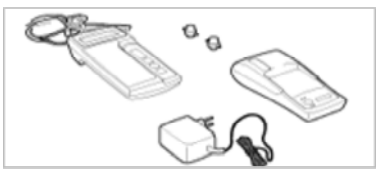
	Electronic voltage regulator or alternator faulty	Test alternator
	Wiring faulty	Repair wiring
Discharged battery	Drive belt loose or worn	Adjust tension or replace drive belt
	Wiring connection loose or open circuit	Tighten loose connection or repair wiring
	Fusible link blown	Replace fusible link
	Warning indicator and pre-excitation resistor faulty	Replace components
	Poor grounding	Repair
	Electronic voltage regulator or alternator faulty	Test alternator
	Battery life	Replace battery
Overcharging	Electronic voltage regulator faulty	Replace voltage regulator
	Voltage sensing wire faulty	Repair wire

Starting System

Trouble condition	Probable cause	Remedya
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cables
	Transaxle range switch faulty (Vehicle with automatic transaxle only)	Adjust or replace switch
	Fusible link blown	Replace fusible link
	Starter motor faulty	Repair starter motor
	Ignition switch faulty	Replace ignition switch
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Inspect wiring and fix
	Starter motor faulty	Repair starter motor
Starter keeps running	Starter motor faulty	Repair starter motor
	Ignition wiring faulty	Repair or replace
Starter spins but engine will not crank	Short in wiring	Repair wiring
	Pinion gear teeth broken or starter motor faulty	Repair starter motor
	Ring gear teeth broken	Replace flywheel ring gear or torque converter

Engine Electrical System > General Information > Special Service Tools

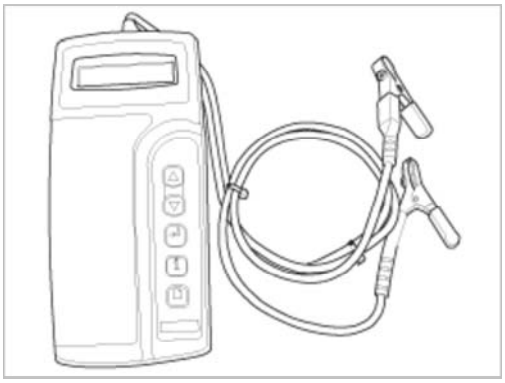
Reference Service Tools

Tool (Number and name)	Illustration	Use
Micro-570 Battery checker		Using with Thermal Printer_182-003A

The Micro 570 Analyzer

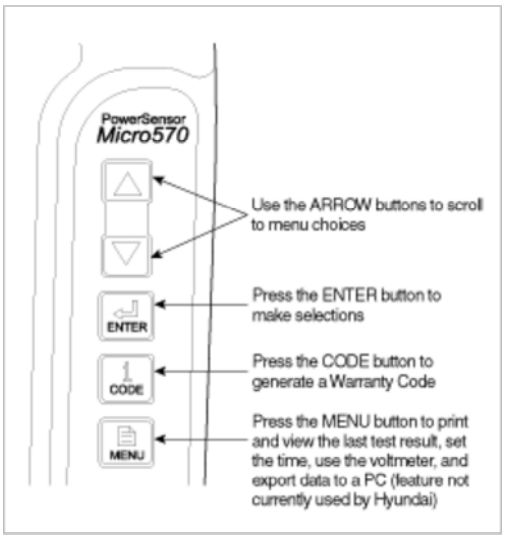
The MICRO 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

> CAUTION
>
> Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.



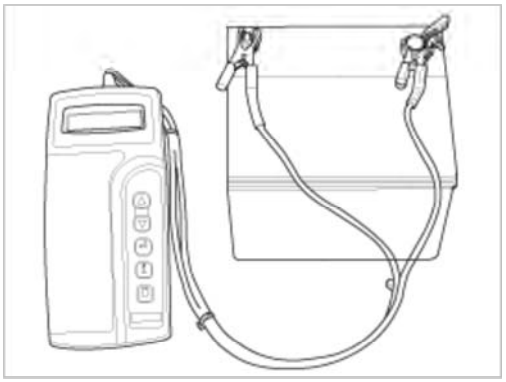
Keypad

The MICRO570 button on the key pad provides the following functions :



Battery Test Procedure

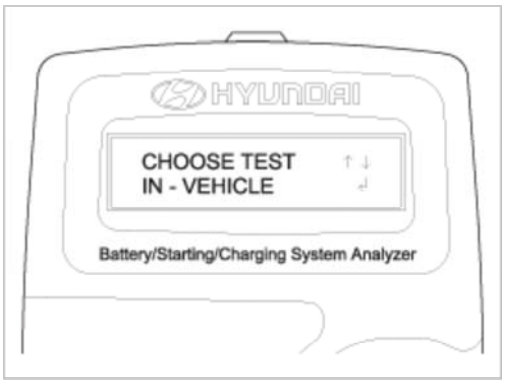
1. Connect the tester to the battery.
   A. Red clamp to battery positive (+) terminal.
   B. Black clamp to battery negative (-) terminal.



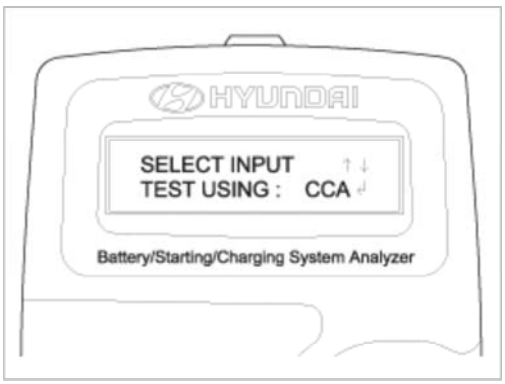
CAUTION

Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN A VEHICLE" or "OUT OF A VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



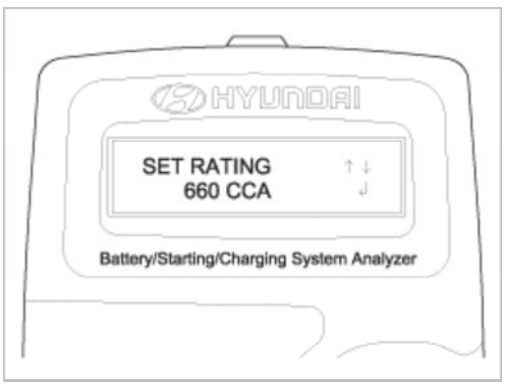
3. Choose either CCA or CCP and press the ENTER button.



NOTE

- CCA : Cold cranking amps, is an SAE specification for cranking batteries at -18°C (0°F).
- CCP : Cold cranking amps, is an SAE specification for korean manufacturer's for cranking batteries at -18°C (0°F).

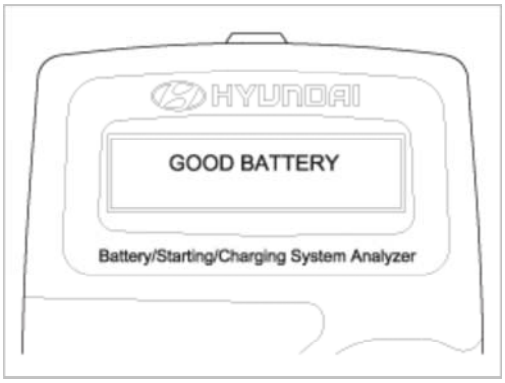
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.



NOTE

The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

5. The tester (Micro570) displays battery test results including voltage and battery ratings.
A relevant action must be given according to the test results by referring to the battery test results as shown in the table below.



NOTE

The battery ratings (CCA) displayed on the tester must be identical to the ratings marked on battery label.

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 by running engine 15 minutes at with no accessories on. Retest to assure Good.
Charge & Retest	Battery is not charged properly - Charge and test the battery again (Failure to charge the battery fully may read incorrect measurement value)
Replace battery	- Replace battery and recheck the charging system. (Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery)
Bad cell-replace	- Charge and retest the battery. And then, test results may cause "REPLACE BATTERY", replace battery and recheck the charging system

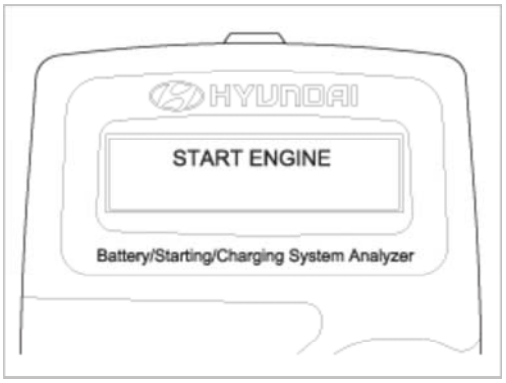
WARNING

Whenever filing a claim for battery, the print out of the battery test results must be attached.

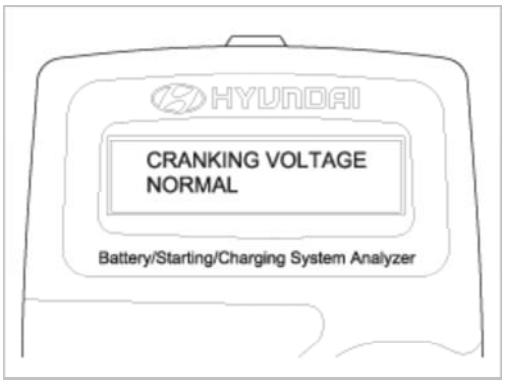
Starter Test Procedure

1. After the battery test, press ENTER immediately for the starter test.

2. After pressing ENTER key, start the engine.



3. Cranking voltage and starter test results will be displayed on the screen.
   Take a relevant action according to the test results by referring to the starter test results as given below.



4. To continue charging system test, press ENTER.

Starter Test Results

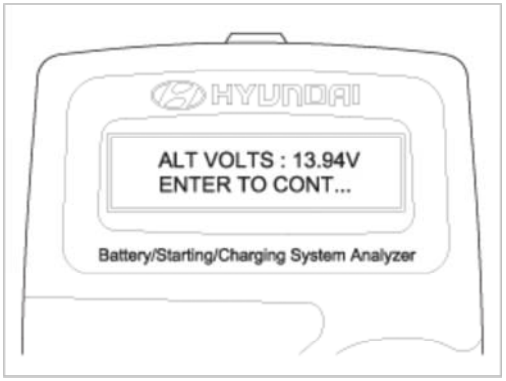
Result On Printer	Remedy
Cranking voltage normal	System shows a normal starter draw
Cranking voltage low	Cranking voltage is lower than normal level - Check starter
Charge battery	The state of battery charge is too low to test - Charge the battery and retest
Replace battery	- Replace battery - If the vehicle is not started though the battery condition of "Good and fully charged" is displayed. - Check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. - If the engine does crank, check fuel system.

Charging System Test Procedure

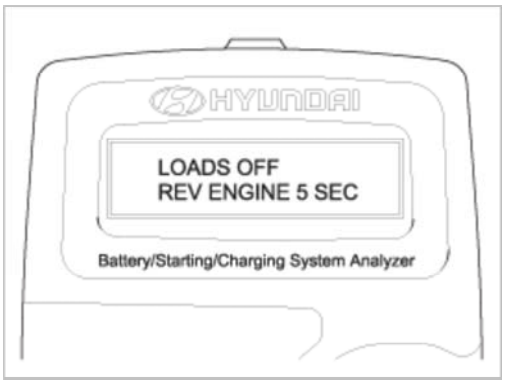
1. Press ENTER to begin charging system test.

2. ENTER button is pressed, the tester displays the actual voltage of alternator.

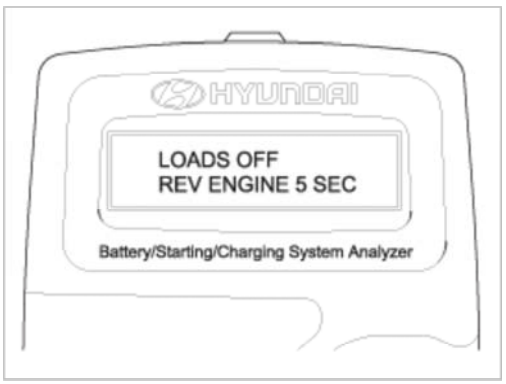
Press ENTER to test the charging system.



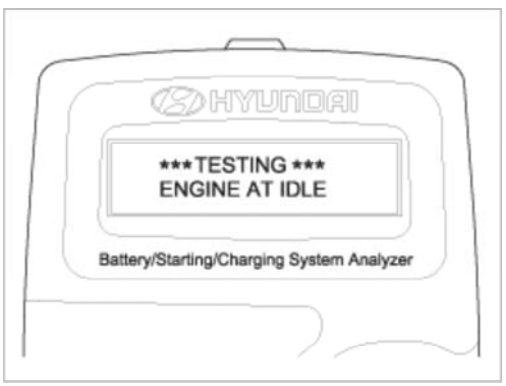
3. Turn off all electrical load and hold engine at 2000rpm for 5 seconds by pressing the accelerator pedal.



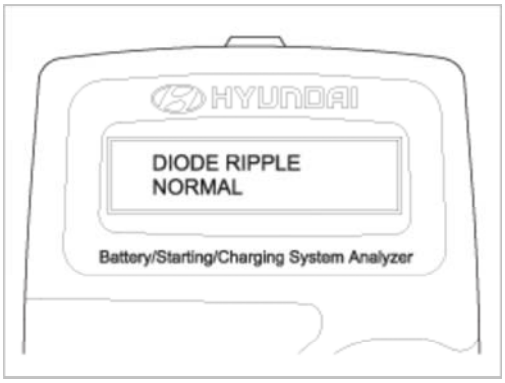
4. Press ENTER.



5. The MICRO 570 analyzer charging system output at idle for comparison to other readings.



6. Take a relevant action according to the test results by referring to the table below after shutting off the engine and disconnect the tester clamps from the battery.



Charging System Test Results

Result On Printer	Remedy
Charging system normal/ Diode ripple normal	Charging system is normal
No charging voltage	Alternator does not supply charging current to battery - Check belts, connection between alternator and battery Replace belts or cable or alternator as necessary
Low charging voltage	Alternator does not supply charging current to battery and electrical load to system fully - Check belts and alternator and replace as necessary
High charging voltage	The voltage from alternator to battery is higher than normal limit during voltage regulating. - Check connection and ground and replace regulator as necessary - Check electrolyte level in the battery
Excess ripple detected	One or more diodes in the alternator is not functioning properly - Check alternator mounting and belts and replace as necessary

Engine Electrical System > Ignition System > Description and Operation

Description

Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are pre-programmed in the memory of the ECM (engine control module).
The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.

Engine Electrical System > Ignition System > Ignition Coil > Repair procedures

Inspection

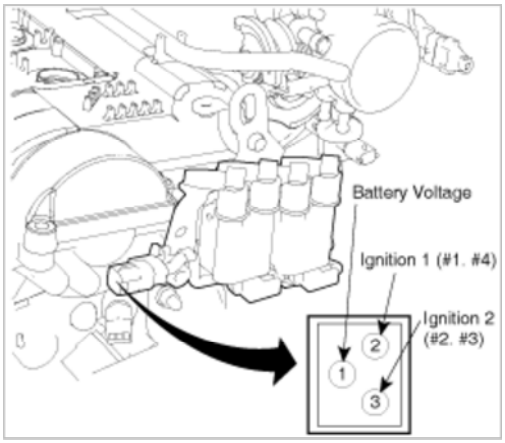
1. Measure the primary ciol resistance between terminals 1 and 2.

   Standard value : 0.58 ± 10% (Ω)

2. Measure the secondary ciol 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 : 8.8 ± 15% (KΩ)

> CAUTION
>
> When measuring the resistance of the secondary coil, be sure to disconnect the ignition coil connector.



Engine Electrical System > Ignition System > Spark Plug > Repair procedures

Inspection

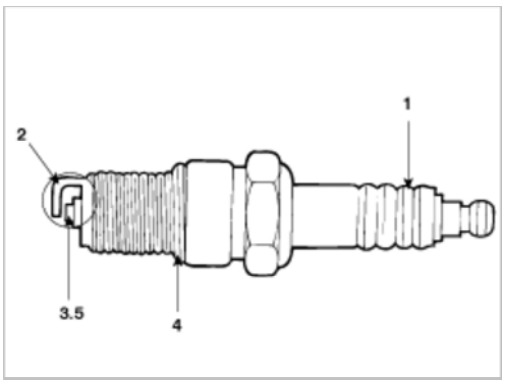
1. Disconnect the spark plug cables from the spark plugs.

> 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 all spark plugs from the cylinder head.

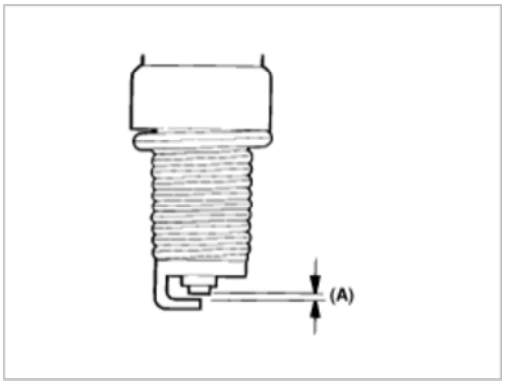
> CAUTION
>
> Be careful that no contaminants enter through the spark plug holes.

3. Check the spark plugs for the following :
   A. Broken insulator
   B. Worn electrode
   C. Carbon deposits
   D. Damaged or broken gasket
   E. Condition of the porcelain insulator at the tip of the spark plug



4. Check the spark plug gap using a wire gap(A) gauge, and adjust if necessary.

Standard value : 1.0-1.1 mm (0.039-0.043 in)



5. Re-insert the spark plug and tighten to the specified torque.
   If it is over torqued, damage to the threads of the cylinder head may result.

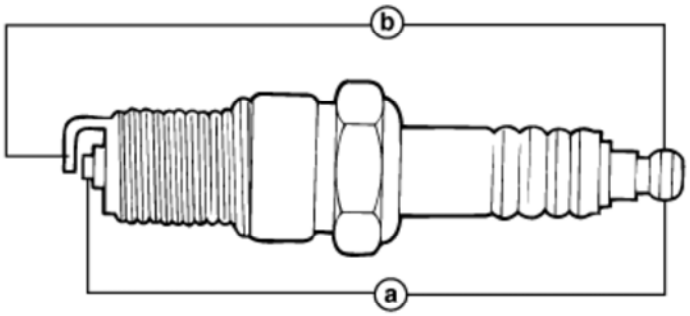
Tightening torque :
20-30 Nm (2.0-3.0 kgf.m, 15-21 lb-ft)

Analyzing Spark Plugs

Engine conditions can be analyzed by examining the tip deposits near the electrode.

Condition	Dark deposits	White deposits
Description	• Fuel mixture too rich • Low air intake	• Fuel misture too lean • Advanced ignition timing • Insufficient plug tightening

Resistance Inspection



1) Open/Short resistance -ⓐ

Result	Specification		Remedy	Probable cause and state
	Champion	NGK		
Normal	∞		-	-
Not OK	NOT∞		Relpace	· Cause : Open in spark plugs · State : Misfire→engine skipping or hesitation

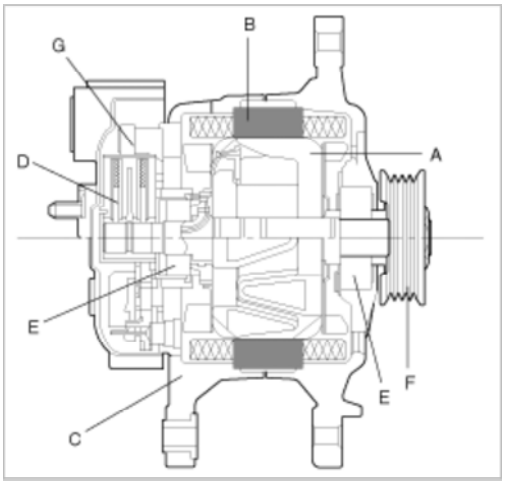
2) Insulation resistance (with 500~1000V voltmeter)-ⓑ

Result	Specification		Remedy	Probable cause and state
	Champion	NGK		
Normal	50 MΩ above		-	-
Not OK	50 MΩ below		Relpace	· Cause : Carbon or insulator crack · State : Engine skipping or hesitation

Engine Electrical System > Charging System > Description and Operation

Description

The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire. The alternator has six built-in diodes (three positive and three negtive), each rectifying AC current to DC current. Therefore, DC curent appears at alternator "B" terminal.
In addition, the charging voltage of the alternator is regulated by the battery voltage detection system. The main components of the alternator are the rotor(A), stator(B), rectifier(C), brushes(D), bearings(E) V-ribbed belt pulley(F). The brush holder contains a built-in electronic voltage regulator(G).



Engine Electrical System > Charging System > Repair procedures

Inspection

Voltage Drop Test

This test determines if the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

Preparation

1. Turn the ignition switch to "OFF."

> NOTE
>
> To identify connection problems, be sure not to disturb either of the two terminals or their connections during this test.

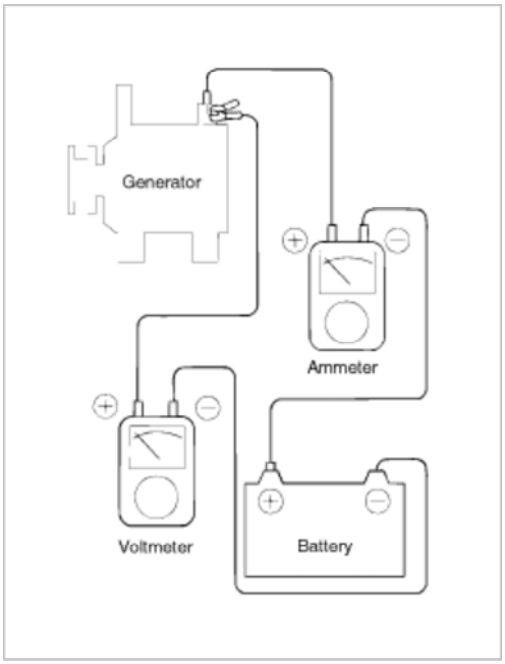
2. Connect a digital voltmeter between the alternator "B" terminal and battery (+) terminal. Connect the (+) lead wire of the voltmeter to the"B" terminal and the (-) lead wire to the battery (+) terminal.

Conditions For Testing

With the engine running and headlamps, blower motor etc. ON, check the reading on the voltmeter.

Result

1. The voltmeter should read a standard 0.2V.
2. If the reading is above 0.2V, poor wiring should be suspected.
   Check wiring from alternator 'B' terminal through the fusible link to the battery (+) terminal.
   Check for loose wiring or color change from an overheated harness. Correct and check again.
3. On completion of the test, set the engine at idle.
   Then turn off the headlamps, blower motor etc., and ignition.



Output Current Test

This test determines if the alternator gives an output current that is equivalent to the nominal output.

Preparation

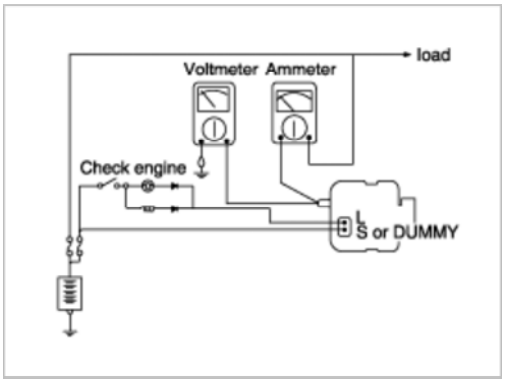
1. Prior to the test, check the following items and correct as necessary.
   (1) Check if that the battery installed in the vehicle is in good condition. For details, see "BATTERY".

   > NOTE
   >
   > 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.

   (2) Check the tension of the alternator drive belt. See "COOLING".
2. Turn the ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 100A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire ofthe 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 wireto 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 the same value as the battery voltage. If the voltmeter reads 0V, an open circuit in the wire between the alternator "B" terminal and battery (-) terminal, a blown fusible link or poorground is suspected.
2. Start the engine and turn the headlights on.
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 maximumoutput current value indicated by the ammeter.

> NOTE
>
> After the engine starts, the charging current quickly drops. Therefore, the above operation must be done quickly to readthe maximum current value correctly.

Result

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

Limit value : 45A

> NOTE
>
> 1. The nominal output current value is shown on the nameplate affixed to the alternator body.
> 2. 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. In such case, keep the headlights on to discharge the battery, or use the lights of another vehicle to increase the electrical load.
>   The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.
>   In such a case, reduce the temperature before testing again.

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

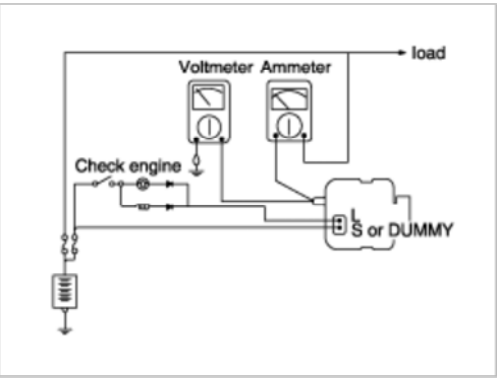
Regulated Voltage Test

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

Preparation

1. Prior to the test, check the following items and correct if necessary.
   (1) Check that the battery installed in the vehicle is fully charged. For battery checking method, see the "BATTERY" section.
   (2) 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 "S(L)" terminal of the alternator and ground.
   Connect the (+) lead of the voltmeter to the "S(L)" terminal of the alternator. Connect the (-) lead to a good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 100A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeterto the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



Test

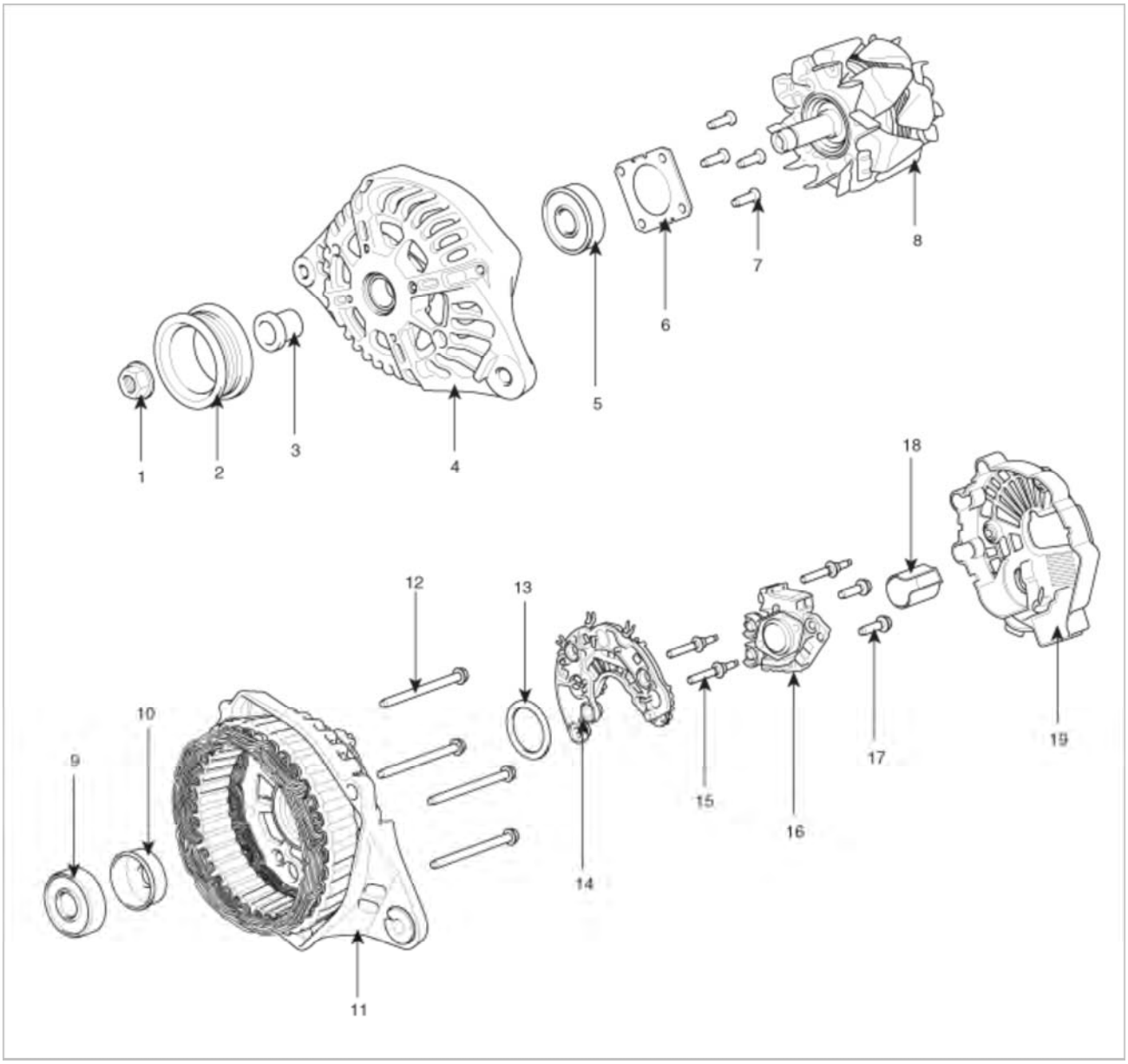
1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.
   Voltage : Battery voltage
   If it reads 0V, there is an open circuit in the wire between the alternator "S(L)" terminal and the battery and the battery (+), or the fusible link isblown.
2. Start the 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, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternatoris faulty.
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, ammeter, and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Reconnect the battery ground cable.

Engine Electrical System > Charging System > Alternator > Components and Components Location

Components

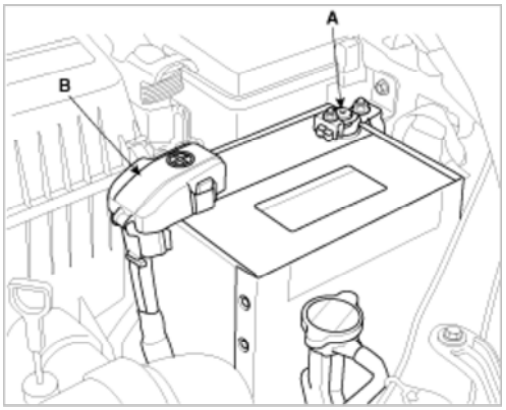


1. Nut	6. Bearing cover	11. Rear cover	16. Brush bolder assembly
2. Pulley	7. Bearing cover bolts	12. Bolts	17. Brush holder bolts
3. Spacer	8. Rotor coil	13. Seal	18. Slipring guide
4. Front cover assembly	9. Rear bearing	14. Rectifier assembly	19. Cover
5. Front bearing	10. Bearing cover	15. Stud bolts	

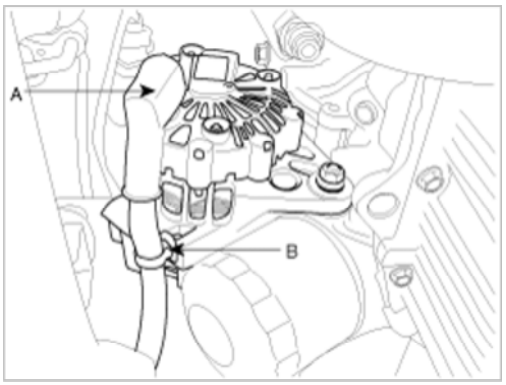
Engine Electrical System > Charging System > Alternator > Repair procedures

Removal

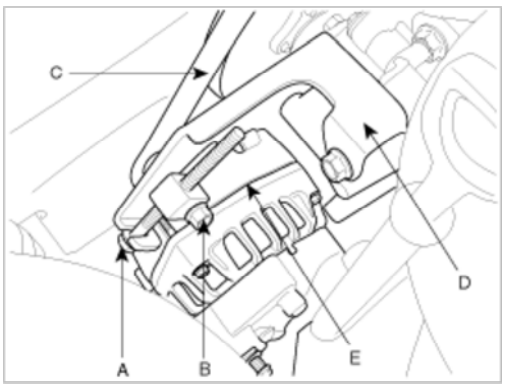
1. Disconnect the battery negative terminal(A) first, then the positive terminal(B).



2. Deisconnect the alternator connector(A) and "B" terminal cable from the alternator. Losen the cpip(B).



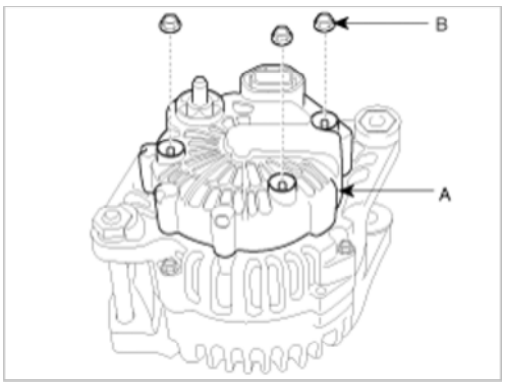
3. Remove the adjusting bolt(A), mounting bolt(B), the alternator belt(C) and the alternator mounting bracket(D).
4. Pull out the through bolt, then remove the alternator(E).



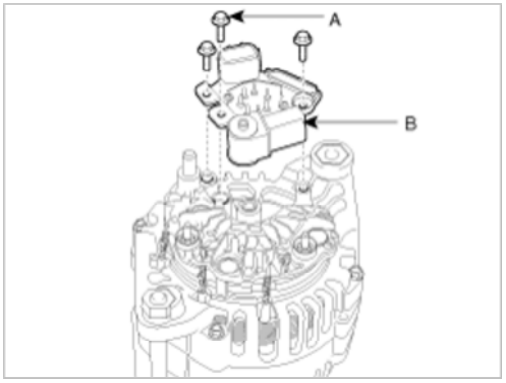
5. Installation is the reverse of removal.
6. Adjust the alternator belt tension after installation.

Disassembly

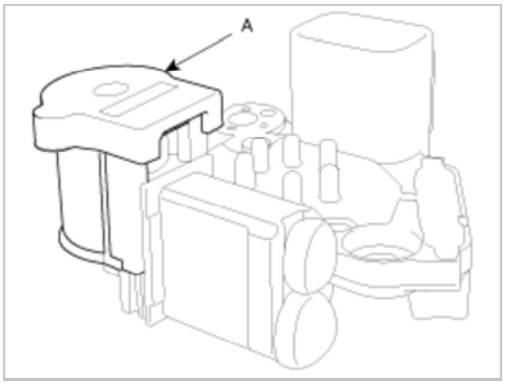
1. Remove the alternator cover(A) after removing three nuts(B).



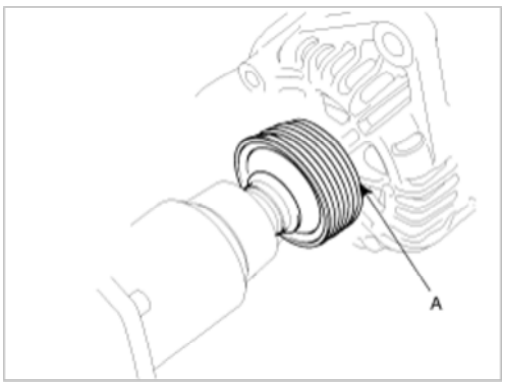
2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



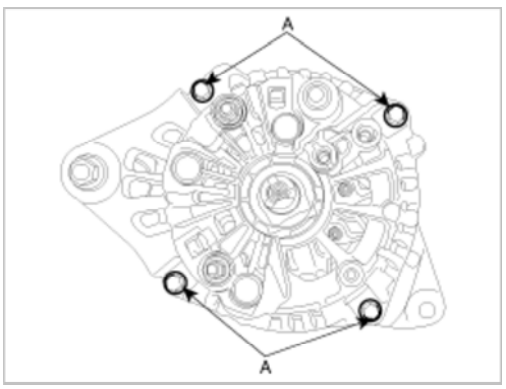
3. Remove the slip ring guide(A).



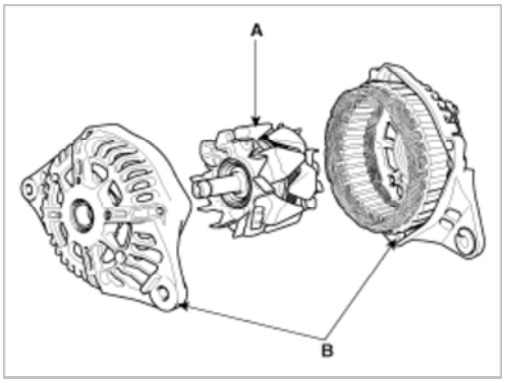
4. Remvoe the nut, pully(A) and spacer.



5. Loosen the 4 through bolts(A).



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

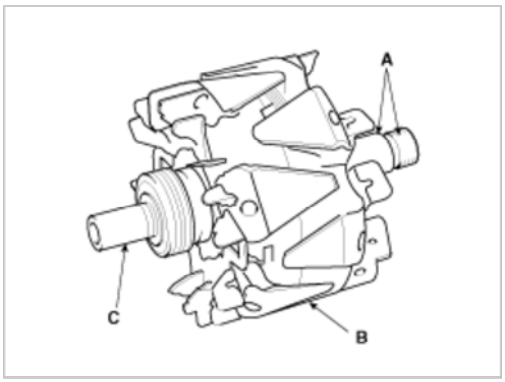


7. Reassembly is the reverse of disassembly.

Inspection

Rotor

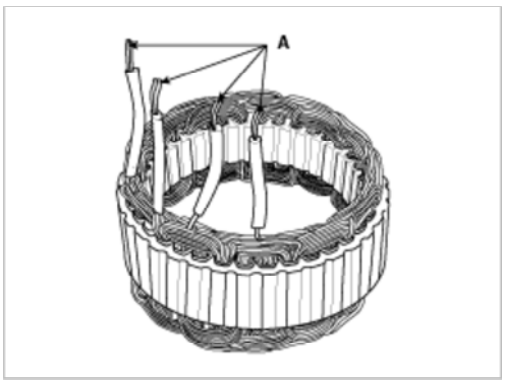
1. Check that there is continuity between the slip rings(A).



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.

Stator

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



2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the alternator.

Alternator Belt Inspection And Adjustment

NOTE

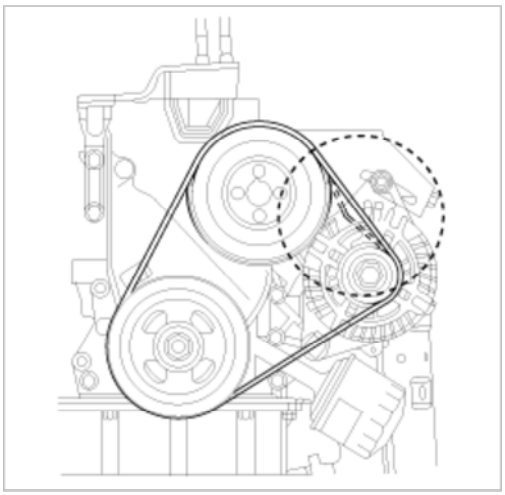
When using a new belt, first adjust the deflection or tension to the values for the new belt, then readjust the deflection or tension to the values for the used belt after running engine for five minutes.

Deflection method :
Apply a force of 98N (10 kgf, 22 lbf), and measure the deflection between the alternator and water pump pulley.

Deflection
Used Belt : 5.1 ~ 6.0 mm (0.20 ~ 0.236 in)
New Belt : 4.0 ~ 4.4 mm (0.15 ~ 0.173 in)

NOTE

If the belt is worn or damaged, replace it.

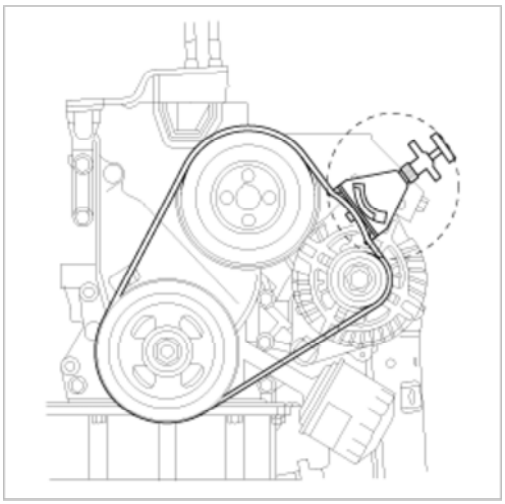


Belt tension gauge method :
Follow the gauge manufacturer's instructions, install the beil tension gange. (Measurement may be done at any spans of pullys)

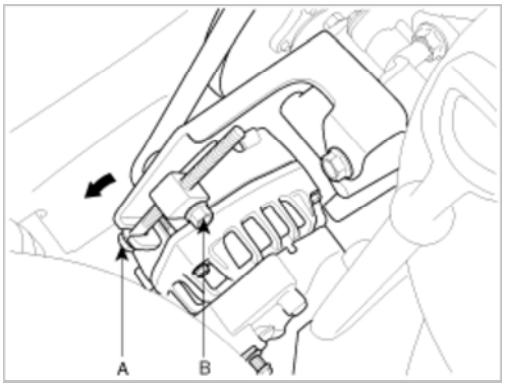
New Belt : 686 ± 49 N (70 ± 5 kgf, 154 ± 11 lbf)
Used Belt : 441 ± 49 N (45 ± 5 kgf, 99 ± 11 lbf)

NOTE

If the belt is worn or damaged, replace it.



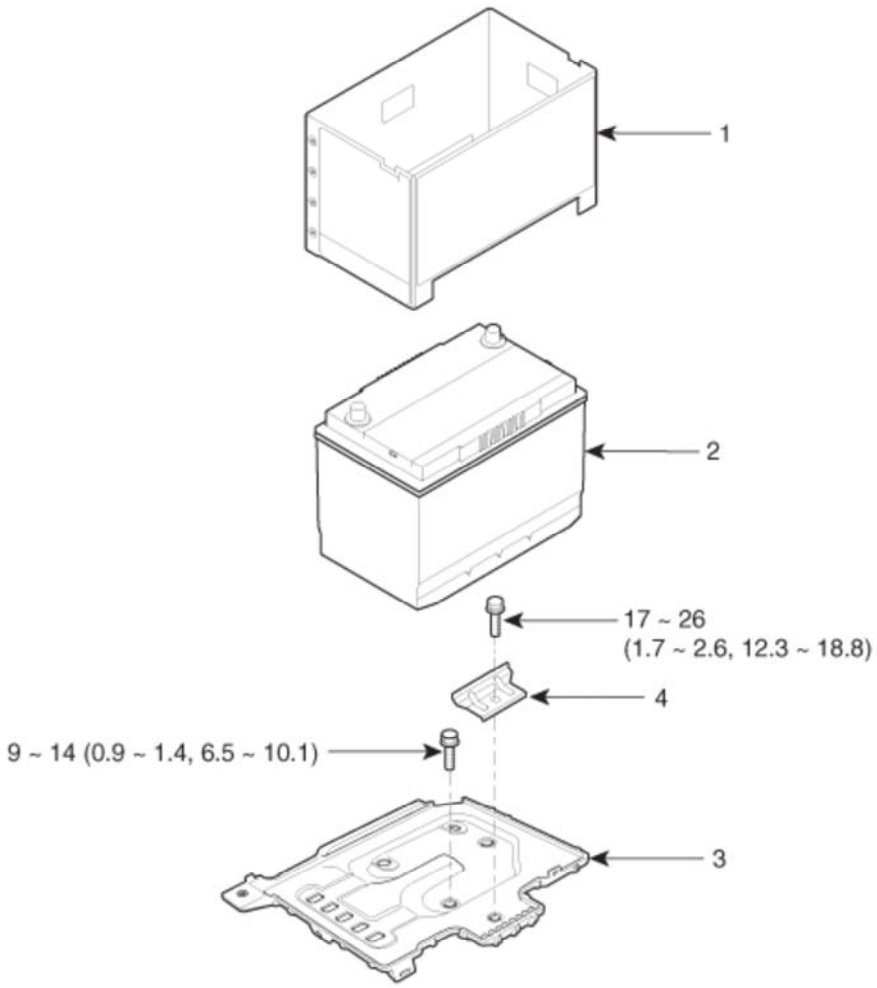
If adjustment is necessary :
1. Loosen the adjusting bolt(A) and the lock bolt(B).
2. Move the alternator to obtain the proper belt tension, then retighten the nuts.



3. Recheck the deflection or tension of the belt.

Engine Electrical System > Charging System > Battery > Components and Components Location

Components



1. Battery insulation pad	3. Battery tray
2. Battery	4. Battery mounting braket

Engine Electrical System > Charging System > Battery > Description and Operation

Description

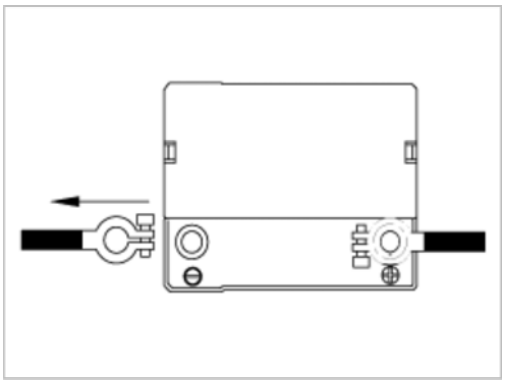
1. A maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to a maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.

Engine Electrical System > Charging System > Battery > Repair procedures

Cleaning

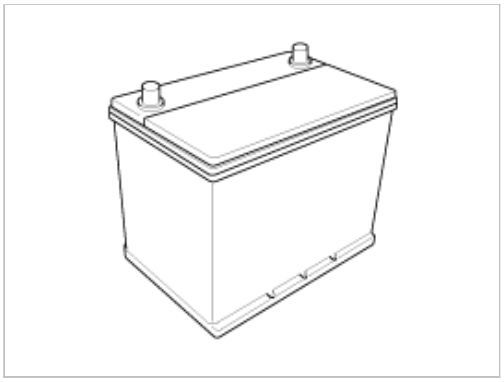
1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

> CAUTION
>
> Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Heavy rubber gloves (not the household type) should be wore when removing the battery.



4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

> CAUTION
>
> When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.
> A spark will occur when the circuit is broken. Keep open flames away form battery.

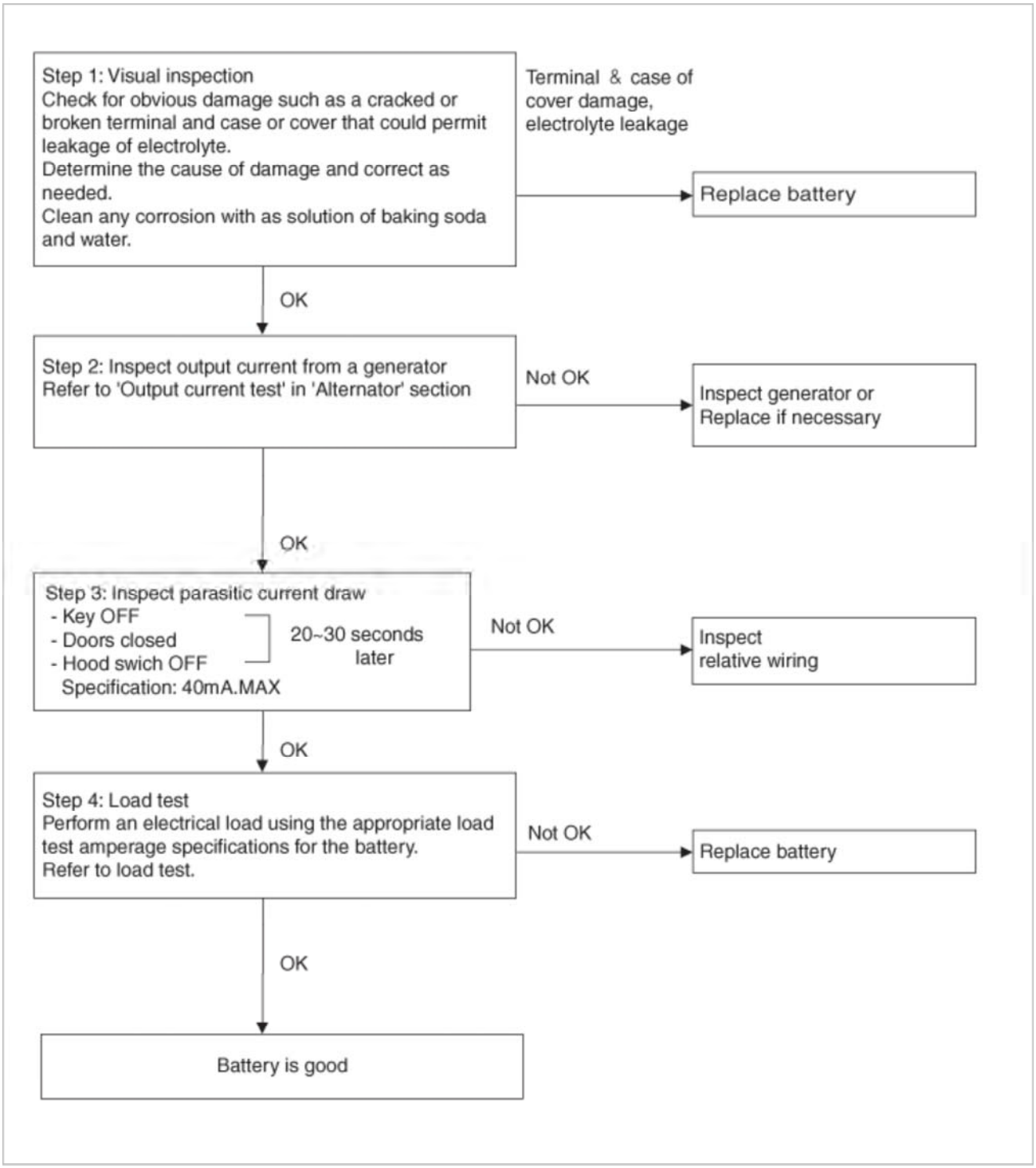


NOTE

After disconnecting then reconnecting the battery negative cable, reset some parts that require the reset procedures. (Refer to BE group - General Information)

Inspection

Battery Diagnostic Flow



Load Test

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

Voltage	Temperature
9.6V	20°C (68.0°F) and above

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

NOTE

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

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 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

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 No.8(10A) fuse from the fuse/relay box.
2. Turn the ignition switch to START (III) with the shift lever in or 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.
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.

Check for wear and Damage

The starter should crank the engine smoothly and steadily. If the starter engages, but cranks the engine erratically, remove it, and inspect he starter drive gear and torque converter ring gear for damage.
Check the drive gear overrunning clutch for binding or slipping when the armature is rotated with the drive gear held. If damaged, replace the gears.

Check Cranking Voltage and Current Draw

Cranking voltage should be no less than 8.7 volts on A/T models, and 8.0 volts on M/T models.
Current draw should be no more than 230 amperes on A/T models, and 200 amperes on M/T models.
If cranking voltage is too low, or current draw too high, check for :

- dead or low battery.
- open circuit in starter armature commutator segments.
- starter armature dragging.
- shorted armature winding.
- excessive drag in engine.

Check Cranking rpm

Engine speed during cranking should be above 100 rpm.
If speed is too low, check for :

- loose battery or starter terminals.
- excessively worn starter brushes.
- open circuit in commutator segments.
- dirty or damaged helical splines or drive gear.
- defective drive gear overrunning clutch.

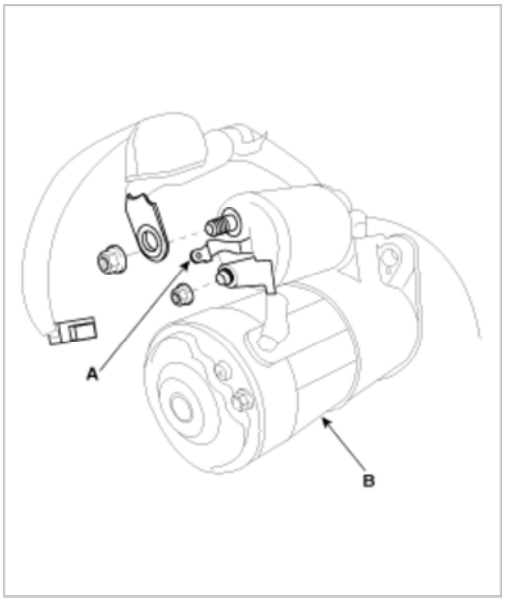
Check starter disengagement

With the shift lever in N or P position (A/T) or with the clutch pedal depressed (M/T), turn the ignition switch to START(III), and release to ON(II).
The starter drive gear should disengage from the torque converter ring gear or flywheel ring gear when you release the key.
If the drive gear hangs up on the torque converter ring gear or flywheel ring gear, check for :

- solenoid plunger and switch malfunction.
- dirty drive gear assembly or damaged overrunning clutch.

Starter Solenoid Test

1. Check the hold-in coil for continuity between the S terminal(A) and the armature housing(B) (ground). The coil is OK if there is continuity.

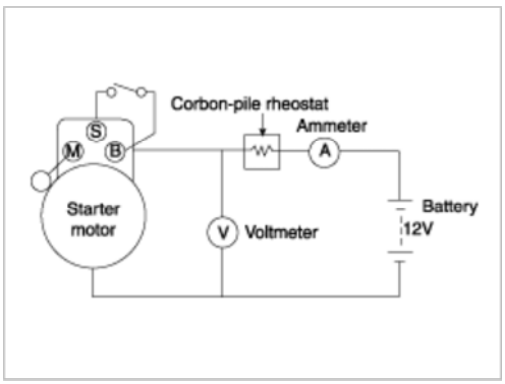


2. Check the pull-in coil for continuity between the S and M terminals. The coil is OK if there is continuity.

Free Running Test

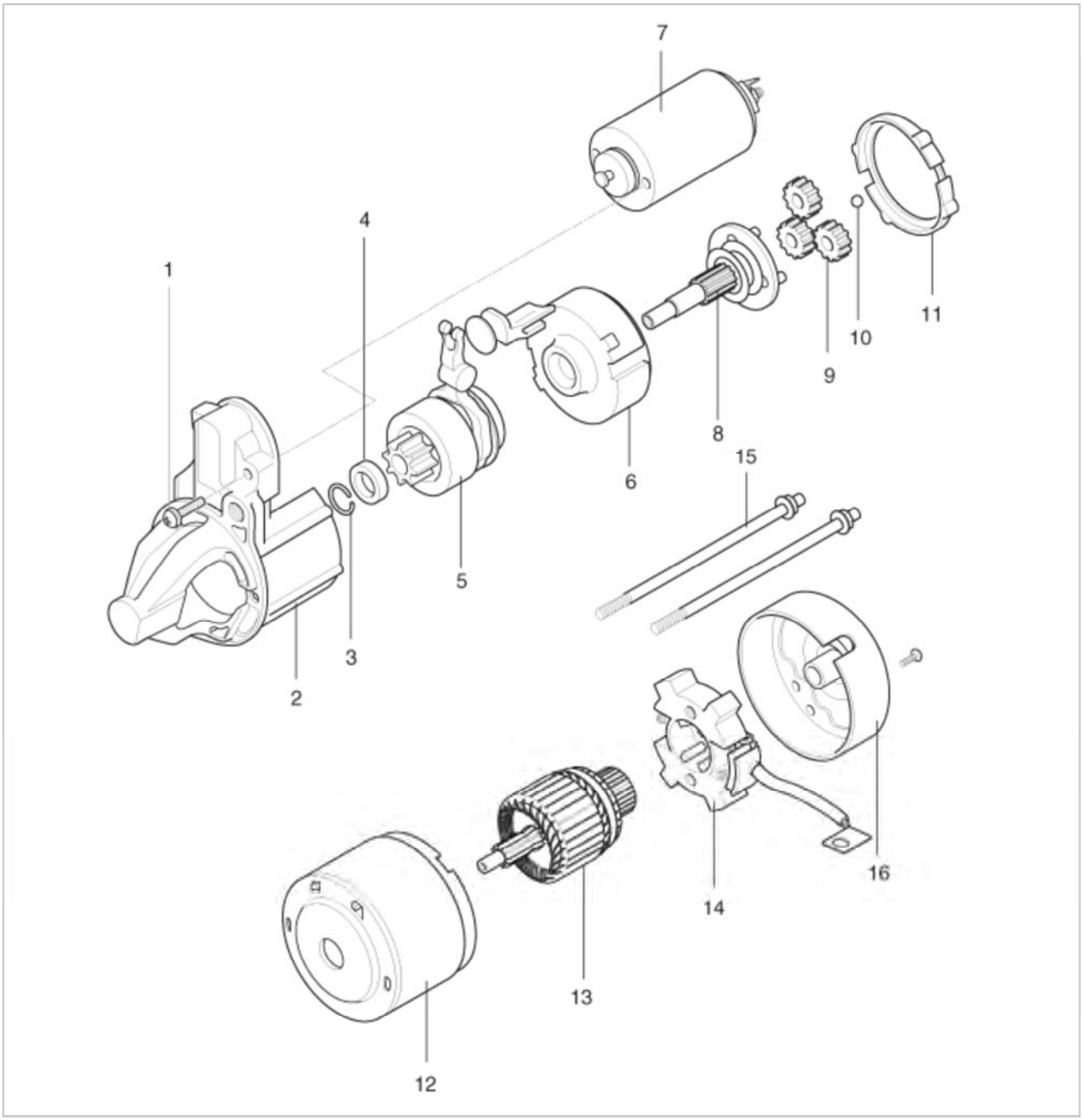
1. Place the starter motor in a vise equipped with soft jaws and connecta fully-charged 12-volt battery to starter motor as follows :
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostatas shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the startermotor body.
6. Adjust until battery voltage shown on the voltmeter reads 11 volts.
7. Confirm that the maximum amperage is within the specifications andthat the starter motor turns smoothly and freely :

Current : Max. 90 Amps
Speed : Min. 2,800 rpm



Engine Electrical System > Starting System > Starter > Components and Components Location

Components



1. Screw	6. Ring gear	11. Packing A
2. Front bracket	7. Solenoid	12. Yoke assembly
3. Stop ring	8. Sun gear	13. Armature
4. Snap ring	9. Planetary gear	14. Brush holder
5. Overrun clutch	10. Ball	15. Planetary gear holder screws
		16. Rear bracket

Engine Electrical System > Starting System > Starter > Repair procedures

Removal

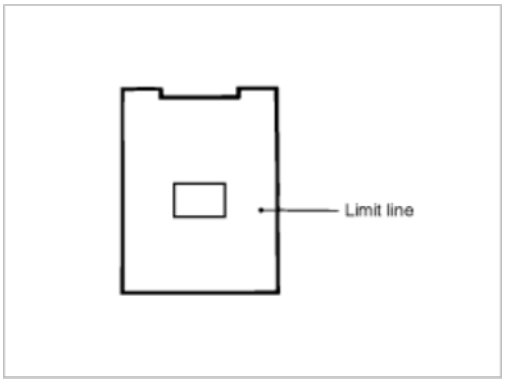
1. Disconnect the battery ground cable.
2. Remove the speedometer cavble and the shift cable.
3. Disconnect the starter motor connector and terminal.
4. Remove the starter motor assembly.

5. Installation is the reverse order of removal.

Inspection

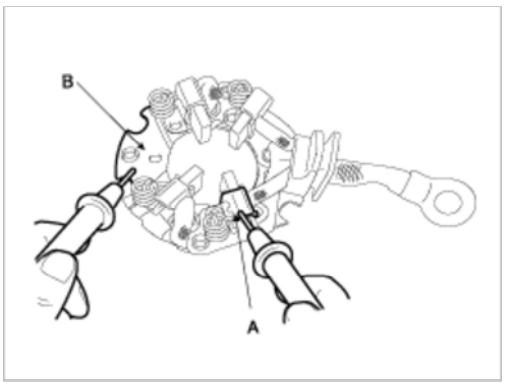
Brush

A brush worn down to the wear limit line should be replaced.



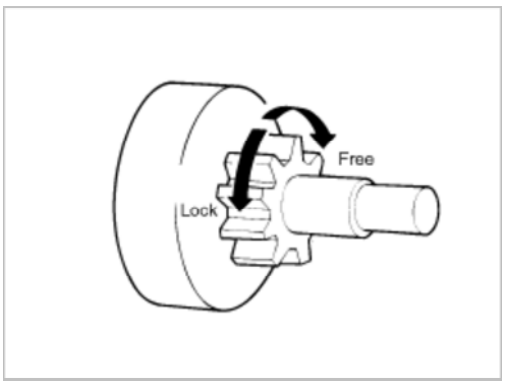
Brush Holder

Make sure there is no continuity between the (+) brush holder (A) and (-) plate (B). If there is continuity, replace the brush holder assembly.



Overrunning Clutch

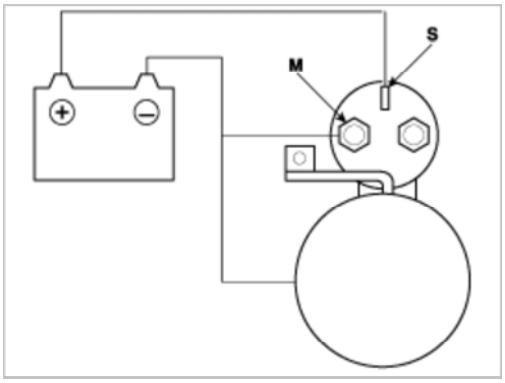
Inspect the pinion and spline teeth for wear or damage. Replace if damaged. Also inspect the flywheel ring gear for damage.
Rotate the pinion. It should turn freely in a clockwise direction, and lock when turned counterclockwise.



Pinion Gap Adjustment

1. Disconnect the wire from the M-terminal.
2. Connect a 12V battery between the S-terminal and the M-terminal.
3. Set the switch to "ON", and the pinion will move out.

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



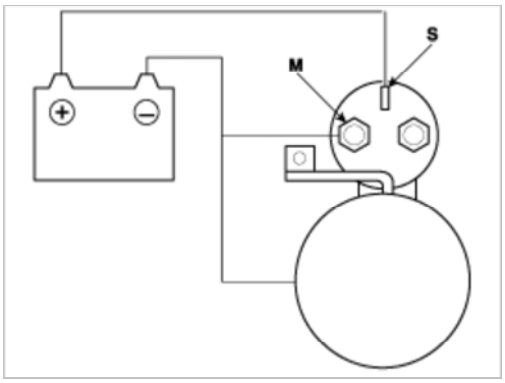
4. Check the pinion to stopper clearance (pinion gap)with a feeler gauge. If the pinion gap is out of specification,adjust by adding or removingwashers betweenthe solenoid and the front bracket.

Solenoid Pull-in Test

1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the S-terminal andM-terminal.

> CAUTION
>
> This test must be performed quickly (in less than10 seconds) to prevent the coil from burning.

3. If the pinion moves out, the pull-in coil is good. If itdoesn't, replace the solenoid.

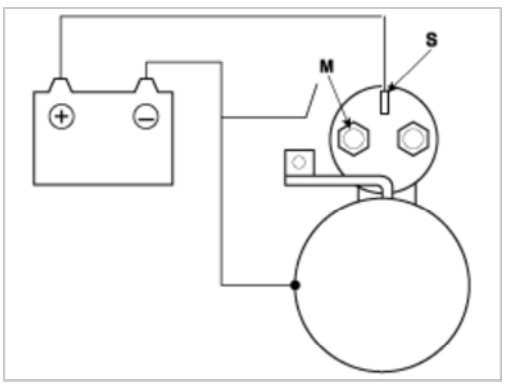


Solenoid Hold-in Test

1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the S-terminal andthe body.

> CAUTION
>
> This test must be performed quickly (in less than10 seconds) to prevent the coil from burning.

3. If the pinion remains out, everything is in order. If thepinion moves in, the hold-in circuit is open. Replacethe magnetic switch.

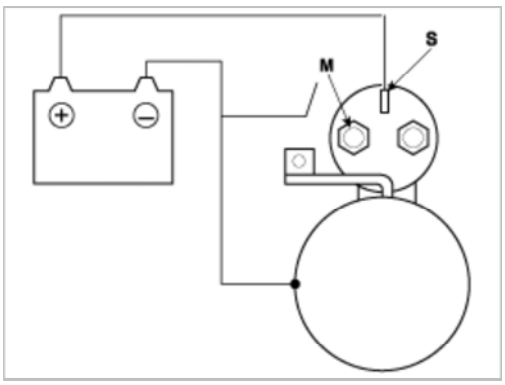


Solenoid Return Test

1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the M-terminal andthe body.

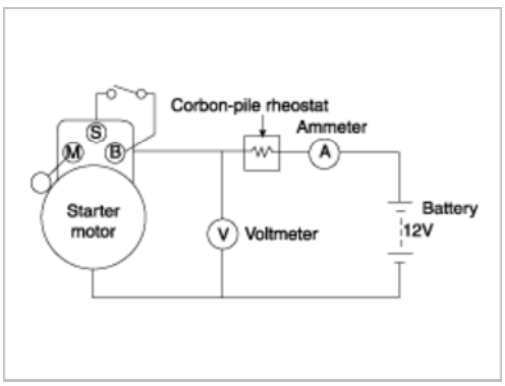
> **CAUTION**
>
> This test must be performed quickly (in less than10 seconds) to prevent the coil from burning.

3. Pull out the pinion and then release it. If the pinionreturns quickly to its original position, everything is inorder. If it doesn't, replace thesolenoid.



Performance Test (NO-LOAD)

1. Make the no-load circuit test as shown.
2. After adjusting the rheostat until the battery voltageshown on the voltmeter reads 11.5 volts, confirm thatthe maximum amperage draw is within the specificationsand that the starter motor turns smoothly andfreely.

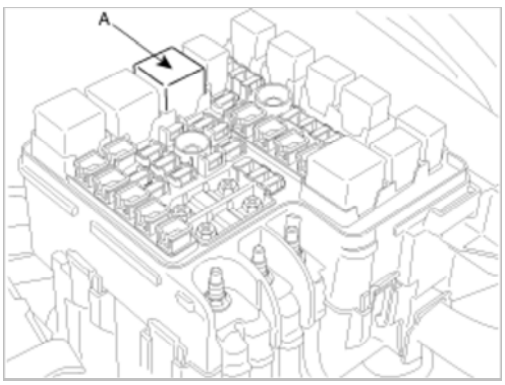


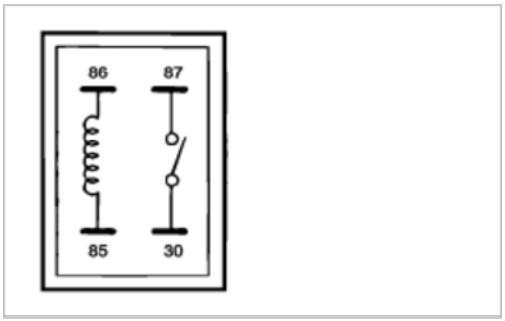
Engine Electrical System > Starting System > Starter Relay > Repair procedures

Inspection

Remove the starter relay(A) and check continuity between the terminals. If the continuity is not as specified, replace the relay.

Condition \ Terminal	85	86	87	30
When de-energized	○	○		
When energized	○	○	○	○





Engine Electrical System > Cruise Control System > Troubleshooting

Troubleshooting

Before starting troubleshooting, inspect each of the following sections, and if there is an abnormality, carry out a repair.

1. Check that the actuator and pulley assembly are all normal.
2. Check if the pulley assembly and the movement of cables are working smoothly.
3. Check if there is no excessive play or tension in each cable.

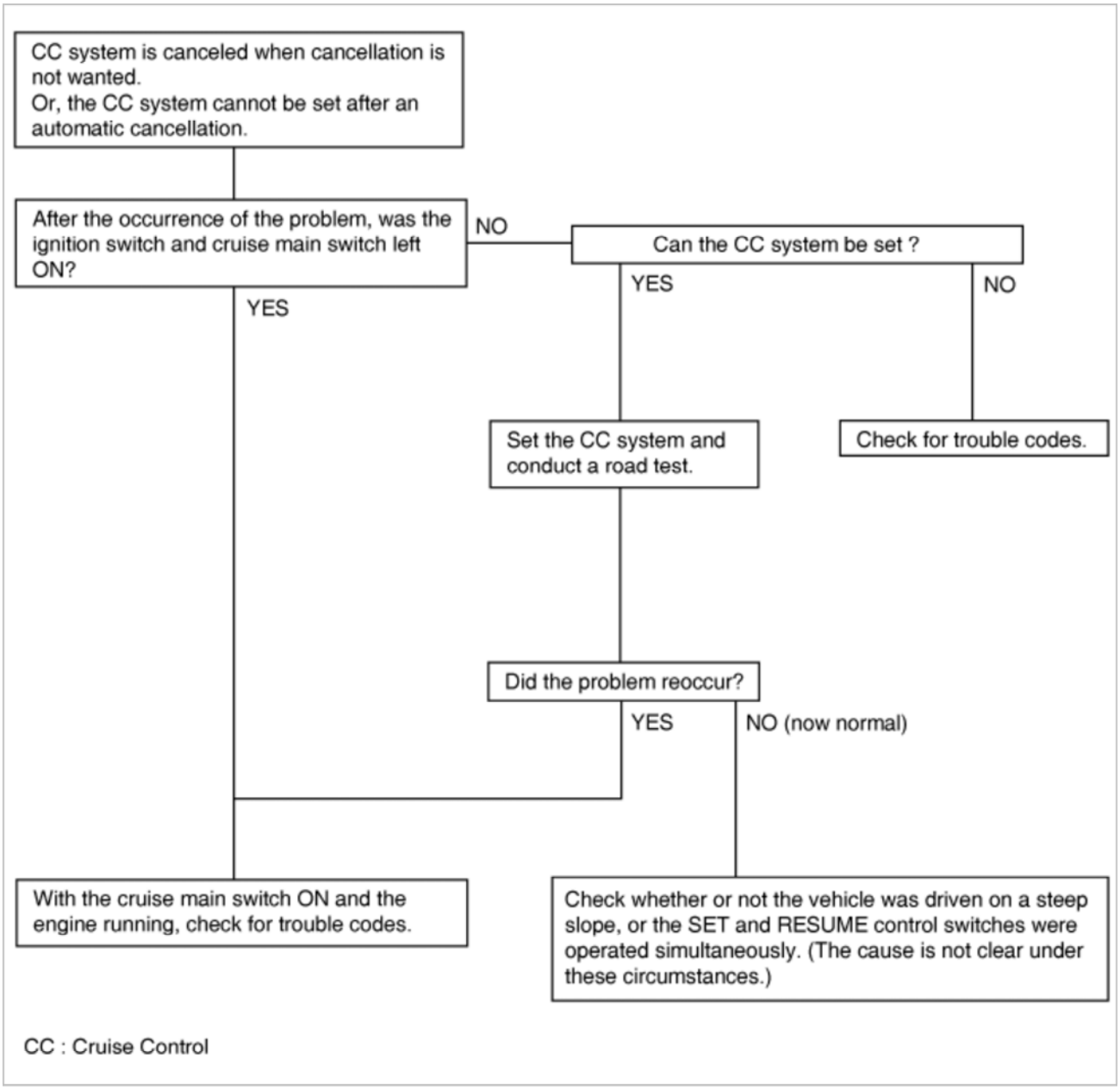
Troubleshooting Procedures

First, select the applicable malfunction symptom from the "TROUBLE SYMPTOM CHARTS" shown on nest pages.
Determine the condition of all function circuits.

1. Make the following preliminary inspections.
   A. Check that the installation of the actuator, accelerator cable are correct, and that the cables and links are securely connected.
   B. Check that the accelerator pedal moves smootyly.
   C. Adjust the cable so there is not excessive tension or excessive play on the accelerator cable.
   D. Check that the actuator and unit assembly, cruise main, control switch and the connector of each cancel switch are connected securely.
2. Check in the sequence indicated in the "TROUBLE SYMPTOM CHARTS".
3. If a normal condition is indicated, replace the cruise control module.

Trouble Symptom Charts

Trouble Symptom 1



Trouble Symptom 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downwqrd "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the speedometer cable or speedometer drive gear	
	Malfunction of the actuator and unit	Replace the actuator and unit

Trouble Symptom 3

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the brake pedal is deprssed	Damaged or disconnected wiring of the stop lamp switch	Repair the harness or replace the stop lamp switch
	Malfunction of the actuator and unit	Replace the actuator and unit

Trouble Symptom 4

Trouble symptom	Probable cause	Remedy

The CC system is not canceled when the shift lever is moved to the "N" position (It is canceled, however, when the brake pedal is depressed	Damaged or disconnected wiring of inhibitor switch input circuit	Repair the harness or repair or replace the ingibitor switch
	Improper adjustment of inhibitor switch	
	Malfunction of the actuator and unit	Replace the actuator and unit

Trouble Symptom 5

Trouble symptom	Probable cause	Remedy
Cannot decelerate (coast) by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	Repair the harness or replace the SET switch
	Actuator circuit poor contact	Repair the harness or replace the actuator
	Malfunction of the actuator	
	Malfunction of the actuator and unit	Replace the actuator and unit

Trouble Symptom 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the RESUME switch	Damaged or disconnected wiring, or short circuit, or RESUME switch input circuit	Repair the harness or RESUME switch
	Actuator circuit poor contact	Repair the harness or replace the actuator
	Malfunction of the actuator	
	Malfunction of the actuator and unit	Replace the actuator and unit

Trouble Symptom 7

Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the speedometer cable or the speedometer drive gear	
	Malfunction of the actuator and unit	Replace the actuator and unit

Trouble Symptom 8

Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

Trouble Symptom 9

Trouble symptom	Probable cause	Remedy
Malfunction of control function by ON/OFF switching of idle switch	Malfunction of circuit related to idle switch function	Repair the narness or replace the part
	Malfunction of the actuator and unit	

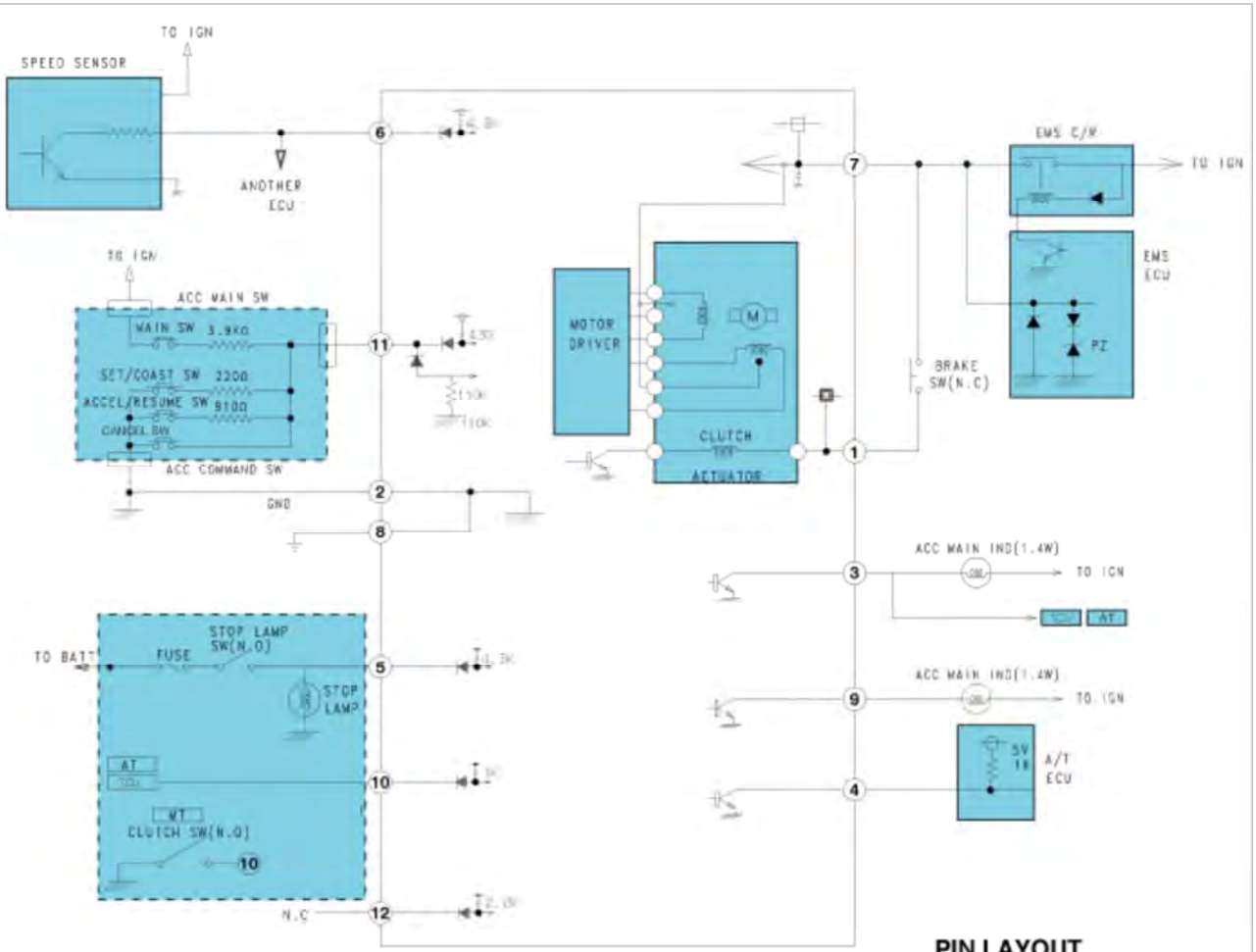
Trouble Symptom 10

Trouble symptom	Probable cause	Remedy
Overdrive is not canceled during fixed		

speed driving	Malfunction of circuit related to overdrive cancellation, or malfunction of actuator and unit	Repair the harness or replace the part
No shift to overdrive during manual driving		

Engine Electrical System > Cruise Control System > Cruise Control Actuator > Schematic Diagrams

Circuit Diagram



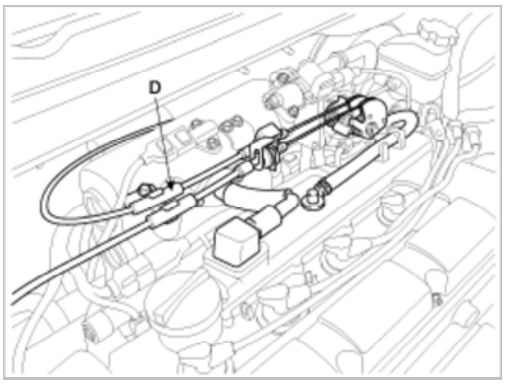
PIN LAYOUT

No	Name	Note
1	BRK	AUTUATOR CLUTCH
2	GND	GND
3	SET	SET INDICATOR
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

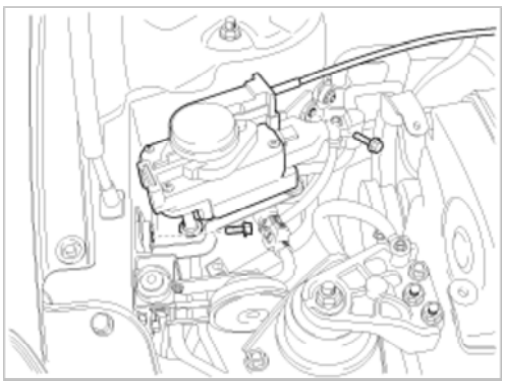
Engine Electrical System > Cruise Control System > Cruise Control Actuator > Repair procedures

Removal

1. Remove the battery negative and the cruise control cable from the throttle assembly by turning the throttle lever to the full-open position.
2. Remove the auto-cruise control cable(D).



3. Remove the actuator and unit assembly(A) mounting bolt.

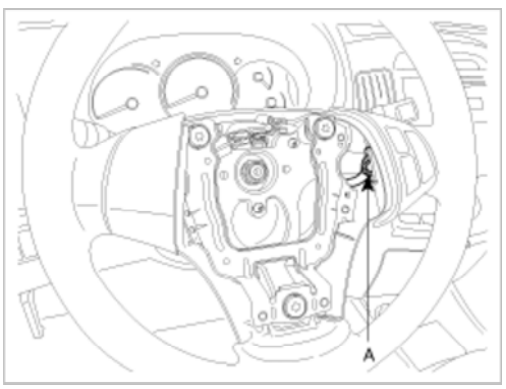


4. Installation is the reverse order of removal.

Engine Electrical System > Cruise Control System > Cruise Control Switch > Repair procedures

Removal

1. Remove the air bag module assembly. (Refer to 'RT','ST' group)
2. Disconnect the auto cruise control main switch connector.



3. Remove the auto cruise control main switch assembly.
4. To install, reverse the removal procedure.

Inspection

1. Operate the switchs and check for continuity between the terminals.
2. If continuity is not as specified, replace the switch.

Switches	State	Terminals							
		1	2	3	4	5	6	7	8
Main	ON							○—○	
Set/ Coast							○—○		
Accel/ Resume							○—○		
Cancel							○—○		

Emission Control System > General Information > Description and Operation

Description

Emissions Control System consists of three major systems.

- Crankcase Emission Control System prevents blow-by gas from releasing into the atmosphere. This system recycles gas back into the intake manifold (Closed Crankcase Ventilation Type).
- Evaporative Emission Control System prevents evaporative gas from releasing into the atmosphere. This system burns gas at appropriate engine operating condition after gathering it in the canister.
- Exhaust Emission Control System converts the three pollutants [hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx)] into harmless substances by using the 3-way catalytic converter.

Emission Control System > General Information > Specifications

Specifications

Purge Control Solenoid Valve (PCSV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0 [20°C(68°F)]

Fuel Tank Pressure Sensor (FTPS)

▷ Type: Piezo-Resistive Pressure Sensor

▷ Specification

Pressure (kPa)	Output Voltage (V)
-6.67	0.5
0	2.5
+6.67	4.5

Canister Close Valve (CCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	15.5 ~ 18.5 [20°C(68°F)]

Tightening Torques

Item	kgf.m	N.m	lb-ft
Positive Crankcase Ventilation (PCV) Valve installation	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7

Emission Control System > General Information > Troubleshooting

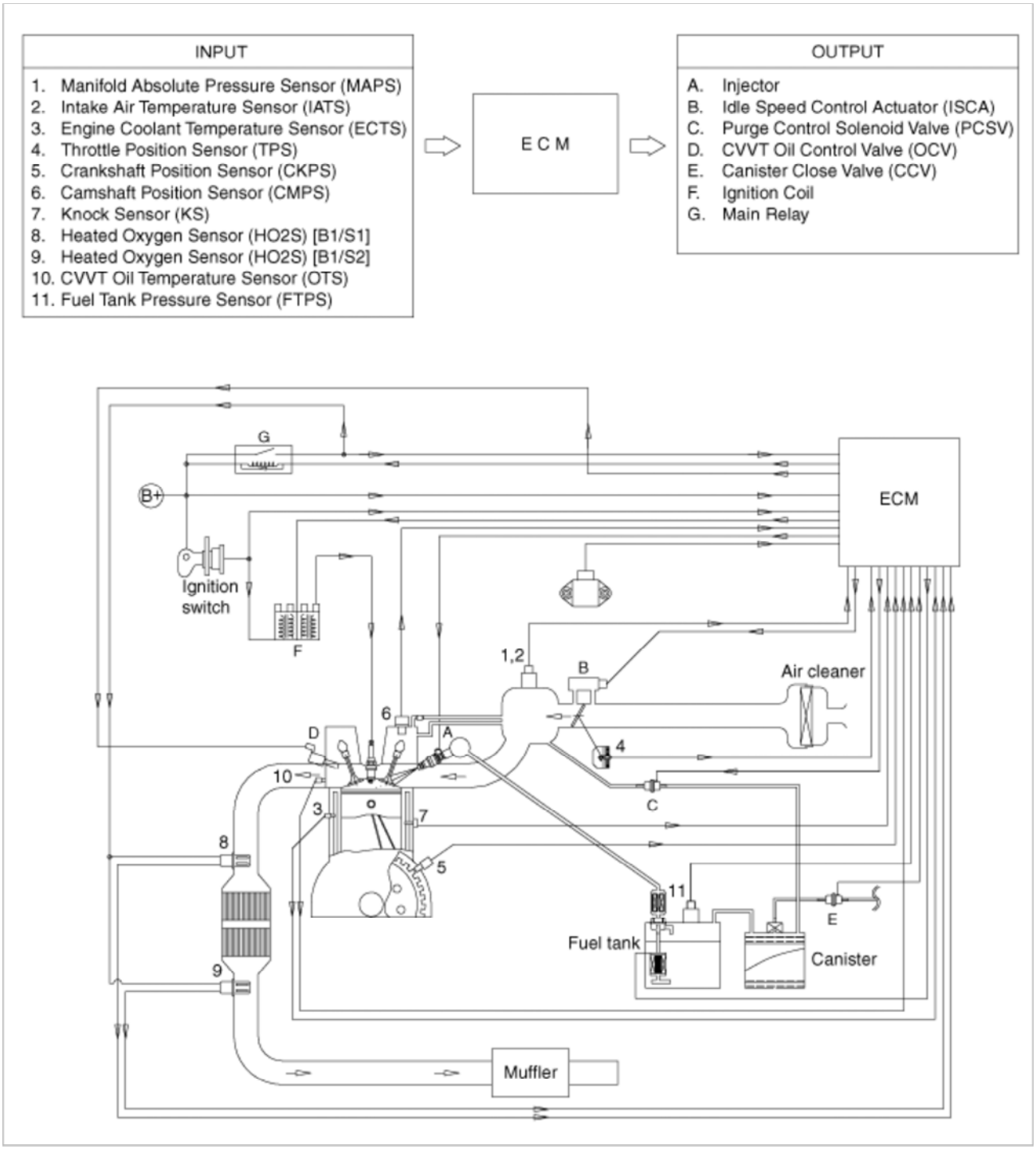
Troubleshooting

Symptom	Suspect area
Engine will not start or stuggle to start	Vapor hose damaged or disconnected
Engine stuggle to start	Malfunction of the Purge Control Solenoid Valve
Rough idle or engine stalls	Vapor hose damaged or disconnected
	Malfunction of the PCV valve
Rough idle	Malfunction of the Evaporative Emission Control System

Excessive oil consumption	Positive crankcase ventilation line clogged

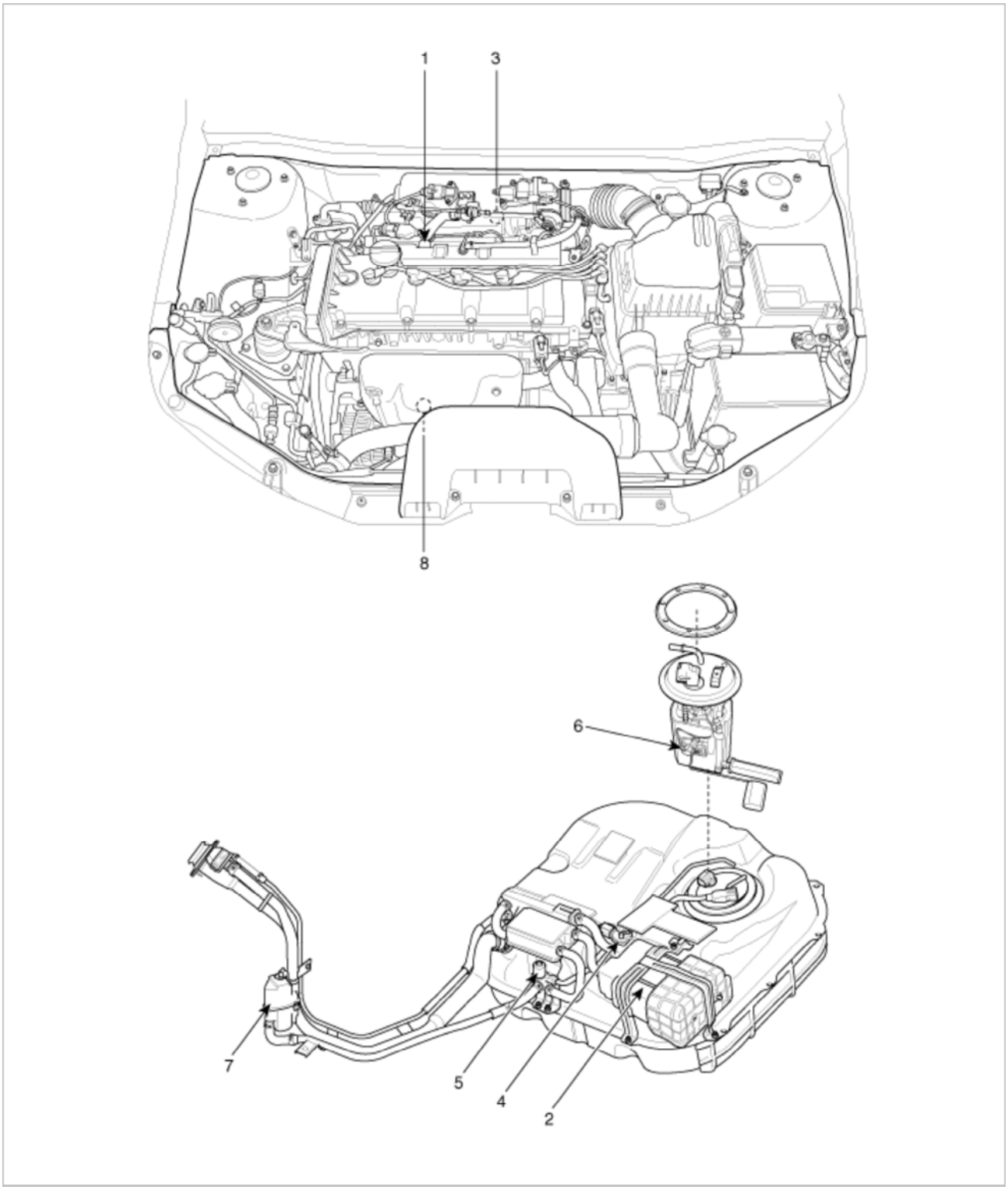
Emission Control System > General Information > Schematic Diagrams

Schematic Diagram



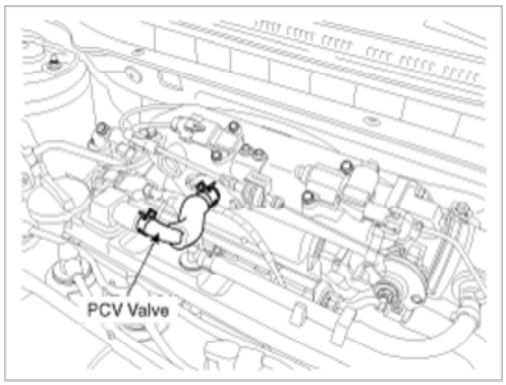
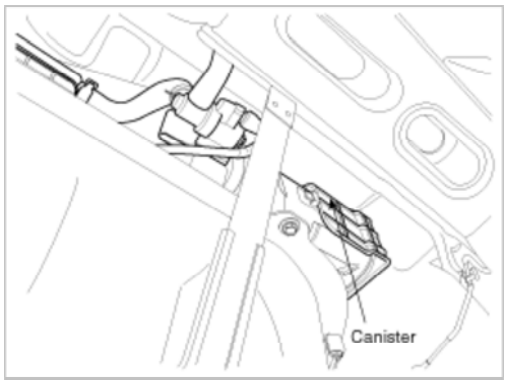
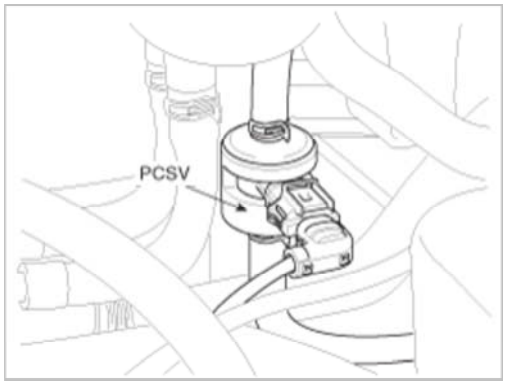
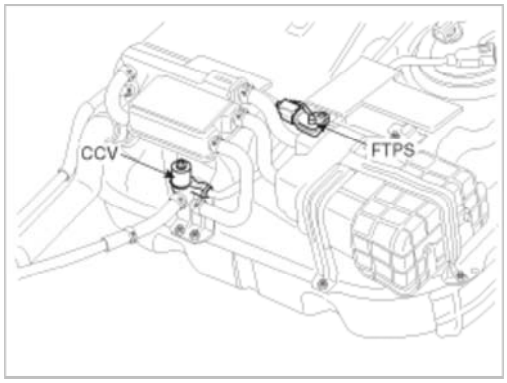
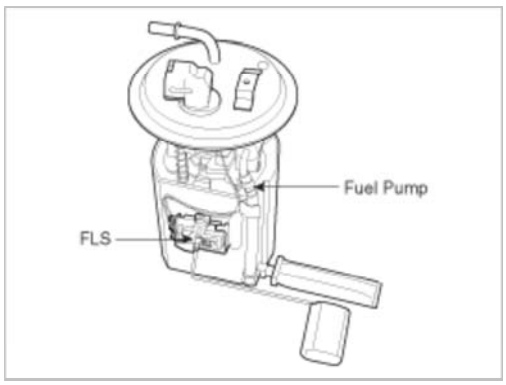
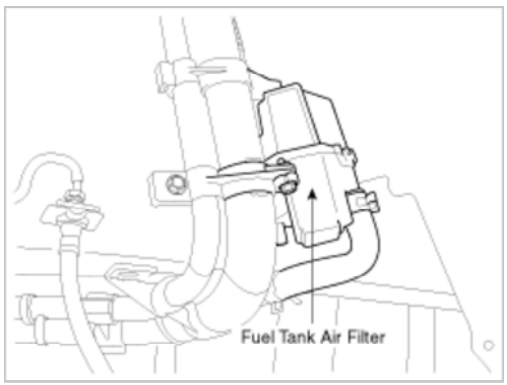
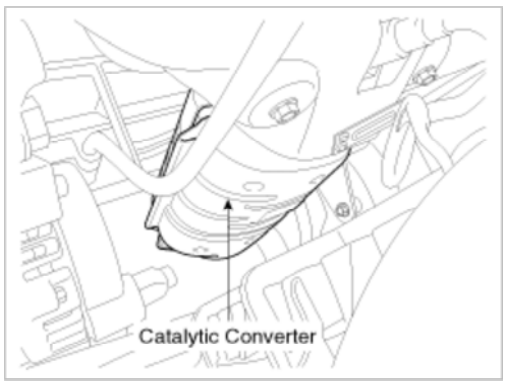
Emission Control System > General Information > Components and Components Location

Components Location



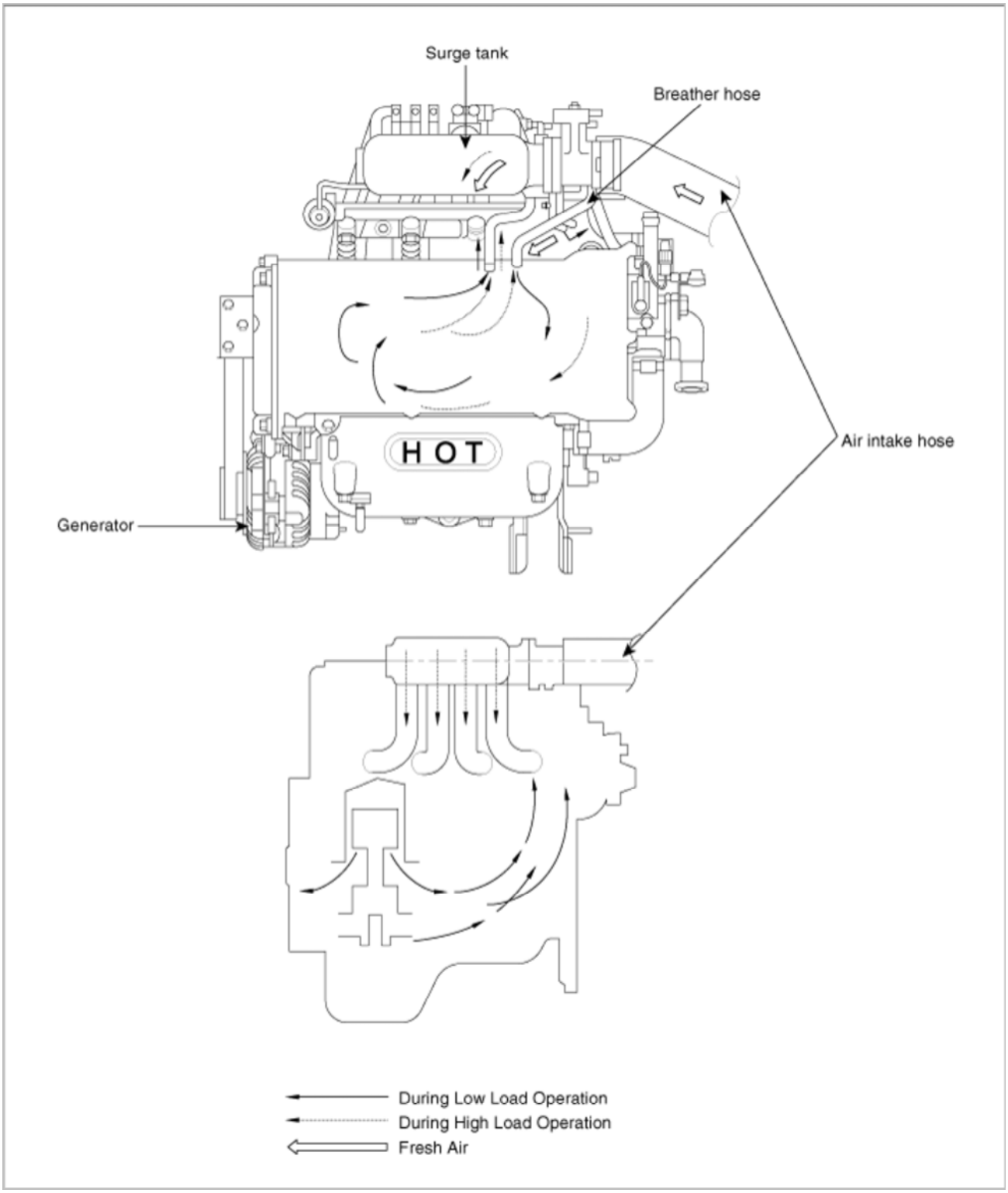
1. PCV Valve	5. Canister Close Valve (CCV)
2. Canister	6. Fuel Level Sensor (FLS)
3. Purge Control Solenoid Valve (PCSV)	7. Fuel Tank Air Filter
4. Fuel Tank Pressure Sensor (FTPS)	8. Catalytic Converter (MCC)

1. PCV Valve	2. Canister

	
3. Purge Control Solenoid Valve (PCSV)	4. Fuel Tank Pressure Sensor (FTPS) 5. Canister Close Valve (CCV)
	
6. Fuel Level Sensor (FLS)	7. Fuel Tank Air Filter
	
8. Catalytic Converter (MCC)	
	

Emission Control System > Crankcase Emission Control System > Schematic Diagrams

Schematic Diagram



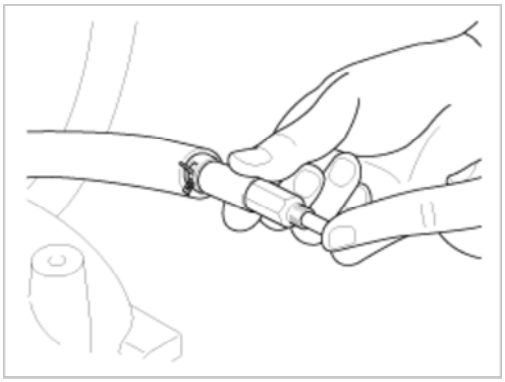
Emission Control System > Crankcase Emission Control System > Repair procedures

Inspection

1. After disconnecting the vapor hose from the PCV valve, remove the PCV valve.
2. Reconnect the PCV valve to the vapor hose.
3. Run the engine at idle, and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum can be felt.

NOTE

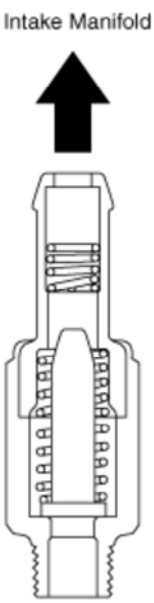
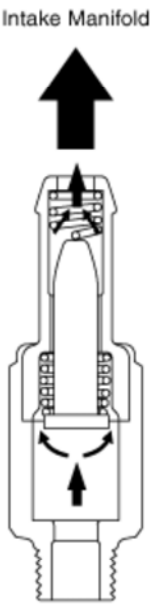
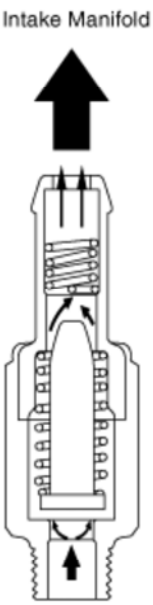
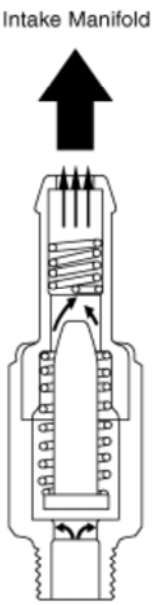
The plunger inside the PCV valve will move back and forth at vacuum.



4. If the vacuum is not felt, clean or replace the vapor hose.

Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Description and Operation

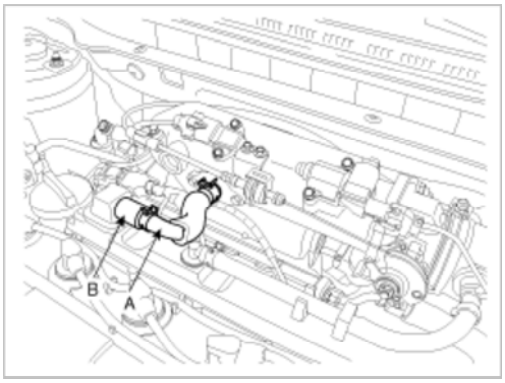
Operation Principle

Engine Condition	Not Running	Idling or Decelerating	Normal Operation	Accelerating and High Load
Vacuum in Intake Manifold	0	High	Moderate	Low
PCV Valve	Close	Slightly Open	Properly Open	Fully Open
Blow-by Gas Flow	0	Small	Medium	Large
Schematic Diagram				

Emission Control System > Crankcase Emission Control System > Positive Crankcase Ventilation (PCV) Valve > Repair procedures

Removal

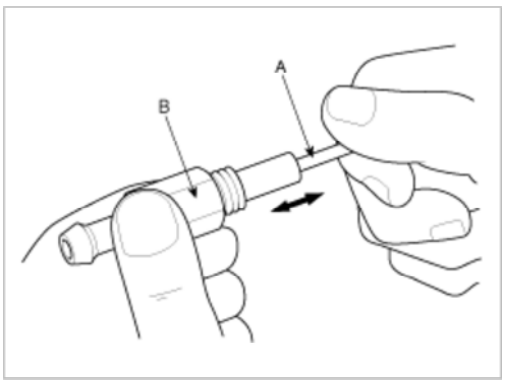
1. Disconnect the vapor hose (A).



2. Remove the PCV valve (B).

Inspection

1. Insert a thin stick (A) into the PCV valve (B) from the threaded side to check that the plunger moves.



NOTE

If the plunger does not move (PCV valve is clogged), clean or replace the valve.

Installation

1. Installation is reverse of removal.

PCV Valve installation:
7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

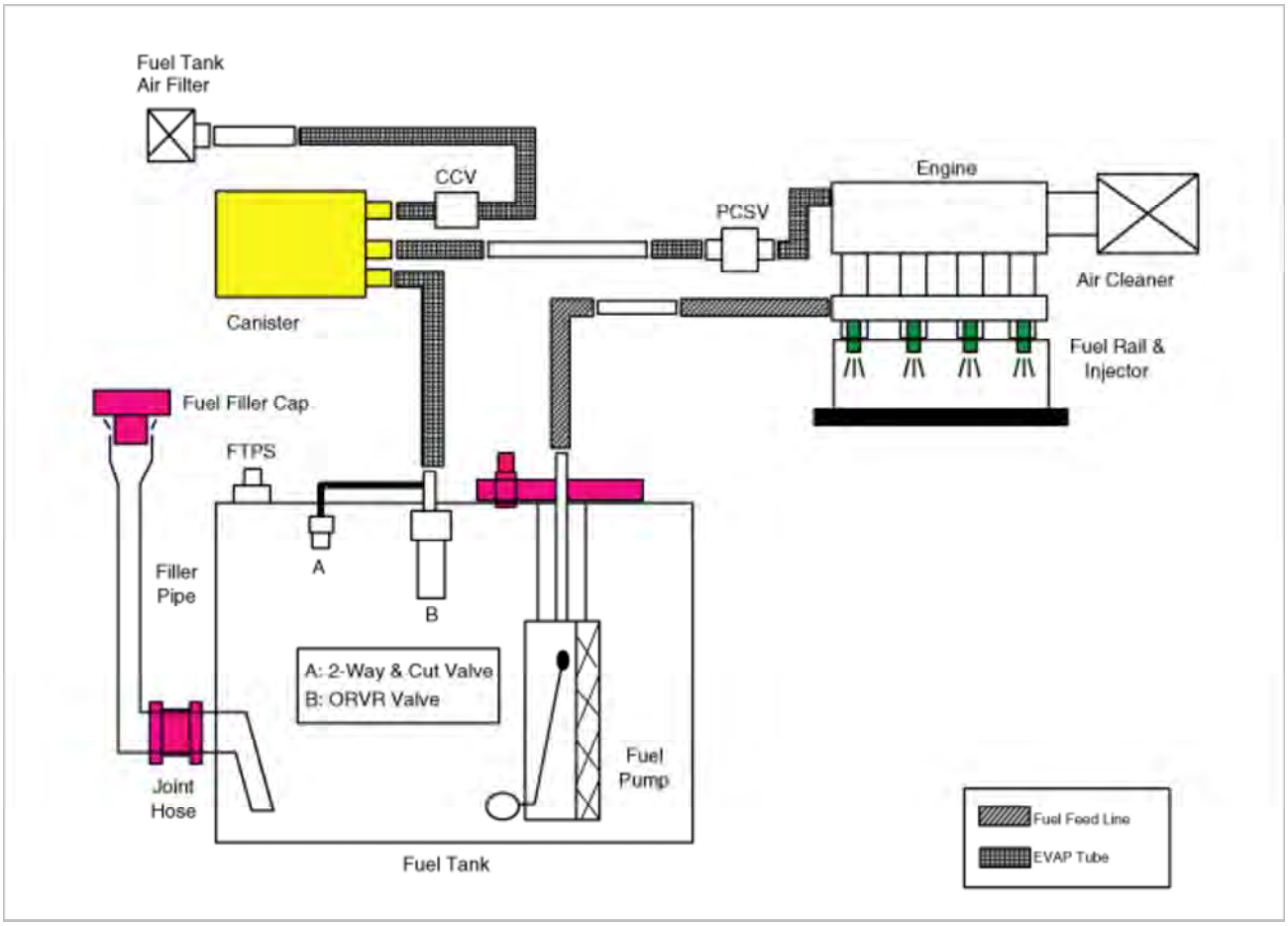
Emission Control System > Evaporative Emission Control System > Description and Operation

Description

Evaporative Emission Control System prevents fuel vapor stored in fuel tank from vaporizing into the atmosphere. When the fuel evaporates in the fuel tank, the vapor passes through vent hoses or tubes to canister filled with charcoal. The canister temporarily holds the vapor in the charcoal. If ECM determines to draw the gathered vapor into the combustion chambers during certain operating conditions, it will vacuum into intake manifold.

Emission Control System > Evaporative Emission Control System > Schematic Diagrams

Schematic Diagram



Canister

Canister is filled with charcoal and absorbs evaporated vapor in fuel tank. The gathered fuel vapor in canister is drawn into the intake manifold by the ECM/PCM when appropriate conditions are set.

Purge Control Solenoid Valve (PCSV)

Purge Control Solenoid Valve (PCSV) is installed in the passage connecting canister and intake manifold. It is a duty type solenoid valve and is operated by ECM/PCM signal.
To draw the absorbed vapor into the intake manifold, the ECM/PCM will open the PCSV, otherwise the passage remains closed.

Fuel Filler Cap

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

Fuel Tank Pressure Sensor (FTPS)

The Fuel Tank Pressure Sensor (FTPS) is an integral part of the monitoring system. The FTPS checks Purge Control Solenoid Valve (PCSV) operation and leaks in the Evaporative Emission Control System by monitoring pressure and vacuum level in the fuel tank during PCSV operating cycles.

Canister Close Valve (CCV)

The Canister Close Valve (CCV) is located between the canister and the fuel tank air filter. It closes off the air inlet to the canister for the Evaporative Emissions System and also prevents fuel vapors from escaping from the Canister when the vehicle is not operating.

Evaporative System Monitoring

Evaporative Emission Control Monitoring System consists of fuel vapor generation, evacuation, and leakage check step. At first, the OBD-II system checks if vapor generation due to fuel temperature is small enough to start monitoring. Then it evacuates the evaporative system by means of PCSV with ramp in order to maintain a certain vacuum level. The final step is to check if there is vacuum loss by any leakage of the system.

Vapor Generation Checking

During stabilization period, the PCSV and the CCV are closed. The system pressure is measured as starting pressure

(DP_A). After a certain defined period (T1), the system pressure (DP_B) is measured again and the difference from the starting pressure is calculated. If this difference (DP_B - DP_A) is bigger than a threshold, there should be excessive vapor and the monitor is aborted for next checking. On the contrary, if the difference is lower than another negative threshold, PCSV is regarded as malfunction such as clogged at open position.

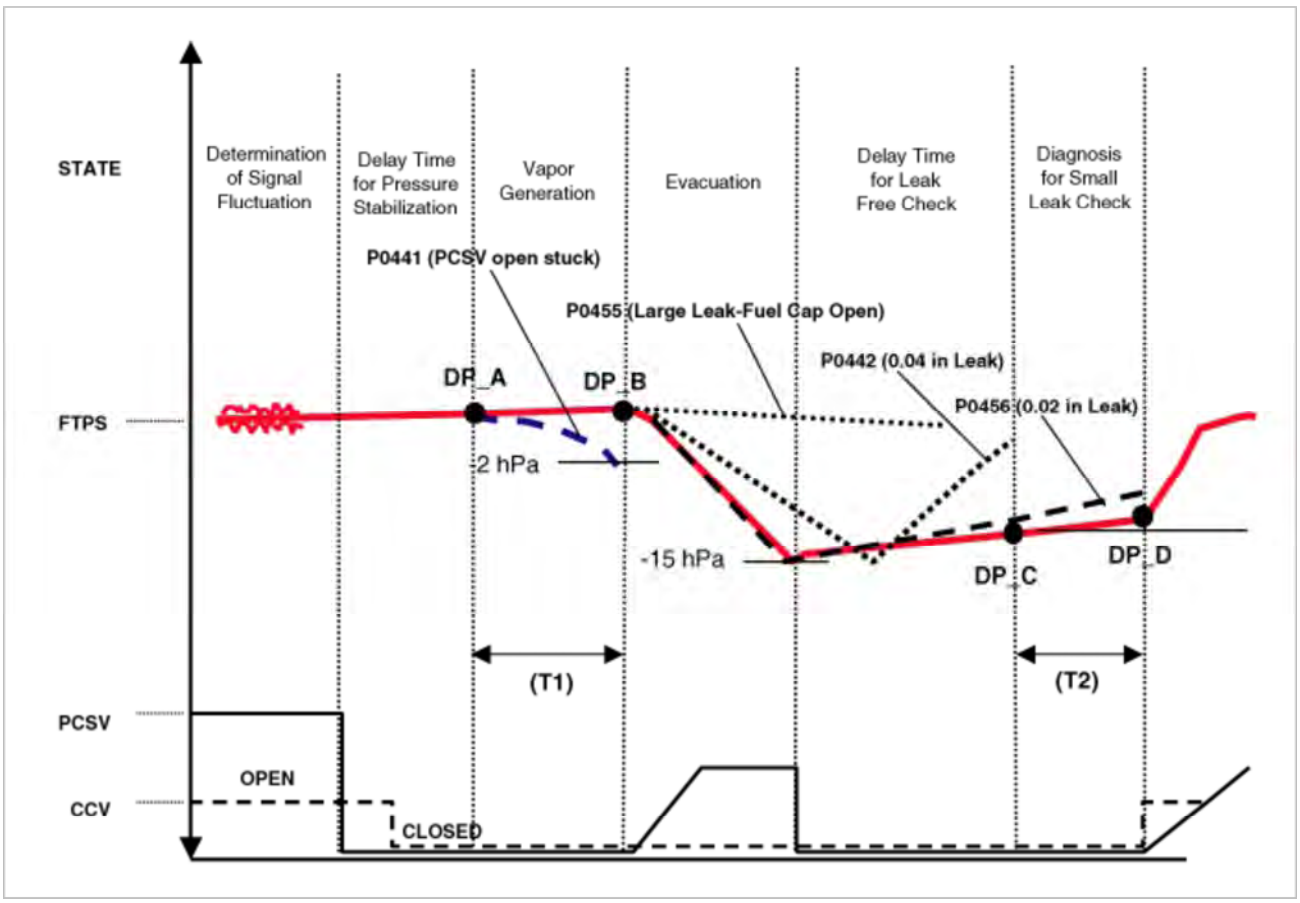
Evacuation

PCSV is opened with a certain ramp for the pressure to reach down to a certain level. If pressure can't be lowered below a threshold, the system is regarded as fuel cap-opened or having a large leakage.

Leaking Checking

PCSV is closed and the system waits for a period to get stabilized pressure. During checking period (T2), the system measures the beginning and the end of the system pressure (DP_C, DP_D). The diagnosis value is the pressure difference corrected by natural vapor generation (DP_B - DP_A) rate from the vapor generation checking step.

Evaporative System Monitoring

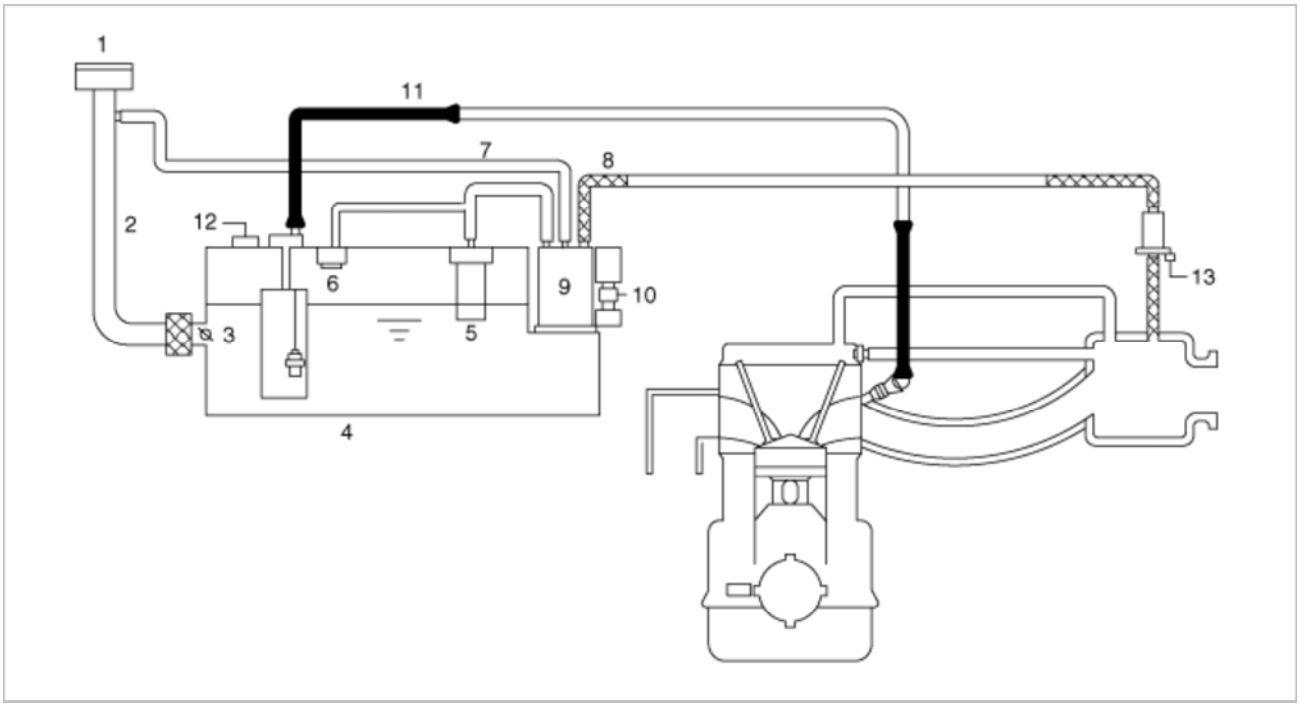


Evaporative And ORVR Emission Control System

This system consists of a fill vent valve, fuel shut-off valve, fuel cut valve (for roll over), two way valve (pressure/vacuum relief), fuel liquid/vapor separator which is installed beside the filler pipe, charcoal canister which is mounted under the rear floor LH side member and protector, tubes and miscellaneous connections.

While refueling, ambient air is drawn into the filler pipe so as not to emit fuel vapors in the air. The fuel vapor in the tank is then forced to flow into the canister via the fill vent valve. The fuel liquid/vapor separator isolates liquid fuel and passes the pure vapor to the charcoal canister.

While the engine is operating, the trapped vapor in the canister is drawn into the intake manifold and then into the engine combustion chamber. According to this purge process, the charcoal canister is purged and recovers its absorbing capability.



1. Fuel Filler Cap	8. Evaporative Hose
2. Fuel Filler Pipe	9. Canister
3. Fuel Shut-OFF Valve	10. Canister Close Valve (CCV)
4. Fuel Tank	11. Fuel Feed Line
5. ORVR Valve	12. Fuel Tank Pressure Sensor (FTPS)
6. 2-Way & Cut Valve	13. Purge Control Solenoid Valve (PCSV)
7. Evaporative Hose	

Emission Control System > Evaporative Emission Control System > Repair procedures

Inspection

[System Inspection]

1. Disconnect the vapor hose from the throttle body and connect a vacuum pump to the nipple on the throttle body.
2. Check the following points with applying vacuum using the vacuum pump.
   · At Cold Engine [Engine Coolant Temperature < 60°C(140°F)]

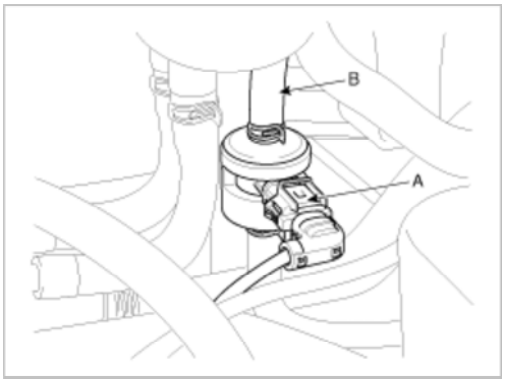
Engine Operating Condition	Applied Vacuum	Result
Idle	0.5kgf/cm² (50kPa,7.3psi)	Vacuum is held
3,000rpm		

· At Warmed Engine [Engine Coolant Temperature > 80°C(176°F)]

Engine Operating Condition	Applied Vacuum	Result
Idle	0.5kgf/cm² (50kPa,7.3psi)	Vacuum is held
Within 3 minutes after engine start at 3,000 rpm	Try to apply vacuum	Vacuum is released
In 3 minutes after engine start at 3,000 rpm	0.5kgf/cm² (50kPa,7.3psi)	Vacuum will be held momentarily, after which, it will be released

[PCSV Inspection]

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the PCSV connector (A).



3. Disconnect the vapor hose (B) which is connected with the intake manifold from the PCSV.
4. After connecting a vacuum pump to the nipple, apply vacuum.
5. With the PCSV control line grounded, check valve operation when applying battery voltage to the PCSV or not.

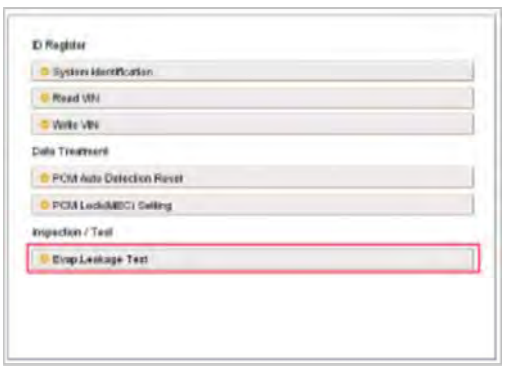
Battery Voltage	Valve	Vacuum
Connected	Open	Released
Disconnected	Close	Maintained

6. Measure the coil resistance of the PCSV.

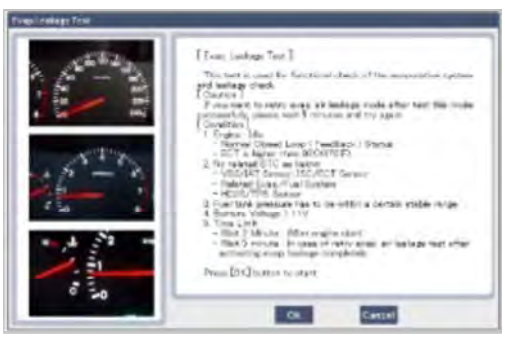
Specification: 14.0 ~ 18.0Ω [20°C(68°F)]

[EVAP. Leakage Test]

1. Select "Evap. Leakage Test".



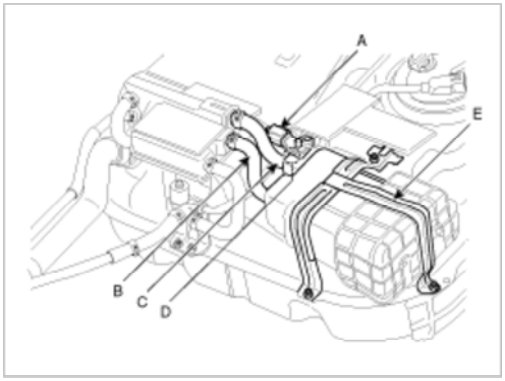
2. Proceed test in a accordance with the screen introduction.



Emission Control System > Evaporative Emission Control System > Canister > Repair procedures

Removal

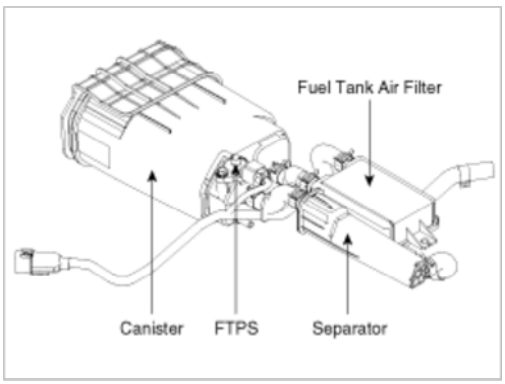
1. Remove the fuel tank (Refer to "FUEL TANK" in this group).
2. Disconnect the fuel tank pressure sensor connector (A).



3. Disconnect the vapor hoses (B,C) from the canister.
4. Disconnect the vapor tube quick-connector (D) from the canister.
5. Remove the canister band (E), and then remove the canister from the fuel tank.

Inspection

1. Check for the following items visually.
   A. Cracks or leakage of the canister
   B. Loose connection, distortion, or damage of the vapor hose/tube



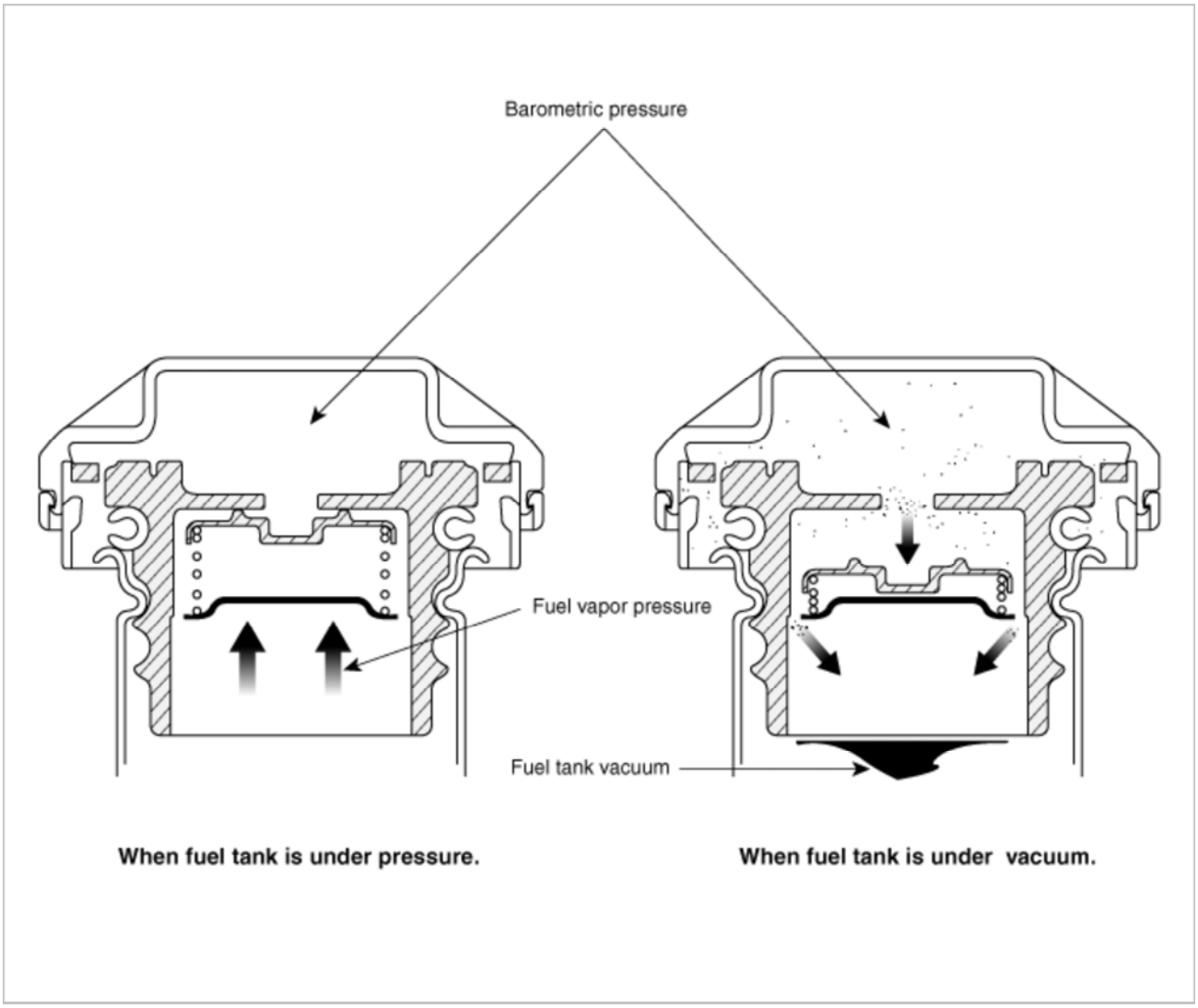
Installation

Installation is reverse of removal.

Emission Control System > Evaporative Emission Control System > Fuel Filler Cap > Description and Operation

Description

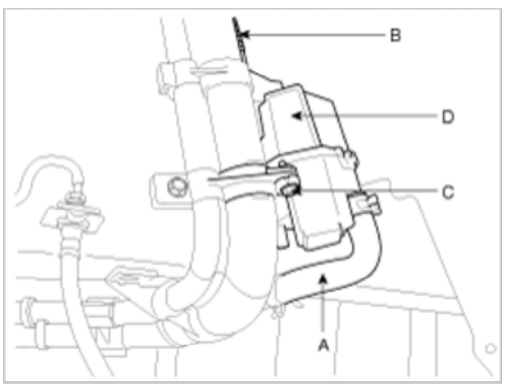
A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which would seal the fuel filler. After the gasket on the fuel filler cap and the filler neck flange contact each other, the ratchet produces a loud clicking noise indicating the seal has been set.



Emission Control System > Evaporative Emission Control System > Fuel Tank Air Filter > Repair procedures

Replacement

1. Remove the Rear-Left wheel house inner cover.
2. Disconnect the vapor hoses (A,B) from the fuel tank air filter.



3. After removing the installation bolt (C), remove the fuel tank air filter (D).
4. Install a new fuel tank air fiter.

Emission Control System > Exhaust Emission Control System > Description and Operation

Description

Exhaust emissions (CO, HC, NOx) are controlled by a combination of engine modifications and the addition of special control components.
Modifications to the combustion chamber, intake manifold, camshaft and ignition system form the basic control system. These items have been integrated into a highly effective system which controls exhaust emissions while maintaining good drivability and fuel economy.

Air/Fuel Mixture Control System [Multiport Fuel Injection (MFI) System]

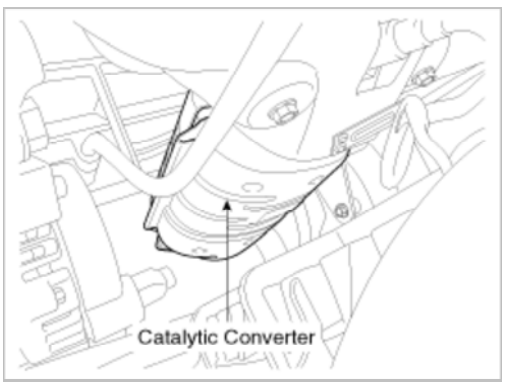
The MFI system uses signals from the heated oxygen sensor to activate and control the injector installed in the manifold for each cylinder, thus precisely regulating the air/fuel mixture ratio and reducing emissions.
This in turn allows the engine to produce exhaust gas of the proper composition to permit the use of a three way catalyst. The three way catalyst is designed to convert the three pollutants [hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx)] into harmless substances. There are two operating modes in the MFI system.

1. Open Loop air/fuel ratio is controlled by information programmed into the ECM.
2. Closed Loop air/fuel ratio is adjusted by the ECM based on information supplied by the oxygen sensor.

Emission Control System > Exhaust Emission Control System > Catalytic Converter > Description and Operation

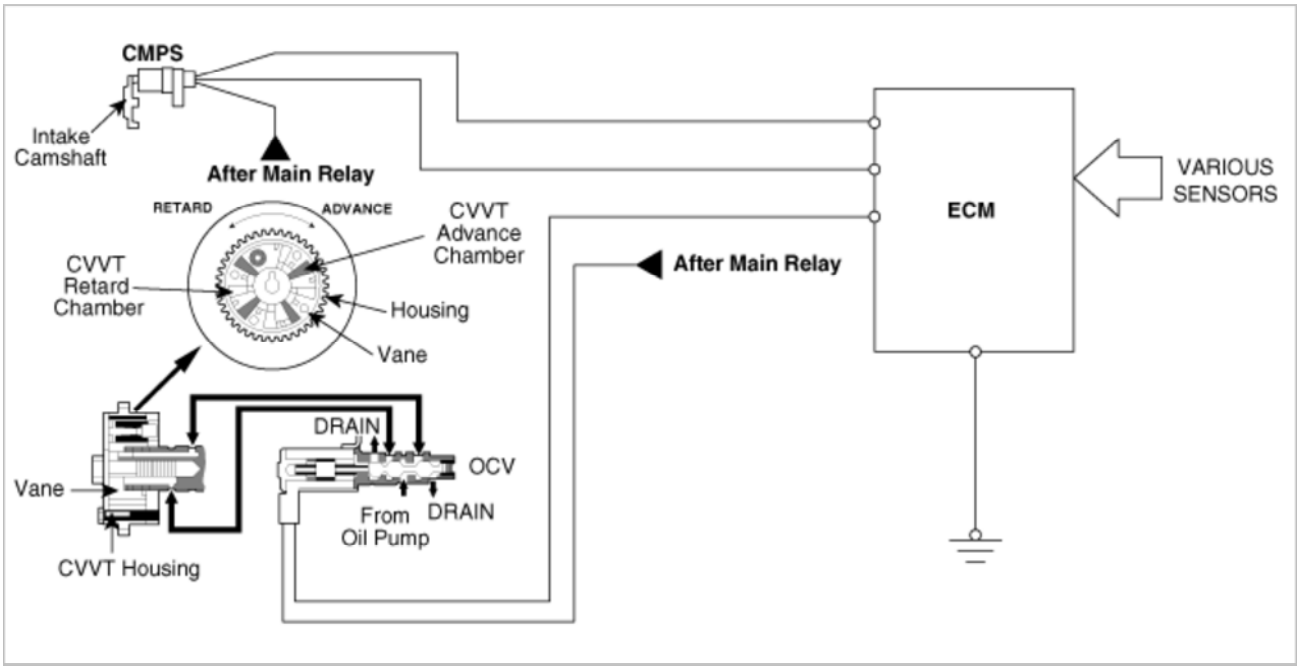
Description

The catalytic converter of the gasoline engine is a three way catalyst. It oxidizes carbon monoxide and hydrocarbons (HC), and separates oxygen from the oxides of nitrogen (NOx).
There are two types of three-way catalyst; Palette type and Monolith type.

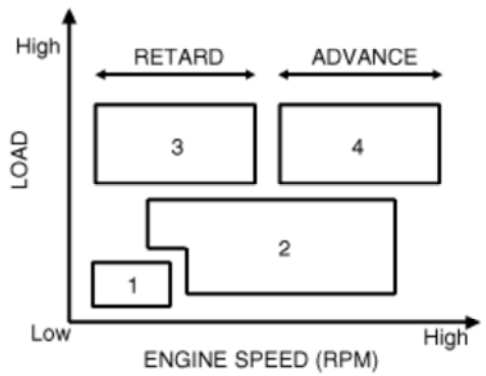


Emission Control System > Exhaust Emission Control System > CVVT (Continuously Variable Valve Timing) System > Description and Operation

Description



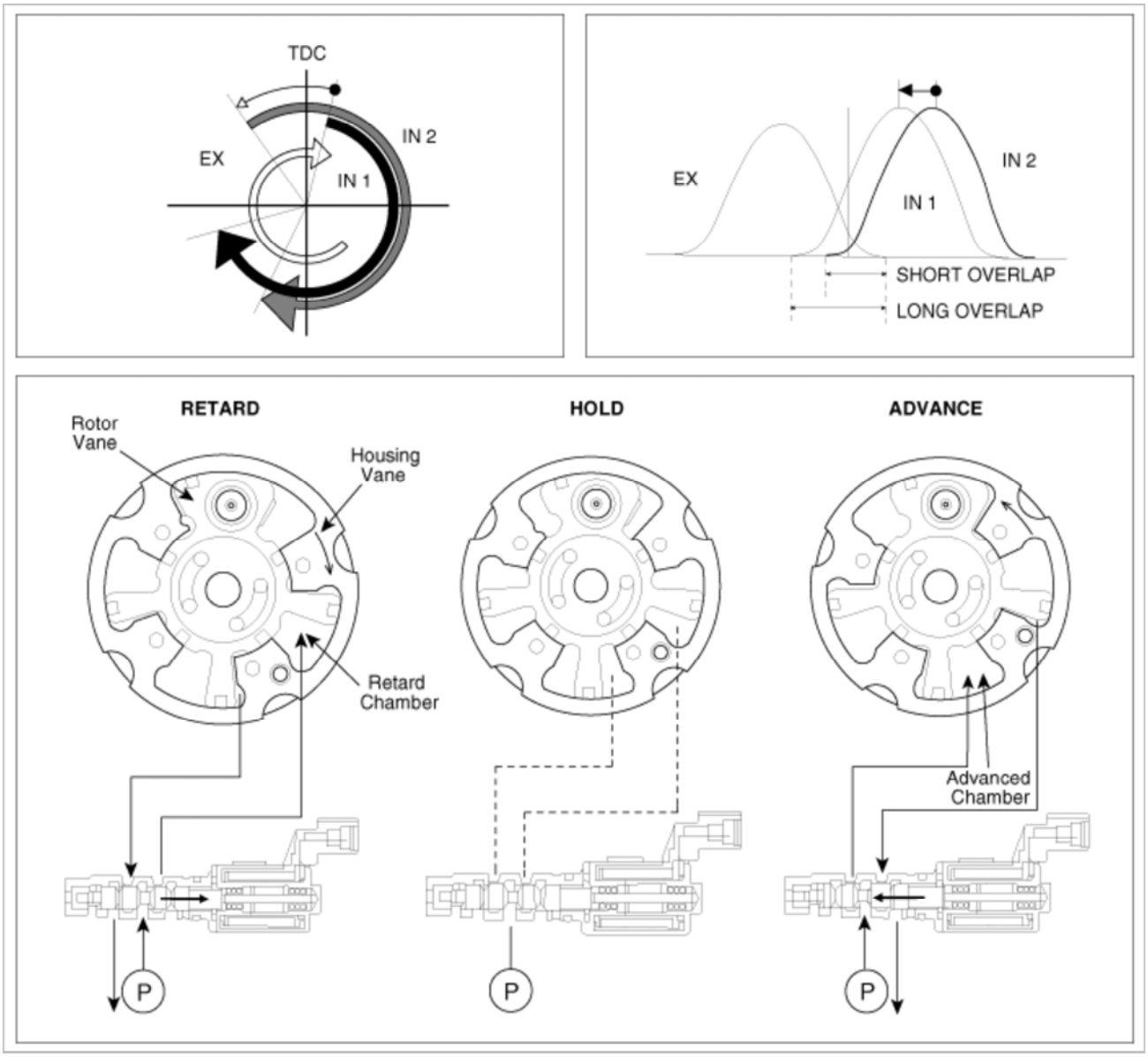
The CVVT (Continuously Variable Valve Timing) which is installed on the exhaust camshaft controls intake valve open and close timing in order to improve engine performance.
The intake valve timing is optimized by CVVT system depending on engine rpm.
This CVVT system improves fuel efficiency and reduces 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 Principle

The CVVT system makes continuous intake valve timing changes based on operating conditions.
Intake valve timing is optimized to allow the engine to produce maximum power.
Cam angle is advanced to obtain the EGR effect and reduce pumping loss. The intake valve is closed quickly to reduce the entry of the air/fuel mixture into the intake port and improve the changing effect.
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 (CVVT Oil Control Valve) spool location at this time is as follows.

Oil pump → Advance oil chamber (Little by little open the inflow side to the advance oil chamber) → Almost close the drain side

Be sure there might be a difference in the position according to the engine running state (rpm, oil temperature, and oil pressure).

Specifications

Fuel Delivery System

Items	Specification	
Fuel Tank	Capacity	53lit. (14.0 U.S.gal., 56.0 U.S.qt., 46.6 Imp.qt.)
Fuel Filter	Type	Paper type
Fuel Pressure Regulator	Regulated Fuel Pressure	338 ~ 348kpa (3.45 ~ 3.55kgf/cm², 49.0 ~ 50.5psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor
Fuel Return System	Type	Returnless

Sensors

Manifold Absolute Pressure Ssensor (MAPS)
▹ Type: Piezo-resistive pressure sensor type
▹ Specification

Pressure (kPa)	Output Voltage (V)
20.0	0.79
46.7	1.84
101.32	4.0

Intake Air Temperature Sensor (IATS)
▹ Type: Thermistor type
▹ Specification

Temperature [°C(°F)]	Resistance (kΩ)
-40(-40)	40.93 ~ 48.35
-30(-22)	23.43 ~ 27.34
-20(-4)	13.89 ~ 16.03
-10(14)	8.50 ~ 9.71
0(32)	5.38 ~ 6.09
10(50)	3.48 ~ 3.90
20(68)	2.31 ~ 2.57
25(77)	1.90 ~ 2.10
30(86)	1.56 ~ 1.74
40(104)	1.08 ~ 1.21
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

Engine Coolant Temperature Sensor (ECTS)
▹ Type: Thermistor type
▹ Specification

Temperature [°C(°F)]	Resistance (kΩ)
-40(-40)	48.14
-20(-4)	14.13 ~ 16.83
0(32)	5.79
20(68)	2.31 ~ 2.59

40(104)	1.15
60(140)	0.59
80(176)	0.32

Throttle Position Sensor (TPS)
▷ Type: Variable resistor type
▷ Specification

Throttle Angle	Output Voltage (V)
C.T	0.25 ~ 0.9
W.O.T	Min. 4.0V

Items	Specification
Sensor Resistance (kΩ)	1.6 ~ 2.4 (20°C)

Heated Oxygen Sensor (HO2S)
▷ Type: Zirconia (ZrO2) type
▷ Specification

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

Item	Specification
Heater Resistance (Ω)	Approx. 9.0 (20°C)

Camshaft Position Sensor (CMPS)
▷ Type: Hall effect type
Crankshaft Position Sensor (CKPS)
▷ Type: Hall effect type
Knock Sensor (KS)
▷ Type: Piezo-electricity type
▷ Specification

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

CVVT Oil Temperature Sensor (OTS)
▷ Type: Thermistor type
▷ Specification

Temperature [°C(°F)]	Resistance (kΩ)
-40(-40)	52.15
-20(-4)	16.52
0(32)	6.0
20(68)	2.45
40(104)	1.11
60(140)	0.54
80(176)	0.29

Fuel Tank Pressure Sensor (FTPS)
▷ Type: Piezo-Resistive Pressure Sensor
▷ Specification

Pressure (kPa)	Output Voltage (V)

-6.67	0.5
0	2.5
+6.67	4.5

Actuators

Injector

▷ Number: 4

▷ Specification

Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 [20°C (68°F)]

Idle Speed Control Actuator (ISCA)

▷ Type: Double coil type

▷ Specification

Item	Specification
Closing Coil Resistance (Ω)	14.6 ~ 16.2 [20°C (68°F)]
Opening Coil Resistance (Ω)	11.1 ~ 12.7 [20°C (68°F)]

Duty (%)	Air Flow Rate (㎥/h)
15	0.8 ~ 1.8
35	6.3 ~ 10.3
70	35.5 ~ 45.0
96	49.0 ~ 59.0

Purge Control Solenoid Valve (PCSV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0 [20°C (68°F)]

CVVT Oil Control Valve (OCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	6.9 ~ 7.9 [20°C (68°F)]

Ignition Coil

▷ Type: Double ended type

▷ Specification

Item	Specification
Primary Coil Resistance (Ω)	0.58Ω±10％ [20°C (68°F)]
Secondary Coil Resistance (kΩ)	8.8kΩ±15％ [20°C (68°F)]

Canister Close Valve (CCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	15.5 ~ 18.5 [20°C (68°F)]

Service Standard

Items	Specification

Ignition Timing	BTDC 5° ± 10°		
Idle Speed	A/CON OFF	Neutral,N,P-range	660 ± 100 rpm
		D-range	
	A/CON ON	Neutral,N,P-range	
		D-range	

Tightening Torques

Engine Control System

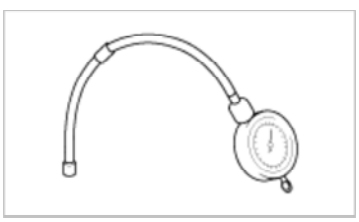
Item	kgf.m	N.m	lb-ft
ECM installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Manifold absolute pressure sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Engine coolant temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Throttle position sensor installation screw	0.15 ~ 0.25	1.5 ~ 2.5	1.1 ~ 1.8
Crankshaft position sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Knock sensor installation bolt	1.7 ~ 2.7	16.7 ~ 26.4	12.3 ~ 19.5
Heated oxygen sensor (Bank 1 / Sensor 1) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Heated oxygen sensor (Bank 1 / Sensor 2) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
CVVT oil temperature sensor installation	2.0~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Idle speed control actuator installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Purge control solenoid valve bracket installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
CVVT oil control valve installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Ignition coil installation bolt/nut	1.9 ~ 2.7	18.6 ~ 26.4	13.7 ~ 19.5
Throttle body installation nut	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4

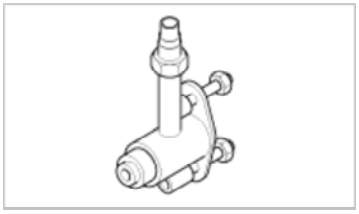
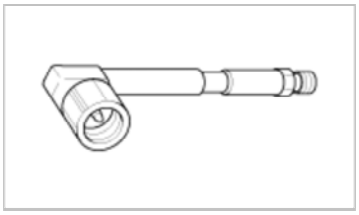
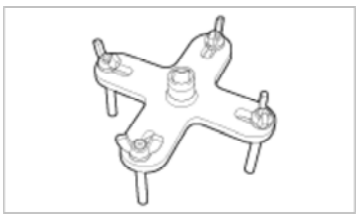
Fuel Delivery System

Item	kgf.m	N.m	lb-ft
Fuel tank band installation nut	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
Fuel pump plate cover tightening	8.0 ~ 10.0	78.5 ~ 98.1	57.9 ~ 72.4
Delivery pipe installation bolt	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4

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)
09310-2B200 Fuel Pump Plate Cover Wrench		Removeing and installation fuel pump plate cover

Fuel System > General Information > Troubleshooting

Basic Troubleshooting

Basic Troubleshooting Guide

1	**Bring Vehicle to Workshop**

2	**Analyze Customer's Problem**

- Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	**Verify Symptom, and then Check DTC and Freeze Frame Data**

- Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC).
- Record the DTC and freeze frame data.

NOTE

To erase DTC and freeze frame data, refer to Step 5.

4	**Confirm the Inspection Procedure for the System or Part**

- Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	**Erase the DTC and Freeze Frame Data**

WARNING

NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET".

6	**Inspect Vehicle Visually**

- Go to Step 11, if you recognize the problem.

7	**Recreate (Simulate) Symptoms of the DTC**

- Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.
- If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.

8	**Confirm Symptoms of Problem**

- If DTC(s) is/are not displayed, go to Step 9.
- If DTC(s) is/are displayed, go to Step 11.

9	**Recreate (Simulate) Symptom**

- Try to recreate or simulate the condition of the malfunction as described by the customer.

10	**Check the DTC**

- If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE.
- If DTC(s) occur(s), go to Step 11.

11	**Perform troubleshooting procedure for DTC**
12	**Adjust or repair the vehicle**
13	**Confirmation test**
14	**END**

Customer Problem Analysis Sheet

1. VEHICLE INFORMAITON

VIN No.		Transmission	☐ M/T ☐ A/T ☐CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile	CPF (Diesel Engine)	☐ With CPF ☐ Without CPF

2. SYMPTOMS

☐ Unable to start	☐ Engine does not turn over ☐ Incomplete combustion ☐ Initial combustion does not occur
☐ Difficult to start	☐ Engine turns over slowly ☐ Other_____
☐ Poor idling	☐ Rough idling ☐ Incorrect idling ☐ Unstable idling (High:_____ rpm, Low:_____rpm) ☐ Other
☐ Engine stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C ON ☐ Shifting from N to D-range ☐ Other_____
☐ Others	☐ Poor driving (Surge) ☐ Knocking ☐ Poor fuel economy ☐ Back fire ☐ After fire ☐ Other_____

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other_____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other_____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ 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

5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

Basic Inspection Procedure

Measuring Condition of Electronic Parts' Resistance

The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20°C, 68°F), unless stated otherwise.

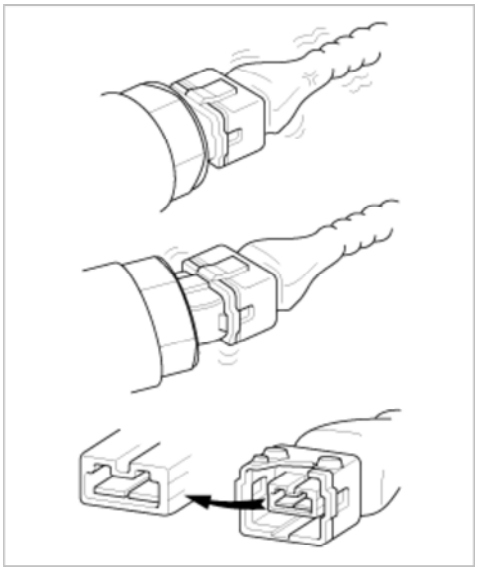
> NOTE
>
> The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.

Intermittent Problem Inspection Procedure

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, the technician should thoroughly make out a "Customer Problem Analysis Sheet" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).

2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● 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 source.

> WARNING
>
> • DO NOT heat components to the point where they may be damaged.
> • DO NOT heat the ECM directly.

● Simulating Water Sprinkling

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

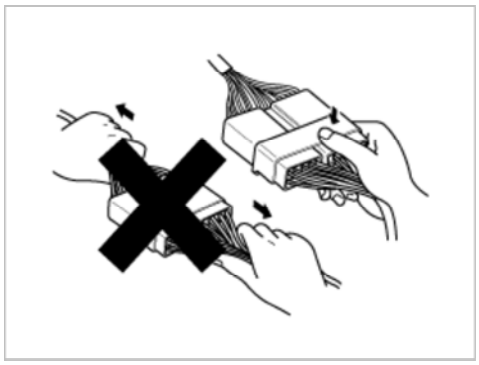
> WARNING
>
> DO NOT sprinkle water directly into the engine compartment or electronic components.

● Simulating Electrical Load

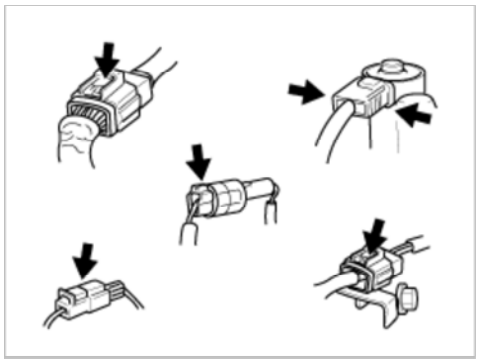
1) Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, rear window defogger, etc.).

Connector Inspection Procedure

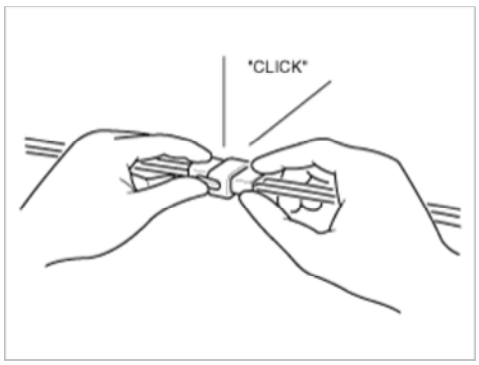
1. Handling of Connector
   A. Never pull on the wiring harness when disconnecting connectors.



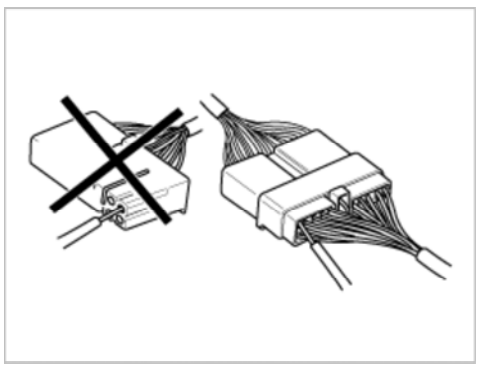
B. When removing the connector with a lock, press or pull locking lever.



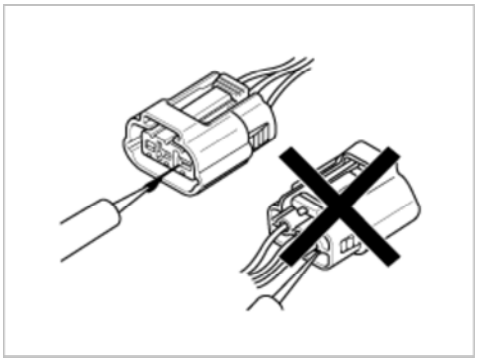
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



D. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



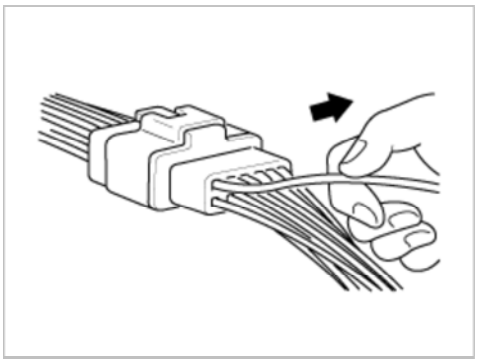
E. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



NOTE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

2. Checking Point for Connector
   A. While the connector is connected:
      Hold the connector, check connecting condition and locking efficiency.
   B. When the connector is disconnected:
      Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.
      Visually check for rust, contamination, deformation and bend.
   C. Check terminal tightening condition:
      Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.
   D. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



3. Repair Method of Connector Terminal
   A. Clean the contact points using air gun and/or shop rag.

NOTE

Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

   B. In case of abnormal contact pressure, replace the female terminal.

Wire Harness Inspection Procedure

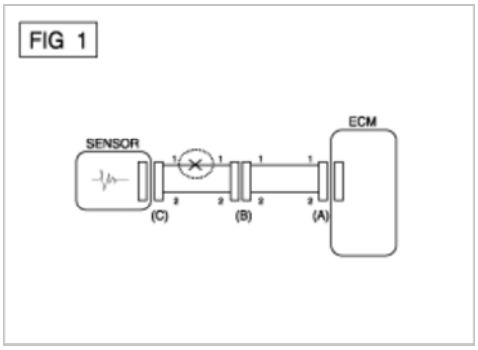
1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

Electrical Circuit Inspection Procedure

● Check Open Circuit

1. Procedures for Open Circuit
   A. Continuity Check
   B. Voltage Check

   If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

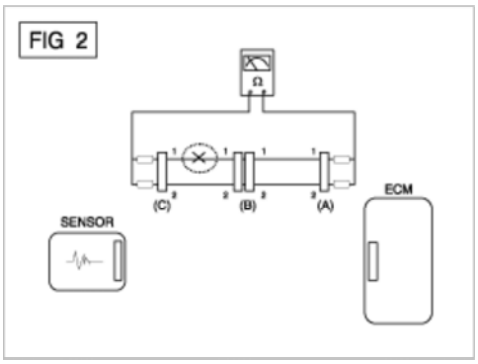


2. Continuity Check Method

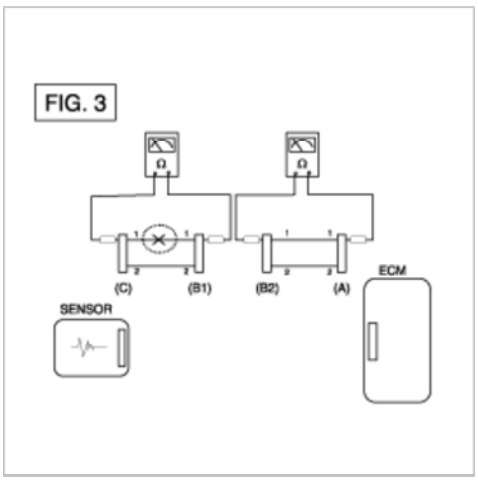
> **NOTE**
>
> When measuring for resistance, lightly shake the wire harness above and below or side to side.

Specification (Resistance)
1Ω or less → Normal Circuit
1MΩ or Higher → Open Circuit

A. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].
In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.



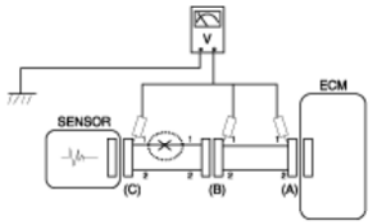
B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (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).

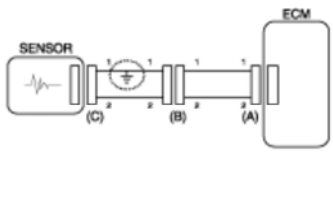
FIG 4



● Check Short Circuit

1. Test Method for Short to Ground Circuit
   A. Continuity Check with Chassis Ground
   If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5



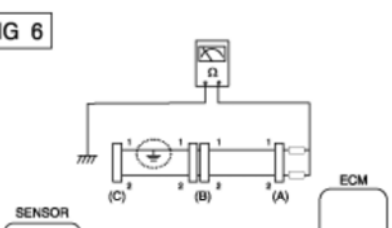
2. Continuity Check Method (with Chassis Ground)

> NOTE
>
> Lightly shake the wire harness above and below, or side to side when measuring the resistance.

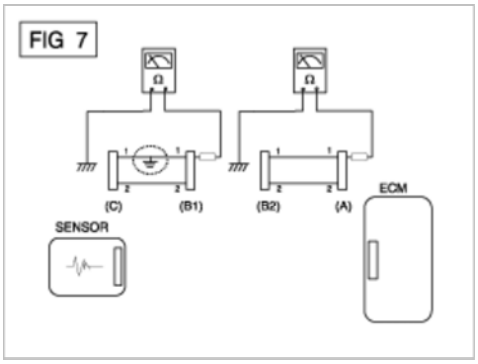
Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

A. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].
   The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

FIG 6



B. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].
   The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).



Symptom Troubleshooting Guide Chart

Main symptom	Diagnostic procedure	Also check for
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECT sensor and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	1. Check the fuel pressure 2. Check the Injector 3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECT sensor and circuit (Check DTC)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit 4. Check the ECT Sensor and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving habitsIs · A/C on full time or the defroster mode on? · Are tires at correct pressure? · Is excessively heavy load being carried? · Is acceleration too much, too often?	• DTC • Low compression

	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	• Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe · Pinched, kinked or blocked? · Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

Fuel System > Engine Control System > Description and Operation

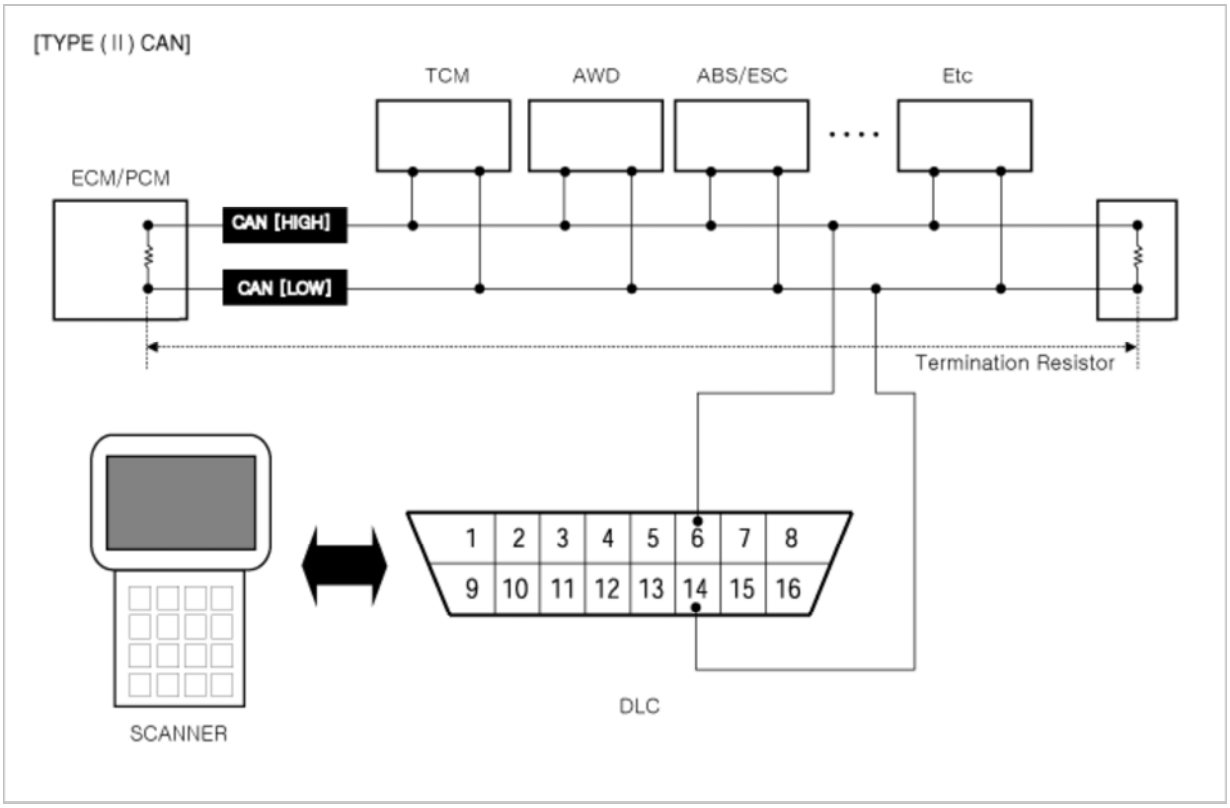
OBD-II review

1. Overview

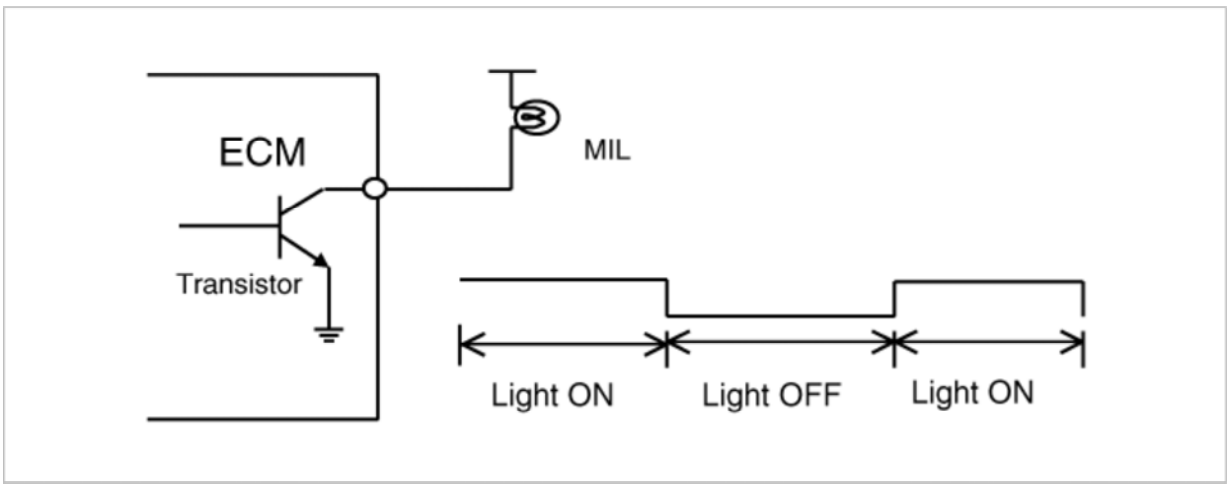
The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in california beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, Exhust Gas Recirculation (EGR) system and additional emission related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the fault and the need for repair of the emission control system. Associated with the MIL was a fault code or Diagnostic Trouble Code (DTC) idenfying the specific area of the fault.
The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations were followed until 1999 when the federal regulations were used.
The OBD-II system meets government regulations by monitoring the emission control system. When a system or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.
The diagnostic executive is a computer program in the Engine Control Module (ECM) or PowertrainControl Module (PCM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeze frame data and scan tool interface.
Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM, load and warm status at the point the first fault is detected. Previously stored conditions will be replaced only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.
The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM) or Powertrain Control Module (PCM).
The ECM or PCM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random access memory, and others), the ECM or PCM generates output signals to control various relays, solenoids and actuators.

2. Configuration of hardware and related terms

1) GST (Generic scan tool)



2) MIL (Malfunction indication lamp) - MIL activity by transistor



The Malfunction Indicator Lamp (MIL) is connected between ECM or PCM-terminal Malfunction Indicator Lamp and battery supply (open collector amplifier).
In most cars, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit.
Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.
▹ At ignition ON and engine revolution (RPM)< MIN. RPM, the MIL is switched ON for an optical check by the driver.
3) MIL illumination

When the ECM or PCM detects a malfunction related emission during the first driving cycle, the DTC and engine data are stored in the freeze frame memory. The MIL is illuminated only when the ECM or PCM detects the same malfunction related to the DTC in two consecutive driving cycles.
4) MIL elimination

● Misfire and Fuel System Malfunctions:
For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.
● All Other Malfunctions:
For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.
5) Erasing a fault code

The diagnostic system may erase a fault code if the same fault is not re-registered in at least 40 engine warm-up cycles, and the MIL is not illuminated for that fault code.

6) Communication Line (CAN)

- Bus Topology : Line (bus) structure
- Wiring : Twisted pair wire
- Off Board DLC Cable Length : Max. 5m
- Data Transfer Rate

- Diagnostic : 500 kbps
- Service Mode (Upgrade, Writing VIN) : 500 or 1Mbps)

7) Driving cycle

A driving cycle consists of engine start up, and engine shut off.
8) Warm-up cycle

A warm-up cycle means sufficient vehicle operation such that the engine coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit.
9) Trip cycle

A trip means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system except catalyst efficiency or evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.
10) DTC format

- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.

The letter of the beginning of the DTC identifies the function of the monitored device that has failed. A "P" indicates a powertrain device, "C" indicates a chassis device. "B" is for body device and "U" indicates a network or data link code. The first number indicates if the code is generic (common to all manufacturers) or if it is manufacturer specific. A "0" & "2" indicates generic, "1" indicates manufacturer-specific. The second number indicates the system that is affected with a number between 1 and 7.
The following is a list showing what numbers are assigned to each system.

1. Fuel and air metering
2. Fuel and air metering(injector circuit malfunction only)
3. Ignition system or misfire
4. Auxiliary emission controls
5. Vehicle speed controls and idle control system
6. Computer output circuits
7. Transmission

The last two numbers of the DTC indicates the component or section of the system where the fault is located.
11) Freeze frame data

When a freeze frame event is triggered by an emission related DTC, the ECM or PCM stores various vehicle information as it existed the moment the fault ocurred. The DTC number along with the engine data can be useful in aiding a technician in locating the cause of the fault. Once the data from the 1st driving cycle DTC ocurrence is stored in the freeze frame memory, it will remain there even when the fault ocurrs again (2nd driving cycle) and the MIL is illuminated.

- Freeze Frame List

1) Calculated Load Value
2) Engine RPM
3) Fuel Trim
4) Fuel Pressure (if available)
5) Vehicle Speed (if available)
6) Coolant Temperature
7) Intake Manifold Pressure (if available)
8) Closed-or Open-loop operation
9) Fault code

3. OBD-II system readiness tests

1) Catalyst monitoring

The catalyst efficiency monitor is a self-test strategy within the ECM or PCM that uses the downstream Heated Oxygen Sensor (HO2S) to determine when a catalyst has fallen below the minimum level of effectiveness in its ability to control exhaust emission.
2) Misfire monitoring

Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering, or poor compression. Any combustion that does not occur within the cylinder at the proper time is also a misfire. The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalyst from permanent damage and to alert the customer of an emission failure or an inspection maintenance failure by illuminating the MIL . When a misfire is detected, special software called freeze frame data is enabled. The freeze frame data captures the operational state of the vehicle when a fault is detected from misfire detection monitor strategy.

3) Fuel system monitoring

The fuel system monitor is a self-test strategy within the ECM or PCM that monitors the adaptive fuel table The fuel control system uses the adaptive fuel table to compensate for normal variability of the fuel system components caused by wear or aging. During normal vehicle operation, if the fuel system appears biased lean or rich, the adaptive value table will shift the fuel delivery calculations to remove bias.

4) Engine cooling system monitoring

The cooling system monitoring is a self-test strategy within the ECM or PCM that monitors ECTS (Engine Coolant Temperature Sensor) and thermostat about circuit continuity, output range, rationality faults.

5) O2 sensor monitoring

OBD-II regulations require monitoring of the upstream Heated O2 Sensor (H2OS) to detect if the deterioration of the sensor has exceeded thresholds. An additional HO2S is located downstream of the Warm-Up Three Way Catalytic Converter (WU-TWC) to determine the efficiency of the catalyst.

Although the downstream H2OS is similar to the type used for fuel control, it functions differently. The downstream HO2S is monitored to determine if a voltage is generated. That voltage is compared to a calibrated acceptable range.

6) Evaporative emission system monitoring

The EVAP. monitoring is a self-test strategy within the ECM or PCM that tests the integrity of the EVAP. system. The complete evaporative system detects a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.040 inch and 0.020 inch diameter orifice.

7) Air conditioning system monitoring

The A/C system monitoring is a self-test strategy within the ECM or PCM that monitors malfunction of all A/C system components at A/C ON.

8) Comprehensive components monitoring

The comprehensive components monitoring is a self-test strategy within the ECM or PCM that detects fault of any electronic powertrain components or system that provides input to the ECM or PCM and is not exclusively an input to any other OBD-II monitor.

9) A/C system component monitoring

Requirement:

If a vehicle incorporates an engine control strategy that alters off idle fuel and/or spark control when the A/C system is on, the OBD II system shall monitor all electronic air conditioning system components for malfunctions that cause the system to fail to invoke the alternate control while the A/C system is on or cause the system to invoke the alternate control while the A/C system is off.

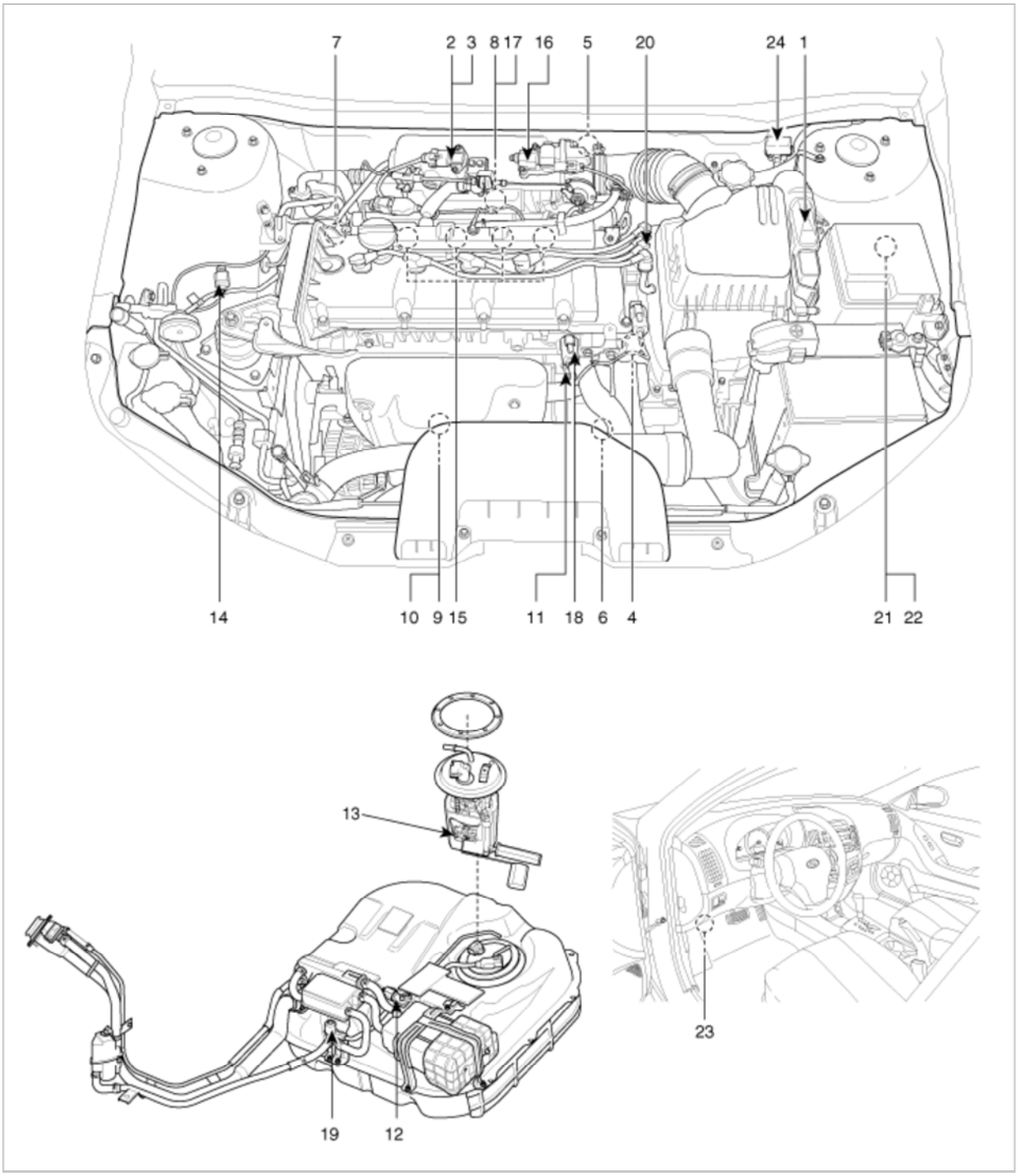
Additionally, the OBD II system shall monitor for malfunction all electronic air conditioning system components that are used as part of the diagnostic strategy for any other monitored system or component.

Implementation plan:

No engine control strategy incorporated that alters offidle fuel and/or spark control when A/C system is on. Malfuction of A/C system components is not used as a part of the diagnostic strategy for other monitored system or component.

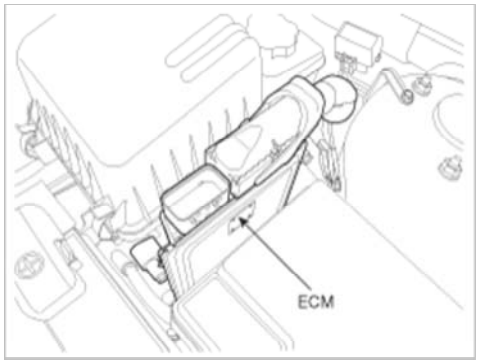
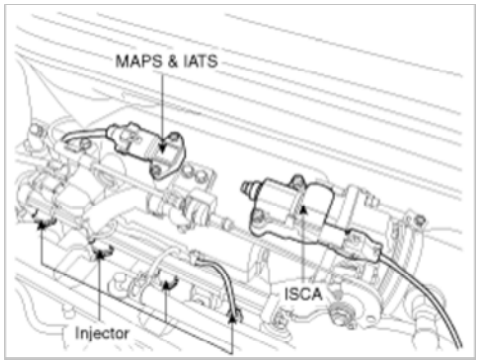
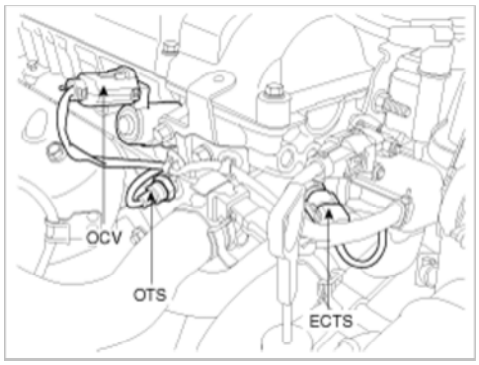
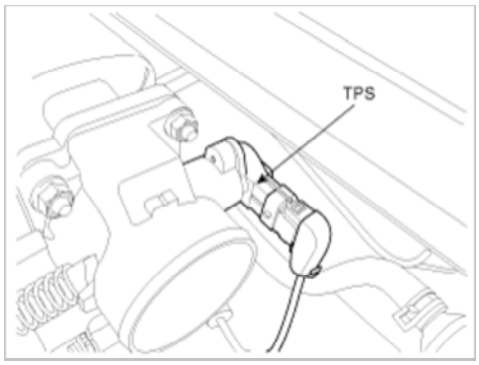
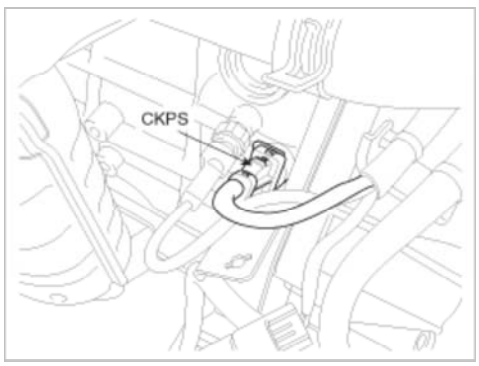
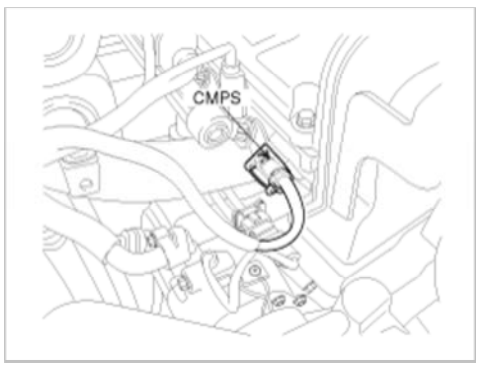
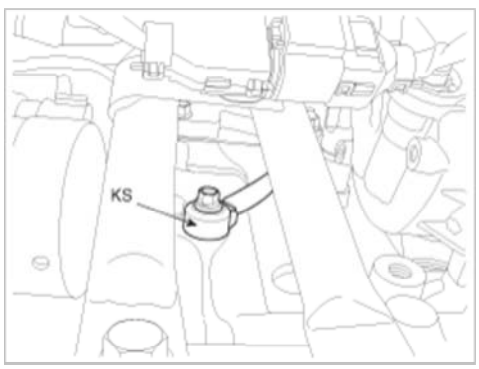
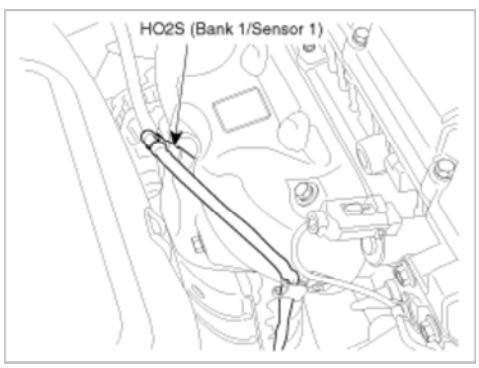
Fuel System > Engine Control System > Components and Components Location

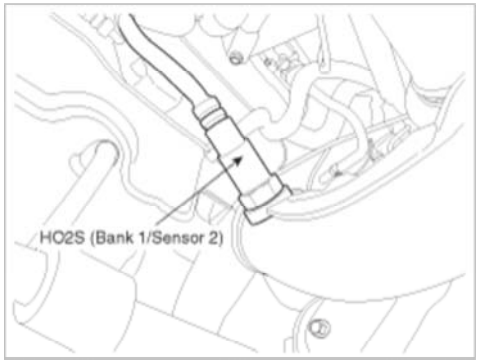
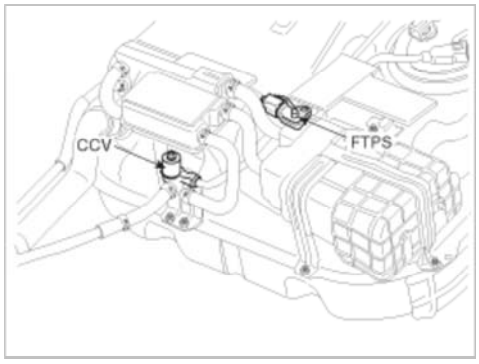
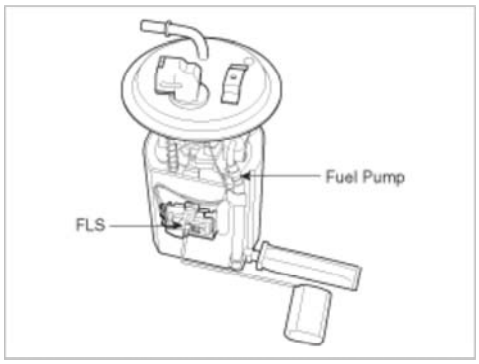
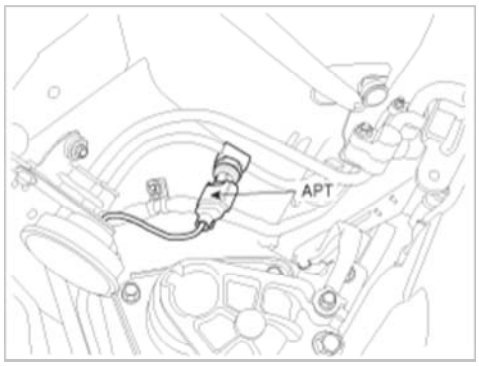
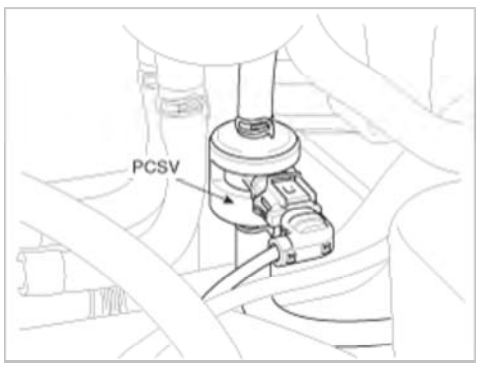
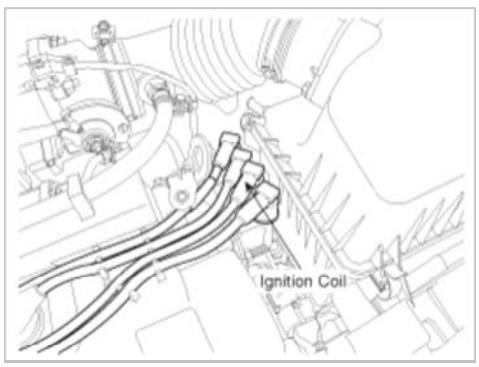
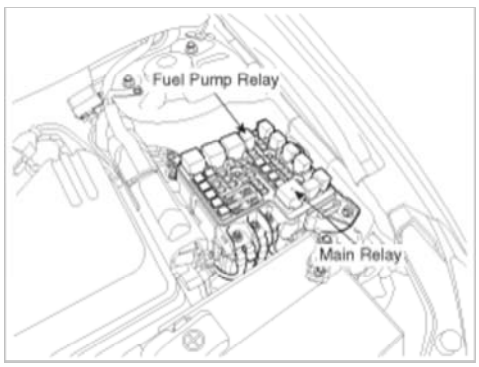
Components Location



1. ECM (Engine Control Module)	13. Fuel Level Sensor (FLS)
2. Manifold Absolute Pressure Sensor (MAPS)	14. A/C Pressure Transducer (APT)
3. Intake Air Temperature Sensor (IATS)	15. Injector
4. Engine Coolant Temperature Sensor (ECTS)	16. Idle Speed Control Actuator (ISCA)
5. Throttle Position Sensor (TPS)	17. Purge Control Solenoid Valve (PCSV)
6. Crankshaft Position Sensor (CKPS)	18. CVVT Oil Control Valve (OCV)
7. Camshaft Position Sensor (CMPS)	19. Canister Close Valve (CCV)
8. Knock Sensor (KS)	20. Ignition Coil
9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]	21. Main Relay
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]	22. Fuel Pump Relay
11. CVVT Oil Temperature Sensor (OTS)	23. Data Link Connector (DLC)
12. Fuel Tank Pressure Sensor (FTPS)	24. Multi-Purpose Check Connector

1. ECM (Engine Control Module)	2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS) 15. Injector

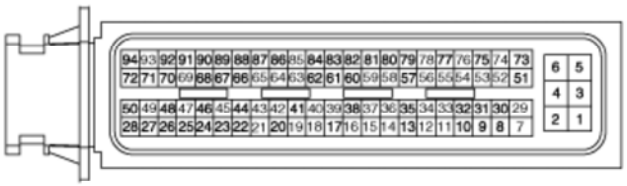
	16. Idle Speed Control Actuator (ISCA)
	
4. Engine Coolant Temperature Sensor (ECTS) 11. CVVT Oil Temperature Sensor (OTS) 18. CVVT Oil Control Valve (OCV)	5. Throttle Position Sensor (TPS)
	
6. Crankshaft Position Sensor (CKPS)	7. Camshaft Position Sensor (CMPS)
	
8. Knock Sensor (KS)	9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
	
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]	12. Fuel Tank Pressure Sensor (FTPS) 19. Canister Close Valve (CCV)

	
13. Fuel Level Sensor (FLS)	14. A/C Pressure Transducer (APT)
	
17. Purge Control Solenoid Valve (PCSV)	20. Ignition Coil
	
21. Main Relay 22. Fuel Pump Relay	
	

Fuel System > Engine Control System > Engine Control Module (ECM) > Specifications

ECM Terminal And Input/Output signal

ECM Harness Connector



CONNECTOR [CBG-K]

ECM Terminal Function

Connector [CBG-K]

Pin No.	Description	Connected to
1	Power Ground	Chassis Ground
2	Battery voltage supply after ignition switch	Ignition Switch
3	Power Ground	Chassis Ground
4	Battery voltage supply after main relay	Main Relay
5	ECM Ground	Chassis Ground
6	Battery Power (B+)	Battery
7	Ignition Coil (Cylinder #1,4) control output [With Immobilizer]	Ignition Coil (Cylinder #1,4)
	Ignition Coil (Cylinder #2,3) control output [Without Immobilizer]	Ignition Coil (Cylinder #2,3)
8	Shield	Ignition Coil
9	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
10	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)
11	-	
12	Ground	Immobilizer Control Module
13	A/C Pressure Transducer signal input	A/C Pressure Transducer (APT)
14	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
15	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)
16	Sensor ground	Heated Oxygen Sensor (Sensor 1)
17	Heated Oxygen Sensor (Sensor 1) signal input	Heated Oxygen Sensor (Sensor 1)
18	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
19	-	
20	-	
21	Sensor ground	Knock Sensor (KS)
22	Knock Sensor signal input	Knock Sensor (KS)
23	Sensor power (+5V)	Throttle Position Sensor (TPS)
24	-	
25	Injector (Cylinder #1) control output	Injector (Cylinder #1)
26	Injector (Cylinder #3) control output	Injector (Cylinder #3)
27	Injector (Cylinder #4) control output	Injector (Cylinder #4)
28	Injector (Cylinder #2) control output	Injector (Cylinder #2)
29	Ignition Coil (Cylinder #2,3) control output [With Immobilizer]	Ignition Coil (Cylinder #2,3)
	Ignition Coil (Cylinder #1,4) control output [Without Immobilizer]	Ignition Coil (Cylinder #1,4)
30	-	
31	-	

32	-	
33	Fuel Tank Pressure Sensor signal input	Fuel Tank Pressure Sensor (FTPS)
34	Sensor ground	Fuel Tank Pressure Sensor (FTPS)
35	-	
36	-	
37	Sensor ground	CVVT Oil Temperature Sensor (OTS)
38	Heated Oxygen Sensor (Sensor 2) signal input	Heated Oxygen Sensor (Sensor 2)
39	Sensor ground	Heated Oxygen Sensor (Sensor 2)
40	CVVT Oil Temperature Sensor signal input	CVVT Oil Temperature Sensor (OTS)
41	Throttle Position Sensor signal input	Throttle Position Sensor (TPS)
42	Sensor ground	Throttle Position Sensor (TPS)
43	-	
44	-	
45	-	
46	-	
47	Sensor power (+5V)	A/C Pressure Transducer (APT)
48	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS), Fuel Tank Pressure Sensor (FTPS)
49	-	
50	-	
51	-	
52	-	
53	Vehicle speed signal input	ABS/ESC Control Module [With ABS/ESC]
54	-	
55	Wheel Speed Sensor [A] signal input	Wheel Speed Sensor (WSS)[Without ABS/ESC]
56	Wheel Speed Sensor [B] signal input	Wheel Speed Sensor (WSS)[Without ABS/ESC]
57	Sensor ground	A/C Pressure Transducer (APT)
58	-	
59	-	
60	A/C switch "ON" signal input	A/C Switch
61	-	
62	A/C thermal switch signal input	A/C Thermal Switch
63	Fuel consumption signal output	Trip Computer
64	Main Relay control output	Main Relay
65	Cooling Fan Relay [Low] control output	Cooling Fan Relay [Low]
66	CVVT Oil Control Valve control output	CVVT Oil Control Valve (OCV)
67	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
68	-	
69	Immobilizer lamp control output	Immobilizer Lamp
70	Fuel Pump Relay control output	Fuel Pump Relay
71	-	
72	-	
73	Battery voltage supply after main relay	Main Relay
74	Alternator load signal input	Alternator
75	Immobilizer communication line	Immobilizer Control Module
76	-	

77	CAN [HIGH]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
78	CAN [LOW]	Other control module, Data Link Connector (DLC), Multi-Purpose Check Connector
79	Sensor ground	Camshaft Position Sensor (CMPS)
80	Camshaft Position Sensor signal input	Camshaft Position Sensor (CMPS)
81	Sensor ground	Crankshaft Position Sensor (CKPS)
82	Crankshaft Position Sensor signal input	Crankshaft Position Sensor (CKPS)
83	-	
84	-	
85	-	
86	Engine speed signal output	Cluster (Tachometer)
87	A/C Compressor Relay control output	A/C Compressor Relay
88	Cooling Fan Relay [High] control output	Cooling Fan Relay [High]
89	Idle Speed Control Actuator [OPEN] control output	Idle Speed Control Actuator (ISCA)
90	Idle Speed Control Actuator [CLOSE] control output	Idle Speed Control Actuator (ISCA)
91	Canister Close Valve control output	Canister Close Valve (CCV)
92	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)
93	Heated Oxygen Sensor (Sensor 1) Heater control output	Heated Oxygen Sensor (Sensor 1)
94	Heated Oxygen Sensor (Sensor 2) Heater control output	Heated Oxygen Sensor (Sensor 2)

ECM Terminal Input/Output Signal

Connector [CBG-K]

Pin No.	Description	Condition	Type	Level	Test Result
1	Power Ground	Idle	DC	Max. 50mV	
2	Battery voltage supply after ignition switch	IG OFF	DC	Max. 1.0V	1.18mV
		IG ON		Battery Voltage	12.7V
3	Power Ground	Idle	DC	Max. 50mV	-4.37mV
4	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	-5.1mV
		IG ON		Battery Voltage	12.3V
5	ECM Ground	Idle	DC	Max. 50mV	10.1mV
6	Battery Power (B+)	Always	DC	Battery Voltage	12.2V
7	Ignition Coil (Cylinder #1,4) control output [With Immobilizer]	Idle	Pulse	1st Voltage: 300 ~ 400V	372V
				ON Voltage: Max. 2.0V	1.6V
	Ignition Coil (Cylinder #2,3) control output [Without Immobilizer]	Idle	Pulse	1st Voltage: 300 ~ 400V	372V
				ON Voltage: Max. 2.0V	1.6V
8	Shield	Idle	DC	Max. 50mV	18.3mV
9	Sensor ground	Idle	DC	Max. 50mV	18.7mV
10	Manifold Absolute Pressure Sensor signal input	IG ON	DC	3.9 ~ 4.1V	4.09V
		Idle		0.8 ~ 1.6V	1.44V
11	-				
12	Ground	Idle	DC	Max. 50mV	
13	A/C Pressure Transducer signal input	Idle	DC	0.4 ~ 4.6V	A/C OFF:1.18V A/C ON:1.48V

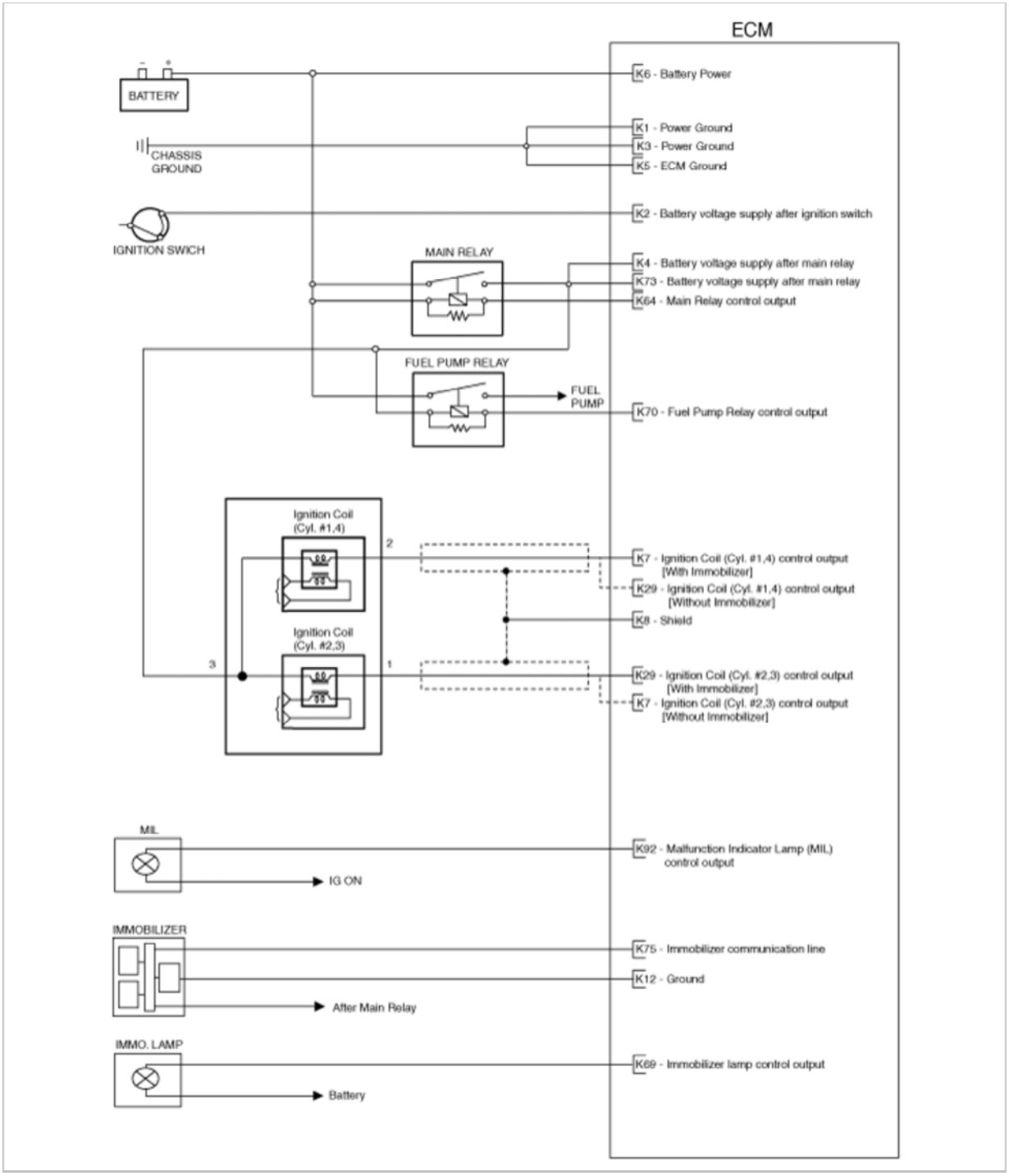
14	Sensor ground	Idle	DC	Max. 50mV	13.0mV
15	Engine Coolant Temperature Sensor signal input	Idle	DC	0.5 ~ 4.5V	1.84V
16	Sensor ground	Idle	DC	Max. 50mV	
17	Heated Oxygen Sensor (Sensor 1) signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	
				Lean: Max. 0.4V	
18	Intake Air Temperature Sensor signal input	Idle	Analog	0 ~ 5.0V	3.63V
19	-				
20	-				
21	Sensor ground	Idle	DC	Max. 50mV	
22	Knock Sensor signal input	Knocking	Variable Frequency		
		Normal			
23	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.03V
24	-				
25	Injector (Cylinder #1) control output	Idle	DC	Hi: Battery Voltage	14.4V
				Lo: Max. 1.0V	280mV
				Vpeak: Max. 80V	48.8V
26	Injector (Cylinder #3) control output	Idle	DC	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	240mV
				Vpeak: Max. 80V	49.0V
27	Injector (Cylinder #4) control output	Idle	DC	Hi: Battery Voltage	14.4V
				Lo: Max. 1.0V	280mV
				Vpeak: Max. 80V	48.8V
28	Injector (Cylinder #2) control output	Idle	DC	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	240mV
				Vpeak: Max. 80V	49.0V
29	Ignition Coil (Cylinder #1,4) control output [With Immobilizer]	Idle	Pulse	1st Voltage: 300 ~ 400V	376V
				ON Voltage: Max. 2.0V	1.36V
	Ignition Coil (Cylinder #2,3) control output [Without Immobilizer]	Idle	Pulse	1st Voltage: 300 ~ 400	376V
				ON Voltage: Max. 2.0V	1.36V
30	-				
31	-				
32	-				
33	Fuel Tank Pressure Sensor signal input	Idle	DC	0.4 ~ 4.6 V	2.58V
34	Sensor ground	Idle	DC	Max. 50mV	16.1mV
35	-				
36	-				
37	Sensor ground	Idle	DC	Max. 50mV	17.3mV
38	Heated Oxygen Sensor (Sensor 2) signal input	Racing	Analog	Rich: 0.6 ~ 1.0V	640mV
				Lean: Max. 0.4V	22mV
39	Sensor ground	Idle	DC	Max. 50mV	3.14mV
40	CVVT Oil Temperature Sensor signal input	Idle	Analog	0.5 ~ 4.5V	950mV
		C.T		0.25 ~ 0.9V	307mV

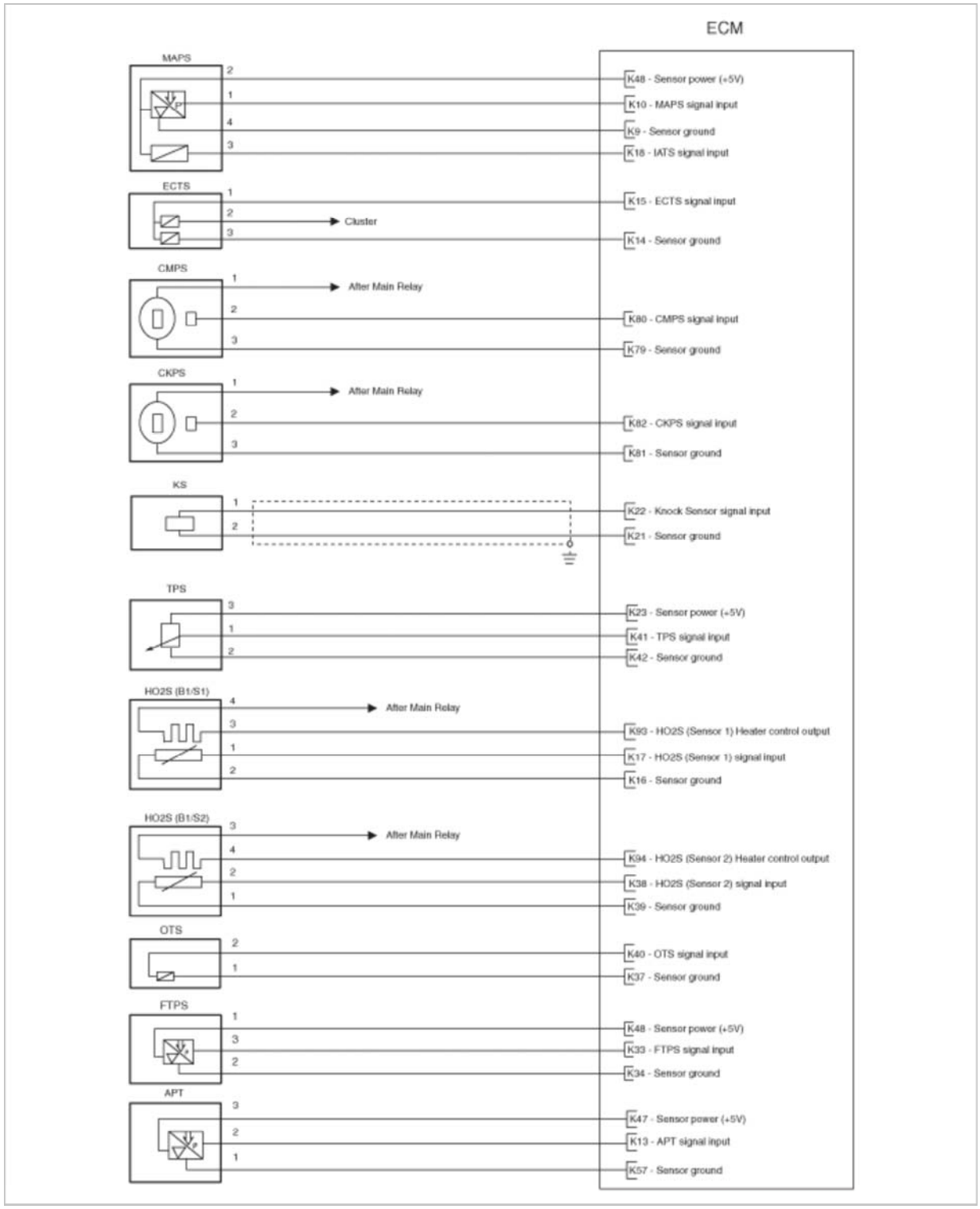
41	Throttle Position Sensor signal input	W.O.T	Analog	Min. 4.0V	4.28V
42	Sensor ground	Idle	DC	Max. 50mV	13.6mV
43	-				
44	-				
45	-				
46	-				
47	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	2.61mV
		IG ON		4.9 ~ 5.1V	5.04V
48	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	3.16mV
		IG ON		4.9 ~ 5.1V	5.06V
49	-				
50	-				
51	-				
52	-				
53	Vehicle speed signal input	Vehicle Run	Pulse	Hi: Min. 4.5V	13.0V
				Lo: Max. 0.5V	-200mV
54	-				
55	Wheel Speed Sensor [A] signal input	Vehicle Run (30km/h)	SINE Wave	15Hz: Min. 0.13Vpp	
				1,000Hz: Min 0.2Vpp	
				Overall: Max. 250Vpp	
56	Wheel Speed Sensor [B] signal input	Vehicle Run (30km/h)	SINE Wave	15Hz: Min. 0.13Vpp	
				1,000Hz: Min 0.2Vpp	
				Overall: Max. 250Vpp	
57	Sensor ground	Idle	DC	Max. 50mV	10mV
58	-				
59	-				
60	A/C switch "ON" signal input	A/C S/W OFF	DC	Max. 1.0V	0mV
		A/C S/W ON		Battery Voltage	12.8V
61	-				
62	A/C thermal switch signal input	A/C S/W OFF	DC	Max. 1.0V	0mV
		A/C S/W ON		Battery Voltage	12.8V
63	Fuel consumption signal output	Idle	Pulse	Hi : Battery Voltage	13.8V
				Lo : Max. 1.0V	0.1V
64	Main Relay control output	Relay OFF	DC	Battery Voltage	12.9V
		Relay ON		Max. 1.0V	0.88V
65	Cooling Fan Relay [Low] control output	Relay OFF	DC	Battery Voltage	12.9V
		Relay ON		Max. 1.0V	30mV
66	CVVT Oil Control Valve control output	Idle	Pulse	Hi : Battery Voltage	14.8V
				Lo : Max. 1.0V	100mV
67	Purge Control Solenoid Valve control output	Active Inactive	Pulse	Hi: Battery Voltage	14.2V
				Lo: Max. 1.0V	100mV
68	-				
69	Immobilizer lamp control output	Lamp OFF	DC	Battery Voltage	
		Lamp ON		Max. 2.0V	
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	13V

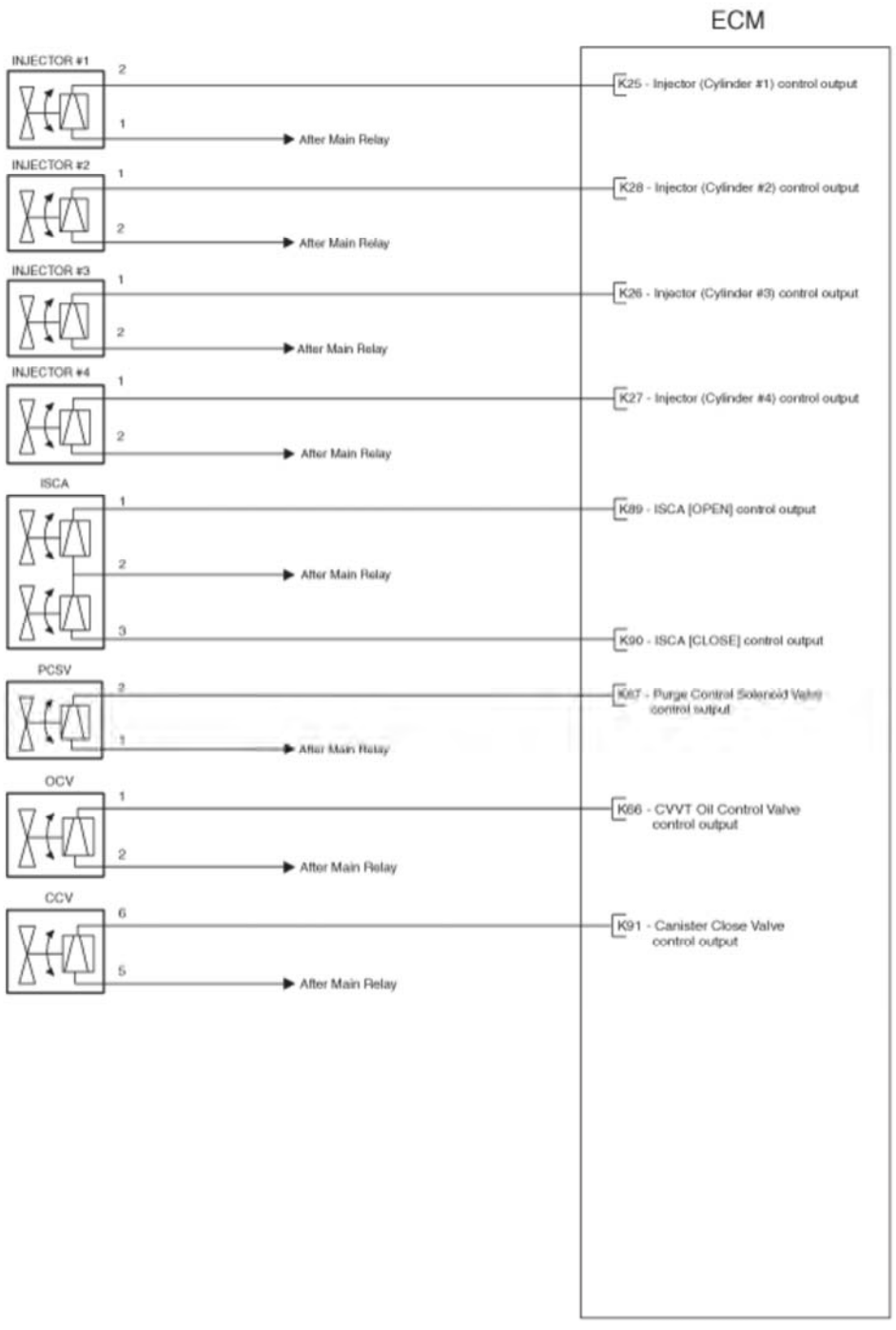
		Relay ON		Max. 1.0V	100mV
71	-				
72	-				
73	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0V	-5.1mV
		IG ON		Battery Voltage	12.3V
74	Alternator load signal input	Idle	Pulse	Hi : Battery Voltage	14.0V
				Lo : Max. 1.5V	10mV
75	Immobilizer communication line	When communicating after IG ON	Pulse	Hi: Min. 8.5V	
				Lo: Max. 3.5V	
76	-				
77	CAN [HIGH]	RECESSIVE	Pulse	2.0 ~ 3.0V	2.55V
		DOMINANT		2.75 ~ 4.5V	3.57V
78	CAN [LOW]	RECESSIVE	Pulse	2.0 ~ 3.0V	2.55V
		DOMINANT		0.5 ~ 2.25V	1.44V
79	Sensor ground	Idle	DC	Max. 50mV	10mV
80	Camshaft Position Sensor signal input	Idle	Pulse	Hi: Vcc	5.0V
				Lo: Max. 0.5V	0.2V
81	Sensor ground	Idle	DC	Max. 50mV	10mV
82	Crankshaft Position Sensor signal input	Idle	Pulse	Hi: Vcc	5.0V
				Lo: Max. 0.5V	40mV
83	-				
84	-				
85	-				
86	Engine speed signal output	Idle	Pulse	Hi: Battery Voltage	14.0V
				Lo: Max. 0.5V	100mV
				Freq : 20 ~ 26Hz	21.8Hz
87	A/C Compressor Relay control output	Relay OFF	DC	Battery Voltage	14.1V
		Relay ON		Max. 1.0V	0.1V
88	Cooling Fan Relay [High] control output	Relay OFF	DC	Battery Voltage	14.1V
		Relay ON		Max. 1.0V	320mV
89	Idle Speed Control Actuator [OPEN] control output	Idle	Pulse	Hi: Battery Voltage	14.6V
				Lo: Max. 1.0V	192mV
90	Idle Speed Control Actuator [CLOSE] control output	Idle	Pulse	Hi: Battery Voltage	14.9V
				Lo: Max. 1.0V	248mV
91	Canister Close Valve control output	Active Inactive	Pulse	Hi: Battery Voltage	14.0V
				Lo: Max. 1.0V	170mV
92	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Battery Voltage	13V
		Lamp ON		Max. 1.0V	50mV
93	Heated Oxygen Sensor (Sensor 1) Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14V
				Lo: Max. 1.0V	0.3V
94	Heated Oxygen Sensor (Sensor 2) Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14V
				Lo: Max. 1.0V	0.3V

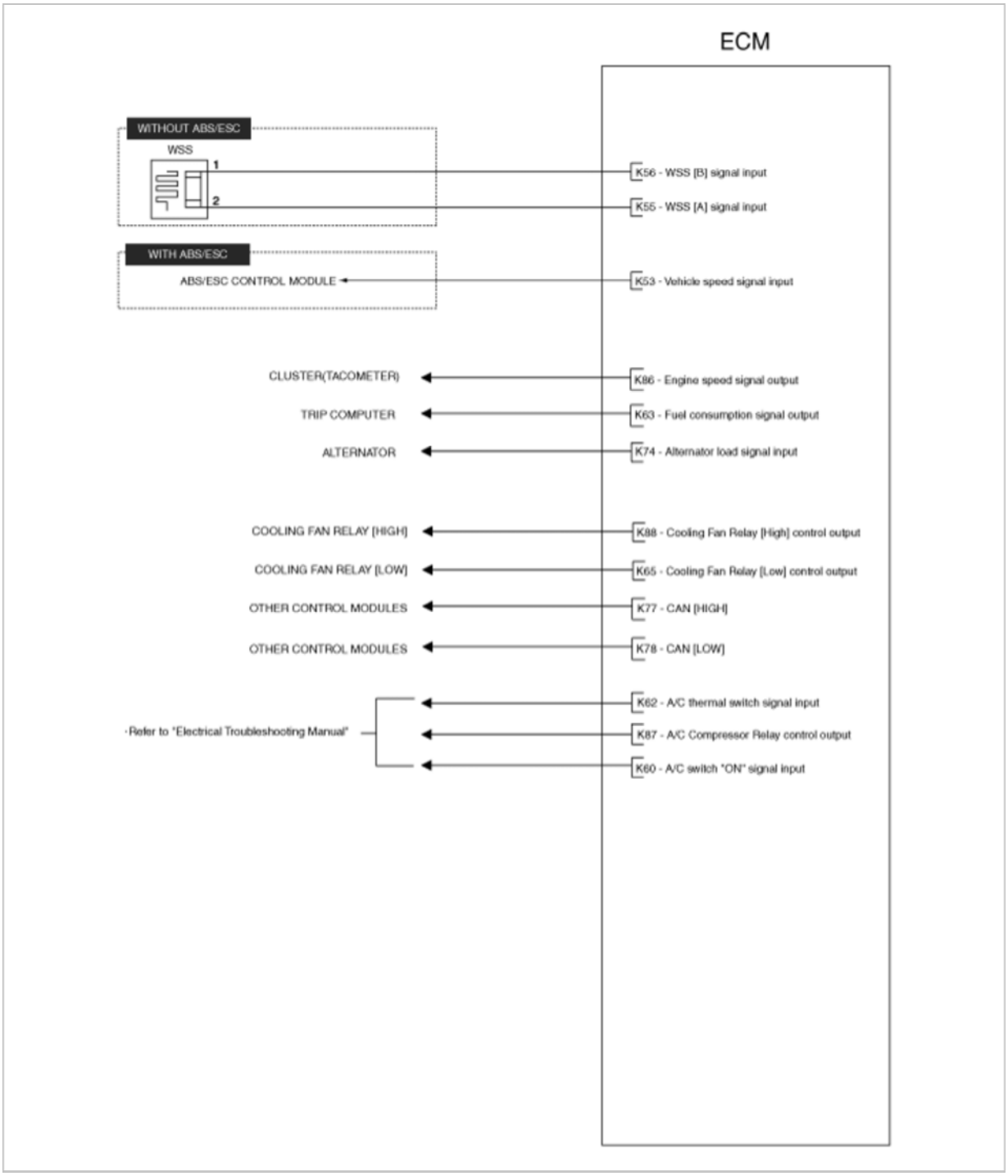
Fuel System > Engine Control System > Engine Control Module (ECM) > Schematic Diagrams

Circuit Diagram




ECM
MAPS
2
1
4
3
K48 - Sensor power (+5V)
K10 - MAPS signal input
K9 - Sensor ground
K18 - IATS signal input
ECTS
1
2
3
Cluster
K15 - ECTS signal input
K14 - Sensor ground
CMPS
1
2
3
After Main Relay
K80 - CMPS signal input
K79 - Sensor ground
CKPS
1
2
3
After Main Relay
K82 - CKPS signal input
K81 - Sensor ground
KS
1
2
K22 - Knock Sensor signal input
K21 - Sensor ground
TPS
3
1
2
K23 - Sensor power (+5V)
K41 - TPS signal input
K42 - Sensor ground
HO2S (B1/S1)
4
3
1
2
After Main Relay
K93 - HO2S (Sensor 1) Heater control output
K17 - HO2S (Sensor 1) signal input
K16 - Sensor ground
HO2S (B1/S2)
3
4
2
1
After Main Relay
K94 - HO2S (Sensor 2) Heater control output
K38 - HO2S (Sensor 2) signal input
K39 - Sensor ground
OTS
2
1
K40 - OTS signal input
K37 - Sensor ground
FTPS
1
3
2
K48 - Sensor power (+5V)
K33 - FTPS signal input
K34 - Sensor ground
APT
3
2
1
K47 - Sensor power (+5V)
K13 - APT signal input
K57 - Sensor ground

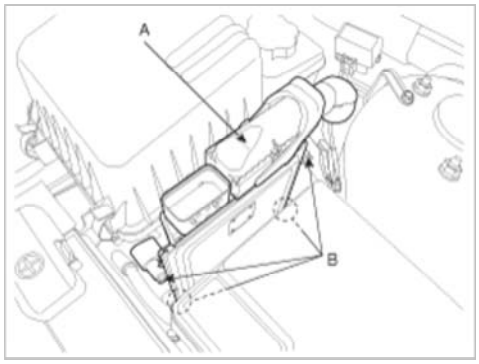

ECM
INJECTOR #1
2
1
After Main Relay
K25 - Injector (Cylinder #1) control output
INJECTOR #2
1
2
After Main Relay
K28 - Injector (Cylinder #2) control output
INJECTOR #3
1
2
After Main Relay
K26 - Injector (Cylinder #3) control output
INJECTOR #4
1
2
After Main Relay
K27 - Injector (Cylinder #4) control output
ISCA
1
2
3
After Main Relay
K89 - ISCA [OPEN] control output
K90 - ISCA [CLOSE] control output
PCSV
2
1
After Main Relay
K87 - Purge Control Solenoid Valve control output
OCV
1
2
After Main Relay
K66 - CVVT Oil Control Valve control output
CCV
6
5
After Main Relay
K91 - Canister Close Valve control output



Fuel System > Engine Control System > Engine Control Module (ECM) > Repair procedures

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the ECM connector (A).



3. Remove the air cleaner & ECM assembly (Refer to "Engine And Transaxle Assembly" in EM group).
4. Remove the ECM mounting bolts (B) and then remove the ECM.

Installation

NOTE

- In case of the vehicle equipped with immobilizer, perform "Key Teaching" procedure together (Refer to "Immobilizer" in BE group).

1. Installation is reverse of removal.

ECM installation bolts:
9.8 ~ 11.8N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7lb-ft)

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 pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, replace the ECM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the ECM.
4. RE-TEST THE ORIGINAL ECM : Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

VIN Programming Procedure

VIN (Vehicle Identification Number) is a number that has the vehicle's information (Maker, Vehicle Type, Vehicle Line/Series, Body Type, Engine Type, Transmission Type, Model Year, Plant Location and so forth. For more information, please refer to the group "GI" in this SERVICE MANUAL). When replacing an ECM, the VIN must be programmed in the ECM. If there is no VIN in ECM memory, the fault code (DTC P0630) is set.

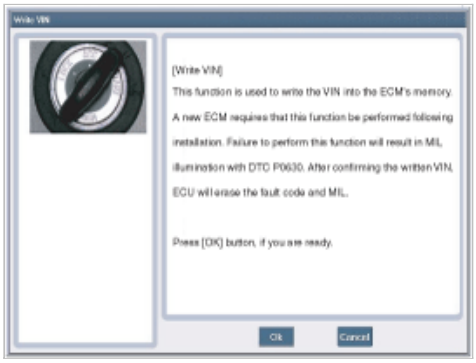
CAUTION

The programmed VIN cannot be changed. When writing the VIN, confirm the VIN carefully

1. Select "VIN Writing" function in "Vehicle S/W Management".
2. Select "Write VIN" in "ID Resister".

3. Input the VIN.

> **WARNING**
>
> Before inputing the VIN, confirm the VIN again because the programmed VIN cannot be changed.

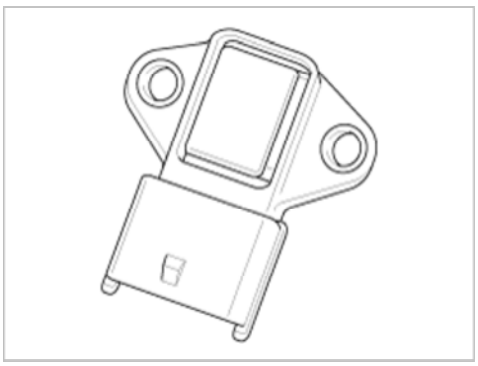


4. Turn the ignition switch OFF, then back ON.

Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Description and Operation

Description

Manifold Absolute Pressure Sensor (MAPS) is a speed-density type sensor and is installed on the surge tank. It senses absolute pressure of the surge tank and transfers the analog signal proportional to the pressure to the ECM. By using this signal, the ECM calculates the intake air quantity and engine speed.
The MAPS consists of a piezo-electric element and a hybrid IC amplifying the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. Because 100% vacuum and the manifold pressure apply to both sides of the sensor respectively, this sensor can output analog signal by using the silicon variation proportional to pressure change.

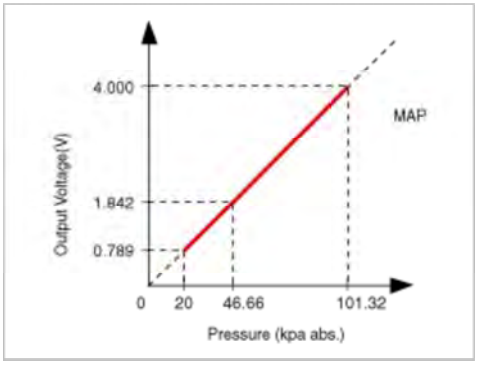


Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Specifications

Specification

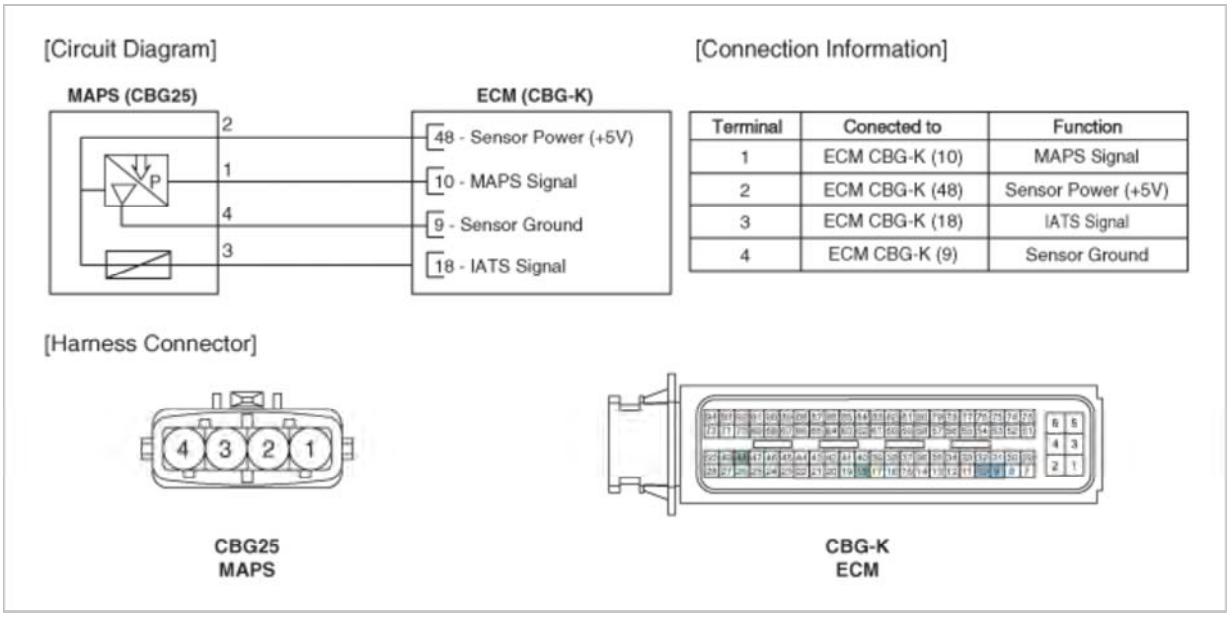
Pressure (kPa)	Output Voltage (V)
20.0	0.79

46.66	1.84
101.32	4.0



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Manifold Absolute Pressure Sensor (MAPS) > Repair procedures

Inspection

1. Connect a scan tool on Data Link Connector (DLC).
2. Check MAPS output voltage at idle and IG ON.

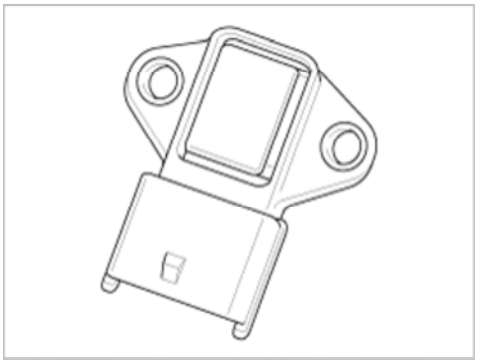
Condition	Output Voltage (V)
IG ON	3.9 ~ 4.1
Idle	0.8 ~ 1.6

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Description and Operation

Description

Intake Air Temperature Sensor (IATS) is included inside Manifold Absolute Pressure Sensor and detects the intake air temperature.
To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the

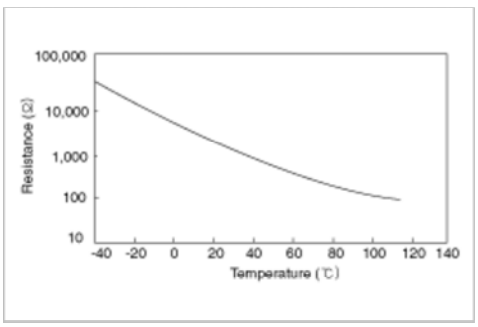
temperature. So the ECM uses not only MAPS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature.



Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Specifications

Specification

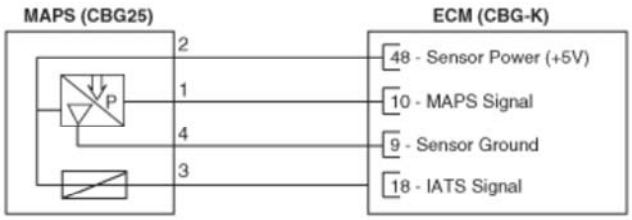
Temperature [°C(°F)]	Resistance(kΩ)
-40 (-40)	40.93 ~ 48.35
-30 (-22)	23.43 ~ 27.34
-20 (-4)	13.89 ~ 16.03
-10 (14)	8.50 ~ 9.71
0 (32)	5.38 ~ 6.09
10 (50)	3.48 ~ 3.90
20 (68)	2.31 ~ 2.57
25 (77)	1.90 ~ 2.10
30 (86)	1.56 ~ 1.74
40 (104)	1.08 ~ 1.21
60 (140)	0.54 ~ 0.62
80 (176)	0.29 ~ 0.34



Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]



[Connection Information]

Terminal	Conected to	Function
1	ECM CBG-K (10)	MAPS Signal
2	ECM CBG-K (48)	Sensor Power (+5V)
3	ECM CBG-K (18)	IATS Signal
4	ECM CBG-K (9)	Sensor Ground

[Harness Connector]

CBG25
MAPS

CBG-K
ECM

Fuel System > Engine Control System > Intake Air Temperature Sensor (IATS) > Repair procedures

Inspection

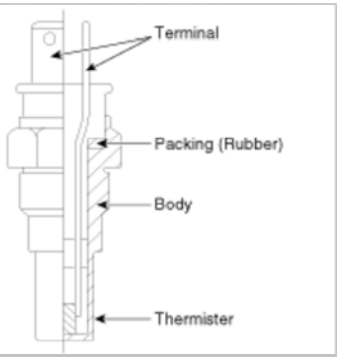
1. Turn ignition switch OFF.
2. Disconnect IATS connector.
3. Measure resistance between IATS terminals 3 and 4.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Description and Operation

Description

Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature.
The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference +5V is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes.
During cold engine operation, the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



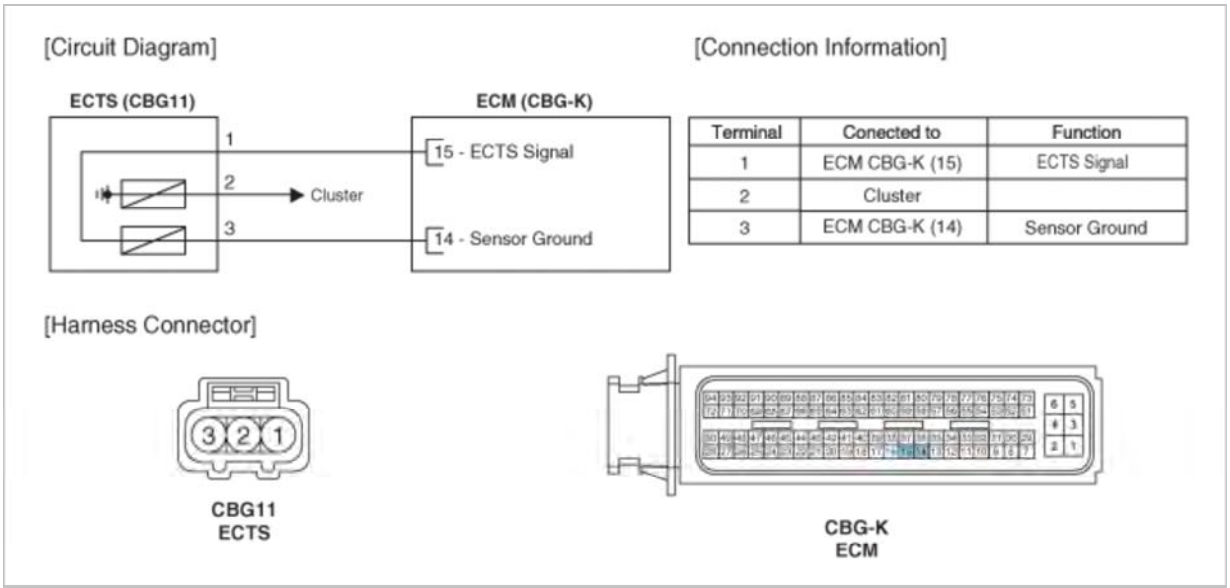
Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Specifications

Specification

Temperature [°C(°F)]	Resistance(kΩ)
-40(-40)	48.14
-20(-4)	14.13 ~ 16.83
0(32)	5.79
20(68)	2.31 ~ 2.59
40(104)	1.15
60(140)	0.59
80(176)	0.32

Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Engine Coolant Temperature Sensor (ECTS) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect ECTS connector.
3. Remove the ECTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between ECTS terminals 1 and 3.
5. Check that the resistance is within the specification.

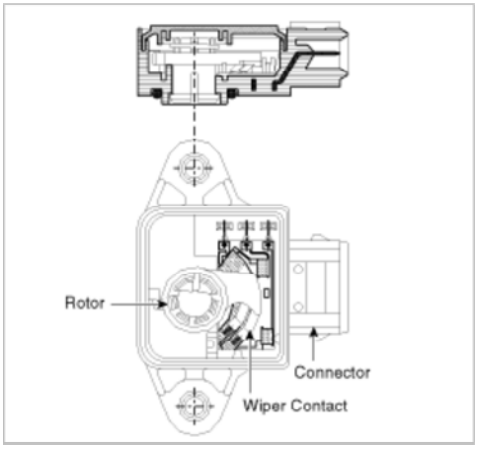
Specification: Refer to “Specification”

Fuel System > Engine Control System > Throttle Position Sensor (TPS) > Description and Operation

Description

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) which is changed according to the throttle angle.
During acceleration, the TPS resistance between the reference +5V and the signal terminal decreases and output voltage increases; during deceleration, the TPS resistance increases and TPS output voltage decreases. The TPS output voltage will

vary from 0.25~0.9V at closed throttle to minimum 4.0V at wide-open throttle.
The ECM determines operating conditions such as idle (closed throttle), part load, acceleration / deceleration, and wide-open throttle by using the TPS signal. Also the ECM uses the Manifold Absolute Pressure Sensor (MAPS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.



Fuel System > Engine Control System > Throttle Position Sensor (TPS) > Specifications

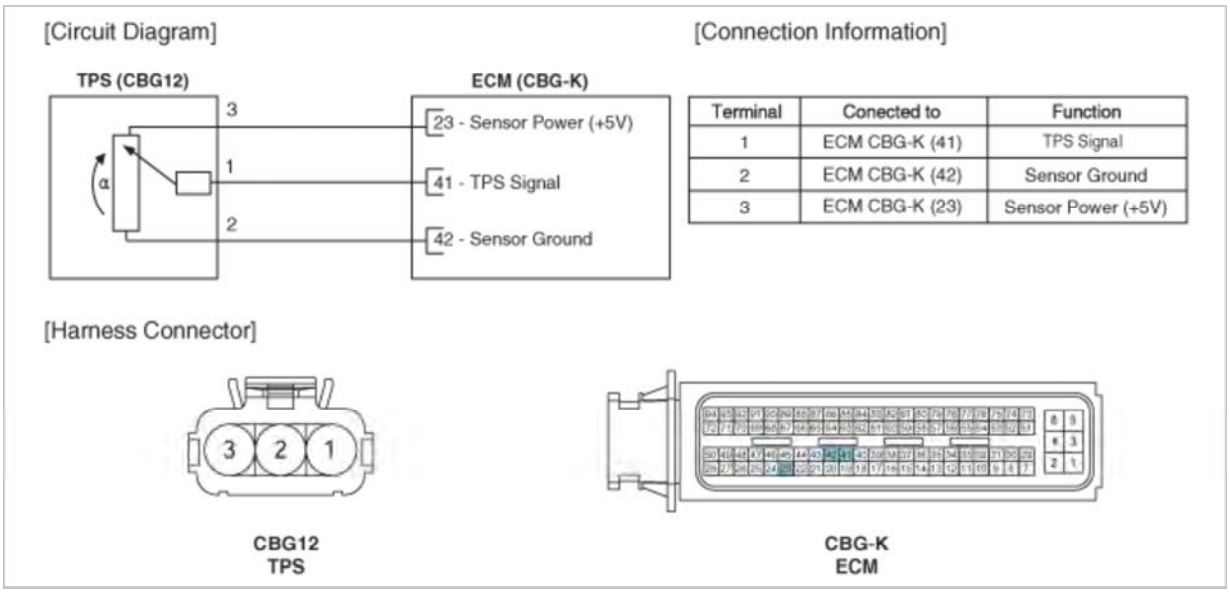
Specification

Throttle Angle	Output Voltage(V)
C.T	0.25 ~ 0.9
W.O.T	Min. 4.0

Item	Specification
Sensor Resistance(kΩ)	1.6 ~ 2.4(20°C)

Fuel System > Engine Control System > Throttle Position Sensor (TPS) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Throttle Position Sensor (TPS) > Repair procedures

Inspection

1. Connect a scan tool on the Data Link Connector (DLC).
2. Start engine and check output voltages of TPS at C.T and W.O.T.

Specification: Refer to “Specification”

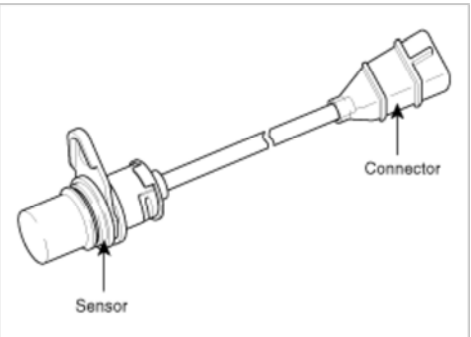
3. Turn ignition switch OFF and disconnect the scan tool from the DLC.
4. Disconnect TPS connector and measure resistance between TPS terminals 2 and 3.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Description and Operation

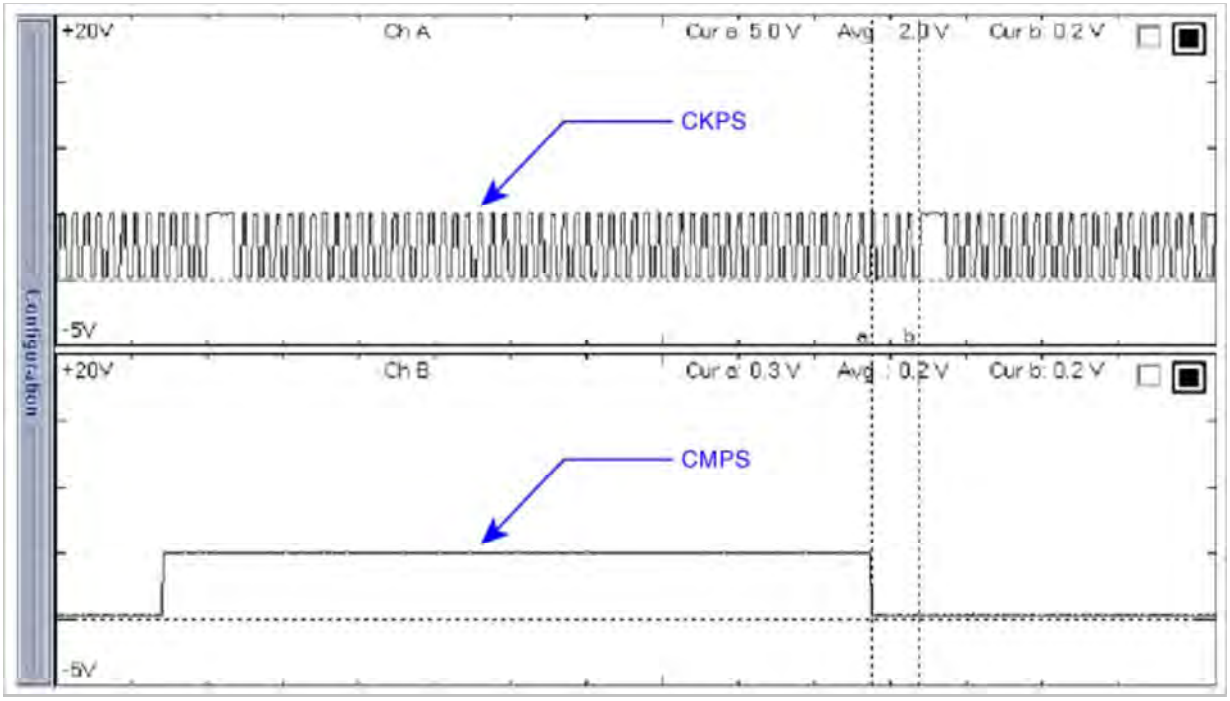
Description

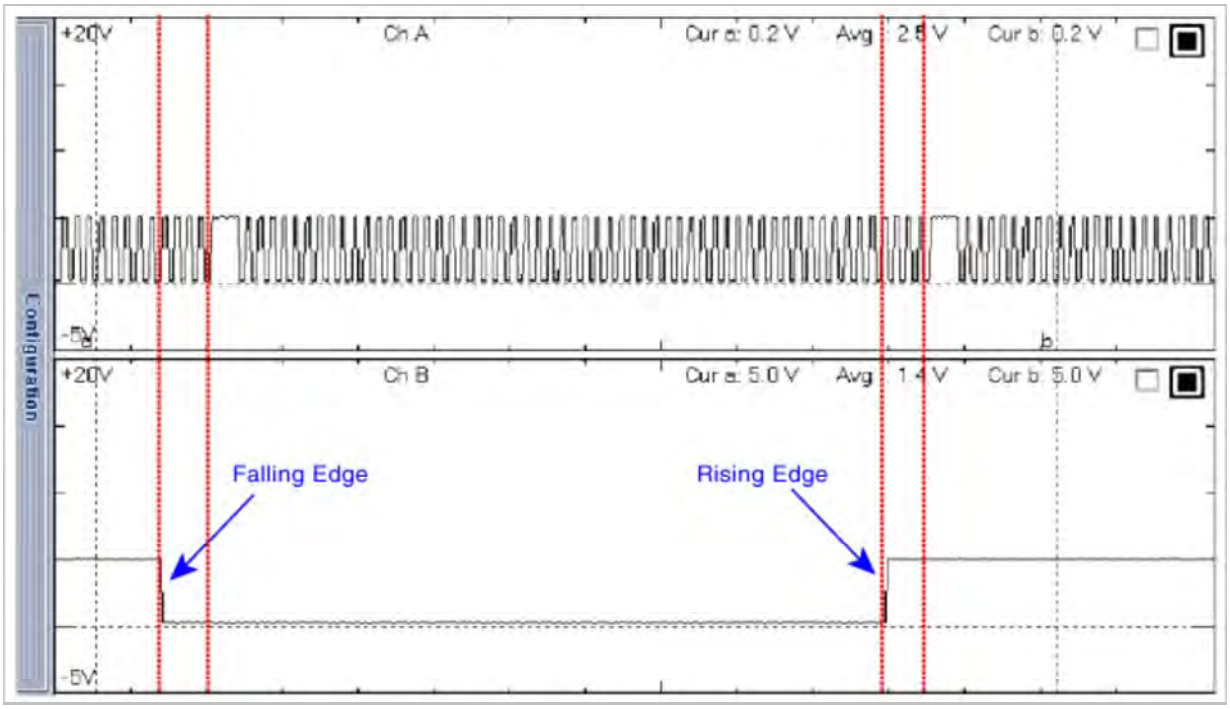
Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, the engine may stop because of CKPS signal missing. This sensor is installed on the cylinder block or the transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs.
The target wheel consists of 58 slots and 2 missing slots on 360 degrees CA (Crank Angle).



Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Troubleshooting

Waveform

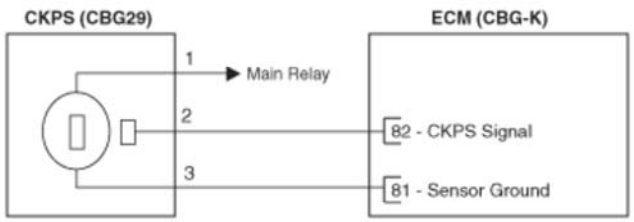




Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]



[Connection Information]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CBG-K (82)	CKPS Signal
3	ECM CBG-K (81)	Sensor Ground

[Harness Connector]

CBG29
CKPS

CBG-K
ECM

Fuel System > Engine Control System > Crankshaft Position Sensor (CKPS) > Repair procedures

Inspection

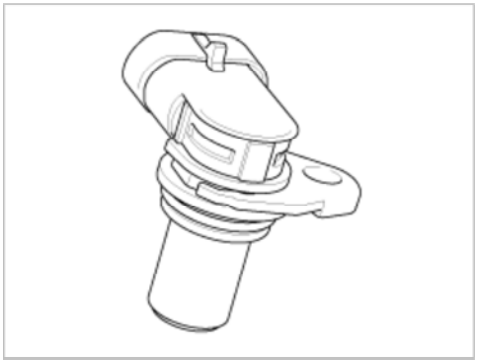
1. Check signal waveform of CKPS and CMPS using a scan tool.

Specification: Refer to “Waveform”

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Description and Operation

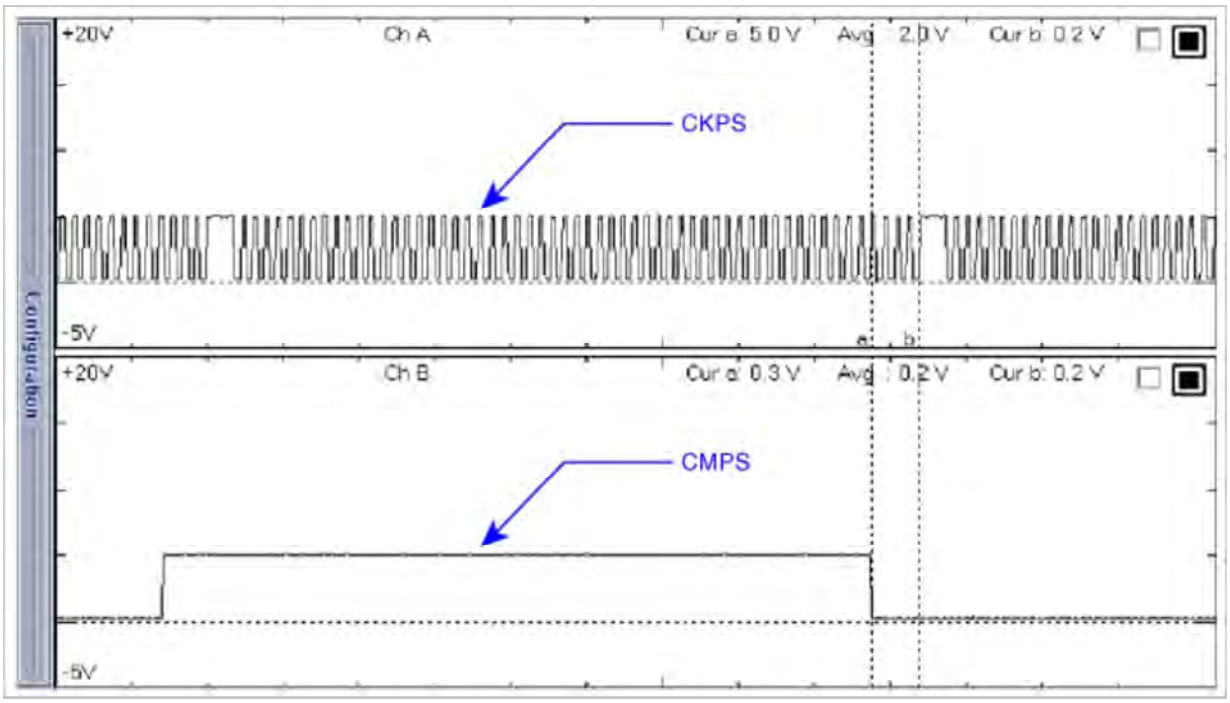
Description

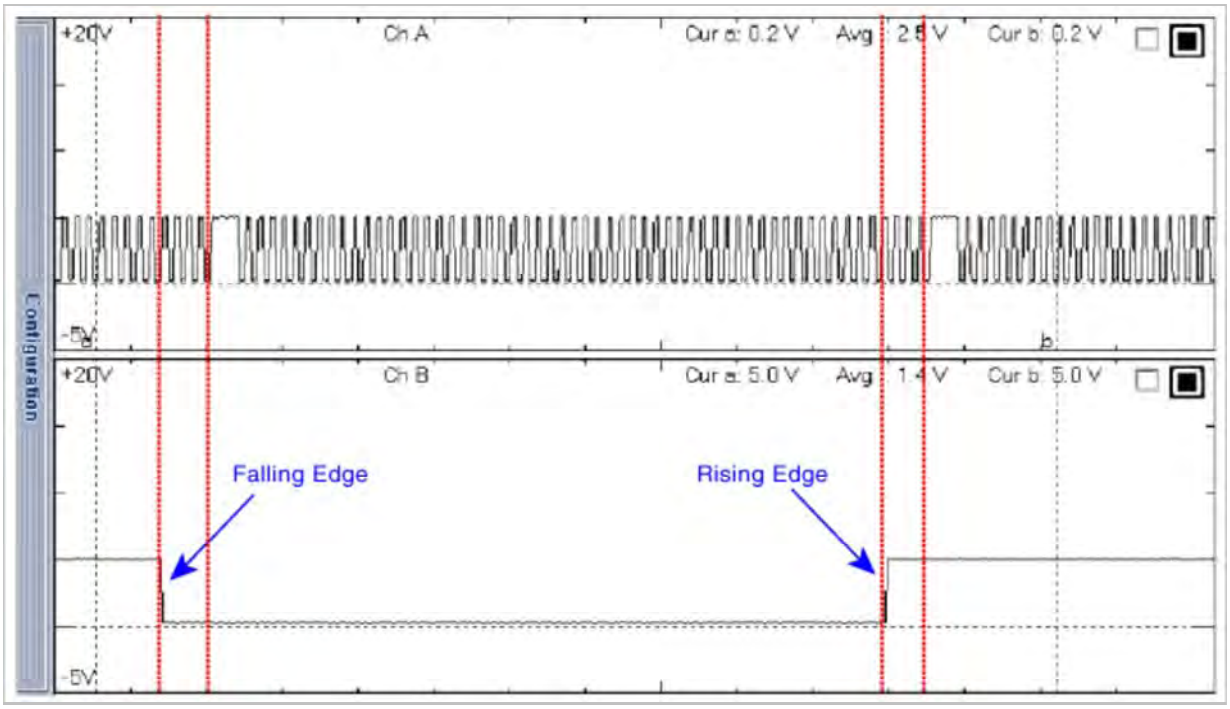
Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element.
It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.
The CMPS is installed on engine head cover and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow.



Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Troubleshooting

Waveform

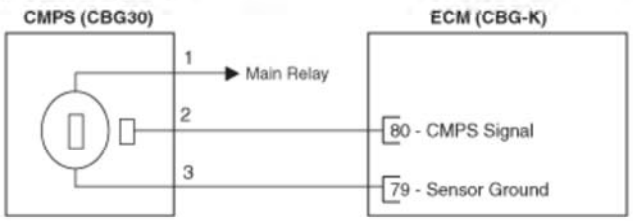




Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]



[Connection Information]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CBG-K (80)	CMPS Signal
3	ECM CBG-K (79)	Sensor Ground

[Harness Connector]

CBG30
CMPS

CBG-K
ECM

Fuel System > Engine Control System > Camshaft Position Sensor (CMPS) > Repair procedures

Inspection

1. Check signal waveform of CKPS and CMPS using a scan tool.

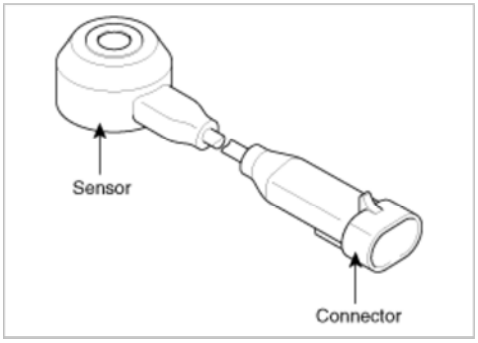
Specification: Refer to “Waveform”

Fuel System > Engine Control System > Knock Sensor (KS) > Description and Operation

Description

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) is installed on the cylinder block and senses engine knocking.

When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. At this time, this sensor transfers the voltage signal higher than the specified value to the ECM and the ECM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the ECM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.



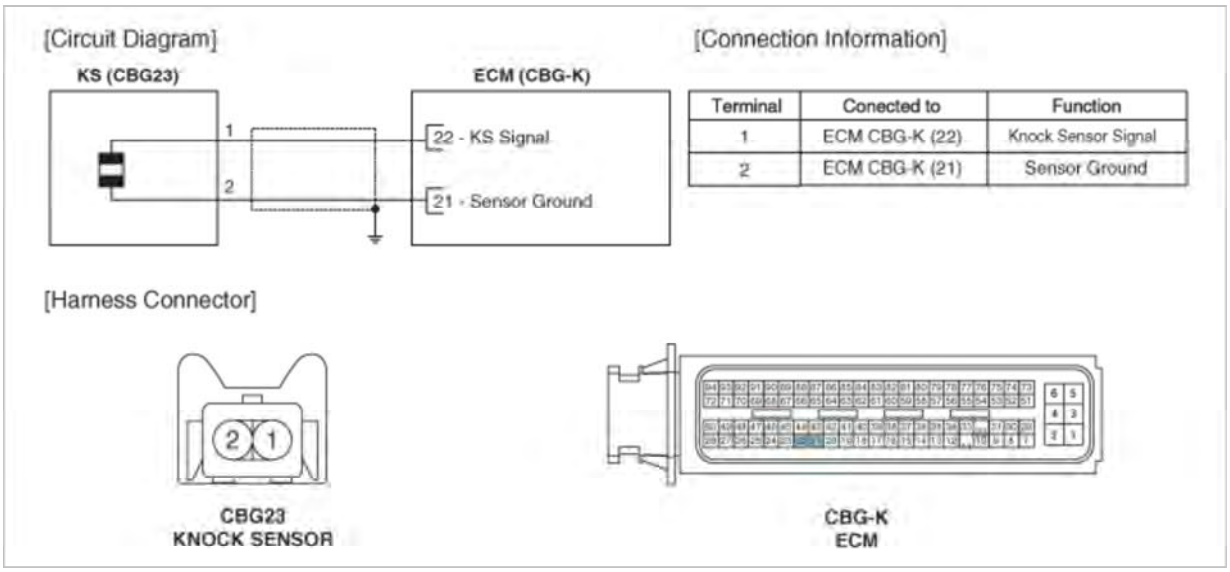
Fuel System > Engine Control System > Knock Sensor (KS) > Specifications

Specification

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

Fuel System > Engine Control System > Knock Sensor (KS) > Schematic Diagrams

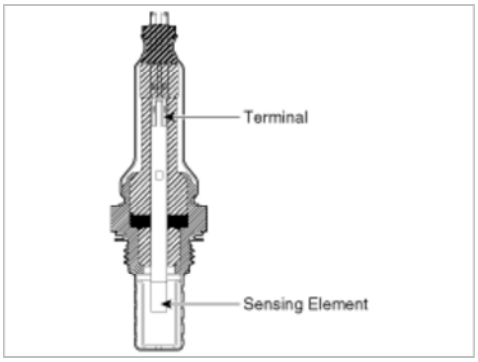
Circuit Diagram



Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Description and Operation

Description

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalytic Converter (MCC).
After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the corresponding voltage signal to the ECM. When A/F ratio is rich or lean, it generates approximately +1V or 0V respectively.
In order that this sensor normally operates, the temperature of the sensor tip must be higher than predetermined temperature. So it has a heater which is controlled by the ECM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Specifications

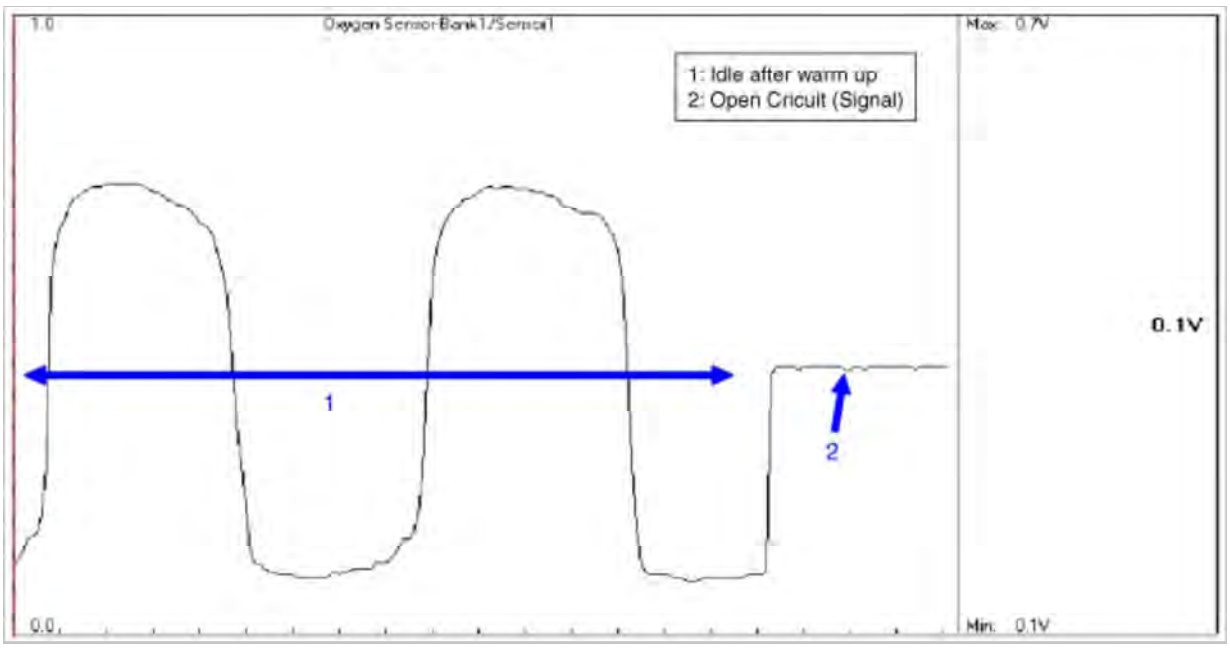
Specification

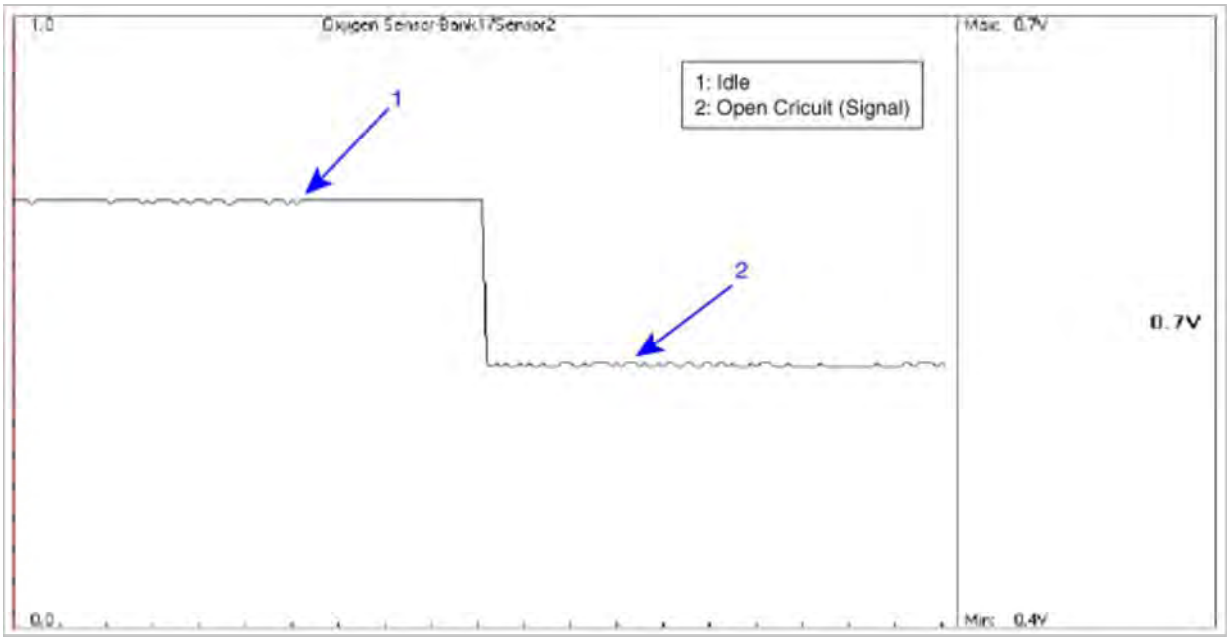
A/F Ratio (λ)	Output Voltage(V)
Rich	0.6 ~ 1.0
Lean	0 ~ 0.4

Item	Specification
Heater Resistance(Ω)	Approx. 9.0(20°C)

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Troubleshooting

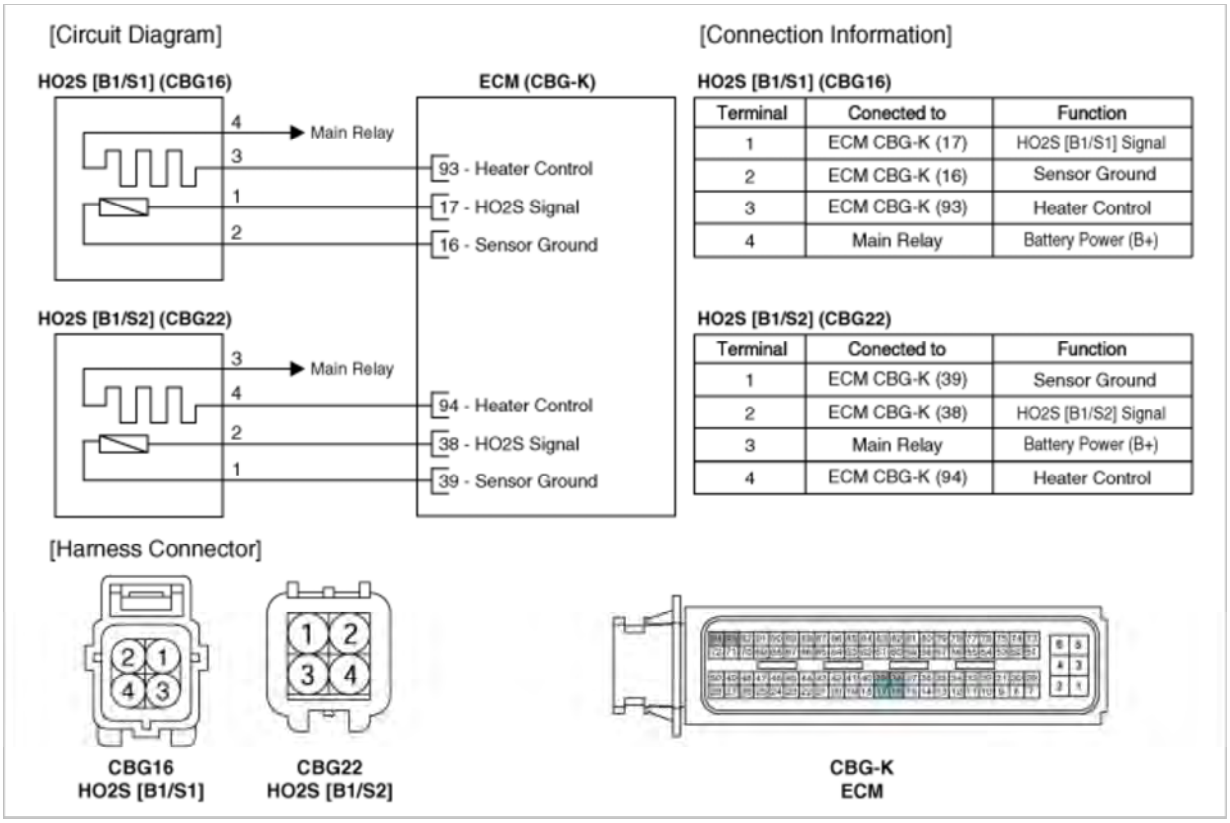
Waveform





Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Schematic Diagrams

Circuit Diagram



[Connection Information]

HO2S [B1/S1] (CBG16)

Terminal	Conected to	Function
1	ECM CBG-K (17)	HO2S [B1/S1] Signal
2	ECM CBG-K (16)	Sensor Ground
3	ECM CBG-K (93)	Heater Control
4	Main Relay	Battery Power (B+)

HO2S [B1/S2] (CBG22)

Terminal	Conected to	Function
1	ECM CBG-K (39)	Sensor Ground
2	ECM CBG-K (38)	HO2S [B1/S2] Signal
3	Main Relay	Battery Power (B+)
4	ECM CBG-K (94)	Heater Control

Fuel System > Engine Control System > Heated Oxygen Sensor (HO2S) > Repair procedures

Inspection

1. Check signal waveform of HO2S using a scan tool.

Specification: Refer to "Waveform"

2. Disconnect the HO2S connector.
3. Measure resistance between HO2S heater terminals 3 and 4.

4. Check that the resistance is within the specification.

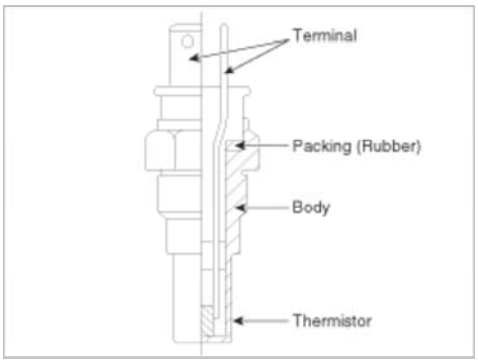
Specification: Refer to “Specification”

Fuel System > Engine Control System > CVVT Oil Temperature Sensor (OTS) > Description and Operation

Description

The Continuously Variable Valve Timing (CVVT) system controls the amount of valve overlap by varying the amount of oil flow into an assembly mounted on the intake camshaft through ECM control of an oil control valve. An Oil Temperature Sensor (OTS) is used to allow ECM monitoring of engine oil temperature. As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements.

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



Fuel System > Engine Control System > CVVT Oil Temperature Sensor (OTS) > Specifications

Specification

Temperature [°C(°F)]	Resistance (kΩ)
-40(-40)	52.15
-20(-4)	16.52
0(32)	6.0
20(68)	2.45
40(104)	1.11
60(140)	0.54
80(176)	0.29

Fuel System > Engine Control System > CVVT Oil Temperature Sensor (OTS) > Schematic Diagrams

Circuit Diagram

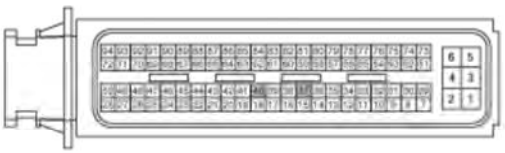
[Circuit Diagram]

[Connection Information]

Terminal	Connected to	Function
1	ECM CBG-K (37)	Sensor Ground
2	ECM CBG-K (40)	OTS Signal

[Harness Connector]

CBG03
OTS



CBG-K
ECM

Fuel System > Engine Control System > CVVT Oil Temperature Sensor (OTS) > Repair procedures

Inspection

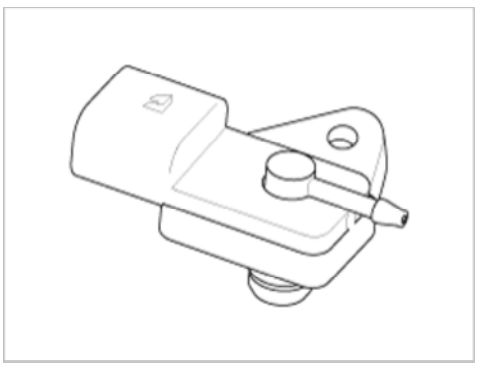
1. Turn the ignition switch OFF.
2. Disconnect the OTS connector.
3. Remove the OTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between the OTS terminals 1 and 2.
5. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Description and Operation

Description

Fuel Tank Pressure Sensor (FTPS) is a component of the evaporative emission control system and is installed on the fuel tank, the fuel pump, or the canister. It checks the purge control solenoid valve operation and detects a leakage of the system.

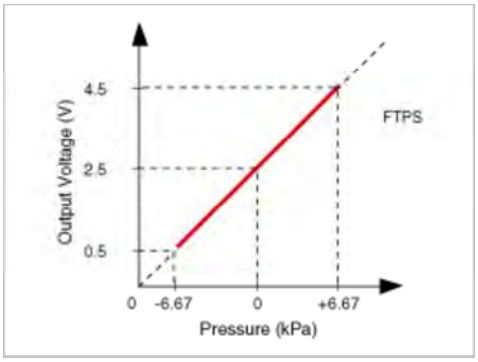


Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Specifications

Specification

Pressure (kPa)	Output Voltage (V)
-6.67	0.5
0	2.5

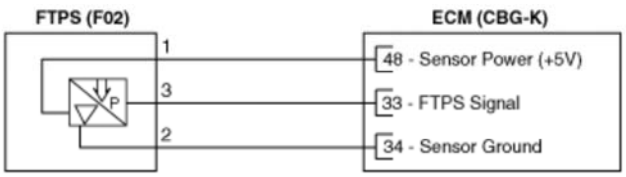
+6.67	4.5



Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	ECM CBG-K (48)	Sensor Power (+5V)
2	ECM CBG-K (33)	FTPS Signal
3	ECM CBG-K (34)	Sensor Ground

[Harness Connector]

F02
FTPS

CBG-K
ECM

Fuel System > Engine Control System > Fuel Tank Pressure Sensor (FTPS) > Repair procedures

Inspection

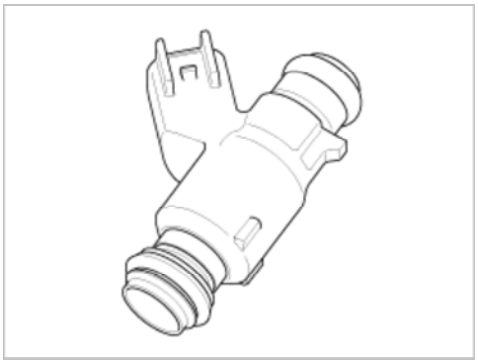
1. Connect a scantool on the Data Link Connector (DLC).
2. Measure the output voltage of the FTPS.

Specification: Refer to "Specification"

Fuel System > Engine Control System > Injector > Description and Operation

Description

Based on information from various sensors, the ECM can calculate the fuel amount to be injected. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of injection time. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.



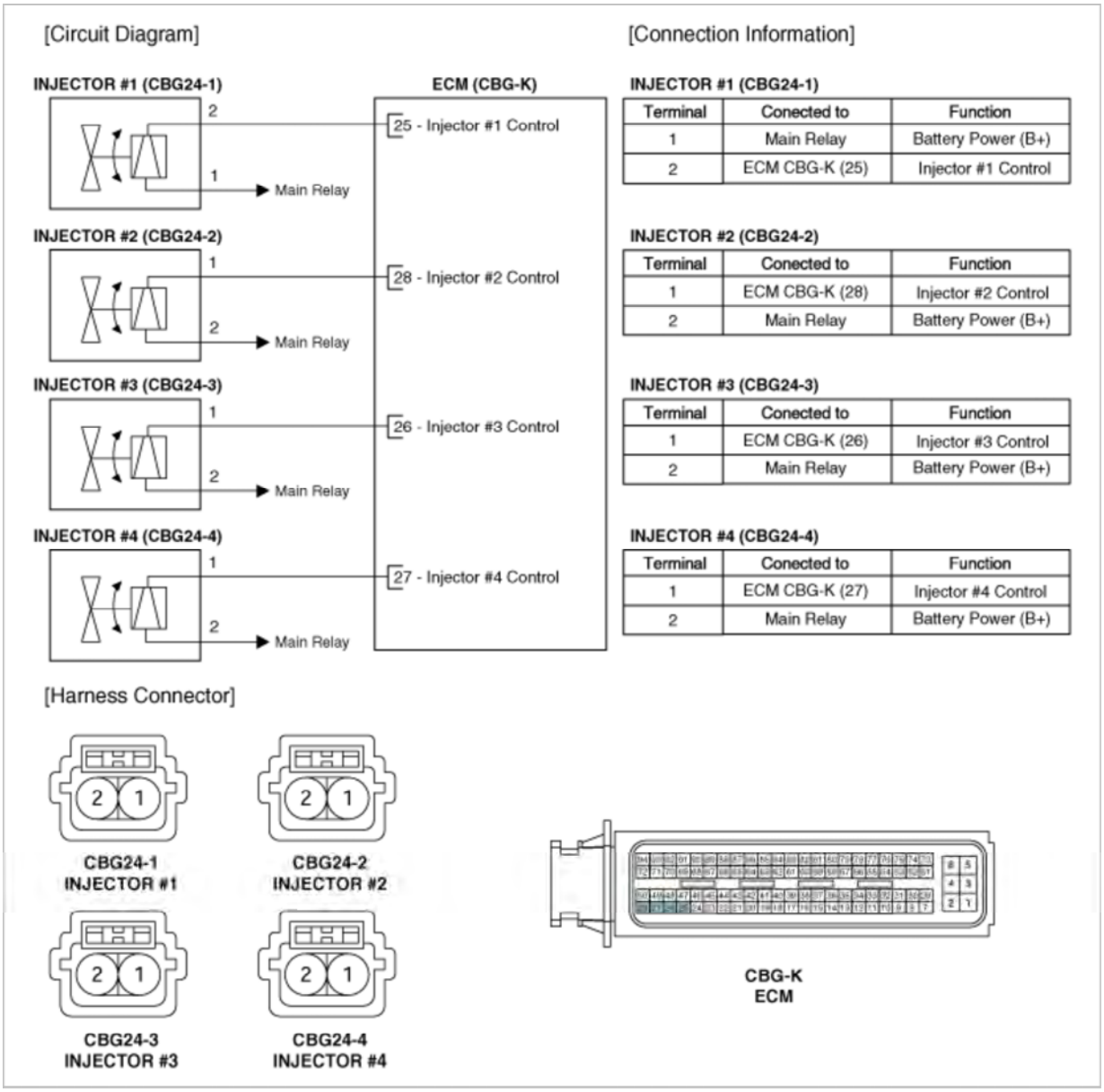
Fuel System > Engine Control System > Injector > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 [20°C(68°F)]

Fuel System > Engine Control System > Injector > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Injector > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect injector connector.
3. Measure resistance between injector terminals 1 and 2.
4. Check that the resistance is within the specification.

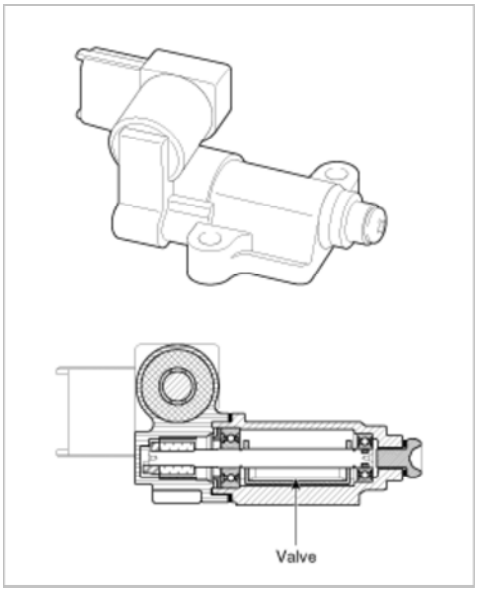
Specification: Refer to “Specification”

Fuel System > Engine Control System > Idle Speed Control Actuator (ISCA) > Description and Operation

Description

The Idle Speed Control Actuator (ISCA) is installed on the throttle body and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle valve is closed.
The function of the ISCA is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting.
The ISCA consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates

to control the by-pass airflow into the engine.



Fuel System > Engine Control System > Idle Speed Control Actuator (ISCA) > Specifications

Specification

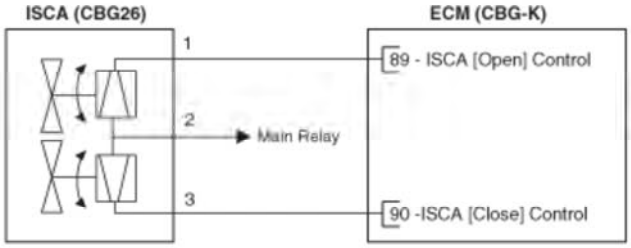
Item	Specification
Opening Coil Resistance (Ω)	14.6 ~ 16.2 [20°C(68°F)]
Closing Coil Resistance (Ω)	11.1 ~ 12.7 [20°C(68°F)]

Duty (%)	Air Flow Rate (㎥/h)
15	0.8 ~ 1.8
35	6.3 ~ 10.3
70	35.5 ~ 45.0
96	49.0 ~ 59.0

Fuel System > Engine Control System > Idle Speed Control Actuator (ISCA) > Schematic Diagrams

Circuit Diagram

[Circuit Diagram]



[Connection Information]

Terminal	Conected to	Function
1	ECM CBG-K (89)	ISCA [Open] Control
2	Main Relay	Battery Power (B+)
3	ECM CBG-K (90)	ISCA [Close] Control

[Harness Connector]

CBG26
ISCA

CBG-K
ECM

Fuel System > Engine Control System > Idle Speed Control Actuator (ISCA) > Repair procedures

Inspection

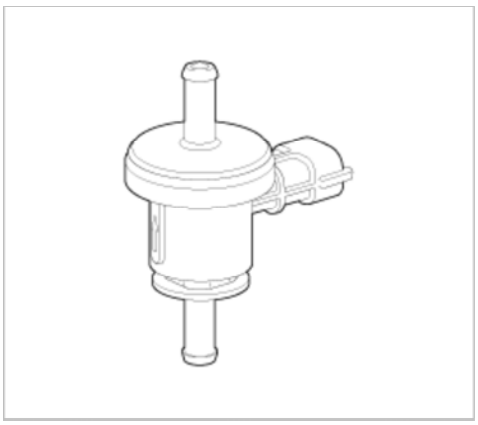
1. Turn ignition switch OFF.
2. Disconnect ISCA connector.
3. Measure resistance between ISCA terminals 2 and 1 [Opening Coil].
4. Measure resistance between ISCA terminals 2 and 3 [Closing Coil].
5. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Description and Operation

Description

Purge Control Solenoid Valve (PCSV) is a solenoid valve and is installed on the surge tank and controls the passage between the canister and the intake manifold.
The evaporative gases gathered in the canister are delivered to the intake manifold when the PCSV is open by ECM control signal.



Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Specifications

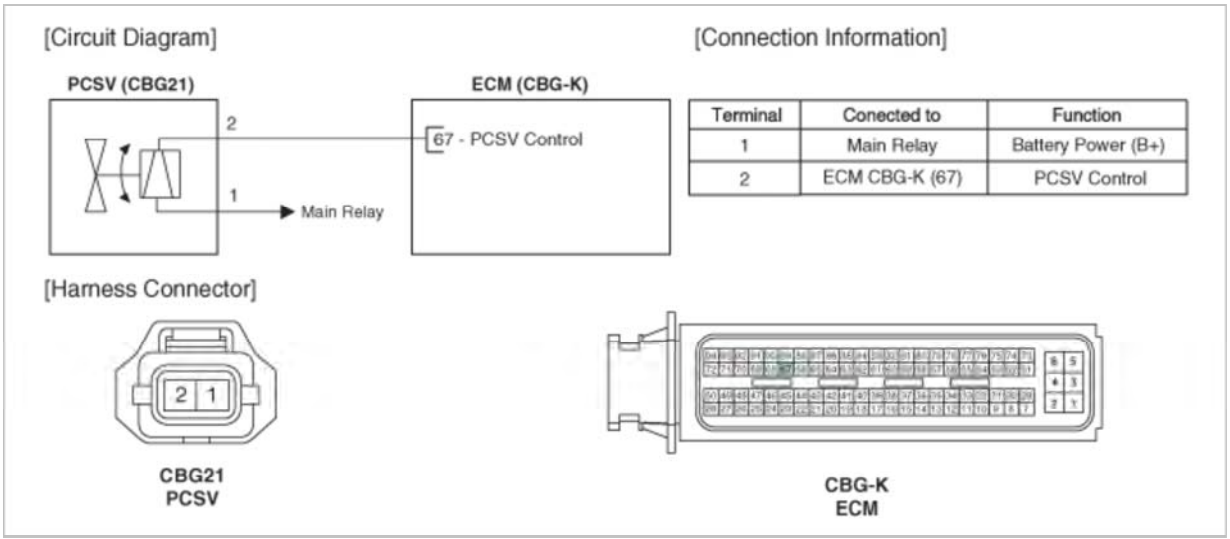
Specification

Item	Specification

Coil Resistance (Ω)	14.0 ~ 18.0 [20°C(68°F)]

Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Purge Control Solenoid Valve (PCSV) > Repair procedures

Inspection

1. Turn ignition switch OFF.
2. Disconnect PCSV connector.
3. Measure resistance between PCSV terminals 1 and 2.
4. Check that the resistance is within the specification.

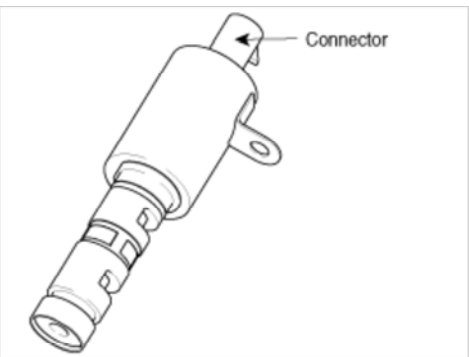
Specification: Refer to “Specification”

Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Description and Operation

Description

The Continuously Variable Valve Timing (CVVT) system controls the amount of valve overlap by varying the amount of oil flow into an assembly mounted on the intake camshaft through ECM control of an oil control valve. An Oil Temperature Sensor (OTS) is used to allow ECM monitoring of engine oil temperature. As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements.

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



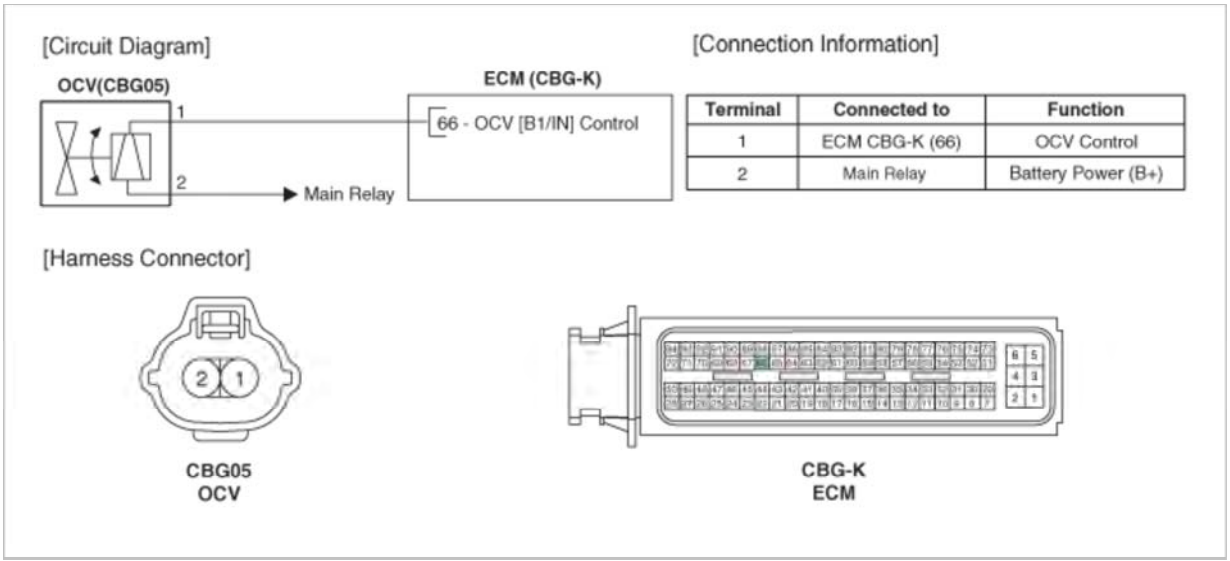
Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	6.9 ~ 7.9 [20°C(68°F)]

Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > CVVT Oil Control Valve (OCV) > Repair procedures

Inspection

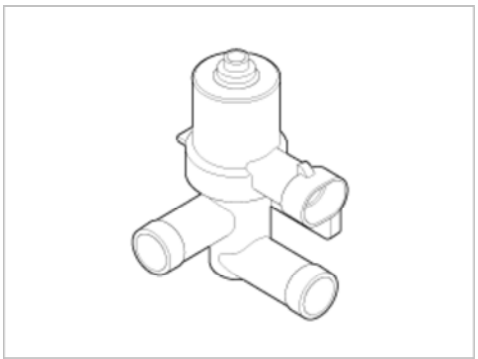
1. Turn the ignition switch OFF.
2. Disconnect the OCV connector.
3. Measure resistance between the OCV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Fuel System > Engine Control System > Canister Close Valve (CCV) > Description and Operation

Description

Canister Close Valve (CCV) is installed on the canister ventilation line. It seals evaporative emission control system by shutting the canister from the atmosphere when leakage detecting system operates.



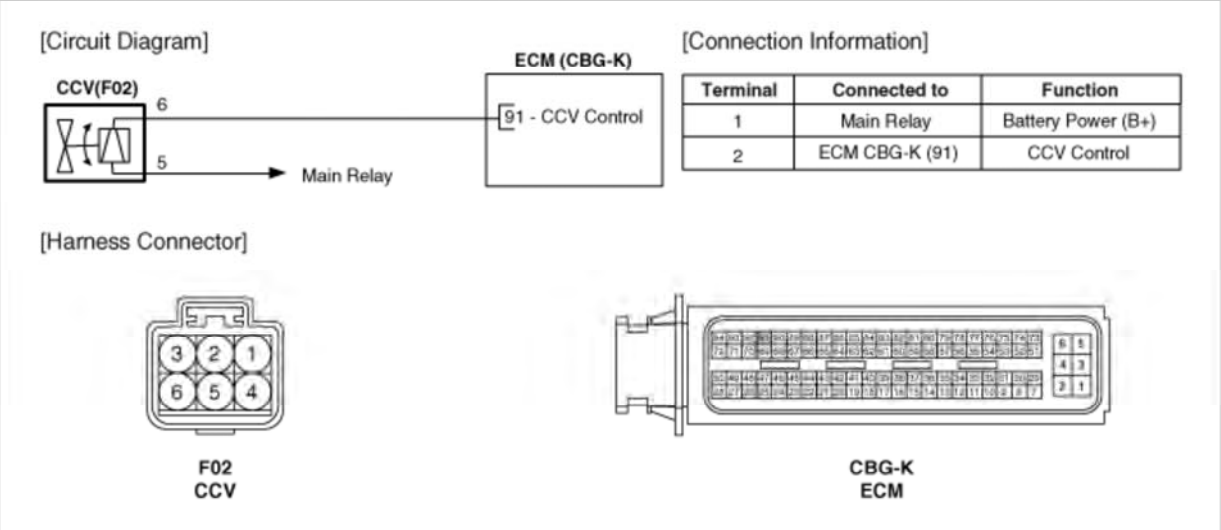
Fuel System > Engine Control System > Canister Close Valve (CCV) > Specifications

Specification

Item	Specification
Coil Resistance (Ω)	15.5 ~ 18.5 (20°C)

Fuel System > Engine Control System > Canister Close Valve (CCV) > Schematic Diagrams

Circuit Diagram



Fuel System > Engine Control System > Canister Close Valve (CCV) > Repair procedures

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the CCV connector.
3. Measure resistance between the CCV terminal 5 and6.
4. Check that the resistance is within the specification.

Specification: Refer to "Specification"

5. Disconnect the vapor hose connected with the canister from the CCV.
6. Connect a vacuum pump to the nipple.
7. Ground the CCV control line and apply battery voltage to the CCV power supply line.
8. Apply vacuum and check the valve operation.

Specification: Vacuum maintained

Fuel System > Engine Control System > Troubleshooting

Inspection Chart For Diagnostic Trouble Codes (DTC)

DTC	Description	MIL
P0011	"A" Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)	●
P0016	Crankshaft Position–Camshaft Position Correlation (Bank 1 / Sensor A)	●
P0030	HO2S Heater Control Circuit (Bank 1 / Sensor 1)	●
P0031	HO2S Heater Control Circuit Low (Bank 1 / Sensor 1)	●
P0032	HO2S Heater Control Circuit High (Bank 1 / Sensor 1)	●

P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)	●
P0037	HO2S Heater Control Circuit Low (Bank 1 / Sensor 2)	●
P0038	HO2S Heater Control Circuit High (Bank 1 / Sensor 2)	●
P0076	Intake Valve Control Solenoid Circuit-Low (Bank 1)	●
P0077	Intake Valve Control Solenoid Circuit-High (Bank 1)	●
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	●
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	●
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	●
P0113	Intake Air Temperature Sensor 1 Circuit High Input	●
P0116	Engine Coolant Temperature Circuit Range/Performance	●
P0117	Engine Coolant Temperature Circuit Low Input	●
P0118	Engine Coolant Temperature Circuit High Input	●
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	●
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	●
P0128	Coolant Thermostat (Coolant Temperature below Thermostat Regulating Temperature)	●
P0130	O2 Sensor Circuit (Bank 1 / Sensor 1)	●
P0131	O2 Sensor Circuit Low Voltage (Bank 1 / Sensor 1)	●
P0132	O2 Sensor Circuit High Voltage (Bank 1 / Sensor 1)	●
P0133	O2 Sensor Circuit Slow Response (Bank 1 / Sensor 1)	●
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	●
P0136	O2 Sensor Circuit (Bank 1 / Sensor 2)	●
P0137	O2 Sensor Circuit Low Voltage (Bank 1 / Sensor 2)	●
P0138	O2 Sensor Circuit High Voltage (Bank 1 / Sensor 2)	●
P0139	O2 Sensor Circuit Slow Response (Bank 1 / Sensor 2)	●
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 / Sensor 2)	●
P0170	Fuel Trim (Bank 1)	●
P0171	System Too Lean (Bank 1)	●
P0172	System Too Rich (Bank 1)	●
P0196	Engine Oil Temperature Sensor-Range/Performance	●
P0197	Engine Oil Temperature Sensor Low Input	●
P0198	Engine Oil Temperature Sensor High Input	●
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	●
P0300	Random/Multiple Cylinder Misfire Detected	●
P0301		

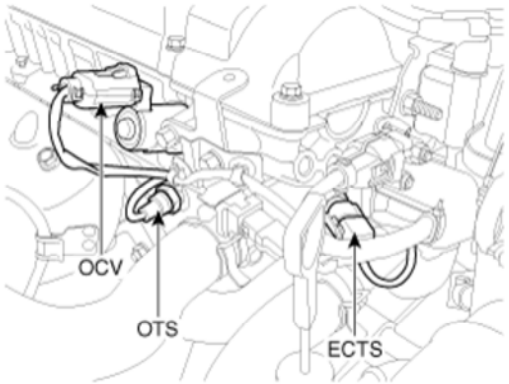
	Cylinder 1-Misfire detected	●
P0302	Cylinder 2-Misfire detected	●
P0303	Cylinder 3-Misfire detected	●
P0304	Cylinder 4-Misfire detected	●
P0315	Crankshaft Position System Variation Not Learned	▲
P0325	Knock Sensor 1 Circuit (Bank 1 or Single Sensor)	●
P0335	Crankshaft Position Sensor "A" Circuit	●
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	●
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●
P0441	Evaporative Emission System Incorrect Purge Flow	●
P0442	Evaporative Emission System-Leak detected (Small Leak)	●
P0444	Evaporative Emission System-Purge Control Valve Circuit Open	●
P0445	Evaporative Emission System-Purge Control Valve Circuit Shorted	●
P0447	Evaporative Emission System-Vent Control Circuit Open	●
P0448	Evaporative Emission System-Vent Control Circuit Shorted	●
P0449	Evaporative Emission System-Vent Valve/Solenoid Circuit	●
P0451	Evaporative Emission System-Pressure Sensor Range/Performance	●
P0452	Evaporative Emission System-Pressure Sensor Low Input	●
P0453	Evaporative Emission System-Pressure Sensor High Input	●
P0454	Evaporative Emission System-Pressure Sensor Intermittent	●
P0455	Evaporative Emission System-Leak detected (Large Leak)	●
P0456	Evaporative Emission System-Leak detected (Very Small Leak)	●
P0501	Vehicle Speed Sensor "A" Range/Performance	●
P0505	Idle Air Control System	●
P0506	Idle Air Control System-RPM Lower than Expected	●
P0507	Idle Air Control System-RPM Higher than Expected	●
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	▲
P0700	Transmission Control System (MIL Request)	●
P1505	Idle Speed Control Actuator Signal Low of Coil #1	●
P1506	Idle Speed Control Actuator Signal High of Coil #1	●
P1507	Idle Speed Control Actuator Signal Low of Coil #2	●
P1508	Idle Speed Control Actuator Signal High of Coil #2	●
U0001	High Speed CAN Communication Bus OFF	●
U0101	Lost Communication With TCM	●

NOTE

●: MIL ON & Memory
▲: MIL OFF & Memory

Fuel System > Engine Control System > P0011 \'A\' Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)

Component Location



General Description

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the exhaust camshaft. There is no variation in valve timing of the exhaust cam because the exhaust camshaft is driven by the timing belt. The timing of the intake cam is varied by the relative operation the CVVT vane to the housing. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV(Oil Control Valve). As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease by changing the valve open/close timing of the intake camshaft.

DTC Description

The deviation of the camshaft position from the target point is evaluated during stable driving condition. The PCM accumulates this deviation for a certain period and sets DTC P0011 when the accumulated deviation is too high. The target camshaft position is predetermined value depending on engine speed and throttle angle in the PCM.

DTC Detecting Condition

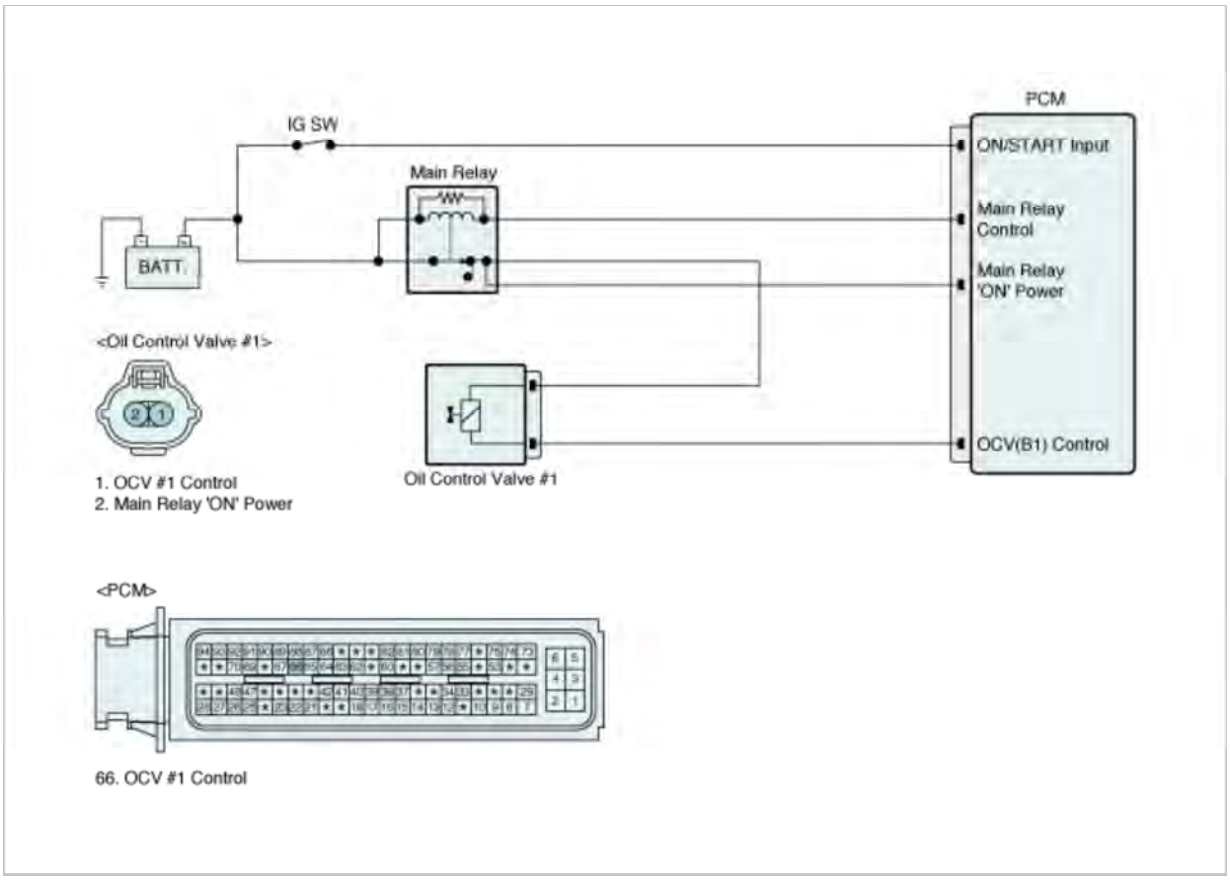
Item		Detecting Condition	Possible Cause
DTC Strategy	case1	• Monitor deviation between camshaft position setpoint and actual value	• Faulty Oil leak • Faulty Oil pump • Faulty Intake valve control solenoid
	case2	• Deviation between actual CAM position and CAM setpoint position in case of changing setpoint (slow response of actuator)	
Enable Conditions	case1	• No relevant failure • 11V < Battery voltage < 16V • CVVT control : enabled • Holding position adaptation not active • Camshaft setpoint moved more than 5 times for this Driving Cycle • Stable camshaft set-point moving by more than 1.125°CRK moving • Camshaft position setpoint-actual > 5°CRK • 600rpm < Engine speed < 5000rpm • 20°C(68°F) < Engine oil temperature < 100°C(212°F)	
	case2	• CVVT control active • Camshaft set-point moving by more than 20°CRK • Camshaft set-point moved more than 5 times since engine start • 600 rpm < Engine speed < 5000 rpm • 20 °C(68°F) < Oil temperature < 110 °C(230°F) • No relevant failure • 11V < Battery voltage < 16V	
Threshold	case1	• Integral of Camshaft position setpoint - Camshaft position actual value > 150°CRK/sec.	

Value	case2	• CAM position movement < 2.6 °CRK within 0.7 sec. (with CAM set-point moving by 20 °CRK)	
Diagnostic Time	case1	• Approx. 38~300 seconds depending on CAM deviation	
	case2	• 350 sec.	
Mil On Condition		• 2 Driving Cycles	

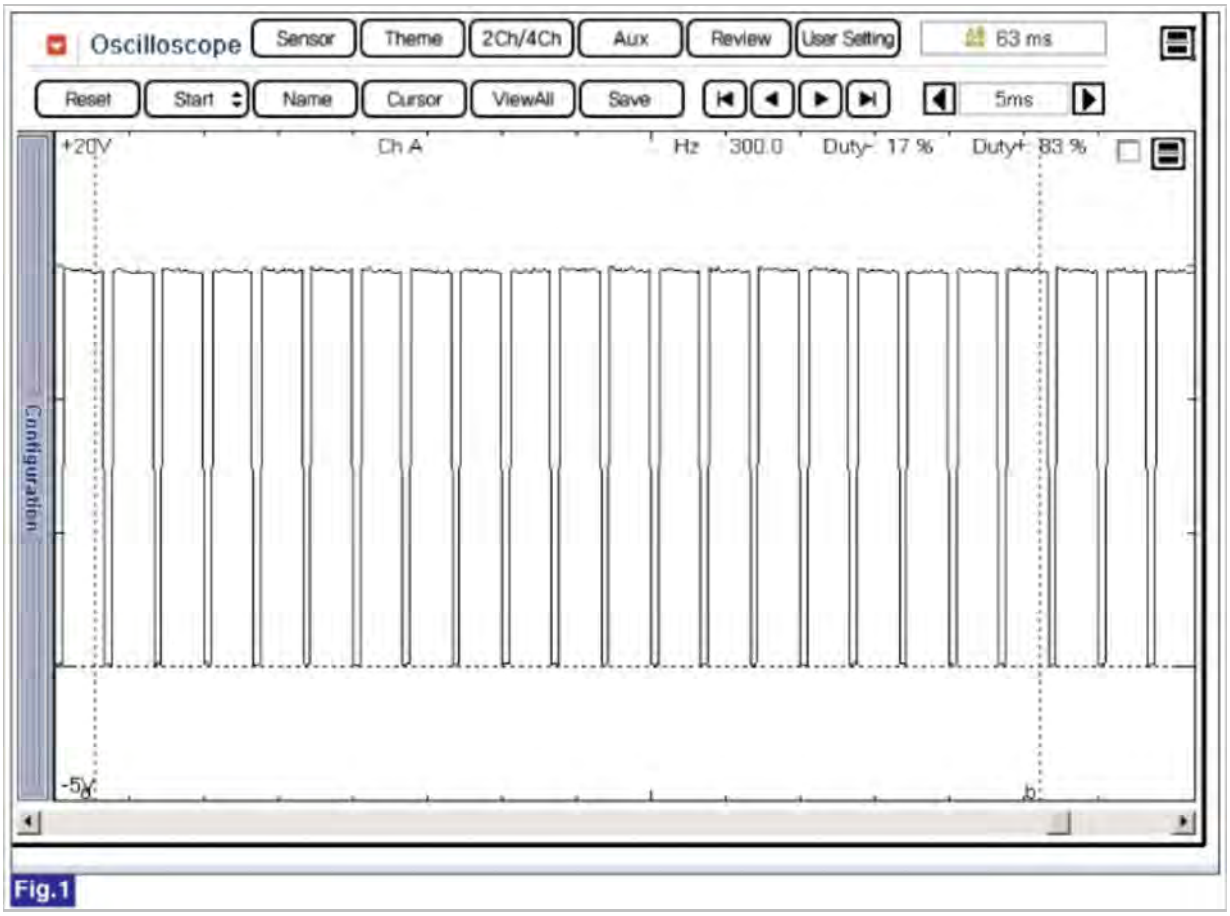
Specification

Intake OCV	Normal Parameter
Insulation Resistance (Ω)	Above 50 MΩ

Diagnostic Circuit Diagram



Signal Waveform & Data



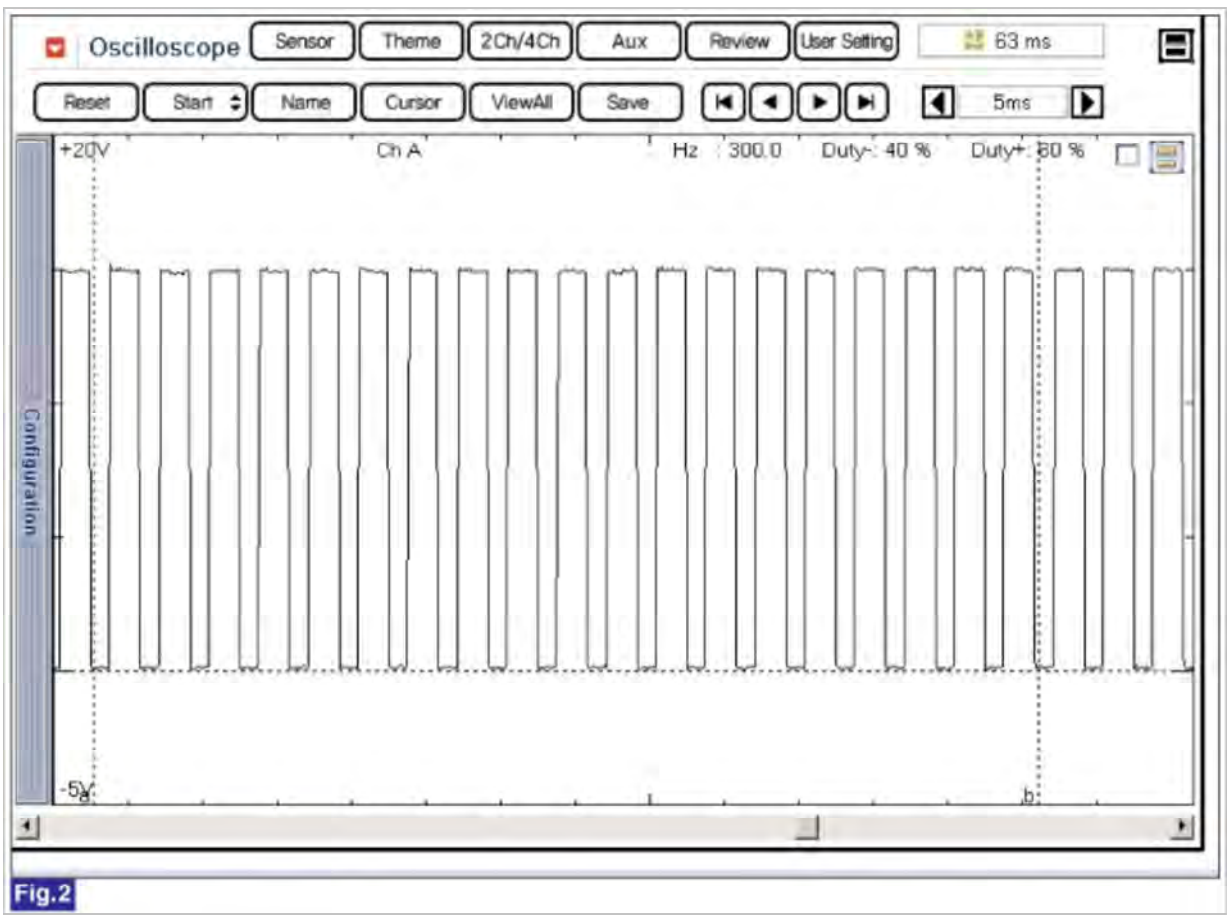


Fig.1) Normal OCV (-) duty ratio with idle : Approx. 12~20%
Fig.2) Normal OCV (-) duty ratio with maintaining 2000RPM : Approx. 30~50%

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

■ Check OCV and Filter

1. Check resistance of OCV
   (1) Ignition "OFF"
   (2) Disconnect intake OCV connector.
   (3) Measure resistance between terminals 1 and 2 of the intake OCV connector.(Component side)

   Specification : Approx. 6.9~7.9Ω at 20°C(68°F)

   (4) Is resistance within the specification?

YES	▸ Go to next step as below
NO	▸ Replace OCV and then go to "Verification of Vehicle Repair" procedure

2. Check operation of OCV

(1) Start the engine and let it idle.

(2) With OCV connector still disconnected, connect 12V and a ground to 2 and 1 of the OCV(Component side).
Specification :

Test Condition	Disconnect OCV connector	Apply battery voltage
Normal Value	Normal engine speed	Rough idle or engine stall

(3) Has a problem been found?

YES	▸ Go to next step as below.
NO	▸ Go to "Check CVVT(Continuously Variable Valve Timing) Assembly" procedure.

3. Check OCV and Filter
(1) Ignition"OFF"

(2) Check OCV filter for sticking or contamination.

(3) Remove the OCV and visually check the spool column of OCV for contamination.

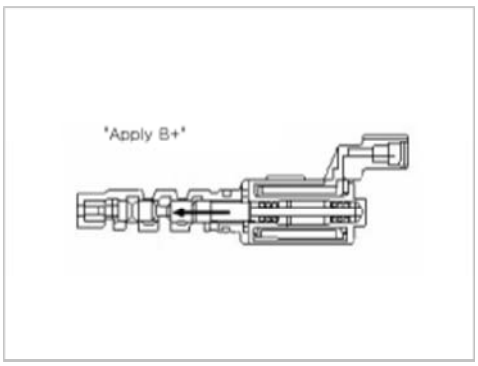
(4) Has a problem been found?

YES	▸ Clean or replace as necessary and then go to "Verification of Vehicle Repair" procedure .
NO	▸ Go to next step as below.

(5) Apply 12V and a ground to 2 and 1 terminals of the OCV(Component side).

(6) Verify that a "clicking" sound is heard when applying the battery voltage.

(7) Repeat this procedure 4 or 5 times to ensure intake OCV reliability.

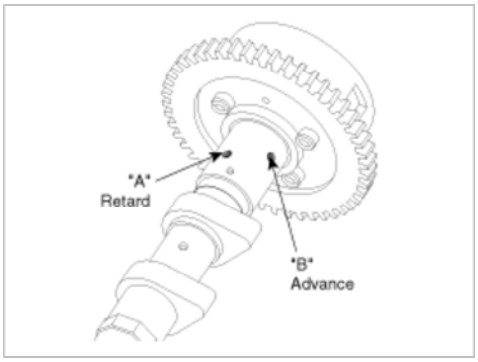


(8) Is OCV working properly?

YES	▸ Go to next step as below
NO	▸ Check OCV for contamination, deterioration, or damage. Substitute with a known-good OCV and check for proper operation. If the problem is corrected, replace OCV and then go to "Verification of Vehicle Repair" procedure.

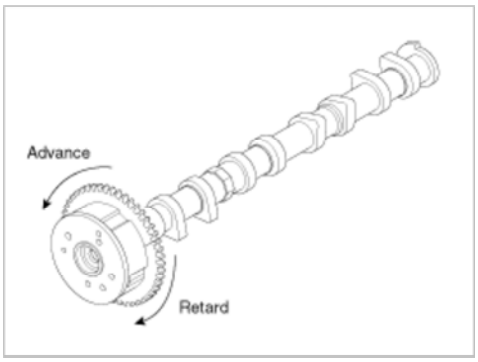
■ Check CVVT(Continuously Variable Valve Timing) Assembly

1. Remove the CVVT assembly. Refer to "Removal Procedure" in Workshop Manual.
2. Check that the CVVT assembly is locked.
3. The one of the 2 holes on the cam journal is for advances(upper) and the rest is for retards(lower). Apply masking tape to all oil path holes except the one advance hole("B") indicated by the arrow as shown in the figure.



4. To release the CVVT lock pin, wrap some tape around the tip of an air pressure adapter and apply low air pressure of approx. 150kPa(1.5kg/cm², 21 psi) to the exposed camshaft port. Wrap a shop towel or rag around the CVVT because residual oil may leak out of the unit when applying air pressure.
5. With low air pressure applied, turn the CVVT to the ADVANCE direction as indicated in the figure.

> **NOTE**
>
> If too much air leaks when applying the low air pressure, the CVVT lock pin may not release and the CVVT may not turn.



6. Allow the CVVT assembly to move in the ADVANCE and DELAY directions to ensure there is no binding and that it moves freely.(Movable smoothly in the range about 20°)
7. Turn the CVVT by hand and make sure it locks in the maximum delay angle position.
8. Is CVVT assembly working properly?

YES	▸ Go to next step as below
NO	▸ Replace the CVVT assembly 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	▸ Check valve timing. Refer to "P0016: Crankshaft Position-Camshaft Position Correlation(Bank1)" procedure. 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.

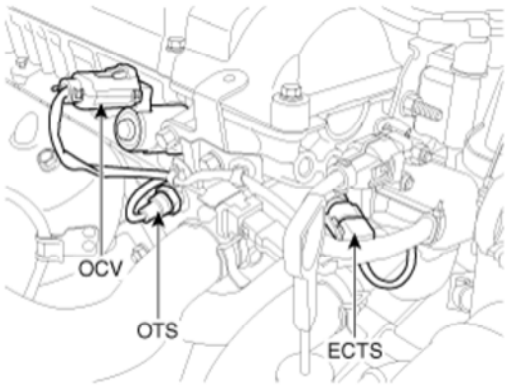
1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter .

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..

Fuel System > Engine Control System > P0016 Crankshaft Position–Camshaft Position Correlation (Bank 1 Sensor A)

Component Location



General Description

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the exhaust camshaft. There is no variation in valve timing of the exhaust cam because the exhaust camshaft is driven by the timing belt. The timing of the intake cam is varied by the relative operation the CVVT vane to the housing. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV(Oil Control Valve). As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease by changing the valve open/close timing of the intake camshaft.

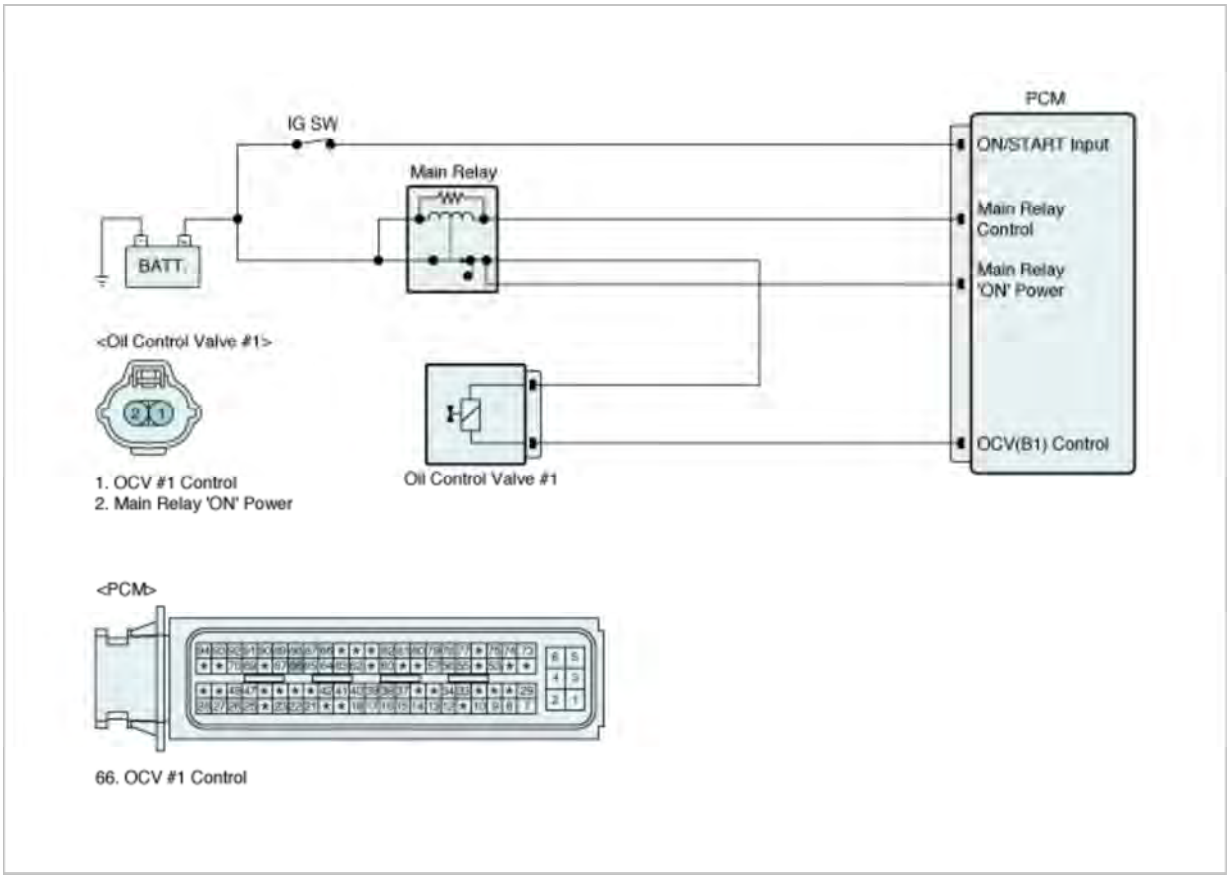
DTC Description

This diagnosis checks the camshaft position plausibility whether the expected range plus some margin is not violated that might be caused by a wrong engine repair, or a chain/belt misalignment. DTC P0016 is set when actual camshaft position is too much retarded or advanced than full retard position or full advance position. To continue the adjustment in such case could lead to a damage of the engine by hitting the valves with the piston.

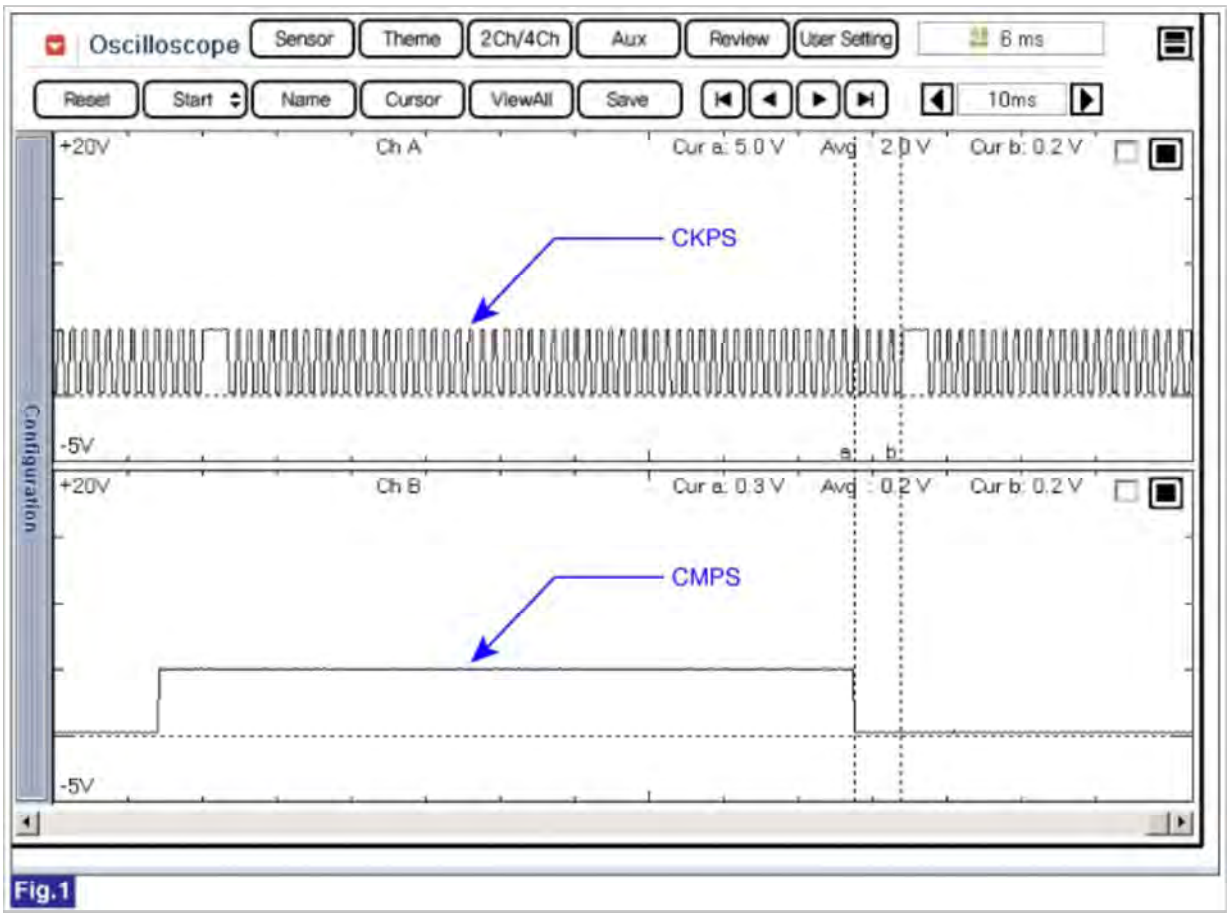
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check Camshaft Signal Switching	• Abnormal installation of camshaft • Abnormal installation of crankshaft • Abnormal installation of tone wheel
Enable Conditions	• 6V < Battery voltage < 16V • CVVT control state : Full retard postion or Control	
Threshold Value	• Camshaft switching out of 109 ~ 141° CRK in full retard position, 70° ~ 140° CRK during CVVT control	
Diagnostic Time	• 8 Sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data



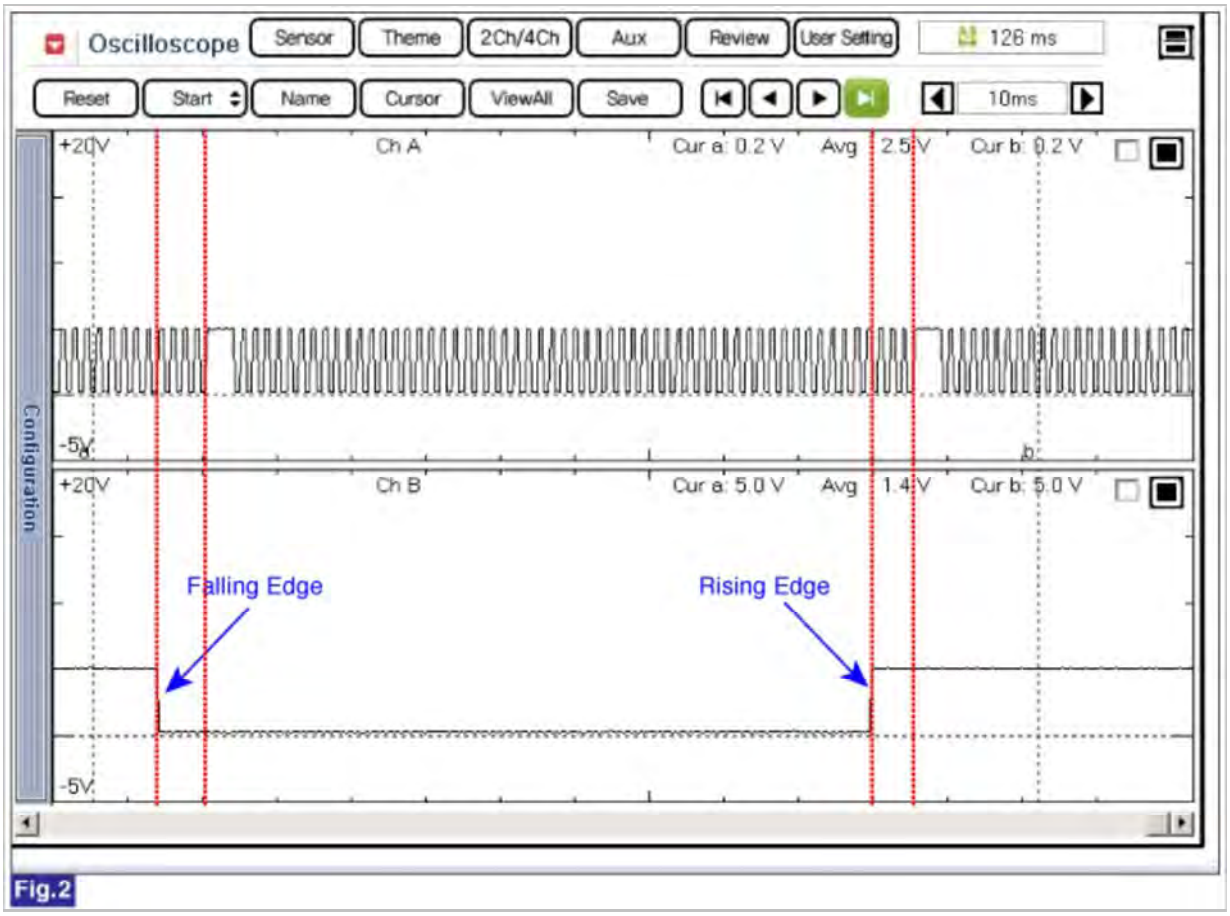
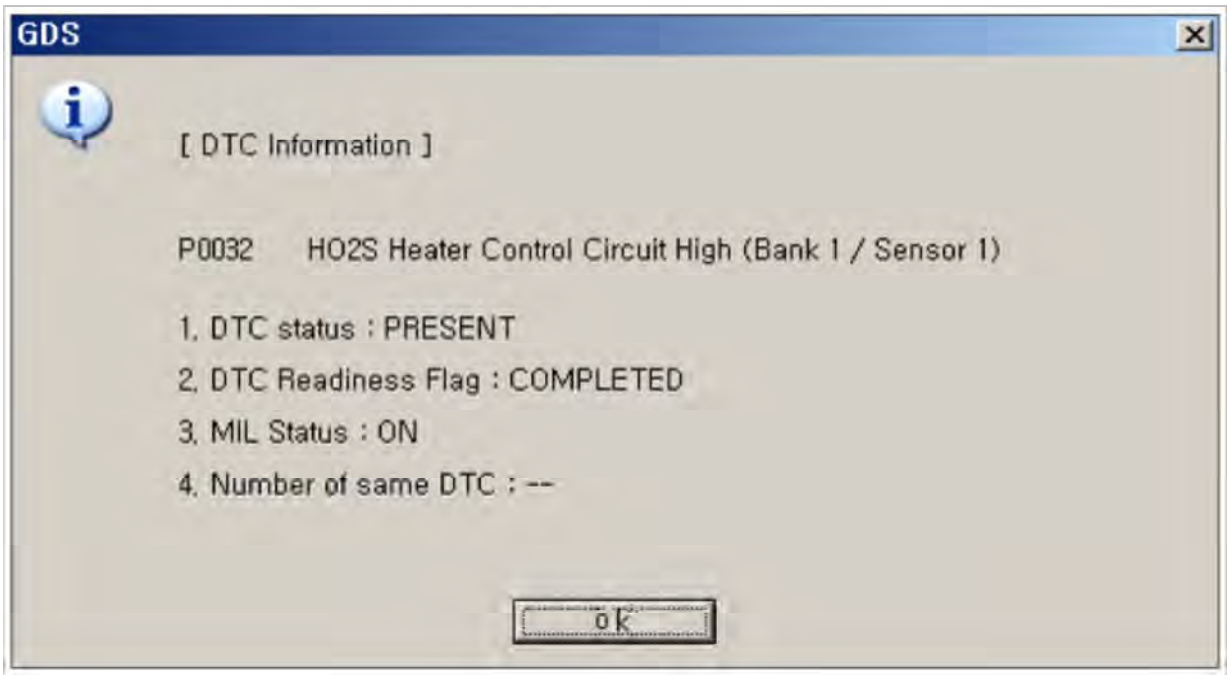


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2)The CMPS falling(rising) edge is coincided with 3rd~5th tooth of the CKP from one longer signal(missing tooth)

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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"?

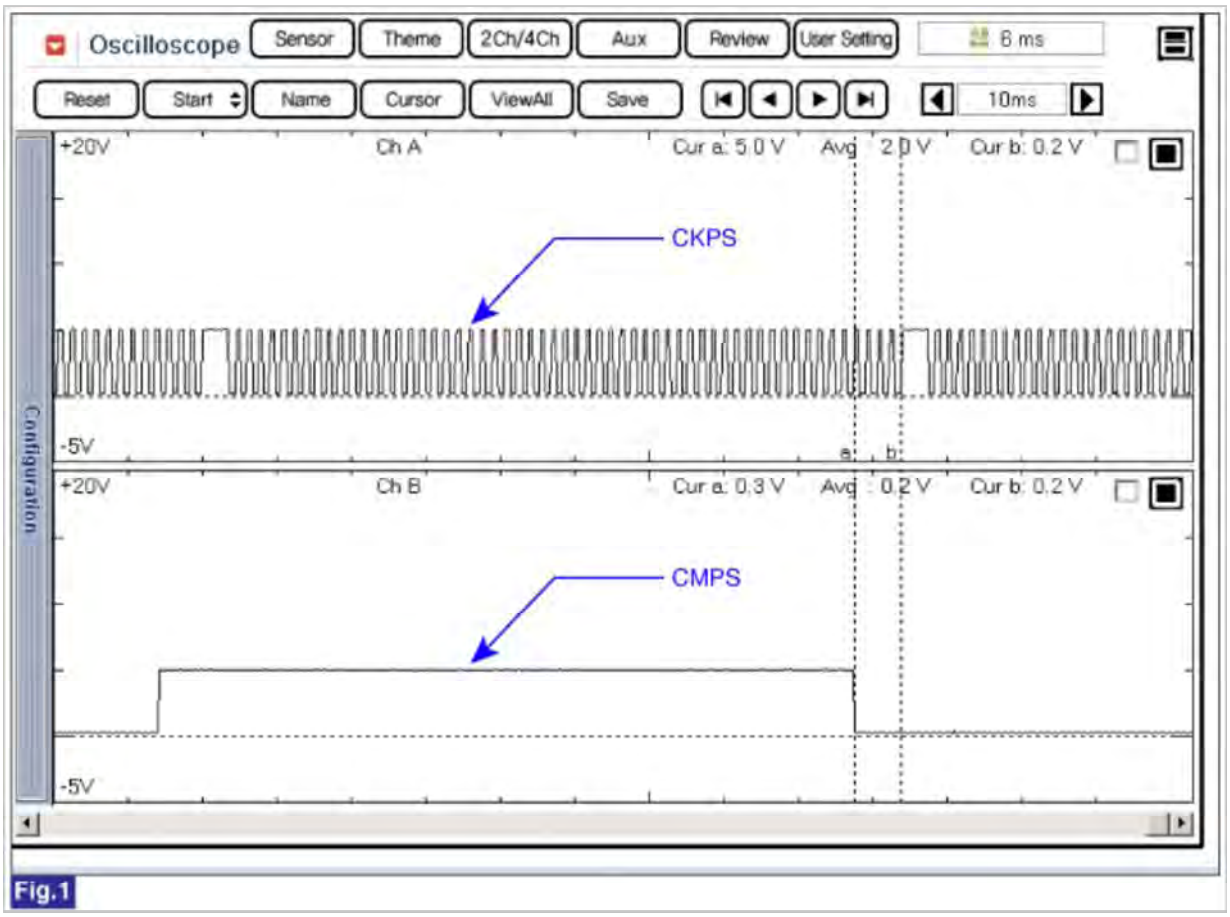
NOTE

- 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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Timing Inspection
   (1) With ignition "OFF", set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS(back probe), (-): ground
   Channel B (+): terminal 2 of the CMPS(back probe), (-): ground
   (2) Start the engine and check for signal waveform whether synchronize with camshaft sensor or not and tooth is missing refer to sample waveforms as below.



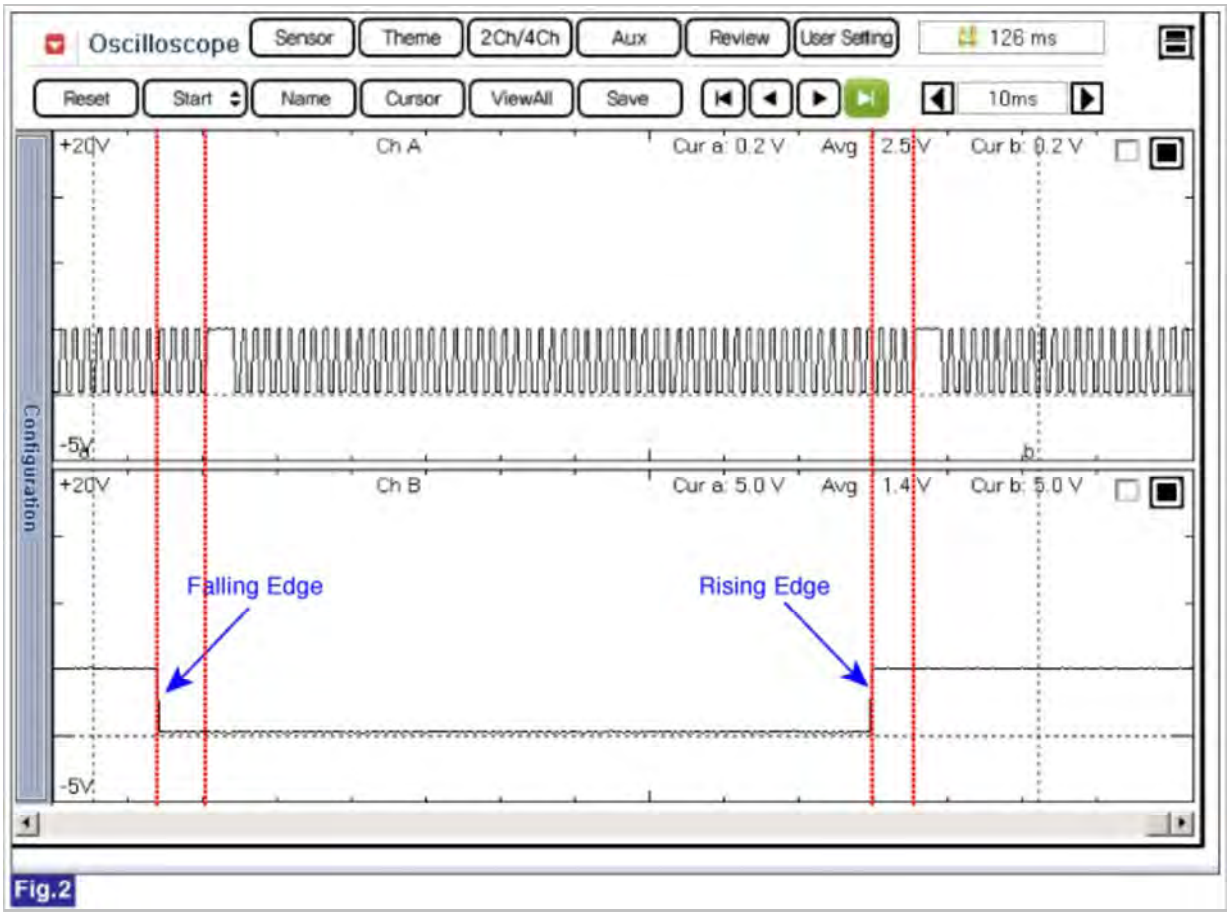


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2) The CMPS falling(rising) edge is coincided with 3rd~5th tooth of the CKP from one longer signal(missing tooth)

(3) Is the signal waveform normal?

YES	▸ Go to next step as below
NO	▸ Check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys for the followings. • Alignment of the timing belt • Alignment of the camshaft timing chainReadjust or repair as necessary and go to "Verification of Vehicle Repair" procedure

■ Check OCV and Filter

1. Check operation of OCV
   (1) Ignition "OFF"
   (2) Disconnect intake OCV connector.
   (3) Start the engine and let it idle.
   (4) With OCV connector still disconnected, connect 12V and a ground to 2 and 1 of the OCV(Component side).
   Specification :

Test Condition	Disconnect OCV connector	Apply battery voltage
Normal Value	Normal engine speed	Rough idle or engine stall

   (5) Has a problem been found?

YES	▸ Go to next step as below.
NO	▸ Go to "Check CVVT(Continuously Variable Valve Timing) Assembly" procedure.

2. Check OCV and Filter
   (1) Ignition"OFF"

(2) Check OCV filter for sticking or contamination.

(3) Remove the OCV and visually check the spool column of OCV for contamination

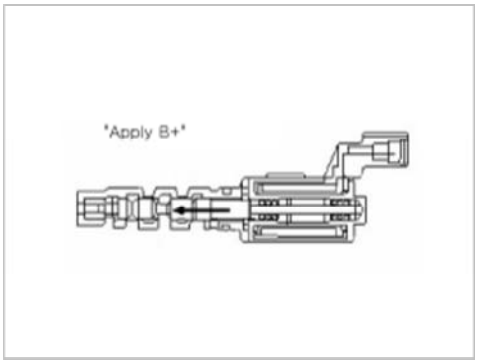
(4) Has a problem been found?

YES	▸ Clean or replace as necessary and then go to "Verification of Vehicle Repair" procedure
NO	▸ Go to next step as below

(5) Apply 12V and a ground to 2 and 1 terminals of the OCV(Component side).

(6) Verify that a "clicking" sound is heard when applying the battery voltage.

(7) Repeat this procedure 4 or 5 times to ensure intake OCV reliability.

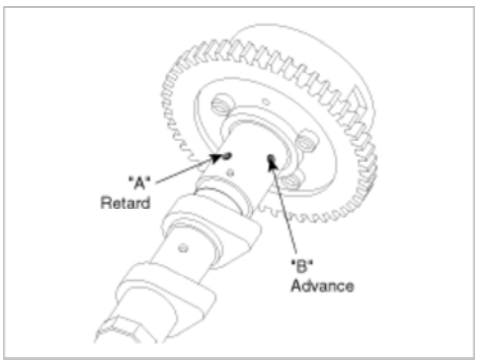


(8) Is OCV working properly?

YES	▸ Go to next step as below
NO	▸ Check OCV for contamination, deterioration, or damage. Substitute with a known-good OCV and check for proper operation. If the problem is corrected, replace OCV and then go to "Verification of Vehicle Repair" procedure

■ Check CVVT(Continuously Variable Valve Timing) Assembly

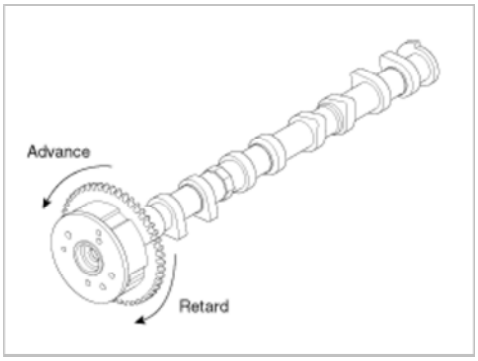
1. Remove the CVVT assembly. Refer to "Removal Procedure" in Workshop Manual
2. Check that the CVVT assembly is locked.
3. The one of the 2 holes on the cam journal is for advances(upper) and the rest is for retards(lower). Apply masking tape to all oil path holes except the one advance hole("B") indicated by the arrow as shown in the figure.



4. To release the CVVT lock pin, wrap some tape around the tip of an air pressure adapter and apply low air pressure of approx. 150kPa(1.5kg/cm², 21 psi) to the exposed camshaft port. Wrap a shop towel or rag around the CVVT because residual oil may leak out of the unit when applying air pressure.
5. With low air pressure applied, turn the CVVT to the ADVANCE direction as indicated in the figure.

NOTE

If too much air leaks when applying the low air pressure, the CVVT lock pin may not release and the CVVT may not turn.



6. Allow the CVVT assembly to move in the ADVANCE and DELAY directions to ensure there is no binding and that it moves freely.(Movable smoothly in the range about 20°)
7. Turn the CVVT by hand and make sure it locks in the maximum delay angle position.
8. Is CVVT assembly working properly?

YES	▸ Go to next step as below.
NO	▸ Replace the CVVT assembly 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	▸ 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.

Verification of Vehicle Repair

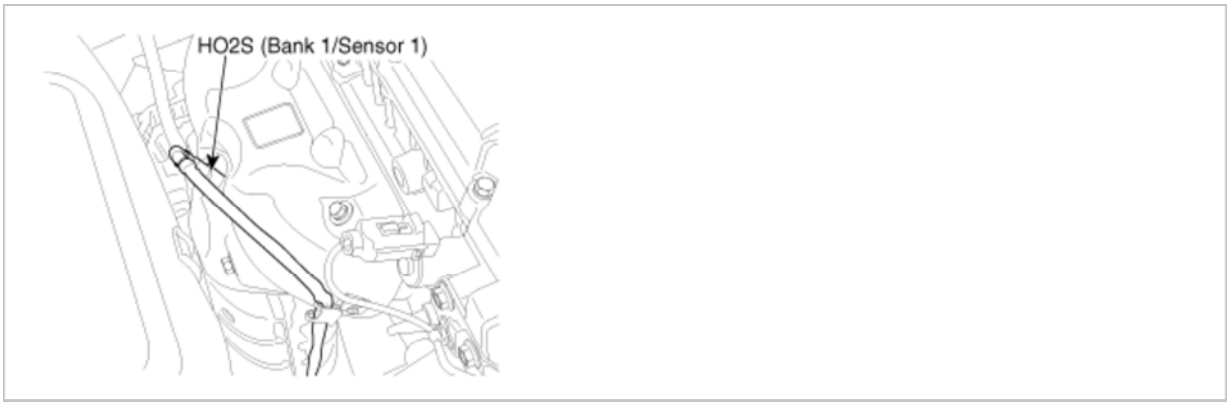
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0030 HO2S Heater Control Circuit (Bank 1 / Sensor 1)

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 PCM 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 PCM determines if a front HO2S heater fault has occurred and sets DTC P0030 if the front HO2S heater control driver inside the PCM 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.

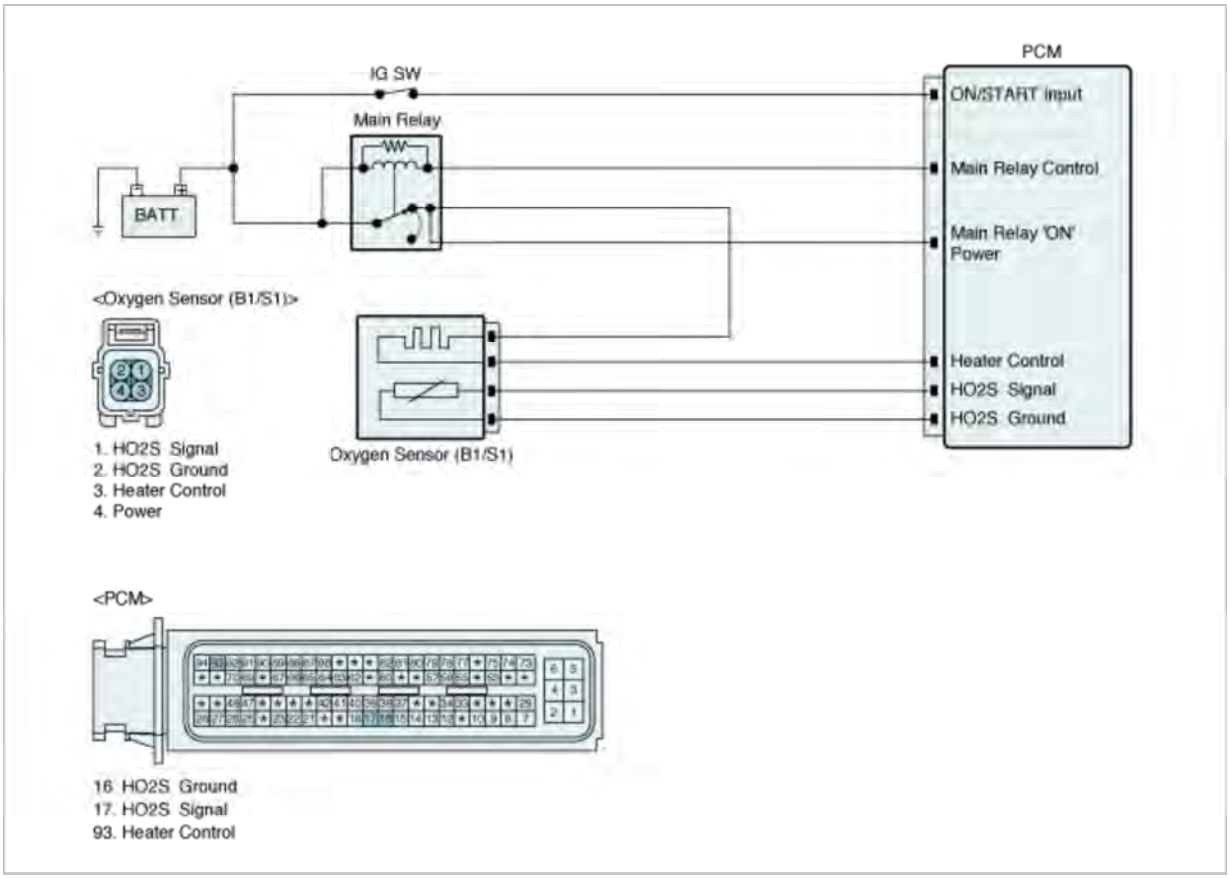
DTC Detecting Condition

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	• 11 < Battery voltage < 16V • Dewpoint exceeded • No relevant failure • Time after start elapsed:240 sec. • 1% < Heater power < 99% • Exhaust gas Temp. model < 650°C	
Threshold Value	• Element resistance > 2100 Ω (Element temperature < 500° C)	
Diagnostic Time	• 5 min.	
Mil On Condition	• 2 Driving Cycles	
Fail Safe	• EVAP. emission control function is controlled in minimum operation mode	

Specification

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S connector
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between power terminal of HO2S(B1/S1) heater harness connector and chassis ground.

Specification : B+

5. Is voltage display near the specified value?

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 Sensor fuse" is installed and not blown. Repair as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

Control Circuit Inspection

1. Measure voltage between control terminal of HO2S(B1/S1) heater harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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. Has a problem been found?

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. Measure resistance between power and control terminals of HO2S(B1/S1) heater(Component Side).
Specification :

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

3. Is HO2S heater resistance display near the specified value?

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 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.

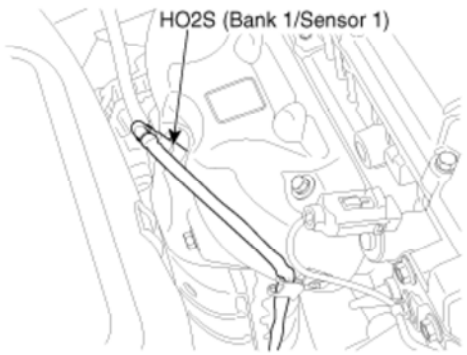
Verification of Vehicle Repair

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

Fuel System > Engine Control System > P0031 HO2S Heater Control Circuit Low (Bank 1 / Sensor 1)

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 PCM 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

PCM sets DTC P0031 if the PCM detects that the front HO2S heater control circuit is short to ground.

DTC Detecting Condition

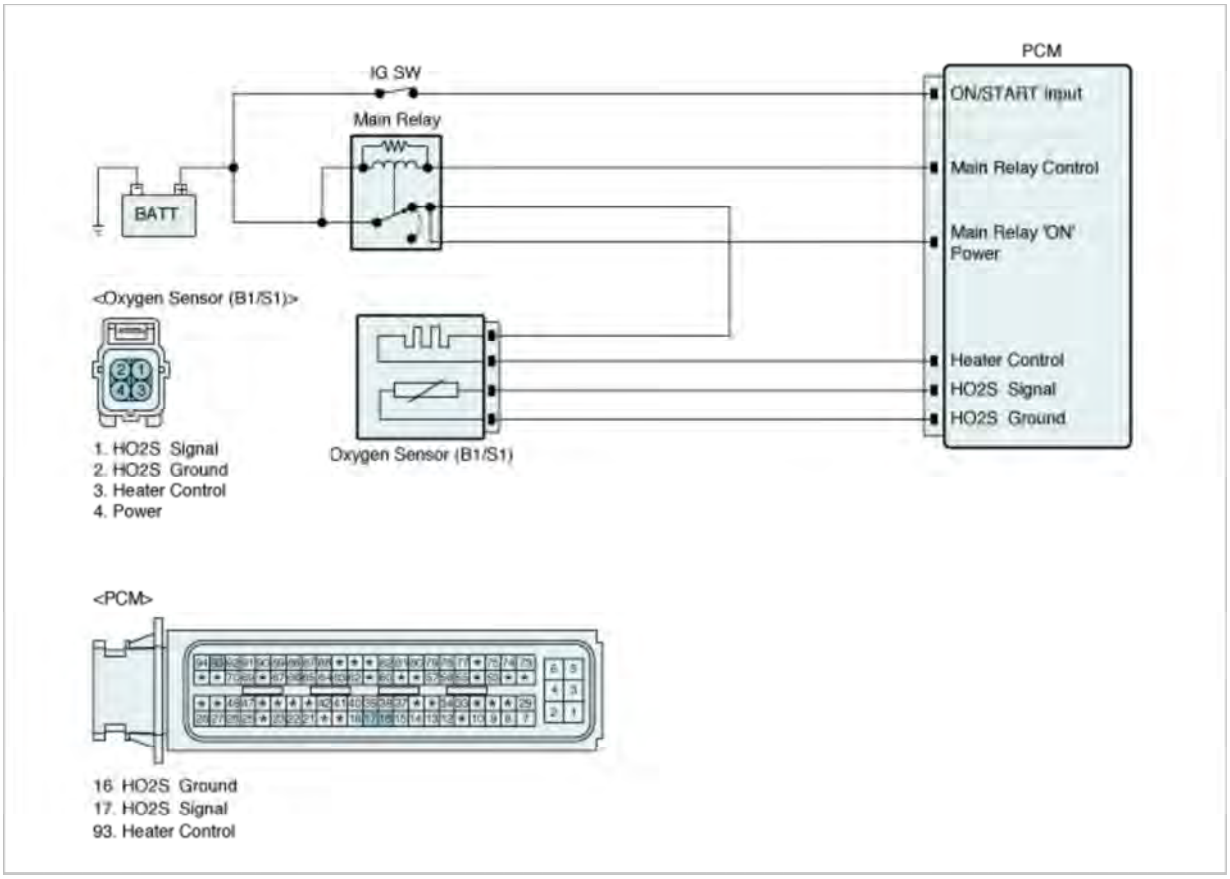
Item	Detecting Condition	Possible Cause

DTC Strategy	• Electrical Check	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Poor connection or damaged harness • Faulty HO2S
Enable Conditions	• 10V < Battery voltage < 16V • 1.2% < Heater power < 99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 10 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S sensor connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between power terminal of the HO2S heater harness connector and chassis ground.

Specification : B+

5. Is voltage display near the specified value?

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 "15A Sensor fuse" is installed and not blown. Repair as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

Control Circuit Inspection

1. Measure voltage between control terminal of the HO2S heater harness connector and chassis ground.
2. Is voltage display near the specified value?

YES	▸ Go to next step as below.
NO	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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. Has a problem been found?

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. Measure resistance between power and control terminals of HO2S(B1/S1) heater(Component Side).
   Specification :

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

3. Is HO2S heater resistance display near the specified value?

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 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

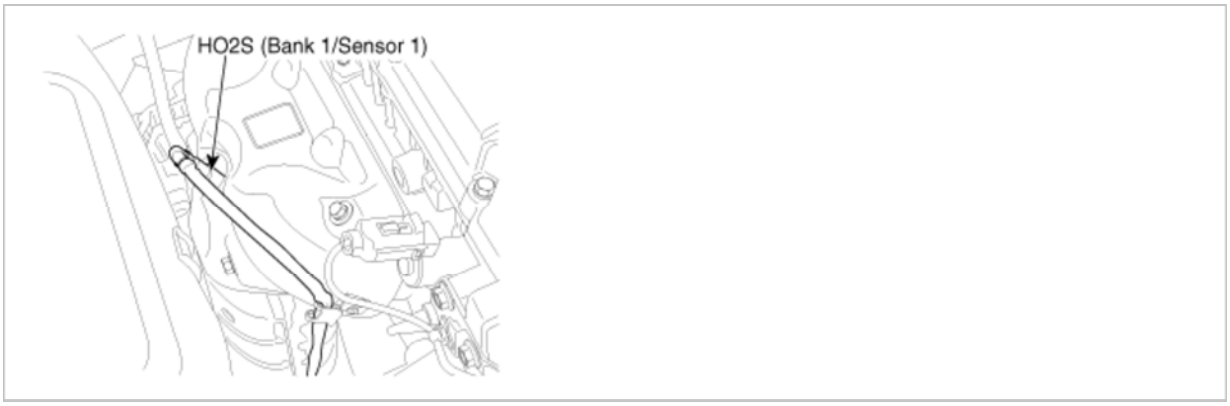
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0032 HO2S Heater Control Circuit High (Bank 1 / Sensor 1)

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 PCM 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

PCM sets DTC P0032 if the PCM detects that the front HO2S heater control line is open or short to battery circuit.

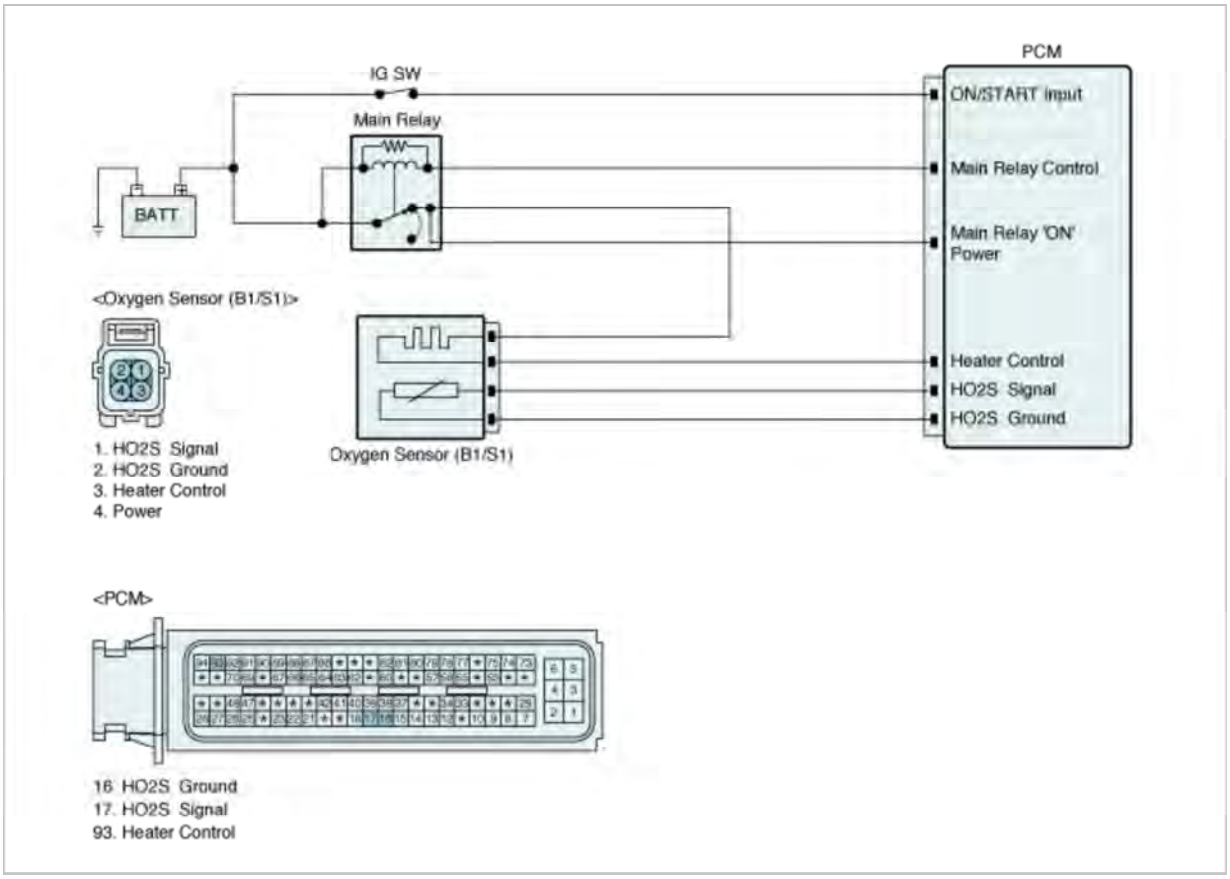
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open or short to battery in control harness • Poor connection or damaged harness • Faulty HO2S
Enable Conditions	• 10V < Battery voltage < 16V • 1% < Heater power < 99%	
Threshold Value	• Short to Battery or Line break	
Diagnostic Time	• 10 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Control Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S sensor connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between control terminal of the HO2S heater harness connector and chassis ground.

Specification : Approx. 4~5V

5. Is voltage within the specification?

YES	▸ Go to next step as below
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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. Has a problem been found?

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. Measure resistance between power and control terminals of HO2S(B1/S1) heater(Component Side).
Specification :

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

3. Is HO2S heater resistance display near the specified value?

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 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

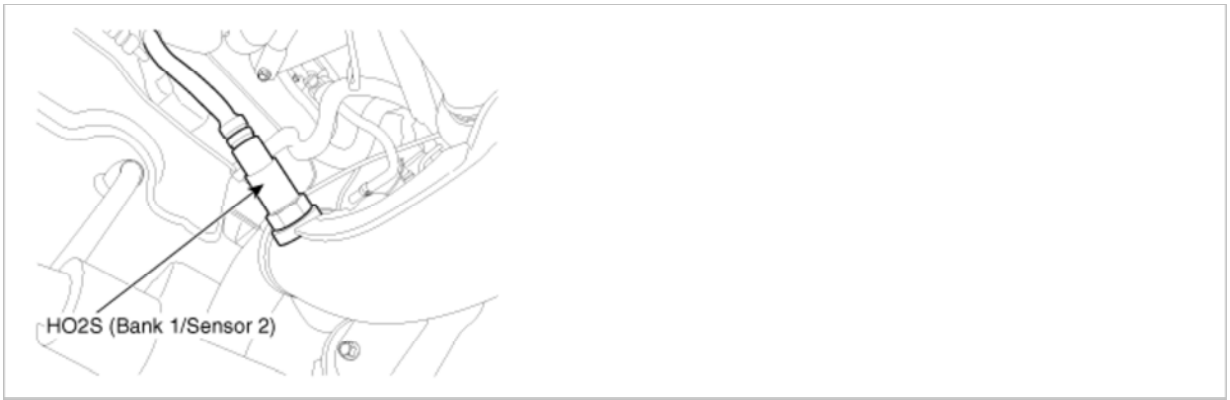
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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..

Fuel System > Engine Control System > P0036 HO2S Heater Control Circuit (Bank 1 / Sensor 2)

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 PCM 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 PCM determines when a rear HO2S heater fault occurs and sets DTC P0036 if measured rear HO2S resistance is lower than the predetermined threshold.

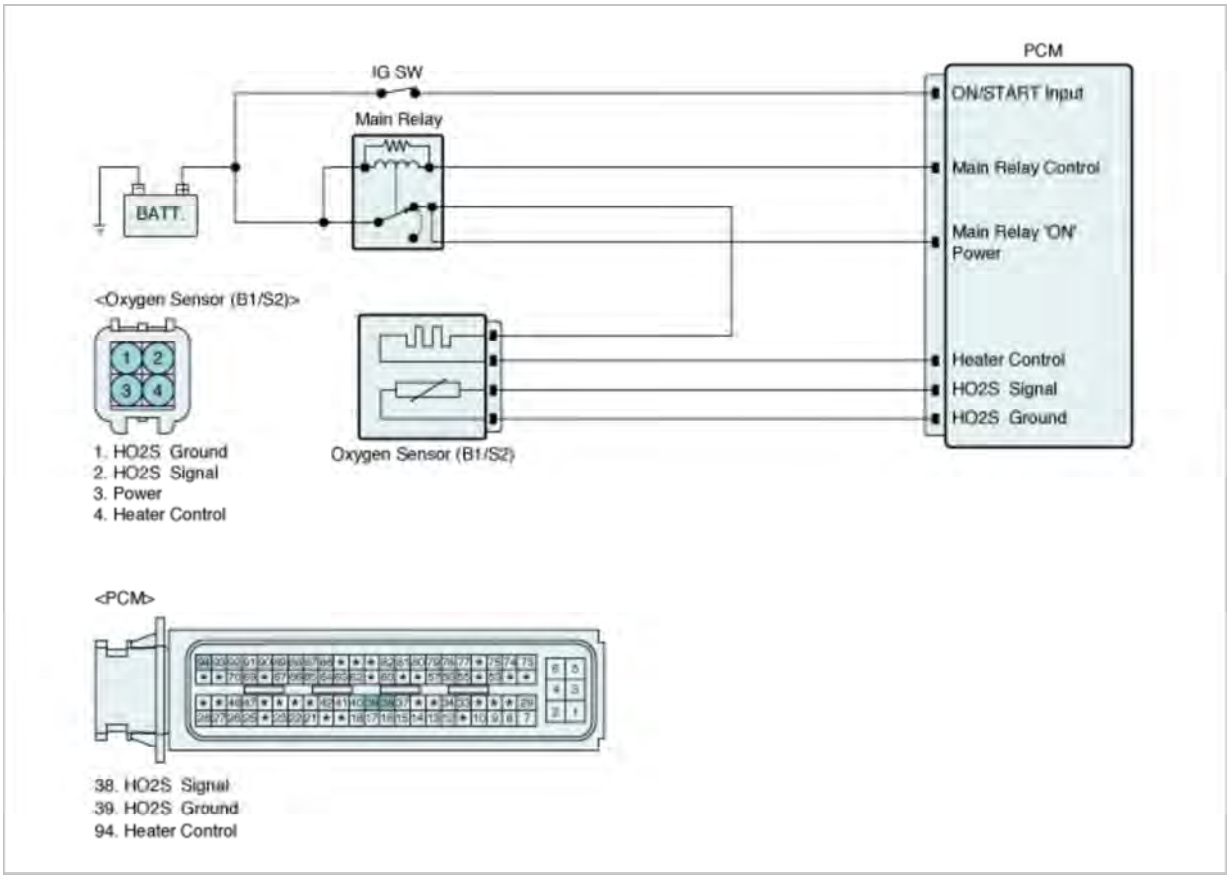
DTC Detecting Condition

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 • Poor connection or damaged harness • Faulty HO2S
Enable Conditions	• HO2S sensor pre-heating phase finished • 1% < Heater PWM < 99% • Time after start elapsed:240 sec. • 11V<Battery voltage<16V • Exhaust gas temp.model<650°C(1,202°F) • No relevant failure	
Threshold Value	• HO2S Element Resistance > 1100 Ohm (Catalyst Temperature < 550°C(1022°F))	
Diagnostic Time	• 5 min.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S sensor connector
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between power terminal 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 "SENSOR2 FUSE 15A" is installed and not blown. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

Control Circuit Inspection

1. Measure voltage between control terminal of the HO2S heater harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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.

Component Inspection

1. Ignition "OFF"
2. Measure resistance between power terminal and control terminal of the sensor connector (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

3. Is resistance within the specification?

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 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 GDS 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..

Fuel System > Engine Control System > P0037 HO2S Heater Control Circuit Low (Bank 1 / Sensor 2)

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 PCM 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

PCM sets DTC P0037 if the PCM detects that the rear HO2S heater control line is short to ground.

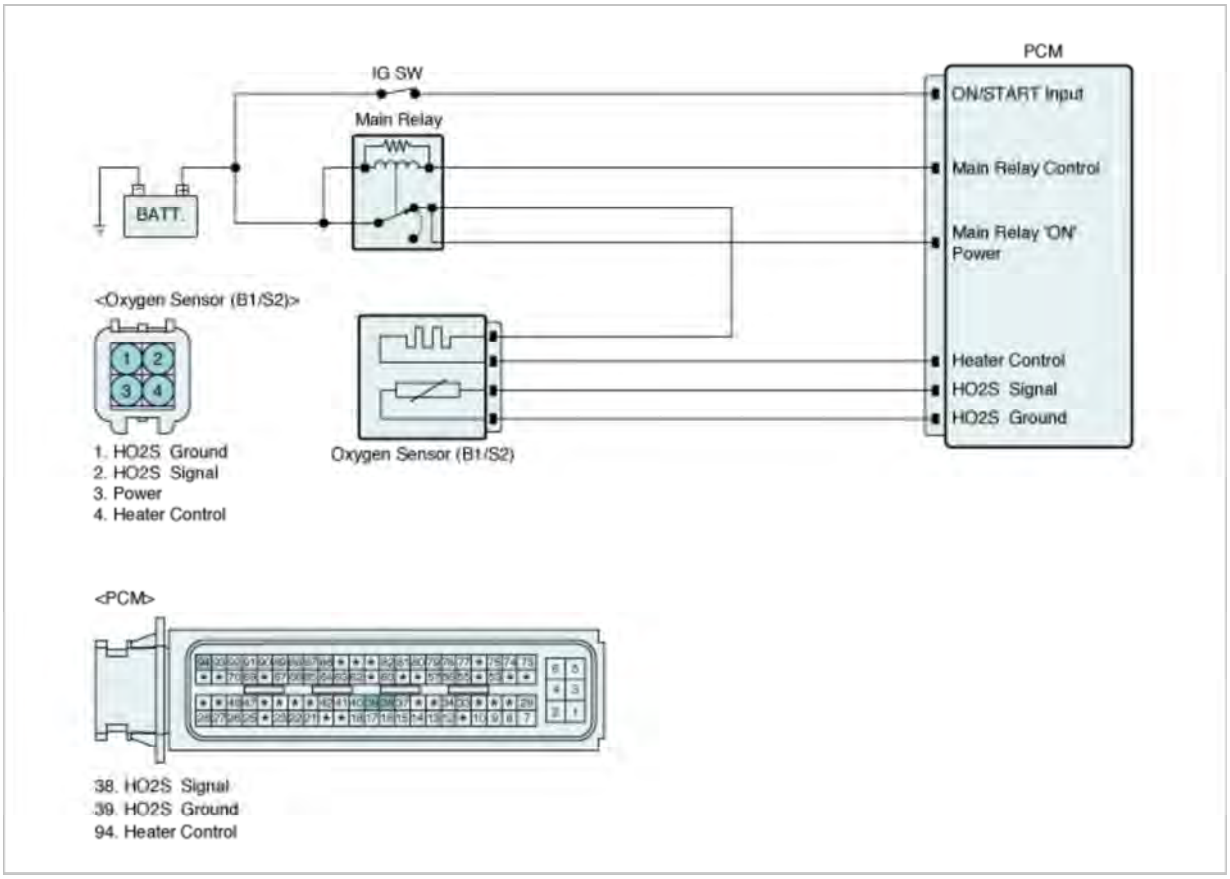
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Related fuse blown or missing • Open or short to ground in power supply or control harness • Poor connection or damaged harness • Faulty HO2S
Enable Conditions	• 10V < Battery voltage < 16V • 1% < Heater PWM < 99%	
Threshold Value	• Short to ground	
Diagnostic Time	• 10 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S sensor connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between power terminal 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 "SENSOR2 FUSE 15A" is installed and not blown. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

Control Circuit Inspection

1. Measure voltage between control terminal of the HO2S heater harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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.

Component Inspection

1. Ignition "OFF"
2. Measure resistance between power terminal and control terminal of the sensor connector (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

3. Is resistance within the specification?

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 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

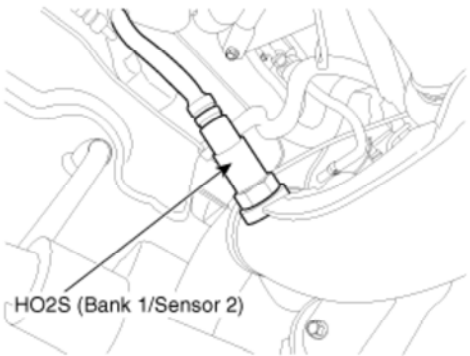
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0038 HO2S Heater Control Circuit High (Bank 1 / Sensor 2)

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 PCM 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

PCM sets DTC P0038 if the PCM detects that the rear HO2S heater control line is open or short to battery line.

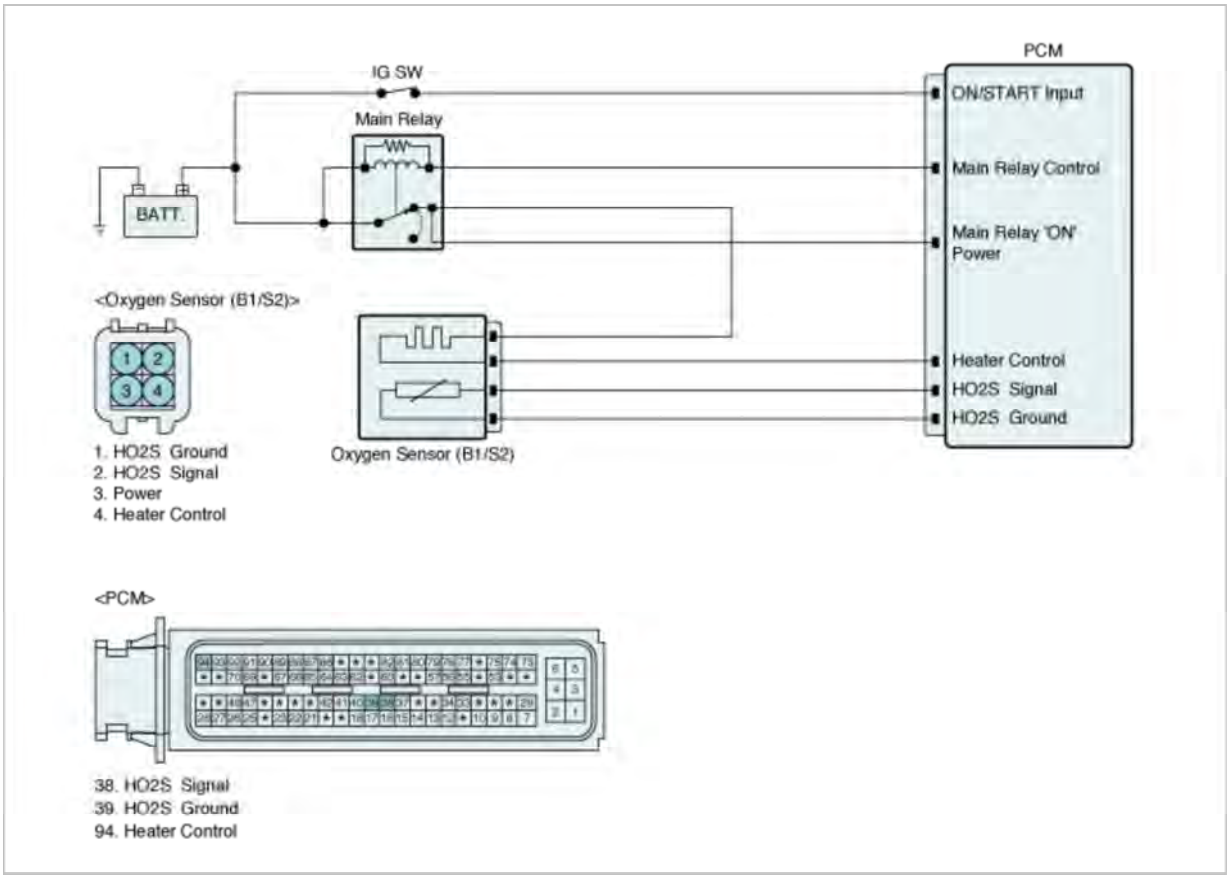
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open or short to battery in control harness • Poor connection or damaged harness • Faulty HO2S
Enable Conditions	• 10V < Battery voltage < 16V • 1% < Heater PWM < 99%	
Threshold Value	• Short to Battery or Line break	
Diagnostic Time	• 10 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Control Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S sensor connector
3. Ignition "ON" & Eng. "OFF"
4. Measure voltage between control terminal of the HO2S heater harness connector and chassis ground.

Specification : Approx. 4~5V

5. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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.

Component Inspection

1. Ignition "OFF"
2. Measure resistance between power terminal and control terminal of the sensor connector (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Heater Resistance (Ω)
18~20	64~82	Approx. 9

3. Is resistance within the specification?

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 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

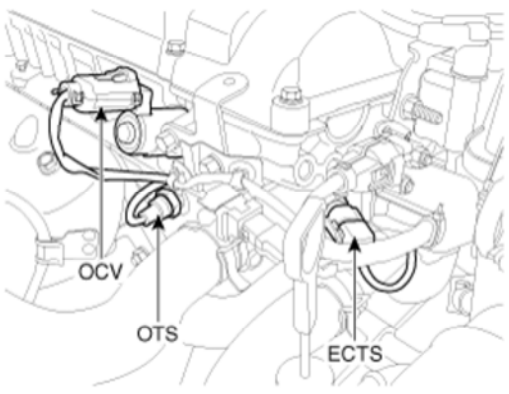
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0076 Intake Valve Control Solenoid Circuit-Low (Bank 1)

Component Location



General Description

The CVVT (Continuously Variable Valve Timing) system built on the camshaft helps the engine decrease the exhaust gas and increase engine power and fuel economy by changing the valve open/close timing of the intake camshaft continuously. The intake valve control solenoid, the main control part of the CVVT, changes the direction of the oil path through the CVVT by the duty

control of the PCM and changes the open and close timing of the intake and exhaust valves.

DTC Description

PCM sets DTC P0076 if the PCM detects that the intake valve control solenoid control circuit is short to ground.

DTC Detecting Condition

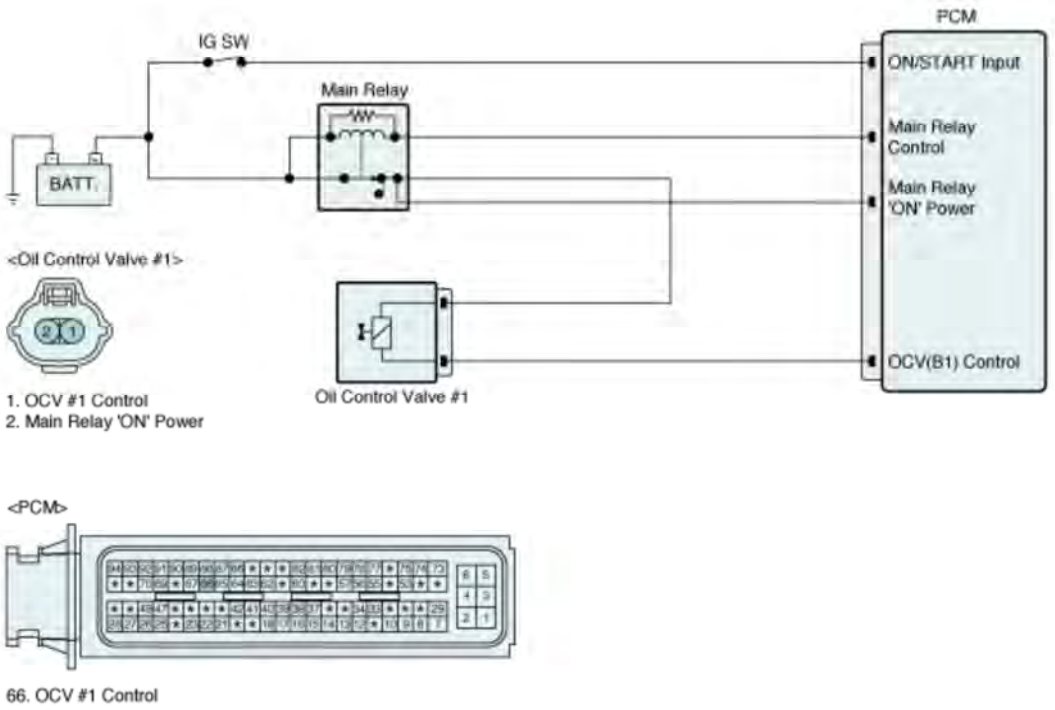
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Short to ground in control circuit • Poor connection or damaged harness • Faulty Intake Valve Control Solenoid
Enable Conditions	• 10V < Battery voltage < 16V	
Threshold Value	• Short to ground	
Diagnostic Time	• 2 seconds	
Mil On Condition	• 2 Driving Cycles	

Specification

Oil Control Valve	Normal Parameter At 20°C (68°F)
Insulation Resistance	Above 50MΩ

Temp.(°C)	Temp.(°F)	Resistance(Ω)	Temp.(°C)	Temp.(°F)	Resistance(Ω)
0	32	6.2 ~ 7.4	60	140	8.0 ~ 9.2
10	50	6.5 ~ 7.7	70	158	8.3 ~ 9.5
20	68	6.9 ~ 7.9	80	176	8.6 ~ 9.8
30	86	7.1 ~ 8.3	90	194	8.9 ~ 10.1
40	104	7.4 ~ 8.6	100	212	9.2 ~ 10.4
50	122	7.7 ~ 8.9			

Diagnostic Circuit Diagram



Signal Waveform & Data

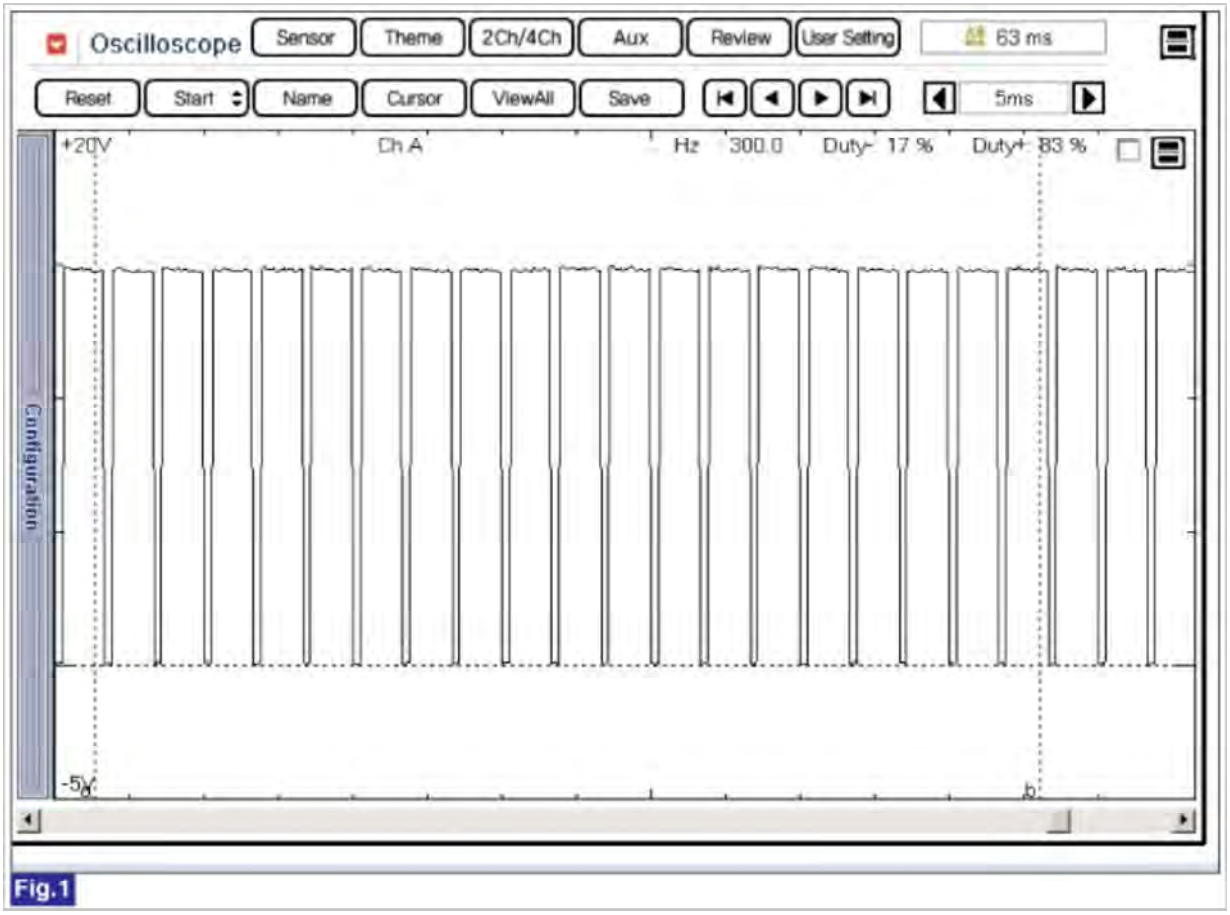


Fig.1

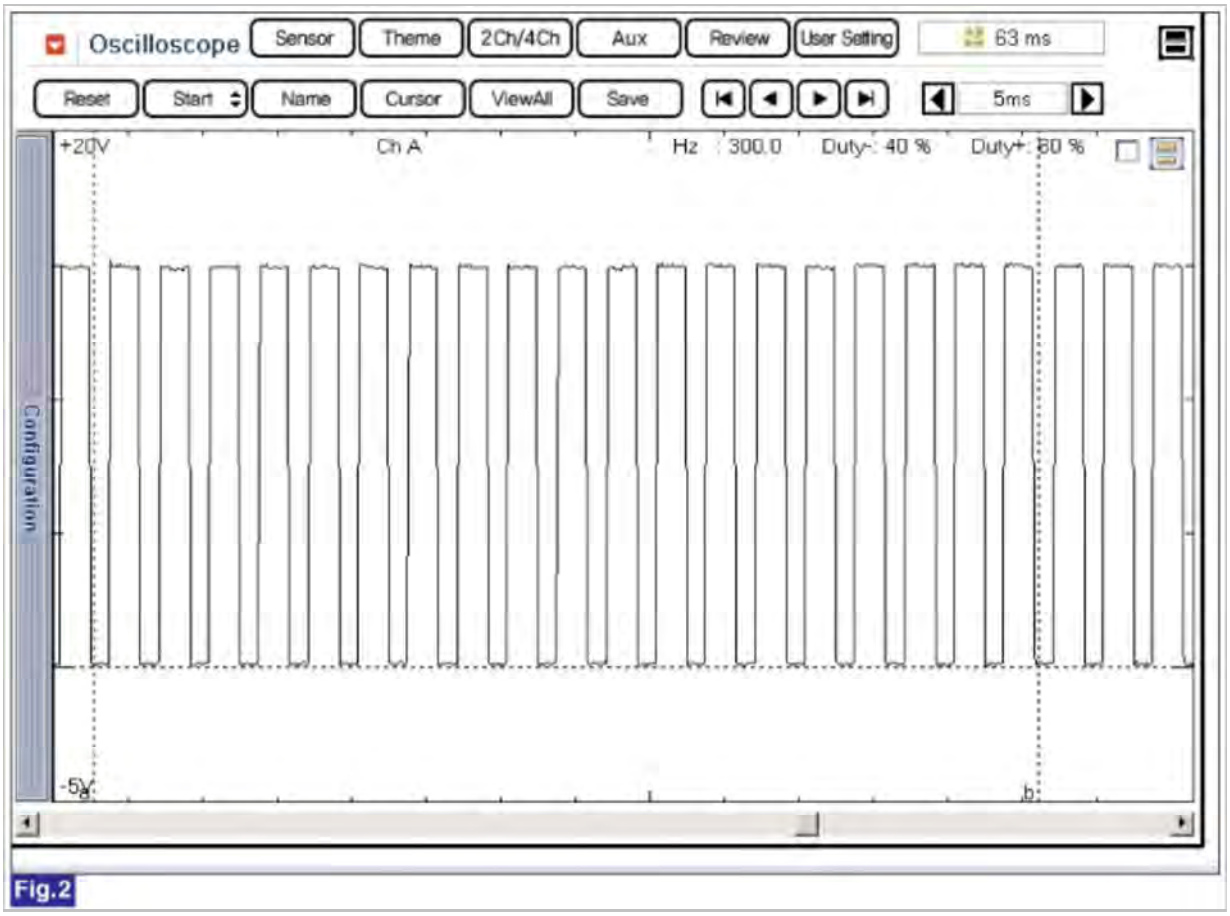
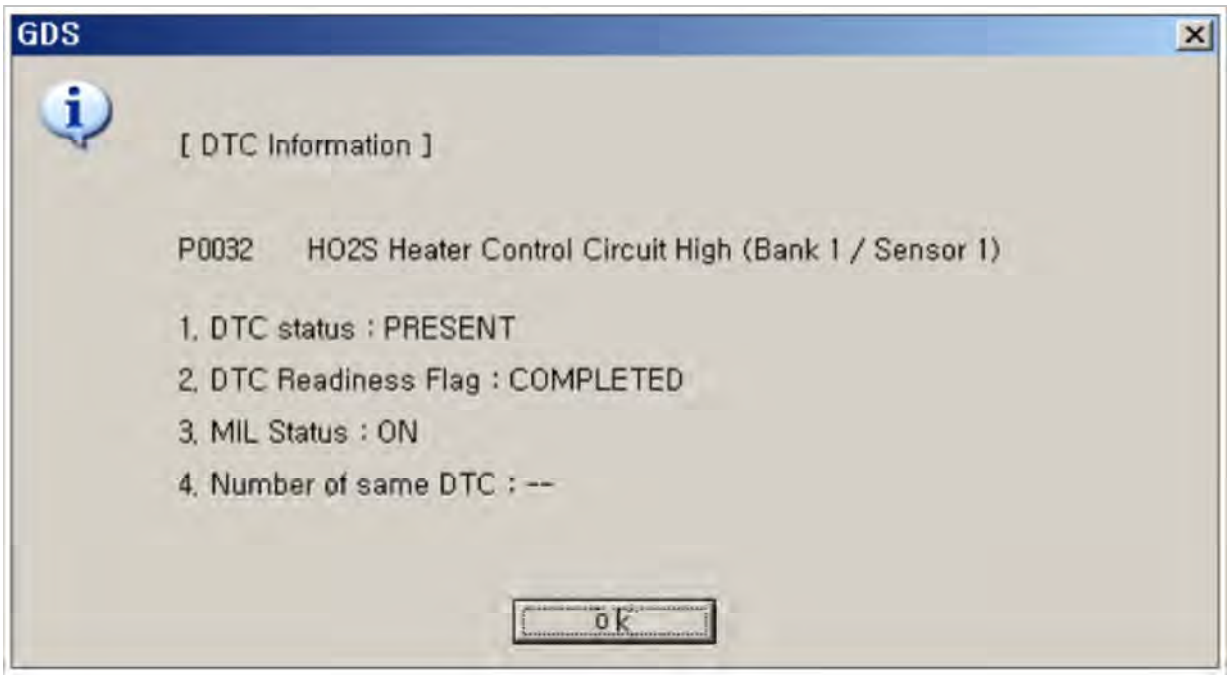


Fig.1) Normal OCV (-) duty ratio with idle : Approx. 12~20%
Fig.2) Normal OCV (-) duty ratio with maintaining 2000RPM : Approx. 30~50%

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect oil control valve connector
3. Measure resistance between power terminal and control terminal of the solenoid connector(Component side).
   Specification :

Temp.(°C)	Temp.(°F)	Resistance(Ω)
0	32	6.2 ~ 7.4
10	50	6.5 ~ 7.7
20	68	6.9 ~ 7.9
30	86	7.1 ~ 8.3
40	104	7.4 ~ 8.6
50	122	7.7 ~ 8.9
60	140	8.0 ~ 9.2
70	158	8.3 ~ 9.5
80	176	8.6 ~ 9.8
90	194	8.9 ~ 10.1
100	212	9.2 ~ 10.4

4. Is resistance within specification?

YES	▸ Go to next step as below.
NO	▸ Check oil control valve for contamination, deterioration, or damage. Substitute with a known-good solenoid and check for proper operation. If the problem is corrected, replace solenoid and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of the oil control valve harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within specification?

YES	▸ Go to "Control Circuit Inspection" procedure.
NO	▸ Repair open or short to ground in the power supply circuit and go to "Verification of Vehicle Repair" procedure.

Control circuit inspection

1. Measure voltage between terminal 1 of the oil control valve harness connector and chassis ground.

Specification : Approx. 3~4V

NOTE

Signal waveform in control circuit with ignition ON & Engine OFF

2. Is voltage within specification?

YES	▸ Go to "Terminal and Connector Inspection" procedure.
NO	▸ Repair short to ground in control 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	▸ 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.

Verification of Vehicle Repair

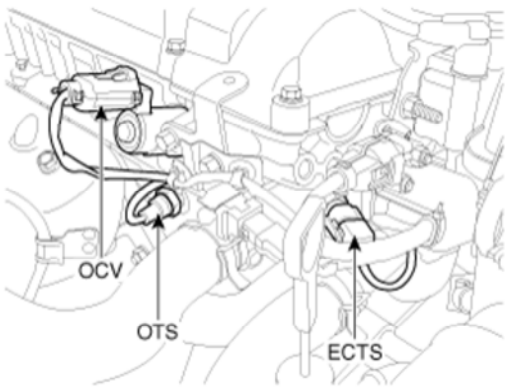
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0077 Intake Valve Control Solenoid Circuit-High (Bank 1)

Component Location



General Description

The CVVT (Continuously Variable Valve Timing) system built on the camshaft helps the engine decrease the exhaust gas and

increase engine power and fuel economy by changing the valve open/close timing of the intake camshaft continuously. The intake valve control solenoid, the main control part of the CVVT, changes the direction of the oil path through the CVVT by the duty control of the PCM and changes the open and close timing of the intake and exhaust valves.

DTC Description

PCM sets DTC P0077 if the PCM detects that the OCV control circuit is open or short to battery.

DTC Detecting Condition

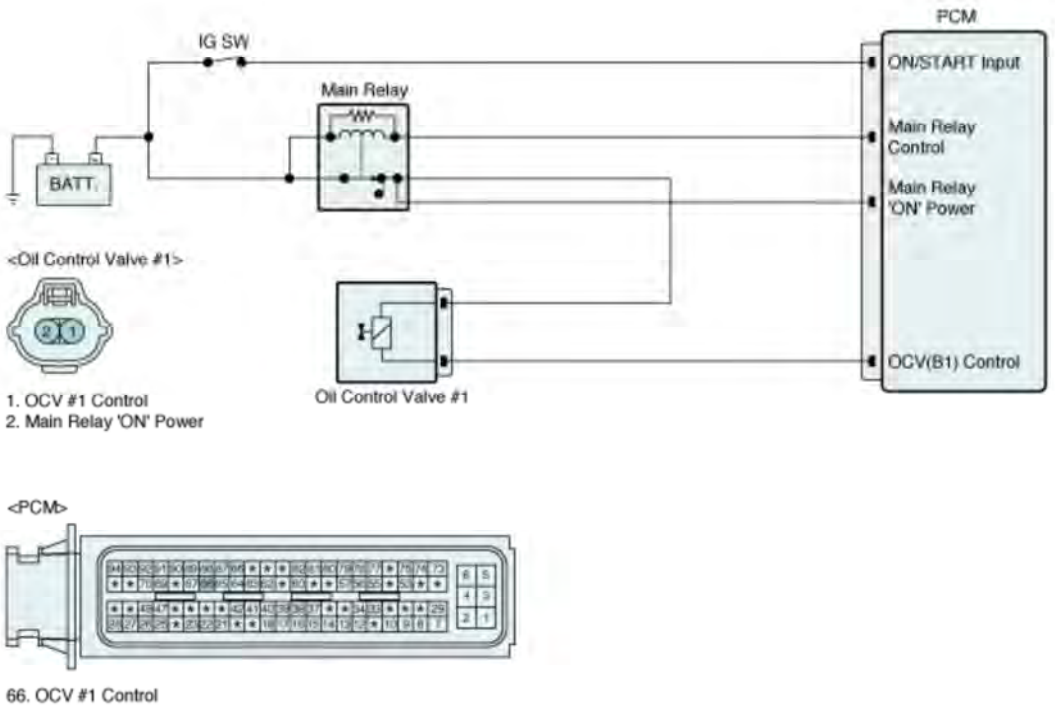
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open or short to battery in control circuit • Poor connection or damaged harness • Faulty Intake Valve Control Solenoid
Enable Conditions	• 10V < Battery voltage < 16V	
Threshold Value	• Short to battery or Line break	
Diagnostic Time	• 2 seconds	
Mil On Condition	• 2 Driving Cycles	

Specification

Oil Control Valve	Normal Parameter At 20°C (68°F)
Insulation Resistance	Above 50MΩ

Temp.(°C)	Temp.(°F)	Resistance(Ω)	Temp.(°C)	Temp.(°F)	Resistance(Ω)
0	32	6.2 ~ 7.4	60	140	8.0 ~ 9.2
10	50	6.5 ~ 7.7	70	158	8.3 ~ 9.5
20	68	6.9 ~ 7.9	80	176	8.6 ~ 9.8
30	86	7.1 ~ 8.3	90	194	8.9 ~ 10.1
40	104	7.4 ~ 8.6	100	212	9.2 ~ 10.4
50	122	7.7 ~ 8.9			

Diagnostic Circuit Diagram



Signal Waveform & Data

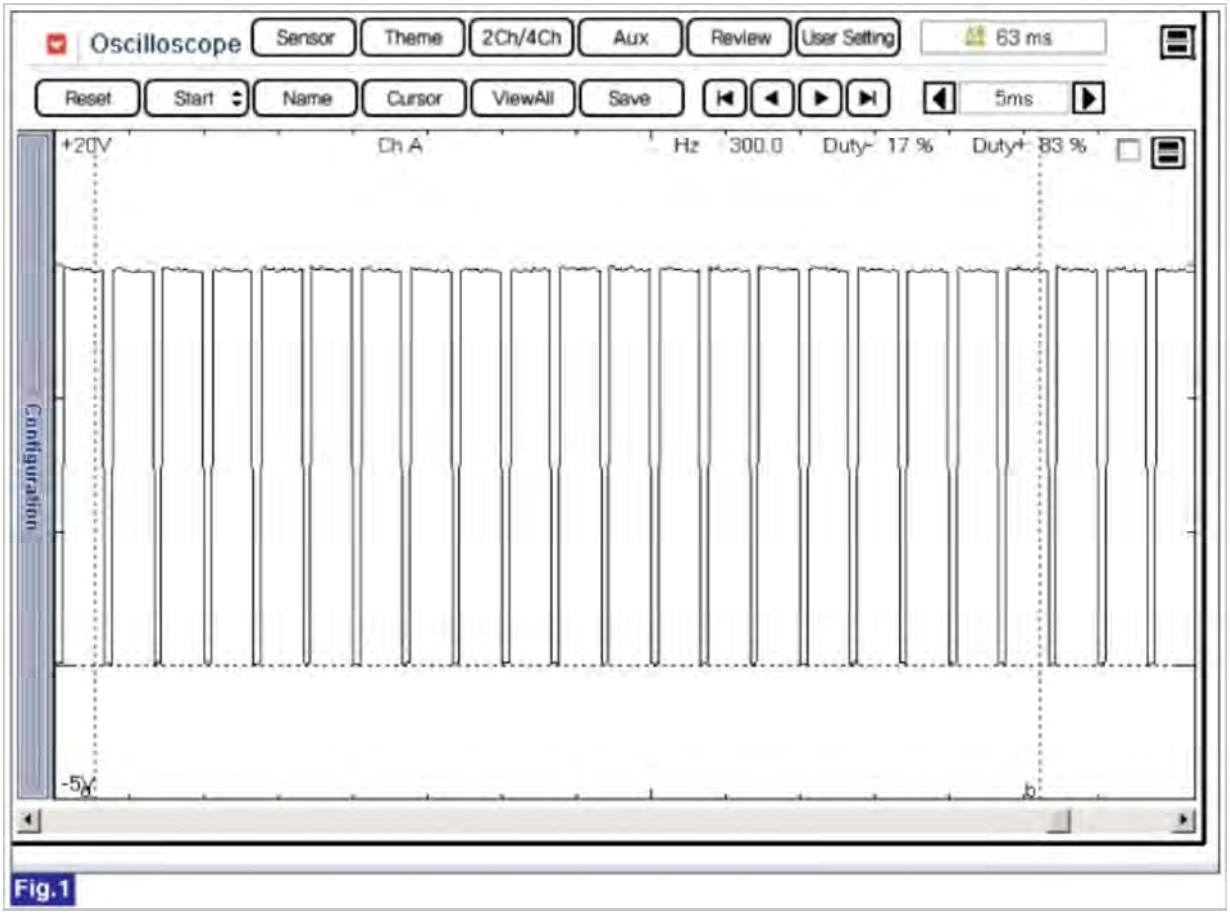


Fig.1

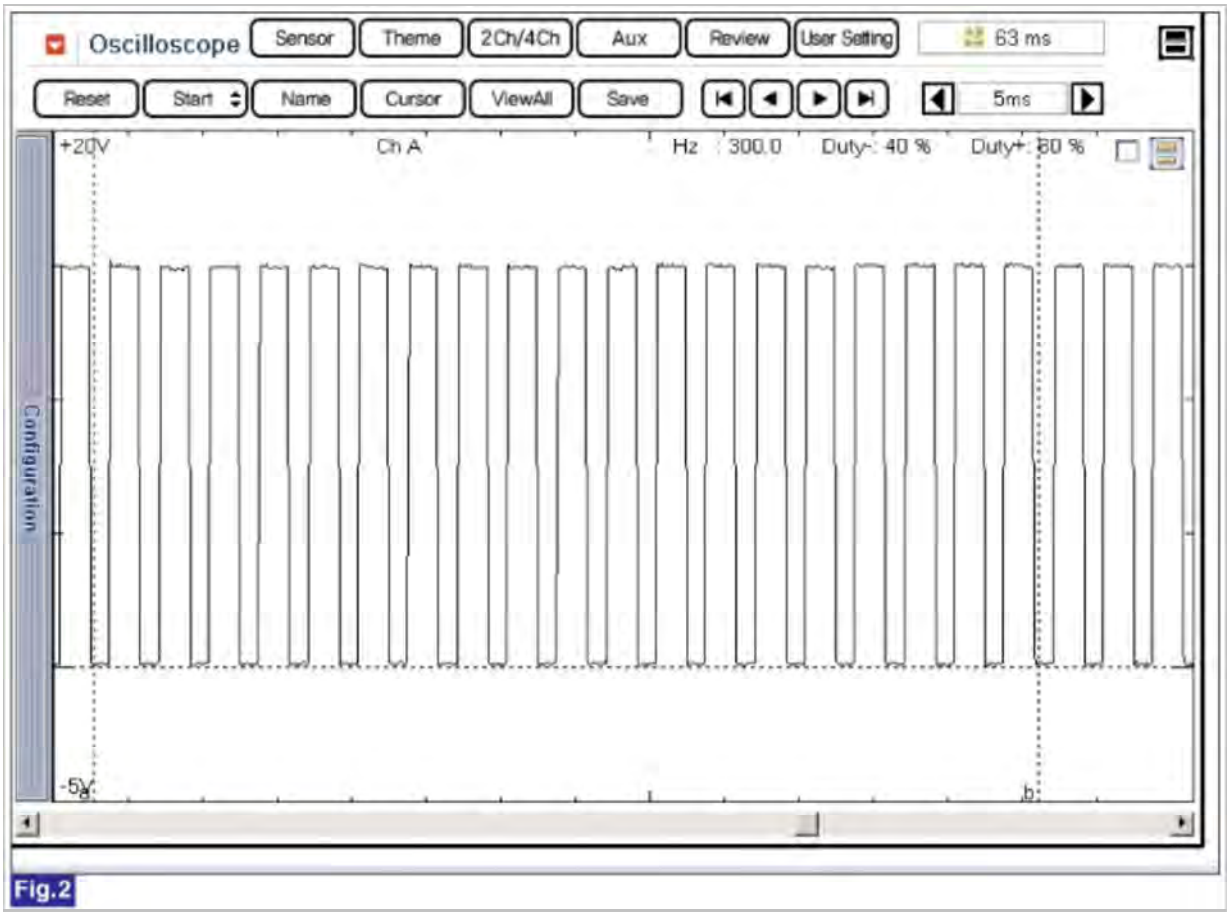
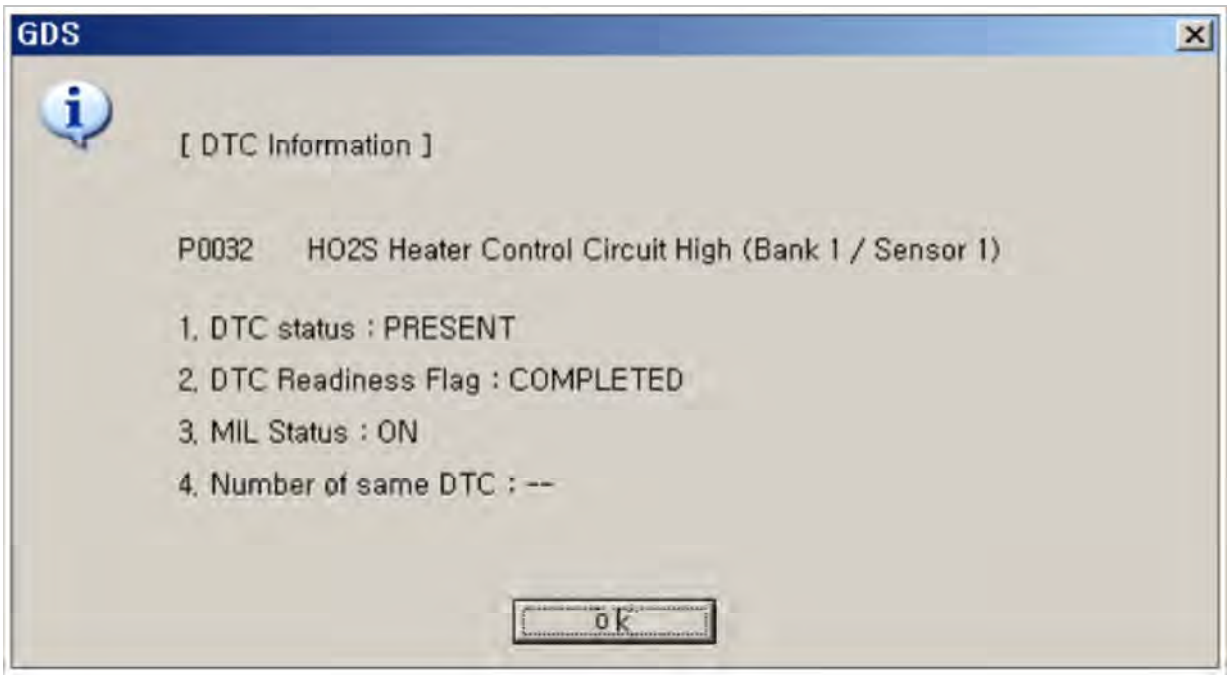


Fig.1) Normal OCV (-) duty ratio with idle : Approx. 12~20%
Fig.2) Normal OCV (-) duty ratio with maintaining 2000RPM : Approx. 30~50%

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect oil control valve connector
3. Measure resistance between power terminal and control terminal of the solenoid connector(Component side).
   Specification :

Temp.(°C)	Temp.(°F)	Resistance(Ω)
0	32	6.2 ~ 7.4
10	50	6.5 ~ 7.7
20	68	6.9 ~ 7.9
30	86	7.1 ~ 8.3
40	104	7.4 ~ 8.6
50	122	7.7 ~ 8.9
60	140	8.0 ~ 9.2
70	158	8.3 ~ 9.5
80	176	8.6 ~ 9.8
90	194	8.9 ~ 10.1
100	212	9.2 ~ 10.4

4. Is resistance within specification?

YES	▸ Go to next step as below.
NO	▸ Check oil control valve for contamination, deterioration, or damage. Substitute with a known-good solenoid and check for proper operation. If the problem is corrected, replace solenoid and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of the oil control valve harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within specification?

YES	▸ Go to "Control Circuit Inspection" procedure.
NO	▸ Repair open or short to ground in the power supply circuit and go to "Verification of Vehicle Repair" procedure.

Control circuit inspection

1. Measure voltage between terminal 1 of the oil control valve harness connector and chassis ground.

Specification : Approx. 3~4V

NOTE

Signal waveform in control circuit with ignition ON & Engine OFF

2. Is voltage within specification?

YES	▸ Go to "Terminal and Connector Inspection" procedure.
NO	▸ Repair short to ground in control 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	▸ 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.

Verification of Vehicle Repair

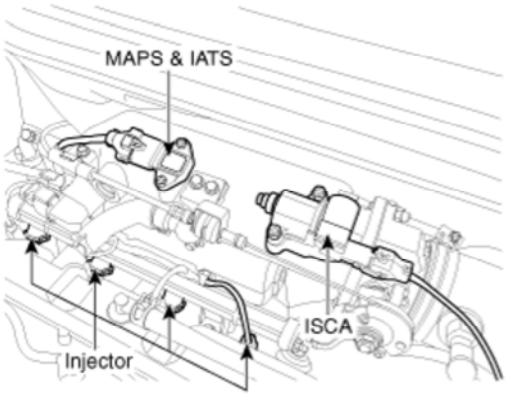
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0106 Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance

Component Location



General Description

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. MAPS(Manifold Absolute

Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is also called Speed-Density Type. MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are outputted by the transformation of diagphragm according to the change of pressure inside of intake manifold.

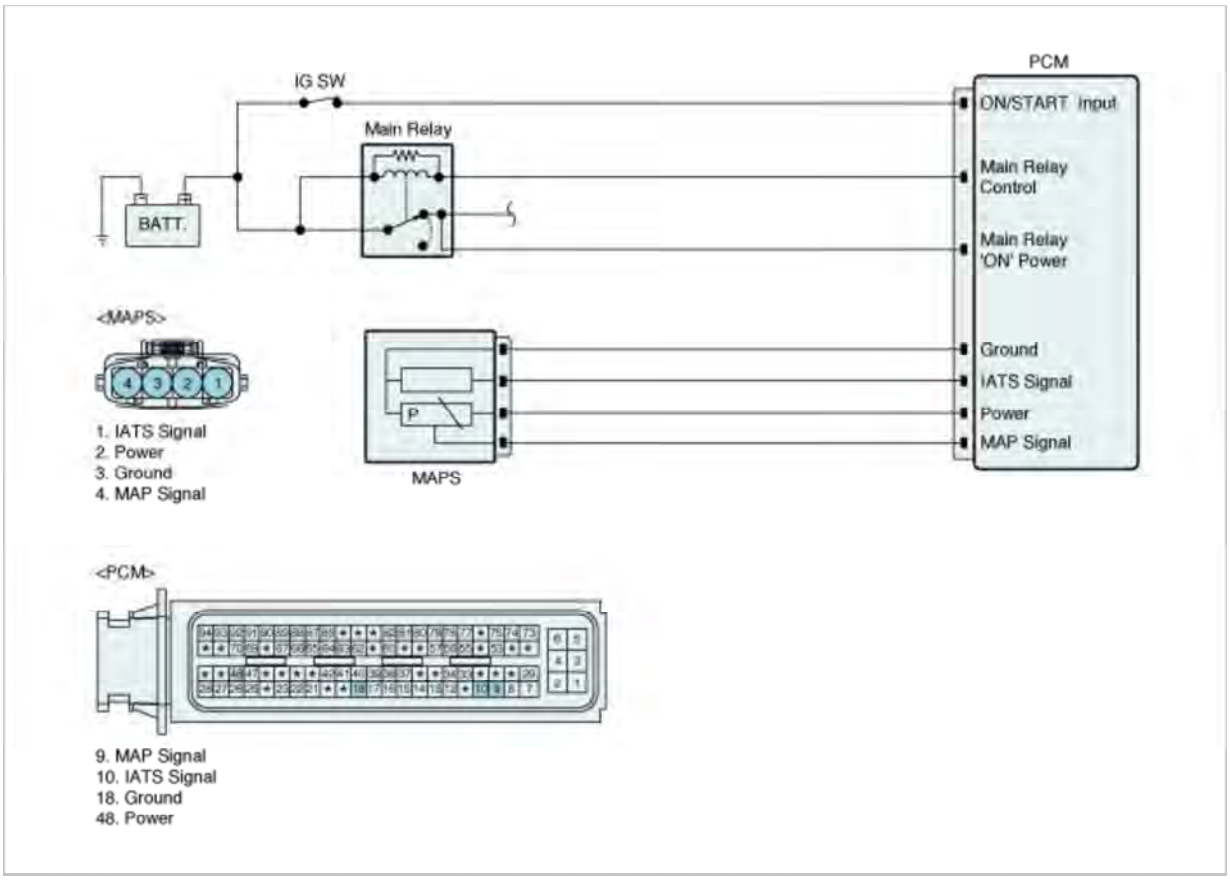
DTC Description

PCM compares the MAPS output and calculated MAPS value while enable condition is met. If the acutal MAP value is higher than Maximum threshold or lower than Minimum threshold for a pre-determined time, PCM determines that a fault exists and a DTC is stored.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Plausability check	• Dirty air cleaner. • Oil Cap or Dipstick missing or not installed correctly. • Air leak in intake system • Contact resistance in connectors. • Faulty MAPS or TPS
Enable Conditions	• No relevant failure • 11 V≤ Battery voltage ≤ 16V • Lambda close loop control activated	
Threshold Value	• Difference between model pressure and measured pressure > 280hpa	
Diagnostic Time	• 200 revolutions	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

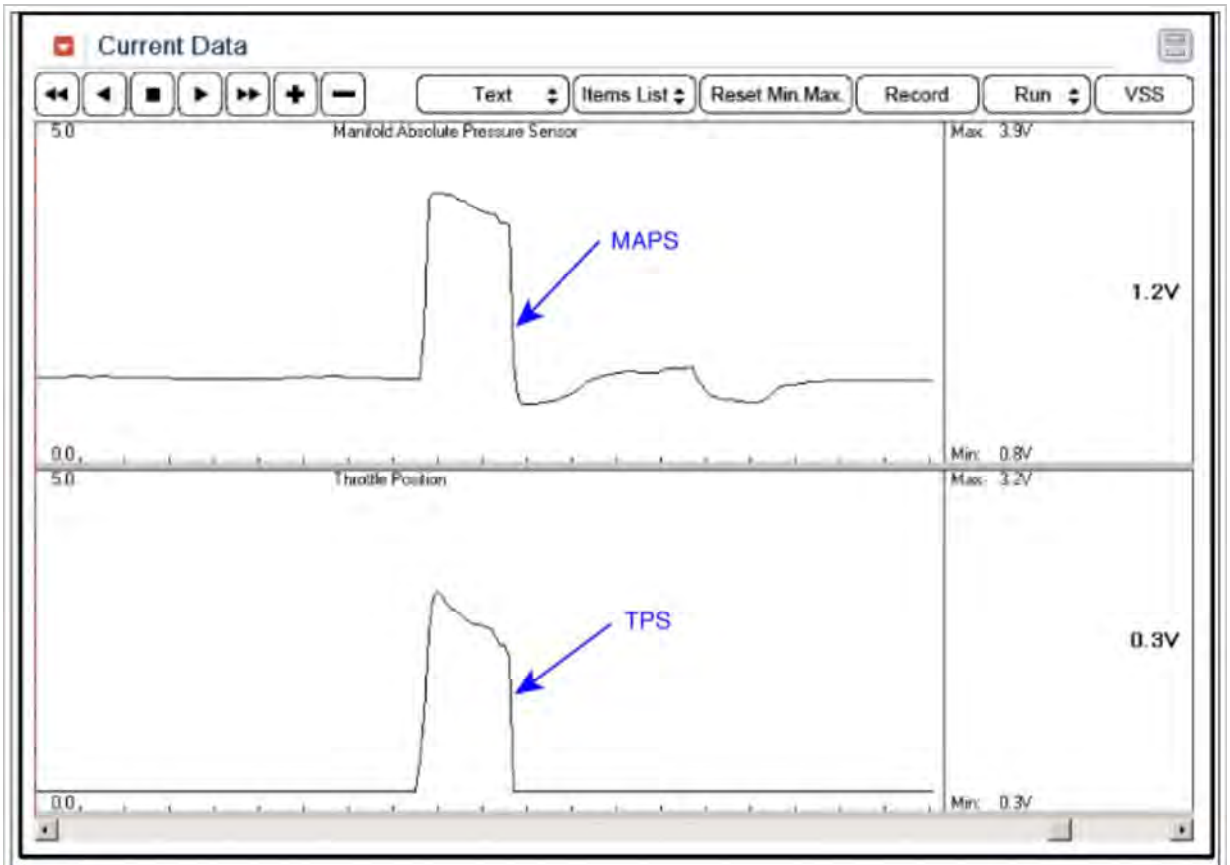


Fig.1

As often as possible, the MAPS signal should be compared with the TPS signal. Check whether the MAPS and TPS signals increase at the same time when accelerating. During acceleration, the MAPS output voltage increases; during deceleration, the MAPS output voltage decreases.

Monitor DTC Status

NOTE

If any DTCs relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

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 next step as below.

Voltage Inspection

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between each of signal / power / ground terminals of MAPS harness connector and chassis ground.

Specification : MAP signal terminal : Approx. 5V
Power terminal : Approx. 5V
Ground terminal : Below 0V

5. Is the measured voltage within specification ?

YES	▸ Go to "Component Inspection " procedure.

NO	▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Check MAPS performance.
   (1) IG "OFF".
   (2) Connnect CH A probe to signal terminal of MAPS and CH B probe to signal terminal of TPS connector.
   (3) Warm up the engine to normal operating temperature.
   (4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator pedal.
   Specification :

Pressure (kPa)	Voltage(V)
Approx. 20	Approx. 0.7~0.8
Approx. 35	Approx. 1.3~1.4
Approx. 60	Approx. 2.3~2.4
Approx. 95	Approx. 3.7~3.8
Approx. 101	Approx. 3.9~4.1

   (5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K ?

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known - good MAPS and check for proper operation. If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

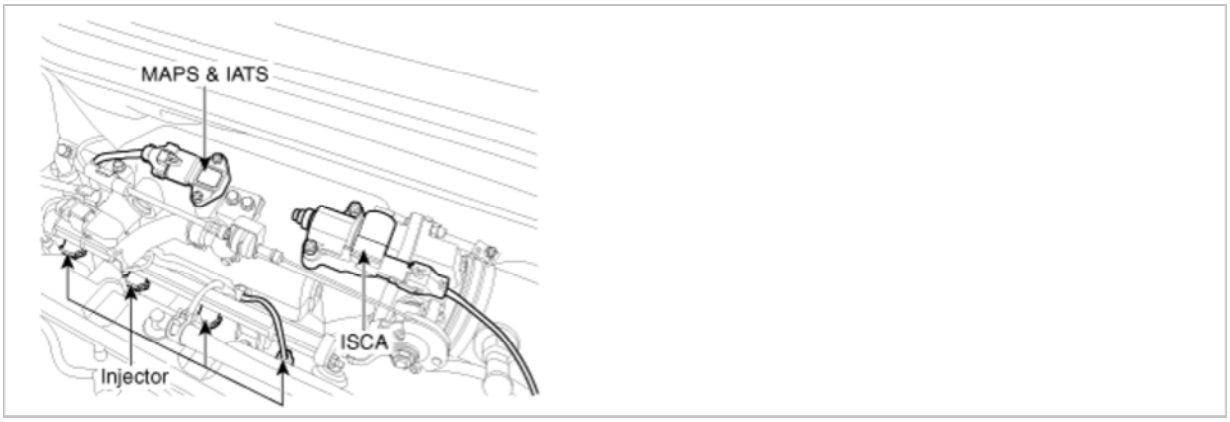
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0107 Manifold Absolute Pressure/Barometric Pressure Circuit Low Input

Component Location



General Description

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is also called Speed-Density Type. MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are outputted by the transformation of diagphragm according to the change of pressure inside of intake manifold.

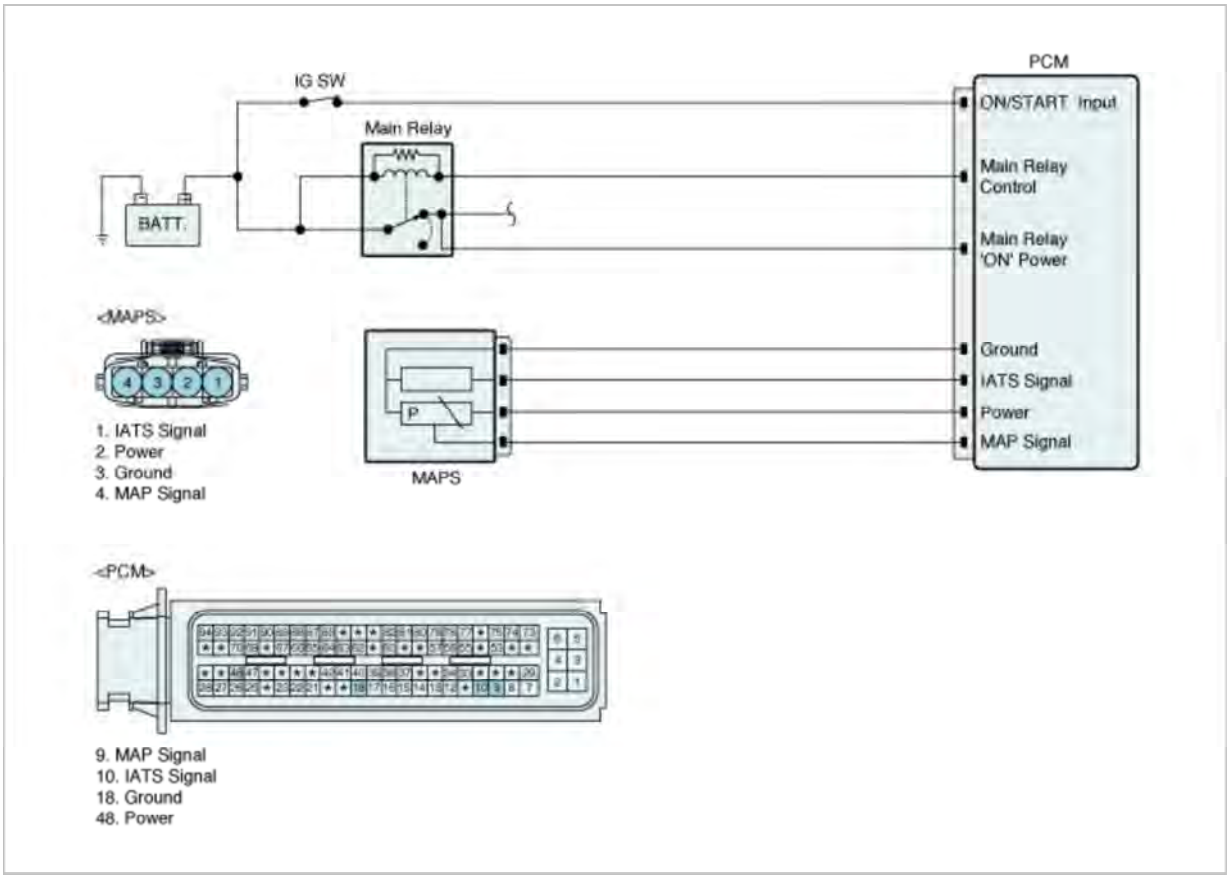
DTC Description

If sensor signal input is lower than 0.25V during 5 sec, PCM sets DTC P0107.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range Check	• Poor connection • Open or short to ground in power circuit • Short to ground in signal circuit • MAPS • PCM
Enable Conditions	• 10 < Battery voltage < 16 • Engine speed > 544rpm	
Threshold Value	• Sensor voltage < 0.1 V	
Diagnostic Time	• 0.1 sec	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

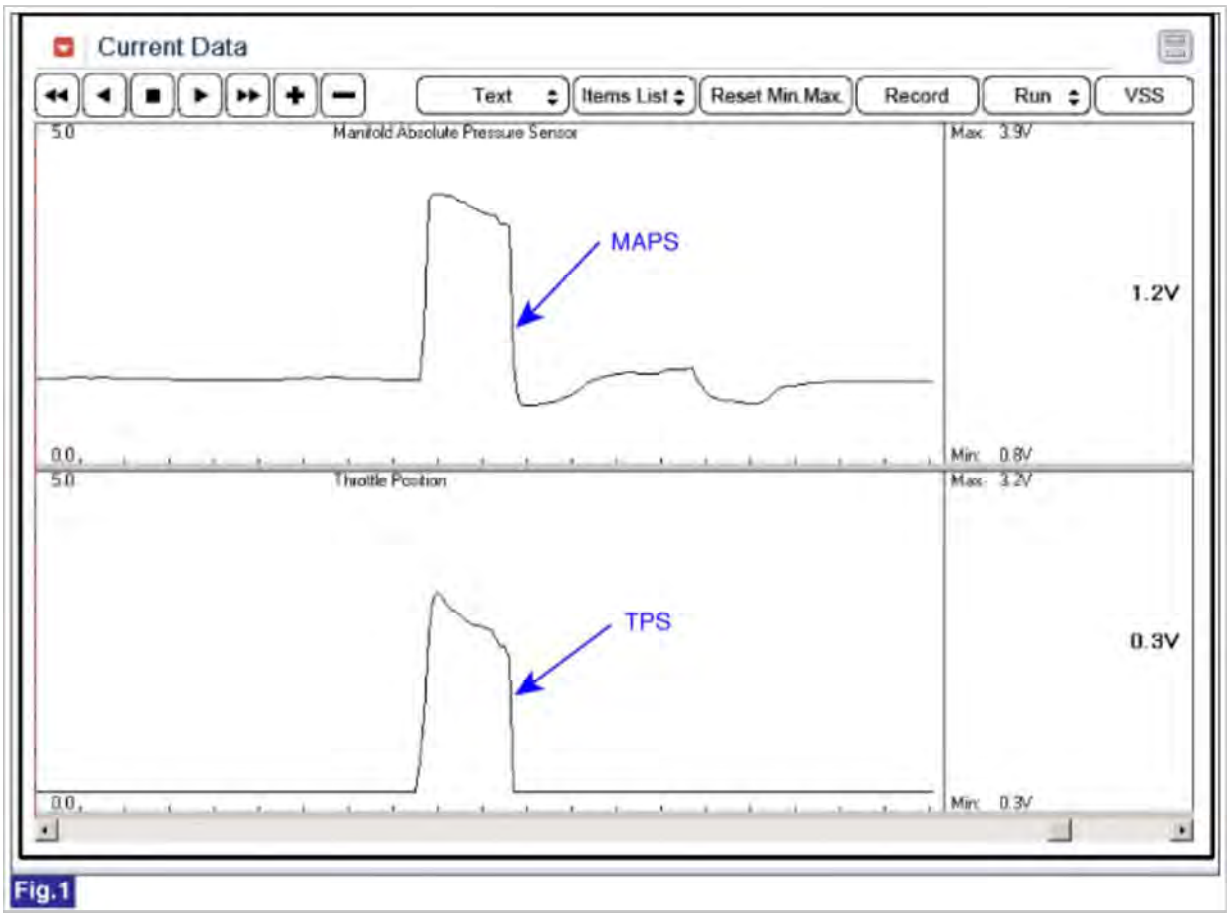


Fig.1

As often as possible, the MAPS signal should be compared with the TPS signal. Check whether the MAPS and TPS signals increase at the same time when accelerating. During acceleration, the MAPS output voltage increases; during deceleration, the MAPS output voltage decreases.

Monitor DTC Status

NOTE

If any DTCs relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

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 next step as below.

Power Circuit Inspection

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure the voltage between power terminal of MAPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES	▸ Go to "Signal Circuit Inspection " procedure.
NO	▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Signal Circuit Inspection

1. Measure the voltage between signal terminal of MAPS harness connector and chassis ground.

Specification : Approx. 5V

2. Is the measured voltage within specification ?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Check MAPS performance.
   (1) IG "OFF".
   (2) Connnect CH A probe to signal terminal of MAPS and CH B probe to signal terminal of TPS connector.
   (3) Warm up the engine to normal operating temperature.
   (4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator pedal.
   Specification :

Pressure (kPa)	Voltage(V)
Approx. 20	Approx. 0.7~0.8
Approx. 35	Approx. 1.3~1.4
Approx. 60	Approx. 2.3~2.4
Approx. 95	Approx. 3.7~3.8
Approx. 101	Approx. 3.9~4.1

   (5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K ?

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known - good MAPS and check for proper operation. If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

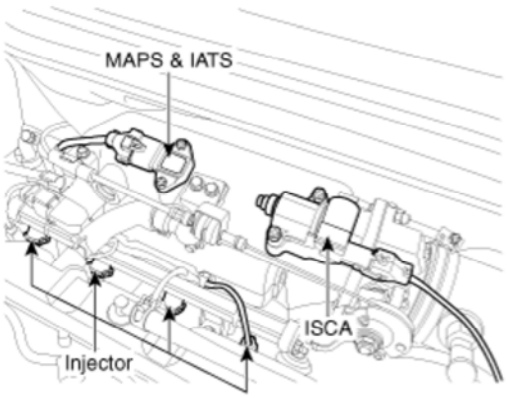
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0108 Manifold Absolute Pressure/Barometric Pressure Circuit High Input

Component Location



General Description

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is also called Speed-Density Type. MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow. MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are outputted by the transformation of diagphragm according to the change of pressure inside of intake manifold.

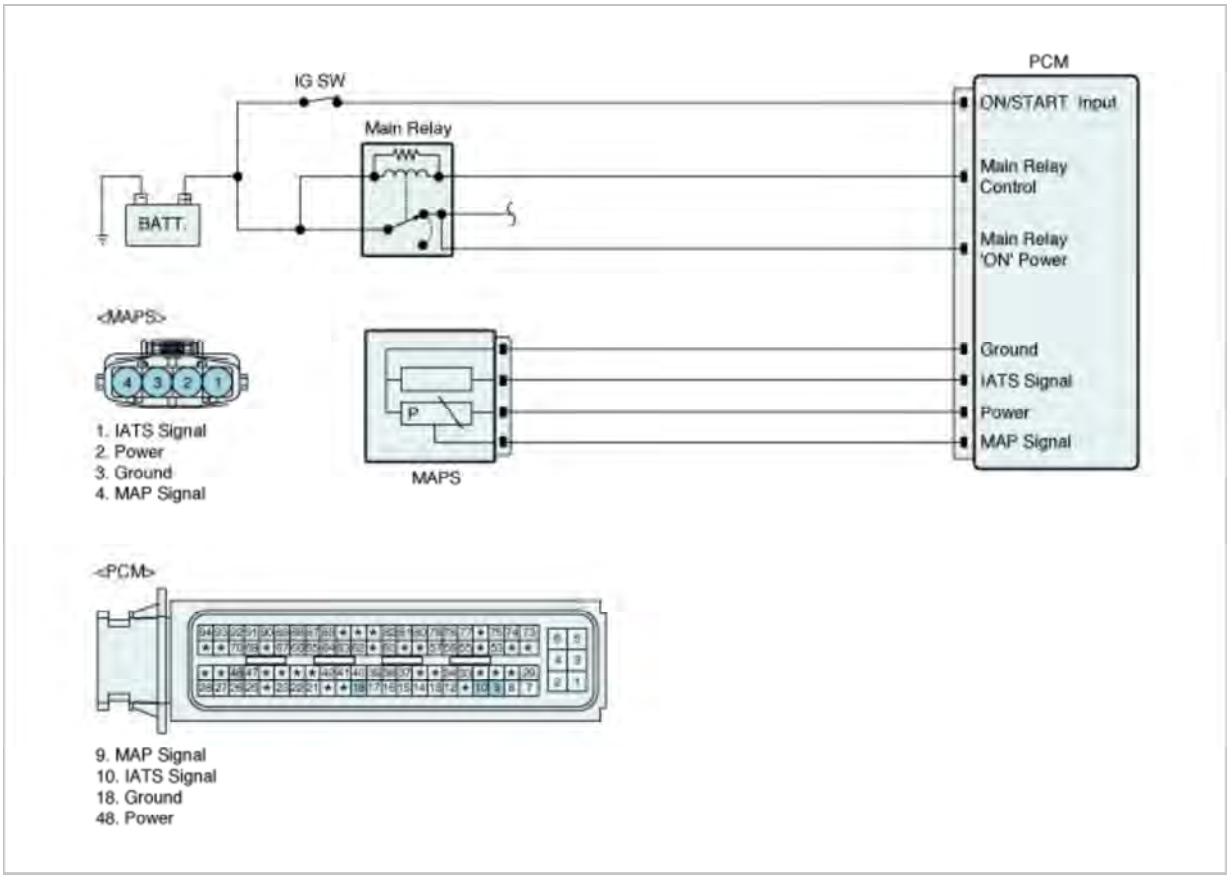
DTC Description

If sensor signal input is higher than 4.88V during 5 sec, PCM sets DTC P0108.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range Check	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • MAPS • PCM
Enable Conditions	• 10 < Battery voltage < 16	
Threshold Value	• Sensor voltage > 4.35V	
Diagnostic Time	• 0.1 sec	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

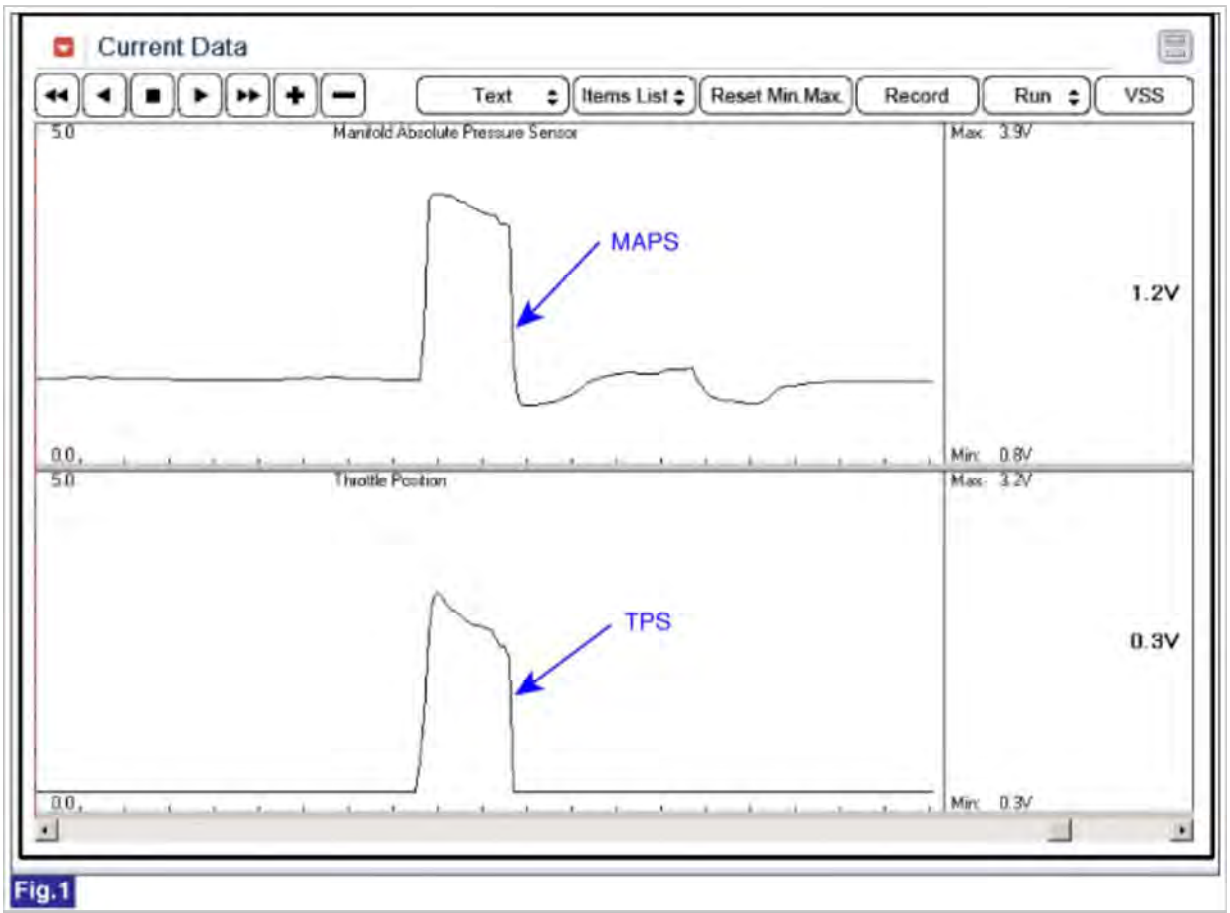


Fig.1

As often as possible, the MAPS signal should be compared with the TPS signal. Check whether the MAPS and TPS signals increase at the same time when accelerating. During acceleration, the MAPS output voltage increases; during deceleration, the MAPS output voltage decreases.

Monitor DTC Status

NOTE

If any DTCs relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

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 next step as below.

Signal Circuit Inspection

1. Check short to battery in harness.
   (1) IG "OFF".
   (2) Disconnect MAPS and PCM connector.
   (3) IG "ON" & Eng. "OFF"
   (4) Measure the voltage between signal terminal of the MAPS harness connector and chassis ground.

   Specification : 0V

   (5) Is the measured voltage within specification ?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Ground Circuit Inspection

1. IG "OFF".
2. Measure the resistance between ground terminal of MAPS harness connector and chassis ground.

   Specification : Below 1Ω

3. Is the measured resistance within specification ?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Check MAPS performance.
   (1) IG "OFF".
   (2) Connnect CH A probe to signal terminal of MAPS and CH B probe to signal terminal of TPS connector.
   (3) Warm up the engine to normal operating temperature.
   (4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator pedal.
   Specification :

Pressure (kPa)	Voltage(V)
Approx. 20	Approx. 0.7~0.8
Approx. 35	Approx. 1.3~1.4
Approx. 60	Approx. 2.3~2.4
Approx. 95	Approx. 3.7~3.8
Approx. 101	Approx. 3.9~4.1

   (5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K ?

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known - good MAPS and check for proper operation. If the problem is corrected, replace MAPS 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.

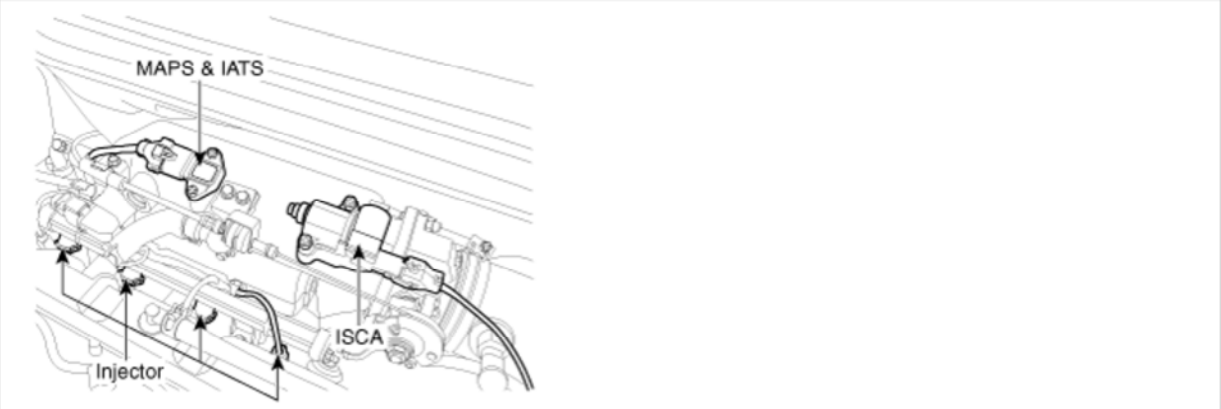
1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .

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.

Fuel System > Engine Control System > P0111 Intake Air Temperature Sensor 1 Circuit Range / Performance

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 PCM is supplied to the IATS via a resistor in the PCM. That is, the resistor in the PCM 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 PCM corrects basic fuel injection duration and ignition timing.

DTC Description

The purpose of this diagnosis is to detect a stuck intake air temperature signal. The diagnostic function checks whether after a variation of the calculated intake air temperature also a variation of the measured intake air temperature is detected.PCM sets DTC P0111 when the variation of measured intake air temperature from engine start is smaller than threshold while variation of calculated intake air temperature by PCM is greater than threshold.

DTC Detecting Condition

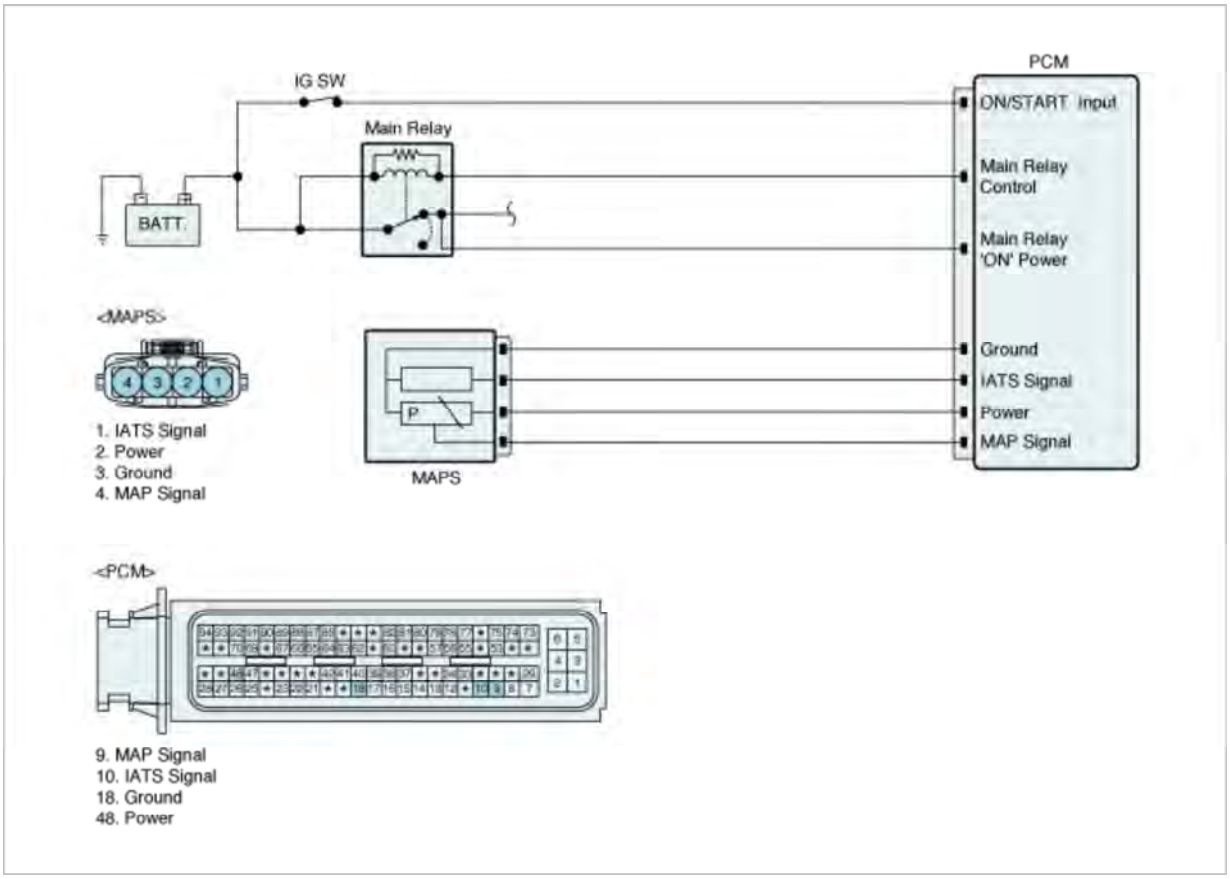
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check intake air temperature signal stuck.	• Contact resistance in connections • Faulty IAT sensor
Enable Conditions	• Time after engine start > 300sec. • Coolant temp. > 76°C(168.8°F) • Coolant temp. increasing after start > 40°C(104°F) • Accumulated time for vehicle speed > 70km/h(44mph) for more than 100sec. • No relevant failure	
Threshold Value	• Intake air temperature signal stuck.	
Diagnostic Time	• 5 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)

-10	14	8.5~9.7	20	68	2.3~2.5
0	32	5.4~6.1	30	86	1.6~1.7
10	50	3.5~3.9	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Signal Waveform & Data

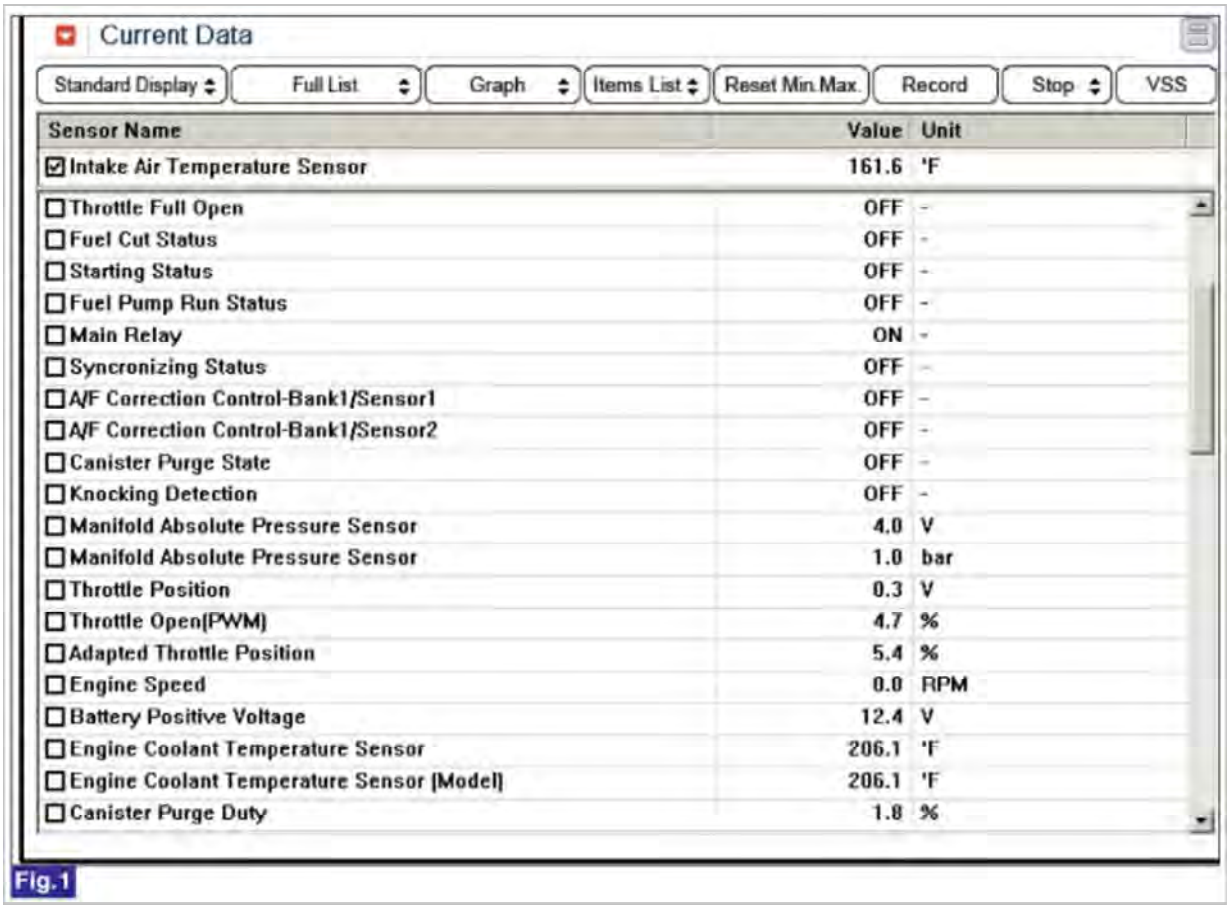


Fig.1) Intake Air Temp. sensor : Approx. 161.6°F at IG ON

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step 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 IATS connector
3. Measure resistance between terminals 3and 4 of the sensor connector(Component side).
   Specification :

Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-10	14	8.5~9.7
0	32	5.4~6.1
10	50	3.5~3.9
20	68	2.3~2.5
30	86	1.6~1.7
80	176	Approx. 0.3

4. Is resistance within the specification?

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 IATS for contamination, deterioration, or damage. Substitute with a known-good IATS and check for proper operation. If the problem is corrected, replace IATS 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.

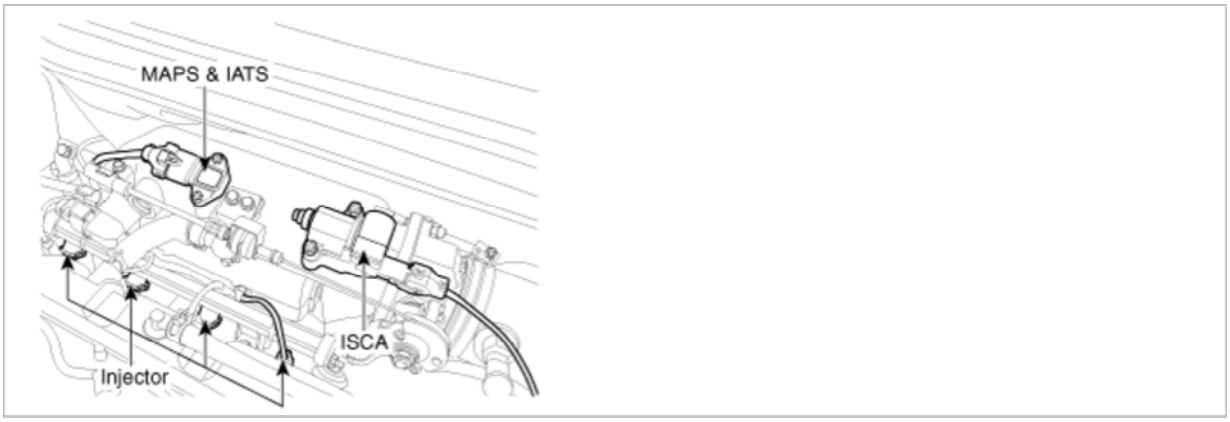
1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter .
4. Is parameter displayed "History(Not Present) fault"?

	▸ System performing to specification at this time. Clear the DTC

YES	
NO	▸ Go to the applicable troubleshooting procedure.

Fuel System > Engine Control System > P0112 Intake Air Temperature Sensor 1 Circuit Low Input

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 PCM is supplied to the IATS via a resistor in the PCM. That is, the resistor in the PCM 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 PCM corrects basic fuel injection duration and ignition timing.

DTC Description

PCM sets DTC P0112 if the PCM detects signal voltage lower than the possible range of a properly operating IATS.

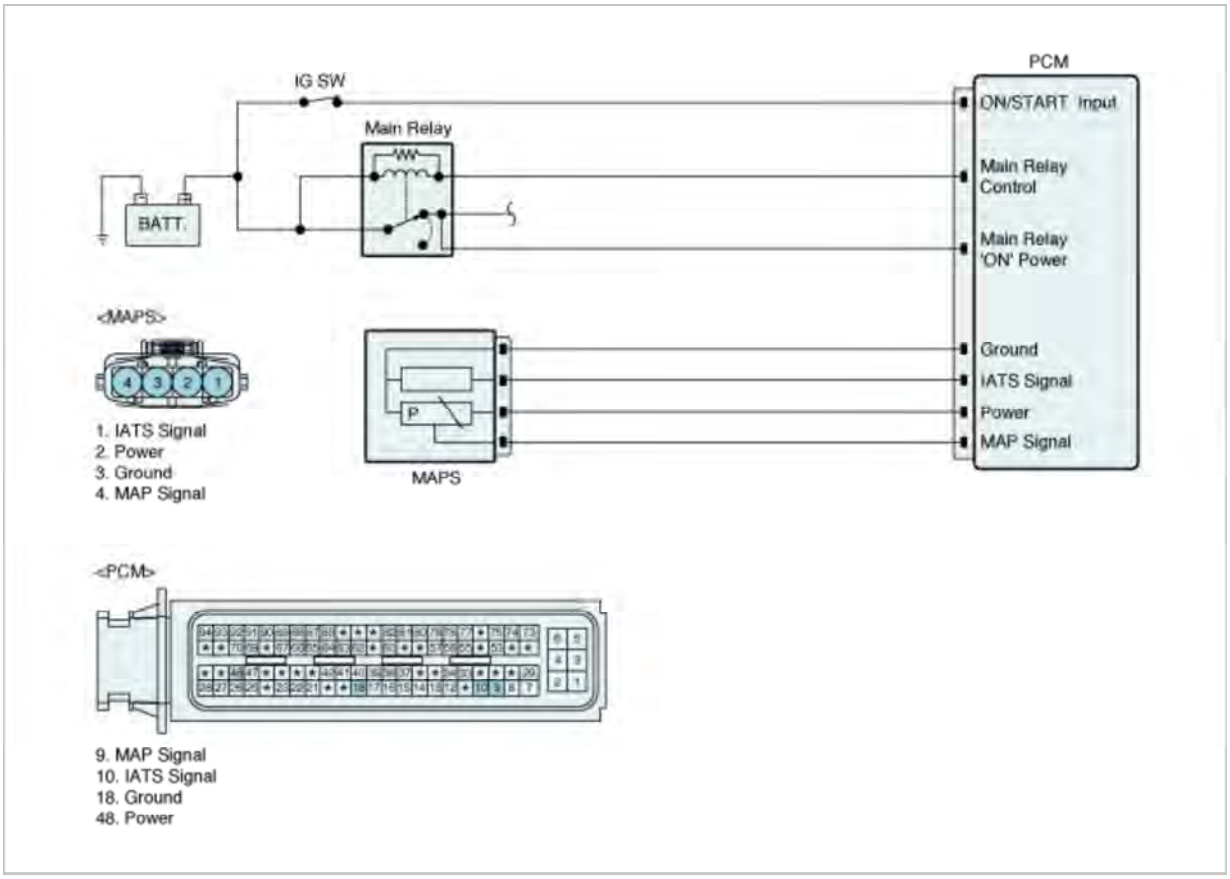
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Poor connection or damaged harness • Faulty IAT sensor
Enable Conditions	• 6V < Battery voltage<16V	
Threshold Value	• Measured intake air temperature > 142°C(287°F)	
Diagnostic Time	• 5 seconds	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-10	14	8.5~9.7	20	68	2.3~2.5
0	32	5.4~6.1	30	86	1.6~1.7
10	50	3.5~3.9	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Signal Waveform & Data

Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
☑ Intake Air Temperature Sensor	161.6	°F
☐ Throttle Full Open	OFF	-
☐ Fuel Cut Status	OFF	-
☐ Starting Status	OFF	-
☐ Fuel Pump Run Status	OFF	-
☐ Main Relay	ON	-
☐ Syncronizing Status	OFF	-
☐ A/F Correction Control-Bank1/Sensor1	OFF	-
☐ A/F Correction Control-Bank1/Sensor2	OFF	-
☐ Canister Purge State	OFF	-
☐ Knocking Detection	OFF	-
☐ Manifold Absolute Pressure Sensor	4.0	V
☐ Manifold Absolute Pressure Sensor	1.0	bar
☐ Throttle Position	0.3	V
☐ Throttle Open(PWM)	4.7	%
☐ Adapted Throttle Position	5.4	%
☐ Engine Speed	0.0	RPM
☐ Battery Positive Voltage	12.4	V
☐ Engine Coolant Temperature Sensor	206.1	°F
☐ Engine Coolant Temperature Sensor (Model)	206.1	°F
☐ Canister Purge Duty	1.8	%

Fig.1

Intake Air Temp. sensor : Approx. 161.6°F at IG ON

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Signal Circuit Inspection

1. Ignition "OFF"
2. Disconnect PCM and IAT sensor connector
3. Measure the resistance between signal terminal of IATS 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 "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 "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF"
2. Disconnect IATS connector
3. Measure resistance between terminals 3and 4 of the sensor connector(Component side).
   Specification :

Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-10	14	8.5~9.7
0	32	5.4~6.1
10	50	3.5~3.9
20	68	2.3~2.5
30	86	1.6~1.7
80	176	Approx. 0.3

4. Is resistance within the specification?

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 IATS for contamination, deterioration, or damage. Substitute with a known-good IATS and check for proper operation. If the problem is corrected, replace IATS and then go to "Verification of Vehicle Repair" procedure.

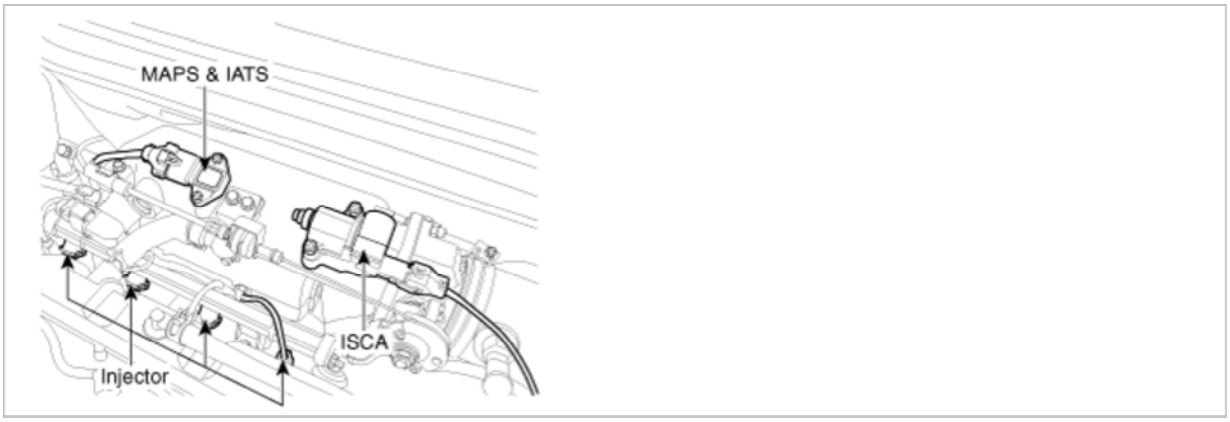
Verification of Vehicle Repair

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

Fuel System > Engine Control System > P0113 Intake Air Temperature Sensor 1 Circuit High Input

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 PCM is supplied to the IATS via a resistor in the PCM. That is, the resistor in the PCM 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 PCM corrects basic fuel injection duration and ignition timing.

DTC Description

PCM sets DTC P0113 if the PCM detects signal voltage higher than the possible range of a properly operating IATS.

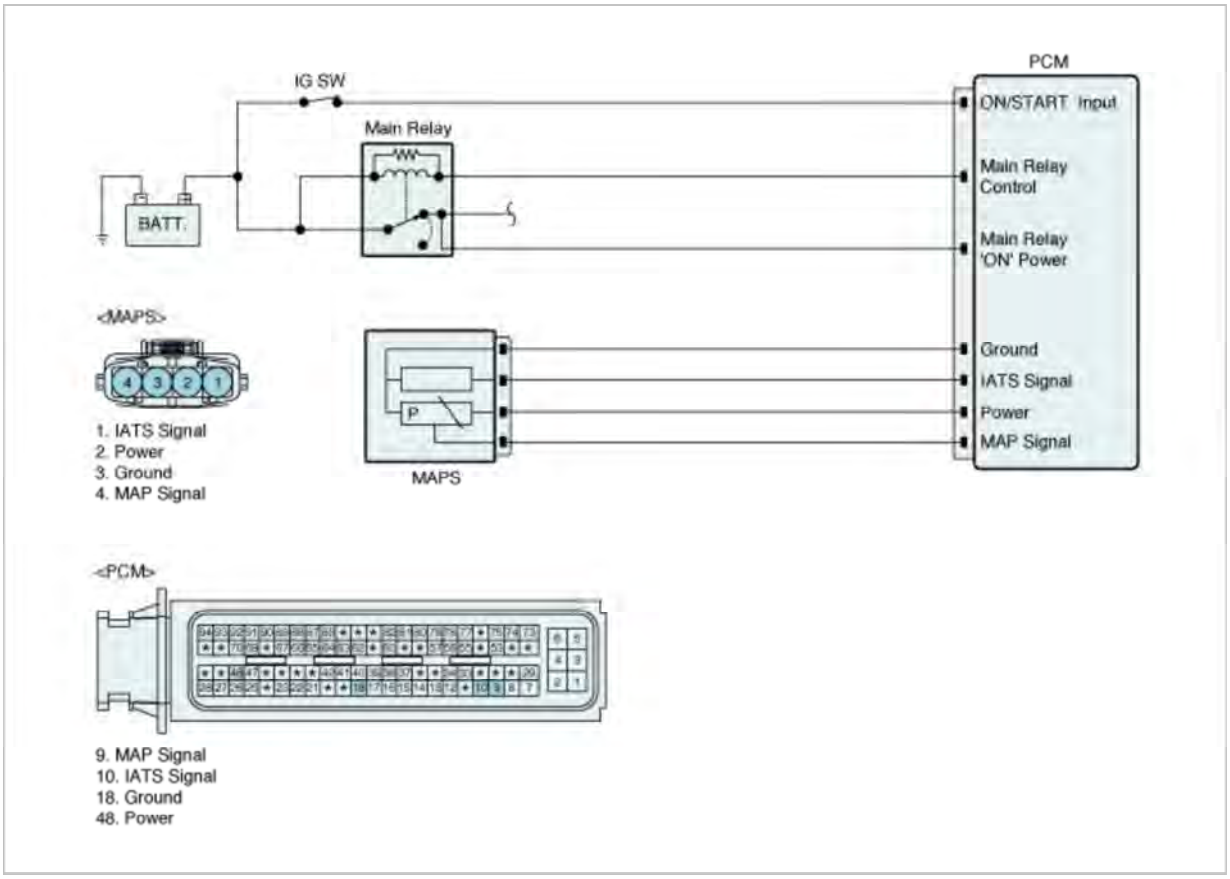
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to battery in signal harness • Open in signal or ground circuit • Poor connection or damaged harness • Faulty IAT sensor
Enable Conditions	• Time after start > 110 sec.	
Threshold Value	• Measured intake air temperature < -46°C(-51°F)	
Diagnostic Time	• 5 seconds	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-10	14	8.5~9.7	20	68	2.3~2.5
0	32	5.4~6.1	30	86	1.6~1.7
10	50	3.5~3.9	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Signal Waveform & Data

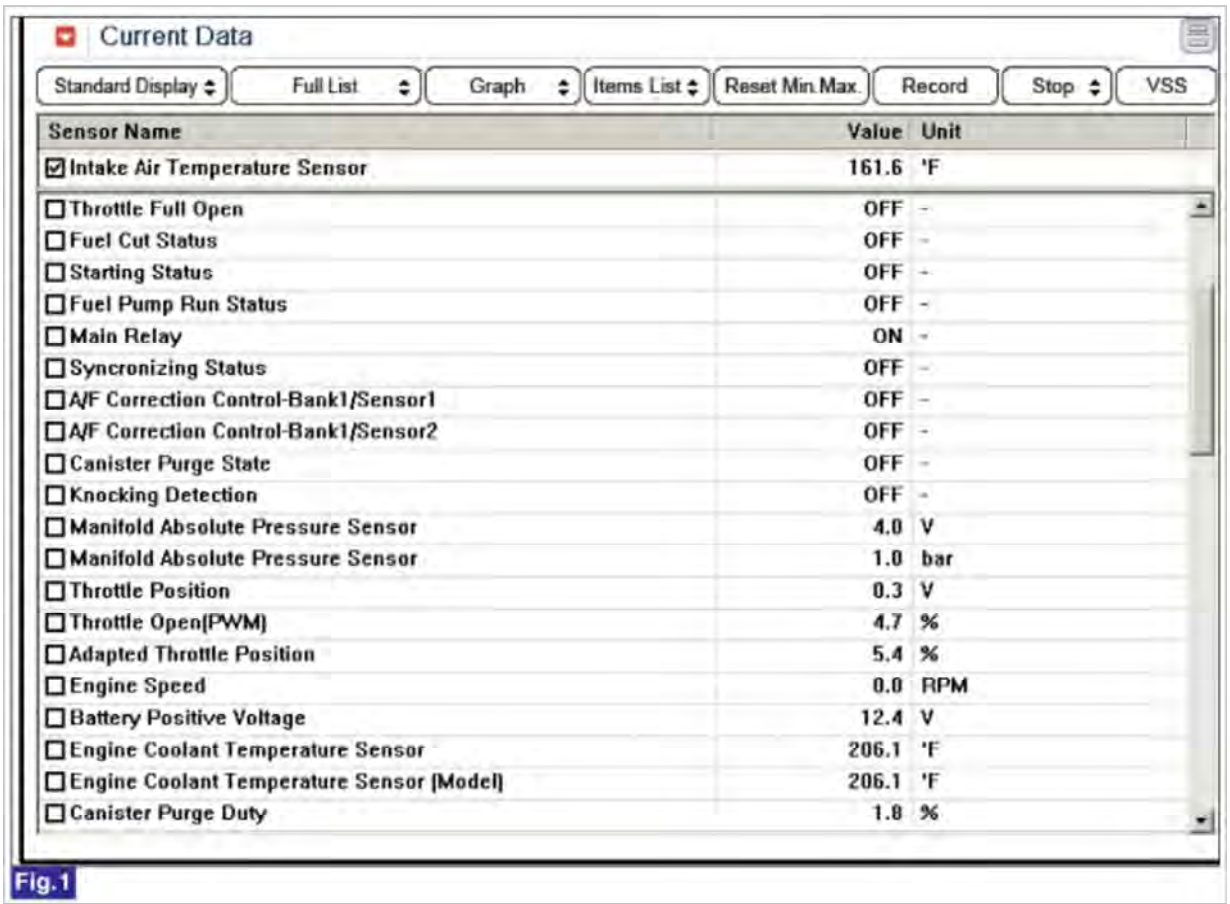


FIG.1) Intake Air Temp. sensor : Approx. 161.6°F at IG ON

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Ground circuit inspection

1. Ignition "OFF"
2. Disconnect IATS connector
3. Measure the resistance between ground terminal of IATS harness connector and chassis ground.

Specification : Approx. 0Ω

4. Is the measured resistance within specification ?

YES	▸ Go to next step as below.
NO	▸ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure the voltage between signal terminal of IATS harness connector and chassis ground.

Specification : Approx. 5V

3. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check for open or short to battery in signal harness. 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 next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect IATS connector
3. Measure resistance between terminals 3and 4 of the sensor connector(Component side).
   Specification :

Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-10	14	8.5~9.7
0	32	5.4~6.1
10	50	3.5~3.9
20	68	2.3~2.5
30	86	1.6~1.7
80	176	Approx. 0.3

4. Is resistance within the specification?

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 IATS for contamination, deterioration, or damage. Substitute with a known-good IATS and check for proper operation. If the problem is corrected, replace IATS and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

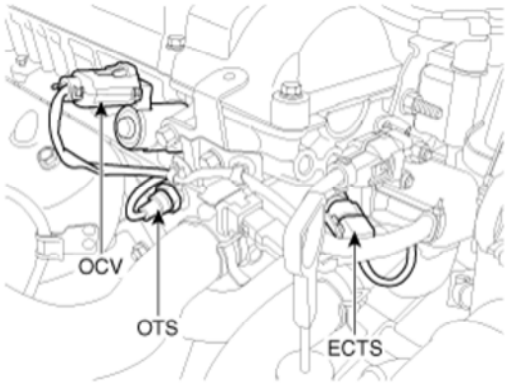
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0116 Engine Coolant Temperature Circuit Range / Performance

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 PCM is supplied to the ECTS via a resistor in the PCM. That is, the resistor in the PCM 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 PCM 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

PCM sets DTC P0116 if the PCM detects stuck low, high or implausible high ECT signal

DTC Detecting Condition

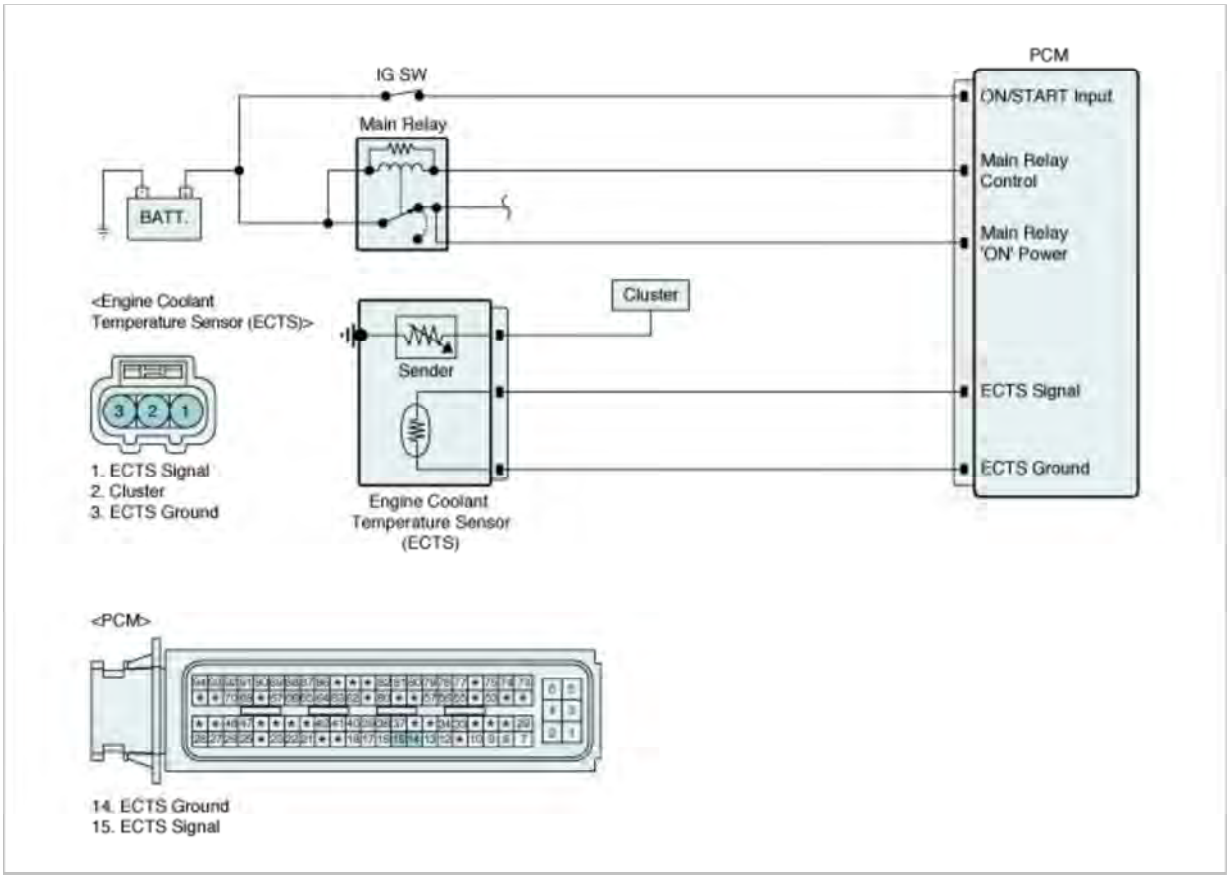
Item		Detecting Condition & Fail Safe	Possible Cause
DTC Strategy	case 1	• Signal stuck Low	• Contact resistance in connections. • Insufficient Engine Coolant • Faulty Thermostat • Faulty ECT sensor
	case 2	• Signal stuck High	
Enable Conditions	case 1	• No relevant failure • 6V < Battery voltage <16V	
	case 2	• No relevant failure • Engine oil temp. at engine stop of previous DC > 70°C(158°F) • 6V < Battery voltagy < 16V • Engine oil temperature at Start < 35°C(95°F)	
Threshold Value	case 1	• Engine coolant temperature signal stuck	
	case 2	• Engine coolant temperature at start > 53°C(127°F) with oil temperature < 35°C(95°F)	
Diagnostic Time	case 1	• 10~30 minutes depends on coolant temp. at start	
	case 2	• Immediate	
Mil On Condition		• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	14.1 ~ 16.8	40	104	Approx. 1.2

0	32	Approx. 5.8	60	140	Approx. 0.6
20	68	2.3 ~ 2.6	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Signal Waveform & Data

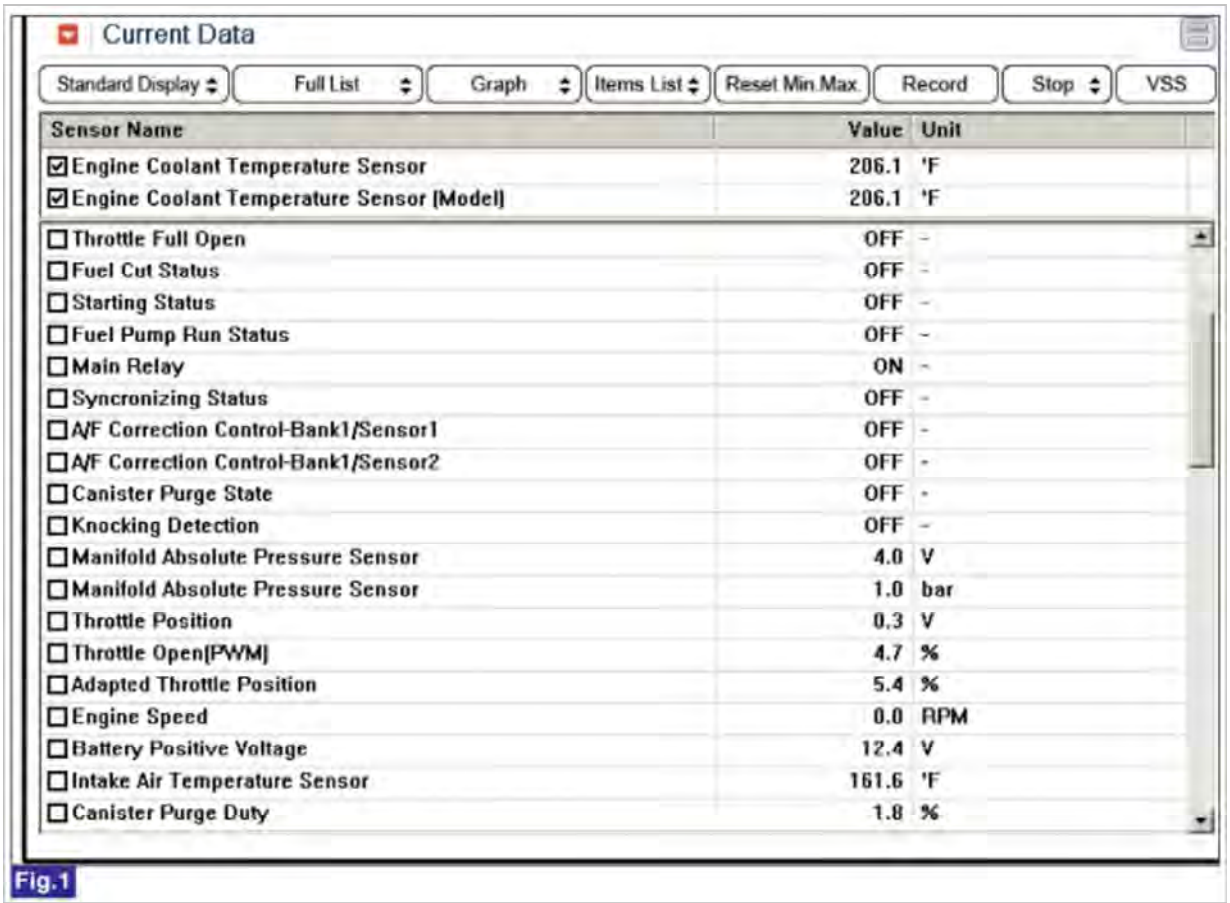


Fig.1) Engine Coolant Temp. sensor : Approx. 206.1 °F after warm up. (at IG ON)

Monitor DTC Status

NOTE

If any DTCs relating to ECTS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Monitor GDS Data

1. Allow the engine to cool completely
2. Run the cold engine at idle for 5 minutes and observe cooling fan status.

> NOTE
>
> Ensure that the A/C is OFF

3. Check the engine coolant temperature parameter at idle with the GDS.
4. Is the engine coolant temperature increase to above 50°C(122°F)
5. Are the cooling fans running when engine coolant temperature is low(less than approximately 98°C(208°F)) with A/C OFF?

YES	▸ Check for short circuit in cooling fan harness or cooling fan relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ - With ignition "ON", Install GDS and select "COOLING FAN RELAY" on the Actuation Test mode. - Activates "COOLING FAN RELAY" by pressing "STRT(F1)" key - Repeat this procedure 4 or 5 times to ensure cooling fan reliability. - If cooling fan works properly, go to next step as below - If NG, check for intermittent fault caused by poor contact in the sensor's and/or PCM's connector. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

System Inspection

1. Coolant Level Inspection
   (1) Check the cooling system coolant level.

(2) Is the coolant in the reservoir at the proper level?

YES	▸ Go to next step as below.
NO	▸ Repair or add engine coolant as necessary and go to "Verification of Vehicle Repair" procedure.

2. Thermostat Inspection
   (1) Check if the thermostat bypass valve is stuck in the open position or if the correct type of thermostat was installed. Replace thermostat as necessary and go to "Verification of Vehicle Repair" procedure.
   (2) Check the valve opening temperature of the thermostat

   Specification (Valve opening temperature) : 80~84°C(176~183°F):

   (3) If the opening temperature is not as specified, Replace thermostat as necessary and go to "Verification of Vehicle Repair" procedure. If OK, go to next step as below

3. ECT Sensor 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)
-20	-4	14.1 ~ 16.8
0	32	Approx. 5.8
20	68	2.3 ~ 2.6
40	104	Approx. 1.2
60	140	Approx. 0.6
80	176	Approx. 0.3

   (4) Is resistance within the specification?

YES	▸ Go to next step as below.
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.

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	▸ 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.

Verification of Vehicle Repair

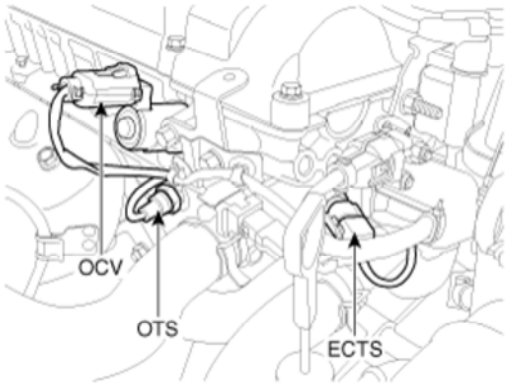
After a repair, it is essential to verify that the fault has been corrected.
1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable 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.

Fuel System > Engine Control System > P0117 Engine Coolant Temperature Circuit Low Input

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 PCM is supplied to the ECTS via a resistor in the PCM. That is, the resistor in the PCM 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 PCM 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

PCM sets DTC P0117 if the PCM detects signal voltage lower than the possible range of a properly operating ECTS.

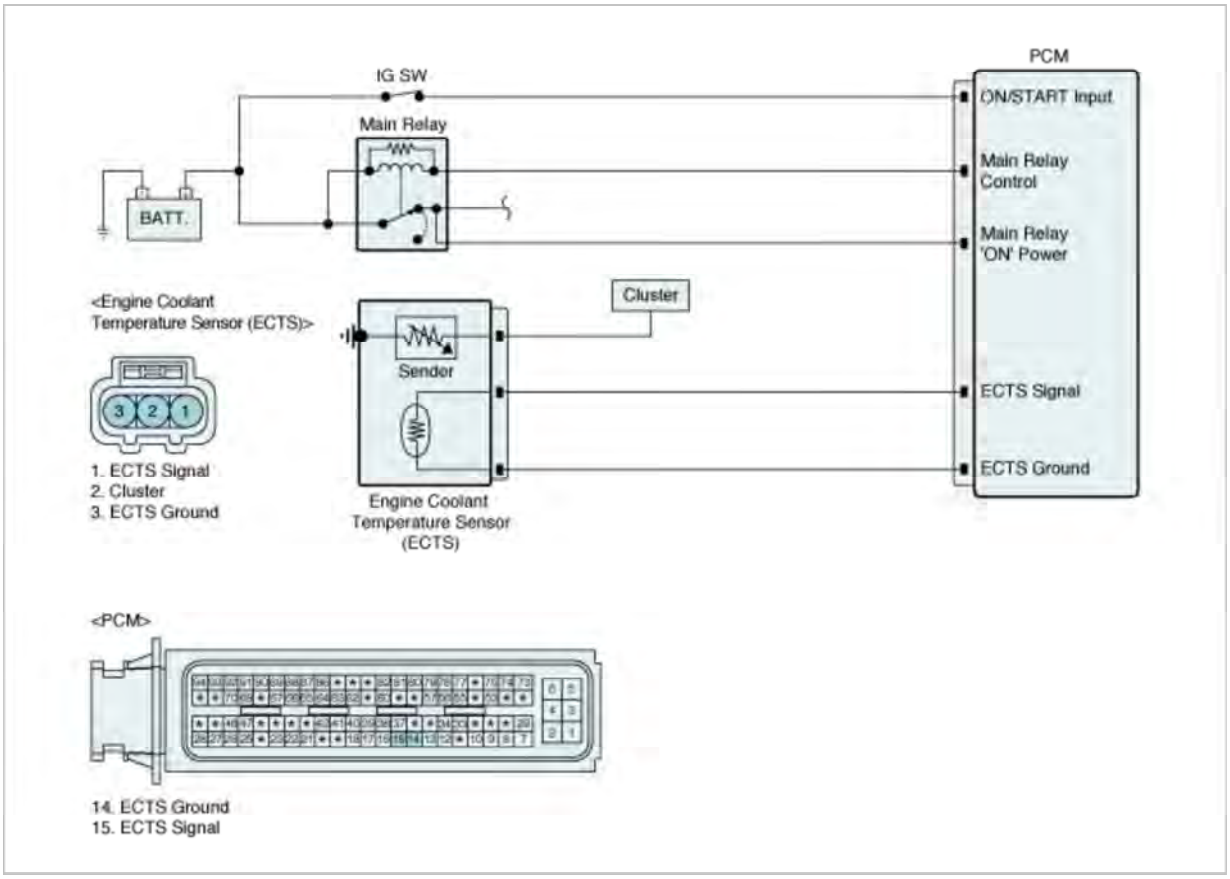
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Poor connection or damaged harness • Faulty ECT sensor
Enable Conditions	• 6V < Battery voltage <16V	
Threshold Value	• Measured coolant temperature > 138°C(280°F).	
Diagnostic Time	• 5 sec.	
Mil On Condition	• 2 Driving Cycles	

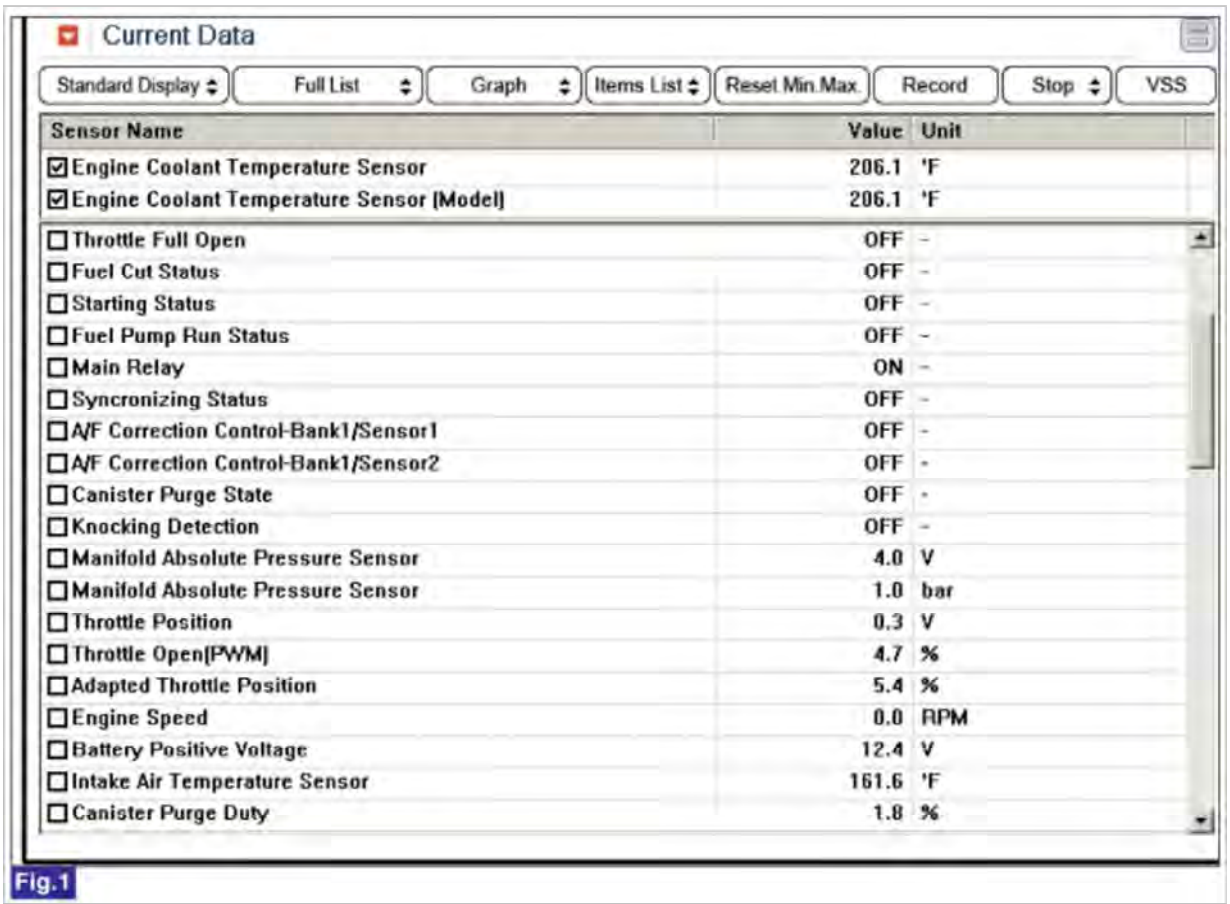
Specification

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	14.1 ~ 16.8	40	104	Approx. 1.2
0	32	Approx. 5.8	60	140	Approx. 0.6
20	68	2.3 ~ 2.6	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Signal Waveform & Data



Sensor Name	Value	Unit
☑ Engine Coolant Temperature Sensor	206.1	°F
☑ Engine Coolant Temperature Sensor [Model]	206.1	°F
☐ Throttle Full Open	OFF	-
☐ Fuel Cut Status	OFF	-
☐ Starting Status	OFF	-
☐ Fuel Pump Run Status	OFF	-
☐ Main Relay	ON	-
☐ Syncronizing Status	OFF	-
☐ A/F Correction Control-Bank1/Sensor1	OFF	-
☐ A/F Correction Control-Bank1/Sensor2	OFF	-
☐ Canister Purge State	OFF	-
☐ Knocking Detection	OFF	-
☐ Manifold Absolute Pressure Sensor	4.0	V
☐ Manifold Absolute Pressure Sensor	1.0	bar
☐ Throttle Position	0.3	V
☐ Throttle Open[PWM]	4.7	%
☐ Adapted Throttle Position	5.4	%
☐ Engine Speed	0.0	RPM
☐ Battery Positive Voltage	12.4	V
☐ Intake Air Temperature Sensor	161.6	°F
☐ Canister Purge Duty	1.8	%

Fig.1) Engine Coolant Temp. sensor : Approx. 206.1 °F after warm up. (at IG ON)

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Signal Circuit Inspection

1. Ignition "OFF"
2. Disconnect ECTS connector
3. Measure the resistance between signal terminal of ECTS 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 the resistance between signal terminal and ground terminal of ECTS connector. (Component side)
Specification :

Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	14.1 ~ 16.8
0	32	Approx. 5.8
20	68	2.3 ~ 2.6
40	104	Approx. 1.2
60	140	Approx. 0.6
80	176	Approx. 0.3

2. Is resistance within the specification?

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 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.

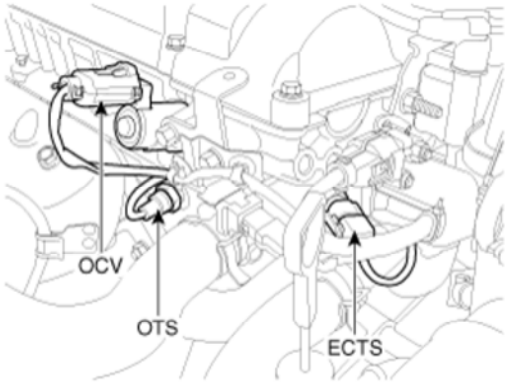
Verification of Vehicle Repair

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

Fuel System > Engine Control System > P0118 Engine Coolant Temperature Circuit High Input

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 PCM is supplied to the ECTS via a resistor in the PCM. That is, the resistor in the PCM 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 PCM 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

PCM sets DTC P0118 if the PCM detects signal voltage higher than the possible range of a properly operating ECTS.

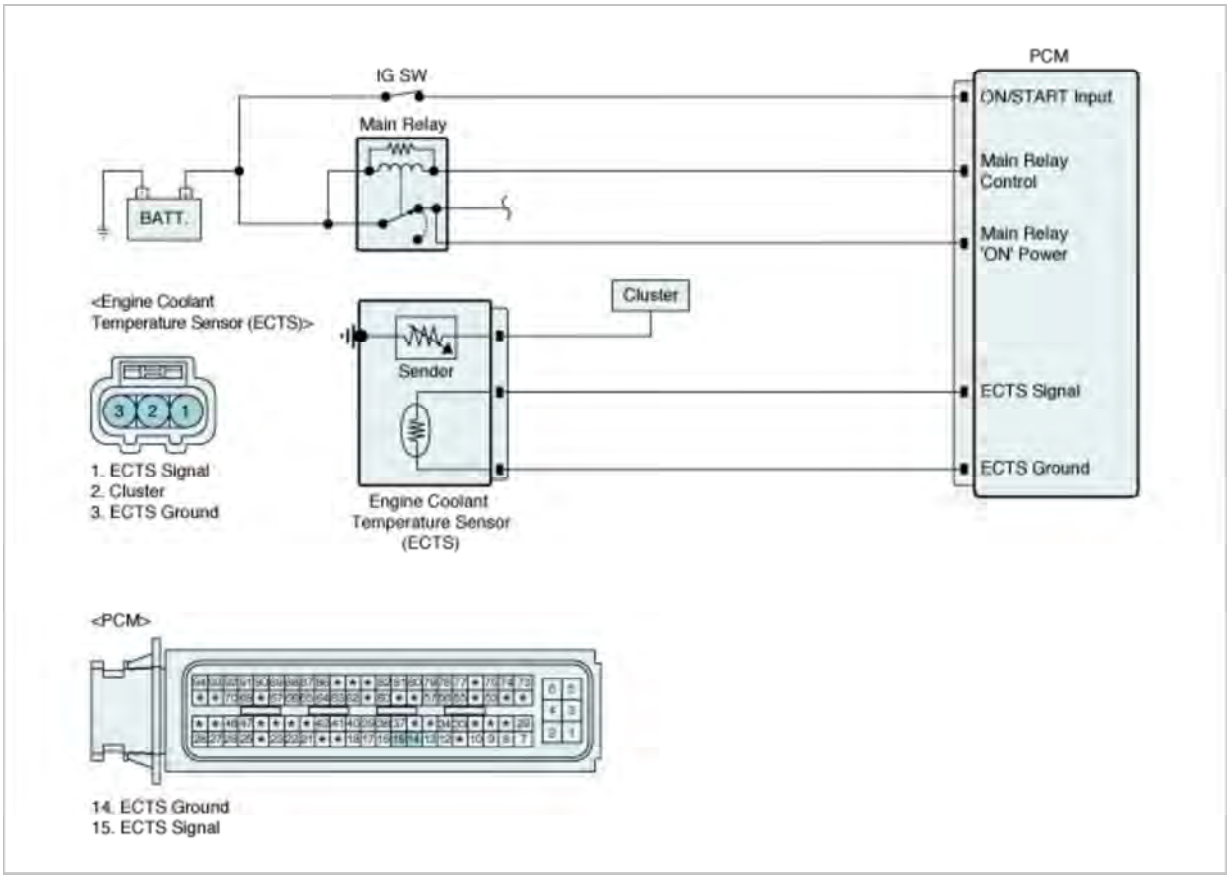
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to battery in signal harness • Open in signal or ground circuit • Poor connection or damaged harness • Faulty ECT sensor
Enable Conditions	• 6V < Battery voltage • Time after start > 110 sec. (If Intake air temperature < -30° C (-22°F))	
Threshold Value	• Measured coolant temperature < -46°C(-51°F)	
Diagnostic Time	• 5 sec.	
Mil On Condition	• 2 Driving Cycles	

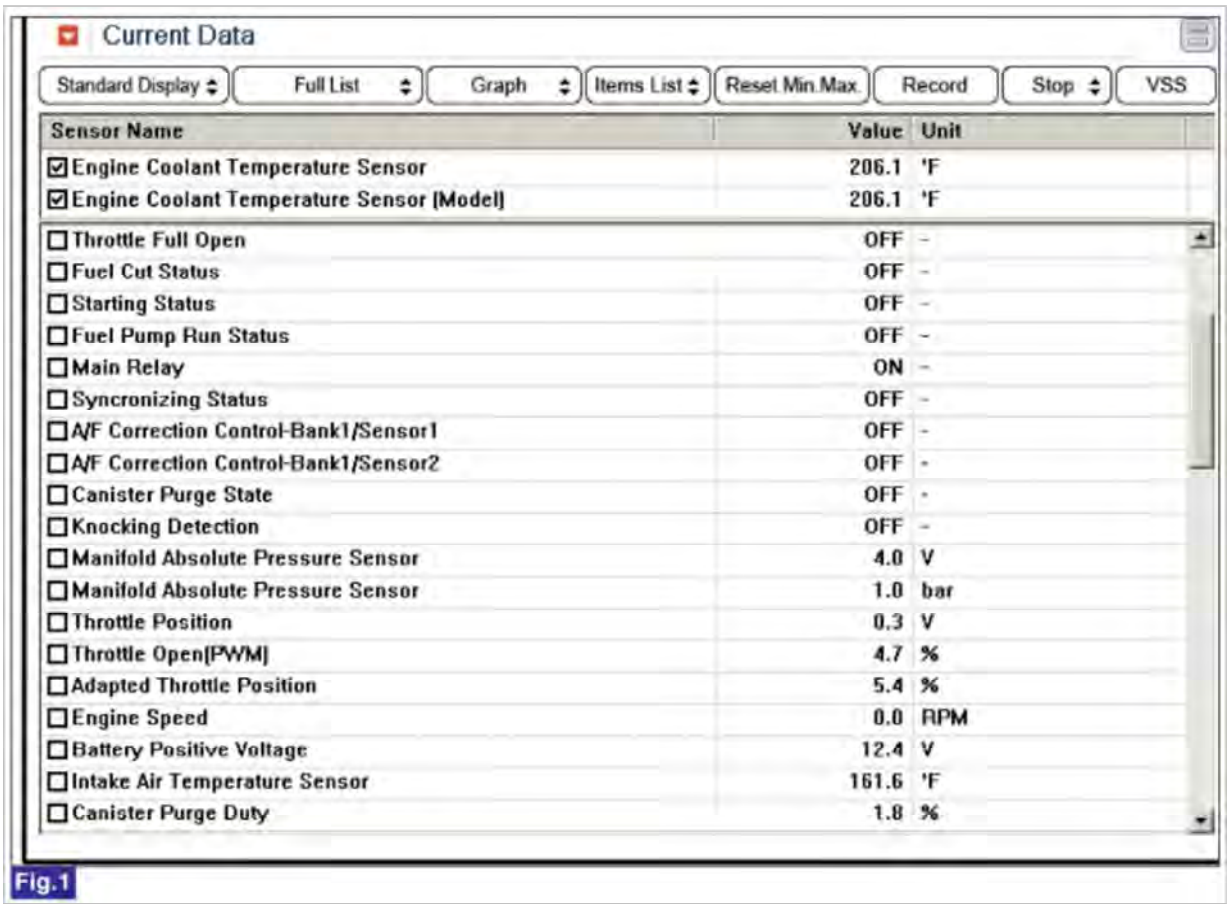
Specification

Temp.(°C)	Temp.(°F)	Resistance(kΩ)	Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	14.1 ~ 16.8	40	104	Approx. 1.2
0	32	Approx. 5.8	60	140	Approx. 0.6
20	68	2.3 ~ 2.6	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Signal Waveform & Data



Sensor Name	Value	Unit
☑ Engine Coolant Temperature Sensor	206.1	°F
☑ Engine Coolant Temperature Sensor [Model]	206.1	°F
☐ Throttle Full Open	OFF	-
☐ Fuel Cut Status	OFF	-
☐ Starting Status	OFF	-
☐ Fuel Pump Run Status	OFF	-
☐ Main Relay	ON	-
☐ Syncronizing Status	OFF	-
☐ A/F Correction Control-Bank1/Sensor1	OFF	-
☐ A/F Correction Control-Bank1/Sensor2	OFF	-
☐ Canister Purge State	OFF	-
☐ Knocking Detection	OFF	-
☐ Manifold Absolute Pressure Sensor	4.0	V
☐ Manifold Absolute Pressure Sensor	1.0	bar
☐ Throttle Position	0.3	V
☐ Throttle Open[PWM]	4.7	%
☐ Adapted Throttle Position	5.4	%
☐ Engine Speed	0.0	RPM
☐ Battery Positive Voltage	12.4	V
☐ Intake Air Temperature Sensor	161.6	°F
☐ Canister Purge Duty	1.8	%

Fig.1) Engine Coolant Temp. sensor : Approx. 206.1 °F after warm up. (at IG ON)

Monitor GDS Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Ground circuit inspection

1. Ignition "OFF"
2. Disconnect ECTS connector
3. Measure the resistance between ground terminal of ECTS harness connector and chassis ground.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

Signal Circuit InspectionGDS

1. Check for short to battery in signal harness
   (1) Disconnect PCM connector.

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

(3) Measure the voltage between signal terminal of the sensor harness connector and chassis ground.

Specification : Approx. 0V

(4) Is voltage within the specification?

YES	▸ Go to "Terminal and Connector Inspection" procedure.
NO	▸ Check for short to battery or open in signal harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for open in signal harness
(1) Ignition "OFF"

(2) Measure the resistance between signal terminal of ECTS harness connector and signal connector of PCM harness connector.

Specification : Approx. 0Ω

(3) Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Check for open in signal harness. 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 next step as below.

Component Inspection

1. Measure the resistance between signal terminal and ground terminal of ECTS connector. (Component side)
Specification :

Temp.(°C)	Temp.(°F)	Resistance(kΩ)
-20	-4	14.1 ~ 16.8
0	32	Approx. 5.8
20	68	2.3 ~ 2.6
40	104	Approx. 1.2
60	140	Approx. 0.6
80	176	Approx. 0.3

2. Is resistance within the specification?

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 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

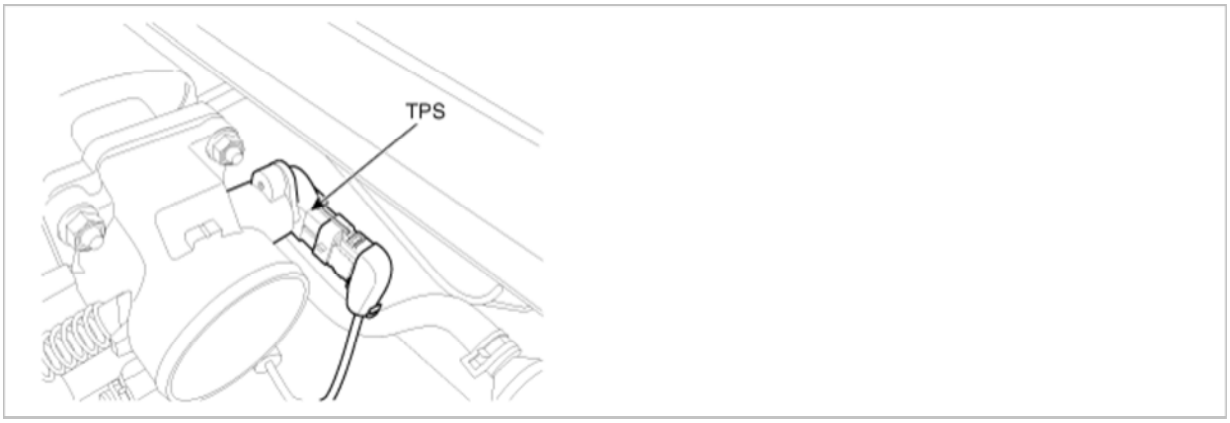
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0121 Throttle/Pedal Position Sensor/Switch \'A\' Circuit Range/Performance

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 PCM supplies a reference 5V to the TPS and the output voltage increases directly with the opening of the throttle valve. The PCM determines operating conditions such as idle (closed throttle), part load, acceleration/deceleration, and wide-open throttle from the TPS. Also The PCM uses the Mass Air Flow Sensor (MAFS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC Description

The DTC P0121 is set when the intake manifold model filtered reduced area controller is out of range in low or high load.

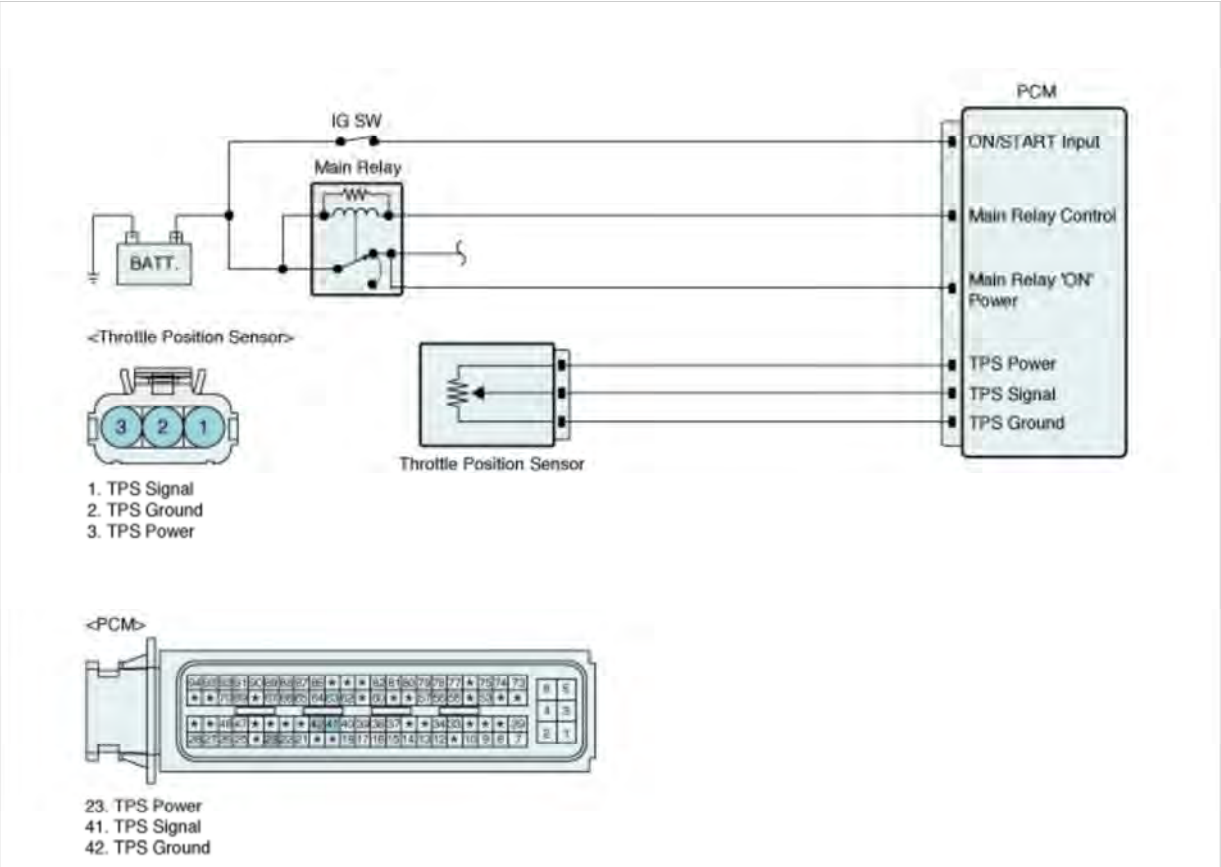
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Plausability check	• Poor connection or damaged harness • Faulty TP Sensor(TPS)
Enable Conditions	• No relevant failure • 11V < Battery voltage < 16V • Lambda control active	
Threshold Value	• Difference between modeled and measured pressure > 280hpa • Lambda controller deviation in same direction	
Diagnostic Time	• 200 revolutions	
Mil On Condition	• 2 Driving Cycles	

Specification

		Closed throttle status	Wide open throttle
Throttle opening angle(°)		0 ~ 0.5 °	Approx. 86 °
Voltage (V)		0.20 ~ 0.47 V	4.2 ~ 4.7 V
Resistance (kΩ)	Terminal 1 & 2	0.71 ~ 1.38 kΩ	2.7 kΩ
	Terminal 2 & 3		

Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	GDS Screen
		TPS VOLTAGE	
Normal value with ignition "ON" & engine "OFF"	Accelerator pedal released	0.20~0.47V	Fig.1
Normal value with engine ON & accelerator pedal fully depressed		4.2~4.7V	-
Abnormal value with ignition "ON" & engine "OFF"	Power circuit open	0.01V	Fig. 2
	Ground circuit open	4.99V	Fig. 3
	TPS signal circuit open	4.99V	Fig. 4
	TPS signal circuit short to ground	Approx. 0V	-
	TPS signal circuit short to battery	Above 4.99V	-

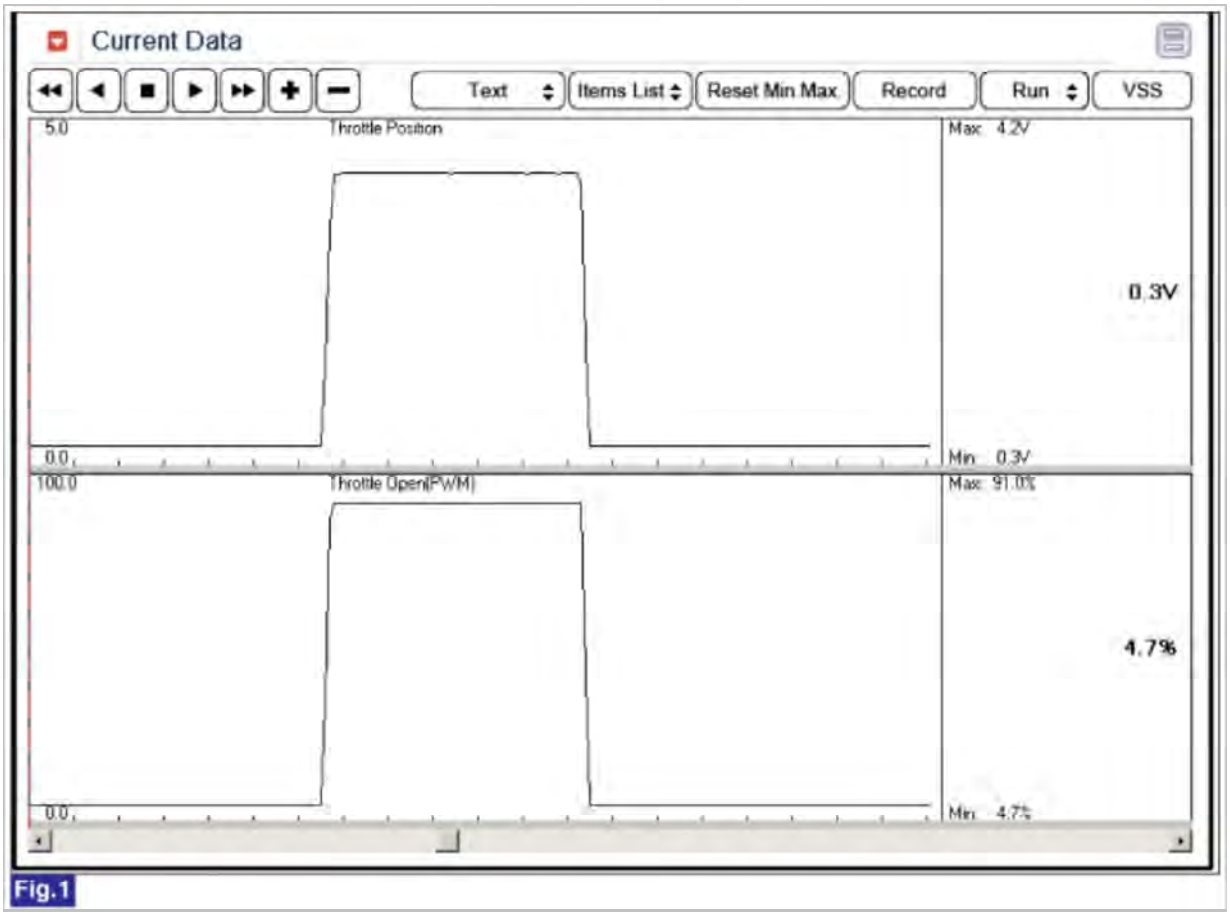


Fig.1

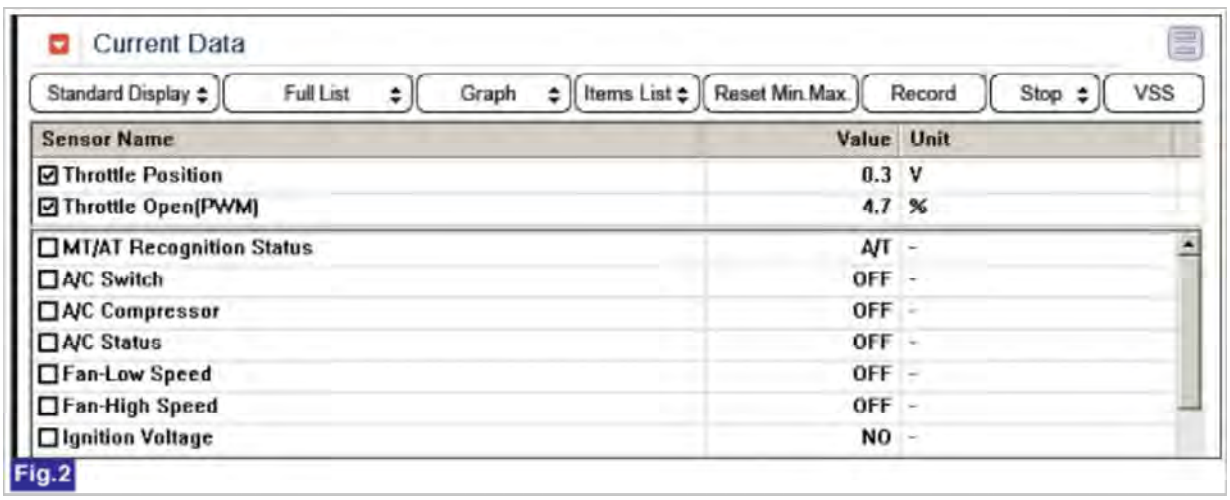


Fig.2

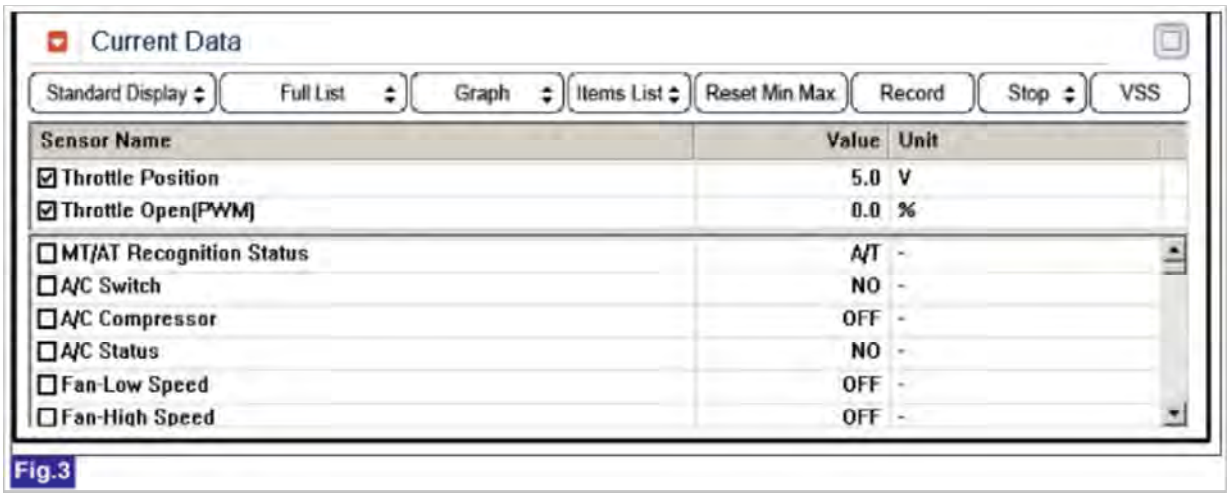


Fig.3

Fig.1) Signal increases proportionally with throttle open and close angle

Fig.2) Normal value with IG "ON"
Fig.3) Open in signal or ground circuit : Approx. 5V

Monitor DTC Status

NOTE

If any DTCs relating to TPS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Air Leakage Inspection

1. Visually/physically inspect the following items:
   - Vacuum hoses for splits, kinks and improper connections.
   - EVAP system for leakage
   - 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.

Terminal and Connector Inspection

NOTE

Check for open or short circuit in harness. Refer to "Signal Waveform & Data" in the "General Information" procedure

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.

Component Inspection

1. Ignition "OFF"
2. Disconnect TPS connector
3. Measure resistance between power terminal and ground terminal of TPS connector(Component side)

Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position

4. With still TPS connector disconnected, measure resistance between signal terminal and ground terminal of TPS 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 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 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

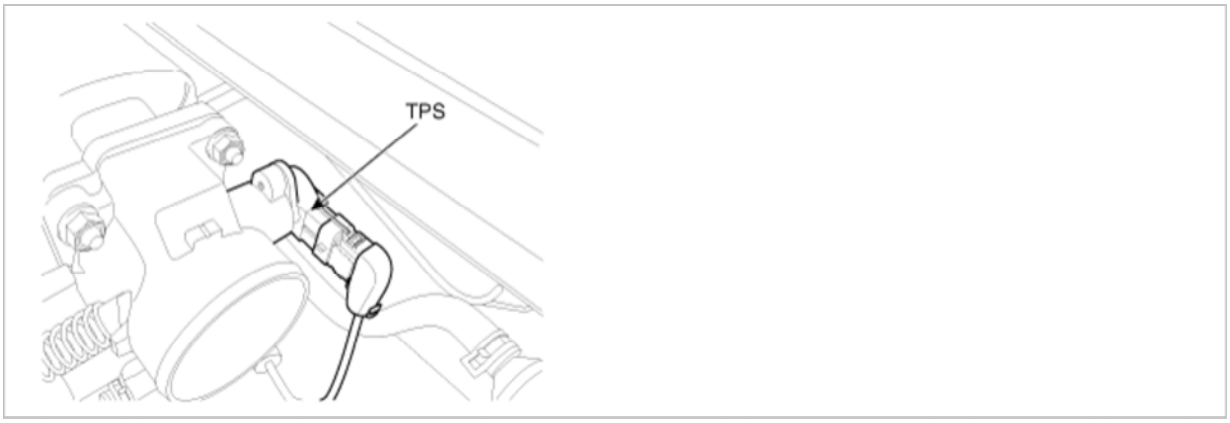
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0122 Throttle Position Sensor 1 Signal Circuit Low Input

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 PCM supplies a reference 5V to the TPS and the output voltage increases directly with the opening of the throttle valve. The PCM determines operating conditions such as idle (closed throttle), part load, acceleration/deceleration, and wide-open throttle from the TPS. Also The PCM uses the Mass Air Flow Sensor (MAFS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC Description

PCM sets DTC P0122 if the PCM detects signal voltage lower than the possible range of a properly operating TPS.

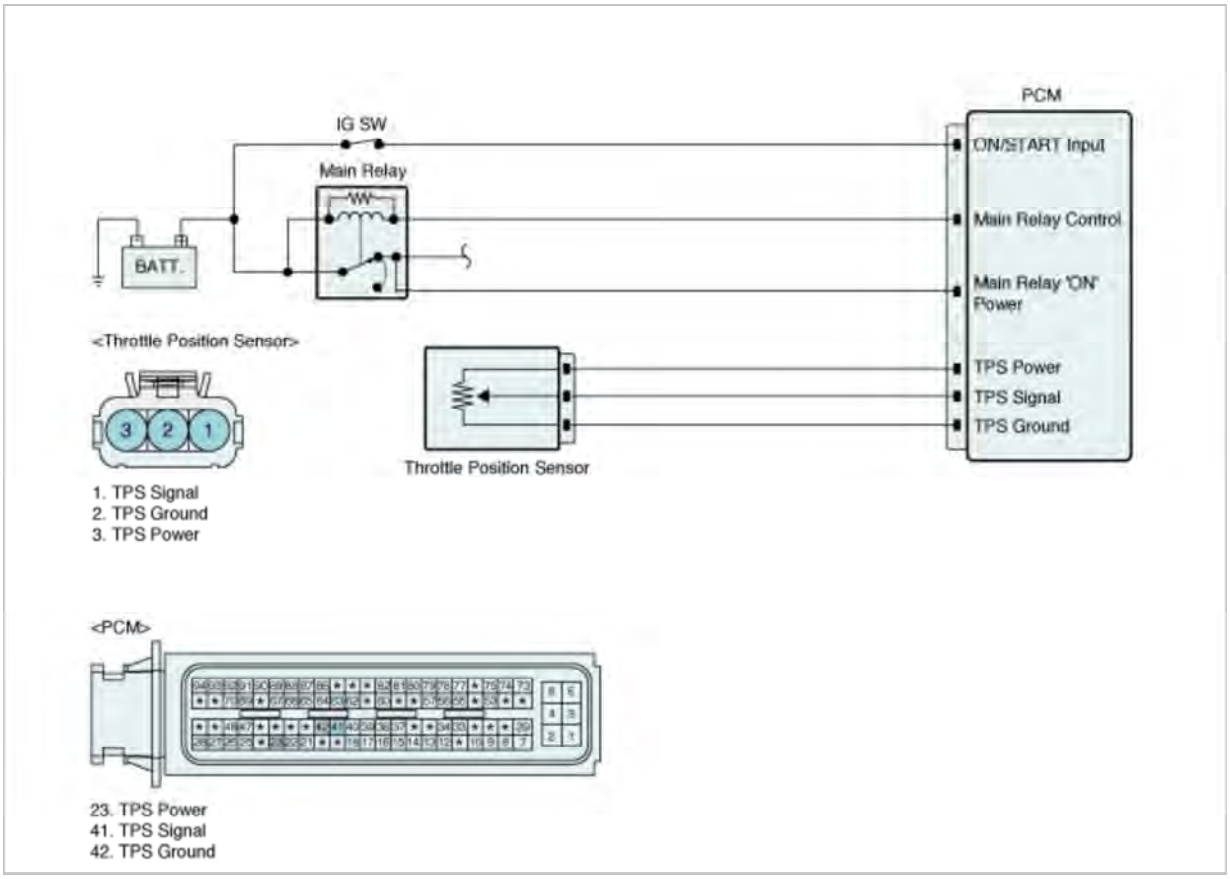
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Open in power supply harness • Short to ground in power supply or signal harness • Poor connection or damaged harness • Faulty TP sensor
Enable Conditions	• 6V < Battery voltage < 16V	
Threshold Value	• Voltage < 0.14 V	
Diagnostic Time	• 1 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

		Closed throttle status	Wide open throttle
Throttle opening angle(°)		0 ~ 0.5 °	Approx. 86 °
Voltage (V)		0.20 ~ 0.47 V	4.2 ~ 4.7 V
Resistance (kΩ)	Terminal 1 & 2	0.71 ~ 1.38 kΩ	2.7 kΩ
	Terminal 2 & 3		

Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	GDS Screen
		TPS VOLTAGE	
Normal value with ignition "ON" & engine "OFF"	Accelerator pedal released	0.20~0.47V	Fig.1
Normal value with engine ON & accelerator pedal fully depressed		4.2~4.7V	-
Abnormal value with ignition "ON" & engine "OFF"	Power circuit open	0.01V	Fig. 2
	Ground circuit open	4.99V	Fig. 3
	TPS signal circuit open	4.99V	Fig. 4
	TPS signal circuit short to ground	Approx. 0V	-
	TPS signal circuit short to battery	Above 4.99V	-

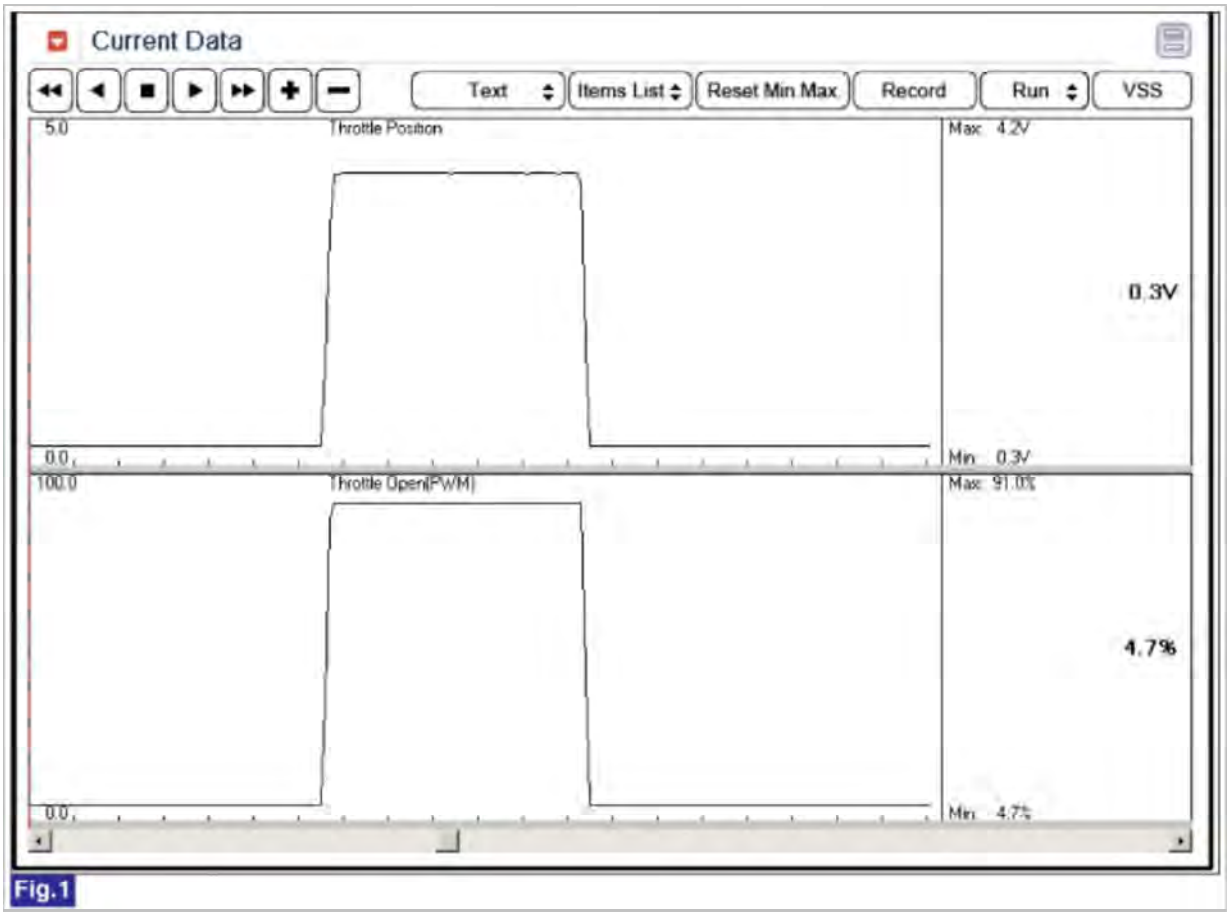


Fig.1

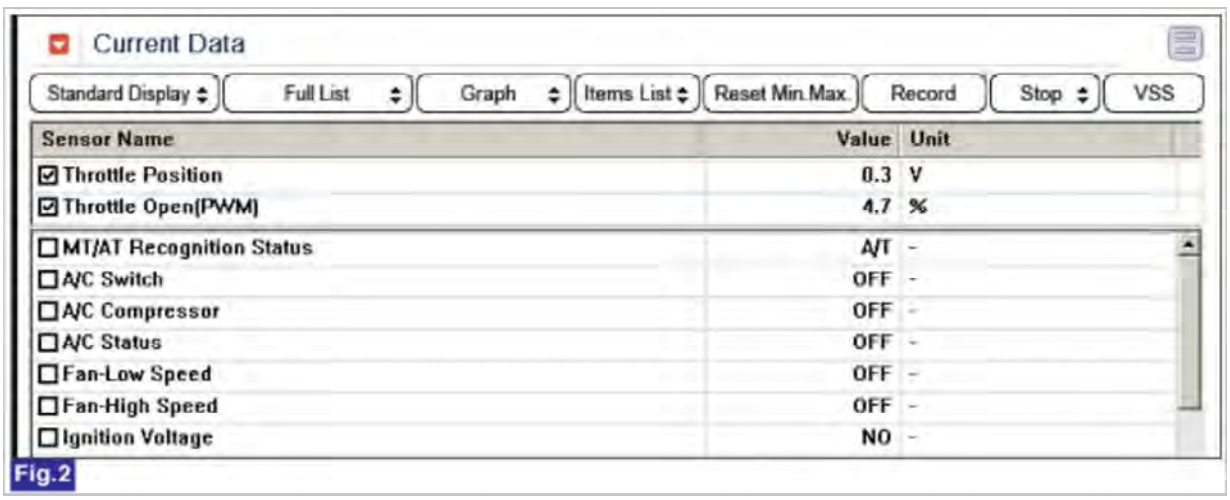


Fig.2

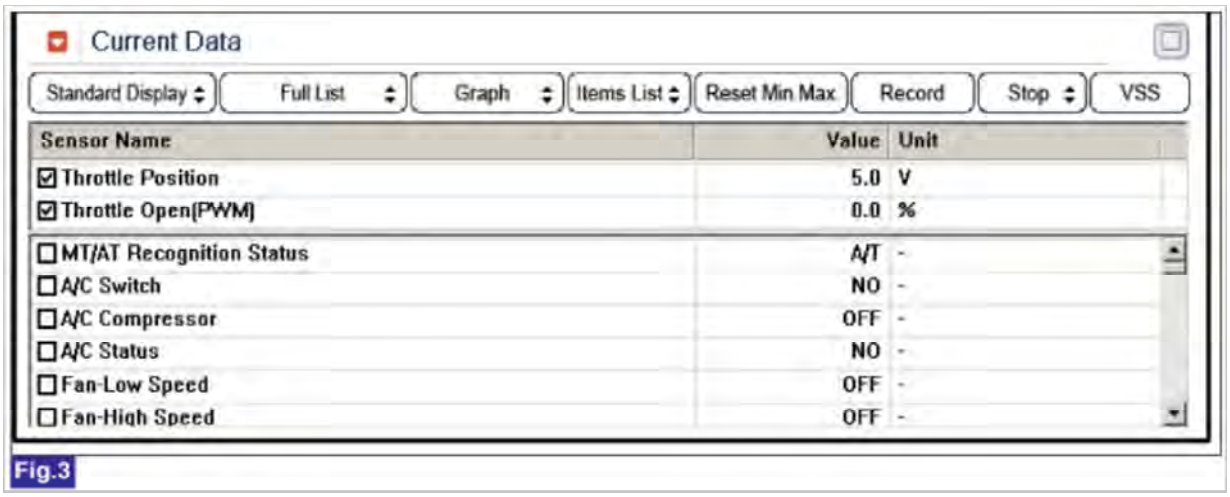


Fig.3

Fig.1) Signal increases proportionally with throttle open and close angle

Fig.2) Normal value with IG "ON"
Fig.3) Open in signal or ground circuit : Approx. 5V

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Power Circuit Inspection

> NOTE
>
> Check for open or short circuit in harness. Refer to "Signal Waveform & Data" in the "General Information" procedure

1. Ignition "OFF"
2. Disconnect TPS connector
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between power terminal of TPS harness connector and chassis ground

Specification : Approx. 5V

5. Is voltage within the specification?

	▸ Go to next step as below.

YES	
NO	▸ Possibility of open or short to ground in 5V reference circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Signal Circuit Inspection

NOTE

Check for open or short circuit in harness. Refer to "Signal Waveform & Data" in the "General Information" procedure

1. Measure voltage between signal terminal of the sensor harness connector and chassis ground

Specification : Approx. 5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check the short to ground in signal circuit. 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 next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect TPS connector.
3. Measure resistance between power terminal and ground terminal of TPS connector(Component side)

Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position

4. With still TPS connector disconnected, measure resistance between signal terminal and ground terminal of TPS 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 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 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 GDS 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.

Fuel System > Engine Control System > P0123 Throttle Position Sensor 1 Signal Circuit High Input

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 PCM supplies a reference 5V to the TPS and the output voltage increases directly with the opening of the throttle valve. The PCM determines operating conditions such as idle (closed throttle), part load, acceleration/deceleration, and wide-open throttle from the TPS. Also The PCM uses the Mass Air Flow Sensor (MAFS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC Description

PCM sets DTC P0123 if the PCM detects signal voltage higher than the possible range of a properly operating TPS

DTC Detecting Condition

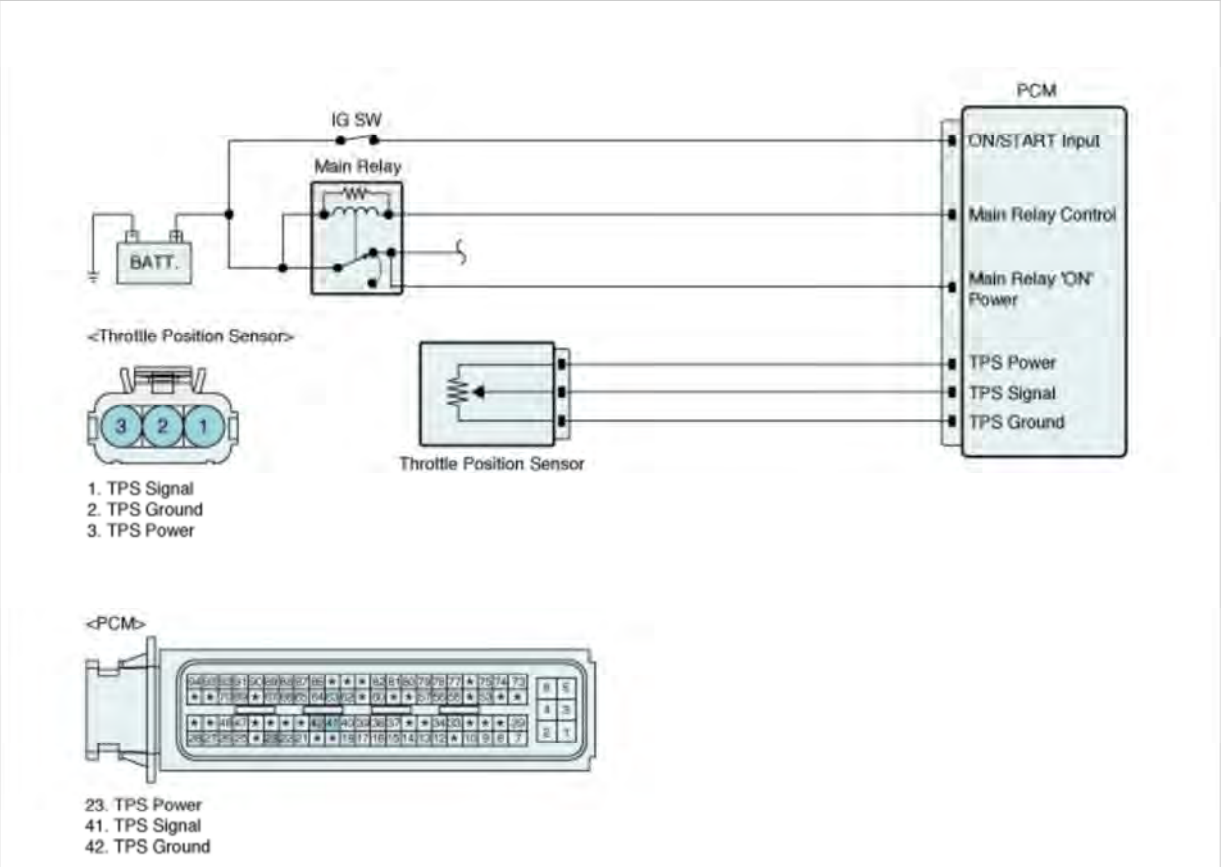
Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Open in signal or ground circuit • Short to battery in signal circuit • Poor connection or damaged harness • Faulty TP sensor
Enable Conditions	• 6V < Battery voltage <16V	
Threshold Value	• Voltage > 4.86 V	
Diagnostic Time	• 1 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

	Closed throttle status	Wide open throttle
Throttle opening angle(°)	0 ~ 0.5 °	Approx. 86 °
Voltage (V)	0.20 ~ 0.47 V	4.2 ~ 4.7 V

Resistance (kΩ)	Terminal 1 & 2	0.71 ~ 1.38 kΩ	2.7 kΩ
	Terminal 2 & 3		

Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	GDS Screen
		TPS VOLTAGE	
Normal value with ignition "ON" & engine "OFF"	Accelerator pedal released	0.20~0.47V	Fig.1
Normal value with engine ON & accelerator pedal fully depressed		4.2~4.7V	-
Abnormal value with ignition "ON" & engine "OFF"	Power circuit open	0.01V	Fig. 2
	Ground circuit open	4.99V	Fig. 3
	TPS signal circuit open	4.99V	Fig. 4
	TPS signal circuit short to ground	Approx. 0V	-
	TPS signal circuit short to battery	Above 4.99V	-

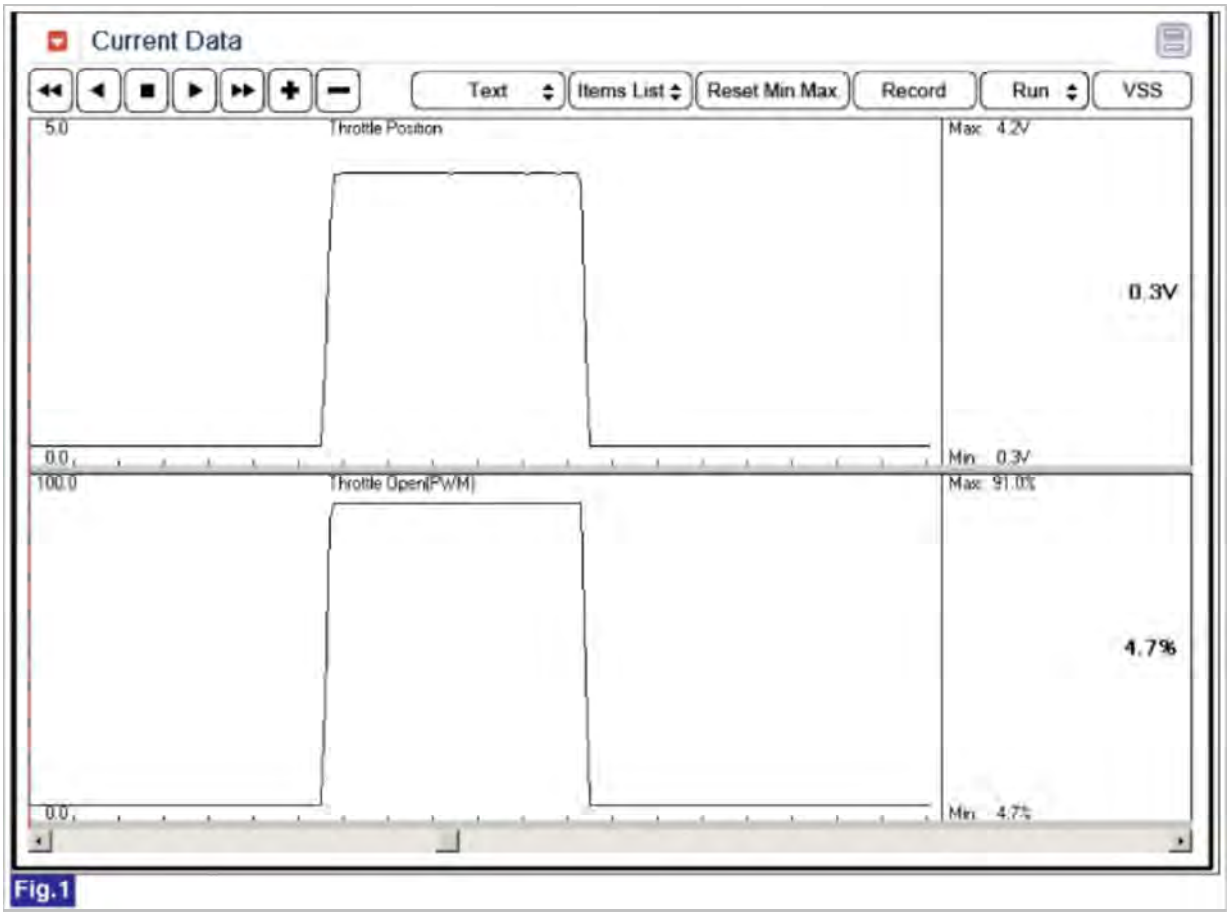


Fig.1

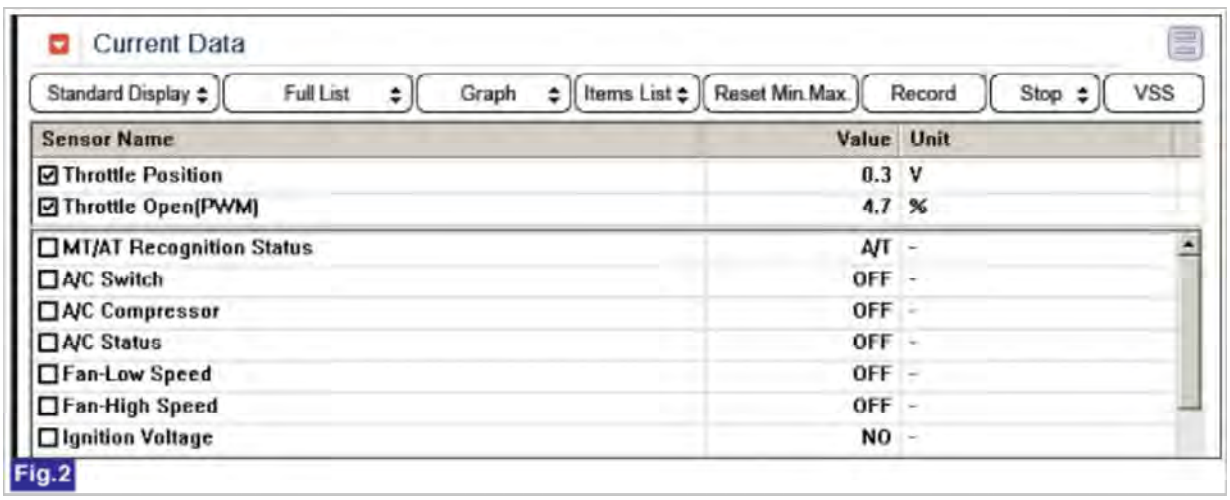


Fig.2

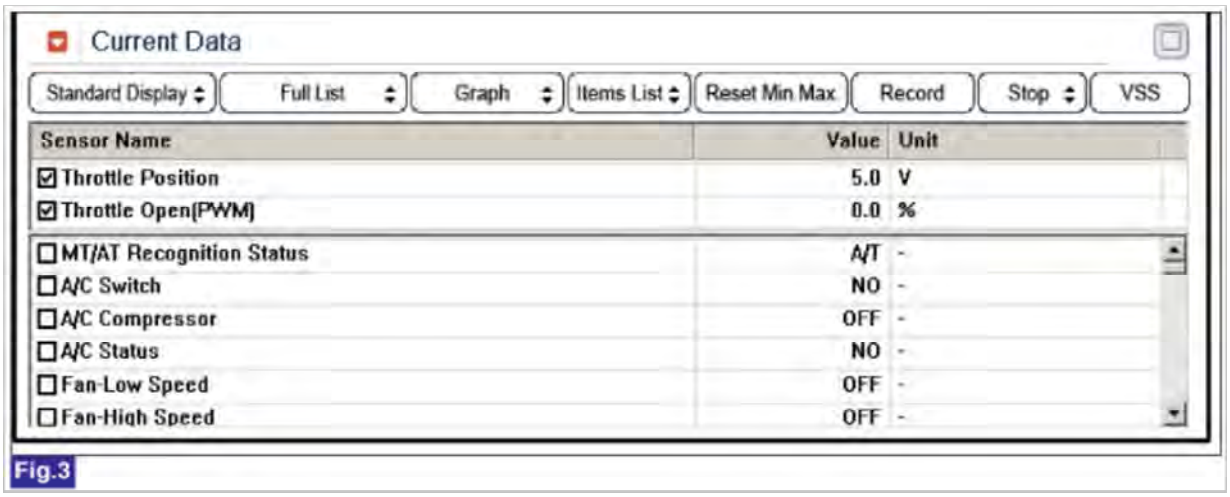


Fig.3

Fig.1) Signal increases proportionally with throttle open and close angle

Fig.2) Normal value with IG "ON"
Fig.3) Open in signal or ground circuit : Approx. 5V

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Ground Circuit Inspection

> NOTE
> Check for open or short circuit in harness. Refer to "Signal Waveform & Data" in the "General Information" procedure

1. Ignition "OFF"
2. Disconnect TPS connector.
3. Measure resistance between ground terminal of TPS harness connector and chassis ground.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES	▸ Go to next step as below.

NO	▸ Check the ground circuit for an open. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Signal Circuit Inspection

NOTE

Check for open or short circuit in harness. Refer to "Signal Waveform & Data" in the "General Information" procedure

1. Check for short to battery in signal circuit
   (1) Disconnect PCM connector
   (2) Ignition "ON" & Engine "OFF"
   (3) Measure voltage between signal terminal of TPS 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.

2. Check for open in signal circuit
   (1) Ignition "OFF"
   (2) Measure resistance between signal terminal of TPS harness connector and TPS signal terminal of the ECM harness connector.

   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.

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.

Component Inspection

1. Ignition "OFF"
2. Disconnect TPS connector
3. Measure resistance between power terminal and ground terminal of TPS connector(Component side)

   Specification : Approx. 1.6 ~ 2.4 kΩ at all throttle position

4. With still TPS connector disconnected, measure resistance between signal terminal and ground terminal of TPS 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 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 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

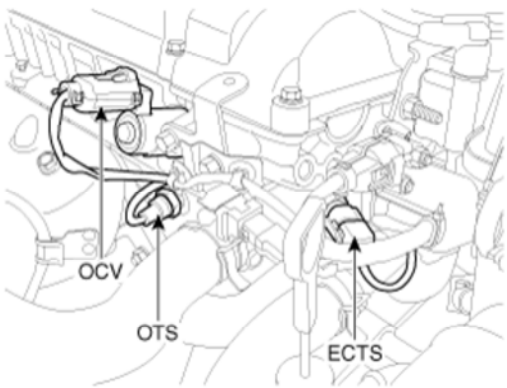
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0125 Insufficient Coolant Temperature for Closed Loop Fuel Control

Component Location



General Description

An Engine Coolant Temperature Sensor (ECTS) monitors the temperature of the coolant. This input is used by the PCM 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 PCM sets DTC P0125.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Coolant temperature too low for Lambda regulation	• Faulty cooling system • Faulty ECT sensor
Enable Conditions	• Minimum time(-15°C : approx.200sec, -10°C : approx.150sec, -4°C : 100sec.,25°C : 40sec.) after start versus coolant temperature at Start • No relevant failure • 6V< Battery voltage <16V	
Threshold Value	• Lambda control not active when modelled coolant temp. > minimum coolant temp. for Lambda regulation	
Diagnostic Time	• Immediate	
Mil On Condition	• 2 Driving Cycles	

Specification

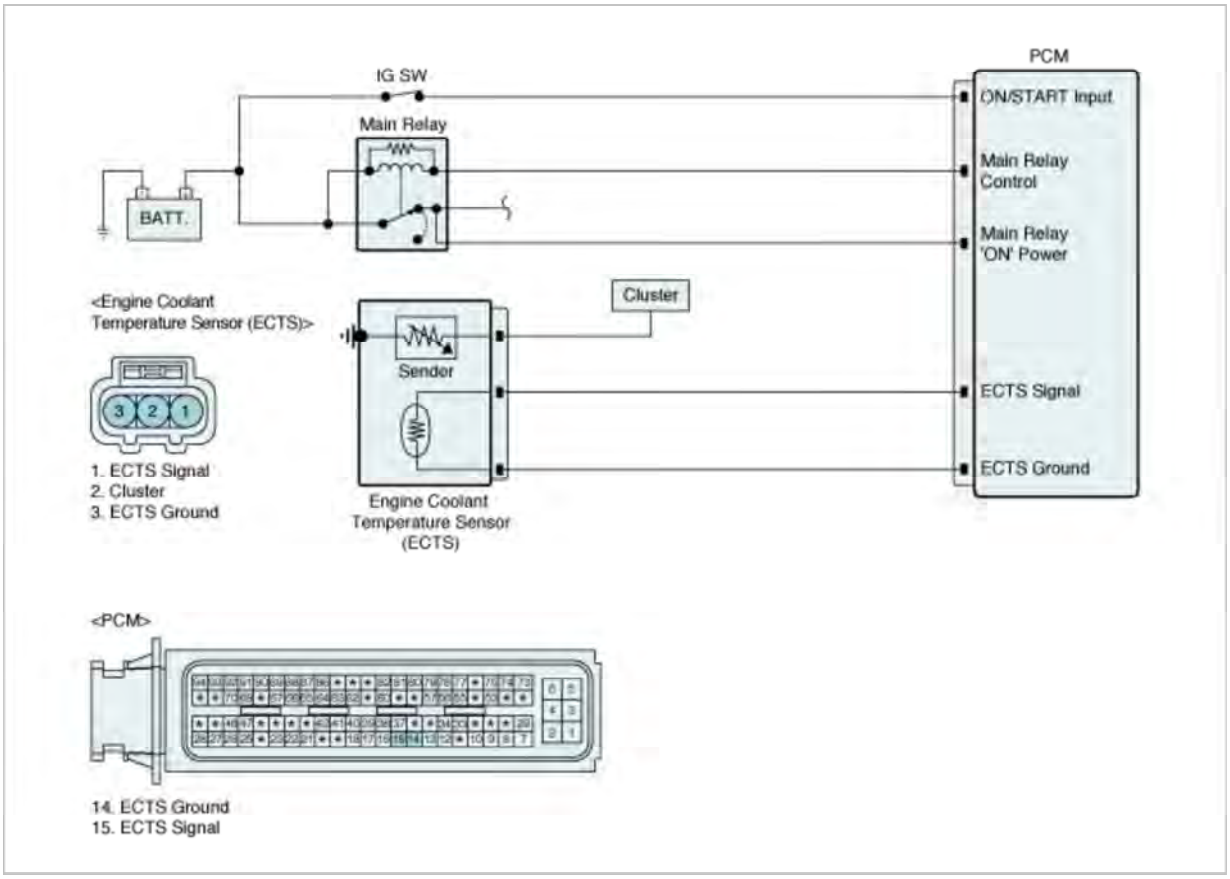
[ECTS]

Temp.(°C)	Resistance(kΩ)	Temp.(°C)	Resistance(kΩ)
-20	14.1 ~ 16.8	40	Approx. 1.2
0	Approx. 5.8	60	Approx. 0.6
20	2.3 ~ 2.6	80	Approx. 0.3

[THERMOSTAT]

THERMOSTAT	Normal Parameter
Valve Opening Temp.	80~84°C
Valve Closing Temp.	77°C
Full Open Lift	Approx. 8mm(95°C)

Diagnostic Circuit Diagram

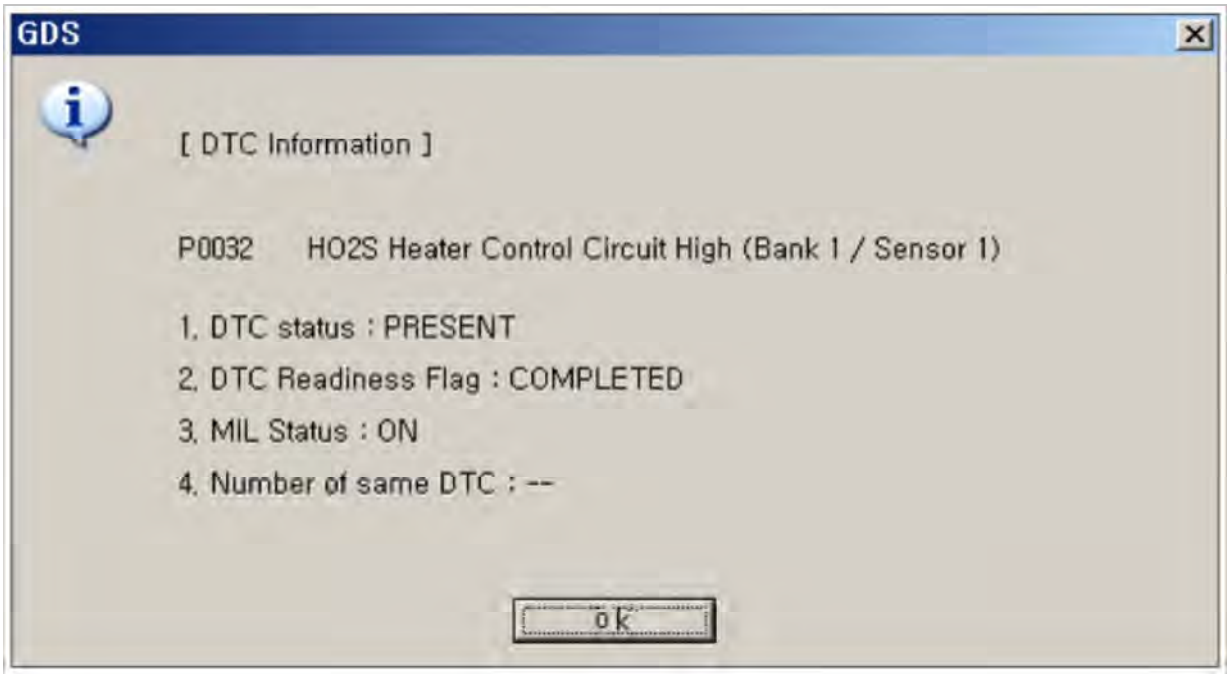


Monitor DTC Status

NOTE

If any codes relating to ECTs are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Monitor GDS Data

1. Allow the engine to cool completely.
2. Run the cold engine at idle for 5 minutes and observe cooling fan status.

> NOTE
>
> Ensure that the A/C is OFF

3. Check the engine coolant temperature parameter at idle with the GDS.
4. Is the engine coolant temperature increase to above 50°C (122°F)

YES	▸ Go to "Terminal and Connector Inspection"procedure.
NO	▸ Go to next step as below.

5. Are the cooling fans running when engine coolant temperature is low (less than approximately 98°C(208°F)) with A/C OFF?

YES	▸ Check for short circuit in cooling fan harness or cooling fan relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ With ignition "ON", Install GDS and select "COOLING FAN RELAY" on the Actuation Test mode. - Activates "COOLING FAN RELAY" by pressing "STRT(F1)" key - Repeat this procedure 4 or 5 times to ensure cooling fan reliability. - If cooling fan works properly, go to next step as below - If NG, check for intermittent fault caused by poor contact in the sensor’s and/or PCM’s connector. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

System Inspection

1. Coolant Level Inspection
   (1) Check the cooling system coolant level.
   (2) Is the coolant in the reservoir at the proper level?

YES	▸ Go to next step as below.
NO	▸ Repair or add engine coolant as necessary and go to "Verification of Vehicle Repair" procedure.

2. Thermostat Inspection
   (1) Check if the thermostat bypass valve is stuck in the open position or if the correct type of thermostat was installed. Replace thermostat as necessary and go to "Verification of Vehicle Repair" procedure.
   (2) Check the valve opening temperature of the thermostat.

   Specification(Valve opening temperature) : 80~84°C(176~183°F)

   (3) If the opening temperature is not as specified, Replace thermostat as necessary and go to "Verification of Vehicle Repair" procedure.If OK, go to next step as below.

3. ECT Sensor Inspection
   (1) Ignition "OFF"
   (2) Disconnect ECTS connector.
   (3) Measure resistance between signal terminal and ground terminal of ECTS connector.(Component side).
   Specification :

Temp.(°C)	Resistance(kΩ)
-20	14.1 ~ 16.8
0	Approx. 5.8
20	2.3 ~ 2.6
40	Approx. 1.2
60	Approx. 0.6
80	Approx. 0.3

   (4) Is resistance within the specification?

YES	▸ Go to next step as below.
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.

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.

Verification of Vehicle Repair

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

1. Connect GDS 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

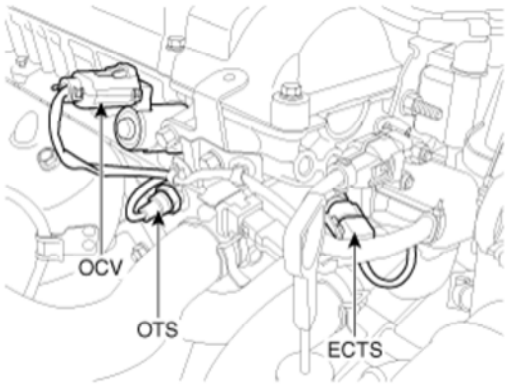
in the freeze frame data or enable conditions .

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.

Fuel System > Engine Control System > P0128 Coolant Thermostat (Coolant Temperature below Thermostat Regulating Temperature)

Component Location



General Description

An Engine Coolant Temperature Sensor (ECTS) monitors the temperature of the coolant. This input is used by the PCM 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 PCM checks measured coolant temperature as soon as calculated coolant temperature reaches threshold 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 & Fail Safe	Possible Cause
DTC Strategy	• Coolant temp.not reached warm up state	• Faulty cooling system • Faulty ECT sensor • Poor connection or damaged harness
Enable Conditions	• Fuel-cut off phase <20% • Low load phase < 50% • Intake air temperature decrease compared to Start Intake air temperature > -20°C(-4°F) • -10°C(14°F) < Coolant temperature at start < 54.4°C(130°F) • -10°C(14°F) < Intake air temperature at start • No high engine speed(4800rpm) with vehicle stopped • No relevant failure	
Threshold Value	• Measured coolant temp. < 74°C(165°F) When modelled coolant temp. > 85°C(185°F)	
Diagnostic Time	• 10~30 min. depending on coolant temperature at start and driving pattern	

Mil On Condition	• 2 Driving Cycles	

Specification

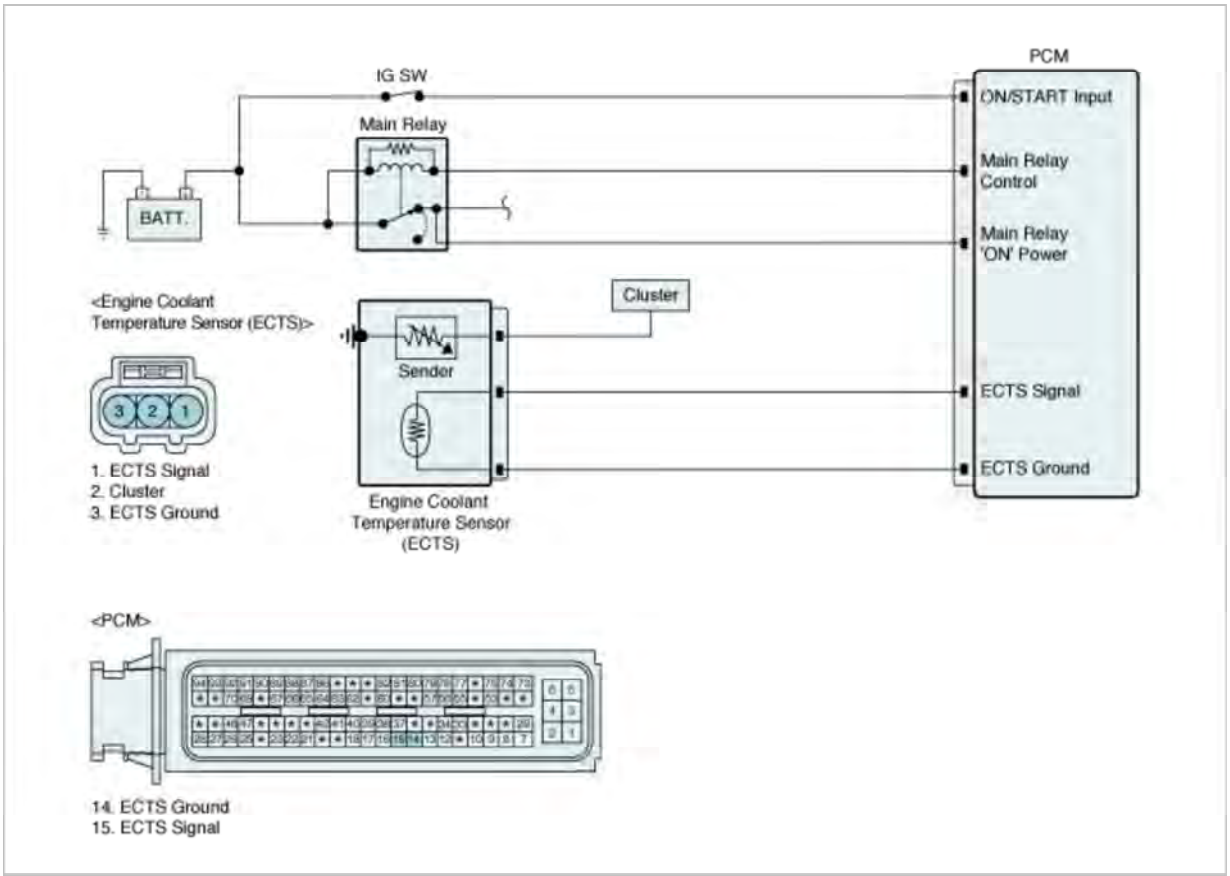
[ECTS]

Temp.(°C)	Resistance(kΩ)	Temp.(°C)	Resistance(kΩ)
-20	14.1 ~ 16.8	40	Approx. 1.2
0	Approx. 5.8	60	Approx. 0.6
20	2.3 ~ 2.6	80	Approx. 0.3

[THERMOSTAT]

THERMOSTAT	Normal Parameter
Valve Opening Temp.	80~84°C
Valve Closing Temp.	77°C
Full Open Lift	Approx. 8mm(95°C)

Diagnostic Circuit Diagram



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 GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.

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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Monitor GDS Data

1. Allow the engine to cool completely.
2. Run the cold engine at idle for 5 minutes and observe cooling fan status.

> NOTE
>
> Ensure that the A/C is OFF

3. Check the engine coolant temperature parameter at idle with the GDS.
4. Is the engine coolant temperature increase to above 50°C (122°F)

YES	▸ Go to "Terminal and Connector Inspection"procedure.
NO	▸ Go to next step as below.

5. Are the cooling fans running when engine coolant temperature is low (less than approximately 98°C(208°F)) with A/C OFF?

YES	▸ Check for short circuit in cooling fan harness or cooling fan relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ With ignition "ON", Install GDS and select "COOLING FAN RELAY" on the Actuation Test mode. - Activates "COOLING FAN RELAY" by pressing "STRT(F1)" key - Repeat this procedure 4 or 5 times to ensure cooling fan reliability. - If cooling fan works properly, go to next step as below - If NG, check for intermittent fault caused by poor contact in the sensor’s and/or PCM’s connector. Repair

	as necessary and go to "Verification of Vehicle Repair" procedure.

System Inspection

1. Coolant Level Inspection
   (1) Check the cooling system coolant level.
   (2) Is the coolant in the reservoir at the proper level?

YES	▸ Go to next step as below.
NO	▸ Repair or add engine coolant as necessary and go to "Verification of Vehicle Repair" procedure.

2. Thermostat Inspection
   (1) Check if the thermostat bypass valve is stuck in the open position or if the correct type of thermostat was installed. Replace thermostat as necessary and go to "Verification of Vehicle Repair" procedure.
   (2) Check the valve opening temperature of the thermostat.

   Specification(Valve opening temperature) : 80~84°C(176~183°F)

   (3) If the opening temperature is not as specified, Replace thermostat as necessary and go to "Verification of Vehicle Repair" procedure.If OK, go to next step as below.

3. ECT Sensor Inspection
   (1) Ignition "OFF"
   (2) Disconnect ECTS connector.
   (3) Measure resistance between signal terminal and ground terminal of ECTS connector.(Component side).
   Specification :

Temp.(°C)	Resistance(kΩ)
-20	14.1 ~ 16.8
0	Approx. 5.8
20	2.3 ~ 2.6
40	Approx. 1.2
60	Approx. 0.6
80	Approx. 0.3

   (4) Is resistance within the specification?

YES	▸ Go to next step as below.
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.

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.

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0130 O2 Sensor Circuit(Bank 1 / Sensor 1)

Component Location

General Description

The HO2S(Heated Oxygen Sensor) is used to supply the PCM 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 (PCM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the PCM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The PCM 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.

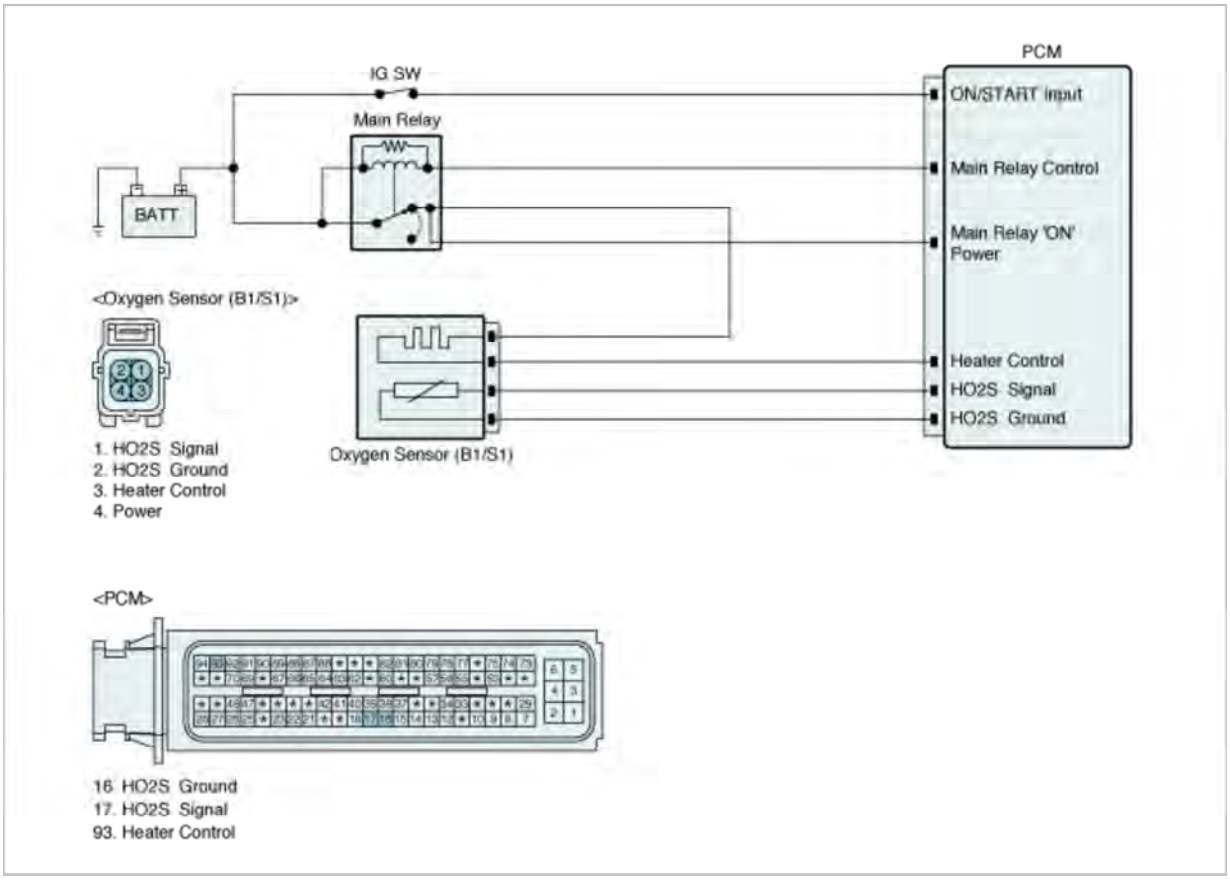
DTC Description

PCM sets DTC P0130 if the PCM detects that the front HO2S signal circuit is open.

DTC Detecting Condition

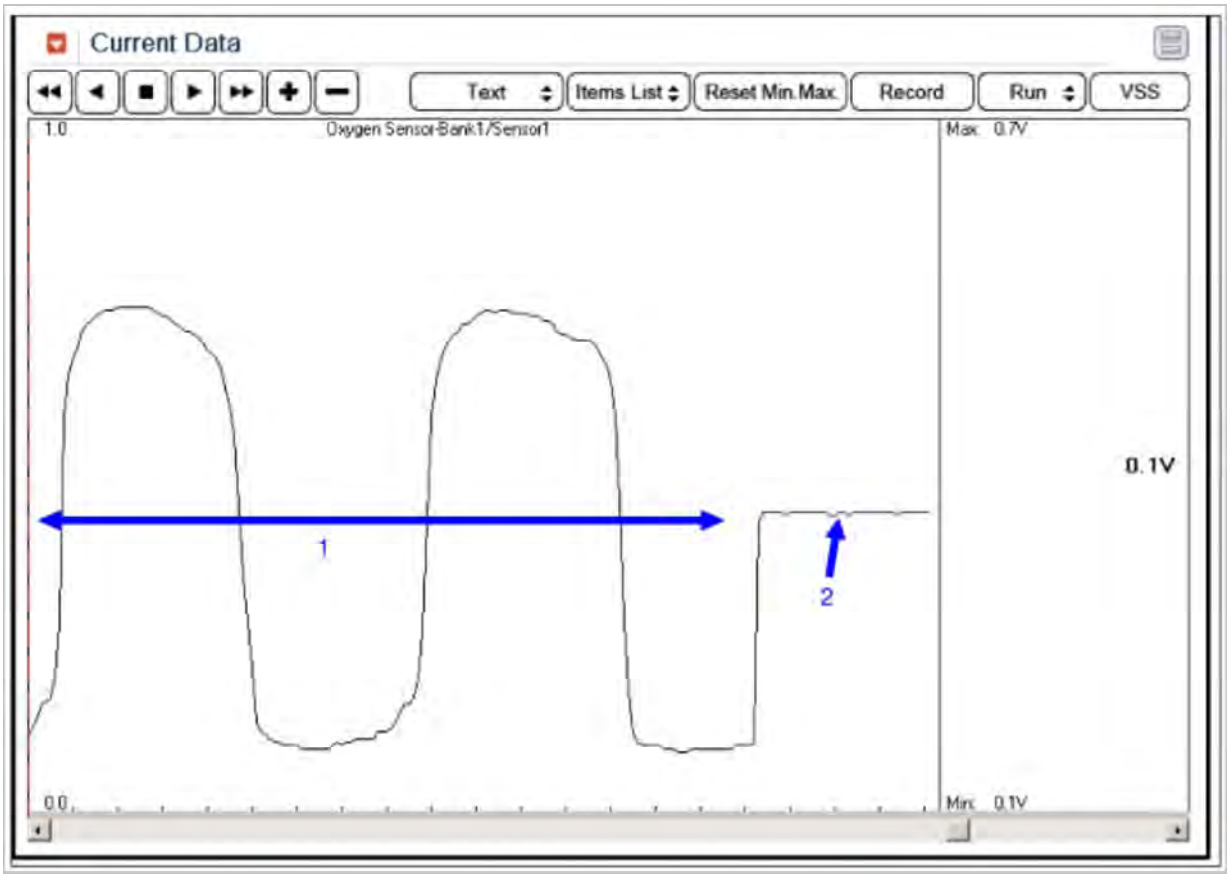
Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage range check	• Open in signal harness • Open in ground harness • Poor connection or damaged harness • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	Case1	• Depending on Start temp.(-30°C:100s~90°C:30s)	
	Case2	• 10V< Battery voltage • Exhaust gas temperature > 600°C(1112°F) • Lambda control active • No relevant failure	
Threshold Value	Case1	• Lambda control not active within the defined time	
	Case2	• 0.37V< HO2S < 0.49V	
Diagnostic Time	Case1	• 30~100 sec.(depending on Start temp)	
	Case2	• 10sec.	
MIL On Condition		• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

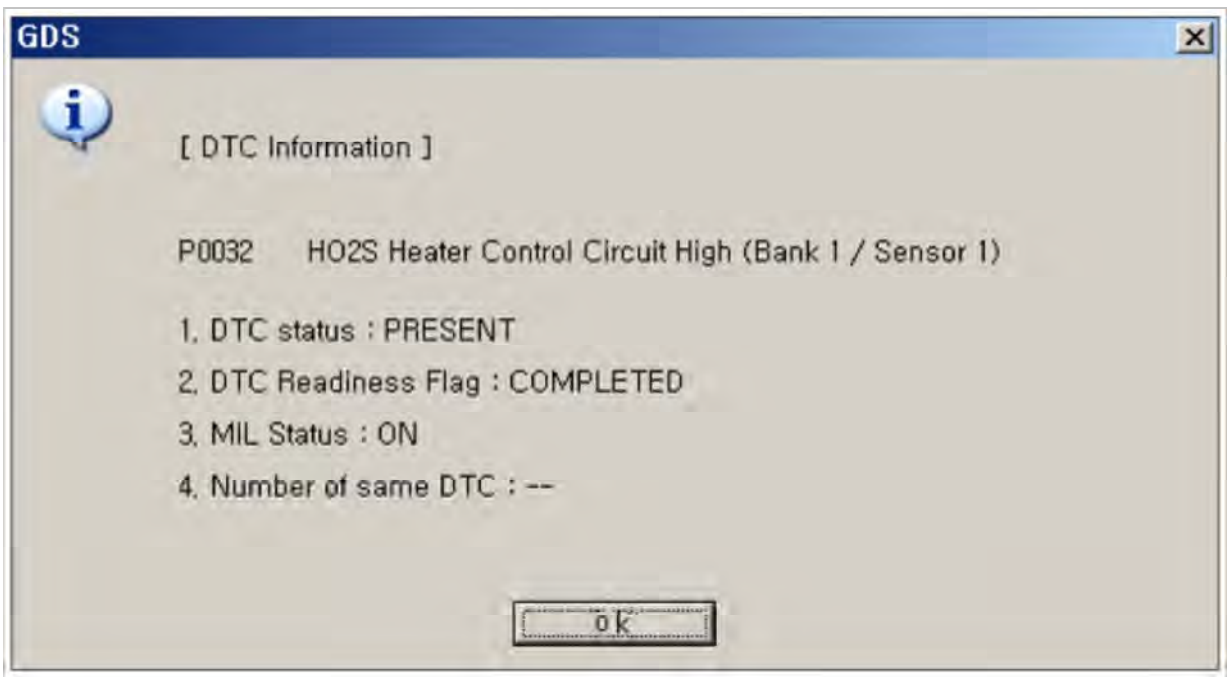
Test Condition		GDS Parameter	
		O2 SNSR VOL.-B1/S1	O2 SNSR VOL.-B1/S2
Normal Value when circuit is normal	Idle after warm up	Signal is switching from rich (above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V



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.
2. GDS display with open in signal circuit : Approx. 0.43~0.45V

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Ground Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S connector.
3. Measure resistance between ground terminal of HO2S(B1/S1) harness connector and chassis ground

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES	▸ Go to "Signal circuit inspection" procedure.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between signal terminal of HO2S(B1S1) harness connector and chassis ground

Specification : Approx. 0.4~0.5V

3. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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.

Component Inspection

1. Visually/physically inspect the following items:
   - Inspect the front HO2S for any silicon contamination. This contamination will be indicated by a white powdery coating on the portion of the sensor exposed to the exhaust stream and this will result in a but false(high) voltage signal
   - If contamination is evident on the HO2S, fix the source of the sensor contamination before replacing the sensor to prevent future contamination. Go to "Verification of Vehicle Repair" procedure.
2. Warm up the engine to normal operating temperature and let it idle.
3. Connect GDSand monitor the O2 SNSR VOL.-B1/S1 parameter on the GDSdata 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) at idle.

4. Is sensor switching properly?

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 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

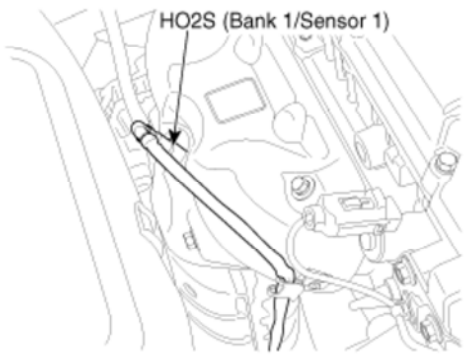
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0131 O2 Sensor Circuit Low Voltage(Bank 1 / Sensor 1)

Component Location



General Description

The linear O2 sensor is mounted on the front side of the Catalytic Converter (warm-up catalytic converter) or in the front exhaust pipe. It detects a wide range of air/fuel ratios in the exhaust gas from the rich to lean regions. This linear O2 sensor produces a current that corresponds to a specific air/fuel ratio. The PCM monitors this signal and determines whether the air/fuel mixture is rich or lean. The PCM constantly monitors the linear O2 sensor and increases or decreases the fuel injection duration using this signal. This is called closed-loop fuel control operation.

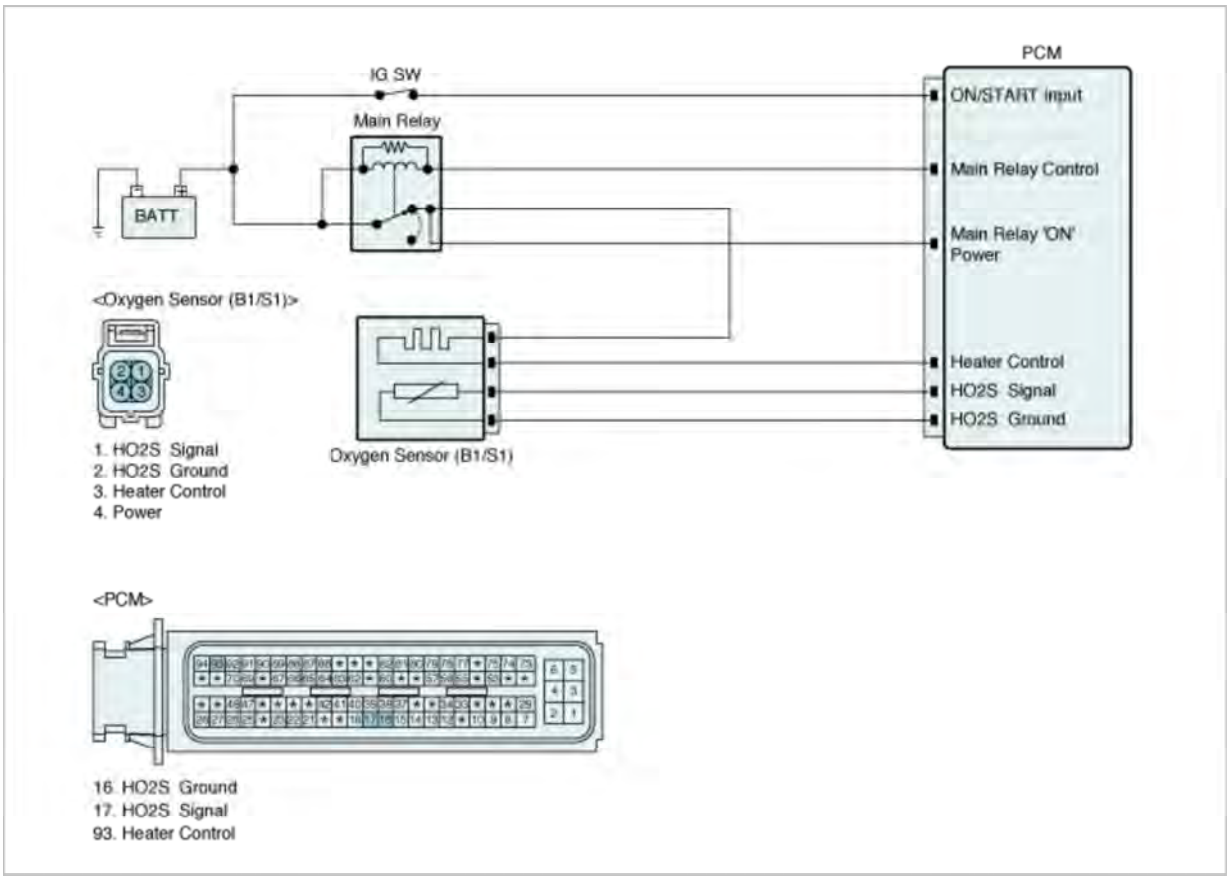
DTC Description

The control unit of the linear oxygen sensor built inside the PCM monitors short circuit error on all front Heated Oxygen Sensor (HO2S) control lines (PIN#19, PIN#40, PIN#41 and PIN#53) and PCM sets P0131 with short circuit to ground.If same code is set again in the next driving cycle, MIL is illuminated.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Poor connection or damaged harness • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	• Canister Purge valve closed • 10V < Battery voltage • No relrvant failure	
Threshold Value	• Short circuit to ground	
Diagnostic Time	• 40 sec.	
Mil On Condition	• 2 Driving Cycles	

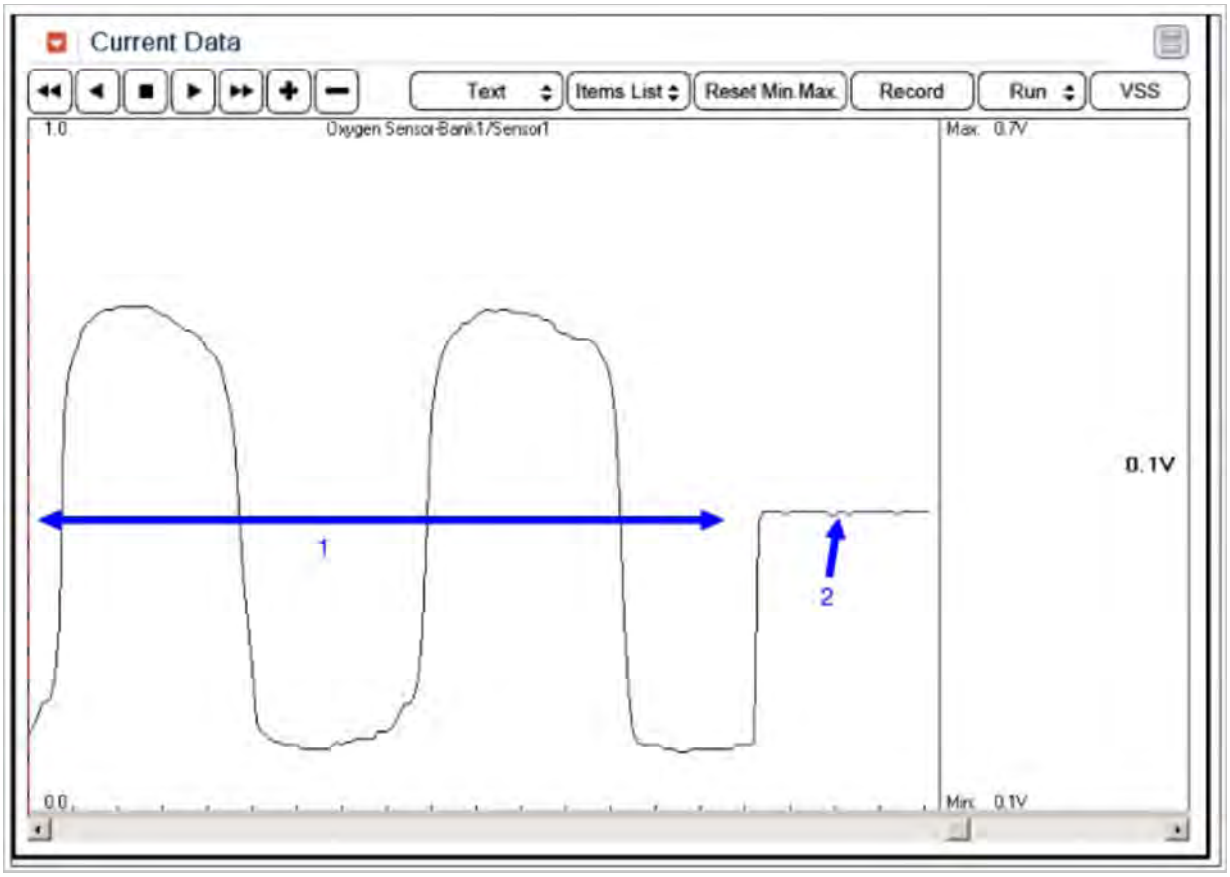
Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	
		O2 SNSR VOL.-B1/S1	O2 SNSR VOL.-B1/S2
Normal Value when circuit is normal	Idle after warm up	Signal is switching from rich (above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-

HO2S(B1S2) signal circuit open	-	Approx. 0.43~0.45V



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.
2. GDS display with open in signal circuit : Approx. 0.43~0.45V

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Signal Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S and PCM connector.
3. Measure resistance between signal terminal of HO2S(B1S1) harness connector and chassis ground.

Specification : Infinite

4. Is HO2S display near the specification?

YES	▸ Go to next step as below.
NO	▸ Repair open or short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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.

Component Inspection

1. - 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 GDSand monitor the "O2 SNSR VOLT.(B1/S1)" parameter on the GDSdata list.

Test Condition : Engine "ON" & In Closed loop mode

Specification : - Normal HO2S(B1S1) value with engine warm-up and idling : Approx. 1.5~2.0V
- Signal decreases with rich air/fuel mixture and increases with lean air/fuel mixture
- Voltage at Fuel cut-off mode : Approx. 3.0~4.0V

4. Is sensor data near the specified value?

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	▸ 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

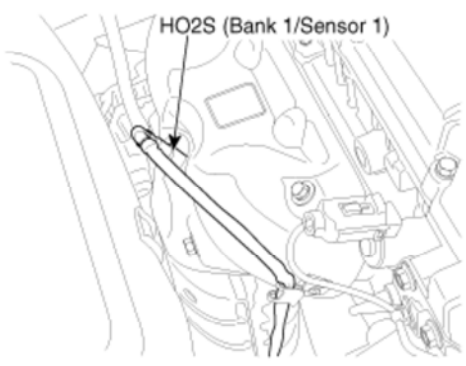
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0132 O2 Sensor Circuit High Voltage(Bank 1 / Sensor 1)

Component Location



General Description

The linear O2 sensor is mounted on the front side of the Catalytic Converter (warm-up catalytic converter) or in the front exhaust pipe. It detects a wide range of air/fuel ratios in the exhaust gas from the rich to lean regions. This linear O2 sensor produces a current that corresponds to a specific air/fuel ratio. The PCM monitors this signal and determines whether the air/fuel mixture is rich or lean. The PCM constantly monitors the linear O2 sensor and increases or decreases the fuel injection duration using this signal. This is called closed-loop fuel control operation.

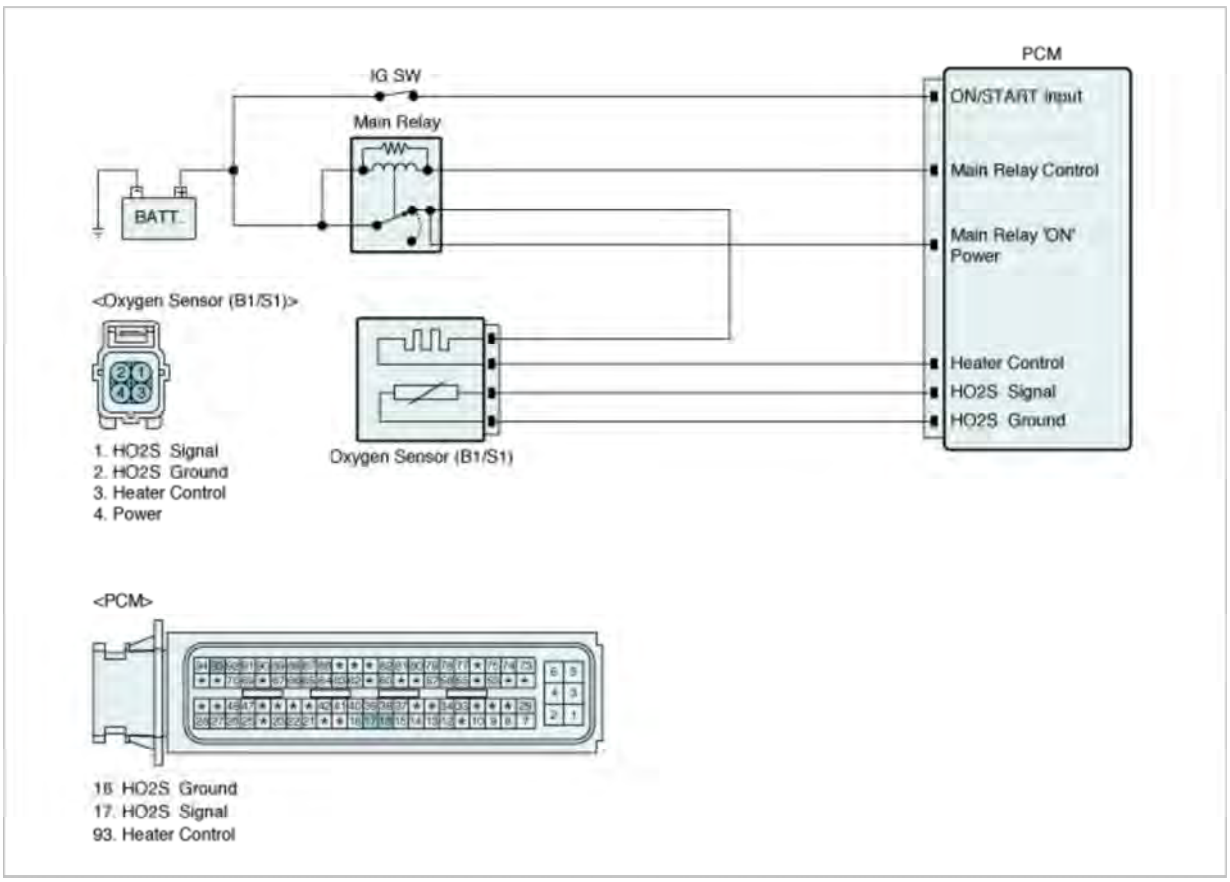
DTC Description

PCM sets DTC P0132 if the HO2S(B1S1) voltage remains excessively high for a predetermined time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range check	• Short to Battery in signal harness • Poor connection or damaged harness • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	• No relevant failure • 10V < Battery voltage	
Threshold Value	• Short Circuit to Battery	
Diagnostic Time	• 1 sec	
Mil On Condition	• 2 Driving Cycles	

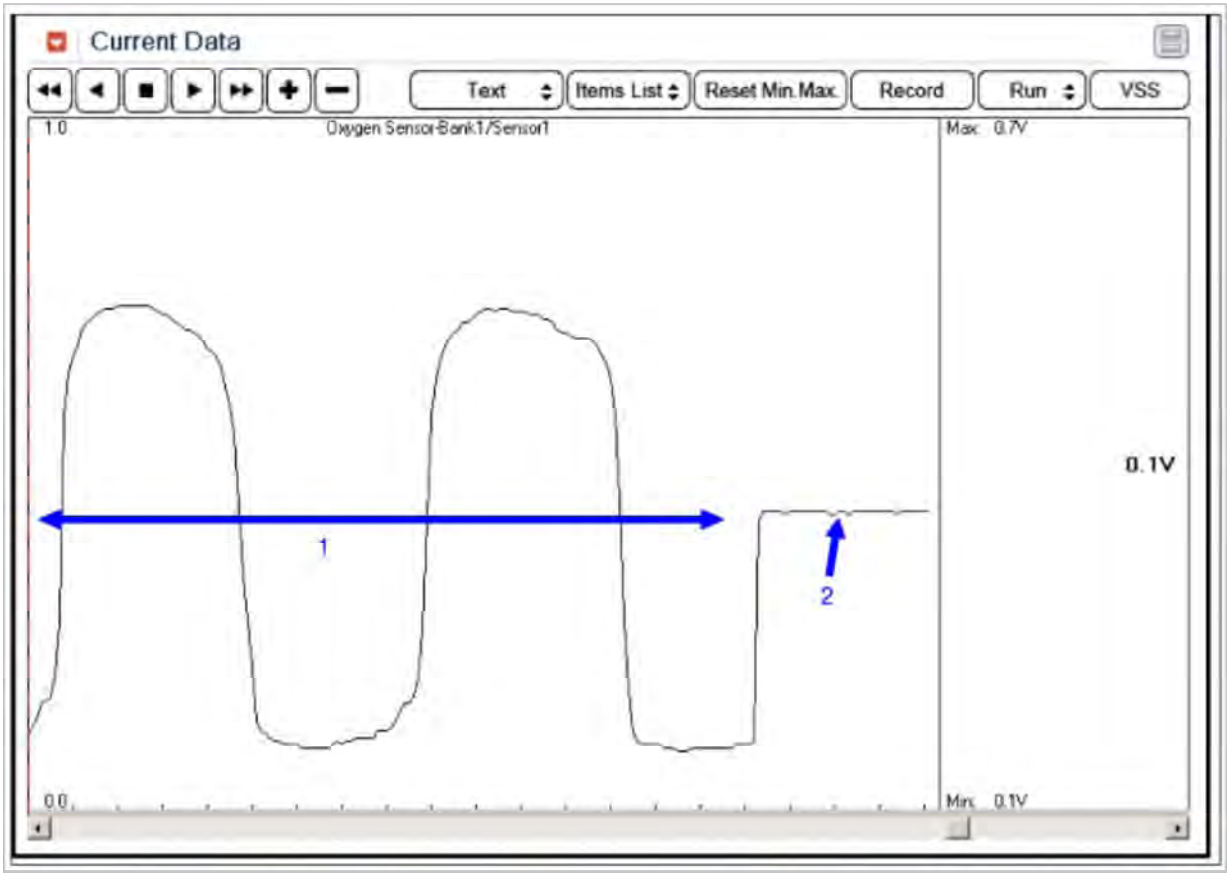
Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	
		O2 SNSR VOL.-B1/S1	O2 SNSR VOL.-B1/S2
Normal Value when circuit is	Idle after warm up	Signal is switching from rich (above 0.45V) to lean(below	above 0.7V

normal		0.45V) a minimum of 3 times in 10	
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V



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.
2. GDS display with open in signal circuit : Approx. 0.43~0.45V

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Signal Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S and PCM connector.
3. Ignition "OFF", Engine "ON"
4. Measure voltage between signal terminal of HO2S(B1S1) harness connector and chassis ground

Specification : Approx. 0.4~0.5V

5. Is HO2S display near the specification?

YES	▸ Go to next step as below.
NO	▸ Repair open or short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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.

Component Inspection

1. - 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 let it idle.
3. Connect GDSand monitor the "O2 SNSR VOLT.(B1/S1)" parameter on the GDSdata list.

Test Condition : Engine "ON" & In Closed loop mode

Specification : - Normal HO2S(B1S1) value with engine warm-up and idling : Approx. 1.5~2.0V
- Signal decreases with rich air/fuel mixture and increases with lean air/fuel mixture
- Voltage at Fuel cut-off mode : Approx. 3.0~4.0V

4. Is sensor data near the specified value?

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	▸ 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

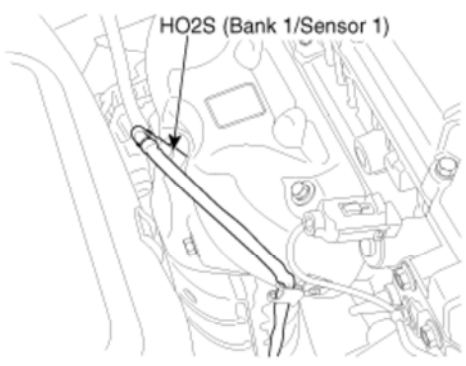
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0133 O2 Sensor Circuit Slow Response (Bank 1 / Sensor 1)

Component Location



General Description

The linear O2 sensor is mounted on the front side of the Catalytic Converter (warm-up catalytic converter) or in the front exhaust pipe. It detects a wide range of air/fuel ratios in the exhaust gas from the rich to lean regions. This linear O2 sensor produces a current that corresponds to a specific air/fuel ratio. The PCM monitors this signal and determines whether the air/fuel mixture is rich or lean. The PCM constantly monitors the linear O2 sensor and increases or decreases the fuel injection duration using this signal. This is called closed-loop fuel control operation.

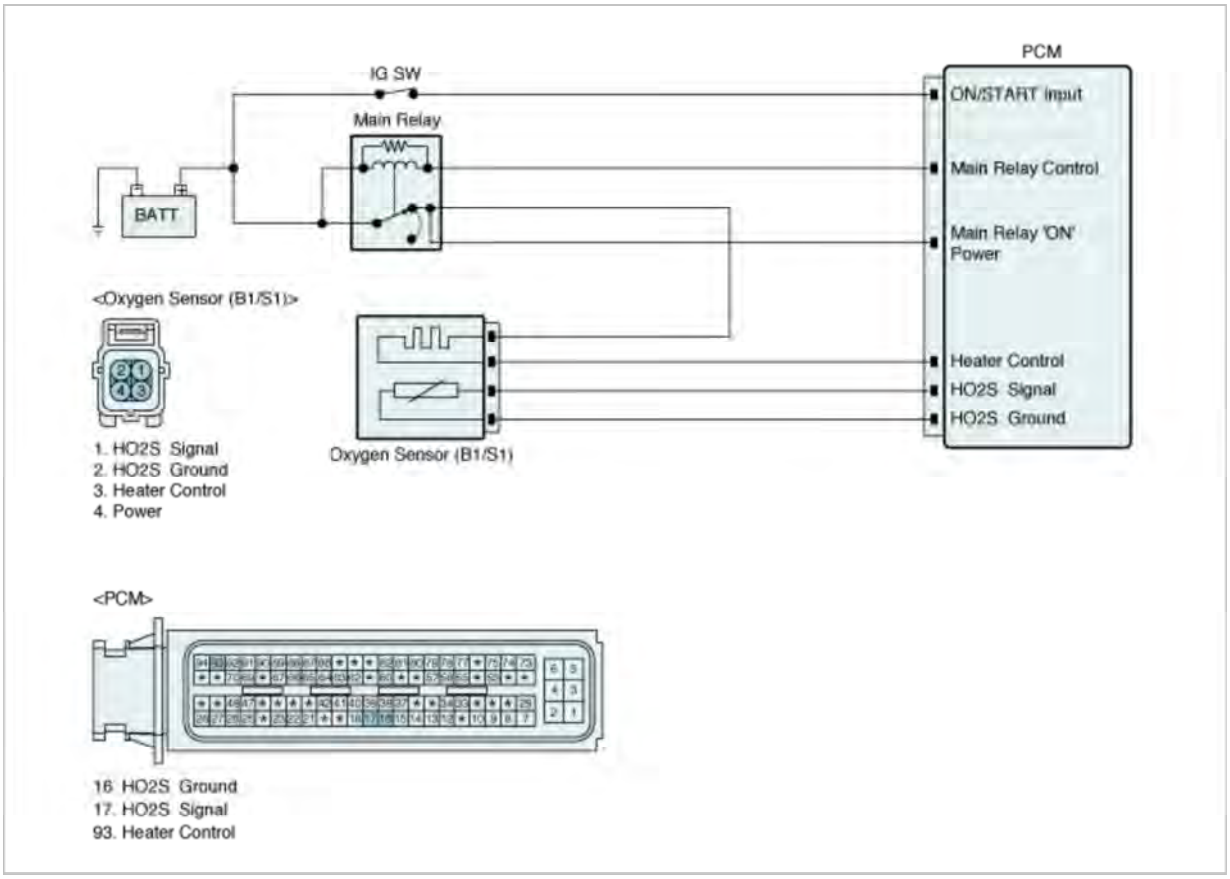
DTC Description

The PCM 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 PCM sets DTC P0133 when the amplitude of oxygen sensor is equal to or less than minimum amplitude threshold.

DTC Detecting Condition

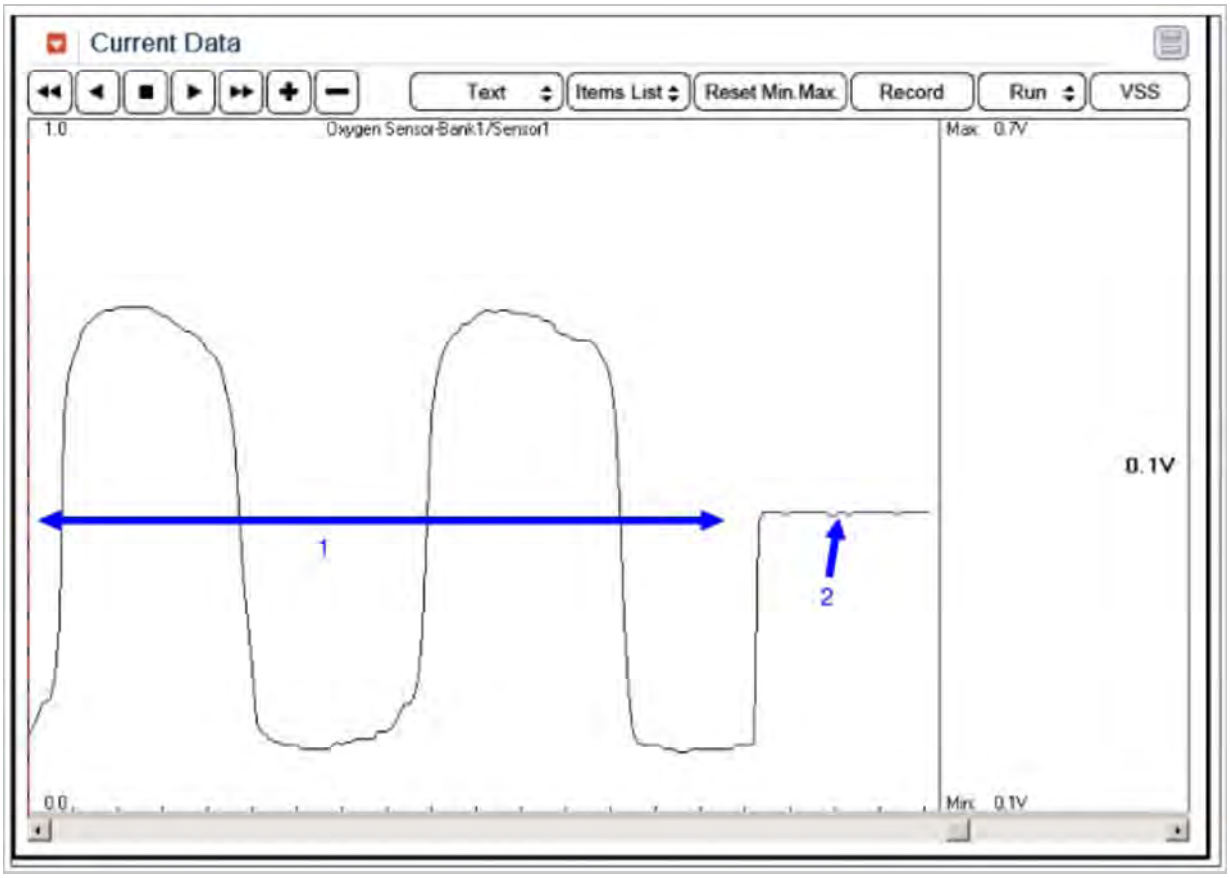
Item	Detecting Condition	Possible Cause
DTC Strategy	• Lambda Regulation Frequency Check	• Leak in intake or exhaust system. • Poor connection or damaged harness • HO2S contamination
Enable Conditions	• 400°C < Modeled catalyst temp. < 900°C • Lambda regulation active • Engine speed < 3400 rpm • 200 mg/rev < Engine Load < 700 mg/rev • Coolant temperature > 74°C(165°F) • 3 mph < Vehicle speed < 112 mph • Canister purge closed • No relevant failure • 11V<Battery voltage	
Threshold Value	• Average Ratio between measured and maximum allowed frequency during 100 Lambda regulation cycles > 0.95	
Diagnostic Time	• 20 Forced stimulation cycles	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

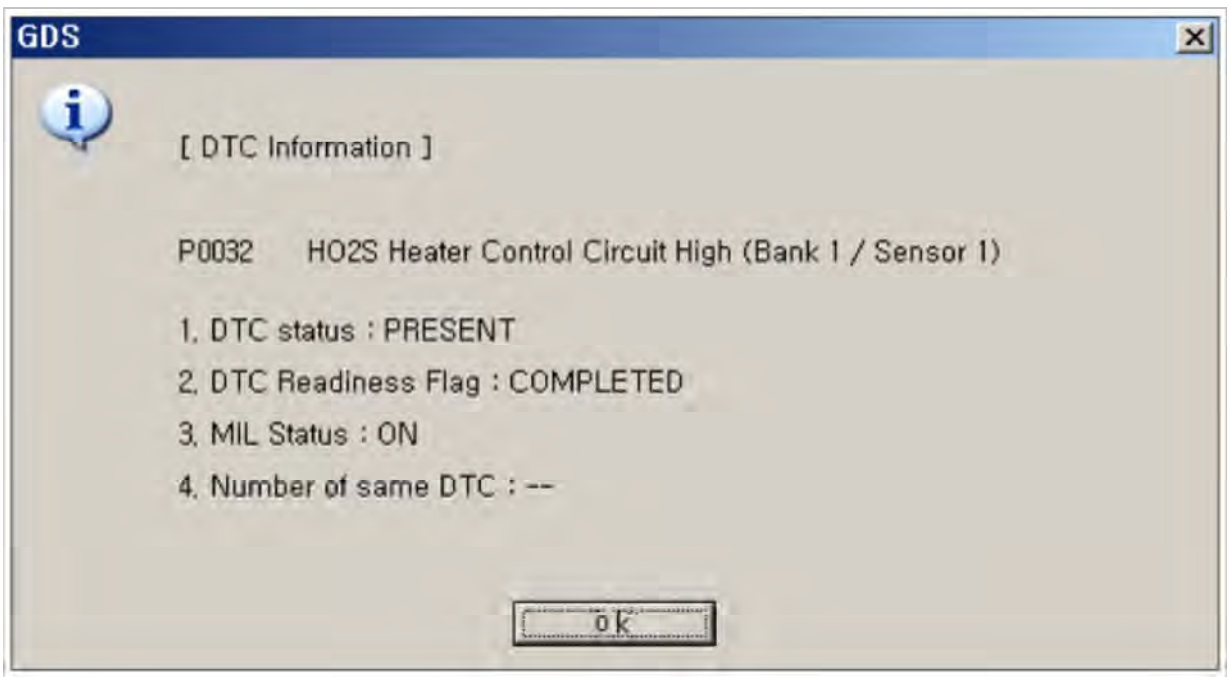
Test Condition		GDS Parameter	
		O2 SNSR VOL.-B1/S1	O2 SNSR VOL.-B1/S2
Normal Value when circuit is normal	Idle after warm up	Signal is switching from rich (above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V



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.
2. GDS display with open in signal circuit : Approx. 0.43~0.45V

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Air Leakage Inspection

1. Visually/physically inspect the following items:
   - Vacuum hoses for splits, kinks and improper connections.
   - Exhaust system between HO2S and Three way catalyst for air leakage
   - EVAP system for leakage
   - 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.

Visual/Physical Inspection

1. Visually/physically inspect the following items:
   - Ensure that the HO2S is securely installed.
   - Check for corrosion on terminals
   - Check for terminal tension (at the HO2S and at the PCM)
   - Check for damaged wiring
   - Check the HO2S ground circuit for a good connection
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. Visually/physically inspect following items:
   - 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 GDSand monitor the "O2 SNSR VOLT.(B1/S1)" parameter on the GDSdata list.

Test Condition : Engine "ON" & In Closed loop mode

Specification : - Normal HO2S(B1S1) value with engine warm-up and idling : Approx. 1.5~2.0V
- Signal decreases with rich air/fuel mixture and increases with lean air/fuel mixture
- Voltage at Fuel cut-off mode : Approx. 3.0~4.0V

4. Is sensor data near the specified value?

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	▸ 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

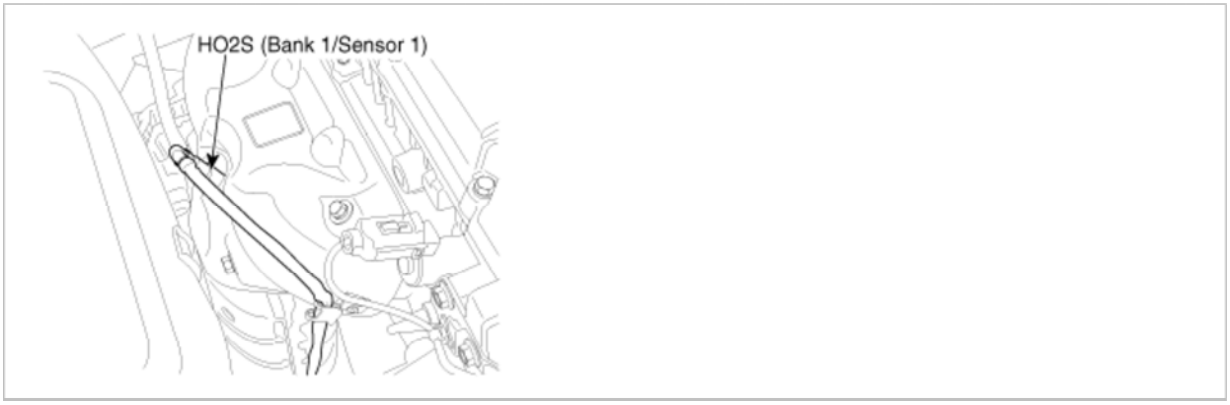
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0134 O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)

Component Location



General Description

The HO2S(Heated Oxygen Sensor) is used to supply the PCM 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 (PCM) monitors this voltage and determines if the exhaust gas is lean or rich. If the voltage input at the PCM is under approx. 0.45V the exhaust is lean, and if the voltage input is over approx. 0.45V the exhaust is rich. The PCM 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

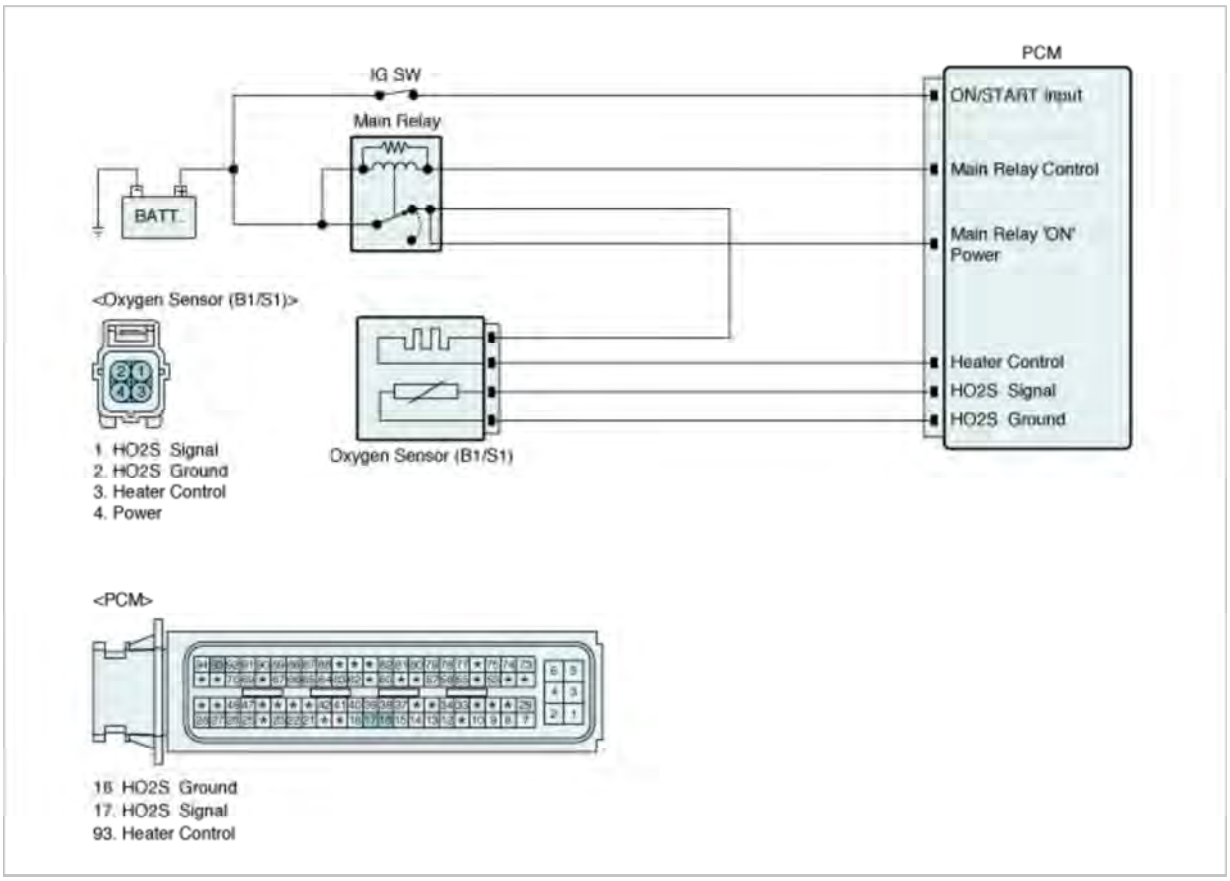
1. Signal amplitude plausibility error : In order to determine the signal amplitude plausibility, the PCM monitors front HO2S signal level from rich to lean and from lean to rich. The PCM sets DTC P0134, If the difference of the signal transition level is too small.
2. Signal plausibility error during fuel cut-off : PCM sets DTC P0134, if the HO2S(B1S1) signal is too high during fuel cut-off period for a predetermined time.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy	Case1	• Signal plausibility during fuel cut-off	
	Case2	• Signal amplitude plausibility	

Enable Conditions	Case1	• fule cut off active • Fule cut off phase • 16g< Integrated Mass Air Flow since Fuel Cut-Off begin • No relevant failure • 10V< Battery voltage	• Poor connection or damaged harness • HO2S contamination
	Case2	• Signal stroke valid • Lambda controller not on the limit • Lean / rich cycle time < 2.5 sec • No relevant failure • 10V< Battery voltage	
Threshold Value	Case1	• HO2S voltage at fuel-cut mode > 0.1V	
	Case2	• Upstream O2 sensor signal stroke < 0.25 V	
Diagnostic Time	Case1	• 5 sec.	
	Case2	• 120 sec.	
MIL On Condition		• 2 Driving Cycles	

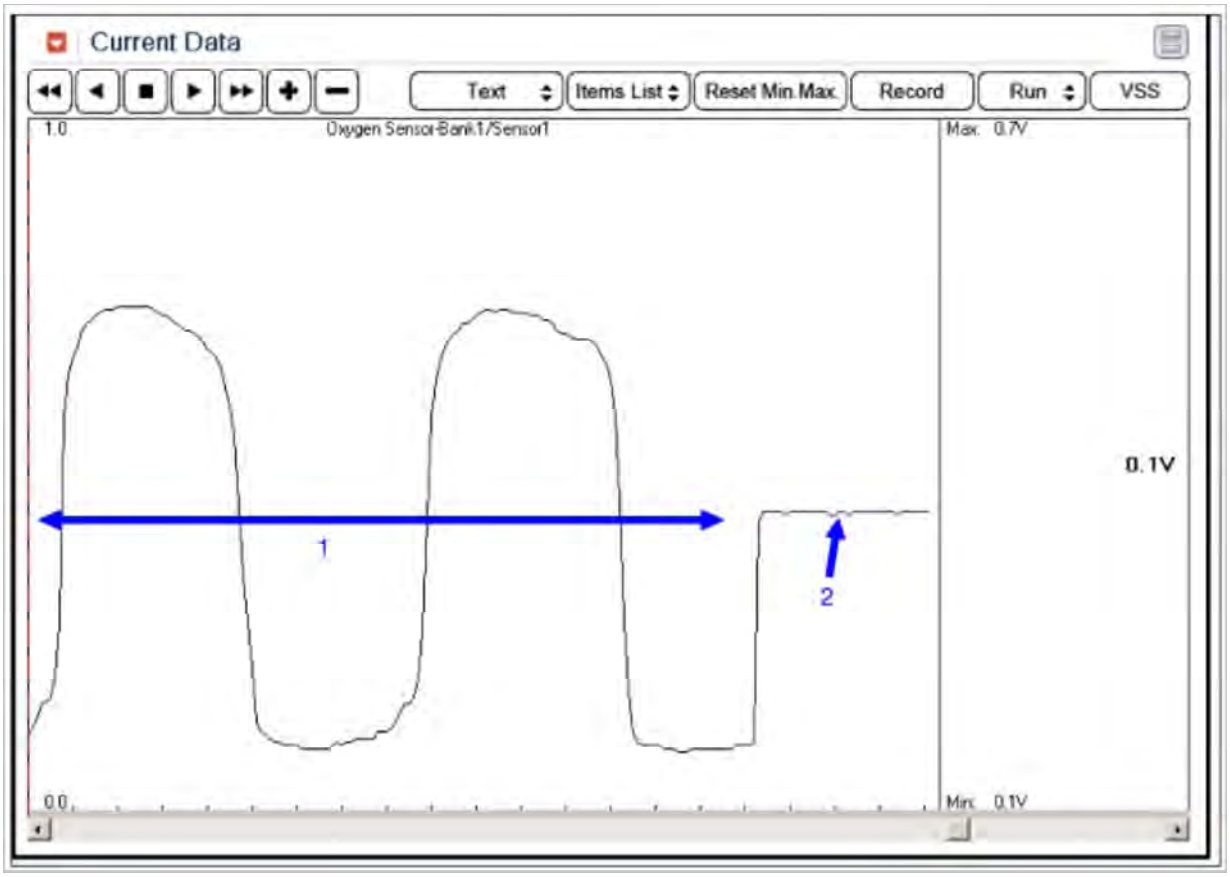
Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	
		O2 SNSR VOL.-B1/S1	O2 SNSR VOL.-B1/S2
Normal Value when circuit is normal	Idle after warm up	Signal is switching from rich (above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-

HO2S(B1S2) signal circuit open	-	Approx. 0.43~0.45V



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.
2. GDS display with open in signal circuit : Approx. 0.43~0.45V

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Terminal and Connector Inspection

1. Ignition "ON" & Engine "OFF"
2. Monitor the O2 SNSR VOL.-B1/S1 parameter on the GDSdata list while wiggling the wiring harness and related connectors.
3. The value should remain more or less unchanged. If not, check for the following conditions:
   - Check for corrosion on terminals
   - Check for terminal tension (at the HO2S and at the PCM)
   - Check for damaged wiring
   - Check the HO2S ground circuit for a good connection
   - Check the 15A sensor2 fuse
   - Check front and rear HO2S for connections being reversed.
4. 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. Visually/physically inspect the following conditions:
   - Ensure that the HO2S is securely installed.
   - Silicon contamination. This contamination will be indicated by a white powdery coating on the portion of the sensor exposed to the exhaust stream and this will result in a but false(high) voltage signal.
   - Fuel, engine coolant or oil contamination.
   - Use of improper sealant.
   - If contamination is evident on the HO2S, Fix the source of the sensor contamination before replacing the sensor to prevent

future contamination. Go to "Verification of Vehicle Repair" procedure.

2. Warm up the engine to normal operating temperature and let it idle.
3. Connect GDSand monitor the O2 SNSR VOL.-B1/S1 parameter on the GDSdata list.

Specification : Refer to "Signal Waveform & Data" in the "General Information" procedure. 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) at idle.

4. Is sensor switching properly?

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 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 GDS 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.

Fuel System > Engine Control System > P0136 O2 Sensor Circuit(Bank 1 / Sensor 2)

Component Location

General 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.

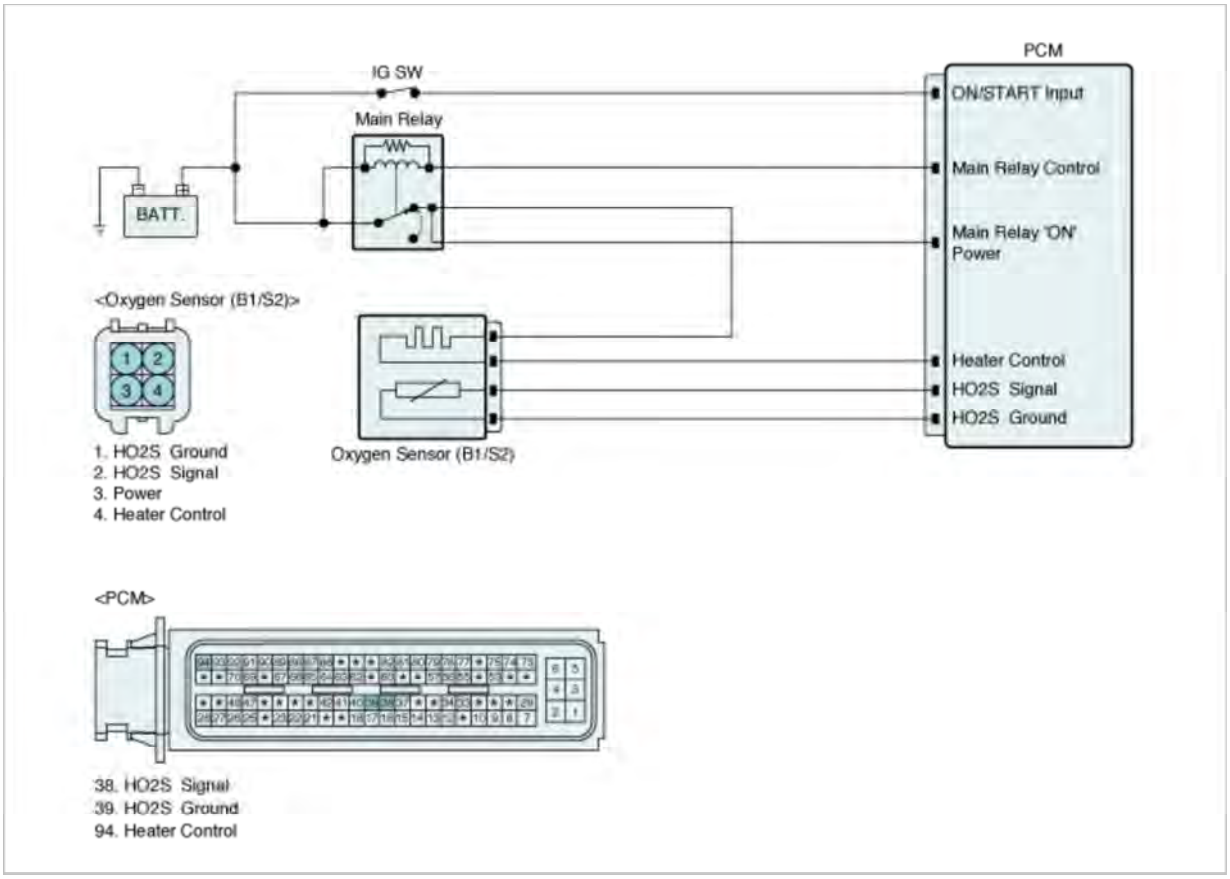
DTC Description

PCM sets DTC P0136 if the PCM detects that the rear HO2S signal circuit is open.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Open in signal harness • Open in ground harness • Poor connection or damaged harness • Faulty Heated HO2S Sensor (HO2S)
Enable Conditions	• HO2S Sensor operative readiness • No relevant failure • 10V < Battery voltage	
Threshold Value	• 0.37 < Downstream HO2S Sensor voltage < 0.49V & sensor element resistance > 60kΩ	
Diagnostic Time	• 30 sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	
		O2 SNSR VOL.-B1/S1	O2 SNSR VOL.-B1/S2
Normal Value when circuit is normal	Idle after warm up	Signal is switching from rich (above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

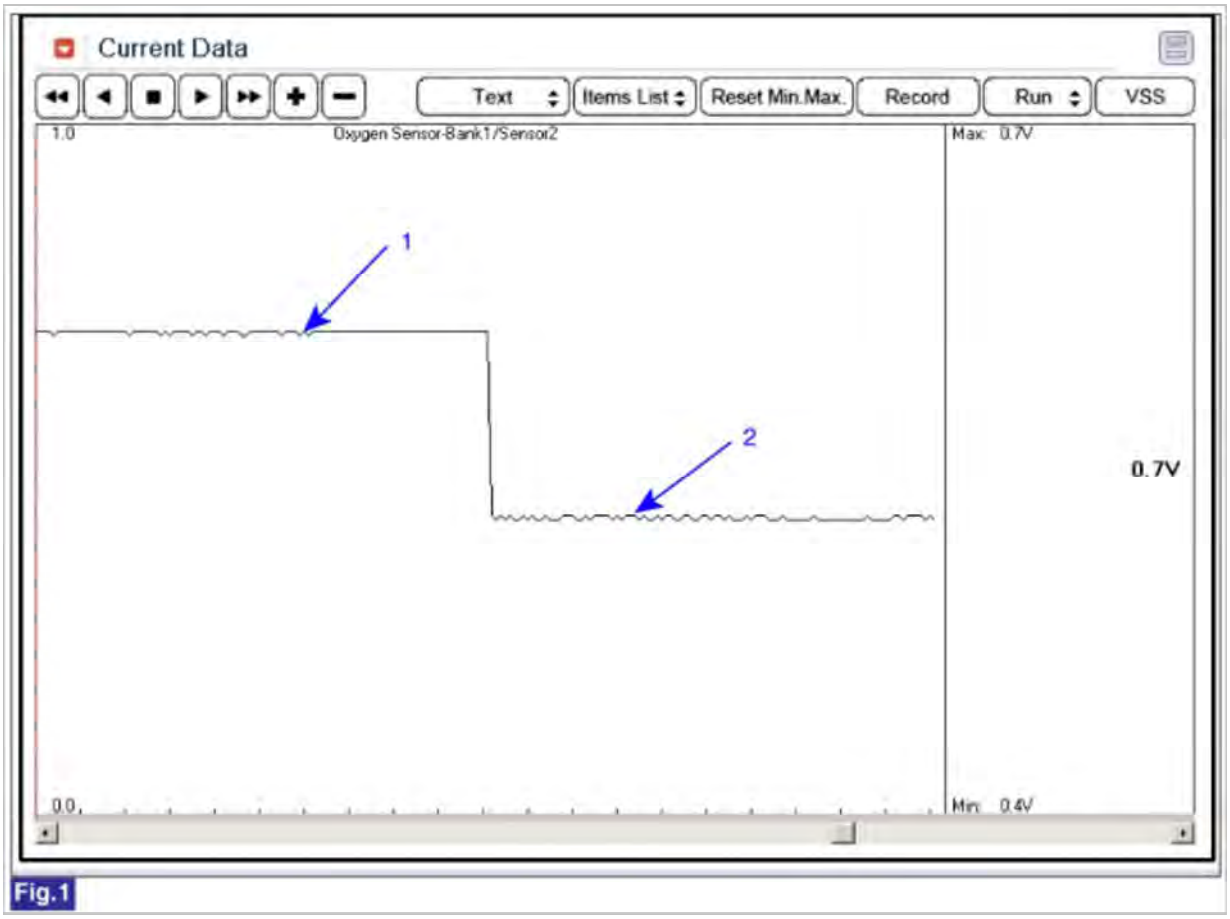
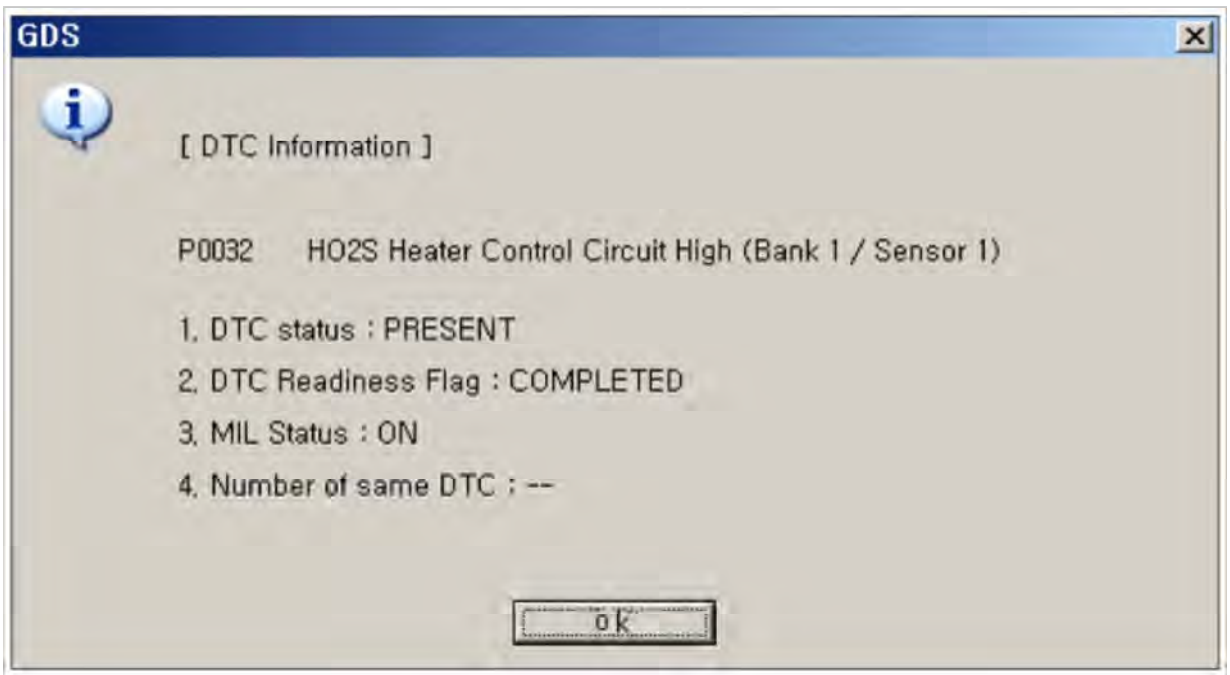


Fig.1) HO2S signal waveform with idle after warm up :
1: Normal status(Approx. above 0.7V), 2: Open in signal circuit(Approx. 0.4~0.5V)

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Ground Circuit Inspection

1. Ignition "OFF"
2. Disconnect HO2S connectors.
3. Measure resistance between Ground terminals of HO2S(B1S2) harness connector and chassis ground.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES	▸ Go to "Signal circuit inspection" procedure.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between signal terminal of HO2S(B1S2) harness connector and chassis ground.

Specification : Approx. 0.4~0.5V

3. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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.

Component Inspection

1. With ignition "OFF", reconnect the HO2S connector.
2. Warm up the engine to normal operating temperature and let it idle.
3. Connect GDSand monitor the HO2S SNSR VOL.-B1/S2 parameter on the GDSdata list.

Specification : Above 0.7V at idle

4. Is sensor data near the specified value?

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 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 GDS 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.

Fuel System > Engine Control System > P0137 O2 Sensor Circuit Low Voltage (Bank 1 / Sensor 2)

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 PCM 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.

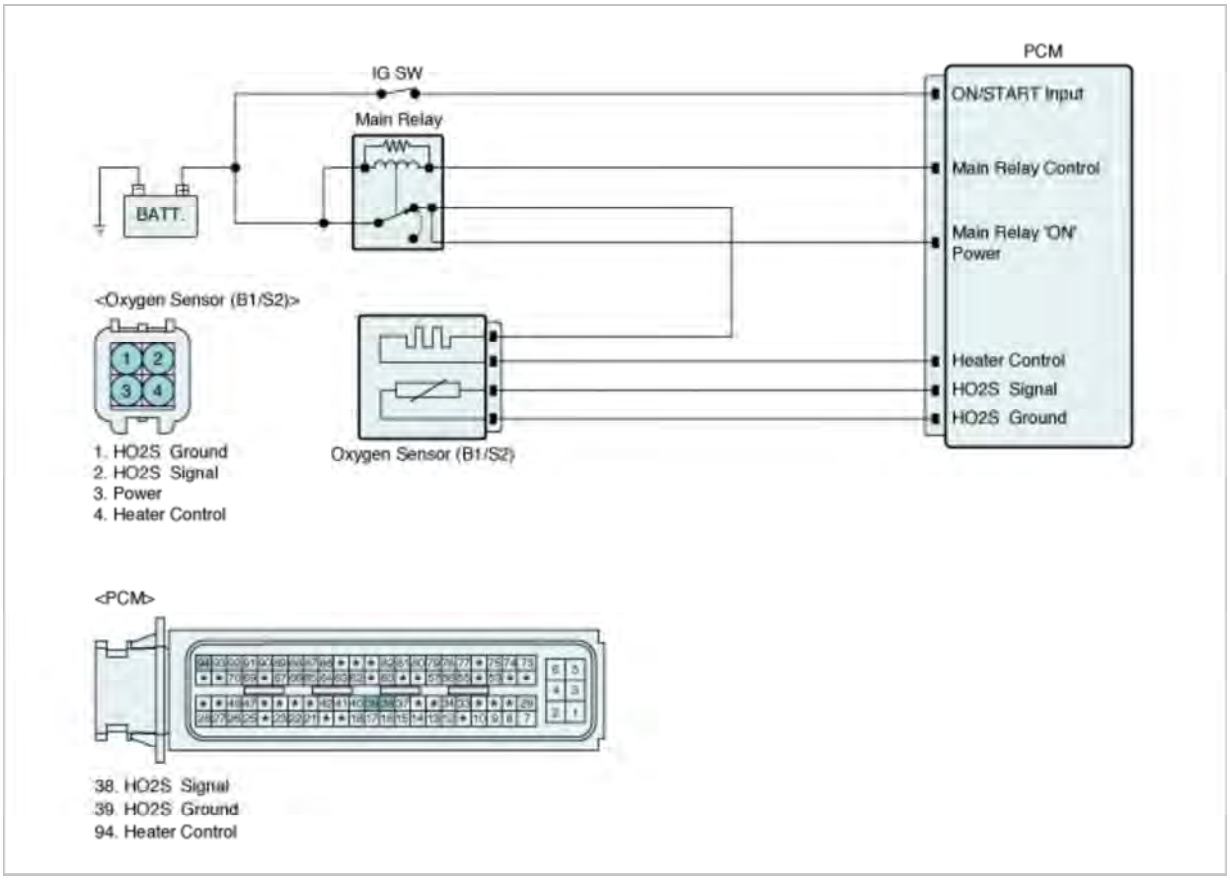
DTC Description

PCM sets DTC P0137 if the HO2S(B1S2) voltage remains excessively low for a predetermined time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to ground in signal harness • Poor connection or damaged harness • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	• Catalyst temperature model > 400°C(752°F) • Lambda regulation active • Lambda controller not on the limit • Catalyst purge after Fuel Cut Off not active • No relevant failure • 10V < Battery voltage	
Threshold Value	• Downstream O2 Sensor voltage < 0.02V & sensor element resistance < 30Ω	
Diagnostic Time	• 20 sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	
		HO2S SNSR VOL.-B1/S1	HO2S SNSR VOL.-B1/S2
Normal Value when circuit is normal	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.	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

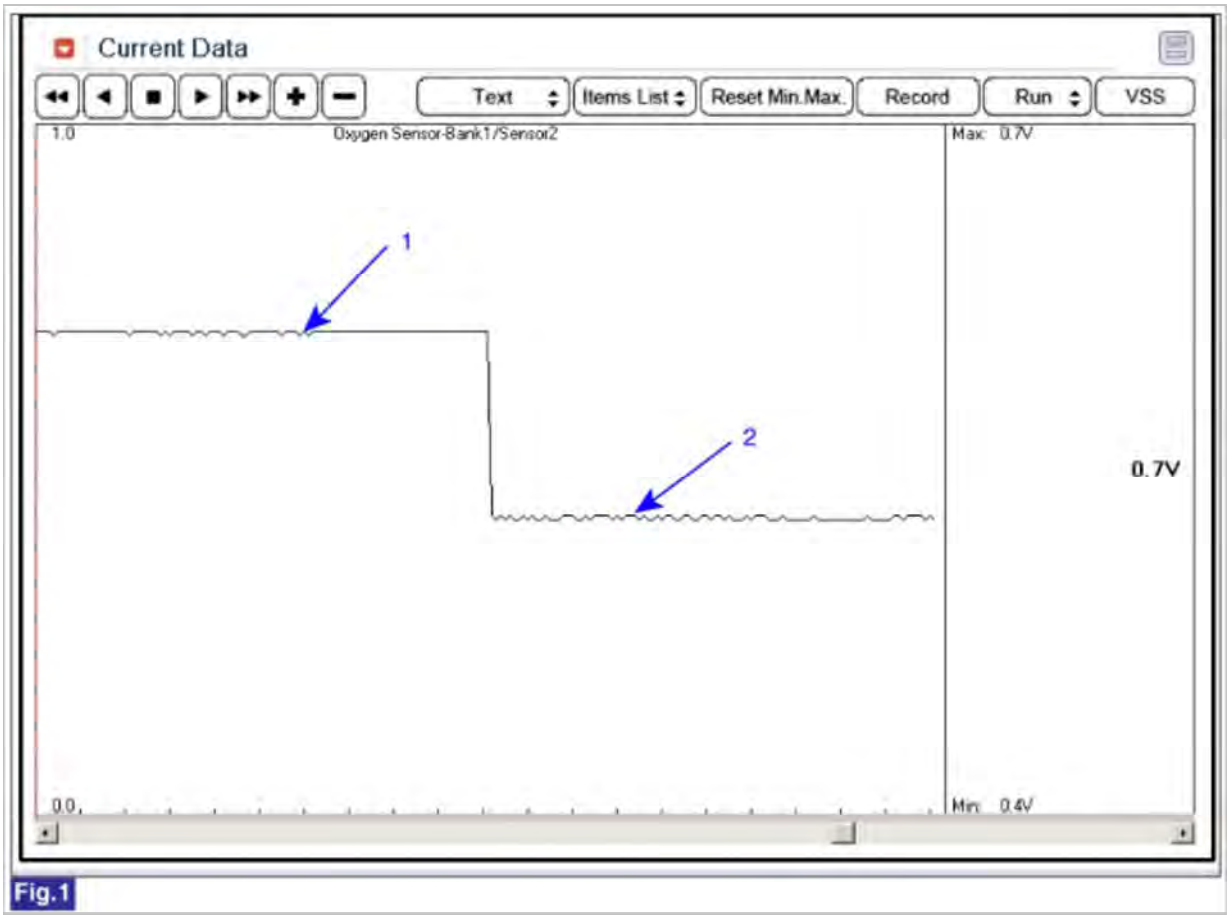
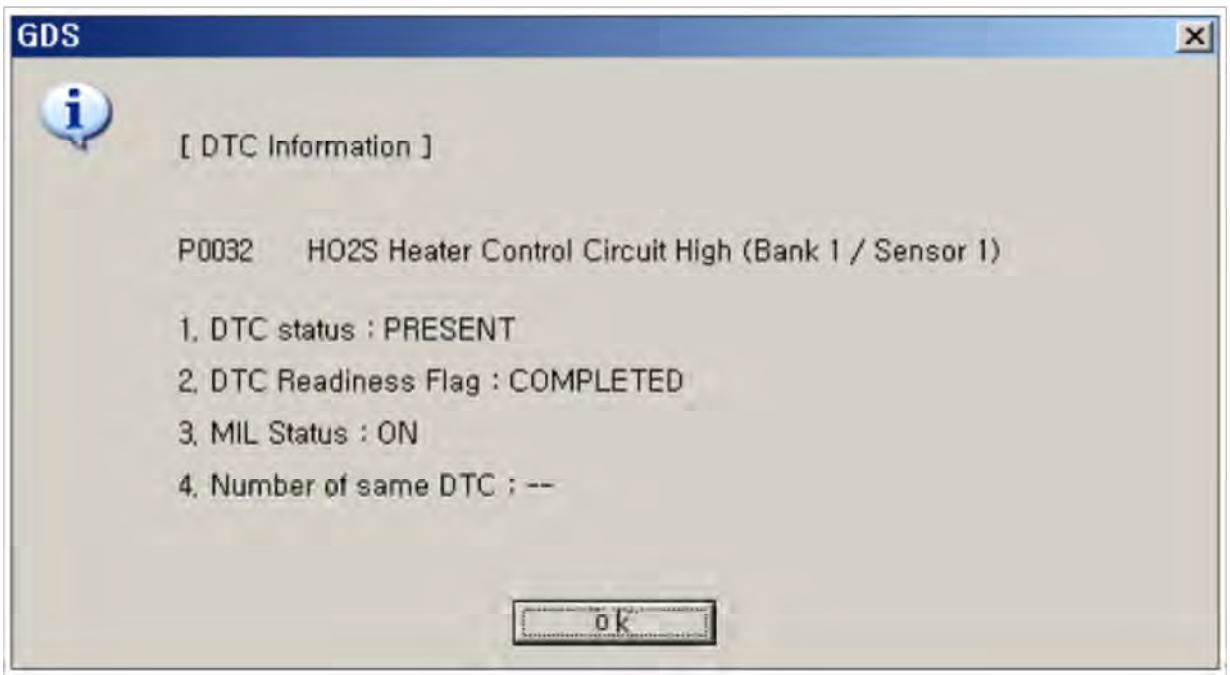


Fig.1) HO2S signal waveform with idle after warm up :
1: Normal status(Approx. above 0.7V), 2: Open in signal circuit(Approx. 0.4~0.5V)

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Signal Circuit Inspection

1. Ignition "OFF"
2. Disconnect PCM and HO2S connector.
3. Measure resistance between signal terminal of HO2S(B1S2) harness connector and chassis ground.

Specification : Infinite

4. Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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. Has a problem been found?

YES	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. With ignition "OFF", reconnect the HO2S connector.
2. Warm up the engine to normal operating temperature and let it idle.
3. Connect GDSand monitor the HO2S SNSR VOL.-B1/S2 parameter on the GDSdata list.

Specification : Above 0.7V at idle

4. Is sensor data near the specified value?

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 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 GDS 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.

Fuel System > Engine Control System > P0138 O2 Sensor Circuit High Voltage (Bank 1 / Sensor 2)

Component Location

General 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.

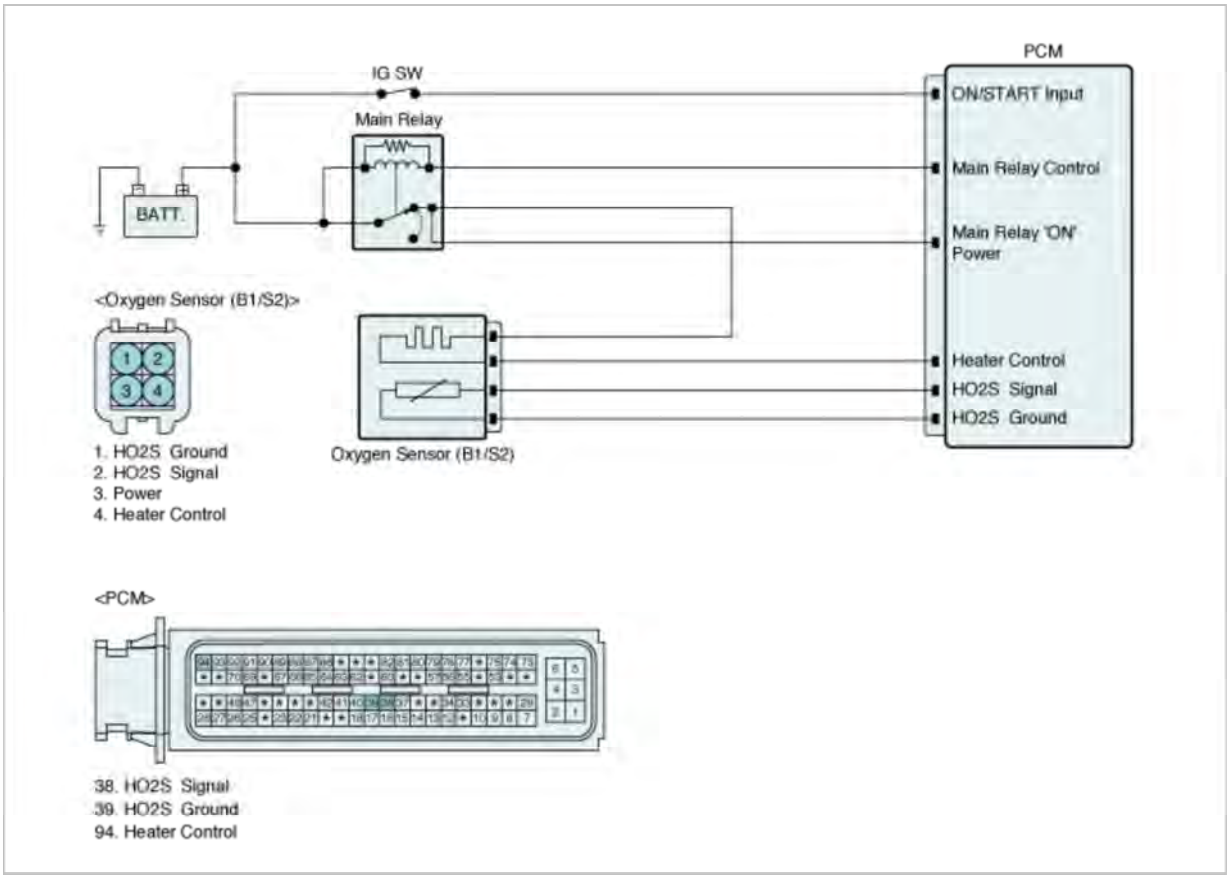
DTC Description

PCM sets DTC P0138 if the HO2S(B1S2) voltage remains excessively high for a predetermined time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage range check	• Short to Battery in signal harness • Poor connection or damaged harness • Faulty Heated O2 Sensor(HO2S)
Enable Conditions	• 10V < Battery voltage • No relevant failure	
Threshold Value	• Sensor voltage >1.3V	
Diagnostic Time	• 1 sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	
		HO2S SNSR VOL.-B1/S1	HO2S SNSR VOL.-B1/S2
Normal Value when circuit is normal	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.	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

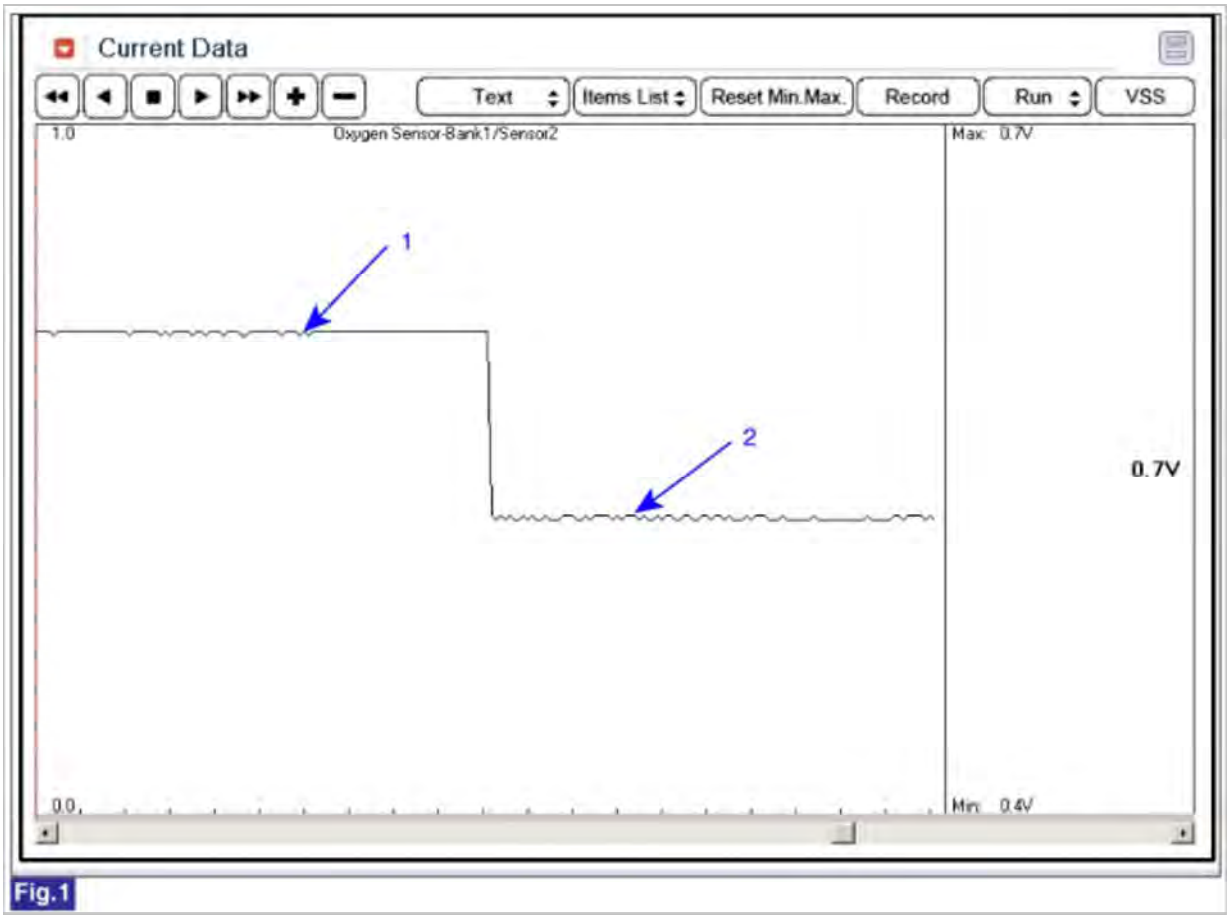
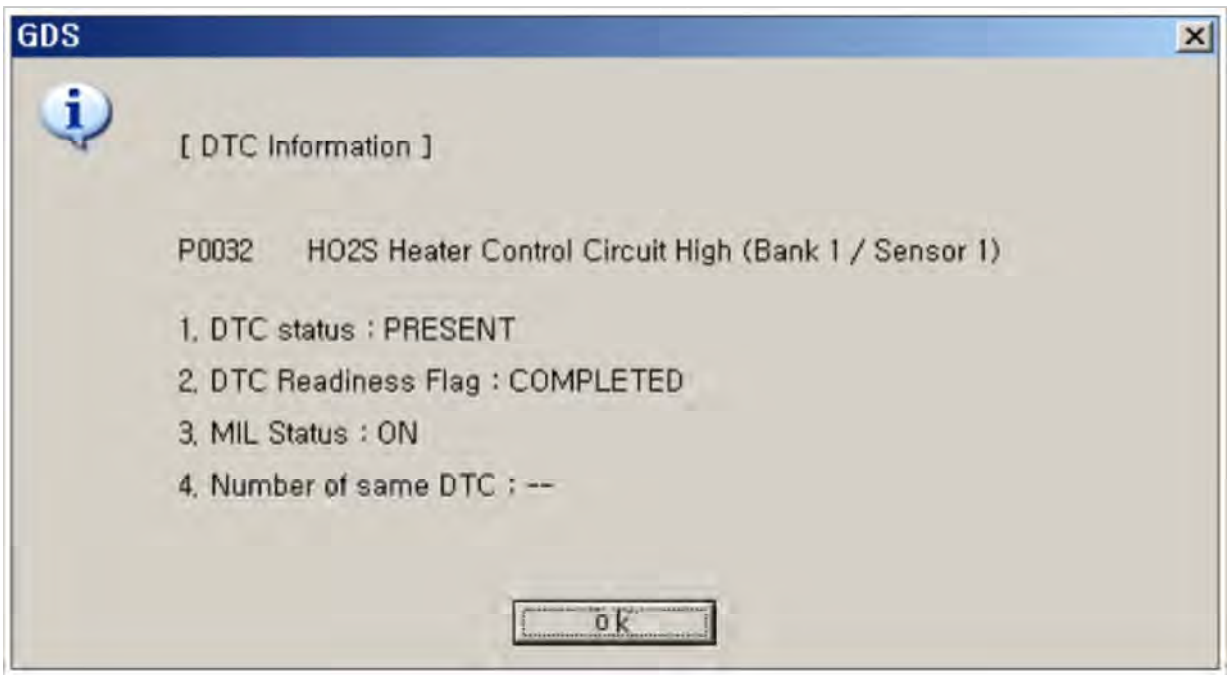


Fig.1) HO2S signal waveform with idle after warm up :
1: Normal status(Approx. above 0.7V), 2: Open in signal circuit(Approx. 0.4~0.5V)

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Signal Circuit Inspection

1. Ignition "OFF"
2. Disconnect PCM and HO2S connector.
3. Ignition "ON" & Engine"OFF"
4. Measure resistance between signal terminal of HO2S(B1S2) harness connector and chassis ground.

Specification : Approx. 0.4~0.5V

5. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. NOTE HO2S must have a clean air reference to function properly. The air is obtained by way of the sensor wire(s). Do not attempt to repair the wire(s), connector, or the terminals.

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. Has a problem been found?

YES	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. With ignition "OFF", reconnect the HO2S connector.
2. Warm up the engine to normal operating temperature and let it idle.
3. Connect GDSand monitor the HO2S SNSR VOL.-B1/S2 parameter on the GDSdata list.

Specification : Above 0.7V at idle

4. Is sensor data near the specified value?

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 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 GDS 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.

Fuel System > Engine Control System > P0139 O2 Sensor Circuit Slow Response(Bank 1 / Sensor 2)

Component Location

General 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

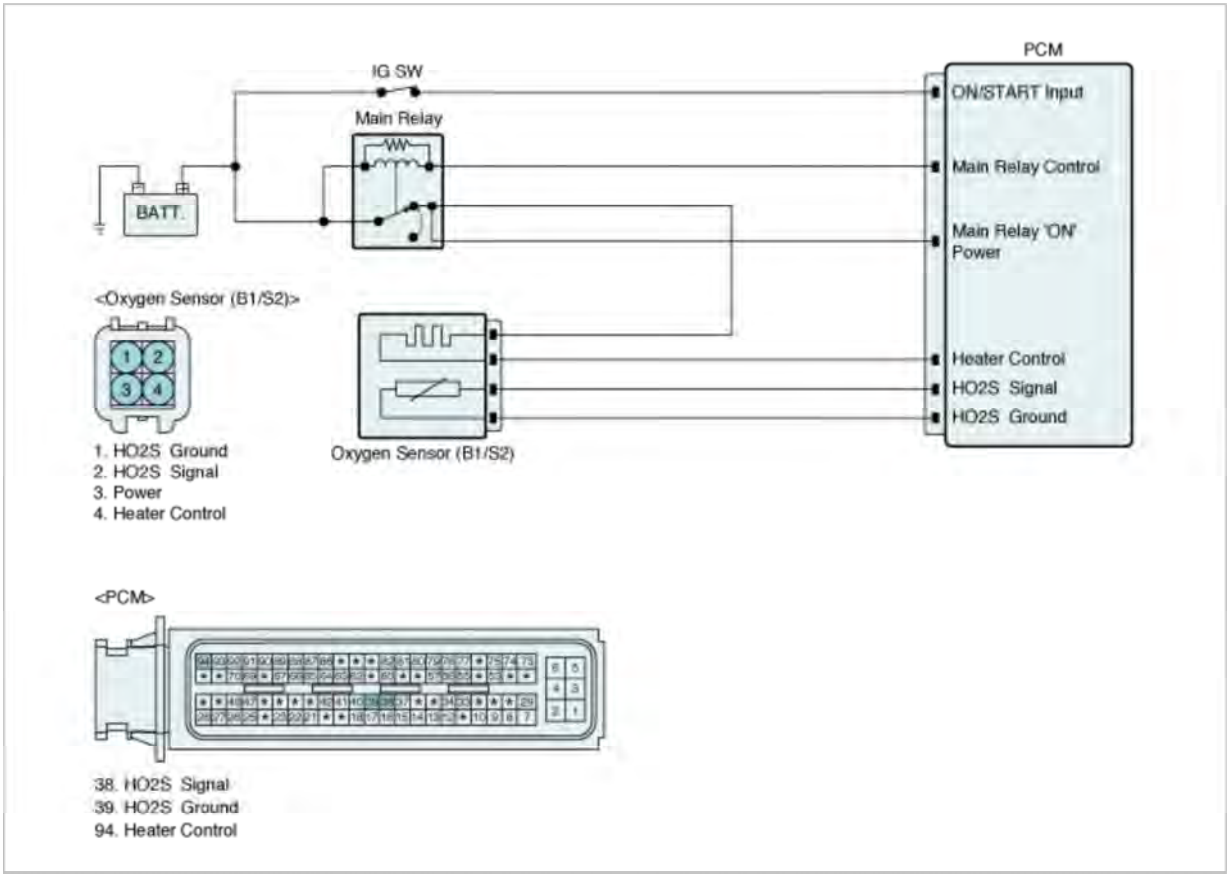
The PCM monitors rich-lean switching time of rear heated oxygen sensor (HO2S) after fuel cut-off to validate dynamic behavior of rear heated oxygen sensor (HO2S). After detection of fuel cut-off engine operating state, the PCM measures rich-lean switching time of the rear heated oxygen sensor (HO2S) signal and compares it to the predetermined limit value. DTC P0139 is set when the switching time is bigger than the limit value.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Switching Time check at entry in Fuel Cut-Off	• Leak in intake or exhaust system • Faulty fuel system. • Front and rear HO2S connections reversed. • Poor connection or damaged harness • HO2S contamination
Enable Conditions	• Catalyst temp.model >350°C(662°F) • No relevant failure • 11V < Battery voltage • Downstream O2 sensor signal at entry in fuel cut off > 0.55V • 4.8Km/h(3MPH)<Vehicle speed<180Km/h(112MPH)	
Threshold Value	• Average ratio(between measured and maximum allowed switching time at entry in fuel cut-off) > 1	

Diagnostic Time	• 3 fuel cut-off phases	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	
		HO2S SNSR VOL.-B1/S1	HO2S SNSR VOL.-B1/S2
Normal Value when circuit is normal	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.	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

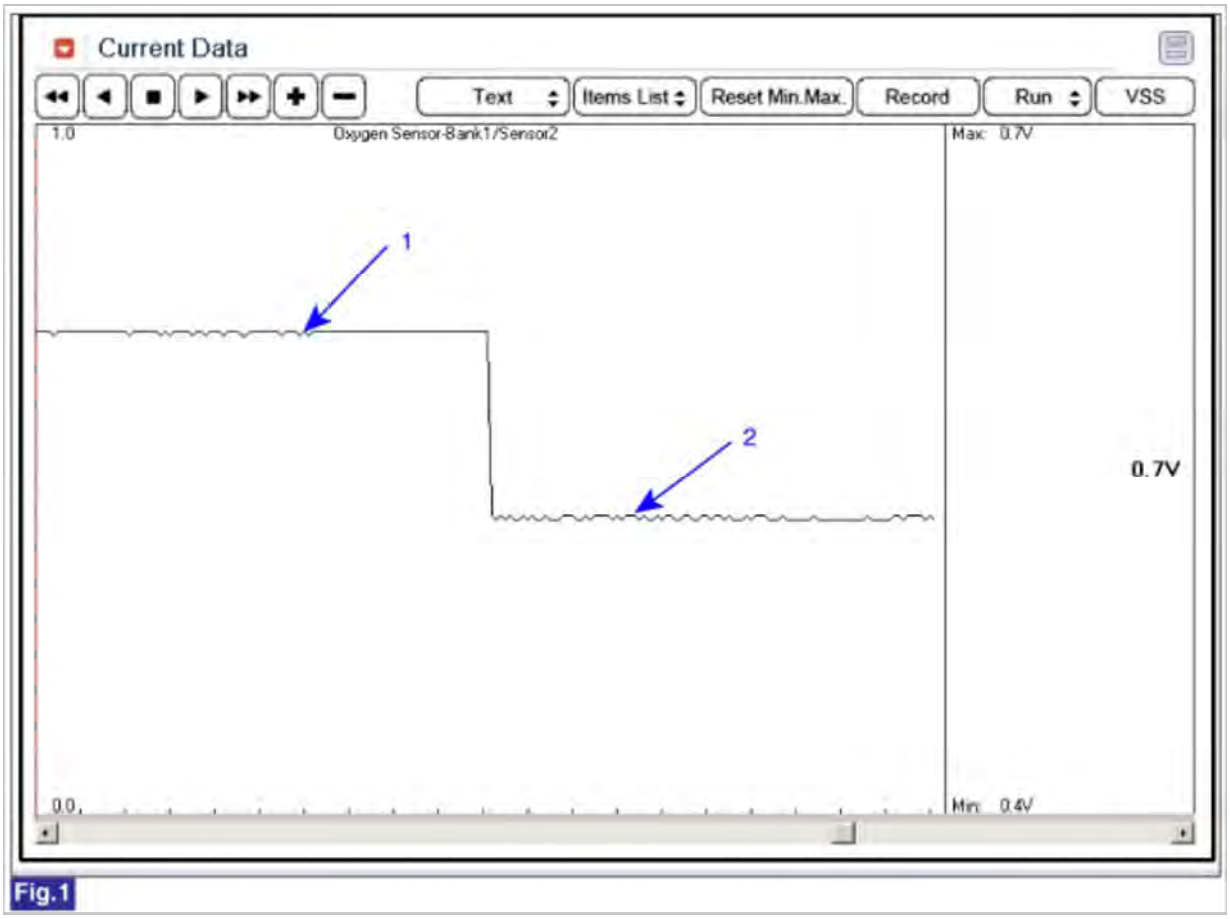
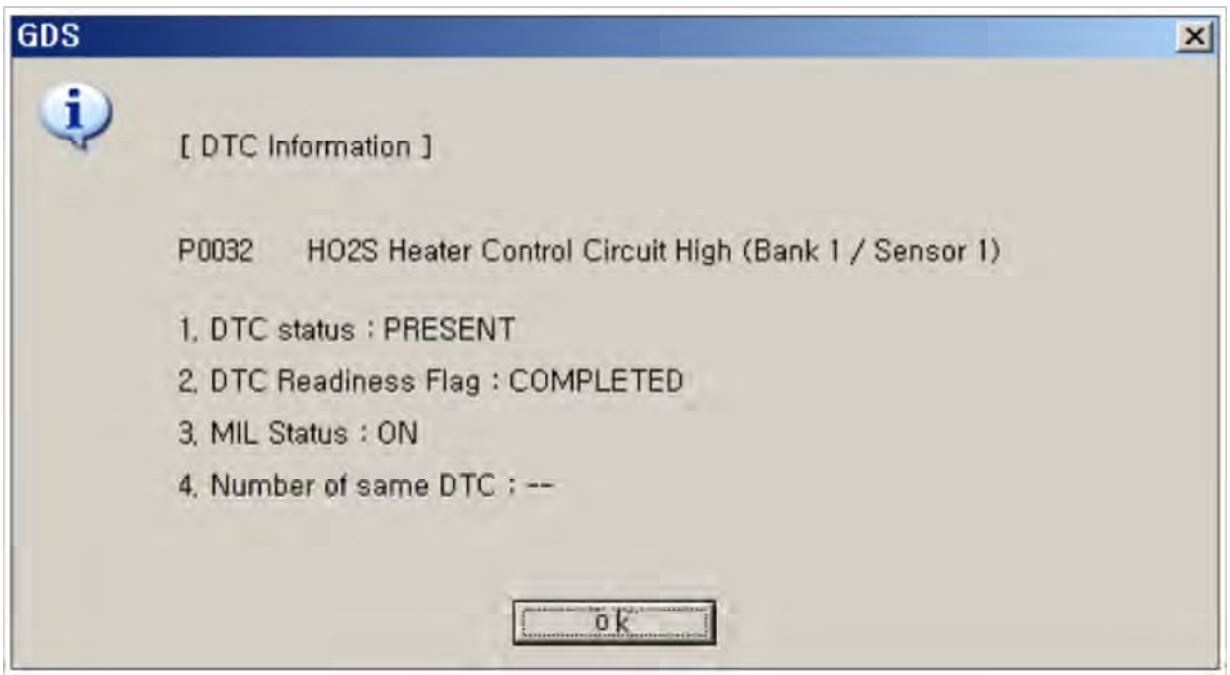


Fig.1) HO2S signal waveform with idle after warm up :
1: Normal status(Approx. above 0.7V), 2: Open in signal circuit(Approx. 0.4~0.5V)

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Visually/physically inspect the following conditions:
   '- Ensure that the sensor is securely installed
   '- Check for corrosion on terminals
   '- Check for damaged wiring
   '- Repair as necessary and go to next step
2. Warm up the engine to normal operating temperature and let it idle.
3. Connect GDSand monitor the O2 SNSR VOL.-B1/S2 parameter on the GDSdata list.

Specification : Above 0.6V at idle

4. Is sensor data near the specified value?

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 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.

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 next step as below.

Air Leakage Inspection

1. Visually/physically inspect the following items:
   '- Vacuum hoses for splits, kinks and improper connections.
   '- Exhaust system between HO2S and Three way catalyst for air leakage.
   '- EVAP system for leakage.
   '- 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.

Visual/Physical Inspection

1. Visually/physically inspect the following items:
   '- Check for corrosion on terminals.
   '- Check for terminal tension (at the HO2S and at the PCM)

'- Check for damaged wiring.
'- Check the HO2S ground circuit for a good connection.
'- Check front and rear HO2S for connections being reversed.

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.

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0140 O2 Sensor Circuit No Activity Detected (Bank 1 / Sensor 2)

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 PCM 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

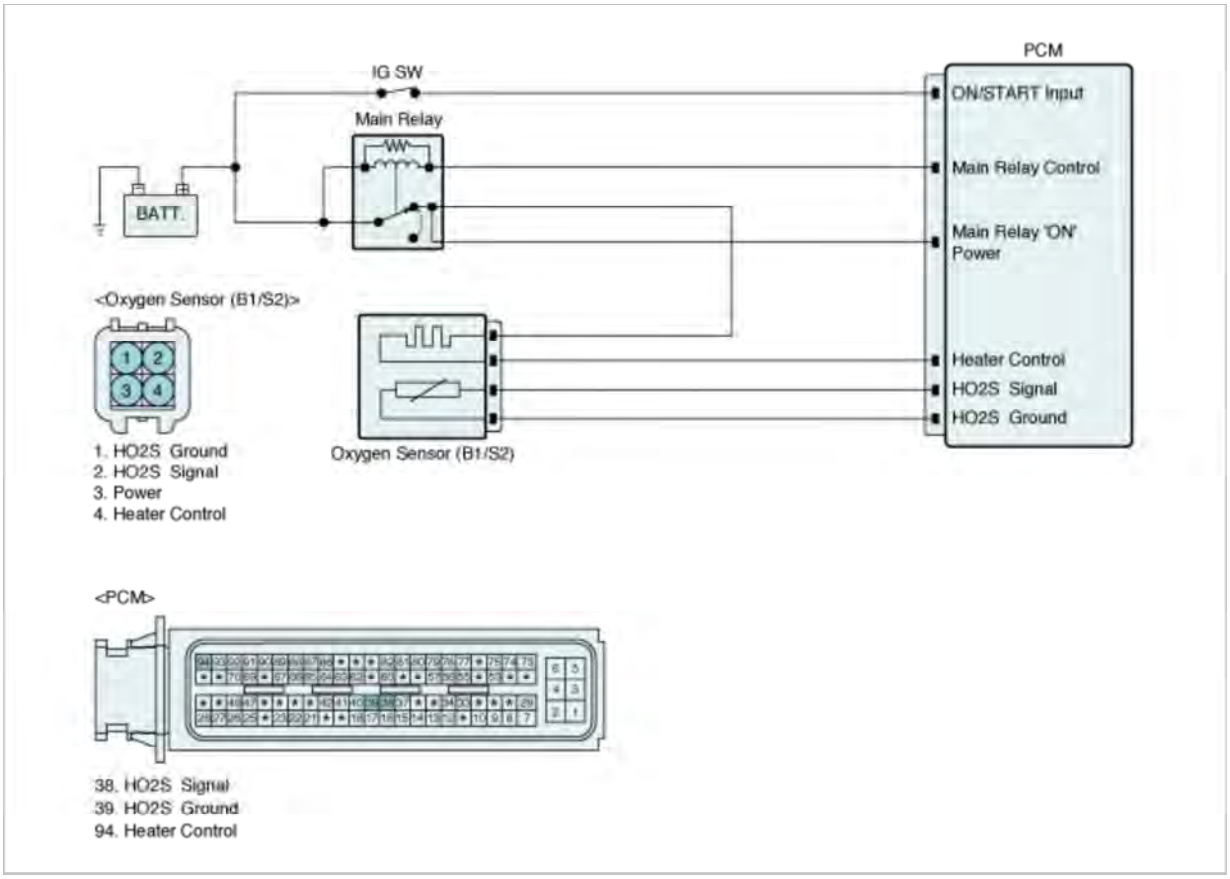
Due to possible oxygen sensor defects (e.g. reference air poisoning) or faults in the injection system (e.g. leaking fuel injector), the rear oxygen sensor may not provide the expected lean or rich signal level during fuel cut-off or full load condition. Hence, the oxygen sensor signal is checked for plausibility during this engine operating states.There are 2 cases which DTC P0140 sets.
(I) Signal monitoring during fuel cut-off: The PCM 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 PCM monitors rear O2 sensor signal level after leaving fuel cut-off and sets DTC P0140 when signal remains at or below 0.6V.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
		• Signal Plausability with Rich mixture (during Catalyst Purge	

DTC Strategy	case1	after Fuel Cut-off)	• Related fuse blown or missing • Poor connection or damaged harness • HO2S contamination
	case2	• Signal Plausibility with Lean mixture (during Fuel Cut-Off)	
Enable Conditions	case1	• Integrated mass air flow in last fuel cut off > 10g • Integrated mass air flow in part load > 250g • Downstream HO2S sensor signal at end of last fuel cut off < 0.25V • Minimum HO2S(S1) during Catalyst Purge phase < 0.5V • Catalyst temperature > 348°C(658°F) • No relevant failure • 11V < Battery voltage < 16V	
	case2	• 20g < Integrated mass air flow since begin • No relevant failure • 10V < Battery voltage • Fuel Cut Off active • Fuel cut off phase	
Threshold Value	case1	• Voltage <0.55V	
	case2	• Voltage with fuel cut > 0.1V	
Diagnostic Time	case1	• 3 valid fuel cut-off phases	
	case2	• 2 sec.	
Mil On Condition		• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

Test Condition		GDS Parameter	
		HO2S SNSR VOL.-B1/S1	HO2S SNSR VOL.-B1/S2

Normal Value when circuit is normal	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.	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

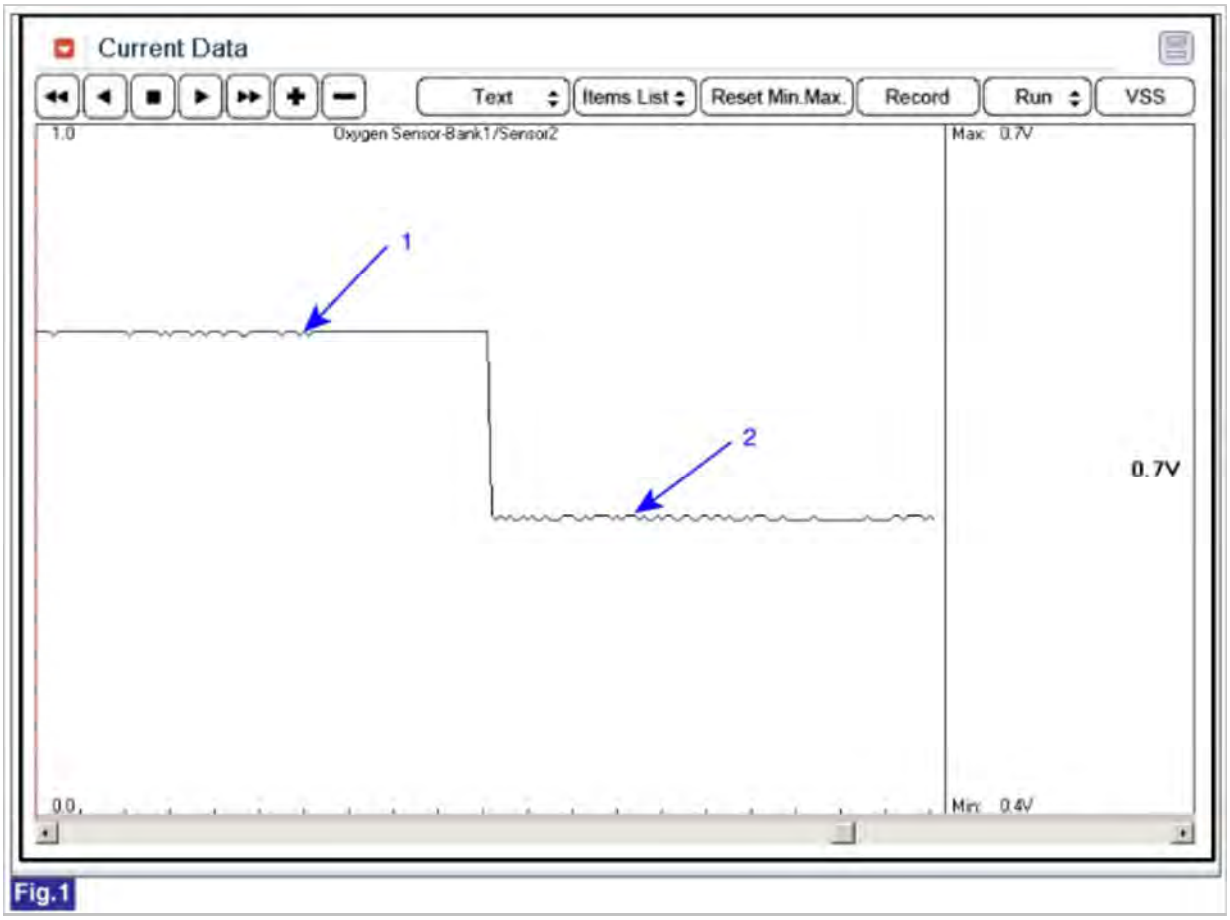


Fig.1) HO2S signal waveform with idle after warm up :
1: Normal status(Approx. above 0.7V), 2: Open in signal circuit(Approx. 0.4~0.5V)

Monitor DTC Status

NOTE

If any DTCs relating to HO2S are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Terminal and Connector Inspection

1. Ignition "ON" & Engine "OFF"
2. Monitor the HO2S SNSR VOL.-B1/S2 parameter on the GDSdata list while wiggling the wiring harness and related connectors. Refer to "Signal Waveform & Data" in the "General Information" procedure.
3. The value should remain more or less unchanged. If not, check for the following conditions:
   '- Check for corrosion on terminals.
   '- Check for terminal tension (at the HO2S and at the PCM)
   '- Check for damaged wiring.
   '- Check the HO2S ground circuit for a good connection.
   '- Check the 15A sensor2 fuse.
   '- Check front and rear HO2S for connections being reversed.
4. 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. Visually/physically inspect the following conditions:
   '- Ensure that the sensor is securely installed
   '- Check for corrosion on terminals
   '- Check for damaged wiring
   '- Repair as necessary and go to next step

2. Warm up the engine to normal operating temperature and let it idle.
3. Connect GDSand monitor the O2 SNSR VOL.-B1/S2 parameter on the GDSdata list.

Specification : Above 0.7V at idle

4. Is sensor data near the specified value?

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 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 GDS 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.

Fuel System > Engine Control System > P0170 Fuel Trim (Bank 1)

General Description

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM 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 PCM 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 PCM 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

If the fuel trim values reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The PCM sets DTC P0170 if no proportional fuel adaptation occurs for a defined time after the short term fuel trim has reached its minimum or maximum threshold.

DTC Detecting Condition

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	• Lambda control active • Coolant temperature > 70°C(158°F) • No relevant failure • 10V < Battery voltage < 16V	
Threshold Value	• Lambda controller< -30% or >+50%	
Diagnostic Time	• 30 seconds	
Mil On Condition	• 2 Driving Cycles	

Signal Waveform & Data

1. GDS Display for HO2S

Test Condition		GDS Parameter	
		HO2S SNSR VOL.-B1/S1	HO2S SNSR VOL.-B1/S2
Normal Value when circuit is normal	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.	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

2. MAPS Terminal voltage with pressure

Pressure (kPa)	Approx. 20	Approx. 35	Approx. 60	Approx. 95	Approx. 101
Voltage(V)	Approx. 0.7~0.8	Approx. 1.3~1.4	Approx. 2.3~2.4	Approx. 3.7~3.8	Approx. 3.9~4.1

3. GDS Display for TPS

Test Condition		GDS Parameter
		TPS VOLTAGE
Normal value with ignition "ON" & engine "OFF"	Accelerator pedal released	0.20~0.47V
Normal value with engine ON & accelerator pedal fully depressed		4.2~4.7V
Abnormal value with ignition "ON" & engine "OFF"	Power circuit open	0.01V
	Ground cicuit open	4.99V
	TPS signal circuit open	4.99V
	TPS signal circuit short to ground	Approx. 0V
	TPS signal circuit short to battery	Above 4.99V

Monitor DTC Status

NOTE

If any DTCs relating to INJECTOR,HO2S,ECTS, or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Monitor Actuation Test

NOTE

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. Install GDS and select INJECTOR #1 parameter on the Actuation Test mode.
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.

1. Was each cylinder's rpm drop within the same value?

YES	▸Go to next step as below.
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 cylinders. NOTE

	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 for the following areas:
   '- Vacuum hoses for splits, kinks and improper connections.- Throttle body gasket
   '- Throttle body gasket
   '- Gasket between intake manifold and cylinder head
   '- Seals between intake manifold and fuel injectors
   '- Exhaust system between HO2S and Three way catalyst for air leakage
2. Visually/physically inspect the restriction in intake/exhaust system for the following areas:
   '- Air cleaner filter element for excessive dirt or for any foreign objects
   '- Throttle body inlet for damage or for any foreign objects
   '- Throttle bore and throttle plate for chocking and for any foreign objects
   '- Restricted exhaust system
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 next step as below.

4. Inspect the leakage in EVAP. system for the following conditions:
   (1) Check the EVAP canister for fuel saturation. If the EVAP canister is full of fuel, visually and physically inspect the EVAP and fuel system.
   Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. If OK, go to next step.
   (2) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (3) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (4) Does the valve hold vacuum?

YES	▸ Go to next step as below.
NO	▸ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

Sensor Inspection

NOTE

Refer to "Signal Waveform & Data" in the "General Information" procedure .

1. Visually/physically inspect the HO2S for the following conditions:
   - Ensure that the HO2S is securely installed.
   - Silicon contamination. This contamination will be indicated by a white powdery coating on the portion of the sensor exposed to the exhaust stream and this will result in a but false(high) voltage signal.
   - Fuel, engine coolant or oil contamination.
   - Use of improper sealant.
   - If contamination is evident on the HO2S, Fix the source of the sensor contamination before replacing the sensor to prevent future contamination. Go to "Verification of Vehicle Repair" procedure.
2. Visually/physically inspect the MAFS for the following conditions:
   - Contamination or deterioration
   - Poor connection or damaged harness
3. Check for an intermittent TPS false signal. TPS signal displayed on a GDSshould increase steadily when depressing accelerator pedal after starting.
4. Verify that the PCM ground connections are clean and properly tightened.
5. If test result is NG, repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
   If OK, go to next step as below.

NOTE

If the contamination is evident on the HO2S or MAFS. Fix the source of the sensor contamination before replacing the sensor to prevent future contamination.

Positive Crankcase Ventilation System 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. Check crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
3. Warm up the engine to normal operating temperature
4. Connect GDSand note the "SHORT TERM FUEL-B1" parameter on the GDSdata list.
5. Disconnect and plug the positive crankcase ventilation at the intake manifold side.
6. Monitor the "SHORT TERM FUEL-B1" parameter on the GDSdata list once again.

Specification : The value should remain more or less unchanged

7. Is the displayed value within the specified value?

YES	▸ Go to next step as below.
NO	▸ Check the PCV(Positive Crankcase Ventilation) valve for operation properly. Refer to "EM" group in Workshop Manual. If OK, check that engine oil is diluted with fuel. Change the oil or filter as necessary and go to "Verification of Vehicle Repair" procedure.

Fuel System Inspection

1. Fuel Line 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 normal idle status.

   Specification : 338~348kPa(3.45~3.55kg/cm²)

   (4) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump	Fuel Pump (Fuel Pressure Regulator)
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pump (Fuel Pressure Regulator)

2. Fuel Pressure Hold Inspection
   (1) Stop the engine and check for a change in the fuel pressure gauge reading.

   Specification : After engine stops, the gauge reading should hold for minimum 5 minutes

   (2) Is fuel pressure within the specified value?

YES	▸ Visually/physically inspect the engine mechanical problem for the following: - Worn cylinder - Worn valve - Worn piston or piston ring ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure
	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to

NO	"Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel pressure drops slowly	Injector leak	Injector
Fuel pressure drops immediately	Stuck open in check valve of the fuel pump	Fuel pump

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0171 System too Lean (Bank 1)

General Description

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM 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 PCM 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 PCM 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

If the lambda controller reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The PCM sets DTC P2096 if no proportional post catalyst fuel trim adaptation occurs for a defined time after the lambda controller has reached its maximum threshold.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of fueling control (Long term + Short term)	• Three Way Catalytic Converter (TWC) • Rear HO2S
Enable Conditions	• Lambda control active • Canister load < 1	
Threshold Value	• Lambda controller + Trim value > +35%(more than 60sec. Within 180 sec.)	
Diagnostic Time	• 60 sec.	
Mil On Condition	• 2 Driving Cycles	

Signal Waveform & Data

1. GDS Display for HO2S

	GDS Parameter

Test Condition		HO2S SNSR VOL.-B1/S1	HO2S SNSR VOL.-B1/S2
Normal Value when circuit is normal	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.	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

2. MAPS Terminal voltage with pressure

Pressure (kPa)	Approx. 20	Approx. 35	Approx. 60	Approx. 95	Approx. 101
Voltage(V)	Approx. 0.7~0.8	Approx. 1.3~1.4	Approx. 2.3~2.4	Approx. 3.7~3.8	Approx. 3.9~4.1

3. GDS Display for TPS

Test Condition		**GDS Parameter**
		TPS VOLTAGE
Normal value with ignition "ON" & engine "OFF"	Accelerator pedal released	0.20~0.47V
Normal value with engine ON & accelerator pedal fully depressed		4.2~4.7V
Abnormal value with ignition "ON" & engine "OFF"	Power circuit open	0.01V
	Ground cicuit open	4.99V
	TPS signal circuit open	4.99V
	TPS signal circuit short to ground	Approx. 0V
	TPS signal circuit short to battery	Above 4.99V

Monitor DTC Status

NOTE

If any DTCs relating to INJECTOR,HO2S,ECTS, or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Monitor Actuation Test

NOTE

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. Install GDS and select INJECTOR #1 parameter on the Actuation Test mode.
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.

1. Was each cylinder's rpm drop within the same value?

YES	▸Go to next step as below.
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 cylinders. NOTE

	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 for the following areas:
   '- Vacuum hoses for splits, kinks and improper connections.- Throttle body gasket
   '- Throttle body gasket
   '- Gasket between intake manifold and cylinder head
   '- Seals between intake manifold and fuel injectors
   '- Exhaust system between HO2S and Three way catalyst for air leakage
2. Visually/physically inspect the restriction in intake/exhaust system for the following areas:
   '- Air cleaner filter element for excessive dirt or for any foreign objects
   '- Throttle body inlet for damage or for any foreign objects
   '- Throttle bore and throttle plate for chocking and for any foreign objects
   '- Restricted exhaust system
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 next step as below.

4. Inspect the leakage in EVAP. system for the following conditions:
   (1) Check the EVAP canister for fuel saturation. If the EVAP canister is full of fuel, visually and physically inspect the EVAP and fuel system.
   Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. If OK, go to next step.
   (2) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (3) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (4) Does the valve hold vacuum?

YES	▸ Go to next step as below.
NO	▸ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

Sensor Inspection

NOTE

Refer to "Signal Waveform & Data" in the "General Information" procedure .

1. Visually/physically inspect the HO2S for the following conditions:
   - Ensure that the HO2S is securely installed.
   - Silicon contamination. This contamination will be indicated by a white powdery coating on the portion of the sensor exposed to the exhaust stream and this will result in a but false(high) voltage signal.
   - Fuel, engine coolant or oil contamination.
   - Use of improper sealant.
   - If contamination is evident on the HO2S, Fix the source of the sensor contamination before replacing the sensor to prevent future contamination. Go to "Verification of Vehicle Repair" procedure.
2. Visually/physically inspect the MAFS for the following conditions:
   - Contamination or deterioration
   - Poor connection or damaged harness
3. Check for an intermittent TPS false signal. TPS signal displayed on a GDSshould increase steadily when depressing accelerator pedal after starting.
4. Verify that the PCM ground connections are clean and properly tightened.
5. If test result is NG, repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
   If OK, go to next step as below.

NOTE

If the contamination is evident on the HO2S or MAFS. Fix the source of the sensor contamination before replacing the sensor to prevent future contamination.

Positive Crankcase Ventilation System 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. Check crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
3. Warm up the engine to normal operating temperature
4. Connect GDSand note the "SHORT TERM FUEL-B1" parameter on the GDSdata list.
5. Disconnect and plug the positive crankcase ventilation at the intake manifold side.
6. Monitor the "SHORT TERM FUEL-B1" parameter on the GDSdata list once again.

Specification : The value should remain more or less unchanged

7. Is the displayed value within the specified value?

YES	▸ Go to next step as below.
NO	▸ Check the PCV(Positive Crankcase Ventilation) valve for operation properly. Refer to "EM" group in Workshop Manual. If OK, check that engine oil is diluted with fuel. Change the oil or filter as necessary and go to "Verification of Vehicle Repair" procedure.

Fuel System Inspection

1. Fuel Line 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 normal idle status.

   Specification : 338~348kPa(3.45~3.55kg/cm²)

   (4) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump	Fuel Pump (Fuel Pressure Regulator)
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pump (Fuel Pressure Regulator)

2. Fuel Pressure Hold Inspection
   (1) Stop the engine and check for a change in the fuel pressure gauge reading.

   Specification : After engine stops, the gauge reading should hold for minimum 5 minutes

   (2) Is fuel pressure within the specified value?

YES	▸ Visually/physically inspect the engine mechanical problem for the following: - Worn cylinder - Worn valve - Worn piston or piston ring ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure
	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to

NO	"Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel pressure drops slowly	Injector leak	Injector
Fuel pressure drops immediately	Stuck open in check valve of the fuel pump	Fuel pump

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0172 System too Rich (Bank 1)

General Description

In order to provide the best possible combination of drivability, fuel economy and emission control, the PCM uses a closed loop air/fuel metering system. The PCM 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 PCM 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 PCM 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

If the lambda controller reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The PCM sets DTC P2097 if no proportional post catalyst fuel trim adaptation occurs for a defined time after the lambda controller has reached its minimum threshold.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring deviation of fueling control (Long term + Short term)	• Three Way Catalytic Converter (TWC) • Rear HO2S
Enable Conditions	• No relevant failure • Estimated fuel dilution in oil limited in rich side	
Threshold Value	• Lambda controller + Trim value < -25 %(more than 60sec. Within 180sec.)	
Diagnostic Time	• 60 sec.	
Mil On Condition	• 2 Driving Cycles	

Signal Waveform & Data

1. GDS Display for HO2S

	GDS Parameter

Test Condition		HO2S SNSR VOL.-B1/S1	HO2S SNSR VOL.-B1/S2
Normal Value when circuit is normal	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.	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

2. MAPS Terminal voltage with pressure

Pressure (kPa)	Approx. 20	Approx. 35	Approx. 60	Approx. 95	Approx. 101
Voltage(V)	Approx. 0.7~0.8	Approx. 1.3~1.4	Approx. 2.3~2.4	Approx. 3.7~3.8	Approx. 3.9~4.1

3. GDS Display for TPS

Test Condition		**GDS Parameter**
		TPS VOLTAGE
Normal value with ignition "ON" & engine "OFF"	Accelerator pedal released	0.20~0.47V
Normal value with engine ON & accelerator pedal fully depressed		4.2~4.7V
Abnormal value with ignition "ON" & engine "OFF"	Power circuit open	0.01V
	Ground cicuit open	4.99V
	TPS signal circuit open	4.99V
	TPS signal circuit short to ground	Approx. 0V
	TPS signal circuit short to battery	Above 4.99V

Monitor DTC Status

NOTE

If any DTCs relating to INJECTOR,HO2S,ECTS, or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Monitor Actuation Test

NOTE

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. Install GDS and select INJECTOR #1 parameter on the Actuation Test mode.
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.

1. Was each cylinder's rpm drop within the same value?

YES	▸Go to next step as below.
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 cylinders. NOTE

	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 for the following areas:
   '- Vacuum hoses for splits, kinks and improper connections.- Throttle body gasket
   '- Throttle body gasket
   '- Gasket between intake manifold and cylinder head
   '- Seals between intake manifold and fuel injectors
   '- Exhaust system between HO2S and Three way catalyst for air leakage
2. Visually/physically inspect the restriction in intake/exhaust system for the following areas:
   '- Air cleaner filter element for excessive dirt or for any foreign objects
   '- Throttle body inlet for damage or for any foreign objects
   '- Throttle bore and throttle plate for chocking and for any foreign objects
   '- Restricted exhaust system
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 next step as below.

4. Inspect the leakage in EVAP. system for the following conditions:
   (1) Check the EVAP canister for fuel saturation. If the EVAP canister is full of fuel, visually and physically inspect the EVAP and fuel system.
   Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. If OK, go to next step.
   (2) Remove the manifold side vacuum hose from the EVAP canister purge valve.
   (3) Using a hand vacuum pump apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve.
   (4) Does the valve hold vacuum?

YES	▸ Go to next step as below.
NO	▸ Repair air leakage and go to "Verification of Vehicle Repair" procedure.

Sensor Inspection

NOTE

Refer to "Signal Waveform & Data" in the "General Information" procedure .

1. Visually/physically inspect the HO2S for the following conditions:
   - Ensure that the HO2S is securely installed.
   - Silicon contamination. This contamination will be indicated by a white powdery coating on the portion of the sensor exposed to the exhaust stream and this will result in a but false(high) voltage signal.
   - Fuel, engine coolant or oil contamination.
   - Use of improper sealant.
   - If contamination is evident on the HO2S, Fix the source of the sensor contamination before replacing the sensor to prevent future contamination. Go to "Verification of Vehicle Repair" procedure.
2. Visually/physically inspect the MAFS for the following conditions:
   - Contamination or deterioration
   - Poor connection or damaged harness
3. Check for an intermittent TPS false signal. TPS signal displayed on a GDSshould increase steadily when depressing accelerator pedal after starting.
4. Verify that the PCM ground connections are clean and properly tightened.
5. If test result is NG, repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
   If OK, go to next step as below.

NOTE

If the contamination is evident on the HO2S or MAFS. Fix the source of the sensor contamination before replacing the sensor to prevent future contamination.

Positive Crankcase Ventilation System 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. Check crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
3. Warm up the engine to normal operating temperature
4. Connect GDSand note the "SHORT TERM FUEL-B1" parameter on the GDSdata list.
5. Disconnect and plug the positive crankcase ventilation at the intake manifold side.
6. Monitor the "SHORT TERM FUEL-B1" parameter on the GDSdata list once again.

Specification : The value should remain more or less unchanged

7. Is the displayed value within the specified value?

YES	▸ Go to next step as below.
NO	▸ Check the PCV(Positive Crankcase Ventilation) valve for operation properly. Refer to "EM" group in Workshop Manual. If OK, check that engine oil is diluted with fuel. Change the oil or filter as necessary and go to "Verification of Vehicle Repair" procedure.

Fuel System Inspection

1. Fuel Line 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 normal idle status.

   Specification : 338~348kPa(3.45~3.55kg/cm²)

   (4) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump	Fuel Pump (Fuel Pressure Regulator)
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pump (Fuel Pressure Regulator)

2. Fuel Pressure Hold Inspection
   (1) Stop the engine and check for a change in the fuel pressure gauge reading.

   Specification : After engine stops, the gauge reading should hold for minimum 5 minutes

   (2) Is fuel pressure within the specified value?

YES	▸ Visually/physically inspect the engine mechanical problem for the following: - Worn cylinder - Worn valve - Worn piston or piston ring ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure
	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to

NO	"Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel pressure drops slowly	Injector leak	Injector
Fuel pressure drops immediately	Stuck open in check valve of the fuel pump	Fuel pump

Verification of Vehicle Repair

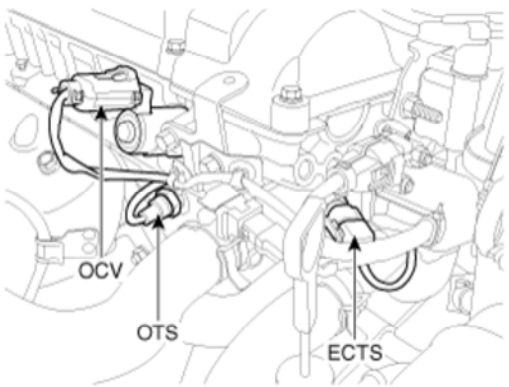
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0196 Engine Oil Temperature Sensor-Range / Performance

Component Location



General Description

The fluid of the CVVT is the engine oil and its density changes according to the engine oil temperature. At this time the Oil Temperature Sensor (OTS) helps compensation against the temperature differences. The Oil Temperature Sensor measures the engine oil temperature before the engine oil comes into the Oil-flow Control Valve (OCV).
According to the measured temperature, the Engine Control Module (PCM) compensates the oil-flow control valve operation time.

DTC Description

The purpose of this diagnosis is to detect a stuck oil temperature signal or implausibly low ,high signal. For the stuck signal detection, the PCM checks whether after a variation of the calculated oil temperature also a variation of the measured oil temperature is detected and sets DTC P0196 if the variation of the measured oil temperature is lower than the threshold.For the implausibly high, low signal detection, the PCM compares measured engine oil temperature with calculated oil temperature or coolant temperature and sets DTC P0196 when one of following conditions is met.

1. Measured oil temperature is implausibly low when calculated oil temperature is high.
2. Measured oil temperature is implausibly high when coolant is low without any relevant failure.
3. Measured oil temp. < threshold but calculated oil temp. > threshold.

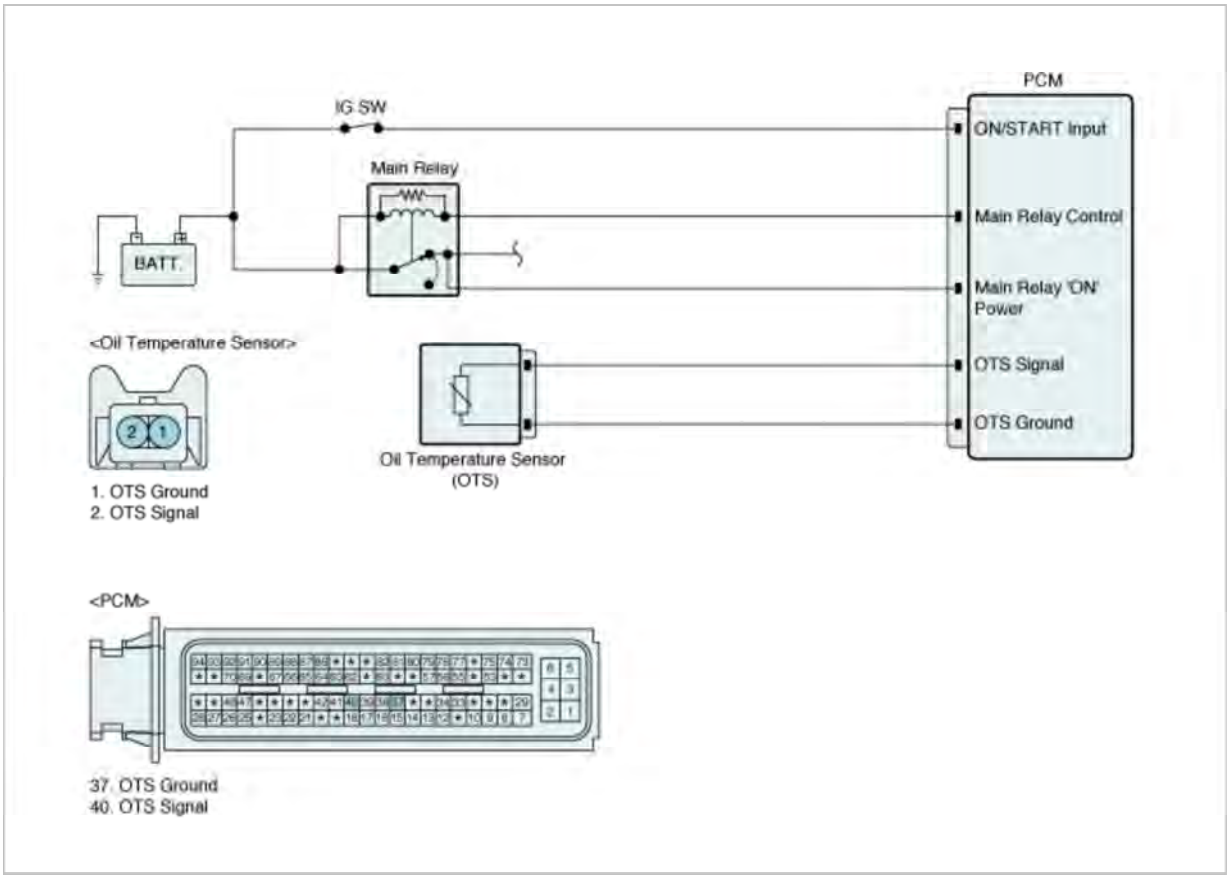
DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy	case1	• Sensor signal Stuck	• Poor connection or damaged harness • Faulty OTS
	case2	• Signal plausability	
Enable Conditions	case1	• Engine coolant temperature at start < 40°C(104°F) • No relevant failure • 6 < Battery voltage<16V	
	case2	• 6 < Battery voltage < 16V • No relevant failure	
Threshold Value	case1	• Measured oil temperature increase < 10~35°C(50~63°F) (Threshold depends on Coolant temperature at start)	
	case2	• Measured oil temperature < 20°C(68°F) • Measured oil temperature > 100°C(212°F)	
Diagnostic Time	case1	• 10-30 min. (depends on Engine Coolant Temp. and driving condition at start)	
	case2	• 15 seconds.	
Mil On Condition		• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)	Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)
-20	-4	Approx. 14.1~16.9	40	104	Approx. 1.1~1.2
0	32	Approx. 6	60	140	Approx. 0.5~0.6
20	68	Approx. 2.3~2.6	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Signal Waveform & Data

Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
☑ Engine Oil Temperature	204.8	°F
☐ Engine Coolant Temperature Sensor	204.8	°F
☐ Engine Coolant Temperature Sensor [Model]	206.1	°F
☐ Intake Air Temperature Sensor	162.9	°F
☐ Canister Purge Duty	1.8	%
☐ Relative Fuel Part Of Purge Control	0.0	%
☐ Cylinder 1 Injection Time	0.0	mS
☐ Cylinder 2 Injection Time	0.0	mS
☐ Cylinder 3 Injection Time	0.0	mS
☐ Cylinder 4 Injection Time	0.0	mS
☐ Actual Torque	0.0	%
☐ Oxygen Sensor Heating Time-Bank1/Sensor1	130	mS
☐ Oxygen Sensor Heating Time-Bank1/Sensor2	130	mS
☐ Oxygen Sensor-Bank1/Sensor1	0.4	V
☐ Oxygen Sensor-Bank1/Sensor2	0.4	V
☐ Target Idle Speed	630	RPM
☐ Idle Speed Control Actuator	15.6	%
☐ Engine Speed	0	RPM
☐ Calculated Oil Temperature	204.8	°F
☐ Ignition Angle-Cylinder1	15.8	°
☐ Ignition Angle-Cylinder2	15.8	°

Fig.1

Fig 1) Engine Oil Temp. Sensor : Approx. 204.8°F after warm up.(at IG ON)

Monitor DTC Status

NOTE

If any DTCs relating to OTS(Oil Temperature Sensor) or ECT(Engine Coolant Temperature)Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Monitor GDS Data

1. Allow the engine to cool.
2. Run the cold engine at idle for 5 minutes.
3. Check the engine coolant temperature parameter at idle with the GDS.
4. Is the engine coolant temperature increase to above 50°C(122°F)

YES	▸ Go to next step as below.
NO	▸ Check ECTS for contamination, deterioration, poor connection or damaged harness. 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(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.

Component Inspection

1. Ignition "OFF"
2. Disconnect OTS connector.
3. Measure resistance between terminals 1 and 2 of OTS connector.(Component side)
   Specification :

Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)
-20	-4	Approx. 14.1~16.9
0	32	Approx. 6
20	68	Approx. 2.3~2.6
40	104	Approx. 1.1~1.2
60	140	Approx. 0.5~0.6
80	176	Approx. 0.3

4. Is resistance within the specification?

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 OTS for contamination, deterioration, or damage. Substitute with a known-good OTS and check for proper operation. If the problem is corrected, replace OTS and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

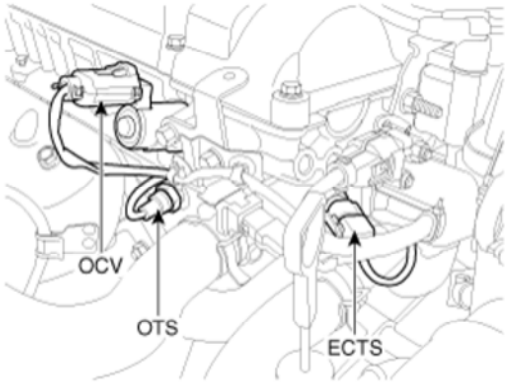
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0197 Engine Oil Temperature Sensor Low Input

Component Location



General Description

The fluid of the CVVT is the engine oil and its density changes according to the engine oil temperature. At this time the Oil Temperature Sensor (OTS) helps compensation against the temperature differences. The Oil Temperature Sensor measures the engine oil temperature before the engine oil comes into the Oil-flow Control Valve (OCV).
According to the measured temperature, the Engine Control Module (PCM) compensates the oil-flow control valve operation time.

DTC Description

PCM sets DTC P0197 if the PCM detects signal voltage lower than the possible range of a properly operating OTS.

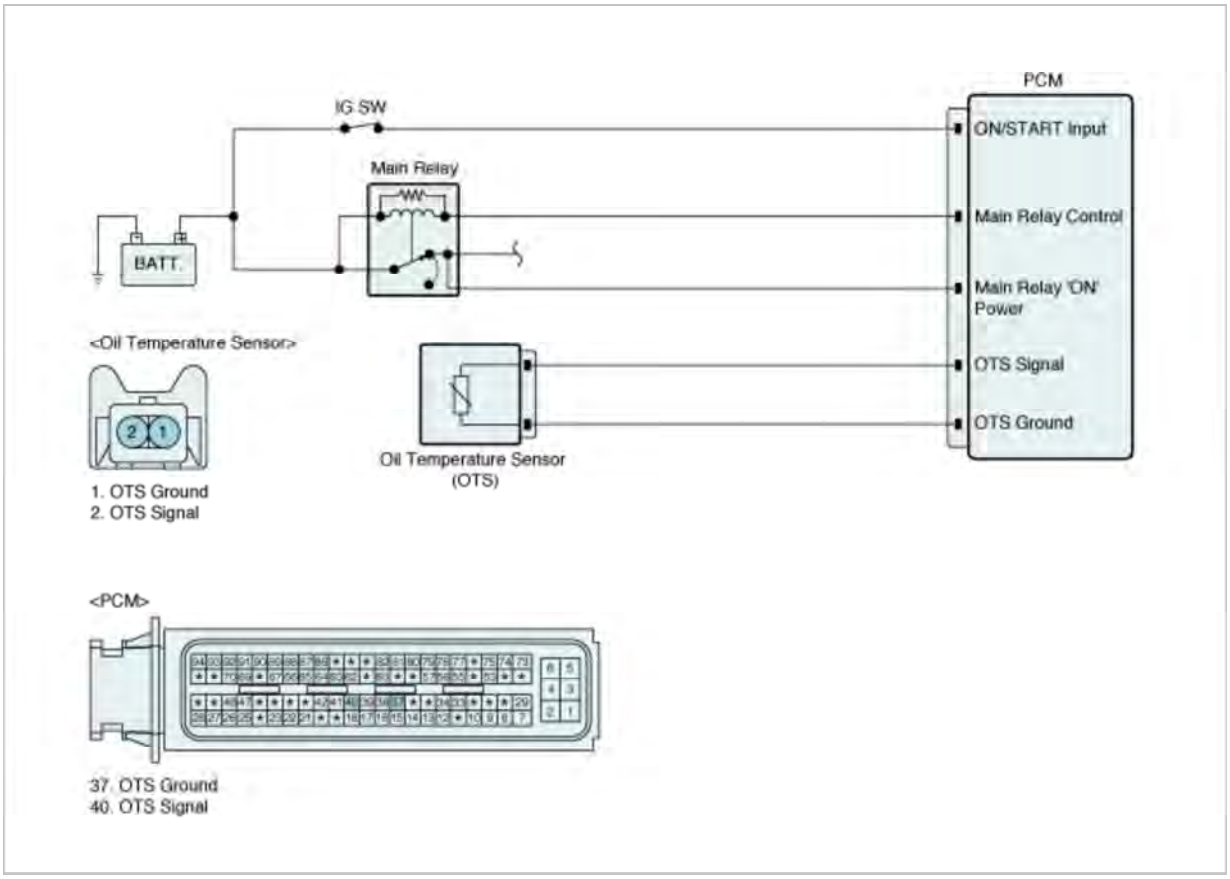
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range Check	• Short circuit to ground • Poor connection or damaged harness • Faulty OTS
Enable Conditions	• Engine coolant temperature < 100°C(212°F)	
Threshold Value	• Oil temperature > 154°C(309°F)	
Diagnostic Time	• 5 seconds	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)	Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)
-20	-4	Approx. 14.1~16.9	40	104	Approx. 1.1~1.2
0	32	Approx. 6	60	140	Approx. 0.5~0.6
20	68	Approx. 2.3~2.6	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Signal Circuit Inspection

1. Ignition "OFF"
2. Disconnect OTS connector
3. Measure resistance between signal terminal of OTS 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 OTS connector.(Component side)
Specification :

Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)
-20	-4	Approx. 14.1~16.9
0	32	Approx. 6
20	68	Approx. 2.3~2.6
40	104	Approx. 1.1~1.2
60	140	Approx. 0.5~0.6
80	176	Approx. 0.3

2. Is resistance within the specification?

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 OTS for contamination, deterioration, or damage. Substitute with a known-good OTS and check for proper operation. If the problem is corrected, replace OTS and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

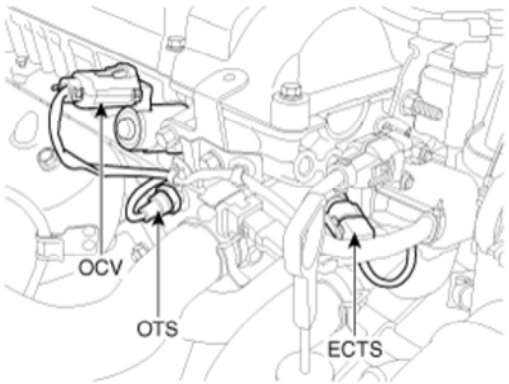
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0198 Engine Oil Temperature Sensor High Input

Component Location



General Description

The fluid of the CVVT is the engine oil and its density changes according to the engine oil temperature. At this time the Oil Temperature Sensor (OTS) helps compensation against the temperature differences. The Oil Temperature Sensor measures the engine oil temperature before the engine oil comes into the Oil-flow Control Valve (OCV).
According to the measured temperature, the Engine Control Module (PCM) compensates the oil-flow control valve operation time.

DTC Description

PCM sets DTC P0198 if the PCM detects signal voltage higher than the possible range of a properly operating OTS.

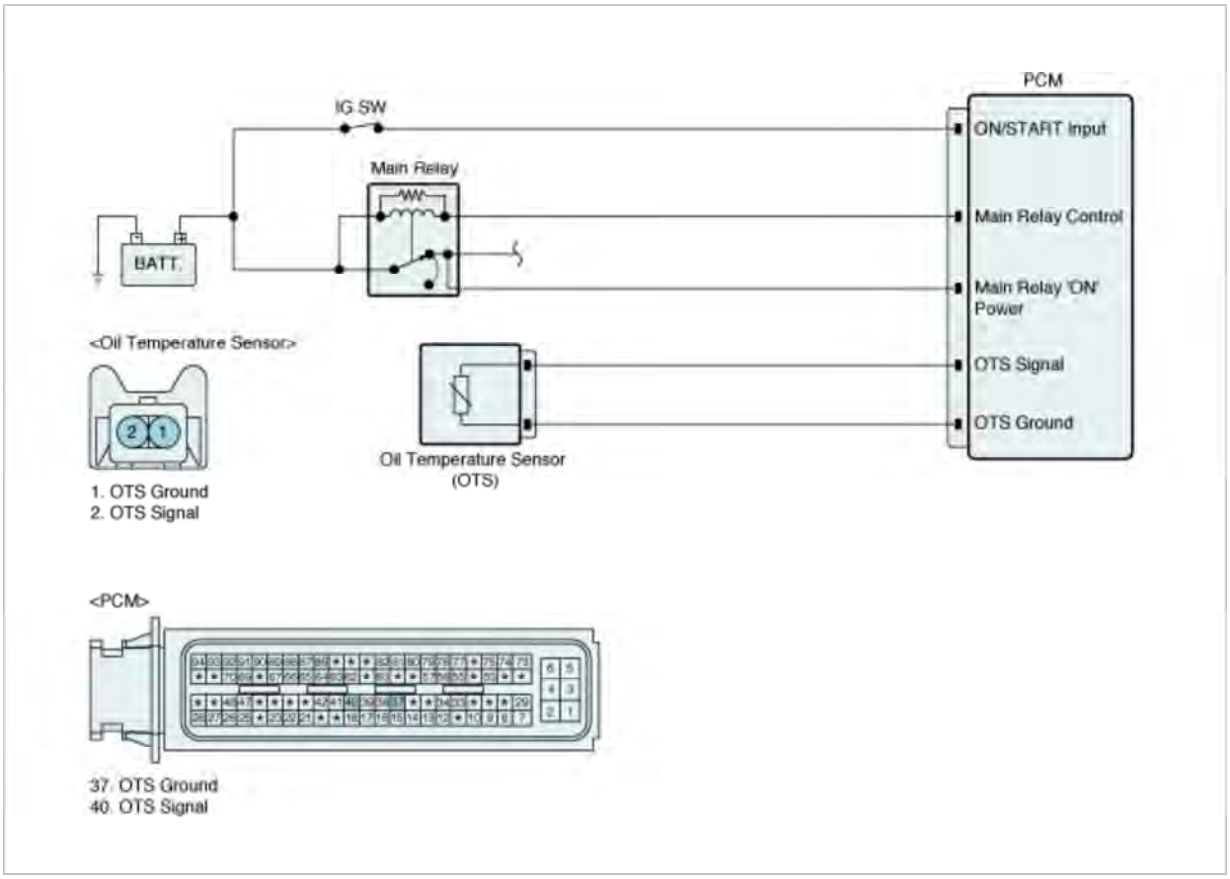
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage Range Check	• Open or short circuit to battery • Poor connection or damaged harness • Faulty OTS
Enable Conditions	• Time after Start if coolant temperature < -10°C) >5 min.	
Threshold Value	• Oil temperature < -36°C(-33°F)	
Diagnostic Time	• 5 seconds	
Mil On Condition	• 2 Driving Cycles	

Specification

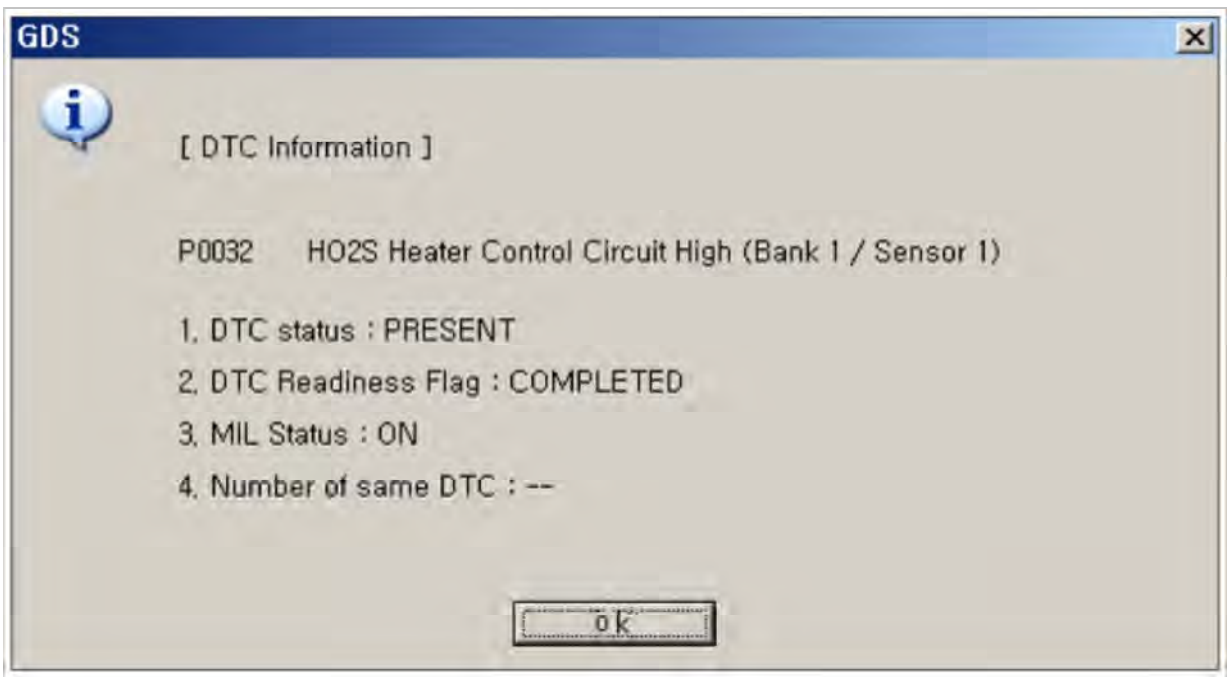
Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)	Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)
-20	-4	Approx. 14.1~16.9	40	104	Approx. 1.1~1.2
0	32	Approx. 6	60	140	Approx. 0.5~0.6
20	68	Approx. 2.3~2.6	80	176	Approx. 0.3

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Ground circuit inspection

1. Ignition "OFF"
2. Disconnect OTS connector
3. Measure resistance between ground terminal of OTS harness connector and chassis ground

Specification : Approx. 0Ω

4. Is resistance within specification?

YES	▸ Go to next step as below.
NO	▸ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

Signal Circuit Inspection

1. Check the signal circuit for short to battery
   (1) Disconnect PCM harness connector
   (2) Ignition "ON" & Engine "OFF"
   (3) Measure voltage between signal terminal of OTS harness connector and chassis ground

   Specification : Approx. 0V

   (4) Is voltage within specification?

YES	▸ Go to next step as below.
NO	▸ Check for short to battery in signal circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check the signal circuit for open
   (1) Ignition "OFF"
   (2) Measure resistance between signal terminal of OTS harness connector and OTS signal terminal of PCM harness connector.
   (3) Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check for open in signal circuit. 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 next step as below.

Component Inspection

1. Measure resistance between terminals 1 and 2 of OTS connector.(Component side)
   Specification :

Temp.(°C)	Temp.(°F)	OTS Resistance(kΩ)
-20	-4	Approx. 14.1~16.9
0	32	Approx. 6
20	68	Approx. 2.3~2.6
40	104	Approx. 1.1~1.2
60	140	Approx. 0.5~0.6
80	176	Approx. 0.3

2. Is resistance within the specification?

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 OTS for contamination, deterioration, or damage. Substitute with a known-good OTS and check for proper operation. If the problem is corrected, replace OTS and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

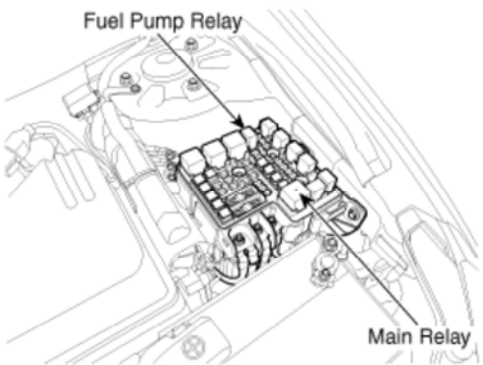
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0230 Fuel Pump Primary Circuit

Component Location



General Description

The PCM provides ground to one side of the coil in the fuel pump relay to control the fuel pump relay. The other side of the fuel pump relay coil is connected to fuel pump relay, which activates when the ignition switch is ON. The PCM monitors the control circuit between the fuel pump relay and the PCM. When the ignition switch is turned ON, the PCM energizes the fuel pump relay, which sends power to the fuel pump.

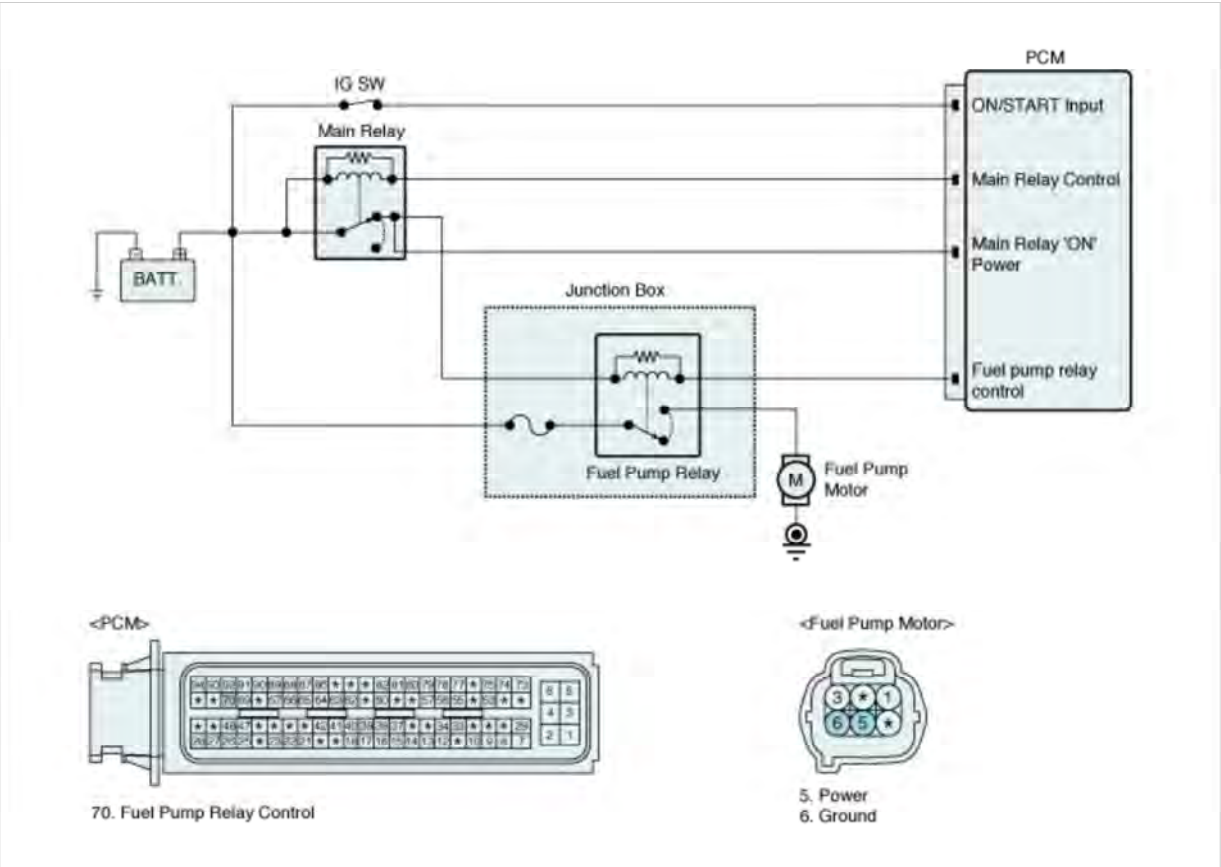
DTC Description

PCM sets DTC P0230 if the PCM detects the fuel pump relay control circuit is open, short to ground or battery.

DTC Detecting Condition

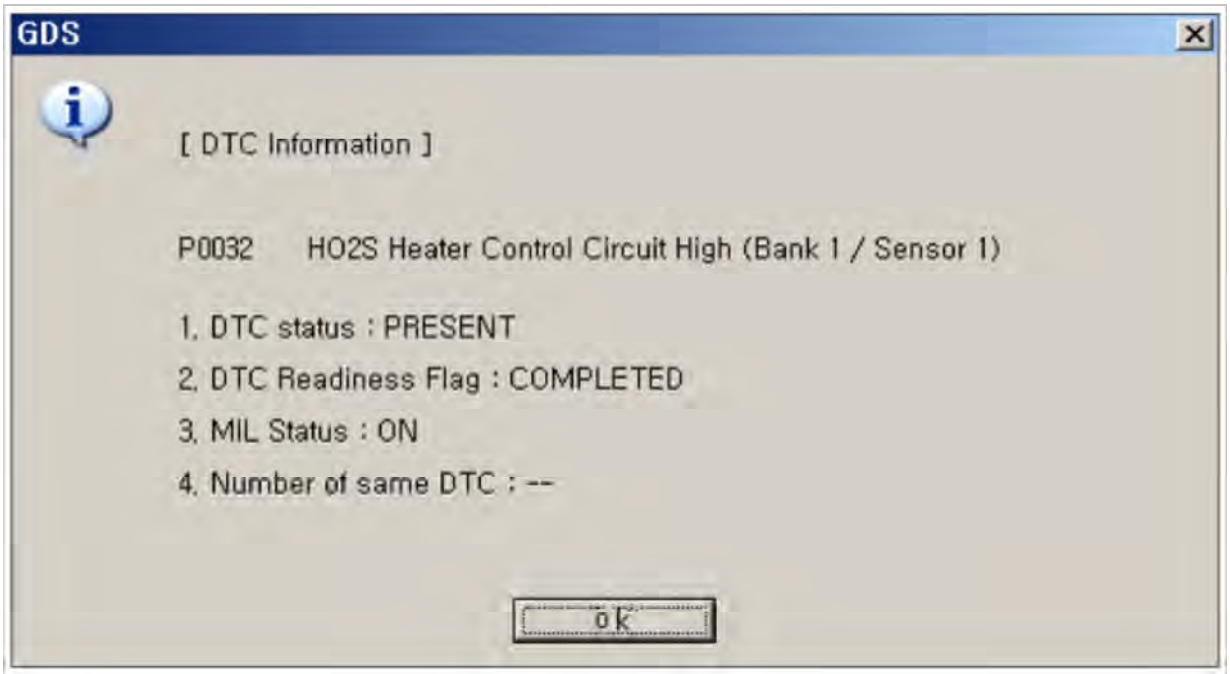
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open or short in harness • Poor connection or damaged harness • Faulty fuel pump relay
Enable Conditions	• 10V < Battery voltage < 16V	
Threshold Value	• Shot to Ground/Battery or Line Break	
Diagnostic Time	• 3 seconds	
Mil On Condition	• -	

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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.

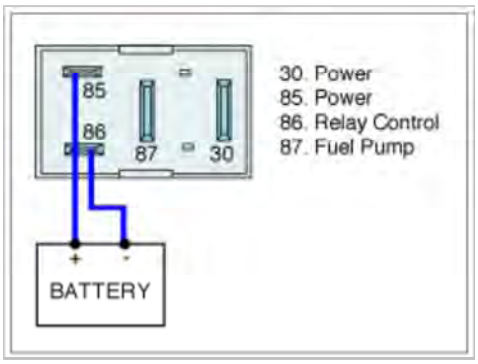
YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. With Ignition OFF, remove the fuel pump relay
2. Measure resistance between terminals 85 and 86 of the fuel pump relay(Component side)

Specification : Approx. 70~120Ω at 20°C(68°F)

3. Apply 12V and a ground to 85 and 86 terminals of the fuel pump relay(Components side).



4. Check if the main relay works well when it is energized. (If the fuel pump relay works normally, a clicking sound can be heard.)
5. Does the fuel pump relay operate normally?

YES	▸ Go to next step as below.
NO	▸ Check fuel pump relay for contamination, deterioration, or damage. Substitute with a known-good fuel

	pump relay and check for proper operation. If the problem is corrected, replace fuel pump relay and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power supply terminals of fuel pump relay harness and chassis ground.

Specification : Approx. B+

3. 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. Measure voltage between control terminal of Fuel Pump Relay harness connector and chassis ground.

Specification : 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check for open or short in control circuit. 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	▸ Thoroughly 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.

Verification of Vehicle Repair

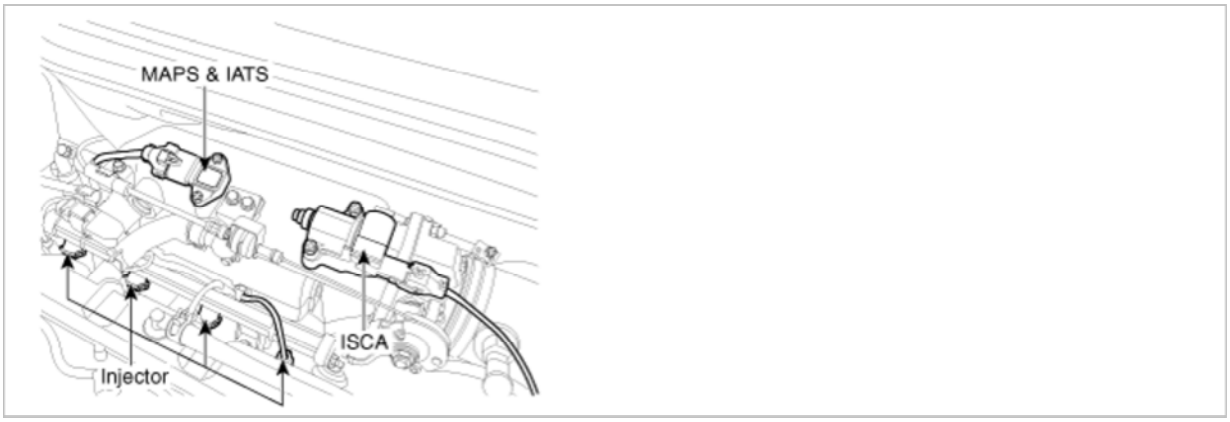
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0261 Cylinder 1 Injector Circuit Low

Component Location



General Description

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC Description

PCM sets DTC P0261 if the PCM detects that injector (Cylinder #1) control circuit is shorted to ground.

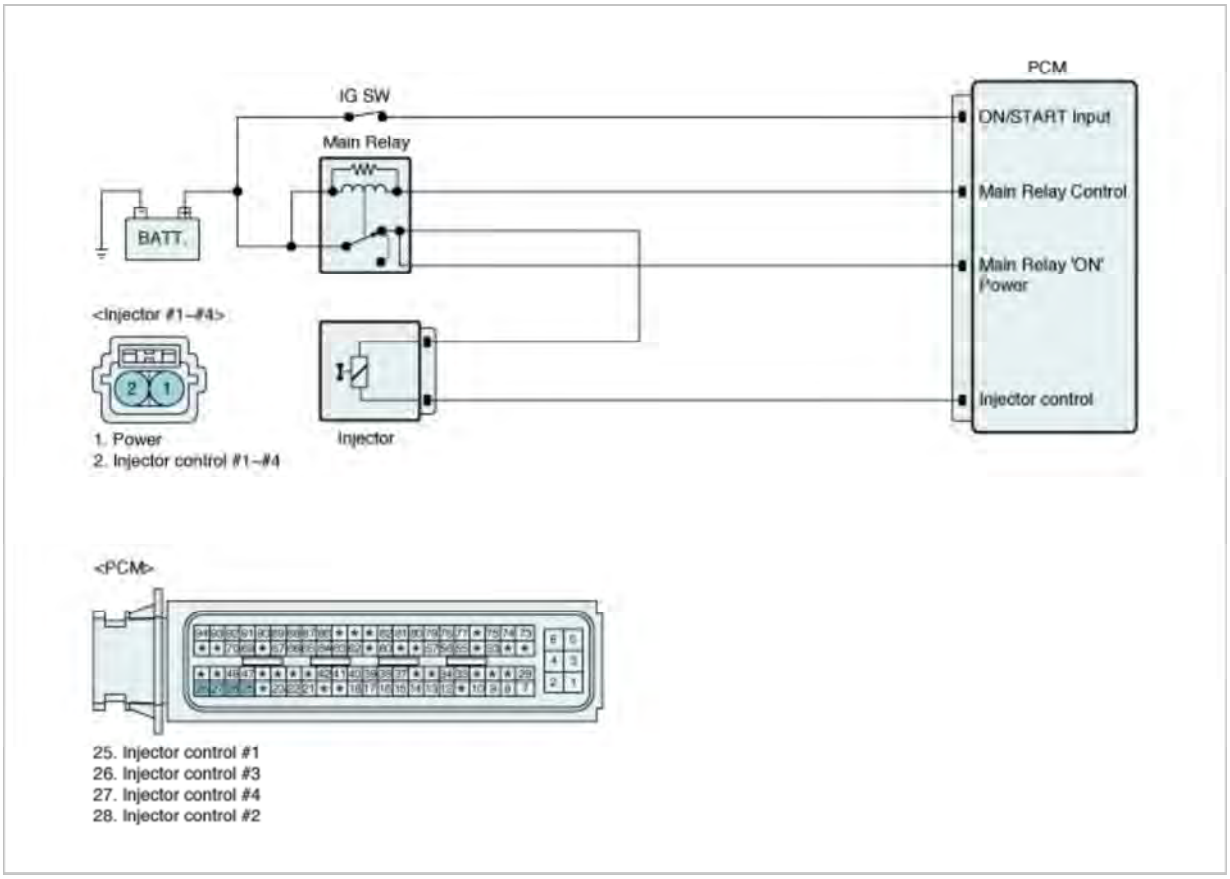
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open in power supply harness • Short to ground in control harness • Poor connection or damaged harness • Faulty injector
Enable Conditions	• 10V < Battery voltage < 16V • Engine speed(rpm) >30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect injector connector
3. Measure resistance between control terminal and power terminal of the injector connector. (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

4. Is resistance within the specification?

YES	▸ 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal 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 10A 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 control terminal of the injector harness connector and chassis ground.

Specification : Infinite

2. Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair open or short to ground in control 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	▸ 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.

Verification of Vehicle Repair

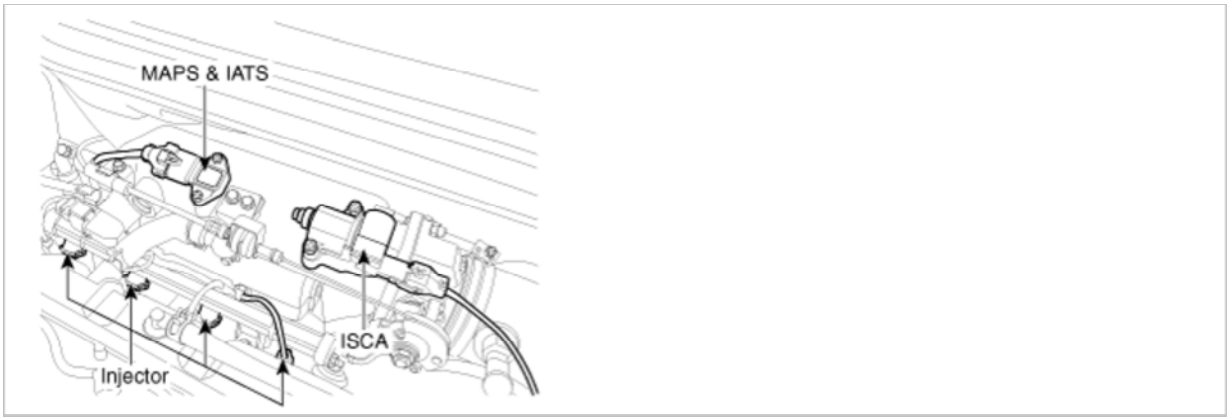
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0262 Cylinder 1 Injector Circuit High

Component Location



General Description

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC Description

PCM sets DTC P0262 if the PCM detects that injector (Cylinder #1) control circuit is open or shorted to battery voltage.

DTC Detecting Condition

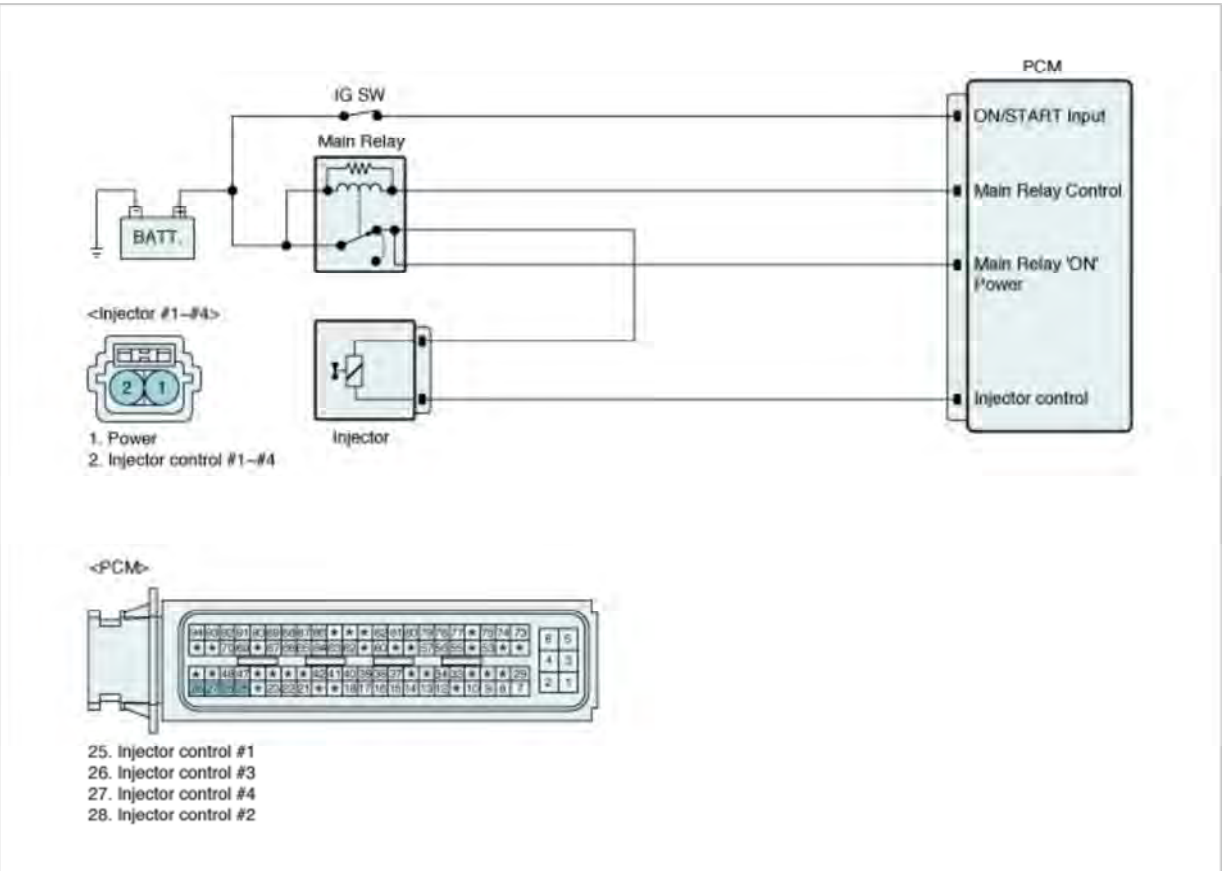
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open or short to battery in control harness. • Open or short to battery in control
Enable Conditions	• 10V < Battery voltage < 16V • Engine speed(rpm) >30	
Threshold Value	• Short to battery or Line break	

Diagnostic Time	• 1.5 sec.	harness. • Faulty injector
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect injector connector
3. Measure resistance between control terminal and power terminal of the injector connector. (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

4. Is resistance within the specification?

YES	▸ 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal 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. Measure voltage between control terminal of the injector harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check control circuit for open or short. 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	▸ 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.

Verification of Vehicle Repair

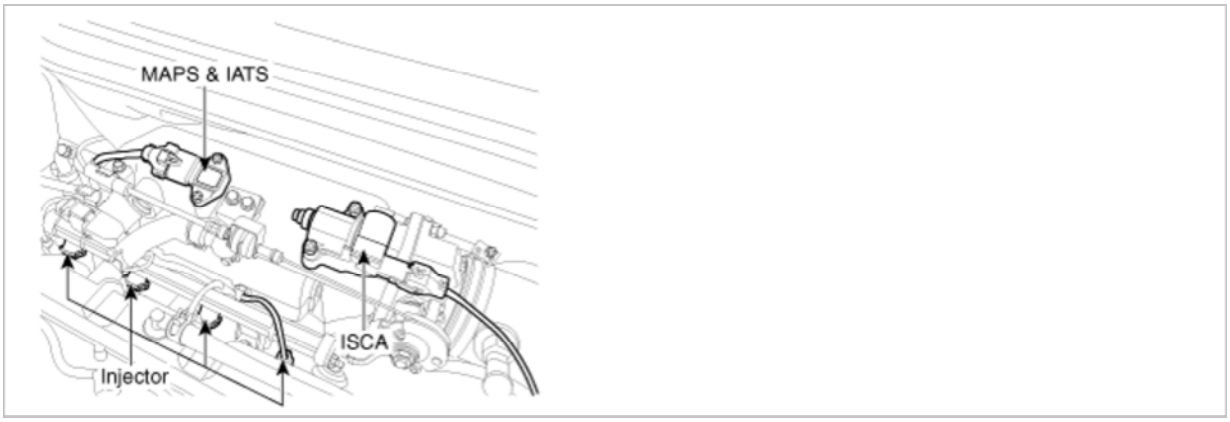
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0264 Cylinder 2 Injector Circuit Low

Component Location



General Description

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC Description

PCM sets DTC P0264 if the PCM detects that injector (Cylinder #2) control circuit is shorted to ground.

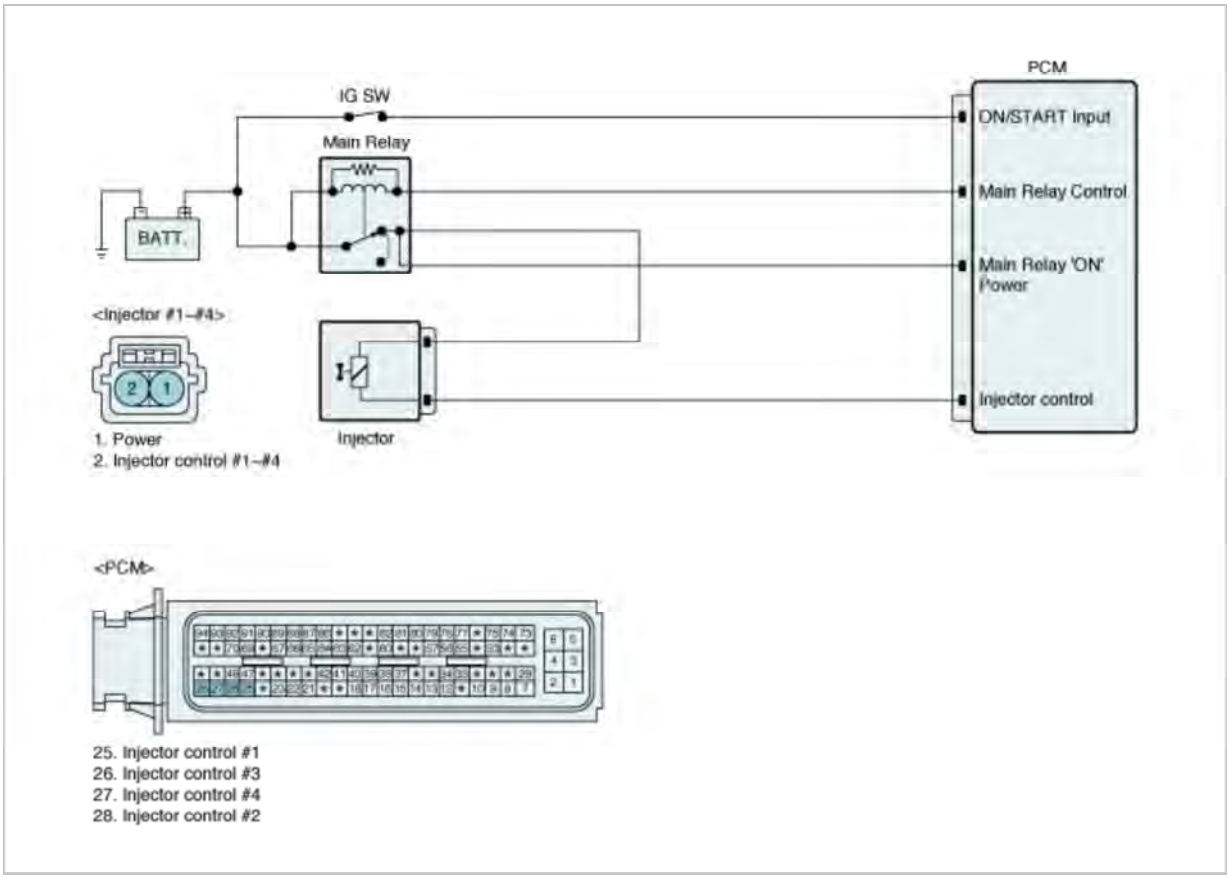
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open in power supply harness • Short to ground in control harness • Poor connection or damaged harness • Faulty injector
Enable Conditions	• 10V < Battery voltage < 16V • Engine speed(rpm) >30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect injector connector
3. Measure resistance between control terminal and power terminal of the injector connector. (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

4. Is resistance within the specification?

YES	▸ 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal 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 10A 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 control terminal of the injector harness connector and chassis ground.

Specification : Infinite

2. Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair open or short to ground in control 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	▸ 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.

Verification of Vehicle Repair

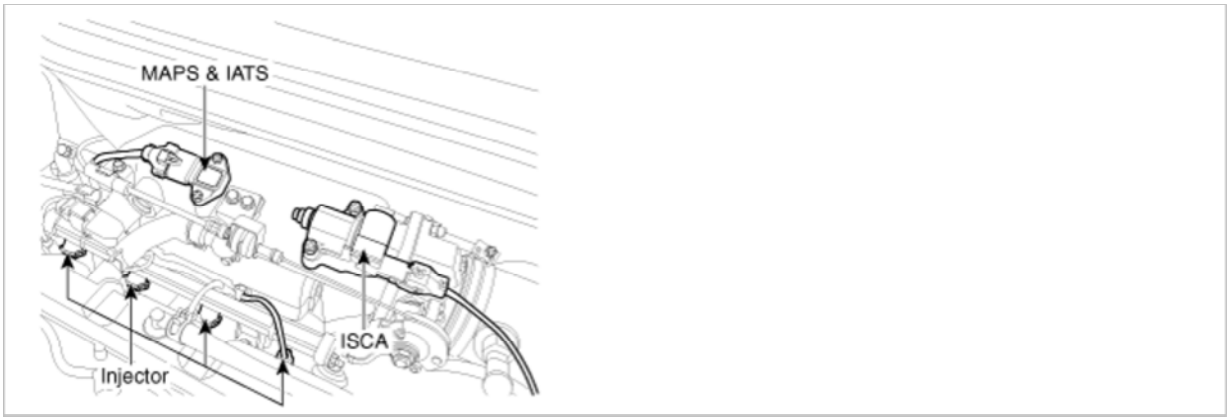
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0265 Cylinder 2 Injector Circuit High

Component Location



General Description

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC Description

PCM sets DTC P0265 if the PCM detects that injector (Cylinder #2) control circuit is open or shorted to battery voltage.

DTC Detecting Condition

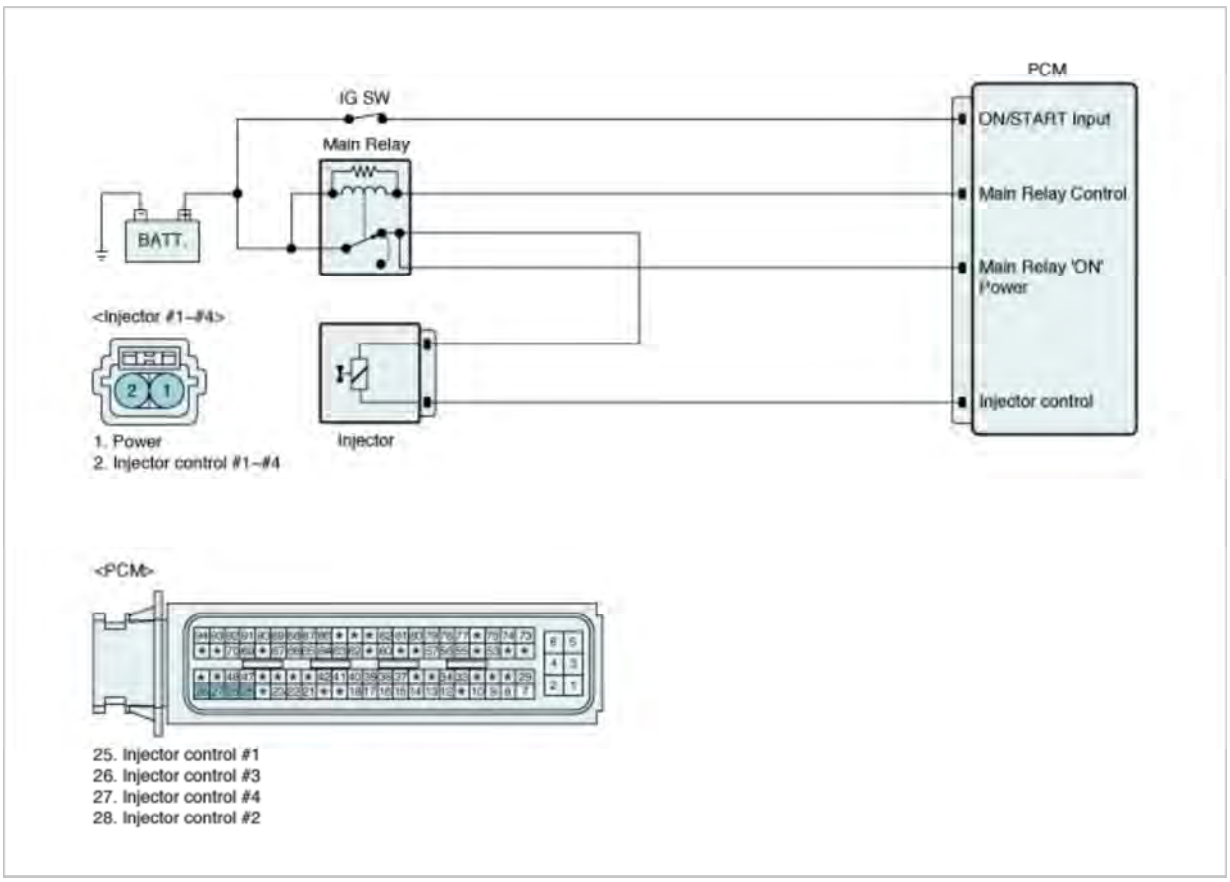
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open or short to battery in control harness. • Poor connection or damaged
Enable Conditions	• 10V < Battery voltage < 16V • Engine speed(rpm) >30	
Threshold Value	• Short to battery or Line break	

Diagnostic Time	• 1.5 sec.	harness • Faulty injector
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect injector connector
3. Measure resistance between control terminal and power terminal of the injector connector. (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

4. Is resistance within the specification?

YES	▸ 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal 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. Measure voltage between control terminal of the injector harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check control circuit for open or short. 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	▸ 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.

Verification of Vehicle Repair

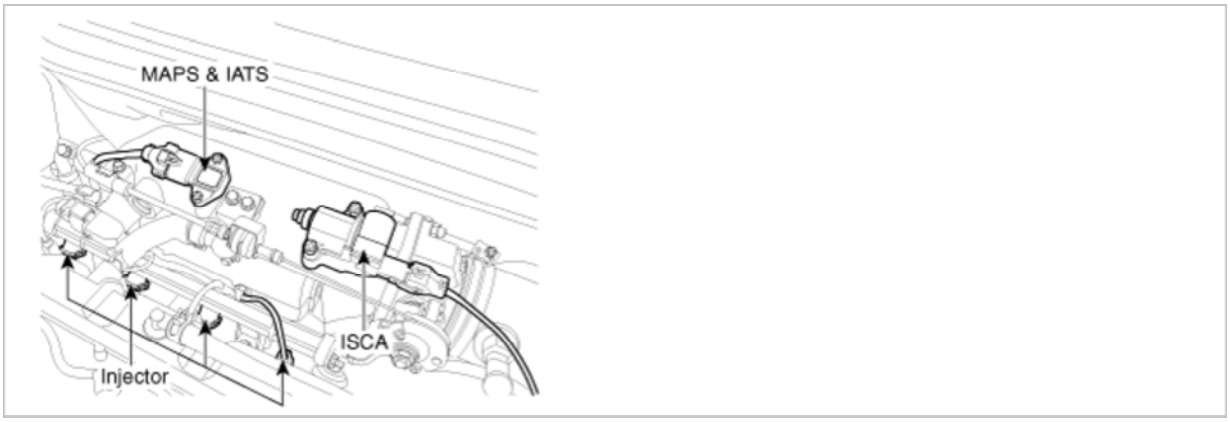
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0267 Cylinder 3 Injector Circuit Low

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 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.

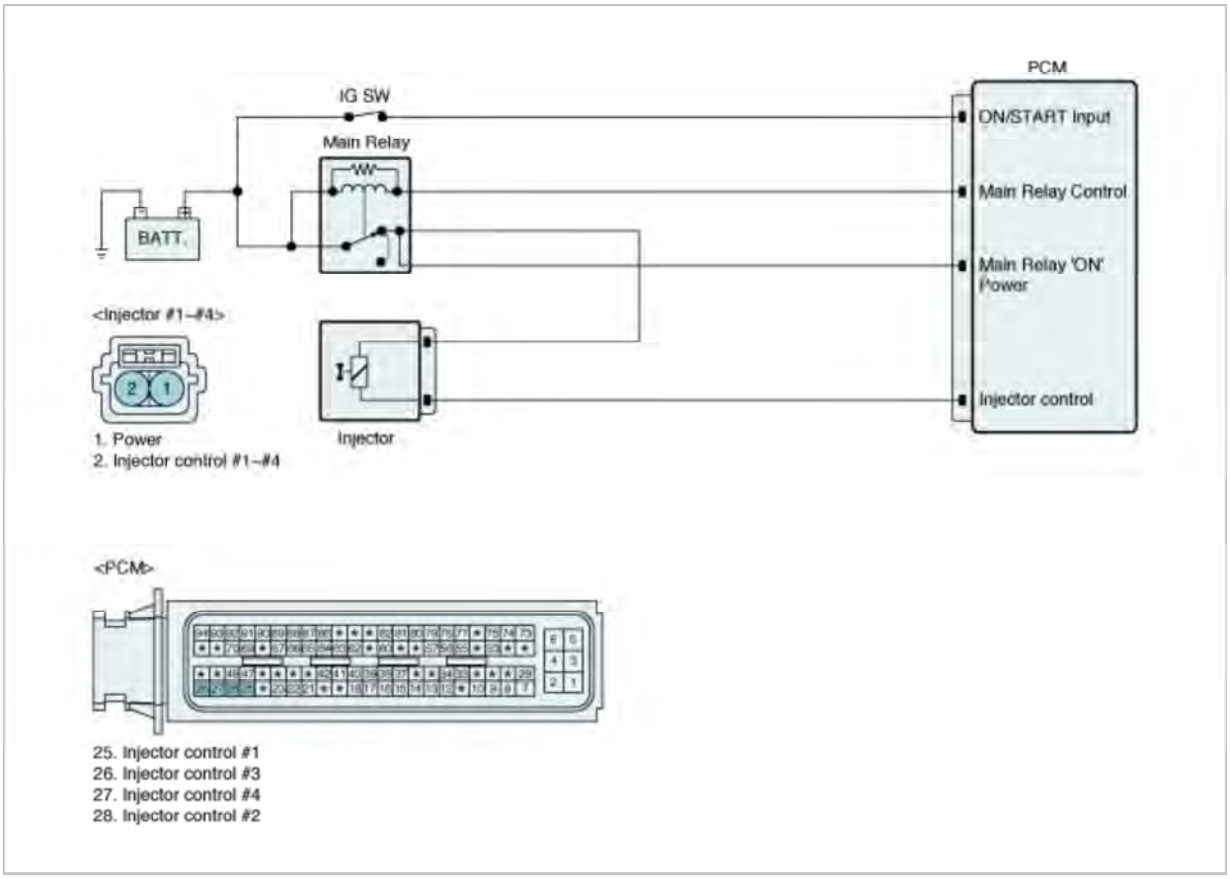
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open in power supply harness • Short to ground in control harness • Poor connection or damaged harness • Faulty injector
Enable Conditions	• 10V < Battery voltage < 16V • Engine speed(rpm) >30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect injector connector
3. Measure resistance between control terminal and power terminal of the injector connector. (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

4. Is resistance within the specification?

YES	▸ 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal 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 10A 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 control terminal of the injector harness connector and chassis ground.

Specification : Infinite

2. Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair open or short to ground in control 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	▸ 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.

Verification of Vehicle Repair

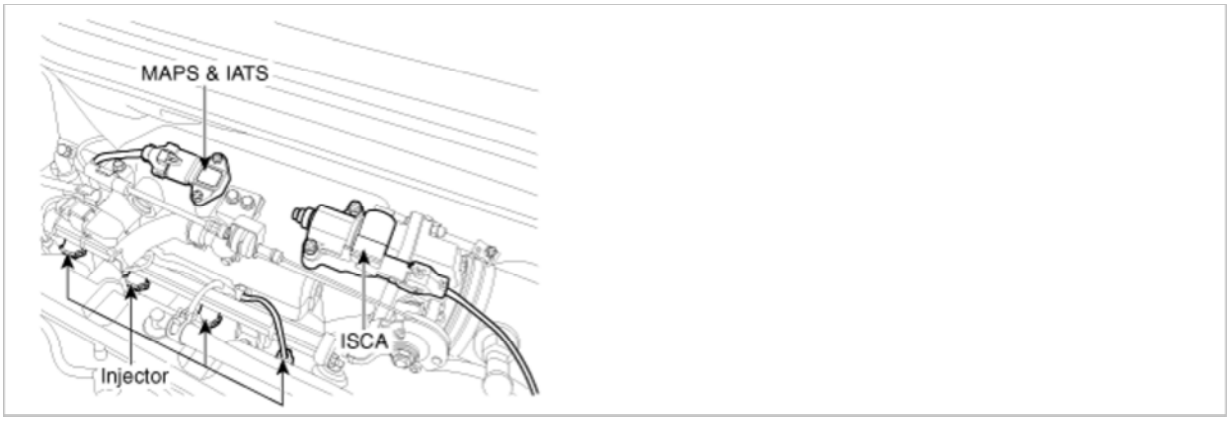
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0268 Cylinder 3 Injector Circuit High

Component Location



General Description

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC Description

PCM sets DTC P0268 if the PCM detects that injector (Cylinder #3) control circuit is open or shorted to battery voltage.

DTC Detecting Condition

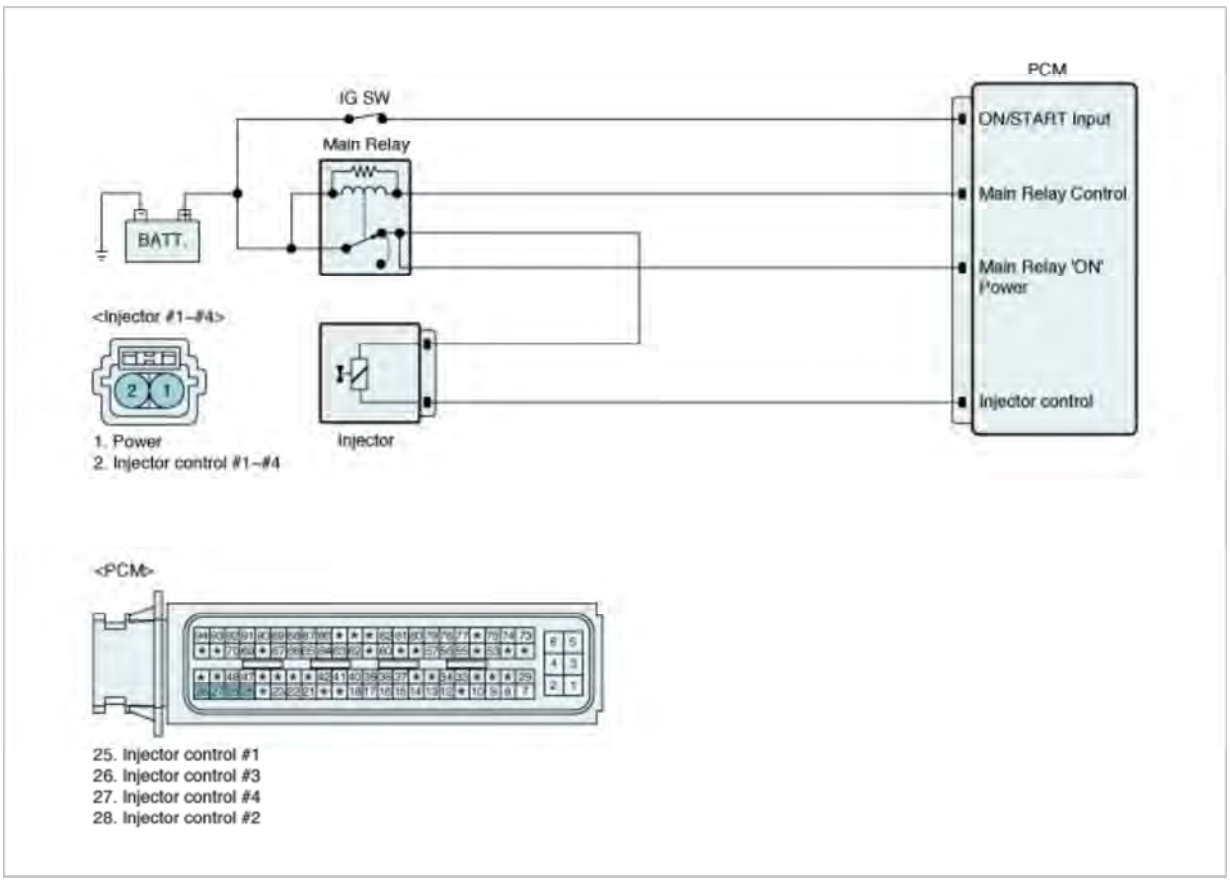
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open or short to battery in control harness. • Poor connection or damaged
Enable Conditions	• 10V < Battery voltage < 16V • Engine speed(rpm) >30	
Threshold Value	• Short to battery or Line break	

Diagnostic Time	• 1.5 sec.	harness • Faulty injector
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect injector connector
3. Measure resistance between control terminal and power terminal of the injector connector. (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

4. Is resistance within the specification?

YES	▸ 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal 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. Measure voltage between control terminal of the injector harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check control circuit for open or short. 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	▸ 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.

Verification of Vehicle Repair

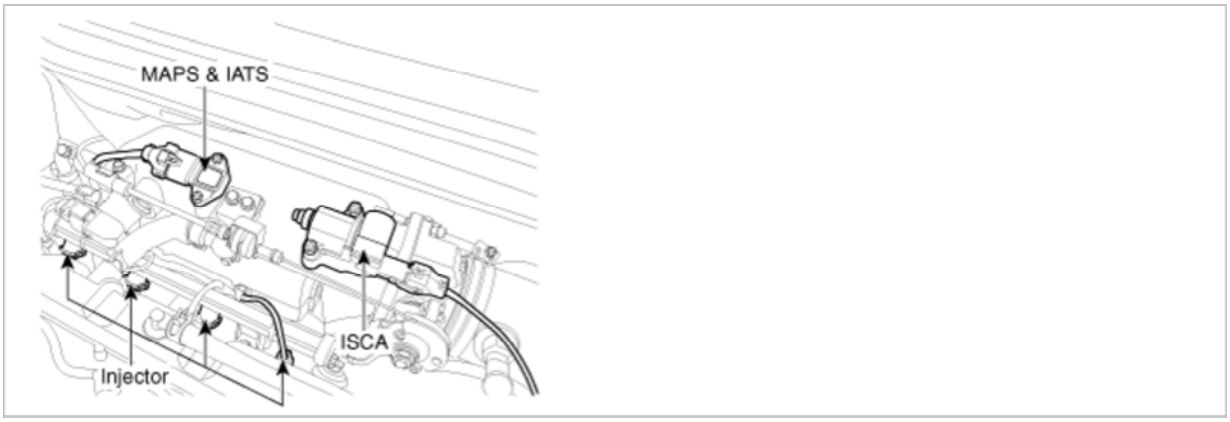
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0270 Cylinder 4 Injector Circuit Low

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 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.

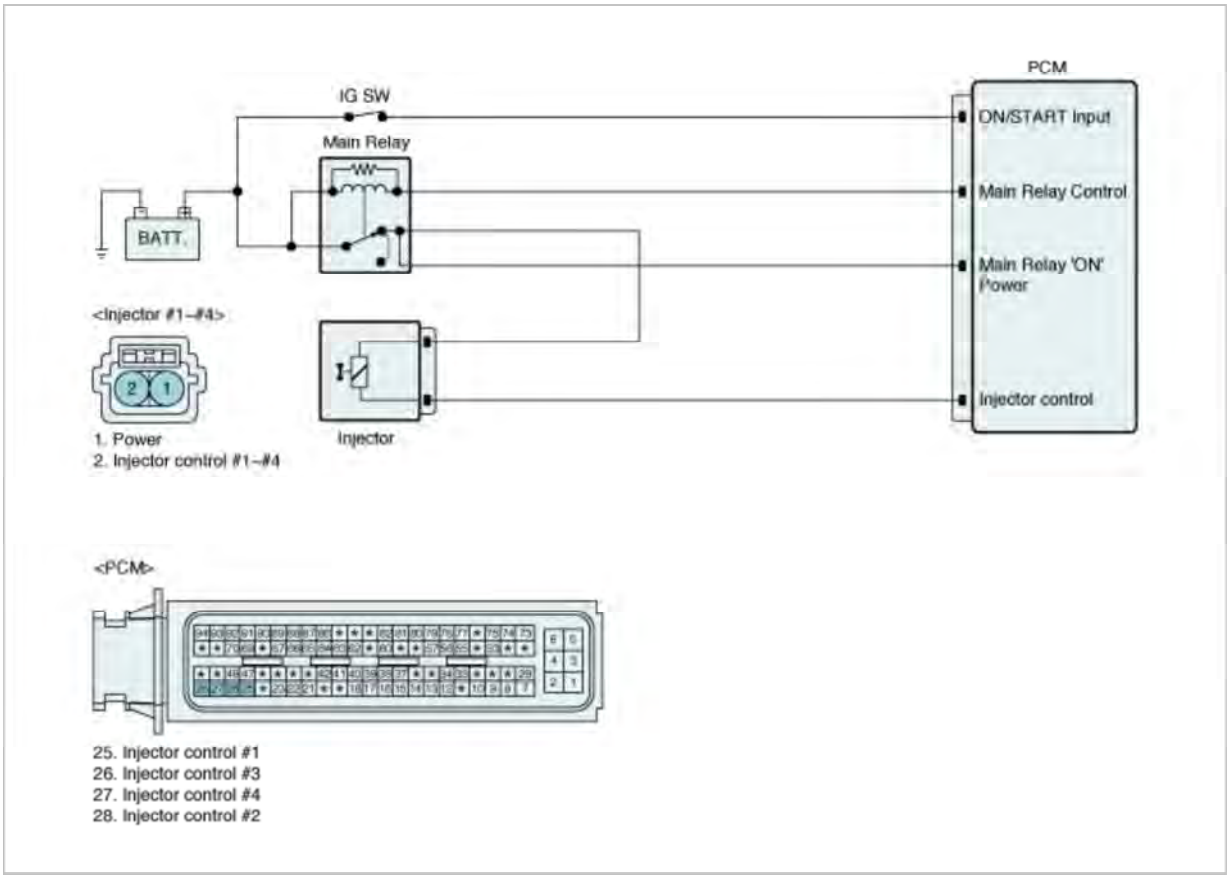
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open in power supply harness • Short to ground in control harness • Poor connection or damaged harness • Faulty injector
Enable Conditions	• 10V < Battery voltage < 16V • Engine speed(rpm) >30	
Threshold Value	• Short to ground	
Diagnostic Time	• 1.5 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect injector connector
3. Measure resistance between control terminal and power terminal of the injector connector. (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

4. Is resistance within the specification?

YES	▸ 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal 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 10A 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 control terminal of the injector harness connector and chassis ground.

Specification : Infinite

2. Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair open or short to ground in control 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	▸ 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.

Verification of Vehicle Repair

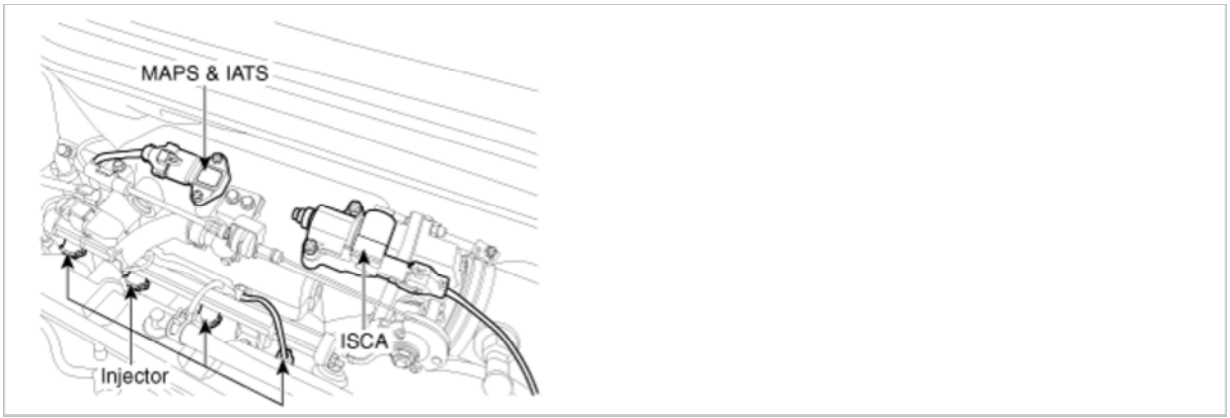
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0271 Cylinder 4 Injector Circuit High

Component Location



General Description

Based on information from various sensors, the PCM 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 PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC Description

PCM sets DTC P0271 if the PCM detects that injector (Cylinder #4) control circuit is open or shorted to battery voltage.

DTC Detecting Condition

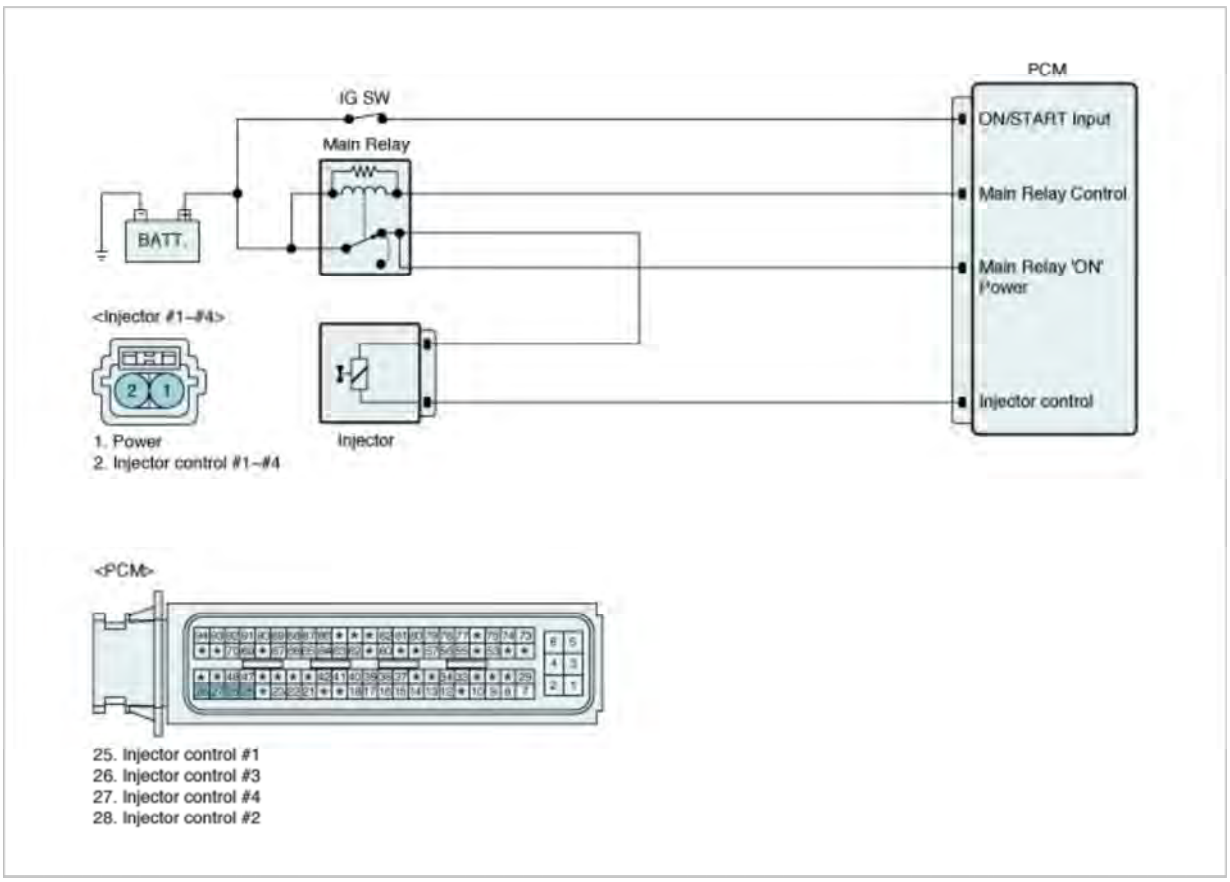
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical Check	• Open or short to battery in control harness. • Poor connection or damaged
Enable Conditions	• 10V < Battery voltage < 16V • Engine speed(rpm) >30	
Threshold Value	• Short to battery or Line break	

Diagnostic Time	• 1.5 sec.	harness • Faulty injector
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect injector connector
3. Measure resistance between control terminal and power terminal of the injector connector. (Component side)
   Specification :

Temp.(°C)	Temp.(°F)	Resistance (Ω)
20	68	13.8~15.2

4. Is resistance within the specification?

YES	▸ 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal 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. Measure voltage between control terminal of the injector harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check control circuit for open or short. 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	▸ 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.

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0300 Random/Multiple Cylinder Misfire Detected

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

If the ECM detects that engine speed variation indicates a misfire sufficient to cause three-way catalyst converter damage or emissions level to exceed standard value, the ECM sets misfire DTC. If the misfire rate is high enough to damage the catalyst, the MIL will flash to alert the vehicle operator. 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, high-tension 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	• 156 < Mass air flow(mg/rev.) < 710 (depends on RPM , Coolant temp.) • 512 < Engine speed(RPM) < 6500 • 141 < Throttle gradient(°TPS/sec.) < 199 • Coolant temperature > 20°C (-4°F) if Start temperature < -7°C (19.4°F) • No rough road • No relevant failure • 11V< Battery voltage • Fuel cut off not active	
Threshold Value	• Misfire detected on 2 or more cylinders	
Mil On Condition	• When misfire rate is high enough to damage the catalyst : Immediate • When emissions level to exceed standard value : 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Primary ignition coil (Ω)	Secondary ignition coil(kΩ)
20	68	0.5~0.6	7.5~10.2

Monitor DTC Status

NOTE

If any DTCs related 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 procedure. If the misfire rate is high enough to cause possible catalyst damage(if the MIL was blinking), ensure that the monitoring for DTC P0420 is completed and passed after verifying the misfire repair.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 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 any misfire DTCs related to companion cylinders{P0301(Cylinder1)&P0304(Cylinder4), P0302 (Cylinder2))&P0303(Cylinder3)} are also stored, go to "Ignition System Inspection" procedure.If not, go to next step as below.

Visual Inspection

1. Visually/physically inspect for the following conditions
   - Vacuum hoses in engine room for splits, kinks and improper installation
   - Positive crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
   - Verify that the ECM ground connections are clean and properly tightened.
2. Check MAFS and ECTS for the following conditions:
   - Contamination, deterioration, poor connection or damaged harness
   - The MAF signal displayed on the scantool should increase as engine speed increases
   - The engine coolant temperature displayed on the scantool should close to the actual coolant temperature.
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 next step as below

Timing Inspection

1. With ignition "OFF", set up an oscilloscope as follows :
   Channel A (+): terminal 3 of the Crankshaft Position Sensor(CKPS), (-): ground
   Channel B (+): terminal 3 of the Camshaft Position Sensor(CMPS), (-): ground
2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not.

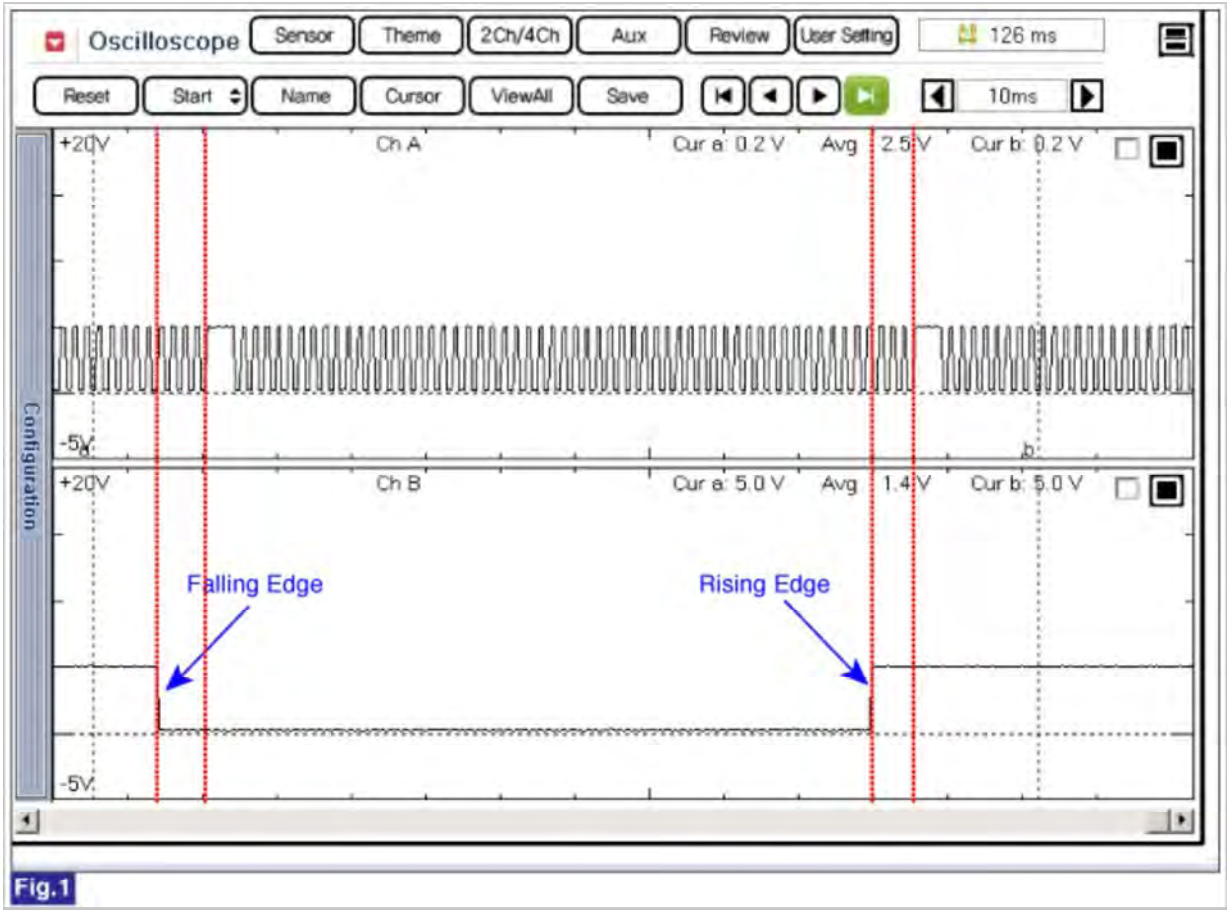


Fig.1)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

3. Is the signal waveform normal?

YES	▸ Go to next step as below.
NO	▸ Repair or readjust as necessary, if air gap of the CKPS is exceeds specification [0.3~1.7 mm (0.012~0.067 in)]. If OK, check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure.

Ignition System Inspection

1. Spark Plug Cable & Ignition Coil Inspection
   (1) Visually/physically inspect the spark plug cable and ignition coil related to the misfiring cylinder(s) for the following conditions.
   - Damage, cracks, carbon and flashover
   - Poor connection or damaged harness
   - Connected to the incorrect cylinders at the ignition coil and spark plug

   (2) Measure the resistance of the spark plug cable related to the misfiring cylinder(s)

   Specification : 5.6kΩ/m ±20%

   (3) Measure the resistance of the primary and secondary ignition coil related to the misfiring cylinder(s)

Specification : Primary Ignition Coil Resistance : Approx. 0.5~0.6Ω at 20°C(68°F)
Secondary Ignition Coil Resistance : Approx. 7.5~10.2kΩ at 20°C(68°F)

(4) Was a problem found in any of the above areas?

YES	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

2. Spark Plug Inspection

(1) Visually/physically inspect the spark plug related to the misfiring cylinder(s) for the following conditions
- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for electrode gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(2) Was a problem found in any of the above areas?

YES	▸ Replace or adjust as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Fuel System Inspection

1. Fuel Line 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 normal idle status

Specification : 338~348kPa(3.45~3.55kg/cm²)

(4) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump	Fuel Pump(Fuel Pressure Regulator)
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pump(Fuel Pressure Regulator)

2. Fuel Pressure Hold Inspection

(1) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for minimum 5 minutes

(2) Is fuel pressure within the specified value?

YES	▸ Go to next step as below
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel pressure drops slowly	Injector leak	Injector
Fuel pressure drops immediately	Stuck open in check valve of the fuel pump	Fuel pump

Engine Compression Test

1. Warm up the engine to normal operating temperature. Verify the battery must be at or near full charge.
2. With ignition "OFF", disconnect the ignition coil connectors and the spark plug cables
3. Install compression pressure gauge to the spark plug hole.
4. With wide open throttle by hand, cranking the engine and record the compression readings from all of the cylinders

Specification : Compression pressure : 1,283kPa (13.0kgf/cm², 185psi)
Minimum pressure : 1,135kPa (11.5kgf/cm², 164psi)
Difference between each cylinder : 100kPa (1.0kgf/cm², 15psi) or less

5. Is compression pressure within the specified value?

YES	▸ Verify if the engine has excessive coolant consumption. If yes, check for damaged inlet water passage, engine block, cylinder head or head gasket. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ 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 compression test for cylinders with low compression pressure.- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket. Repair or 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 GDS 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.

Fuel System > Engine Control System > P0301 Cylinder 1-Misfire detected

Component Location

General Description

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The PCM 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 PCM 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 PCM 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 PCM uses the signal to distinguish the phenomenon from actual misfiring.

DTC Description

If the PCM detects that engine speed variation indicates a misfire sufficient to cause three-way catalyst converter damage or emissions level to exceed standard value, the PCM sets DTC P0301. If the misfire rate is high enough to damage the catalyst, the MIL will flash to alert the vehicle operator.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, high-tension 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		• 156 < Mass air flow(mg/rev.) < 710 (depends on RPM , Coolant temp.) • 512 < Engine speed(RPM) < 6500 • 141 < Throttle gradient(°TPS/sec.) < 199 • Coolant temperature > 20°C (-4°F) if Start temperature < -7°C (19.4°F) • No rough road • No relevant failure • 11V< Battery voltage • Fuel cut off not active	
Threshold Value	Case1	• Misfire = 12~54% within 200 rev.(Catalyst temperature >1050°C (1922°F))	
	Case2	• Misfire = 1.2% within 1000 rev.	
Diagnosis Time	Case1	• 200 revolution or 3*200 revolution	
	Case2	• 1000 revolution or 4*1000 revolution	
Mil On Condition	Case1	• Immediate	
	Case2	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Primary ignition coil (Ω)	Secondary ignition coil(kΩ)
20	68	0.5~0.6	7.5~10.2

Monitor DTC Status

NOTE

If any DTCs related 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 procedure. If the misfire rate is high enough to cause possible catalyst damage(if the MIL was blinking), ensure that the monitoring for DTC P0420 is completed and passed after verifying the misfire repair.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 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 any misfire DTCs related to companion cylinders{P0301(Cylinder1)&P0304(Cylinder4), P0302 (Cylinder2))&P0303(Cylinder3)} are also stored, go to "Ignition System Inspection" procedure.If not, go to next step as below.

Visual Inspection

1. Visually/physically inspect for the following conditions
   - Vacuum hoses in engine room for splits, kinks and improper installation
   - Positive crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
   - Verify that the ECM ground connections are clean and properly tightened.
2. Check MAFS and ECTS for the following conditions:
   - Contamination, deterioration, poor connection or damaged harness
   - The MAF signal displayed on the scantool should increase as engine speed increases
   - The engine coolant temperature displayed on the scantool should close to the actual coolant temperature.
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 next step as below.

Timing Inspection

1. With ignition "OFF", set up an oscilloscope as follows :
   Channel A (+): terminal 3 of the Crankshaft Position Sensor(CKPS), (-): ground
   Channel B (+): terminal 3 of the Camshaft Position Sensor(CMPS), (-): ground
2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not.

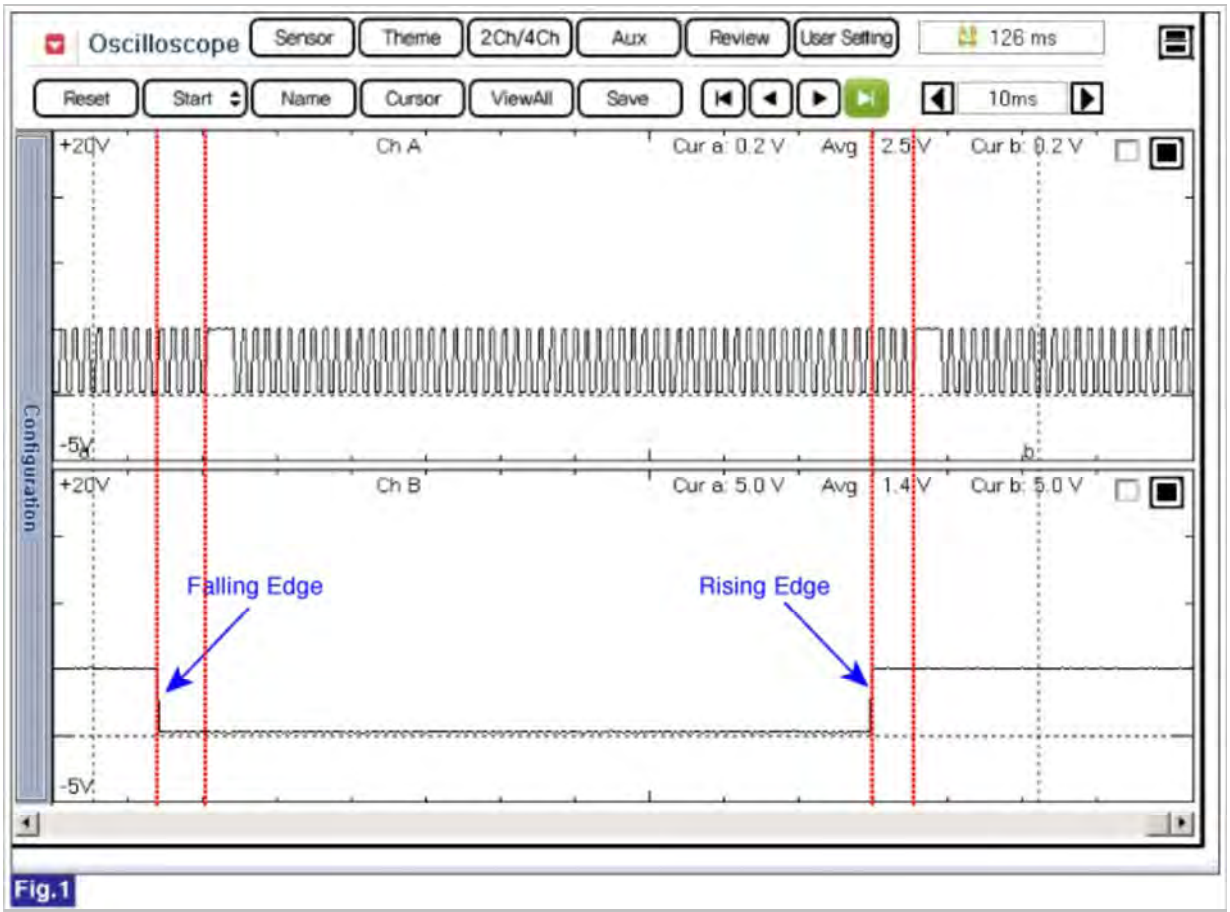


Fig.1)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

3. Is the signal waveform normal?

YES	▸ Go to next step as below.
NO	▸ Repair or readjust as necessary, if air gap of the CKPS is exceeds specification [0.3~1.7 mm (0.012~0.067 in)]. If OK, check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure.

Ignition System Inspection

1. Spark Plug Cable & Ignition Coil Inspection
   (1) Visually/physically inspect the spark plug cable and ignition coil related to the misfiring cylinder(s) for the following conditions.
   - Damage, cracks, carbon and flashover
   - Poor connection or damaged harness
   - Connected to the incorrect cylinders at the ignition coil and spark plug

   (2) Measure the resistance of the spark plug cable related to the misfiring cylinder(s)

   Specification : 5.6kΩ/m ±20%

   (3) Measure the resistance of the primary and secondary ignition coil related to the misfiring cylinder(s)

   Specification : Primary Ignition Coil Resistance : Approx. 0.5~0.6Ω at 20°C(68°F)
   Secondary Ignition Coil Resistance : Approx. 7.5~10.2kΩ at 20°C(68°F)

   (4) Was a problem found in any of the above areas?

YES	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

2. Spark Plug Inspection

(1) Visually/physically inspect the spark plug related to the misfiring cylinder(s) for the following conditions
- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for electrode gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(2) Was a problem found in any of the above areas?

YES	▸ Replace or adjust as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Fuel System Inspection

1. Fuel Line 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 normal idle status

Specification : 338~348kPa(3.45~3.55kg/cm²)

(4) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump	Fuel Pump(Fuel Pressure Regulator)
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pump(Fuel Pressure Regulator)

2. Fuel Pressure Hold Inspection

(1) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for minimum 5 minutes

(2) Is fuel pressure within the specified value?

YES	▸ Go to next step as below
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel pressure drops slowly	Injector leak	Injector
Fuel pressure drops immediately	Stuck open in check valve of the fuel pump	Fuel pump

Engine Compression Test

1. Warm up the engine to normal operating temperature. Verify the battery must be at or near full charge.
2. With ignition "OFF", disconnect the ignition coil connectors and the spark plug cables
3. Install compression pressure gauge to the spark plug hole.
4. With wide open throttle by hand, cranking the engine and record the compression readings from all of the cylinders

Specification : Compression pressure : 1,283kPa (13.0kgf/cm², 185psi)
Minimum pressure : 1,135kPa (11.5kgf/cm², 164psi)
Difference between each cylinder : 100kPa (1.0kgf/cm², 15psi) or less

5. Is compression pressure within the specified value?

YES	▸ Verify if the engine has excessive coolant consumption. If yes, check for damaged inlet water passage, engine block, cylinder head or head gasket. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ 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 compression test for cylinders with low compression pressure.- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

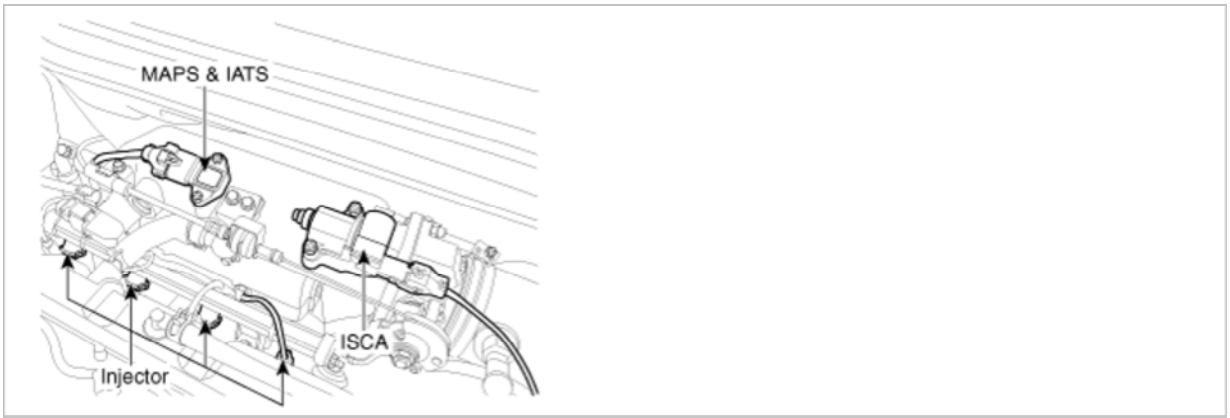
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0302 Cylinder 2-Misfire detected

Component Location



General Description

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The PCM 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 PCM 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 PCM 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 PCM uses the signal to distinguish the phenomenon from actual misfiring.

DTC Description

If the PCM detects that engine speed variation indicates a misfire sufficient to cause three-way catalyst converter damage or emissions level to exceed standard value, the PCM sets DTC P0302. If the misfire rate is high enough to damage the catalyst, the MIL will flash to alert the vehicle operator.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, high-tension 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		• 156 < Mass air flow(mg/rev.) < 710 (depends on RPM , Coolant temp.) • 512 < Engine speed(RPM) < 6500 • 141 < Throttle gradient(°TPS/sec.) < 199 • Coolant temperature > 20°C (-4°F) if Start temperature < -7°C (19.4°F) • No rough road • No relevant failure • 11V< Battery voltage • Fuel cut off not active	
Threshold Value	Case1	• Misfire = 12~54% within 200 rev.(Catalyst temperature >1050°C (1922°F))	
	Case2	• Misfire = 1.2% within 1000 rev.	
Diagnosis Time	Case1	• 200 revolution or 3*200 revolution	
	Case2	• 1000 revolution or 4*1000 revolution	
Mil On Condition	Case1	• Immediate	
	Case2	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Primary ignition coil (Ω)	Secondary ignition coil(kΩ)
20	68	0.5~0.6	7.5~10.2

Monitor DTC Status

NOTE

If any DTCs related 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 procedure. If the misfire rate is high enough to cause possible catalyst damage(if the MIL was blinking), ensure that the monitoring for DTC P0420 is completed and passed after verifying the misfire repair.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 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 any misfire DTCs related to companion cylinders{P0301(Cylinder1)&P0304(Cylinder4), P0302 (Cylinder2))&P0303(Cylinder3)} are also stored, go to "Ignition System Inspection" procedure.If not, go to next step as below.

Visual Inspection

1. Visually/physically inspect for the following conditions
   - Vacuum hoses in engine room for splits, kinks and improper installation
   - Positive crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
   - Verify that the ECM ground connections are clean and properly tightened.
2. Check MAFS and ECTS for the following conditions:
   - Contamination, deterioration, poor connection or damaged harness
   - The MAF signal displayed on the scantool should increase as engine speed increases
   - The engine coolant temperature displayed on the scantool should close to the actual coolant temperature.
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 next step as below.

Timing Inspection

1. With ignition "OFF", set up an oscilloscope as follows :
   Channel A (+): terminal 3 of the Crankshaft Position Sensor(CKPS), (-): ground
   Channel B (+): terminal 3 of the Camshaft Position Sensor(CMPS), (-): ground
2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not.

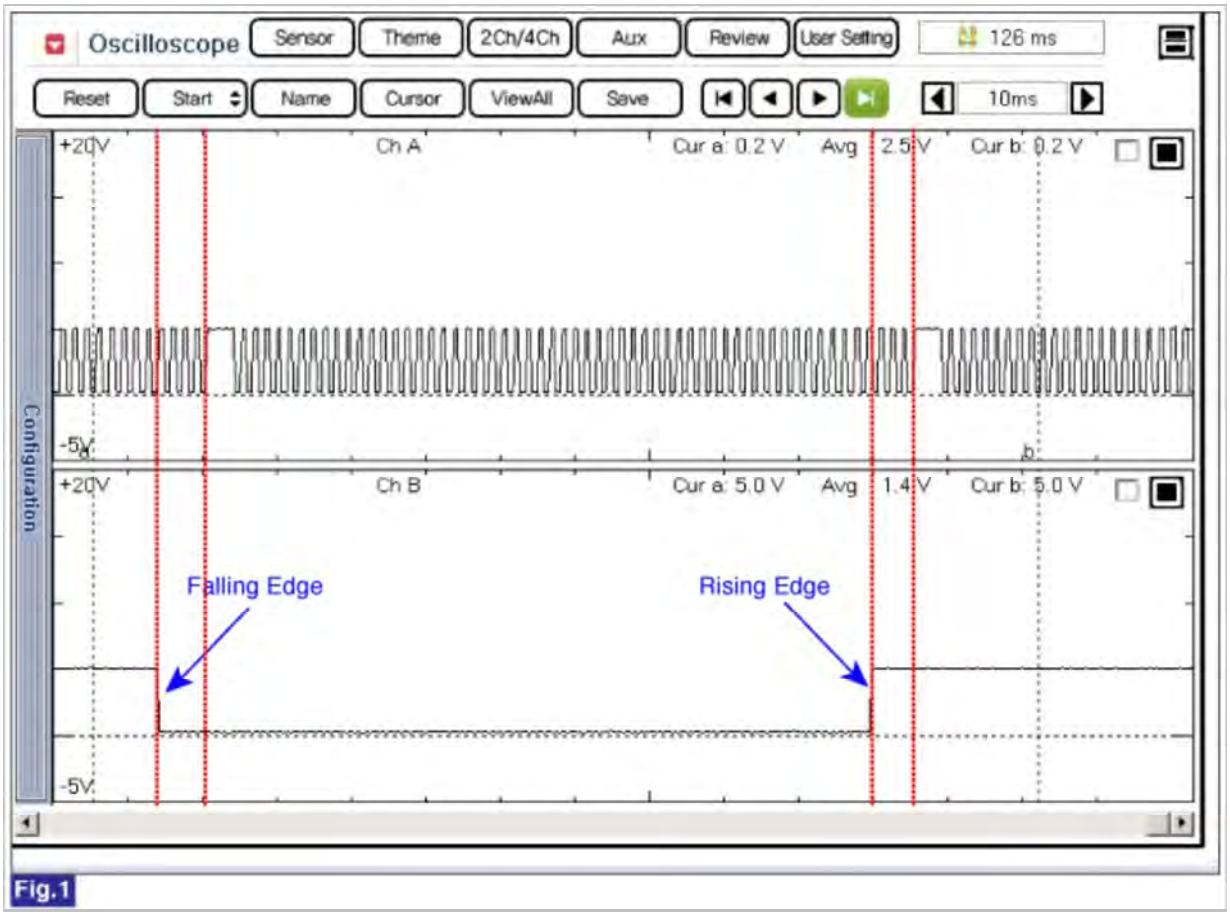


Fig.1)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

3. Is the signal waveform normal?

YES	▸ Go to next step as below.
NO	▸ Repair or readjust as necessary, if air gap of the CKPS is exceeds specification [0.3~1.7 mm (0.012~0.067 in)]. If OK, check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure.

Ignition System Inspection

1. Spark Plug Cable & Ignition Coil Inspection
   (1) Visually/physically inspect the spark plug cable and ignition coil related to the misfiring cylinder(s) for the following conditions.
   - Damage, cracks, carbon and flashover
   - Poor connection or damaged harness
   - Connected to the incorrect cylinders at the ignition coil and spark plug

   (2) Measure the resistance of the spark plug cable related to the misfiring cylinder(s)

   Specification : 5.6kΩ/m ±20%

   (3) Measure the resistance of the primary and secondary ignition coil related to the misfiring cylinder(s)

   Specification : Primary Ignition Coil Resistance : Approx. 0.5~0.6Ω at 20°C(68°F)
   Secondary Ignition Coil Resistance : Approx. 7.5~10.2kΩ at 20°C(68°F)

   (4) Was a problem found in any of the above areas?

YES	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

2. Spark Plug Inspection

(1) Visually/physically inspect the spark plug related to the misfiring cylinder(s) for the following conditions
- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for electrode gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(2) Was a problem found in any of the above areas?

YES	▸ Replace or adjust as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Fuel System Inspection

1. Fuel Line 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 normal idle status

Specification : 338~348kPa(3.45~3.55kg/cm²)

(4) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump	Fuel Pump(Fuel Pressure Regulator)
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pump(Fuel Pressure Regulator)

2. Fuel Pressure Hold Inspection

(1) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for minimum 5 minutes

(2) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel pressure drops slowly	Injector leak	Injector
Fuel pressure drops immediately	Stuck open in check valve of the fuel pump	Fuel pump

Engine Compression Test

1. Warm up the engine to normal operating temperature. Verify the battery must be at or near full charge.
2. With ignition "OFF", disconnect the ignition coil connectors and the spark plug cables
3. Install compression pressure gauge to the spark plug hole.
4. With wide open throttle by hand, cranking the engine and record the compression readings from all of the cylinders

Specification : Compression pressure : 1,283kPa (13.0kgf/cm², 185psi)
Minimum pressure : 1,135kPa (11.5kgf/cm², 164psi)
Difference between each cylinder : 100kPa (1.0kgf/cm², 15psi) or less

5. Is compression pressure within the specified value?

YES	▸ Verify if the engine has excessive coolant consumption. If yes, check for damaged inlet water passage, engine block, cylinder head or head gasket. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ 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 compression test for cylinders with low compression pressure.- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

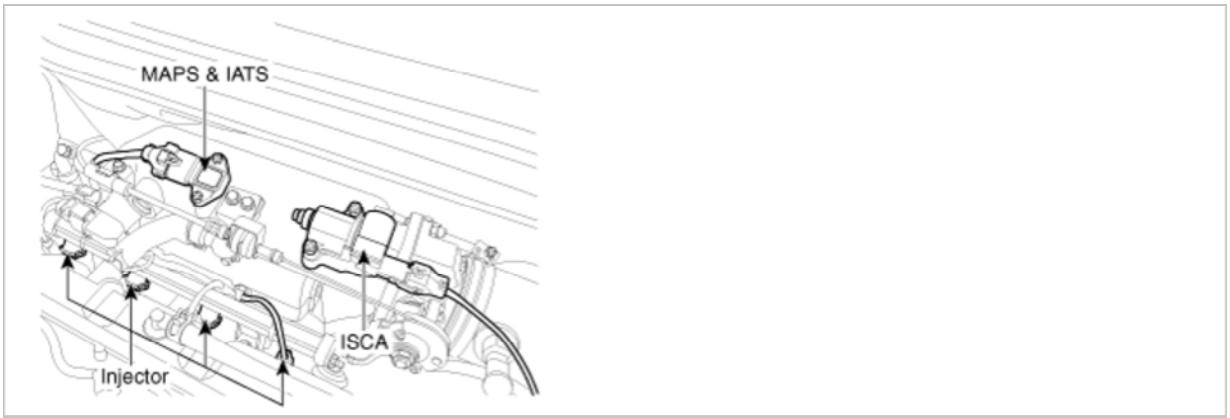
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0303 Cylinder 3-Misfire detected

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

If the PCM detects that engine speed variation indicates a misfire sufficient to cause three-way catalyst converter damage or emissions level to exceed standard value, the PCM sets DTC P0303. If the misfire rate is high enough to damage the catalyst, the MIL will flash to alert the vehicle operator.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, high-tension 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		• 156 < Mass air flow(mg/rev.) < 710 (depends on RPM , Coolant temp.) • 512 < Engine speed(RPM) < 6500 • 141 < Throttle gradient(°TPS/sec.) < 199 • Coolant temperature > 20°C (-4°F) if Start temperature < -7°C (19.4°F) • No rough road • No relevant failure • 11V< Battery voltage • Fuel cut off not active	
Threshold Value	Case1	• Misfire = 12~54% within 200 rev.(Catalyst temperature >1050°C (1922°F))	
	Case2	• Misfire = 1.2% within 1000 rev.	
Diagnosis Time	Case1	• 200 revolution or 3*200 revolution	
	Case2	• 1000 revolution or 4*1000 revolution	
Mil On Condition	Case1	• Immediate	
	Case2	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Primary ignition coil (Ω)	Secondary ignition coil(kΩ)
20	68	0.5~0.6	7.5~10.2

Monitor DTC Status

NOTE

If any DTCs related 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 procedure. If the misfire rate is high enough to cause possible catalyst damage(if the MIL was blinking), ensure that the monitoring for DTC P0420 is completed and passed after verifying the misfire repair.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 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 any misfire DTCs related to companion cylinders{P0301(Cylinder1)&P0304(Cylinder4), P0302 (Cylinder2))&P0303(Cylinder3)} are also stored, go to "Ignition System Inspection" procedure.If not, go to next step as below.

Visual Inspection

1. Visually/physically inspect for the following conditions
   - Vacuum hoses in engine room for splits, kinks and improper installation
   - Positive crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
   - Verify that the ECM ground connections are clean and properly tightened.
2. Check MAFS and ECTS for the following conditions:
   - Contamination, deterioration, poor connection or damaged harness
   - The MAF signal displayed on the scantool should increase as engine speed increases
   - The engine coolant temperature displayed on the scantool should close to the actual coolant temperature.
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 next step as below.

Timing Inspection

1. With ignition "OFF", set up an oscilloscope as follows :
   Channel A (+): terminal 3 of the Crankshaft Position Sensor(CKPS), (-): ground
   Channel B (+): terminal 3 of the Camshaft Position Sensor(CMPS), (-): ground
2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not.

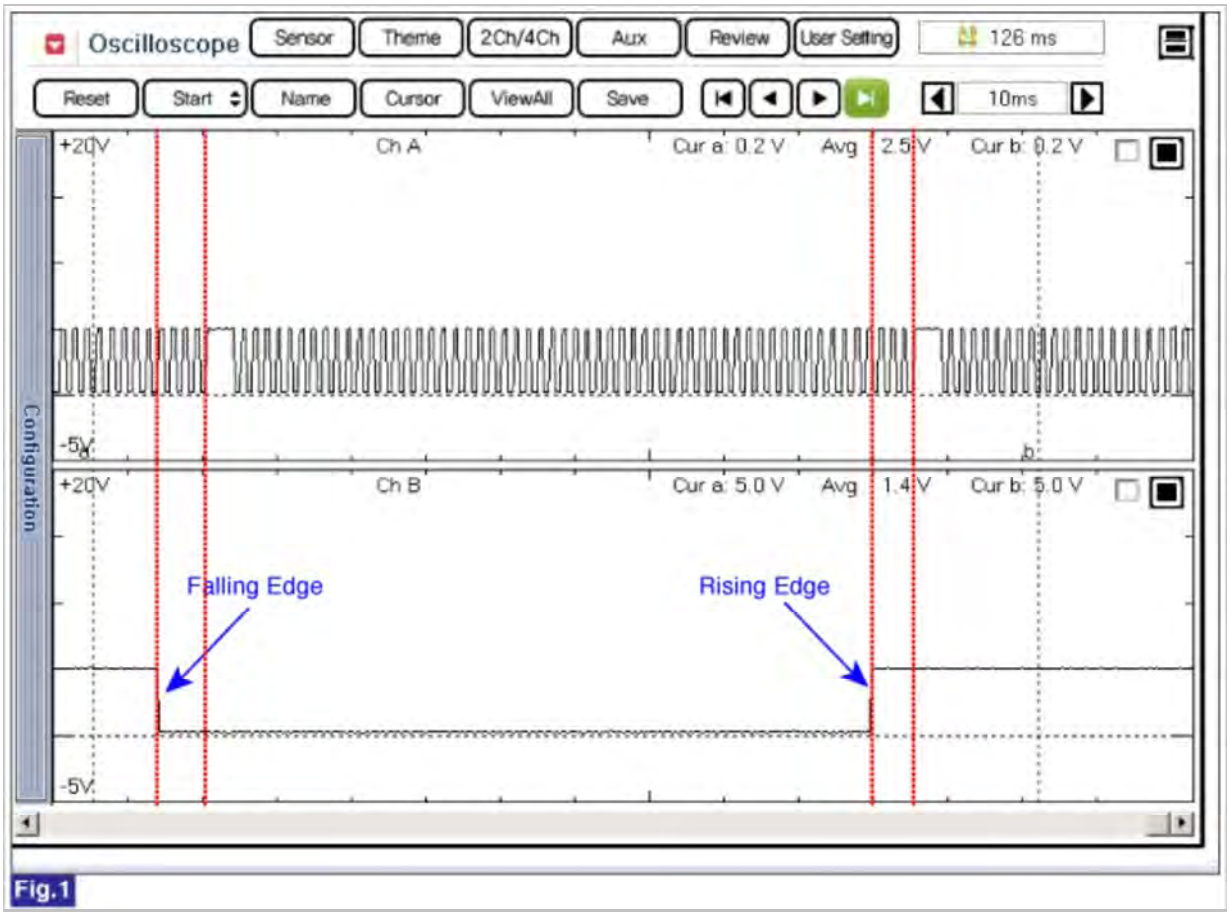


Fig.1)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

3. Is the signal waveform normal?

YES	▸ Go to next step as below.
NO	▸ Repair or readjust as necessary, if air gap of the CKPS is exceeds specification [0.3~1.7 mm (0.012~0.067 in)]. If OK, check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure.

Ignition System Inspection

1. Spark Plug Cable & Ignition Coil Inspection
   (1) Visually/physically inspect the spark plug cable and ignition coil related to the misfiring cylinder(s) for the following conditions.
   - Damage, cracks, carbon and flashover
   - Poor connection or damaged harness
   - Connected to the incorrect cylinders at the ignition coil and spark plug

   (2) Measure the resistance of the spark plug cable related to the misfiring cylinder(s)

   Specification : 5.6kΩ/m ±20%

   (3) Measure the resistance of the primary and secondary ignition coil related to the misfiring cylinder(s)

   Specification : Primary Ignition Coil Resistance : Approx. 0.5~0.6Ω at 20°C(68°F)
   Secondary Ignition Coil Resistance : Approx. 7.5~10.2kΩ at 20°C(68°F)

   (4) Was a problem found in any of the above areas?

YES	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

2. Spark Plug Inspection

(1) Visually/physically inspect the spark plug related to the misfiring cylinder(s) for the following conditions
- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for electrode gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(2) Was a problem found in any of the above areas?

YES	▸ Replace or adjust as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Fuel System Inspection

1. Fuel Line 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 normal idle status

Specification : 338~348kPa(3.45~3.55kg/cm²)

(4) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump	Fuel Pump(Fuel Pressure Regulator)
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pump(Fuel Pressure Regulator)

2. Fuel Pressure Hold Inspection

(1) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for minimum 5 minutes

(2) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel pressure drops slowly	Injector leak	Injector
Fuel pressure drops immediately	Stuck open in check valve of the fuel pump	Fuel pump

Engine Compression Test

1. Warm up the engine to normal operating temperature. Verify the battery must be at or near full charge.
2. With ignition "OFF", disconnect the ignition coil connectors and the spark plug cables
3. Install compression pressure gauge to the spark plug hole.
4. With wide open throttle by hand, cranking the engine and record the compression readings from all of the cylinders

Specification : Compression pressure : 1,283kPa (13.0kgf/cm², 185psi)
Minimum pressure : 1,135kPa (11.5kgf/cm², 164psi)
Difference between each cylinder : 100kPa (1.0kgf/cm², 15psi) or less

5. Is compression pressure within the specified value?

YES	▸ Verify if the engine has excessive coolant consumption. If yes, check for damaged inlet water passage, engine block, cylinder head or head gasket. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ 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 compression test for cylinders with low compression pressure.- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

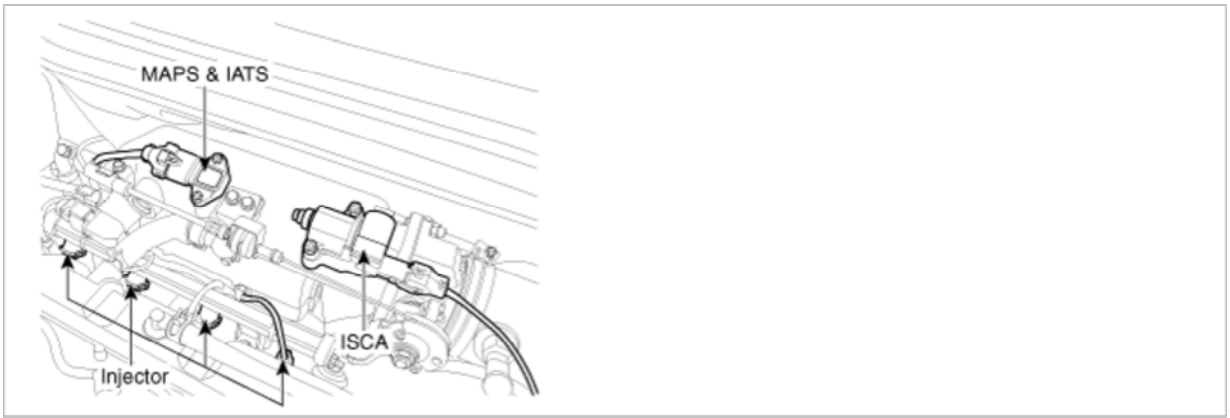
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0304 Cylinder 4-Misfire detected

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

If the PCM detects that engine speed variation indicates a misfire sufficient to cause three-way catalyst converter damage or emissions level to exceed standard value, the PCM sets DTC P0304. If the misfire rate is high enough to damage the catalyst, the MIL will flash to alert the vehicle operator.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Calculation of engine roughness	• Faulty spark plugs, high-tension 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		• 156 < Mass air flow(mg/rev.) < 710 (depends on RPM , Coolant temp.) • 512 < Engine speed(RPM) < 6500 • 141 < Throttle gradient(°TPS/sec.) < 199 • Coolant temperature > 20°C (-4°F) if Start temperature < -7°C (19.4°F) • No rough road • No relevant failure • 11V< Battery voltage • Fuel cut off not active	
Threshold Value	Case1	• Misfire = 12~54% within 200 rev.(Catalyst temperature >1050°C (1922°F))	
	Case2	• Misfire = 1.2% within 1000 rev.	
Diagnosis Time	Case1	• 200 revolution or 3*200 revolution	
	Case2	• 1000 revolution or 4*1000 revolution	
Mil On Condition	Case1	• Immediate	
	Case2	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	Primary ignition coil (Ω)	Secondary ignition coil(kΩ)
20	68	0.5~0.6	7.5~10.2

Monitor DTC Status

NOTE

If any DTCs related 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 procedure. If the misfire rate is high enough to cause possible catalyst damage(if the MIL was blinking), ensure that the monitoring for DTC P0420 is completed and passed after verifying the misfire repair.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 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 any misfire DTCs related to companion cylinders{P0301(Cylinder1)&P0304(Cylinder4), P0302 (Cylinder2))&P0303(Cylinder3)} are also stored, go to "Ignition System Inspection" procedure.If not, go to next step as below.

Visual Inspection

1. Visually/physically inspect for the following conditions
   - Vacuum hoses in engine room for splits, kinks and improper installation
   - Positive crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
   - Verify that the ECM ground connections are clean and properly tightened.
2. Check MAFS and ECTS for the following conditions:
   - Contamination, deterioration, poor connection or damaged harness
   - The MAF signal displayed on the scantool should increase as engine speed increases
   - The engine coolant temperature displayed on the scantool should close to the actual coolant temperature.
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 next step as below.

Timing Inspection

1. With ignition "OFF", set up an oscilloscope as follows :
   Channel A (+): terminal 3 of the Crankshaft Position Sensor(CKPS), (-): ground
   Channel B (+): terminal 3 of the Camshaft Position Sensor(CMPS), (-): ground
2. Start the engine and check for signal waveform whether synchronize with camshaft sensor or not.

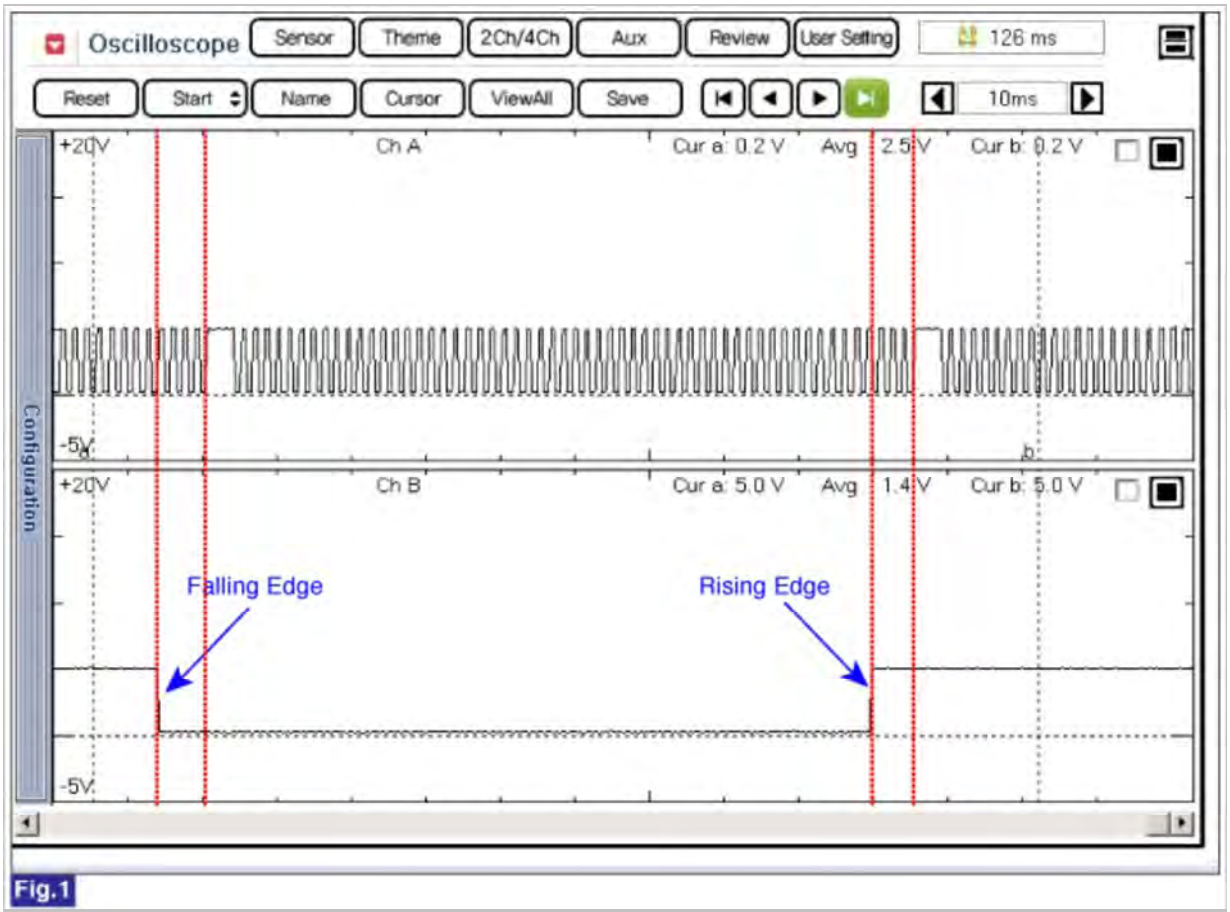


Fig.1)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

3. Is the signal waveform normal?

YES	▸ Go to next step as below.
NO	▸ Repair or readjust as necessary, if air gap of the CKPS is exceeds specification [0.3~1.7 mm (0.012~0.067 in)]. If OK, check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure.

Ignition System Inspection

1. Spark Plug Cable & Ignition Coil Inspection
   (1) Visually/physically inspect the spark plug cable and ignition coil related to the misfiring cylinder(s) for the following conditions.
   - Damage, cracks, carbon and flashover
   - Poor connection or damaged harness
   - Connected to the incorrect cylinders at the ignition coil and spark plug

   (2) Measure the resistance of the spark plug cable related to the misfiring cylinder(s)

   Specification : 5.6kΩ/m ±20%

   (3) Measure the resistance of the primary and secondary ignition coil related to the misfiring cylinder(s)

   Specification : Primary Ignition Coil Resistance : Approx. 0.5~0.6Ω at 20°C(68°F)
   Secondary Ignition Coil Resistance : Approx. 7.5~10.2kΩ at 20°C(68°F)

   (4) Was a problem found in any of the above areas?

YES	▸ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

2. Spark Plug Inspection

(1) Visually/physically inspect the spark plug related to the misfiring cylinder(s) for the following conditions
- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for electrode gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

(2) Was a problem found in any of the above areas?

YES	▸ Replace or adjust as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Fuel System Inspection

1. Fuel Line 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 normal idle status

Specification : 338~348kPa(3.45~3.55kg/cm²)

(4) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump	Fuel Pump(Fuel Pressure Regulator)
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pump(Fuel Pressure Regulator)

2. Fuel Pressure Hold Inspection

(1) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for minimum 5 minutes

(2) Is fuel pressure within the specified value?

YES	▸ Go to next step as below.
NO	▸ Inspect the suspected area. Refer to table as below. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected Area
Fuel pressure drops slowly	Injector leak	Injector
Fuel pressure drops immediately	Stuck open in check valve of the fuel pump	Fuel pump

Engine Compression Test

1. Warm up the engine to normal operating temperature. Verify the battery must be at or near full charge.
2. With ignition "OFF", disconnect the ignition coil connectors and the spark plug cables
3. Install compression pressure gauge to the spark plug hole.
4. With wide open throttle by hand, cranking the engine and record the compression readings from all of the cylinders

Specification : Compression pressure : 1,283kPa (13.0kgf/cm², 185psi)
Minimum pressure : 1,135kPa (11.5kgf/cm², 164psi)
Difference between each cylinder : 100kPa (1.0kgf/cm², 15psi) or less

5. Is compression pressure within the specified value?

YES	▸ Verify if the engine has excessive coolant consumption. If yes, check for damaged inlet water passage, engine block, cylinder head or head gasket. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
NO	▸ 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 compression test for cylinders with low compression pressure.- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket. Repair or 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 GDS 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.

Fuel System > Engine Control System > P0315 Crankshaft Position System Variation Not Learned

Component Location

General Description

The Crankshaft Position Sensor (CKPS) is a hall effect type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft; there are 58 slots in the target wheel where one is longer than the others. When the slot in the wheel aligns with the sensor, the sensor voltage outputs low. When the metal (tooth) in the wheel aligns with the sensor, the sensor voltage outputs high. During one crankshaft rotation there are 58 rectangular signals and one longer signal. The PCM calculates engine RPM by using the sensor’ s signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the PCM identifies which cylinder is at top dead center.

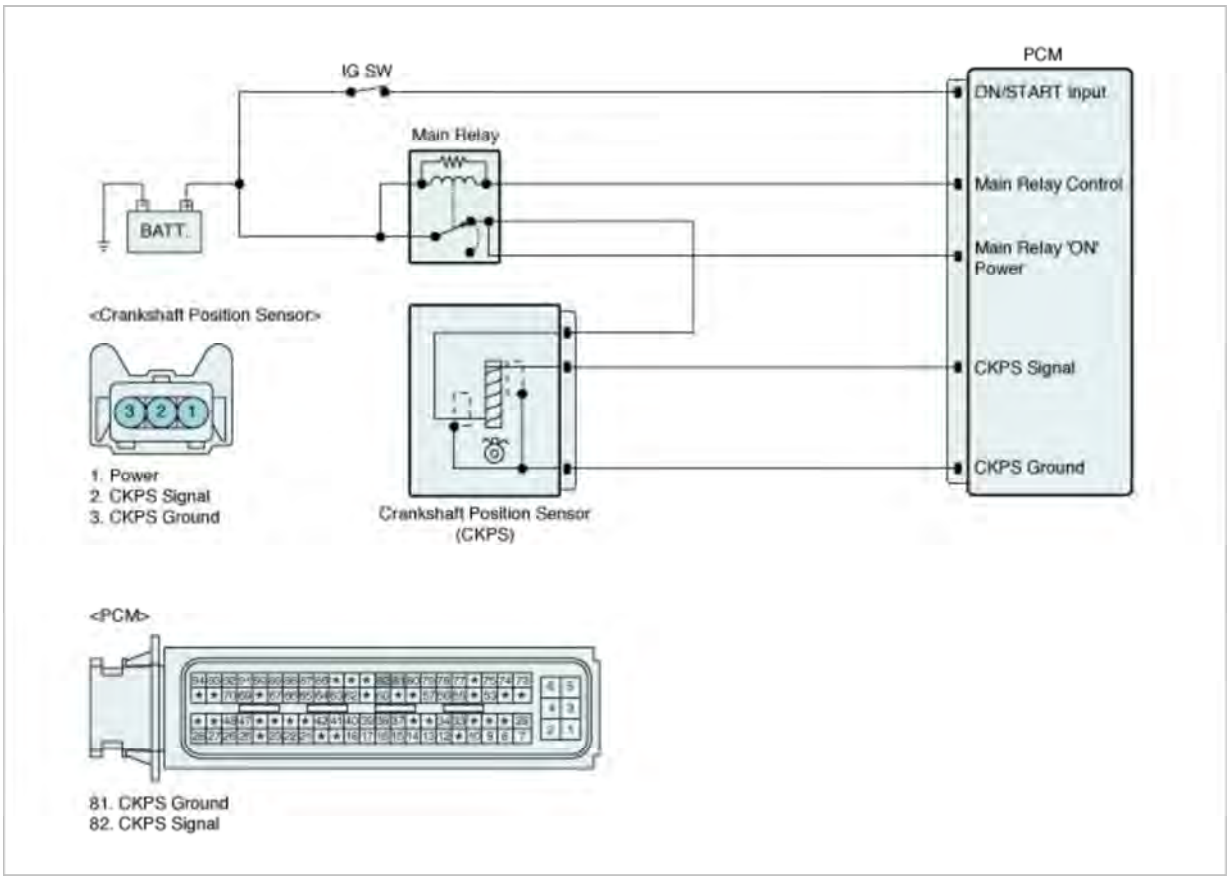
DTC Description

The PCM sets DTC P0315 when the number of crankshaft teeth during one revolution is incorrect or crankshaft signal is missing while camshaft signal is detected.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitor segment time adaptation	• Improperly installed target wheel • Poor connection or damaged harness
Enable Conditions	• 2000 < Segment Time adaptation running in Fuel Cut-Off within an Engine Speed range(RPM) < 3000 • No relevant failure	
Threshold Value	• Segment Time adaptation on the Limit > 5/1000	
Diagnostic Time	• -	
Mil On Condition	• -	

Diagnostic Circuit Diagram



Signal Waveform & Data

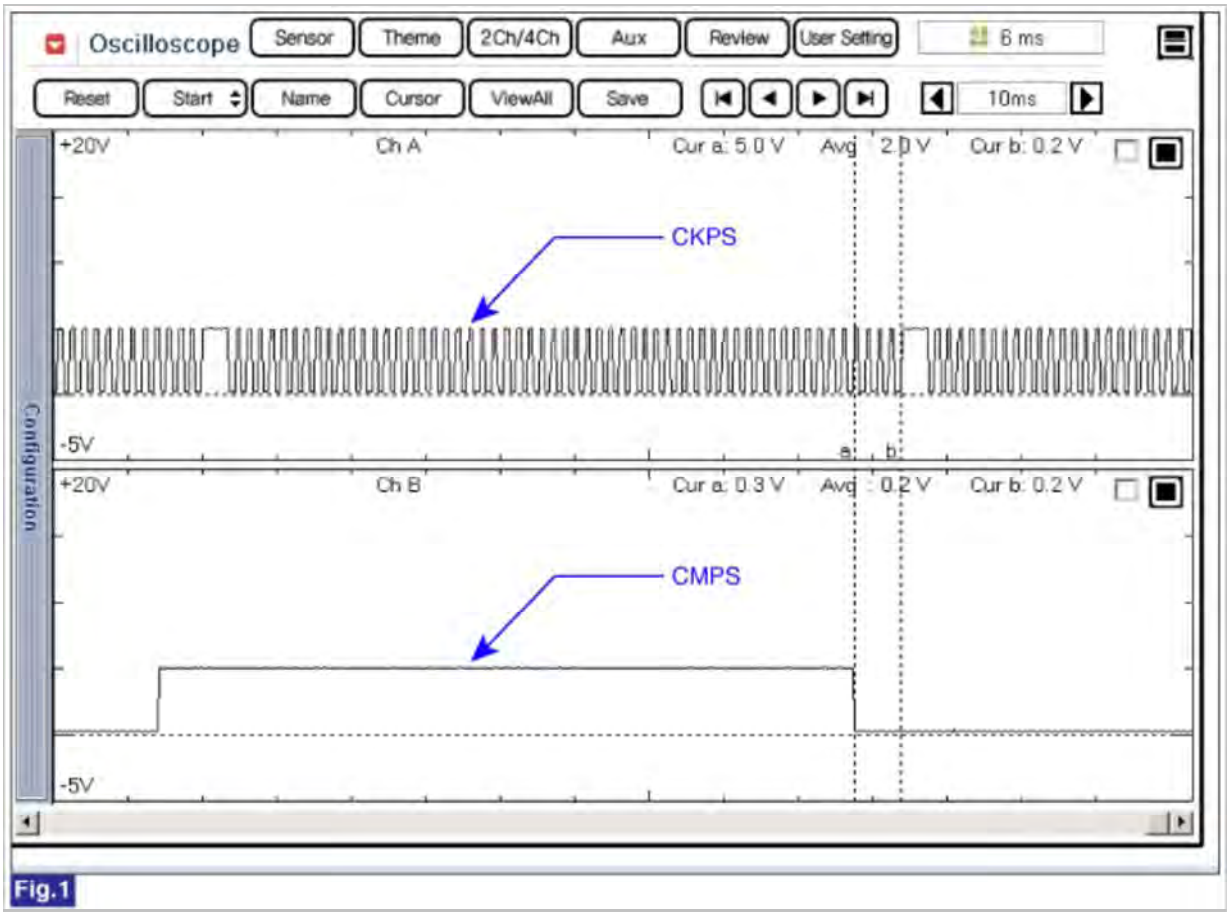


Fig.1

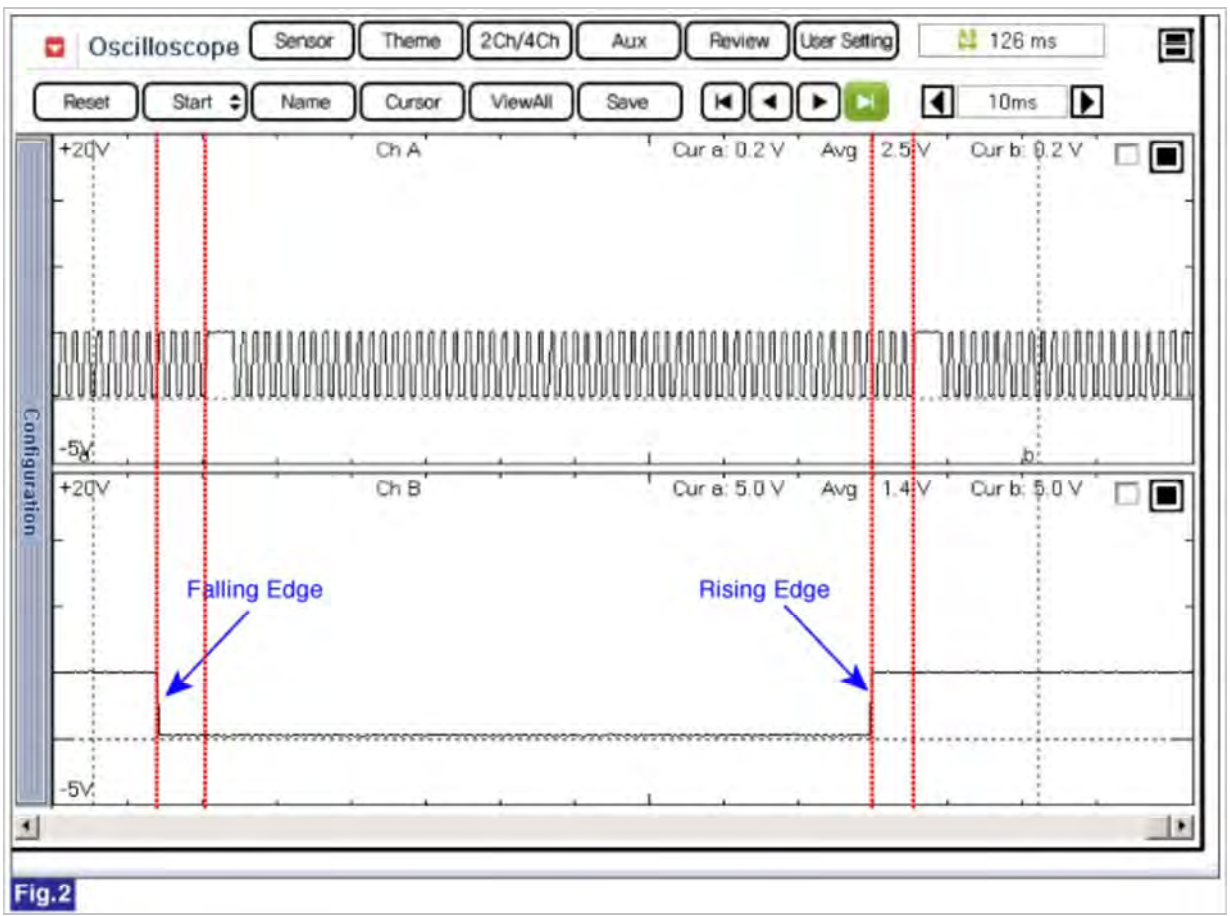


Fig.2

Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS(back probe), (-): ground
   Channel B (+): terminal 2 of the CMPS(back probe), (-): ground
2. Start the engine and check for signal waveform compared with reference waveform as below.

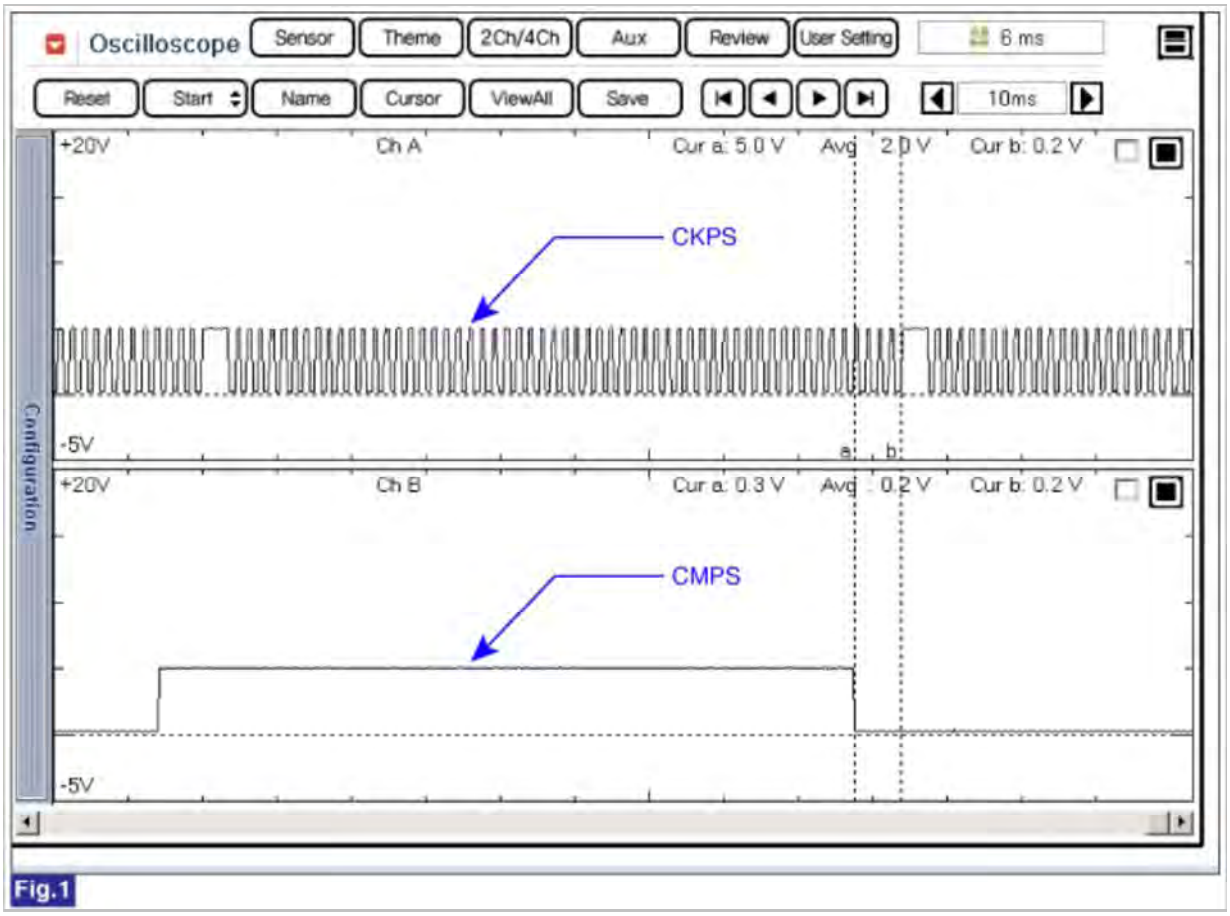


Fig.1

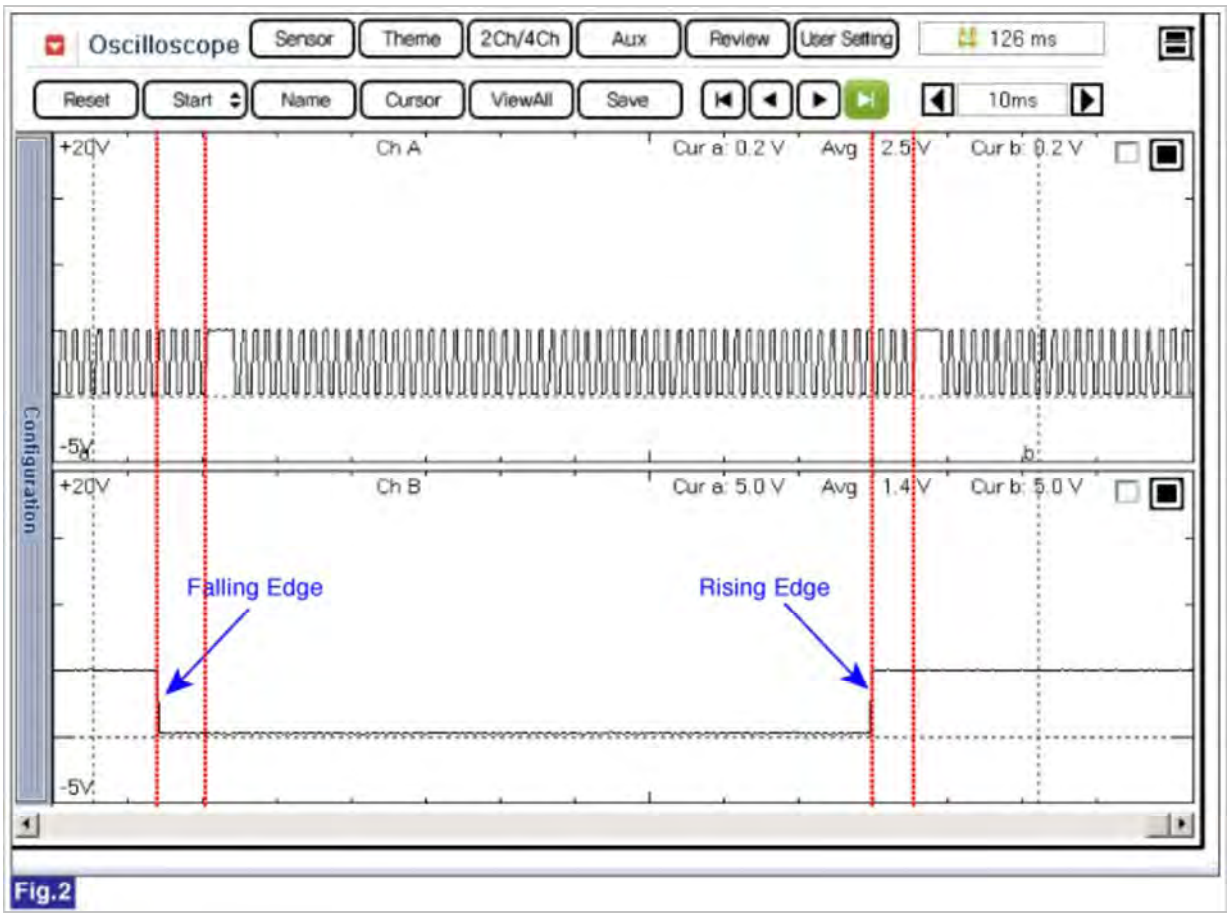


Fig.2

Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2) The CMPS falling(rising) edge is coincided with 3rd~5th tooth of the CKP from one longer signal(missing tooth)

3. Is the signal waveform normal?

YES	▸ Go to next step as below.
NO	▸ Remove CKP and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to "Verification of Vehicle Repair" procedure. NOTE Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from housing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A" - If fail to synchronize with CMP sensor, check that the crankshaft and camshaft are correctly aligned the matching marks of the pulleys. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure. - Check CKPS for contamination, deterioration, or damage. Substitute with a known-good CKPS and check for proper operation. If the problem is corrected, replace CKPS 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(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 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.

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0325 Knock Sensor 1 Circuit (Bank 1 or Single Sensor)

Component Location

General Description

The knock sensor is attached to the cylinder block and senses engine knocking. The sensor contains a piezoelectric element that converts vibration (or noise) into voltage signal and sends this signal to PCM. With input signals from camshaft position and crankshaft position sensor, PCM can identify which cylinder is knocking. PCM filters vibrations and determines if the vibrations are knocking signal. The Engine Control Module (PCM) uses this signal to suppress knocking by retarding ignition timing. The PCM will set a code (Malfunction Indicator Lamp will Not turn on) if during two driving cycles the Knock sensor's output voltage falls below minimum threshold. This code indicates an unexpected vibration is being read by the Knock sensor or PCM under normal engine operation.

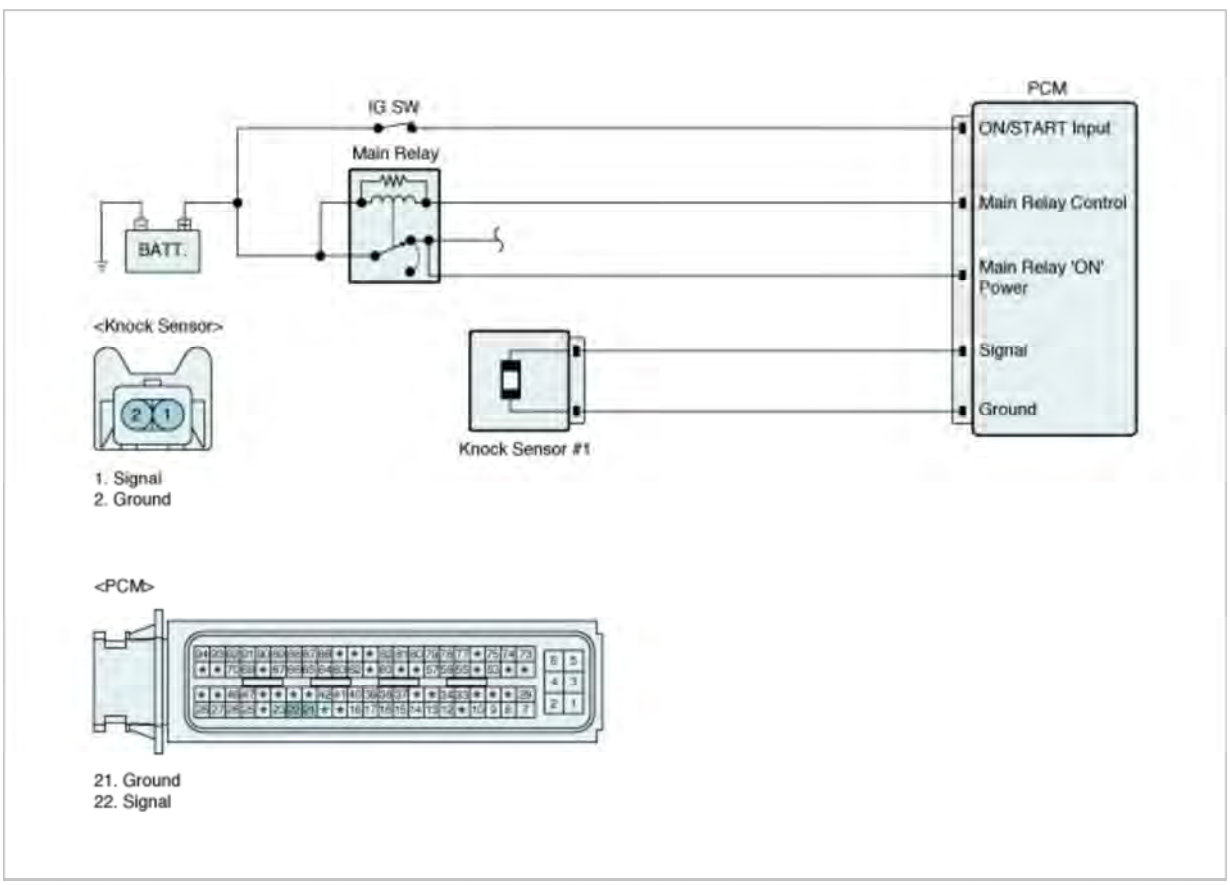
DTC Description

The PCM monitors the range of the analog input signal from knock sensor to check sensor failure that is short circuit or open circuit. If the difference between knock signal and noise level is smaller than the threshold during defined time period, the DTC P0325 is set. In case the noise level is higher than the upper threshold or lower than the lower threshold, the DTC P0325 is set too.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Plausability check	• Open/short in signal or ground circuit • Poor connection or damaged harness • Faulty knock sensor
Enable Conditions	• Engine speed > 2200 rpm • Engine load > 0.4g/rev.(220mg/tdc) • No relevant failure	
Threshold Value	• Difference between sensor signal and noise level < 0.08V	
Diagnostic Time	• 10 sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Ground circuit inspection

1. Ignition "OFF"
2. Disconnect Knock sensor and PCM connectors
3. Measure resistance between ground terminal of the sensor harness connector and Knock signal of the PCM harness connector.

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES	▸ Go to "Signal Circuit Inspection" procedure.
NO	▸ Check for an open in ground circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Signal Circuit Inspection

1. Check for short to ground in signal circuit

(1) Measure resistance between signal terminal of the sensor harness connector and chassis ground.

Specification : Infinite

(2) Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Check signal circuit for short to ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short to power in signal circuit
   (1) Disconnect PCM connector
   (2) Ignition "ON" & Engine "OFF"
   (3) Measure voltage between signal terminal of sensor 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 signal harness
   (1) Ignition "OFF"
   (2) Measure resistance between signal terminal of sensor harness connector and Knock signal terminal of the PCM harness connector.

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.

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. 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.
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

Component Inspection

1. Component resistance inspection
   (1) Measure resistance between signal terminal and ground terminal 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 (+): Signal terminal, (-): Ground terminal

(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 : Approx. 16 ~ 28N·m(160~250 kg·cm,11.8~18.4 lb·ft)

4. Has a problem been found?

YES	▸ Check knock sensor for contamination, deterioration, or damage. Substitute with a known-good sensor and check for proper operation. If the problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

Verification of Vehicle Repair

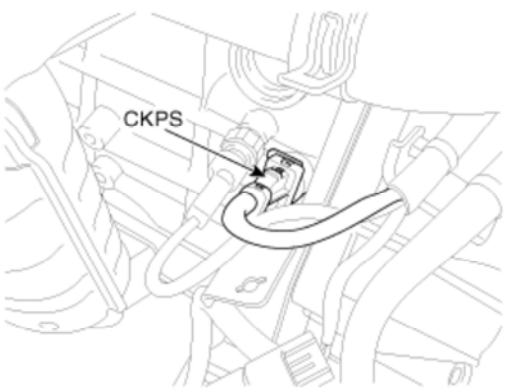
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0335 Crankshaft Position Sensor \'A\' Circuit

Component Location



General Description

The Crankshaft Position Sensor (CKPS) is a hall effect type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft; there are 58 slots in the target wheel where one is longer than the others. When the slot in the wheel aligns with the sensor, the sensor voltage outputs low. When the metal (tooth) in the wheel aligns with the sensor, the sensor voltage outputs high. During one crankshaft rotation there are 58 rectangular signals and one longer signal. The PCM calculates engine RPM by using the sensor’ s signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the PCM identifies which cylinder is at top dead center.

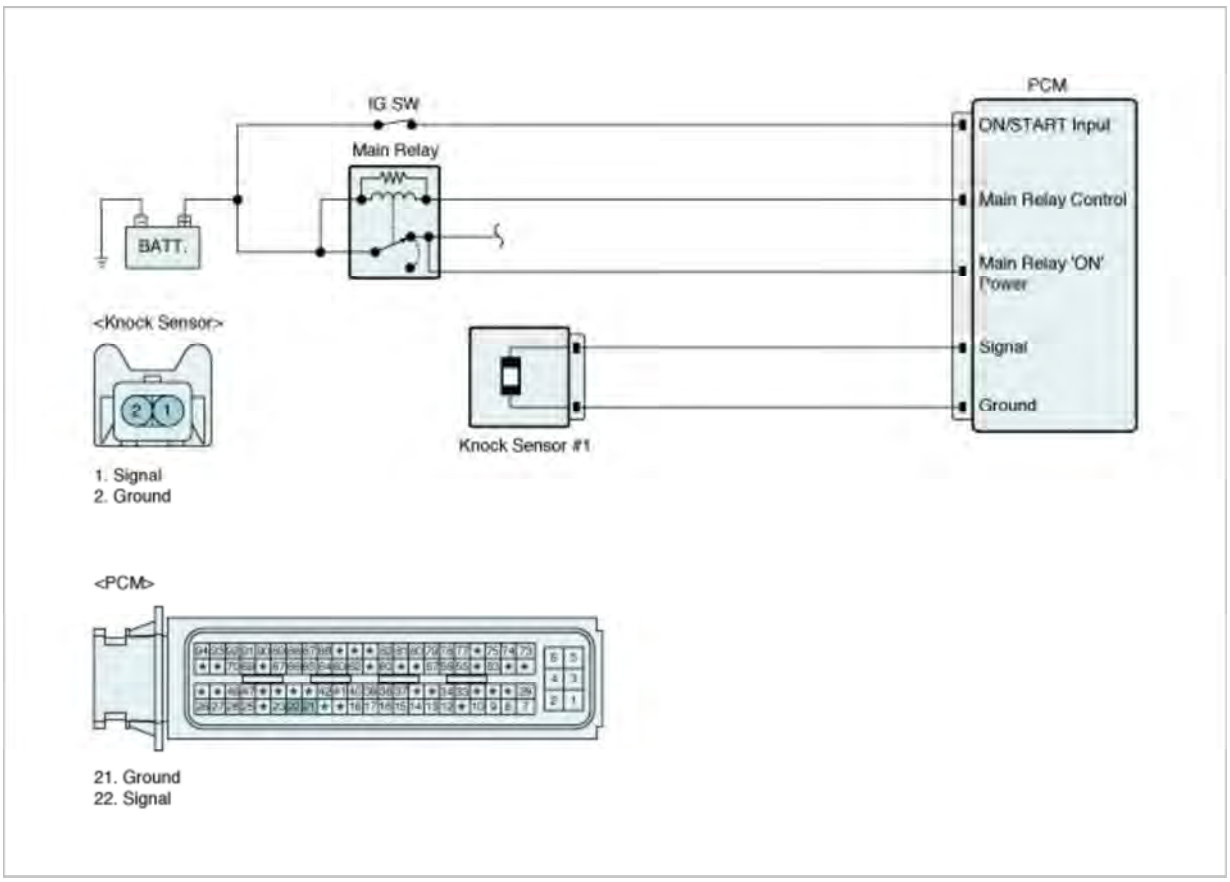
DTC Description

The PCM sets DTC P0335 when the number of crankshaft teeth during one revolution is incorrect or crankshaft signal is missing while camshaft signal is detected.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Check camshaft signal switching	• Open or short in signal, ground or power supply circuit • Poor connection or damaged harness • Damage to the connecting flange/flywheel • Misadjust crankshaft and camshaft pulley position • Faulty CKP sensor
Enable Conditions		• 6V< Battery voltage < 16V • Camshaft signal valid	
Threshold Value	Case1	• No crankshaft teeth during 4 camshaft signal transition	
	Case2	• Crankshaft teeth detected but synchronization not successful	
	Case3	• Number of Crankshaft Teeth within one revolution to high or too low	
Diagnosis Time	Case1	• 2 revolutions	
	Case2	• 2 revolutions	
	Case3	• 2.5 revolutions	
Mil On Condition		• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

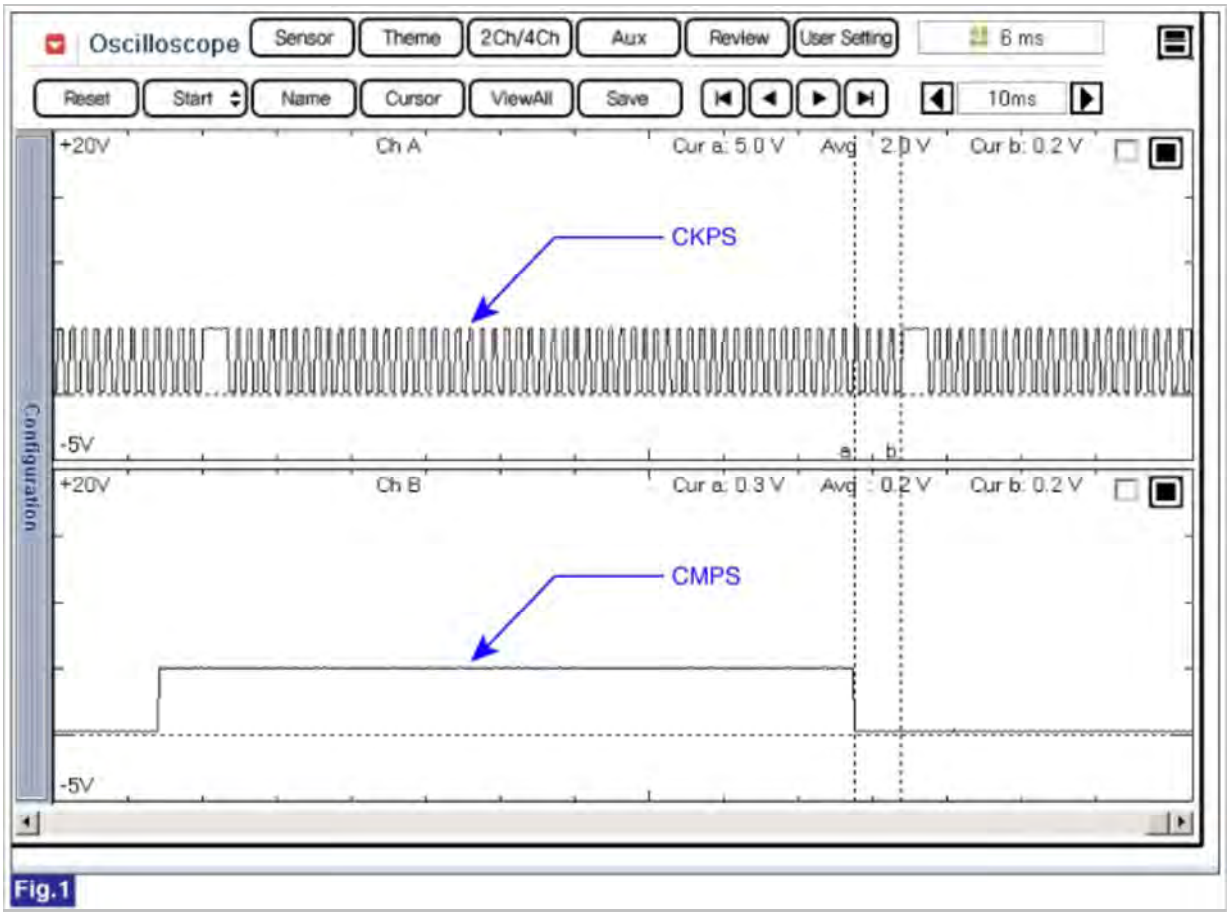


Fig.1

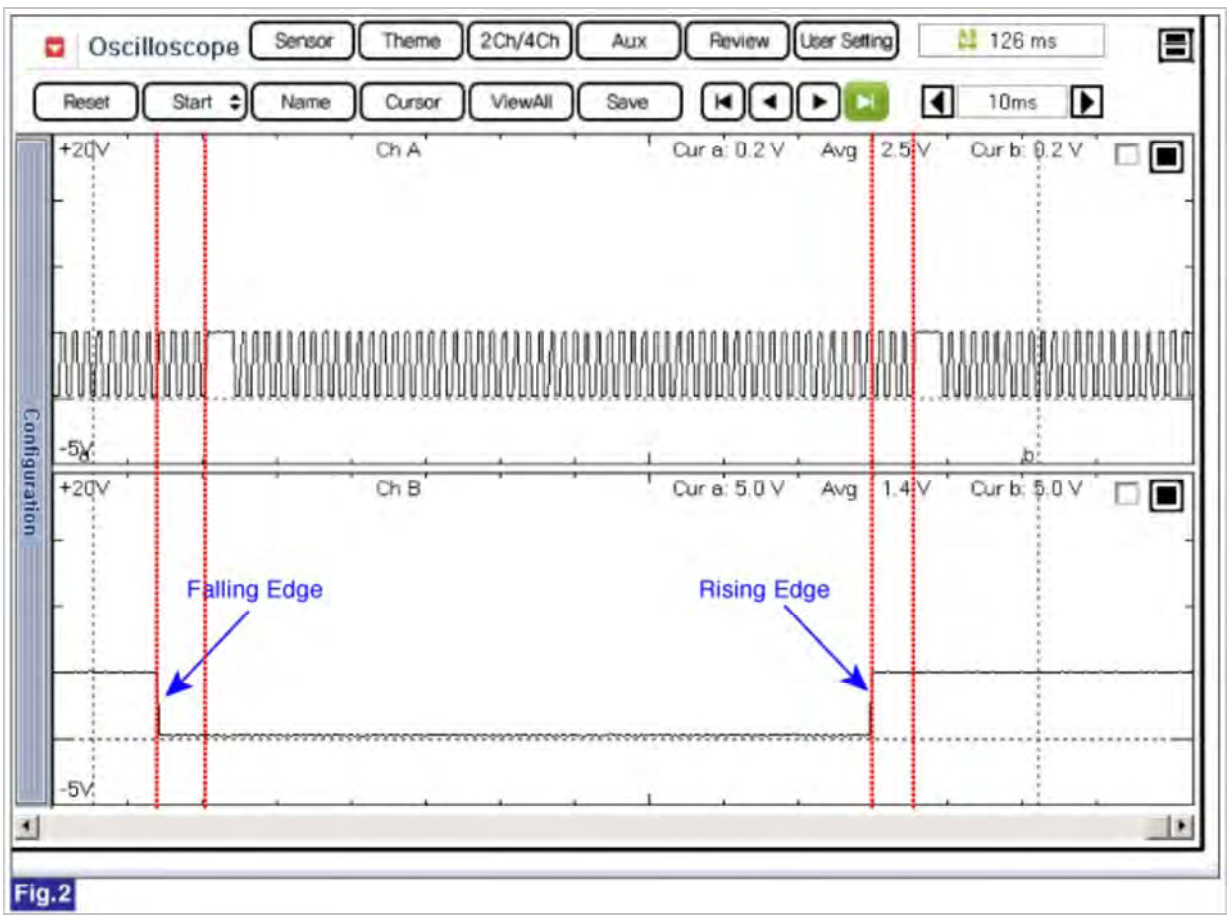


Fig.2

Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

Monitor Scantool Data

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect CKP sensor connector
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between power terminal of CKPS 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 CKPS. ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground circuit inspection

1. Ignition "OFF"
2. Measure resistance between ground terminal of CKPS 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 or short to ground in signal circuit
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between signal terminal of CKPS harness connector and chassis ground.

   Specification : Approx. 5V

   (3) 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 short to power in signal circuit
   (1) Ignition "OFF"
   (2) Disconnect PCM connector
   (3) Ignition "ON" & Engine "OFF"
   (4) Measure voltage between signal terminal of CKPS 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.

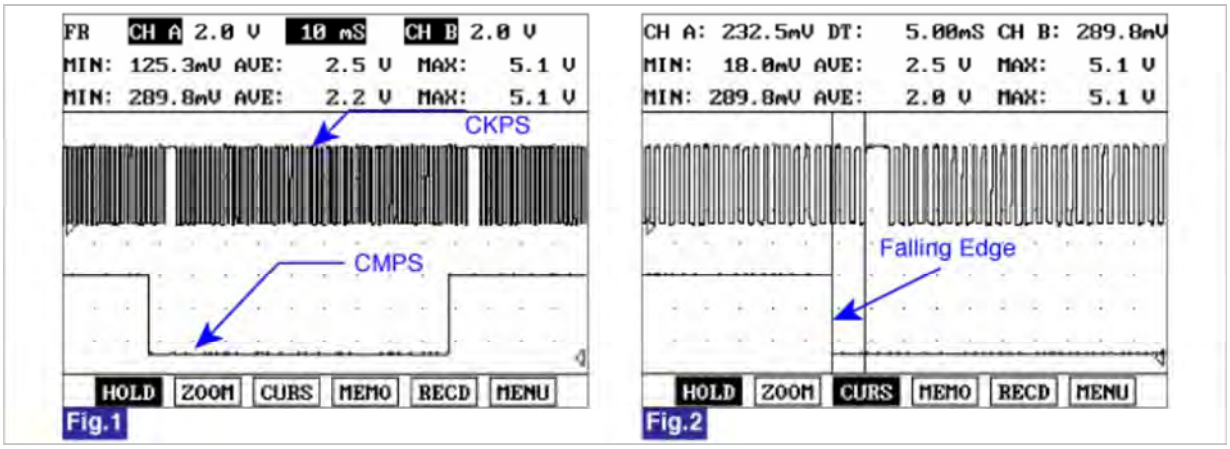
Terminal and Connector Inspection

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. 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.
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.

Component Inspection

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS(back probe), (-): ground
   Channel B (+): terminal 2 of the CMPS(back probe), (-): ground
2. Start the engine and check for signal waveform compared with reference waveform as below.



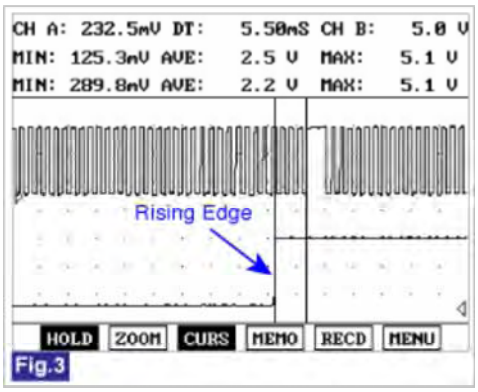


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3rd~5th tooth of the CKP from one longer signal(missing tooth)

3. Is the signal waveform normal?

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	▸ Remove CKP and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to "Verification of Vehicle Repair" procedureNote) Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from housing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A" ▸ If air gap is OK, check CKPS for contamination, deterioration, or damage. Substitute with a known-good CKPS and check for proper operation. If the problem is corrected, replace CKPS and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

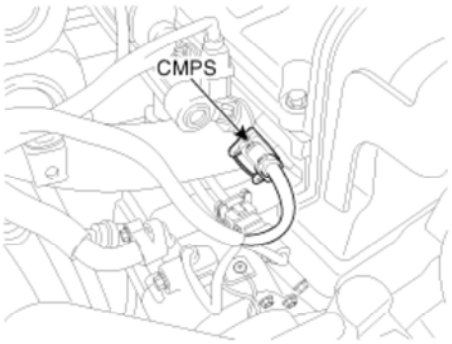
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0340 Camshaft Position Sensor \'A\' Circuit (Bank 1 or Single Sensor)

Component Location



General Description

The Camshaft Position Sensor (CMPS) is a sensor that detects the compression TDC of the NO. 1 cylinder. The CMPS consists of a hall type sensor and a target on the end of the intake camshaft. When the target triggers the sensor, the sensor voltage is 5V. If not, the sensor voltage is 0V. These CMPS signal is sent to the PCM and the PCM uses the CMPS signal for synchronizing the firing of sequential fuel injectors.

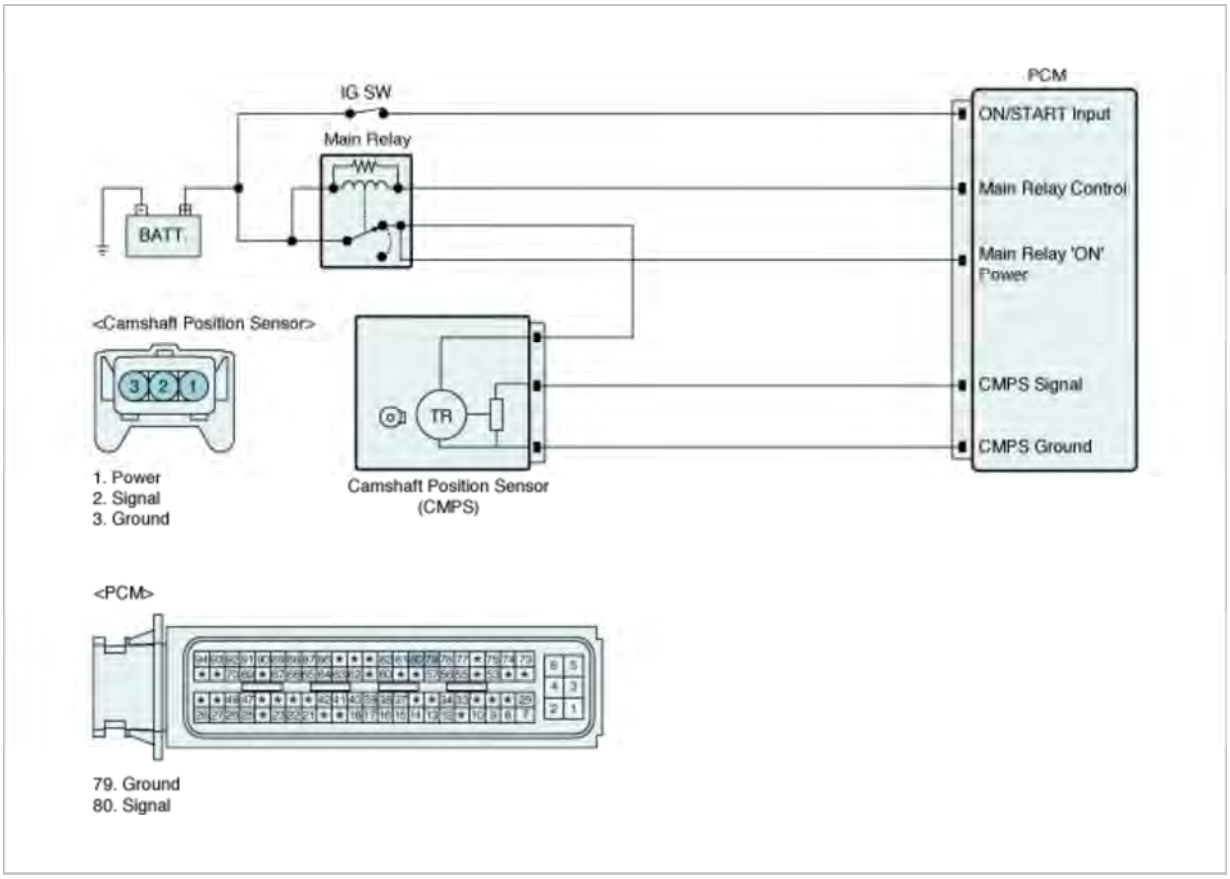
DTC Description

The PCM monitors the camshaft sensor signal transition position which must change only once per crankshaft revolution. If no camshaft signal is detected while crankshaft signal is detected, the PCM sets DTC P0340.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check camshaft signal switching	• Open or short in signal, ground or power supply circuit • Poor connection or damaged harness • Misadjust crankshaft and camshaft pulley position • Faulty CMP sensor
Enable Conditions	• 6V< Battery voltage < 16V • No crankshaft error	
Threshold Value	• No camshaft edge detected	
Diagnostic Time	• 40 revolutions	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Monitor DTC Status

1. Clear the DTC with GDS.
2. Operate the vehicle within the following conditions:
   - Engine run time at idle over 10 minutes
   - Engine Oil Temp. is between 20°C(68°F) and 110°C(230°F)
3. Ignition"ON" & Engine"OFF"
4. Using a GDS, monitor DTC
5. Go to applicable troubleshooting procedure for the following conditions
   - If any DTCs related to OCV(P0011) are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting procedure.
   - If DTC P0340 is set again, go to next step as below.
   - If other DTCs are stored, go to the applicable troubleshooting procedure.
   - If no DTC output, go to "Verification of Vehicle Repair" procedure.
6. Click "DTC Status" on the menu bar to see DTC's information.
7. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
8. Read "DTC Status" parameter
9. 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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect CMP sensor connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between power terminal of CMPS 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 CMPS. ▸ Especially check for open or blown 10A sensor fuse. ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground circuit inspection

1. Ignition "OFF"
2. Measure resistance between ground terminal of CMPS 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 short to ground in signal harness
   (1) Measure resistance between signal terminal of CMPS 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.

2. Check for short to battery in signal harness
   (1) Disconnect PCM connector
   (2) Ignition "ON" & Engine "OFF"
   (3) Measure voltage between signal terminal of CMPS 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 signal harness
   (1) Ignition "OFF"
   (2) Measure resistance between signal terminal of CMPS harness connector and CMPS signal terminal of the PCM

connector.

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.

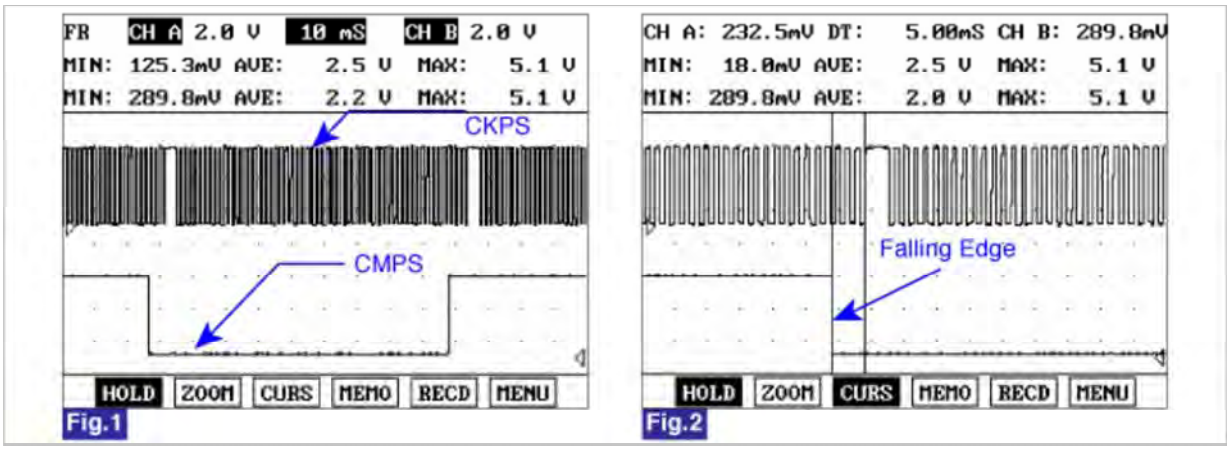
Terminal and Connector Inspection

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. 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.
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

Component Inspection

1. Set up an oscilloscope as follows :
   Channel A (+): terminal 2 of the CKPS(back probe), (-): ground
   Channel B (+): terminal 2 of the CMPS(back probe), (-): ground
2. Start the engine and check for signal waveform compared with reference waveform as below.



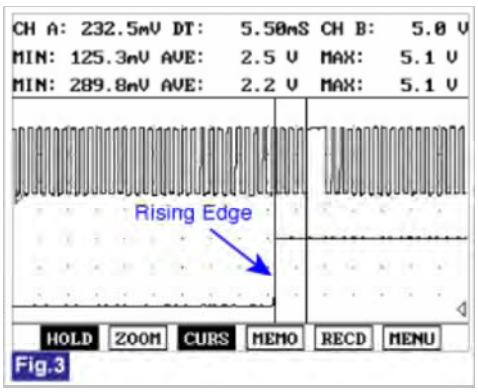


Fig.1) The square wave signal should be smooth and without any distortion.
Fig.2,3) The CMPS falling(rising) edge is coincided with 3rd~5th tooth of the CKP from one longer signal(missing tooth)

3. Is the signal waveform normal?

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	▸ Remove CKP and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to "Verification of Vehicle Repair" procedureNote) Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from housing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A" ▸ If air gap is OK, check CKPS for contamination, deterioration, or damage. Substitute with a known-good CKPS and check for proper operation. If the problem is corrected, replace CKPS and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

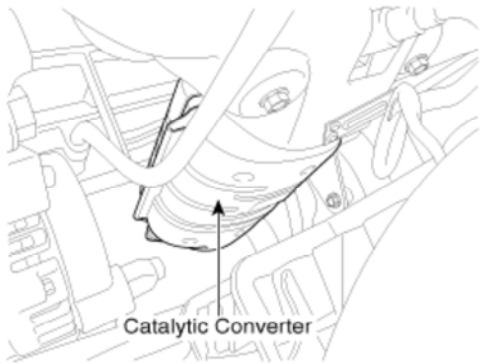
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0420 Catalyst System Efficiency below Threshold (Bank 1)

Component Location



General Description

The PCM 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 PCM 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 PCM 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	• Check catalyst oxygen storage capacity by evaluation downstream HO2S sensor fluctuations	• Exhaust gas leaks • Faulty rear HO2S • Faulty three way catalyst converter
Enable Conditions	• Coolant temperature >74°C(165°F) • 4.8Km/h(3MPH) < Vehicle speed > 179.2Km/h(112MPH) • Engine speed < 3400rpm • 200 < Engine Load(mg/rev) > 700 • 400°C(752°F) ≤ Catalyst temp. model ≤ 900°C(1652°F) • Lambda regulation active • Canister Purge Valve not on CLOSE state • Catalyst purge after Fuel Cut-off finished • No relevant failure • 11V < Battery voltage < 16V	
Threshold Value	• Average malfunction index > 1.75	
Diagnostic Time	• 100 Lambda Controller Cycles	
Mil On Condition	• 2 Driving Cycles	

Signal Waveform & Data

GDS Display for HO2S

Test Condition		GDS Parameter	
		HO2S SNSR VOL.-B1/S1	HO2S SNSR VOL.-B1/S2
Normal Value when circuit is normal	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.	above 0.7V
HO2S(B1S1) signal circuit open		Approx. 0.43~0.45V	-
HO2S(B1S2) signal circuit open		-	Approx. 0.43~0.45V

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.

Monitor Scantool Data

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Exhaust system Inspection

1. Visually/physically inspect the following conditions:
   '- Exhaust system between HO2S and Three way catalyst for air leakage, restriction and damage.
   '- 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:
   '- Ensure that the HO2S is securely installed.(Pigtail and wiring harness not making contact with the exhaust pipe)
   '- Check for corrosion on terminals
   '- Check for terminal tension (at the HO2S and at the PCM)
   '- 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:

'- Severe discoloration caused by excessive temperature
'- Dents and holes
'- Internal rattle caused by a damaged catalyst

2. 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 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.

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0441 Evaporative Emission System Incorrect Purge Flow

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 PCM 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 PCM and controls fuel vapor from the canister to the intake manifold.

DTC Description

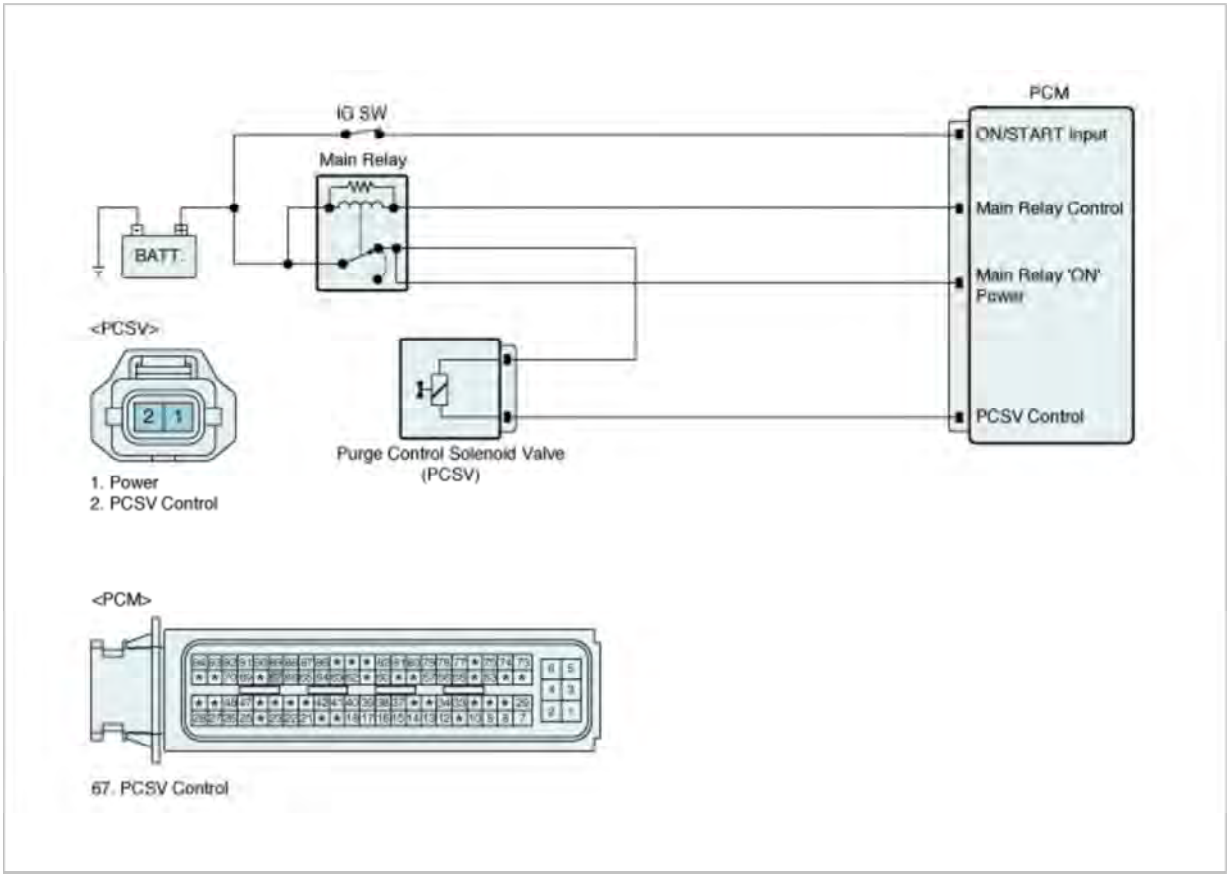
During "test of vapour generation" a new value from the tank pressure sensor is measured and compared with the start pressure at beginning of "test of vapour generation".The PCM sets DTC P0441 if the pressure signal decrease occurs and the difference is below the predetermined threshold.
If same error code is set in the next driving cycle, the PCM illuminates the MIL.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause

DTC Strategy	• Monitoring Fuel Tank Pressure during Vapor Generation check	• Leakage on hose to PCSV • Faulty PCSV
Enable Conditions	• 4°C(39.2°F) < Start Coolant temp. < 35°C(95°F) • Ambient air temperature model >-10°C(14°F) • Vehicle speed< 10km/h(6mph) • Time after start >590 sec. • Limited Canister saturation • Estimated altitude< 2.4km(8000ft) • Idle speed engine operating state • Minimum canister purge time: 5~25sec.(depending on canister load) • Differential fuel tank Pressure : -11~4 hpa • 11V < Battery voltage < 16V	
Threshold Value	• Differential fuel tank Pressure < -2 hpa	
Diagnostic Time	• 0,5 sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Monitor DTC Status

1. Start engine to normal operating temperature

> **NOTE**
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install GDS and clear DTC
3. 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%

4. Is DTC P0441 set again?

YES	▸ Go to next step as below
NO	▸ 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 looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

Component Inspection

■ **PCSV Inspection**

1. Ignition "OFF"
2. Disconnect the hose leading from the PCSV to intake manifold at intake manifold.
3. Using a vacuum pump, apply vacuum to the manifold side of the vacuum hose and verify PCSV holds vacuum.
4. Ignition "ON" & Engine "OFF"
5. Install GDS and select "EVAP PURGE VALVE" on the Actuation Test mode
6. Activates "EVAP PURGE VALVE" by pressing "STRT(F1)" key
7. Verify PCSV release vacuum while valve is activating(should hear a faint click from PCSV)
8. Repeat this procedure 4 or 5 times to ensure PCSV reliability.
   Specification:

Test Condition	Specification
PCSV is ON(should hear a faint click from PCSV)	Holds vacuum
PCSV is OFF	Release vacuum

9. Is PCSV working properly?

YES	▸ Go to next step as below
NO	▸ Verify arrow on PCSV is pointing towards intake manifold. If it is not, reverse installation. Reinstall as necessary and go to "Verification of Vehicle Repair" procedure. If OK, thoroughly check fuel vapor hoses and hose clamps between PCSV and intake manifold. Repair as necessary. If OK, test with a new PCSV and check for proper operation. If problem is corrected, replace PCSV 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	▸ 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

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 GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install GDS 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 > Engine Control System > P0442 Evaporative Emission System-Leak detected (small leak)

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 PCM 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 PCM 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 PCM illuminates the MIL.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring Fuel Tank Pressure Trend after generating underpressure in Tank	• Fuel filler cap damage or missing • Faulty or damaged fuel filler pipe • Leaking, disconnected or plugged fuel vapor lines • CANISTER CLOSE VALVE • PCSV • Canister • Faulty Fuel Tank Pressure Sensor (FTPS) • Fuel in lines due to faulty Rollover Valve
Enable Conditions	• 4°C(39.2°F) < Start Coolant temp. < 35°C(95°F) • Ambient air temperature model >-10°C(14°F) • Vehicle speed< 10km/h(6mph) • Time after start >590 sec. • Limited Canister saturation • Estimated altitude< 2.4km(8000ft) • Idle speed engine operating state • Minimum canister purge time: 5~25sec.(depending on canister load) • Differential fuel tank Pressure : -11~4 hpa	

	• 11V < Battery voltage < 16V	• On-Board Refueling Vapor Recovery Valve (ORVR valve) or stuck closed CCV
Threshold Value	• Leak diameter > 0.73mm	
Diagnostic Time	• 30 sec. In idle when all enable conditions fulfilled	
Mil On Condition	• 2 Driving Cycles	

Monitor DTC Status

1. Start engine to normal operating temperature

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install GDS and clear DTC
3. 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%

4. Is DTC P0441 set again?

YES	▸ Go to next step as below.
NO	▸ 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 looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ PCSV to Intake manifold Line Inspection

1. Ignition "OFF"
2. Disconnect the hose leading from the PCSV to the intake manifold at PCSV
3. Using a vacuum pump, apply specified vacuum[Approx. 25cmHg(10 inHg)] to the manifold side of the valve and verify PCSV holds vacuum.
4. Ignition "ON" & Engine "OFF"
5. Install GDS and select "EVAP PURGE VALVE" on the Actuation Test mode
6. Activates "EVAP PURGE VALVE" by pressing "STRT(F1)" key
7. Verify PCSV release vacuum while valve is activating(should hear a faint click from PCSV)
8. Repeat this procedure 4 or 5 times to ensure PCSV reliability.
   Specification:

Test Condition	Specification
PCSV is ON(should hear a faint click from PCSV)	Holds vacuum
PCSV is OFF	Release vacuum

9. Is PCSV working properly?

YES	▸ Go to next step as below.
NO	▸ Verify arrow on PCSV is pointing towards intake manifold. If it is not, reverse installation. Reinstall as necessary and go to "Verification of Vehicle Repair" procedure. If OK, thoroughly check fuel vapor hoses and hose clamps between PCSV and intake manifold. Repair as

	necessary. If OK, test with a new PCSV and check for proper operation. If problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

■ Canister Closing Valve(CCV) Line Inspection

1. Reconnect all EVAP hardware that was previously disconnected
2. Disconnect hose connecting Canister Closing Valve(CCV) to canister
3. Ignition "ON" & Engine "OFF"
4. Blow air to the canister side of the valve and verify air escapes to the air filter side.
5. Install GDS and select "CANISTER CLOSE VALVE" on the Actuation Test mode
6. Activates "CANISTER CLOSE VALVE" by pressing "STRT(F1)" key
7. Blow air into hose and verify air does not escape.
8. Repeat this procedure 4 or 5 times to ensure CCV reliability.
9. Is CCV working properly?

YES	▸ Go to next step as below.
NO	▸ Check for cracks or damage in hose connecting CCV and canister. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. If OK, replace CCV. If CCV was stuck closed, inspect all lines and canister for liquid fuel. Replace any contaminated components and blow out lines and go to "Verification of Vehicle Repair" procedure.

■ Fuel Tank Pressure Sensor Inspection

1. Ignition "ON" & Engine "OFF" .
2. Measure FTPS output voltage between Signal terminal (back probe) of the FTPS harness connector and chassis ground

Specification : Voltage increases proportionally with decreasing pressure(Approx. 2.5V to 4.5V)

Pressure(kPa)	Voltage(V)
-3.75	4.5
0	1.5
1.25	0.5

3. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary. 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.

■ PCSV to Canister Line Inspection

1. Check for leakage in hose
   (1) Reconnect all EVAP hardware that was previously disconnected
   (2) Disconnect the hose leading from the canister to the PCSV at canister
   (3) Using a vacuum pump, apply specified vacuum[Approx. 4 inHg(14 kPa)] to the manifold side of the valve for 1 minute and verify PCSV holds vacuum.
   (4) Is pressure within specification?

YES	▸ Go to next step as below.
NO	▸ Check for cracks or damage in hose connecting PCSV and canister. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for leakage in canister

(1) Disconnect hose clamps and remove canister assembly

(2) Block the hose of between:
- ●Canister and fuel filler neck
- ●Canister and CCV
- ●Canister and PCSV

(3) Apply maximum of 4 inHg(14 kPa) pressure through fuel tank port from canister

(4) With system sealed and pressurized, check for leaks

(5) Were any leak(s) found?

YES	▸ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

■ Fuel Tank Line Inspection

1. Relieve the fuel system pressure and remove the fuel tank (caution)
   Before removing the fuel tank, make sure the fuel hoses are not leaking.
2. Block all of the following outlets:
   (1) Fuel lines
   (2) Fuel filler neck
3. Apply maximum of 10cmHg(4 inHg) pressure to the EVAP. hose at the fuel tank. Then, pinch the EVAP. hose to retain the pressure
4. Check the suspect area for leaks with a soap solution.
5. Were any leak(s) found?

YES	▸ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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 GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install GDS 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 GDSspecification at this time.

Fuel System > Engine Control System > P0444 Evaporative Emission System-Purge Control Valve Circuit Open

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 PCM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the PCM and controls fuel vapor flow from the canister to the intake manifold.

DTC Description

PCM sets DTC P0444 if the PCM detects that the PCSV control circuit is open.

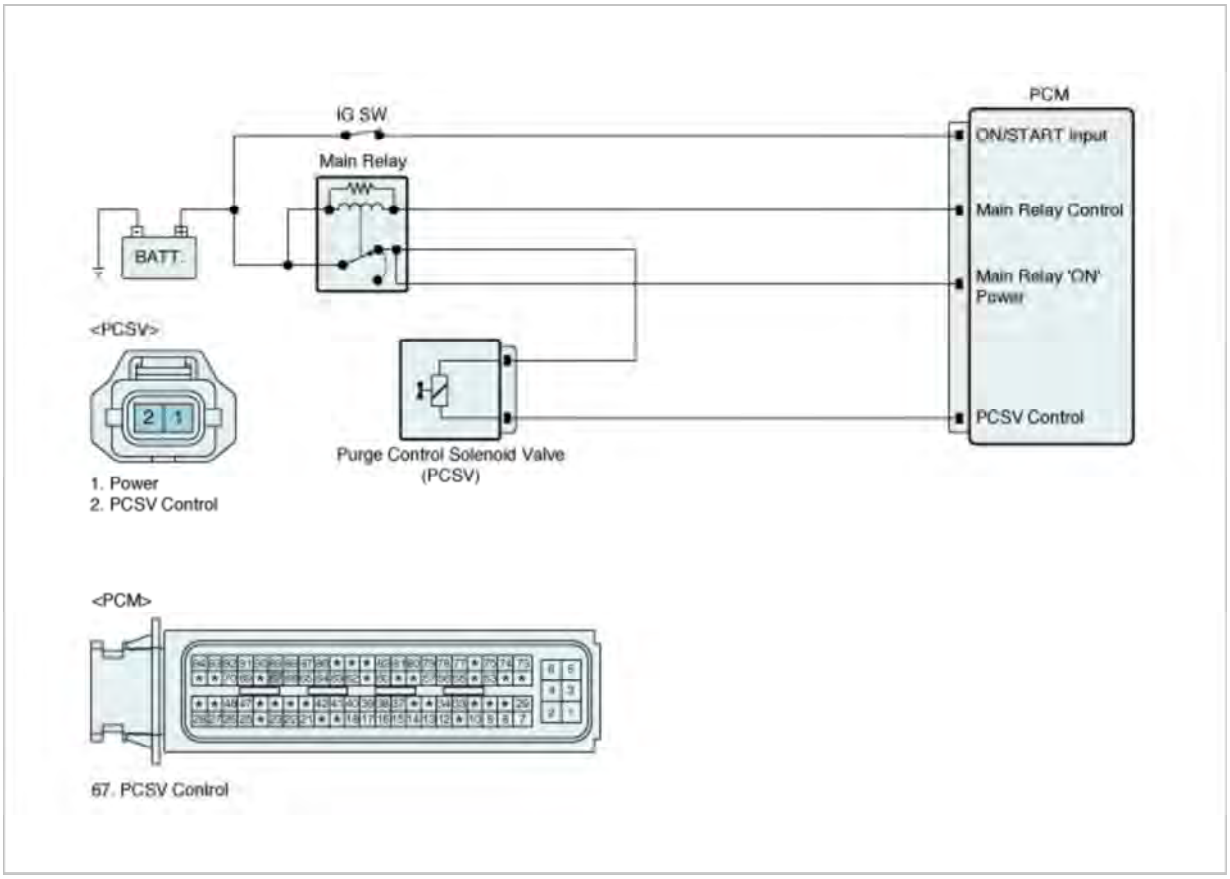
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Open in PCSV harness • Poor connection or damaged harness • Faulty PCSV
Enable Conditions	• 10 < Battery voltage(V) < 16 • 2% < Canister purge duty > 98%	
Threshold Value	• Line break	
Diagnostic Time	• 3 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	PCSV Resistance(Ω)
20	68	Approx. 16

Diagnostic Circuit Diagram



Signal Waveform & Data

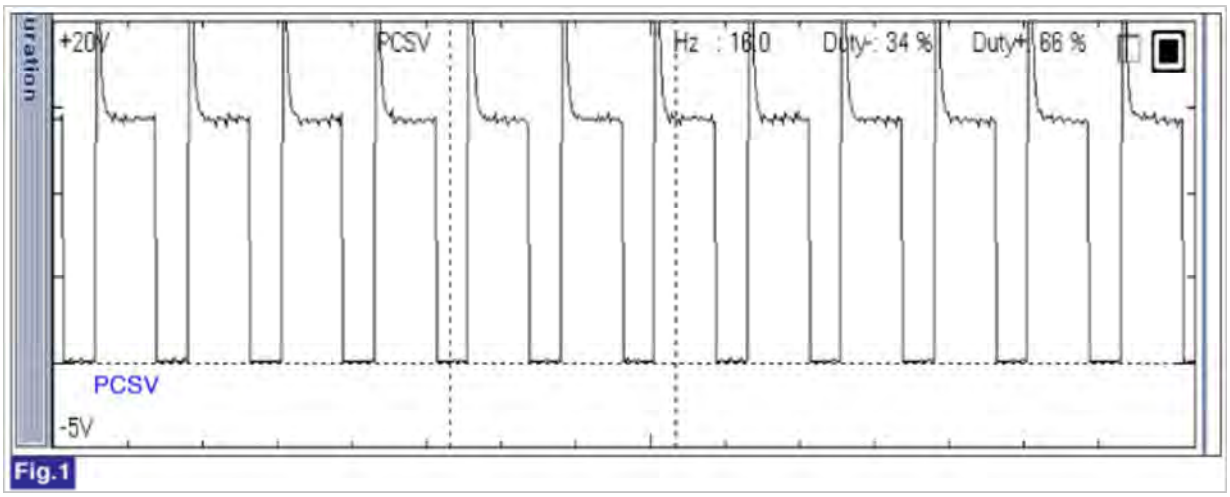


Fig 1) Normal waveform with idle

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect PCSV connector
3. Measure resistance between power terminal and signal terminal of PCSV connector(Component side).

Temp.(°C)	Temp.(°F)	PCSV Resistance(Ω)
20	68	Approx. 16

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

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of 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. Measure voltage between Control terminal of the PCSV harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below
NO	▸ Check control circuit for open or short. 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	▸ 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

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0445 Evaporative Emission System-Purge Control Valve Circuit Shorted

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 PCM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the PCM and controls fuel vapor flow from the canister to the intake manifold.

DTC Description

PCM sets DTC P0445 if the PCM detects that the PCSV control circuit is shorted to ground or shorted to battery voltage.

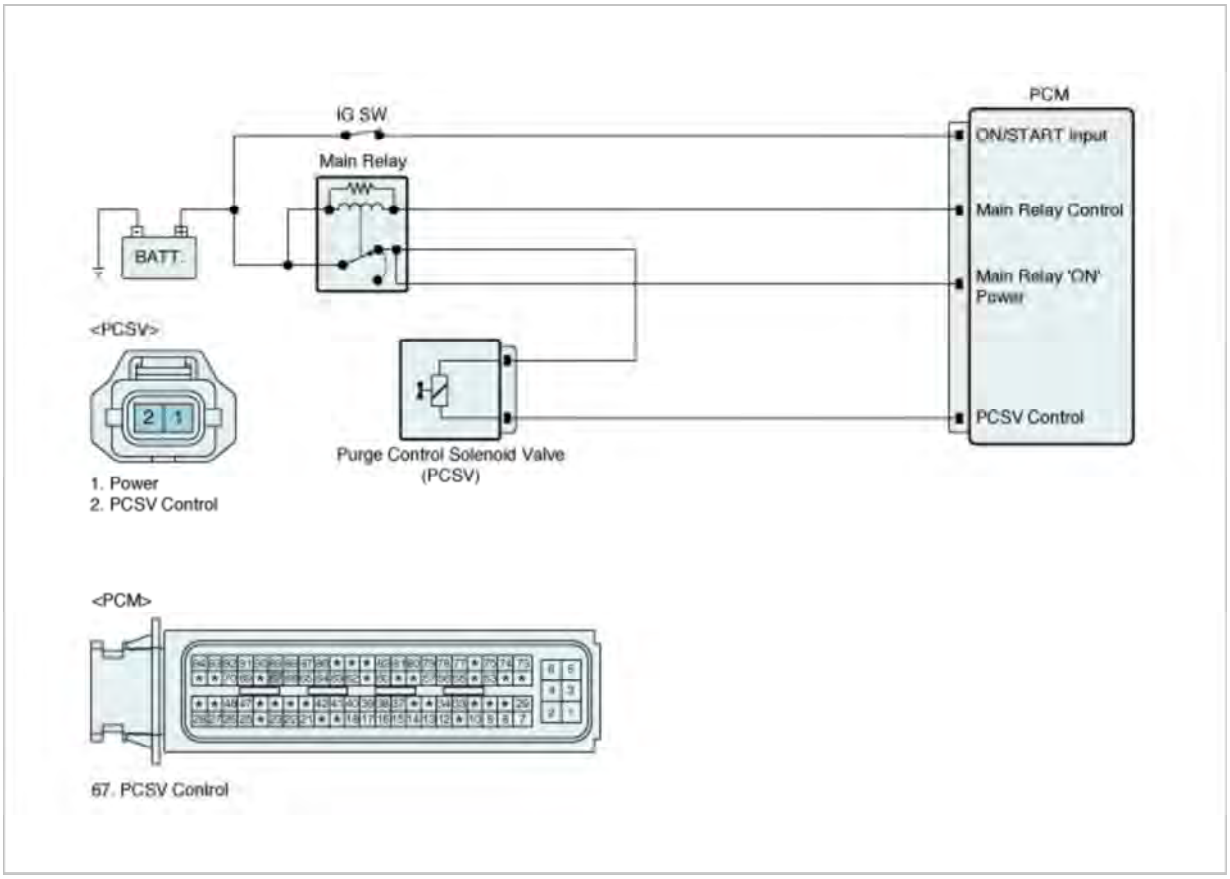
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Short in PCSV harness • Poor connection or damaged harness • Faulty PCSV
Enable Conditions	• 10 < Battery voltage(V) < 16 • 2% < Canister purge duty > 98%	
Threshold Value	• Short to ground or Short to Battery	
Diagnostic Time	• 3 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temp.(°C)	Temp.(°F)	PCSV Resistance(Ω)
20	68	Approx. 16

Diagnostic Circuit Diagram



Signal Waveform & Data

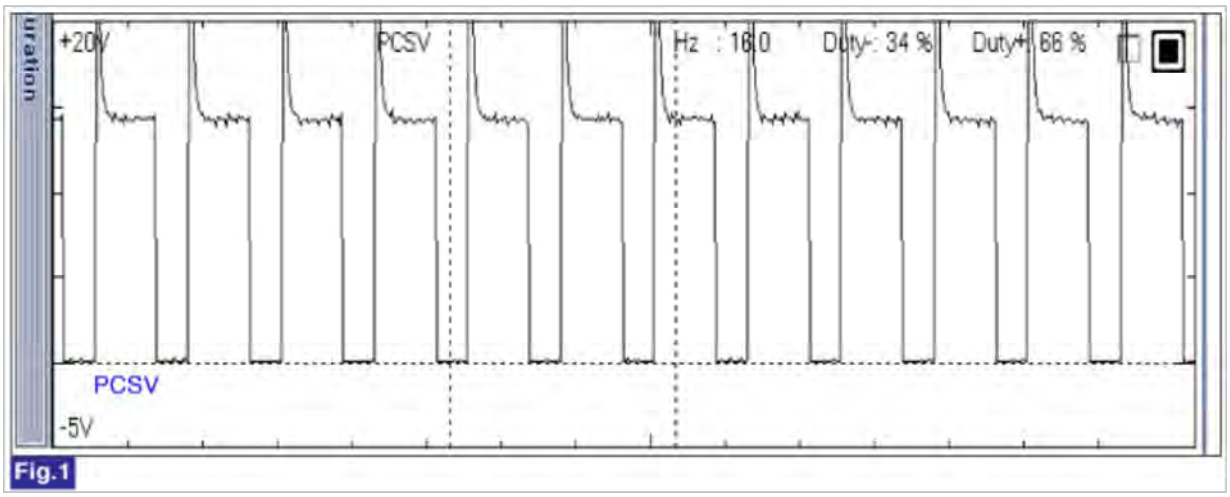
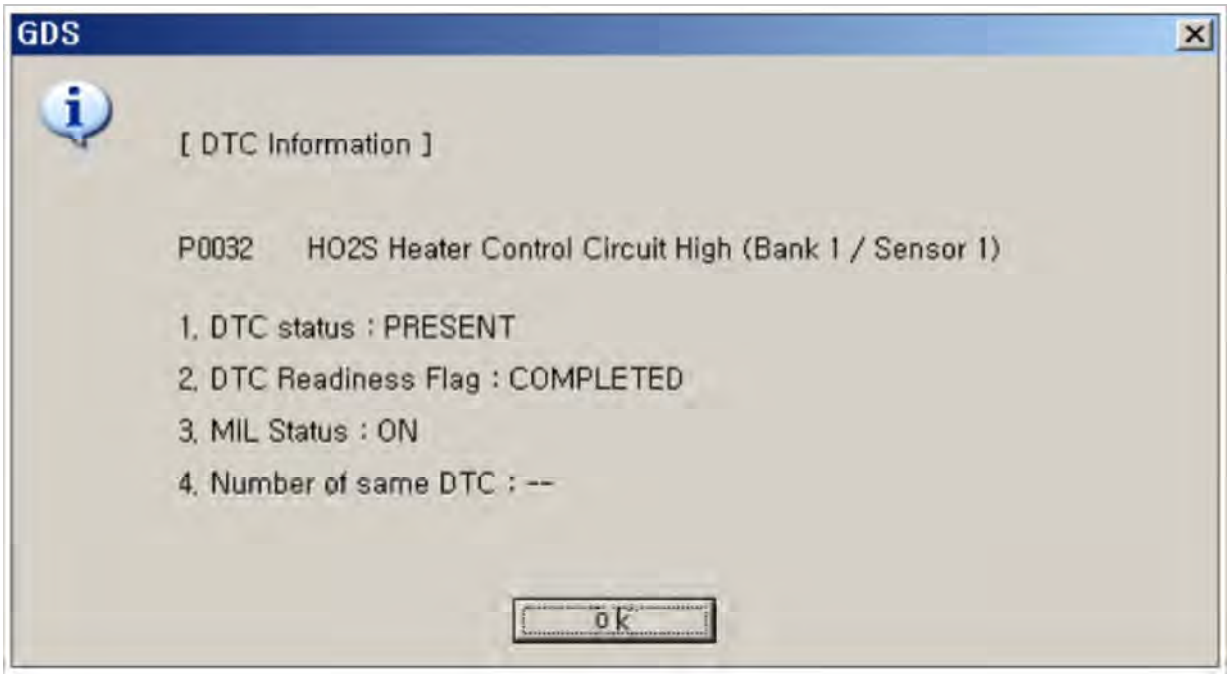


Fig 1) Normal waveform with idle

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect PCSV connector
3. Measure resistance between power terminal and signal terminal of PCSV connector(Component side).

Temp.(°C)	Temp.(°F)	PCSV Resistance(Ω)
20	68	Approx. 16

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

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of PCSV harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES	▸ Go to next step as below
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. Measure voltage between control terminal of PCSV harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below
NO	▸ Check control circuit for open or short. 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	▸ 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

Verification of Vehicle Repair

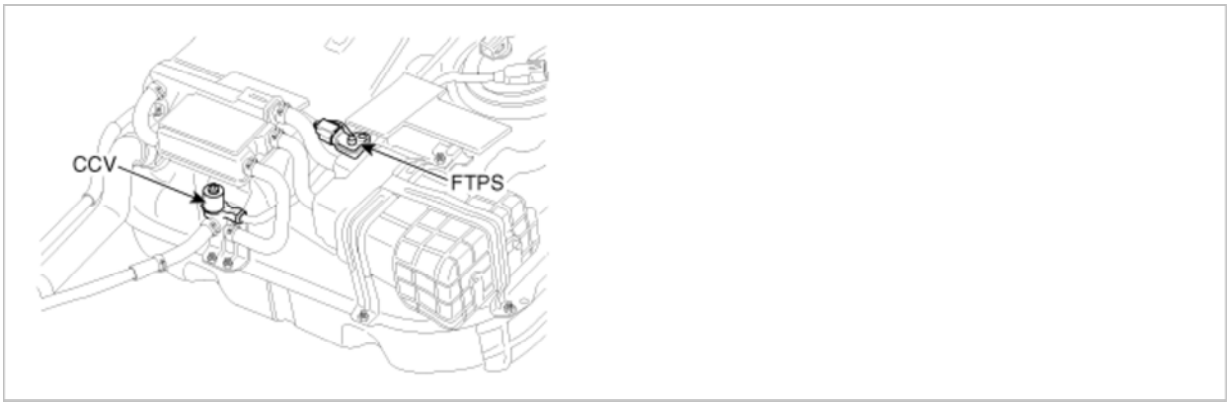
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0447 Evaporative Emission System-Vent Control Circuit Open

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

PCM sets DTC P0447 if the PCM detects that the CCV control line is open.

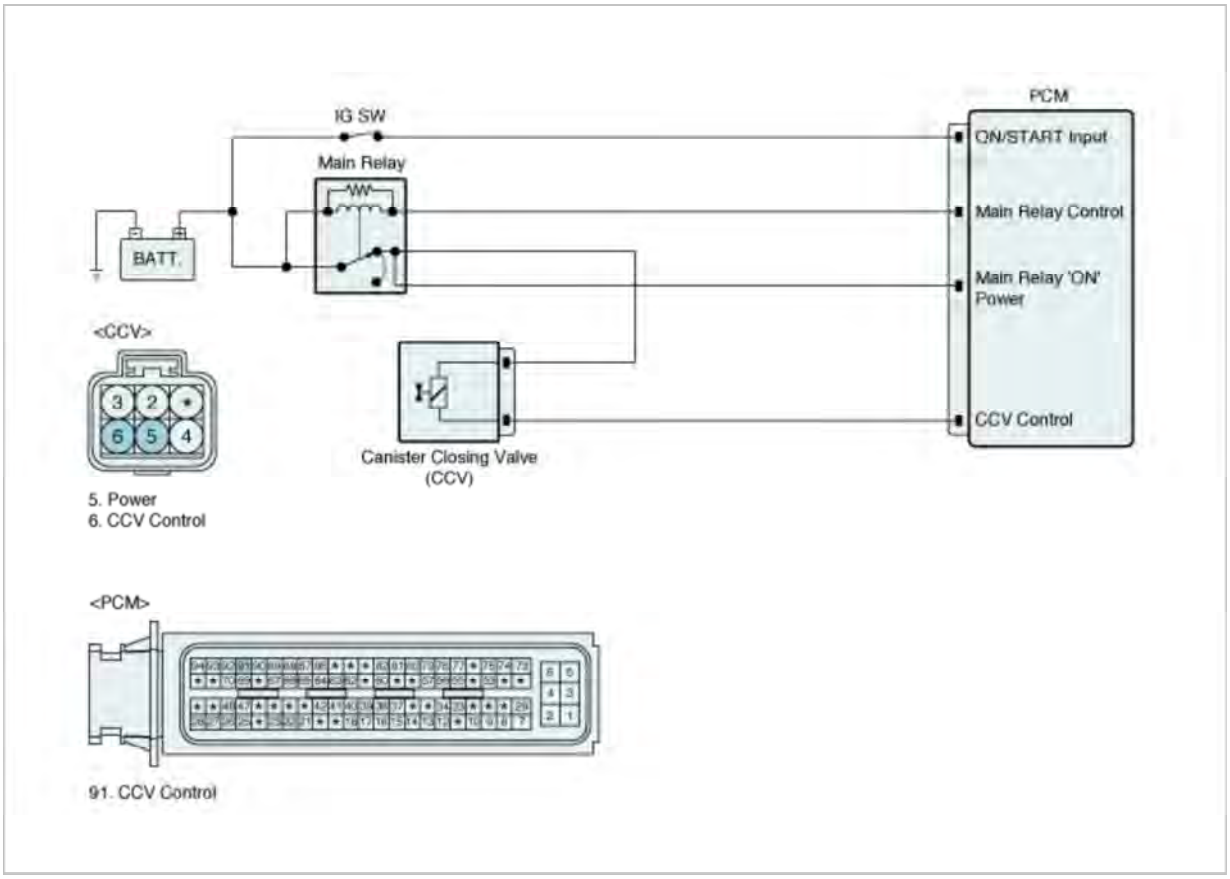
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Open in CCV harness • Poor connection or damaged harness • Faulty CCV
Enable Conditions	• 10V < Battery voltage < 16V	
Threshold Value	• Line Break	
Diagnostic Time	• 3 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Canister Close Valve	Normal Parameter At 20°C (68°F)
Resistance	23 ~ 26Ω

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect CCV connector
3. Measure resistance between Power terminal and Control terminal 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

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of the CCV harness connector and chassis ground

Specification : Approx. 12V

3. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check for an open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Control Circuit Inspection

1. Measure voltage between control terminal of the CCV harness connector and chassis ground.

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Terminal and connection 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 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.

Verification of Vehicle Repair

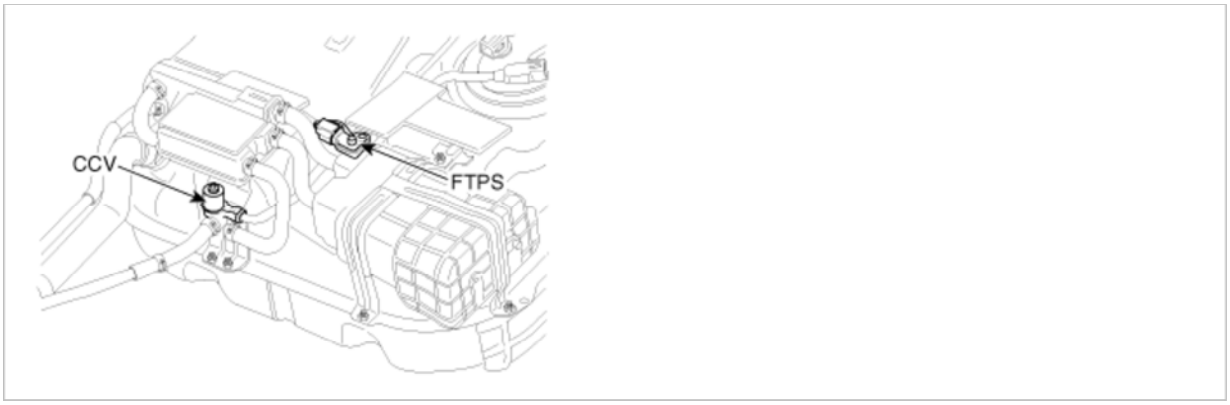
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0448 Evaporative Emission System - Vent Control Circuit Shorted

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

PCM sets DTC P0448 if the PCM detects that the CCV control line is short to ground or short to battery line.

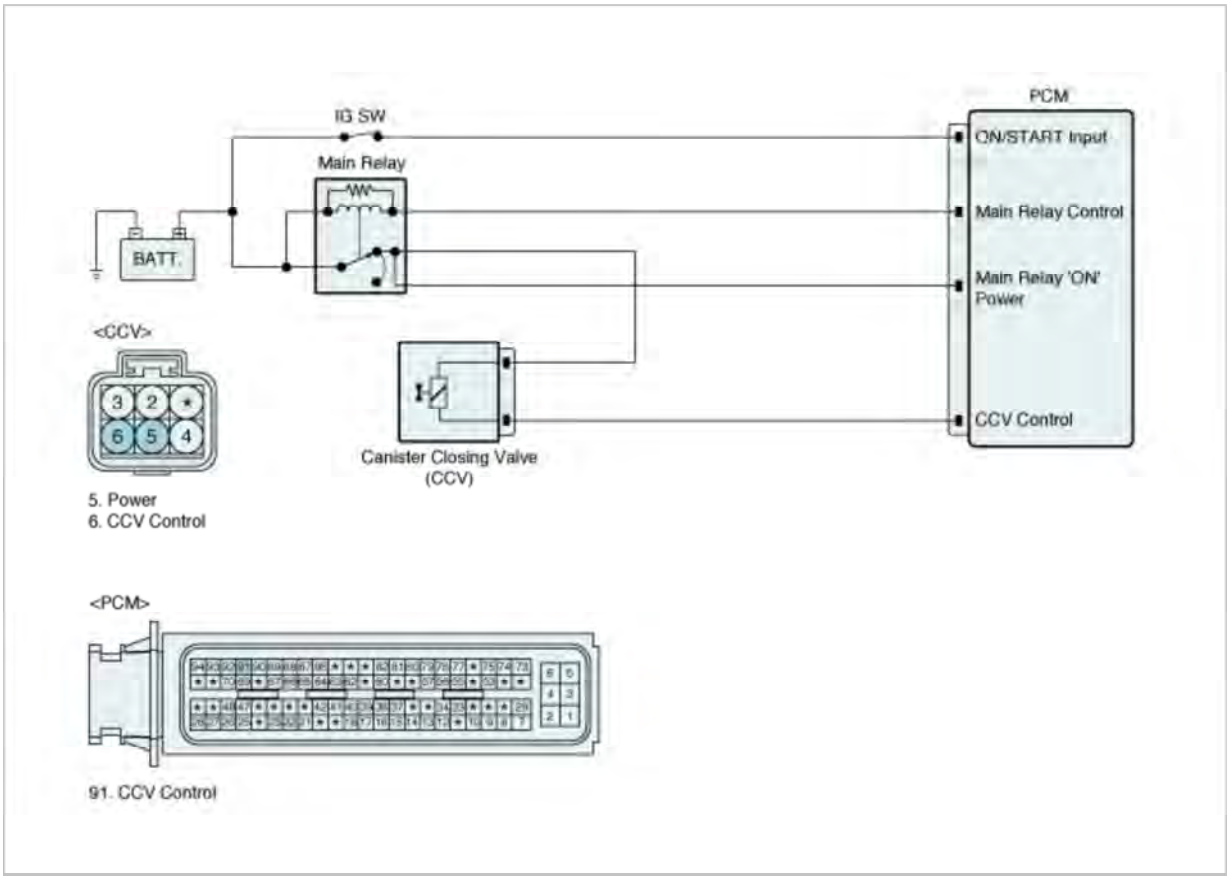
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Short circuit in CCV harness • Poor connection or damaged harness • Faulty CCV
Enable Conditions	• 10V < Battery voltage < 16V	
Threshold Value	• Short circuit to ground or battery	
Diagnostic Time	• 3 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

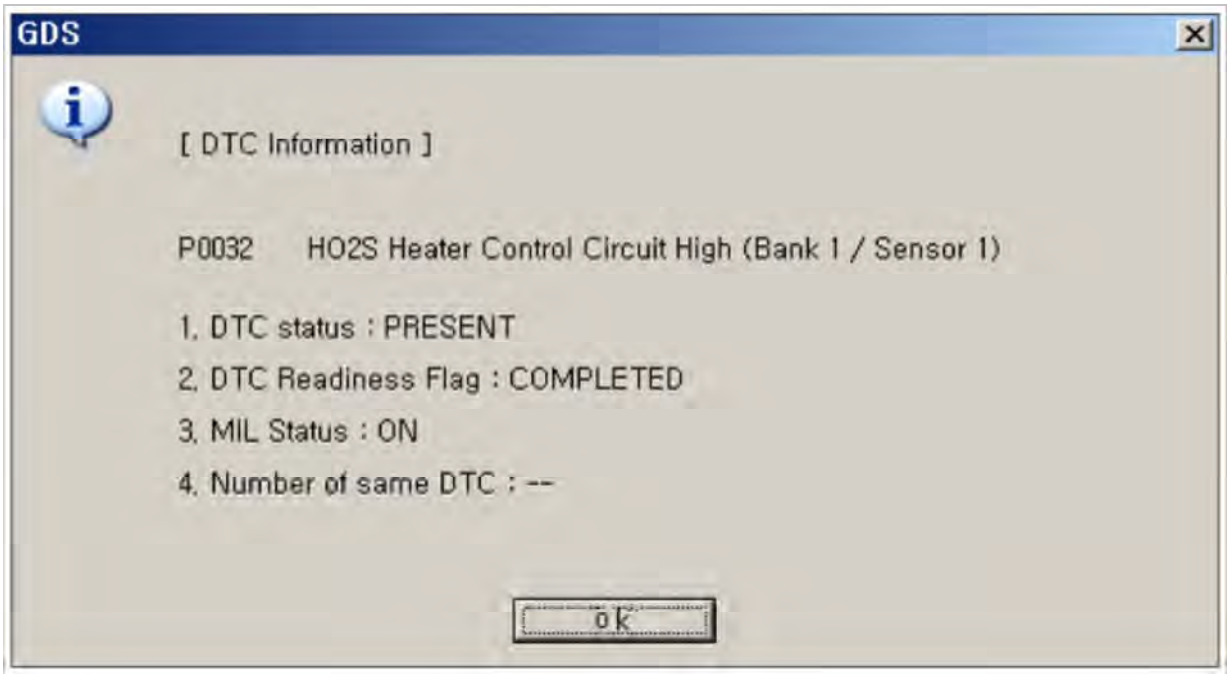
Canister Close Valve	Normal Parameter At 20°C (68°F)
Resistance	23 ~ 26Ω

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect CCV connector
3. Measure resistance between Power terminal and Control terminal 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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of the CCV harness connector and chassis ground.

Specification : Approx. 12V

3. Is voltage within the specification?

	▸ Go to next step as below.

YES	
NO	▸ Check for an open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Control Circuit Inspection

1. Measure voltage between control terminal of the CCV harness connector and chassis ground

Specification : Approx. 4~5V

2. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Terminal and connection 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 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.

Verification of Vehicle Repair

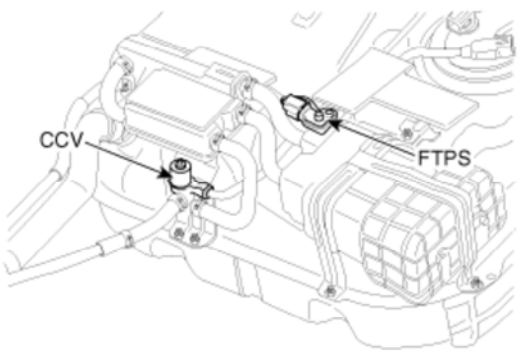
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0449 Evaporative Emission System-Vent Valve / Solenoid Circuit

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 PCM measures pressure in the fuel tank by means of tank pressure sensor during all engine operating states except engine stop and start. PCM sets DTC P0449 if the PCM detects that the fuel tank pressure is too low as a result of the stuck closed CCV. And the same error code is set in the next driving cycle, the PCM illuminates the MIL.

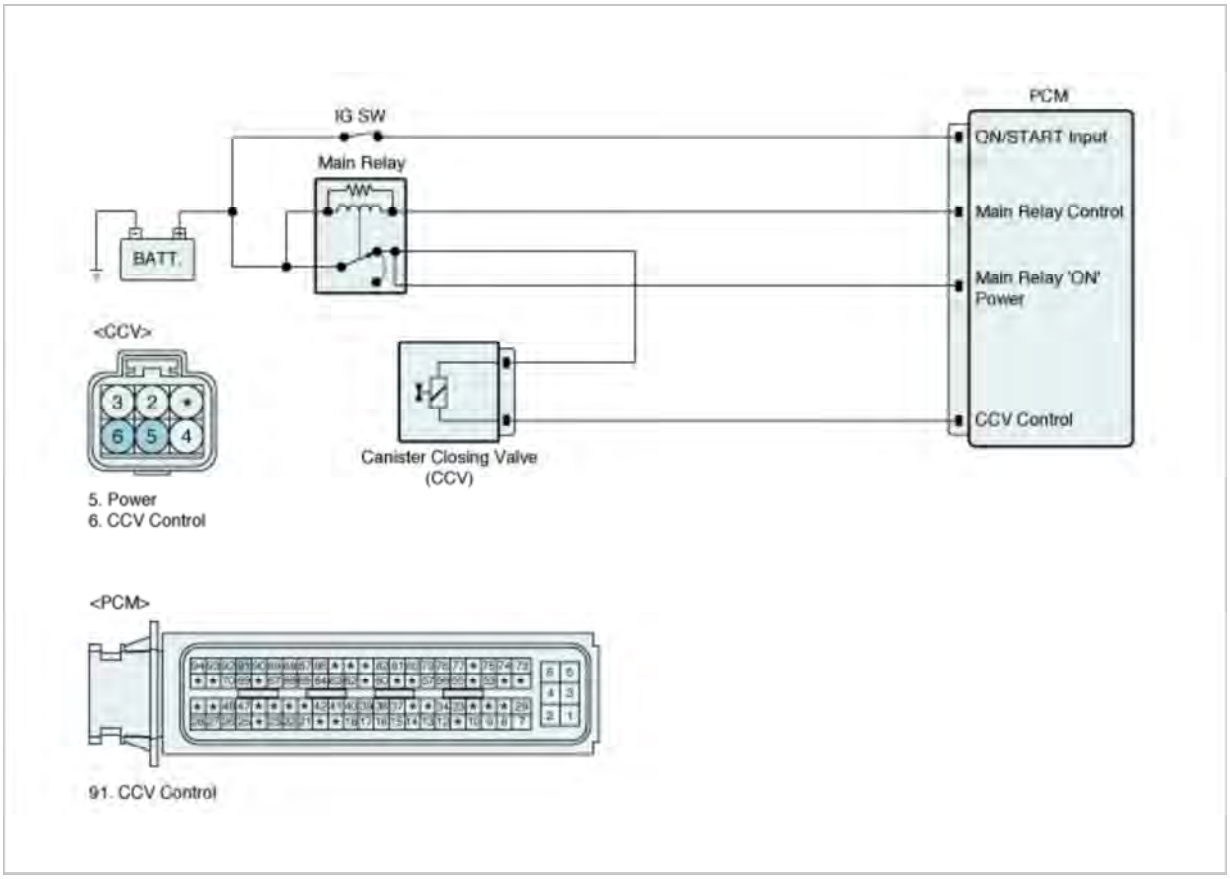
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Ventilation control valve stuck closed	• Canister air filter contamination • Faulty CCV
Enable Conditions	• Leak detection test not active • No tank pressure sensor error • 11V < Battery voltage < 16V	
Threshold Value	• Fuel Tank underpressure(below -30 hPa) too high • Differential fuel tank pressure V_DTP<1.6V	
Diagnostic Time	• 10 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Canister Close Valve	Normal Parameter At 20°C (68°F)
Resistance	23 ~ 26Ω

Diagnostic Circuit Diagram



Monitor DTC Status

NOTE

If DTCs (or pending codes) relating to CCV are present, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

■ Canister Air-Filter inspection

1. Disassemble the Canister Air-Filter and hose from their respective positions.
2. Check the Canister air-filter for contamination.
3. Is Canister Air-Filter contaminated with dust?

YES	▸ Replace as necessary and go to "Verification of Vehicle Repair" procedure
NO	▸ Go to "Canister Closing Valve(CCV) inspection" procedure

■ Canister Closing Valve(CCV) inspection

1. Reconnect all EVAP hardware that was previously disconnected
2. Disconnect hose connecting Canister Closing Valve(CCV) to canister
3. Ignition "ON" & Engine "OFF"
4. Blow air to the canister side of the valve and verify air escapes to the air filter side.
5. Install GDS and select "CANISTER CLOSE VALVE" on the Actuation Test mode
6. Activates "CANISTER CLOSE VALVE" by pressing "STRT(F1)" key
7. Blow air into hose and verify air does not escape.
8. Repeat this procedure 4 or 5 times to ensure CCV reliability.
9. Is CCV working properly?

NOTE

If hose was pinched or restricted:
1) Fueling would be difficult if not impossible.
2) Restriction or blockage could cause pressure to accumulate in tank triggering a P0451.

YES	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure
NO	▸ If CCV was stuck closed, inspect all lines and canister for liquid fuel. Replace any contaminated components and blow out lines. 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.

Terminal and connection 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	▸ 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 for open or short in power supply circuit. Measure voltage between terminal 5 of the CCV harness connector and chassis ground(Approx. 5V) Check for open or short in control circuit. Measure voltage between terminal 6 of the CCV harness connector and chassis ground(Approx. 4~5V) ▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

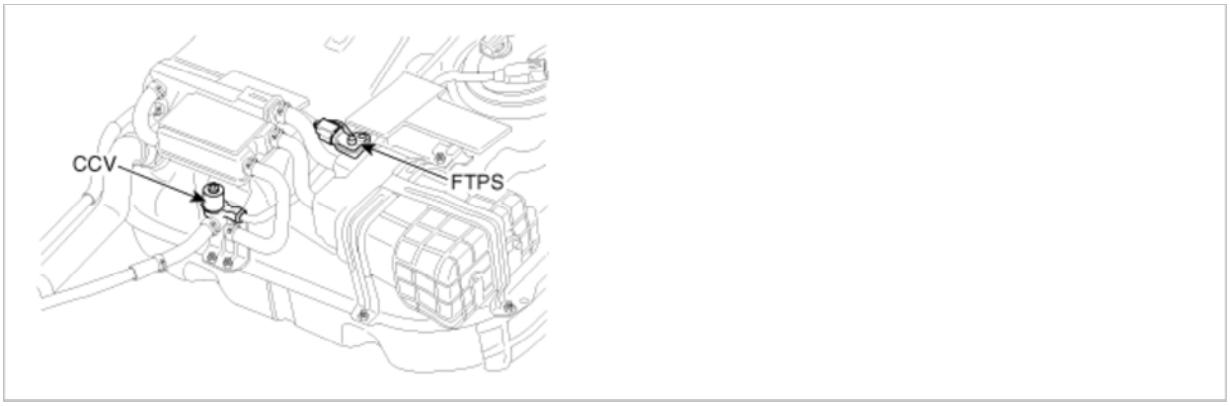
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0451 Evaporative Emission System-Pressure Sensor Range / Performance

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 PCM 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

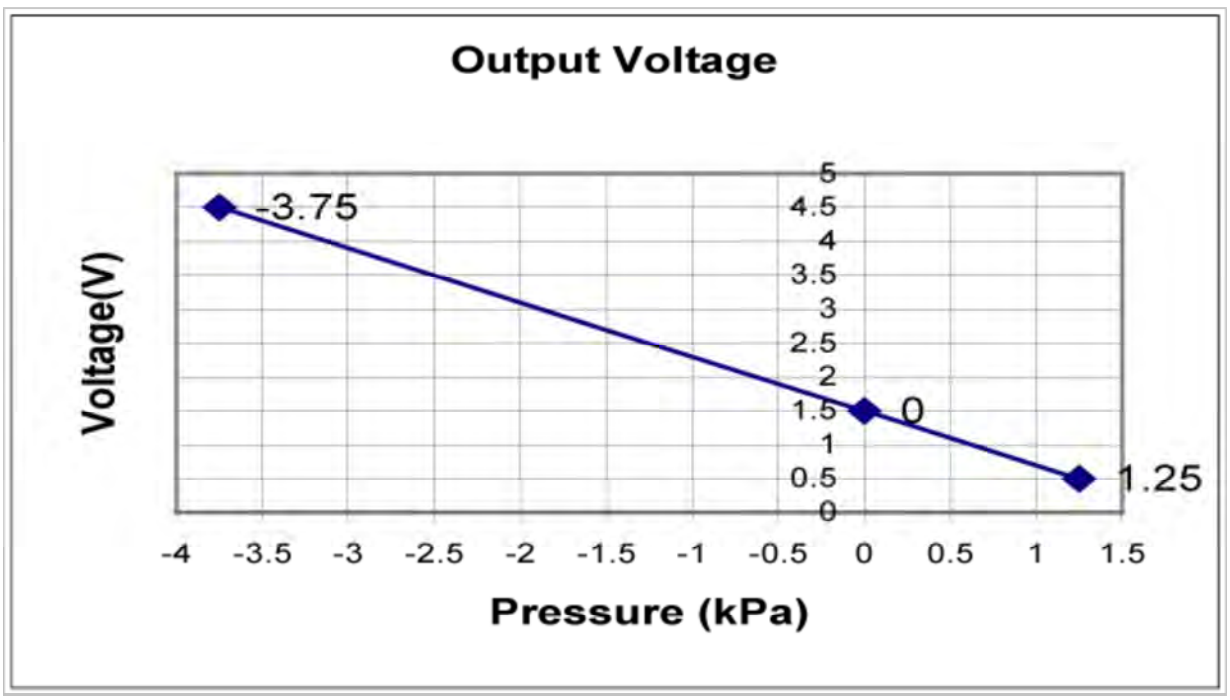
The PCM monitors pressure in the fuel tank by means of Fuel Tank Pressure Sensor (FTPS) during purge control valve opening or closing phase. This monitoring will determine if pressure sensor signal is stuck. The PCM sets DTC P0451 if pressure variation is smaller than the predetermined threshold.
If same error code is set in the next driving cycle, the PCM illuminates the MIL.

DTC Detecting Condition

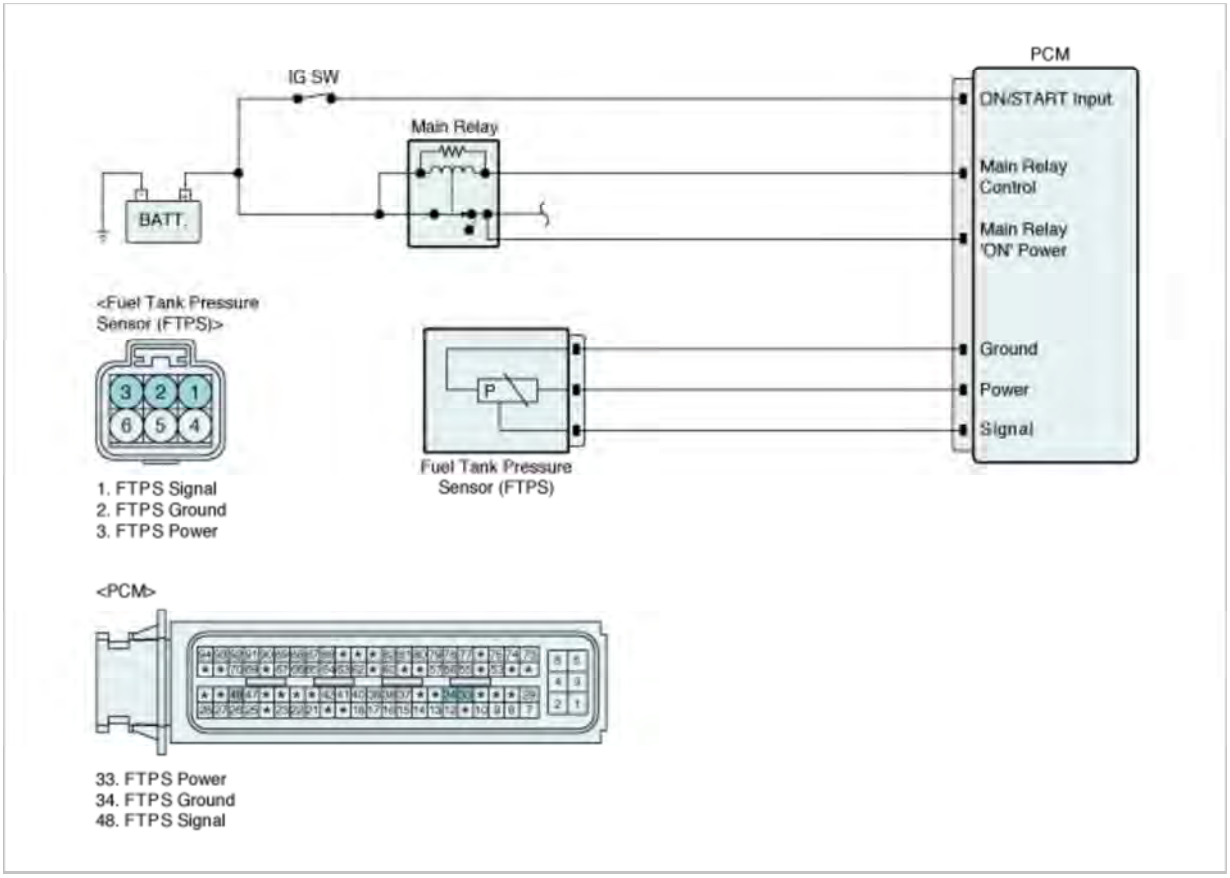
Item	Detecting Condition	Possible Cause
DTC Strategy	• Plausability Check,Signal Stuck	• Poor connection or damaged harness • Faulty FTPS
Enable Conditions	• Vehicle speed > 45km/h(28mph) • Canister purge flow variation >0.28g/sec. during 13 sec. • Minimum tank pressure signal voltage > 0,32 V • Modeled ambient air temperature >-10°C(14°F) • No relevant failure • 11 < Battery Voltage <16V	
Threshold Value	• Tank pressure signal variation < 15 mV	
Diagnostic Time	• 65Sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Pressure	-3.75 kPa(-1.10 inHg)	0 kPa(0 inHg)	1.25 kPa(0.37 inHg)
FTPS output voltage	4.5 V	1.5 V	0.5 V



Diagnostic Circuit Diagram



Monitor DTC Status

NOTE

If DTCs (or pending codes) relating to FTPS are present, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature.

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install GDS and clear DTC.
3. 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%

4. Is DTC P0451 set again?

YES	▸ Go to next step as below.
NO	▸ 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 looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Terminal and connection 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

Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between signal terminal of the sensor harness connector and chassis ground(Do not disconnect FTPS harness connector)

Specification : Voltage increases proportionally with decreasing pressure(Approx. 2.5V to 4.5V)

Pressure(kPa(hPa))	Voltage(V)
-3.75(-37.5)	4.5
0	1.5
1.25(12.5)	0.5

3. Is voltage within the specification?

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 for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary. ▸ 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. Reconnect all EVAP hardware that was previously disconnected
2. Start engine to normal operating temperature

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install GDS and clear DTC
4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below

NOTE

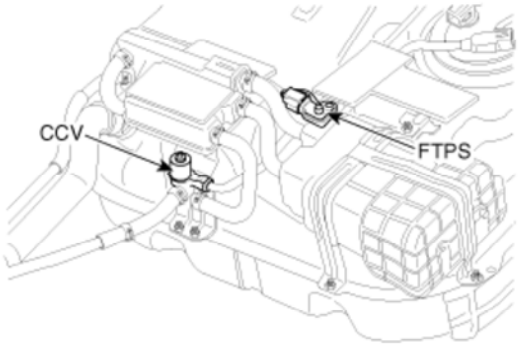
EVAP. Leakage Test enable conditions
- Following conditions must be fulfilled to start the test.
  1. Engine warm up at Idle Status
  2. No relevant DTC
  3. Fuel level is below 80%

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 > Engine Control System > P0452 Evaporative Emission System-Pressure Sensor Low Input

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 PCM 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

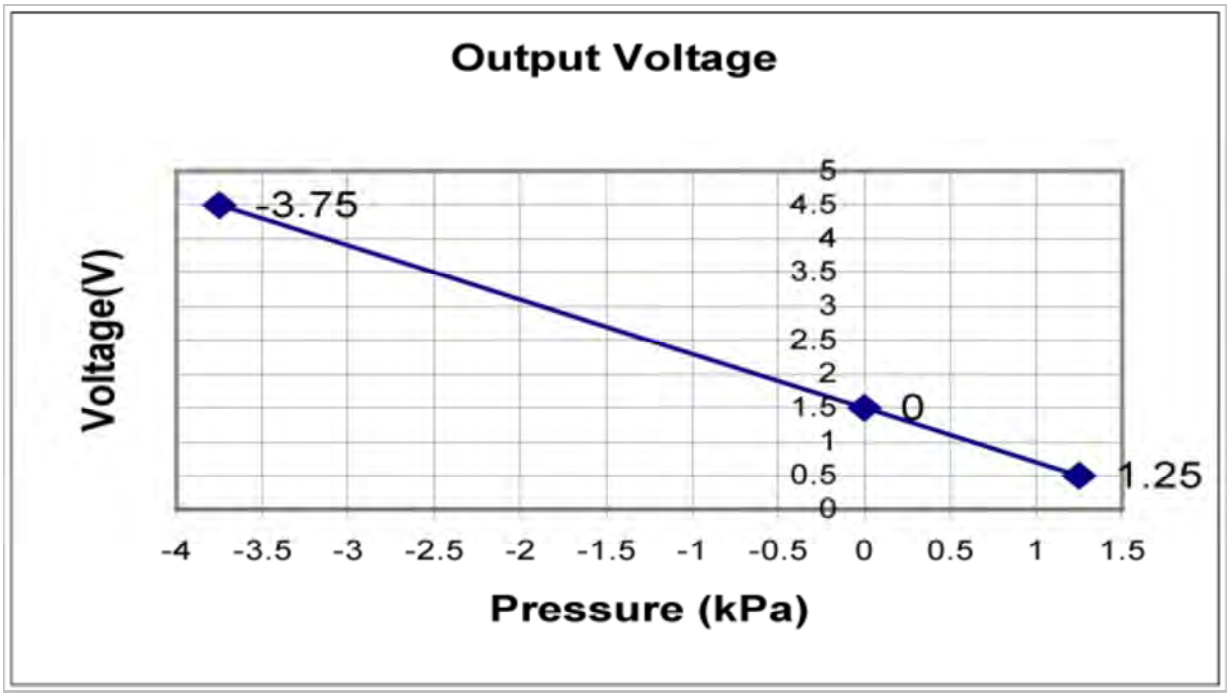
PCM sets DTC P0452 if the PCM detects signal voltage lower than the possible range of a properly operating FTPS.

DTC Detecting Condition

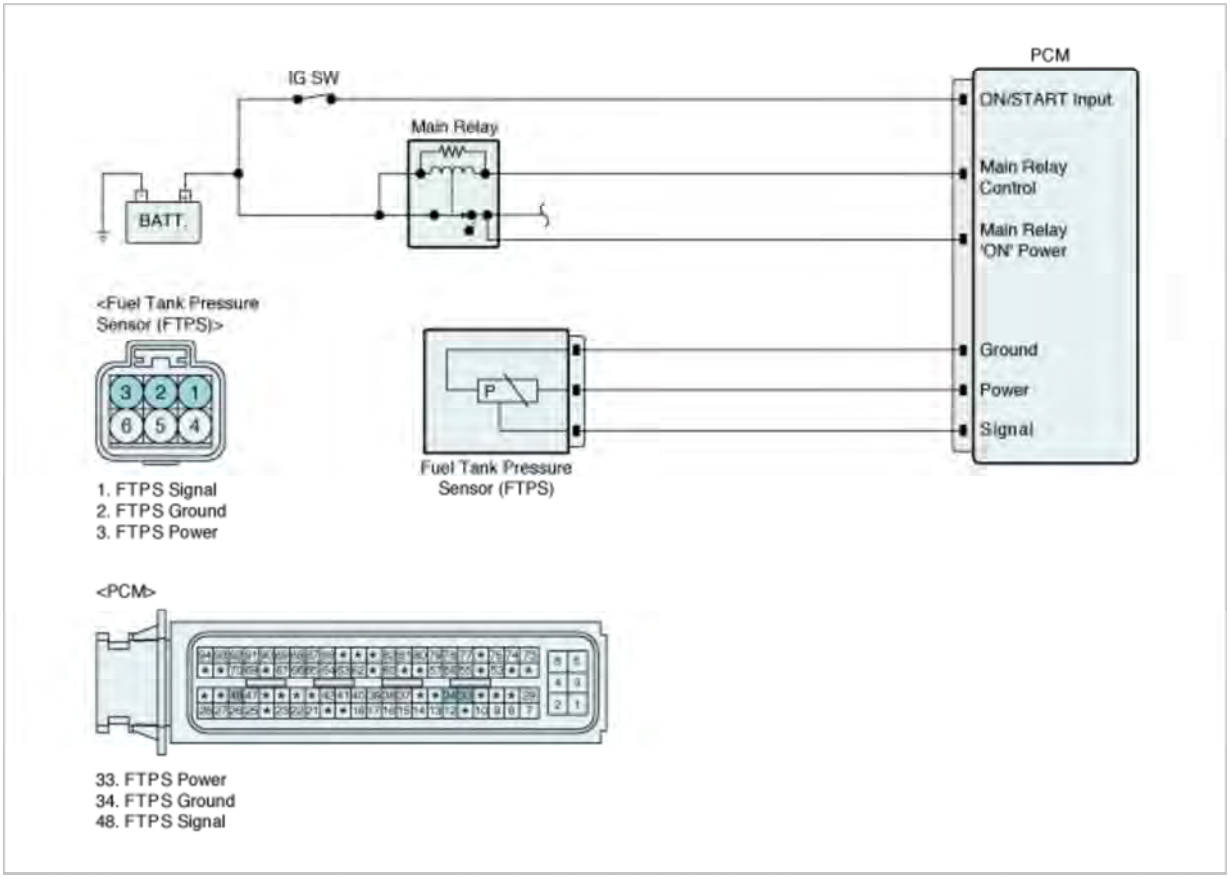
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Short to ground in FTPS harness • Poor connection or damaged harness • Faulty FTPS
Enable Conditions	• 11V< Battery voltage <16V	
Threshold Value	• Tank pressure signal < 0.32V	
Diagnostic Time	• 0.5 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Pressure	-3.75 kPa(-1.10 inHg)	0 kPa(0 inHg)	1.25 kPa(0.37 inHg)
FTPS output voltage	4.5 V	1.5 V	0.5 V

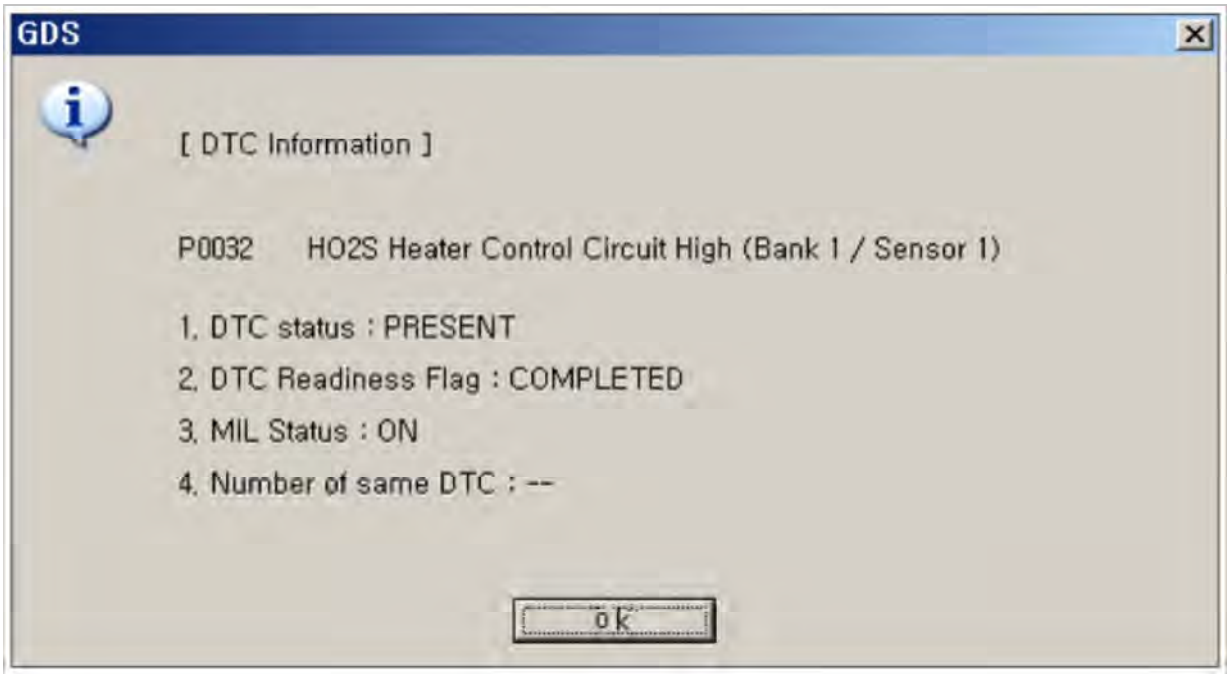


Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect FTPS connector.
3. Ignition "ON" & Engine "OFF"
4. Measure voltage between power terminal of the FTPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is voltage within the specification?

YES	▸ Go to next step as below.
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. Ignition "ON" & Engine "OFF"
2. Measure voltage between signal terminal of the FTPS harness connector and chassis ground.

Specification : Approx. 5V

3. Is voltage within the specification?

YES	▸ Go to next step as below.

NO	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Terminal and connection 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.

Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between signal terminal of the sensor harness connector and chassis ground(Do not disconnect FTPS harness connector)

Specification : Voltage increases proportionally with decreasing pressure(Approx. 2.5V to 4.5V)

Pressure(kPa(hPa))	Voltage(V)
-3.75(-37.5)	4.5
0	1.5
1.25(12.5)	0.5

3. Is voltage within the specification?

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 for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary. ▸ 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

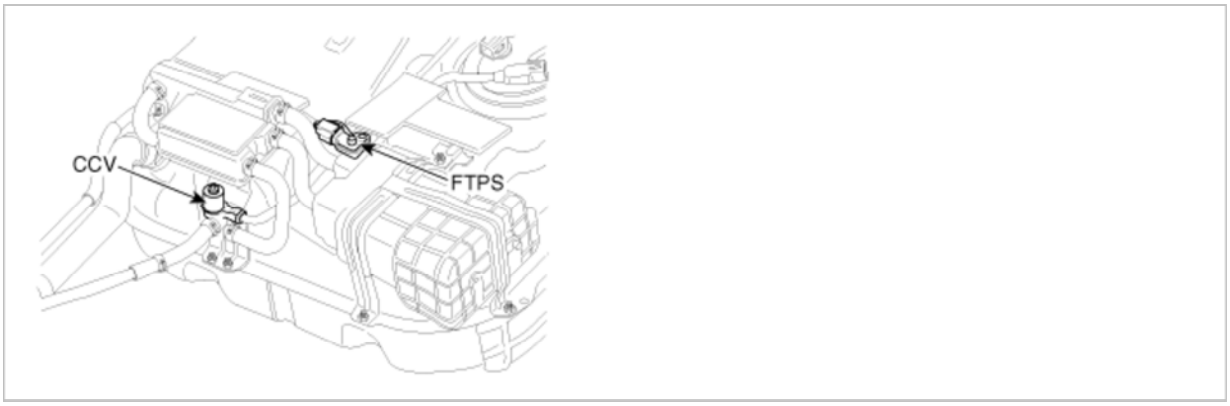
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0453 Evaporative Emission System-Pressure Sensor High Input

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 PCM 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

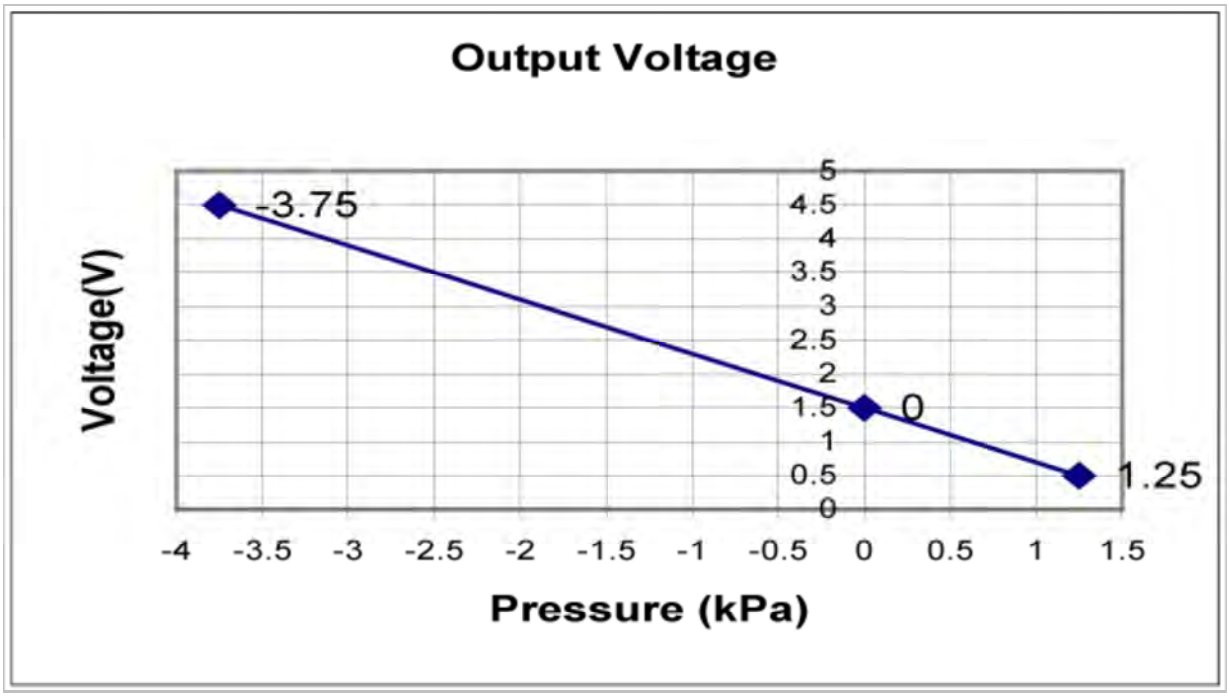
PCM sets DTC P0453 if the PCM detects signal voltage higher than the possible range of a properly operating FTPS.

DTC Detecting Condition

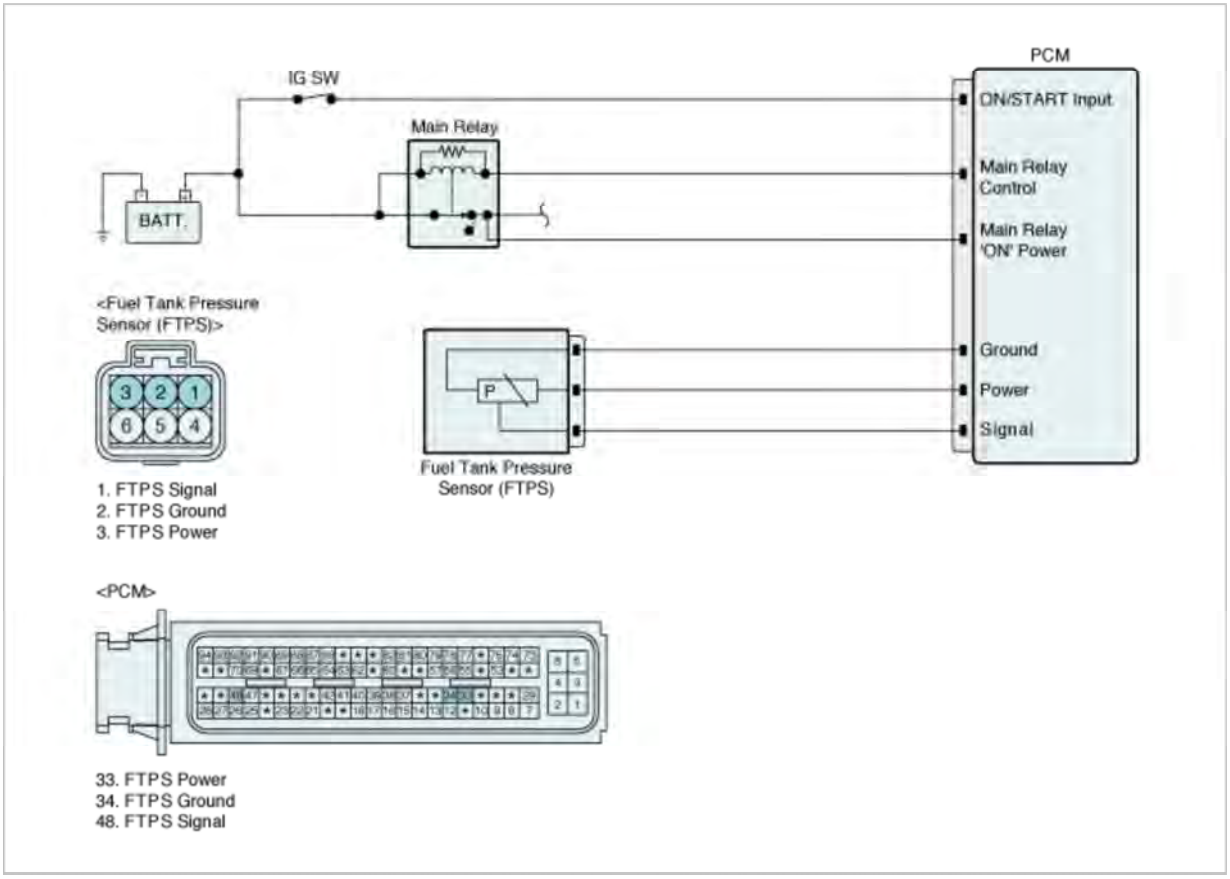
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Short to battery in FTPS harness • Open in FTPS harness • Poor connection or damaged harness • Faulty FTPS
Enable Conditions	• 11V< Battery voltage <16V	
Threshold Value	• Tank pressure signal >4.78V	
Diagnostic Time	• 0.5 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Pressure	-3.75 kPa(-1.10 inHg)	0 kPa(0 inHg)	1.25 kPa(0.37 inHg)
FTPS output voltage	4.5 V	1.5 V	0.5 V



Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Ground Circuit Inspection

1. Ignition "OFF"
2. Disconnect FTPS connector
3. Measure resistance between ground terminal of the FTPS harness connector and chassis ground

Specification : Approx. 0Ω

4. Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Check for a open or short to battery in ground circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Signal Circuit Inspection

1. Check for open in signal circuit
   (1) Ignition "ON" & Engine "OFF"
   (2) Measure voltage between signal terminal of the FTPS harness connector and chassis ground.

Specification : Approx. 5V

   (3) 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 short to battery in signal circuit
   (1) Ignition "OFF"
   (2) Disconnect PCM connector
   (3) Ignition "ON" & Engine "OFF"
   (4) Measure voltage between signal terminal of the FTPS 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.

Terminal and connection 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.

Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between signal terminal of the sensor harness connector and chassis ground(Do not disconnect FTPS harness connector)

   Specification : Voltage increases proportionally with decreasing pressure(Approx. 2.5V to 4.5V)

Pressure(kPa(hPa))	Voltage(V)
-3.75(-37.5)	4.5
0	1.5
1.25(12.5)	0.5

3. Is voltage within the specification?

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 for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary. 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 GDS 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

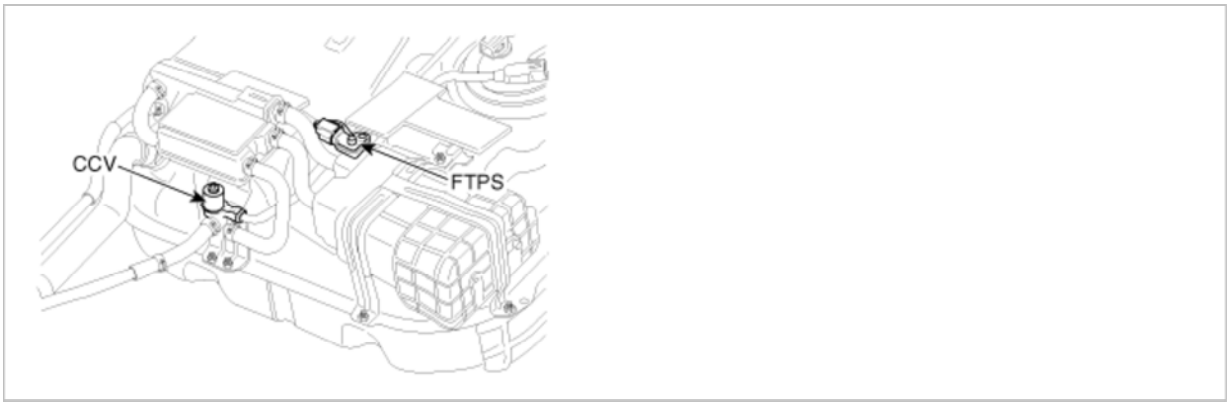
in the freeze frame data or enable conditions .

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.

Fuel System > Engine Control System > P0454 Evaporative Emission System-Pressure Sensor Intermittent

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 PCM 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 PCM 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 PCM sets DTC P0454 if the pressure fluctuation is bigger than predetermined threshold.
If same error code is set in the next driving cycle, the PCM illuminates the MIL.

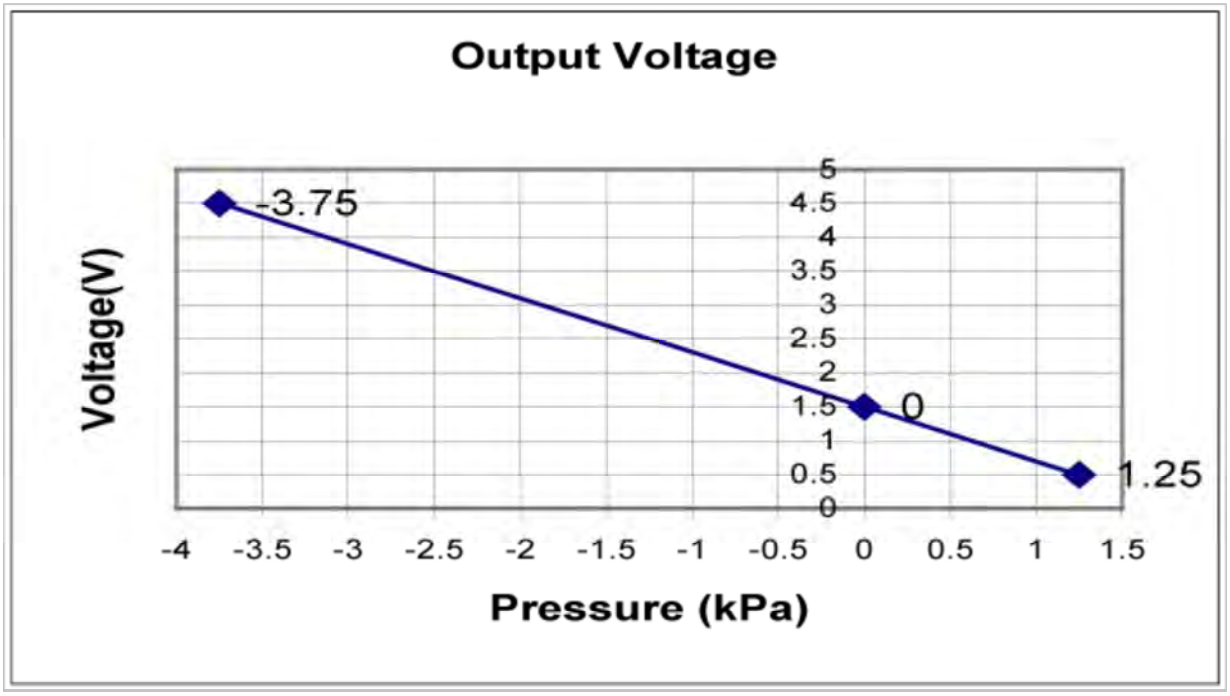
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Noisy signal check	• Poor connection or damaged harness • Faulty FTPS
Enable Conditions	• 4°C(39.2°F) < Start Coolant temp. < 35°C(95°F) • Ambient air temperature model >-10°C(14°F) • Vehicle speed< 10km/h(6mph) • Time after start >590 sec. • Limited Canister saturation • Estimated altitude< 2.4km(8000ft) • Idle speed engine operating state • Minimum canister purge time: 5~25sec.(depending on canister load) • Differential fuel tank Pressure : -11~4 hpa • 11V < Battery voltage < 16V	
Threshold Value	• Leak detection test inhibited more than 3 times due to noise in tank pressure signal	
Diagnostic Time	• 3 times Leak test inhibited by Noisy signal	

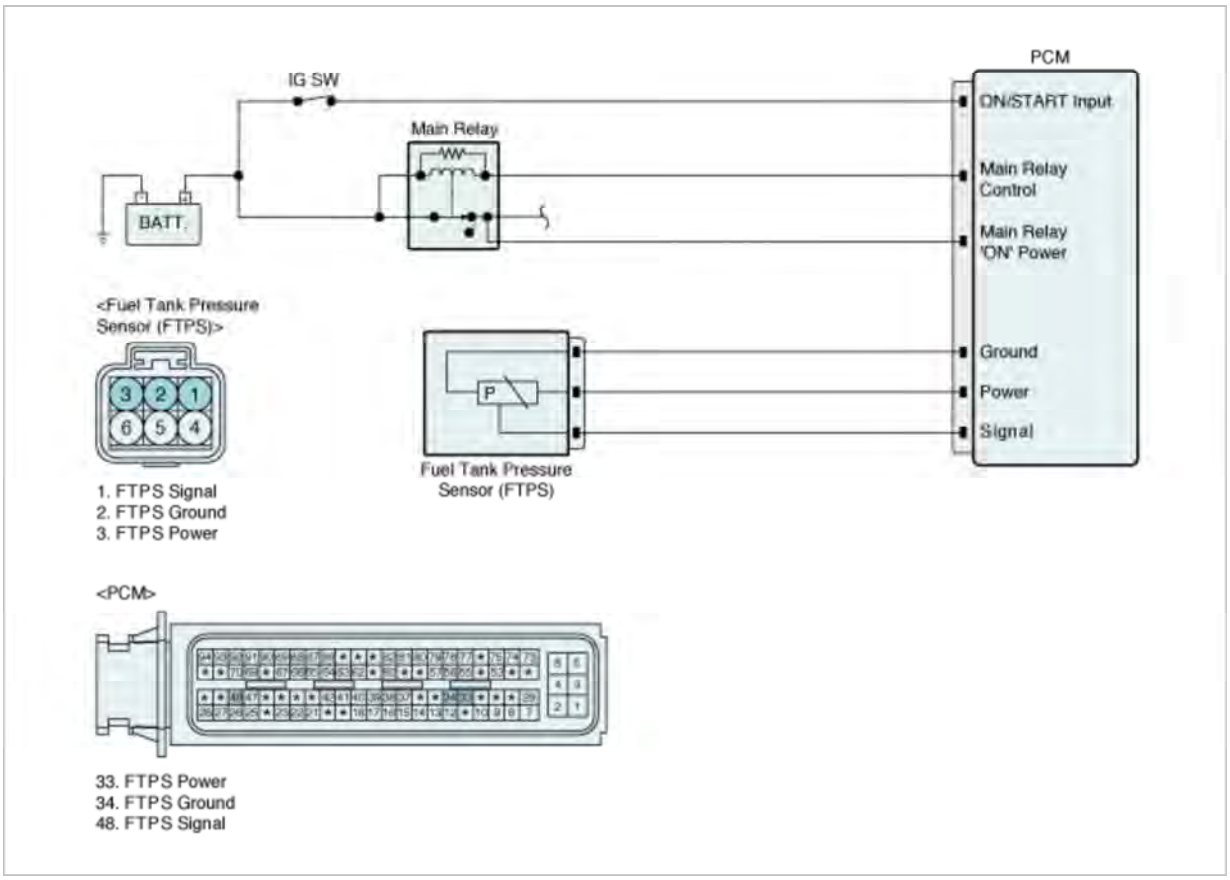
Mil On Condition	• 2 Driving Cycles	

Specification

Pressure	-3.75 kPa(-1.10 inHg)	0 kPa(0 inHg)	1.25 kPa(0.37 inHg)
FTPS output voltage	4.5 V	1.5 V	0.5 V



Diagnostic Circuit Diagram



Monitor DTC Status

NOTE

If DTCs (or pending codes) relating to FTPS are present, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature.

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install GDS and clear DTC
3. 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%

4. Is DTC P0454 set again?

YES	▸ Go to next step as below.
NO	▸ 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 looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Terminal and connection 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.

Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between signal terminal of the sensor harness connector and chassis ground(Do not disconnect FTPS harness connector)

Specification : Voltage increases proportionally with decreasing pressure(Approx. 2.5V to 4.5V)

Pressure(kPa(hPa))	Voltage(V)
-3.75(-37.5)	4.5
0	1.5
1.25(12.5)	0.5

3. Is voltage within the specification?

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 for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary. 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. Reconnect all EVAP hardware that was previously disconnected
2. Start engine to normal operating temperature

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install GDS 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 > Engine Control System > P0455 Evaporative Emission System-Leak detected (Large leak)

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

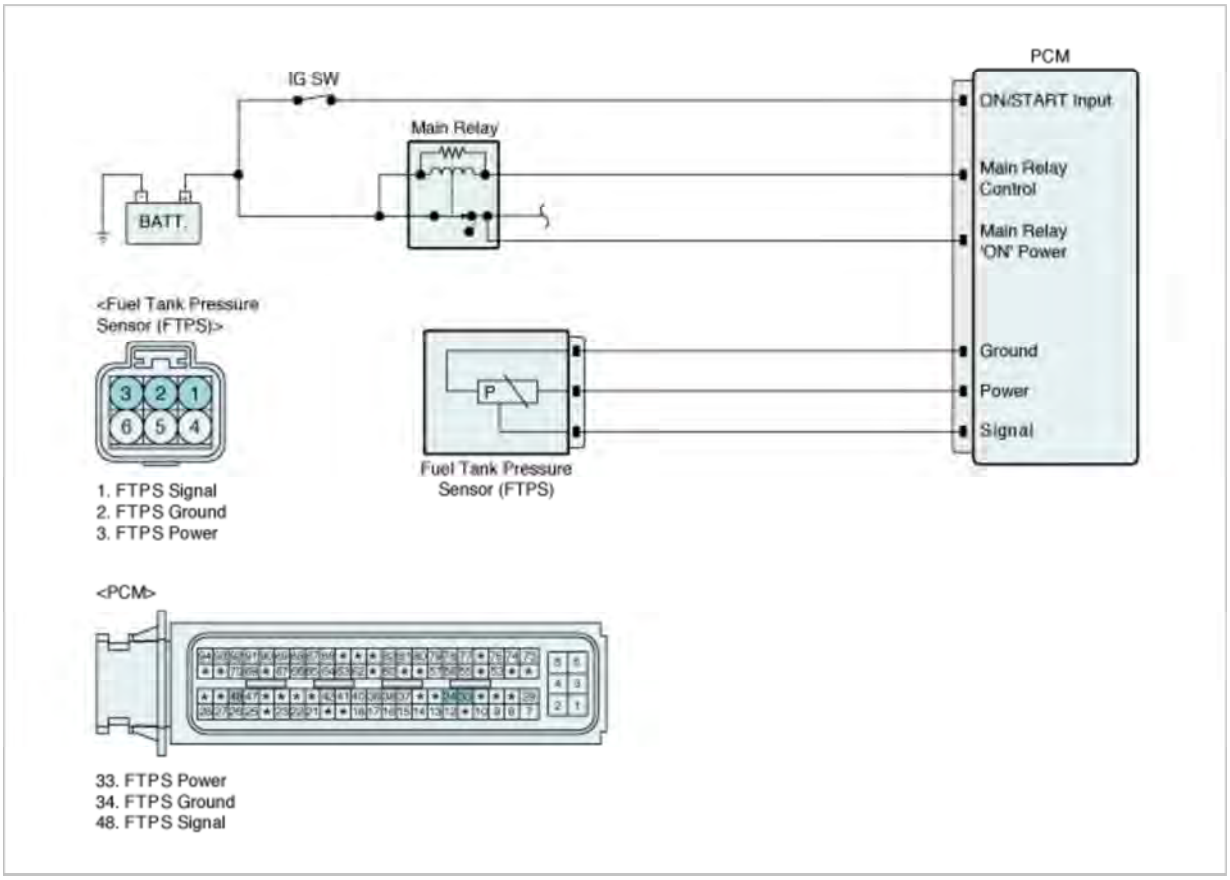
The PCM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. This vacumm generation phase will determine if there is a large leak like tank cap open or canister shut off valve (CCV) stuck open. The PCM 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 PCM illuminates the MIL.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check fuel tank underpressure during evacuation	

Enable Conditions		• 4°C(39.2°F) < Start Coolant temp. < 35°C(95°F) • Ambient air temperature model >-10°C(14°F) • Vehicle speed< 10km/h(6mph) • Time after start >590 sec. • Limited Canister saturation • Estimated altitude< 2.4km(8000ft) • Idle speed engine operating state • Minimum canister purge time: 5~25sec.(depending on canister load) • Differential fuel tank Pressure : -11~4 hpa • 11V < Battery voltage < 16V	• Leakage in EVAP. System
Threshold Value	Case1	• Time to generate underpressure < -1500Pa(-15hPa) in fuel tank too long	
	Case2	• Time for tank pressure to decrease < 150 Pa(1.5 hPa) during Evacuation	
Diagnostic Time	Case1	• 30 sec. in idle when all enable conditions fulfilled	
	Case2	• 20 sec. in idle when all enable conditions fulfilled	
Mil On Condition		• 2 Driving Cycles	

Diagnostic Circuit Diagram



Monitor DTC Status

NOTE

If any codes relating to Fuel tank pressure sensor, Canister closing valve or PCSV circuits are present, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature

NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install GDS and clear DTC
3. 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%

4. Is DTC P0455 set again?

YES	▸ Go to next step as below.
NO	▸ 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 looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Fuel Filler Cap & Pipe Inspection

1. Check fuel filler cap for being tightly installed, has o-ring seal installed and is in good condition.
2. Verify cap releases pressure / vacuum at specified values

Specification : Approx. 2 psi pressure and approximately 1.5 inches of mercury vacuum).

3. Are cap, o-ring and release pressures okay?

YES	▸ Thoroughly check fuel filler pipe for cracks, damage and o-ring seat for deformation and replace as necessary. Go to next step as below.
NO	▸ Replace fuel filler cap and go to "Verification of Vehicle Repair" procedure

■ PCSV to Intake manifold Line Inspection

1. Ignition "OFF"
2. Disconnect the hose leading from the PCSV to intake manifold at intake manifold.
3. Using a vacuum pump, apply vacuum to the manifold side of the vacuum hose and verify PCSV holds vacuum.
4. Ignition "ON" & Engine "OFF"
5. Install GDS and select "EVAP PURGE VALVE" on the Actuation Test mode
6. Activates "EVAP PURGE VALVE" by pressing "STRT(F1)" key
7. Verify PCSV release vacuum while valve is activating(should hear a faint click from PCSV)
8. Repeat this procedure 4 or 5 times to ensure PCSV reliability.
   Specification:

Test Condition	Specification
PCSV is ON(should hear a faint click from PCSV)	Holds vacuum
PCSV is OFF	Release vacuum

9. Is PCSV working properly?

YES	▸ Go to next step as below
NO	▸ Verify arrow on PCSV is pointing towards intake manifold. If it is not, reverse installation. Reinstall as necessary and go to "Verification of Vehicle Repair" procedure.

	If OK, thoroughly check fuel vapor hoses and hose clamps between PCSV and intake manifold. Repair as necessary. If OK, test with a new PCSV and check for proper operation. If problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure

■ Canister Closing Valve(CCV) Line Inspection

1. Reconnect all EVAP hardware that was previously disconnected
2. Disconnect hose connecting Canister Closing Valve(CCV) to canister
3. Ignition "ON" & Engine "OFF"
4. Blow air to the canister side of the valve and verify air escapes to the air filter side.
5. Install GDS and select "CANISTER CLOSE VALVE" on the Actuation Test mode
6. Activates "CANISTER CLOSE VALVE" by pressing "STRT(F1)" key
7. Blow air into hose and verify air does not escape.
8. Repeat this procedure 4 or 5 times to ensure CCV reliability.
9. Is CCV working properly?

YES	▸ Go to next step as below
NO	▸ Check for cracks or damage in hose connecting CCV and canister. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. If OK, replace CCV. If CCV was stuck closed, inspect all lines and canister for liquid fuel. Replace any contaminated components and blow out lines and go to "Verification of Vehicle Repair" procedure

■ Fuel Tank Pressure Sensor(FTPS) Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between signal terminal of the sensor harness connector and chassis ground(Do not disconnect FTPS harness connector)

Specification : Voltage increases proportionally with decreasing pressure(Approx. 2.5V to 4.5V)

Pressure(kPa(hPa))	Voltage(V)
-3.75(-37.5)	4.5
0	1.5
1.25(12.5)	0.5

3. Is voltage within the specification?

YES	▸ Go to "Purge Control Solenoid Valve(PCSV) Inspection" procedure
NO	▸ Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary. 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

■ PCSV to Canister Line Inspection

1. Check for leakage in hose
   (1) Reconnect all EVAP hardware that was previously disconnected
   (2) Disconnect the hose leading from the canister to the PCSV at canister
   (3) Using a vacuum pump, apply specified vacuum[Approx. 4 inHg(14 kPa)] to the manifold side of the valve for 1 minute and verify PCSV holds vacuum.
   (4) Is pressure within specification?

YES	▸ Go to next step as below
NO	▸ Check for cracks or damage in hose connecting PCSV and canister. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for leakage in canister
   (1) Disconnect hose clamps and remove canister assembly
   (2) Block the hose of between:
   - Canister and fuel filler neck
   - Canister and CCV
   - Canister and PCSV
   (3) Apply maximum of 4 inHg(14 kPa) pressure through fuel tank port from canister
   (4) With system sealed and pressurized, check for leaks
   (5) Were any leak(s) found?

YES	▸ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure
NO	▸ Go to "Fuel Tank Line Inspection" procedure

■ Fuel Tank Line Inspection

1. Relieve the fuel system pressure and remove the fuel tankCaution)
   Before removing the fuel tank, make sure the fuel hoses are not leaking.
2. Block all of the following outlets:
   (1) Fuel lines
   (2) Fuel filler neck
3. Apply maximum of 10cmHg(4 inHg) pressure to the EVAP. hose at the fuel tank. Then, pinch the EVAP. hose to retain the pressure
4. Check the suspect area for leaks with a soap solution.
5. Were any leak(s) found?

YES	▸ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure
NO	▸ 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

Verification of Vehicle Repair

1. Reconnect all EVAP hardware that was previously disconnected
2. Start engine to normal operating temperature

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install GDS 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 > Engine Control System > P0456 Evaporative Emission System-Leak detected (very small leak)

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 PCM 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 PCM 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 PCM illuminates the MIL.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring Fuel Tank Pressure Trend after generating underpressure in Fuel Tank	• Fuel filler cap damage or missing • Faulty or damaged fuel filler pipe • Leaking, disconnected or plugged fuel vapor lines • CANISTER CLOSE VALVE • PCSV • Canister • Faulty Fuel Tank Pressure Sensor (FTPS) • Fuel in lines due to faulty Rollover Valve • On-Board Refueling Vapor Recovery Valve (ORVR valve) or stuck closed CCV
Enable Conditions	• 4°C(39.2°F) < Start Coolant temp.< 35°C(95°F) • Ambient Air temperature model > -10°C • Time after Start 590 sec. • Vehicle speed< 5km/h(3mph) • Estimated altitude< 2.4km(8000ft) • Differential fuel tank pressure: -11 ~ 4hPa • Limited canister saturation >-10% • Minimum purge time 5~25 sec(depending on canister load) • No relevant failure • 11V < Battery voltage > 16V	
Threshold Value	• 0.73mm (0.03in) > Leak diameter > 0.42mm (0.017in)	
Diagnostic Time	• 30 sec. In idle when all enable conditions fulfilled	
Mil On Condition	• 3 Driving Cycles	

Monitor DTC Status

1. Start engine to normal operating temperature

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install GDS and clear DTC
3. 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%

4. Is DTC P0455 set again?

YES	▸ Go to next step as below

NO	▸ 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 looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

Component Inspection

■ PCSV to Intake manifold Line Inspection

1. Ignition "OFF"
2. Disconnect the hose leading from the PCSV to the intake manifold at PCSV
3. Using a vacuum pump, apply specified vacuum[Approx. 25cmHg(10 inHg)] to the manifold side of the valve and verify PCSV holds vacuum.
4. Ignition "ON" & Engine "OFF"
5. Install GDS and select "EVAP PURGE VALVE" on the Actuation Test mode
6. Activates "EVAP PURGE VALVE" by pressing "STRT(F1)" key
7. Verify PCSV release vacuum while valve is activating(should hear a faint click from PCSV)
8. Repeat this procedure 4 or 5 times to ensure PCSV reliability.
   Specification:

Test Condition	Specification
PCSV is ON(should hear a faint click from PCSV)	Holds vacuum
PCSV is OFF	Release vacuum

9. Is PCSV working properly?

YES	▸ Go to next step as below
NO	▸ Verify arrow on PCSV is pointing towards intake manifold. If it is not, reverse installation. Reinstall as necessary and go to "Verification of Vehicle Repair" procedure. If OK, thoroughly check fuel vapor hoses and hose clamps between PCSV and intake manifold. Repair as necessary. If OK, test with a new PCSV and check for proper operation. If problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure

■ Canister Closing Valve(CCV) Line Inspection

1. Reconnect all EVAP hardware that was previously disconnected
2. Disconnect hose connecting Canister Closing Valve(CCV) to canister
3. Ignition "ON" & Engine "OFF"
4. Blow air to the canister side of the valve and verify air escapes to the air filter side.
5. Install GDS and select "CANISTER CLOSE VALVE" on the Actuation Test mode
6. Activates "CANISTER CLOSE VALVE" by pressing "STRT(F1)" key
7. Blow air into hose and verify air does not escape.
8. Repeat this procedure 4 or 5 times to ensure CCV reliability.
9. Is CCV working properly?

YES	▸ Go to next step as below
NO	▸ Check for cracks or damage in hose connecting CCV and canister. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure. If OK, replace CCV. If CCV was stuck closed, inspect all lines and canister for liquid fuel. Replace any contaminated components and blow out lines and go to "Verification of Vehicle Repair" procedure

■ Fuel Tank Pressure Sensor(FTPS) Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between signal terminal of the sensor harness connector and chassis ground(Do not disconnect FTPS harness connector)

Specification : Voltage increases proportionally with decreasing pressure(Approx. 2.5V to 4.5V)

Pressure(kPa(hPa))	Voltage(V)
-3.75(-37.5)	4.5
0	1.5
1.25(12.5)	0.5

3. Is voltage within the specification?

YES	▸ Go to "Purge Control Solenoid Valve(PCSV) Inspection" procedure
NO	▸ Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary. 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

■ PCSV to Canister Line Inspection

1. Check for leakage in hose
   (1) Reconnect all EVAP hardware that was previously disconnected
   (2) Disconnect the hose leading from the canister to the PCSV at canister
   (3) Using a vacuum pump, apply specified vacuum[Approx. 4 inHg(14 kPa)] to the manifold side of the valve for 1 minute and verify PCSV holds vacuum.
   (4) Is pressure within specification?

YES	▸ Go to next step as below
NO	▸ Check for cracks or damage in hose connecting PCSV and canister. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

2. Check for leakage in canister
   (1) Disconnect hose clamps and remove canister assembly
   (2) Block the hose of between:
   - Canister and fuel filler neck
   - Canister and CCV
   - Canister and PCSV
   (3) Apply maximum of 4 inHg(14 kPa) pressure through fuel tank port from canister
   (4) With system sealed and pressurized, check for leaks
   (5) Were any leak(s) found?

YES	▸ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure
NO	▸ Go to next step as below

■ Fuel Tank Line Inspection

1. Relieve the fuel system pressure and remove the fuel tankCaution)
   Before removing the fuel tank, make sure the fuel hoses are not leaking.
2. Block all of the following outlets:
   (1) Fuel lines
   (2) Fuel filler neck
3. Apply maximum of 10cmHg(4 inHg) pressure to the EVAP. hose at the fuel tank. Then, pinch the EVAP. hose to retain the pressure
4. Check the suspect area for leaks with a soap solution.
5. Were any leak(s) found?

YES	▸ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure
NO	▸ 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.

Verification of Vehicle Repair

1. Reconnect all EVAP hardware that was previously disconnected
2. Start engine to normal operating temperature

> NOTE
>
> Evaporative Emissions Systems (EVAP) Leak Tests can be run by the GDS. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

3. Install GDS 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 > Engine Control System > P0501 Vehicle Speed Sensor \'A\' Range/Performance

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 PCM not only if the vehicle speed is low or high but also if the vehicle is or is not moving. The PCM 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

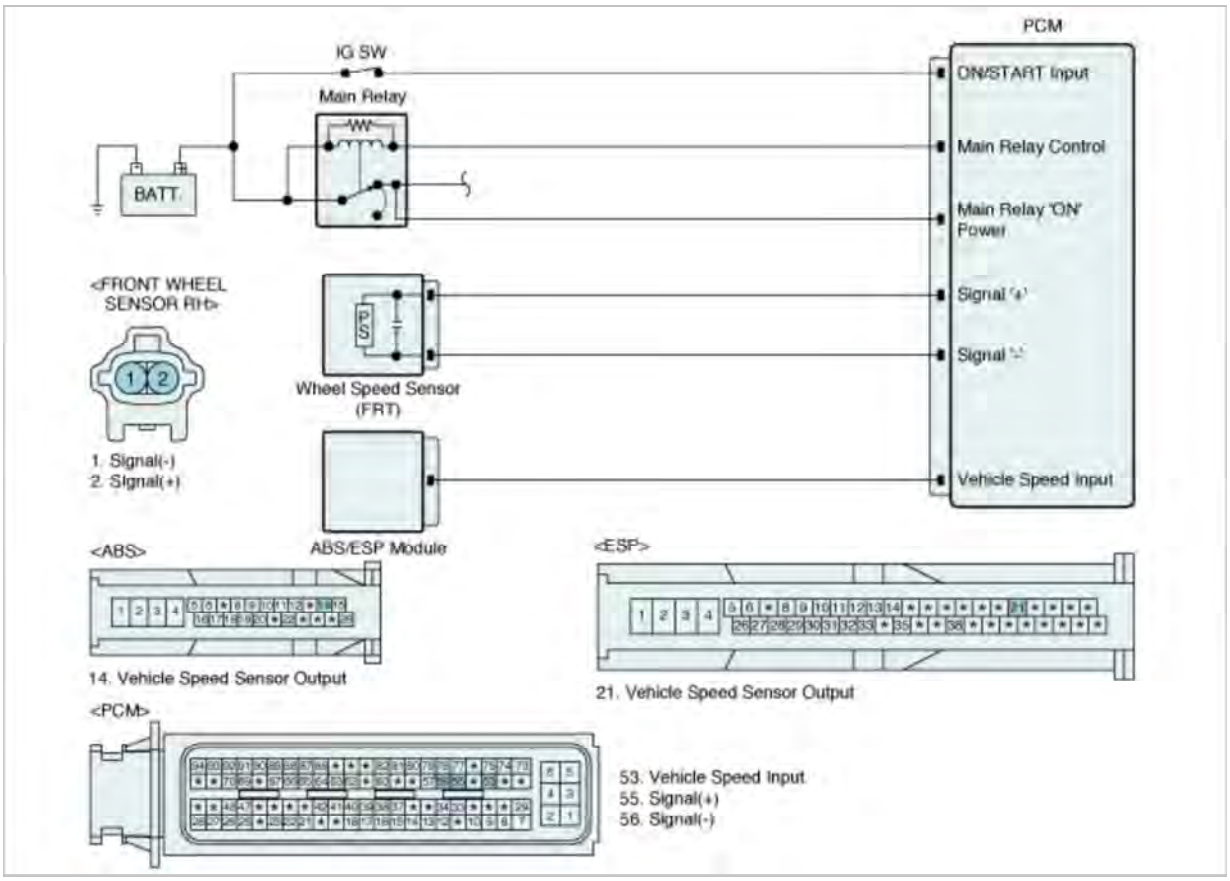
The PCM evaluates engine speed and mass air flow if there is no vehicle speed signal. This evaluation of both values will detect open circuit or short circuit errors on the wheel speed sensor. The PCM sets DTC P2159 if there is no vehicle speed signal from wheel speed sensor while both engine speed and mass air flow are higher than predetermined threshold during the predetermined time

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy	case1	• Plausibility Check	• Open or short in harness • Poor connection or damaged harness • VSS
	case2	• Electrical Check	
Enable Conditions	case1	• Engine speed >2100rpm • Engine Load > 446 mg/rev • No fuel injection shut off • Coolant Temp. > 60°C(140°F) • 10V < Battery voltage < 16 V	
	case2	• Vehicle speed > 0 • 10V < Battery voltage < 16 V	
Threshold Value	case1	• Vehicle Speed = 0 with high engine speed and engine load	

	case2	• Signal voltage exceeds threshold	
Diagnostic Time	case1	• 60sec.	
	case2	• 10sec.	
Mil On Condition		• 2 Driving Cycles	

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Signal Circuit Inspection

■ **[With ABS]**

1. Check for short to ground in signal circuit
   (1) Ignition "OFF"
   (2) Disconnect PCM and ABS Control Module connectors
   (3) Measure resistance between Vehicle speed input terminal of PCM 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 battery in signal circuit
   (1) Ignition "ON" & Engine"OFF"
   (2) Measure voltage between Vehicle speed input terminal of PCM harness connector and chassis ground

   Specification : Approx. 0V

   (3) 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 signal circuit
   (1) Ignition "OFF"
   (2) Measure resistance between terminals 53 of the PCM harness connector and 14 of the ABS Control Module harness connector

   Specification : Approx. 0Ω

   (3) Is resistance within the specification?

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	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

■ [Without ABS system]

1. Check for short to ground in Signal circuit
   (1) Ignition "OFF"
   (2) Measure resistance between Vehicle speed input terminal of PCM harness connector and Vehicle speed output terminal of ABS/ESP Control Module harness connector.

   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 battery in signal circuit
   (1) Ignition "ON" & Engine"OFF"
   (2) Measure voltage between Vehicle speed input terminal of PCM harness connector and chassis ground

   Specification : Approx. 0V

   (3) 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 signal circuit
   (1) Ignition "OFF"
   (2) Measure resistance between Vehicle speed input terminal of PCM harness connector and Vehicle speed output terminal of ABS/ESP Control Module harness connector.

   Specification : Approx. 0Ω

   (3) Is resistance within the specification?

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	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

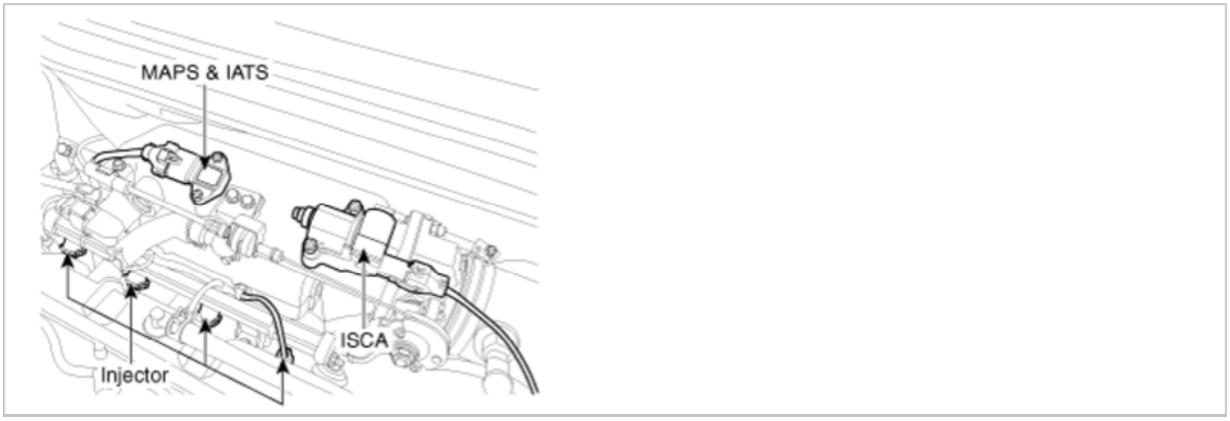
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0505 Idle Air Control System

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 PCM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the throttle valve opening is stable. The PCM sets DTC P0505 if the difference to the target idle engine speed is lower or higher than the predetermined threshold.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Plausibilit Check	• A stuck or binding throttle plate • Maladjustment of the accelerator cable • Restriction in intake or exhaust system • Carbonustment of the accelerator cable • Contact resistance in connectors • Faulty ICA valve
Enable Conditions	• No relevant failure • Catalyst heating active • Drive train is not engaged • Estimated altitude > 820 hpa • 11V< Battery voltage <16V • Time after start elapsed > 20 sec. • Lambda controller not active	
Threshold Value	• Integral of deviation between MAP_setpoint and MAP_sensor > threshold value.	
Diagnostic Time	• 12 seconds	
Mil On Condition	• 2 Driving Cycles	

Signal Waveform & Data

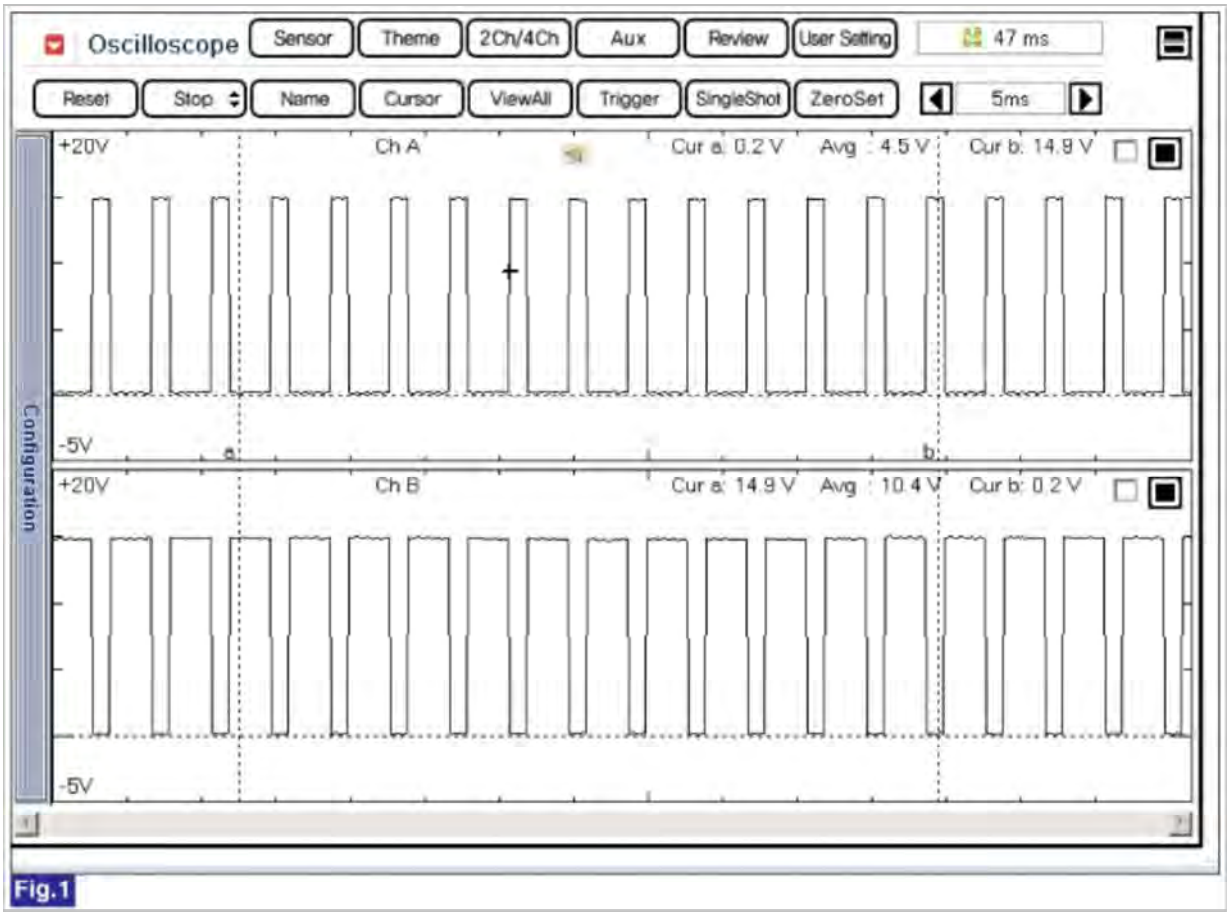


Fig 1) The above waveforms are the voltage signals generated when the ISCA operates. This ISCA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ISCA Opening coil during idle.
The right side is the waveform of the ISCA Closing coil during idle.

Monitor DTC Status

NOTE

If any MAFS or ISCA codes are present, do ALL REPAIRS associated with them before proceeding with this troubleshooting tree.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

System Inspection

■ Air Leakage Inspection

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Check for throttle Plate being held open with excessive carbon deposits
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Positive crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage
2. 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 next step as below

■ Check for restricted intake or exhaust system

1. Visually/physically inspect the following items:
   - Air cleaner filter element for excessive dirt or for any foreign objects
   - Throttle body inlet for damage or for any foreign objects
   - 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 next step as below

■ Accelerator Cable & Throttle plate Inspection

1. Visually/physically inspect the following items. Repair or adjust as necessary and go to next step.
   - Check that the Accelerator Cable is not sticking or moving sluggishly.
   - Check Accelerator Cable free play [0.040~0.120 in. (1.0~3.0 mm)].
2. Remove Intake Hose and inspect Throttle Plate for excessive carbon deposits.
3. Is Throttle Plate being held open with excessive carbon deposits?

YES	▸ Replace or repair 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 next step as below

Component Inspection

■ ISCA 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 GDS 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 Valve moving freely and not carbon fouled?

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 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

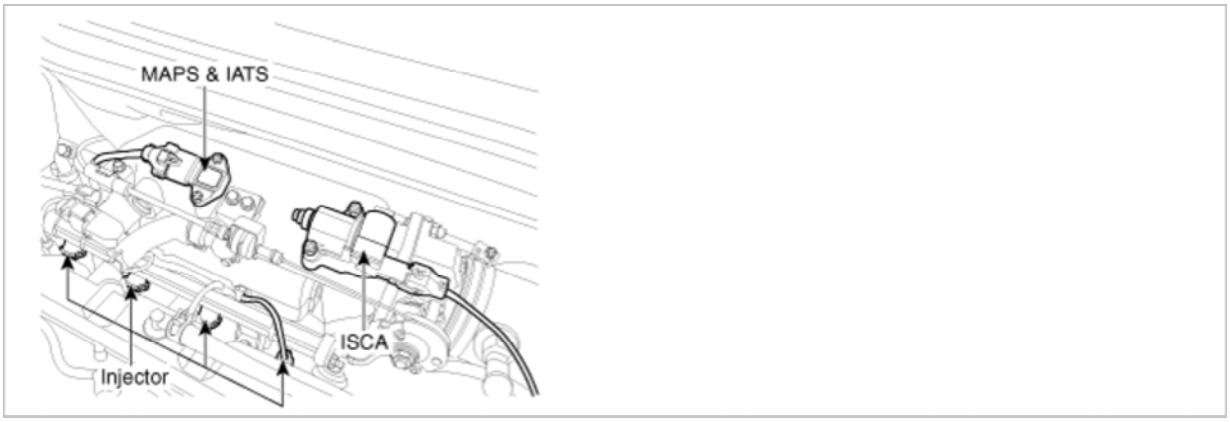
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0506 Idle Air Control System-RPM Lower than Expected

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 PCM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the throttle valve opening is stable. The PCM 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	• Monitor deviation between target idle speed and actual engine speed	• Restriction in intake or exhaust system • Carbonustment of the accelerator cable • Contact resistance in connectors • Faulty ICA valve
Enable Conditions	• Coolant temperature >74°C(165.2°F) • Closed throttle : 10sec.(continuously) • Vehicle speed = 0 • 20 sec. after engine start. • 10V< Battery voltage <16V • No relevant failure • Engine load < 1000 mg/rev	
Threshold Value	• Engine speed-Target idle speed < -100rpm (Engine speed too low)	
Diagnostic Time	• 16 seconds	
Mil On Condition	• 2 Driving Cycles	

Signal Waveform & Data

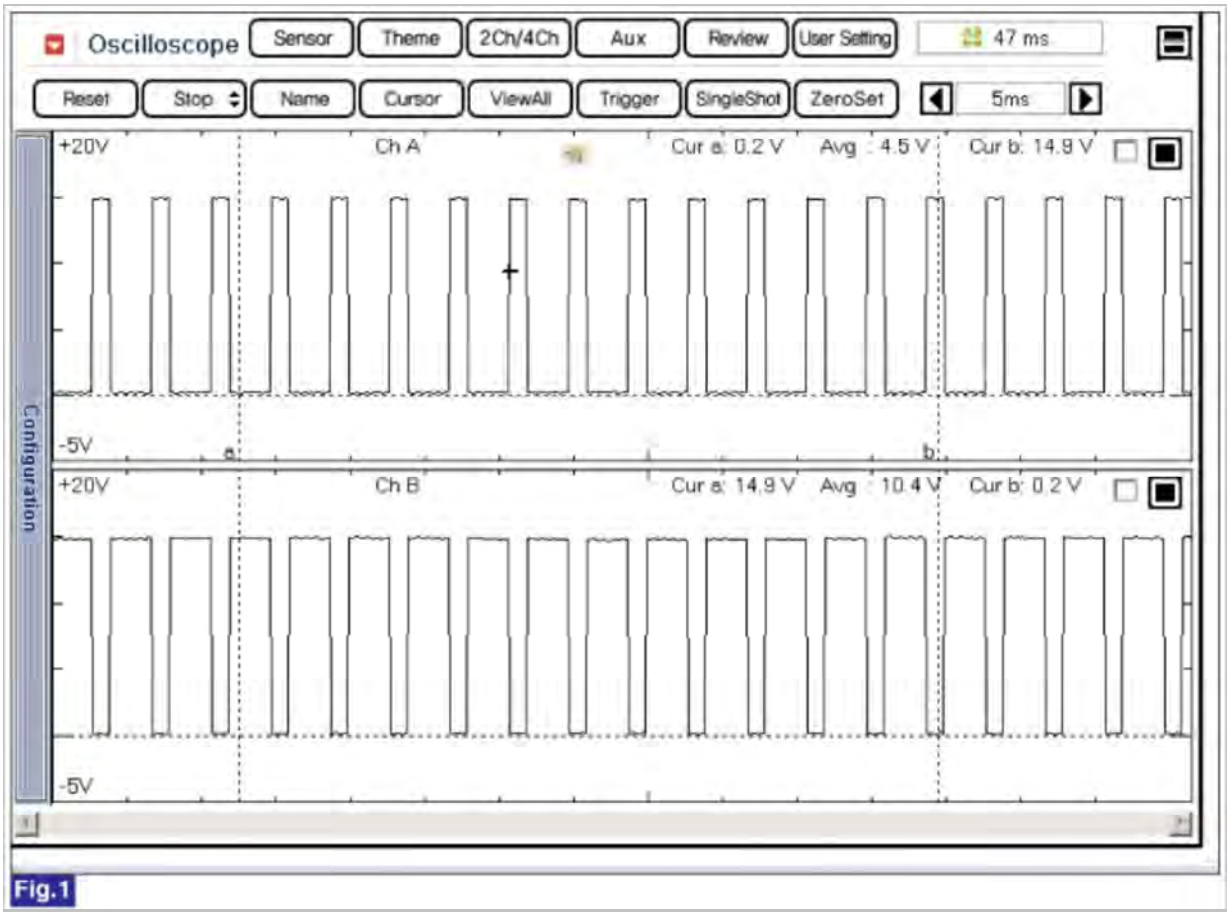


Fig 1) The above waveforms are the voltage signals generated when the ISCA operates. This ISCA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ISCA Opening coil during idle.
The right side is the waveform of the ISCA Closing coil during idle.

Monitor DTC Status

NOTE

If any MAFS or ISCA codes are present, do ALL REPAIRS associated with them before proceeding with this troubleshooting tree.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

System Inspection

■ Check for restricted intake or exhaust system

1. Visually/physically inspect the following items:
   - Air cleaner filter element for excessive dirt or for any foreign objects
   - Throttle body inlet for damage or for any foreign objects
   - 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 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 next step as below

Component Inspection

■ ISCA 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 GDS 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 Valve moving freely and not carbon fouled?

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 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

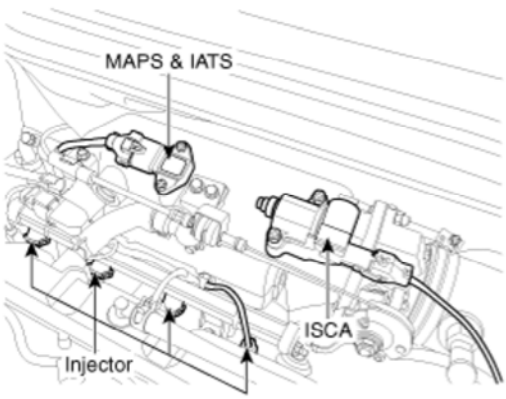
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0507 Idle Air Control System-RPM Higher than Expected

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 PCM monitors engine speed deviation from the target idle engine speed when the vehicle is stopped and the throttle valve opening is stable. The PCM sets DTC P0507 if the difference to the target idle engine speed is higher than the predetermined threshold.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitor deviation between target idle speed and actual engine speed	• A stuck or binding throttle plate • Maladjustment of the accelerator cable • Contact resistance in connectors • Faulty ICA valve
Enable Conditions	• Coolant temperature >74°C(165.2°F) • Closed throttle : 10sec.(continuously) • Vehicle speed = 0 • 20 sec. after engine start. • 10V< Battery voltage <16V • No relevant failure • Engine load < 1000 mg/rev	
Threshold Value	• Engine speed-Target idle speed > +200rpm (Engine speed too high)	
Diagnostic Time	• 16 seconds	
Mil On Condition	• 2 Driving Cycles	

Signal Waveform & Data

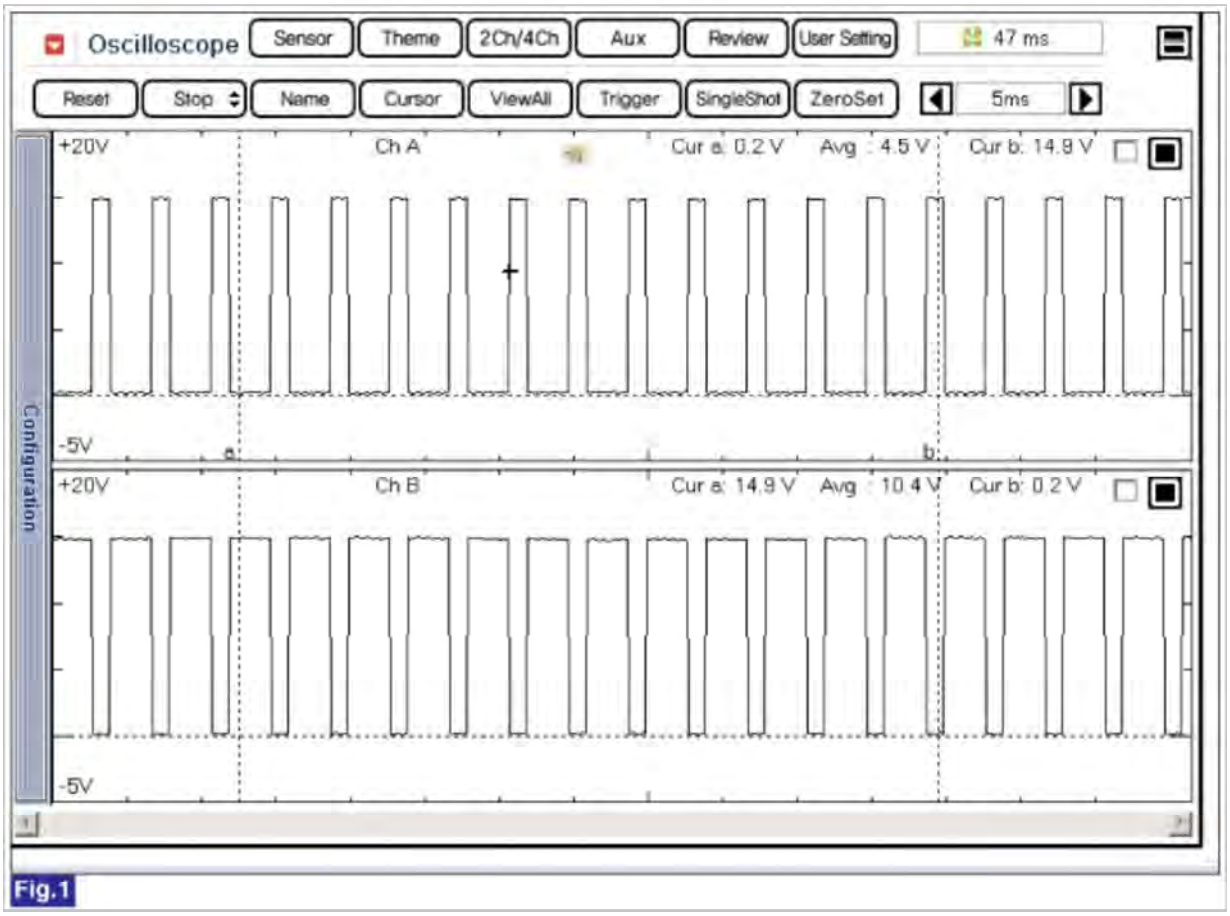


Fig 1) The above waveforms are the voltage signals generated when the ISCA operates. This ISCA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ISCA Opening coil during idle.
The right side is the waveform of the ISCA Closing coil during idle.

Monitor DTC Status

NOTE

If any MAFS or ISCA codes are present, do ALL REPAIRS associated with them before proceeding with this troubleshooting tree.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

System Inspection

■ Accelerator Cable & Throttle plate Inspection

1. Visually/physically inspect the following items. Repair or adjust as necessary and go to next step.
   - Check that the Accelerator Cable is not sticking or moving sluggishly.
   - Check Accelerator Cable free play [0.040~0.120 in. (1.0~3.0 mm)].
2. Remove Intake Hose and inspect Throttle Plate for excessive carbon deposits.
3. Is Throttle Plate being held open with excessive carbon deposits?

YES	▸ Replace or repair as necessary and go to "Verification of Vehicle Repair" procedure
NO	▸ Go to next step as below

■ **Air Leakage Inspection**

1. Visually/physically inspect the air leakage in intake/exhaust system as following items,
   - Check for throttle Plate being held open with excessive carbon deposits
   - Vacuum hoses for splits, kinks and improper connections.
   - Throttle body gasket
   - Positive crankcase ventilation valve for improper installation, damaged o-rings and malfunctioning .
   - Gasket between intake manifold and cylinder head
   - Seals between intake manifold and fuel injectors
   - Exhaust system between HO2S and Three way catalyst for air leakage
2. 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 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 next step as below

Component Inspection

■ **ISCA 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 GDS 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 Valve moving freely and not carbon fouled?

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 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

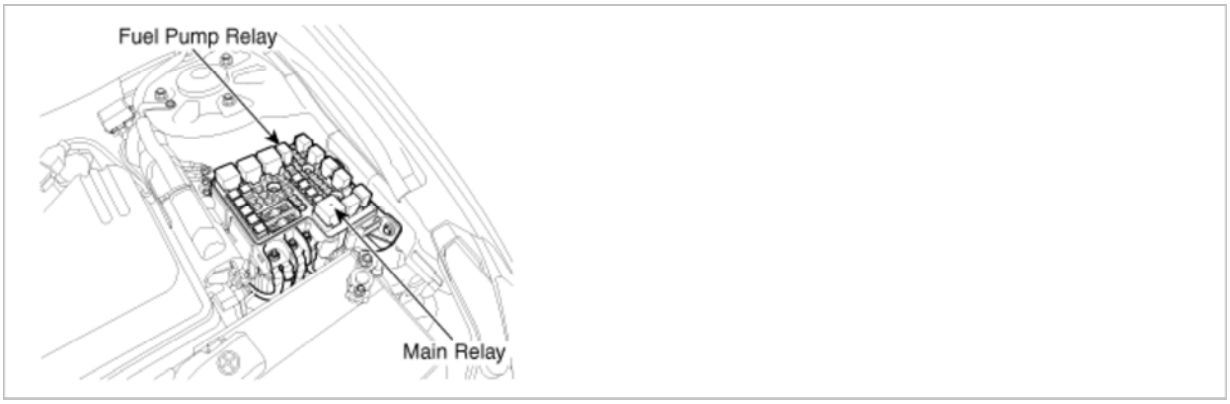
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0560 System Voltage

Component Location



General Description

The PCM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The PCM monitors battery voltage and the voltage after the main relay.

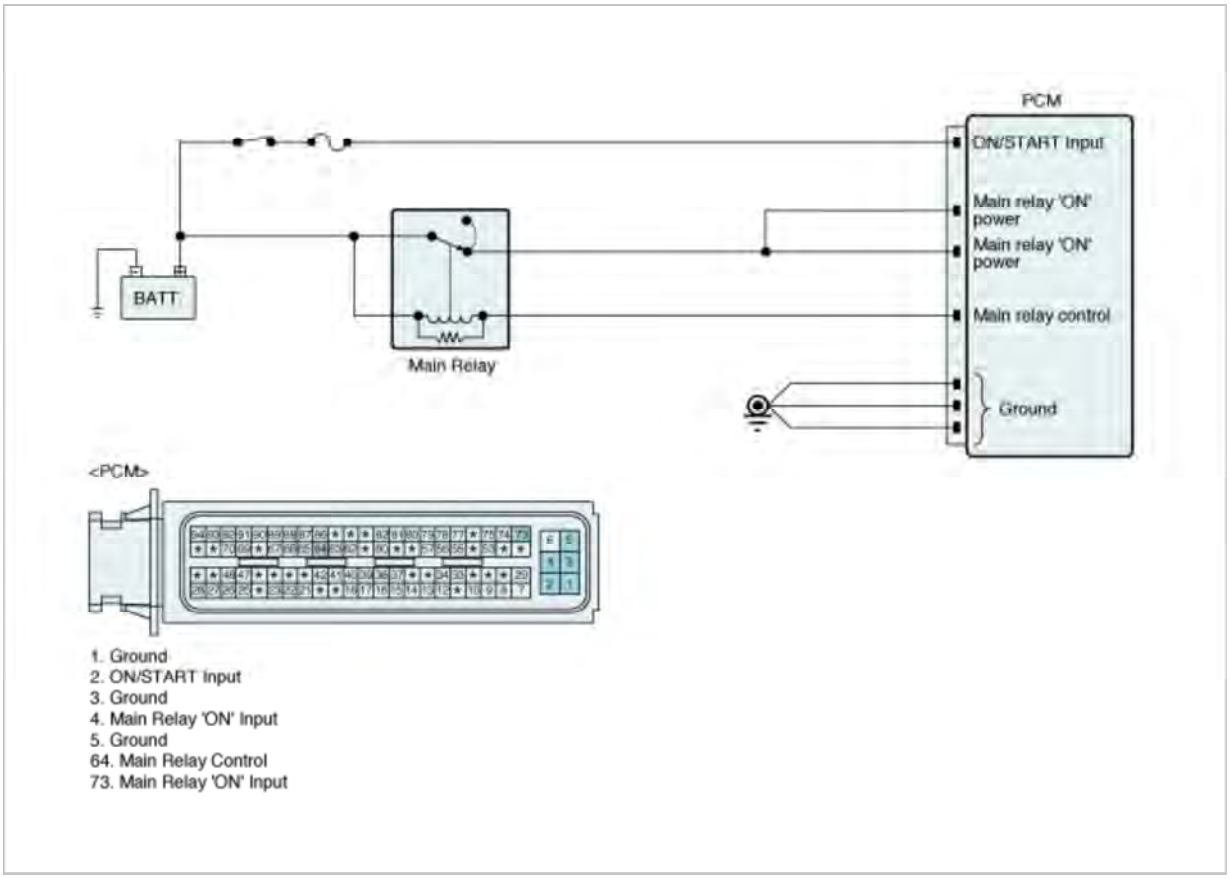
DTC Description

The PCM 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 PCM 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 Main Relay	• Open or short circuit • Poor connection or damaged harness
Enable Conditions	case1	• Ignition "ON" • Battery voltage >10V	
	case2	• Ignition "OFF"	
Threshold Value	case1	• Voltage after Main Relay <6 V	
	case2	• Voltage after Main Relay >6 V	
Diagnostic Time	case1	• 180 msec.	
	case2	• 180 msec.	
Mil On Condition		• -	

Diagnostic Circuit Diagram



Signal Waveform & Data

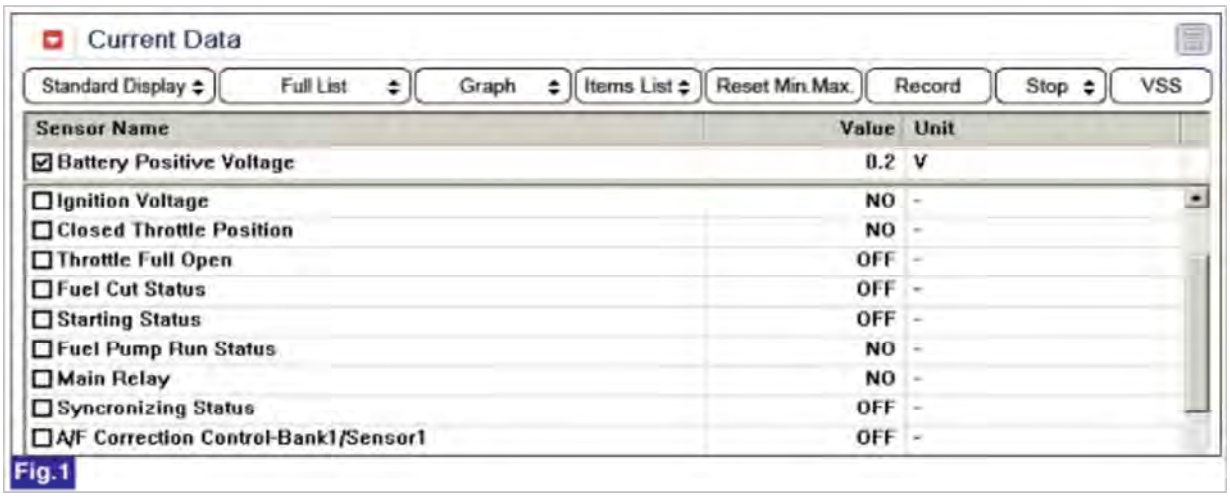


Fig 1) Open circuit in Main relay control of the PCM harness terminal : Approx. 0.2V(Battery voltage parameter)

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. With Ignition OFF, remove the main relay
2. Measure resistance between power terminal and control terminal of the main relay(Component side).

Specification : Approx. 70~120Ω at 20°C(68°F)

3. Apply 12V and a ground to power and control terminals of the main relay(Components side).
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	▸ Check main relay for contamination, deterioration, or damage. Substitute with a known-good main relay and check for proper operation. If the problem is corrected, replace main relay and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure the voltage between power terminals of the main relay harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES	▸ Go to next step as below
NO	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

4. Measure the voltage between 'power to sensor' terminal of the main relay harness connector and chassis ground.

Approx. 1.5V

5. Is value within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Control Circuit Inspection

1. Ignition "OFF"
2. With ECM connector disconnected, measure voltage between main relay control terminal of the PCM harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Check control circuit for open or short circuit between main relay and PCM. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

■ Ignition Switch Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure the voltage between 'ON/START Input' terminal of the ECM harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the specification?

YES	▸ Go to next step as below.
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	▸ 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

Verification of Vehicle Repair

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

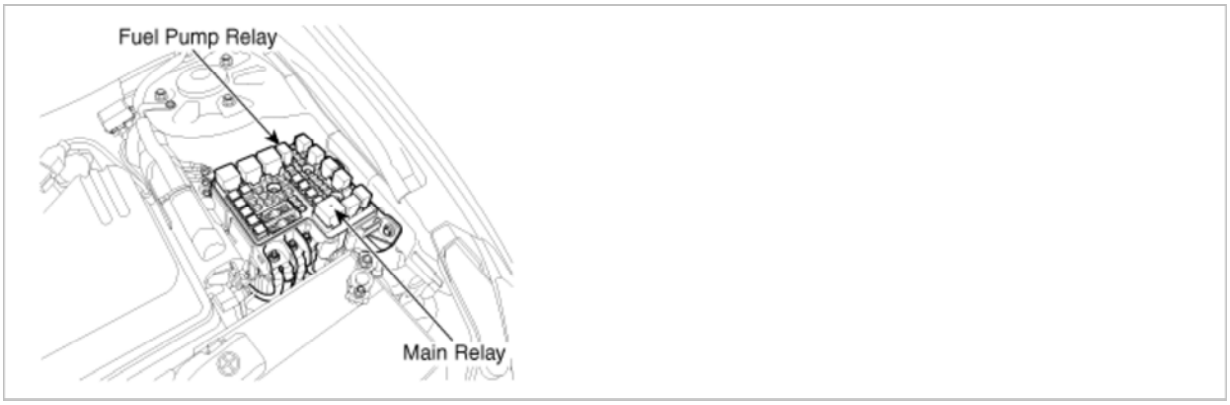
1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions .
3. Read "DTC Status" parameter .

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.

Fuel System > Engine Control System > P0562 System Voltage Low

Component Location



General Description

The PCM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The PCM monitors battery voltage and the voltage after the main relay.

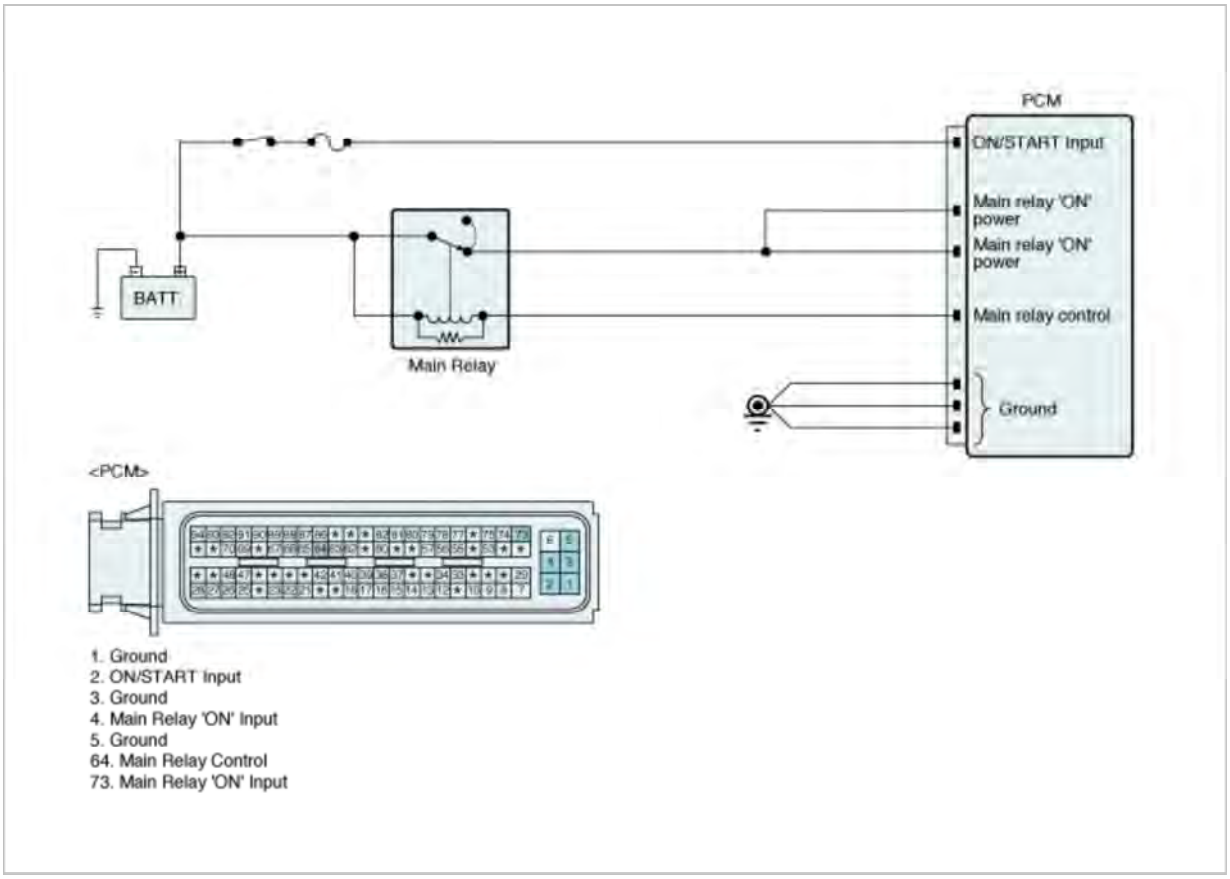
DTC Description

PCM sets DTC P0562 if the PCM detects system voltage lower than the possible range of battery voltage.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Contact resistance in connectors • Faulty charging system
Enable Conditions	• No main relay failure	
Threshold Value	• Voltage after main relay when ON < 10V	
Diagnostic Time	• 30 sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

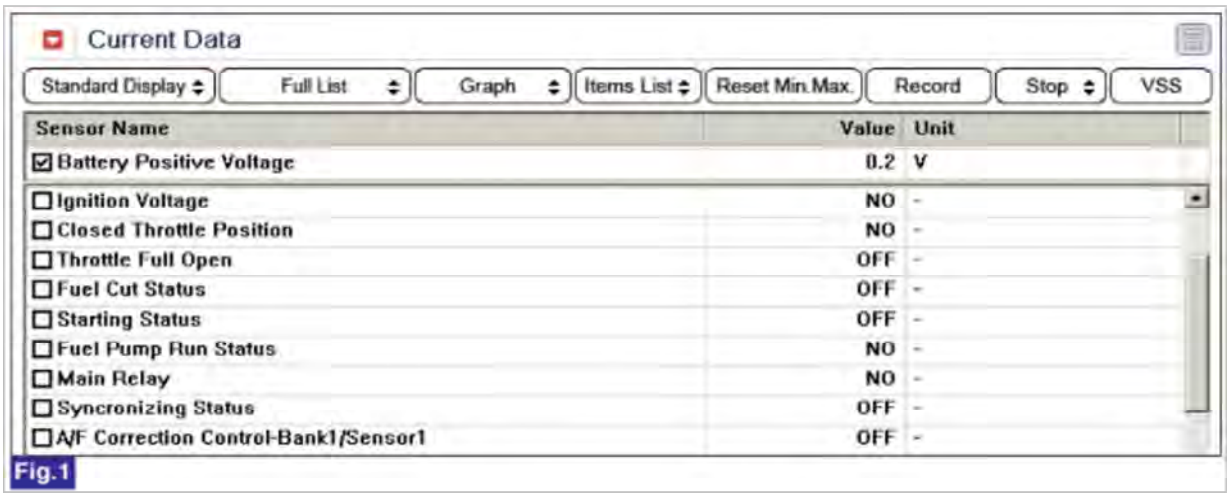


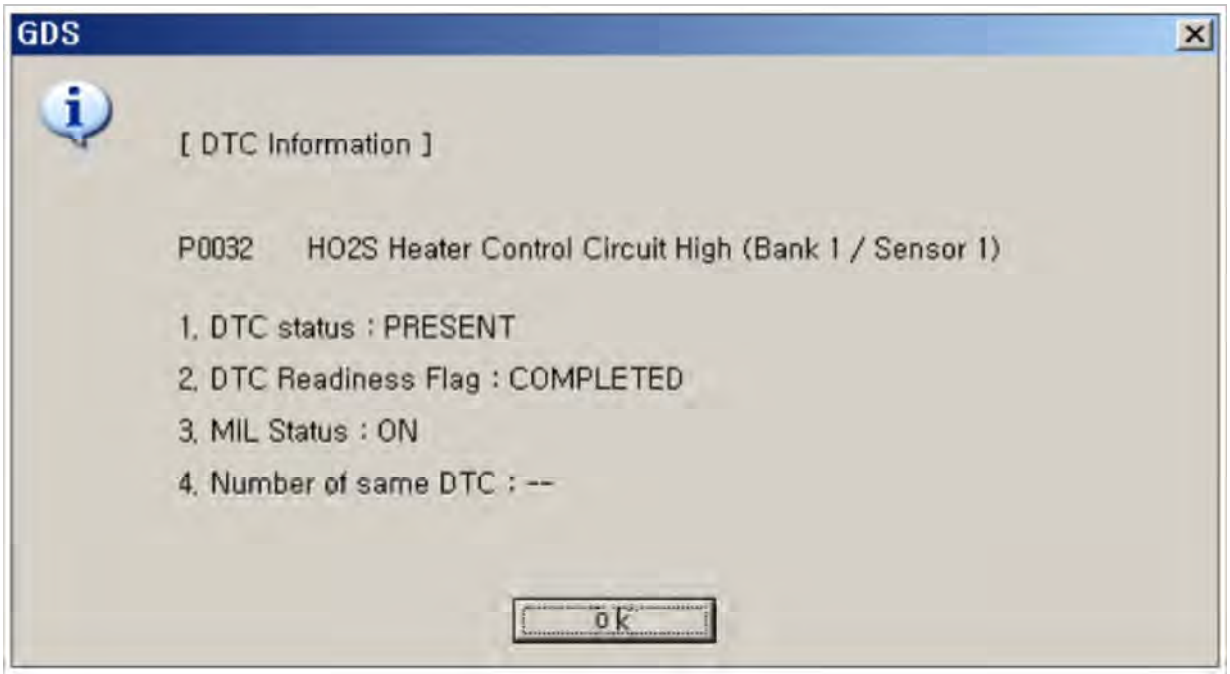
Fig 1) Open circuit in Main relay control of the PCM harness terminal : Approx. 0.2V(Battery voltage parameter)

Monitor DTC Status

NOTE

If any codes relating to system voltage(P0562) is stored, do ALL REPAIRS associated with those codes before proceeding with troubleshooting

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

System Inspection

1. Start the engine and raise the engine speed to 2,500~3,000 RPM
2. Turn ON all electrical loads by turning on the headlamps, and by turning on the high blower motor, etc
3. Monitor the battery(ignition) voltage parameter on the Scantool data list
   Specification :

Ambient temperature °C(°F)	Reference Voltage(V)
-20(-4)	Approx. 14.2~15.4
20(68)	Approx. 14.0~15.0
60(140)	Approx. 13.7~14.9
80(176)	Approx. 13.5~14.7

4. Is the battery voltage within the specification?

YES	▸ Go to next step as below
NO	▸ Possibility of charging system malfunction. Repair or replace alternator and battery. Refer to Charging System group in Workshop manual. 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(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 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

Verification of Vehicle Repair

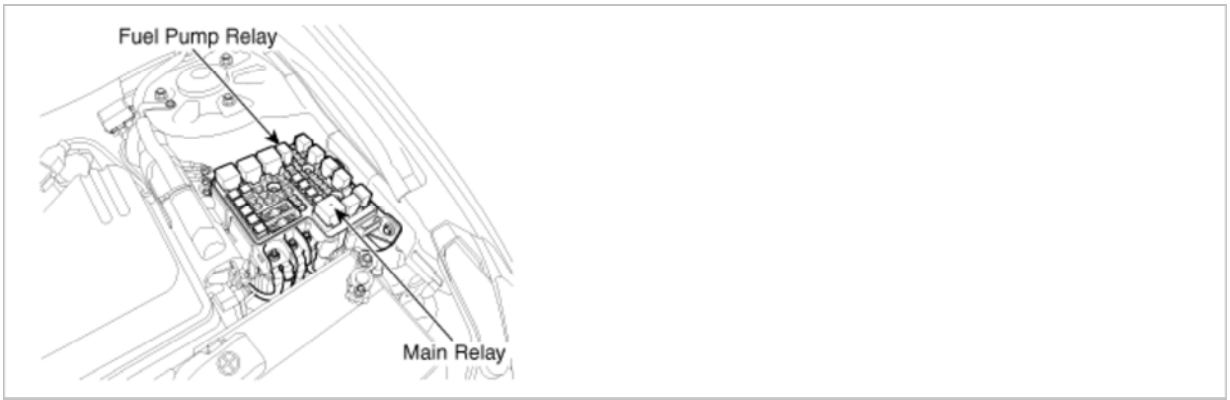
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P0563 System Voltage High

Component Location



General Description

The PCM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The PCM monitors battery voltage and the voltage after the main relay.

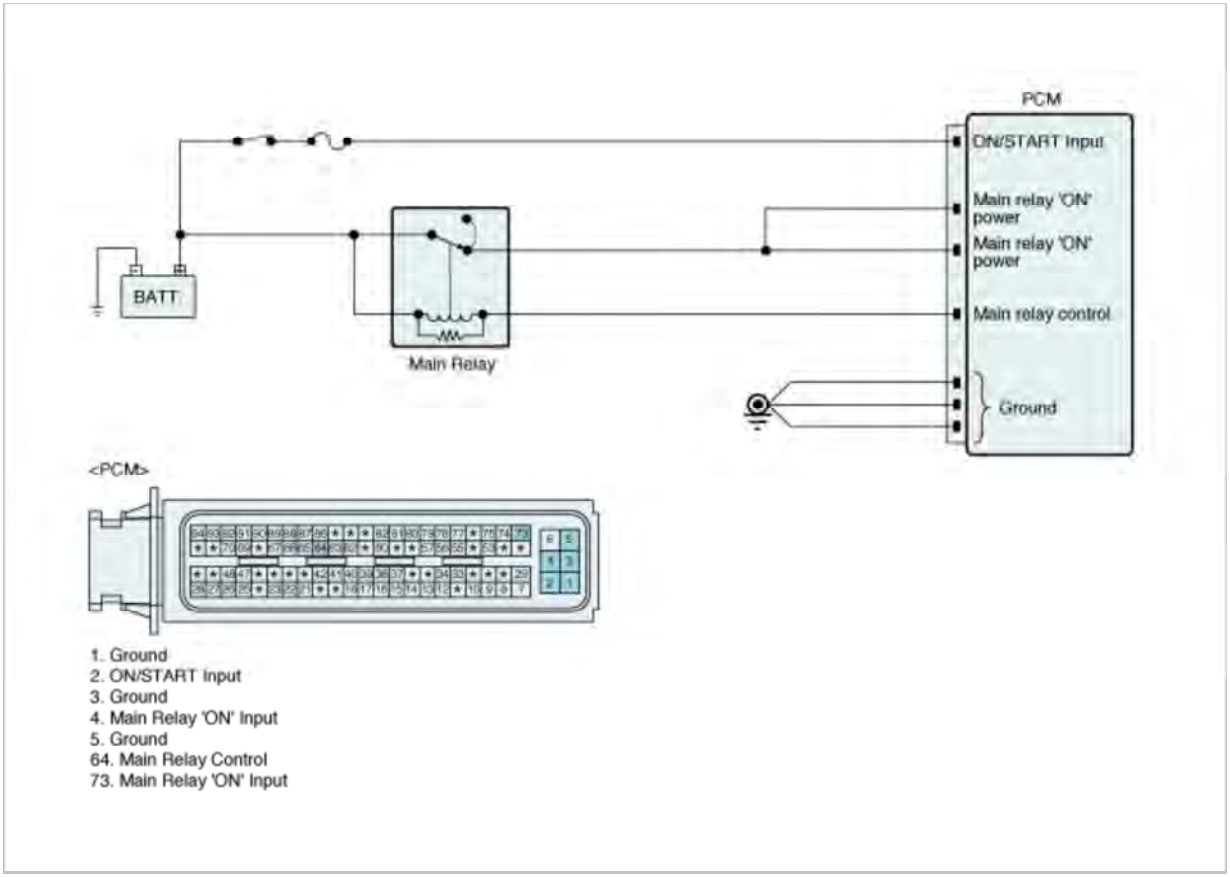
DTC Description

PCM sets DTC P0563 if the PCM detects system voltage higher than the possible range of battery voltage.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Contact resistance in connectors • Faulty charging system
Enable Conditions	• Vehicle speed > 10kph(6mph)	
Threshold Value	• Voltage after main relay when ON > 16V	
Diagnostic Time	• 30 sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

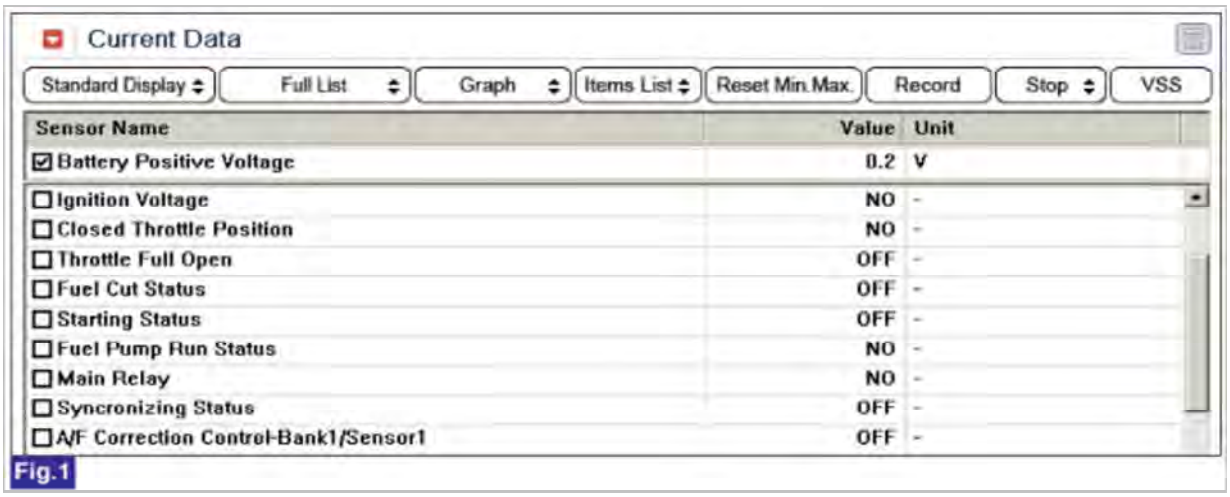


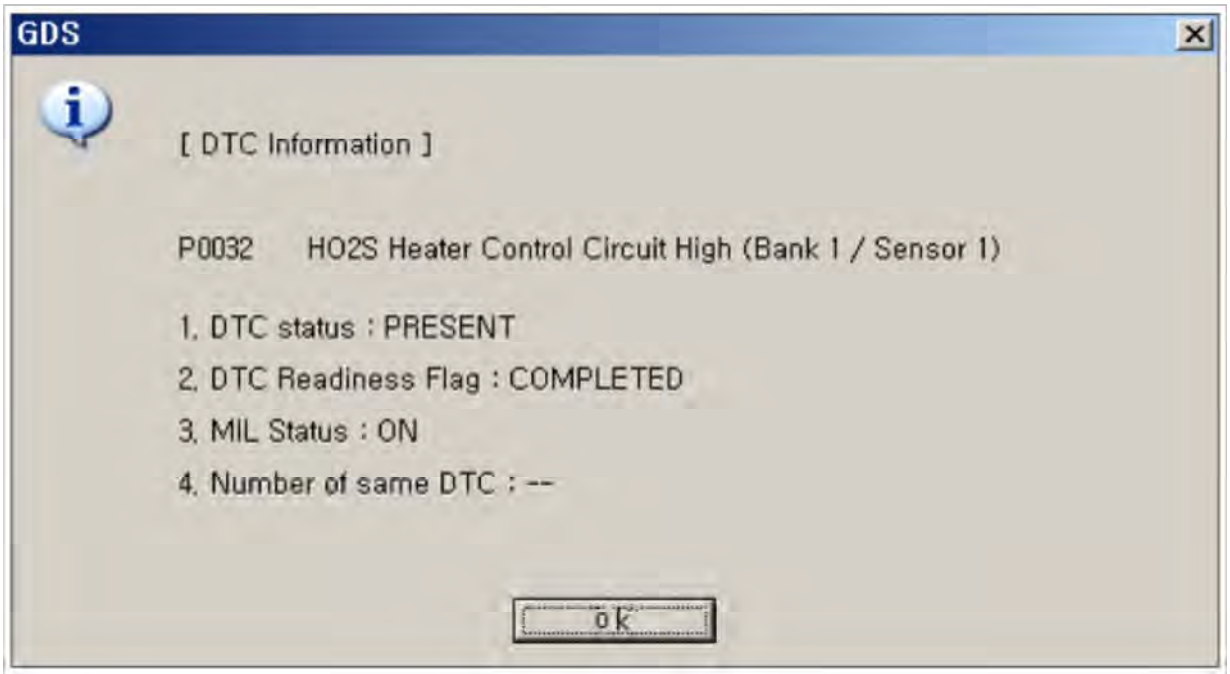
Fig 1) Open circuit in Main relay control of the PCM harness terminal : Approx. 0.2V(Battery voltage parameter)

Monitor DTC Status

NOTE

If any codes relating to system voltage(P0563) is stored, do ALL REPAIRS associated with those codes before proceeding with troubleshooting

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

System Inspection

1. Start the engine and raise the engine speed to 2,500~3,000 RPM
2. Turn ON all electrical loads by turning on the headlamps, and by turning on the high blower motor, etc
3. Monitor the battery(ignition) voltage parameter on the Scantool data list
   Specification :

Ambient temperature °C(°F)	Reference Voltage(V)
-20(-4)	Approx. 14.2~15.4
20(68)	Approx. 14.0~15.0
60(140)	Approx. 13.7~14.9
80(176)	Approx. 13.5~14.7

4. Is the battery voltage within the specification?

YES	▸ Go to next step as below
NO	▸ Possibility of charging system malfunction. Repair or replace alternator and battery. Refer to Charging System group in Workshop manual. 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(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 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

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > P0605 Internal Control Module Read Only Memory (ROM) Error

Component Location

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 PCM 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 PCM
Enable Conditions	• -	
Threshold Value	• RAM test or checksum error	
Diagnostic Time	• 100 msec.	

Mil On Condition	• 2 Driving Cycles	

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Terminal and Connector Inspection

■ Back Up Voltage Inspection

1. Ignition "OFF"
2. Disconnect PCM connector
3. Ignition "ON"
4. Are circuits remaining stable at battery voltage?

YES	▸ Using a scan tool, check PCM software version and upgrade as necessary. If version is the newest one, check PCM for contamination, deterioration, or damage. Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.

	NOTE It is necessary to perform the TPS adaptation procedure with Scan tool when the throttle body assembly or PCM is replaced. ■ TPS adaptation procedure 1. Erase previous TPS adaptation value using Scan tool. 2. Ignition "OFF" and then "ON" without cranking. Wait for 10 seconds under enable conditions - Enable conditions : Battery >10V & Intake Air Temp. >5.3°C(41.5°F) & 5.3°C(41.5°F) <Engine CoolantTemp. <99.8°C(211.6°F) 3. After TPS adaptation, the system normality should be confirmed by reading out "FMY" on the Scan Tool
NO	▸ If voltage fluctuates, check circuit 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 GDS 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.

Fuel System > Engine Control System > P0630 VIN Not Programmed or Incompatible-ECM/PCM

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 SAE J1979 specifications. Using a scan tool, PERFORM "VIN WRITING" procedure after replacing or reflashing a PCM.

DTC Description

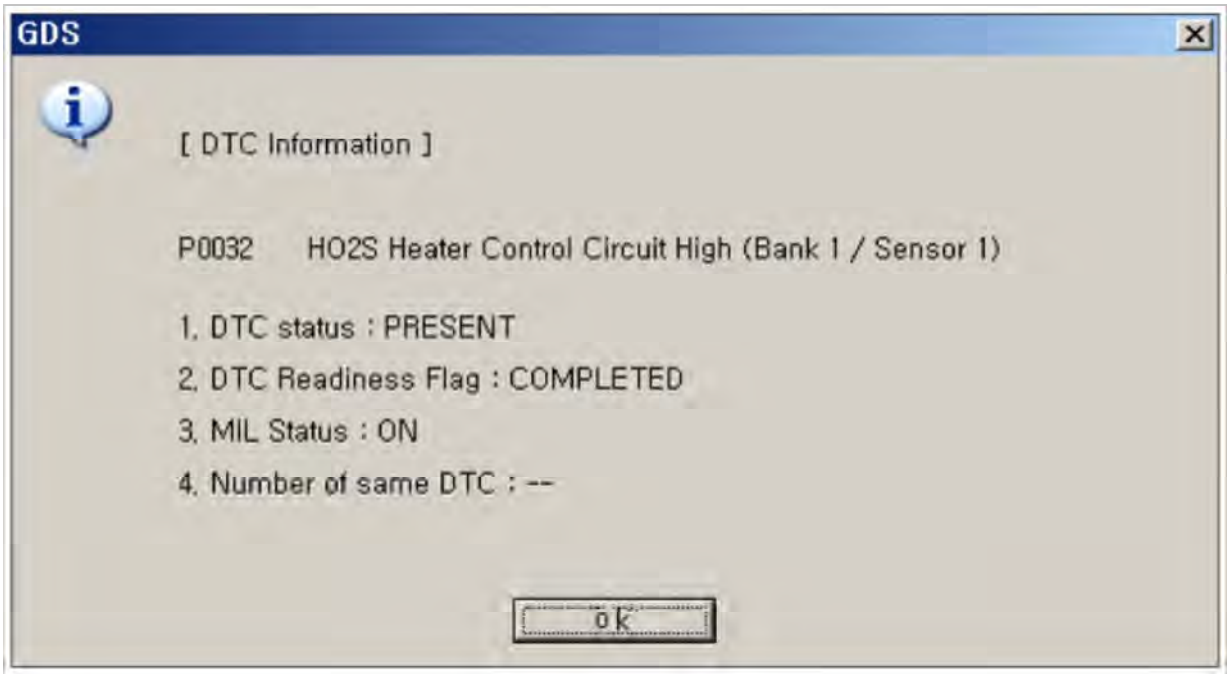
The PCM monitors ROM areas and sets DTC P0630 if there is no Vehicle Identification Number(VIN) information.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check whether VIN is exist	• PCM is Virgin(not programmed) status
Enable Conditions	• -	
Threshold Value	• -	
Diagnostic Time	• -	
Mil On Condition	• Immediate	

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

System Inspection

1. Was the PCM 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 PCM and check for proper operation. If the problem is corrected, replace PCM. 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 GDS 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.

Fuel System > Engine Control System > P0650 Malfunction Indicator Lamp (MIL) Control Circuit

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 indicator lamp is lit to indicate that the MIL operates normally and goes off after starting

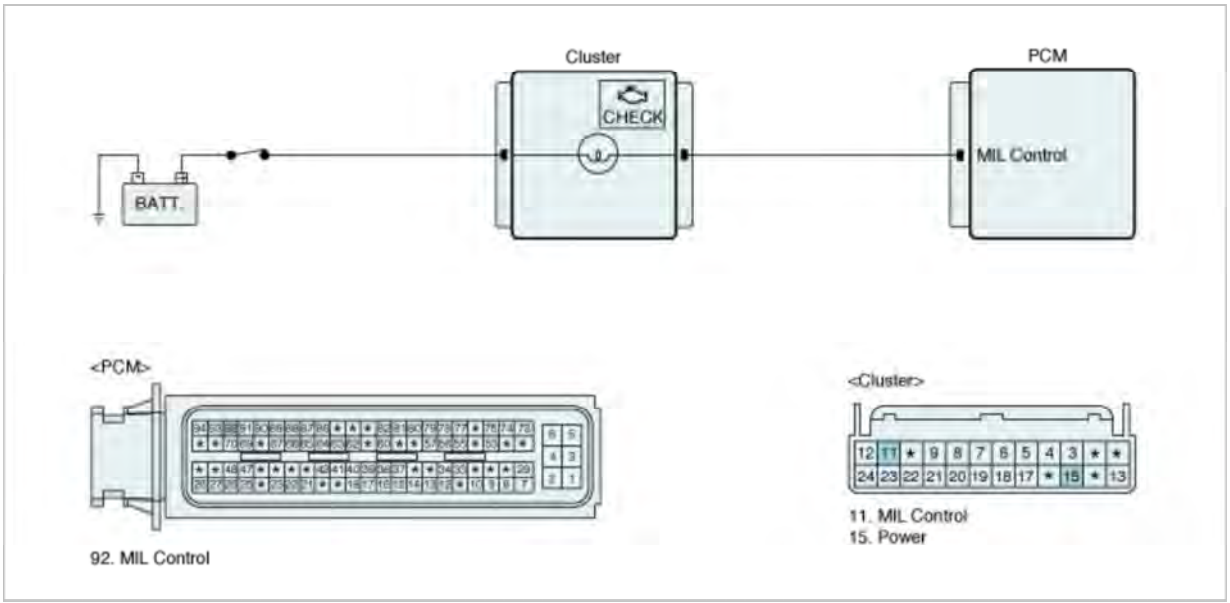
DTC Description

PCM sets DTC P0650 if the PCM detects that the MIL control line is open or short circuit to ground or battery line.

DTC Detecting Condition

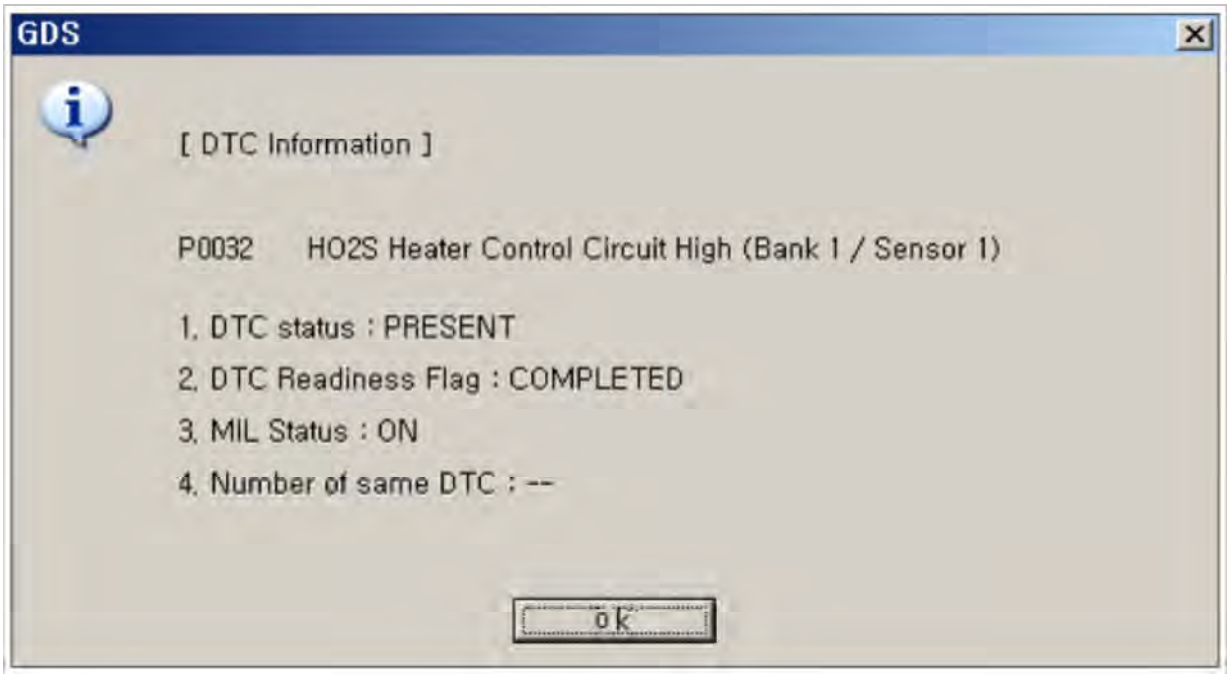
Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Open or short between MIL and PCM • Poor connection or damaged harness • Burned out MIL bulb
Enable Conditions	• 10V < Battery voltage < 16V	
Threshold Value	• Short to ground or battery or line break	
Diagnostic Time	• 10 sec.	
Mil On Condition	• -	

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Terminal and Connector Inspection

■ Control Circuit Inspection

1. Ignition "OFF"
2. Disconnect PCM connector
3. Ignition "ON" & Engine "OFF"
4. Using a suitable wire, jumper the terminal 92 of the PCM harness connector to chassis ground.
5. Is MIL bulb illuminated?

YES	▸ Go to next step as below
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 Meter Fuse. Repair as necessary and go to "Verification of Vehicle Repair" procedure

6. Remove wire from PCM harness connector
7. Does MIL bulb go out?

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 for source of short to GND between bulb and PCM. 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 GDS 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.

Fuel System > Engine Control System > P0700 Transmission Control System (MIL Request)

General Description

The TCM can request activation of the MIL lamp Via a communication line to the PCM. This is only a request from TCM to PCM 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	• TCU request via CAN	• Transaxle system
Enable Conditions	• -	
Threshold Value	• Failure from TCU	
Diagnostic Time	• -	
Mil On Condition	• Immediate	

Monitor DTC Status

1. This is only a request from TCM to PCM to turn the MIL on. The fault code is stored in the TCM. The Freeze Frame Data is stored in the PCM under the P0700 request code. Be sure to retrieve freeze frame data before clearing code P0700 from PCM.
2. Check the transaxle system

Verification of Vehicle Repair

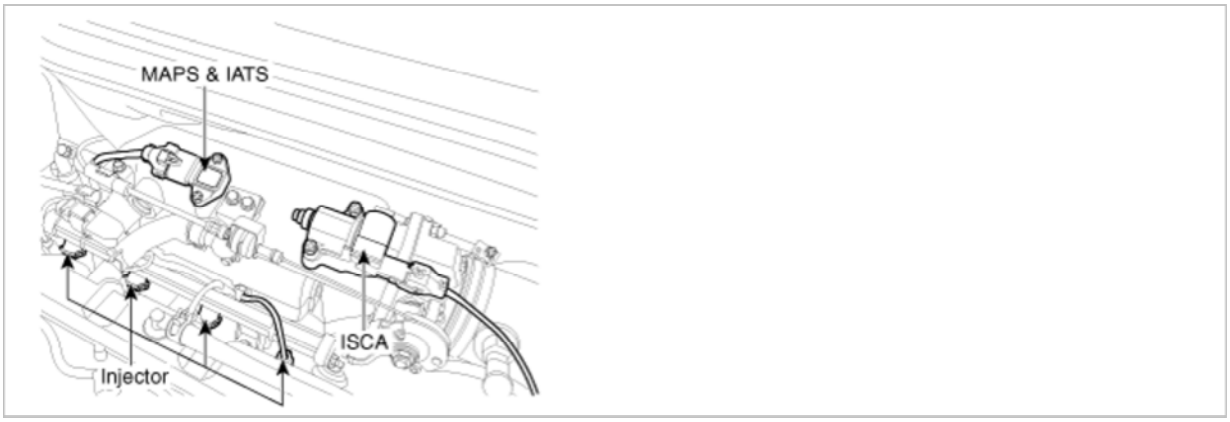
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P1505 Idle Speed Control Actuator Signal Low of Coil #1

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 valve is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting. The ISCA valve consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the PCM controls both coils by grounding their control circuits. According to the control signals from the PCM, the valve rotor rotates to control the by pass airflow into the engine.

DTC Description

PCM sets DTC P1505 if the PCM detects that the ISCA(OPEN) control circuit is open or short to ground.

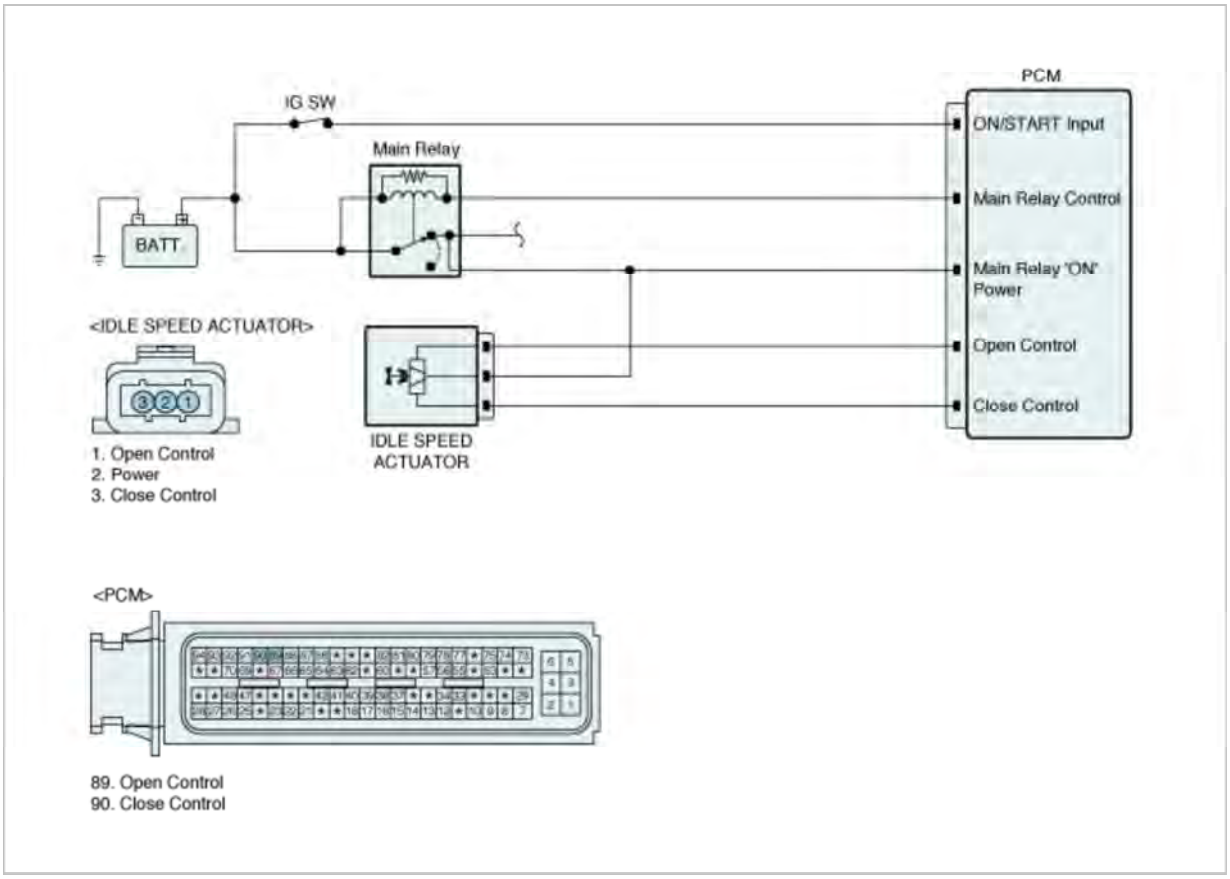
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Open or short to ground in harness • Poor connection or damaged harness • Faulty ICA valve
Enable Conditions	• 10V < Battery voltage < 16V	
Threshold Value	• Short to ground or line break	
Diagnostic Time	• 2 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temperature	Opening Coil(Ω)	Closing Coil(Ω)
20°C(68°F)	11.1~12.7	14.6~16.2

Diagnostic Circuit Diagram



Signal Waveform & Data

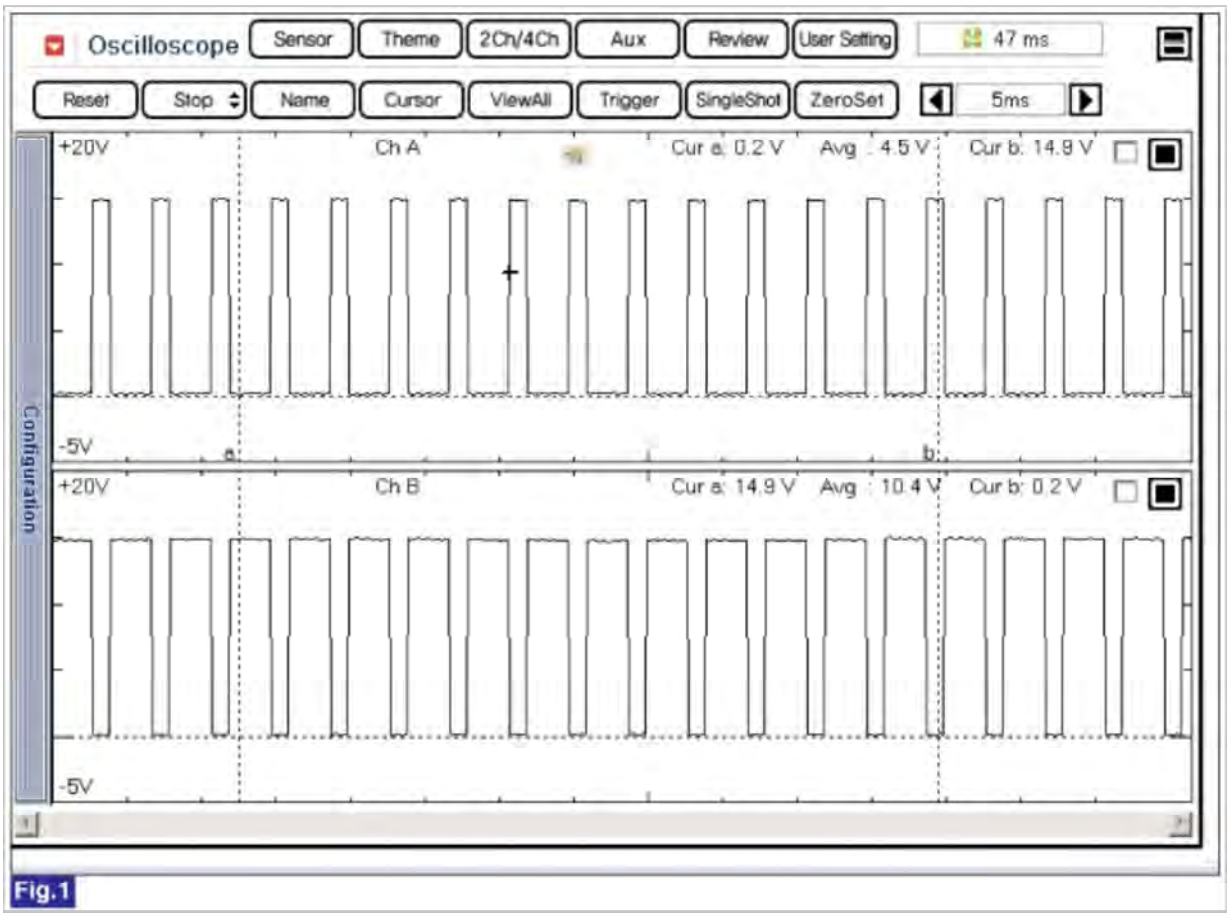


Fig 1) The above waveforms are the voltage signals generated when the ISCA operates. This ISCA is a duty type and the time opened determines the duty amount. The left side is the waveform of the ISCA Opening coil during idle.
The right side is the waveform of the ISCA Closing coil during idle.

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect ISCA valve connector
3. Measure resistance between Open control terminal and power terminal of ISCA connector(Component side).
   Specification

Temperature	Opening Coil(Ω)
20°C(68°F)	11.1~12.7

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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of ISCA harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the Specification?

YES	▸ Go to next step as below.
NO	▸ Check for an open or short to ground in the power supply circuit between the ISCA valve and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Signal circuit inspection

1. Measure voltage between Open control terminal of ISCA harness connector and chassis ground.

Specification : Approx. 2~4V

2. Is voltage within the Specification?

YES	▸ Go to next step as below.
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	▸ Thoroughly 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

Verification of Vehicle Repair

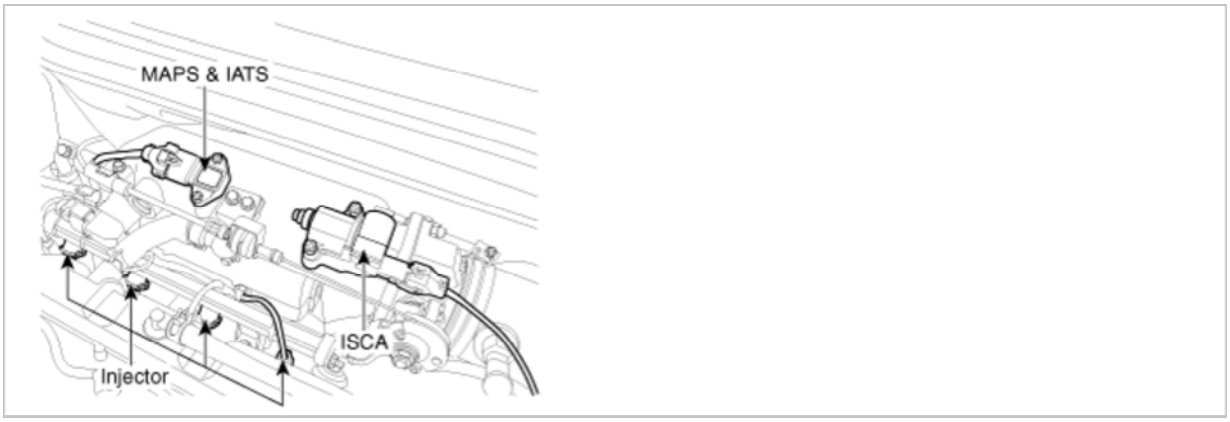
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P1506 Idle Speed Control Actuator Signal High of Coil #1

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 valve is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting. The ISCA valve consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the PCM controls both coils by grounding their control circuits. According to the control signals from the PCM, the valve rotor rotates to control the by pass airflow into the engine.

DTC Description

PCM sets DTC P1506 if the PCM detects that the ISCA(OPEN) control circuit is short to battery.

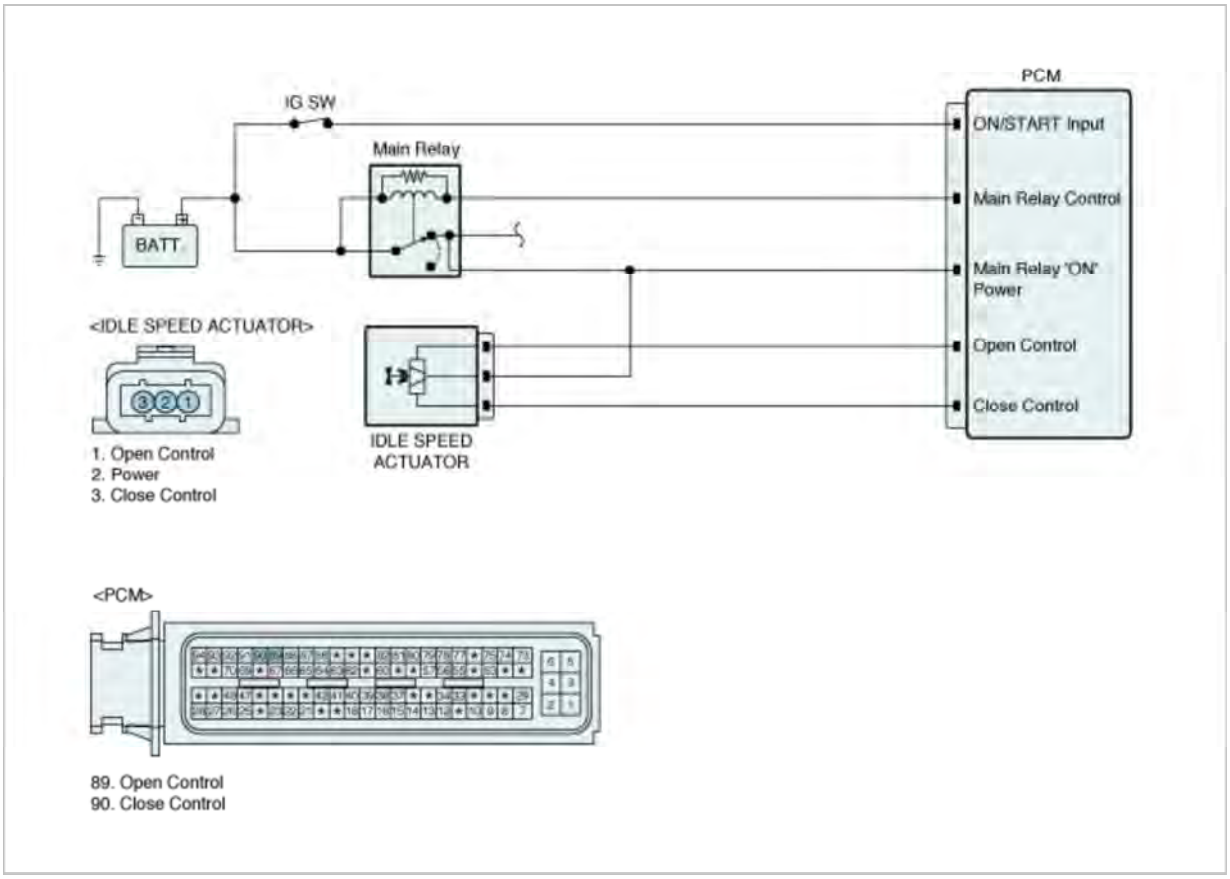
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Short to battery in harness • Poor connection or damaged harness • Faulty ICA valve
Enable Conditions	• 10V < Battery voltage < 16V	
Threshold Value	• Short to battery	
Diagnostic Time	• 2 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temperature	Opening Coil(Ω)	Closing Coil(Ω)
20°C(68°F)	11.1~12.7	14.6~16.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect ISCA valve connector
3. Measure resistance between Open control terminal and power terminal of ISCA connector(Component side).
   Specification

Temperature	Opening Coil(Ω)
20°C(68°F)	11.1~12.7

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

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of ISCA harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the Specification?

YES	▸ Go to next step as below
NO	▸ Check for an open or short to ground in the power supply circuit between the ISCA valve and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure

Signal circuit inspection

1. Measure voltage between Close control terminal of ISCA harness connector and chassis ground.

Specification : Approx. 1~2V

2. Is voltage within the Specification?

YES	▸ Go to next step as below
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	▸ Thoroughly 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

Verification of Vehicle Repair

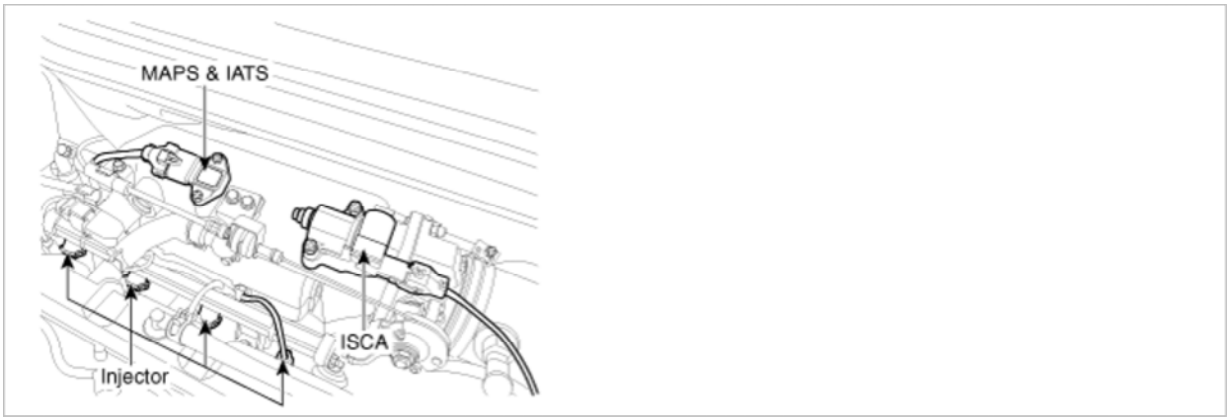
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P1507 Idle Speed Control Actuator Signal Low of Coil #2

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 valve is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting. The ISCA valve consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the PCM controls both coils by grounding their control circuits. According to the control signals from the PCM, the valve rotor rotates to control the by pass airflow into the engine.

DTC Description

PCM sets DTC P1507 if the PCM detects that the ISCAV(CLOSE) control line is open or short to ground.

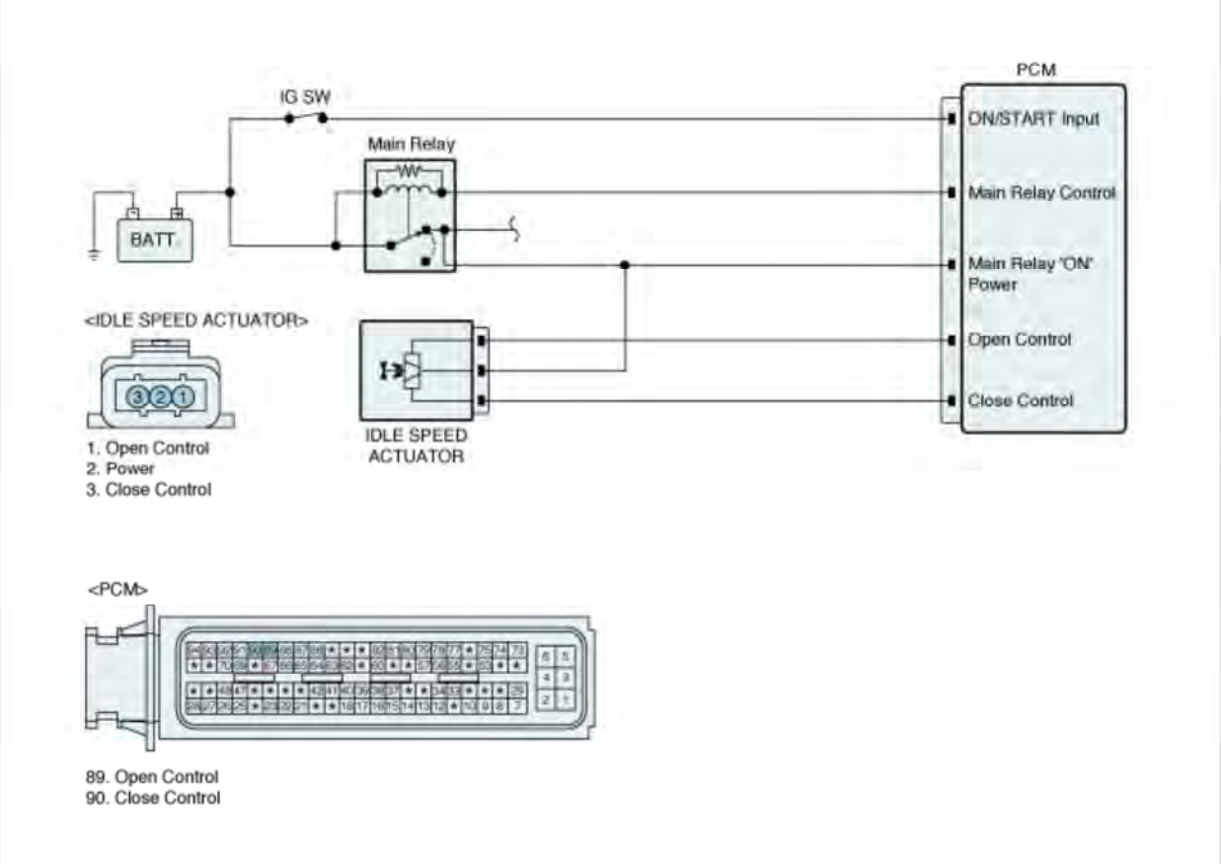
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Open or short to ground in harness • Poor connection or damaged harness • Faulty ICA valve
Enable Conditions	• 20% < PWM output < 80%	
Threshold Value	• Short to ground or line break	
Diagnostic Time	• 2 sec.	
Mil On Condition	• 2 Driving Cycles	

Specification

Temperature	Opening Coil(Ω)	Closing Coil(Ω)
20°C(68°F)	11.1~12.7	14.6~16.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect ISCA valve connector
3. Measure resistance between Close control terminal and power terminal of ISCA connector(Component side).
   Specification

Temperature	Opening Coil(Ω)
20°C(68°F)	14.6~16.2

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.

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of ISCA harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the Specification?

YES	▸ Go to next step as below
NO	▸ Check for an open or short to ground in the power supply circuit between the ISCA valve and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure

Signal circuit inspection

1. Measure voltage between Close control terminal of ISCA harness connector and chassis ground.

Specification : Approx. 1~2V

2. Is voltage within the Specification?

YES	▸ Go to next step as below
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	▸ Thoroughly 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

Verification of Vehicle Repair

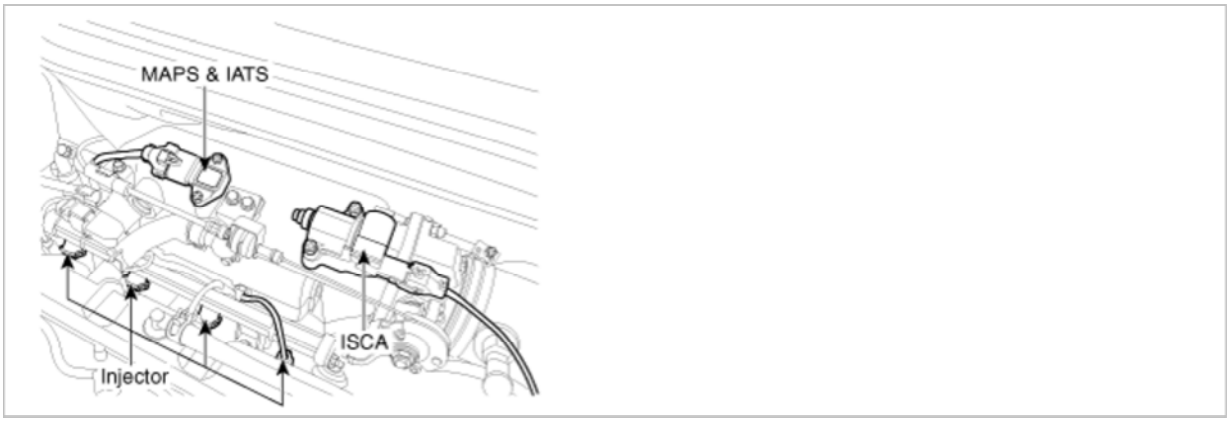
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS 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.

Fuel System > Engine Control System > P1508 Idle Speed Control Actuator Signal High of Coil #2

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 valve is closed. The function of the ISCA valve is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting. The ISCA valve consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the PCM controls both coils by grounding their control circuits. According to the control signals from the PCM, the valve rotor rotates to control the by pass airflow into the engine.

DTC Description

PCM sets DTC P1508 if the PCM detects that the ISCA(CLOSE) control circuit is short to battery.

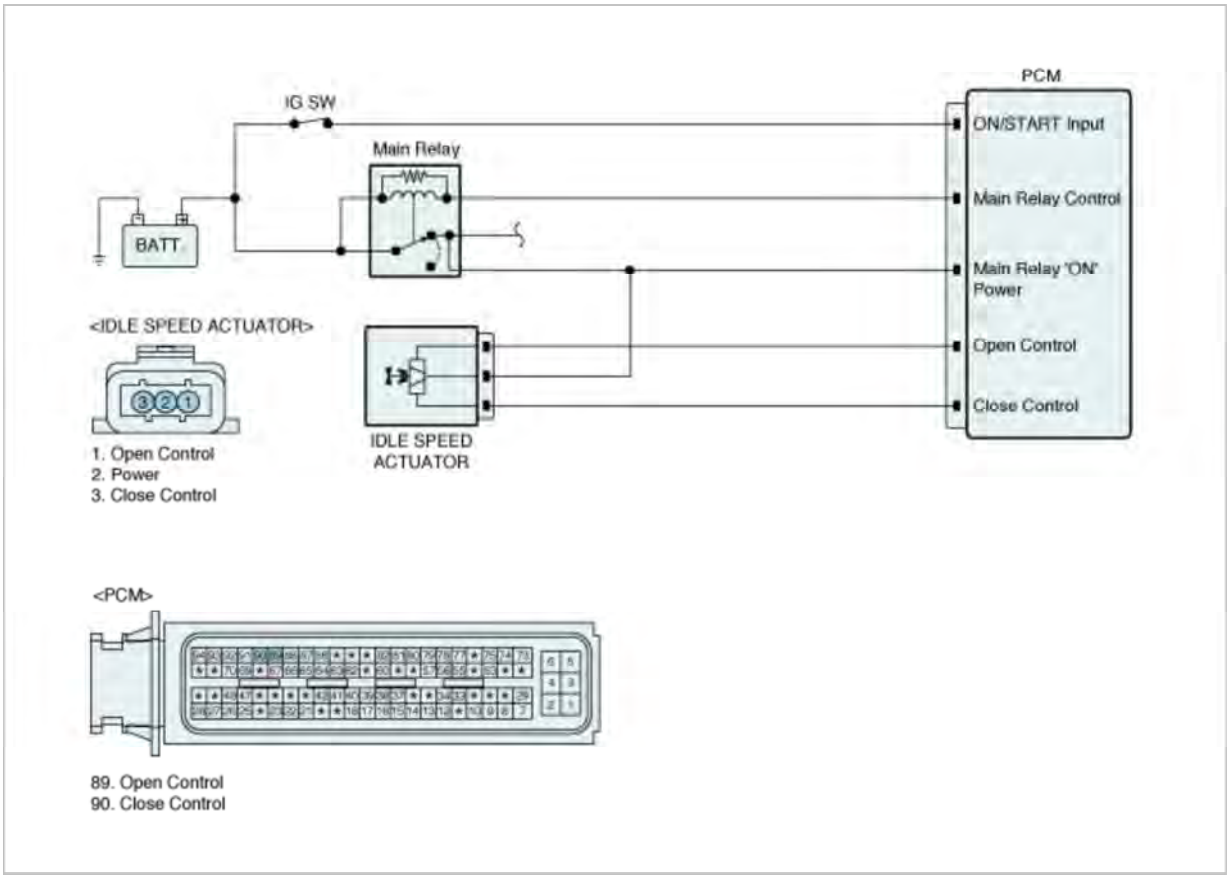
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Electrical check	• Short to battery in harness • Poor connection or damaged harness • Faulty ICA valve
Enable Conditions	• 10V < Battery voltage < 16V • 20% < PWM output < 80%	
Threshold Value	• Short to battery	
Diagnostic Time	• 2 sec.	
Fail Safe	• ECM controls idle speed with predetermined value	
Mil On Condition	• 2 Driving Cycles	

Specification

Temperature	Opening Coil(Ω)	Closing Coil(Ω)
20°C(68°F)	11.1~12.7	14.6~16.2

Diagnostic Circuit Diagram



Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Disconnect ISCA valve connector
3. Measure resistance between Close control terminal and power terminal of ISCA connector(Component side).
   Specification

Temperature	Opening Coil(Ω)
20°C(68°F)	14.6~16.2

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

Power Circuit Inspection

1. Ignition "ON" & Engine "OFF"
2. Measure voltage between power terminal of ISCA harness connector and chassis ground.

Specification : Approx. B+

3. Is voltage within the Specification?

YES	▸ Go to next step as below
NO	▸ Check for an open or short to ground in the power supply circuit between the ISCA valve and main relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure

Signal circuit inspection

1. Measure voltage between Close control terminal of ISCA harness connector and chassis ground.

Specification : Approx. 1~2V

2. Is voltage within the Specification?

YES	▸ Go to next step as below
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	▸ Thoroughly 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

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > U0001 High Speed CAN Communication Bus off

General Description

A communication line exists between the Engine Control Module(PCM) 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 PCM. 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 PCM and ABS control module use CAN lines.

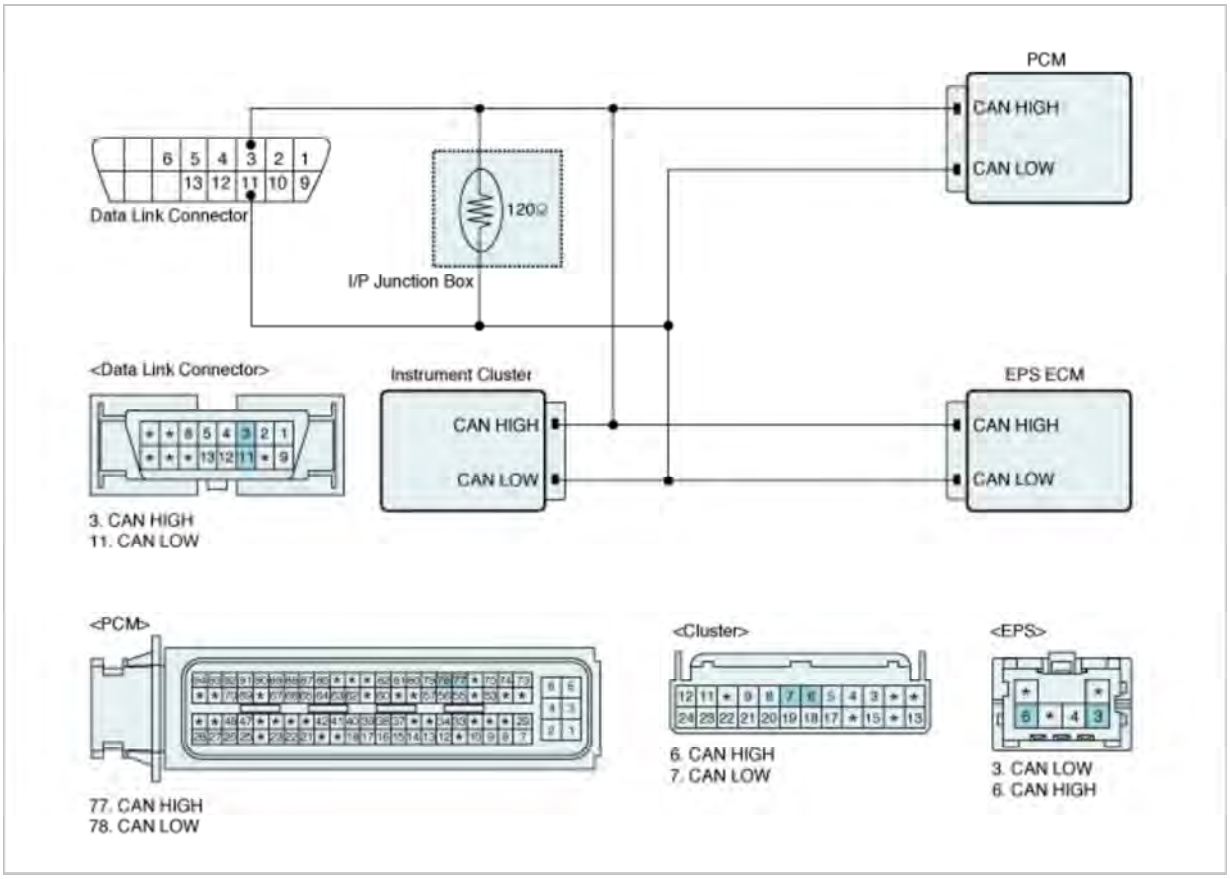
DTC Description

The PCM determines CAN communication error and sets DTC U0001 if communication with other control devices (e.g. ABS) via CAN is impossible or PCM detects that communication time via CAN exceeds threshold value.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check CAN message transfer status	• Open or short in CAN line • Poor connection or damaged harness • Faulty PCM
Enable Conditions	• Battery voltage >10V • Engine speed >32rpm • Delay time >0.5 sec.	
Threshold Value	• -	
Diagnostic Time	• 20 wrong messages received by PCM	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

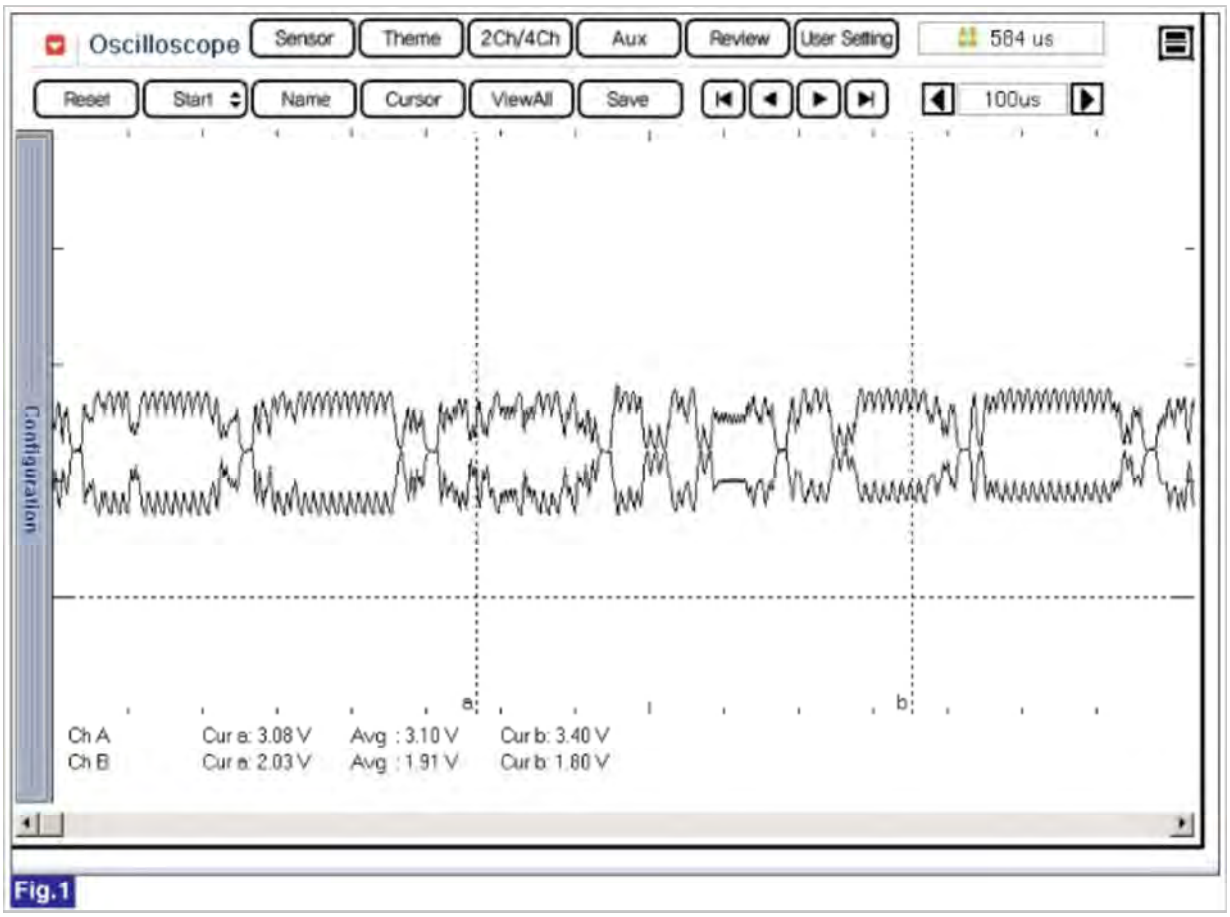


Fig 1) Normal waveform with ignition ON

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Check CAN communication line for open

1. Ignition "OFF"
2. Disconnect PCM harness connector
3. Measure resistance between High signal terminal and Low signal terminal of PCM harness connector.

Specification : Approx. 110~130Ω

4. Is resistance within the specification?

YES	▸ Go to next step as below
NO	▸ Check for open in wiring related to the CAN communication(PCM, EPS, MTS and vertical resistor at the junction box). Repair as necessary and then go to "Verification of Vehicle Repair" procedure NOTE Vertical Resistor Resistance : Approx. 110~130Ω

Check CAN communication line for short to ground

1. Measure resistance between High signal terminal of PCM harness connector and chassis ground.
2. Measure resistance between Low signal terminal of PCM harness connector and chassis ground

Specification : Infinite(above 10kΩ)

3. Is resistance within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair CAN communication line for a short to ground. And then go to "Verification of Vehicle Repair" procedure.

Check CAN communication line for short to battery

1. Disconnect the connectors related to the CAN communication
2. Ignition "ON" & Engine "OFF"
3. Measure voltage between High signal terminal of PCM harness connector and chassis ground.
4. Measure voltage between Low signal terminal of PCM harness connector and chassis ground.

Specification : Approx. 0V

5. Is voltage within the specification?

YES	▸ Go to next step as below.
NO	▸ Repair CAN communication line for a short to battery. 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(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

Component Inspection

1. Ignition "OFF"
2. Measure resistance between High signal terminal and Low signal terminal of PCM connector(PCM side).

Specification : Approx. 110~130Ω

3. Is resistance within the specification?

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 PCM for contamination, deterioration, or damage. Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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

1. Connect GDS 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.

Fuel System > Engine Control System > U0101 Lost Communication With TCM

General Description

A communication line exists between the Engine Control Module(PCM) 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 PCM. 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 PCM and ABS control module use CAN lines.

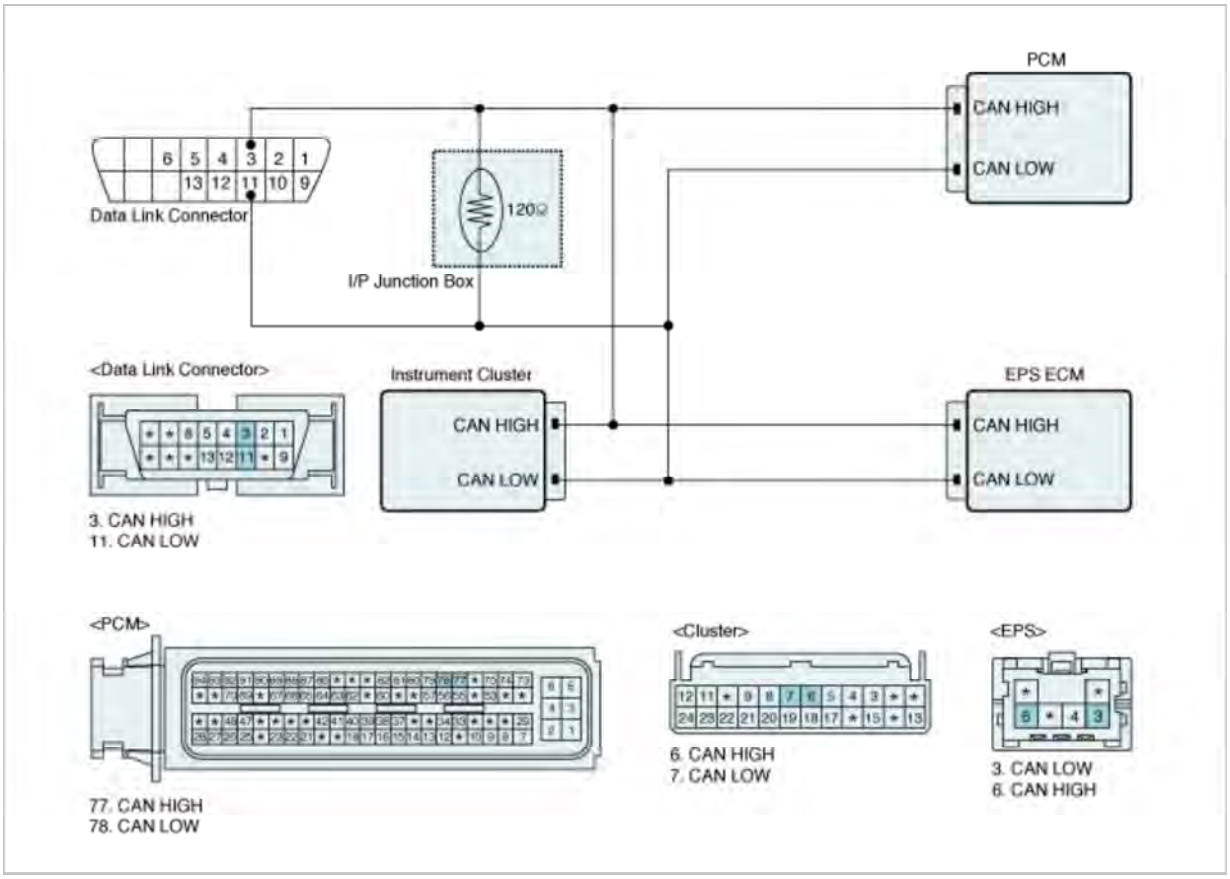
DTC Description

The PCM determines CAN communication error and sets DTC U0101 if no message received from TCM

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• No Message coming from TCU	• Poor connection or damaged harness • Faulty PCM
Enable Conditions	• Battery voltage >10V • Engine speed >32rpm • Delay time >0.5 sec.	
Threshold Value	• Time exceeded with no Message > 1 sec.	
Diagnostic Time	• 1 sec.	
Mil On Condition	• 2 Driving Cycles	

Diagnostic Circuit Diagram



Signal Waveform & Data

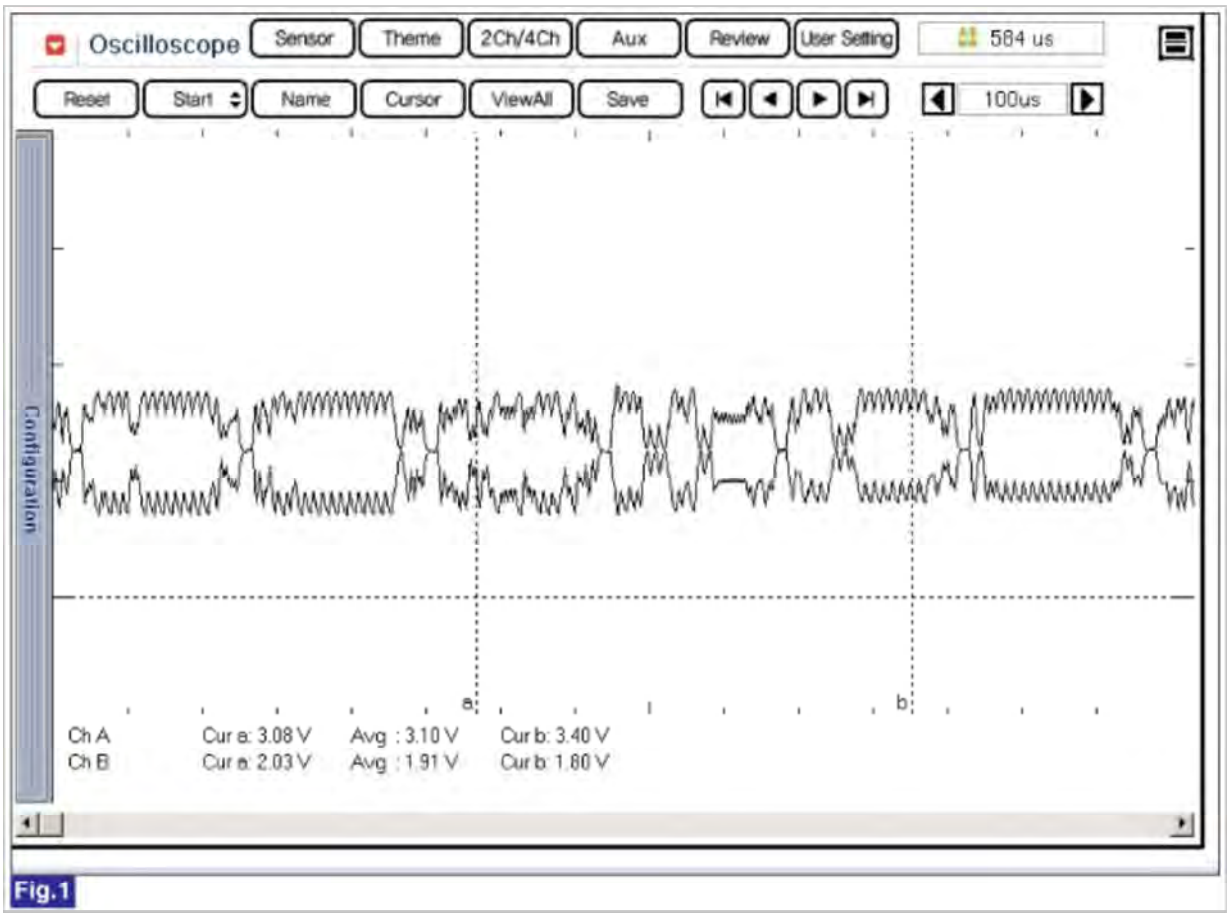


Fig 1) Normal waveform with ignition ON

Monitor DTC Status

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode
2. Click "DTC Status" on the menu bar to see DTC's information.
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 PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to next step as below.

Component Inspection

1. Ignition "OFF"
2. Measure resistance between High signal terminal and Low signal terminal of PCM connector(PCM side).

Specification : Approx. 110~130Ω

3. Is resistance within the specification?

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 PCM for contamination, deterioration, or damage. Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.

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	▸ Check for continuity in wiring related to the CAN communication line(PCM, EPS, MTS and vertical resistor at the junction box.). Repair as necessary and then go to "Verification of Vehicle Repair" procedure

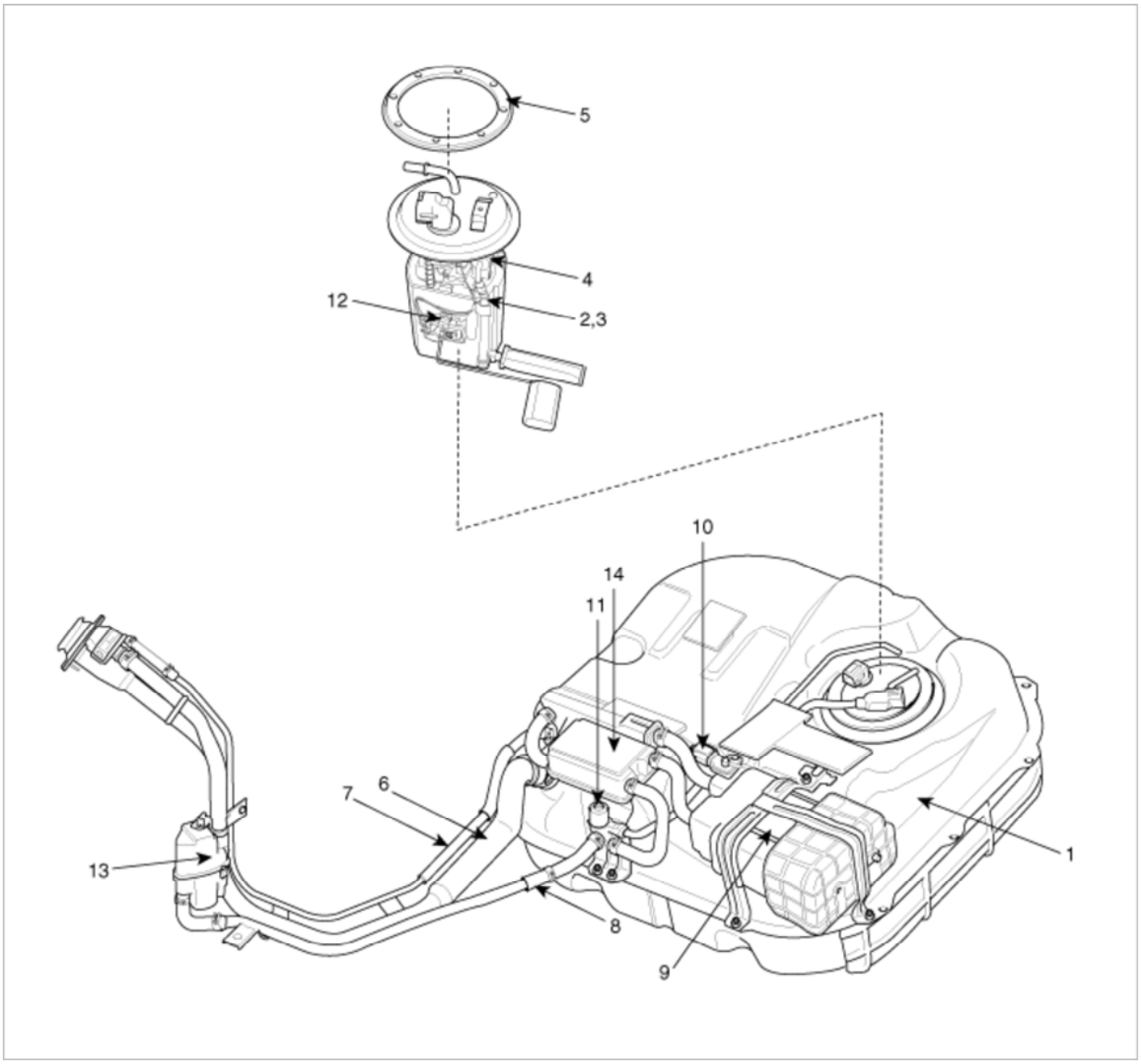
Verification of Vehicle Repair

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

Fuel System > Fuel Delivery System > Components and Components Location

Component Location



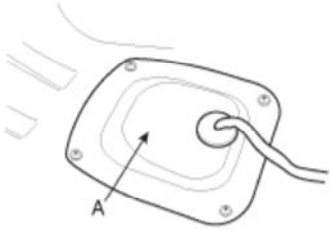
1. Fuel Tank	8. Ventilation Hose
2. Fuel Pump	9. Canister
3. Fuel Filter (Included Fuel Pump)	10. Fuel Tank Pressure Sensor (FTPS)
4. Fuel Pressure Regulator	11. Canister Close Valve (CCV)
5. Fuel Pump Plate Cover	12. Fuel Level Sensor (FLS)
6. Fuel Filler Hose	13. Fuel Tank Air Filter
7. Leveling Hose	14. Separator

Fuel System > Fuel Delivery System > Repair procedures

Fuel Pressure Test

1. PREPARING

1. Remove the rear seat cushion (Refer to "Seat" in BD group).
2. Open the service cover (A).

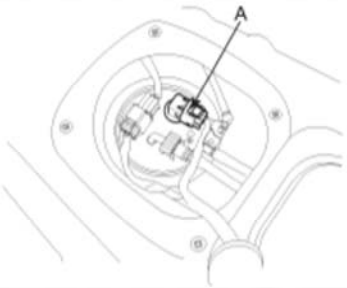


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



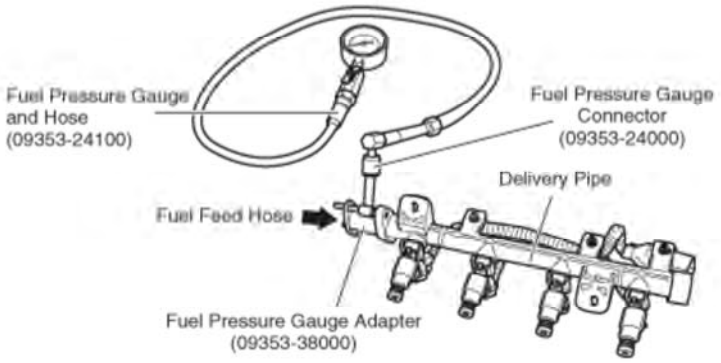
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

1. Disconnect the fuel feed hose from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gage Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gage Connector (09353-24000) to the Fuel Pressure Gage Adapter (09353-38000).
4. Connect the Fuel Pressure Gage and Hose (09353-24100) to Fuel Pressure Gage Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gage Adapter (09353-38000).



4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESSURE TEST

1. Diconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 338 ~ 348 kpa (3.45 ~ 3.55 kgf/㎠, 49.0 ~ 50.5 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor 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.

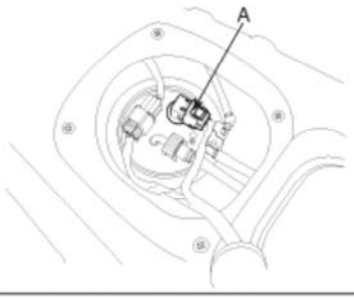
After engine stops, the gage reading should hold for about 5 minutes

- 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

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.



NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.

7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

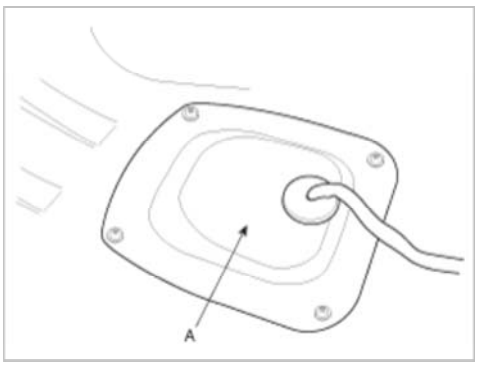
8. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

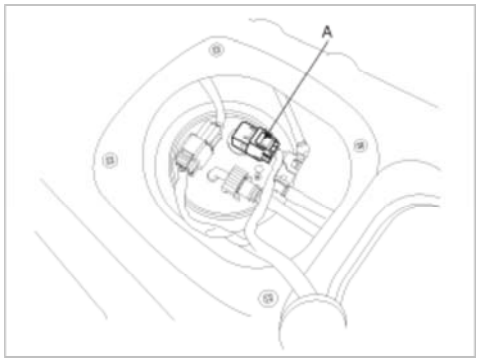
Fuel System > Fuel Delivery System > Fuel Tank > Repair procedures

Removal

1. Preparation
   (1) Remove the rear seat cushion (Refer to "Seat" in BD group).
   (2) Open the service cover (A).



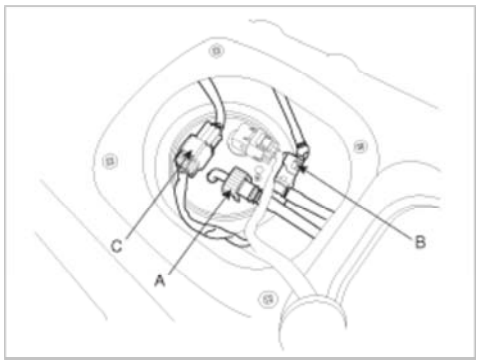
   (3) Disconnect the fuel pump connector (A).



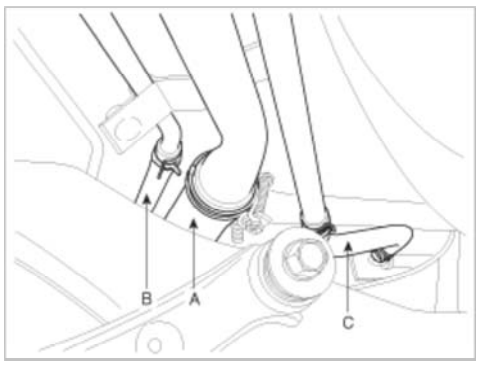
(4) Start the engine and wait until fuel in fuel line is exhausted.

(5) After engine stalls, turn the ignition switch to OFF position.

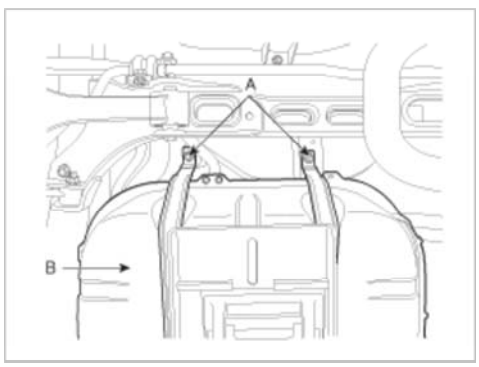
2. Disconnect the fuel feed quick-connector (A), the vapor vacuum tube quick-connector (B), and the canister close valve connector (C).



3. Lift the vehicle and support the fuel tank with a jack.
4. Disconnect the fuel filler hose (A), the leveling hose (B) and the vapor hose (C).



5. Unscrew the fuel tank band mounting nuts (A) and remove the fuel tank (B).



Installation

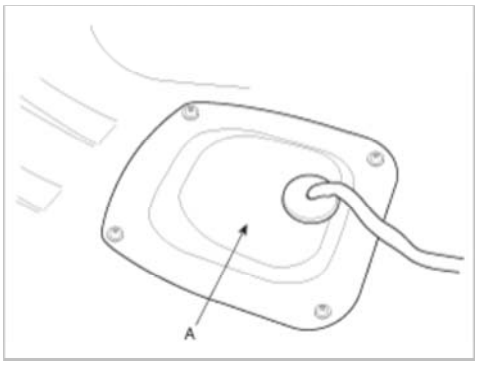
Installation is reverse of removal.

Fuel tank band installation nut:
39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

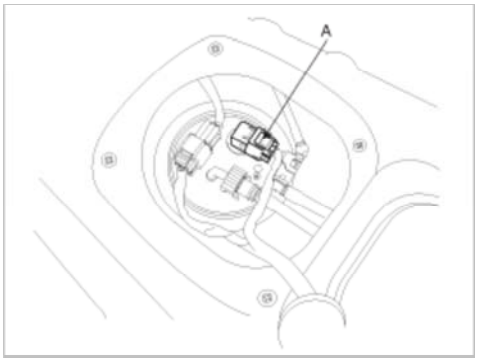
Fuel System > Fuel Delivery System > Fuel Pump > Repair procedures

Removal

1. Preparation
   (1) Remove the rear seat cushion (Refer to "Seat" in BD group).
   (2) Open the service cover (A).

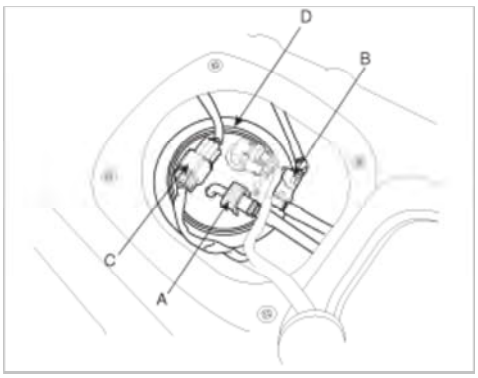


   (3) Disconnect the fuel pump connector (A).

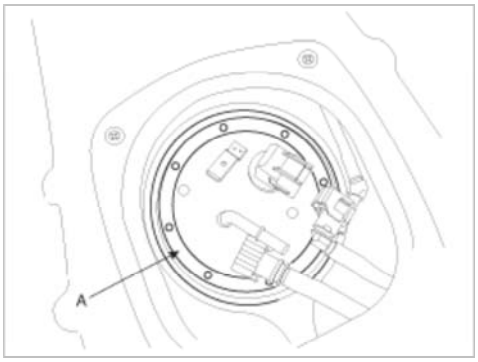


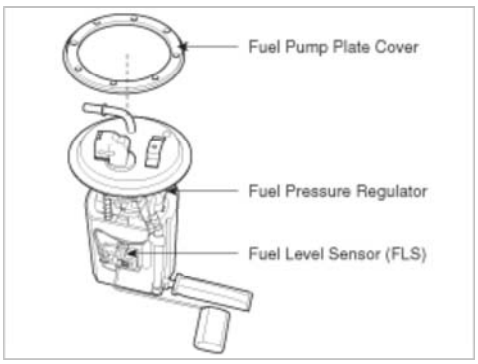
   (4) Start the engine and wait until fuel in fuel line is exhausted.
   (5) After engine stalls, turn the ignition switch to OFF position.

2. Disconnect the fuel feed tube quick-connector (A), the vapor tube quick-connector (B), and the canister close valve connector (C).



3. Remove the rubber cover (D).
4. Remove the fuel pump plate cover (A) with the special service tool (SST No.: 09310-2B200), and then remove the fuel pump assembly





Installation

Installation is reverse of removal.

Fuel Pump Plate Cover Tightening :
78.5 ~ 98.1 N.m (8.0 ~ 10.0 kgf.m, 57.9 ~ 72.4lb-ft)

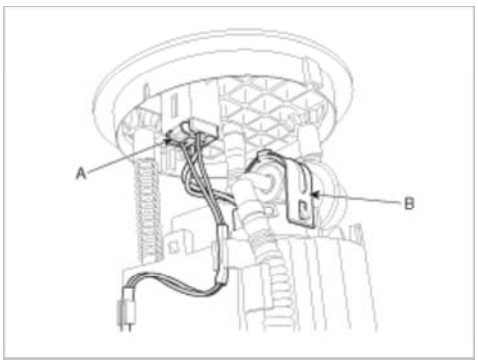
CAUTION

When installing the fuel pump module, be careful not to get the seal-ring entangled.

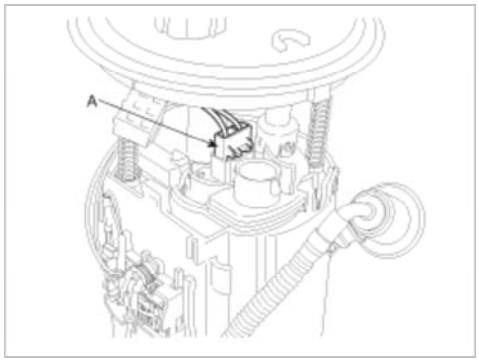
Fuel System > Fuel Delivery System > Fuel Filter > Repair procedures

Replacement

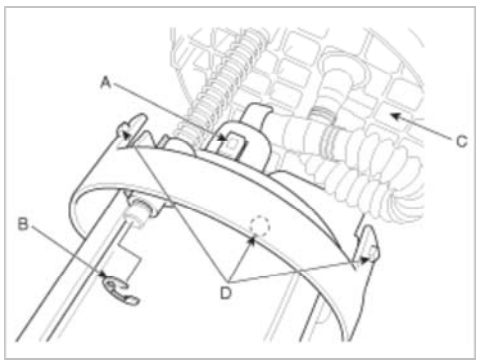
1. Remove the fuel pump (Refer to “Fuel Pump” in this group).
2. Disconnect the electric pump & sender wiring connector (A) and remove the regulator cap (B).



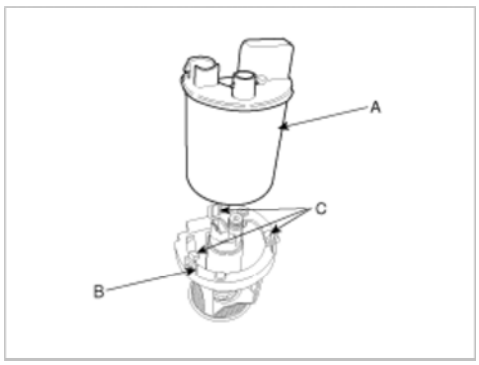
3. Disconnect the electric pump wiring connector (A) from the pump.



4. Disconnect the feed tube connector (A).



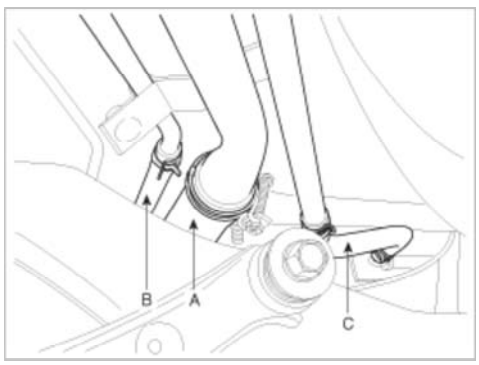
5. Remove the cushion pipe fixing clip (B) after pressing the head assembly (C).
6. Separate the head assembly (C) from the fuel pump & filter assembly after disengaging the three fixing hooks (D).
7. Separate the fuel filter (A) from the fuel pump assembly (B) after disengaging the three fixing hooks (C).



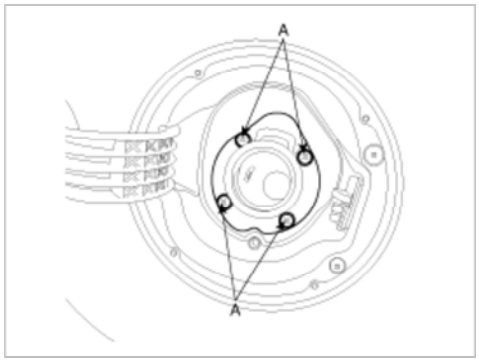
Fuel System > Fuel Delivery System > Filler-Neck Assembly > Repair procedures

Removal

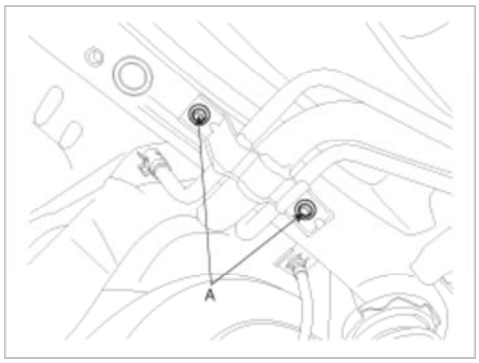
1. Disconnect the fuel filler hose (A), the leveling hose (B) and the ventilation hose (C).



2. Open the fuel filler door and unfasten the filler-neck assembly mounting screws (A).



3. Remove the rear-LH wheel, tire, and the inner wheel house.
4. Remove the bracket mounting bolt (A) and remove the filler-neck assembly.



Installation

1. Installation is reverse of removal.

Specifications

Item	Specification
Clutch operation method	Hydraulic type
Clutch disc Type Facing diameter (outside x inside)mm (in)	 Single dry with diaphragm Ø225 × Ø150 (Ø8.9 × Ø5.9)
Clutch cover assembly Type	 Diaphragm spring strap
Clutch release cylinder * I.D. mm (in)	 20.64 (0.81)
Clutch master cylinder * I.D. mm(in)	 15.87 (0.62)

* I.D: Inside diameter

Service Standard

Standard value	
Clutch disc thickness [When free]	8.55 ± 0.3 mm (0.335 ±0.012 in)
Clutch pedal height [Without carpet]	182.8 mm (7.19 in)
Clutch pedal free play	6 ~ 13 mm (0.24 ~ 0.51 in)
Clutch pedal stroke	140 ± 3mm (5.5 ± 0.12 in)
Limit	
Clutch disc rivet depth	1.2 mm (0.047 in)
Diaphragm spring end height difference	0.5 mm (0.02 in)
Clutch master cylinder clearance to piston	0.15 mm (0.006 in)

Tightening Torques

Item	Nm	kgf.m	lb-ft
Clutch pedal to pedal support member (Clutch pedal bracket)	17 ~ 26	1.7 ~ 2.6	12.3~ 18.8
Clutch pedal support member to master cylinder	6 ~ 8	0.6 ~ 0.8	4.3 ~ 5.8
Clutch tube flare nut	13 ~ 17	1.3 ~ 1.7	9.4 ~ 12.4
Clutch tube bracket	8~ 10	0.8 ~ 1.0	5.8 ~ 7.24
Clutch release cylinder	15 ~ 22	1.5 ~ 2.2	10.9 ~ 16.0
Clutch release cylinder union bolt	25 ~ 35	2.5 ~ 3.5	18.1 ~ 25.5
Clutch cover assembly	15 ~ 22	1.5 ~ 2.2	10.9 ~ 16.0
Ignition lock switch nut	8 ~ 10	0.8 ~ 1.0	5.8 ~ 7.3

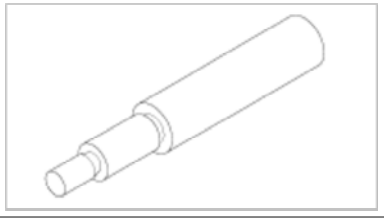
Lubricants

Items	Specified lubricants	Quantity
Contact surface of release bearing and fulcrum of clutch release fork	CASMOLY L9508	As required
Inner surface of clutch release bearing	CASMOLY L9508	As required
Inner surface of clutch release cylinder and outer circumference of piston and cup	Brake fluid DOT 3 or DOT 4	As required

Inner surface of clutch disc spline	CASMOLY L9508	As required
Inner surface of clutch master cylinder and outer circumference of piston assembly	Brake fluid DOT 3 or DOT 4	As required
Clutch master cylinder push rod, clevis pin and washer	Wheel bearing grease SAE J310, NLGI No.2V	As required
Clutch pedal shaft and bushings	Chassis grease SAE J310a, NLGI No.1	As required
Contact portion of release fork to release cylinder push rod	CASMOLY L9508	As required
Input shaft spline	CASMOLY L9508	As required

Clutch System > General Information > Special Service Tools

Special Service Tools

Tool (Number and name)	Illustration	Use
09411-11000 Clutch disc guide		Installation of the clutch disc.

Clutch System > General Information > Troubleshooting

Troubleshooting

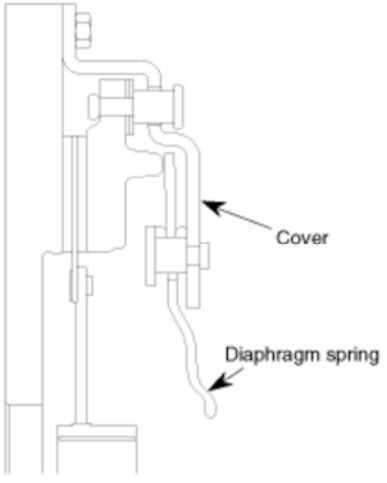
Trouble symptom		Suspect area	Remedy
Clutch slipping • Car will not respond to engine speed during acceleration • Insufficient vehicle speed • Lack of power during uphill driving		Insufficient pedal free play	Adjust
		Clogged hydraulic system	Correct or replace parts
		Excessive wear of clutch disc facing	Replace
		Hardened clutch disc facing, or oil on surface	Replace
		Damaged pressure plate or flywheel	Replace
		Weak or broken pressure spring	Replace
Difficult gear shifting (gear noise during shifting)		Excessive pedal free play	Adjust
		Hydraulic system fluid leaks, air trapping or clogging	Repair or replace parts
		Unusual wear or corrosion of the clutch disc spline	Replace
		Excessive vibration (distortion) of the clutch disc	Replace
Clutch noisy	When the clutch is not used	Insufficient play of the clutch pedal	Adjust
		Excessive wear of the clutch disc facing	Replace
	A noise is heard after the clutch is disengaged	Unusual wear and/ or damage of the release bearing	Replace
	A noise is heard when the clutch is disengaged	Insufficient grease on the sliding surface of the bearing sleeve	Repair
		Improperly installed clutch assembly or bearing	Repair

	A noise is heard when the car suddenly rolled up with the clutch partially engaged	Damaged pilot bushing	Replace
Hard pedal effort		Insufficient lubrication of the clutch pedal	Repair
		Insufficient lubrication of the spline part of clutch disc	Repair
		Insufficient lubrication of the clutch release lever shaft	Repair
Hard to shift or will not shift		Excessive clutch pedal free play	Adjust the pedal free play
		Faulty of the clutch release cylinder	Repair the release cylinder
		Clutch disc out of place, runout is excessive or lining broken	Inspect the clutch disc
		Spline on the input shaft or clutch disc dirty or burned	Repair as necessary
		Faulty of the clutch pressure plate	Replace the clutch cover
Clutch slips		Insufficient clutch pedal free play	Adjust the pedal free play
		Clogged of the hydraulic system	Repair or replace parts
		Clutch disc lining oily or worn out	Inspect the clutch disc
		Faulty pressure plate	Replace the clutch cover
		Binding of the release fork	Inspect the release fork
Clutch grabs/chatters		Clutch disc lining oily or worn out	Inspect the clutch disc
		Faulty the pressure plate	Replace the clutch cover
		Bent clutch diaphragm spring	Replace the clutch cover
		Worn or broken torsion spring	Replace the clutch disc
		Engine mounts loose	Repair as necessary
Clutch noisy		Damaged the clutch pedal bushing	Replace the clutch pedal bushing
		Loose part inside housing	Repair as necessary
		Worn or dirty release bearing	Replace the replease bearing
		Sticking release fork or linkage	Repair as necessary

Clutch System > Clutch System > Description and Operation

Description

General Clutch Cover



· In a general clutch cover, the diaphragm spring increases the weight to the disc in proportion to abrasion.

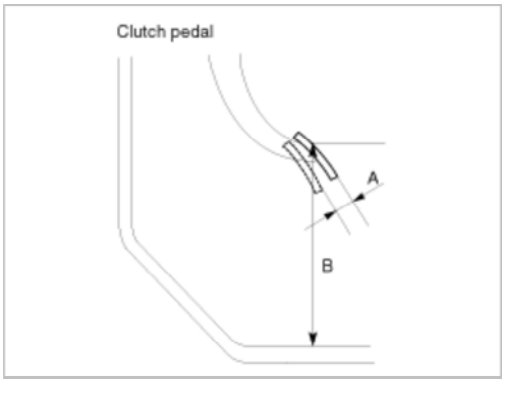
Clutch System > Clutch System > Repair procedures

Service Adjustment Procedure

Clutch Pedal Inspection And Adjustment

1. Measure the clutch pedal height (from the face of the pedal pad to the floorboard) and the clutch pedal clevis pin play (measured at the face of the pedal pad.)

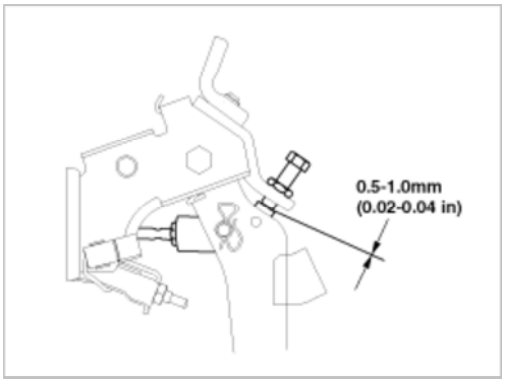
Standard value
(A) : 6 ~ 13 mm (0.24~0.51 in)
(B)182.8 mm (7.19 in)



2. If the clutch pedal freeplay and height is not within the standard value range, adjust as follows:
   (1) Turn and adjust the bolt within the standard value, then secure by tightening the lock nut.

NOTE

If the clutch pedal height is lower than the standard value, loosen the bolt and adjust the push rod.
After adjustment, tighten the bolt so that the clearance with pedal stopper becomes 0.5mm(0.02 in) to 1.0mm (0.04 in) and secure with lock nut.



(2) Turn the push rod to agree with the standard value and then secure the push rod with the lock nut.

> **CAUTION**
>
> When adjusting the clutch pedal height or the clutch pedal play, be careful not to push the push rod toward the master cylinder.

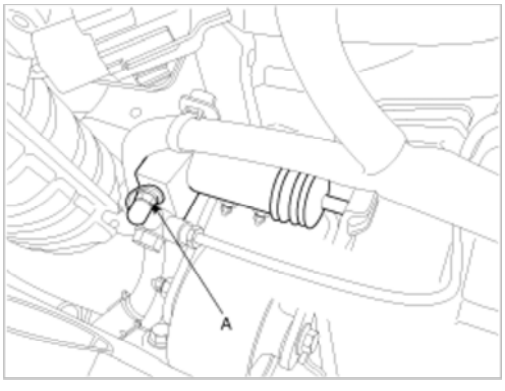
3. If the clutch pedal free play and the distance between the clutch pedal and the floor board when the clutch is disengaged, do not meet with the standard values, it may be the result of either air in the hydraulic system or a faulty clutch master cylinder. Bleed the air or disassemble and inspect the master cylinder or clutch.

Bleeding

> **CAUTION**
>
> Use the specified fluid. Avoid mixing different brands of fluid.

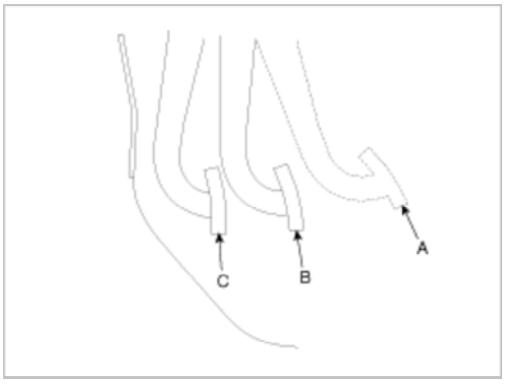
Specified fluid : SAE J1703 (DOT 3 or DOT 4)

1. Loosen the bleeder screw(A) at the clutch release cylinder.



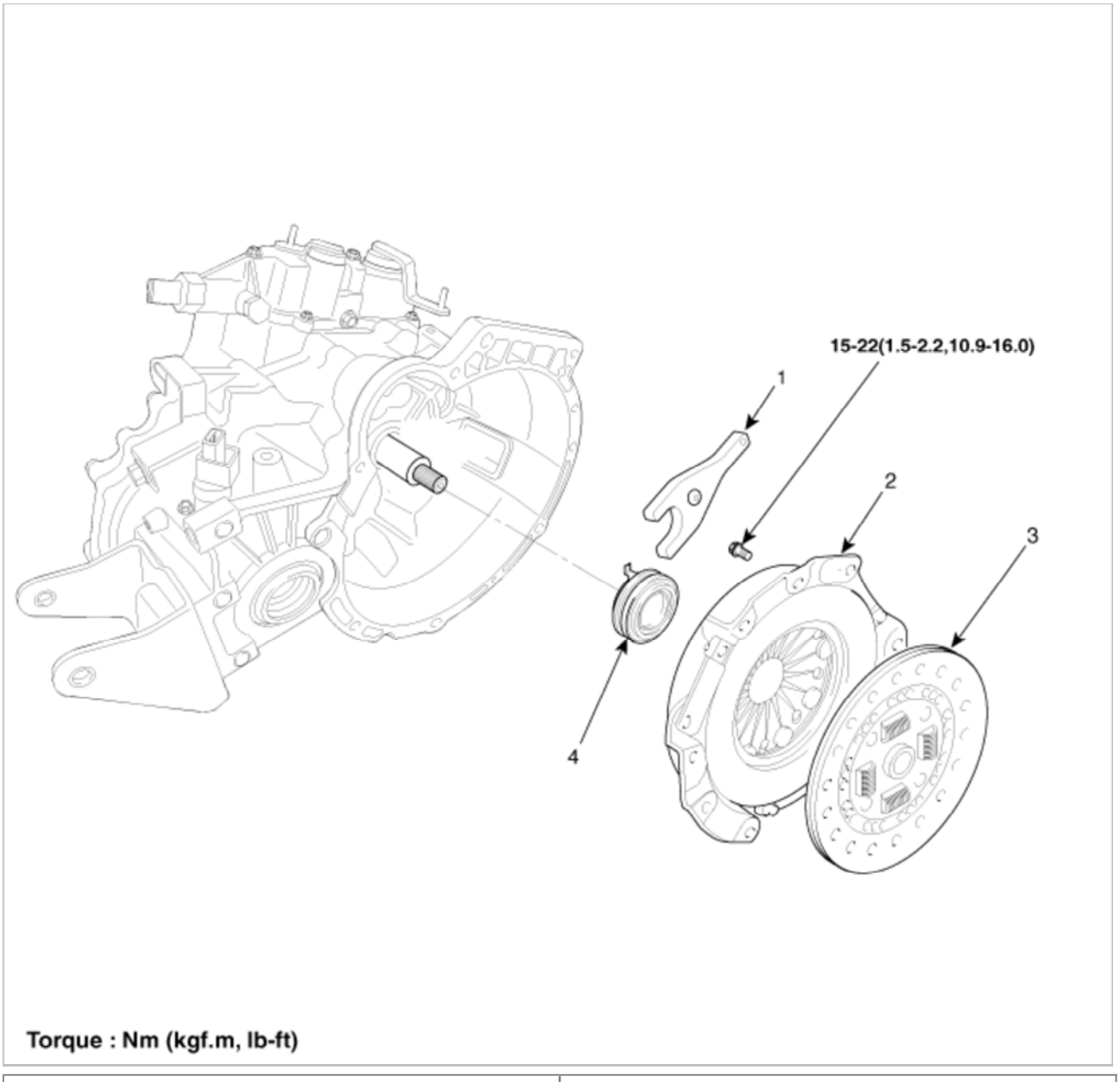
2. Depress the clutch pedal slowly until all air is expelled.
3. Hold the clutch pedal down until the bleeder is retightened.
4. Refill the clutch master cylinder with the specified fluid.

> **CAUTION**
>
> The rapidly-repeated operation of the clutch pedal in B-C range may disrupt the release cylinder's position. During the bleeding operation, press the clutch pedal to the floor after it returns to the "A" point.



Clutch System > Clutch System > Clutch Cover And Disc > Components and Components Location

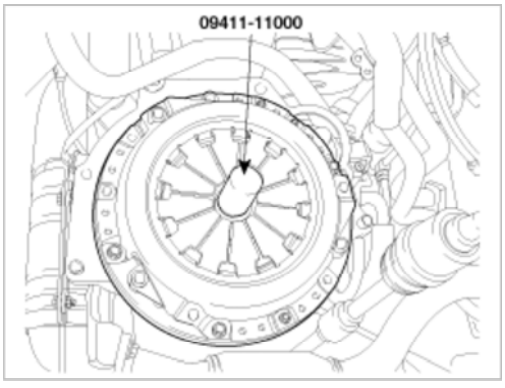
Components



1. Clutch release fork 2. Clutch disc cover	3. Clutch disc 4. Clutch release bearing

Removal

1. Remove the transaxle assembly. (Refer to Manual transaxle's removal in MT group)
2. Insert the special tool (09411-11000) in the clutch disc to prevent the disc from shifting.



3. Loosen the bolts(Gasoline : 6ea, Diesel 1.6 : 9ea, Diesel 2.0 : 6ea) which attach the clutch cover to the flywheel in a star pattern. Loosen the bolts in succession, one or two turns at a time, to avoid bending the cover.

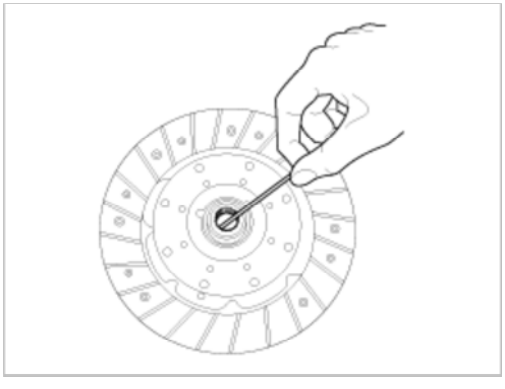
> NOTE
>
> Do not clean the clutch disc or the release bearing with cleaning solvent.

Installation

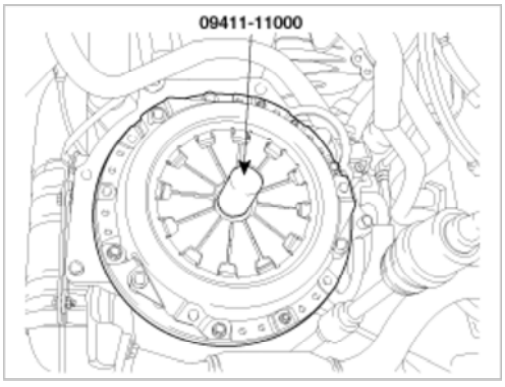
1. Apply multipurpose grease to the spline of the disc.

Grease: CASMOLY L 9508

> CAUTION
>
> When installing the clutch, apply grease to each part, but be careful not to apply excessive grease.
> It can cause clutch slippage and vibration (shudder).

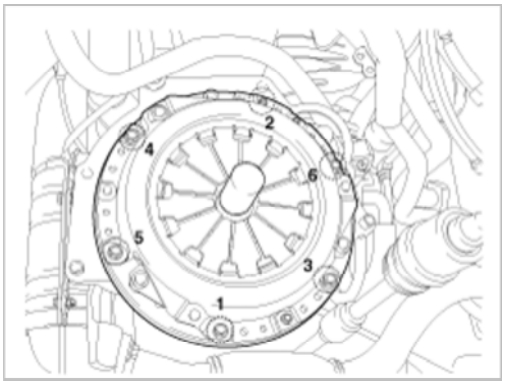


2. Temporarily install the clutch disc assembly to the flywheel using the special tool (09411-11000).



3. Tighten the bolts one or two steps at a time in a star pattern.

Tightening torque :
15 ~ 22 Nm (1.5 ~ 2.2 kgf.m, 10.9 ~ 16.0 lb-ft)



4. Remove the clutch disc guide (09411-11000).
5. Install the transaxle assembly to the engine. (Refer to Manual transaxle's installation in MT group)

Inspection

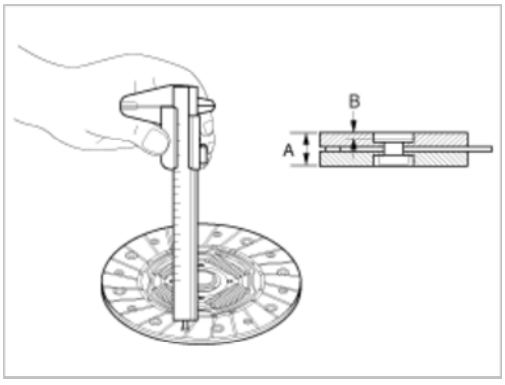
Clutch cover assembly

1. Check the diaphragm spring end for wear and uneven height.
2. Check the pressure plate surface for wear, cracks and color change.
3. Check the rivets for looseness and replace the clutch cover assembly if necessary.

Clutch disc

1. Check the clutch facing for loose rivets, uneven contact, deterioration due to seizure, adhesion of oil, or grease, and replace the clutch disc if defective.
2. Measure the thickness of the disc when free.

Standard value
Clutch disc thickness(A)[when free]
Clutch disc rivet depth(B)
: refer to 'SERVICE STANDARD' in GENERAL section.



3. Check for the torsion spring play and damage and if defective, replace the clutch disc.
4. Clean the splines on the input shaft and install the clutch disc.
   If the disc does not slide smoothly or if play is excessive, replace the clutch disc and/or the input shaft.

Clutch release bearing

> CAUTION
>
> The release bearing is packed with grease. Do not use cleaning solvent or oil.

Standard grease : CASMOLY L9508

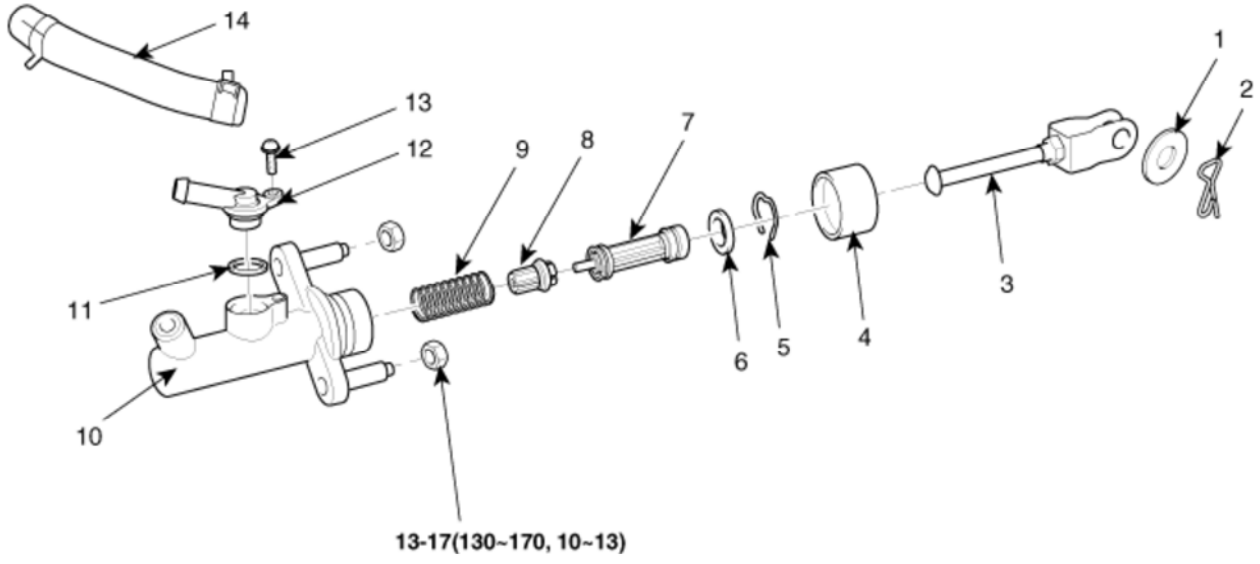
1. Check the bearing for seizure, damage or abnormal noise. Also check the diaphragm spring contacting points for wear.
2. Replace the bearing if the release fork contacting points are worn abnormally.

Clutch release fork

If there is abnormal wear at the point of contact with the bearing, replace the release fork assembly.

Clutch System > Clutch System > Clutch Master Cylinder > Components and Components Location

Components



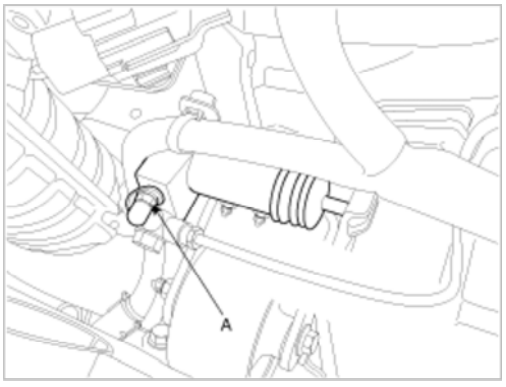
Torque : Nm (kgf.cm, lb-ft)

7. Piston assembly	8. Spring seat
1. Washer	9. Spring
2. Snap pin	10. Body assembly
3. Rod assembly	11. O-ring
4. Boot	12. Nipple
5. Key	13. Bolt
6. Plate	14. Flexible hose
7. Piston assembly	

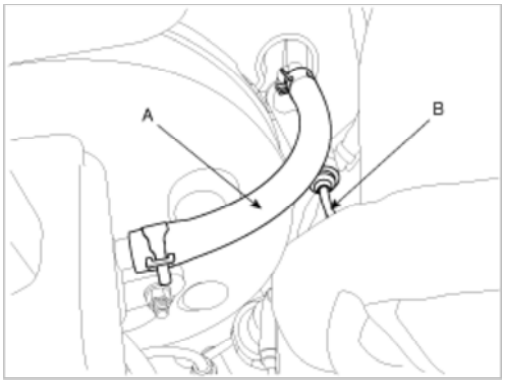
Clutch System > Clutch System > Clutch Master Cylinder > Repair procedures

Removal

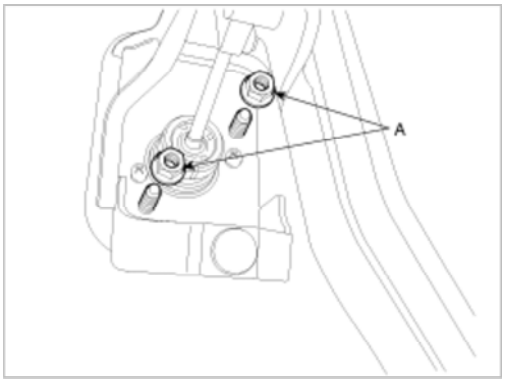
1. Drain the brake fluid through the bleeding plug (A).



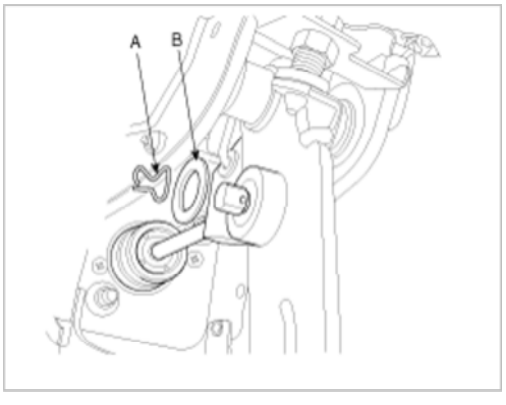
2. Remove the flexible hose (A) connected to brake reserve tank from the master cylinder.



3. Disconnect the clutch tube (B) from the master cylinder.
4. Disconnect the two ignition lock switch connectors.
5. Remove the clutch pedal mounting nuts(A-2ea) and the bracket mounting nut.



6. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer (B).

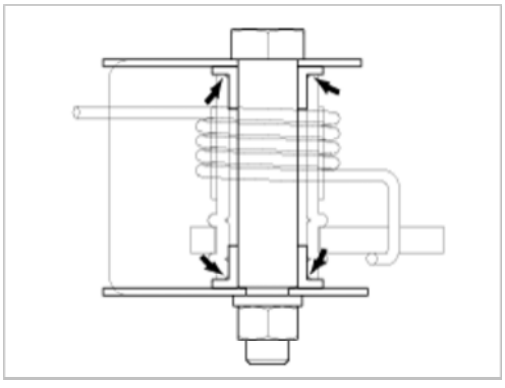


7. Remove the screws mounting the master cylinder to the clutch pedal assembly.

Installation

1. Apply the specified grease to the clutch pedal and bushings.

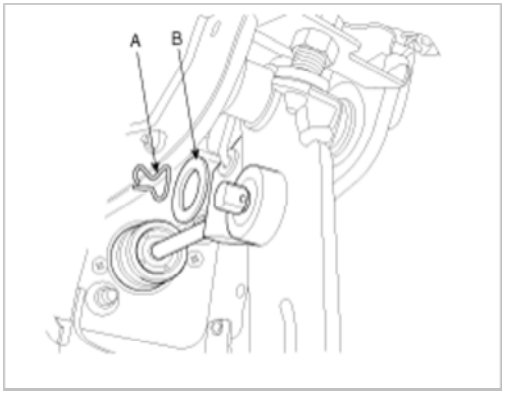
Chassis grease : SAE J310a, NLGI No.1



2. Install the screws or nut mounting the master cylinder to the clutch pedal assembly.
3. Apply the specified grease to the snap pin(A) and washer.

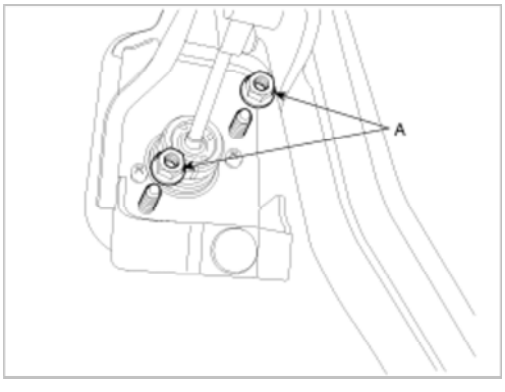
Wheel bearing grease : SAE J310, NLGI No.2

4. Connect the push rod to the clutch pedal by installing the snap pin (A) and washer (B).



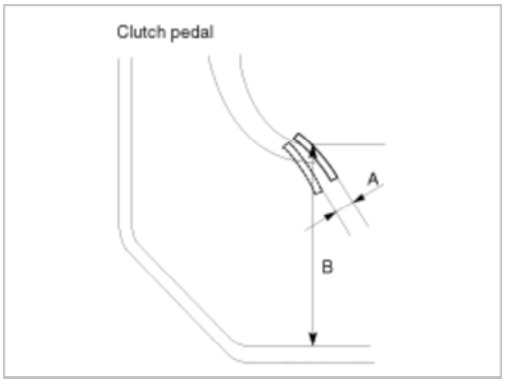
5. Install the clutch pedal mounting nuts (A-2ea).

Tightening torque :
17 ~ 26Nm (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)

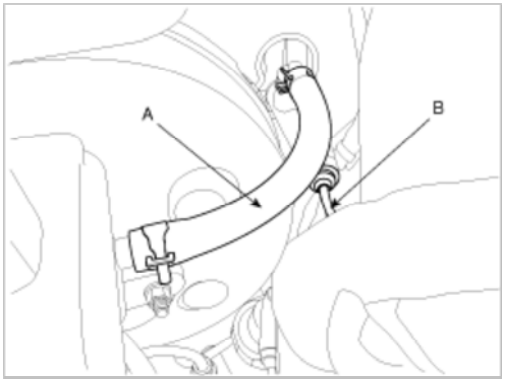


6. Adjust the clutch pedal within the standard value, then secure by tightening the lock nut.

Standard value
Free play (A)
6~13mm (0.24~0.51 in)
Height (B)
182.8mm (7.19 in)



7. Connect the flexible hose of the brake reserve tank to the master cylinder.



8. Connect the clutch tube(B) to the master cylinder.
9. Refill the brake fluid.
10. Bleed the air in the clutch system.(refer to Bleeding in Serive Adjustment Procedure)

Disassembly

1. Remove the piston stop ring.
2. Pull out the push rod and piston assembly.
3. Remove the reserve tank band, reserve tank cap, and reserve tank.

> NOTE
>
> 1. Use care not to damage the master cylinder body and piston assembly.
> 2. Do not disassemble the piston assembly.

Inspection

1. Check the inside of the cylinder body for rust, pitting or scoring.
2. Check the piston cup for wear or distortion.
3. Check the piston for rust, pitting or scoring.
4. Check to make sure the clutch line tube is not clogged or restricted in any way.
5. Measure the master cylinder inside diameter and the piston outside diameter with a cylinder gauge micrometer.

> NOTE
>
> Measure the inside diameter of the master cylinder at three places (bottom, middle, and top) in a perpendicular direction.

6. If the master cylinder-to-piston clearance exceeds the limit, replace the master cylinder and/or piston assembly.

Limit : 0.15 mm (0.006 in)

Reassembly

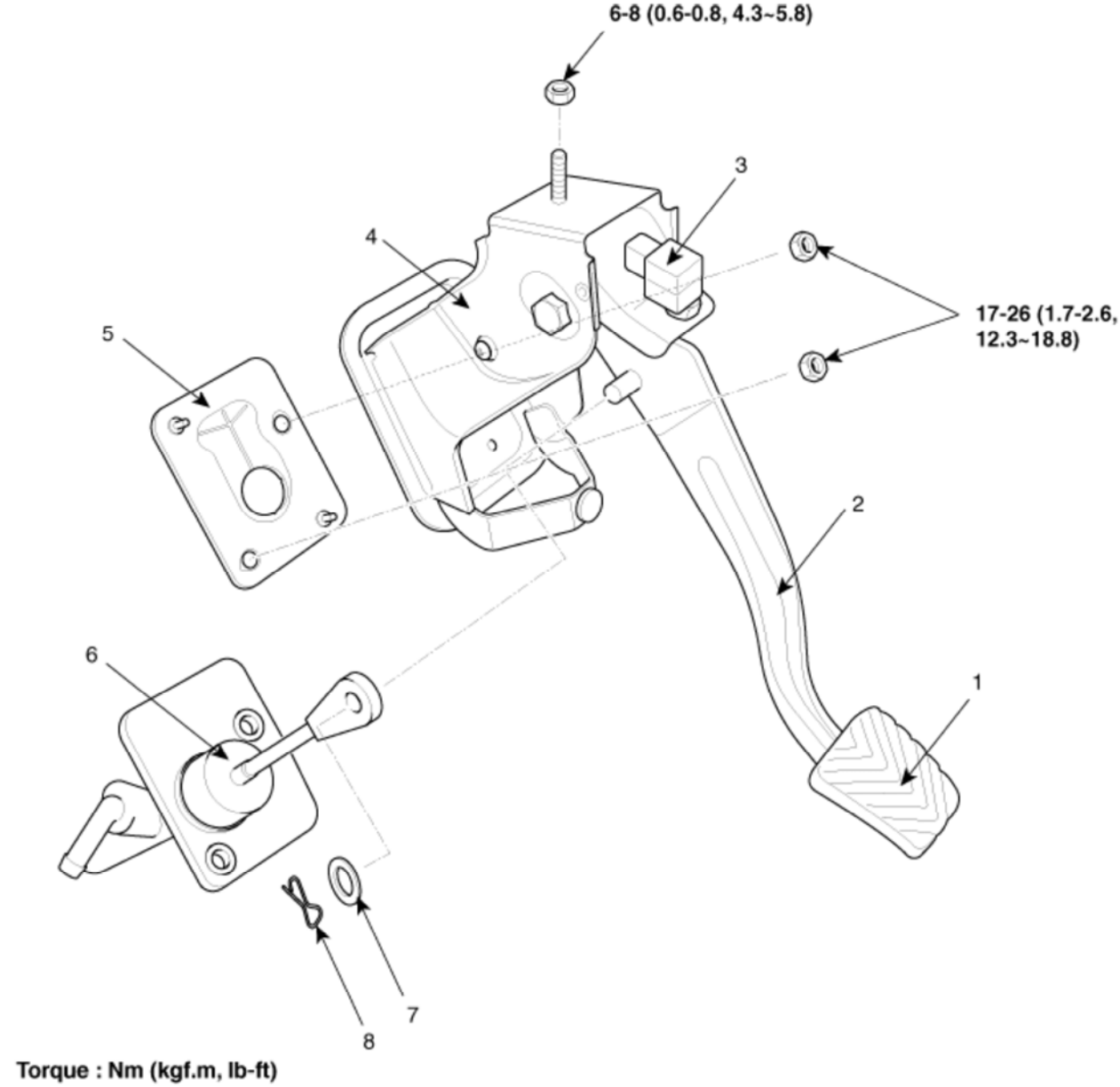
1. Apply the specified fluid to the inner surface of the master cylinder body (A) and to the entire periphery of the piston assembly (B).

Specified fluid : Brake fluid DOT 3 or DOT 4

2. Install the piston assembly.
3. Install the piston snap ring.
4. Install the push rod assembly.

Clutch System > Clutch System > Clutch Pedal > Components and Components Location

Components



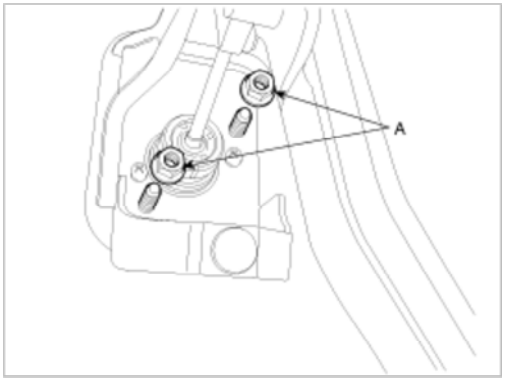
1. Pedal pad	5. Dust cover
2. Clutch arm assembly	6. Master cylinder assembly
3. Ignition lock switch	7. Washer

4. Clutch member assembly	8. Snap pin

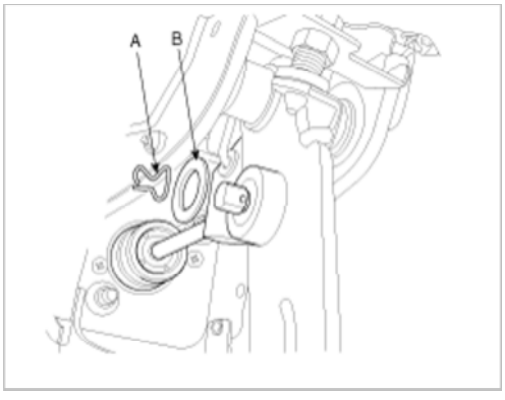
Clutch System > Clutch System > Clutch Pedal > Repair procedures

Removal

1. Disconnect the two ignition lock switch connectors.
2. Remove the clutch pedal mounting nuts(A-2ea) and the bracket mounting nut.



3. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer (B).

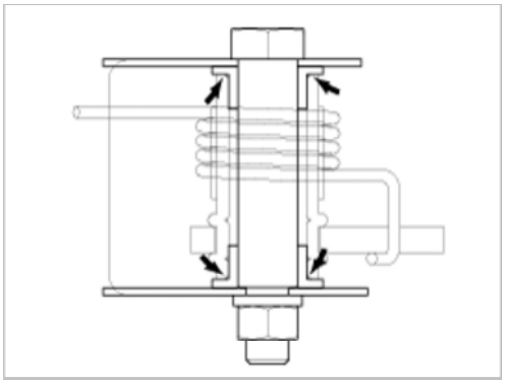


4. Remove the screws or nut mounting the master cylinder to the clutch pedal assembly.

Installation

1. Apply the specified grease to the clutch pedal and bushings.

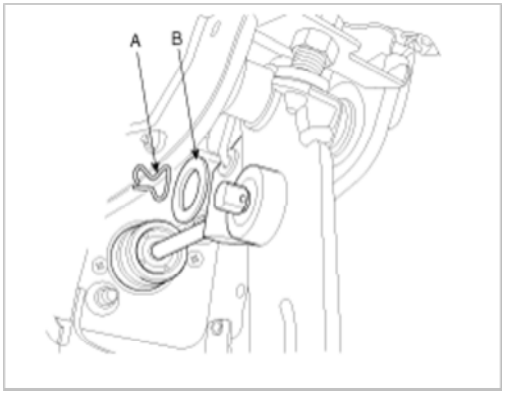
Chassis grease : SAE J310a, NLGI No.1



2. Install the screws or nut mounting the master cylinder to the clutch pedal assembly.
3. Apply the specified grease to the snap pin(A) and washer.

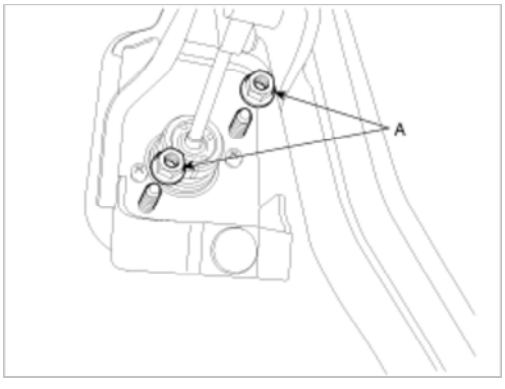
Wheel bearing grease : SAE J310, NLGI No.2

4. Connect the push rod to the clutch pedal by installing the snap pin (A) and washer (B).



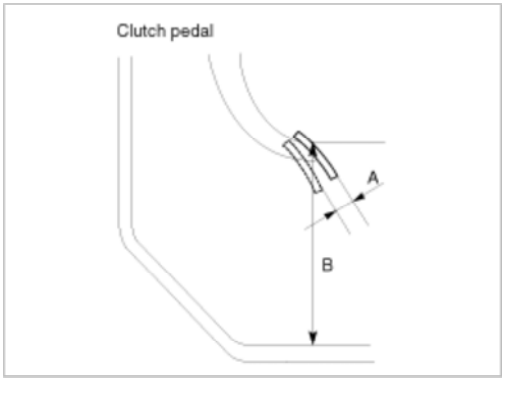
5. Install the clutch pedal mounting nuts (A-2ea).

Tightening torque :
17 ~ 26Nm (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



6. Adjust the clutch pedal within the standard value, then secure by tightening the lock nut.

Standard value
Free play (A)
6~13mm (0.24~0.51 in)
Height (B)
182.8mm (7.19 in)

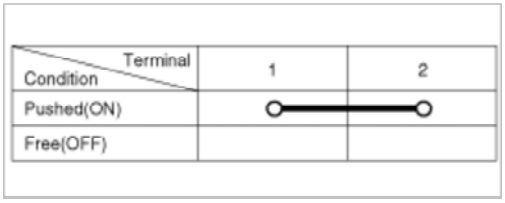


Inspection

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.

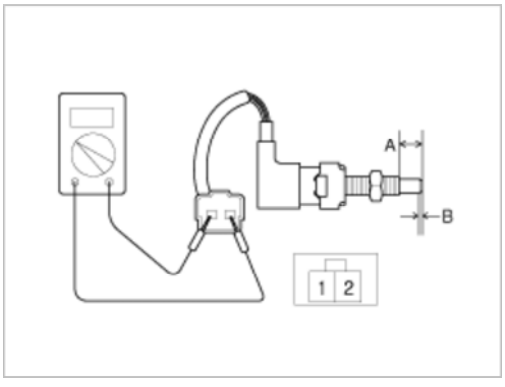
Ignition lock switch inspection

Remove the ignition lock switch and check for continuity between the terminals. If the continuity is not as specified, replace the switch.



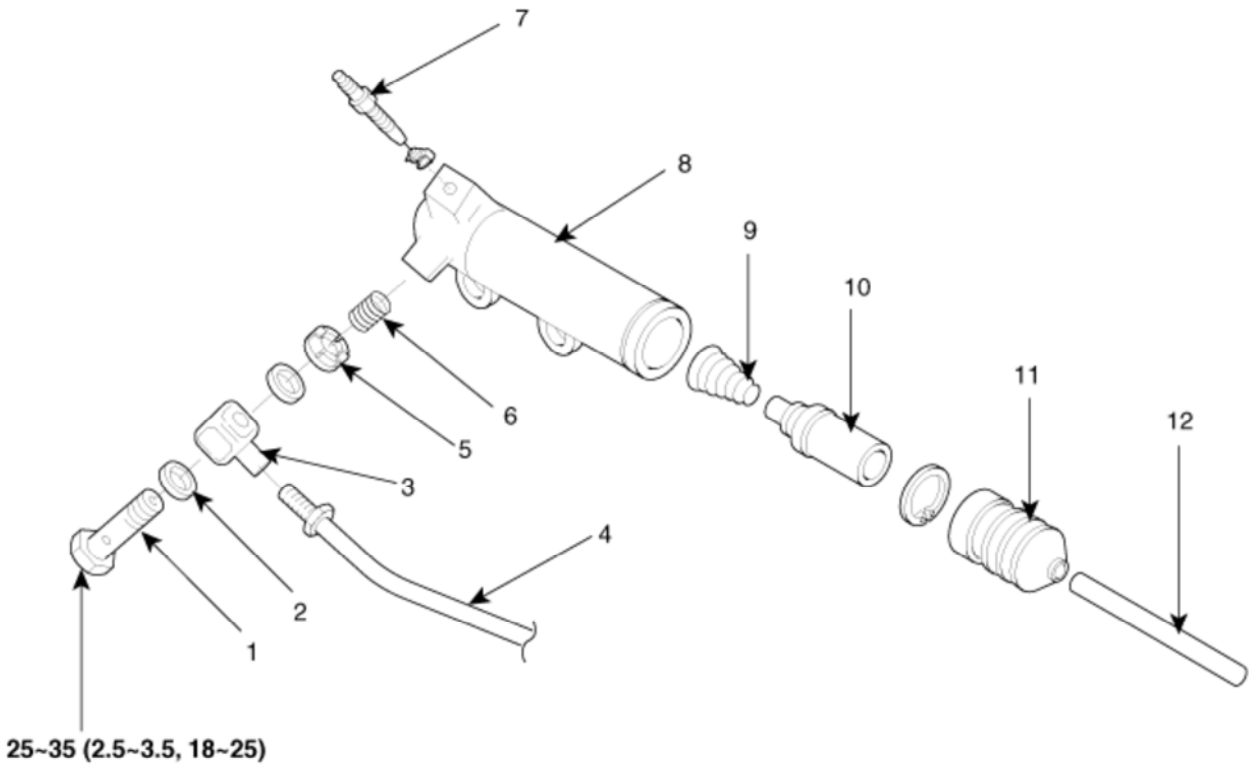
Standard value

Full stroke(A) : 12.0 ± 0.3mm (0.472 ± 0.012 in.)
ON-OFF point (B) : 2.0 ± 0.3mm (0.078 ± 0.012 in)



Clutch System > Clutch System > Clutch Release Cylinder > Components and Components Location

Components



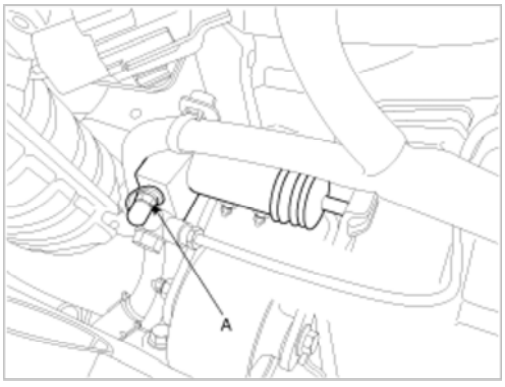
Torque : Nm (kgf.m, lb-ft)

1. Union bolt	7. Bleeder screw
2. Gasket	8. Release cylinder
3. Tube joint	9. Return spring
4. Clutch tube	10. Piston
5. Valve plate	11. Boot
6. Valve spring	12. Push rod

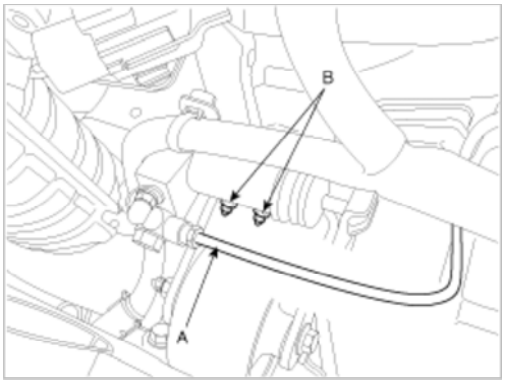
Clutch System > Clutch System > Clutch Release Cylinder > Repair procedures

Removal

1. Drain the brake fluid through the bleed plug(A).



2. Disconnect the clutch tube(A).

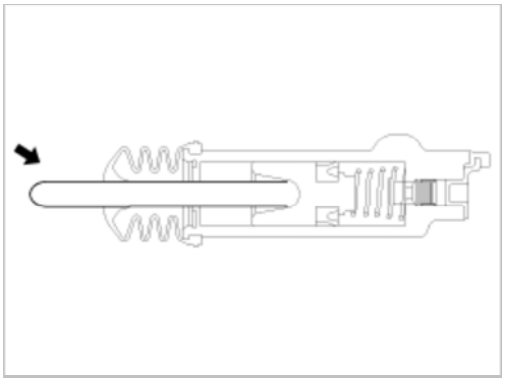


3. Remove the two clutch release cylinder mounting nuts(B-2ea).

Installation

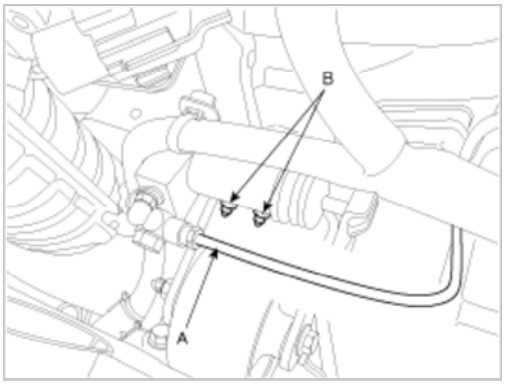
1. Coat the clutch clevis push rod specified grease.

Specified grease : CASMOLY L9508



2. Install the release cylinder mounting nuts(B-2ea).

Tightening torque :
15 ~ 22Nm (150 ~220 kgf.cm, 11 ~ 16 lb-ft)

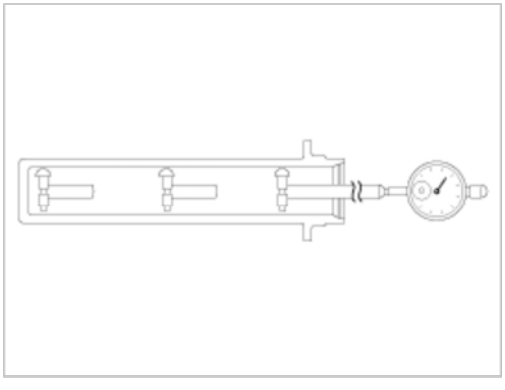


3. Install the clutch tube(A).
4. Refill the brake fluid.
5. Bleed the air in the clutch system.
   (refer to Bleeding in Service Adjustment Procedure)

Inspection

1. Check the release cylinder bore for rust and damage.
2. Measure the release cylinder bore at three locations (bottom, middle, and top) with a cylinder gauge and replace the release cylinder assembly if the bore-to-piston clearance exceeds the limit.

Limit clearance to piston : 0.25mm (0.0098 in)



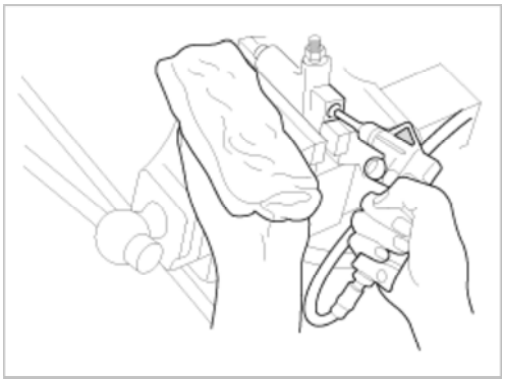
3. Check the clutch release cylinder for fluid leakage.
4. Check the clutch release cylinder boots for damage.

Disassembly

1. Remove the clutch hose, valve plate, spring, push rod, and boot.
2. Remove any dirt from the piston bore opening of the release cylinder.
3. Remove the piston from the release cylinder using compressed air.

CAUTION

- Use rags to prevent the piston from popping out and causing injury.
- Apply compressed air slowly. Keep the fluid from splashing in your eyes or on your skin.

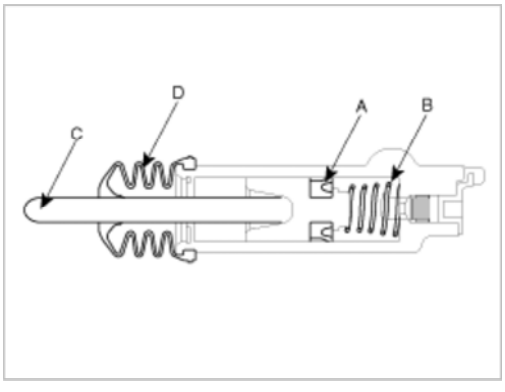


Reassembly

1. Apply specified brake fluid to the release cylinder bore and the outer surface of the piston and piston cup, and push the piston cup assembly into the cylinder.

Specified fluid : Brake fluid DOT 3 or DOT 4

2. Install the valve plate(A), Spring(B), push rod(C) and boot(D).



Specifications

Engine type		Gasoline 2.0
Transaxle type		M5CF2
Gear ratio	1st	3.308
	2nd	1.962
	3rd	1.257
	4th	0.976
	5th	0.778
	Reverse	3.583
Final gear ratio		4.188

Service Standard

Items	Standard value [in(mm)]
Input shaft rear bearing end play	0.00-0.0019L(0.00-0.05L)
Output shaft bearing end play (At 70kgf load)	0.00-0.0019T(0.00-0.05T)
Input shaft front bearing end play	0.00-0.0019L(0.00-0.05L)
Differential bearing end play (At 70kgf load)	0.0059T-0.0078T(0.15T-0.20T)
Differential pinion backlash	0.001L-0.0039L(0.025L-0.10L)

T: Indicate tightening of -(minus) direction of end play
L: Indicate loosening of +(plus) direction of end play

Tightening Torques

Standard value		Nm	kgf.m	lb-ft
Oil drain plug		60-80	6.0-8.0	43.4-57.8
Oil filler plug		60-80	6.0-8.0	43.4-57.8
Shift control cable bracket on transaxle side		20-27	2.0-2.7	14.5-19.5
Rear roll support bracket bolt		50-65	5.0-6.5	36.2-47.0
Front roll support bracket bolt		50-65	5.0-6.5	36.2-47.0
Transaxle support bracket bolts		60-80	6.0-8.0	43.4-57.8
Transaxle mounting bracket bolts		90-110	9.0-11.0	65.1-79.5
Clutch release lever fulcrum bolt		55-60	5.5-6.0	39.8-43.4
Transaxle upper mounting bolts		60-80	6.0-8.0	43.4-57.8
Transaxle lower mounting bolts	TM → ENG	43-55	4.3-5.5	31.1-39.8
	ENG → TM	30-42	3.0-4.2	21.7-30.4

WARNING

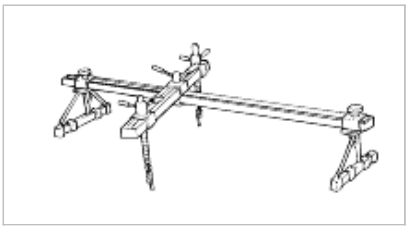
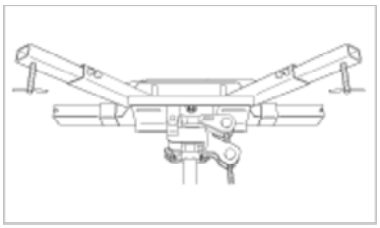
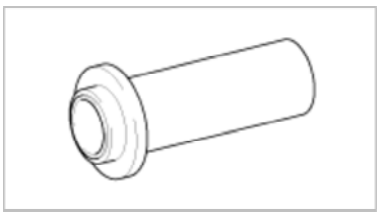
Always follow torque tightening levels. Failure to follow such levels can result in parts breaking if over-tightened or loosening if under-tightened. In either case, serious personal injury or death could result to vehicle occupants.

Lubricants

Items	Recommnend lubricant	Quantity
Transaxle gear oil	SAE 75W/85 API GL-4 TGO-7(MS517-14) ZIC G-F TOP 75W/85 HD GEAR OIL XLS 75W/85	2.0ℓ(2.1US qt, 1.76Imp qt)
Air Breather	MS721-38	As requried
Transaxle housing	MS721-40 or MS721-38	As requried
Surface of release fork and bearing	Grease (CASMOLY L9508)	As requried

Manual Transaxle System > General Information > Special Service Tools (M5CF2)

Special Service Tools

Tools (Number and Name)	Illustration	Use
09200-38001 Engine support fixture		Removal and installation of the transaxle
09624-38000 Crossmember supporter		Supporting of crossmember
09452-21200 Oil seal installer		Installation of differential oil seal

Manual Transaxle System > General Information > Troubleshooting (M5CF2)

Troubleshooting

Symptom	Probable cause	Remedy
Vibration, noise	Loose or damaged transaxle and engine mounts	Tighten or replace mounts
	Inadequate shaft end play	Correct end play
	Worn or damaged gears	Replace gears
	Inadequate grade of oil	Replace with specified oil
	Low oil level	Replenish
	Inadequate engine idle speed	Adjust idle speed
Oil leakage	Broken or damaged, oil seal or O-ring	Replace control cable oil seal or O-ring
Hard shift	Faulty control cable	Replace control cable

	Poor contact or wear of synchronizer ring and gear cone	Correct or replace
	Inadequate grade of oil	Replace with specified oil
Jumps out of gear	Worn gear shift fork or broken poppet spring	Replace shift fork or poppet spring
	Synchronizer hub-to-sleeve spline clearance too large	Replace synchronizer hub and sleeve

Manual Transaxle System > Manual Transaxle System > Repair procedures (M5CF2)

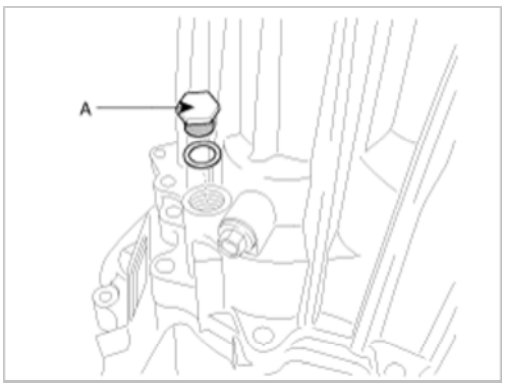
Service Adjustment Procedure

Transaxle Gear Oil Level

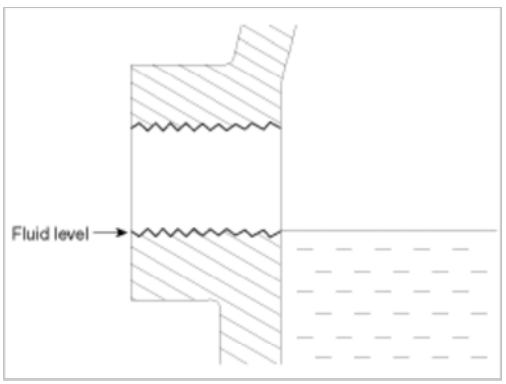
Inspection

Inspect each component for evidence of leakage.
Check the gear oil level by removing the filler plug.
If the oil is contaminated, it is necessary to replace it with new oil.

1. Remove oil filler plug(A).



2. Check level with finger.
   Oil level must be up to fill the hole, if not, add oil until it runs over.

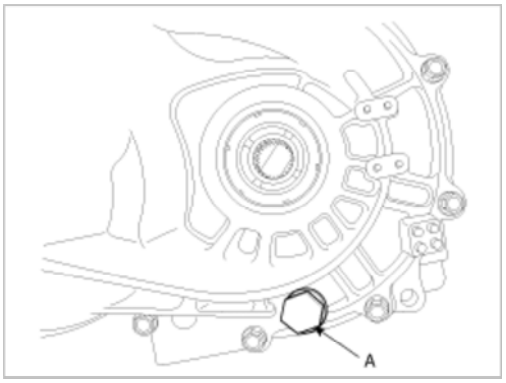


3. Install filler plug.

Tightening torque :
60-80 Nm (6.0-8.0 kgf.m, 43.4-57.8 lb-ft)

Replacement

1. With the vehicle parked on a level surface, remove the drain plug.
2. Drain the transaxle oil after loosening the drain plug(A).



3. Install the drain plug with new washer.

Tightening torque :
60-80 Nm (6.0-8.0 kgf.m, 43.4-57.8 lb-ft)

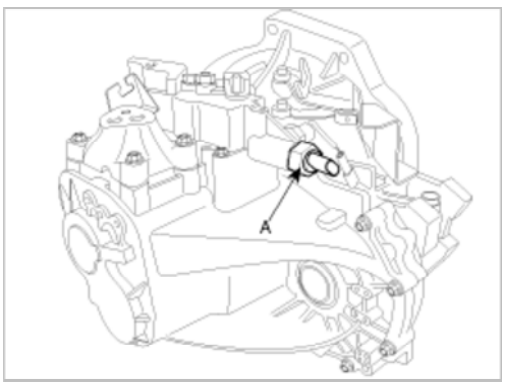
4. Add new oil through the fille plug hole and, fill it just below the plug opening.

Standard oil SAE 75W/85, API GL-4
Oil capacity: 2.0 liter (2.1 US qt, 1.76 lmp qt)

Backup Lamp Switch

Inspection

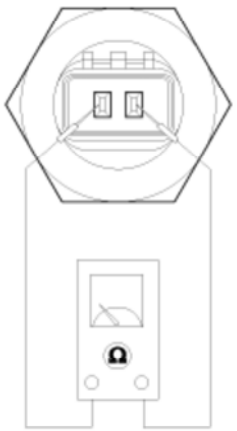
1. Disconnect the backup lamp switch(A).



2. Check the continuity between no. 1 and 2 terminals of backup lamp switch.
When the shift lever is in reverse, there should be contunuity.

Condition	1	2
Reverse Range	●	●
Other Range		

•The back up Lamp "ON" shall keep over 0.5mm(0.02in) From ON-OFF poinrt.



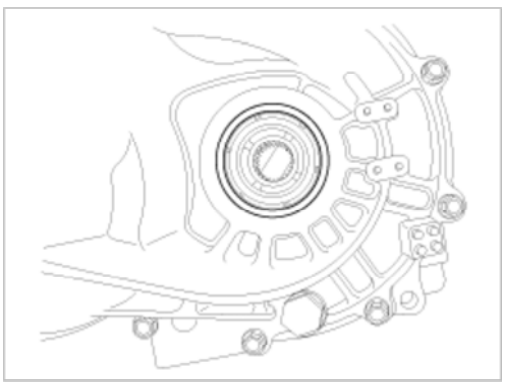
3. If necessary, repair or replace the backup lamp switch.

Tightening torque :
30-35 Nm (3.0-3.5 kgf.m, 21.7-25.3 lb-ft)

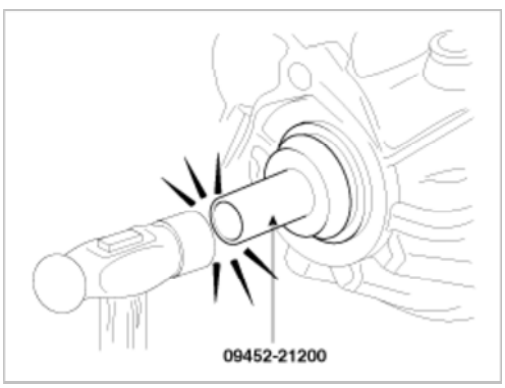
Drive Shaft Oil Seal

Replacement

1. Disconnect the drive shaft from the transaxle. (refer to Drive shaft in DS group)
2. Using a flat-tip screwdriver, remove the oil seal.

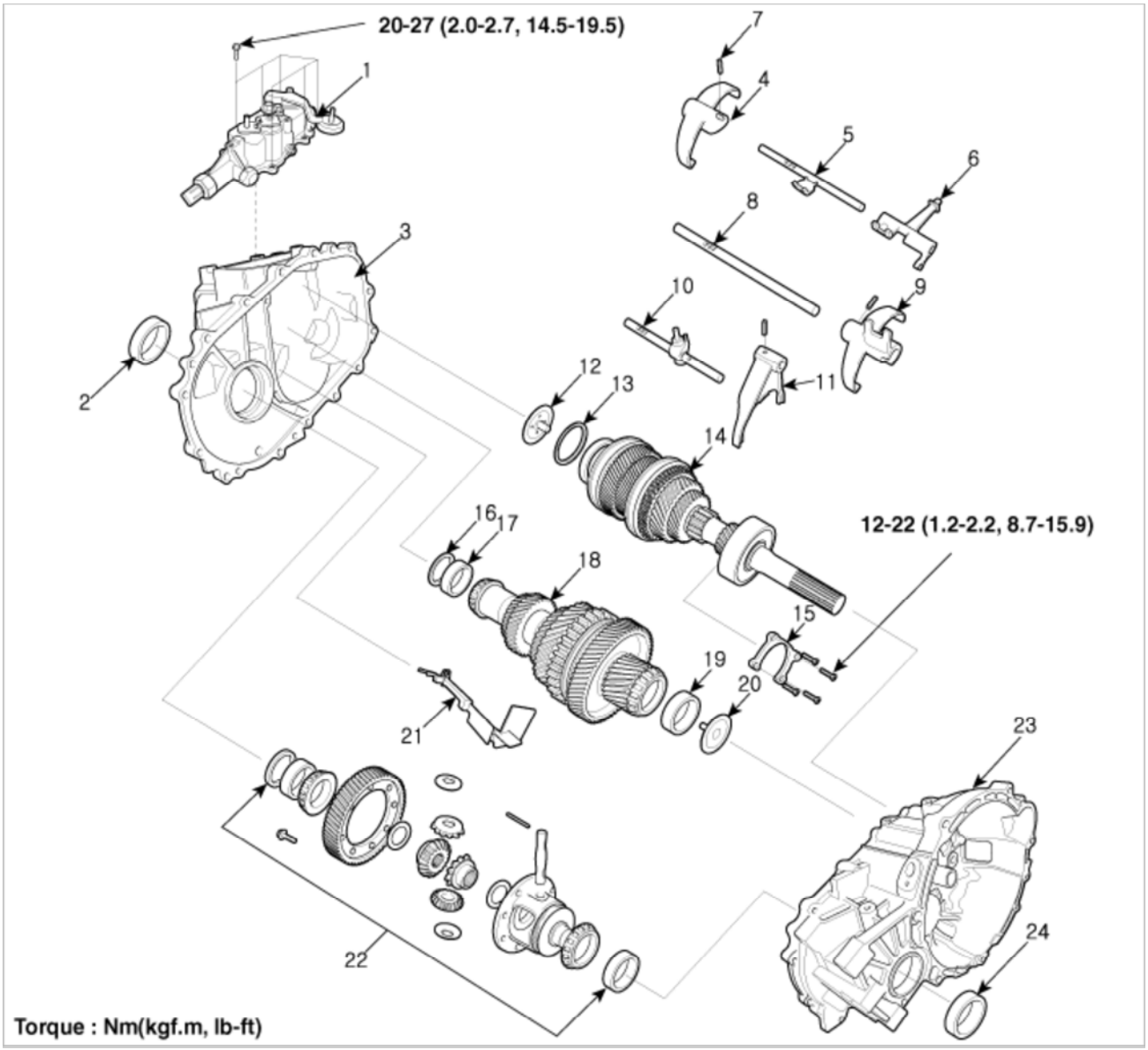


3. Using the special tool(09452-21200), tap the drive shaft oil seal into the transaxle.



Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Components and Components Location (M5CF2)

Components



1. Control shaft complete	9. 3rd & 4th shift lug and fork	17. Output shaft rear outer racer
2. Oil seal (LH)	10. 1st & 2nd shift rail	18. Output shaft assembly
3. Transaxle case	11. 1st & 2nd shift fork	19. Output shaft front outer racer
4. 5th shift fork	12. Input shaft oil guide	20. Output shaft oil guide
5. 5th shift rail	13. Snap ring	21. Oil guide
6. Reverse shift lug	14. Input shaft assembly	22. Differential assembly
7. Spring pin	15. Input shaft bearing retainer	23. Clutch housing
8. 3rd & 4th shift rail	16. Spacer	24. Oil seal (RH)

Manual Transaxle System > Manual Transaxle System > Manual Transaxle > Repair procedures (M5CF2)

Removal

CAUTION

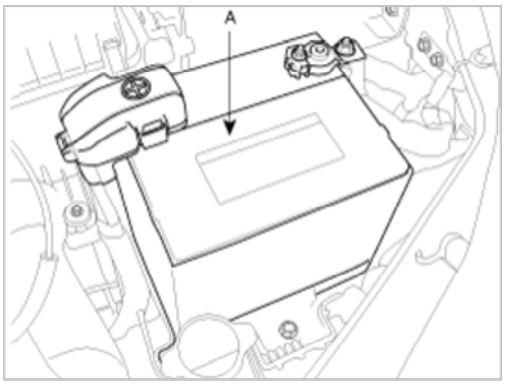
- Use fender covers to avoid damaging painted surfaces.

• To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

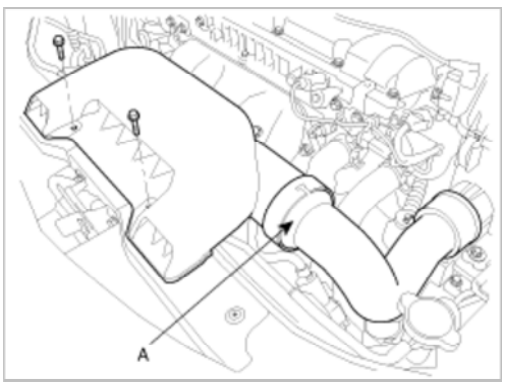
NOTE

• Mark all wiring and hoses to avoid misconnection.

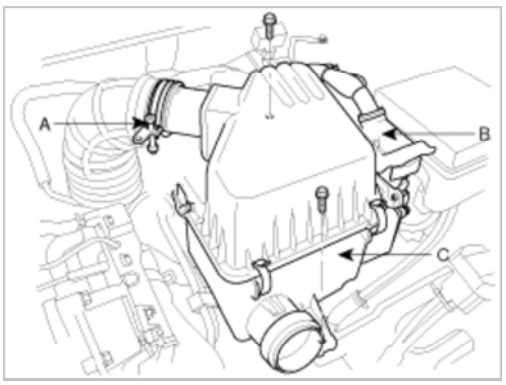
1. Remove the engine cover. (refer to Engine and Transaxle Assembly in EM group)
2. Remove the battery (A) after removing the battery terminal.



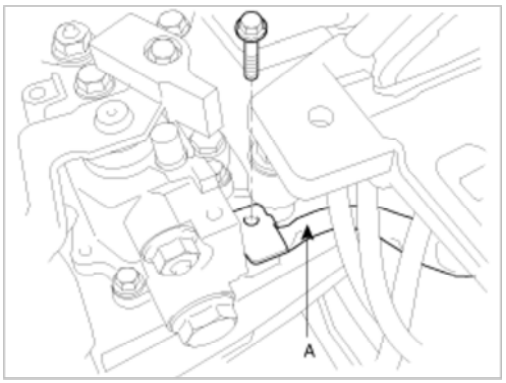
3. Remove the air duct assembly(A).



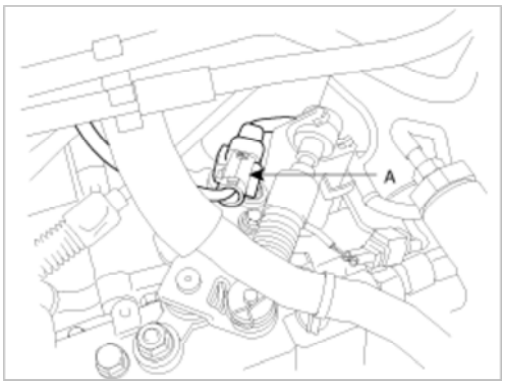
4. Remove the air cleaner assembly (C) by disconnecting the clamp (A) and the ECM connector (B).



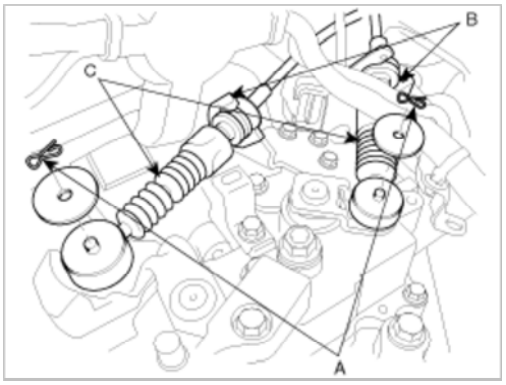
5. Remove the ground cable from transaxle (A).



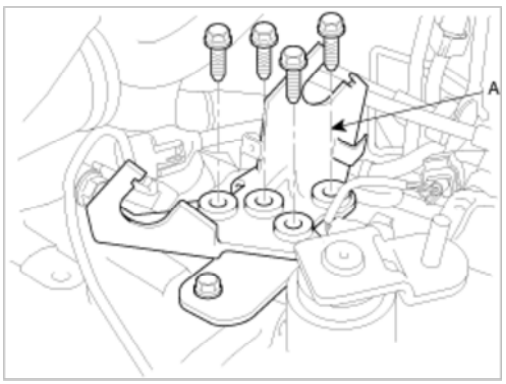
6. Disconnect the vehicle speed sensor and the back lamp switch integrated connector (A).



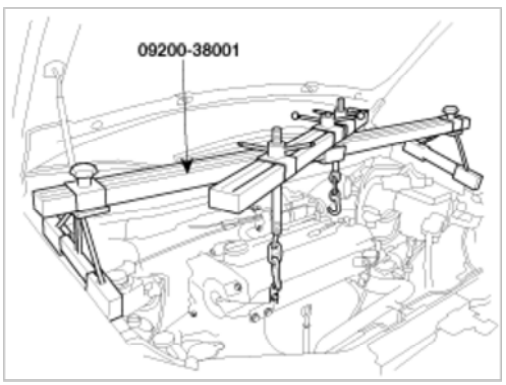
7. Remove the control cable assembly (C) by removing the snap pins (A) and clips (B).



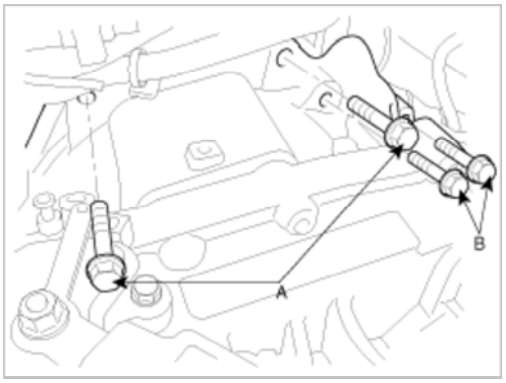
8. Remove the shift control cable bracket (A).



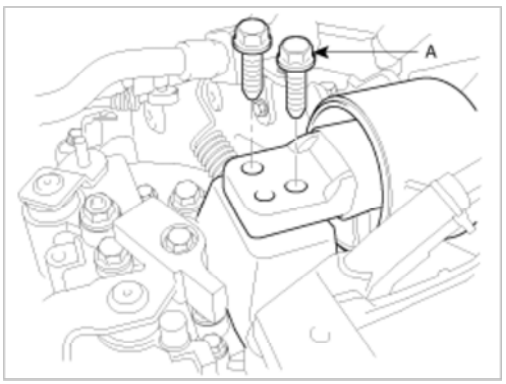
9. Using the special tool (09200-38001), support the engine assembly safely.



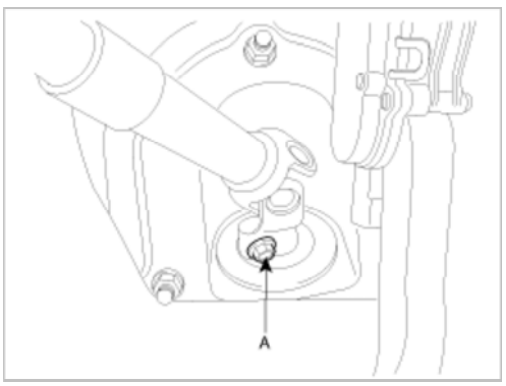
10. Remove the transaxle upper mounting bolts (A-2ea) and the starter motor mounting bolts (B-2ea).



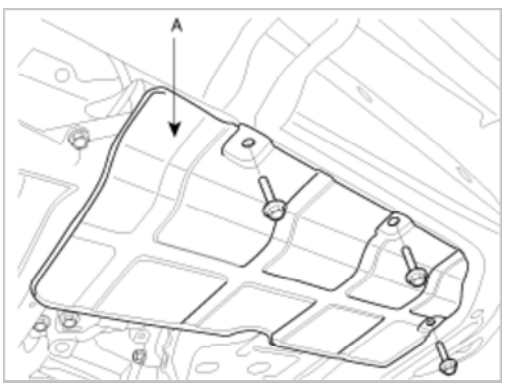
11. After removing the four bolts, take the transaxle insulator mounting bracket (A) off.

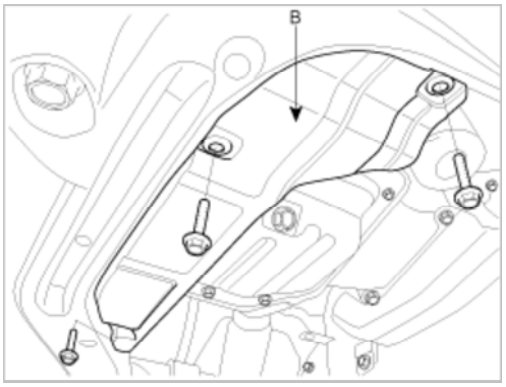


12. Remove the steering joint assembly bolt. (refer to Steering column/shaft in ST group)

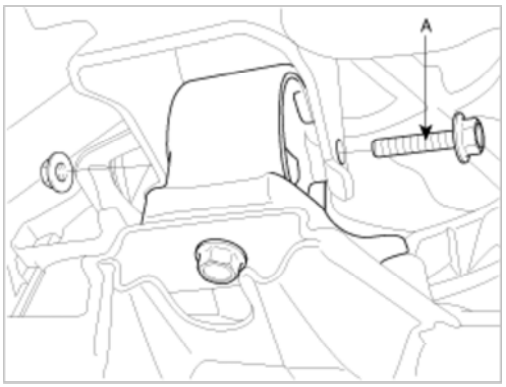


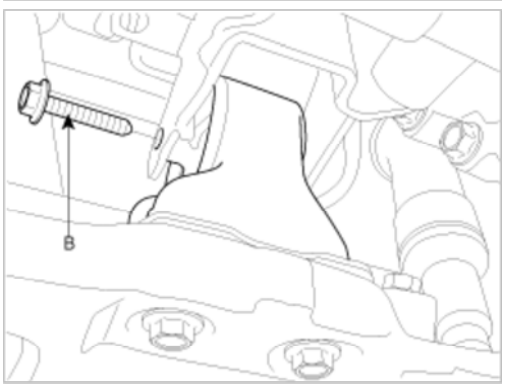
13. Lifting up the vehicle.
14. Remove the front wheels and tires.
15. Remove the lower arm ball joint mounting nut, the stabilizer link mounting nut, and the tie rod end mounting nut from the front knuckles. (refer to Front suspension system in SS group)
16. Remove the under shield cover(A,B).



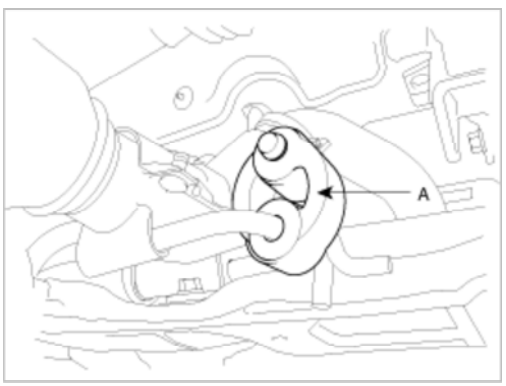


17. Remove the roll stopper mounting bolts (A,B).

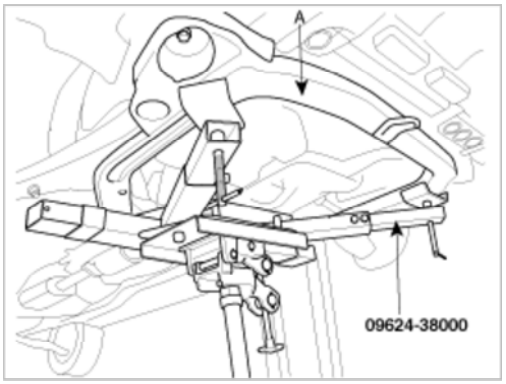




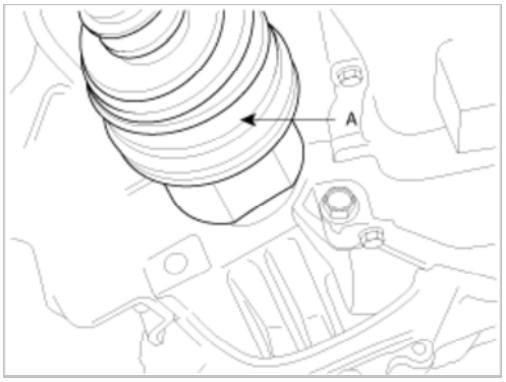
18. Disconnect the muffler hanger rubber (A).

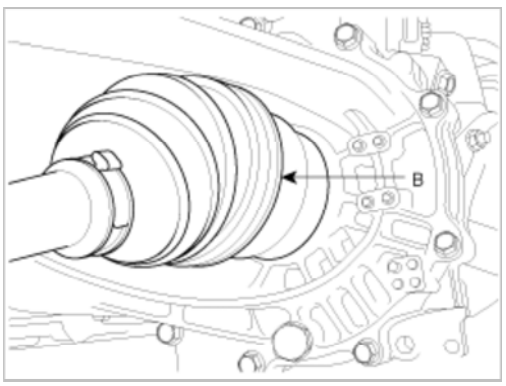


19. Supporting the sub frame (A) with a jack and the Special tool (09624-38000), remove the mounting bolts.(refer to Stabilizer removal in SS group)

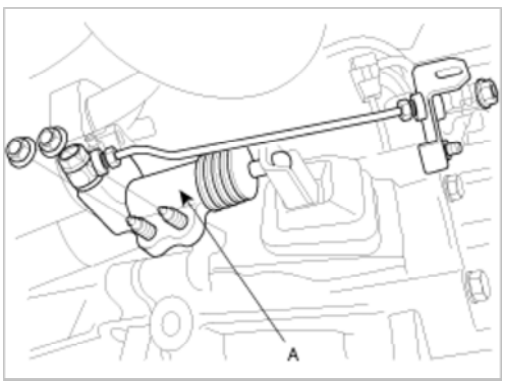


20. Disconnect the drive shafts (A,B) from the transaxle.

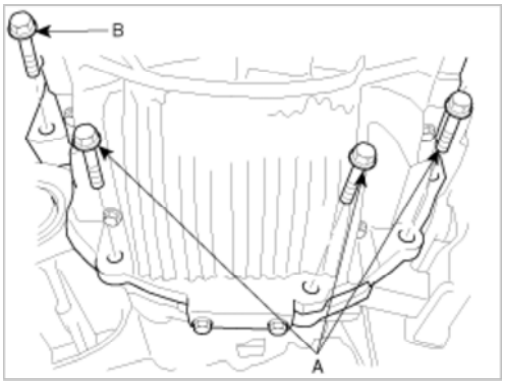




21. Remove the clutch release cylinder assembly (A).



22. Remove one mounting bolt from the transaxle side and the other from the engine side.
23. Supporting the transaxle with a jack, remove the transaxle lower mounting bolts(A-3ea, B-1ea).

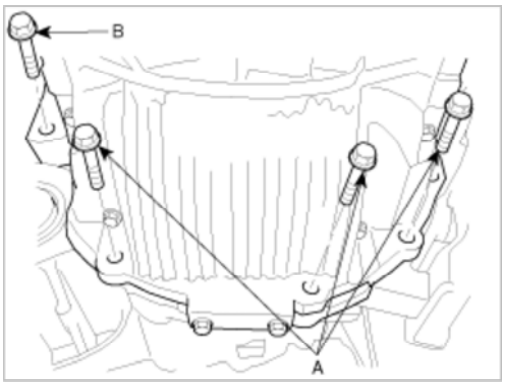


24. Lowering the jack slowly, remove the transaxle.

Installation

1. Install the transaxle lower mounting bolts (A-3ea,B-1ea) after fitting the transaxle assembly into the engine assembly.

Tightening torque :
[A] 43-55Nm (4.3-5.5kgf.m, 31.1-39.8lb-ft)
[B] 30-42Nm (3.0-4.2kgf.m, 21.7-30.4lb-ft)

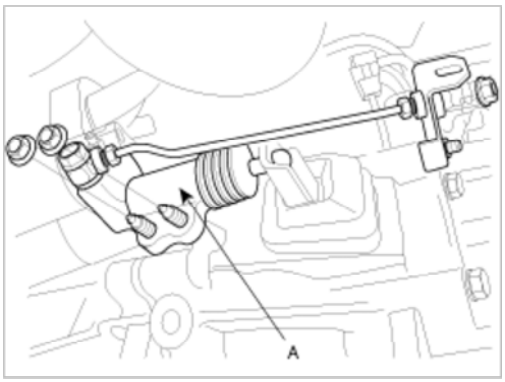


2. Install one mounting bolt (A), from the transaxle side and the other (B) from the engine side.

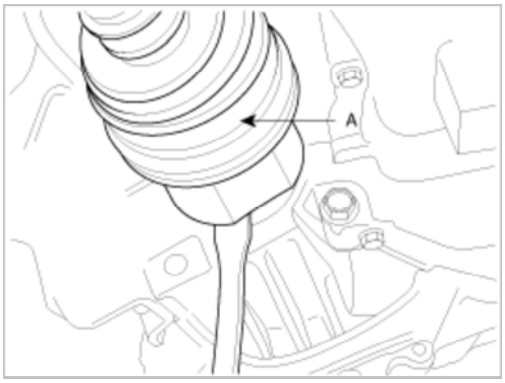
Tightening torque :
[A] 43-55Nm (4.3-5.5kgf.m, 31.1-39.8lb-ft)
[B] 30-42Nm (3.0-4.2kgf.m, 21.7-30.4lb-ft)

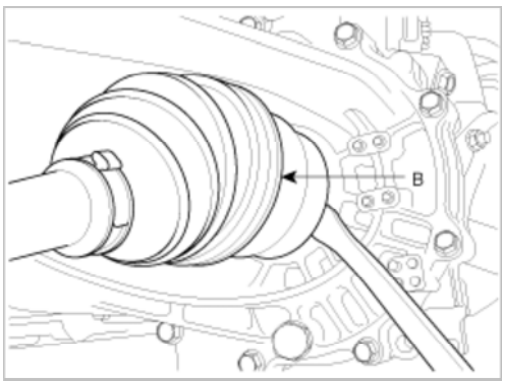
3. Install the clutch release cylinder assembly (A).

Tightening torque :
15-22Nm (1.5-2.2kgf.m, 10.8-15.9lb-ft)



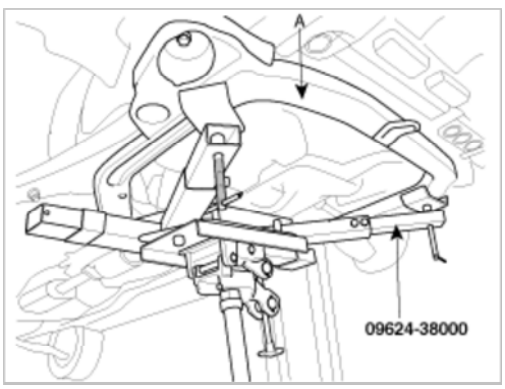
4. Connect the drive shafts (A,B) to the transaxle.



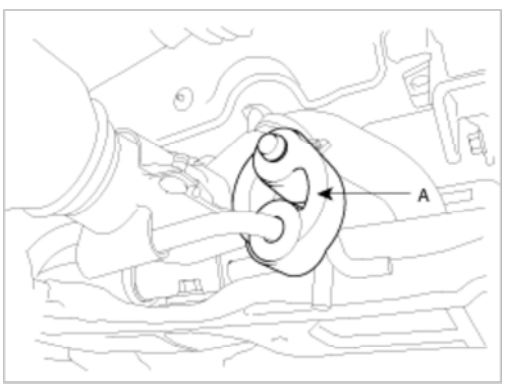


5. Supporting the sub frame (A) with a jack and the Special tool(09624-38000), install the mounting bolts. (refer to Stabilizer installation in SS group)

Tightening torque :
140-160Nm (14-16kgf.m, 101-118lb-ft)

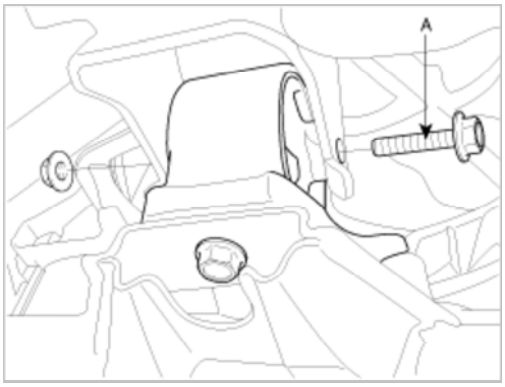


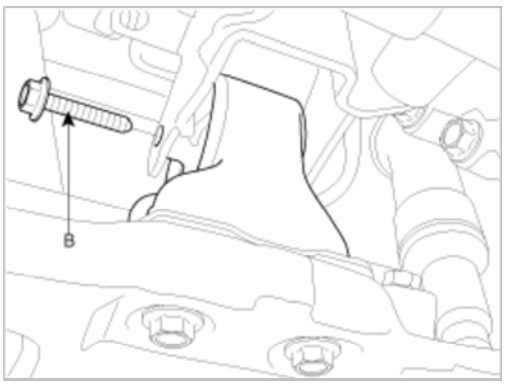
6. Install the muffler hanger rubber (A).



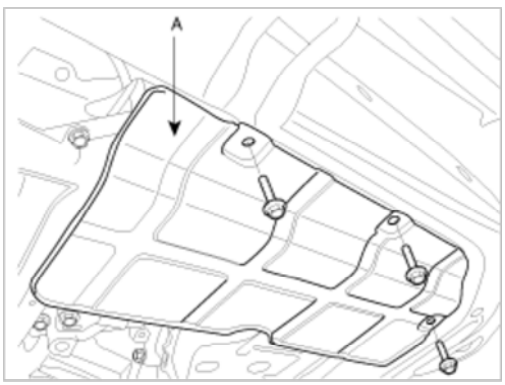
7. Install the roll stopper bracket bolts. (A,B)

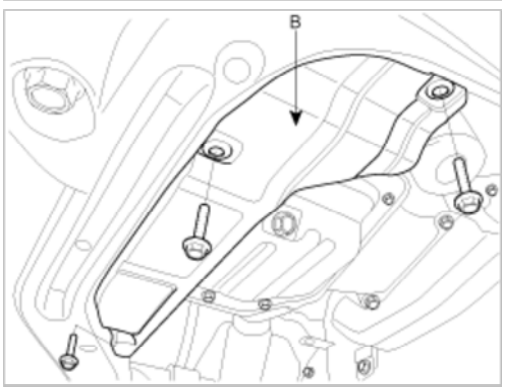
Tightening torque :
50-65Nm (5-6.5kgf.m, 36.2-47.0lb-ft)





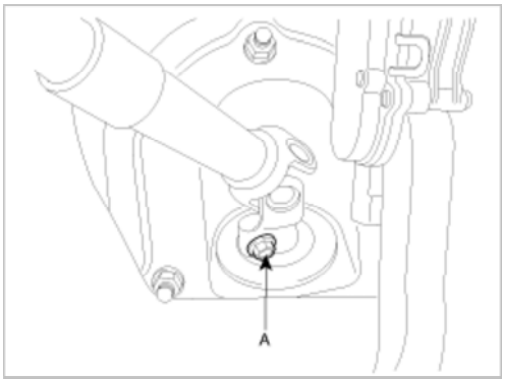
8. Install the under shield cover(A,B).





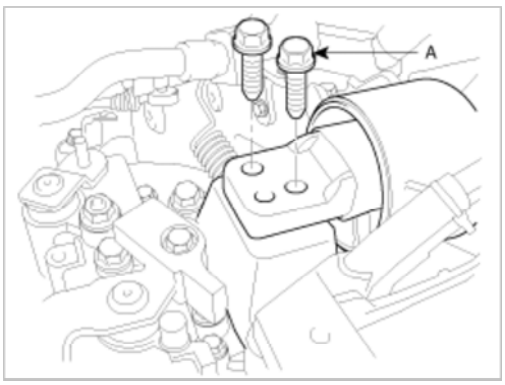
9. Install the lower arm ball joint mounting nut, the stabilizer link mounting nut, and the tie rod end mounting nut to the front knuckles. (refer to Front suspension system in SS group)
10. Install the front wheels and tires. (refer to installation in SS group)
11. Install the steering joint assembly bolt (A). (refer to Steering column/shaft in ST group)

Tightening torque :
18-25Nm (1.8-2.5kgf.m, 13.0-18.1lb-ft)

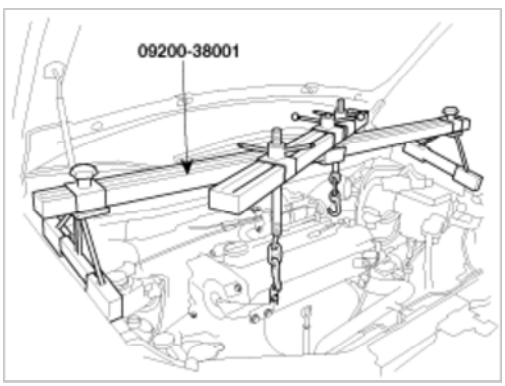


12. Install the transaxle insulator mounting bracket bolts (A).

Tightening torque :
90-110Nm (9.0-11.0kgf.m, 65.1-79.5lb-ft)

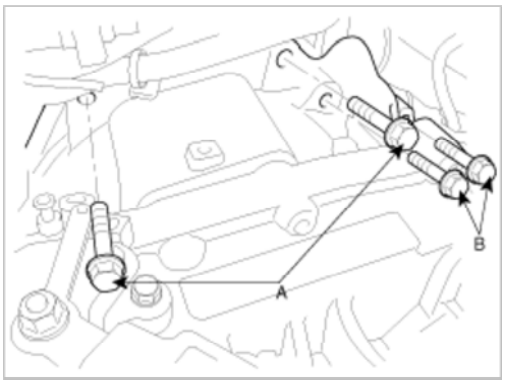


13. Remove the special tool (09200-38001).



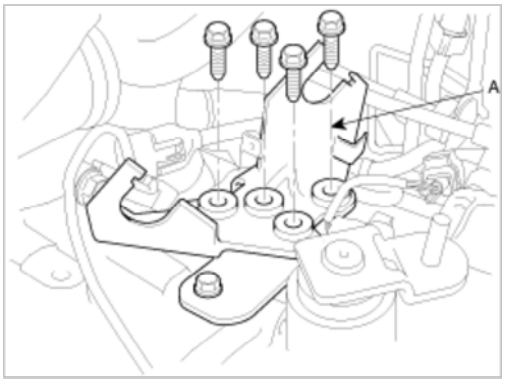
14. Install the transaxle upper mounting bolts (A-2ea) the starter motor mounting bolts. (B-2ea).

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

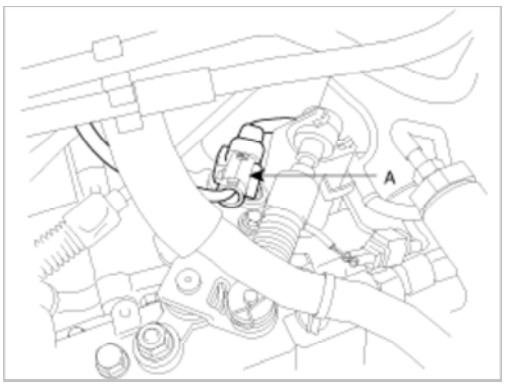


15. Install the control cable bracket (A).

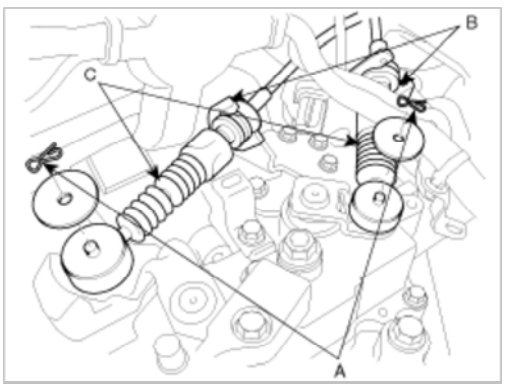
Tightening torque :
15-22Nm (1.5-2.2 kgf.m, 10.8-15.9lb-ft)



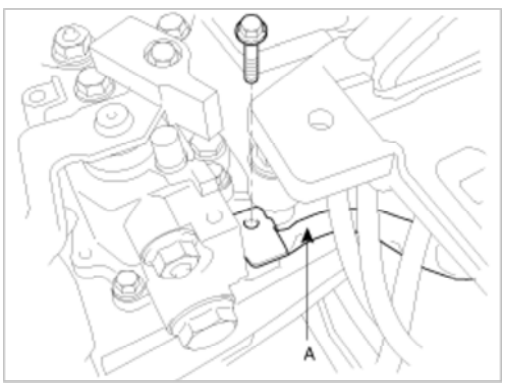
16. Connect the vehicle speed sensor and the back lamp switch integrated connector (A).



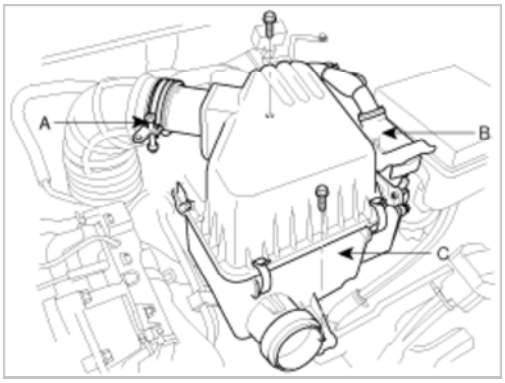
17. Install the control cable assembly (A) by installing the clips (B) and pins (C).



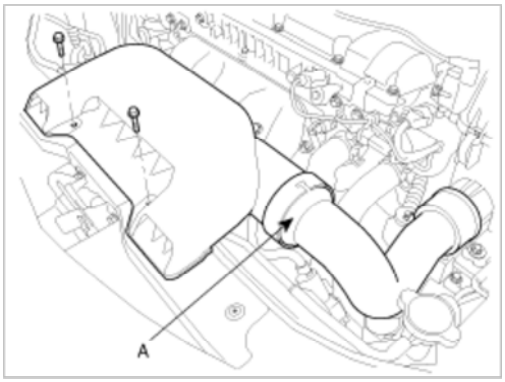
18. Install the ground cable (A) to transaxle.



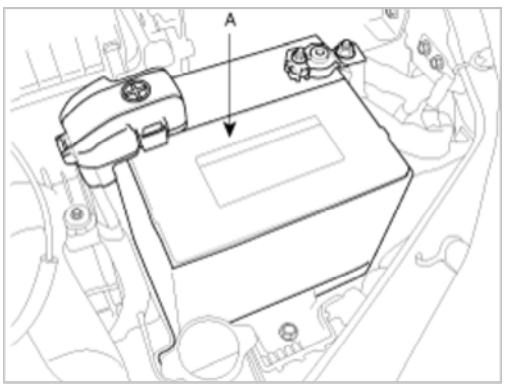
19. Install the air cleaner assembly (C) by connecting the clamp (A) and the ECM connector (B).



20. Install the air duct assembly (A).



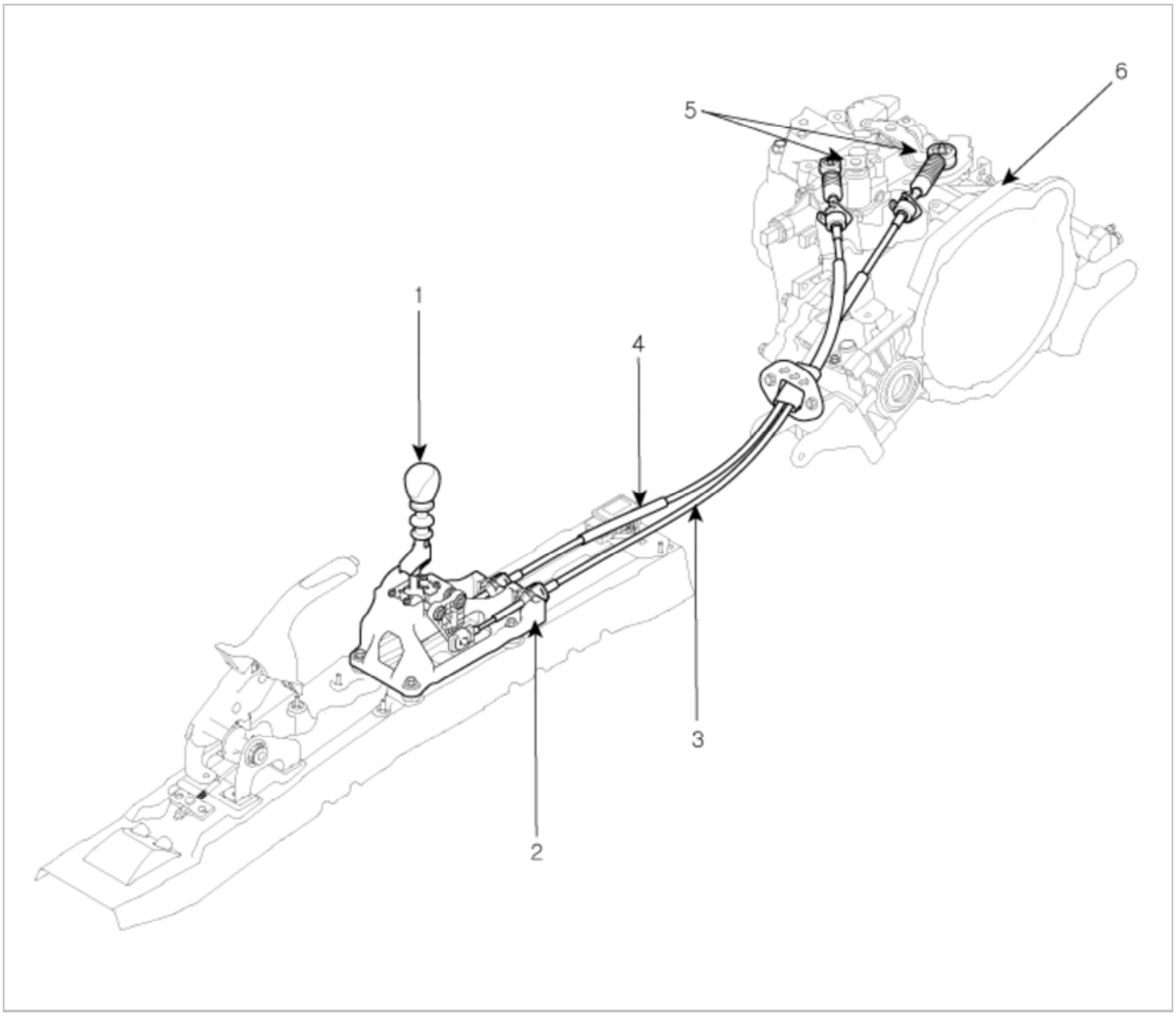
21. Install the battery (A) and the battery terminal.



22. Install the engine cover. (refer to Engine and Transaxle Assembly in EM group)

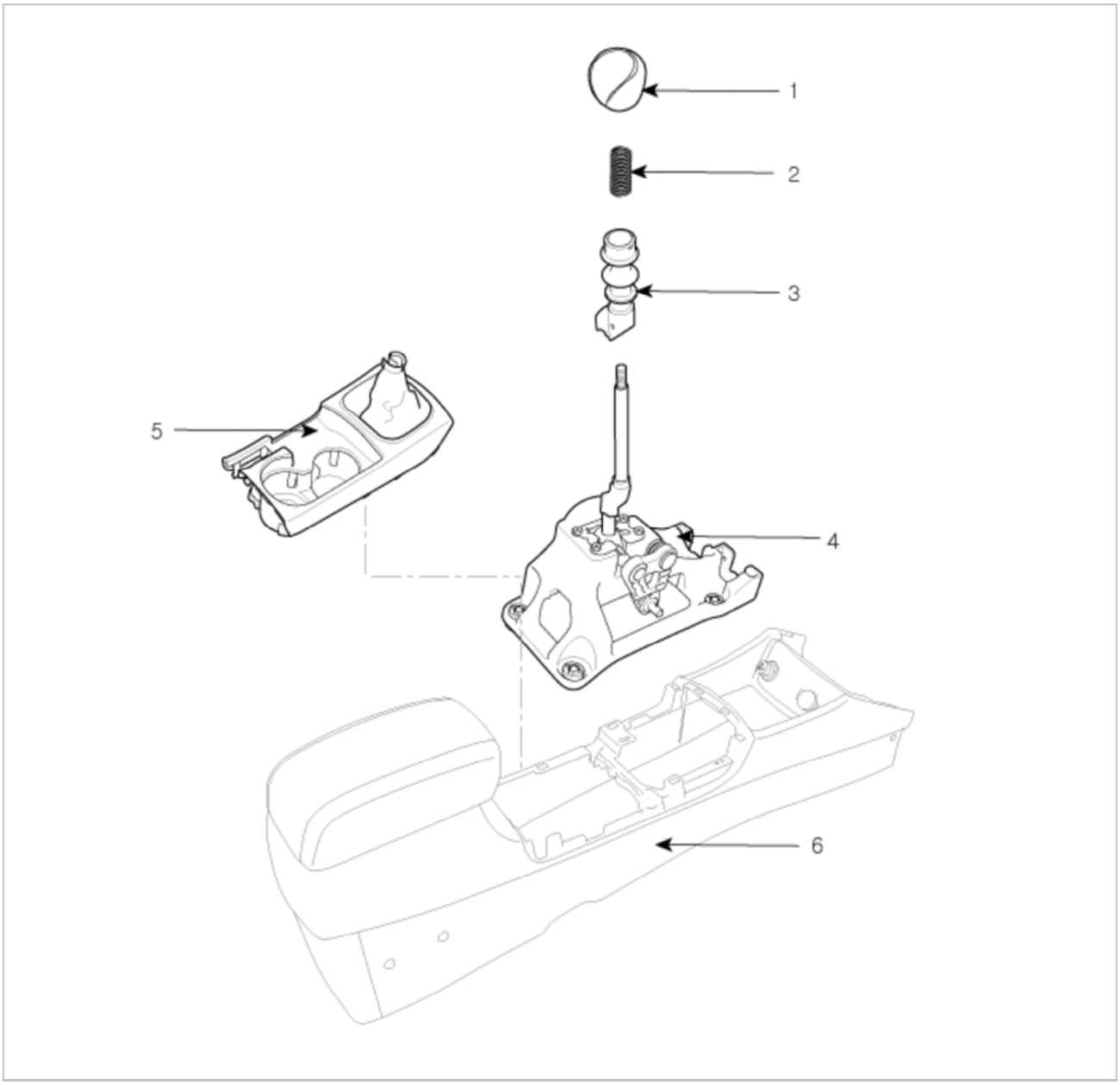
Manual Transaxle System > Manual Transaxle Control System > Manual Transaxle Shift Control > Components and Components Location (M5CF2)

Components(1)



1. Shift lever knob	4. Shift cable assembly
2. Shift lever assembly	5. Shift lever assembly(Manual Transaxle Side)
3. Select cable assembly	6. Manual transaxle assembly

Components(2)

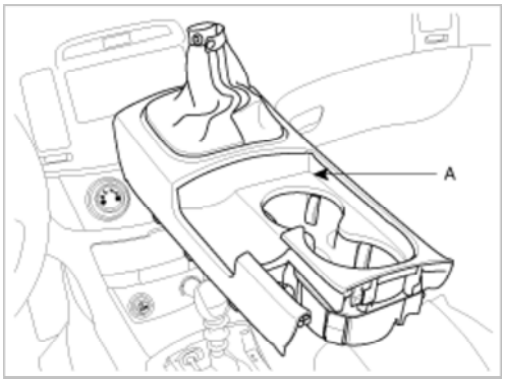


1. Shift lever knob 2. Spring 3. Skirt	4. Shift lever assembly 5. Console upper cover 6. Centor console

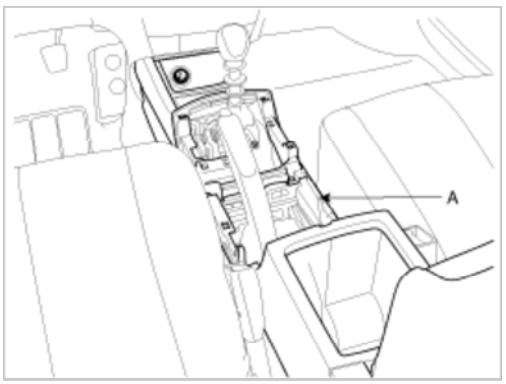
Manual Transaxle System > Manual Transaxle Control System > Manual Transaxle Shift Control > Repair procedures (M5CF2)

Removal

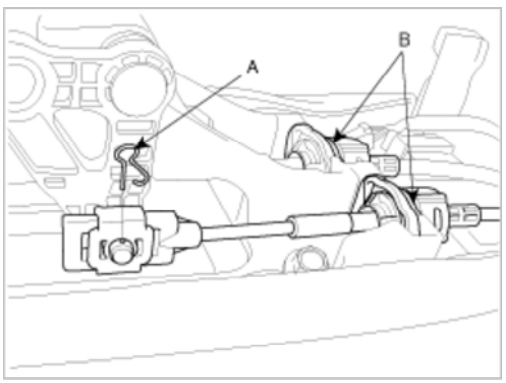
1. Remove the upper cover (A) from the center console.



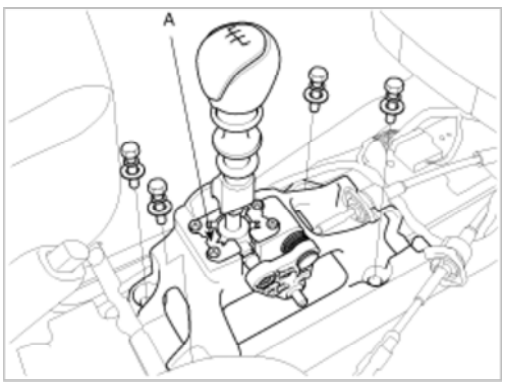
2. Remove the center console. (refer to Console in BD group)



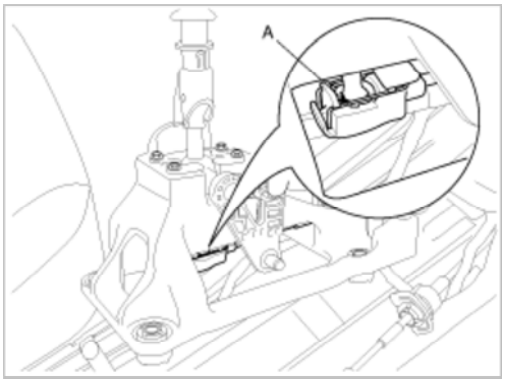
3. Remove the snap pin (A) and the clips (B).



4. Remove the shift lever assembly (A).

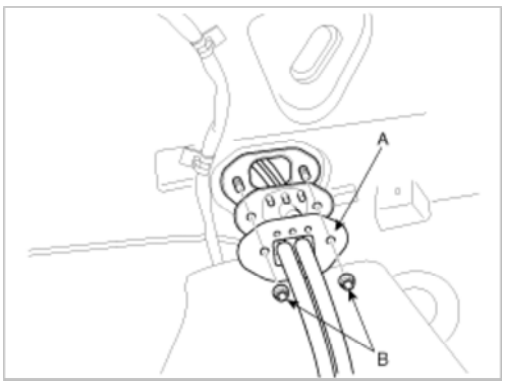


5. Remove the clip (A) from the shift cable.



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

> NOTE
>
> In case, remove the crush pad and cowl cross bar. (refer to Crush pad in BD group and Heater unit in HA group)



7. Remove the cable assembly from the transaxle. (refer to Manual Transaxle's removal)
8. Remove the select and shift cable assemblies.

Inspection

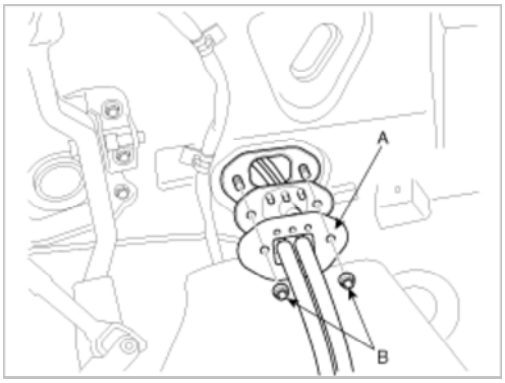
1. Check the select cable for proper operation and for damage.
2. Check the shift cable for proper operation and for damage.
3. Check the boots for damage.
4. Check the boots for wear, abrasion, sticking, restricted movement or damage.
5. Check for the weak or damaged spring.

Installation

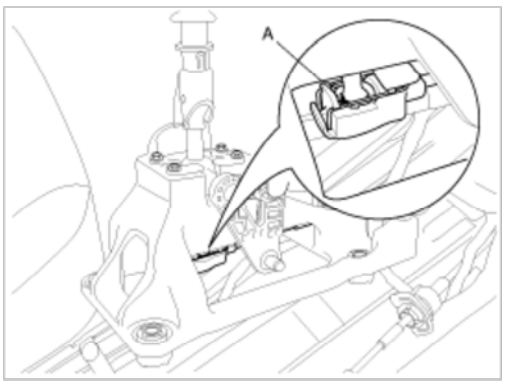
1. Install the cable assembly placing the select and shift lever in neutral position.(refer to Manual Transaxle's installation)
2. Install the retainer (A) and nuts(B).

Tightening torque :
12-15Nm (1.2-1.5kgf.m, 8.7-10.8lb-ft)

> NOTE
>
> In case, install the crush pad and cowl cross bar. (refer to Crush pad in BD group and Heater unit in HA group)

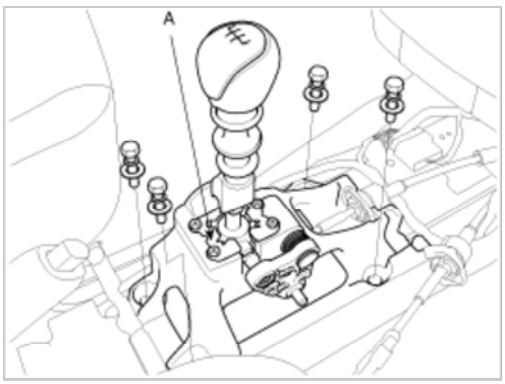


3. Install the clip (A) connecting the shift cable and the shift lever.



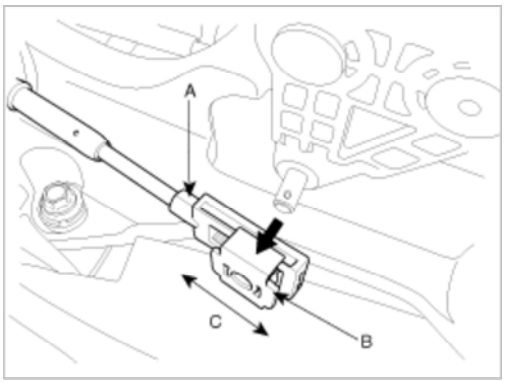
4. Install the shift lever assembly (A).

Tightening torque :
9~14Nm(0.9~1.4kgf.m, 6~9.5lb-ft)

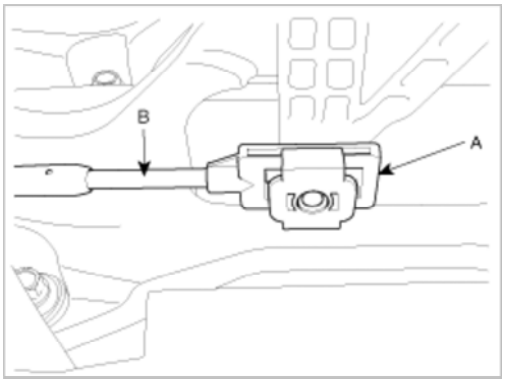


5. Move the slide clip (B) of guide member (A) in the direction as shown in the illustration.

> NOTE
>
> Adjust the slide clip fit into the select lever moving the slide clip in the direction.

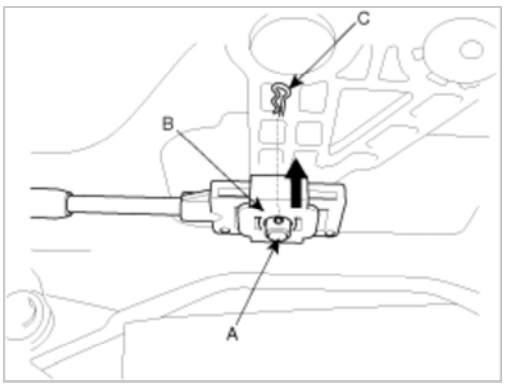


6. Install the guide member (A) of the select cable (B).

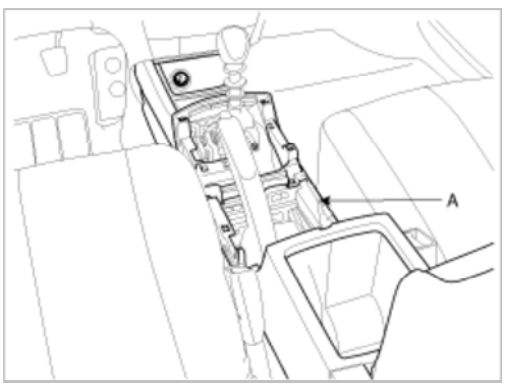


7. Adjust the slide clip (B) to fit it into the select lever pin (A) and install the snap pin (C).

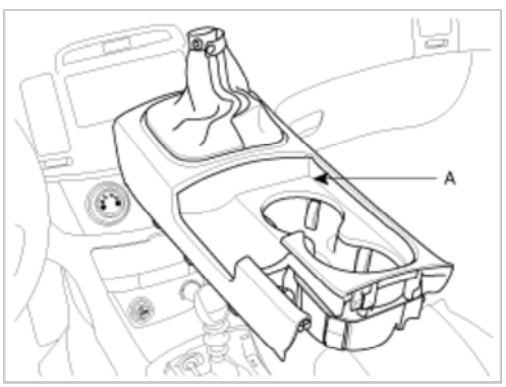
> NOTE
>
> Insert the slide clip in the direction as shown in the illustration.



8. Install the center console (A).



9. Install the upper cover (A) to the center console.



Specifications

Transaxle model		A4CF2
Engine model		Gasoline 2.0L
T/con		3 elements 2 phases 1 stage
T/con size (Φ)		236
O/PUMP type		Parachoid
T/M CASE type		Separated
Friction elements		Clutch: 3EA
		Brake: 2EA
		OWC : 1EA
Planetary gear		2EA
Gear ratio	1st	2.919
	2nd	1.551
	3rd	1.000
	4th	0.713
	Reverse	2.480
Final gear ratio		4.121
Fluid pressure balance piston		2EA
Stall speed		2,000~2,700 rpm
Accumulator		4EA
Solenoid valve		6EA (PWM:5EA, VFS:1EA)
Shift lever position		7 range (P,R,N,D,3,2,L)
Oil filter		1EA

Tightening Torques

Item	Nm	kgf.m	lb-ft
Control cable bracket	19~23	1.9~2.3	14~17
Input speed sensor	10~12	1.0~1.2	7~8
Output speed sensor	10~12	1.0~1.2	7~8
Manual control lever	17~21	1.0~2.1	13~15
Inhibitor switch	10~12	1.0~1.2	7~8
Oil pan	10~12	1.0~1.2	7~8
Valve body mounting bolt	10~12	1.0~1.2	7~8
Oil drain plug	35~45	3.5~4.5	25~32
Pressure check plug	8~10	0.8~1.0	6~7
Front roll stopper bracket subframe bolt	50~65	5.0~6.5	36~47
Rear roll stopper bracket subframe bolt	50~65	5.0~6.5	36~47
Transaxle mounting sub bracket bolt	60~80	6.0~8.0	43~58

Lubricants

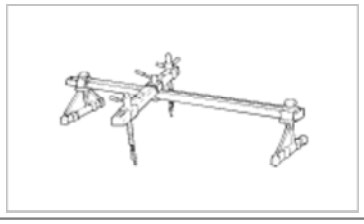
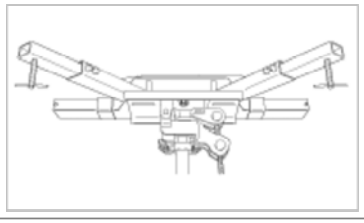
Item	Specified lubricant	Quantity
Transaxle fluid liter (US qt, Imp.qt)	GENUINE DIAMOND ATF SP-III or SK ATF SP -III	6.6 (6.9, 5.81)

Sealant

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

Automatic Transaxle System > General Information > Special Service Tools (A4CF2)

Special Service Tools

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

Automatic Transaxle System > Automatic Transaxle System > Description and Operation (A4CF2)

Description

The new small sized automatic transaxle (A4CF2) is for gasoline 2.0 engine.
The transaxle (A4CF2) is improved on the durability, fuel consumption and efficiency by the new main features as followed.

The new main features

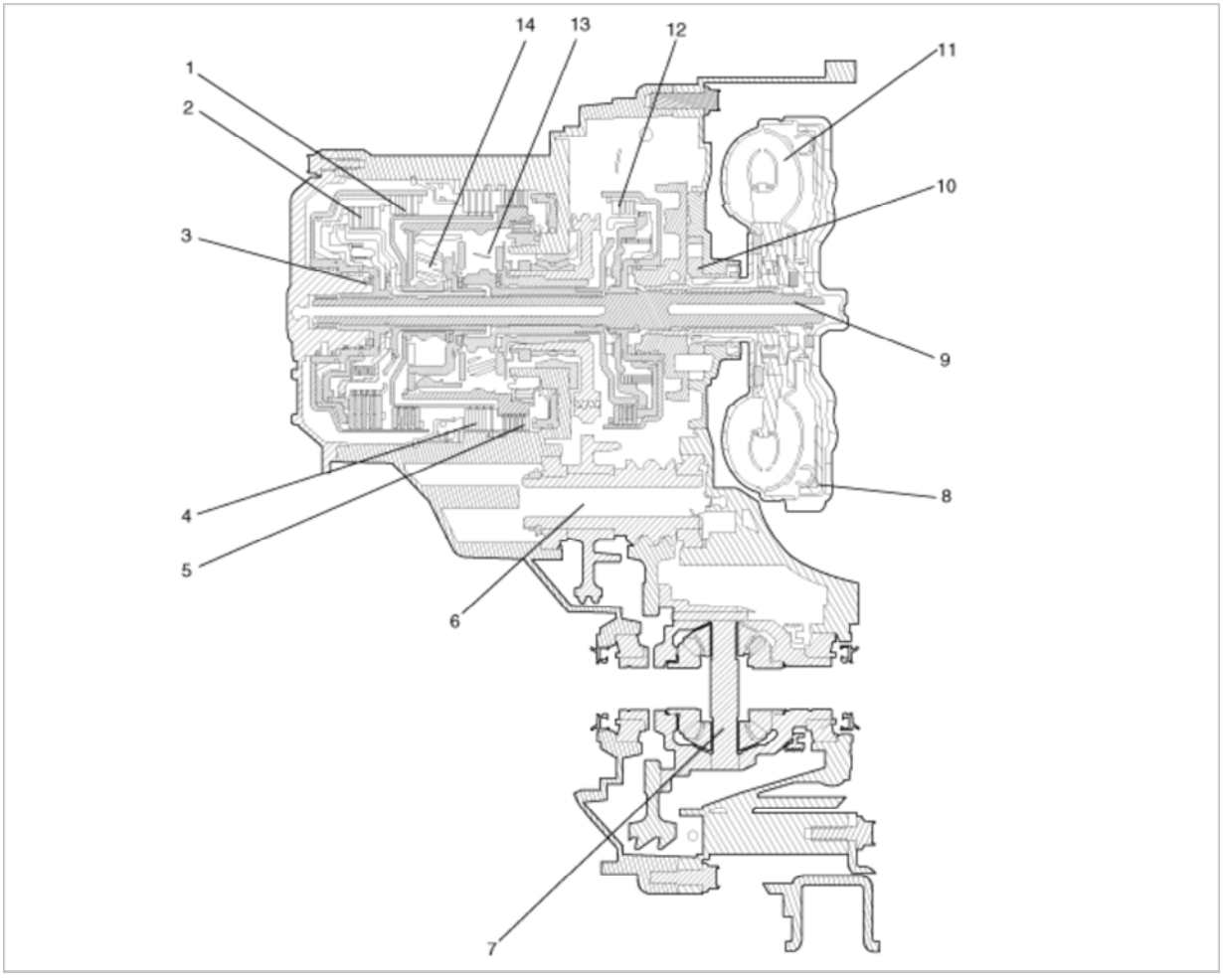
1. The hydraulic centrifugal oil pressure balance piston.
2. The full line pressure variable control system.
3. The long travel damper clutch.
4. The disc type return spring.
5. The ultra flat torque converter.

Functions

Item	Contents
Components	The full line pressure variable control operates in the valve body to improve the fuel consumption.
	The long travel damper clutch is applied to the torque converter to improve the engine revolution change reduction capability and the fuel consumption. (17~20°)
	The oil pump of the trochocentric type is changed to parachoid type to improve the processing and the capacity efficiency at the low RPM range.
	The disc type return spring is applied to the low&reverse brake to improve the durability and reduce the length.
	The hydraulic centrifugal oil pressure balance piston is applied to the inside of clutch to improve the durability and the shift control capability.
	The low noise gear and the gear teeth face grinding are applied to the transfer driven gear to improve the

	noise and the durability.
Electronic control system	The oil pressure value set by TCM is coupled with the engine torque so that the stable shift feeling can be improved.
	The engine torque reduction control operates effectively to improve the shift feeling and the durability.
	It can be the skip shift of 1↔3 and 2↔4 when shifting.
	The reverse clutch, not L/R brake is controlled when controlling the N→R shift so that the N→R shift feeling can be improved.
	The range of the damper clutch direct control expands to improve the fuel consumption.
	The current control chip is installed into the TCM to regulate the solenoid control current and control the oil pressure securely according to the change of the temperature and voltage.
	The FPC(Flexible Printed Circuit) harness is composed of the thin and flat copper in the insulating film like electric wire.
	The tachometer is operated by the change of the frequency forwarded from the TCM to the instrument cluster, not vehicle speed sensor.

Transaxle Structure



1. Reverse clutch	8. Damper clutch
2. Overdrive clutch	9. Input shaft
3. Rear cover	10. Oil pump assembly
4. Second brake	11. Torque converter assembly
5. Low and reverse brake	12. Underdrive clutch
6. Output shaft	13. Output planetary carrier
7. Differential	14. Overdrive planetary carrier

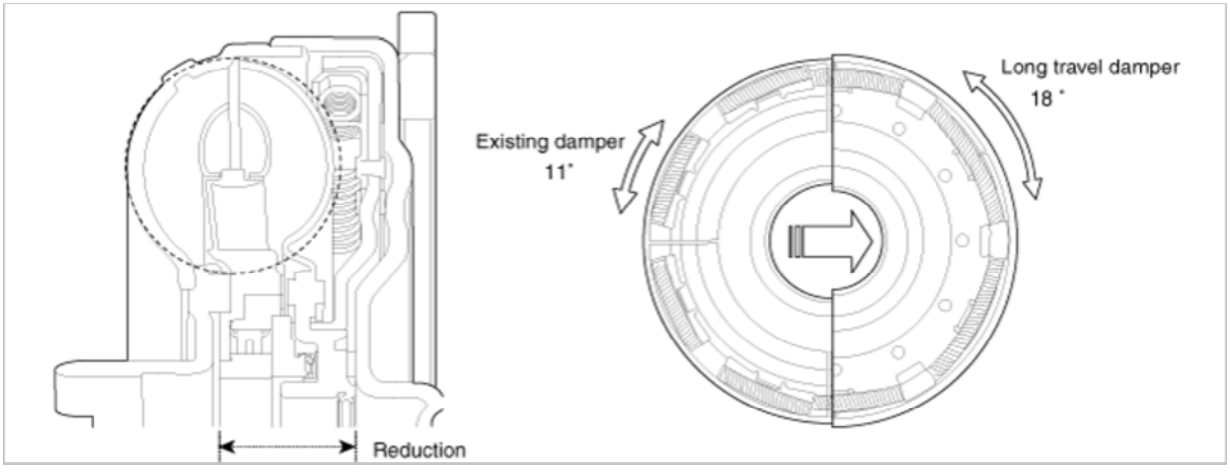
Mechanical system

Function

Torque Converter

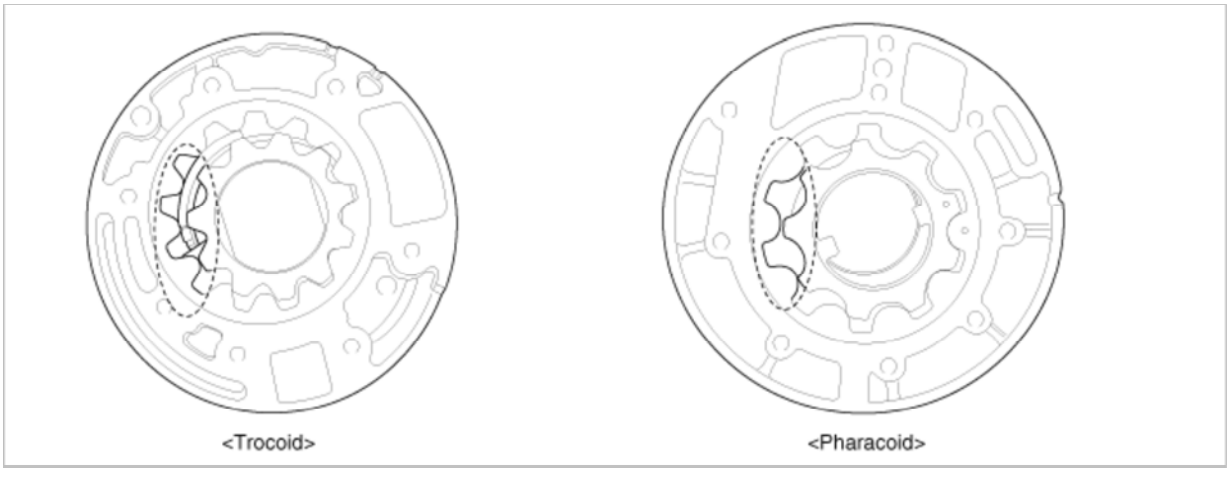
The torque converter, as the power plant which delivers the power of engine to the automatic transaxle, consists of 3 elements, 2 phases and 1 stage type.

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



Oil Pump

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

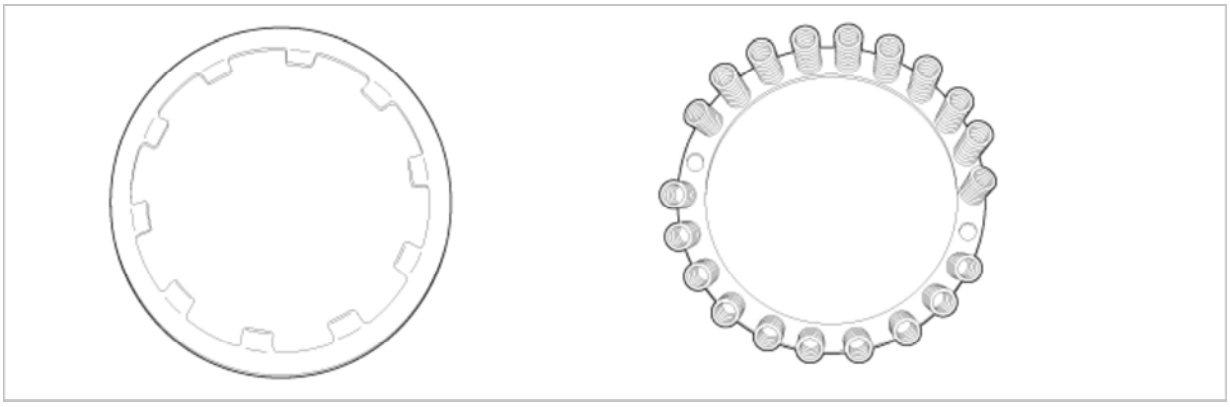


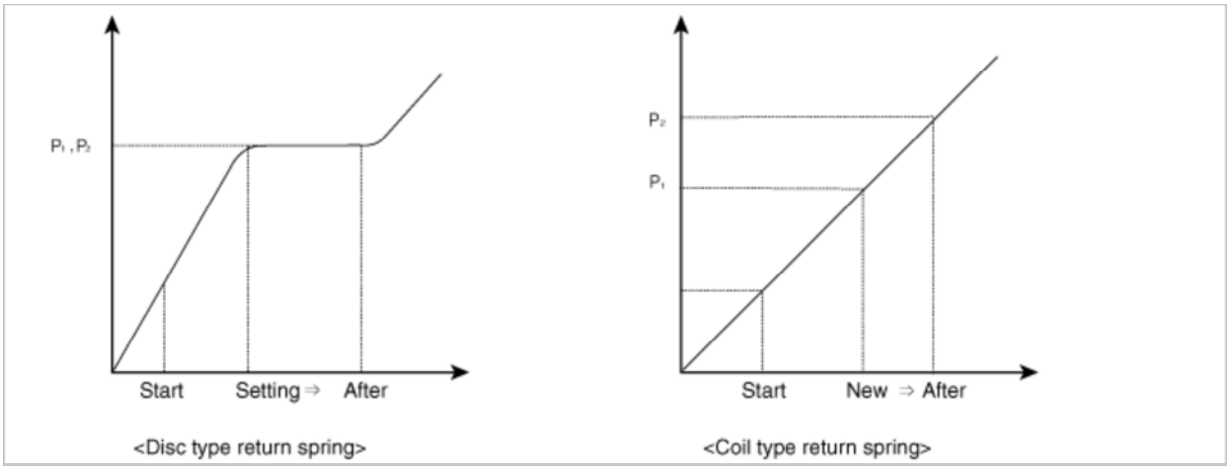
Brakes

The automatic transaxle (A4CF2) uses the low and reverse brake and the second brake. The low and reverse brake is fixed by the low and reverse annulus gear and overdrive planetary carrier.

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

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

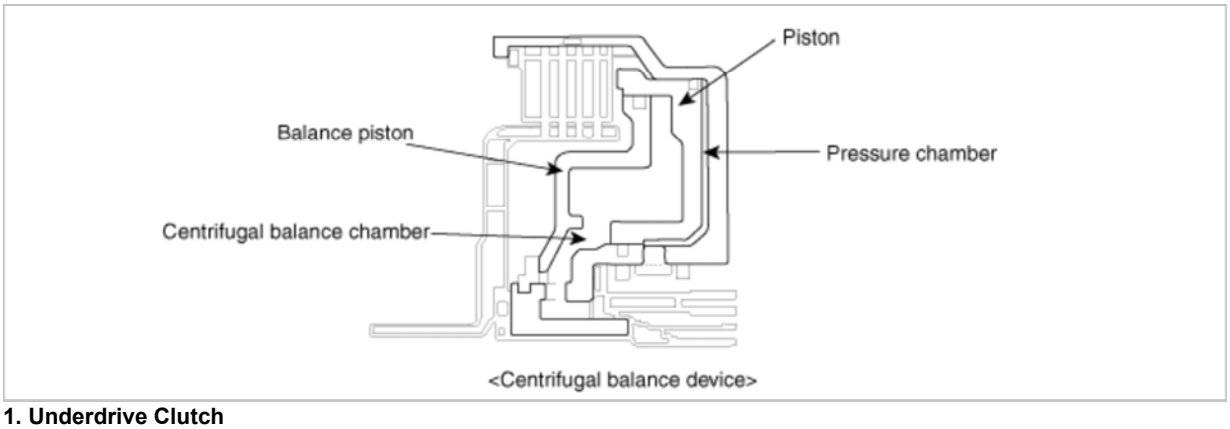




<Disc type return spring>
<Coil type return spring>

Clutch

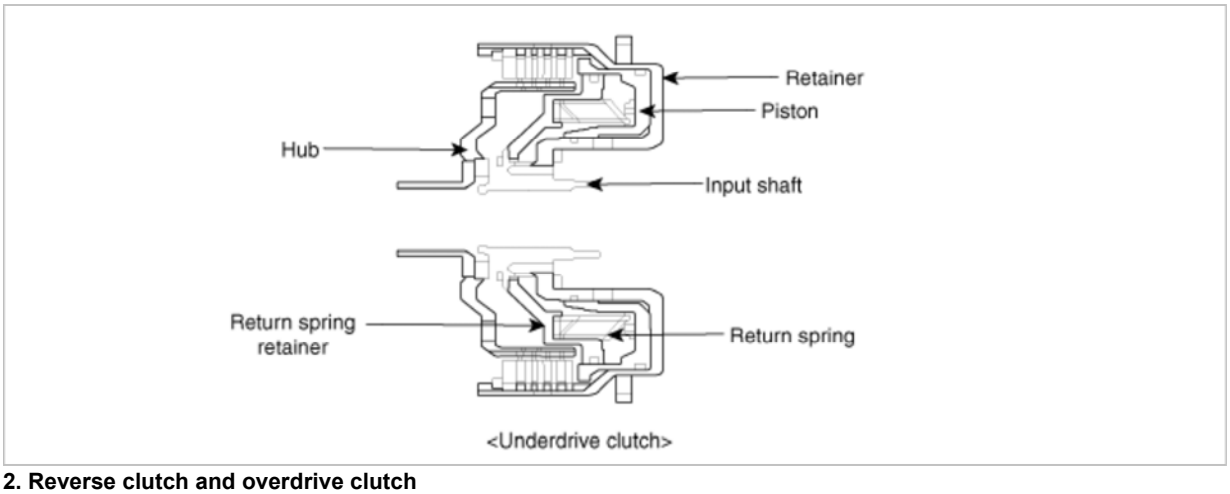
The multiple clutches and the one way clutch are used as the transaxle device.
The retainer of each clutch is composed of the precision sheet metal parts to realize the productivity and the light weight.
The hydraulic centrifugal oil pressure balance device places inside the clutch assembly.
Generally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



<Centrifugal balance device>

1. Underdrive Clutch

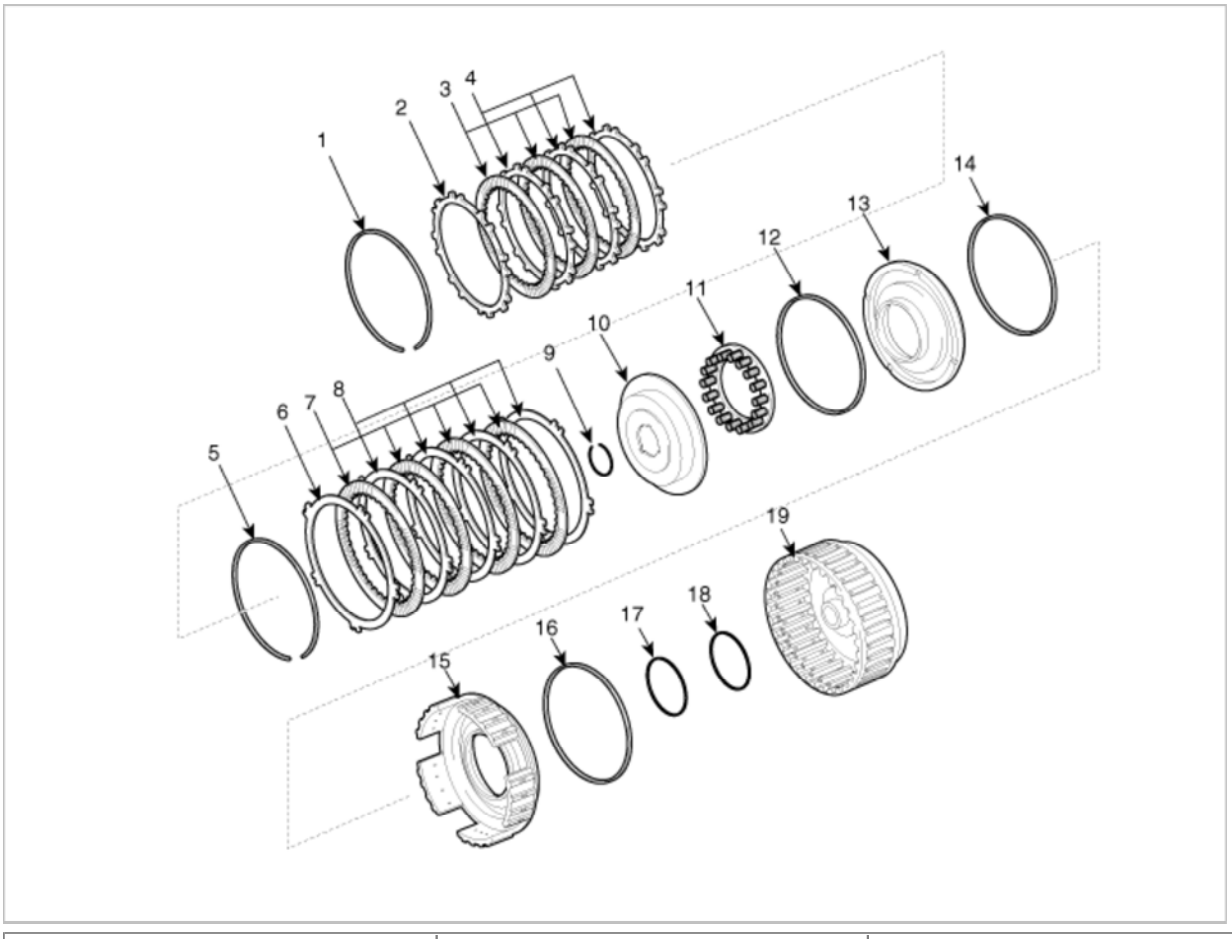
The driving force of input shaft is delivered to the underdrive sun gear.
The operating oil pressure in the underdrive clutch components operates between the piston and the retainer and pushes the piston to the clutch discs to deliver the driving force from the retainer to the hub.



2. Reverse clutch and overdrive clutch

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

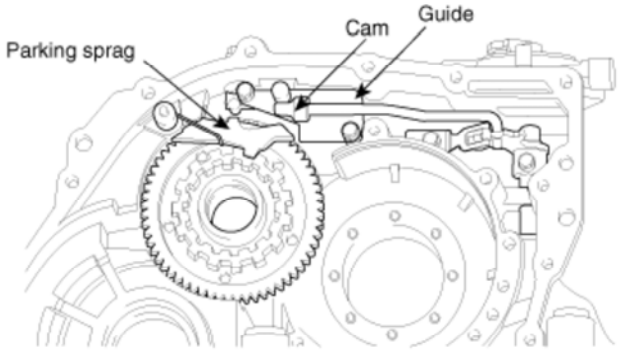
Structure Of The Reverse And The Overdrive Clutch



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

Parking System

The parking system for A4CF2 model is the cam type.
The roller type installed to the existing new generation AT needs the support to move the roller when operating the parking system and is so complicated. But the cam type for A4CF2 model doesn't need the support and the structure is simply. It only needs the guide to prevent from moving the cam idly.



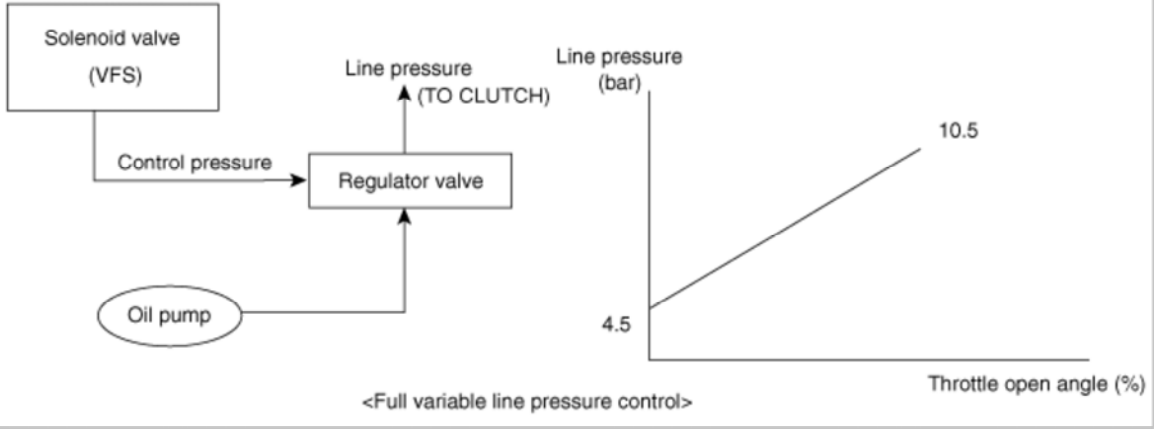
<Parking system>

Operation

Hydraulic Control System

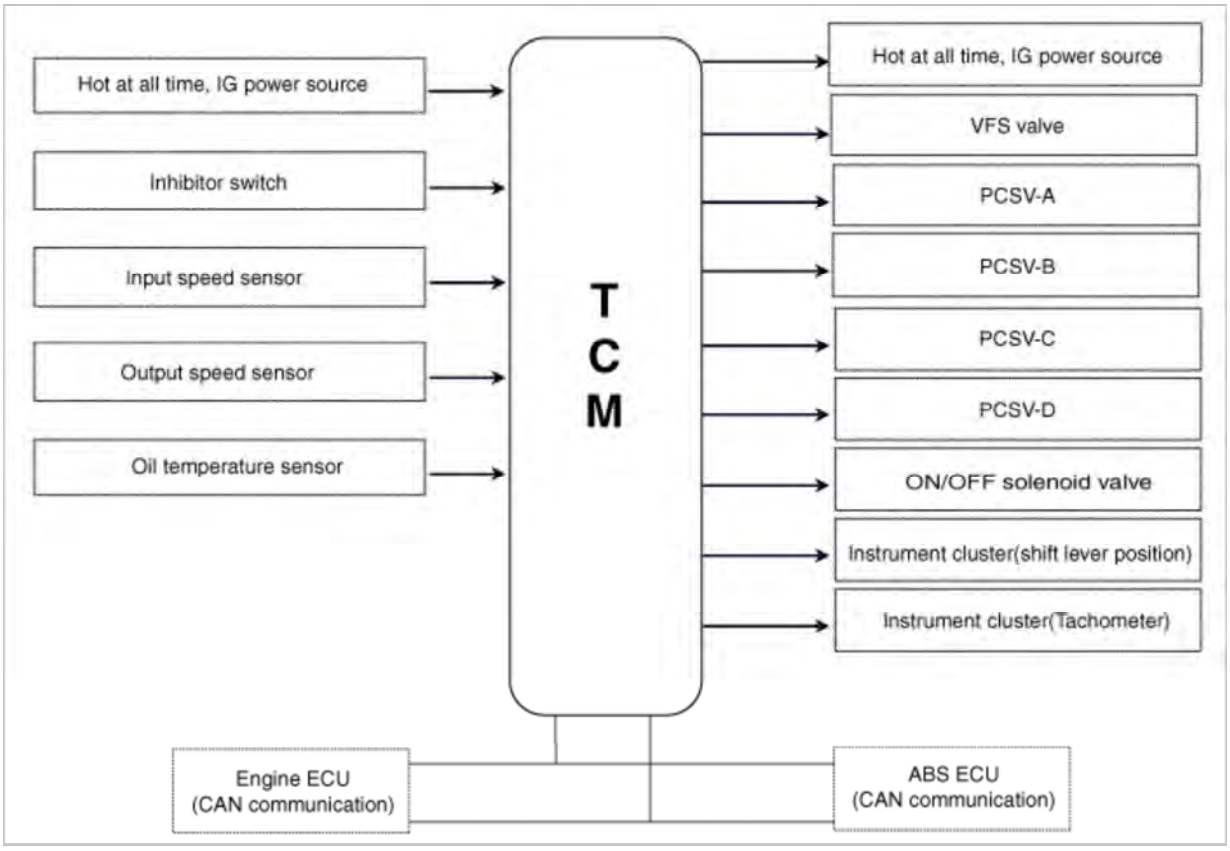
Main Features

The VFS (Variable Force Solenoid) installed in the valve body is applied to transaxle(A4CF2). VFS varies the line pressure from 4.5bar to 10.5bar according to throttle open angle and shift range to improve the fuel consumption and shift ability.
And the reducing valve which is installed in the valve body makes the solenoid control pressure using the reducing pressure instead of the line pressure like the HIVEC transaxle.
The material of spool valve in the valve body is changed from the steel to aluminum to reduce the oil leakage by the thermal expansion between the valve body and spool valve at the high temperature.
The switch valve, the solenoid valve and the fail safe valve are operated to drive the vehicle at the 3rd speed and reverse even thought the malfunction of the electronic control parts occur.



<Full variable line pressure control>

Electronic Control System

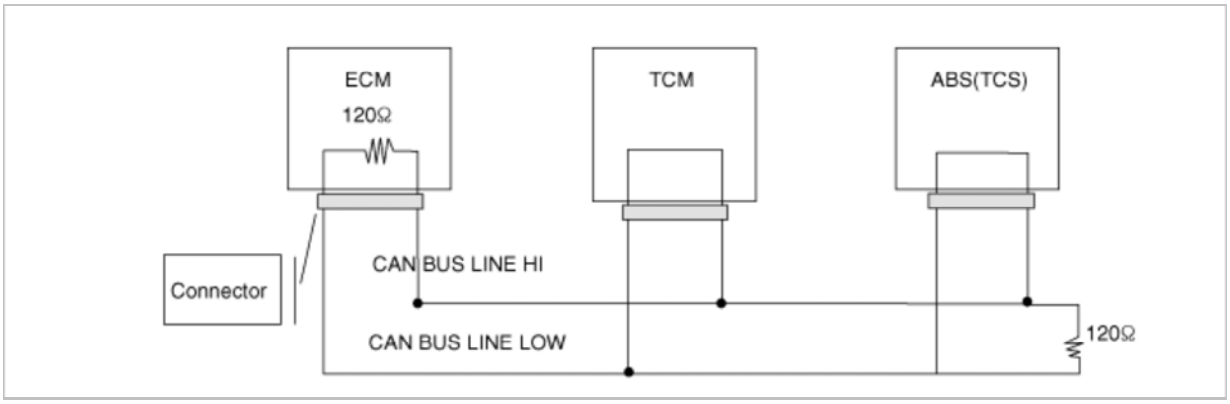


Sensor And Actuator Function

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

CAN Communication

Layout



ECM- TCM CAN Communication error management

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

Automatic Transaxle System > Automatic Transaxle System > Repair procedures (A4CF2)

Basic Inspection Adjustment

Transaxle Fluid Level

Inspection

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

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

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

Automatic transaxle fluid :
DIAMOND ATF SP-III, SK ATF SP-III
Automatic transaxle fluid capacity:
6.6liter(6.9 US qt, 5.81Imp.qt)

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

6. Insert the oil level gauge securely.

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

Replacement

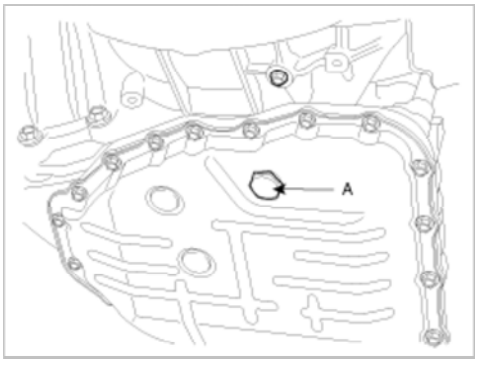
If you have a fluid changer, use this changer to replace the fluid. If you do not have a fluid replace the fluid by the following procedure.

1. Disconnect the hose, which connects the transmission and the oil cooler (inside the radiator).
2. Start the engine and let the fluid drain out.

Running conditions : "N" range with engine idling

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

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



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

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

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

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

6. Repeat the procedure in step (2).

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

7. Pour the new fluid in through the oil filler tube.
8. Reconnect the hose, 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" or "P" position.
11. Drive the vehicle until the fluid temperature rises to the normal temperature (70~80°C(158~176°F)), and then check the fluid level again. The fluid level must be at the HOT mark.
12. Firmly insert the oil level gauge into the oil filler tube.

Torque Converter Stall Test

This test measures the maximum engine speed when the select lever is at the "D" or "R" position and the torque converter stalls to test the operation of the torque converter, starter motor and one-way clutch operation and the holding performance of the

clutches and brakes in the transmission.

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

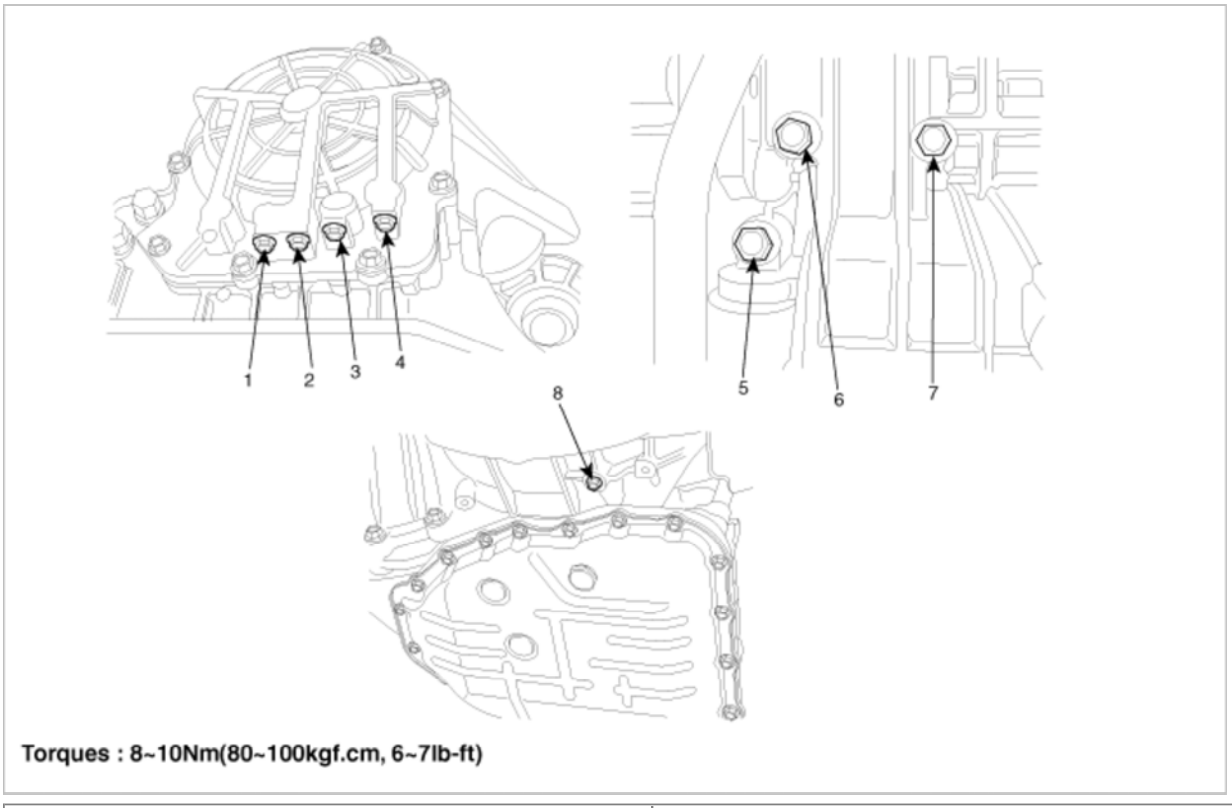
1. Check the automatic transmission fluid level and temperature and the engine coolant temperature.
   A. Fluid level : At the HOT mark on the oil level gauge
   B. Fluid temperature : 80~100°C (176~212°F)
   C. Engine coolant temperature : 80~100°C (176~212°F)
2. Check both rear wheels (left and right).
3. Pull the parking brake lever on, with the brake pedal fully depressed.
4. Start the engine.
5. Move the select lever to the "D" position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

> **CAUTION**
>
> - The throttle should not be left fully open for any more than 5 seconds.
> - If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 r/min to let the automatic transaxle fluid cool down before carrying out subsequent tests.
> - Move the select lever to the "R" position and carry out the same test again.
>
> Stall rpm : 2,000~2,700 RPM

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

Hydraulic Pressure Test

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



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

Standard Hydraulic Pressure Table

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

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

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

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

Automatic Transaxle System > Automatic Transaxle System > Troubleshooting (A4CF2)

Troubleshooting

Diagnostic Trouble Codes (Inspection Procedure)

Check the Diagnostic Trouble Codes

1. Turn the ignition switch to OFF.
2. Connect the Hi-scan tool to the DLC connector for diagnosis.
3. Turn the ignition switch to ON.
4. Check the diagnostic trouble codes using the Hi-scan tool.
5. Read the output diagnostic trouble codes. Then follow the remedy procedures according to the "DIAGNOSTIC TROUBLE CODE DESCRIPTION" on the following pages.

NOTE

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

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

NOTE

DTC cleaning should only be done with the scan tool.

Diagnostic Trouble Code Table

No.	Code	Description	MIL	Remark
1	P0605	Internal Control Module Read Only Memory(ROM) Error	●	
2	P0707	Transmission Range Sensor Circuit Low Input	●	
3	P0708	Transmission Range Sensor Circuit High Input	●	
4	P0711	Transmission Fluid Temperature Sensor 'A' Circuit Range/Performance	●	
5	P0712	Transmission Fluid Temperature Sensor 'A' Circuit Low Input	●	
6	P0713	Transmission Fluid Temperature Sensor 'A' Circuit High Input	●	
7	P0717	Input/Turbine Speed Sensor 'A' Circuit No Signal	●	
8	P0721	Output Speed Sensor Circuit Range/Performance	●	
9	P0722	Output Speed Sensor Circuit No Signal	●	
10	P0731	Gear 1 Incorrect Ratio	●	
11	P0732	Gear 2 Incorrect Ratio	●	
12	P0733	Gear 3 Incorrect Ratio	●	
13	P0734	Gear 4 Incorrect Ratio	●	
14	P0741	Torque Converter Clutch Circuit Performance or Stuck Off	●	
15	P0743	Torque Converter Clutch Circuit Electrical	●	
16	P0748	Pressure Control Solenoid Valve(VFS) 'A' Electrical		
17	P0750	Shift Control Solenoid Valve 'A'	●	
18	P0755	Shift Control Solenoid Valve 'B'	●	
19	P0760	Shift Control Solenoid Valve 'C'(2nd Brake Solenoid)	●	
20	P0765	Shift Control Solenoid Valve 'D'	●	
21	P0880	TCM Power Signal Error Open/Short (GND)	●	
22	U0001	High Speed CAN Communication Bus off	●	
23	U0100	Lost Communication With ECM/PCM 'A'	●	

Automatic Transaxle System > Automatic Transaxle System > P0605 Internal Control Module Read Only Memory(ROM) Error

Component Location

General Description

The TCU check ROM I.D all the time,in order to maintain for best condition and surrounding.

DTC Description

The TCU set this code When the ROM I.D is changed by ecternal force or input non-available data

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• ROM checksum error	• Faulty TCM
Enable Conditions	• IG "on"	
Threshold Value	• Checksums of SW and calibration data are different from the origins 3times at TCU wake up	
Diagnostic Time	• -	
Fail Safe	• Locked in 3 rd gear.	

Monitor GDS Data

1. Connect GDS to data link connector(DLC)
2. Ignition "ON".
3. Confirm the "ROM I.D"
4. Perform the "ROM UP-DATE"
5. Perform the Re-diagnosis
6. Is "DTC" disappeared?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure
NO	▸ Replace PCM/TCM 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.

Automatic Transaxle System > Automatic Transaxle System > P0707 Transmission Range Sensor Circuit Low Input

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.

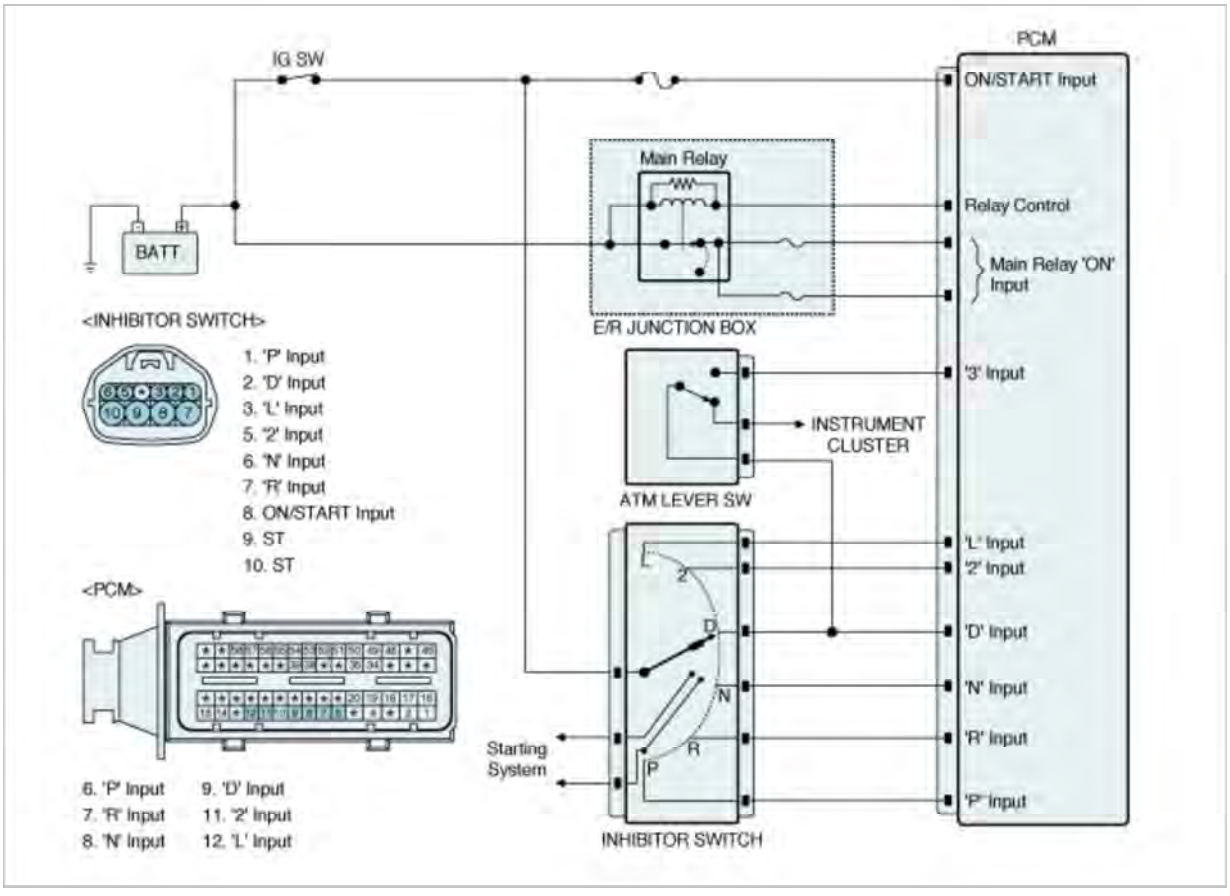
DTC Description

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

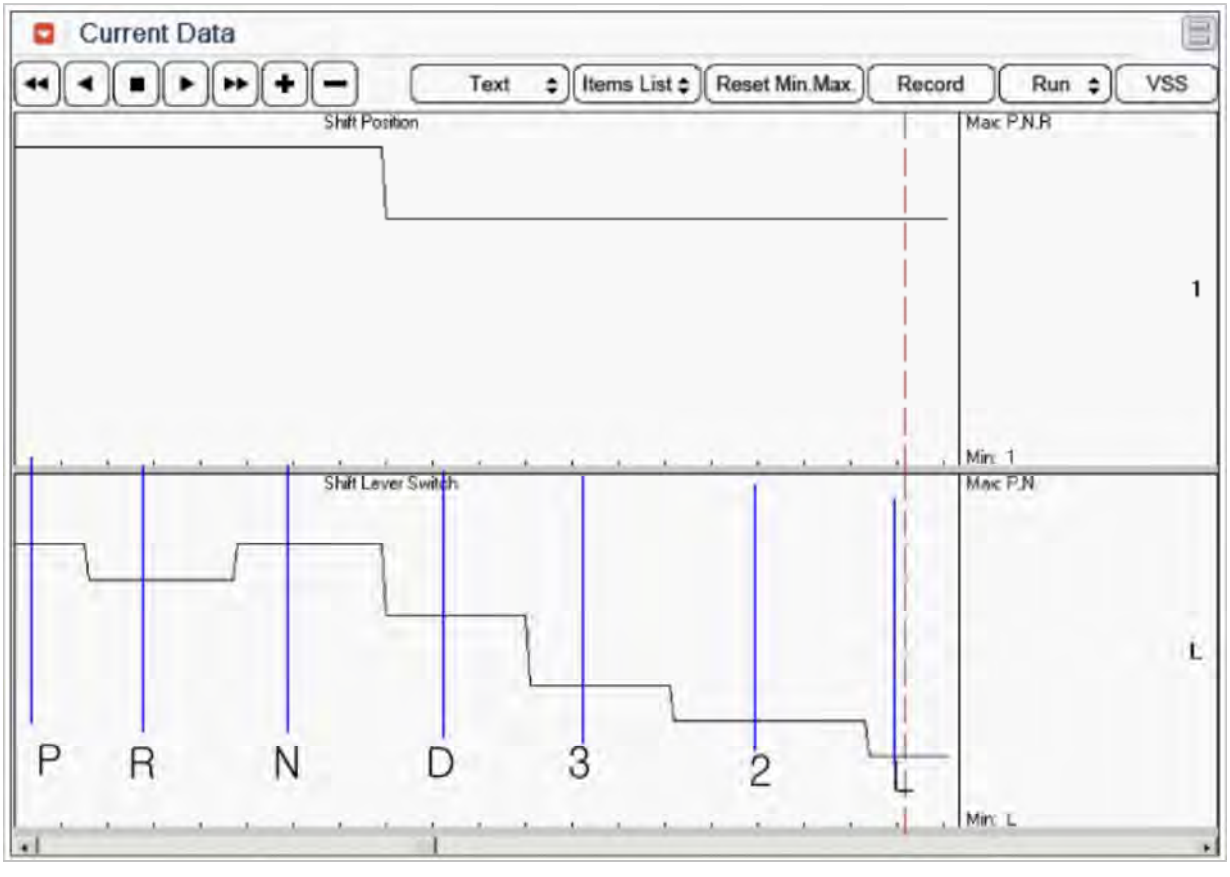
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit low	• Open or short in circuit • Faulty Shift cable adjustment • Faulty Inhibitor switch and Manual control lever position adjustment • Faulty TRANSAXLE RANGE SWITCH • Faulty TCM(PCM)
Enable Conditions	• Engine Speed >1200rpm • Ignition key input voltage ≥ 10V	
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)	

Diagnostic Circuit Diagram



Signal Waveform



Monitor GDS Data

1. Connect scantool to data link connector(DLC)

2. Ignition "ON" & Engine "OFF".
3. Monitor the "TRANSAXLE RANGE SWITCH" parameter on the scantool.
4. Move selector lever from "P" range to "L" range.

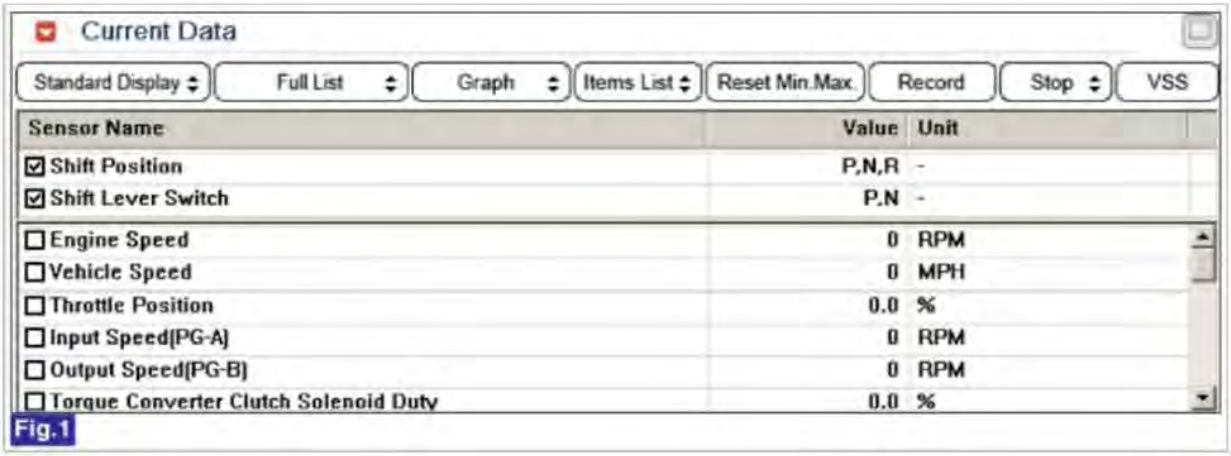


Fig.1

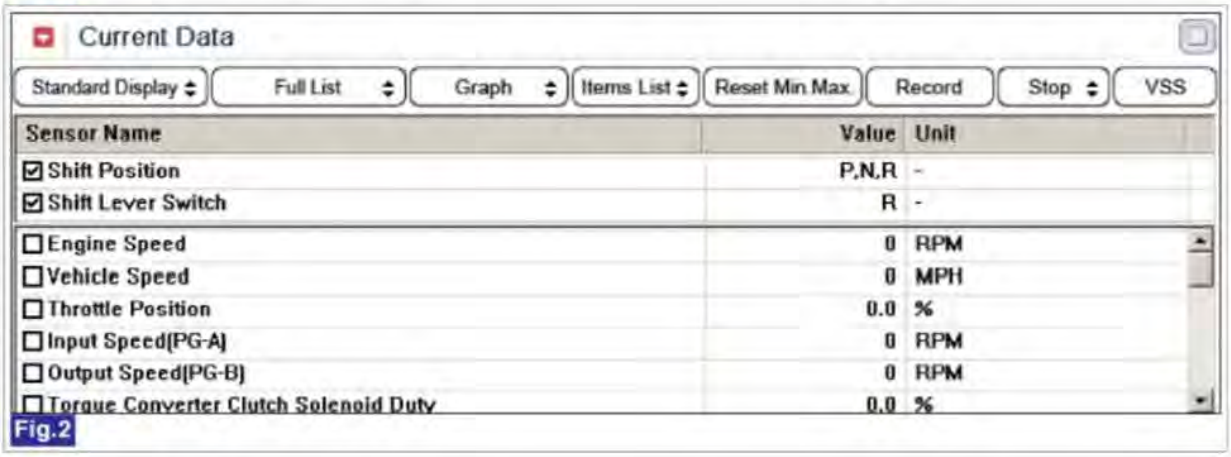


Fig.2

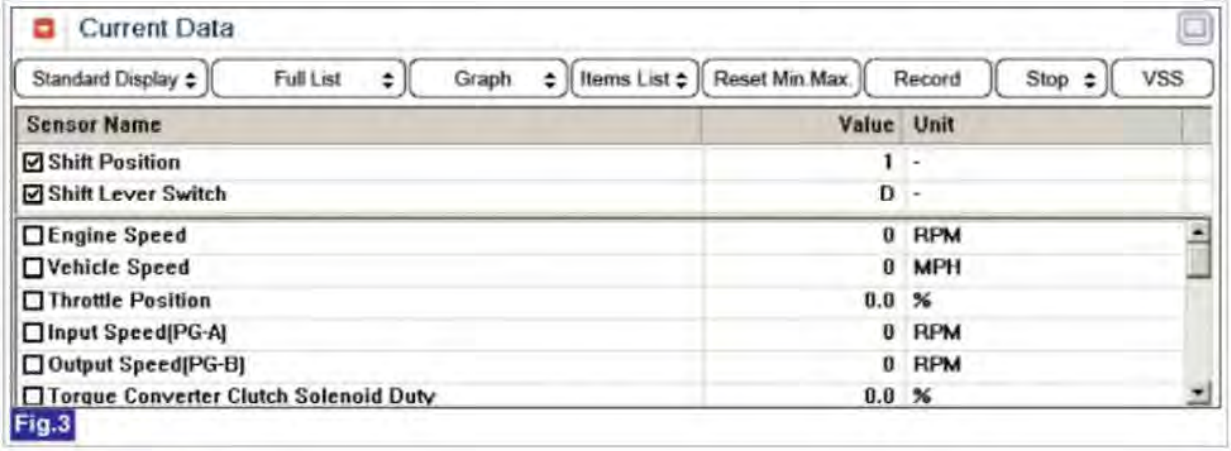


Fig.3

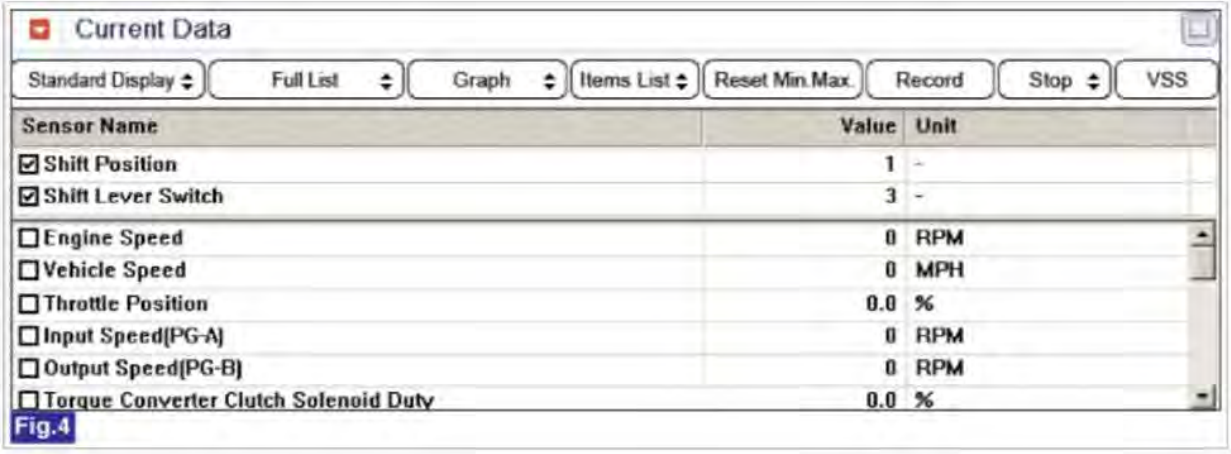


Fig.4

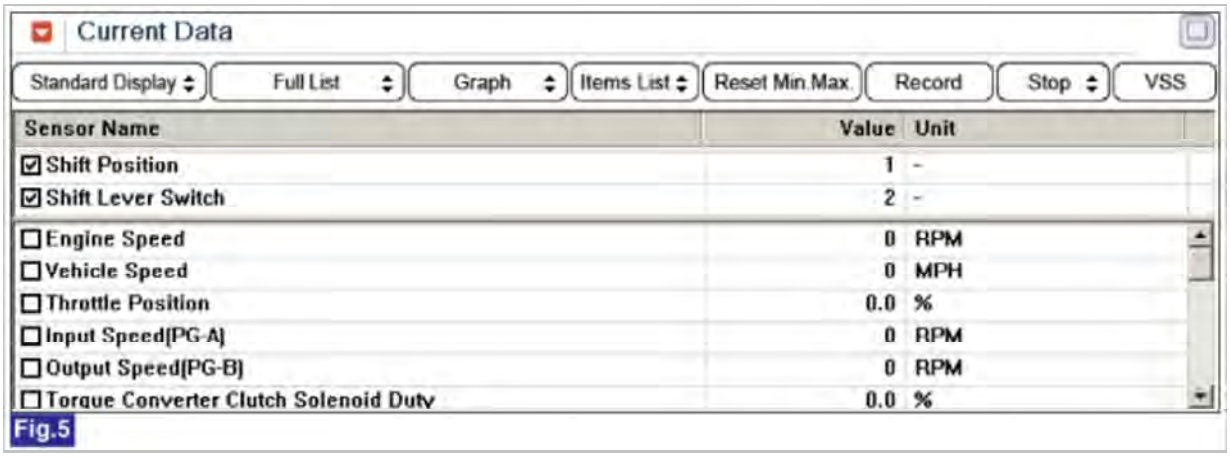


Fig.5

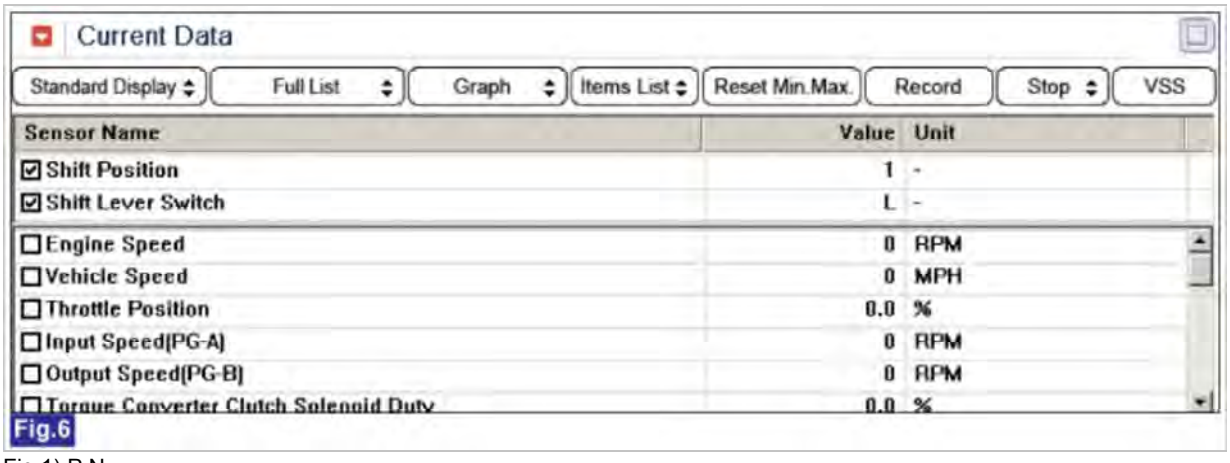


Fig.6

Fig 1) P,N
Fig 2) "R"
Fig 3) "D" Range
Fig 4) "3" Range
Fig 5) "2" Range
Fig 6) "L" Range

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "W/Harness Inspection" procedure.

※ Most of fault that happen about inhibitor switch, result from faulty shift cable adjustment or incorrect location of manual control lever and inhibitor switch. So, when DTC which related Inhibitor switch or engine start defectiveness at "P" range happen, After check the shift cable adjustment or location of manual control lever and inhibitor switch, repair or replace as necessary.

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 vehicle Repair" procedure.
NO	▸ Go to "Power circuit inspection" procedure.

Power Circuit Inspection

1. CHECK POWER TO RANGE SWITCH ,

(1) Disconnect "TRANSAXLE RANGE SWITCH" connector.

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

(3) Measure voltage between "Power supply" teminal 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 Fuse1-10A 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 :

Pin No of "TRANSAXLE RANGE SWITCH"	CBG01 No1	CBG01 No7	CBG01 No6	CBG01 No2	CBG01 No5	CBG01 No3
Pin No of "TCM(PCM)" harness	CBG-A No6	CBG-A No7	CBG-A No8	CBG-A No9	CBG-A No11	CBG-A No12
Specification	0Ω	0Ω	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 teminal of the sensor.

Specification : approx. 0 Ω (refer to the "TABLE" as below)

[Range Switch Continuity Check Table (Case Of Sports Mode Vehicle Has No 3,2,L Range)]

Range	**Terminal**						
	P	**R**	**N**	**D**	**3**	**2**	**L**
1				●			
2						●	
3	●						
4			●				
5					●		●
6							
7		●					
8	●	●	●	●	●	●	●
9	●		●				
10	●		●				

4. Is resistance within specifications ?

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

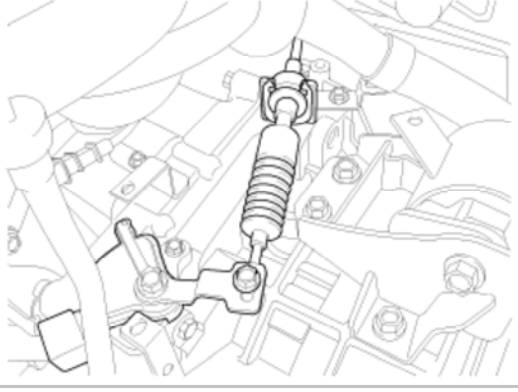
After a repair, it is essential to verify that the fault has been corrected.

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.

Automatic Transaxle System > Automatic Transaxle System > P0708 Transmission Range Sensor Circuit High Input

Component Location



General Description

The Transaxle Range Switch sends the shift lever position information to the TCM 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 judges the shift lever position by reading all signals, for the Transaxle Range Switch, simultaneously.

DTC Description

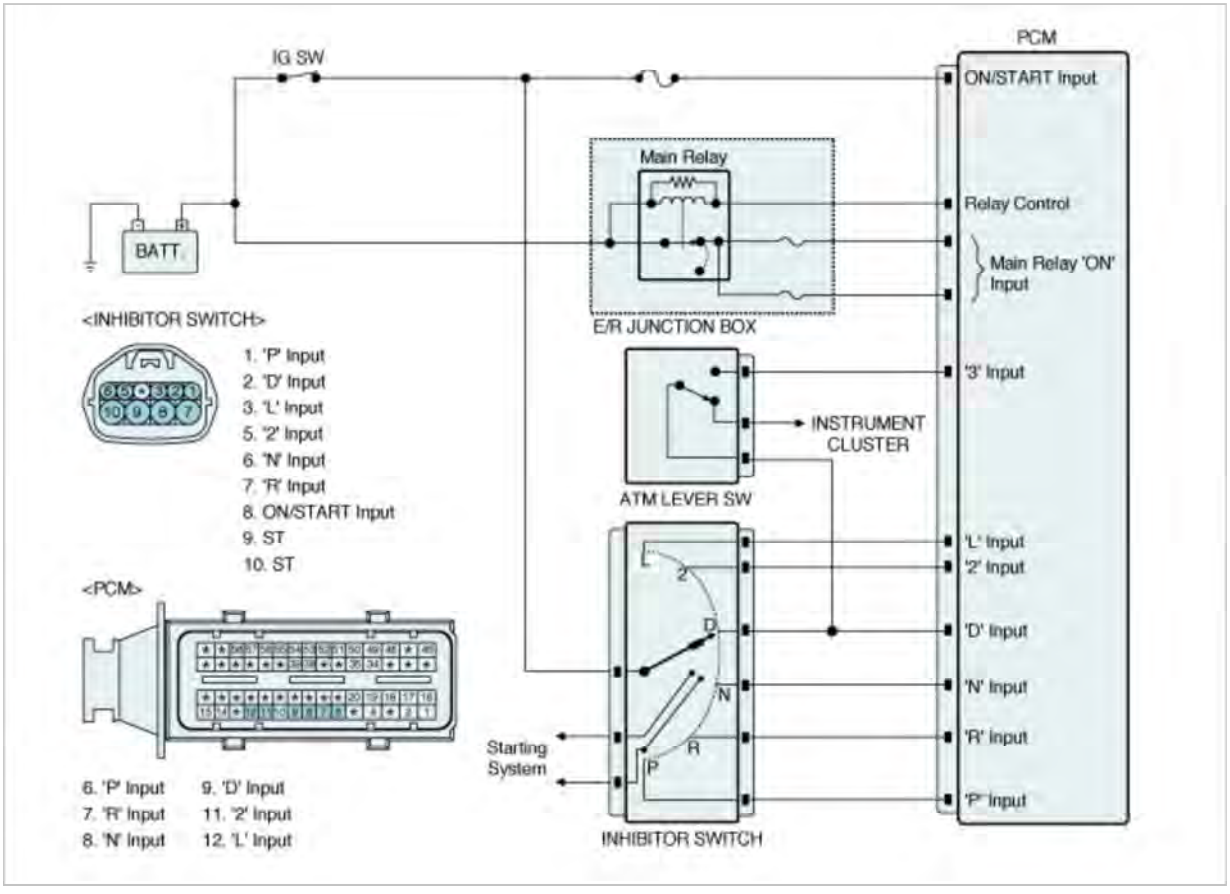
The TCM sets this code when the Transaxle Range Switch outputs multiple signals for more than 30 seconds.

DTC Detecting Condition

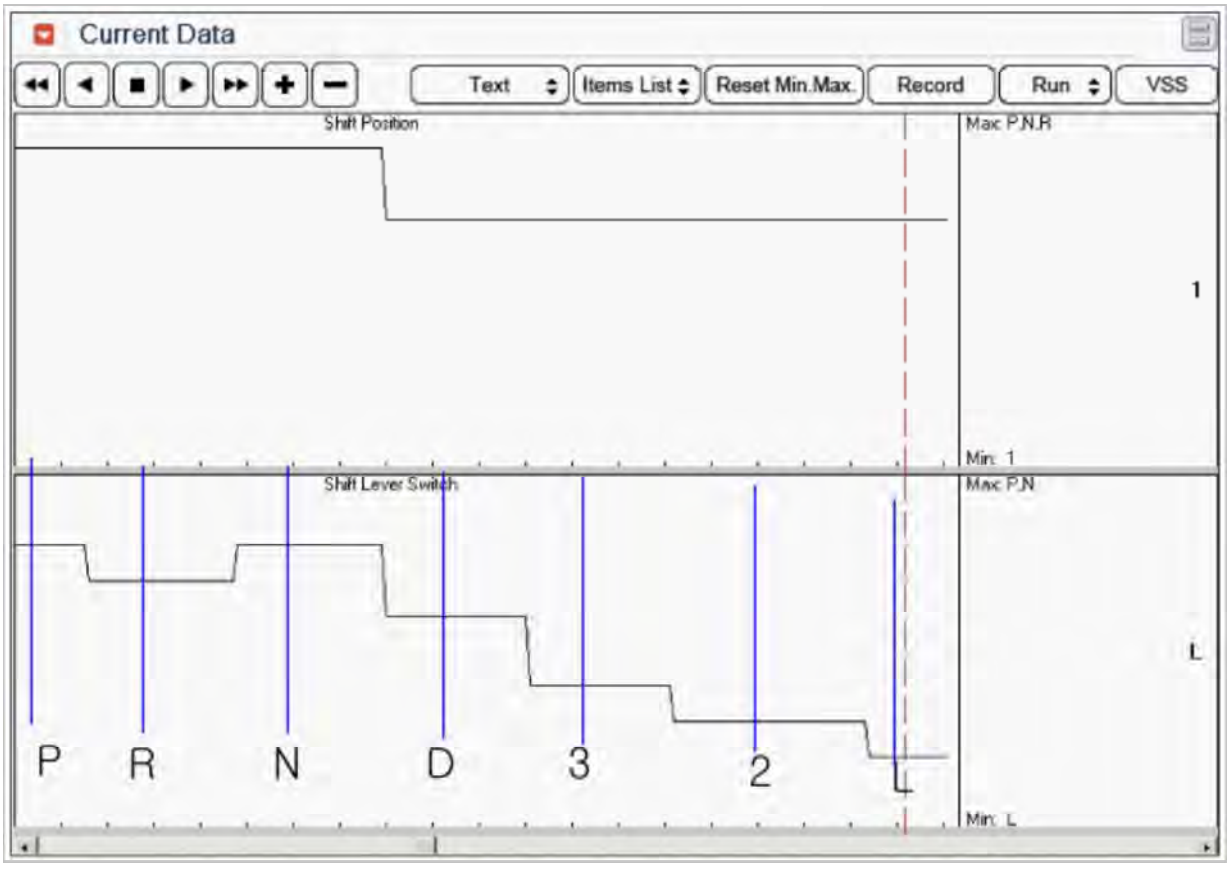
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit high	• Open or short in TRANSAXLE RANGE SWITCH • Faulty Shift cable adjustment • Faulty Inhibitor switch and Manual control lever position adjustment • Faulty TRANSAXLE RANGE SWITCH • Faulty PCM
Enable Conditions	• Ignition key input voltage ≥ 10V	
Threshold Value	• Multiple signal	
Diagnostic Time	• More than 10sec	
Fail Safe	• Recognition as previous signal - When signal is input "D" and "N" at the same time,TCM regards it as "N" RANGE. - After PCM/TCM Reset,If the if the PCM/TCM detects multiple signal or no signal, then it holds the 3rd gear	

	position.	

Diagnostic Circuit Diagram



Signal Waveform



Monitor GDS Data

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

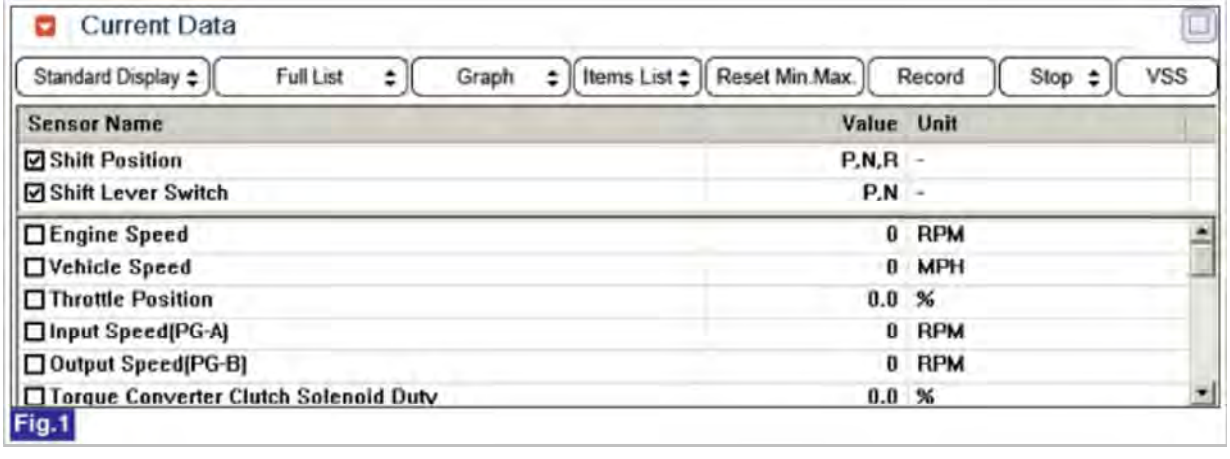


Fig.1

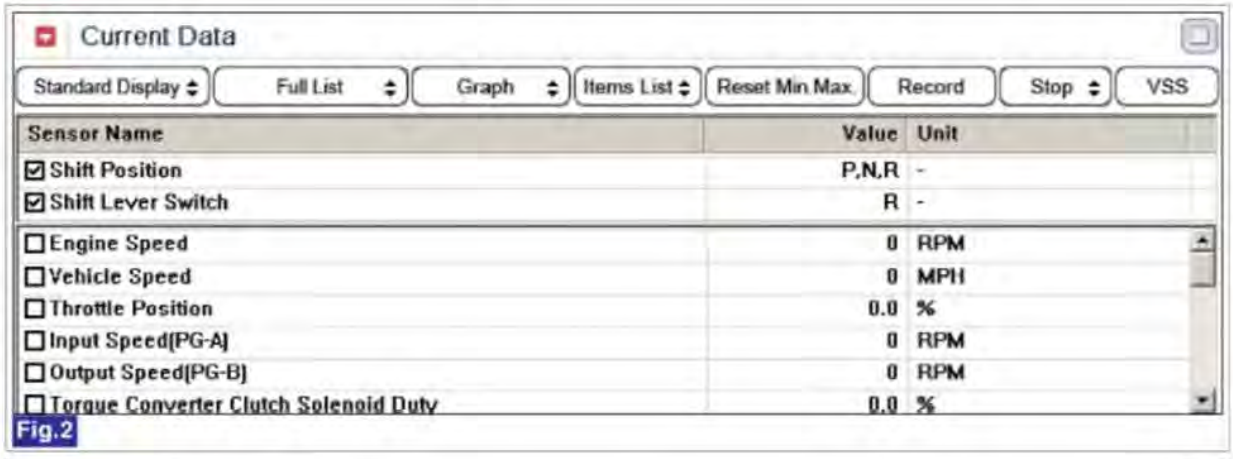


Fig.2

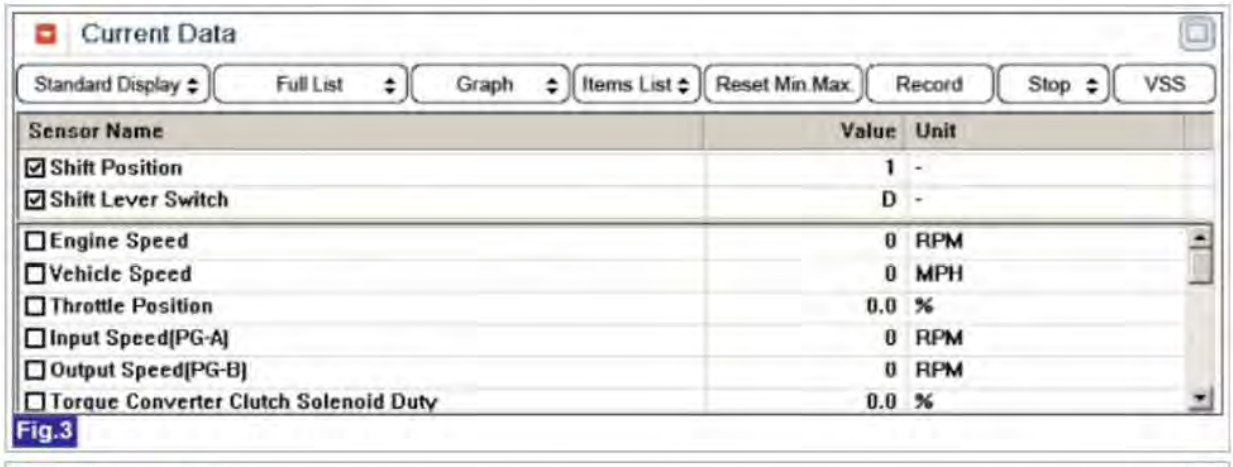


Fig.3

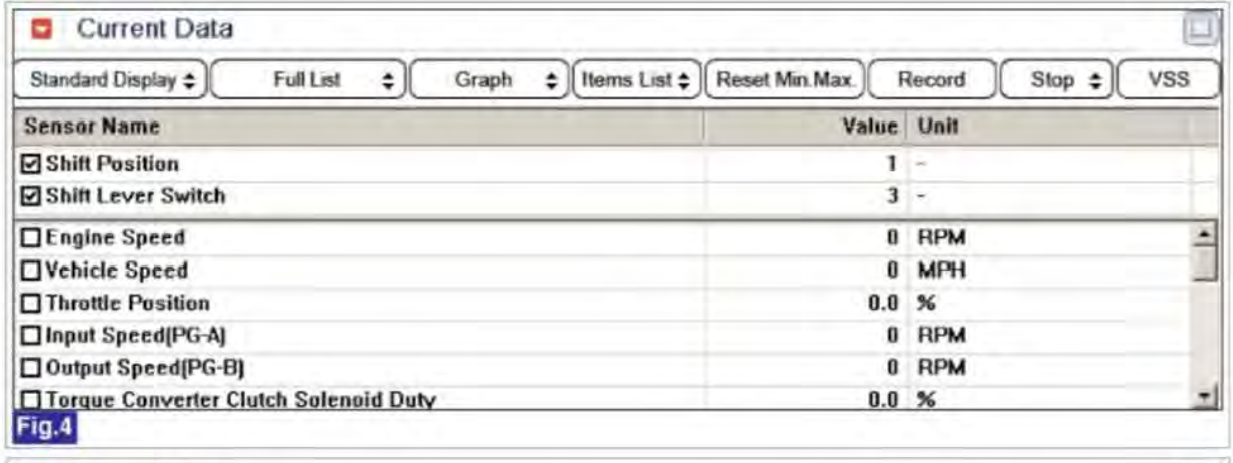


Fig.4

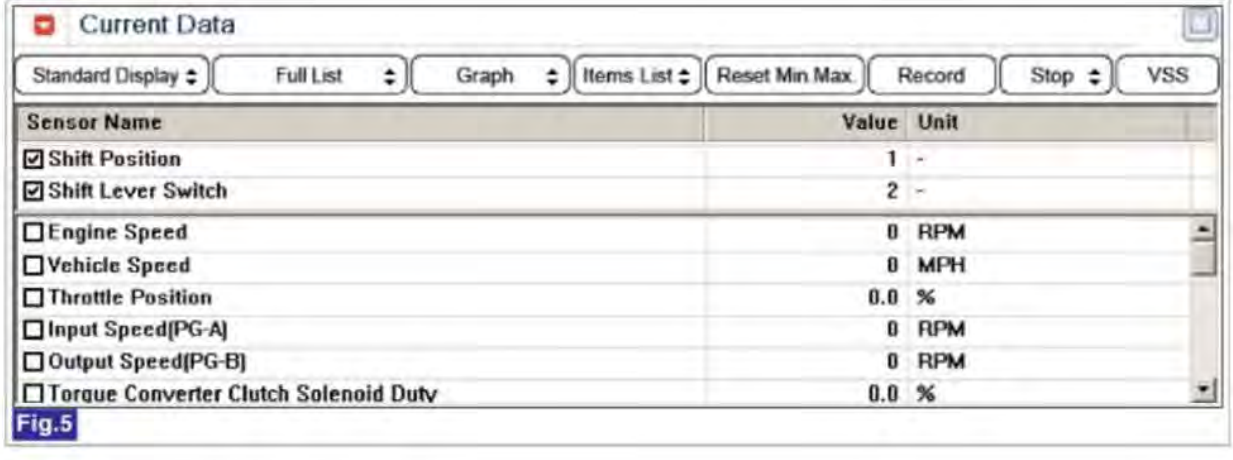


Fig.5

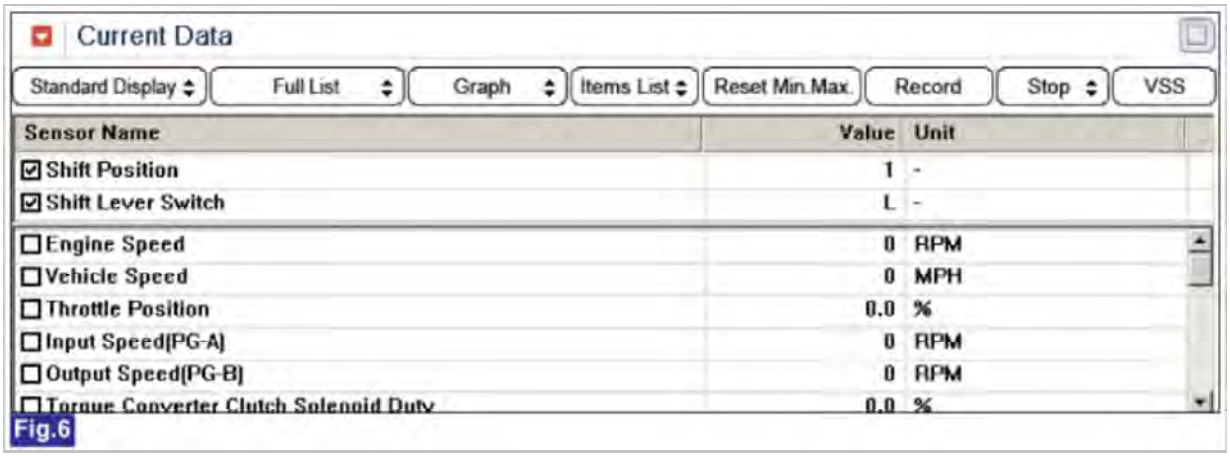


Fig 1) P,N
Fig 2) "R"
Fig 3) "D" Range
Fig 4) "3" Range
Fig 5) "2" Range
Fig 6) "L" Range

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "W/Harness Inspection" procedure.

※ Most of fault that happen about inhibitor switch, result from faulty shift cable adjustment or incorrect location of manual control lever and inhibitor switch. So, when DTC which related Inhibitor switch or engine start defectiveness at "P" range happen, After check the shift cable adjustment or location of manual control lever and inhibitor switch, repair or replace as necessary.

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 vehicle Repair" procedure.
NO	▸ Go to "Power circuit inspection" procedure.

Power Circuit Inspection

1. Disconnect "TRANSAXLE RANGE SWITCH" connector.
2. Ignition "ON" & Engine "OFF".
3. Measure voltage between each teminal of the sensor harness connector and chassis ground.
   Specification :

Terminal(CGG01)	1	2	3	4	5	6	7	8	9	10
Specification	0V	0V	0V	*	0V	0V	0V	12V	0V	0V

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 teminals of the sensor harness to check for Short.

Specification : Infinite

4. Is resistance within specifications?

YES	▸ Go to "Component inspection" procedure.
NO	▸ Check for Short 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 teminal of the sensor.

Specification : approx. 0 Ω (refer to the "TABLE" as below)

[Range Switch Continuity Check Table (Case Of Sports Mode Vehicle Has No 3,2,L Range)]

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

4. Is resistance within specifications ?

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

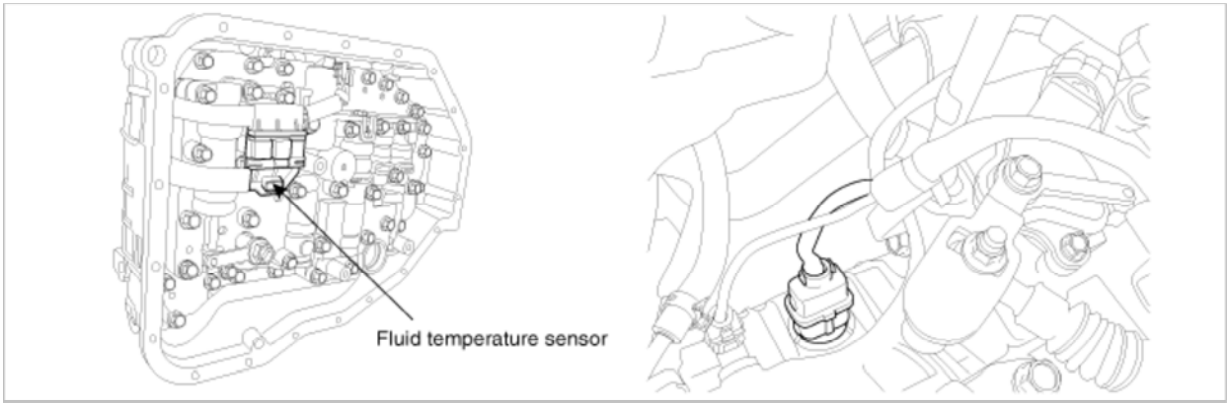
After a repair, it is essential to verify that the fault has been corrected.

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.

Automatic Transaxle System > Automatic Transaxle System > P0711 Transmission Fluid Temperature Sensor \'A\' Circuit Range/Performance

Component Location



General Description

The automatic transmission fluid(ATF) temperature sensor is installed in the Valve Body. This sensor uses a thermistor whose resistance changes according to the temperature changes. The TCM supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic transmission fluid(ATF) temperature provides very important data for the TCM'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 regards the ATF temperature as fixed at a value of 80 ° C.

DTC Detecting Condition

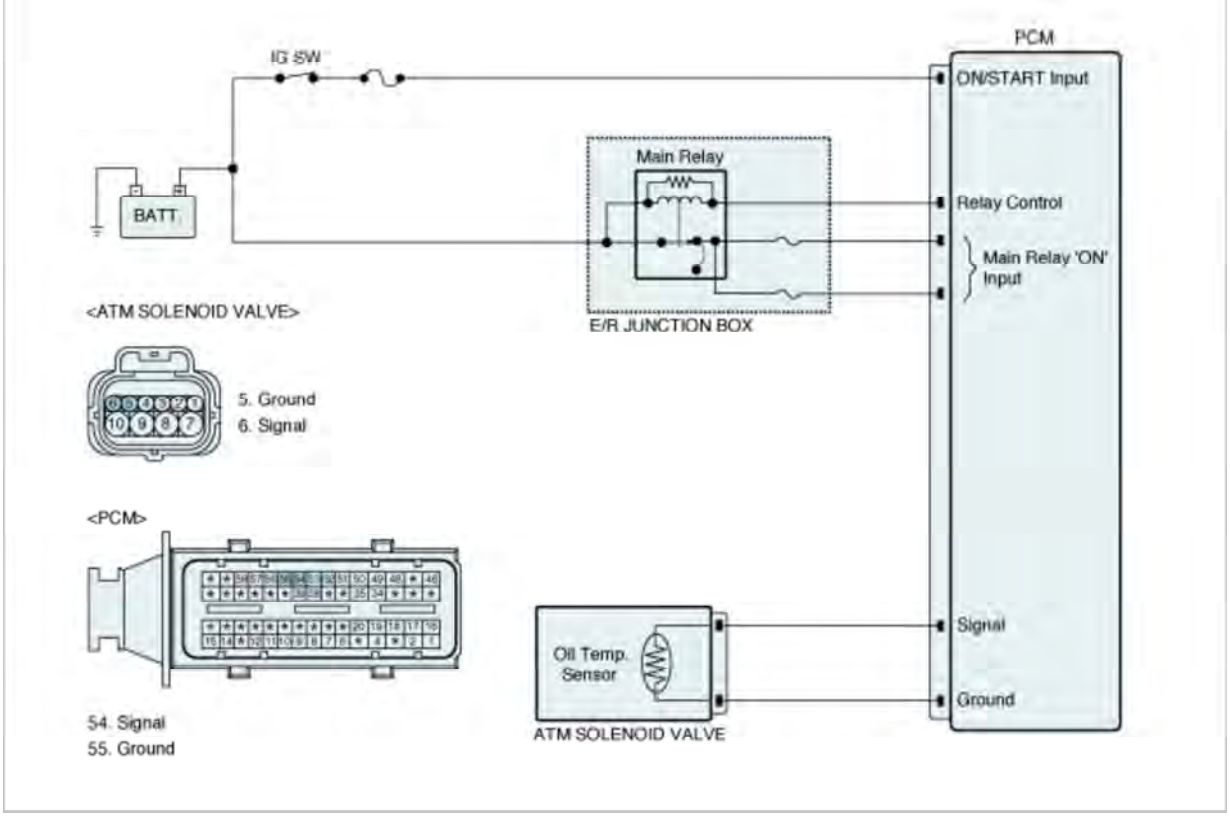
Item		Detecting Condition	Possible Cause
Case 1	DTC Strategy	• Rationality stuck-low	• Open or short in circuit • Faulty sensor • Faulty PCM
	Enable Conditions	• Output Speed ≥ 1000rpm • Engine Speed ≥ 1000rpm • Accumulated time in above two condition 5min • TFT at start-up and ambient temp. (<50°C) and (>-7°C) or TFT at start-up <30°C Engine coolant temp. increase since start-up >40°C	
	Threshold Value	• Since start-up	
Case 2	DTC Strategy	• Rationality stuck-high	
	Enable Conditions	• TFT at previous engine-off >50°C • Engine coolant temp. at previous engine-off >73.5°C • Engine coolant temp. drop from the previous engine-off >34°C • Intake air temperature < 35°C • Time after TCM turns on 0.5sec	
	Threshold Value	• TFT drop <2°C from the previous engine-off	
Case 3	DTC Strategy	• Rationality-low	
	Enable Conditions	• Output Speed ≥ 1000rpm • Engine Speed ≥ 1000rpm • Accumulated time in above two condition 5min • Ignition key input voltage>10V	

	Threshold Value	• TFT.≤-10°C
Diagnostic Time		• 1 event
Fail Safe		• Learning control and Intelligent shift are inhibited. • Fluid temperature is regarded as 80°C

Specification

Temperature °C(°F)	Resistance (kΩ)	Temperature °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		

Diagnostic Circuit Diagram



Monitor GDS Data

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

Specification : Increasing Gradually

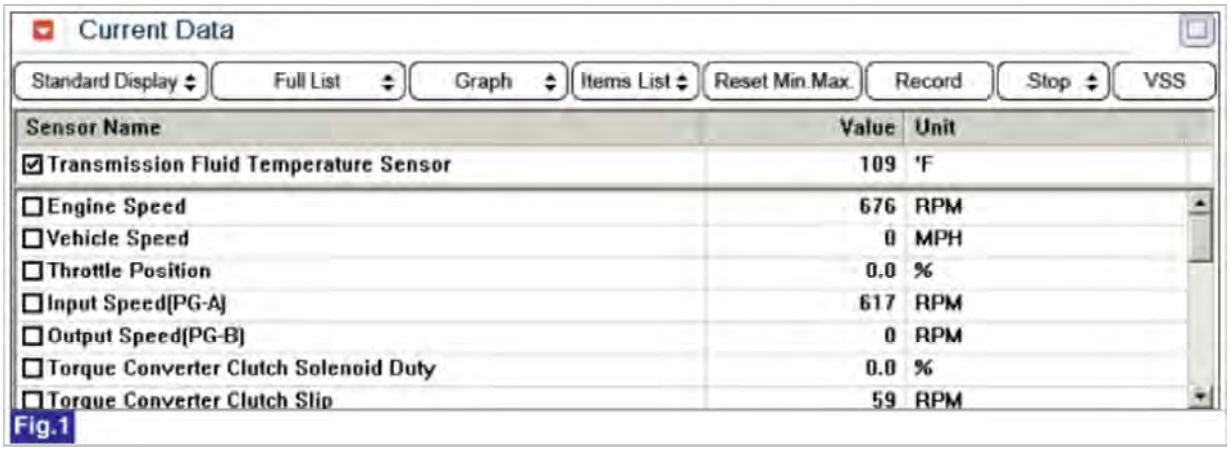


Fig.1

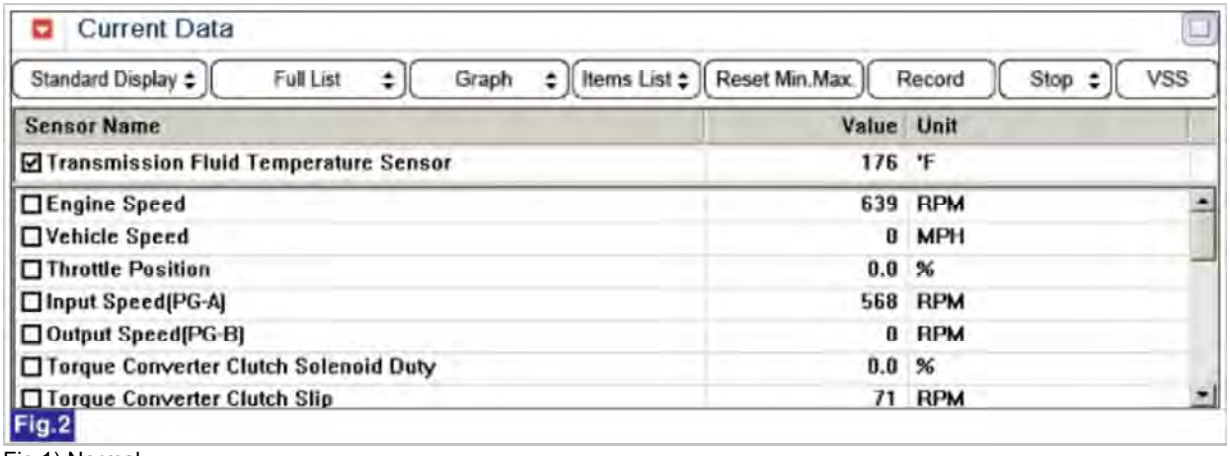


Fig.2

Fig 1) Normal
Fig 2) Signal circuit open

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "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 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 "Signal" terminal of the "TRANSAXLE FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 5 V

4. Is voltage within specifications ?

YES	▸ Go to "Ground circuit inspection" procedure.
NO	▸ Check for open or short in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

Ground Circuit Inspection

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

Specification : Approx. 0 Ω

4. s 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

■ Check "TRANSAXLE FLUID TEMPERATURE SENSOR"

1. Ignition "OFF" .
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the resistance between "Signal" terminals and "Ground" of the "TRANSAXLE FLUID TEMPERATURE SENSOR".

Specification : Refer to " Reference data"

[Reference data]

Temperature °C(°F)	Resistance (kΩ)	Temperature °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 PCM/TCM " as below
NO	▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and Go to "Verification Vehicle Repair" procedure.

■ Check PCM

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

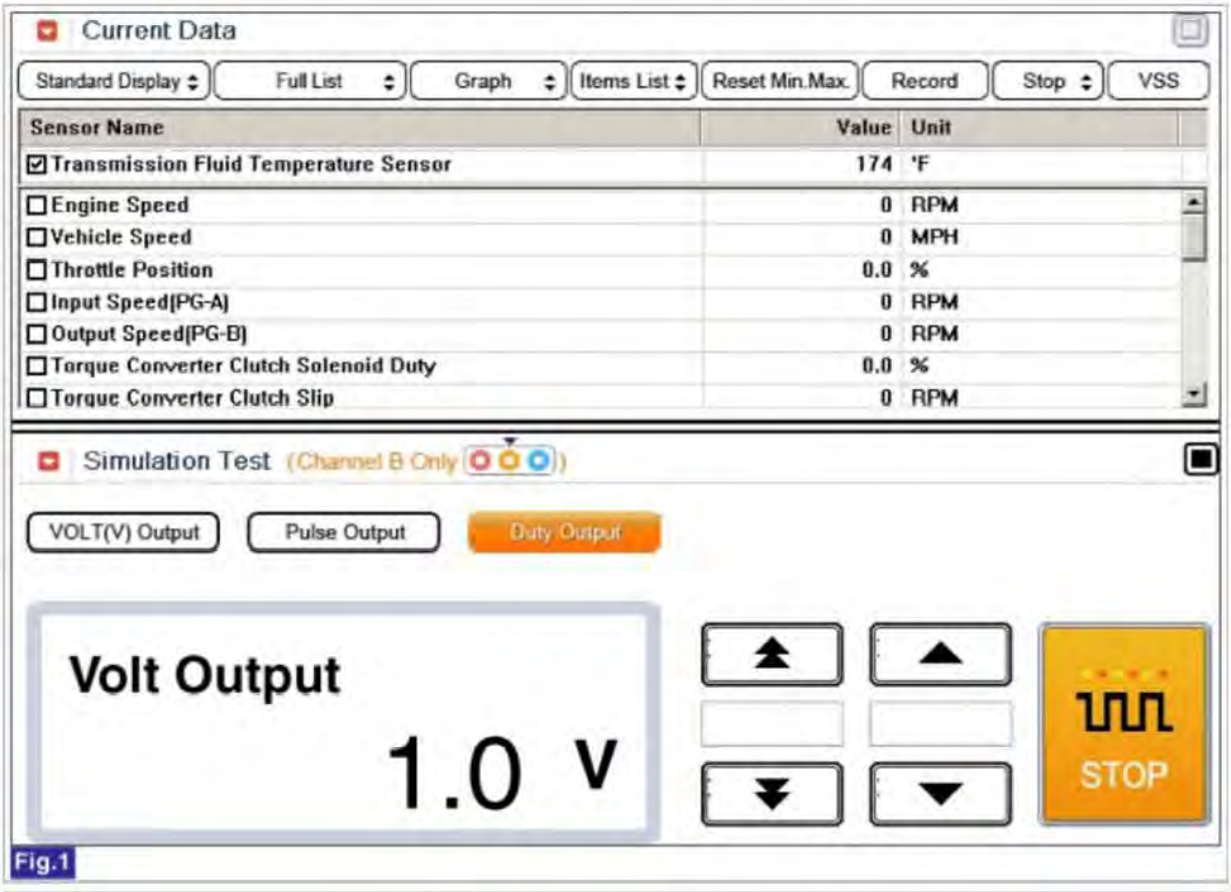


Fig.1

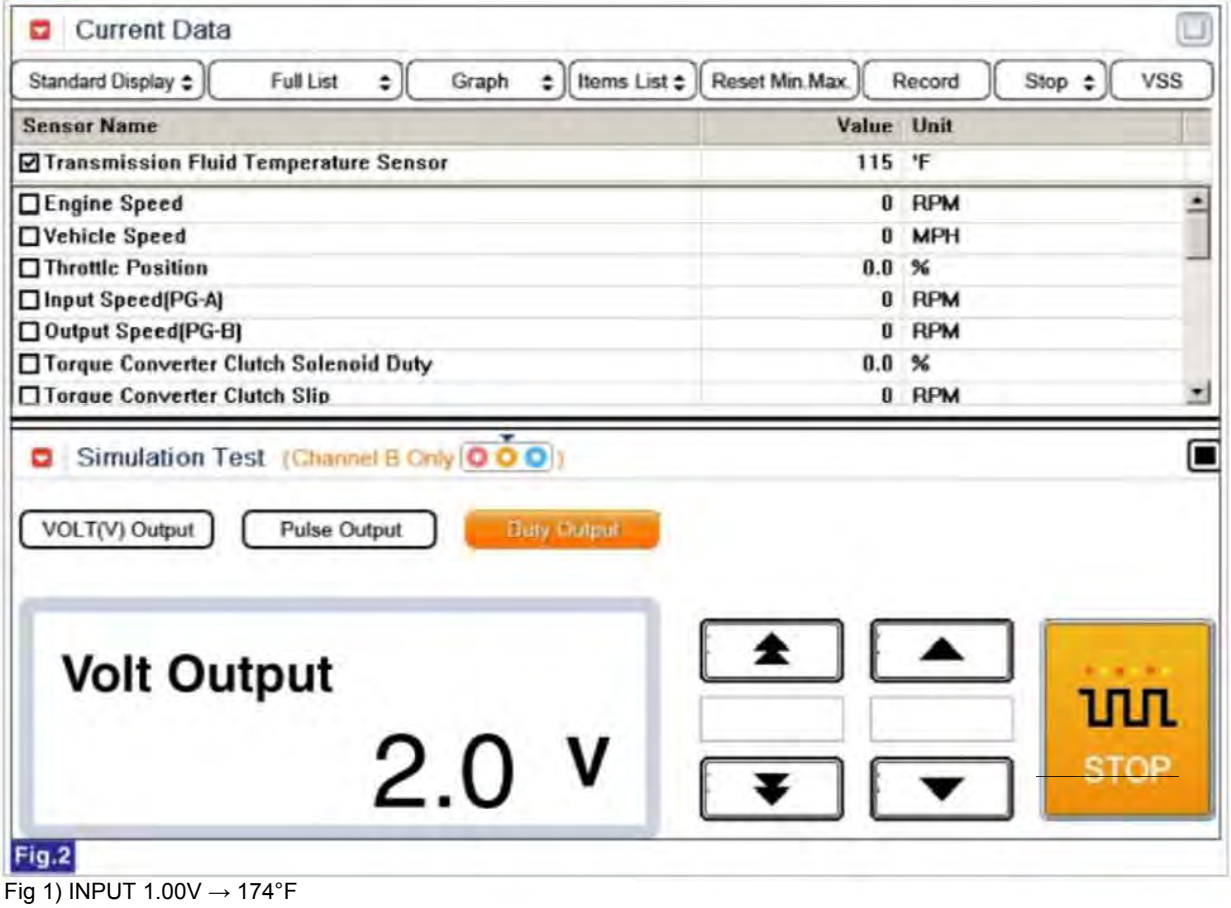


Fig.2

Fig 1) INPUT 1.00V → 174°F

Fig 2) INPUT 2.00V → 115°F

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

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

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

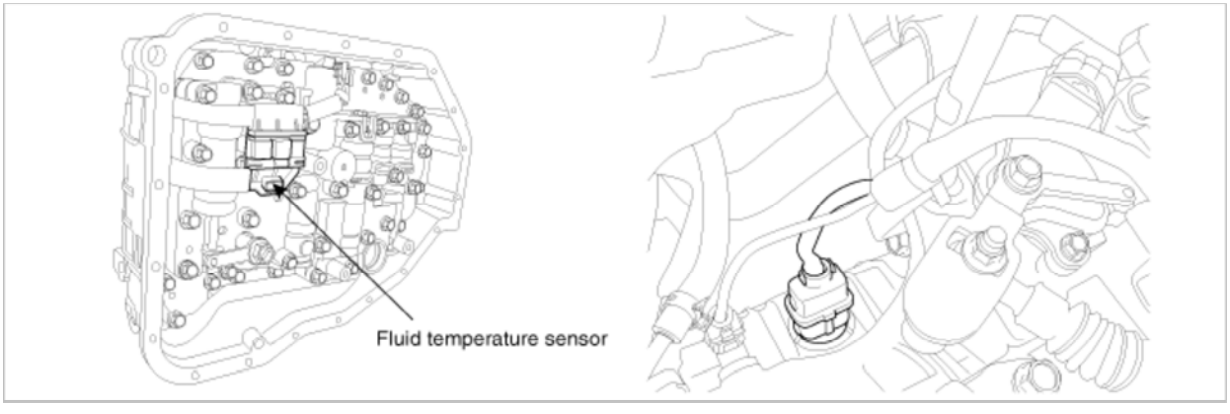
After a repair, it is essential to verify that the fault has been corrected.

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.

Automatic Transaxle System > Automatic Transaxle System > P0712 Transmission Fluid Temperature Sensor \'A\' Circuit Low Input

Component Location



General Description

The automatic transmission fluid(ATF) temperature sensor is installed in the Valve Body. This sensor uses a thermistor whose resistance changes according to the temperature changes. The TCM supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic transmission fluid(ATF) temperature provides very important data for the TCM’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 regards the ATF temperature as fixed at a value of 80 ° C.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit low	• Short to ground in circuit • Faulty sensor • Faulty PCM
Enable Conditions	• Ignition key input voltage ≥ 10V	
Threshold Value	• Voltage <0.1V	
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited.	

	• Fluid temperature is regarded as 80°C	

Specification

Temperature °C(°F)	Resistance (kΩ)	Temperature °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
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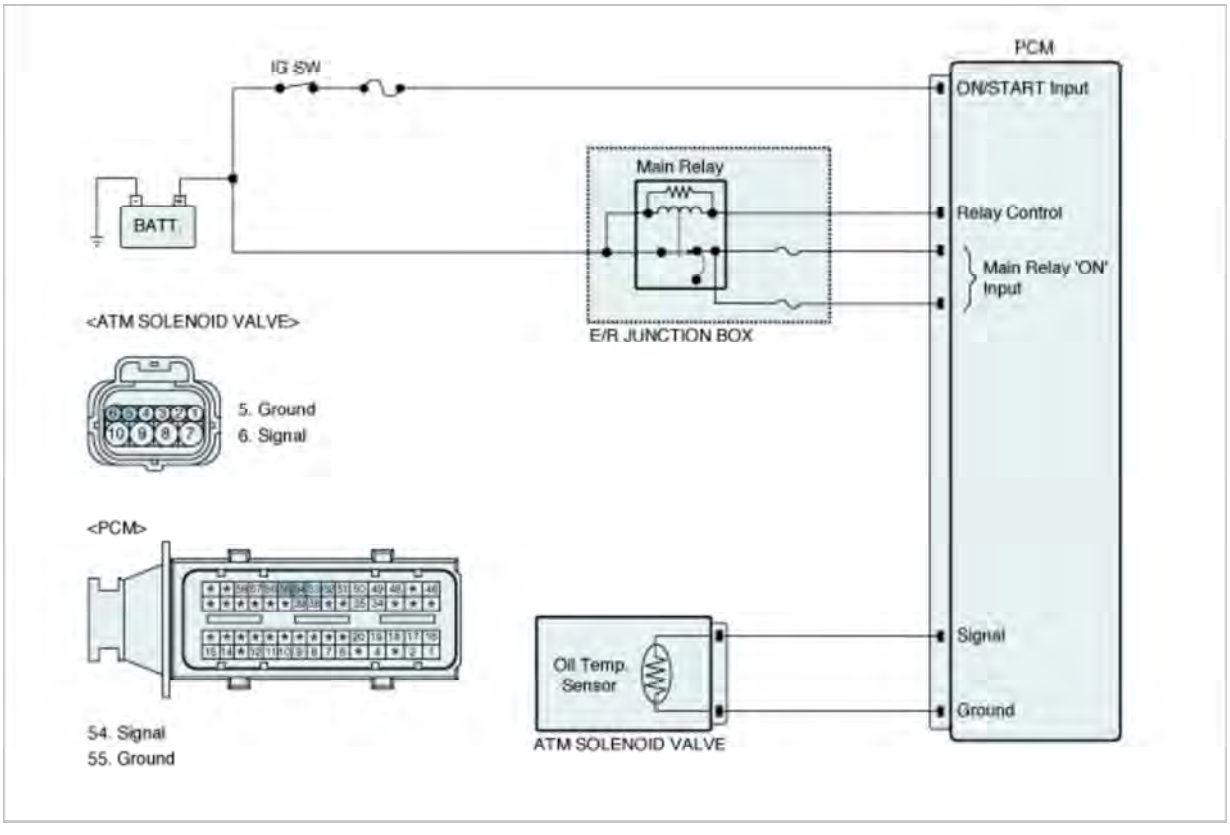
Diagnostic Circuit Diagram



Monitor GDS Data

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

Specification : Increasing Gradually

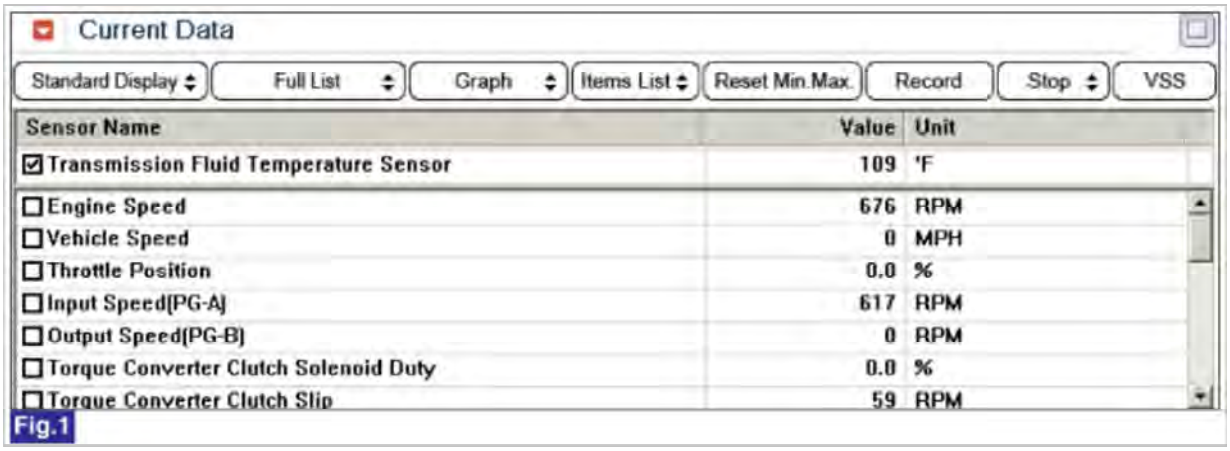


Fig.1

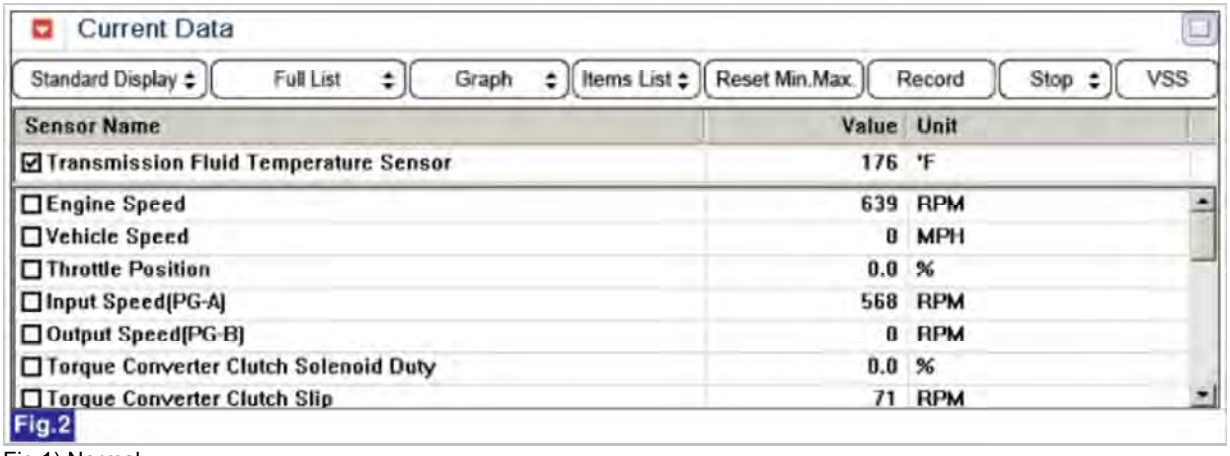


Fig.2

Fig 1) Normal
Fig 2) Signal circuit open

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "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 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 "Signal" terminal of the "TRANSAXLE FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 5 V

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

■ Check "TRANSAXLE FLUID TEMPERATURE SENSOR"

1. Ignition "OFF" .
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the resistance between "Signal" terminals and "Ground" of the "TRANSAXLE FLUID TEMPERATURE SENSOR".

Specification : Refer to " Reference data"

[Reference data]

Temperature °C(°F)	Resistance (kΩ)	Temperature °C(°F)	Resistance (kΩ)
-40(-40)	139.5	80(176)	1.08
-20(-4)	47.7	100(212)	0.63
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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 PCM/TCM " as below
NO	▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and Go to "Verification Vehicle Repair" procedure.

■ Check PCM

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

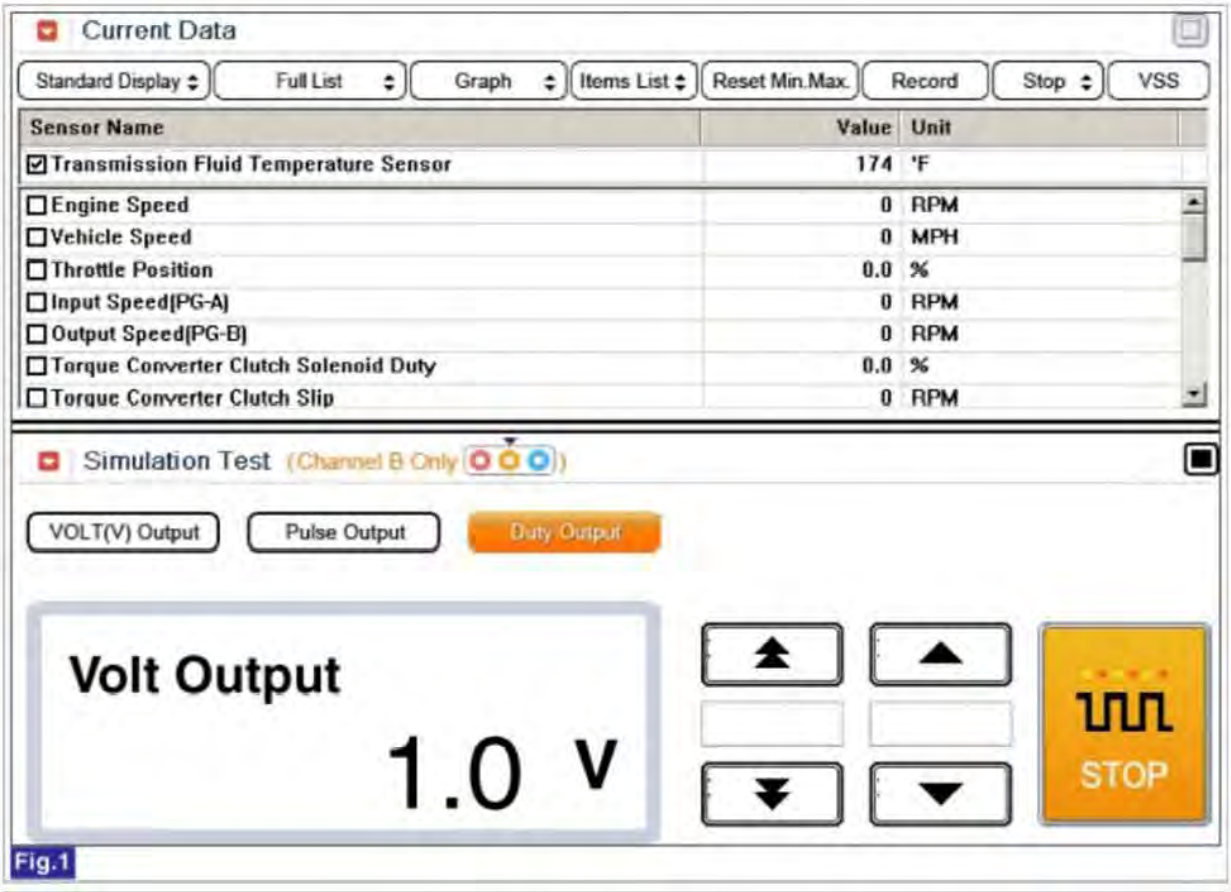


Fig.1

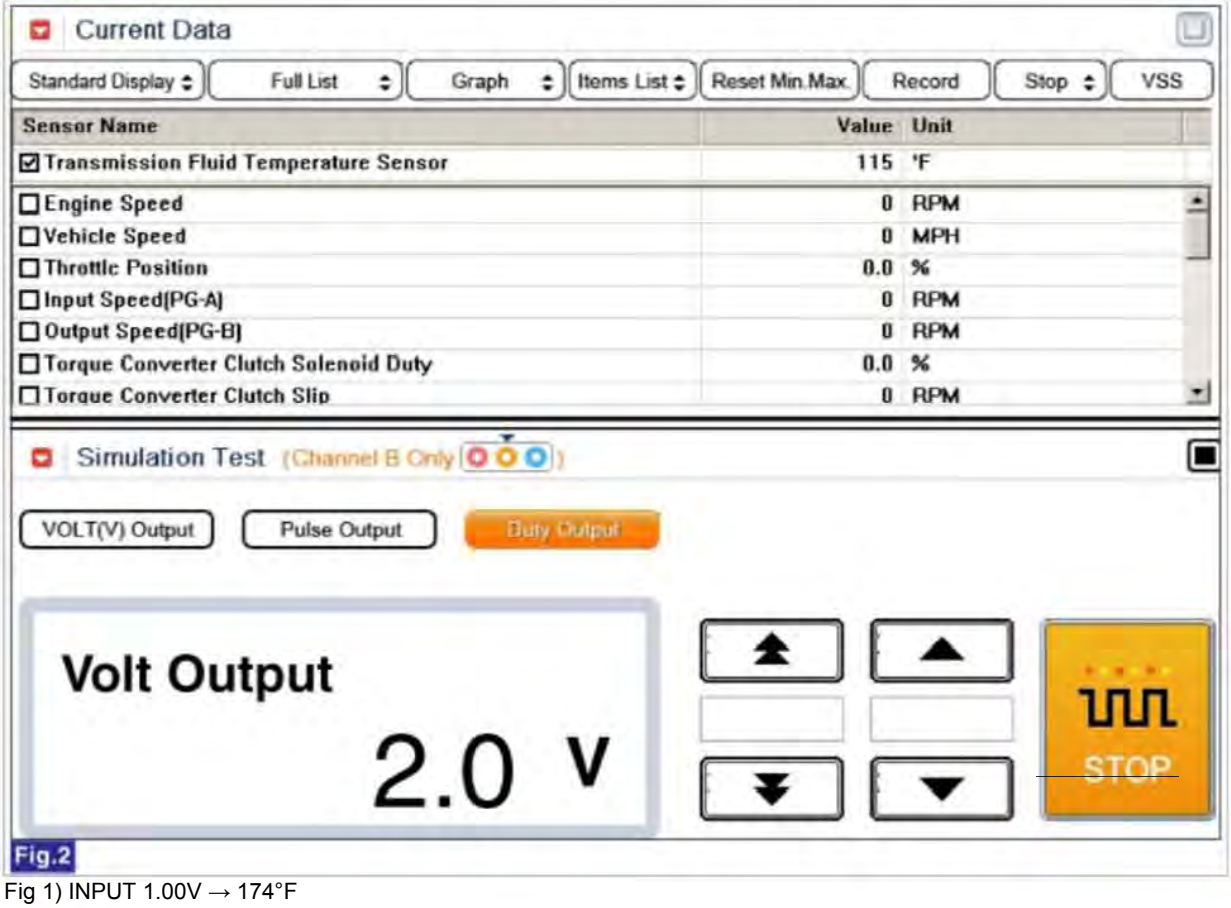


Fig.2

Fig 1) INPUT 1.00V → 174°F

Fig 2) INPUT 2.00V → 115°F

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

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

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

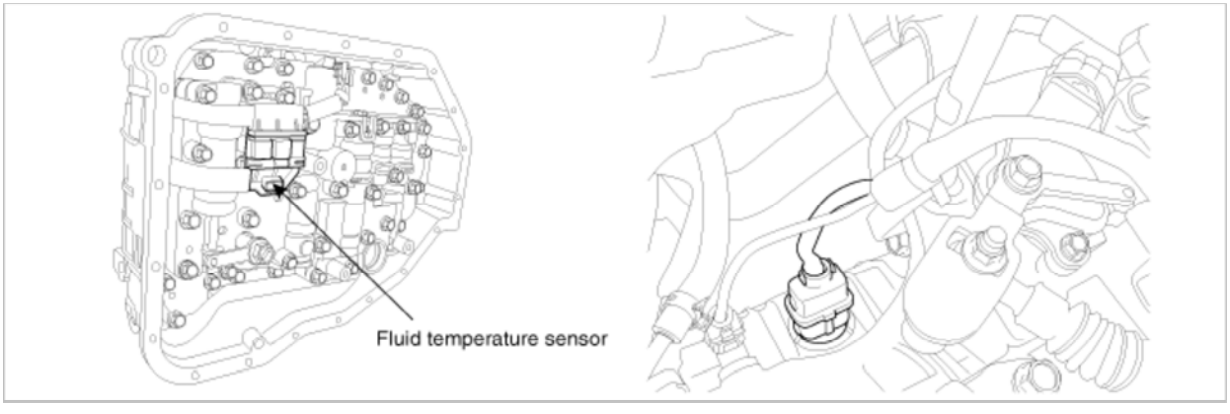
After a repair, it is essential to verify that the fault has been corrected.

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.

Automatic Transaxle System > Automatic Transaxle System > P0713 Transmission Fluid Temperature Sensor \'A\' Circuit High Input

Component Location



General Description

The automatic transmission fluid(ATF) temperature sensor is installed in the Valve Body. This sensor uses a thermistor whose resistance changes according to the temperature changes. The TCM supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic transmission fluid(ATF) temperature provides very important data for the TCM’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 regards the ATF temperature as fixed at a value of 80 ° C.

DTC Detecting Condition

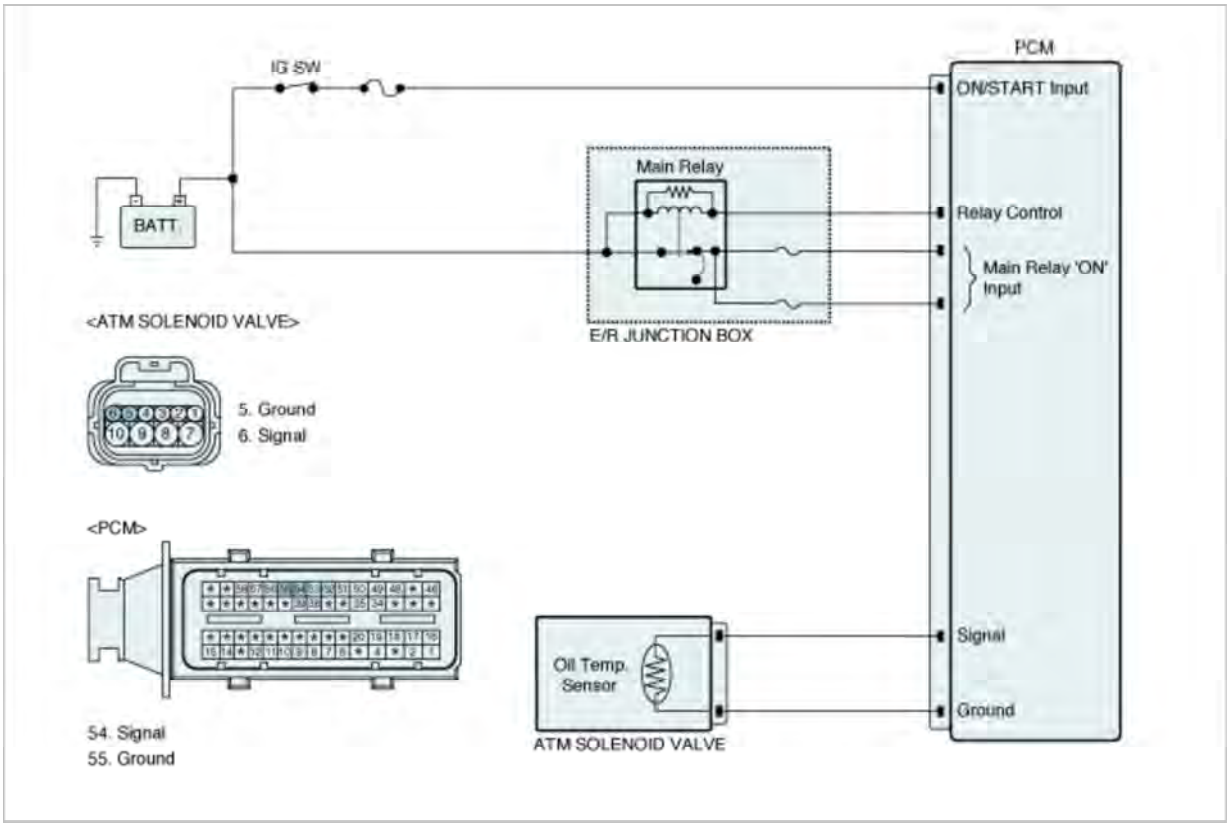
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit high	• Open in circuit • Faulty sensor • Faulty PCM
Enable Conditions	• Ignition key input voltage>10V	
Threshold Value	• Voltage ≥4.9V	
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited.	

	• Fluid temperature is regarded as 80°C	

Specification

Temperature °C(°F)	Resistance (kΩ)	Temperature °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		

Diagnostic Circuit Diagram



Monitor GDS Data

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

Specification : Increasing Gradually

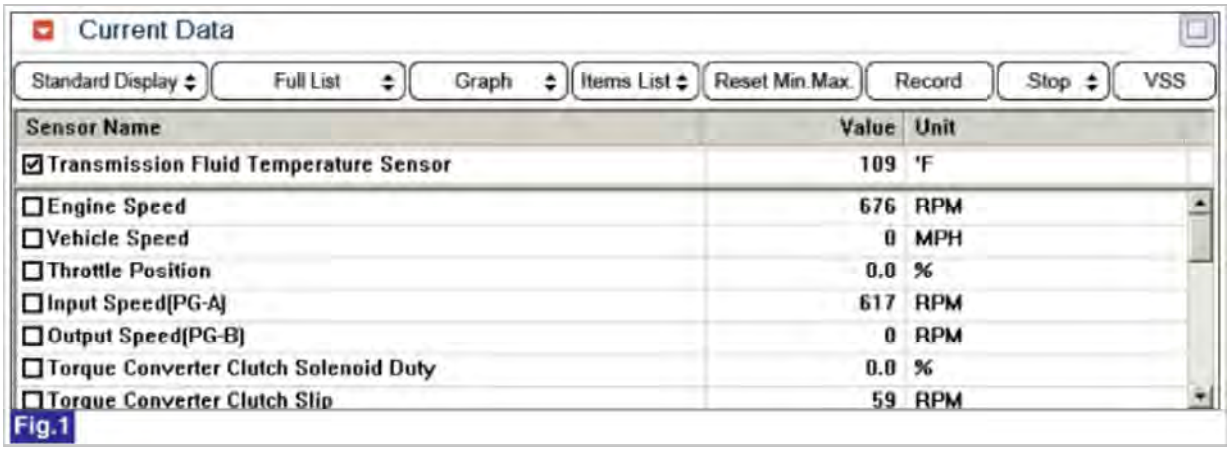


Fig.1

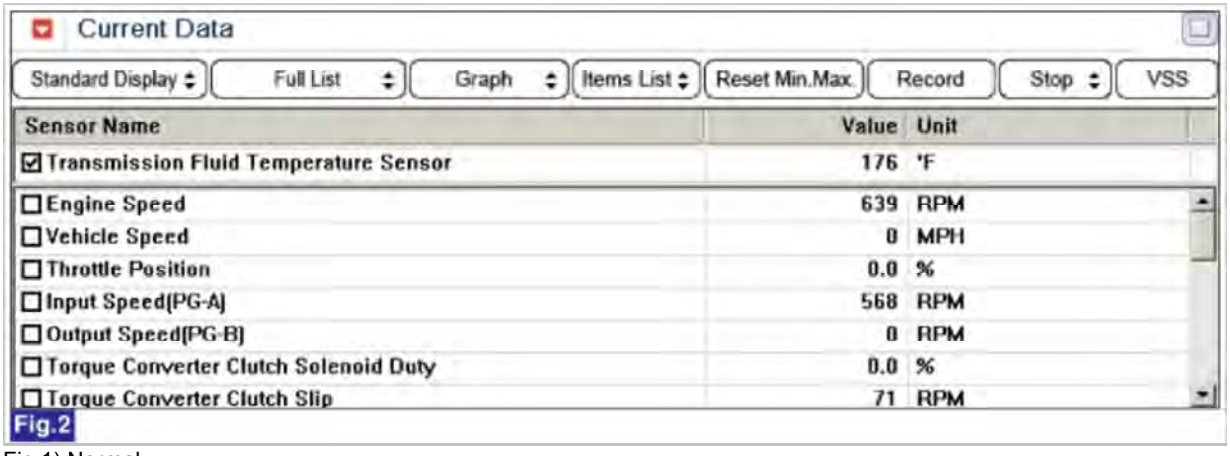


Fig.2

Fig 1) Normal
Fig 2) Signal circuit open

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "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 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 "Signal" terminal of the "TRANSAXLE FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification : Approx. 5 V

4. Is voltage within specifications ?

YES	▸ Go to "Ground circuit inspection" procedure.
NO	▸ Check for open or short in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

Ground Circuit Inspection

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

Specification : Approx. 0 Ω

4. s 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

■ Check "TRANSAXLE FLUID TEMPERATURE SENSOR"

1. Ignition "OFF" .
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the resistance between "Signal" terminals and "Ground" of the "TRANSAXLE FLUID TEMPERATURE SENSOR".

Specification : Refer to " Reference data"

[Reference data]

Temperature °C(°F)	Resistance (kΩ)	Temperature °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 PCM/TCM " as below
NO	▸ Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and Go to "Verification Vehicle Repair" procedure.

■ Check PCM

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

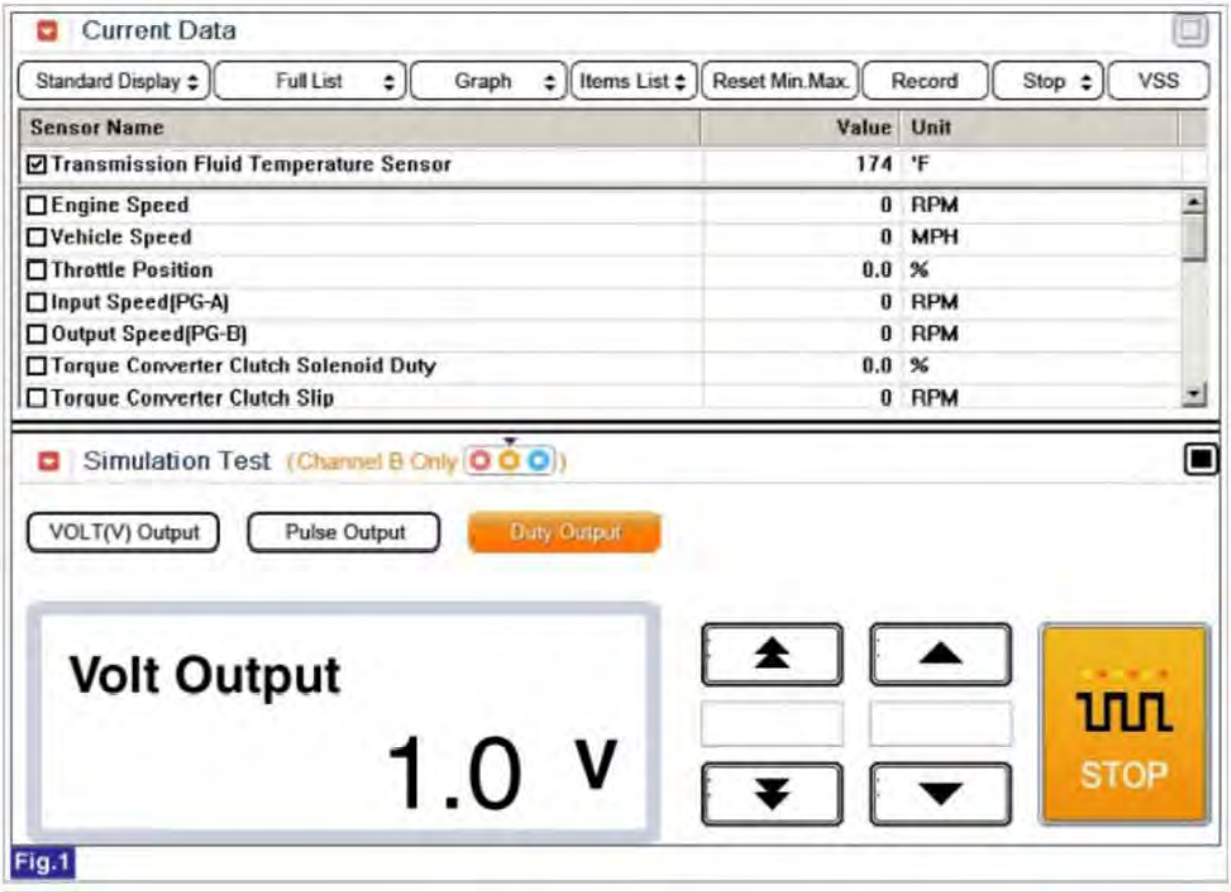


Fig.1

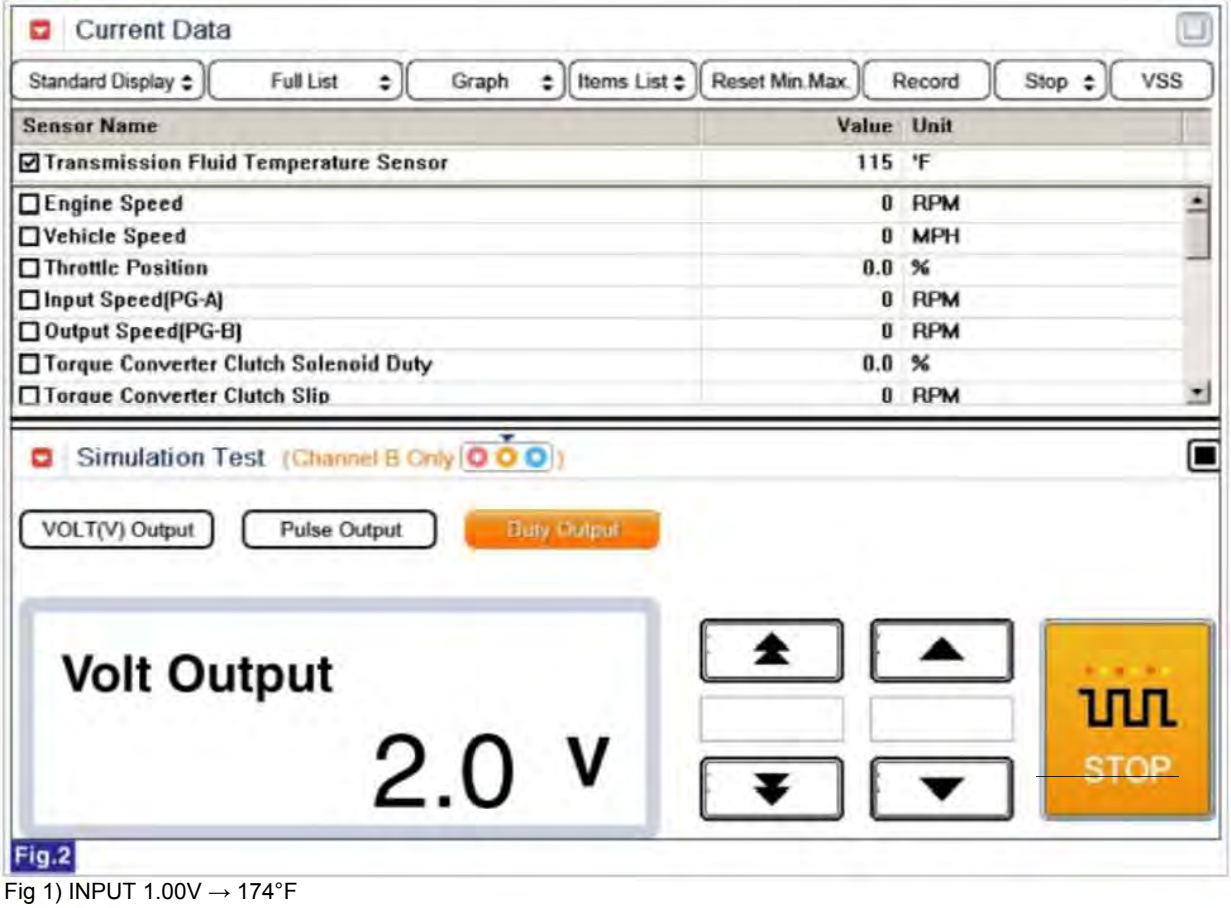


Fig.2

Fig 1) INPUT 1.00V → 174°F

Fig 2) INPUT 2.00V → 115°F

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

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

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

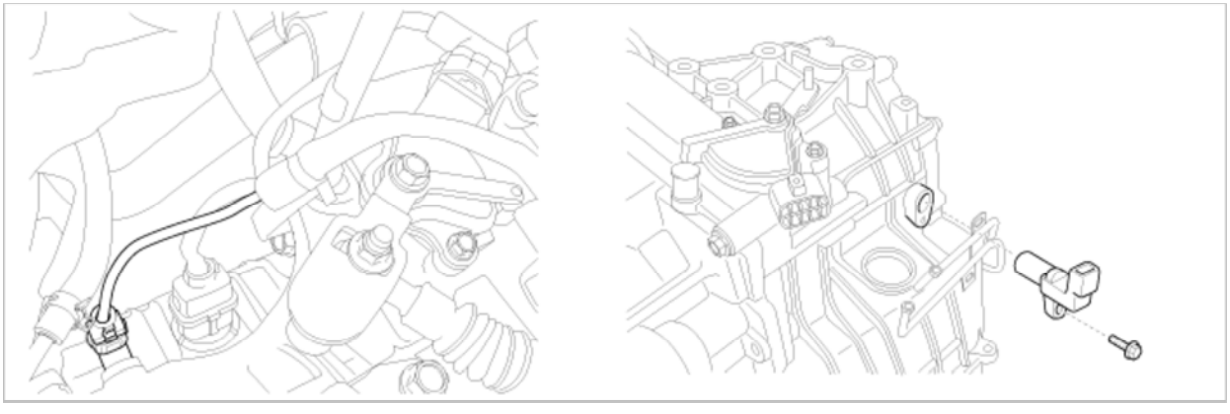
After a repair, it is essential to verify that the fault has been corrected.

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.

Automatic Transaxle System > Automatic Transaxle System > P0717 Input/Turbine Speed Sensor \'A\' Circuit No Signal

Component Location



General Description

The input(turbine) speed sensor outputs pulse-signals according to the revolutions of the input shaft of the transmission. The PCM/TCM 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 PCM/TCM 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 PCM/TCM if this code is detected.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit no signal	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty INPUT SPEED SENSOR • Faulty PCM/TCM
Enable Conditions	• TR switch D range • Vehicle Speed >25km/h • Engine speed >2600rpm at 1st,2nd gear • Ignition key input voltage >10V	
Threshold Value	• Input speed = 0rpm	
Diagnostic Time	• More than 1sec	

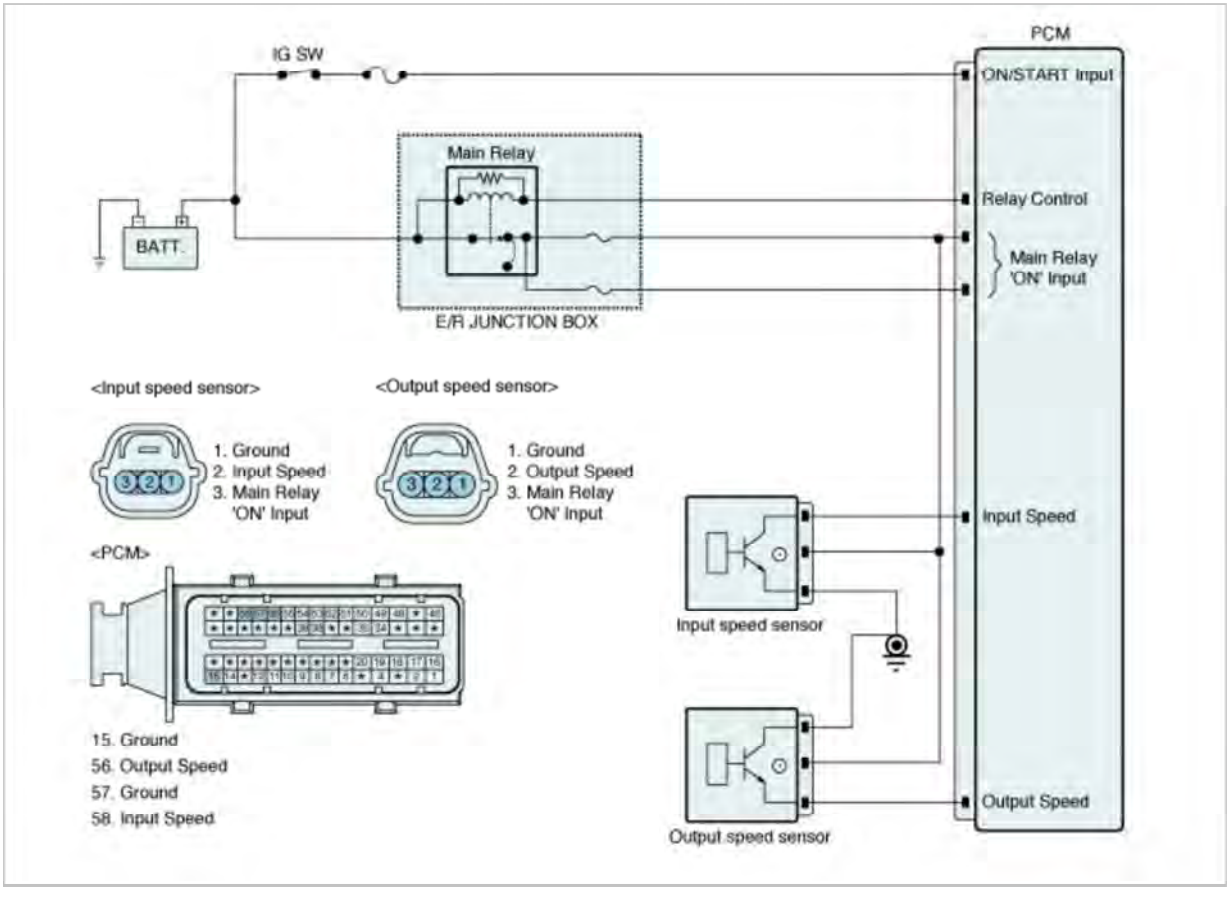
Fail Safe	• Locked into 3rd or 2nd gear. • Manual shifting is possibe (2 nd → 3 rd ,3 rd → 2 nd)	

Specification

Input shaft & Output shaft speed sensor

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

Diagnostic Circuit Diagram



Signal Waveform

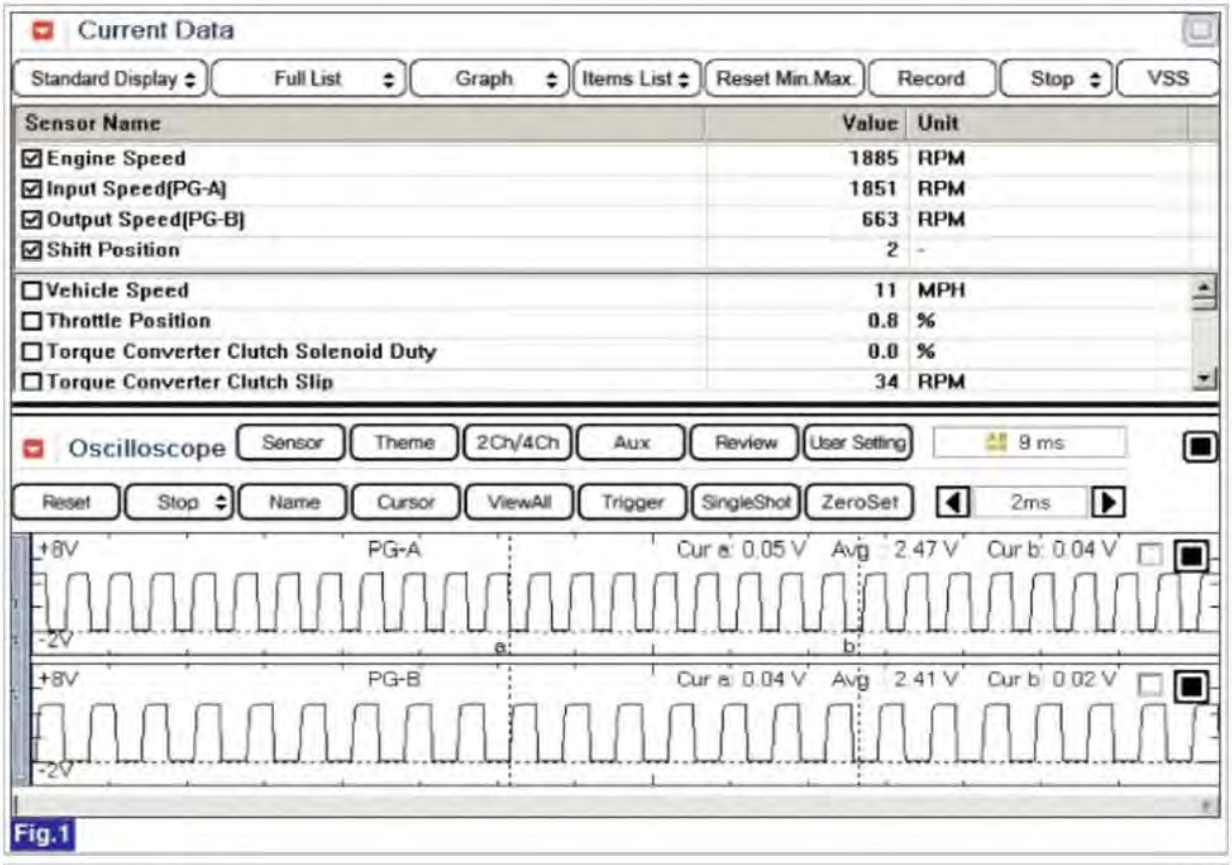


Fig.1

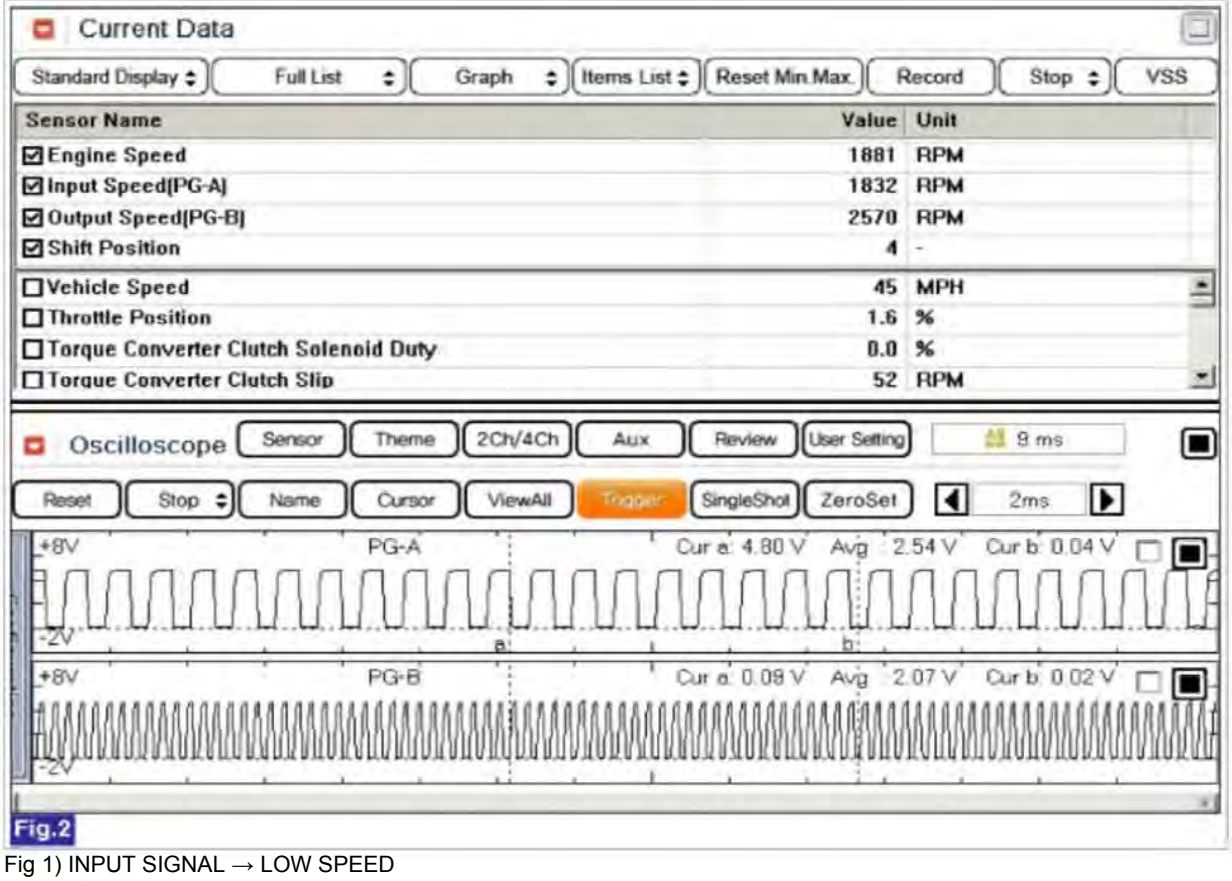


Fig.2

Fig 1) INPUT SIGNAL → LOW SPEED
Fig 2) INPUT SIGNAL → HIGH SPEED

Monitor GDS Data

1. Connect scantool to data link connector(DLC)
2. Engine "ON" .

3. Monitor the "INPUT SPEED SENSOR" parameter on the scantool.
4. Drive the vehicle

Specification : Increasing Gradually

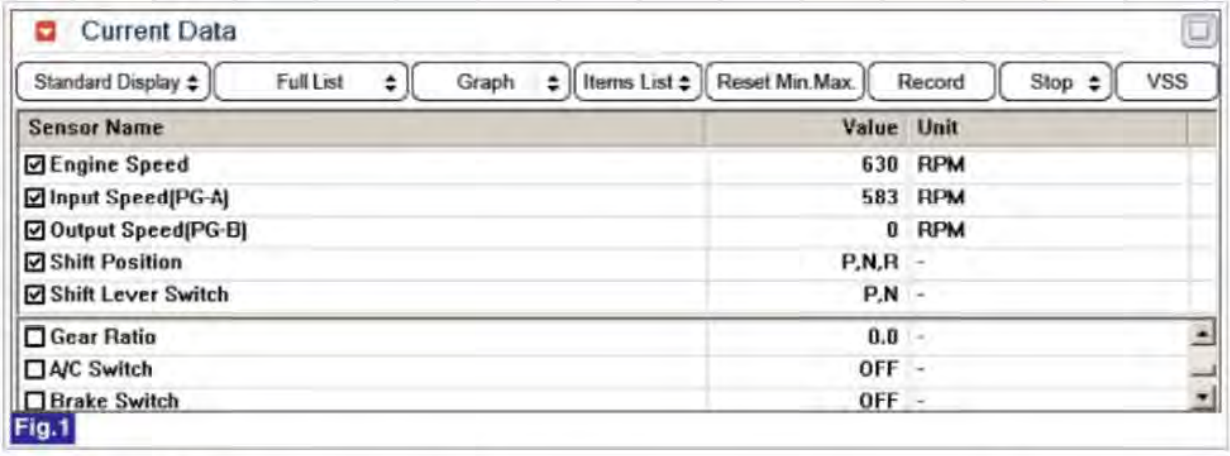


Fig.1

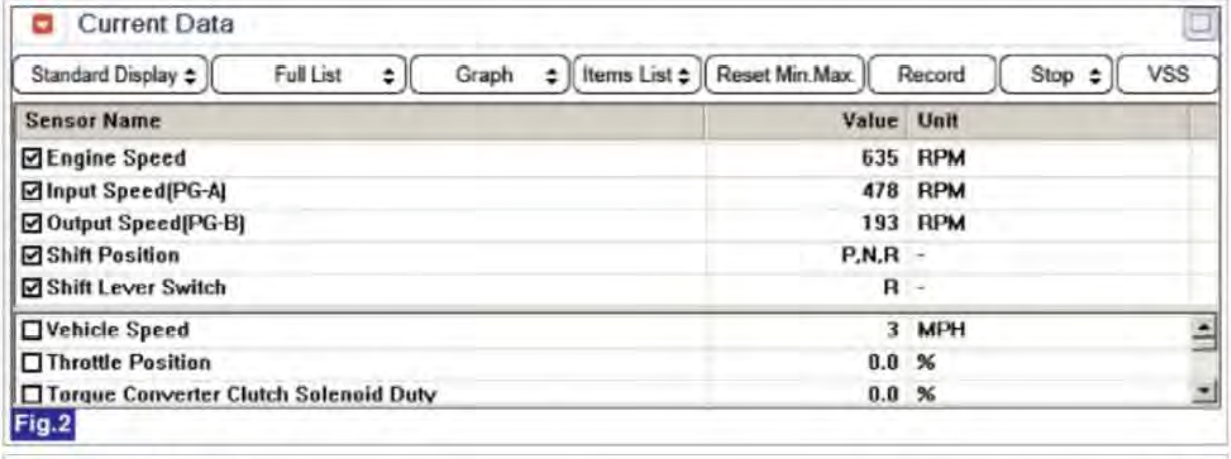


Fig.2

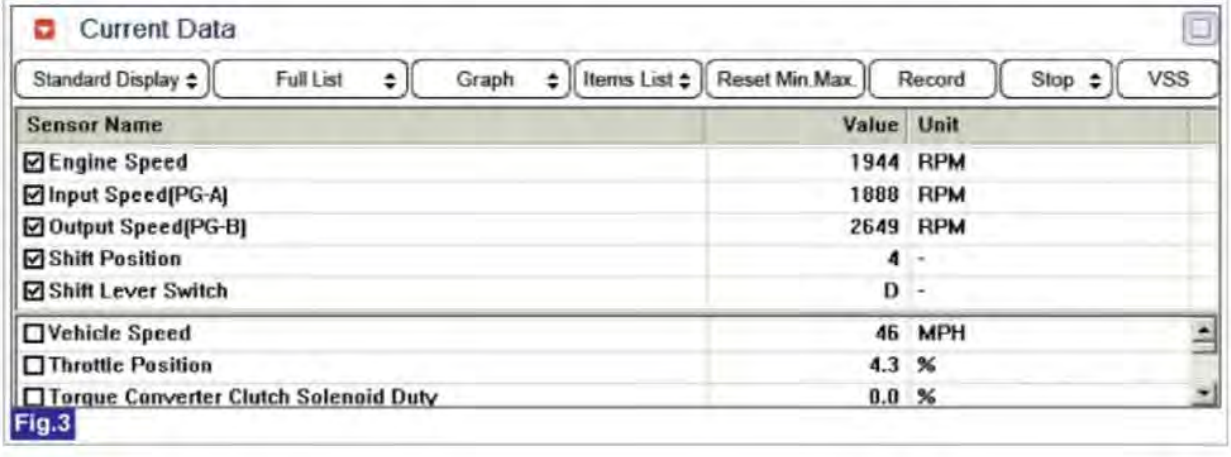


Fig.3

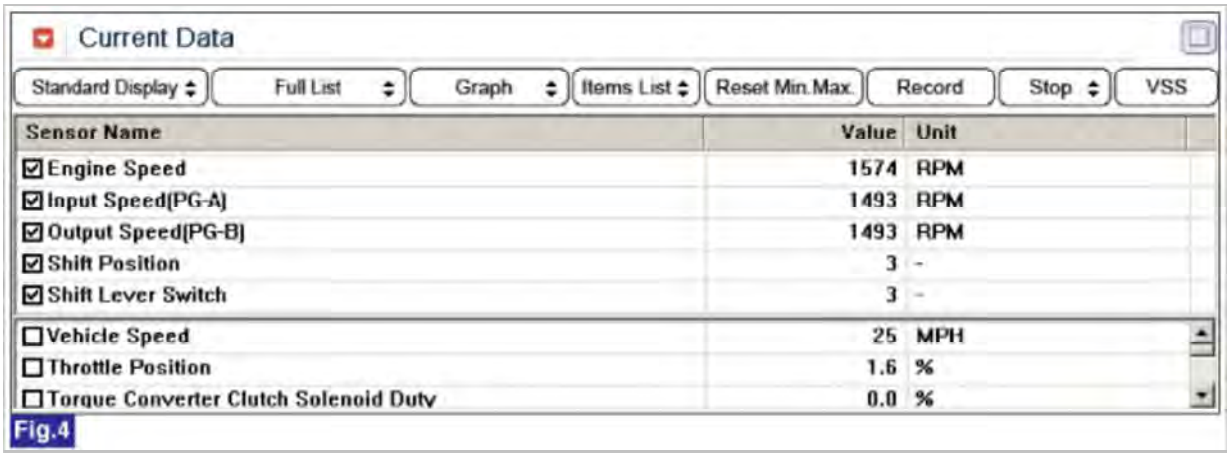


Fig.4

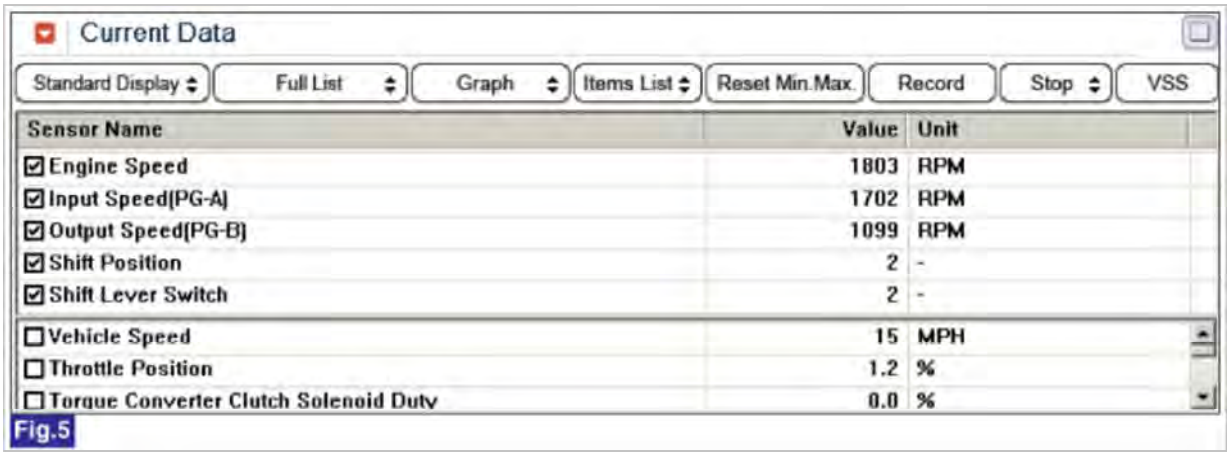


Fig.5

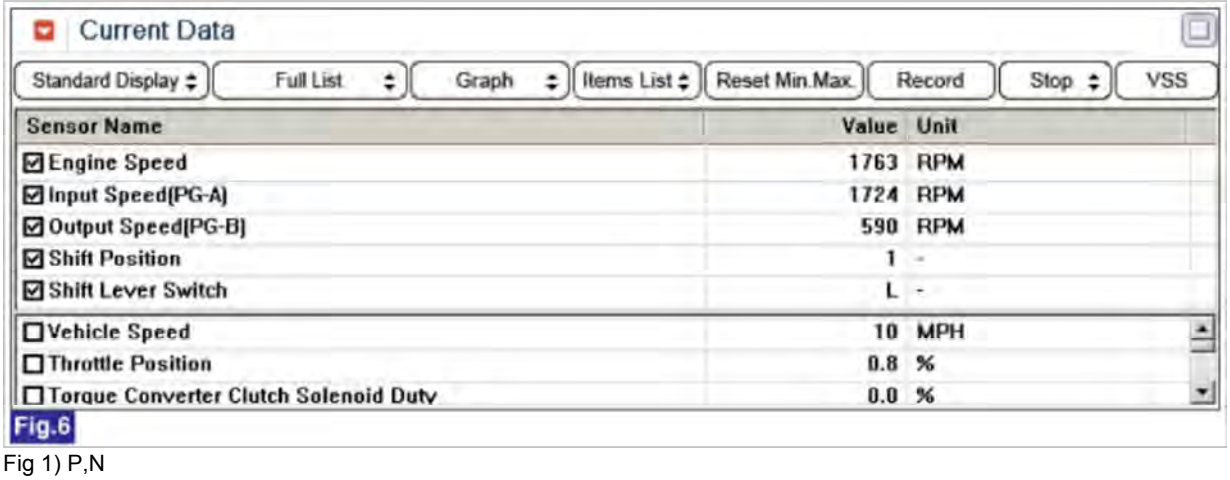


Fig.6

Fig 1) P,N
Fig 2) "R"
Fig 3) "4" Range
Fig 4) "3" Range
Fig 5) "2" Range
Fig 6) "L" Range

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "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 vehicle Repair" procedure.
NO	▸ Go to "Signal circuit inspection" procedure.

Signal Circuit Inspection

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

Specification : Approx. 5V

4. Is voltage within specifications ?

YES	▸ Go to "Power 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 PCM/TCM" of the "Component Inspection" procedure.

Power Circuit Inspection

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

Specification : Approx. B+

4. Is voltage within specifications ?

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 "Ground" terminal of the INPUT SPEED 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. ▸ If ground circuit in harness is OK, Go to "Check PCM/TCM" of the "Component Inspection" procedure.

Component Inspection

■ **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 Gab	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	Input sensor	Above 4 MΩ
	Output sensor	Above 4 MΩ
Voltage	High	4.8 ~ 5.2V
	Low	Below 0.8V

YES	▸ Go to "CHECK PCM/TCM " as below
NO	▸ Replace "INPUT SPEED SENSOR" as necessary and Go to "Verification Vehicle Repair" procedure.

■ Check PCM/TCM

1. Ignition "ON" & Engine "OFF".
2. Connect "INPUT SPEED SENSOR" connector.
3. Install scantool and slect a SIMU-SCAN,
4. Simulate frequency to INPUT SPEED SENSOR signal circuit.

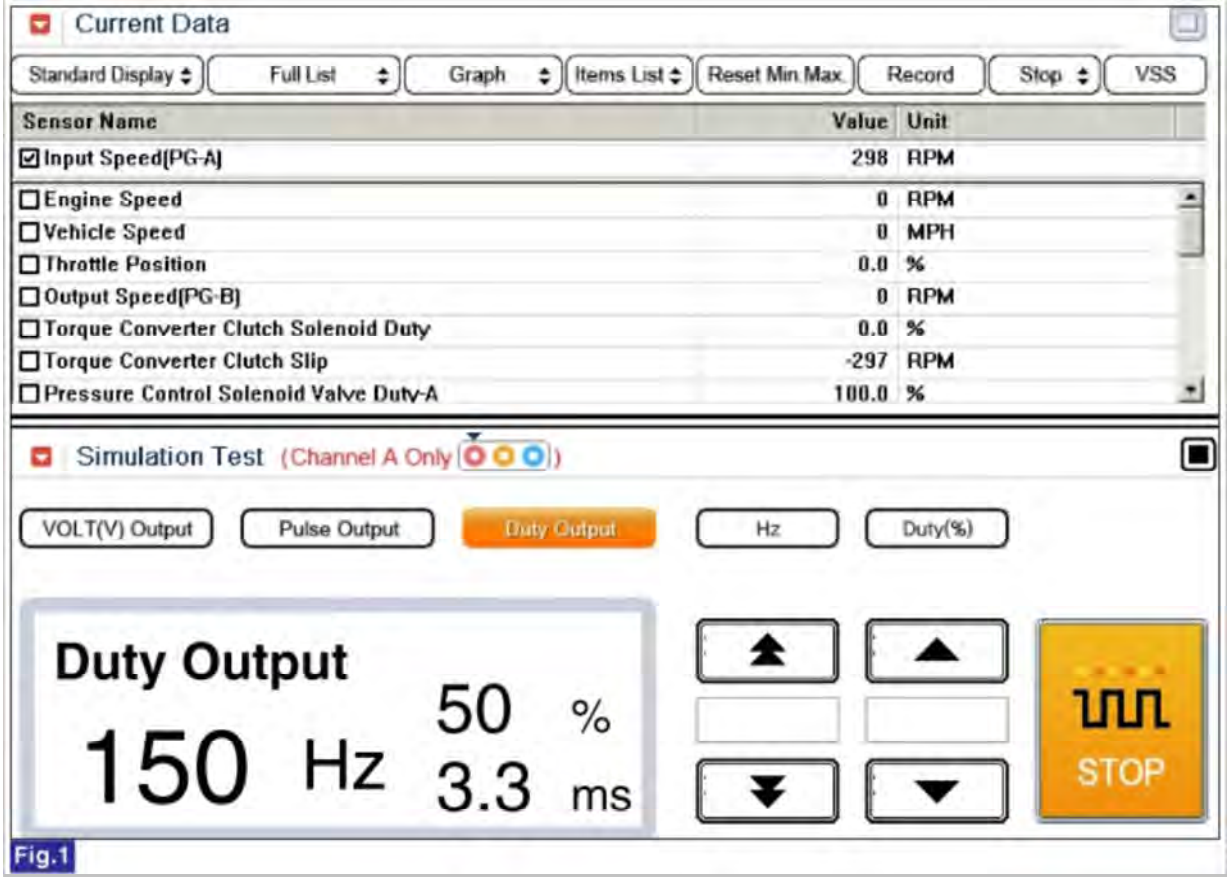


Fig.1

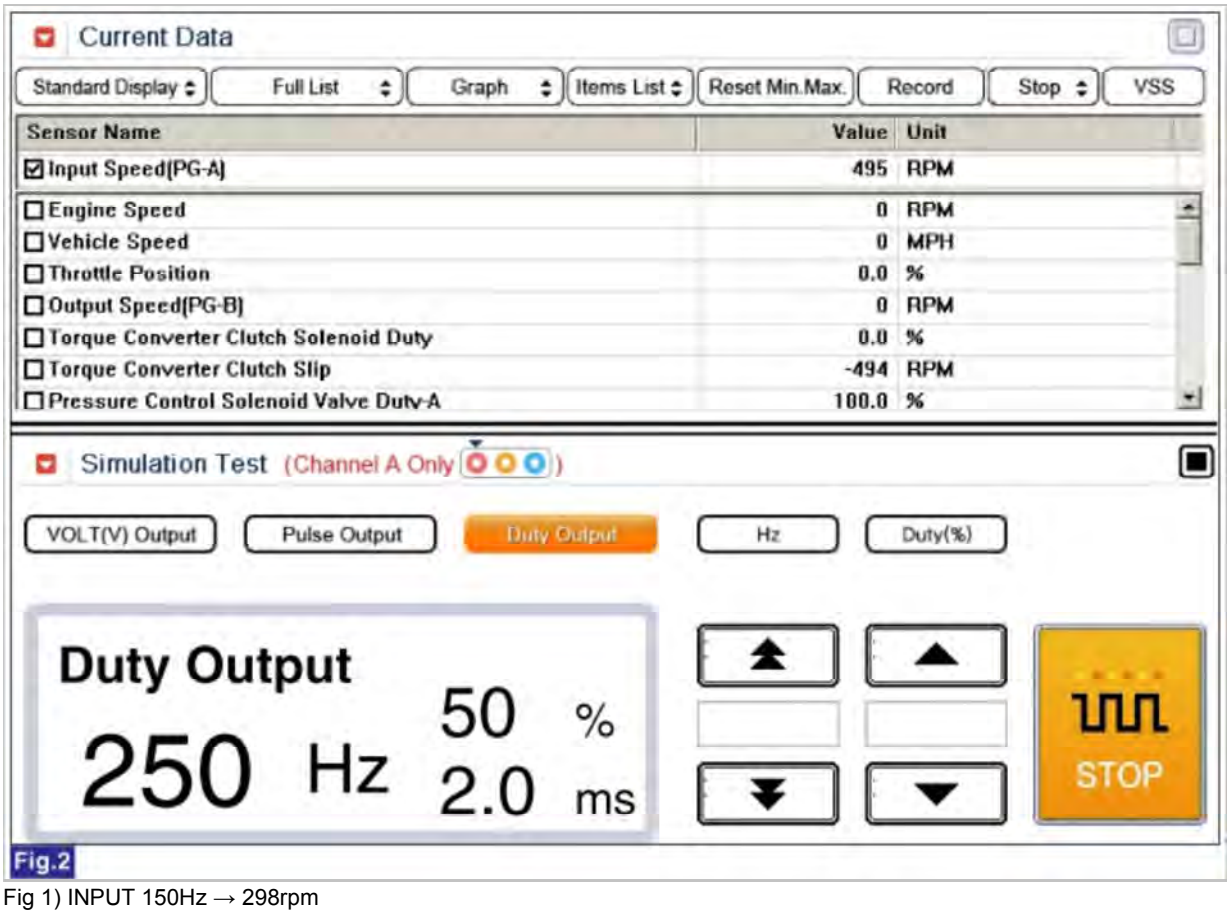


Fig 1) INPUT 150Hz → 298rpm
Fig 2) INPUT 250Hz → 495rpm
※ The values are subject to change according to vehicle model or conditions

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

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

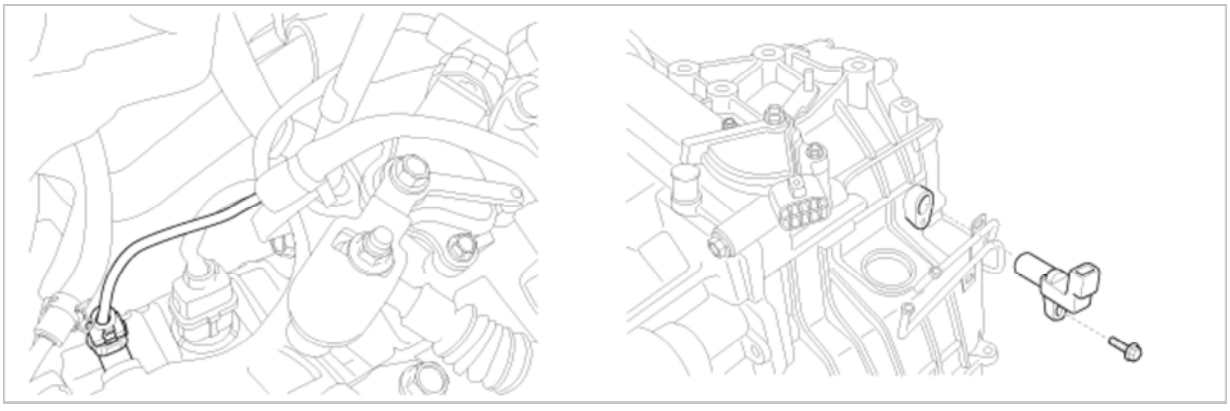
After a repair, it is essential to verify that the fault has been corrected.

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.

Automatic Transaxle System > Automatic Transaxle System > P0721 Output Speed Sensor Circuit Range/Performance

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 sets this code if the calculated value of the signals is noticeably different from the value calculated, using the Vehicle Speed Sensor output, when the vehicle is running faster than 18.6MPH(30km/h). The TCM will initiate the fail safe function if this code is detected.

DTC Detecting Condition

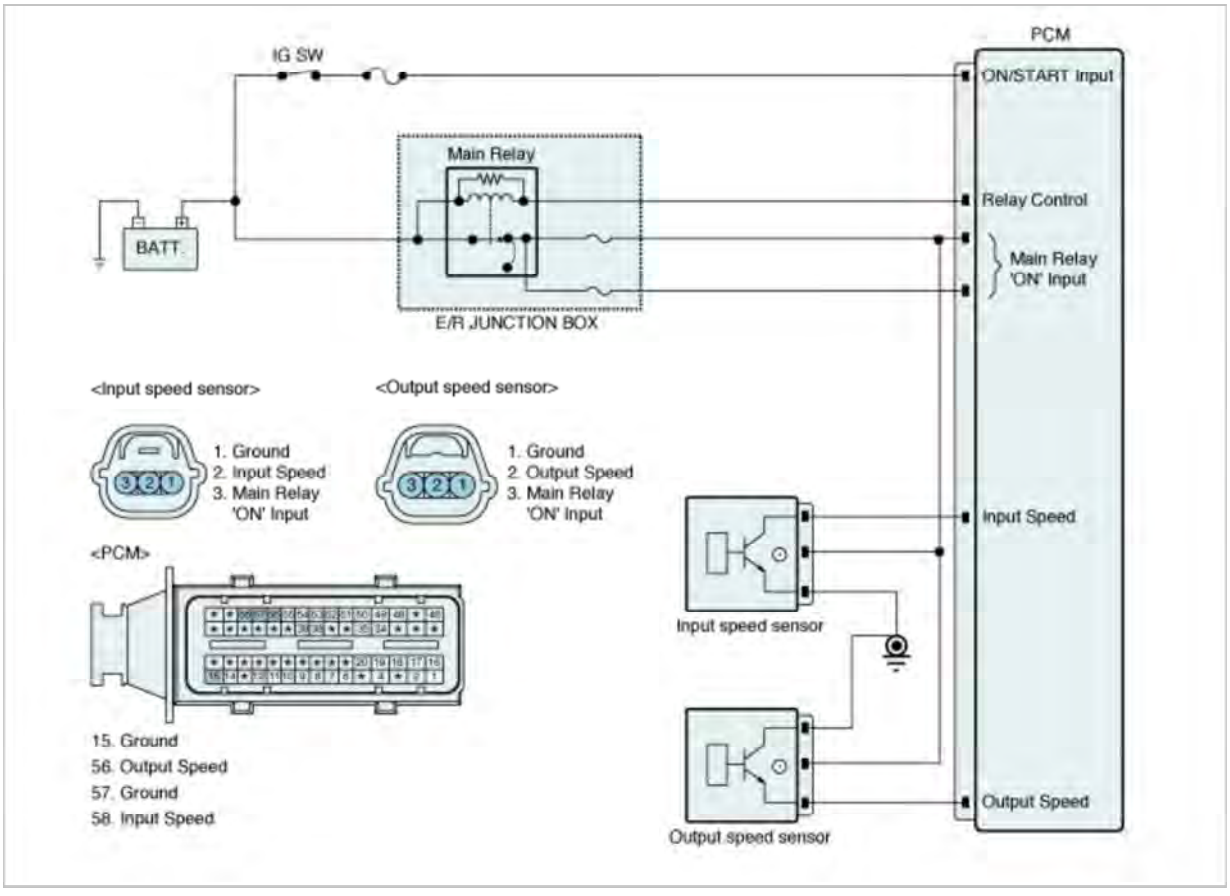
<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible Cause</th></tr>
<tr><td rowspan="2">Case 1</td><td>DTC Strategy</td><td>• Rationality-low</td><td rowspan="7">• Signal circuit is open or short
• Sensor power circuit is open
• Sensor ground circuit is open
• Faulty OUTPUT SPEED SENSOR
• Faulty PCM</td></tr>
<tr><td>Threshold Value</td><td>• Vehicle speed equivalent to <0.5 X vehicle speed output speed</td></tr>
<tr><td rowspan="2">Case 2</td><td>DTC Strategy</td><td>• Rationality-high</td></tr>
<tr><td>Threshold Value</td><td>• Vehicle speed equivalent to >1.5 X vehicle speed output speed</td></tr>
<tr><td colspan="2">Enable Conditions</td><td>• TR switch D range
• Vehicle speed >50km/h
• Engine speed >2000rpm
• Voltage of Battery >10V</td></tr>
<tr><td colspan="2">Diagnostic Time</td><td>• More than 4sec</td></tr>
<tr><td colspan="2">Fail Safe</td><td>• 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)</td></tr>
</table>

Specification

Input shaft & Output shaft speed sensor

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

Diagnostic Circuit Diagram



Signal Waveform

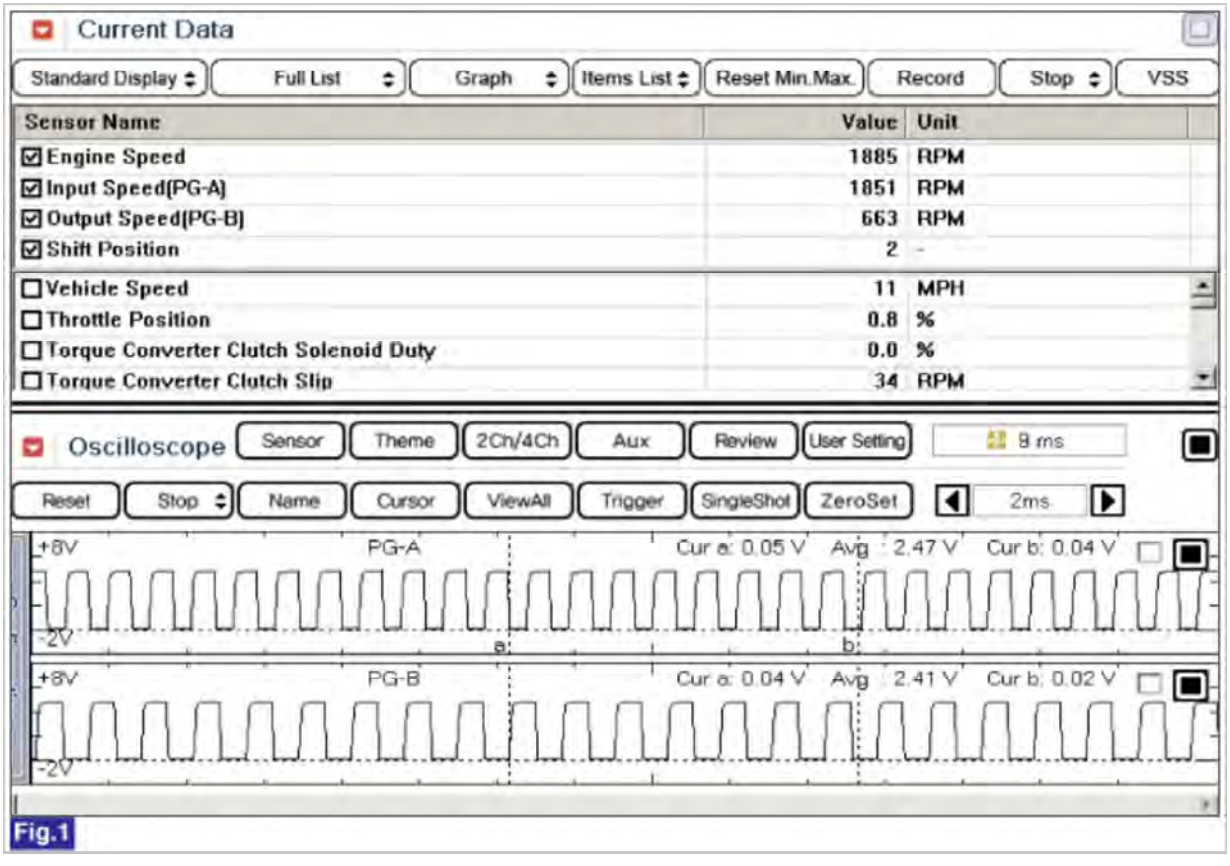


Fig.1

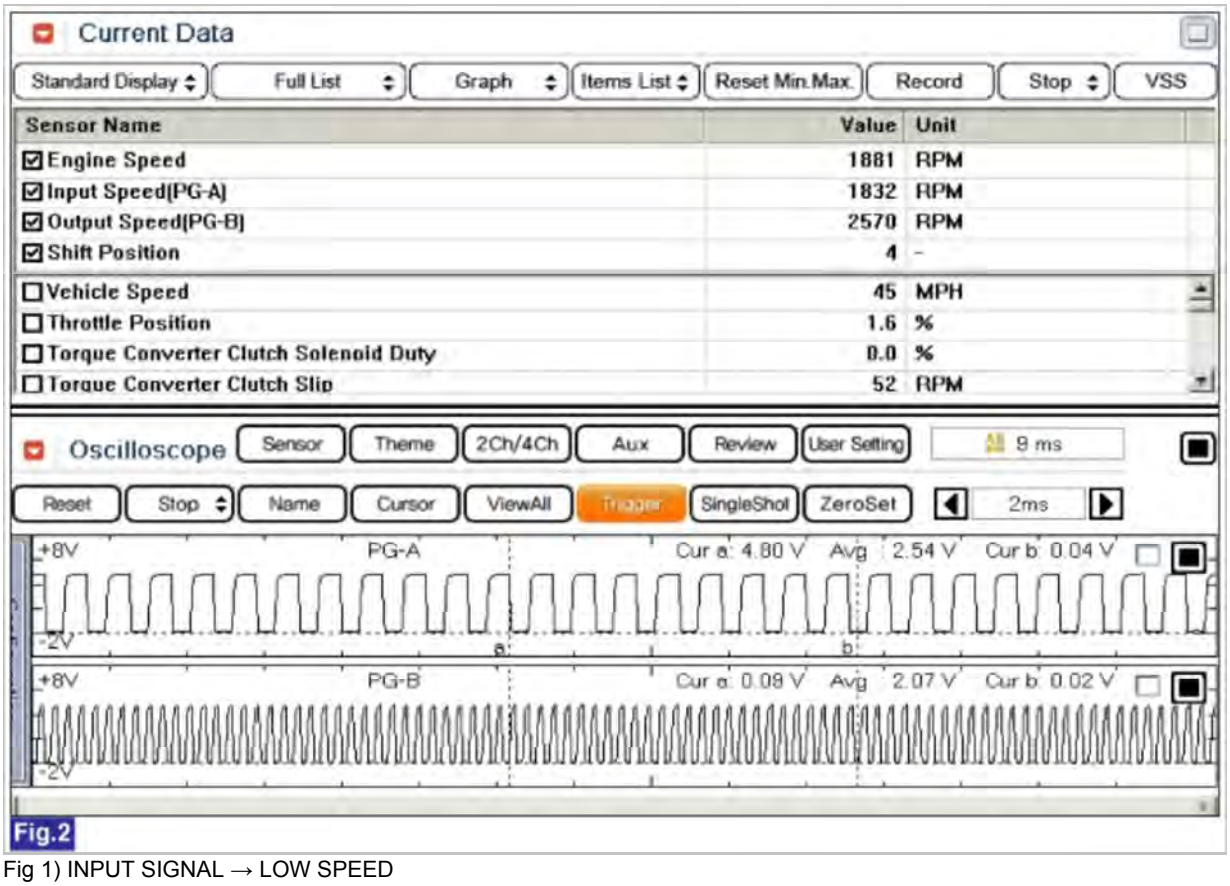
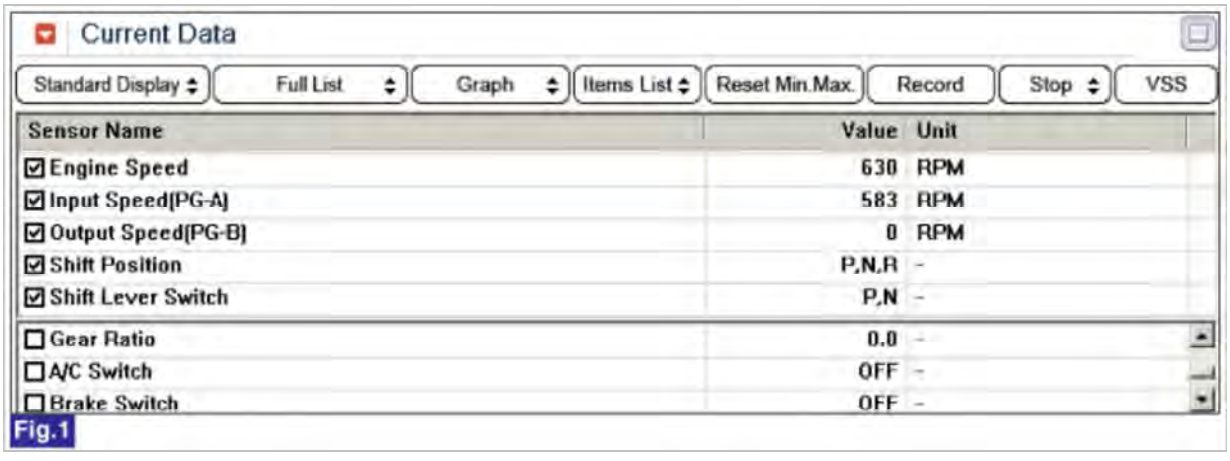


Fig 1) INPUT SIGNAL → LOW SPEED
Fig 2) INPUT SIGNAL → HIGH SPEED

Monitor GDS Data

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

Specification : Increasing Gradually



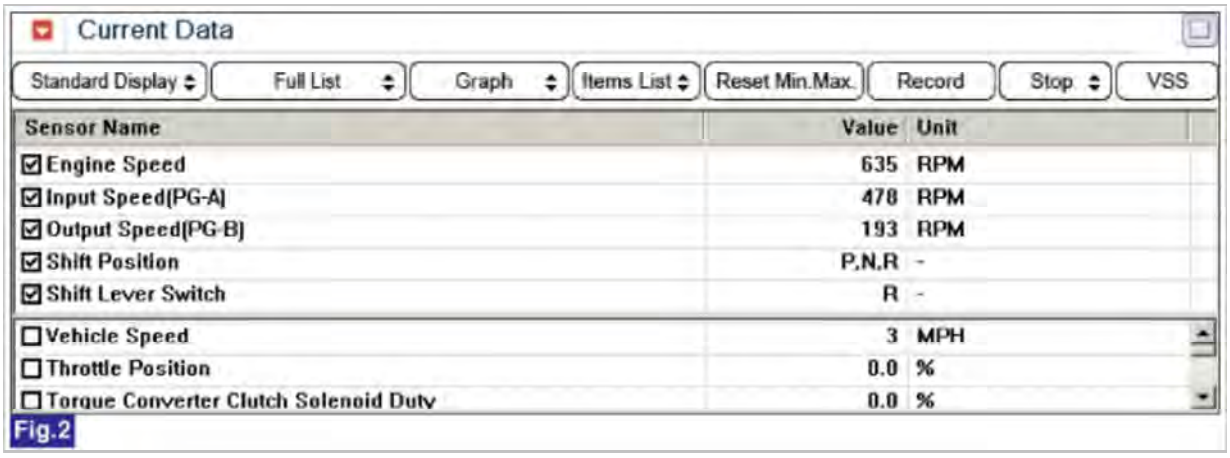


Fig.2

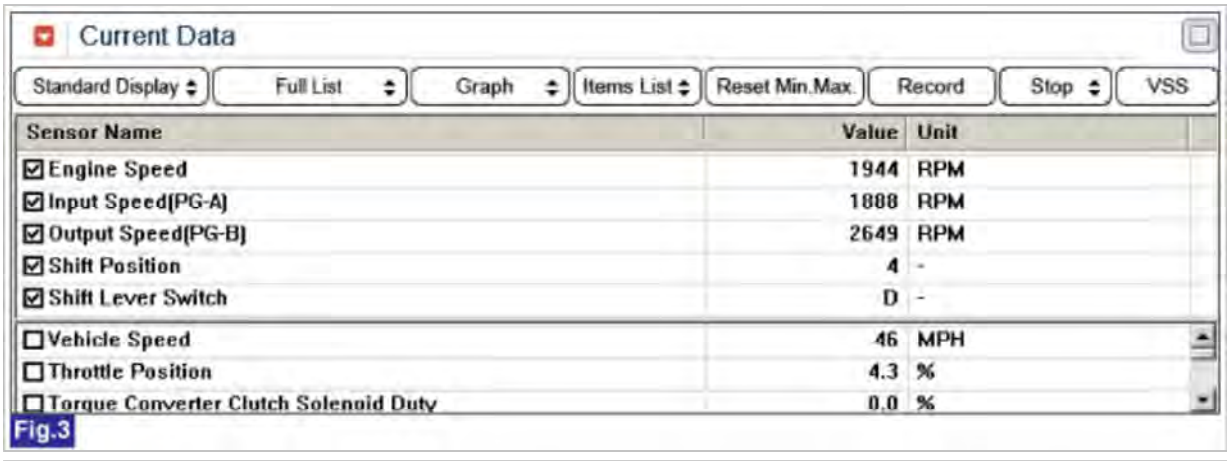


Fig.3

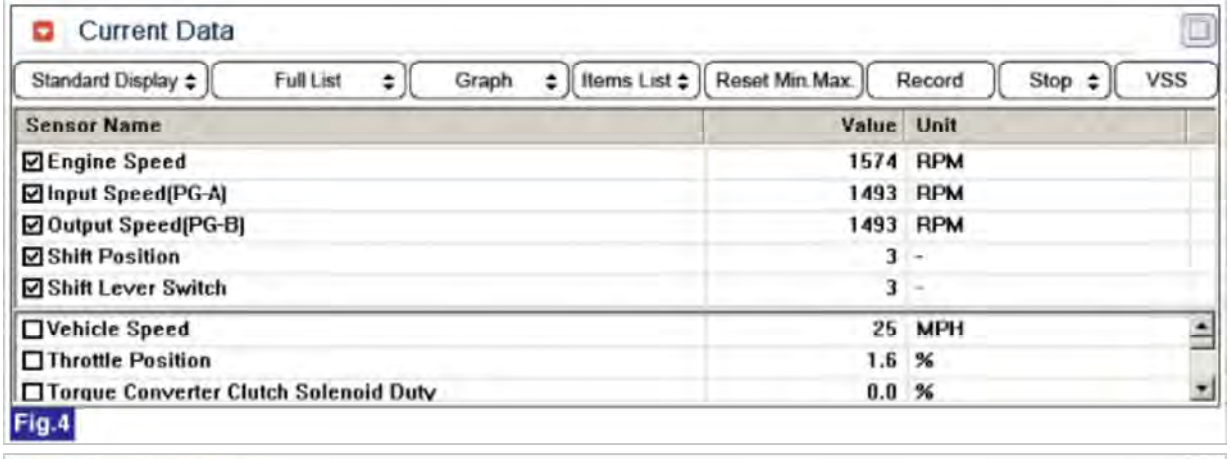


Fig.4

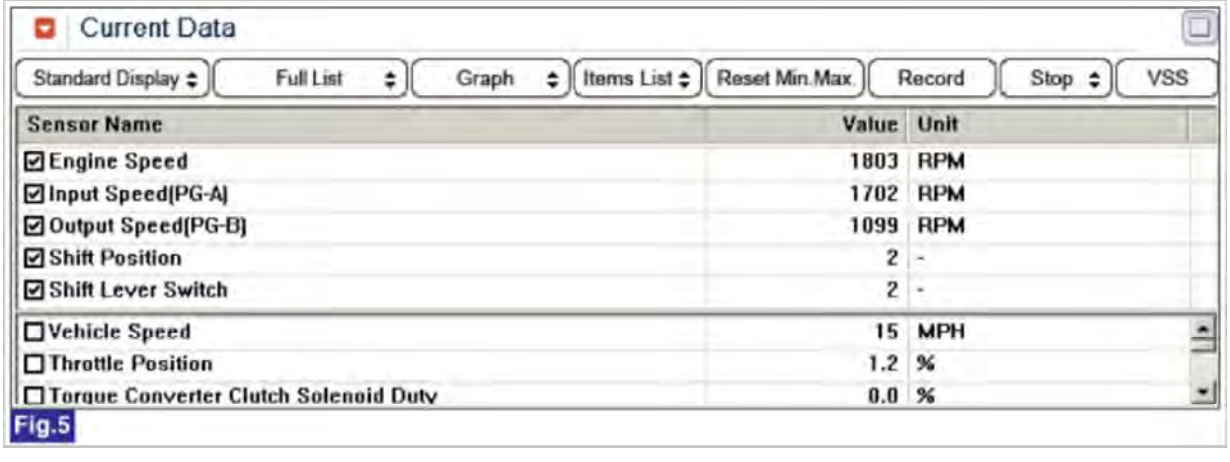


Fig.5

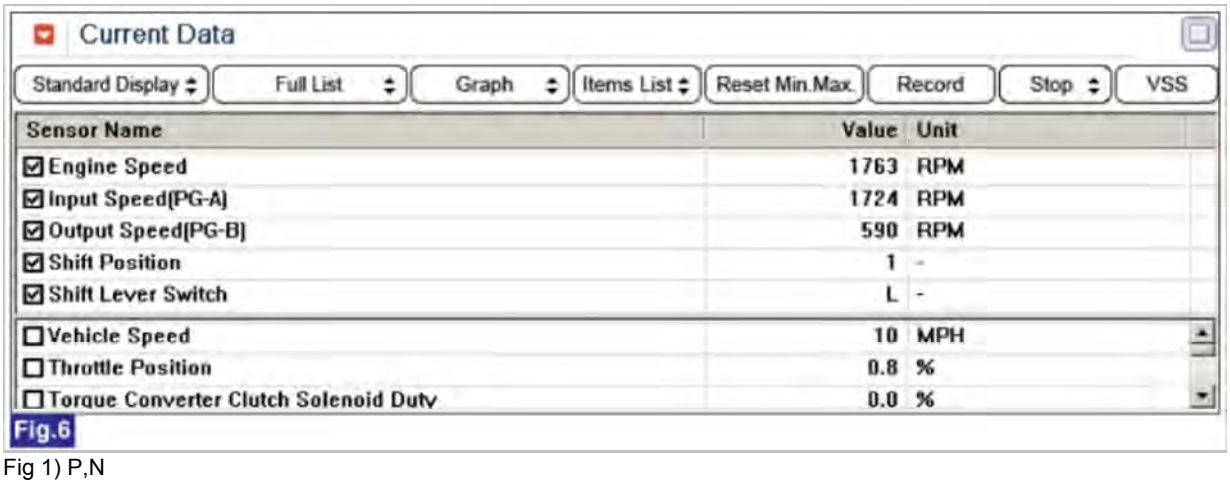


Fig 1) P,N
Fig 2) "R"
Fig 3) "4" Range
Fig 4) "3" Range
Fig 5) "2" Range
Fig 6) "L" Range

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "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 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 "Signal" terminal of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : Approx. 5V

4. Is voltage within specifications ?

YES	▸ Go to "Power 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 PCM/TCM" of the "Component Inspection" procedure.

Power Circuit Inspection

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

Specification : Approx. B+

4. Is voltage within specifications ?

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 "Ground" terminal of the OUTPUT SPEED 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. ▸ If ground circuit in harness is OK, Go to "Check PCM/TCM" of the "Component Inspection" procedure.

Component Inspection

■ 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 Gab	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	Input sensor	Above 4 MΩ
	Output sensor	Above 4 MΩ
Voltage	High	4.8 ~ 5.2V
	Low	Below 0.8V

YES	▸ Go to "CHECK PCM/TCM " as below
NO	▸ Replace "OUTPUT SPEED SENSOR" as necessary and Go to "Verification Vehicle Repair" procedure.

■ Check PCM/TCM

1. Ignition "ON" & Engine "OFF".
2. Connect "OUTPUT SPEED SENSOR" connector.
3. Install scantool and slect a SIMU-SCAN,
4. Simulate frequency to OUTPUT SPEED SENSOR signal circuit.

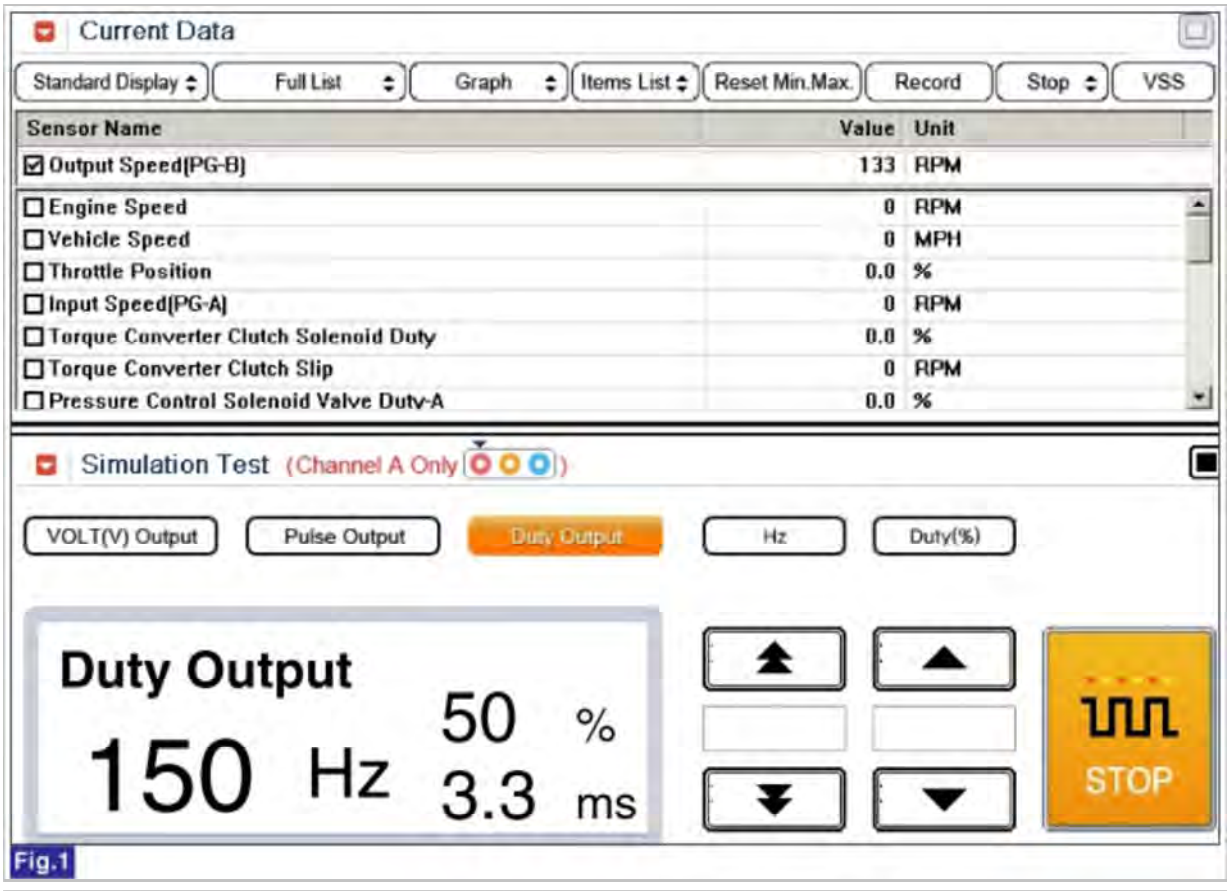


Fig.1

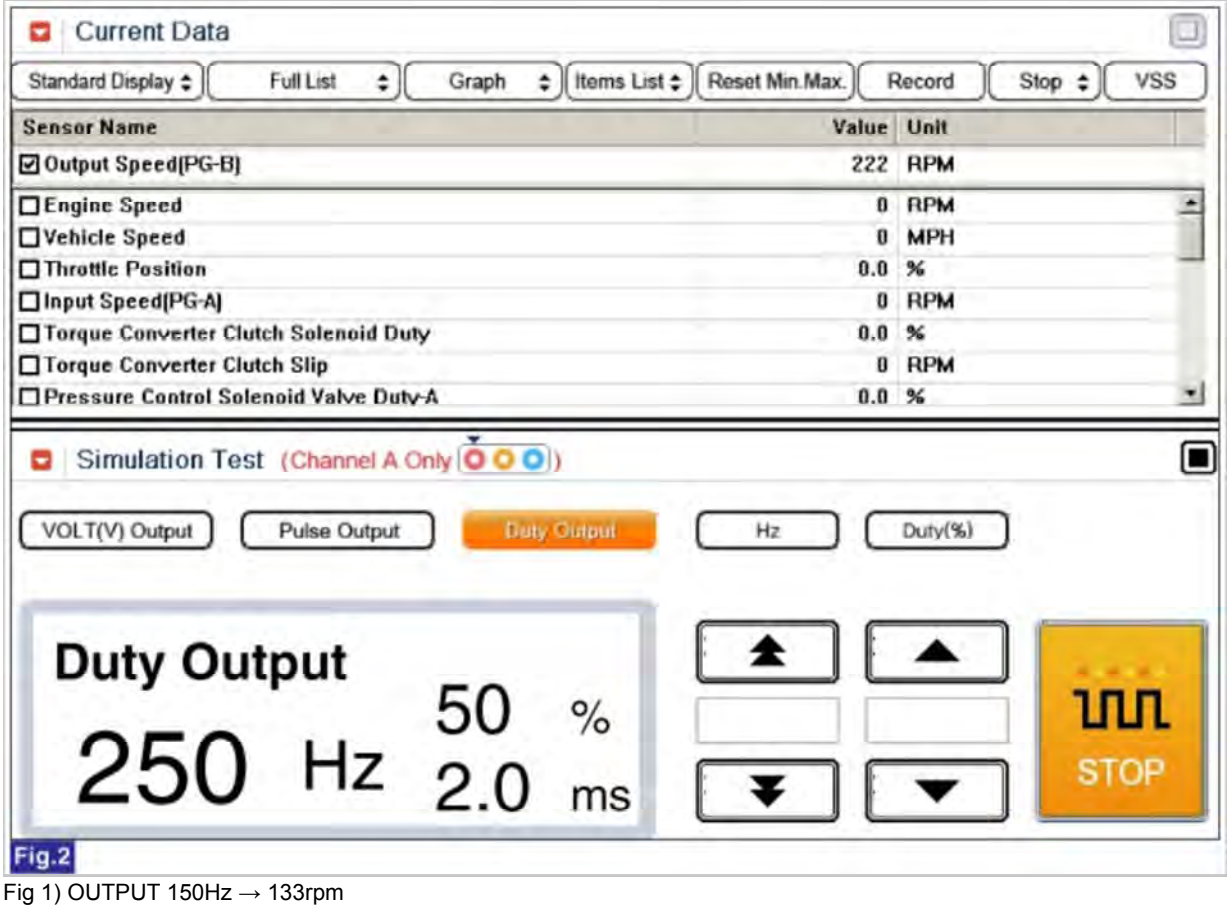


Fig.2

Fig 1) OUTPUT 150Hz → 133rpm
Fig 2) OUTPUT 250Hz → 222rpm
※ The values are subject to change according to vehicle model or conditions

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

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

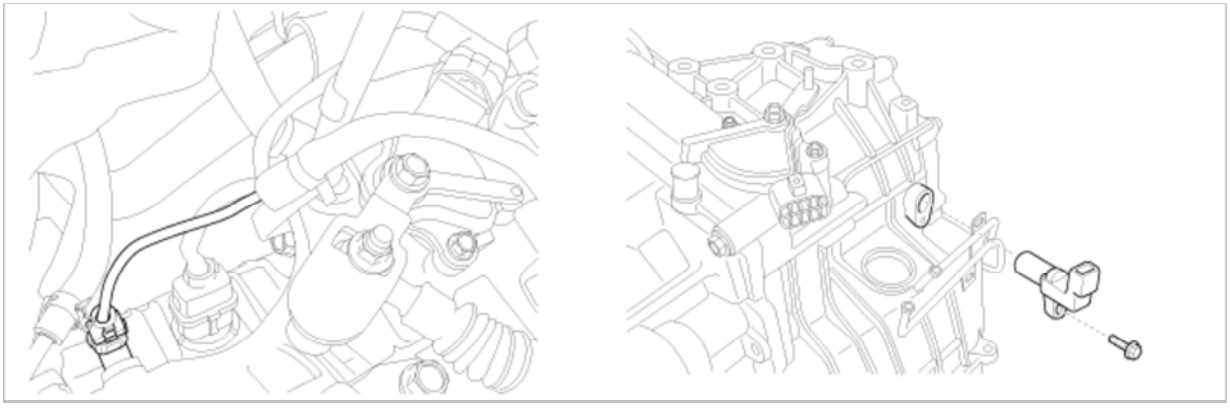
After a repair, it is essential to verify that the fault has been corrected.

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.

Automatic Transaxle System > Automatic Transaxle System > P0722 Output Speed Sensor Circuit No Signal

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 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 will initiate the fail safe function if this code is detected.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit no signal	• Signal circuit is open or short • Sensor power circuit is open • Sensor ground circuit is open • Faulty OUTPUT SPEED SENSOR
Enable Conditions	• TR switch D range • TVehicle Speed >20km/h • Engine speed >2600rpm at 1st,2nd gear	
Threshold Value	• Output speed = 0rpm	
Diagnostic Time	• More than 4sec	

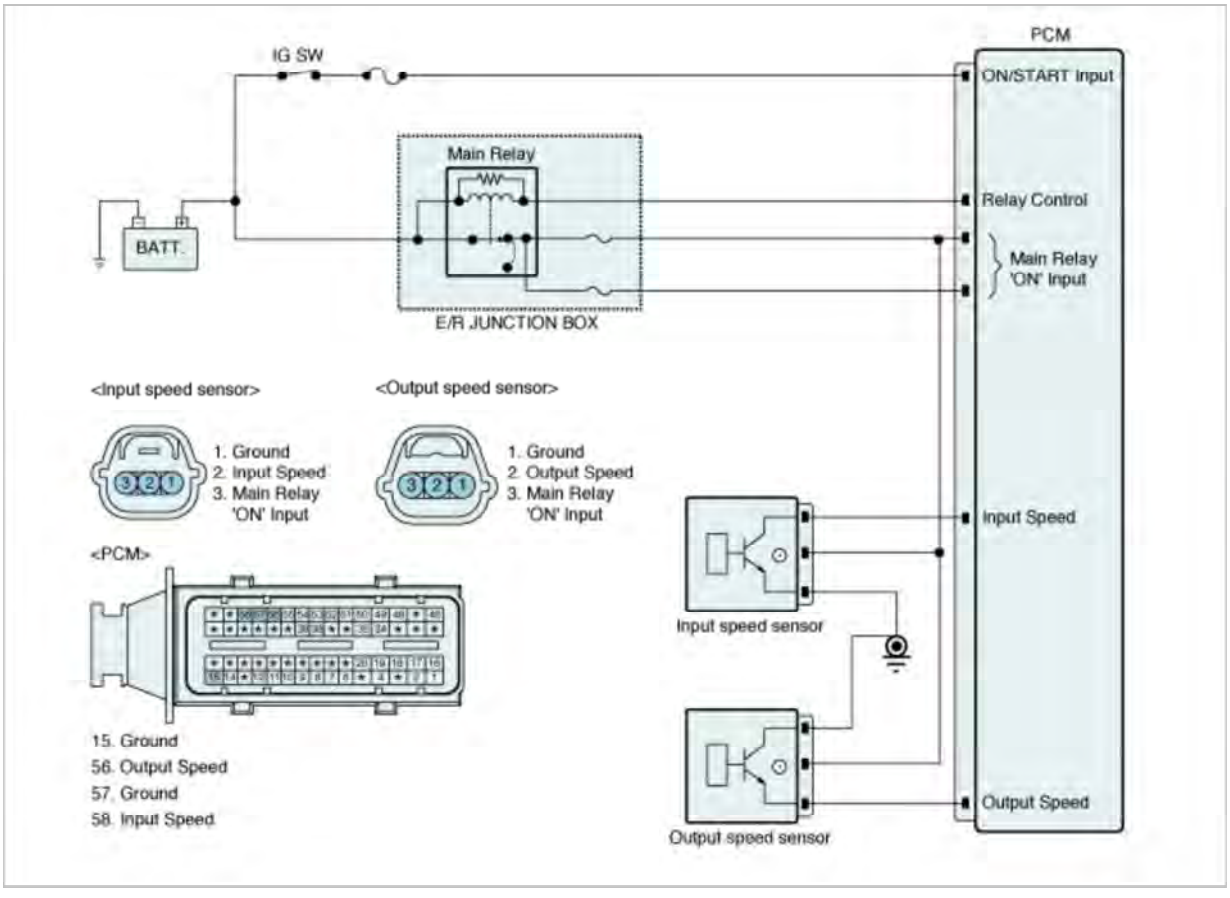
Fail Safe	• Locked into 3rd or 2nd gear. • Apply an electric current to Solenoide valve • Manual shifting is possibe (2 nd → 3 rd ,3 rd → 2 nd)	• Faulty PCM

Specification

Input shaft & Output shaft speed sensor

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

Diagnostic Circuit Diagram



Signal Waveform

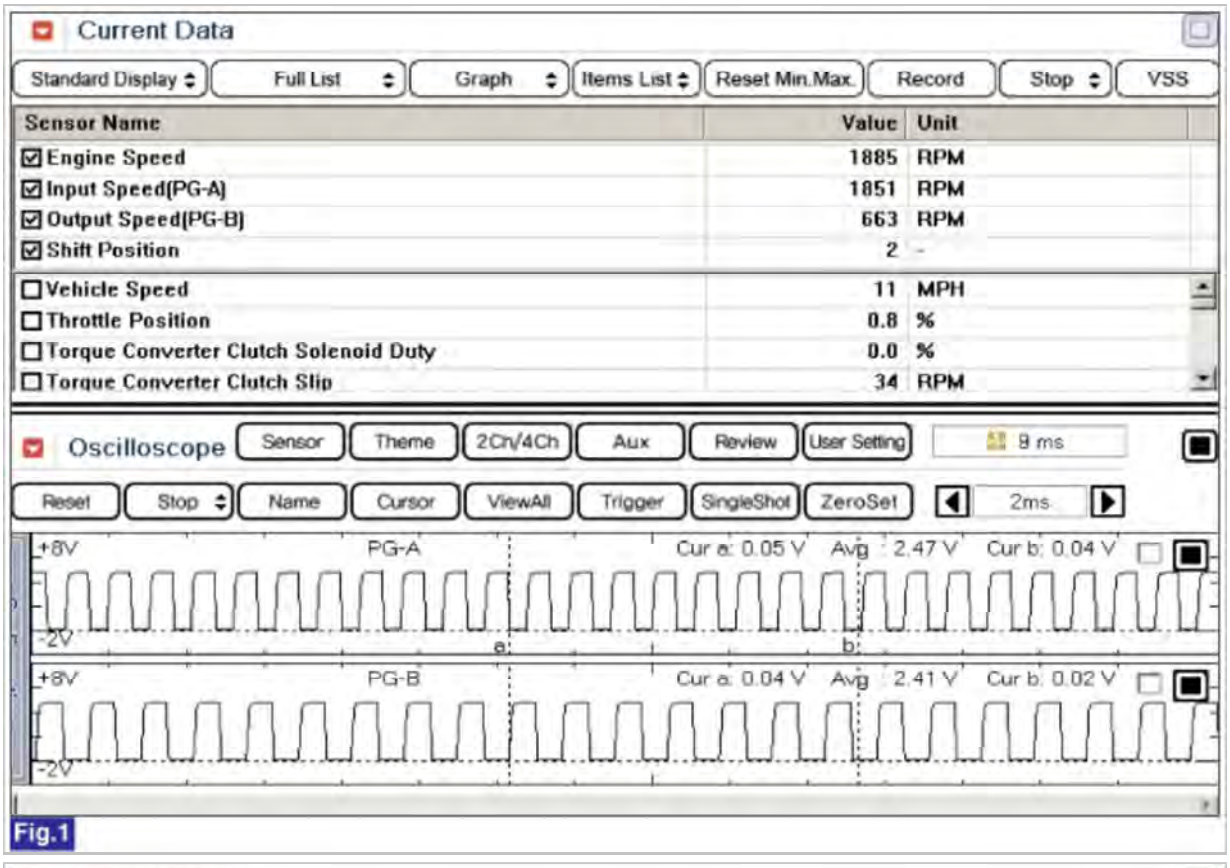


Fig.1

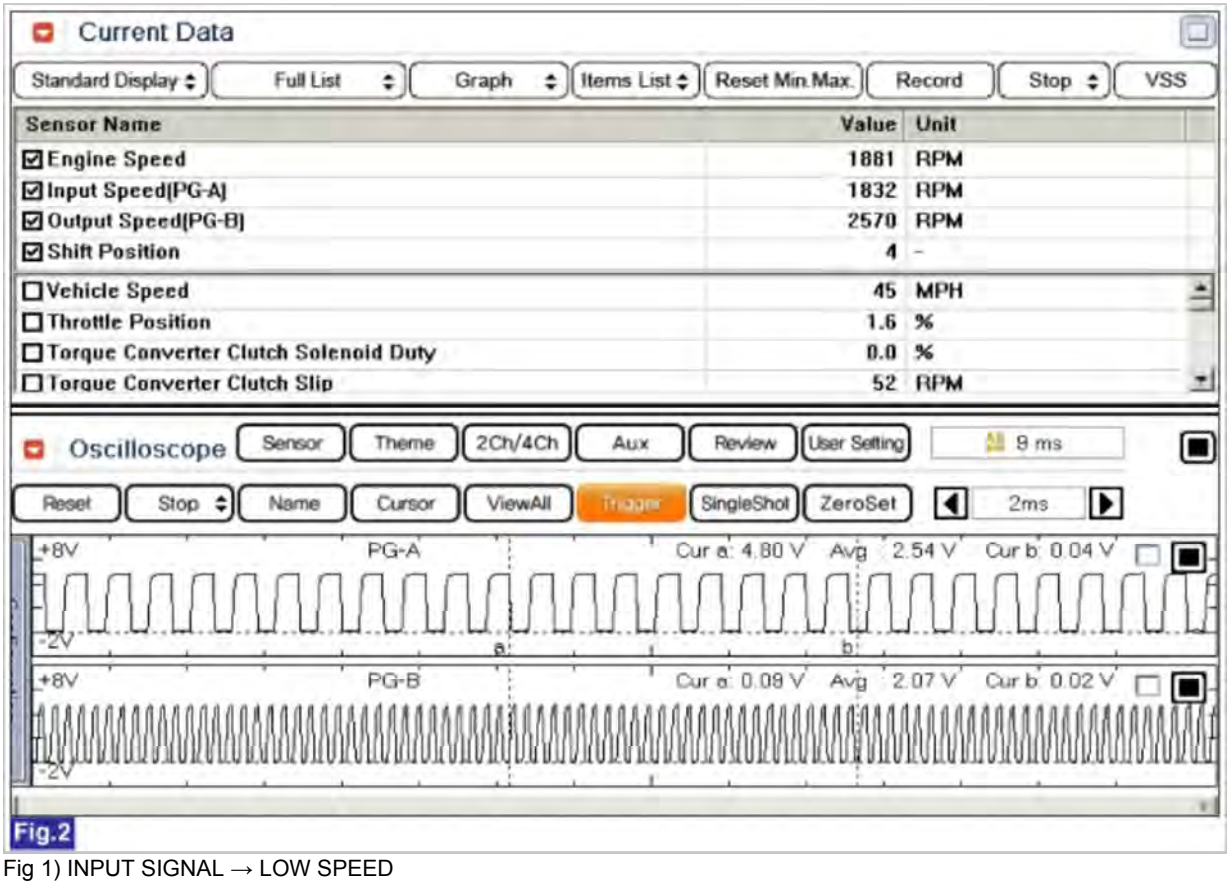


Fig.2

Fig 1) INPUT SIGNAL → LOW SPEED
Fig 2) INPUT SIGNAL → HIGH SPEED

Monitor GDS Data

1. Connect scantool to data link connector(DLC)
2. Engine "ON" .

3. Monitor the "INPUT SPEED SENSOR" parameter on the scantool.
4. Drive the vehicle

Specification : Increasing Gradually

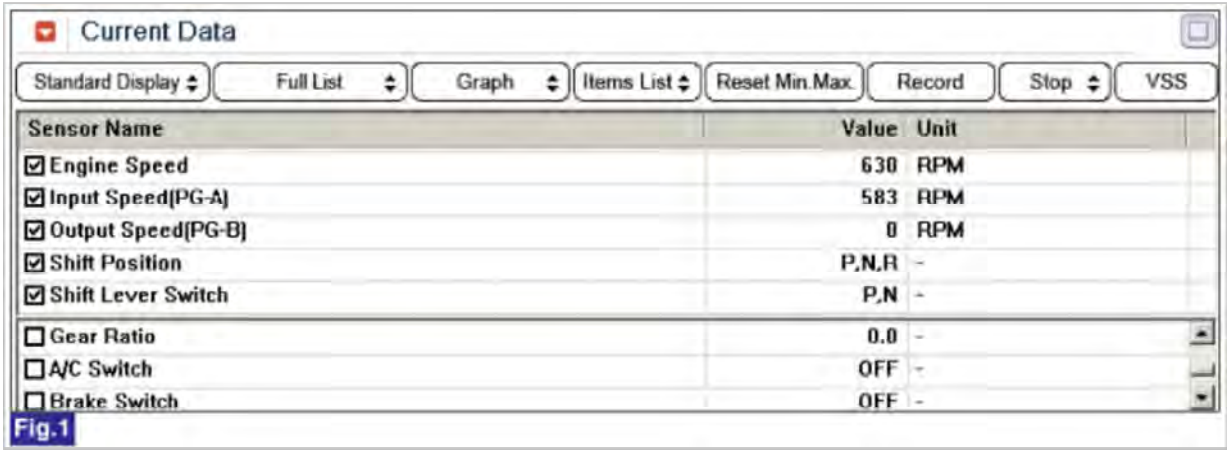


Fig.1

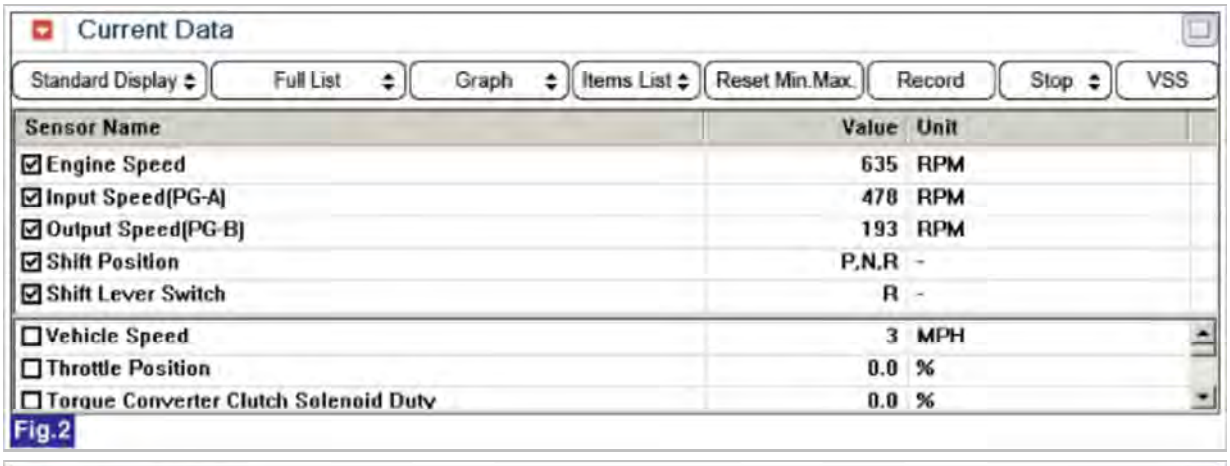


Fig.2

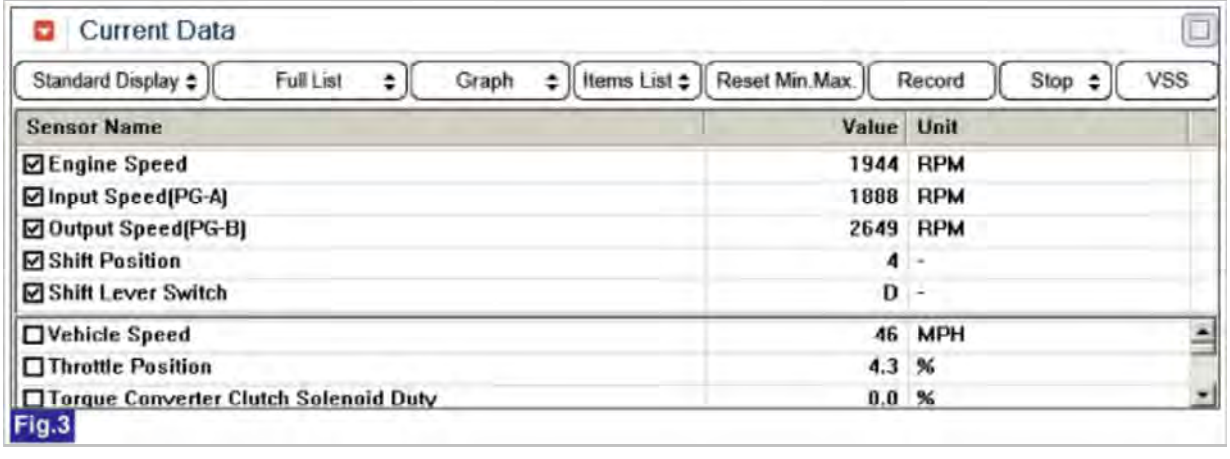


Fig.3

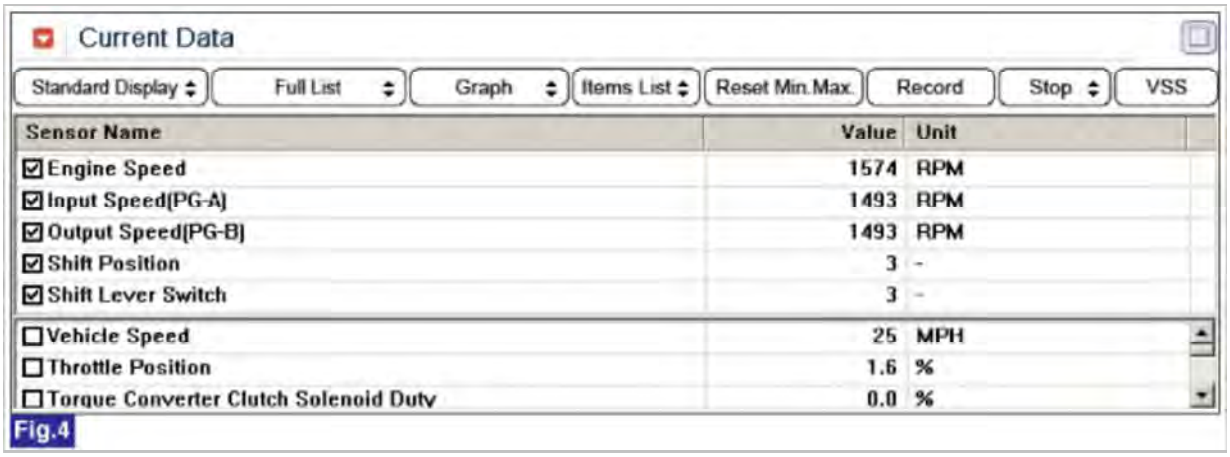


Fig.4

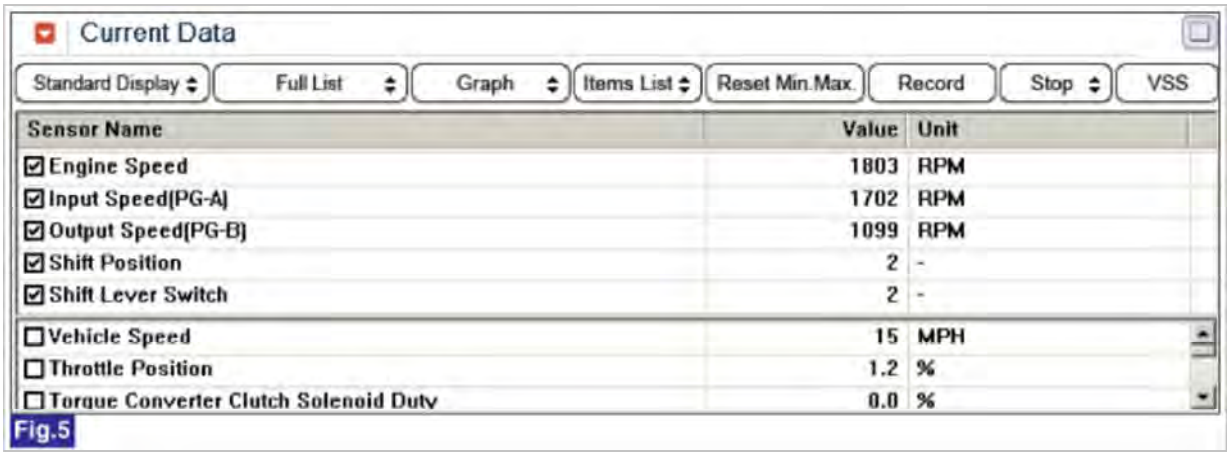


Fig.5

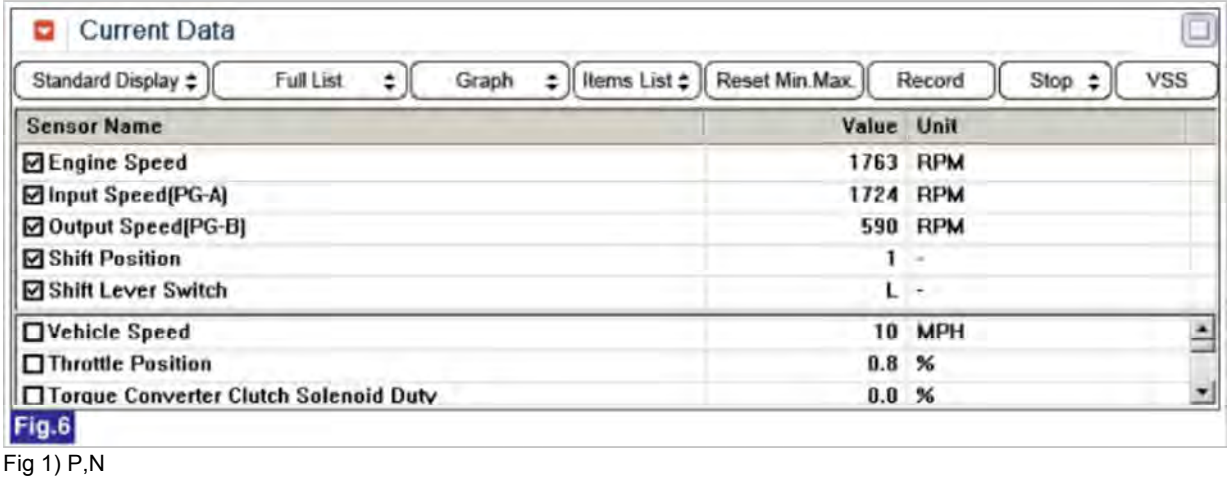


Fig.6

Fig 1) P,N
Fig 2) "R"
Fig 3) "4" Range
Fig 4) "3" Range
Fig 5) "2" Range
Fig 6) "L" Range

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "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 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 "Signal" terminal of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification : Approx. 5V

4. Is voltage within specifications ?

YES	▸ Go to "Power 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 PCM/TCM" of the "Component Inspection" procedure.

Power Circuit Inspection

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

Specification : Approx. B+

4. Is voltage within specifications ?

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 "Ground" terminal of the OUTPUT SPEED 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. ▸ If ground circuit in harness is OK, Go to "Check PCM/TCM" of the "Component Inspection" procedure.

Component Inspection

■ 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"

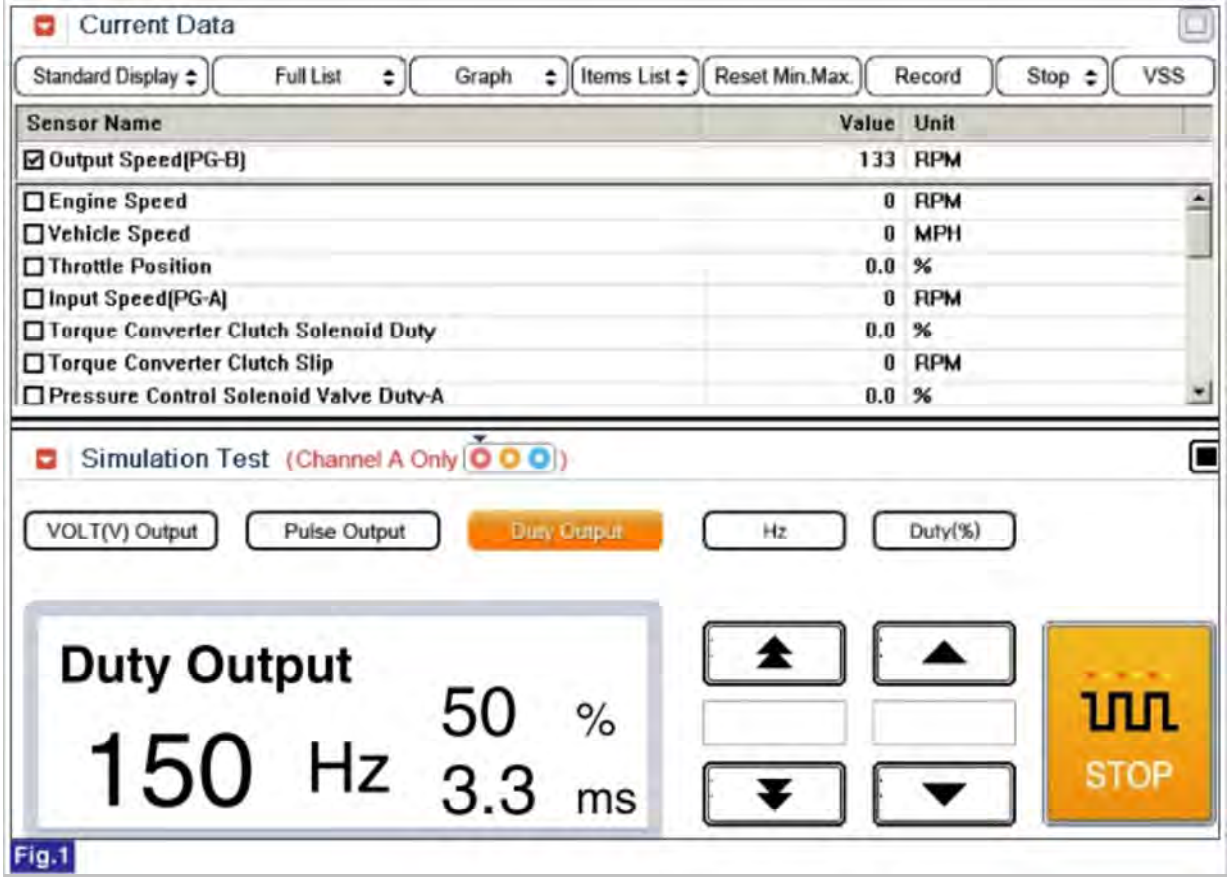
4. Is resistance within specifications?
[Reference data]

Data	Reference Data	
Current	22 mA	
Air Gap	Input sensor	1.3 mm
	Output sensor	0.85 mm
Resistance	Input sensor	Above 4 MΩ
	Output sensor	Above 4 MΩ
Voltage	High	4.8 ~ 5.2V
	Low	Below 0.8V

YES	▸ Go to "CHECK PCM/TCM " as below
NO	▸ Replace "OUTPUT SPEED SENSOR" as necessary and Go to "Verification Vehicle Repair" procedure.

■ Check PCM/TCM

1. Ignition "ON" & Engine "OFF".
2. Connect "OUTPUT SPEED SENSOR" connector.
3. Install scantool and slect a SIMU-SCAN,
4. Simulate frequency to OUTPUT SPEED SENSOR signal circuit.



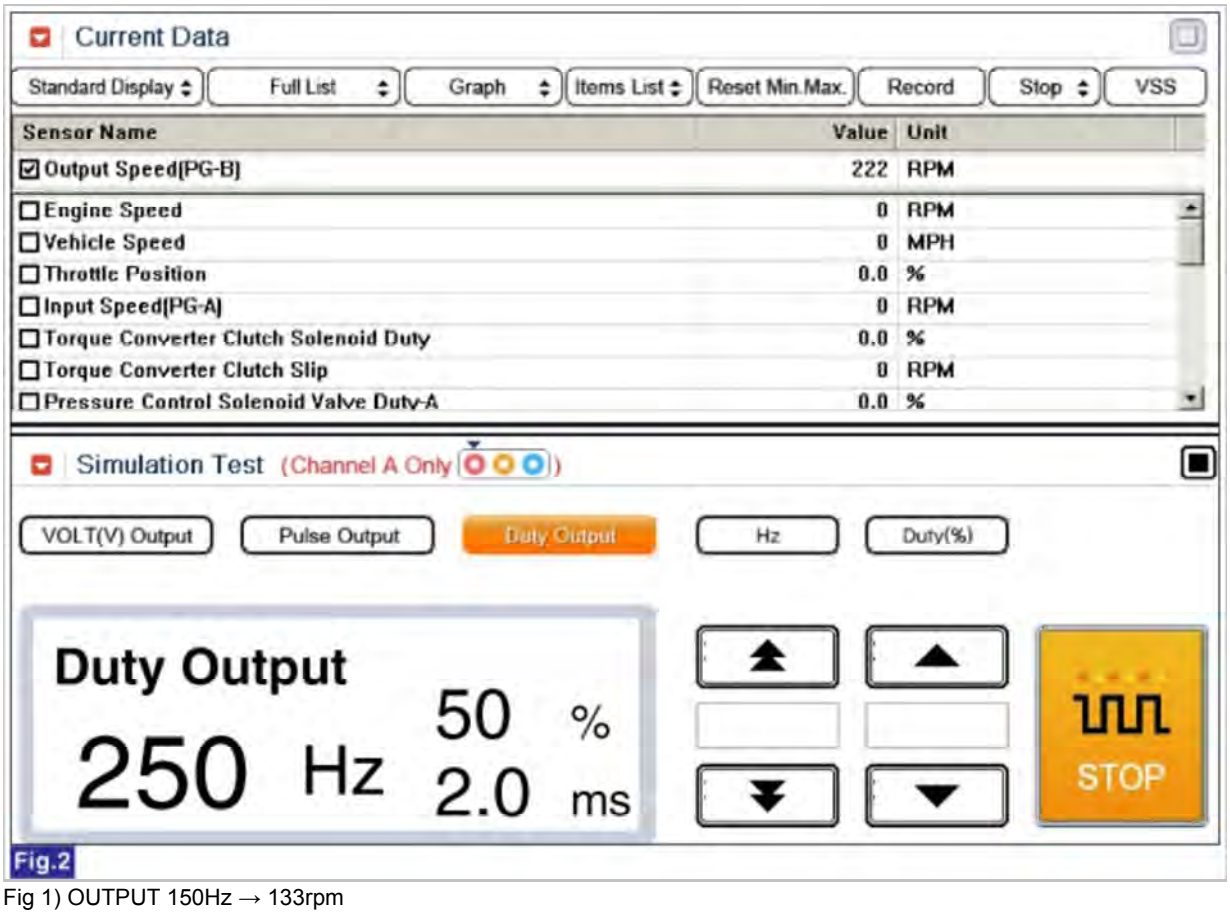


Fig 1) OUTPUT 150Hz → 133rpm
Fig 2) OUTPUT 250Hz → 222rpm
※ The values are subject to change according to vehicle model or conditions

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

YES	▸ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

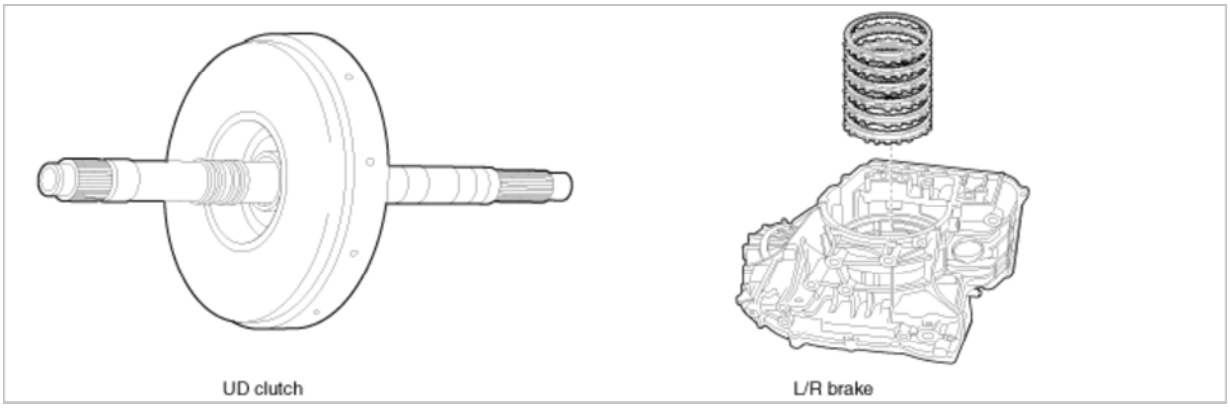
After a repair, it is essential to verify that the fault has been corrected.

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.

Automatic Transaxle System > Automatic Transaxle System > P0731 Gear 1 Incorrect Ratio

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 2842 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

Item	Detecting Condition	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	• Solenoid power voltage >10V • TFT >-10°C • Time after shift changing finish >2secs • Engine speed >450rpm • Output speed >200rpm • Input speed >0rpm • Shift stage 1st. Gear • TR switch Only one signal	
Threshold Value	• Output speed <(input speed-200rpm)/1st. gear ratio	
Diagnostic Time	• More than 1sec. for 4 times	
Fail Safe	• Locked into 3 rd gear.(If diagnosis code P0731 is output four times, the transaxle is locked into 3rd gear)	

Specification

Input shaft & Output shaft speed sensor

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

Signal Waveform

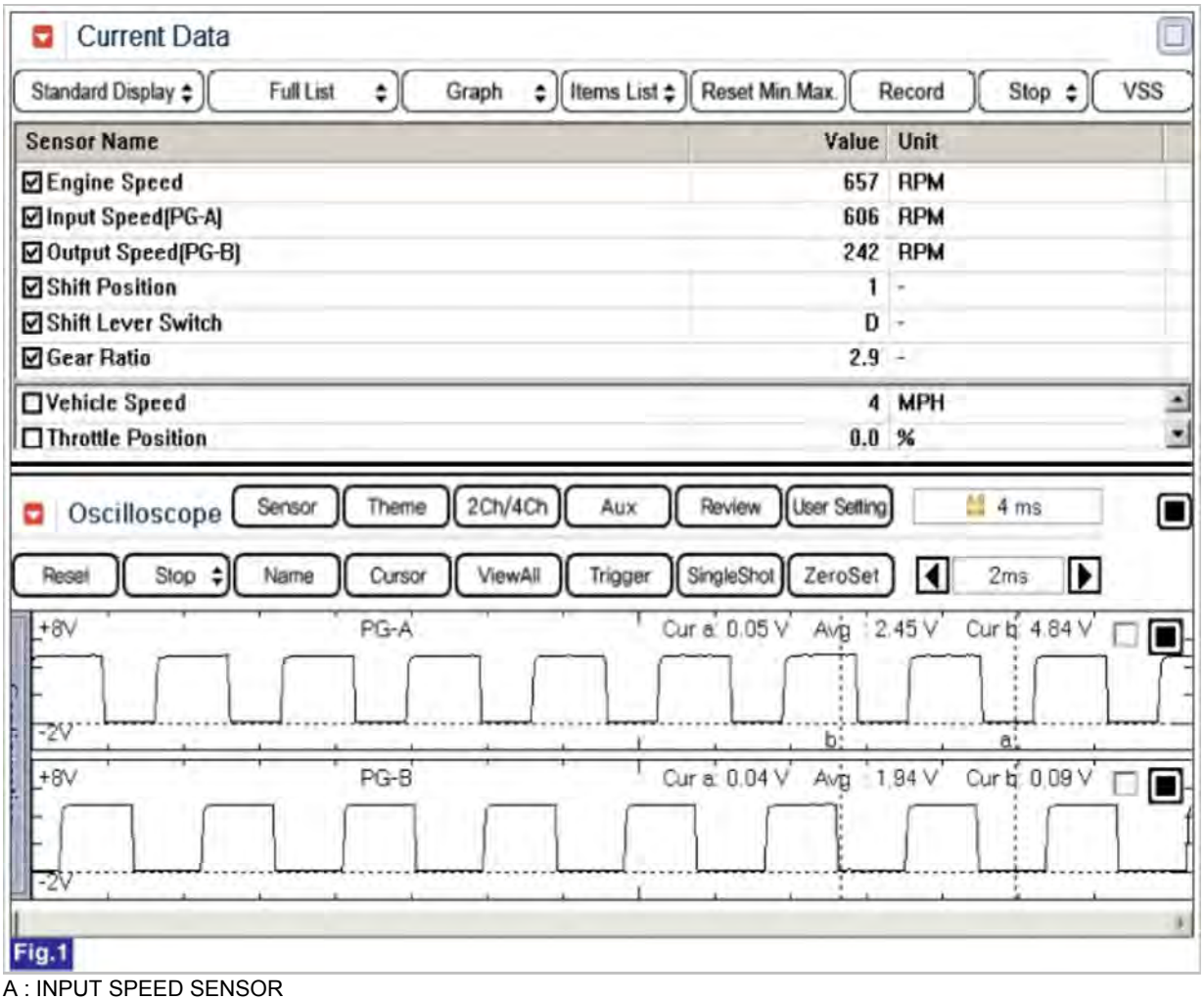


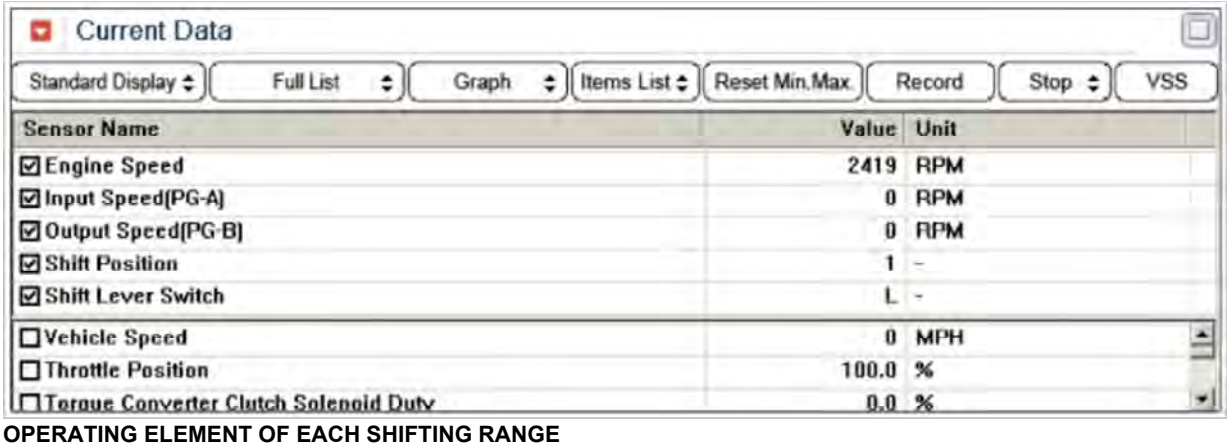
Fig.1

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

Monitor GDS 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 : 2000~2700 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

	UD/C	OD/C	REV/C	2ND/B	LR/B	OWC

P					●	
R			●		●	
N					●	
D1	●				●	●
D2	●			●		
D3	●	●				
D4		●		●		
L	●				●	●

NOTE

Stall test procedure in D1 and reason
Procedure
1. Warm up the engine
2. After positioning the select lever in "D" ,depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum
* The slippage of 1st gear operating parts can be detected by stall test in D
Reason for stall test
1. If there is no mechanical defaults in A/T, every slippage occur in torque converter.
2. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If 1st gear operating part has faults, input speed revolution will be out.
4. If oupput speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specifications?

YES	▸ Go to "W/Harness Inspection" procedure
NO	▸ Go to "Component Inspection" procedure

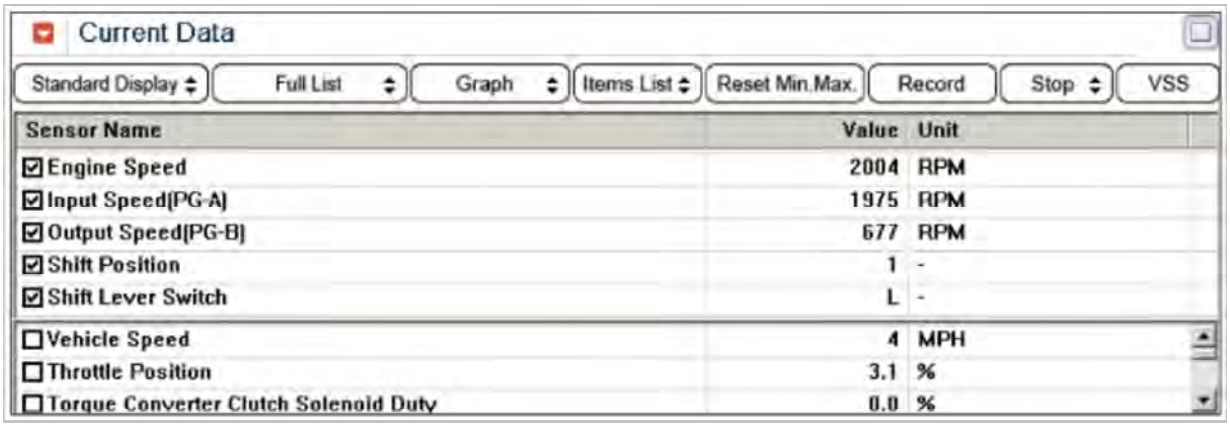
CAUTION

1. Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
2. Check the A/T fluid level and temperature and the engine coolant temperature.
● Fluid level : At the hot mark on the oil level gauge.
● Fluid temperature : 176 °F~ 212 °F (80~100 °C).
● Engine coolant temperature : 176 °F~ 212 °F (80~100 °C).
3. Chock both rear wheel(left and right).
4. Pull the parking brake lever on with the brake pedal fully depressed.
5. The throttle should not be left fully open for more than eight second.
6. 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 guage 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 :

No	Manual V/V Position	Shifting					Element	Pressure(Kgf/cm²)				
		PCSV-A	PCSV-B	PCSV-C	PCSV-D	ON/OFF		LR	2-4(2ND)	UD	OD	REV
1	D	0	100	0	0	ON	LR	10.5±0.2	0	10.5±0.2	0	0
2	↑	50	↑	↑	↑	↑	↑	5.7±0.4	↑	↑	↑	↑
3	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑	↑
4	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑	↑
5	↑	↑	0	↑	100	OFF	2-4(2ND)	0	10.5±0.2	↑	↑	↑
6	↑	↑	50	↑	↑	↑	↑	↑	5.7±0.4	↑	↑	↑
7	↑	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑
8	↑	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑
9	↑	0	↑	↑	↑	↑	OD	↑	↑	↑	10.5±0.2	↑
10	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	5.7±0.4	↑
11	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.3	↑
12	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0	↑
13	↑	↑	↑	0	0	↑	UD	↑	↑	10.5±0.2	↑	↑
14	↑	↑	↑	50	↑	↑	↑	↑	↑	5.8±0.4	↑	↑
15	↑	↑	↑	75	↑	↑	↑	↑	↑	1.0±0.3	↑	↑
16	↑	0	↑	100	↑	↑	↑	↑	↑	0	↑	↑
17	R	↑	0	↑	↑	ON	REV	17.5±0.2	↑	↑	↑	17.5±0.2
18	↑	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	8.7±0.6
19	↑	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.5
20	↑	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0

※ The values are subject to change according to vehicle model or conditions

5. Is oil pressure value within specifications?

YES	▸ Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification Vehicle Repair" procedure.
NO	▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "Verification Vehicle Repair " procedure.

Verification of Vehicle Repair

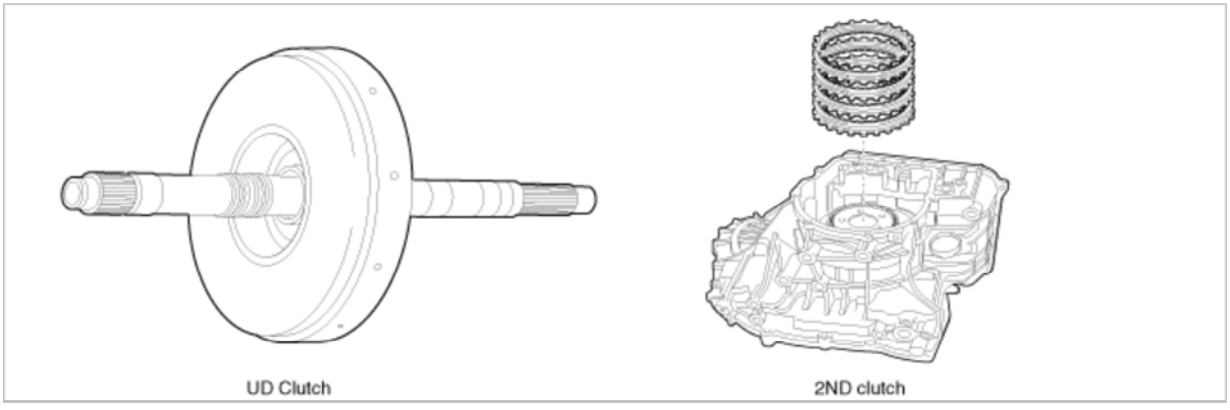
After a repair, it is essential to verify that the fault has been corrected.

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 > Automatic Transaxle System > P0732 Gear 2 Incorrect Ratio

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 1529 rpm.

DTC Description

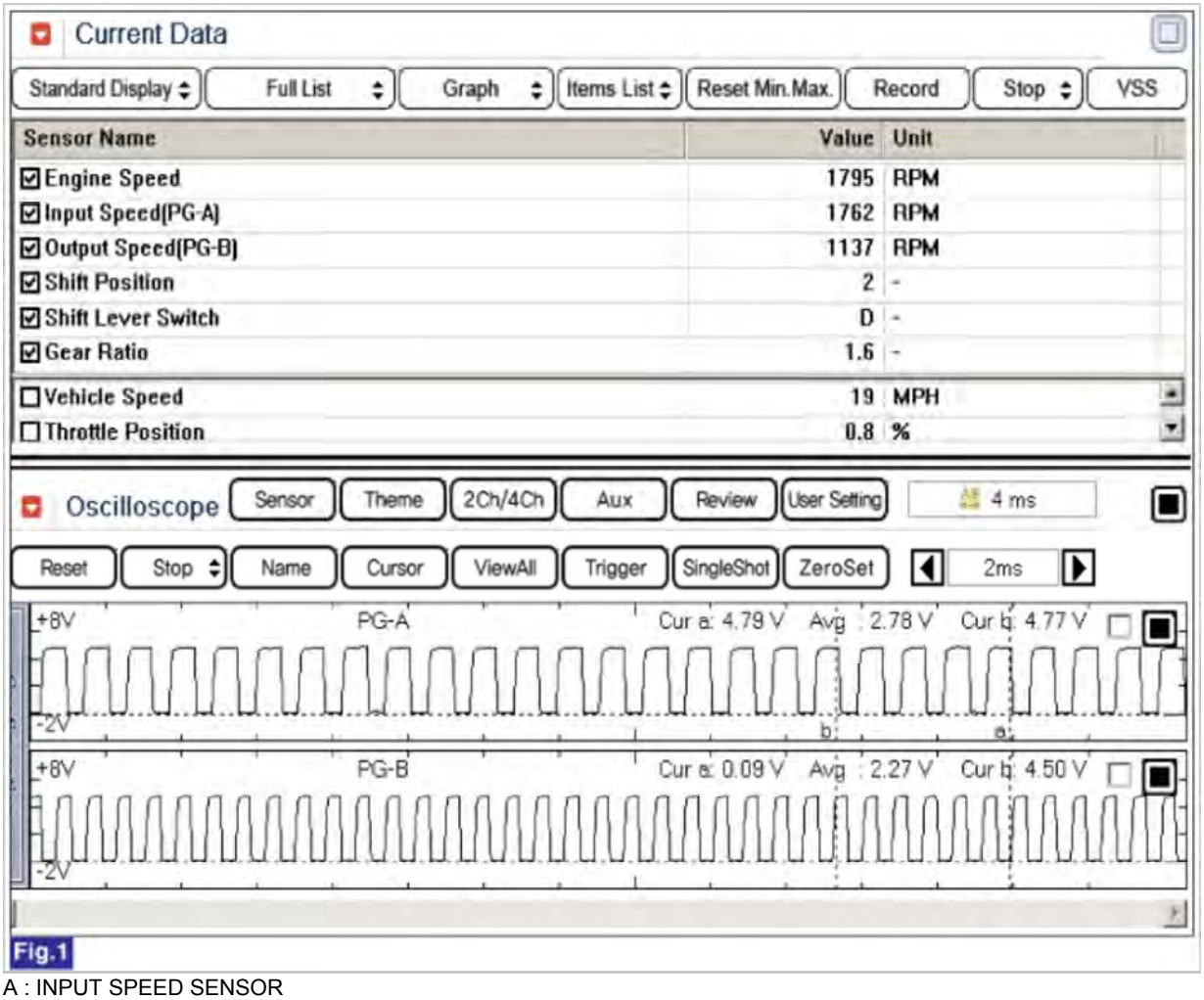
This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 2nd gear ratio, while the transaxle is engaged in 2nd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfuctioning rather than an electrical issue.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• 2nd gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor
Enable Conditions	• Solenoid power voltage >10V • TFT >-10°C • Time after shift changing finish >2secs • Engine speed >450rpm • Output speed >500rpm • Input speed >0rpm • Shift stage 2nd. gear	

	• TR switch Only one signal	• Faulty UD clutch or 2-4 brake
Threshold Value	• Output speed >(input speed+200rpm)/2nd. gear ratio • Output speed <(input speed-200rpm)/2nd. gear ratio	
Diagnostic Time	• More than 1sec. for 4 times	
Fail Safe	• Locked into 3 rd gear.(If diagnosis code P0732 is output four times, the transaxle is locked into 3rd gear)	

Signal Waveform



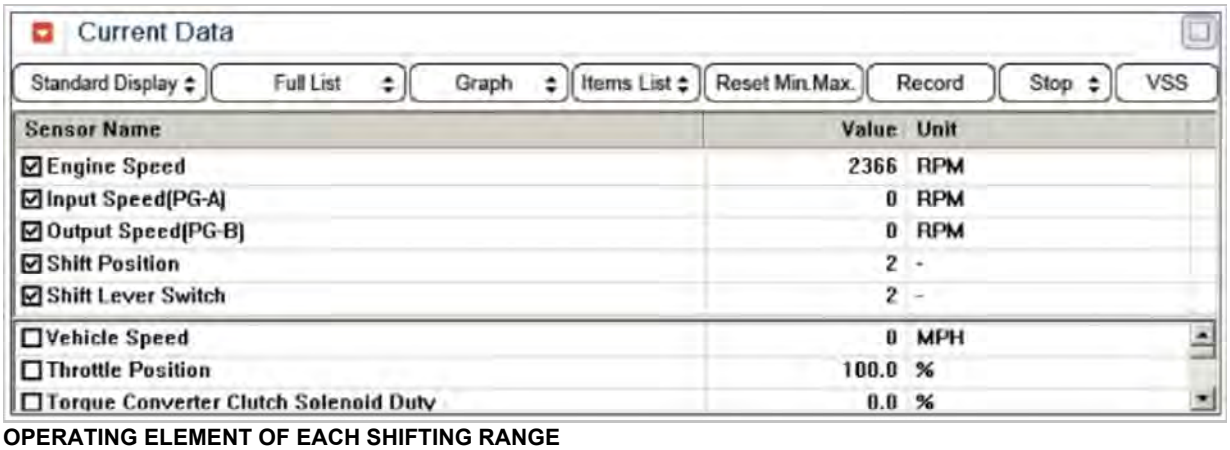
A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

Monitor GDS 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 : 2000~2700 engine rpm

* This test is possible only for "HOLD S/W" or "SPORTS MODE" applied vehicles.



OPERATING ELEMENT OF EACH SHIFTING RANGE

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

NOTE

Stall test procedure in D2 and reason
Procedure
1. Warm up the engine
2. After positioning the select lever in "D" or "ON" of the HOLD SW (Operate UP SHIFT in case of "SPORTS MODE"),depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum
* The slippage of 2ND BRAKE can be detected by stall test in D2
Reason for stall test
1. If there is no mechanical defaults in A/T, every slippage occur in torque converter.
2. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If 2nd brake system(2nd gear operating part) has faults, input speed revolution will be out.
4. If oupput speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specifications?

YES	▸ Go to "W/Harness Inspection" procedure
NO	▸ Go to "Component Inspection" procedure

CAUTION

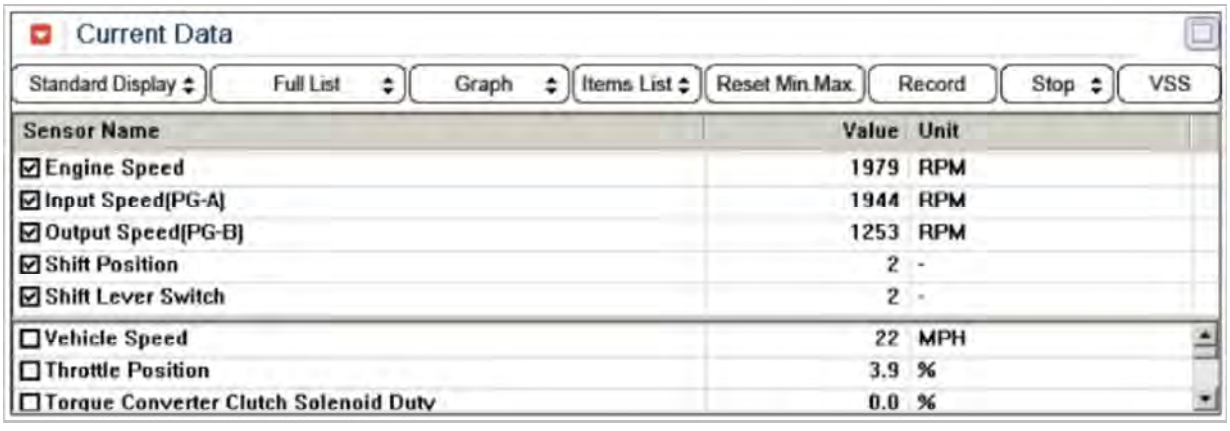
1. Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
2. Check the A/T fluid level and temperature and the engine coolant temperature.
● Fluid level : At the hot mark on the oil level gauge.
● Fluid temperature : 176 °F~ 212 °F (80~100 °C).
● Engine coolant temperature : 176 °F~ 212 °F (80~100 °C).
3. Chock both rear wheel(left and right).
4. Pull the parking brake lever on with the brake pedal fully depressed.
5. The throttle should not be left fully open for more than eight second.
6. 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 guage to "UD" and "2-4/B" port.
2. Engine "ON".
3. Drive a car with gear position 2 in "SPORTS MODE".
4. Compare it with referance data as below.
   Specification :

No	Manual V/V Position	Shifting					Element	Pressure(Kgf/cm²)				
		PCSV-A	PCSV-B	PCSV-C	PCSV-D	ON/OFF		LR	2-4(2ND)	UD	OD	REV
1	D	0	100	0	0	ON	LR	10.5±0.2	0	10.5±0.2	0	0
2	↑	50	↑	↑	↑	↑	↑	5.7±0.4	↑	↑	↑	↑
3	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑	↑
4	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑	↑
5	↑	↑	0	↑	100	OFF	2-4 (2ND)	0	10.5±0.2	↑	↑	↑
6	↑	↑	50	↑	↑	↑	↑	↑	5.7±0.4	↑	↑	↑
7	↑	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑
8	↑	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑
9	↑	0	↑	↑	↑	↑	OD	↑	↑	↑	10.5±0.2	↑
10	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	5.7±0.4	↑
11	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.3	↑
12	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0	↑
13	↑	↑	↑	0	0	↑	UD	↑	↑	10.5±0.2	↑	↑
14	↑	↑	↑	50	↑	↑	↑	↑	↑	5.8±0.4	↑	↑
15	↑	↑	↑	75	↑	↑	↑	↑	↑	1.0±0.3	↑	↑
16	↑	0	↑	100	↑	↑	↑	↑	↑	0	↑	↑

17	R	↑	0	↑	↑	ON	REV	17.5±0.2	↑	↑	↑	17.5±0.2
18	↑	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	8.7±0.6
19	↑	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.5
20	↑	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0

※ The values are subject to change according to vehicle model or conditions

5. Is oil pressure value within specifications?

YES	▸ Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification Vehicle Repair" procedure.
NO	▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "Verification Vehicle Repair " procedure.

Verification of Vehicle Repair

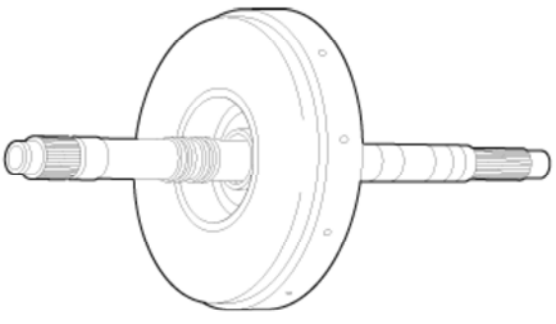
After a repair, it is essential to verify that the fault has been corrected.

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 ?

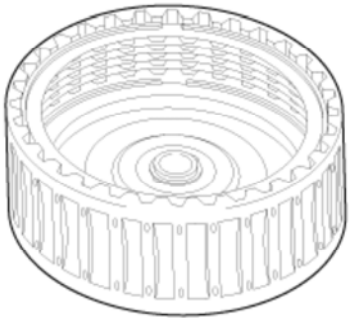
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Automatic Transaxle System > Automatic Transaxle System > P0733 Gear 3 Incorrect Ratio

Component Location



UD Clutch



OD Clutch

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 1000 rpm.

DTC Description

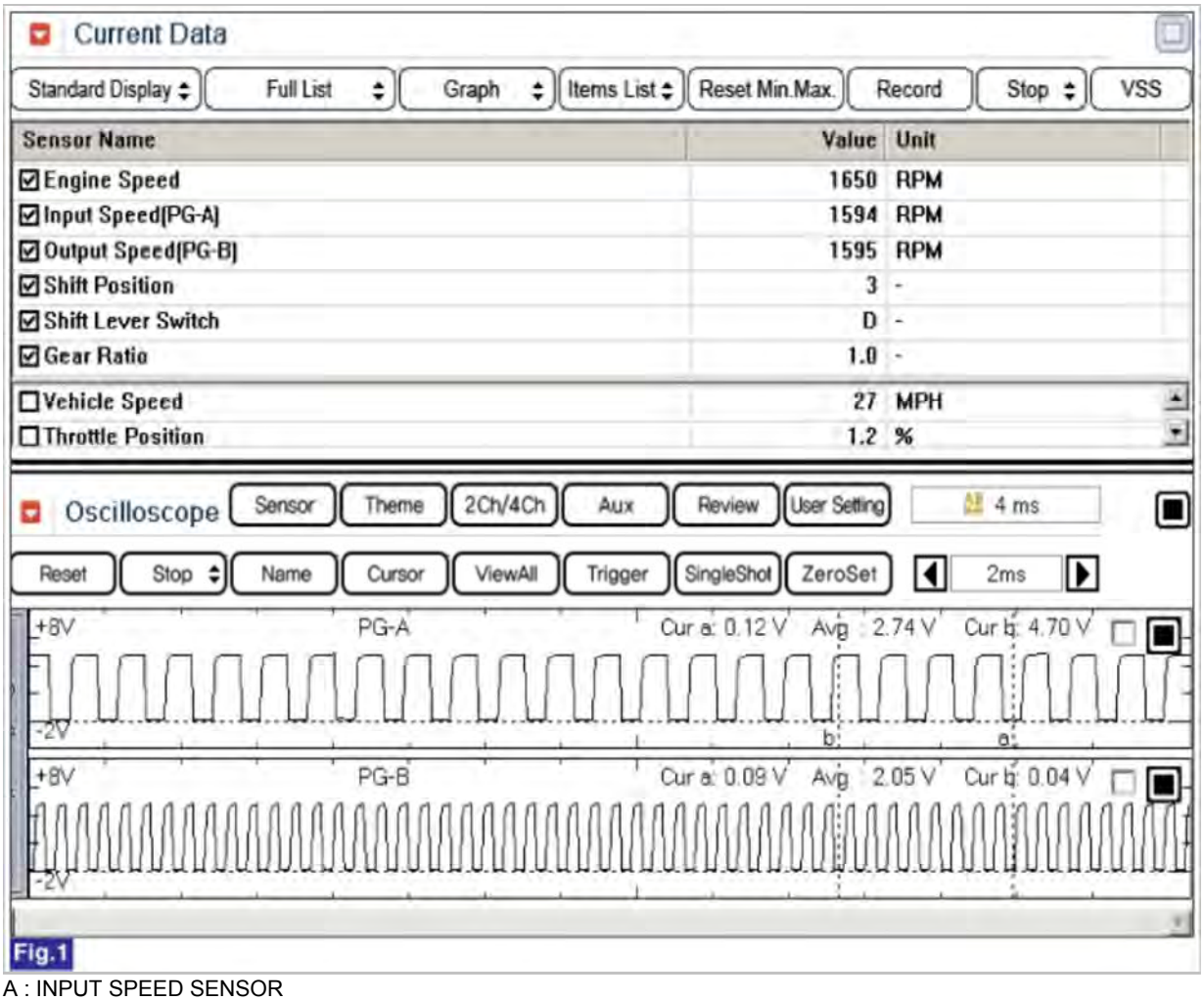
This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 3rd gear ratio, while the transaxle is engaged in 3rd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfuctioning rather than an electrical issue.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• 3rd gear incorrect ratio	

Enable Conditions	• Solenoid power voltage >10V • TFT >-10°C • Time after shift changing finish >2secs • Engine speed >450rpm • Output speed >900rpm • Input speed >0rpm • Shift stage 3rd. Gear • TR switch Only one signal	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or 2-4 brake
Threshold Value	• Output speed >(input speed+200rpm)/3rd. gear ratio • Output speed <(input speed-200rpm)/3rd. gear ratio	
Diagnostic Time	• More than 1sec. for 4 times	
Fail Safe	• Locked into 3 rd gear.(If diagnosis code P0733 is output four times, the transaxle is locked into 3rd gear)	

Signal Waveform

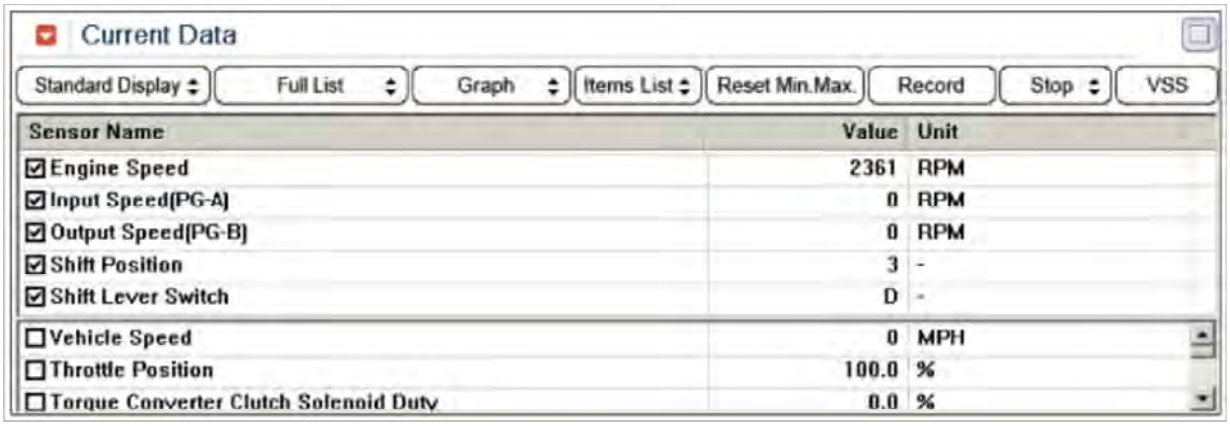


A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

Monitor GDS 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 : 2000~2700 engine rpm



OPERATING ELEMENT OF EACH SHIFTING RANGE

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

NOTE

Stall test procedure in D3 and reason
Procedure
1. Warm up the engine
2. After making 3rd gear hold by disconnecting the solenoid connector, and Then depress the foot brake pedal fully After that, step on the accelerator pedal to the maximum
* The slippage of OD clutch can be detected by stall test in D3.
Reason for stall test
1. If there is no mechanical defaults in A/T, every slippage occur in torque converter.
2. Therfore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If OD clutch system(3rd gear operating part) has faults, input speed revolution will be output.
4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.

5. Is "STALL TEST " within specifications?

YES	▸ Go to "W/Harness Inspection" procedure
NO	▸ Go to "Component Inspection" procedure

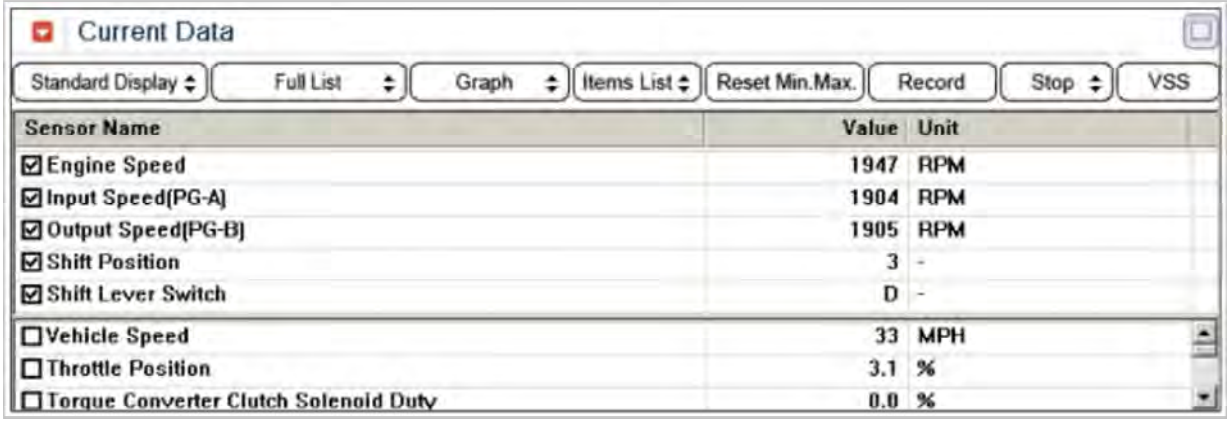
CAUTION

1. Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
2. Check the A/T fluid level and temperature and the engine coolant temperature.
● Fluid level : At the hot mark on the oil level gauge.
● Fluid temperature : 176 °F~ 212 °F (80~100 °C).
● Engine coolant temperature : 176 °F~ 212 °F (80~100 °C).
3. Chock both rear wheel(left and right).
4. Pull the parking brake lever on with the brake pedal fully depressed.
5. The throttle should not be left fully open for more than eight second.
6. 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 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 guage to "UD" and "OD" port.
2. Engine "ON".
3. Disconnect the solenoide valve connector.
4. Drive a car with gear position 3 in fail mode.
5. Compare it with referance data as below.
   Specification :

No	Manual V/V Position	Shifting					Element	Pressure(Kgf/cm²)				
		PCSV-A	PCSV-B	PCSV-C	PCSV-D	ON/OFF		LR	2-4(2ND)	UD	OD	REV
1	D	0	100	0	0	ON	LR	10.5±0.2	0	10.5±0.2	0	0
2	↑	50	↑	↑	↑	↑	↑	5.7±0.4	↑	↑	↑	↑
3	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑	↑
4	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑	↑
5	↑	↑	0	↑	100	OFF	2-4 (2ND)	0	10.5±0.2	↑	↑	↑
6	↑	↑	50	↑	↑	↑	↑	↑	5.7±0.4	↑	↑	↑
7	↑	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑
8	↑	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑
9	↑	0	↑	↑	↑	↑	OD	↑	↑	↑	10.5±0.2	↑
10	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	5.7±0.4	↑
11	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.3	↑
12	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0	↑
13	↑	↑	↑	0	0	↑	UD	↑	↑	10.5±0.2	↑	↑

14	↑	↑	↑	50	↑	↑	↑	↑	↑	5.8±0.4	↑	↑
15	↑	↑	↑	75	↑	↑	↑	↑	↑	1.0±0.3	↑	↑
16	↑	0	↑	100	↑	↑	↑	↑	↑	0	↑	↑
17	R	↑	0	↑	↑	ON	REV	17.5±0.2	↑	↑	↑	17.5±0.2
18	↑	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	8.7±0.6
19	↑	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.5
20	↑	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0

※ The values are subject to change according to vehicle model or conditions

6. Is oil pressure value within specifications?

YES	▸ Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification Vehicle Repair" procedure.
NO	▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "Verification Vehicle Repair " procedure.

Verification of Vehicle Repair

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

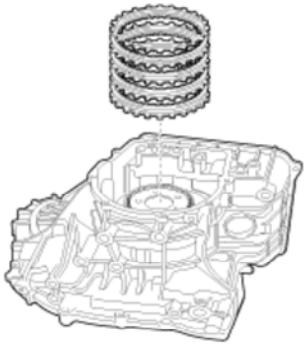
1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Automatic Transaxle System > Automatic Transaxle System > P0734 Gear 4 Incorrect Ratio

Component Location

OD Clutch



2ND Brake

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.

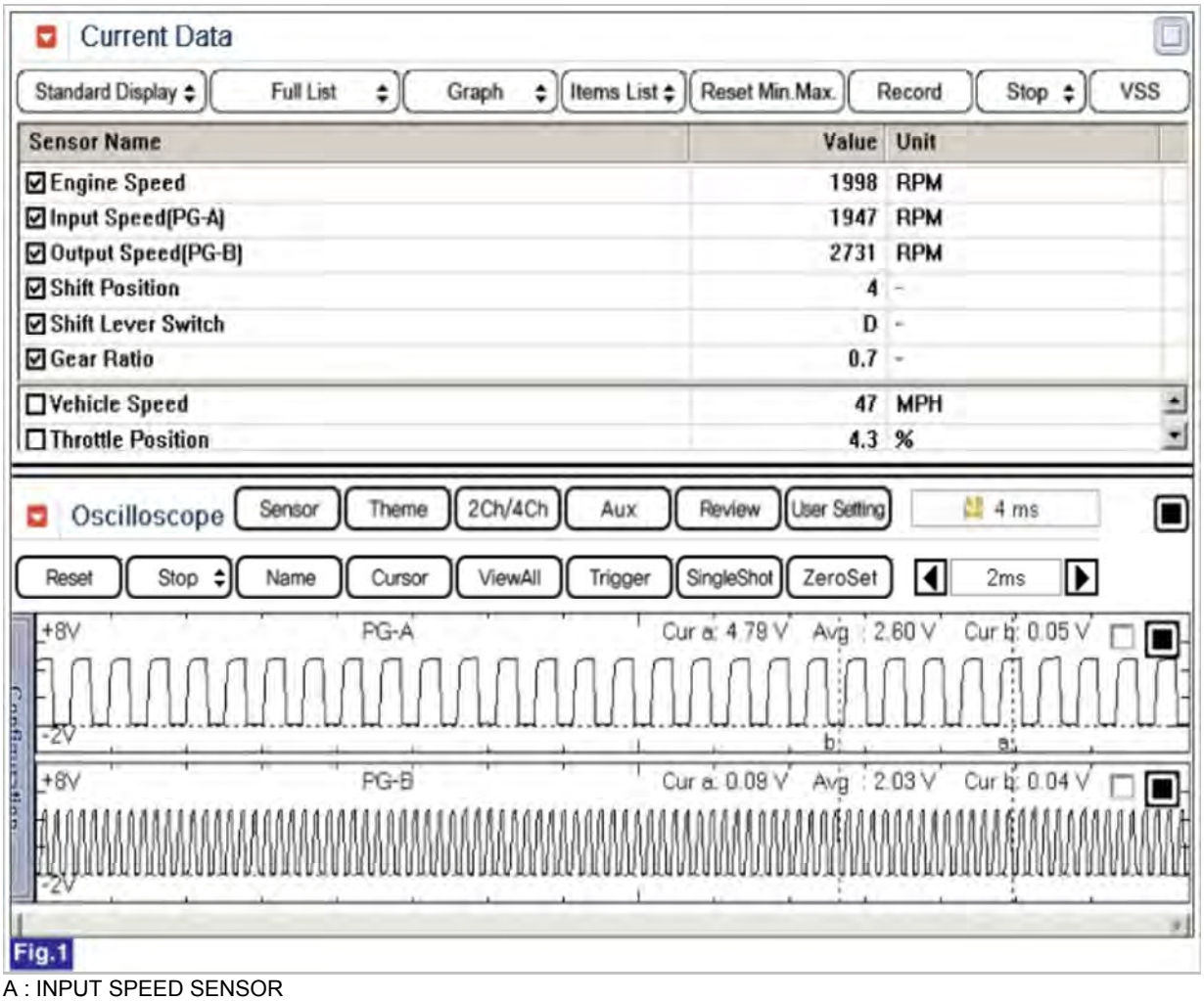
DTC Description

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

Item	Detecting Condition	Possible Cause
DTC Strategy	• 4th gear incorrect ratio	• Faulty Input speed sensor • Faulty output speed sensor • Faulty UD clutch or 2-4 brake
Enable Conditions	• Solenoid power voltage >10V • TFT >-10°C • Time after shift changing finish >2secs • Engine speed >450rpm • Output speed >900rpm • Input speed >0rpm • Shift stage 4th. Gear • TR switch Only one signal	
Threshold Value	• Output speed >(input speed+200rpm)/4th. gear ratio • Output speed <(input speed-200rpm)/4th. gear ratio	
Diagnostic Time	• More than 1sec. for 4 times	
Fail Safe	• Locked into 3 rd gear.(If diagnosis code P0734 is output four times, the transaxle is locked into 3rd gear)	

Signal Waveform



A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

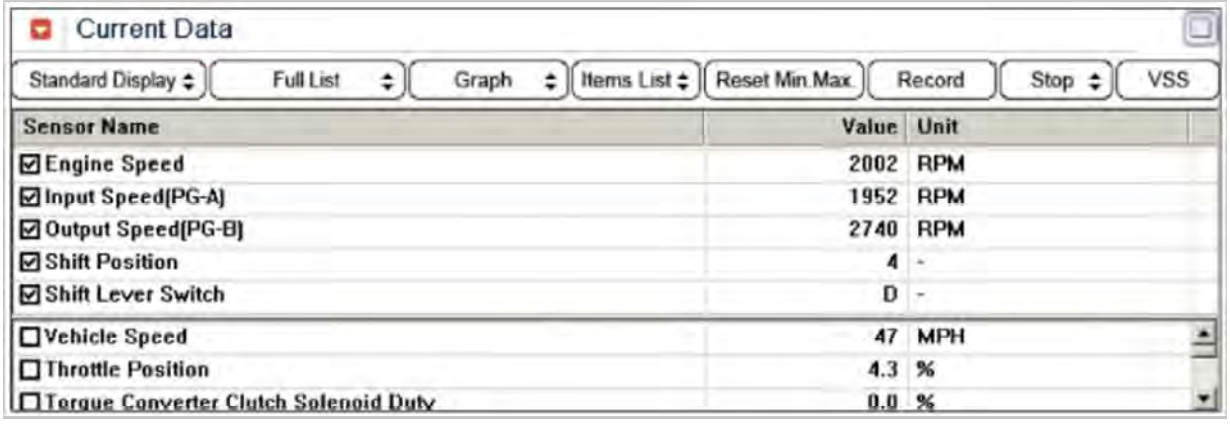
Monitor GDS Data

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

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.

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 guage 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 :

No	Manual V/V Position	Shifting					Element	Pressure(Kgf/cm²)				
		PCSV-A	PCSV-B	PCSV-C	PCSV-D	ON/OFF		LR	2-4(2ND)	UD	OD	REV
1	D	0	100	0	0	ON	LR	10.5±0.2	0	10.5±0.2	0	0
2	↑	50	↑	↑	↑	↑	↑	5.7±0.4	↑	↑	↑	↑
3	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑	↑
4	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑	↑
5	↑	↑	0	↑	100	OFF	2-4 (2ND)	0	10.5±0.2	↑	↑	↑
6	↑	↑	50	↑	↑	↑	↑	↑	5.7±0.4	↑	↑	↑
7	↑	↑	75	↑	↑	↑	↑	↑	0.9±0.3	↑	↑	↑
8	↑	↑	100	↑	↑	↑	↑	↑	0	↑	↑	↑
9	↑	0	↑	↑	↑	↑	OD	↑	↑	↑	10.5±0.2	↑
10	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	5.7±0.4	↑
11	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.3	↑
12	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0	↑
13	↑	↑	↑	0	0	↑	UD	↑	↑	10.5±0.2	↑	↑
14	↑	↑	↑	50	↑	↑	↑	↑	↑	5.8±0.4	↑	↑

15	↑	↑	↑	75	↑	↑	↑	↑	↑	1.0±0.3	↑	↑
16	↑	0	↑	100	↑	↑	↑	↑	↑	0	↑	↑
17	R	↑	0	↑	↑	ON	REV	17.5±0.2	↑	↑	↑	17.5±0.2
18	↑	↑	50	↑	↑	↑	↑	↑	↑	↑	↑	8.7±0.6
19	↑	↑	75	↑	↑	↑	↑	↑	↑	↑	↑	0.9±0.5
20	↑	↑	100	↑	↑	↑	↑	↑	↑	↑	↑	0

※ The values are subject to change according to vehicle model or conditions

5. Is oil pressure value within specifications?

YES	▸ Repair AUTO TRANSAXLE(Clutch or Brake) as necessary and Go to "Verification Vehicle Repair" procedure.
NO	▸ Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and Go to "Verification Vehicle Repair " procedure.

Verification of Vehicle Repair

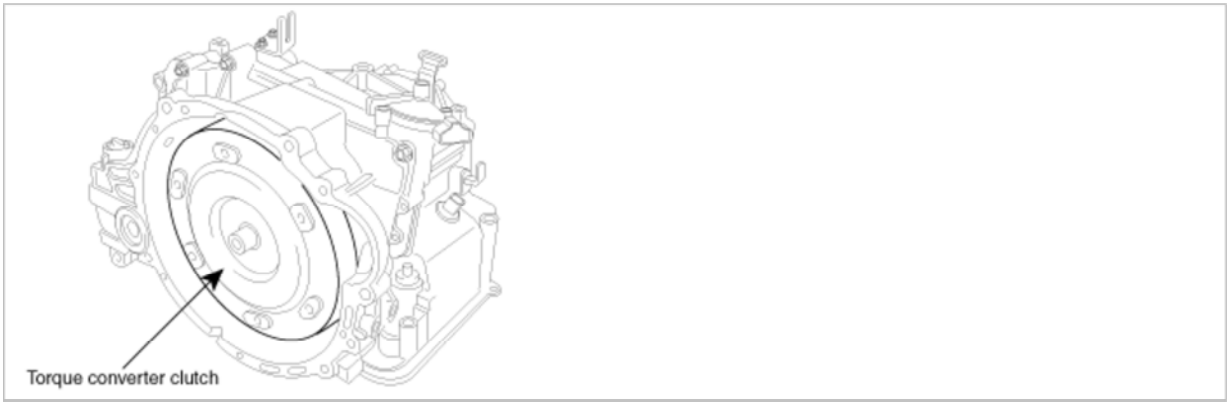
After a repair, it is essential to verify that the fault has been corrected.

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 > Automatic Transaxle System > P0741 Torque Converter Clutch Circuit Performance or Stuck Off

Component Location



General Description

The PCM/TCM 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 PCM/TCM 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 PCM/TCM 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 PCM/TCM increases the duty ratio by appling more

hyraulic pressure. When slip rpm does not drop under some value with 100% duty ratio, the PCM/TCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Stuck "OFF".	※ TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty bady control valve • Faulty PCM/TCM
Enable Conditions	• Solenoid PWM >0% • Throttle Position >5%...12%(depends on TIS) • Shift stage 3,4th gear	
Threshold Value	• Time during 100% duty >2secs	
Diagnostic Time	• More than 20...30sec. for 2 times	
Fail Safe	• Damper clutch abnormal system (If diagnosis code P0741 is output four times, TORQUE CONVERTER(DEMPER) CLUTCH is not controlled by PCM/TCM)	

Monitor GDS Data

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

Specification : TCC SOL. DUTY > 30% In that condition TCC SLIP<100RPM

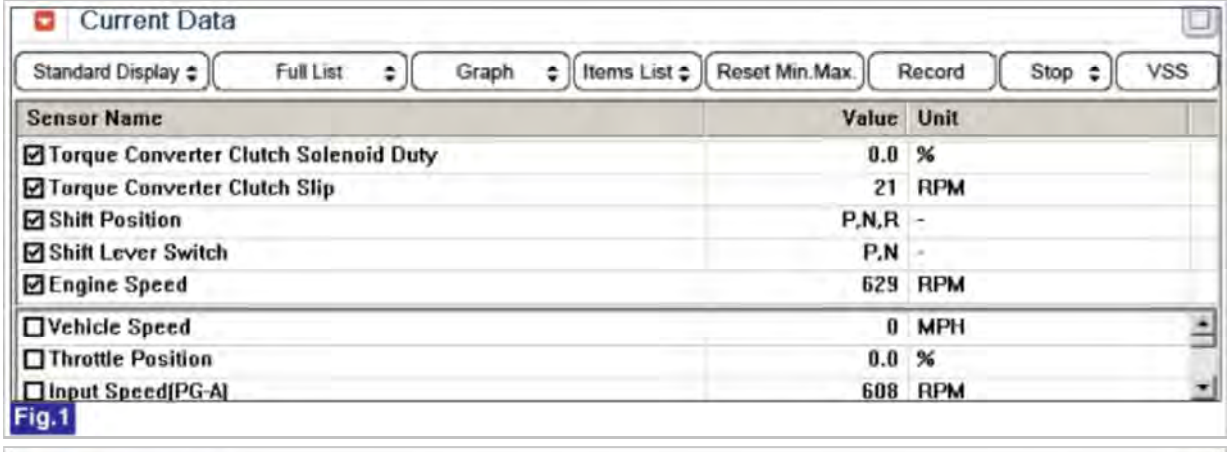


Fig.1

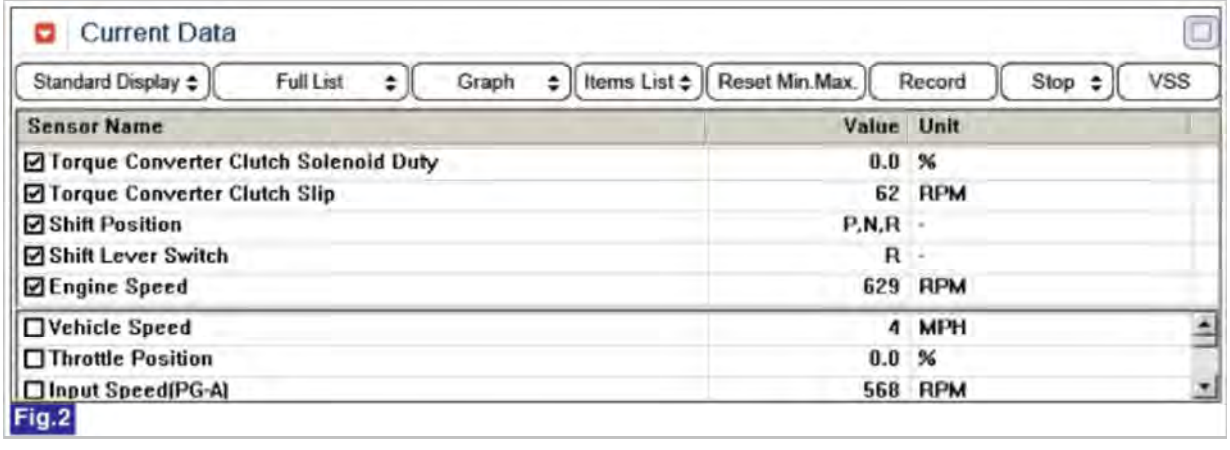


Fig.2

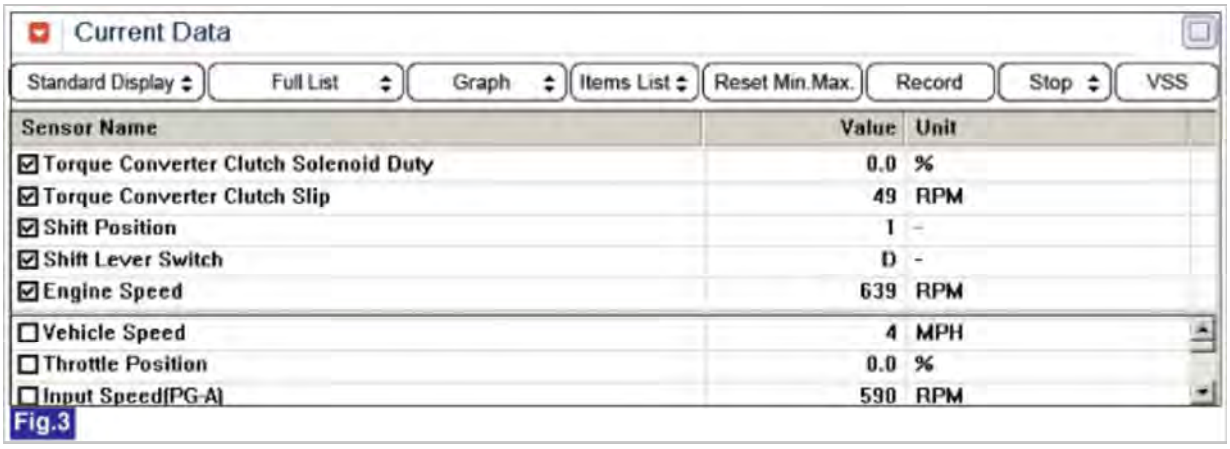


Fig.3

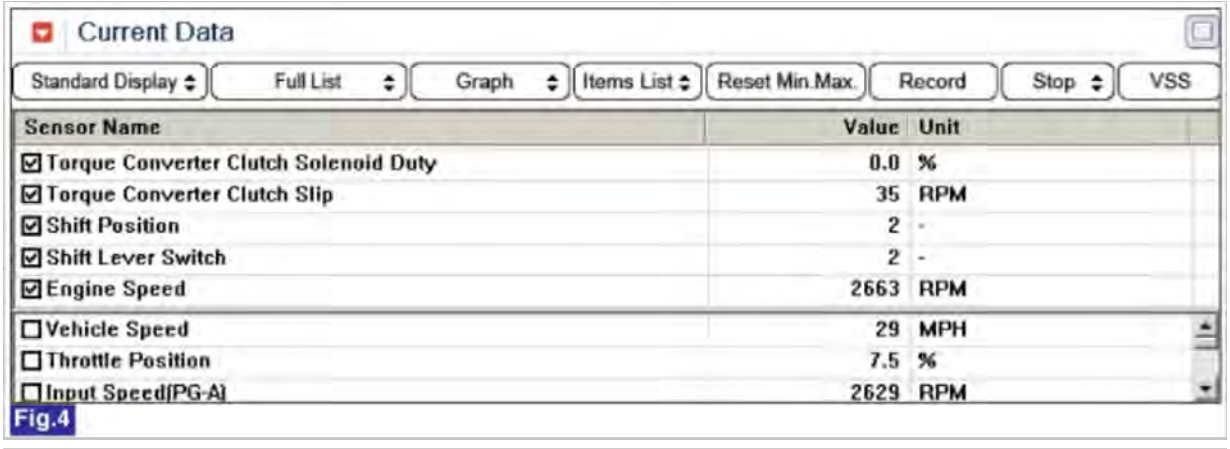


Fig.4

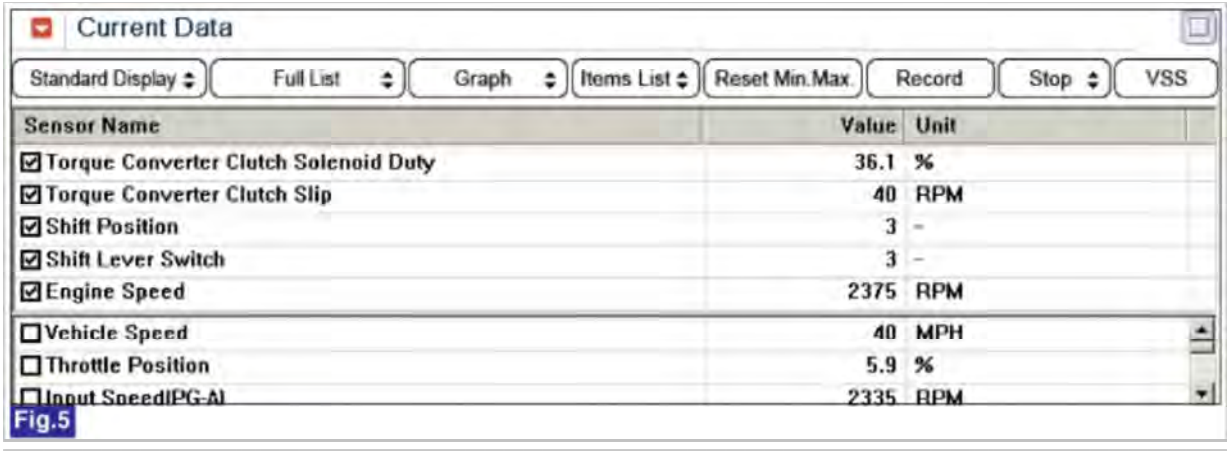


Fig.5

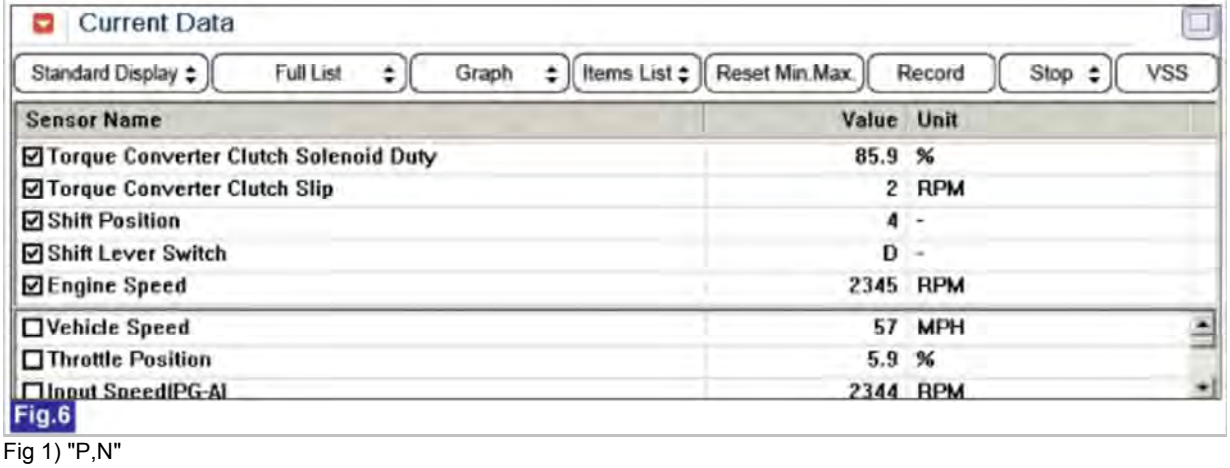


Fig.6

Fig 1) "P,N"
Fig 2) "R"
Fig 3) "1st" gear
Fig 4) "2nd" gear
Fig 5) "3rd" gear

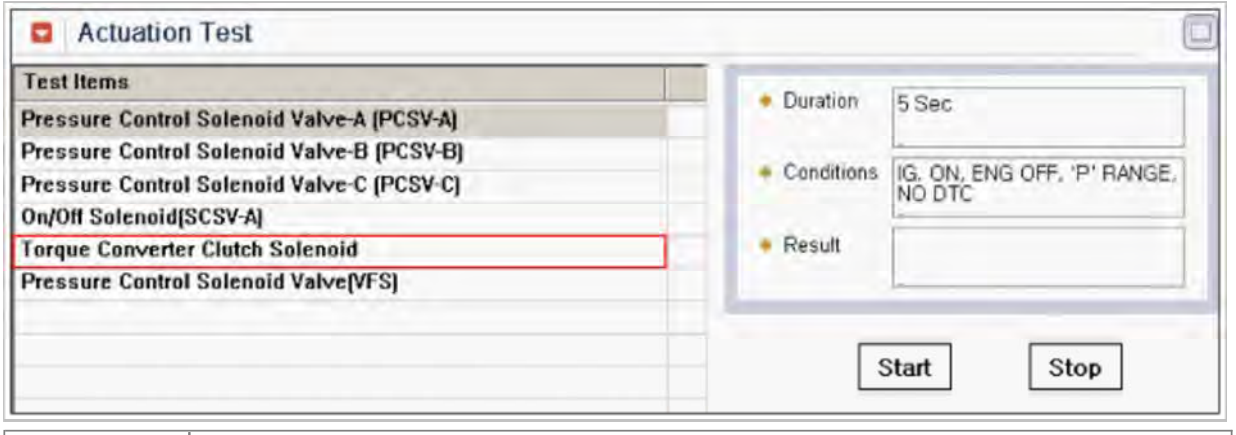
Fig 6) "4th" gear

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Check Torque Converter Clutch Solenoid Valve
   (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) Is Actuator Testing performed normally ?



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 guage to "DR" port.
   (2) Ignition "ON" & Engine "OFF".
   (3) After connecting GDS and monitor the "TCC SOLENIOD VALVE DUTY" parameter on the GDS data list.
   (4) Select 1st gear and accelerate Engine speed to 2500 rpm.
   (5) Measure oil pressure.
   (6) Is oil pressure value within specification?

Specification : Above 2.0~4.6kg/cm²(Engine Speed : 2500rpm,DCC sol Duty : 50%)

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 > Automatic Transaxle System > P0743 Torque Converter Clutch Circuit Electrical

Component Location

General Description

The PCM/TCM 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 PCM/PCM/TCM 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 PCM/TCM 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 PCM/TCM judges that DCCSV circuit is malfunctioning and sets this code.

DTC Detecting Condition

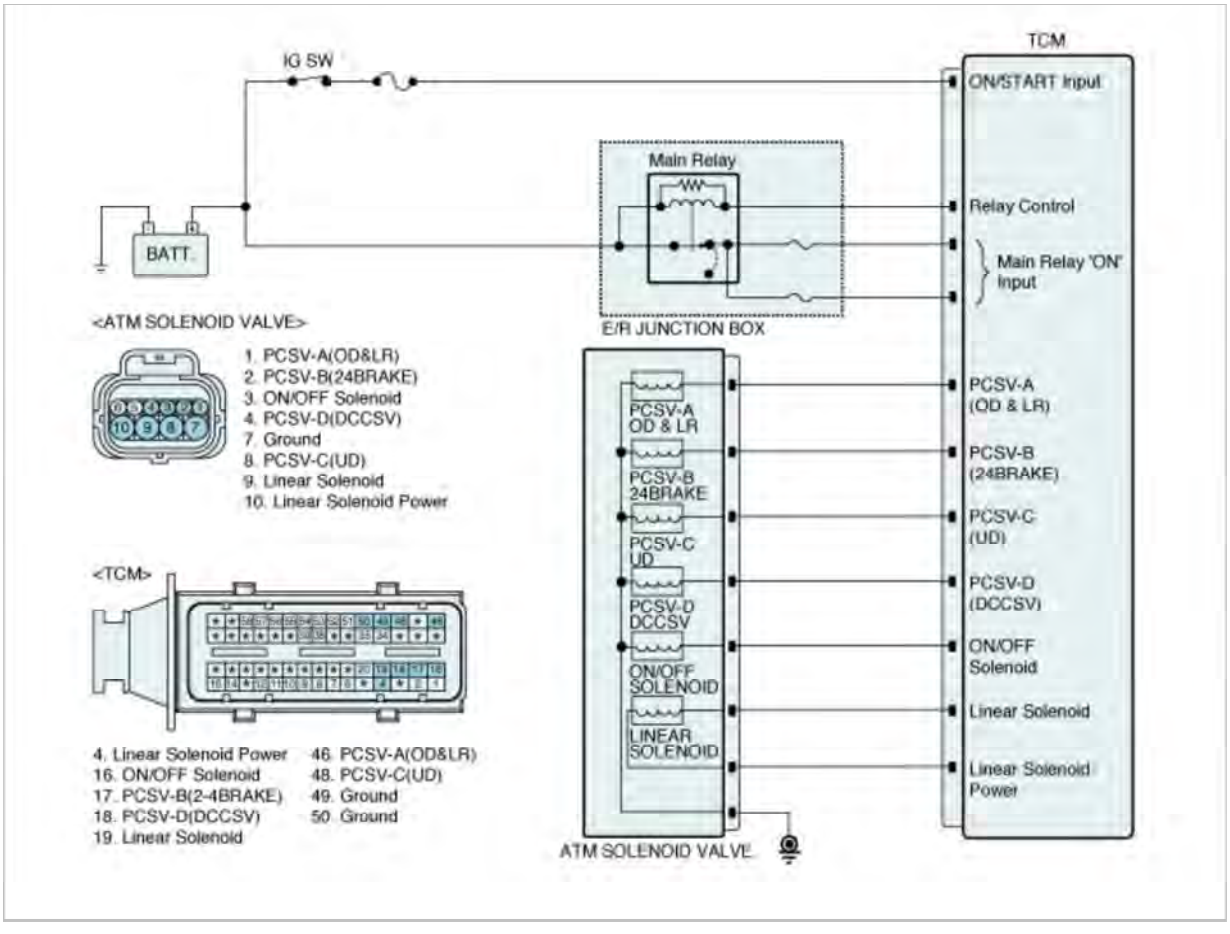
Item		Detecting Condition	Possible Cause
Case 1	DTC Strategy	• Circuit low	※ TORQUE CONVERTER (DAMPER) CLUTCH : TCC • Open or short in circuit • Faulty TCC SOLENOID VALVE • Faulty PCM/TCM
	Enable Conditions	• Solenoid PWM 0%	
	Threshold Value	• Feedback Voltage <5.5V	
Case 2	DTC Strategy	• Circuit high	
	Enable Conditions	• Solenoid PWM 100% • Time after TCM turns on 0.5 sec • Solenoid power voltage >10V and <16V	
	Threshold Value	• Feedback Voltage >battery voltage-1V	
Diagnostic Time		• More than 0.3sec	
Fail Safe		• Locked in 3 rd gear.	

Specification

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -30°C~130°C
- Frequency :PCSV-A,B,C,D :50Hz (at the ATF temp. -20°C above)
  VFS : 400~1000
  ※ KM series : 35Hz
- Internal resistance : 3.5 ± 0.2 Ω(20°C)
- Surge voltage : 56 V

Diagnostic Circuit Diagram



Signal Waveform

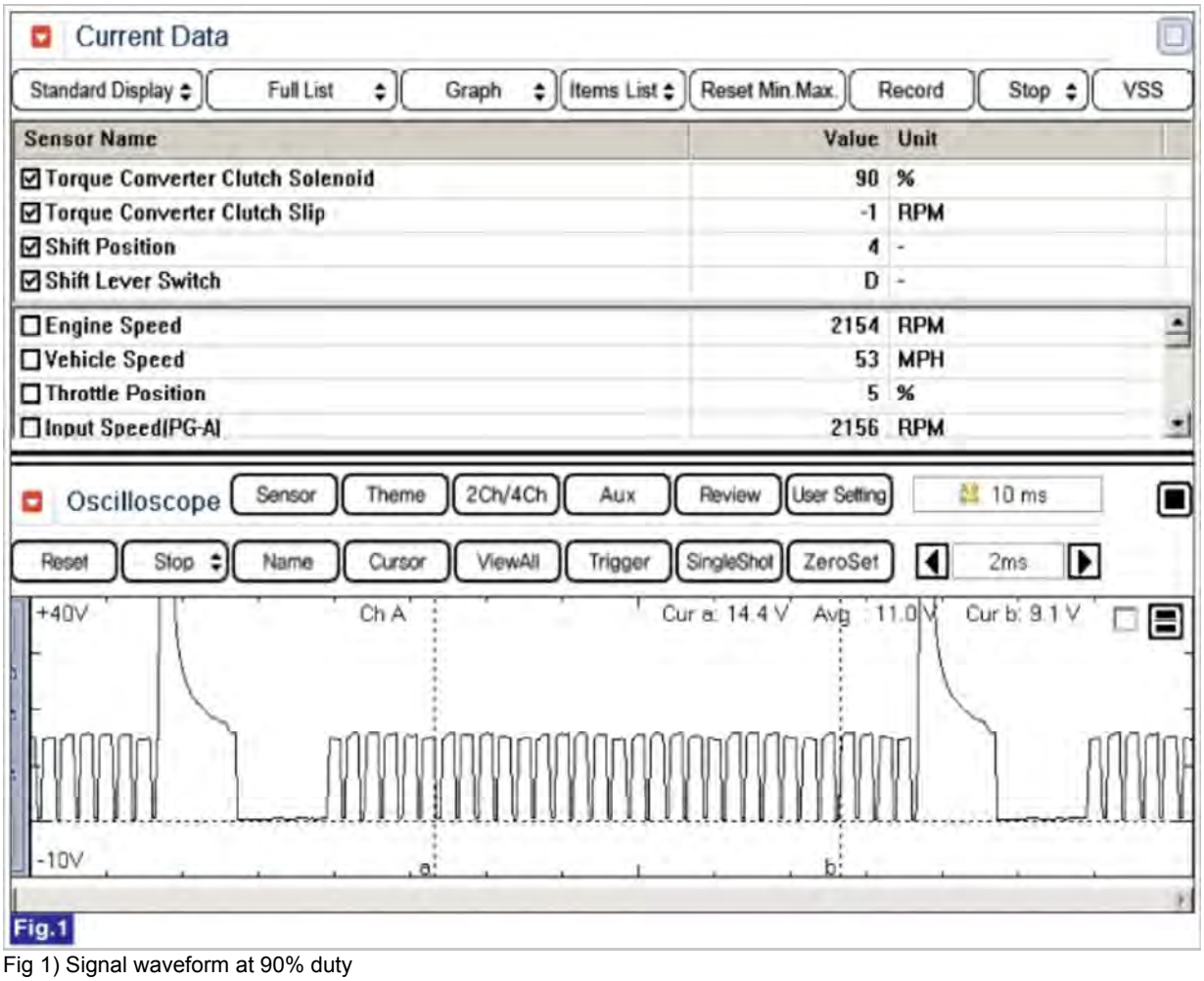
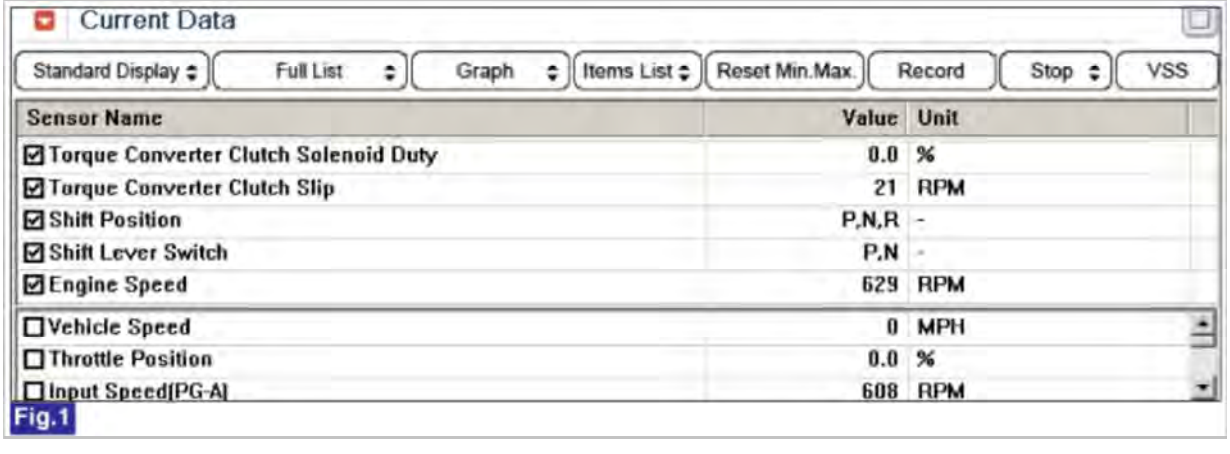


Fig 1) Signal waveform at 90% duty

Monitor GDS Data

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

Specification : TCC SOL. DUTY > 30% In that condition TCC SLIP<100RPM



Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
☑ Torque Converter Clutch Solenoid Duty	0.0	%
☑ Torque Converter Clutch Slip	62	RPM
☑ Shift Position	P,N,R	-
☑ Shift Lever Switch	R	-
☑ Engine Speed	629	RPM
☐ Vehicle Speed	4	MPH
☐ Throttle Position	0.0	%
☐ Input Speed(PG-A)	568	RPM

Fig.2

Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
☑ Torque Converter Clutch Solenoid Duty	0.0	%
☑ Torque Converter Clutch Slip	49	RPM
☑ Shift Position	1	-
☑ Shift Lever Switch	D	-
☑ Engine Speed	639	RPM
☐ Vehicle Speed	4	MPH
☐ Throttle Position	0.0	%
☐ Input Speed(PG-A)	590	RPM

Fig.3

Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
☑ Torque Converter Clutch Solenoid Duty	0.0	%
☑ Torque Converter Clutch Slip	35	RPM
☑ Shift Position	2	-
☑ Shift Lever Switch	2	-
☑ Engine Speed	2663	RPM
☐ Vehicle Speed	29	MPH
☐ Throttle Position	7.5	%
☐ Input Speed(PG-A)	2629	RPM

Fig.4

Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
☑ Torque Converter Clutch Solenoid Duty	36.1	%
☑ Torque Converter Clutch Slip	40	RPM
☑ Shift Position	3	-
☑ Shift Lever Switch	3	-
☑ Engine Speed	2375	RPM
☐ Vehicle Speed	40	MPH
☐ Throttle Position	5.9	%
☐ Input Speed(PG-A)	2335	RPM

Fig.5

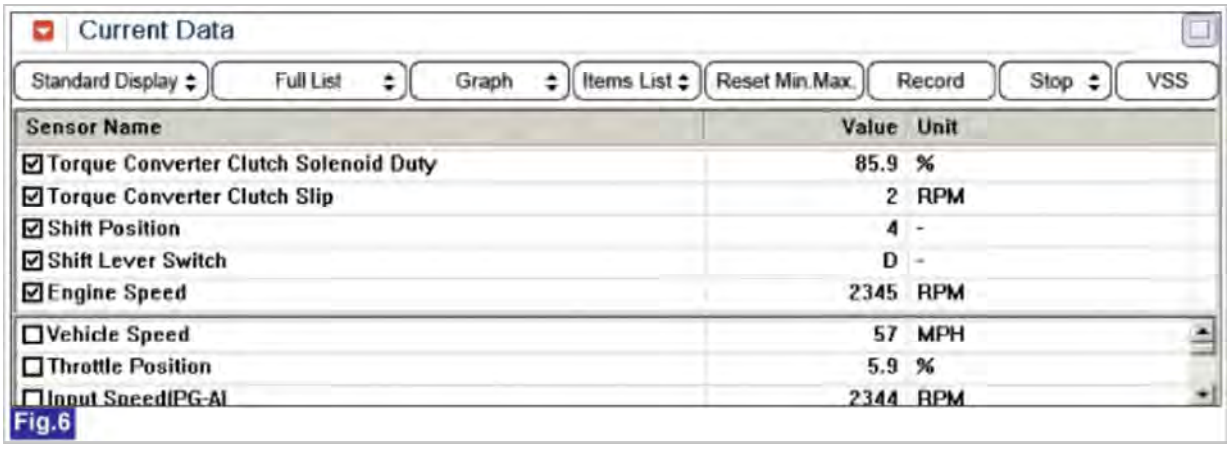


Fig 1) "P,N"
Fig 2) "R"
Fig 3) "1st" gear
Fig 4) "2nd" gear
Fig 5) "3rd" gear
Fig 6) "4th" gear

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

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "W/Harness Inspection " procedure.

Terminal and Connector Inspection

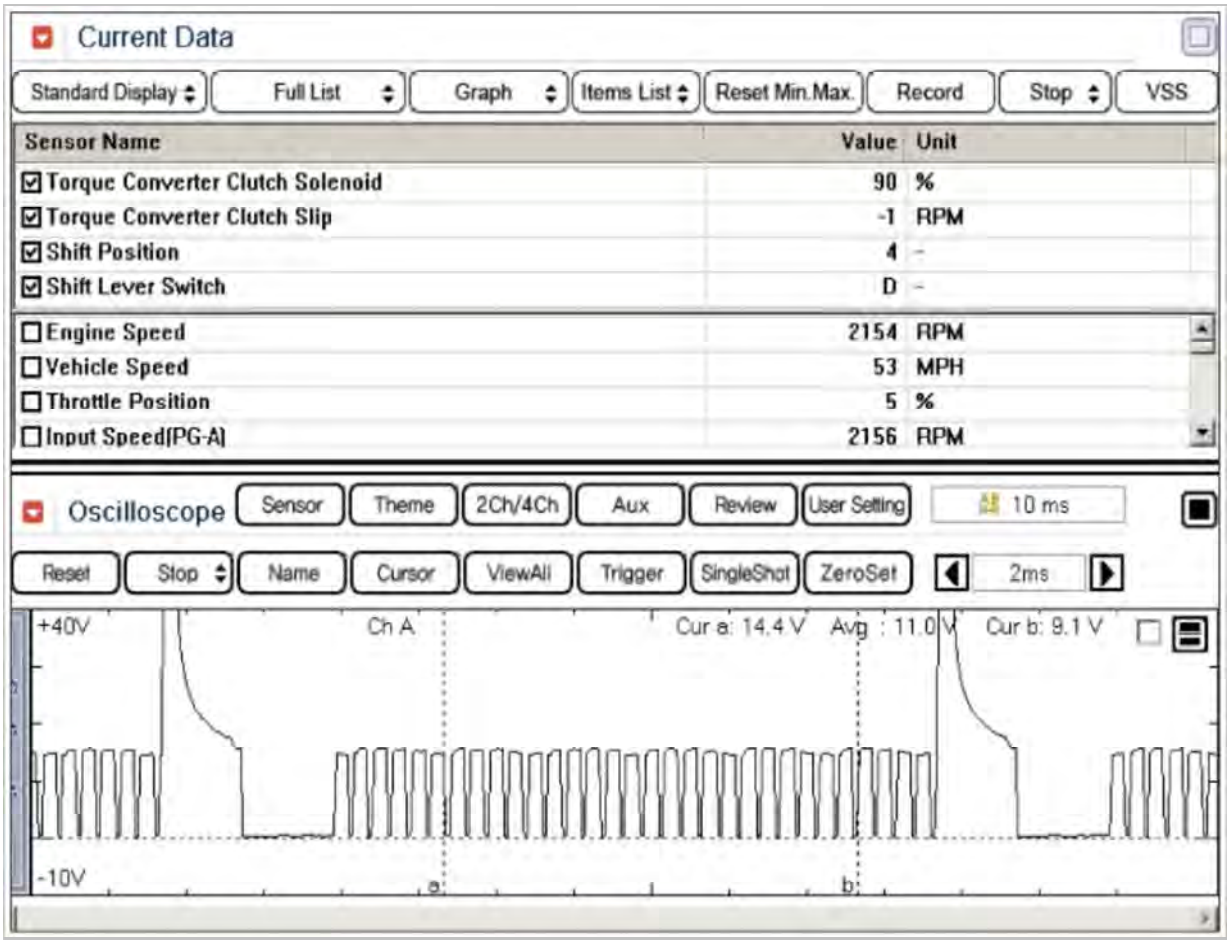
1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,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

YES	▸ Repair as necessary and go to "Verification vehicle Repair" procedure.
NO	▸ Go to "Power Circuit Inspection" procedure.

Power Circuit Inspection

1. Connect "A/T SOLENOID VALVE" connector and install device for measuring wave form.
2. Turn on the Engine and operate Damper clutch.
3. Measure wave form between "PCSV-D(DCCSV)" teminal of the sensor harness connector and chassis ground.

Wave form of DCCSV



4. Is measured normally operating wave form?

YES	▸ Go to "Signal circuit inspection" procedure.
NO	▸ 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 "PCSV-D(DCCSV)" terminal of the ATM SOLENOID VALVE harness connector and "PCSV-D(DCCSV)" terminal of the PCM/TCM 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 "PCM/TCM" connector.
   (3) Measure resistance between "PCSV-D(DCCSV)" terminal 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

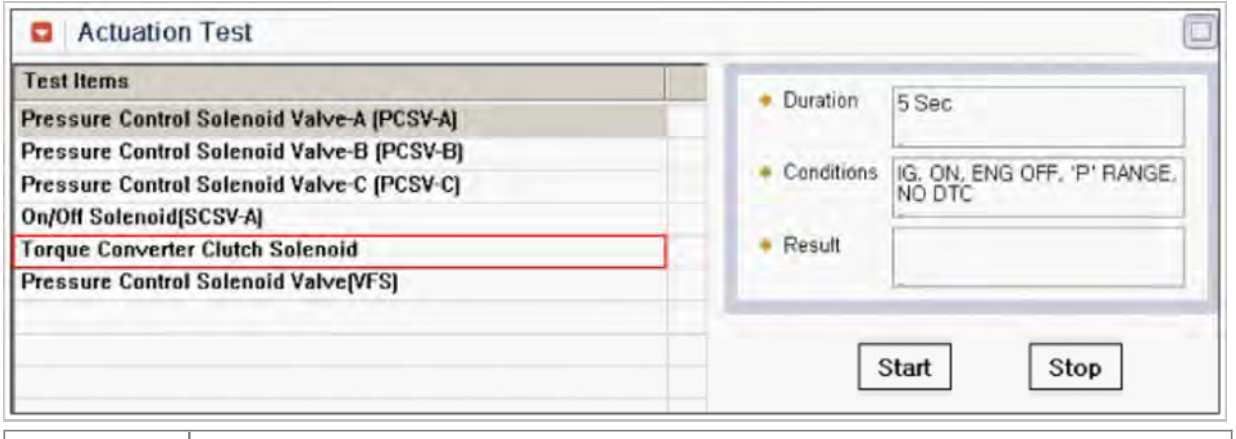
1. Check Solenoid Valve
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector.
   (3) Measure resistance between "PCSV-D(DCCSV)" terminal and "Ground" terminal of the ATM SOLENOID VALVE harness connector.

   Specification : Approximately 3.5 ± 0.2 Ω (25°C)

   (4) Is resistance within specifications?

YES	▸ Go to "CHECK PCM/TCM" as below.
NO	▸ Replace DCC SOLENOID VALVE as necessary and go to "Verification Vehicle Repair" procedure.

2. Check PCM/PCM/TCM
   (1) Connect GDS to data link connector(DLC)
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T Solenoide valve Actuator test and Operate Actuator test.
   (4) Is Actuator Testing performed normally ?



YES	▸ Go to "Verification Vehicle Repair" procedure.
NO	▸ Replace PCM/TCM as necessary and Go to "Verificaiton Vehicle Repair" procedure.

ACTUATOR TEST CONDITION
1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0km/h
5. Throttle position sensor< 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

Verification of Vehicle Repair

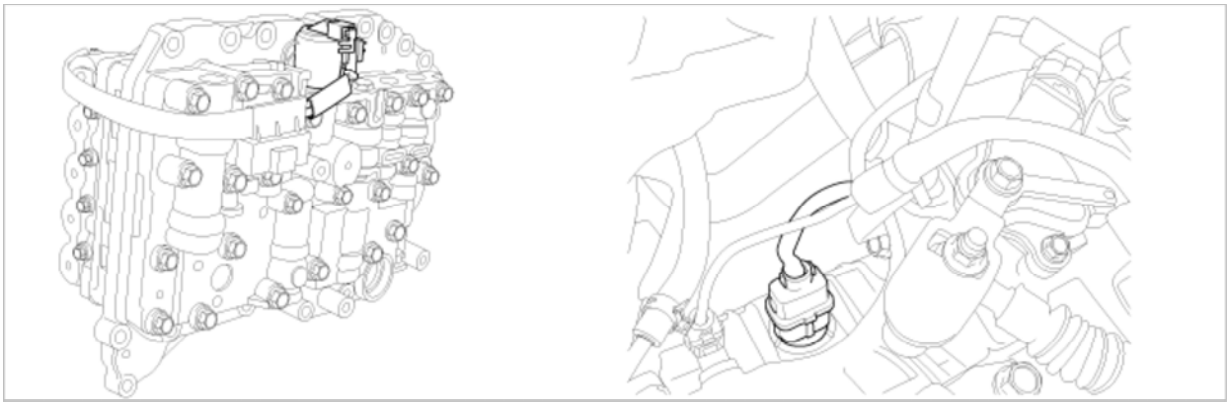
After a repair, it is essential to verify that the fault has been corrected.
1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Automatic Transaxle System > Automatic Transaxle System > P0748 Pressure Control Solenoid Valve(VFS) \'A\' Electrical

Component Location



General Description

Variable Foced Solenoid (Linear Solenoid) : With the duty control which uses higher frequency(600Hz), instead of the existing PWM type which adapts low frequency(60Hz) to control,spool valve can be conrolled precisely
In PWM control,the amount of oil flow is determined by the duration of "ON"signal among continuously repeated ON/OFF signals.
In VFS, the amount is decided by how widely spool valve open the passage of going through.

DTC Description

The TCM checks the VFS 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 judges that the Low and Reverse control solenoid circuit is malfunctioning and sets this code.

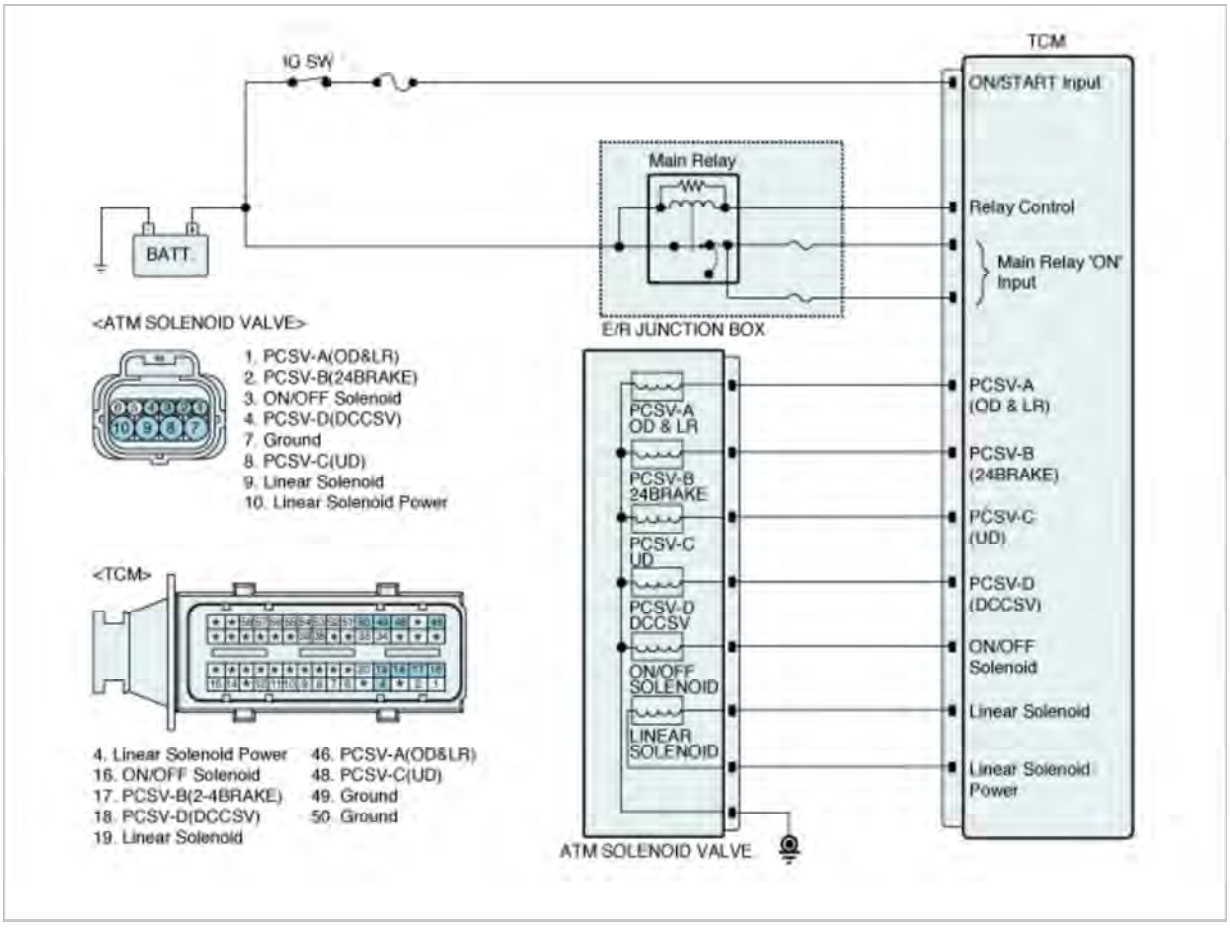
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check feed back period	• Open or short in circuit • Faulty VF SOLENOID VALVE • Faulty PCM/TCM
Enable Conditions	• 16V > Actuator(TCU) power supply voltage >10V	
Threshold Value	• Circuit open or short to ground	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked in 3 rd gear.	

Specification

Solenoid Valve for Pressure Control
- Sensor type : Normal open 3-way
- Operating temperature : -30°C~130°C
- Frequency :PCSV-A,B,C,D :50Hz (at the ATF temp. -20°C above)
  VFS : 400~1000
  ※ KM series : 35Hz
- Internal resistance : 3.5 ± 0.2 Ω(20°C)
- Surge voltage : 56 V

Diagnostic Circuit Diagram



Signal Waveform

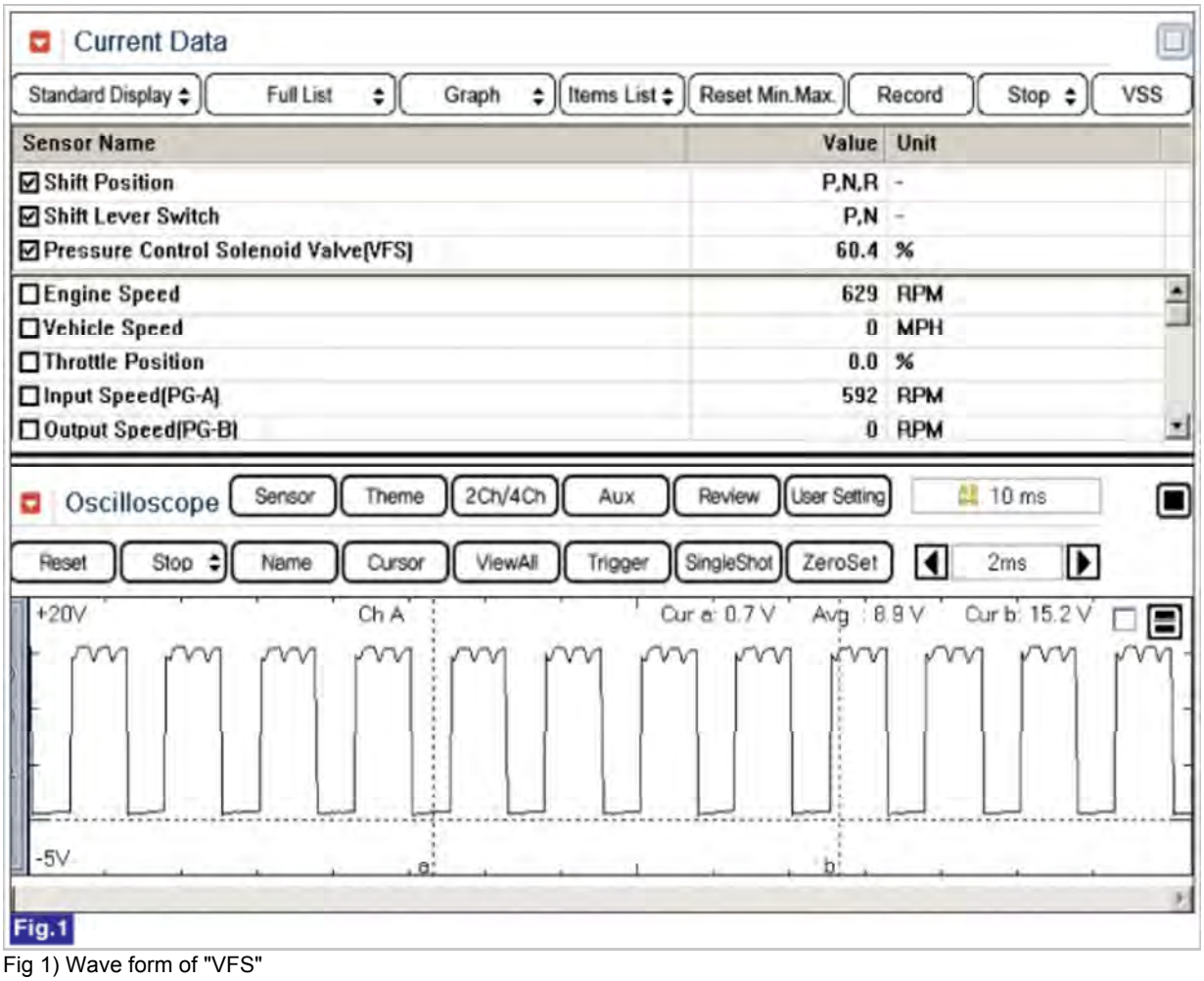
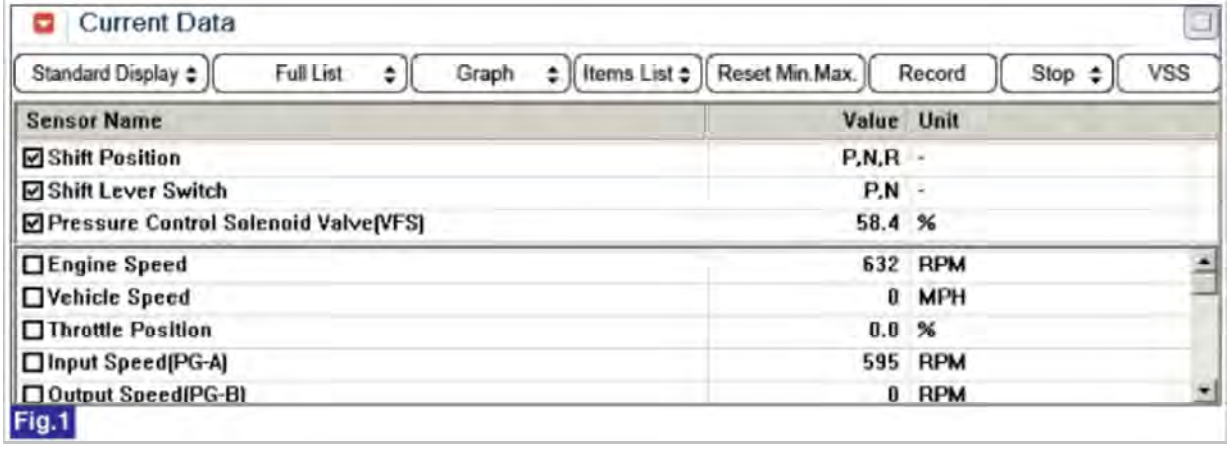


Fig 1) Wave form of "VFS"

Monitor GDS Data

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



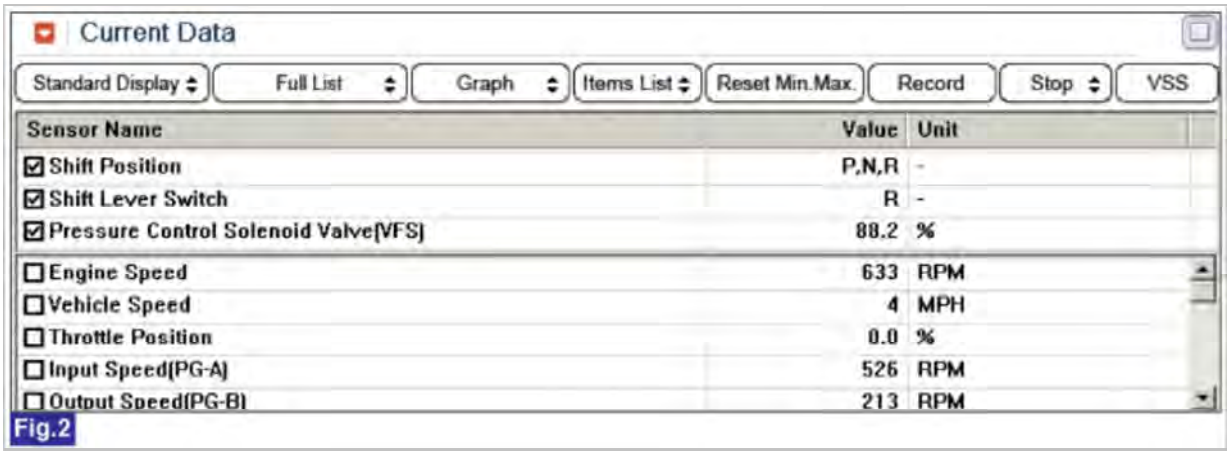


Fig.2

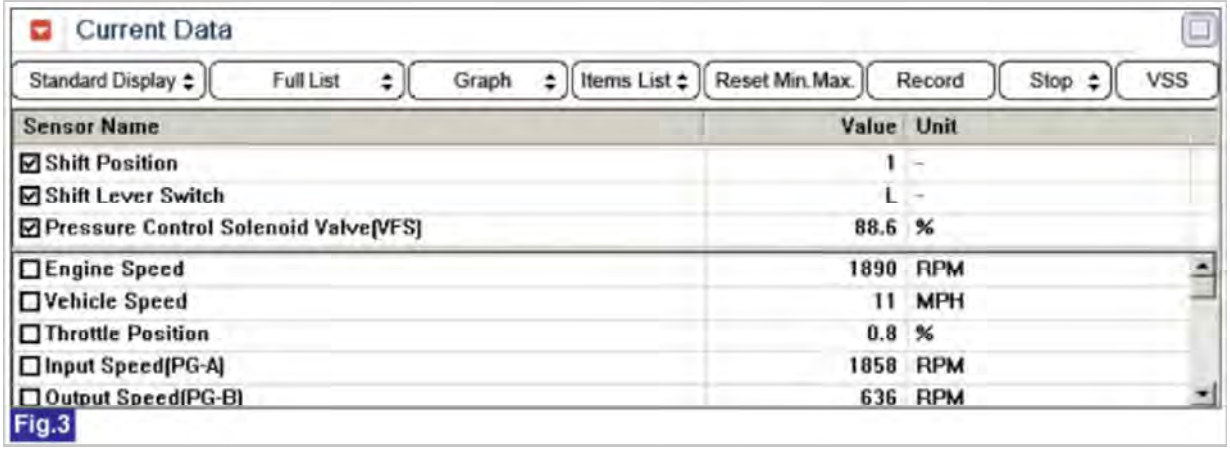


Fig.3

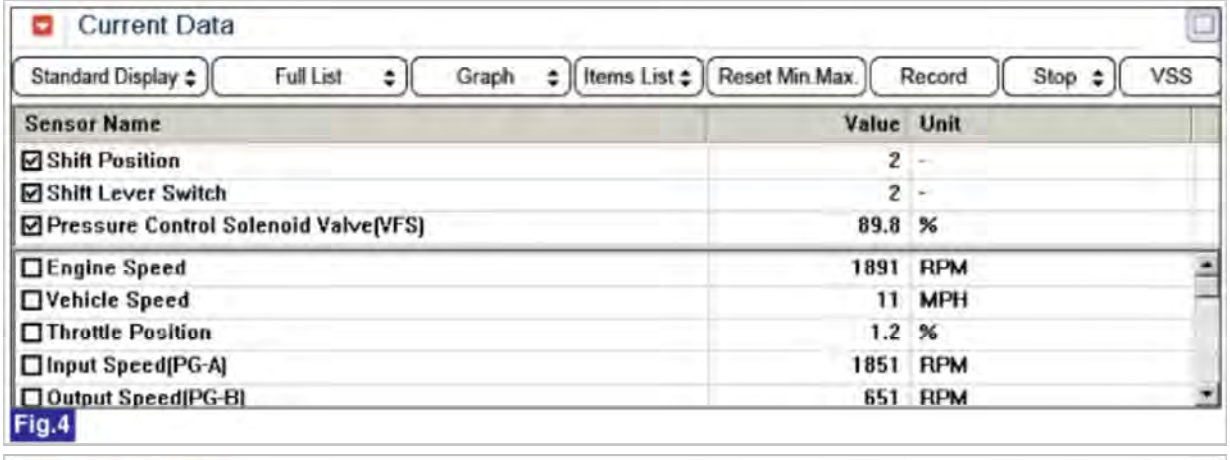


Fig.4

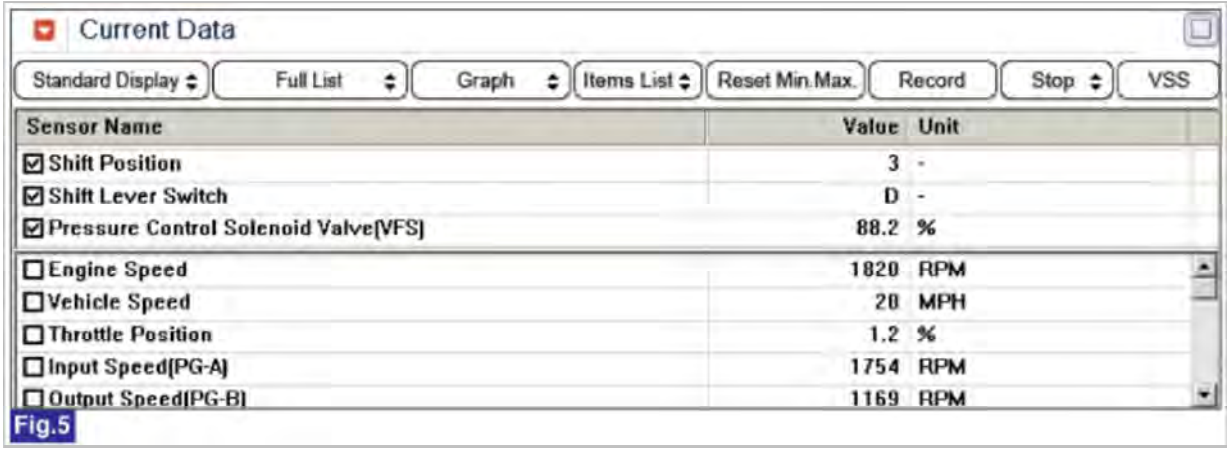


Fig.5

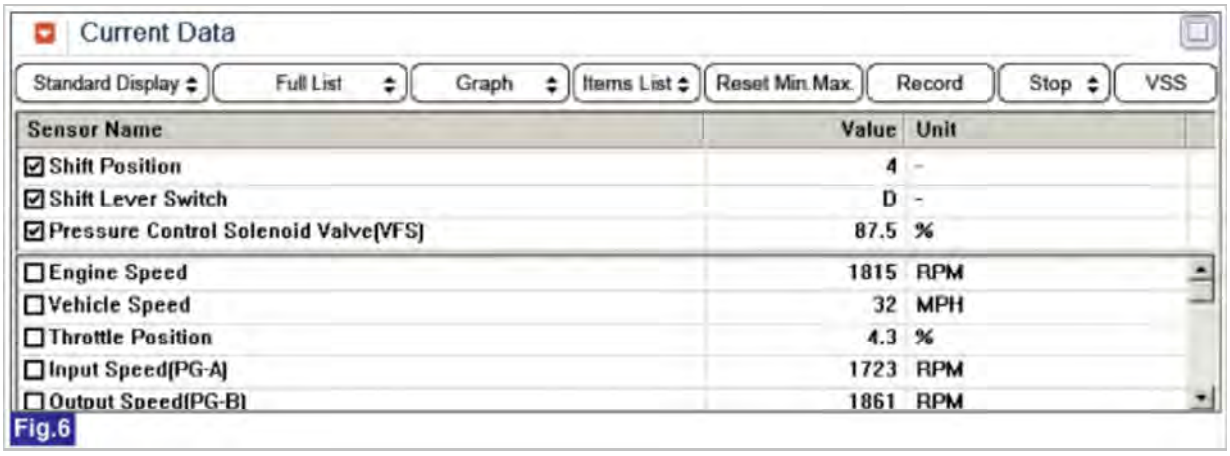


Fig 1) "P,N"
Fig 2) "R"
Fig 3) "1st" gear
Fig 4) "2nd" gear
Fig 5) "3rd" gear
Fig 6) "4th" gear

5. Does "VF SOL DUTY " follow the referance data?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "W/Harness Inspection " procedure.

Terminal and Connector Inspection

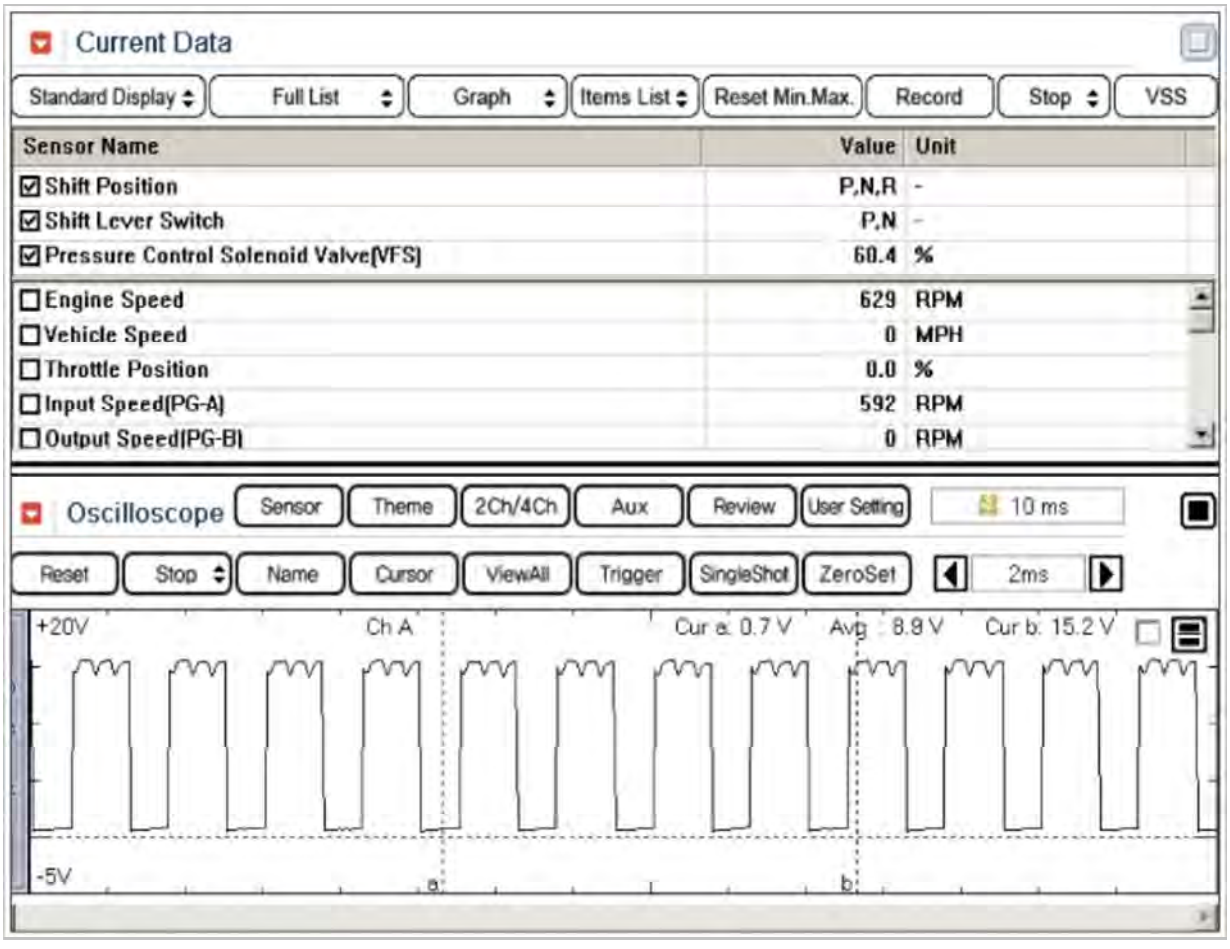
1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,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

YES	▸ Repair as necessary and go to "Verification vehicle Repair" procedure.
NO	▸ Go to "Power Circuit Inspection" procedure.

Power Circuit Inspection

1. Check signal waveform
   (1) Connect "A/T SOLENOID VALVE" connector and install device for measuring wave form.
   (2) Turn on the Engine and Drive in nomal condition.
   (3) Measure wave form between "LINEAR SOLENOID" teminal of the sensor harness connector and chassis ground.

Wave form of LINEAR SOLENOID



(4) Is measured normally operating wave form?

YES	▸ Go to "Check open or short to ground in the power harness" procedure.
NO	▸ Check for open in harness. Repair as necessary and Go to "Verification Vehicle Repair" procedure.

2. Check open or short to ground in the power harness

(1) Ignition "OFF".

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

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

(4) Measure resistance between "LINEAR SOLENOID" terminal of the ATM SOLENOID VALVE harness connector and "LINEAR SOLENOID" terminal of the PCM/TCM harness connector.

Specification : In case of open - approx. 0 Ω
In case of short to ground - Infinite

(5) Is measured normally operating wave form?

YES	▸ Go to "Signal circuit inspection" procedure.
NO	▸ Check for open or short to ground 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 "LINEAR SOLENOID" terminal of the ATM SOLENOID VALVE harness connector and "LINEAR SOLENOID" terminal of the PCM/TCM 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 "PCM/TCM" connector.

(3) Measure resistance between "LINEAR SOLENOID" terminal 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 Valve

(1) Ignition "OFF".

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

(3) Measure resistance between "Pressure Control Solenoid Valve" terminal and "Ground" terminal of the ATM SOLENOID VALVE harness connector.

Specification : Approximately 3.5 ± 0.2 Ω (25°C)

(4) Is resistance within specifications?

YES	▸ Go to "CHECK PCM/TCM" as below.
NO	▸ Replace "VF SOL VALVE" as necessary and go to "Verification Vehicle Repair" procedure.

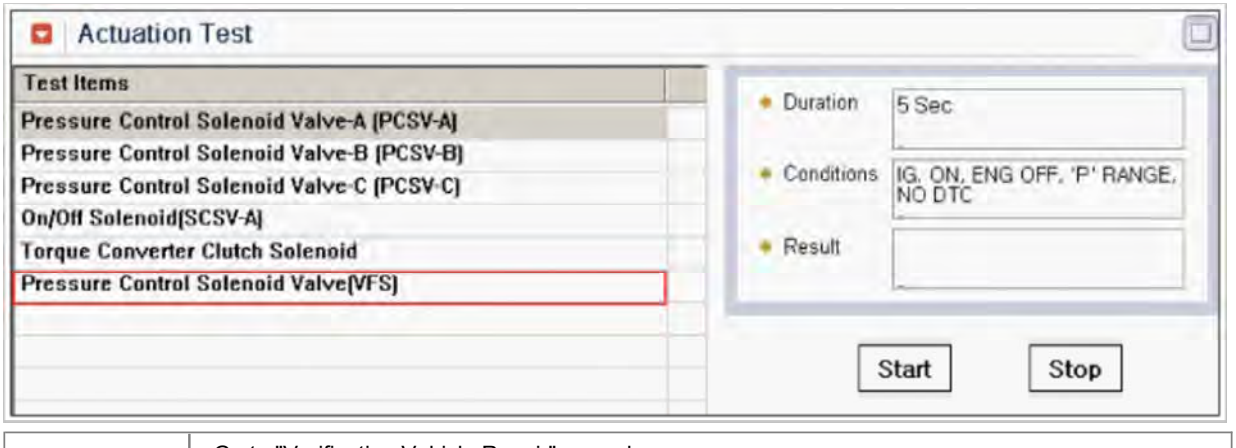
2. Check PCM/TCM

(1) Connect GDS 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 "VF SOL VALVE" Actuator Testing Function ?



	▸ Go to "Verification Vehicle Repair" procedure.

YES	
NO	▸ Replace PCM/TCM as necessary and Go to "Verificaiton Vehicle Repair" procedure.

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0km/h
5. Throttle position sensor< 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

Verification of Vehicle Repair

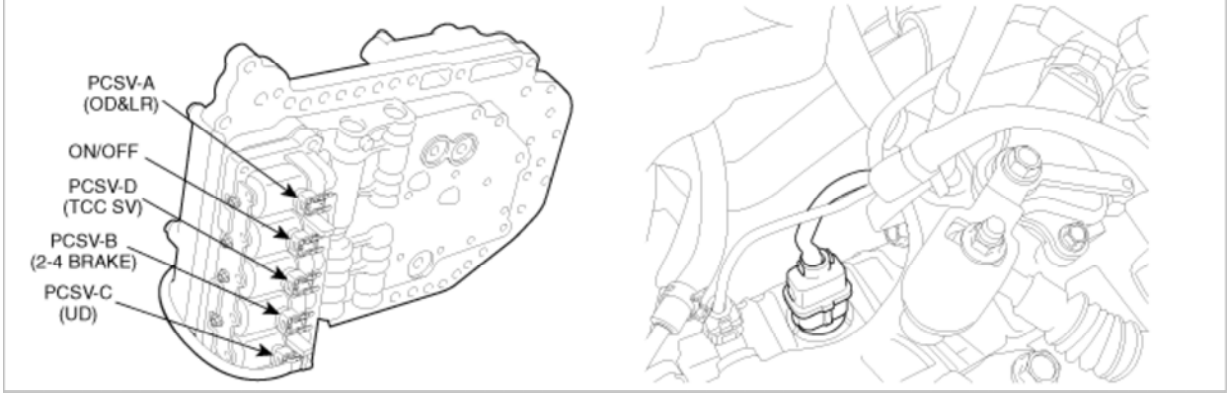
After a repair, it is essential to verify that the fault has been corrected.

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 > Automatic Transaxle System > P0750 Shift Control Solenoid Valve \'A\' (Low&Reverse Brake Solenoid)

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), 2-4 (2-4 Brake), UD (Under Drive Clutch), OD (Over Drive Clutch).

DTC Description

The PCM/TCM 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 PCM/TCM judges that the Low and Reverse control solenoid circuit is malfunctioning and sets this code.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
	DTC Strategy	• Circuit low	

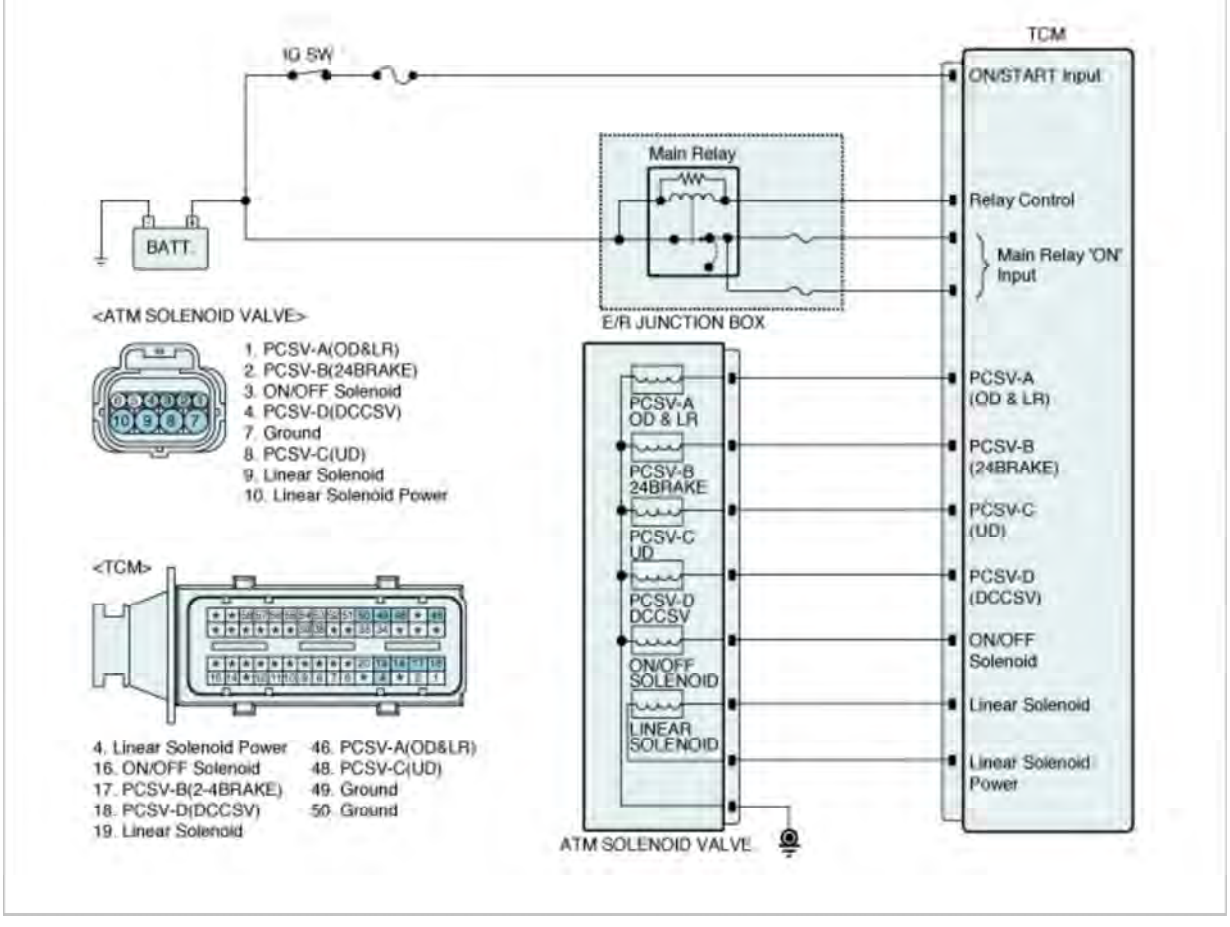
Case 1	Enable Conditions	• Solenoid PWM 0%	• Open or short in circuit • Faulty ON/OFF SOLENOID VALVE • Faulty PCM/TCM
	Threshold Value	• Feedback Voltage <5.5V	
Case 2	DTC Strategy	• Circuit high	
	Enable Conditions	• Solenoid PWM 100% • Shift status in-gear • Time after TCM turns on 0.5 sec • Solenoid power voltage >10V and <16V	
	Threshold Value	• Feedback Voltage >battery voltage-1V	
Diagnostic Time		• More than 0.3sec	
Fail Safe		• Locked in 3 rd gear.	

Specification

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -30°C~130°C
- Frequency :PCSV-A,B,C,D :50Hz (at the ATF temp. -20°C above)
  VFS : 400~1000
  ※ KM series : 35Hz
- Internal resistance : 3.5 ± 0.2 Ω(20°C)
- Surge voltage : 56 V

Diagnostic Circuit Diagram



Signal Waveform

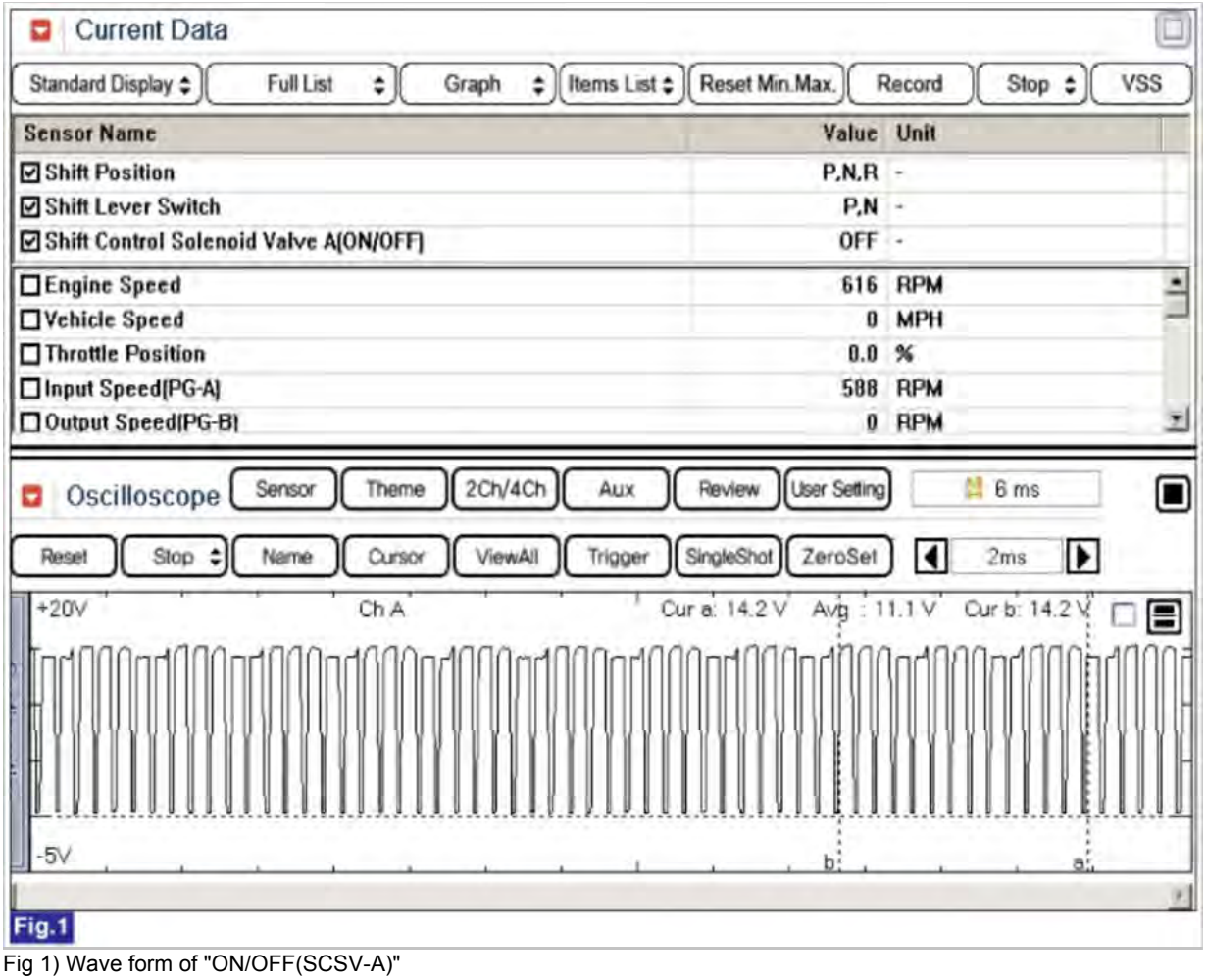
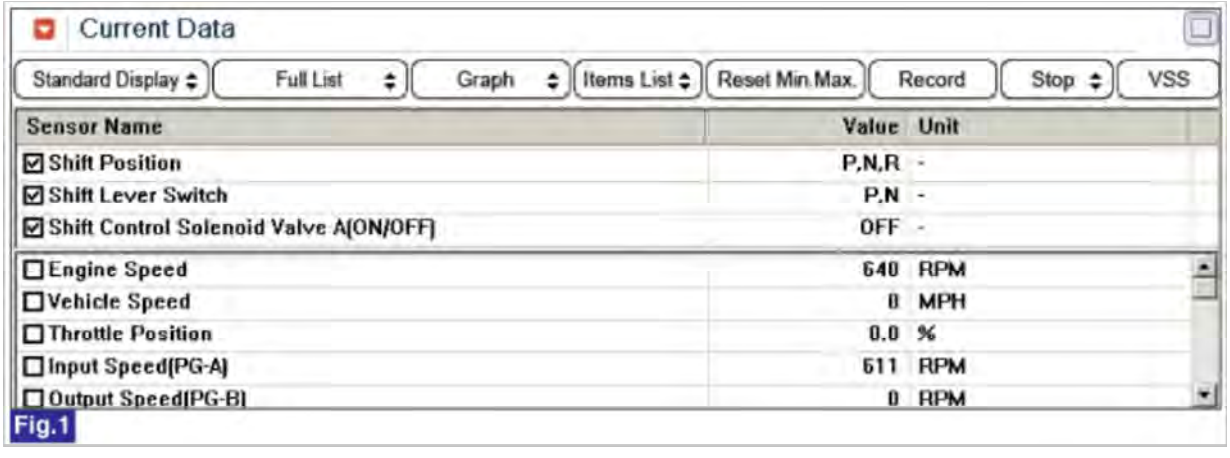


Fig 1) Wave form of "ON/OFF(SCSV-A)"

Monitor GDS Data

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "ON/OFF(SCSV-A) SOLENOID VALVE" parameter on the GDS.
4. Shift gear at each position.



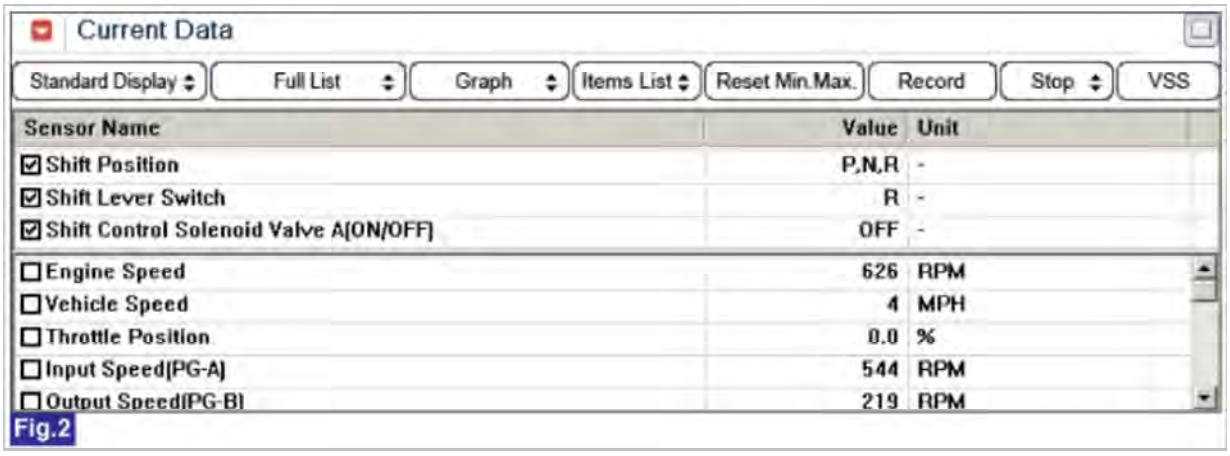


Fig.2

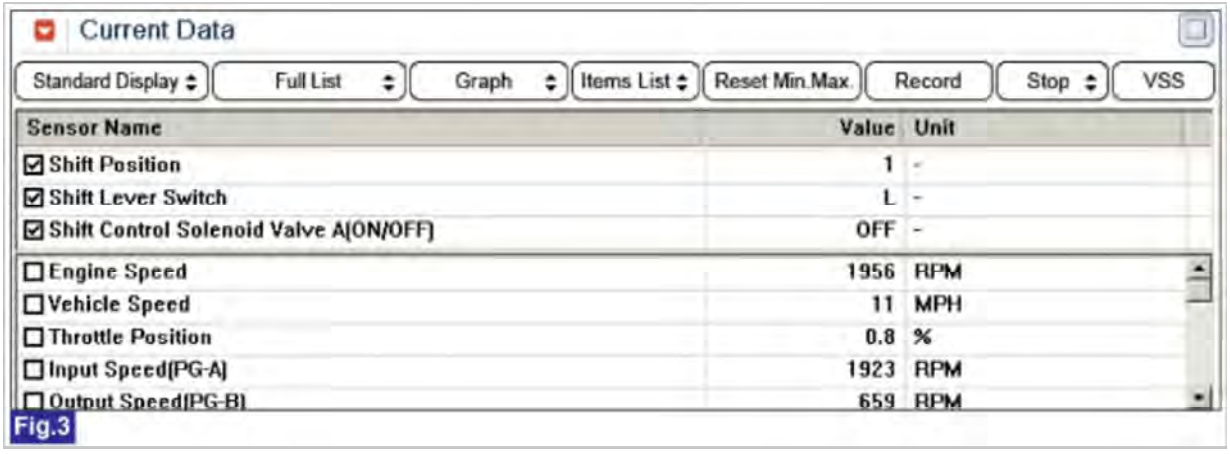


Fig.3

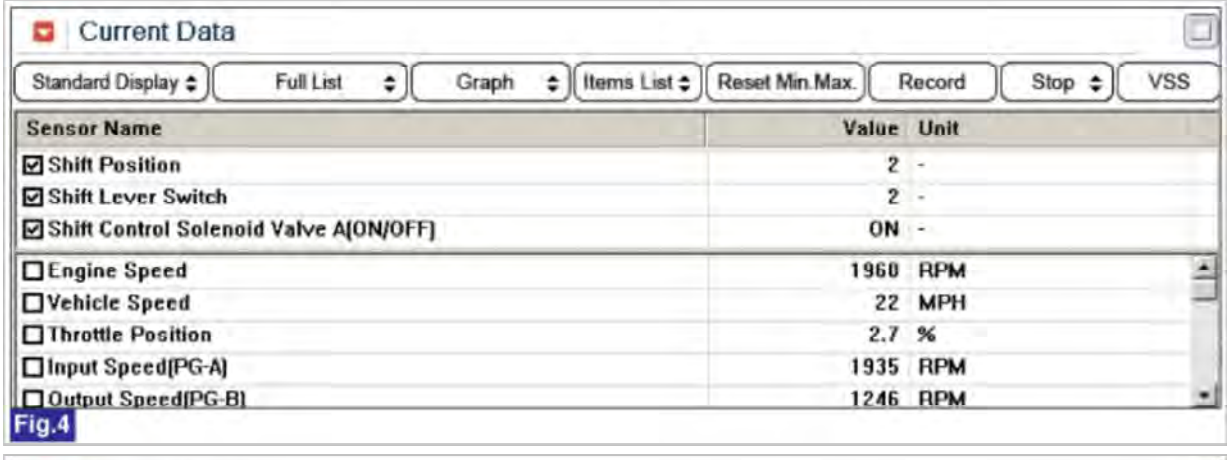


Fig.4

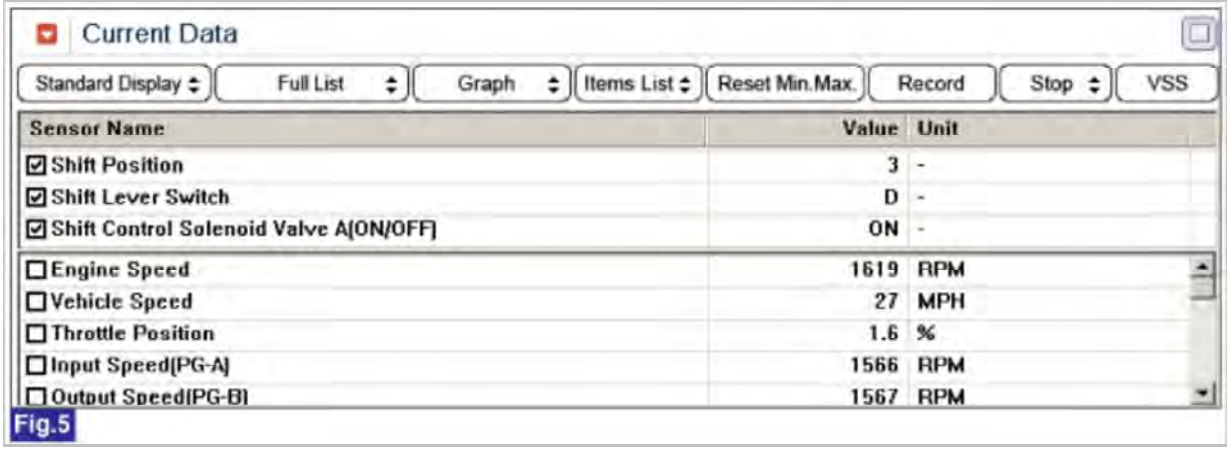


Fig.5

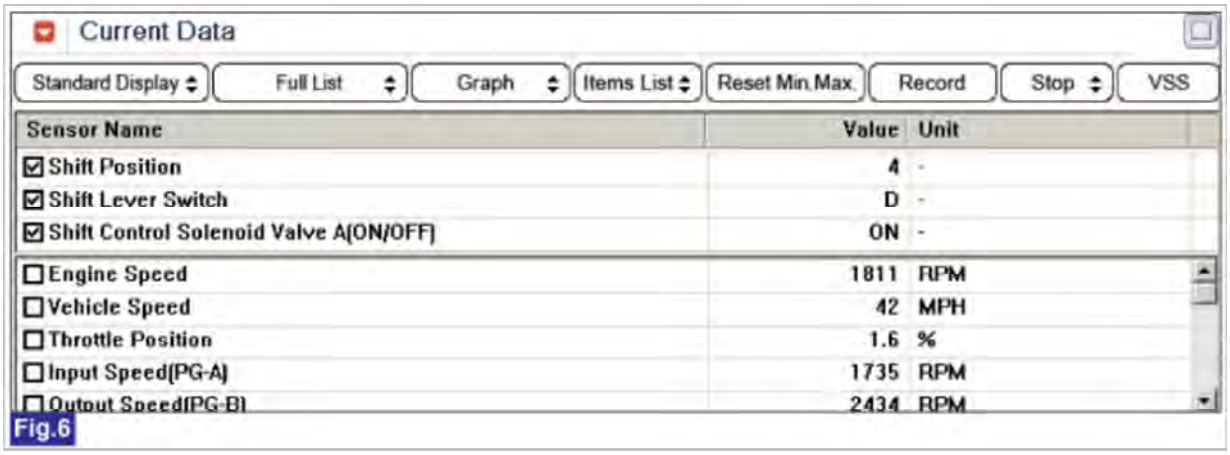


Fig 1) "P,N"
Fig 2) "R"
Fig 3) "1st" gear
Fig 4) "2nd" gear
Fig 5) "3rd" gear
Fig 6) "4th" gear

5. Does "ON/OFF SOL VALVE" follow the referance data?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "W/Harness Inspection " procedure.

Terminal and Connector Inspection

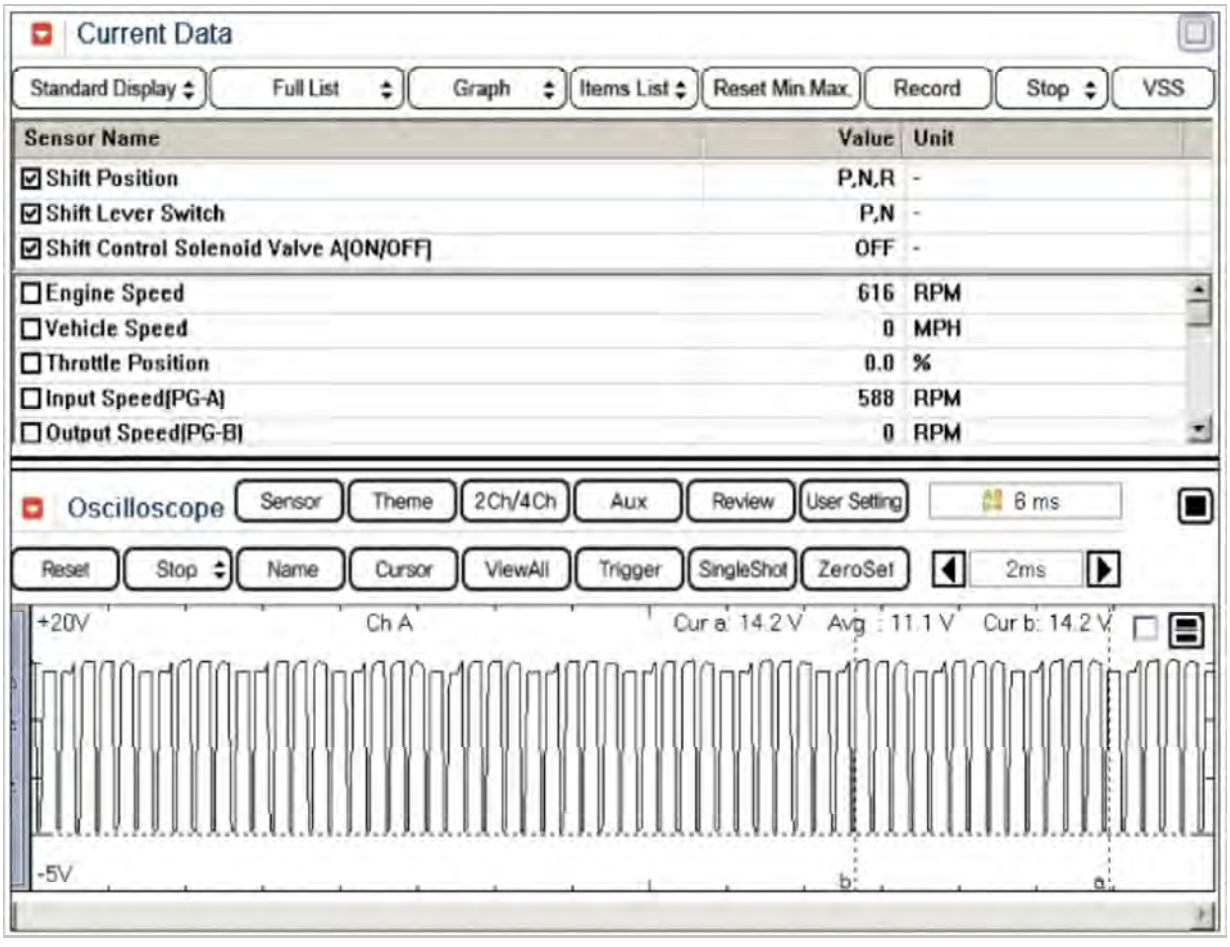
1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,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

YES	▸ Repair as necessary and go to "Verification vehicle Repair" procedure.
NO	▸ Go to "Power Circuit Inspection" procedure.

Power Circuit Inspection

1. Connect "A/T SOLENOID VALVE" connector and install device for measuring wave form.
2. Turn on the Engine and Drive in nomal condition.
3. Measure wave form between "ON/OFF(SCSV-A) SOLENOID VALVE" teminal of the sensor harness connector and chassis ground.

Wave form of ON/OFF SOLENOID



4. Is measured normally operating wave form?

YES	▸ Go to "Signal circuit inspection" procedure.
NO	▸ 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 "ON/OFF(SCSV-A) SOLENOID VALVE" terminal of the ATM SOLENOID VALVE harness connector and "ON/OFF(SCSV-A) SOLENOID VALVE" terminal of the PCM/TCM 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 "PCM/TCM" connector.
   (3) Measure resistance between "ON/OFF SOLENOID V/V" terminal 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

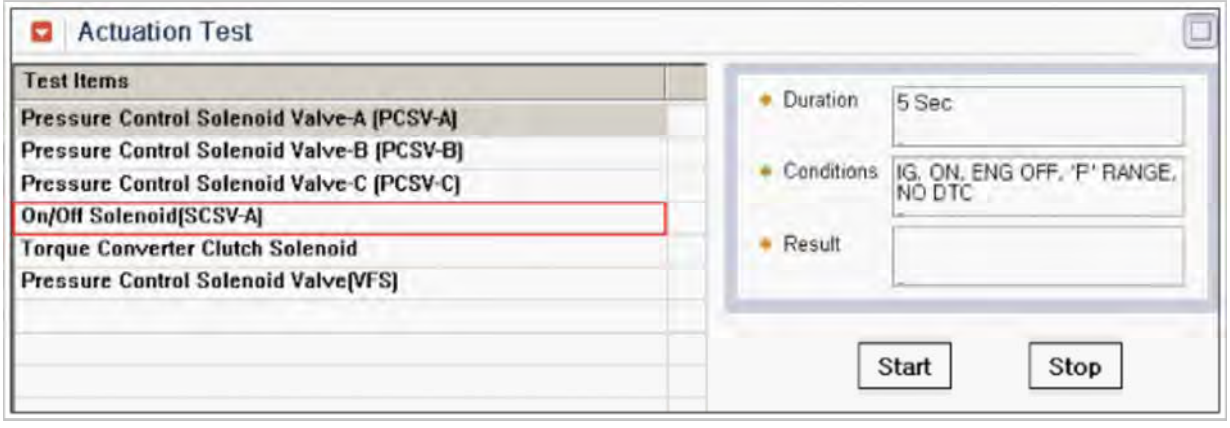
1. Check Solenoid Valve
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector.
   (3) Measure resistance between "ON/OFF SOLENOID V/V" terminal and "Ground" terminal of the ATM SOLENOID VALVE harness connector.

   Specification : Approximately 3.5 ± 0.2 Ω (25°C)

   (4) Is resistance within specifications?

YES	▸ Go to "CHECK PCM/TCM" as below.
NO	▸ Replace ON/OFF SOLENOID VALVE as necessary and go to "Verification Vehicle Repair" procedure.

2. Check PCM/PCM/TCM
   (1) Connect GDS to data link connector(DLC)
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T Solenoide valve Actuator test and Operate Actuator test.
   (4) Is Actuator Testing performed normally ?



YES	▸ Go to "Verification Vehicle Repair" procedure.
NO	▸ Replace PCM/TCM as necessary and Go to "Verificaiton Vehicle Repair" procedure.

ACTUATOR TEST CONDITION
1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0km/h
5. Throttle position sensor< 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

Verification of Vehicle Repair

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 > Automatic Transaxle System > P0755 Shift Control Solenoid Valve \'B\'(Under Drive Clutch Solenoid)

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), 2-4 (2-4 Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch).

DTC Description

The PCM/TCM 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 PCM/TCM judges that Under Drive Clutch contorl solenoid circuit is malfunctioning and sets this code.

DTC Detecting Condition

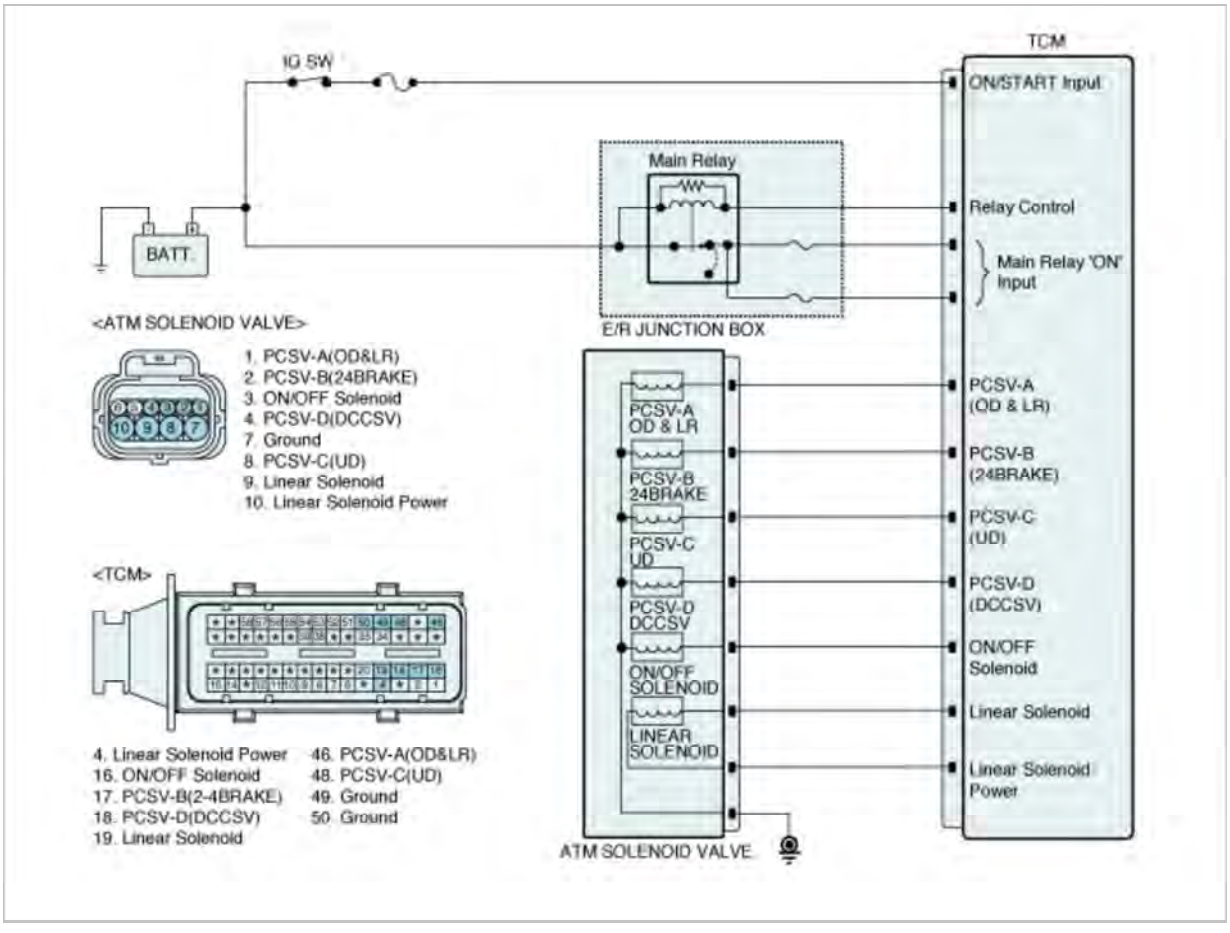
Item		Detecting Condition	Possible Cause
Case 1	DTC Strategy	• Circuit low	• Open or short in circuit • Faulty UD SOLENOID VALVE • Faulty PCM/TCM
	Enable Conditions	• Solenoid PWM 0%	
	Threshold Value	• Feedback Voltage <5.5V	
Case 2	DTC Strategy	• Circuit high	
	Enable Conditions	• Solenoid PWM 100% • Shift status in-gear • Time after TCM turns on 0.5 sec • Solenoid power voltage >10V and <16V	
	Threshold Value	• Feedback Voltage >battery voltage-1V	
Diagnostic Time		• More than 0.3sec	
Fail Safe		• Locked in 3 rd gear.	

Specification

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -30°C~130°C
- Frequency :PCSV-A,B,C,D :50Hz (at the ATF temp. -20°C above)
  VFS : 400~1000
  ※ KM series : 35Hz
- Internal resistance : 3.5 ± 0.2 Ω(20°C)
- Surge voltage : 56 V

Diagnostic Circuit Diagram



Signal Waveform

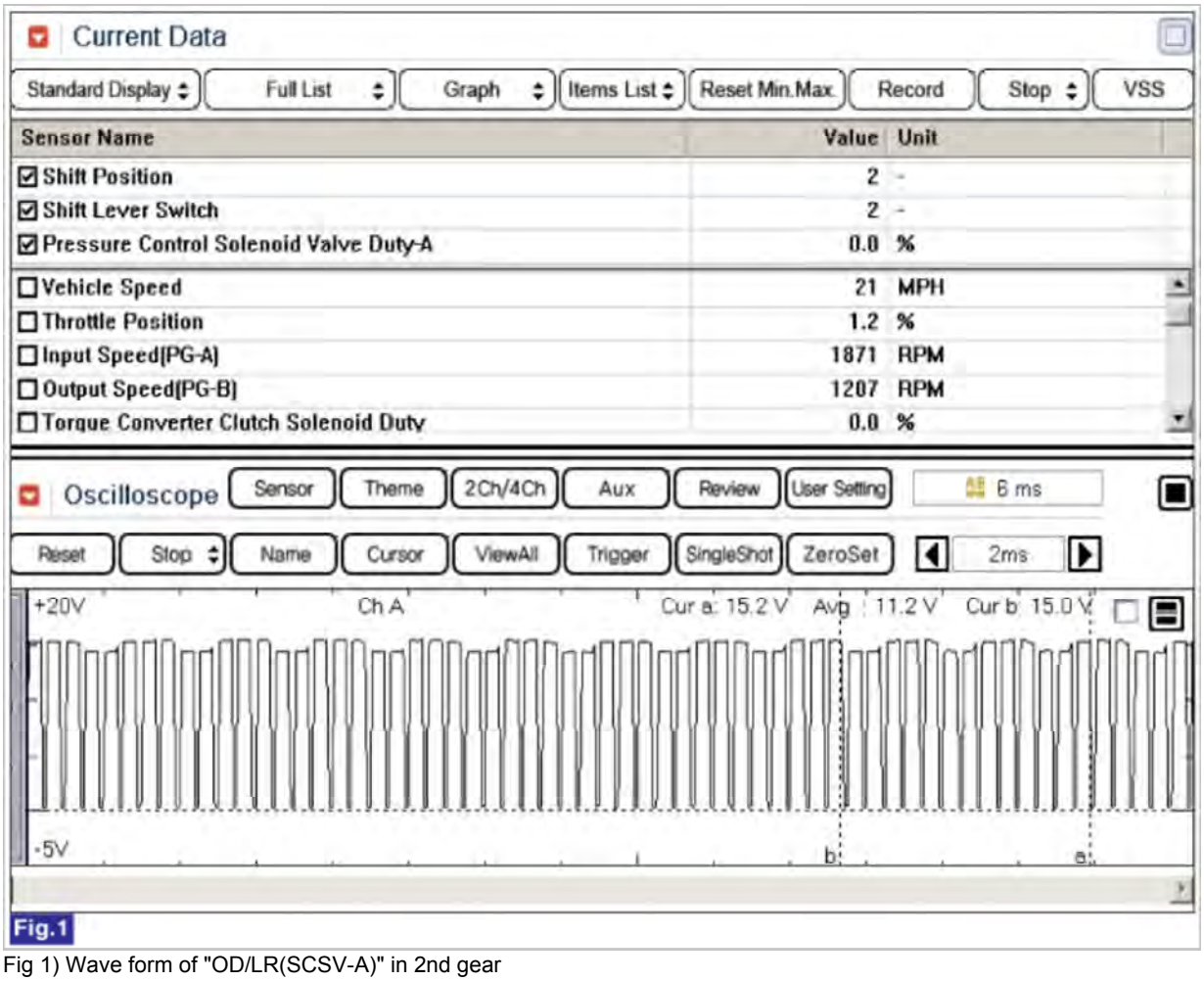
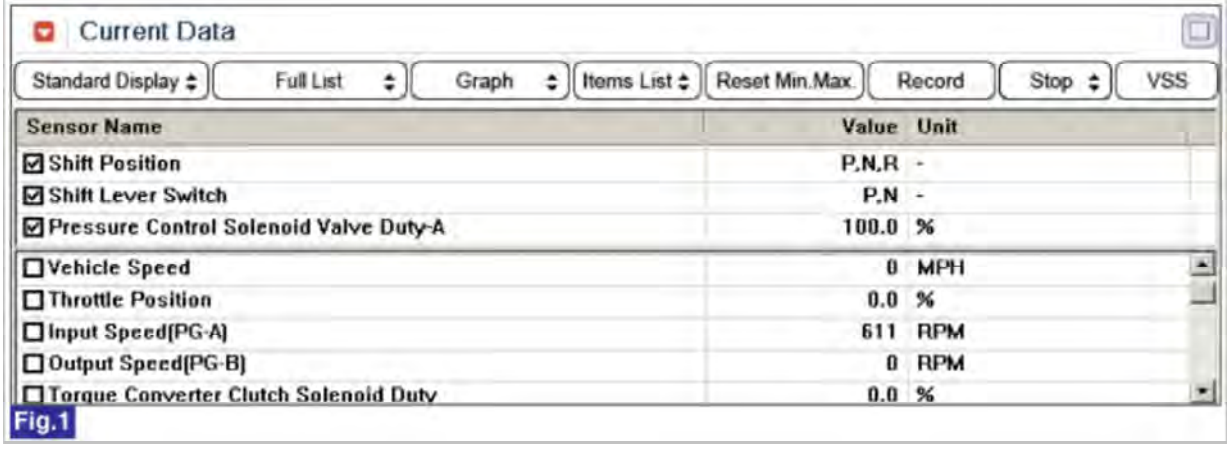


Fig 1) Wave form of "OD/LR(SCSV-A)" in 2nd gear

Monitor GDS Data

1. Connect scantool to data link connector(DLC)
2. Engine "ON".
3. Monitor the "PCSV-A(OD &LR) SOLENOID VALVE" parameter on the GDS.
4. Shift gear at each position.



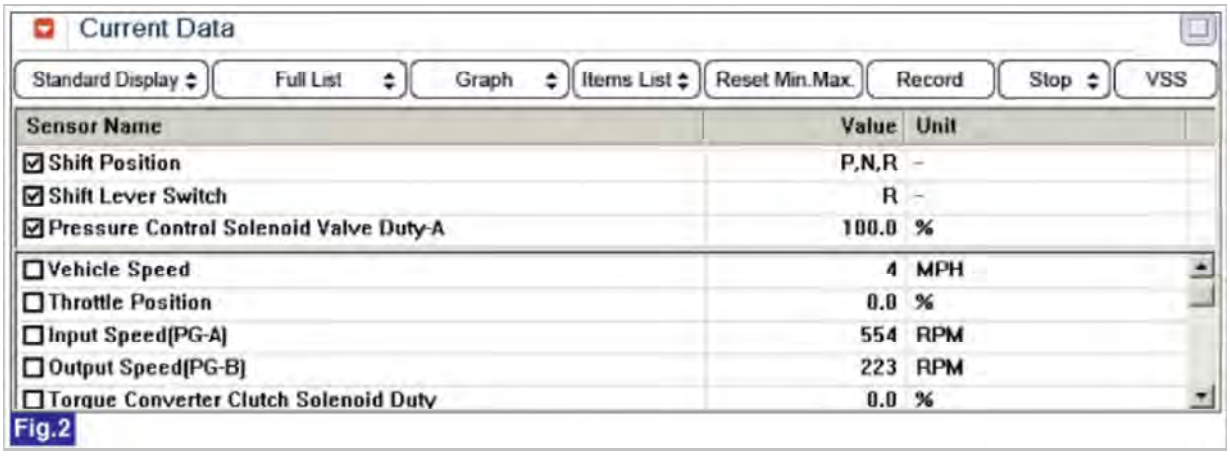


Fig.2

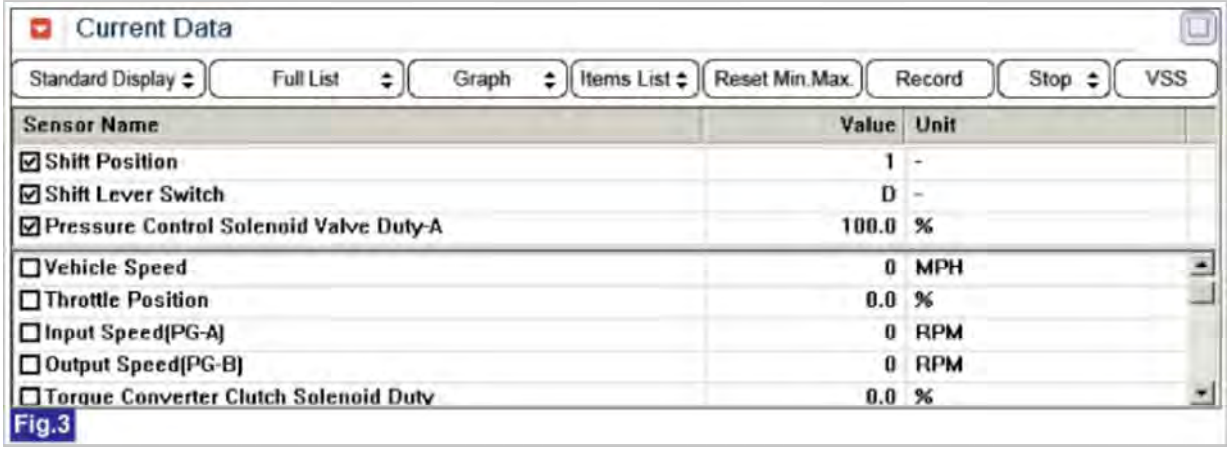


Fig.3

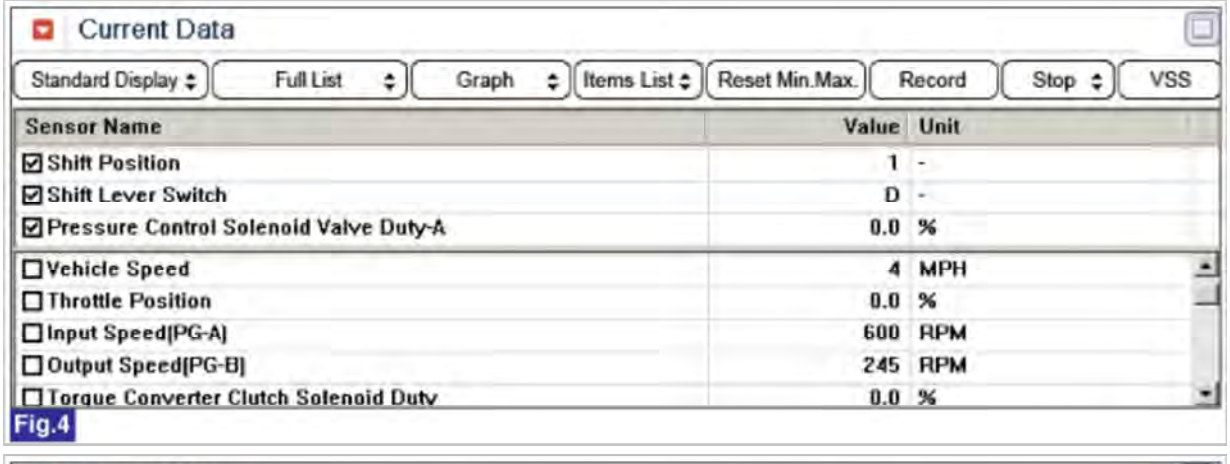


Fig.4

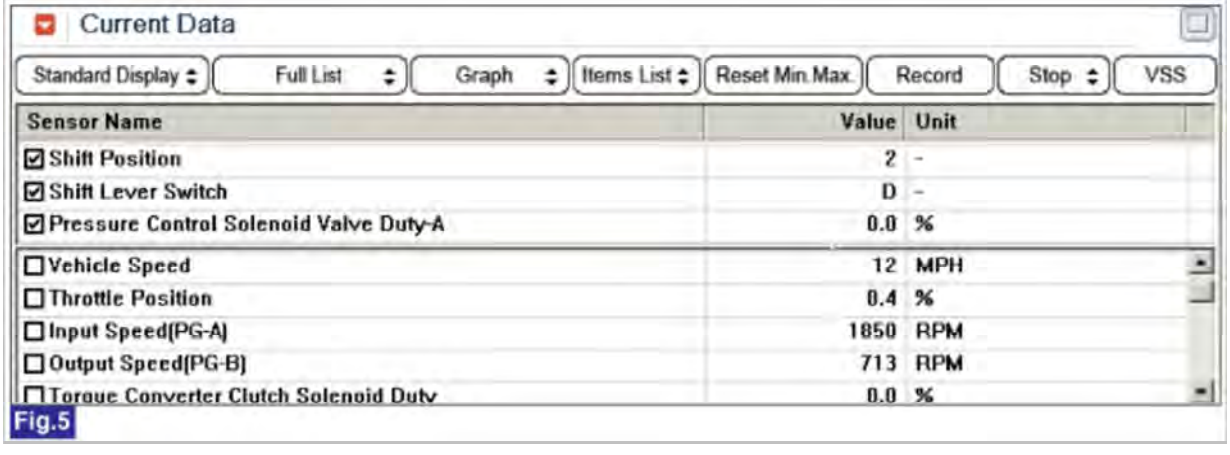


Fig.5

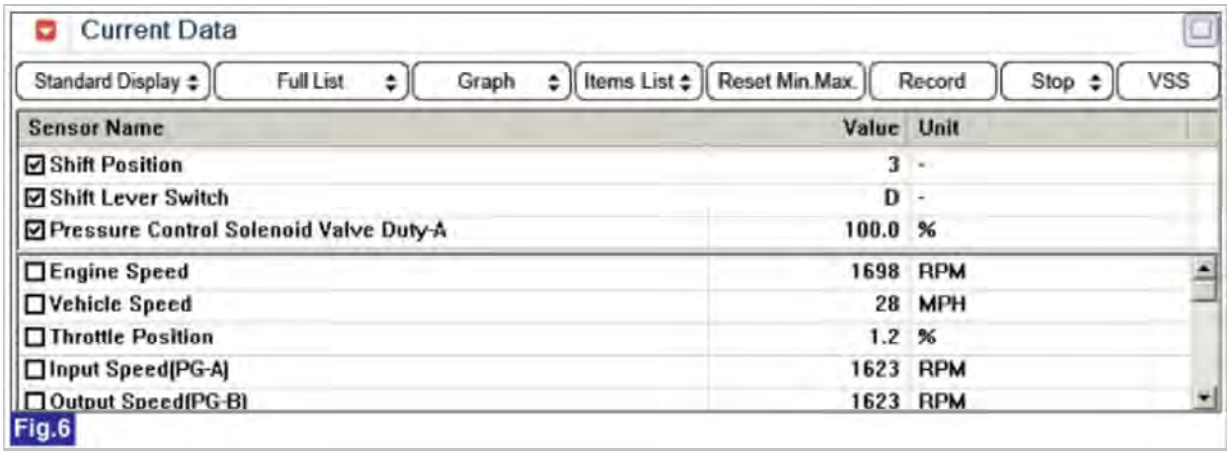


Fig.6

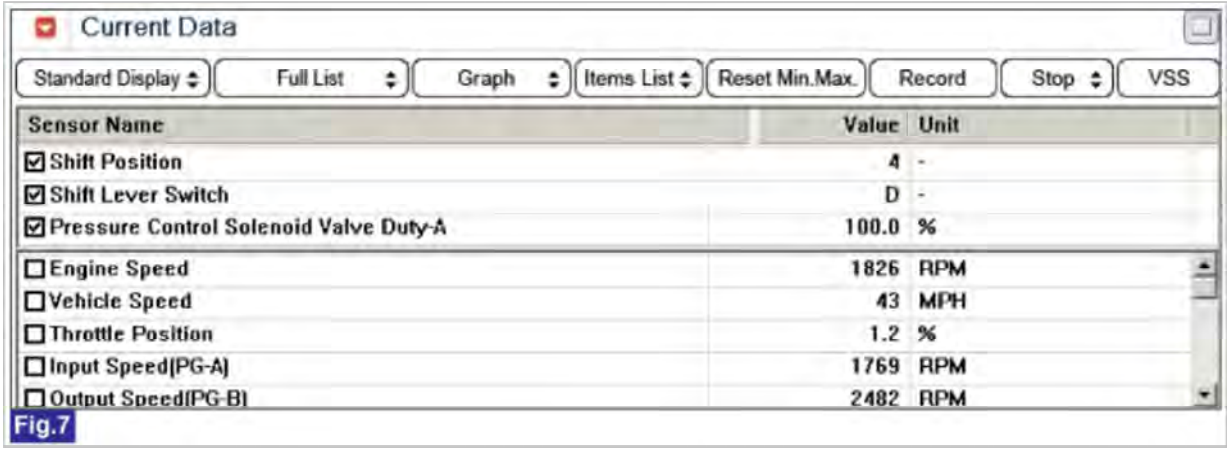


Fig.7

Fig 1) "P,N"
Fig 2) "R"
Fig 3) "D Range 1st" gear,VEHICLE SPEED=0
Fig 4) "D Range 1st" gear
Fig 5) "D Range 2nd" gear
Fig 6) "D Range 3rd" gear
Fig 7) "D Range 4th" gear

5. Does "PCSV-A(OD &LR) SOLENOID VALVE" follow the referance data?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or TCM(PCM)'s connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "W/Harness Inspection " procedure.

Terminal and Connector Inspection

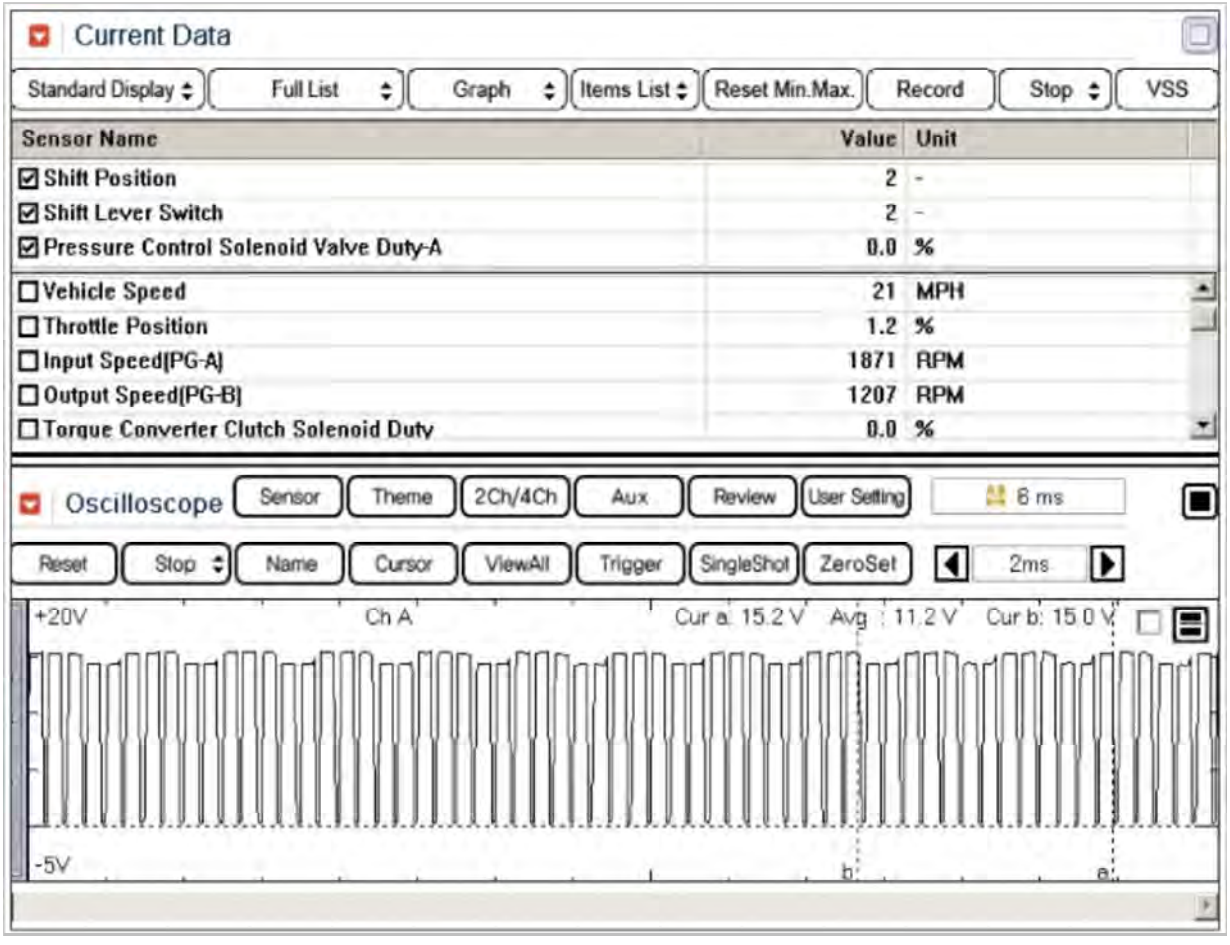
1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,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

YES	▸ Repair as necessary and go to "Verification vehicle Repair" procedure.
NO	▸ Go to "Power Circuit Inspection" procedure.

Power Circuit Inspection

1. Connect "A/T SOLENOID VALVE" connector and install device for measuring wave form.
2. Turn on the Engine and operate Damper clutch.
3. Measure wave form between "PCSV-A(OD&LR)" teminal of the sensor harness connector and chassis ground.

Wave form of OD/LR SOLENOID



4. Is measured normally operating wave form?

YES	▸ Go to "Signal circuit inspection" procedure.
NO	▸ 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 "PCSV-A(OD&LR)" terminal of the ATM SOLENOID VALVE harness connector and "PCSV-A(OD&LR)" terminal of the PCM/TCM 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 "PCM/TCM" connector.
   (3) Measure resistance "PCSV-A(OD&LR)" between terminal 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

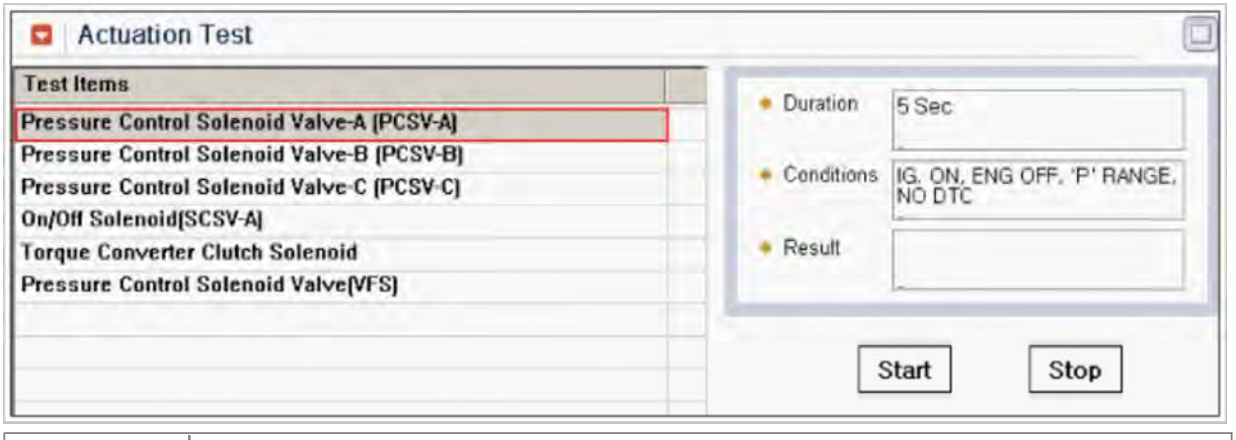
1. Check Solenoid Valve
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector.
   (3) Measure resistance between "PCSV-A(OD&LR)" terminal and "Ground" terminal of the ATM SOLENOID VALVE harness connector.

   Specification : Approximately 3.5 ± 0.2 Ω (25°C)

   (4) Is resistance within specifications?

YES	▸ Go to "CHECK PCM/TCM" as below.
NO	▸ Replace PCSV-A(OD &LR) SOLENOID VALVE as necessary and go to "Verification Vehicle Repair" procedure.

2. Check PCM/PCM/TCM
   (1) Connect GDS to data link connector(DLC)
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T Solenoide valve Actuator test and Operate Actuator test.
   (4) Is Actuator Testing performed normally ?



YES	▸ Go to "Verification Vehicle Repair" procedure.
NO	▸ Replace PCM/TCM as necessary and Go to "Verificaiton Vehicle Repair" procedure.

ACTUATOR TEST CONDITION
1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0km/h
5. Throttle position sensor< 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

Verification of Vehicle Repair

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 > Automatic Transaxle System > P0760 Shift Control Solenoid Valve \'C\'(2nd Brake Solenoid)

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), 2-4(2-4 Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch).

DTC Description

The PCM/TCM 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 PCM/TCM judges that 2nd Brake drive contorl solenoid circuit is malfunctioning and sets this code.

DTC Detecting Condition

Item		Detecting Condition & Limp Home	Possible cause
Case 1	DTC Strategy	• Circuit low	• Open or short in circuit • Faulty 2-4 SOLENOID VALVE • Faulty PCM/TCM
	Enable Conditions	• Solenoid PWM 0%	
	Threshold Value	• Feedback Voltage <5.5V	
Case 2	DTC Strategy	• Circuit high	
	Enable Conditions	• Solenoid PWM 100% • Shift status in-gear • Time after TCM turns on 0.5 sec • Solenoid power voltage >10V and <16V	
	Threshold Value	• Feedback Voltage >battery voltage-1V	
Diagnostic Time		• more than 0.3sec	

Fail Safe	• Locked in 3 rd gear.	

Specification

Solenoid Valve for Pressure Control

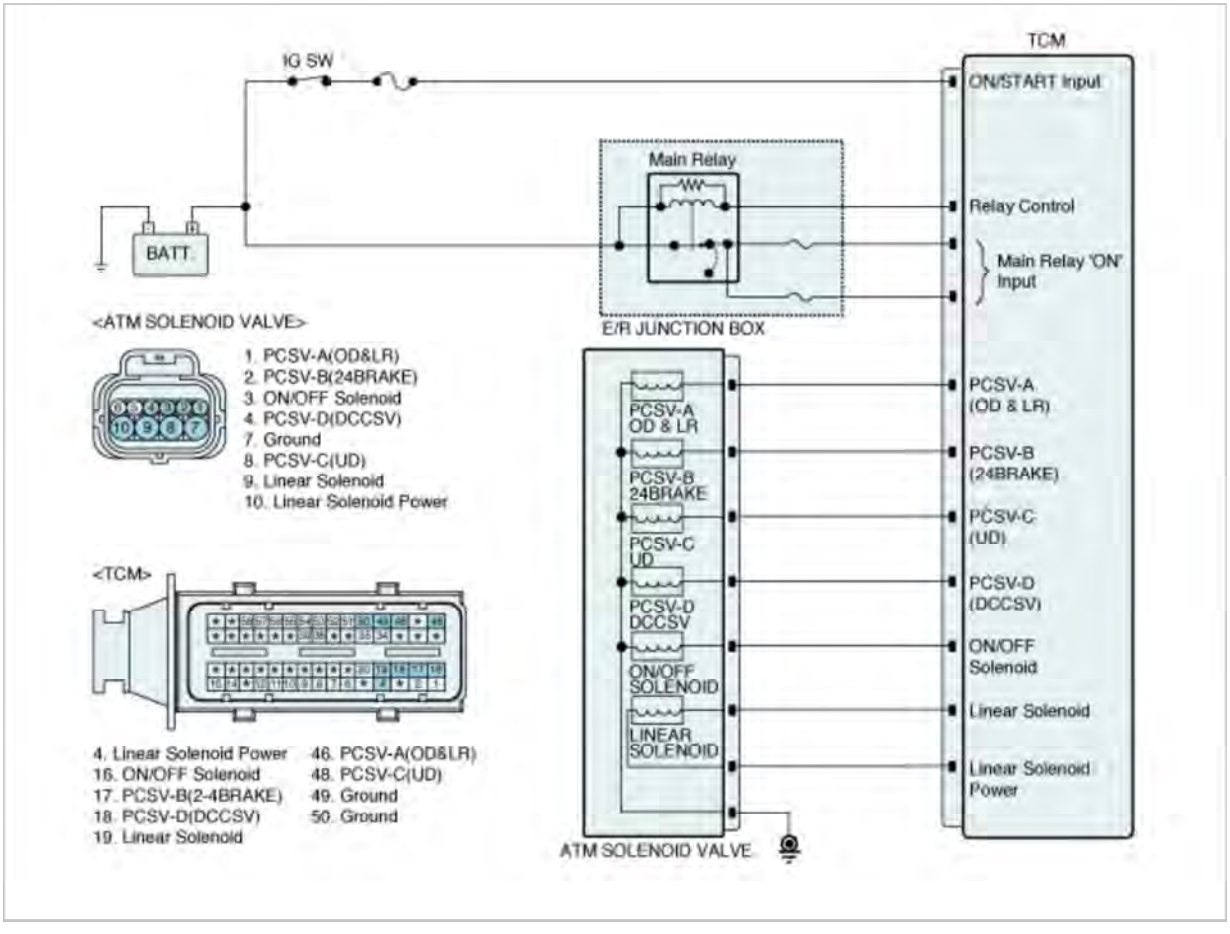
- Sensor type : Normal open 3-way
- Operating temperature : -30°C~130°C
- Frequency :PCSV-A,B,C,D :50Hz (at the ATF temp. -20°C above)

VFS : 400~1000

※ KM series : 35Hz

- Internal resistance : 3.5 ± 0.2 Ω(20°C)
- Surge voltage : 56 V

Diagnostic Circuit Diagram



Signal Waveform

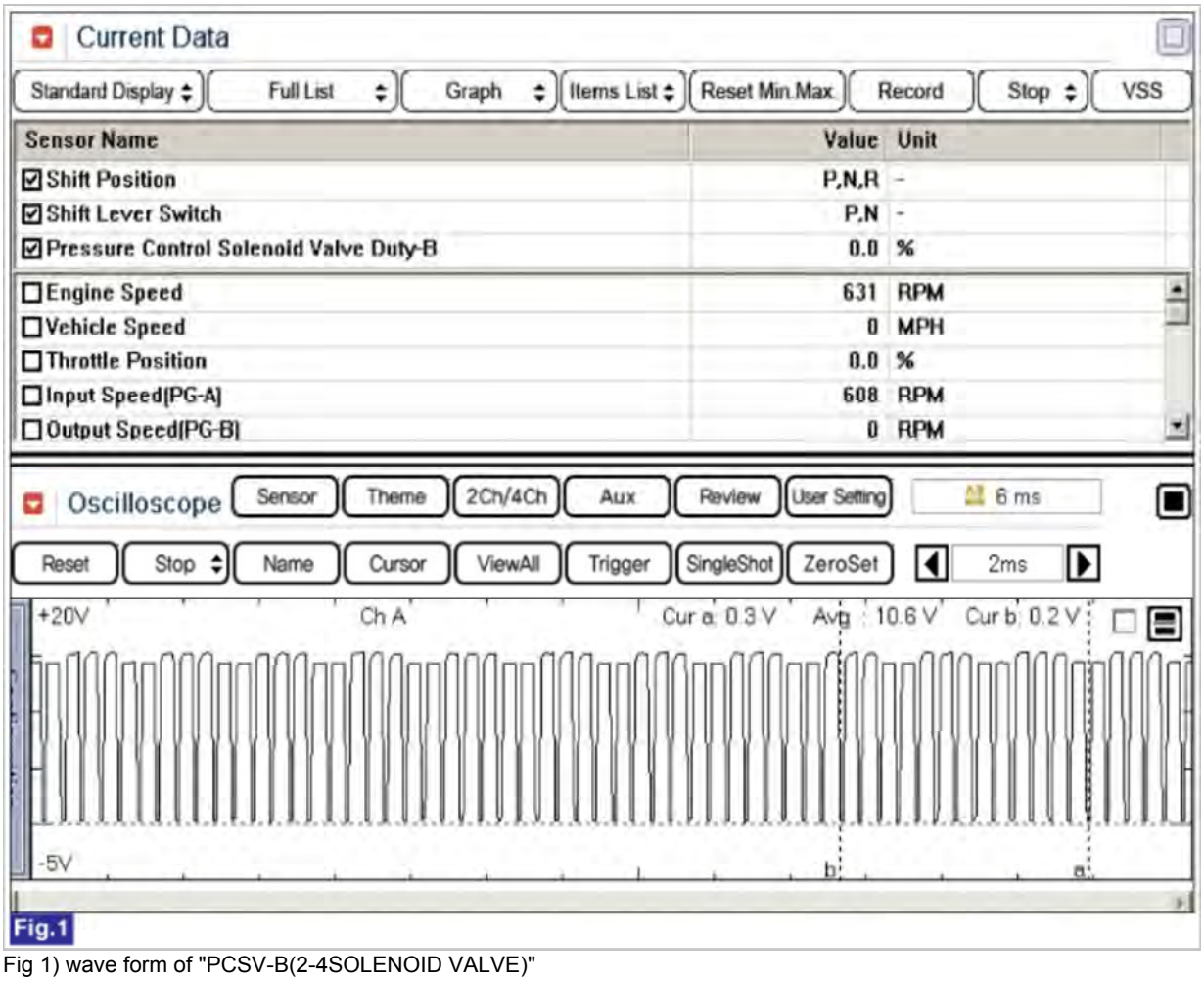


Fig 1) wave form of "PCSV-B(2-4SOLENOID VALVE)"

Monitor GDS Data

1. Connect GDS to data link connector(DLC)
2. Engine "ON".
3. Monitor the "PCSV-B(2-4SOLENOID VALVE)" parameter on the GDS
4. Shift gear at each position .

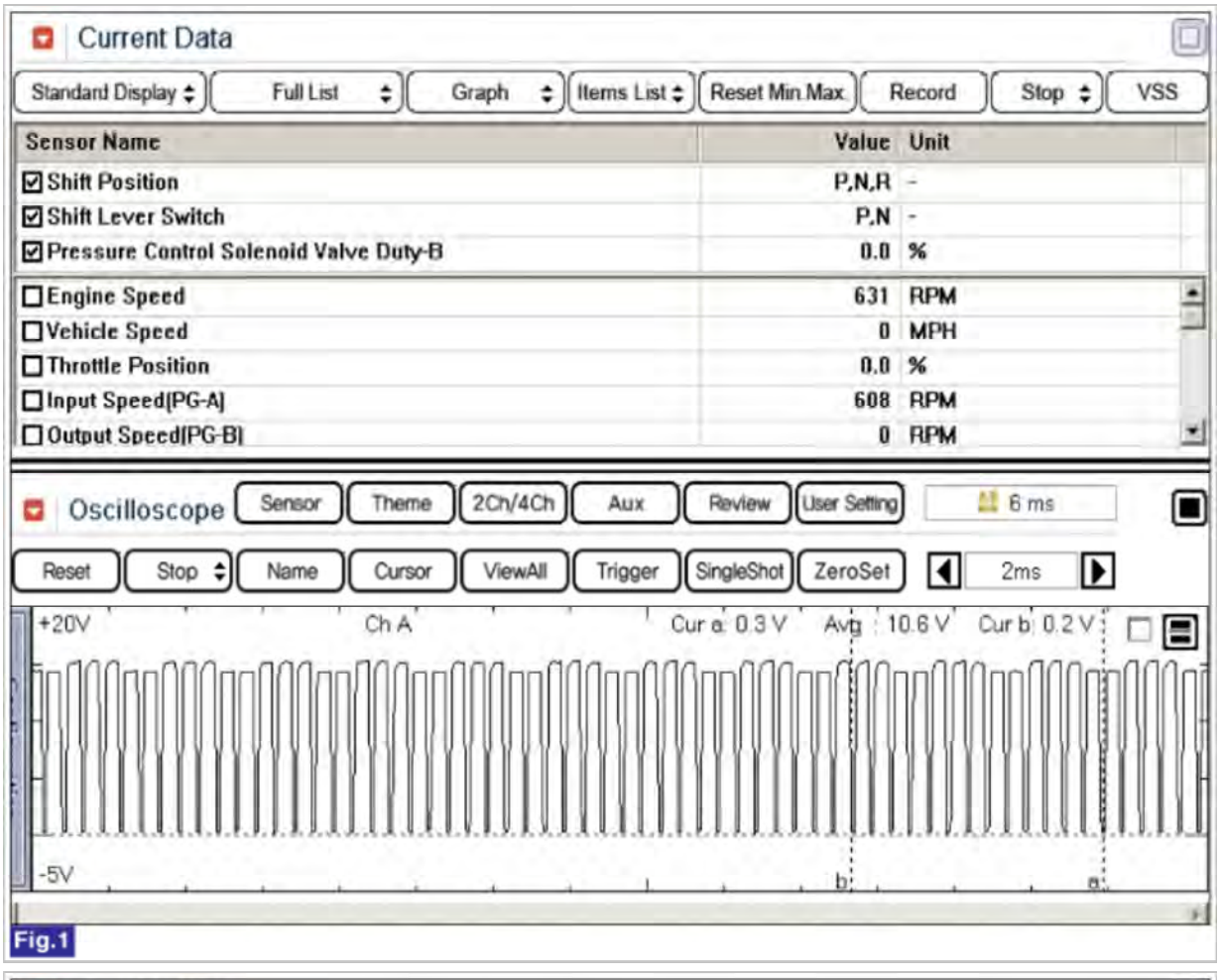

Current Data
Standard Display
Full List
Graph
Items List
Reset Min.Max.
Record
Stop
VSS
Sensor Name
Value
Unit
Shift Position
P,N,R
-
Shift Lever Switch
P,N
-
Pressure Control Solenoid Valve Duty-B
0.0
%
Engine Speed
631
RPM
Vehicle Speed
0
MPH
Throttle Position
0.0
%
Input Speed(PG-A)
608
RPM
Output Speed(PG-B)
0
RPM
Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
6 ms
Reset
Stop
Name
Cursor
ViewAll
Trigger
SingleShot
ZeroSet
2ms
+20V
Ch A
Cur a: 0.3 V
Avg : 10.6 V
Cur b: 0.2 V
-5V
b
a

Fig.1

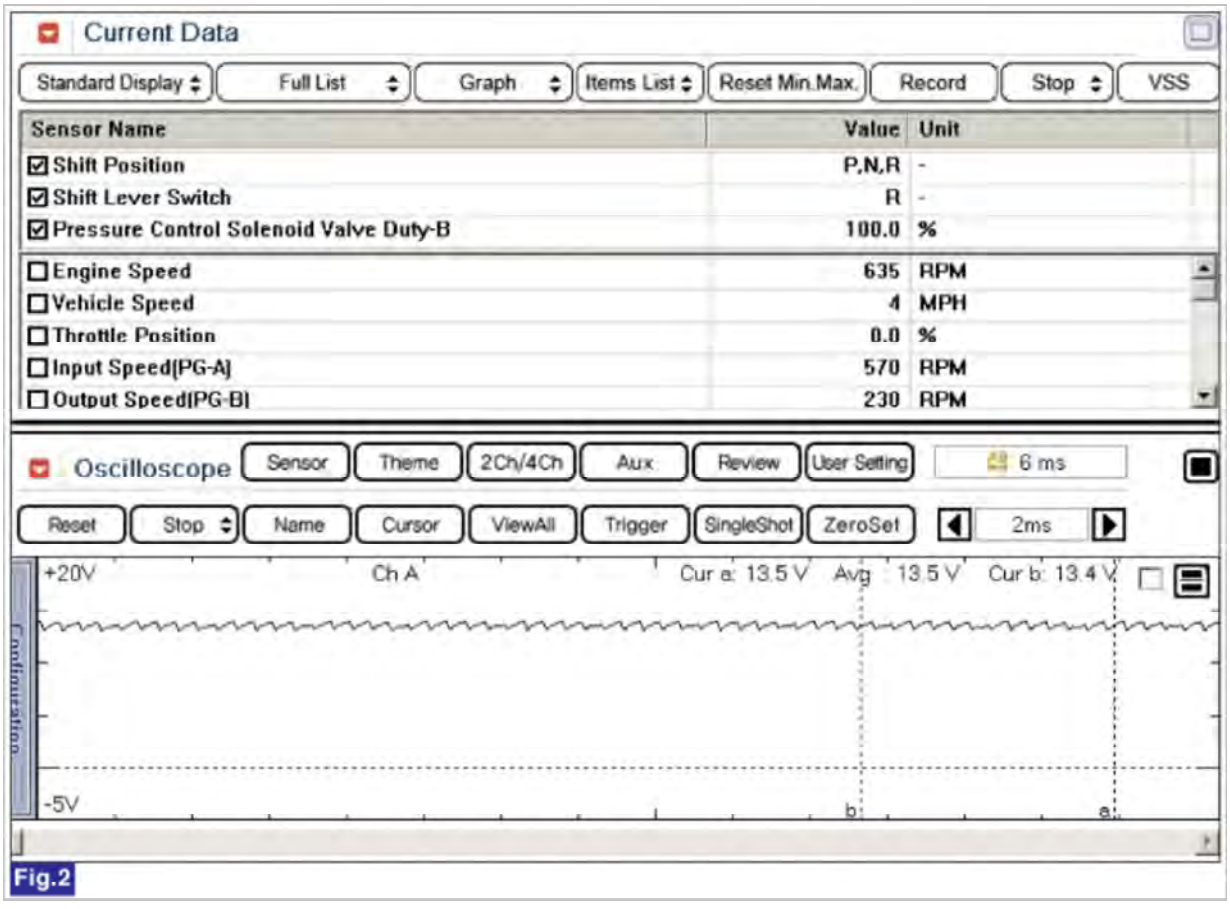
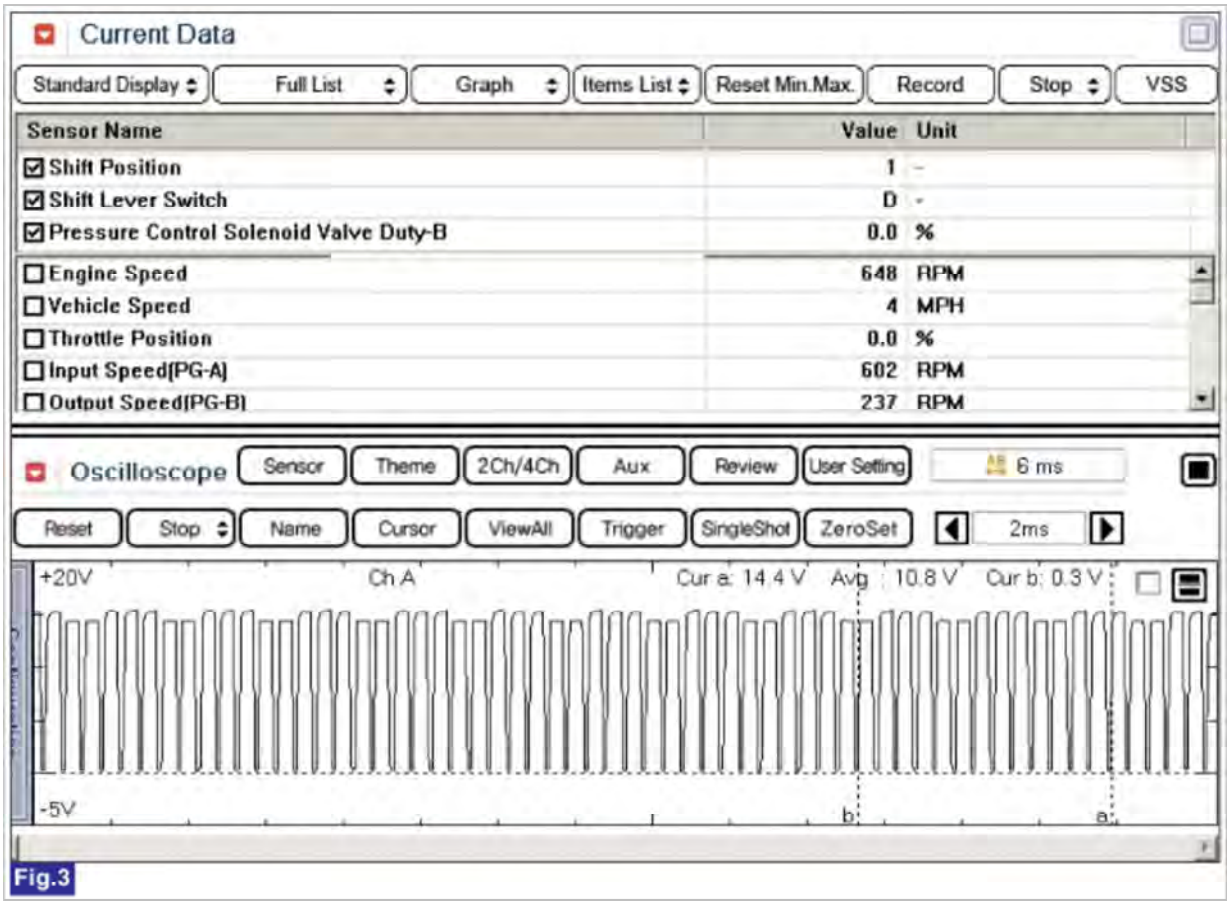
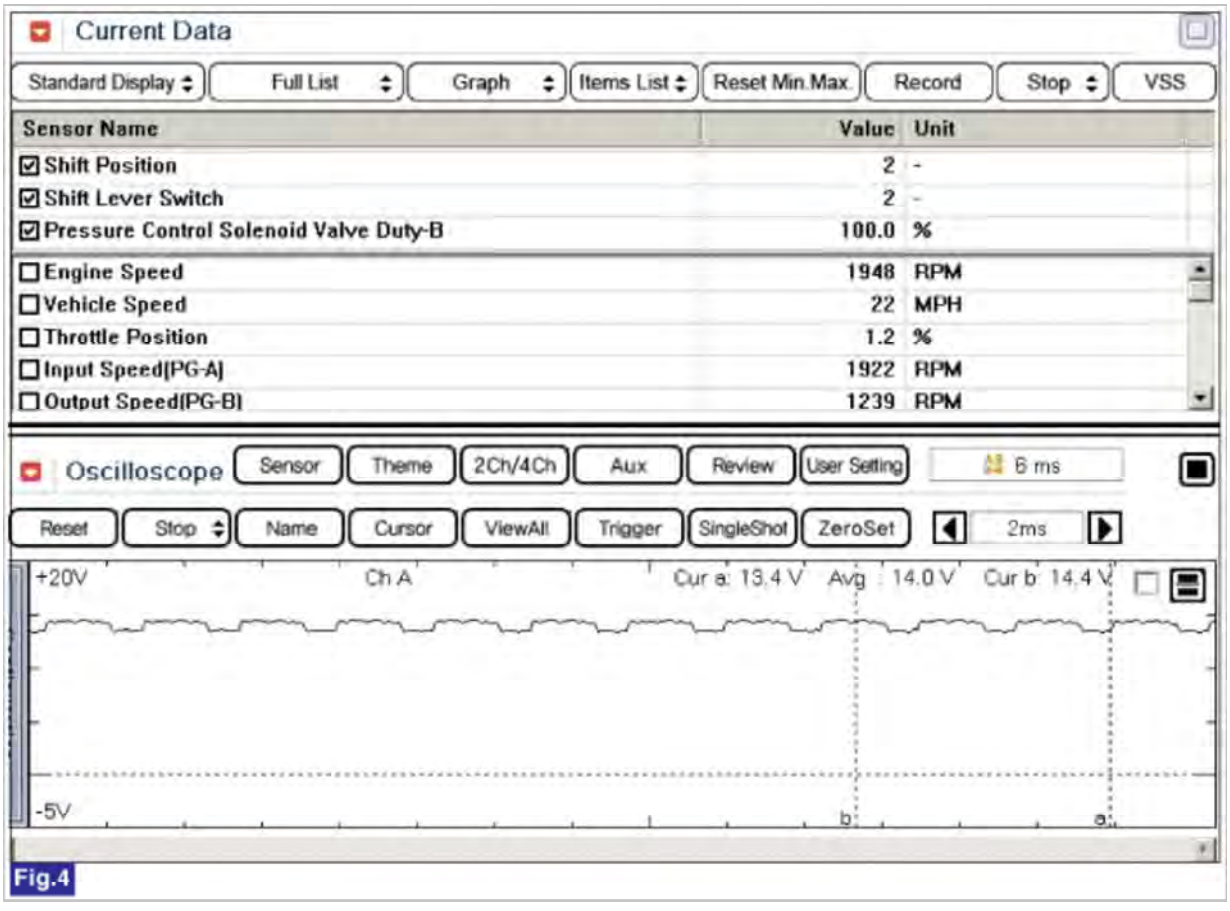

Current Data
Standard Display
Full List
Graph
Items List
Reset Min.Max.
Record
Stop
VSS
Sensor Name
Value
Unit
Shift Position
P,N,R
-
Shift Lever Switch
R
-
Pressure Control Solenoid Valve Duty-B
100.0
%
Engine Speed
635
RPM
Vehicle Speed
4
MPH
Throttle Position
0.0
%
Input Speed(PG-A)
570
RPM
Output Speed(PG-B)
230
RPM
Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
6 ms
Reset
Stop
Name
Cursor
ViewAll
Trigger
SingleShot
ZeroSet
2ms
+20V
Ch A
Cur a: 13.5 V
Avg : 13.5 V
Cur b: 13.4 V
-5V
b
a

Fig.2


Current Data
Standard Display
Full List
Graph
Items List
Reset Min.Max.
Record
Stop
VSS
Sensor Name
Value
Unit
Shift Position
1
-
Shift Lever Switch
D
-
Pressure Control Solenoid Valve Duty-B
0.0
%
Engine Speed
648
RPM
Vehicle Speed
4
MPH
Throttle Position
0.0
%
Input Speed(PG-A)
602
RPM
Output Speed(PG-B)
237
RPM
Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
6 ms
Reset
Stop
Name
Cursor
ViewAll
Trigger
SingleShot
ZeroSet
2ms
+20V
Ch A
Cur a: 14.4 V
Avg : 10.8 V
Cur b: 0.3 V
-5V
b
a
Fig.3


Current Data
Standard Display
Full List
Graph
Items List
Reset Min.Max.
Record
Stop
VSS
Sensor Name
Value
Unit
Shift Position
2
-
Shift Lever Switch
2
-
Pressure Control Solenoid Valve Duty-B
100.0
%
Engine Speed
1948
RPM
Vehicle Speed
22
MPH
Throttle Position
1.2
%
Input Speed(PG-A)
1922
RPM
Output Speed(PG-B)
1239
RPM
Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
6 ms
Reset
Stop
Name
Cursor
ViewAll
Trigger
SingleShot
ZeroSet
2ms
+20V
Ch A
Cur a: 13.4 V
Avg : 14.0 V
Cur b: 14.4 V
-5V
b
a
Fig.4

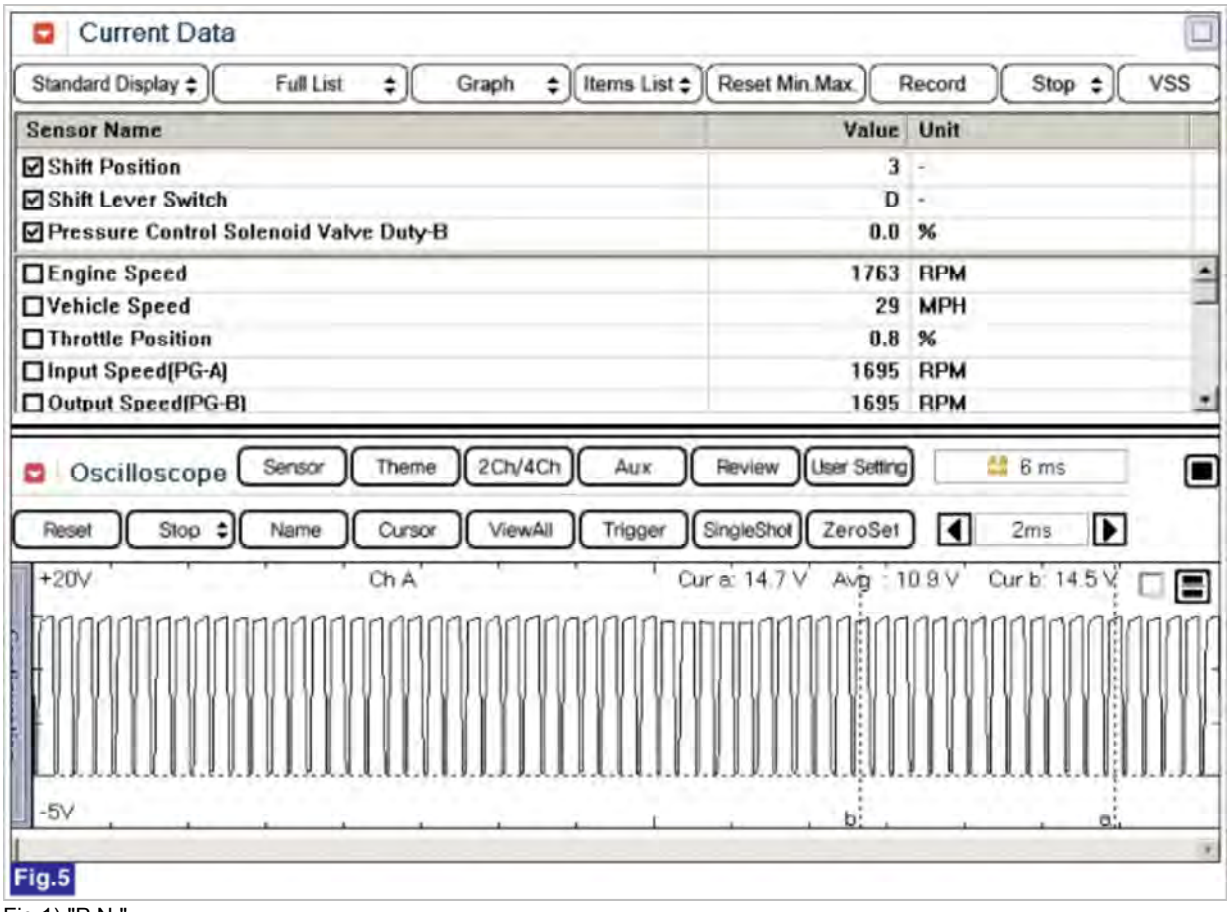


Fig 1) "P,N "
Fig 2) "R"
Fig 3)"D Range1st" gear
Fig 4)"2nd" gear
Fig 5) D Range"3rd" gear
Fig 6) "D Range 4th" gear

5. Does "PCSV-B(2-4SOLENOID VALVE)" follow the referance data?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and TCM(PCM) memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure
NO	▸ Go to "W/Harness Inspection " procedure

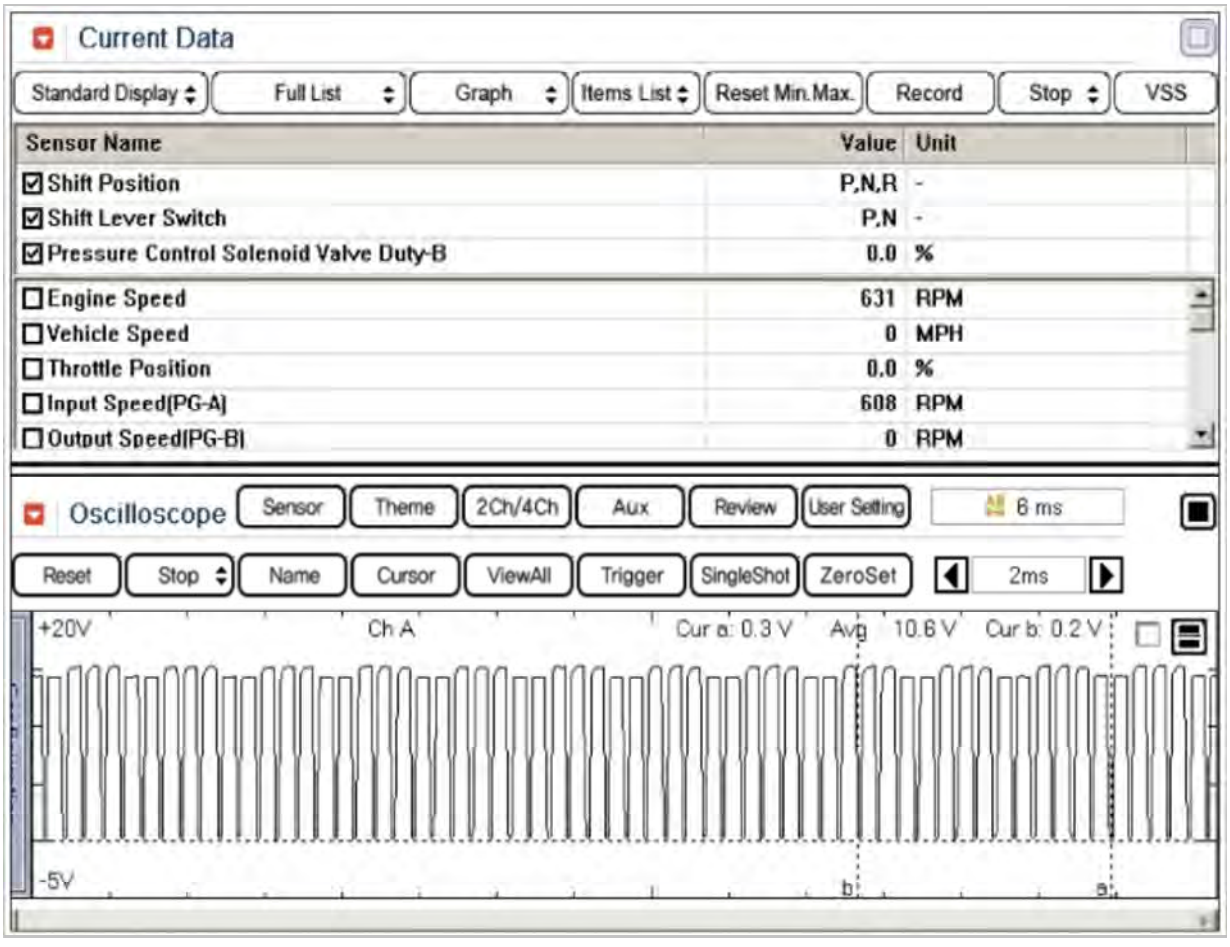
Terminal and Connector Inspection

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 then go to "Verification of Vehicle Repair" procedure
NO	▸ Go to "Power Circuit Inspection" procedure

Power Circuit Inspection

1. Connect "A/T SOLENOID VALVE" connector and install device for measuring wave form
2. Turn on the Engine and operate Damper clutch
3. Measure wave form between "PCSV-B(2-4BRAKE)" teminal of the sensor harness connector and chassis ground.



4. Is measured normally operating wave form?

YES	▸ Go to "Signal circuit inspection" procedure
NO	▸ 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 "PCSV-B(2-4BRAKE)" terminal of the ATM SOLENOID VALVE harness connector and "PCSV-B(2-4BRAKE)" terminal of the PCM/TCM 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 "PCM/TCM" connector
   (3) Measure resistance between "PCSV-B(2-4BRAKE)" terminal 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

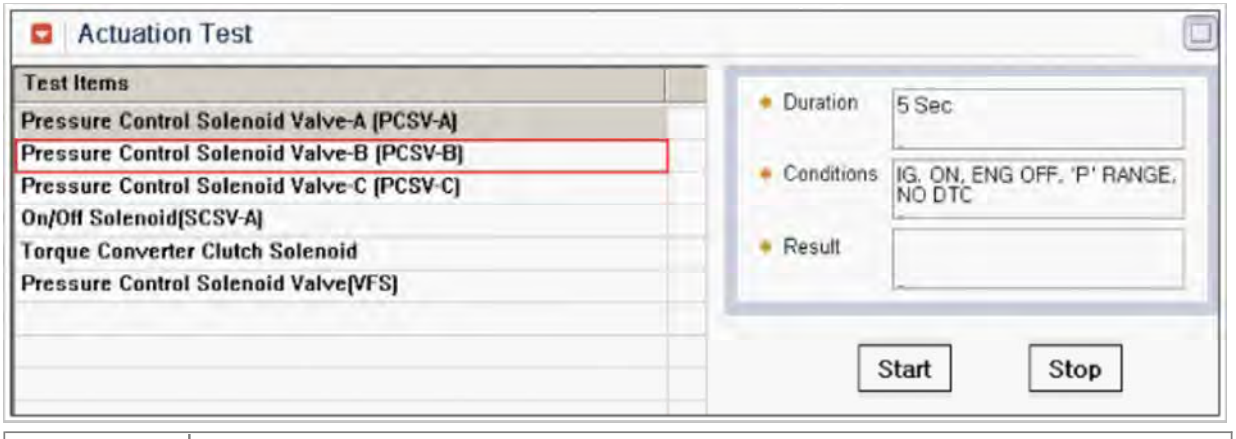
1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector
   (3) Measure resistance between "PCSV-B(2-4BRAKE)" terminal and "Ground" terminal of the ATM SOLENOID VALVE harness connector

   Specification: Approximately 3.5 ± 0.2 Ω (25°C)

   (4) Is resistance within specifications?

YES	▸ RGo to "CHECK PCM/TCM" as below
NO	▸ Replace PCSV-B(2-4SOLENOID VALVE) as necessary and go to "Verification Vehicle Repair" procedure

2. CHECK PCM/PCM/TCM
   (1) Connect GDS to data link connector(DLC)
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T Solenoide valve Actuator test and Operate Actuator test.
   (4) Is Actuator Testing performed normally ?



YES	▸ Go to "Verification Vehicle Repair" procedure
NO	▸ Replace PCM/TCM as necessary and Go to "Verificaiton Vehicle Repair" procedure

ACTUATOR TEST CONDITION
1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0km/h
5. Throttle position sensor< 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

Verification of Vehicle Repair

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 > Automatic Transaxle System > P0765 Shift Control Solenoid Valve \'D\'(Over Drive Clutch Solenoid)

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), 2-4 (2-4 Brake), UD (Under Drive Clutch), OD (Over Drive Clutch), REV (Reverse Clutch).

DTC Description

The PCM/TCM 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 PCM/TCM judges that the OVER DRIVE CLUTCH drive control solenoid circuit is malfunctioning and sets this code.

DTC Detecting Condition

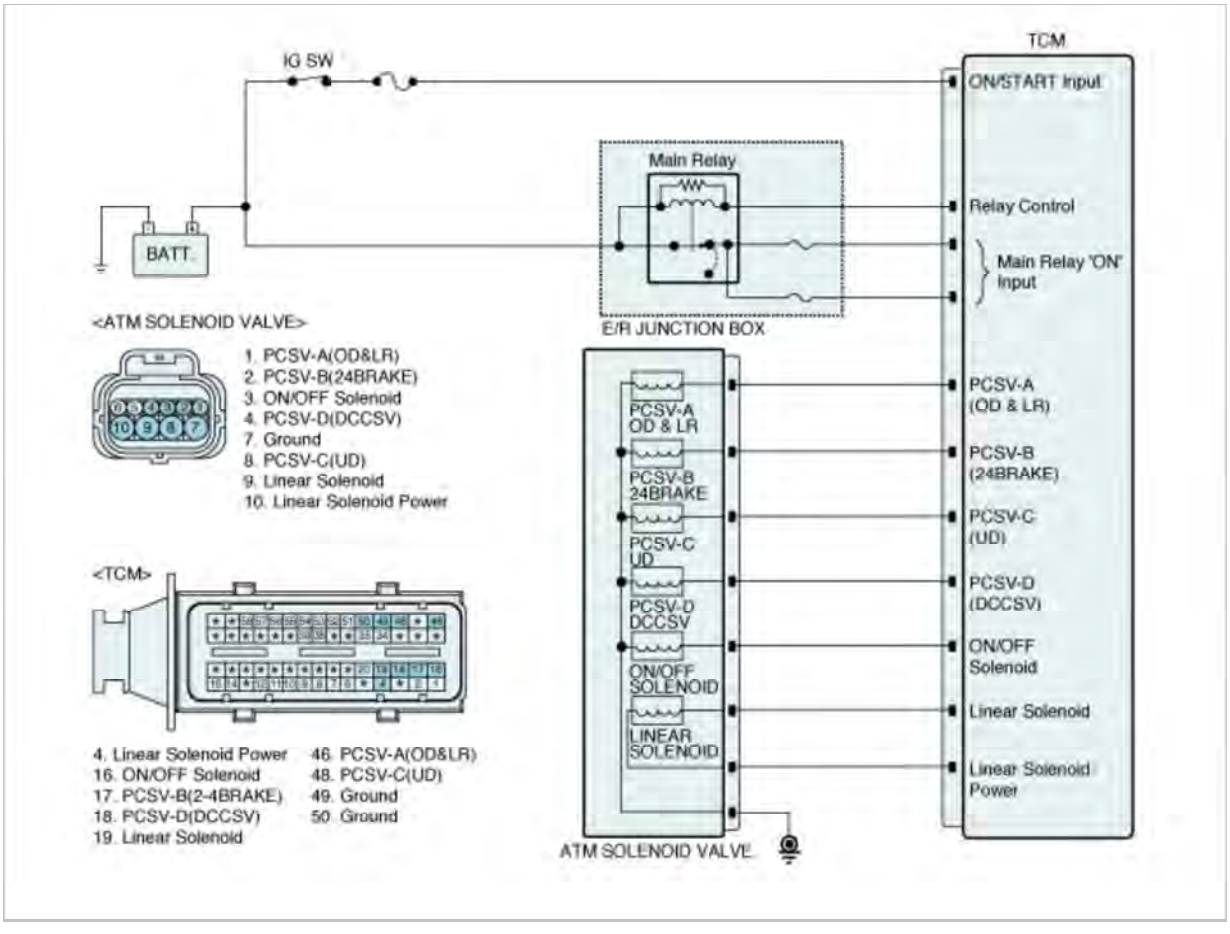
Item		Detecting Condition & Limp Home	Possible cause
Case 1	DTC Strategy	• Circuit low	• Open or short in circuit • Faulty UD SOLENOID VALVE • Faulty PCM/TCM
	Enable Conditions	• Solenoid PWM 0%	
	Threshold Value	• Feedback Voltage <5.5V	
Case 2	DTC Strategy	• Circuit high	
	Enable Conditions	• Solenoid PWM 100% • Shift status in-gear • Time after TCM turns on 0.5 sec • Solenoid power voltage >10V and <16V	
	Threshold Value	• Feedback Voltage >battery voltage-1V	
Diagnostic Time		• more than 0.3sec	
Fail Safe		• Locked in 3 rd gear.	

Specification

Solenoid Valve for Pressure Control

- Sensor type : Normal open 3-way
- Operating temperature : -30°C~130°C
- Frequency :PCSV-A,B,C,D :50Hz (at the ATF temp. -20°C above)
  VFS : 400~1000
  ※ KM series : 35Hz
- Internal resistance : 3.5 ± 0.2 Ω(20°C)
- Surge voltage : 56 V

Diagnostic Circuit Diagram



Signal wave form

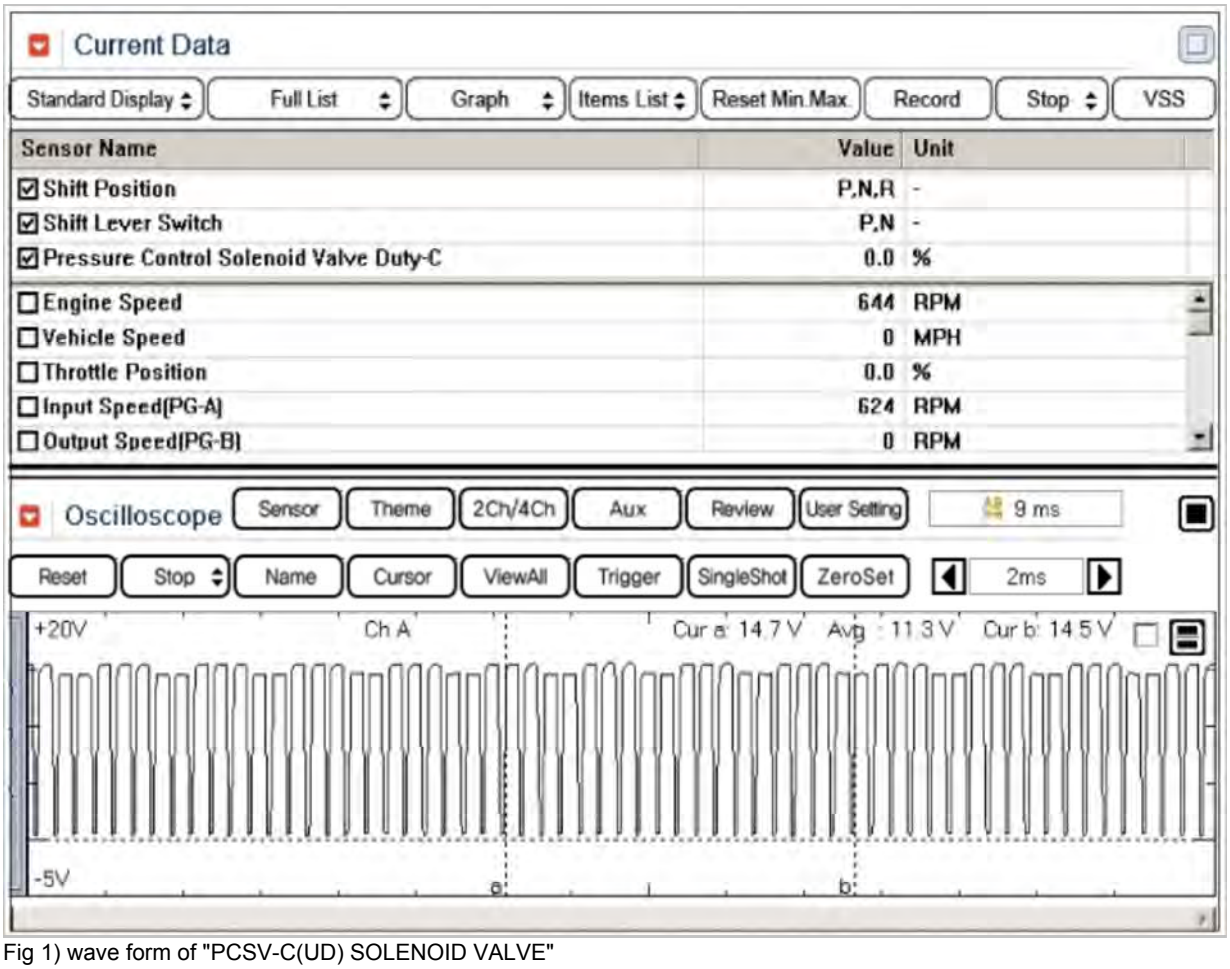
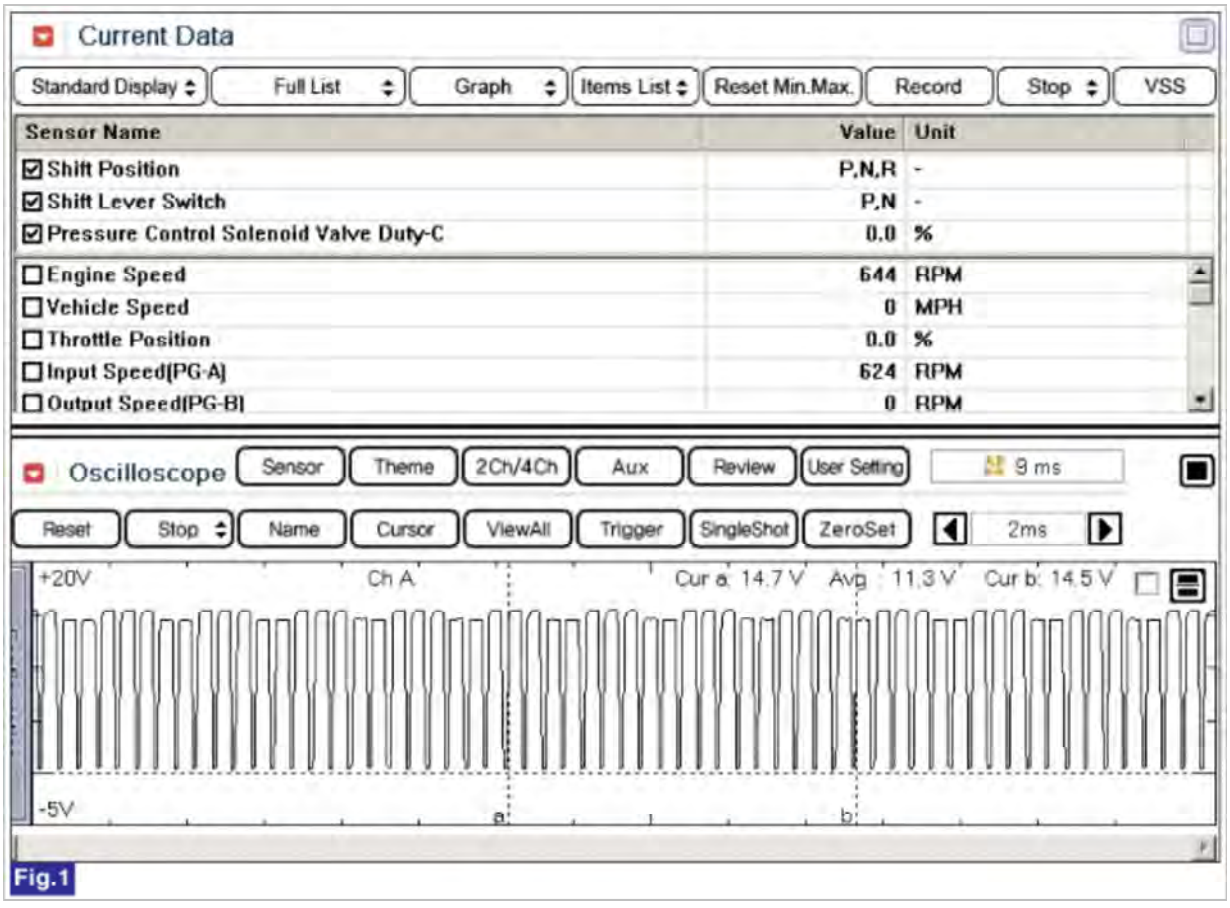
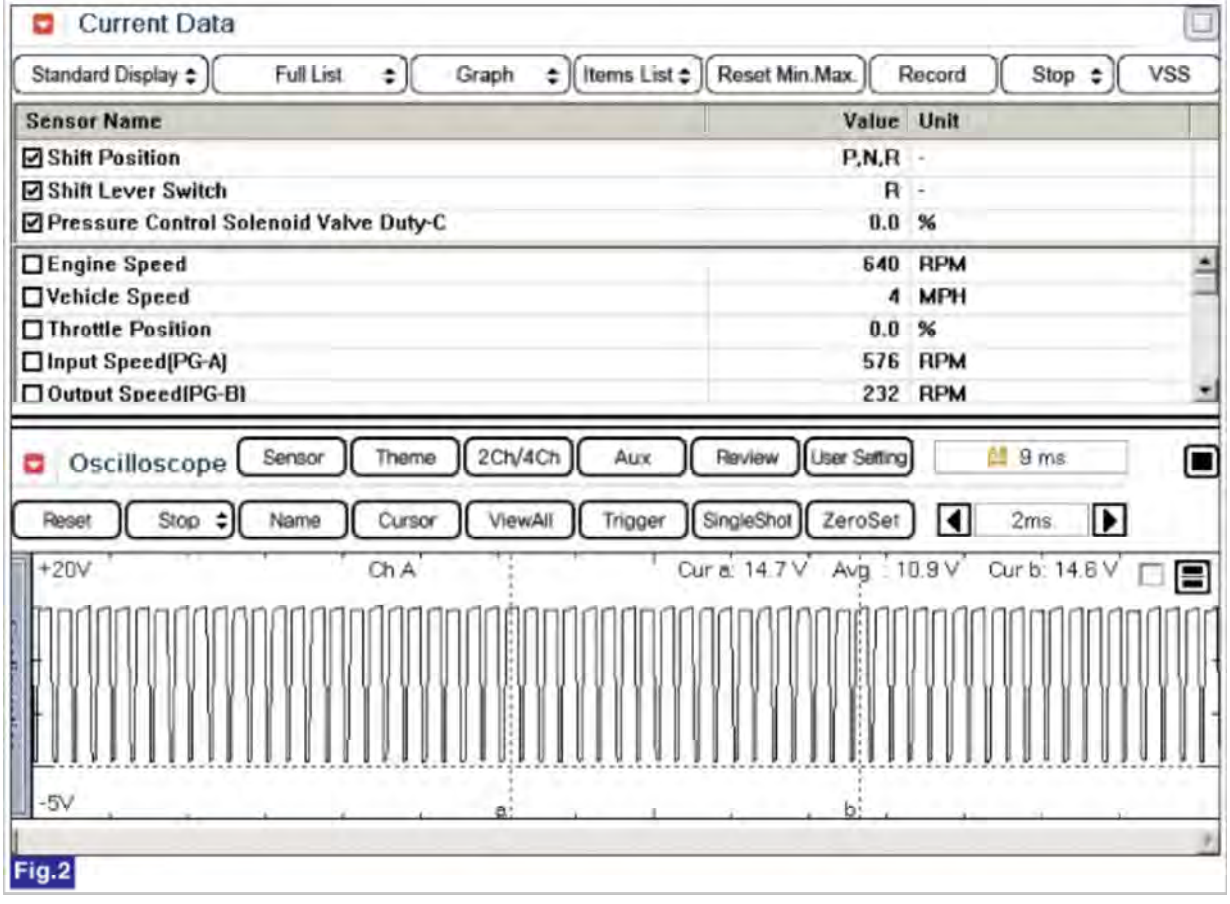


Fig 1) wave form of "PCSV-C(UD) SOLENOID VALVE"

Monitor GDS Data

1. Connect GDS to data link connector(DLC)
2. Engine "ON".
3. Monitor the "PCSV-C(UD) SOLENOID VALVE" parameter on the GDS
4. Shift gear at each position .


Current Data
Standard Display
Full List
Graph
Items List
Reset Min.Max.
Record
Stop
VSS
Sensor Name
Value
Unit
Shift Position
P,N,R
-
Shift Lever Switch
P,N
-
Pressure Control Solenoid Valve Duty-C
0.0
%
Engine Speed
644
RPM
Vehicle Speed
0
MPH
Throttle Position
0.0
%
Input Speed(PG-A)
624
RPM
Output Speed(PG-B)
0
RPM
Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
9 ms
Reset
Stop
Name
Cursor
ViewAll
Trigger
SingleShot
ZeroSet
2ms
+20V
Ch A
Cur a: 14.7 V
Avg : 11.3 V
Cur b: 14.5 V
-5V
a
b
Fig.1


Current Data
Standard Display
Full List
Graph
Items List
Reset Min.Max.
Record
Stop
VSS
Sensor Name
Value
Unit
Shift Position
P,N,R
-
Shift Lever Switch
R
-
Pressure Control Solenoid Valve Duty-C
0.0
%
Engine Speed
640
RPM
Vehicle Speed
4
MPH
Throttle Position
0.0
%
Input Speed(PG-A)
576
RPM
Output Speed(PG-B)
232
RPM
Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
9 ms
Reset
Stop
Name
Cursor
ViewAll
Trigger
SingleShot
ZeroSet
2ms
+20V
Ch A
Cur a: 14.7 V
Avg : 10.9 V
Cur b: 14.6 V
-5V
a
b
Fig.2

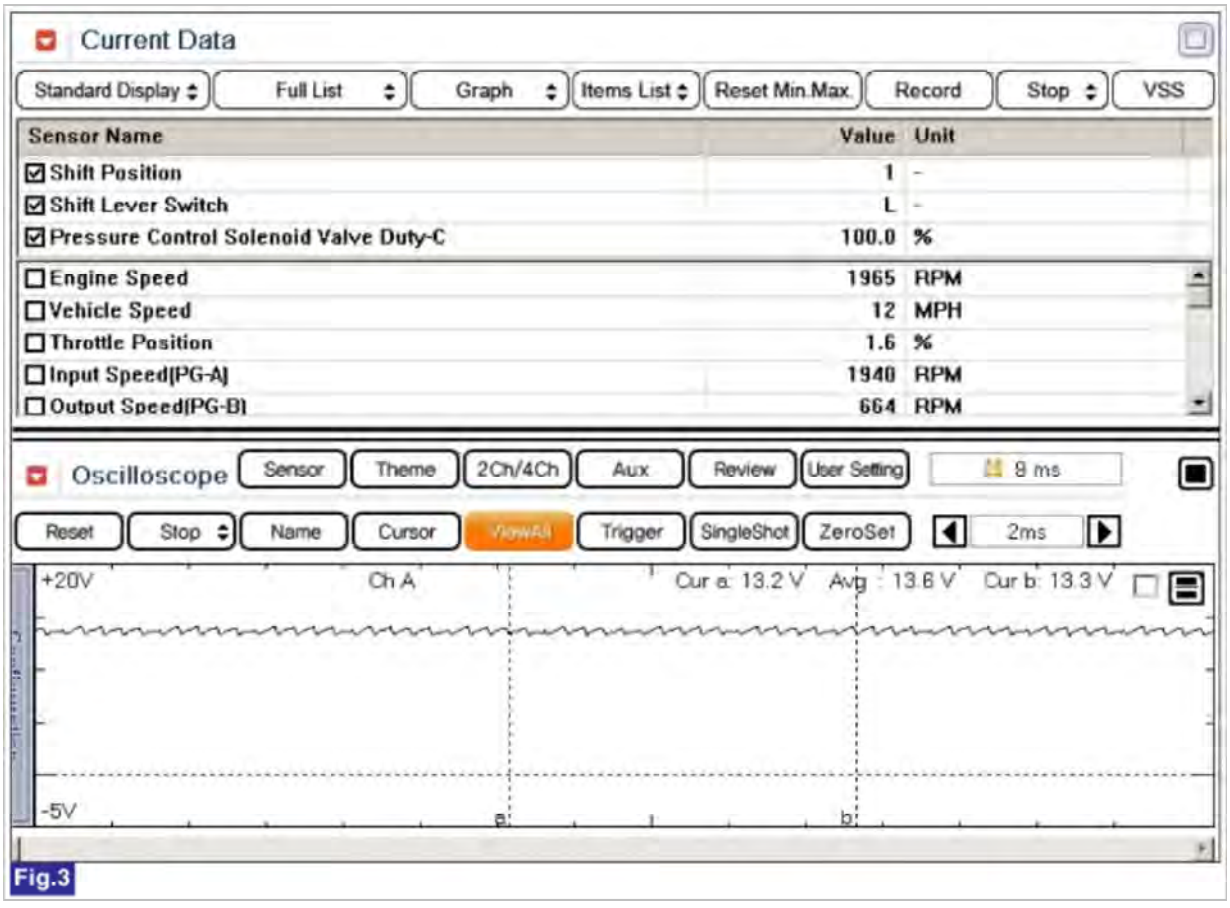

Current Data
Standard Display
Full List
Graph
Items List
Reset Min.Max.
Record
Stop
VSS
Sensor Name
Value
Unit
Shift Position
1
-
Shift Lever Switch
L
-
Pressure Control Solenoid Valve Duty-C
100.0
%
Engine Speed
1965
RPM
Vehicle Speed
12
MPH
Throttle Position
1.6
%
Input Speed[PG-A]
1940
RPM
Output Speed[PG-B]
664
RPM
Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
9 ms
Reset
Stop
Name
Cursor
ViewAll
Trigger
SingleShot
ZeroSet
2ms
+20V
Ch A
Cur a: 13.2 V
Avg : 13.6 V
Cur b: 13.3 V
-5V
a
b

Fig.3

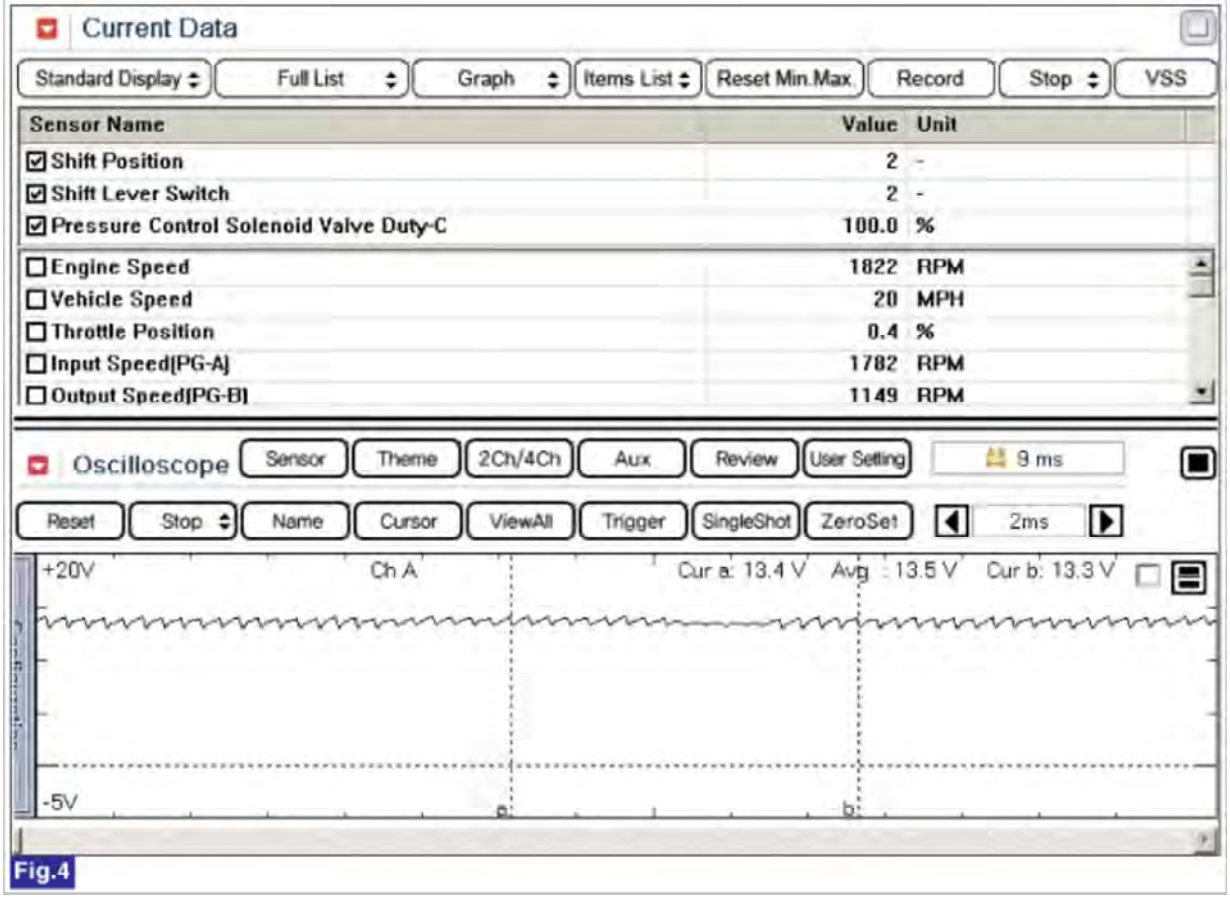

Current Data
Standard Display
Full List
Graph
Items List
Reset Min.Max.
Record
Stop
VSS
Sensor Name
Value
Unit
Shift Position
2
-
Shift Lever Switch
2
-
Pressure Control Solenoid Valve Duty-C
100.0
%
Engine Speed
1822
RPM
Vehicle Speed
20
MPH
Throttle Position
0.4
%
Input Speed[PG-A]
1782
RPM
Output Speed[PG-B]
1149
RPM
Oscilloscope
Sensor
Theme
2Ch/4Ch
Aux
Review
User Setting
9 ms
Reset
Stop
Name
Cursor
ViewAll
Trigger
SingleShot
ZeroSet
2ms
+20V
Ch A
Cur a: 13.4 V
Avg : 13.5 V
Cur b: 13.3 V
-5V
a
b

Fig.4

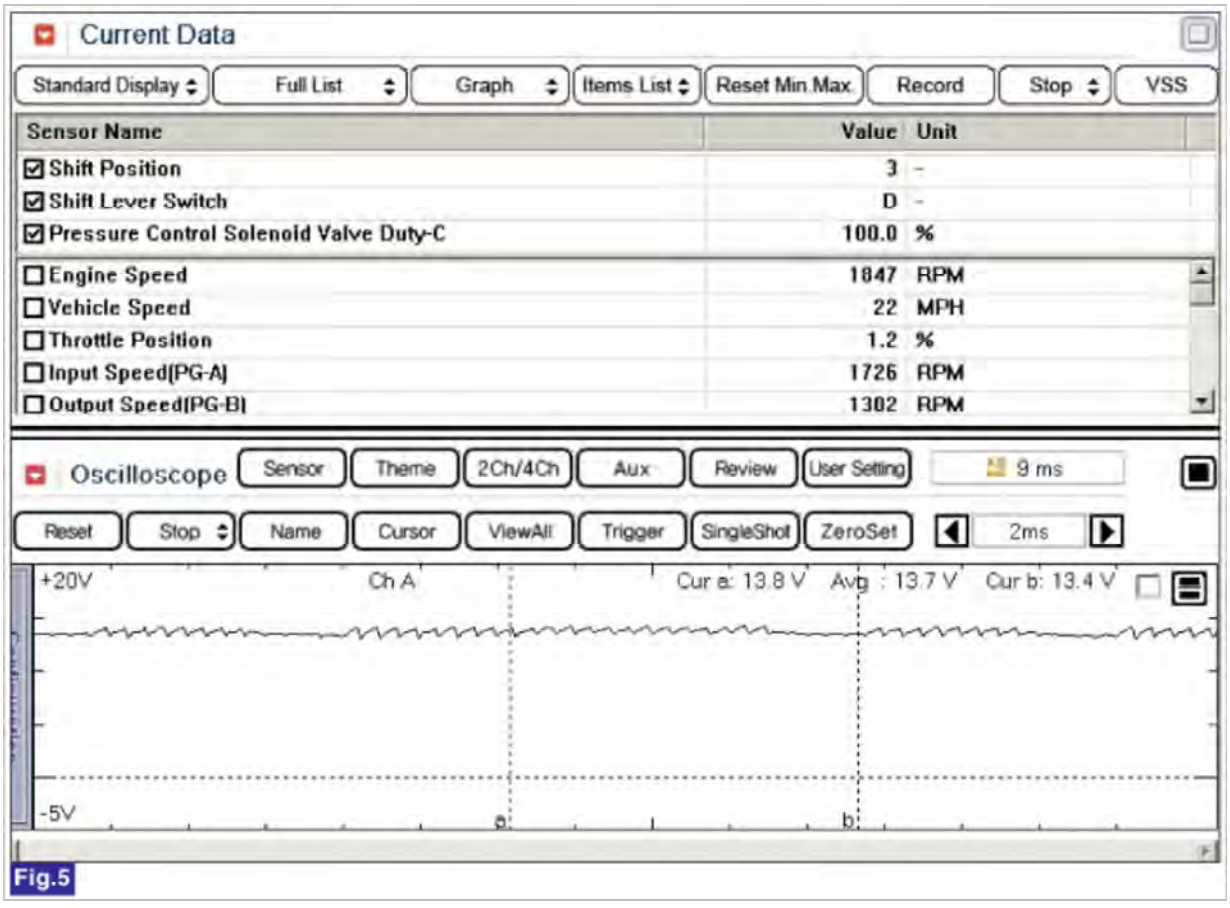


Fig.5

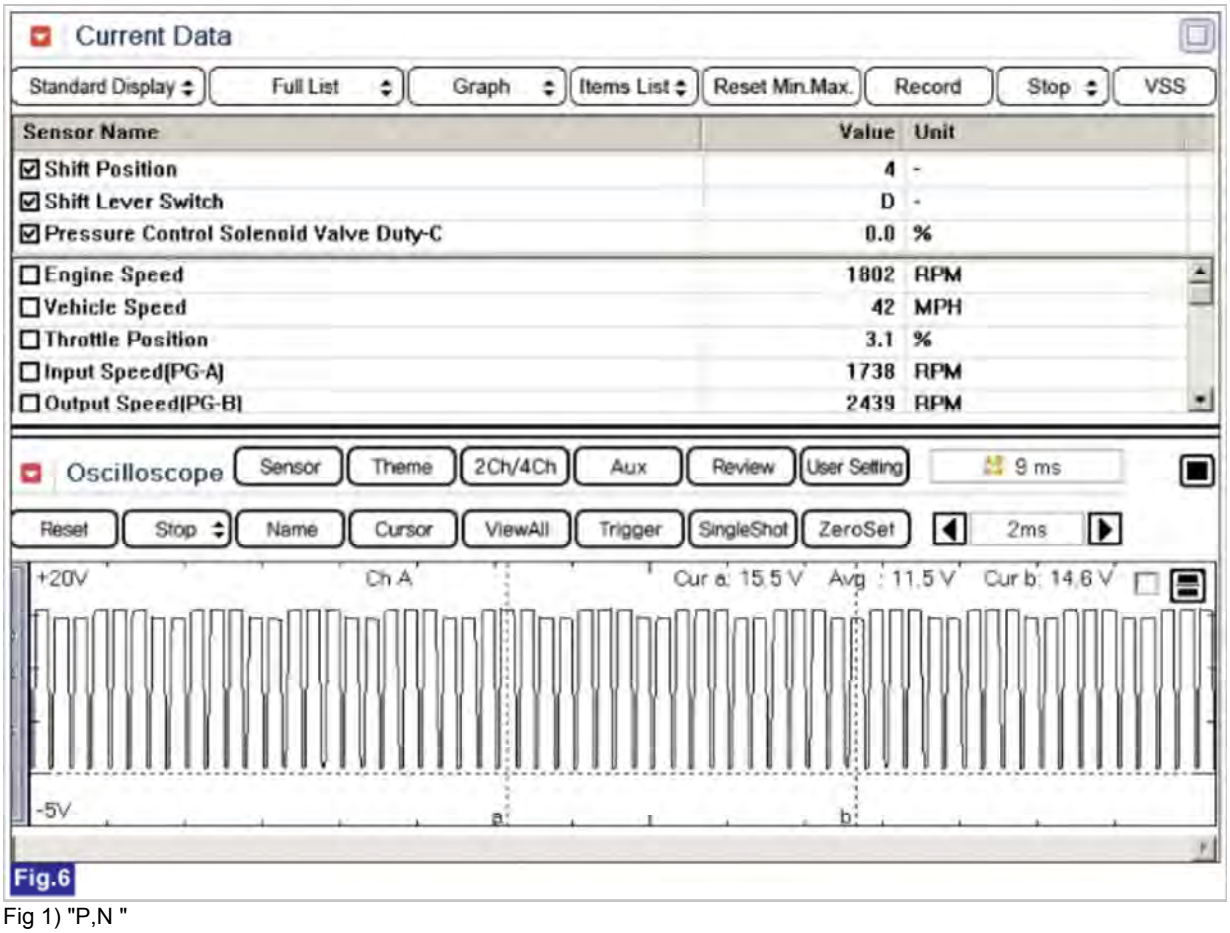


Fig.6

Fig 1) "P,N "
Fig 2) "R"
Fig 3) "1st" gear
Fig 4) "2nd" gear

Fig 5) "3rd" gear
Fig 6) "D Range 4th" gear

5. Does " PCSV-C(UD) SOLENOID VALVE" follow the referance data?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure
NO	▸ Go to "W/Harness Inspection " procedure

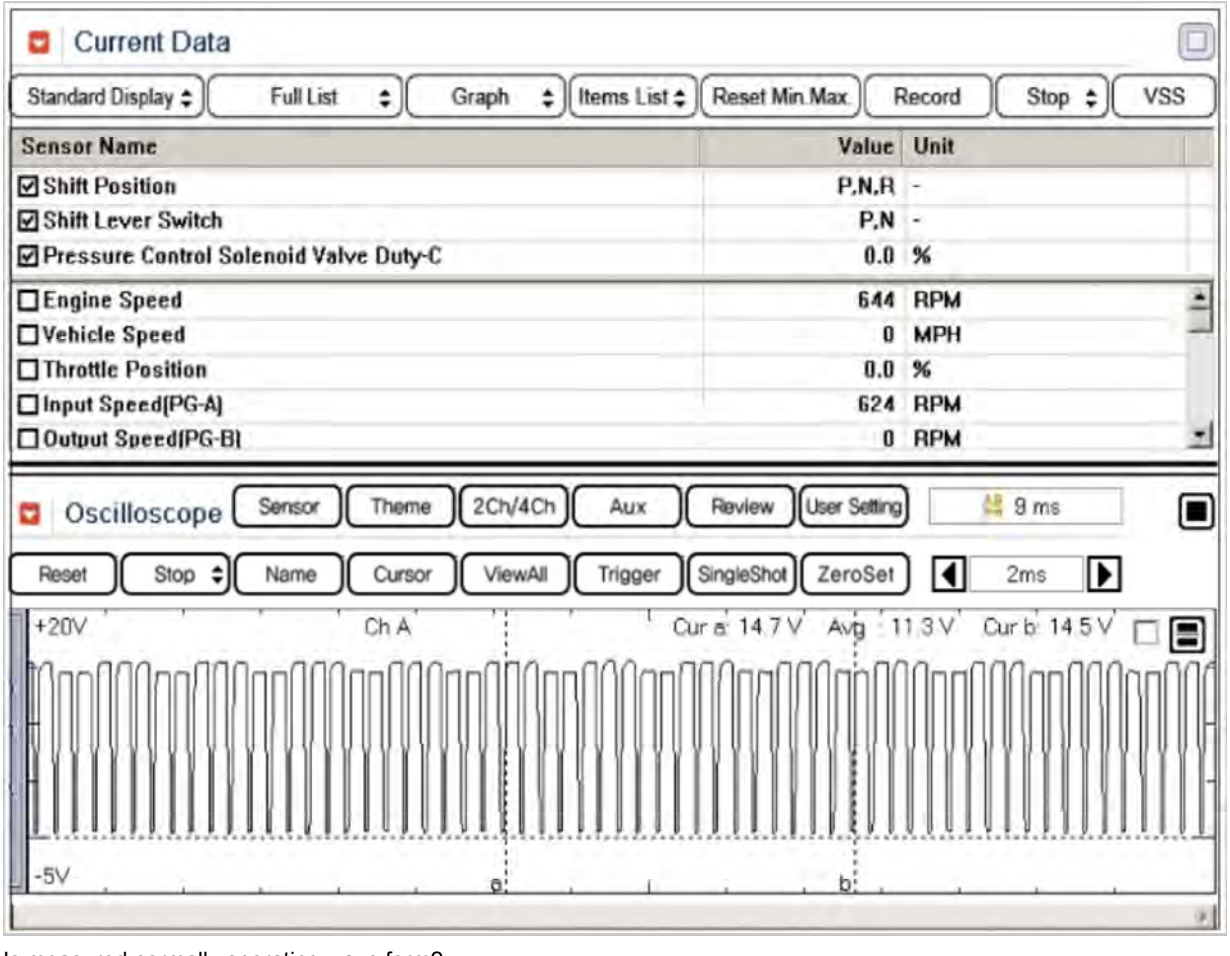
Terminal and Connector Inspection

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 then go to "Verification of Vehicle Repair" procedure
NO	▸ Go to "Power Circuit Inspection" procedure

Power circuit inspection

1. Connect "A/T SOLENOID VALVE" connector and install device for measuring wave form
2. Turn on the Engine and operate Damper clutch
3. Measure wave form between "PCSV-C(UD)" teminal of the sensor harness connector and chassis ground.



4. Is measured normally operating wave form?

YES	▸ Go to "Signal circuit inspection" procedure

NO	▸ 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 "PCSV-C(UD)" terminal of the ATM SOLENOID VALVE harness connector and "PCSV-C (UD)" terminal of the PCM/TCM 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 "PCM/TCM" connector
   (3) Measure resistance between "PCSV-C(UD)" terminal 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

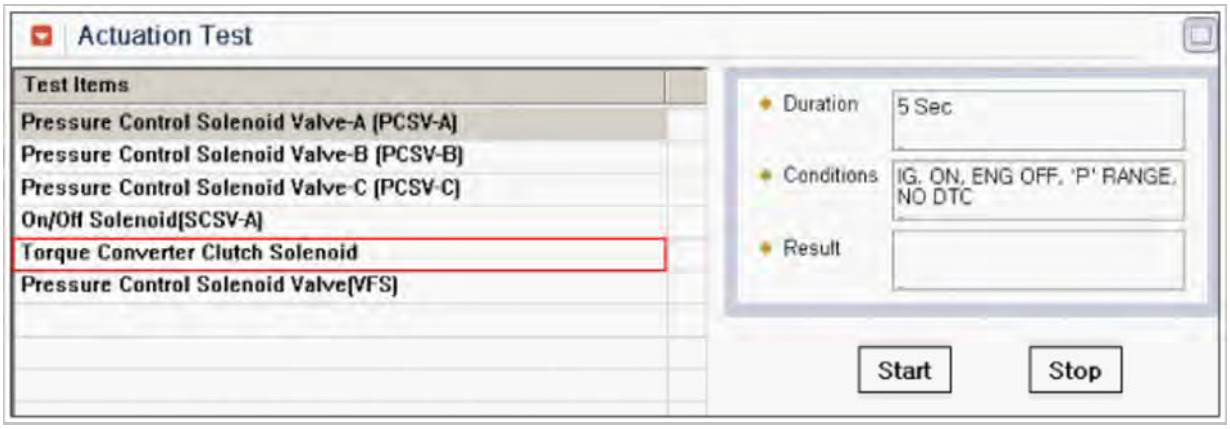
1. CHECK SOLENOID VELVE
   (1) Ignition "OFF".
   (2) Disconnect "A/T SOLENOID VALVE" connector
   (3) Measure resistance between "PCSV-C(UD)" terminal and "Ground" terminal of the ATM SOLENOID VALVE harness connector

   Specification: Approximately 3.5 ± 0.2 Ω (25°C)

   (4) Is resistance within specifications?

YES	▸ Go to "CHECK PCM/TCM" as below
NO	▸ Replace PCSV-C(UD) SOLENOID VALVE as necessary and go to "Verification Vehicle Repair" procedure

2. CHECK PCM/PCM/TCM
   (1) Connect GDS to data link connector(DLC)
   (2) Ignition "ON" & Engine "OFF".
   (3) Select A/T Solenoide valve Actuator test and Operate Actuator test.



YES	▸ Go to "Verification Vehicle Repair" procedure
NO	▸ Replace PCM/TCM as necessary and Go to "Verificaiton Vehicle Repair" procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle Speed 0km/h
5. Throttle position sensor< 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

Verification of Vehicle Repair

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 > Automatic Transaxle System > P0880 TCM Power Signal Error Open/Short (GND)

Component Location

General Description

The TCM monitors suppling voltage to "SOLENOID VALVE"
The gear position is fixed at 3rd gear When input value is higher or lower than specification.

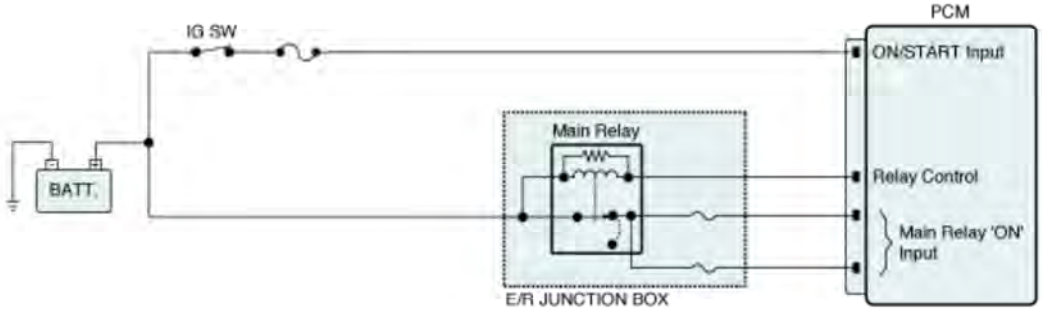
DTC Description

The TCM set this code If an input voltage is higher or lower than specification.

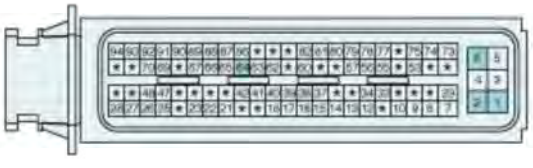
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check Voltage range	• Open or Short in harness • Faulty TCM
Enable Conditions	• 22V ≥ Input voltage to TCM ≥ 9V and Time after TCM turns on >0.5sec	
Threshold Value	• 24.5V< Solenoid power voltage< 7V	
Diagnostic Time	• more than 0.1sec	
Fail Safe	• Locked in 3 rd gear.	

Diagnostic Circuit Diagram



<PCM>



1. Main Relay 'ON' Input
2. Main Relay 'ON' Input
64. Relay Control

Monitor GDS Data

1. Connect GDS to data link connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Monitor the "BATTERY VOLTAGE " parameter on the GDS

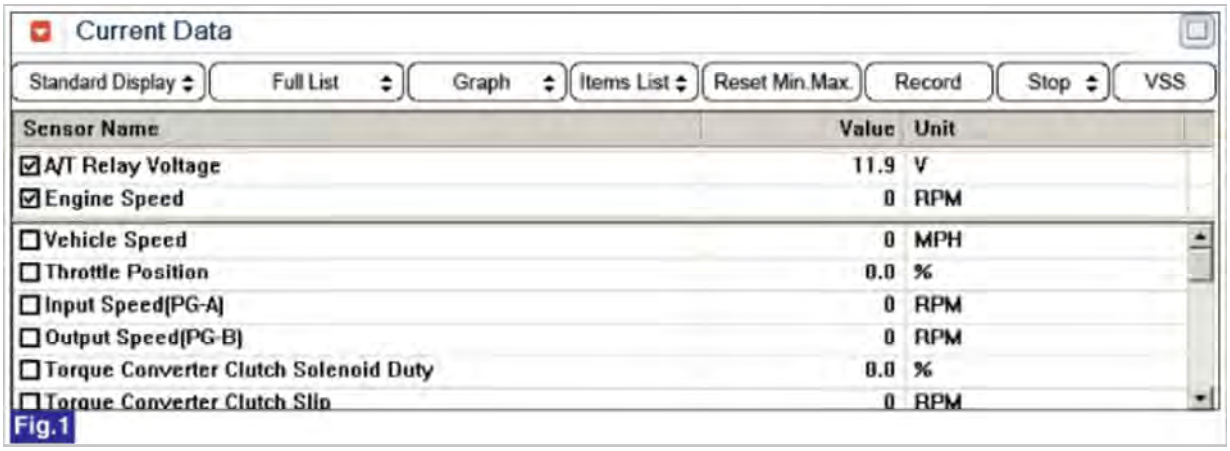


Fig.1

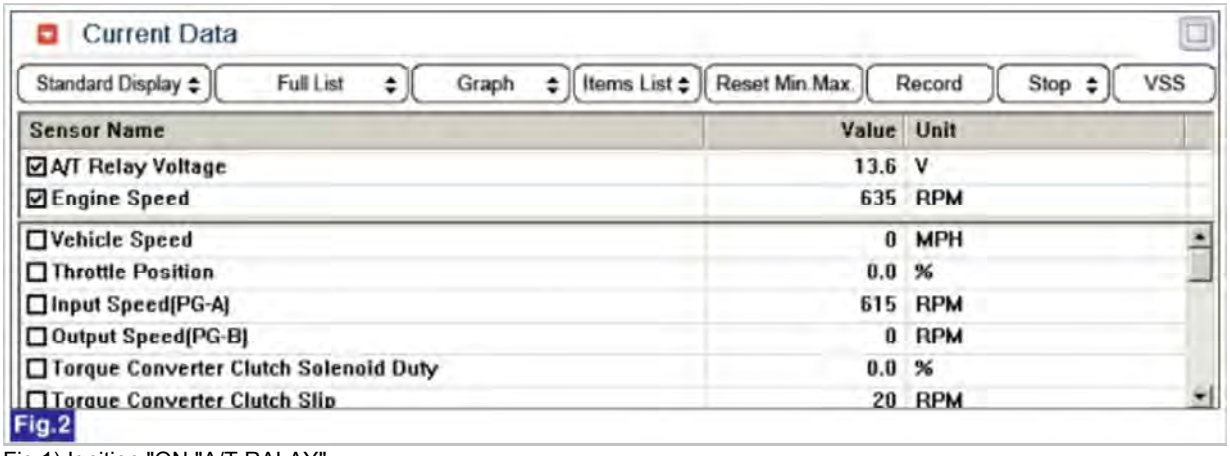


Fig.2

Fig 1) Ignition "ON "A/T RALAY"
Fig 2) Idle "A/T RALAY"

4. Does "BATTERY VOLTAGE " follow the referance data?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared. Throughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage.Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.
NO	▸ Go to "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 vehicle Repair" procedure
NO	▸ Go to "Power circuit inspection" procedure

Power Circuit Inspection

1. IIG "ON" Engine "OFF" .
2. Disconnect the "PCM/TCM" connector
3. Measure voltage between "Power supply" terminals of PCM harness connector and chassis ground.

Specification : approx. 12V

4. Is voltage within specifications?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared.And go to Verification of Vehicle Repair procedure.
NO	▸ Substitute with a known-good PCM/TCM and check for proper operation. If the problem is corrected, replace PCM/TCM 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.

Automatic Transaxle System > Automatic Transaxle System > U0001 High Speed CAN Communication Bus off

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 and ABSCM 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

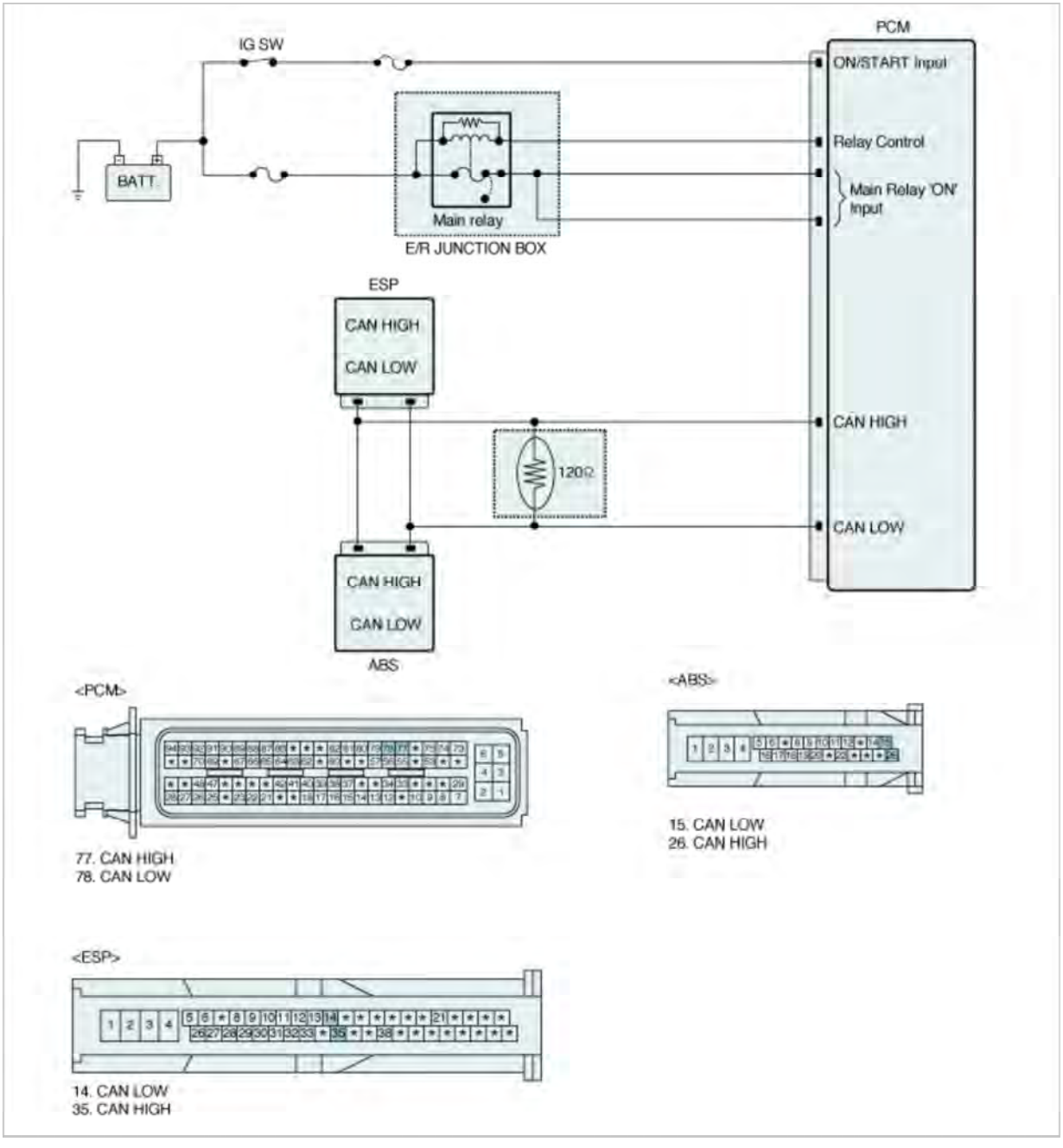
The TCM reads data on the CAN-BUS line and checks whether the data is equal to the data which the TCM sent before. If the data is not the same the TCM decides that either the CAN-BUS line or TCM are malfuncting and sets this code.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN BUS OFF	• Open or Short in CAN communication harness • Faulty ECM • Faulty TCM
Enable Conditions	• Input speed >1000rpm • Time after TCM turns on >0.5sec	
Threshold Value	• BUS OFF flag of ON CAN Controller	
Diagnostic Time	• more than 1sec	
Fail Safe	• INTELLIGENT SHIFT is inhibited • learning for oil pressure control is inhibited • Torque Retard requirement is inhibited.	

	• direct connection control of DCC is inhibited.	

Diagnostic Circuit Diagram



Signal wave form

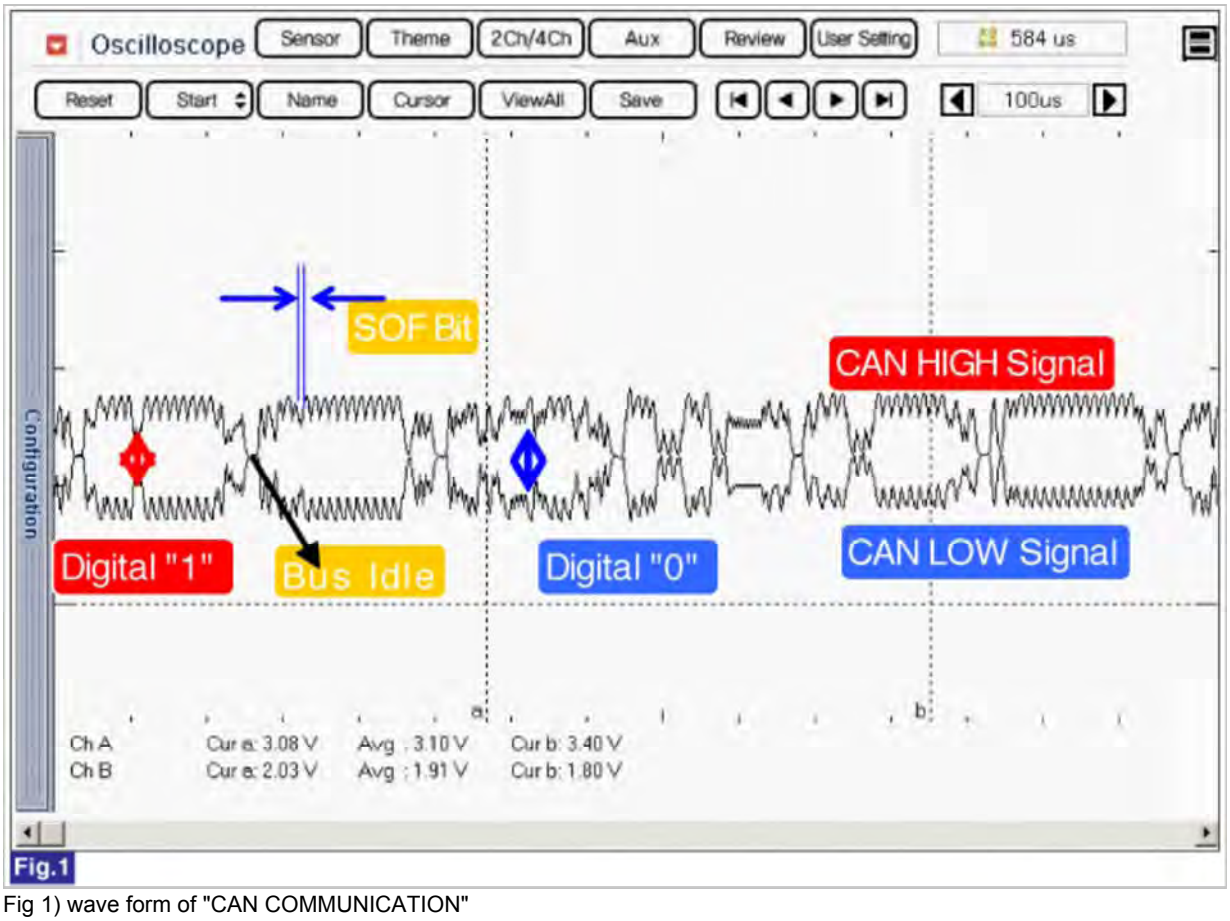
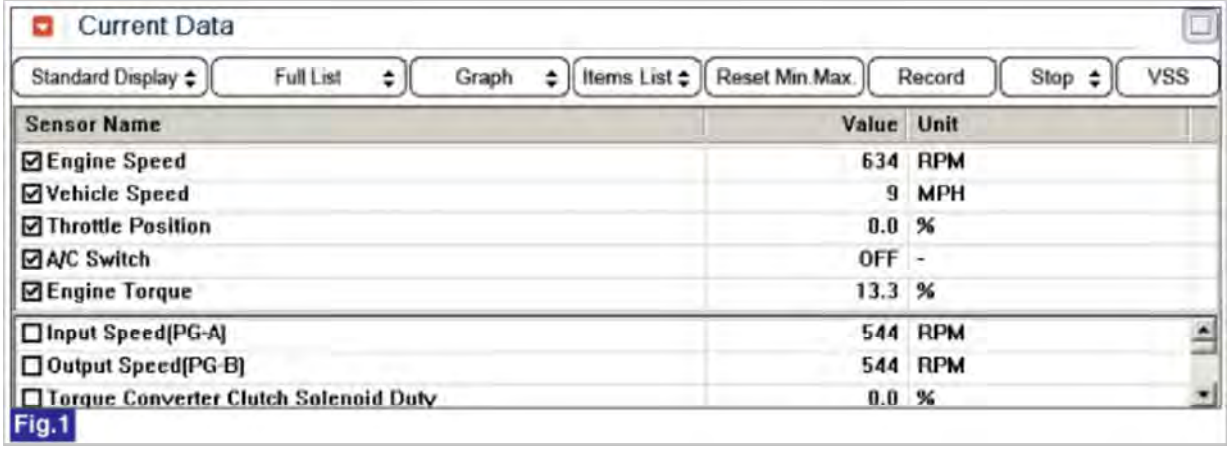


Fig 1) wave form of "CAN COMMUNICATION"

Monitor GDS Data

1. Connect GDS to data link connector(DLC)
2. Engine "ON".
3. Monitor the "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, VEHICLE SPEED SENSOR, THROTTLE P. SENSOR)" parameters on the GDS



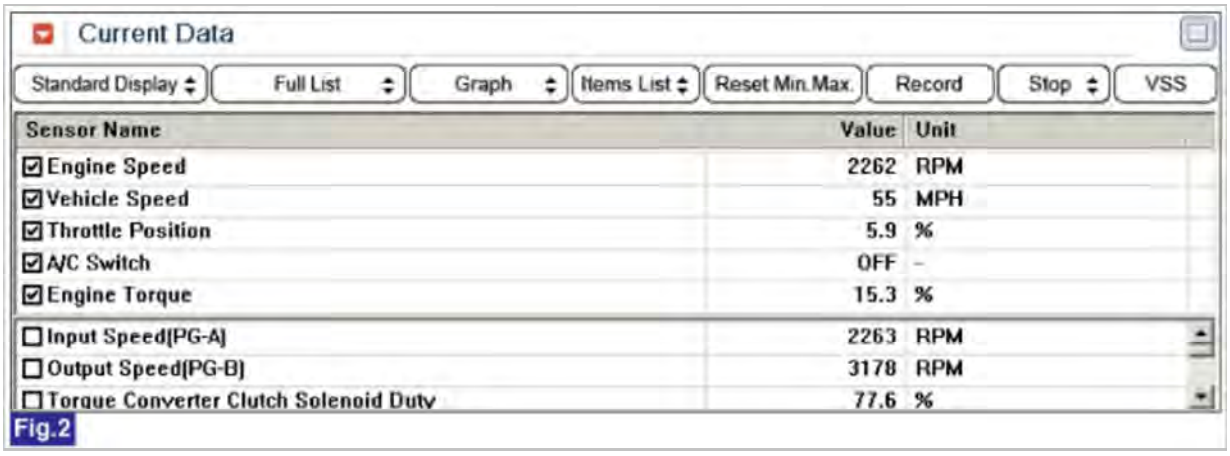


Fig 1) Low-RPM
Fig 2) High-RPM

4. Does "CAN BUS LINE DATA " follow the referance data?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared.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 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 "OFF".
2. Disconnect "PCM" connector.
3. Measure resistance between CAN high terminal and CAN low terminal of PCM harness connector.

Specification : Approx. 120 Ω ± 10Ω

1. Is measured resistance within specifications?

YES	▸ Substitute with a known-good "PCM/TCM" and check for proper operation. If the problem is corrected, replace "PCM/TCM" and Go to "verification of vehicle repair" procedure
NO	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage of ECM.and then Repair or replace Resistance for CAN communication 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 > Automatic Transaxle System > U0100 Lost Communication With ECM/PCM \'A\'

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 and ABSCM by using CAN communication. The CAN communicaton is one of the vehicle communications method, which is now widely used to transfer the vehicle data.

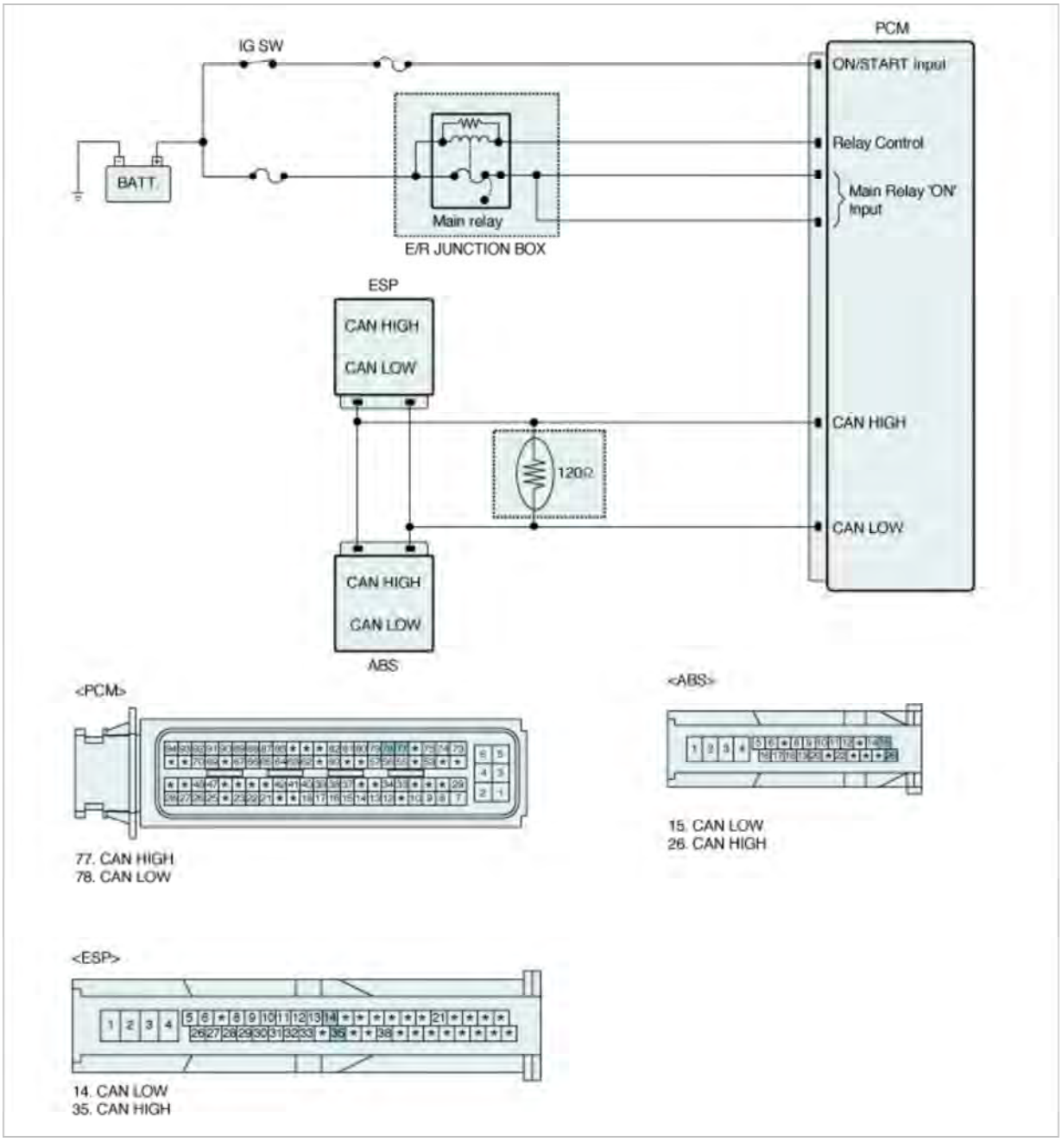
DTC Description

The TCM reads data on the CAN-BUS line and checks whether the data is equal to the data which the TCM sent before. If the data is not the same the TCM decides that either the CAN-BUS line or TCM are malfuncting and sets this code.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• No message from ECM	• Open or Short in CAN communication harness • Faulty ECM • Faulty TCM
Enable Conditions	• Input speed >1000rpm • Time after TCM turns on >0.5sec	
Threshold Value	• Message from ECM No message	
Diagnostic Time	• more than 1.5sec	
Fail Safe	• INTELLIGENT SHIFT is inhibited • learning for oil pressure control is inhibited • Torque Retard requirement is inhibited. • direct connection control of DCC is inhibited.	

Diagnostic Circuit Diagram



Signal Waveform

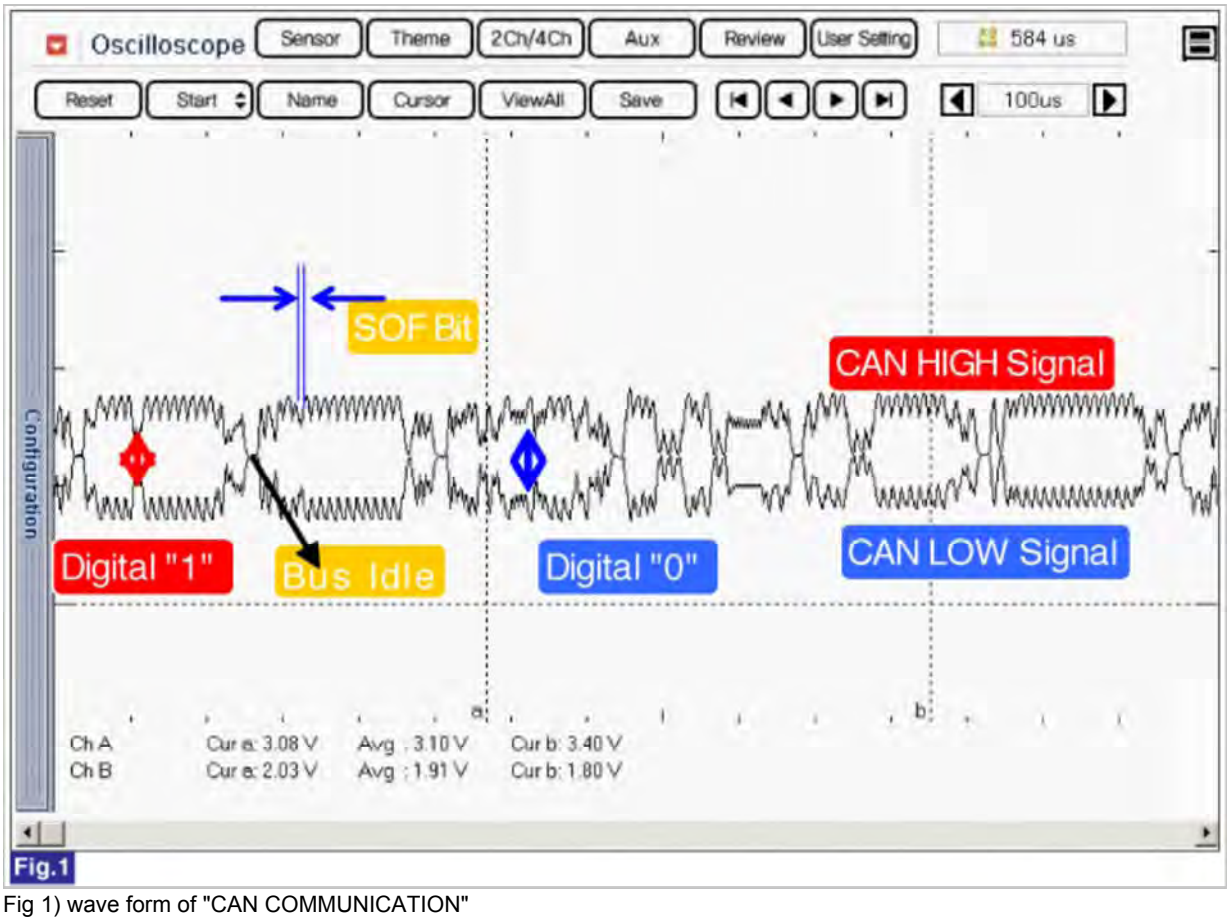
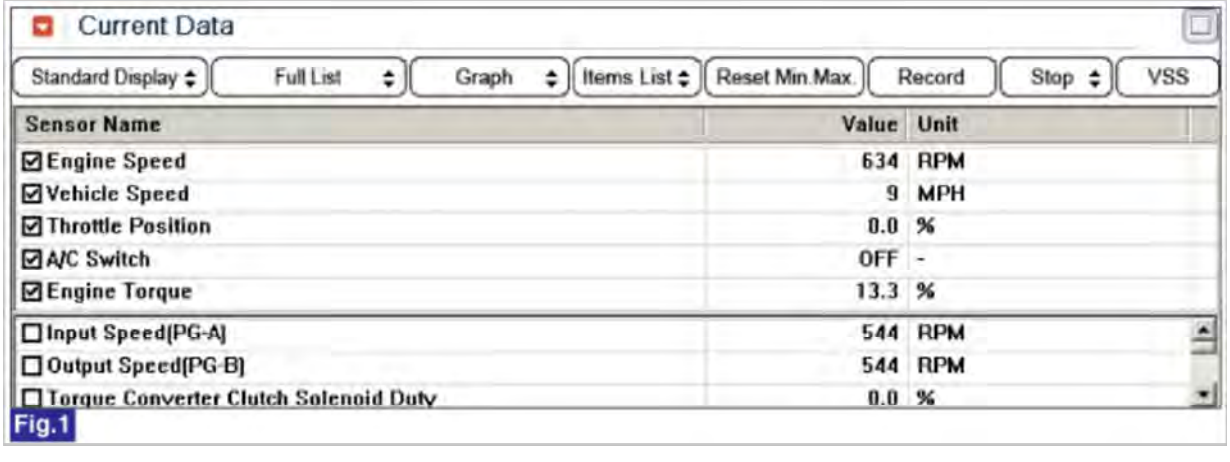


Fig 1) wave form of "CAN COMMUNICATION"

Monitor GDS Data

1. Connect GDS to data link connector(DLC)
2. Engine "ON".
3. Monitor the "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, VEHICLE SPEED SENSOR, THROTTLE P. SENSOR)" parameters on the GDS



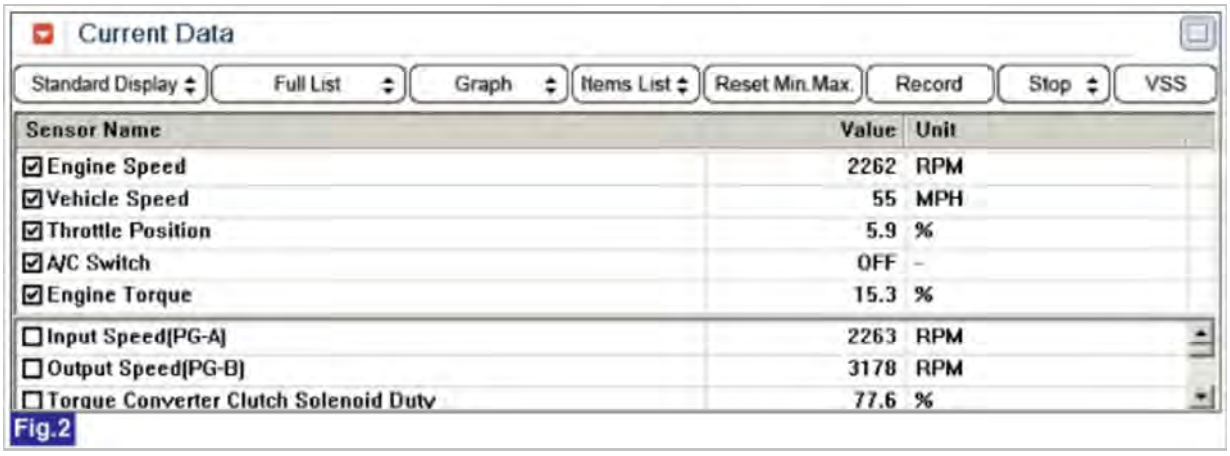


Fig 1) Low-RPM
Fig 2) High-RPM

4. Does "CAN BUS LINE DATA " follow the referance data?

YES	▸ Fault is intermittent caused by poor contact in the sensor's and/or PCM/TCM's connector or was repaired and PCM/TCM memory was not cleared.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 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 "OFF".
2. Disconnect "PCM" connector.
3. Measure resistance between CAN high terminal and CAN low terminal of PCM harness connector.

Specification : Approx. 120 Ω ± 10Ω

1. Is measured resistance within specifications?

YES	▸ Substitute with a known-good "PCM/TCM" and check for proper operation. If the problem is corrected, replace "PCM/TCM" and Go to "verification of vehicle repair" procedure
NO	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage of ECM.and then Repair or replace Resistance for CAN communication 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.

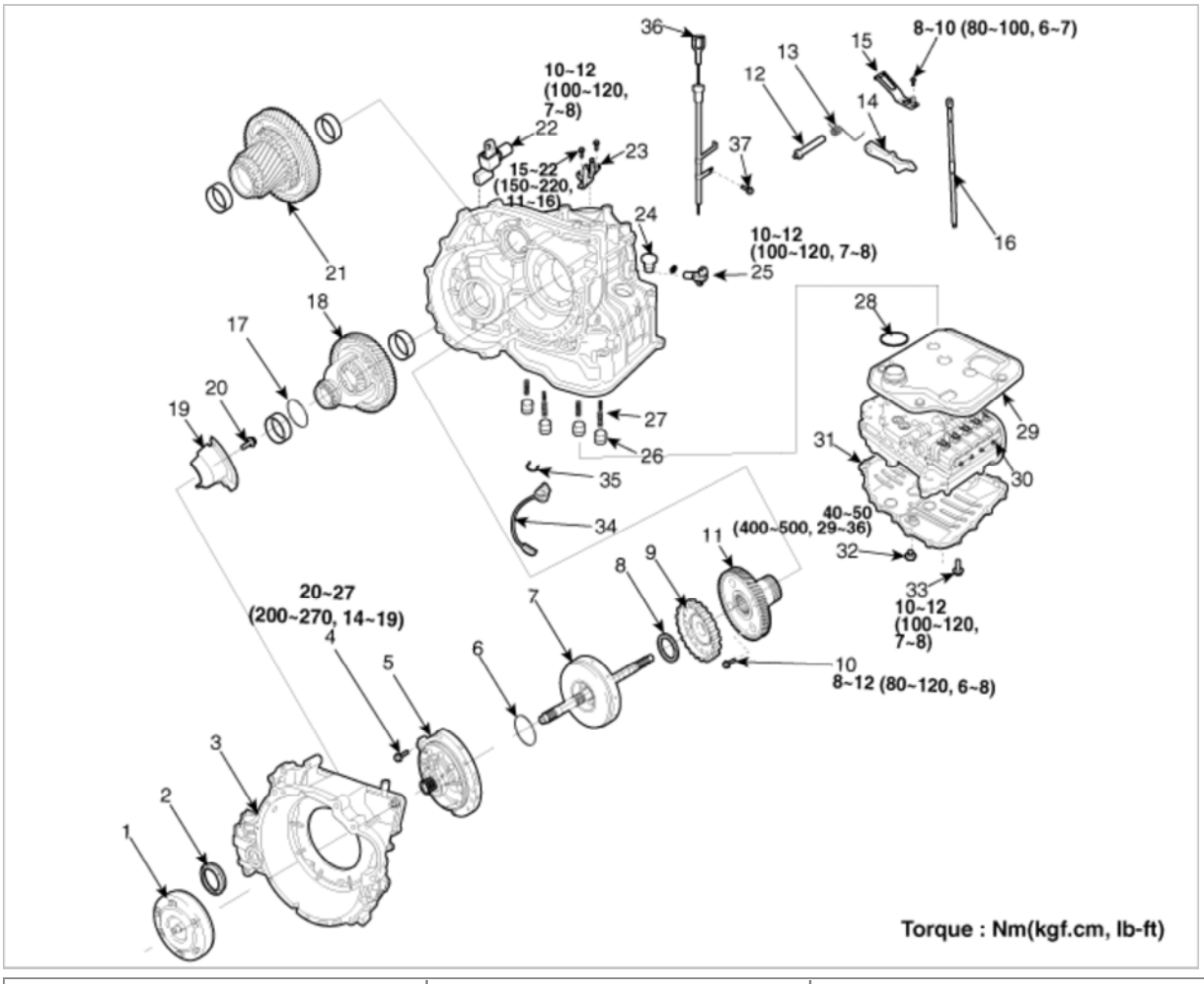
1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.

NO	▸ System performing to specification at this time.

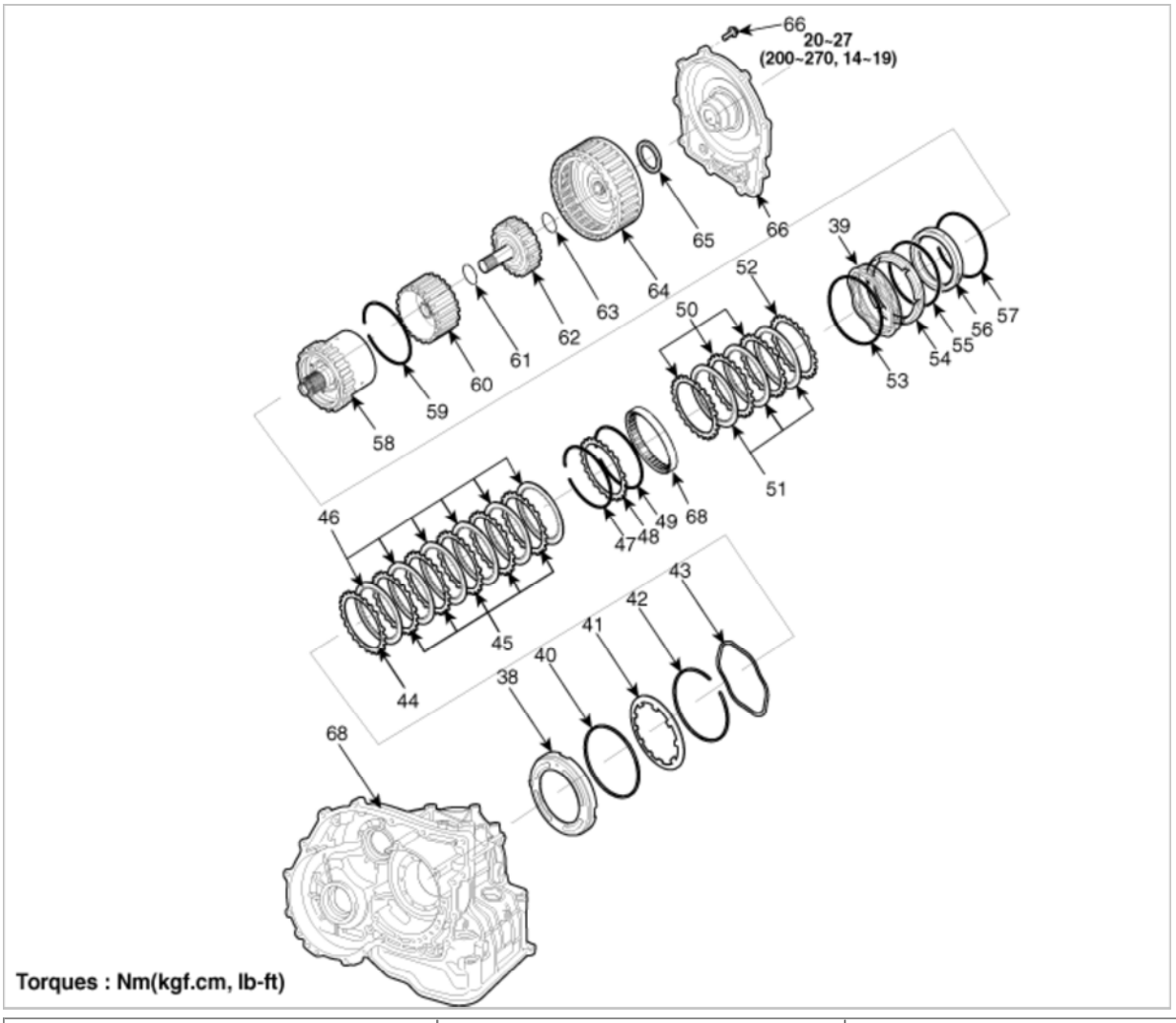
Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Components and Components Location (A4CF2)

Components(1)



1. Torque converter	14. Parking sprag	27. Coil spring
2. Differential oil seal	15. Detent spring	28. O-ring
3. Converter housing	16. Manual control shaft	29. Oil filter
4. Oil pump mounting bolt	17. Spacer	30. Valve body assembly
5. Oil pump assembly	18. Differential	31. Oil pan
6. Thrust washer	19. Oil separate	32. Drain plug
7. Underdrive(U/D) clutch	20. Oil separate mounting bolt	33. Valve body cover bolt
8. Thrust bearing	21. Transfer driven gear	34. Valve body connector
9. Underdrive(U/D) clutch hub	22. Output shaft speed sensor	35. Valve body connector mounting clip
10. Transfer drive gear mounting bolt	23. Shift cable bracket	36. Oil level gauge
11. Transfer drive gear	24. Plug	37. Oil level gauge bracket bolt
12. Parking sprag shaft	25. Input shaft speed sensor	
13. Sprag spring	26. Accumulator piston	

Components(2)



38. Low & reverse brake piston	49. Snap ring	60. Reverse sun gear
39. Return spring	50. 2ND brake plate	61. Thrust bearing
40. Low & reverse brake spring retainer	51. 2ND brake disc	62. Overdrive(O/D) hub
41. Low & reverse brake return spring	52. 2ND brake pressure plate	63. Thrust bearing
42. Snap ring	53. Snap ring	64. Reverse & Overdrive(O/D) clutch
43. Wave spring	54. 2ND brake piston	65. Thrust bearing
44. Low & reverse pressure plate	55. D-ring	66. Rear cover
45. Low & reverse brake plate	56. 2ND brake retainer	67. Rear cover bolt
46. Low & reverse brake disc	57. D-ring	68. One way clutch inner race
47. Snap ring	58. Low & reverse planetary gear set	69. Transmission case
48. Reaction plate	59. Snap ring	

Automatic Transaxle System > Automatic Transaxle System > Automatic Transaxle > Repair procedures (A4CF2)

Removal

CAUTION

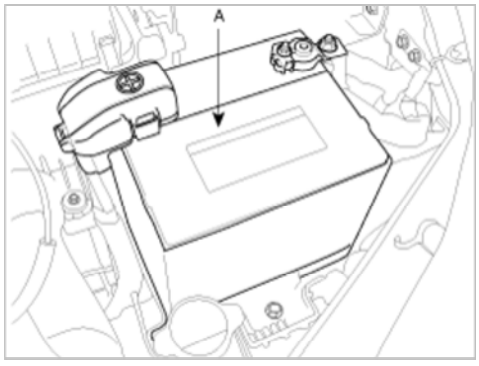
- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE

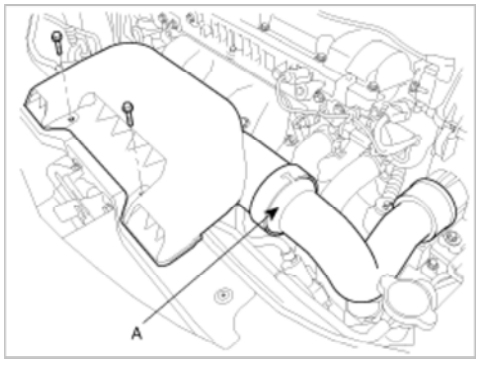
- Mark all wiring and hoses to avoid misconnection.

1. Remove the engine cover.
   (refer to Engine and Transaxle Assembly in EM group)

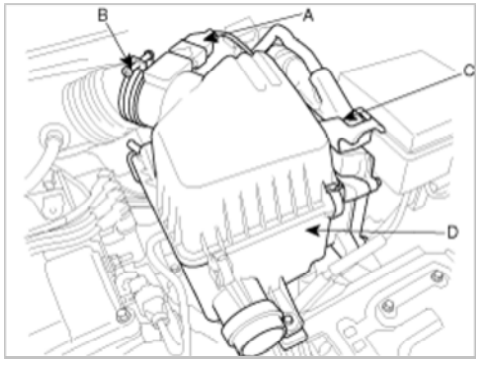
2. Remove the battery (A) after removing the battery terminal.



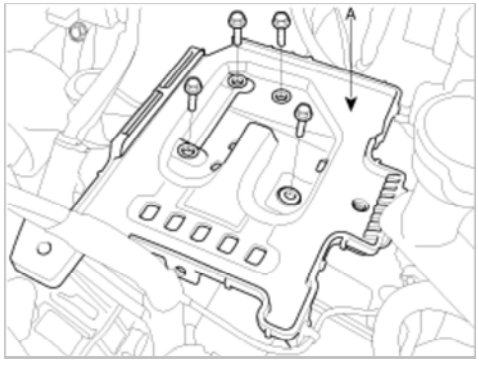
3. Remove the air duct assembly (A).



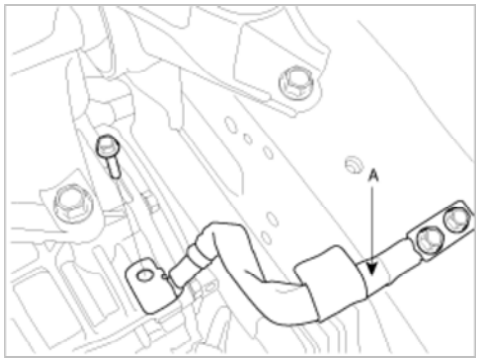
4. Remove the air cleaner assembly (D) by disconnecting the AFS(Air Flow Sensor) connector (A), the clamp (B) and the ECM connector (C).



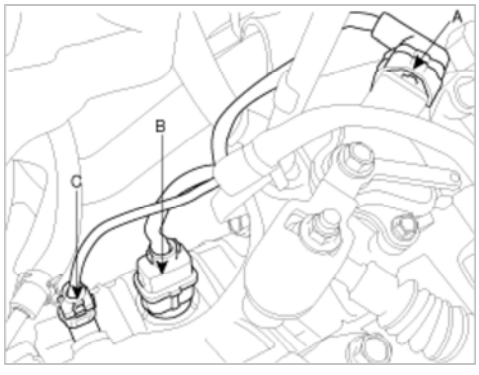
5. Remove the battery tray (A).



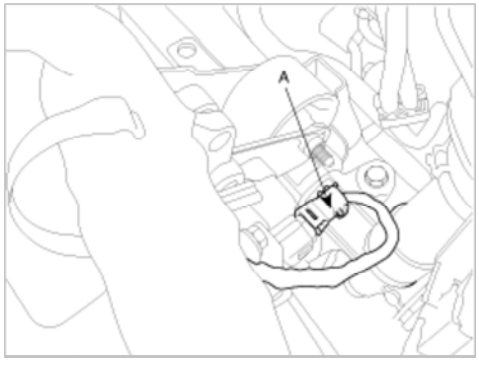
6. Remove the ground cable from transaxle (A).



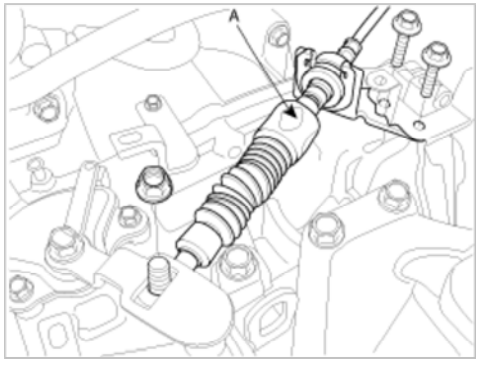
7. Disconnect the inhibiter switch connector (A), solenoid valve connector (B) and the input speed sensor connector (C).



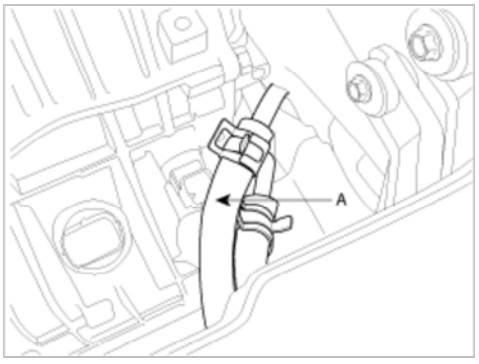
8. Disconnect the output speed sensor connector (A).



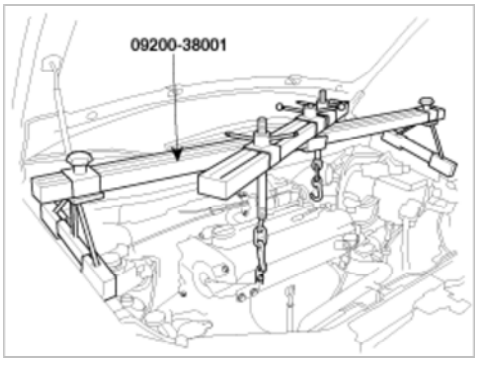
9. Remove the control cable assembly (A).



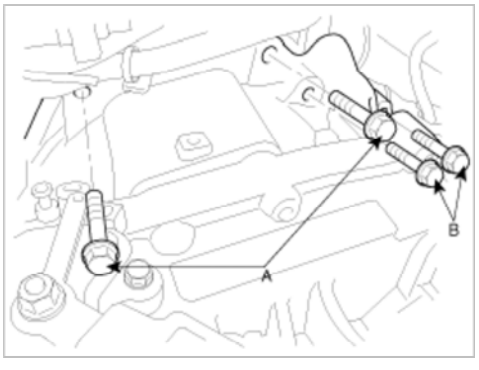
10. Remove the oil cooler hoses (A).



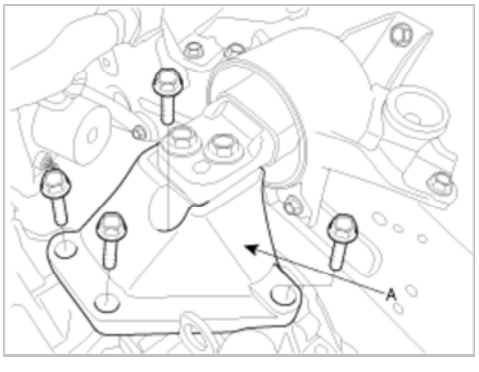
11. Install the special tools (09200-38001), the engine support fixture and the adapter on the engine assembly.



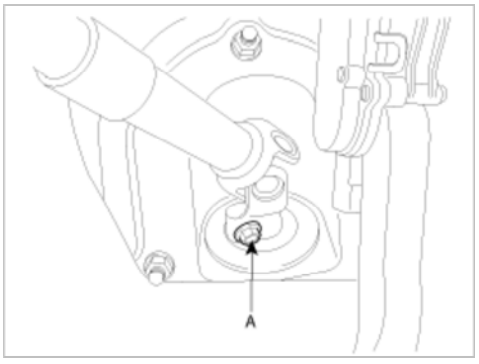
12. Remove the transaxle upper mounting bolts (A-2ea) and the starter motor mounting bolts (B-2ea).



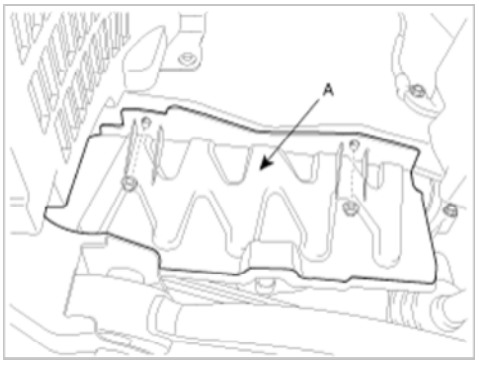
13. After removing the four bolts, take the transaxle insulator mounting bracket (A) off.



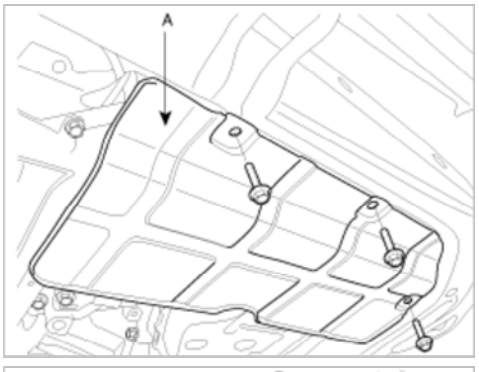
14. Remove the steering joint assembly bolt (A). (refer to Steering column/shaft in ST group)

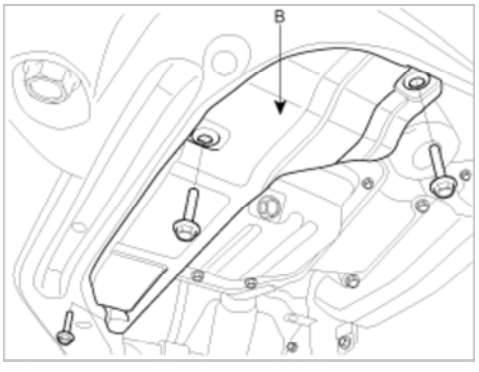


15. Remove the front wheels and tires. (refer to removal in SS group)
16. Remove the side mud cover (A).

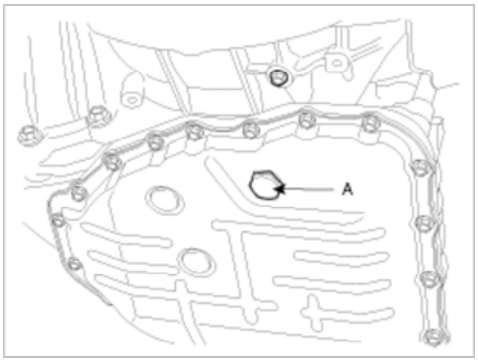


17. Remove the under shield cover (A, B).

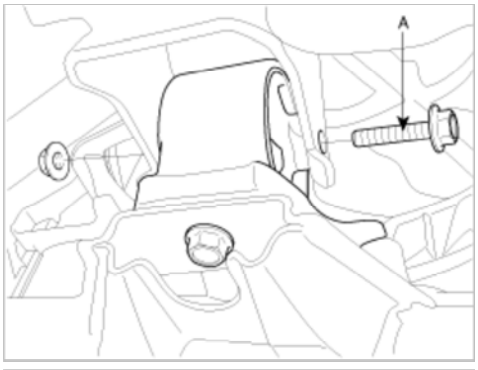


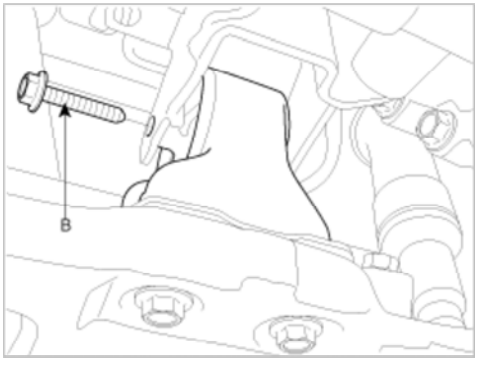


18. Drain the transaxle fluid by removing the oil drain plug (A).

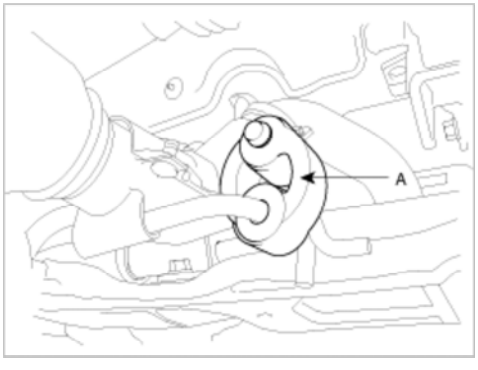


19. Remove the lower arm ball joint mounting nut, the stabilizer link mounting nut, and the tie rod end mounting nut from the front knuckles. (refer to Front suspension system in SS group)
20. Remove the roll stopper mounting bolts (A, B).

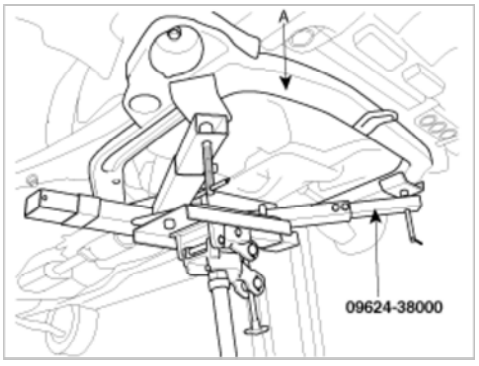




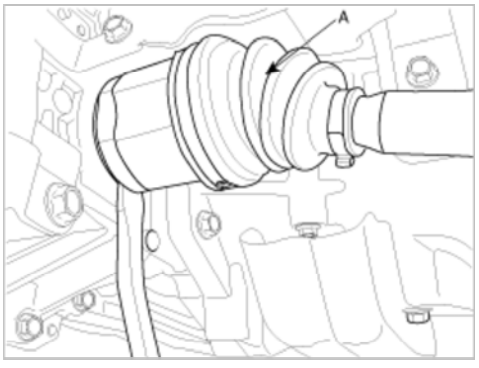
21. Remove the muffler hanger rubber (A).

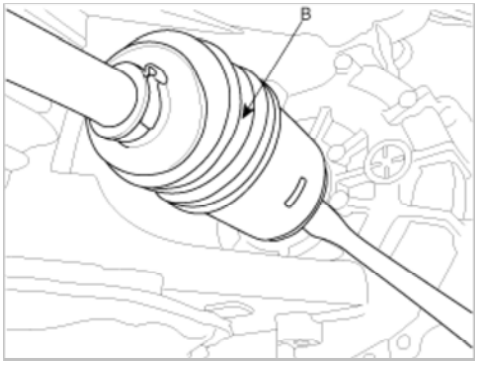


22. Supporting the sub frame (A) with a jack and the Special tool (09624-38000), remove the mounting bolts.(refer to Stabilizer's removal in SS group)

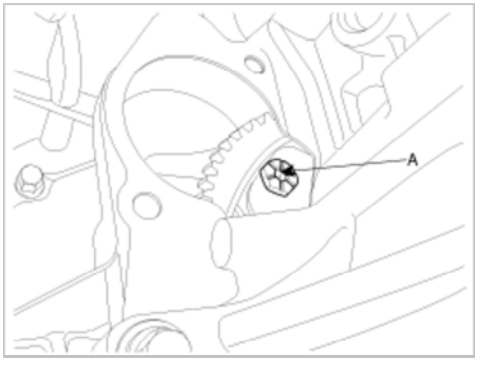


23. Disconnect the drive shafts (A,B) from the transaxle.

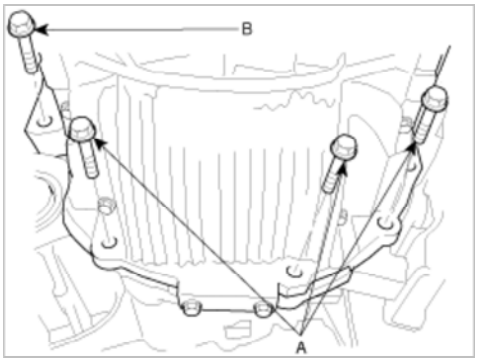




24. Remove the torque converter assembly mounting bolts (A-4ea).



25. Remove one mounting bolt from the transaxle side and the other from the engine side.
26. Supporting the transaxle with a jack, remove the transaxle lower mounting bolts (A-3ea, B-1ea).



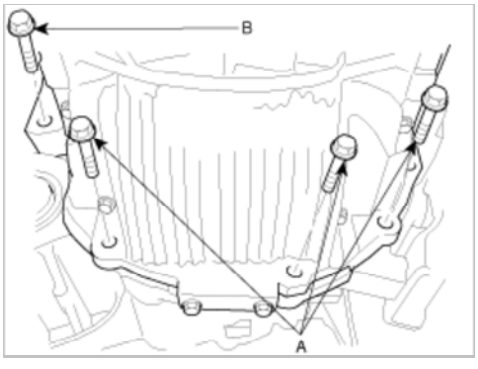
27. Lowering the jack slowly, remove the transaxle.

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

Installation

1. Install the transaxle lower mounting bolts (A-3ea, B-1ea) after fitting the transaxle assembly into the engine assembly.

Tightening torque :
43-55Nm (4.3-5.5kgf.m, 31.1-39.8lb-ft)

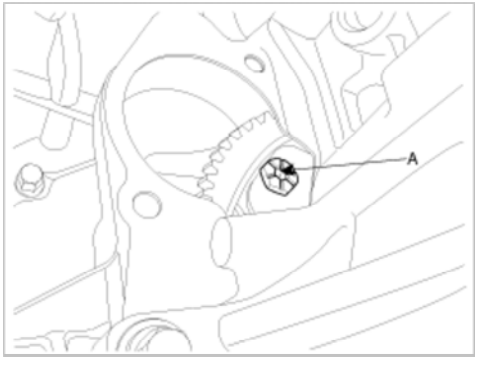


2. Install one mounting bolt from the transaxle side and the other from the engine side.

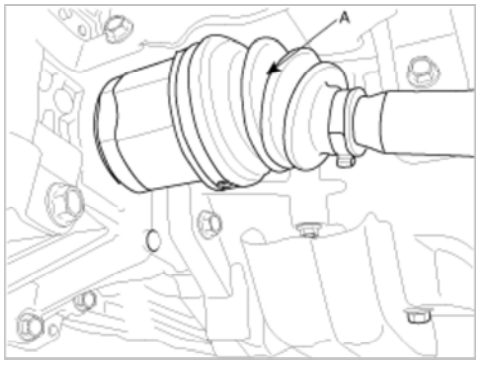
Tightening torque :
43-55Nm (4.3-5.5kgf.m, 31.1-39.8lb-ft)

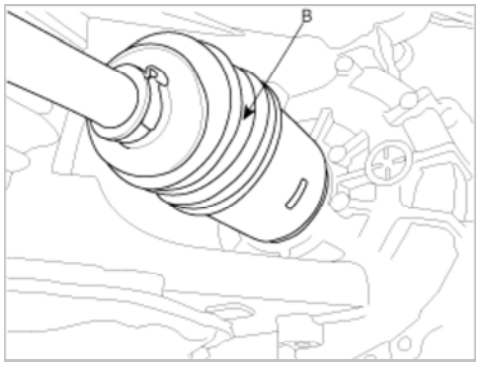
3. Install the torque converter assembly mounting bolts (A-4ea).

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



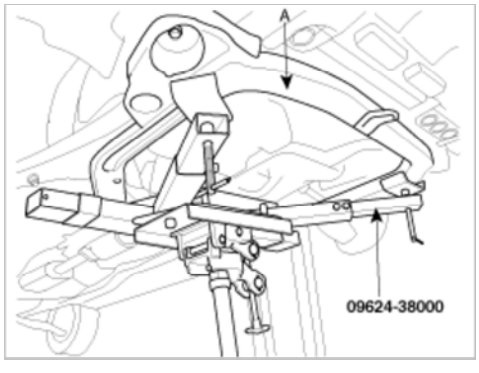
4. Connect the drive shafts (A, B) to the transaxle.



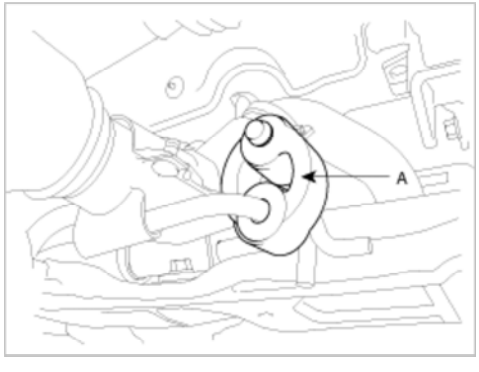


5. Supporting the sub frame (A) with a jack and the Special tool(09624-38000), install the mounting bolts. (refer to Stabilizer's installation in SS group).

Tightening torque :
140-160Nm (14-16kgf.m, 101-118lb-ft)

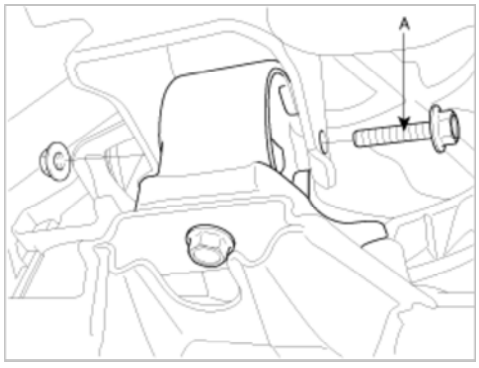


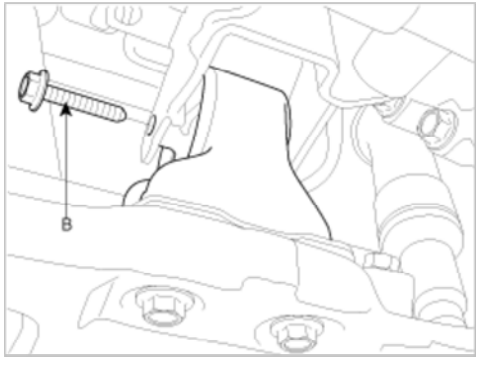
6. Install the muffler hanger rubber (A).



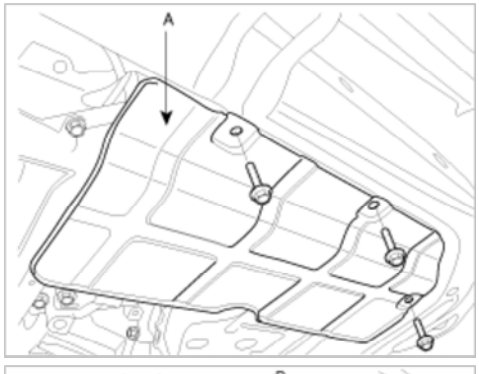
7. Install the roll stopper mounting bolts (A, B).

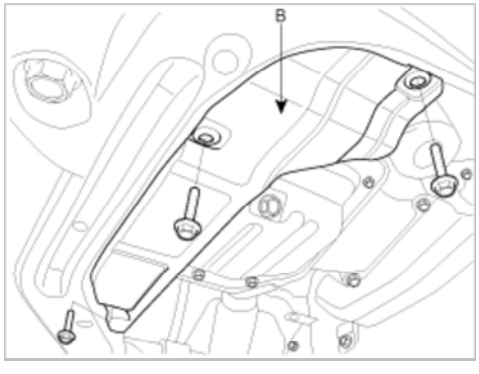
Tightening torque :
50-65Nm (5-6.5kgf.m, 36.2-47.0lb-ft)



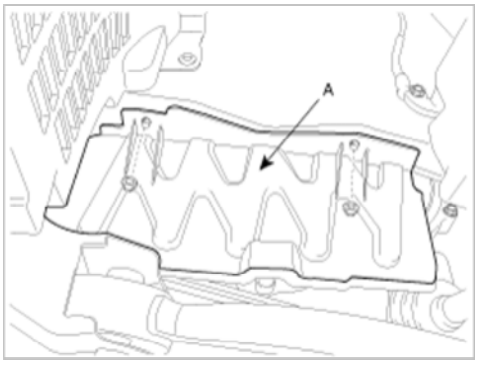


8. Install the lower arm ball joint mounting nut, the stabilizer link mounting nut, and the tie rod end mounting nut to the front knuckles. (refer to Front suspension system in SS group)
9. Install the under shield cover (A, B).

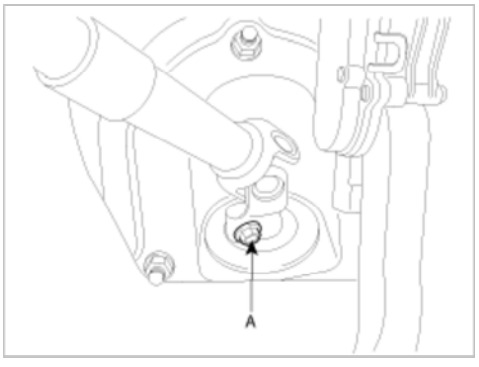




10. Install the side mud cover (A).

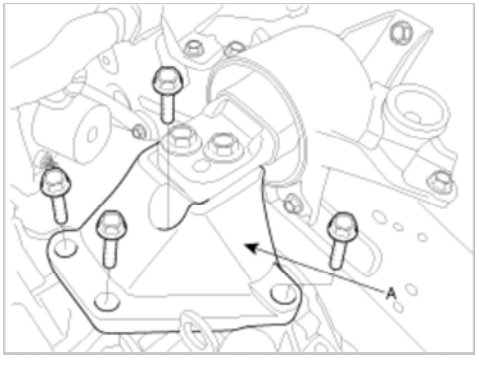


11. Install the front wheels and tires. (refer to installation in SS group)
12. Install the steering joint assembly bolt (A). (refer to Steering column/shaft in ST group)



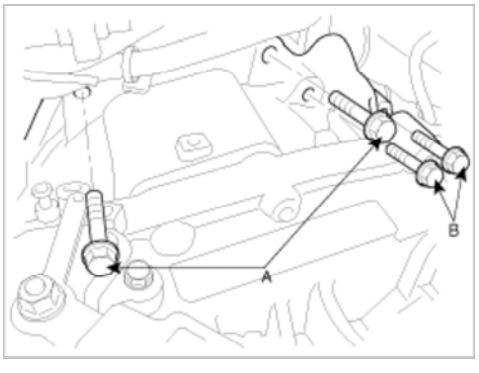
13. Install the transaxle insulator mounting bracket bolts (A).

Tightening torque :
60-80Nm (6.0-8.0kgf.m, 43.4-57.9lb-ft)

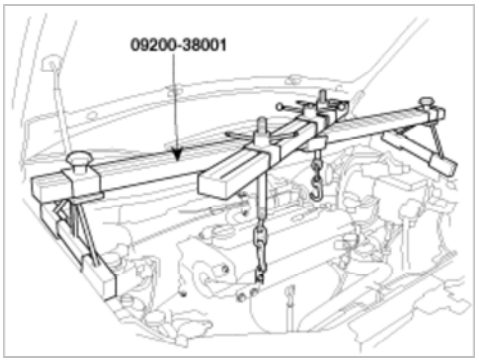


14. Install the transaxle upper mounting bolts (A-2ea) the starter motor mounting bolts (B-2ea).

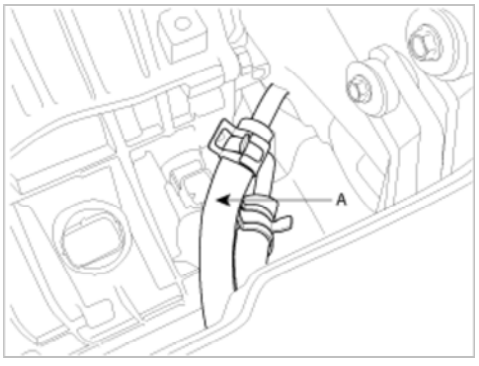
Tightening torque :
[A] 60-80Nm (6.0-8.0kgf.m, 43.4-57.9lb-ft)
[B] 43-55Nm (4.3-5.5kgf.m, 31.1-39.8lb-ft)



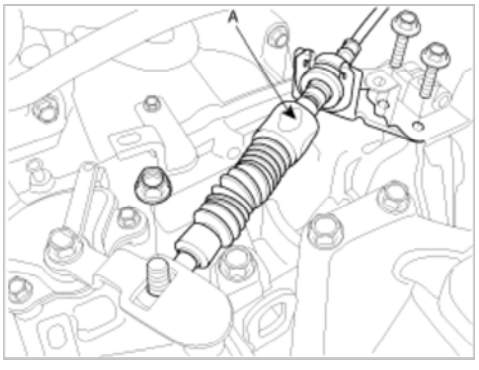
15. Remove the special tool (09200-38001).



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

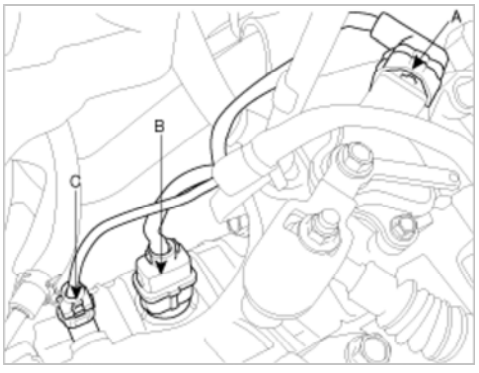


17. Install the control cable assembly (A).

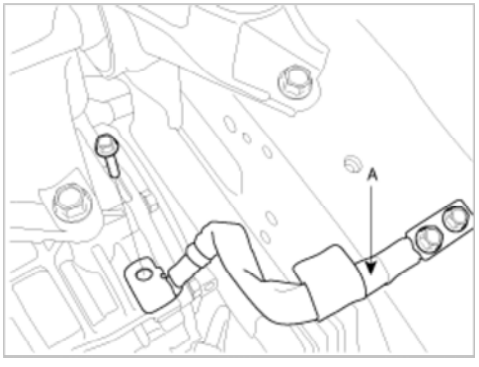


18. Install the output speed sensor connector (A).

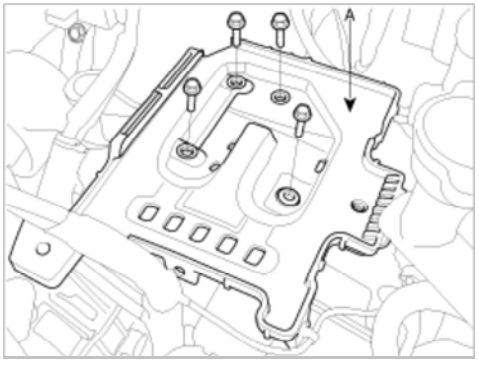
19. Connect the inhibiter switch connector (A), solenoid valve connector (B) and the input speed sensor connector (C).



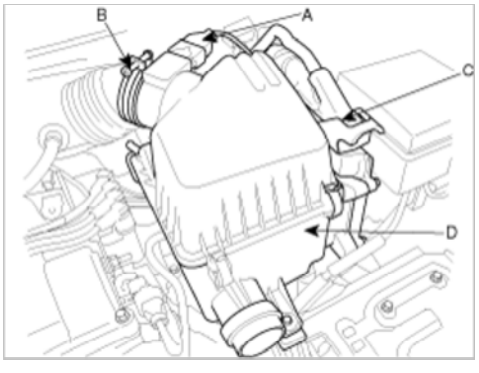
20. Install the ground cable (A) to transaxle.



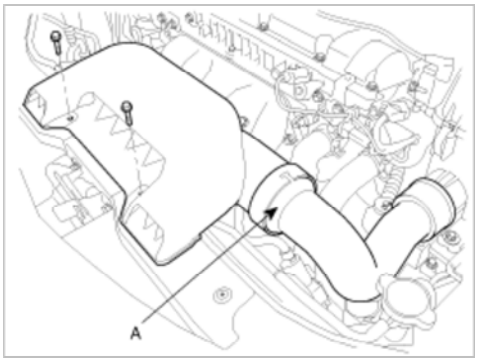
21. Install the battery tray (A).



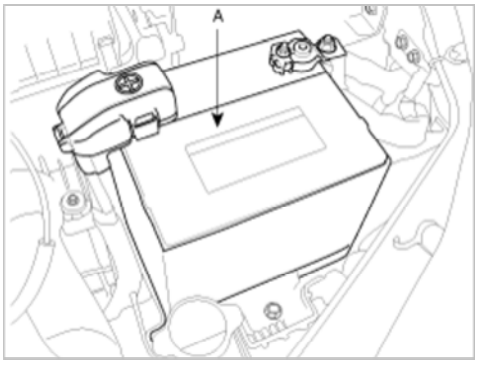
22. Install the air cleaner assembly (D) by connecting the AFS(Air Flow Sensor) connector (A), the clamp (B) and the ECM connector (C).



23. Install the air duct assembly(A).



24. Install the battery (A) and the battery terminal.

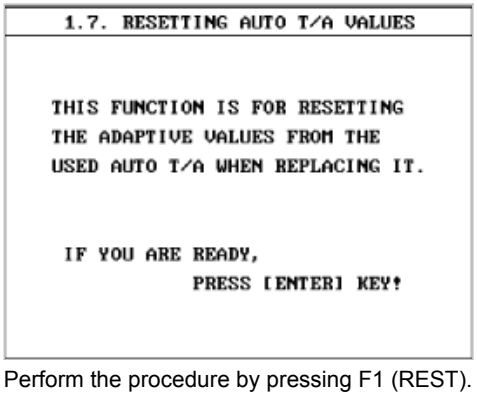


25. Install the engine cover.
    (refer to Engine and Transaxle Assembly in EM group)
    After completing the installation perform the following procedure;
    A. Adjust the shift cable.
    B. Refill the transaxle fluid.
    C. Clean the battery posts and cable terminals with sandpaper and grease them to prevent corrosion before installing.

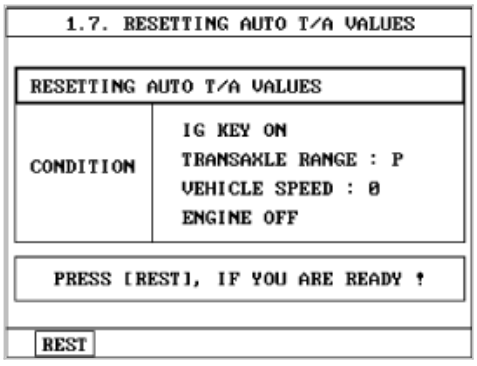
NOTE

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

1) Connect the Hi-Scan Pro connector to the data link connector under the crash pad and power cable to the cigar jack under the center facia.
2) Turn the ignition switch on and power on the Hi-Scan Pro.
3) Select the vehicle's name.
4) Select 'AUTOMATIC TRANSAXLE'.
5) Select 'RESETTING AUTO T/A VALUES' and perform the procedure



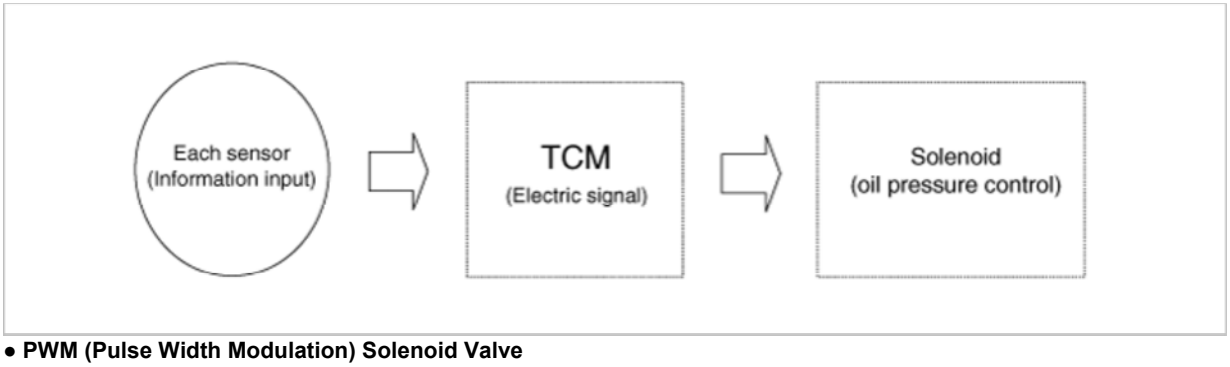
6) Perform the procedure by pressing F1 (REST).



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

Description

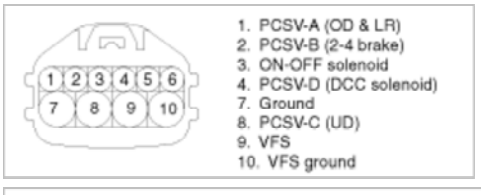
TCM calculates the best condition using the information from all kinds of sensors. If the solenoid valve receives the information on the oil pressure, the solenoid valve actuates according to the driving signal. All kinds of regulators in the valve body are controlled to change the oil passage and also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

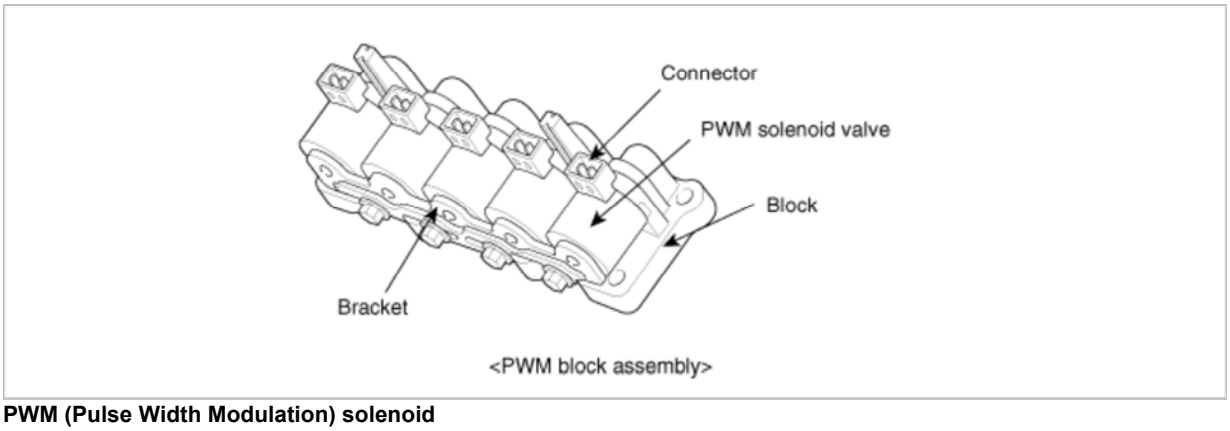


● PWM (Pulse Width Modulation) Solenoid Valve

Structure and functions

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





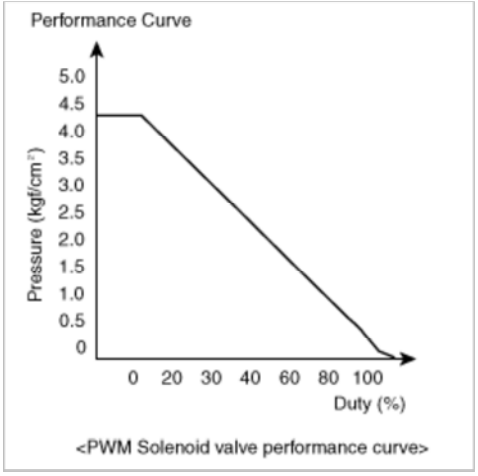
<PWM block assembly>

PWM (Pulse Width Modulation) solenoid

Range	PWM solenoid valve				
	PCSV-A (SCSV-B)	PCSV-B (SCSV-C)	PCSV-C (SCSV-D)	PCSV-D (TCC SV)	ON, OFF (SCSV-A)

N, P	OFF	ON	ON	OFF	ON
1st	ON	ON	OFF	OFF	ON
2nd	ON	OFF	OFF	ON	OFF
3rd	OFF	ON	OFF	ON	OFF
4th	OFF	OFF	ON	ON	OFF
Reverse	OFF	OFF	ON	OFF	ON
LOW	OFF	ON	OFF	OFF	ON

PWM (Pulse Width Modulation) Solenoid Valve Control Feature

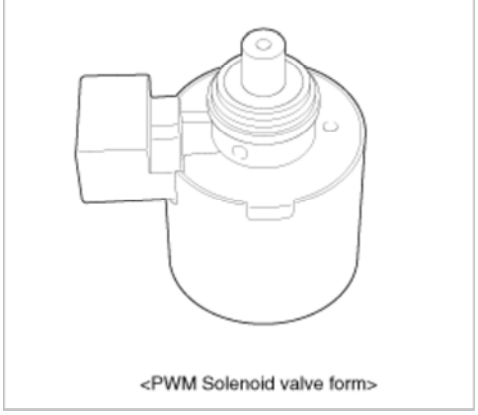


<PWM Solenoid valve performance curve>

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

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

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

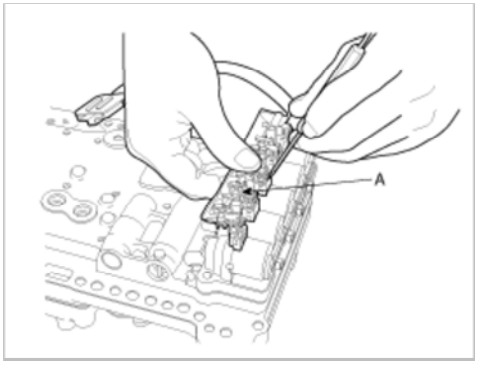

<PWM Solenoid valve form>

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

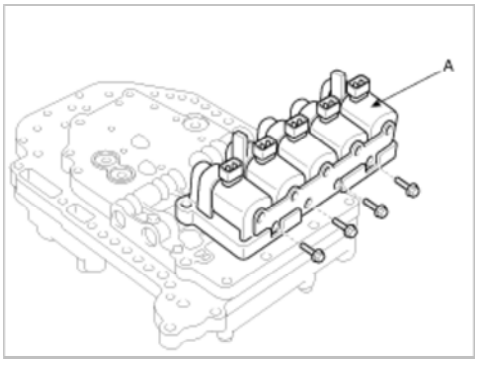
Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.

4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in 'A4CF2' overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in 'A4CF2' overhaul manual)
8. Disconnect the main harness(A) from valve body.



9. Remove the solenoid valve assembly(A).



Installation

1. Install the solenoid valve.

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

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

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

3. Install the valve body. (Refer to Valve body's reassembly in 'A4CF2' overhaul manual)

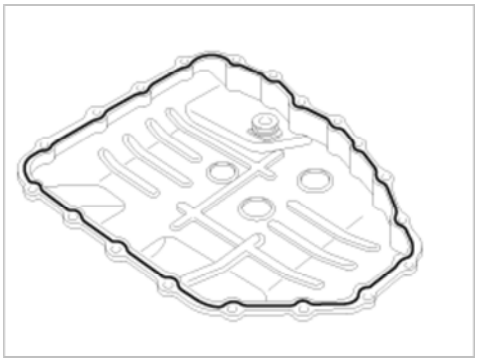
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the oil filter.

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

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

Liquid gasket Part name : Threebond 1281B



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

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

7. Install the drain plug.

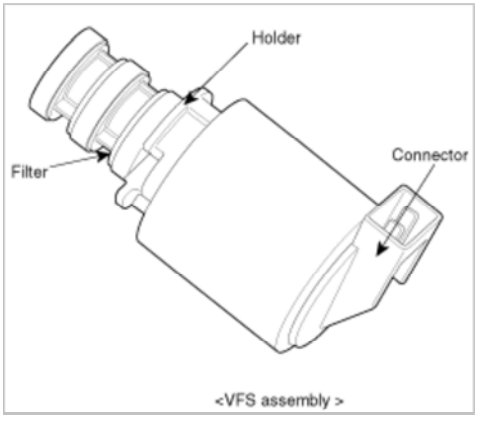
Tightening torque :
40~50Nm(4.0~5.0kgf.m, 28.9~36.2lb-ft)

8. Installation is the reverse of the removal.

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

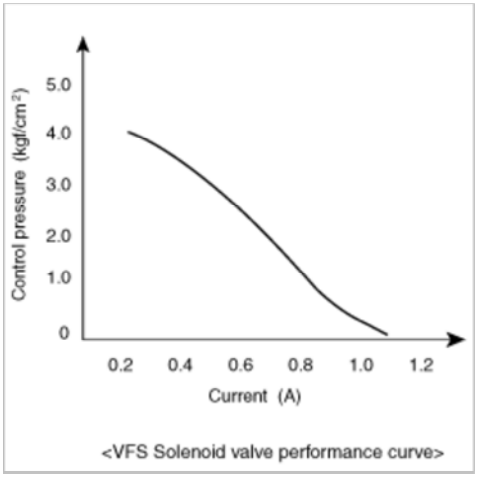
Description

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



<VFS assembly >

VFS (Variable Force Solenoid) Valve Control Feature



<VFS Solenoid valve performance curve>

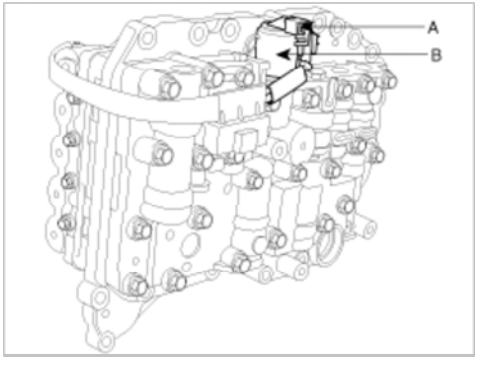
PWM solenoid valve is controlled linearly according to the current value.

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

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

Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in 'A4CF2' overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in 'A4CF2' overhaul manual)
8. Disconnect the VFS solenoid valve connector (A).

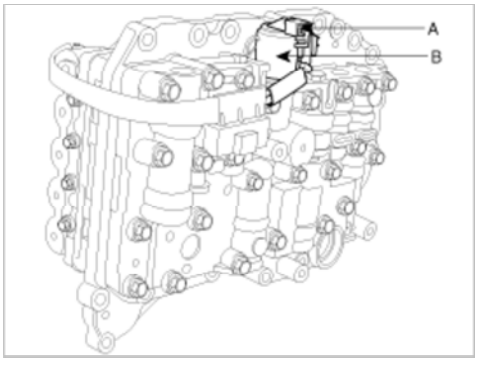


9. Remove the solenoid valve assembly (B).

Installation

1. Install the solenoid valve (B).

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



2. Connect the solenoid valve connector (A).

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

3. Install the valve body. (Refer to Valve body's reassembly in 'A4CF2' overhaul manual)

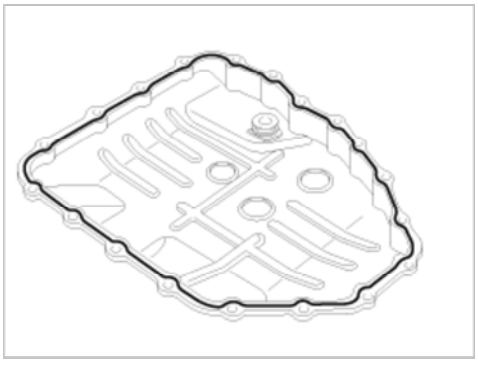
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

4. Install the oil filter.

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

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

Liquid gasket Part name : Threebond 1281B



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

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

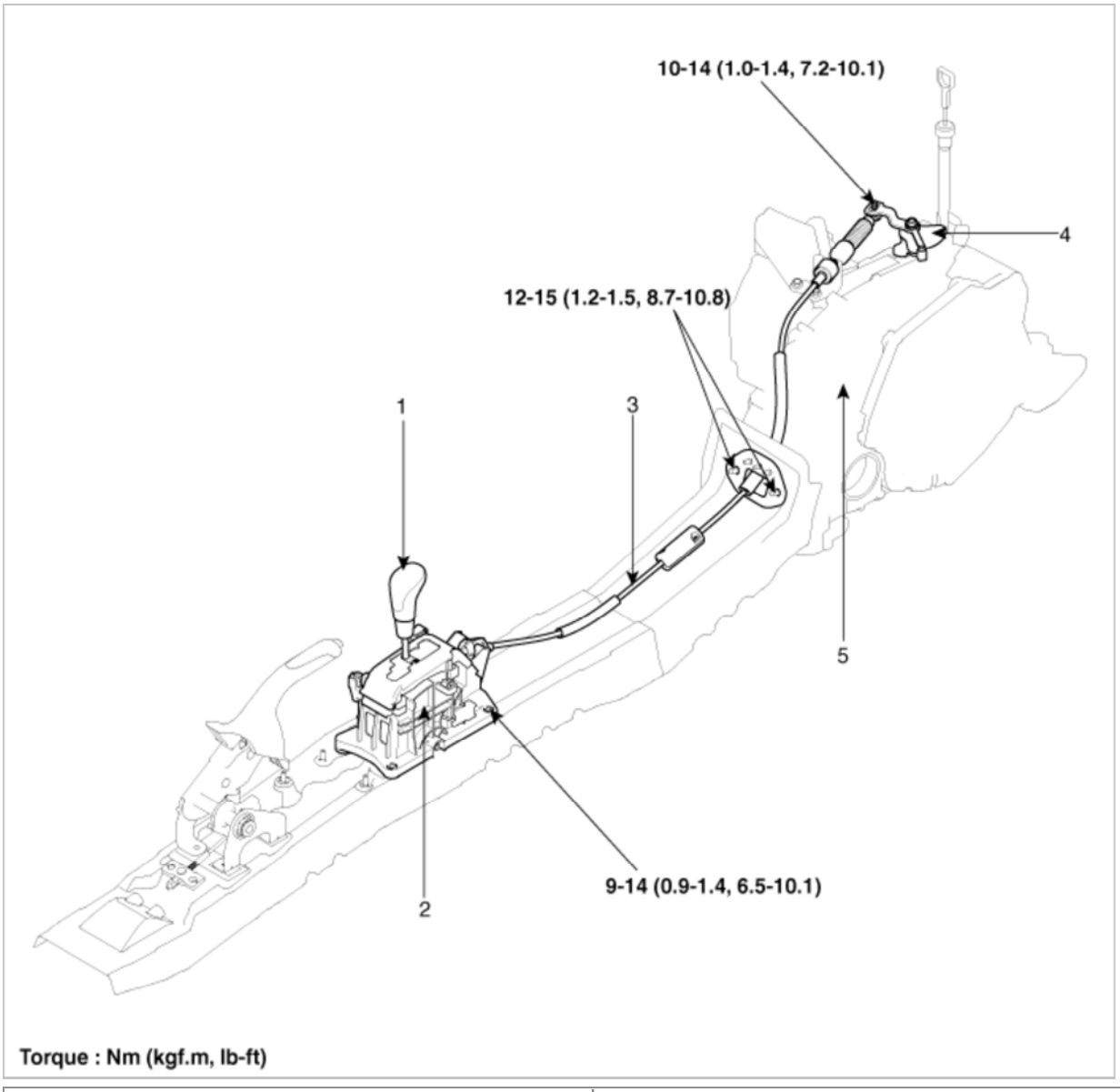
7. Install the drain plug.

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

8. Installation is the reverse of the removal.

Automatic Transaxle System > Automatic Transaxle Control System > Shift Lever > Components and Components Location (A4CF2)

Components

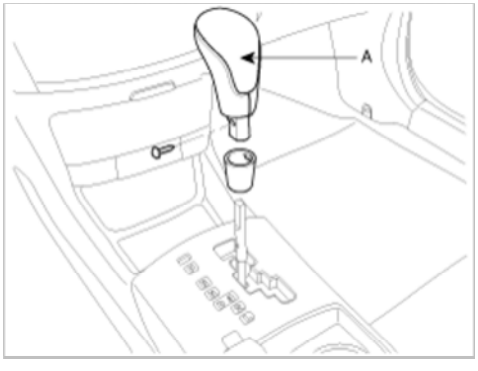


1. Shift lever knob 2. Shift lever assembly 3. Control cable assembly	4. Manual lever assembly 5. Automatic transaxle assembly

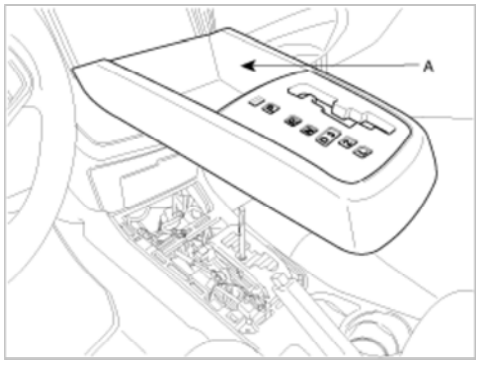
Automatic Transaxle System > Automatic Transaxle Control System > Shift Lever > Repair procedures (A4CF2)

Removal

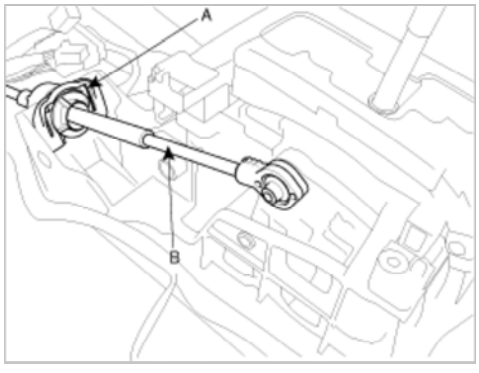
1. Remove the shift lever knob (A).



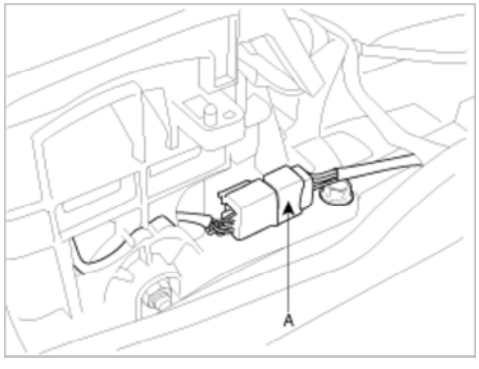
2. Remove the center console cover (A).



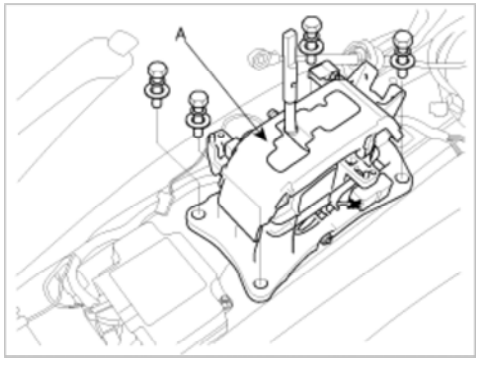
3. Remove the center console. (refer to Console in BD group)
4. Remove the shift cable assembly (B) by removing the clamp (A).



5. Disconnect the interlock switch connector (A).

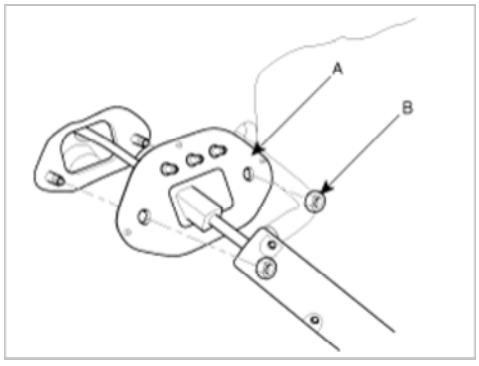


6. Remove the shift lever assembly (A).



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

> **NOTE**
>
> In case, remove the crush pad and cowl cross bar. (refer to Crush pad in BD group and Heater unit in HA group)



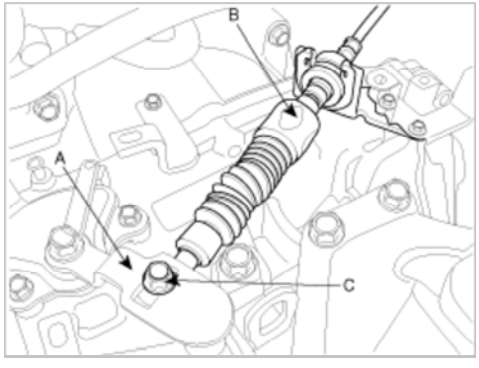
8. Remove the shift cable assembly from the transaxle (refer to Automatic transaxle's removal).
9. Remove the shift cable assembly.

Adjustment

Adjusting the shift cable

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

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



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

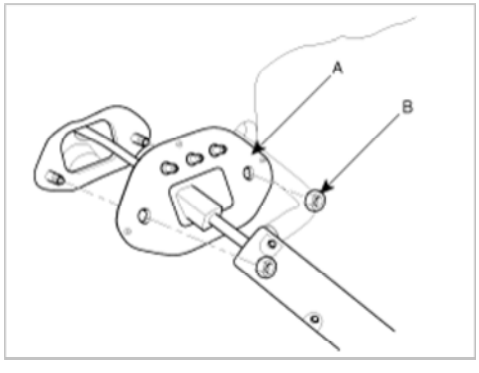
Installation

1. Install the retainer (A) and nuts (B).

Tightening torque :
12-15Nm (1.2-1.5kgf.m, 8.7-10.8lb-ft)

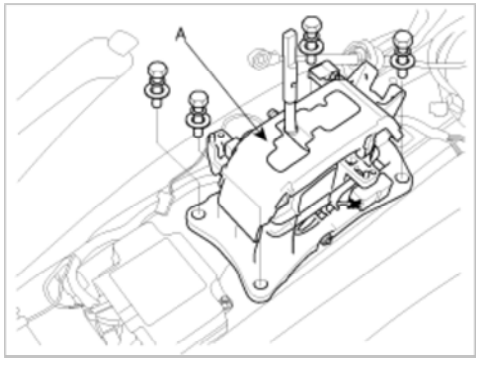
NOTE

In case, install the crush pad and cowl cross bar. (refer to Crush pad in BD group and Heater unit in HA group)

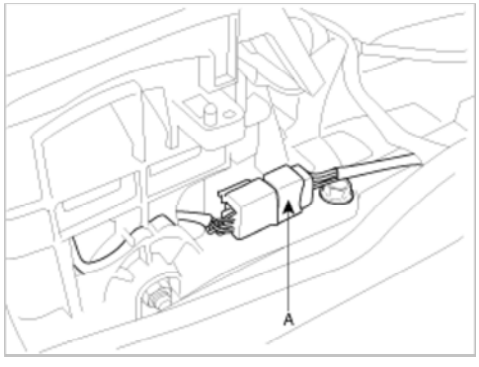


2. Install the shift lever assembly (A).

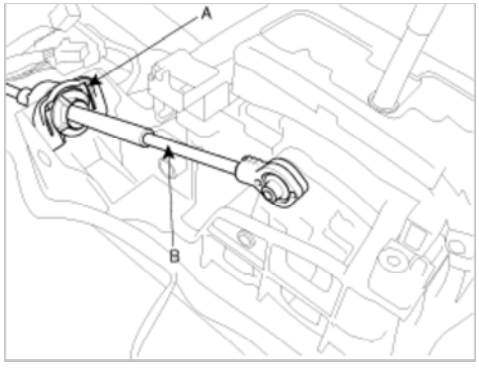
Tightening torque :
9-14Nm (0.9-1.4kgf.m, 6.5-10.1lb-ft)



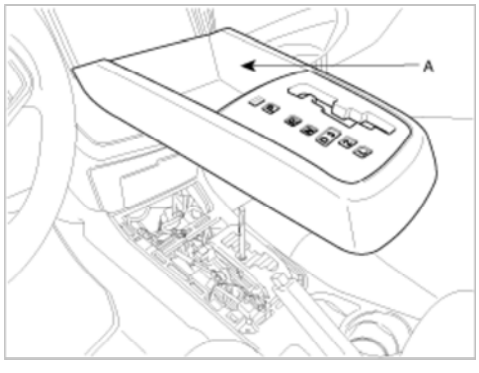
3. Connect the interlock switch connector (A).



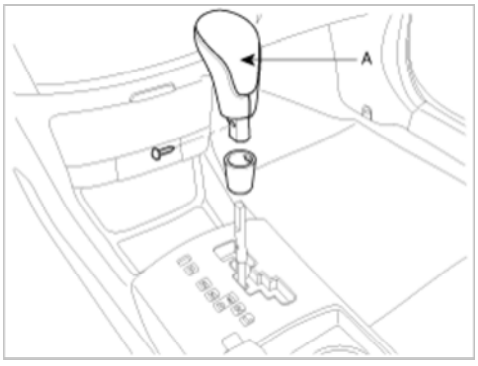
4. Install the shift cable assembly (B) by installing the clamp (A).



5. Install the center console. (refer to Console in BD group)
6. Install the center console cover (A).



7. Install the shift lever knob (A).

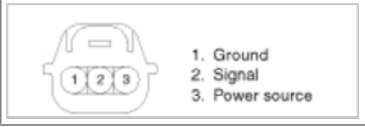


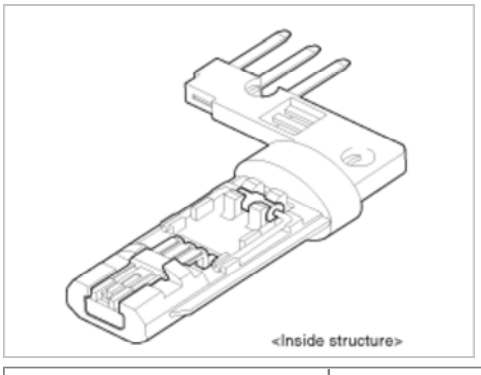
8. Install the shift cable assembly to transaxle. (refer to Automatic transaxle's installation)

> NOTE
>
> Before completing installation, adjust the shift cable referring to ADJUSTMENT section.

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

Description

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



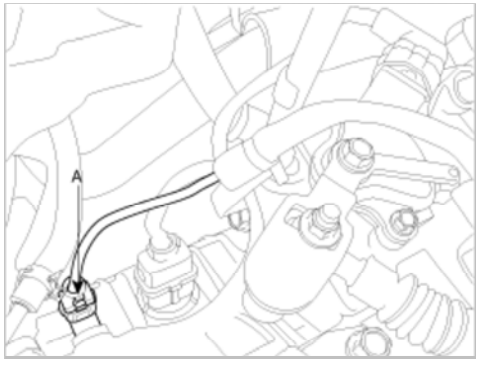
Item	Inspection item	Standard value
Air gap	Input speed sensor	0.035in(0.9mm)
Sensor resistance	Input speed sensor	Over 1 MΩ
Output voltage	HIGH	Over 4.8V
	LOW	Below 0.8V

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

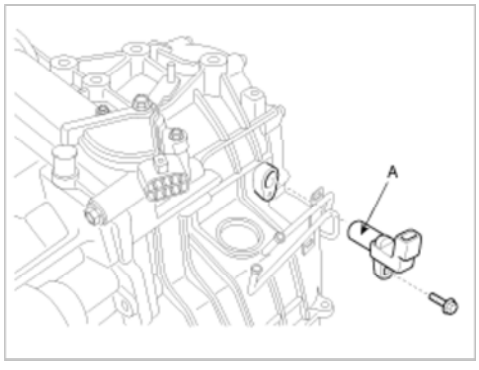
Removal

1. Remove the battery terminal.

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



6. Remove the input speed sensor(A).



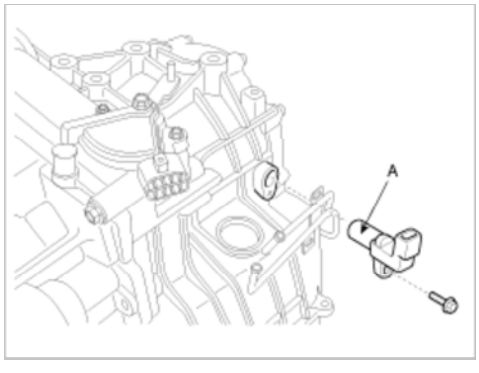
Installation

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

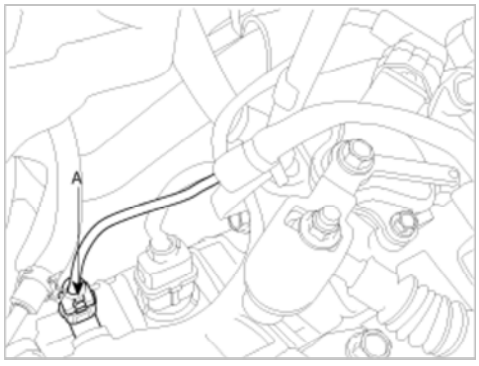
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

CAUTION

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



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

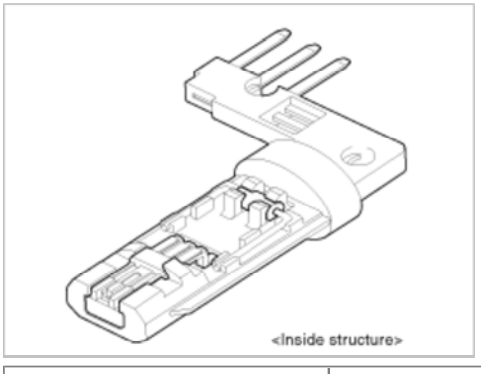


4. Installation is the reverse of removal.

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

Description

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



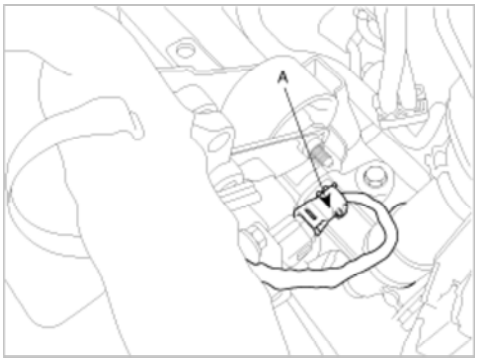
Item	Inspection item	Standard value
Air gap	Output speed sensor	0.025in(0.65mm)
Sensor resistance	Output speed sensor	Over 1 MΩ
Output voltage	HIGH	Over 4.8V
	LOW	Below 0.8V

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

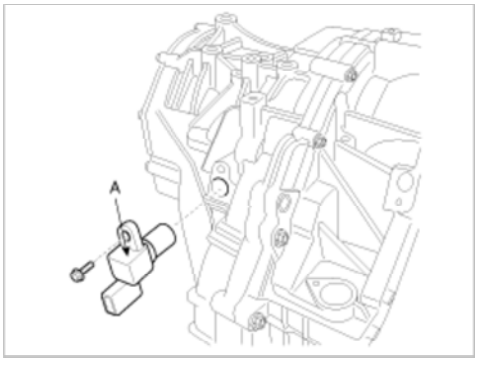
Removal

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

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



6. Remove the output speed sensor(A).



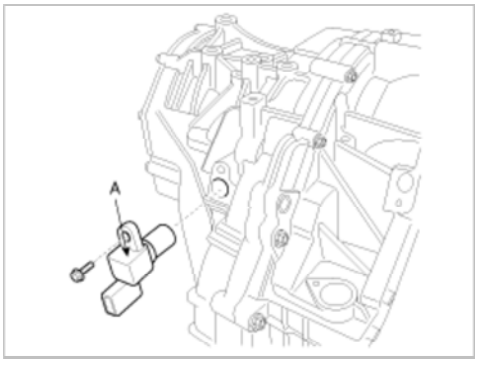
Installation

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

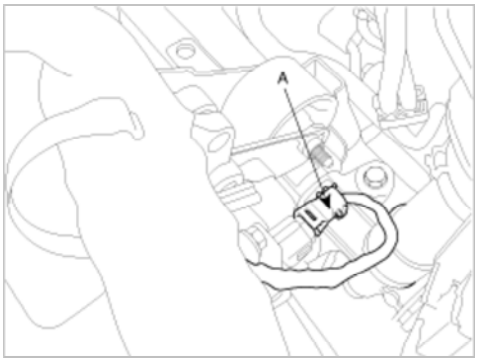
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

CAUTION

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



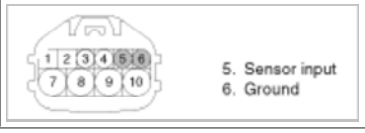
3. Check the connector for dust, dirt, or oil, then connect the output speed sensor connector (A) securely.



4. Installation is the reverse of removal.

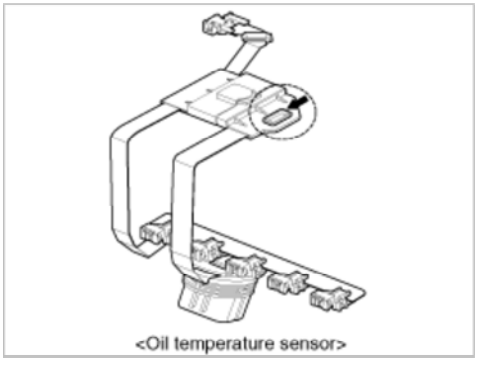
Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Description and Operation (A4CF2)

Description

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

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

Installation Location

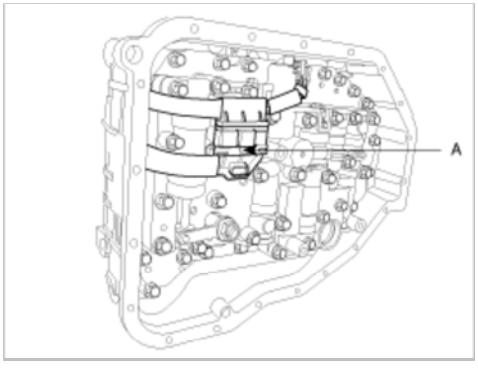


Automatic Transaxle System > Automatic Transaxle Control System > Transaxle Oil Temperature Sensor > Repair procedures (A4CF2)

Removal

1. Remove the battery terminal.
2. Lift the vehicle.
3. Remove the under cover.

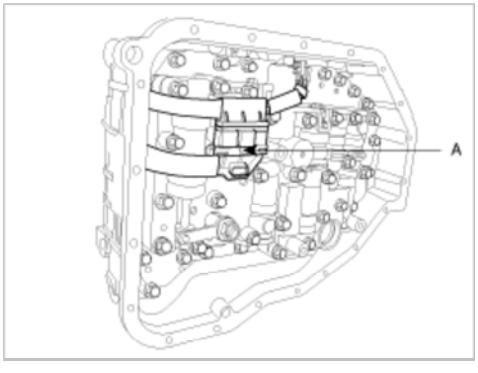
4. Loosen the drain plug and drain the transaxle oil.
5. Remove the oil pan. (Refer to Automatic transaxle's disassembly in 'A4CF2' overhaul manual)
6. Remove the oil filter.
7. Remove the valve body. (Refer to Valve body's disassembly in 'A4CF2' overhaul manual)
8. Disconnect the main harness connector (A) from the valve body.



Installation

1. Connect the main harness connector (A) to the valve body.

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



2. Install the valve body. (Refer to Valve body's reassembly in 'A4CF2' overhaul manual)

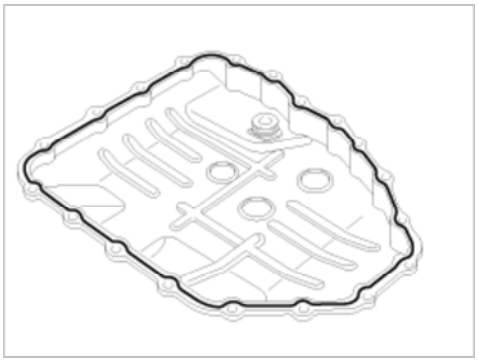
Tightening torque :
10~12Nm(1.0~1.2kgf.m, 7~8lb-ft)

3. Install the oil filter.

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

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

Liquid gasket Part name : Threebond 1281B



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

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

6. Install the drain plug.

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

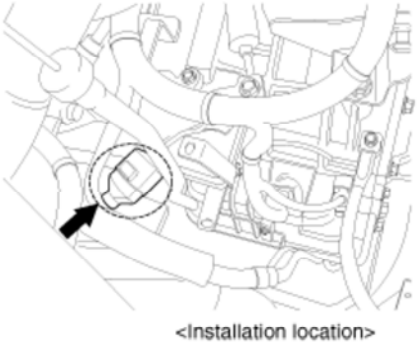
7. Installation is the reverse of the removal.

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

Description

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

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



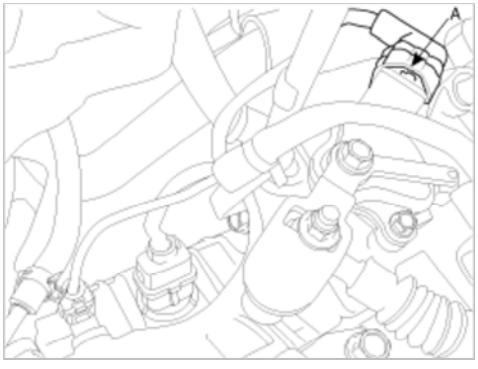
Shift lever / Terminal No.	P	R	N	D	2	L
1	●					
2				●		
3						●
4						
5					●	
6			●			
7		●				
8	●	●	●	●	●	●
9	●		●			
10	●		●			

Automatic Transaxle System > Automatic Transaxle Control System > Inhibiter Switch > Repair

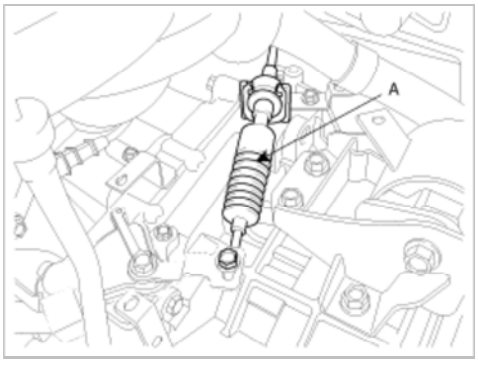
procedures (A4CF2)

Removal

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



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



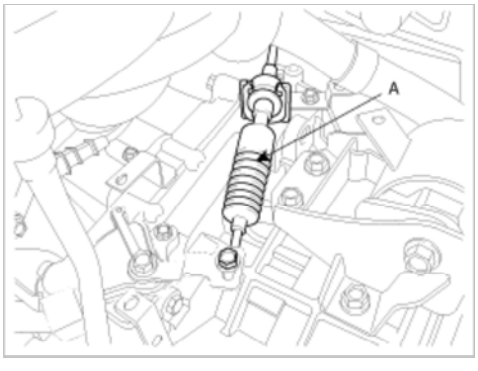
7. Remove the inhibitor switch and manual control lever.

Installation

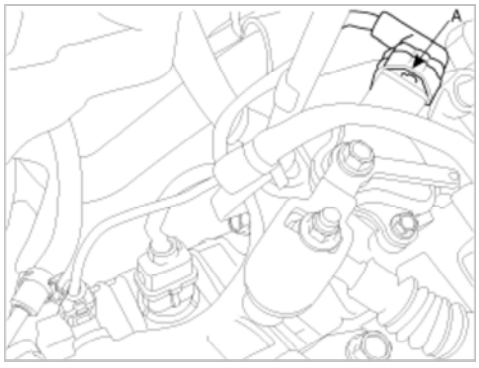
1. Set the inhibitor switch to the "N" position.
2. Set the inhibitor switch control shaft to the "N" position.
3. Install the inhibitor switch and manual control lever.

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

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



5. Connect the inhibitor switch connector (A).



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

Specification

Driveshaft

Engine	T/M		Joint type		Max. permissible angle	
			Outer	Inner	Outer	Inner
Gasoline 2.0	M/T & A/T	Left	BJ22	UTJ-II22	46°	23°
		Right	BJ22	TJ22	46°	23°
Gasoline 1.6	M/T & A/T	Left	BJ22	UTJ-II22	46°	23°
		Right	BJ22	TJ22	46°	23°
Gasoline 1.4	M/T	Left	BJ22	UTJ-II22	46°	23°
		Right	BJ22	TJ22	46°	23°
Front wheel bearing						
Bearing type			Double row angular contact ball bearing			
Starting torque			1.8 Nm (18 kgf.cm, 1.31 lb-ft) or below			
Rear hub & bearing assembly						
Bearing type			Double row angular contact ball bearing			
Starting torque			1.0 Nm (10 kgf.cm, 0.7 lb-ft) or below			

BJ : Birfield Joint
TJ : Journal Tripod Joint
SFJ : Shudderless Free-ring Joint
UTJ : U-TYPE Tripod Joint
Inner : On transaxle side
Outer : On tire side

Tightening Torque

Items	Nm	Kgf.m	lb-ft
Wheel nut	88.3~107.9	9.0~11.0	65.1~79.6
Driveshaft nut (Castle nut)	196.1~274.6	20.0~28.0	144.7~202.5
Lower arm ball joint assembly to knuckle bolts	98.1~117.7	10.0~12.0	72.3~86.8
Wheel speed sensor bolt	6.9~9.8	0.7~1.0	5.1~7.96
Front caliper assembly to knuckle bolts	78.5~98.1	8.0~10.0	57.9~72.3
Tie rod end castle nut	23.5~33.3	2.4~3.4	17.4~24.6
Front strut assembly to knuckle bolts	137.3~156.9	14.0~16.0	101.3~115.7
Rear lower arm to carrier assembly bolts	137.3~156.9	14.0~16.0	101.3~115.7
Rear lower arm to cross member bolts	137.3~156.9	14.0~16.0	101.3~115.7
Rear upper arm to carrier assembly bolts	98.1~117.7	10.0~12.0	72.3~86.8
Rear caliper assembly to carrier assembly bolts	49.0~58.8	5.0~6.0	36.2~43.4
Rear shockabsorber assembly to carrier assembly bolts	137.3~156.9	14.0~16.0	101.3~115.7
Assist arm to carrier assembly bolts	44.1~53.9	4.5~5.5	32.5~39.8
Trailing arm to carrier assembly bolts	34.3~53.9	3.5~5.5	25.3~39.8
Carrier assembly to rear hub assembly bolts	68.6~88.3	7.0~9.0	50.6~65.1

CAUTION

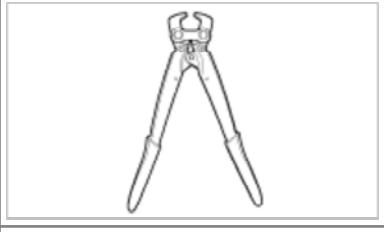
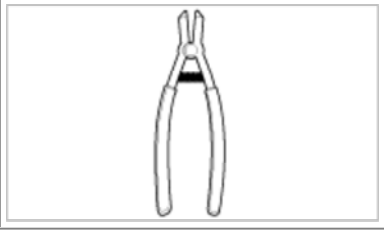
Replace self-locking nuts with new ones after removal.

Lubricants

Joint type	Recommended grease	Quantity
BJ22	RBA	100g
BJ24	RBA	130g
BJ25	RBA	160g
TJ22	CW-13TJ	125g
UTJ-II22	CW-13TJ	130g
UTJ-II25	CW-13TJ	200g

Driveshaft and axle > General Information > Special Service Tools

Special Service Tools

Tool(Number and Name)	Illustration	Use
09568-4A000 Ball joint remover		Removal of the front lower arm and tie rod end ball joint
09495-3K000 Band installer		Installation of ear type boot band
09495-39100 Band installer		Installation of hook type boot band

Driveshaft and axle > General Information > Troubleshooting

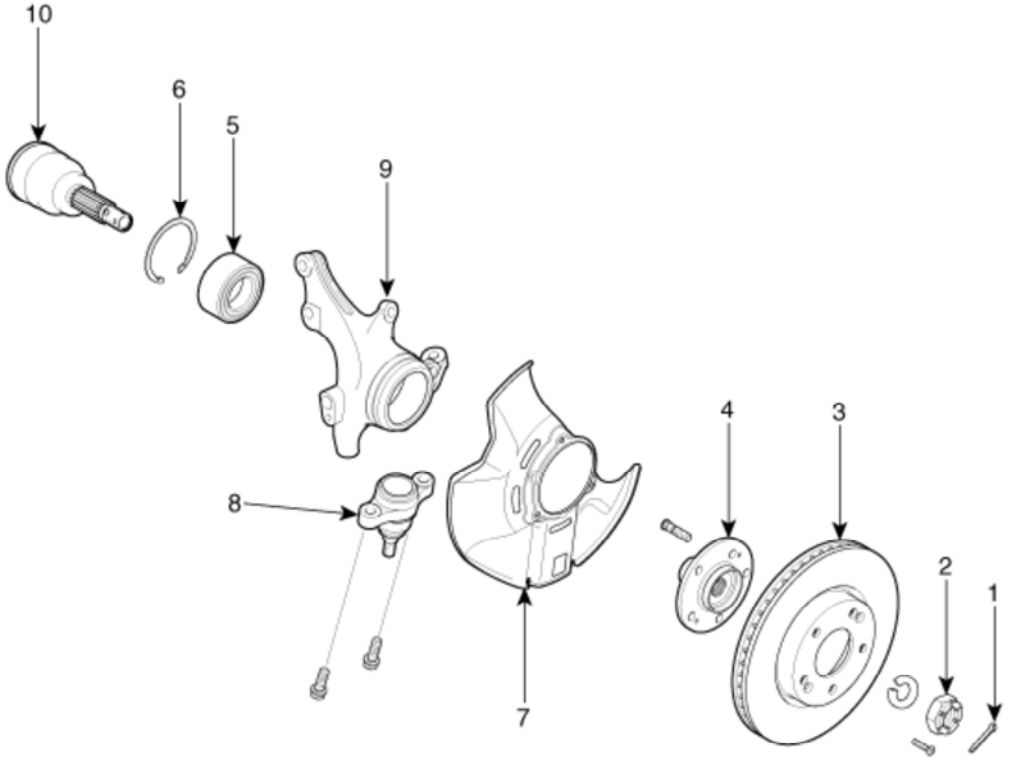
Troubleshooting

Trouble Symptom	Probable cause	Remedy
Vehicle pulls to one side	Scoring of driveshaft ball joint	Replace
	Wear, rattle or scoring of wheel bearing	Replace
	Defective front suspension and steering	Adjustment or Replace
Vibration	Wear, damage or bending of driveshaft	Replace
	Driveshaft rattle and hub serration	Replace

	Wear, rattle or scratching of wheel bearing	Replace
Shimmy	Defective wheel balance	Adjustment or Replace
	Defective front suspension and steering	Adjustment or Replace
Excessive noise	Wear, damage or bending of driveshaft	Replace
	Rattle of driveshaft and worn hub splines	Replace
	Wear, rattle or scoring of wheel bearing	Replace
	Loose hub nut	Adjustment or Replace
	Defective front suspension and steering	Adjustment or Replace

Driveshaft and axle > Front Axle Assembly > Front Hub - Axle > Components and Components Location

Components

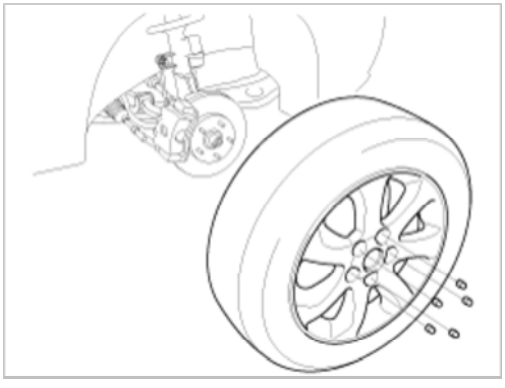


1. Split pin	6. Snap ring
2. Driveshaft nut (castle nut)	7. Dust cover
3. Brake disc	8. Lower arm ball joint
4. Hub	9. Knuckle
5. Wheel bearing	10. Driveshaft

Driveshaft and axle > Front Axle Assembly > Front Hub - Axle > Repair procedures

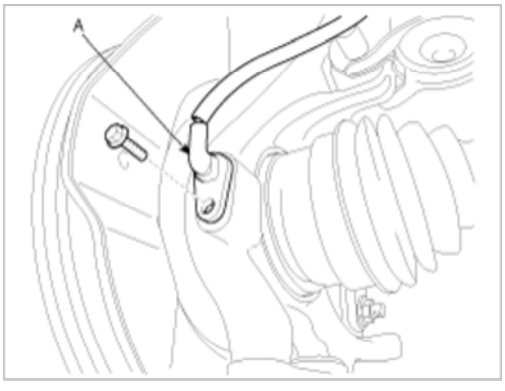
Removal

1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.

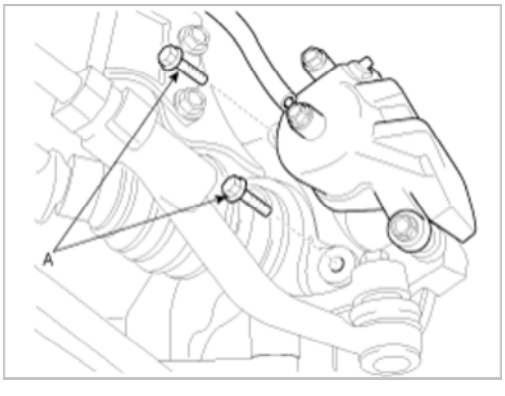


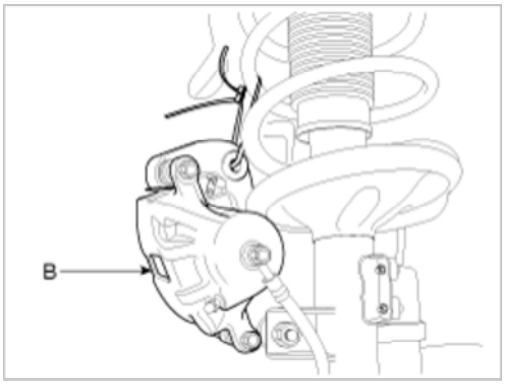
> **CAUTION**
>
> Be careful not to damage to the hub bolts when removing the front wheel and tire.

3. Remove the wheel speed sensor (A) from the knuckle.

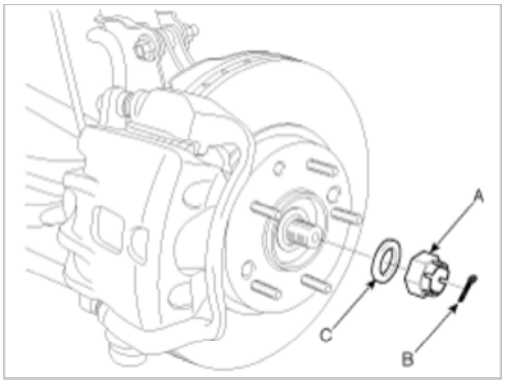


4. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire.

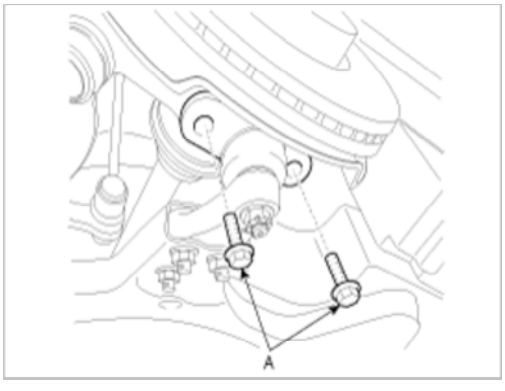




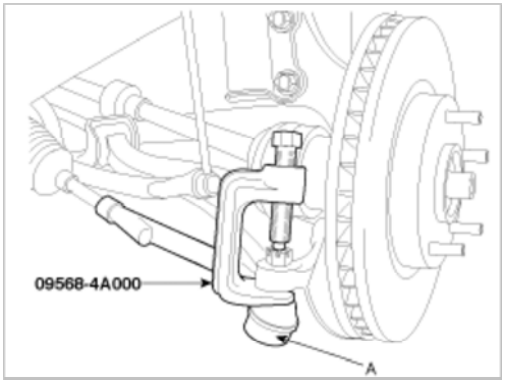
5. Remove the split pin (B), then remove castle nut (A) and washer (C) from the front hub under applying the break.



6. Remove the ball joint assembly mounting bolt (A) from the knuckle.

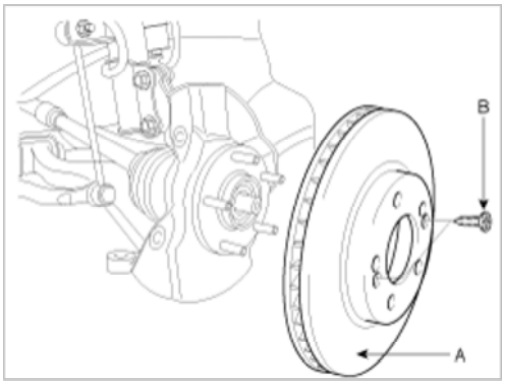


7. Remove the tie rod end ball joint from the knuckle.
   (1) Remove the split pin and castle nut.
   (2) Disconnect the ball joint (A) from knuckle by using the special tool (09568-4A000).

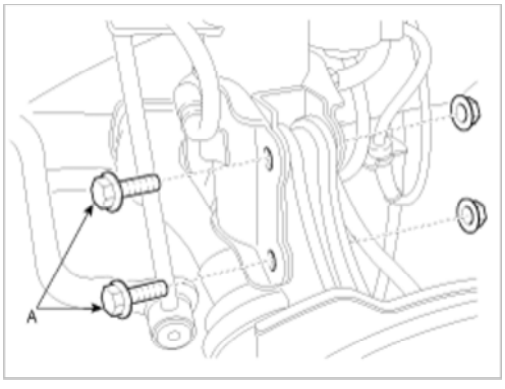


> **CAUTION**
>
> Apply a few drops of oil to the special tool. (Boot contact part)

8. Remove the brake disc (A) from the front hub assembly after remove the screws (B).



9. Remove the strut assembly mounting bolts (A) and nuts.



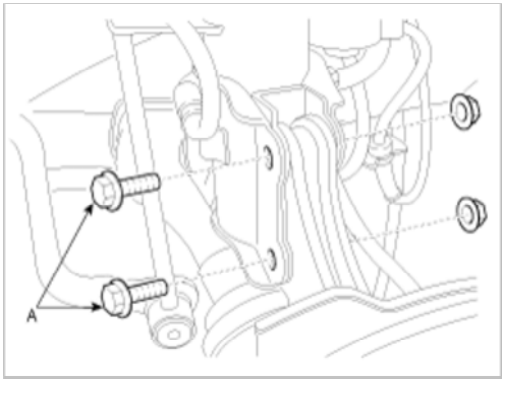
10. Remove the hub and knuckle assembly.

> CAUTION
>
> Be careful not to damage the boot and rotor teeth.

Installation

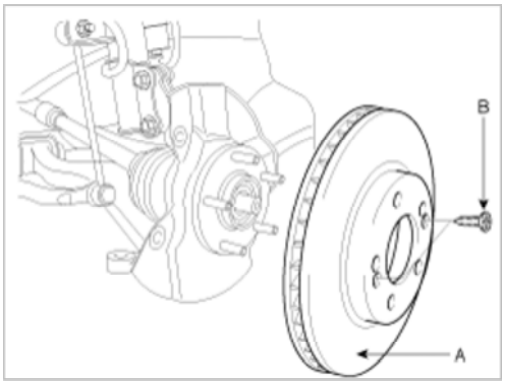
1. Install the hub and knuckle assembly to the drive shaft.
2. Install the knuckle to the strut assembly and tighten mounting bolts (A) and nuts.

Tightening torque Nm (kgf.m, lb-ft) :
Bolts(A): 137.3~156.9 (14.0~16.0, 101.3~115.7)



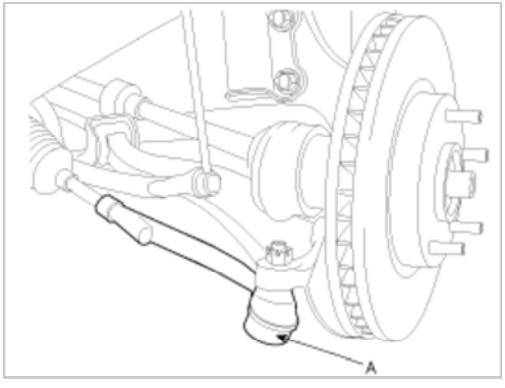
3. Install the brake disc (A) to the front hub assembly, and tighten the screws (B).

Tightening torque Nm (kgf.m, lb-ft) :
Bolt(B) : 2.94~5.88 (0.3~0.6, 2.17~4.33)



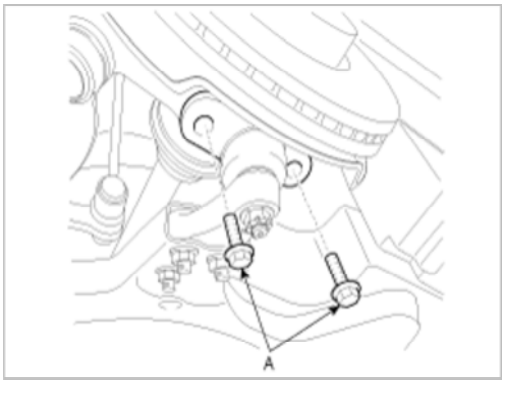
4. Install the tie rod end ball joint (A) to the knuckle.
5. Install the nut and split pin.

Tightening torque Nm (kgf.m, lb-ft) :
23.5~33.3 (2.4~3.4, 17.4~24.6)



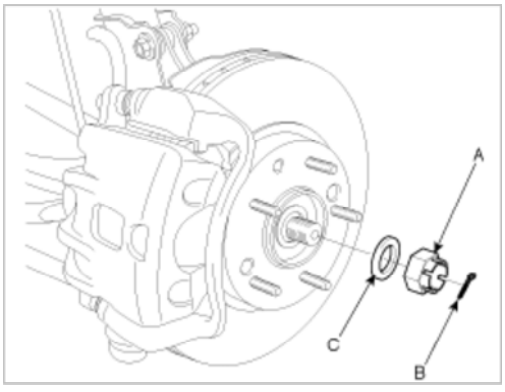
6. Install the ball joint assembly mounting bolt (A) to the knuckle.

Tightening torque Nm (kgf.m, lb-ft) :
Bolt(A) : 98.1~117.7 (10~12, 72.3~86.8)



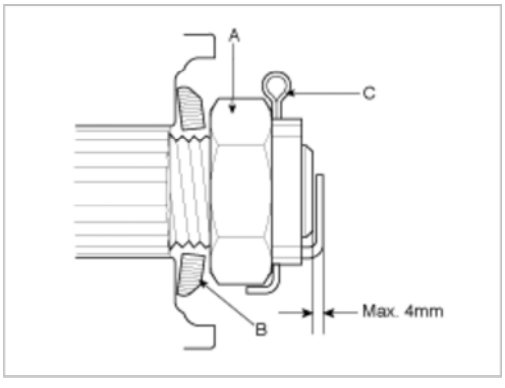
7. Install the washer (C), castle nut (A) and split pin (B) to the front hub assembly.

Tightening torque Nm (kgf.m, lb-ft) :
196.1~274.6 (20~28, 144.7~202.5)



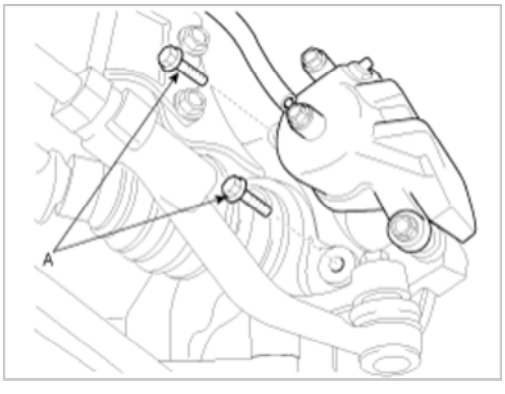
CAUTION

The washer (B) should be assembled with convex surface outward when installing the castle (A) nut and split pin (C).



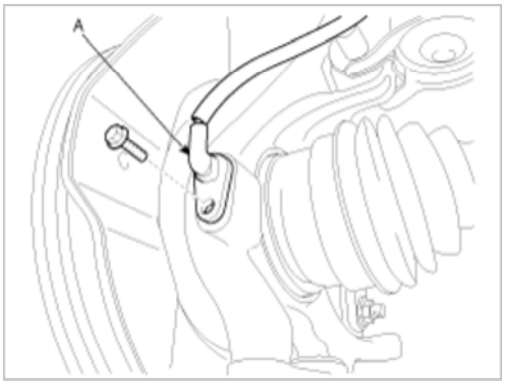
8. Install the brake caliper and then tighten the mounting bolts(A).

Tightening torque Nm (kgf.m, lb-ft) :
78.5~98.1 (8~10, 57.9~72.3)



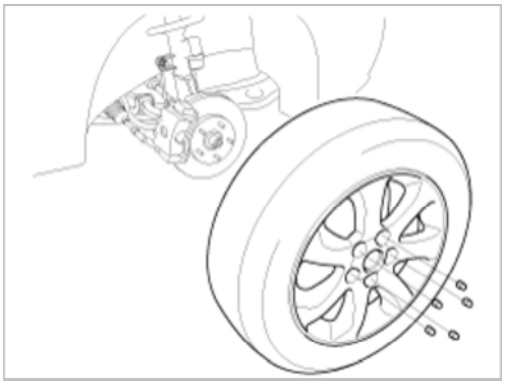
9. Install the wheel speed sensor (A) to the knuckle.

Tightening torque Nm (kgf.m, lb-ft) :
6.9~10.8 (0.7~1.1, 5.1~7.95)



10. Install the wheel and the tire to the front hub.

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

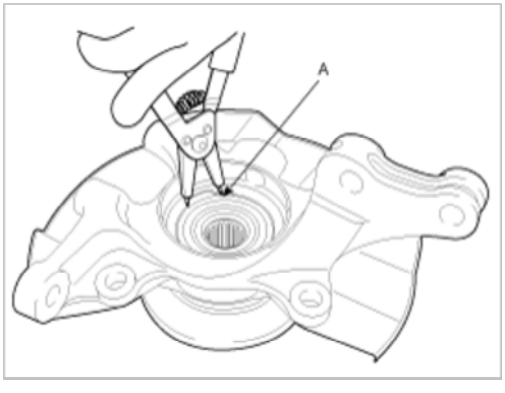


CAUTION

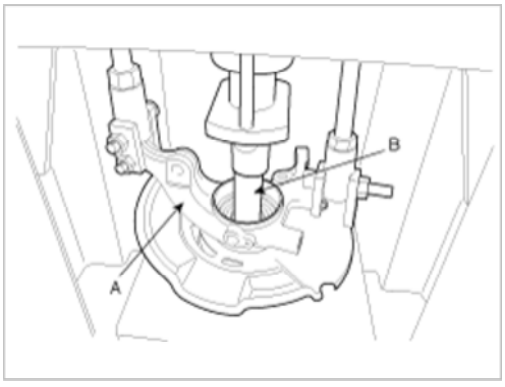
Be careful not to damage the hub bolts when installing the front wheel and tire.

Disassembly

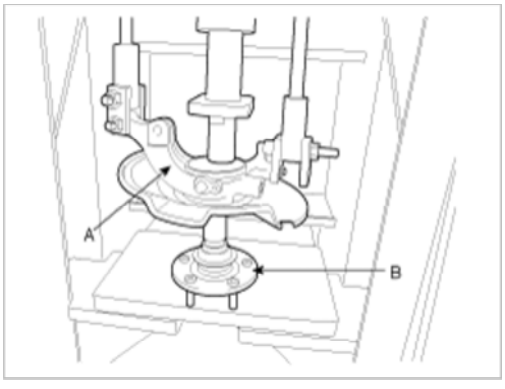
1. Remove the snap ring (A).



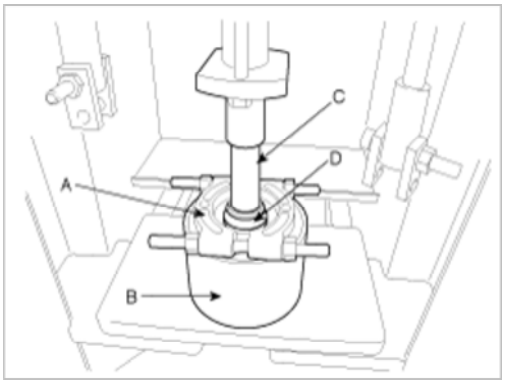
2. Remove the hub assembly from the knuckle assembly.
   (1) Install the front knuckle assembly (A) on press.
   (2) Lay a suitable adapter (B) upon the hub assembly shaft.



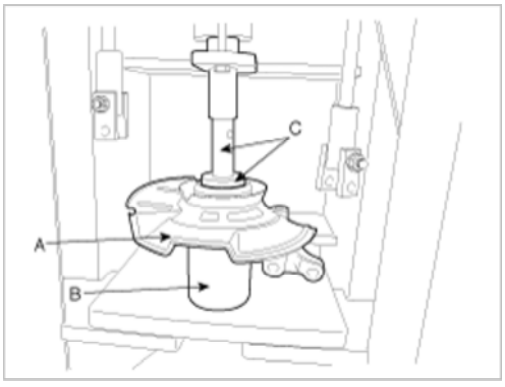
(3) Remove the hub assembly (B) from the knuckle assembly (A) by using press.



3. Remove the hub bearing inner race from the hub assembly.
   (1) Install a suitable tool (A) for removing the hub bearing inner race on the hub assembly.
   (2) Lay the hub assembly and tool (A) upon a suitable adapter (B).
   (3) Lay a suitable adapter (C) upon the hub assembly shaft.
   (4) Remove the hub bearing inner race (D) from the hub assembly by using press.



4. Remove the hub bearing outer race from the knuckle assembly.
   (1) Lay the hub assembly (A) upon a suitable adapter (B).
   (2) Lay a suitable adapter (C) upon the hub bearing outer race.
   (3) Remove the hub bearing outer race from the knuckle assembly by using press.



5. Replace hub bearing with a new one.

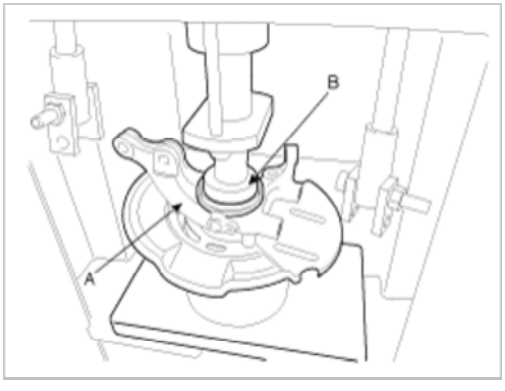
Inspection

1. Check the hub for cracks and the splines for wear.
2. Check the brake disc for scoring and damage.
3. Check the knuckle for cracks.
4. Check the bearing for cracks or damage.

Reassembly

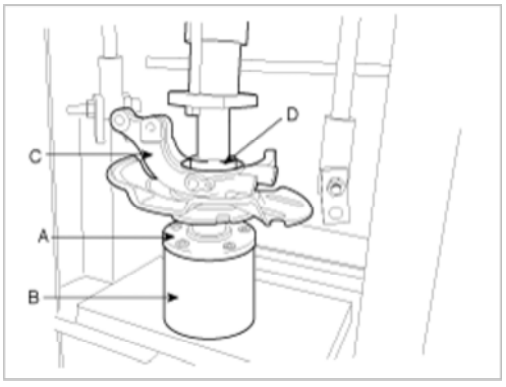
1. Install the hub bearing to the knuckle assembly.
   (1) Lay the knuckle assembly (A) on press.
   (2) Lay a new hub bearing upon the knuckle assembly (A).
   (3) Lay a suitable adapter (B) upon the hub bearing.
   (4) Install the hub bearing to the knuckle assembly by using press.

> CAUTION
>
> - Do not press against the inner race of the hub bearing because that can cause damage to the bearing assembly.
> - Always use a new wheel bearing assembly.

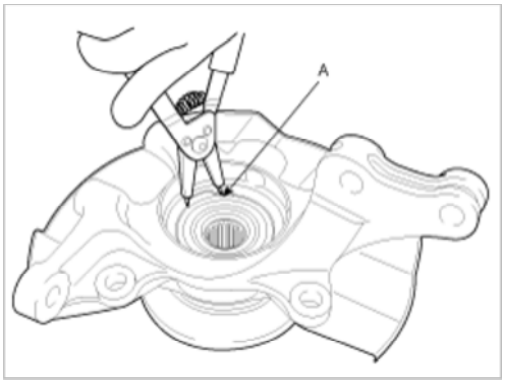


2. Install the hub assembly to the knuckle assembly.
   (1) Lay the hub assembly (A) upon a suitable adapter (B).
   (2) Lay the knuckle assembly (C) upon the hub assembly (A).
   (3) Lay a suitable adapter (D) upon the hub bearing.
   (4) Install the hub assembly (A) to the knuckle assembly (C) by using press.

> CAUTION
>
> - Do not press against the inner race of the hub bearing because that can cause damage to the bearing assembly.

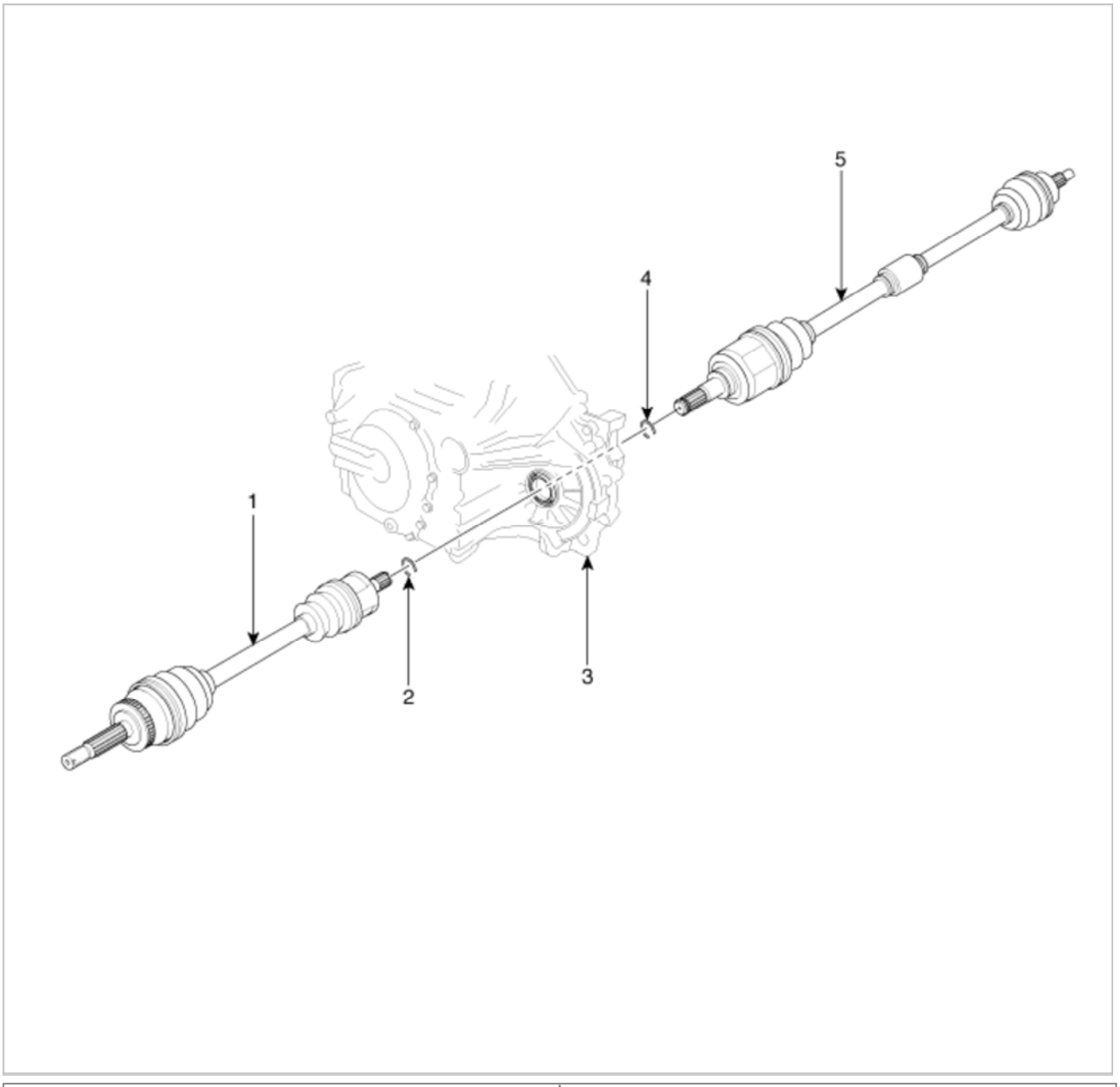


3. Install the snap ring (A).



Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Components and Components Location

Component

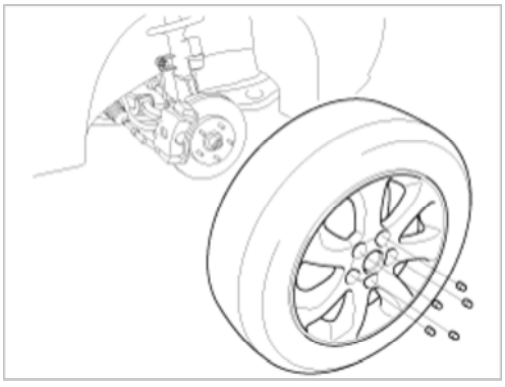


1. Driveshaft (LH) 2. Circlip 3. Transaxle	4. Circlip 5. Driveshaft (RH)

Driveshaft and axle > Driveshaft Assembly > Front Driveshaft > Repair procedures

Removal

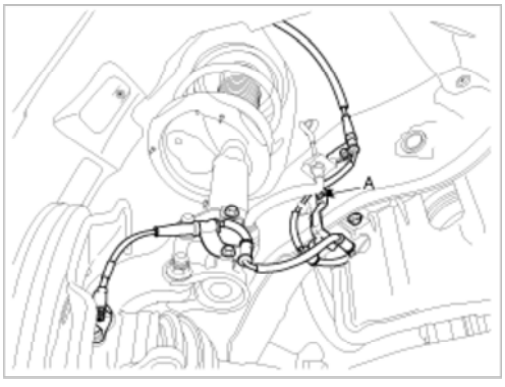
1. Loosen the wheel nuts slightly.
   Raise the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire from front hub.



CAUTION

Be careful not to damage to the hub bolts when removing the front wheel and tire.

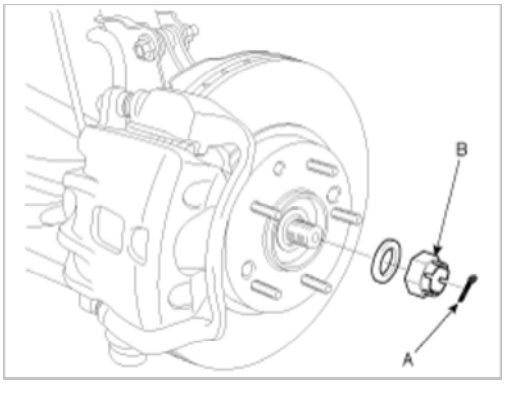
3. Remove the front wheel speed sensor cable bracket mounting bolt (A).



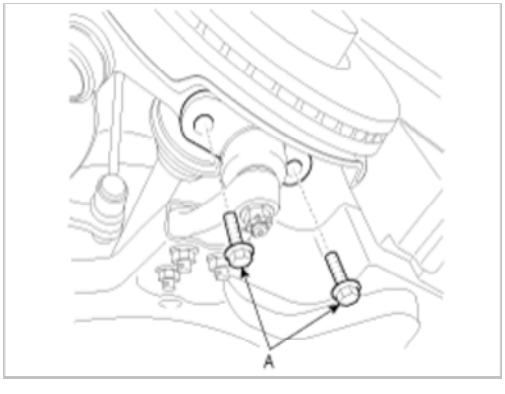
CAUTION

If the bracket mounting bolt (A) is not removed, the front wheel speed sensorcable may be damaged.

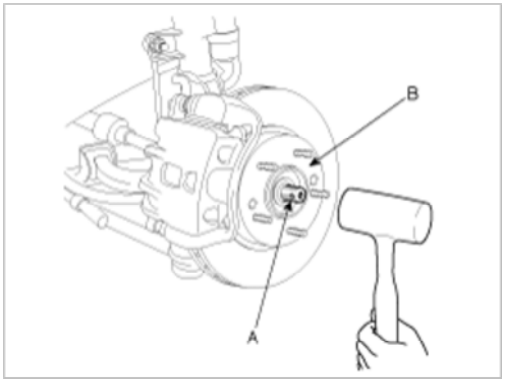
4. Remove the split pin (A), then remove castle nut (B) and washer from the front hub under applying the break.



5. Remove the ball joint assembly mounting bolt (A) from the knuckle.

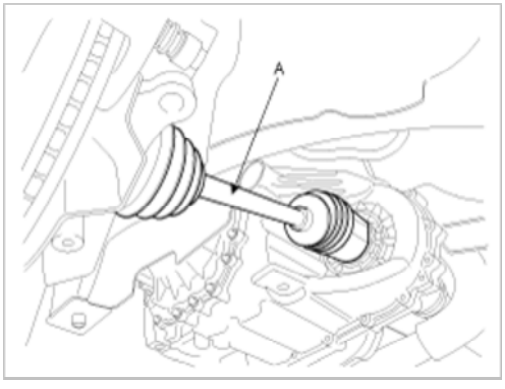


6. Using a plastic hammer, disconnect driveshaft (A) from the axle hub (B).

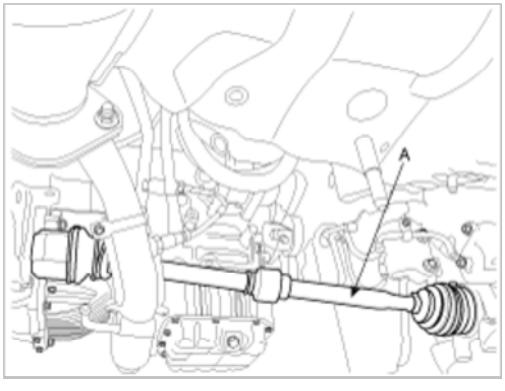


7. Insert a pry bar between the transaxle case and joint case, and separate the driveshaft (A) from the transaxle case.

[LH]



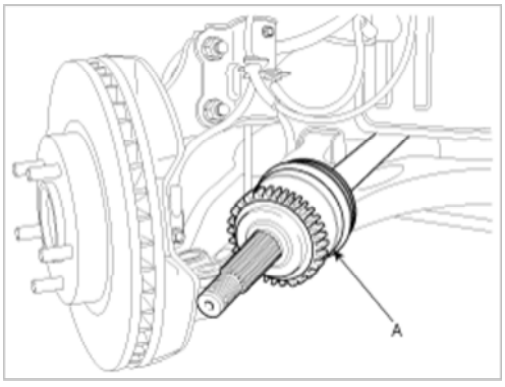
[RH]



CAUTION

- Use a pry bar being careful not to damage the transaxle and joint.
- Do not insert the pry bar too deep, as this may cause damage to the oil seal.
- Do not pull the driveshaft by excessive force it may cause components inside the joint kit to dislodge resulting in a torn boot or a damaged bearing.

8. Pull out the driveshaft (A) from the transaxle case.



CAUTION

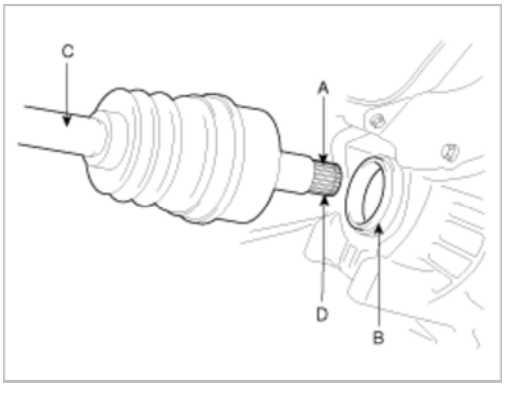
- Plug the hole of the transaxle case with the oil seal cap to prevent contamination.
- Support the driveshaft properly.
- Replace the retainer ring whenever the driveshaft is removed from the transaxle case.

Installation

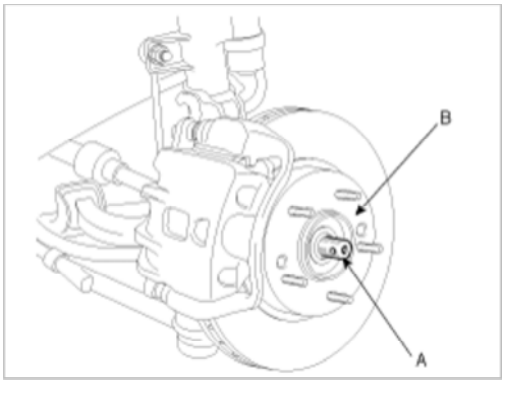
1. Apply gear oil on the oil seal contacting surface (B) of transaxle case and the driveshaft splines (A).

CAUTION

- Replace circlip with new one.
- Be careful not to install a different kind, when replacing the circlip.



2. Before installing the driveshaft (C), set the opening side of the circlip (D) facing downward.
3. After installation, check that the driveshaft (C) cannot be removed by hand.
4. Install the driveshaft (A) to the axle hub (B).



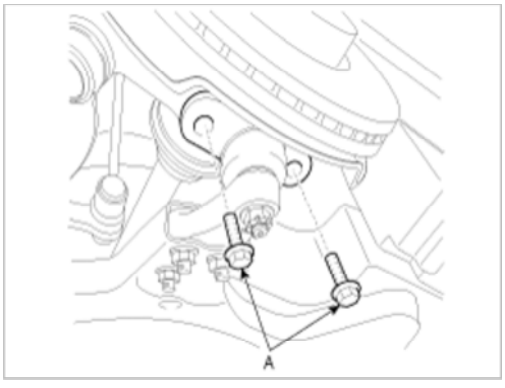
CAUTION

- Be careful not to damage the both boots.
- Keep clean without contamination on contacting point between the hub-bearingand BJ.

• Check again the both boots for depression.

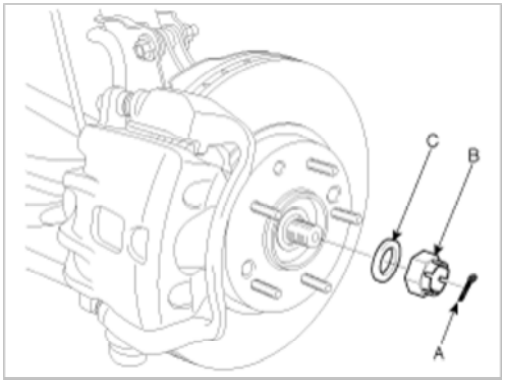
5. Install the ball joint assembly mounting bolt (A) to the knuckle.

Tightening torque Nm (kgf.m, lb-ft) :
98.1~117.7 (10~12, 72.3~86.8)



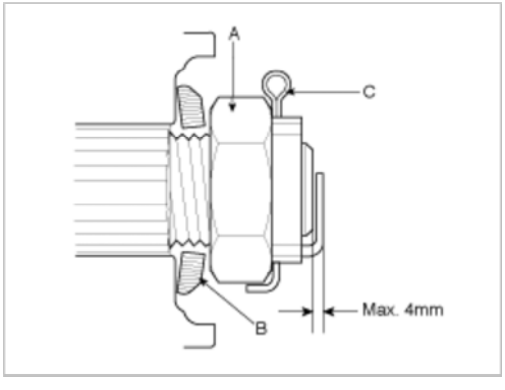
6. Install the washer (C), castle nut (B) and split pin (A) to the front hub assembly.

Tightening torque Nm (kgf.m, lb-ft) :
196.1~274.6 (20~28, 144.7~202.5)



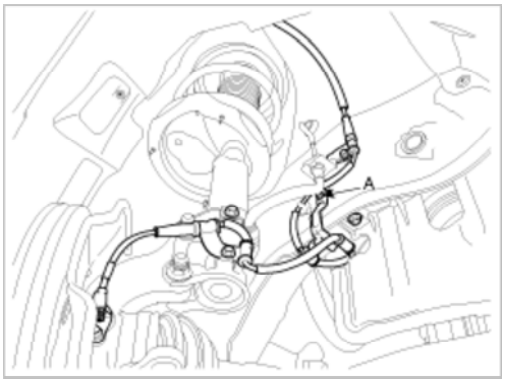
CAUTION

The washer (B) should be assembled with convex surface outward when installing the castle nut (A) and split pin (C).



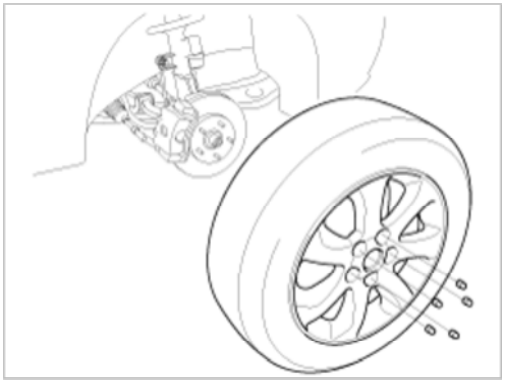
7. Install the front wheel speed sensor cable bracket mounting bolt (A).

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



8. Install the wheel and the tire to the front hub.

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



CAUTION

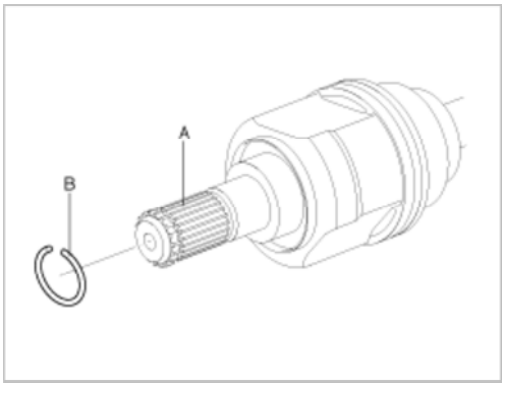
Be careful not to damage the hub bolts when installing the front wheel and tire.

Disassembly (TJ-BJ Type)

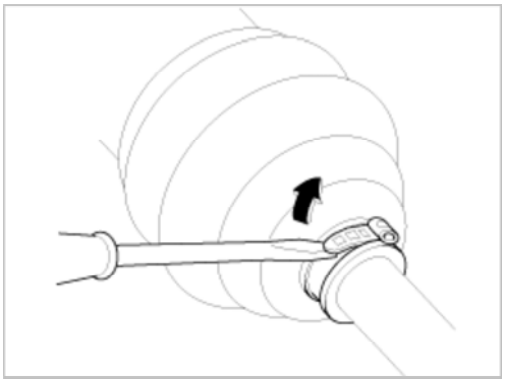
CAUTION

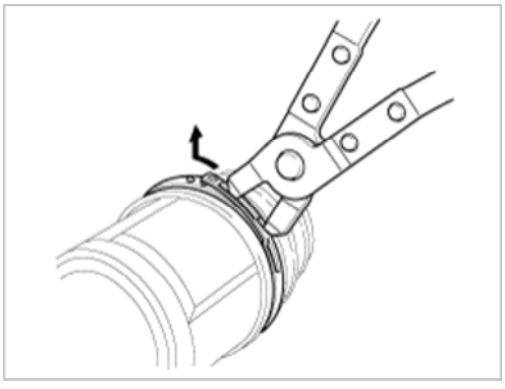
- Do not disassemble the BJ assembly.
- Special grease must be applied to the driveshaft joint. Do not substitute with another type of grease.
- The boot and Dynamic damper band should be replaced with a new one.

1. Remove the circlip (B) from driveshaft splines (A) of the transaxle side TJ case.

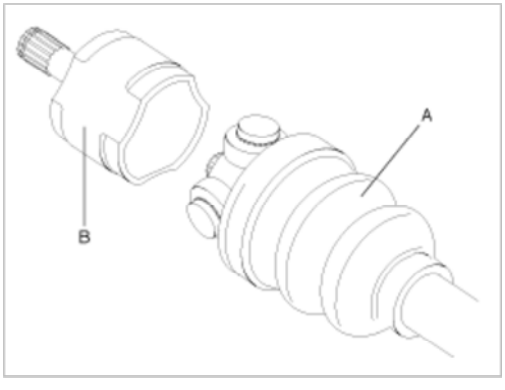


2. Remove the both boot clamps from the transaxle side TJ case.
   (1) Using a flat-tipped (-) screwdriver, remove the both clamps of the transaxle side.



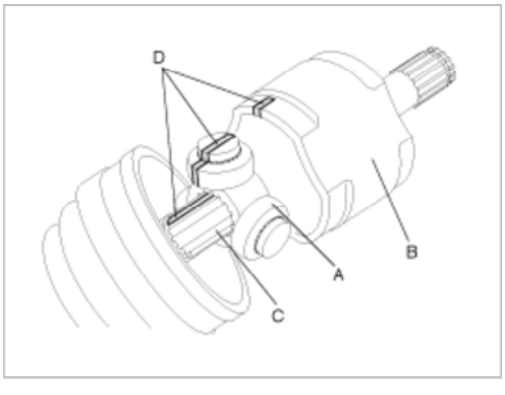


3. Pull out the boot from the transaxle side joint(TJ).
4. While dividing joint(TJ) boot (A) of the transaxle side, wipe the grease in TJ case (B) and collect them respectively.

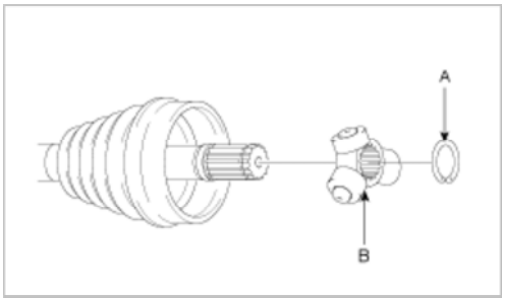


CAUTION

- Be careful not to damage the boot.
- According to illustration below, put alignment marks (D) across spider roller assembly (A), TJ case (B), shaft splines (C) to aid in reassembly.

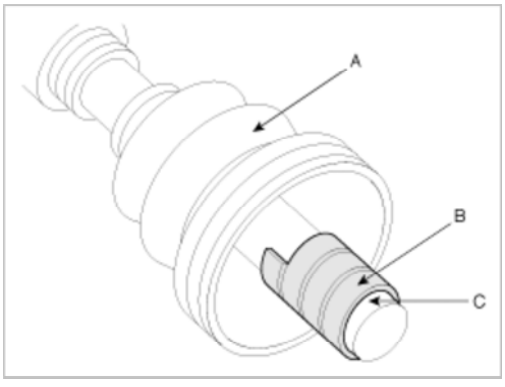


5. Using a snap ring plier or flat-tipped (-) screwdriver, remove the circlip (A).

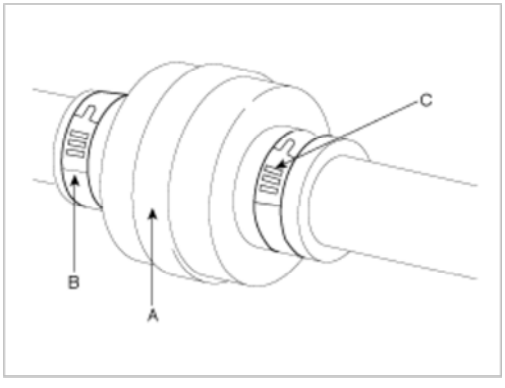


6. Remove the spider assembly (B) from the driveshaft (A).
7. Clean the spider assembly.
8. Remove the boot (A) of the transaxle side joint(TJ).

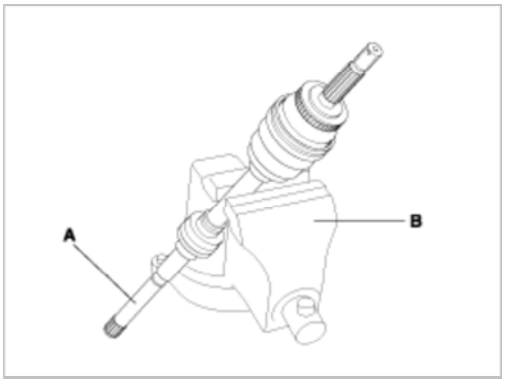
> CAUTION
>
> For reusing the boot (A), wrap tape (B) around the driveshaft splines (C) to protect the boot (A).



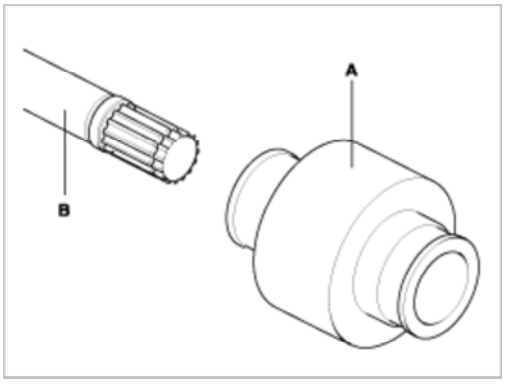
9. Remove both side of bands (B,C) of dynamic damper (A).



10. Fix the driveshaft (A) with a vice (B) as illustrated.



11. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.
12. Saperate the dynamic damper (A) from the shaft (B) carefully.

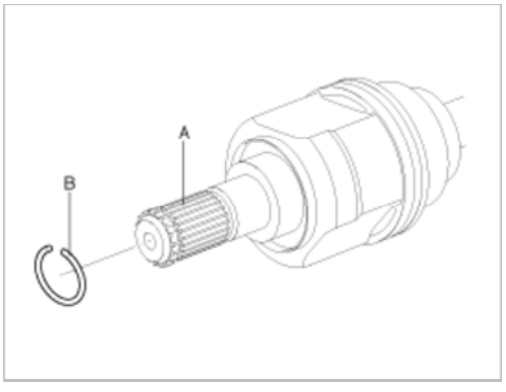


Disassembly (UTJ-BJ Type)

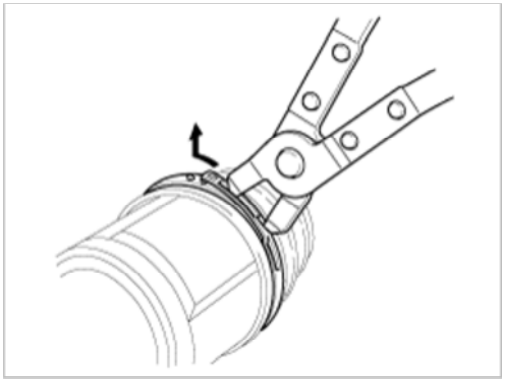
NOTE

- Do not disassemble the BJ assembly.
- Special grease must be applied to the drive shaft joint. Do not substitutewith another type of grease.
- The boot band should be replaced with a new one.

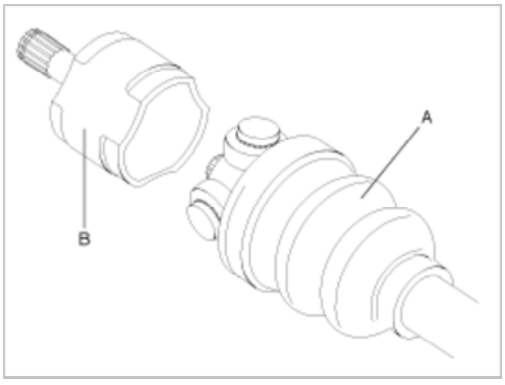
1. Remove the clip (B) from driveshaft splines (A) of the transaxle side.



2. Remove both boot bands from the transaxle side UTJ case.

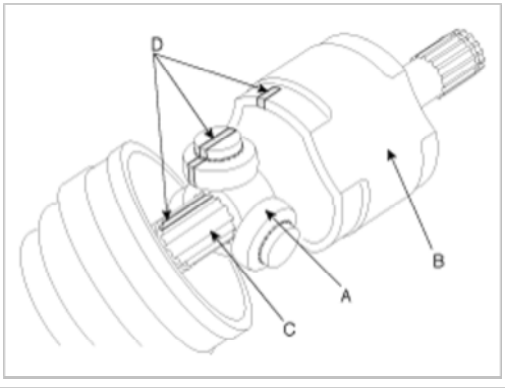


3. Pull out the boot from the transaxle side joint(UTJ).
4. When separating the joint and boot (A), remove the grease from the UTJ case (B).

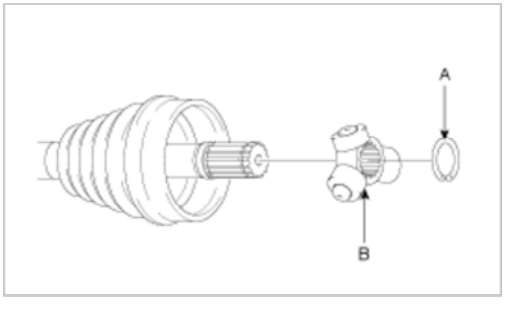


CAUTION

- Be careful not to damage the boot.
- According to illustration below, put alignment marks across spider roller assembly (A), UTJ case (B), shaft splines (C) to aid in reassembly.



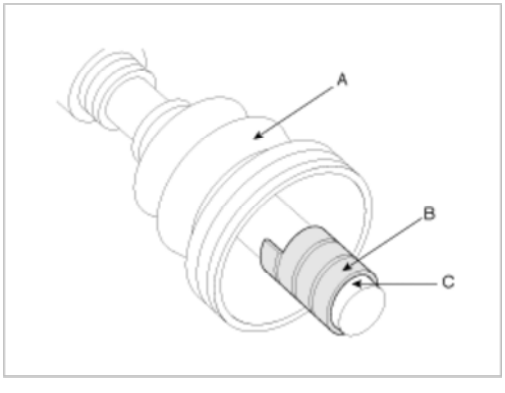
5. Using a plier or flat-tipped (-) screwdriver, remove the snap ring (A).



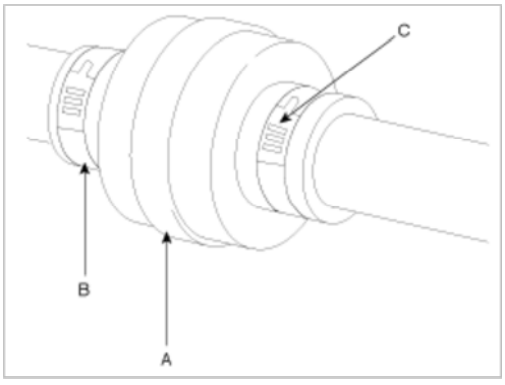
6. Remove the spider assembly (B) from drive shaft (A).
7. Clean the spider assembly.
8. Remove the boot (A), of the transaxle side joint(UTJ).

CAUTION

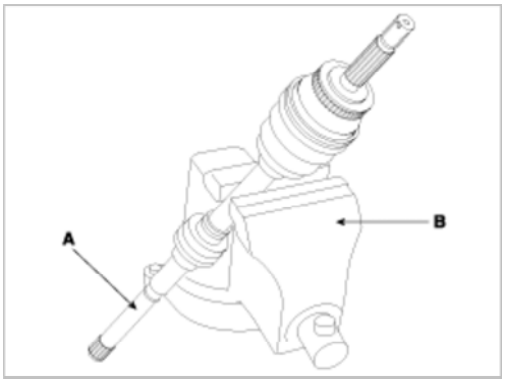
Wrap tape (B) around the driveshaft splines (C) to protect the boot (A).



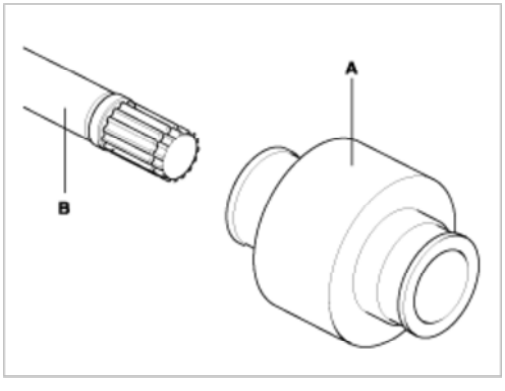
9. Remove both side of bands (B,C) of the dynamic damper (A).



10. Fix the driveshaft (A) with a vice (B) as illustrated.

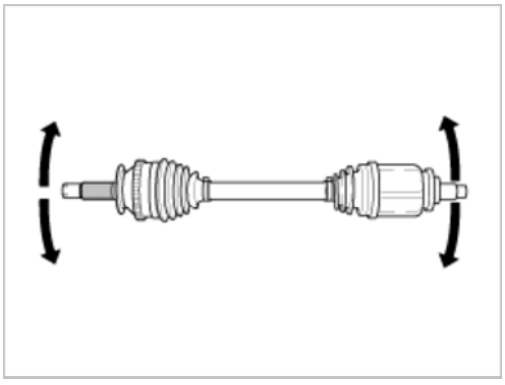


11. Apply soap powder on the shaft to prevent being damaged between the shaft spline and the dynamic damper when the dynamic damper is removed.
12. Separate dynamic damper (A) from the shaft (B) carefully.



Inspection

1. Check the driveshaft boots for damage and deterioration.
2. Check the boots for grease leak.
3. Check the ball joint for wear and damage.
4. Check the splines for wear and damage.
5. Check the dynamic damper for cracks, wear and position.



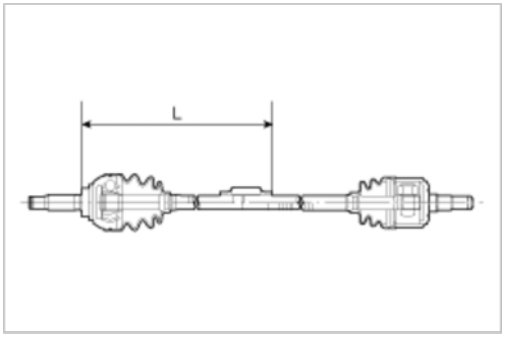
6. Check the driveshaft for cracks and wears.

Reassembly (TJ-BJ Type)

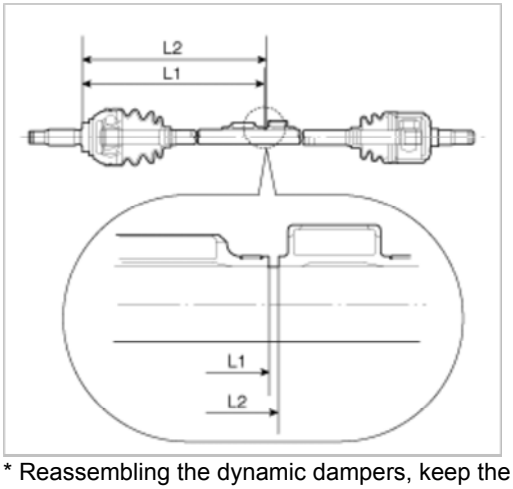
1. Wrap tape around the driveshaft splines (TJ. side) to prevent damage to the boots.
2. To reassemble the dynamic damper, keeping the shaft in the straight, tighten the dynamic damper with dynamic damper band.

Items		Distance (L)	
		Distance (L1) mm(in)	Distance (L2) mm(in)
Gasoline 2.0	M/T	351.5~353.5 (13.83~13.92)	357~359 (14.05~14.13)
	A/T		
Gasoline 1.6	M/T	360~362 (14.17~14.25)	
	A/T		
Gasoline 1.4	M/T		

<Gasoline 1.4/1.6>

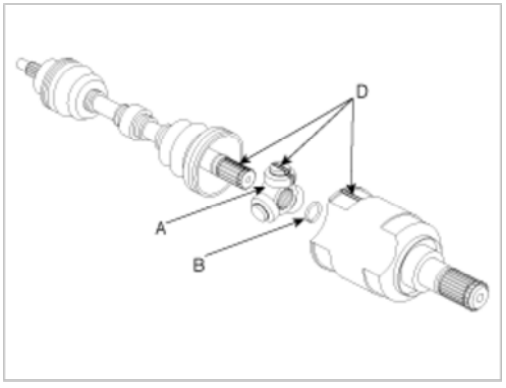


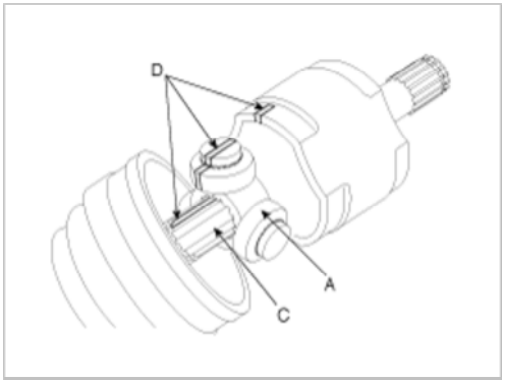
<Gasoline 2.0/V1.6 AT>



* Reassembling the dynamic dampers, keep the distance L1 and L2 to prevert the contact each dampers.

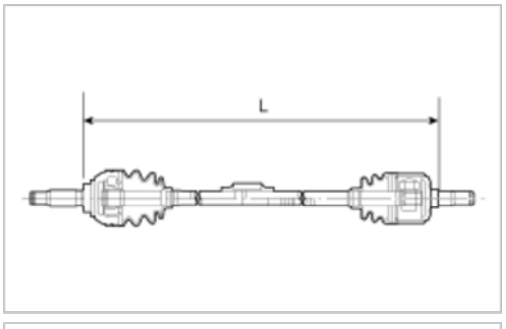
3. Install the TJ boot bands and TJ boot.
4. Install the spider assembly (A) and the circlip (B) to the spline (C) on driveshaft.
   At this time align the marks (D) each other.

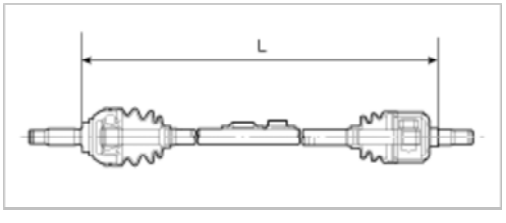




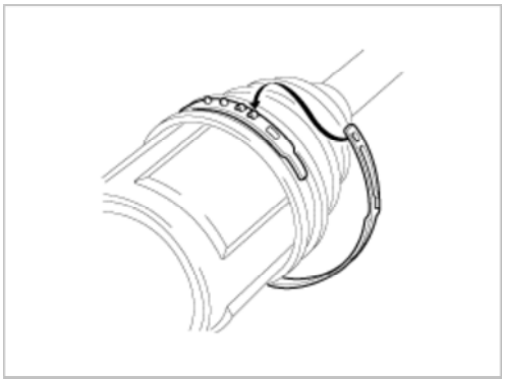
5. Add the specified grease to the TJ as mush as wiped away at inspection.
6. Install the TJ boots.
7. To control the air in the TJ boot, keep the specified distance between the boot bands when they are tightened.

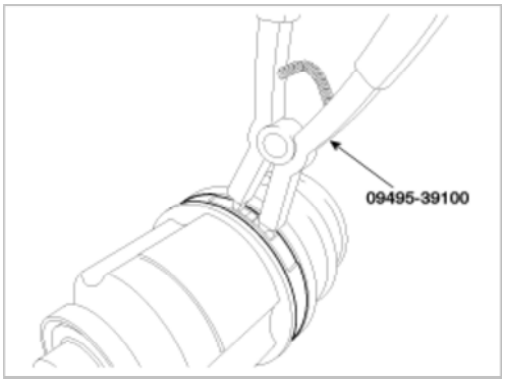
Items		Distance (L) mm(in)	
		LH side	RH side
Gasoline 2.0	M/T	538.6 (21.2)	806.8 (31.7)
	A/T		
Gasoline 1.6	M/T	533.6 (21.0)	806.8 (31.7)
	A/T		
Gasoline 1.4	M/T		





8. Using the SST (09454-39100), install the boot bands.



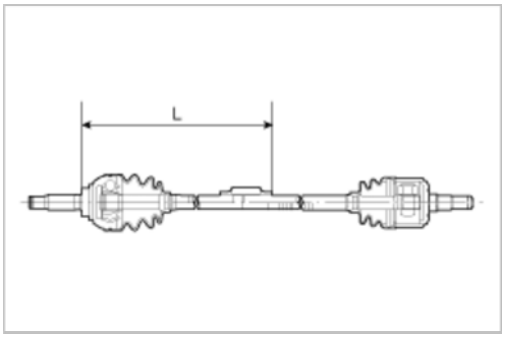


Reassembly (UTJ-BJ Type)

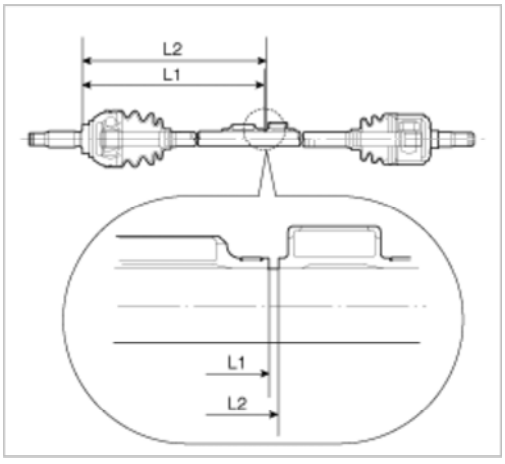
1. Wrap tape around the drive shaft splines (UTJ side) to prevent damage to the boots.
2. Apply grease to the joint(BJ) boot on the side of wheel and install the boots.
3. Install the bands to both boots.
4. To install the dynamic damper, keep the BJ shaft in a straight line and secure the dynamic damper with the dynamic damper bands.

Items		Distance (L)	
		Distance (L1) mm(in)	Distance (L2) mm(in)
Gasoline 2.0	M/T	351.5~353.5 (13.83~13.92)	357~359 (14.05~14.13)
	A/T		
Gasoline 1.6	M/T	360~362 (14.17~14.25)	
	A/T		
Gasoline 1.4	M/T		

<Gasoline 1.4/1.6>

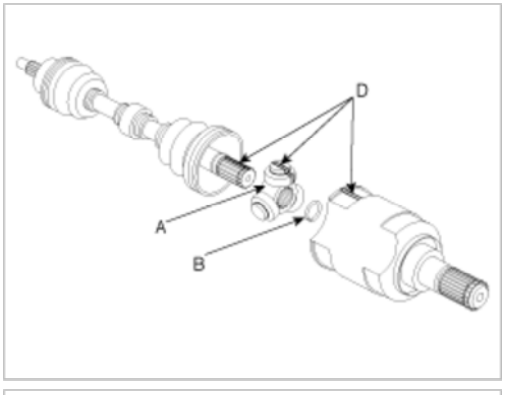


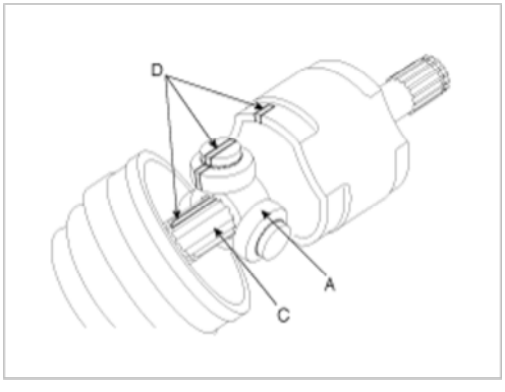
<Gasoline 2.0/V1.6 AT>



* Reassembling the dynamic dampers, keep the distance L1 and L2 to prevert the contact each dampers.

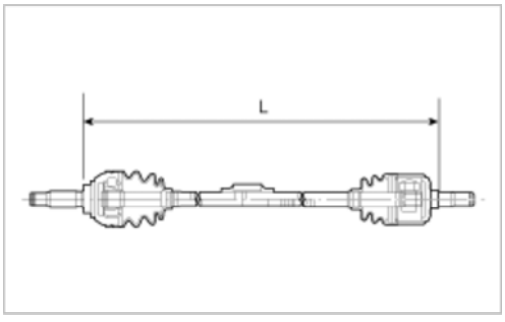
5. Install the UTJ boot bands and UTJ boot.
6. Using the alignment marks (D) made during disassembly as a guide, install the spider assembly (A) and snap ring (B) on the driveshaft splines (C).

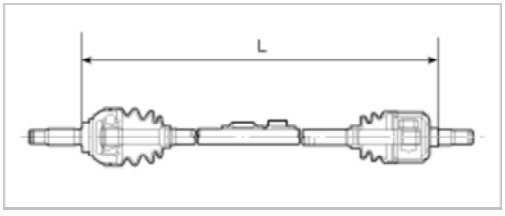




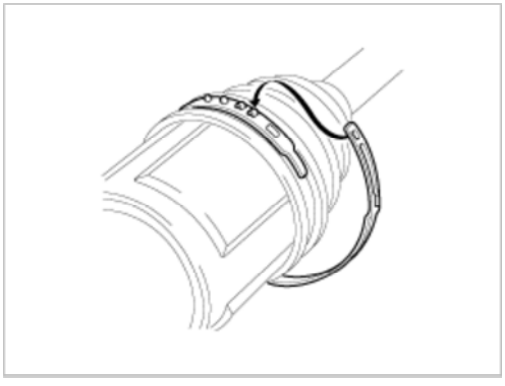
7. Add the specified grease to the joint(UTJ) boot as mush as wiped away at inspection.
8. Install the boots.
9. To control the air in the UTJ boot, keep the specified distance between the boot bands when they are tightened.
   Standard value [L]

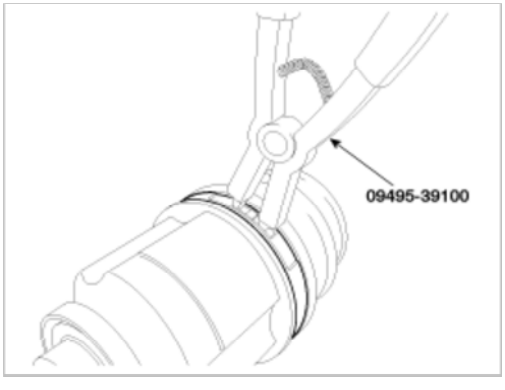
Items		Distance (L) mm(in)	
		LH side	RH side
Gasoline 2.0	M/T A/T	538.6 (21.2)	806.8 (31.8)
Gasoline 1.6	M/T	533.6 (21.0)	806.8 (31.7)
	A/T		
Gasoline 1.4	M/T		





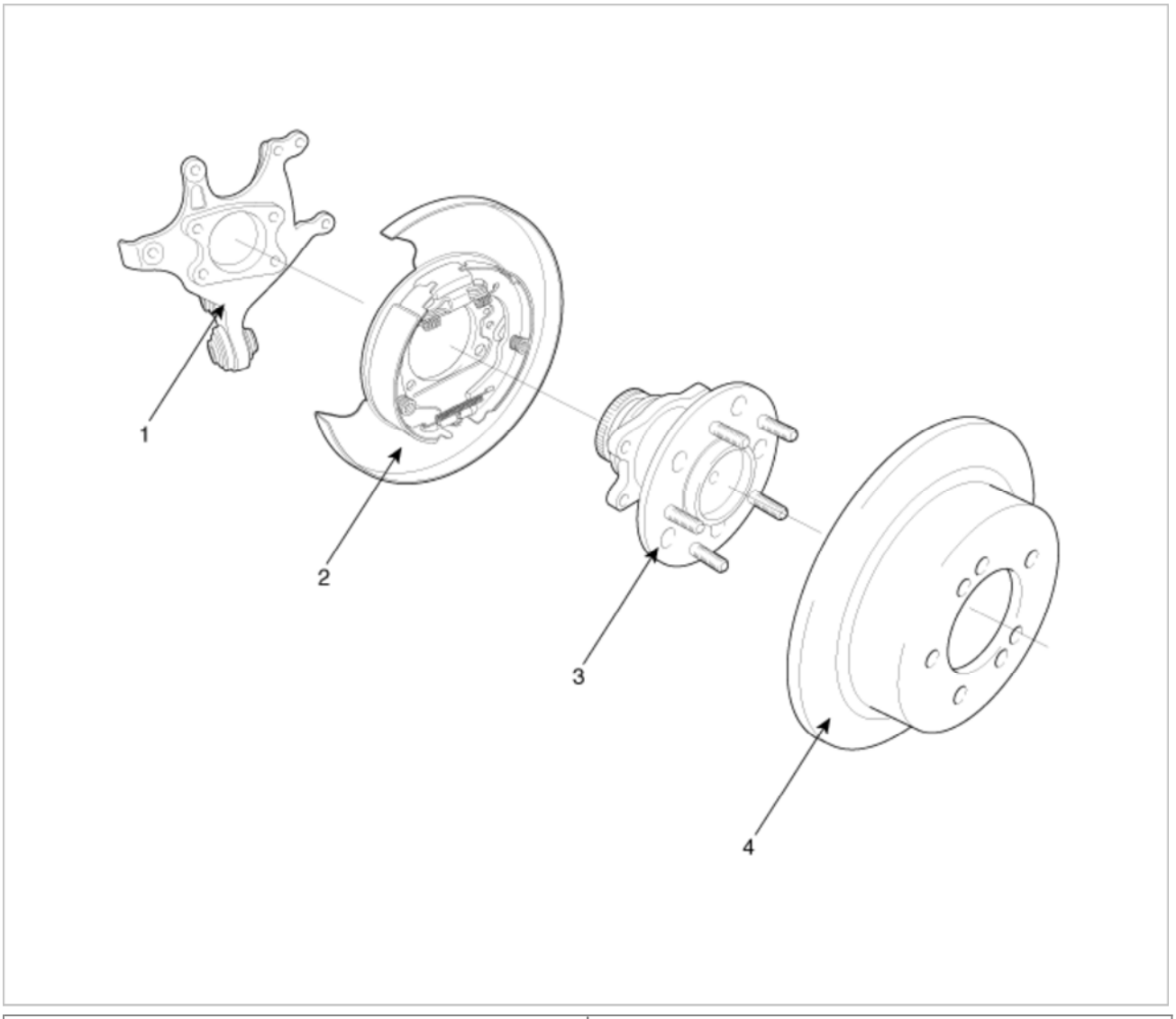
10. Using the SST(09454-39100), install the boot bands.





Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Components and Components Location

Component

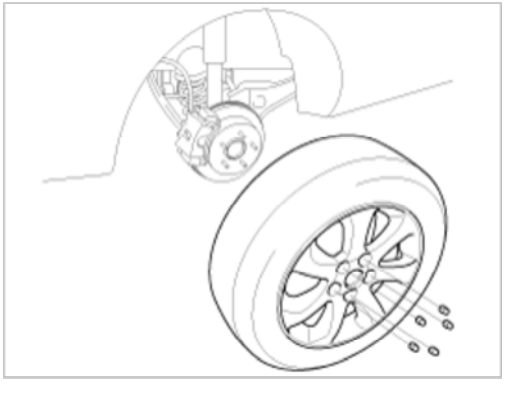


1. Carrier assembly 2. Rear brake assembly	3. Hub & bearing assembly 4. Rear brake disc

Driveshaft and axle > Rear Axle Assembly > Rear Hub - Carrier > Repair procedures

Removal

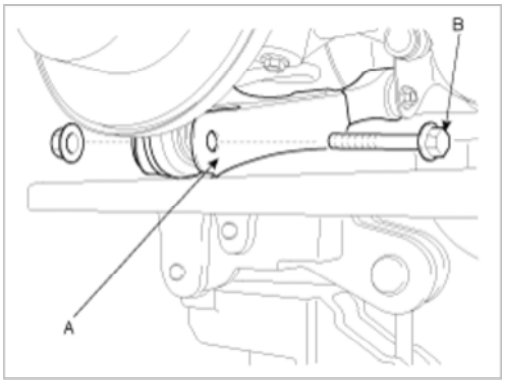
1. Release the parking brake.
2. Loosen the wheel nuts slightly.
3. Raise the vehicle, and make sure it is securely supported.
4. Remove the rear wheel and tire from rear hub.



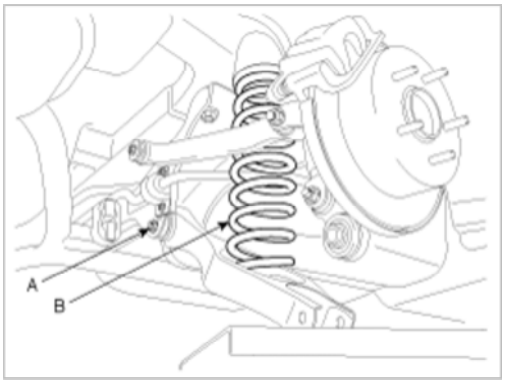
CAUTION

Be careful not to damage to the hub bolts when removing the rear wheel and tire.

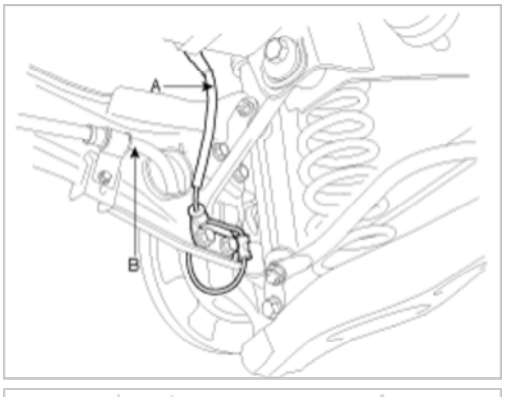
5. Remove the mounting bolt (B) of the rear lower arm (A) and the rear carrier, while supporting the lower arm (A) with a jack as shown in the illustration.

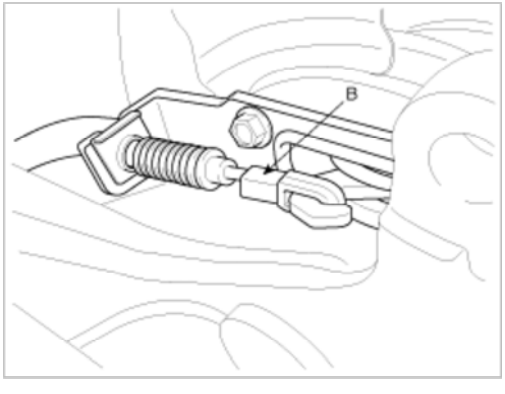


6. Loosen the mounting nut (A) of the cross member and the rear lower arm, then remove the coil spring (B) by taking down the jack.

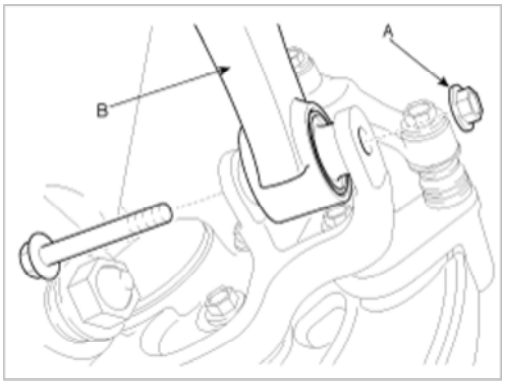


7. Remove the wheel speed sensor (A) and parking brake cable (B).

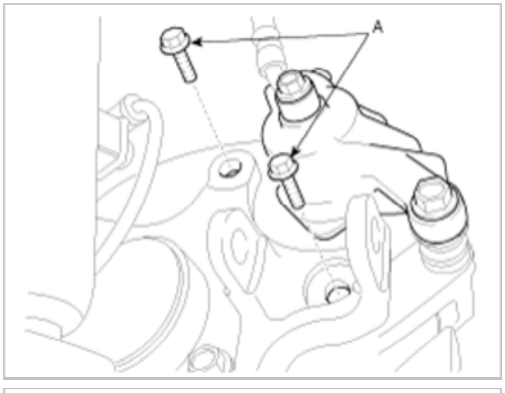


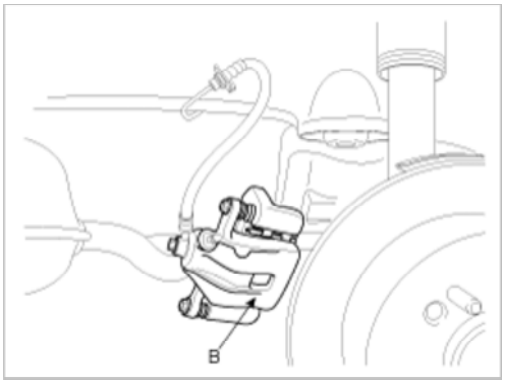


8. Disconnect the upper arm (B) from the carrier assembly after loosen the nut (A).

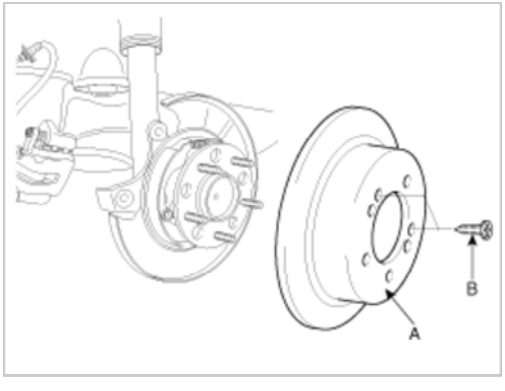


9. Remove the brake caliper mounting bolts (A), and then place the brake caliper assembly (B) with wire as shown in the illustration.

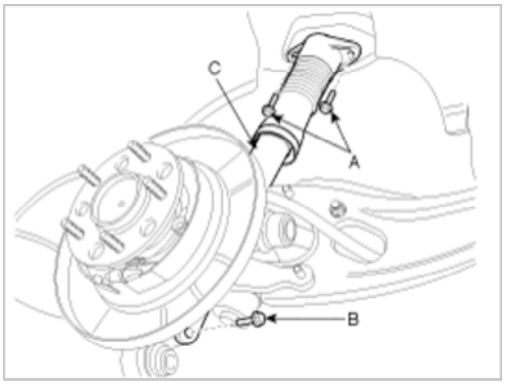




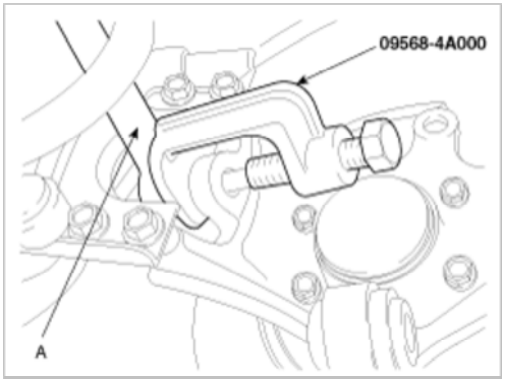
10. Remove the rear brake disc assembly (A) after loosen the screw (B).



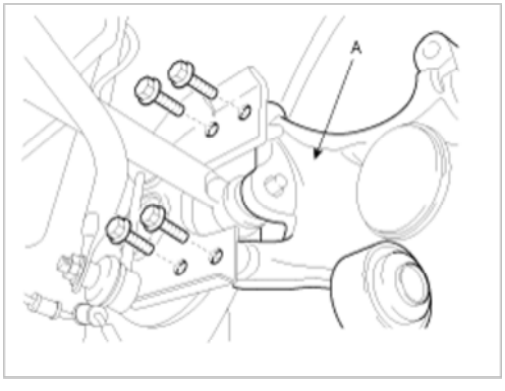
11. Remove the rear strut assembly (C) after loosen the bolt (A, B).



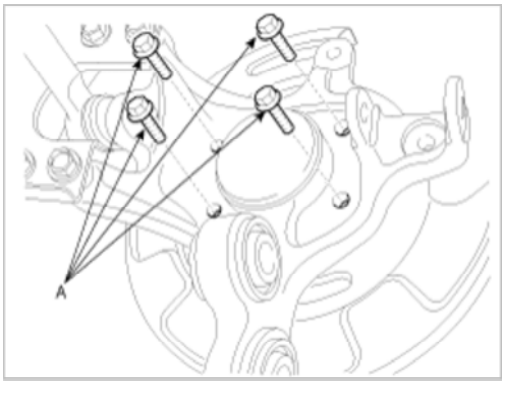
12. Remove the split pin and castle nut from the assist arm.
13. Using the SST (09568-4A000), disconnect the assist arm (A) from the carrier assembly.

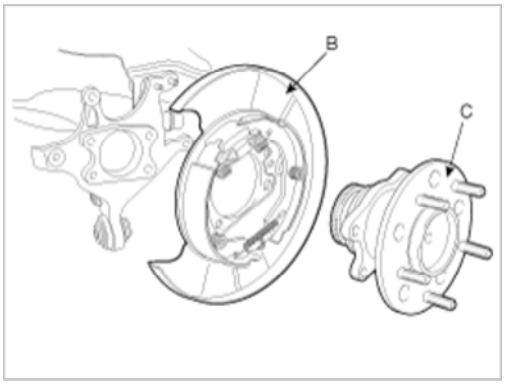


14. Remove the carrier assembly (A) from the trailing arm after remove the mounting bolts.



15. Remove the rear hub assembly (C) and rear brake assembly (B) after remove mounting bolts (A).

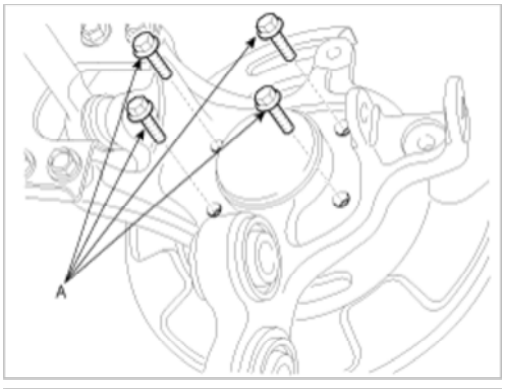


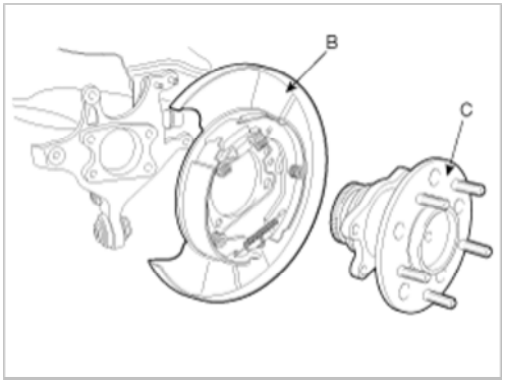


Installation

1. Install the rear hub assembly (C) and rear brake assembly (B) to the rear carrier, then tighten mounting bolts (A).

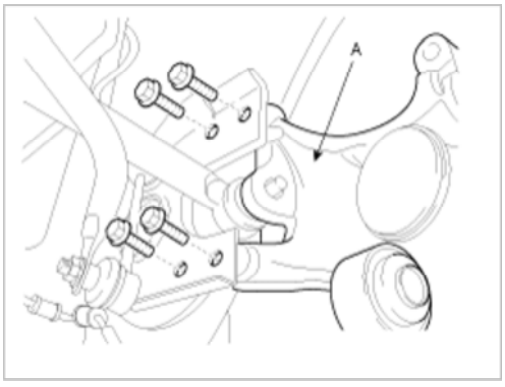
Tightening torque Nm (kgf.m, lb-ft) :
68.6~88.3 (7.0~9.0, 50.6~65.1)





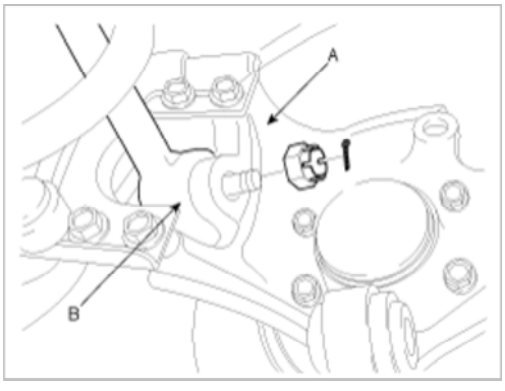
2. Install the carrier assembly (A) to the trailing arm, then tighten the mounting bolts.

Tightening torque Nm (kgf.m, lb-ft) :
34.3~53.9 (3.5~5.5, 25.3~39.8)



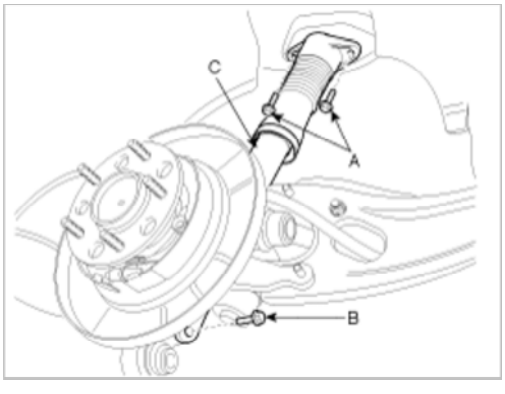
3. Install the assist arm(B) to the carrier assembly (A) , then install the castle nut and split pin.

Tightening torque Nm (kgf.m, lb-ft) :
44.1~53.9 (4.5~5.5, 32.5~39.8)



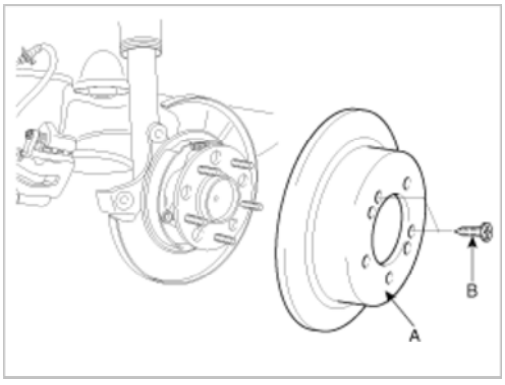
4. Install the rear strut assembly (C), then tighten the bolt (A, B).

Tightening torque Nm (kgf.m, lb-ft) :
Bolt(A) : 49.0~63.7 (5.0~6.5, 36.2~47.0)
Bolt(B) : 137.3~156.9 (14.0~16.0, 101.3~115.7)



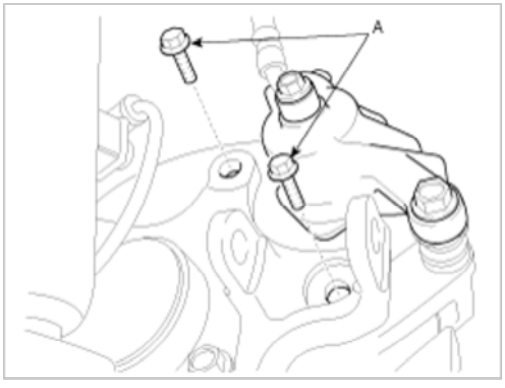
5. Install the rear brake disc assembly (A) and tighten screw (B).

Tightening torque Nm (kgf.m, lb-ft) :
Bolt(B) : 4.9~5.88 (0.5~0.6, 3.61~4.33)



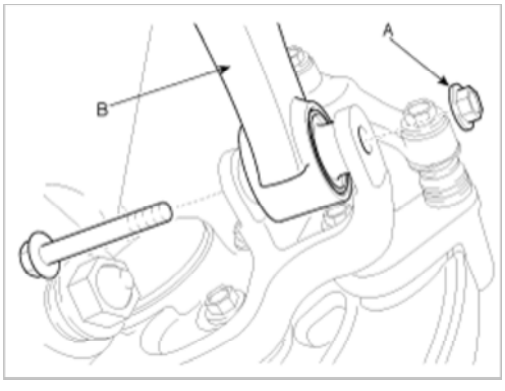
6. Install the brake caliper, then tighten the brake caliper mounting bolts (A).

Tightening torque Nm (kgf.m, lb-ft) :
49.0~58.8 (5.0~6.0, 36.2~43.4)

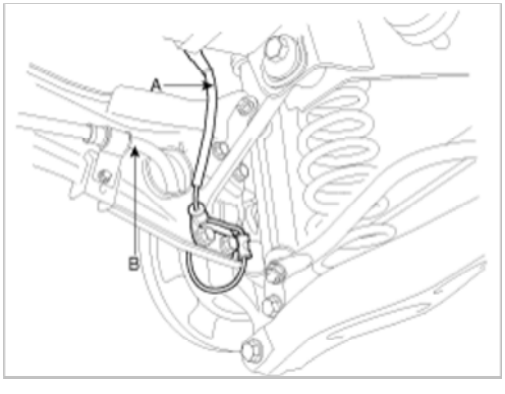


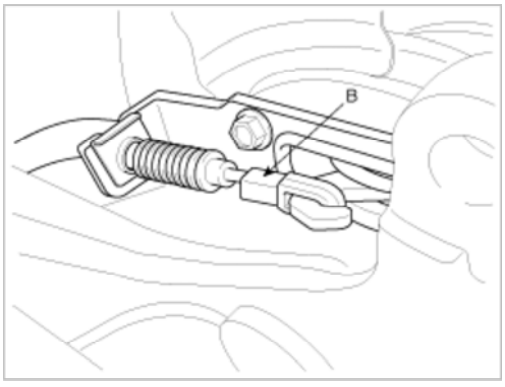
7. Install the upper arm (B) from the carrier assembly , then tighten the nut (A).

Tightening torque Nm (kgf.m, lb-ft) :
Nut(A) : 98.1~117.7 (10~12, 72.3~86.8)

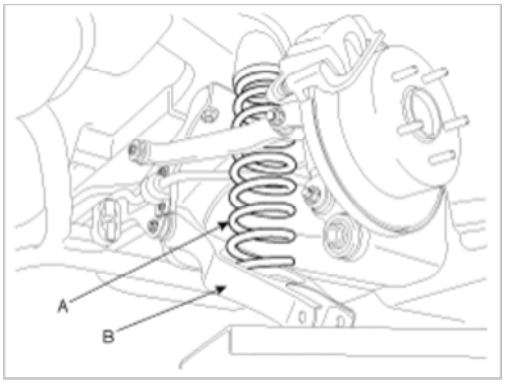


8. Install the wheel speed sensor (A) and parking brake cable (B).



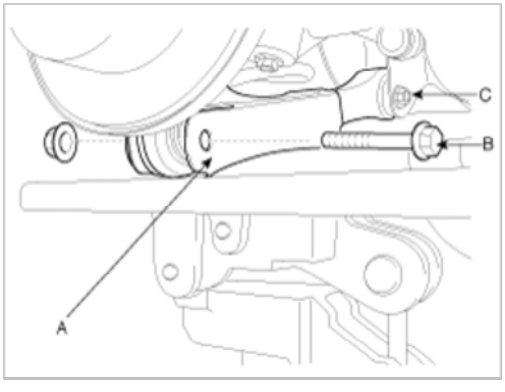


9. Install the coil spring (A) on the rear lower arm (B), then slowly jack-up the rear lower arm (B) by using jack.



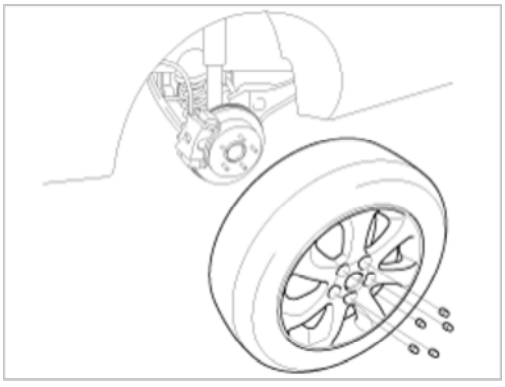
10. Install the mounting bolt (B) of the rear lower arm (A) and the rear carrier with a specified torque, while supporting the lower arm (A) with a jack as shown in the illustration. Tighten the mounting bolt (C) of the cross member and the rear lower arm with a specified torque.

Tightening torque Nm (kgf.m, lb-ft) :
Bolt (B, C) :137.3~156.9 (14.0~16.0, 101.3~115.7)



11. Install the wheel and the tire to the rear hub.

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



CAUTION

Be careful not to damage the hub bolts when installing the rear wheel and tire.

Inspection

1. Check the hub for cracks and the splines for wear.
2. Check the bearing for cracks or damage.
3. Check the brake disc for scoring and damage.
4. Check the rear axle carrier for cracks.
5. Check the rear tone wheel for chipped the teeth.

Specifications

Front Suspension

Item			Specification
Suspension type			Macpherson strut
Shock absorber	Type		Gas pressurized
	225 Tire	Stroke	149.0mm (5.87in.)
		I.D. color	Blue
	Other	Stroke	154.2mm (6.07in.)
		I.D. color	Europe: Red
			Except Europe: Yellow
Coil spring	Free Height - I.D. color		296.3mm (11.67in.) - White
			305.6mm (12.03in.) - Blue
			311.9mm (12.28in.) - Green
			318.5mm (12.54in.) - Red
			324.8mm (12.79in.) - Yellow
			344.5mm (13.56in.) - Violet
			330.2mm (13.00in.) - Green-White
			342.1mm (13.47in.) - Green-Blue
			350.2mm (13.79in.) - Green-Red
			350.5mm (13.80in.) - Green-Yellow
			358.3mm (14.11in.) - Green-Violet
			382.3mm (15.05in.) - Green-Gray

Rear Suspension

Item			Specification
Suspension type			Multi link coil spring
Shock absorber	Type		Gas pressurized
	225 Tire	Stroke	148.4mm (5.84in.)
		I.D. color	Blue
	Other	Stroke	162.6mm (6.40in.)
		I.D. color	Europe: Red
			Except Europe: Yellow
Coil spring	Free Height - I.D. color		327.4mm (12.89in.) - White
			333.5mm (13.13in.) - Blue
			310.8mm (12.24in.) - Green
			317.1mm (12.48in.) - Red
			330.5mm (13.01in.) - Yellow
			336.8mm (13.26in.) - Violet

Wheel and Tire

Item	Specification

Tire		185/65 R15
		195/65 R15
		205/55 R16
		225/45 R17
Wheel	Steel	5.5J × 15
		6.0J × 16
	Aluminum	5.5J × 15
		6.0J × 16
		7.0J × 17
Tire pressure	Front	2.2kg/cm² (32psi)
	Rear	2.2kg/cm² (32psi)

Wheel Alignment

Item		Specification	
		Front	Rear
Toe-in	Total	0°±0.2°	0.1±0.2°
	Individual	0°± 0.1°	0.05°±0.1°
Camber angle		-0.6°±0.5°	-1.15°±0.5°
Caster angle		4.43°±0.5°	-
King-pin angle		13.65°±0.5°	-

Tightening Torques

Front Suspension

Item	Tightening torque (kgf.m)		
	N.m	Kgf.m	lb-ft
Hub nuts	90 ~ 110	9.0 ~ 11.0	65 ~ 80
Strut assembly to wheel housing penal bolts	45 ~ 60	4.5 ~ 6.0	33 ~ 43
Strut assembly to knuckle bolts	140 ~ 160	14.0 ~ 16.0	101 ~ 116
Strut assembly self locking nut	50 ~ 70	5.0 ~ 7.0	36 ~ 51
Stabilizer link to strut assembly nut	100 ~ 120	10.0 ~12.0	72 ~ 87
Lower arm to sub frame bolt & nut (Front)	140 ~ 160	14.0 ~ 16.0	101 ~ 116
Lower arm to sub frame bolt & nut (Rear)	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Lower arm ball joint castle nut	80 ~ 90	8.0 ~ 9.0	58 ~ 65
Stabilizer bar to stabilizer link nut	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Stabilizer bracket mounting bolts	45 ~ 55	4.5 ~ 5.5	33 ~ 40
Sub frame to body bolts and nuts	160 ~ 180	16.0 ~ 18.0	116 ~ 130
Sub frame stay mounting bolts & nut	45 ~ 55	4.5 ~ 5.5	33 ~ 40
Front & Rear roll stopper bolt & nut	50 ~ 65	5.0 ~ 6.5	36 ~ 47
Lower arm ball joint to knuckle bolts	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Tie-rod end castle nut	24 ~ 34	2.4 ~ 3.4	17 ~ 25
Universal join to pinion of steering gear bolt	30 ~ 35	3.0 ~ 3.5	22 ~ 25

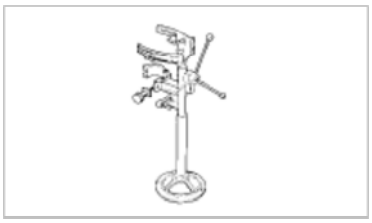
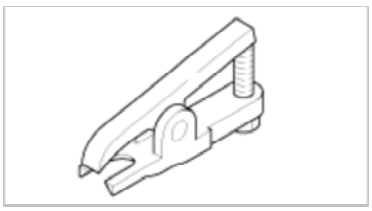
Rear Suspension

Item	Tightening torque (kgf.m)		
	N.m	Kgf.m	lb-ft

Hub nuts	90 ~ 110	9.0 ~ 11.0	65 ~ 80
Shock absorber to wheel housing penal bolts	50 ~ 65	5.0 ~ 6.5	36 ~ 47
Shock absorber to carrier bolt& nut	140 ~ 160	14.0 ~ 16.0	101 ~ 116
Shock absorber self locking nut	20 ~ 25	2.0 ~ 2.5	14 ~ 18
Upper arm to carrier bolt & nut	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Upper arm to cross member bolt	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Lower arm to carrier bolt & nut	140 ~ 160	14.0 ~ 16.0	101 ~ 116
Lower arm to cross member bolt	140 ~ 160	14.0 ~ 16.0	101 ~ 116
Assist arm to carrier castle nut	45 ~ 55	4.5 ~ 5.5	33 ~ 40
Assist arm to cross member cam bolt & nut	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Trailing arm to carrier bolts	35 ~ 55	3.5 ~ 5.5	25 ~ 40
Trailing arm to body bolts	140 ~ 160	14.0 ~ 16.0	101 ~ 116
Stabilizer link to trailing arm nut	45 ~ 55	4.5 ~ 5.5	33 ~ 40
Stabilizer bar to stabilizer link nut	45 ~ 55	4.5 ~ 5.5	33 ~ 40
Stabilizer bar bracket bolts	45 ~ 55	4.5 ~ 5.5	33 ~ 40

Suspension System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use
09546-26000 Strut spring compressor		Compression of coli spring
09568-34000 Ball joint puller		Removal of ball joint

Suspension System > General Information > Troubleshooting

Troubleshooting

Symptom	Possible cause	Remedy
Hard steering	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Low tire pressure No power assist	Correct Replace Adjust Repair and replace
Poor return of steering wheel to center	Improper front wheel alignment	Correct
Poor or rough ride	Improper front wheel alignment Malfunctioning shock absorber Broken or worn stabilizer Broken or worn coil spring	Correct Repair or replace Replace Replace

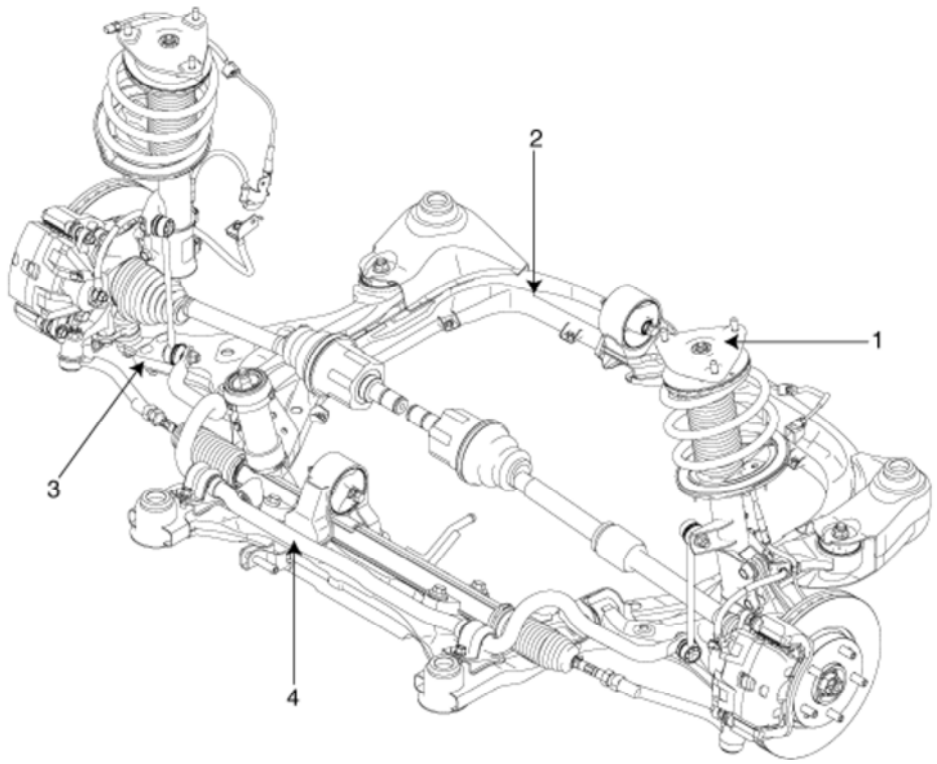
	Worn lower arm bushing	Replace the lower arm assembly
Abnormal tire wear	Improper front wheel alignment Improper tire pressure Malfunctioning shock absorber	Correct Adjust Replace
Wandering	Improper front wheel alignment Poor turning resistance of lower arm ball joint Loose or worn lower arm bushing	Correct Repair Retighten or replace
Vehicle pulls to one side	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Broken or worn coil spring Bent lower arm	Correct Replace Replace Repair
Steering wheel shimmy	Improper front wheel alignment Poor turning resistance of lower arm ball joint Broken or worn stabilizer Worn lower arm bushing Malfunctioning shock absorber Broken or worn coil spring	Correct Replace Replace Replace Replace Replace
Bottoming	Broken or worn coil spring Malfunctioning shock absorber	Replace Replace

Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in Neutral is not related to the tire and wheel. As a general rule, tire and wheel vibrations felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.
Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Perform a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions

Wheel and tire diagnosis		
Rapid wear at the center	Rapid wear at both shoulders	Wear at one shoulder
• Center-tread down to fabric due to excessive over inflated tires • Lack of rotation • Excessive toe on drive wheels • Heavy acceleration on drive	• Under-inflated tires • Worn suspension components • Excessive cornering speeds • Lack of rotation	• Toe adjustment out of specification • Camber out of specification • Damaged strut • Damaged lower arm
Partial wear	Feathered edge	Wear pattern
• Caused by irregular burrs on brake drums	• Toe adjustment out of specification • Damaged or worn tie rods • Damaged knuckle	• Excessive toe on non-drive wheels • Lack of rotation

Suspension System > Front Suspension System > Components and Components Location

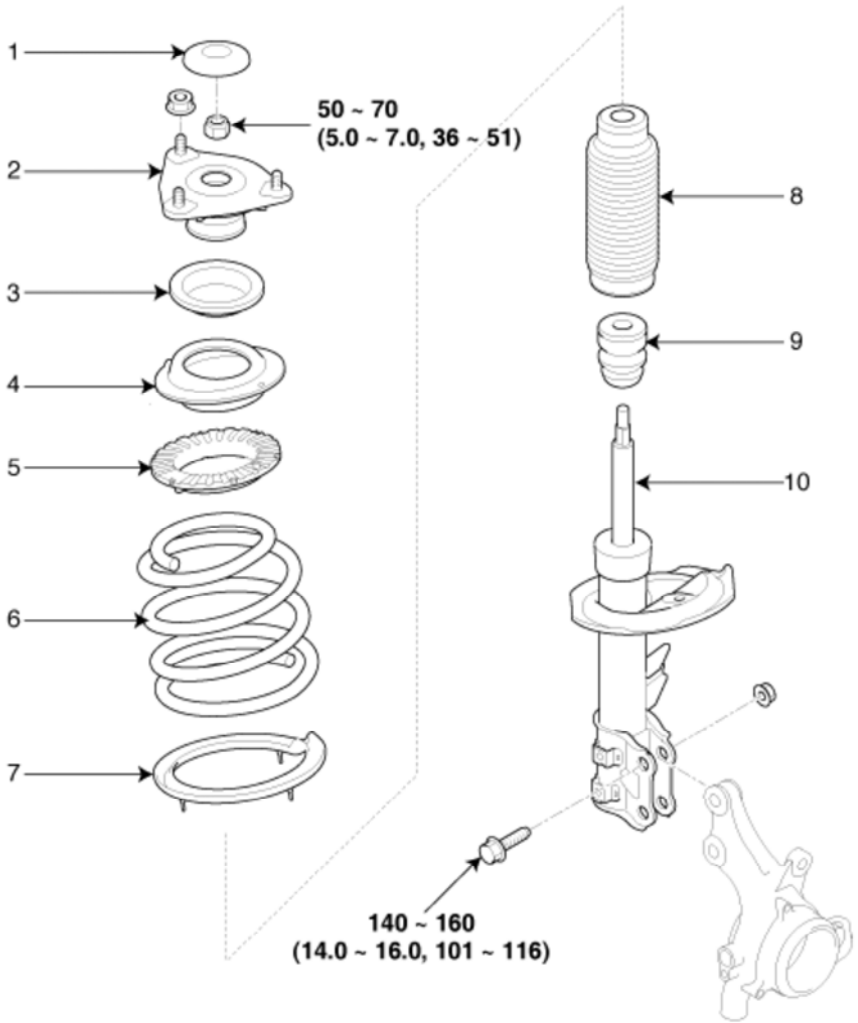
Components



1. Front strut assembly 2. Sub frame	3. Front lower arm 4. Front stabilizer bar

Suspension System > Front Suspension System > Front Strut Assembly > Components and Components Location

Components



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

1. Insulator cap	6. Coil spring
2. Insulator assembly	7. Spring lower pad
3. Strut bearing	8. Dust cover
4. Spring upper seat	9. Bumper rubber
5. Spring upper pad	10. Shock absorber

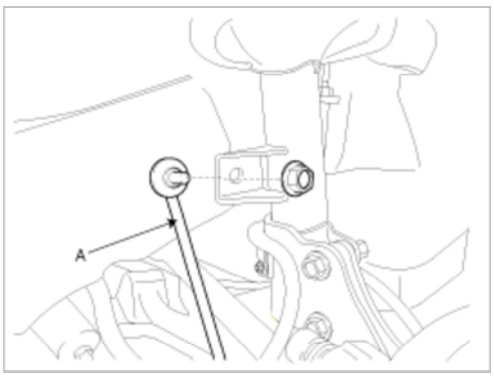
Suspension System > Front Suspension System > Front Strut Assembly > Repair procedures

Removal

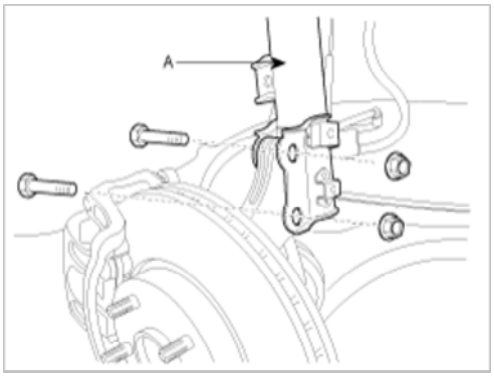
1. Remove the front wheel & tire.

> CAUTION
>
> Be careful not to damage to the hub bolts when removing the front wheel & tire.

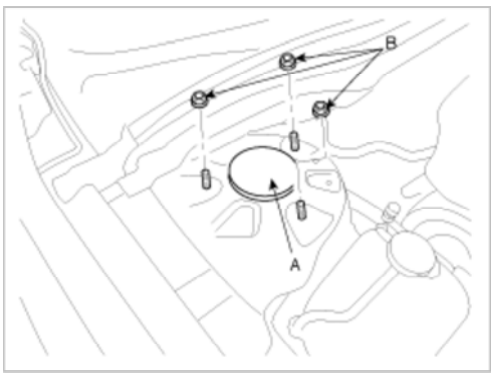
2. Remove the brake hose and the wheel speed sensor bracket from the front strut assembly by loosening the mounting bolts.
3. Disconnect the stabilizer link (A) with the front strut assembly after loosening the nut.



4. Disconnect the front strut assembly (A) with the knuckle by loosening the bolt & nut.

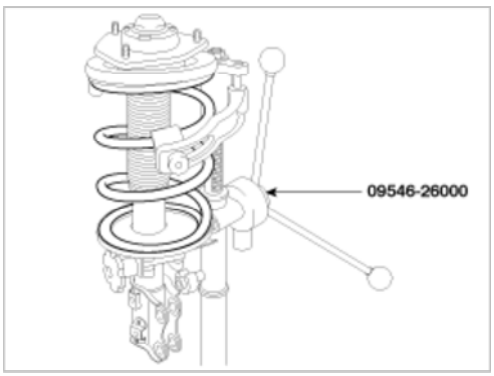


5. Remove the front strut cap (A).
6. Remove the front strut assembly from the wheel housing panel by loosening the mounting nuts (B).



Disassembly

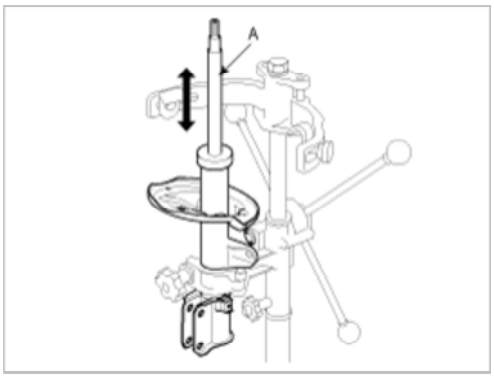
1. Compress the coil spring with a SST (09546-26000). Do not compress the spring more than necessary.
2. Loosen the self-locking nut.



Inspection

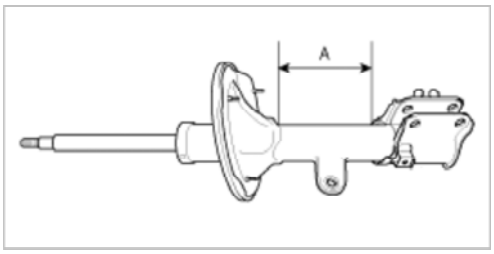
1. Check the strut bearing for wear and damage.

2. Check the spring upper and lower seat for damage and deterioration.
3. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.



Disposal

1. Fully extend the piston rod.
2. Drill a hole on the (A) section to discharge gas from the cylinder.



CAUTION

The gas coming out is harmless, but be careful of chips that may fly when drilling. Be sure to wear safety goggles or eye protection when performing this task.

Reassembly

1. Install the front shock absorber to SST (09546-26000).
2. Assemble the components of the front strut assembly in sequence. (Refer to Front strut assembly components)
3. After seating the upper and lower ends of the coil spring in the upper and lower spring seat grooves correctly, tighten new self-locking nut.

Tightening torque :
50 ~ 70N.m (5.0 ~ 7.0kgf.m, 36 ~ 51lb-ft)

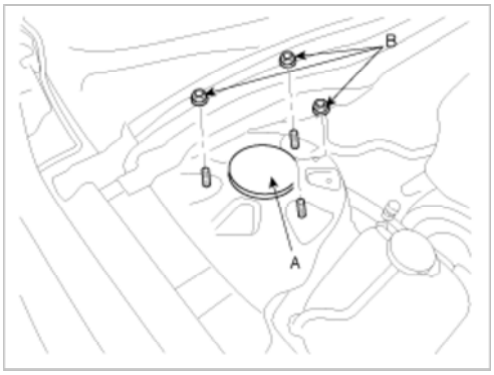
4. Remove the special service tool.

Installation

1. Install the front strut assembly to the wheel housing panel by tightening the mounting nuts (B).

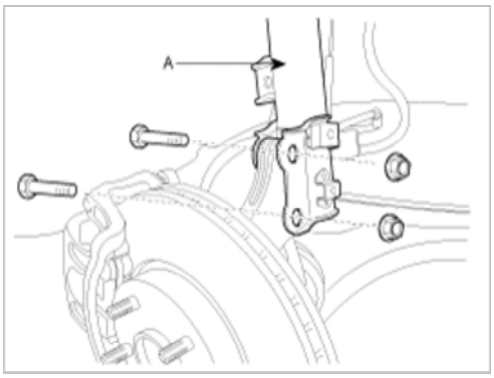
Tightening torque :
45 ~ 60N.m (4.5 ~ 6.0kgf.m, 33 ~ 43lb-ft)

2. Install the front strut cap (A).



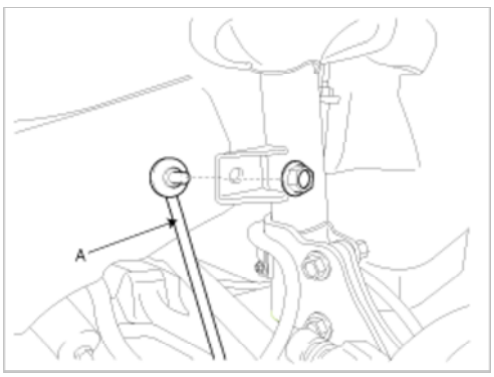
3. Connect the front strut assembly (A) with the knuckle by tightening the bolts & nuts.

Tightening torque :
140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)



4. Install the stabilizer link (A) to the front strut assembly and then tighten the nut.

Tightening torque :
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



5. Install the brake hose and wheel speed sensor bracket to front strut assembly by tightening the mounting bolts.
6. Install the front wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

Suspension System > Front Suspension System > Front Lower Arm > Repair procedures

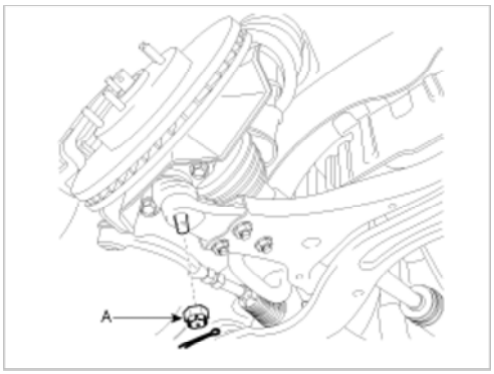
Removal

1. Remove the front wheel & tire.

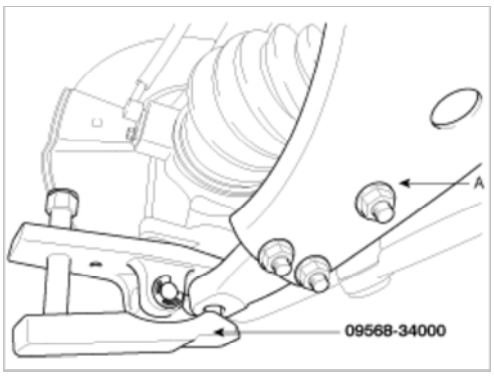
CAUTION

Be careful not to damage to the hub bolts when removing the front wheel & tire.

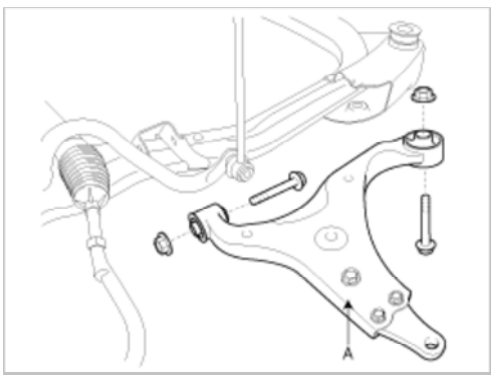
2. Remove the split pin and the castle nut (A) from the lower arm ball joint.



3. Separate the lower arm (A) from the lower arm ball joint by using SST (09568-34000).



4. Loosen the bolts and nuts and then remove the lower arm (A) from the sub frame.



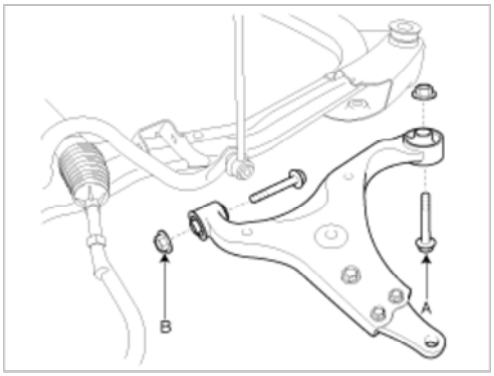
Inspection

1. Check the bushing for wear and deterioration.
2. Check the lower arm for deformation.
3. Check the all bolts and nuts

Installation

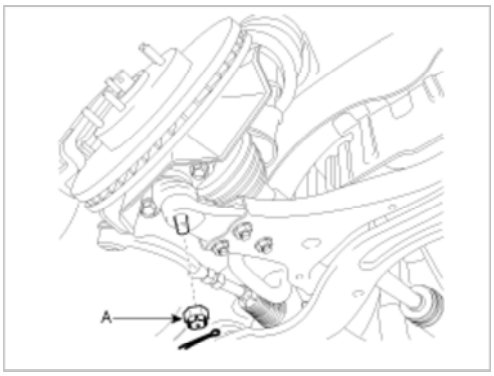
1. Install the front lower arm to the sub frame and then tighten the bolts (A, B) and nuts.

Tightening torque
Bolt & nut (A): 140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)
Bolt & nut (B): 100 ~ 120N.m (10.0 ~12.0kgf.m, 72 ~ 87lb-ft)



2. Connect the lower arm with the ball joint and then install the castle nut (A) and the split pin.

Tightening torque :
80 ~ 90N.m (8.0 ~ 9.0kgf.m, 58 ~ 65lb-ft)



3. Install the front wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

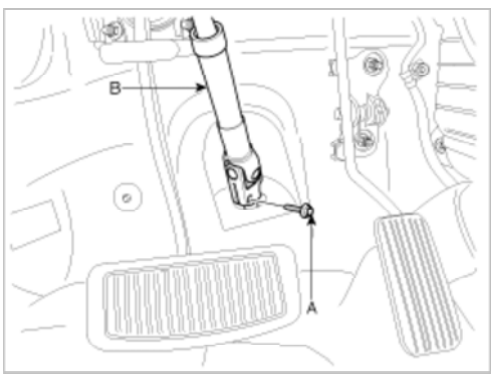
Suspension System > Front Suspension System > Front Stabilizer Bar > Repair procedures

Removal

1. Remove the front wheel & tire.

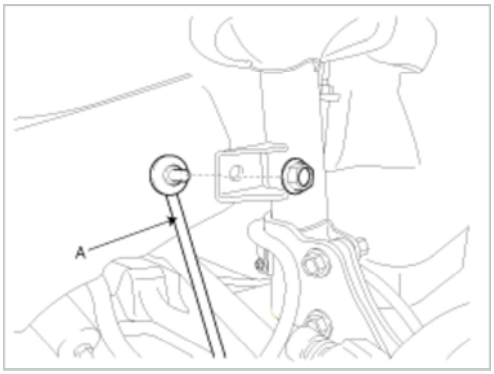
> CAUTION
>
> Be careful not to damage to the hub bolts when removing the front wheel & tire.

2. Loosen the bolt (A) and then disconnect the universal joint assembly (B) from the pinion of the steering gear box.

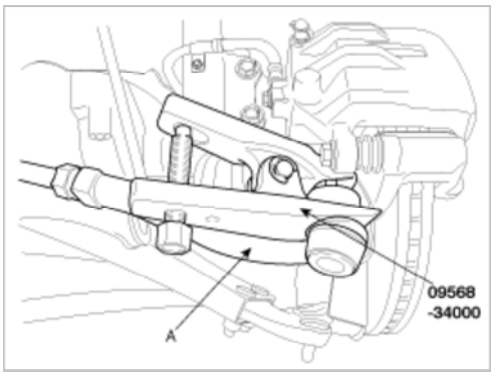


> CAUTION
>
> Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

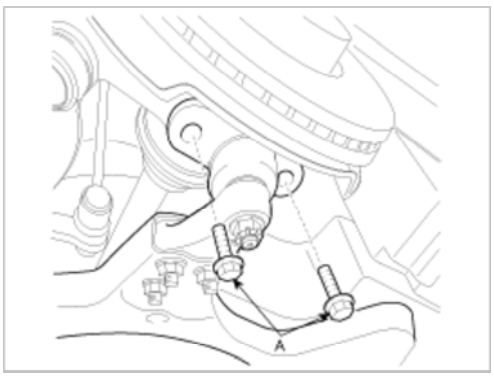
3. Disconnect the stabilizer link (A) from the front strut assembly by loosening the nut.



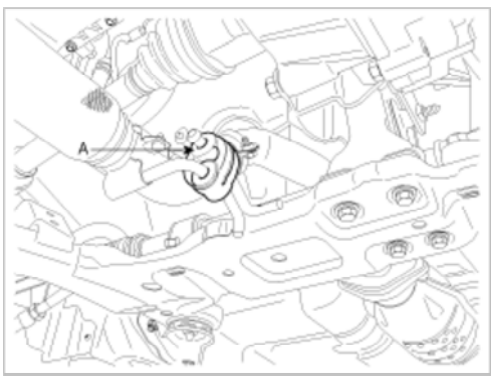
4. Remove the split pin and castle nut and then disconnect the tie rod end (A) from the front knuckle by using a SST (09568-34000).



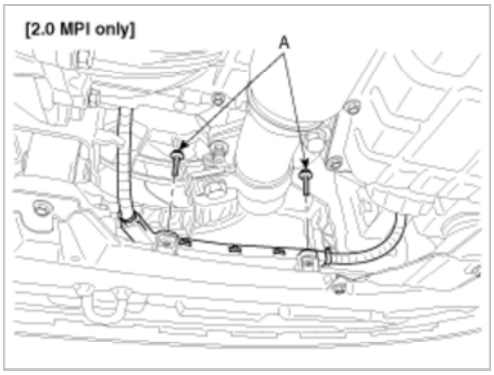
5. Disconnect the front lower arm with the knuckle by loosening the mounting bolts (A).



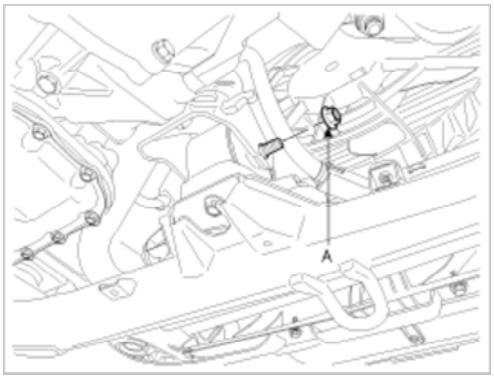
6. Remove the muffler rubber hanger (A).

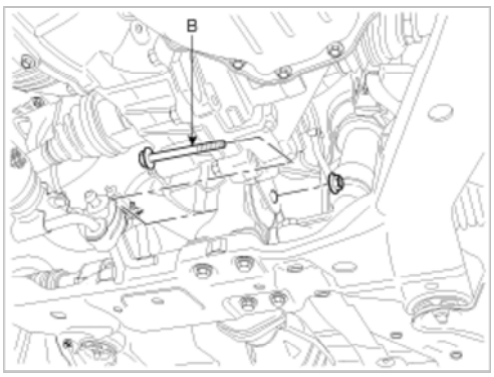


7. Loosen the wiring harness protector mounting bolts (A).

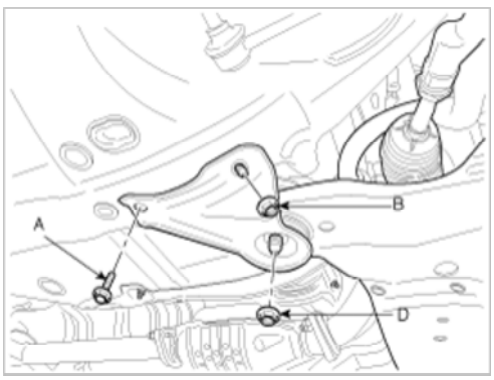


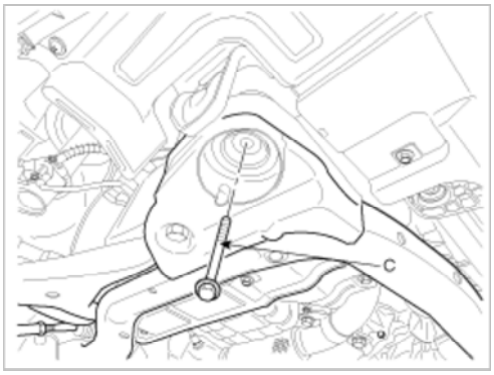
8. Remove the front and rear roll stopper bolts & nut (A, B).

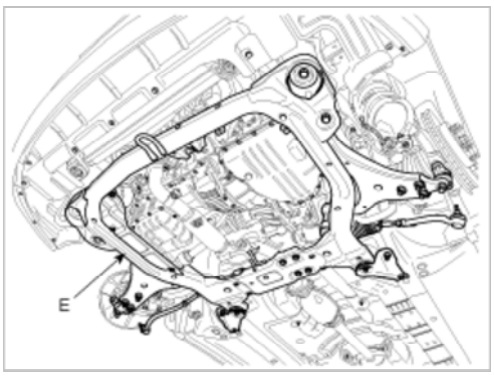




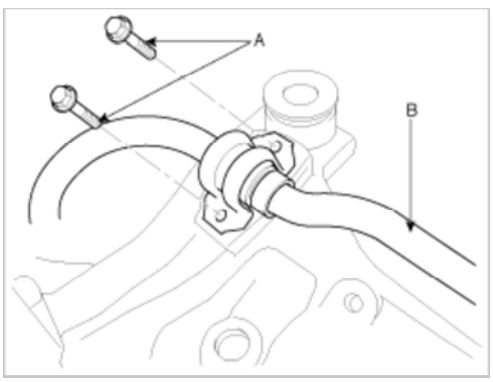
9. Remove the sub frame (E) and the sub frame stay by loosening the mounting bolts (A, C) and nuts (B, D).



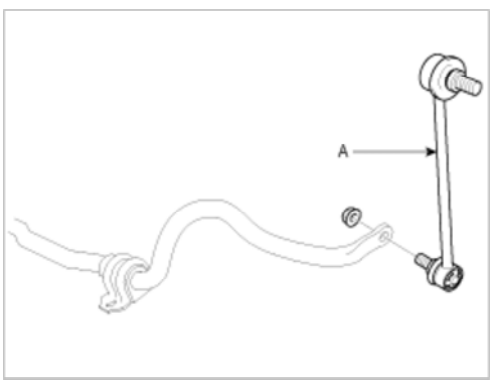




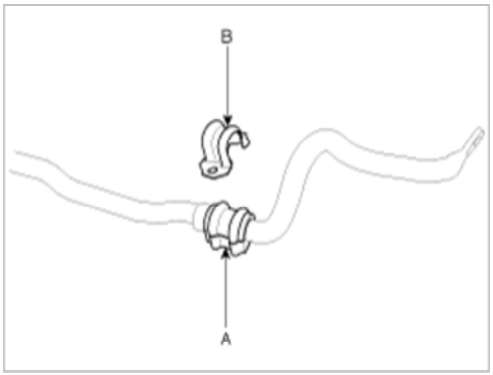
10. Remove stabilizer (B) from the sub frame by loosening the bracket mounting bolts (A).



11. Disconnect the stabilizer link (A) with the stabilizer bar by loosening the nut.



12. Remove the bushing (A) and the bracket (B) from the stabilizer bar.

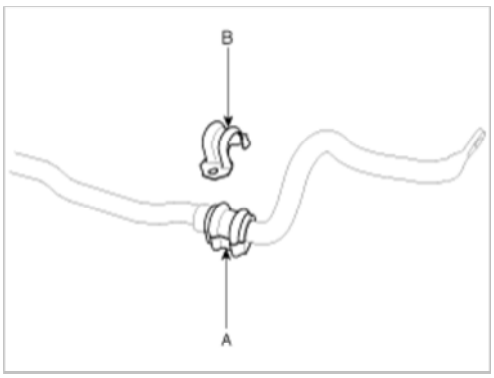


Inspection

1. Check the bushing for wear and deterioration.
2. Check the front stabilizer bar for deformation.
3. Check the front stabilizer link ball joint for damage.

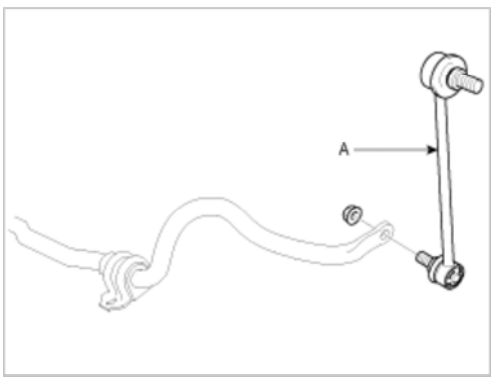
Installation

1. Install the bushing (A) and the bracket (B) to the stabilizer bar.



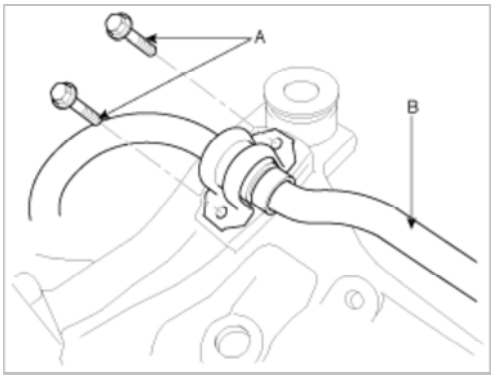
2. Connect the stabilizer link (A) with the stabilizer bar by tightening the nut.

Tightening torque :
100~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



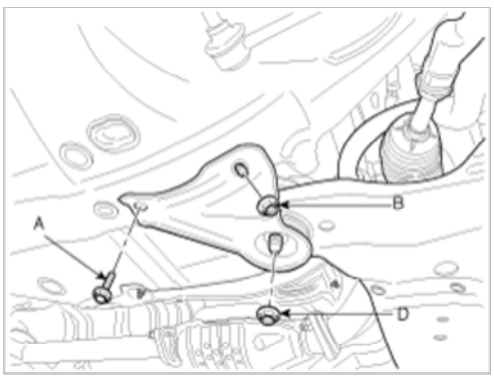
3. Install the stabilizer (B) to the sub frame by tightening the bracket mounting bolts (A).

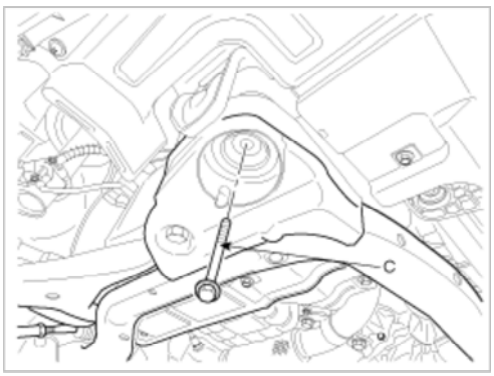
Tightening torque :
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)

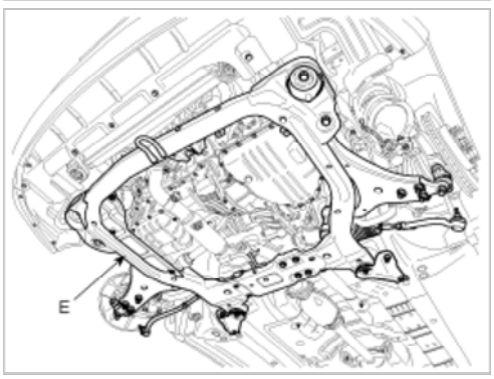


4. Install the sub frame (E) and the sub frame stay by tightening the mounting bolts (A, C) and nuts (B, D).

Tightening torque :
Sub fame mounting bolts (C) and nuts (D):
160 ~ 180N.m (16.0 ~ 18.0kgf.m, 116 ~ 130lb-ft)
Sub frame stay mounting bolts (A) and nuts (B):
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)

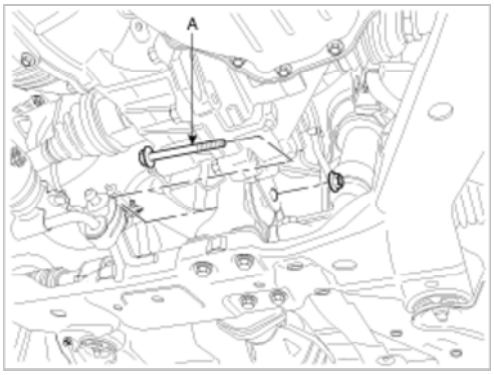






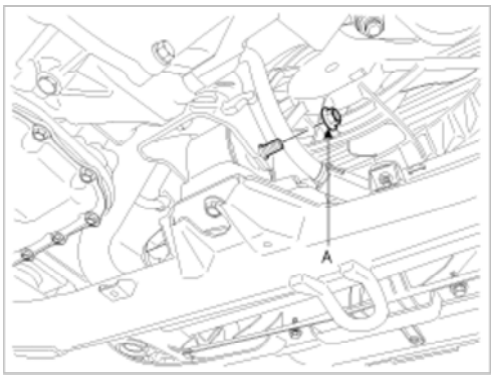
5. Tighten the rear roll stopper through bolt(A).

Tightening torque :
50 ~ 65N.m (5.0 ~ 6.5kgf.m, 36 ~ 47lb-ft)

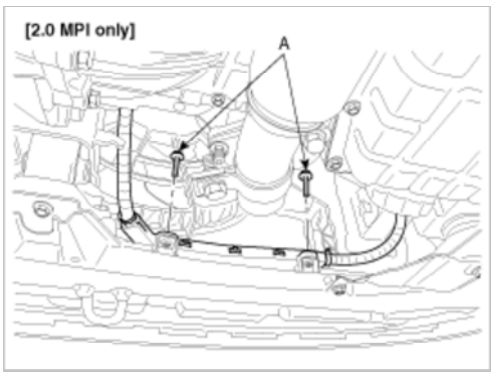


6. Tighten the front roll stopper through bolt & nut (A).

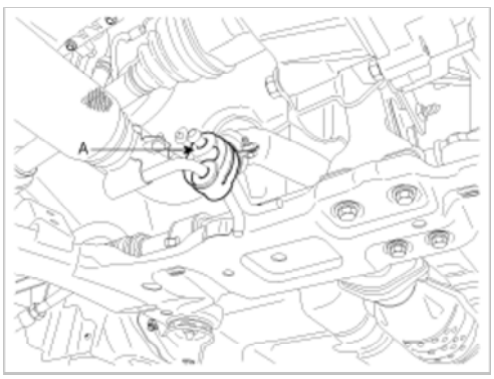
Tightening torque :
50 ~ 65N.m (5.0 ~ 6.5kgf.m, 36 ~ 47lb-ft)



7. Install the wire harness protector to sub frame by tightening the mounting bolts (A).

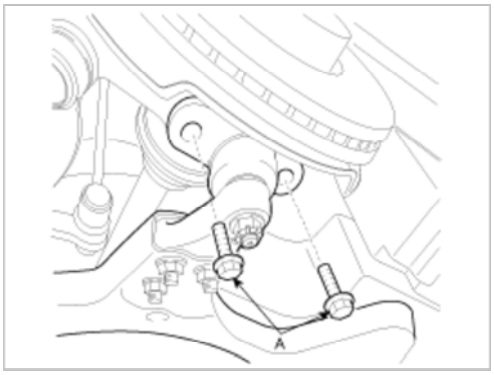


8. Install the muffler rubber hanger (A).



9. Connect the lower arm with the knuckle by tightening the mounting bolts (A).

Tightening torque :
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

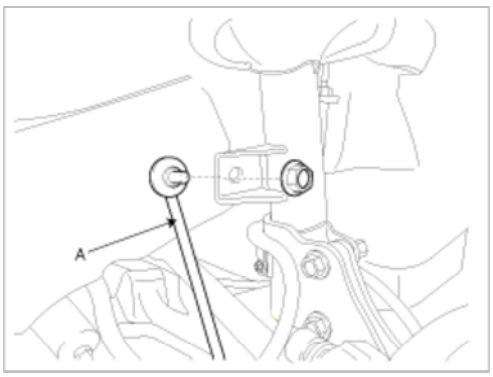


10. Connect the tie rod end with the knuckle and then install the castle nut and split pin.

Tightening torque :
24 ~ 34N.m (2.4 ~3.4kgf.m, 17 ~ 25lb-ft)

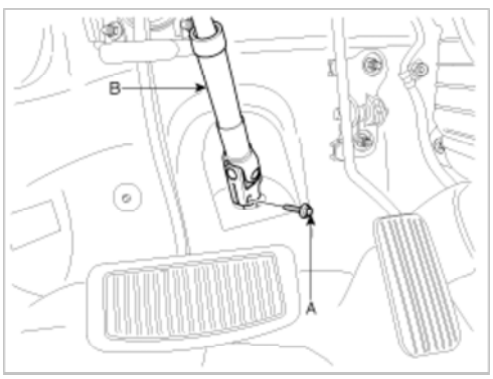
11. Connect the stabilizer link (A) with the front strut assembly and then tighten the nut.

Tightening torque :
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



12. Connect the universal joint assembly (B) with the pinion of the steering gear box and then tighten the bolt (A).

Tightening torque :
30 ~ 35N.m (3.0 ~ 3.5kgf.m, 22 ~ 25lb-ft)

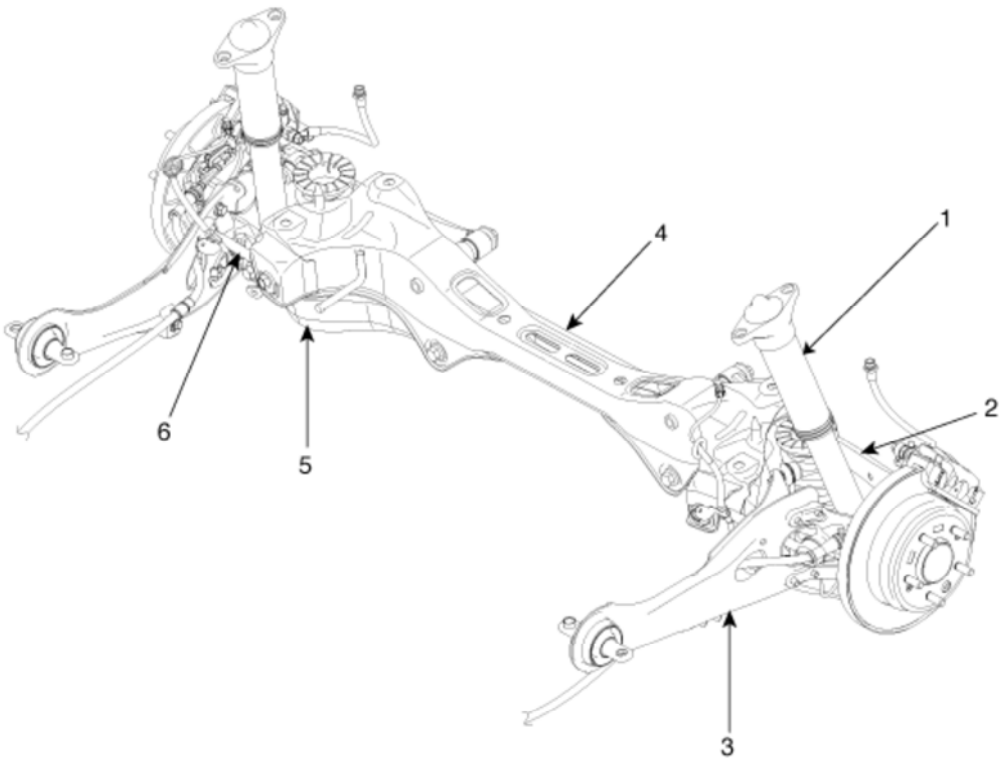


13. Install the front wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

Suspension System > Rear Suspension System > Components and Components Location

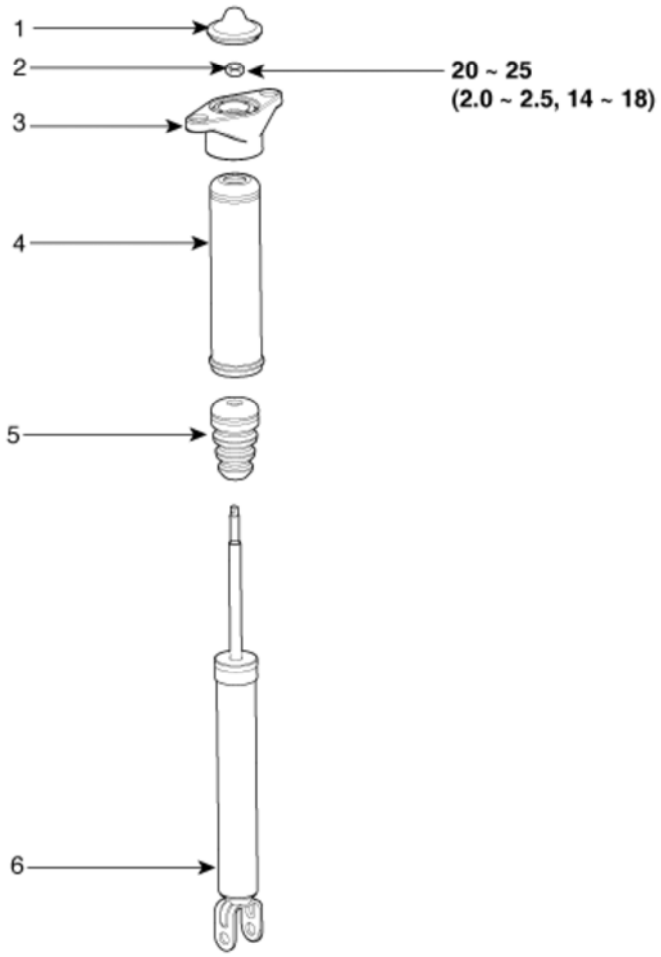
Components



1. Rear shock absorber 2. Rear upper arm 3. Rear trailing arm	4. Rear stabilizer bar 5. Rear lower arm 6. Rear assist arm

Suspension System > Rear Suspension System > Rear Shock Absorber > Components and Components Location

Components



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

1. Insulator cover 2. Self locking nut 3. Bracket assembly	4. Dust cover 5. Bumper rubber 6. Shock absorber

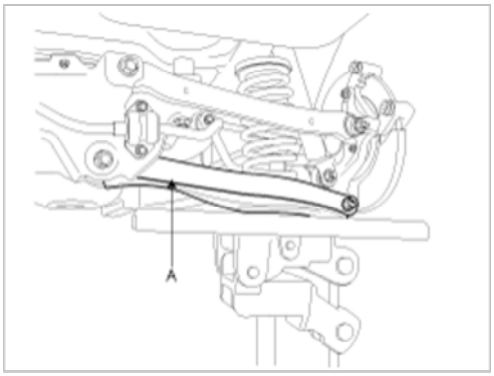
Suspension System > Rear Suspension System > Rear Shock Absorber > Repair procedures

Removal

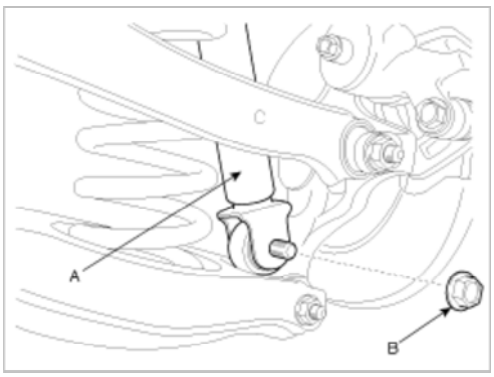
1. Remove the rear wheel & tire.

> **CAUTION**
>
> Be careful not to damage to the hub bolts when removing the rear wheel & tire.

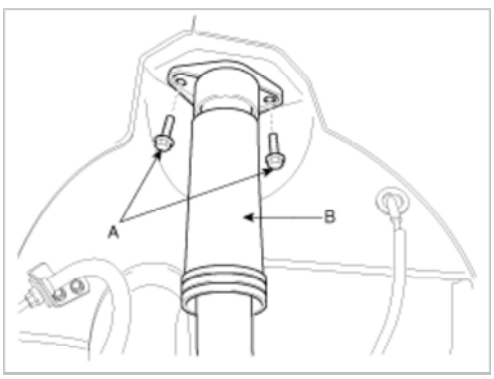
2. Support the lower portion of the rear lower arm (A) with the jack.



3. Remove the bolt & nut (B) holding the rear shock absorber (A) to the carrier assembly.

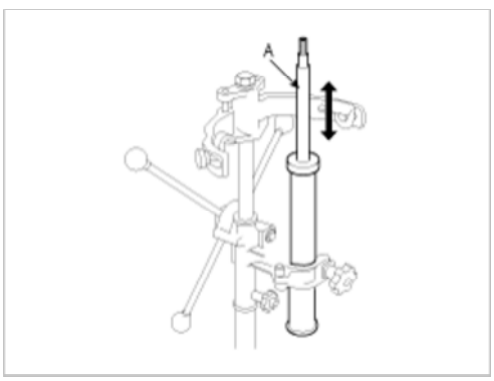


4. Remove the rear shock absorber (B) from the wheel housing by loosening the mounting bolts (A).



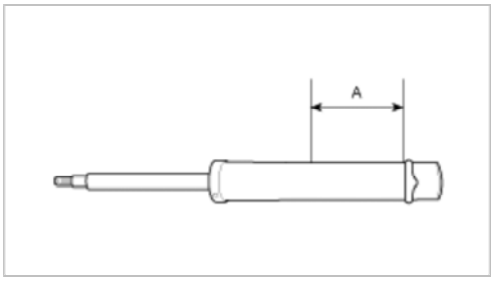
Inspection

1. Check the rubber parts for wear and deterioration.
2. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.



Disposal

1. Fully extend the piston rod.
2. Drill a hole on the (A) section to discharge gas from the cylinder.



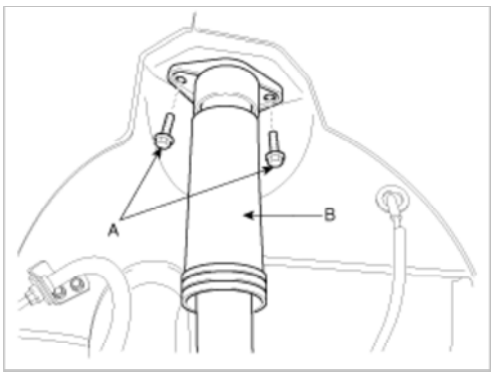
CAUTION

The gas coming out is harmless, but be careful of chips that may fly when drilling. Be sure to wear safety goggles or eye protection when performing this task.

Installation

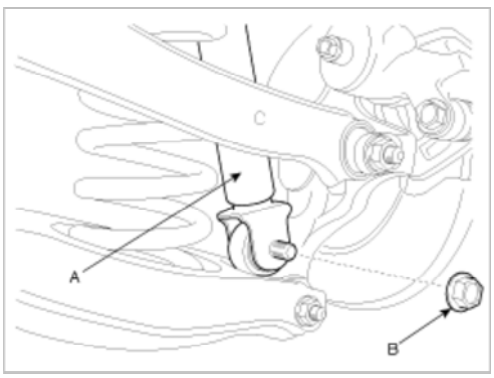
1. Install the rear shock absorber (B) to the wheel housing penal by tightening the bracket mounting bolts (A).

Tightening torque :
50 ~ 65N.m (5.0 ~ 6.5kgf.m, 36 ~ 47lb-ft)



2. Connect the rear shock absorber (A) with the carrier assembly and then tighten the bolt & nut (B).

Tightening torque :
140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)



3. Install the rear wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

Suspension System > Rear Suspension System > Rear Upper Arm > Repair procedures

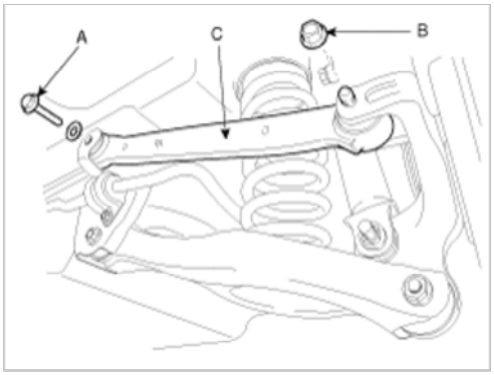
Removal

1. Remove the rear wheel & tire.

CAUTION

Be careful not to damage to the hub bolts when removing the rear wheel & tire.

2. Remove the rear upper arm (C) by loosening the mounting bolts & nut (A, B).



Inspection

1. Check the bushing for wear and deterioration.
2. Check the rear upper arm or damage and deformation.
3. Check for all bolts and nut.

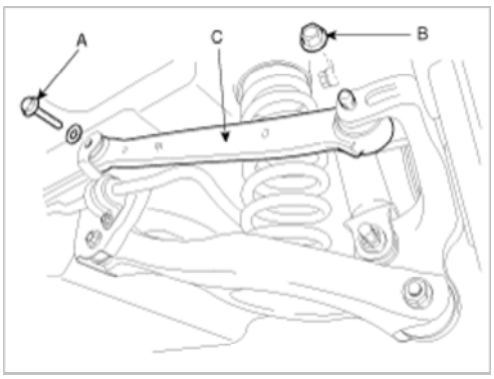
Installation

1. Install the rear upper arm (C) between the rear cross member and the carrier assembly and then tighten the mounting bolts and nut (A, B).

Tightening torque
Bolt (A): 100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)
Bolt & Nut (B): 100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

CAUTION

Install the rear upper arm so that the letter "R" can face the rear of vehicle.



2. Install the rear wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

Suspension System > Rear Suspension System > Rear Lower Arm > Repair procedures

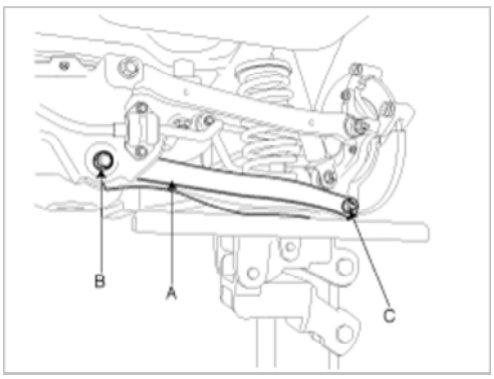
Removal

1. Remove the rear wheel & tire.

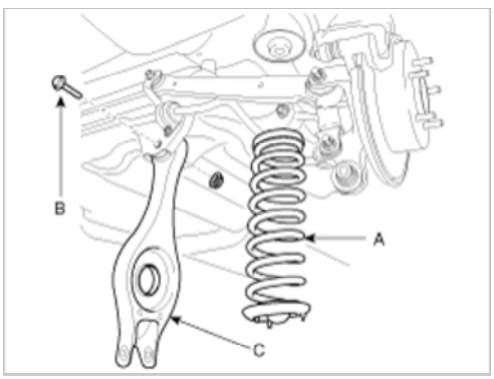
CAUTION

Be careful not to damage to the hub bolts when removing the rear wheel & tire.

2. Support the lower portion of the rear lower arm (A) with a jack.
3. Temporarily loosen the bolt (B) holding the cross member to the rear lower arm. Do not remove it.
4. Remove the bolt & nut (C) holding the rear lower arm to the carrier assembly.



5. Lower the jack and then remove the coil spring (A) and the spring pad.
6. Remove the rear lower arm (C) from the cross member by removing the bolt (B) completely.

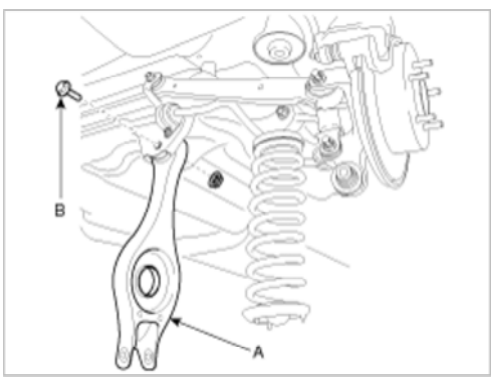


Inspection

1. Check the bushing for wear and deterioration.
2. Check the rear lower arm for deformation.
3. Check the coil spring and spring pad for deterioration and deformation.
4. Check for all bolts and nut.

Installation

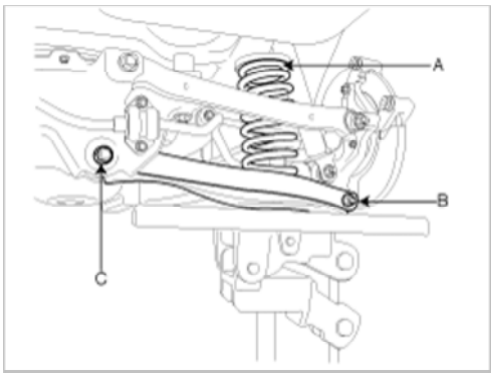
1. Connect the rear lower arm (A) with the cross member and then temporarily tighten the bolt (B).



2. Install the coil spring (A) and support the lower portion of the rear lower arm with a jack.
3. Adjust height of the jack to place the bolt (B) holding rear lower arm and carrier assembly through the mating holes.

4. Tighten the bolt and nut (B, C) to the specified torque.

Tightening torque :
140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)



5. Install the rear wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

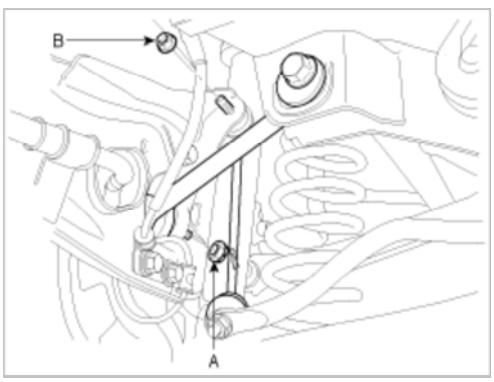
Suspension System > Rear Suspension System > Rear Assist Arm > Repair procedures

Removal

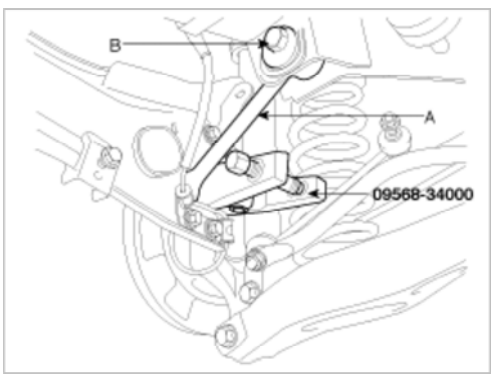
1. Remove the rear wheel & tire.

> CAUTION
>
> Be careful not to damage to the hub bolts when removing the rear wheel & tire.

2. Remove the split pin and castle nut (A) from the rear assist arm.
3. Disconnect the rear stabilizer link with the trailing arm by loosening the nut (B).



4. Disconnect the ball joint of the rear assist arm (A) with the carrier assembly with the SST (09568-34000).
5. Loosen the nut and then remove the cam bolt (B) rear assist arm (A) from the cross member.



Inspection

1. Check the bushing for wear and deterioration.
2. Check the rear assist arm for deformation.
3. Check the ball joint for damage.
4. Check for the all bolts, nut, and washer.

Installation

1. Install the rear assist arm (A) and the cam bolt (B) to cross member and then tighten the nut.

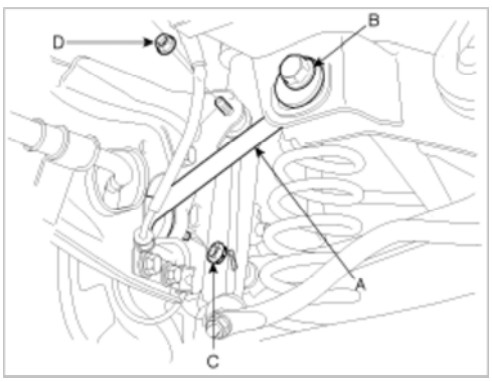
Tightening torque :
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

2. Connect the ball joint of the rear assist arm (A) with the carrier assembly.
3. Install the castle nut (C) and split pin to the ball joint of the rear assist arm.

Tightening torque :
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)

4. Connect the rear stabilizer link with the trailing arm and then tighten the nut (D).

Tightening torque :
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)



5. Install the rear wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

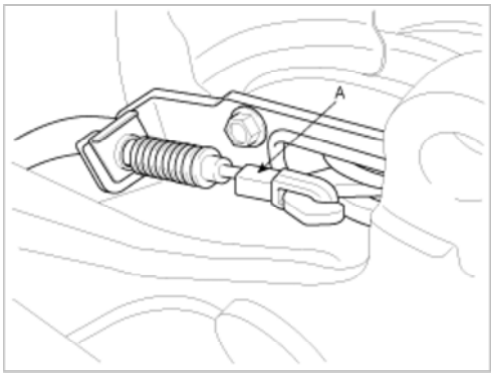
Suspension System > Rear Suspension System > Rear Trailing Arm > Repair procedures

Removal

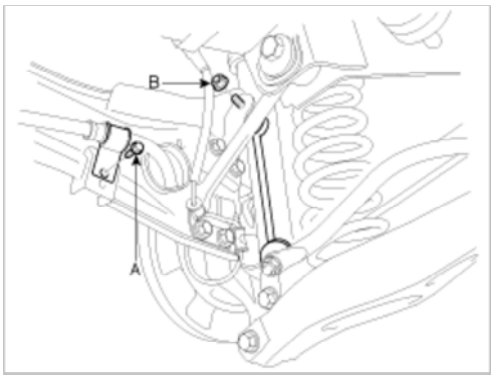
1. Remove the rear wheel & tire.

> CAUTION
>
> Be careful not to damage to the hub bolts when removing the rear wheel & tire.

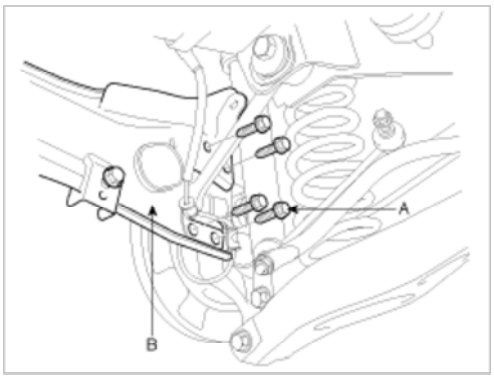
2. Disconnect the parking brake cable (A) with the rear brake assembly.



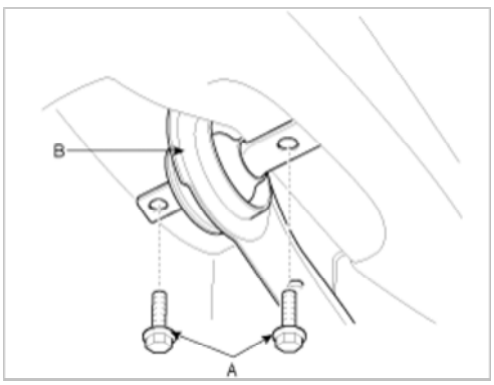
3. Remove the parking brake cable bracket from the trailing arm by loosening the mounting bolt (A).
4. Disconnect the rear stabilizer link with the trailing arm by loosening the nut (B).



5. Disconnect the trailing arm (B) with the carrier assembly by loosening mounting bolts (A).



6. Remove the rear trailing arm (B) by loosening the mounting bolts (A).



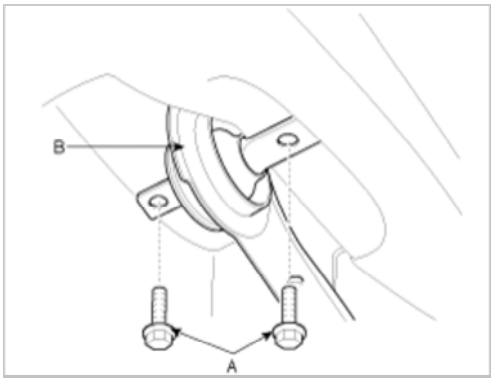
Inspection

1. Check the bushing for wear and deterioration.
2. Check the rear trailing arm for deformation.
3. Check for all bolts and nuts.

Instllation

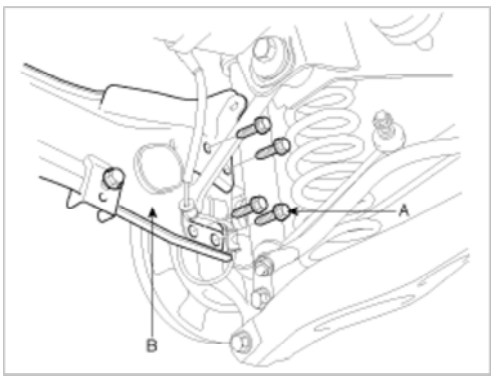
1. Install the rear trailing arm (B) to the body by tightening the mounting bolts (A).

Tightening torque :
140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)

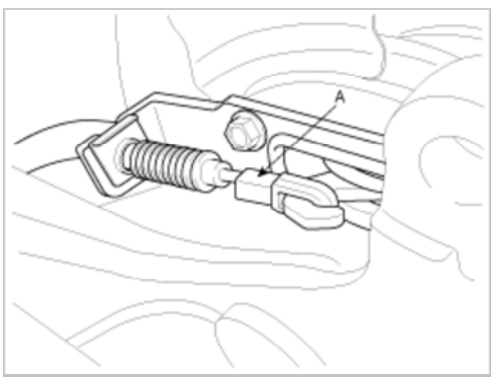


2. Connect the trailing arm (B) with the carrier assembly by tightening the bolts (A).

Tightening torque :
35 ~ 55N.m (3.5 ~ 5.5kgf.m, 25 ~ 40lb-ft)



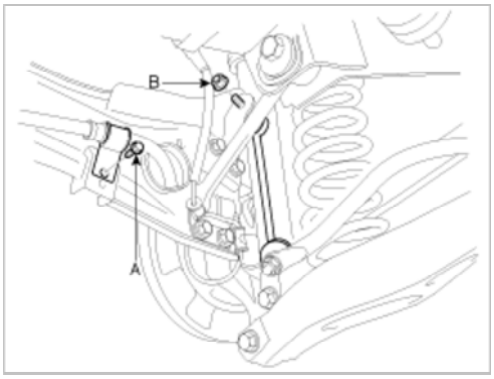
3. Connect the parking brake cable (A) with the rear brake assembly.



4. Connect the rear stabilizer link with the trailing arm and then tightening the nut (B).

Tightening torque :
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 30 ~ 40lb-ft)

5. Install the parking brake cable bracket to the trailing arm by mounting bolt (A).



6. Install the rear wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

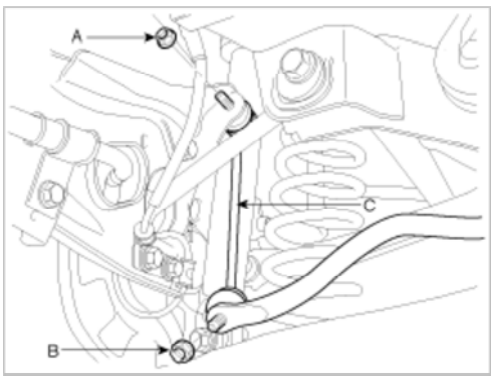
Suspension System > Rear Suspension System > Rear Stabilizer Bar > Repair procedures

Removal

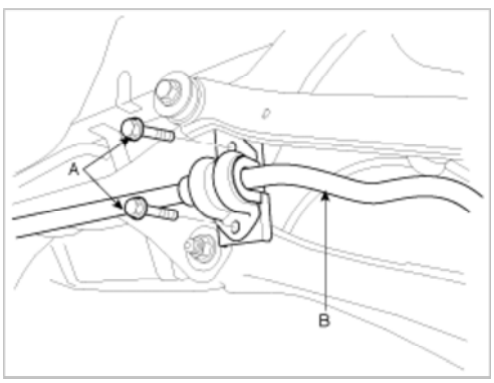
1. Remove the rear wheel & tire.

> CAUTION
>
> Be careful not to damage to the hub bolts when removing the rear wheel & tire.

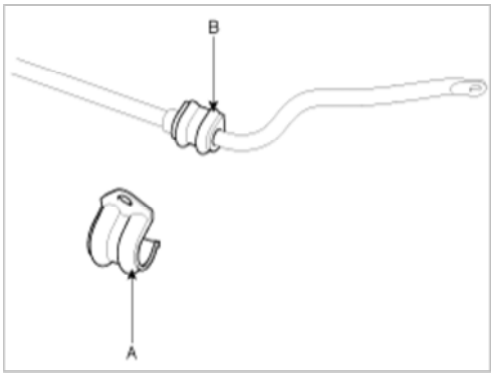
2. Remove the stabilizer link (C) by loosening the nuts (A, B).



3. Remove the rear stabilizer bar (B) from the cross member by loosening the bracket mounting bolts (A).



4. Remove the mounting bracket (A) and bushing (B) from the rear stabilizer bar.

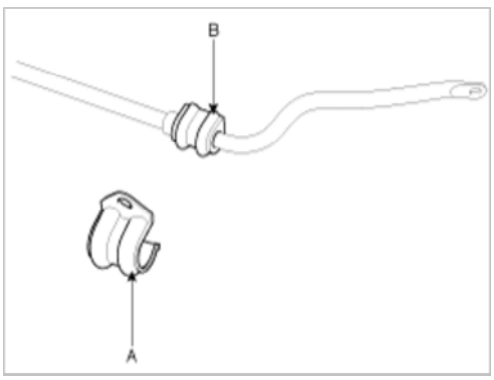


Inspection

1. Check the rear stabilizer bar for deformation.
2. Check the rear stabilizer link ball joint for damage.

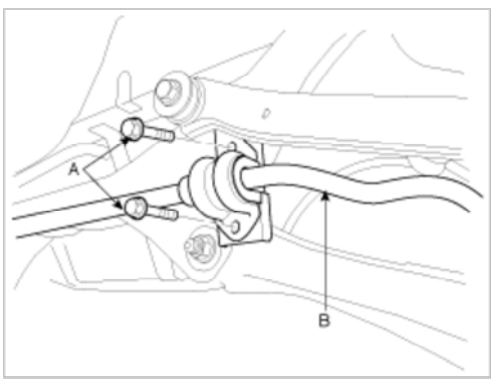
Installation

1. Install the mounting bracket (A) and bushing (B) to the rear stabilizer bar.



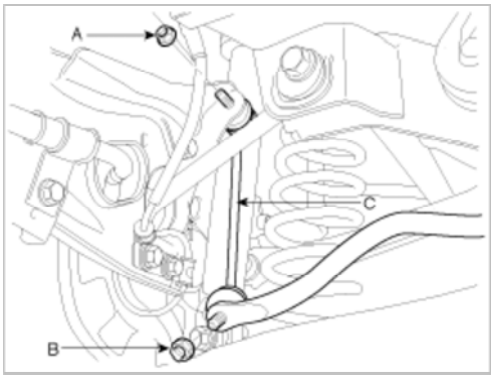
2. Install the rear stabilizer bar (B) to the cross member by tightening the bracket mounting bolts (A).

Tightening torque :
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)



3. Connect the rear stabilizer link (C) between the rear stabilizer bar and the trailing arm and then tighten the nut (A, B).

Tightening torque :
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)



4. Install the rear wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

Suspension System > Tires/Wheels > Tire > Repair procedures

Tire Wear

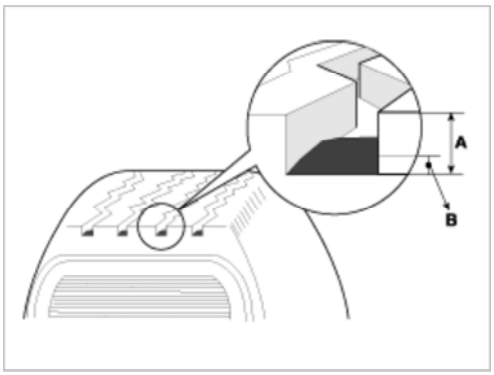
1. Measure the tread depth of the tires.

Tread depth [limit] : 1.6 mm (0.063 in)

2. If the remaining tread depth (A) is less than the limit, replace the tire.

NOTE

When the tread depth of the tires is less than 1.6 mm(0.063 in), the wear indicators (B) will appear.

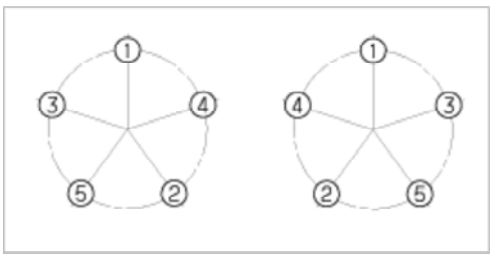


Suspension System > Tires/Wheels > Wheel > Repair procedures

Hub Nut Tightening Sequence

Tighten the hub nuts as follows.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)



CAUTION

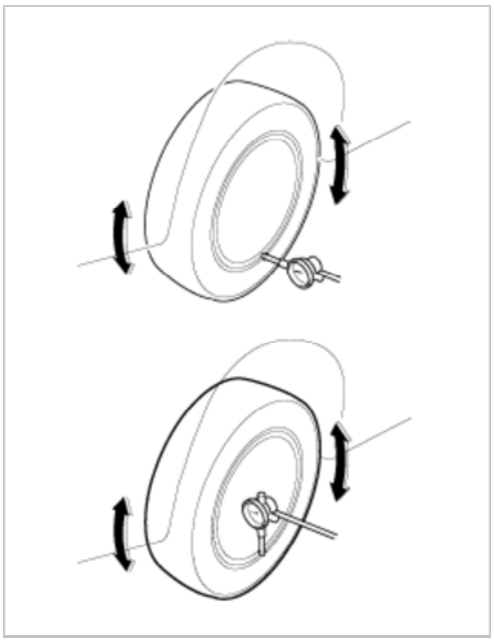
When using an impact gun, final tightening torque should be checked using a torque wrench.

Run Out Inspection

1. Jack up the vehicle.
2. Measure the wheel Run-out by using a dial indicator as illustration below.

Run-out	Aluminum	Steel
Radial mm(in)	Below 0.3(0.012)	Below 0.6(0.024)
Lateral mm(in)	Below 0.3(0.012)	Below 1.0(0.039)

3. If measured value exceeds the standard value, replace the wheel.



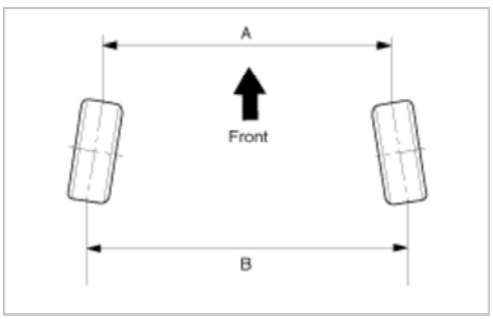
Suspension System > Tires/Wheels > Alignment > Repair procedures

Front Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the front wheel alignment, always position the vehicle on a level surface with the front wheels facing straight ahead.
Prior to inspection, make sure that the front suspension and steering system are in normal operating condition and that the tires are inflated to the specified pressure.

Toe

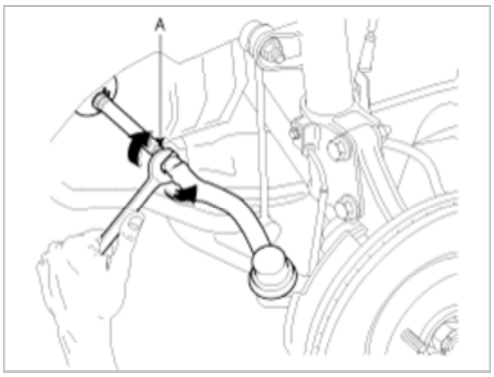


B - A > 0: Toe in (+)
B - A < 0: Toe out (-)

Toe Adjustment

1. Loosen the tie rod end lock nut.
2. Remove the bellows clip to prevent the bellows from being twisted.
3. Adjust the toe by screwing or unscrewing the tie rod. Toe adjustment should be made by turning the right and left tie rods by the same amount.

Toe-in
Total : 0°±0.2°
Individual : 0°± 0.1°



4. When completing the toe adjustment, install the bellows clip and tighten the tie rod end lock nut to specified torque.

Tightening torque :
50 ~ 55N.m (5.0 ~ 5.5kgf.m, 36 ~ 40lb-ft)

Camber and Caster

Camber and Caster are pre-set at the factory, so they do not need to be adjusted. If the camber and caster are not within the standard value, replace or repair the damaged parts and then inspect again.

Camber angle: -0.6°±0.5°

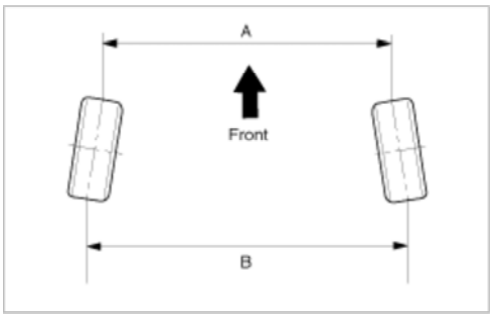
Caster angle : 4.43°±0.5°

Rear Wheel Alignment

CAUTION

When using a commercially available computerized wheel alignment equipment to inspect the rear wheel alignment, always position the vehicle on a level surface.
Prior to inspection, make sure that the rear suspension system is in normal operating condition and that the tires are inflated to the specified pressure.

Toe

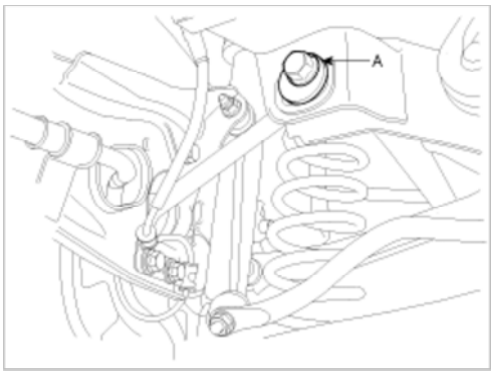


B - A > 0: Toe in (+)
B - A < 0: Toe out (-)

Toe Adjustment

1. Loosen the nut holding the assist arm cam bolt (A).
2. Adjust rear toe by turning the rear assist arm cam bolt (A) clockwise or counter clockwise. Toe adjustment should be made by turning the right and left cam bolt by the same amount.

Toe-in
Total : 0.1°±0.2°
Individual : 0.05°± 0.1°



3. When completing the toe adjustment, tighten the nut to specified torque.

Tightening torque :
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

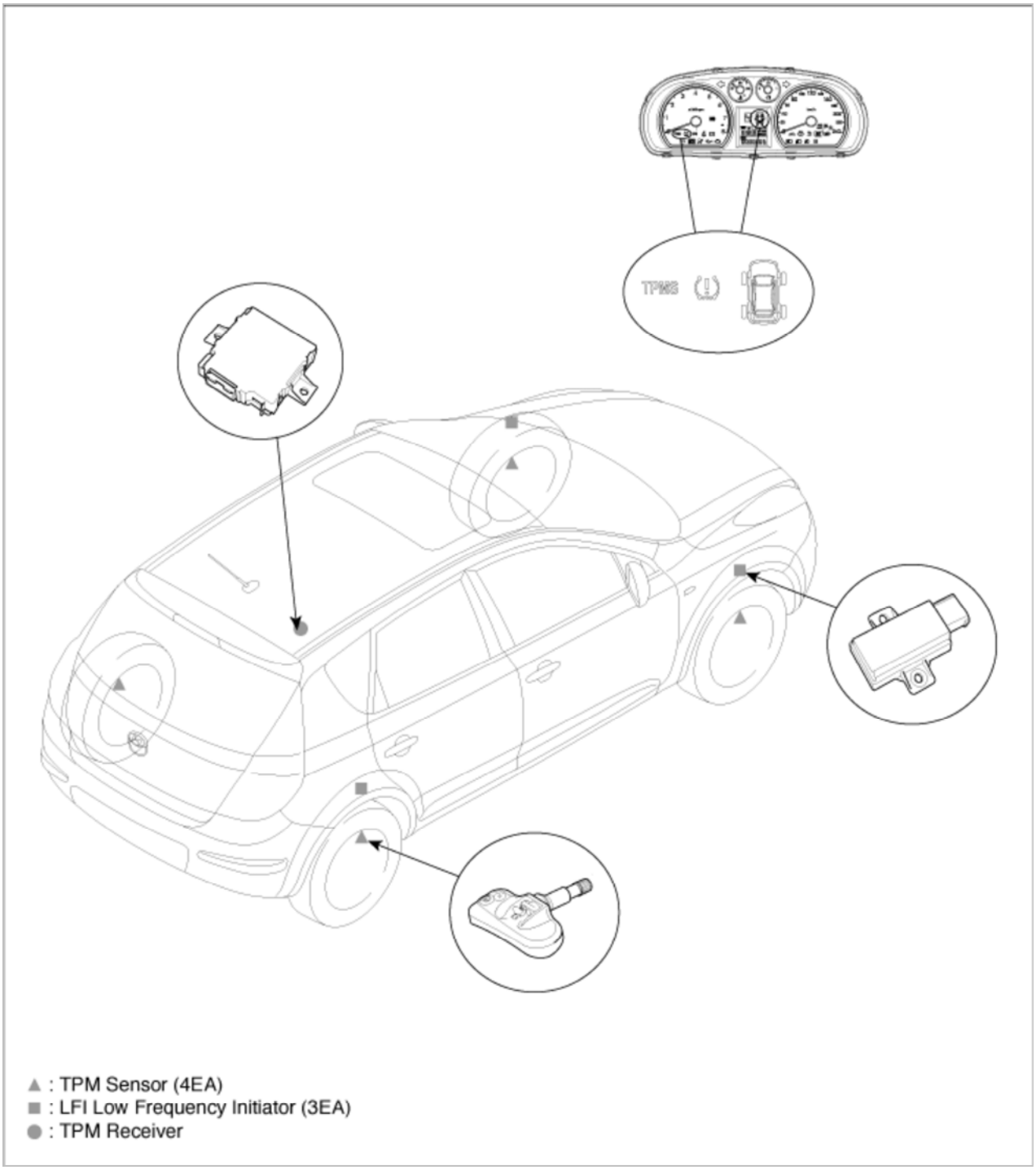
Camber

Camber is pre-set at the factory, so it does not need to be adjusted. If the camber is not within the standard value, replace or repair the damaged parts and then inspect again.

Camber: -1.15°±0.5°

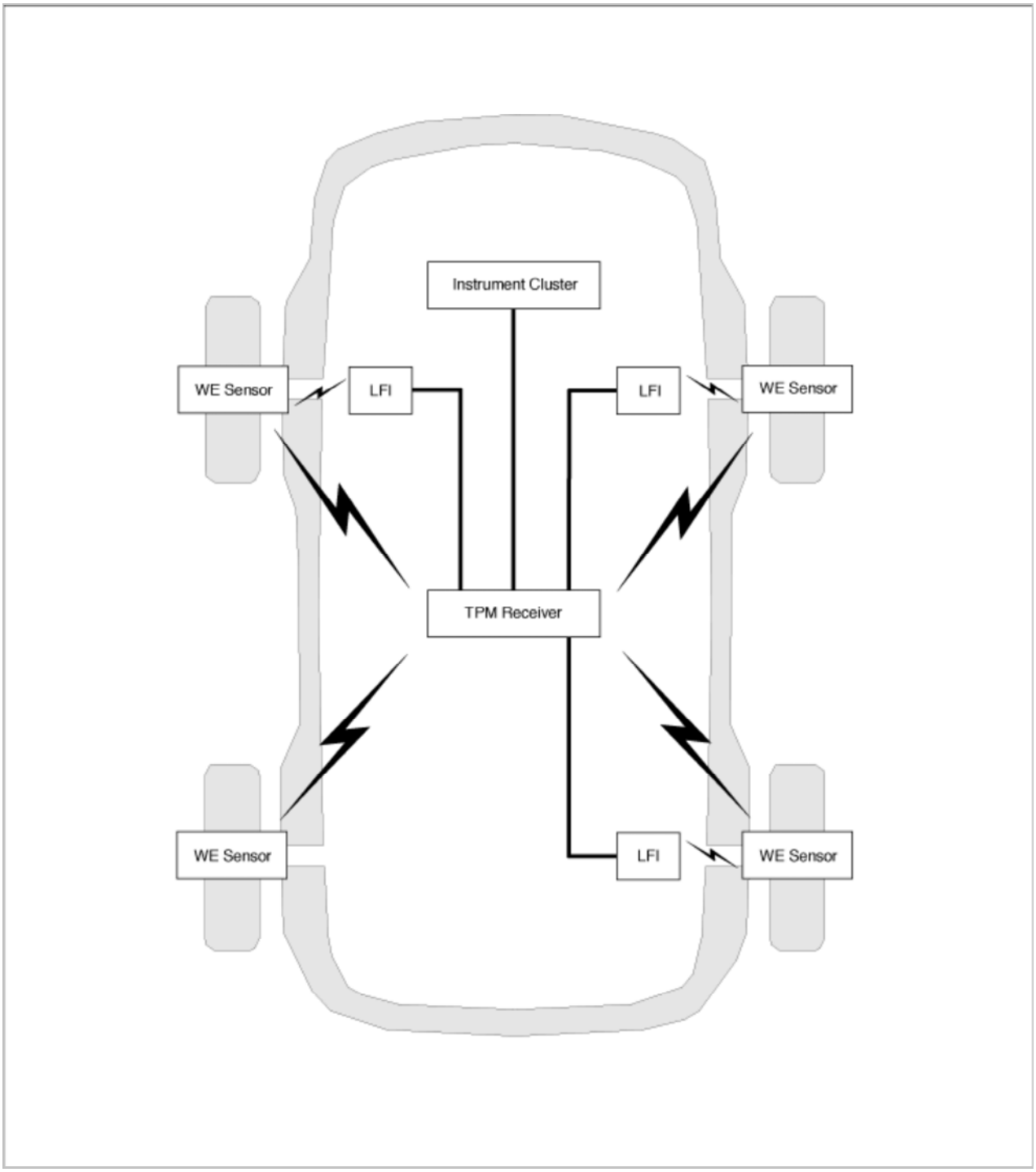
Suspension System > Tire Pressure Monitoring System > Components and Components Location

Components



Suspension System > Tire Pressure Monitoring System > Schematic Diagrams

Schematic Diagram



Suspension System > Tire Pressure Monitoring System > Description and Operation

Description

1. System Description

NOTE

AL: Auto Learning
CAN: Controller Area Network
ECU: Electronic Control Unit
IC: Instrument Cluster
LF: Low Frequency
LFI: Low Frequency Initiator
MIL: Malfunction Indicator LED

RF: Radio Frequency
WE: Wheel Electronic
WU: Wheel Unit

The TPMS monitors the pressure and temperature of a vehicles tire to alert on pressure variations that may impact the driving conditions. Messages deduced from processed data are displayed at the Instrument Cluster (IC) via 2 warning lamps and 4 tire-related LEDs. In parallel, the ECU executes error evaluation on input and output signals. Pressure monitoring during parking is provided.
The ECU processes data from the WE sensor, determines the state of the tires and communicates the required warning message via the CAN line to the driver.

2. Functional Description

Warning Thresholds

Hard Warning

One non temperature compensated hard warning threshold applies to front and rear axle of vehicle. If the pressure reported by the WE sensor is below the tire-specific minimum pressure then the low pressure warning telltale and the telltale indicating position of the under-inflated tire is illuminated immediately. A warning is reset when tire pressure is reported to be at 211kPa (30.6psi).

NOTE

TPMS warning can be light on because the tire pressure declined by low temperature in the cold weather.

Fast Pressure Loss

Fast pressure loss function is deactivated during parking and only active while driving. So it is avoided that a warning is set when the driver manually deflates the tire to a level above hard warning threshold.
Upon a rapid pressure decrease the WE emits a delta-p telegram which triggers the fast pressure loss function to start. Including the first dp-telegram the function waits for a 2nd telegram of the same wheel electronic and calculates the pressure loss rate. If the pressure drops by more than 20kPa/min, a "fast pressure loss" warning is generated and displayed with a maximum of 60s delay while driving.

Initialization

The initialization function determines which WE sensor identifier belongs to the vehicle.
The corresponding set of identifiers is stored in the ECU memory and used to determine if a received RF telegram comes from a wheel unit, which belongs to the vehicle.
Only telegrams containing known (initialized) identifiers are being supervised in the warning algorithm.
The initialization function is implemented in two independent parts: as an auto learning function and as an auto location function.

Initialization-auto Learning

AL starts every time, the vehicle was parked long enough to change or permute wheels (19min), and is traveling again at a speed that ensures that the WE sensors are transmitting.
AL is automatically considering all WE identifiers received and extracts, based on statistical evaluation, IDs belonging to the WEs mounted on the vehicle. If new (unknown) IDs are detected, their recurrence will be tracked by AL.
AI compares the acceleration reported by the wheel unit to the vehicle speed to rule out transmissions received from neighboring vehicles traveling with different speeds.
A WE sensor identifier is assigned to the vehicle when 8 RF telegrams have been received while driving above 25km/h.

Initialization-auto Location

This function gives very reliable full localization information.
It relies on the physical properties of long wave emissions in the frequency range of 125 kHz. These emissions are inductively sensed in the wheel unit.
The localization consists in a classification of the WU identifiers in the following order:
0. Left Front Wheel
1. Right Front Wheel
2. Right Rear Wheel

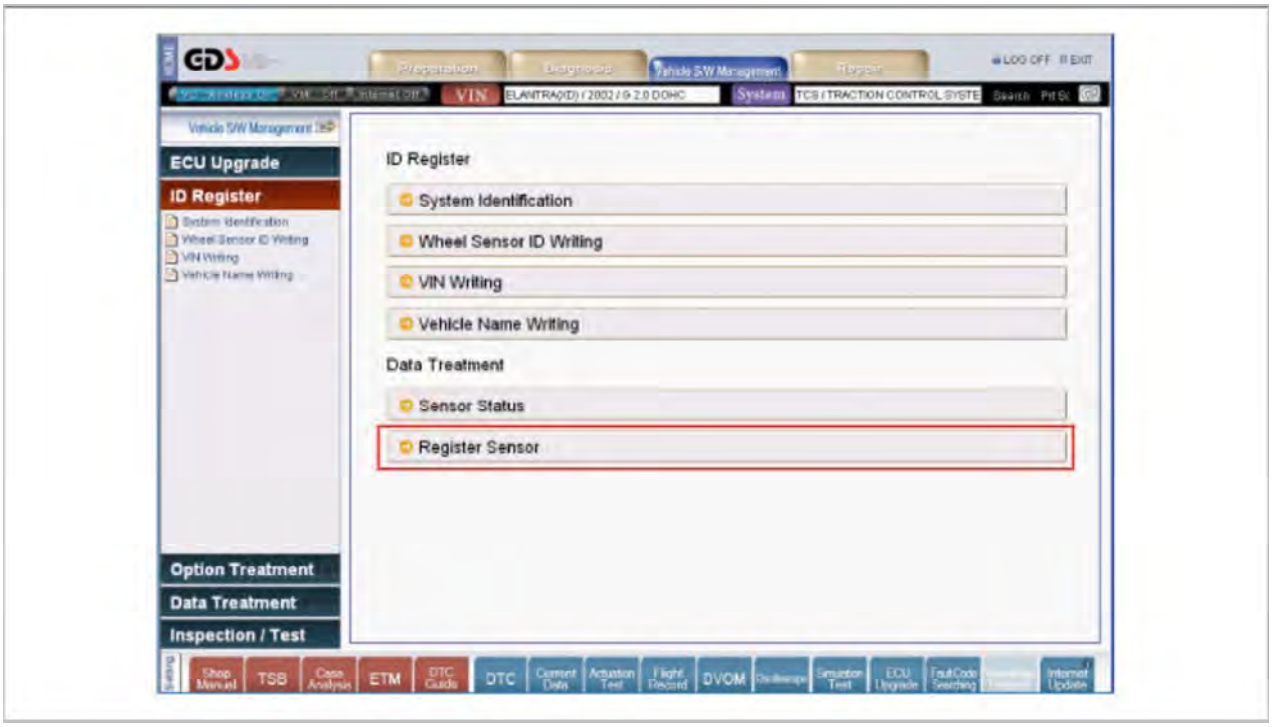
After activation of the initiators the system listens for wheel units reporting that their transmission was caused by an LF trigger signal. If such a transmission is received, the respective identifier is assigned to the triggered wheel well.
The position of the WE, which belongs to the wheel well without LF initiator, is deduced by identifying the WE sensor, that never detected LF, but assigned to the vehicle by auto learning.

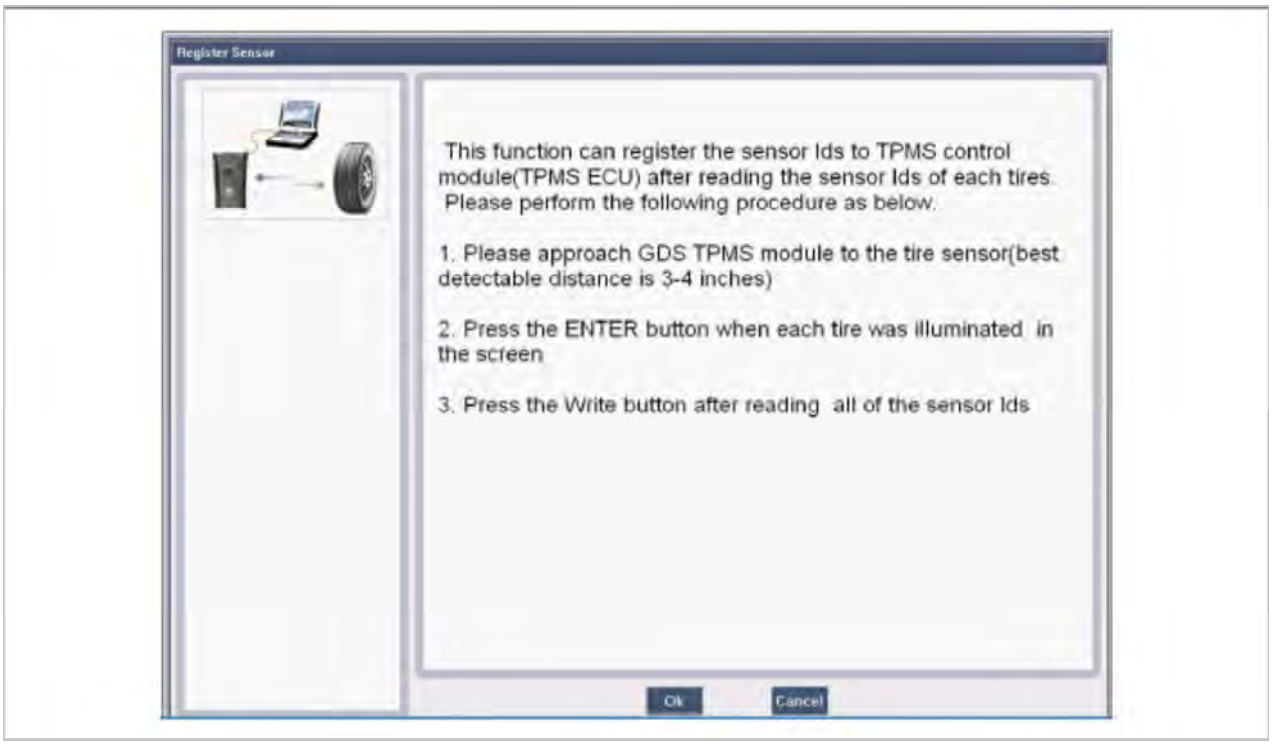
Sensor Registraion

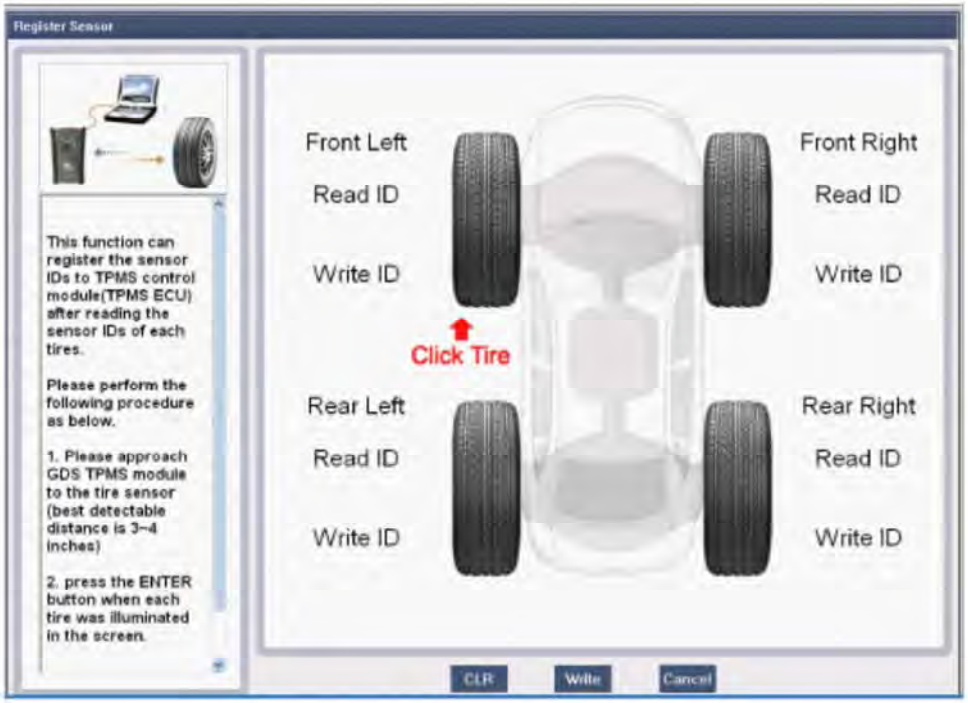
CAUTION

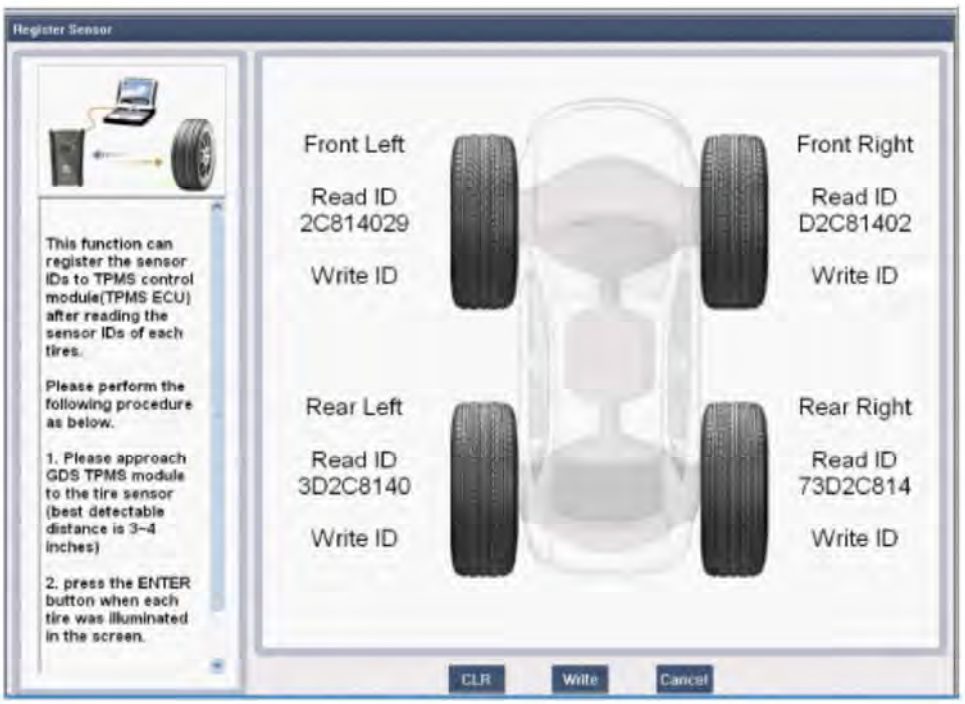
If the sensor registration procedure is not performed by GDS after replacing the TPM sensor or Receiver, TPMS is not operated.

1. Install GDS (Global Diagnostic System) and GDS TPMS module to vehicle.
2. Select the model and perform the sensor registration procedure according to instruction of the GDS as follows.



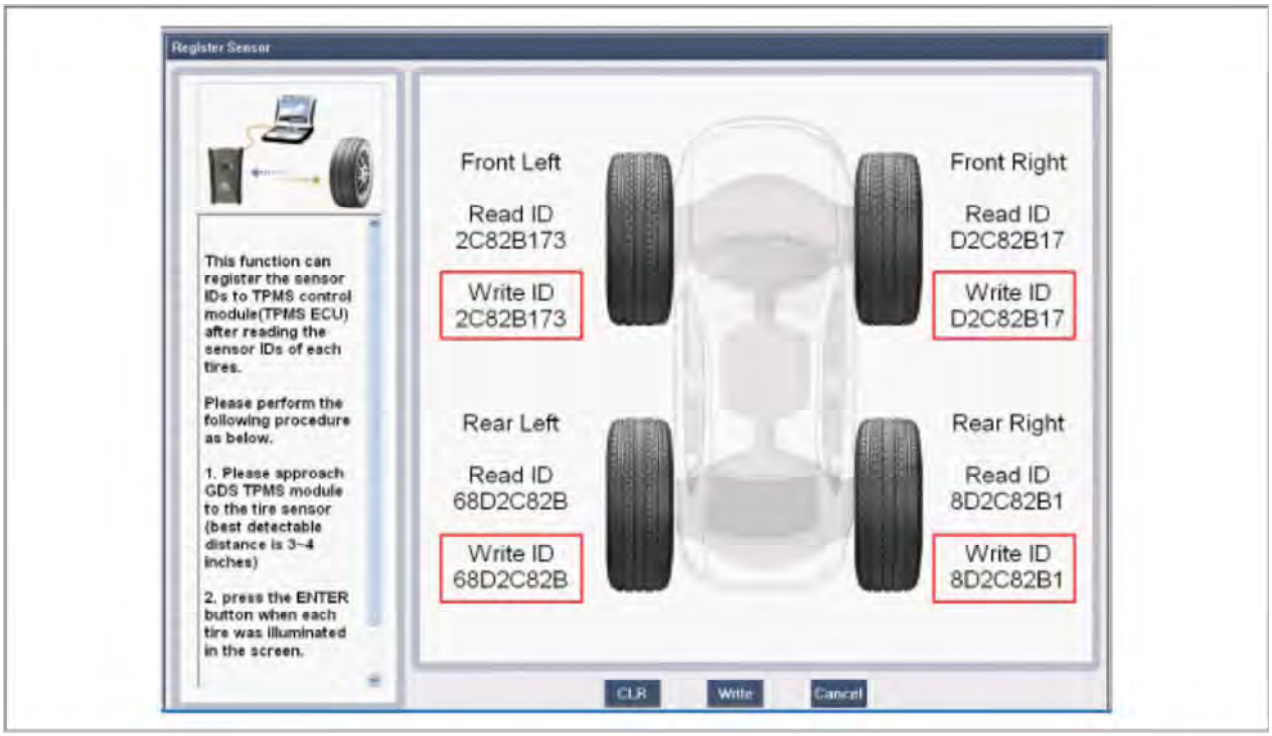



Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires.
Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor (best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen.
Front Left
Read ID
Write ID
Front Right
Read ID
Write ID
Click Tire
Rear Left
Read ID
Write ID
Rear Right
Read ID
Write ID
CLR
Write
Cancel


Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires.
Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor (best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen.
Front Left
Read ID
2C814029
Write ID
Front Right
Read ID
D2C81402
Write ID
Rear Left
Read ID
3D2C8140
Write ID
Rear Right
Read ID
73D2C814
Write ID
CLR
Write
Cancel

Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires.
Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor (best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen.
Front Left
Read ID
2C82B173
Front Right
Read ID
D2C82B17
Write ID
Writing success !!!
Press [OK] button.
Ok
Rear Right
Read ID
8D2C82B1
Write ID
CLR
Write
Cancel

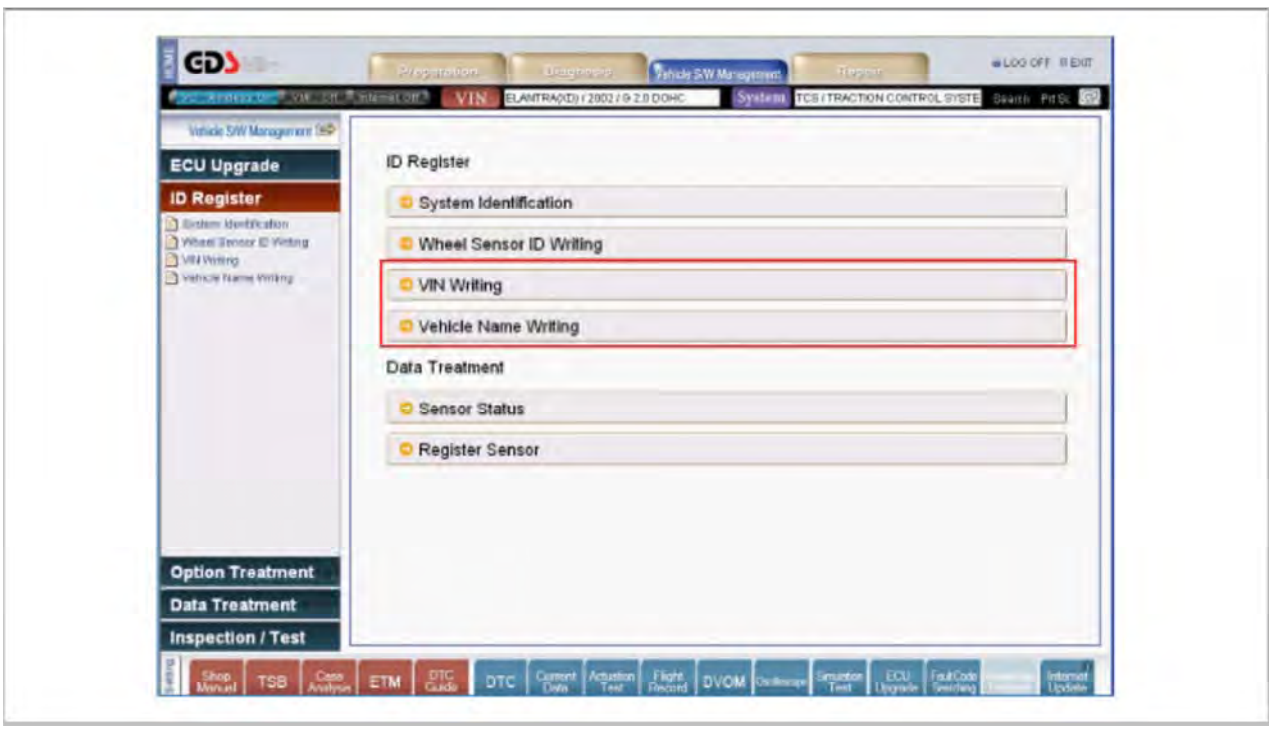
Register Sensor
This function can register the sensor IDs to TPMS control module(TPMS ECU) after reading the sensor IDs of each tires.
Please perform the following procedure as below.
1. Please approach GDS TPMS module to the tire sensor (best detectable distance is 3~4 inches)
2. press the ENTER button when each tire was illuminated in the screen.
Front Left
Read ID
2C814029
Front Right
Read ID
D2C81402
Write ID
GDS TPMS
Sensor Searching...
Cancel
Rear Right
Read ID
3D2C8140
Write ID
Read ID
73D2C814
Write ID

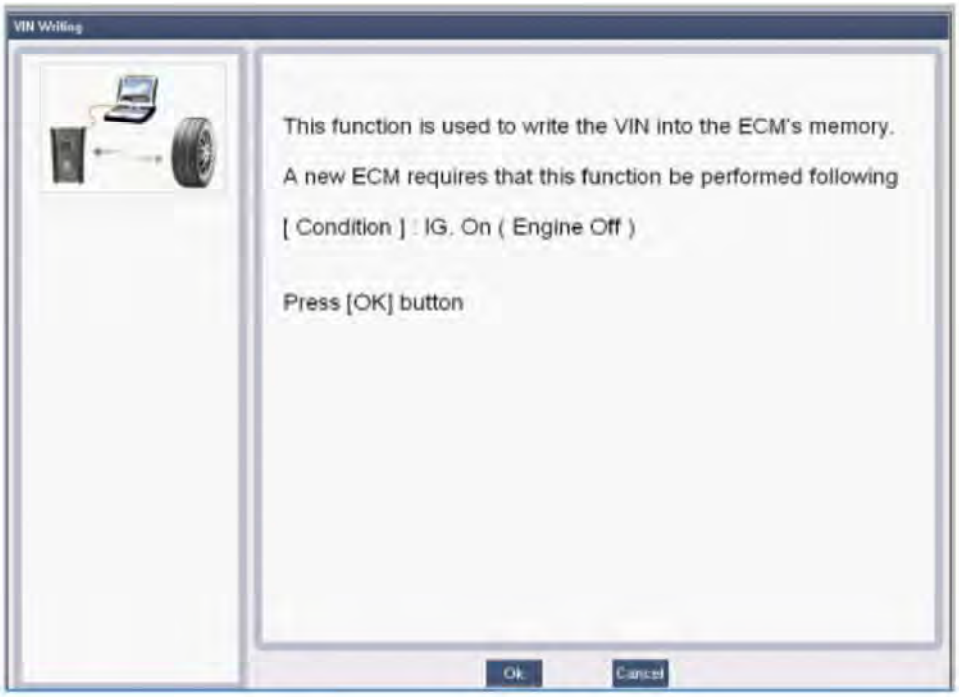


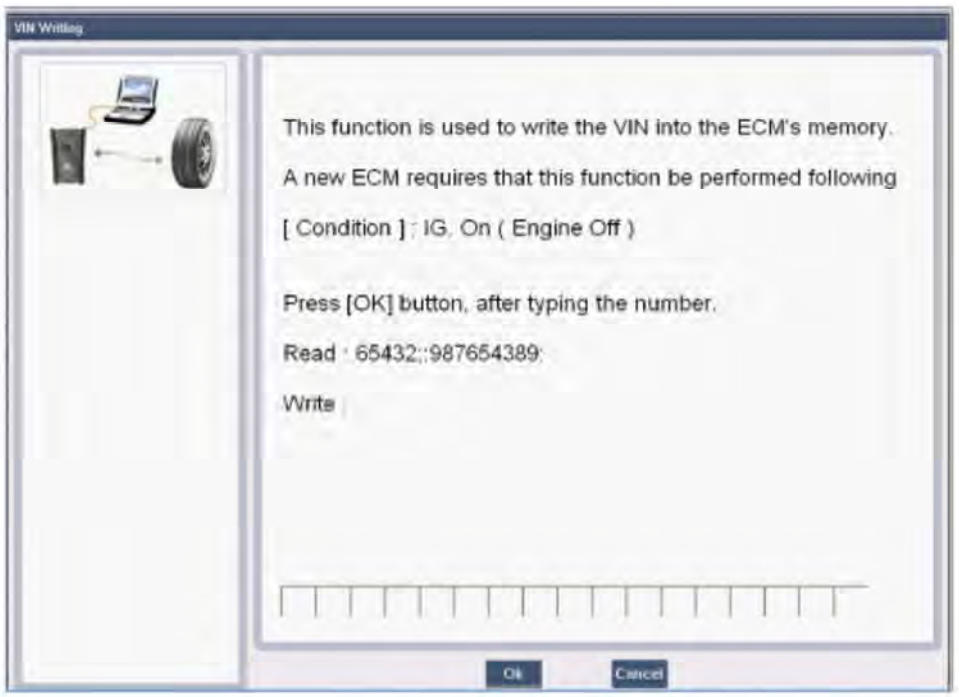
Vin And Vehicle Name Writing

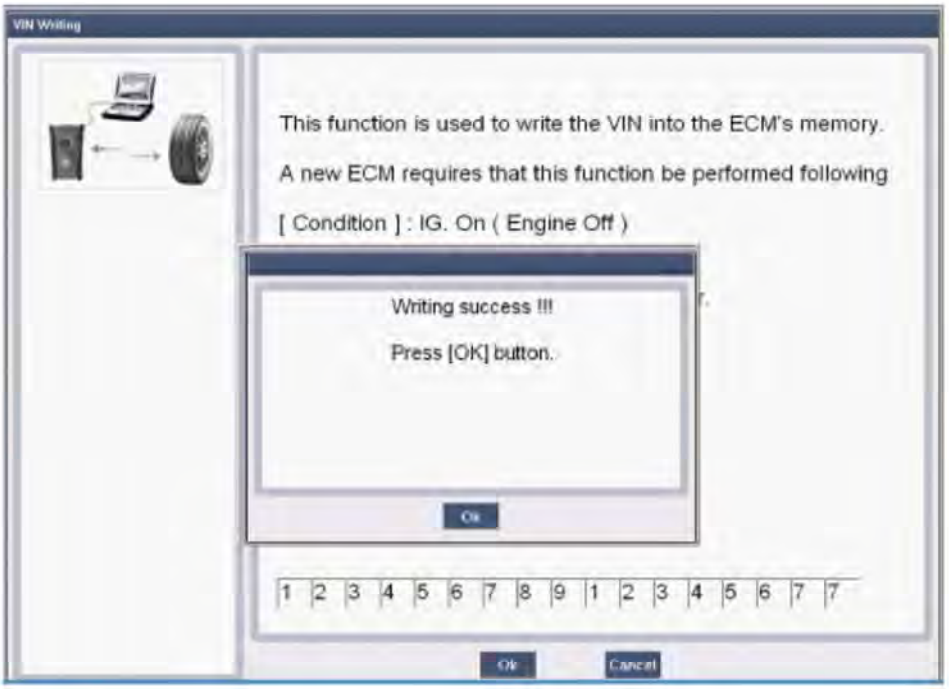
1. Install GDS (Global Diagnostic System) and GDS TPMS module to vehicle.
2. Select the model and perform the VIN and vehicle name writing procedure according to instruction of the GDS as follows.

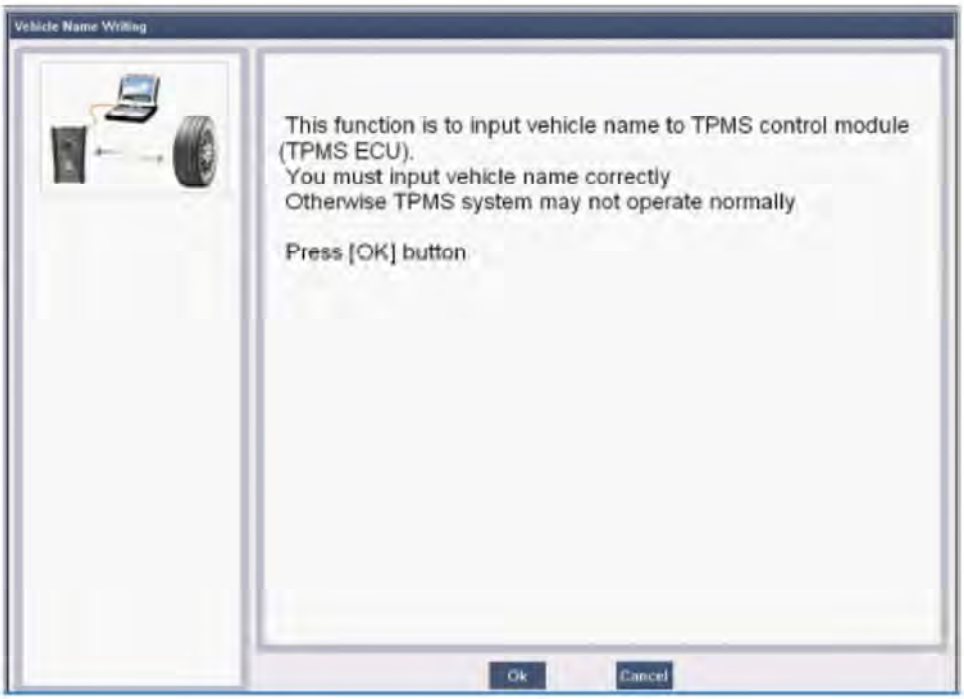
[VIN Writing]

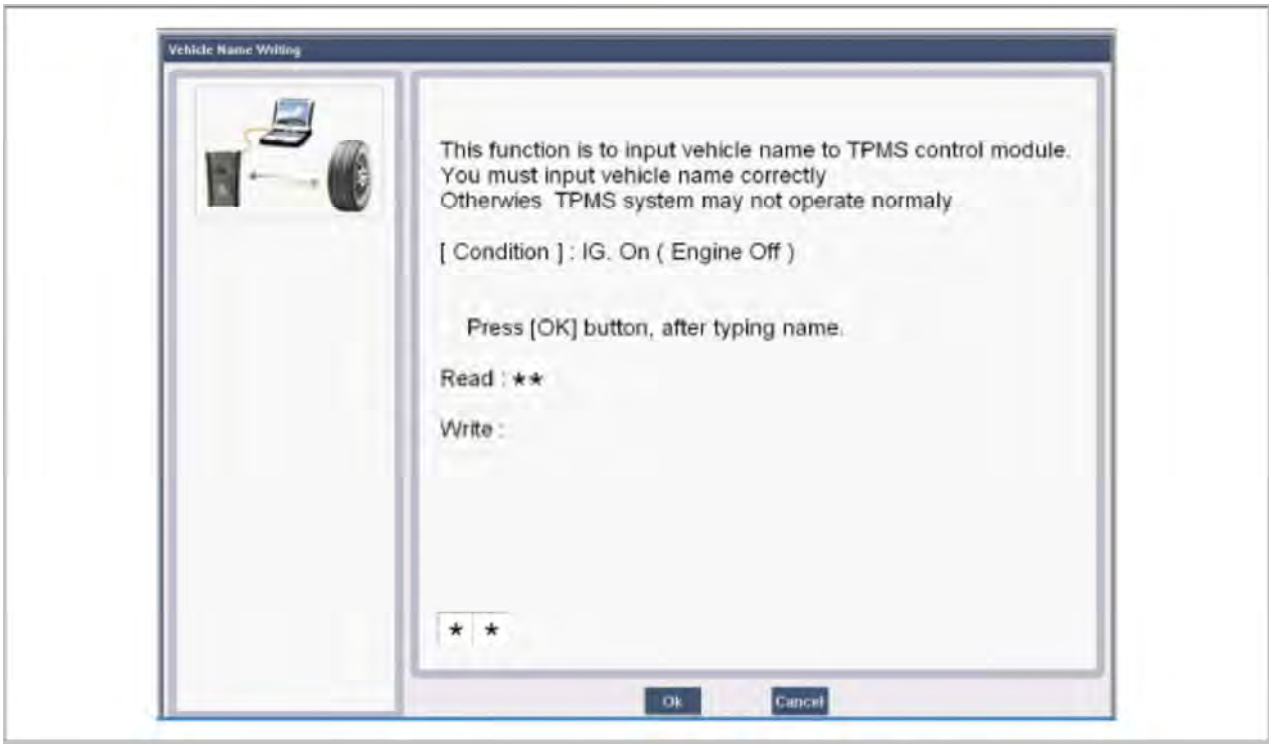


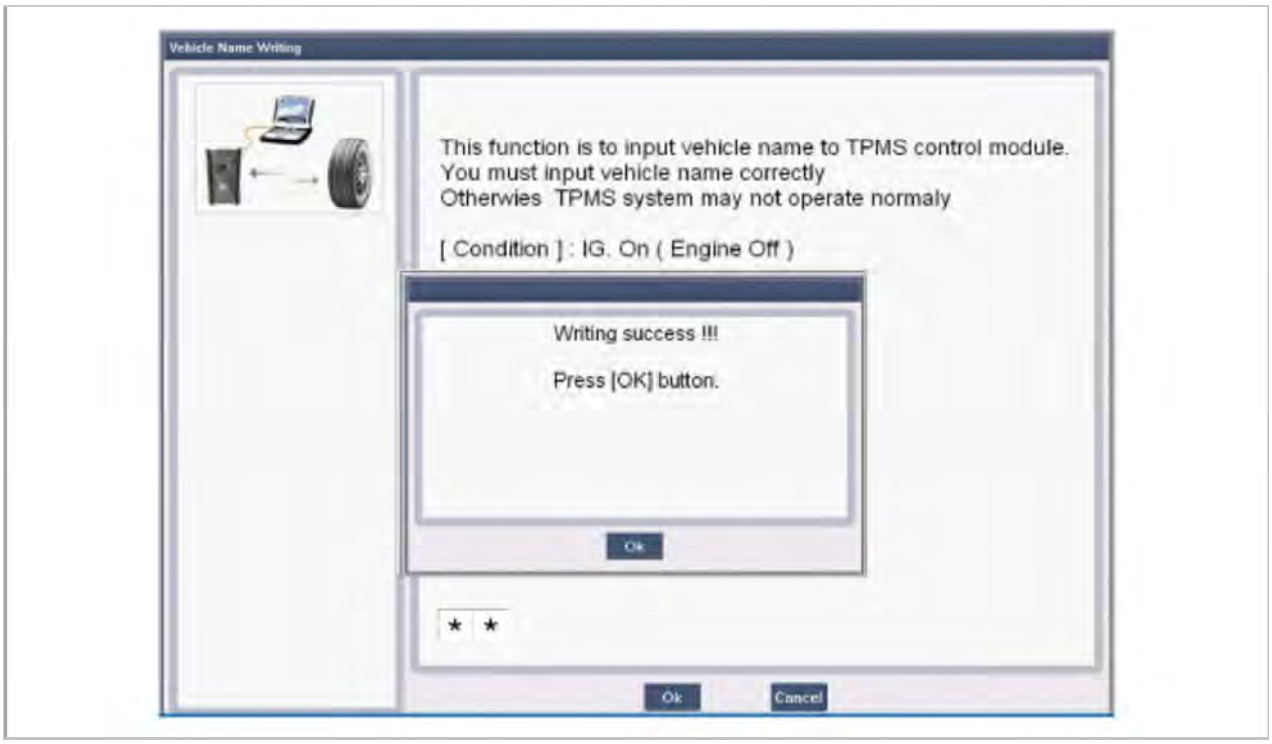

VIN Writing
This function is used to write the VIN into the ECM's memory.
A new ECM requires that this function be performed following
[Condition] : IG. On (Engine Off)
Press [OK] button
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
A new ECM requires that this function be performed following
[Condition] : IG. On (Engine Off)
Press [OK] button, after typing the number.
Read : 65432::987654389:
Write
Ok
Cancel


VIN Writing
This function is used to write the VIN into the ECM's memory.
A new ECM requires that this function be performed following
[Condition] : IG. On (Engine Off)
Writing success !!!
Press [OK] button.
Ok
1 2 3 4 5 6 7 8 9 1 2 3 4 5 6 7 7
Ok
Cancel


Vehicle Name Writing
This function is to input vehicle name to TPMS control module (TPMS ECU).
You must input vehicle name correctly
Otherwise TPMS system may not operate normally
Press [OK] button
Ok
Cancel





Suspension System > Tire Pressure Monitoring System > TPMS Sensor > Repair procedures

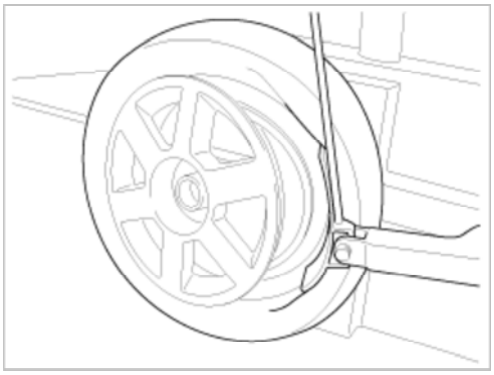
Removal

Removing The Tire From The Rim

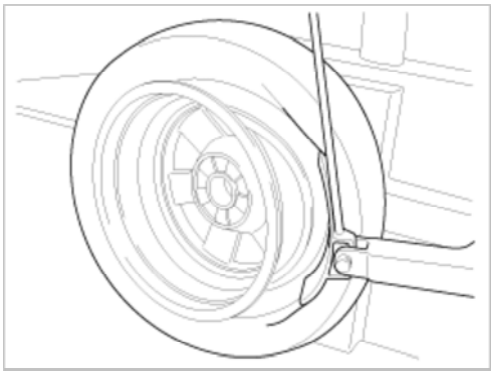
CAUTION

During all the operations on the tire, the sensor must be correctly maintained and thus it is FORBIDDEN to unscrew the nut and to force the sensor into the wheel. This could damage the sensor.

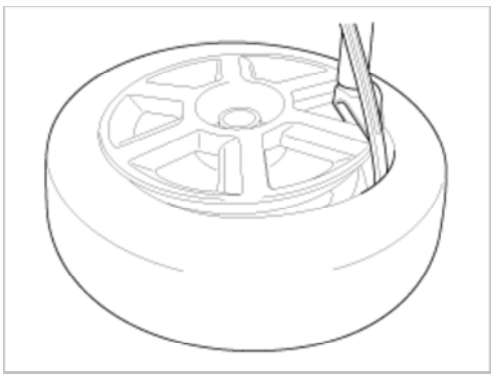
1. Take off the first side of the tire. The tool should not be used near the valve (no less than 30 cm).



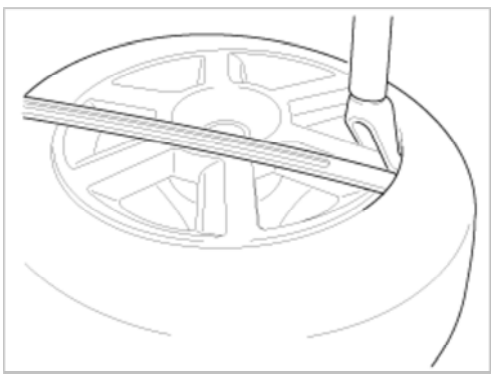
2. Take off the second side of the tire. The tool should not be used near the valve (No less than 30 cm).



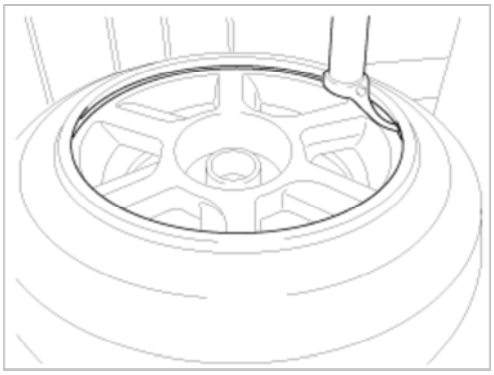
3. Dismount the first side of the tire: Place the shoe of the tool between 5 and 15 cm away from the sensor and use the tire lever as shown in the picture.



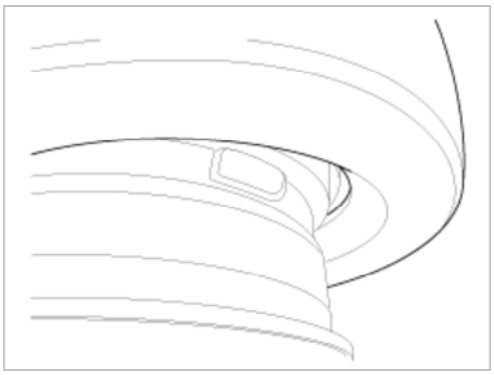
4. By using the tire lever, extract the external side wall of the tire and engage on the shoe of the machine. The lever and the tire must not come into contact with the sensor. Then remove the lever.



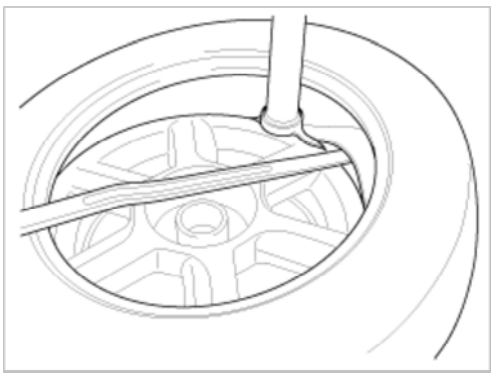
5. The wheel rotation allows the complete extraction of the first side of tire.



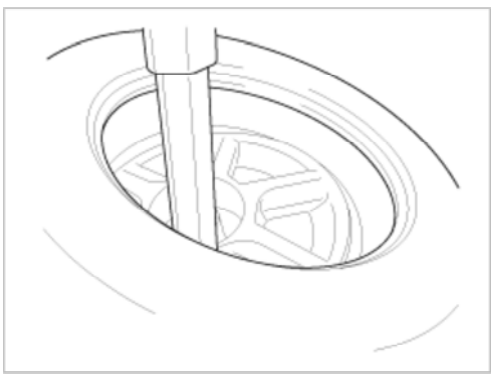
6. Raise the tire to prepare the introduction of the tire lever to aid extraction of the second side wall, the same recommendations as for the first side wall will apply.



7. By using the tire lever, extract the external side wall of the tire and engage the shoe of the machine. The lever and the tire must not come into contact with the sensor. Then remove the lever.

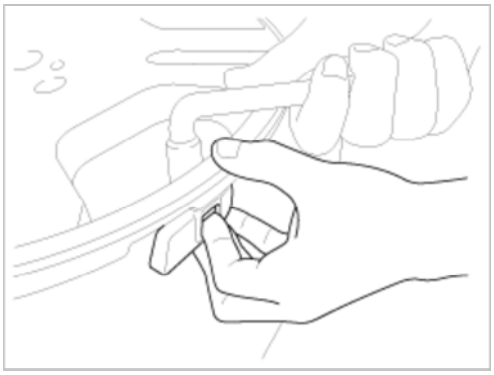


8. Extract entirely the second side wall of the tire.

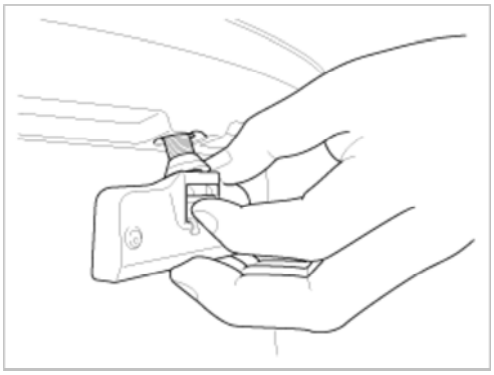


Pressure Sensor Removing

1. While supporting the sensor unit, unscrew the nut.



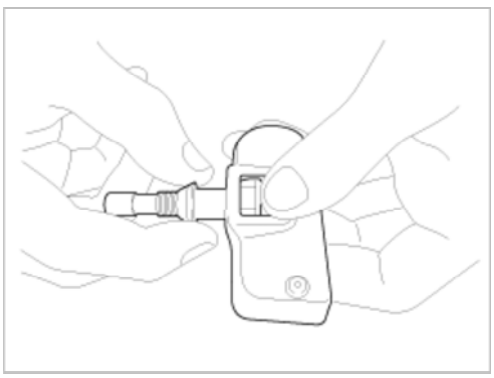
2. Remove the sensor.



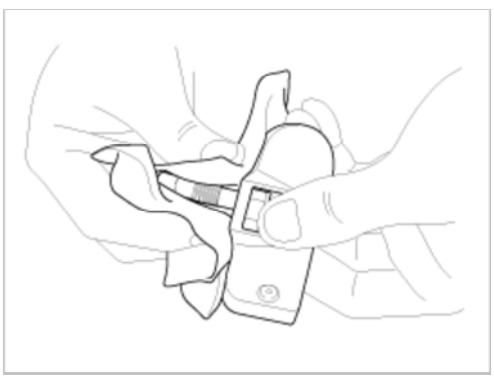
Installation

Sensor Reinstallation

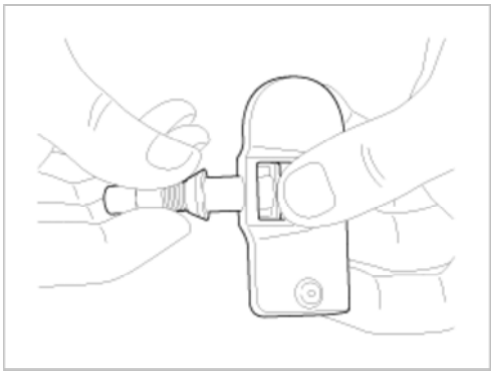
1. Hold the sensor and the seal washer, then extract it, this also extracts the seal. Take care to not damage the valve thread.



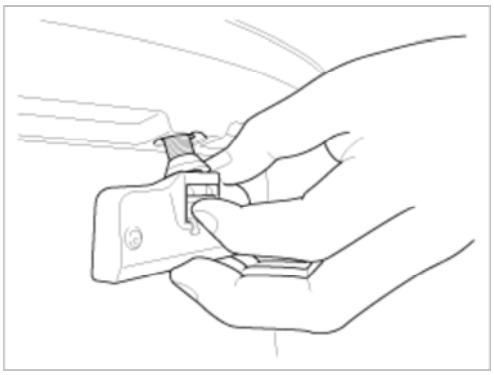
2. Clean the sensor and the valve stem holding the valve using a dry cloth as shown on the picture. Take care to support the rear of the valve with a thumb so that there is no movement of the stem.



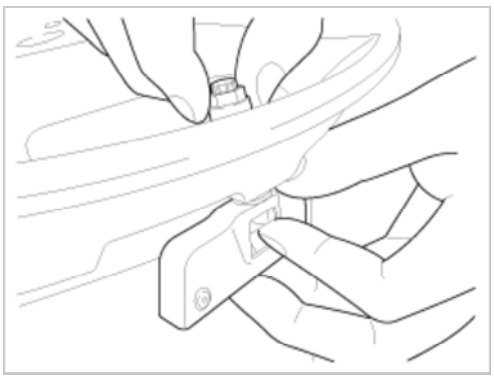
3. When removing the sensor, a new washer and seal must be used. Insert these up to the base of the sensor, making sure to secure the valve base with a thumb, as shown. Wipe the seal and threading.



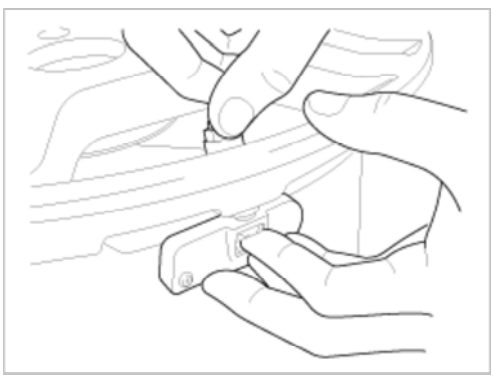
4. Insert the valve, in the valve hole, without modifying the angle of the stem (retain position of delivery). The laser marking should be visible to the operator.



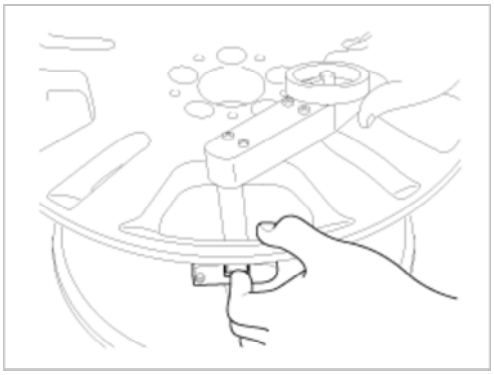
5. When the valve is completely inserted, maintain the sensor in contact with the rim (as shown on the picture), then screw manually the nut until it is in contact with the wheel (without force).



6. While maintaining the sensor contact with the rim by applying pressure to the back of the valve, slightly press on the cap towards the center of the wheel in order to adapt the angle of the valve/sensor to the profile of the rim. It is mandatory to guarantee the contact of the housing unit on the rim drop center.



7. While maintaining the sensor unit and valve in position, screw the nut with a torque wrench.
   Apply a torque of 7.5 ~ 8.5Nm (0.76 ~ 0.86kgf.m, 5.5 ~ 6.2lb-ft).
   Take care that the wrench socket is correctly inserted on the nut.



8. Check the followings.
   (1) It is normal that the seal washer becomes bent during the nut tightening.
   (2) Check that the visible part of the antenna is not damaged or broken.
   (3) The plastic bridge should neither be cracked nor broken. It is designed so that it will fracture due to an error in the assembly process (too high torque, bad positioning……). Any defect must mean the rejection of the sensor.

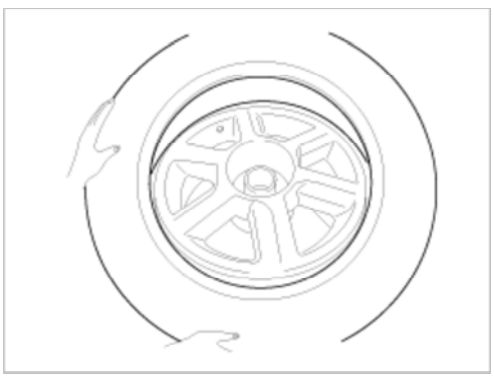
Mounting of Tire

CAUTION

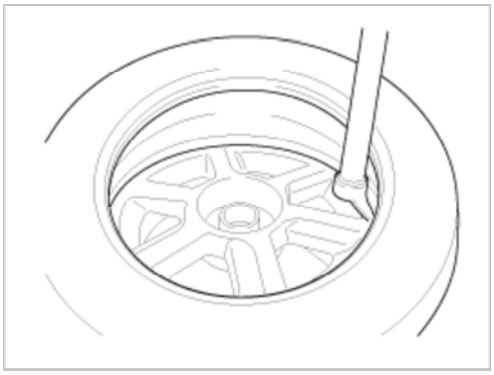
- Before any tire mounting operation, make sure that the sensor has been correctly mounted and tightened to the rim.
- No lubricant product or any other material may partially or completely cover the air pressure inlet hole of the sensor.
- The assembly tools have to never have a collision with the sensor.
- The tire cannot be in contact with the sensor only after it is engaged in the rim and after the exceeded peak of traction. Therefore, generally at the end of the assembly.

1. Prepare the tire and fix the rim as usual.

2. Put the tire on the rim, so that the cross point of the belt with the rim is between 15 and 20 cm away from the valve (see the picture).

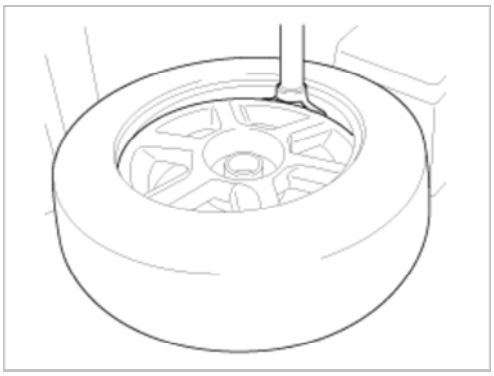


3. Engage the shoe and make sure that 20cm is maintained between the cross point and the valve. The arrow shows the direction of rotation of the wheel.

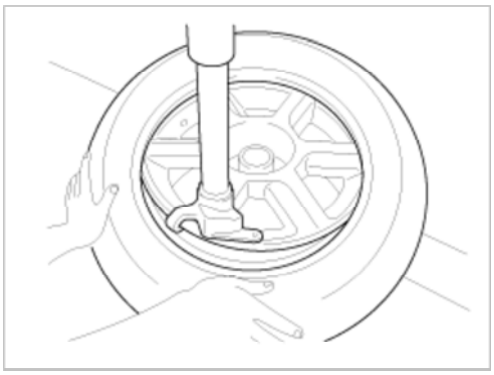


4. Turn the wheel in order to engage all the first side of the tire.

> NOTE
>
> The standard shoes can pass over the sensor without damaging it.

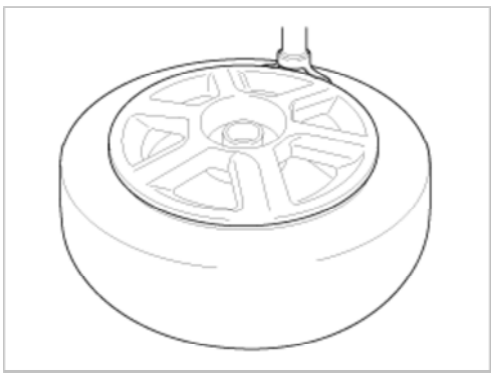


5. Put the second side of the tire in position, so that the cross point of the belt with the rim is approximately 20 cm away from the valve (see the picture). The curved arrow shows the direction of rotation of the wheel.



6. Turn the wheel in order to engage all of the second side of the tire.

> NOTE
>
> The standard shoes can pass over the sensor without damaging it.

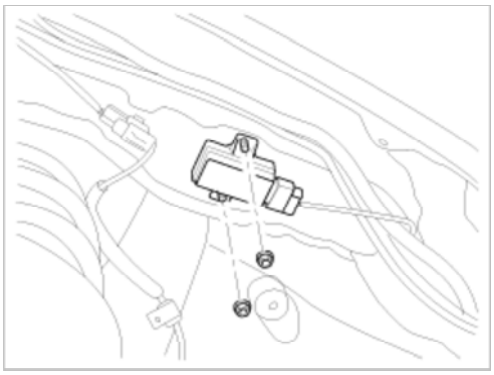


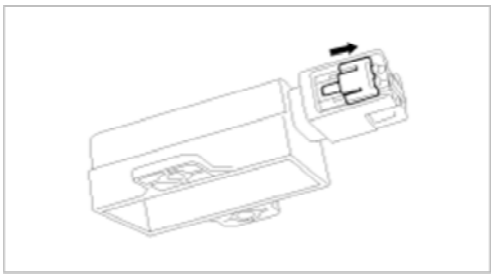
7. Perform the Register Sensor procedure. (Refer to Register Sensor.)

Suspension System > Tire Pressure Monitoring System > TPMS Initiator > Repair procedures

Replacement

1. Disconnect the battery negative cable from the battery.
2. Remove the wheel and the wheel cover.
3. Remove the malfunctioning part and fit new part.



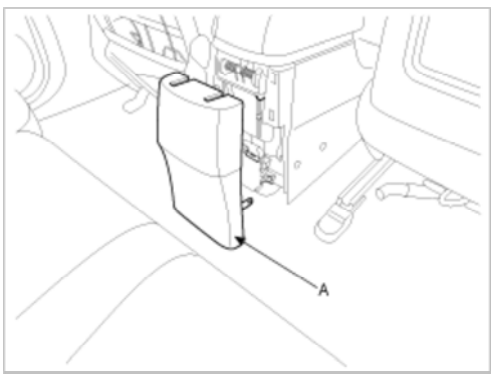


4. Reinstall the wheel and wheel cover.
5. Connect the battery negative cable to the battery.

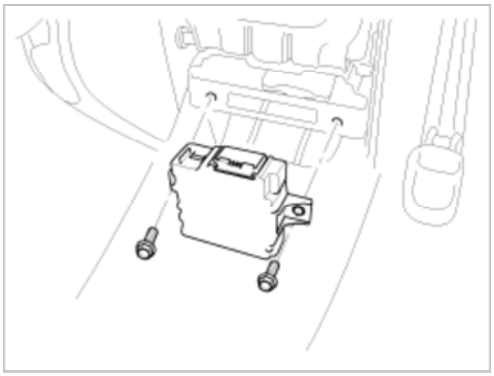
Suspension System > Tire Pressure Monitoring System > TPMS Receiver > Repair procedures

Replacement

1. Disconnect the battery negative cable from the battery.
2. Remove the floor console rear cover (A).



3. Remove the malfunctioning part and fit new part.



4. Reinstall the floor console rear cover.
5. Connect the battery negative cable to the battery.
6. Perform the VIN and Vehicle name writing procedure. (Refer to VIN and Vehicle name writing.)
7. Perform the sensor registration procedure. (Refer to Sensor registration.)

Suspension System > Tire Pressure Monitoring System > Troubleshooting

Troubleshooting

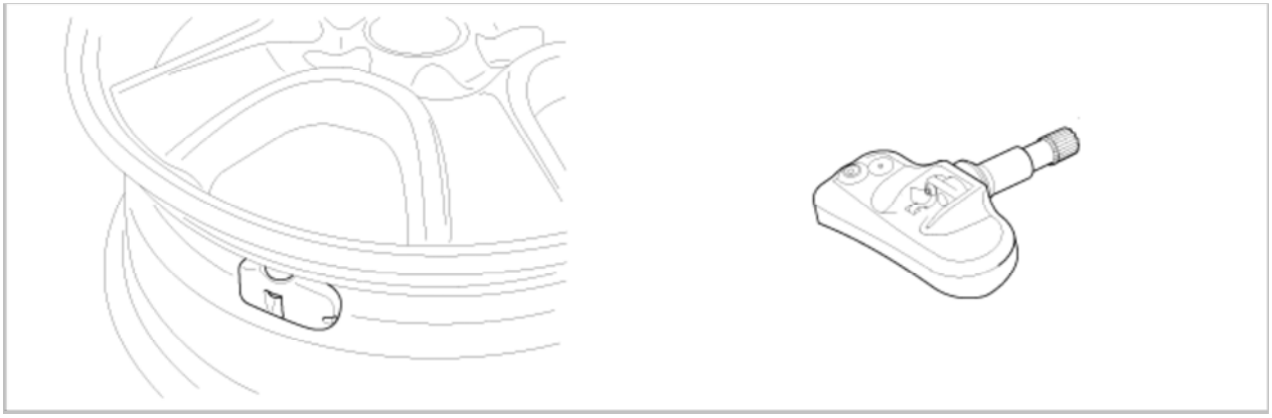
Diagnostic Trouble Code Chart(DTC)

DTC	Description	MIL
C1121	Left Front Sensor Battery Voltage Low	×
C1122	Right Front Sensor Battery Voltage Low	×
C1123	Left Rear Sensor Battery Voltage Low	×
C1124	Right Rear Sensor Battery Voltage Low	×
C1126	Vehicle Battery Voltage Low	○
C1127	Vehicle Battery Voltage High	○
C1300	TPMS ECU IRX not Responding	○
C1312	Left Front Sensor Radio Frequency Channel Failure	○
C1313	Right Front Sensor Radio Frequency Channel Failure	○
C1314	Left Rear Sensor Radio Frequency Channel Failure	○
C1315	Rear Right Sensor Radio Frequency Channel Failure	○
C1322	Left Front Sensor Over Temperature	×
C1323	Right Front Sensor Over Temperature	×
C1324	Left Rear Sensor Over Temperature	×
C1325	Right Rear Sensor Over Temperature	×
C1332	Left Front Sensor Fault	○
C1333	Right Front Sensor Fault	○
C1334	Left Rear Sensor Fault	○
C1335	Right Rear Sensor Fault	○
C1337	Left Front Low Frequency Initiator Fail Pulse Detected	○
C1338	Right Front Low Frequency Initiator Fail Pulse Detected	○
C1339	Right Rear Low Frequency Initiator Fail Pulse Detected	○
C1341	Auto Location Failure FL	○
C1342	Auto Location Failure FR	○
C1343	Auto Location Failure RL	○
C1344	Auto Location Failure RR	○

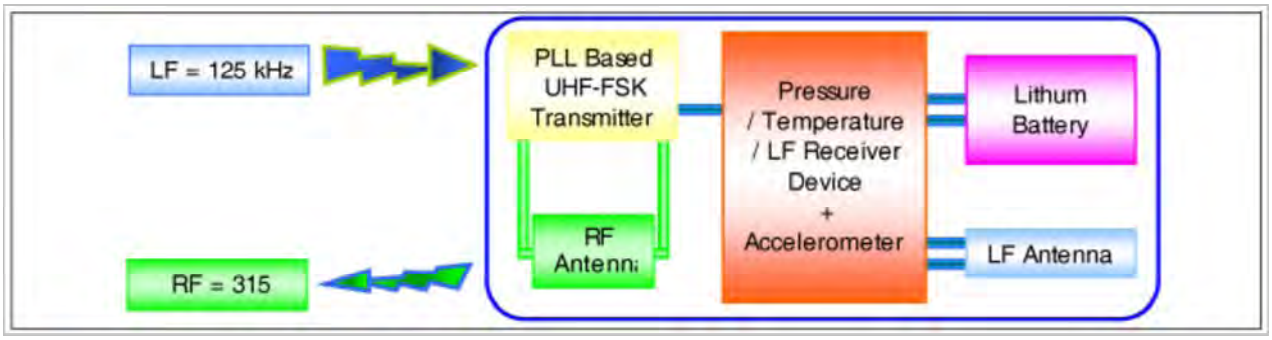
C1351	Left Front Low Frequency Initiator Open/Short Failure	×
C1352	Right Front Low Frequency Initiator Open/Short Failure	×
C1353	Right Rear Low Frequency Initiator Open/Short Failure	×
C1611	Vehicle Signal (VSS) Time Out	○
C1616	CAN Bus off	○
C1661	Receiver EEPROM Failure	○
C1662	Auto Learning Failure	○

Suspension System > Tire Pressure Monitoring System > C1121 Sensor 1, Front Left Sensor Battery Voltage Low

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.

The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower

than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 1 battery voltage is below 2.2Vdc. The most likely cause is battery passing it's expected life / sensor failure.

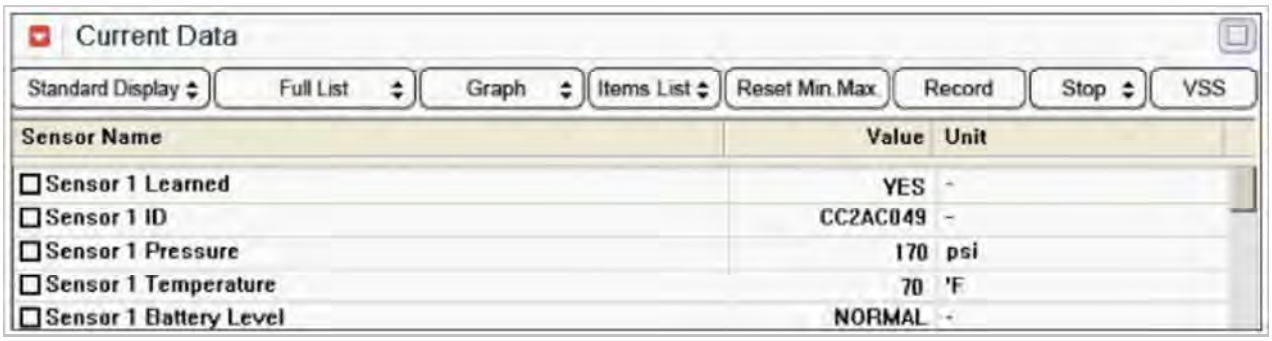
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 1	• Sensor 1 battery low • Faulty Sensor 1
Enable Conditions	• IGN ON	
Threshold value	• Sensor 1 battery voltage < 2.2V for 20 consecutive bursts at temperatures above -10 °C	
Mil On conditon	• Not applicable	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the "BATTERY VOLTAGE" of TPMS sensor on the scantool.

Specification: The value of Sensor 1 battery is 'Normal'.



5. Is the sensor battery normal?

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	▸ Replace Sensor 1 and register sensor ID with 'GDS TPMS'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

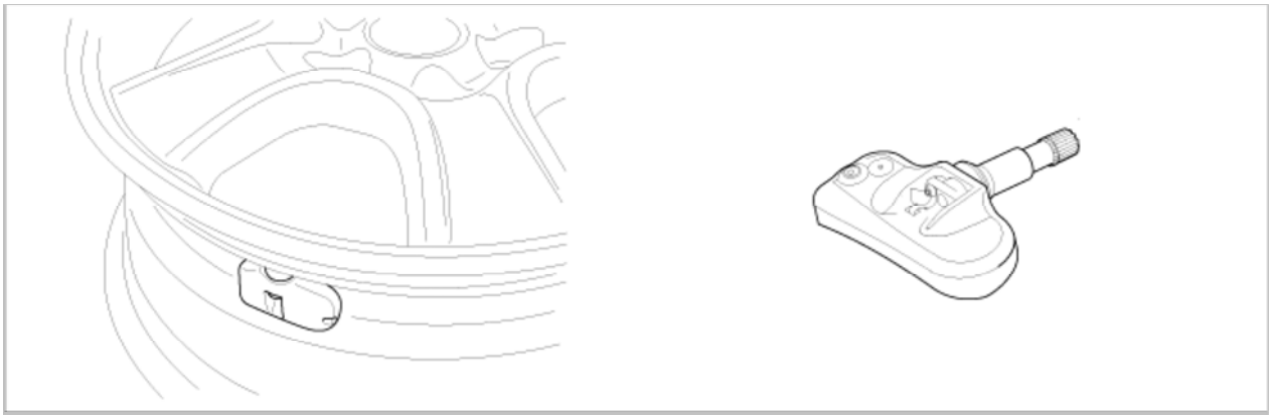
After a repair, it is essential to verify that the fault has been corrected.

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

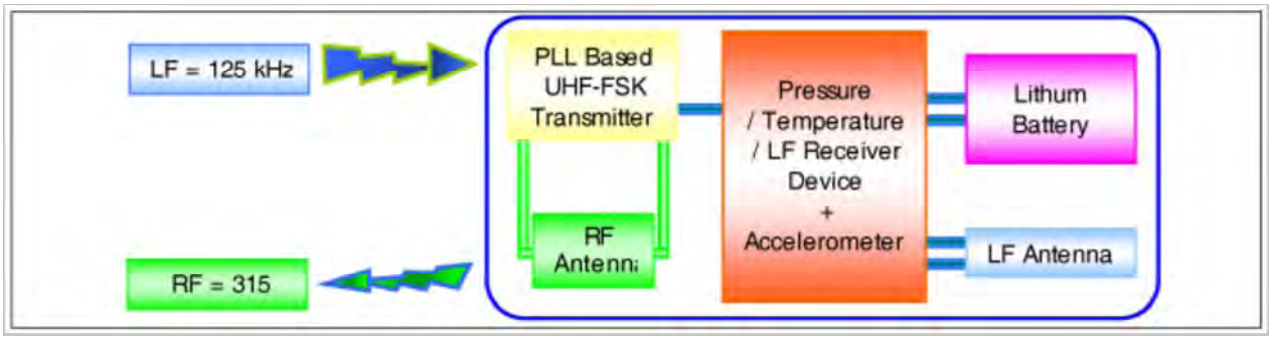
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1122 Sensor 2, Front Right Sensor Battery Voltage Low

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.

The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 2 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

DTC Detecting Condition

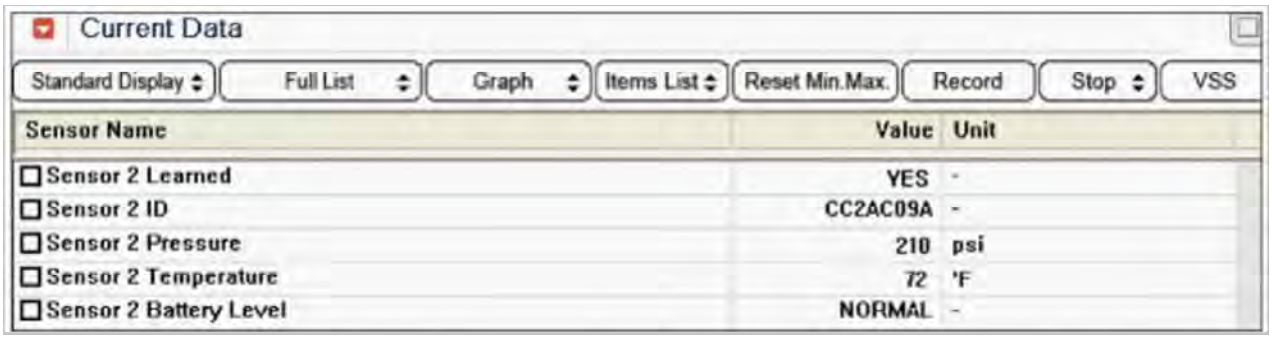
Item	Detecting Condition	Possible Cause

DTC Strategy	• Check RF message from Sensor 2	• Sensor 2 battery low • Faulty Sensor 2
Enable Conditions	• IGN ON	
Threshold value	• Sensor 2 battery voltage < 2.2V for 20 consecutive bursts at temperatures above -10 °C	
Mil On conditon	• Not applicable	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the "BATTERY VOLTAGE" of TPMS sensor on the scantool.

Specification: The value of Sensor 2 battery is 'Normal'.



5. Is the sensor battery normal?

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	▸ Replace Sensor 2 and register sensor ID with 'GDS TPMS'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

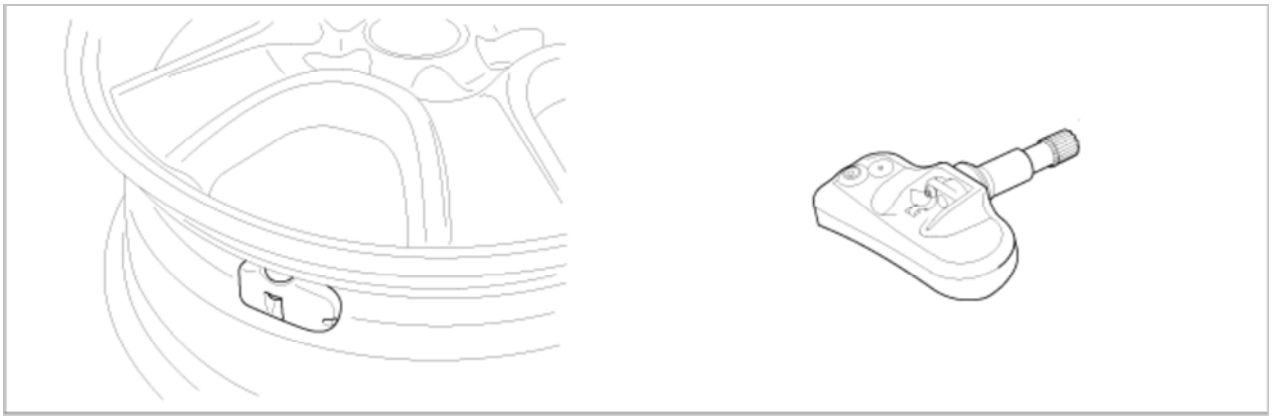
After a repair, it is essential to verify that the fault has been corrected.

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 ?

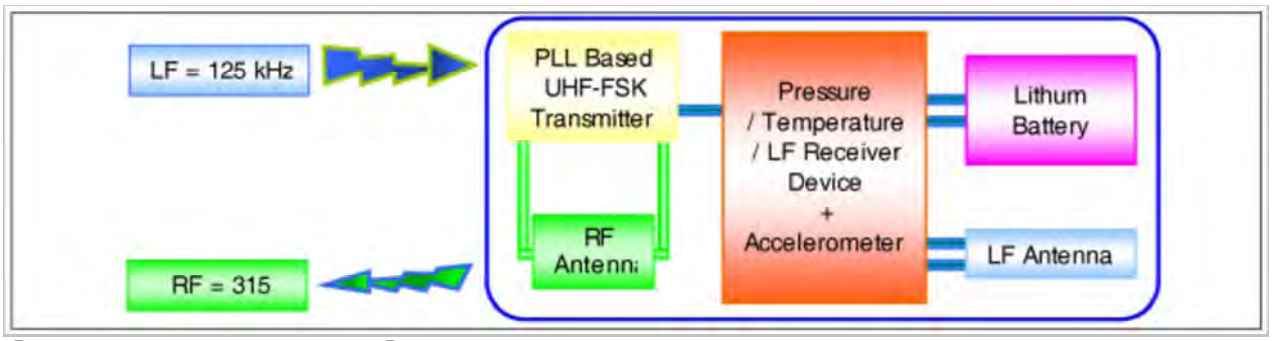
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1123 Sensor 3, Rear Left Sensor Battery Voltage Low

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.

The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 3 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

DTC Detecting Condition

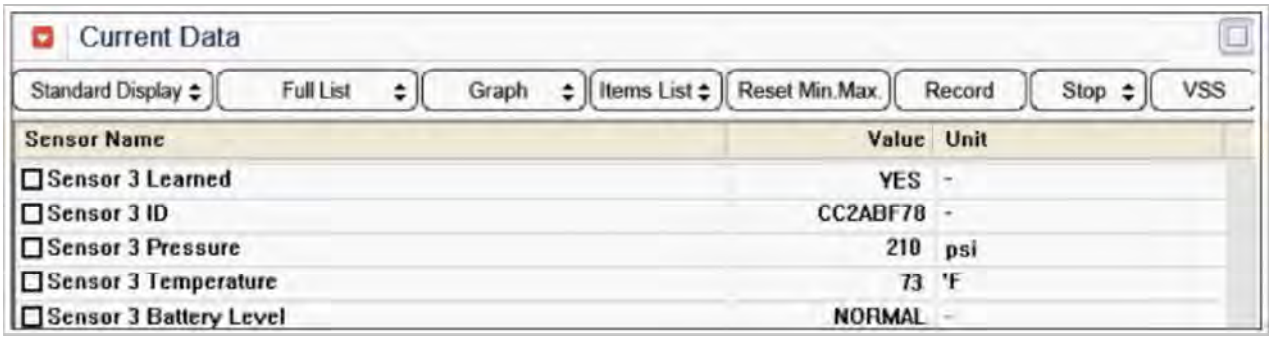
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 3	• Sensor 3 battery low • Faulty Sensor 3
Enable Conditions	• IGN ON	
Threshold value	• Sensor 3 battery voltage < 2.2V for 20 consecutive bursts at temperatures above -10 °C	

Mil On conditon	• Not applicable	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the "BATTERY VOLTAGE" of TPMS sensor on the scantool.

Specification: The value of Sensor 3 battery is 'Normal'.



5. Is the sensor battery normal?

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	▸ Replace Sensor 3 and register sensor ID with 'GDS TPMS'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

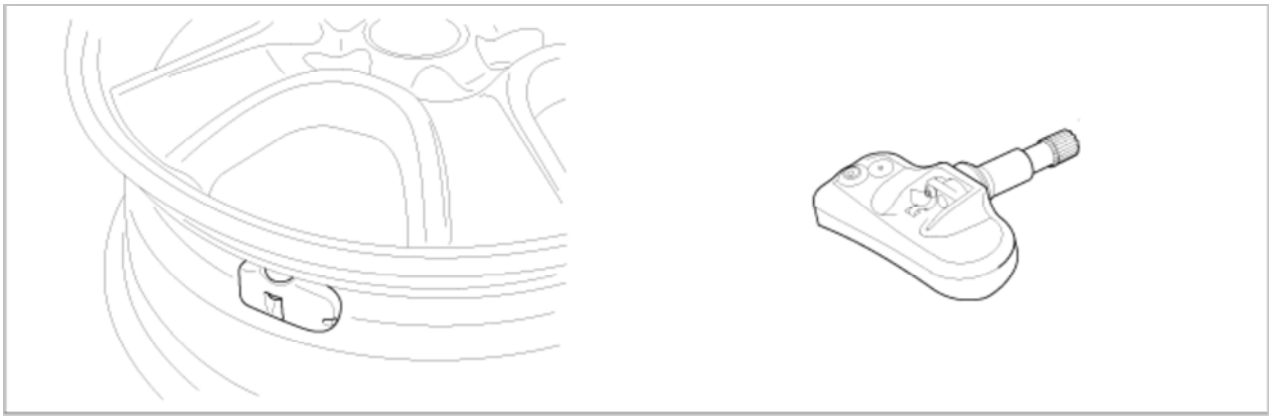
After a repair, it is essential to verify that the fault has been corrected.

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 ?

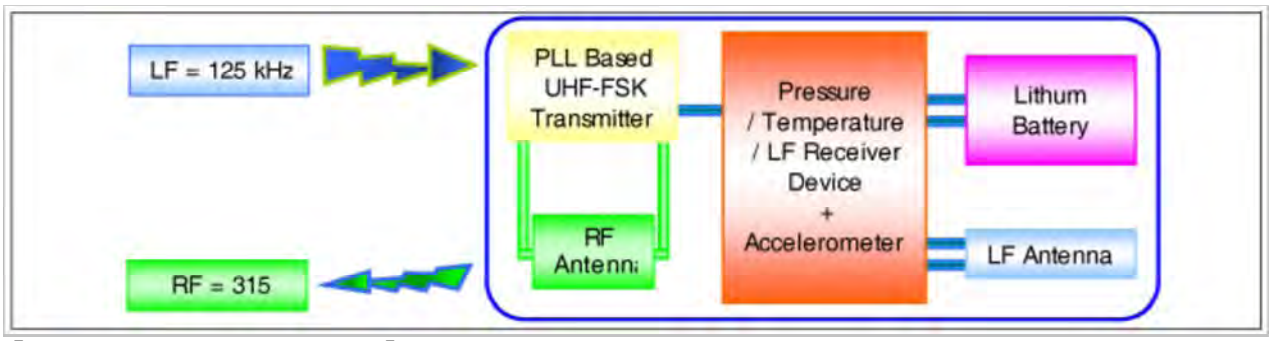
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1124 Sensor 4, Rear Right Sensor Battery Voltage Low

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor
Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.
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DTC Description

This DTC indicates that the Sensor 4 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

DTC Detecting Condition

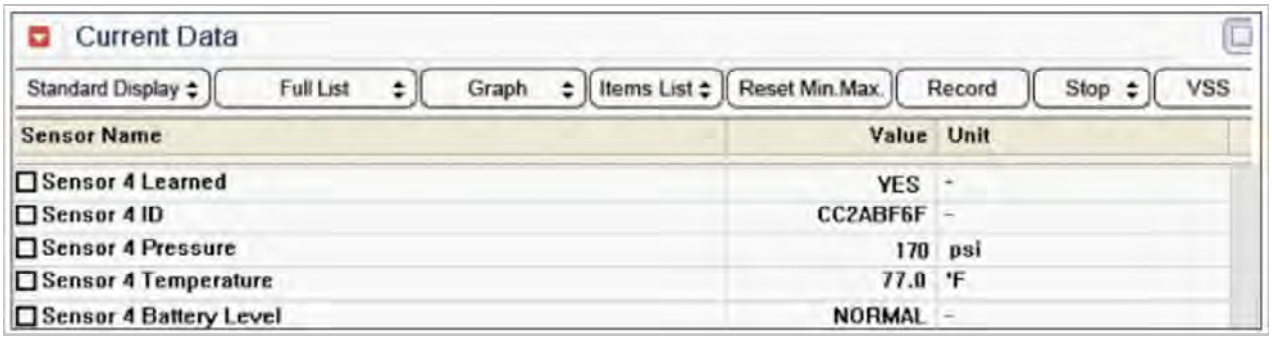
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 4	• Sensor 4 battery low • Faulty Sensor 4
Enable Conditions	• IGN ON	
Threshold value	• Sensor 4 battery voltage < 2.2V for 20 consecutive bursts at temperatures above -10 °C	

Mil On conditon	• Not applicable	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the "BATTERY VOLTAGE" of TPMS sensor on the scantool.

Specification: The value of Sensor 4 battery is 'Normal'.



5. Is the sensor battery normal?

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	▸ Replace Sensor 4 and register sensor ID with 'GDS TPMS'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

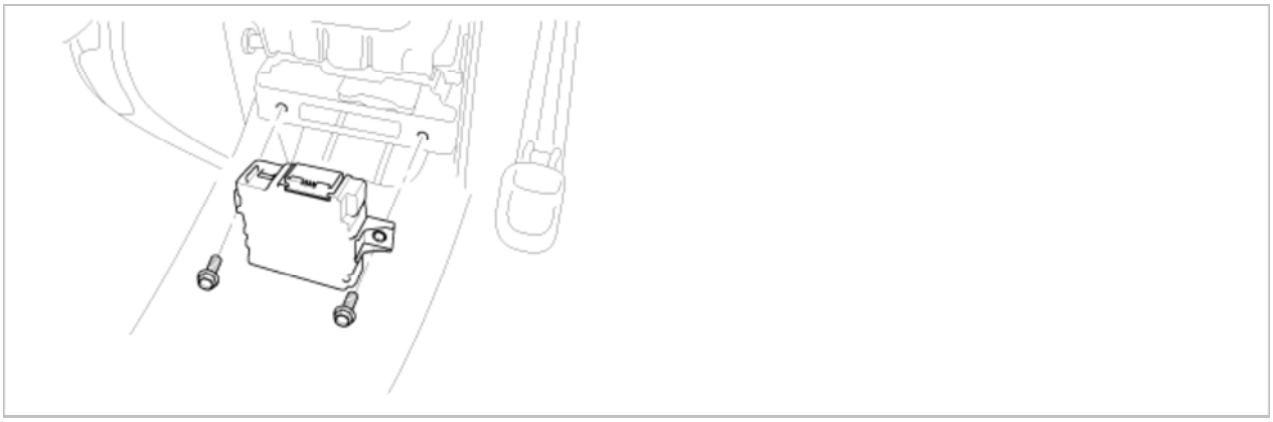
After a repair, it is essential to verify that the fault has been corrected.

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 > Tire Pressure Monitoring System > C1126 TPMS ECU Battery Voltage Low

Component Location



General Description

TPM Receiver
TPM Receiver is integrated with the TPM module installed in the back side of center console. The operating battery of TPM module is supplied from the vehicle battery.
Upon reception of the broadcast from the WE sensor, the TPMS receiver is able to associate the unique WE ID code with the wheel's position on the vehicle. The TPMS Warning Algorithm continues to evaluate the pressure and temperature of each tire, and is responsible for making the decision to alert the driver to a potentially dangerous tire inflation condition via a visible 'TREAD' indicator.

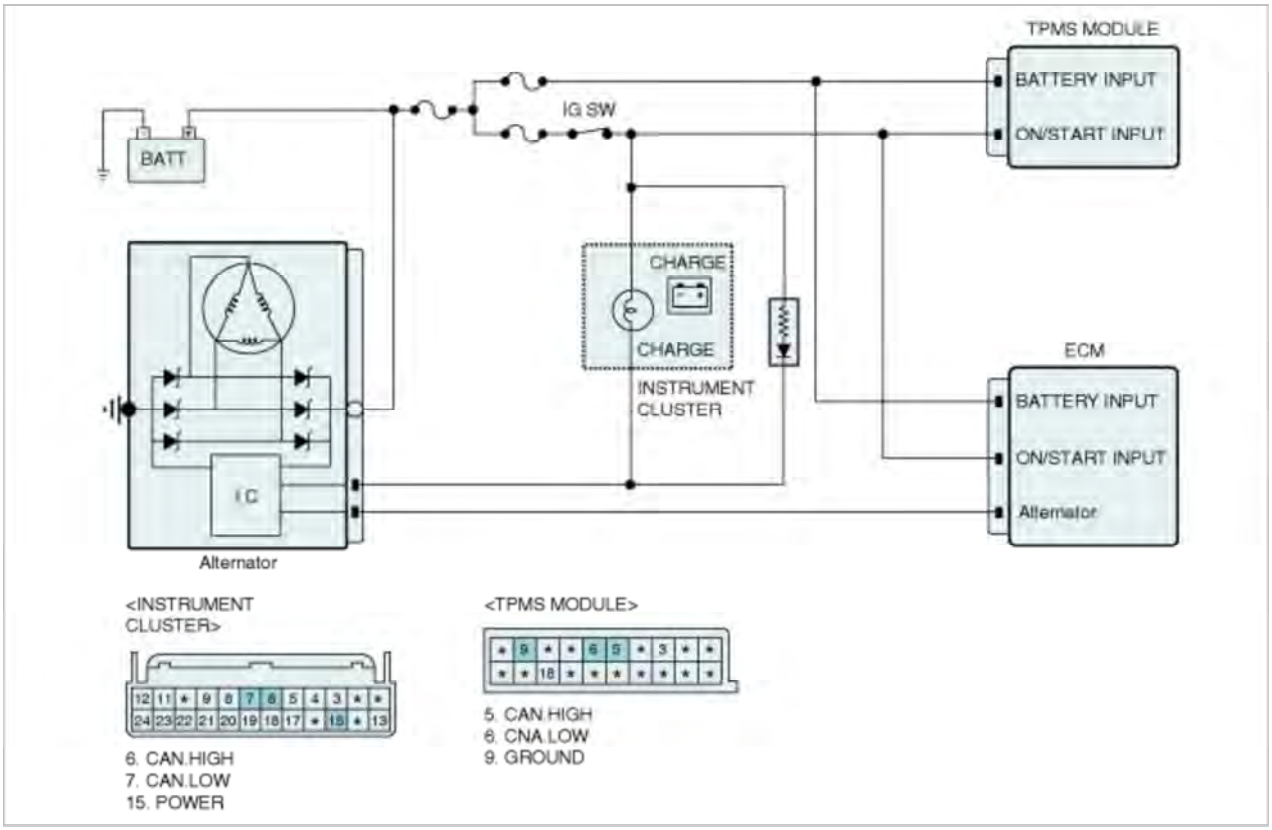
DTC Description

This DTC indicates that the Vehicle/receiver battery level is Low.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check vehicle battery voltage	• Faulty charging system • Vehicle battery low • Faulty TPMS Receiver
Enable Conditions	• IGN ON	
Threshold value	• Battery voltage < 9.0 V • Consecutive over 5 sec.	
Mil On conditon	• TPMS waring lamp ON.	

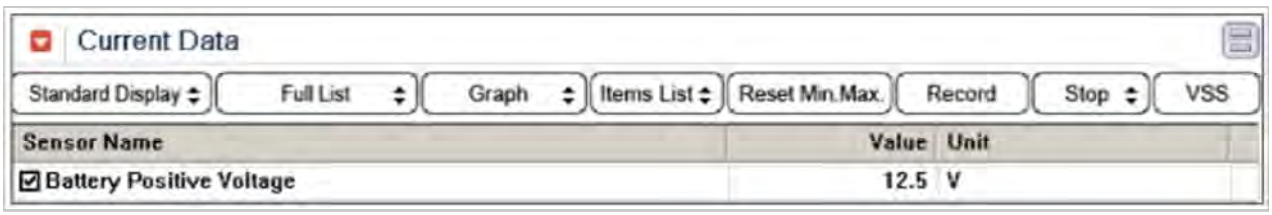
Diagnostic Circuit Diagram



Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the "BATTERY VOLTAGE" of TPMS sensor on the scantool.
5. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.
6. Monitor the parameter of 'Battery Positive Voltage' on the screen.

Specification : 'Battery Positive Voltage' is more than 9 V



7. 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 "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 2,500RPM(idle) over 2 minutes.

Specification : more than 9 V

4. Is the measured voltage within specifications?

YES	▸ Substitute with a known-good TPMS receiver and check for proper operation. ▸ If the problem is corrected, replace TPMS receiver and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Check for fault in charging system and check for tension of alternator 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

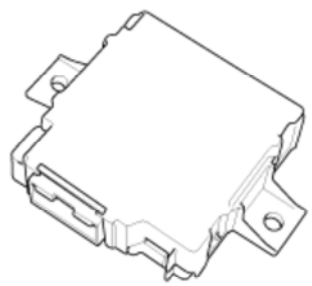
After a repair, it is essential to verify that the fault has been corrected.

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 > Tire Pressure Monitoring System > C1300 LF/RF External Interference Failure

Component Location



General Description

TPMS Receiver is located in the back side of center console. The operating battery of TPMS module is supplied from the vehicle battery. Data such as Tire pressure, Temperature, Acceleration ,TPMS sensor battery status and TPMS sensor valve ID from TPMS sensors are transmitted to TPMS receiver in the form of RF signal. TPMS module accomplishes Tire Monitoring and Warning Logic with received data.

DTC Description

This DTC indicates that a commumication failure is occurred between micro controller and RF receiver in the TPMS ECU. In such a case no WE sensor data can be received/processed by the TPMS algorithm.

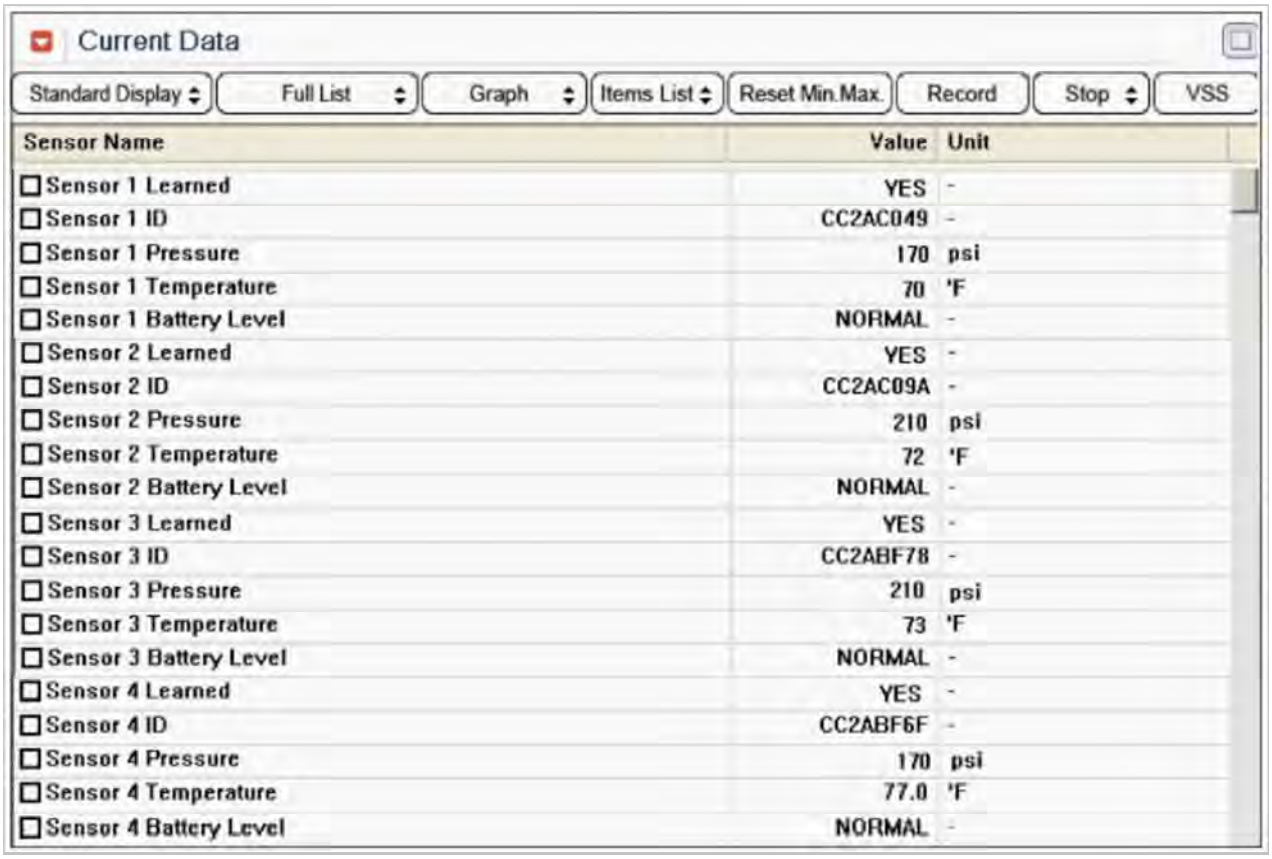
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• RF check	• A RF Interference from external sources
Enable Conditions	• All 4 active WE sensors are mute	
Threshold value	• No telegrams received for the last scheduled 8 transmissions from all 4 active WE sensors. • The Innovative receiver (IRX) does not respond.	
Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the parameters of 4 active WE sensors data.

Specification : the parameters related to 4 active WE sensors are displayed normally.



5. Are the parameters normal?

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	▸ Substitute with a known-good TPMS receiver module and check for proper operation.

	▸ If the problem is corrected, replace TPMS receiver module and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

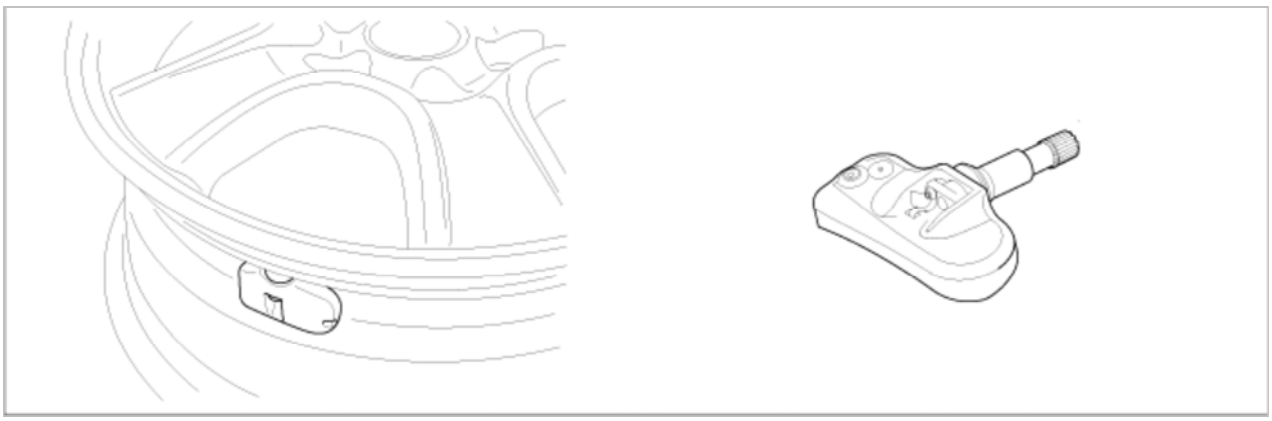
After a repair, it is essential to verify that the fault has been corrected.

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 ?

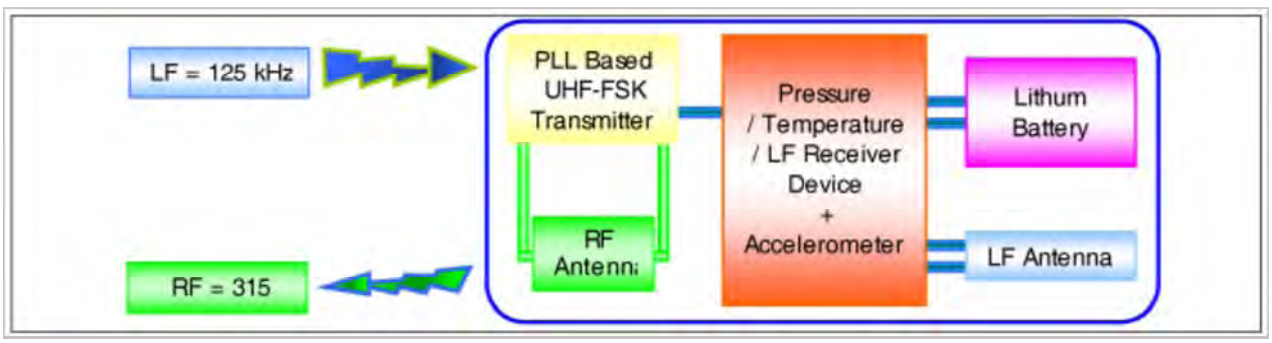
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1312 Front Left Sensor RF Channel Failure

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This

measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.
The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.
The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

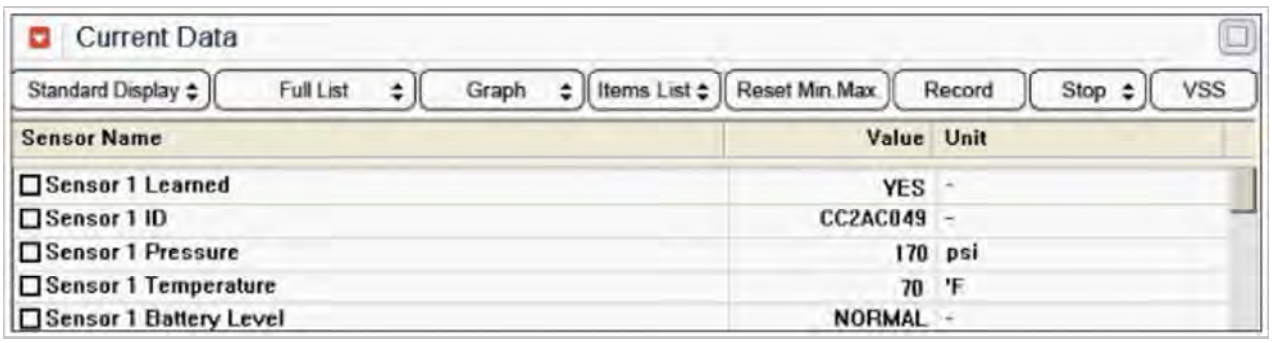
This DTC indicates that the Sensor 1 battery voltage is below 2.2Vdc. The most likely cause is battery passing it's expected life / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 1	• Sensor 1 fault. • Shielding in Sensor 1.
Enable Conditions	• Vehicle Speed is above 25km/h.	
Threshold value	• No RF message received from Sensor 1since driving for 540s	
Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to TPMS sensor on the scantool.



5. Are parameters normal?

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	▸ Check for vehicle interference sources. ▸ 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.

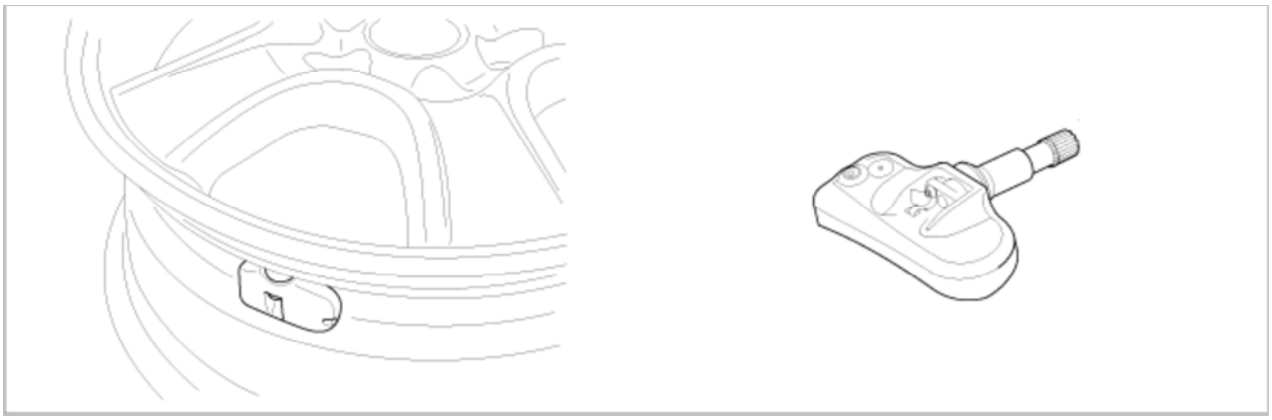
1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a TPMS exciter or scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.

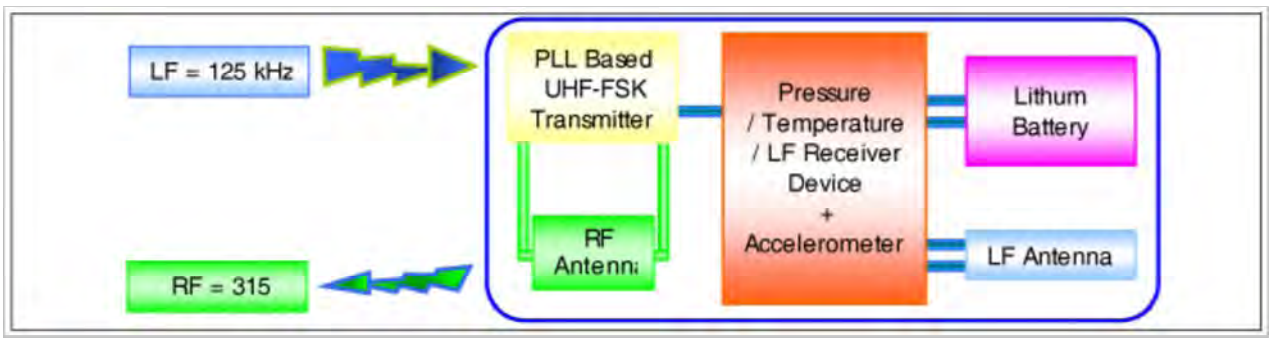
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1313 Front Right Sensor RF Channel Failure

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor
Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.
The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.
The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.
The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.
The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

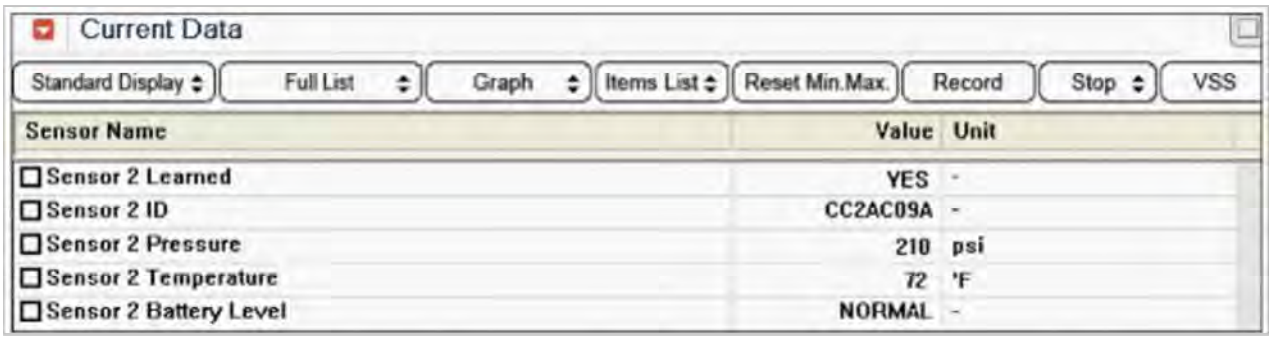
This DTC indicates that the Sensor 2 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 2	• Sensor 2 in storage state. • Shielding in Sensor 2.
Enable Conditions	• Vehicle Speed is above 25km/h.	
Threshold value	• No RF message received from Sensor 2 since driving for 540s	
Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to TPMS sensor on the scantool.



5. Are parameters normal?

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	▸ Check for vehicle interference sources. ▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

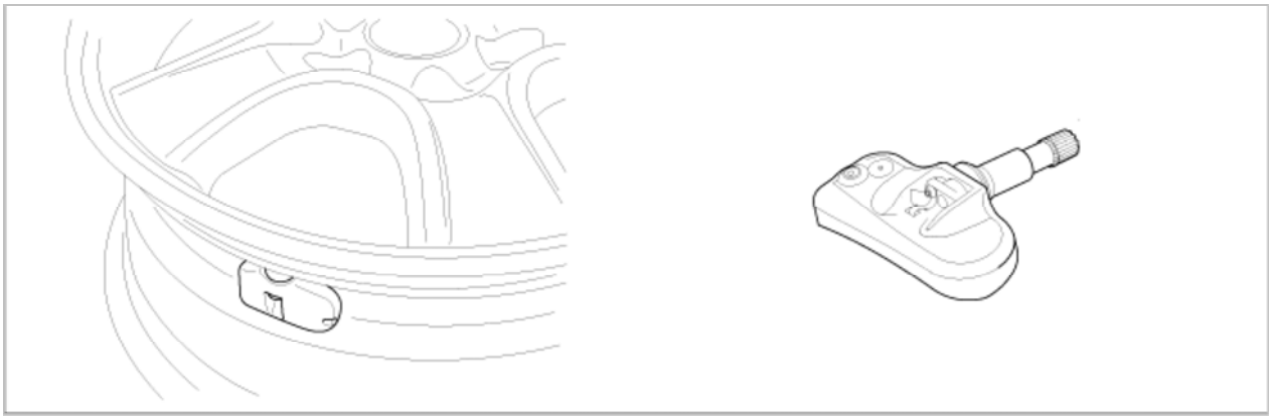
After a repair, it is essential to verify that the fault has been corrected.

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 ?

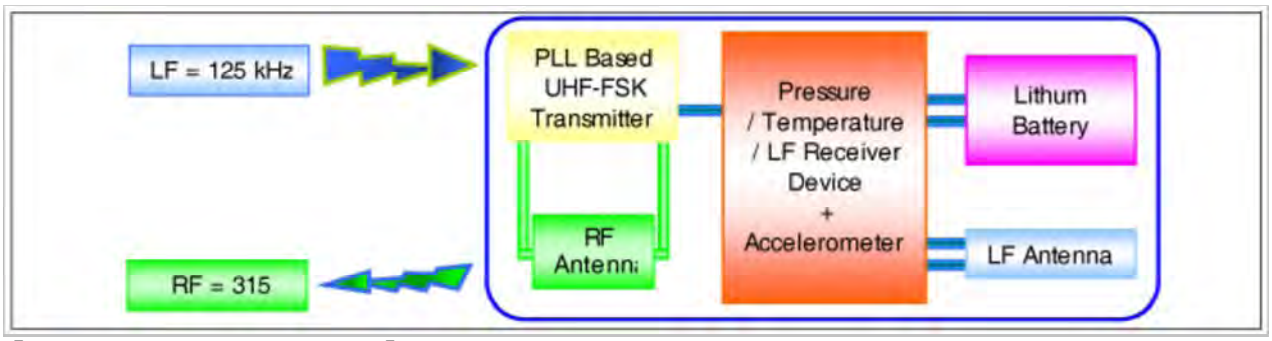
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1314 Rear Left Sensor RF Channel Failure

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.

The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 3 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

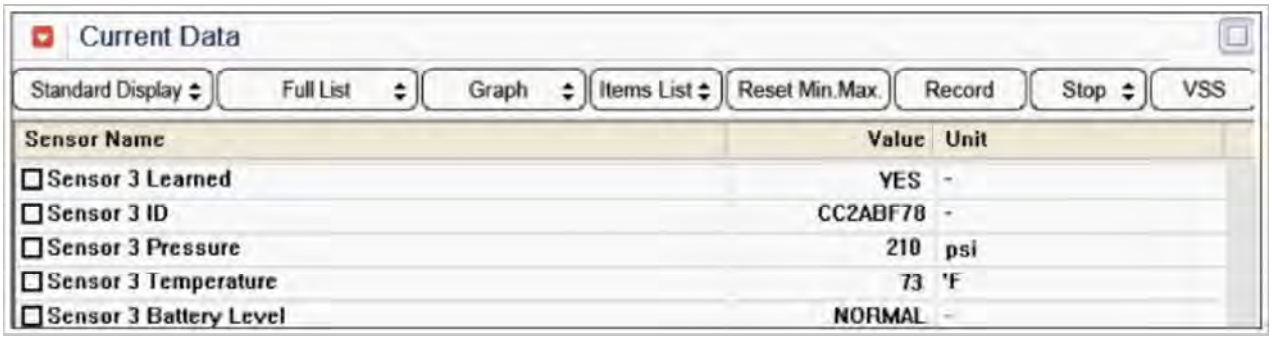
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 3	• Sensor 3 in storage state. • Shielding in Sensor 3.
Enable Conditions	• Vehicle Speed is above 25km/h.	
Threshold value	• No RF message received from Sensor 3 since driving for 540s	

Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to TPMS sensor on the scantool.



5. Are parameters normal?

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	▸ Check for vehicle interference sources. ▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

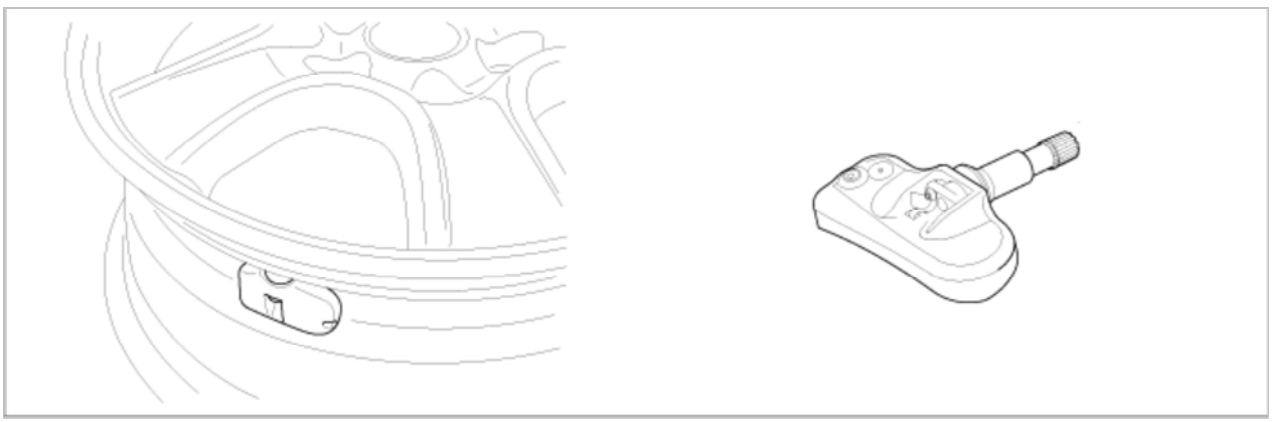
After a repair, it is essential to verify that the fault has been corrected.

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

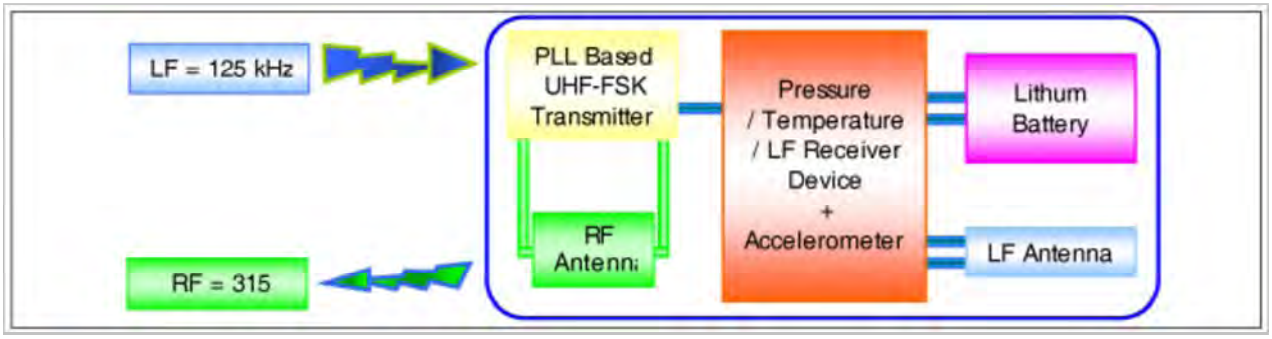
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1315 Rear Right Sensor RF Channel Failure

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor
Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.
The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.
The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.
The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.
The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

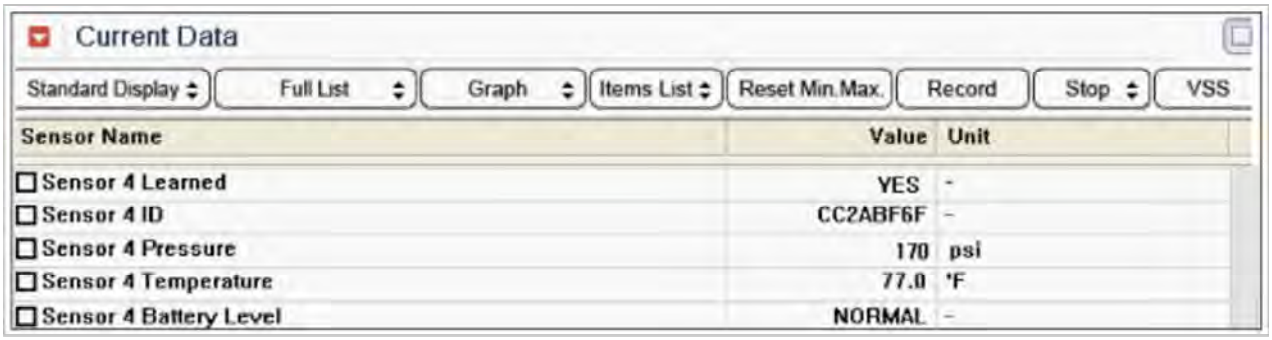
This DTC indicates that the Sensor 4 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 4	• Sensor 4 in storage state. • Shielding in Sensor 4.
Enable Conditions	• Vehicle Speed is above 25km/h.	
Threshold value	• No RF message received from Sensor 4 since driving for 540s	
Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to TPMS sensor on the scantool.



5. Are parameters normal?

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	▸ Check for vehicle interference sources. ▸ Repair if necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

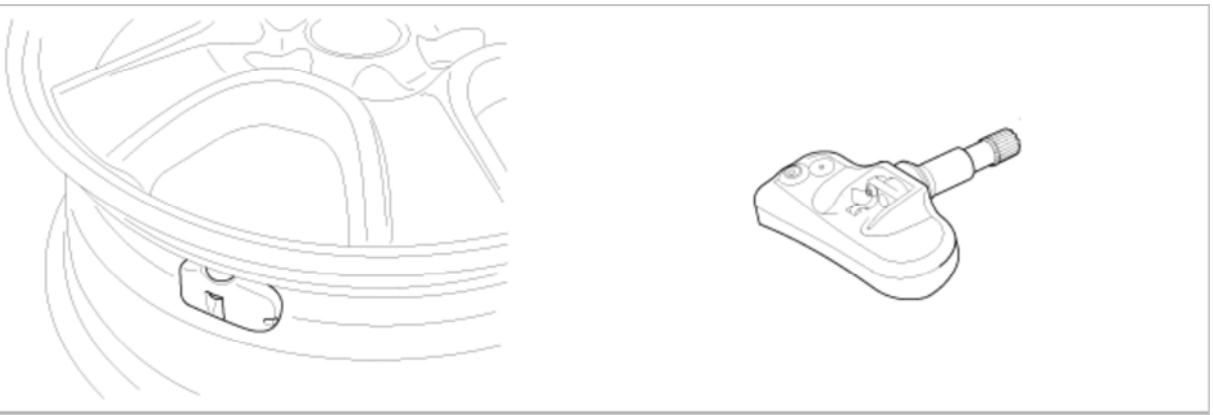
After a repair, it is essential to verify that the fault has been corrected.

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

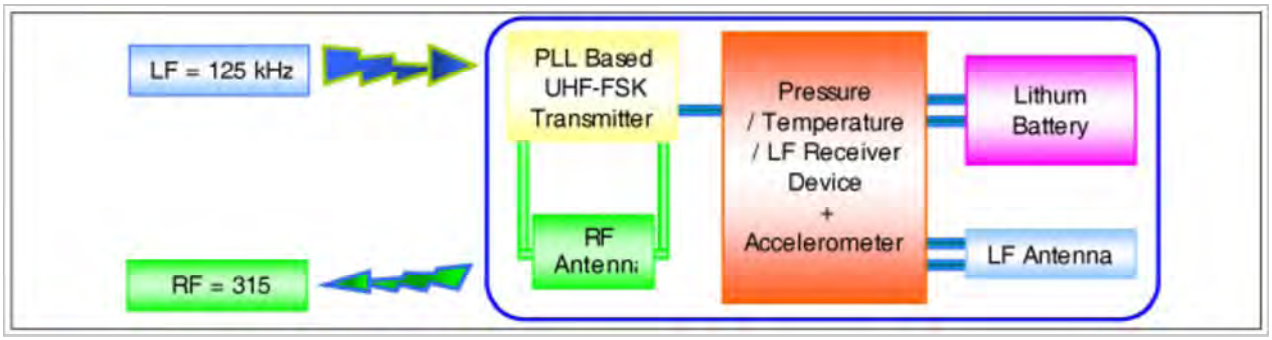
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1322 Front Left Sensor Over Temperature

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.

The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 1 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

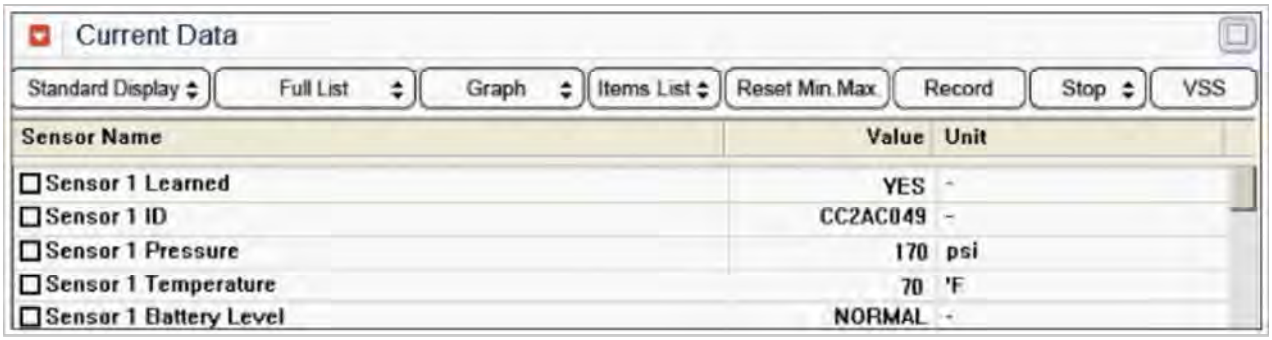
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 1	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable Conditions	• IGN ON	
Threshold value	• Sensor 1 data is missing since 360s of driving & last received temperature > 239°F (115°C).	
Mil On conditon	• Not applicable	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to sensor's temperature on the scantool.

Specification: Below 239°F(115°C)



5. 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

【Check wheel / tire】

1. Cool the heat of the Sensor 1's wheel / tire.
2. IG OFF & IG ON. And Wait for 1 minute.
3. Monitor the parameter related to 'Sensor 1 Temperature' on the GDS.

Specification : Below 239°F(115°C)

4. Is parameter within specifications?

YES	▸ Fault can be because of temporary overheating. ▸ Go to "Verification of vehicle Repair" procedure.
NO	▸ Check if there is a part to lead to overheated WE sensor. ▸ Replace Sensor 1 and register sensor ID with 'TPMS exciter'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

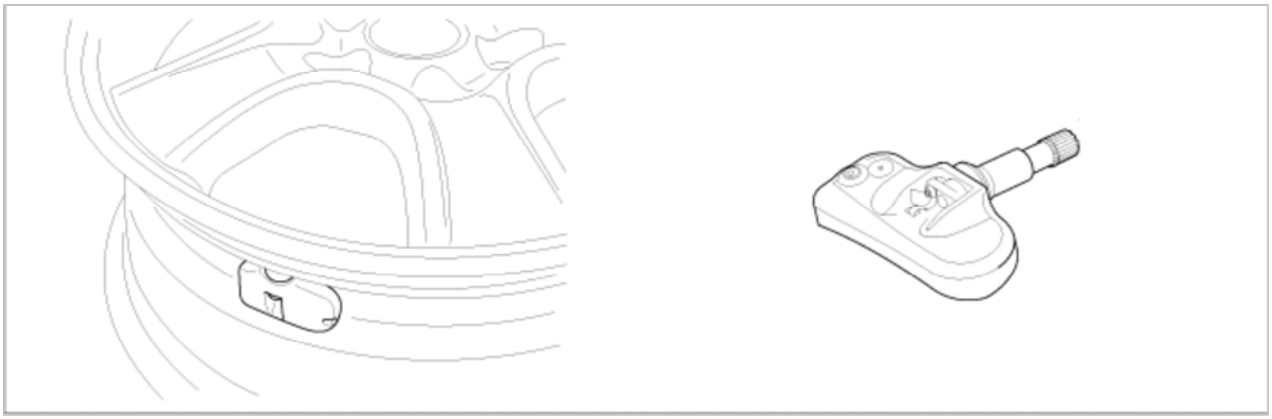
After a repair, it is essential to verify that the fault has been corrected.

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

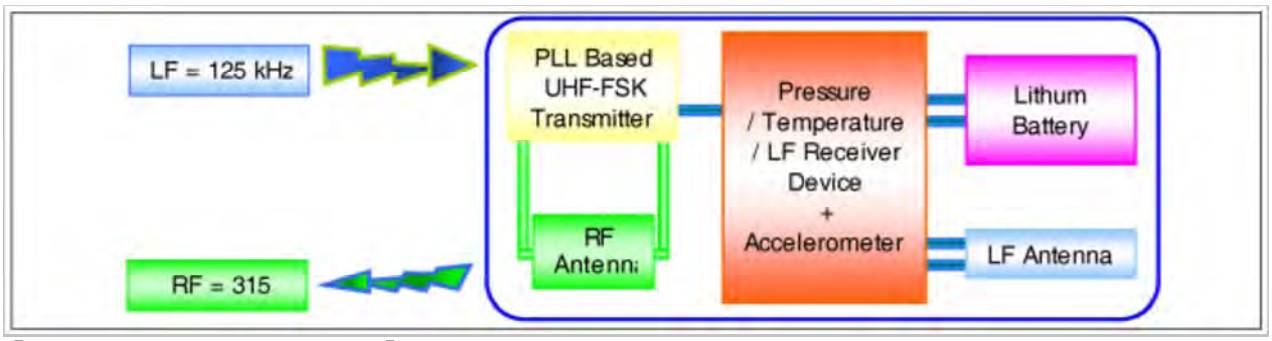
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1323 Front Right Sensor Over Temperature

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 2 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

DTC Detecting Condition

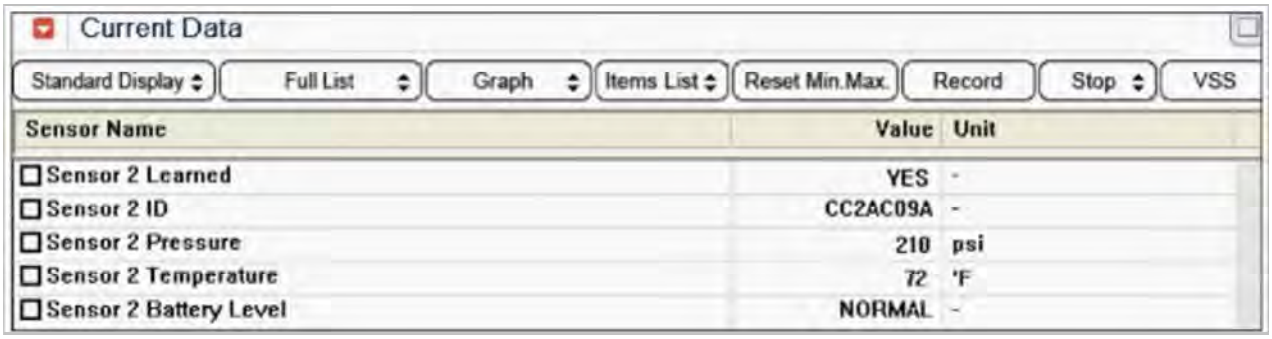
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 2	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable Conditions	• IGN ON	
Threshold value	• Sensor 2 data is missing since 360s of driving & last received temperature > 239°F(115°C).	

Mil On conditon	• Not applicable	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to sensor's temperature on the scantool.

Specification: Below 239°F(115°C)



5. 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

【Check wheel / tire】

1. Cool the heat of the Sensor 2's wheel / tire.
2. IG OFF & IG ON. And Wait for 1 minute.
3. Monitor the parameter related to 'Sensor 2 Temperature' on the GDS.

Specification : Below 239°F(115°C)

4. Is parameter within specifications?

YES	▸ Fault can be because of temporary overheating. ▸ Go to "Verification of vehicle Repair" procedure.
NO	▸ Replace Sensor 2 and register sensor ID with 'TPMS exciter'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

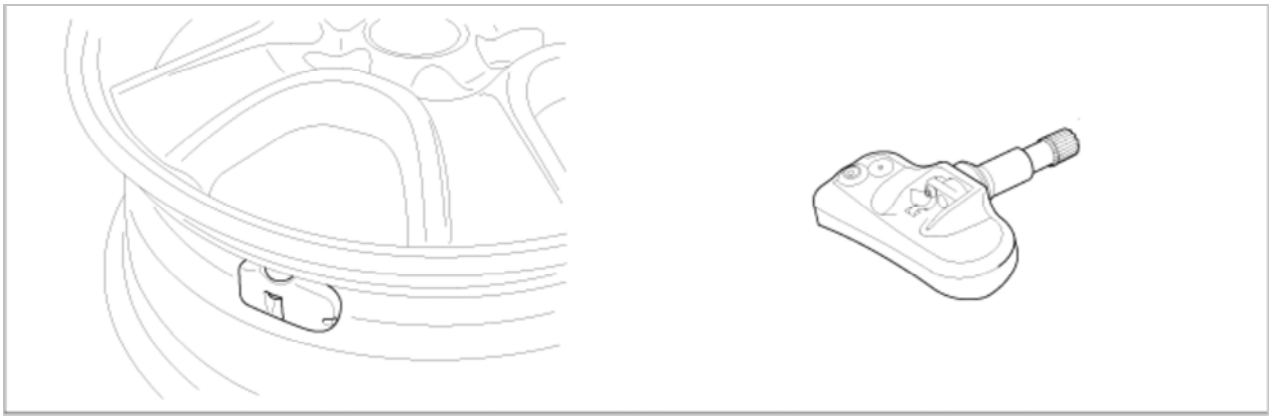
After a repair, it is essential to verify that the fault has been corrected.

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

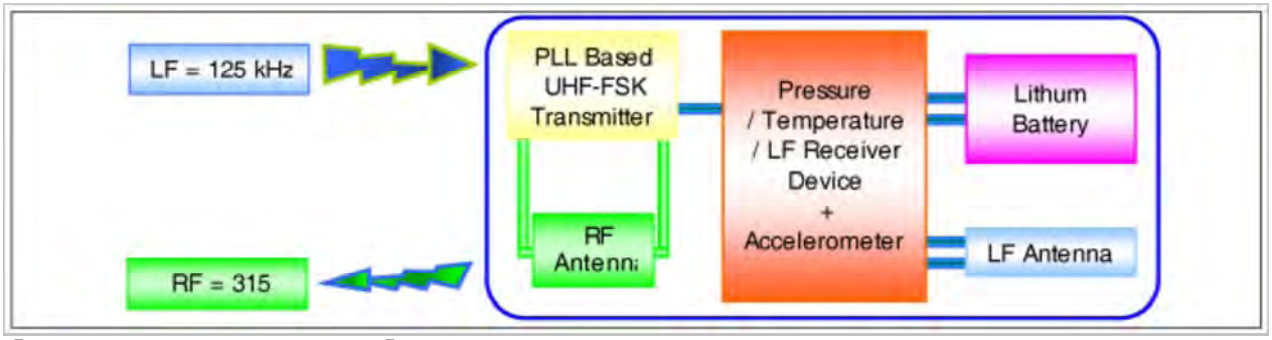
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1324 Rear Left Sensor Over Temperature

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 3 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

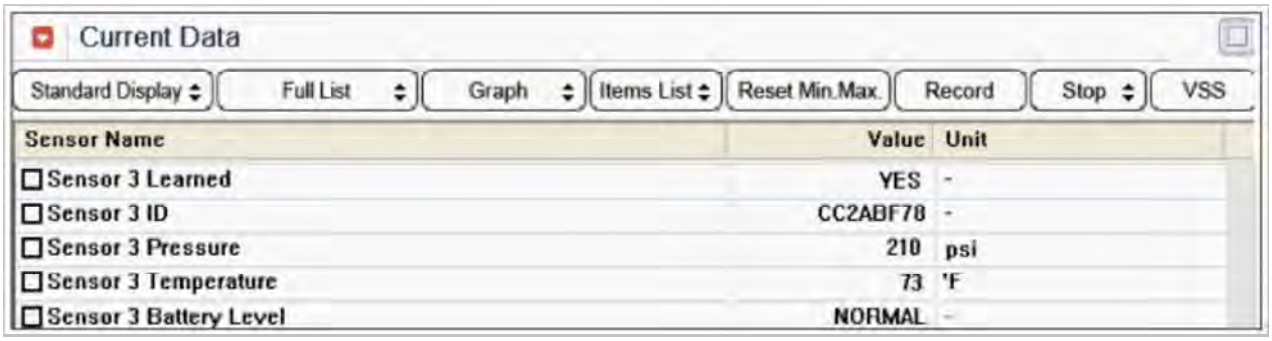
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 3	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable Conditions	• IGN ON	
Threshold value	• Sensor 3 data is missing since 360s of driving & last received temperature > 239°F(115°C).	
Mil On conditon	• Not applicable	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to sensor's temperature on the scantool.

Specification: Below 239°F(115°C)



5. 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

【Check wheel / tire】

1. Cool the heat of the Sensor 3's wheel / tire.
2. IG OFF & IG ON. And Wait for 1 minute.
3. Monitor the parameter related to 'Sensor 3 Temperature' on the GDS.

Specification : Below 239°F(115°C)

4. Is parameter within specifications?

YES	▸ Fault can be because of temporary overheating. ▸ Go to "Verification of vehicle Repair" procedure.
NO	▸ Check if there is a part to lead to overheated WE sensor. ▸ Replace Sensor 3 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.

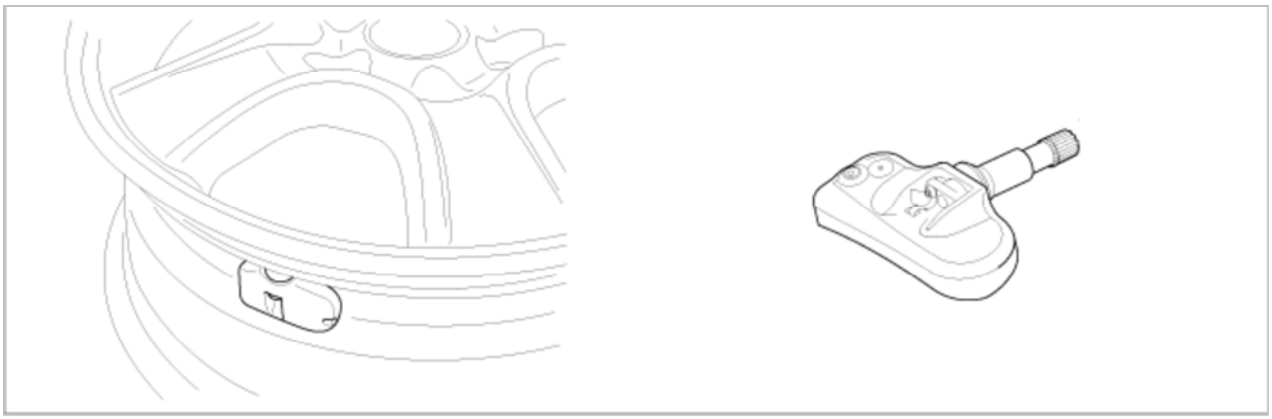
1. Connect TPMS exciter or scantool and select "Diagnostic Trouble Codes(DTCs)" mode

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 ?

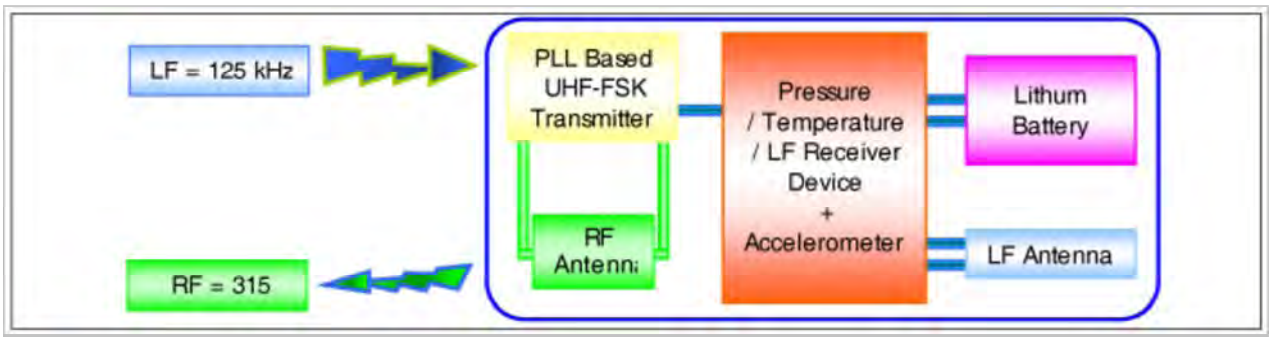
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1325 Rear Right Sensor Over Temperature

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor
Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.
The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.
The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.
The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 4 battery voltage is below 2.2Vdc. The most likely cause is battery passing it's expected life / sensor failure.

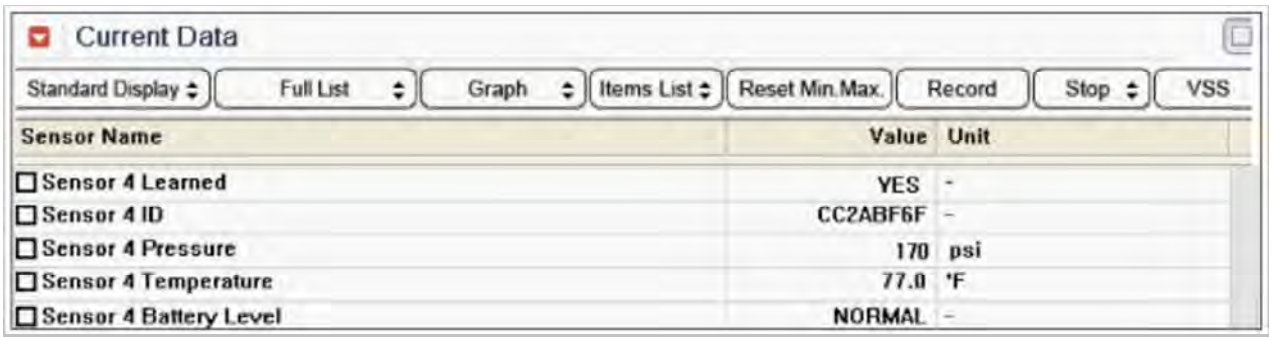
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 4	• Damaged tire • Excessive braking • Driving while the parking brake is on.
Enable Conditions	• IGN ON	
Threshold value	• Sensor 4 data is missing since 360s of driving & last received temperature > 239°F(115°C).	
Mil On conditon	• Not applicable	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to sensor's temperature on the scantool.

Specification: Below 239°F(115°C)



5. 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

【Check wheel / tire】

1. Cool the heat of the Sensor 4's wheel / tire.
2. IG OFF & IG ON. And Wait for 1 minute.
3. Monitor the parameter related to 'Sensor 4 Temperature' on the GDS.

Specification : Below 239°F(115°C)

4. Is parameter within specifications?

YES	▸ Fault can be because of temporary overheating. ▸ Go to "Verification of vehicle Repair" procedure.
NO	▸ Check if there is a part to lead to overheated WE sensor. ▸ Replace Sensor 4 and register sensor ID with 'TPMS exciter'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

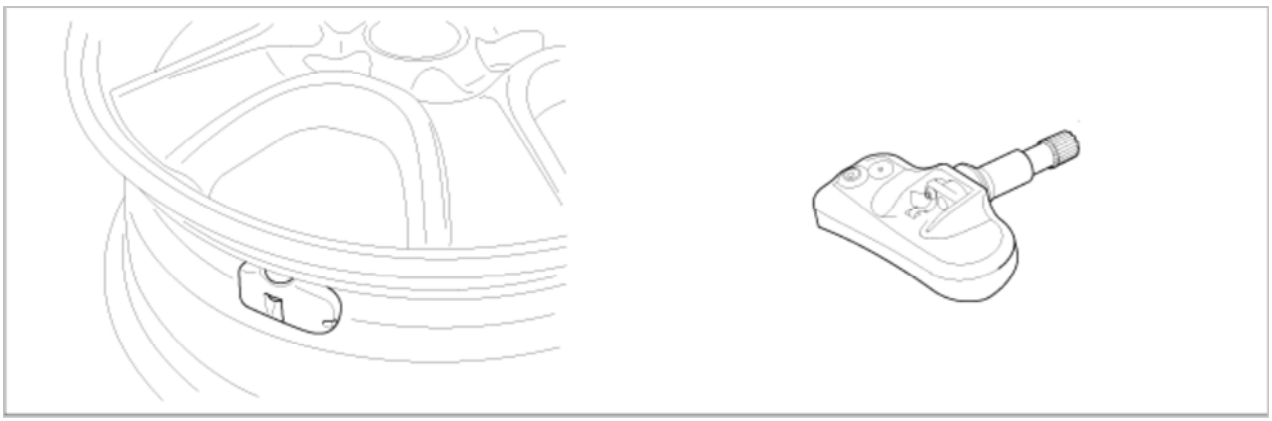
After a repair, it is essential to verify that the fault has been corrected.

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 ?

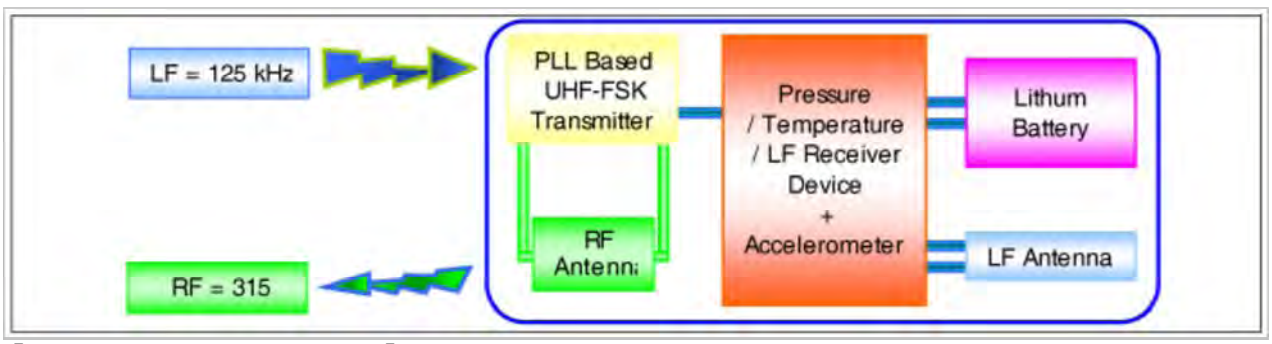
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1332 Front Left Sensor Fault

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.
The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 1 battery voltage is below 2.2Vdc. The most likely cause is battery passing it's expected life / sensor failure.

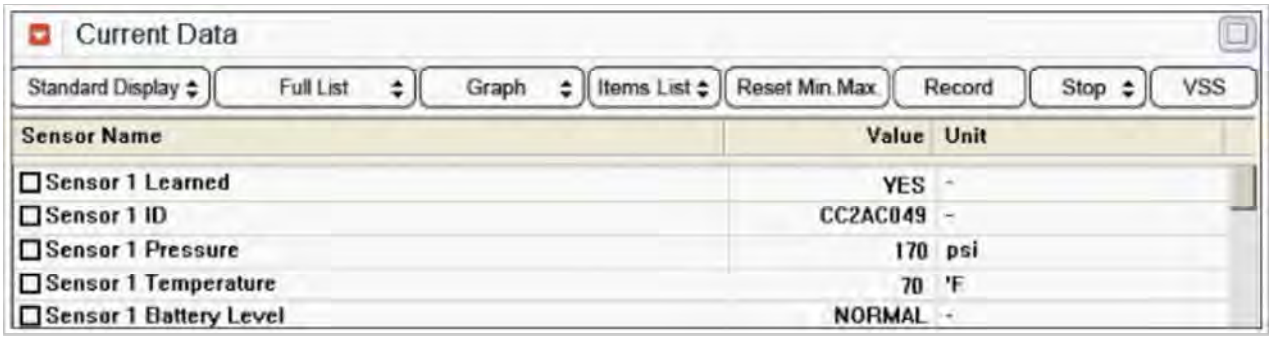
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 1	• Damage to Sensor 1 • Faulty Sensor 1
Enable Conditions	• IGN ON	
Threshold value	• After reception of a single frame from WE sensor with pressure, temperature or acc set to 00h. (The pressure, temperature and acceleration value of a WE sensor data frame indicates 00h when the WE detected a fault of its sensors). • Plausibility check detected a defect of temperature or pressure sensor or a defect of both sensors. (Pressure and temperature sensor are defect when they report irregular changes of pressure and temperature)	
Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to TPMS sensor on the scantool.

Specification: the parameters related to Sensor 1 is displayed normally.



5. Are the parameters normal?

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	▸ Replace Sensor 1 and register sensor ID with 'GDS TPMS'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

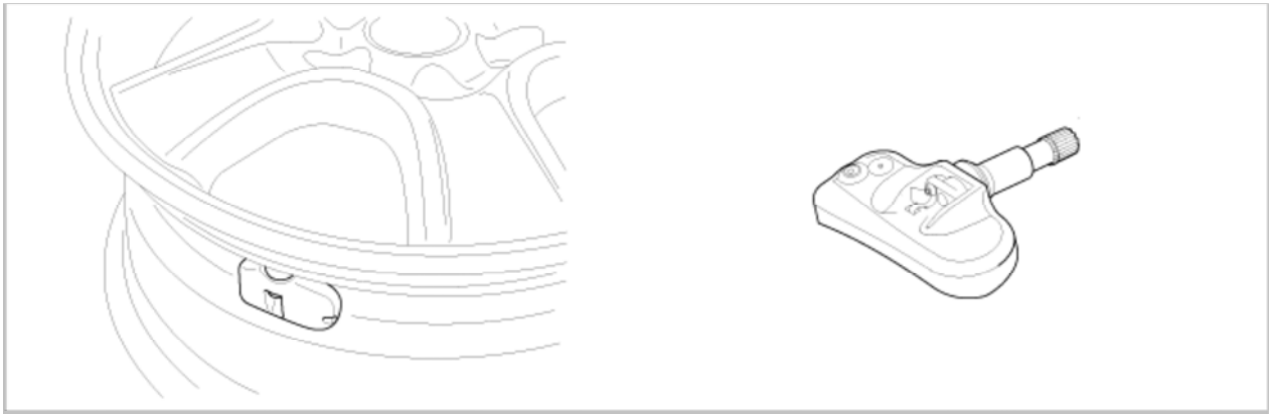
After a repair, it is essential to verify that the fault has been corrected.

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

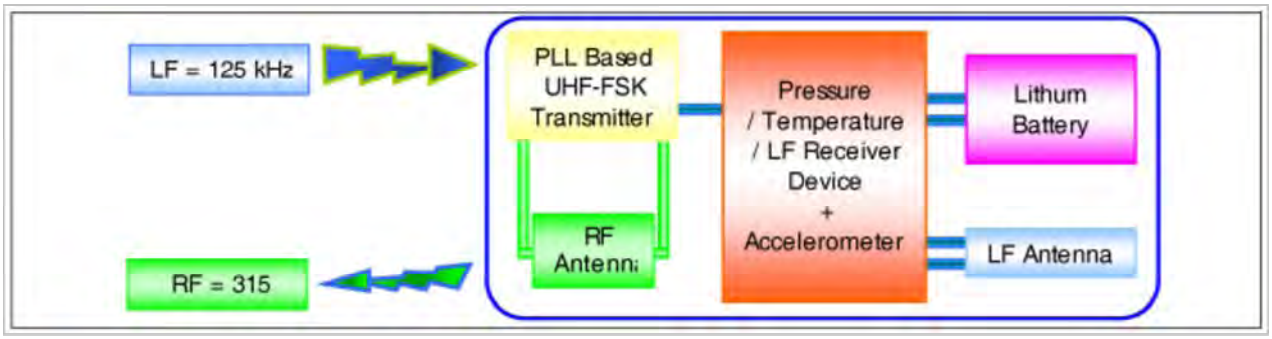
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1333 Front Right Sensor Fault

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

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The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

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The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.

The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 2 battery voltage is below 2.2Vdc. The most likely cause is battery passing it's expected life / sensor failure.

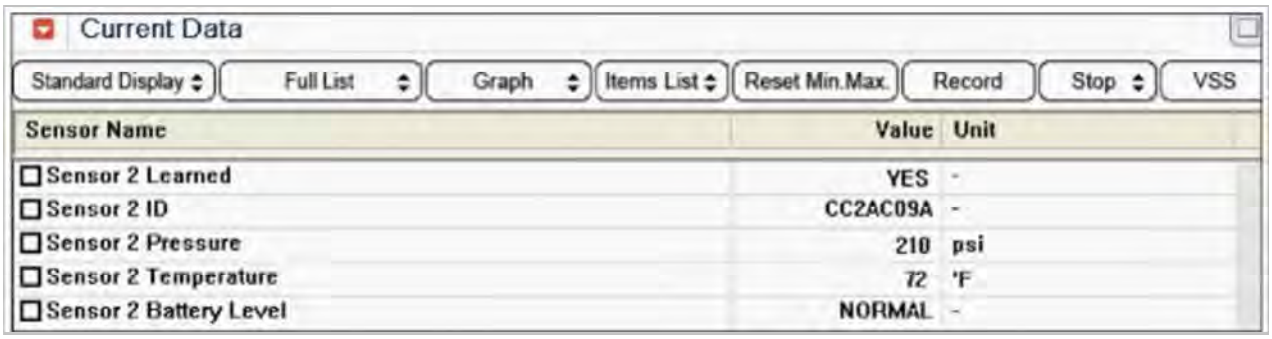
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 2	• Damage to Sensor 2 • Faulty Sensor 2
Enable Conditions	• IGN ON	
Threshold value	• After reception of a single frame from WE sensor with pressure, temperature or acc set to 00h. (The pressure, temperature and acceleration value of a WE sensor data frame indicates 00h when the WE detected a fault of its sensors). • Plausibility check detected a defect of temperature or pressure sensor or a defect of both sensors. (Pressure and temperature sensor are defect when they report irregular changes of pressure and temperature)	
Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to TPMS sensor on the scantool.

Specification: the parameters related to Sensor 2 is displayed normally.



5. Are the parameters normal?

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	▸ Replace Sensor 2 and register sensor ID with 'GDS TPMS'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

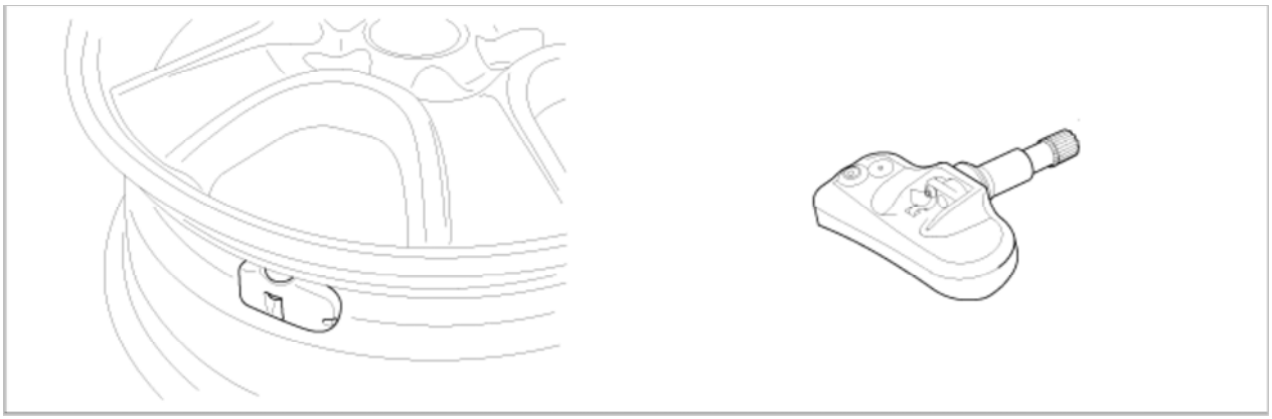
After a repair, it is essential to verify that the fault has been corrected.

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

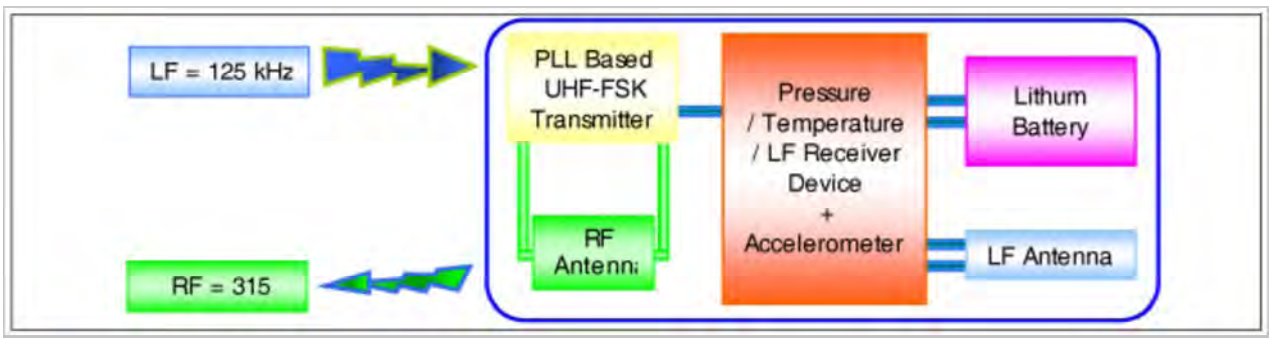
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1334 Left Rear Sensor Fault

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.

The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 3 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

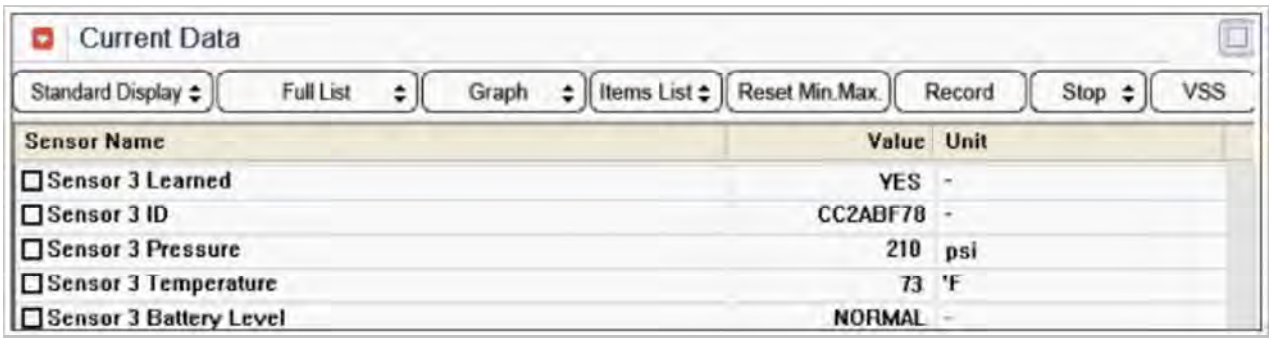
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 3	• Damage to Sensor 3 • Faulty Sensor 3
Enable Conditions	• IGN ON	
Threshold value	• After reception of a single frame from WE sensor with pressure, temperature or acc set to 00h. (The pressure, temperature and acceleration value of a WE sensor data frame indicates 00h when the WE detected a fault of its sensors). • Plausibility check detected a defect of temperature or pressure sensor or a defect of both sensors. (Pressure and temperature sensor are defect when they report irregular changes of pressure and temperature)	
Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to TPMS sensor on the scantool.

Specification: the parameters related to Sensor 3 is displayed normally.



5. Are the parameters normal?

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	▸ Replace Sensor 3 and register sensor ID with 'GDS TPMS'. ▸ Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

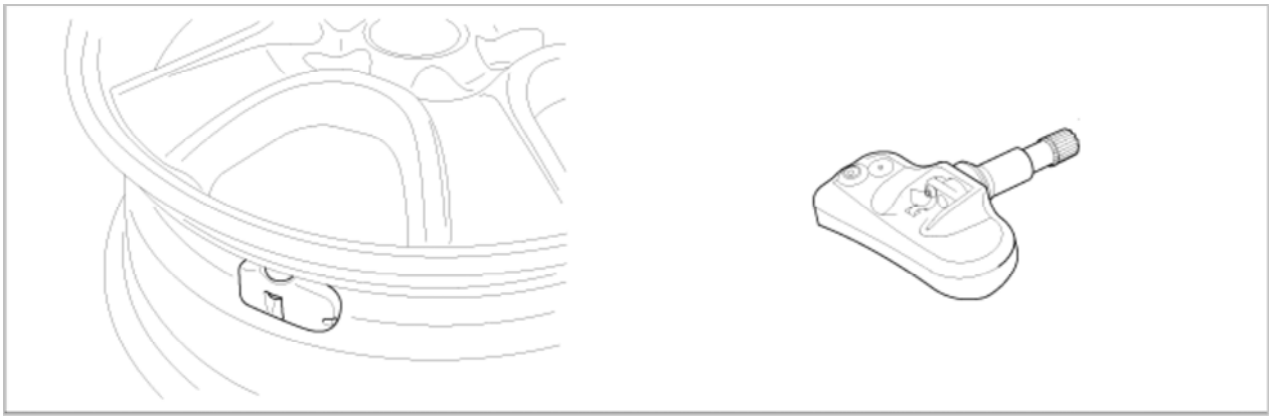
After a repair, it is essential to verify that the fault has been corrected.

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

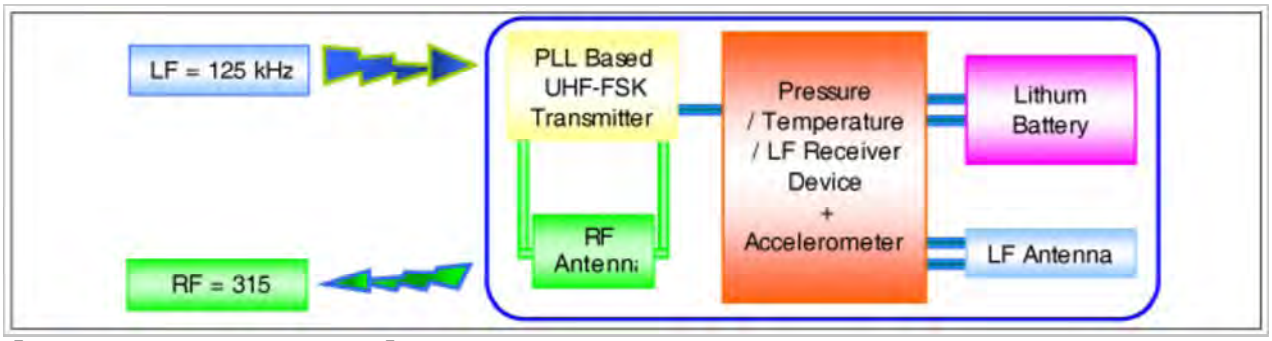
YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Suspension System > Tire Pressure Monitoring System > C1335 Rear Right Sensor Fault

Component Location



General Description



【Wheel Electronic (WE) sensor unit】- TPMS sensor

Each vehicle wheel is fitted with a Wheel Electronic (WE) sensor unit attached to the valve on the inside of the wheel. The WE unit is powered with a self-contained battery utilizing a high temperature rated CR (Manganese Dioxide Lithium) chemistry. The operating voltage range for the WE module is 1.8Vdc to 3.6Vdc, and the operating temperature range is -40° C ~120°C. The WE measures tire pressure, temperature, and acceleration periodically. The pressure, temperature, and acceleration information is converted to digital form within the MCU inside the WE sensor.

The WE sensor is equipped with a Radio Frequency (RF) transmitter circuit which is used to periodically broadcast information from inside the tire. All WE sensor units operate on the same RF channel frequency, and each broadcast message includes pressure and temperature data, a unique ID code, operating state data, status information, and digital error-detection data.

The pressure measured by the WE sensor is an absolute pressure value. The pressure measurement range is 100kPa to 450kPa. The acceleration data is used within the WE sensor to determine whether the vehicle is moving or stationary. The acceleration status is the decision maker within the WE module that determines if the tire is moving or stationary. This measurement is used within the WE module to enable different operating modes depending on the status of the acceleration value. Over the fully specified operating temperature range, if the acceleration measurement is greater than or equal to 5G, the WE module assumes the tire is moving.

The basic function of the WE Sensor is to transmit frame every minute when WE is in mode MD(mode driving) mode. During MD mode,The WE sensor transmits RF messages every 1 minute if the acceleration measurement is greater than 5G.

The WE sensor enters mode MP(Mode Parking) where it transmits RF messages once every 13 hours if acceleration is lower than 5g for 15 mimutes. When the WE sensor is in mode MFB(Mode First Burst : mode for Auto Location and Auto Learning), it transmits RF message once every 15 seconds.

DTC Description

This DTC indicates that the Sensor 4 battery voltage is below 2.2Vdc. The most likely cause is battery passing it’s expected life / sensor failure.

DTC Detecting Condition

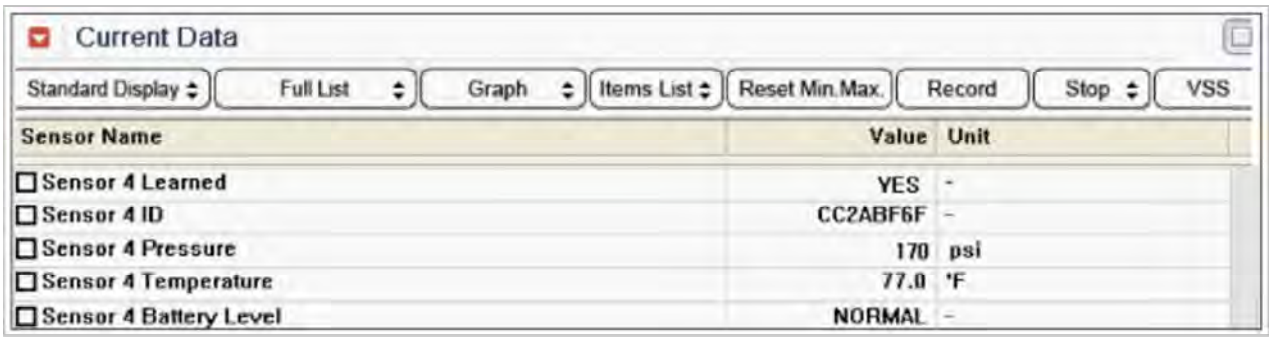
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check RF message from Sensor 4	
Enable Conditions	• IGN ON	

Threshold value	• After reception of a single frame from WE sensor with pressure, temperature or acc set to 00h. (The pressure, temperature and acceleration value of a WE sensor data frame indicates 00h when the WE detected a fault of its sensors). • Plausibility check detected a defect of temperature or pressure sensor or a defect of both sensors. (Pressure and temperature sensor are defect when they report irregular changes of pressure and temperature)	• Damage to Sensor 4 • Faulty Sensor 4
Mil On conditon	• Active DTC is set	

Monitor Scantool Data

1. Park the vehicle on an even ground.
2. Connect scantool to Data Link Connector(DLC).
3. IG "ON"
4. Monitor the service data related to TPMS sensor on the scantool.

Specification: the parameters related to Sensor 4 is displayed normally.



5. Are the parameters normal?

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	▸ Replace Sensor 4 and register sensor ID with 'GDS TPMS'. ▸ 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 GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using GDS, 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 > Tire Pressure Monitoring System > C1613 CAN Wrong Message

General Description

Varous TPMS functions rely on a speed signal that reprots reliably actual vehicle speed. Three speed signals(ABS1 FR wheel, EMS1 speed signal, TCS5 FR wheel) campared since one signal alone may report incorrect vehicle speed which

would go undetected. Three signals must report same vehicle speed. If not, a DTC shall be set to active, and TPMS Warning indicator shall turn on.

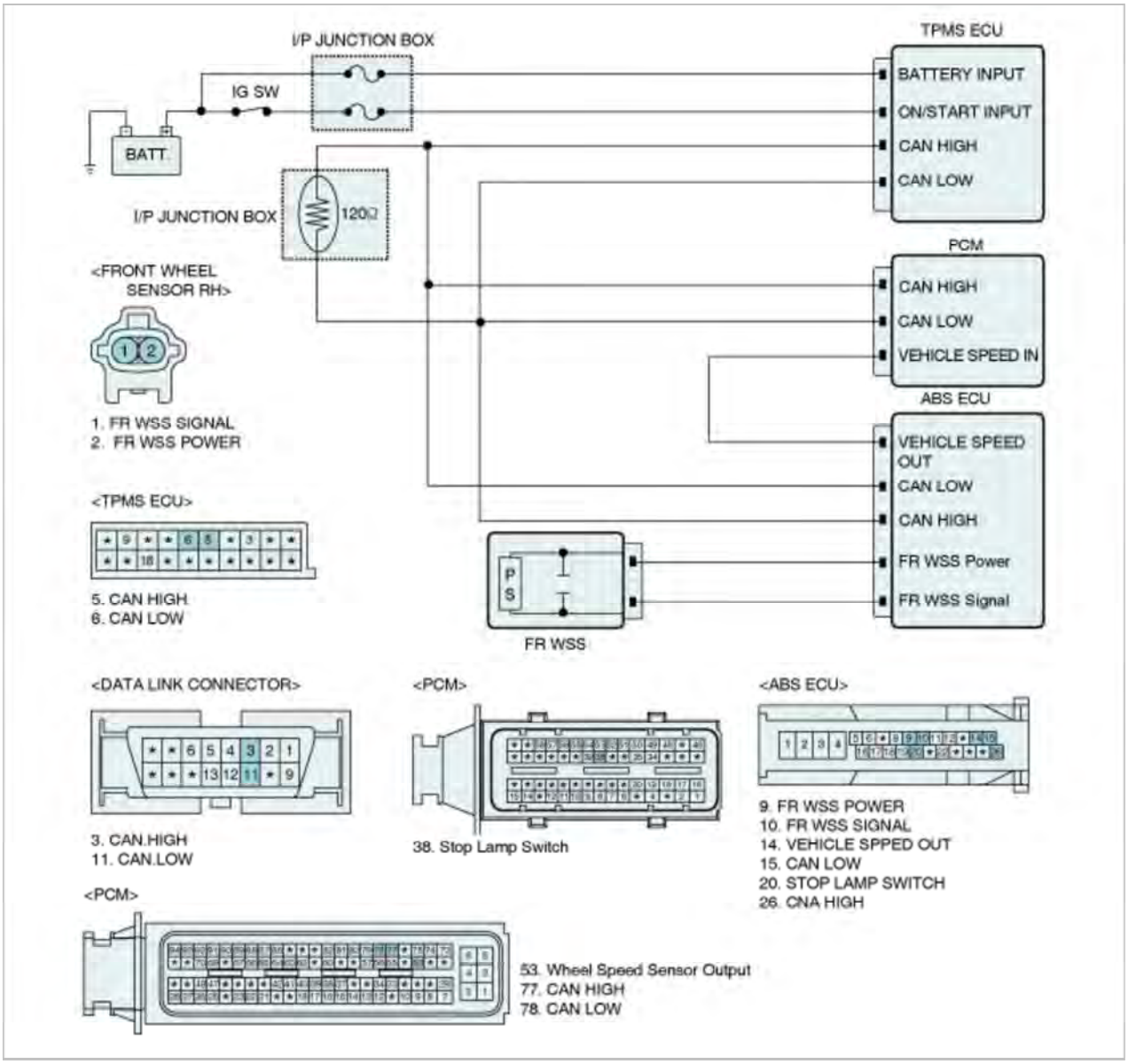
DTC Description

This DTC indicates that there is a fault in speed inputs to receiver failure. It can be caused by damage to speed sensor, receiver input failure, incorrectly wired harness & shorted or open pins.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Speed input signal check	• Faulty speed sensor • Shorted/open speed input
Enable Conditions	• Continuously (IG ON)	
Threshold value	• CAN signal vehicle speed by EMS not received for 2s. • CAN signal vehicle speed by EMS < 25Km/h and CAN signal wheel FR by ABS > vehicle speed +10Km/h for 4s. • CAN signal vehicle speed by EMS < 25Km/h and CAN signal wheel FR by TCS > vehicle speed +10Km/h for 4s.	
Mil On conditon	• Active DTC is set	

Diagnostic Circuit Diagram



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 "Signal Circuit Inspection" procedure.

Signal Circuit Inspection

■ Open Check

1. Ignition "OFF" & Engine "OFF".
2. Disconnect TPMS ECU, PCM and ABS ECU connector.
3. Measure resistance between CAN HIGH, LOW terminal of the TPMS ECU harness connector and CAN HIGH, LOW terminal terminal of the PCM harness connector.
4. Measure resistance between CAN HIGH, LOW terminal of the TPMS ECU harness connector and CAN HIGH, LOW terminal terminal of the ABS ECU harness connector.

5. Measure resistance between Vehicle speed in terminal of the PCM harness connector and Vehicle speed out terminal of the ABS ECU harness connector.
6. Measure resistance between FR WSS Power terminal of the ABS ECU harness connector and FR WSS Power terminal of the FR WSS harness connector.
7. Measure resistance between FR WSS Signal terminal of the ABS ECU harness connector and FR WSS Signal terminal of the FR WSS harness connector.

Specification : 0 Ω

8. Is the measured resistance within specifications?

YES	▸ Faulty FR WSS, ABS ECU and PCM may cause this DTC. ▸ Substitute with a known-good component and check for proper operation. If problem is corrected, it's failure should cause this DTC. After doing an appropriate repair, Go to "Verification of Vehicle Repair" procedure.
NO	▸ Repair in speed signal circuit between each control unit harness connector and TPMS receiver harness connector 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 GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using GDS, 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 > Tire Pressure Monitoring System > C1616 CAN Bus Off

General Description

TPM Receiver uses CAN communication line for daignosis tool, receiving vehicle speed signal, sending signal to instrument cluster.
TPM Receiver receives tire imformation form WE sensor and it evaluates and analyzes the data. If it is necessary to inform driver about state of TPMS, the ECU sends messages to the instrument cluster via CAN.

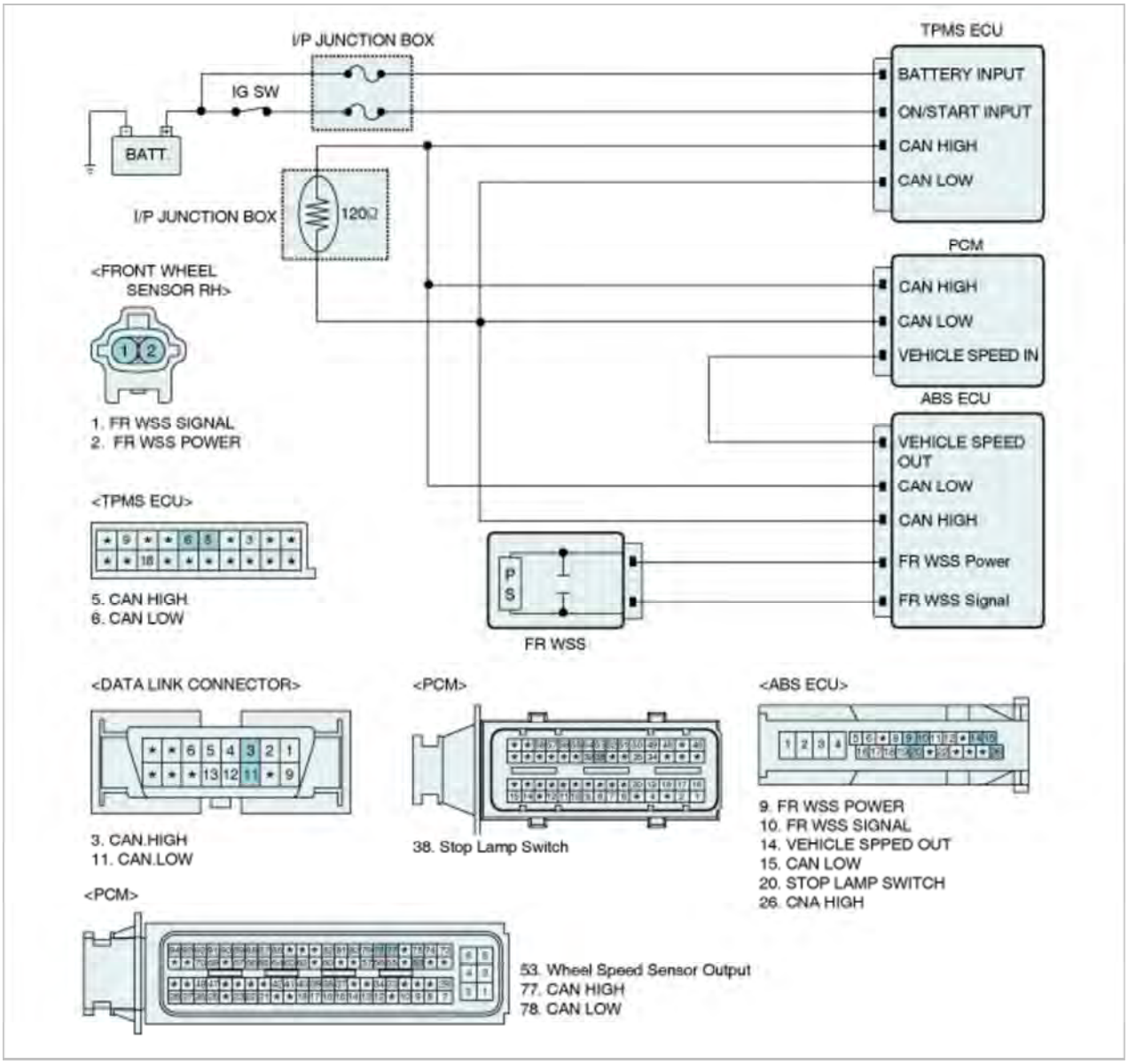
DTC Description

The TPMS ECU checks the CAN communication lines for normal control, and sets this code if CAN controller failed to send or receive message.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check Receiver module	• Open or Short CAN communication line
Enable Conditions	• IGN ON	
Threshold value	• CAN controller counted 10 times from 0 to 256 in 8 increments.	
Mil On conditon	• Not applicable (When the communication fails, MIL goes on by cluster)	

Diagnostic Circuit Diagram



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 "CAN Signal Circuit Inspection" procedure.

CAN Signal Circuit Inspection

■ Short Check (to ground)

1. Ignition "OFF" & Engine "OFF".
2. Disconnect TPMS ECU, PCM and ABS ECU connector.
3. Measure resistance between CAN LOW terminal, CAN HIGH terminal of the TPMS ECU harness connector and chassis ground.

Specification : ∞ Ω

4. Is the measured resistance within specifications?

YES	▸ Go to next procedure.
NO	▸ If abnormal resistance is detected in CAN HIGH circuit, Repair short to ground in CAN HIGH circuit and then go to "Verification of vehicle Repair" procedure. ▸ If abnormal resistance is detected in CAN LOW circuit, Repair short to ground in CAN LOW circuit and then go to "Verification of vehicle Repair" procedure.

■ CAN BUS Resistance Check

1. Ignition "OFF" & Engine "OFF".
2. Disconnect TPMS ECU, PCM and ABS ECU connector.
3. Measure resistance between CAN LOW terminal and CAN HIGH terminal of the TPMS ECU harness connector.

Specification : Approx. 120Ω

4. Is the measured resistance within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ In case of the resistance "approx. 1Ω" : Repair mutual short in CAN signal circuit of the TPMS ECU and then go to "Verification of vehicle Repair" procedure. ▸ In case of the resistance "∞ Ω" : Repair open in CAN signal circuit of the TPMS ECU and then go to "Verification of vehicle Repair" procedure. ▸ In case of the resistance "approx. 120 Ω" : Check the resistances(122Ω) in I/P junction box and ECM, repair as necessary and then go to "Verification of vehicle Repair" procedure.

Component Inspection

1. Set up 'GDS' with 'GDS TPMS'.
2. Select the "TPMS" system.
3. Execute "DTC Analysis" mode and clear DTC.
4. Check the present DTC.
5. Is 'C1616' present ?

YES	▸ Substitute with a known-good TPMS Receiver module and check for proper operation. ▸ If the problem is corrected, replace TPMS Receiver module and go to "Verification of vehicle Repair" procedure.
NO	▸ TPMS receiver complete successful Auto-location. ▸ System is OK.

Verification of Vehicle Repair

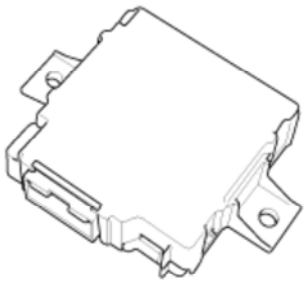
After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using GDS, 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 > Tire Pressure Monitoring System > C1661 Receiver EEPROM Failure

Component Location



General Description

TPM Receiver uses CAN communication line for daignosis tool, receiving vehicle speed signal, sending signal to instrument cluster.
TPM Receiver receives tire imformation form WE sensor and it evaluates and analyzes the data. If it is necessary to inform driver about state of TPMS, the ECU sends messages to the instrument cluster via CAN.

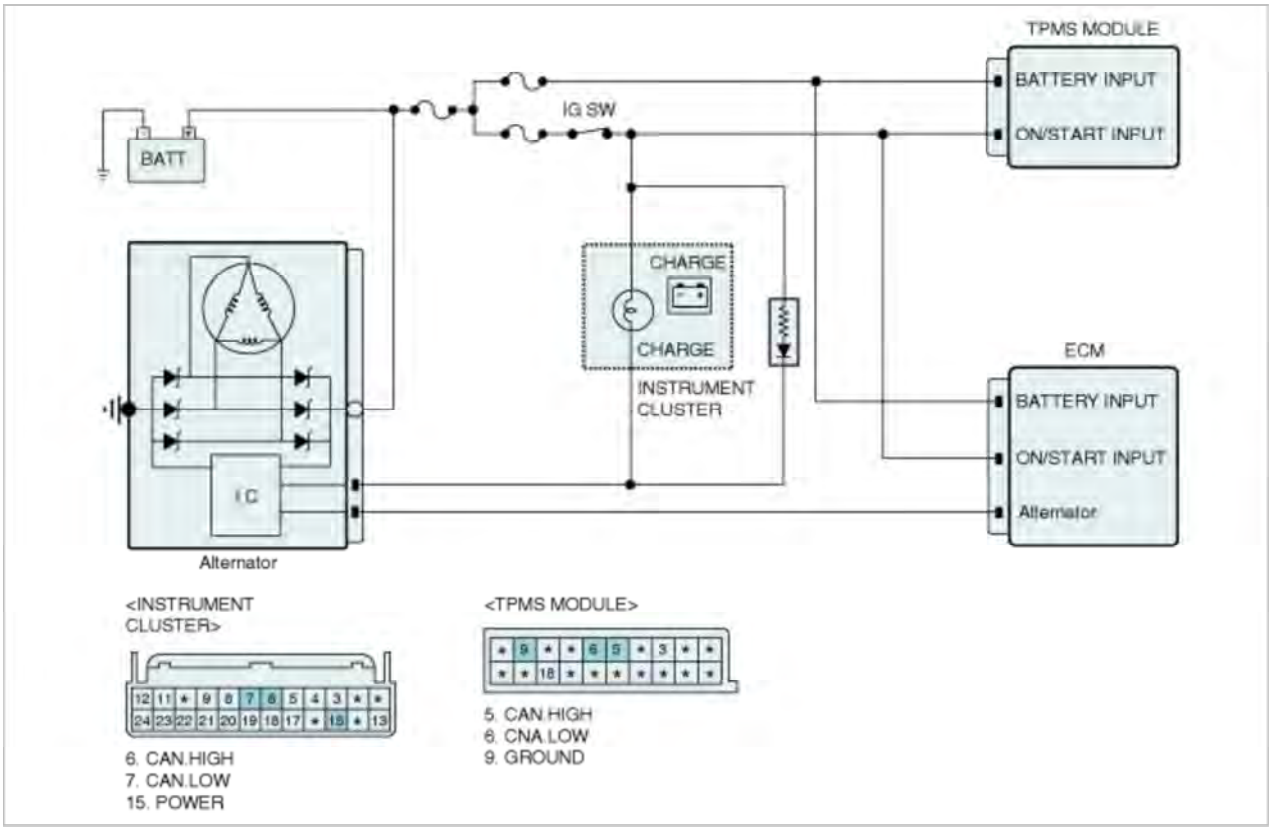
DTC Description

This DTC indicates that the receiver has a problem reading or writing to EEPROM. The most likely cause is TPMS Receiver failure.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check Receiver module	• Faulty TPMS Receiver
Enable Conditions	• IGN ON	
Threshold value	• Writing in the EEPROM was unsuccessful.	
Mil On conditon	• Active DTC set	

Diagnostic Circuit Diagram



Component Inspection

1. Set up 'GDS' with 'GDS TPMS'.
2. Select the "TPMS" system.
3. Execute "DTC Analysis" mode and clear DTC.
4. Check the present DTC.
5. Is 'C1661' present ?

YES	▸ Substitute with a known-good TPMS Receiver module and check for proper operation. ▸ If the problem is corrected, replace TPMS Receiver module and go to "Verification of vehicle Repair" procedure.
NO	▸ System is OK.

Verification of Vehicle Repair

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

1. Connect GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using GDS, 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 > Tire Pressure Monitoring System > C1662 Auto Learning failure

Component Location

General Description

Auto Learning
AL(Auto Learning) starts every time, the vehicle was parked long enough to change or permute wheels(19min), and i straveling again at a speed that ensures that the WE sensors are transmitting. AL is automatically considering all WE identifiers received and extracts, based on statistical evaluation, IDs belonging to the WEs mounted on the vehicle. If new IDs are detected their recurrence will be tracked by AL. When AL is in progress, tire pressure monitoring is running in parallel with the old set of identifiers known from the last run of AL.

DTC Description

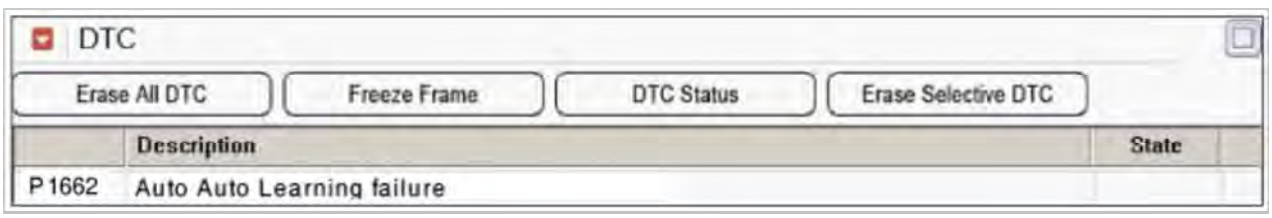
This DTC indicates that A failure of Auto-learning happens when less than WE sensors were learned.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check pulse	• Faulty WE sensor
Enable Conditions	• On start of driving after parking for more than 19min.	
Threshold value	• Auto learning failed and at least one WE sensor is missing.	
Mil On conditon	• Active DTC set	

Monitor Scantool Data

1. Park the vehicle on a level surface.
2. Set up 'GDS' with 'GDS TPMS'.
3. Select the "TPMS" system.
4. Execute "DTC Analysis" mode.
5. Check the present DTC.



6. Are there any DTC's except for 'C1662'?

YES	▸ Do all repairs associated with detected DTC's.
NO	▸ Fault is intermittent. It has been repaired and TPMS receiver module memory is not cleared yet. ▸ 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 GDS and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using GDS, 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.

Steering System > General Information > Specifications

General

Specifications

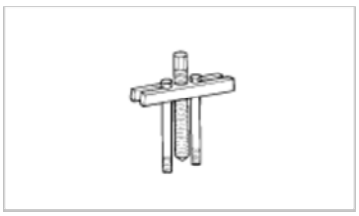
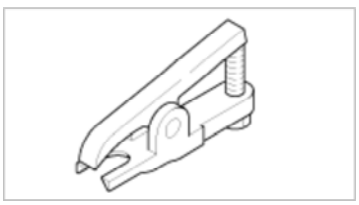
Item		Specification
Type		EPS (Electric Power Steering) system
Steering wheel rotation (Lock to lock)	Vehicles with D2.0 engine or 225 tire	2.58 turns and over
	Others	2.69 turns and over
Steering gear (Rack stroke)	Type	Rack & Pinion
	Vehicles with D2.0 engine or 225 tire	134mm (5.28in.)
	Others	140mm (5.51in.)

Tightening Torques

Items	Tightening torque		
	N.m	kgf.m	lb-ft
Hub nuts	90 ~ 110	9.0 ~ 11.0	65 ~ 80
Steering wheel lock nut	40 ~ 50	4.0 ~ 5.0	29 ~ 36
Steering column mounting bolts and nuts	13 ~ 18	1.3 ~ 1.8	9.4 ~ 13.0
Bolt connecting universal joint to pinion	30 ~ 35	3.0 ~ 3.5	22 ~ 25
Bolt connecting steering column to universal joint	30 ~ 35	3.0 ~ 3.5	22 ~ 25
Tie-rod end castle nut	24 ~ 34	2.4 ~ 3.4	17 ~ 25
Lower arm ball joint bolts	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Steering gear box mounting bolts	60 ~ 80	6.0 ~ 8.0	43 ~ 58
Stabilizer link nut	100 ~ 120	10.0 ~ 12.0	72 ~ 87
Front and Rear roll stopper bolt & nut	50 ~ 65	5.0 ~ 6.5	36 ~ 47
Rear roll stopper mounting bolts	50 ~ 65	5.0 ~ 6.5	36 ~ 47
Sub frame stay mounting bolts & nuts	45 ~ 55	4.5 ~ 5.5	33 ~ 40
Sub frame mounting bolts & nuts	160~ 180	16.0 ~ 18.0	116 ~ 130

Steering System > General Information > Special Service Tools

Special Serveic Tools

Tool (Number and Name)	Illustration	USE
09561-11001 Steering wheel puller		Removal of the steering wheel
09568-34000 Ball joint puller		Removal of the tie rod end ball joint

Steering System > Electric Power Steering > Description and Operation

Description

EPS (Electric power steering, Column assist type) system uses an electric motor to assist the steering force and it is an engine operation independent steering system.
EPS control module controls the motor operation according to information received from the each sensor and CAN (Controller Area Network), resulting in a more precise and timely control of steering assist than conventional engine-driven hydraulic systems.
Components (Steering Angle Sensor, Torque Sensor, Fail-safe relay, etc.) of the EPS system are located inside the steering column & EPS unit assembly and the steering column & EPS unit assembly must not be disassemble to inspect or replace them.

Notes With Regard To Diagnosis

Trouble factor	Check item	Trouble symtom	Explanation	Note
Drop, impact, and overload	Motor	Abnormal noise	- Visable or unvisable damage can occur. The steering wheel could pull to one side by using the dropped parts. - Precise parts of motor/ECU are sensitive to vibration and impact. - Overload can cause unexpected damage	- Do not use the impacted EPS. - Do not overload each parts.
	ECU	Circuit damage - Wrong welding point - Broken PCB - Damaged precise parts		
	Torque sensor	Insufficient steering effort	Overload to INPUT shaft can cause malfunction of the torque sensor	- Do not impact the connecting parts (When inserting and torquing) - Use the specified tool to remove the steering wheel. (Do not hammer on it) - Do not use the impacted EPS
	Shaft	Insufficient steering effort (Uneven between LH and RH)		Do not use the impacted EPS
Pull/Dent	Harness	- Malfunction-impossible power operation - Malfunction of EPS	Disconnection between harness connecting portion and harness	Do not overload the harness
Abnormal storage temperature	Motor/ECU	Abnormal steering effort by improper operation of the motor/ECU	- Waterproof at the normal condition - Even a little moisture can cause malfunction of the precise parts of the motor/ECU	- Keep the normal temperature and proper moisture, while storaging - Avoid drowning

1. Do not impact the electronic parts, if they are dropped or impacted, replace them with new ones.
2. Avoid heat and moisture to the electronic parts.
3. Do not contact the connect terminal to avoid deformation and static electricity.
4. Do not impact the motor and torque sensor parts, if they are dropped or impacted, replace them with new ones.
5. The connector should be disconnected or connected with IG OFF.

Steering System > Electric Power Steering > Repair procedures

General Inspection

After or before servicing the EPS system, perform the troubleshooting and test procedure as follows. Compare the system condition with normal condition in the table below and if abnormal symptom is detected, perform necessary remedy and inspection.

Test condition	Normal condition: Motor must not supply steering assist.		
	Symptom	Possible cause	Remedy
IG Off	Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		IG power supplies	Inspect the IG power supply line.

Test condition	Normal condition: Motor must not supply steering assist, Warning lamp is illuminated.		
	Symptom	Possible cause	Remedy
IG On/Engine Off	Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		EMS CAN signal is not received.	Inspect the CAN line.
	Warning lamp is not illuminated.	Cluster fault	Inspect the cluster and cluster harness

Test condition	Normal condition: Motor supplies steering assist, Warning lamp is not illuminated.		
	Symptom	Possible cause	Remedy
IG On/Engine On	Warning lamp is illuminated and Motor dose not supply steering assist.	EPS (Hot at all times) and IG power supply fault	Inspect the connector and harness for EPS (Hot at all times) and IG power supply line.
		DTC is detected by system.	Perform the self test using a scan tool and repair or replace.
	Warning lamp is illuminated and Motor supplies steering assist.	ASP is not calibrated.	Perform the ASP calibration using a scan tool.
		CAN communication between EPS and cluster is fault.	Inspect the CAN line.

ASP: Absolute Steering Position
CAN: Controller Area Network
EMS: Engine Management System

CAUTION

The following symptoms may be occurred during normal vehicle operation and if there is no EPS warning light illumination, it is not malfunction of EPS system.

- After turning the ignition switch on, the steering wheel becomes heavier while it performs EPS system diagnostics, for about 2 seconds, then it becomes normal steering condition.
- After turning the ignition switch on or off, EPS relay noise may occur but it is normal.
- When it is steered, while the vehicle is stopped or in low driving speed, motor noise may occur but it is normal operating one.

Caution when ASP (Absolute Steering Position) calibration or EPS type recognition

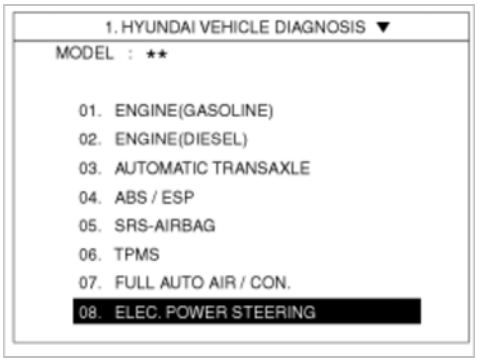
- Check if the battery is fully charged before ASP calibration or EPS type recognition.
- Be careful not to disconnect any cables connected to the vehicle or scan tool during ASP calibration or EPS type recognition.
- When the ASP calibration or EPS type recognition is completed, turn the ignition switch off and wait for several seconds, then start the engine to confirm normal operation of the vehicle.

Scan tool (Hi-Scan Pro) installation

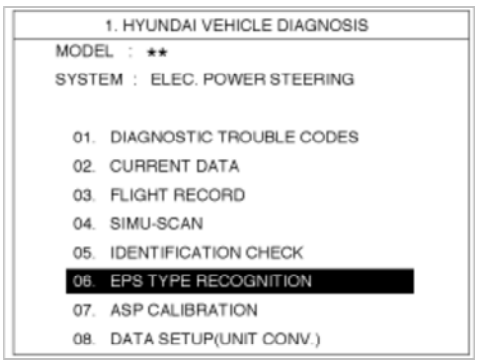
1. Attach the CAN interface module to the Hi-Scan Pro main body and securely tighten the two bolts.
2. Install the CAN interface module to the Data Link Cable and securely tighten the two bolts.

ASP calibration procedure

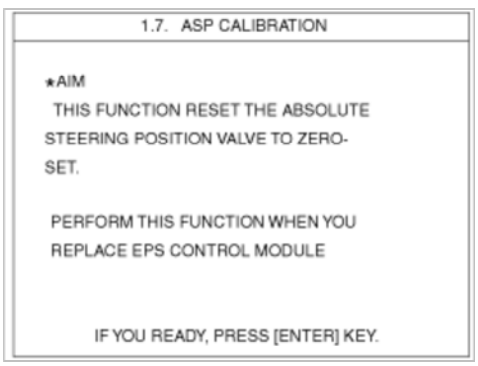
1. Plug DLC cable from a scan tool into the vehicle's data link connector located under the instrument panel on the driver's side.
2. Turn the ignition switch ON position.
3. Turn the steering wheel so that the front wheel can face straight ahead.
4. Select a model and ELECTRIC POWER STEERING.



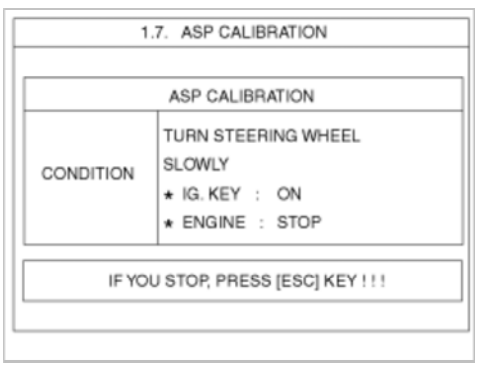
5. Select the ASP CALIBRATION and press ENTER.



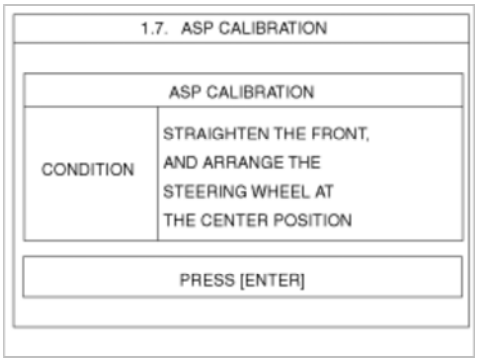
6. Check the massage on the screen and press ENTER'.



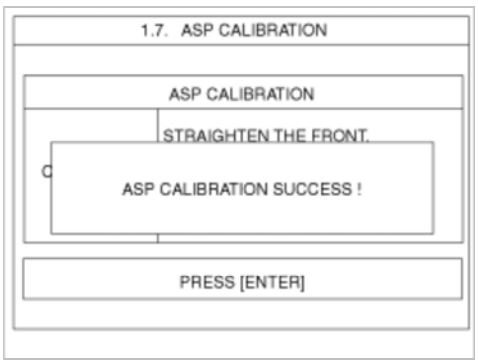
7. Confirm the vehicle condition (IG On) and then turn the steering wheel until massage changes to the next screen.



8. When the massage is displayed on the screen as follows, turn the steering wheel so that the front wheel can face straight ahead and then press ENTER.

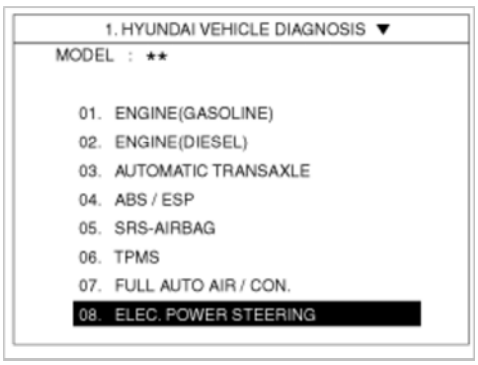


9. When the calibration is completed, the massage will be displayed on the screen as follows.

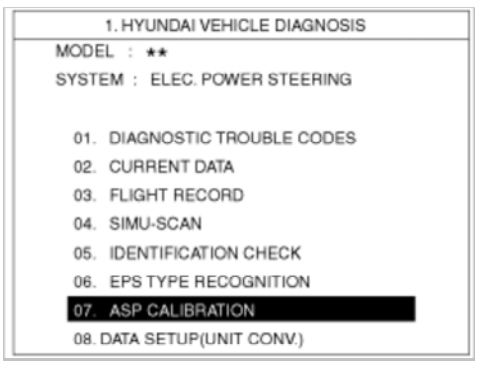


EPS type recognition procedure

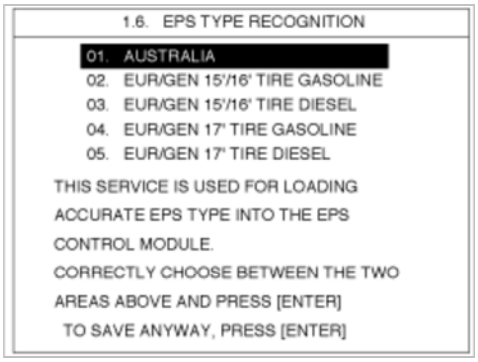
1. Plug DLC cable from a scan tool into the vehicle's data link connector located under the instrument panel on the driver's side.
2. Turn the ignition switch ON position.
3. Select a model and ELECTRIC POWER STEERING.



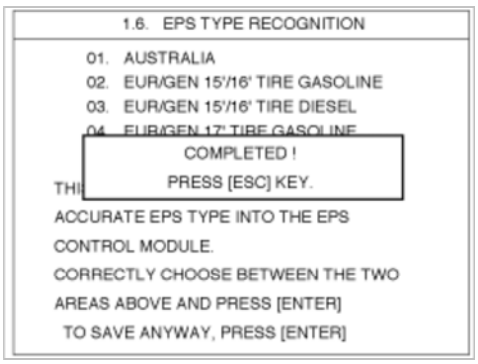
4. Select the EPS type recognition and press ENTER.



5. Select the affected area and press ENTER.

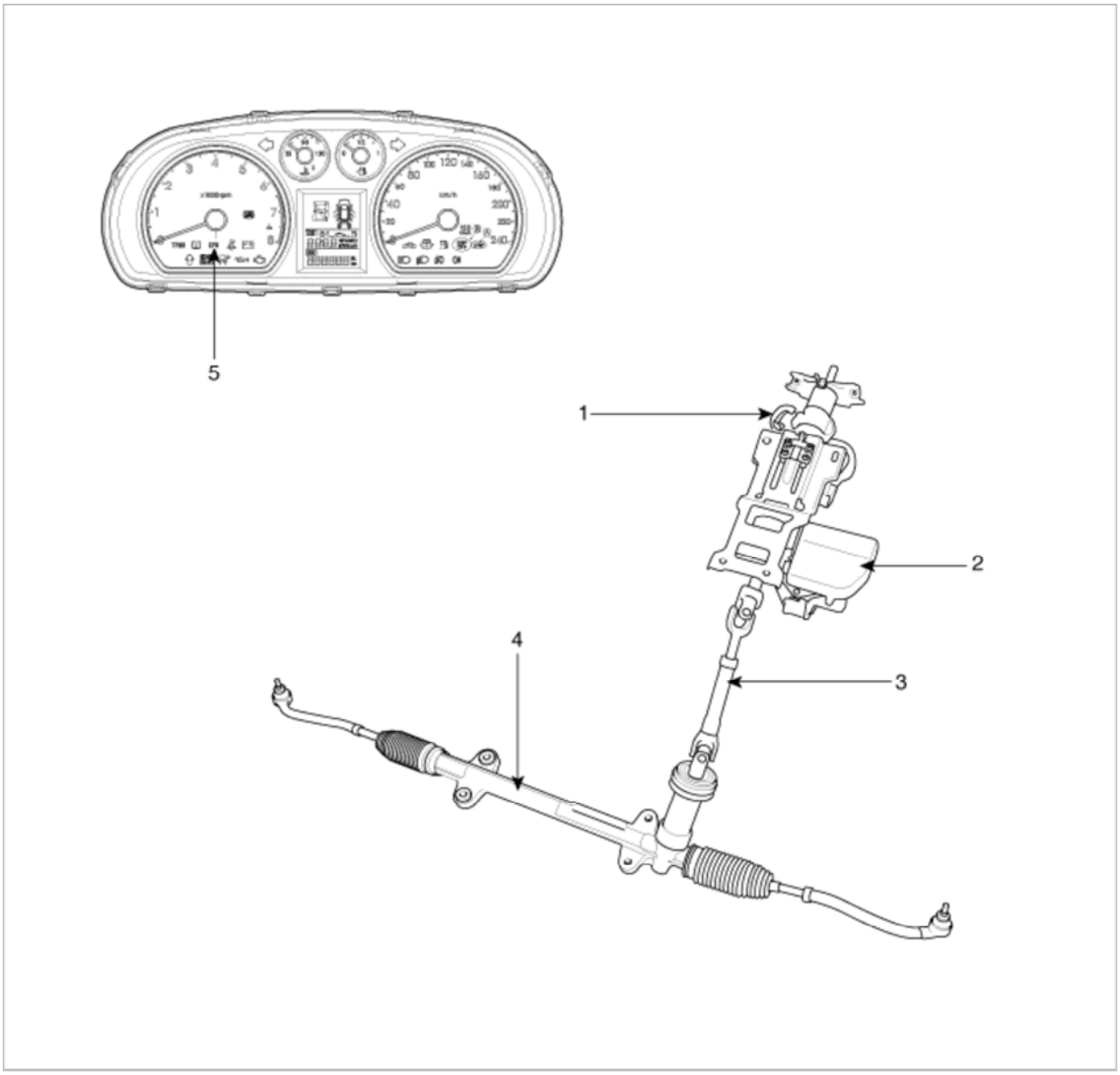


6. When the EPS type recognition is completed, the massage will be displayed on the screen as follows.



Steering System > Electric Power Steering > Components and Components Location

Components

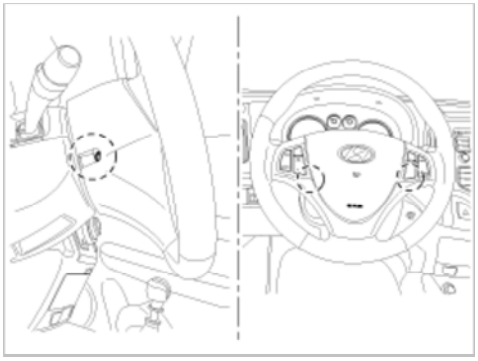


1. Key lock assembly 2. Steering column & EPS unit assembly 3. Universal joint assembly	4. Steering gear box 5. EPS warning lamp

Steering System > Electric Power Steering > Steering Column and Shaft > Repair procedures

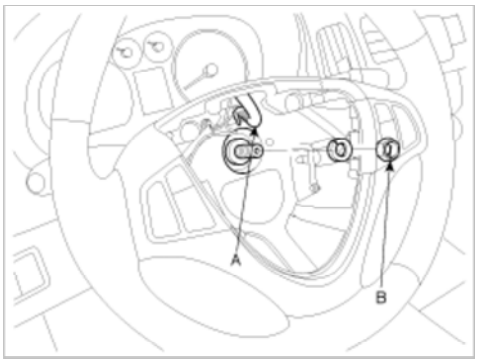
Removal

1. Disconnect the battery negative cable from the battery and then wait for 30 seconds.
2. Turn the steering wheel so that the front wheels can face straight ahead.
3. Loosen the torx bolts which are located on the both side of the steering wheel.



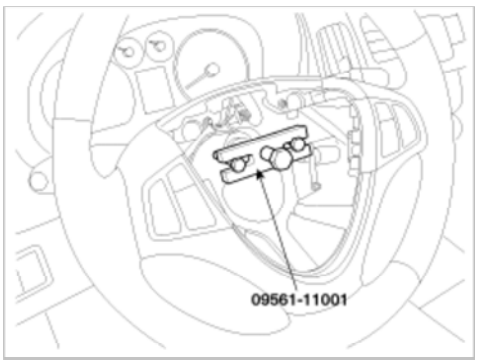
4. Disconnect the connector (A) from the airbag module and then remove the airbag module (B) from the steering wheel.

5. Disconnect the remote switch connector (A) and remove the steering wheel lock nut (B) and washer.

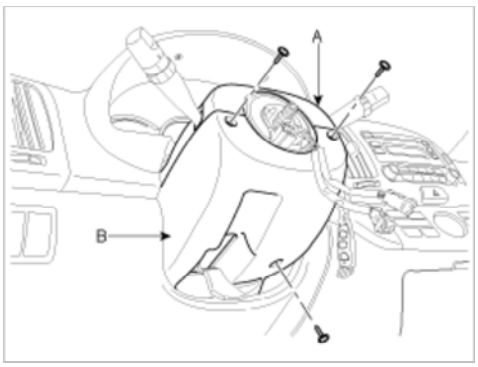


6. Remove the steering wheel from the steering column shaft by using a SST (09561-11001).

> **CAUTION**
>
> Do not hammer on the steering wheel to remove it; it may damage the steering column & EPS unit.

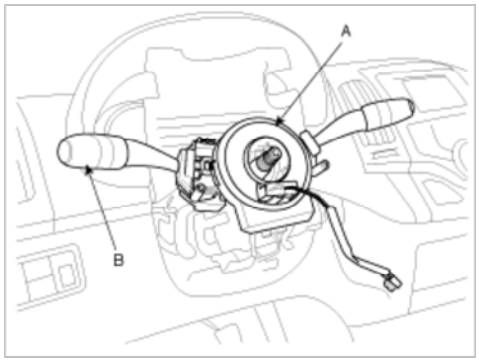


7. Remove the steering column upper (A) and lower (B) shroud.

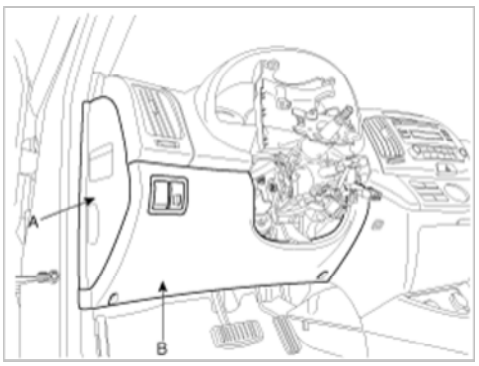


> **CAUTION**
>
> When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

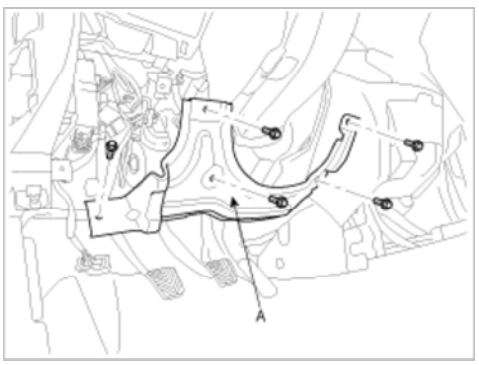
8. Disconnect the connectors from the lower portion of the clock spring and then remove the clock spring (A) from the steering column shaft.
9. Remove the multifunction switches (B) from the steering column with the portion indicated by the arrow pressed.



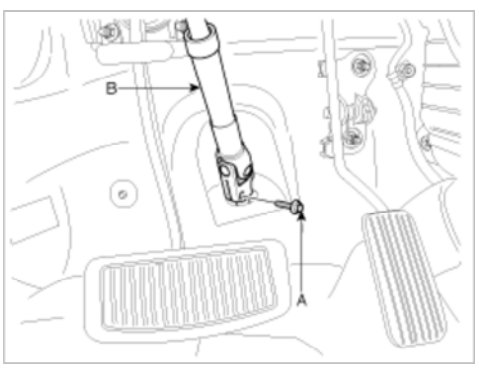
10. Remove the lower side panel (A) and crash pad (B).



11. Remove the reinforce panel (A).

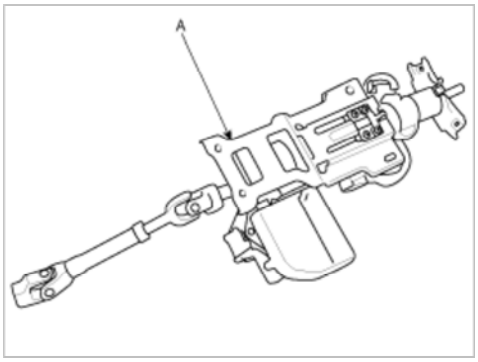


12. Loosen the bolt (A) and then disconnect the universal joint assembly (B) from the pinion of the steering gear box.



> **CAUTION**
>
> Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

13. Disconnect all connectors connected to the steering column & EPS unit assembly.
14. Remove the steering column & EPS unit assembly (A) by loosening the mounting bolts and nuts.

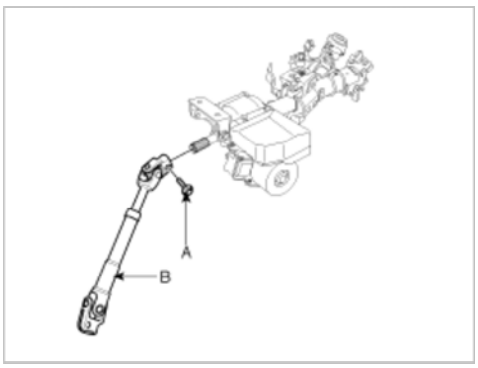


Disassembly and Reassembly

> **CAUTION**
>
> Do not disassemble the steering column & EPS unit assembly.

1. Loosen the bolt (A) and then disconnect the universal joint assembly (B) from the steering column assembly.

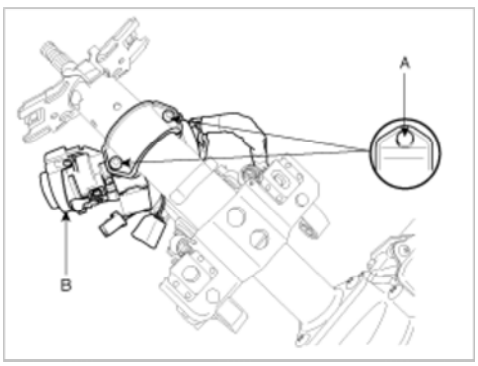
   Tightening torque :
   30 ~ 35N.m (3.0 ~ 3.5kgf.m, 22 ~ 25lb-ft)



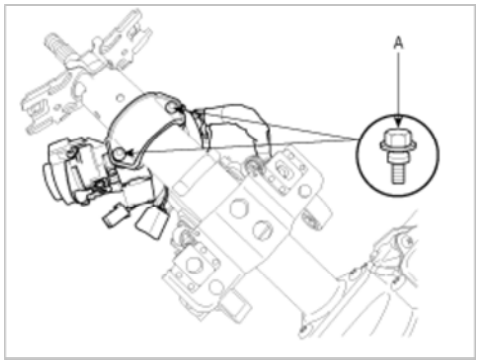
2. Make a groove the head of special bolts (A) by a punch.

   > **CAUTION**
   >
   > Do not impact the steering column mounting bracket and EPS unit.

3. Loosen the special bolts by using screw driver and than remove the key lock assembly (B) from the steering column assembly.



4. Reassembly is the reverse of the disassembly. When reassembling the key lock assembly, install the key lock assembly to the steering column and then tighten new special bolts until its head (A) is cut off.



Inspection

1. Check the steering column for damage and deformation.
2. Check the connection for play, damage and smooth operation.
3. Check the join bearing for damage and wear.
4. Check the tilt bracket for damage and cracks.
5. Check the key lock assembly for proper operation and replace it if necessary.

Installation

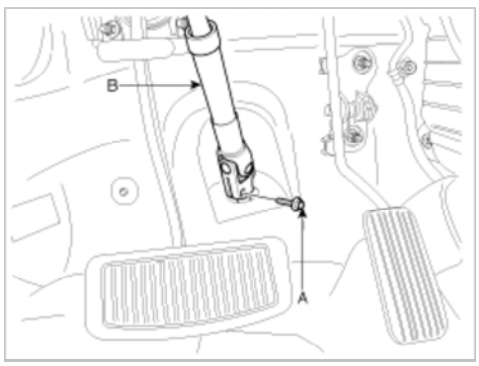
> **CAUTION**
>
> Apply the multipurpose grease to sliding surface of the each part before the installation.

1. Install the steering column & universal joint assembly by tightening the bolts and nuts.

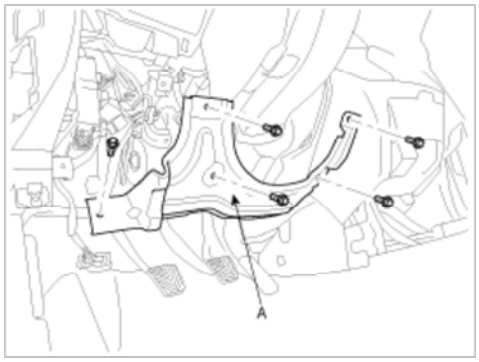
Tightening torque :
13 ~ 18N.m (1.3 ~ 1.8kgf.m, 9.4 ~ 13.0lb-ft)

2. Connect all connectors connected to the steering column & EPS unit assembly.
3. Connect the universal joint assembly (B) to pinion of the steering gear box and then tighten the bolt (A).

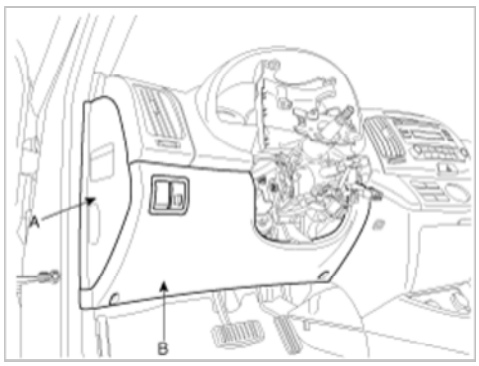
Tightening torque :
30 ~ 35N.m (3.0 ~ 3.5kgf.m, 22 ~ 25lb-ft)



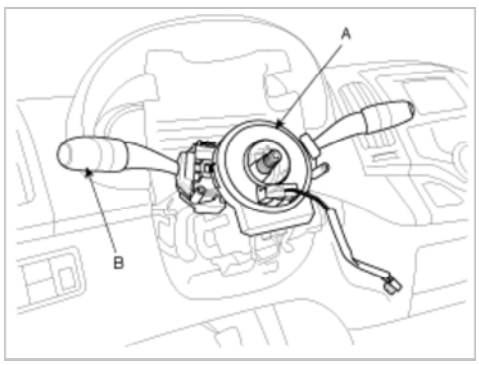
4. Install the reinforce panel (A).



5. Install the lower crash pad (A) & side panel.



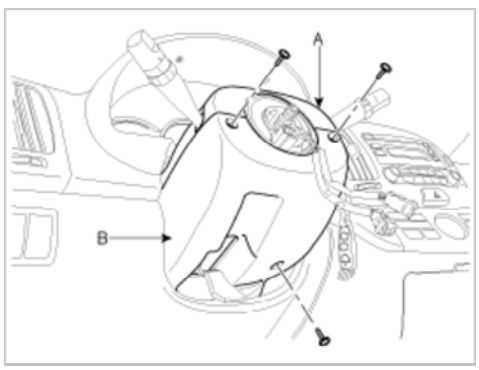
6. Install the multifunction switches (B) to steering column.
7. Install the clock spring (B) to steering column assembly and then connect the connectors (A).



CAUTION

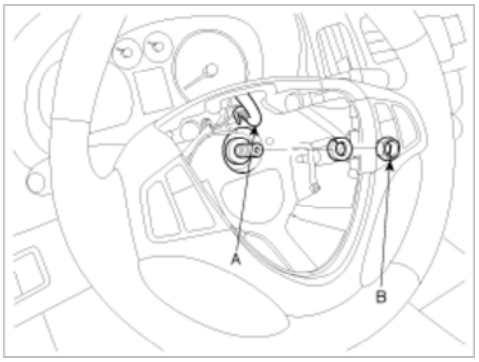
When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

8. Install the steering column upper (A) and lower (B) shroud.

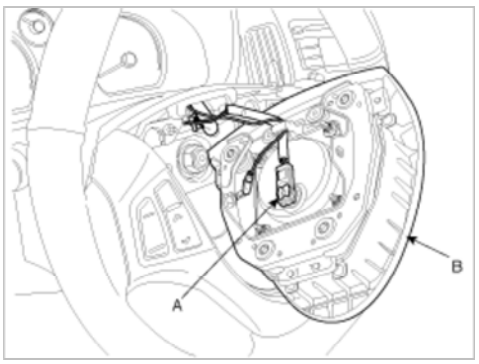


9. Connect the remote switch connector (A).
10. Install the steering wheel to the steering column shaft and then tighten the lock nut (B) and the washer together.

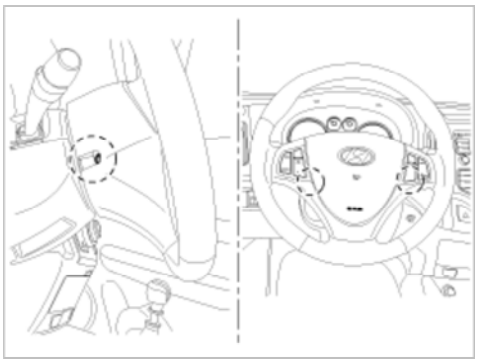
Tightening torque :
40 ~ 50N.m (4.0 ~ 5.0kgf.m, 29 ~ 36lb-ft)



11. Connect the connector (A) to air bag module and then install the airbag module (B) to steering wheel.



12. Tighten the torx bolts which are located on the both side of the steering wheel.

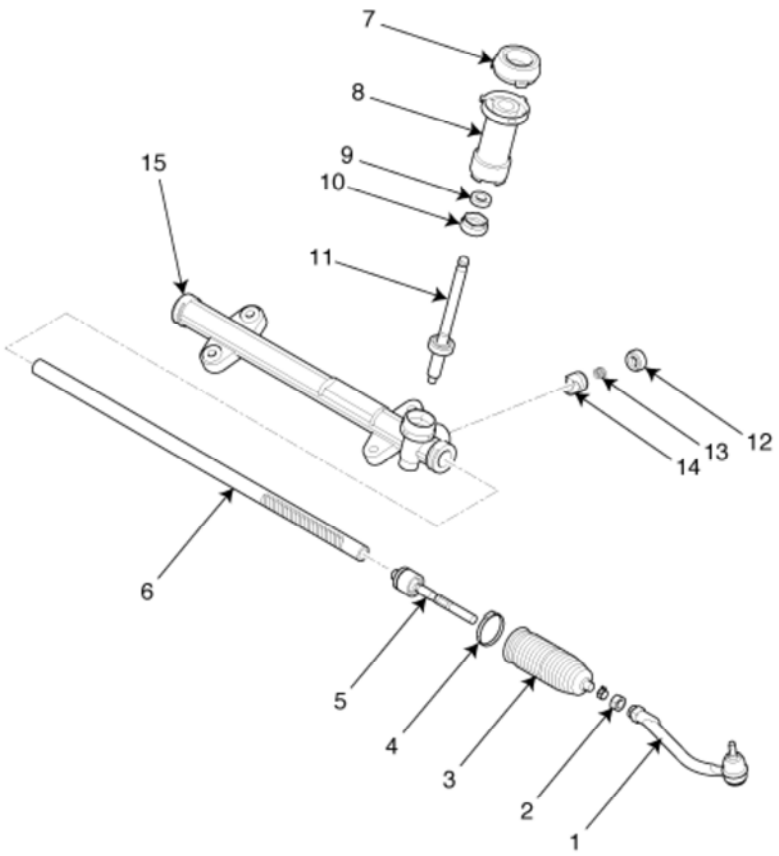


13. Connect the battery negative cable to the battery.
14. Check and adjust the front wheel alignment. (Refer to SS group)
15. When the steering column & EPS unit assembly is replaced, perform EPS type recognition procedure using a scan tool. (Refer to EPS type recognition)
16. Perform the ASP (Absolute Steering Position) calibration procedure. (Refer to ASP calibration)

> **CAUTION**
>
> If the ASP calibration procedure is not performed. EPS warning lamp will be turned on or flicker and vehicle may pull to the left or the right.

Steering System > Electric Power Steering > Steering Gear box > Components and Components Location

Steering Gear Box

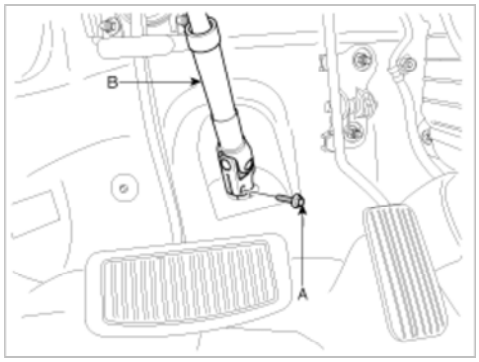


1. Tie rod end	6. Rack bar	11. Pinion assembly
2. Lock nut	7. Dust packing	12. Yoke plug
3. Bellows band	8. Dust cap	13. Yoke spring
4. Bellows	9. Oil seal	14. Support yoke assembly
5. Tie rod	10. Pinion plug	15. Rack housing

Steering System > Electric Power Steering > Steering Gear box > Repair procedures

Removal

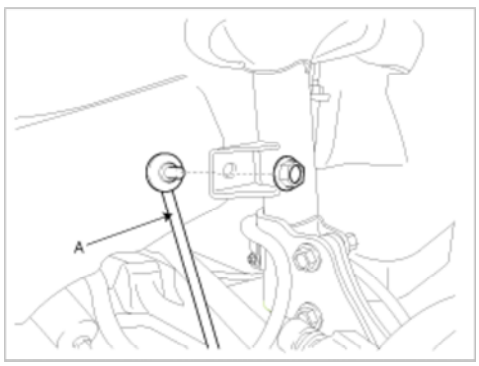
1. Remove the front wheel & tire.
2. Loosen the bolt (A) and then disconnect the universal joint assembly (B) with the pinion of the steering gear box.



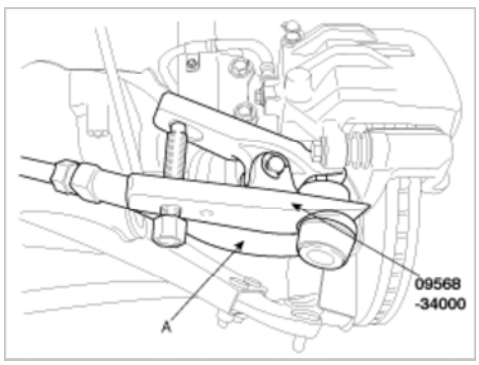
CAUTION

Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

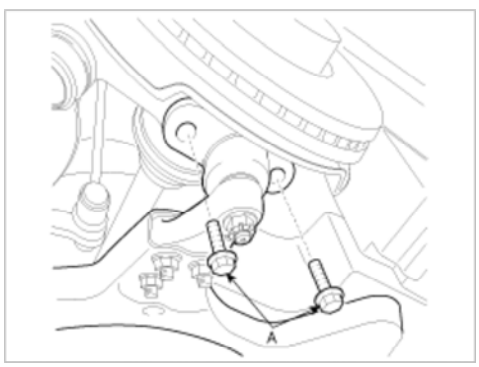
3. Disconnect the stabilizer link (A) from the front strut assembly by loosening the nut.



4. Remove the split pin and castle nut and then disconnect the tie rod end (A) with the knuckle by using a SST (09568-34000).

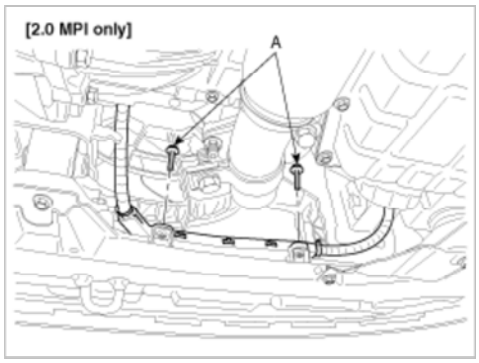


5. Disconnect the front lower arm with the knuckle by loosening the mounting bolts (A).

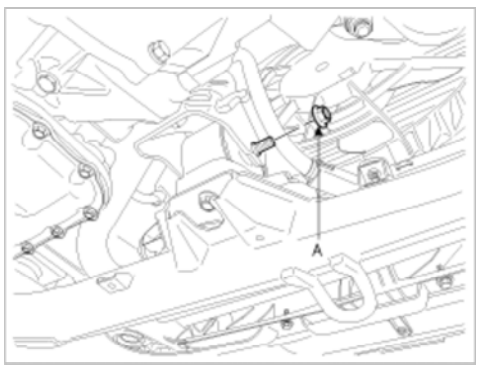


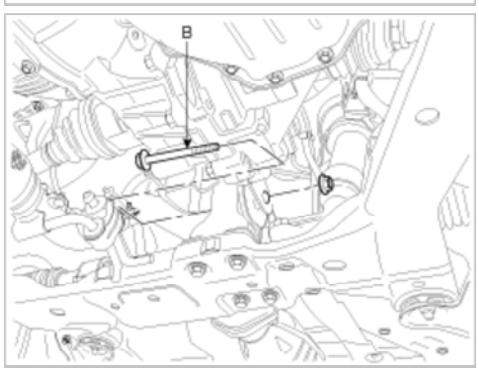
6. Remove the muffler rubber hanger (A).

7. Loosen the wiring harness protector bolts (A).

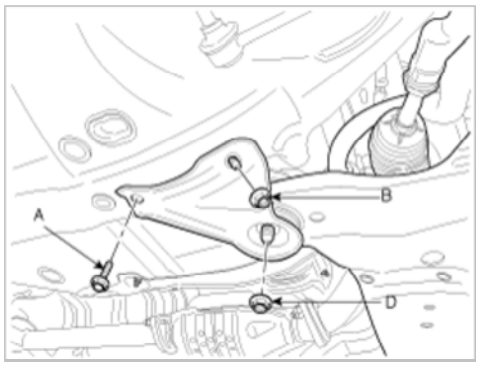


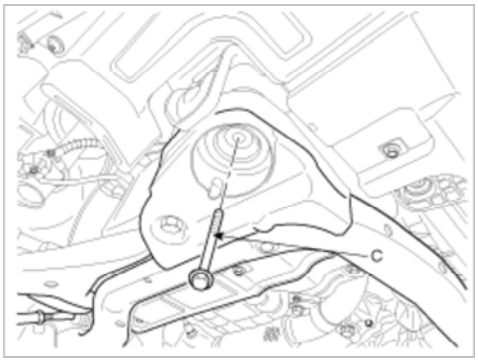
8. Remove the front and rear roll stopper bolt and nut (A, B).

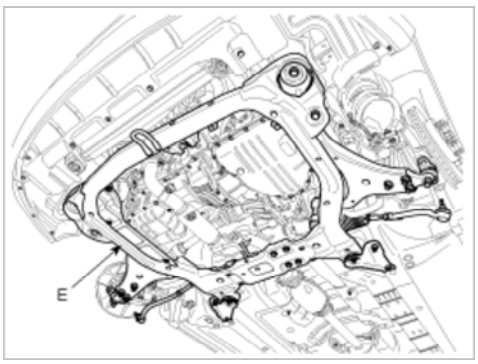




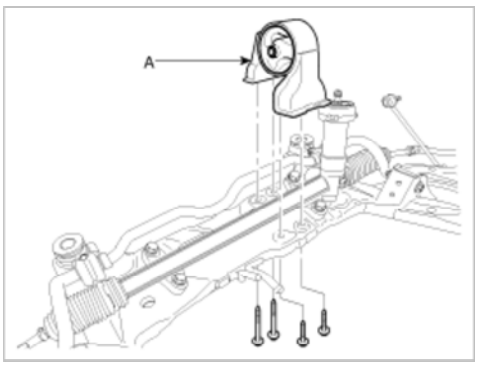
9. Remove the sub frame (E) and sub frame stay by loosening the mounting bolts (A, C) and nuts (B, D).



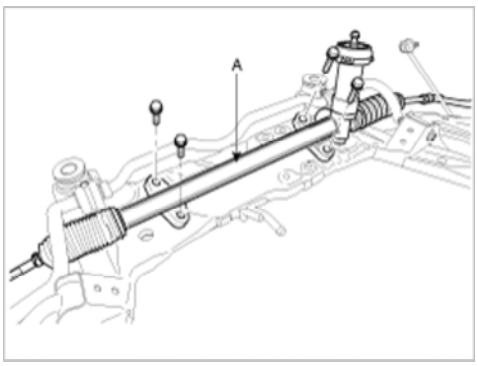




10. Remove the rear roll stopper (A) from the sub frame by loosening mounting bolts.

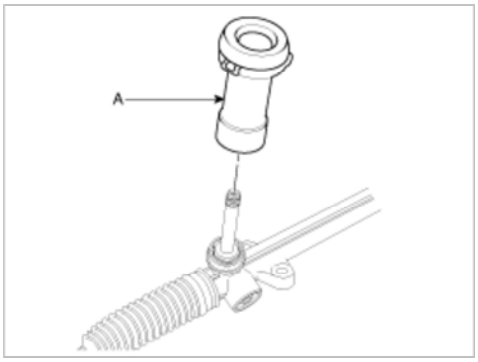


11. Remove the steering gear box (A) from the sub frame by loosening the mounting bolts.

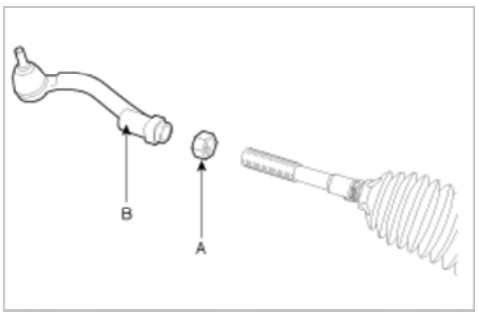


Disassembly

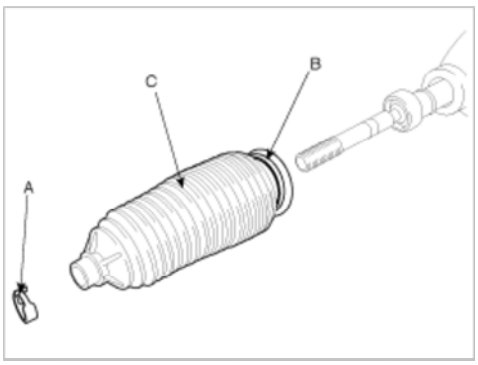
1. Remove the dust packing & cap (A) from the pinion housing.



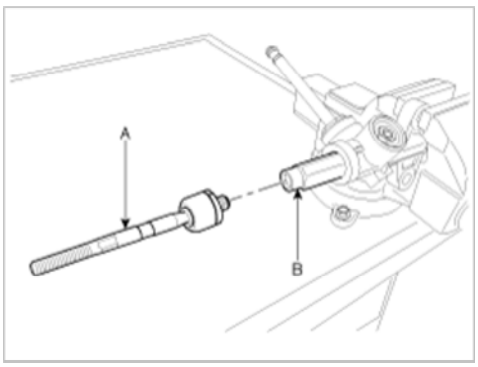
2. Loosen the lock nut and then remove the tie rod end (B) and lock nut (A) from the tie rod.



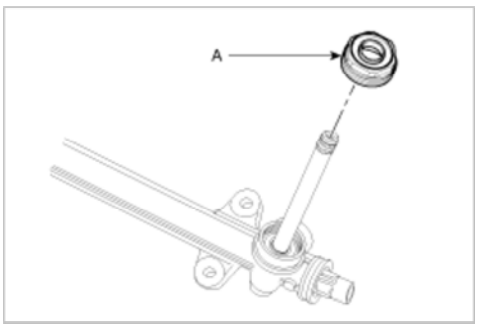
3. Remove the bellows clip (A) and band (B) and then pull the bellows (C) away from the end of the tie rod.



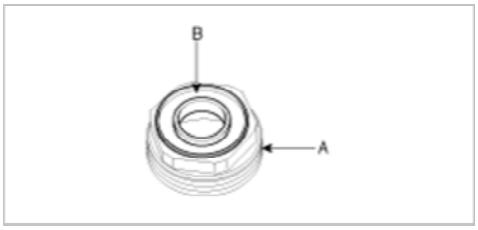
4. Remove the tie rod (B) from the rack bar (A) by unscrewing the tie rod inner ball joint.



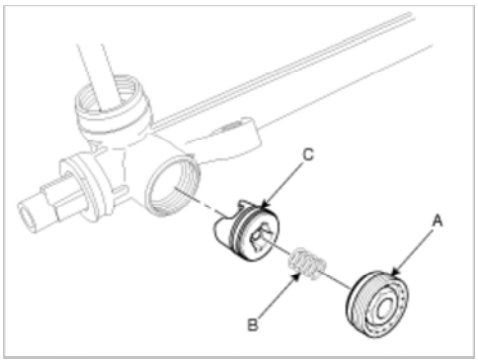
5. Remove the plug (A) from the pinion housing.



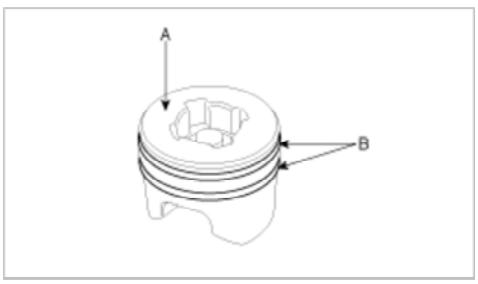
6. Remove the oil seal (B) from the plug (A).



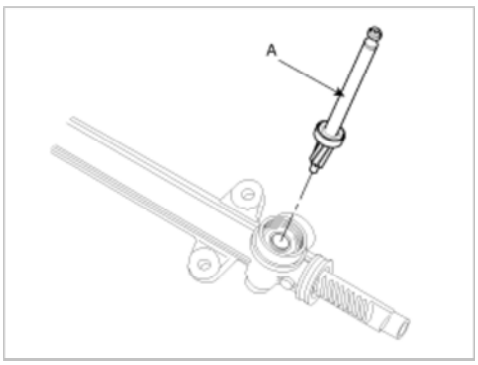
7. Remove the yoke plug (A) and spring (B) and then pull out the support yoke (C).



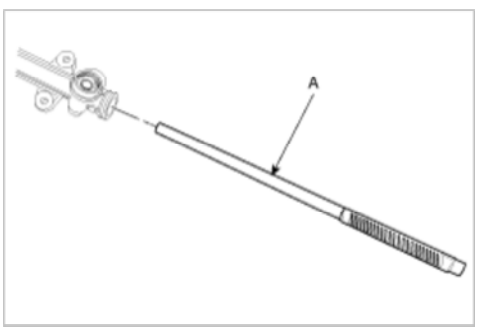
8. Remove the O-rings (B) from the support yoke assembly (A).



9. Pull the pinion assembly (A) out of the pinion housing.



10. Pull the rack bar (A) out of the rack housing.



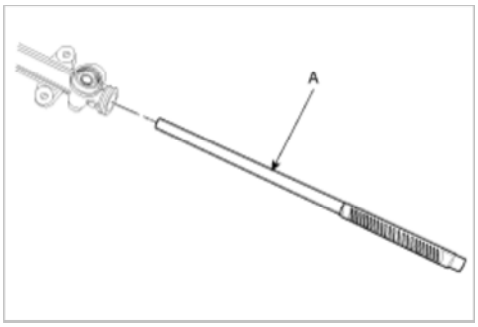
Inspection

1. Rack bar
   A. Check the rack gear for damage.
   B. Check the rack bar for bend and deformation.

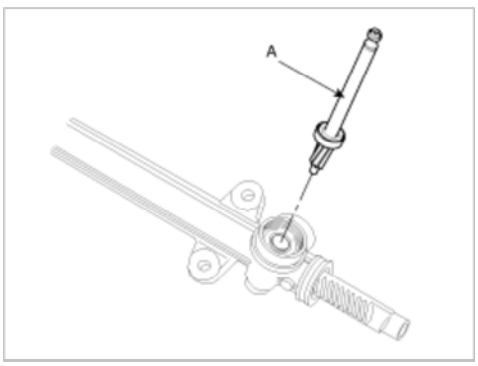
2. Pinion assembly
   A. Check the pinion gear for damage.
   B. Check the surface contacting the oil seal for damage.
   C. Check the oil seal for damage.
3. Check the inside of rack housing for damage.
4. Check the bellows for being torn.

Reassembly

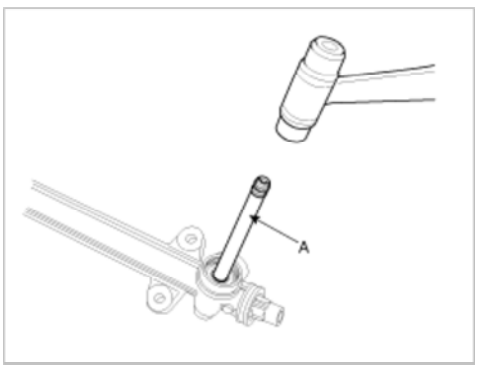
1. Apply the grease to rack gear teeth and then insert the rack bar (A) into the rack hosing.



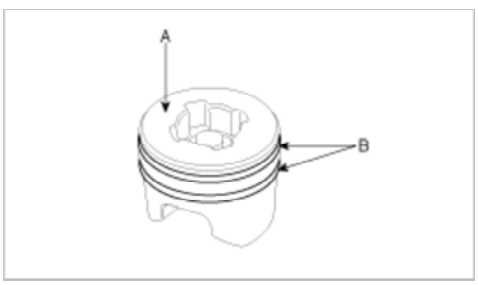
2. Insert the pinion assembly (A) into the pinion housing.



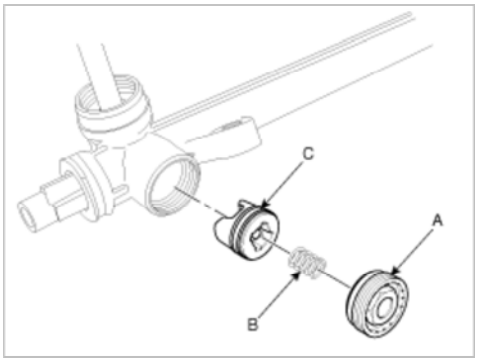
3. Tap the top of the pinion assembly with a plastic hammer to seat the pinion assembly thoroughly.



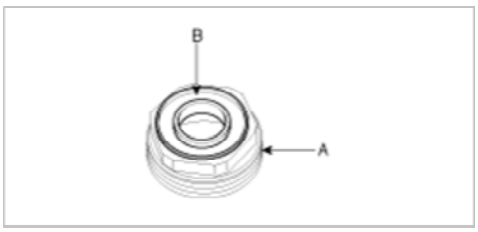
4. Assemble new O-rings (B) to support yoke (A).



5. Insert the support yoke assembly (C) into the housing.
6. Apply the sealant to the thread of the yoke plug and then assemble the yoke plug (A) and the yoke spring (B) together.

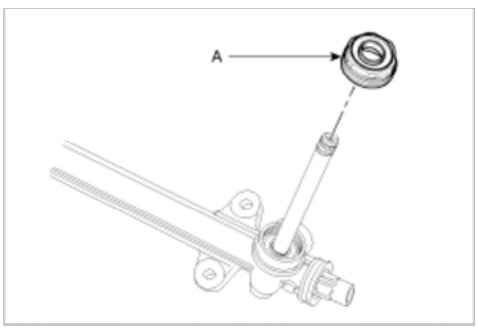


7. Apply the grease to the edge of the new oil seal (B) and then assemble it to the pinion plug (A).



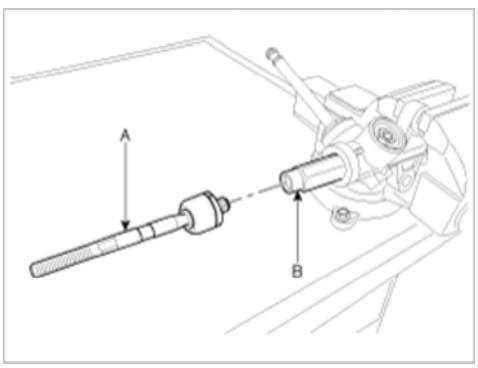
8. Apply the sealant to the thread of the plug and then assemble the pinion plug (A) to the housing.

Tightening torque :
60 ~ 80N.m (6.0 ~ 8.0kgf.m, 43 ~ 58lb-ft)

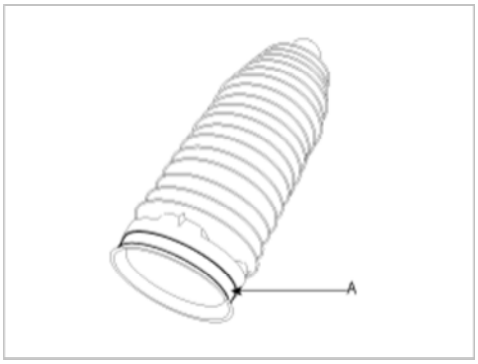


9. Apply loctite (Three bond-1374) to the thread of the tie rod inner ball joint and then assemble the tie rod (A) to the rack bar (B).

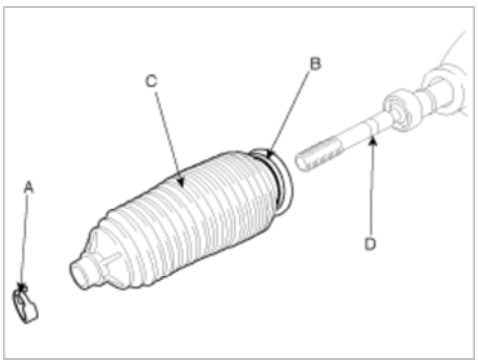
Tightening torque :
110 ~ 130N.m (11.0 ~ 13.0kgf.m, 65 ~ 94lb-ft)



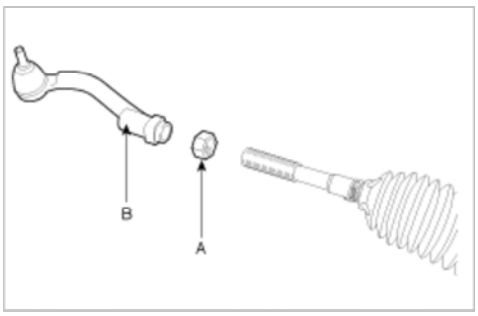
10. Assemble new bellows band (A) to the bellows.



11. Apply the grease (Kyoto Yushi-One Luber2128 to the portion (D) of the tie-rod.
12. Apply the sealant (Three bond-1141E) to the bellows mating surface of therack housing.
13. Assemble the bellows (C) to rack housing and then tighten the bellows clip (A) and band (B).



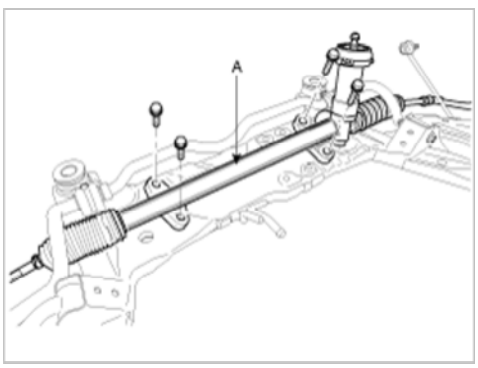
14. Assemble the lock nut (A) and tie rod end (B) to tie rod.



Installation

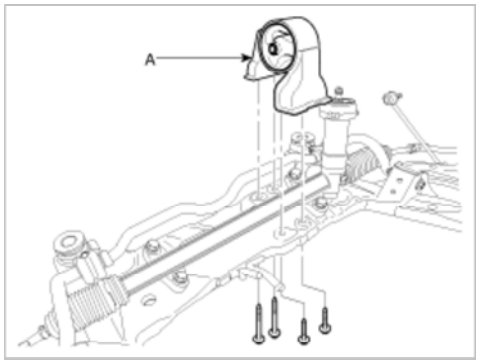
1. Install the steering gear box (A) to the sub frame by tightening the mounting bolts.

Tightening torque :
60 ~ 80N.m (6.0 ~ 8.0kgf.m, 43 ~ 58lb-ft)



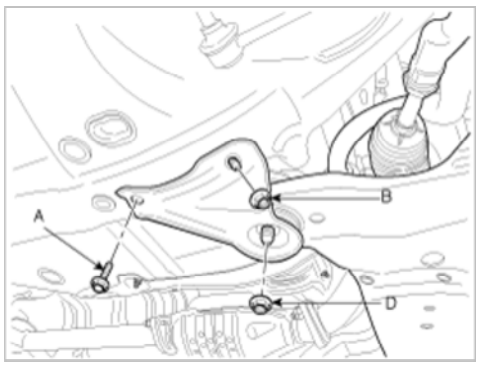
2. Install the rear roll stopper (A) to the sub frame by tightening the mounting bolts.

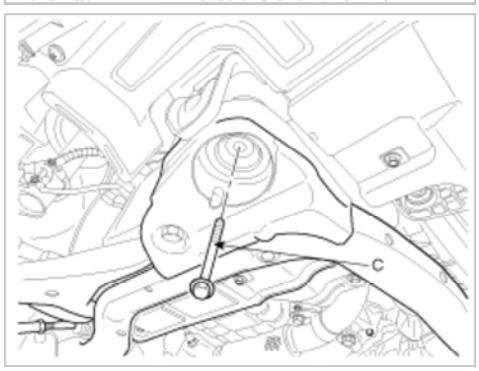
Tightening torque :
50 ~ 65N.m (5.0 ~ 6.5kgf.m, 36 ~ 47lb-ft)

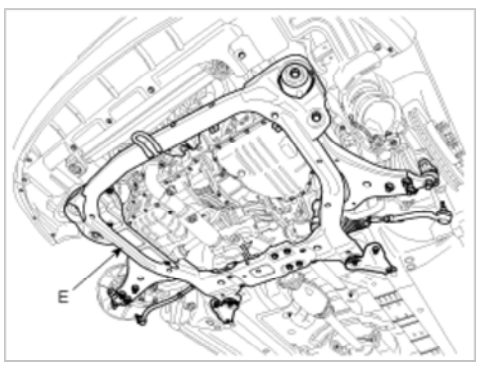


3. Install the sub frame (E) and sub frame stay by tightening the mounting bolts (A, C) and nuts (B, D).

Tightening torque
Sub frame mounting bolts (C) and nuts (D):
160 ~ 180N.m (16.0 ~ 18.0kgf.m, 116 ~ 130lb-ft)
Sub frame stay mounting bolt (A) and nut (B):
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)

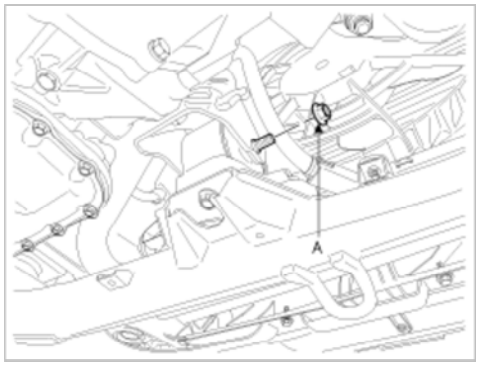


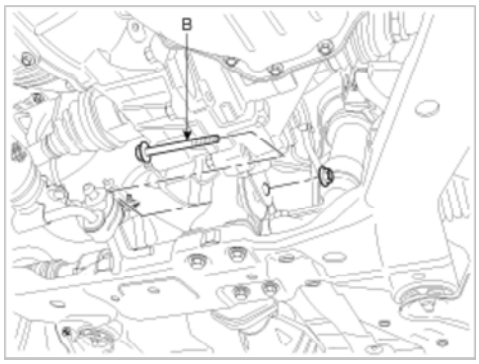




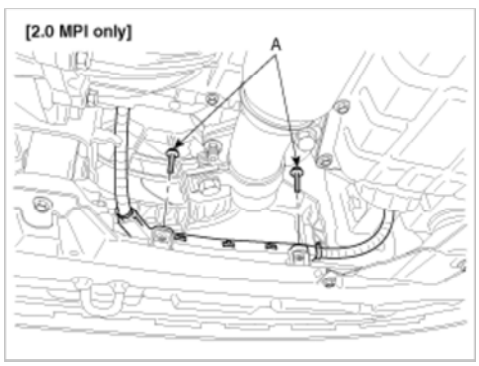
4. Tighten the front and rear roll stopper bolt and nut (A, B).

Tightening torque :
50 ~ 65N.m (5.0 ~ 6.5kgf.m, 36 ~ 47lb-ft)





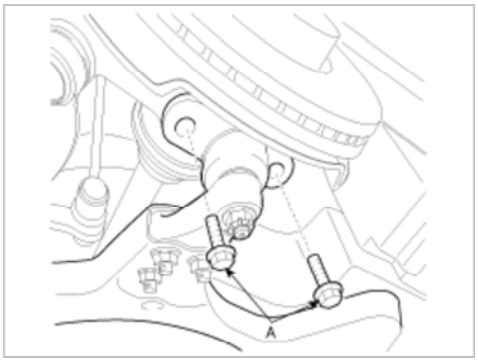
5. Install the wiring harness protector to the sub-frame by tightening the bolts (A).



6. Install the muffler rubber hanger (A).

7. Connect the lower arm with the knuckle by tightening the bolts (A).

Tightening torque :
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

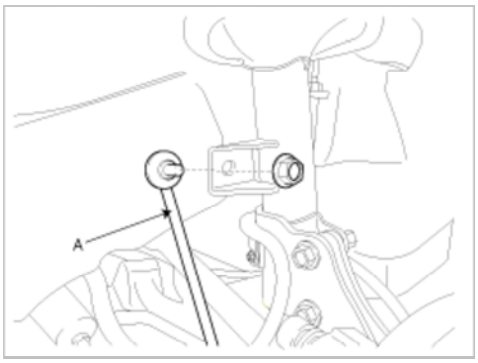


8. Connect the tie rod end with the knuckle and then install the castle nut and split pin.

Tightening torque :
24 ~ 34N.m (2.4 ~3.4kgf.m, 17 ~ 25lb-ft)

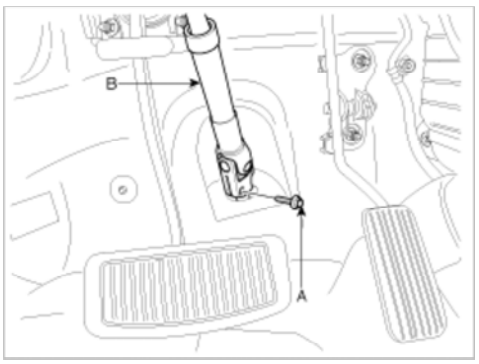
9. Connect the stabilizer link (A) with the front strut assembly and than tighten the nut.

Tightening torque :
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



10. Connect the universal joint assembly (B) with the pinion of the steering gear box and then tighten the bolt (A).

Tightening torque :
30 ~ 35N.m (3.0 ~ 3.5kgf.m, 22 ~ 25lb-ft)



11. Install the front wheel & tire.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

12. Check and adjust the front wheel alignment. (Refer to SS group)
13. Perform the ASP (Absoulte Steering Position) calibration procedure. (Refer to ASP calibration)

> CAUTION
>
> If the ASP calibration procedure is not performed, EPS warning lamp will be turned on or flicker and behicle may pull to the left or the right.

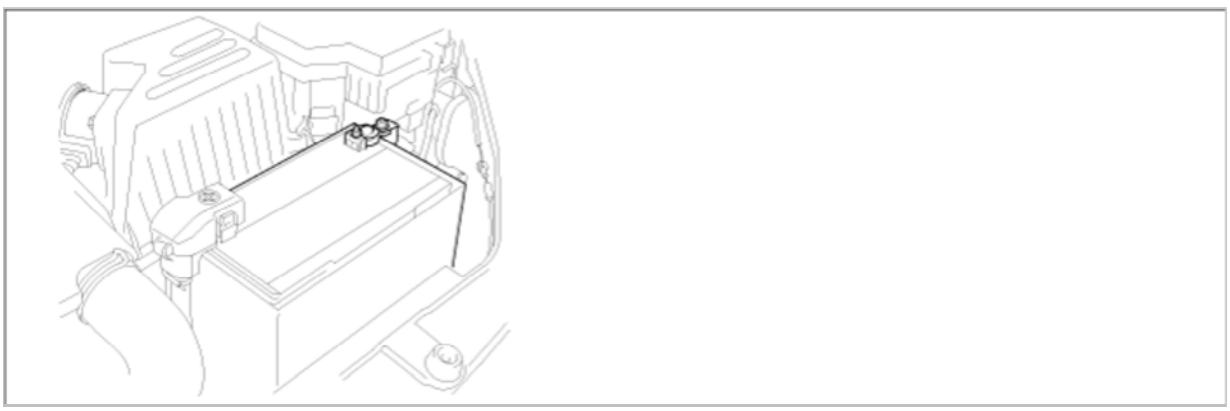
Steering System > Electric Power Steering > Troubleshooting

Diagnostic Trouble Code Chart(dtc)

DTC CODE	Trouble description
C1101	Battery Voltage High
C1102	Battery Voltage Low
C1103	Battery Voltage Out of Range
C1259	Steering Angle Sensor - Electrical Malfunction
C1261	Steering Angle Sensor Not Calibrated
C1290	Torque sensor main signal fail
C1603	Sensor CAN hardware error
C1604	ECU Hardware Error
C1611	CAN time - out ECM
C1616	CAN Bus off
C1617	EMS Invalid Engine Speed
C1700	Byte Coding Error
C1702	Variant Coding Error
C1704	ECU Fail - Safe Relay Fail
C1705	ECU Pre - Charge Circuit Fail
C2101	Motor relay circuit
C2400	Motor
C2401	Motor circuit
C2412	Motor Short or Open
C2413	Motor current fail (current over)

Steering System > Electric Power Steering > C1101 Battery Voltage High

Component Location



General Description

EPS CM controls EPS solenoid current accurately according to vehicle speed. EPS CM monitors that operating voltage supplied as IG S/W is too high or too low on "power supply terminal". If excessive high voltage or low voltage is detected, EPS CM stops current supply to solenoid to prevent unexpected operation or damage.

DTC Description

EPS CM sets this code if high voltage caused by faulty alternator or poor connention in power supply circuit is detected.

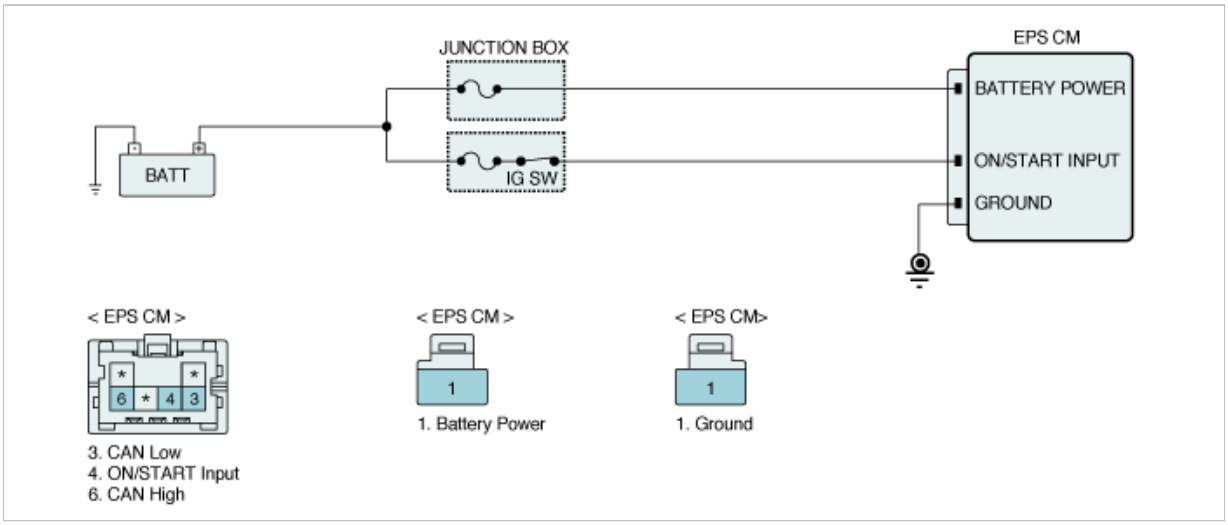
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Battery Voltage Monitoring	• Open/short in power circuit. • Faulty ground circuit. • Faulty charging system.
Enable conditions	• Engine "ON"	
Threshold value	• When Vign is higher than 18V for more than 400ms.	
Fail Safe	• EPS warning lamp "ON"	
Restoration conditions	• When Vign is lower than 17V for more than 400ms.	

Specification

Bat. Voltage	IG Key ON	ENG. ON
	Approx. 11.8 [V]~12.5 [V]	Approx. 12.5 [V] ~ 14.5 [V]

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Start engine and turn the headight and the heatwire on.
3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.
4. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

Specification : less than 17 [V]

5. Is parameter within specifications?

YES	▸ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES	▸ Repair as 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 heatwire "ON".
3. Measure voltage between terminal (+) and (-) of battery while maintaining ENG RPM 2,500RPM over 2 minutes.

Specification : Less than 17 [V]

4. Is the measured voltage within specifications?

YES	▸ Go to "Power Circuit Inspection" procedure.
NO	▸ Check that the tension of drive velt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and Check for damaged harness and poor connection between alternator and battery. ▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

■ **Open or Short Check**

1. Ignition "OFF"
2. Disconnect EPS CM connector.
3. Engine "ON", headight and heatwire "ON".
4. Measure voltage between battery power terminal of EPS CM harness connector and chassis ground maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

Specification : less than 17 [V]

5. Is the measured voltage within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Check for open or blown fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and EPS CM harness connector and then go to "Verification of vehicle Repair" procedure.

Ground Circuit Inspection

■ **Open or Short Check**

1. Ignition "OFF".
2. Disconnect EPS CM connector.
3. Measure resistance between ground terminal of EPS CM harness connector and chassis ground.

Specification : Approx. 1.0 Ω

4. Is the measured resistance within specifications?

YES	▸ Substitute with a known-good steering column & EPS unit assembly and check for proper operation. If

	the problem is corrected,replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Check for open or contact resistance in ground harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

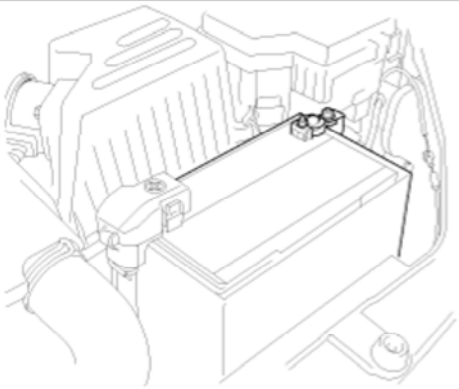
After a repair, it is essential to verify that the fault has been corrected.

1. Connect 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.

Steering System > Electric Power Steering > C1102 Battery Voltage Low

Component Location



General Description

EPS CM controls EPS solenoid current accurately according to vehicle speed. EPS CM monitors that operating voltage supplied as IG S/W is too high or too low on "power supply terminal". If excessive high voltage or low voltage is detected, EPS CM stops current supply to solenoid to prevent unexpected operation or damage.

DTC Description

EPS CM sets this code and turns on warning lamp if excessive low voltage caused by faulty alternator or poor connention in power supply circuit is detected.

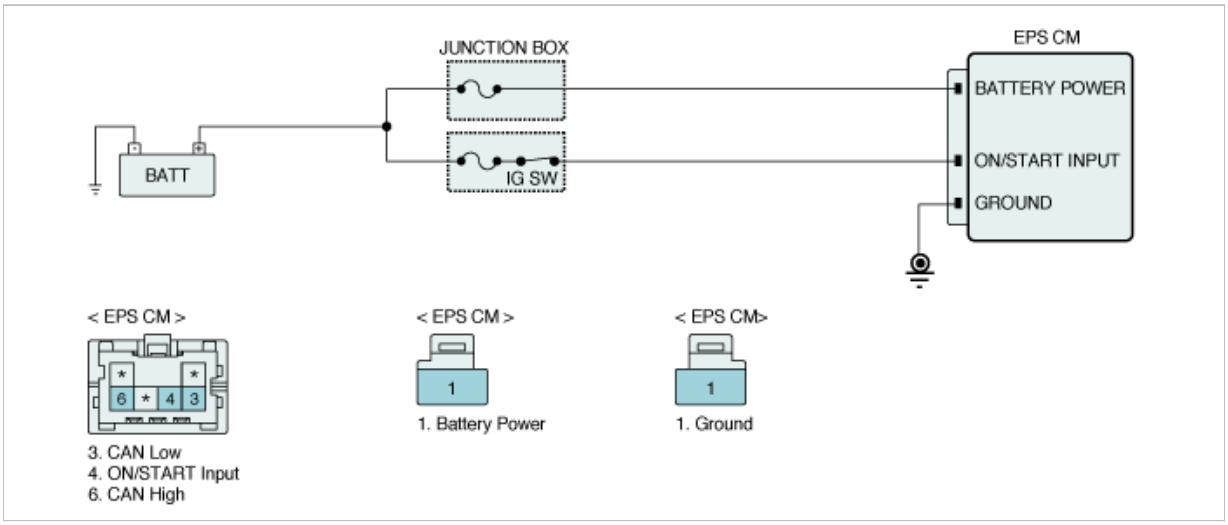
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Battery Voltage Monitoring	• Open/short in power circuit. • Faulty ground circuit. • Faulty charging system. • Over discharge
Enable conditions	• Engine "ON"	
Threshold value	• When Vign is lower than 9V for more than 10s.	
Fail Safe	• EPS warning lamp "ON"	
Restoration conditions	• When Vign is higher than 10V for more than 10s.	

Specification

Bat. Voltage	IG Key ON	ENG. ON
	Approx. 11.8 [V]~12.5 [V]	Approx. 12.5 [V] ~ 14.5 [V]

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Start engine and turn the headight and the heatwire on.
3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.
4. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

Specification : more than 10 [V]

5. Is parameter within specifications?

YES	▸ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found?

YES	▸ Repair as 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 heatwire "ON".
3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

Specification : More than 10 [V]

4. Is the measured voltage within specifications?

YES	▸ Go to "Power Circuit Inspection" procedure.
NO	▸ Check that the tension of drive velt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and Check for damaged harness and poor connection between alternator and battery. ▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

■ Open or Short Check

1. Ignition "OFF"
2. Disconnect EPS CM connector.
3. Engine "ON", headight and heatwire "ON".
4. Measure voltage between battery power terminal of EPS CM harness connector and chassis ground maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

Specification : More than 10 [V]

5. Is the measured voltage within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Check for open or blown fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and EPS CM harness connector and then go to "Verification of vehicle Repair" procedure.

Ground Circuit Inspection

■ Open or Short Check

1. Ignition "OFF".
2. Disconnect EPS CM connector.
3. Measure resistance between ground terminal of EPS CM harness connector and chassis ground.

Specification : Approx. 1.0 Ω

4. Is the measured resistance within specifications?

YES	▸ Substitute with a known-good steering column & EPS unit assembly and check for proper operation. If the problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Check for open or contact resistance in ground 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 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.

Steering System > Electric Power Steering > C1103 Ignition Voltage Fault

General Description

EPS CM receives vehicle speed and engine RPM signal from EMS(Engine Management System) via CAN line and controls motor current accurately according to driver's steering intention. EPS CM monitors that operating voltage supplied as IG S/W is too high or too low on "power supply terminal". If excessive high voltage or low voltage is detected, EPS CM stops current supply to solenoid to prevent unexpected operation or damage.

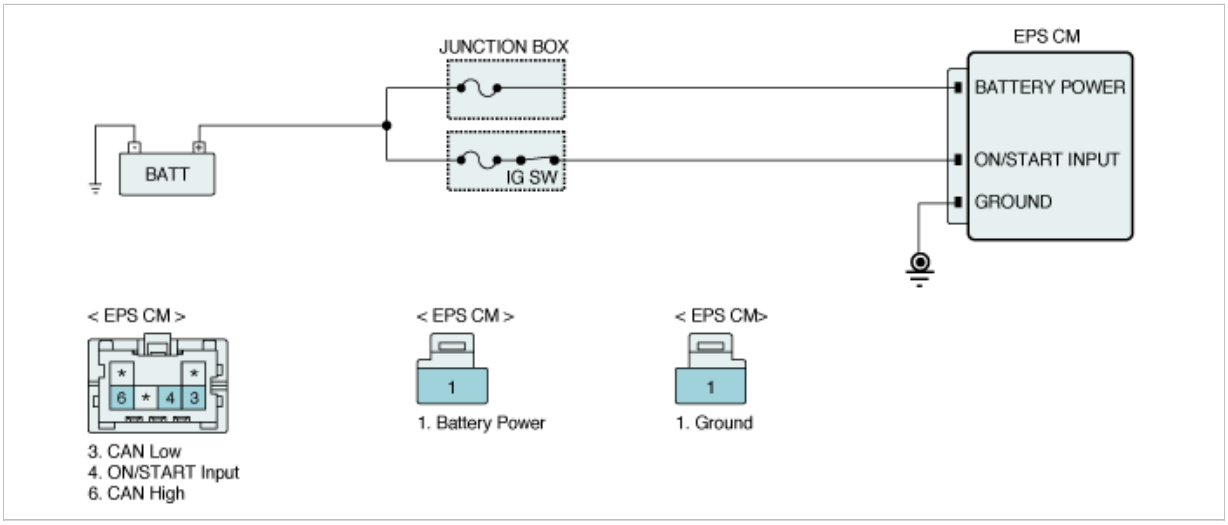
DTC Description

EPS is designed to operate only at engine "ON" because it's current attrition rate is high. It decides whether engine operates or not from vehicle speed and engine RPM. EPS CM sets this code and turns on warning lamp if IG S/W turns off when engine is operating.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage Monitoring	• Faulty ground circuit • Poor connection in ground circuit • Open in IG circuit
Enable conditions	• Engine RPM > 500 & Vehicle speed > 2.7Km/h	
Threshold value	• IG S/W Off	
Fail Safe	• EPS warning lamp "ON" (Back up function maintained for 310sec)	
Restoration conditions	• IG On	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Start engine and turn the headight and the heatwire on.
3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.
4. Maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

Specification : Battery Voltage

5. Is parameter within specifications?

YES	▸ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/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 Circuit Inspection" procedure.

Power Circuit Inspection

■ Open or Short Check

1. Ignition "OFF"
2. Disconnect EPS CM connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between ON/START INPUT terminal of EPS CM harness connector and chassis ground.

Specification : Battery Voltage

5. Is the measured voltage within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Check for open or blown fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and EPS CM harness connector and then go to "Verification of vehicle Repair" procedure.

Ground Circuit inspection

■ Open or Short Check

1. Ignition "OFF".
2. Disconnect EPS CM connector.
3. Measure resistance between ground terminal of EPS CM harness connector and chassis ground.

Specification : Approx. 1.0 Ω

4. Is the measured resistance within specifications?

YES	▸ Substitute with a known-good steering column & EPS unit assembly and check for proper operation. If the problem is corrected,replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
	▸ Check for open or contact resistance in ground harness.

NO	Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

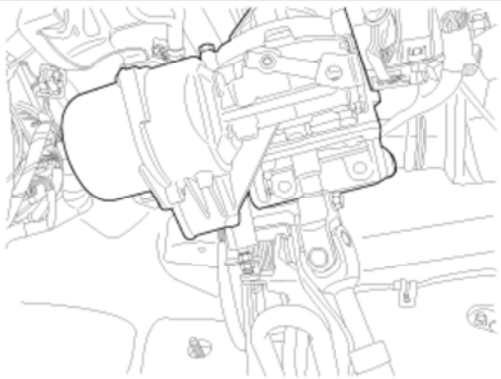
After a repair, it is essential to verify that the fault has been corrected.

1. Connect 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.

Steering System > Electric Power Steering > C1259 Steering Angle Sensor – Electrical Malfunction

Component Location



General Description

EPS is designed to provide directional control and smooth feeling to driver when driver operates steering wheel. There is a function to detect rotation speed and direction of steering wheel in Torque Sensor. Rotation speed and direction signals are used for "damper" and "return" control, "assist" control.

DTC Description

Steering angle sensor error can be set when loss of steering angle due to internal fault or open in ECU internal circuit occurs. If steering sensor error occurs EPS CM stops "damper" and "return" control. Therefore driver can be uncomfortable due to no return force during U-Turn, high speed driving, but there is no problem for driving because basic assist control still alives.

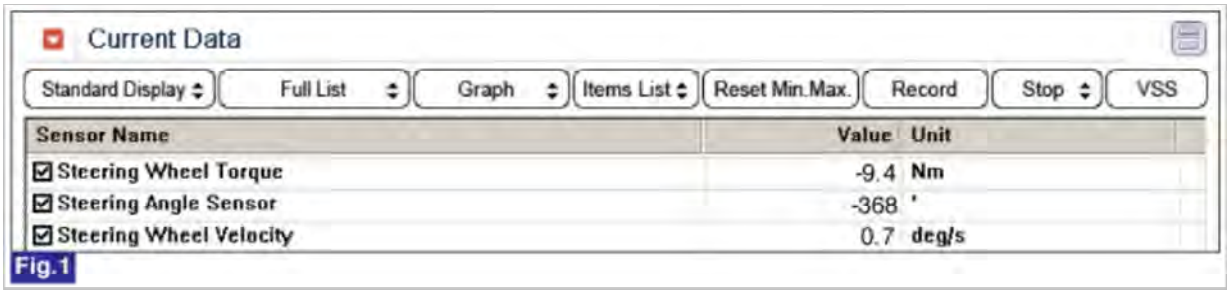
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Edge number of motor hall sensor signal counting	• Faulty EPS CM • Faulty Hall Sensor of the motor • ASP Setting error
Enable conditions	• Engine On	
Threshold value	• Steering angle > 600, Steering angle < -600	
Fail Safe	• "damper" and "return" control are stopped	
Restoration conditions	• ASP Setting	

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)

2. Ignition "ON" & Engine "ON".
3. Turn the steering wheel to the left or right.
4. Monitor the "STEERING ANGLE SNSR" parameters on the Scantool.



5. Whenever steering wheel is turned, is the steering sensor's scantool data changed?

YES

(1) Connect scantool to Data Link Connector(DLC).

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

(3) Set the steering wheel so that the wheels point straight ahead

(4) Monitor the "STEERING ANGLE SENSOR" parameters on the Scantool.

Specification : Approx. 0 °

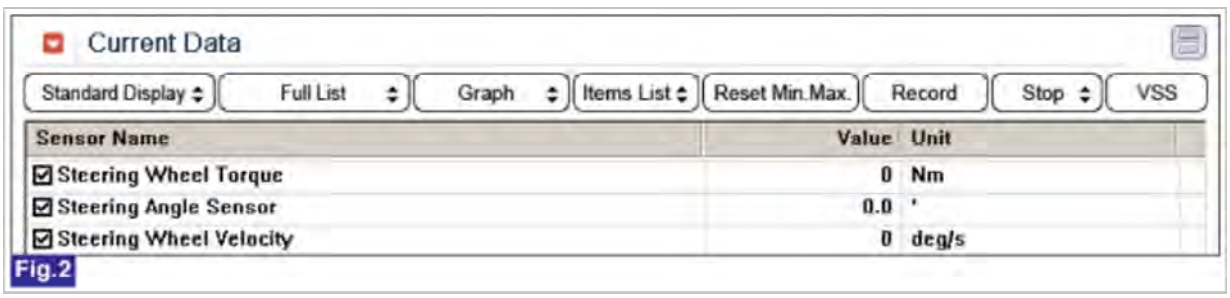


Fig.2) Center position (IG ON & Eng ON)

(5) If parameter is displayed within specifications

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Go to number 6. procedure.

NO

▸ Go to "W/Harness Inspection" procedure.

6. Perform steering angle sensor calibration.

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

(2) Set the steering wheel so that the wheels point straight ahead

(3) Connect scantool to Data Link Connector(DLC).

(4) Perform ASP calibration. (figure 3).

(5) Go to "Compnent Inspection" Precedure.

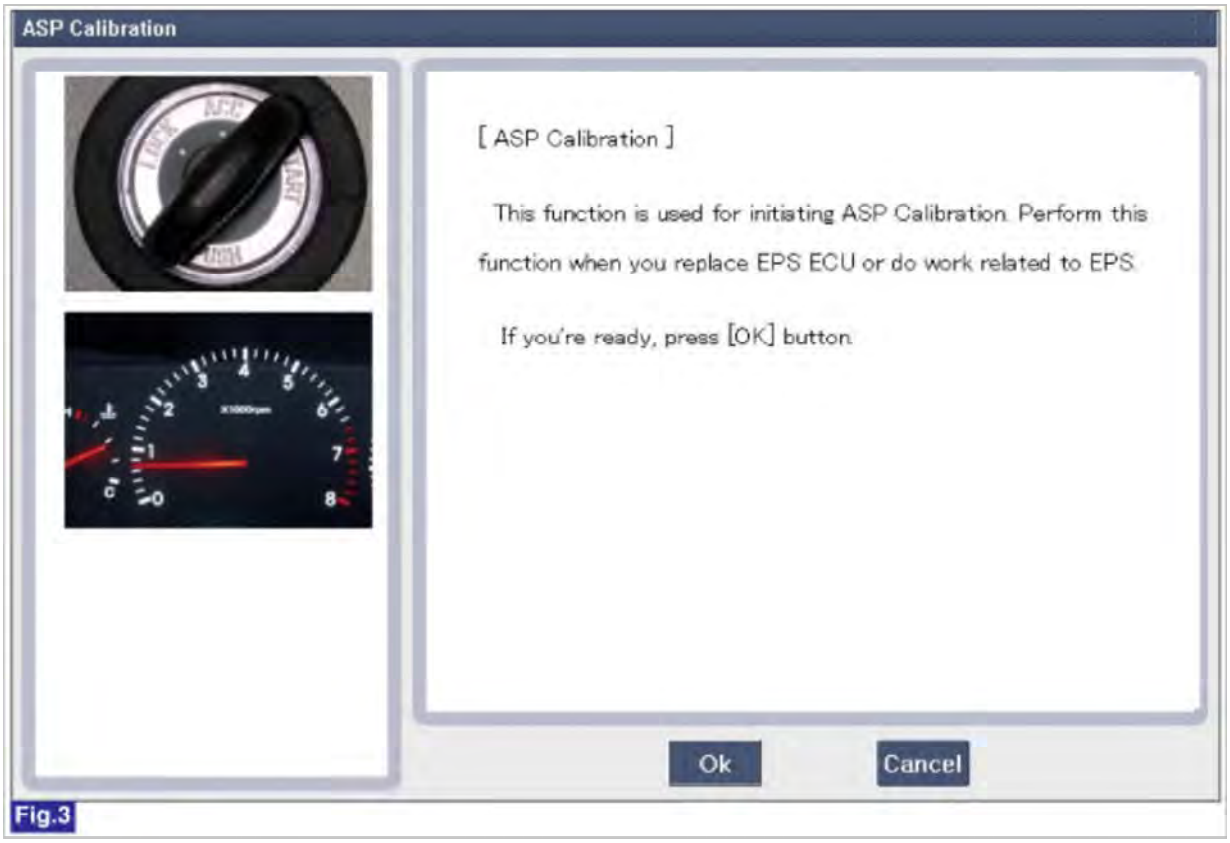


Fig.3

Terminal and Connector Inspection

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

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Operate the vehicle within DTC Detecting Condition in General Information. (turn right and left at least 1 time)
6. Select "Diagnostic Trouble Codes(DTCs)" mode again.
7. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly and check for proper operation. If the problem is corrected,replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

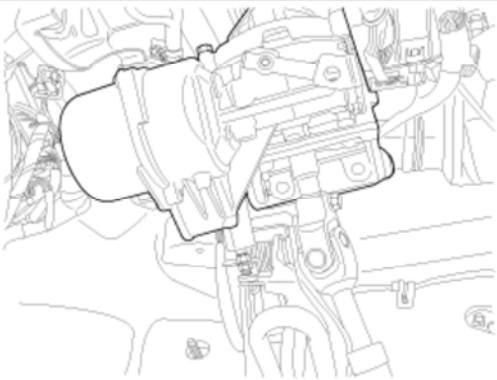
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
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.

Steering System > Electric Power Steering > C1261 Steering Angle Sensor Not Calibrated

Component Location



General Description

EPS CM controls EPS solenoid current accurately according to vehicle speed. EPS CM monitors that operating voltage supplied as IG S/W is too high or too low on "power supply terminal". If excessive high voltage or low voltage is detected, EPS CM stops current supply to solenoid to prevent unexpected operation or damage.

DTC Description

EPS CM sets this code if ASP(Absolute Steering Position) zero setting is not done when EPS CM losses steering angle signal due to EPS alinment replace etc. EPS CM stops "damper" and "return" control due to loss of steering angle signal.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• ASP Setting Flag Check	• ASP setting is not done
Enable conditions	• Engine On	
Threshold value	• ASP Setting Flag ≠ 1	
Fail Safe	• Steering angle sensor signal is not available.	
Restoration conditions	• ASP Setting is done well	

Monitor Scantool Data

■ Steering angle calibration

1. Perform steering angle sensor calibration.
   (1) Ignition "ON" & Engine "OFF".
   (2) Set the steering wheel so that the wheels point straight ahead
   (3) Connect scantool to Data Link Connector(DLC).
   (4) Perform steering angle sensor calibration. (figure 1).
   (5) Go to "Compnent Inspection" Precedure.

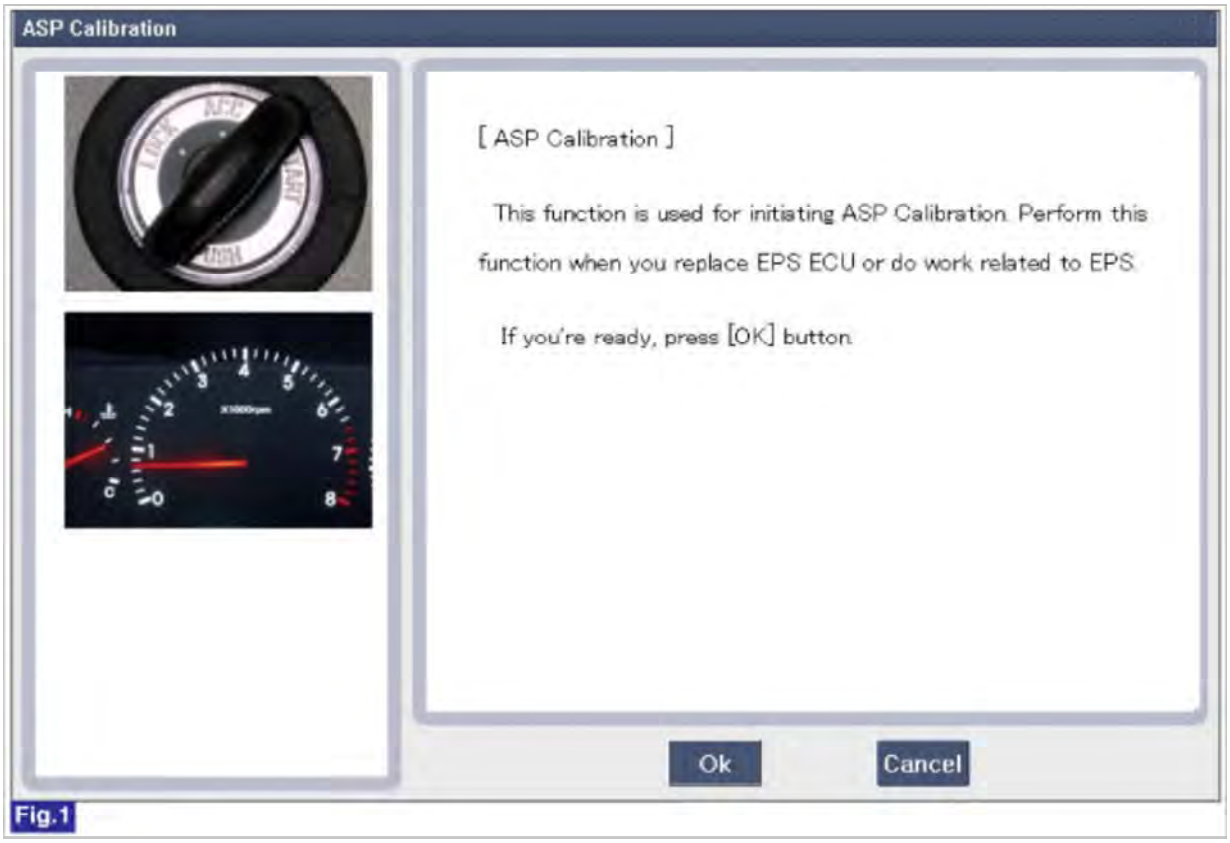


Fig.1

(6) Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. 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.
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.

Steering System > Electric Power Steering > C1290 Torque sensor main signal fail

Component Location

General Description

EPS CM receives torque and rotation speed of steering wheel from torque sensor.
The EPS CM uses a torque sensor as it's main input for determining the amount of steering assists. The input and output shafts are separated by a torsion bar, where the torque sensor is located. The sensor consists of a two detecting plates. Detecting plate 1 is fixed to the output shaft, detecting plate 2 is fixed to the input shaft. As torque is applied to the steering column shaft the alignment of the teeth between detecting plate 1 and 2 changes. The EPS CM recognizes this change.

DTC Description

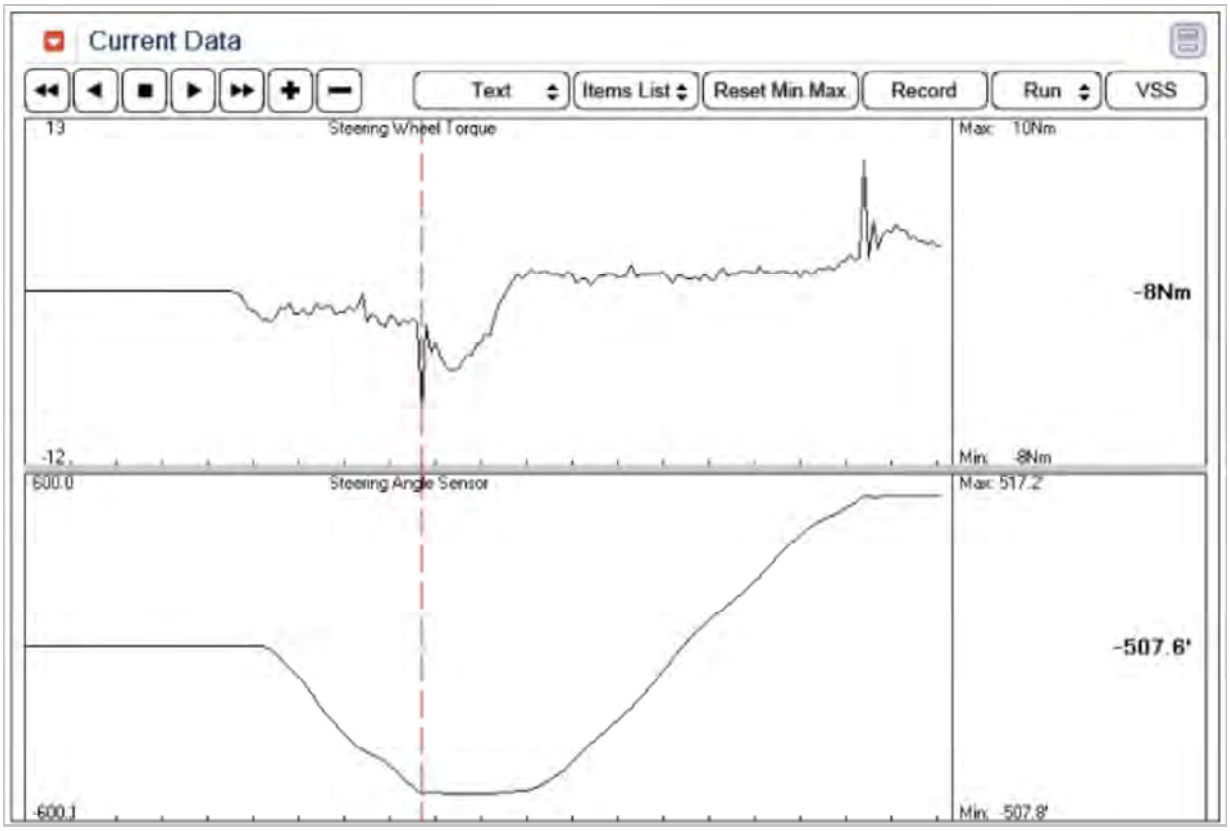
The EPS CM sets this code if torque sensor can't calculate torque and rotation speed normally due to open or short in torque sensor circuit or discordance between 2 sensing element signal.
The EPS CM turns on warning lamp and stops assist control.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Chenk signal & Compare 2 sensing element signal	• Poor connection in torque sensor • Improper installation of toeque sensor
Enable conditions	• IG ON	
Threshold value	• Signal error or discordance between 2 sensing element signal	
Fail Safe	• EPS warning lamp "ON", EPS control is inhibited	
Restoration conditions	• Normal condition after IG on → off	

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "ON".
3. Turn the steering wheel to the left or right.
4. Monitor the "Torque Sensor" parameters on the Scantool.



5. Whenever steering wheel is turned, is the steering sensor's scantool data changed?

YES	▸ Fault is intermittent and caused either by poor contact in Torque sensor or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Repair or replace as necessary and then 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 and terminal s. 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 as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Operate the vehicle within DTC Detecting Condition in General Information. (turn right and left at least 1 time)
6. Select "Diagnostic Trouble Codes(DTCs)" mode again.
7. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.

NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

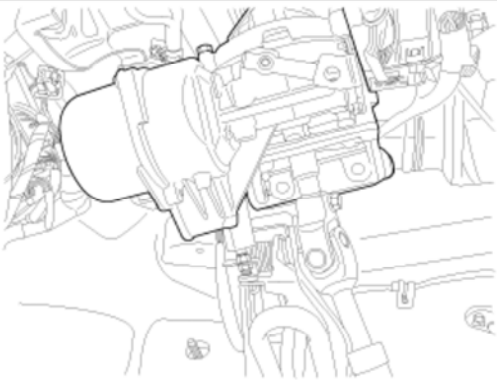
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
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.

Steering System > Electric Power Steering > C1603 Derating (EPS Thermal Protection)

Component Location



General Description

EPS uses an electric motor to provide directional contol to the driver. An electric mortor consumes much current during operating. It can be overheat under excessive use, at that time EPS CM restricts motor current for protecting EPS from unexpected problem.

DTC Description

EPS CM sets this code If temperature of EPS CM is higher than 85°C (185°F) due to excessive use.
EPS CM restricts assist steering function to decrease motor current.
EPS CM inhibits assist steering if temperature of EPS CM is higher than 120°C (248°F).

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check motor temperature	• Continous Steering operation
Enable conditions	• IG ON & Engine ON	
Threshold value	• Temperature of EPS CM > 85°C (185°F).	
Fail Safe	• The power of EPS is restricted.	
Restoration conditions	• Temperature of EPS CM < 85°C (185°F).	

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "ON".

3. Monitor the "MOTOR TEMPERATURE" parameters on the Scantool.

Specification : Less than 85°C (185°F)

Fig.1) Normal data (IG ON & ENG ON)

4. Is the measured "Motor Temperature" within specifications?

YES	▸ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Go to "Verification of Vehicle Repair" procedure.
NO	▸ Wait till the EPS motor cool down sufficiently. Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ The DTC code can be set by excessive EPS control in normal system status. Go to "Verification of Vehicle Repair" procedure. 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.
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.

Steering System > Electric Power Steering > C1604 ECU Hardware Error

Component Location

General Description

EPS CM monitors internal circuit to protect abnormal operation. This test includes hardware (MCU, RAM, ROM and so on) test.

DTC Description

EPS CM checks operating condition of H/W periodically. EPS CM sets this code and turns on warning lamp if there is a fault in H/W. At that time EPS CM inhibits EPS opreation.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check ECU H/W	• Faulty MCU • Faulty memory
Enable conditions	• IG ON	
Threshold value	• ECU H/W error occurs	
Fail Safe	• EPS warning lamp "ON", EPS control is inhibited	
Restoration conditions	• Normal condition after IG on → off	

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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet.

	Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

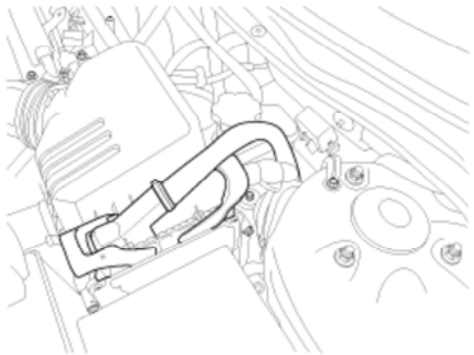
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
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.

Steering System > Electric Power Steering > C1611 CAN Time-out ECM

Component Location



General Description

EPS provides a different assist force according to vehicle speed when engine ON. EPS CM receives engine condition and vehicle speed from ECM as EMS1 signal.

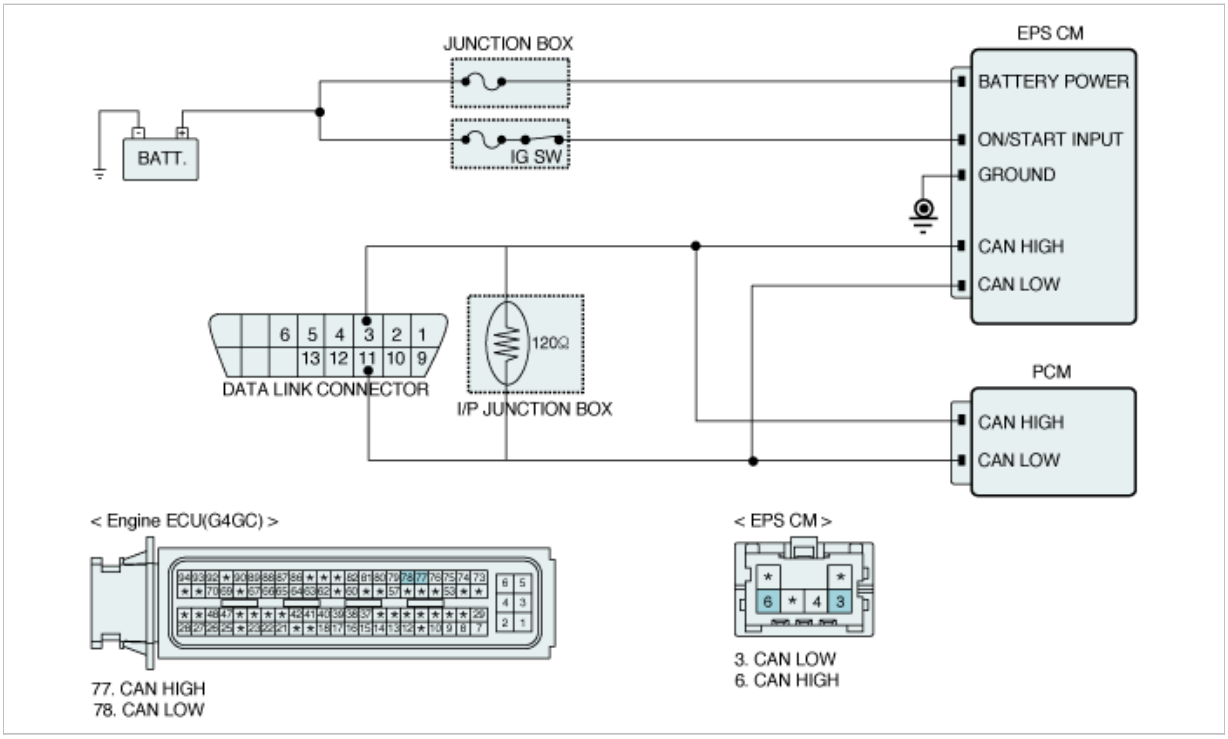
DTC Description

EPS CM sets this code if EMS1 message is not received within predefined time.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check EMS1 message time interval.	• Open or short in CAN harness of engine side • Faulty ECM
Enable conditions	• -	
Threshold value	• EMS 1 message isn't received for more than 1s.	
Fail Safe	• EPS CM sets vehicle speed as 40kph (25mile).	
Restoration conditions	• EMS 1 message is received for more than 1s.	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "ON".
3. Monitor the "VEHICLE SPEED SENSOR" parameters on the Scantool..
4. Drive the vehicle approx watching the speedometer on the instrument panel.

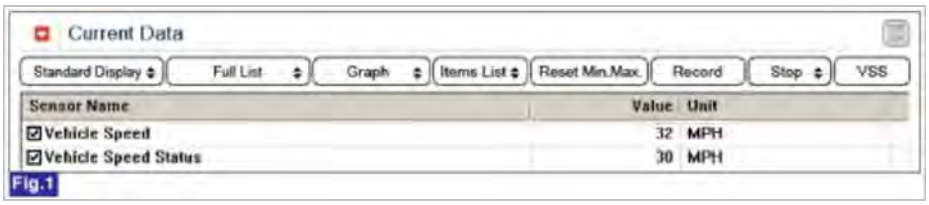


Fig.1) Stand Still (IG ON & ENG ON)

5. Is parameter within specifications?

YES	▸ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "CAN Circuit Inspection" procedure.

CAN Circuit Inspection (EPS ↔ ECM)

■ **Open Check**

1. Ignition "OFF".
2. Disconnect EPS CM & ECU connector .
3. Measure resistance between CAN HIGH terminal of the EPS CM harness connector and CAN HIGH terminal terminal of the ECM harness connector.
4. Measure resistance between CAN LOW terminal of the EPS CM harness connector and CAN LOW terminal terminal of the ECM harness connector.

Specification : Approx. below 1Ω

5. Is the measured resistance within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Check Open between EPS CM & engine ECU harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good PCM(ECM) and check for proper operation. If problem is corrected, replace PCM(ECM) and then go to "Verification of Vehicle Repair" procedure. If NG, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent and caused either by poor contact in connectors or wiring harness, or it has been repaired and EPS CM memory is not cleared yet. 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.
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.

Steering System > Electric Power Steering > C1616 CAN Bus Off

Component Location

General Description

EPS CM controls warning lamp by sending a signal via CAN line. After sending a message, EPS CM checks signal about whether other ECU receives a signal correctly. If EPS CM receives signal from other ECU it recognizes that a message was transmitted normally.

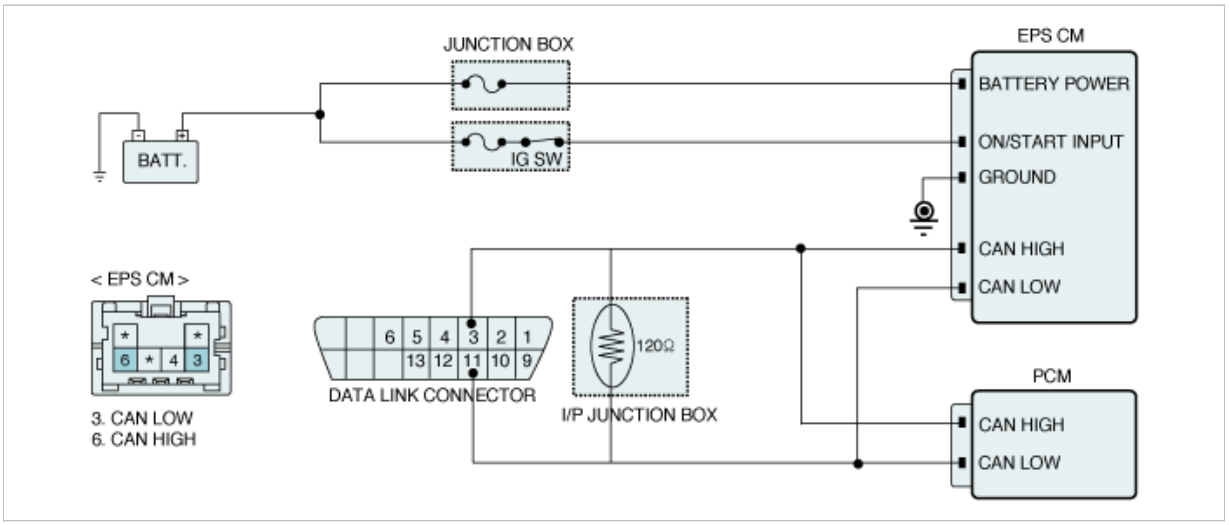
DTC Description

EPS CM sets this code If EPS doesn't transmit or receive a message normally.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check signal	• Open or short in CAN line
Enable conditions	• IG ON	
Threshold value	• EPS CM can't receive signal from other ECU	
Fail Safe	• -	
Restoration conditions	• EPS CM receives signal from other ECU	

Diagnostic Circuit Diagram



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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "CAN Signal Circuit Inspection" procedure.

CAN Signal Circuit Inspection

■ Short Check (to ground)

1. Ignition "OFF" & Engine "OFF".
2. Disconnect the EPS CM connector.
3. Measure resistance between CAN LOW terminal, CAN HIGH terminal of the EPS CM harness connector and chassis ground.

Specification : ∞ Ω

4. Is the measured resistance within specifications?

YES	▸ Go to next procedure.
NO	▸ Go to next procedure. If abnormal resistance is detected in CAN HIGH circuit, Repair short to ground in CAN HIGH circuit and then go to "Verification of vehicle Repair" procedure. If abnormal resistance is detected in CAN LOW circuit, Repair short to ground in CAN LOW circuit and then go to "Verification of vehicle Repair" procedure.

■ CAN BUS Resistance Check

1. Ignition "OFF" & Engine "OFF".
2. Disconnect the EPS CM and PCM connector.
3. Measure resistance between CAN LOW terminal and CAN HIGH terminal of the EPS CM harness connector.

Specification : Approx. 120Ω

4. Is the measured value within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ In case of the resistance "approx. 1Ω" : Repair mutual short in CAN signal circuit of the EPS CM and then go to "Verification of vehicle Repair" procedure. In case of the resistance "∞ Ω" : Repair open in CAN signal circuit of the EPS CM and then go to "Verification of vehicle Repair" procedure. In case of the resistance "approx. 120 Ω" : Check the resistances(122Ω) in I/P junction box and PCM, repair as necessary and then go to "Verification of vehicle Repair" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

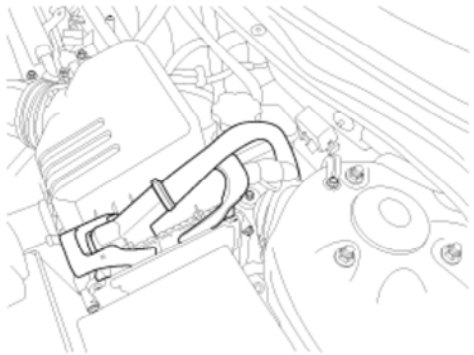
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
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.

Steering System > Electric Power Steering > C1617 EMS Invalid Engine Speed

Component Location



General Description

EPS provides different assist force according to vehicle speed while engine ON. A vehicle speed signal must be inputted normally to EPS CM for normal EPS control.

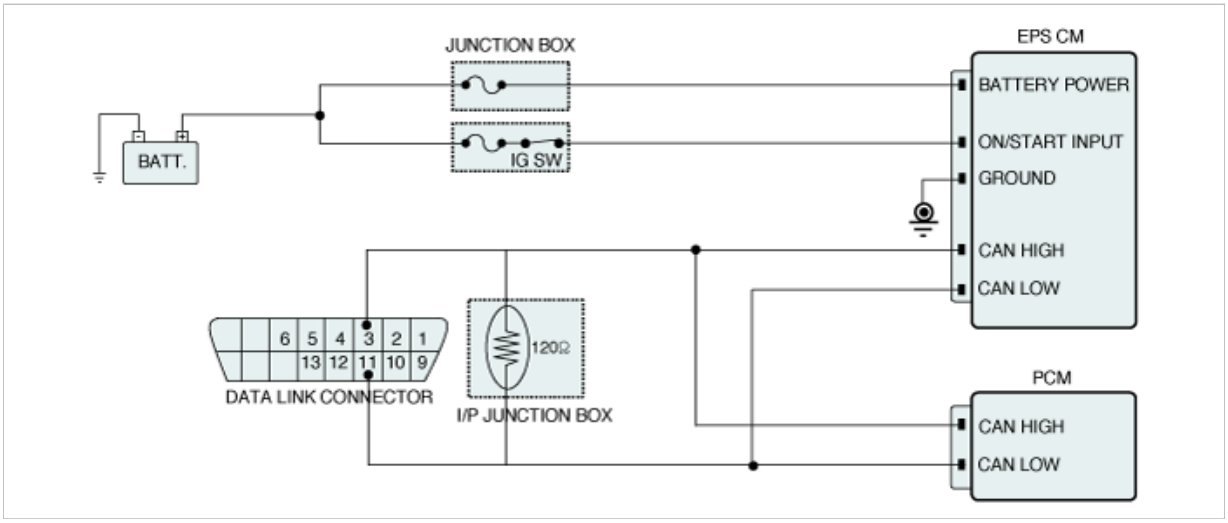
DTC Description

EPS CM sets this code if EPS CM doesn't receives a vehicle speed signal from EMS normally. At that time it controls EPS system by using predefined vehicle speed value.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check received message from ECM	• Faulty ECM
Enable conditions	• IG ON	
Threshold value	• Vehicle speed signal is INVALID	
Fail Safe	• EPS CM sets vehicle speed as 40kph (25mile).	
Restoration conditions	• Received vehcle speed signal from ECM is normal.	

Diagnostic Circuit Diagram



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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

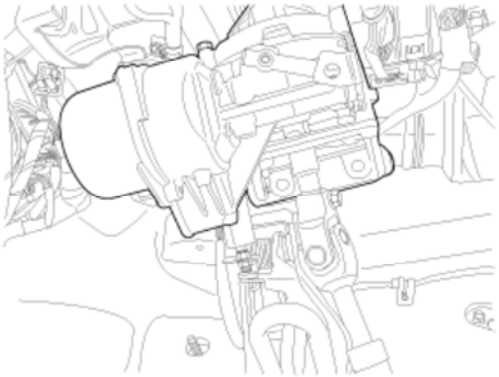
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
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.

Steering System > Electric Power Steering > C1700 Byte Coding Error

Component Location



General Description

EPS CM has a various parameter setting for different steering feeling according to applied region. EPS CM reads a proper parameter setting according to applied region.

DTC Description

EPS CM sets this code if parameter setting data read from memory is out of normal range.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check parameter setting	• Faulty ECU internal memory
Enable conditions	• IG ON	
Threshold value	• Improper parameter setting is read	
Fail Safe	• Default parameter setting is used	
Restoration conditions	• Proper parameter setting is read	

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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly and check for proper operation. If the problem is corrected,replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.

NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

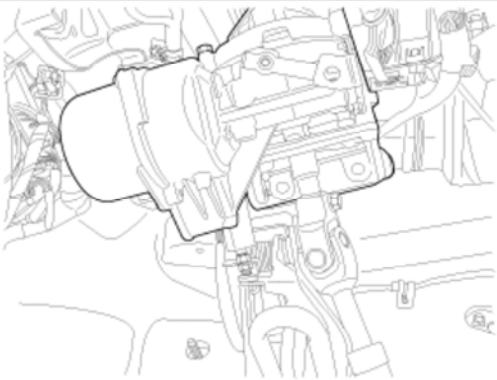
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
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.

Steering System > Electric Power Steering > C1702 Variant Coding Error

Component Location



General Description

EPS CM has a various parameter setting for different steering feeling according to applied region. EPS CM reads a predefined parameter setting according to applied region. Therefore operation to select applied region has to be done.

DTC Description

EPS CM sets this code if selection of applied region isn't done.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check applied region Flag	• Selection of applied region isn't done.
Enable conditions	• IG ON	
Threshold value	• Selection of applied region isn't done.	
Fail Safe	• Default parameter is used for control	
Restoration conditions	• After selection of applied region.	

Monitor Scantool Data

■ EPS Type recognition

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "OFF" and then Ignition "ON".

3. Choose the area type (figure 1).
4. Ignition "OFF" & Wating 20sec.
5. Ignition "ON".
6. Select "Diagnostic Trouble Codes(DTCs)" mode again.
7. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. Go to "Verification of Vehicle Repair" procedure.

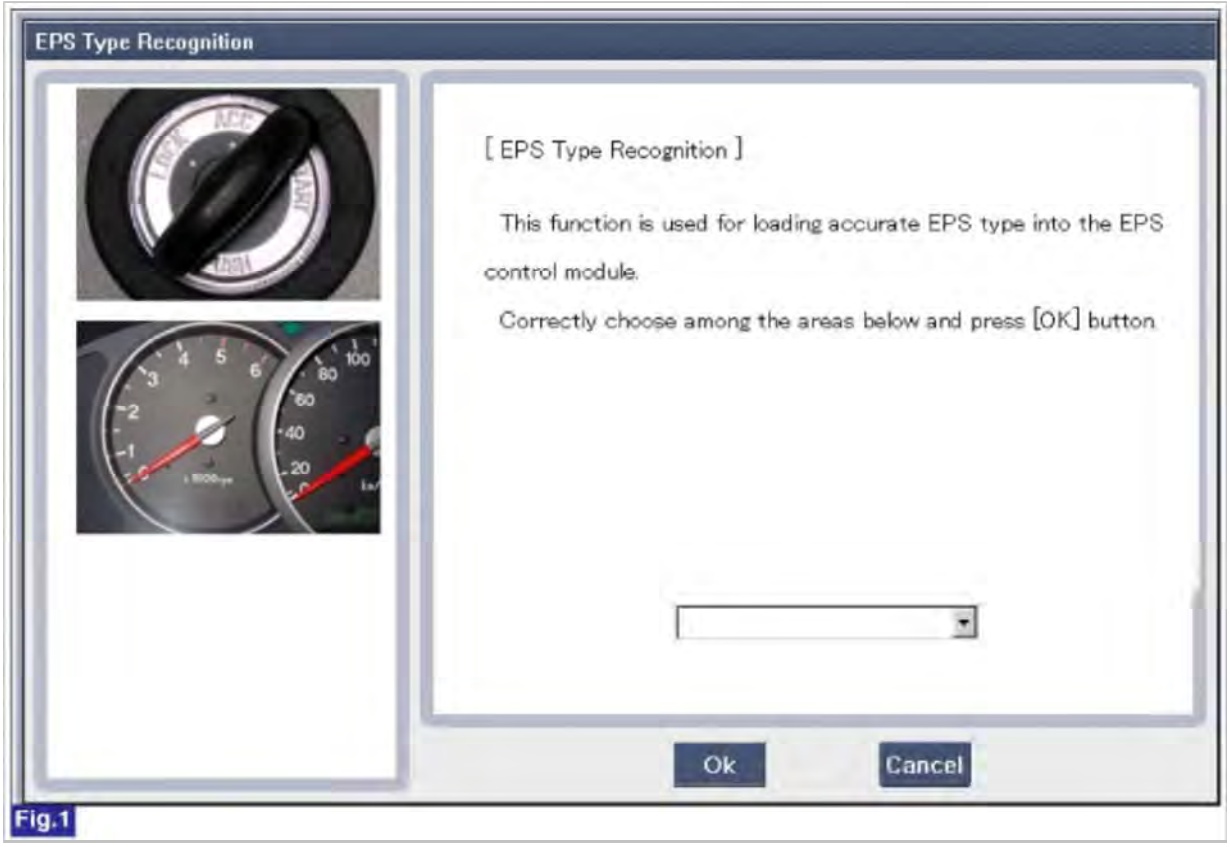


Fig.1

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.
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.

Steering System > Electric Power Steering > C1704 ECU Fail-Safe Relay Fail

Component Location

General Description

EPS CM has a relay to cut off current to a motor if abnormal operation is detected.
EPS CM checks a condition of relay while ig ON.

DTC Description

EPS CM sets this code and turns on warning lamp if a relay can't be on state when it receives a commend to turn it on.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check relay state	• Faulty fail safe relay
Enable conditions	• IG ON	
Threshold value	• Relay isn't operated	
Fail Safe	• Waring lamp ON, EPS control is inhibited	
Restoration conditions	• Normal condition after IG on → off	

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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. 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.
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.

Steering System > Electric Power Steering > C1705 ECU Precharge Circuit Fault

Component Location

General Description

EPS uses an electric motor to provide directional contol to the driver. EPS CM has a charging circuit to supply current to a motor temoporarily.

DTC Description

EPS CM sets this code and turns on warning lamp if charged voltage is too low due to a abnormal charging circuit. At that time EPS CM inhibits it's own function.

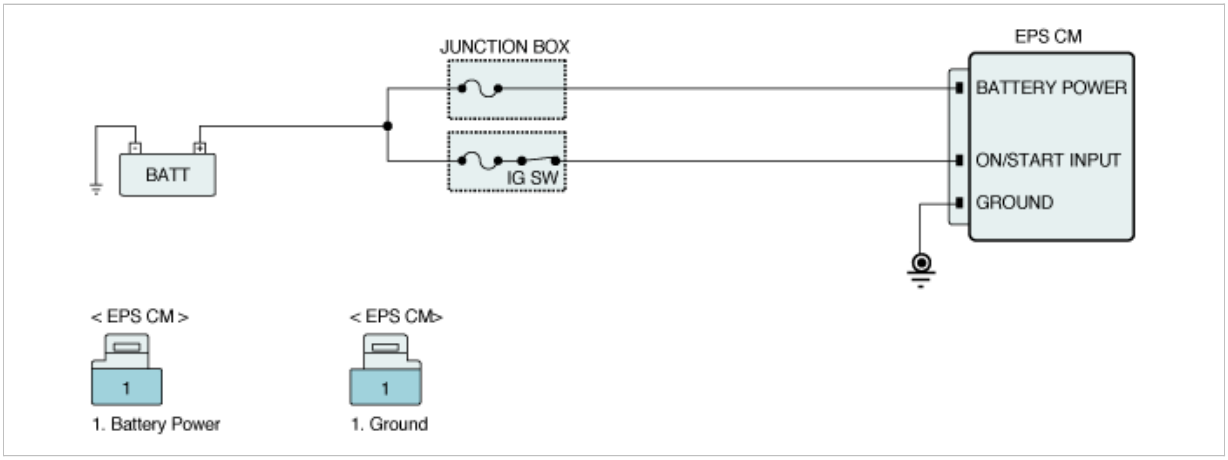
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage	• Poor connetion in power circuit • Poor connection in ground circuit • Over charging
Enable conditions	• IG ON	
Threshold value	• Charging circuit voltage too low	
Fail Safe	• Waring lamp ON, EPS control is inhibited	
Restoration conditions	• Normal condition after IG on → off	

Specification

Bat. Voltage	IG Key ON	ENG. ON
	Approx. 11.8 [V]~12.5 [V]	Approx. 12.5 [V] ~ 14.5 [V]

Diagnostic Circuit Diagram



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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as 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 heatwire "ON".
3. Measure voltage between terminal (+) and (-) of battery maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

   Specification : More than 10 [V]

4. Is the measured voltage within specifications?

YES	▸ Go to "Power Circuit Inspection" procedure.
NO	▸ Check that the tension of drive velt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and Check for damaged harness and poor connection between alternator and battery. ▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

■ Open or Short Check

1. Ignition "OFF"
2. Disconnect EPS CM connector.
3. Engine "ON", headight and heatwire "ON".
4. Measure voltage between battery power terminal of EPS CM harness connector and chassis ground maintaining ENG. RPM at 2,500RPM(idle) over 2 minutes.

   Specification : less than 17 [V]

5. Is the measured voltage within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Check for open or blown fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and EPS CM harness connector and then go to "Verification of vehicle Repair" procedure.

Ground Circuit Inspection

■ Open or Short Check

1. Ignition "OFF".
2. Disconnect EPS CM connector.
3. Measure resistance between ground terminal of EPS CM harness connector and chassis ground.

Specification : Approx. 1.0 Ω

4. Is the measured resistance within specifications?

YES	▸ Substitute with a known-good steering column & EPS unit assembly and check for proper operation. If the problem is corrected,replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Check for open or contact resistance in ground harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

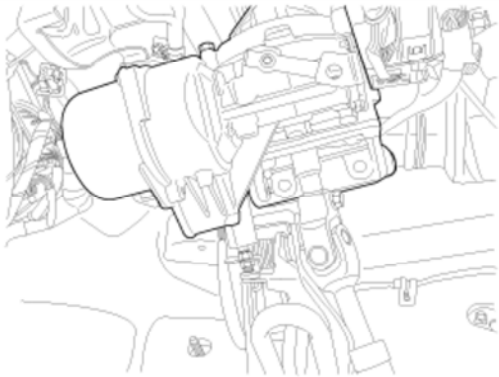
After a repair, it is essential to verify that the fault has been corrected.

1. Connect 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.

Steering System > Electric Power Steering > C2101 Motor relay circuit

Component Location



General Description

EPS uses an electric motor to provide directional contol to the driver.
EPS CM cuts off a motor relay to protect EPS from abnormal operation if a system has an error.

DTC Description

EPS CM checks a motor relay condition by testing. EPS CM sets this code and turns on warning lamp if a motor relay can't be cut off in abnormal condition.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check Motor relay condition	• Faulty motor relay
Enable conditions	• IG ON	
Threshold value	• Motor relay can't be cut off	
Fail Safe	• EPS warning lamp "ON"	
Restoration conditions	• Normal condition after IG on → off	

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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. 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.
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.

Steering System > Electric Power Steering > C2400 Motor Fault - Motor Not Running

Component Location

General Description

EPS uses an electric motor to provide directional contol to the driver.
To confirm operating state of the motor is essential for controlling the EPS system as intended.

DTC Description

ESP CM measures motor velocity by using motor position sensor and motor output torque by using current sensor to confirm whether the motor operates normally or not. After measure then it compares measured values and calculated values. EPS CM sets this coed and turns on warning lamp if there is a difference between two values.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check motor velocity, torque signal	• Faulty Motor • Faulty Motor position sensor • Faulty current sensor
Enable conditions	• Engine ON	
Threshold value	• Comparion value not the same	
Fail Safe	• EPS warning lamp "ON"	
Restoration conditions	• Normal condition after IG on → off	

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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.

NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

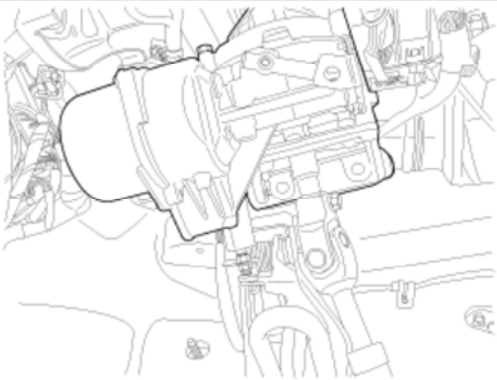
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
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.

Steering System > Electric Power Steering > C2401 Motor circuit

Component Location



General Description

There is a sensor to detect a motor position in EPS CM for controlling EPS motor preciously.
ESP CM controls a motor according to a data read from this sensor.

DTC Description

EPS CM sets this code and inhibits EPS if a data read from motor position sensor has an error.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check Motor position sensor signal	• Faulty Motor position sensor • Poor connection of connector
Enable conditions	• IG ON	
Threshold value	• Abnormal sensor signal detected	
Fail Safe	• EPS warning lamp "ON"	
Restoration conditions	• Normal condition after IG on → off	

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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.

3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. Go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

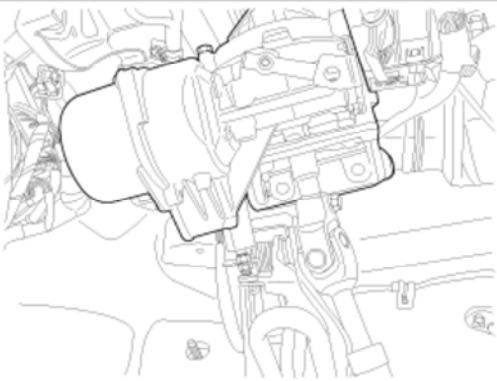
After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
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.

Steering System > Electric Power Steering > C2412 Motor Short or Open

Component Location



General Description

EPS uses an electric motor to provide directional contol to the driver.
EPS CM always monitors voltage of the motor because current of the motor is controlled by voltage.

DTC Description

Three phase current of the motor is controlled by three phase voltage.
EPS CM sets this code and inhibits EPS control if these voltage values are different from predefined value.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check Motor voltage	• Faulty Motor • Faulty ECU voltage sensor
Enable conditions	• Engine ON	
Threshold value	• Comparion voltage not the same	
Fail Safe	• EPS warning lamp "ON"	
Restoration conditions	• Normal condition after IG on → off	

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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared. 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.
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.

Steering System > Electric Power Steering > C2413 Motor current fail (current over)

Component Location

General Description

EPS uses an electric motor to provide directional contol to the driver.
EPS CM always monitors current of the motor because power of the EPS system is decided by current.

DTC Description

EPS CM compares current measured by internal current sensor with predefined value at same torque condition.
EPS CM sets this code and inhibits EPS function if a gap between two values is out of specified range.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check Motor current	• Faulty Motor • Faulty ECU current sensor
Enable conditions	• Engine ON	
Threshold value	• Comparion current not the same	
Fail Safe	• EPS warning lamp "ON"	
Restoration conditions	• Normal condition after IG on → off	

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 all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage.
3. Has a problem been found ?

YES	▸ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly check for proper operation. If problem is corrected, replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure.
	▸ Fault is intermittent caused by faulty EPS CM or was repaired and EPS CM memory was not cleared.

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 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.

Restraint > General Information > General Information

General

The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger, side airbag and belt pretensioner in certain frontal or side collisions.
The SRS (Airbag) consists of : a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit ; side airbag modules located in the driver and passenger seat contain the folded cushion and an inflator unit ; curtain airbag modules located inside of the headliner which contains folded cushions and inflator units. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measure the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

SRSCM (SRS Control Module)

SRSCM will detect front impact with front impact sensor, and side impact with side impact sensor, and determine airbag module deployment.

1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provide ignition voltage for front airbag, side airbag, curtain airbag and pretensioner 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 the fault 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 > Specifications

Specification

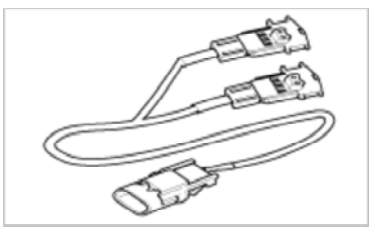
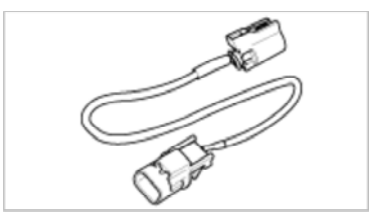
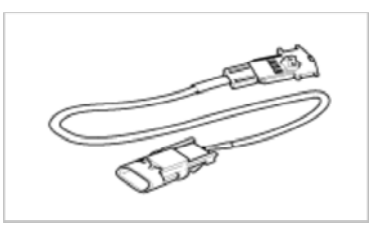
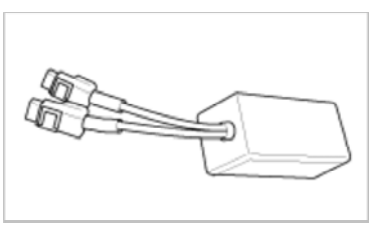
Item	Resistance (Ω)
Driver Airbag (DAB)	1.6 ~ 4.7
Passenger Airbag (PAB)	1.6 ~ 4.7
Side Airbag (SAB)	1.6 ~ 4.7
Curtain Airbag (CAB)	1.6 ~ 4.7
Seat Belt Pretensioner (BPT)	1.6 ~ 4.7

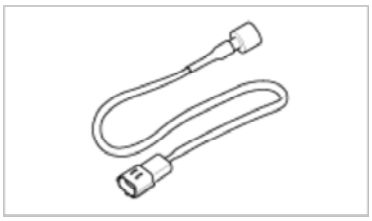
Tightening Torques

Item	Nm	kgf·m	lb-ft
Driver Airbag (DAB)	7.9 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0
Passenger Airbag (PAB)	8.0 ~ 9.0 3.7 ~ 4.3	Bolt : 0.8 ~ 0.9 Nut : 0.38 ~ 0.44	5.9 ~ 6.6 2.7 ~ 3.2
Curtain Airbag (CAB)	10.8 ~ 12.7	1.1 ~ 1.3	7.9 ~ 9.4
Side Airbag (SAB)	5.9 ~ 7.9	0.6 ~ 0.8	4.4 ~ 5.9
Seat Belt Anchor Bolt (BPT)	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
SRSCM Mounting Bolt	9.5 ~ 13.6	1.0 ~ 1.4	7.0 ~ 10.0
Front Impact Sensor (FIS) Mounting Bolt	6.8 ~ 7.9	0.7 ~ 0.8	5.0 ~ 5.8
Side Impact Sensor (SIS) Mounting Bolt	6.8 ~ 7.9	0.7 ~ 0.8	5.0 ~ 5.8

Restraint > General Information > Special Service Tools

Special Service Tools

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0757A-38510		Use with deployment tool (Advanced : DAB, PAB)
Deployment adapter 0957A-3F100		Use with deployment tool. (SAB)
Deployment adapter 0957A-38500		Use with deployment tool. (Depowered : DAB, PAB, CAB, BPT) (Advanced : CAB, BPT)
Dummy 0957A-38200		Simulator to check the resistance of each wiring harness
Dummy adapter 0957A-3F000		Use with dummy (SAB)

Dummy adapter 0957A-2G000		Use with dummy (DAB, PAB, CAB, BPT)

DAB : Driver Airbag
PAB : Passenger Airbag
SAB : Side Airbag
CAB : Curtain Airbag
BPT : Belt Pretensioner

Restraint > General Information > General Safety Information and Caution

Precautions

General Precautions

Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

  NOTE

  The contents in the memory are not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

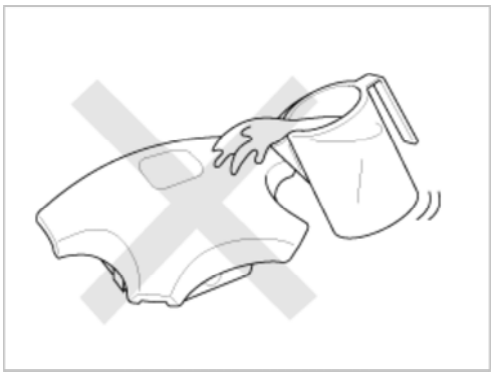
- Use the replacement parts which are manufactured to the same standards as the original parts and quality.
  Do not install used SRS parts from another vehicle.
  Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it.
  Do not install any part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.

- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

Airbag Handling and Storage

Do not disassemble the airbags; it has no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.
For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.

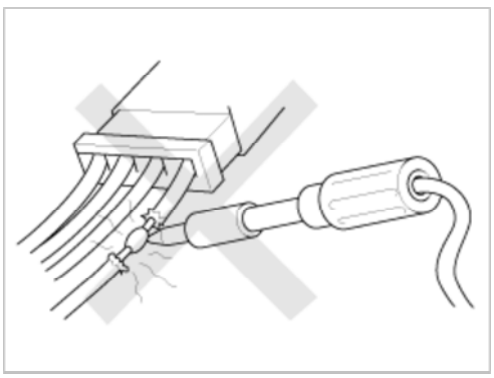


- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85°C/185°F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRS unit or the side impact sensors whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
- During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRS unit and the side impact sensor. The airbags could accidentally deploy and cause damage or injury.
- After a collision in which the airbags were deployed, replace the front airbags and the SRS unit. After a collision in which the side airbag was deployed, replace the side airbag, the front impact sensor and side impact sensor on the side where the side airbag deployed and the SRS unit. After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRS unit and the side impact sensors. If there is any damage, replace the SRS unit, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRS unit, the front impact sensor or the side impact sensors
- Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRS unit.
- Be sure the SRS unit, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
- Do not spill water or oil on the SRS unit,or the front impact sensor or the side impact sensors and keep them away from dust.
- Store the SRS unit, the front impact sensor and the side impact sensors in a cool (less than 40°C/104°F) and dry (less than 80% relative humidity, no moisture) area.

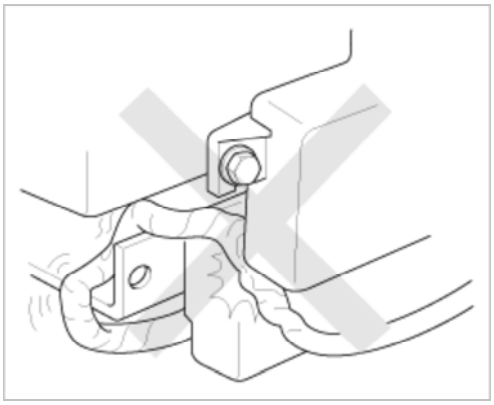
Wiring Precautions

SRS wiring can be identified by special yellow outer covering (except the SRS circuits under the front seats).
Observe the instructions described in this section.

- Never attempt to modify, splice, or repair SRS wiring.
  If there is an open or damage in SRS wiring, replace the harness.



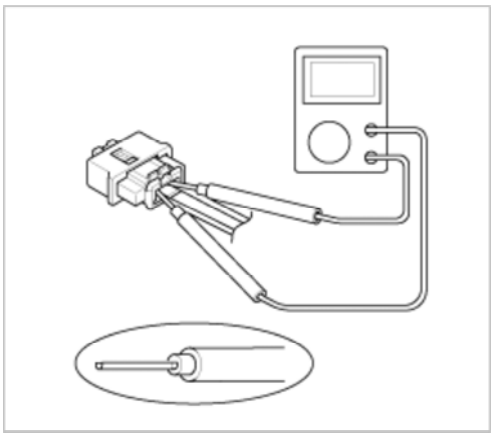
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- 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.

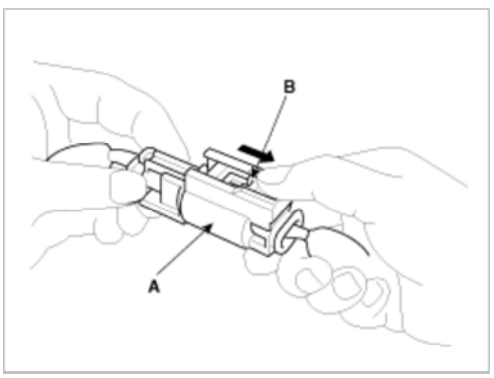


- Use a u-shaped probe. Do not insert the probe forcibly.
- Use specificed service connectors for troubleshooting. Using improper tools could cause an error in inspection due to poor metal contact.

Airbag Connector

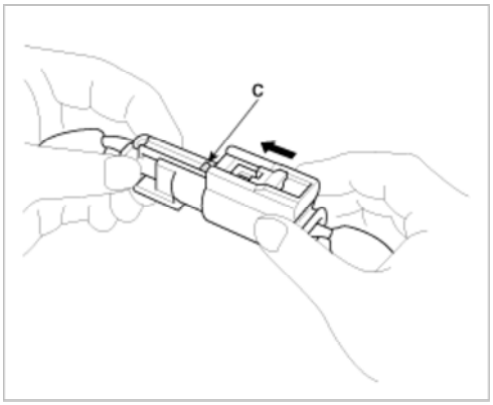
Disconnecting

To release the lock, pull the spring-loaded sleeve (A) and the slider (B), while holding the opposite half of the connector. Pull the connector halves apart. Be sure to pull on the sleeve and not on the connector half.



Connecting

Hold both connector halves and press firmly until the projection (C) of the sleeve-side connector clicks to lock.

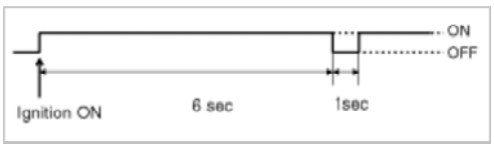


Restraint > General Information > Description and Operation

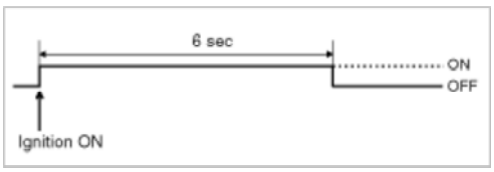
Warning Lamp Activation

As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward. However, in order to warn the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.

1. Active fault or historical fault counter is greater or equal to 10



2. Normal or historical fault counter is less than 10



SRSCM Independent Warning Lamp Activation

There are certain fault conditions in which the SRSCM cannot function and thus cannot control the operation of the standard warning lamp. In these cases, the standard warning lamp is directly activated by appropriate circuitry that operates independently of the SRSCM. These cases are:

1. Loss of battery supply to the SRSCM : warning lamp turned on continuously.
2. Loss of internal operating voltage : warning lamp turned on continuously.
3. Loss of Microprocessor operation : warning lamp turned on continuously.
4. SRSCM not connected : warning lamp turned on continuously through the shorting bar.

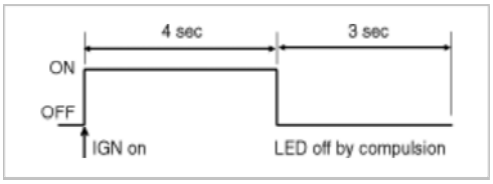
Telltale Lamp Activation(Advanced Only)

The Telltale Lamp indicates the Passenger Airbag(PAB) enabled and disabled status based on occupant status of passenger seat. If the passenger seat is empty or occupied with 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 turn.
Occupant status information and telltale ststus are as below table.

Occupant Status	Telltale Lamp	PAB
Empty	ON	Disabled
Child (Small Occupant)	ON	Disabled
Adult (Large Occupant)	OFF	Enabled
Defect	OFF	Enabled

After ignition on, telltale lamp will turn on for 4 seconds and turn off for 3 seconds during the initialization phase and be turned

off afterward until receipt of first valid suppression message from OCS system.



Restraint > General Information > Repair procedures

Component Replacement After Deployment

NOTE

Before doing any SRS repairs, use the Hi-Scan Pro to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.
- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Front impact sensors
- SRS wiring harnesses
- Inspect the clock spring for heat damage.
  If any damage found, replace the clock spring.

When the seat belt pretensioner(s) deployed after a collision, replace the following items.
- Seat belt pretensioner(s)
- SRSCM (if B1658 detected)
- Front impact sensors
- SRS wiring harnesses

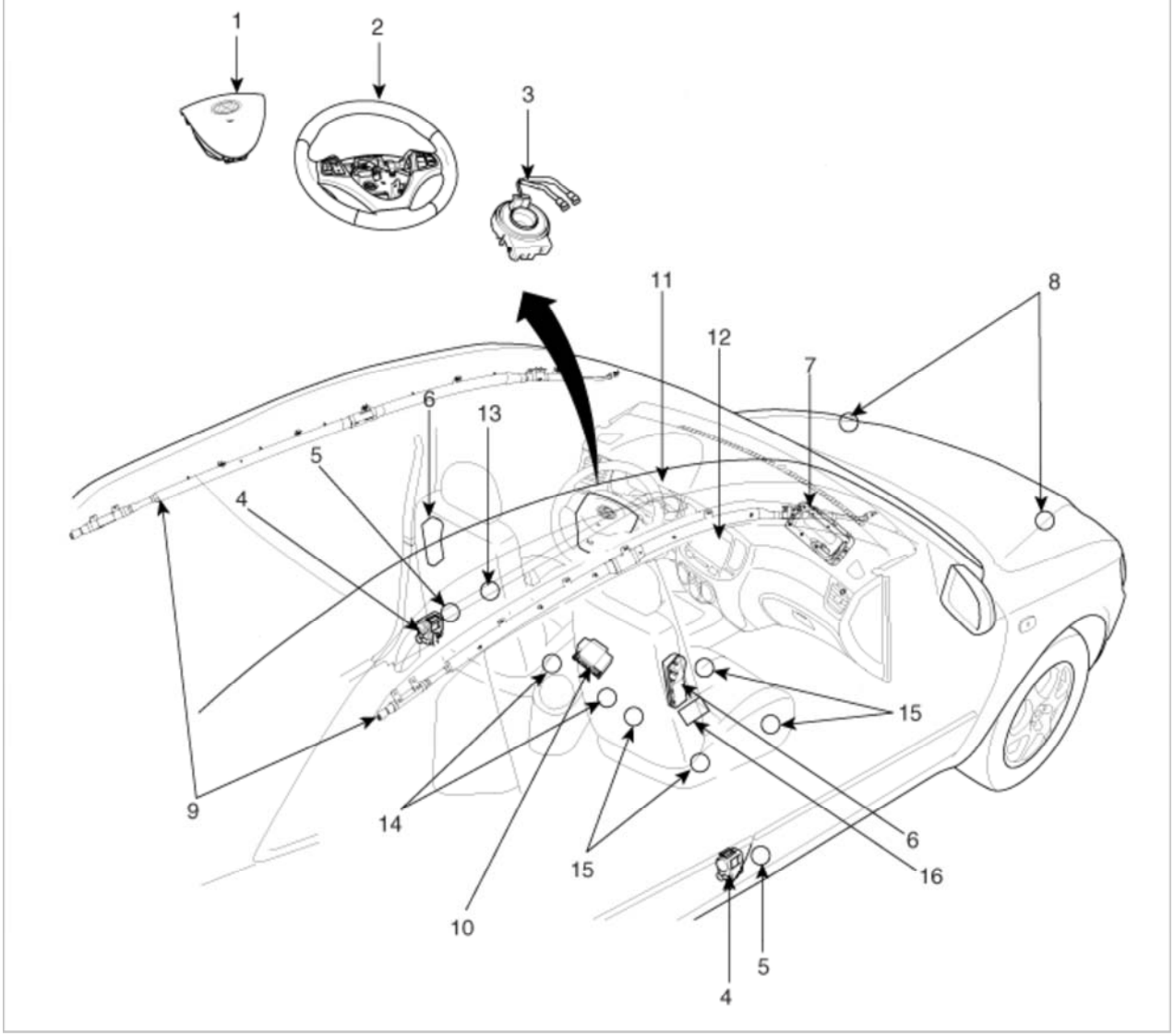
When the side/curtain airbag(s) deployed after a collision, replace the following items.
- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

After the vehicle is completely repaired, confirm the SRS airbag system is OK.
- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

Restraint > General Information > Components and Components Location

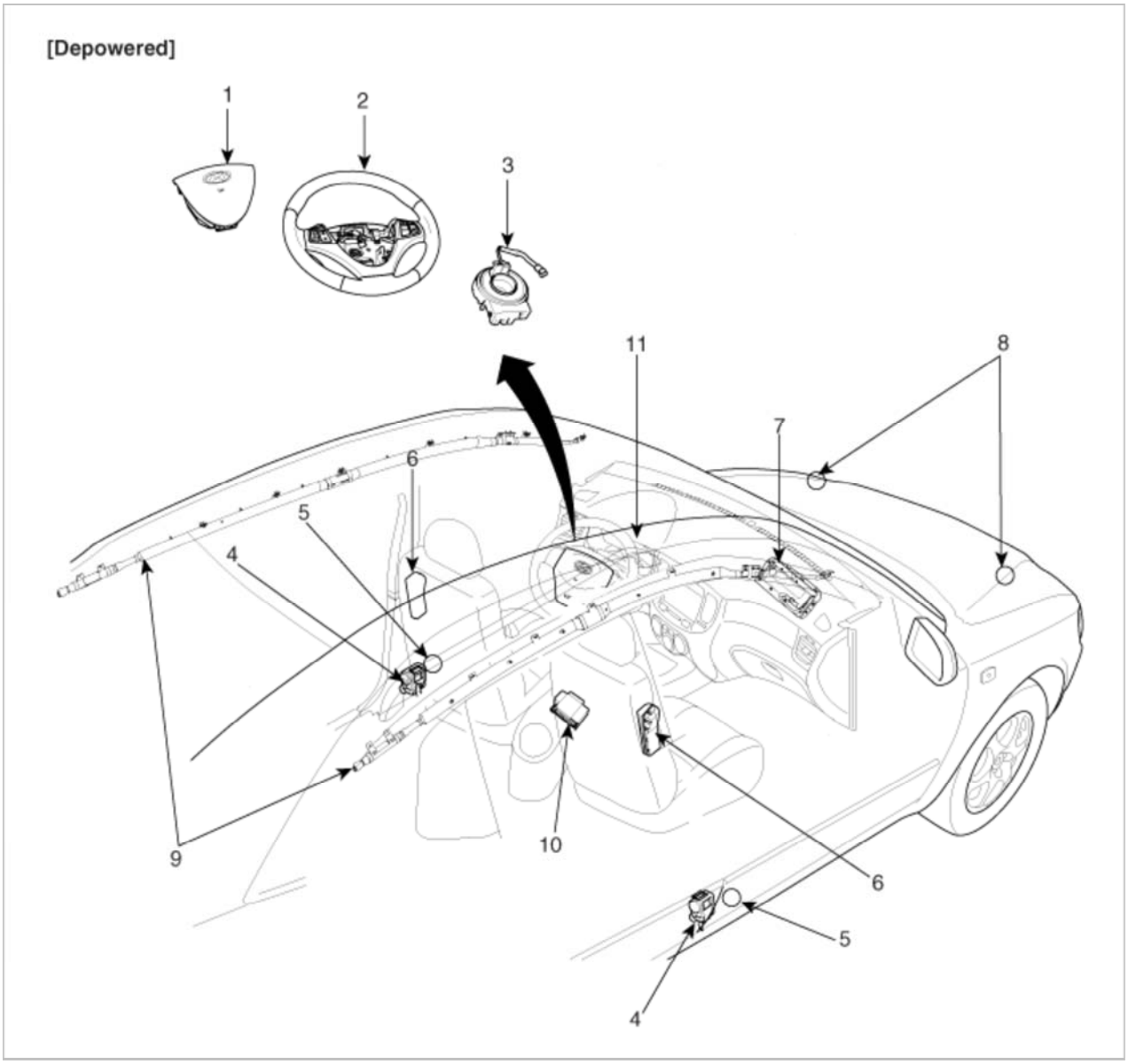
Components (1)

[Advancsd]



1. Driver Airbag (DAB) 2. Steering Wheel 3. Clock Spring 4. Seat Belt Pretensioner (BPT) 5. Side Impact Sensor (SIS) 6. Side Airbag (SAB) 7. Passenger Airbag (PAB) 8. Front Impact Sensor (FIS)	9. Curtain Airbag (CAB) 10. Supplemental Restraint System Control Module (SRSCM) 11. Airbag Warning Lamp 12. Telltale Lamp 13. Seat Track Position Sensor (STPS) 14. Seat Belt Buckle Switch 15. Weight Sensor 16. Weight Classification System(WCS) Module

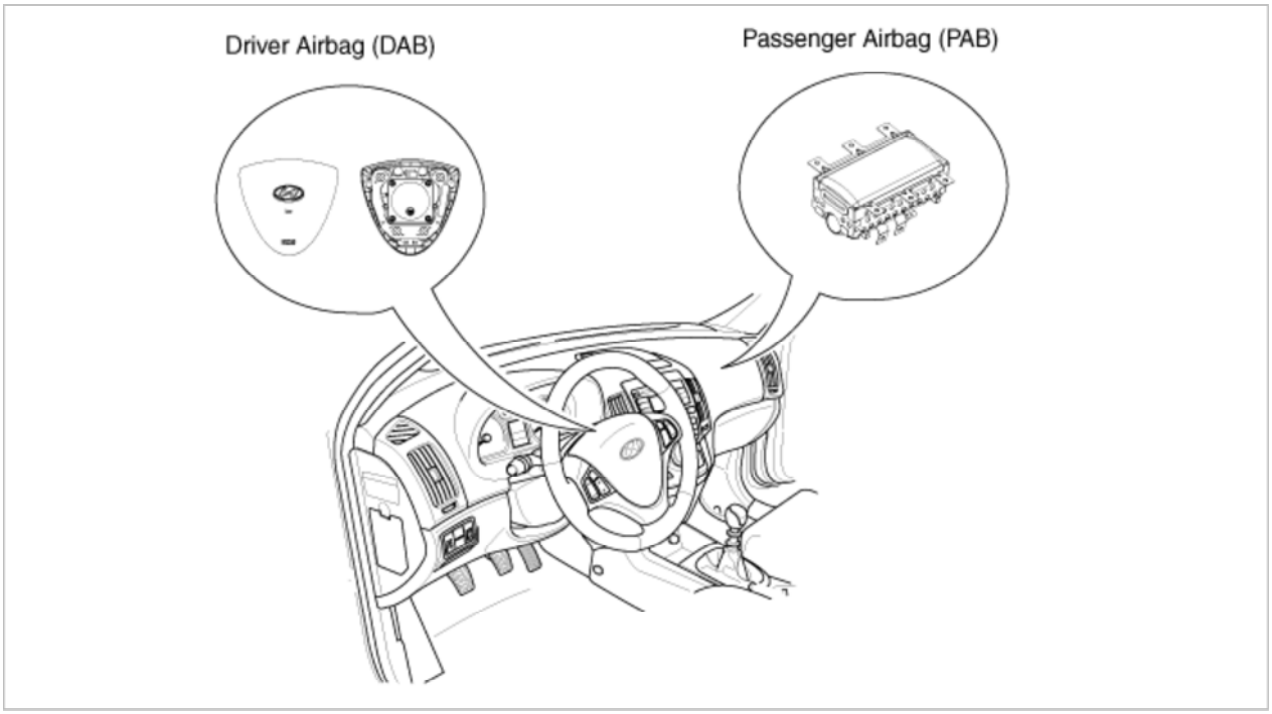
Components (2)



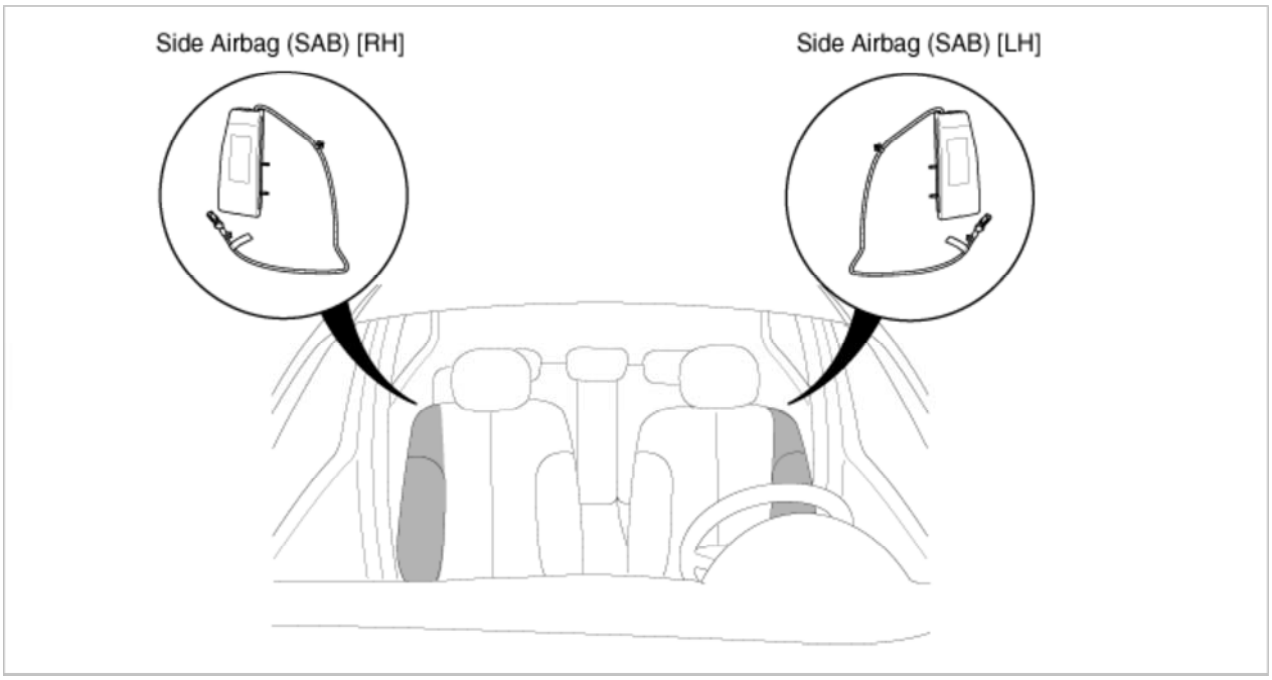
1. Driver Airbag (DAB)	7. Passenger Airbag (PAB)
2. Steering Wheel	8. Front Impact Sensor (FIS)
3. Clock Spring	9. Curtain Airbag (CAB)
4. Seat belt Pretensioner (BPT)	10. Supplemental Restraint System Control Module (SRSCM)
5. Side Impact Sensor (SIS)	11. Airbag Warning Lamp
6. Side Airbag (SAB)	

Components Location

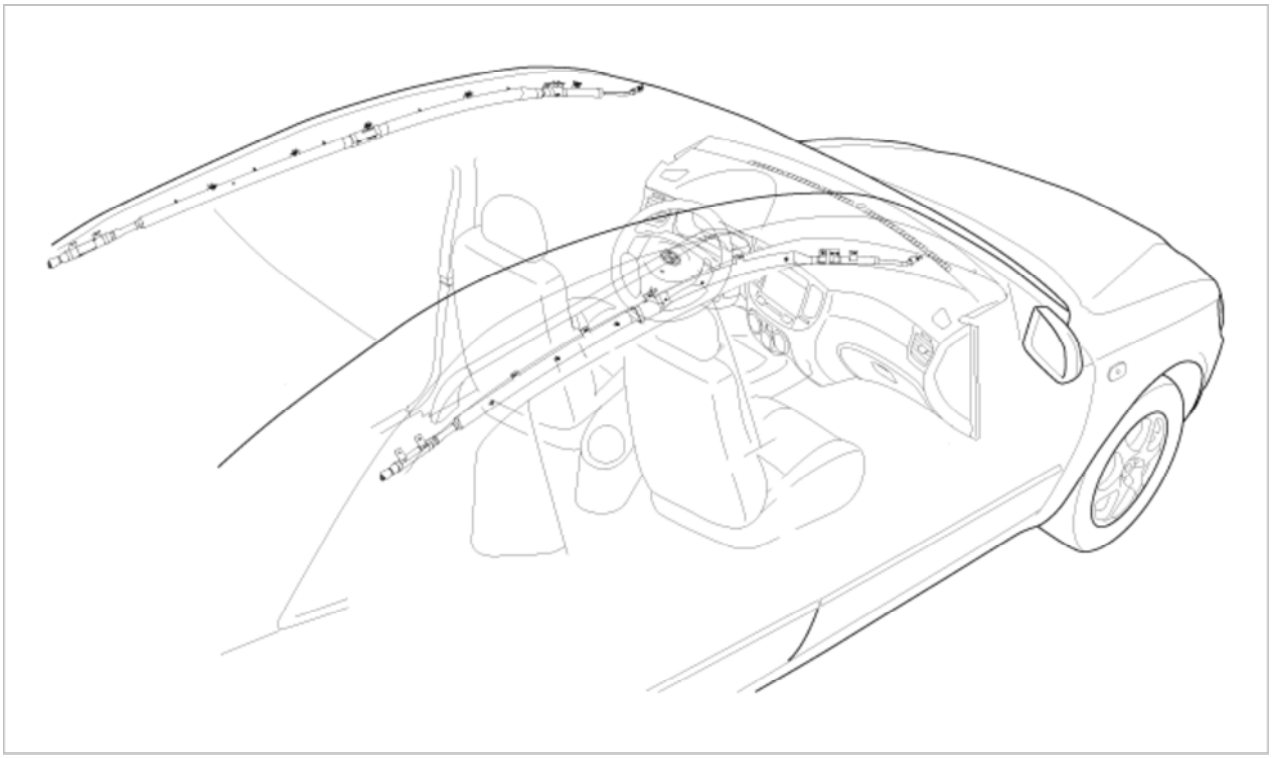
Driver Airbag (DAB) / Passenger Airbag (PAB)



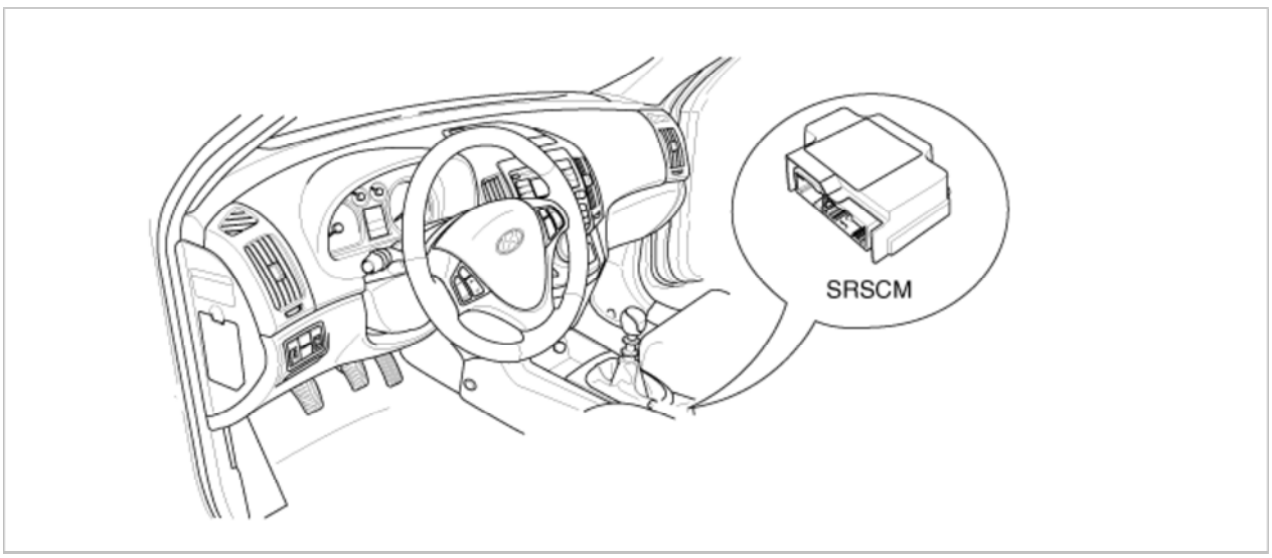
Side Airbag (SAB)



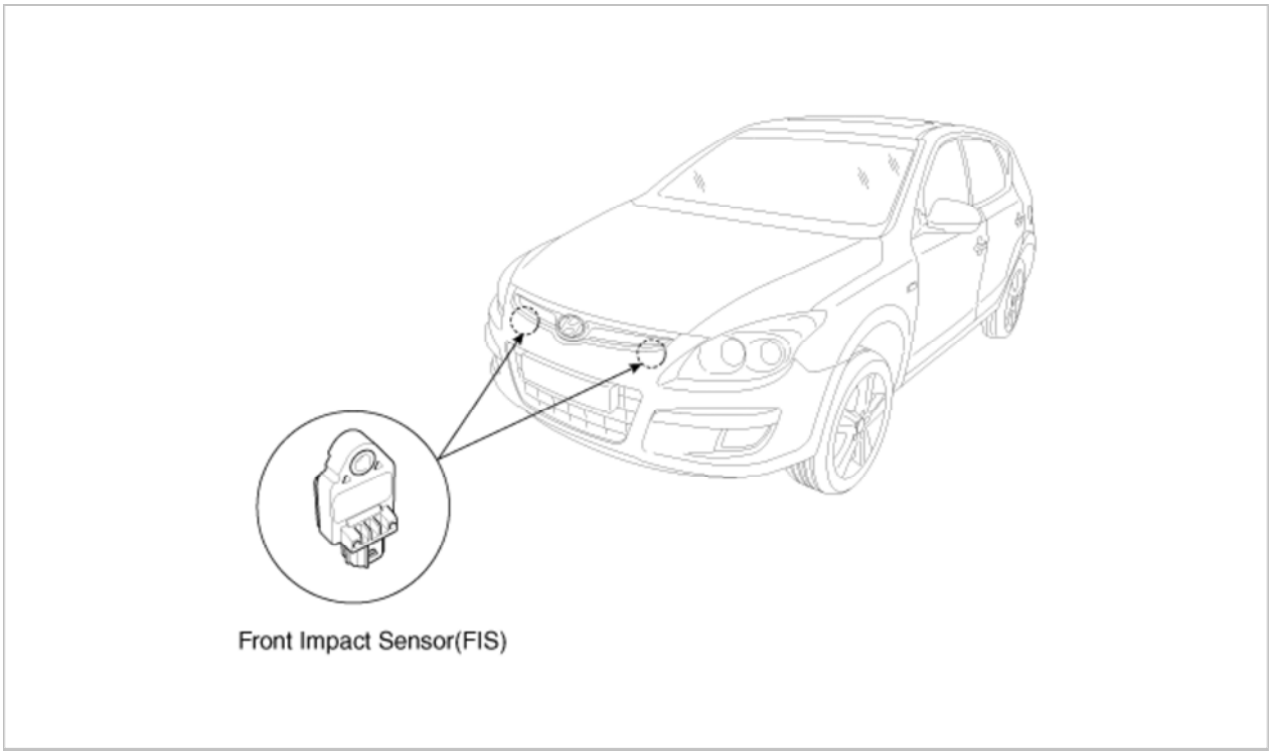
Curtain Airbag (CAB)



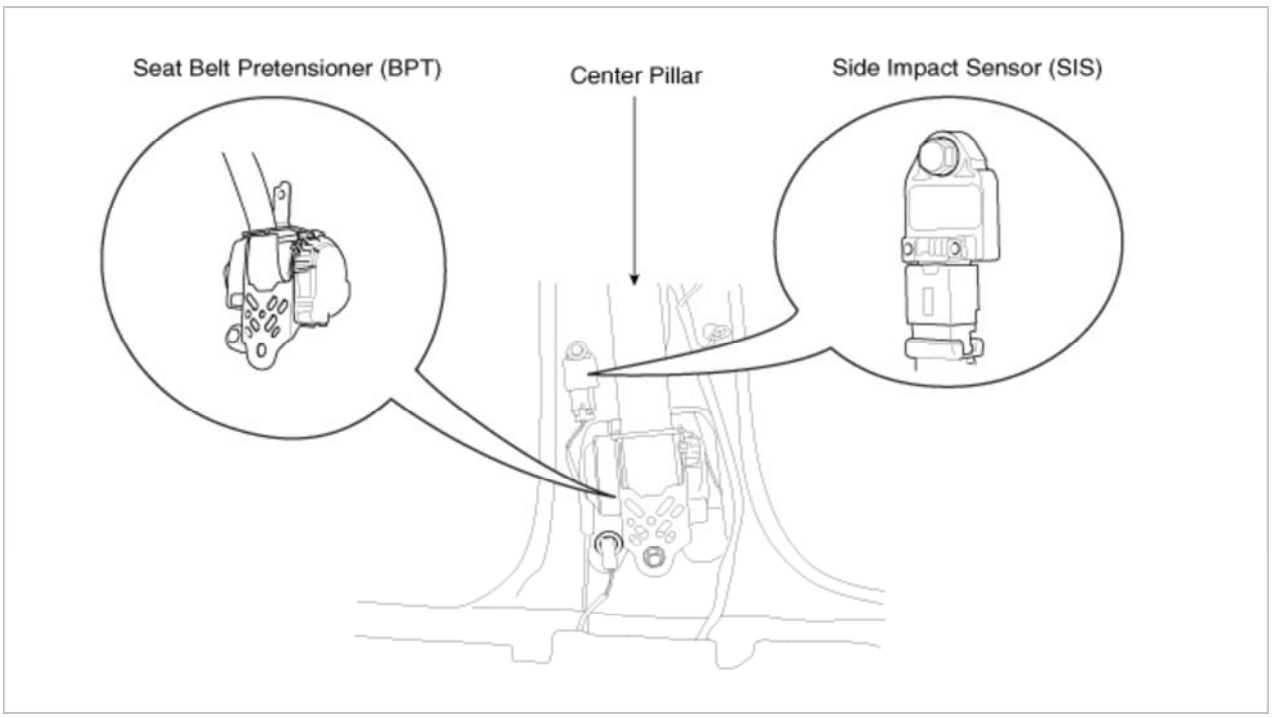
Supplemental Restraint System Control Module (SRSCM)



Front Impact Sensor (FIS)



Seat Belt Pretensioner (BPT) / Side Impact Sensor (SIS)



Restraint > SRSCM > SRS Control Module (SRSCM) > Description and Operation

Description

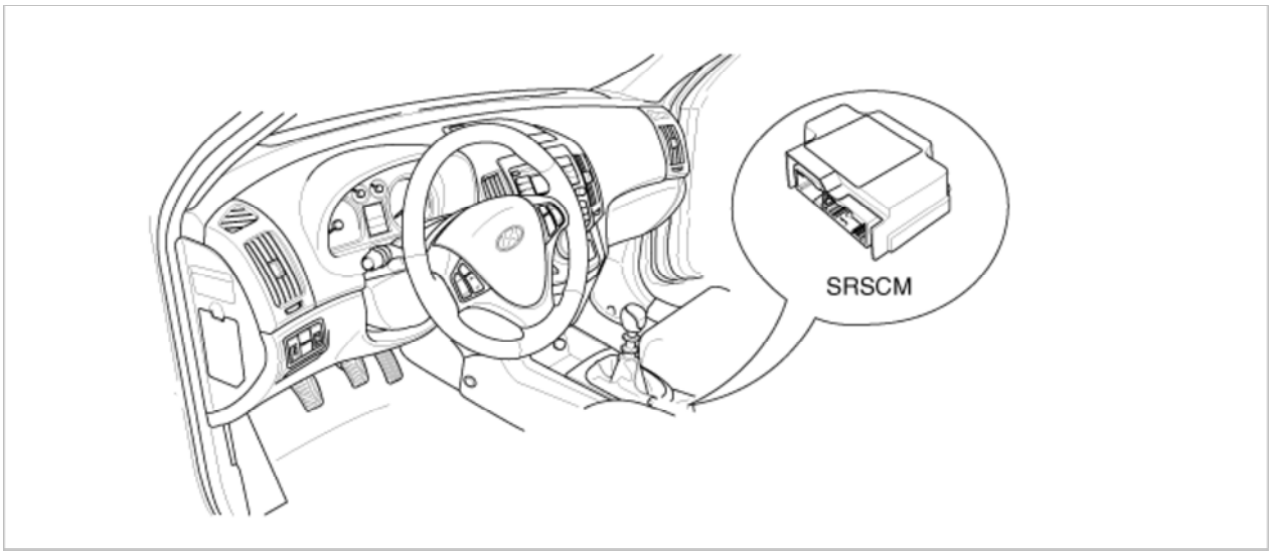
The primary purpose of the SRSCM(Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag deployment is required, the SRSCM must supply sufficient power to the pretensioners and airbag igniters to initiate deployment. The SRSCM determines that an impact may require deployment of the pretensioners and airbags from data obtained from impact sensors and other components in conjunction with a safing function.

The SRSCM will not be ready to detect a crash or to activate the restraint system devices until the signals in the SRSCM circuitry stabilize. It is possible that the SRSCM could activate the safety restraint devices in approximately 2 seconds but is guaranteed to fully function after prove-out is completed. The SRSCM must perform a diagnostic routine and light a system

readiness indicator at key-on. The system must perform a continuous diagnostic routine and provide fault annunciation through a warning lamp indicator in the event of fault detection. A serial diagnostic communication interface will be used to facilitate servicing of the restraint control system.

Restraint > SRSCM > SRS Control Module (SRSCM) > Components and Components Location

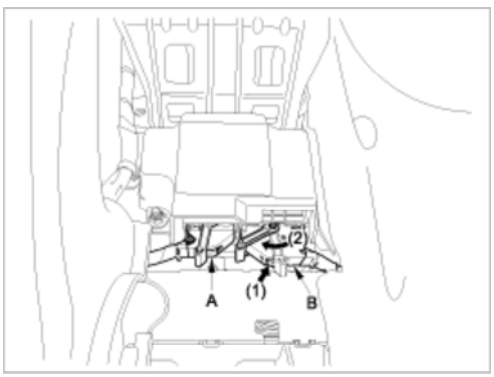
Components



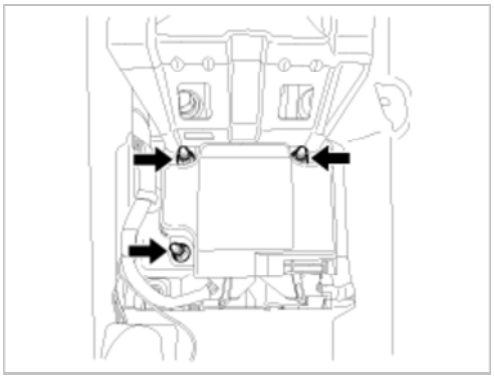
Restraint > SRSCM > SRS Control Module (SRSCM) > Repair procedures

Removal

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Disconnect the DAB, PAB, SAB, CAB and BPT connectors.
4. Remove the floor console. (Refer to the Body group - Console)
5. Press the lock(1), then pull back the connector lever(2) until it clicks.



6. Disconnect the SRSCM harness connector(A) and (B) from the SRSCM.
7. Remove the SRSCM mounting nuts (3EA) from the SRSCM, then remove the SRSCM.



Installation

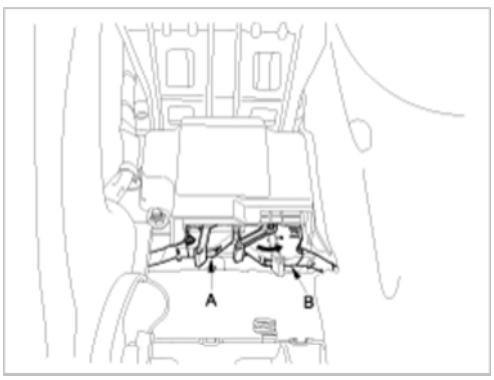
1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Install the SRSCM with the SRSCM mounting nuts.

Tightening Torque
: 9.5 ~ 13.6 Nm (1.0 ~ 1.4 kgf.m, 7.0 ~ 10.0 lb.ft)

NOTE

Use new mounting bolts when replacing th SRSCM after a collision.

4. Connect the SRSCM harness connector.



5. Install the floor console. (Refer to the Body group - Console)
6. Connect the DAB, PAB, SAB, CAB and BPT connectors.
7. Reconnect the battery negative cable.
8. After installing the SRSCM, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

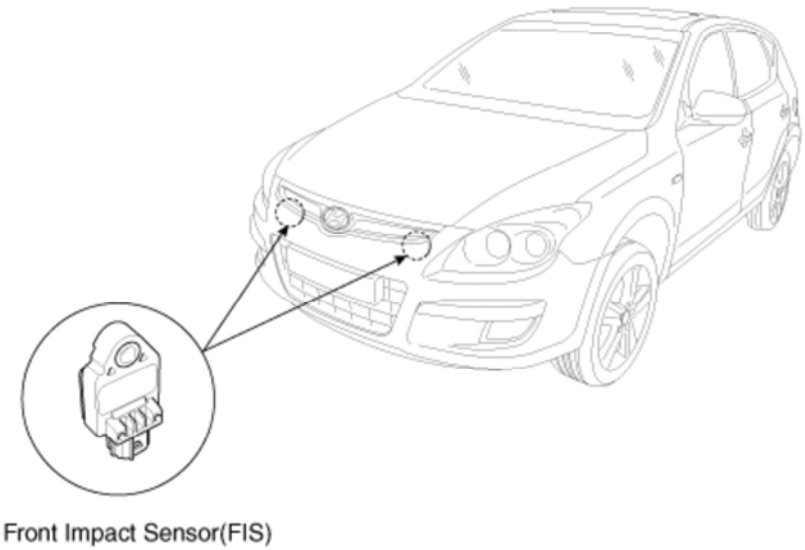
Restraint > SRSCM > Front Impact Sensor (FIS) > Description and Operation

Description

The front impact sensors(FIS) are installed on the upper of the side panel in Front End Module(FEM). They are remote sensors that detect acceleration due to a collision at their mounting locations. The primary purpose of the Front Impact Sensor(FIS) is to provide an indication of a collision. The Front Impact Sensor(FIS) sends acceleration data to the SRSCM.

Restraint > SRSCM > Front Impact Sensor (FIS) > Components and Components Location

Components



Front Impact Sensor(FIS)

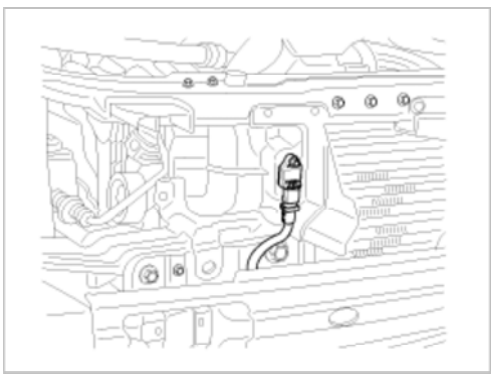
Restraint > SRSCM > Front Impact Sensor (FIS) > Repair procedures

Removal

CAUTION

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front bumper. (Refer to the Body group - Bumper)
3. Disconnect the front impact sensor connector.
4. Remove the front impoct sensor mounting bolt.



5. Remove the front impoct sensor.

Installation

CAUTION

- Be sure to install the harness wire not to be pinched or interfere with other parts.
- Do not turn the ignition switch ON and do not contact the battery cable while replacing the front impact sensor.

1. Install the new Front Impact Sensor with bolt then connect the SRS harness connector to the Front Impact Sensor.

Tightening torque
: 6.8 ~ 7.9 Nm (0.7 ~ 0.8 kgf.m, 5.0 ~ 5.8 lb.ft)

2. Install the front bumper.
3. Reconnect the negative battery cable.
4. After installing the Front Impact Sensor, confirm proper system operation:
   A. Turn the ignition switch ON the SRS indicator light should be turned on for about six seconds and then go off.

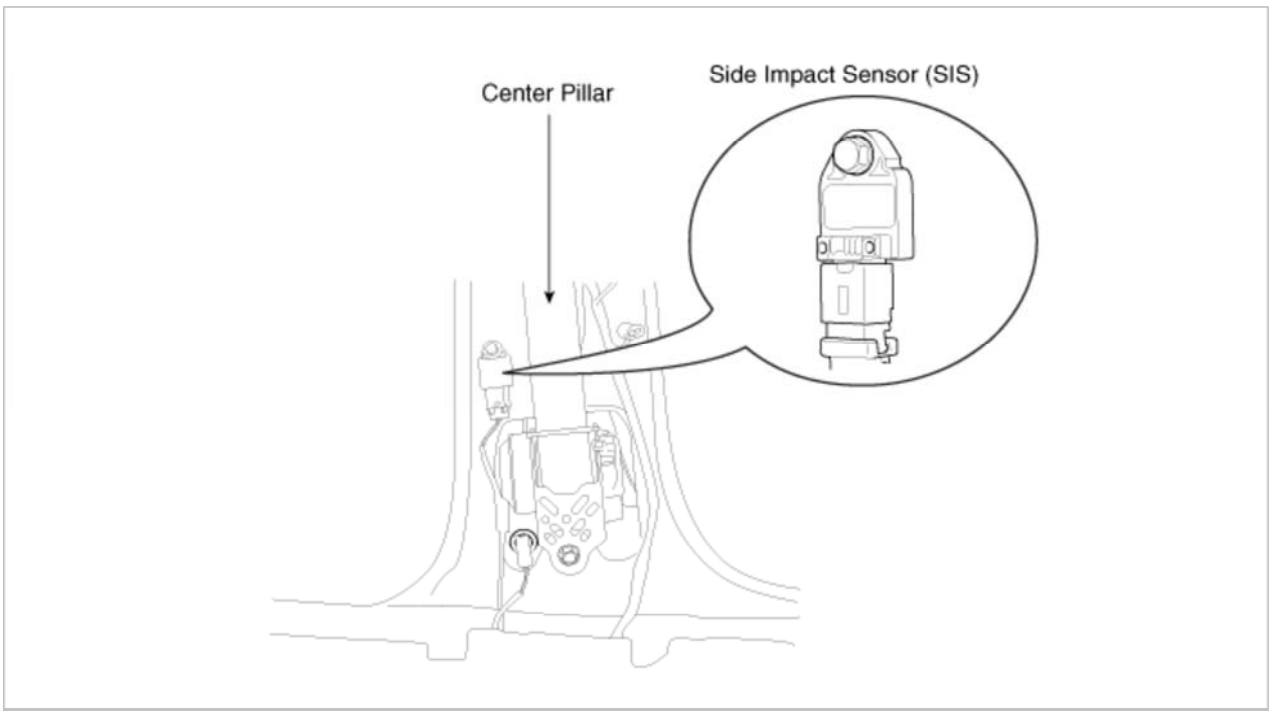
Restraint > SRSCM > Side Impact Sensor (SIS) > Description and Operation

Description

The Side Impact Sensor(SIS) system consists of two front SIS which are installed inside the center Pillar(LH and RH). They are remote sensors that detect acceleration due to collision at their mounting locations. The primary purpose of the Side Impact Sensor(SIS) is to provide an indication of a collision. The Side Impact Sensor(SIS) sends acceleration data to the SRSCM.

Restraint > SRSCM > Side Impact Sensor (SIS) > Components and Components Location

Components



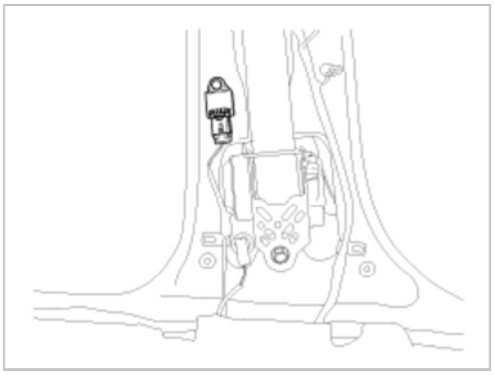
Restraint > SRSCM > Side Impact Sensor (SIS) > Repair procedures

Removal

CAUTION

- Removal of the airbag must be performed according to the precautions/procedures described previously.
- Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the center pillar trim. (Refer to the Body group - Interior trim)
3. Disconnect the Side Impact Sensor connector.
4. Remove the SIS mounting bolt then remove the Side Impact Sensor.



Installation

CAUTION

- Be sure to install the harness wires not to be pinched or interfered with other parts.
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new Side Impact Sensor with the bolt then connect the SRS harness connector to the Side Impact Sensor.

Tightening torque
: 6.8 ~ 7.9 Nm (0.7 ~ 0.8 kgf.m, 5.0 ~ 5.8 lb.ft)

2. Install the center pillar trim.(Refer to the Body group - Interior trim)
3. Reconnect the negative battery cable.
4. After installing the Side Impact Sensor, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > SRSCM > Seat Track Position Sensor (STPS) > Description and Operation

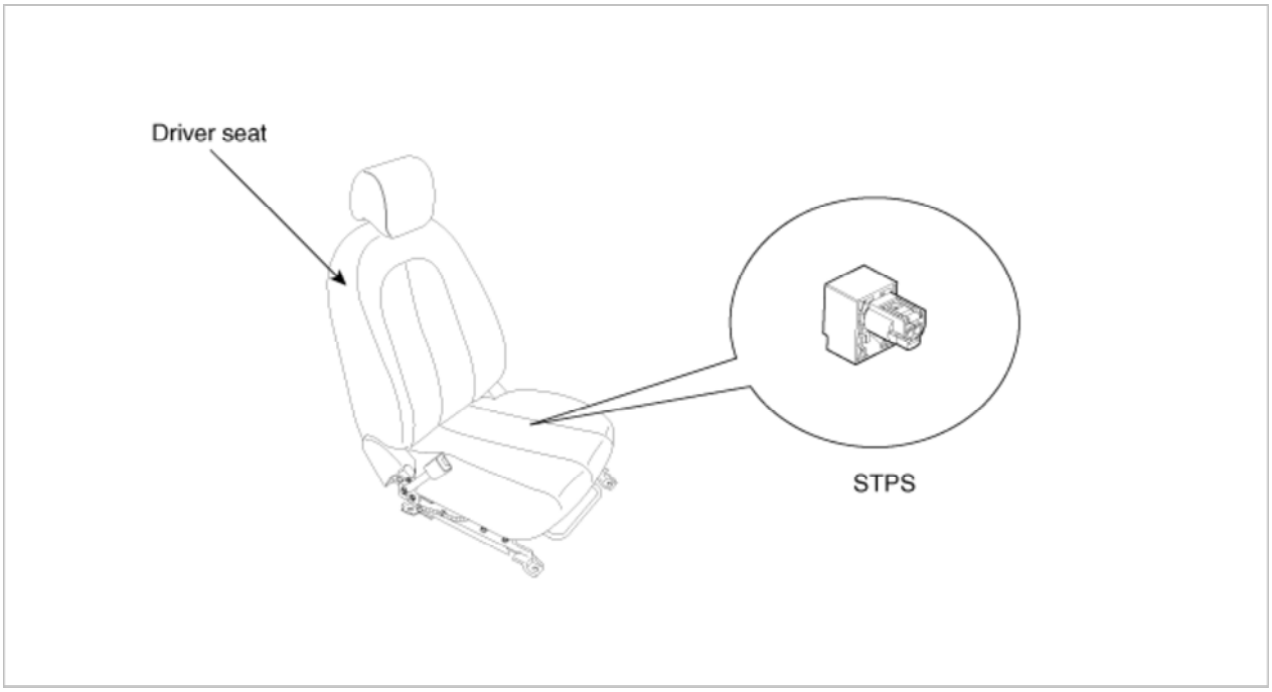
(Advanced Only)

Description

The STPS operated via a non-contacting magnetic proximity sensing device combined with a simple electronic circuit resulting in the ability of producing two separate and distinct logic level signals.
The STPS output signal is altered by the proximity of a separate ferro-magnetic shunt, which is linked via the seat track. The logic signal produced is the result of the proximity device being activated or deactivated.
When the seat is in the forward position zone of the track, the sensor gives a low current (prohibit) signal. When the seat is in the rear position zone of the track, it gives a high current (enable) signal.

Restraint > SRSCM > Seat Track Position Sensor (STPS) > Components and Components Location

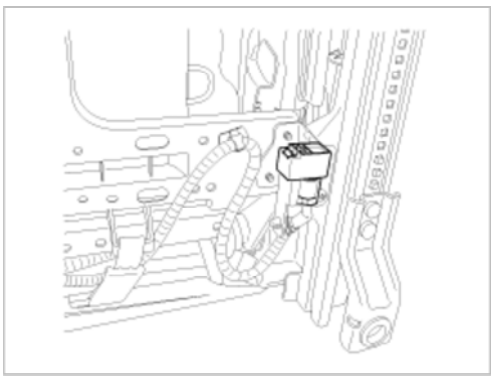
Components



Restraint > SRSCM > Seat Track Position Sensor (STPS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front seat assembly. (Refer to the Body group - Seat)
3. Loosen the two STPS screws, then remove the STPS after disconnecting the STPS connector.



Installation

CAUTION

Be sure to install the harness wires not to be pinched or interfered with other parts.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the ignition key from the vehicle.
3. Install the STPS with two screws.
4. Install the front seat assembly. (Refer to the Body group - Seat)
5. Reconnect the battery negative cable.
6. After installing the Seat Track Position Sensor, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.

Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Description and Operation

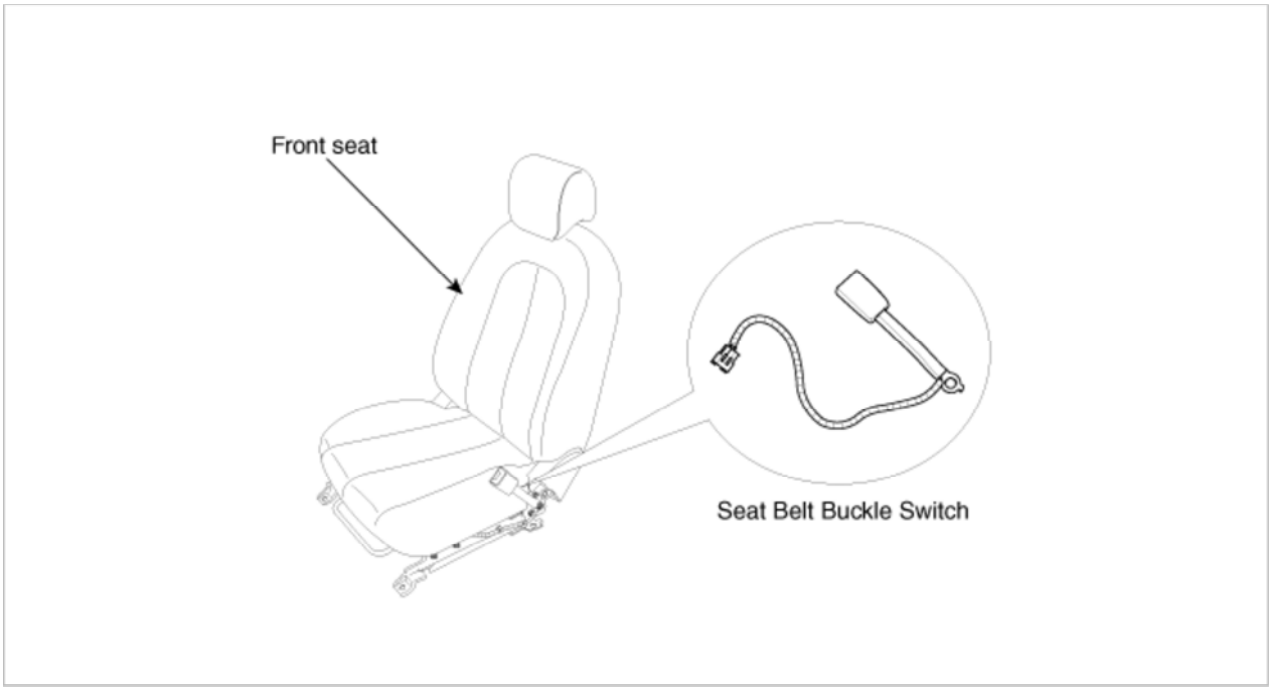
(Advanced Only)

Description

The SRSCM shall monitor the status of the driver and front passenger seat belt buckle. The SRSCM provides one pin each for the driver and front passenger seat belt buckle status input. The seat belt buckle circuit operates from internal boost voltage supplied by the SRSCM, and uses chassis ground for the signal return. The buckle status shall modify the SRSCM deployment. If the buckle status is unbuckled, the corresponding pretensioner will be deactivated.

Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Components and Components Location

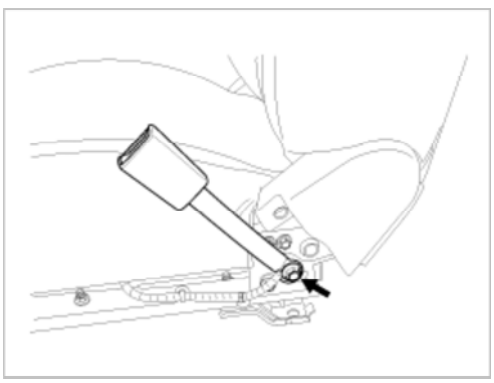
Components



Restraint > SRSCM > Seat Belt Buckle Switch (BS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front seat assembly. (Refer to the Body group - Seat)
3. Loosen the seat belt buckle mounting bolt and remove the seat belt buckle switch.



Installation

CAUTION

Be sure to install the harness wires not to be pinched or interfered with other parts.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.

2. Remove the ignition key from the vehicle.
3. Install the seat belt buckle switch.

Tightening Torque
: 39.2 ~53.9 Nm (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb.ft)

4. Install the front seat assembly. (Refer to the Body group - Seat)
5. Reconnect the battery negative cable.
6. After installing the Seat Belt Buckle Switch, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.

Restraint > SRSCM > Occupant Classification Sensor (OCS) > Description and Operation

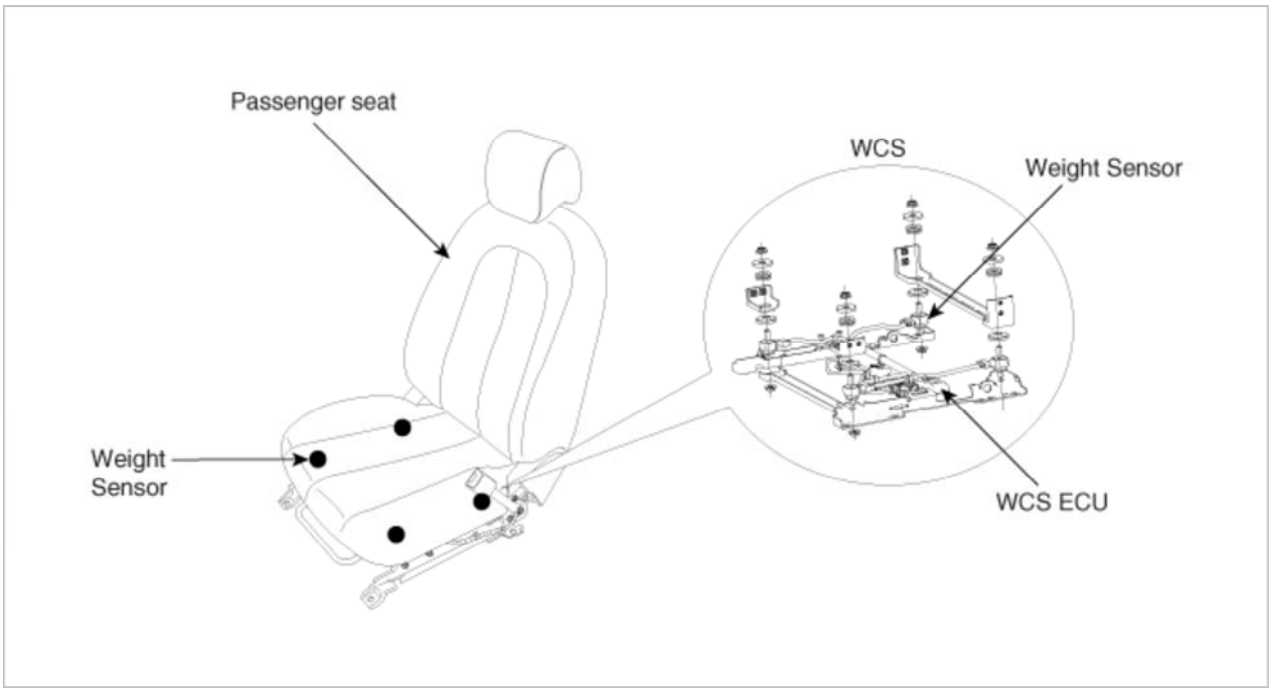
(Advanced Only)

Description

In contrast to the initial one-stage airbag systems, newer restraint systems involve complex logic to select, or alternatively suppress, various levels of safety system deployment. Inherent to an Advanced Restraint System is the ability to discern information regarding passenger occupancy. It is intended that these inputs be provided through the WCS.
The object of such safety system is to reduce the risk and level of injuries by automatically adapting the airbag(s) and seat belt pretensioner to the driving status of the vehicle, its occupants, and the crash severity. The current WCS covered in this specification continually senses and classifies the front passenger side seat. The Occupant Classification System described in this section is Weight Classification System(WCS) of strain gauge type. It consist of 4 weight sensors and ECU which is classifying weight of occupant. It is installed on the seat track assembly.

Restraint > SRSCM > Occupant Classification Sensor (OCS) > Components and Components Location

Components



Restraint > SRSCM > Occupant Classification Sensor (OCS) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the front passenger seat assembly.
   (Refer to the Body group - Seat)

3. Remove the seat track assembly.
   (Refer to the Body group - Seat)

Installation

NOTE

ODS(Occupant Detection System) is utilizing a robust weight measuring technology. Thus, if any of the following conditions occur, WCS reset and accuracy check should be performed.

- The occupant classification ECU or any of the sensors is replaced.
- The vehicle is brought to the repair shop due to an accident or a crash even though the severity seems to be minor.
- The telltale lamp is not illuminated when the passenger seat is not occupied.
- The telltale lamp is delayed more than 10 seconds to be turned off when an adult passenger seats in.
- The passenger seat is removed from the vehicle and reassembled.
- Any accessories (side table, seatback table and seat cover, etc) are replaced or installed.

1. Install the ODS equipped seat track assembly.
   (Refer to the Body group - Seat)
2. Install the front passenger seat assembly. (Refer to the Body group - Seat)
3. Reconnect the battery negative cable.
4. After installing ODS, perform the WCS reset and accuracy check with the Hi-Scan Pro.

NOTE

Check that seat is not occupied and empty before performing the operation. Make sure that the back pocket is empty. In order to perform the accuracy check, the command zero operation should be finished normally. Make sure the procedure be finished normally.

(1) Adjust the seat position according to the table below.

Item	Remark
Seat track position	Rearmost position
Seat recliner angle	Normal (upright)
Head rest position	Lowest position
Lifter position	Lowest position

Make sure seat belt not to be buckled, and the belt tension be normal.

(2) Connect the Hi-Scan Pro connector to the data link connector located under the crash pad.

(3) Turn the ignition switch on and power on the Hi-Scan Pro.

(4) Perform the WCS reset by using the Hi-Scan Pro.
[System selection screen]
Vehicle Selection_Airbag_02.Weight Classification System_04. WCS RESET_ENTER
(then, Completed is displayed)

(5) Perform the accuracy check by using the Hi-Scan Pro.
[System selection screen]
Vehicle Selection_Airbag_02.Weight Classification System_04. WCS RESET_ESC

(6) Confirm the measured weight is within the standard value. And then press "ESC".

specification : -2.0kg ~ 2.0kg (-4.4lb ~ 4.4lb)

(7) Place a 37kg (81.57lb) weight on the passenger front seat.

(8) Confirm that the result of accuracy check is within the standard value.

specification : 35kg ~ 39kg (77.16lb ~ 85.98lb)

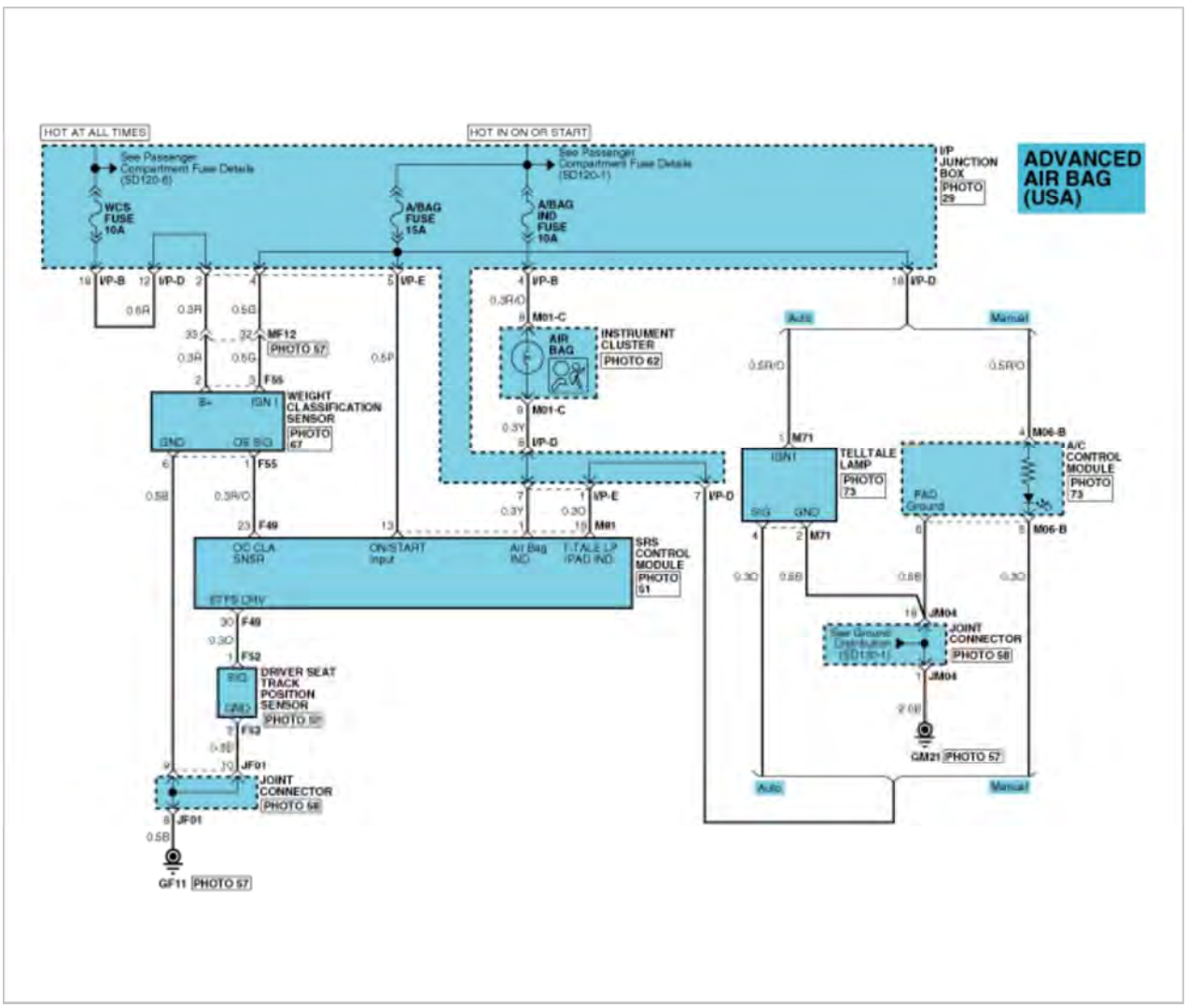
NOTE

- When performing the accuracy check, use a solid metal weight and place it at the center of the seat. If the weight made from liquid is used or the weight slides, the check result may not accurate, and could result in unwanted fail
- When the measured weight deviates from the standard value, check again all the fastening bolts are tightened properly. And make sure there is no interference. During the tightening, be careful not to deform the seat rail or seat structure. If the accuracy check is still not inside the standard value, replace the seat leg assembly.
- When WCS reset operation not finished normally, replace the seat leg assembly.

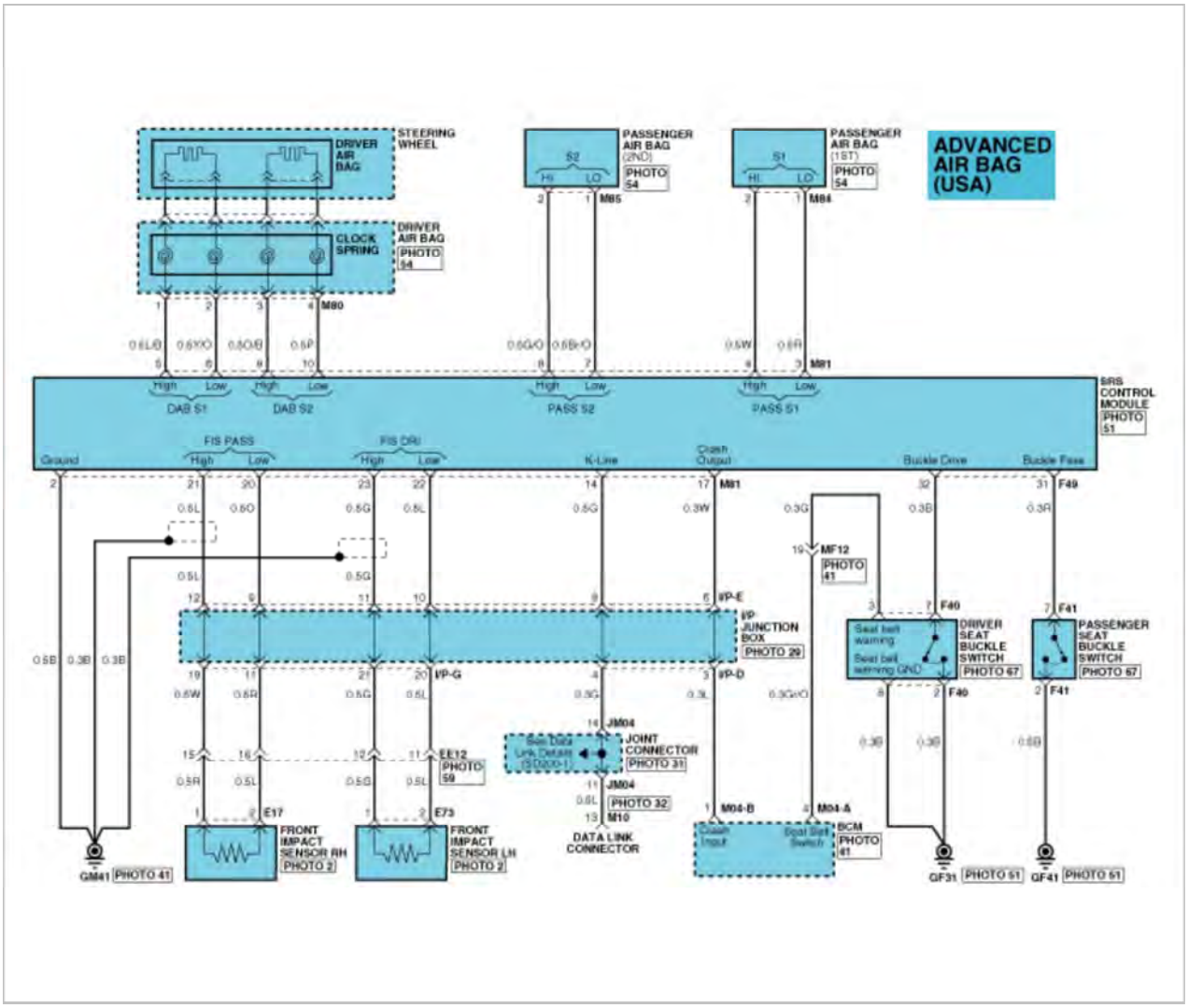
5. After installing the ODS, confirm proper system operation:
   A. Turn the ignition switch ON, the SRS indicator should be turned on for about six seconds and then go off.
   B. Telltale lamp will turn on for 4 seconds and be turned off for 3 seconds. After the 7 seconds, it shall remain off if the ODS does not require suppression and the passenger airbag is enabled.

Restraint > SRSCM > Schematic Diagrams

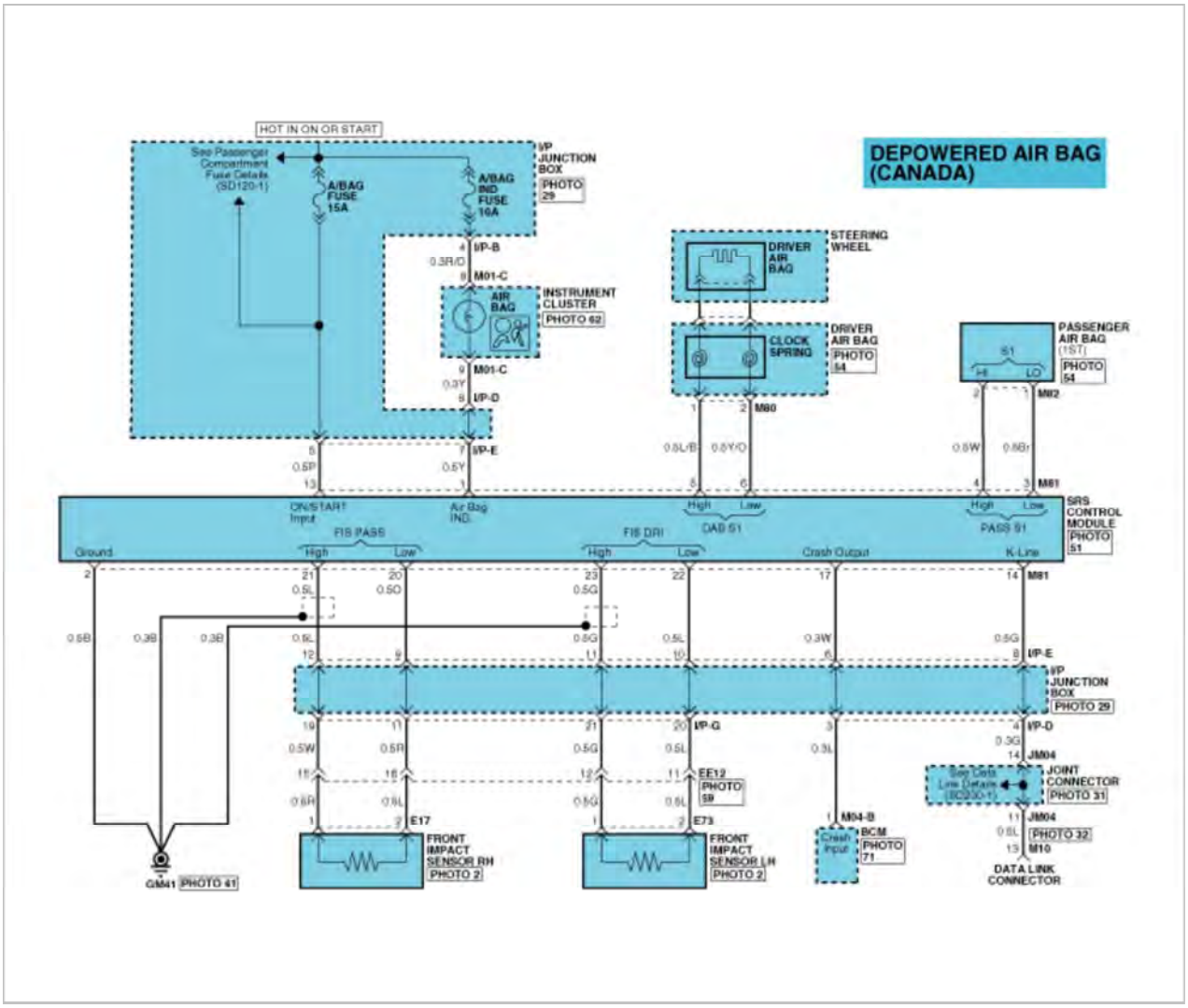
Circuit Diagram (1)



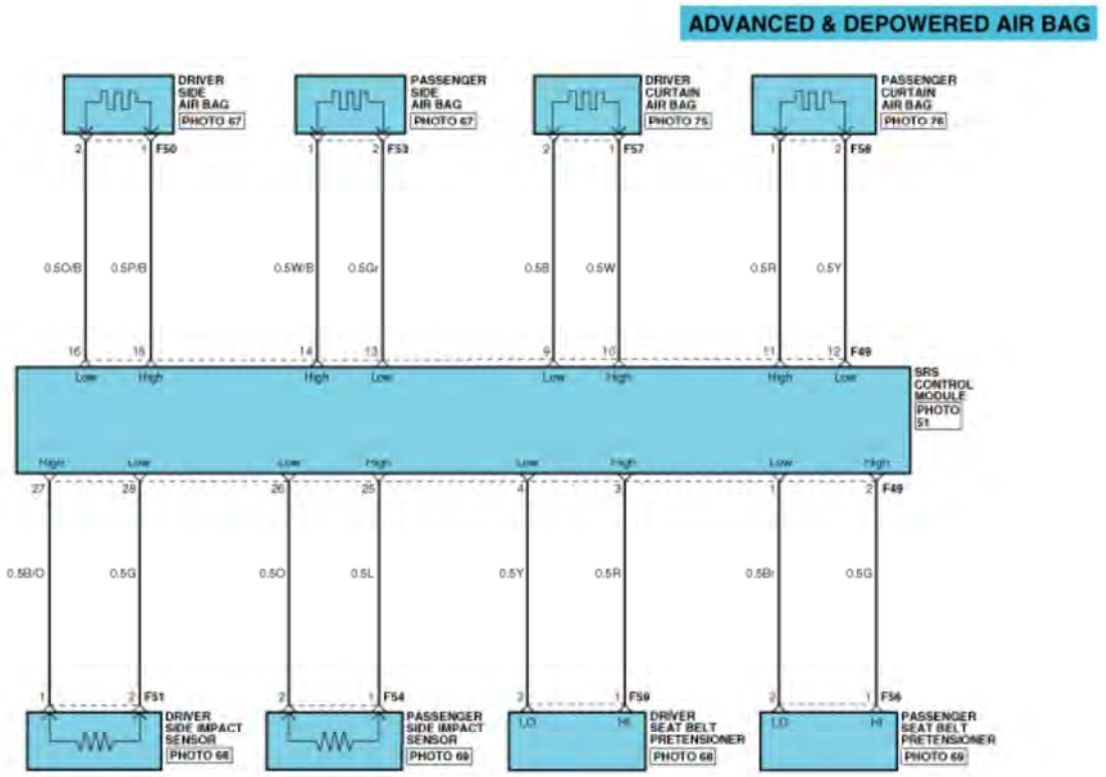
Circuit Diagram (2)



Circuit Diagram (3)

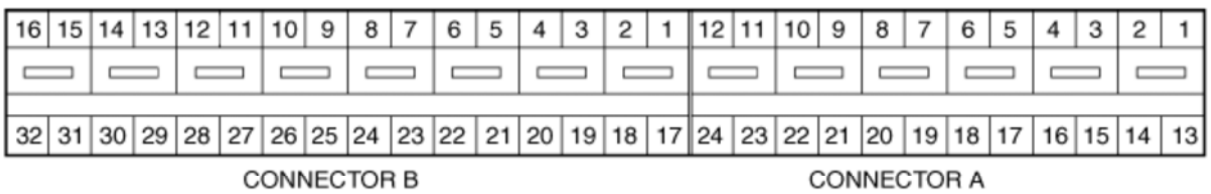


Circuit Diagram (4)



SRSCM Connector Terminal

SRSCM Harness Connector [Advanced]

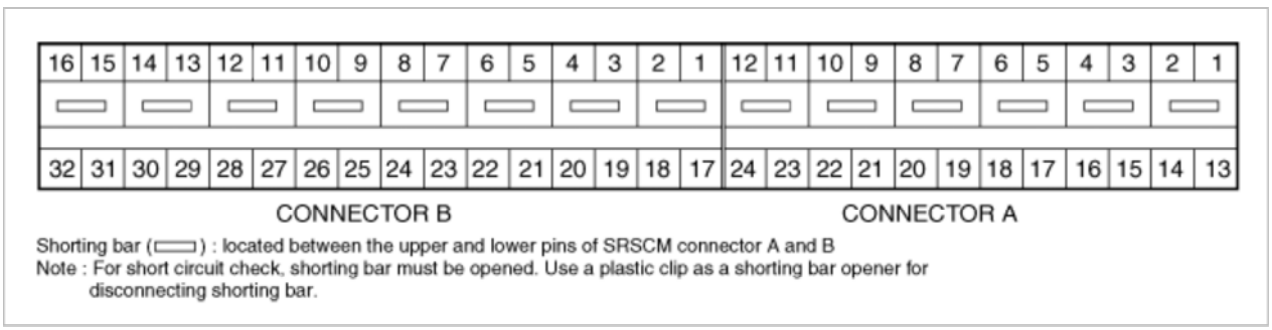


Shorting bar (▭) : located between the upper and lower pins of SRSCM connector A and B
Note : For short circuit check, shorting bar must be opened. Use a plastic clip as a shorting bar opener for disconnecting shorting bar.

Pin	Function (Connector A)	Pin	Function (Connector B)
1	Airbag Warning Lamp	1	Seat Belt Pretensioner [Passenger] Low
2	Ground	2	Seat Belt Pretensioner [Passenger] High
3	(1st Stage) Passenger Airbag Low	3	Seat Belt Pretensioner [Driver] High
4	(1st Stage) Passenger Airbag High	4	Seat Belt Pretensioner [Driver] Low
5	(1st Stage) Driver Airbag High	5	-
6	(1st Stage) Driver Airbag Low	6	-
7	(2nd Stage) Passenger Airbag Low	7	-
8	(2nd Stage) Passenger Airbag High	8	-

9	(2nd Stage) Driver Airbag High	9	Curtain Airbag [Driver] Low
10	(2nd Stage) Driver Airbag Low	10	Curtain Airbag [Driver] High
11	-	11	Curtain Airbag [Passenger] High
12	-	12	Curtain Airbag [Passenger] Low
13	Ignition	13	Side Airbag [Passenger] Low
14	K-Line Diagnostic	14	Side Airbag [Passenger] High
15	-	15	Side Airbag [Driver] High
16	-	16	Side Airbag [Driver] Low
17	Crash Output	17	-
18	Telltale Lamp	18	-
19	-	19	-
20	Front Impact Sensor [Passenger] Low	20	-
21	Front Impact Sensor [Passenger] High	21	-
22	Front Impact Sensor [Driver] Low	22	-
23	Front Impact Sensor [Driver] High	23	Occupant Classification
24	-	24	-
		25	Side Impact Sensor [Passenger] High
		26	Side Impact Sensor [Passenger] Low
		27	Side Impact Sensor [Driver] High
		28	Side Impact Sensor [Driver] Low
		29	-
		30	Seat Track Position Sensor [Driver]
		31	Seat Belt Buckle Switch [Passenger]
		32	Seat Belt Buckle Switch [Driver]

SRSCM Harness Connector [Depowered]



Shorting bar (▭) : located between the upper and lower pins of SRSCM connector A and B
Note : For short circuit check, shorting bar must be opened. Use a plastic clip as a shorting bar opener for disconnecting shorting bar.

Pin	Function (Connector A)	Pin	Function (Connector B)
1	Airbag Warning Lamp	1	Seat Belt Pretensioner [Passenger] Low
2	Ground	2	Seat Belt Pretensioner [Passenger] High
3	(1st Stage) Passenger Airbag Low	3	Seat Belt Pretensioner [Driver] High
4	(1st Stage) Passenger Airbag High	4	Seat Belt Pretensioner [Driver] Low
5	(1st Stage) Driver Airbag High	5	-
6	(1st Stage) Driver Airbag Low	6	-
7	-	7	-
8	-	8	-
9	-	9	Curtain Airbag [Driver] Low

10	-	10	Curtain Airbag [Driver] High
11	-	11	Curtain Airbag [Passenger] High
12	-	12	Curtain Airbag [Passenger] Low
13	Ignition	13	Side Airbag [Passenger] Low
14	K-Line Diagnostic	14	Side Airbag [Passenger] High
15	-	15	Side Airbag [Driver] High
16	-	16	Side Airbag [Driver] Low
17	Crash Output	17~24	-
18	-	25	Side Impact Sensor [Passenger] High
19	-	26	Side Impact Sensor [Passenger] Low
20	Front Impact Sensor [Passenger] Low	27	Side Impact Sensor [Driver] High
21	Front Impact Sensor [Passenger] High	28	Side Impact Sensor [Driver] Low
22	Front Impact Sensor [Driver] Low	29	-
23	Front Impact Sensor [Driver] High	30	-
24	-	31	-
		32	-

Restraint > SRSCM > Troubleshooting

Diagnostic Trouble Code (DTC) Table

DTC	Fault Descriptions	Remark
B1101	Battery voltage high	
B1102	Battery voltage low	
B1322	WCS(Weight Classification System) ECU Defect	
B1324	WCS(Weight Classification System) Communication Error	
B1325	WCS(Weight Classification System) Wrong ID	
B1328	FIS(Front Impact Sensor)-Driver defect	
B1329	FIS(Front Impact Sensor)-Driver communication error	
B1333	FIS(Front Impact Sensor)-Passenger defect	
B1334	FIS(Front Impact Sensor)-Passenger communication error	
B1346	Driver airbag resistance too High (1st stage)	
B1347	Driver airbag resistance too Low (1st stage)	
B1348	Driver airbag resistance circuit short to Ground (1st stage)	
B1349	Driver airbag resistance circuit short to Battery (1st stage)	
B1352	Passenger airbag resistance too High (1st stage)	
B1353	Passenger airbag resistance too Low (1st stage)	
B1354	Passenger airbag resistance circuit short to Ground (1st stage)	
B1355	Passenger airbag resistance circuit short to Battery (1st stage)	
B1361	Pretensioner front-Driver resistance too High	
B1362	Pretensioner front-Driver resistance too Low	
B1363	Pretensioner front-Driver resistance circuit short to Ground	
B1364	Pretensioner front-Driver resistance circuit short to Battery	
B1367	Pretensioner front-Passenger resistance too High	
B1368	Pretensioner front-Passenger resistance too Low	

B1369	Pretensioner front-Passenger resistance circuit short to Ground	
B1370	Pretensioner front-Passenger resistance circuit short to Battery	
B1371	STPS(Seat Track Position Sensor)-Driver instability	
B1378	Side airbag front-Driver resistance too High	
B1379	Side airbag front-Driver resistance too Low	
B1380	Side airbag front-Driver resistance circuit short to Ground	
B1381	Side airbag front-Driver resistance 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 resistance circuit short to Ground	
B1385	Side airbag front-Passenger resistance circuit short to Battery	
B1387	STPS(Seat Track Position Sensor)-Driver short or short to Ground	
B1388	STPS(Seat Track Position Sensor)-Driver open or short to Battery	
B1389	STPS(Seat Track Position Sensor)-Driver defect	
B1395	Firing loops interconnection fault	
B1400	SIS(Side Impact Sensor) front-Driver defect	
B1403	SIS(Side Impact Sensor) front-Passenger defect	
B1409	SIS(Side Impact Sensor) front-Driver communication error	
B1410	SIS(Side Impact Sensor) front-Passenger communication error	
B1473	Inflatable curtain airbag front-Driver resistance too High	
B1474	Inflatable curtain airbag front-Driver resistance too Low	
B1475	Inflatable curtain airbag front-Driver resistance circuit short to Ground	
B1476	Inflatable curtain airbag front-Driver resistance circuit short to Battery	
B1477	Inflatable curtain airbag front-Passenger resistance too High	
B1478	Inflatable curtain airbag front-Passenger resistance too Low	
B1479	Inflatable curtain airbag front-Passenger resistance circuit short to Ground	
B1480	Inflatable curtain airbag front-Passenger resistance circuit short to Battery	
B1481	Driver airbag resistance too High (2nd stage)	
B1482	Driver airbag resistance too Low (2nd stage)	
B1483	Driver airbag resistance circuit short to Ground (2nd stage)	
B1484	Driver airbag resistance circuit short to Battery (2nd stage)	
B1485	Passenger airbag resistance too High (2nd stage)	
B1486	Passenger airbag resistance too Low (2nd stage)	
B1487	Passenger airbag resistance circuit short to Ground (2nd stage)	
B1488	Passenger airbag resistance circuit short to Battery (2nd stage)	
B1511	Buckle Switch Driver open or short to Battery	
B1512	Buckle Switch Driver short or short to Ground	
B1513	Buckle Switch Passenger open or short to Battery	
B1514	Buckle Switch Passenger short or short to Ground	
B1515	Buckle Switch Driver defect	
B1516	Buckle Switch Passenger defect	
B1517	Buckle Switch Driver instability	
B1518	Buckle Switch Passenger instability	
B1620	Internal fault - Replace SRSCM	

	Crash recorded in 1st stage only (Frontal - Replace SRSCM)	
B1651	Crash recorded in front-Driver side airbag (Replace SRSCM)	
B1652	Crash recorded in front-Passenger side airbag (Replace SRSCM)	
B1670	Crash recorded in full stage (Frontal - Replace SRSCM)	
B2500	Warning lamp Failure	
B2502	Passenger airbag Telltale lamp Failure	

Restraint > SRSCM > B1101 Battery Voltage High

General Description

SRSCM (Supplemental Restraints System Control Module) checks input voltage when "IG ON" to make air bag system work properly.
If input voltage is out of normal range, there can be malfunction in system operation. In this case, Check battery and charging system.

DTC Description

The SRSCM sets DTC B1101 and turns warning light on if voltage above threshold value is detected for more than 4 sec. (If voltage within threshold value is detected for 4 sec. SRSCM regards DTC as being cleared and turns warning light off).

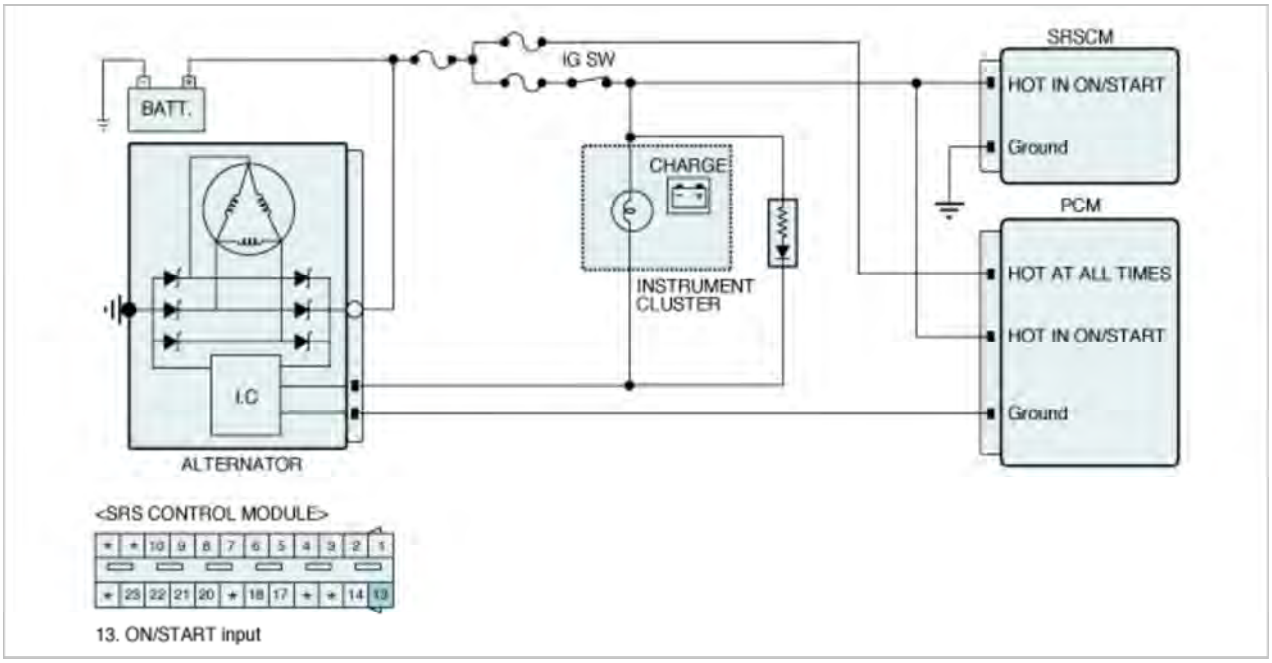
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check voltage	• Poor connection of connected part. • Open/Short circuit in power harness. • Open/Short circuit in ground harness. • Faulty charging system. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• 16.0V < Vbatt	
Diagnostic Time	Qualification	• More than 4 sec	
	De-Qualification	• More than 4 sec	

Specification

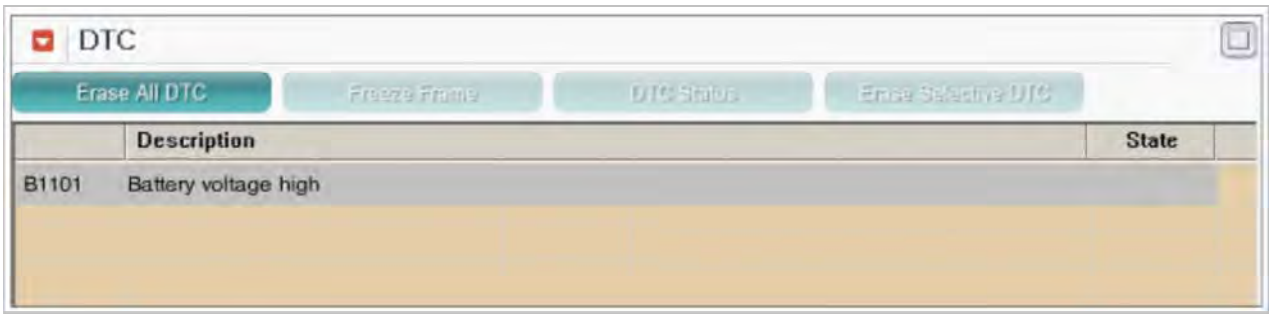
Test Condition	Voltage
Idle & WOT	Approx. 9 ≤ Vbatt ≤ 16

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Charging System Inspection" procedure.

Charging System Inspection

1. Engine "ON", headight and heatwire "ON".
2. Measure voltage between the battery terminal (+) and (-) maintaining ENG. RPM 2,500RPM (idle) over 2 minutes.

Specification : Approx. 9V ~16V

3. Is the measured voltage within specifications?

YES	▸ Go to "Power Circuit Inspection" procedure.
NO	▸ Substitute with a known-good alternator and check for proper operation. If the problem is corrected, replace alternator and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

1. Ignition "OFF'.
2. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
3. Disconnect the SRSCM connector.
4. Connect the battery (-) terminal cable and start engine.
5. Measure voltage between terminal "ON/START input" of the SRSCM harness connector and chassis ground.

Specification : Approx. 9V ~16V

6. Is the measured voltage within specifications?

YES	▸ Go to "Ground circuit inspection" procedure.
NO	▸ Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
3. Disconnect the SRSCM connector.
4. Measure resistance between terminal "Ground" of the SRSCM harness connector and chassis ground.

Specification : Approx. 1 Ω below.

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1102 Battery Voltage Low

General Description

SRSCM (Supplemental Restraints System Control Module) checks input voltage when "IG ON" to make air bag system work properly.
If input voltage is out of normal range, there can be malfunction in system operation. In this case, Check battery and charging system.

DTC Description

The SRSCM sets DTC B1102 and turns warning light on if voltage below threshold value is detected for more than 4 sec. (If voltage within threshold value is detected for 4 sec. SRSCM regards DTC as being cleared and turns warning light off).

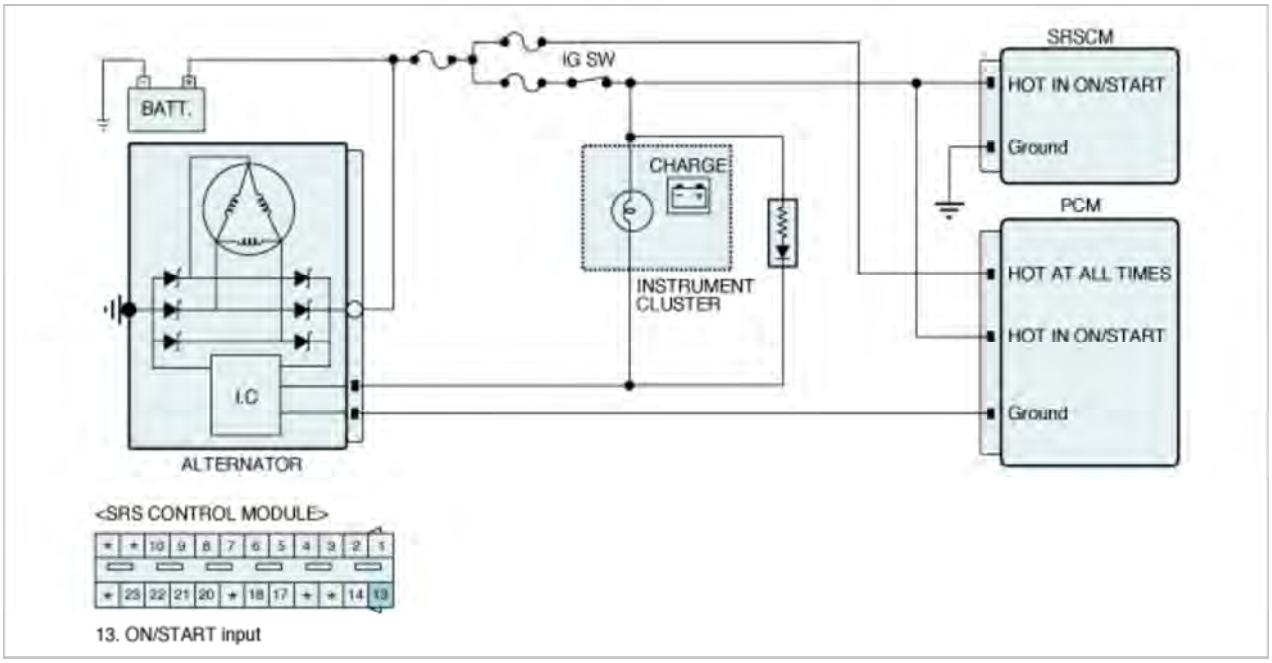
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check voltage	• Poor connection of connected part. • Open/Short circuit in power harness. • Open/Short circuit in ground harness. • Faulty charging system. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• 6 ≤ Vbatt ≤ 16	
Diagnostic Time	Qualification	• More than 4 sec	
	De-Qualification	• More than 4 sec	

Specification

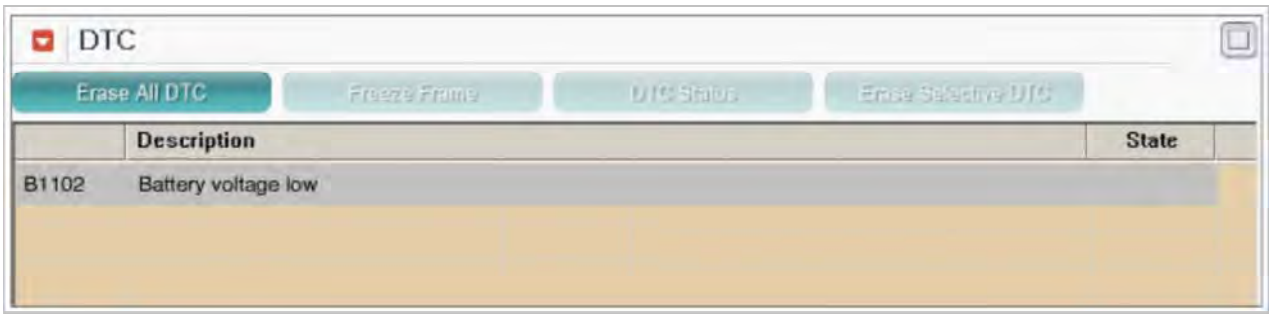
Test Condition	Voltage
Idle & WOT	Approx. 9 ≤ Vbatt ≤ 16

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Charging System Inspection" procedure.

Charging System Inspection

1. Engine "ON", headight and heatwire "ON".
2. Measure voltage between the battery terminal (+) and (-) maintaining ENG. RPM 2,500RPM (idle) over 2 minutes.

Specification : Approx. 9V ~16V

3. Is the measured voltage within specifications?

YES	▸ Go to "Power Circuit Inspection" procedure.
NO	▸ Substitute with a known-good alternator and check for proper operation. If the problem is corrected, replace alternator and then go to "Verification of Vehicle Repair" procedure.

Power Circuit Inspection

1. Ignition "OFF'.
2. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
3. Disconnect the SRSCM connector.
4. Connect the battery (-) terminal cable and start engine.
5. Measure voltage between power terminal of the SRSCM harness connector and chassis ground.

Specification : Approx. 9V ~16V

6. Is the measured voltage within specifications?

YES	▸ Go to "Ground circuit inspection" procedure.
NO	▸ Thoroughly check all connectors (and connections) for looseness, bending, corrosion, contamination, deterioration, and/or damage. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
3. Disconnect the SRSCM connector.
4. Measure resistance between ground terminal of the SRSCM harness connector and chassis ground.

Specification : Approx. 1 Ω below.

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.

4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1322 WCS(Weight Classification System) ECU Defect

General Description

In contrast to the initial one-stage airbag systems, newer restraint systems involve complex logic to select, or alternatively suppress, various levels of safety system deployment.
Inherent to an advanced Restraint System is the ability to discern information regarding passenger occupancy.
It is intended that these inputs be provided through the weight measuring OC system.
The object of such safety system is to reduce the risk and level of injuries by automatically adapting the airbag(s) and seat belt pretensioner to the driving status of the vehicle, its occupants, and the crash severity.
The current OC system covered in this specification continually senses and classifies the front passenger side seat.
OCS is utilizing a robust weight measuring technology. Thus, if any of the following conditions occur, ‘command zero’ and ‘accuracy check’ should be performed
The weight classification ECU or any of the sensors is replaced.
The vehicle is brought to the repair shop due to an accident or a crash even though the severity seems to be minor.
The passenger airbag ON indicator is not illuminated when the passenger seat is not occupied.
The passenger airbag ON indicator is delayed more than 10 seconds to be turned off when an adult passenger seats in.
The passenger seat is removed from the vehicle and re-assembled.
Any accessories (side table, seatback table and seat cover, etc) are replaced or installed.

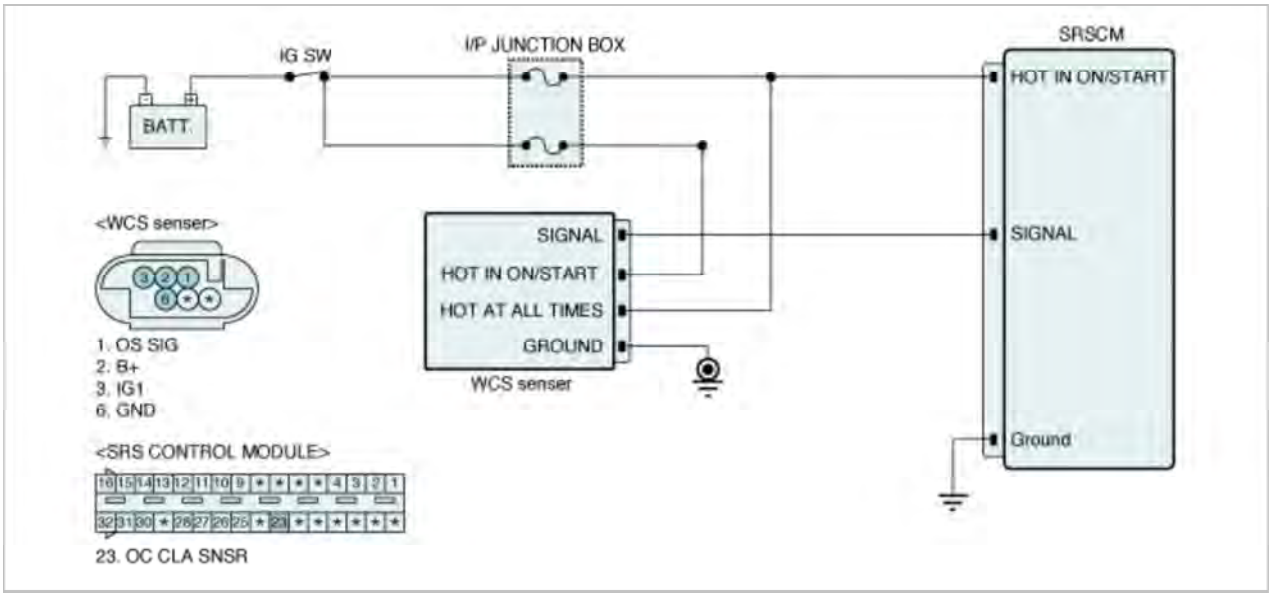
DTC Description

The SRSCM sets DTC B1322 if there is any fault in Weight Classification System Sensor circuit.

DTC Detecting Condition

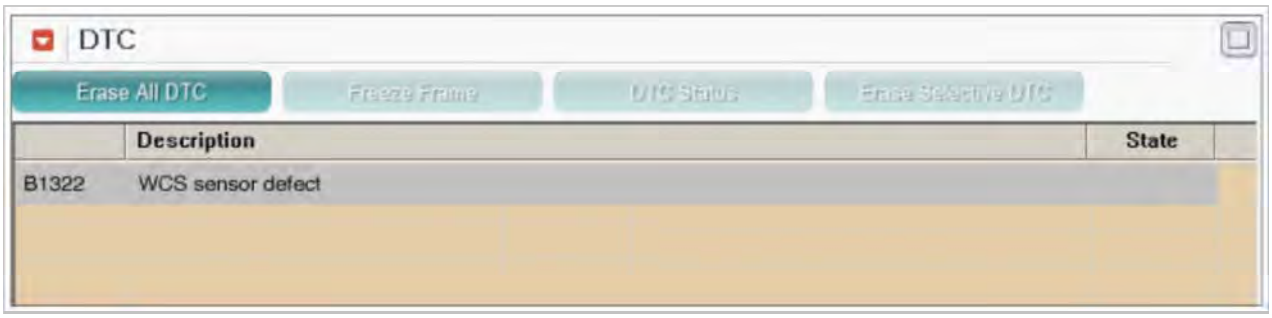
Item		Detecting Condition	Possible cause
DTC Strategy		• WCS sensor failure	• Poor connection of connected part. • Faulty WCS. • WCS Reset isn't performed • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Driver FIS Faulty	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• N/A	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 and Go to "WCS Reset" 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 then go to "Verification of Vehicle Repair" procedure and Go to "WCS Reset" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect WCS sensor connector .
5. Substitute the WCS sensor or WCS Module and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure and Go to "WCS Reset" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, and replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure and Go to "WCS Reset" procedure.
NO	▸ Substitute a known-good WCS Sensor or known-good seat assembly or WCS Module, and check for proper operation. If the problem is corrected, replace WCS Sensor or seat assembly and Go to "WCS Reset" procedure.

■ WCS Reset

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select Weight Classification System and select "WCS Reset" mode.
3. You will see comments and current weight measured.
4. Make sure the measure weight is caused by occupant or tools or interference.
5. And then press “ENTER”

Fig 1) Select System

Fig 2) Weight Classification System Select

Fig 3) Weight Classification System Reset

Fig 4) EMPTY Data

Specification : Approx. - 4.0 kg ~ + 4.0 kg

6. The ‘WCS Reset’ operation will take 3~10 second.
7. Make sure that there should not be vibration or weight adding to the passenger front seat.

Fig 5) Weight Classification System Reset

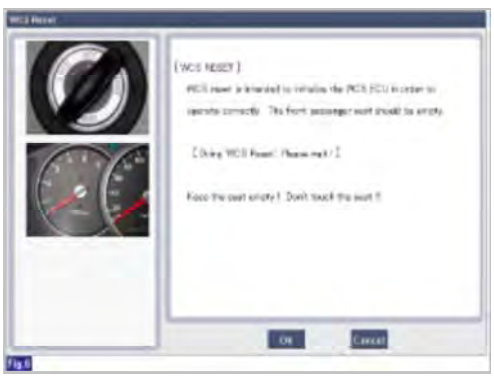


Fig 6) Weight Classification System Reset

8. If the ‘WCS Reset’ operation is finished successfully, you will see the following screen.

Fig 7) Normal Data

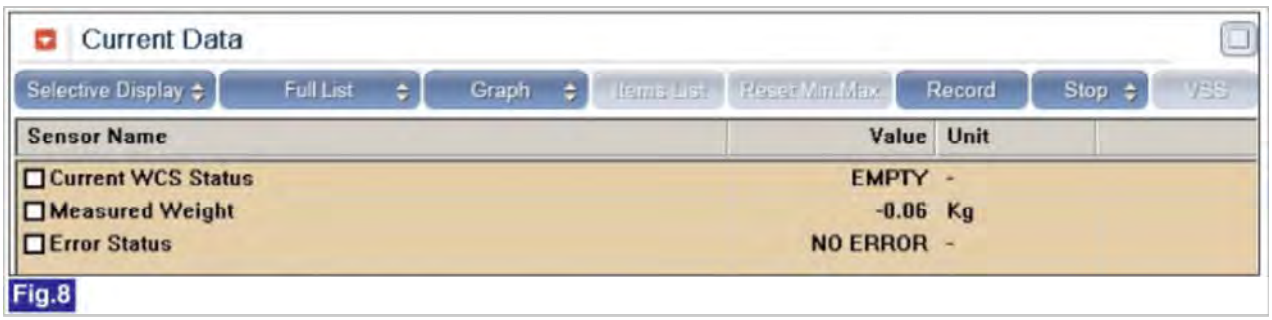


Fig 8) Current Data

Specification : Approx. - 4.0 kg ~ + 4.0 kg

9. Is the displayed parameter the same as the above 7 figure?

YES	▸ WCS reset is performed correctly ▸ Go to "Verification of Vehicle Repair" procedure.
NO	▸ WCS reset isn't performed correctly. ▸ Go to the applicable troubleshooting 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1324 WCS(Weight Classification System) Communication Error

General Description

In contrast to the initial one-stage airbag systems, newer restraint systems involve complex logic to select, or alternatively suppress, various levels of safety system deployment.
Inherent to an advanced Restraint System is the ability to discern information regarding passenger occupancy.
It is intended that these inputs be provided through the weight measuring OC system.
The object of such safety system is to reduce the risk and level of injuries by automatically adapting the airbag(s) and seat belt pretensioner to the driving status of the vehicle, its occupants, and the crash severity.
The current OC system covered in this specification continually senses and classifies the front passenger side seat.
OCS is utilizing a robust weight measuring technology. Thus, if any of the following conditions occur, ‘command zero’ and ‘accuracy check’ should be performed

The weight classification ECU or any of the sensors is replaced.
The vehicle is brought to the repair shop due to an accident or a crash even though the severity seems to be minor.
The passenger airbag ON indicator is not illuminated when the passenger seat is not occupied.
The passenger airbag ON indicator is delayed more than 10 seconds to be turned off when an adult passenger seats in.
The passenger seat is removed from the vehicle and re-assembled.
Any accessories (side table, seatback table and seat cover, etc) are replaced or installed.

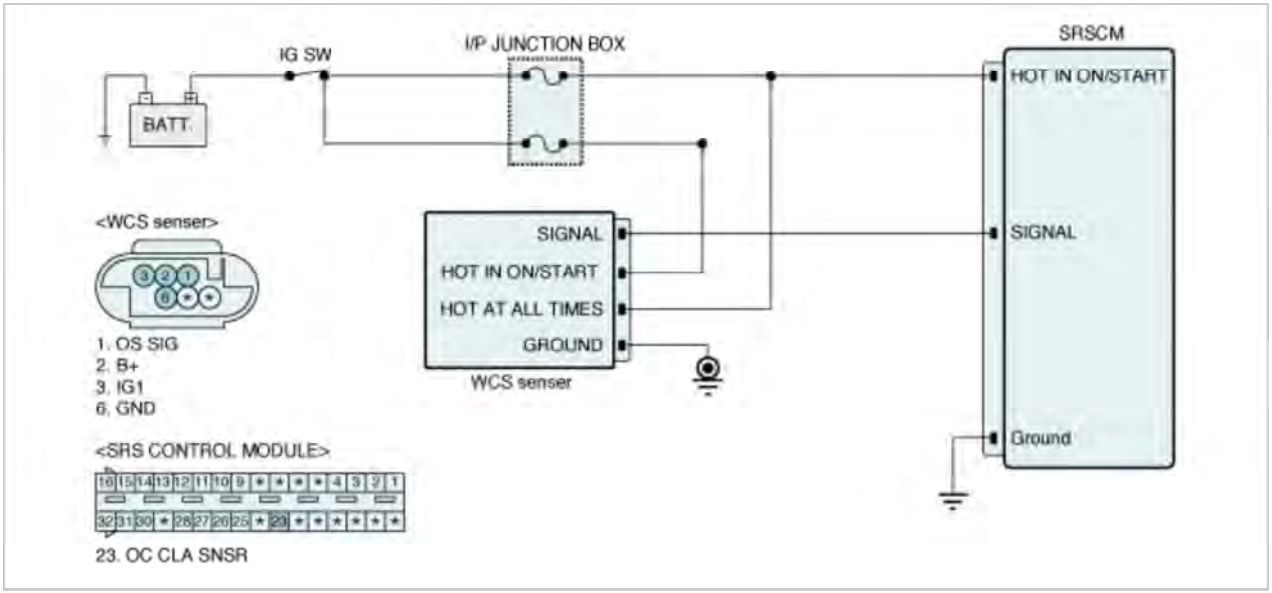
DTC Description

The SRSCM sets DTC B1324 if there is any error in communication between Weight Classification System ECU and SRSCM.

DTC Detecting Condition

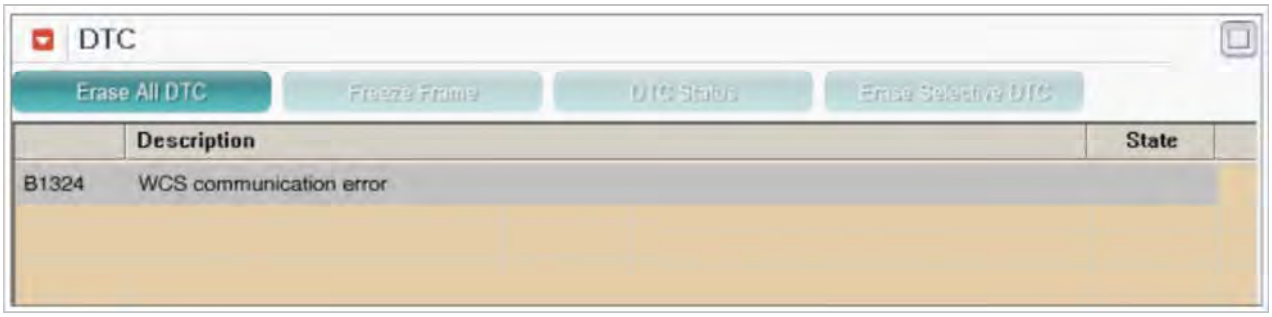
Item		Detecting Condition	Possible cause
DTC Strategy		• Communication error	• Poor connection of connected part. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• WCS Communication line open, short	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• N/A	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Intermittent failure, system is OK at this moment. Do not change WCS(= Weight Classification System). ▸ Fault is intermittent caused by poor contact in the connector/wiring harness or was repaired and SRSCM 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 and Go to "WCS Reset" 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 shorting bar/shorting bar release pin and 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 and Go to "WCS Reset" procedure.
NO	▸ Go to "Power Circuit Inspection" procedure

Power Circuit Inspection

1. Check for an open or short circuit in the WCS Power Circuit.
   (1) Disconnect WCS connector from wiring harness.
   (2) Ignition "ON" & Engine "OFF".
   (3) Measure voltage between terminal "supply voltage" and chassis ground.

   Specification : Battery Voltage

   (4) Is the measured voltage within specifications?

YES	▸ Go to "Communication K LINE Inspection" procedure.
NO	▸ Substitute the SRSCM main harness or WCS Module and check for proper operation. If the problem is corrected, replace SRSCM main harness or WCS Module and then go to "Verification of Vehicle Repair" procedure and Go to "WCS Reset" procedure.

Communication K LINE Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery negative cable, then disconnect the positive cable, and wait at least one minutes.
4. Disconnect the WCS MODULE from the WCS wiring harness.

5. Disconnect the SRSCM from the WCS wiring harness.
6. Measure resistance between of the WCS Communication K LINE wiring connector and BCM harness connector.

Specification : approx. 1 Ω below

7. Is the measured resistance within specifications?

YES	▸ Go to "WCS Reset" procedure.
NO	▸ Substitute the SRSCM main harness or WCS Module or SRSCM and check for proper operation. If the problem is corrected, replace SRSCM main harness WCS Module or SRSCM and then go to "Verification of Vehicle Repair" procedure and Go to "WCS Reset" procedure.

WCS Reset

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select Weight Classification System and select "WCS Reset" mode.
3. You will see comments and current weight measured.
4. Make sure the measure weight is caused by occupant or tools or interference.
5. And then press “ENTER”

Fig 1) Select System

Fig 2) Weight Classification System Select

Fig 3) Weight Classification System Reset

Fig 4) EMPTY Data

Specification : Approx. - 4.0 kg ~ + 4.0 kg

6. The ‘WCS Reset’ operation will take 3~10 second.
7. Make sure that there should not be vibration or weight adding to the passenger front seat.

Fig 5) Weight Classification System Reset

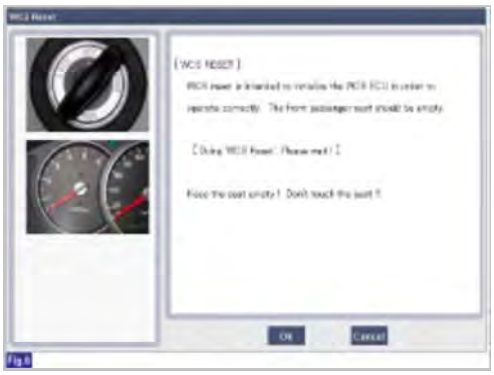


Fig 6) Weight Classification System Reset

8. If the ‘WCS Reset’ operation is finished successfully, you will see the following screen.

Fig 7) Normal Data

Fig 8) Current Data

Specification : Approx. - 4.0 kg ~ + 4.0 kg

9. Is the displayed parameter the same as the above 7 figure?

YES	▸ WCS reset is performed correctly ▸ Go to "Verification of Vehicle Repair" procedure.
NO	▸ WCS reset isn't performed correctly. ▸ Go to the applicable troubleshooting 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1325 WCS(Weight Classification System) Wrong ID

General Description

In contrast to the initial one-stage airbag systems, newer restraint systems involve complex logic to select, or alternatively suppress, various levels of safety system deployment.
Inherent to an advanced Restraint System is the ability to discern information regarding passenger occupancy.
It is intended that these inputs be provided through the weight measuring OC system.
The object of such safety system is to reduce the risk and level of injuries by automatically adapting the airbag(s) and seat belt pretensioner to the driving status of the vehicle, its occupants, and the crash severity.
The current OC system covered in this specification continually senses and classifies the front passenger side seat.
OCS is utilizing a robust weight measuring technology. Thus, if any of the following conditions occur, ‘command zero’ and ‘accuracy check’ should be performed
The weight classification ECU or any of the sensors is replaced.
The vehicle is brought to the repair shop due to an accident or a crash even though the severity seems to be minor.
The passenger airbag ON indicator is not illuminated when the passenger seat is not occupied.
The passenger airbag ON indicator is delayed more than 10 seconds to be turned off when an adult passenger seats in.
The passenger seat is removed from the vehicle and re-assembled.
Any accessories (side table, seatback table and seat cover, etc) are replaced or installed.

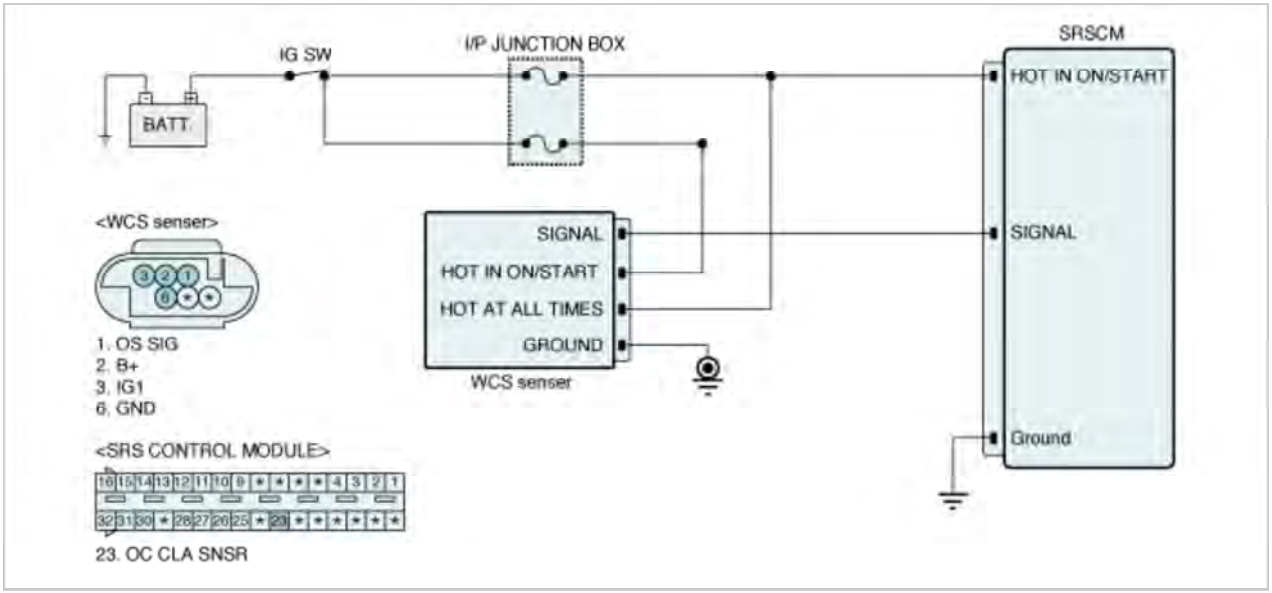
DTC Description

The SRSCM sets DTC B1325 if Weight Classification System Sensor with wrong ID is detected.

DTC Detecting Condition

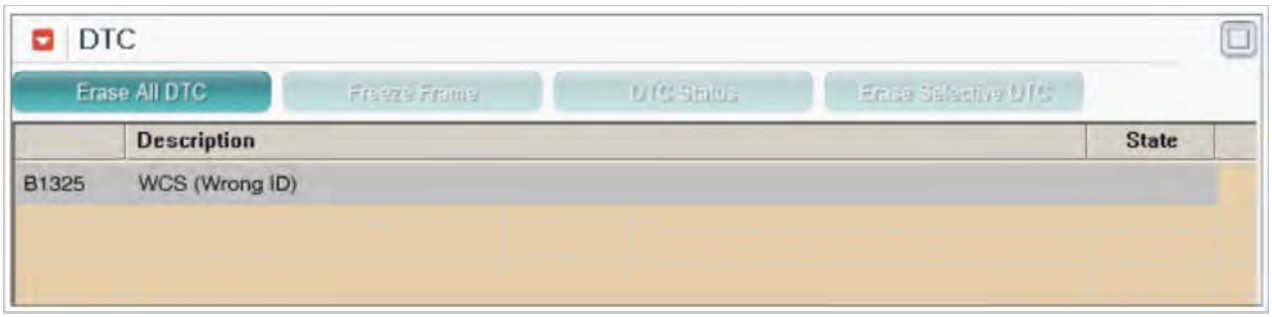
Item		Detecting Condition	Possible cause
DTC Strategy		• Wrong ID(mismatch)	• WCS wrong ID. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• WCS ID mismatch	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• N/A	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 and Go to "WCS Reset" 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 then go to "Verification of Vehicle Repair" procedure and Go to "WCS Reset" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect WCS sensor connector .
5. Substitute the WCS sensor or WCS Module and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure and Go to "WCS Reset" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, and replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure and Go to "WCS Reset" procedure.
NO	▸ Substitute a known-good WCS Sensor or known-good seat assembly or WCS Module,and check for proper operation. If the problem is corrected, replace WCS Sensor or seat assembly and Go to "WCS Reset" procedure.

■ WCS Reset

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select Weight Classification System and select "WCS Reset" mode.
3. You will see comments and current weight measured.
4. Make sure the measure weight is caused by occupant or tools or interference.
5. And then press “ENTER”

Fig 1) Select System

Fig 2) Weight Classification System Select

Fig 3) Weight Classification System Reset

Fig 4) EMPTY Data

Specification : Approx. - 4.0 kg ~ + 4.0 kg

6. The ‘WCS Reset’ operation will take 3~10 second.
7. Make sure that there should not be vibration or weight adding to the passenger front seat.

Fig 5) Weight Classification System Reset

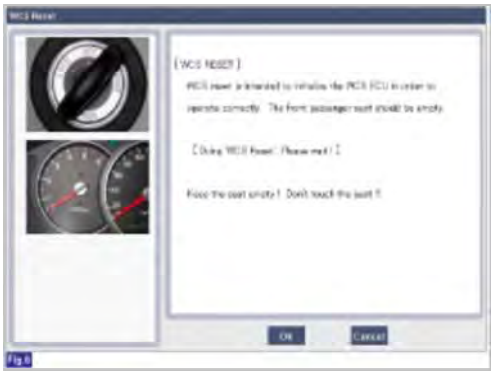


Fig 6) Weight Classification System Reset

8. If the 'WCS Reset' operation is finished successfully, you will see the following screen.

Fig 7) Normal Data

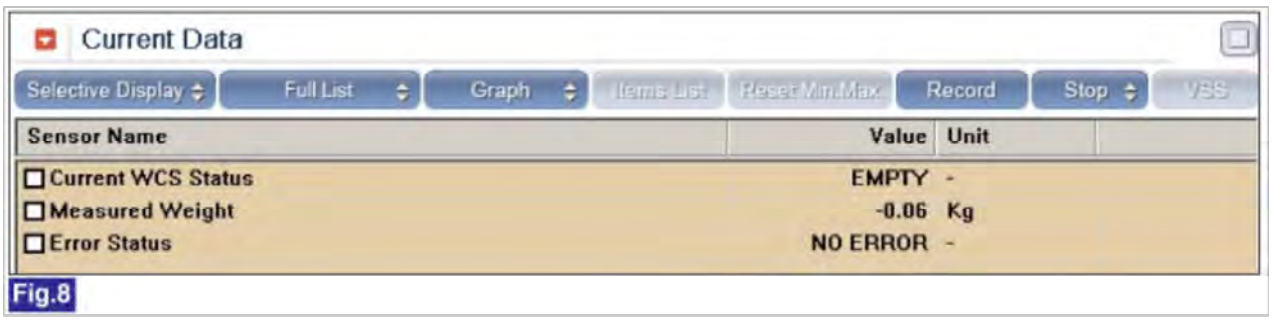


Fig 8) Current Data

Specification : Approx. - 4.0 kg ~ + 4.0 kg

9. Is the displayed parameter the same as the above 7 figure?

YES	▸ WCS reset is performed correctly ▸ Go to "Verification of Vehicle Repair" procedure.
NO	▸ WCS reset isn't performed correctly. ▸ Go to the applicable troubleshooting 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1328 FIS(Front Impact Sensor)-Driver Defect

General Description

Front Impact Sensor(FIS)located at both sides of the front of engine room detects head-on collision.
When FIS delivers collision signal to SRSCM, SRSCM checks if safing sensor located in SRSCM detects collusion.
and if both FIS and safing sensor detects collision simultaneously, SRSCM operates front air bag.

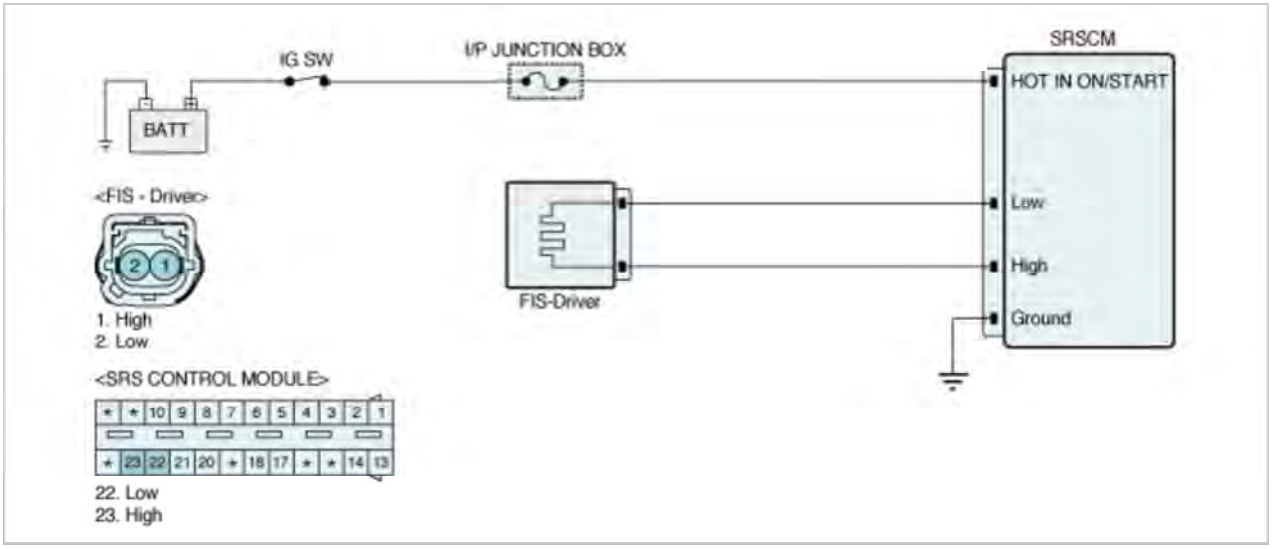
DTC Description

The SRSCM sets DTC B1328 if there is any fault in Driver side front impact sensor.

DTC Detecting Condition

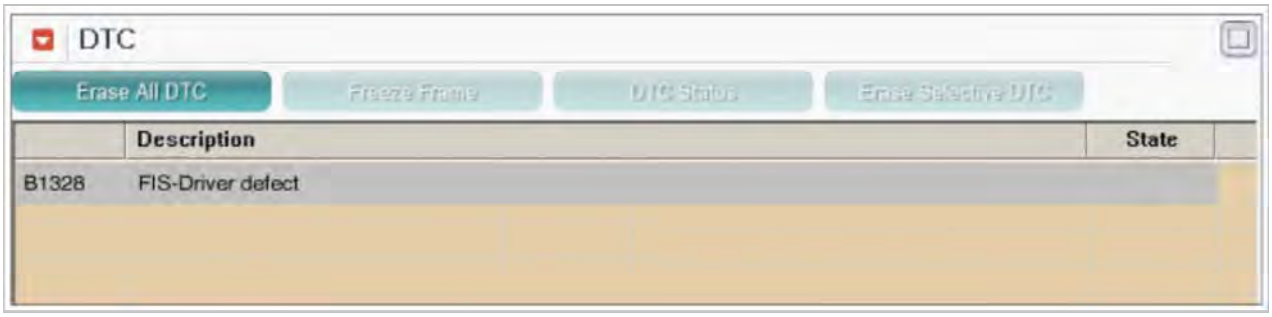
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Poor connection of connected part. • Faulty DFIS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Driver FIS Faulty	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect DFIS connector .
5. Substitute the DFIS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedur ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good DFIS, and check for proper operation. If the problem is corrected, replace DFIS 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1329 FIS(Front Impact Sensor)-Driver Communication error

General Description

Front Impact Sensor(FIS)located at both sides of the front of engine room detects head-on collision.
When FIS delivers collision signal to SRSCM, SRSCM checks if safing sensor located in SRSCM detects collusion.
andand if both FIS and safing sensor detects collision simultaneously, SRSCM operates front air bag.

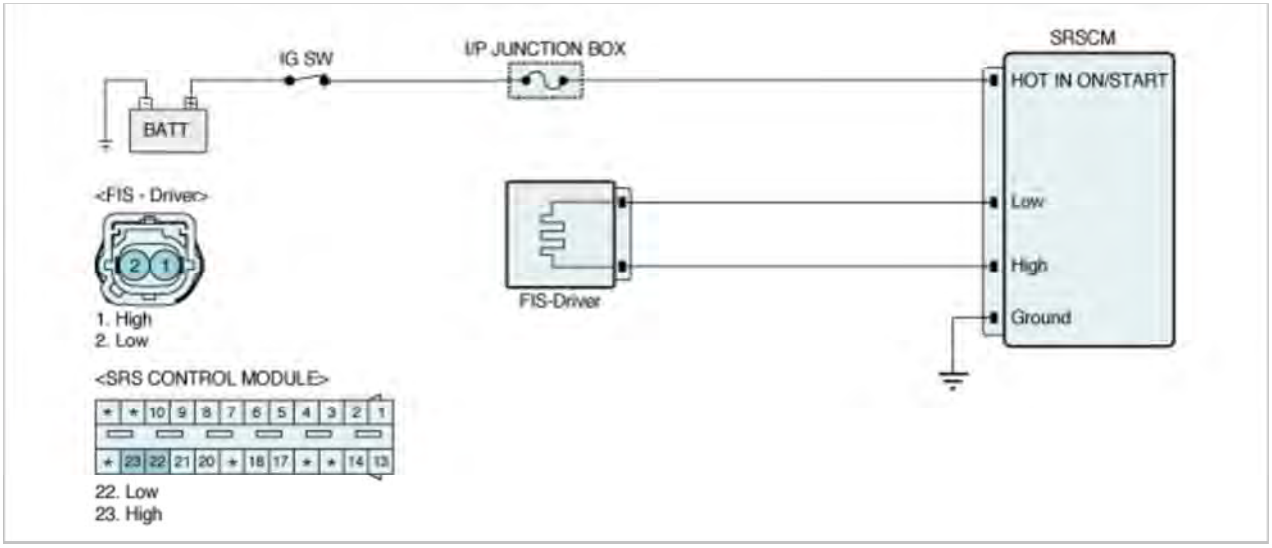
DTC Description

The SRSCM sets DTC B1329 if there is any error in communication between DFIS and SRSCM

DTC Detecting Condition

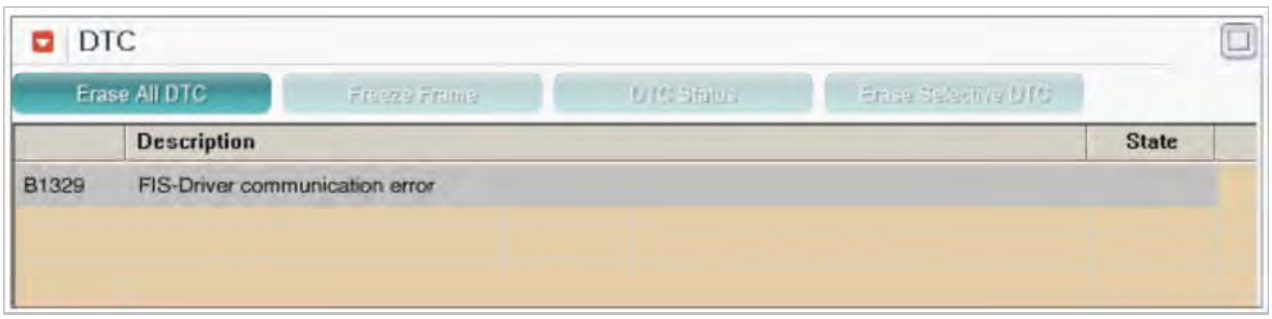
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Poor connection of connected part. • Faulty DFIS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Driver FIS short, open	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused

NO	by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect DFIS connector .
5. Substitute the DFIS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedur ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good DFIS, and check for proper operation. If the problem is corrected, replace DFIS 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1333 FIS(Front Impact Sensor)-Passenger Defect

General Description

Front Impact Sensor(FIS)located at both sides of the front of engine room detects head-on collision.
When FIS delivers collision signal to SRSCM, SRSCM checks if safing sensor located in SRSCM detects collusion.
and if both FIS and safing sensor detects collision simultaneously, SRSCM operates front air bag.

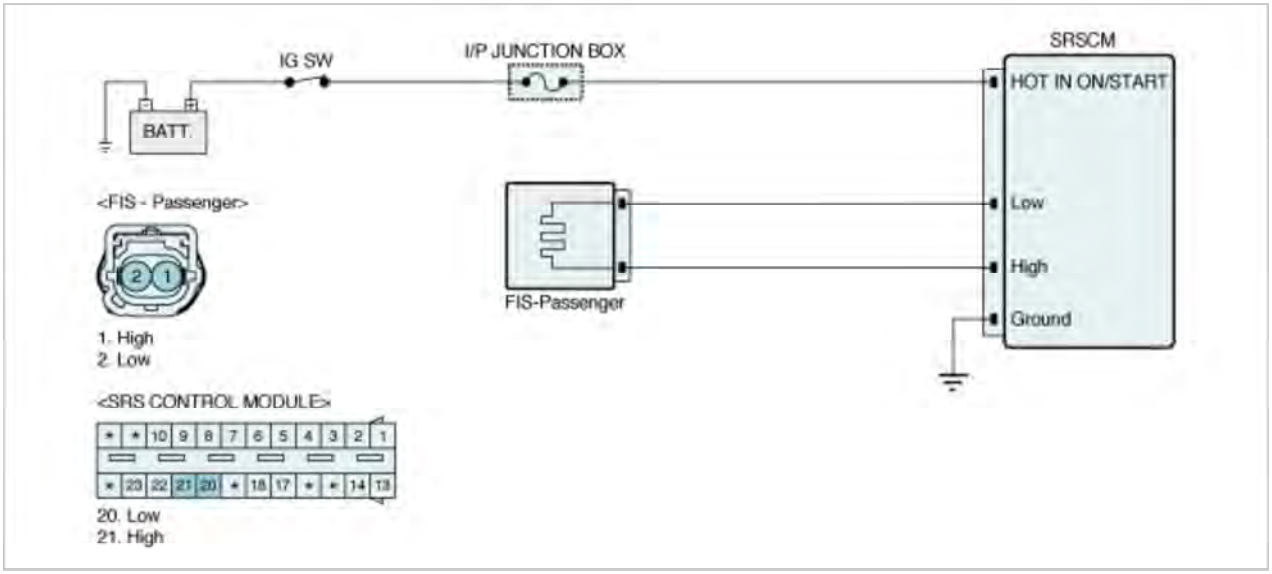
DTC Description

The SRSCM sets DTC B1333 if there is any fault in Passenger side front impact sensor

DTC Detecting Condition

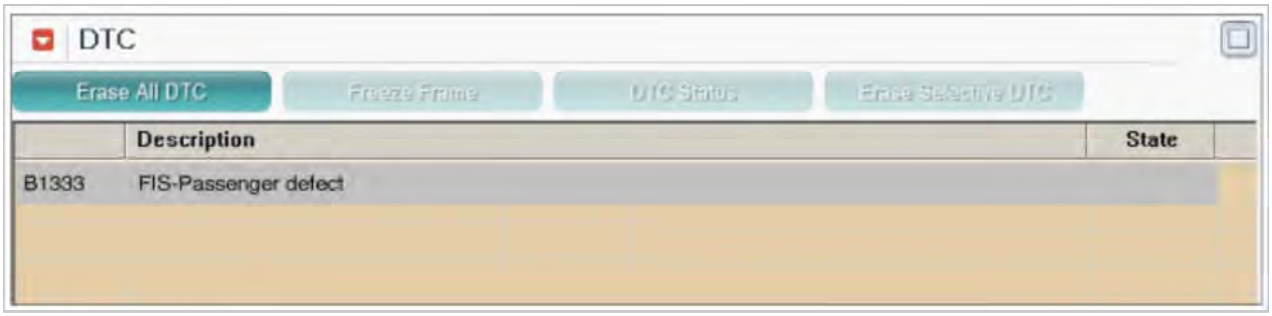
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Poor connection of connected part. • Faulty PFIS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Passenger FIS Faulty	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect PFIS connector .
5. Substitute the PFIS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedur ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good PFIS, and check for proper operation. If the problem is corrected, replace PFIS 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1334 FIS(Front Impact Sensor)-Passenger Communication error

General Description

Front Impact Sensor(FIS)located at both sides of the front of engine room detects head-on collision.
When FIS delivers collision signal to SRSCM, SRSCM checks if safing sensor located in SRSCM detects collusion.
and if both FIS and safing sensor detects collision simultaneously, SRSCM operates front air bag.

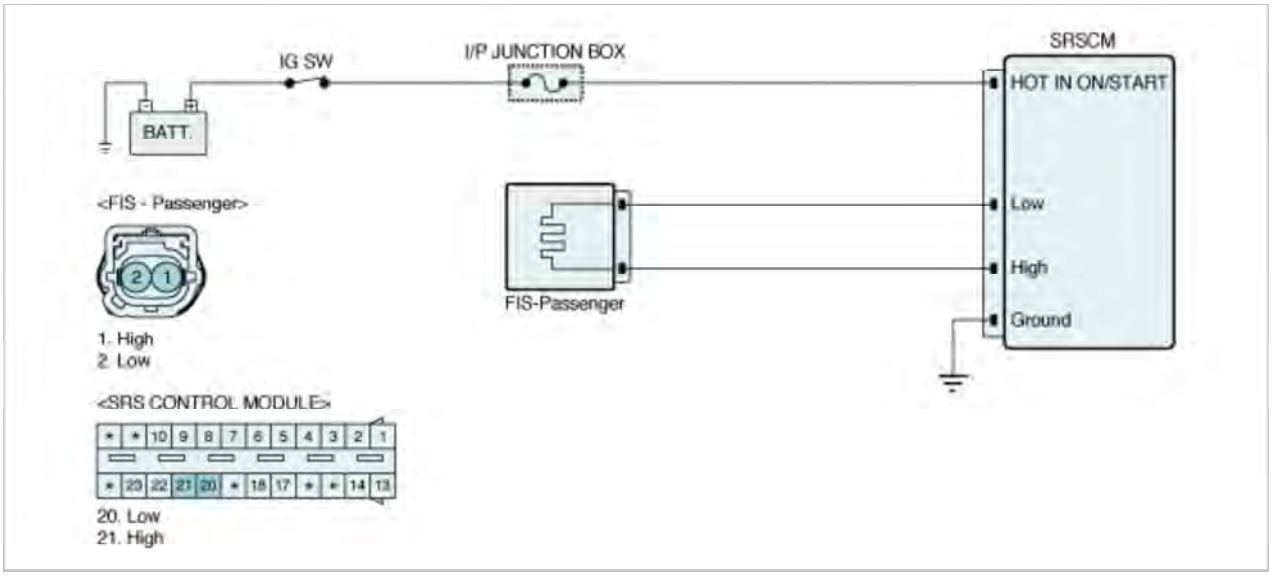
DTC Description

The SRSCM sets DTC B1334 if there is any error in communication between PFIS and SRSCM

DTC Detecting Condition

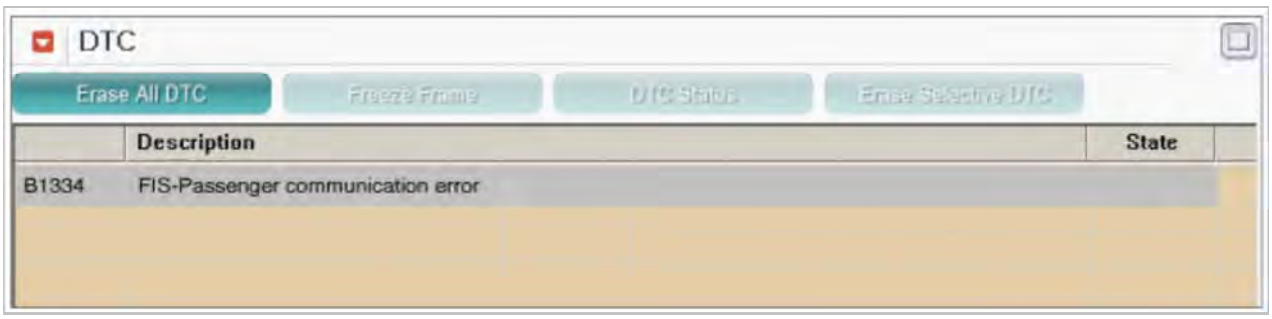
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Poor connection of connected part. • Faulty PFIS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Passenger FIS short, open	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect PFIS connector .
5. Substitute the PFIS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedur ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good PFIS, and check for proper operation. If the problem is corrected, replace PFIS 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1346 Driver Airbag Resistance too High (1st stage)

General Description

Driver Air bag module (hereinafter referred to DAB) located at center of steering wheel protects driver by reducing impact of collision.
DAB is consist of air bag, pat cover and two inflator.
There are power,circuit for ignition, gas generator and diffuser screen in inflator.
Air bag reduces impact of collision by fillied up gas.
In collision, pat cover splits and through this crack, air bag emerges and deploys.
Inflator generates gas that expands air bag.
Clock spring is located between steering wheel and column. It connects SCSRM to DAB.

CAUTION

Never measure resistance of DAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1346 if the measured resistance value of DAB circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

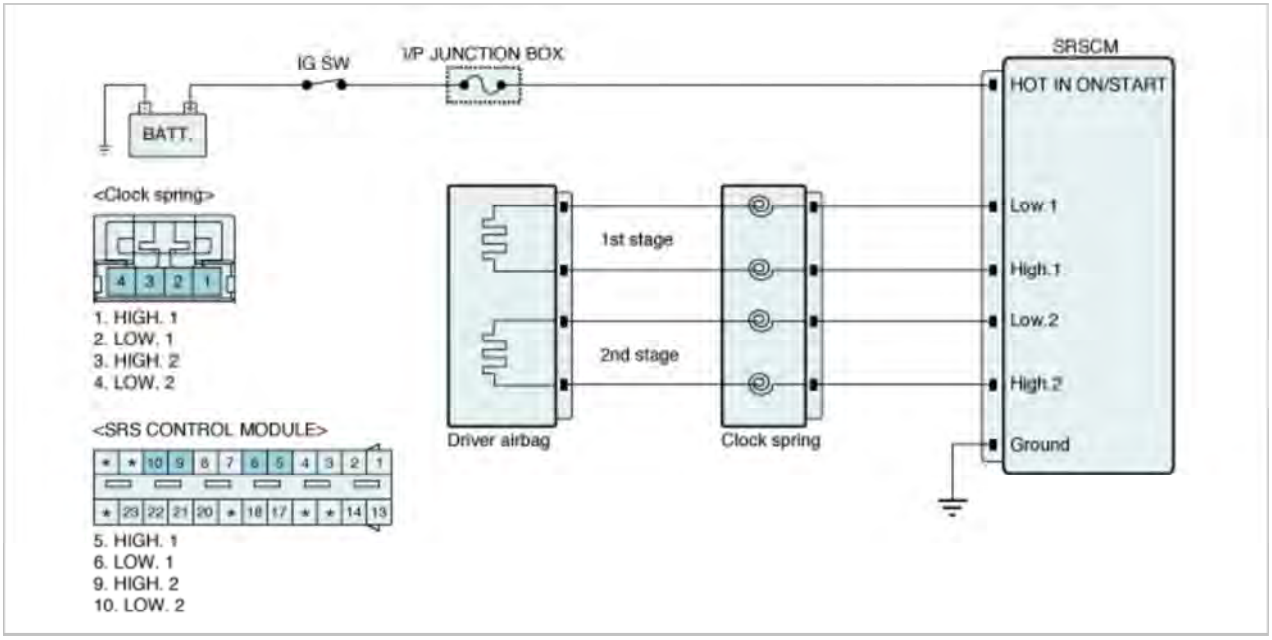
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DAB. • Faulty Clock spring. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DAB(1st stage) resistance ≥ 6.1 Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

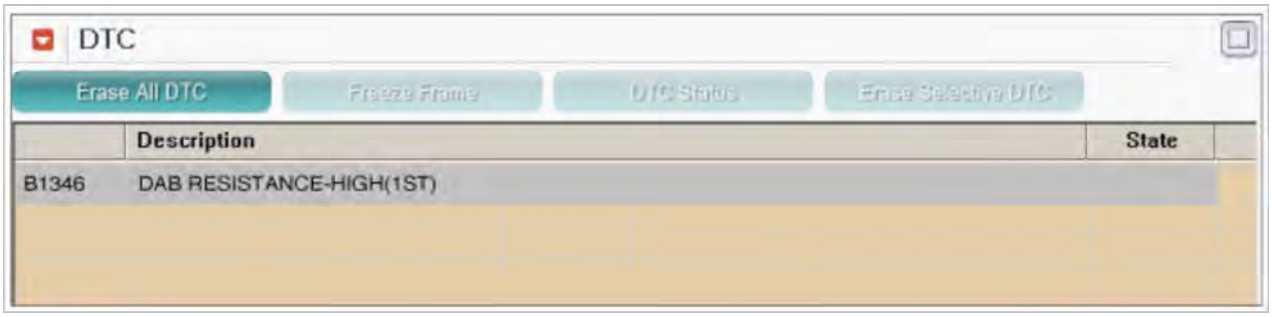
Test Condition	Resistance
Ignition ON	1.6Ω< DAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the DAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to DAB connector of the clock spring harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DAB or 2Ω resistor.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Clock Spring Circuit Inspection" procedure.
NO	▸ Substitute a known-good DAB assembly, and check for proper operation. If the problem is corrected, replace DAB and then go to "Verification of Vehicle Repair" procedure.

Clock Spring Circuit Inspection

1. Ignition "OFF" .

2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" and "High.1" of the Clock Spring harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute the Clock spring and check for proper operation. If the problem is corrected, replace Clock spring and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" and "High.1" of the DAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1347 Driver Airbag Resistance too Low (1st stage)

General Description

Driver Air bag module (hereinafter referred to DAB) located at center of steering wheel protects driver by reducing impact of collision.
DAB is consist of air bag, pat cover and two inflator.

There are power,circuit for ignition, gas generator and diffuser screen in inflator.
Air bag reduces impact of collision by fillied up gas.
In collision, pat cover splits and through this crack, air bag emerges and deploys.
Inflator generates gas that expands air bag.
Clock spring is located between steering wheel and column. It connects SCSRM to DAB.

> **CAUTION**
>
> Never measure resistance of DAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1347 if the measured resistance value of DAB circuit is less than the threshold value(1.0Ω)
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

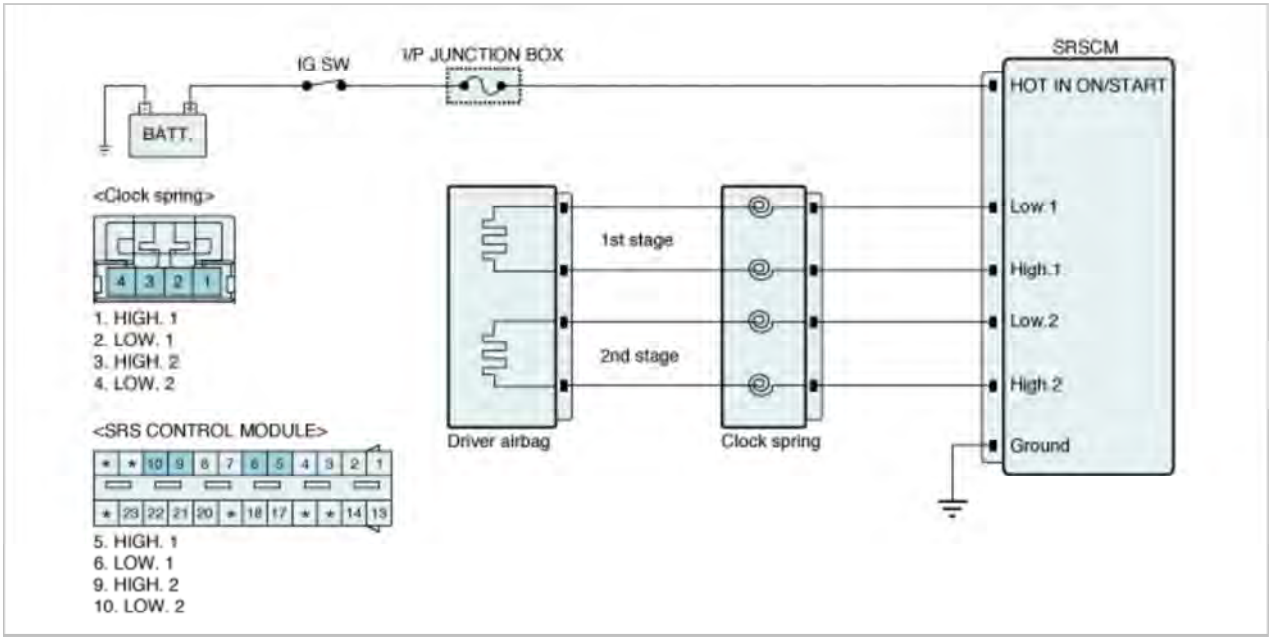
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DAB. • Faulty Clock spring. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DAB(1st stage) resistance ≤ 1.1 Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< DAB resistance < 4.7Ω

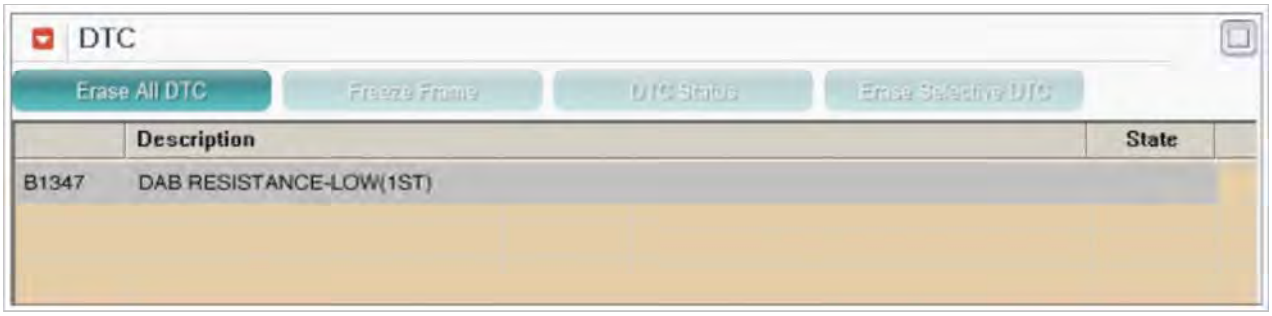
Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.

3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the DAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to DAB connector of the clock spring harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DAB or 2Ω resistor.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Clock Spring Circuit Inspection" procedure.
NO	▸ Substitute a known-good DAB assembly, and check for proper operation. If the problem is corrected, replace DAB and then go to "Verification of Vehicle Repair" procedure.

Clock Spring Circuit Inspection

1. Ignition "OFF" .
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" and "High.1" of the Clock Spring harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute the Clock spring and check for proper operation. If the problem is corrected, replace Clock spring and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" and "High.1" of the DAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1348 Driver Airbag resistance circuit short to Ground (1st stage)

General Description

Driver Air bag module (hereinafter referred to DAB) located at center of steering wheel protects driver by reducing impact of collision.

DAB is consist of air bag, pat cover and two inflator.
There are power,circuit for ignition, gas generator and diffuser screen in inflator.
Air bag reduces impact of collision by fillied up gas.
In collision, pat cover splits and through this crack, air bag emerges and deploys.
Inflator generates gas that expands air bag.
Clock spring is located between steering wheel and column.
It connects SCSRM to DAB.

> **CAUTION**
>
> Never measure resistance of DAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1348 if there is a short to ground in DAB harness
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while

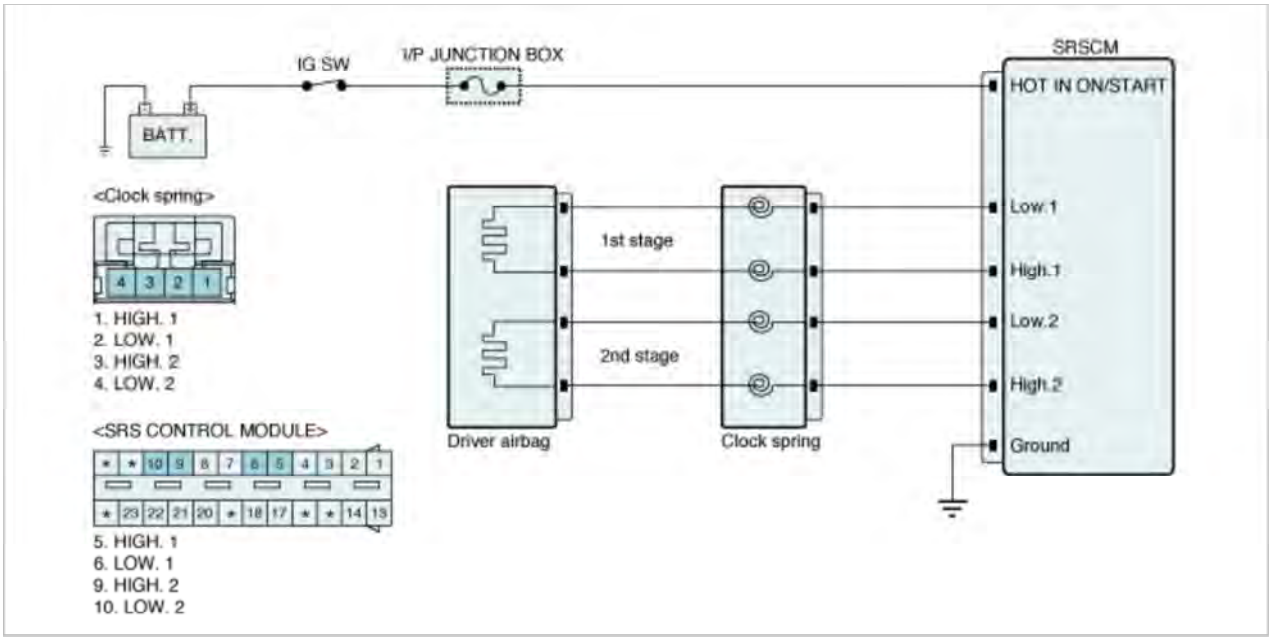
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in DAB harness. • Poor connection of connected part. • Faulty DAB. • Faulty Clock spring. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

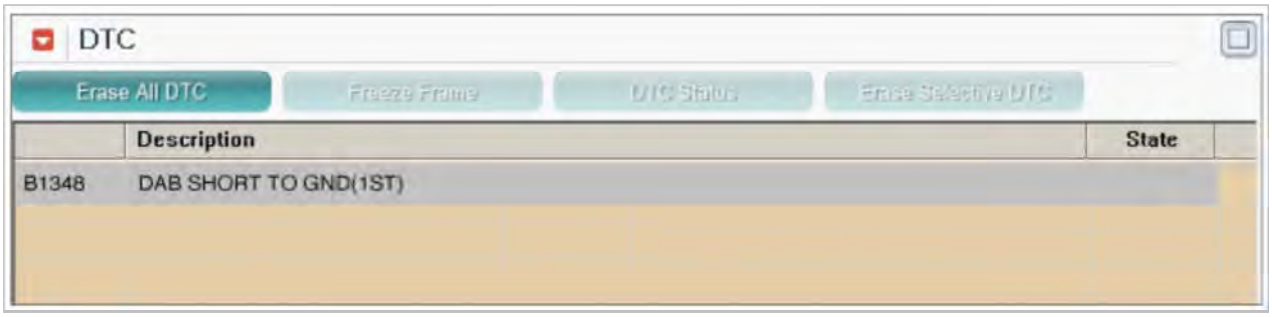
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the DAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to DAB connector of the clock spring harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DAB or 2Ω resistor.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Clock Spring Circuit Inspection" procedure.
NO	▸ Substitute a known-good DAB assembly, and check for proper operation. If the problem is corrected, replace DAB and then go to "Verification of Vehicle Repair" procedure.

Clock Spring Circuit Inspection

1. Ignition "OFF" .
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" or "High.1" of the clock spring harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute the Clock spring and check for proper operation. If the problem is corrected, replace Clock spring and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" or "High.1" of the DAB harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1349 Driver Airbag resistance circuit short to Battery (1st stage)

General Description

Driver Air bag module (hereinafter referred to DAB) located at center of steering wheel protects driver by reducing impact of collision.
DAB is consist of air bag, pat cover and two inflator.
There are power,circuit for ignition, gas generator and diffuser screen in inflator.
Air bag reduces impact of collision by fillied up gas.
In collision, pat cover splits and through this crack, air bag emerges and deploys.
Inflator generates gas that expands air bag.
Clock spring is located between steering wheel and column. It connects SCSRM to DAB.

> **CAUTION**
>
> Never measure resistance of DAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1349 if there is a short to power in DAB harness
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

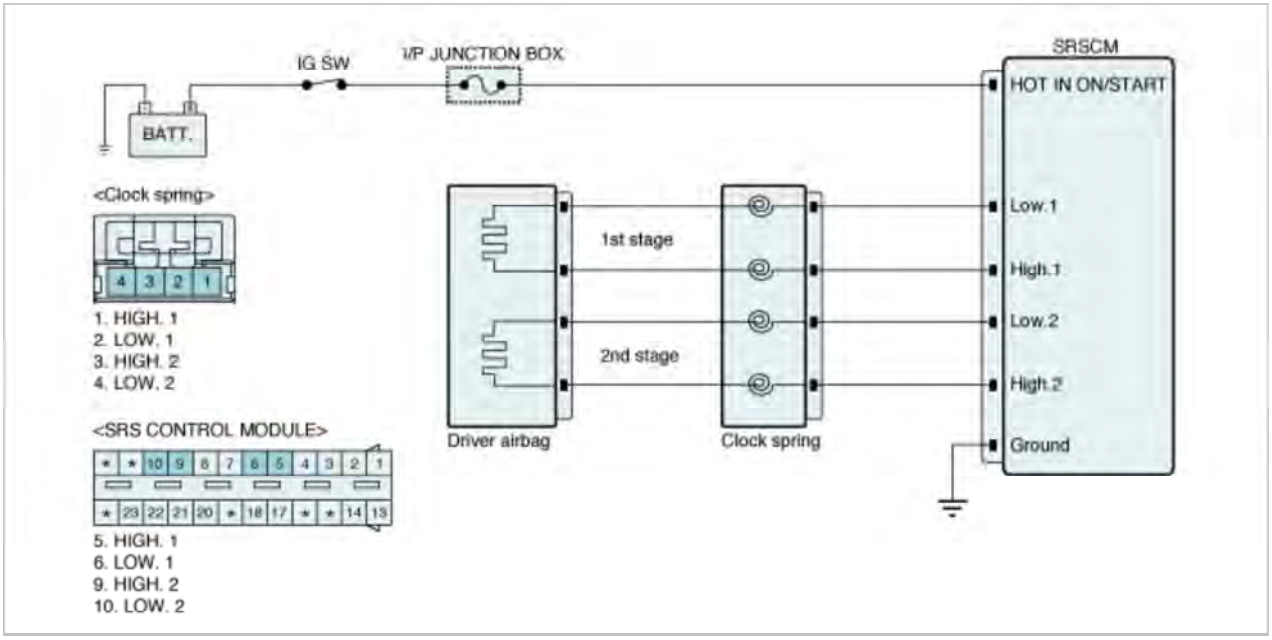
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in DAB harness. • Poor connection of connected part. • Faulty DAB. • Faulty Clock spring. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

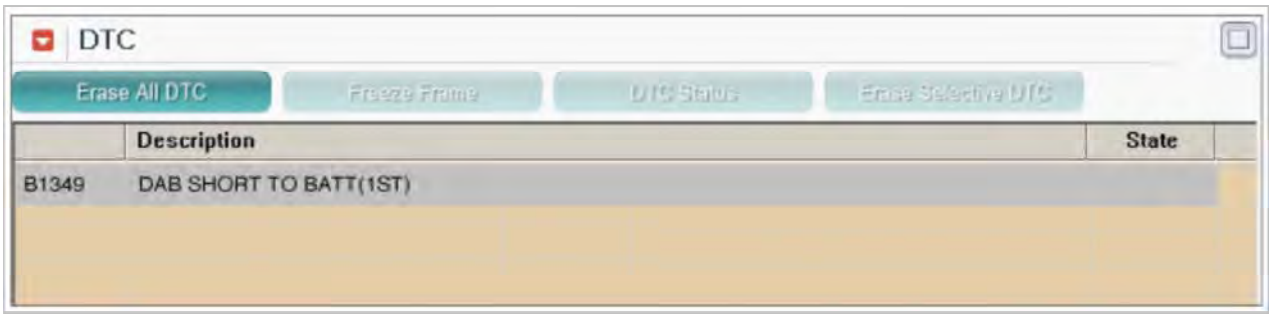
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the DAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to DAB connector of the clock spring harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DAB or 2Ω resistor.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Clock Spring Circuit Inspection" procedure.

NO	▸ Substitute a known-good DAB assembly, and check for proper operation. If the problem is corrected, replace DAB and then go to "Verification of Vehicle Repair" procedure.

Clock Spring Circuit Inspection

1. Ignition "OFF" .
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".
5. Measure Voltage between terminal "Low.1" or "High.1" of the clock spring harness connector and chassis ground.

Specification : 0V

6. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute the Clock spring and check for proper operation. If the problem is corrected, replace Clock spring and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF" and wait at least one minutes.
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the main harness.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy.

5. Measure voltage between terminal "Low.1" or "High.1" of the DAB harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.

NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1352 Passenger Airbag Resistance too High (1st Stage)

General Description

Passenger Air bag module (hereinafter referred to PAB) located at passenger side crush pad protects passenger by reducing impact of collision.
PAB is consist of air bag, pat cover and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of PAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1352 if the measured resistance value of PAB circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while

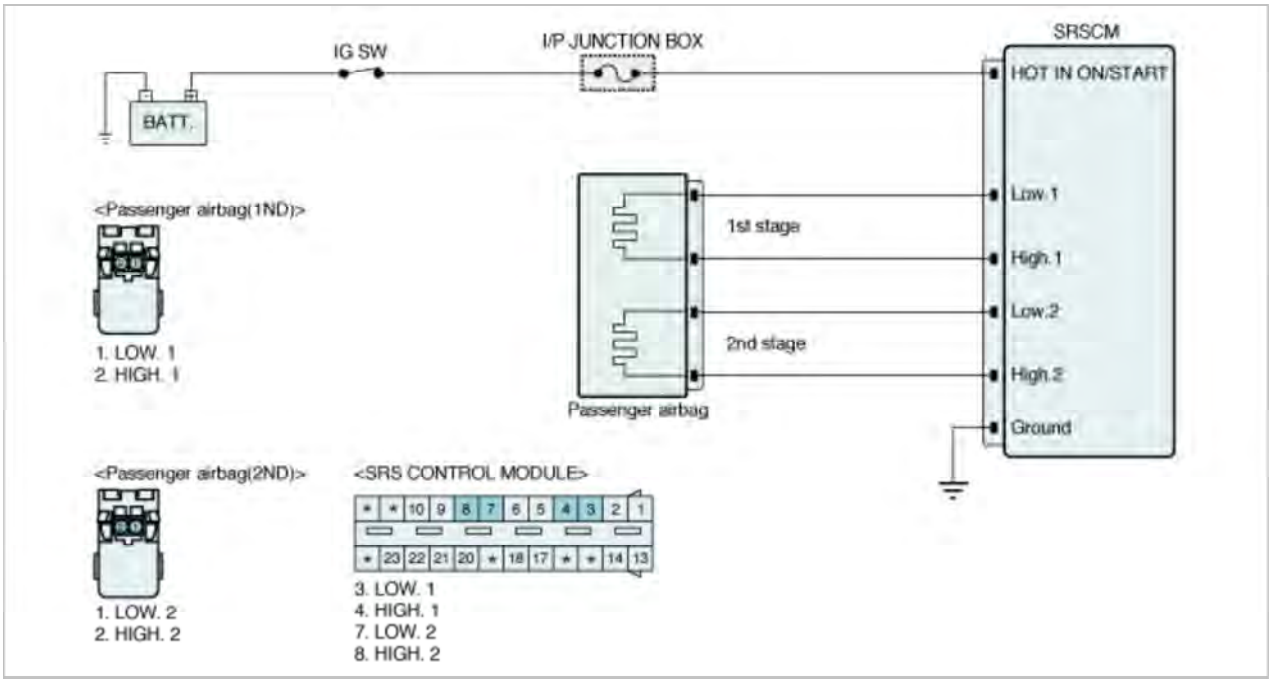
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PAB(1st stage) resistance ≥ 6.1 Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

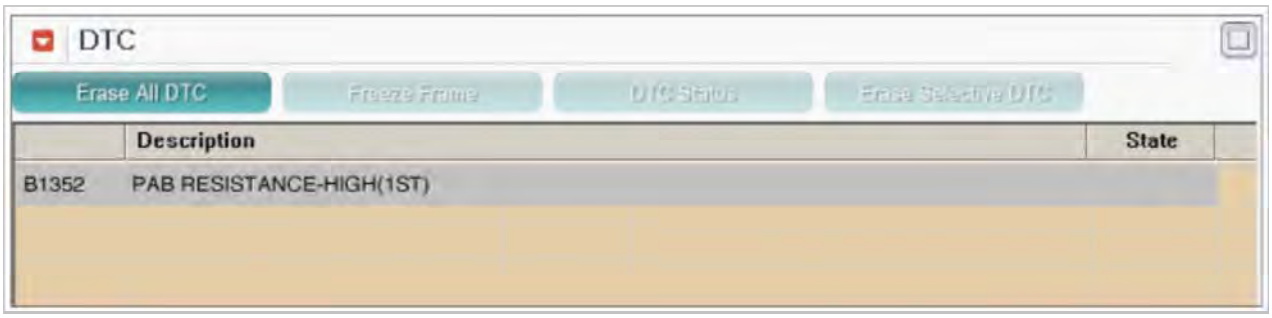
Test Condition	Resistance
Ignition ON	1.6Ω< PAB(1st stage) resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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.
	▸ Go to "Squib Circuit Inspection" procedure.

NO	

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the PAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to PAB harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PAB or 2Ω resistor.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PAB assembly, and check for proper operation. If the problem is corrected, replace PAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PAB connector and SRSCM main harness connector.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" and "High.1" of the PAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1353 Passenger Airbag Resistance too Low (1st stage)

General Description

Passenger Air bag module (hereinafter referred to PAB) located at passenger side crush pad protects passenger by reducing impact of collision.
PAB is consist of air bag, pat cover and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of PAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1353 if the measured resistance value of PAB circuit is less than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

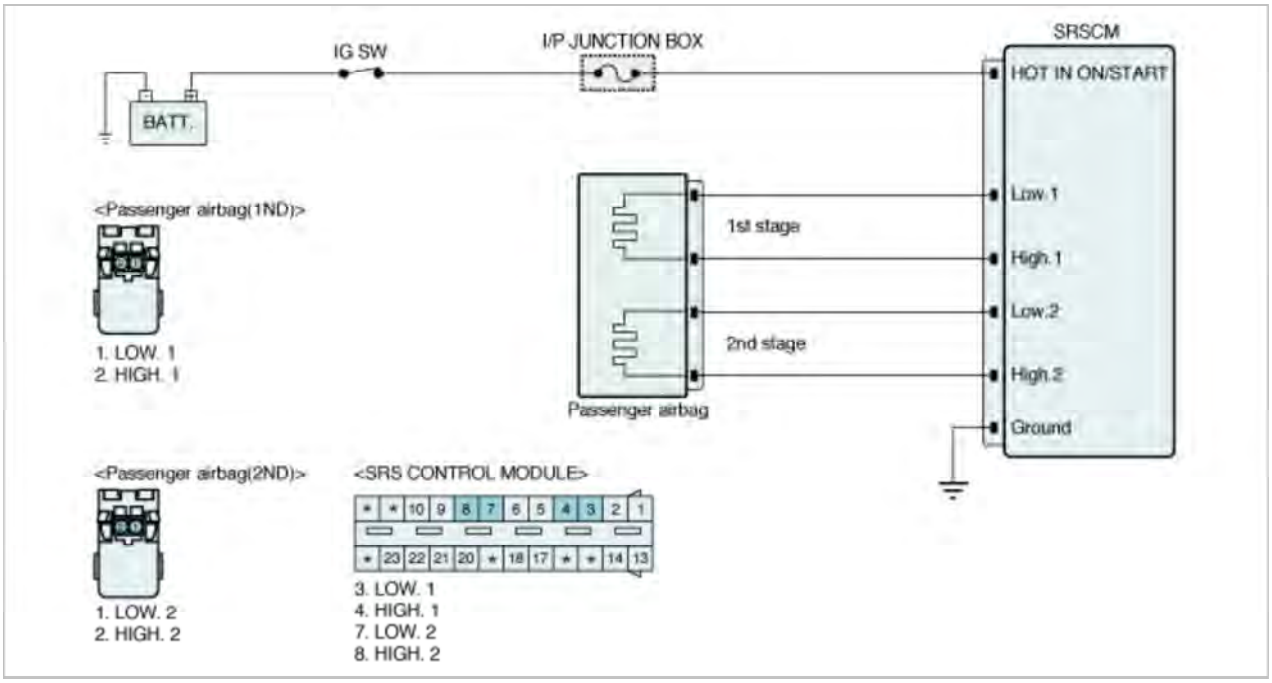
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PAB(1st stage) resistance ≤ 1.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

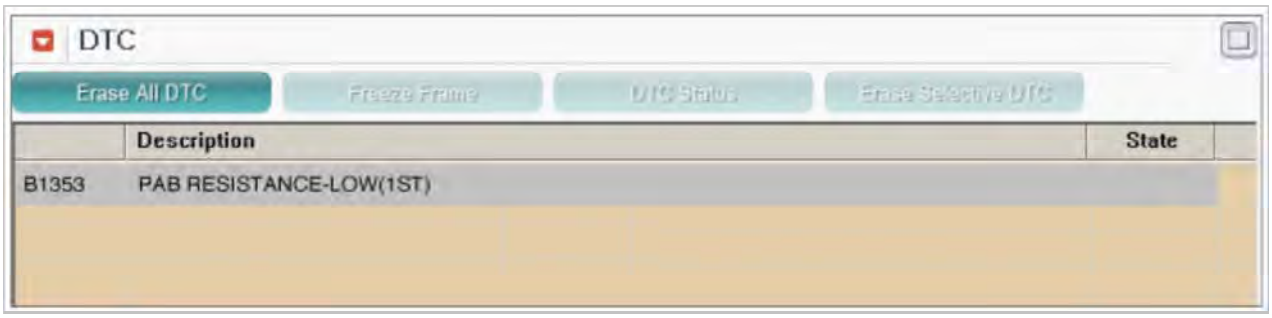
Test Condition	Resistance
Ignition ON	1.6Ω< PAB(1st stage) resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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.
	▸ Go to "Squib Circuit Inspection" procedure.

NO	

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the PAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to PAB harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PAB or 2Ω resistor.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PAB assembly, and check for proper operation. If the problem is corrected, replace PAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PAB connector and SRSCM main harness connector.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" and "High.1" of the PAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1354 Passenger Airbag Resistance Circuit Short to Ground (1st Stage)

General Description

Passenger Air bag module (hereinafter referred to PAB) located at passenger side crush pad protects passenger by reducing impact of collision.
PAB is consist of air bag, pat cover and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of PAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1354 if there is a short to ground in PAB harness
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

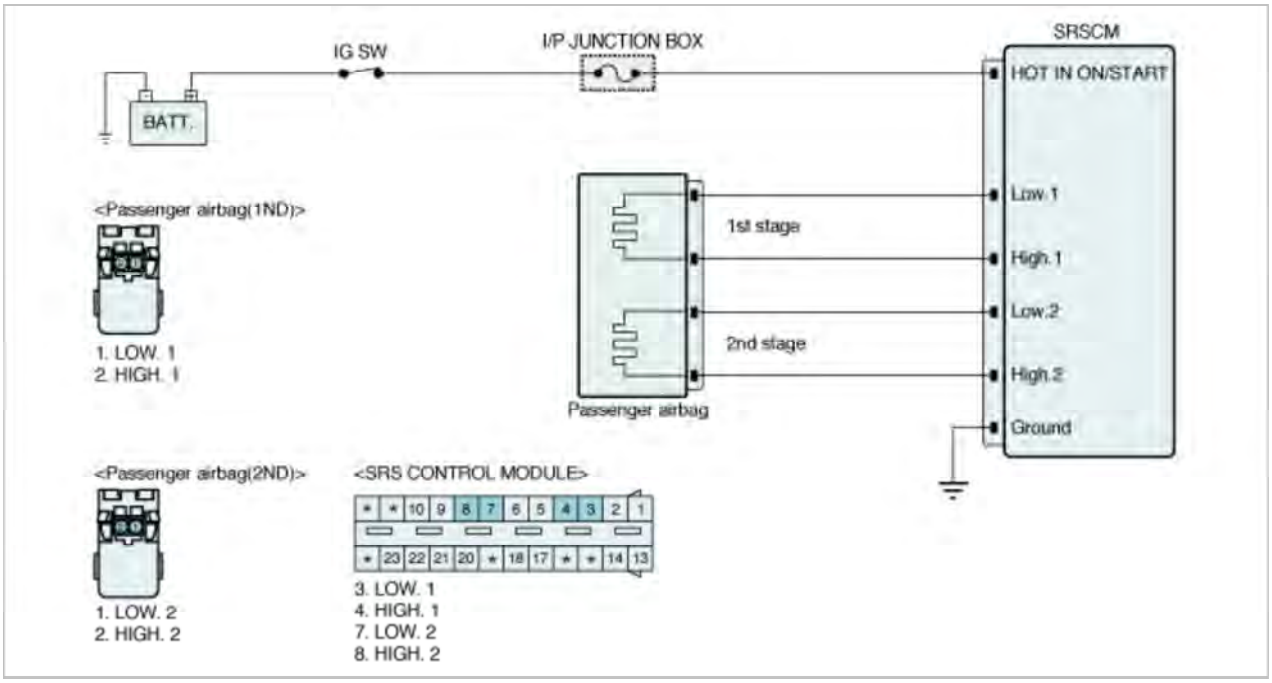
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in PAB harness. • Poor connection of connected part. • Faulty PAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

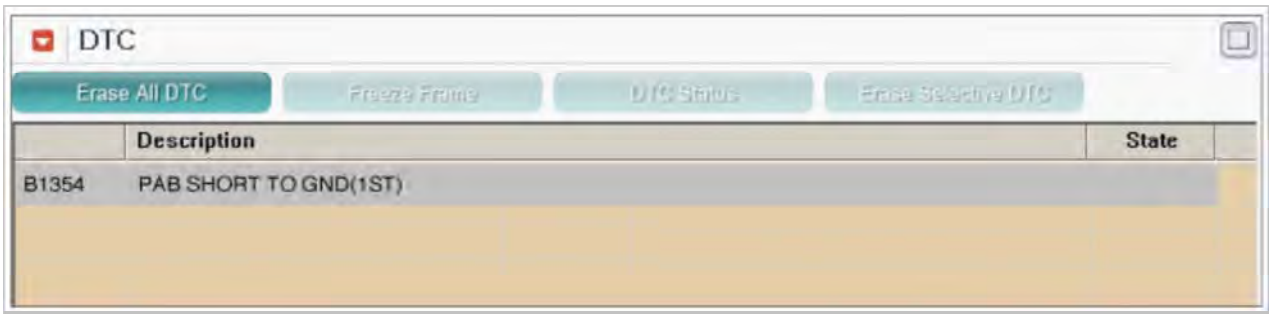
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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.
	▸ Go to "Squib Circuit Inspection" procedure.

NO	

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the PAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to PAB harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PAB or 2Ω resistor.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PAB assembly, and check for proper operation. If the problem is corrected, replace PAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PAB connector and SRSCM main harness connector.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.1" or "High.1" of the PAB harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1355 Passenger Airbag Resistance Circuit Short to Battery (1st Stage)

General Description

Passenger Air bag module (hereinafter referred to PAB) located at passenger side crush pad protects passenger by reducing impact of collision.
PAB is consist of air bag, pat cover and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of PAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1355 if there is a short to power in PAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

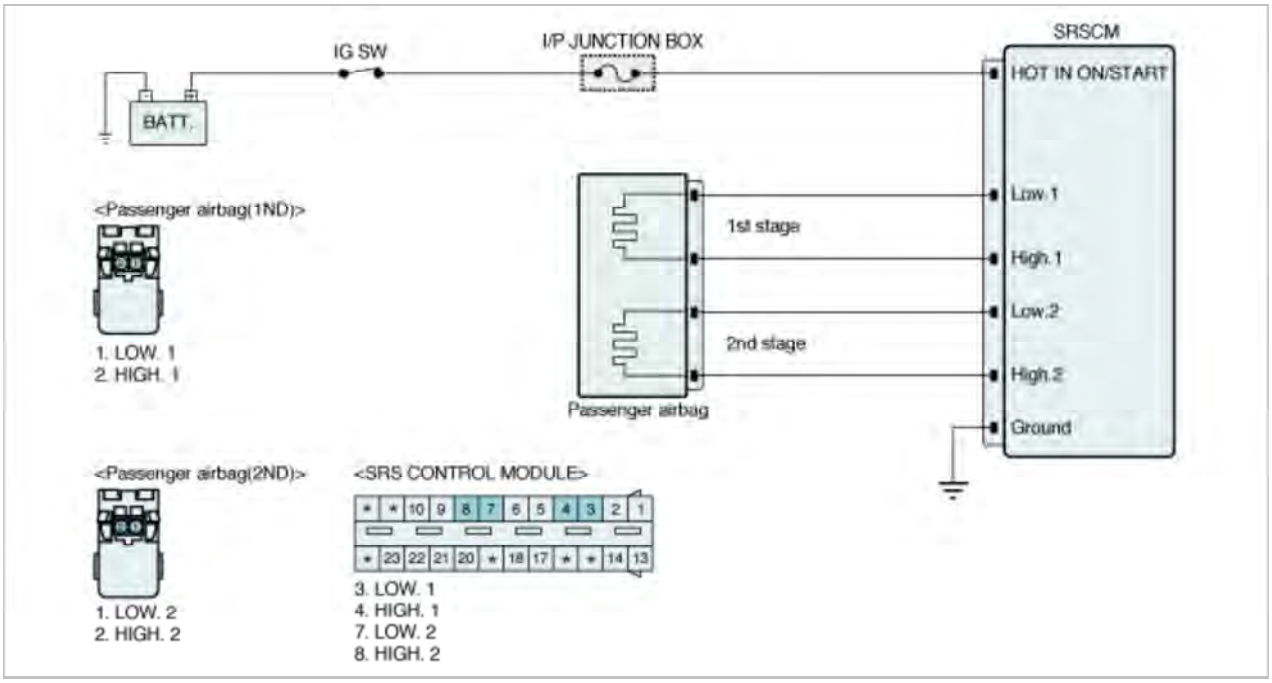
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in PAB harness. • Poor connection of connected part. • Faulty PAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

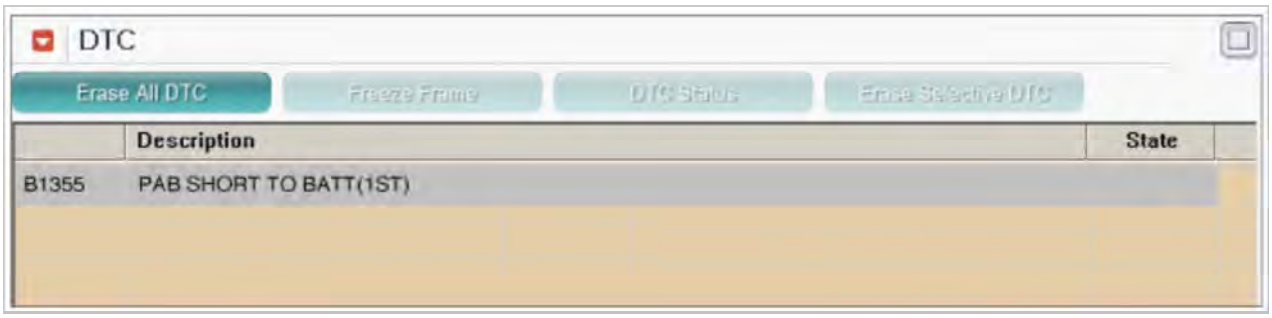
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. ▸ RRepair 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 shorting bar/shorting bar release pin and 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.
	▸ Go to "Squib Circuit Inspection" procedure.

NO	

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the PAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to PAB harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PAB or 2Ω resistor.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PAB assembly, and check for proper operation. If the problem is corrected, replace PAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PAB connector and SRSCM main harness connector.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Measure voltage between terminal "Low.1" or "High.1" of the PAB harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.

NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1361 Pretensioner Front-Driver Resistance too High

General Description

Seat Belt Pretensioner(hereinafter referred to BPT) is located at both side of center pillar.
BPT tightens seat belt before air bag deploys to protect passenger from bumping against crush pad, steering wheel and front window.
In BPT, there are a ignition circuit and cylinder for rewinding belt.
Cylinder has piston that can rewind seat belt in it.
Gas chamber generates expansive force of gases to push piston in cylinder.

> CAUTION
>
> Never measure resistance of BPT directly, Current of measuring device may cause unexpected BPT depoy.

DTC Description

The SRSCM sets DTC B1361 if the measured resistance value of DBPT circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

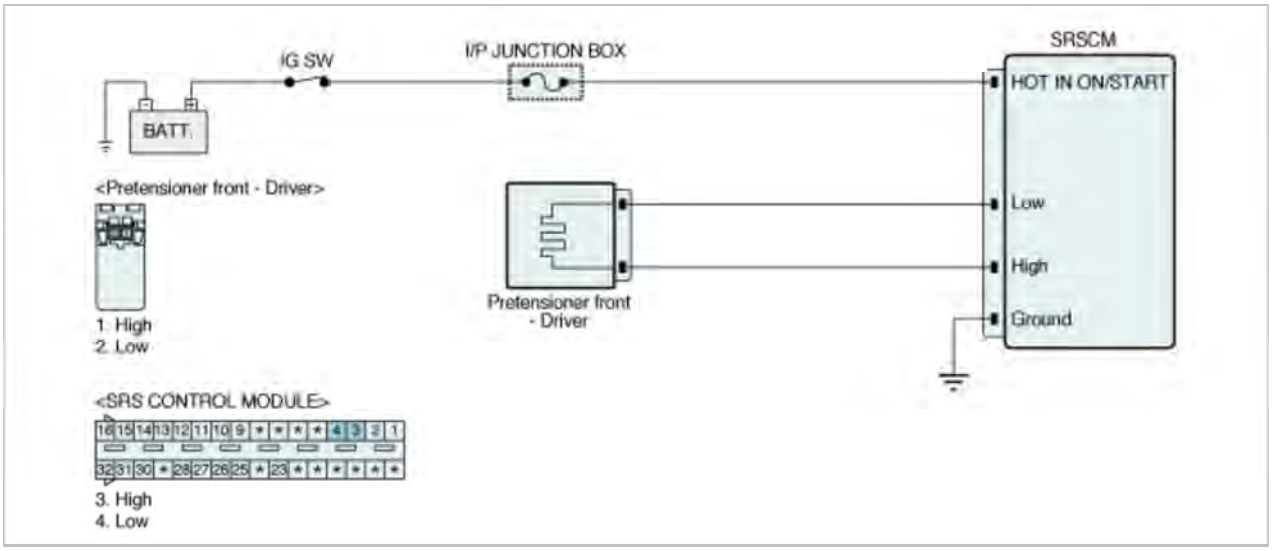
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DBPT. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DBPT resistance ≥ 6.1 Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< DBPT resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DBPT module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DBPT or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DBPT assembly, and check for proper operation. If the problem is corrected, replace DBPT and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DBPT connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the DBPT harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1362 Pretensioner Front-Driver Resistance too Low

General Description

Seat Belt Pretensioner(hereinafter referred to BPT) is located at both side of center pillar.
BPT tightens seat belt before air bag deploys to protect passenger from bumping against crush pad, steering wheel and front window.
In BPT, there are a ignition circuit and cylinder for rewinding belt.
Cylinder has piston that can rewind seat belt in it.
Gas chamber generates expansive force of gases to push piston in cylinder.

CAUTION

Never measure resistance of BPT directly, Current of measuring device may cause unexpected BPT depoy.

DTC Description

The SRSCM sets DTC B1362 if the measured resistance value of DBPT circuit is less than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

DTC Detecting Condition

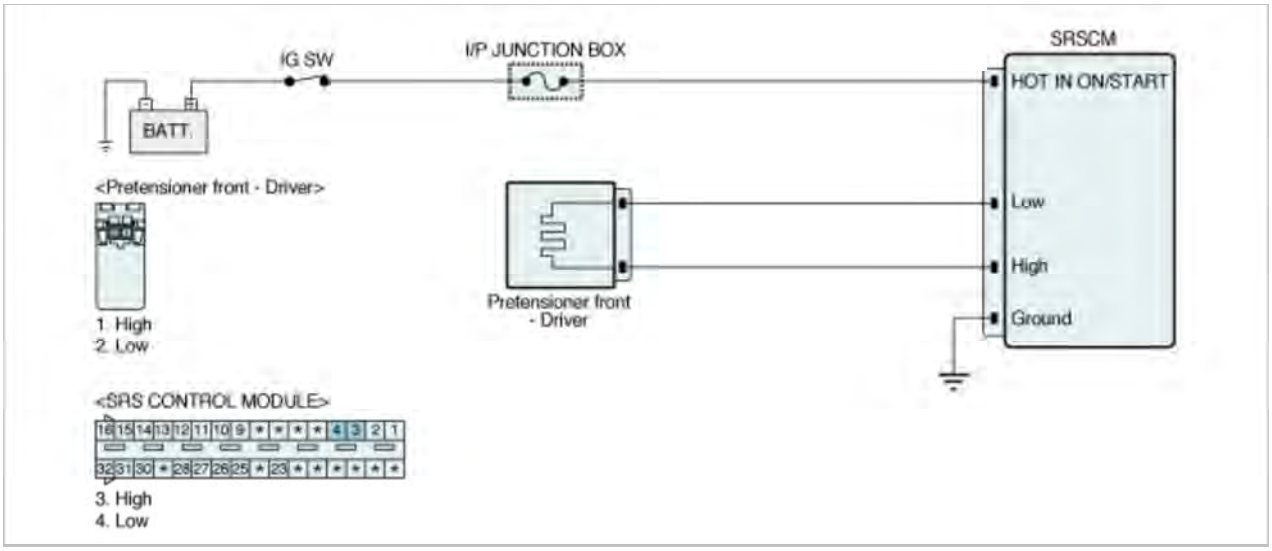
Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DBPT.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DBPT resistance ≤ 1.1Ω	
Diagnostic	Qualification	• More than 1 sec	

Time	De-Qualification	• More than 2 sec	• Faulty SRSCM.

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< DBPT resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DBPT module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DBPT or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DBPT assembly, and check for proper operation. If the problem is corrected, replace DBPT and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DBPT connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the DBPT harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1363 Pretensioner front-Driver resistance circuit short to Ground

General Description

Seat Belt Pretensioner(hereinafter referred to BPT) is located at both side of center pillar.
BPT tightens seat belt before air bag deploys to protect passenger from bumping against crush pad, steering wheel and front window.
In BPT, there are a ignition circuit and cylinder for rewinding belt.
Cylinder has piston that can rewind seat belt in it.
Gas chamber generates expansive force of gases to push piston in cylinder.

CAUTION

Never measure resistance of BPT directly, Current of measuring device may cause unexpected BPT depoy.

DTC Description

The SRSCM sets DTC B1363 if there is a short to ground in DBPT harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

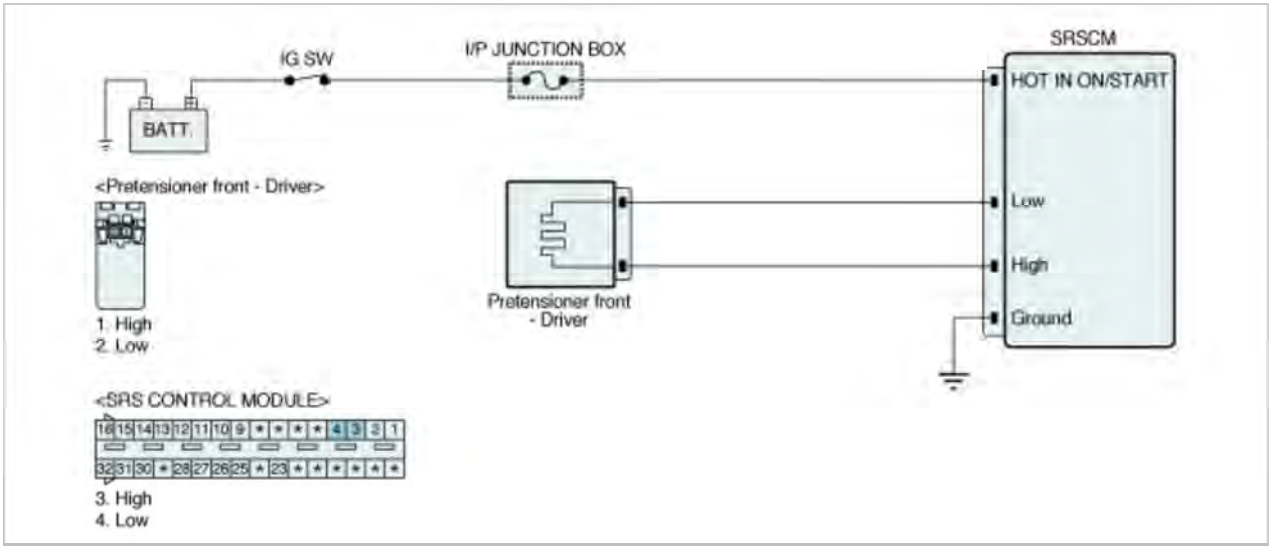
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in DBPT harness. • Poor connection of connected part. • Faulty DBPT. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DBPT module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DBPT or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DBPT assembly, and check for proper operation. If the problem is corrected, replace DBPT and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DBPT connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" or "High" of the DBPT harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1364 Pretensioner front-Driver resistance circuit short to Battery

General Description

Seat Belt Pretensioner(hereinafter referred to BPT) is located at both side of center pillar.
BPT tightens seat belt before air bag deploys to protect passenger from bumping against crush pad, steering wheel and front window.
In BPT, there are a ignition circuit and cylinder for rewinding belt.
Cylinder has piston that can rewind seat belt in it.
Gas chamber generates expansive force of gases to push piston in cylinder.

CAUTION

Never measure resistance of BPT directly, Current of measuring device may cause unexpected BPT depoy.

DTC Description

The SRSCM sets DTC B1364 if there is a short to power in DBPT harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

DTC Detecting Condition

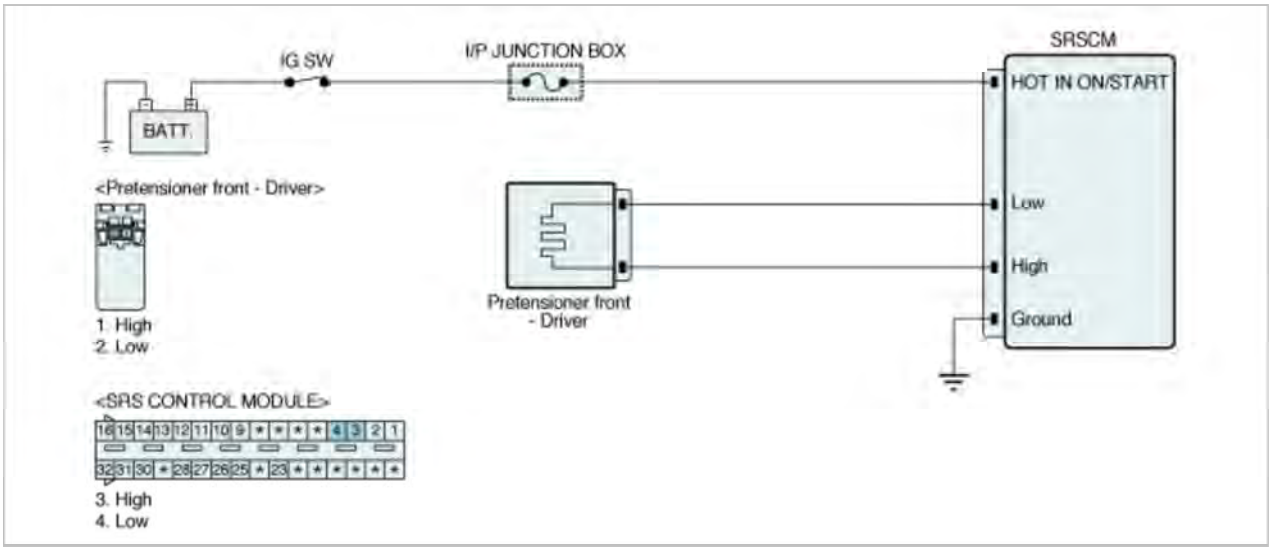
Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in DBPT harness. • Poor connection of connected part. • Faulty DBPT.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
	Qualification		

Diagnostic Time		• More than 1 sec	• Faulty SRSCM.
	De-Qualification	• More than 2 sec	

Specification

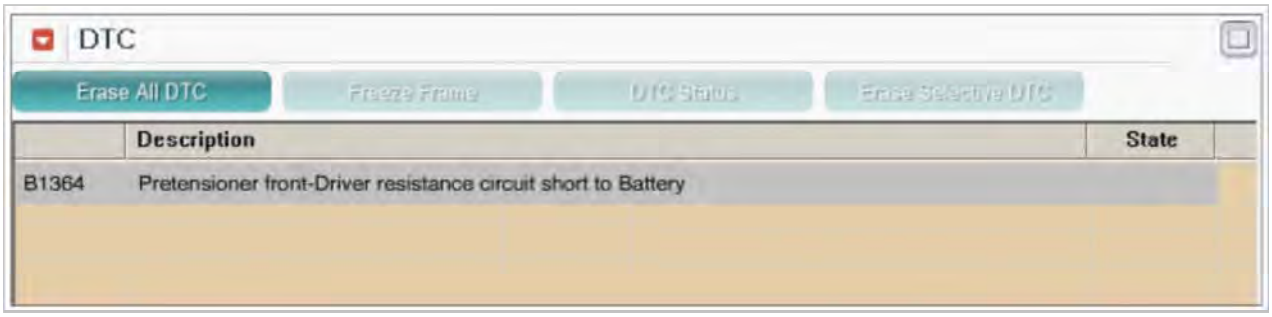
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DBPT module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DBPT or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DBPT assembly, and check for proper operation. If the problem is corrected, replace DBPT and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DBPT connector and SRSCM main harness connector.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".
5. Measure voltage between terminal "Low" or "High" of the DBPT harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1367 Pretensioner Front-Passenger Resistance too High

General Description

Seat Belt Pretensioner(hereinafter referred to BPT) is located at both side of center pillar.
BPT tightens seat belt before air bag deploys to protect passenger from bumping against crush pad, steering wheel and front window.
In BPT, there are a ignition circuit and cylinder for rewinding belt.
Cylinder has piston that can rewind seat belt in it.
Gas chamber generates expansive force of gases to push piston in cylinder.

CAUTION

Never measure resistance of BPT directly, Current of measuring device may cause unexpected BPT depoy.

DTC Description

The SRSCM sets DTC B1367 if the measured resistance value of PBPT circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

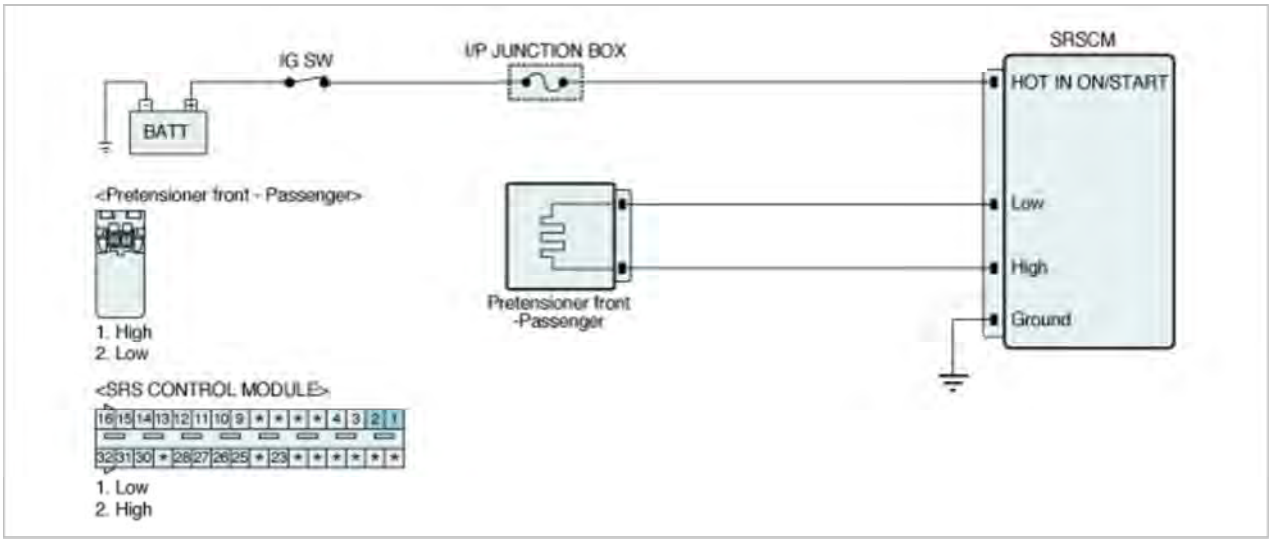
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PBPT. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PBPT resistance ≥ 6.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< PBPT resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".

2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PBPT module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PBPT or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PBPT assembly, and check for proper operation. If the problem is corrected, replace PBPT and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PBPT connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the PBPT harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1368 Pretensioner Front-Passenger Resistance too Low

General Description

Seat Belt Pretensioner(hereinafter referred to BPT) is located at both side of center pillar.
BPT tightens seat belt before air bag deploys to protect passenger from bumping against crush pad, steering wheel and front window.
In BPT, there are a ignition circuit and cylinder for rewinding belt.
Cylinder has piston that can rewind seat belt in it.
Gas chamber generates expansive force of gases to push piston in cylinder.

> CAUTION

Never measure resistance of BPT directly, Current of measuring device may cause unexpected BPT depoy.

DTC Description

The SRSCM sets DTC B1368 if the measured resistance value of PBPT circuit is less than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

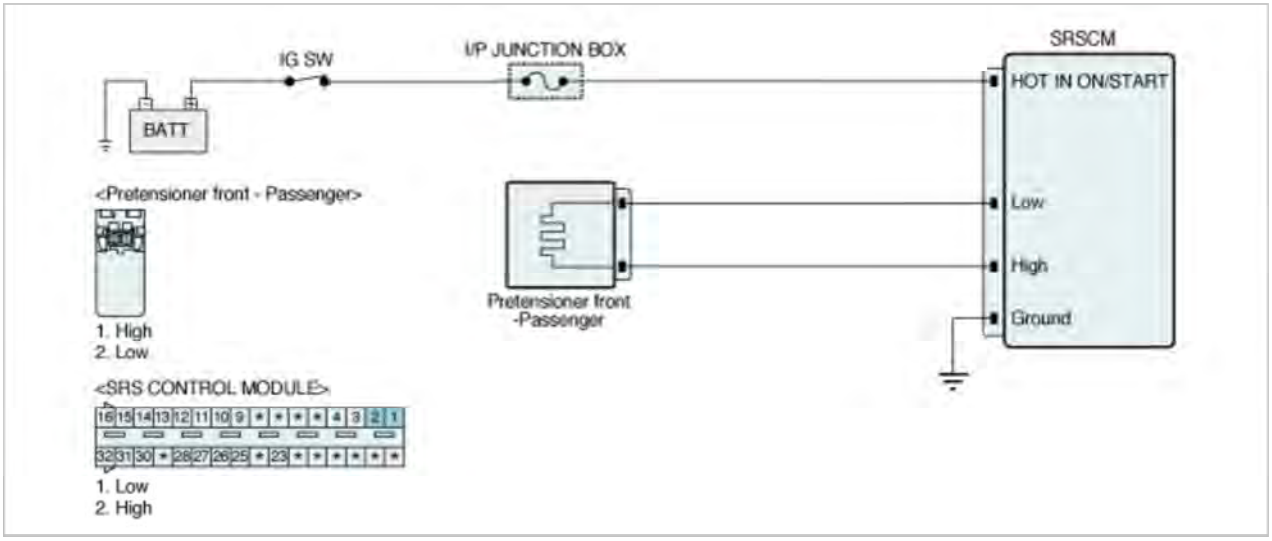
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PBPT. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DBPT resistance ≤ 1.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< PBPT resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PBPT module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PBPT or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PBPT assembly, and check for proper operation. If the problem is corrected, replace PBPT and then go to "Verification of Vehicle Repair" procedure.

Main harness Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PBPT connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the PBPT harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1369 Pretensioner Front-Passenger Resistance Circuit Short to Ground

General Description

Seat Belt Pretensioner(hereinafter referred to BPT) is located at both side of center pillar.
BPT tightens seat belt before air bag deploys to protect passenger from bumping against crush pad, steering wheel and front window.
In BPT, there are a ignition circuit and cylinder for rewinding belt.
Cylinder has piston that can rewind seat belt in it.
Gas chamber generates expansive force of gases to push piston in cylinder.

CAUTION

Never measure resistance of BPT directly, Current of measuring device may cause unexpected BPT depoy.

DTC Description

The SRSCM sets DTC B1369 if there is a short to ground in PBPT harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

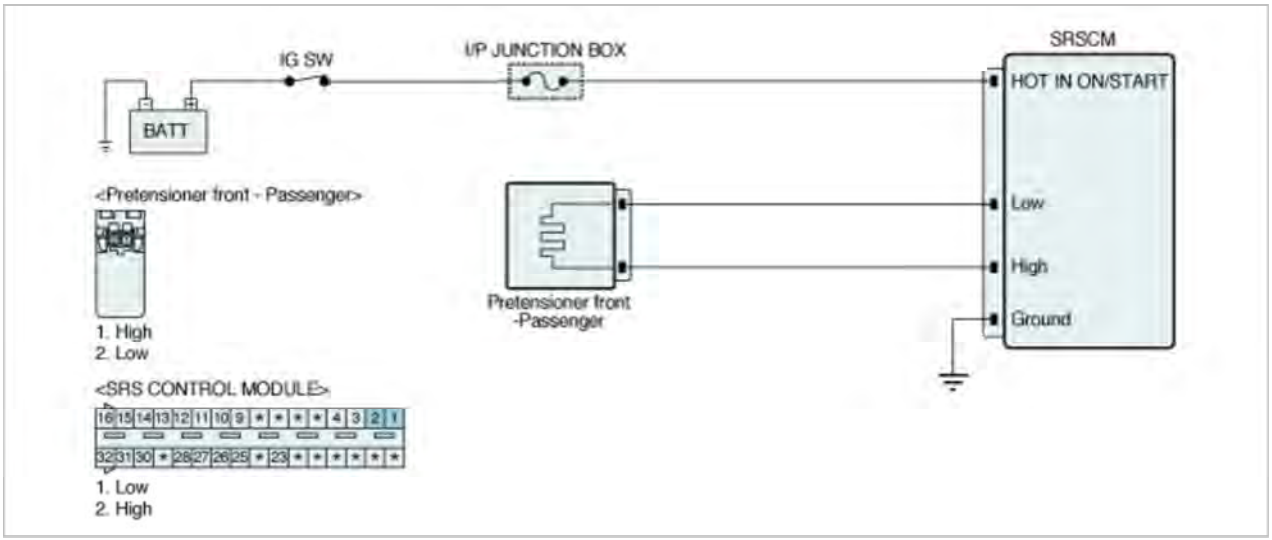
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in PBPT harness. • Poor connection of connected part. • Faulty PBPT. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PBPT module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PBPT or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PBPT assembly, and check for proper operation. If the problem is corrected, replace PBPT and then go to "Verification of Vehicle Repair" procedure.

Main harness Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PBPT connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" or "High" of the PBPT harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1370 Pretensioner Front-Passenger Resistance Circuit Short to Battery

General Description

Seat Belt Pretensioner(hereinafter referred to BPT) is located at both side of center pillar.
BPT tightens seat belt before air bag deploys to protect passenger from bumping against crush pad, steering wheel and front window.
In BPT, there are a ignition circuit and cylinder for rewinding belt.
Cylinder has piston that can rewind seat belt in it.
Gas chamber generates expansive force of gases to push piston in cylinder.

> **CAUTION**
>
> Never measure resistance of BPT directly, Current of measuring device may cause unexpected BPT depoy.

DTC Description

The SRSCM sets DTC B1370 if there is a short to power in PBPT harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

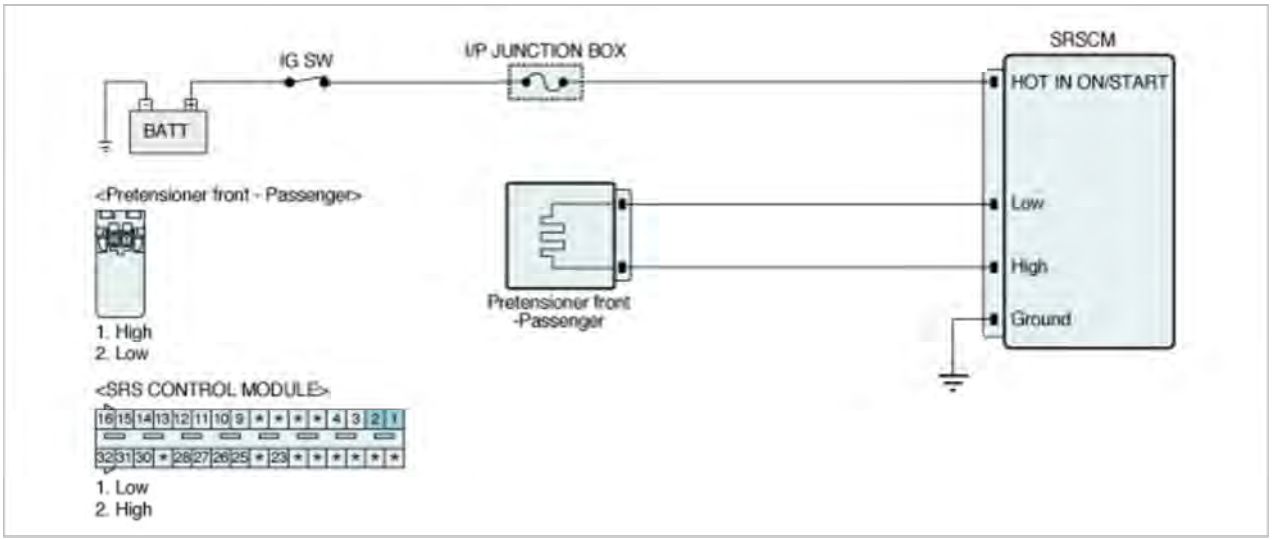
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in PBPT harness. • Poor connection of connected part. • Faulty PBPT. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	Resistance

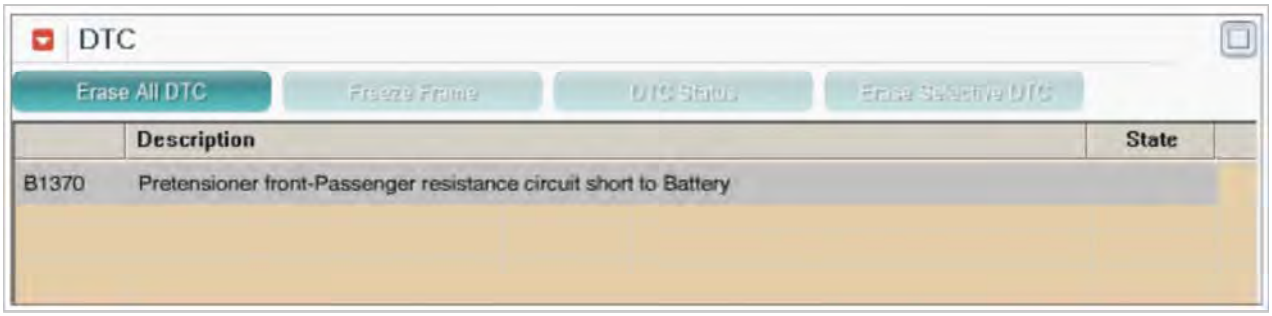
Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.

4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PBPT module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PBPT or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PBPT assembly, and check for proper operation. If the problem is corrected, replace PBPT and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PBPT connector and SRSCM main harness connector.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".

5. Measure voltage between terminal "Low" or "High" of the PBPT harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1371 STPS(Seat Track Position Sensor)-Driver instability

General Description

STPS located underneath driver seat detects horizental position of driver seat and delivers it to SRSCM.
Signal of STPS is the one of major parameters that determine the way dual output type airbag deploys.

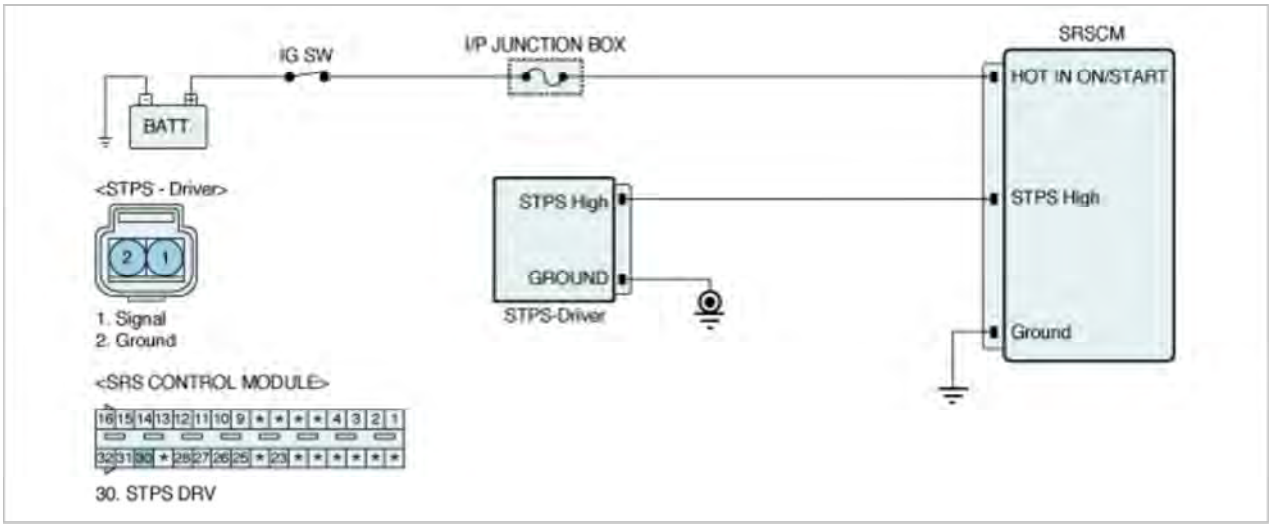
DTC Description

The SRSCM sets DTC B1371 if the value of driver side STPS changes frequently.

DTC Detecting Condition

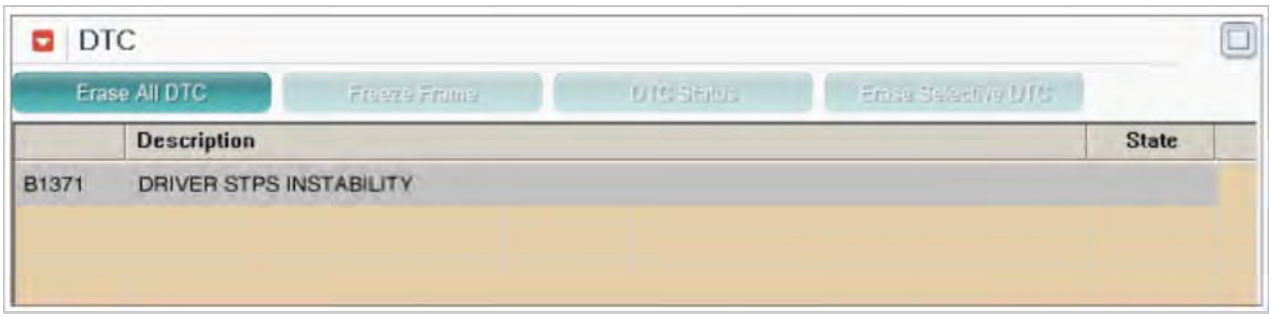
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Poor connection of connected part. • Faulty STPS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• In a case there is not five equivalent information out of twenty status information for STPS-Driver	
Diagnostic Time	Qualification	• 2 sec	
	De-Qualification	• N/A	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Terminal and Connector Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect STPS connector.
5. Substitute the STPS and check for proper operation.
6. Has a problem been found?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good STPS, and check for proper operation. If the problem is corrected, replace STPS and then go to "Verification of Vehicle Repair" procedure.

Restraint > SRSCM > B1378 Side Airbag Front-Driver Resistance too High

General Description

Side Airbag (hereinafter referred to SAB) located in driver and passenger seat protects passenger's head and shoulder. SAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of SAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1378 if the measured resistance value of DSAB circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

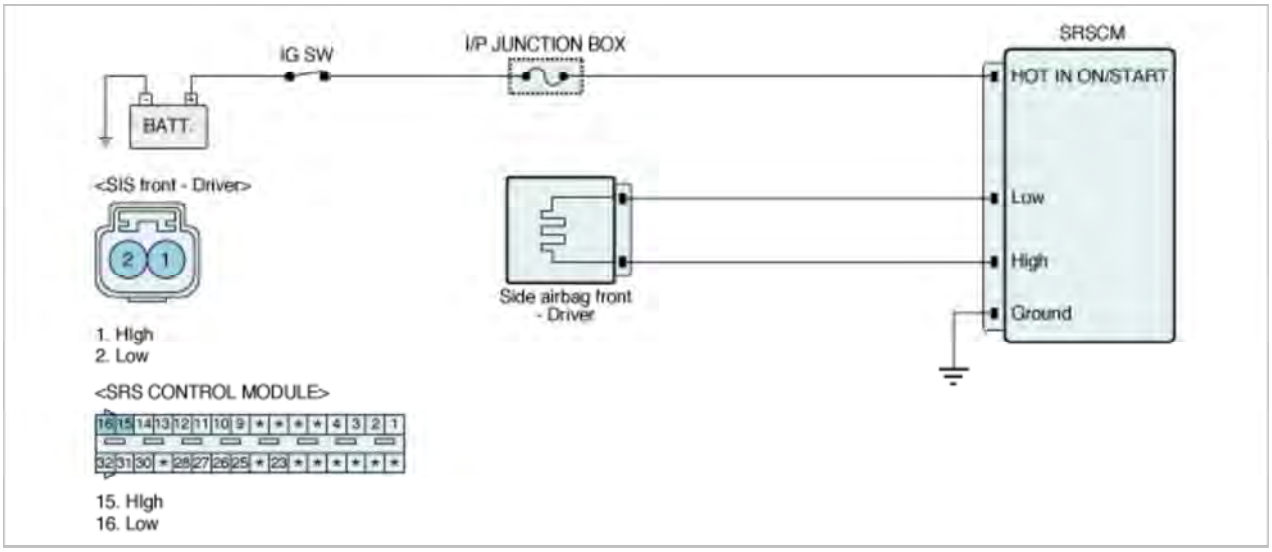
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DSAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DSAB resistance ≥ 6.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

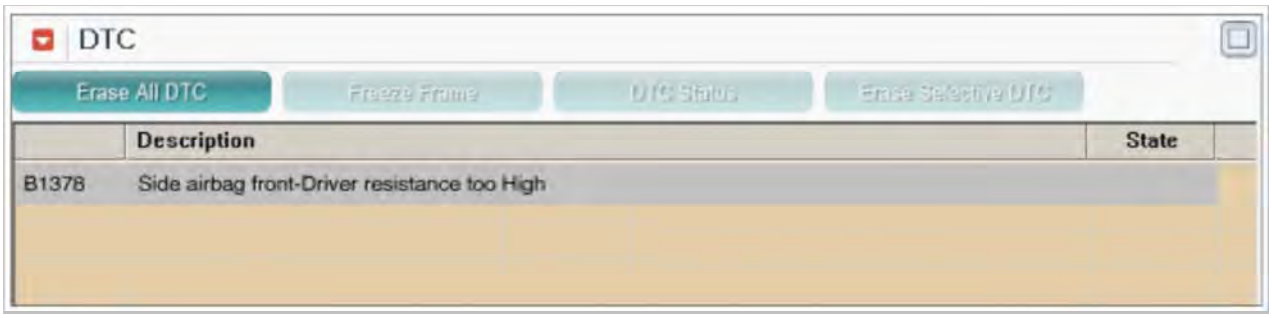
Test Condition	Resistance
Ignition ON	1.6Ω< DSAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DSAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-3F000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DSAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DSAB assembly, and check for proper operation. If the problem is corrected, replace DSAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DSAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the DSAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1379 Side Airbag Front-Driver Resistance too Low

General Description

Side Airbag (hereinafter referred to SAB) located in driver and passenger seat protects passenger's head and shoulder. SAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of SAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1379 if the measured resistance value of DAB circuit is less than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

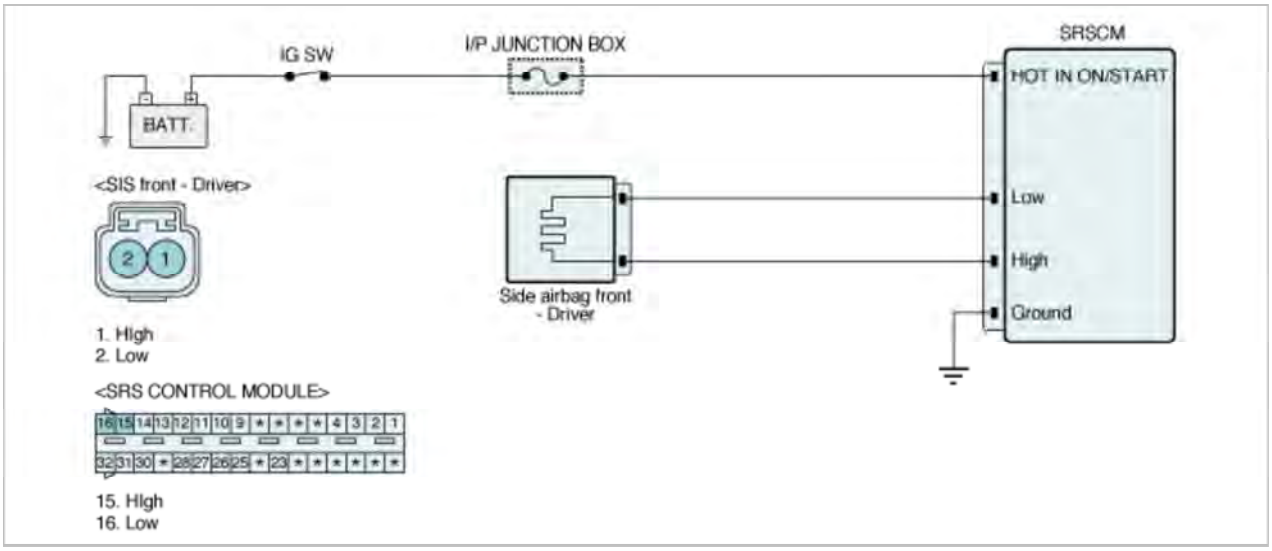
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DSAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DSAB resistance ≤ 1.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< DSAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DSAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-3F000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DSAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DSAB assembly, and check for proper operation. If the problem is corrected, replace DSAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DSAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the DSAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1380 Side Airbag Front-Driver Resistance Circuit Short to Ground

General Description

Side Airbag (hereinafter referred to SAB) located in driver and passenger seat protects passenger's head and shoulder. SAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of SAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1380 if there is a short to ground in DSAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

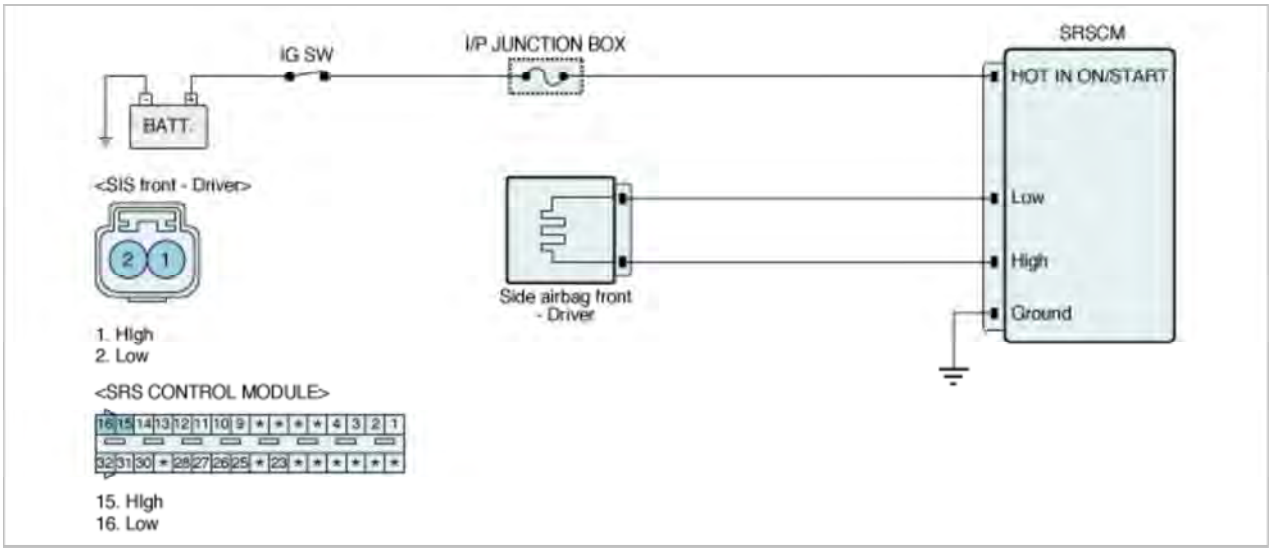
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in DSAB harness. • Poor connection of connected part. • Faulty DSAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DSAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-3F000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DSAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DSAB assembly, and check for proper operation. If the problem is corrected, replace DSAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DSAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" or "High" of the DSAB harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1381 Side Airbag Front-Driver Resistance Circuit Short to Battery

General Description

Side Airbag (hereinafter referred to SAB) located in driver and passenger seat protects passenger's head and shoulder. SAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of SAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1381 if there is a short to power in DSAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

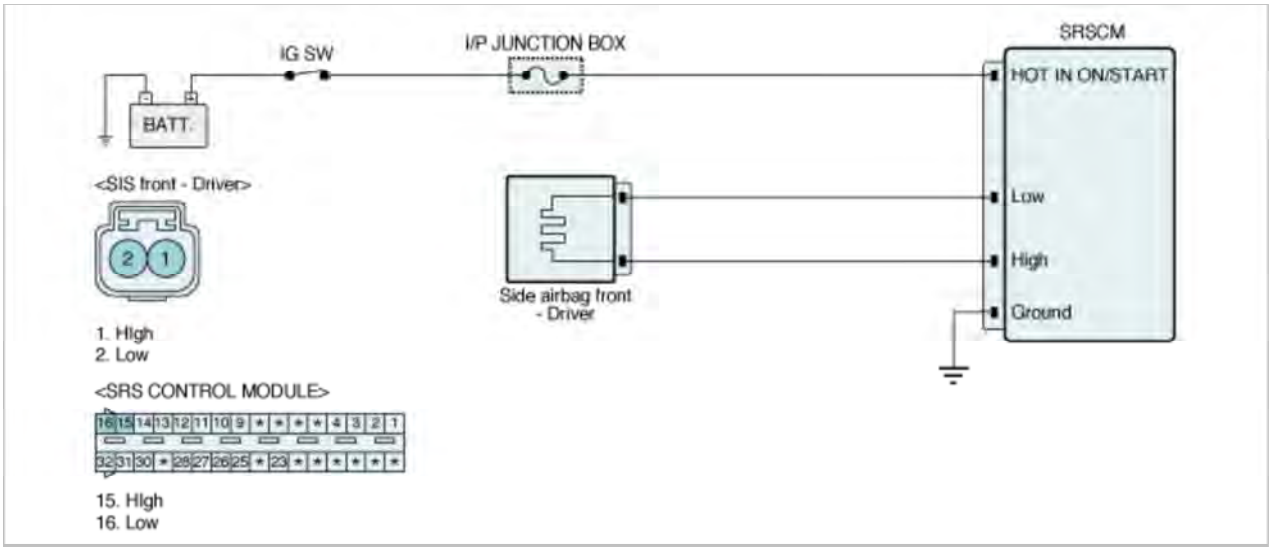
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in DSAB harness. • Poor connection of connected part. • Faulty DSAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

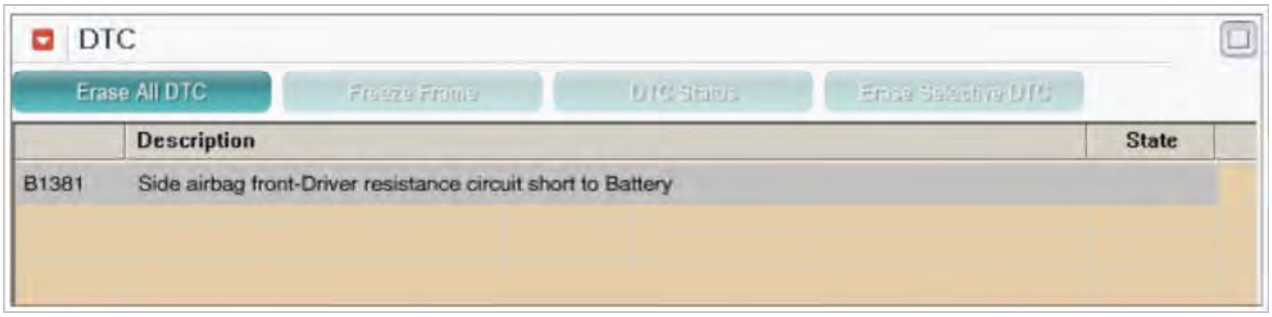
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DSAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-3F000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DSAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DSAB assembly, and check for proper operation. If the problem is corrected, replace DSAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DSAB connector and SRSCM main harness connector.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".

5. Measure voltage between terminal "Low" or "High" of the DSAB harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1382 Side Airbag Front-Passenger Resistance too High

General Description

Side Airbag (hereinafter referred to SAB) located in driver and passenger seat protects passenger's head and shoulder. SAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of SAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1382 if the measured resistance value of PSAB circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

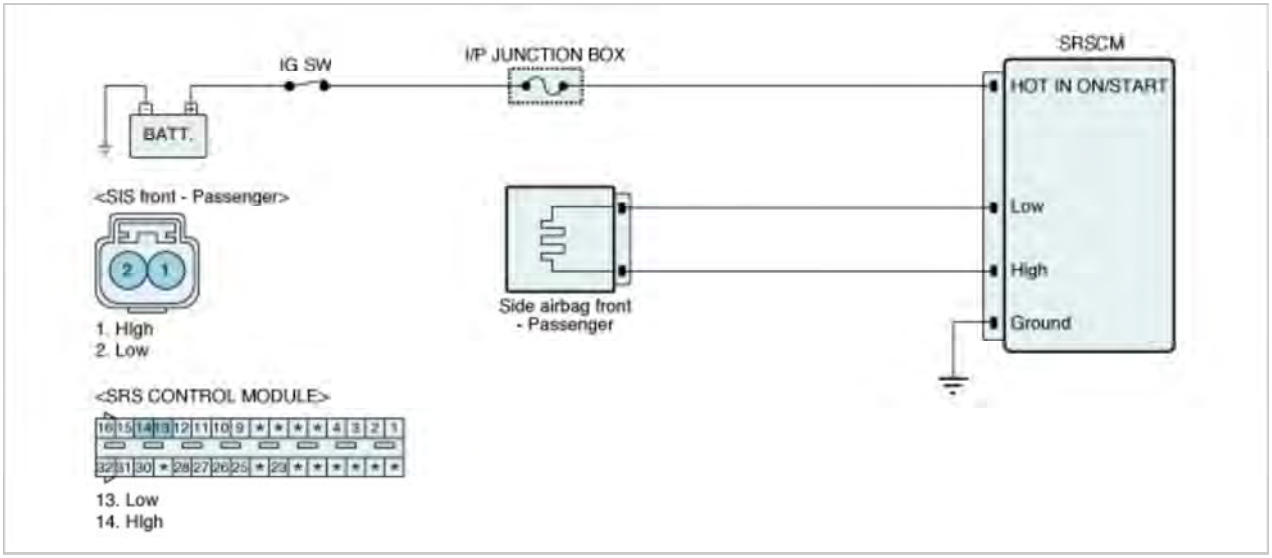
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PSAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PSAB resistance ≥ 6.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< PSAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PSAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-3F000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PSAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PSAB assembly, and check for proper operation. If the problem is corrected, replace PSAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PSAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the PSAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1383 Side Airbag Front-Passenger Resistance too Low

General Description

Side Airbag (hereinafter referred to SAB) located in driver and passenger seat protects passenger's head and shoulder. SAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of SAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1383 if the measured resistance value of PSAB circuit is less than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

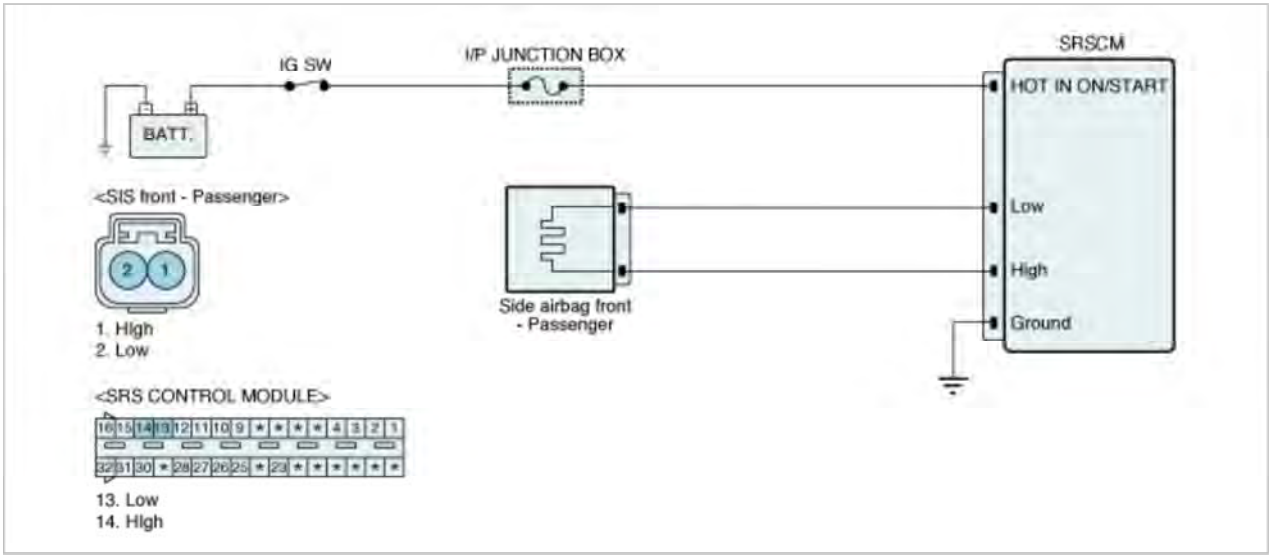
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PSAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PSAB resistance ≤ 1.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< PSAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PSAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-3F000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PSAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PSAB assembly, and check for proper operation. If the problem is corrected, replace PSAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PSAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the PSAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1384 Side Airbag Front-Passenger Resistance Circuit Short to Ground

General Description

Side Airbag (hereinafter referred to SAB) located in driver and passenger seat protects passenger's head and shoulder. SAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of SAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1384 if there is a short to ground in PSAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

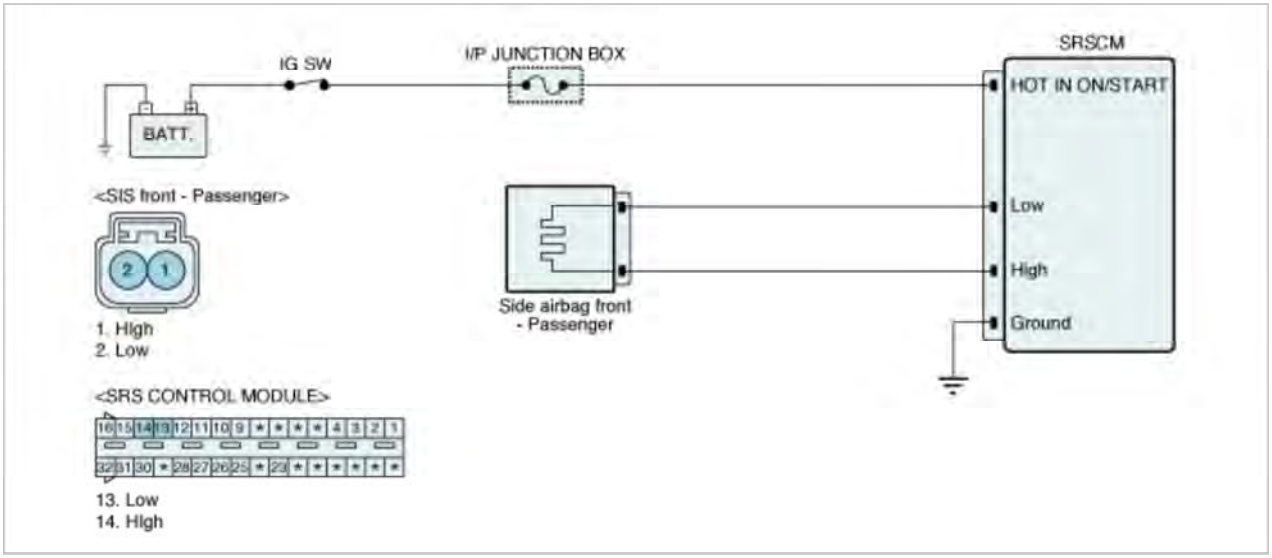
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in PSAB harness. • Poor connection of connected part. • Faulty PSAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PSAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-3F000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PSAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PSAB assembly, and check for proper operation. If the problem is corrected, replace PSAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PSAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" or "High" of the PSAB harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1385 Side Airbag Front-Passenger Resistance Circuit Short to Battery

General Description

Side Airbag (hereinafter referred to SAB) located in driver and passenger seat protects passenger's head and shoulder. SAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of SAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1385 if there is a short to power in PSAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

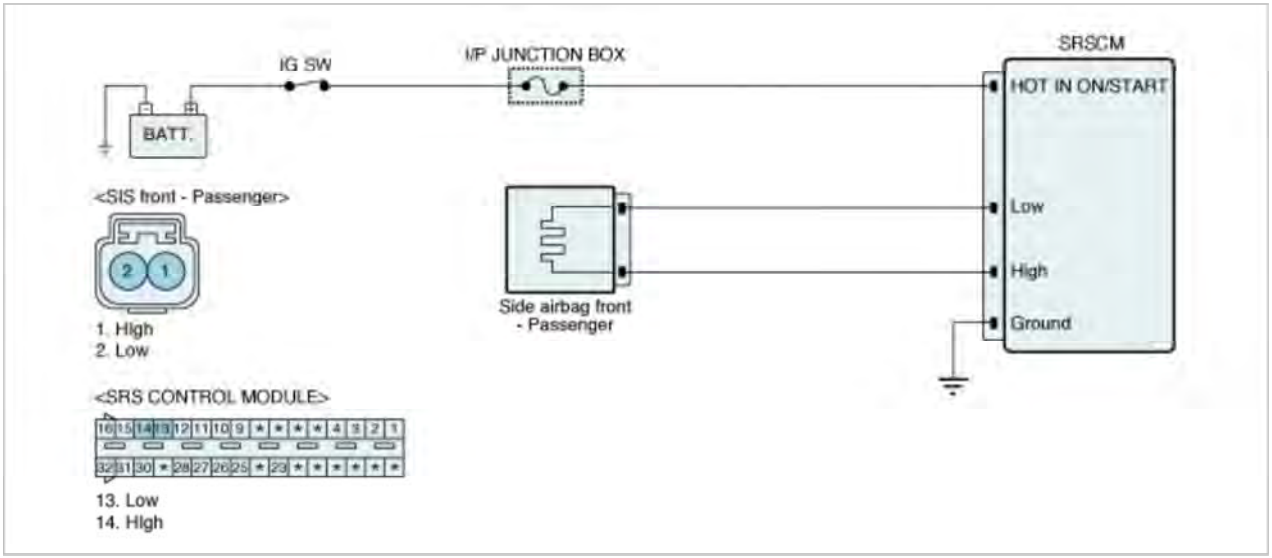
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in PSAB harness. • Poor connection of connected part. • Faulty PSAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

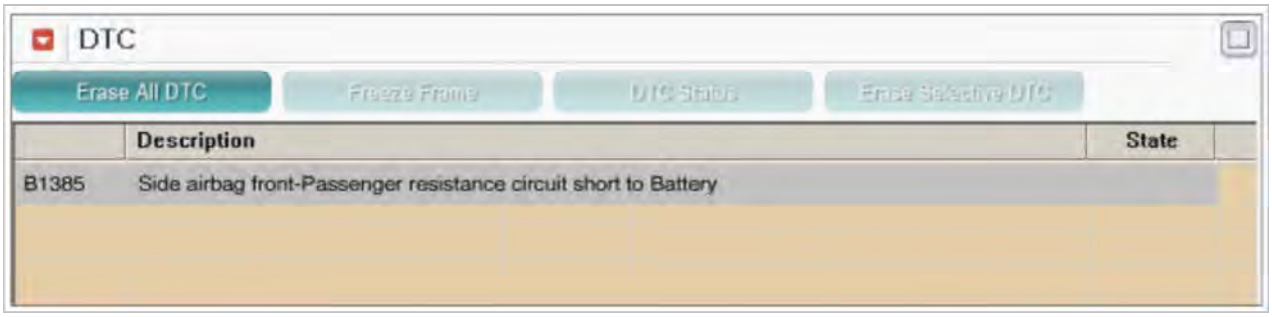
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PSAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-3F000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PSAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PSAB assembly, and check for proper operation. If the problem is corrected, replace PSAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PSAB connector and SRSCM main harness connector.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".

5. Measure voltage between terminal "Low" or "High" of the PSAB harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1387 STPS(Seat Track Position Sensor)-Driver Short or Short to Ground

General Description

STPS located underneath passenger seat detects horizental position of passenger seat and delivers it to SRSCM.
Signal of STPS is the one of major parameters that determine the way dual output type airbag deploys.

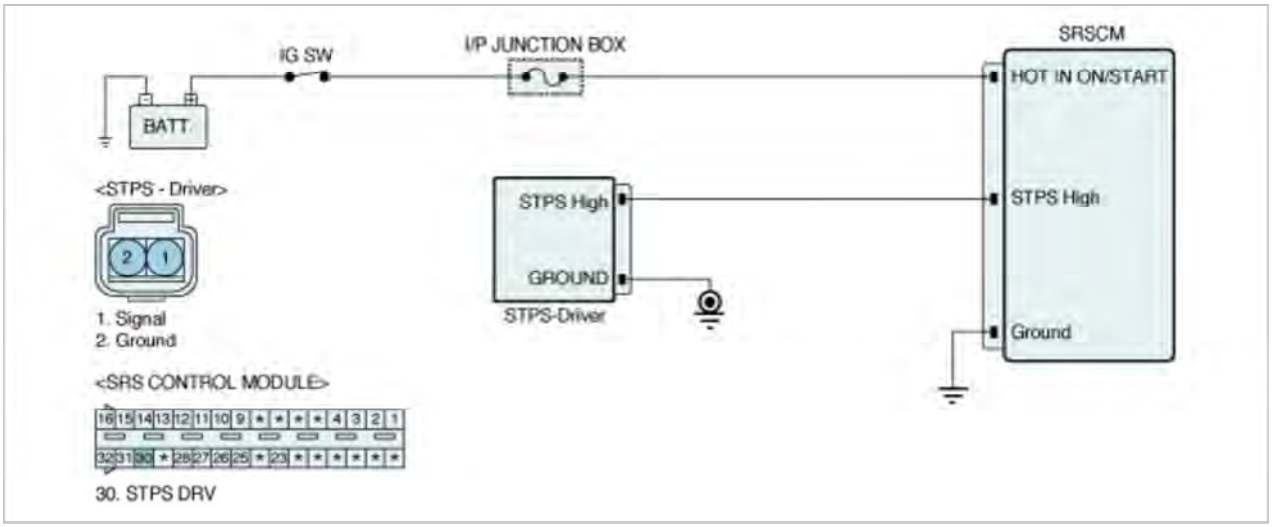
DTC Description

The SRSCM sets DTC B1387 if there is a short to ground in Driver STPS harness.

DTC Detecting Condition

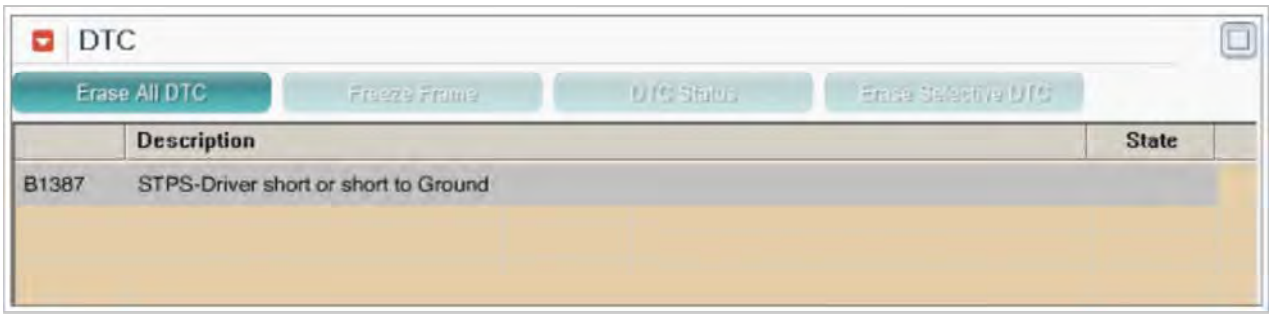
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Short to ground in STPS harness. • Poor connection of connected part. • Faulty STPS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Short to ground or short among wires	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Main harness circuit inspection" procedure.

Main harness circuit Inspection

1. Ignition "OFF".

2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect STPS connector and SRSCM main harness connector.
4. Measure resistance between terminal "High" of the STPS harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect STPS connector .
5. Substitute the STPS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ SSubstitute a known-good STPS, and check for proper operation. If the problem is corrected, replace STPS 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1388 STPS(Seat Track Position Sensor)-Driver Open or Short to Battery

General Description

STPS located underneath passenger seat detects horizental position of passenger seat and delivers it to SRSCM.
Signal of STPS is the one of major parameters that determine the way dual output type airbag deploys.

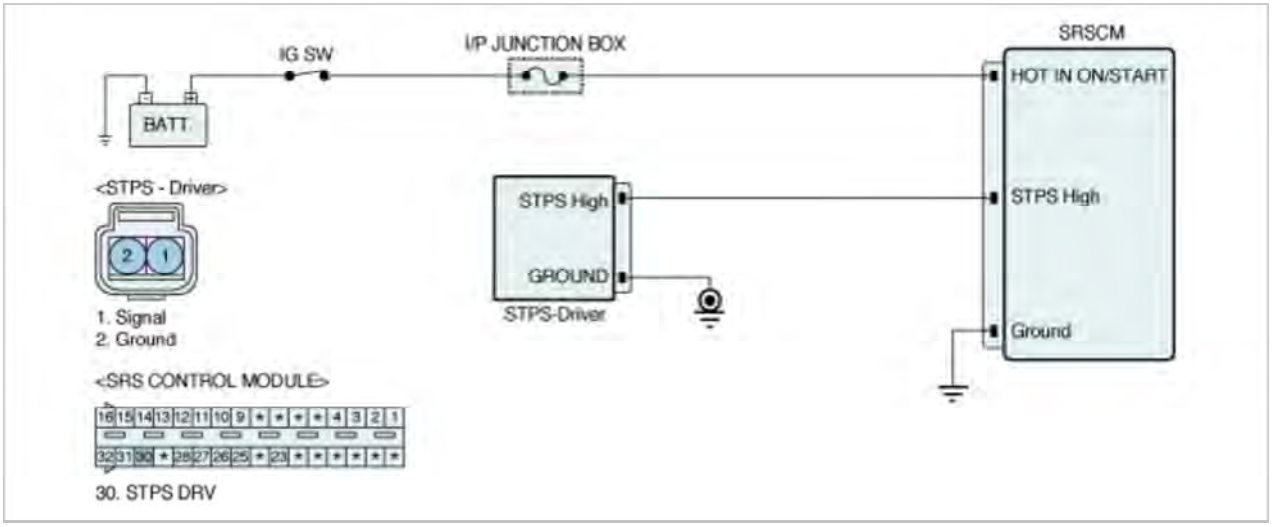
DTC Description

The SRSCM sets DTC B1388 if there is a short to power in Driver STPS harness.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Short to power in STPS harness. • Poor connection of connected part. • Faulty STPS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Open circuit or Wire circuit short to power	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/horting bar release pin and 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Main harness circuit inspection" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect STPS connector and SRSCM main harness connector.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".
5. Measure voltage between terminal "High" of the STPS harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect STPS connector .
5. Substitute the STPS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ SSubstitute a known-good STPS, and check for proper operation. If the problem is correctd, replace STPS 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1389 STPS(Seat Track Position Sensor)-Driver Defect

General Description

STPS located underneath passenger seat detects horizental position of passenger seat and delivers it to SRSCM. Signal of STPS is the one of major parameters that determine the way dual output type airbag deploys.

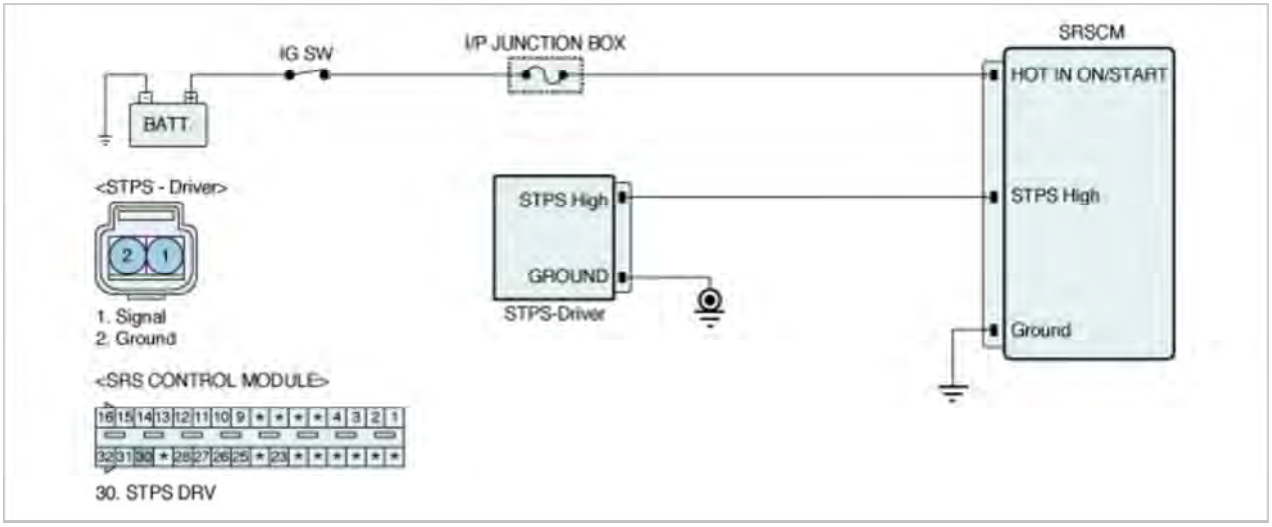
DTC Description

The SRSCM sets DTC B1389 if there is any fault in STPS circuit.

DTC Detecting Condition

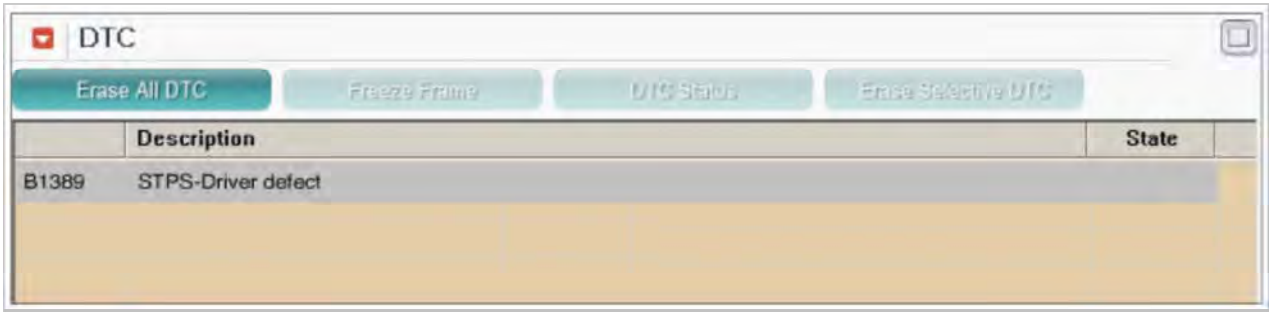
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Poor connection of connected part. • Faulty STPS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• STPS-Driver defect	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect STPS connector .
5. Substitute the STPS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ SSubstitute a known-good STPS, and check for proper operation. If the problem is correctd, replace STPS 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1395 Firing Loops Interconnection Fault

General Description

Every air bag module has its firing circuit that ignits powder to deploy air bag according to signal of SRSCM.

SRSCM checks every air bag module when ignition "ON". Once any fault is detected, it is erased only by scantool.

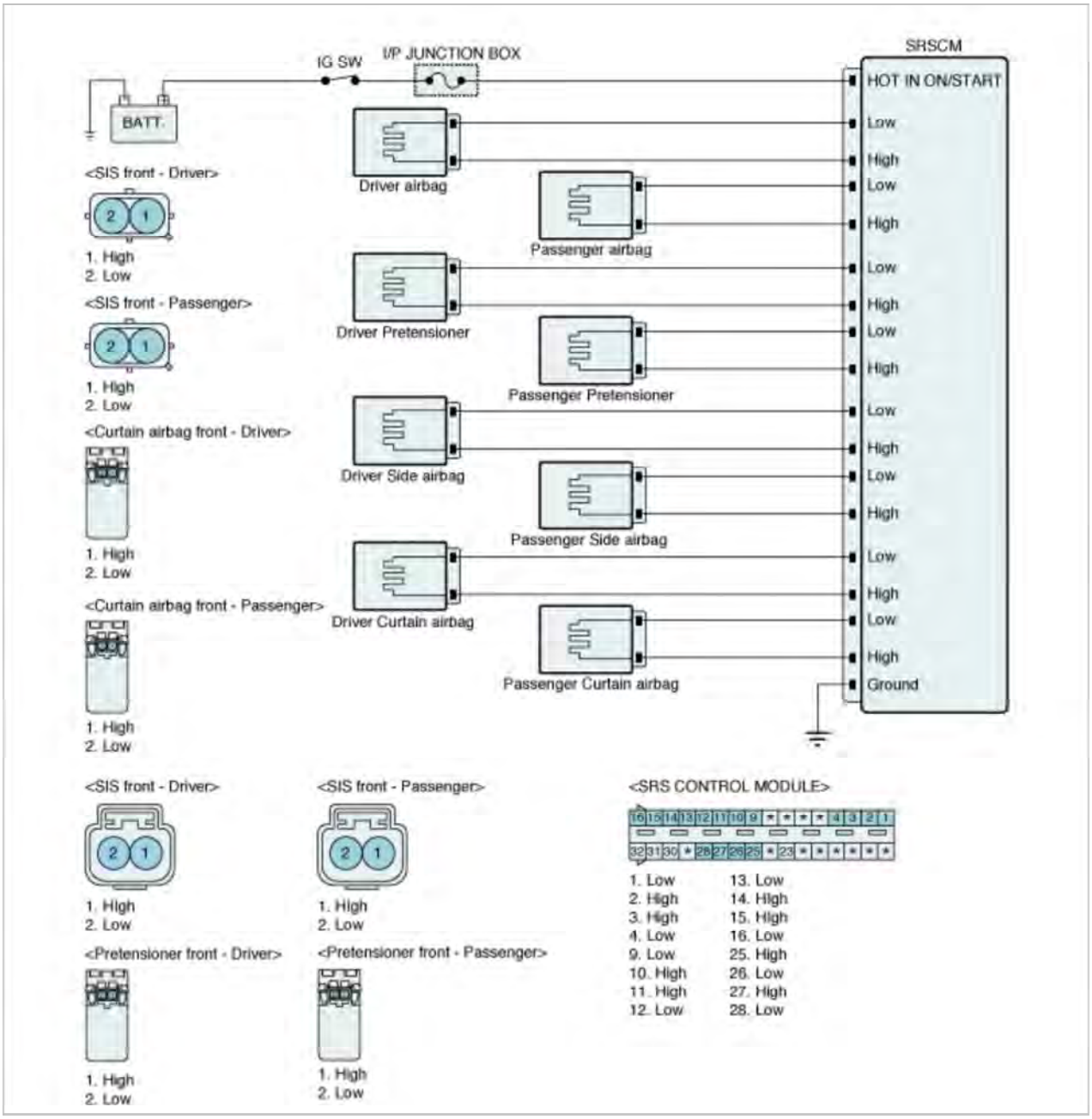
DTC Description

The SRSCM sets DTC B1395 if there's any short circuit in harness of every firing circuit to one another.

DTC Detecting Condition

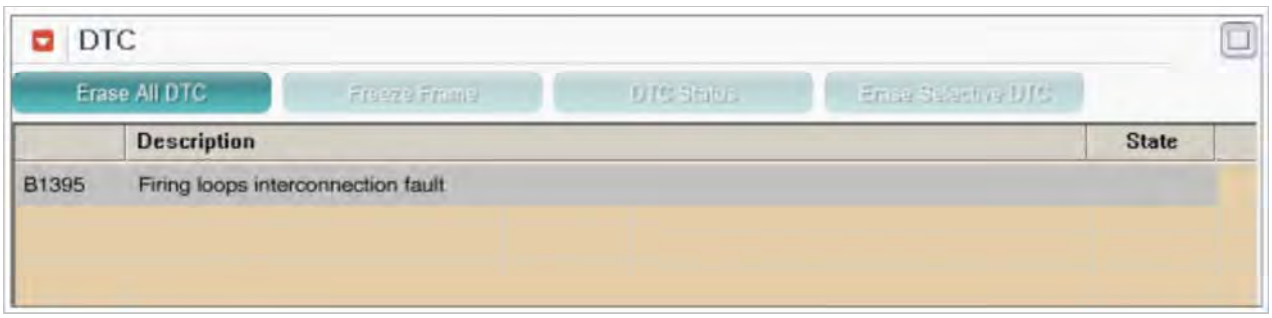
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• short circuit in squib harness. • SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Only check during start-up phase(Short between adjacent squib circuits)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• NA	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ CCheck for short between ignition circuits of DAB,PAB,BPT,CAB,SAB. If the condition of harness and component is OK, this fault is caused by SRSCM internal error so replace a known-good SRSCM and then go to "Verification of Vehicle Repair" procedure. .
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 select "Diagnostic Trouble Codes(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1400 SIS(Side Impact Sensor) Front-Driver defect

General Description

Side Impact Sensor(SIS) is located in both side of center pillar detects broad collision.
When SIS delivers collision signal to SRSCM, SRSCM checks if safing sensor located in SRSCM detects collusion. and if both SIS and safing sensor detects collision simultaneously, SRSCM operates side air bag.

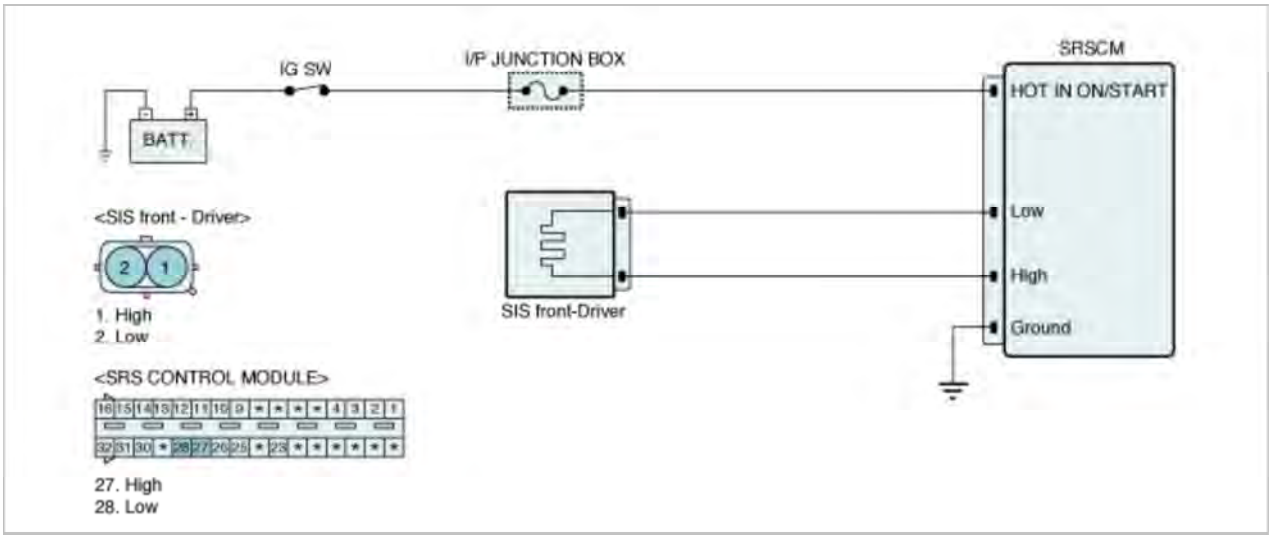
DTC Description

The SRSCM sets DTC B1400 if there is any fault in DSIS circuit.

DTC Detecting Condition

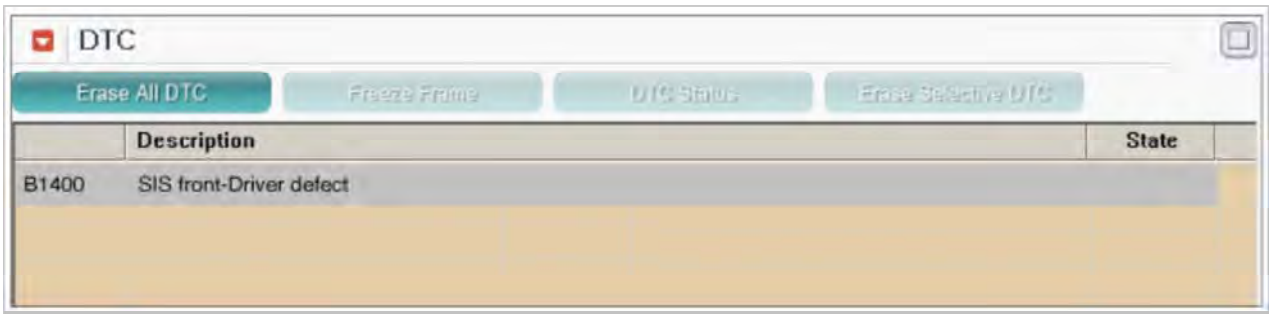
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Faulty DSIS circuit. • Faulty DSIS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• SIS front-Driver Faulty	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 shorting 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 "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect DSIS connector .
5. Substitute the DSIS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good DSIS, and check for proper operation. If the problem is corrected, replace DSIS 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1403 SIS(Side Impact Sensor)Front-Passenger Defect

General Description

Side Impact Sensor(SIS) is located in both side of center pillar detects broad collision.
When SIS delivers collision signal to SRSCM, SRSCM checks if safing sensor located in SRSCM detects collusion. and if both SIS and safing sensor detects collision simultaneously, SRSCM operates side air bag.

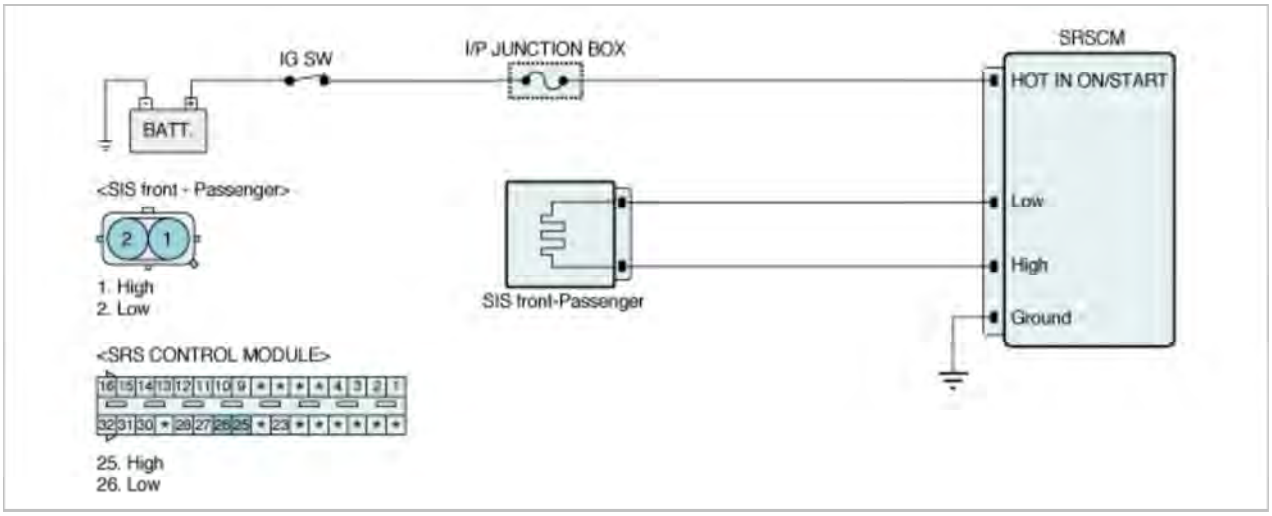
DTC Description

The SRSCM sets DTC B1403 if there is any fault in PSIS circuit.

DTC Detecting Condition

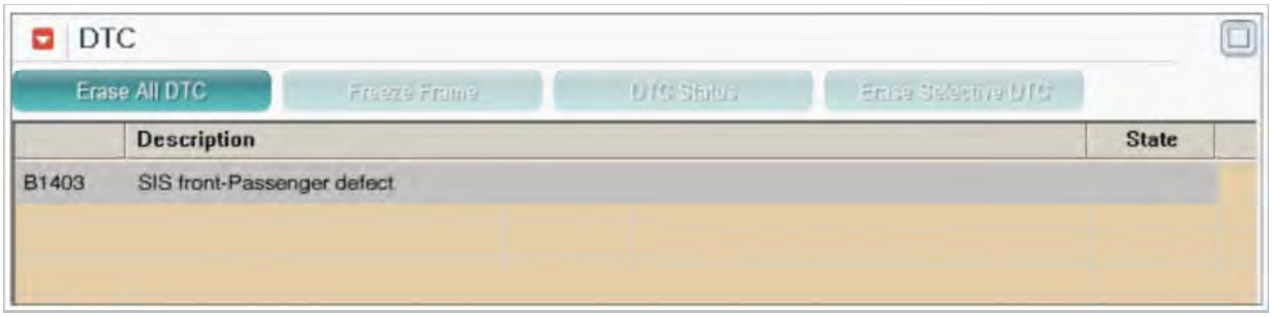
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Faulty PSIS circuit. • Faulty PSIS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• SIS front-Passenger Faulty	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 shorting 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 "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.

2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect PSIS connector.
5. Substitute the PSIS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good PSIS, and check for proper operation. If the problem is corrected, replace PSIS 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1409 SIS(Side Impact Sensor) Front-Driver Communication Error

General Description

Side Impact Sensor(SIS) is located in both side of center pillar detects broad collision.
When SIS delivers collision signal to SRSCM, SRSCM checks if safing sensor located in SRSCM detects collusion. and if both SIS and safing sensor detects collision simultaneously, SRSCM operates side air bag.

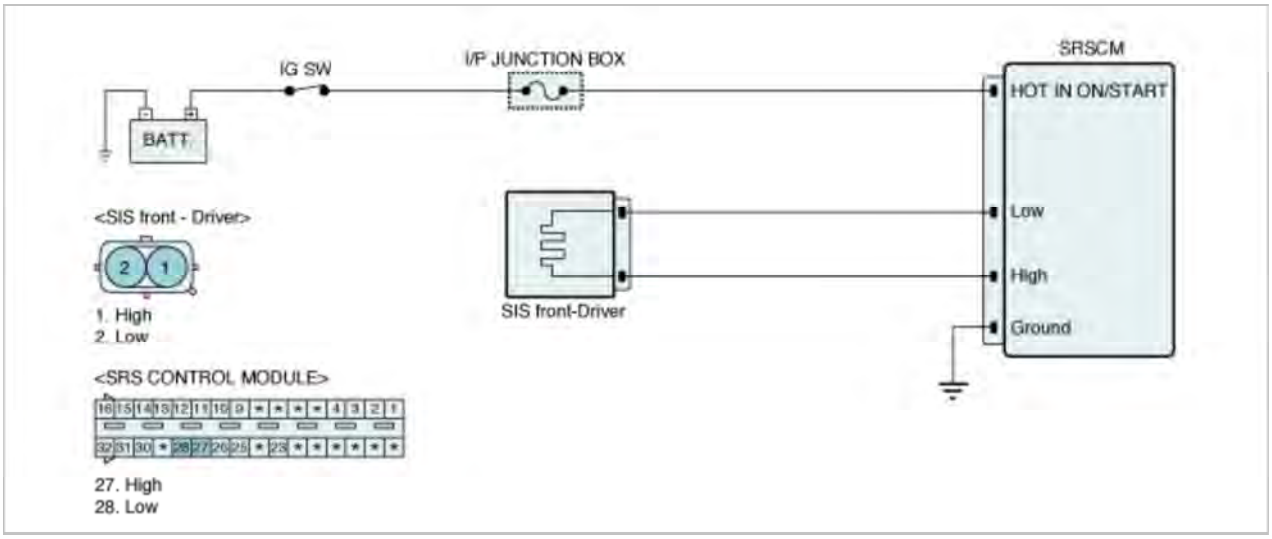
DTC Description

The SRSCM sets DTC B1409 if there is any error in communication between DSIS and SRSCM.

DTC Detecting Condition

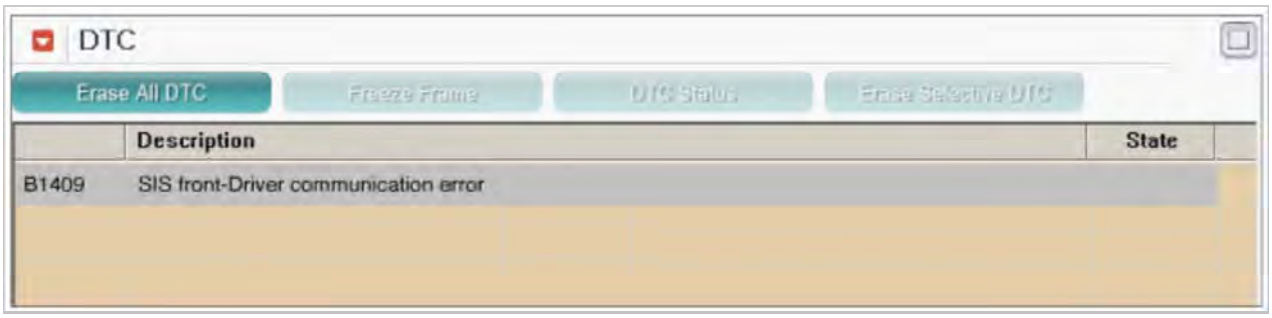
Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Faulty DSIS circuit. • Faulty DSIS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• SIS front-Driver short, open	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 shorting 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 "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect DSIS connector.
5. Substitute the DSIS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good DSIS, and check for proper operation. If the problem is corrected, replace SRSCM 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1410 SIS(Side Impact Sensor) Front-Passenger Communication Error

General Description

Side Impact Sensor(SIS) is located in both side of center pillar detects broad collision.
When SIS delivers collision signal to SRSCM, SRSCM checks if safing sensor located in SRSCM detects collusion. and if both SIS and safing sensor detects collision simultaneously, SRSCM operates side air bag.

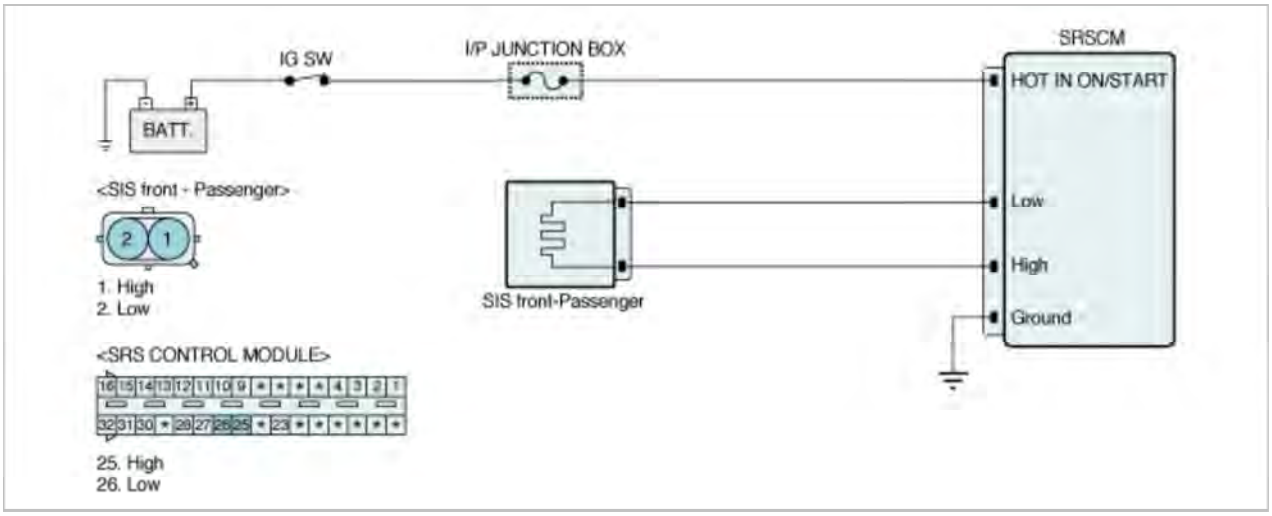
DTC Description

The SRSCM sets DTC B1410 if there is any error in communication between PSIS and SRSCM.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check current(PWM type)	• Faulty PSIS circuit. • Faulty PSIS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• SIS front-Passenger short, open	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 shorting 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 "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.

2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect PSIS connector .
5. Substitute the PSIS and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good PSIS, and check for proper operation. If the problem is corrected, replace SRSCM 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1473 Inflatable Curtain Airbag Front-Driver Resistance too High

General Description

Curtain Airbag (hereinafter referred to CAB)is located at driver and passenger side of headliner
It protects passenger's head and shoulder from fragments of glass or something sharpen caused by overturn.
CAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of CAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1473 if the measured resistance value of DCAB circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

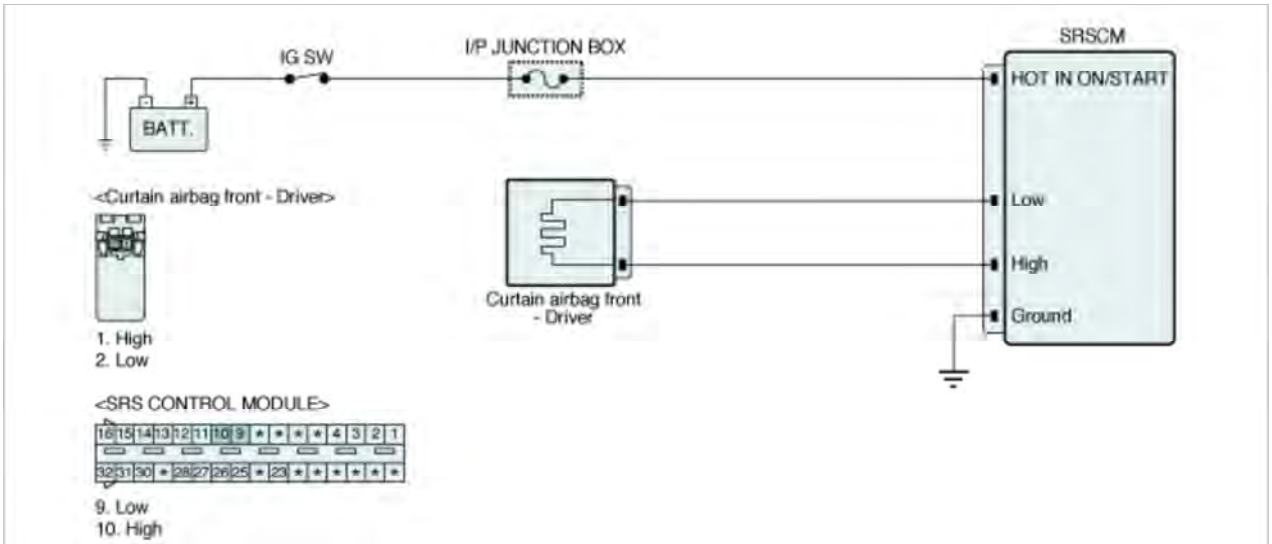
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DCAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DCAB resistance ≥ 6.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< DCAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DCAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DCAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DCAB assembly, and check for proper operation. If the problem is corrected, replace DCAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DCAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the DCAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1474 Inflatable Curtain Airbag Front-Driver Resistance too Low

General Description

Curtain Airbag (hereinafter referred to CAB)is located at driver and passenger side of headliner
It protects passenger's head and shoulder from fragments of glass or something sharpen caused by overturn.
CAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> **CAUTION**
>
> Never measure resistance of CAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1474 if the measured resistance value of DCAB circuit is less than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

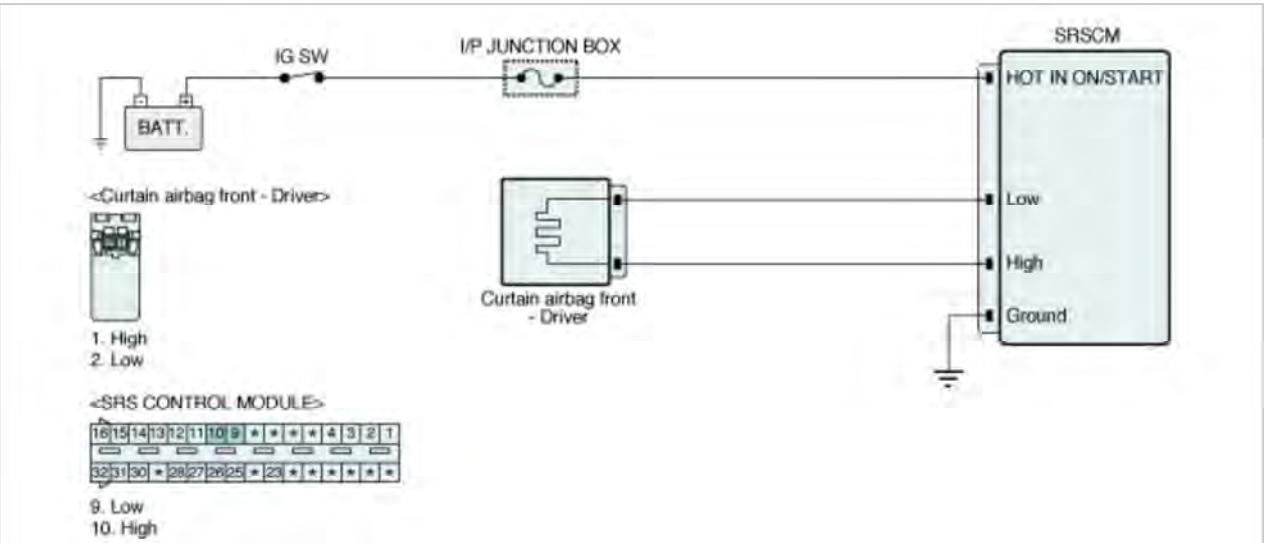
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DCAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DCAB resistance ≤ 1.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< DCAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DCAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DCAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DCAB assembly, and check for proper operation. If the problem is corrected, replace DCAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DCAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the DCAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1475 Inflatable Curtain Airbag Front-Driver Resistance Circuit Short to Ground

General Description

Curtain Airbag (hereinafter referred to CAB)is located at driver and passenger side of headliner
It protects passenger's head and shoulder from fragments of glass or something sharpen caused by overturn.
CAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of CAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1475 if there is a short to ground in DCAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

DTC Detecting Condition

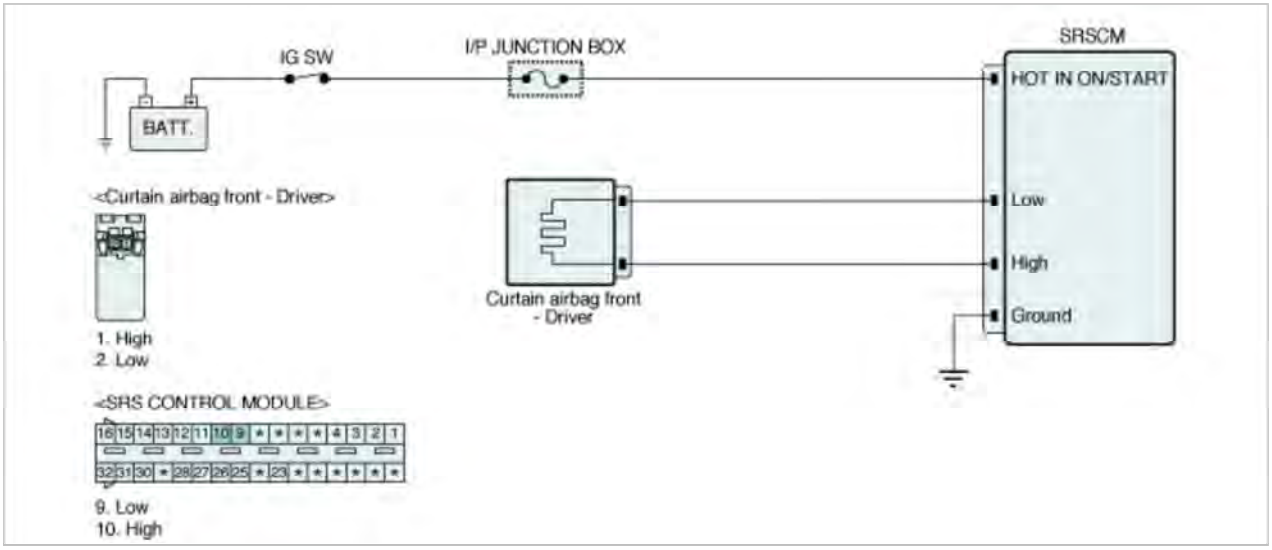
Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in DCAB harness. • Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DCAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance

Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF"
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DCAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DCAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DCAB assembly, and check for proper operation. If the problem is corrected, replace DCAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DCAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" or "High" of the DCAB harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1476 Inflatable Curtain Airbag Front-Driver Resistance Circuit Short to Battery

General Description

Curtain Airbag (hereinafter referred to CAB)is located at driver and passenger side of headliner

It protects passenger's head and shoulder from fragments of glass or something sharpen caused by overturn.
CAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> **CAUTION**
>
> Never measure resistance of CAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1476 if there is a short to power in DCAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

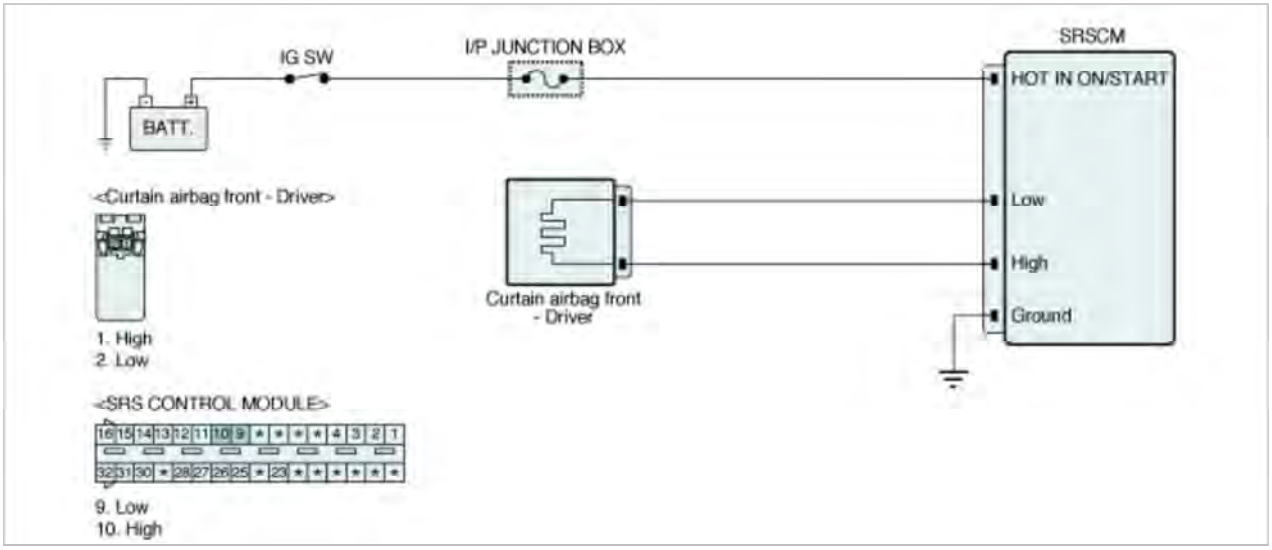
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in DCAB harness. • Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DCAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect DCAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DCAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DCAB assembly, and check for proper operation. If the problem is corrected, replace DCAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect DCAB connector and SRSCM main harness connector.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".

5. Measure voltage between terminal "Low" or "High" of the DCAB harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1477 Inflatable Curtain Airbag Front-Passenger Resistance too High

General Description

Curtain Airbag (hereinafter referred to CAB)is located at driver and passenger side of headliner
It protects passenger's head and shoulder from fragments of glass or something sharpen caused by overturn.
CAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of CAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1477 if the measured resistance value of PCAB circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

DTC Detecting Condition

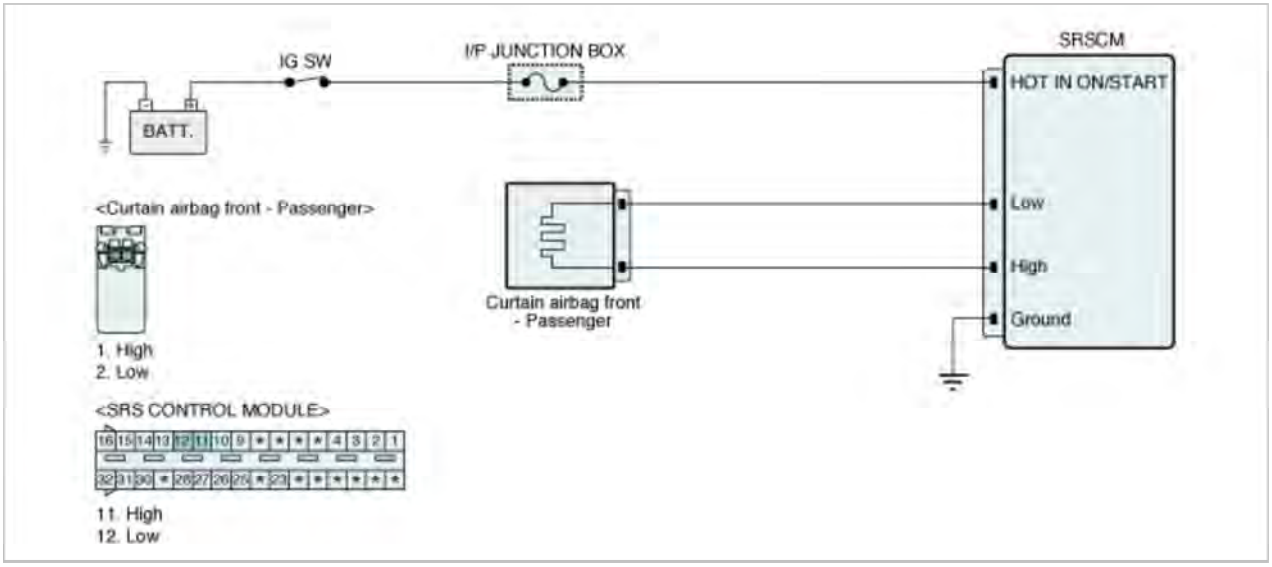
Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PCAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PCAB resistance ≥ 6.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance

Ignition ON	1.6Ω< PCAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PCAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PCAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DCAB assembly, and check for proper operation. If the problem is corrected, replace DCAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PCAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the PCAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1478 Inflatable Curtain Airbag Front-Passenger Resistance too Low

General Description

Curtain Airbag (hereinafter referred to CAB)is located at driver and passenger side of headliner
It protects passenger's head and shoulder from fragments of glass or something sharpen caused by overturn.
CAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> **CAUTION**
>
> Never measure resistance of CAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1478 if the measured resistance value of PCAB circuit is less than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

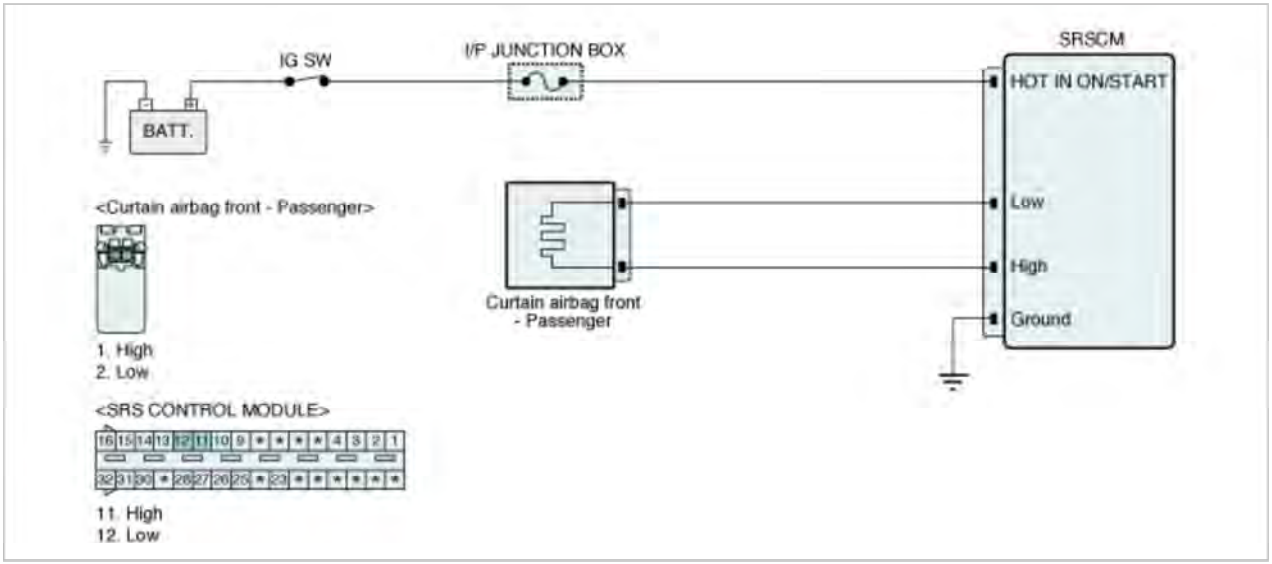
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PCAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PCAB resistance ≤ 1.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< PCAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PCAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PCAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DCAB assembly, and check for proper operation. If the problem is corrected, replace DCAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PCAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" and "High" of the PCAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1479 Inflatable Curtain Airbag Front-Passenger Resistance Circuit Short to Ground

General Description

Curtain Airbag (hereinafter referred to CAB)is located at driver and passenger side of headliner
It protects passenger's head and shoulder from fragments of glass or something sharpen caused by overturn.
CAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of CAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1479 if there is a short to ground in PCAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

DTC Detecting Condition

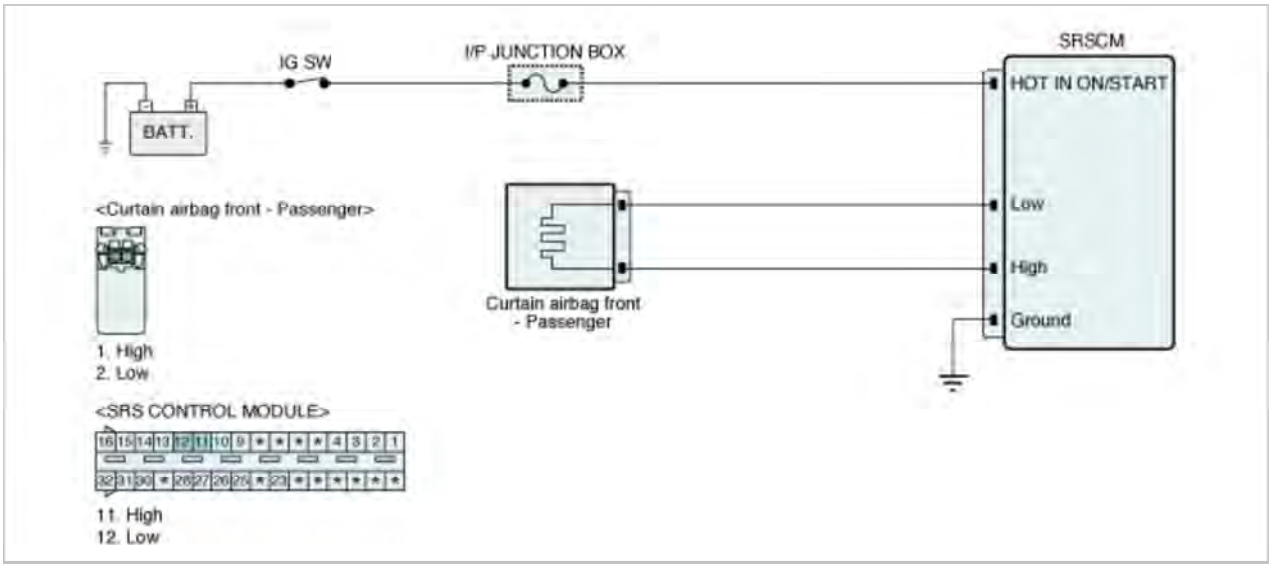
Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in PCAB harness. • Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PCAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance

Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PCAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PCAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DCAB assembly, and check for proper operation. If the problem is corrected, replace DCAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PCAB connector and SRSCM main harness connector.
4. Measure resistance between terminal "Low" or "High" of the PCAB harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1480 Inflatable Curtain Airbag Front-Passenger Resistance Circuit Short to Battery

General Description

Curtain Airbag (hereinafter referred to CAB)is located at driver and passenger side of headliner
It protects passenger's head and shoulder from fragments of glass or something sharpen caused by overturn.
CAB is consist of air bag and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> **CAUTION**
>
> Never measure resistance of CAB directly, Current of measuring device may cause unexpected air bag deploy.

DTC Description

The SRSCM sets DTC B1480 if there is a short to power in PCAB harness.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

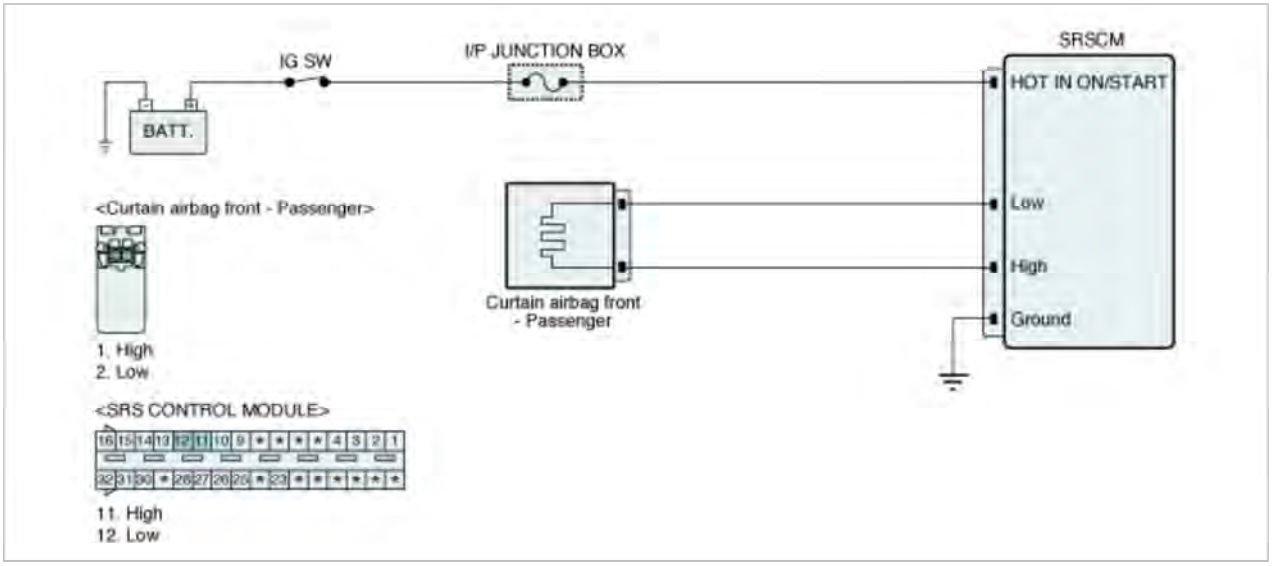
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in PCAB harness. • Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PCAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	RS >10kΩ

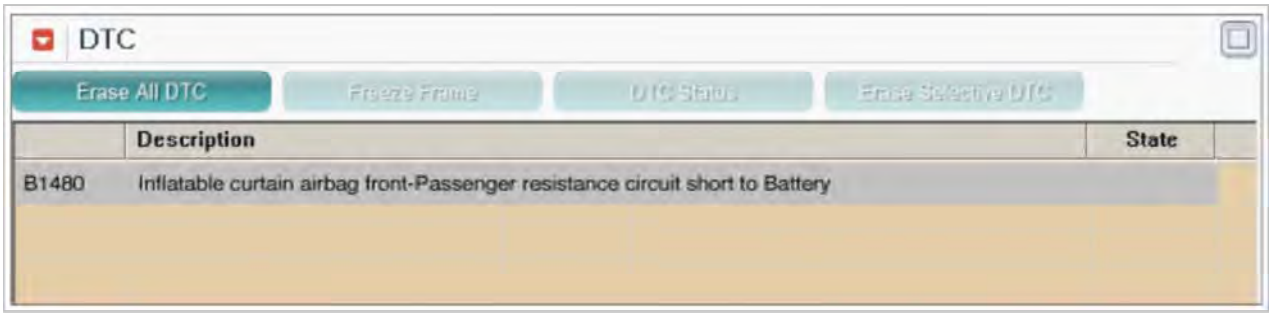
Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.

4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Disconnect PCAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to main harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PCAB or 2Ω resistor.

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good DCAB assembly, and check for proper operation. If the problem is corrected, replace DCAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PCAB connector and SRSCM main harness connector.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".

5. Measure voltage between terminal "Low" or "High" of the PCAB harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1481 Driver Airbag Resistance too High (2nd stage)

General Description

Driver Air bag module (hereinafter referred to DAB) located at center of steering wheel protects driver by reducing impact of collision.
DAB is consist of air bag, pat cover and inflator.
There are power,circuit for ignition, gas generator and diffuser screen in inflator.
Air bag reduces impact of collision by fillied up gas.
In collision, pat cover splits and through this crack, air bag emerges and deploys.
Inflator generates gas that expands air bag.
Clock spring is located between steering wheel and column. It connects SCSRM to DAB.

CAUTION

Never measure resistance of DAB directly, Current of measuring device may cause unexpected air bag deploy.

Dual output type airbag deploys two bags in sequence within specified time difference.
It can protect driver with less impact of gas expention force, that can reduce driver's injury
Constituent is the same as single output type airbag.

DTC Description

The SRSCM sets DTC B1481 if the measured resistance value of DAB circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

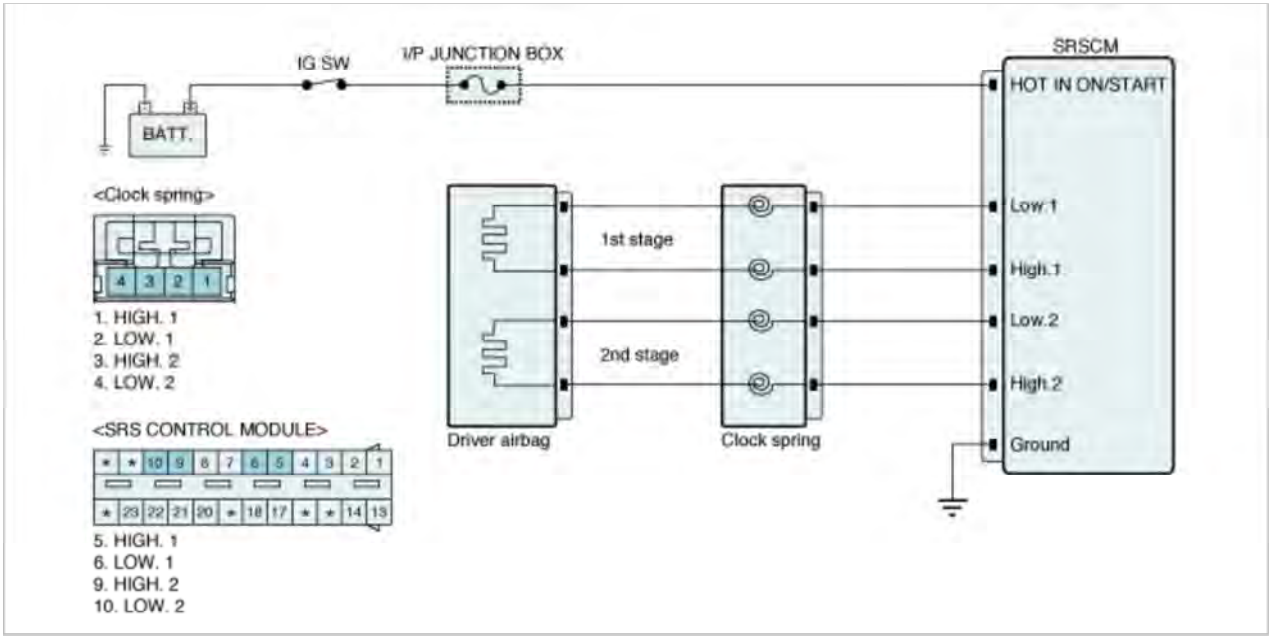
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty DAB. • Faulty Clock spring. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• DAB(2nd stage) resistance ≥ 6.1 Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

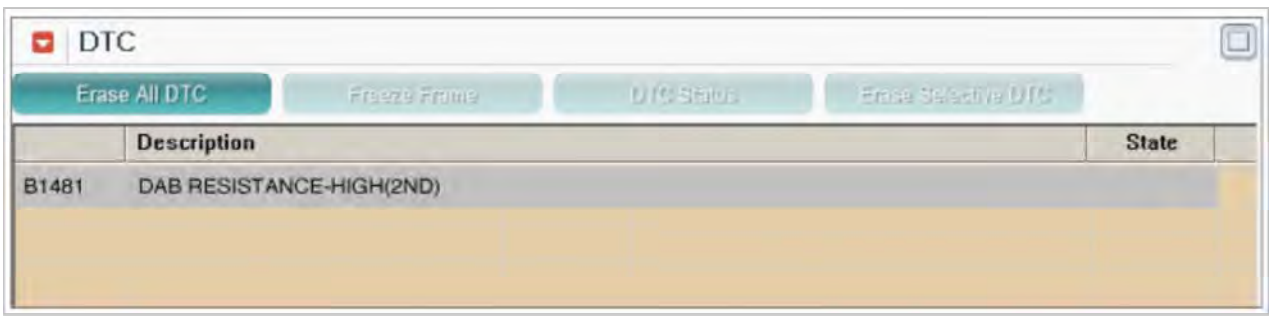
Test Condition	Resistance
Ignition ON	1.6Ω< DAB resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the DAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to DAB connector of the clock spring harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DAB or 2Ω resistor.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Clock Spring Circuit Inspection" procedure.
NO	▸ Substitute a known-good DAB assembly, and check for proper operation. If the problem is corrected, replace DAB and then go to "Verification of Vehicle Repair" procedure.

Clock Spring Circuit Inspection

1. Ignition "OFF" .
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" and "High.2" of the Clock Spring harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute the Clock spring and check for proper operation. If the problem is corrected, replace Clock spring and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

WARNING

Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" and "High.2" of the DAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1482 Driver Airbag Resistance too Low (2nd stage)

General Description

Driver Air bag module (hereinafter referred to DAB) located at center of steering wheel protects driver by reducing impact of collision.
DAB is consist of air bag, pat cover and inflator.
There are power,circuit for ignition, gas generator and diffuser screen in inflator.
Air bag reduces impact of collision by fillied up gas.
In collision, pat cover splits and through this crack, air bag emerges and deploys.
Inflator generates gas that expands air bag.
Clock spring is located between steering wheel and column. It connects SCSRM to DAB.

CAUTION

Never measure resistance of DAB directly, Current of measuring device may cause unexpected air bag deploy.

Dual output type airbag deploys two bags in sequence within specified time difference.
It can protect driver with less impact of gas expention force, that can reduce driver's injury
Constituent is the same as single output type airbag.

DTC Description

The SRSCM sets DTC B1482 if the measured resistance value of DAB circuit is less than the threshold value(1.0Ω)
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

DTC Detecting Condition

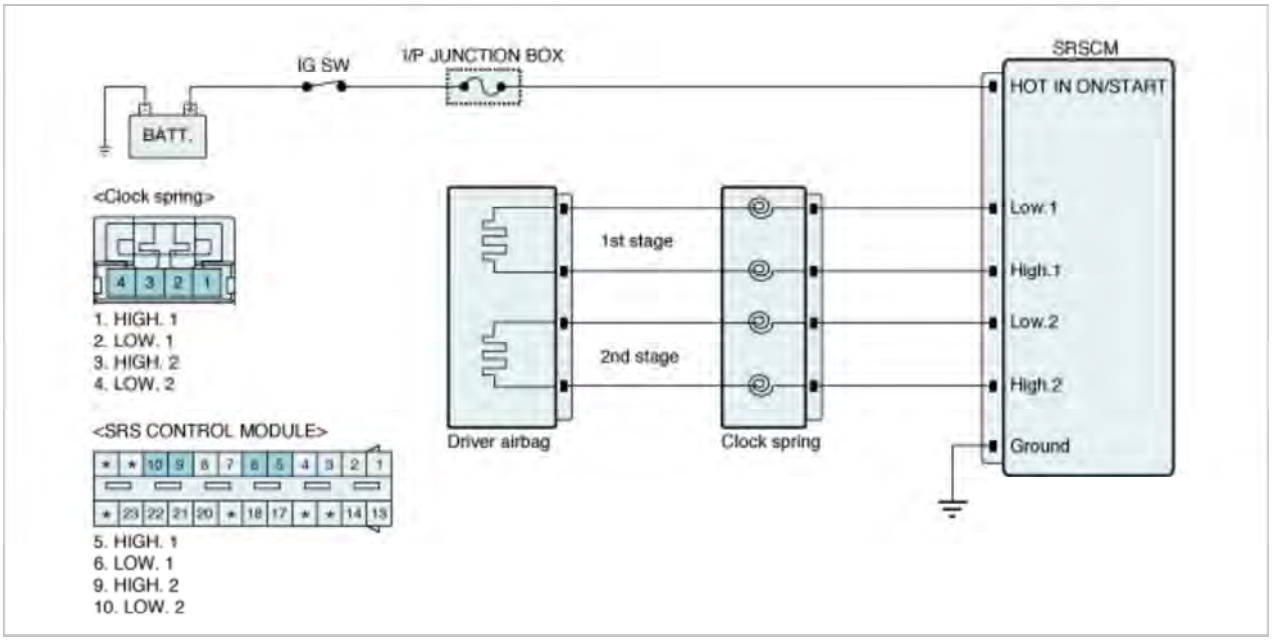
Item	Detecting Condition	Possible cause
DTC Strategy	• Check Resistance	• Poor connection of connected part. • Poor connection between
Enable Conditions	• Ignition "ON"	

Threshold Value		• DAB(2nd stage) resistance ≤ 1.1 Ω	shorting bar and release pin. • Faulty DAB. • Faulty Clock spring. • Faulty SRSCM.
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

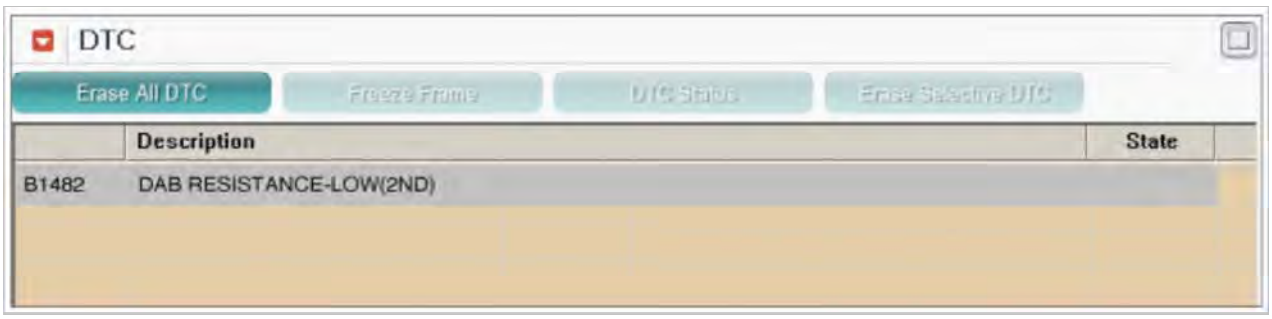
Test Condition	Resistance
Ignition ON	1.6Ω< DAB(2nd stage) resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the DAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to DAB connector of the clock spring harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DAB or 2Ω resistor.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Clock Spring Circuit Inspection" procedure.
NO	▸ Substitute a known-good DAB assembly, and check for proper operation. If the problem is corrected, replace DAB and then go to "Verification of Vehicle Repair" procedure.

Clock Spring Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" and "High.2" of the Clock Spring harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute the Clock spring and check for proper operation. If the problem is corrected, replace Clock spring and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" and "High.2" of the DAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1483 Driver Airbag Resistance Circuit Short to Ground (2nd stage)

General Description

Driver Air bag module (hereinafter referred to DAB) located at center of steering wheel protects driver by reducing impact of collision.
DAB is consist of air bag, pat cover and inflator.
There are power,circuit for ignition, gas generator and diffuser screen in inflator.
Air bag reduces impact of collision by fillied up gas.
In collision, pat cover splits and through this crack, air bag emerges and deploys.
Inflator generates gas that expands air bag.
Clock spring is located between steering wheel and column. It connects SCSRM to DAB.

> CAUTION
>
> Never measure resistance of DAB directly, Current of measuring device may cause unexpected air bag deploy.

Dual output type airbag deploys two bags in sequence within specified time difference.
It can protect driver with less impact of gas expention force, that can reduce driver's injury
Constituent is the same as single output type airbag.

DTC Description

The SRSCM sets DTC B1483 if there is a short to ground in DAB harness
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while

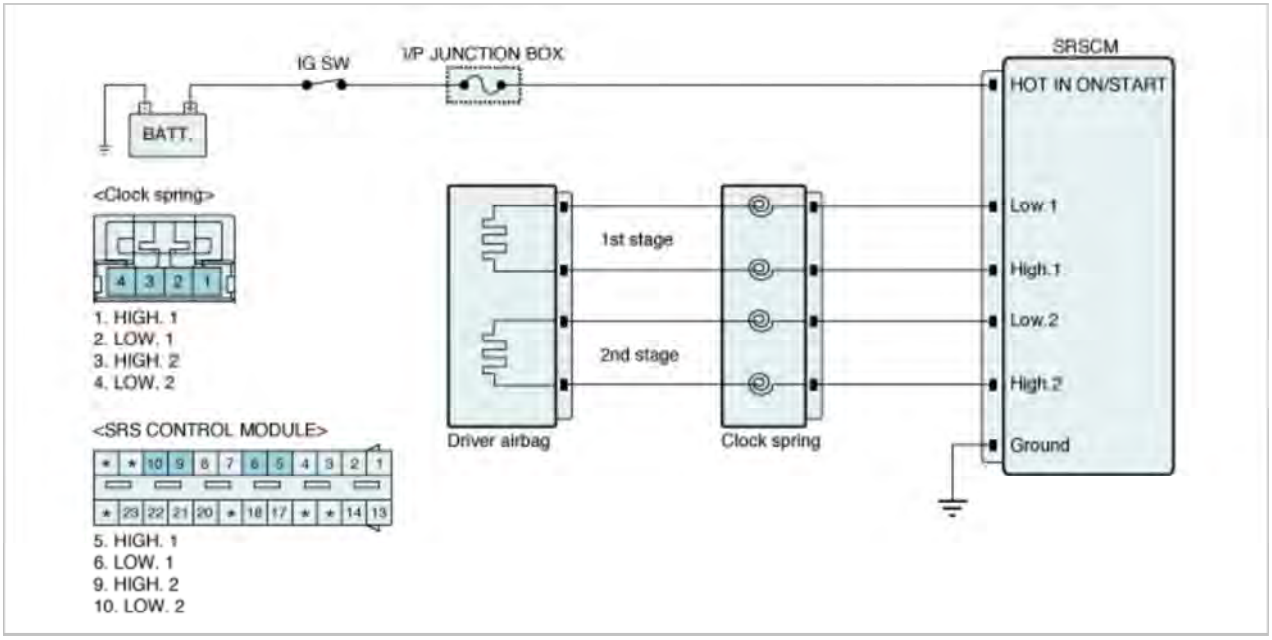
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in DAB harness. • Poor connection of connected part. • Faulty DAB. • Faulty Clock spring. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

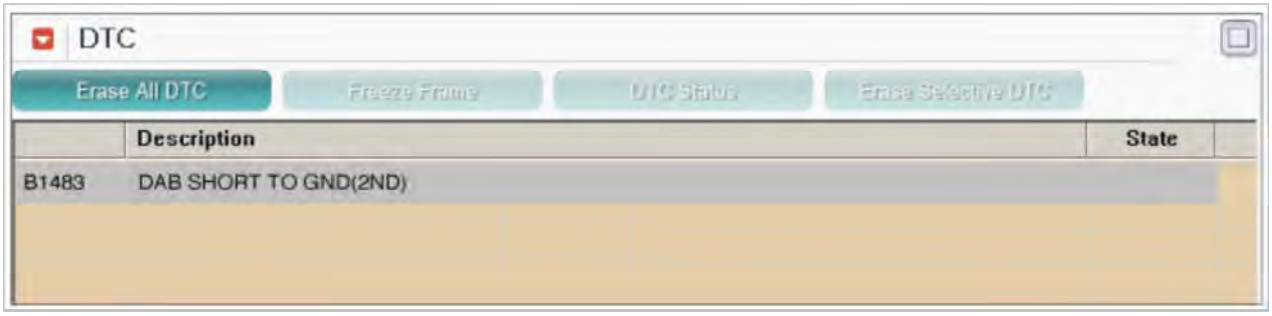
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF"
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the DAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to DAB connector of the clock spring harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DAB or 2Ω resistor.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Clock Spring Circuit Inspection" procedure.
NO	▸ Substitute a known-good DAB assembly, and check for proper operation. If the problem is corrected, replace DAB and then go to "Verification of Vehicle Repair" procedure.

Clock Spring Circuit Inspection

1. Ignition "OFF" .
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" or "High.2"of the clock spring harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute the Clock spring and check for proper operation. If the problem is corrected, replace Clock spring and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" or "High.2"of the DAB harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1484 Driver Airbag Resistance Circuit Short to Battery (2nd stage)

General Description

Driver Air bag module (hereinafter referred to DAB) located at center of steering wheel protects driver by reducing impact of collision.
DAB is consist of air bag, pat cover and inflator.
There are power,circuit for ignition, gas generator and diffuser screen in inflator.
Air bag reduces impact of collision by fillied up gas.
In collision, pat cover splits and through this crack, air bag emerges and deploys.
Inflator generates gas that expands air bag.
Clock spring is located between steering wheel and column. It connects SCSRM to DAB.

> CAUTION
>
> Never measure resistance of DAB directly, Current of measuring device may cause unexpected air bag deploy.

Dual output type airbag deploys two bags in sequence within specified time difference.
It can protect driver with less impact of gas expention force, that can reduce driver's injury
Constituent is the same as single output type airbag.

DTC Description

The SRSCM sets DTC B1484 if there is a short to power in DAB harness
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

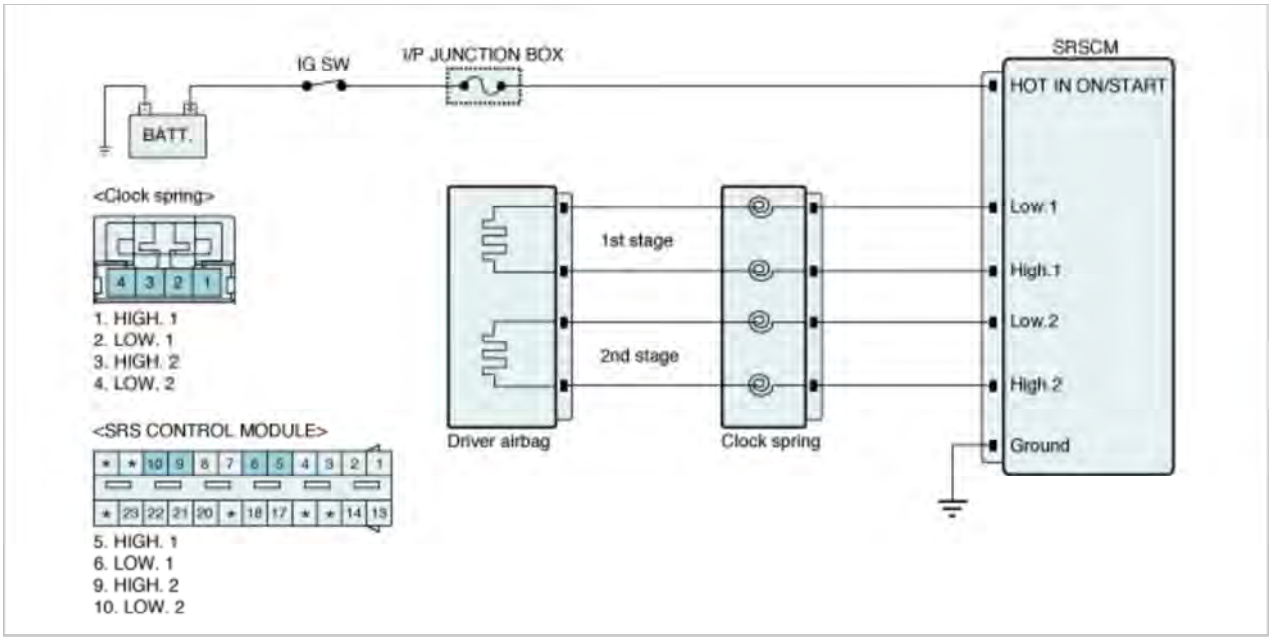
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in DAB harness. • Poor connection of connected part. • Faulty DAB. • Faulty Clock spring. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

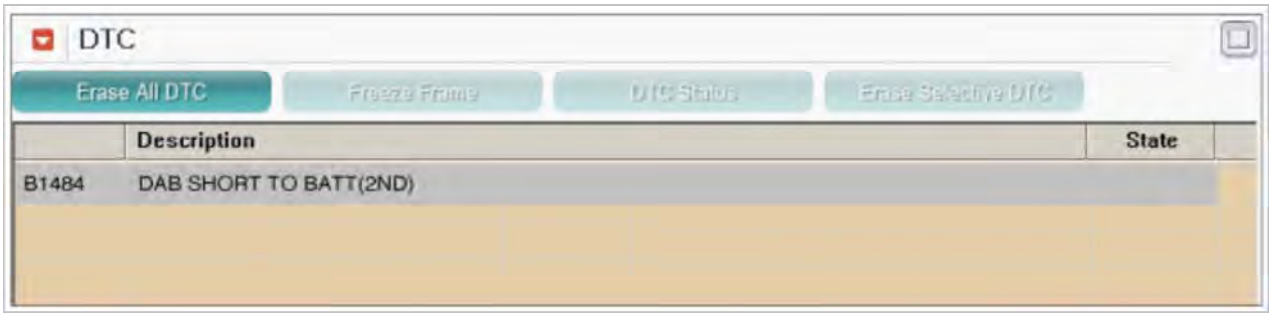
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the DAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to DAB connector of the clock spring harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good DAB or 2Ω resistor.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Clock Spring Circuit Inspection" procedure.
NO	▸ Substitute a known-good DAB assembly, and check for proper operation. If the problem is corrected, replace DAB and then go to "Verification of Vehicle Repair" procedure.

Clock Spring Circuit Inspection

1. Ignition "OFF" .

2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Remove DAB module and disconnect SRSCM connector of the clock spring harness.

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".
5. Measure Voltage between terminal "Low.2" or "High.2" of the clock spring harness connector and chassis ground.

Specification : 0V

6. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute the Clock spring and check for proper operation. If the problem is corrected, replace Clock spring and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF" and wait at least one minutes.
2. Remove DAB module and disconnect SRSCM connector of the main harness.
3. Ignition "ON" & Engine "OFF".

> WARNING
>
> Lay Removed DAB facing upward for unexpected air bag deploy .

4. Measure voltage between terminal "Low.2" or "High.2" of the DAB harness connector and chassis ground.

Specification : approx. 0V

5. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1485 Passenger Airbag Resistance too High(2nd stage)

General Description

Passenger Air bag module (hereinafter referred to PAB) located at passenger side crush pad protects passenger by reducing impact of collision.

PAB is consist of air bag, pat cover and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> **CAUTION**
>
> Never measure resistance of PAB directly, Current of measuring device may cause unexpected air bag deploy.

Dual output type airbag deploys two bags in sequence within specified time difference.
It can protect driver with less impact of gas expention force, that can reduce driver's injury
Constituent is the same as single output type airbag.

DTC Description

The SRSCM sets DTC B1485 if the measured resistance value of PAB circuit is more than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while

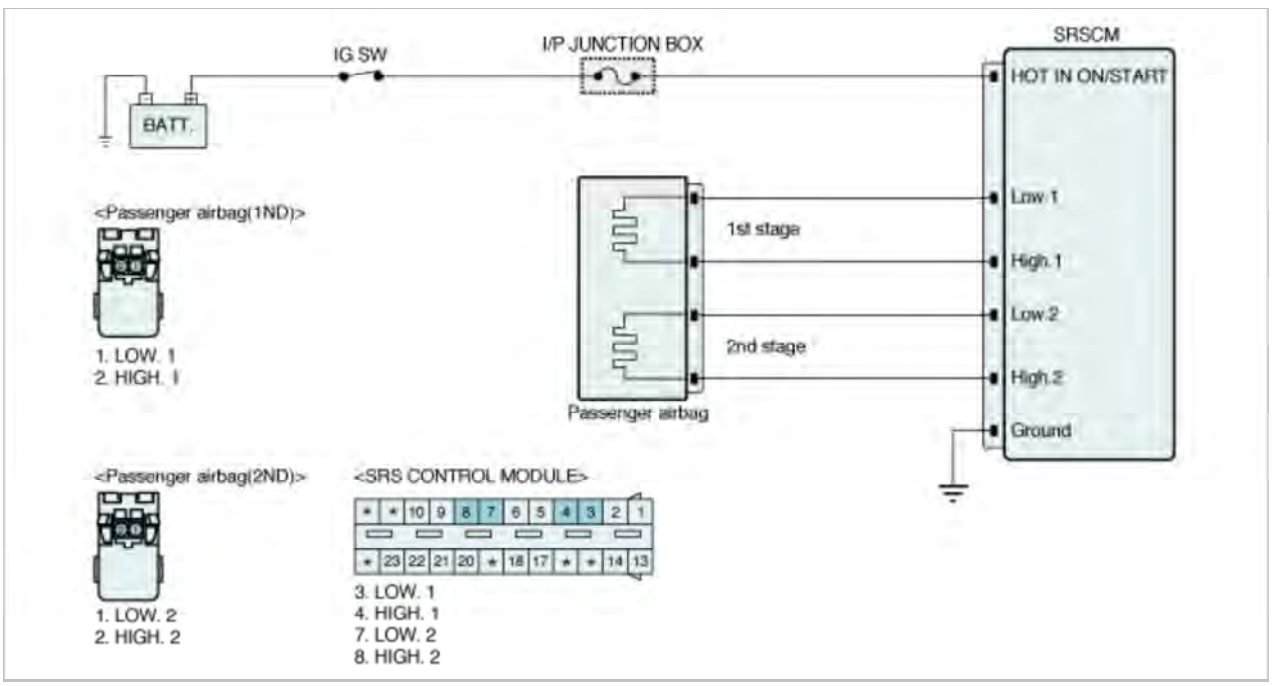
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PAB(2nd stage) resistance ≥ 6.1 Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

Test Condition	Resistance
Ignition ON	1.6Ω< PAB(2nd stage) resistance < 4.7Ω

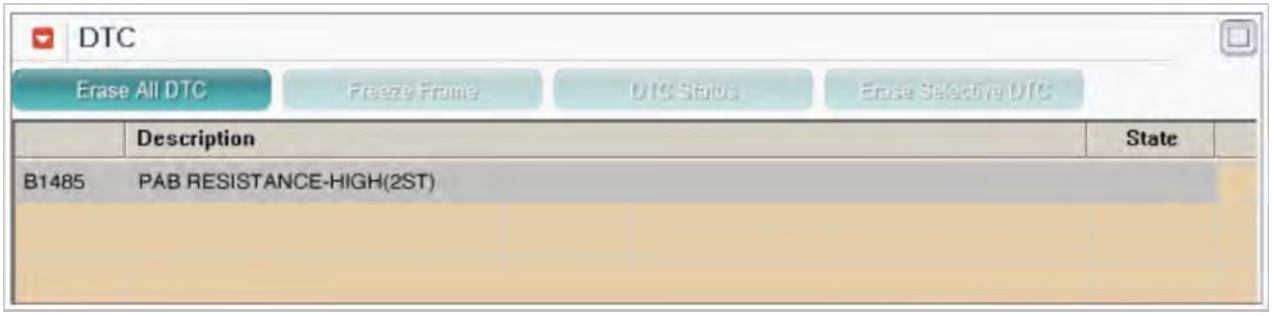
Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.

2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the PAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to PAB harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PAB or 2Ω resistor.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PAB assembly, and check for proper operation. If the problem is corrected, replace PAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PAB connector and SRSCM main harness connector.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" and "High.2" of the PAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1486 Passenger Airbag Resistance too Low(2nd stage)

General Description

Passenger Air bag module (hereinafter referred to PAB) located at passenger side crush pad protects passenger by reducing impact of collision.
PAB is consist of air bag, pat cover and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of PAB directly, Current of measuring device may cause unexpected air bag deploy.

Dual output type airbag deploys two bags in sequence within specified time difference.
It can protect driver with less impact of gas expention force, that can reduce driver's injury
Constituent is the same as single output type airbag.

DTC Description

The SRSCM sets DTC B1486 if the measured resistance value of PAB circuit is less than the threshold value.
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

DTC Detecting Condition

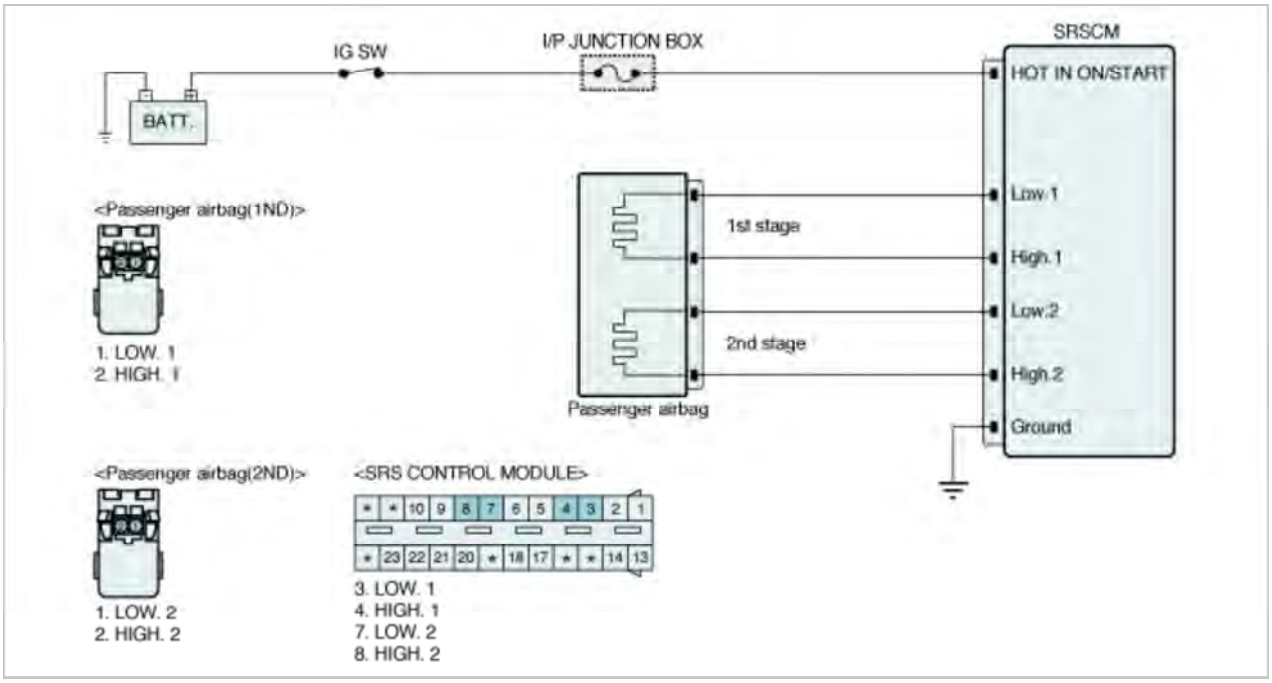
Item	Detecting Condition	Possible cause

DTC Strategy		• Check Resistance	• Poor connection of connected part. • Poor connection between shorting bar and release pin. • Faulty PAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• PAB(2nd stage) resistance ≤ 1.1Ω	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

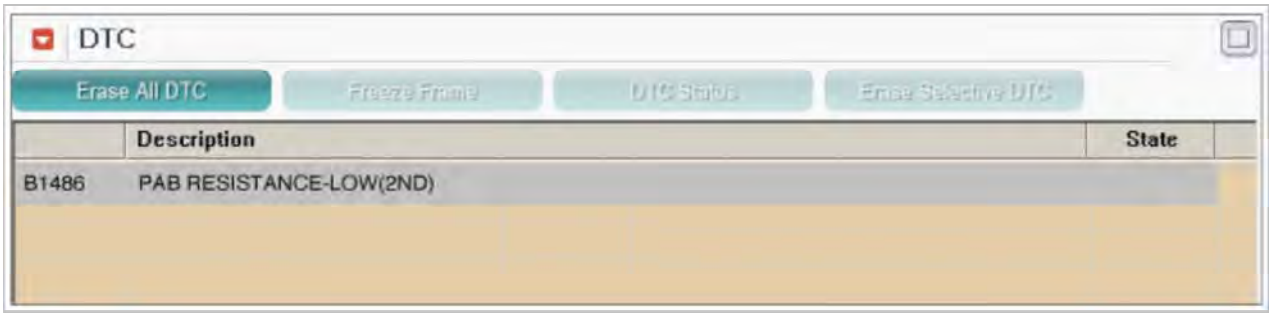
Test Condition	Resistance
Ignition ON	1.6Ω< PAB(2nd stage) resistance < 4.7Ω

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.

NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the PAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to PAB harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PAB or 2Ω resistor.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PAB assembly, and check for proper operation. If the problem is corrected, replace PAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PAB connector and SRSCM main harness connector.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" and "High.2" of the PAB harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation.

	If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1487 Passenger Airbag Resistance Circuit Short to Ground (2nd stage)

General Description

Passenger Air bag module (hereinafter referred to PAB) located at passenger side crush pad protects passenger by reducing impact of collision.
PAB is consist of air bag, pat cover and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

> CAUTION
>
> Never measure resistance of PAB directly, Current of measuring device may cause unexpected air bag deploy.

Dual output type airbag deploys two bags in sequence within specified time difference.
It can protect driver with less impact of gas expention force, that can reduce driver's injury
Constituent is the same as single output type airbag.

DTC Description

The SRSCM sets DTC B1487 if there is a short to ground in PAB harness
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

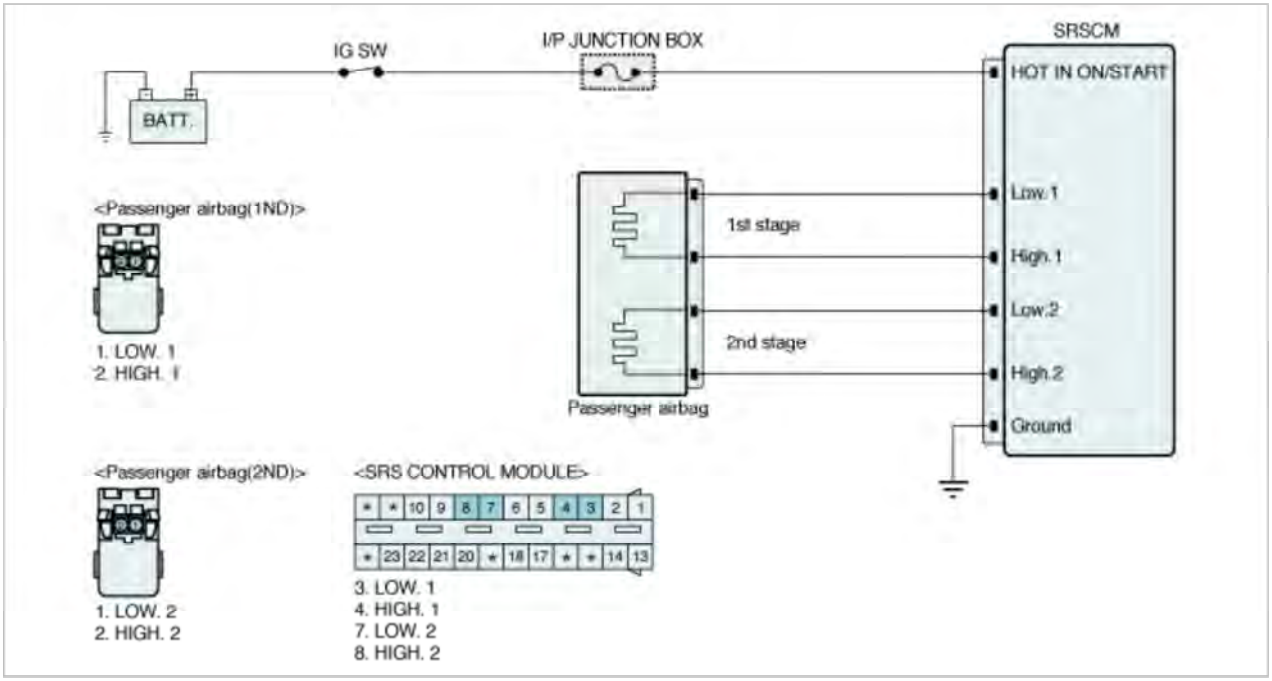
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in PAB harness. • Poor connection of connected part. • Faulty PAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Short to ground or short among wires)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

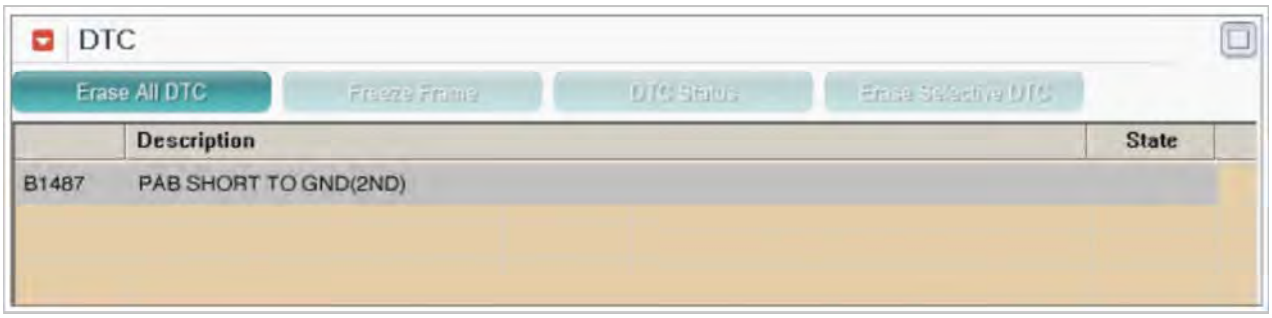
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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 "Squib Circuit Inspection" procedure.

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the PAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to PAB harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PAB or 2Ω resistor.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PAB assembly, and check for proper operation. If the problem is corrected, replace PAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PAB connector and SRSCM main harness connector.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Measure resistance between terminal "Low.2" or "High.2" of the PAB harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1488 Passenger Airbag Resistance Circuit Short to Battery (2nd stage)

General Description

Passenger Air bag module (hereinafter referred to PAB) located at passenger side crush pad protects passenger by reducing impact of collision.
PAB is consist of air bag, pat cover and inflator.
Air bag reduces impact of collision by fillied up gas.
Inflator keeps gas and uses it to deploy air bag on collision.

CAUTION

Never measure resistance of PAB directly, Current of measuring device may cause unexpected air bag deploy.

Dual output type airbag deploys two bags in sequence within specified time difference.
It can protect driver with less impact of gas expention force, that can reduce driver's injury
Constituent is the same as single output type airbag.

DTC Description

The SRSCM sets DTC B1488 if there is a short to power in PAB harness
*In this case, SRSCM checks if there's any fault in circuit by sending current for a while.

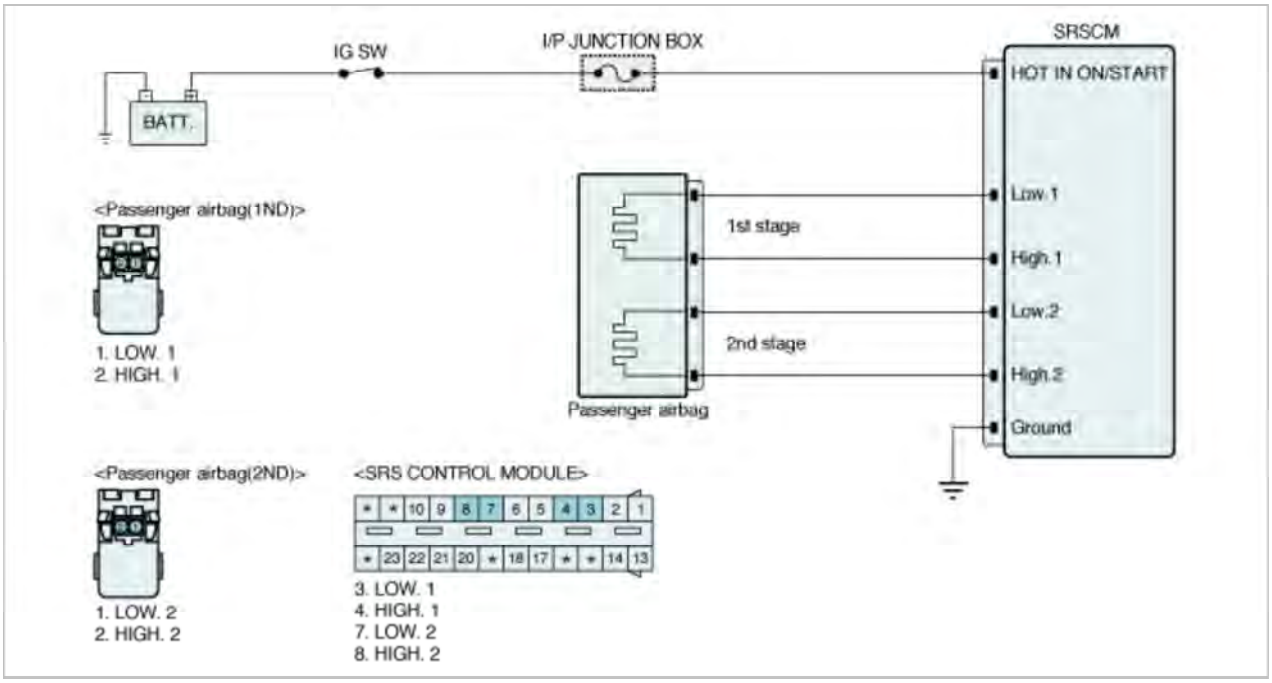
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in PAB harness. • Poor connection of connected part. • Faulty PAB. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Rs < 1kΩ (Open circuit or Wire circuit short to power)	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Specification

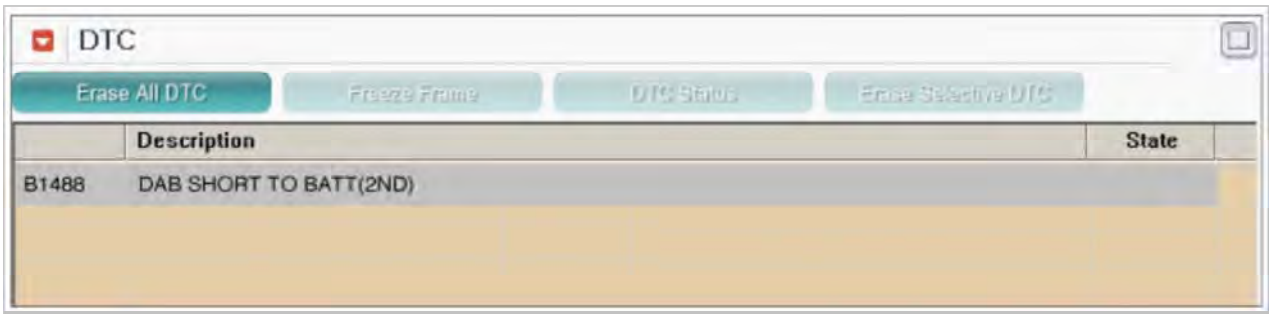
Test Condition	Resistance
Ignition ON	RS >10kΩ

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting bar/shorting bar release pin and 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.
	▸ Go to "Squib Circuit Inspection" procedure.

NO	

Squib Circuit Inspection

1. Ignition "OFF".
2. Disconnect (-) terminal cable from battery and wait for 1 minutes or more.
3. Remove the PAB module and connect the dummy (0957A-38200) and dummy adapter (0957A-2G000) to PAB harness connector.

> NOTE
>
> If dummy and dummy adaptor are not able to be prepared, use a known-good PAB or 2Ω resistor.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect (-) terminal cable to battery and Ignition "ON" & Engine "OFF" and wait for 30 seconds or more.
5. Connect scantool to Data Link Connector(DLC) and clear DTC with scantool and diagnose again.
6. Is DTC present problem ?

YES	▸ Go to "Main harness circuit inspection" procedure.
NO	▸ Substitute a known-good PAB assembly, and check for proper operation. If the problem is corrected, replace PAB and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect PAB connector and SRSCM main harness connector.

> WARNING
>
> Lay Removed PAB facing upward for unexpected air bag deploy .

4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".
5. Measure voltage between terminal "Low.2" or "High.2" of the PAB harness connector and chassis ground.

Specification : approx. 0V

6. Is the measured voltage within specifications?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.

NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1511 Buckle Switch Driver open or short to Battery

General Description

Seat-belt Buckle Switch(SBBS) is located in driver and passenger side seat.
SRSCM checks if seatbelt is buckled by signal of SBBS.
SRSCM controls air bag module and BPT differently in accordance with vehicle speed at the moment of collision and signal from SBBS.

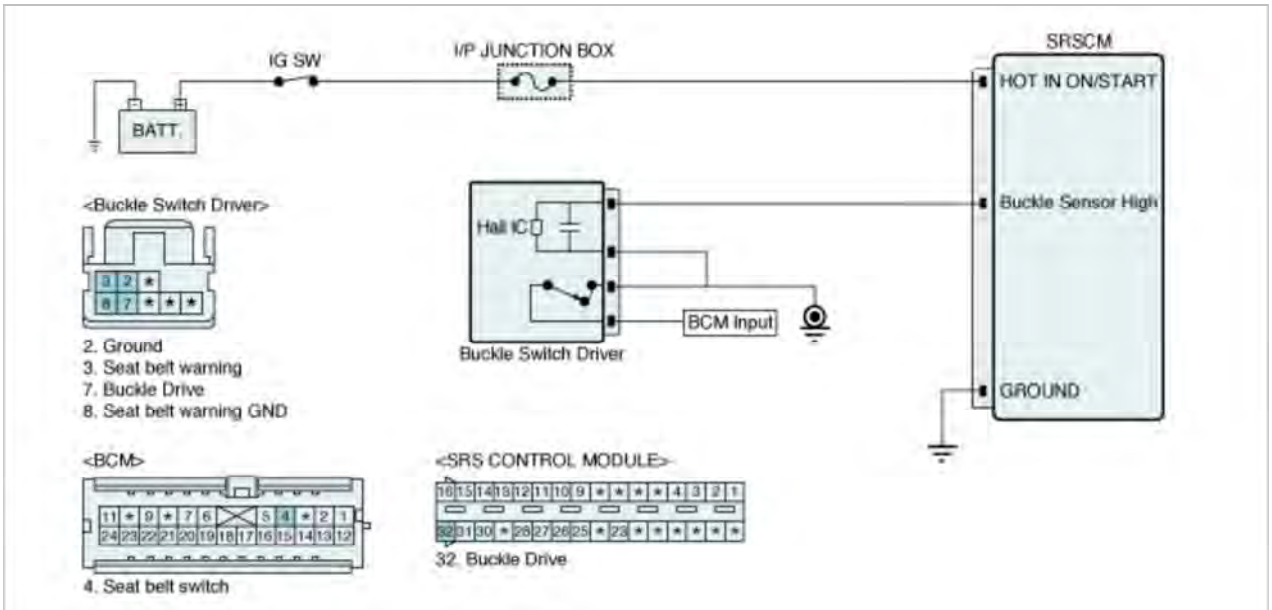
DTC Description

The SRSCM sets DTC B1511 if there is a open circuit or short to power in DSBBS harness.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in DSBBS harness. • Open circuit in DSBBS harness. • Poor connection of connected part. • Faulty DSBBS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Open circuit or Wire circuit short to power	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Main harness circuit inspection(1)" procedure.

Main harness Circuit Inspection(1)

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
3. Disconnect Seat-belt Buckle Switch connector and SRSCM main harness connector.
4. Measure resistance between of the Buckle Switch Driver wiring connector and SRSCM harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection(2)" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection(2)

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
3. Disconnect Seat-belt Buckle Switch connector and SRSCM main harness connector.
4. Ignition "ON" & Engine "OFF"
5. Measure voltage between terminal "High" of the Seat-belt Buckle Switch harness connector and chassis ground.

Specification : 0V

6. Is the measured resistance within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect Seat-belt Buckle Switch connector .
5. Substitute the Seat-belt Buckle Switch and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good Seat-belt Buckle Switch, and check for proper operation. If the problem is corrected, replace Seat-belt Buckle 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1512 Buckle Switch Driver short or short to Ground

General Description

Seat-belt Buckle Switch(SBBS) is located in driver and passenger side seat.
SRSCM checks if seatbelt is buckled by signal of SBBS.
SRSCM controls air bag module and BPT differently in accordance with vehicle speed at the moment of collision and signal from SBBS.

DTC Description

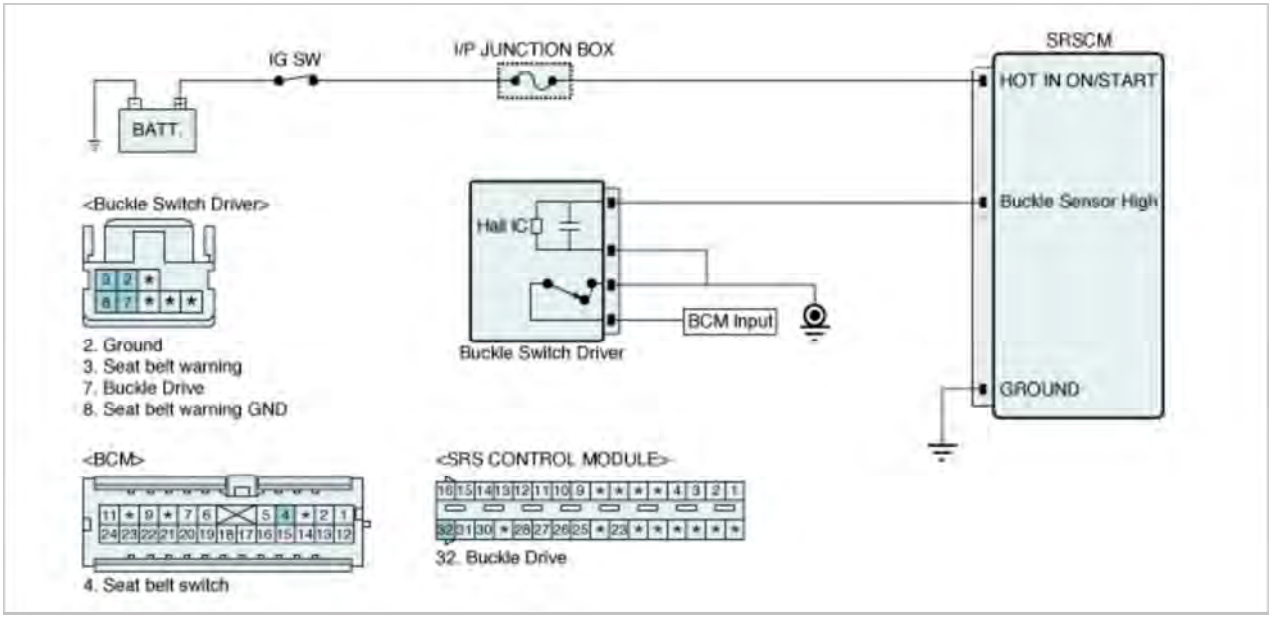
The SRSCM sets DTC B1512 if there is a short or short to ground in DSBBS harness.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check Resistance	• Short to ground in DSBBS harness. • Short circuit in DSBBS harness. • Poor connection of connected part.
Enable Conditions	• Ignition "ON"	
Threshold Value	• Short to ground or short among wires	

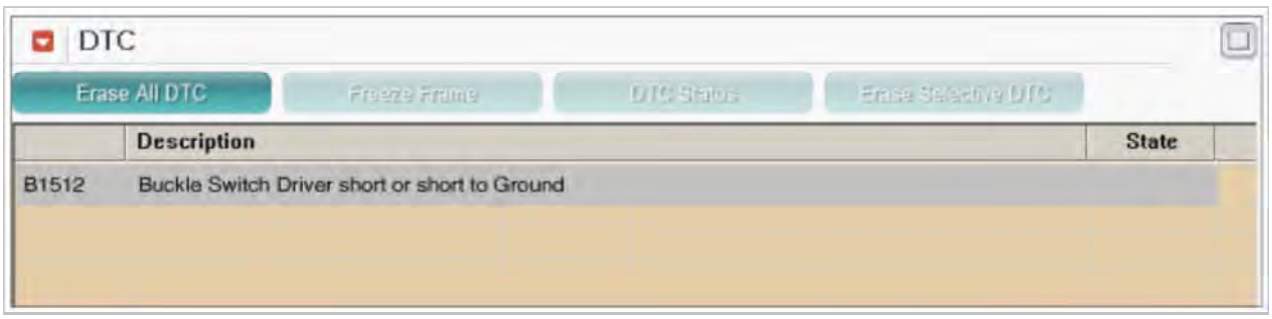
Diagnostic Time	Qualification	• More than 1 sec	• Faulty DSBBS. • Faulty SRSCM.
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Main harness circuit inspection" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect Seat-belt Buckle Switch connector and SRSCM main harness connector.
4. Measure resistance between terminal "High" of the Seat-belt Buckle Switch harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect Seat-belt Buckle Switch connector .
5. Substitute the Seat-belt Buckle Switch and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good Seat-belt Buckle Switch, and check for proper operation. If the problem is corrected, replace Seat-belt Buckle 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1513 Buckle Switch Passenger open or short to Battery

General Description

Seat-belt Buckle Switch(SBBS) is located in driver and passenger side seat.

SRSCM checks if seatbelt is buckled by signal of SBBS.
SRSCM controls air bag module and BPT differently in accordance with vehicle speed at the moment of collision and signal from SBBS.

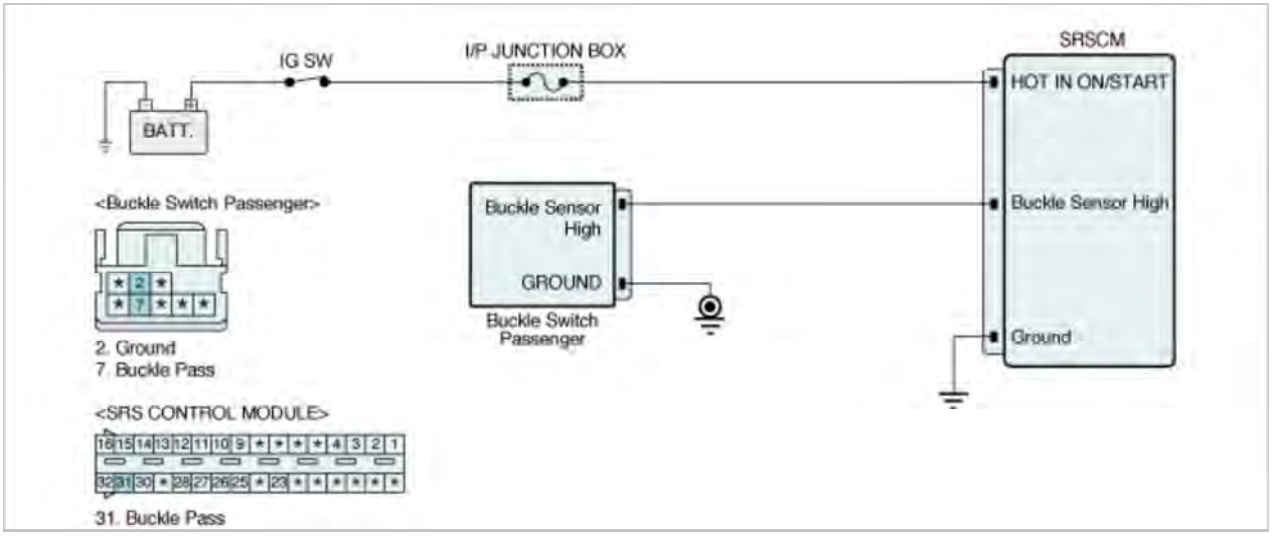
DTC Description

The SRSCM sets DTC B1513 if there is a open circuit or short to power in PSBBS harness.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to power in PSBBS harness. • Open circuit in PSBBS harness. • Poor connection of connected part. • Faulty PSBBS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Open circuit or Wire circuit short to power	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.

5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused

	by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Main harness circuit inspection(1)" procedure.

Main harness Circuit Inspection (1)

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
3. Disconnect Seat-belt Buckle Switch connector and SRSCM main harness connector.
4. Measure resistance between of the Buckle Switch Passenger wiring connector and SRSCM harness connector.

Specification : approx. 1 Ω below

5. Is the measured resistance within specifications?

YES	▸ Go to "Main harness circuit inspection(2)" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.

Main harness Circuit Inspection (2)

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
3. Disconnect Seat-belt Buckle Switch connector and SRSCM main harness connector.
4. Ignition "ON" & Engine "OFF"
5. Measure voltage between terminal "High" of the Seat-belt Buckle Switch harness connector and chassis ground.

Specification : 0V

6. Is the measured resistance within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".

3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect Seat-belt Buckle Switch connector .
5. Substitute the Seat-belt Buckle Switch and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good Seat-belt Buckle Switch, and check for proper operation. If the problem is corrected, replace Seat-belt Buckle 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1514 Buckle Switch Passenger short or short to Ground

General Description

Seat-belt Buckle Switch(SBBS) is located in driver and passenger side seat.
SRSCM checks if seatbelt is buckled by signal of SBBS.
SRSCM controls air bag module and BPT differently in accordance with vehicle speed at the moment of collision and signal from SBBS.

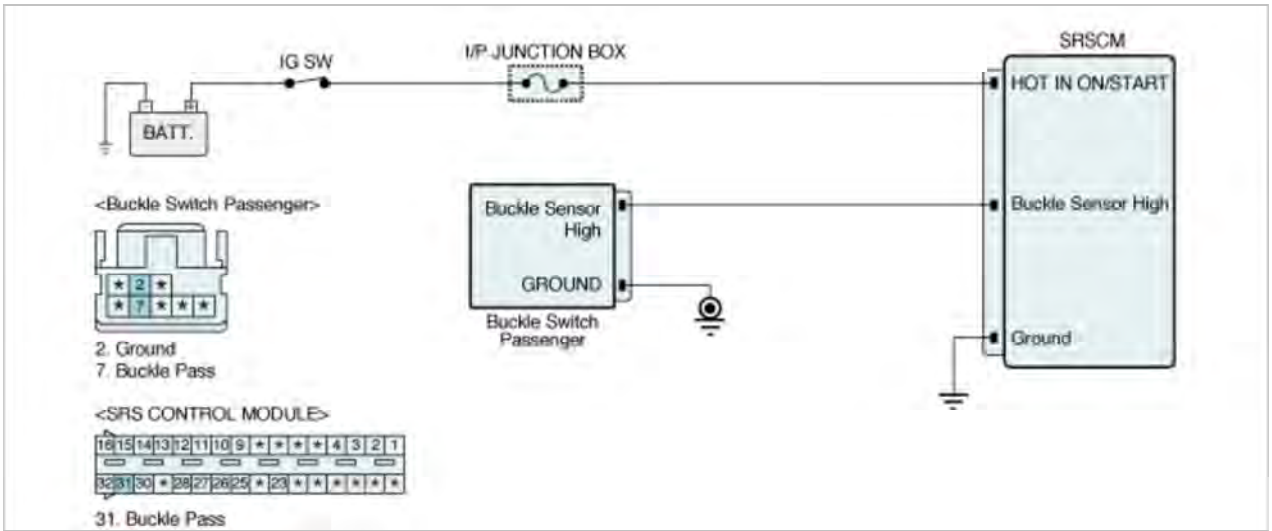
DTC Description

The SRSCM sets DTC B1514 if there is a short or short to ground in PSBBS harness.

DTC Detecting Condition

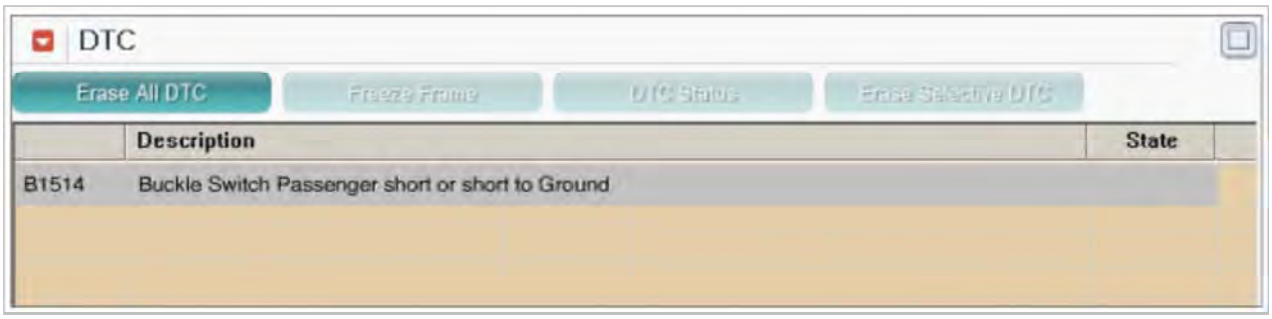
Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Short to ground in PSBBS harness. • Short circuit in PSBBS harness. • Poor connection of connected part. • Faulty PSBBS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Short to ground or short among wires	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Main harness circuit inspection" procedure.

Main harness Circuit Inspection

1. Ignition "OFF".

2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect Seat-belt Buckle Switch connector and SRSCM main harness connector.
4. Measure resistance between terminal "High" of the Seat-belt Buckle Switch harness connector and chassis ground.

Specification : ∞

5. Is the measured resistance within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect Seat-belt Buckle Switch connector .
5. Substitute the Seat-belt Buckle Switch and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good Seat-belt Buckle Switch, and check for proper operation. If the problem is corrected, replace Seat-belt Buckle 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1515 Buckle Switch Driver Defect

General Description

Seat-belt Buckle Switch(SBBS) is located in driver and passenger side seat.
SRSCM checks if seatbelt is buckled by signal of SBBS.
SRSCM controls air bag module and BPT differently in accordance with vehicle speed at the moment of collision and signal from SBBS.

DTC Description

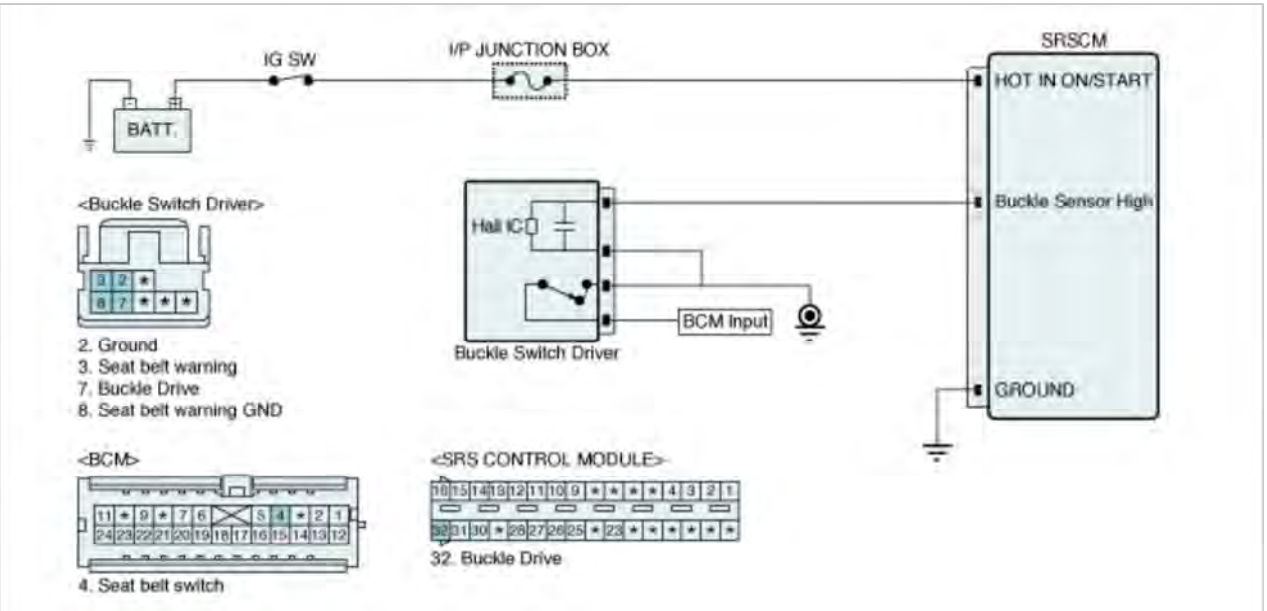
The SRSCM sets DTC B1515 if there is any fault in DSBBS circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible cause

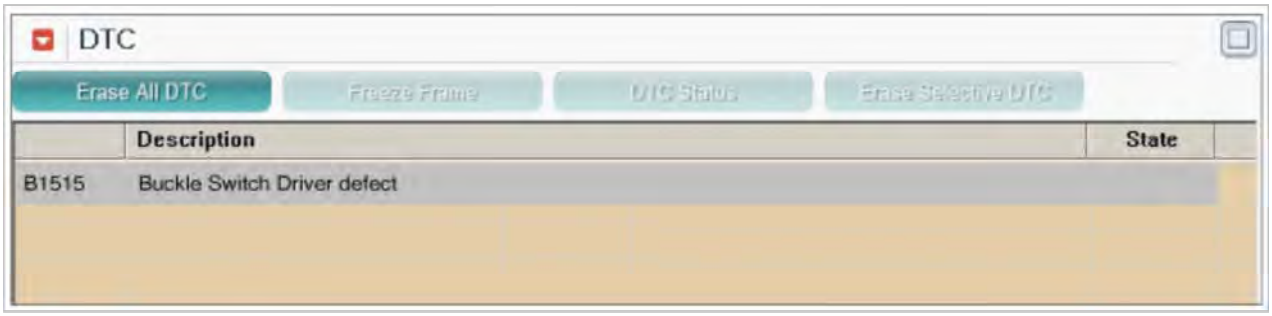
DTC Strategy		• Check Resistance	• Faulty DSBBS circuit. • Faulty DSBBS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Buckle Switch Driver defect	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect Seat-belt Buckle Switch connector .
5. Substitute the Seat-belt Buckle Switch and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good Seat-belt Buckle Switch, and check for proper operation. If the problem is corrected, replace Seat-belt Buckle 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1516 Buckle Switch Passenger Defect

General Description

Seat-belt Buckle Switch(SBBS) is located in driver and passenger side seat.
SRSCM checks if seatbelt is buckled by signal of SBBS.
SRSCM controls air bag module and BPT differently in accordance with vehicle speed at the moment of collision and signal from SBBS.

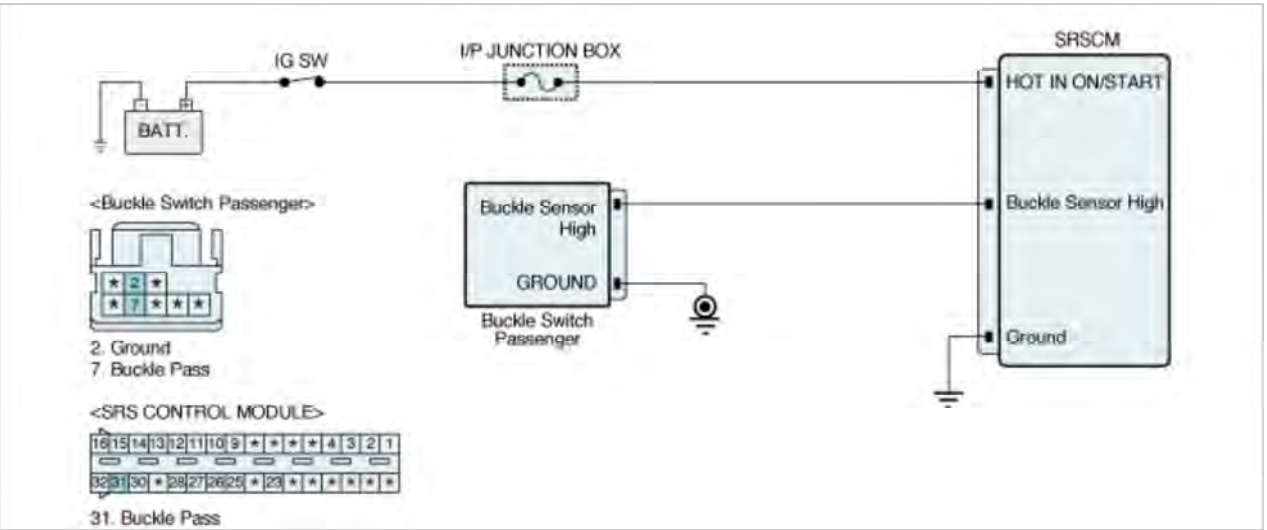
DTC Description

The SRSCM sets DTC B1516 if there is any fault in PSBBS circuit.

DTC Detecting Condition

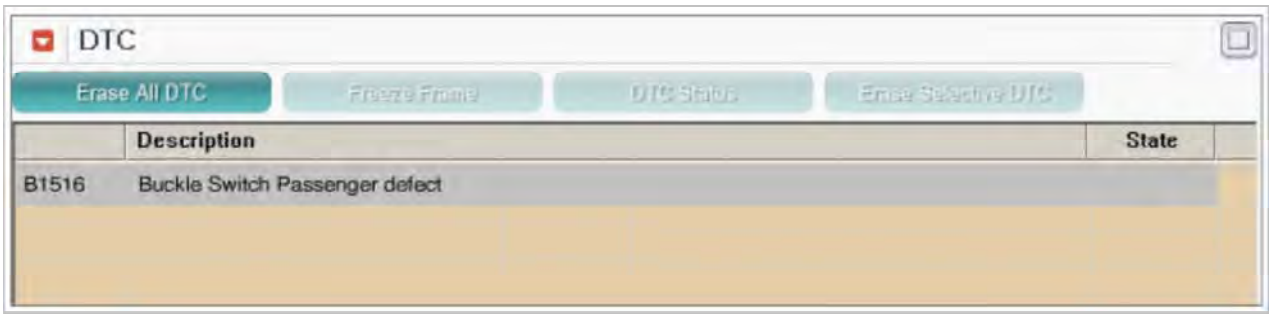
Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Faulty PSBBS circuit. • Faulty PSBBS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• Buckle Switch Passenger defect	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• More than 2 sec	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect Seat-belt Buckle Switch connector .
5. Substitute the Seat-belt Buckle Switch and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good Seat-belt Buckle Switch, and check for proper operation. If the problem is corrected, replace Seat-belt Buckle 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1517 Buckle Switch Driver Instability

General Description

Seat-belt Buckle Switch(SBBS) is located in driver and passenger side seat.
SRSCM checks if seatbelt is buckled by signal of SBBS.
SRSCM controls air bag module and BPT differently in accordance with vehicle speed at the moment of collision and signal from SBBS.

DTC Description

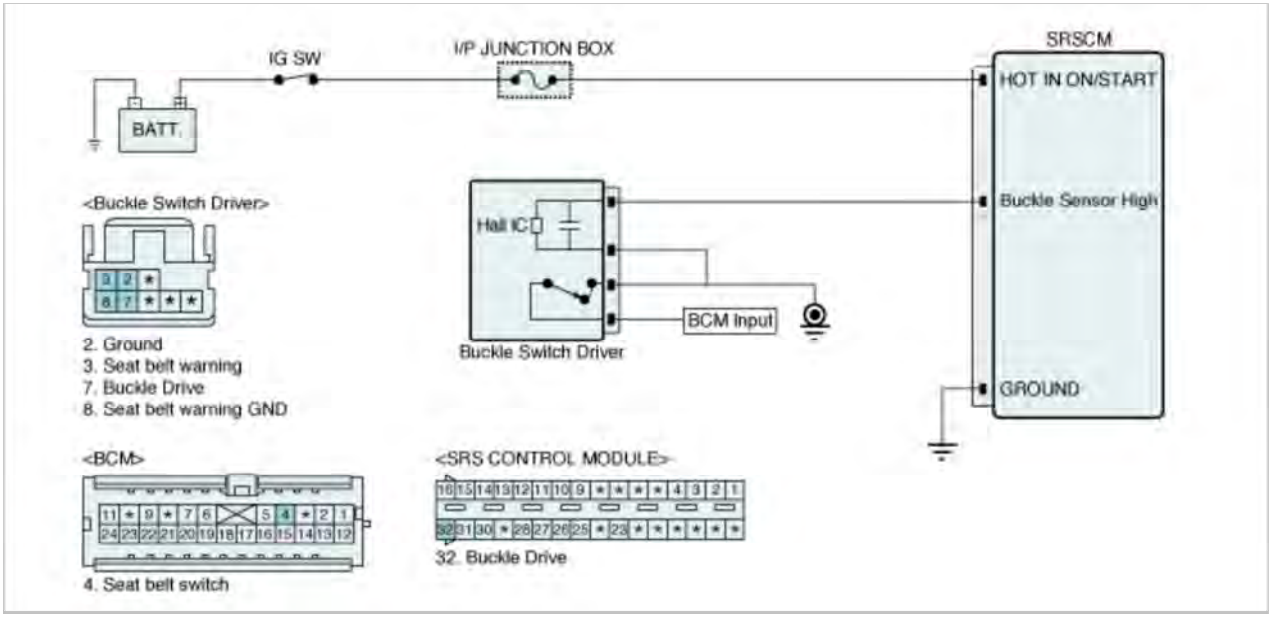
The SRSCM sets DTC B1517 if the value of Seat-belt Buckle Switch changes frequently.

DTC Detecting Condition

Item	Detecting Condition	Possible cause

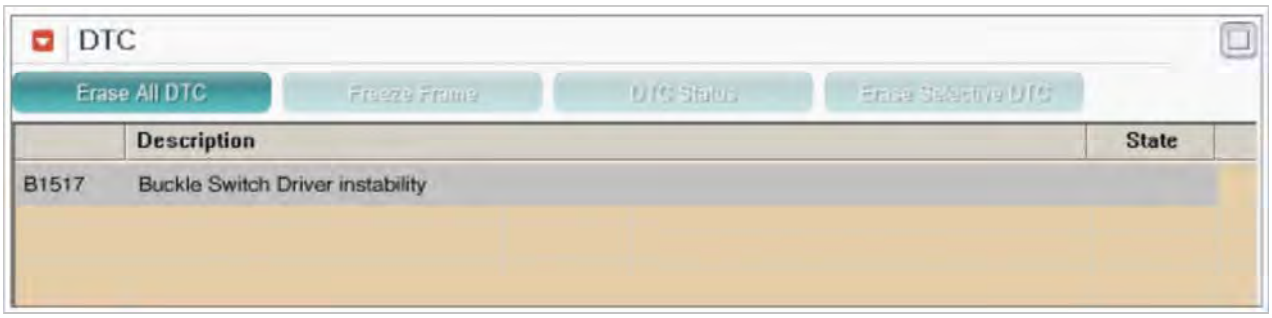
DTC Strategy		• Check Resistance	• Faulty DSBBS circuit. • Faulty DSBBS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• In a case there is not five equivalent information out of twenty status information for Buckle Switch Driver	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• N/A	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect Seat-belt Buckle Switch connector .
5. Substitute the Seat-belt Buckle Switch and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good Seat-belt Buckle Switch, and check for proper operation. If the problem is corrected, replace Seat-belt Buckle 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1518 Buckle Switch Passenger instability

General Description

Seat-belt Buckle Switch(SBBS) is located in driver and passenger side seat.
SRSCM checks if seatbelt is buckled by signal of SBBS.
SRSCM controls air bag module and BPT differently in accordance with vehicle speed at the moment of collision and signal from SBBS.

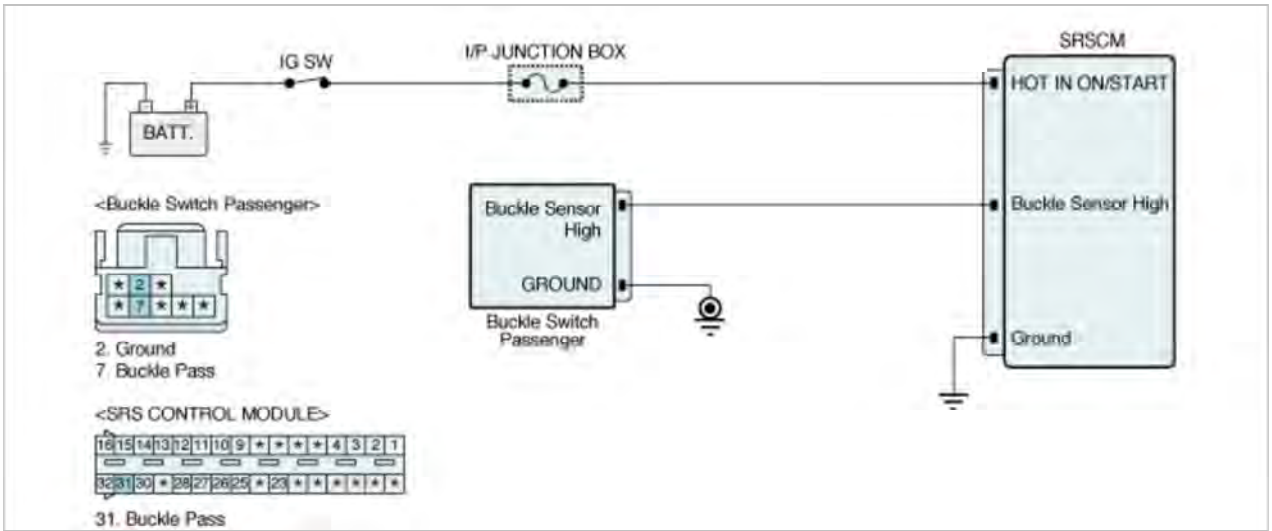
DTC Description

The SRSCM sets DTC B1518 if the value of Seat-belt Buckle Switch changes frequently.

DTC Detecting Condition

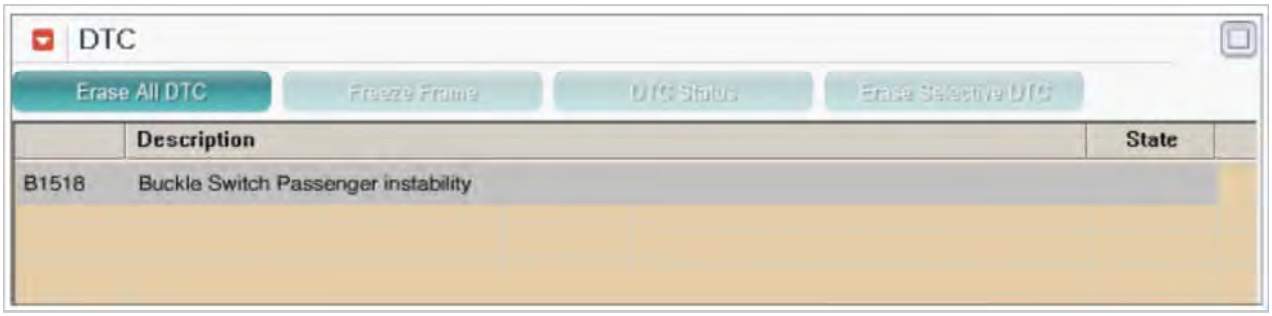
Item		Detecting Condition	Possible cause
DTC Strategy		• Check Resistance	• Faulty PSBBS circuit. • Faulty PSBBS. • Faulty SRSCM.
Enable Conditions		• Ignition "ON"	
Threshold Value		• In a case there is not five equivalent information out of twenty status information for Buckle Switch Passenger	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• N/A	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "ON" & Engine "OFF" and Using a scan tool, clear the DTC.
2. Ignition "OFF".
3. Disconnect the battery (-) terminal cable from the battery, and wait at least one minutes.
4. Disconnect Seat-belt Buckle Switch connector .
5. Substitute the Seat-belt Buckle Switch and check for proper operation.
6. Is DTC present problem ?

YES	▸ Substitute a known-good SRSCM, and check for proper operation. If the problem is corrected, replace SRSCM and then go to "Verification of Vehicle Repair" procedure. ▸ Substitute the SRSCM main harness and check for proper operation. If the problem is corrected, replace SRSCM main harness and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute a known-good Seat-belt Buckle Switch, and check for proper operation. If the problem is corrected, replace Seat-belt Buckle 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1620 Internal fault-Replace SRSCM

General Description

In collision, SRSCM sends current to pertinent air bag for deployment.
Besides SRSCM performs diagnosis of overall air bag system and light warning lamp if there's any fault in it.
Main functions of SRSCM are as follows.

1. Collision and Passenger presence Detection.
2. Determination of BPT, BUPT and air bag deployment in accordane with given condition.
3. Internal and external diagnosis of air bag system.
4. Warning by warning lamp if there's any fault in airbag system.
5. Proffering data for scantool diagnosis.

DTC Description

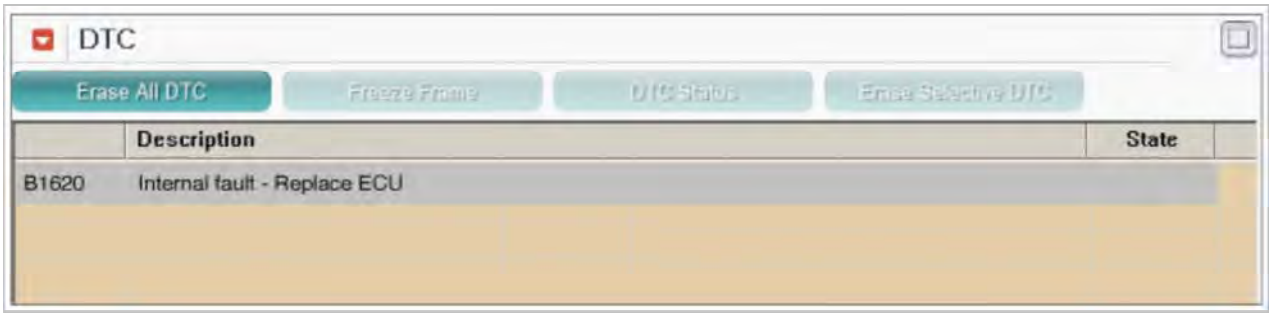
The SRSCM sets DTC B1620 if there is any fault in SRSCM.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check SRSCM	• SRSCM.
Enable Conditions		• Ignition "ON"	
Diagnostic Time	Qualification	• More than 1 sec	
	De-Qualification	• ∞(infinite-DTC cannot be erased)	

Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Internal fault of SRSCM. Substitute with a SRSCM and check for proper operation. If the problem is corrected, replace SRSCM 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1650 Crash Recorded in 1st Stage Only (Frontal-Replace SRSCM)

General Description

In collision, SRSCM sends current to pertinent air bag for deployment.
Besides SRSCM performs diagnosis of overall air bag system and light warning lamp if there's any fault in it.
Main functions of SRSCM are as follows.

1. Collision and Passenger presence Detection.
2. Determination of BPT, BUPT and air bag deployment in accordane with given condition.

3. Internal and external diagnosis of air bag system.
4. Warning by warning lamp if there's any fault in airbag system.
5. Proffering data for scantool diagnosis.

DTC Description

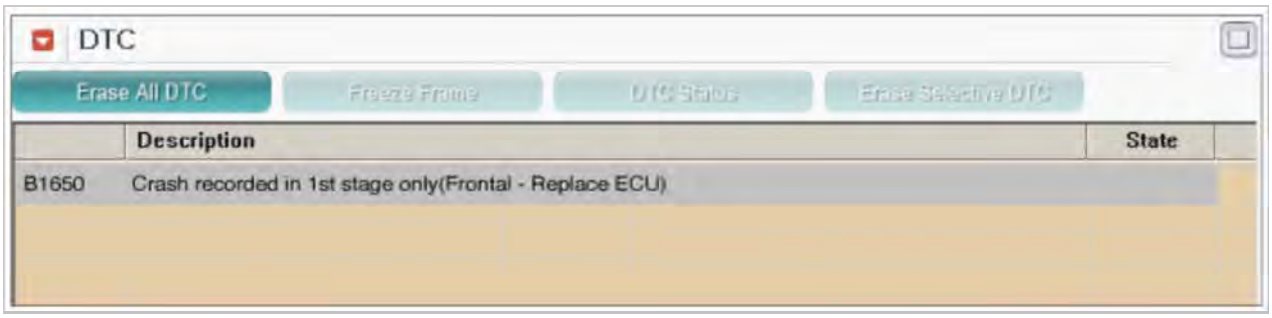
The SRSCM sets DTC B1650 if DAB or PAB deploys.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check DAB or PAB deployment	• SRSCM. • DAB or PAB deployment
Enable Conditions		• Ignition "ON"	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• ∞(infinite-DTC cannot be erased)	

Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ DTC caused by deployment of front air bag. Substitute with a SRSCM and check for proper operation. If the problem is corrected, replace SRSCM 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1651 Crash Recorded in Front-Driver Side Airbag (Replace SRSCM)

General Description

In collision, SRSCM sends current to pertinent air bag for deployment.

Besides SRSCM performs diagnosis of overall air bag system and light warning lamp if there's any fault in it.
Main functions of SRSCM are as follows.

1. Collision and Passenger presence Detection.
2. Determination of BPT, BUPT and air bag deployment in accordane with given condition.
3. Internal and external diagnosis of air bag system.
4. Warning by warning lamp if there's any fault in airbag system.
5. Proffering data for scantool diagnosis.

DTC Description

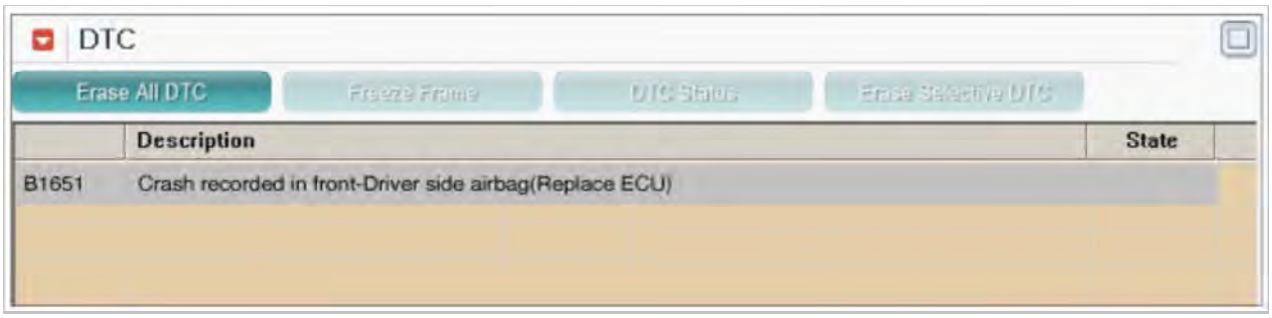
The SRSCM sets DTC B1651 if DSAB and DCAB deploys.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check DSAB and DCAB deployment	• SRSCM. • DSAB and DCAB deployment
Enable Conditions		• Ignition "ON"	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• ∞(infinite-DTC cannot be erased)	

Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ DTC caused by deployment of front driver side air bag. Substitute with a SRSCM and check for proper operation. If the problem is corrected, replace SRSCM 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1652 Crash Recorded in Front-Passenger Side Airbag (Replace SRSCM)

General Description

In collision, SRSCM sends current to pertinent air bag for deployment.
Besides SRSCM performs diagnosis of overall air bag system and light warning lamp if there's any fault in it.
Main functions of SRSCM are as follows.

1. Collision and Passenger presence Detection.
2. Determination of BPT, BUPT and air bag deployment in accordane with given condition.
3. Internal and external diagnosis of air bag system.
4. Warning by warning lamp if there's any fault in airbag system.
5. Proffering data for scantool diagnosis.

DTC Description

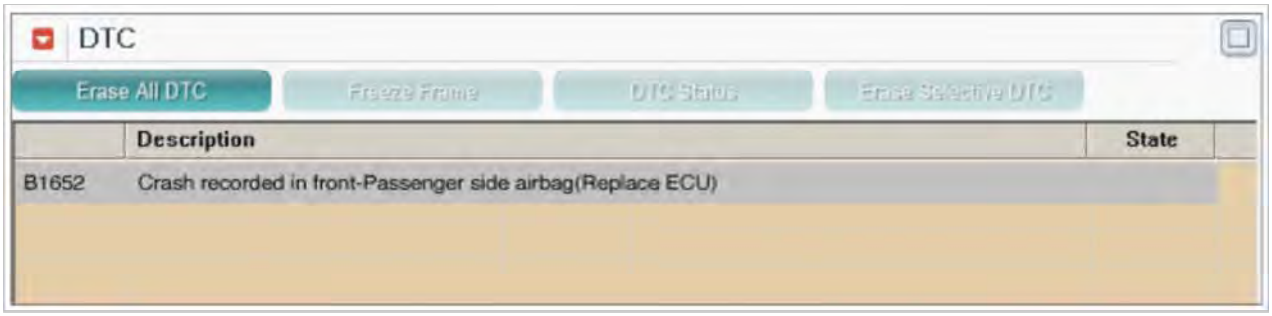
The SRSCM sets DTC B1652 if PSAB and PCAB deploys.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Check PSAB and PCAB deployment	• SRSCM. • PSAB and PCAB deployment
Enable Conditions		• Ignition "ON"	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• ∞(infinite-DTC cannot be erased)	

Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ DTC caused by deployment of front passenger side air bag. Substitute with a SRSCM and check for proper operation. If the problem is corrected, replace SRSCM 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B1670 Crash recorded in full stage (Frontal-Replace SRSCM)

General Description

In collision, SRSCM sends current to pertinent air bag for deployment.
Besides SRSCM performs diagnosis of overall air bag system and light warning lamp if there's any fault in it.
Main functions of SRSCM are as follows.

1. Collision and Passenger presence Detection.
2. Determination of BPT and air bag deployment in accordane with given condition.
3. Internal and external diagnosis of air bag system.
4. Warning by warning lamp if there's any fault in airbag system.
5. Proffering data for scantool diagnosis.

DTC Description

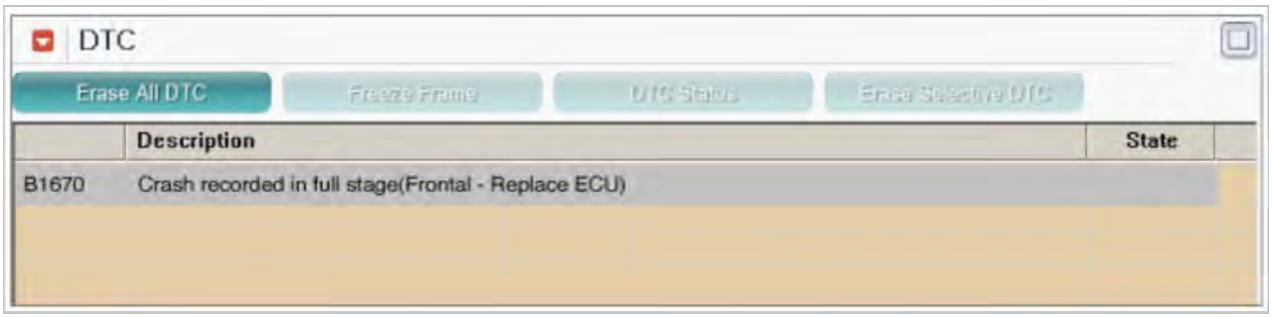
When the Crash recorded in full stage in the SRS Control module.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Crash recorded in full stage in the SRSCM	• Unable to control SRS system due to internal fault. • Crash recorded in full stage
Enable Conditions		• Ignition "ON"	
Threshold Value		• Crash recorded in the SRSCM	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• ∞(infinite-DTC cannot be erased)	

Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ DTC caused by deployment of front full stage(1ST,2ND)air bag. Substitute with a SRSCM and check for proper operation. If the problem is corrected, replace SRSCM 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B2500 Warning lamp Failure

General Description

Air bag warning lamp is located at cluster
When key is in 'ignition on' position, SRSCM performs diagnosis of overall air bag system.If there's no fault, air bag. Warning lamp in cluster flickers for a whlie and then goes out.
SRSCM measures voltage of out terminal of warning lamp to check if warnning lamp is operated in accordance with signal SRSCM sends.

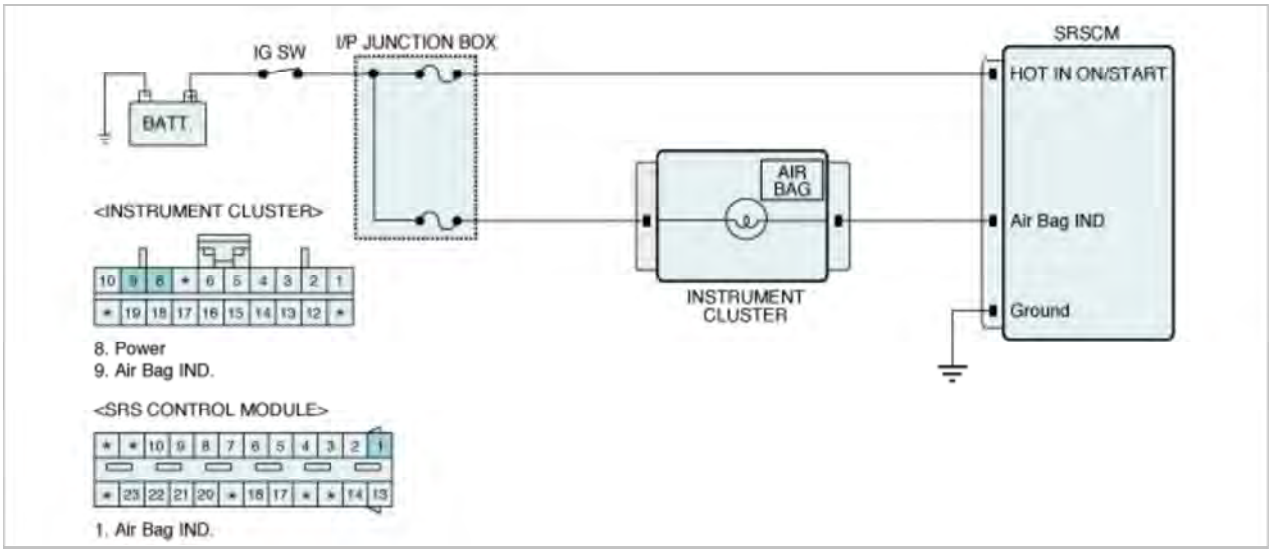
DTC Description

The SRSCM sets DTC B2500 if there is an open circuit or short to ground in air bag circuit harness.

DTC Detecting Condition

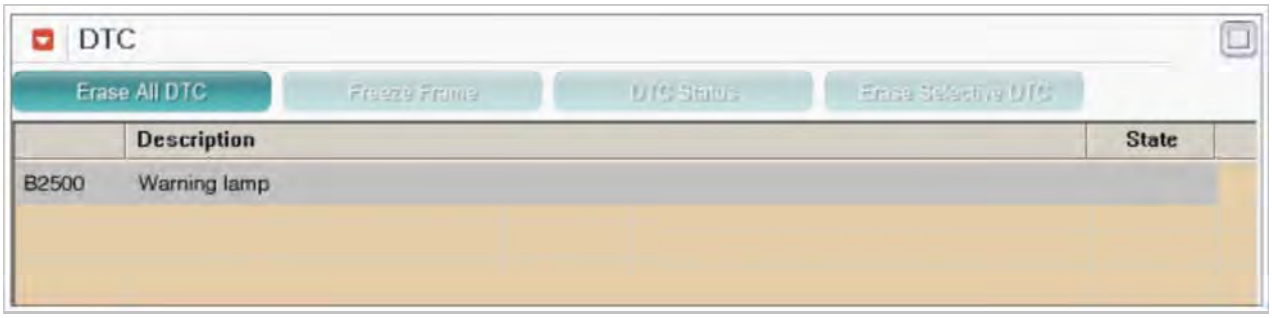
Item		Detecting Condition	Possible cause
DTC Strategy		• Check voltage	• Burnt-out fuse. • Burnt-out warning lamp. • Open circuit in warning lamp harness. • Short circuit in warning lamp harness. • Faulty SRSCM.
Case 1	Enable conditions	• Ignition "ON" • When AWL is commanded ON by the ACU and Shorted to Battery	
	Threshold value	• Battery voltage > 1.5 V	
Case 2	Qualification	• Ignition "ON" • When AWL is commanded OFF by the ACU and Open or shorted to ground	
	De-Qualification	• Battery voltage < 5 V	
Diagnostic Time	Qualification	• More than 1.2 sec remaining	
	De-Qualification	• More than 2(Open)~17(Short) sec remaining	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. Thoroughly check shorting bar/shorting bar release pin and 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 shorting 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 "Warning lamp Circuit Inspection" procedure.

Warning lamp Circuit Inspection

1. Ignition "OFF".
2. Remove the Instrument cluster from crash pad assembly.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "Air bag indicator" of the Instrument cluster harness connector and chassis ground.

Specification : Battery Voltage

5. Is the measured voltage within specifications?

YES	▸ Check warning lamp and connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Check airbag fuse, passenger compartment junction block, harness between junction block and SRS . 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(DTC)" mode
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > SRSCM > B2502 Passenger Airbag Telltale Lamp Failure

General Description

The SRS Telltale Lamp is located on the center of crash pad consists with the Digital Clock.
When the passenger sest are unoccupied, the Telltale Lamp lights up for the notice, and if passenger are occupied under seat,Telltale Lamp are goes off automatically.

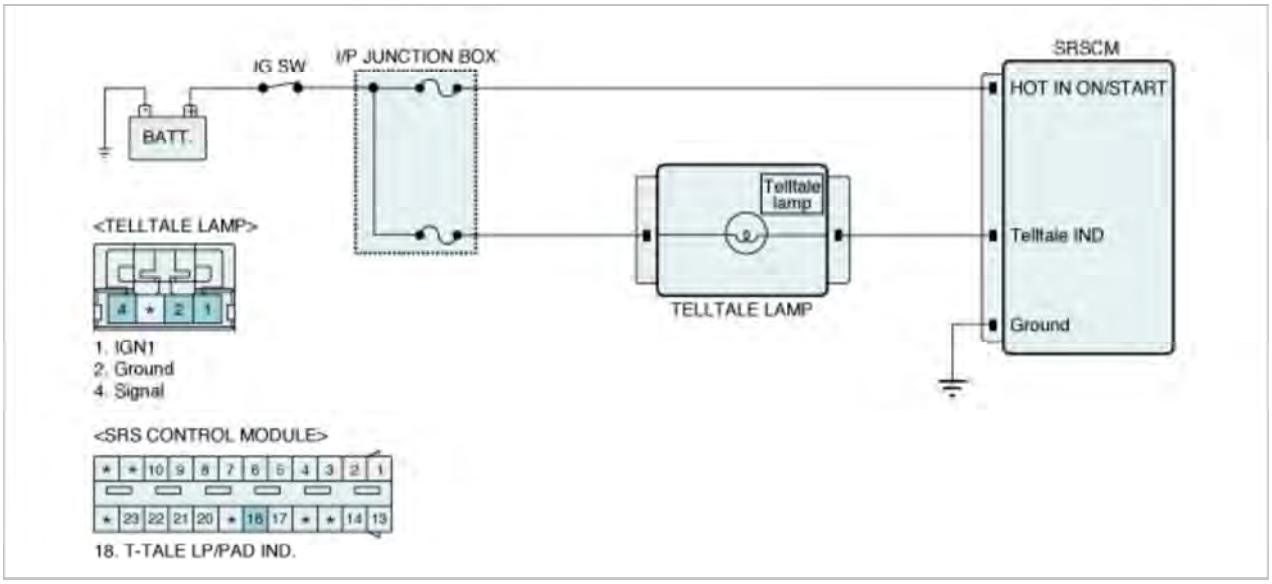
DTC Description

DTC B2502 is recorded when occurrence of a malfunction in the Telltale indicator Lamp system.

DTC Detecting Condition

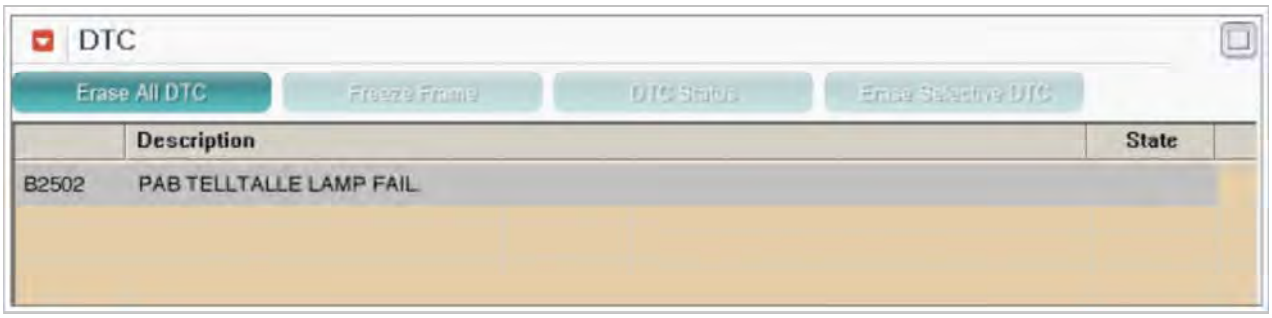
Item		Detecting Condition	Possible cause
DTC Strategy		• Check voltage	• Burnt-out fuse. • Burnt-out Telltale lamp. • Open circuit in Telltale lamp harness. • Short circuit in Telltale lamp harness. • Faulty SRSCM.
Enable Conditions		• Telltale lamp wire open • Telltale lamp wire short	
Diagnostic Time	Qualification	• N/A	
	De-Qualification	• N/A	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Ignition "OFF", connect scantool.
2. Ignition "ON"& Engine "OFF", select "Diagnostic Trouble Codes(DTC)" mode.
3. Monitor diagnostic trouble code and present of trouble code.
4. Using a scan tool, clear the DTC.



5. Is DTC present problem ?

YES	▸ Go to "W/Harness Inspection" procedure.
NO	▸ Displaying nothing(no DTC) or DTC with label "H"(historical) shows that Fault is intermittent caused by poor contact in the part's and/or SRSCM connector or was repaired and SRSCM memory was not cleared. TThoroughly check shorting bar/shorting bar release pin and 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 shorting 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 "Telltale lamp Circuit Inspection" procedure.

Telltale lamp Circuit Inspection

1. Ignition "OFF".
2. Disconnect the battery (-) terminal cable from the battery and wait at least one minutes.
3. Disconnect SRSCM main harness connector.
4. Connect the battery (-) terminal cable to the battery and Ignition "ON" & Engine "OFF".
5. Measure voltage between Telltale lamp terminal of the SRSCM harness connector and chassis ground.

Specification : Batt Voltage

6. Is the measured voltage within specifications?

YES	▸ Check telltale lamp and connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Check airbag fuse, passenger compartment junction block, harness between junction block and SRSCM. 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(DTC)" mode.
2. Using a scan tool, clear the DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTC present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System is performing to specification at this time.

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Description and Operation

Description

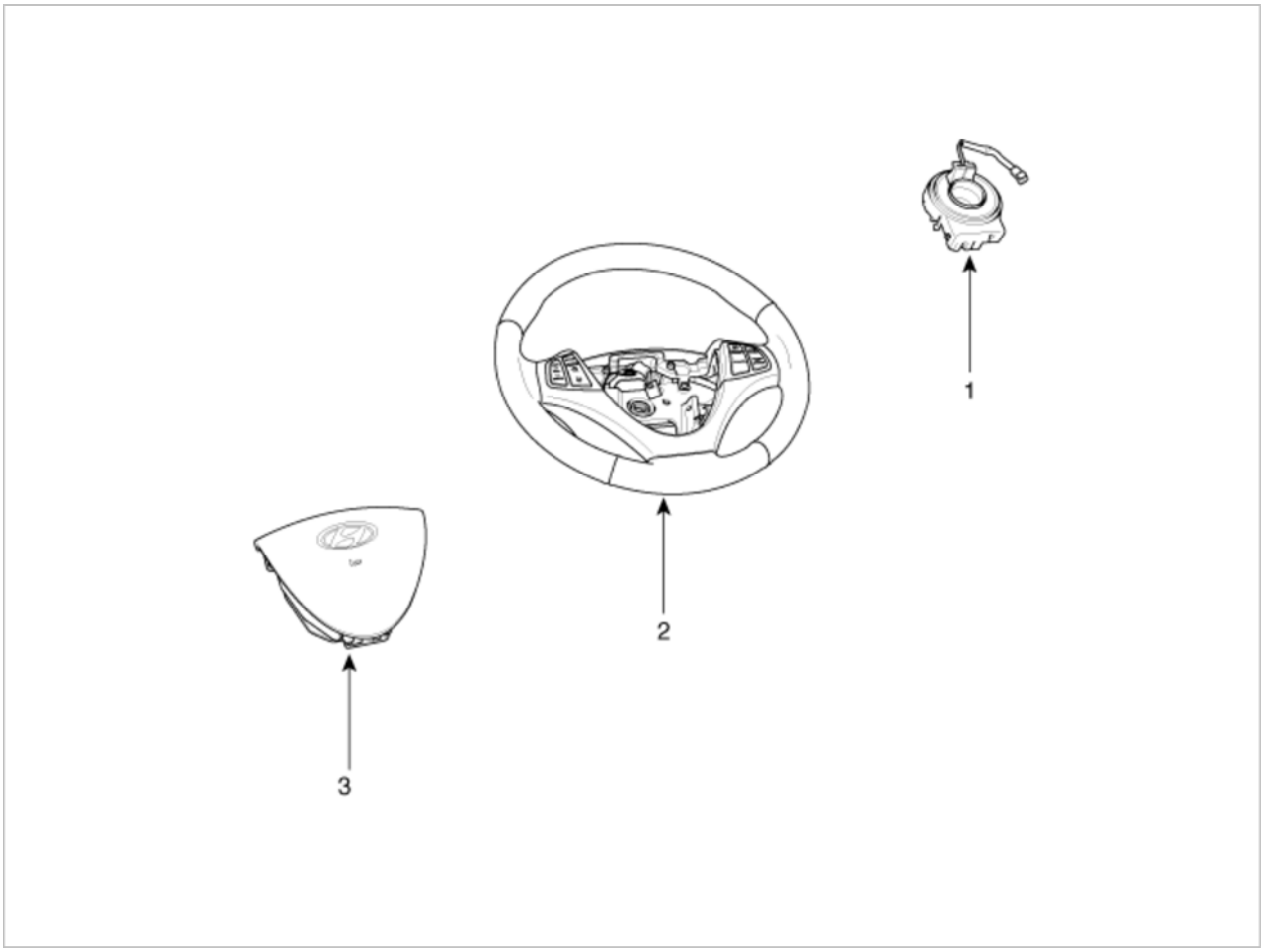
Driver Airbag(DAB) is installed in steering wheel and electrically connected to the SRSCM via clockspring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB).

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Components and Components Location

Components

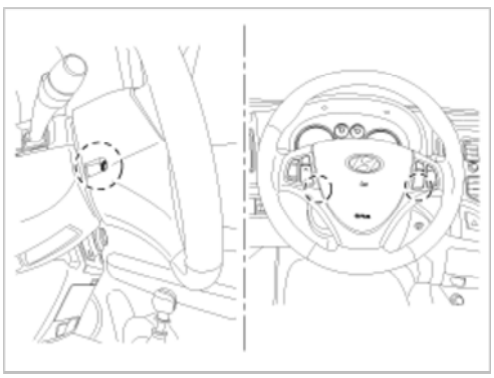


1. Clock Spring 2. Steering Wheel	3. Driver Airbag(DAB)

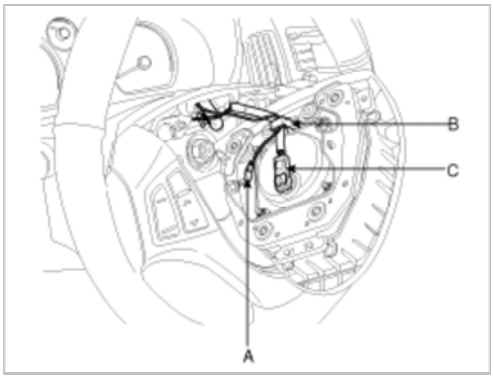
Restraint > Airbag Module > Driver Airbag (DAB) Module and Clock Spring > Repair procedures

Removal

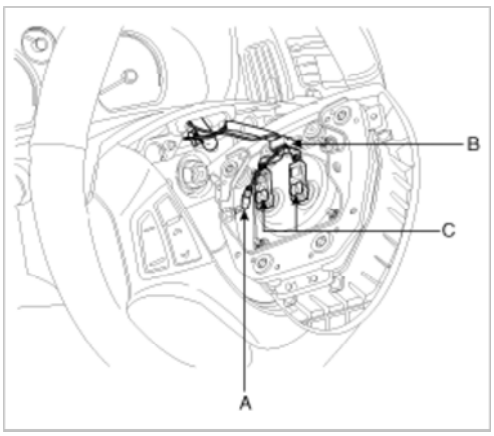
1. Disconnect the battery negative cable and wait at least three minutes before beginning work.
2. Remove the two airbag module mounting bolts.



3. Seperate the airbag module from the steering wheel after disconnecting the connector(C), remove airbag module connector locking pin after removing the wiring fixing clip(B).
   [Depowered]



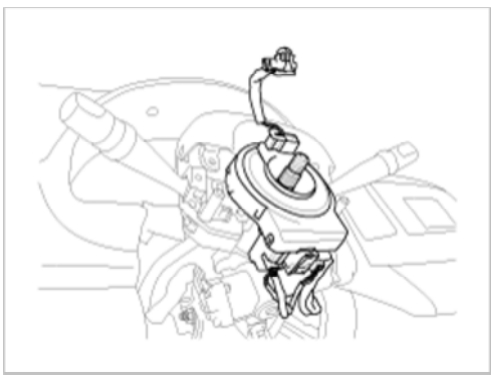
[Advanced]



4. Disconnet the horn connector(A).

> CAUTION
>
> The removed airbag module should be stored in a clean, dry place with the pad cover face up.

5. Remove the steering wheel and steering wheel column cover. (Refer to the Steering System group - Steering column and shaft)
6. Disconnect the clock spring and steering the remote switch connector, then remove the clock spring.



Inspection

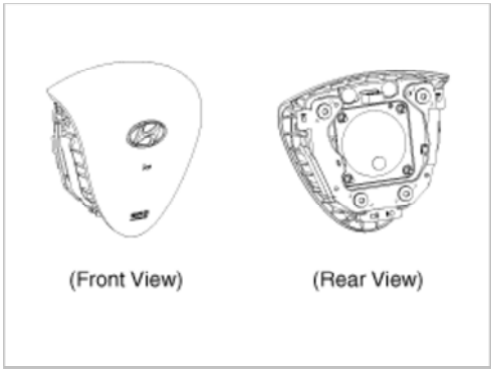
Driver Airbag (DAB)

If any improper parts are found during the following inspection, replace the airbag module with a new one.

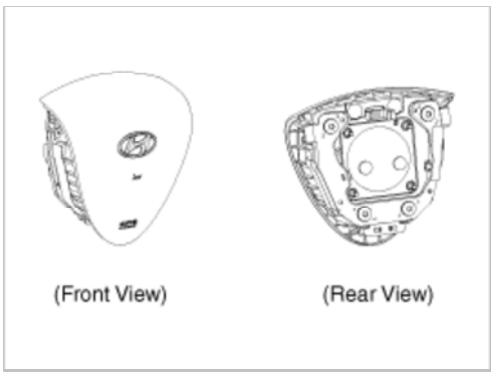
> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.

4. Check airbag inflator case for dents, cracks or deformities.
   [Depowered]



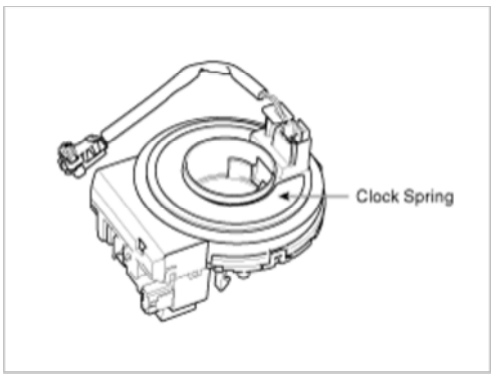
   [Advanced]



5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

Clockspring

1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
2. Check connectors and protective tube for damage, and terminals for deformities.

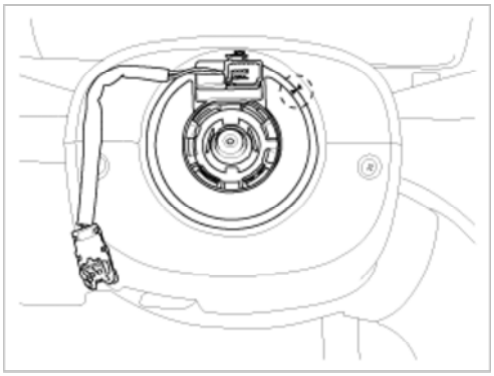


Installation

CAUTION

Center the front wheels and remove the ignition key. Failure to do so may damage the SRS system inoperative, risking serious driver injury.

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Connect the clock spring harness connetor and steering remocon switch harness connector to the clock spring.
4. Set the center position by marking between the clock spring and the cover into line. Make an array the mark (▸ ◂) by turning the clock spring clockwise to the stop and then 3 revolutions counterclockwise.



5. Install the steering wheel column cover and the steering wheel. (Refer to the Steering System group - Steering column and shaft)
6. Connect the Driver Airbag(DAB) module connector and horn connector, then install the Driver Airbag (DAB) module on the steering wheel.
7. Secure the Driver Airbag(DAB) with the new mounting bolts.

Tightening Torque
: 7.9 ~ 10.8 Nm (0.8 ~ 1.1 kgf.m, 5.8 ~ 8.0 lb.ft)

8. Connect the battery negative cable.
9. After installing the airbag, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
   B. Make sure horn button works.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Description and Operation

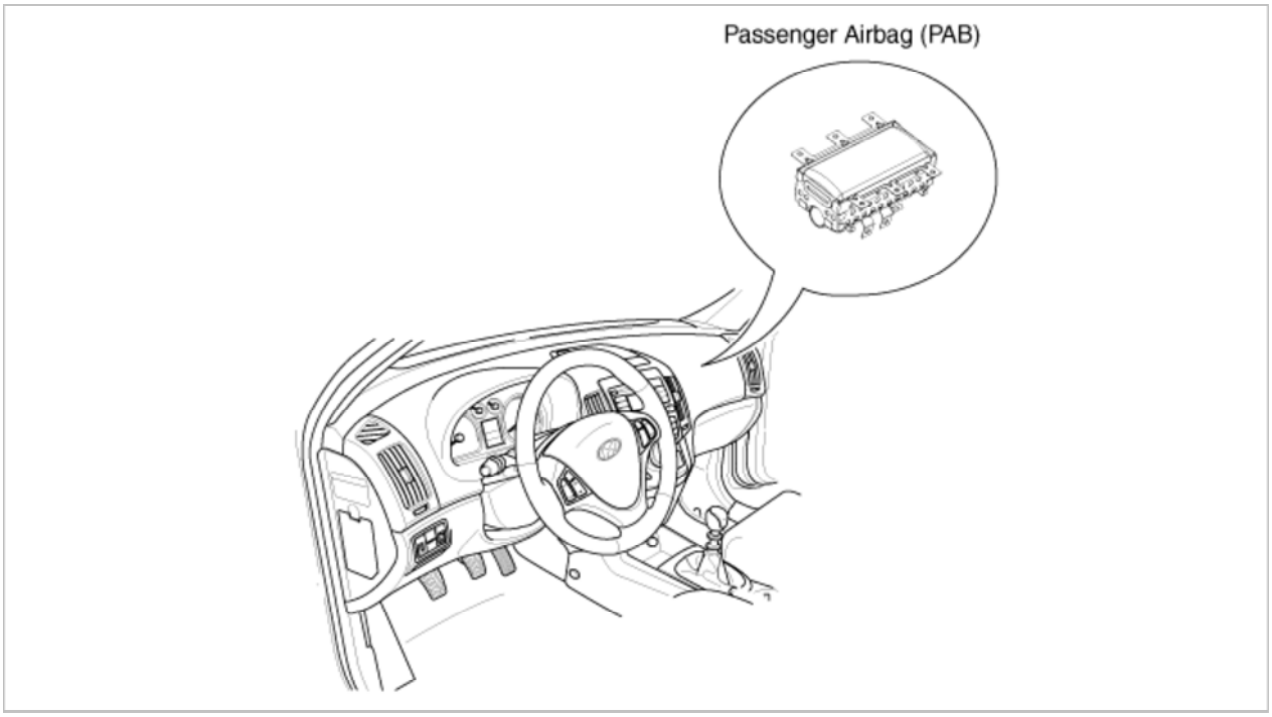
Description

The passenger Airbag(PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Passenger Airbag (PAB) Module > Components and Components Location

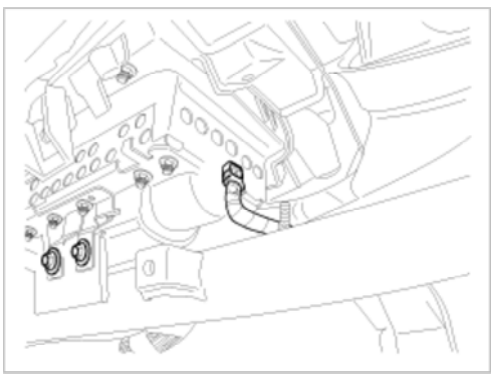
Components



Restraint > Airbag Module > Passenger Airbag (PAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box. (Refer to the Body group - Crash pad)
3. Disconnect the PAB connector and remove the PAB mounting bolts.



4. Remove the crash pad. (Refer to the Body group - Crash pad)

> NOTE
>
> Replace the crash pad which is damaged while PAB is deployed.

5. Remove the mounting nuts from the crash pad. Then remove the passenger airbag.

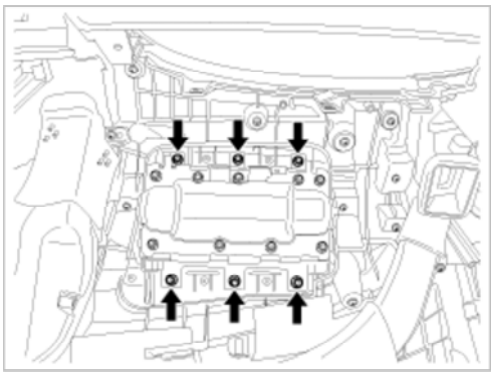
> CAUTION
>
> The removed airbag module should be stored in a clean, dry place with the pad cover face up.

Installation

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Place a Passenger Airbag(PAB) on the crash pad and tighten the Passenger Airbag(PAB) mounting nuts.

Tightening Torque

: 3.7 ~ 4.3 N.m (0.38 ~ 0.44 kgf.m, 2.7 ~ 3.2 lb.ft)



4. Install the crash pad. (Refer to the Body group - Crash pad)
5. Tighten the PAB mounting bolts.

Tightening Torque
: 8.0 ~ 9.0 N.m (0.8 ~ 0.9 kgf.m, 5.9 ~ 6.6 lb.ft)

6. Connect the Passenger Airbag(PAB) harness connector to the SRS main harness connector.
7. Reinstall the golve box. (Refer to the Body group - Crash pad)
8. Reconnect the battery negative cable.
9. After installing the Passenger Airbag(PAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Side Airbag (SAB) Module > Description and Operation

Description

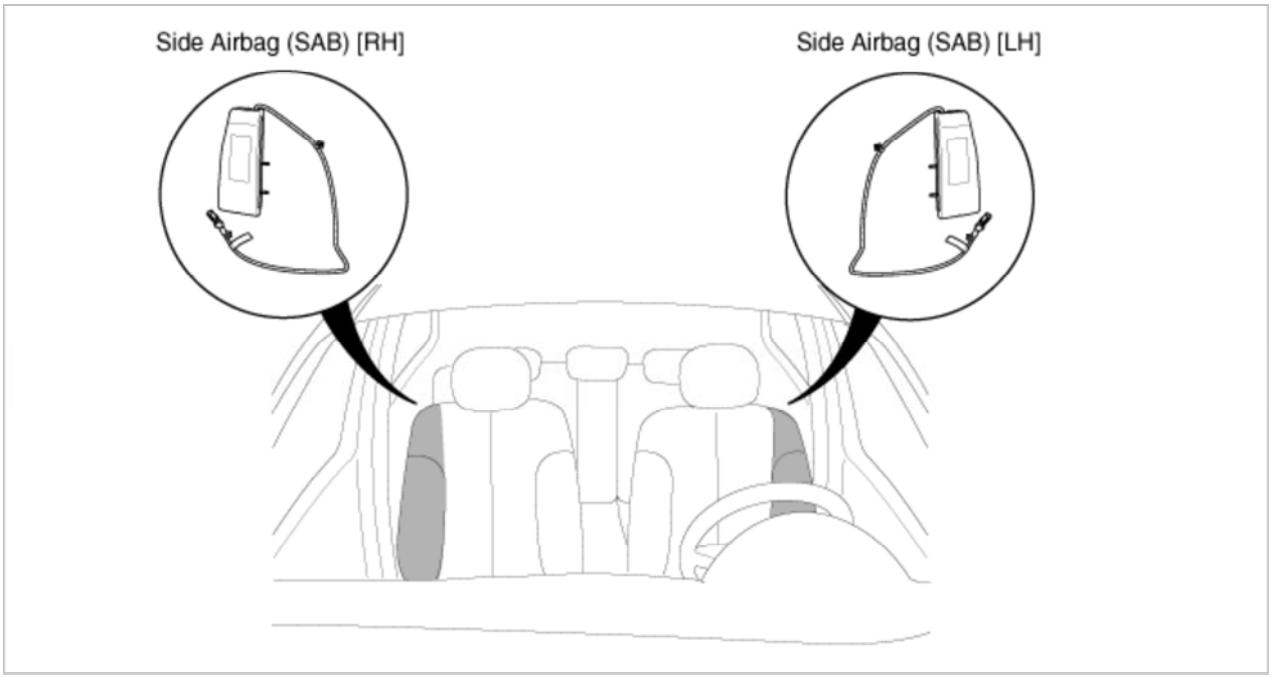
The two Side Airbags(SAB) are installed inside the driver and passenger seat and protects the driver and front passenger from danger when side crash occurs. The SRSCM determines deployment of side airbag by using Side Impact Sensor(SIS) signal.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Side Airbag (SAB) Module > Components and Components Location

Components

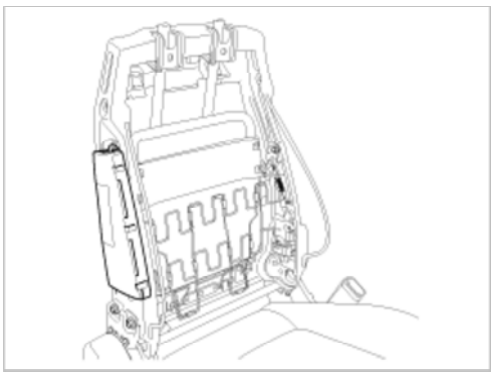


Restraint > Airbag Module > Side Airbag (SAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait at least 3 minutes before beginning work.
2. Remove the front seat assembly. (Refer to the Body group - Seat)
3. Remove the seat-back cover. (Refer to the Body group - Seat)
4. Loosen the SAB mounting nuts and remove the SAB module.

> CAUTION
>
> The removed airbag module should be stored in a clean, dry place with the pad cover face up.



Installation

> CAUTION
>
> Be sure to install the harness wires not to be pinched or interfered with other parts.

> NOTE
>
> - Do not open the lid of the side airbag cover.
> - Use a new mounting nuts when you replace a side airbag.
> - Make sure that the seat-back cover is installed properly. Improper installation may prevent the proper deployment.

1. Remove ignition key from the vehicle.

2. Disconnect the battery negative cable and wait for at least three minutes.
3. Place a Side Airbag(SAB) on the seat-back frame and tighten the side airbag mounting nuts.

Tightening torque
: 5.9 ~ 7.9 Nm (0.6 ~ 0.8 kgf.m, 3.6 ~ 5.0 lb.ft)

4. Install the new seat-back cover. (Refer to the Body group - Seat)
5. Install the seat assembly, then connect the Side Airbag(SAB) harness connector.
6. Recline and slide the front seat forward fully, make sure the harness wires are not pinched or interfering with other parts.
7. Reconnect the battery negative cable.
8. After installing the Side Airbag(SAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Description and Operation

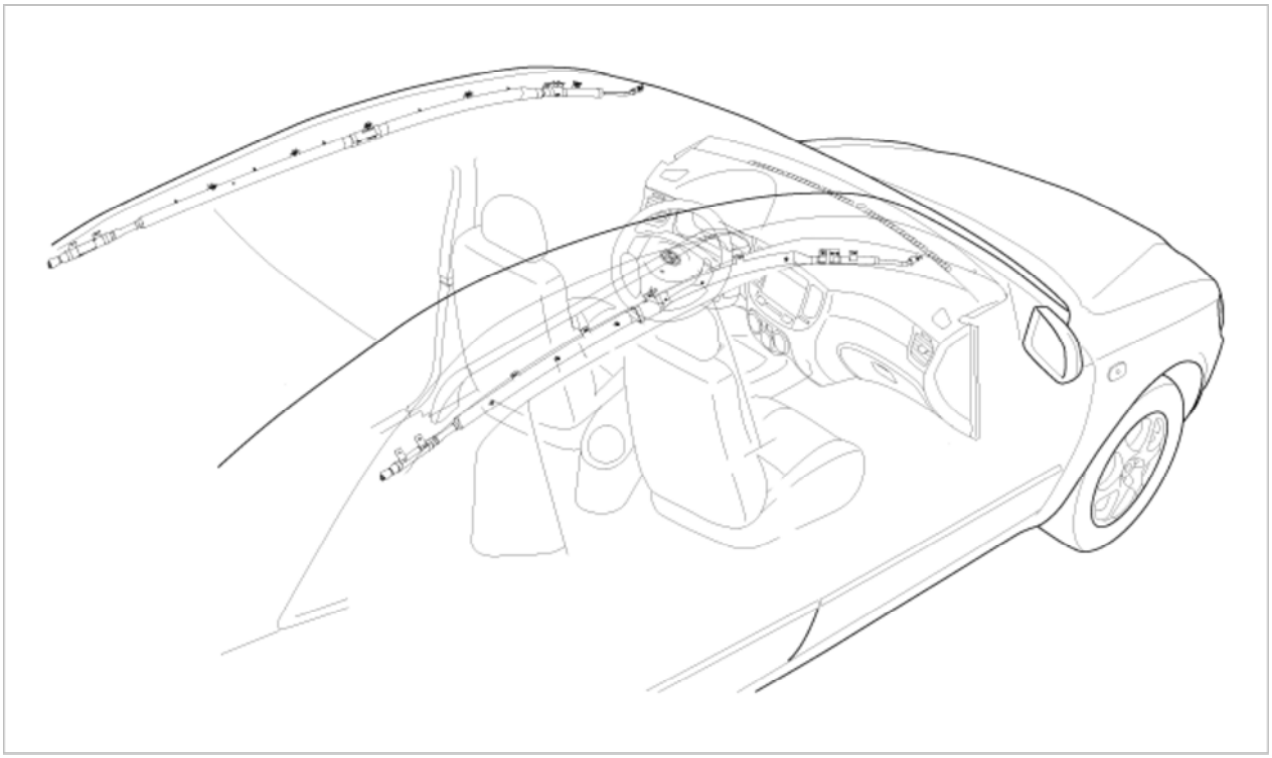
Description

Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passanger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

> CAUTION
>
> Never attempt to measure the circuit resistance of the airbag module even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Restraint > Airbag Module > Curtain Airbag (CAB) Module > Components and Components Location

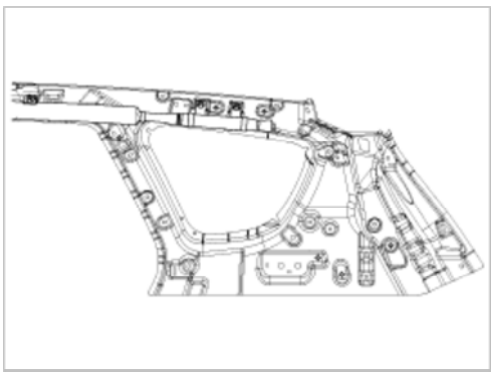
Components



Restraint > Airbag Module > Curtain Airbag (CAB) Module > Repair procedures

Removal

1. Disconnect the battery negative cable and wait for at of least 3 minutes before beginning work.
2. Remove the following parts. (Refer to the Body group - Roof trim)
   A. Side trim, Roof trim
3. Disconnect the Curtain Airbag harness connector.



4. After loosening the mounting bolts, remove the curtain airbag.

Installation

CAUTION

- Be sure to install the harness wires not to be pinched or interfered with other parts.

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Install a Curtain Airbag(CAB) on the mounting bracket.
4. Tighten the CAB mounting bolts.

Tightening Torque
: 10.8 ~ 12.7 Nm(1.1 ~ 1.3 kgf.m, 7.9 ~ 9.4 lb.ft)

CAUTION

• Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.

5. Connect the CAB connector.
6. Install the follwing parts. (Refer to the Body group - Roof trim)
   A. Side trim, Roof trim
7. Reconnect the battery negative cable.
8. After installing the Curtain Airbag(CAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Restraint > Airbag Module > Description and Operation

Airbag Disposal

Special Tool Required

Deployment tool 0957A-34100A

Before scrapping any airbags or side airbags (including those that are still installed in vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped.

If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

Deploying Airbags In The Vehicle

If an SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvage parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag is securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.
   (1) Driver's Airbag :
      A. Remove the driver's airbag and install the SST(Depowered : 0957A-38500, Advanced : 0957A-38510).
      B. Install the driver's airbag on the steering wheel.
   (2) Front Passenger's Airbag :
      A. Remove the glove box, then disconnect the connector between the front passenger's airbag and SRS main harness.
      B. Install the SST(Depowered : 0957A-38500, Advanced : 0957A-38510)
   (3) Side Airbag :
      A. Disconnect the 2P connector between the side airbag and side wire harness.
      B. Install the SST (0957A-3F100).
   (4) Curtain Airbag :
      A. Disconnect the 2P connector between the curtain airbag and wire harness.
      B. Install the SST(0957A-38500).
   (5) Seat Belt Pretensioner :
      A. Disconnect the 2P connector from the seat belt pretensioner.
      B. Install the SST(0957A-38500).
4. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
5. Connect a 12 volt battery to the tool.
6. Push the tool's deployment switch. The airbag should deploy (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)
7. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

Deploying the Airbag Out of the Vehicle

If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows :

1. Confirm that the special is functioning properly by following the check procedure on this page.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

Disposal of Damaged Airbag

1. If installed in a vehicle, follow the removal procedure of driver's airbag front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Description and Operation

Description

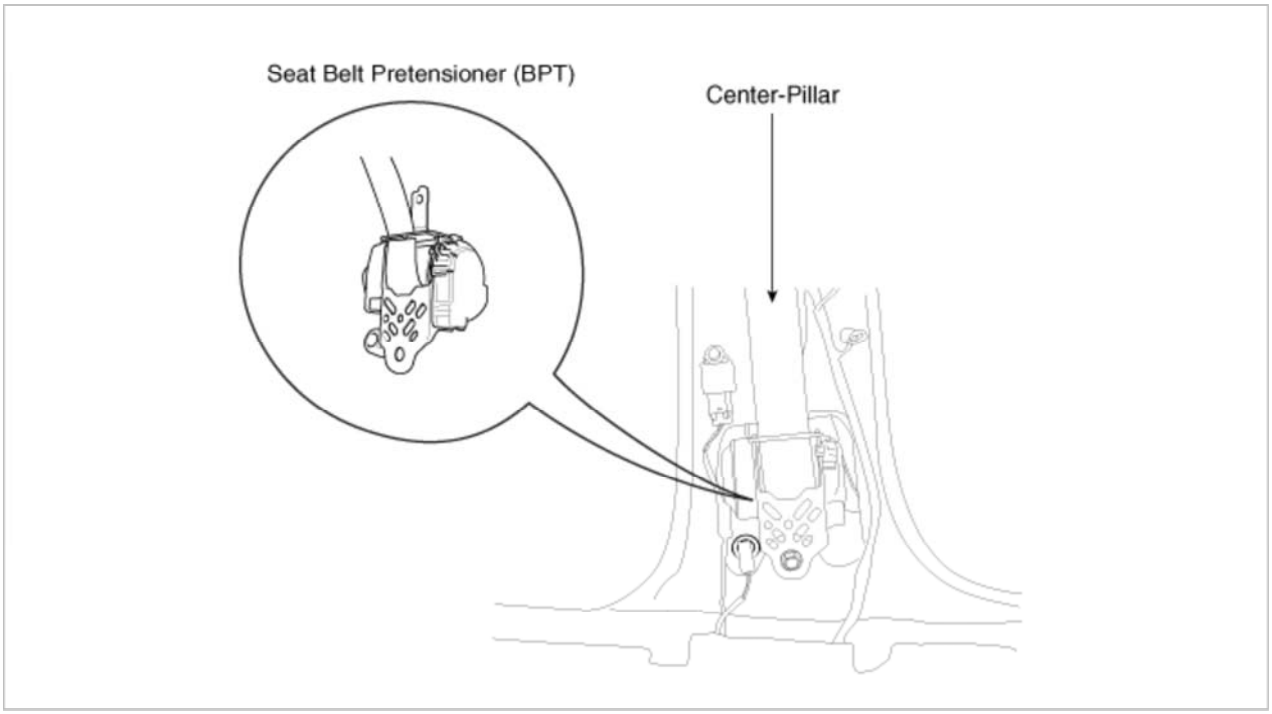
The Seat Belt Pretensioners(BPT) are installed inside Center Pillar(LH & RH). When a vehicle crashes with a certain degree of frontal impact, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupants by retracting the seat belt webbing. This prevents the front occupants from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.

CAUTION

Never attempt to measure the circuit resistance of the Seat Belt Pretensioner(BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Components and Components Location

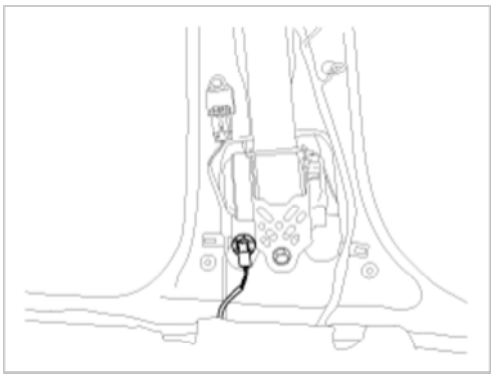
Components



Restraint > Seat Belt Pretensioner > Seat Belt Pretensioner (BPT) > Repair procedures

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the following parts. (Refer to the Body group - Interior trim)
   A. Center pillar trim, Door scuff trim.
3. Disconnect the Seat Belt Pretensioner connector.



4. Remove the lower anchor bolt.
5. Remove the upper anchor bolt.
6. Loosen the Seat Belt Pretensioner mounting bolt and remove the Seat Belt Pretensioner.

Installation

1. Remove ignition key from the vehicle.
2. Disconnect the negative (-) cable from battery and wait for at least three minutes.
3. Install the Seat Belt Pretensioner(BPT) with bolt.
4. Install the upper and lower anchor bolts.

Tightening Torque
: 39.2 ~ 53.9 Nm (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb.ft)

5. Install the follwing parts. (Refer to the Body group - Interior trim)

A. Center pillar trim, Door scuff trim

6. Install the front seat assembly.
7. Reconnect the negative battery cable.
8. After installing the Seat Belt Pretensioner(BPT), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Specifications

Item	Specification
Master cylinder	
Type	Tandem type
I.D.	20.64 mm (0.813 in)
Piston stroke	45 mm (1.77 in)
Fluid level warning sensor	Provided
Brake booster	
Type	Vacuum
Boosting ratio	7.5 : 1
Front brake(Disc)	
Type	Floating type with ventilated disc
Disc O.D.	280 mm(11.02 in)
Disc I.D.	172 mm(6.77 in)
Disc thickness	26 mm(1.02 in)
Pad thickness	11 mm(0.43 in)
Cylinder type	Single piston
Cylinder I.D.	Ø57.15 mm(2.25 in)
Rear brake(Disc)	
Type	Floating type with solid disc
Disc O.D.	262 mm (10.31 in)
Disc I.D.	185 mm (7.28 in)
Disc thickness	10 mm (0.39 in)
Pad thickness	10 mm (0.39 in)
Cylinder type	Single piston
Cylinder I.D.	Ø31.0 mm (1.22 in)
Parking brake	
Actuation	DIH (Drum in hat)
Type	Lever
Drum I.D.	168 mm(6.61 in)

NOTE

ABS : Anti-lock Brake System
CBS : Conventional Brake System

Service Standard

Item	Standard value
Standard value	
Brake pedal height	174.3 mm (6.86 in)
Brake pedal stroke	135 mm (5.31 in)
Stop lamp switch outer case to pedal stopper clearance	1.0 ~ 2.0 mm (0.04 ~ 0.08 in)
Brake pedal free play	3 ~ 8 mm (0.11 ~ 0.31 in)
Booster push rod to master cylinder piston clearance	0mm (at 500 mmHg vacuum)
Parking brake lever stroke when lever assembly is pulled with 196N (20Kg, 44lb force)	7 clicks
Front disc brake pad thickness	11 mm (0.43 in.)
Front disc thickness	26 mm (1.02 in)
Rear disc brake pad thickness	10 mm (0.4 in)
Rear disc brake disc thickness	10 mm (0.4 in)
Rear brake lining thickness	3.3 mm (0.13 in)

Tightening Torques

Item	N.m	kgf.m	lb-ft
Master cylinder to booster mounting nut	9.8 ~ 15.7	1.0 ~ 1.6	7.2 ~ 11.6
Brake booster mounting nut	12.7 ~ 15.7	1.3 ~ 1.6	9.4 ~ 11.6
Bleeder screw	6.9 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Brake tube to HECU(M10 nut)-ABS	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Brake tube to HECU(M12 nut)-ESC	18.6 ~ 22.6	1.9 ~ 2.3	13.7 ~ 16.6
Caliper guide rod bolt	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Caliper mounting bolt (Front)	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Caliper mounting bolt (Rear)	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Brake hose to caliper	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal member assembly bracket mounting nut (cowl side upper mounting)	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Brake pedal member bracket to booster mounting nut	12.7 ~ 15.7	1.3 ~ 1.6	9.4 ~ 11.6
Stop lamp switch mounting nut	7.9 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
HECU mounting bracket bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
HECU bracket mounting nut	5.9 ~ 9.8	0.6 ~ 1.0	4.3 ~ 7.2
Yaw rate & Lateral G sensor mounting bolt	5.0 ~ 8.0	0.51 ~ 0.81	3.7 ~ 5.8

Specification (ABS)

Part	Item		Standard value	Remark
HECU(Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor (Solenoid)	·ABS system:ABS & EBD control
	Type		Motor, valve relay intergrated type	
	Operating voltage		10 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 120 °C (-40 ~ 248 °F)	
Warning lamp	Operating voltage		12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, brake oil, EBD failure
	Current consumption		80 mA	
Acitve wheel speed sensor	Supply voltage		DC 4.5 ~ 20 V	
	Operating temperature		-40 ~ 150 °C (-40 ~ 302 °F)	
	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 ~ 2500 HZ	
	Air gap	Front	0.7 mm (0.027 in)	Typ.0.7 mm(0.03 in)
		Rear	0.5 mm (0.019 in)	Typ.0.7 mm(0.03 in)
	Tone wheel		46 teeth	
	Output duty		30~70 %	

Specification(ESC)

Part	Item	Standard Value	Remark

HECU(Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor (Solenoid)	·Total control(ABS, EBD, TCS, ESC)
	Type		Motor, valve relay intergrated type	
	Operating voltage		10 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 120 °C (-40 ~ 248 °F)	
Warning lamp	Operating voltage		12 V	·ESC Operating Lamp ·ESC Warning Lamp
	Current consumption		80 mA	
Active wheel speed sensor	Supply voltage		DC 4.5 ~ 20V	
	Operating temperature		-40 ~ 150 °C (-40 ~ 302 °F)	
	Output current low		5.9 ~ 8.4 mA	
	Output current high		11.8 ~ 16.8 mA	
	Tone wheel		46 teeth	
	Frequency range		1 ~ 2500 HZ	
	Airgap	Front	0.7 mm (0.027 in)	Typ.0.7 mm(0.03 in)
		Rear	0.5 mm (0.019 in)	Typ.0.7 mm(0.03 in)
Steering Wheel Angle Sensor	Operating Voltage		8V ~ 16 V	
	Current Consumption		Max 150 mA	
	Operating Angular velocity		Max ± 780 °/sec	
Yaw-rate & Lateral G sensor	Operating Voltage		8 V ~ 16 V	
	Current Consumption		Max. 120 mA	
	Yaw Sensor Operating Range		±100 ° /s	
	G Sensor Operating Range		±1.8 G	
	Recessive value		-500 ~ 50 mV	
	Dominant value		1.5 ~ 3 V	

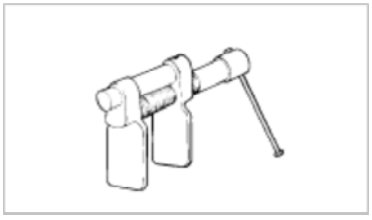
Lubricant

Item	Recommended lubricant	Quantity
Brake fluid	DOT 3 or DOT 4	As required
Brake pedal bushing and brake pedal bolt	Chassis grease	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease	As required
Front caliper guide rod bolt and boot	AI-11P grease	1.2 ~ 2.2g
Rear caliper guide rod and boot	AI-11P grease	1.0 ~ 2.0g (Trailing) 0.8 ~ 2.0g (Leading)

Brake System > General Information > Special Service Tools

Special Service Tools

Tool (Number and Name)	Illustration	Use

09581 - 11000 Piston expander		Pushing back of the front disc and rear disc brake piston

Brake System > General Information > Troubleshooting

Troubleshooting

Problem Symptoms Table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the like cause of the problem. Check each part in order. If necessary, replace these parts.

Symptom	Suspect Area	Remedy
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Master cylinder (Faulty)	Repair Air bleeding Replace Replace
Brake drag	1. Brake pedal free play (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Pad or lining (Cracked or distorted) 5. Piston (Stuck) 6. Piston (Frozen) 7. Return spring (Faulty) 8. Booster system (Vacuum leaks) 9. Master cylinder (Faulty)	Adjust Adjust Repair Replace Replace Replace Replace Replace Replace
Brake pull	1. Piston (sticking) 2. Pad or lining (Oily) 3. Piston (Frozen) 4. Disc (Scored) 5. Pad or lining (Cracked or distorted)	Replace Replace Replace Replace Replace
Hard pedal but brake inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Pad or lining (Oily) 6. Pad or lining (Glazed) 7. Disc (Scored) 8. Booster system (Vacuum leaks)	Repair Air bleeding Replace Replace Replace Replace Replace Replace
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Return spring (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage)	Replace Retighten Replace Replace Clean Replace Replace Replace Replace
Brake fades	1. Master cylinder	Replace
Brake vibration,	1. Disc (Excessive thickness variation)	Replace

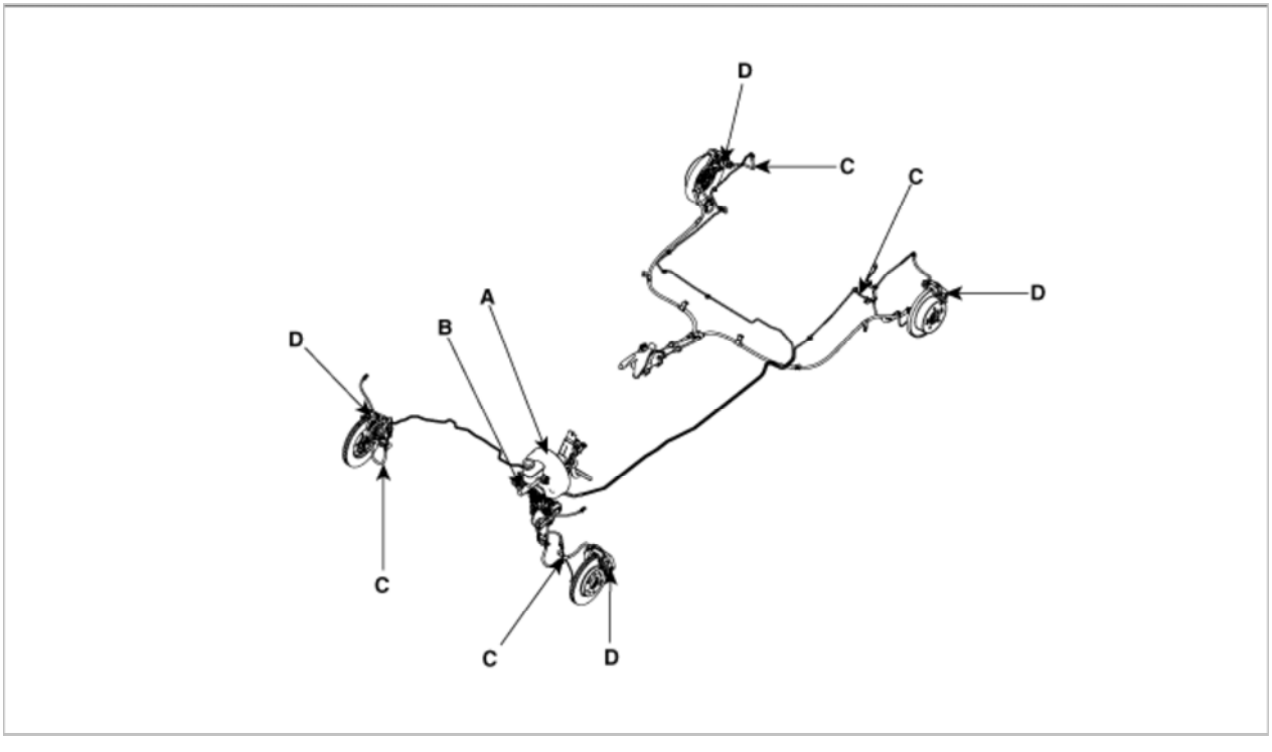
pulsation	2. Disc (Faulty run-out) 3. Disc (Uneven worn or crack) 4. Pad or lining (Uneven worn and contact) 5. Caliper (Faulty pad sliding)	Replace Replace Replace Replace
Brake chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

Brake System > Brake System > Repair procedures

Operation and Leakage Check

Check all of the Following Items:

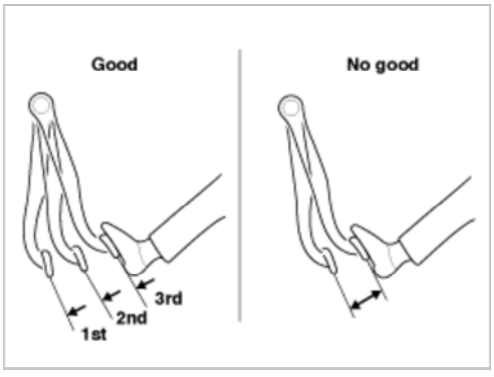
Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage.
	Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled.



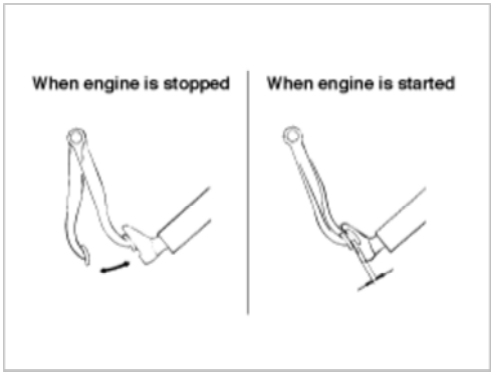
Brake Booster Operating Test

For simple checking of the brake booster operation, carry out the following tests :

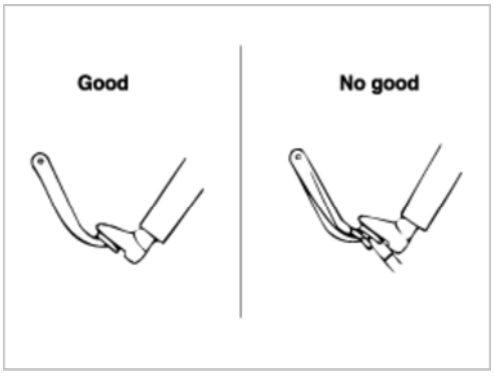
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is defective.



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.



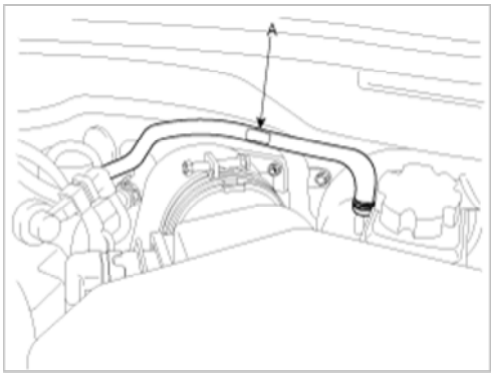
3. With the engine running, step on the brake pedal and then stop the engine. Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective. If the above three tests are okay, the booster performance can be 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 .
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.

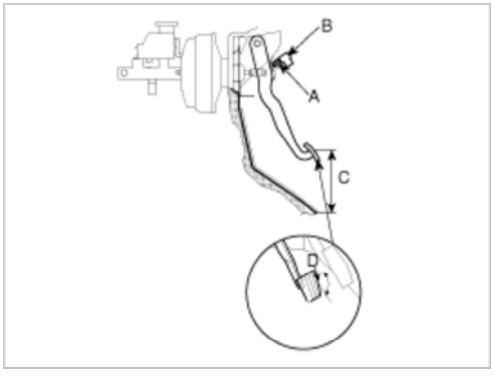


Brake Pedal & Brake Switch Adjustment

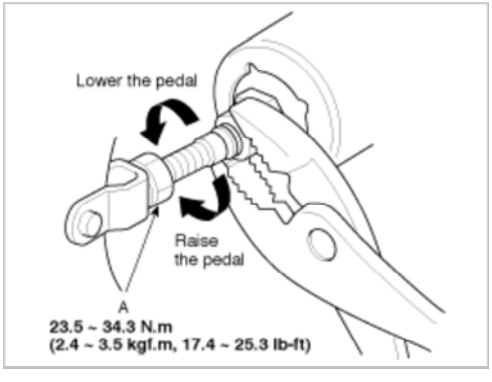
Pedal Height

1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and brake off the brake switch (B) until it is no longer touching the brake pedal.
2. Measure the pedal height (C) from the middle of the left-side center of the pedal pad (D).

Standard pedal height (on the carpet) :
174.3 mm (6.86 in)

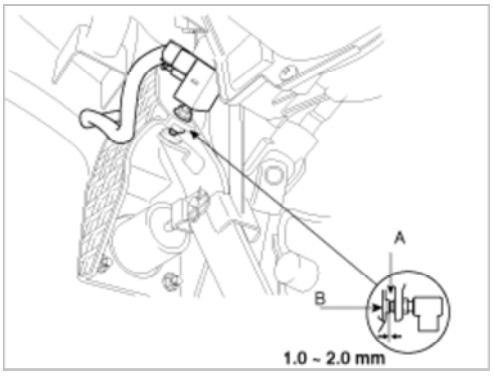


3. Loosen the pushrod locknut (A), and screw the pushrod in or out with pliers until the standard pedal height from the floor is reached. After adjustment, tighten the locknut firmly. Do not adjust the pedal height with the pushrod depressed.



Stop Lamp Switch Clearance

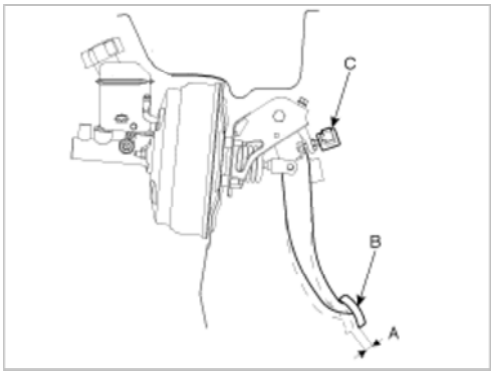
Screw in the stop lamp switch until its switch rod is fully depressed (threded end (A) touching the pad (B) on the pedal arm) then brake off the switch 3/4 turn to make 1.0~2.0 mm(0.04~0.08 in.) of clearance between the stop lamp switch pad. Make sure that the brake lights go off when the pedal is released.



Pedal Free Play

1. With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal(B) down by hand, and confirm that the amount of movement(A) before resistance is met (the free play) is within the standard value.

Standard value : 3 ~ 8 mm (0.117 - 0.312 in.)

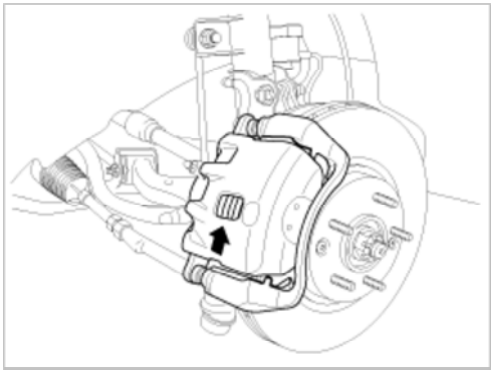


2. If free play does not reach the standard value, check that clearance between the outer case of stop lamp switch(C) and brake pedal is within the standard value. If free play exceeds the standard value, it is probably due to excessive clearance between the clevis pin and brake pedal arm. Check for excessive clearance and replace faulty parts as required.
3. Start the engine, depress the brake pedal with approximately 120kg(1176.8N, 264.5 lb) of force, and check for oil leakage in the master cylinder, brake line and each connecting part. Repair the faulty parts as required.

Inspection of Front Disc Brake Pad

1. Check the brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 11.0 mm (0.43 in.)
Service limit : 2.0 mm (0.0787 in.)



CAUTION

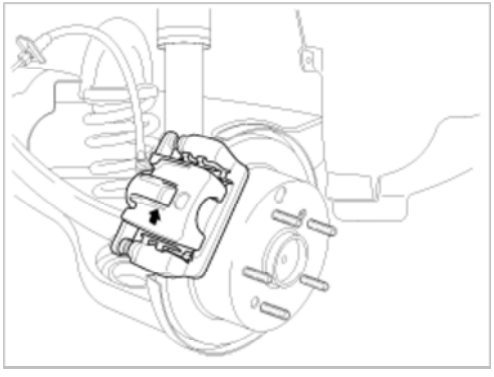
- If the pad lining thickness is out of specification, left and right pads must be replaced as a complete set.
- When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston

and the guide rod.

Inspection of Rear Disc Brake Pad

1. Check the brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 10.0 mm (0.39 in.)
Service limit : 2.0 mm (0.0787 in.)

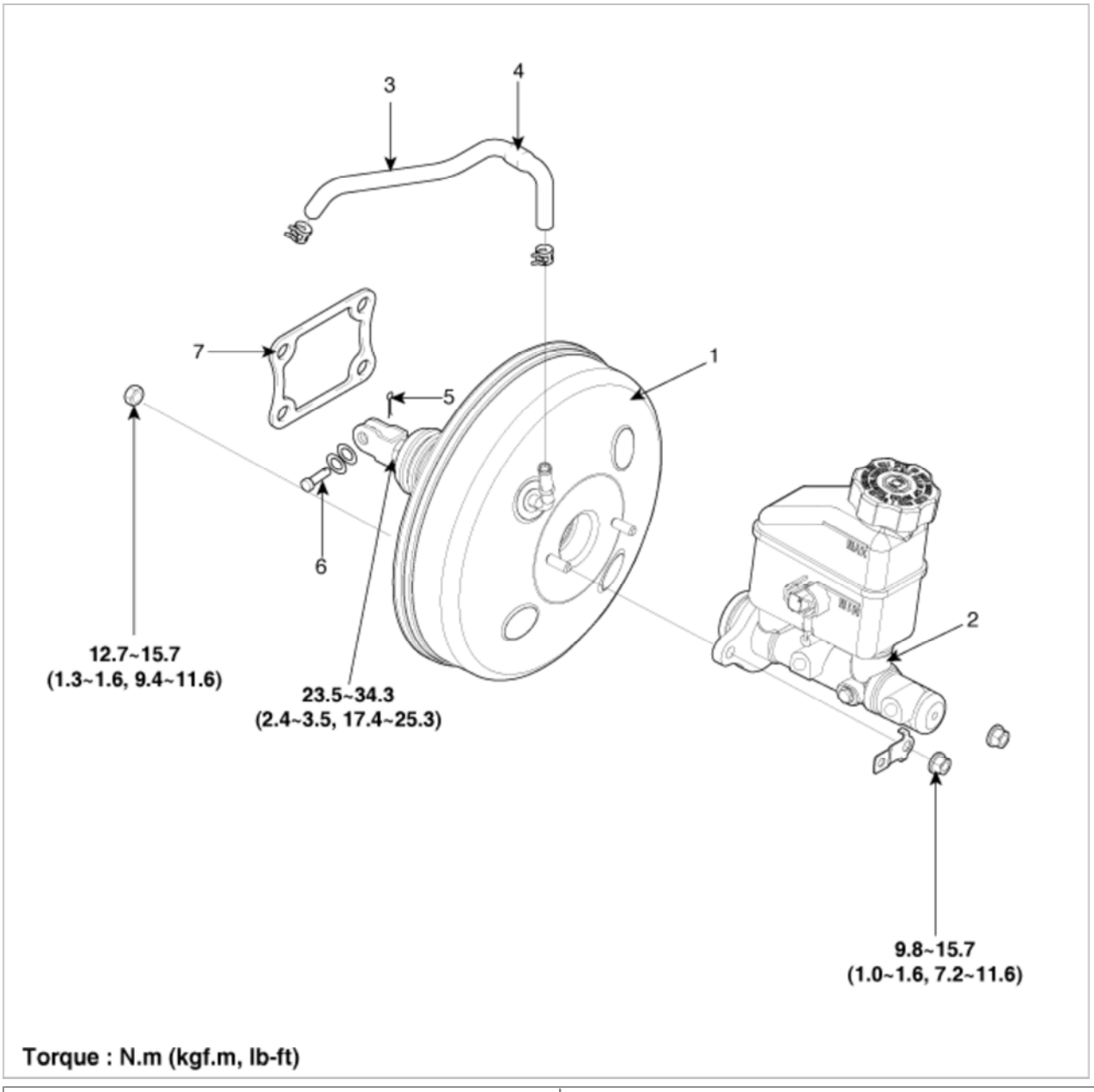


CAUTION

- 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

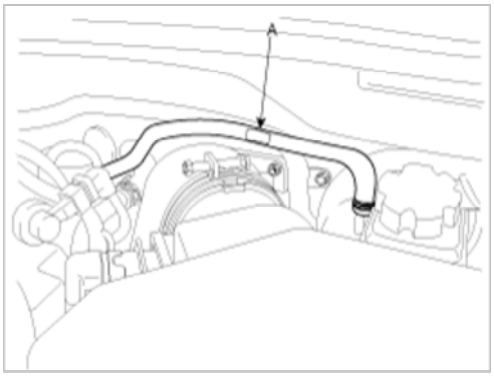


1. Brake booster 2. Master cylinder 3. Vaccum hose 4. Check valve	5. Snap pin 6. Clevis pin 7. Seal

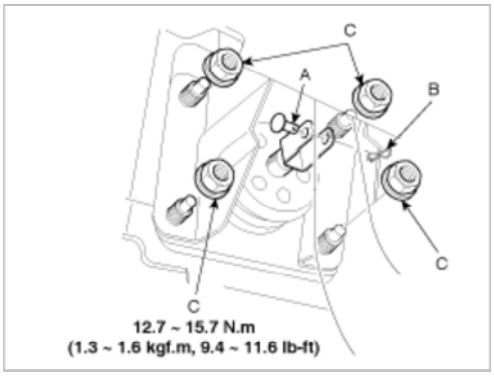
Brake System > Brake System > Brake Booster > Repair procedures

Removal

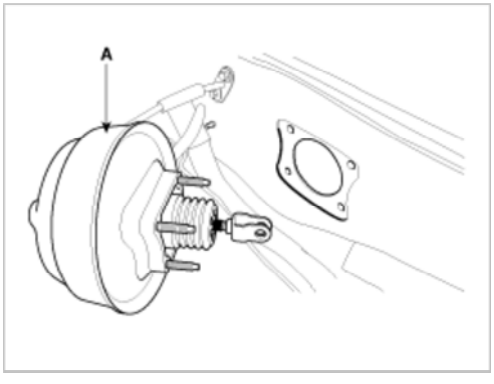
1. Disconnect the vacuum hose (B) from the brake booster (A).



2. Remove the master cylinder.
   (Refer to "Master cylinder - Removal")
3. Remove the clevis pin (A) and snap pin (B).



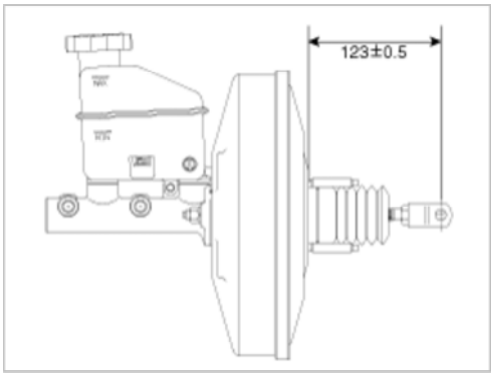
4. Remove the four booster mounting nuts (C).
5. Remove the brake booster (A) from the engine compartment.



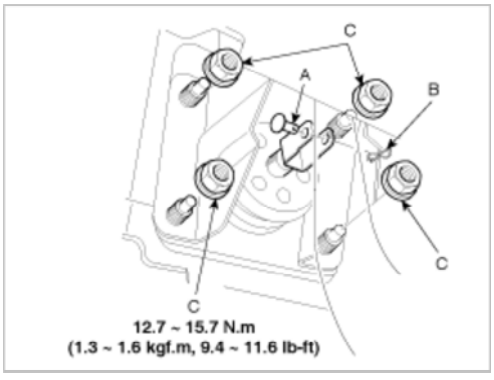
Installation

1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length(A) : 123 ± 0.5 mm (4.84 ± 0.02 in)



2. Insert the booster and tighten the nuts (C).



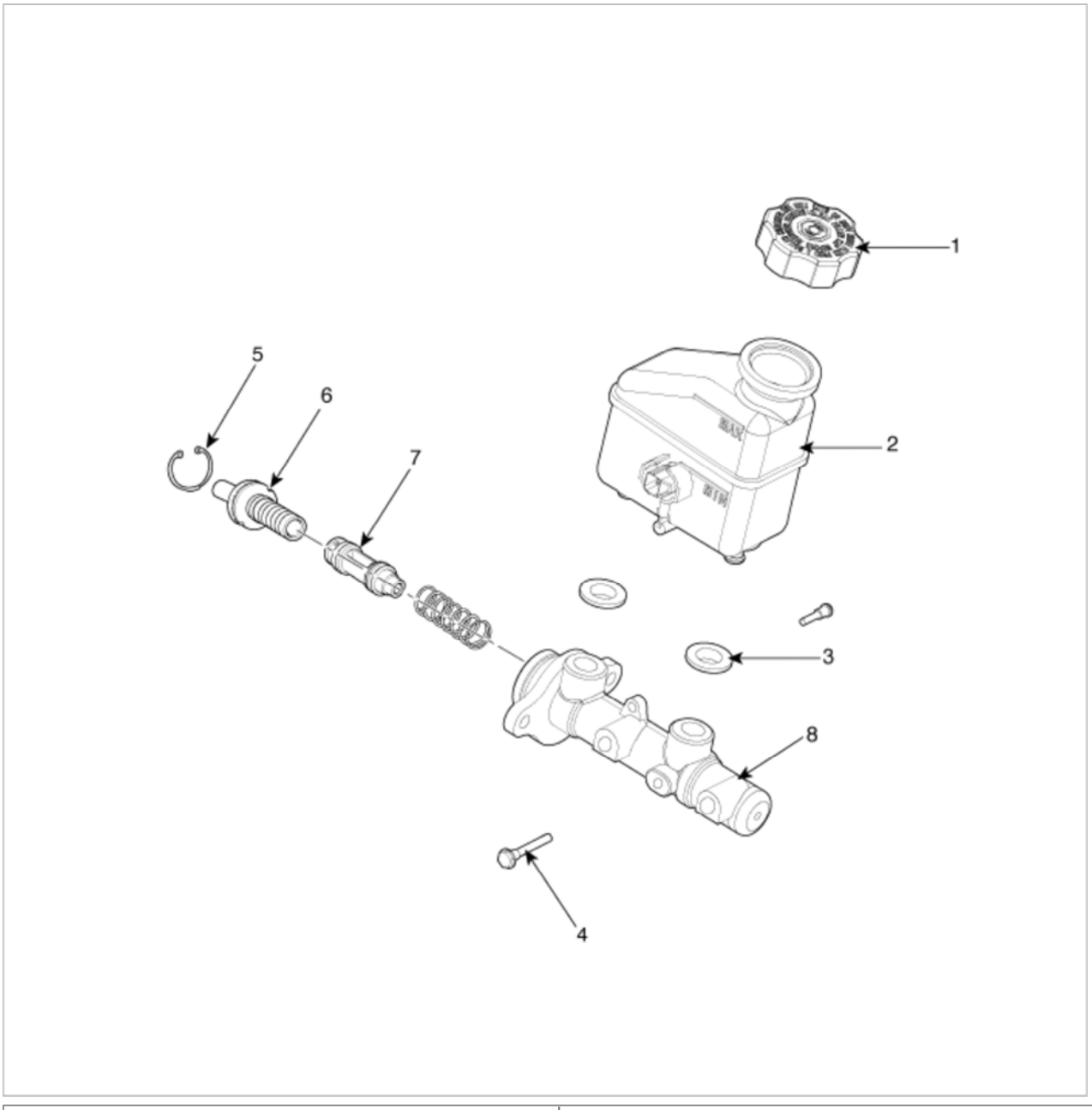
3. Connect the booster push rod and brake pedal with a clevis pin (A) and install a snap pin (B) to the clevis pin (A).

> CAUTION
>
> Grease the pin before installing the snap pin.
> Always use a new snap pin.

4. Install the master cylinder, then install the brake tubes to the master cylinder.
5. Connect the vacuum hose to the brake booster.
6. After filling the brake reservoir with brake fluid, bleed the system.
7. Check for fluid leakage.
8. Check and adjust the brake pedal for proper operation.

Brake System > Brake System > Master Cylinder > Components and Components Location

Components

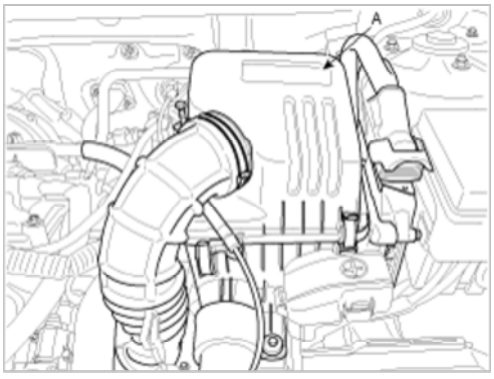


1. Reservoir cap	5. Retainer
2. Reservoir	6. Primary piston assembly
3. Grommet	7. Secondary piston assembly
4. Cylinder pin	8. Master cylinder body

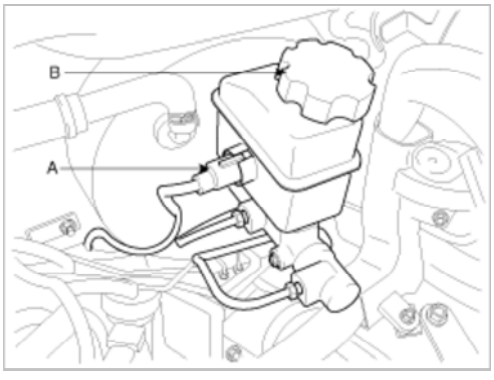
Brake System > Brake System > Master Cylinder > Repair procedures

Removal

1. Remove air cleaner assembly (A). (Refer to EM Gr.)



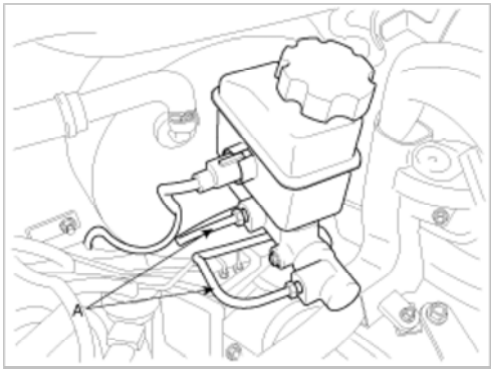
2. Disconnect the brake fluid level switch connector (A), and remove the reservoir cap (B).



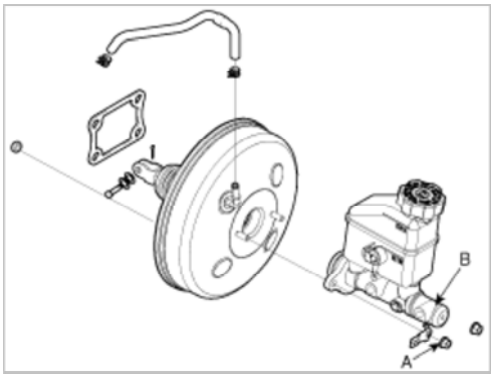
3. Remove the brake fluid from the master cylinder reservoir with a syringe.

> **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.

4. Disconnect the brake lines (A) from the master cylinder. To prevent spills, cover the hose joints with rags or shop towels.



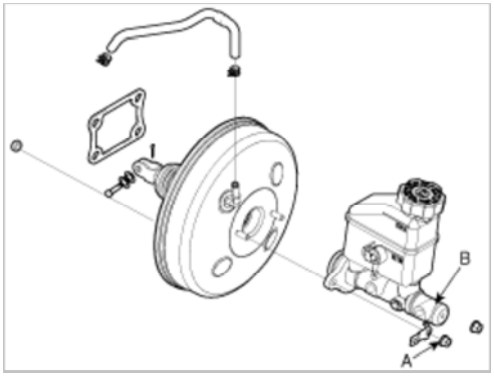
5. Remove the master cylinder mounting nuts (A) and washers.
6. Remove the master cylinder (B) from the brake booster. Be careful not to bend or damage the brake lines when removing the master cylinder.



Installation

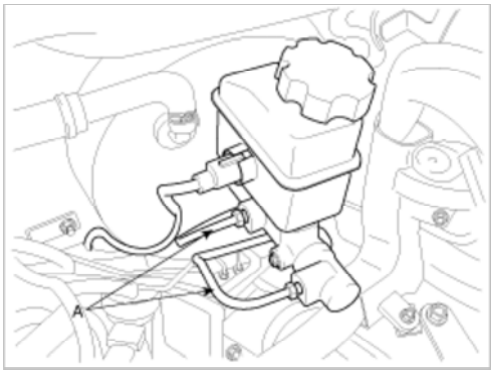
1. Install the master cylinder (B) to the brake booster.
2. Install the master cylinder mounting nuts (A) and washers.

Tightening torque :
9.8~15.7N.m (1.0~1.6kgf.m, 7.2~11.6lb-ft)

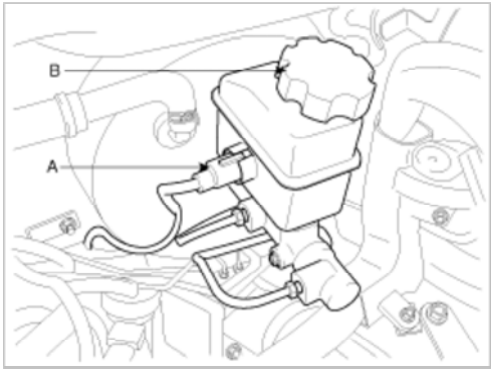


3. Connect the brake lines (A) to the master cylinder.

Tightening torque :
12.7~16.7N.m (1.3~1.7kgf.m, 9.4~12.3lb-ft) - M10
18.6~22.6N.m (1.9~2.3kgf.m, 13.7~18.6lb-ft) - M12



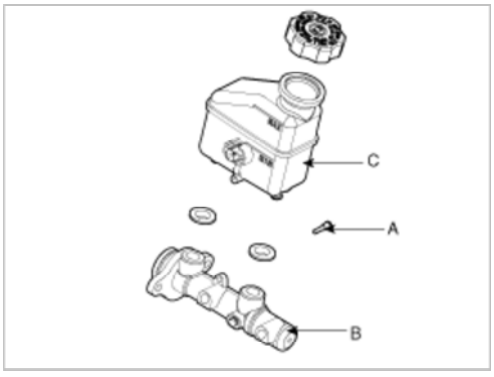
4. Connect the brake fluid level switch connector (A).



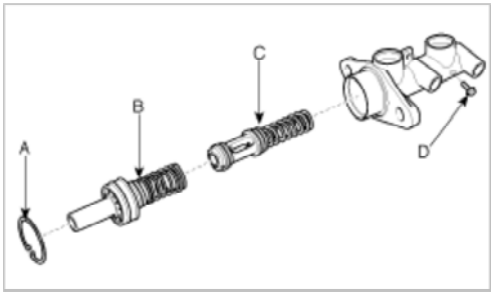
5. Refill the master cylinder reservoir to the MAX line.
6. Bleed the brake system. (Refer to "Bleeding of brake system")

Disassembly

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the reservoir (C) from the master cylinder (B) after remove the mounting screw (A).



3. Remove the retainer ring (A) by using the snap ring pliers.
4. Remove the primary piston assembly (B).
5. Remove the pin (D) with the secondary piston (C) pushed completely using a screwdriver. Remove the secondary piston assembly (C).



NOTE

Do not disassemble the primary and secondary piston assembly.

Inspection

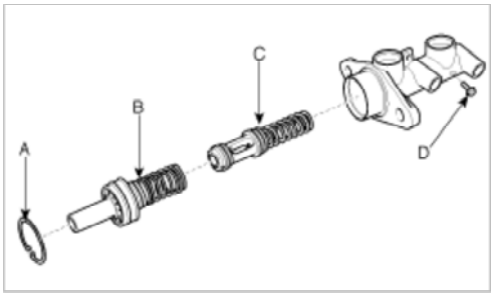
1. Check the master cylinder bore for rust or scratch.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

CAUTION

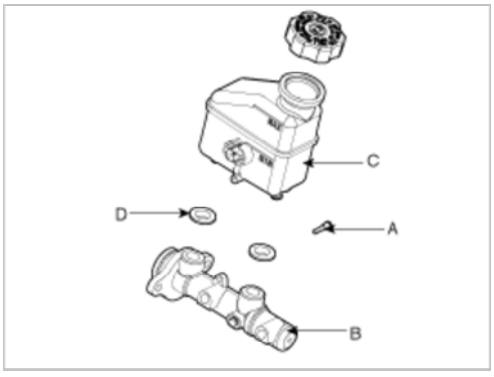
1. If the cylinder bore is damaged, replace the master cylinder assembly.
2. Wash the contaminated parts in alcohol.

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 secondary piston (C) with a screwdriver and install the cylinder pin (D).

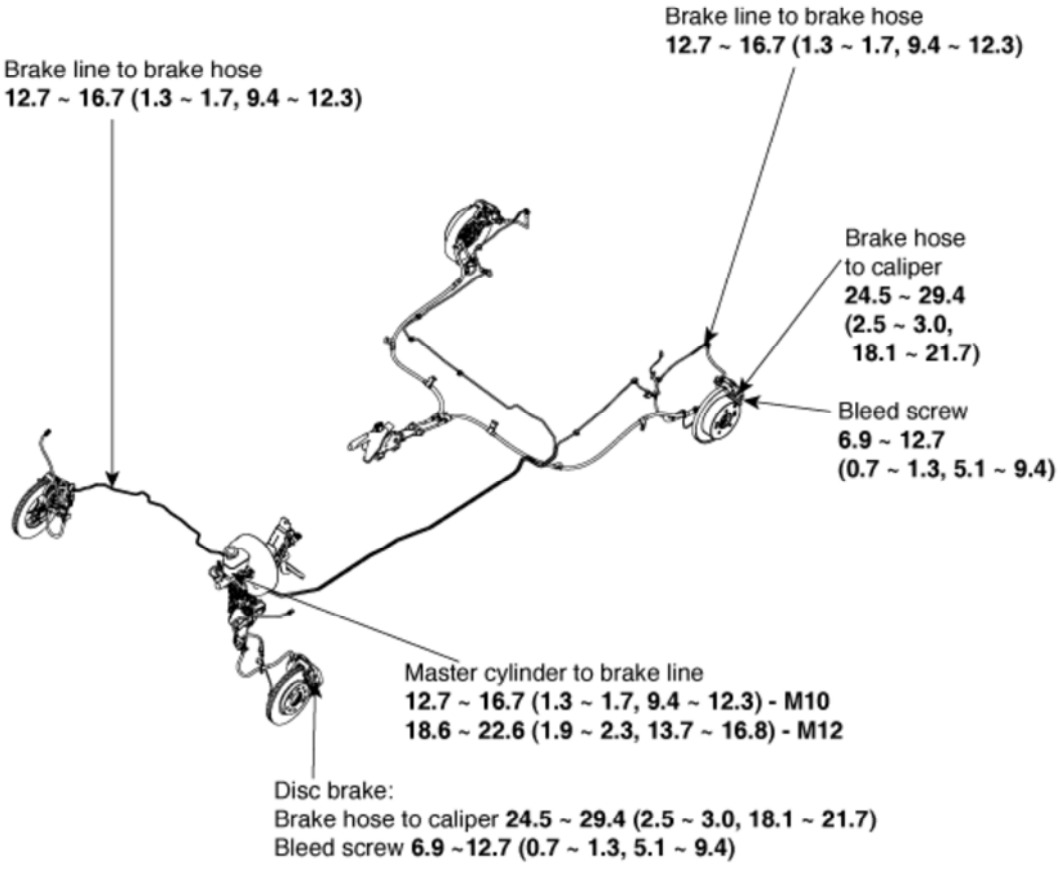


4. Install the primary piston assembly (B) and the retainer ring (A).
5. Mount two grommets (D).
6. Install the reservoir (C) to the master cylinder (B) and tighten the screw (A).



Brake System > Brake System > Brake Line > Components and Components Location

Components

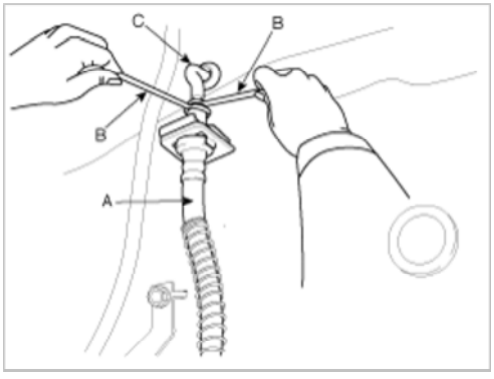


Torque : N.m (kgf.m, lb-ft)

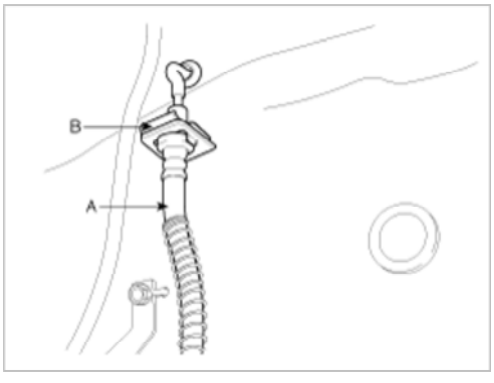
Brake System > Brake System > Brake Line > Repair procedures

Removal

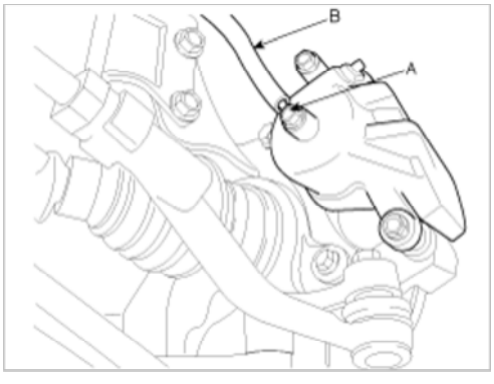
1. Disconnect the brake hose (C) from the brake line (A) using a flare-nut wrench (B).



2. Remove the brake hose clip (B), and then remove the brake hose (A).



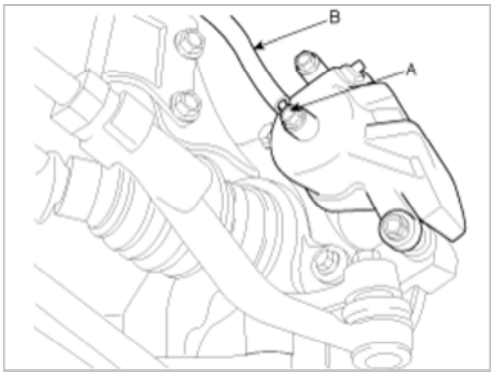
3. Remove the connector bolt (A) from the caliper, and disconnect the brake hose (B) from the caliper.



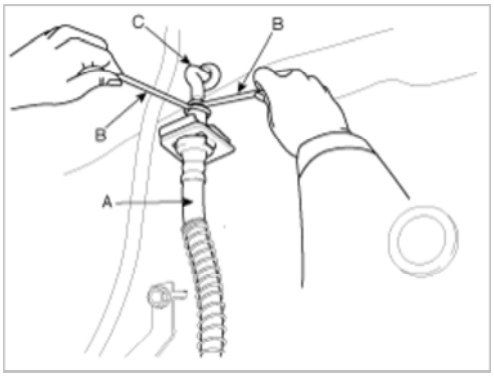
Installation

1. Install a brake hose (B) on the caliper with tightening brake hose bolt (A) and washer.

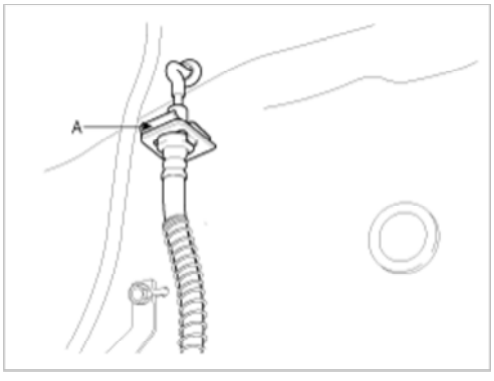
Tightening torque :
24.5 ~ 29.4N.m (2.5 ~ 3.0kgf.m, 18.1 ~ 21.7lb-ft)



2. Connect the brake hose (A) to the brake line (C) using a flare-nut wrench (B).



3. Install the brake hose clip (A) to the brake hose bracket.



4. After installing the brake hose, bleed the brake system.

> **CAUTION**
>
> - Check the brake hoses for interference and twisting.
> - Check the brake hose and line joint for leaks, and tighten if necessary.

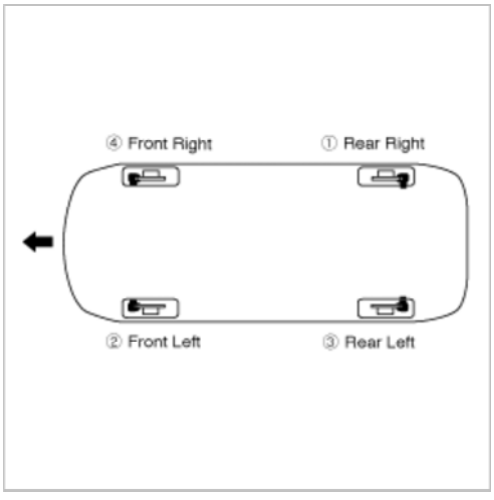
Inspection

1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damaged and oil leakage.
3. Check the brake tube flare nuts for damage and oil leakage.

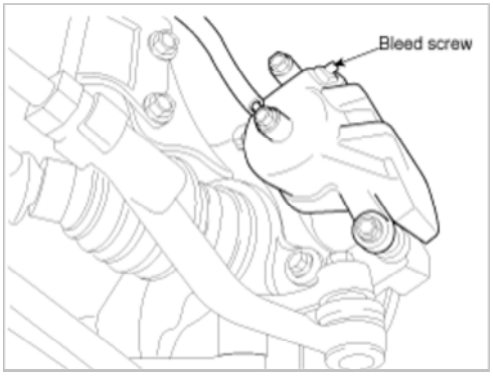
Brake System Bleeding

> **NOTE**
>
> - Do not reuse the drained fluid.
> - Always use Genuine DOT3/DOT4 or Brake Fluid. Using a non-Genuine DOT3/DOT4 or brake fluid can cause corrosion and decrease the life of the system.
> - Make sure no dirt of other foreign matter is allowed to contaminate the brake fluid.
> - Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
> - The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

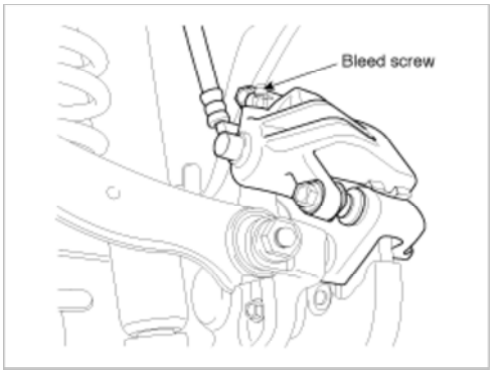
1. Make sure the brake fluid level in the reservoir is at the MAX (upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply steady pressure.
3. Loosen the right-rear brake bleed screw to allow air to escape from the system. Then tighten the bleed screw securely.
4. Repeat the procedure for each wheel in the sequence shown below until air bubbles no longer appear in the fluid.
5. Refill the master cylinder reservoir to the MAX (upper) level line.



Front disc brake :

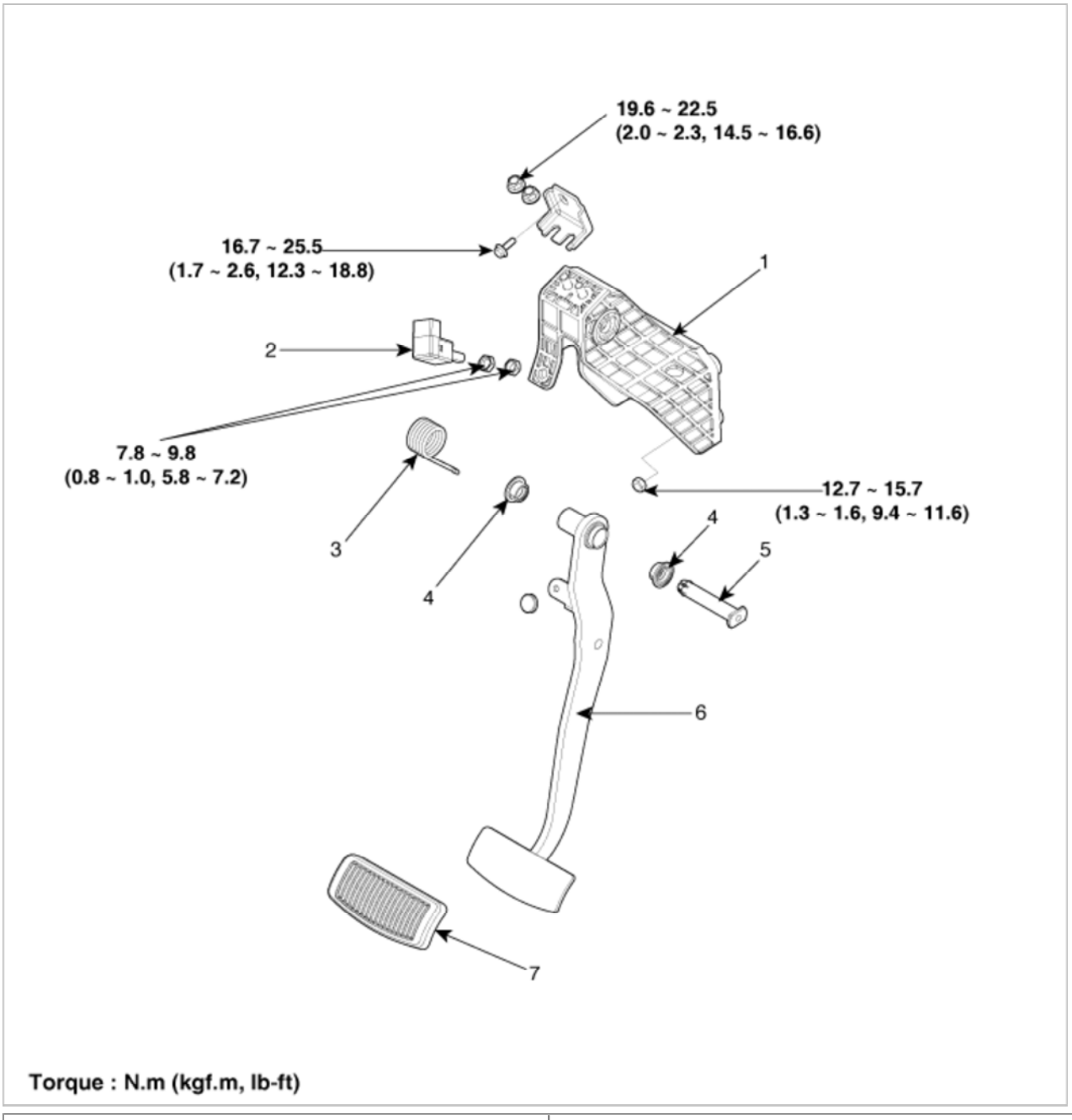


Rear disc brake



Brake System > Brake System > Brake Pedal > Components and Components Location

Components(1)

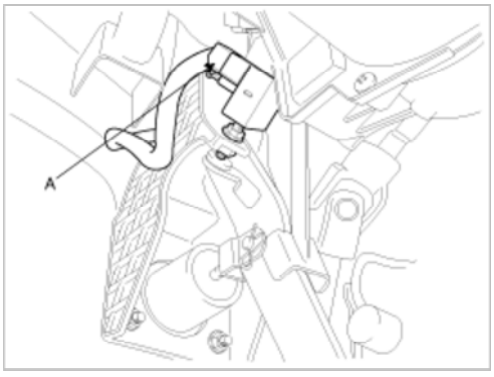


1. Member assembly bracket 2. Stop lamp switch 3. Return spring	4. Bushing 5. Brake pedal

Brake System > Brake System > Brake Pedal > Repair procedures

Removal

1. Remove the lower crash pad.(Refer to BD "crash pad")
2. Pull down steering column shaft after removing 4 bolts.
3. Remove the stop lamp switch connector (A).

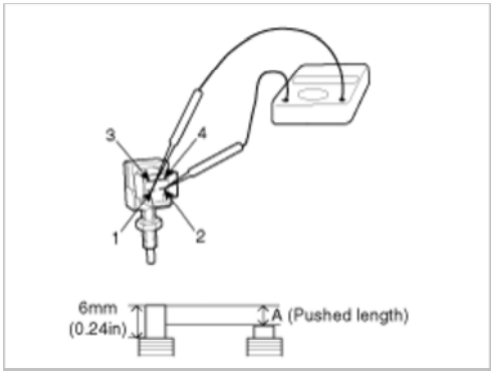


4. Remove the clevis pin and snap pin.
5. Remove the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

Inspection

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting
3. Check all parts for crack and wear.
4. Check the stop lamp switch.
   (1) Connect a circuit tester to the connector (1-2 terminals) of stop lamp switch, and check whether or not there is continuity when the switch rod of the stop lamp switch is pushed in and when it is released.
   (2) The stop lamp switch is in good condition if there is no continuity when the switch rod is pushed.

Item	Terminal	Pushed length(A)	Continuity
Stop lamp switch	1-2	2.3±0.25mm (0.09±0.01in)	ON→OFF
Cruise control switch	3-4	1.8±0.25mm (0.07±0.01in)	OFF→ON



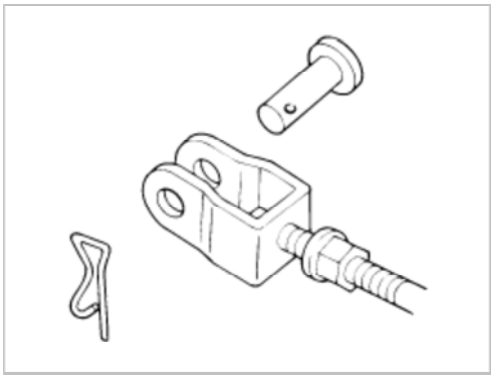
Installation

1. Installation is the reverse of removal.

Grease : LiG-2

> CAUTION
>
> Coat the inner surface of the bushings with the specified grease.

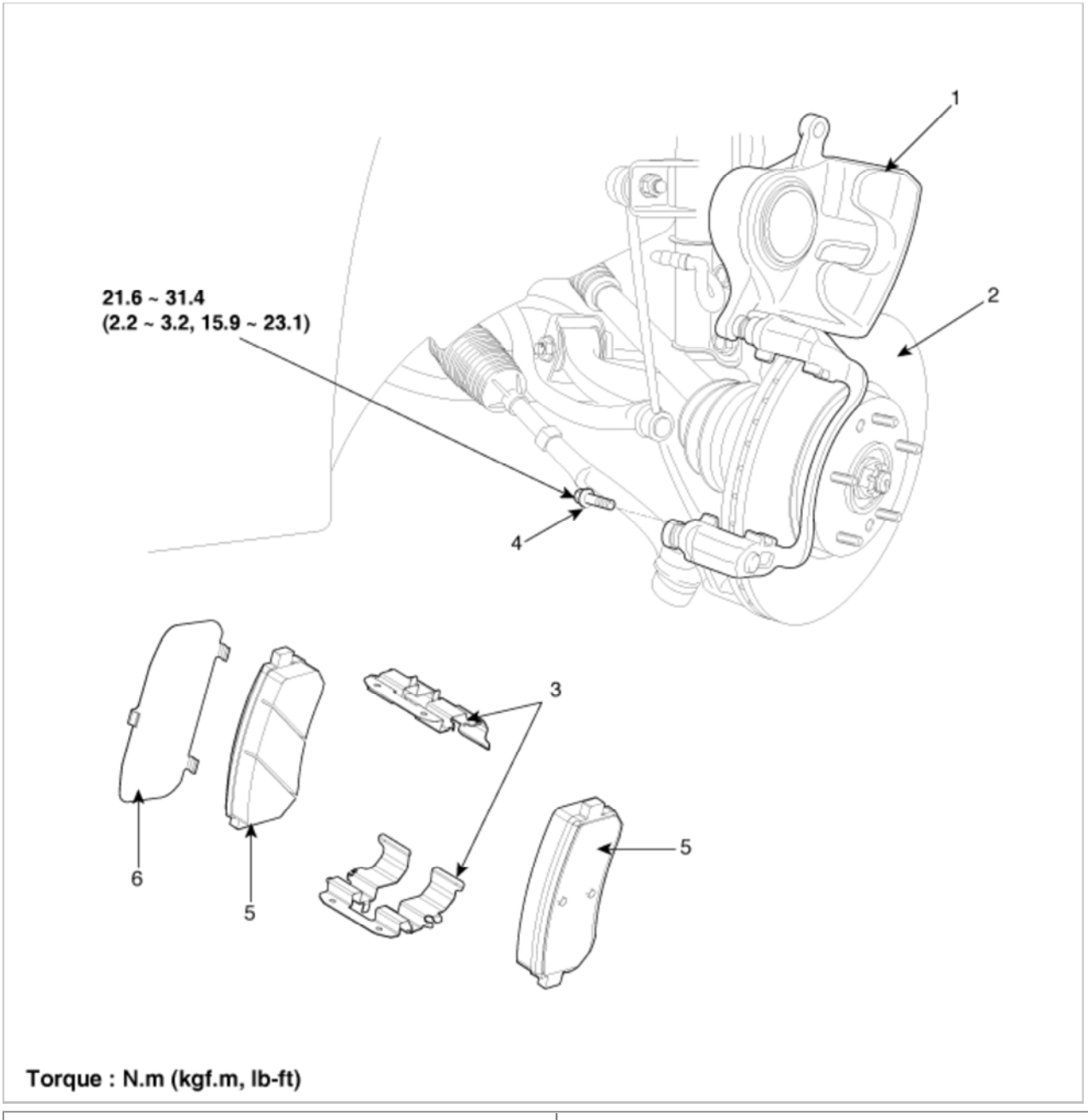
2. Before inserting the pin, apply the specified grease to the joint pin.



3. Adjust the brake pedal height and free play.(Refer to "Brake pedal & stop lamp switch adjustment")
4. Install the stop lamp switch.

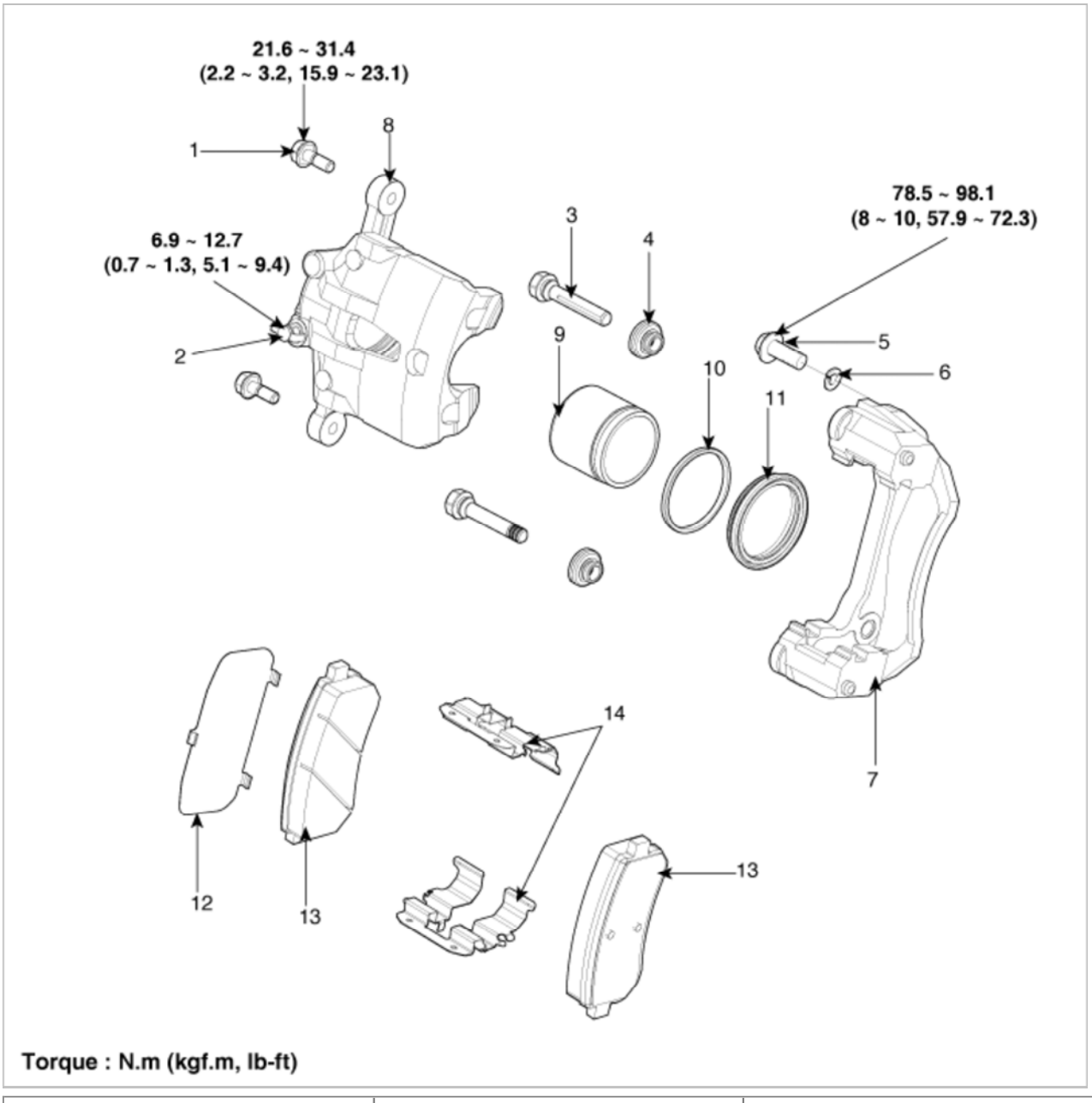
Brake System > Brake System > Front Disc Brake > Components and Components Location

Components(1)



1. Brake caliper 2. Brake disc 3. Pad spring	4. Guide rod bolt 5. Brake pad 6. Brake pad shim

Components(2)

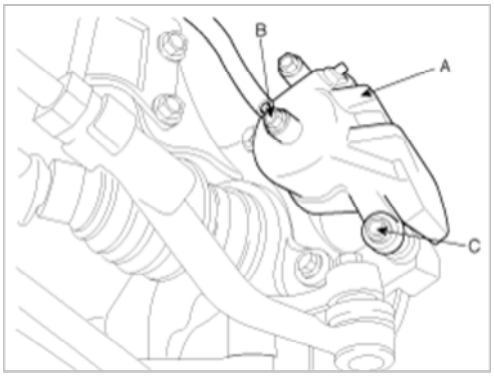


1. Guide rod bolt 2. Bleeder screw 3. Guide rod 4. Boot 5. Caliper mounting bolt	6. Washer 7. Caliper carrier 8. Caliper housing 9. Piston 10. Piston seal	11. Piston boot 12. Shim 13. Brake pad 14. Pad spring

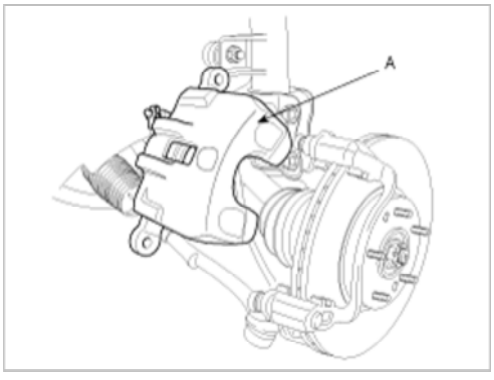
Brake System > Brake System > Front Disc Brake > Repair procedures

Removal

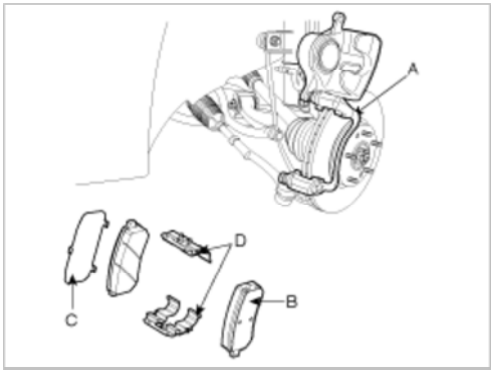
1. Remove the brake hose bolt (B) and the guide rod bolts (C) from the caliper assembly (A).



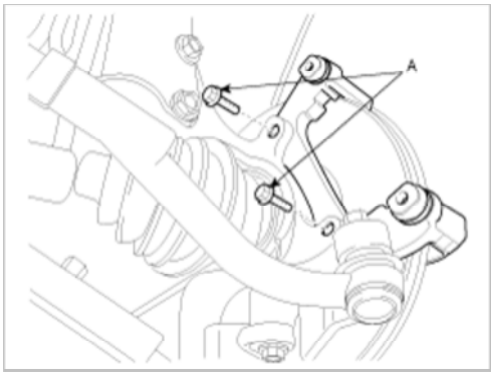
2. Remove the caliper assembly (A).

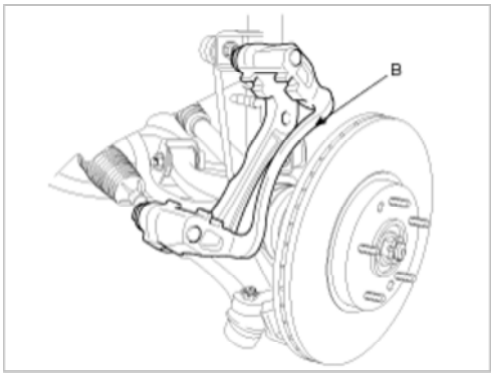


3. Remove the pads (B), the pad shims (C) and the pad springs (D) from the caliper carrier (A).

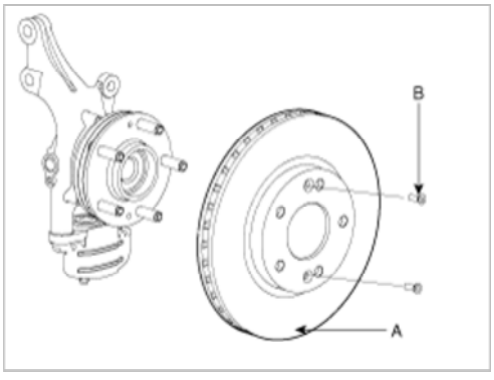


4. Remove the caliper carrier (B) and the caliper mounting bolts (A).



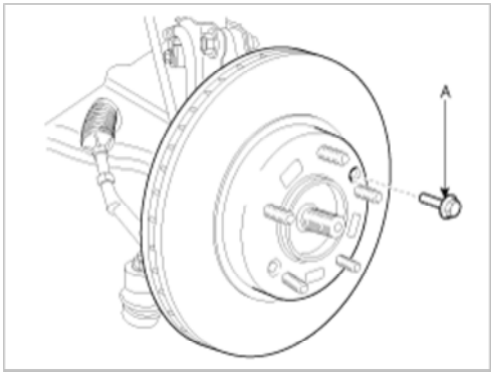


5. Remove the brake disc (A) and the screw (B).



NOTE

Remove the brake disc from hub using M8 bolt (A) if the brake disc has been seized with the hub due to corrosion or overheat.
Be careful not to use the hammer. The disc can be damaged if you remove the disc from the hub by hammer.

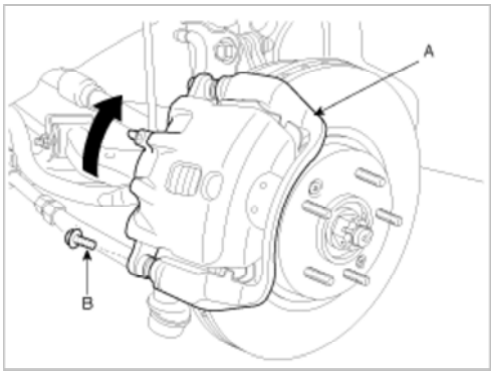


Replacement

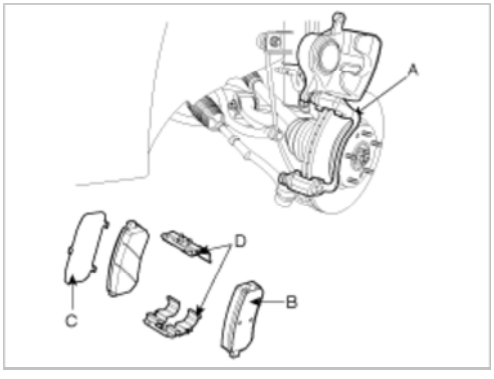
CAUTION

Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use on air hose or brush to clean brake assemblies.

1. Remove guide rod bolt (B) and raise the caliper assembly (A).



2. Remove the pads (B), the pad shims (C) and the pad springs (D) from the caliper carrier (A).

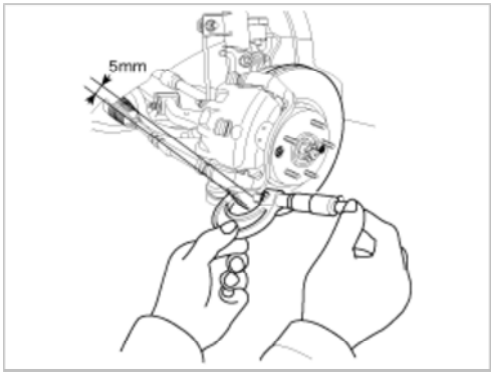


Inspection

Front Brake Disc Thickness Check

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 positions at least.

Front brake disc thickness
Standard value : 26.0 mm (1.02 in)
Limit : 24.0 mm (0.94 in)

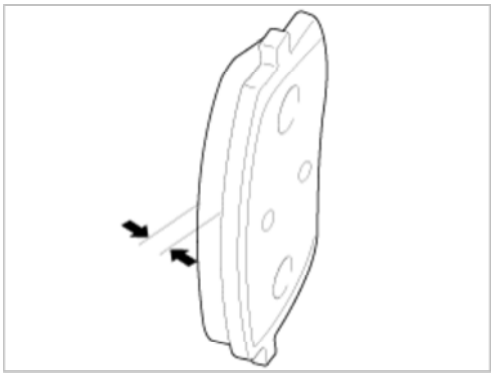


2. Thickness variation should not exceed 0.005 mm (0.0002in) (circumference) and 0.01 mm(0.0004 in) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assemblies for left and right of the vehicle.

Front Brake Pad Check

1. Check the pad wear. Measure the pad thickness. replace it if it is less than the specified value.

Pad thickness
Standard value : 11.0 mm (0.43 in)
Service limit : 2.0 mm (0.0787 in)

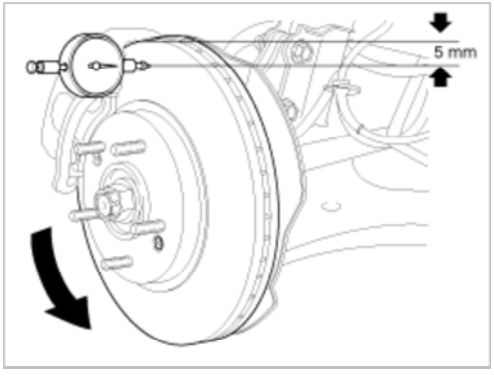


2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

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 : 0.04 mm (0.0020 in) or less

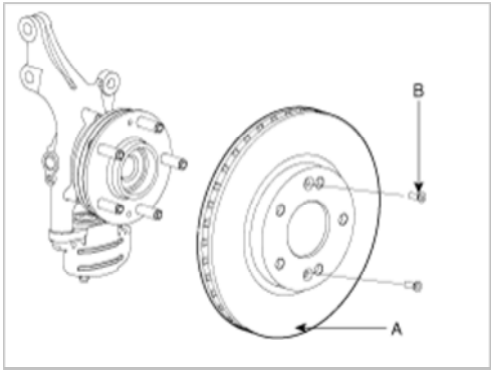


2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it and then check the run out of the brake disc again.
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

Installation

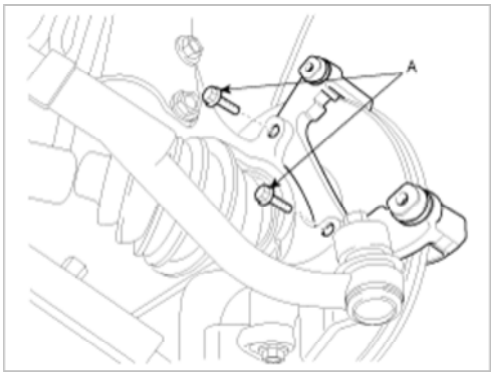
1. Install the brake disc (A) and tighten the screw (B).

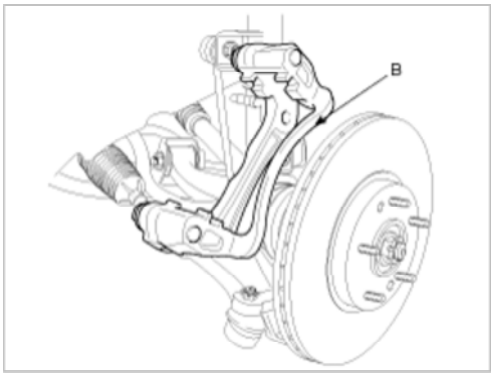
Tightening torque :
4.9~5.9N.m (0.5~0.6kgf.m, 3.6~4.3lb-ft)



2. Install the caliper carrier (B) and tighten the caliper mounting bolts (A).

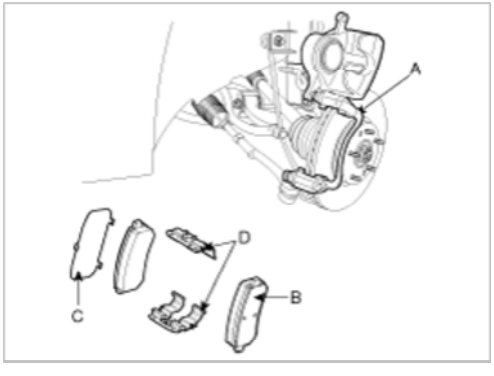
Tightening torque :
78.5~98.1N.m (8.0~10.0kgf.m, 57.9~72.3lb-ft)



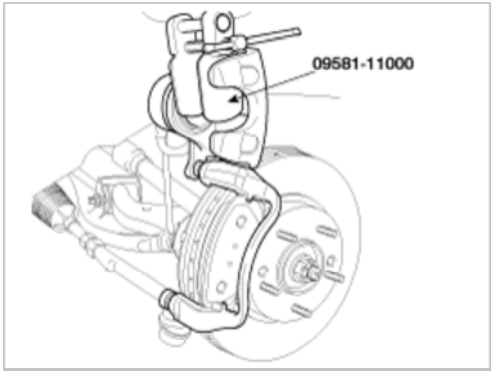


3. Install the pad springs (D) to the caliper carrier (A).
4. Install the brake pads (B) and pad shims (C) on the pad springs correctly. Install the pad with the wear indicator on the inside. If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.

> **NOTE**
>
> 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.



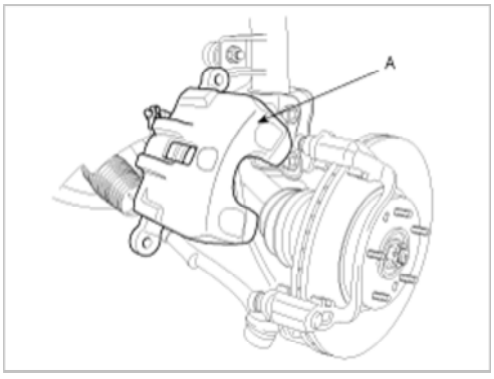
5. Push in the piston using the SST(09581-11000) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when installing the caliper.



6. Install the caliper assembly(A).

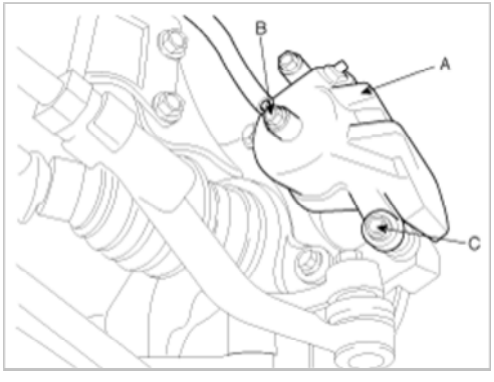
NOTE

Be careful not to damage the piston pin boot and piston boot.



7. Install the brake hose bolt (B) and the guide rod bolts (C) to the caliper assembly (A).

Tightening torque :
Bolt (B) : 24.5~29.4N.m (2.5~3.0kgf.m, 18.1~21.7lb-ft)
Bolt (C) : 21.6~31.4N.m (2.2~3.2kgf.m, 15.9~23.1lb-ft)



8. Refill the master cylinder reservoir to the MAX line.
9. Bleed the brake system. (Refer to "Bleeding of brake system")
10. Depress the brake pedal several times to make sure the brakes work, then test-drive.

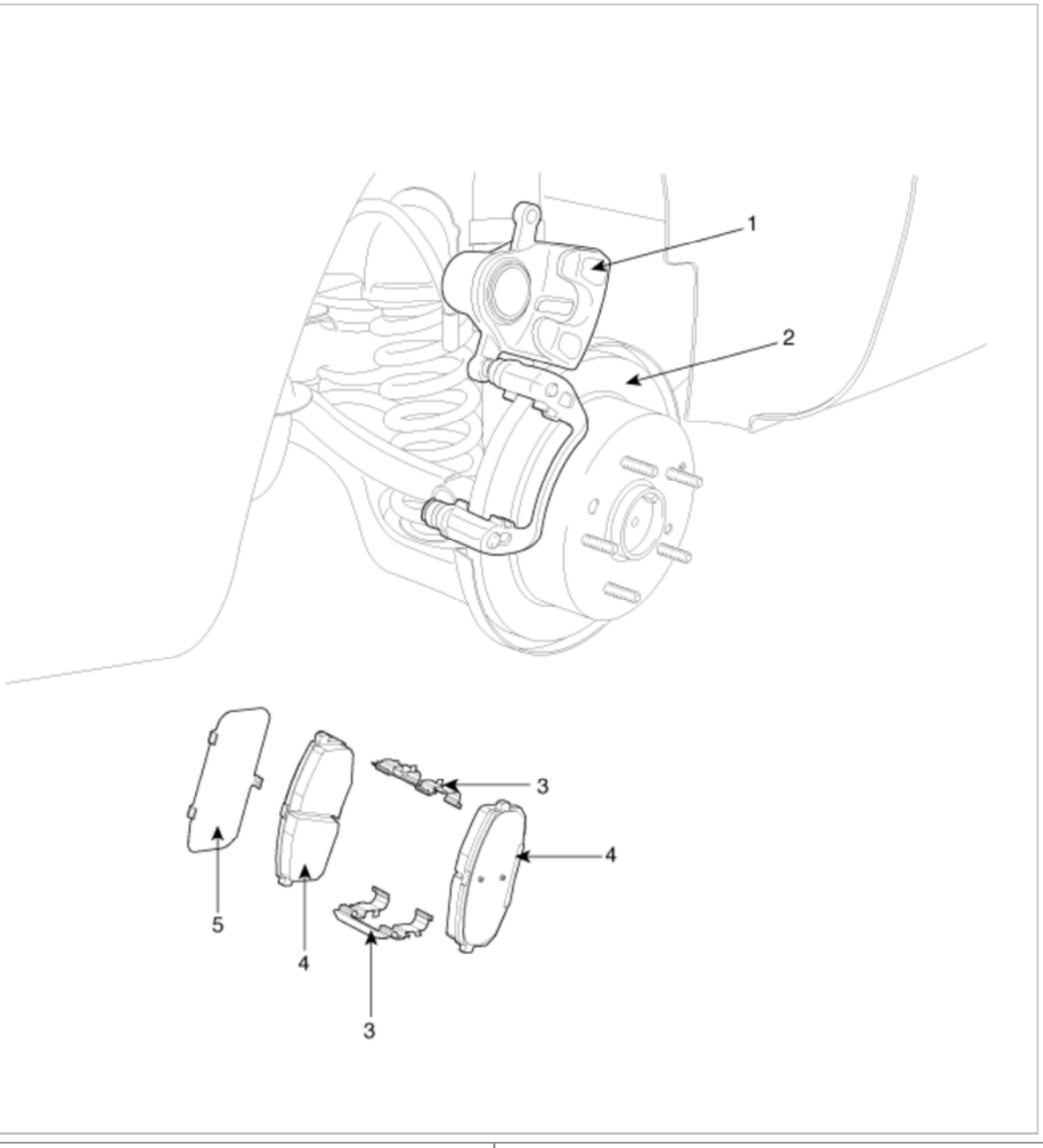
NOTE

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.

11. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

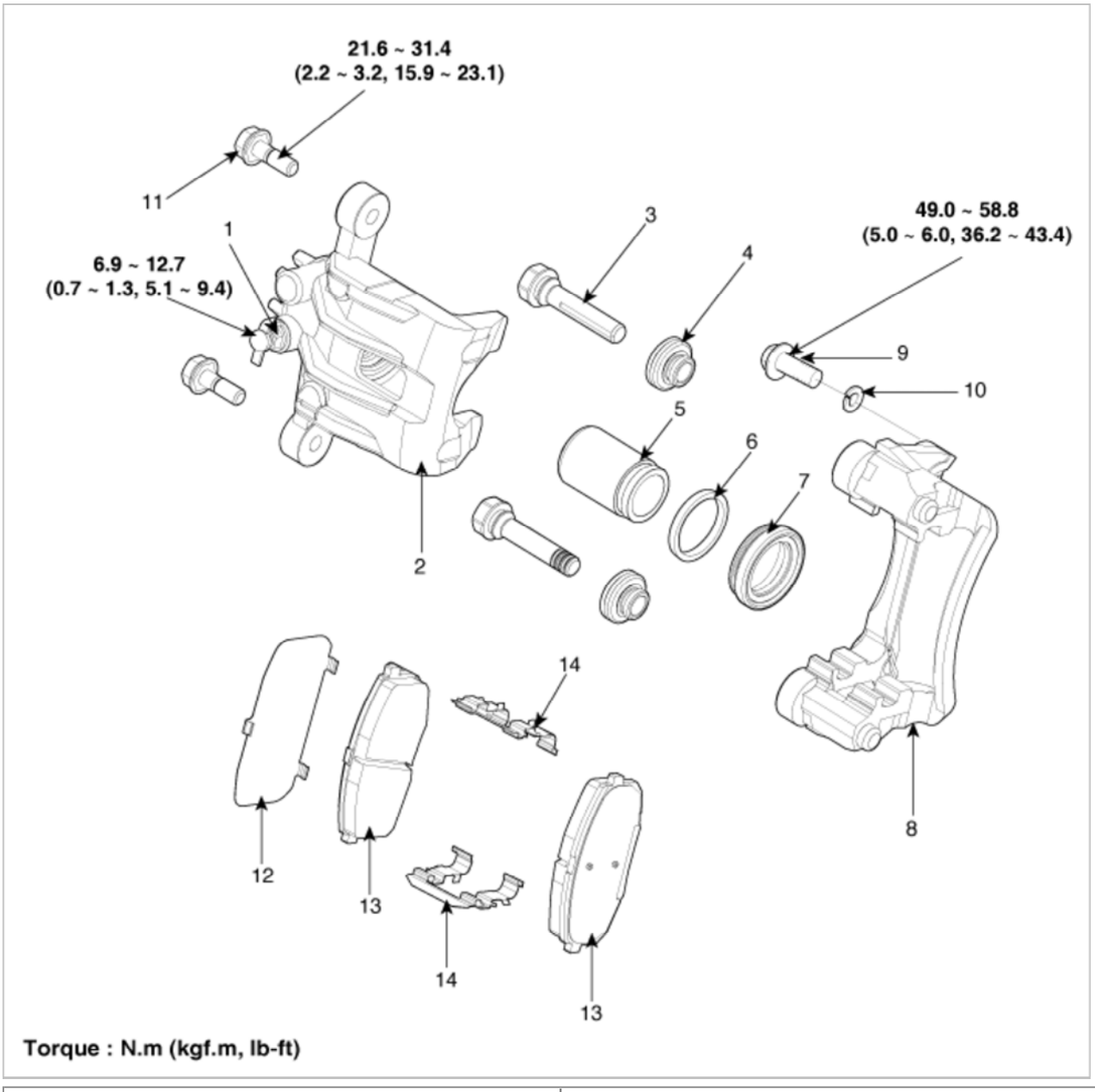
Brake System > Brake System > Rear Disc Brake > Components and Components Location

Component Location



1. Brake caliper 2. Brake disc 3. Pad spring	4. Brake pad 5. Brake pad shim

Components

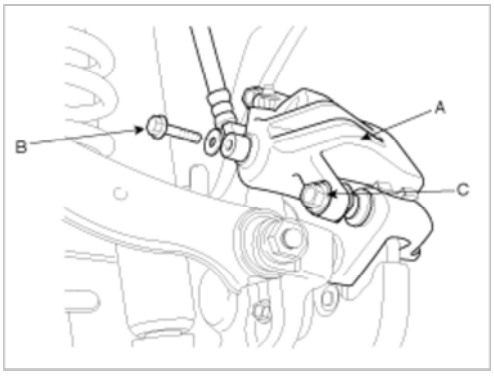


1. Bleeder screw	8. Caliper carrier
2. Caliper housing	9. Caliper mounting bolt
3. Guide rod	10. Washer
4. Boot	11. Guide rod bolt
5. Piston	12. Inner shim
6. Piston seal	13. Brake Pad
7. Piston boot	14. Pad spring

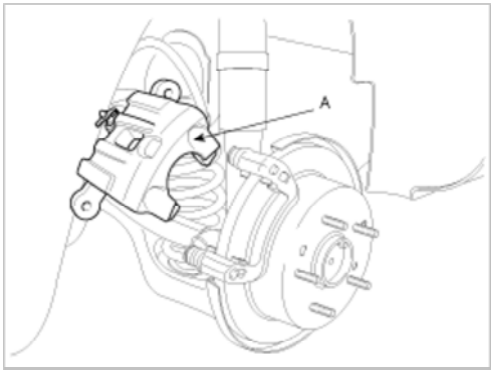
Brake System > Brake System > Rear Disc Brake > Repair procedures

Removal

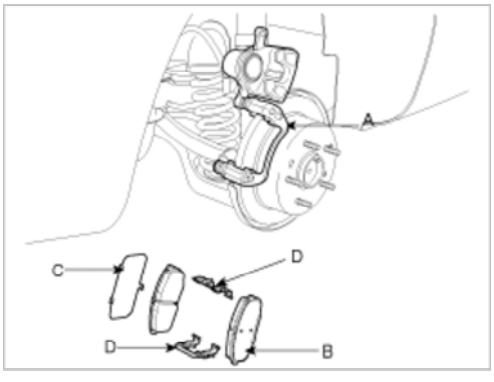
1. Remove the brake hose bolt (B) and the guide rod bolts (C) from the caliper assembly (A).



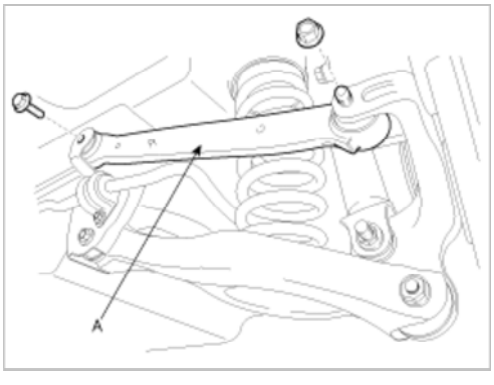
2. Remove the caliper assembly (A).



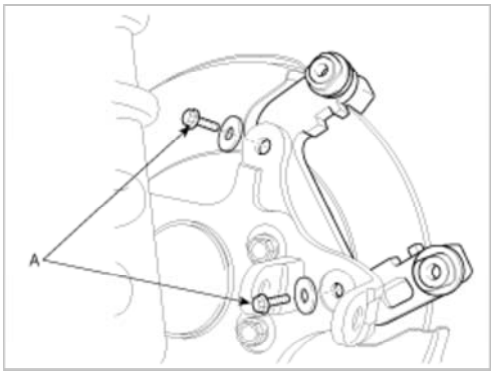
3. Remove the pads (B), the pad shims (C) and the pad springs (D) from the caliper carrier (A).

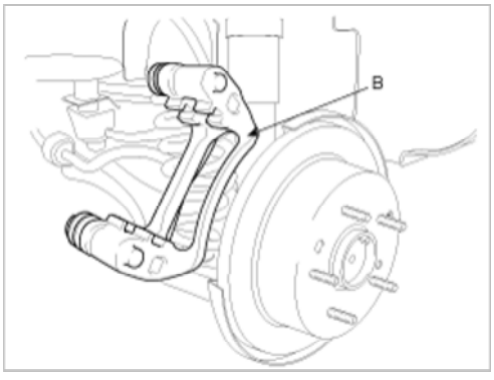


4. Remove the rear upper arm (A).

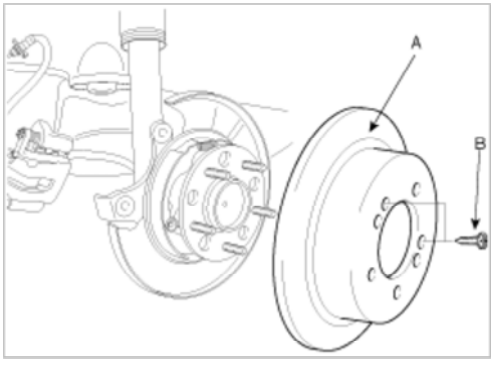


5. Remove the caliper carrier (B) and the caliper mounting bolts (A).





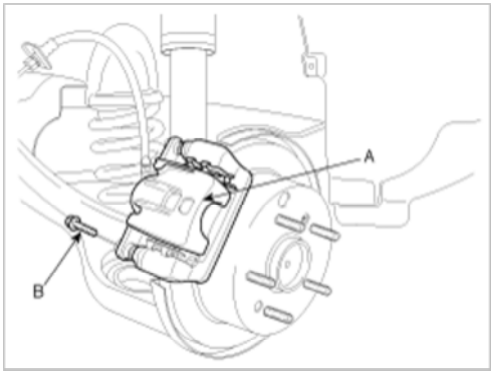
6. Remove the brake disc (A) and the screw (B).



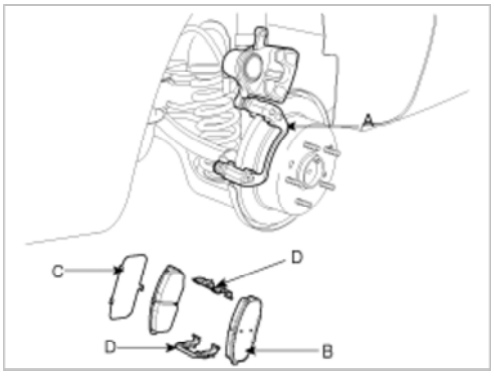
Replacement

> **CAUTION**
>
> Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
> - Avoid breathing dust particles.
> - Never use on air hose or brush to clean brake assemblies.

1. Remove guide rod bolt (B) and raise the caliper assembly (A).



2. Remove the pads (B), the pad shims (C) and the pad springs (D) from the caliper carrier (A).

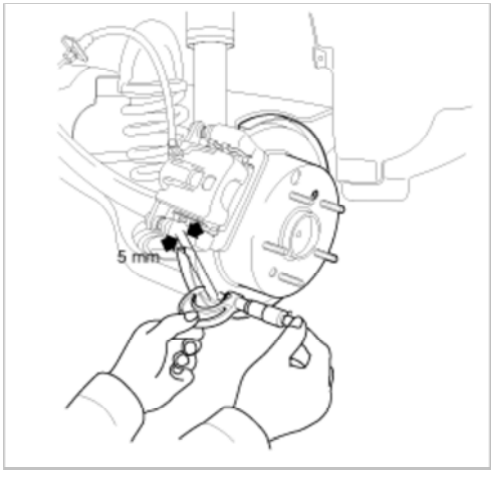


Inspection

Rear Brake Disc Thickness Check

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 positions at least.

Rear brake disc thickness
Standard value : 10.0 mm (0.39 in)
Limit : 8.4 mm (0.33 in)

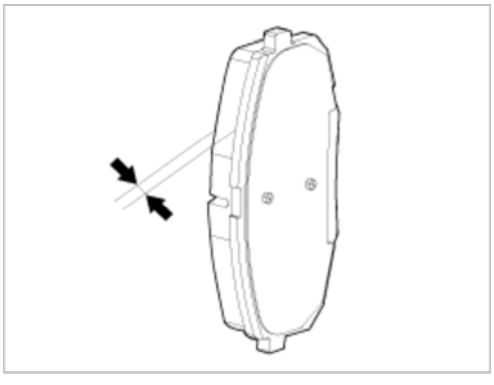


2. Thickness variation should not exceed 0.01 mm (0.0004in) (circumference) and 0.01 mm(0.0004 in) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assemblies for left and right of the vehicle.

Rear Brake Pad Check

1. Check the pad wear. Measure the pad thickness. replace it if it is less than the specified value.

Pad thickness
Standard value : 10.0 mm (0.39 in)
Service limit : 2.0 mm (0.0787 in)

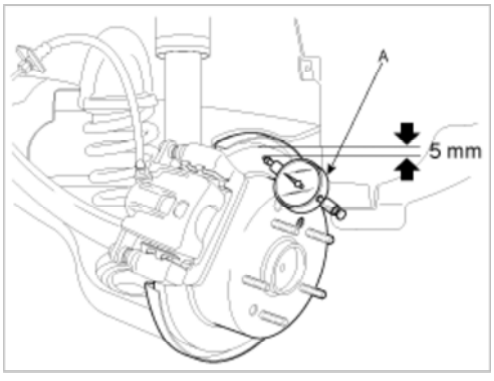


2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

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 : 0.05 mm (0.0020 in) or less

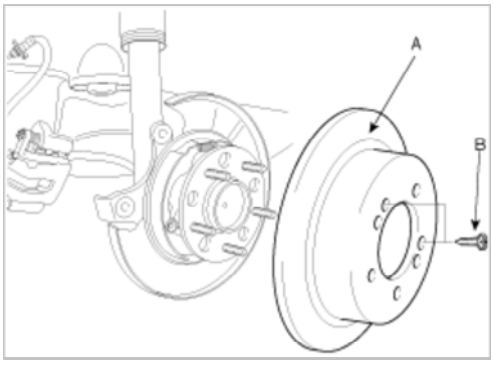


2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it and then check the run out of the brake disc again.
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

Installation

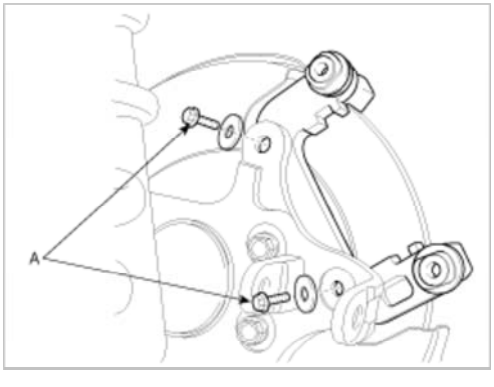
1. Install the brake disc (A) and tighten the screw (B).

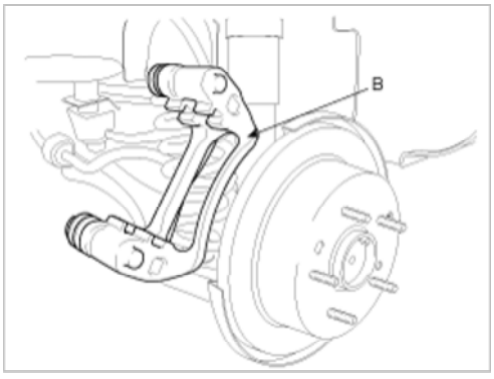
Tightening torque :
4.9~5.9N.m (0.5~0.6kgf.m, 3.6~4.3lb-ft)



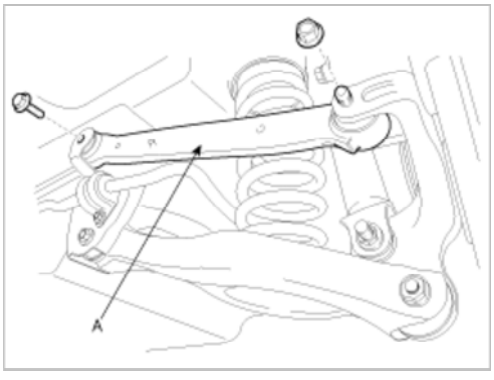
2. Install the caliper carrier (B) and tighten the caliper mounting bolts (A).

Tightening torque :
49.0~58.8N.m (5.0~6.0kgf.m, 36.2~43.4lb-ft)



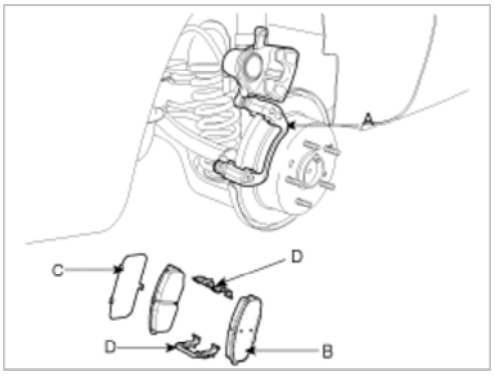


3. Install the rear upper arm (A).

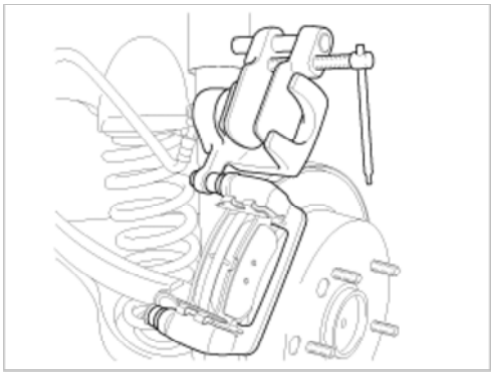


4. Install the pad springs (D) to the caliper carrier (A).
5. Install the brake pads (B) and pad shims (C) on the pad springs correctly. Install the pad with the wear indicator on the inside. If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.

> NOTE
>
> 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.

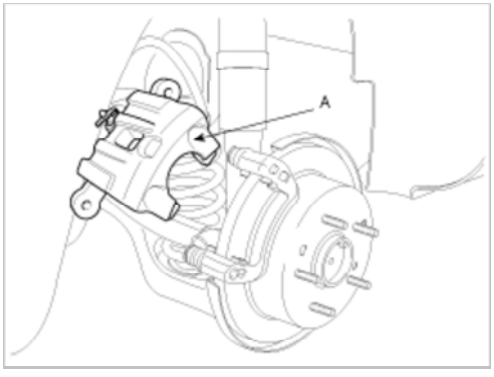


6. Push in the piston using the SST(09581-11000) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when installing the caliper.



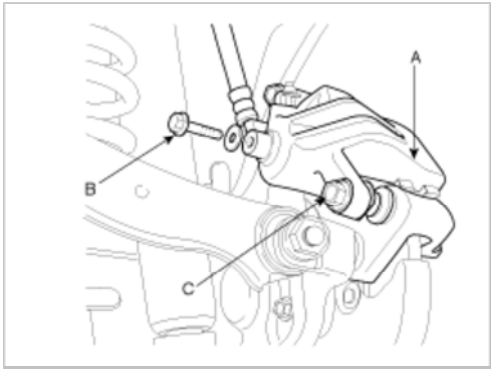
7. Install the caliper assembly (A).

> NOTE
>
> Be careful not to damage the piston pin boot.



8. Install the brake hose bolt (B) and the guide rod bolts (C) to the caliper assembly (A).

Tightening torque :
Bolt (B) : 24.5~29.4N.m (2.5~3.0kgf.m, 18.1~21.7lb-ft)
Bolt (C) : 21.6~31.4N.m (2.2~3.2kgf.m, 15.9~23.1lb-ft)



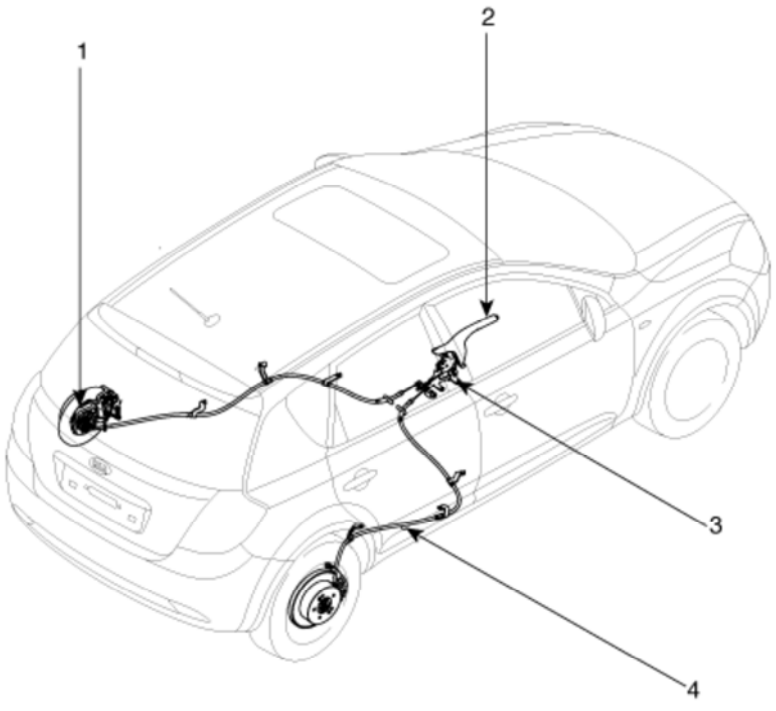
9. Refill the master cylinder reservoir to the MAX line.
10. Bleed the brake system. (Refer to "Bleeding of brake system")
11. Depress the brake pedal several times to make sure the brakes work, then test-drive.

> 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.

12. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

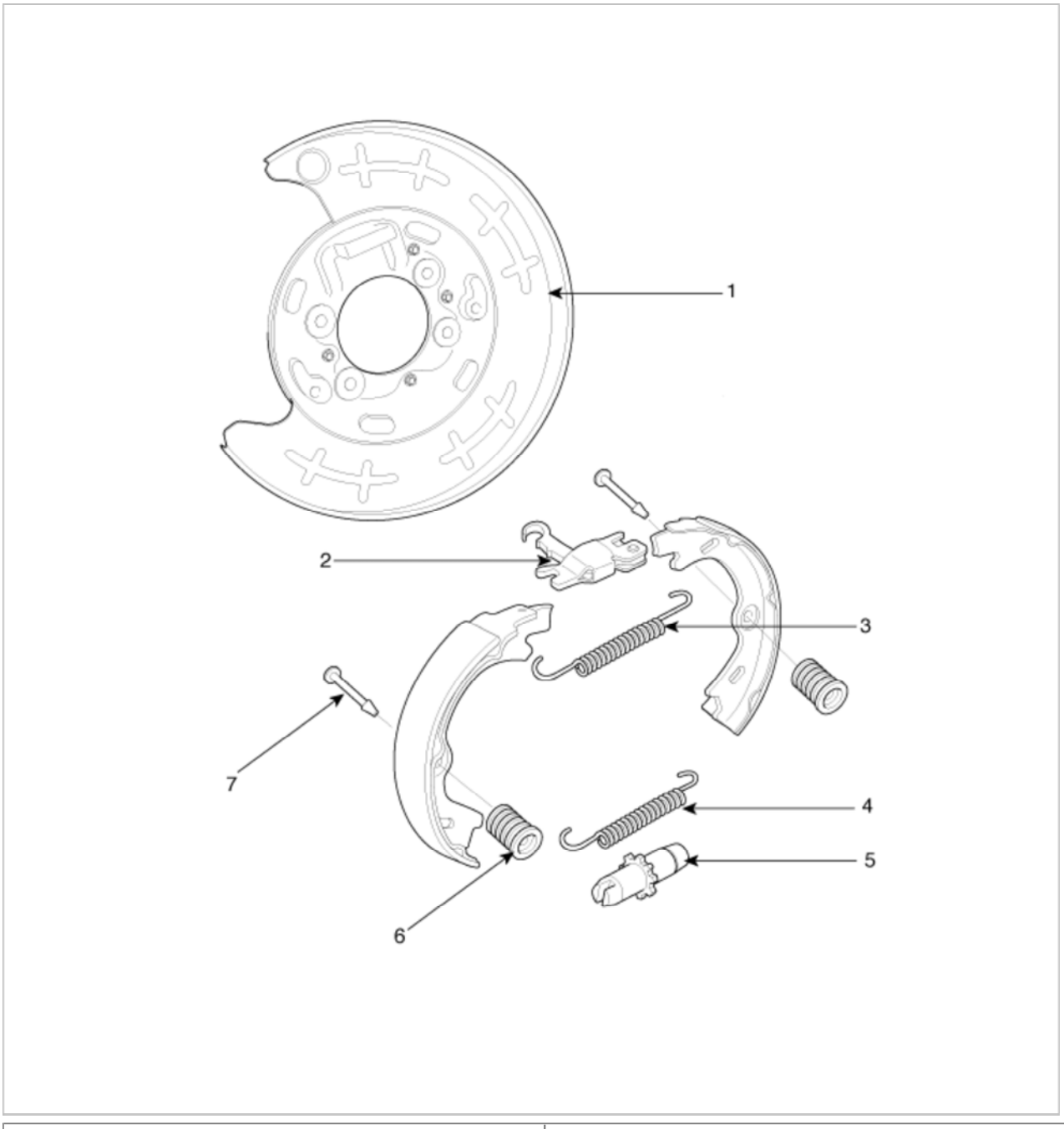
Brake System > Parking Brake System > Parking Brake Assembly > Components and Components Location

Component Location



1. Rear parking brake
2. Parking brake lever
3. Parking brake switch
4. Parking brake cable

Component



1. Backing plate 2. Operating lever 3. Upper spring 4. Lower spring	5. Adjuster 6. Shoe hold down spring 7. Shoe hold down pin

Brake System > Parking Brake System > Parking Brake Assembly > Repair procedures

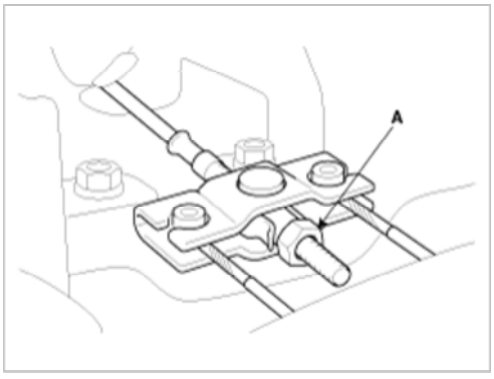
Removal

Parking Brake Lever

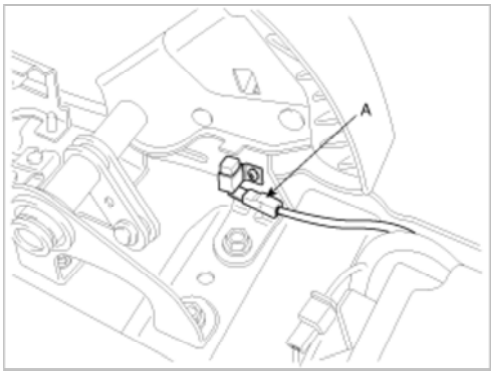
NOTE

The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

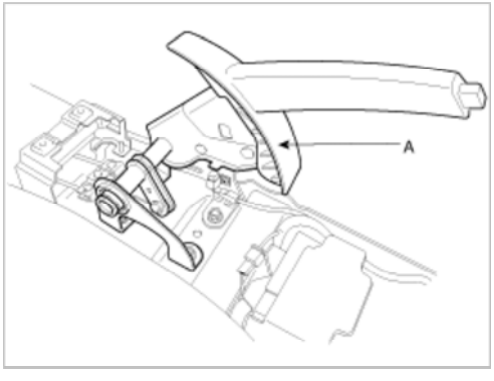
1. Remove the floor console. (Refer to Body group - "Floor console")
2. Loosen the adjusting nut (A) and the parking brake cables.



3. Disconnect the connector (A) of parking brake switch.

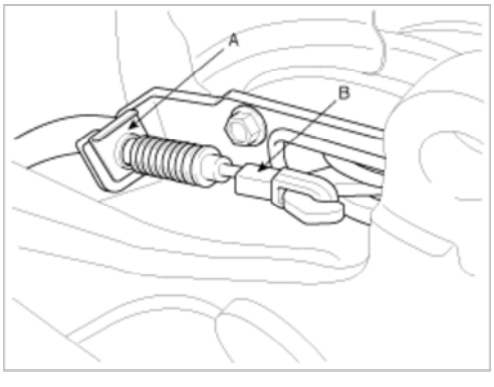


4. Remove the parking brake lever assembly (A) with loosening the bolts.

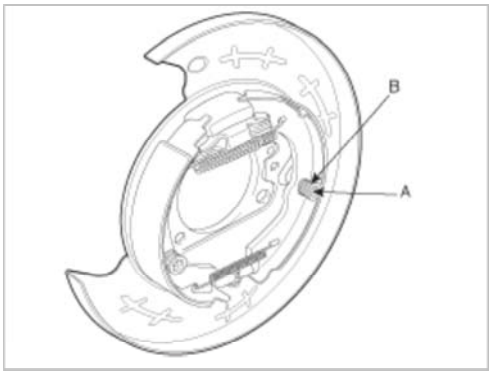


Parking Brake Shoe

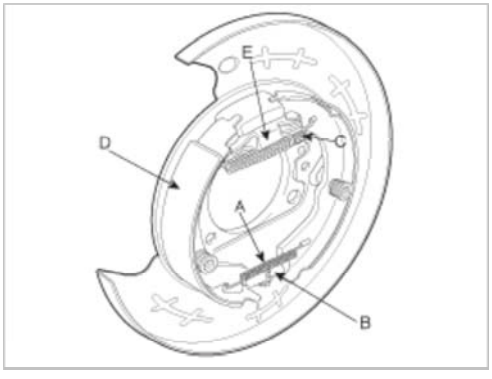
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel, then remove the brake caliper. (Refer to "Rear disc brake removal")
3. Remove the parking brake cable (B), after remove the clip (A).



4. Remove the shoe hold down pin (A) and spring (B) by pressing and rotating the spring.



5. Remove the adjuster assembly (B) and the lower return spring (A).

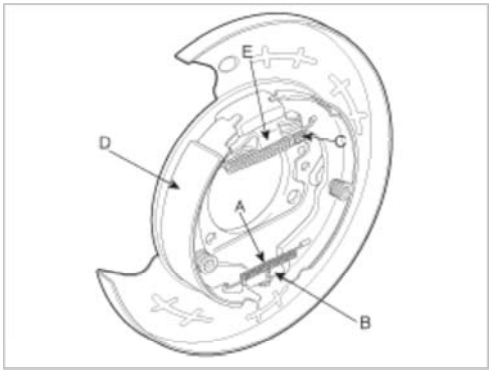


6. Remove the upper return spring (C) and the brake shoes (D).
7. Remove the operating lever assembly (E).

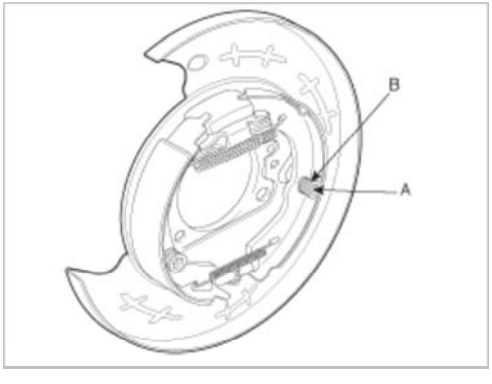
Installation

Parking Brake Shoe

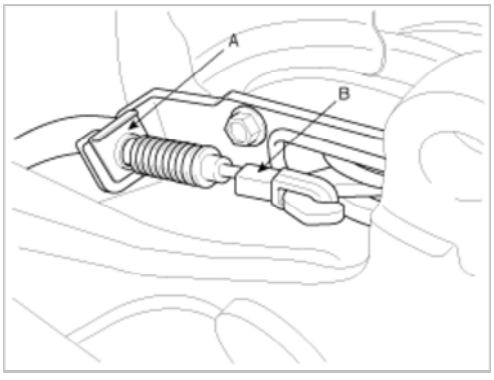
1. Install the operating lever assembly (E).



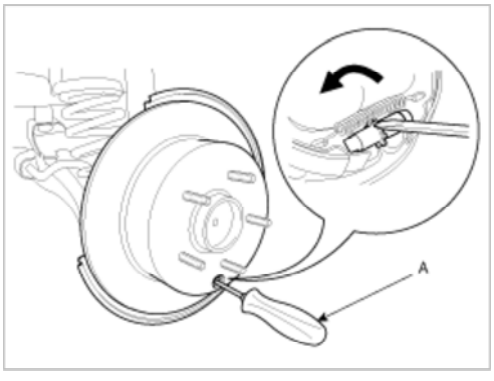
2. Install the upper return spring (C) and the brake shoes (D).
3. Install the adjuster assembly (B) and the lower return spring (A).
4. Install the shoe hold down pin (A) and spring (B) by pressing and rotating the spring.



5. Install the parking brake cable (B), then install the clip (A).



6. Install the rear brake disc, then adjust the rear brake shoe clearance.
   (1) Remove the plug from the disc.
   (2) Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 5 notches in the opposite direction.



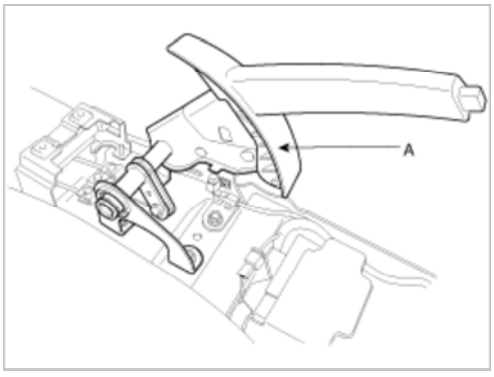
7. Install the brake caliper. (Refer to "Rear brake installation")
8. Install the tire and wheel.
9. Adjust the parking brake lever.
10. If the parking brake shoe or the brake disc are replaced a newly one, perform the brake shoe bed-in procedure.
    (1) While operating the parking brake lever for 69 N(7 kgf, 15 lb) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 60 kph (37.3 mph).
    (2) Repeat the above procedure more than two times.
    (3) Must be held on at 30% grade.

> CAUTION
>
> After adjusting parking brake, verify the following;
> 1. Must be free from malfunction when the parking pedal is operated at 686N(70 kgf, 154 lb).
> 2. Check that all parts move smoothly.
> 3. The parking brake indicator lamp must be on after the parking lever is applied and must be off after the lever is released.

Parking Brake Lever

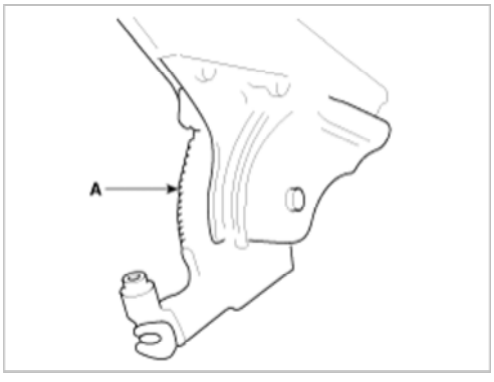
1. Install the parking brake lever assembly, then tighten the mounting bolts.

Tightening torque :
8.8 ~ 13.7N.m(0.9 ~ 1.4kgf.m, 6.5 ~ 10.1lb-ft)



2. Apply a coating of the specified grease to each sliding parts (A) of the ratchet plate or the ratchet pawl.

Specified grease :
Multi purpose grease RheoGel 429 (MS511-54, LT2)

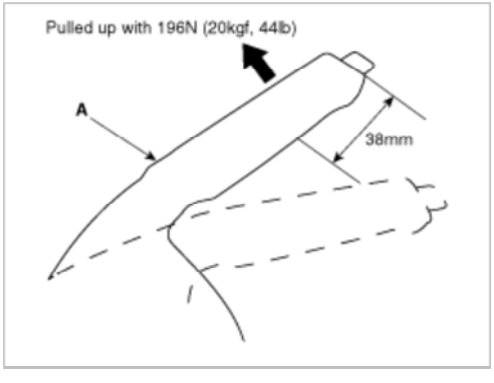


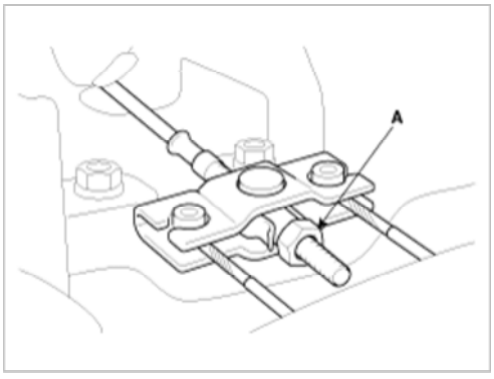
3. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :
7 cliks (Pull the lever with 20kg)

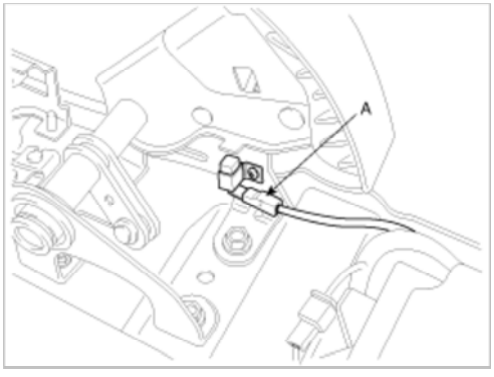
NOTE

After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke. (Refer to "Parking brake shoe installation")





4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Reconnect the connector (A) of parking brake switch.



NOTE

Inspect the continuity of parking brake switch.

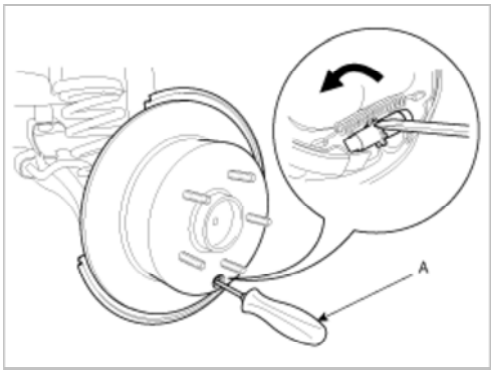
When the brake lever is pulled : continuity
When the brake lever is released : no continuity

7. Install the floor console.
(Refer to Body group - "Floor console")

Adjustment

Parking Brake Shoe Clearance Adjustment

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the plug from the disc.
4. Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 5 notches in the opposite direction.



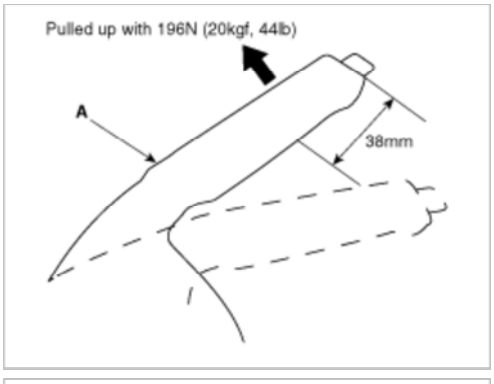
Parking Brake Lever Stroke Adjustment

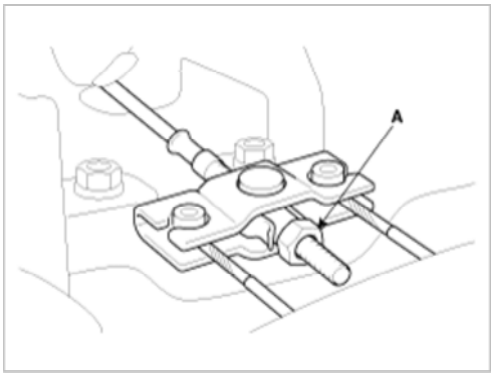
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the floor console. (Refer to Boby group - "Floor console")
3. Adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :
7 cliks (Pull the lever with 20kg)

NOTE

After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke. (Refer to "Parking brake shoe installation")

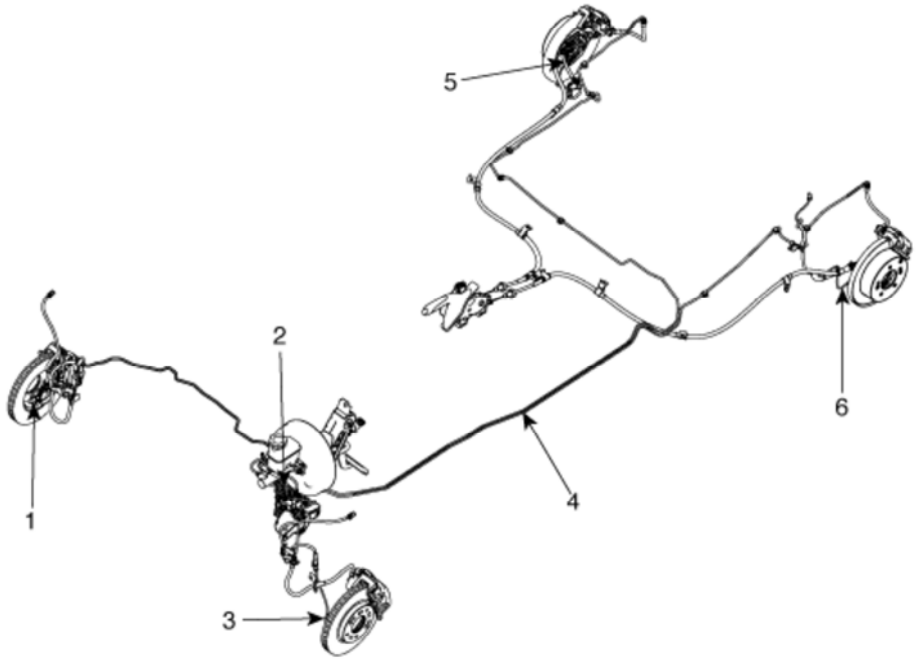




4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Install the floor console. (Refer to Boby group - "Floor console")

Brake System > ABS(Anti-Lock Brake System) > Components and Components Location

Components



1. Front left wheel speed sensor	4. Hydrauric line
2. ABS control module(HECU)	5. Rear right wheel speed sensor
3. Front right wheel speed sensor	6. Rear left wheel speed sensor

Brake System > ABS(Anti-Lock Brake System) > Description and Operation

Description

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)
This specification is for the wiring design and installation of ABS/TCS/ESC ECU.
This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.
- Control of braking force / traction force/ yaw moment.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

Installation position : engine compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

Operation

The ECU shall be put into operation by switching on the operating voltage (IGN).
On completion of the initialization phase, the ECU shall be ready for operation.
In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

Wheel Sensor Signal Processing

The ECU shall receive wheel speed signal from the four active wheel sensors.
The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the 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 16.8 V), the ECU switches off the valve relay and shuts down the system.
  When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.
- Undervoltage
  In the event of undervoltage(below 9.3 V), 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.

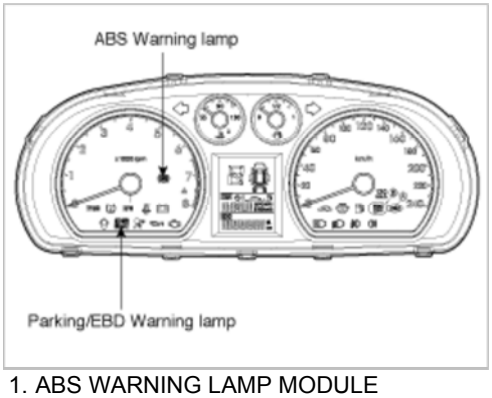
Pump Motor Checking

The ECU performs a pump motor test at a speed of 30km/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 (Air-bleeding line or Roll and Brake Test line).

Warning Lamp module



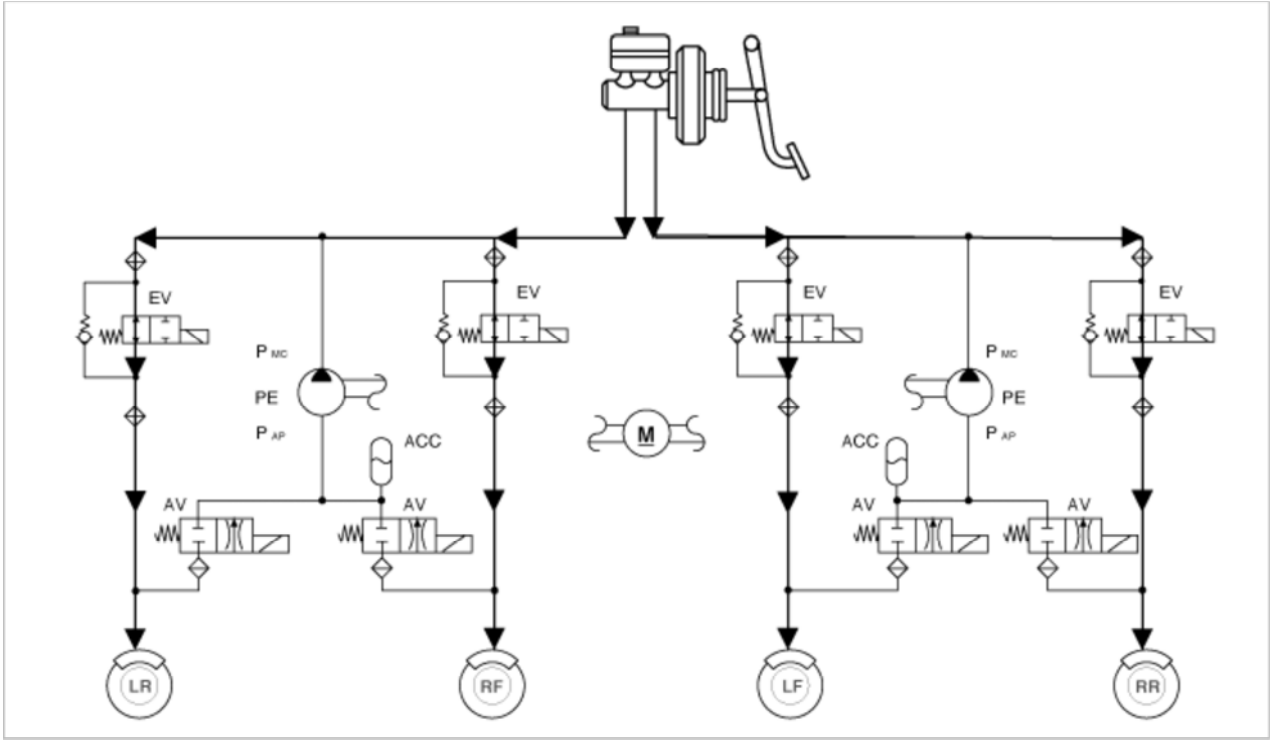
1. ABS WARNING LAMP MODULE
   The active ABS warning lamp module indicates the selftest and failure status of the ABS.The ABS warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. In the event of inhibition of ABS functions by failure.
   C. During diagnostic mode.
   D. When the ECU Connector is seperated from ECU.
2. PARKING/EBD WARNING LAMP MODULE
   The active EBD warning lamp module indicates the selftest and failure status of the EBD.However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.The EBD warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).

B. When the Parking Brake Switch is ON or brake fluid level is low.
C. When the EBD function is out of order.
D. During diagnostic mode.
E. When the ECU Connector is seperated from ECU.

ABS Control

1. NORMAL BRAKING without ABS

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF

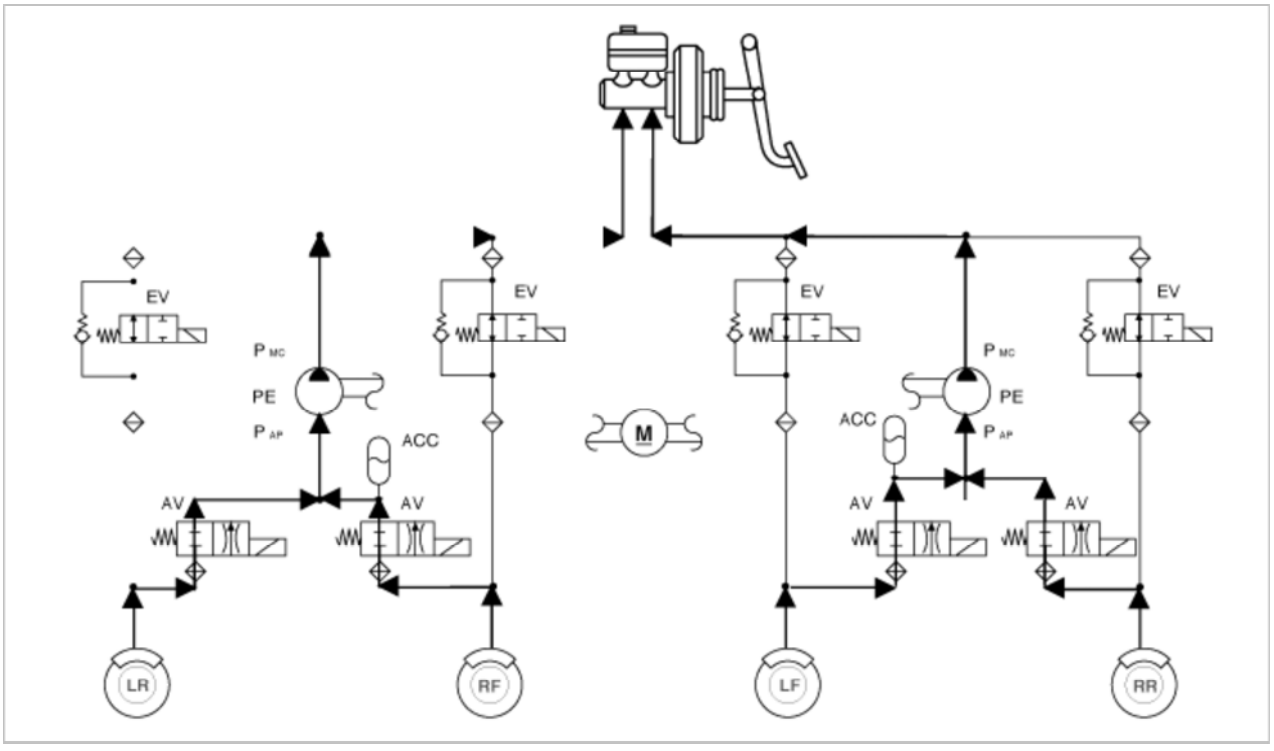


NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

2. DECREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Open	ON(Motor speed control)

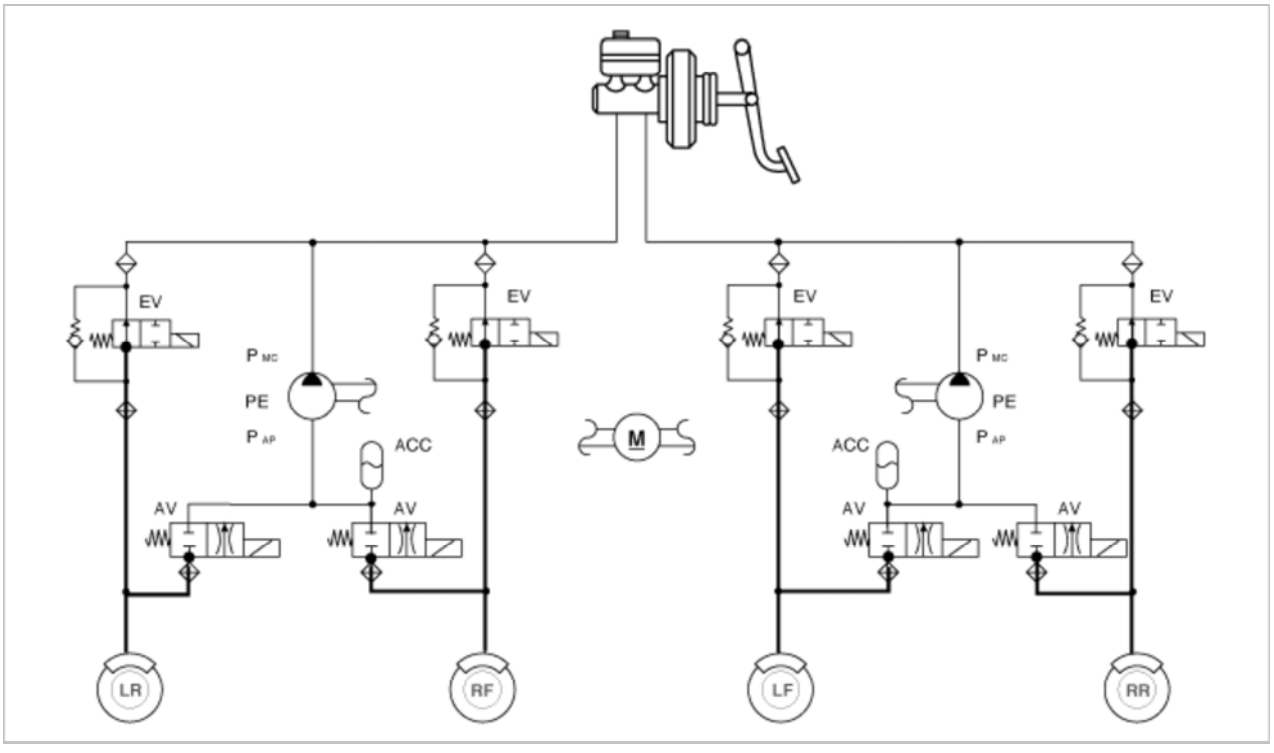


NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

3. HOLD MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Close	OFF

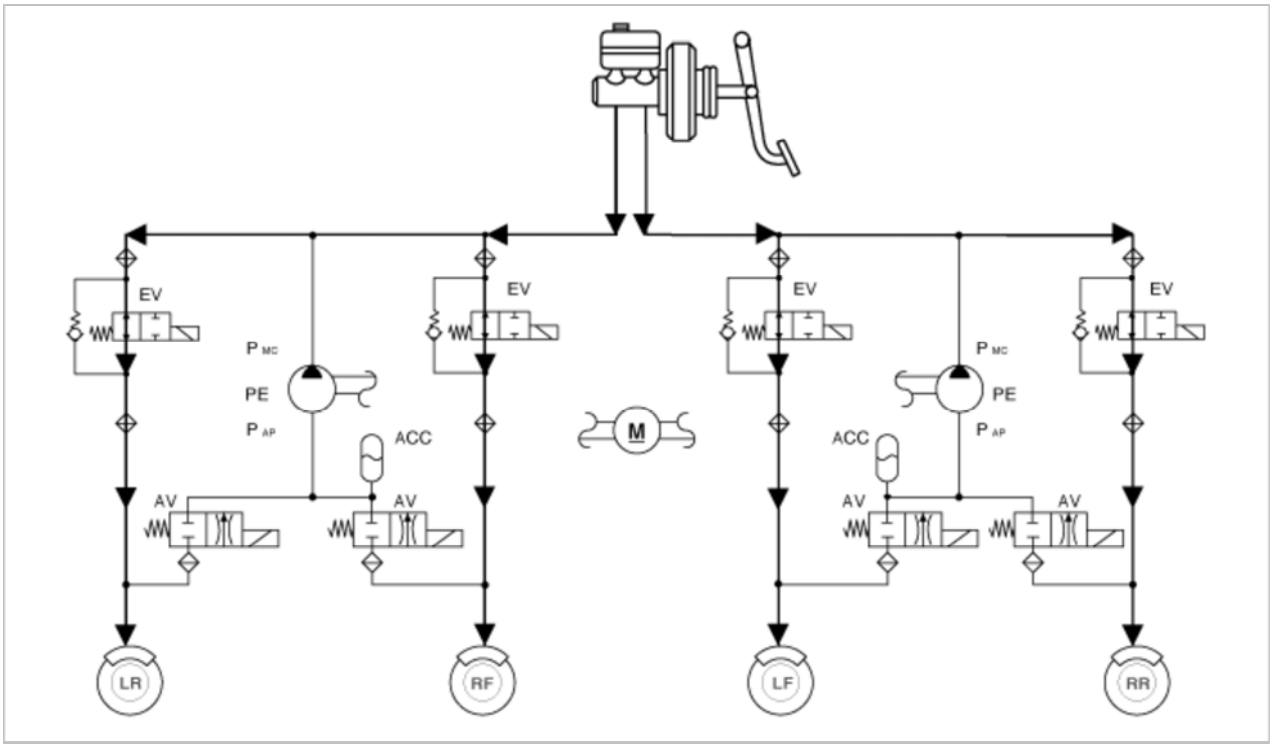


NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

4. INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	ON(Motor speed control)

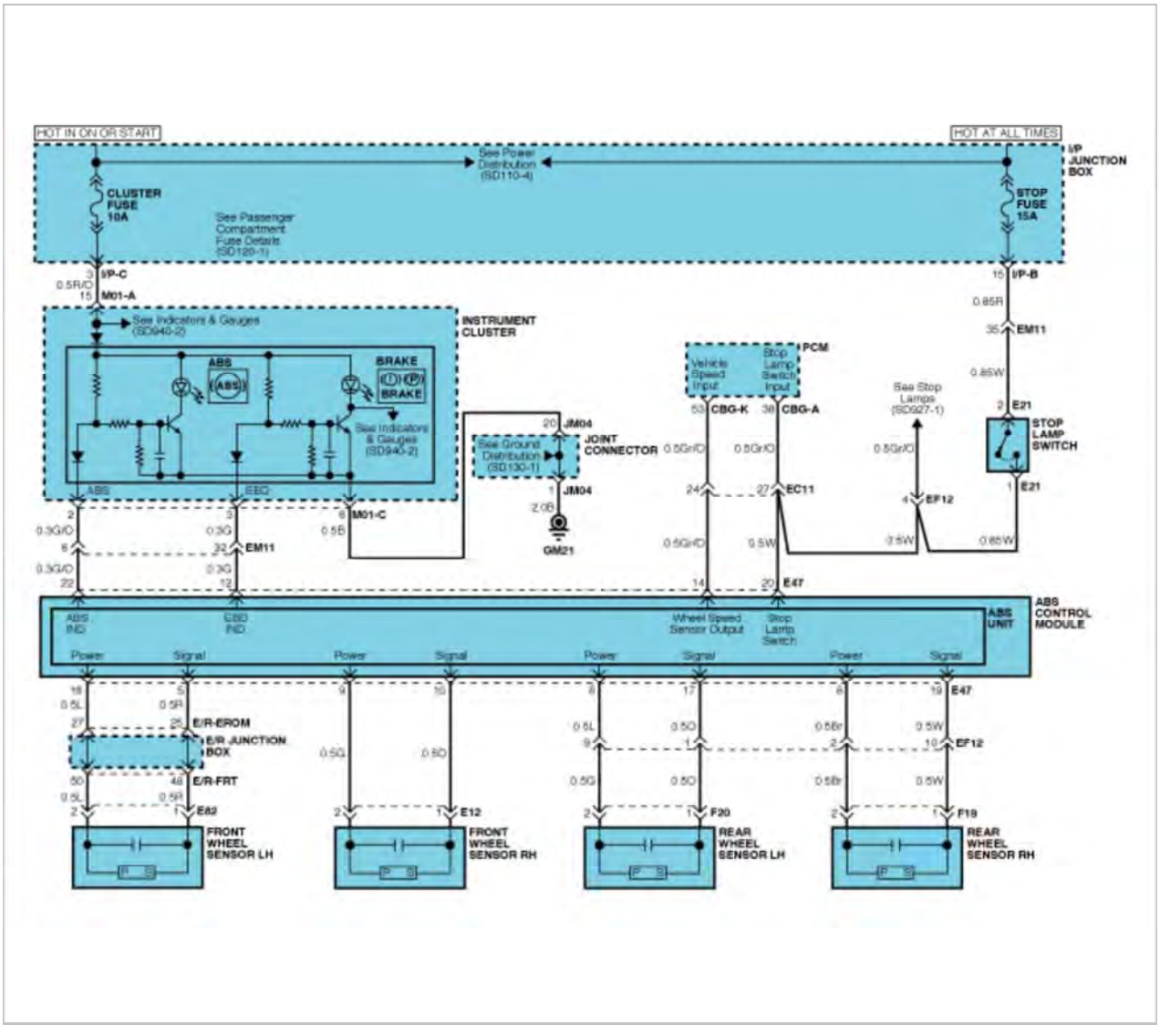


NOTE

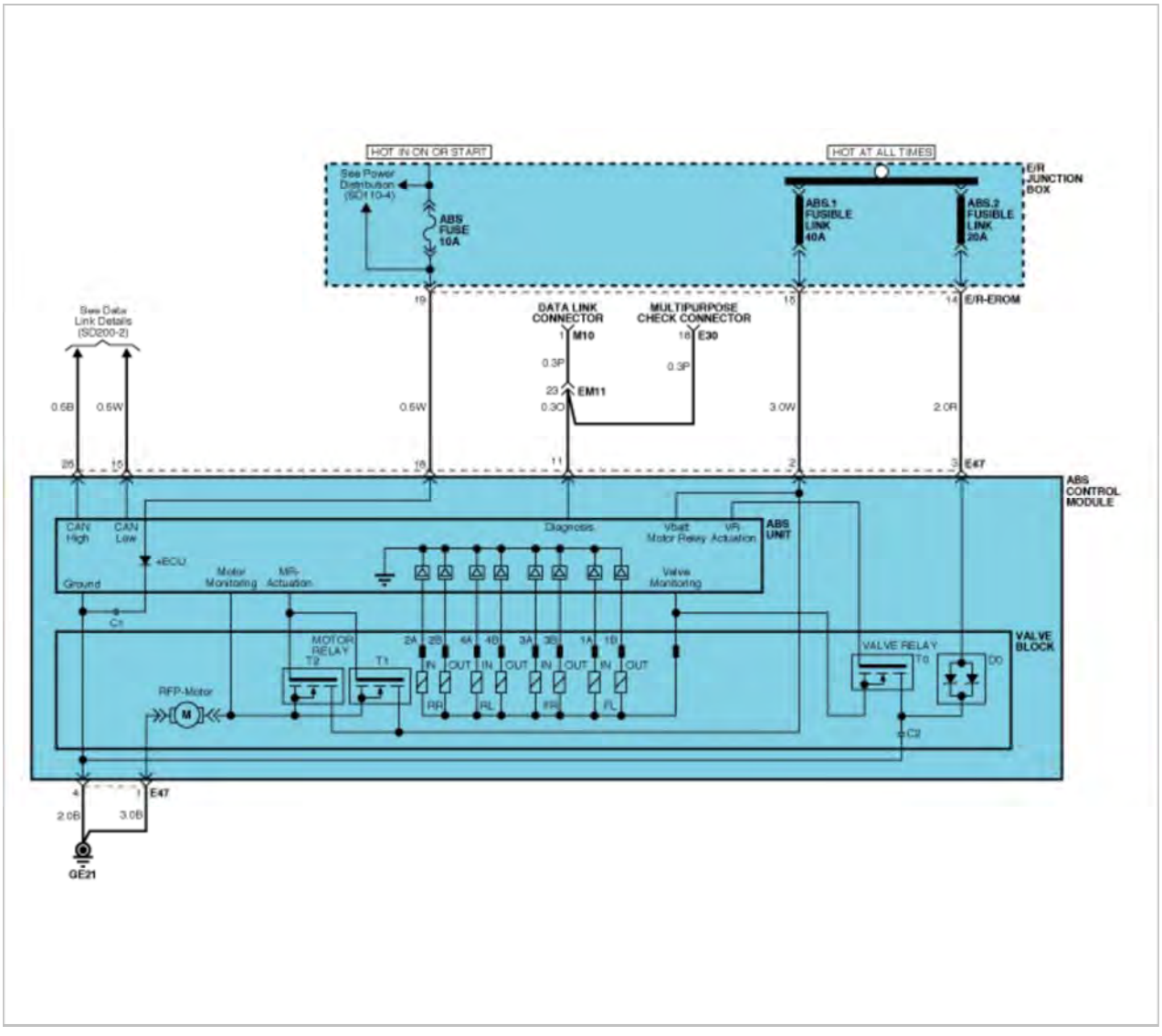
EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

Brake System > ABS(Anti-Lock Brake System) > Schematic Diagrams

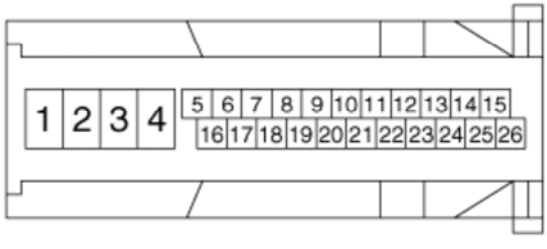
ABS Circuit Diagram(1)



ABS Circuit Diagram(2)



ECU Connector Input/Output(ABS)



Wire No.	Designation	Current		max.permissible wire resistance R_L (mΩ)	min.leakage resistance R_P (kΩ)
		max	min		
1	Ground for recirculation pump	20~39 A	10 A	10	
4	Ground for solenoid valves and ECU	5~15 A	2.5 A	10	
2	Voltage supply for pump motor	20~39 A	10 A	10	200
3	Voltage supply for solenoid valves	5~15 A	2 A	10	200
18	Voltage for hybrid ECU	1 A	500 mA	60	200
5,10,17,19	signal wheel speed sensor FL, FR, RL,RR	16 mA	6 mA	250	200 to ground 1.5M to bat

16,9,6,8	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	10 mA	6 mA	250	200 to ground 1.5M to bat
11	Diagnostic wire K	6 mA	3 mA	250	200
22	ABS-warning lamp actuation	30 mA	5 mA	250	200
12	EBD-warning lamp actuation	30 mA	5 mA	250	200
20	brake light switch	10 mA	5 mA	250	200
15	CAN Low	30 mA	20 mA	250	200
26	CAN High	30 mA	20 mA	250	200

ABS Hecu Connector

Connector terminal		Specification	Condition
Number	Description		
1	Ground for recirculation pump	Current range: Min.10A Max.20~39A	Always
4	Ground for solenoid valves and ECU	Current range: Min.2.5A Max.5~15A	Always
2	Voltage supply for pump motor	Battery voltage	Always
3	Voltage supply for solenoid valves		
16	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG ON
9			
6			
8			
5	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.89~1.26 V Voltage (Low) : 0.44~0.63 V	On driving
10			
17			
19			
11	Diagnostic wire K	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.2 * IG ON	On SCAN TOOL communication
18	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
20	Brake light switch	Voltage (High) ≥ 4.5 V Voltage (Low) ≤ 2.0 V	BRAKE ON/OFF

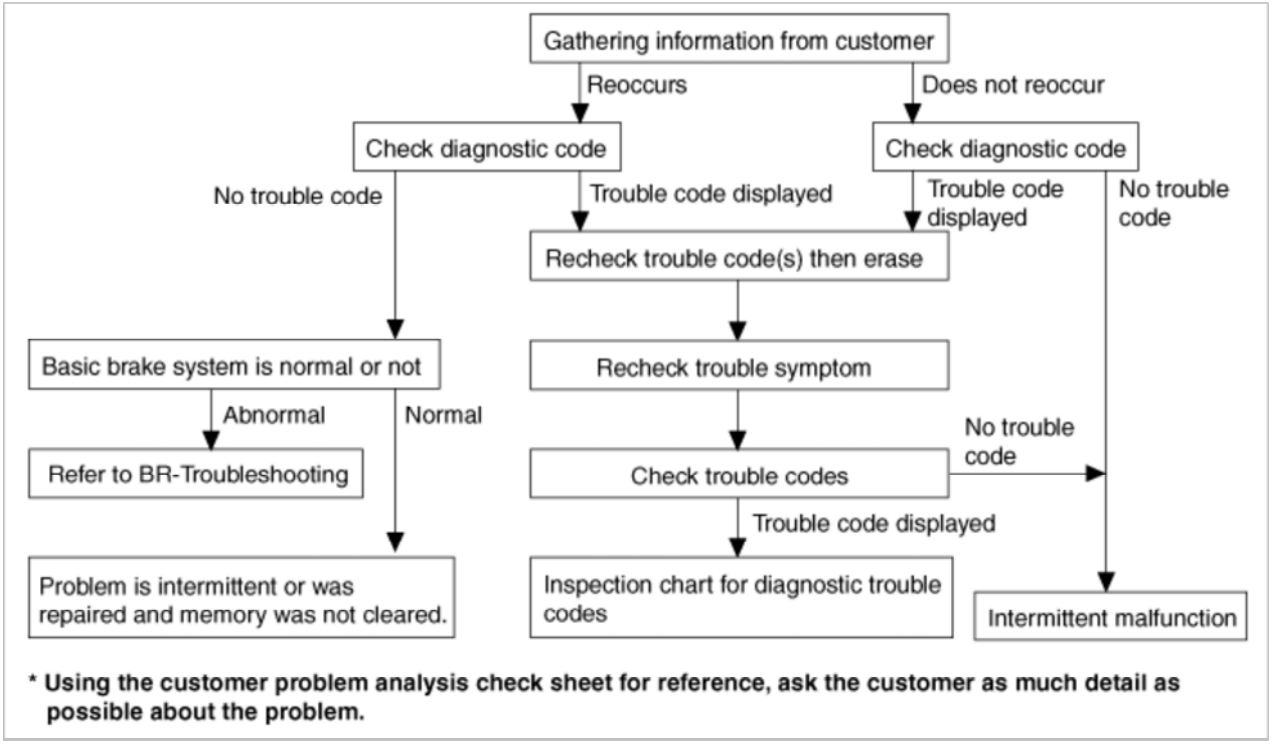
Sensor Output on Scan Tool(ABS)

	Description	Abbreviation	Unit	Remarks
1	Vehicle speed sensor	VEH. SPD	Km/h	
2	Battery voltage	BATT. VOL	V	
3	FL Wheel speed sensor	FL WHEEL	Km/h	
4	FR Wheel speed sensor	FR WHEEL	Km/h	
5	RL Wheel speed sensor	RL WHEEL	Km/h	
6	RR Wheel speed sensor	RR WHEEL	Km/h	
7	ABS Warning lamp	ABS LAMP	-	
8	EBD Warning lamp	EBD LAMP	-	
9	Brake Lamp	B/LAMP	-	
10	Pump relay state	PUMP RLY	-	
11	Valve relay state	VALVE RLY	-	
12	Motor	MOTOR	-	

13	Front Left valve(IN)	FL INLET	-	
14	Front Right valve (IN)	FR INLET	-	
15	Rear Left valve (IN)	RL INLET	-	
16	Rear Right valve (IN)	RR INLET	-	
17	Front Left valve (OUT)	FL OUTLET	-	
18	Front Right valve (OUT)	FR OUTLET	-	
19	Rear Left valve(OUT)	RL OUTLET	-	
20	Rear Right valve (OUT)	RR OUTLET	-	

Brake System > ABS(Anti-Lock Brake System) > Troubleshooting

Standard Flow of Diagnostic Troubleshooting



*** Using the customer problem analysis check sheet for reference, ask the customer as much detail as possible about the problem.**

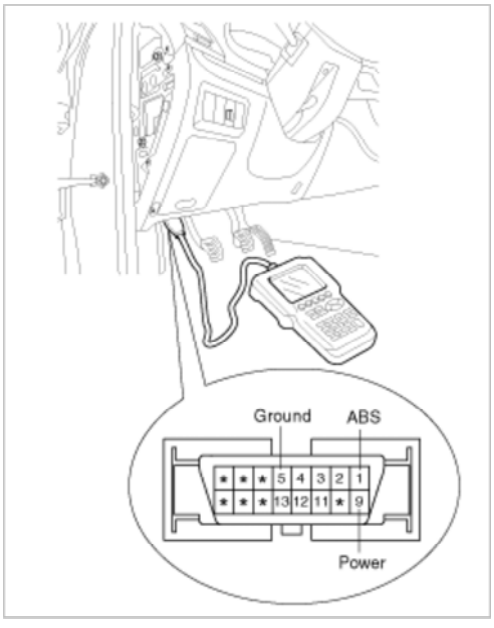
Notes With Regard to Diagnosis

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.	

Scan Tool Check

1. Turn the ignition switch OFF.
2. Connector the Scan tool to the 16P data link connector located the driver's side kick panel.



3. Turn the ignition switch ON.
4. Check for DTC using the Scan tool
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes using the scan tool.
6. Disconnect the Scan tool 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
ABS does not operate.	Only when 1~4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.
ABS does not operate intermittently.	Only when ~4. are all normal and the problem is still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the system is operating to specifications. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.
Communication with Scan tool is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line

Communication with Scan tool is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU

CAUTION

During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

ABS Does Not Operate.

Detecting Condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult.However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Inoperative power source circuit - Inoperative wheel speed sensor circuit - Inoperative hydraulic circuit for leakage - Inoperative HECU

Inspection Procedures

DTC Inspection

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Verify that the system is operating to specifications.
3. Is the system operating to specifications?

NO	▸ Check the power source circuit.
YES	▸ Erase the DTC and recheck using Scan Tool.

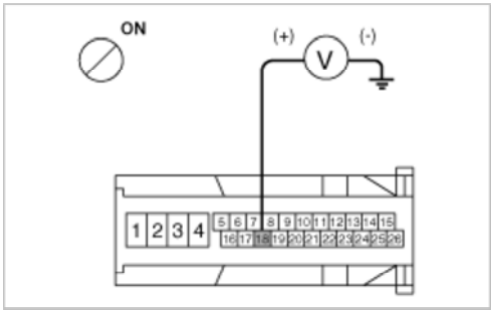
Check the Power Source Circuit

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

3. Is the voltage within specification?

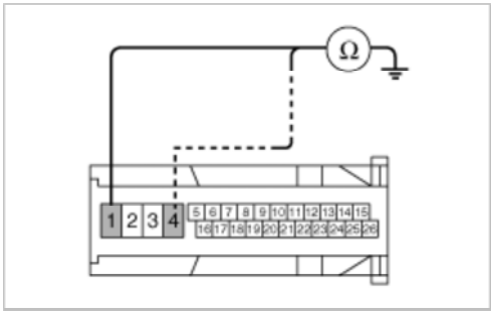
YES	▸ Check the ground circuit.
NO	▸ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



Check the Ground Circuit

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 1,4 of the ABS control module harness side connector and ground point.
3. Is there continuity?

YES	▸ Check the wheel speed sensor circuit.
NO	▸ Repair an open in the wire and ground point.



Check the Wheel Speed Sensor Circuit

1. Refer to the DTC troubleshooting procedures.
2. Is the system operating to specifications?

YES	▸ Check the hydraulic circuit for leakage.
NO	▸ Repair or replace the wheel speed sensor.

Check the Hydraulic Circuit for Leakage

1. Refer to the hydraulic lines.
2. Inspect leakage of the hydraulic lines.
3. Is the system operating to specifications?

YES	▸ The problem is still occurring, replace the ABS control module.
NO	▸ Replace the leaking hydraulic lines.

ABS Does Not Operate (Intermittently).

Detecting Condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Inoperative power source circuit - Inoperative wheel speed sensor circuit - Inoperative hydraulic circuit for leakage - Inoperative HECU

Inspection Procedures

DTC Inspection

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Verify that the system is operating to specifications.
3. Is the system operating to specifications?

NO	▸ Check the wheel speed sensor circuit.
YES	▸ Erase the DTC and recheck using Scan Tool.

Check the Wheel Speed Sensor Circuit

1. Refer to the DTC troubleshooting procedures.
2. Is the system operating to specifications?

YES	▸ Check the stop lamp switch circuit.
NO	▸ Repair or replace the wheel speed sensor.

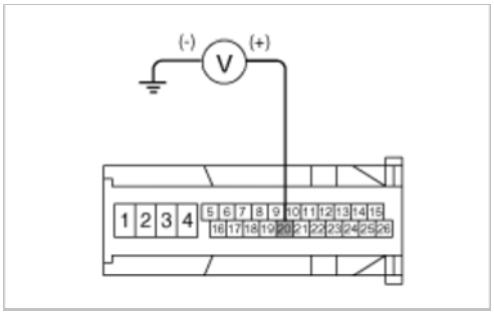
Check the Stop Lamp Switch Circuit

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 20 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification : approximately B+

3. Is the voltage within specification?

YES	▸ Check the hydraulic circuit for leakage.
NO	▸ Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.



Check the Hydraulic Circuit for Leakage

1. Refer to the hydraulic lines.
2. Inspection leakage of the hydraulic lines.
3. Is the system operating to specifications?

YES	▸ The problem is still occurring, replace the ABS control module.
NO	▸ Repair the hydraulic lines for leakage.

Communication with Scan-Tool is not possible.
(Communication with any system is not possible)

Detecting Condition

Trouble Symptoms	Possible Cause
Possible malfunction in the power supply system (including ground) for the diagnosis line.	- An open in the wire - Poor ground - Inoperative power source circuit

Inspection Procedures

Check the Power Supply Circuit for the Diagnosis

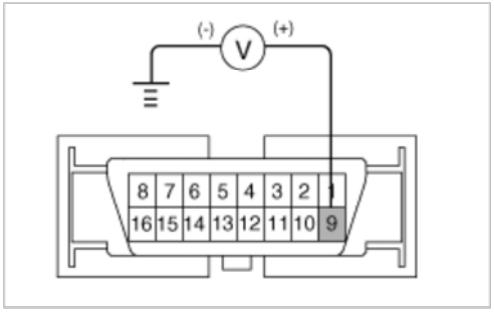
1. Measure the voltage between terminal 9 of the data link connector and body ground.

Specification : approximately B+

2. Is voltage within specification?

YES	▸ Check the ground circuit for the diagnosis.

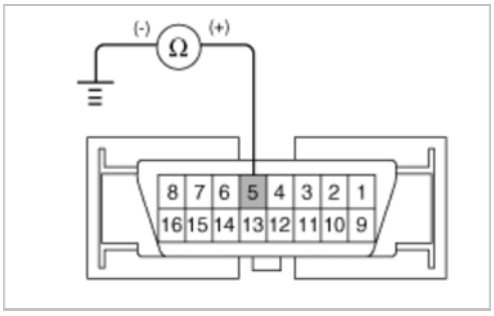
NO	▸ Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.



Check the Ground Circuit for the Diagnosis

1. ▸ Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.
2. Is there continuity?

NO	▸ Repair an open in the wire between terminal 5 of the data link connector and ground point.



Communication with Scan Tool is not possible.
(Communication with ABS only is not possible)

Detecting Condition

Trouble Symptoms	Possible Cause
When communication with Scan Tool is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Inoperative HECU - Inoperative power source circuit

Inspection Procedures

Check for Continuity in the Diagnosis Line

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 11 of the ABS control module connector and 1 of the data link connector.
3. Is there continuity?

YES	▸ Check the power source of ABS control module.
NO	▸ Repair an open in the wire.

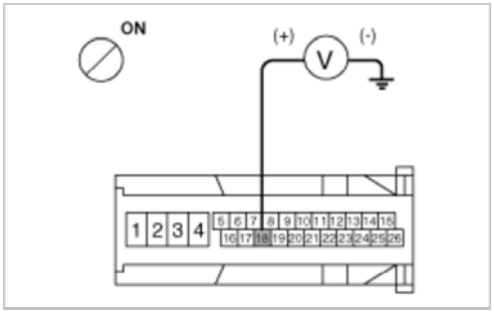
Check the Power Source of ABS Control Module

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

Specification : approximately B+

3. Is voltage within specification?

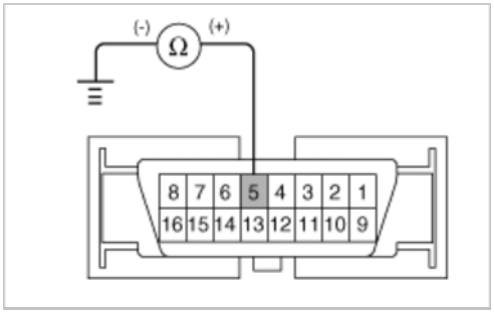
YES	▸ Check for poor ground.
NO	▸ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module.Repair if necessary.



Check for Poor Ground

1. Check for continuity between terminal 5 of the data link connector and ground point.

YES	▸ Replace the ABS control module and recheck.
NO	▸ Repair an open in the wire or poor ground



When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

Detecting Condition

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the inoperative HECU.	- Inoperative ABS warning lamp bulb - Blown No.2 fuse (10A) in the engine compartment junction block - Inoperative ABS warning lamp module - Inoperative HECU

Inspection Procedures

Problem Verification

1. Disconnect the connector from the ABS control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

YES	▸ It is normal. Recheck the ABS control module.
NO	▸ Check the power source for the ABS warning lamp.

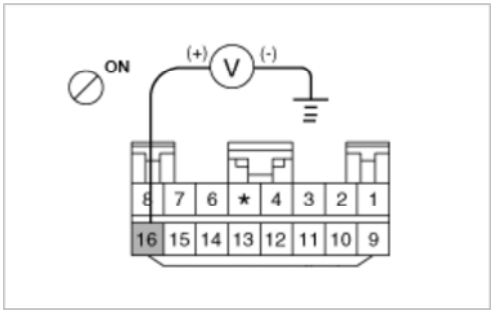
Check the Power Source for the ABS Warning Lamp

1. Disconnect the instrument cluster connector(M01-C) and turn the ignition switch ON.
2. Measure the voltage between terminal 16 of the cluster harness side connector(M01-C) and body ground.

Specification : approximately B+

3. Is voltage within specification?

YES	▸ Repair bulb or instrument cluster assembly.
NO	▸ Check for blown fuse.



Check for Blown Fuse

1. Check continuity of fuse (10A) from the engine compartment junction block.
2. Is there continuity?

YES	▸ Repair an open in the wire between ABS fuse and 13 of cluster connector(M01-A).
NO	▸ Replace the blown fuse.

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

Detecting Condition

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	- An open in the wire - Inoperative instrument cluster assembly - Inoperative ABS warning lamp module - Inoperative HECU

Inspection Procedures

Check DTC Output

1. Connect the Scan Tool to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using Scan Tool.
3. Is DTC output?

YES	▸ Repair circuit indicated by code output.
NO	▸ Check instrument cluster.

Check Instrument Cluster

1. Disconnect the cluster connector and turn the ignition switch ON.
2. Does the ABS warning lamp remains ON?

YES	▸ Replace the instrument cluster.
NO	▸ Check for open the wire.

Check for Open In The Wire

1. Check for continuity in the wire between cluster and ABS control module.
2. Is there continuity?

YES	▸ Replace the ABS control module and recheck.
	▸ Repair an open in the wire between cluster and ABS control module.

NO	

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 brake caliper bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the scan tool to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the scan tool screen.

> **CAUTION**
>
> You must obey the maximum operating time of the ABS motor with the scan tool to prevent the motor pump from burning.

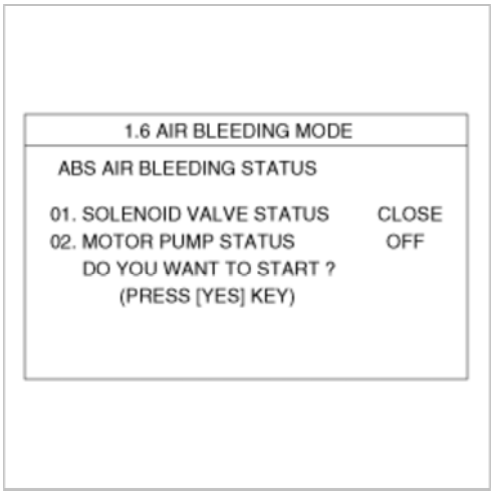
(1) Select Hyundai vehicle diagnosis.

(2) Select vehicle name.

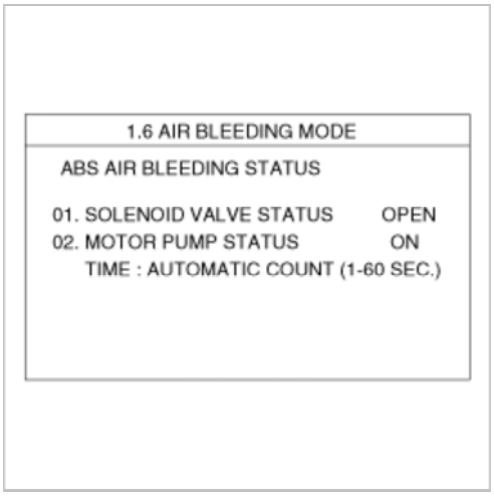
(3) Select Anti-Lock Brake system.

(4) Select air bleeding mode.

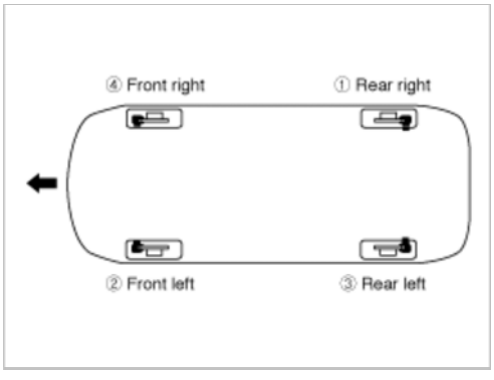
(5) Press "YES" to operate motor pump and solenoid valve.



(6) Wait 60 sec. before operating the air bleeding again.
(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:
6.9 ~ 12.7N.m (0.7 ~ 1.3kgf.m, 5.1~ 9.4lb-ft)

Diagnostic Trouble Codes (DTC)

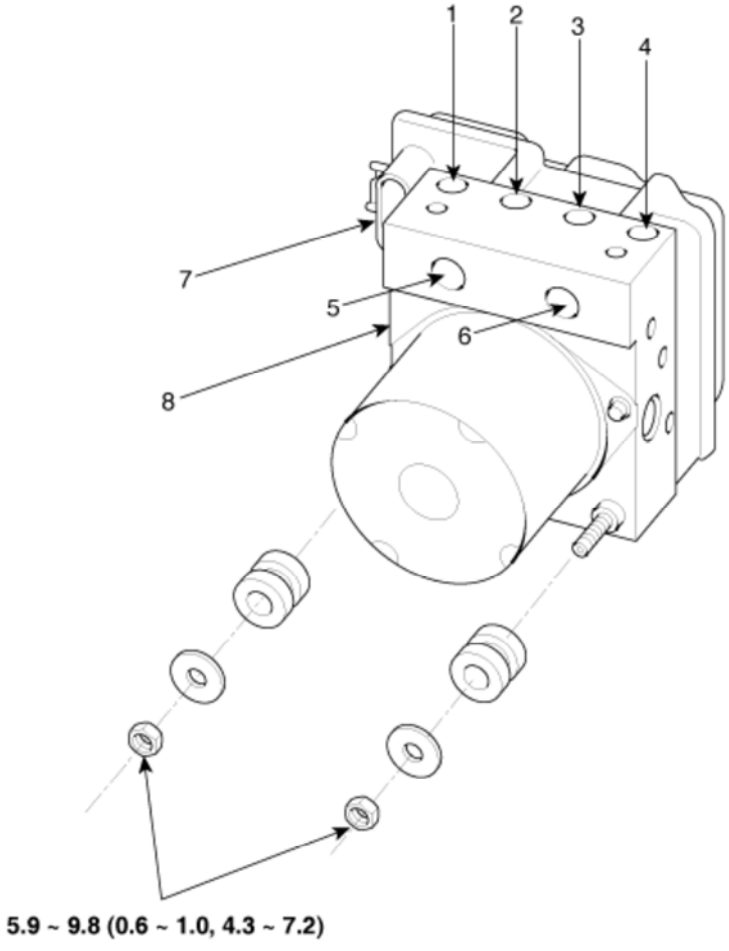
● : MIL ON ○ : MIL OFF

DTC CODE	Trouble description	Warning lamp condition			Etc.
		EBD	ABS	ESC	
C1101	Battery Voltage High	●	●	●	
C1102	Battery Voltage Low	○/●	●	●	
C1200	Wheel Speed Sensor Front-LH Open/Short	○/●	●	●	
C1201	Wheel Speed Sensor Front-LH Range / Performance / Intermittent	○/●	●	●	
C1202	Wheel Speed Sensor Front-LH Invalid/no Signal	○/●	●	●	
C1203	Wheel Speed Sensor Front-RH Open/Short	○/●	●	●	
C1204	Wheel Speed Sensor Front-RH Range / Performance / Intermittent	○/●	●	●	
C1205	Wheel Speed Sensor Front-RH Invalid/no Signal	○/●	●	●	
C1206	Wheel Speed Sensor Rear-LH Open/Short	○/●	●	●	
C1207	Wheel Speed Sensor Rear-LH Range / Performance / Intermittent	○/●	●	●	
C1208	Wheel Speed Sensor Rear-LH Invalid/no Signal	○/●	●	●	

C1209	Wheel Speed Sensor Rear-RH Open/Short	○/●	●	●	
C1210	Wheel Speed Sensor Rear-RH Range / Performance /Intermittent	○/●	●	●	
C1211	Wheel Speed Sensor Rear-RH Invalid/no Signal	○/●	●	●	
C1213	Wheel Speed Frequency Error	○/●	●	●	
C1235	Primary Pressure Sensor-Electrical	○	●	●	ESC only
C1237	Pressure Sensor-Signal	○	●	●	ESC only
C1260	Steering Angle Sensor-Signal	○	○	●	ESC only
C1261	Steering Angle Sensor Not Calibrated	○	○	●	ESC only
C1283	Yaw Rate & Lateral G Sensor-Signal	○	○	●	ESC only
C1503	ESC Switch Error	○	○	○	ESC only
C1513	Brake Switch Error	○	●	●	ESC only
C1604	ECU Hardware Error	●	●	●	
C1605	CAN Hardware Error	○	○	●	ESC only
C1611	CAN Time-out ECM	○	○	●	ESC only
C1612	CAN Time-out TCM	○	○	●	ESC only
C1616	CAN Bus off	○	○	●	ESC only
C1623	CAN Time-out Steering Angle Sensor	○	○	●	ESC only
C1625	CAN Time-out ABS/ESC	○	○	●	ESC only
C1626	Implausible Control	○	●	●	ESC only
C1643	CAN Time-out Yaw Rate & Lateral G Sensor	○	○	●	ESC only
C1702	Variant Coding Error	●	●	●	ESC only
C2112	Valve Relay Error	○/●	●	●	
C2308	Front-LH Valve Error (Inlet Valve)	●	●	●	
C2312	Front-LH Valve Error (Outlet Valve)	●	●	●	
C2316	Front-RH Valve Error (Inlet Valve)	●	●	●	
C2320	Front-RH Valve Error (Outlet Valve)	●	●	●	
C2324	Rear-LH Valve Error (Inlet Valve)	●	●	●	
C2328	Rear-LH Valve Error (Outlet Valve)	●	●	●	
C2332	Rear-RH Valve Error (Inlet Valve)	●	●	●	
C2336	Rear-RH Valve Error (Outlet Valve)	●	●	●	
C2366	TC Valve Primary (USV1) Error	●	●	●	
C2370	TC Valve Secondary (USV2) Error	●	●	●	
C2372	Electronic Shuttle Valve Primary (HSV1) Error	●	●	●	
C2374	Electronic Shuttle Valve Secondary (HSV2) Error	●	●	●	
C2402	Motor Electrical	●	●	●	

Brake System > ABS(Anti-Lock Brake System) > ABS Control Unit > Components and Components Location

Components



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

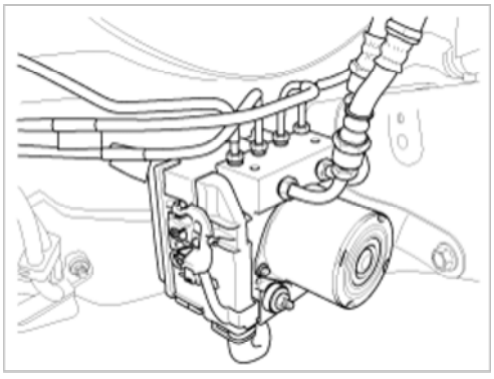
1. Front - right tube 2. Rear - left tube 3. Rear - right tube 4. Front - left tube	5. Master cylinder tube2 6. Master culinder tube1 7. ABS control module connector (26P) 8. ABS control module (HECU)

Brake System > ABS(Anti-Lock Brake System) > ABS Control Unit > Repair procedures

Removal

1. Disconnect the battery(-) terminal.
2. Disconnect the brake tubes from the HECU.

Tightening torque :
5.9 ~ 9.8N.m (0.6 ~ 1.0kgf.m, 4.3 ~ 7.2lb-ft)



3. Disconnect the HECU connector.
4. Remove the HECU by loosening the bracket mounting bolts.

Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)

CAUTION

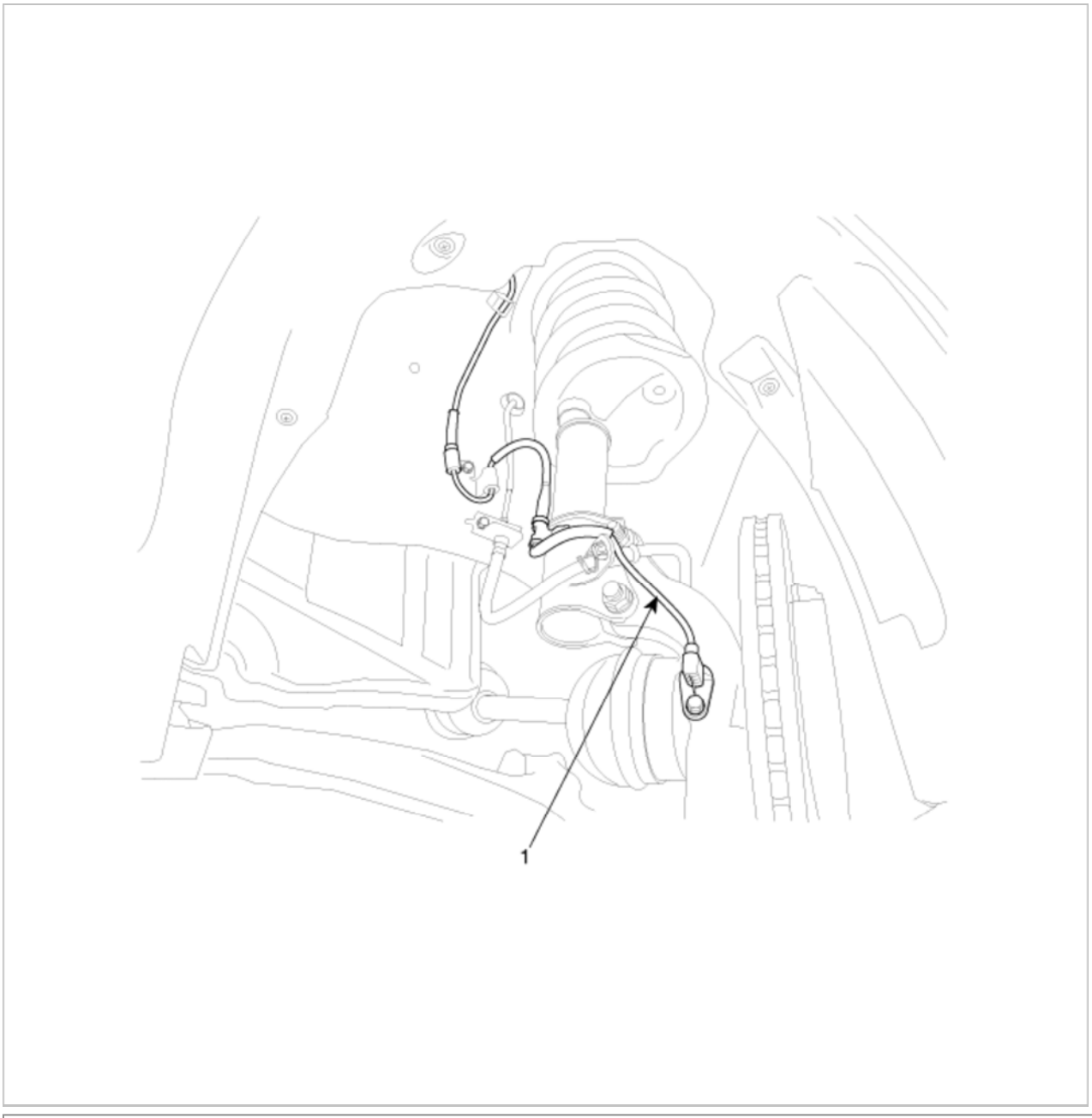
- Never attempt to disassemble the HECU.
- The HECU must be protected during storage and transport, and must not be subjected to excessive shock.

Installation

1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to ABS bleeding)

Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Components and Components Location

Components



1. Front wheel speed sensor

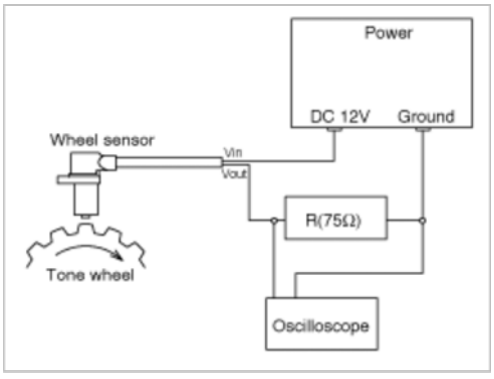
Brake System > ABS(Anti-Lock Brake System) > Front Wheel Speed Sensor > Repair procedures

Inspection

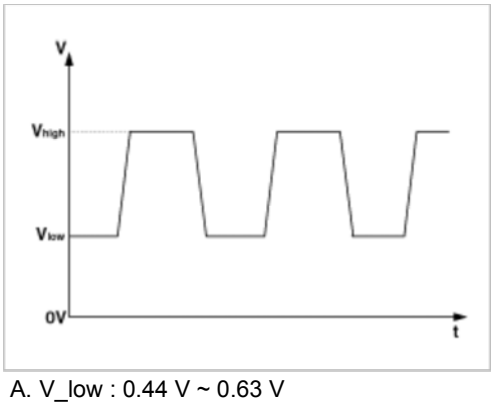
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



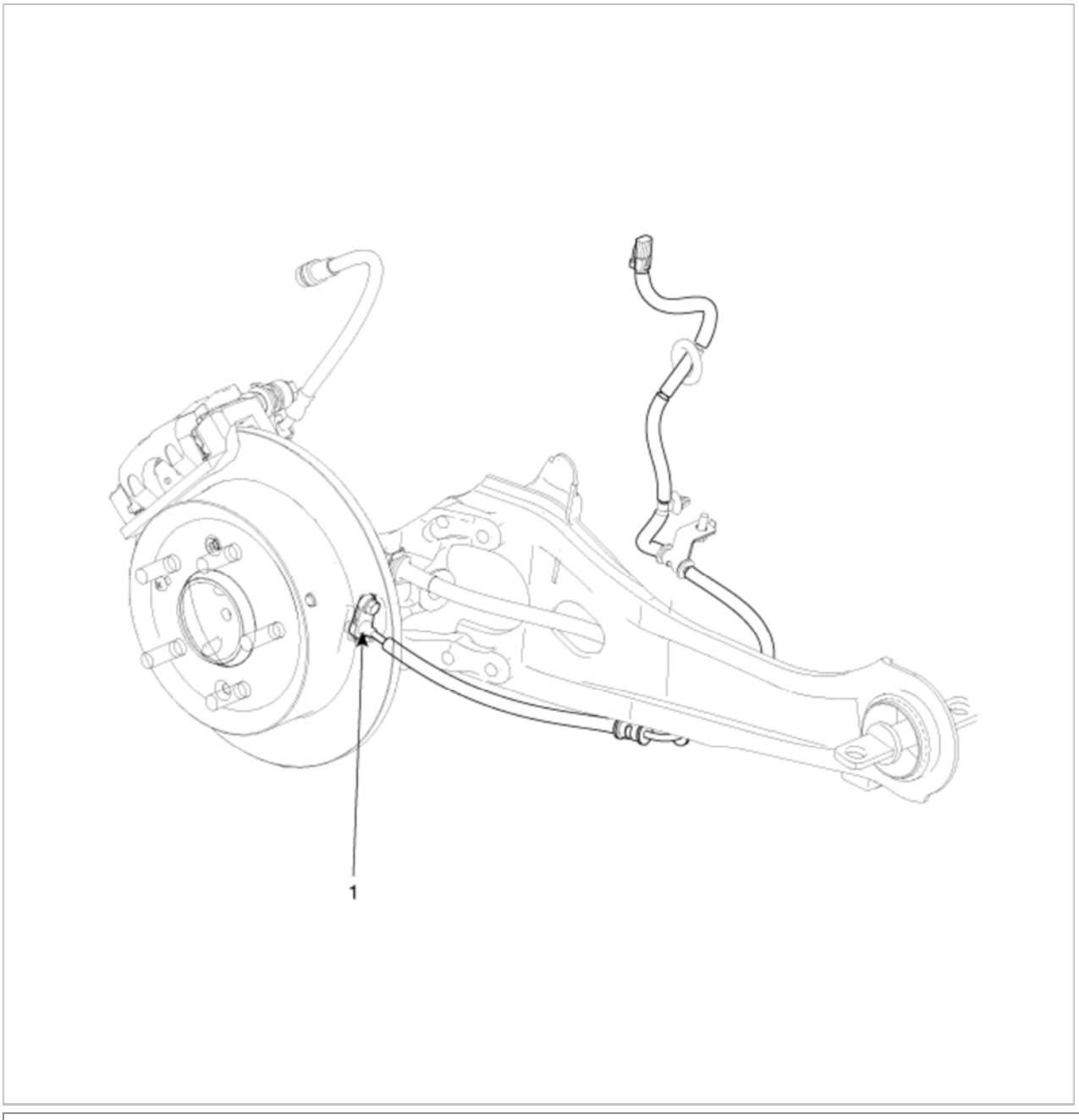
2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



A. V_low : 0.44 V ~ 0.63 V
B. V_high : 0.885 V ~ 1.26 V
C. Frequency range : 1~2,500 Hz

Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Components and Components Location

Components



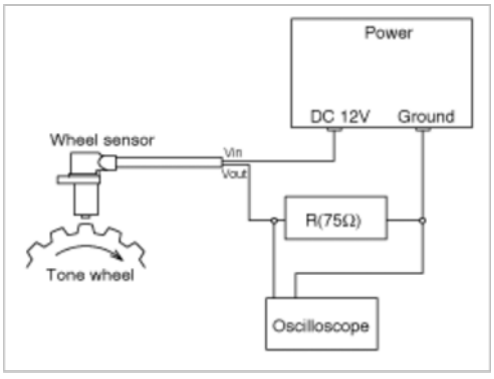
1. Rear wheel speed sensor

Brake System > ABS(Anti-Lock Brake System) > Rear Wheel Speed Sensor > Repair procedures

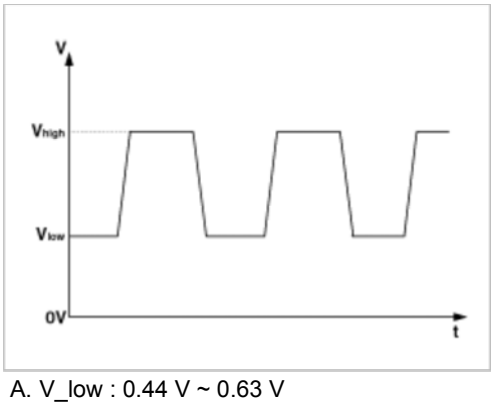
Inspection

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

> CAUTION
>
> In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



A. V_low : 0.44 V ~ 0.63 V
B. V_high : 0.885 V ~ 1.26 V
C. Frequency range : 1~2,500 Hz

Brake System > ABS(Anti-Lock Brake System) > EBD(Electronic Brake-force Distribution) > Description and Operation

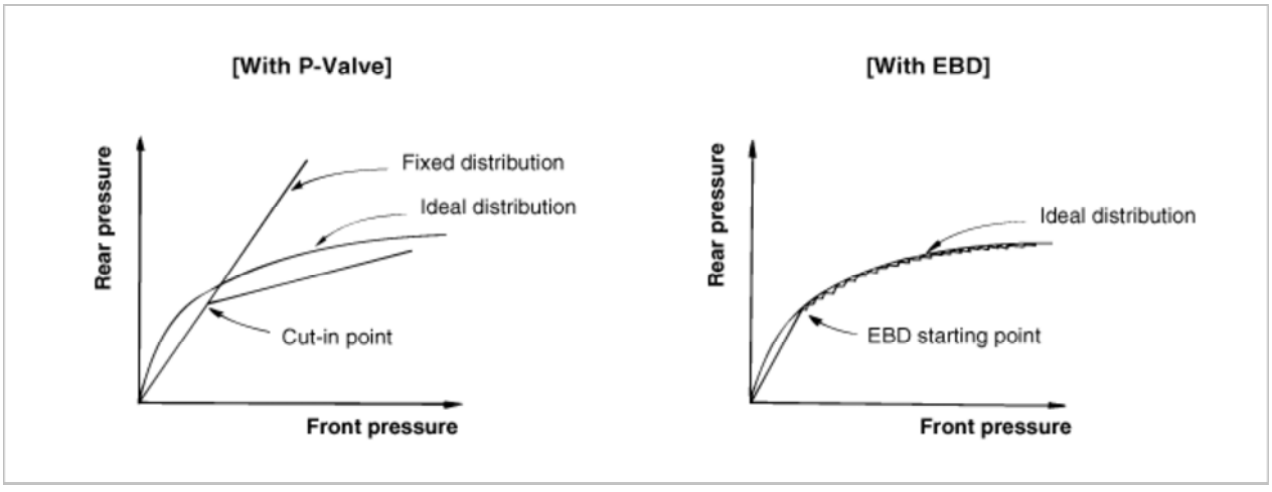
Description

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.

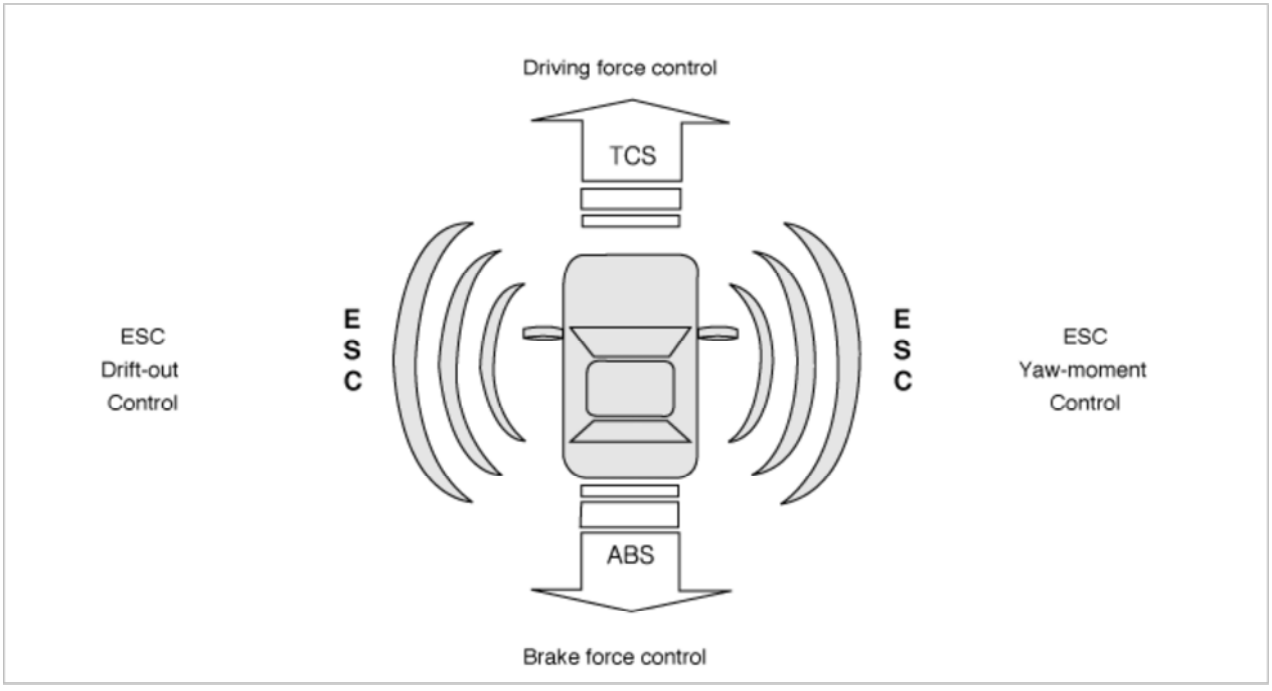
Comparison Between Proportioning Valve and EBD



Brake System > ESC(Electronic Stability Control) System > Description and Operation

Description of ESC

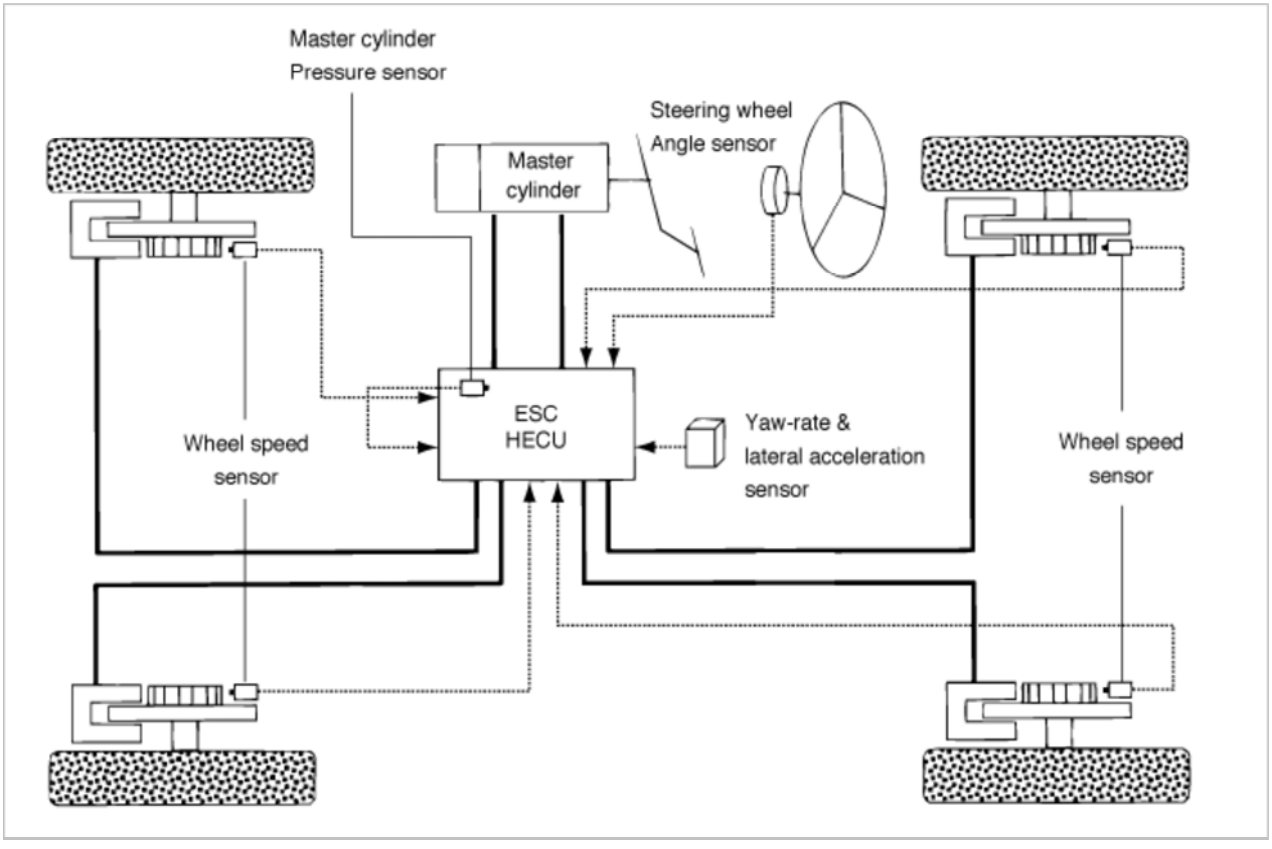
Optimum driving safety now has a name : ESC, the Electronic Stability Control.
ESC recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no needfor actuating the brake or the gas pedal.
ESC adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESC functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.
ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.
Of course, the stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESC function in response to a command by the driver.
In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



Description of ESC Control

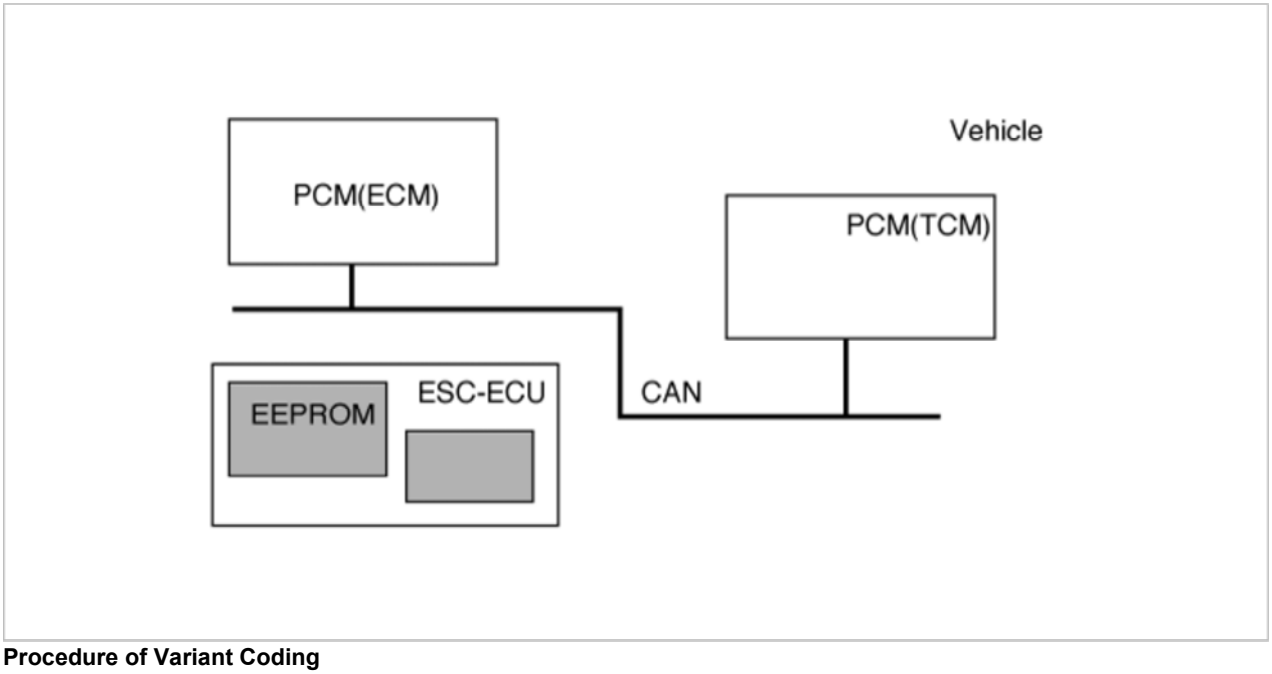
ESC system includes ABS/EBD, TCS and AYC (Active yaw control) function.
ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square waveform.By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels. And, the ECU judges whether the ABS/EBD should be actuated or not.
TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication. TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.

AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).
If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.
After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis) If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESC warning lamp. (fail-safe warning)



Variant Coding

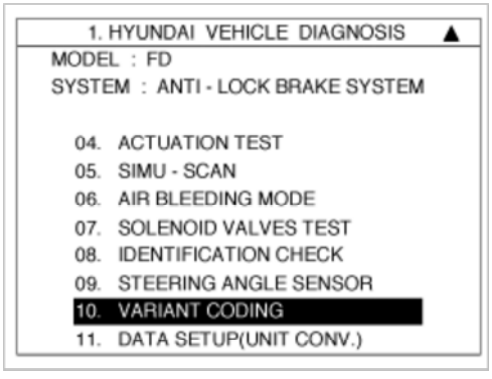
The HECU is programmed with a variant code based on the vehicle powertrain configuration. This variant code is used to determine the appropriate ESC calculations. Variant code programming should be performed whenever an HECU is replaced.



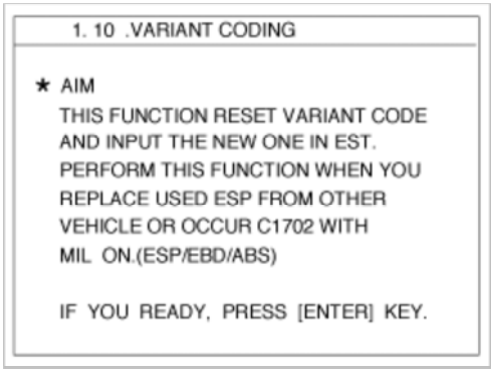
Procedure of Variant Coding

1. Install a PCM(ECM & TCM)/ESC normally.
2. Connect the scan tool to the data link connector located underneath the dash panel.

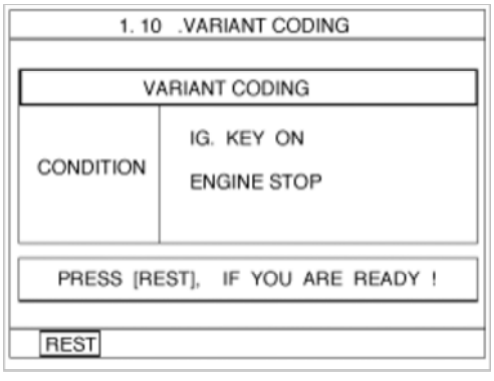
3. Select vehicle name.
4. Select ANTI-LOCK BRAKE SYSTEM.
5. Select the variant coding.



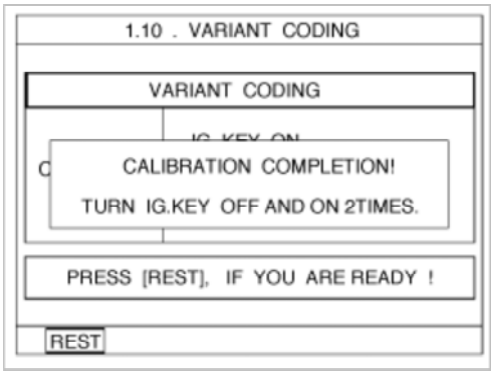
6. Follow the next procedure according to the comment .



7. Confirm the condition , and then push the "REST".



8. If the procedure is finished, the screen is displayed as shown below.

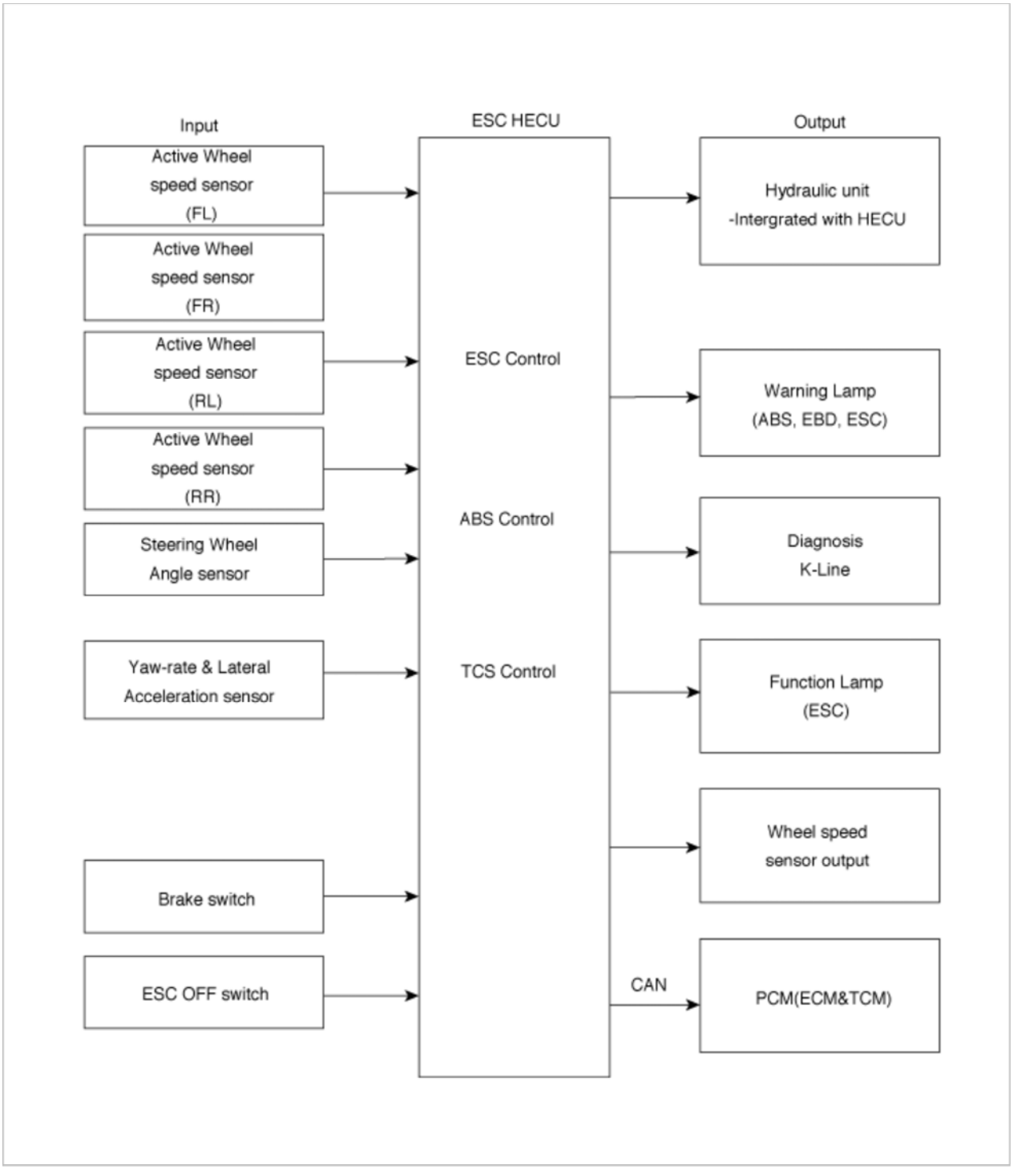


9. IGN off.
10. IGN on.
11. The variant coding is completed.

CAUTION

- If the warning lamp(ESC, EBD, ABS) is illuminated, follow the "Variant coding" again.
- For the vehicle equipped 4WD, delete the DTC(s) memorized in 4WD ECU when variant coading is completed.

Input and Output Diagram



ESC Operation Mode

1. STEP 1
   The ESC analyzes the intention of the driver.

Position of steering wheel
+ Vehicle speed
+ Acceleration pedal
→ ECU decides the intention of the driver.

2. STEP 2
It analyzes the movement of the ESC vehicle.

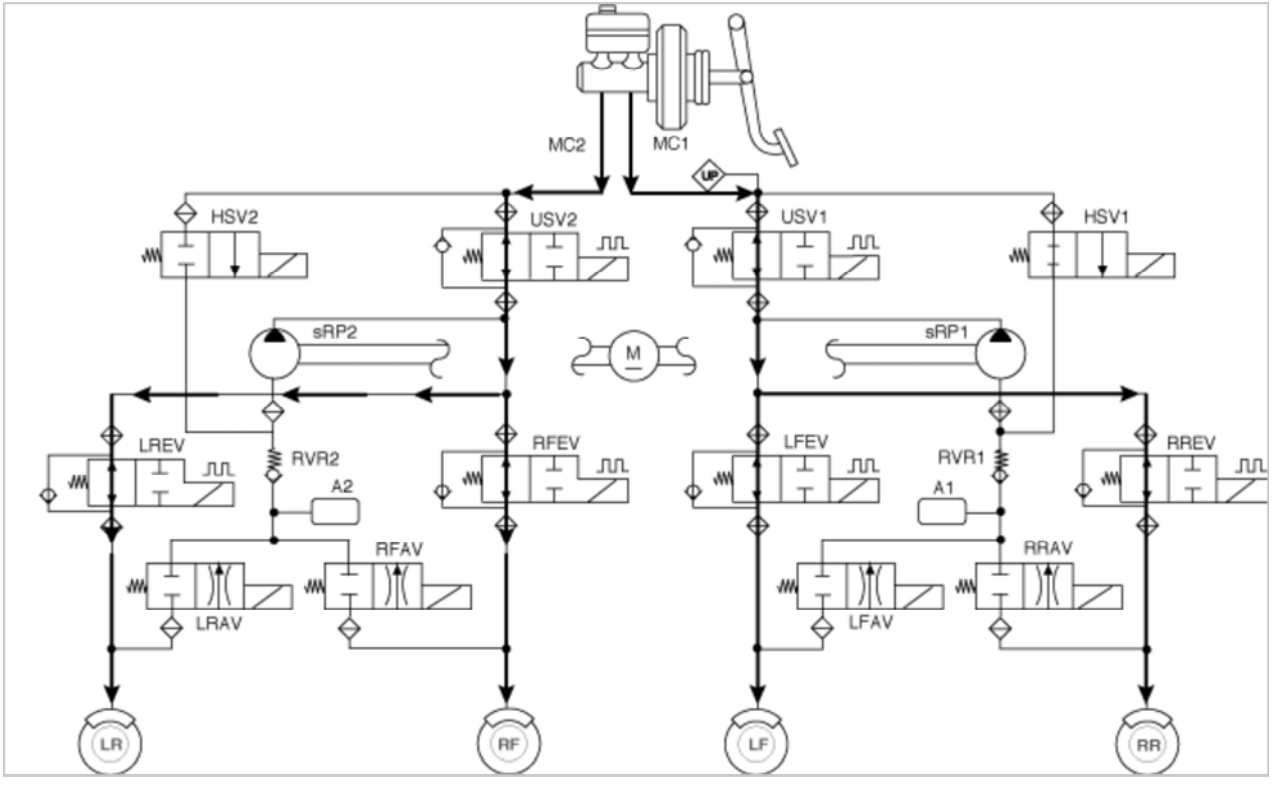
Vehicle rotation speed
+ Operated power to the side
→ ECU decides movement of the ESC vehicle.

3. STEP 3
he HECU calculates the required strategy, then actuates the appropriate valves and sents torque control requests via CAN to maintain vehicle stability.

ESC Operation Mode

1. ESC Non-operation-Normal braking.

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Open	Close	OFF

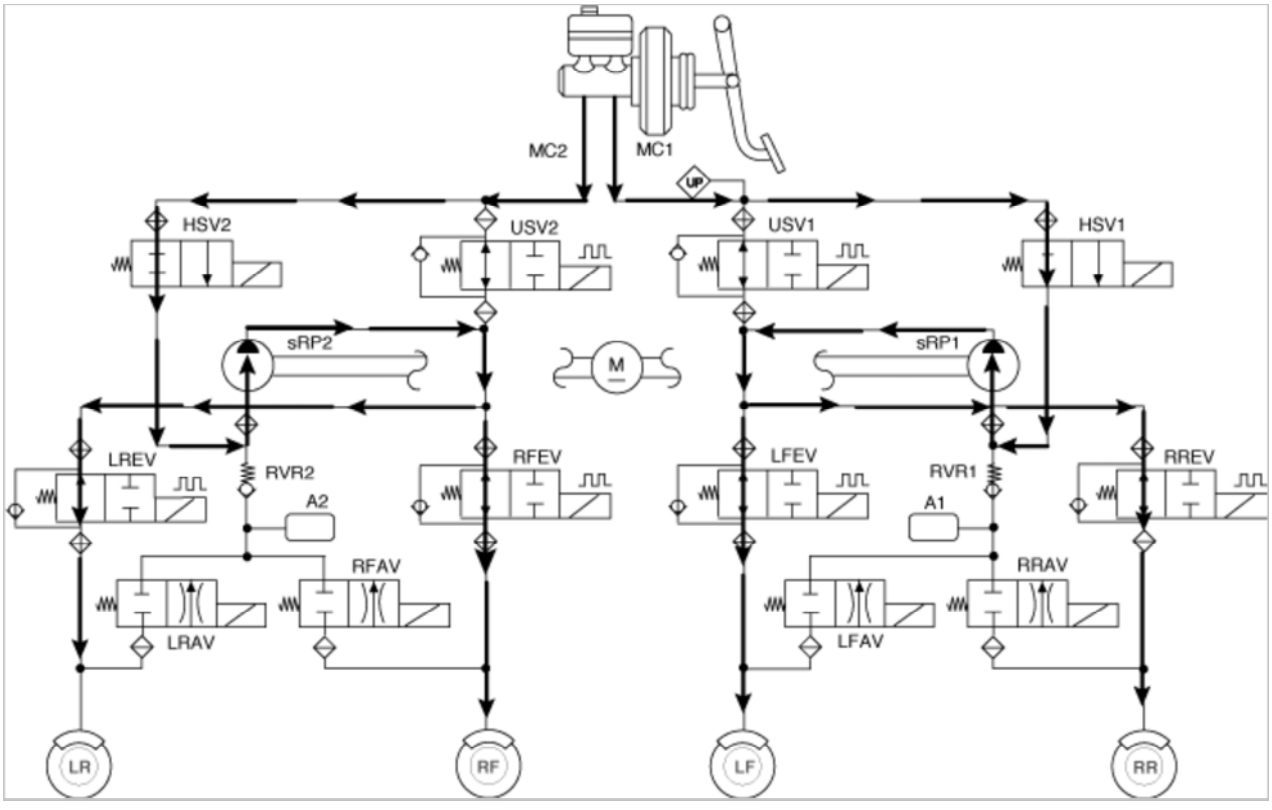


NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve

2. ESC INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Close(Partial)	Open	ON(Motor speed control)

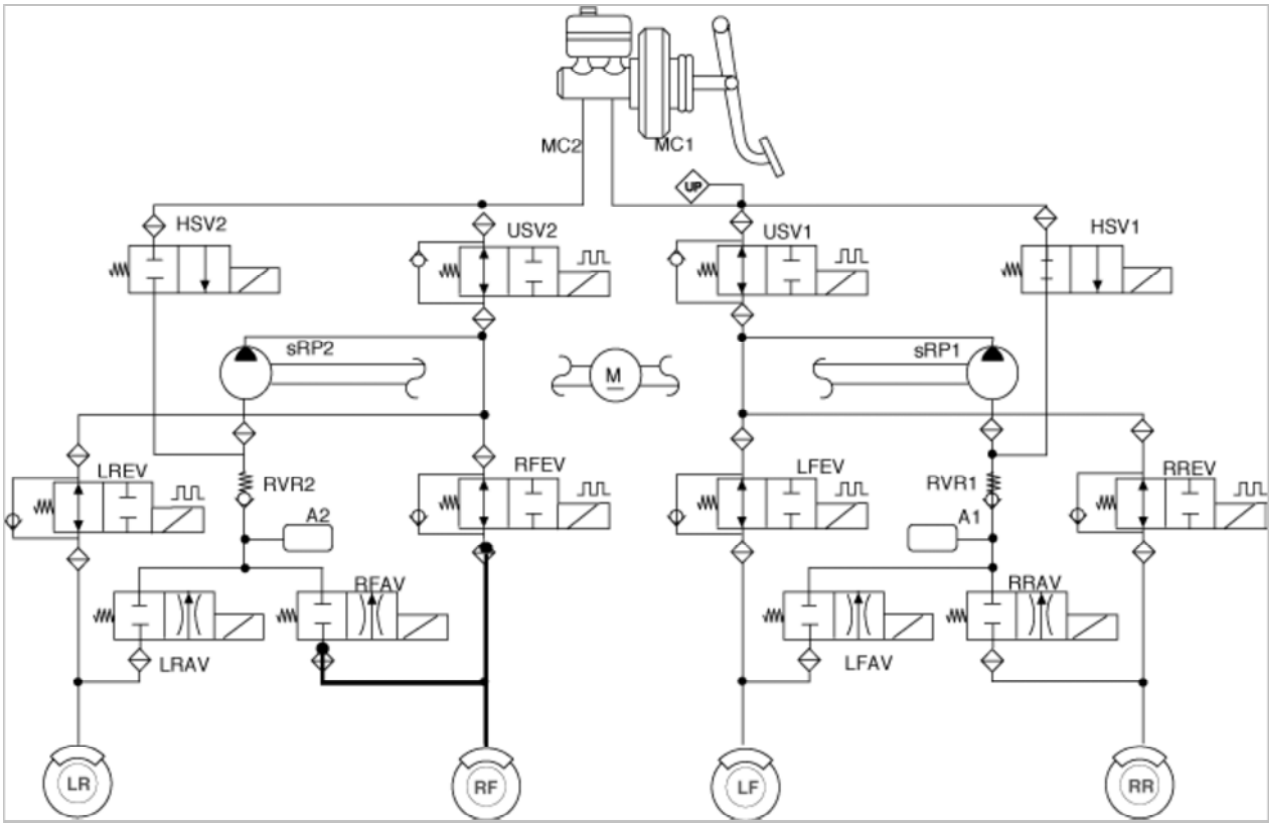


NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve

3. ESC HOLD MODE (FR is only controlled.)

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Close	Close(Partial)	Open	OFF

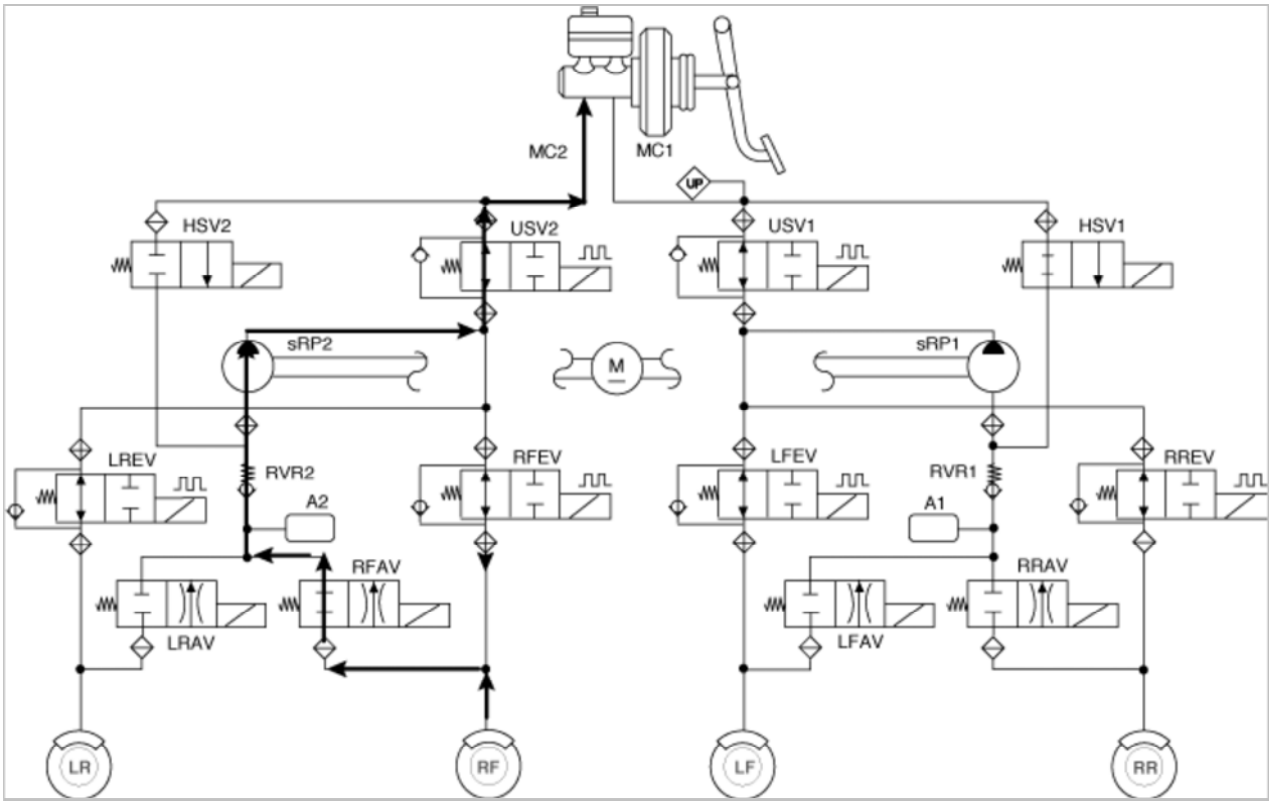


NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve

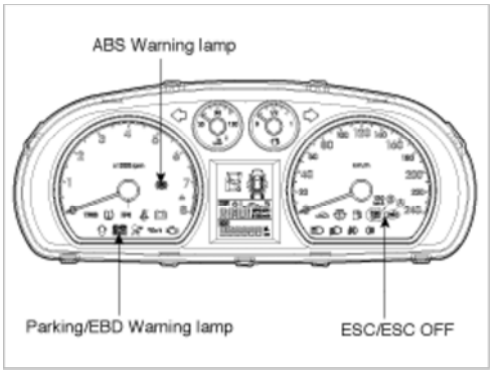
4. ESC DECREASE MODE (FR is only controlled)

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Open	Close(Partial)	Open	ON(Motor speed low control)



NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve



ABS Warning Lamp Module

The active ABS warning lamp module indicates the self-test and failure status of the ABS . The ABS warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.

EBD/Parking Brake Warning Lamp Module

The active EBD warning lamp module indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order .
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.

ESC Warning Lamp (ESC system)

The ESC warning lamp indicates the self-test and failure status of the ESC.
The ESC warning lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESC functions by failure.
- When driver turn off the ESC function by on/off switch.
- During diagnostic mode.

ESC Function Lamp (ESC System)

The ESC function lamp indicates the self-test and operating status of the ESC.
The ESC Function lamp operates under the following conditions :

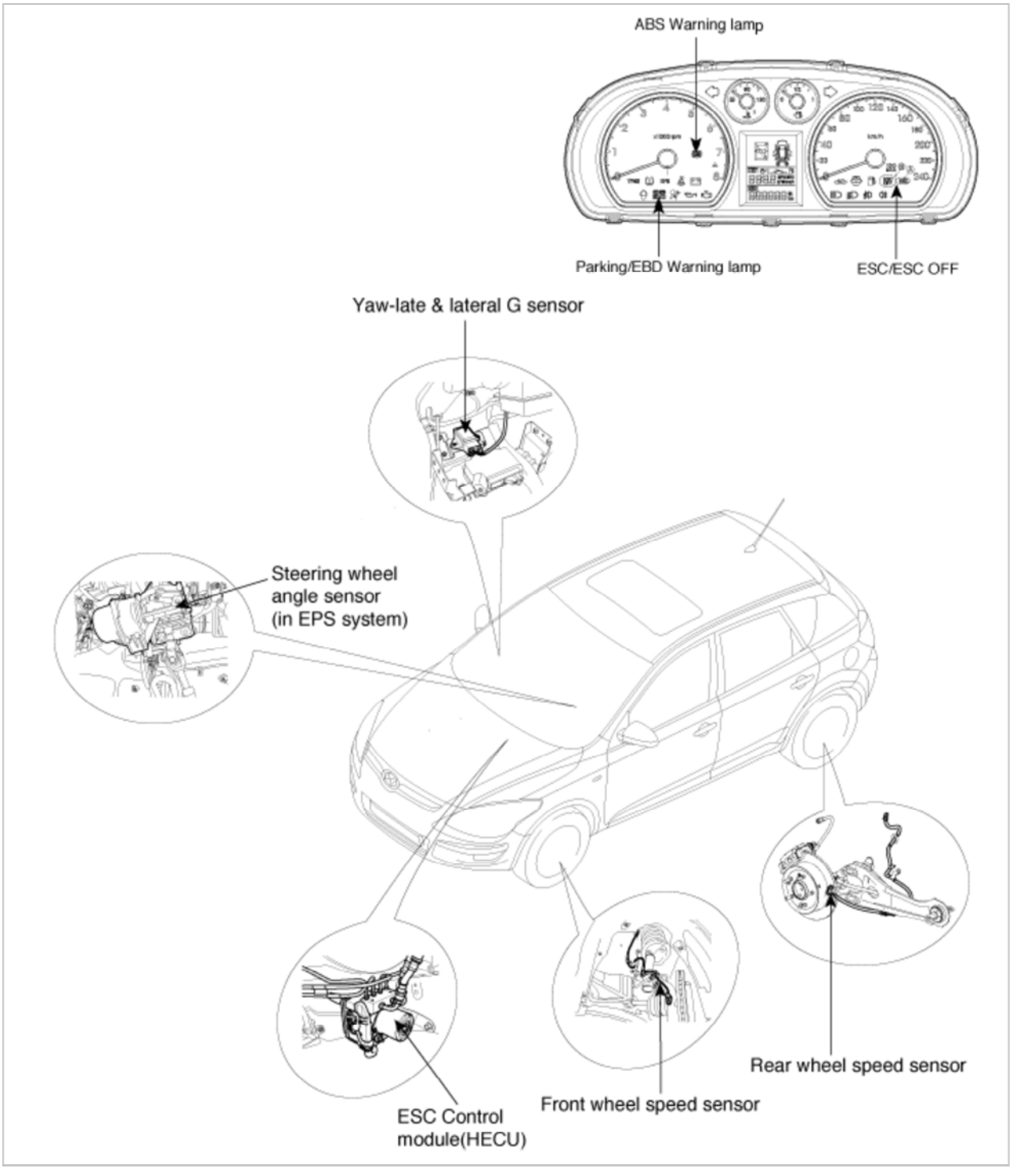
- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESC control is operating. (Blinking - 2Hz)

ESC On/Off Switch (ESC System)

The ESC On/Off Switch shall be used to toggle the ESC function between On/Off states based upon driver input.
The On/Off switch shall be a normally open, momentary contact switch.
Initial status of the ESC function is on and the switch is used to request an ESC status change.

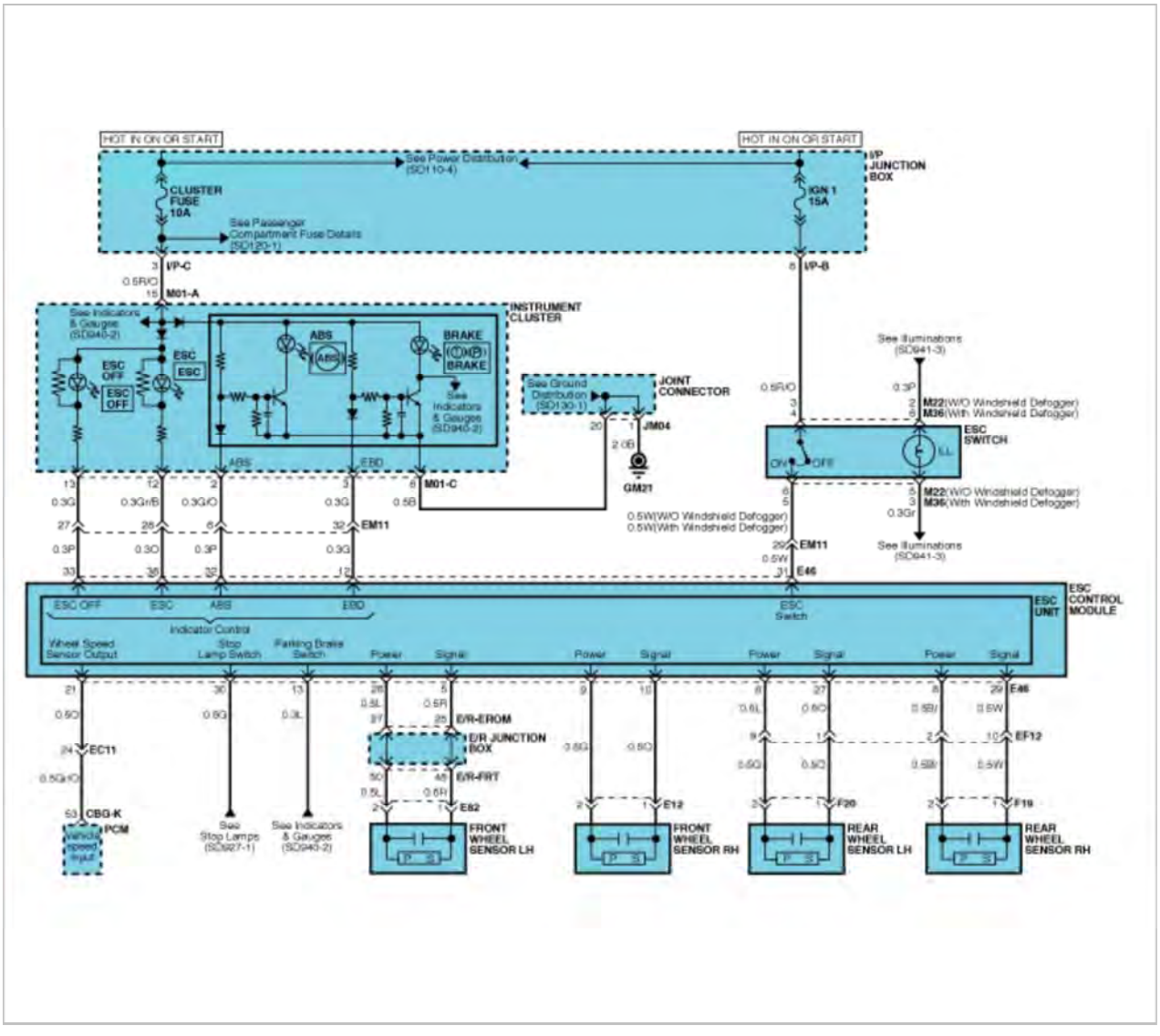
Brake System > ESC(Electronic Stability Control) System > Components and Components Location

Components

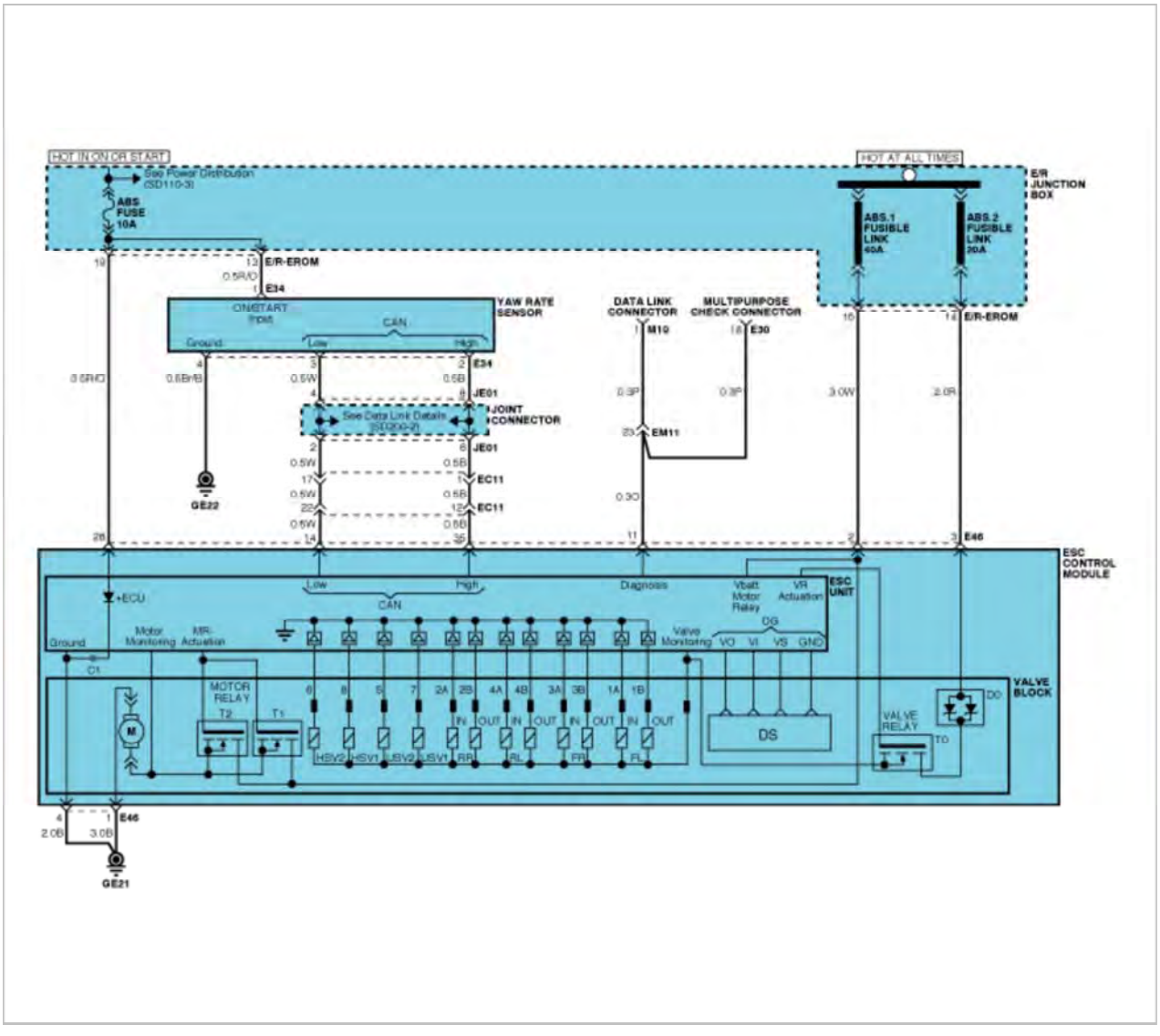


Brake System > ESC(Electronic Stability Control) System > Schematic Diagrams

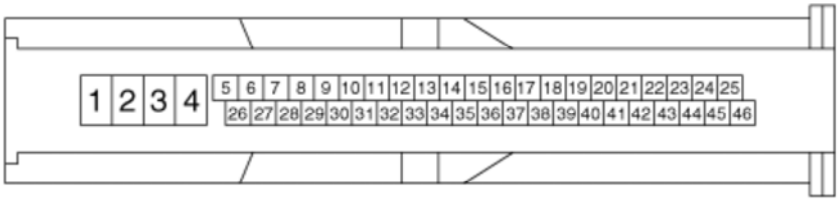
ESC Circuit Diagram(1)



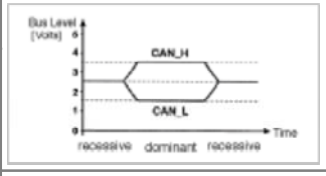
ESC Circuit Diagram(2)



ESC Hecu Connector Input / Output



Connector Terminal		Specifications	Conditions
No	Description		
1	Ground(Pump)	Current range : Min-10 A Max-20 ~ 39 A	Always
4	Ground(Valve,ECU)	Current range : Min-2.5 A Max-5 ~ 15 A	Always
2	Supply voltage(Pump)	Battery voltage	Always
3	Supply voltage(Valve)		
26	Wheel sensor voltage(FL)	Battery voltage	IG ON
9	Wheel sensor voltage(FR)		
6	Wheel sensor voltage(RL)		

8	Wheel sensor voltage(RR)		
5	Wheel sensor signal(FL)	Voltage(High) : 0.89~1.26 V Voltage(Low) : 0.44~0.63 V	RUNNING
10	Wheel sensor signal(FR)		
27	Wheel sensor signal(RL)		
29	Wheel sensor signal(RR)		
11	Diagnosis Input/oupput	Voltage(High) : 0.8 * IG ON more Voltage(Low) : 0.2 * IG ON lower	SCAN TOOL Communication
28	Ignition	Battery voltage	KEY ON/OFF
31	ESC Passive switch	Voltage(High) : 0.6 * IG ON more Voltage(Low) : 0.4 * IG ON lower	Switch ON/OFF
35	CAN High	not communicating:2.5 ± 0.5 V communication : 	IG ON
14	CAN Low		
30	BRAKE LIGHT SWITCH	voltage(High) : ≥ 4.5 V voltage(Low) : ≤ 2.0 V	BRAKE ON/OFF

Brake System > ESC(Electronic Stability Control) System > Troubleshooting

Failure Diagnosis

1. In principle, ESC and TCS controls are prohibited in case of ABS failure.
2. When ESC or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESC failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESC is not installed.

Memory of Fail Code

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as long as the HCU power is on. (X)

Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.

Countermeasures in Fail

1. Shut the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Do not perform any ABS/TCS/ESC functions until normal operating condition is restored.

Warning Lamp On

1. ABS warning lamp turns on when ABS is malfunctioning.
2. ESC operation lamp turns on when ESC is malfunctioning.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

Diagnostic Trouble Codes (DTC)

● : MIL ON ○ : MIL OFF

DTC	Trouble description	Warning lamp condition			Etc.

CODE		EBD	ABS	ESC	
C1101	Battery Voltage High	●	●	●	
C1102	Battery Voltage Low	○/●	●	●	
C1200	Wheel Speed Sensor Front-LH Open/Short	○/●	●	●	
C1201	Wheel Speed Sensor Front-LH Range / Performance / Intermittent	○/●	●	●	
C1202	Wheel Speed Sensor Front-LH Invalid/no Signal	○/●	●	●	
C1203	Wheel Speed Sensor Front-RH Open/Short	○/●	●	●	
C1204	Wheel Speed Sensor Front-RH Range / Performance / Intermittent	○/●	●	●	
C1205	Wheel Speed Sensor Front-RH Invalid/no Signal	○/●	●	●	
C1206	Wheel Speed Sensor Rear-LH Open/Short	○/●	●	●	
C1207	Wheel Speed Sensor Rear-LH Range / Performance / Intermittent	○/●	●	●	
C1208	Wheel Speed Sensor Rear-LH Invalid/no Signal	○/●	●	●	
C1209	Wheel Speed Sensor Rear-RH Open/Short	○/●	●	●	
C1210	Wheel Speed Sensor Rear-RH Range / Performance /Intermittent	○/●	●	●	
C1211	Wheel Speed Sensor Rear-RH Invalid/no Signal	○/●	●	●	
C1213	Wheel Speed Frequency Error	○/●	●	●	
C1235	Primary Pressure Sensor-Electrical	○	●	●	ESC only
C1237	Pressure Sensor-Signal	○	●	●	ESC only
C1260	Steering Angle Sensor-Signal	○	○	●	ESC only
C1261	Steering Angle Sensor Not Calibrated	○	○	●	ESC only
C1283	Yaw Rate & Lateral G Sensor-Signal	○	○	●	ESC only
C1503	ESC Switch Error	○	○	○	ESC only
C1513	Brake Switch Error	○	●	●	ESC only
C1604	ECU Hardware Error	●	●	●	
C1605	CAN Hardware Error	○	○	●	ESC only
C1611	CAN Time-out ECM	○	○	●	ESC only
C1612	CAN Time-out TCM	○	○	●	ESC only
C1616	CAN Bus off	○	○	●	ESC only
C1623	CAN Time-out Steering Angle Sensor	○	○	●	ESC only
C1625	CAN Time-out ABS/ESC	○	○	●	ESC only
C1626	Implausible Control	○	●	●	ESC only
C1643	CAN Time-out Yaw Rate & Lateral G Sensor	○	○	●	ESC only
C1702	Variant Coding Error	●	●	●	ESC only
C2112	Valve Relay Error	○/●	●	●	
C2308	Front-LH Valve Error (Inlet Valve)	●	●	●	
C2312	Front-LH Valve Error (Outlet Valve)	●	●	●	
C2316	Front-RH Valve Error (Inlet Valve)	●	●	●	
C2320	Front-RH Valve Error (Outlet Valve)	●	●	●	
C2324	Rear-LH Valve Error (Inlet Valve)	●	●	●	
C2328	Rear-LH Valve Error (Outlet Valve)	●	●	●	
C2332	Rear-RH Valve Error (Inlet Valve)	●	●	●	

C2336	Rear-RH Valve Error (Outlet Valve)	●	●	●	
C2366	TC Valve Primary (USV1) Error	●	●	●	
C2370	TC Valve Secondary (USV2) Error	●	●	●	
C2372	Electronic Shuttle Valve Primary (HSV1) Error	●	●	●	
C2374	Electronic Shuttle Valve Secondary (HSV2) Error	●	●	●	
C2402	Motor Electrical	●	●	●	

Brake System > ESC(Electronic Stability Control) System > C1101 Battery Voltage High

General Description

The ABS ECU(Electronic Control Unit) checks the battery voltage and alternator output voltage to determine, as a safety issue, whether the ABS system can operate normally or not.
The normal battery voltage range is essential for controlling the ABS system as intended.

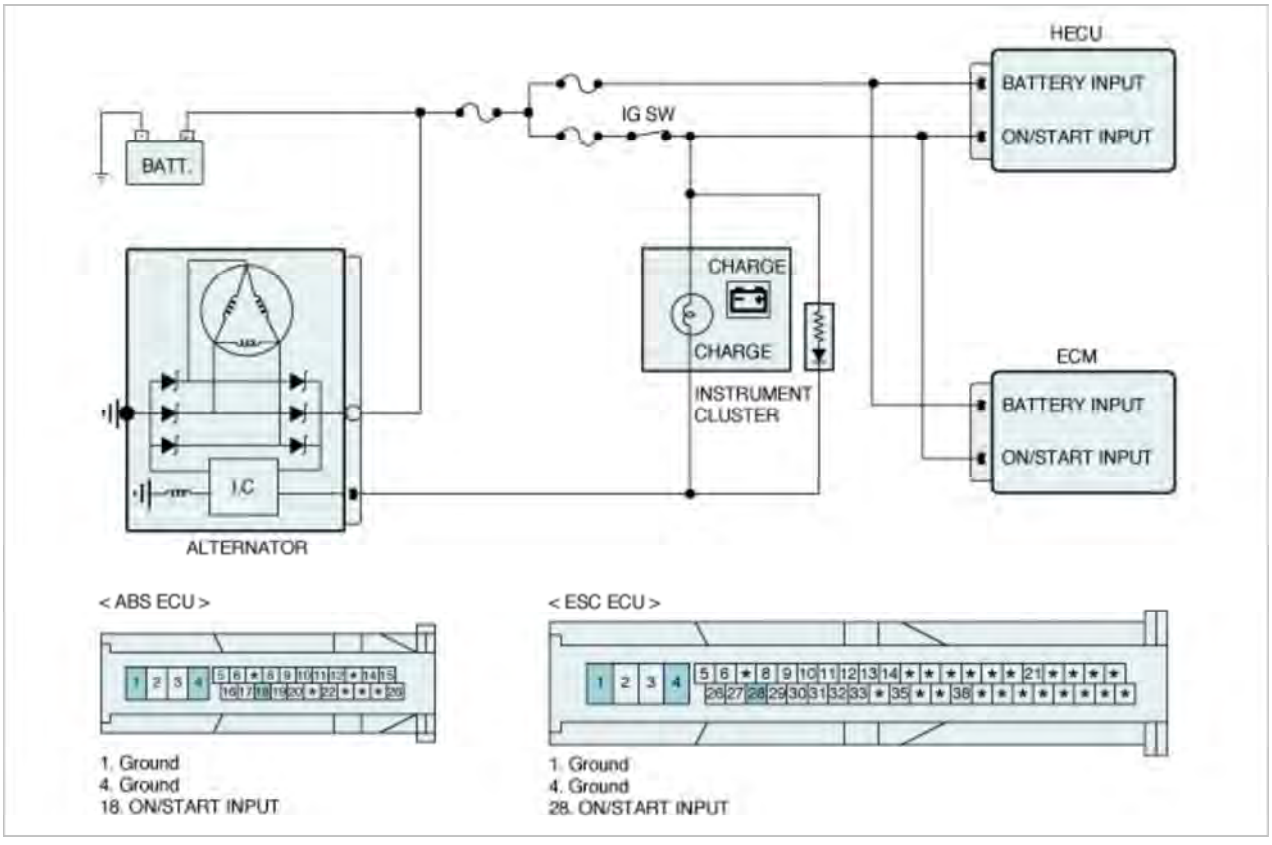
DTC Description

The ABS ECU monitors battery voltage and alternator output voltage by reading the value of voltage.
When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/ESC functions are prohibited.
If the voltage recovers, to within normal operating range, then the controller returns to normal operation as well.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Battery Voltage Monitoring	• Poor connection in power supply circuit (IGN+) • Faulty Alternator
Monitoring Period	• Continuous (Over voltage faults will be always stored.)	
Enable Conditions	• When Vign is higher than 16.8V. - If the voltage is recovered to 16.7V, the controller returns to normal state. - The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.	
Fail-Safe	• The ABS/EBD/ESC functions are inhibited. - The proper function of valves and return pump is not guaranteed. • The ABS/EBD/ESC warning lamps are activated. • The supply voltage to wheel speed sensor is interrupted.	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "ON".
3. Monitor the "Supply Voltage Status" parameter on the scantool.

Specification : Below. 16.7V

Sensor Name	Value	Unit
☑ Supply Voltage Status	12.1	V

Fig.1

Fig.1) Test Condition : Ignition "ON" & Engine "ON".
Normal Data

4. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in power harness (IGN+) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminal condition. 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	▸ Verify presence of battery voltage codes in other ECUs (SRS, etc). If battery voltage codes are not present in other ECUs, go to "Power Circuit Inspection" procedure. If battery voltage codes are present in other ECUs, go to "Alternator Output Voltage Inspection" procedure.

Alternator Output Voltage Inspection

■ **Charging System Check**

1. Ignition "ON" & Engine "ON".
2. Maintain ENG RPM 2,500RPM over 2 minutes.
3. Measure voltage between the battery terminal(+) and the battery terminal(-).

Specification : Below. 18 ± 1.0V

4. Is the measured value within specifications?

YES	▸ Go to "Power Circuit Inspection" procedure.
NO	▸ Check that the tension of drive belt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and Check for damaged harness and poor connection between alternator and battery. If OK, repair or replace alternator and then go to "Verification of vehicle Repair" procedure.

Power Circuit Inspection

■ **Open or Short Check**

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between the battery terminal(+) and power terminal of the HECU harness connector.

Specification : Approx. below 0.2V

3. Is the measured value within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Check for open or blown ABS fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and HECU harness connector and then go to "Verification of vehicle Repair" procedure.

Ground Circuit Inspection

■ **Open or Short Check**

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

Specification : Approx. below 1Ω

4. Is the measured value within specifications?

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	▸ Repair open or short in ground circuit between HECU harness connector and chassis ground 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.
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 > ESC(Electronic Stability Control) System > C1102 Battery Voltage Low

General Description

The ABS ECU(Electronic Control Unit) checks the battery voltage and alternator output voltage to determine, as a safety issue, whether the ABS system can operate normally or not.
The normal battery voltage range is essential for controlling the ABS system as intended.

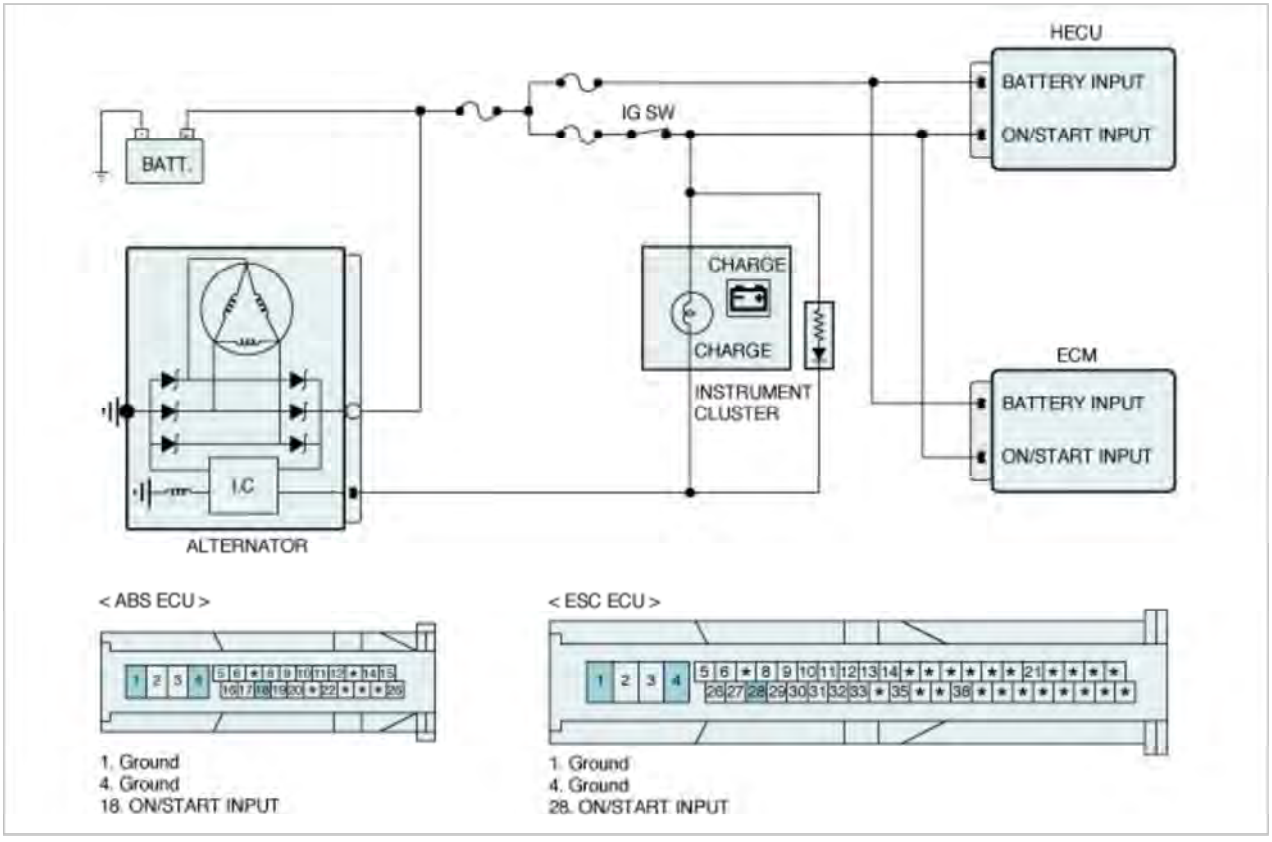
DTC Description

The HECU monitors the battery voltage by reading the value of voltage.
When the voltage is lower than the expected normal value, this code is set.
The ABS/TCS/ESC functions are prohibited and the EBD function is allowed on LOW VOLTAGE CONDITION, the ABS/EBD/TCS/ESC function are prohibited on UNDER VOLTAGE CONDITION.
If the voltage recovers, to within normal operating ranges, then the controller returns to normal operations as well.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Battery Voltage Monitoring	• Poor connection in power supply circuit (ABS) • Faulty HECU
Monitoring Period		• Continuous	
Case1 (Low voltage)	Enable Conditions	• When Vign is lower than 9.3V outside ABS/ESC control. • When Vign is lower than 9.2V inside ABS/ESC control. - If IGN voltage is recovered to 9.6V, the system recovers to normal state. - The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.	
	Fail-Safe	• The ABS/ESC functions are inhibited. • The ABS/ESC warning lamps are activated.	
Case2 (Under voltage)	Enable Conditions	• When Vign is lower than 7.7V. - The system remains in this condition until IGN voltage is recovered to 7.8V. • When Vign is lower than 8.2V for more than 20ms - ESC Only .- The system remains in this condition until IGN voltage is recovered to 8.3V for more than 500ms. - The monitored supply voltage is filtered and limited to a rise time of 4 volts per second. NOTE Under voltage faults are only entered in the EEPROM if the vehicle speed is > 6km/h. If FSA test detect under voltage. this will ve entered, because no vehicle speed is available during test. ※ FSA test : fail save circuit test	
	Fail-Safe	• The ABS/EBD/ESC functions are inhibited. • The ABS/EBD/ESC warning lamps are activated.	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "ON".
3. Monitor the "Supply Voltage Status" parameter on the scantool.

Specification : Above. 9.7± 0.3V

Sensor Name	Value	Unit
☑ Supply Voltage Status	12.1	V

Fig.1

Fig.1) Test Condition : Ignition "ON" & Engine "ON".
Normal Data

4. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in power harness (IGN+) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminal condition. 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 "Alternator Output Voltage Inspection" procedure.

Alternator Output Voltage Inspection

■ Charging System Check

1. Ignition "ON" & Engine "ON".
2. Maintain ENG RPM 2,500RPM over 2 minutes.
3. Measure voltage between the battery terminal(+) and the battery terminal(-).

Specification : Above. 9.7± 0.3V

4. Is the measured value within specifications?

YES	▸ Go to "Power Circuit Inspection" procedure.
NO	▸ Check that the tension of drive belt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and Check for damaged harness and poor connection between alternator and battery. If OK, repair or replace alternator and then go to "Verification of vehicle Repair" procedure.

Power Circuit Inspection

■ Open or Short Check

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between the battery terminal(+) and power terminal of the HECU harness connector.

Specification : Approx. B+

3. Is the measured value within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Check for open or blown ABS fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and HECU harness connector and then go to "Verification of vehicle Repair" procedure.

Ground Circuit Inspection

■ Open or Short Check

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

Specification : Approx. below 1Ω

4. Is the measured value within specifications?

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	▸ Repair open or short in ground circuit between HECU harness connector and chassis ground 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.

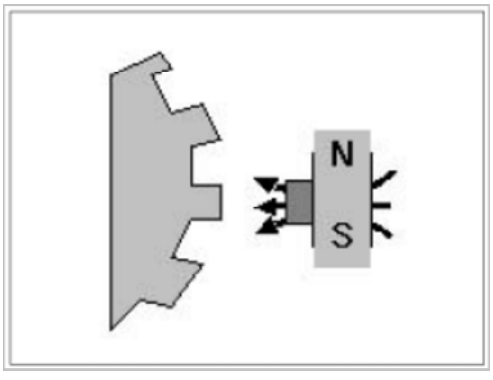
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
4. Are any DTCs present?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1200 Wheel Speed Sensor Front-LH Open/Short

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously.
A direct current is supplied in the wheel speed sensor by a power source in the input amplifier of the control unit.
If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness.
If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON.
Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

DTC Detecting Condition

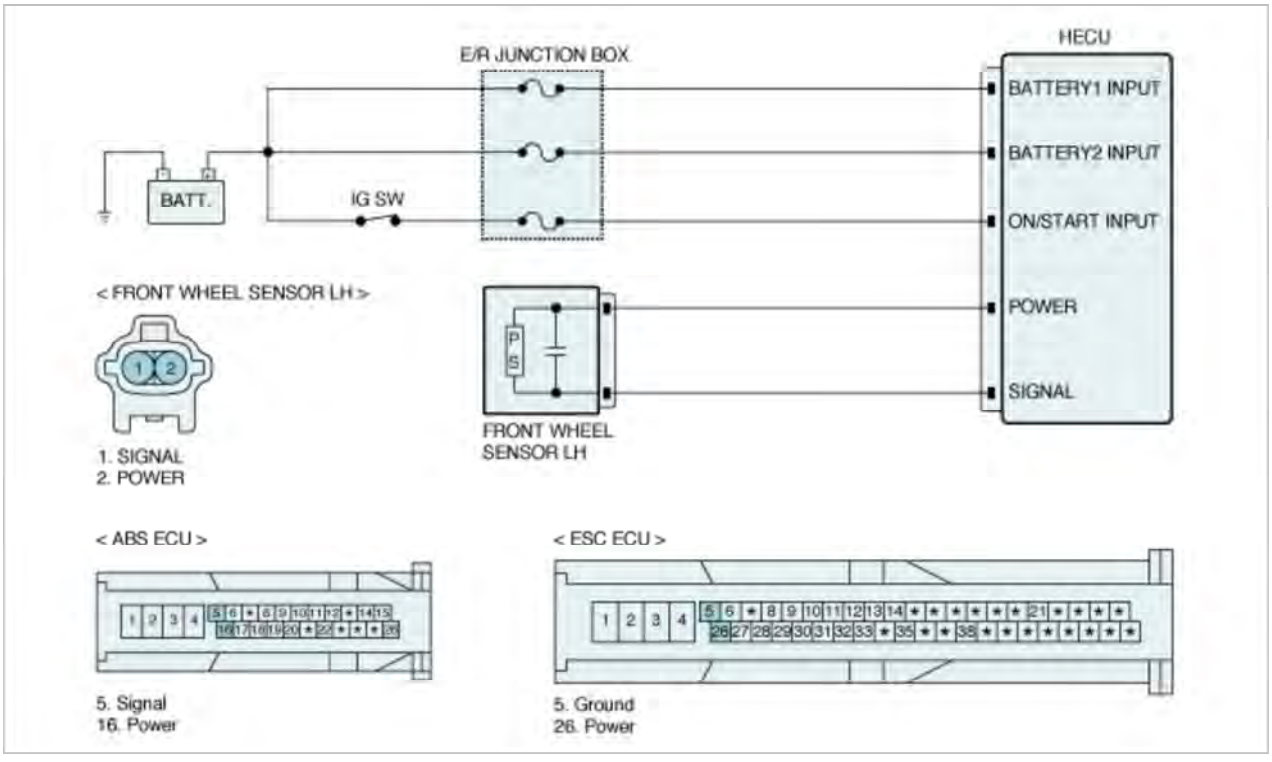
Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	
Case1	Monitoring Period	• Once after power up.	
	Enable Conditions	• Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized. NOTE In case of a WSS power line short to V_batt, this FSA test will detect an under voltage failure. (ABS only) ※ FSA test : fail save circuit test ※ UZ : Ignition Voltage	

Case2	Monitoring Period	• Continuous	
	Enable Conditions	• When the sensor current levels are out of permissible range(LOW : 7mA, HIGH : 14mA) for 200ms.	
Fail-Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.	• Open or short of Wheel speed sensor circuit(FL) • Faulty Wheel speed sensor(FL)

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.7mm

Diagnostic Circuit Diagram



Signal Waveform & Data

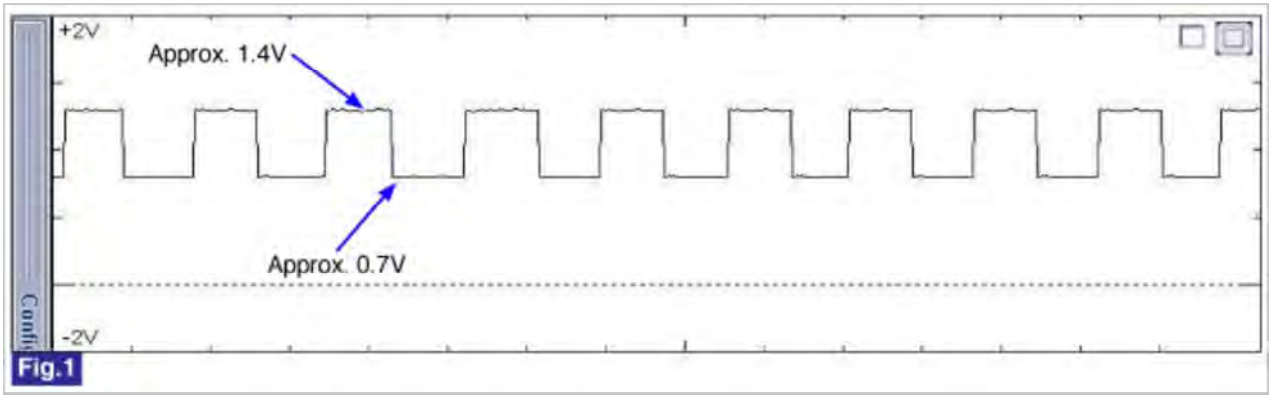


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10km/h. (6.2mph)
4. Monitor the "WHEEL SPD SNSOR-FL" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (FL) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminal condition. 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 Circuit Inspection" procedure.

Power Circuit Inspection

■ Open or Short Check

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+

3. Is the measured value within specifications?

YES	▸ Go to "Signal Circuit Inspection" procedure.
NO	▸ Repair open or short in power circuit between HECU harness connector and wheel speed sensor harness connector and then go to "Verification of vehicle Repair" procedure. If there is no problem in Power circuit, 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.

Signal Circuit Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between wheel speed sensor signal terminal of the HECU harness connector and chassis ground with osciloscope.

Specification : High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

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	▸ Repair open or short in signal circuit between HECU harness connector and wheel speed sensor harness connector, and then go to "Verification of vehicle Repair" procedure. If there is no problem in signal circuit, go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (FL). Go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

Verification of Vehicle Repair

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

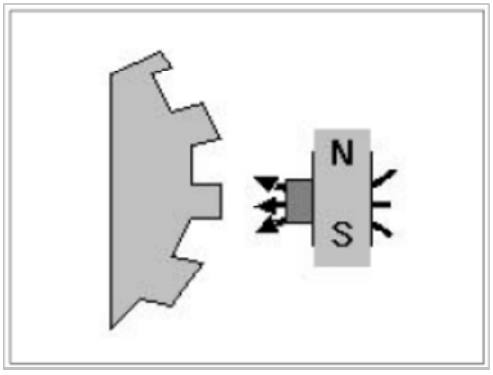
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
4. Are any DTCs present?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1201 Wheel Speed Sensor Front-LH Range / Performance / Intermittent

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously.
This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10km/h to 80km/h.
Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC Detecting Condition

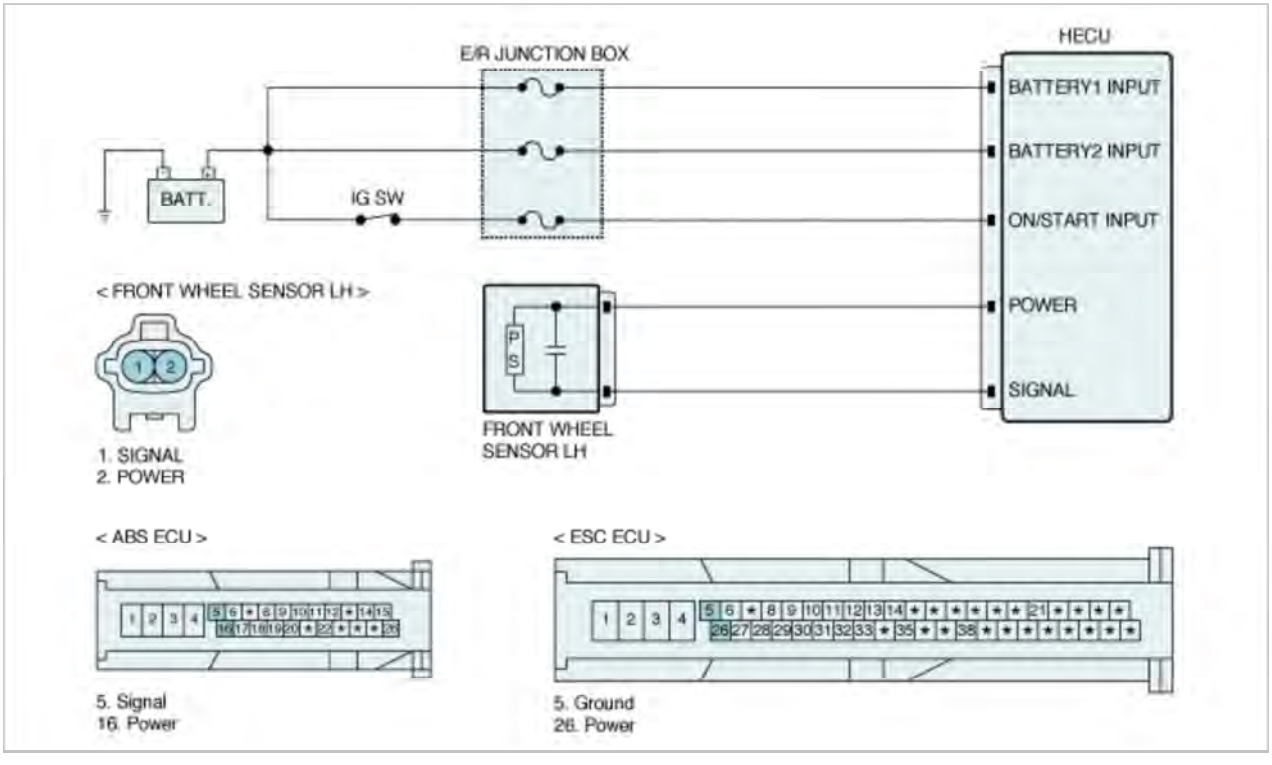
Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor(FL) • Exteral noise
Case1	Monitoring Period	• The monitoring is active from 10 km/h to 80km/h and if no ABS-control is active at a front wheel and a rear wheel.	
	Enable Conditions	• Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• If following interference and signal disturbance is detected, a failure is set after 10s. - non-plausible high frequency received. - non-plausible high wheel acceleration. - non-plausible high wheel jurk. - non-plausible delta T and edges at low speed.	
		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated.	

Fail-Safe	2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.7mm

Diagnostic Circuit Diagram



Signal Waveform & Data

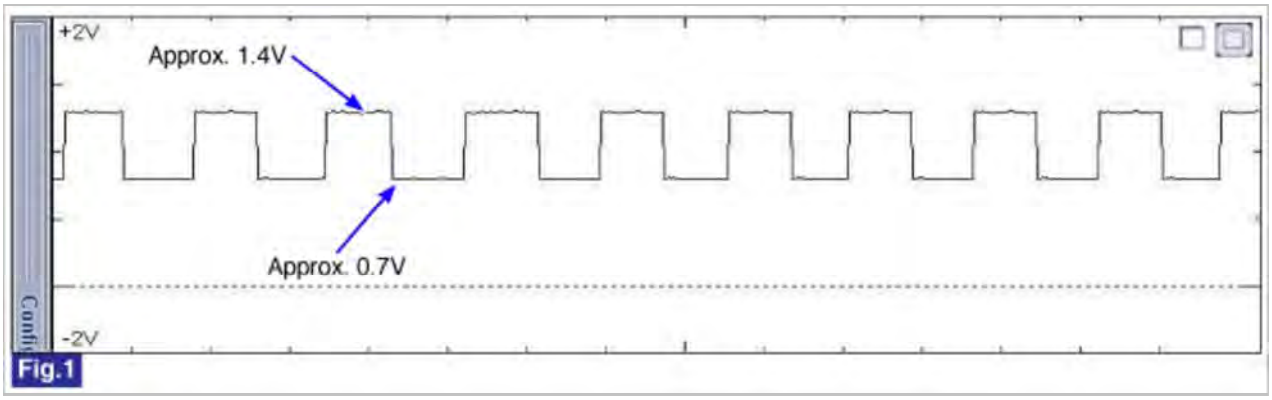


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12km/h. (7.5mph)
4. Monitor the "WHEEL SPD SNSOR-FL" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ **Wheel speed sensor circuit check**

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by faulty HECU, wheel speed sensor or external noise, an interferencebetween harnesses. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification of Vehicle Repair" procedure. If there is no problem in signal circuit, 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	▸ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.

	Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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

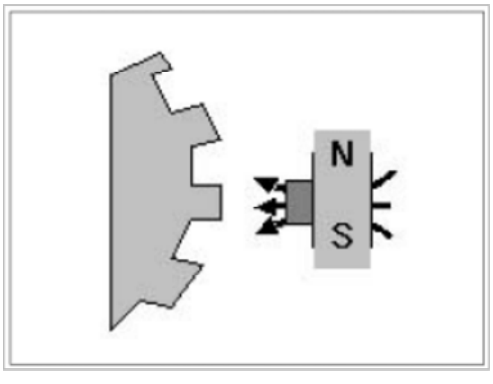
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 12km/h. (7.5mph))
4. Are any DTCs present?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1202 Wheel Speed Sensor Front-LH Invalid/no Signal

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously.
This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75km/h while the vehicle speed is at 12 km/h.
Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	
	Monitoring Period	• Continuous (the conditions below are met and no under voltage is not detected)	
		• If one (or two) wheel are at 2.75km/h and the other wheels are above 12 km/h for longer than 1s.	

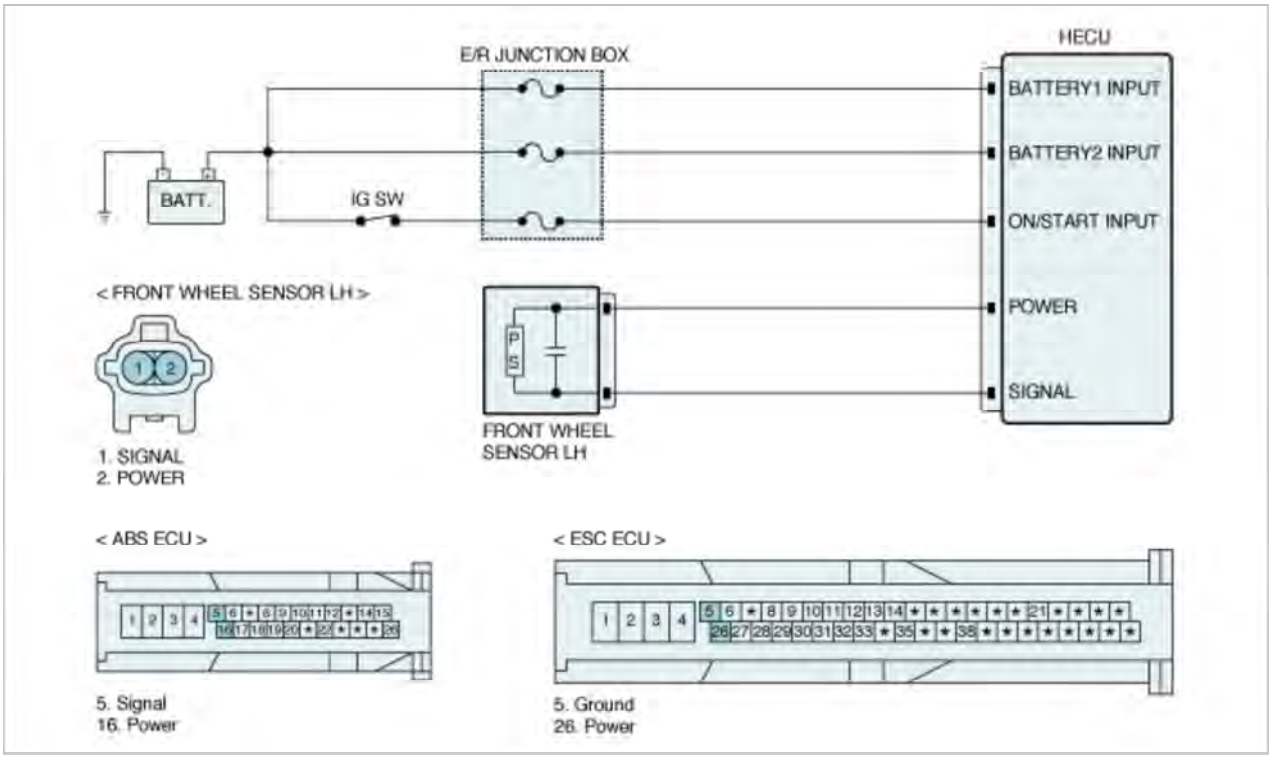
Case1	Enable Conditions	• During driving, when the vehicle accelerates 18km/h after a particular wheel speed gets to 2.75km/h and stays there. At that time, If one (or two) wheel are at 2.75km/h. - This monitoring is performed at the vehicle is accelerated to 12km/h a) once after energizing the system. b) If the vehicle was stationary for approx. 2s. • If one (or two) wheels are under 5km/h and the two fastest wheels have a velocity above 12km/h for more than 20s. - This monitoring is performed continuously.	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor(FL)
Case2 (WSS Dynamic monitoring)	Monitoring Period	• Continuous (If vehicle speed > 12 m/s (43,2 km/h)) - but this monitoring is disabled in the following event 1. aquaplaning. 2. interference. 3. supply voltage below 7.1 or above 18 Volts.	
	Enable Conditions	• No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). - If the dynamic sensor monitor resconses, the failures will be stored into failure memory immediately after a waiting period of 60ms. - If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.	
Case3 - ABS Only	Monitoring Period	• Continuous	
	Enable Conditions	• Vehicle < 100Km/h - Difference of two wheel speeds at FL to RL/FR to RR>1.7m/s (6km/h). - Difference of two wheel speeds at FL to FR/RL to RR>1.7m/s + 1.1m/s. - Difference of two wheel speeds at FL to RR/FR to RL>1.7m/s + 2.2m/s. ※ If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted. • Vehicle > 100Km/h - Difference of two wheel speeds at FL to RL/FR to RR> (6%×Vref). - Difference of two wheel speeds at FL to FR/RL to RR> (6%×Vref + 1.1m/s). - Difference of two wheel speeds at FL to RR/FR to RL> (6%×Vref + 2.2m/s). ※ V_ref : Vehicle Reference Speed difference and additional conditions as shown below. 1. 18s - if fault threshold is exceeding > 1.7m/s resp.6% 2. 9s - if fault threshold is exceeding > 3.3m/s resp. 12% 3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s. 4. If spinning wheel is detected the fault detection filter time is not shorter than 72s. • Fault allocation If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s. Otherwise a general WSS_Generic fauly (C1213) is set. • Detection filter time - Response and detection filter time depend on the amount of the speed	
		• Main Monitoring	

	Monitoring Period	- The main monitor needs additional information of the ESC-sensors and is active for a velocity > 20 km/h and no under voltage is detected. • Backup Monitoring - Continuous
Case4 -ESC Only	Enable Conditions	• Main Monitoring 1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%. 2. detection filter time : - the above conditions apply for 20s for 1 defective wheel speed sensor. - the above conditions apply for 40s for 2 defective wheel speed sensor. NOTE If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set. • Backup Monitoring 1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h. 2. When the velocity is below 50 km/h, if the deviation exceeds an absolute value of 3km/h. 3. detection filter time : normally 20s - In case of a detected curve, the threshold is increased with an additional value of 4 km/h.
Fail Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.7mm

Diagnostic Circuit Diagram



Signal Waveform & Data

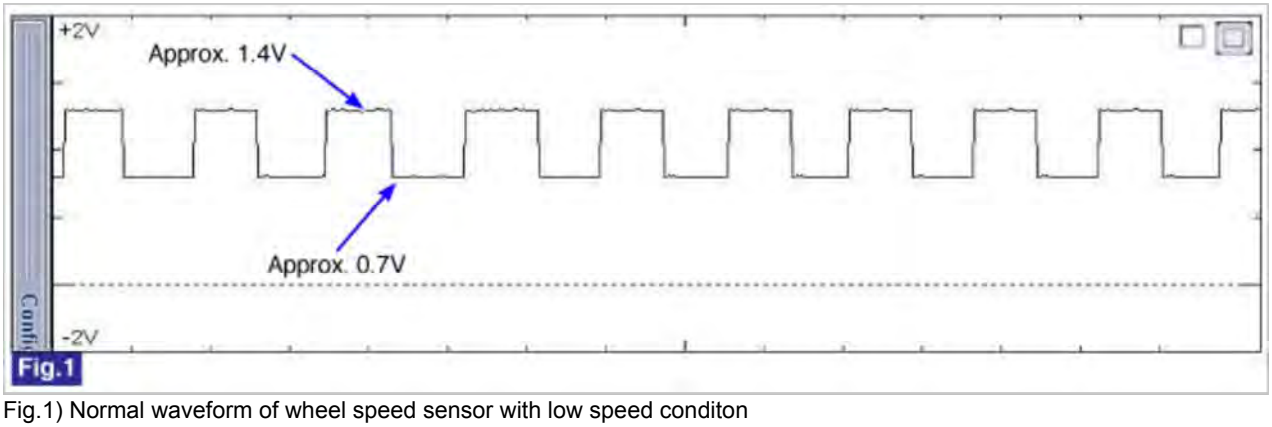


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50km/h. (31.1mph)
4. Monitor the "WHEEL SPD SNSOR-FL" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (FL) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness. 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. If OK, 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	▸ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. 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.

Verification of Vehicle Repair

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

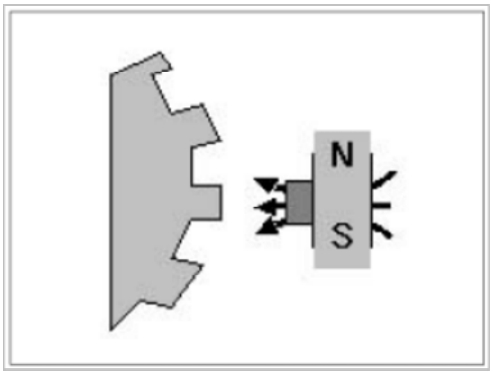
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 50km/h. (31.1mph)
4. Are any DTCs present?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1203 Wheel Speed Sensor Front-RH Open/Short

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously.
A direct current is supplied in the wheel speed sensor by a power source in the input amplifier of the control unit.
If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness.
If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON.
Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

DTC Detecting Condition

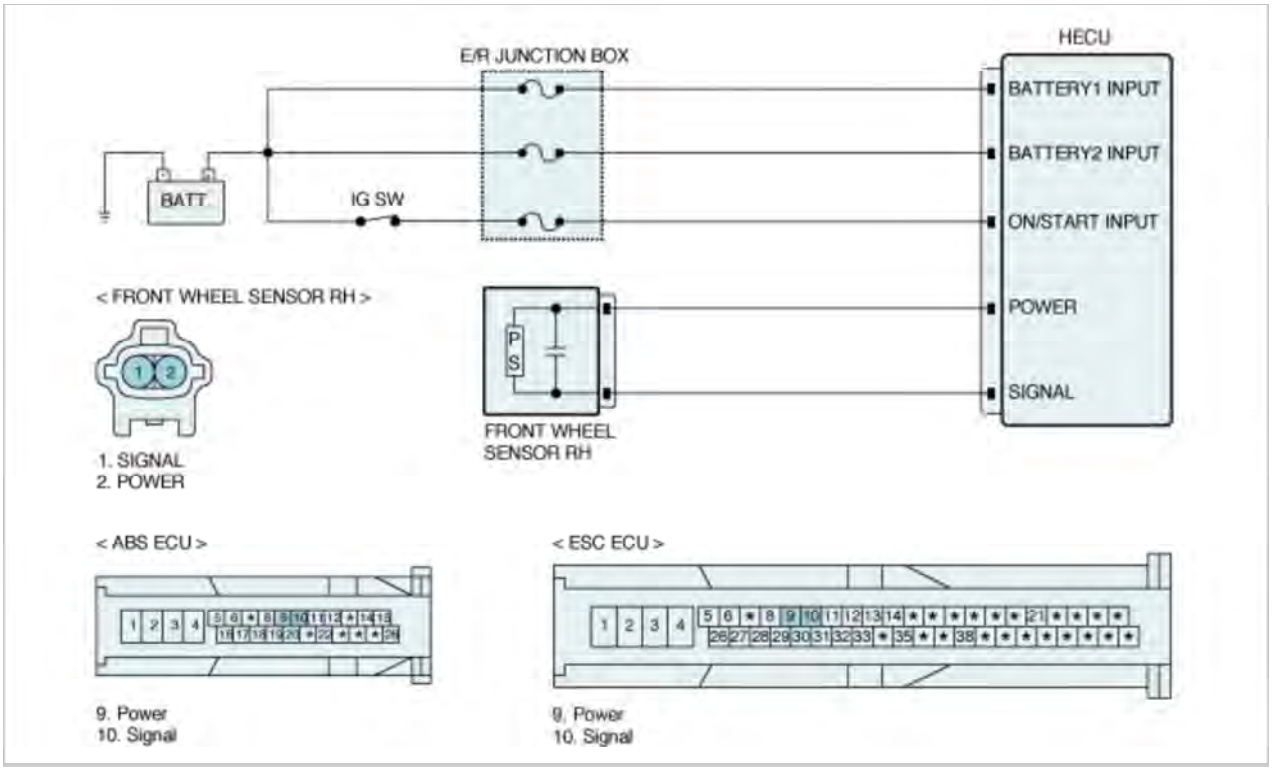
Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Open or short of Wheel speed sensor circuit(FR) • Faulty Wheel speed sensor(FR)
Case1	Monitoring Period	• Once after power up.	
	Enable Conditions	• Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized. NOTE In case of a WSS power line short to V_batt, this FSA test will detect an under voltage failure. (ABS only) ※ FSA test : fail save circuit test ※ UZ : Ignition Voltage	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• When the sensor current levels are out of permissible range(LOW : 7mA, HIGH : 14mA) for 200ms.	
Fail-Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer	

	possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.	

Specifications

Sensor Type	Output Voltage		Airgap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.7mm

Diagnostic Circuit Diagram



Signal Waveform & Data

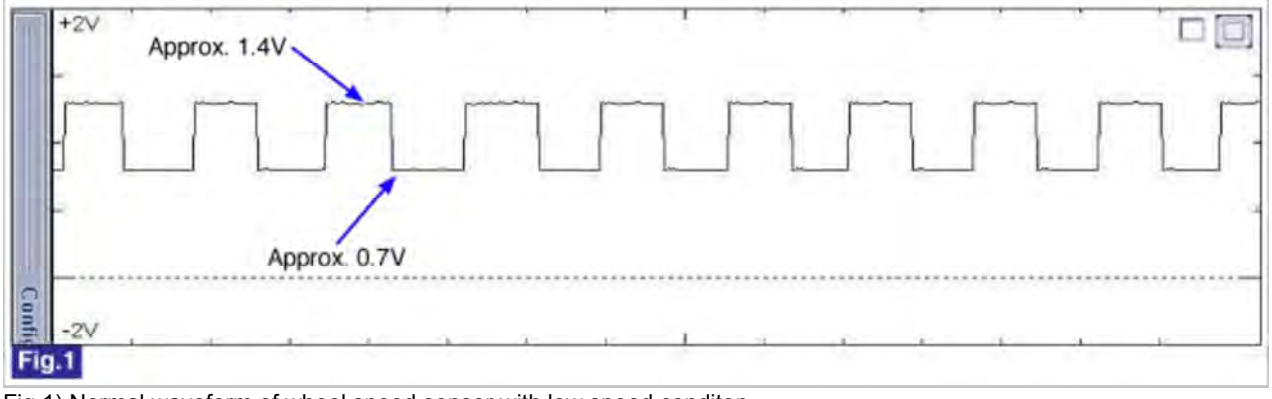


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).

3. Start and drive vehicle in gear and maintain vehicle speed at or above 10km/h. (6.2mph)
4. Monitor the "WHEEL SPD SNSOR-FR" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (FR) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminal condition. 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 Circuit Inspection" procedure.

Power Circuit Inspection

■ Open or Short Check

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+

3. Is the measured value within specifications?

YES	▸ Go to "Signal Circuit Inspection" procedure.
NO	▸ Repair open or short in power circuit between HECU harness connector and wheel speed sensor harness connector and then go to "Verification of vehicle Repair" procedure. If there is no problem in Power circuit, 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.

Signal Circuit Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between wheel speed sensor signal terminal of the HECU harness connector and chassis ground.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

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	▸ Repair open or short in signal circuit between HECU harness connector and wheel speed sensor harness connector, and then go to "Verification of vehicle Repair" procedure. If there is no problem in signal circuit, go to "Component Inspection" procedure.

Component Inspection

■ **Wheel speed sensor circuit check**

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (FR). Go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

Verification of Vehicle Repair

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

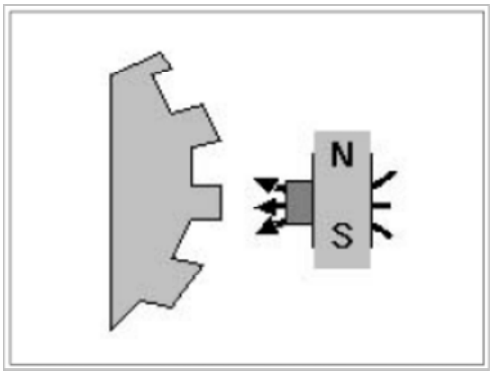
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
4. Are any DTCs present?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1204 Wheel Speed Sensor Front-RH Range / Performance / Intermittent

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously.
This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10km/h to 80km/h.
Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC Detecting Condition

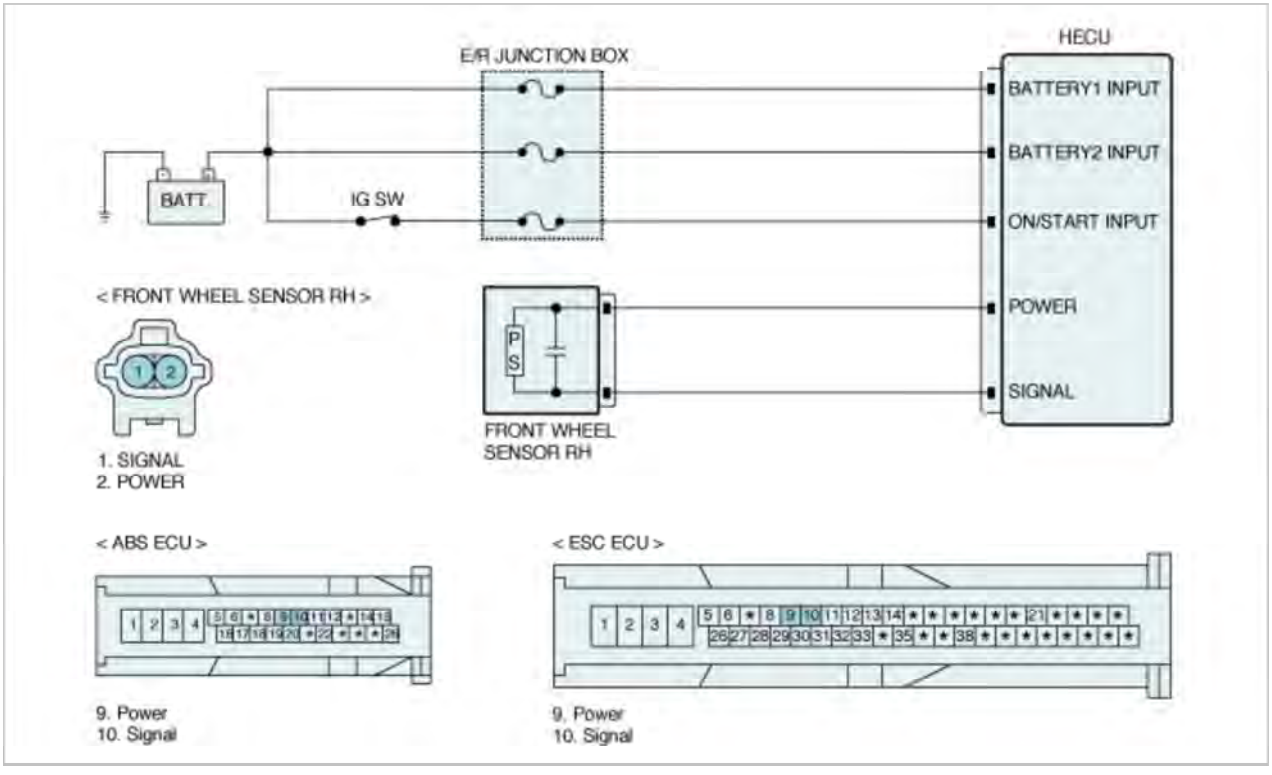
Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor(FR) • Exteral noise
Case1	Monitoring Period	• The monitoring is active from 10 km/h to 80km/h and if no ABS-control is active at a front wheel and a rear wheel.	
	Enable Conditions	• Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• If following interference and signal disturbance is detected, a failure is set after 10s. - non-plausible high frequency received. - non-plausible high wheel acceleration. - non-plausible high wheel jurk. - non-plausible delta T and edges at low speed.	
Fail-Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is	

	decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.7mm

Diagnostic Circuit Diagram



Signal Waveform & Data

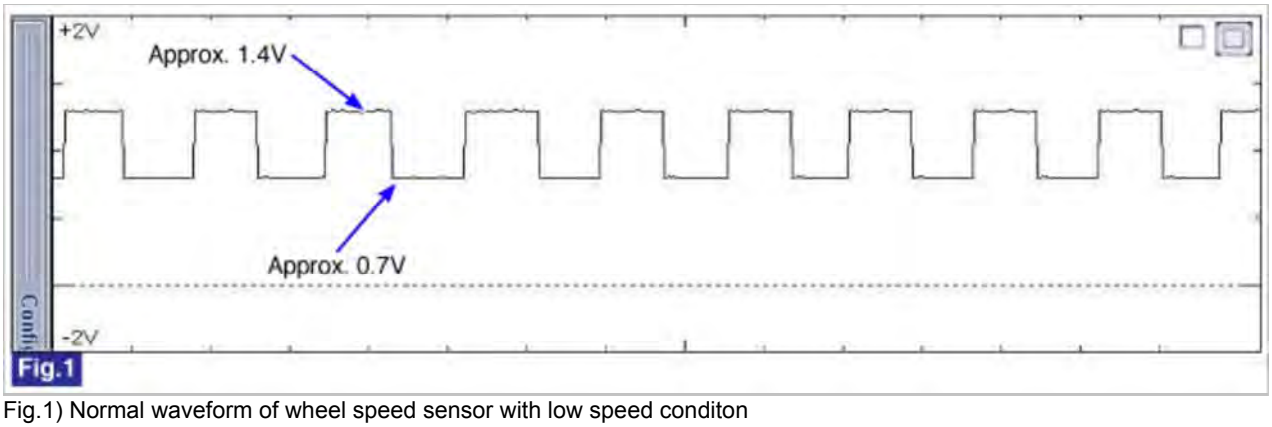


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12km/h. (7.5mph)
4. Monitor the "WHEEL SPD SNSOR-FR" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, 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	▸ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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

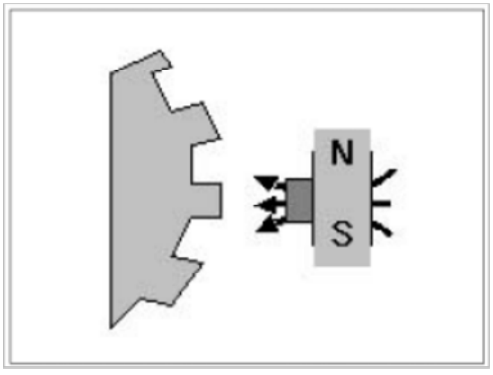
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 12km/h. (7.5mph))
4. Are any DTCs present?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1205 Wheel Speed Sensor Front-RH Invalid/no Signal

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously.
This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75km/h while the vehicle speed is at 12 km/h.
Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor(FR)
Case1	Monitoring Period	• Continuous (the conditions below are met and no under voltage is not detected)	
	Enable Conditions	• If one (or two) wheel are at 2.75km/h and the other wheels are above 12 km/h for longer than 1s. • During driving, when the vehicle accelerates 18km/h after a particular wheel speed gets to 2.75km/h and stays there. At that time, If one (or two) wheel are at 2.75km/h. - This monitoring is performed at the vehicle is accelerated to 12km/h a) once after energizing the system. b) If the vehicle was stationary for approx. 2s. • If one (or two) wheels are under 5km/h and the two fastest wheels have a velocity above 12km/h for more than 20s. - This monitoring is performed continuously.	
Case2 (WSS Dynamic monitoring)	Monitoring Period	• Continuous (If vehicle speed > 12 m/s (43,2 km/h)) - but this monitoring is disabled in the following event 1. aquaplaning. 2. interference. 3. supply voltage below 7.1 or above 18 Volts.	
	Enable	• No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). - If the dynamic sensor monitor resconses, the failures	

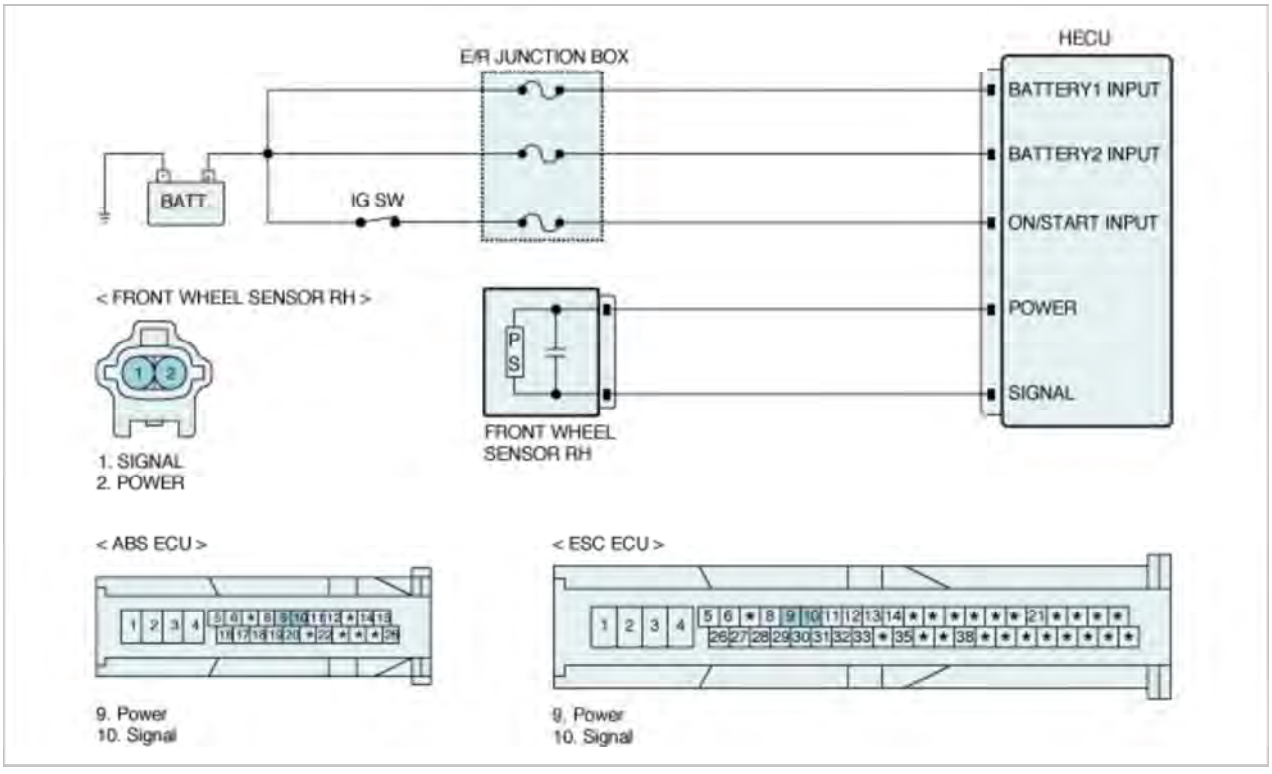
	Conditions	will be stored into failure memory immediately after a waiting period of 60ms. - If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.	
Case3 - ABS Only	Monitoring Period	• Continuous	
	Enable Conditions	• Vehicle < 100Km/h - Difference of two wheel speeds at FL to RL/FR to RR>1.7m/s (6km/h). - Difference of two wheel speeds at FL to FR/RL to RR>1.7m/s + 1.1m/s. - Difference of two wheel speeds at FL to RR/FR to RL>1.7m/s + 2.2m/s. ※ If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted. • Vehicle > 100Km/h - Difference of two wheel speeds at FL to RL/FR to RR> (6%×Vref). - Difference of two wheel speeds at FL to FR/RL to RR> (6%×Vref + 1.1m/s). - Difference of two wheel speeds at FL to RR/FR to RL> (6%×Vref + 2.2m/s). ※ V_ref : Vehicle Reference Speed difference and additional conditions as shown below. 1. 18s - if fault threshold is exceeding > 1.7m/s resp.6% 2. 9s - if fault threshold is exceeding > 3.3m/s resp. 12% 3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s. 4. If spinning wheel is detected the fault detection filter time is not shorter than 72s. • Fault allocation If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s. Otherwise a general WSS_Generic fauly (C1213) is set. • Detection filter time - Response and detection filter time depend on the amount of the speed	
Case4 - ESC Only	Monitoring Period	• Main Monitoring - The main monitor needs additional information of the ESC-sensors and is active for a velocity > 20 km/h and no under voltage is detected. • Backup Monitoring - Continuous	
	Enable Conditions	• Main Monitoring 1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%. 2. detection filter time : - the above conditions apply for 20s for 1 defective wheel speed sensor. - the above conditions apply for 40s for 2 defective wheel speed sensor. NOTE If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set. • Backup Monitoring	

		1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h. 2. When the velocity is below 50 km/h, if the deviation exceeds an absolute value of 3km/h. 3. detection filter time : normally 20s - In case of a detected curve, the threshold is increased with an additional value of 4 km/h.	
Fail Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.7mm

Diagnostic Circuit Diagram



Signal Waveform & Data

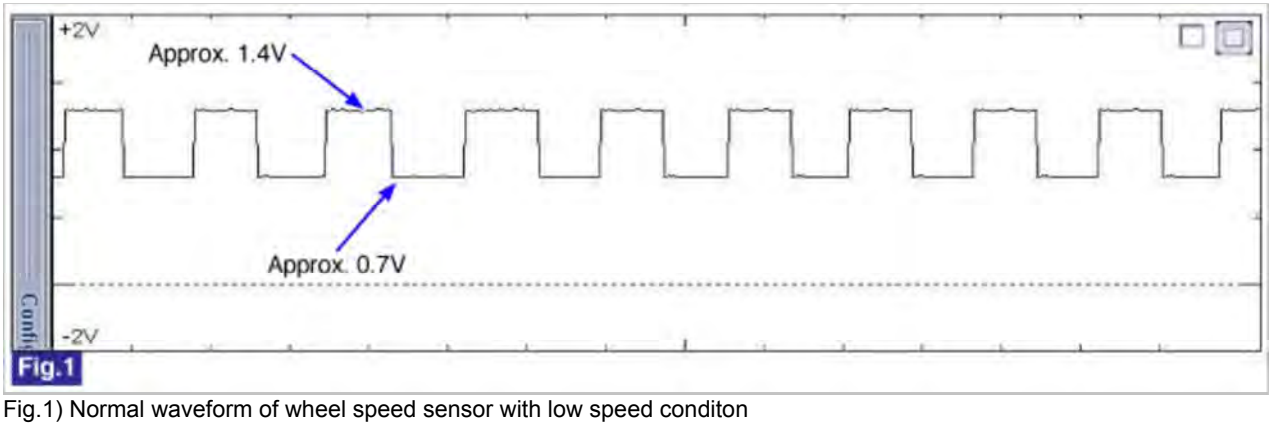


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50km/h. (31.1mph)
4. Monitor the "WHEEL SPD SNSOR-FR" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (FR) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, 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	▸ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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

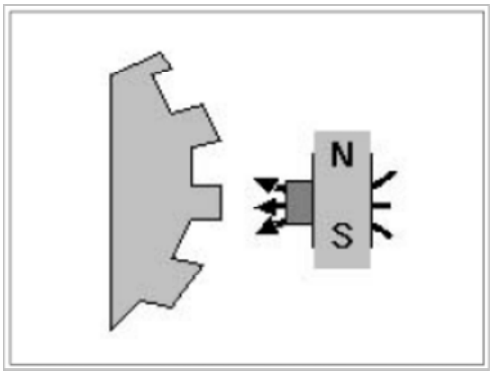
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 50km/h. (31.1mph)
4. Are any DTCs present?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1206 Wheel Speed Sensor Rear-LH Open/Short

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. .
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously.
A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit.
If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cut off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness.
If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON.
Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again.

DTC Detecting Condition

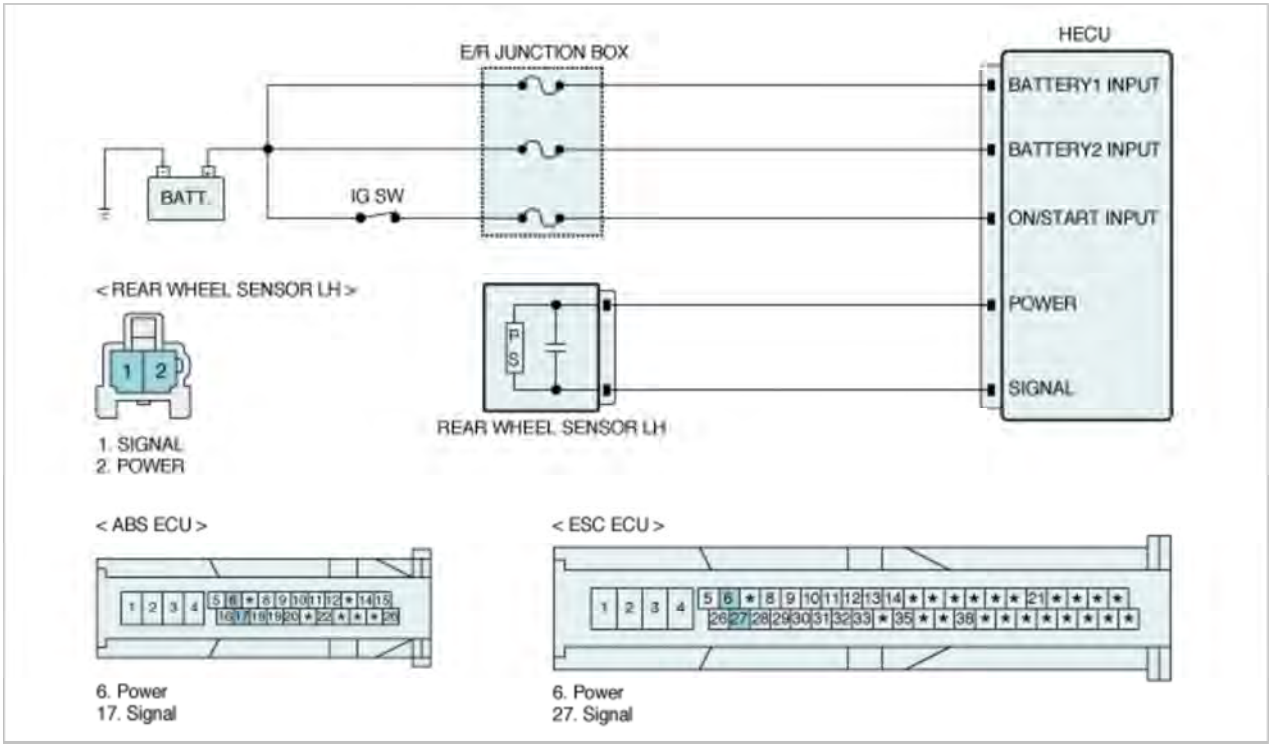
Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Open or short of Wheel speed sensor circuit(RL) • Faulty Wheel speed sensor(RL)
Case1	Monitoring Period	• Once after power up.	
	Enable Conditions	• Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized. NOTE In case of a WSS power line short to V_batt, this FSA test will detect an under voltage failure. (ABS only) ※ FSA test : fail save circuit test ※ UZ : Ignition Voltage	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• When the sensor current levels are out of permissible range(LOW : 7mA, HIGH : 14mA) for 200ms.	
Fail-Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited.	

	- The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.5mm

Diagnostic Circuit Diagram



Signal Waveform & Data

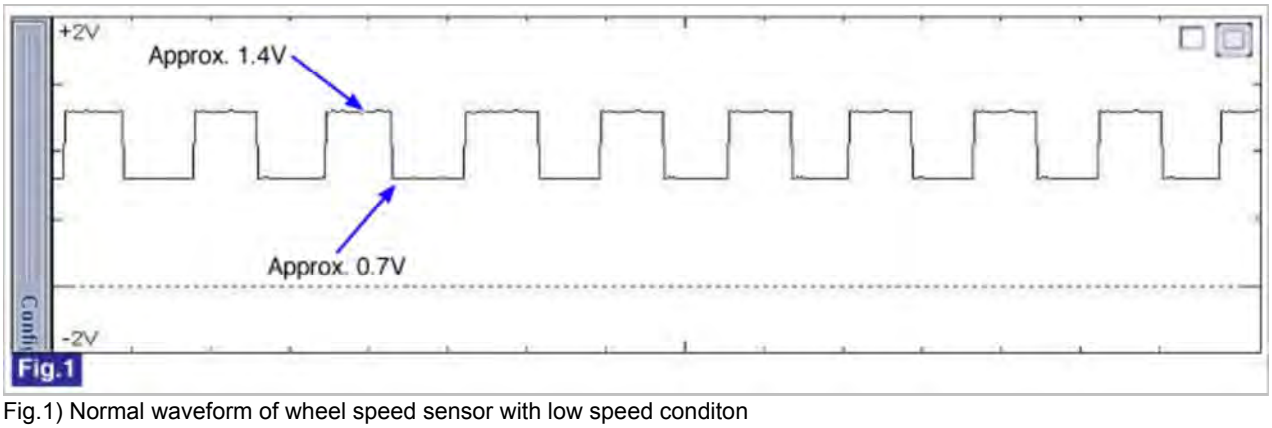


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".

2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10km/h. (6.2mph)
4. Monitor the "WHEEL SPD SNSOR-RL" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (RL) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminal condition. 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 Circuit Inspection" procedure.

Power Circuit Inspection

■ Open or Short Check

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+

3. Is the measured value within specifications?

YES	▸ Go to "Signal Circuit Inspection" procedure.
NO	▸ Repair open or short in power circuit between HECU harness connector and wheel speed sensor harness connector and then go to "Verification of vehicle Repair" procedure. If there is no problem in Power circuit, 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.

Signal Circuit Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between wheel speed sensor signal terminal of the HECU harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

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	▸ Repair open or short in signal circuit between HECU harness connector and wheel speed sensor harness connector, and then go to "Verification of vehicle Repair" procedure. If there is no problem in signal circuit, go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (RL). Go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

Verification of Vehicle Repair

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

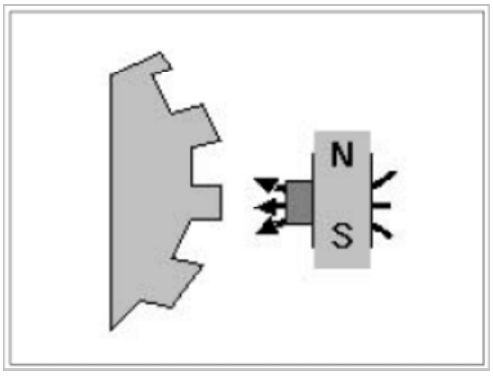
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1207 Wheel Speed Sensor Rear-LH Range / Performance / Intermittent

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously.
This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10km/h to 80km/h.
Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC Detecting Condition

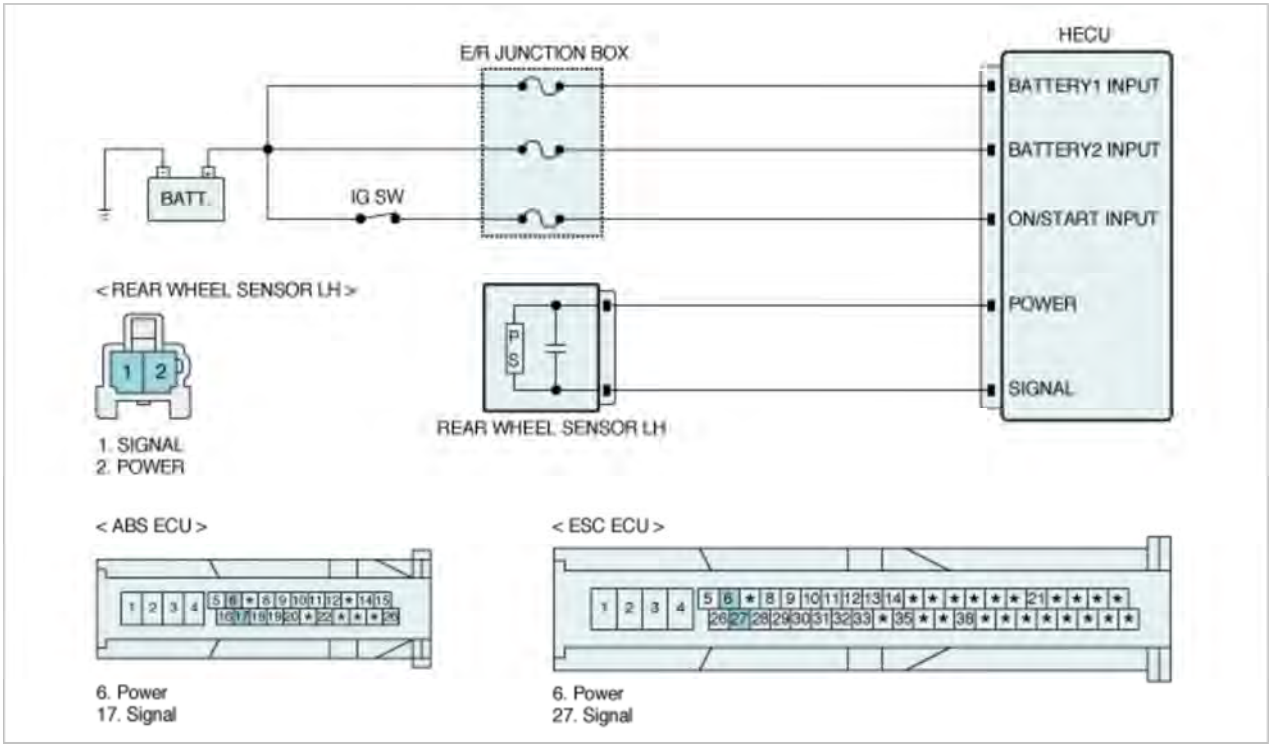
Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal monitoring	• Improper installatio n of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor(RL) • Exteral noise
Case1	Monitoring Period	• The monitoring is active from 10 km/h to 80km/h and if no ABS-control is active at a front wheel and a rear wheel.	
	Enable Conditions	• Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• If following interference and signal disturbance is detected, a failure is set after 10s. - non-plausible high frequency received. - non-plausible high wheel acceleration. - non-plausible high wheel jurk. - non-plausible delta T and edges at low speed.	
Fail-Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is	

	decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.5mm

Diagnostic Circuit Diagram



Signal Waveform & Data

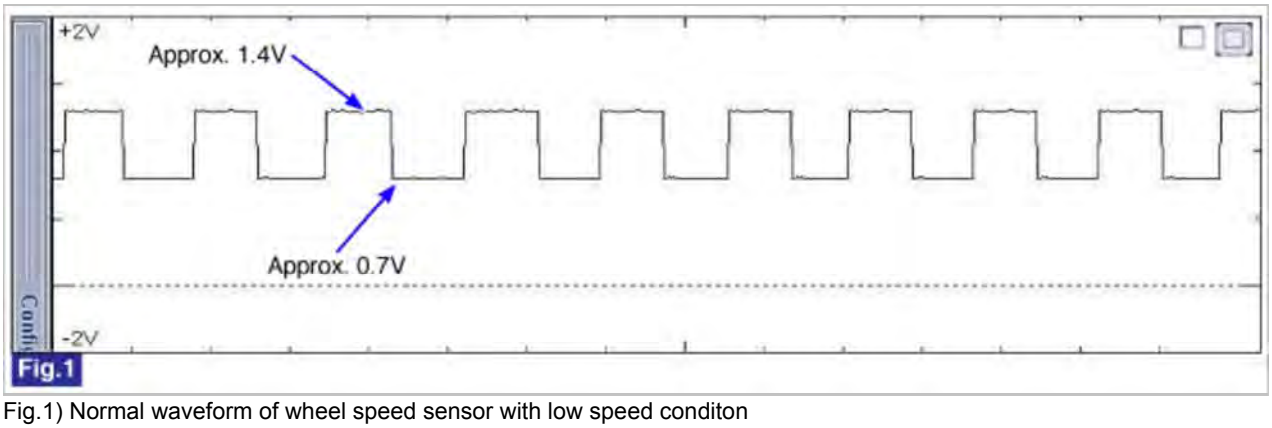


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12km/h. (7.5mph)
4. Monitor the "WHEEL SPD SNSOR-RL" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, 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	▸ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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

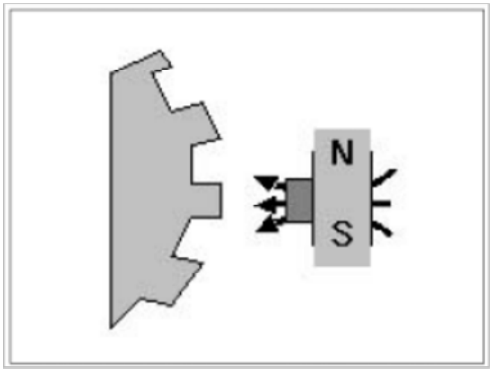
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 12km/h. (7.5mph))
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1208 Wheel Speed Sensor Rear-LH Invalid/no Signal

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. .
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75km/h while the vehicle speed is at 12 km/h. Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor(RL)
Case1	Monitoring Period	• Continuous (the conditions below are met and no under voltage is not detected)	
	Enable Conditions	• If one (or two) wheel are at 2.75km/h and the other wheels are above 12 km/h for longer than 1s. • During driving, when the vehicle accelerates 18km/h after a particular wheel speed gets to 2.75km/h and stays there. At that time, If one (or two) wheel are at 2.75km/h. - This monitoring is performed at the vehicle is accelerated to 12km/h a) once after energizing the system. b) If the vehicle was stationary for approx. 2s. • If one (or two) wheels are under 5km/h and the two fastest wheels have a velocity above 12km/h for more than 20s. - This monitoring is performed continuously.	
Case2 (WSS Dynamic monitoring)	Monitoring Period	• Continuous (If vehicle speed > 12 m/s (43,2 km/h)) - but this monitoring is disabled in the following event 1. aquaplaning. 2. interference. 3. supply voltage below 7.1 or above 18 Volts.	
	Enable Conditions	• No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). - If the dynamic sensor monitor resconses, the failures will be stored into failure memory immediately after a	

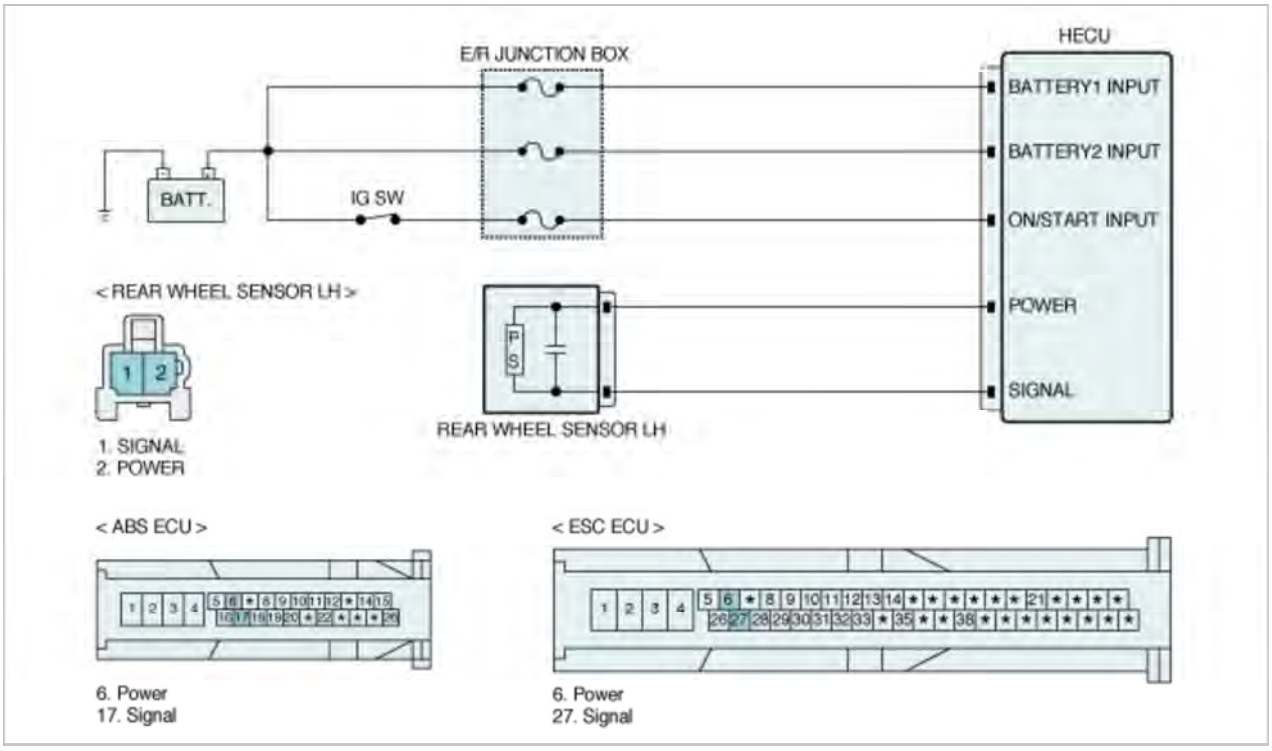
		waiting period of 60ms. - If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.	
Case3 - ABS Only	Monitoring Period	• Continuous	
	Enable Conditions	• Vehicle < 100Km/h - Difference of two wheel speeds at FL to RL/FR to RR>1.7m/s (6km/h). - Difference of two wheel speeds at FL to FR/RL to RR>1.7m/s + 1.1m/s. - Difference of two wheel speeds at FL to RR/FR to RL>1.7m/s + 2.2m/s. ※ If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted. • Vehicle > 100Km/h - Difference of two wheel speeds at FL to RL/FR to RR> (6%×Vref). - Difference of two wheel speeds at FL to FR/RL to RR> (6%×Vref + 1.1m/s). - Difference of two wheel speeds at FL to RR/FR to RL> (6%×Vref + 2.2m/s). ※ V_ref : Vehicle Reference Speed difference and additional conditions as shown below. 1. 18s - if fault threshold is exceeding > 1.7m/s resp.6% 2. 9s - if fault threshold is exceeding > 3.3m/s resp. 12% 3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s. 4. If spinning wheel is detected the fault detection filter time is not shorter than 72s. • Fault allocation If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s. Otherwise a general WSS_Generic fauly (C1213) is set. • Detection filter time - Response and detection filter time depend on the amount of the speed	
Case4 -ESC Only	Monitoring Period	• Main Monitoring - The main monitor needs additional information of the ESC-sensors and is active for a velocity > 20 km/h and no under voltage is detected. • Backup Monitoring - Continuous	
	Enable Conditions	• Main Monitoring 1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%. 2. detection filter time : - the above conditions apply for 20s for 1 defective wheel speed sensor. - the above conditions apply for 40s for 2 defective wheel speed sensor. NOTE If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set. • Backup Monitoring 1. If the deviation between the fastest and the slowest	

		wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h. 2. When the velocity is below 50 km/h, if the deviation exceeds an absolute value of 3km/h. 3. detection filter time : normally 20s - In case of a detected curve, the threshold is increased with an additional value of 4 km/h.	
Fail Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.5mm

Diagnostic Circuit Diagram



Signal Waveform & Data

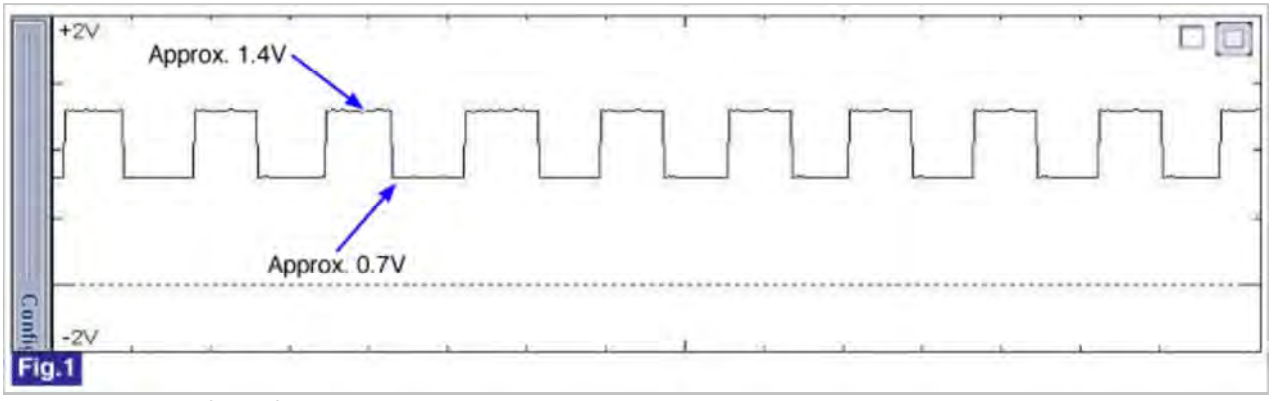


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50km/h. (31.1mph)
4. Monitor the "WHEEL SPD SNSOR-RL" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (RL) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, 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	▸ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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

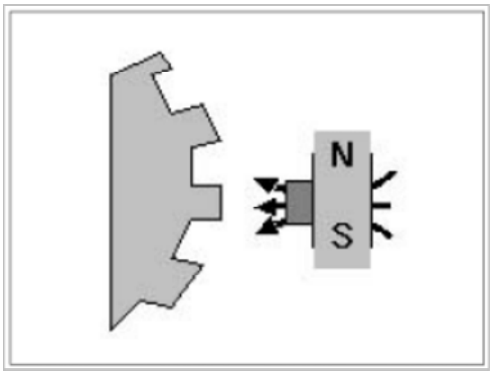
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 50km/h. (31.1mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1209 Wheel Speed Sensor Rear-RH Open/Short

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously.
A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit.
If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cut off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness.
If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON.
Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again.

DTC Detecting Condition

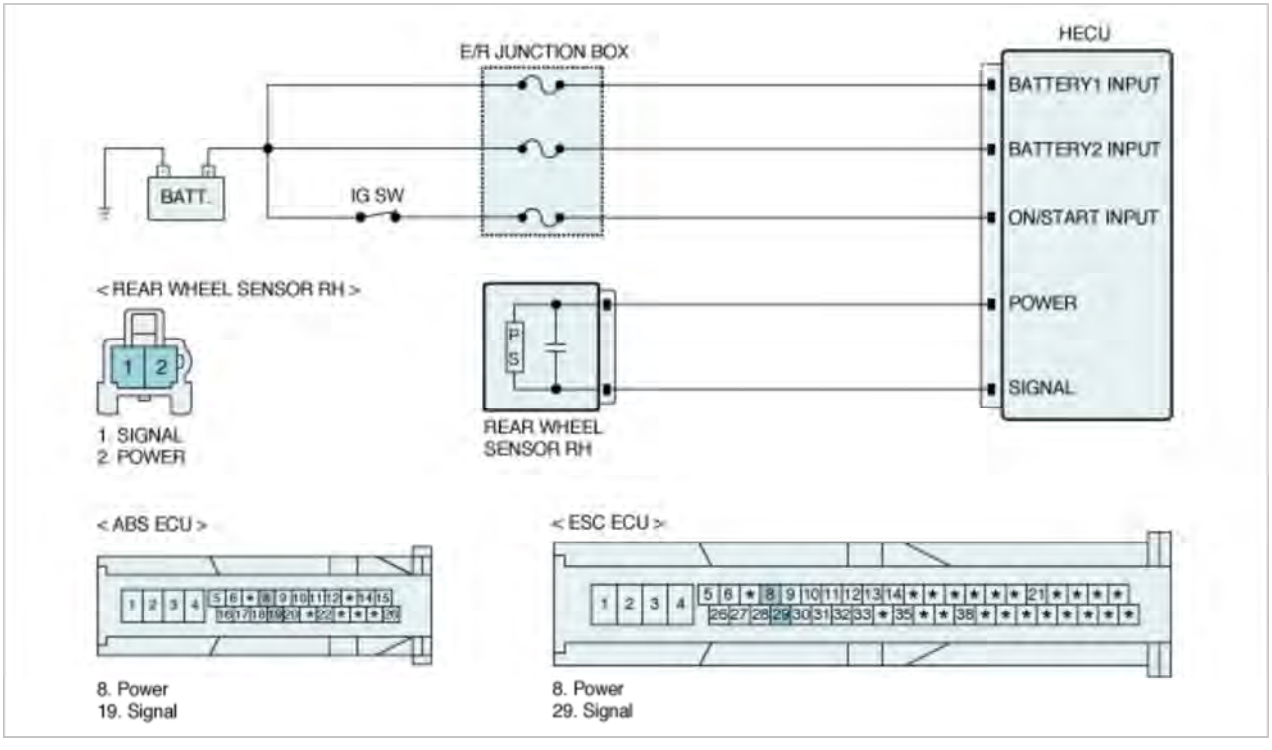
Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Open or short of Wheel speed sensor circuit(RR) • Faulty Wheel speed sensor(RR)
Case1	Monitoring Period	• Once after power up.	
	Enable Conditions	• Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized. NOTE In case of a WSS power line short to V_batt, this FSA test will detect an under voltage failure. (ABS only) ※ FSA test : fail save circuit test ※ UZ : Ignition Voltage	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• When the sensor current levels are out of permissible range(LOW : 7mA, HIGH : 14mA) for 200ms.	
Fail-Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited.	

	- The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.5mm

Diagnostic Circuit Diagram



Signal Waveform & Data

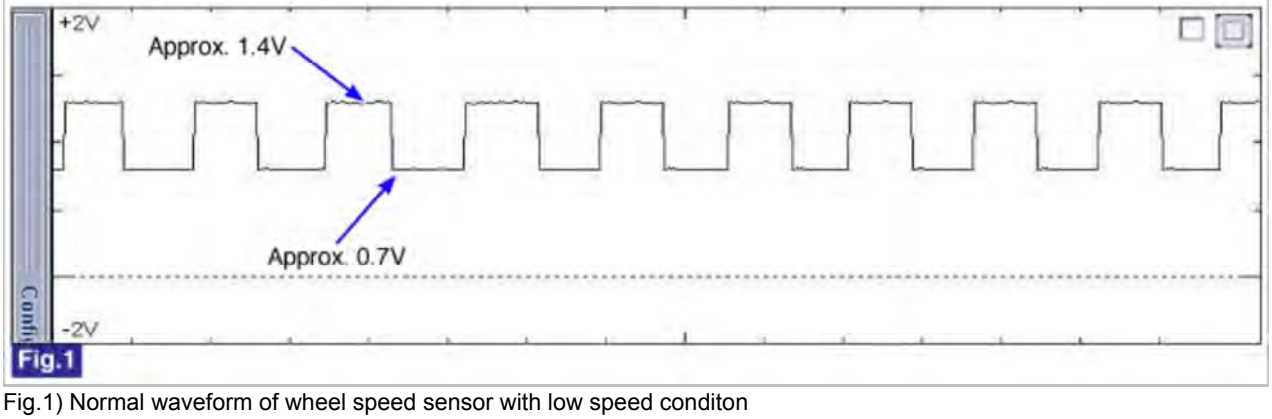


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".

2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10km/h. (6.2mph)
4. Monitor the "WHEEL SPD SNSOR-RR" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (RR) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminal condition. 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 Circuit Inspection" procedure.

Power Circuit Inspection

■ Open or Short Check

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+

3. Is the measured value within specifications?

YES	▸ Go to "Signal Circuit Inspection" procedure.
NO	▸ Repair open or short in power circuit between HECU harness connector and wheel speed sensor harness connector and then go to "Verification of vehicle Repair" procedure. If there is no problem in Power circuit, 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.

Signal Circuit Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between wheel speed sensor signal terminal of the HECU harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

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	▸ Repair open or short in signal circuit between HECU harness connector and wheel speed sensor harness connector, and then go to "Verification of vehicle Repair" procedure. If there is no problem in signal circuit, go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (RR). Go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

Verification of Vehicle Repair

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

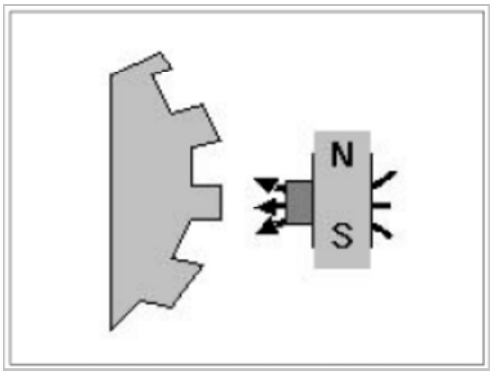
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1210 Wheel Speed Sensor Rear-RH Range / Performance / Intermittent

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously.
This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10km/h to 80km/h.
Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC Detecting Condition

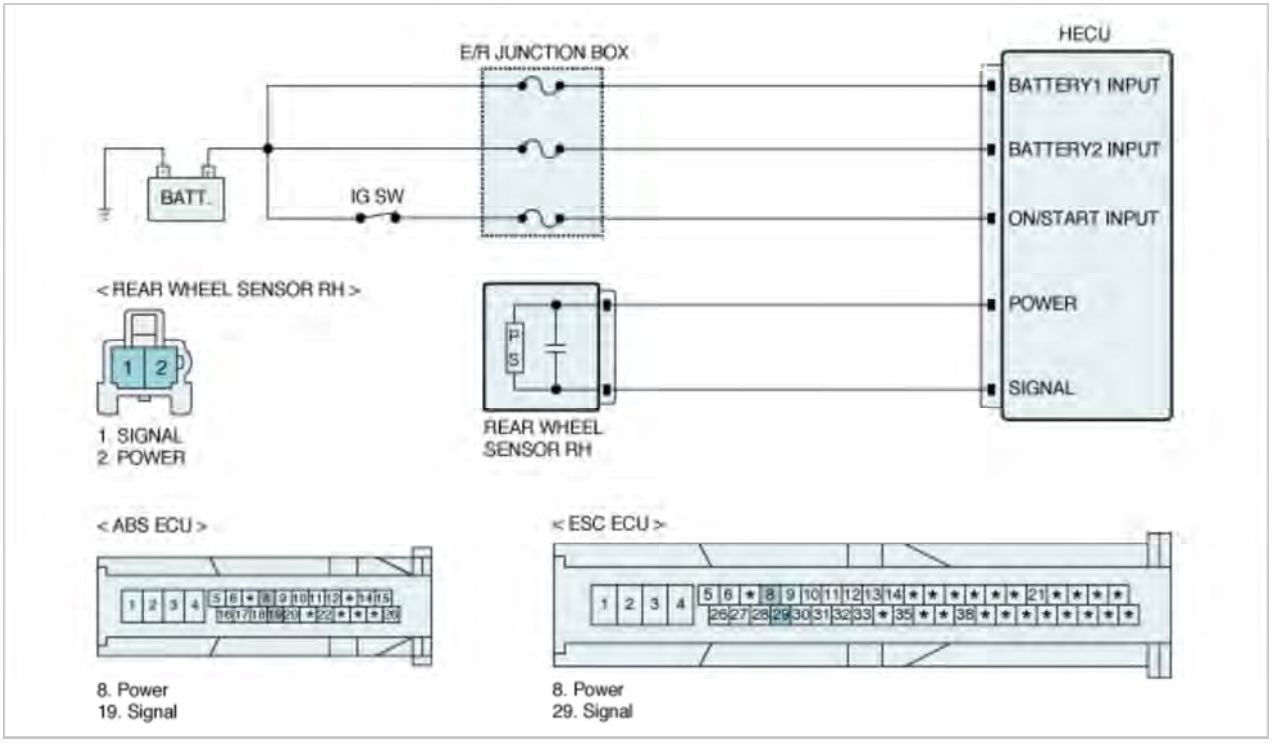
Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor(RR) • Exteral noise
Case1	Monitoring Period	• The monitoring is active from 10 km/h to 80km/h and if no ABS-control is active at a front wheel and a rear wheel.	
	Enable Conditions	• Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 10, a wheel specific fault is stored in the EEPROM.	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• If following interference and signal disturbance is detected, a failure is set after 10s. - non-plausible high frequency received. - non-plausible high wheel acceleration. - non-plausible high wheel jurk. - non-plausible delta T and edges at low speed.	
Fail-Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is	

	decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.5mm

Diagnostic Circuit Diagram



Signal Waveform & Data

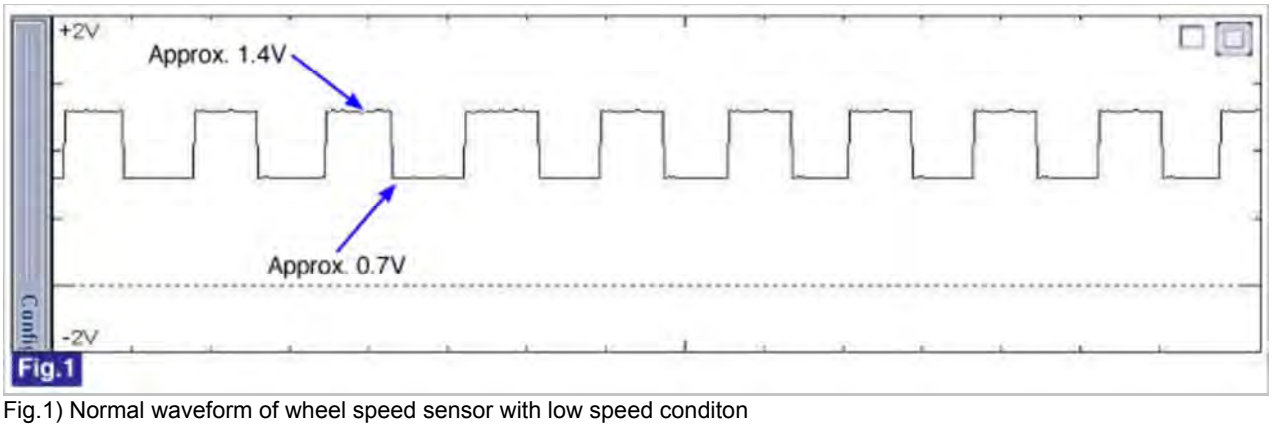


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12km/h. (7.5mph)
4. Monitor the "WHEEL SPD SNSOR-RR" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ **Wheel speed sensor circuit check**

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, 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	▸ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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

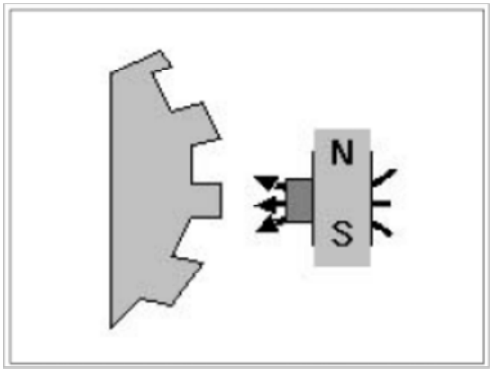
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 12km/h. (7.5mph)).
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1211 Wheel Speed Sensor Rear-RH Invalid/no Signal

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.



DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75km/h while the vehicle speed is at 12 km/h. Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor(RR)
Case1	Monitoring Period	• Continuous (the conditions below are met and no under voltage is not detected)	
	Enable Conditions	• If one (or two) wheel are at 2.75km/h and the other wheels are above 12 km/h for longer than 1s. • During driving, when the vehicle accelerates 18km/h after a particular wheel speed gets to 2.75km/h and stays there. At that time, If one (or two) wheel are at 2.75km/h. - This monitoring is performed at the vehicle is accelerated to 12km/h a) once after energizing the system. b) If the vehicle was stationary for approx. 2s. • If one (or two) wheels are under 5km/h and the two fastest wheels have a velocity above 12km/h for more than 20s. - This monitoring is performed continuously.	
Case2 (WSS Dynamic monitoring)	Monitoring Period	• Continuous (If vehicle speed > 12 m/s (43,2 km/h)) - but this monitoring is disabled in the following event 1. aquaplaning. 2. interference. 3. supply voltage below 7.1 or above 18 Volts.	
	Enable Conditions	• No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43,2 km/h). - If the dynamic sensor monitor resconses, the failures will be stored into failure memory immediately after a waiting period of 60ms.	

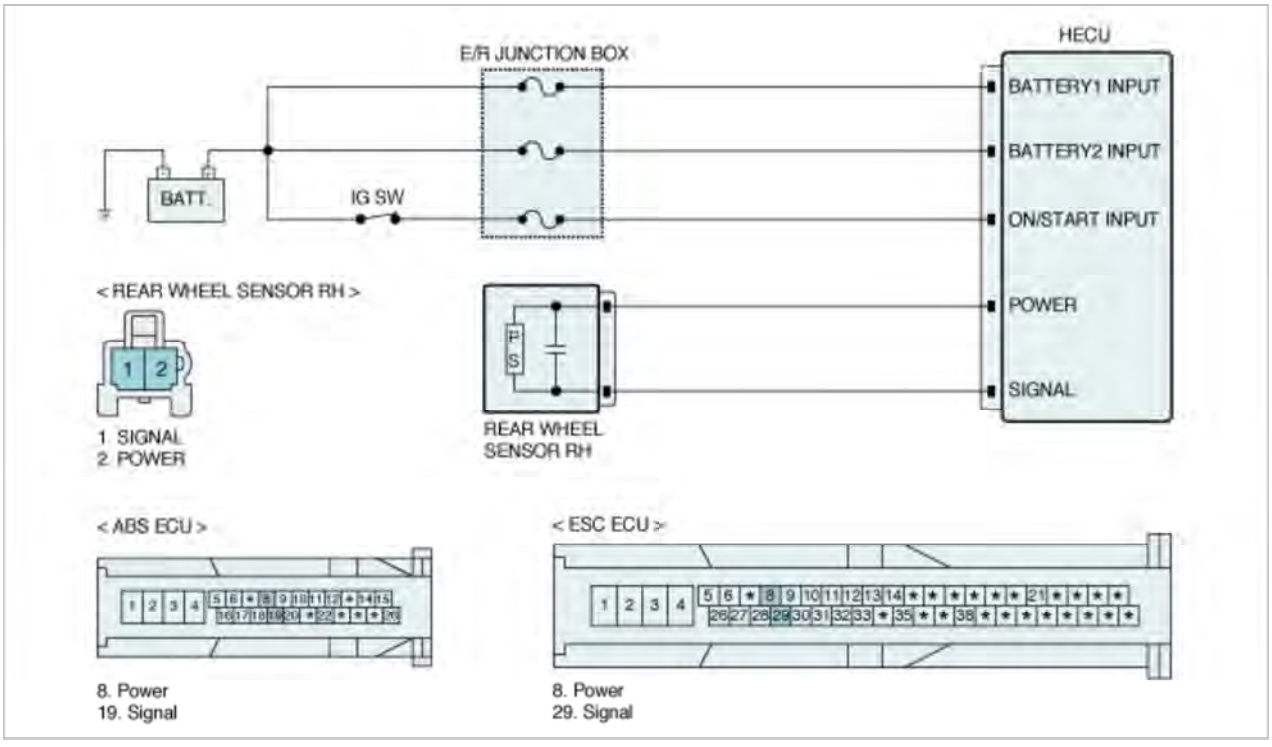
		- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.	
Case3 - ABS Only	Monitoring Period	• Continuous	
	Enable Conditions	• Vehicle < 100Km/h - Difference of two wheel speeds at FL to RL/FR to RR>1.7m/s (6km/h). - Difference of two wheel speeds at FL to FR/RL to RR>1.7m/s + 1.1m/s. - Difference of two wheel speeds at FL to RR/FR to RL>1.7m/s + 2.2m/s. ※ If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted. • Vehicle > 100Km/h - Difference of two wheel speeds at FL to RL/FR to RR> (6%×Vref). - Difference of two wheel speeds at FL to FR/RL to RR> (6%×Vref + 1.1m/s). - Difference of two wheel speeds at FL to RR/FR to RL> (6%×Vref + 2.2m/s). ※ V_ref : Vehicle Reference Speed difference and additional conditions as shown below. 1. 18s - if fault threshold is exceeding > 1.7m/s resp.6% 2. 9s - if fault threshold is exceeding > 3.3m/s resp. 12% 3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s. 4. If spinning wheel is detected the fault detection filter time is not shorter than 72s. • Fault allocation If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s. Otherwise a general WSS_Generic fauly (C1213) is set. • Detection filter time - Response and detection filter time depend on the amount of the speed	
Case4 -ESC Only	Monitoring Period	• Main Monitoring - The main monitor needs additional information of the ESC-sensors and is active for a velocity > 20 km/h and no under voltage is detected. • Backup Monitoring - Continuous	
	Enable Conditions	• Main Monitoring 1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%. 2. detection filter time : - the above conditions apply for 20s for 1 defective wheel speed sensor. - the above conditions apply for 40s for 2 defective wheel speed sensor. NOTE If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set. • Backup Monitoring 1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the	

		velocity is higher than 50 km/h. 2. When the velocity is below 50 km/h, if the deviation exceeds an absolute value of 3km/h. 3. detection filter time : normally 20s - In case of a detected curve, the threshold is increased with an additional value of 4 km/h.	
Fail Safe		• Sensor failure outside of the ABS control cycle 1. 1~2 wheel failure - Only the ABS/ESC functions are inhibited. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. • Sensor failure inside the ABS control cycle 1. 1~2 wheel failure - The ABS/ESC functions are inhibited after end of control. - The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. 2. More than 3 wheels failure - The ABS/EBD/ESC functions are inhibited. - The ABS/EBD/ESC warning lamps are activated. ※ Control of the corresponding wheel is no longer possible. If a sensor fault occurs on a front wheel, pressure is increased; on a rear wheel, pressure is decreased.	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.5mm

Diagnostic Circuit Diagram



Signal Waveform & Data

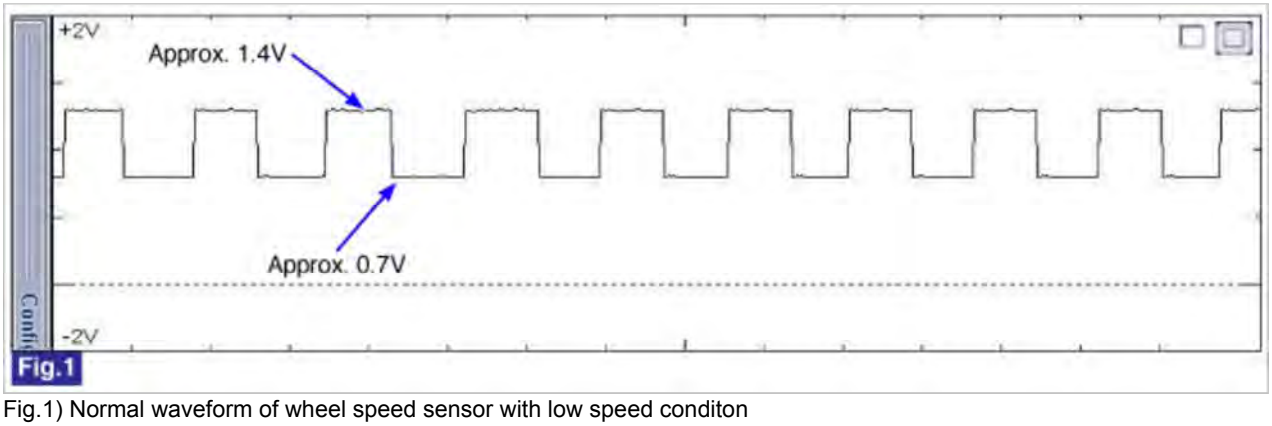


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50km/h. (31.1mph)
4. Monitor the "WHEEL SPD SNSOR-RR" parameter on the Scantool.

Specification :
Compare with other parameters related to wheel speed sensor.
If it is the same as other parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness (RR) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ Wheel speed sensor circuit check

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, 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	▸ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

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.
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 at or above 50km/h. (31.1mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1213 Wheel Speed Frequency Error

General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs.
For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed.
Wheel speed sensor is active hall-sensor type.

DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously.
If power supply of the WSS input amplifier is not normal or the ABS control cycle is continued abnormally, if the exact fault location among 4 WSS can not be determined, This code is set.

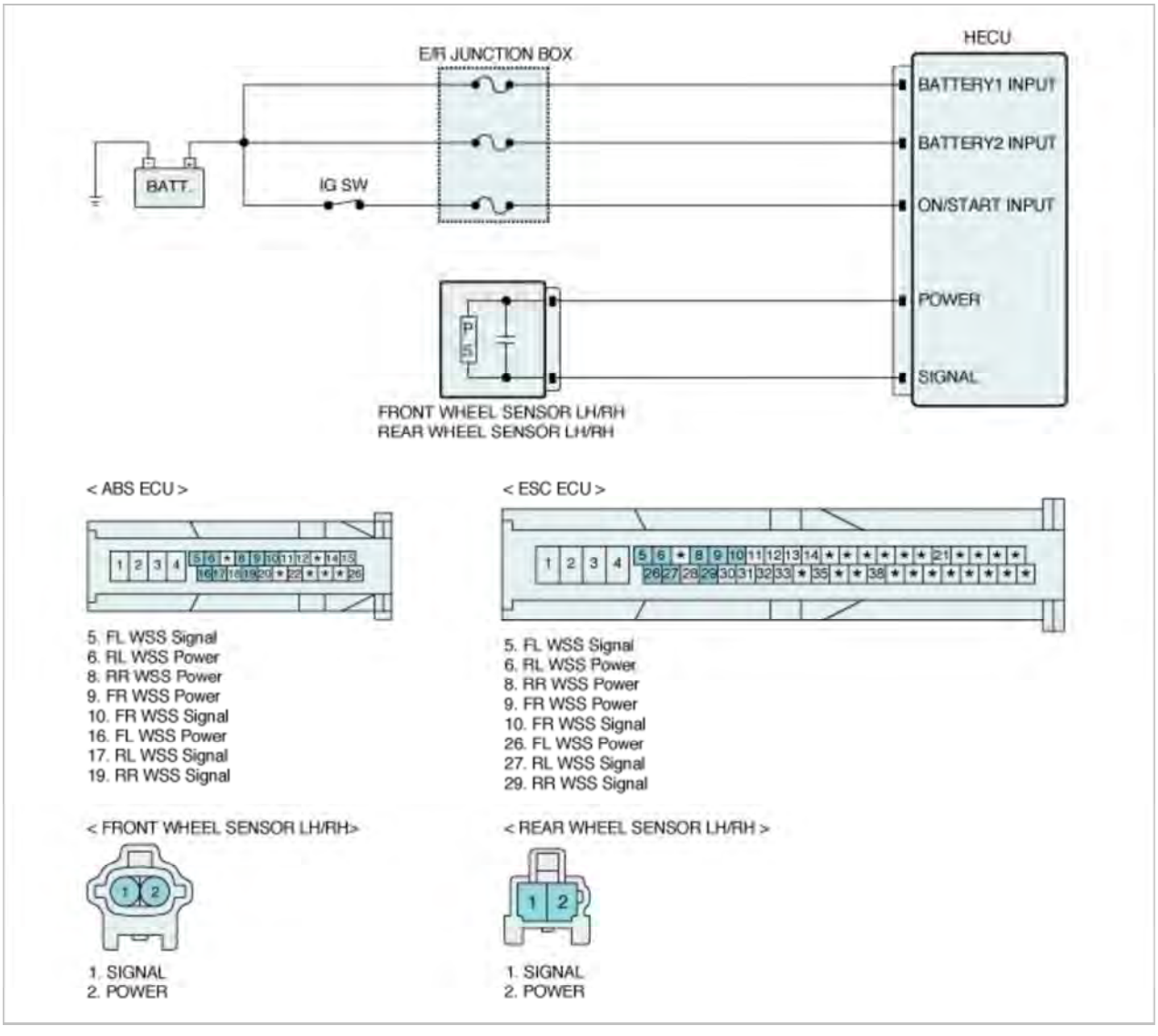
DTC Detecting Condition

Item		Detecting Condition	Possible cause
Case 1	DTC Strategy	• Voltage motorning	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor
	Monitoring Period	• Continuous (If no under voltage, no BLS, no BLS failure is detected)	
	Enable Conditions	• When WSS low voltage is detected.	
	Fail Safe	• Wheel speed sensor signals are not reliable.	
Case2	DTC Strategy	• Signal motorning	
	Monitoring Period	• Continous	
	Enable Conditions	• The monitoring reports a failure if the ABS target slip is exceeded for a time period >= 10 s at one or more wheels. - If the driver brakes or the velocity is lower than 50 km/h (31 MPH) the detection time is increased to 60s.	
	Fail Safe	• Reduced function of the ESC system	

Specifications

Sensor Type	Output Voltage		Air gap
	HIGH	LOW	
Active Type	1.18 ~ 1.68 V	0.59 ~ 0.84 V	0.7 mm - FRONT 0.5 mm - REAR

Diagnostic Circuit Diagram



Signal Waveform & Data

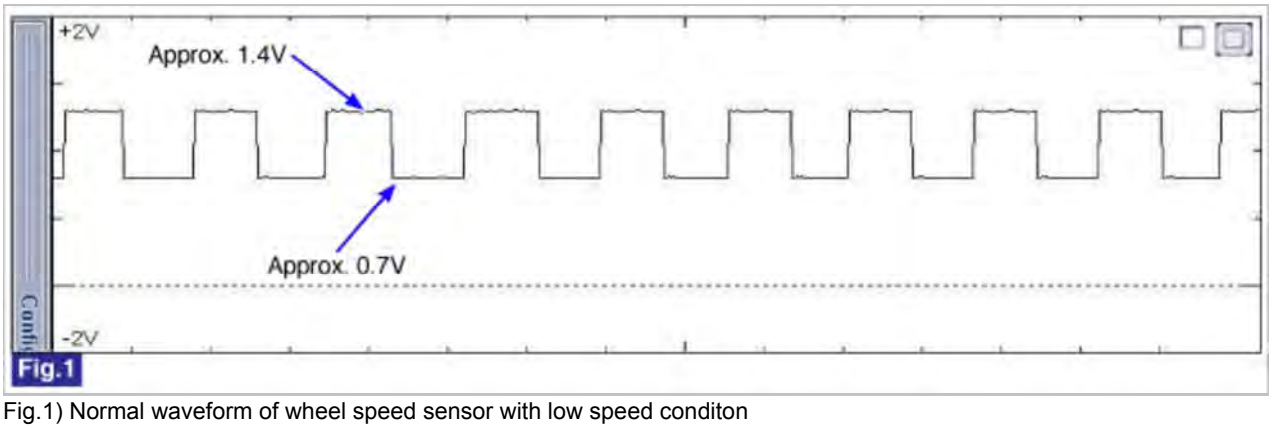


Fig.1) Normal waveform of wheel speed sensor with low speed conditon

Monitor Scantool Data

1. Ignition "ON" & Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50km/h. (31mph)
4. Monitor the "WHEEL SPD SNSOR" parameter on the Scantool.

Specification :

Compare with another parameters related to wheel speed sensor.
If it is the same as another parameters, it is in normal condition.

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

■ **Wheel speed sensor circuit check**

1. Lift the vehicle.
2. Ignition "ON" & Engine "OFF".
3. Turn the wheel by hand.
4. Measure waveform between signal terminal of the wheel speed sensor harness connector and chassis ground with osciloscope.

Specification :
High : 1.18 ~ 1.68V , Low : 0.59 ~ 0.84V
Compare waveforms of all wheel speed sensors.
If they have same waveform, it is in normal condition.

5. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure. If OK, 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	▸ Check the following point at wheel speed sensors which have abnormal waveform. Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure. Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

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.
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 at or above 50km/h. (31.1mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1235 Primary Pressure Sensor-Electrical

General Description

The pressure sensor ,installed in the HECU, sense the brake oil pressure to judge driver's brake intention when ESC is operating.
If pressure of master cyclinder is applied to pressure sensor, the strain of the piezo element is changed and then the resistance of brige circuit is chanded according to changed strain.
Therefore this changed resistance changes output voltage of brige circuit and output voltage changes linearly.
The sensor output is a analog signal in proportion to supply voltage, and the HECU recognizes a pressure value according to signal ratio about supply voltage.

DTC Description

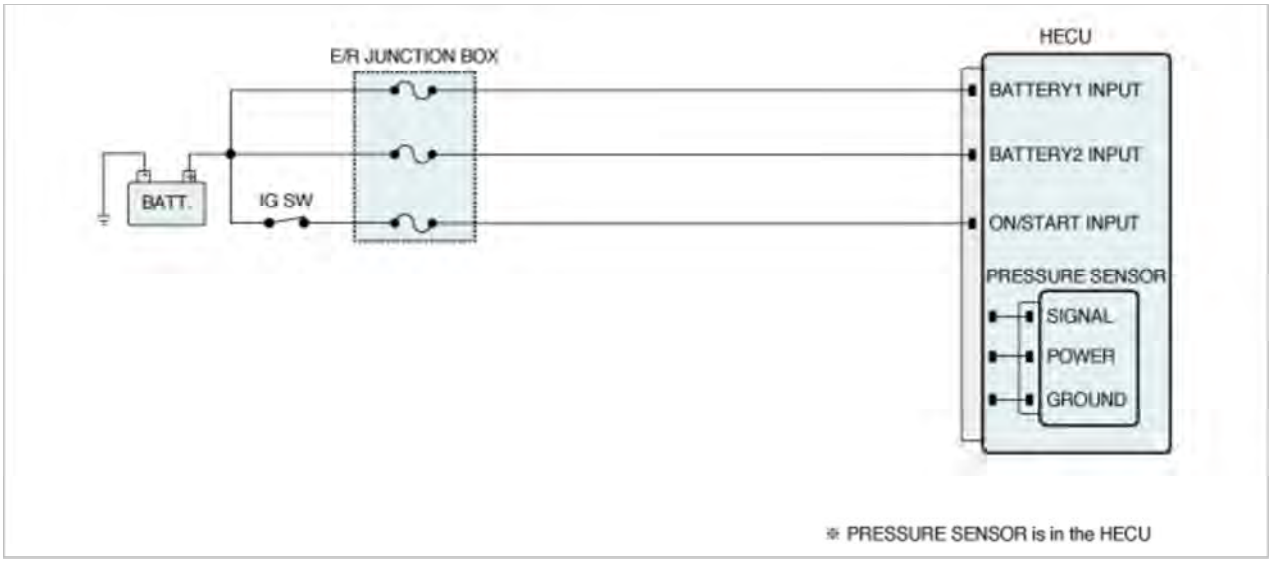
Each unfiltered input signal voltage is monitored to be in the range of 4.7V < input signal voltage < 5.3V.
A failure is detected if the output signal value is out of specified range for more than 100ms or pressure sensor self test form is against to specification during self test.

DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage Monitoring	• Open or short of pressure sensor circuit • Faulty pressure sensor • Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• A sensor supply failure is detected if Sensor Supply Voltage > 5.3V or Sensor Supply Voltage < 4.7V for t >= 60ms.	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• A Fault is set if the DSO signal is voltage of DSO > 4.7V or voltage of DSO < 0.3V for a time t >= 100ms. - DSO : original pressure value.	
Case3	Monitoring Period	• Continuous	
	Enable Conditions	• A Fault is set if the DSI signal is voltage of DSI > 4.7V or voltage of DSI < 0.3V for a time t >= 100ms. - DSI : inverted pressure value.	
Case4	Monitoring Period	• Continuous	
	Enable Conditions	• A Fault is set if the voltage of DSO + DSI > 5.5V or voltage of DSO + DSI < 4.5V for a time t >= 100ms. - DSO : original pressure value. - DSI : inverted pressure value.	
Case5	Monitoring Period	• Once during Power Up	
	Enable Conditions	• POS detects internal sensor malfunctions (sensor element, amplification, etc.). The POS is triggered if no low voltage is present and supply voltage is switched on. The test phase is divided in two 60 ms parts. DSO signal must be < 0.5V for 30 ms. In phase 2 DSO signal must be between 1.9V and 3.1V for also 30 ms then the POS Test is passed. The test phase is divided in two 60 ms parts. DSO and DSI signal must be < 0.5V for 30 ms. In phase 2 DSO and DSI signal must be between 1.9V and 3.1 V for also 30 ms then the POS Test is passed. A fault is set if POS does not satisfy the above conditions - POS : Power on selftest.	

Fail Safe	• No Pressure Signal available. • Sensor failure outside the ABS control cycle - Only the ABS/ESC functions are inhibited, allow the EBD. The ABS/ESC warning lamps are activated and the EBD warning lamp is not activated. • Sensor failure inside the ABS control cycle - Inhibit the ESC control, allow the EBD. The ESC warning lamps are activated. After the control, the ABS functions are inhibited. The ABS warning lamps are activated.	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Press the brake pedal.
4. Monitor the "Pressure Sensor" parameter on the Scantool.

Specification :
Approx. 60bar ~150bar (There is difference in displayed parameter according to braking force)

Sensor Name	Value	Unit
☑ Pressure Sensor	109.4	bar

Fig.1

Fig 1) Test Condition : Ignition "ON" & Engine "ON".
Normal data (There is difference in displayed parameter according to braking force)

5. Whenever brake pedal is pushed down, is the pressure sensor's scantool data changed?

YES	▸ Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".

3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "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.
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 > ESC(Electronic Stability Control) System > C1237 Primary Pressure Sensor-Signal

General Description

The pressure sensor ,installed in the HECU, sense the brake oil pressure to judge driver's brake intention when ESC is operating.
If pressure of master cyclinder is applied to pressure sensor, the strain of the piezo element is changed and then the resistance of brige circuit is chanded according to changed strain.
Therefore this changed resistance changes output voltage of brige circuit and output voltage changes linearly.
The sensor output is a analog signal in proportion to supply voltage, and the HECU recognizes a pressure value according to signal ratio about supply voltage.

DTC Description

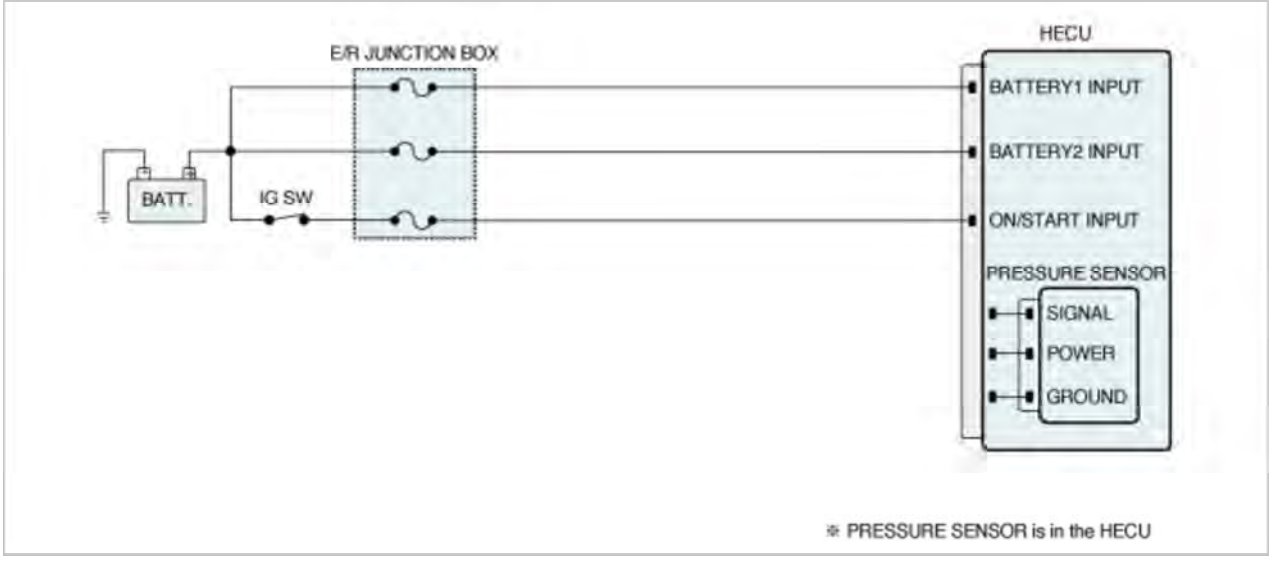
With the driver torque demand and the lateral acceleration a driver braking demand is calculated. Unless the pump motor is opreating or there is a brake signal, The offset compensation is executed.
A failure is detected if offset value exceeded ±15 bar.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage Monitoring	• Open or short of pressure sensor circuit • Faulty pressure sensor • Faulty HECU
Monitoring Period	• After Pressure sensor initialization. • No under voltage • No pumps are running. • No BLS-signal is set.	
Enable Conditions	• The pressure sensor-offset value must be in the range of ± 15 bar. A failure is detected if this range is exceeded.	
	• Reduced function caused by faulty pressure sensor signal. • Sensor failure outside the ABS control cycle - Only the ABS/ESC functions are inhibited, allow the EBD. The ABS/ESC warning lamps are activated and the	

Fail Safe	EBD warning lamp is not activated. • Sensor failure inside the ABS control cycle - Inhibit the ESC control, allow the EBD. The ESC warning lamps are activated. After the control, the ABS functions are inhibited. The ABS warning lamps are activated.	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Press the brake pedal.
4. Monitor the "Pressure Sensor" parameter on the Scantool.

Specification :
Approx. 60bar ~150bar (There is difference in displayed parameter according to braking force)

Sensor Name	Value	Unit
☑ Pressure Sensor	109.4	bar

Fig.1

Fig 1) Test Condition : Ignition "ON" & Engine "ON".
Normal data (There is difference in displayed parameter according to braking force)

5. Whenever brake pedal is pushed down, is the pressure sensor's scantool data changed?

YES	▸ Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.

6. Are any DTCs present ?

YES	▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "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.
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 > ESC(Electronic Stability Control) System > C1260 Steering Angle Sensor Circuit-Signal

General Description

The Steering angle sensor(SAS) is installed in MDPS (Motor Driven Power Steering) and it sends messages to HECU through CAN communication line.
The SAS is used to determine turning direction and speed of the steering wheel.
The HECU uses the signals from the SAS when performing ESC-related calculations.

DTC Description

If the SAS signal is different from calculated value by yaw-rate sensor and wheel speed sensor, mechanically impossible SAS signal is detected, there is a difference between SAS signal and driving condition of the vehicle calculated from yaw-rate sensor and lateral G sensor, a failure is detected.

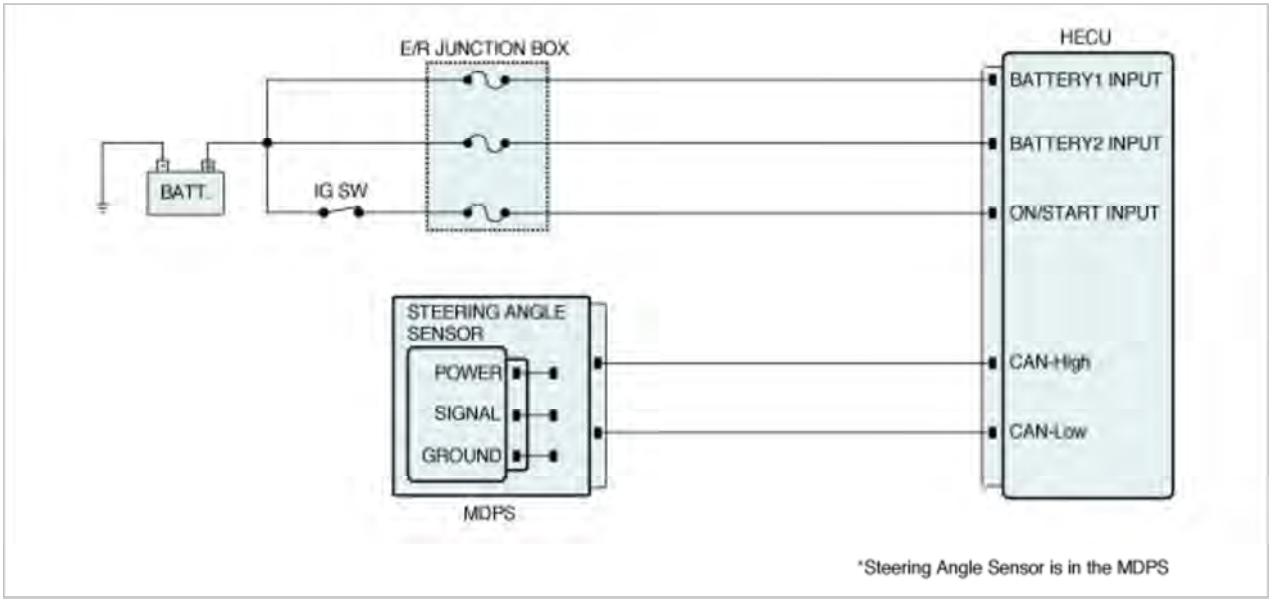
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal Monitoring	• Short of steering angle sensor circuit • Faulty steering angle sensor
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered SAS-value is equivalent to the offset. If the offset value exceeds a threshold of approximately 15 deg a SAS-fault is determined. Failure detection time depends on the driving distance, vehicle speed and on the amount of failed SAS signal. Within 30 km of symmetrical driving the calculated offset corresponds to the sensor offset.	
	Monitoring Period	• Continous (If the following conditions are satisfied) 1. After SAS-initialization and vehicle reference speed > 1.4 m/s (5km/h) 2. No under voltage 3. At least one SAS-message was sent in the current 20ms-cycle.	
		• A SAS-gradient-failure is set, if	

Case2	Enable Conditions	1. Signal gradient (steering angle velocity) from one 20 ms-cycle to another is higher than 40° or 2. Change of this gradient (steering angle acceleration) is higher than 15° : | (LwInK0K1 . LwInK1K2)| > 15° and | (LwInK0K1 + LwInK1K2)| > 15° - LwInK0K1 : Difference of the SAS-signal between the current 20ms-cycle and the last 20ms-cycle. - LwInK1K2 : Difference of the SAS-signal between the last 20ms-cycle and 20ms-cycle before.	
Case3	Monitoring Period	• Continuous (After initialization and no under voltage detected)	
	Enable Conditions	• If range of SAS signal is higher than possible range for more than 300ms, a fault is determined. - Range of SAS signal is limited by mechanical stop of steering mechanism.	
Case4	Monitoring Period	• Continuous (during driving)	
	Enable Conditions	• Based on a vehicle model a reference SAS signal is build. The difference between measured SAS signal and SAS signal calculated from yaw-rate sensor signal is evaluated for fault detection. Dependent on the driving conditions failures in size of [10 + 60 m/s / vehicle reference speed] deg at steering angle are recognized within 400 ~ 4800 ms through three possible recognition paths: 1. Curve Branch (lateral G > 2 m/s² and left and right curve driving) 2. Stability Branch (no large wheel speed differences and stable acceleration) 3. Straight ahead Branch (lateral G < 0.5 m/s² and yaw rate < 2 deg/s) The recognition time depends on the active branch (the time is shorter in a relation 1.:2.:3.-4:2:1) and the value of the permissible time threshold dependent on the deviation between the compared signals (small deviation → long detection time, large deviation → small detection time).	
Case5	Monitoring Period	• Initialization once in every ignition cycle. • The monitoring is active until a reset by a change in the SAS signal or until a right and left cornering can be recognized.	
	Enable Conditions	• If there is no change in the signal, but a right and left cornering has been recognized, a fault is determined. (lateral G > 2 m/s² in combination with a yaw rate > 6 °/s in both directions). - At a minimum change of e.g. 5° in the signal, the monitoring is reset.	
Case6	Monitoring Period	• Continuous (during driving)	
	Enable Conditions	• The measured yaw rate and the yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals don’t fit and forwards driving is detected, a fault is determined.	
Case7	Monitoring Period	• Continuous (during driving)	
	Enable	• Under normal conditions, two SAS messages are sent in one 20ms cycle, which is shown by an increase of the	

	Conditions	message counter by 2. If the message counter shows an increase higher than 3 or lower than 1 in one 20ms-cyle, a fault is stored after 160ms.	
Fail Safe		• Reduced controller function caused by faulty SAS signal. Allow the ABS/EBD control. • The ESC warning lamp is activated.	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "ON".
3. Turn the steering wheel to the left or right.
4. Monitor the "Steering Angle Sensor" parameters on the Scantool.

Sensor Name	Value	Unit
☑ Steering Angle Sensor	0.2	°

Fig.1

Fig 1) Test Condition : Ignition "ON" & Engine "ON".
Normal Data

5. Whenever steering wheel is turned, is the steering sensor's scantool data changed?

YES

(1) Connect scantool to Data Link Connector(DLC).

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

(3) Keep the steering wheel in ceter position.

(4) Monitor the "STEERING ANGLE SNSR" parameters on the Scantool.

Specification : Approx. 0 DEG

(5) Is parameter displayed within specifications?

YES	▸ Go to "Terminal and Connector Inspection" procedure.
NO	▸ Go to next step. (6)

NO

▸ Go to "Terminal and Connector Inspection" procedure.

6. Perform steering angle sensor calibration.
   (1) Ignition "ON" & Engine "OFF".
   (2)
   (3) Connect scantool to Data Link Connector(DLC).
   (4) Go in Elec. Power Steering system.
   (5) Perform ASP calibration. (figure 2).
   (6) Go to "Component Inspection" Precedure.

Fig.2

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 "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Operate the vehicle within DTC Detecting Condition in General Information. (turn right and left at least 1 time)
6. Select "Diagnostic Trouble Codes(DTCs)" mode again.
7. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly and check for proper operation. If the problem is corrected,replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure. Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "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.

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 > ESC(Electronic Stability Control) System > C1261 Steering Angle Sensor Not Calibrated

General Description

The Steering angle sensor(SAS) is installed in MDPS (Motor Driven Power Steering) and it sends messages to HECU through CAN communication line.
The SAS is used to determine turning direction and speed of the steering wheel.
The HECU uses the signals from the SAS when performing ESC-related calculations.

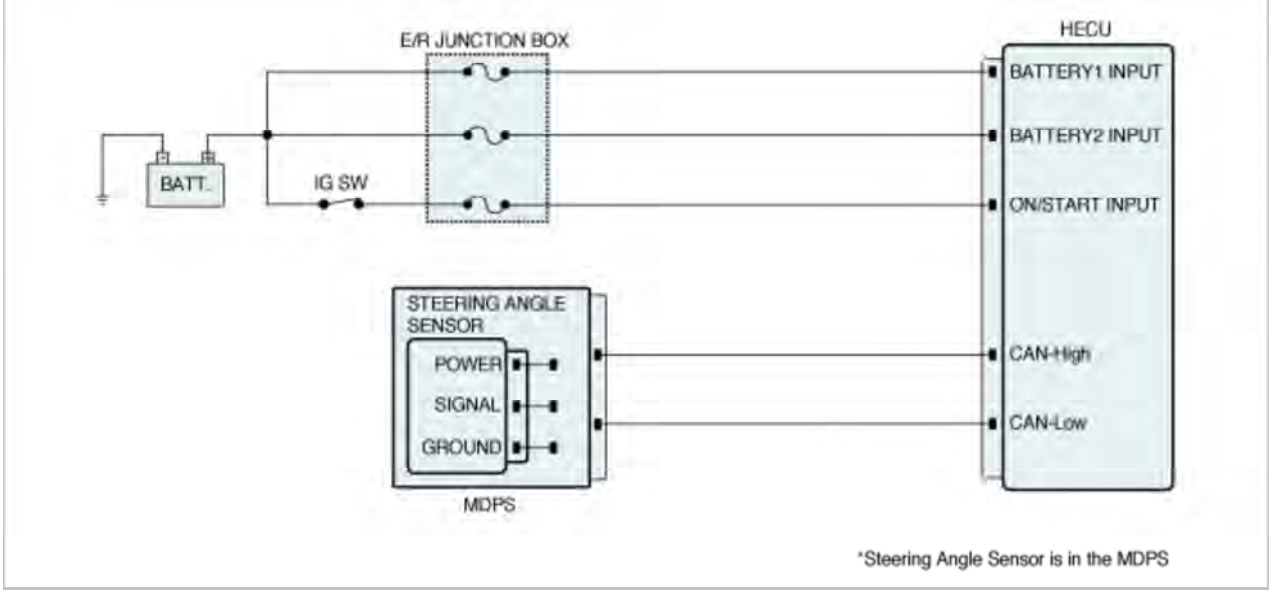
DTC Description

The SAS used for ESC control needs 0 set because the SAS measures an absolute angle.
0 set is done by using the scantool device. If abnormal 0 set is detected or no information in SAS is detected, a failure is recognized.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal Monitoring	• A fail of SAS 0 set
Monitoring Period	• During SAS 0 set.	
Enable Conditions	• The position of steering wheel is out of specified range (straight positon, a max. error ±5°) during SAS 0 setting. • When SAS is not calibrated.	
Fail Safe	• Reduced controller function caused by faulty SAS signal. Allow the ABS/EBD control. • The ESC warning lamp is activated.	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "ON".
3. Monitor the "SAS CALIBRATED" parameters on the Scantool.

Sensor Name	Value	Unit
☑ SAS Calibrated	ON	-

Fig.1

Fig 1) SAS Calibrate normal data
- YES : SAS calibrated, NO : SAS not calibrated.

4. Is parameter displayed within specifications?

YES	▸ Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Line up wheels like Figure 1.
   (1) Perform the wheel alignment.
   (2) Set the steering wheel so that the wheels point straight ahead.
   (3) Go ahead and Go back the vehicle 2~3 times without holding steering wheel.
2. Connect scantool to Data Link Connector(DLC).
3. Go in Elec. Power Steering system.
4. Perform ASP calibration. (Figure 2).
5. Check the condition of "SAS 0 SET" by oprerating the vehicle (turn right and left at least 1 time)

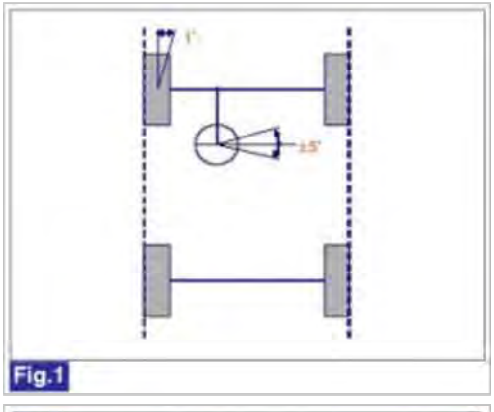


Fig.1

Fig.2

6. Is "SAS 0 SET" completed normally?

YES	▸ Go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 > ESC(Electronic Stability Control) System > C1283 Yaw Rate & Lateral G Sensor-Signal

General Description

The yaw-rate sensor and later G sensor is installed on the lower floor.
The yaw-rate sensor detects acceleration of the vehicle around its vertical axis, while the G sensor detects lateral acceleration of the vehicle.
It sends messages to HECU through CAN communcation line.

DTC Description

A lateral acceleration reference signal is calculated from the wheel speeds, the steering angle and the yaw rate signals to observe the lateral acceleration sensor signal.
The difference between the reference signal and the sensor signal is evaluated for failure detection.
A yaw rate reference signal is calculated from the wheel speeds, the steering angle and the lateral acceleration signals to observe the yaw rate sensor signal.
The difference between the reference signal and the sensor signal, and the gradient of the measured sensor signal is evaluated for the failure detection.
If the difference between estimated value and measured value of the sensor is larger than predefined value for predefined time, the failure is recognized.
Plauibility faults (signals received which fall outside of the sensor characteristics) are also recognized.

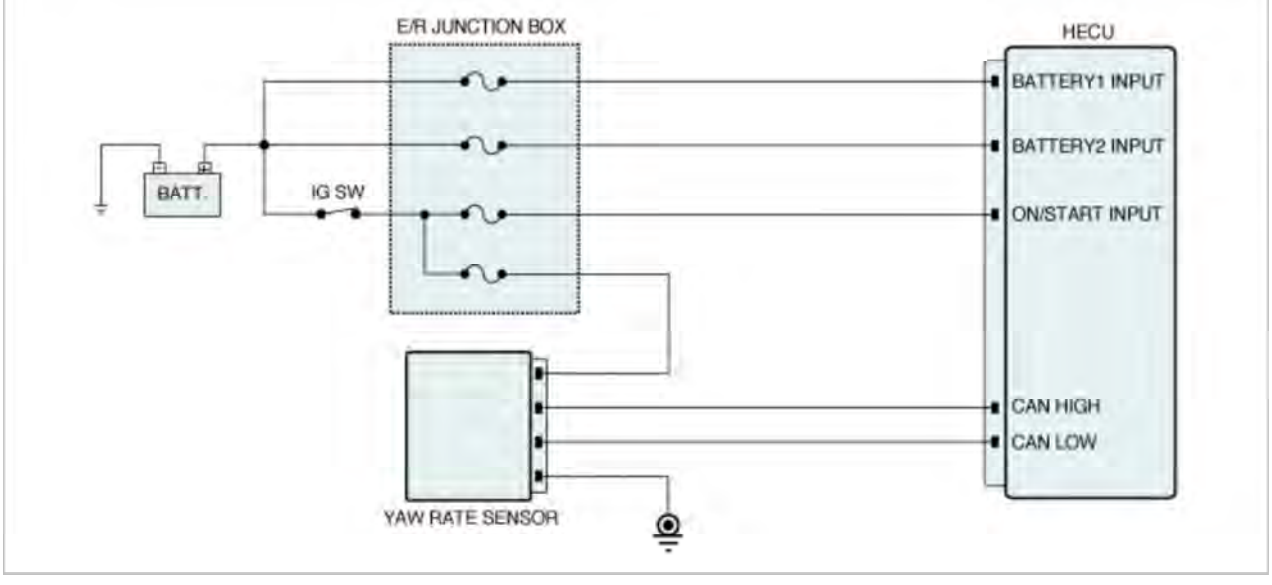
DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal Monitoring	• Faulty Yaw Rate & Lateral G sensor • Open or short of Yaw Rate & Lateral G sensor
Case1	Monitoring Period	• Continuous (during stable driving)	
	Enable Conditions	• By building a reference lateral G from the yaw-rate sensor, wheel speed sensor and the SAS it is possible to test the lateral G Signal on plausibility. If during stable vehicle behavior an lateral G Failure larger than approximately 2.5 m/s2 occurs, the ESC controller will disregard the later G sensor information so that a false ESC intervention is prevented. A fault is recognized after 1.6 s during model validity. • The measured and offset compensated yaw rate signal is compared to the reference yaw rate signal calculated from yaw rate sensor, lateral G sensor, SAS and wheel speed sensor. If the measured yaw rate deviates more than 2.5 °/s plus a dynamic threshold from the reference yaw rate during model validity, a failure is recognized after 1.6 s. The dynamic threshold is between 2.5 °/s and more than 5°/s. A typical value is 3°/s. - During the possibility to observe the recognition time	

		depends on the amount of failure.	
Case2	Monitoring Period	• Continuous (during driving)	
	Enable Conditions	• During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered lateral G value is equivalent to the offset. If the offset value exceeds a threshold of approximately 2.25 m/s2 an lateral G fault is determined.Failure detection time depends on the driving distance, vehicle speed and on the amount of failed lateral G signal. Within 30 km of symmetrical driving the calculated offset corresconds to the sensor offset.	
Case3	Monitoring Period	• Continuous (If no under voltage is detected)	
	Enable Conditions	• A fault is detected If the lateral G is higher than 15 m/s2 for more than 800ms.	
Case4	Monitoring Period	• Continuous (during driving)	
	Enable Conditions	• If the filtered value of lateral G is larger than 7 m/s2 for more than 400 m/s, a fault is set.	
Case5	Monitoring Period	• Continuous (dependent on driving situation)	
	Enable Conditions	• Standstill compensation : - The offset corresconds to the measured and filtered input value. Failure threshold 5.25 °/s. • Fast compensation (during driving if no standstill compensation could be completed): - The offset corresconds to the slightly filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, lateral G sensor and wheel speed sensor. Failure threshold is 7.5 °/s. • Long-term ("normal") compensation (during driving after succeeded standstill or fast offset compensation): - The offset corresconds to the strong filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, lateral G sensor and wheel speed sensor. Failure threshold is 7.5 °/s.	
Case6	Monitoring Period	• After every standstill.	
	Enable Conditions	• Yaw-rate sensor sensitivity is estimated by comparison of the measured yaw rate and the yaw rates calculated from the wheel speed sensor and SAS during cornering. The fault criteria is approx. 25% sensitivity. • The measured yaw rate and the model yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals doesn't fit and forward driving is reconized, a fault is determined. - Driving with a yaw rate of e.g. 10 °/s requires a time of 3s and additional time to reach a velocity 20 m/s to recognize forward driving.	
Case7	Monitoring Period	• Continuous (after initialization of the YRS(yaw rate sensor) and if no under voltage is detected)	
	Enable Conditions	• The yaw rate sensor BITE logic evaluates the BITE-signal by extraction of the measured yaw rate of the vehicle. The allowed range for the BITE-signal is 25°/s ± 7°/s. If the BITE-signal is not in the allowed range, a	

		suspected failure bit is set after 200ms.
Case8	Monitoring Period	• After YRS(yaw rate sensor)-initialization, no under voltage
	Enable Conditions	• Depending on the driving conditions a signal gradient higher than 10 ~ 23 °/s / 40 ms sets a suspected failure bit after 280ms, unless a single signal peak is recognized by a peakfilter.
Case9	Monitoring Period	• Continuous (except spinning, use of handbrake, unsteady driving conditions or a detected under voltage)
	Enable Conditions	• During standstill - The allowed range of the yaw rate sensor signal is ±30°/s. Leaving this range for 5s sets a fault. In case of driving off after the failure was present for longer than 500ms during standstill, the fault is detected immediately. • While driving - The allowed range of the yaw rate sensor signal is ±94.75°/s and a suspected failure bit is set, if the signal is out of this range for 500ms.
Case10	Monitoring Period	• Once after power up and no low voltage.
	Enable Conditions	• A line fault is detected if 0.2V < VLG < 0.8V isn't continued for a time t >= 60ms during POS (POS : power on selftest)
Fail Safe		• Reduced controller function. • Inhibit the ESC control and allow the ABS/EBD control. • The ESC warning lamps are activated.

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Maintain the vehicle standing still.
4. Monitor the "Lateral Acceleration Sensor, Yaw Rate Sensor" parameter on the Scantool.

Specification :
Approx. Lateral Acceleration Sensor : 0G
Approx. Yaw Rate Sensor : -0 deg/s

Sensor Name	Value	Unit
☑ Yaw Rate Sensor-Lateral	0.02	G
☑ Yaw Rate Sensor-Yaw	0.0	deg/s

Fig.1

Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Normal data

5. Is parameter displayed within specifications?

YES	▸ Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminal condition.
   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 "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Operate the vehicle within DTC Detecting Condition in General Information.
6. Select "Diagnostic Trouble Codes(DTCs)" mode again.
7. Are any DTCs present ?

YES	▸ 1) Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification of Vehicle Repair" procedure. 2) Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness or faulty Yaw Rate & Lateral G sensor. 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.
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 > ESC(Electronic Stability Control) System > C1503 TCS/ESC(ESP) Switch Error

General Description

The ESP(ESC) switch is used to temporarily deactivate ESC control.

DTC Description

Trouble code is set when the condition that the level of ESC switch is high is continued for 60sec.
When the ESC switch failure is set, Warning lamps won't illuminate and HECU allow the ABS/EBD/ESC control.

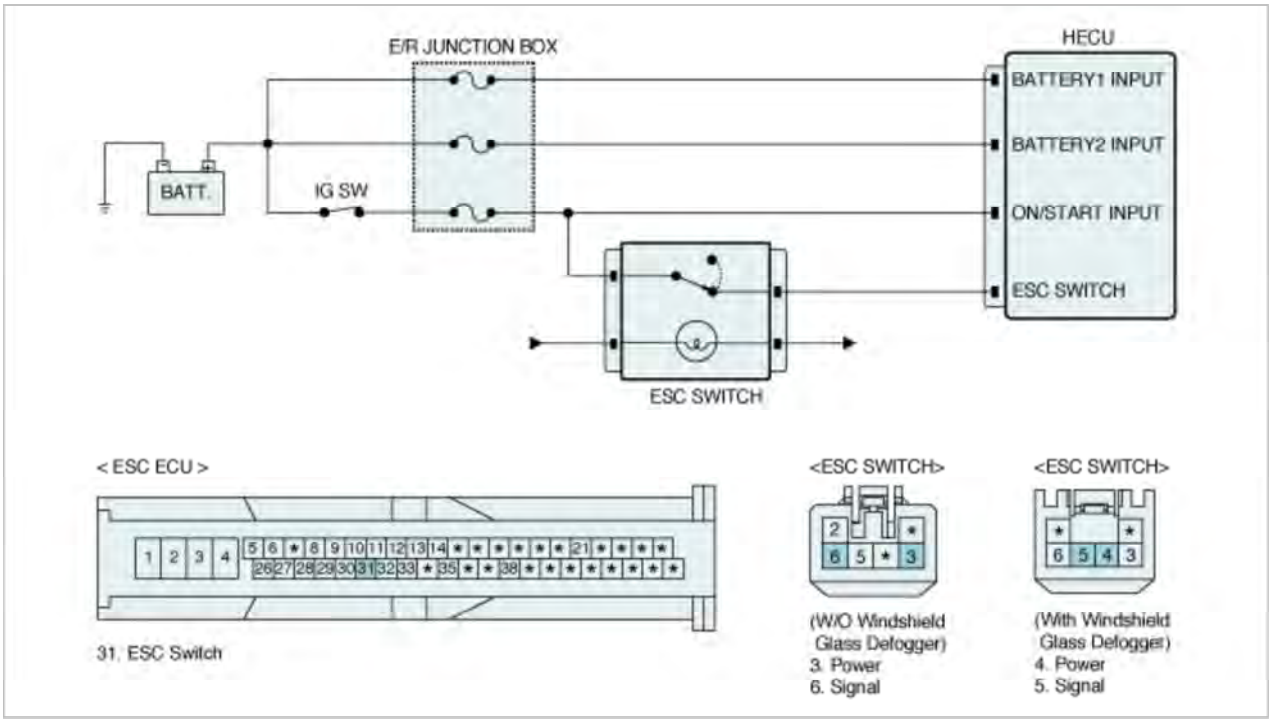
DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Short circuit monitoring	• Open or short ESC switch • Faulty ESC switch
Monitoring Period	• Continuous	
Enable Conditions	• When the ESC switch is ON for 60sec.	
Fail Safe	• Allow the ABS/EBD/ESC control. • The ESC warning lamp is not activated.	

Specification

ESC switch "ON"	Voltage Range of "High"
	Above 60% of the battery voltage

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Press the ESC SWITCH.
4. Monitor the "ESC(ESP) Off Switch" parameter on the scantool.

Sensor Name	Value	Unit
☑ ESC(ESP) Off Switch	ON	-

Fig.1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF".
Normal data

5. Whenever the switch is pushed up/down, is the ESC off switch's scantool data changed ON/OFF?

YES	▸ Fault is intermittent caused by poor connection in ESC switch line or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Signal Circuit Inspection" procedure.

Signal circuit inspection

■ **Open or Short Check**

1. Ignition "ON" & Engine "OFF".
2. Press the ESC SWITCH.
3. Measure voltage between ESC switch signal terminal of the HECU harness connector and chassis ground.

Specification : Approx. B+

4. Is the measured value within specifications?

YES	▸ Go to "Component Inspection" Procedure.
NO	▸ Check for open or blown 10A fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and HECU harness connector and then, go to "Verification of vehicle Repair" procedure. If there is no problem in circuit, Go to "Component Inspection" procedure.

Component Inspection

■ **ESC switch Check**

1. Ignition "OFF" & Engine "OFF".
2. Disconnect the ESC switch connector.
3. Measure resistance between power terminal and siganl terminal of the ESC switch connector.

Specification :
Approx. below 1Ω - (In case of pressing the ESC switch)
Approx. ∞ Ω - (In case of not pressing the ESC switch)

4. Is the measured resistance within specifications?

YES	▸ Fault is intermittent caused by poor connection in ESC switch harness and/or HECU's connector. Go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good ESC switch and check for proper operation. If problem is corrected, replace ESC 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 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 > ESC(Electronic Stability Control) System > C1513 Brake Switch Error

General Description

The brake light switch indicates brake pedal status to the ABS control unit. The switch is turned on when brake is depressed. The brake light switch is a normally-open contact which runs to battery voltage when active (brake depressed).

DTC Description

The brake light signal is a reference to judge driver's intention for braking and The HECU checks open or short circuit of brake light switch for normal ABS/ESC control. If an error is present, the warning lamp will illuminate.
If an error is present, the warning lamp will illuminate.

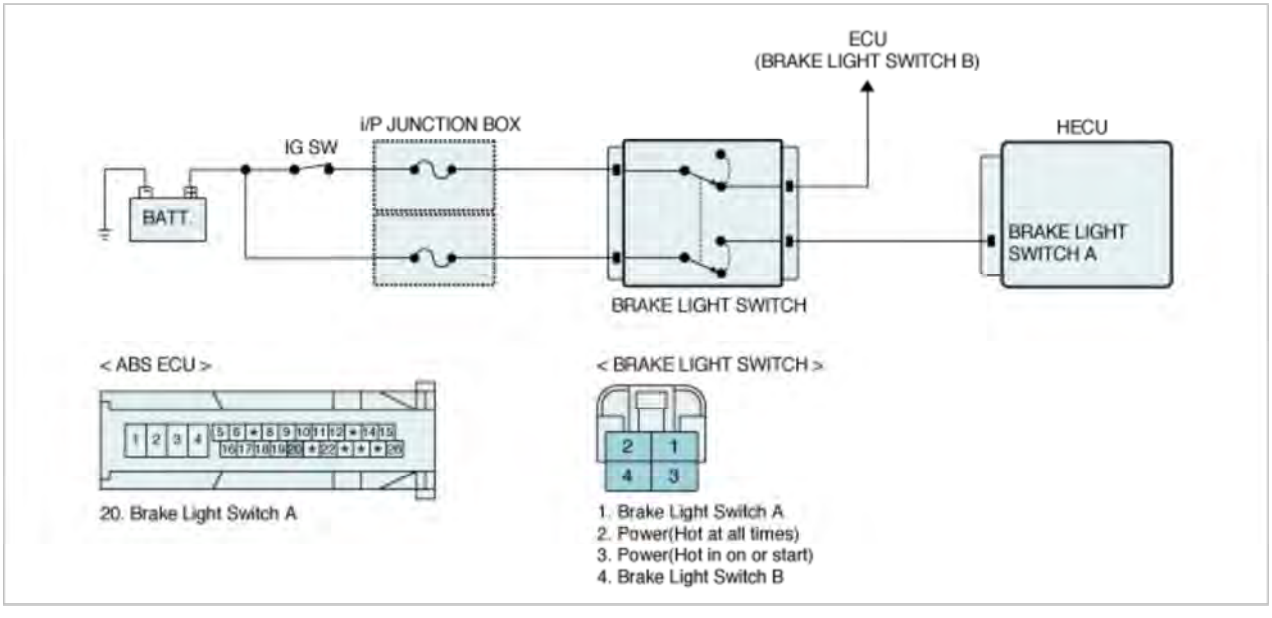
DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Open circuit in brake switch line • Faulty brake light switch
Case1	Monitoring Period	• Continuous (only no under voltage is detected)	
	Enable Conditions	• If the BLS-signals is high for 60 s at following condition. 1. the gas pedal is stepped 2. vehicle speed > 10.8km/h 3. offset compensated pressure < 5 bar 4. no control is active	
Case2	Monitoring Period	• Continuous (only normal voltage)	
	Enable Conditions	• For redundancy reasons an additional BLSpVor-signal is created by the pressure sensor signal. If the pressure sensor is compensated, the threshold for generating the BLSpVor signal is 10 bar. If the pressure sensor is not compensated, the threshold is increased by 15bar. If this signal is set without any hardware-BLS-signals and if no pomp is operated during that time, a fault is set after the braking. • If the pressure signal is higher than 80bar and not both of the hardware-BLS are set, a fault is stored after 1s.	
Fail-Safe		• Inhibit the ESC control and allow the ABS/EBD control. • The ESC warning lamp is activated.	

Specification

Brake Light Switch	Voltage Range of "High"	Voltage Range of "Low"
	7.0V ~ 16.0V	0V ~ 3V

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "OFF".
3. Press the brake pedal.
4. Monitor the "BRAKE LAMP SWITCH" parameter on the scantool.

Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Normal data

5. Whenever brake pedal is pushed down, is the brake switch's scantool data changed ON/OFF?

YES	▸ Fault is intermittent caused by poor connection in brake light switch line and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Signal circuit inspection (brake pedal isn't depressed)" procedure.

Signal circuit inspection (brake pedal isn't depressed)

■ Open or Short Check

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between brake light switch signal A terminal of the HECU harness connector and chassis ground.

Specification : Brake light switch A - 0V

3. Is the measured waveform within specifications?

YES	▸ Go to "Signal circuit inspection (brake pedal is depressed)" procedure.
NO	▸ Check for open or blown 15A, 10A fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and HECU harness connector and then, go to "Verification of vehicle Repair" procedure. If there is no problem in circuit, Go to "Component Inspection" procedure.

Signal circuit inspection (brake pedal is depressed)

■ Open or Short Check

1. Ignition "ON" & Engine "OFF".
2. Press the brake pedal.
3. Measure voltage between brake light switch signal A terminal of the HECU harness connector and chassis ground.

Specification : Brake light switch A - B+

4. Is the measured waveform within specifications?

YES	▸ Fault is intermittent caused by poor connection in brake light switch harness and/or HECU's connector. Go to "Verification of Vehicle Repair" procedure.
NO	▸ Check for open or blown 15A, 10A fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and HECU harness connector and then go to "Verification of vehicle Repair" procedure. If there is no problem in circuit, Go to "Component Inspection" procedure.

Component Inspection

■ Brake light switch Check

1. Ignition "OFF" & Engine "OFF".
2. Disconnect the brake light switch connector.
3. Measure resistance between power terminal and siganl terminal of the brake light switch A, B connector.

Specification :
Resistance between terminals of the brake light switch A - ∞Ω (when the plunger is pushed down), 0Ω (when the plunger isn't pushed down).
Resistance between the terminals of the brake light switch B - ∞Ω (when the plunger is not pushed down), 0Ω (when the plunger is pushed down).

4. Is the measured value within specifications?

YES	▸ Fault is intermittent caused by poor connection in brake light switch harness and/or HECU's connector. Go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good brake light switch and check for proper operation. If problem is corrected, replace brake light switch and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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

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

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C1604 ECU Hardware Error

General Description

The HECU consists of an ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit).
The HCU portion of the assembly contains a pump motor, solenoid valves, and accumulator.
Increase and decrease of hydraulic pressure is opreated by electronic motor, according to a measured signal by wheel speed sensor.
The function of HCU is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder by operating return pump according to HECU control signal while ABS control is active.
The ECU monitors various sensor and switch inputs.
These inputs are used to make decisions regarding HCU component operation.

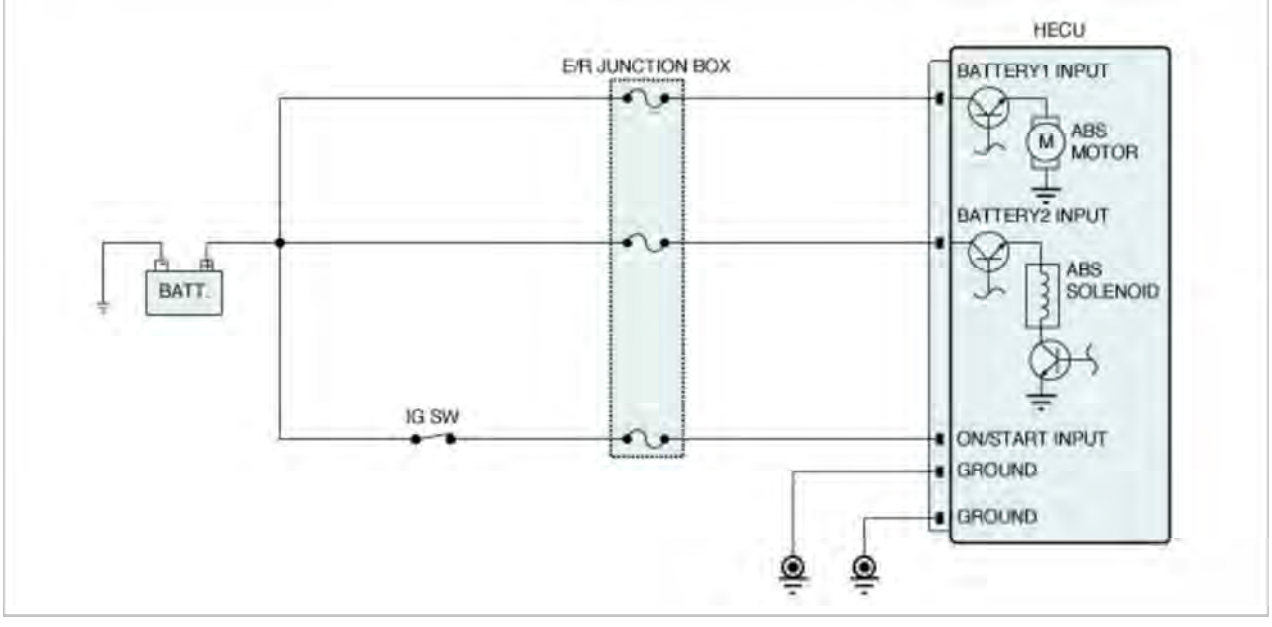
DTC Description

The HECU monitors the operation of the IC components such as memory, register, A/D converter and so on.
The ECU sets this code when the EEPROM data read by the master processor is different than prior data written, or when the master/slave processor detects abnormal operation in RAM, Status Register, Interrupt, Timer, A/D converter or cycle time.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Internal monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• If Internal control unit failures of the master/slave processor or peripheral integrated circuits is detected.	
Case2	Monitoring Period	• Directly after ignition on, during reading of EEPROM-values	
	Enable Conditions	• Failure is set if checksum not correct or PSW-EEPROM-Handler reported unknown failure during EEPROM-value reading. • If EEPROM reading sequence take longer then 3s, a failure is set.	
Fail-Safe		• The ABS/EBD/ESC functions are inhibited. • The ABS/EBD/ESC warning lamps are activated.	

Diagnostic Circuit 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to "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.
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 > ESC(Electronic Stability Control) System > C1605 CAN Hardware Error

General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and ESC control requests, to the Engine PCM(ECM & TCM) through CAN bus line.
The Engine PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests.
The PCM(TCM) maintains current gear positions during ESC control time, in order not to increase power which causes a Kickdown shift.

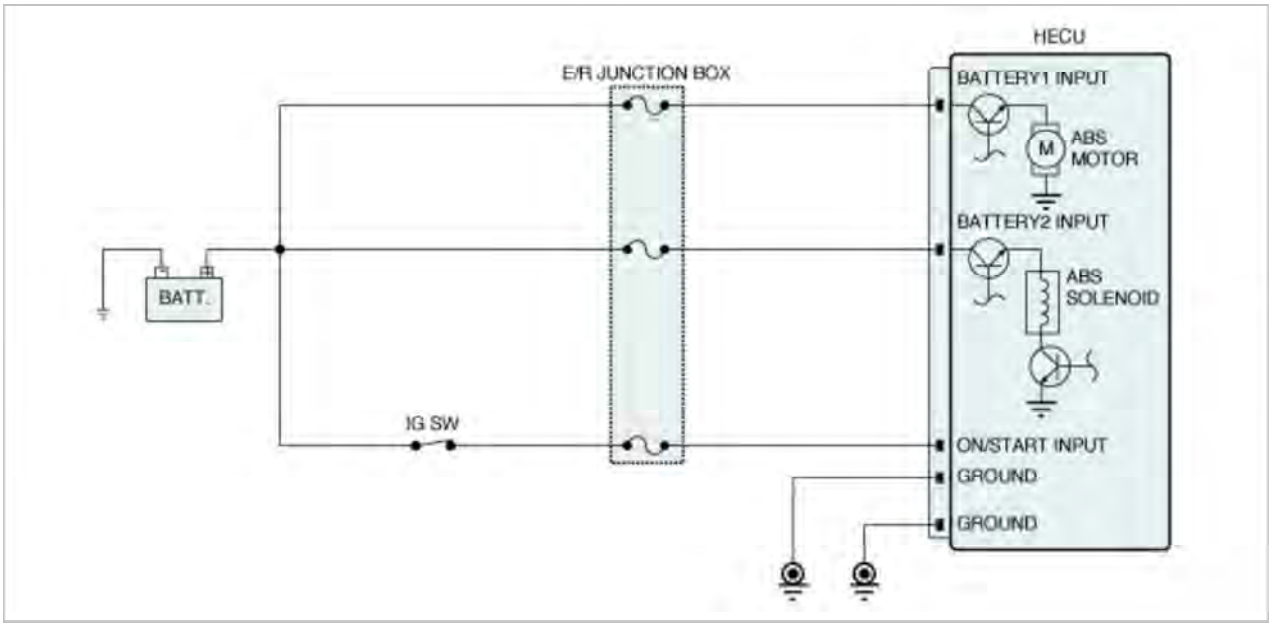
DTC Description

The HECU checks the CAN control module for normal ESC control, and sets this code if CAN control module malfunction is detected.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN control module monitoring	• Faulty HECU
Monitoring Period	• Immediate during start up	
Enable Conditions	• Faults are detected immediately if the initialization software can't have write access to the configuration registers of the CAN-controller module.	
Fail-Safe	• Inhibit the ESC control and allow the ABS/EBD control.	

Diagnostic Circuit 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to "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.
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.
	▸ System performing to specification at this time.

NO	

Brake System > ESC(Electronic Stability Control) System > C1611 CAN Time-out ECM

General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and ESC control requests, to the Engine PCM(ECM & TCM) through CAN bus line.
The Engine PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests.
The PCM(TCM) maintains current gear positions during ESC control time, in order not to increase power which causes a Kickdown shift.

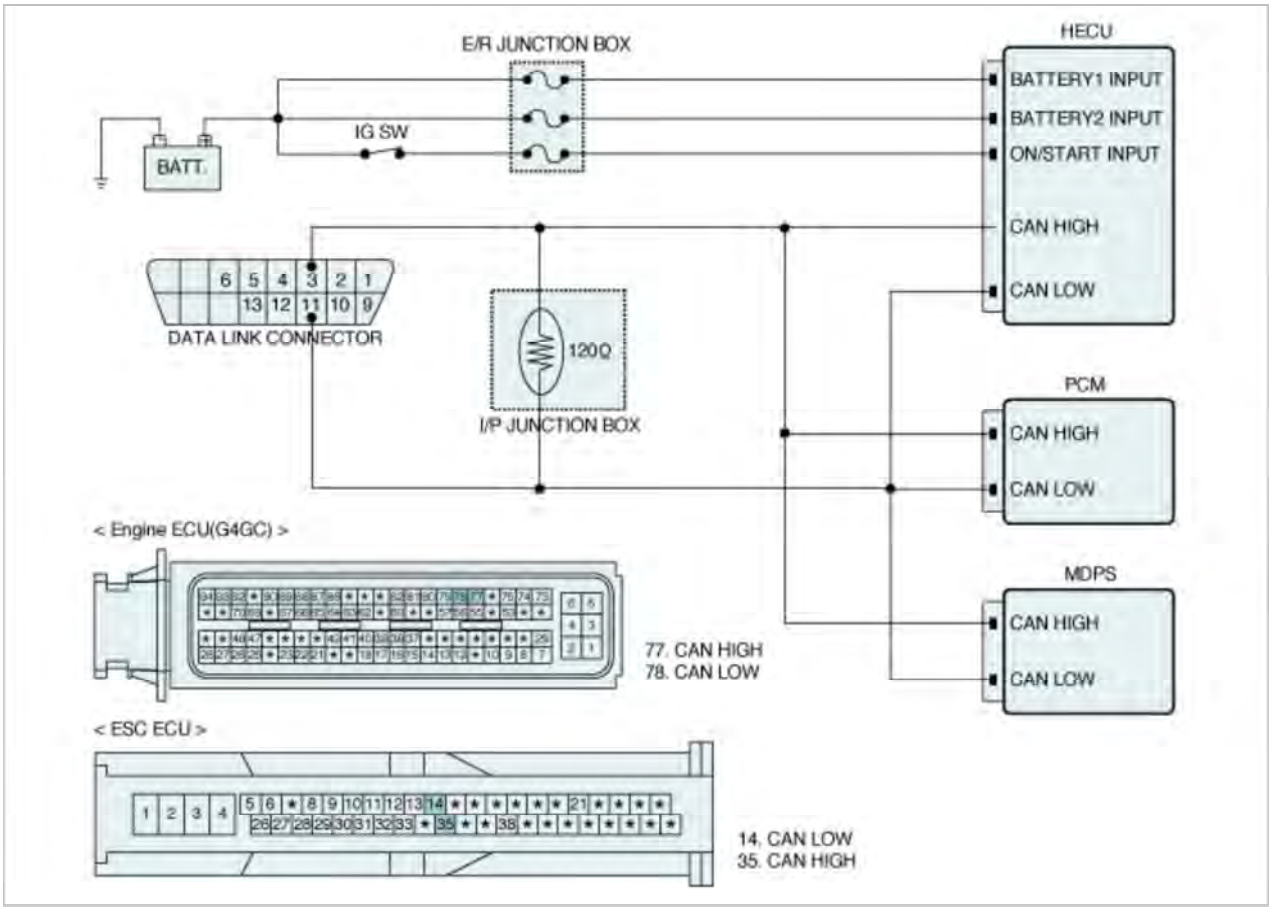
DTC Description

The HECU checks the CAN communcation lines for normal ESC control, and sets this code if a PCM(ECM) message is not received within predefined time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN message monitoring	• Faulty PCM(ECM) • Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if PCM(ECM) message was not received on time by the CAN controller of HECU.	
Fail-Safe	• Inhibit the ESC control and allow the ABS/EBD control.	

Diagnostic Circuit 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Signal circuit inspection" procedure.

Signal Circuit Inspection

■ **Open Check**

1. Ignition "OFF" & Engine "OFF".
2. Disconnect HECU, MDPS and PCM connector.
3. Measure resistance between CAN HIGH (LOW) terminal of the HECU harness connector and CAN HIGH (LOW) terminal terminal of the PCM harness connector.

Specification : Approx. below 1Ω

4. Is the measured resistance within specifications?

YES	▸ Go to "Component inspection" procedure.
NO	▸ Repair open in CAN BUS line between HECU harness connector and PCM harness connector and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON"
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good PCM and check for proper operation. If problem is corrected, replace PCM 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 HECU, faulty PCMor was repaired and HECU memory was not cleared. 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.
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 > ESC(Electronic Stability Control) System > C1612 CAN Time-out TCM

General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and ESC control requests, to the Engine PCM(ECM & TCM) through CAN bus line.
The Engine PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests.
The PCM(TCM) maintains current gear positions during ESC control time, in order not to increase power which causes a Kickdown shift.

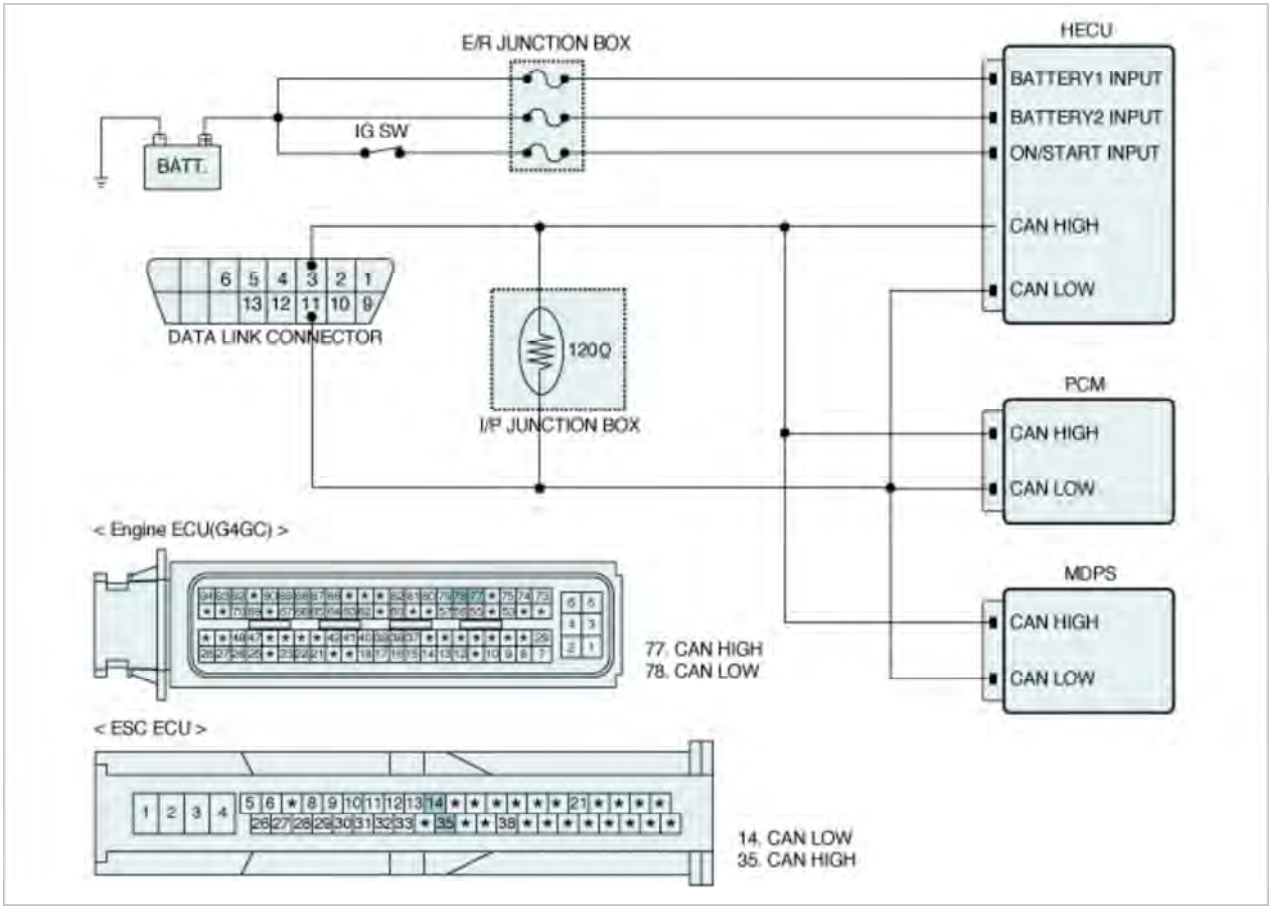
DTC Description

The HECU checks the CAN communcation lines for normal ESC control, and sets this code if an PCM(TCM) message is not received within predefined time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN message monitoring	• Faulty PCM(TCM) • Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if PCM(TCM) message was not received on time by the CAN controller of HECU.	
Fail-Safe	• Inhibit the ESC control and allow the ABS/EBD control.	

Diagnostic Circuit 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Signal circuit inspection" procedure.

Signal Circuit Inspection

■ Open Check

1. Ignition "OFF" & Engine "OFF".
2. Disconnect HECU, MDPS and PCM connector.
3. Measure resistance between CAN HIGH (LOW) terminal of the HECU harness connector and CAN HIGH (LOW) terminal terminal of the PCM harness connector.

Specification : Approx. below 1Ω

4. Is the measured resistance within specifications?

YES	▸ Go to "Component inspection" procedure.
NO	▸ Repair open in CAN BUS line between HECU harness connector and PCM harness connector and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON"
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good PCM and check for proper operation. If problem is corrected, replace PCM 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 HECU, faulty PCM or was repaired and HECU memory was not cleared. 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.
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 > ESC(Electronic Stability Control) System > C1616 CAN Bus Off

General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and ESC control requests, to the Engine PCM(ECM & TCM) through CAN bus line.
The Engine PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests.
The PCM(TCM) maintains current gear positions during ESC control time, in order not to increase power which causes a Kickdown shift.

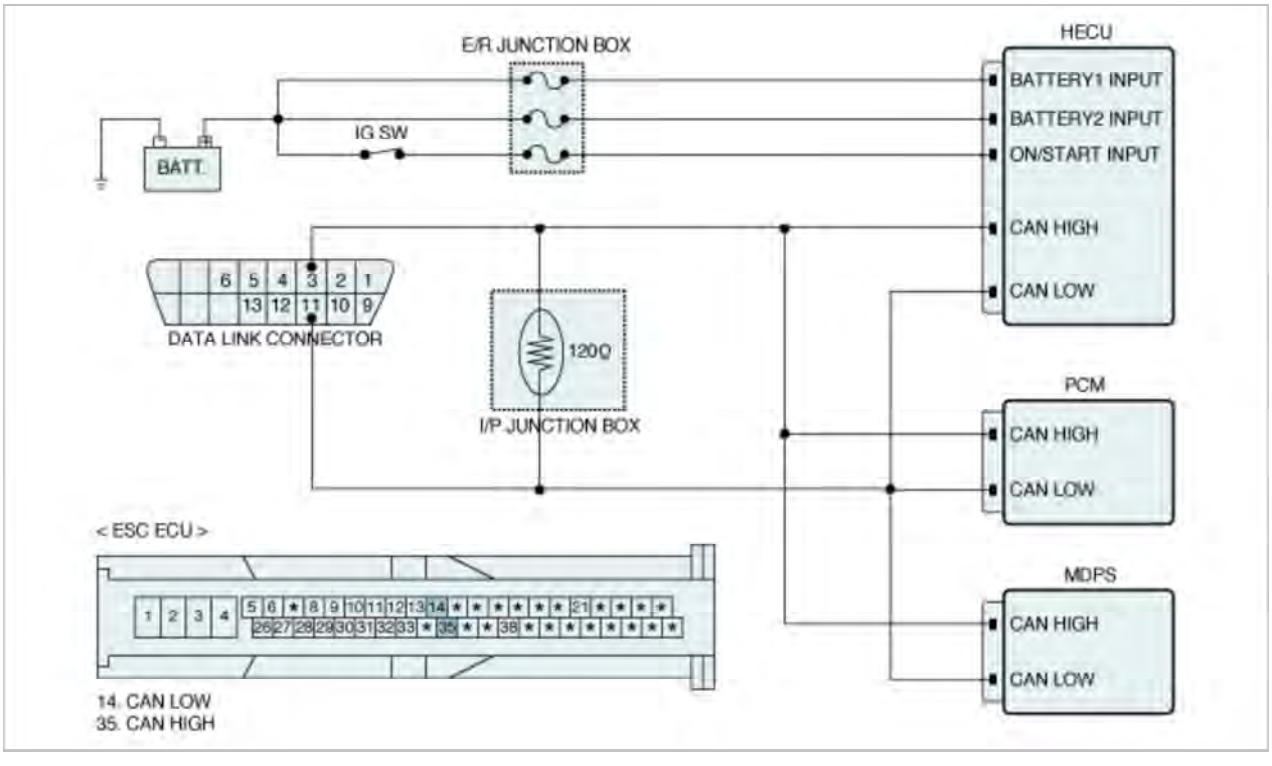
DTC Description

The HECU checks the CAN communication lines for normal ESC control, and sets this code if re-initialization is tried for 15 times in sequence without success.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Open or short monitoring	• Open or short circuit in CAN line
Monitoring Period	• Continuous	
Enable Conditions	• A CAN BUS off fault is established if re-initialization is tried for 15 times in sequence without success.	
Fail-Safe	• Inhibit the ESC control and allow the ABS/EBD control.	

Diagnostic Circuit 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "CAN Signal Circuit Inspection" procedure.

CAN Signal Circuit Inspection

■ Short Check (to ground)

1. Ignition "OFF" & Engine "OFF".
2. Disconnect the HECU connector.
3. Measure resistance between CAN LOW(HIGH) terminal of the HECU harness connector and chassis ground.

Specification : ∞ Ω

4. Is the measured value within specifications?

YES	▸ Go to next procedure.
NO	▸ If abnormal resistance is detected in CAN HIGH circuit, Repair short to ground in CAN HIGH circuit and then go to "Verification of vehicle Repair" procedure. If abnormal resistance is detected in CAN LOW circuit, Repair short to ground in CAN LOW circuit and then go to "Verification of vehicle Repair" procedure.

■ CAN BUS Resistance Check

1. Ignition "OFF" & Engine "OFF".
2. Disconnect the HECU, PCM, and MDPS connector.
3. Measure resistance between CAN LOW terminal and CAN HIGH terminal of the HECU harness connector.

Specification : Approx. 120Ω

4. Is the measured value within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ In case of the resistance "approx. 1Ω" : Repair mutual short in CAN signal circuit of the HECU and then go to "Verification of vehicle Repair" procedure. In case of the resistance "∞ Ω" : Repair open in CAN signal circuit of the HECU and then go to "Verification of vehicle Repair" procedure. In case of the resistance "approx. 120 Ω" : Check the resistances(122Ω) in I/P junction box and ECM, repair as necessary and then go to "Verification of vehicle Repair" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON"
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by poor connection in CAN signal harness and/or HECU's connector. 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.
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 > ESC(Electronic Stability Control) System > C1623 CAN Time-out Steering Angle Sensor

General Description

The Steering angle sensor(SAS) is installed in MDPS (Motor Driven Power Steering) and it sends messages to HECU through CAN communication line.
The SAS is used to determine turning direction and speed of the steering wheel.
The HECU uses the signals from the SAS when performing ESC-related calculations.

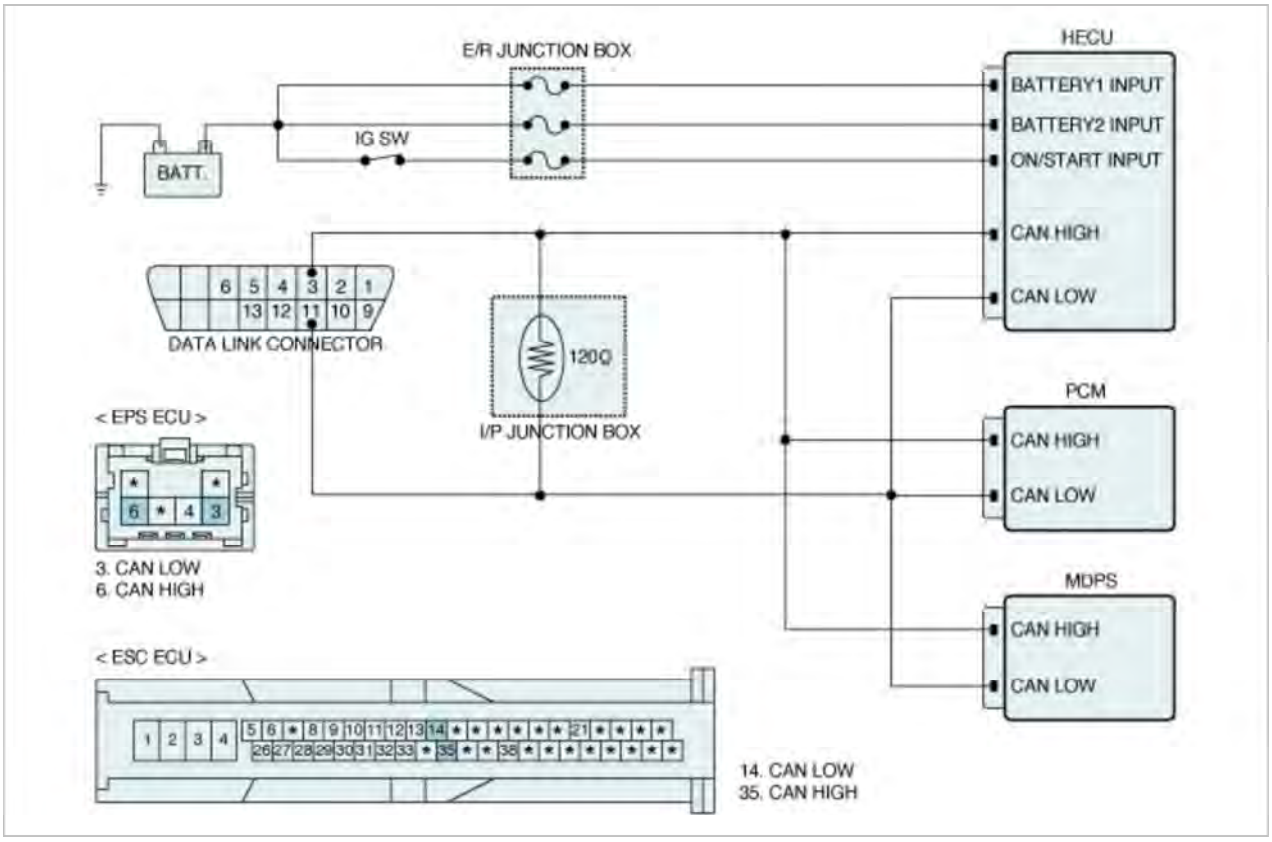
DTC Description

The HECU checks the CAN communcation lines for normal ESC control, and sets this code if an SAS message is not received within predefined time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN message monitoring	• Faulty SAS • Open circuit in SAS line
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if SAS message was not received on time by the CAN controller of HECU.	
Fail-Safe	• Inhibit the ESC control and allow the ABS/EBD control.	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Turn the steering wheel to the left or right.
4. Monitor the "STEERING ANGLE SNSR" parameters on the Scantool.

Sensor Name	Value	Unit
☑ Steering Angle Sensor	0.2	°

Fig.1

Fig 1) Test Condition : Ignition "ON" & Engine "ON".
Normal Data

5. Whenever steering wheel is turned, is the steering sensor's scantool data changed?

YES	▸ Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(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

■ **Open Check**

1. Ignition "OFF" & Engine "OFF".
2. Disconnect HECU, MDPS and PCM connector.
3. Measure resistance between CAN HIGH(LOW) terminal of the HECU harness connector and CAN HIGH(LOW) terminal terminal of the MDPS harness connector.

   Specification : Approx. below 1Ω

4. Is the measured resistance within specifications?

YES	▸ Go to "Component inspection" procedure.
NO	▸ Repair open in CAN BUS line between HECU harness connector and MDPS harness connector and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good steering column & EPS unit assembly and check for proper operation. If the problem is corrected,replace steering column & EPS unit assembly and then go to "Verification of Vehicle Repair" procedure. Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "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.
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 > ESC(Electronic Stability Control) System > C1625 CAN Time-out ABS/ESC (ESP)

General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and ESC control requests, to the Engine PCM(ECM & TCM) through CAN bus line.
The Engine PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests.
The PCM(TCM) maintains current gear positions during ESC control time, in order not to increase power which causes a Kickdown shift.

DTC Description

The HECU checks the CAN communcation lines for normal ESC control, and sets this code if an CAN message is not transmitted within predefined time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN message monitoring	• Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if CAN message was not transmitted on time by the CAN controller of HECU.	
Fail-Safe	• Inhibit the ESC control and allow the ABS/EBD control.	

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 "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON"
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to "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.
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 > ESC(Electronic Stability Control) System > C1626 Implausible Control

General Description

The ESC is a system to stabilize a car during understeer and oversteer events by supplying appropriate wheel with braking pressure according to signal of yaw & G sensor, SAS, WSS, pressure sensor.

DTC Description

Under normal conditions, the inlet valves of all four wheels are not closed during control for longer than 1.28s or If the controller requests pressure-hold or pressure-decrease for longer than 1.28s, a fault is detected.
The ABS/ESC warning lamp is turned ON and the EBD warning lamp is turned OFF.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	• Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• If the controller requests pressure-hold or pressure-decrease for longer than 1.28s, a fault is stored. • Under normal conditon, the inlet valves of all four wheels are not closed during control for longer than 1.28s.	
Fail-Safe	• The ABS/ESC functions are inhibited, allow the EBD control. • The ABS/ESC warning lamps are activated.	

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 "Component Inspection" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON"
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to "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.
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 > ESC(Electronic Stability Control) System > C1643 CAN Time-out Yaw Rate & Lateral G Sensor

General Description

The yaw-rate sensor and later G sensor is installed on the lower floor.
The yaw-rate sensor detects acceleration of the vehicle around its vertical axis, while the G sensor detects lateral acceleration of the vehicle.
It sends messages to HECU through CAN communcition line.

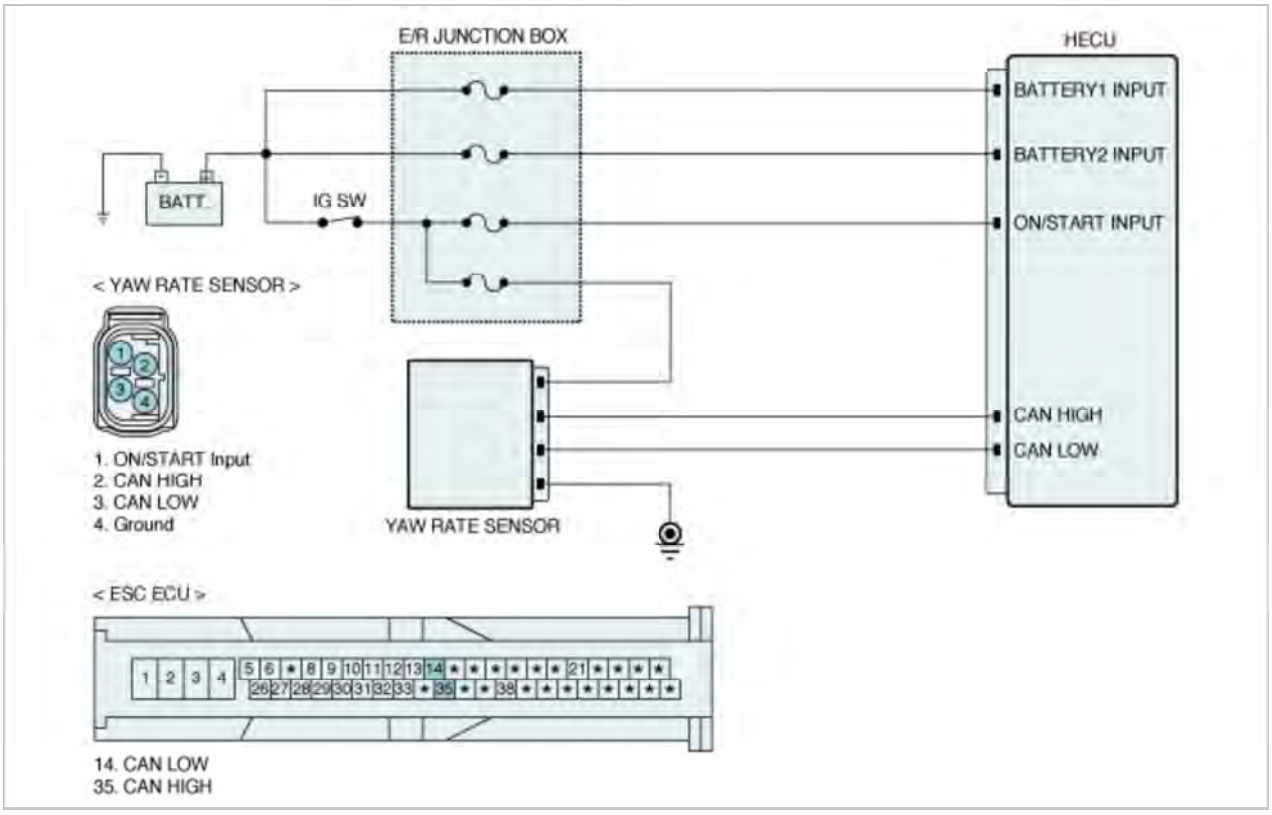
DTC Description

The HECU checks the CAN communcation lines for normal ESC control, and sets this code if an Yaw Rate & Lateral G Sensor message is not received within redefined time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN message monitoring	• Faulty Yaw Rate & Lateral G Sensor • Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if Yaw Rate & Lateral G Sensor message was not received on time by the CAN controller of HECU.	
Fail-Safe	• Inhibit the ESC control and allow the ABS/EBD control.	

Diagnostic Circuit 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Power circuit inspection" procedure.

Power Supply Circuit Inspection

■ Power Supply Check

1. Ignition "ON" & Engine "OFF".
2. Disconnect the Yaw rate & lateral G sensor connector.
3. Measure voltage between power supply terminal of the yaw rate & lateral G sensor harness connector and chassis ground.

Specification : Approx. B+

4. Is the measured value within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Repair open or short in power circuit between battery and Yaw rate & Lateral G sensor harness connector. Check for open or blown 10A fuse referring to "Circuit Diagram". If there is no problem in circuit, Go to "Verification of vehicle Repair" procedure.

Ground Circuit inspection

■ Open Check

1. Ignition "OFF".
2. Disconnet the yaw rate & lateral G sensor harness connector.
3. Measure resistance between ground terminal of the yaw rate & lateral G sensor harness connector and chassis ground.

Specification : Approx. 1 Ω

4. Is the measured resistance within specifications?

YES	▸ Go to "CAN Circuit Inspection" procedure.
NO	▸ Repair open between ground teminal of the yaw rate & lateral G sensor harness connector and chassis ground. If there is no problem in circuit, Go to "Verification of vehicle Repair" procedure.

■ CAN Circuit Inspection

1. Ignition "OFF"
2. Disconnet the HECU harness connector and yaw rate & lateral G sensor harness connector .
3. Measure resistance between CAN HIGH, LOW terminal of the HECU harness connector and CAN HIGH, LOW terminal terminal of the MDPS harness connector.

Specification : Approx. below 1Ω

4. Is the measured resistance within specifications?

YES	▸ Go to "Component inspection" procedure.
NO	▸ Repair open in CAN BUS line between HECU harness connector and Yaw rate & lateral G sensor harness connector and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Ignition "OFF".
2. Ignition "ON"
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ 1) Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification of Vehicle Repair" procedure. 2) Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to "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.
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.
	▸ System performing to specification at this time.

NO	

Brake System > ESC(Electronic Stability Control) System > C1702 Variant Coding Error

General Description

There is no hardware difference of the HECU according to the vehicle's specification, just software is changed by the vehicle parameter used for ESC control. The HECU stores a classified variant code value according to the received data(a kind of engine, engine displacement, a kind of T/M). After then the HECU reads various parameters according to the stored variant value in the memory to use for the ESC control.

DTC Description

The HECU checks the varient code after ignition. If a inappropriate varient code is detected or there is no varient code, a fault is detected.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Internal monitoring	• Replacement of PCM(ECM & TCM)
Monitoring Period	• Once during startup.	
Enable Conditions	• After power on, the HECU does not receive a valid variant code information during the configuration time. • HECU has no valid variant code stored in the EEPROM. • The receieved CAN signals does not lead to a defined and supported variant code. • If an ECU, which has already memorized a valid variant code information, receives a different variant code information. (at a next Power on cycle)	
Fail-Safe	• The ABS/EBD/ESC functions are inhibited. • The ABS/EBD/ESC warning lamps are activated.	

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminal condition.
   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 "Variant Coding" procedure.

Variant Coding

1. Check for improper installation of EMS/TCU/ESC.
2. Connect scantool to Data Link Connector(DLC).
3. Ignition "ON" & Engine "OFF".
4. Perform variant coding. (Figure 1).
5. Disconnect scantool.
6. Ignition "OFF" and then ignition "ON". Go to "Component Inspection"Procedure.

Fig.2

Component Inspection

1. Ignition "OFF".
2. Ignition "ON" & Engine "OFF".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

YES	▸ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to "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.
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 > ESC(Electronic Stability Control) System > C2112 Valve Relay Error

General Description

The HECU supplies battery power to all solonid valves with a valve relay which is controlled by the Electronic Control UNIT (ECU). The valve relay and all solenoid valves are installed inside the HECU (Hydraulic and Electronic Control Unit).

DTC Description

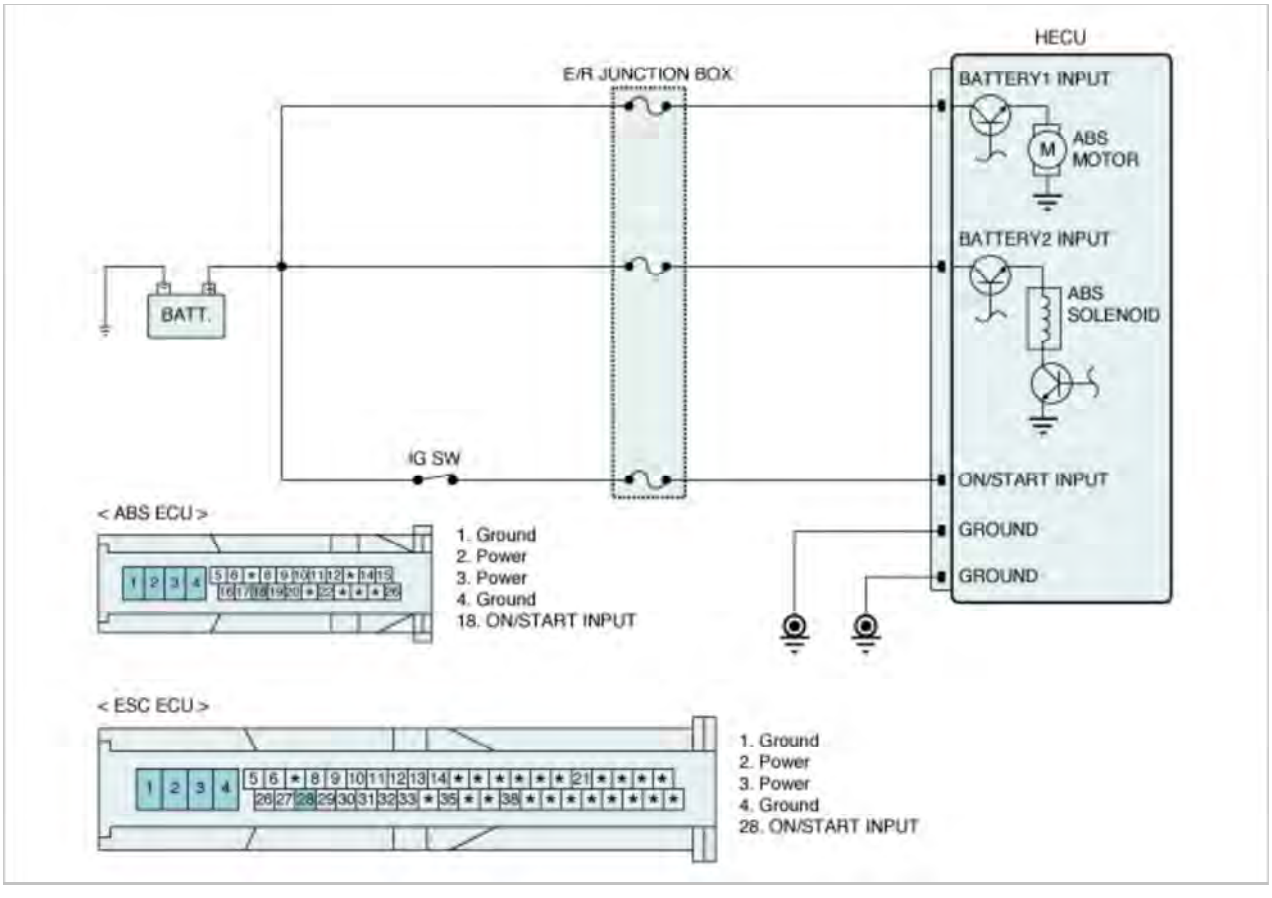
The HECU monitors voltage of the valve relay to check if the HECU can perform ABS control normally.
When the valve relay is switched to ON, the HECU will set this code if the solenoid drive voltage is below permissible voltage ranges for a period of time.
When the valve relay is switched to OFF, the HECU sets this code if the solenoid drive voltage is over the permissible voltage range for a period of time.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause

DTC Strategy		• Voltage monitoring	• Open or short in power supply circuit (IGN+)
Case1	Monitoring Period	• Once during startup.	
	Enable Conditions	• Watchdog and valve relay function is tested during startup. A failure is detected if the valve relay/Enable remains in off position when it is turned on and vice versa. Reason could be short to GND or UZ, interrupted lines or a defective output stage etc.	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• A Fault is detected if valve relay voltage < 0.8 * battery voltage for a time 500ms.	
Case3	Monitoring Period	• Continuous	
	Enable Conditions	• If valve relay malfunction and supply solenoid valve short to battery or supply solenoid valve and medium or high ohmic short of valve relay (or a valve) to valve relay voltage, solenoid valve voltage or GND are detected.	
Fail-Safe		• No valve actuation possible. • The ABS/EBD/ESC functions are inhibited. • The ABS/EBD/ESC warning lamps are activated.	

Diagnostic Circuit Diagram



Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)

2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of all vlaves with Actuation Test.

Specification : It's normal if operating sound is heard.

5. Do all valves operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Power Circuit Inspection" procedure.

Power Supply Circuit Inspection

■ **Open or Short Check**

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power terminal of the HECU harness connector and chassis ground.

Specification : Approx. B+

3. Is the measured value within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Check for open or blown fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and HECU harness connector and then, go to "Verification of vehicle Repair" procedure.

Ground Circuit inspection

■ **Open or Short Check**

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

Specification : Approx. below 1Ω

4. Is the measured value within specifications?

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	▸ Repair open or short in ground circuit between HECU harness connector and chassis ground, 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.
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 > ESC(Electronic Stability Control) System > C2308 Front-LH Valve error (Inlet Valve)

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresconding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresconding valve for more than 30ms. - Current controlled valves and under voltage conditions :detection time is 80ms	
Case2	Monitoring Period	• Immediately after power on • every 20s - The Test is canceled if any control,valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if valve relay voltage is not within 0.1*battery volta ge < valve relay voltage < 0.8*battery voltage when valve relay is switched off. • A Fault is found if valve relay voltage ≥ 0.2*battery voltage after that all valves are switched on sequential. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h.	
	Enable	• The valve and pump motor test detects electrical actuation malfunction of ABS valves.	

	Conditions	The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.	
Fail-Safe		• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of Front left valve(in) with Actuation Test.

Specification : It's normal if operating sound is heard.

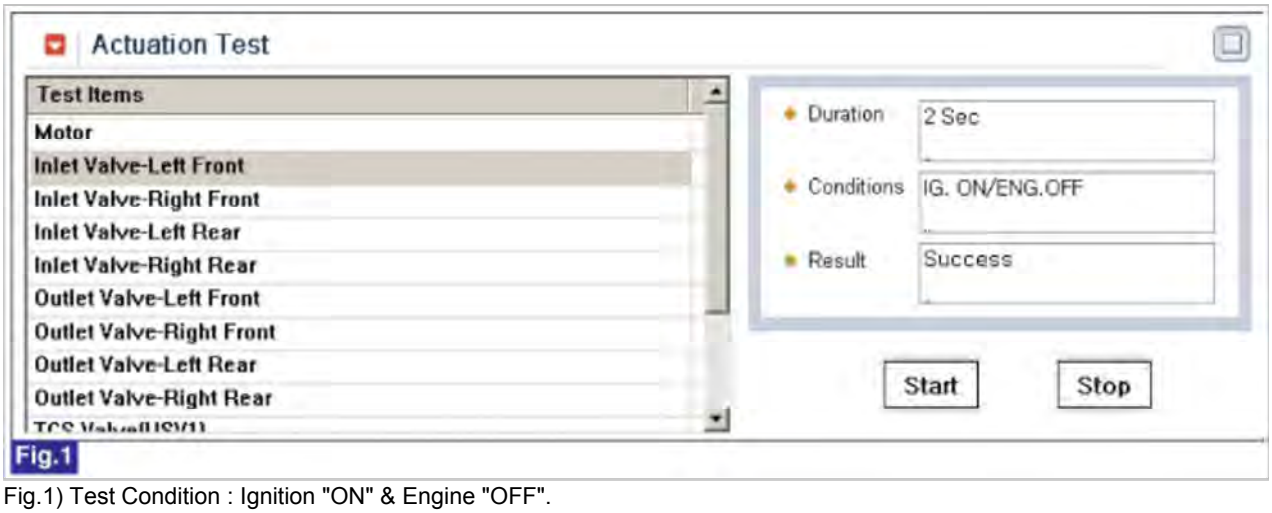


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Front left valve(in)

5. Does a Front left valve(in) operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2312 Front-LH Valve error (Outlet Valve)

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresconding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresconding valve for more than 30ms. - Current controlled valves and under voltage conditions :detection time is 80ms	
Case2	Monitoring Period	• Immediately after power on • every 20s - The Test is canceled if any control,valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if valve relay voltage is not within 0.1*battery voltage < valve relay voltage < 0.8*battery voltage when valve relay is switched off. • A Fault is found if valve relay voltage ≥ 0.2*battery voltage after that all valves are switched on sequential. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h.	
	Enable	• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts	

	Conditions	or shunts between the valve lines). Faults are detected if there is an error during the test.
Fail-Safe		• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of Front left valve(out) with Actuation Test.

Specification : It's normal if operating sound is heard.

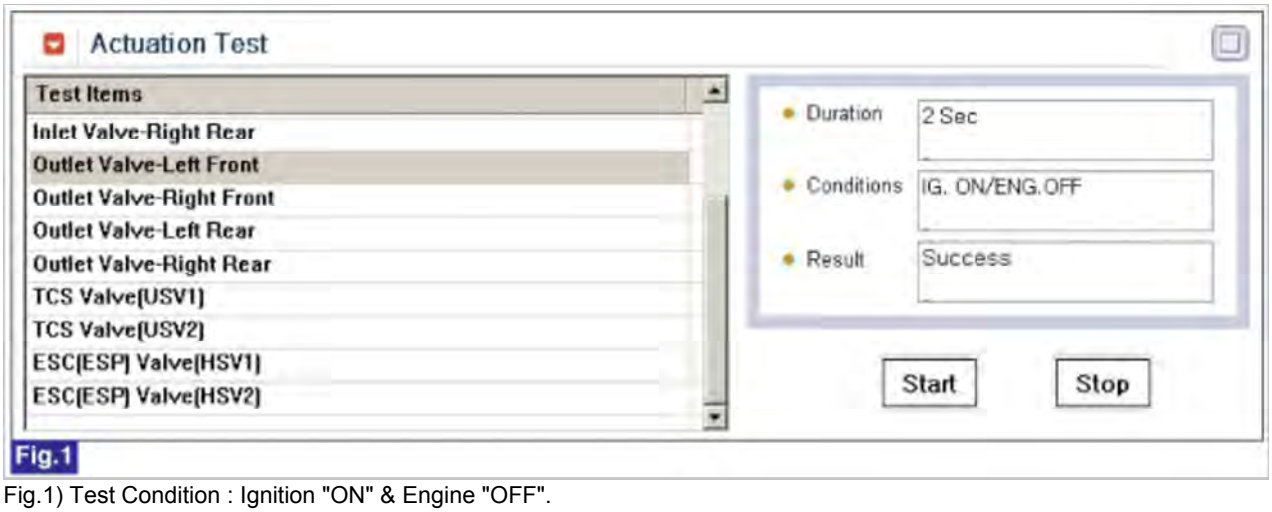


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Front left valve(out)

5. Does a Front left valve(out) operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2316 Front-RH Valve error (Inlet Valve)

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresconding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresconding valve for more than 30ms. - Current controlled valves and under voltage conditions :detection time is 80ms	
Case2	Monitoring Period	• Immediately after power on • every 20s - The Test is canceled if any control,valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if valve relay voltage is not within 0.1*battery voltage < valve relay voltage < 0.8*battery voltage when valve relay is switched off. • A Fault is found if valve relay voltage ≥ 0.2*battery voltage after that all valves are switched on sequential. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h.	
	Enable Conditions	• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if	

	there is an error during the test.	
Fail-Safe	• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of Front right valve(in) with Actuation Test.

Specification : It's normal if operating sound is heard.

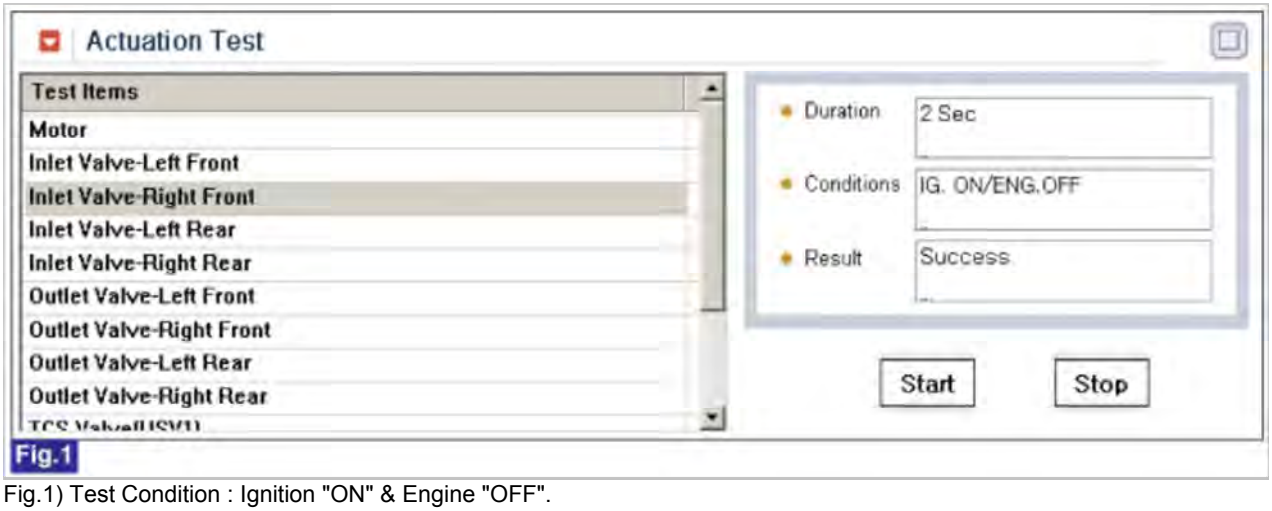


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Front right valve(in)

5. Does a Front right valve(in) operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2320 Front-RH Valve error (Outlet Valve)

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresconding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresconding valve for more than 30ms. - Current controlled valves and under voltage conditions :detection time is 80ms	
Case2	Monitoring Period	• Immediately after power on • every 20s - The Test is canceled if any control,valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if valve relay voltage is not within 0.1*battery voltage < valve relay voltage < 0.8*battery voltage when valve relay is switched off. • A Fault is found if valve relay voltage ≥ 0.2*battery voltage after that all valves are switched on sequential. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h.	
	Enable Conditions	• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.	

Fail-Safe	• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of Front right valve(out)) with Actuation Test.

Specification : It's normal if operating sound is heard.

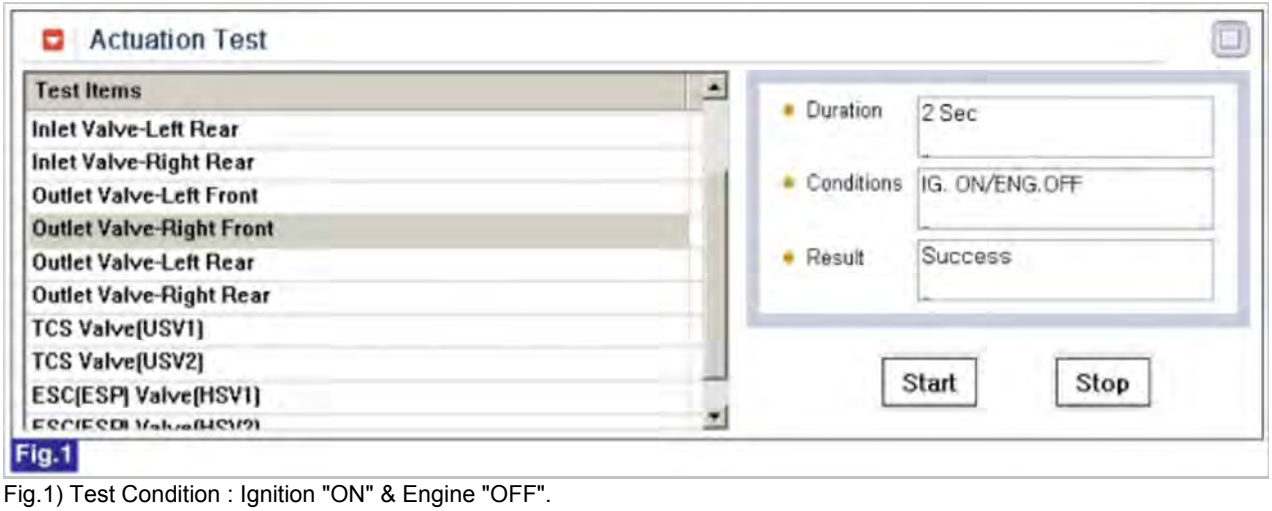


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Front right valve(out)

5. Does a Front right valve(out) operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2324 Rear-LH Valve error (Inlet Valve)

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30ms. - Current controlled valves and under voltage conditions :detection time is 80ms	
Case2	Monitoring Period	• Immediately after power on • every 20s - The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if valve relay voltage is not within 0.1*battery voltage < valve relay voltage < 0.8*battery voltage when valve relay is switched off. • A Fault is found if valve relay voltage ≥ 0.2*battery voltage after that all valves are switched on sequential. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h.	
	Enable Conditions	• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.	

Fail-Safe	• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of Rear left valve(in) with Actuation Test.

Specification : It's normal if operating sound is heard.

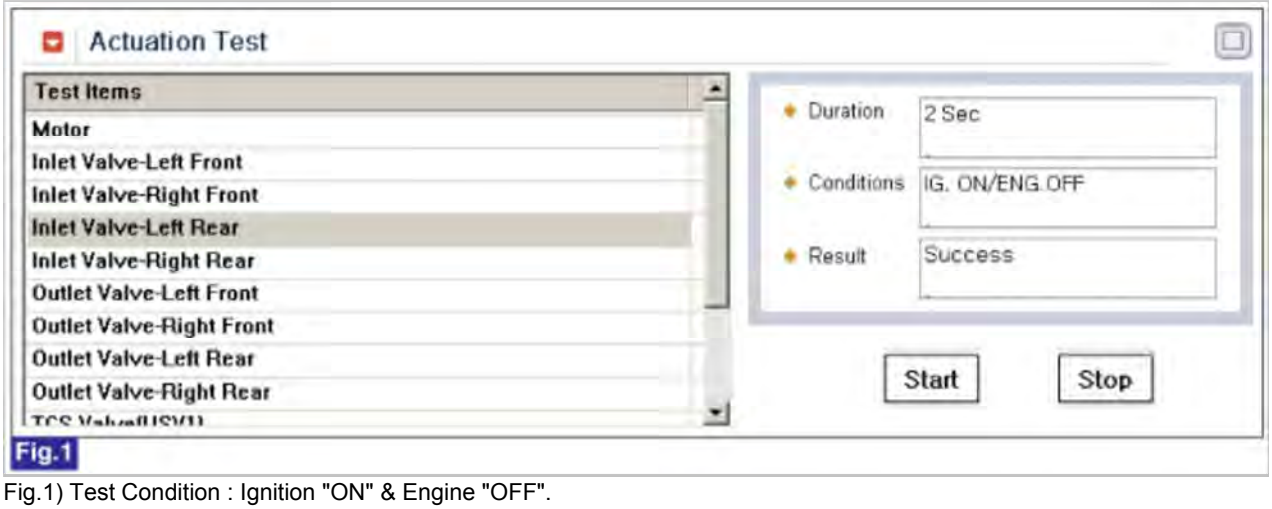


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Rear left valve(in)

5. Does a Rear left valve(in) operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2328 Rear-LH Valve error (Outlet Valve)

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30ms. - Current controlled valves and under voltage conditions :detection time is 80ms	
Case2	Monitoring Period	• Immediately after power on • every 20s - The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if valve relay voltage is not within 0.1*battery voltage < valve relay voltage < 0.8*battery voltage when valve relay is switched off. • A Fault is found if valve relay voltage ≥ 0.2*battery voltage after that all valves are switched on sequential. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h.	
	Enable Conditions	• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.	

Fail-Safe	• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of Rear left valve(out) with Actuation Test.

Specification : It's normal if operating sound is heard.

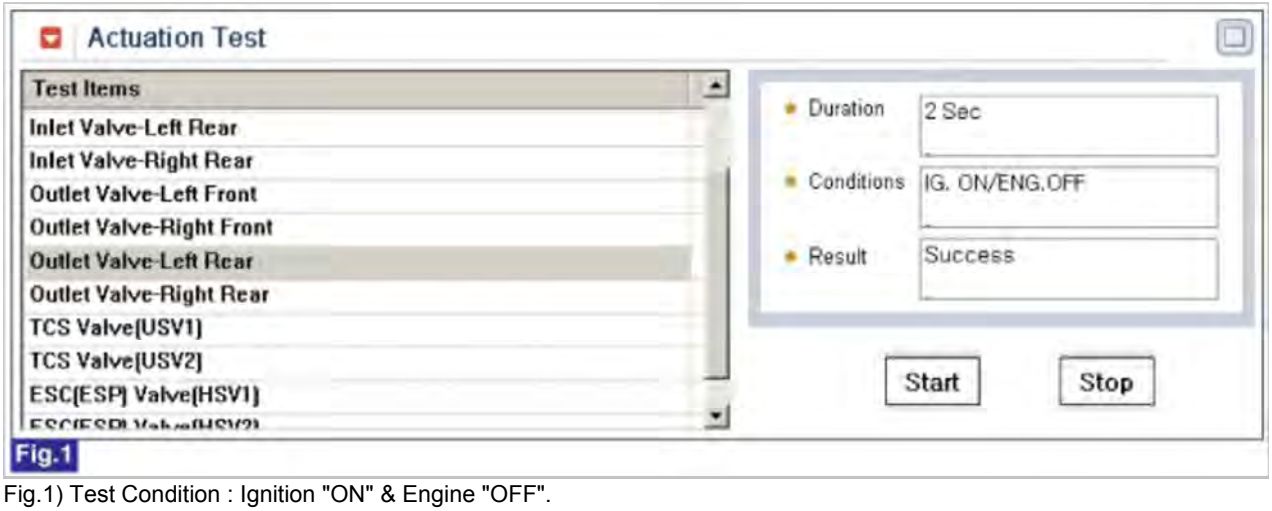


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Rear left valve(out)

5. Does a Rear left valve(out) operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2332 Rear-RH Valve error (Inlet Valve)

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30ms. - Current controlled valves and under voltage conditions :detection time is 80ms	
Case2	Monitoring Period	• Immediately after power on • every 20s - The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if valve relay voltage is not within 0.1*battery voltage < valve relay voltage < 0.8*battery voltage when valve relay is switched off. • A Fault is found if valve relay voltage ≥ 0.2*battery voltage after that all valves are switched on sequential. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h.	
	Enable Conditions	• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.	

Fail-Safe	• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of Rear right valve(in) with Actuation Test.

Specification : It's normal if operating sound is heard.

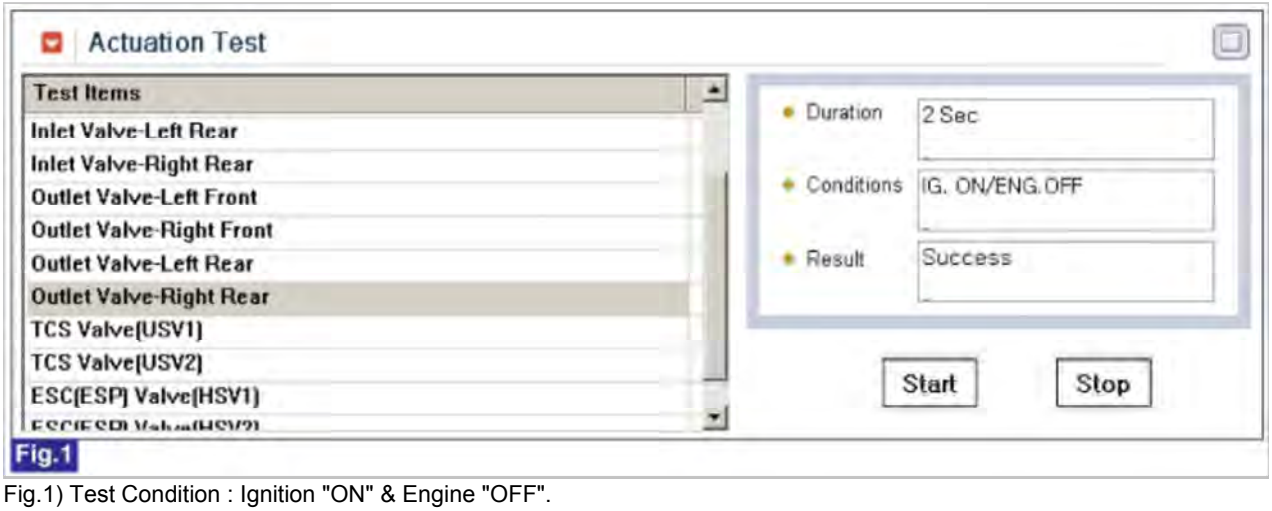


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Rear right valve(in)

5. Does a Rear right valve(in) operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2336 Rear-RH Valve error (Outlet Valve)

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30ms. - Current controlled valves and under voltage conditions :detection time is 80ms	
Case2	Monitoring Period	• Immediately after power on • every 20s - The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if valve relay voltage is not within 0.1*battery voltage < valve relay voltage < 0.8*battery voltage when valve relay is switched off. • A Fault is found if valve relay voltage ≥ 0.2*battery voltage after that all valves are switched on sequential. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is >= 15 km/h.	
	Enable Conditions	• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.	

Fail-Safe	• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of Rear right valve(out) with Actuation Test.

Specification : It's normal if operating sound is heard.

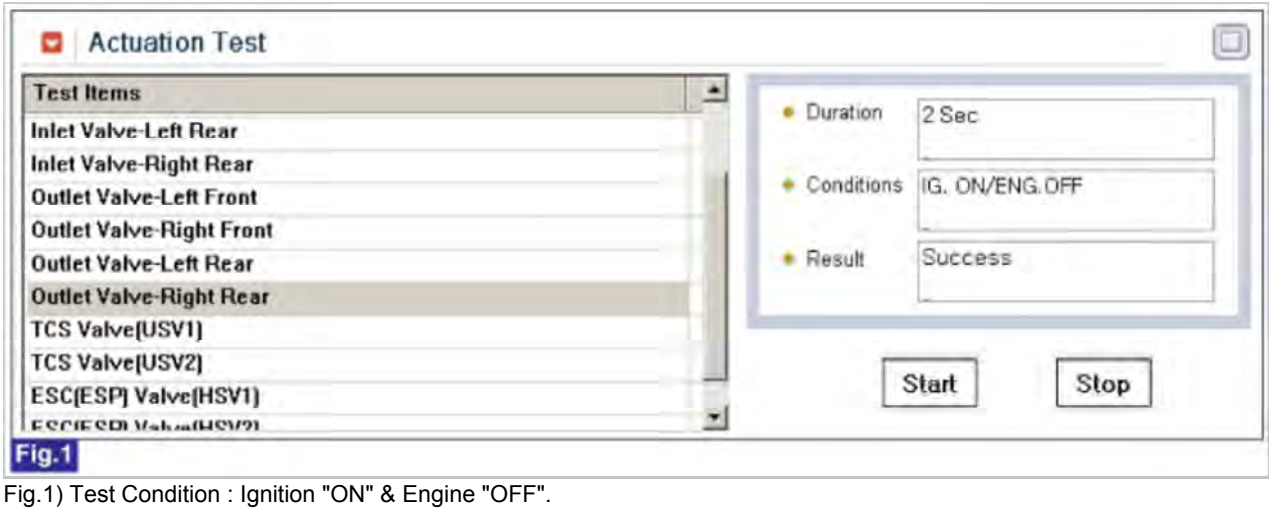


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Rear right valve(out)

5. Does a Rear right valve(out) operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2366 TC Valve Primary (USV1) Error

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresconding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Once after ignition on at standstill if the BLS is off. • At vehicle speed ≥ 15 km/h if the BLS is on.	
	Enable Conditions	• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.	
Case2	Monitoring Period	• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control 1. No BLS is applied 2. Brake pressure is < 10bar 3. Vehicle speed >15km/h 4. Vehicle acceleration > 0.5m/s2 5. Supply voltage > 11 volts.	
	Enable Conditions	• The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils,almost defective coils or malfunction of the valve driver, a failure is reconized.	
Fail-Safe		• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of TCS(USV) valve #1 with Actuation Test.

Specification : It's normal if operating sound is heard.

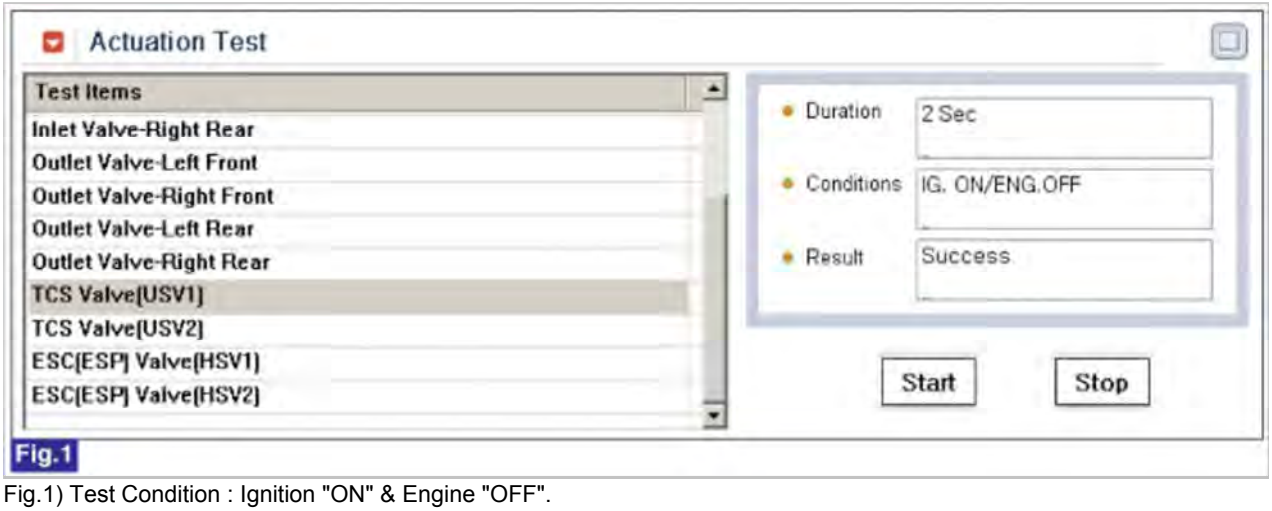


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on TCS(USV) valve #1

5. Does a TCS(USV) valve #1 operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2370 TC Valve Secondary (USV2) Error

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresconding valve.

DTC Detecting Condition

Item		Detecting Condition	Possible Cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case1	Monitoring Period	• Once after ignition on at standstill if the BLS is off. • At vehicle speed ≥ 15 km/h if the BLS is on.	
	Enable Conditions	• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.	
Case2	Monitoring Period	• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control 1. No BLS is applied 2. Brake pressure is < 10bar 3. Vehicle speed >15km/h 4. Vehicle acceleration > 0.5m/s2 5. Supply voltage > 11 volts.	
	Enable Conditions	• The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils,almost defective coils or malfunction of the valve driver, a failure is reconized.	
Fail-Safe		• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESC function is prohibited. • ABS/EBD/ESC warning lamp is turned ON.	

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of TCS(USV) valve #2 with Actuation Test.

Specification : It’s normal if operating sound is heard.

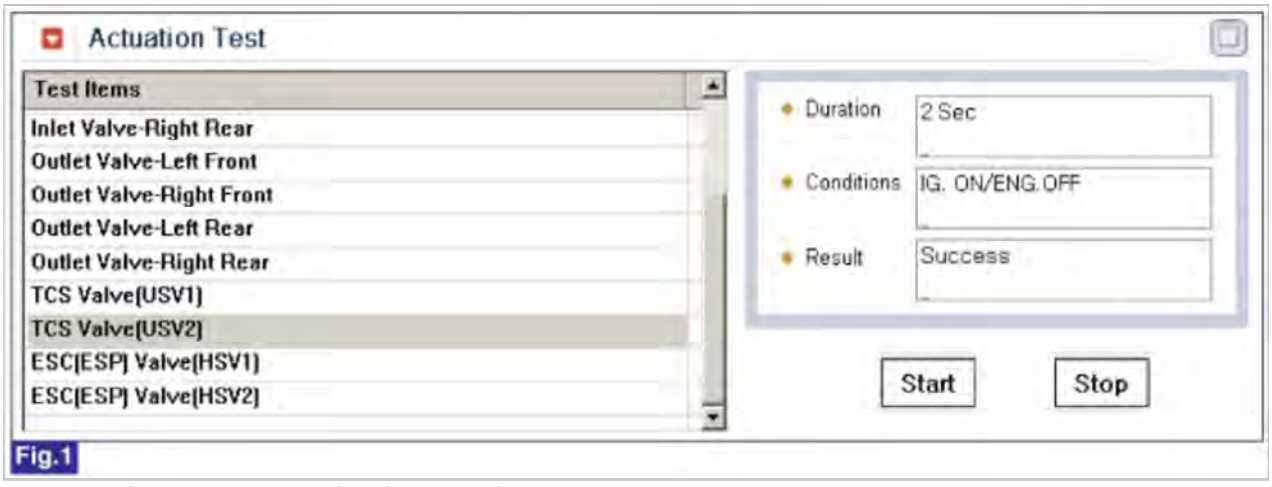


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on TCS(USV) valve #2

5. Does a TCS(USV) valve #2 operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2372 Electronic Shuttle Valve Primary (HSV1) Error

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware

includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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>• Voltage monitoring</td><td rowspan="5">• Faulty HECU</td></tr>
<tr><td rowspan="2">Case1</td><td>Monitoring Period</td><td>• Once after ignition on at standstill if the BLS is off.
• At vehicle speed ≥ 15 km/h if the BLS is on.</td></tr>
<tr><td>Enable Conditions</td><td>• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</td></tr>
<tr><td rowspan="2">Case2</td><td>Monitoring Period</td><td>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control
1. No BLS is applied
2. Brake pressure is < 10bar
3. Vehicle speed >15km/h
4. Vehicle acceleration > 0.5m/s2
5. Supply voltage > 11 volts.</td></tr>
<tr><td>Enable Conditions</td><td>• The drift test is executed only once during an ignition Cycle.
If it detects partly shorted valve coils,almost defective coils or malfunction of the valve driver, a failure is reconized.</td></tr>
<tr><td colspan="2">Fail-Safe</td><td>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.
• ABS/EBD/ESC function is prohibited.
• ABS/EBD/ESC warning lamp is turned ON.</td></tr>
</table>

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of ESC(ESP) valve #1 with Actuation Test.

Specification : It’s normal if operating sound is heard.

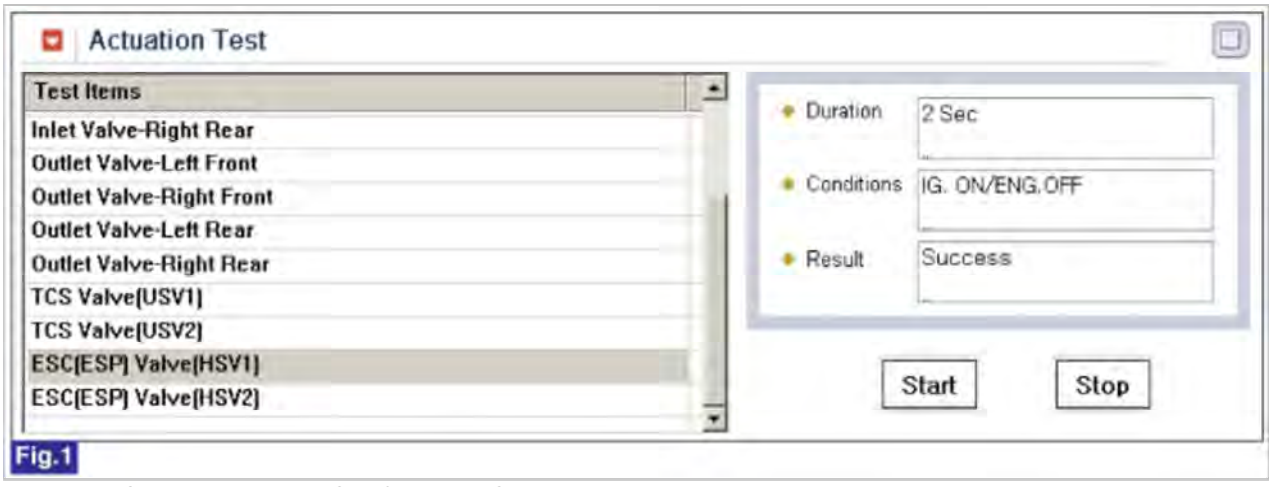


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on ESC(ESP) valve #1

5. Does a ESC(ESP) valve #1 operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2374 Electronic Shuttle Valve Secondary (HSV2) Error

General Description

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware

includes all solenoid valves inside the unit as well as the ECU.
Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected.
For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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>• Voltage monitoring</td><td rowspan="5">• Faulty HECU</td></tr>
<tr><td rowspan="2">Case1</td><td>Monitoring Period</td><td>• Once after ignition on at standstill if the BLS is off.
• At vehicle speed ≥ 15 km/h if the BLS is on.</td></tr>
<tr><td>Enable Conditions</td><td>• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</td></tr>
<tr><td rowspan="2">Case2</td><td>Monitoring Period</td><td>• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control
1. No BLS is applied
2. Brake pressure is < 10bar
3. Vehicle speed >15km/h
4. Vehicle acceleration > 0.5m/s2
5. Supply voltage > 11 volts.</td></tr>
<tr><td>Enable Conditions</td><td>• The drift test is executed only once during an ignition Cycle.
If it detects partly shorted valve coils,almost defective coils or malfunction of the valve driver, a failure is reconized.</td></tr>
<tr><td colspan="2">Fail-Safe</td><td>• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.
• ABS/EBD/ESC function is prohibited.
• ABS/EBD/ESC warning lamp is turned ON.</td></tr>
</table>

Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of ESC(ESP) valve #2 with Actuation Test.

Specification : It’s normal if operating sound is heard.

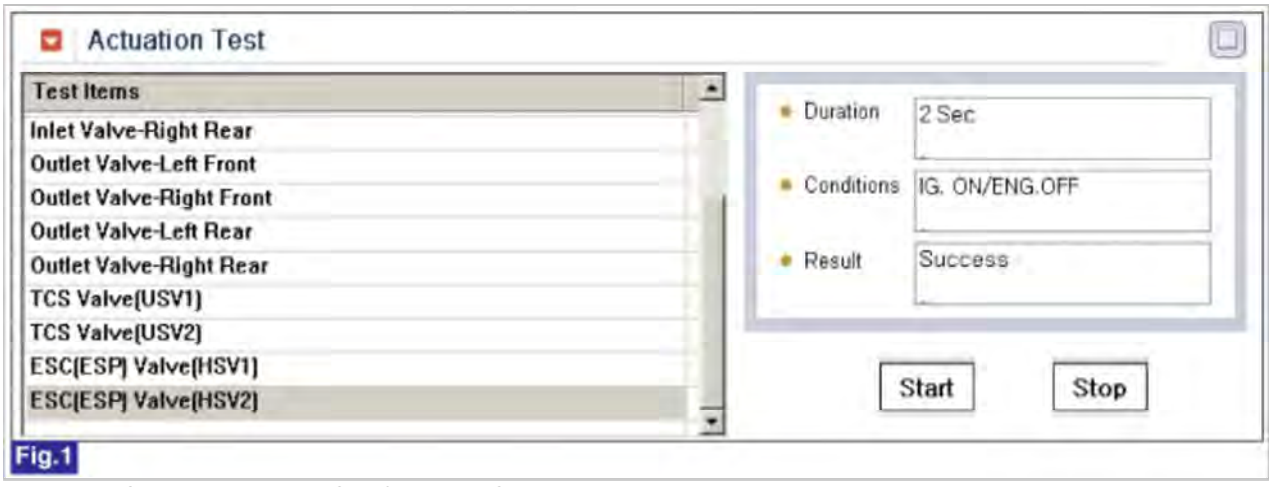


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on ESC(ESP) valve #2

5. Does a ESC(ESP) valve #2 operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ 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.

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.
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 at or above 15km/h. (9mph)
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > C2402 Motor Electrical

General Description

The ABS ECU supplies battery power to the electric motor by way of a motor relay which is controlled by the Electronic Control Unit(ECU).

The electric motor pump supplies hydraulic pressure to all wheel brake calipers by operating the piston inside the pump.

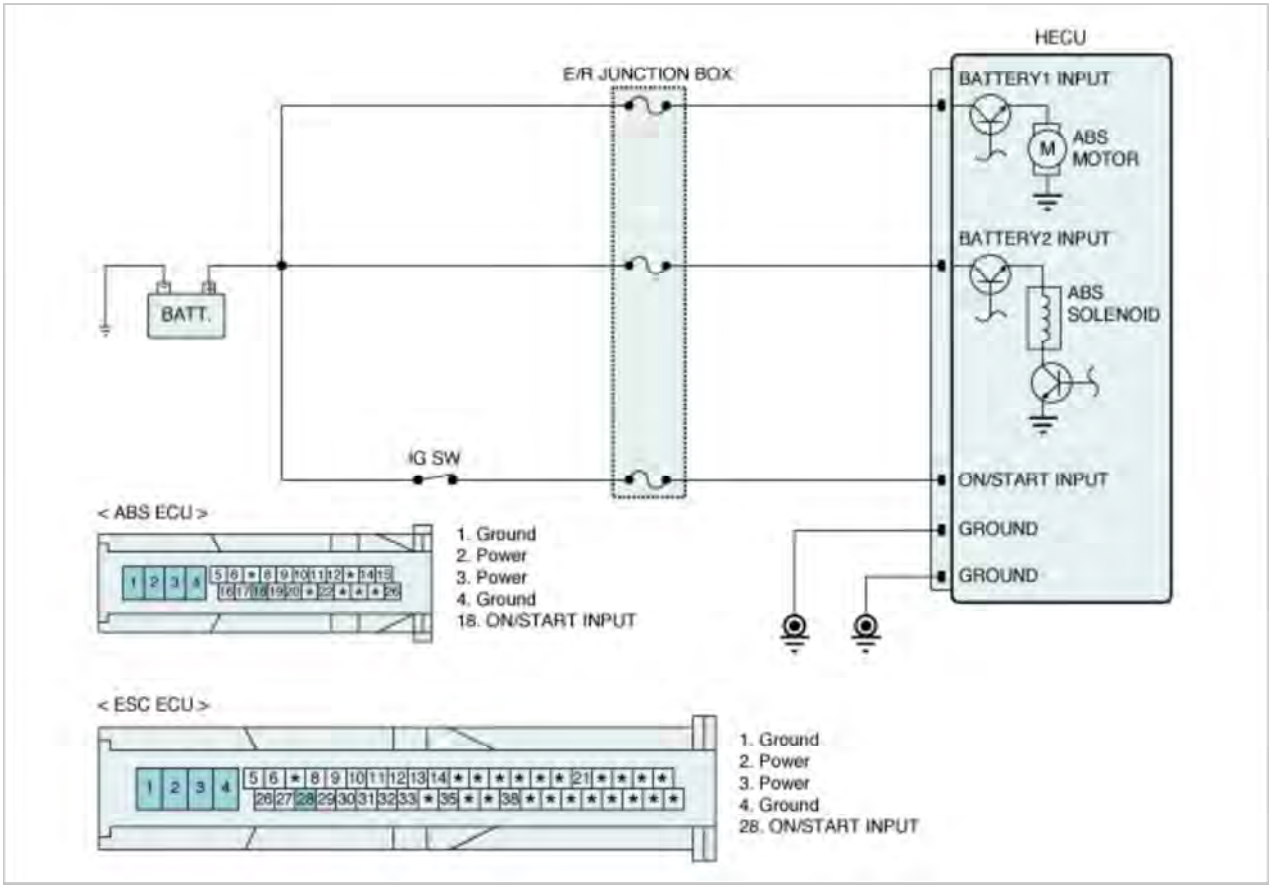
DTC Description

The ABS ECU monitors the pump motor relay or fuse open, open or short in motor or motor lock and then sets this code if a malfunction is detected.
The ABS ECU monitors the pump motor continuously. (Self check by actuating the pump motor at 15km/h isn't performed).

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>• Voltage monitoring</td><td rowspan="6">• Open or short of power supply circuit (ABS1)
• Faulty HECU</td></tr>
<tr><td rowspan="2">Case1</td><td>Monitoring Period</td><td>• Once per loop when pump motor is deactivated, but not check during detected high, low voltage or when the controller is switched off.</td></tr>
<tr><td>Enable Conditions</td><td>• A failure is detected if pump motor voltage > 0.93V continued for 1.8sec.</td></tr>
<tr><td rowspan="2">Case2</td><td>Monitoring Period</td><td>• Once per loop when pump motor is activated.</td></tr>
<tr><td>Enable Conditions</td><td>• A failure is detected if pump motor voltage < 7.3V continued for 1.8sec.</td></tr>
<tr><td rowspan="2">Case3</td><td>Monitoring Period</td><td>• Once per loop when pump motor is activated.</td></tr>
<tr><td>Enable Conditions</td><td>• A failure is detected if the short circuit event has continuously occurred 3 times.
- The short circuit event is counted if pump switch voltage > 0.5V continued for about 1ms when the pump motor is activated
• In case no electrical pump motor short circuit has been detected, a failure is detected if the mechanically locked pump event has continuously occurred 10 times.
- A mechanically locked pump event is counted if pump switch voltage > 0.5V continued for about 20ms when the pump motor is activated.</td></tr>
<tr><td rowspan="2">Case4</td><td>Monitoring Period</td><td>• The active test is initiated by the controller once per IGN cycle in following conditions.
1. The vehicle speed exceeds 8 kph and the ABS warning lamp indicates that there was a failure detected during the previous IGN cycle.
2. The vehicle speed exceeds 20 kph and the brake is not applied.
3. The vehicle speed exceeds 40 kph.
• The test is always done after the end of a pump activation by ABS/TCS/ESC functions.</td><td rowspan="3"></td></tr>
<tr><td>Enable Conditions</td><td>• A defect of the pump is assumed if an insufficient alternator voltage is detected within 14 or 21 ms after the deactivation. The pump motor will then be activated again for about 1.8 s (2nd pump test) and the alternator voltage is evaluated again after deactivation. A failure is detected if this second evaluation also does not show sufficient alternator voltage.</td></tr>
<tr><td colspan="2">Fail-Safe</td><td>• When ABS is inactive
Inhibit pump motor activation, deactivate all control functions but EBD.
• During active ABS control
Inhibit pump motor activation, deactivate all control functions but EBD on completion of ABS cycle.
• The ABS/ ESC warning lamps are activated.</td></tr>
</table>

Diagnostic Circuit Diagram



Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of Motor with Actuation Test.

Specification : It's normal if operating sound is heard.

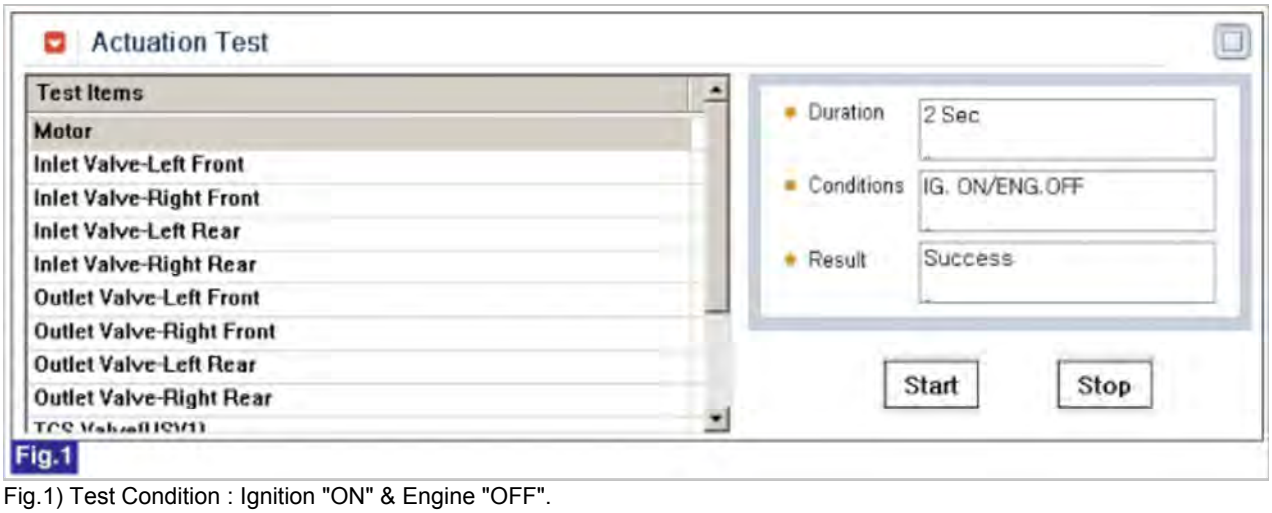


Fig.1) Test Condition : Ignition "ON" & Engine "OFF".
Ex) Actuation Test on Motor

5. Does motor operate normally?

YES	▸ Fault is intermittent caused by poor connection in power harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Terminal and Connector 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 then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Power Circuit Inspection" procedure.

Power Supply Circuit Inspection

■ Open or Short Check

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between power(ABS1) terminal of the HECU harness connector and chassis ground.

Specification : Approx. B+

3. Is the measured value within specifications?

YES	▸ Go to "Ground Circuit Inspection" procedure.
NO	▸ Check for open or blown fuse referring to "Circuit Diagram". Repair open or short in power circuit between battery and HECU harness connector and then, go to "Verification of vehicle Repair" procedure.

Ground Circuit inspection

■ Open or Short Check

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

Specification : Approx. below 1Ω

4. Is the measured value within specifications?

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	▸ Repair open or short in ground circuit between HECU harness connector and chassis ground, 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.
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.

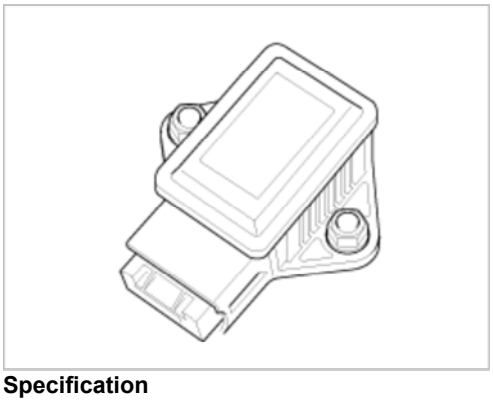
4. Are any DTCs present ?

YES	▸ Go to the applicable troubleshooting procedure.
NO	▸ System performing to specification at this time.

Brake System > ESC(Electronic Stability Control) System > Yaw-rate and Lateral G Sensor > Description and Operation

Description

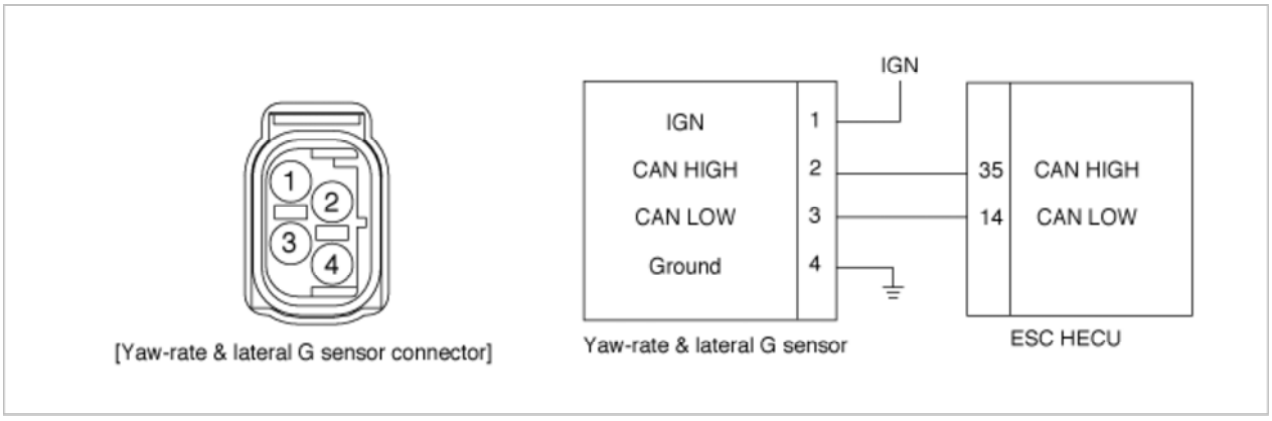
1. The yaw-rate & lateral G sensor is applied for the ESC system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the crash pad lower floor on vehicle.



Specification

Description			Specification	Remark
Nominal supply voltage			11.5 ~ 12.5 V	
Supply voltage range			8 ~ 16 V	
Supply current			Max. 120 mA	
Operating temperature range			-40 ~ 85°C	
Yaw-rate sensor	Measurement range	+w direction, left turn	Min.100 °/s	
		-w direction, right turn	Min.-100 °/s	
	Non-linearity		-1 ~ 1 %	
	Offset (within life,within operating temperature)		3.5 °/S	
	Upper cut-off frequency		Min. 15 Hz	
Lateral G sensor	Measurement range	+y direction, left turn	Min.1.8 g	
		-y direction, right turn	Min. -1.8 g	
	Non-linearity		-4 ~ 4 %	
	Offset (within life,within operating temperature)		-0.1 ~ 0.1 g	
	Upper cut-off frequency		Min. 15 Hz	

Circuit Diagram (Yaw-rate & Lateral G Sensor)



Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Description and Operation

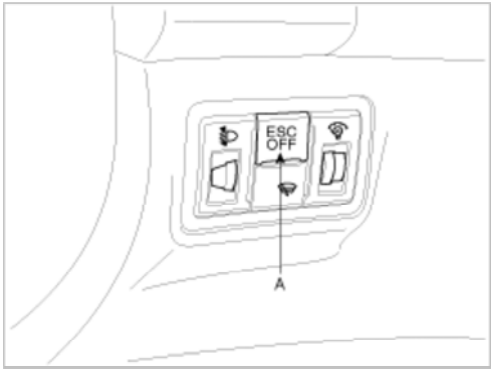
Description

1. The ESC OFF switch is for the user to turn off the ESC system.
2. The ESC OFF lamp is on when ESC OFF switch is engaged.

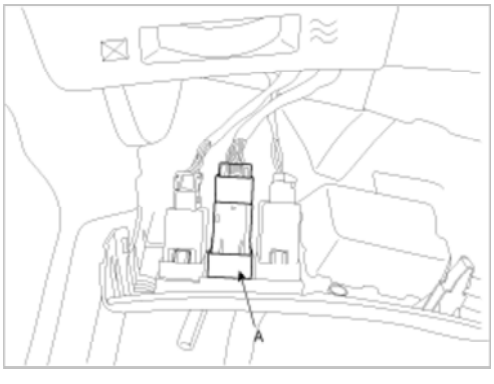
Brake System > ESC(Electronic Stability Control) System > ESC OFF Switch > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad swith assembly (A) by using the trim remover tool.



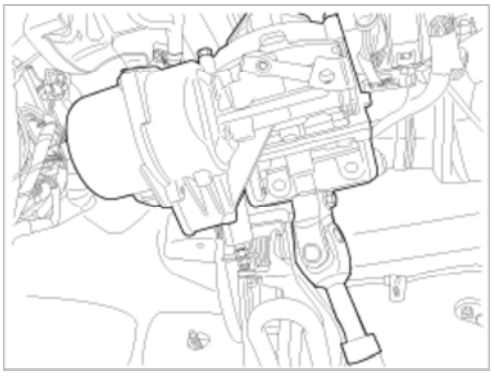
3. Disconnect the "ESC OFF" switch connector (A).



4. Check the continuity between the switch terminals as the ESC OFF switch is engaged. (Refer to circuit diagram)

Brake System > ESC(Electronic Stability Control) System > Steering Angle Sensor > Components and Components Location

Component Location



Brake System > ESC(Electronic Stability Control) System > Steering Angle Sensor > Description and Operation

Description

General Data

The Steering Angle Sensor (SAS) is installed in EPS (Electric Power Steering) and it sends messages to HECU through CAN communication line.
The SAS is used to determine turning direction and speed of the steering wheel.
The HECU uses the signals from the SAS when performing ESC-related calculations.
Components (Steering Angle Sensor, Torque Sensor, Failsafe relay, etc.) of the EPS system are located inside the steering column & EPS unit assembly and the steering column & EPS unit assembly must not be disassemble to inspect or replace them. (Refer to “ST (Steering system) Gr.”)

General Troubleshooting Information

Before Troubleshooting

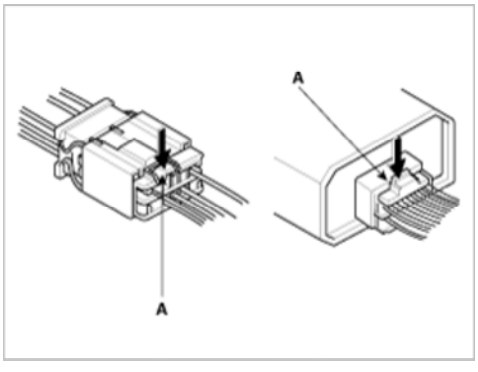
1. Check applicable fuses in the appropriate fuse/relay box.
2. Using the battery checker (MCR-570 KIT), check the battery for damage, state of charge, and clean and tight connections. (Refer to the Engine Electrical System - Battery)

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

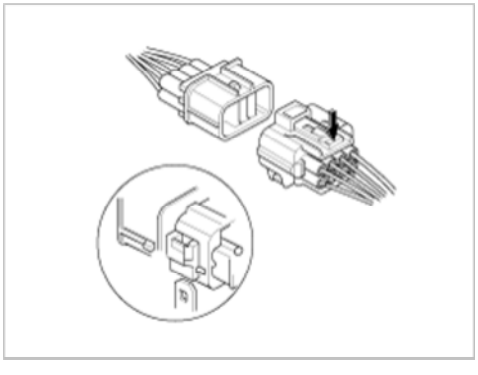
3. Check the alternator belt tension.

Handling Connectors

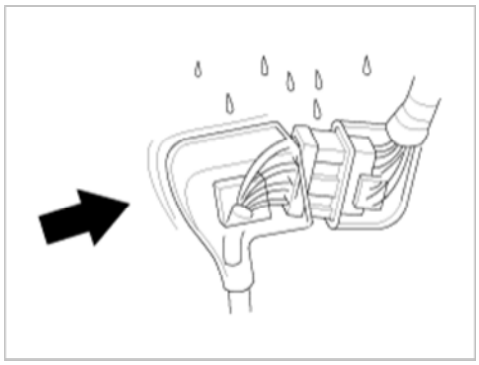
1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



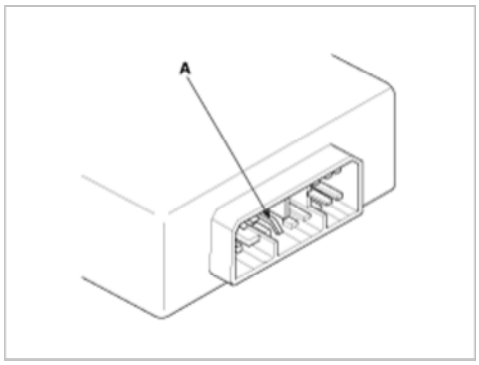
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



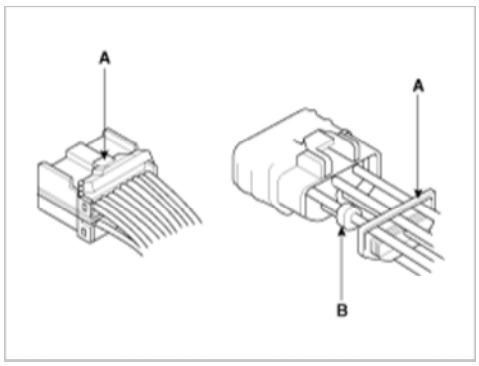
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



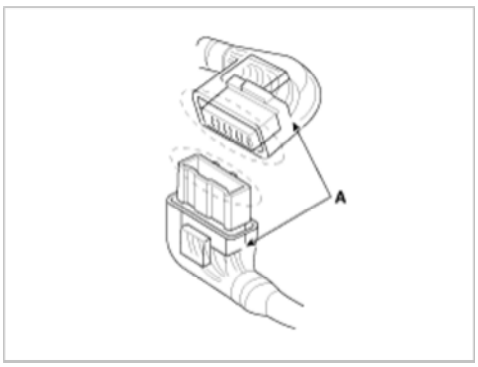
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



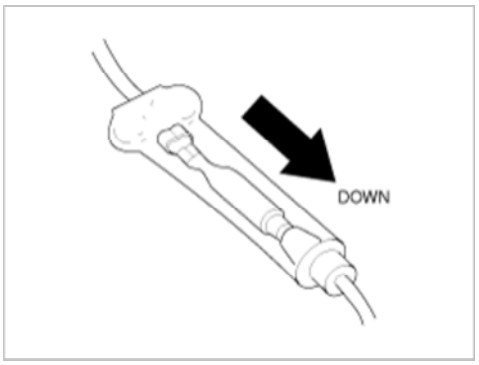
9. Check for loose retainer (A) and rubber seals (B).



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

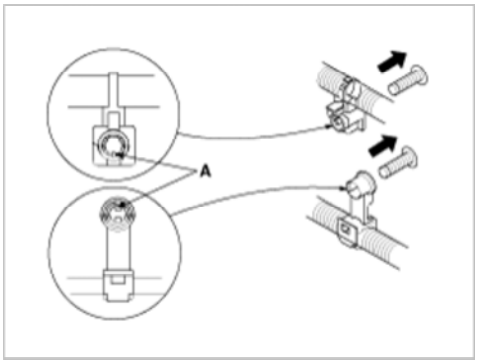


11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.

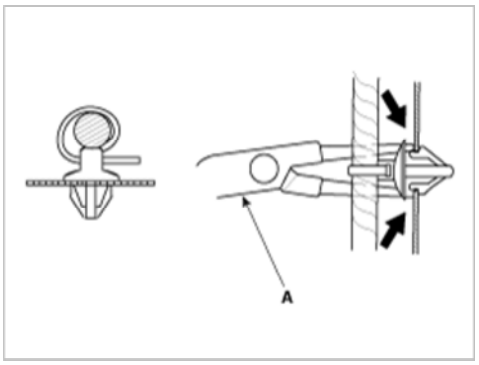


Handling Wires And Harnesses

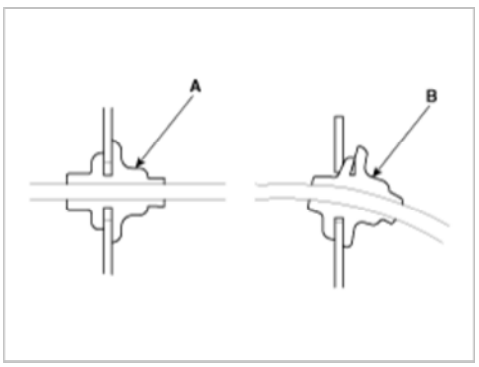
1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



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



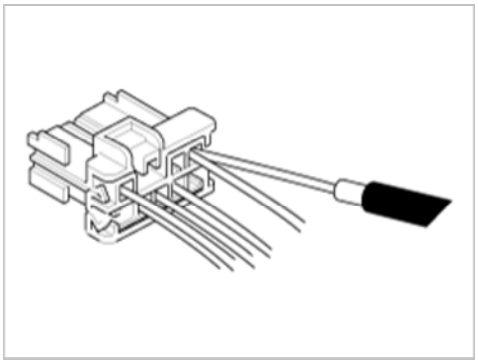
4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).



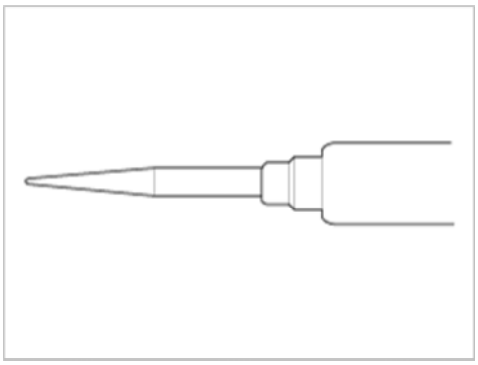
Testing And Repairs

1. Do not use wires or harnesses with broken insulation.
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.

3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the remover tool from the wire side (except waterproof connector).



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



Five-Step Troubleshooting

1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.
3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.
5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Battery Reset

Description

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

SYSTEM	RESETTING
Auto up/down window	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, reset the Auto up/down window system according to the procedure below. 1) Turn the ignition switch to the ON position. 2) Pull up the power window switch in order that the window can close completely, and then keep pulling up the power switch for about 1 second.

Sunroof	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, the sunroof system must be reset according to the procedure below. 1) Turn the ignition switch to the ON position. 2) According to the position of the sunroof, do the following. - In case the sunroof is closed completely or tilted: Push the sunroof control lever upward until the sunroof tilts completely upward. - In case the sunroof is open: Push the sunroof control lever forward until the sunroof closes completely. Push the sunroof control lever upward until the sunroof tilts completely upward. 3) Release the sunroof control lever. 4) Push the sunroof control lever upward until the sunroof has returned to the original tilt position after it is raised a little higher than the maximum tilt position. Then, release the lever. 5) Push the sunroof control lever upward until the sunroof operates as follows; TILT DOWN → SLIDE OPEN → SLIDE CLOSE Then, release the lever.
Trip computer	When the battery is disconnected and reconnected, the set functions of the trip computer become initialized. So, you need to explain this information to the customer.
Clock	When the battery is disconnected and reconnected, the clock becomes initialized. So, the clock should be reset.
Audio	When the battery is disconnected and reconnected, the customer's radio stations become initialized. So, you need to record the customer's radio stations prior to service, and after service, set the customer's radio stations into the audio.

Body Electrical System > Audio > Specifications

Specification

Audio

Item		Specification	
Model		RADIO/CD/MP3/XM (PA710S)	RADIO/CDC/MP3/XM (PA760S)
Power supply		DC 14.4V	
Rated output		Max 43W x 4	Max. 2.5V
Antenna		80PF 75Ω	
Tuning type		PLL SYNTHESIZED TUNING	
Frequency range / Channel space	FM	87.5 ~ 107.9 MHz/200 KHz	
	AM	530 ~ 1710 KHz/10 KHz	

Speaker

Item		Specification
Input Power (W)	Front	Max. 50
	Rear	Max. 50
	Tweeter	Max. 40
Speaker Impedance (Ω)	Front	4.0 ± 0.6
	Rear	4.0 ± 0.6
	Tweeter	3.4 ± 0.5
Speaker Number		6

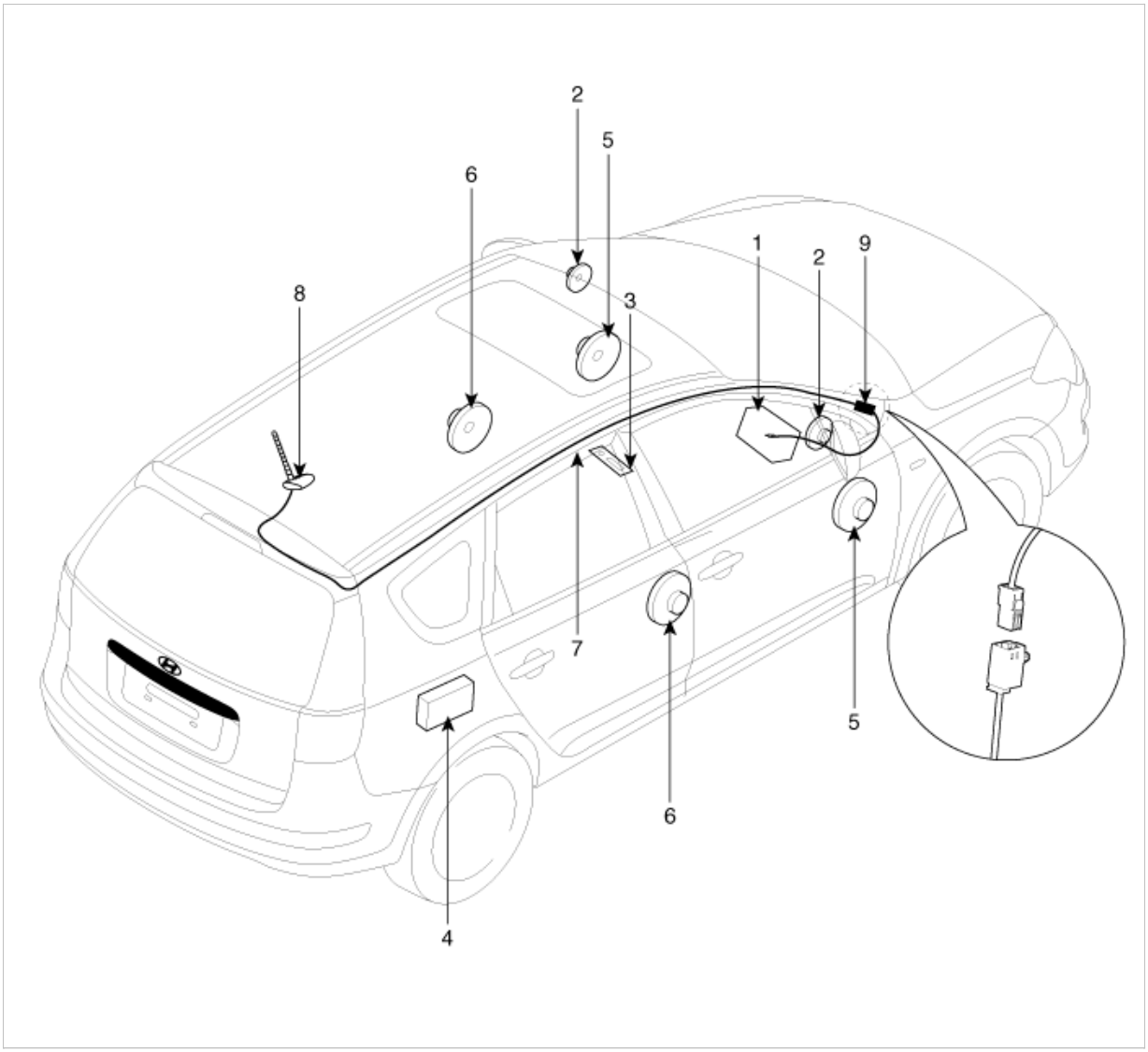
External Amplifier

Item	Specification
Power Supply	DC 14.4V
Output Power (W)	180W (45×4CH)

LOAD Impedance (Ω)	2

Body Electrical System > Audio > Components and Components Location

Component Location



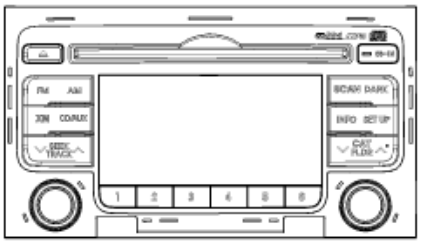
1. Audio unit 2. Tweeter speaker 3. AUX Jack / USB Port 4. External amplifier 5. Front door speaker	6. Rear door speaker 7. Antenna feeder cable 8. Roof antenna (SDARS) 9. Feeder cable joint connector

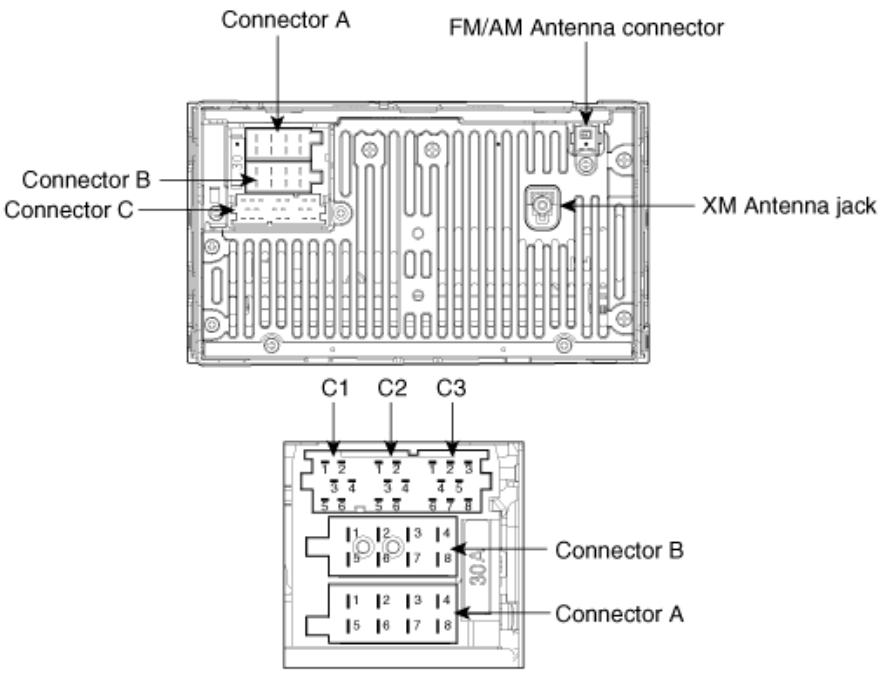
※ SDARS : Satellite Digital Audio Radio Service

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

Components

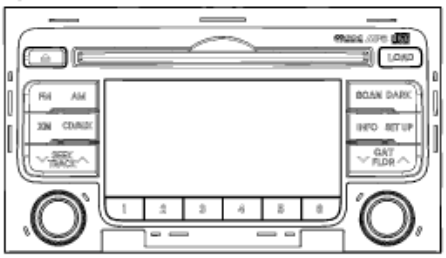
[RADIO/CD/MP3/XM(PA710)]

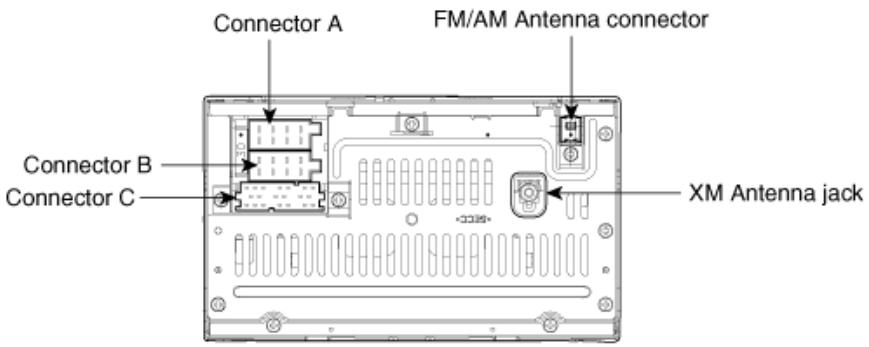


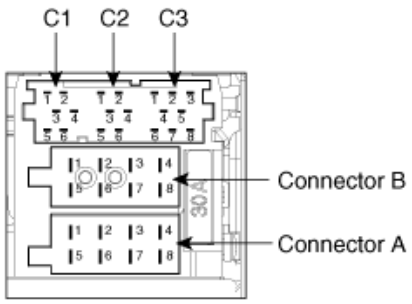


NO	CONNECTOR A	CONNECTOR B	CONNECTOR C1	CONNECTOR C2	CONNECTOR C3
1	SPEED	SPEAKER RR+	-	AUX R IN	-
2	ILL (+)	SPEAKER FR+	-	AUX L IN	USB D-/IPOD TX
3	REMOTE ANNTENA	SPEAKER FL+	-	AUX REF	-
4	BATT +	SPEAKER RL+	-	AUX DETECT	USB D+/IPOD RX
5	TEMP	SPEAKER RR-	TEL MUTE	REMOTE CONTL +	IPOD/USB GND
6	ACC	SPEAKER FR-	-	REMOTE GND	-
7	ILL (-)	SPEAKER FL-			USB/IPOD VDO
8	POWER GND	SPEAKER RL-			-

[RADIO/CDC/MP3/XM(PA760)]

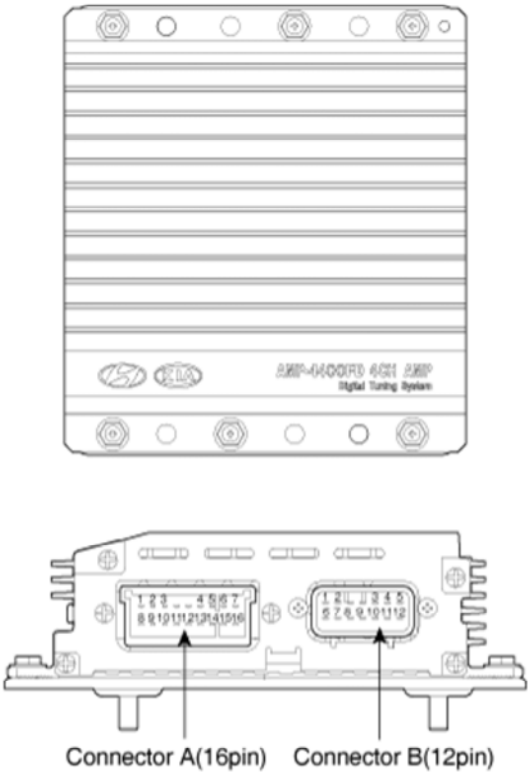






NO	CONNECTOR A	CONNECTOR B	CONNECTOR C1	CONNECTOR C2	CONNECTOR C3
1	SPEED	SPEAKER RR+	-	AUX R IN	E AMP MUTE
2	ILL (+)	SPEAKER FR+	-	AUX L IN	USB D-/IPOD TX
3	REMOTE ANNTENA	SPEAKER FL+	-	AUX REF	-
4	BATT +	SPEAKER RL+	-	AUX DETECT	USB D+/IPOD RX
5	TEMP	SPEAKER RR-	TEL MUTE	REMOTE CONTL +	IPOD/USB GND
6	ACC	SPEAKER FR-	-	REMOTE GND	REMOTE E AMP
7	ILL (-)	SPEAKER FL-			USB/IPOD VDO
8	POWER GND	SPEAKER RL-			-

[EXTERNAL AMPLIFIER]



NO	CONNECTOR A	CONNECTOR B
1	FRONT LEFT OUT +	MUTE
2	-	REMOTE
3	REAR LEFT OUT+	REAR RIGHT IN+
4	B+	FRONT LEFT IN+
5	REAR RIGHT OT+	FRONT RIGHT IN+
6	-	-
7	FRONT RIGHT OUT+	S_GND
8	FRONT LEFT OUT -	REAR LEFT IN-
9	-	REAR LEFT IN+
10	REAR LEFT OUT-	REAR RIGHT IN-
11	GND	FRONT LEFT IN-
12	GND	FRONT RIGHT IN-
13	B+	
14	REAR RIGHT OUT+	
15	-	
16	FRONT RIGHT OUT-	

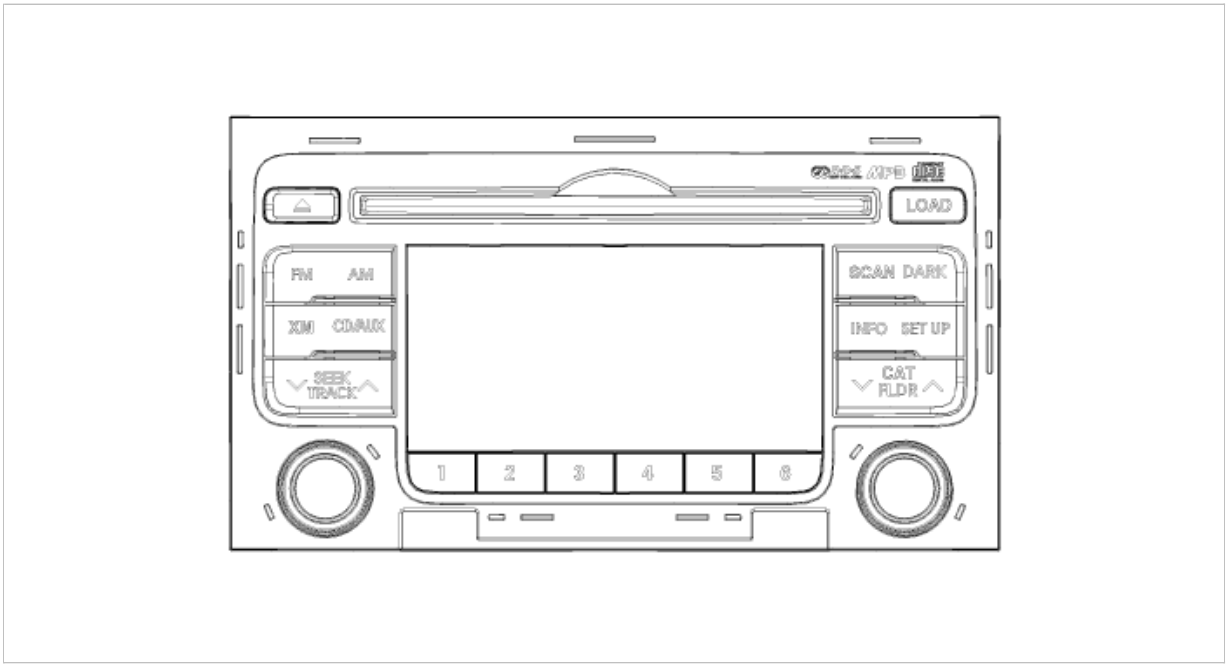
Body Electrical System > Audio > Audio Unit > Repair procedures

Inspection

CD changer operation instructions

NOTE

- CD changer operation instructions may be somewhat different according to the CD changer model.
  The following method is just one example.



1. Press and release LOAD button.

> CAUTION
>
> - Be sure to press LOAD to open the CD slot. If feeding a CD into the slot by force, it may cause damage to the CD changer.

2. After "WAIT" is displayed on the LCD, the CD slot will open with "LOAD" displayed on the LCD.
3. Insert a CD. The player will pull the disc in and begin to play automatically.

> CAUTION
>
> - CD can be inserted only while "LOAD" is blinking on the LCD and the CD slot indicator is flashing.
> - CD must be inserted with the label facing upward.
> - This CD player is suitable only for 12cm discs. DO NOT use irregular shaped CDs.

4. To insert multiple discs, press and hold LOAD button for more than 0.8 seconds. A beep sound will be heard and it will let you load CDs into all of the slots in which no CD has been loaded.

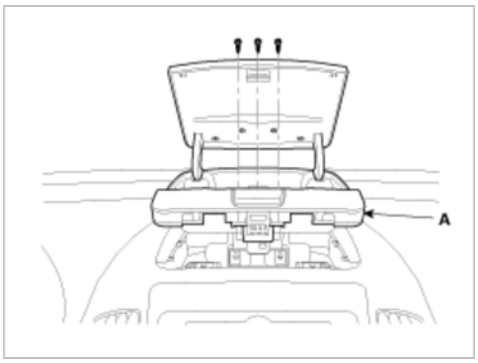
> CAUTION
>
> - This CD player takes up to 6 discs. DO NOT try to load more than six.

CD changer improper operation cases

If inserting a CD into the CD slot by force, the CD door behind the slot may be broken or separated from the head. It will cause the CD player not to work. Be sure to press LOAD button before inserting a CD.
CDs jammed in the CD player deck
DO NOT insert foreign substances like coins or tickets into the CD player. It may cause damage to the CD player.

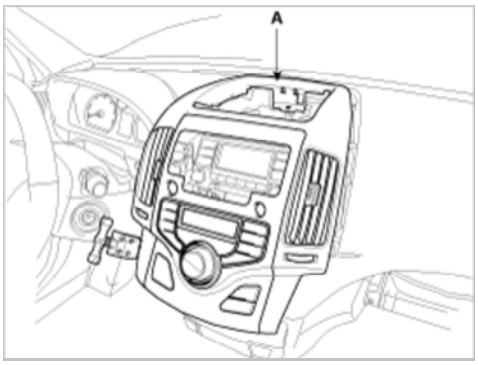
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the upper tray(A).
   (Refer to the Body group - Crash pad).

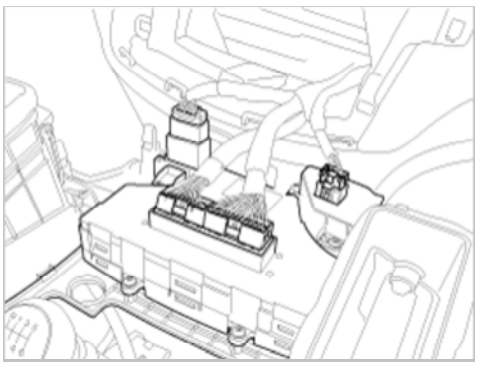


3. Remove the crash pad center facia panel (A).

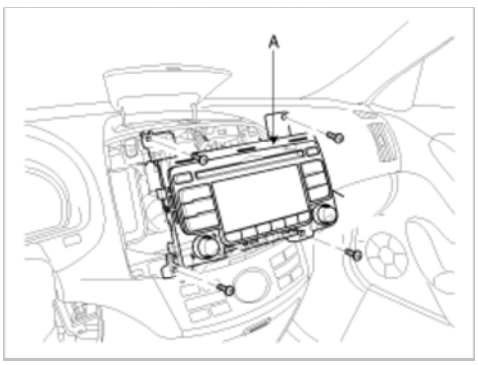
> NOTE
>
> Take care not to scratch the crash pad and related parts.



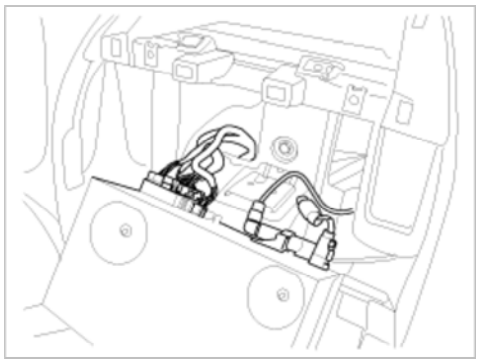
4. Disconnect the connectors from the crash pad center facia panel.



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

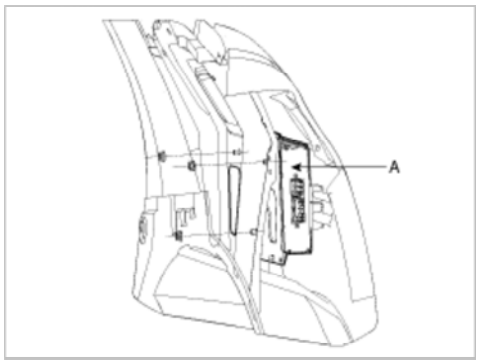


6. Disconnect the audio connectors and cable(A).



External Amplifier

1. Remove the right side trunk trim and disconnecting the connector (Refer to the Body group - Interiortrim).
2. Remove the external amplifier(A) after loosening the 3 nuts.



Installation

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

NOTE

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

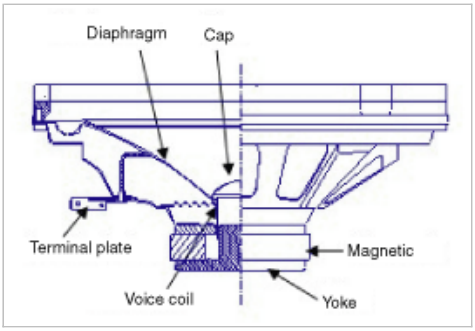
External Amplifier

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

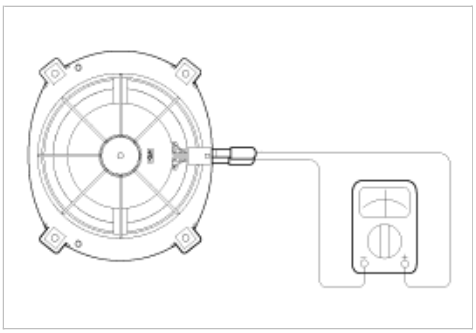
Body Electrical System > Audio > Speakers > Repair procedures

Inspection

1. Troubleshooting for Speaker
   (1) Basic inspection of speaker
   Inspect the sound from speaker after verifying that the speaker mounting screws is removed and the wiring connector is connected precisely to remove vibration transmitted from body trims and surrounding parts.



(2) Case Troubleshooting

No.	Case	Inspection/Remedy
1	Trembling sound	1. Before replacing the speaker, inspect that the mounting screw is installed normally. 2. After re-installing the speaker, verify that no trembling sound is heard. 3. When hearing a trembling sound again, replace the speaker with new one.
2	Noise	1. Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2. In case of radio static, check if there is a noise from CD. 3. When a noise is heard on turning radio and CD on, replace the speaker with new one. NOTE In case there is only radio static, this causes from poor radio reception. Thus the speaker needs no repair and replacement.
3	No sound	Before replacing the speaker, inspection of the wiring connection between the battery and the speaker 1. Before replacing the speaker, inspect the wiring connection between the battery and the speaker is normal. 2. Check the supplying power to the speaker and the resistance, then inspect the sound quality. ■ Specified impedance : 2 ~ 4Ω  3. If the speaker works poorly, replace it with new one.

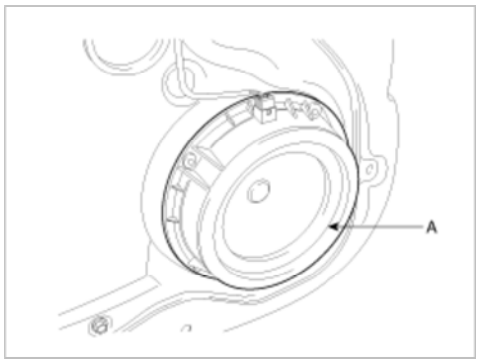
CAUTION

- During handling of speaker
- Do not damage the speaker with impact as like a drop and a throw.
- Be careful not to cover water and oil over the speaker.
- Caution during dealing of speaker because the material of diaphragm is paper which is easy to be torn by impact and external force.
- When modifying audio system as customer pleases, this does electric damage to speaker.
- And, in this case the speakers are not covered by the manufacturer's warranty.

Removal

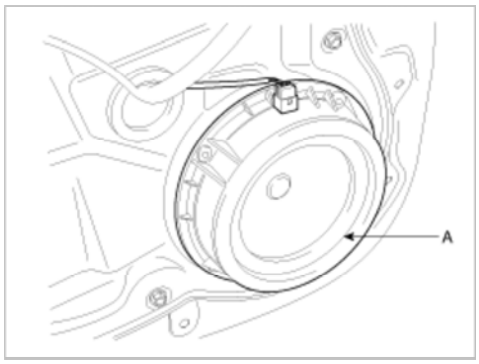
Front Speaker

1. Remove the front door trim.
   (Refer to the Body group - Front door).
2. Remove the front speaker (A) after removing 4 rivets.



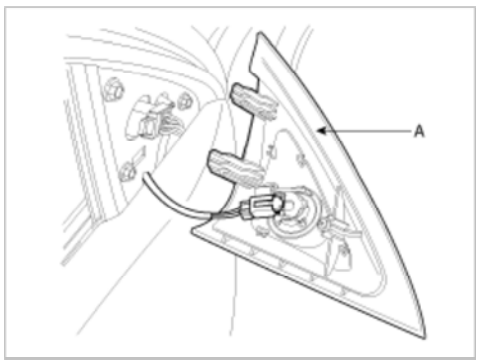
Rear Speaker

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



Tweeter Speaker

1. Remove the front door delta cover.
   (Refer to the Body group - Front door).
2. Remove the tweeter speaker (A) after disconnecting the connector.



Installation

Front Speaker

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

Rear Speaker

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

Tweeter Speaker

1. Install the tweeter speaker after connecting the tweeter speaker connector.
2. Install the front door delta cover.

Body Electrical System > Audio > Antenna > Specifications

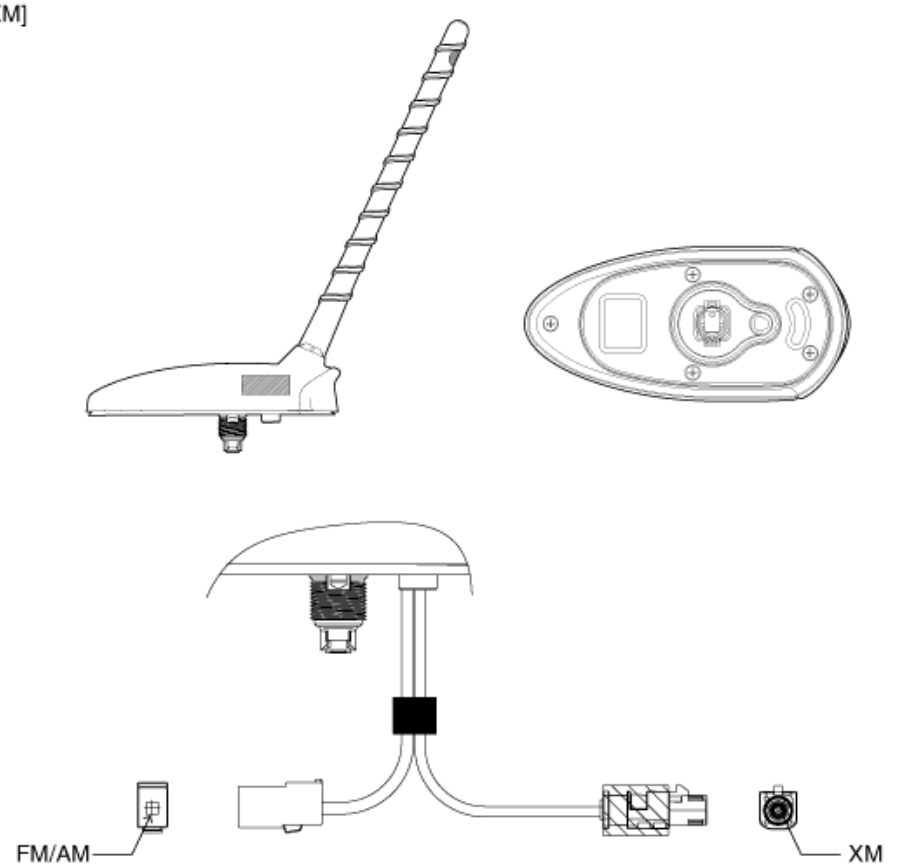
Specifications

Item		Specification
Storage temperature		-40°F ~ 221°F (-40°C ~ 105°C)
Operation temperature		-22°C ~ 185°C (-30°C ~ 85°C)
Operation voltage	AM/FM	DC 10.5 ~ 16.0V
	XM	DC 3.6 ~ 5.5V
Consumption current	AM/FM	MAX 150mA
	XM	MAX 55mA
Input/output impedance	AM/FM	75Ω
	XM	50Ω

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

Component

[Radio + XM]

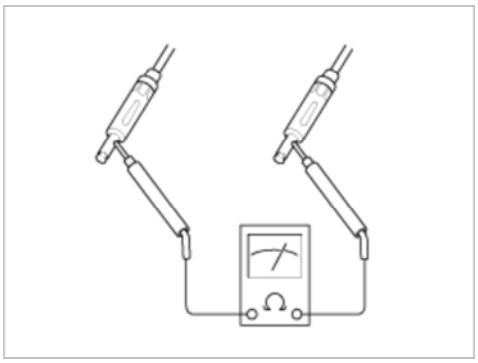


Body Electrical System > Audio > Antenna > Repair procedures

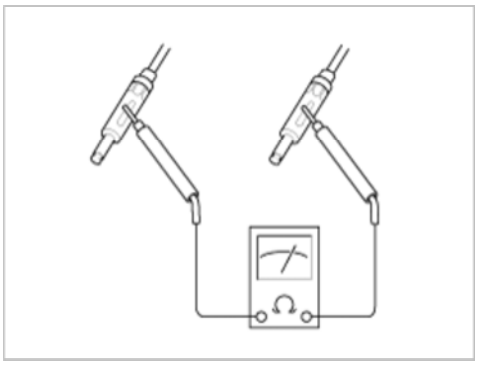
Inspection

Antenna Cable

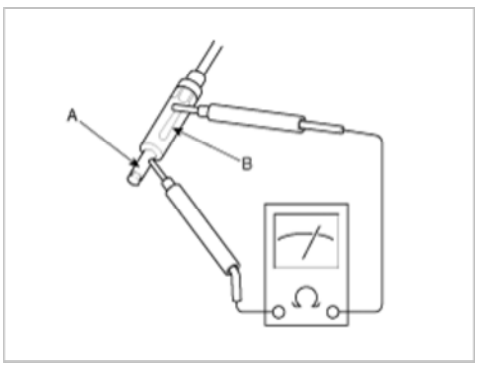
1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



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



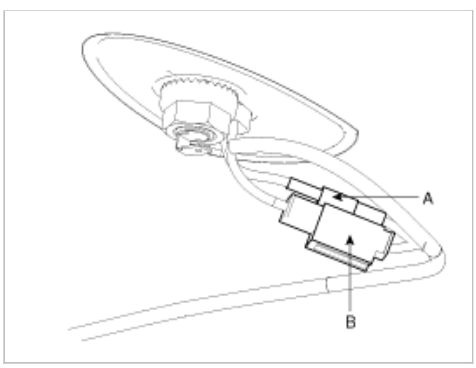
4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.



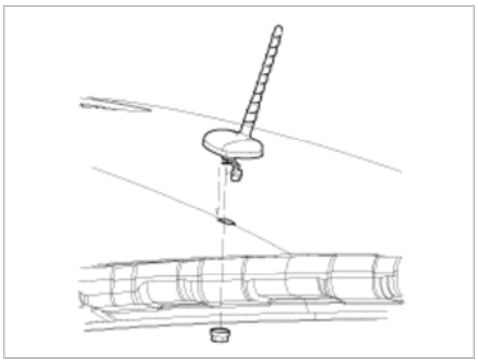
6. If there is continuity, replace the antenna cable.

Replacement

1. Remove the rear roof trim.
   (Refer to the Body group - Roof trim)
2. Disconnect the antenna connectors (2EA) to the feeder cable connectors.
   (A : XM Amplifier connector, B : FM/AM connector)



3. Disconnect the 1P power connector from the roof antenna.
4. Remove the SDARS roof antenna from the roof panel hole after loosening a nut.

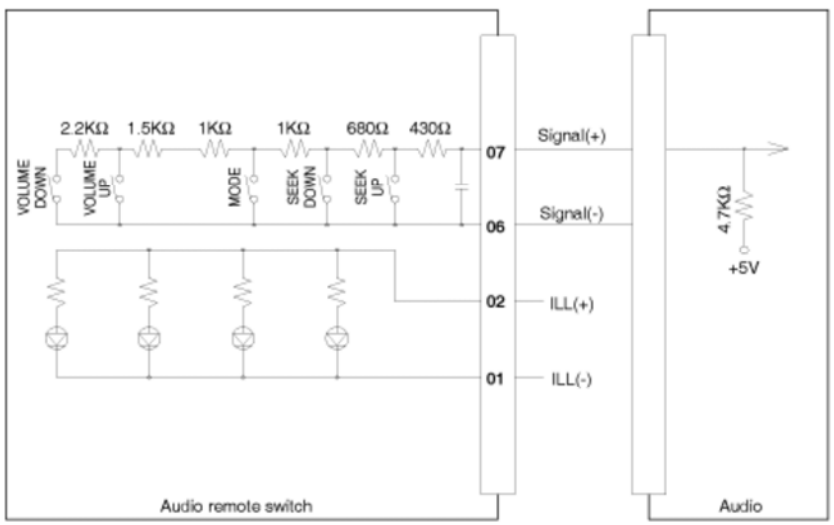


5. Installation is the reverse of removal.

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

Circuit Diagram

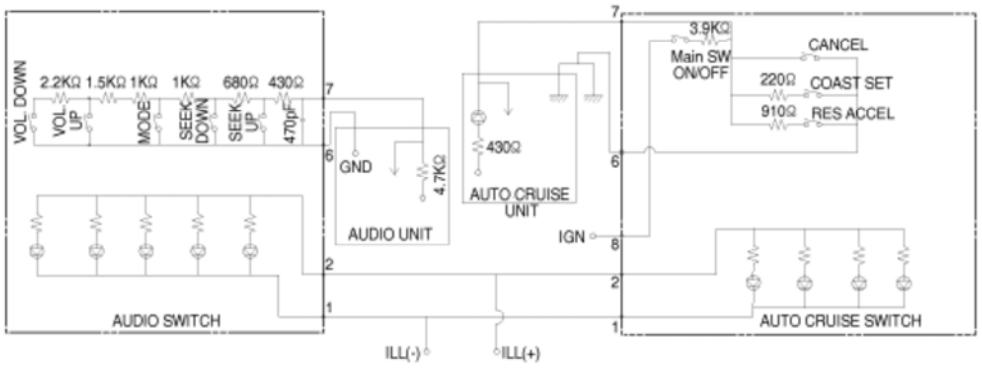
[AUDIO SYSTEM]

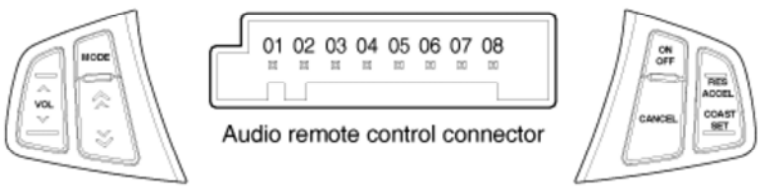


LH

Audio remote control connector

[AUDIO SYSTEM + AUTO CRUISE]



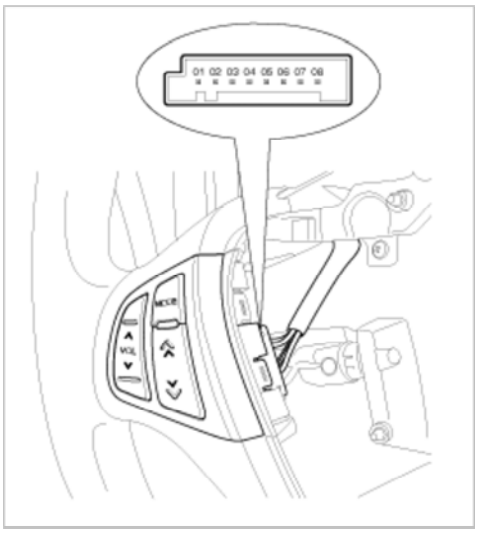


LH RH

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

Inspection

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



[Audio System]

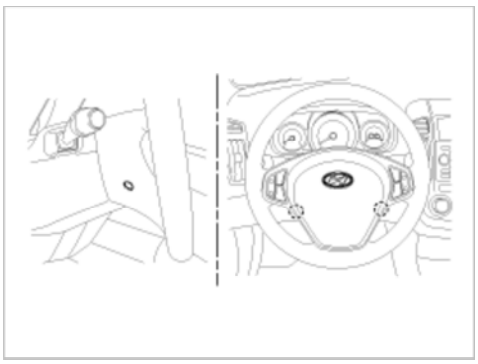
Switch	Connector terminal	Resistance (±1%)
VOLUME DOWN	6-7	6.81 kΩ
VOLUME UP	6-7	4.61 kΩ
MODE	6-7	2.11 kΩ
SEEK DOWN	6-7	1.11 kΩ
SEEK UP	6-7	430 Ω

[Audio system + Audio Cruise]

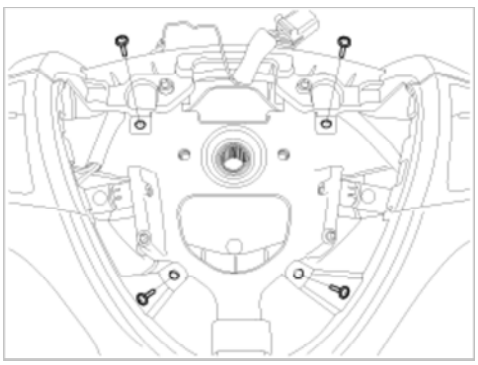
Switch	Connector terminal	Resistance (±1%)
VOLUME DOWN	6-7	6.81 kΩ
VOLUME UP	6-7	4.61 kΩ
MODE	6-7	2.11 kΩ
SEEK DOWN	6-7	1.11 kΩ
SEEK UP	6-7	430 Ω

Removal

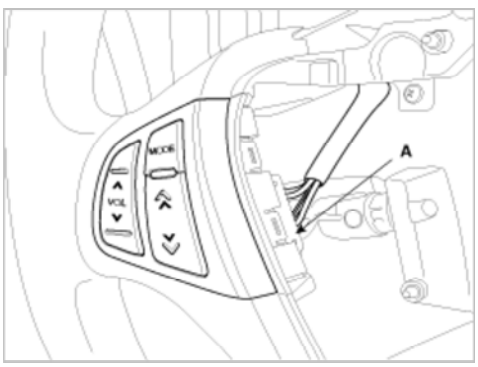
1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module.
   (Refer to the Airbag group - Airbag module and clock spring).



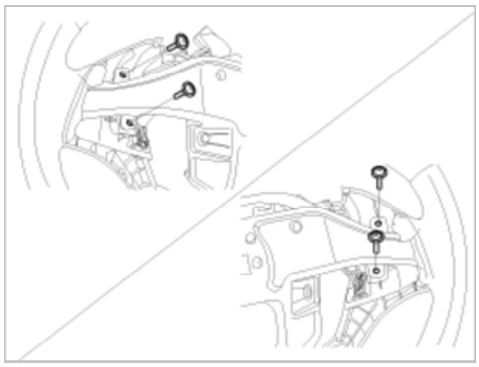
3. Remove the steering wheel after loosening the nut and disconnecting the connector.
   (Refer to the Steering group - Steering column and shaft).
4. Remove the steering wheel lower cover after loosening the 4 screws.



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



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



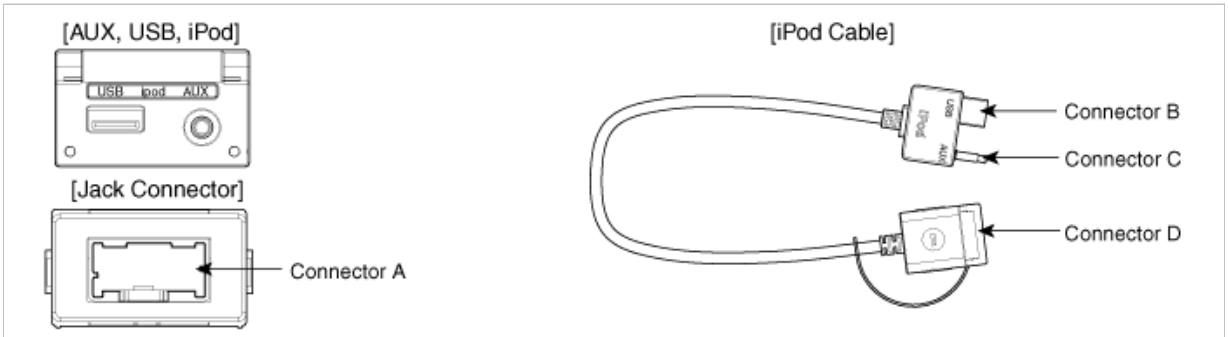
7. Remove the audio remote control switch.

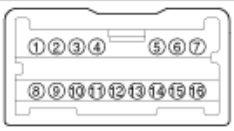
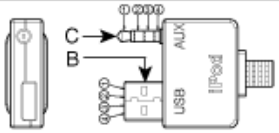
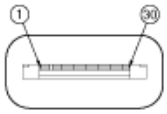
Installation

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

Body Electrical System > Audio > AUX(Auxiliary) jack > Components and Components Location

Components

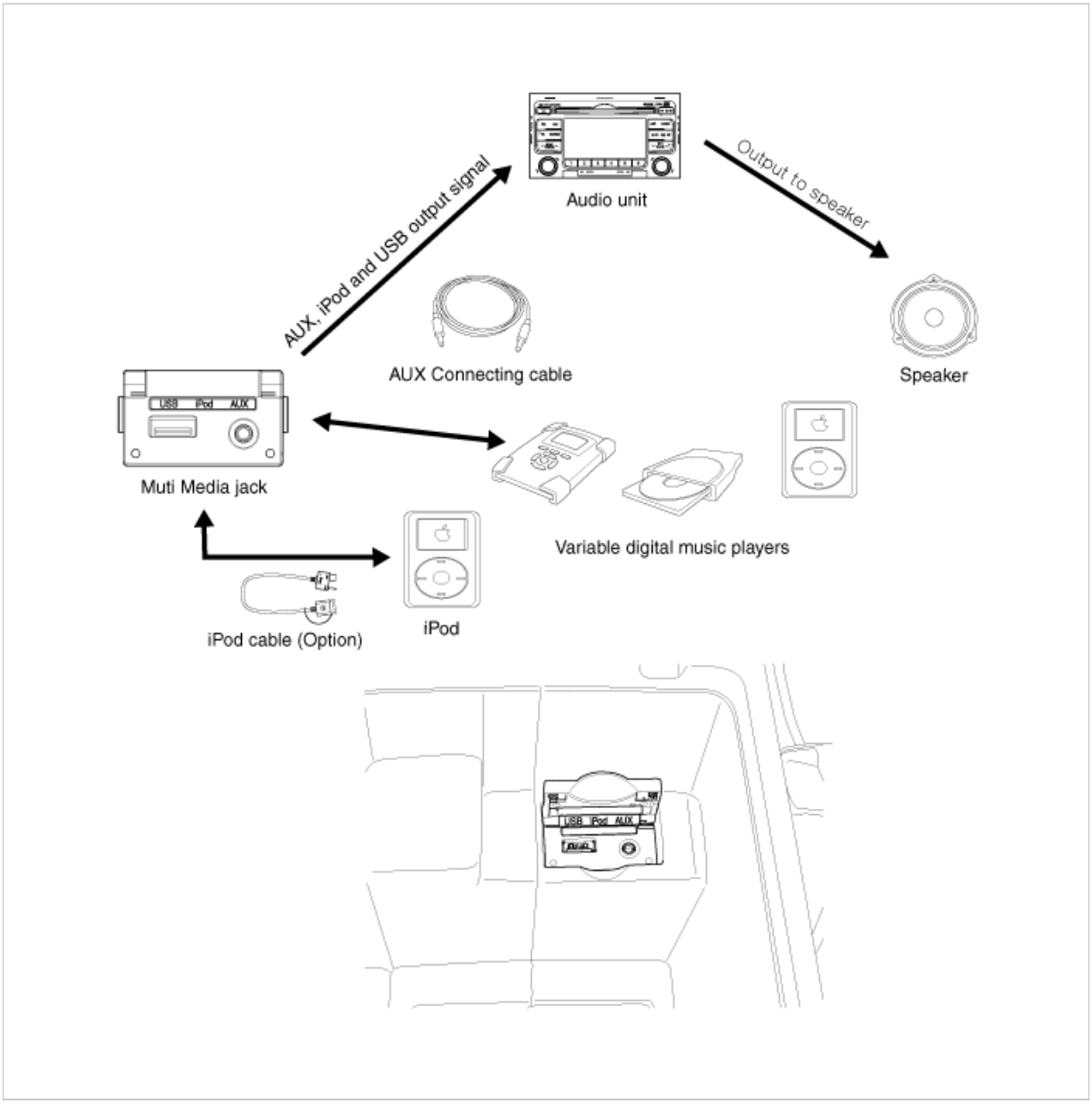


Name	Multi-media Jack Connector A (USB/AUX/iPod)	USB Connector B	AUX Connector C	iPod Connector D
Connector				
1	USB/iPod 5V	USB/iPod 5V	AUX1 L IN	GND
2	USB D-/iPod TX	USB D-/iPod TX	AUX1 R IN	GND
3	USB D+/iPod RX	USB D+/iPod RX	Option/ Video	-
4	USB/iPod GND	USB/iPod GND	AUX1 GND	D+
5	-			-
6	AUX1 REF			D-
7	AUX1 L IN			-
8	ILL+			5V
9	USB Shield GND			-
10	-			ACC ID
11	M/Media GND			-
12	-			-
13	-			-
14	AUX DET			-
15	AUX shield GND			GND
16	AUX1 R IN			GND
17				-
18				RX
19				TX
20				ACC DET
21				-
22				-
23				Video
24				-
25				-
26				-
27				AUX1 L IN
28				AUX1 R IN
29				AUX1 GND
30				Signal wire GND

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

Description

The AUX, iPod and USB JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPod, earphone, USB memory stick, CD player and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added option.
In case of distortions from media connected to the AUX source, this may not be a defect in the radio but the output level of the used media does not match the specification of the AUX input.

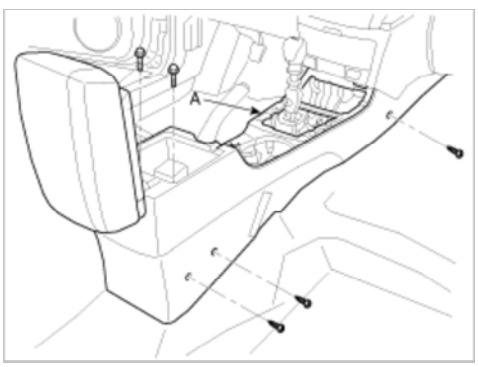


Body Electrical System > Audio > AUX(Auxiliary) jack > Repair procedures

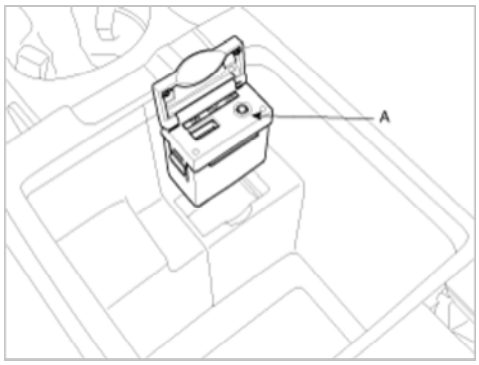
Removal

Multi Media Jack

1. Remove the floor console (A).
   (Refer to Body Gr. - "Console")



2. Disconnect the jack assembly connector from the floor console.
3. Remove the Multi Media Jack (A) from the floor console.



Installation

Multi Media Jack

1. Install the Multi Media Jack.
2. Connect the Multi Media Jack connector.
3. Install the under cover to the floor console.

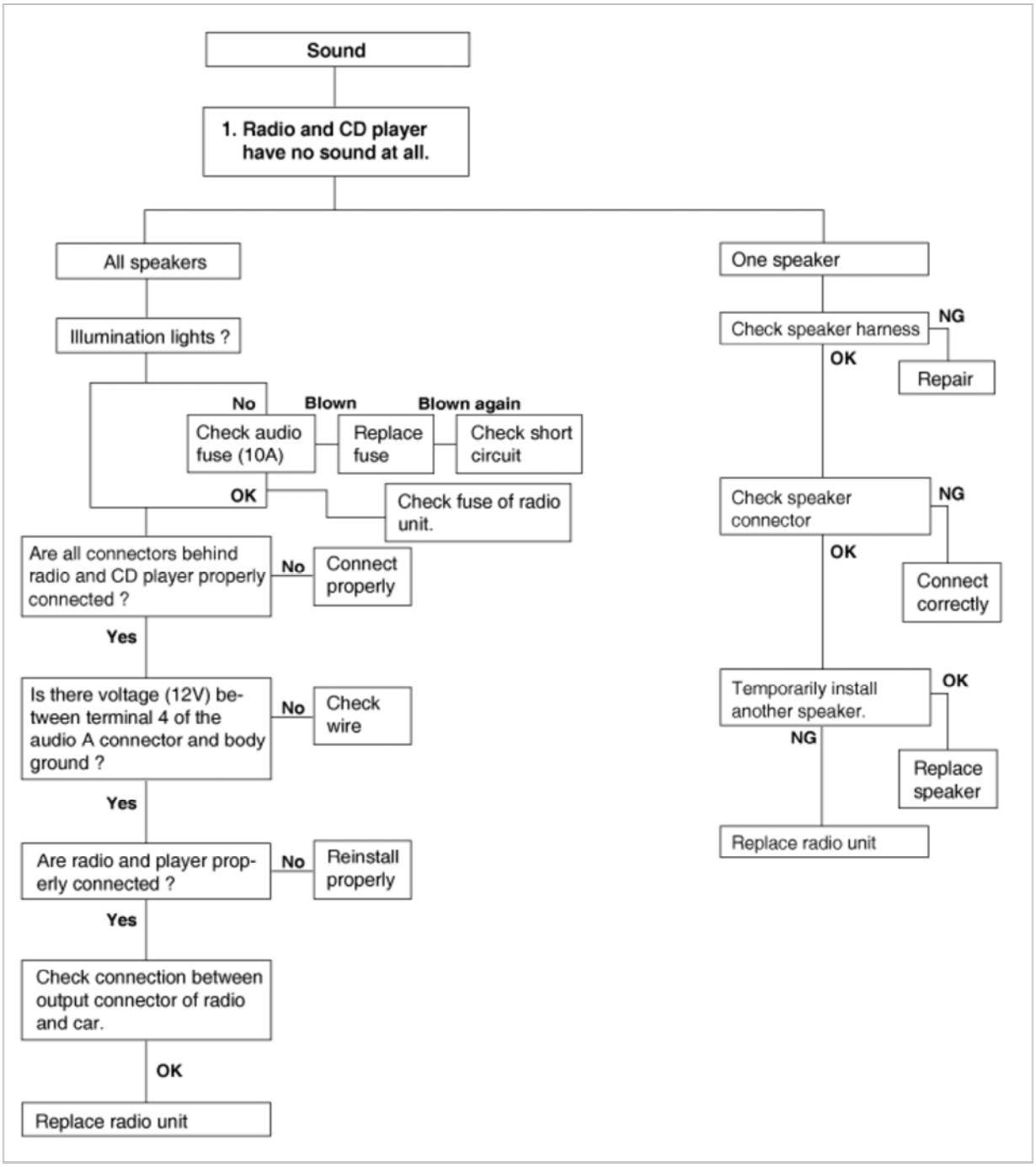
Body Electrical System > Audio > Troubleshooting

Troubleshooting

Customer Complaint Analysis Check Sheet

Item	Status	How to check
System	Audio is not functioning and no function of display	▶ Check the fuse audio unit and vehicle ▶ Check power connections
Radio	No radio reception	▶ Check if the antenna is completely and correctly connected.
	Poor radio reception	▶ Antenna (disc antenna) obscured, antenna rod bent or antenna defective. ▶ Please arrange for an authorized dealer to check the antenna.
	The required station cannot be tuned to using automatic search	▶ Set desired station manually (manual tuning) ▶ Check whether the antenna is completely and correctly connected
CD	CD will not be accepted	▶ Clean CD with damp cloth ▶ The CD does not comply with the CD player specification ▶ See notes on Audio and MP3 CDs
	Distorted sound/skips during CD play	▶ With the set on, wait for 5 minutes until the condensation evaporates
	No sound during CD playback	▶ Some CDs contain multimedia data which is not recognized by the unit ▶ Advance the tracks until music is heard
USB	USB mode is not functioned	▶ Plug in USB drive again

1. System Check Procedure



2. Radio Check Procedure

Chart 1

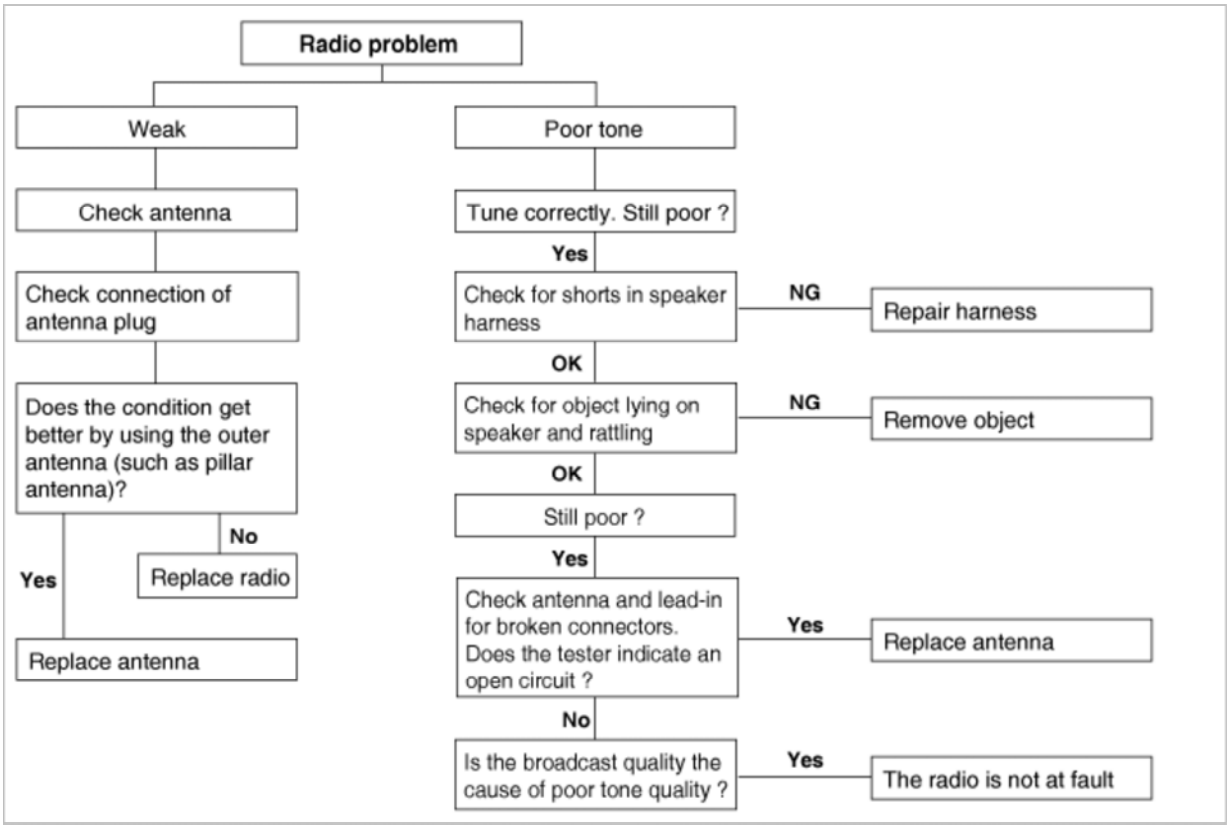


Chart 2

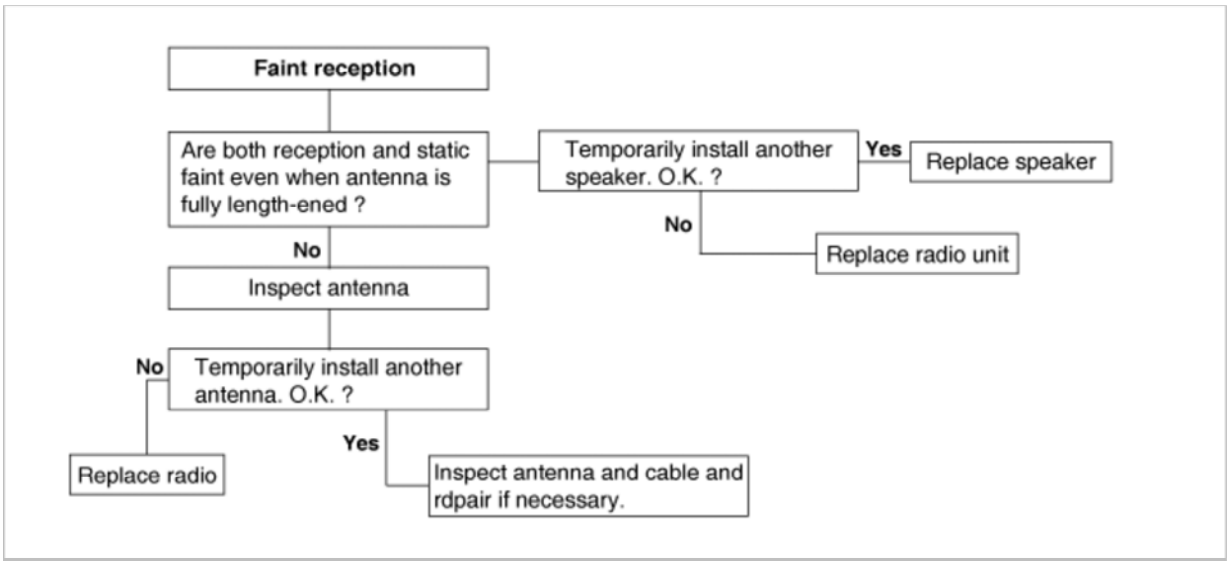


Chart 3

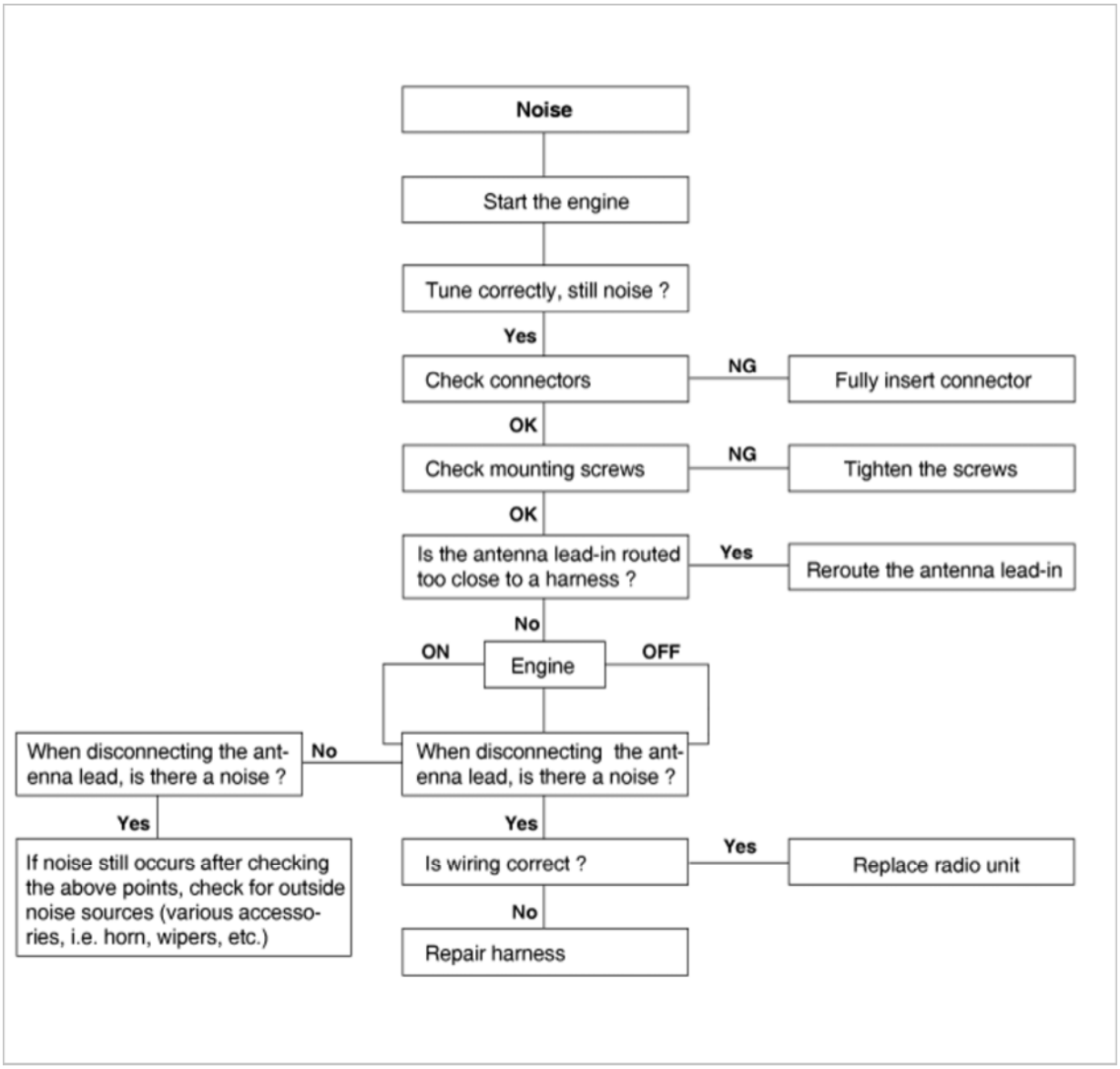

Noise
Start the engine
Tune correctly, still noise ?
Yes
Check connectors
NG
Fully insert connector
OK
Check mounting screws
NG
Tighten the screws
OK
Is the antenna lead-in routed too close to a harness ?
Yes
Reroute the antenna lead-in
No
ON
Engine
OFF
When disconnecting the antenna lead, is there a 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

Chart 4

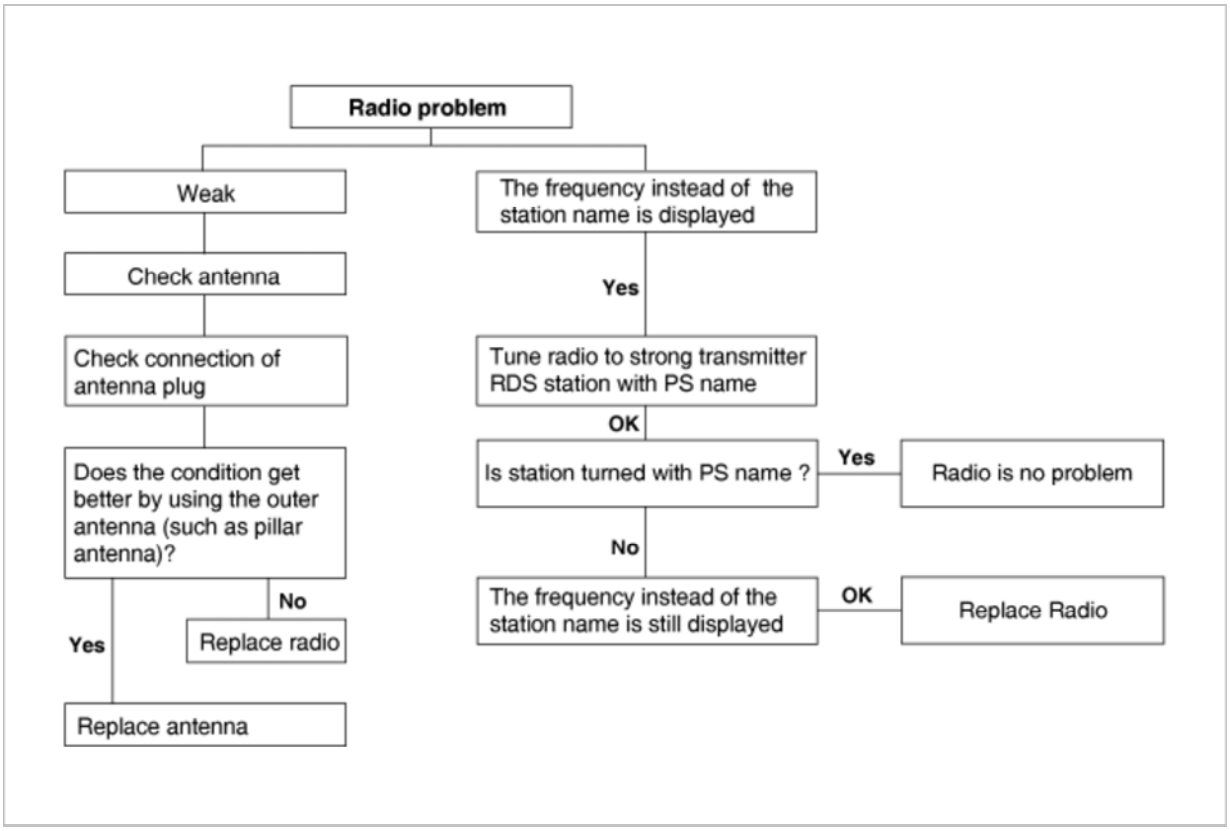


Chart 5

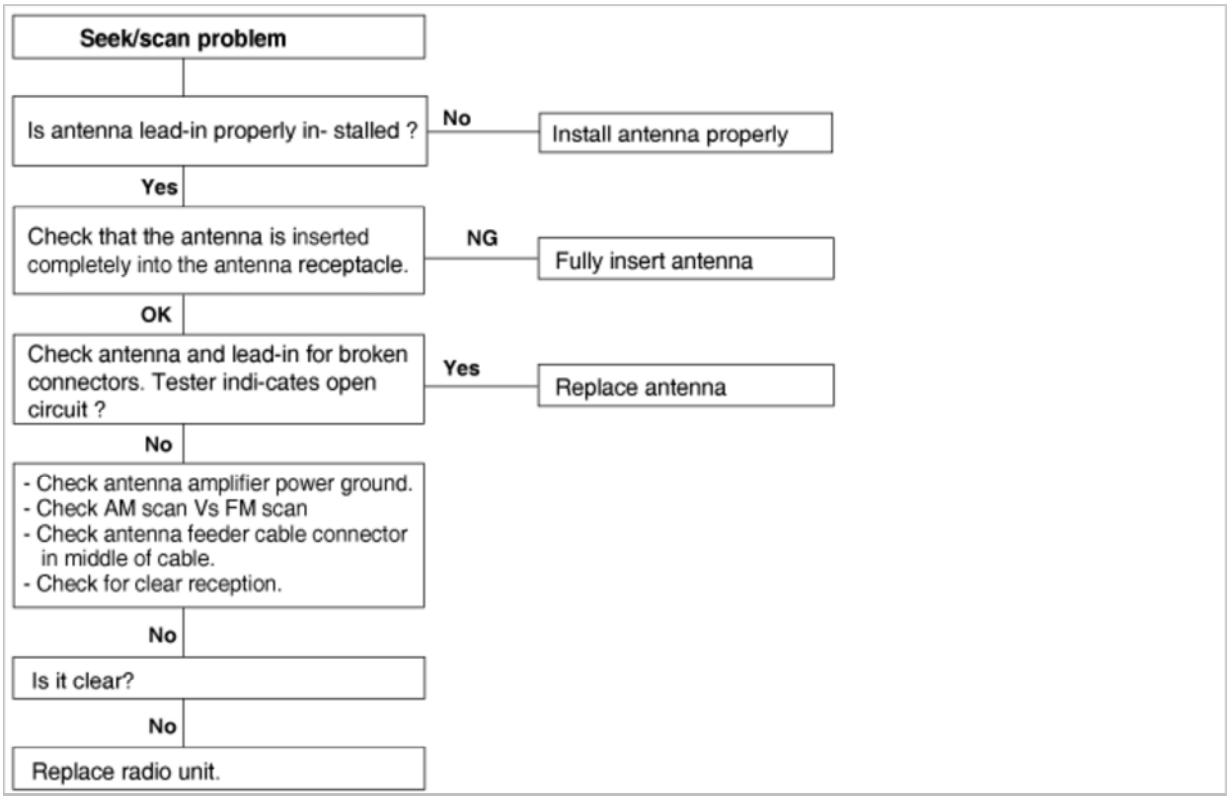
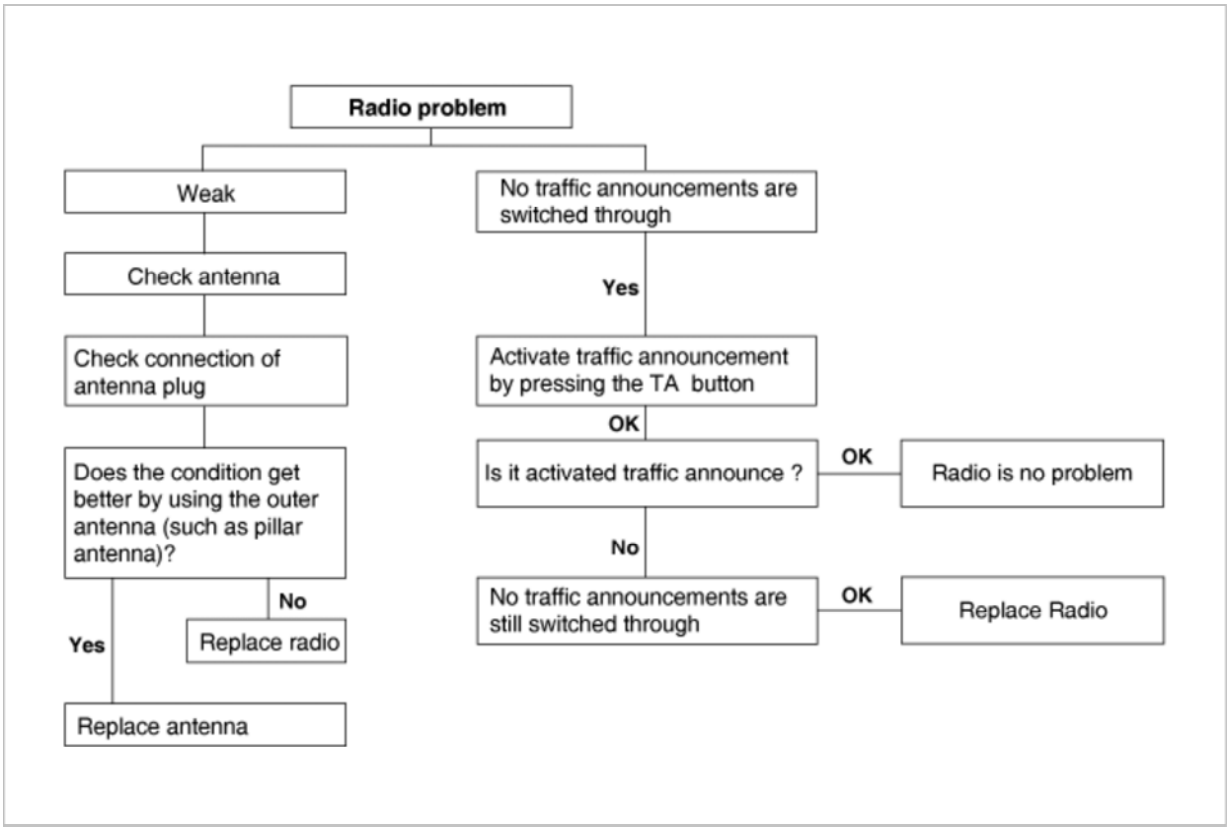


Chart 6



3. CD Check Procedure

Chart 1. CD Will Not Be Accepted

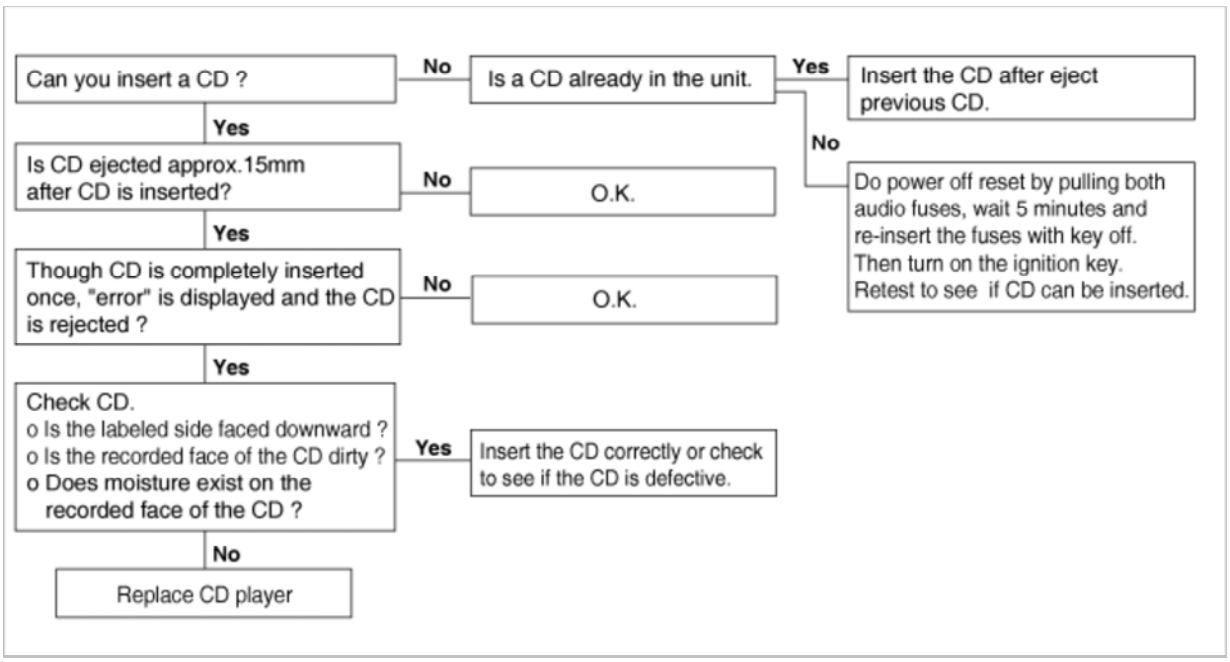


Chart 2. CD Sound Skips

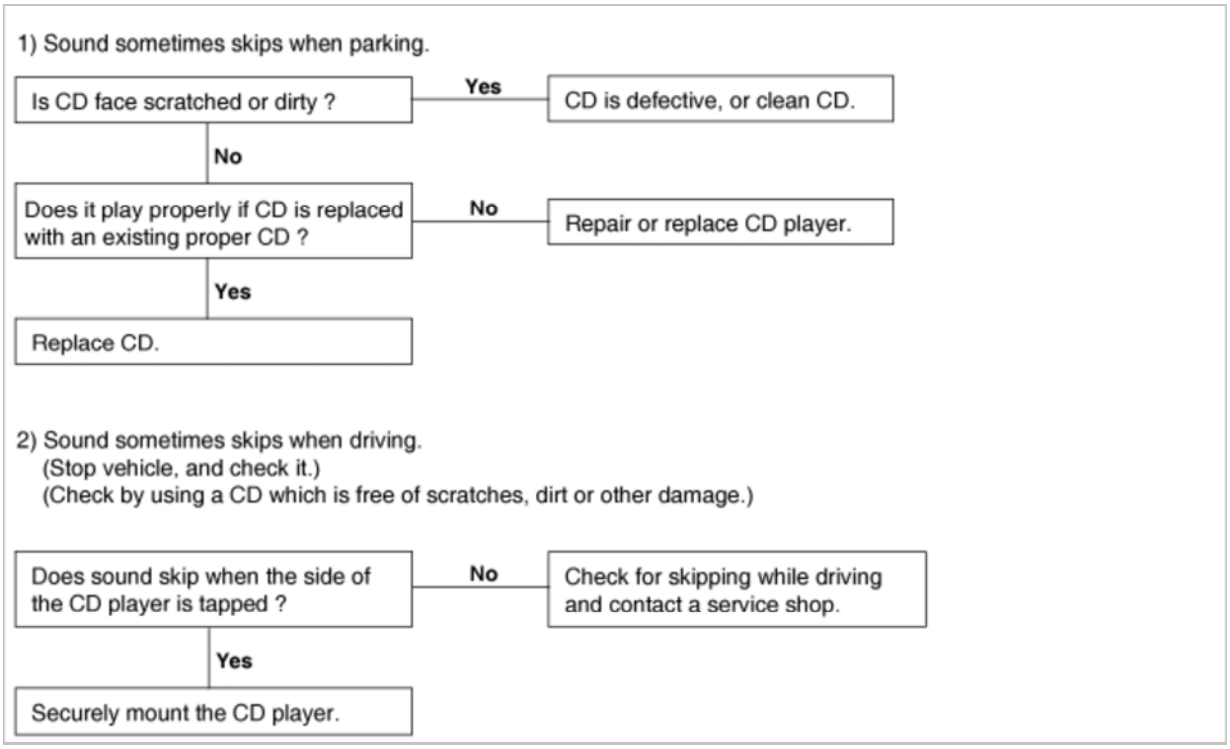
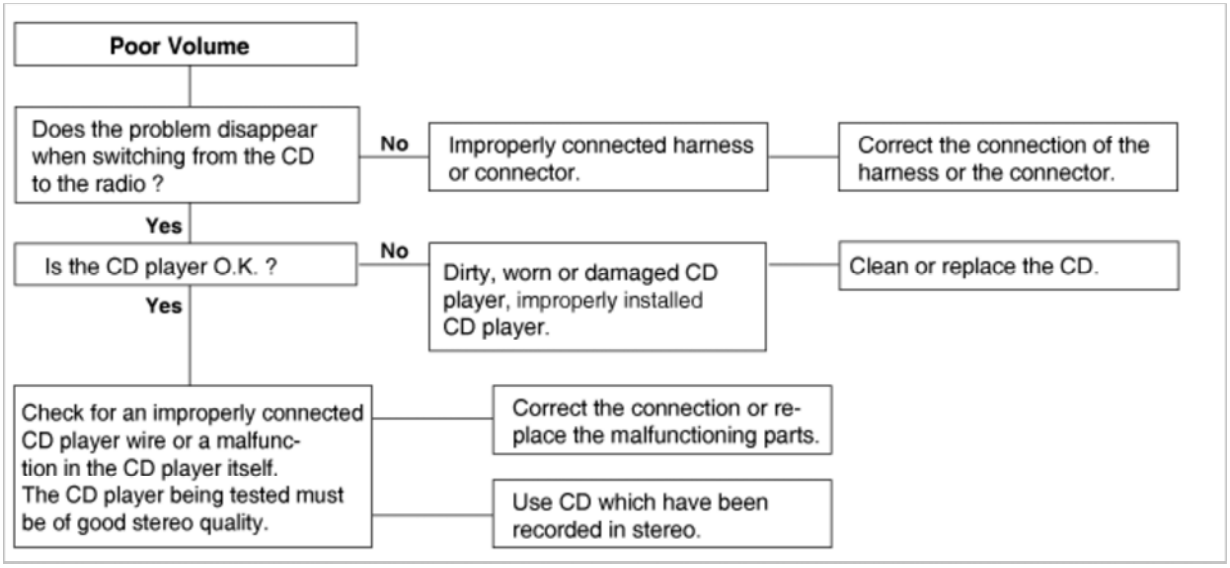
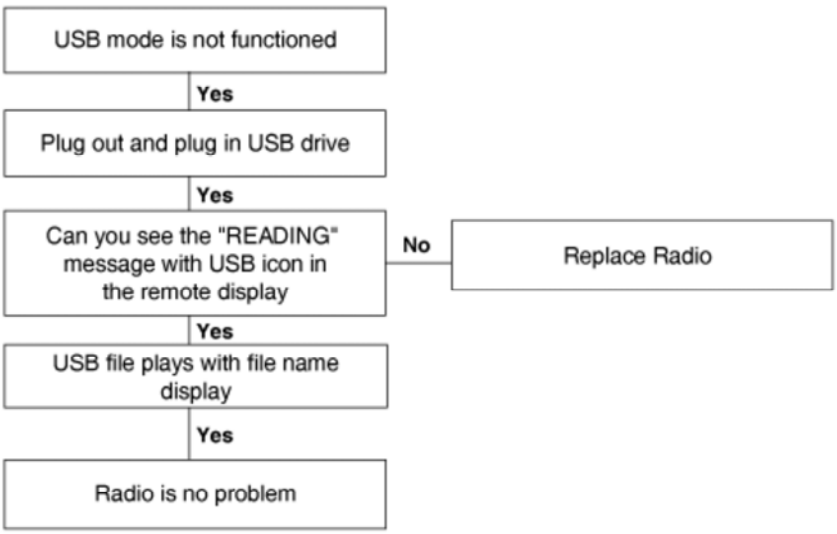


Chart 3



4. USB Check Procedure



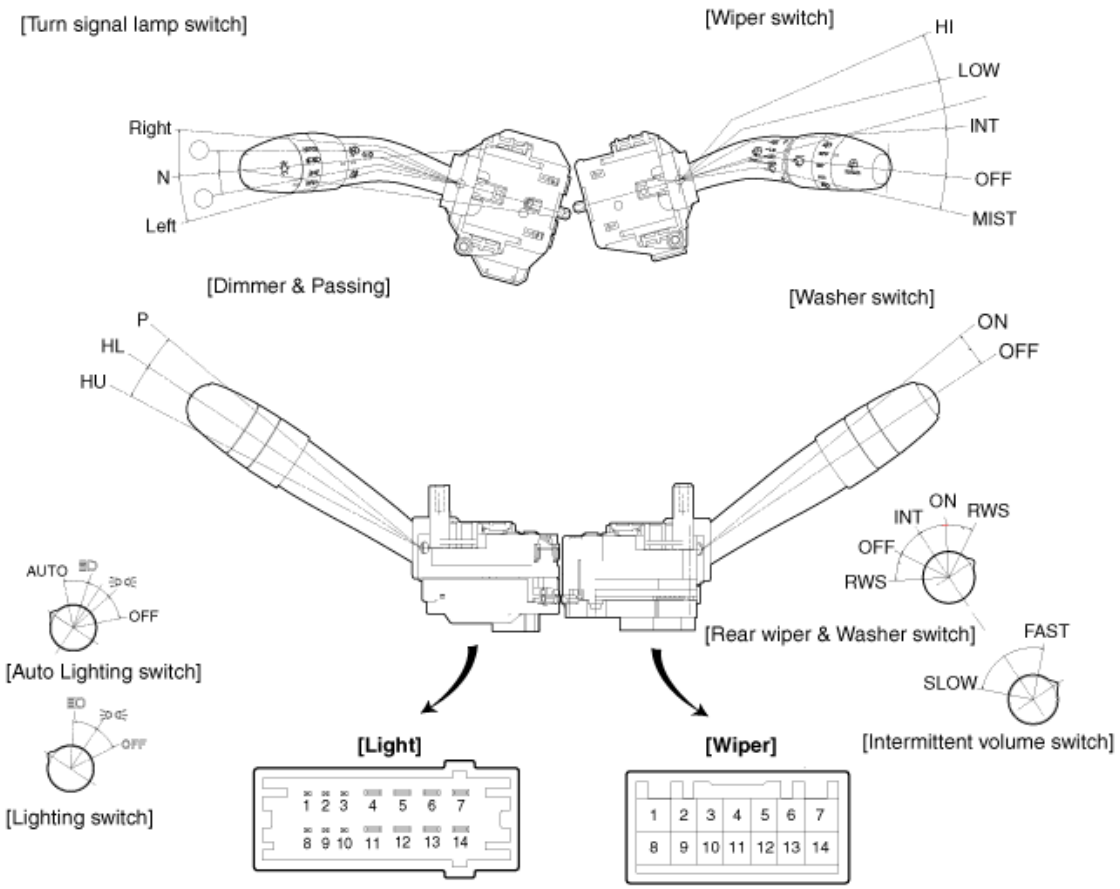
Body Electrical System > Multifunction switch > Specifications

Specifications

Items		Specifications
Rated voltage		DC 12V
Operating temperature range		-30°C ~ +80°C (-22 ~ +176°F)
Lever end play		0.098 in (2.5 mm)
Rated load	Dimmer & passing switch	High : 1A (Relay load) Low : 1A (Relay load) Passing : 1A (Relay load)
	Lighting switch	Lighting : 1A (Relay load)
	Turn signal switch	6.6 ± 0.5A (Lamp load)
	Wiper & mist switch	High : 6.5A (Motor load) Low : 4.5 A (Motor load) Intermittent : 0.22±0.05A(Relay Load) Lock : Max. 28A (Motor load) Mist : 4.5A (Motor load)
	Fog lamp switch	1A (Relay load)
	Rear wiper & Washer	Wiper : 0.2A (Relay load) Washer : 4A (Motor load)

Body Electrical System > Multifunction switch > Components and Components Location

Component



Circuit connection

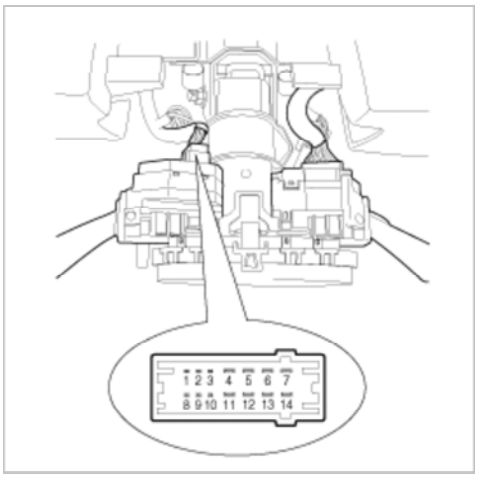
Connector Name	Terminal No.	Description	Connector Name	Terminal No.	Description
Light	1	Lighting switch ground	Wiper	1	Rear washer
	2	Front fog lamp switch		2	-
	3	Front fog lamp ground		3	Rear wiper
	4	Flasher unit power		4	Rear wiper & washer IGN
	5	Turn signal lamp (LH) switch		5	Intermittent wiper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

Body Electrical System > Multifunction switch > Repair procedures

Inspection

Lighting Switch Inspection

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



Lighting Switch (Auto Light)

Position \ Terminal	8	9	10	1
OFF				
I	○	—	—	○
II	○	○	—	○
AUTO			○	○

Lighting Switch

Position \ Terminal	8	9	10	1
OFF				
I	○	—	—	○
II	○	○	○	○

Dimmer And Passing Switch

Position \ Terminal	14	12	13	11
HU		○	—	○
HL			○	○
P	○	○	—	○

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

Turn Signal Switch

Hazard switch	Turn signal switch \ Terminal	6	5	4
OFF	L		○	○
	N			
	R	○	—	○

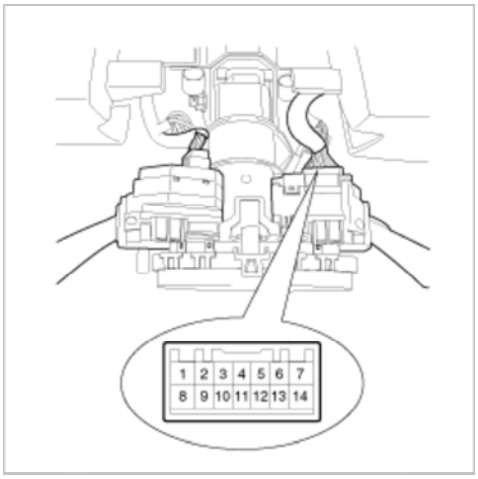
Front Fog Lamp

Position \ Terminal	3	2
OFF		
ON	○	○

Wiper And Washer Switch Inspection

1. With the multi function switch in each position, make sure that continuity exists between the terminals below.

If continuity is not as specified, replace the multi-function switch.



Wiper Switch

[RAIN SENSOR]

Position \ Terminal	14	8	13	9	10	12	6	5
MIST	○		○		○	○		
OFF	○		○					
AUTO	○		○	○	○		○	○
LOW	○				○			
HI		○			○			

[STANDARD]

Position \ Terminal	14	8	13	9	10	12	6	5
MIST	○		○		○	○		
OFF	○		○					
INT	○		○	○	○		○	○
LOW	○				○			
HI		○			○			

Washer Switch

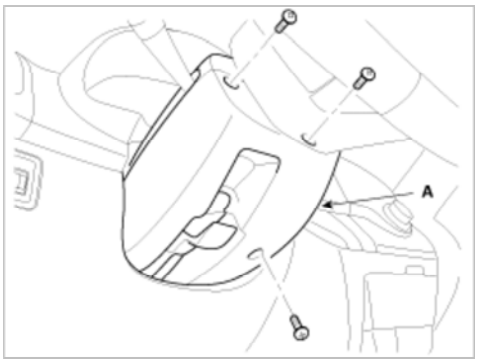
Position \ Terminal	11	10
OFF		
ON	○	○

Rear Wiper & Washer Switch

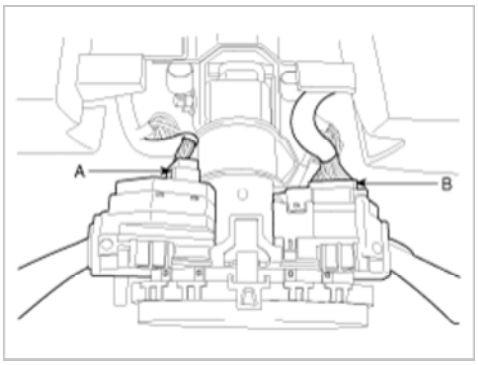
Position \ Terminal	4	3	1
WIPER	○		○
OFF			
ON	○	○	
WASHER	○		○

Removal

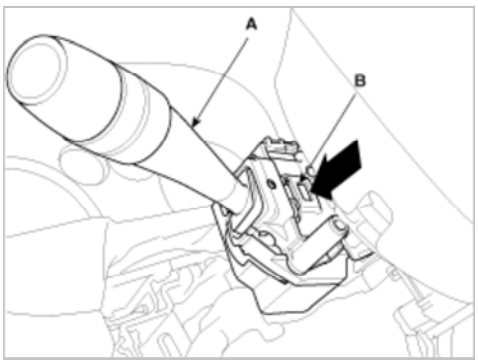
1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds(A) after removing 3 screws.
   (Refer to ST group - Steering column and shaft).



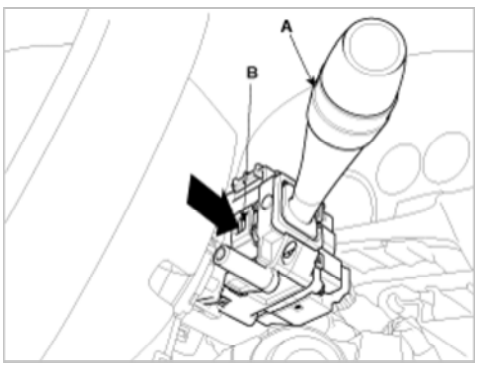
3. Disconnect the light switch connector (A) and the wiper switch connector (B).



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



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

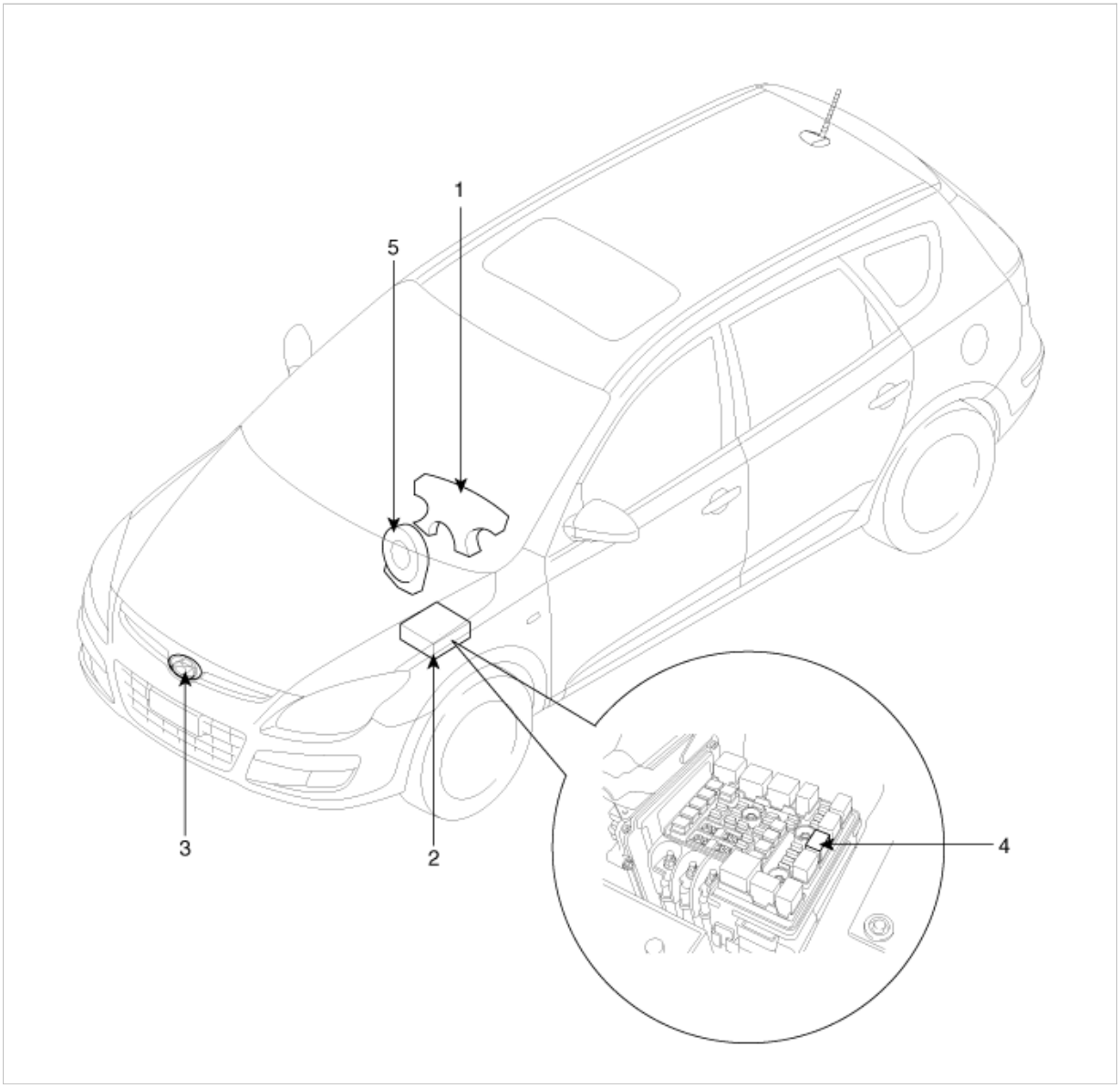


Installation

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

Body Electrical System > Horn > Components and Components Location

Component Location



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

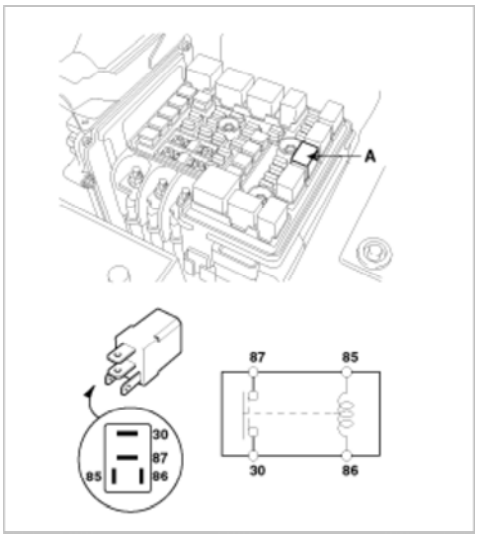
Body Electrical System > Horn > Repair procedures

Inspection

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

Horn Relay Inspection

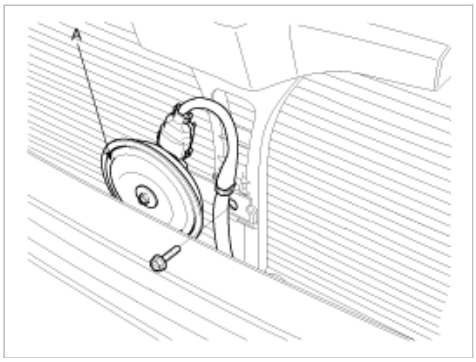
1. Remove the horn relay (A) from the engine room relay box.
2. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
3. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



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

Removal

1. Remove the front bumper. (Refer to the Body group - front bumper).
2. Remove the bolts and disconnect the horn connectors, then remove the low pitch horn (A).



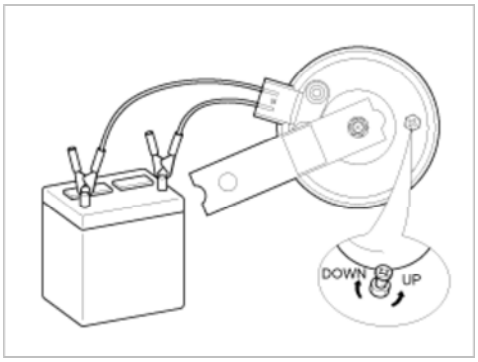
Installation

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

Adjustment

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

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



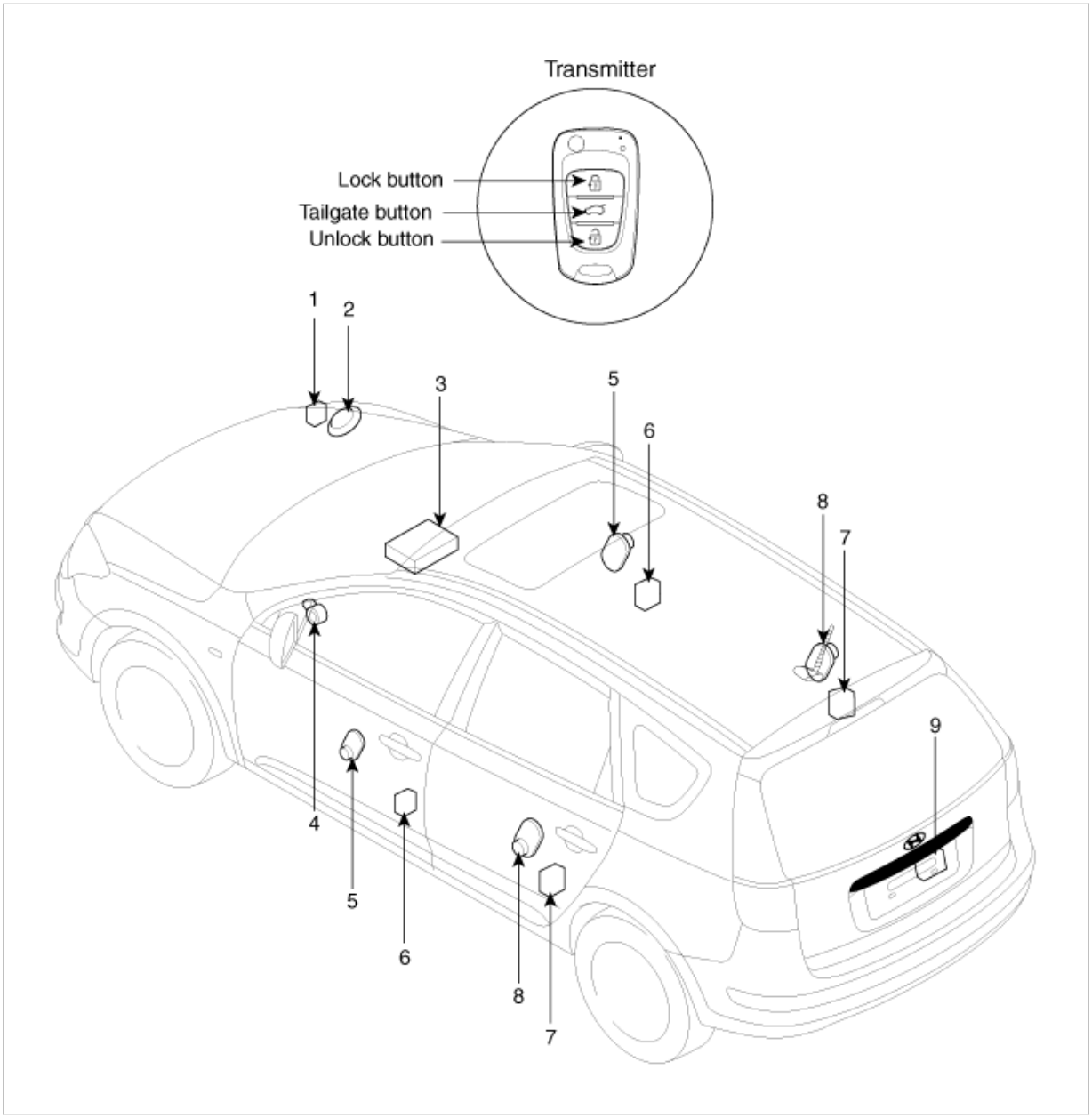
Body Electrical System > Keyless Entry And Burglar Alarm > Specifications

Specifications

Item	
Rated voltage	DC 3V
Service voltage range	DC 2.5V ~ 3.2V
Temperature range	-4°F ~ 140°F (-20°C ~ +60°C)
Storage temperature range	-22°F ~ 176°F (-30°C ~ +80°C)
Modulation method	FSK
Keyless entry transmitter Power source	Lithium 3V battery (1EA)
Transmissible distance	30m or more
Life of battery	2 years or more (at 20 times per day)
Button	4 (Door lock, Door unlock, Tailgate unlock, panic)
Transmission frequency	315 MHz ± 50 MHz

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

Component Location



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

Body Electrical System > Keyless Entry And Burglar Alarm > 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 using a transmitter :

- A door is forced open.
- The tailgate is opened.
- The hood is opened.

When the system is set off, the alarm sounds and the hazard lamp flash for about 30 seconds or until the system is disarmed by unlocking the transmitter or door key.
For the system to arm, the ignition switch must be off and the key removed. Then, the body control module must receive signals that the doors, hood, and tailgate are closed and locked. When everything is closed and locked, none of the control unit inputs are grounded.

The door switches, hood switch and tailgate switch are all close and lock the doors with the remote transmitter and then the system arms after 30s.
If anything is opened after the system is armed, the body control module gets a ground signal from that switch, and the system is set off.
If one of the switches is misadjusted or there is a short in the system, the system will not arm. As long as the body control module continues to get a ground signal, it thinks the vehicle is not closed and locked and will not arm.

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 again, all doors Unlock.
The room lamp, if its switch is in the center position, will come on when you press the Unlock button. If you do not open a door, the light will go off in about 30 seconds, the doors will automatically relock, and the burglar alarm system will rearm. If you relock the doors with the remote transmitter within 30 seconds, the light will go off immediately.
You cannot lock or unlock the doors with the remote transmitter if the key is in the ignition switch.
The system will signal you when the doors lock and unlock by flashing the hazard lamp once when they lock and closed, and twice when they unlock.

Function

Keyless Entry Function

Door Lock / Unlock and Tailgate operations are performed with remocon

1. Keyless entry function is performed in a state that key in SW is eliminated from key cylinder
2. LOCK / Unlock and tailgate signals are received from the transmitter and Door Lock / Unlock and Tailgate signals are output.
3. In case of tailgate, this operation is performed when pushing the button for 0.5s or more.

Transmitter(TX) Spec

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

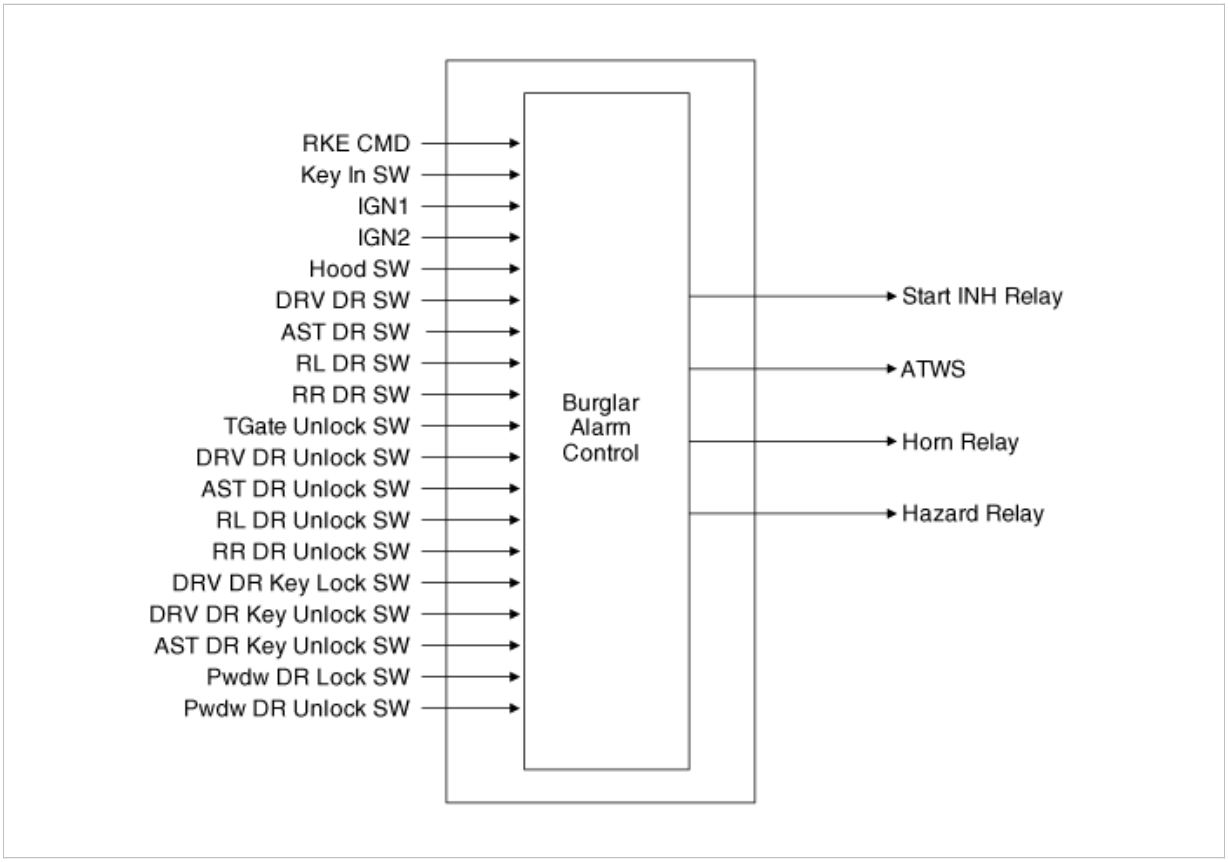
No.	Saved CODE	CODE to change	Changed CODE
1	A	C	C (A is deleted)
2	A, B, C, D	E	E (A, B, C, D is deleted)
3	A, B	C, D, E	C, D, E
4	A, B	C, C, D	C

   (3) For the registration procedures by using Hi-scan tool, refer to "Transmitter Code Registration".

3. Code Saving Procedure
   (1) Open the Door.
   (2) Connect power source for Code Saver (B+), GND, signal lines.
   (3) If it is normal, signal lines will be activated and RED LED will turn on.
   (4) When SW of Code Saver turns on, data will be transmitted via signal lines.
   (5) BCM changes into Code Save mode when receiving data from Code Saver and sends Code Save Start signals via signal lines.
   (6) Code Saver makes Green LED turn on when receiving Code Save Start signals.
   (7) BCM saves Codes when pressing Lock or Unlock button of the transmitter.
   (8) If there are 2 transmitters for Code Saving, register them by performing (7) once more.
   (9) If SW of Code Saver turns off or is disconnected, Code Saving mode will stop.
4. Transmitter signal & Receiver Spec
   (1) Transmission signal
      A. Transmit relevant transmission DATA (Transmission frame) twice by pushing TX SW.
      B. Only LOCK signal is output when pushing TX LOCK SW and Unlock SW at the same time.

Block Diagram

Anti-theft Control Data Flow

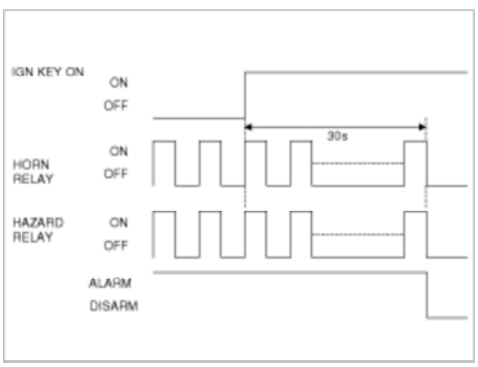


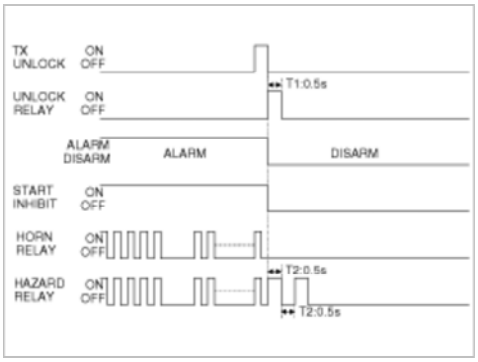
RKE CMD : TX LOCK, TX UNLOCK, T/GATE UNLOCK

Disarm

Condition 1

State	Description
Initial Condition	Alarm state
Event	• Any door open or tailgate unlock SW on & TX unlock. • IGN KEY ON during 30sec. • IGN KEY ON or ALT'L ON after 3sec. • TX(Transmitter) Unlock & Any Door open(4Door SW ON) • TX(Transmitter) Lock & Lock confirm failed • Driver door key unlock switch ON. (user select option : enable) • Driver door key lock SW ON & Lock confirm failed (user select option : enable) • TX tailgate ON.
Action	• The state goes to Disarm state • Hazard relay off, Horn relay off and start inhibit relay off. • TX Unlock - Unlock relay on for 0.5 sec. - Hazard relay on (TWICE)





Condition 2

State	Description
Initial Condition	Disarm state & (IGN KEY OUT) & Any Door open
Event	• TX Unlock
Action	• No state change • TX Unlock - Unlock relay on for 0.5 sec - Hazard relay on (Twice)

Condition 3

State	Description
Initial Condition	ARMWAIT state
Event	• At least one entrance opened • Any door is unlocked • Key in SW ON • Driver door key unlock SW ON (user select option : enable)
Action	The state goes to Disarm state

Condition 4

State	Description
Initial Condition	AUTOLOCKTIMER1 state
Event	• At least one entrance opened • Key in SW ON • Lock by AUTOLOCK, but Lock confirmation failure • Tx Lock, but Lock confirmation failure • Driver door key unlock SW ON, but Lock confirmation failure (user select option : enable)
Action	• The state goes to Disarm state

Condition 5

State	Description
Initial Condition	AUTOLOCKTIMER2 state
Event	• Any Door open • Key in SW ON • Lock by AUTOLOCK, but Lock confirmation failure • Tx Lock, but Lock confirmation failure • Driver door key lock SW ON, but Lock confirmation failure (user select option : enable)
Action	• The state goes to Disarm state

Condition 6

State	Description
Initial Condition	ARM state
Event	• IGN KEY ON • Driver door key unlock SW ON (user select option : enable)
Action	• The state goes to Disarm state

Condition 7

State	Description
Initial Condition	Rearm state
Event	• IGN KEY ON during 30sec or (ALT"L" = ON & IGN KEY ON during 3sec) • Tx Lock, but Lock confirmation failure • Driver door key unlock SW ON (user select option : enable) • Driver door key lock SW ON & Lock confirmation failure (user select option : enable) • TX tailgate ON.
Action	• The state goes to Disarm state • Start Inhibit relay OFF

Condition 8

State	Description
Initial Condition	PRearm state
Event	• Key in SW ON • Driver door key unlock SW ON (user select option : enable) • All entrance closed & Any Door is unlocked • Any Door open & Tx Unlock
Action	• The state goes to Disarm state • TX Unlock - Unlock relay on for 0.5sec - Hazard relay on (Twice)

Condition 9

State	Description
Initial Condition	AutoLockTimer3 state
Event	• Key in SW ON • Hood open • TX LOCK, but LOCK confirmation failure → (user select option : enable) • Driver door key unlock SW ON • Any Door open • Driver door key lock SW ON & Lock confirmation failure
Action	• The state goes to Disarm state (user select option : enable)

Arm

Condition 1

State	Description
Initial Condition	ARM state
Event	• Tx Lock
Action	• No state change • Hazard relay 1Time on(1sec)

Condition 2

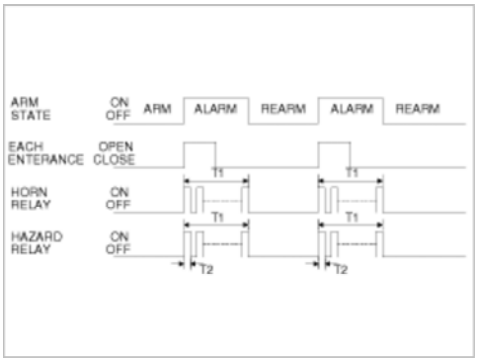
State	Description

Initial Condition	ARMWAIT state
Event	• ARMWAIT TIMER is expired
Action	• The state goes to ARM state

Alarm

Condition 1

State	Description
Initial Condition	ARM state
Event	• Any entrance open (Doors, Tailgate, or HOOD)
Action	• The state goes to Alarm state • The horn is ON two time (ON for 27sec.±2sec., OFF for 10sec.±1sec.) • The hazard is driven also (During Horn driving) • Engine Start Inhibit is ON

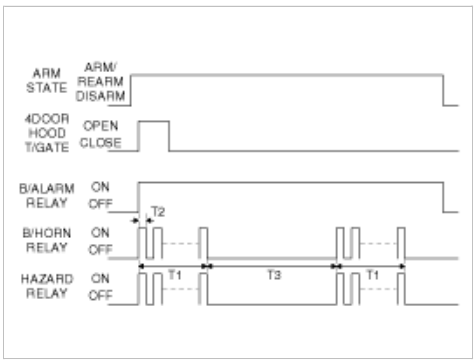


T1 : 27s ± 2sec, T2 : 0.5s ± 0.1sec.

> NOTE
>
> Horn Output : Period : 1sec(Can be calibrated Horn Period), 50% Duty

Condition 2

State	Description
Initial Condition	Rearm state
Event	• Any door open or Hood open or tailgate open
Action	• The state goes to Alarm state • The horn is ON one time for 27sec (±2sec.) • The hazard is driven also (During horn driven)



T1 : 27 ± 2sec, T2 : 0.4 ~ 0.5sec, T3 : 10 ± 1sec

Arm Wait Mode

Condition 1

State	Description
Initial Condition	ARMWAIT state

Event	• Tx Lock
Action	• NO state change • TX LOCK - Hazard relay 1 Time on(1sec)

Condition 2

State	Description
Initial Condition	Disarm state & IGN KEY OUT & All entrances closed (Doors, HOOD and Tailgate)
Event	• Tx Lock & locked confirmed • All doors are closed or Tailgate is closed when all doors locked (user select option : enable) • Driver door key lock SW ON & Locked confirmed → (user select option : enable)
Action	• The state goes to ARMWAIT State • Start ARMWAITTIMER • Hazard relay 1 Time on (1 sec.) (Except key lock)

Condition 3

State	Description
Initial Condition	Alarm state & IGN KEY OUT & All entrances closed(Doors, HOOD and Tailgate)
Event	• Tx Lock & locked confirmed • Driver door key lock SW ON & Locked confirmed (user select option : enable)
Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Horn relay off • Start inhibit relay off • Hazard relay 1Time on(1sec) (TX LOCK)

Condition 4

State	Description
Initial Condition	AUTOLOCKTIMER1 state
Event	• AUTO LOCK confirmed • Tx Lock & locked confirmed • Driver door key lock SW ON & Locked confirmed (user select option : enable)
Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Hazard relay 1Time on(1sec) (AUTO LOCK, TX LOCK)

Condition 5

State	Description
Initial Condition	PRearm state
Event	• Hood and 4door are closed & All doors locked & Tailgate closed.
Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Hazard relay 1Time on(1sec)

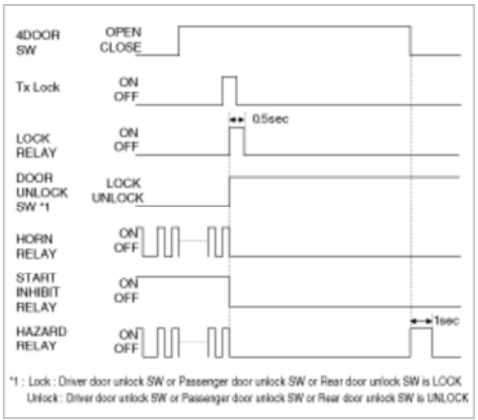
Condition 6

State	Description
Initial Condition	Rearm state
Event	• Tx Lock & locked confirmed • Drive door key lock SW ON & locked confirmed (user select option : enable)

Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Start inhibit relay off • Hazard relay 1Time on(1sec) (TX LOCK)

Condition 7

State	Description
Initial Condition	Auto Lock Timer3 state
Event	• Tx Lock & locked confirmed • Drive door key lock SW ON & locked confirmed (user select option : enable)
Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Hazard relay 1Time on(1sec) (TX LOCK)



Rearm Mode

Condition 1

State	Description
Initial Condition	Alarm state
Event	• All entrance is closed & Alarm Patten finished
Action	• The state goes to Rearm state

Autolocktimer1 Mode

Condition 1

State	Description
Initial Condition	ARM state
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazard relay Twice on(0.5s ON/0.5s OFF)

Condition 2

State	Description
Initial Condition	AUTOLOCKTIMER1 state
Event	• AUTO LOCK TIMERI is expired • Tx Unlock
Action	• No state change • Tx Unlock - Hazard relay Twice on(0.5s ON/0.5s OFF)

	- Restart AUTOLOCKTIMER1 • Expire AUTOLOCKTIMER1 - AUTOLOCK

Condition 3

State	Description
Initial Condition	ARMWAIT state
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazard relay Twice on(0.5s ON/0.5s OFF)

Condition 4

State	Description
Initial Condition	Disarm state & All entrances closed (Doors, HOOD & Tailgate) & IGN KEY OUT
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazard relay Twice on(0.5s ON/0.5s OFF)

Condition 5

State	Description
Initial Condition	Alarm state & All entrances are closed (Doors, HOOD & Tailgate)
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazard relay Twice on(0.5s ON/0.5s OFF) • Start inhibit relay off • Horn relay off

Condition 6

State	Description
Initial Condition	Rearm state
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazard relay Twice on(0.5s ON/0.5s OFF) • Start inhibit relay off

Condition 7

State	Description
Initial Condition	AutoLock Timer3 state
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazard relay Twice on(0.5s ON/0.5s OFF)

Autolocktimer2 Mode

Condition 1

State	Description
Initial Condition	AUTOLOCKTIMER2 state
Event	• Timer is expired • Tx Unlock
Action	• No State change • Tx Unlock - Hazard relay Twice on(0.5s ON/0.5s OFF) - The timer restart • Expire AUTOLOCKTIMER2 - AUTOLOCK

Condition 2

State	Description
Initial Condition	Disarm state & All Doors are closed & (HOOD is opened) & IGN KEY OUT
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER2 state • Start AUTOLOCKTIMER2 • Hazard relay Twice on(0.5s ON/0.5s OFF)

Condition 3

State	Description
Initial Condition	Alarm state & All Door are closed & (HOOD is opened)
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER2 state • Start AUTOLOCKTIMER2 • Hazard relay Twice on(0.5s ON/0.5s OFF) • Start inhibit relay off • Horn relay off

Condition 4

State	Description
Initial Condition	PRearm state All Doors are closed & (HOOD is opened)
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER2 state • Start AUTOLOCKTIMER2 • Hazard relay Twice on(0.5s ON/0.5s OFF)

Autolock Timer3 Mode

Condition 1

State	Description
Initial Condition	ARM state
Event	• Tx Tailgate Unlock
Action	• The state goes to AUTOLOCK TIMER3 state • Start AUTOLOCK TIMER3 • Hazard relay Twice on(0.5s ON/0.5s OFF)

Condition 2

State	Description
Initial Condition	AutoLockTimer3 state

Event	• Tx Tailgate Unlock
Action	• Restart AUTOLOCK TIMER3 state

Condition 3

State	Description
Initial Condition	ARMWAIT state
Event	• Tx Tailgate Unlock
Action	• The state goes to AUTOLOCK TIMER3 state • Start AUTOLOCK TIMER3 • Hazard relay Twice on(0.5s ON/0.5s OFF)

Prearm Mode

Condition 1

State	Description
Initial Condition	AUTOLOCKTIMER2 state
Event	• AUTOLOCK & Locked confirmed • Tx Lock & locked confirmed • Driver door key lock SW ON & Locked confirmed (user select option : enable)
Action	• The state goes to PRearm state

Condition 2

State	Description
Initial Condition	Disarm state & IGN KEY OUT
Event	• ((4Door Not Closed = ON or Tailgate SW = Open or (Hood SW = ON)) & Tx Lock & Locked confirmed • ((4Door Not Closed = ON or Tailgate SW = Open or (Hood SW = ON)) & driver door key lock SW ON on & Locked confirmed (user select option : enable)
Action	• The state goes to PRearm state

Condition 3

State	Description
Initial Condition	Alarm state & IGN KEY OUT (Hood SW ON or Tailgate unlock SW ON or any door open)
Event	• Tx Lock & Locked confirmed • Driver door key lock SW ON & Locked confirmed (user select option : enable)
Action	• The state goes to PRearm state • Start inhibit relay off • Horn relay off • Hazard relay OFF

Condition 4

State	Description
Initial Condition	AUTOLOCKTIMER3 state
Event	• Expire Auto Lock Timer3 • Tailgate open
Action	• The state goes to PRearm state.

Reset

Condition 1

State	Description

Initial Condition	During Alarm, Rearm
Event	• TAKING THE BATTERY OUT then take on.
Action	• The state goes to Alarm mode • Horn relay 1 Times on • Start inhibitor relay ON

Condition 2

State	Description
Initial Condition	ARM state
Event	• TAKING THE BATTERY OUT Then reconnecting
Action	• The state goes to ARM mode

Condition 3

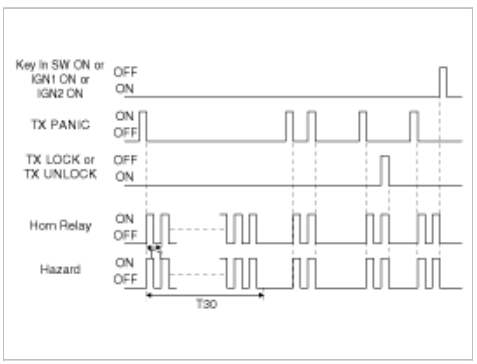
State	Description
Initial Condition	Other state (Except ARM, Alarm, Rearm state)
Event	• TAKING THE BATTERY OUT Then reconnecting
Action	• The state goes to Disarm mode

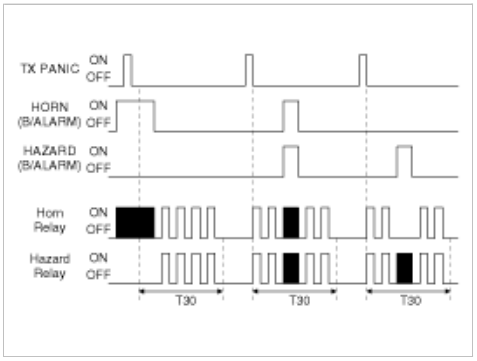
Panic Alarm

This is a function of panic alarm in vehicles using Horn relay and Hazard relay.
On condition of Key In SW OFF, IGN1 OFF, IGN2 OFF operation is started when inputting PANIC of Tx and stopped on condition of situations below.

1. When inputting TX LOCK
2. When inputting TX UNLOCK
3. When inputting PANIC
4. When inputting TX tailgate UNLOCK
5. When inputting Key In SW ON or IGN1 ON or IGN2 ON
6. After finishing PANIC alarm operation
7. When entering the ARM mode
8. When Driver door key unlock SW is ON
9. When Assist door Key Unlock SW is ON
10. When Driver door Key Lock SW is ON
11. When Assist door Key Lock SW is ON

PANIC ALARM operates regardless of Burglar alarm mode but stops when entering the ARM mode and is performed even in the alarm mode by Burglar alarm.
HORN and HAZARD operations by ANTITHEFT function have priority to PANIC ALARM and Horn relay and Hazard relay should be OFF during the break time of 10 sec during the alarm by ANTITHEFT.

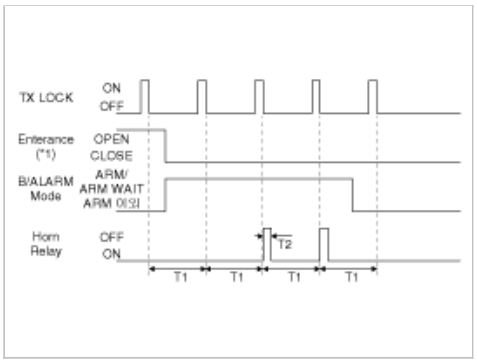




T1 : 0.9 ± 0.1sec, T30 : 27 ± 3sec

Horn Answer Back

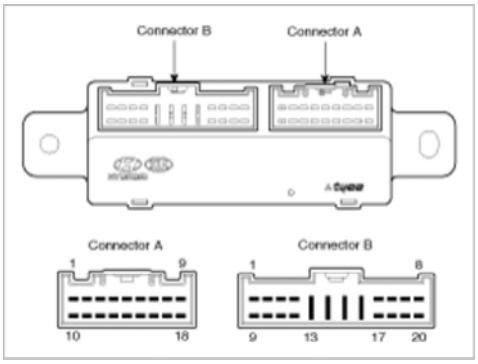
1. HORN OUTPUT is kept pace when operating HAZARD if ARM WAIT condition is maintained by TX LOCK within 4sec after entering ARM WAIT by TX LOCK.
2. HORN OUTPUT is kept pace when operating HAZARD of ARM is maintained by TX LOCK within 4sec after inputting TX LOCK on condition of ARM.
3. Horn relay will not be outputted in case that ARMWAIT or ARM mode is cancelled during T1.
4. Horn relay will be outputted though different TX LOCK which is registered during T1 is received.



*1 OPEN
1) DRV DR SW or AST DR SW or RL DR SW or RR DR SW OPEN
2) Tailgate Unlock SW ON
3) Hood SW OPEN
When one of 1), 2), 3)
CLOSE :
1) DRV DR SW and AST DR SW and RL DR SW and RR DR SW CLOSE
2) Tailgate Unlock SW OFF
3) Hood SW CLOSE
When satisfied all of 1), 2), 3) condition

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

Inspection



Burglar Alarm Horn Relay

Check for continuity between the terminals.

1. There should be continuity between the No.8 and No.18 terminals when power and ground are connected to the No.6 and

No.19 in the ICM-B.

2. There should be no continuity between the No.8 and No.18 terminals when power is disconnected.

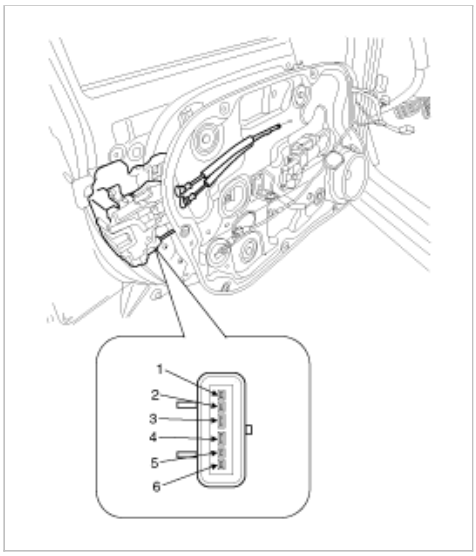
Burglar Alarm Relay

Check for continuity between the terminals.

1. There should be continuity between the No.3 and No.10 terminals when power and ground are connected to the No.1 and No.11 terminals in the ICM-A.
2. There should be no continuity between the No.3 and No.10 terminals when power is disconnected.

Front Door Lock Actuator

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



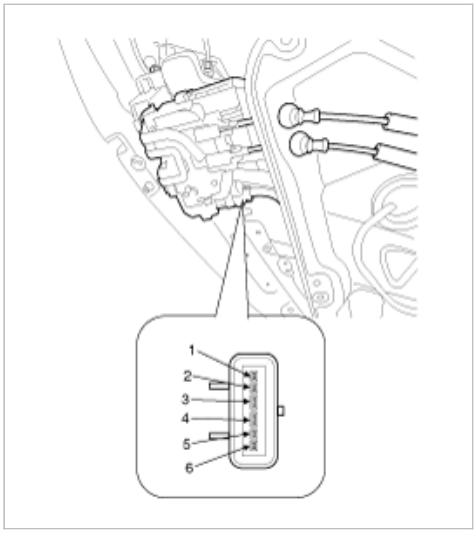
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

[Central Lock]

Position \ Terminal		4	3
Front left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		3	4
Front right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Rear Door Lock Actuator

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



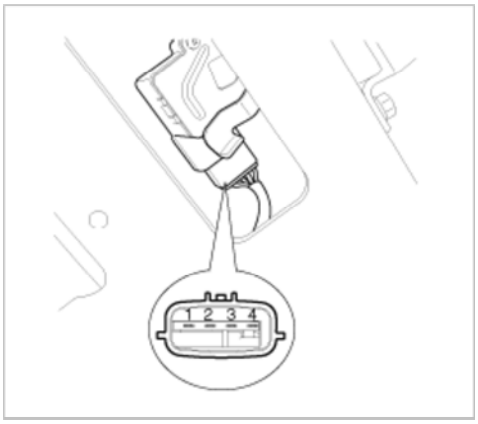
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

[Central Lock]

Position \ Terminal		4	3
Rear left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		3	4
Rear right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Tailgate Lock Actuator Inspection

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

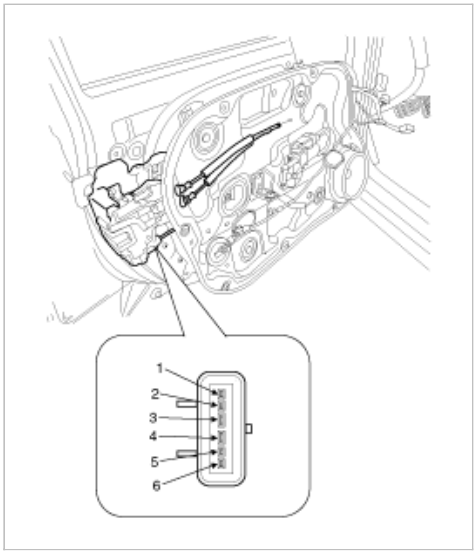


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

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



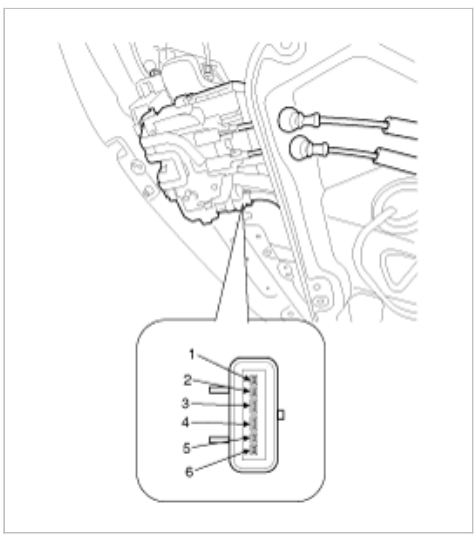
4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

[CENTRAL LOCK]

Position \ Terminal		2	5	1
Front left	Clockwise	○——	——○	
	Counter-clockwise		○——	——○
Position \ Terminal		**5**	**2**	**6**
Front right	Clockwise	○——	——○	
	Counter-clockwise		○——	——○

Rear Door Lock Switch

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



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

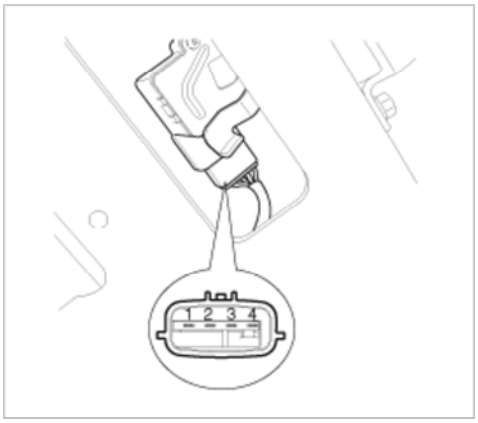
[CENTRAL LOCK]

Position \ Terminal			5	6
Central door lock	Rear left	Lock		
		Unlock	○———	———○

Position \ Terminal			2	1
Central door lock	Rear right	Lock		
		Unlock	○———	———○

Tailgate Switch

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

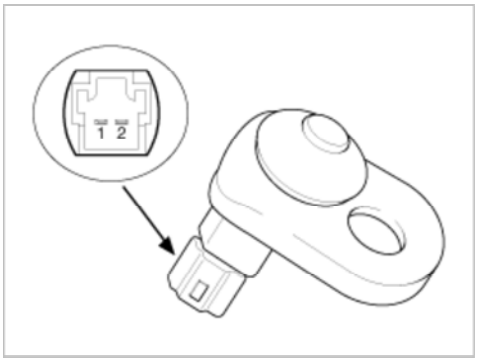


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	2
Lock		
Unlock	○———	———○

Door Switch

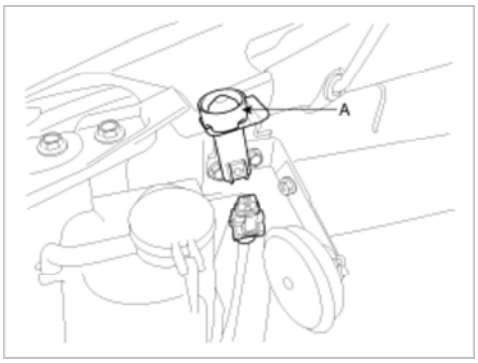
Remove the door switch and check for continuity between the terminals.



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

Hood Switch

1. Disconnect the connector from the hood switch (A).

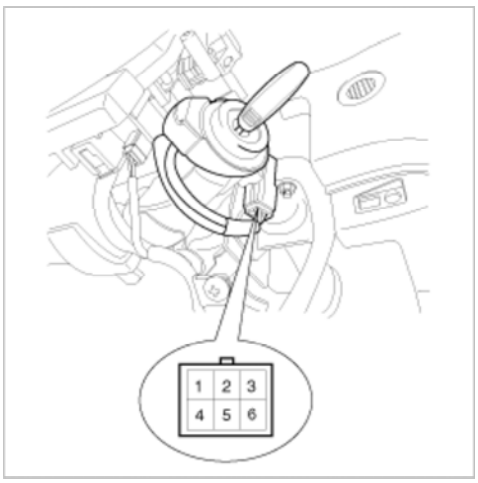


2. Check for continuity between the terminals and ground according to the table.

Terminal / Position	1	2
Hood open (Free)	○	○
Hood close (Push)		

Key In Switch

1. Remove the crash pad lower panel. (Refer to Body group-Crash pad)
2. Disconnect the 6P connector from the key warning switch.

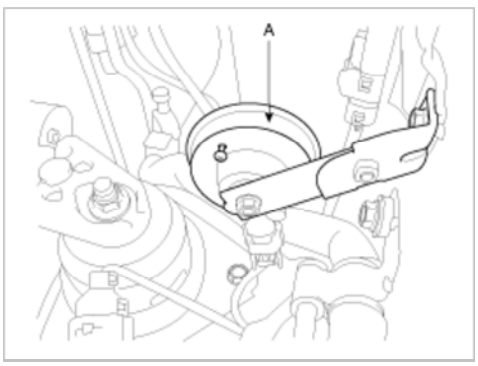


3. Check for continuity between the terminals in each position according to the table.

Terminal / Key position	2	4
Insert	○	○
Removal		

Burglar Horn

1. Remove the burglar horn(A) after removing 1 bolt and disconnect the 2P connector from the burglar horn.

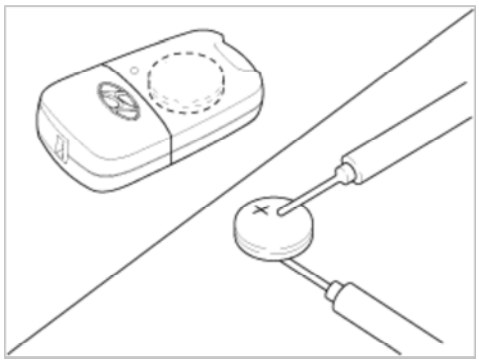


2. Test the burglar horn by connecting battery power to the terminal 1 and ground the terminal 2.
3. The burglar horn should make a sound. If the burglar horn fails to make a sound replace it.

Inspection

1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery and check voltage if the red light doesn't flicker.

Standard voltage : 3V

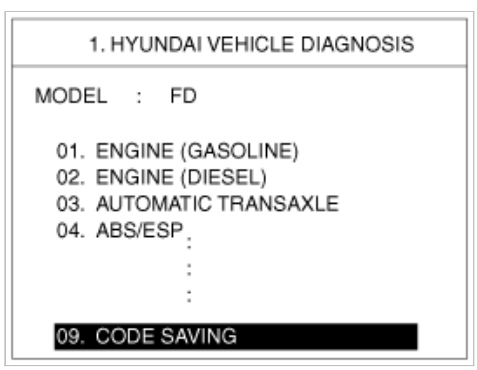


3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter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

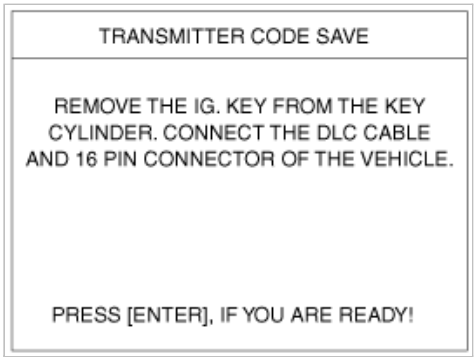
Transmitter Code Registration

1. Connect the DLC cable of scan tool to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on scan tool.

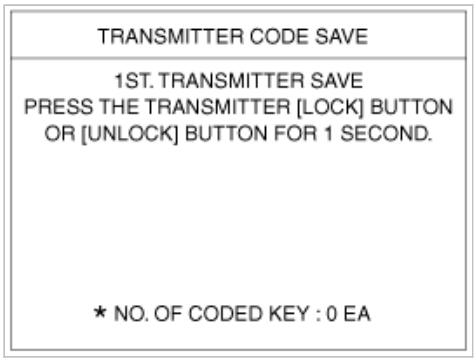
2. Select the vehicle model and then do "CODE SAVING".

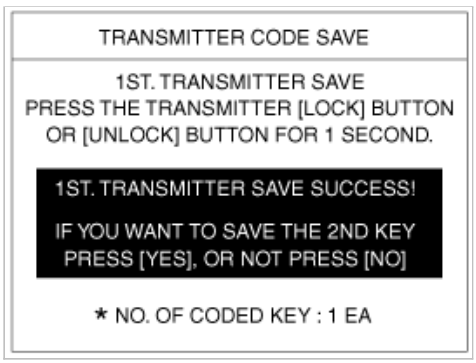


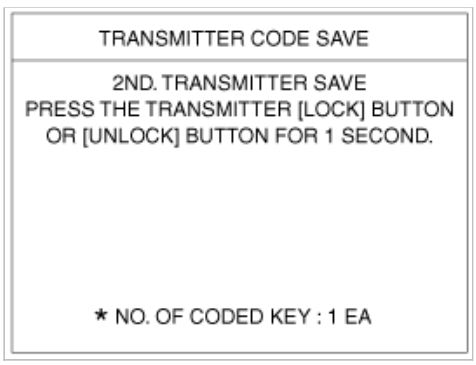
3. After selecting "CODE SAVING" menu, push "ENTER" key, then the screen will be shown as below.



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 4 and then code saving is completed.

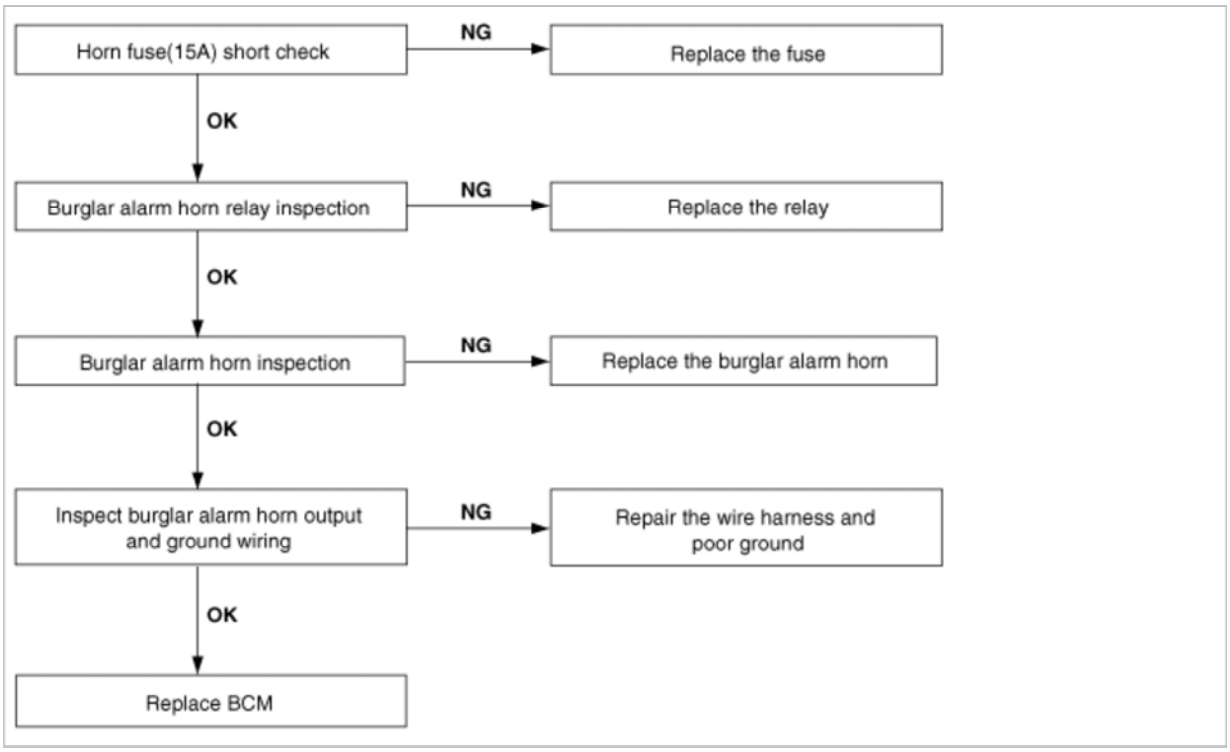




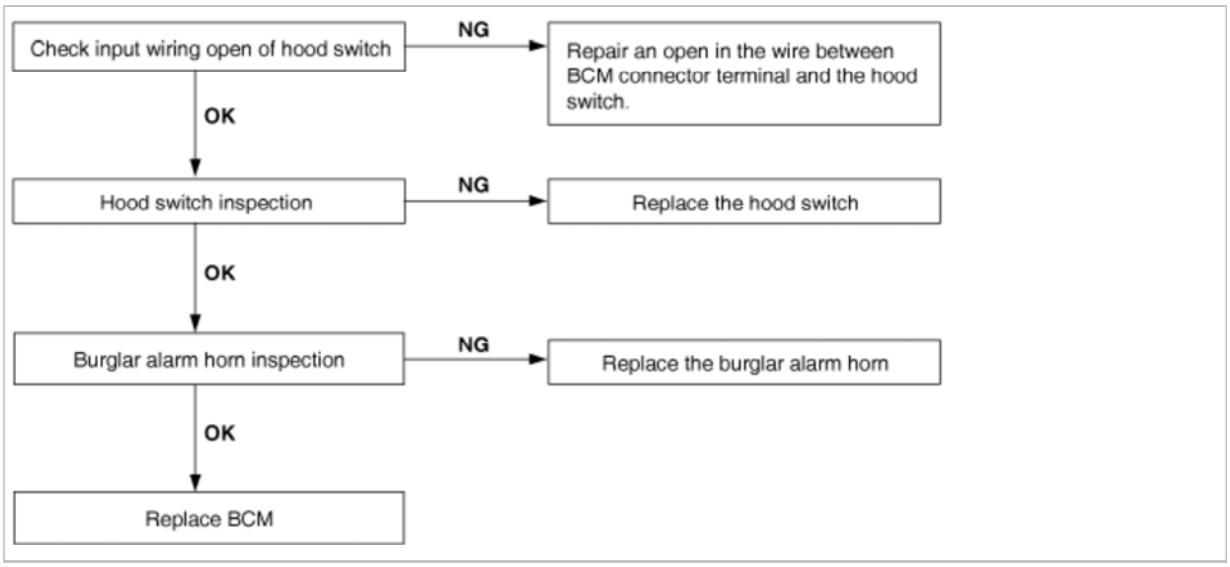


Troubleshooting

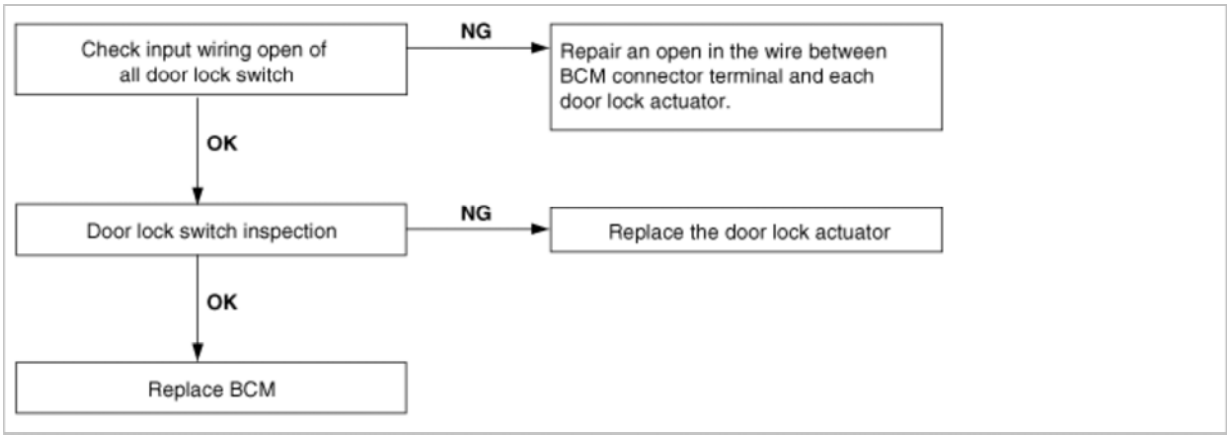
1. Alarm does not work. (Hazard lamps work)



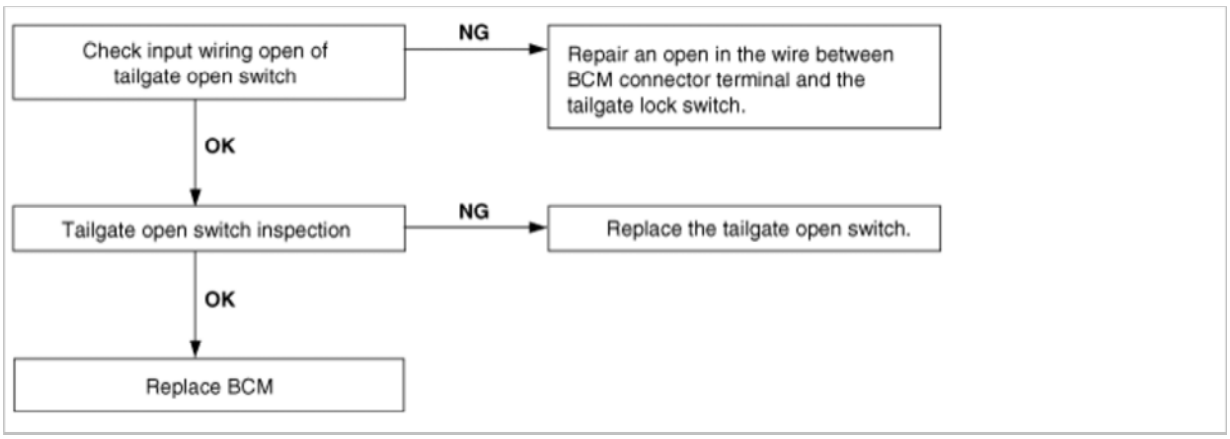
2. When hood is opened in ARM mode, burglar alarm does not work.



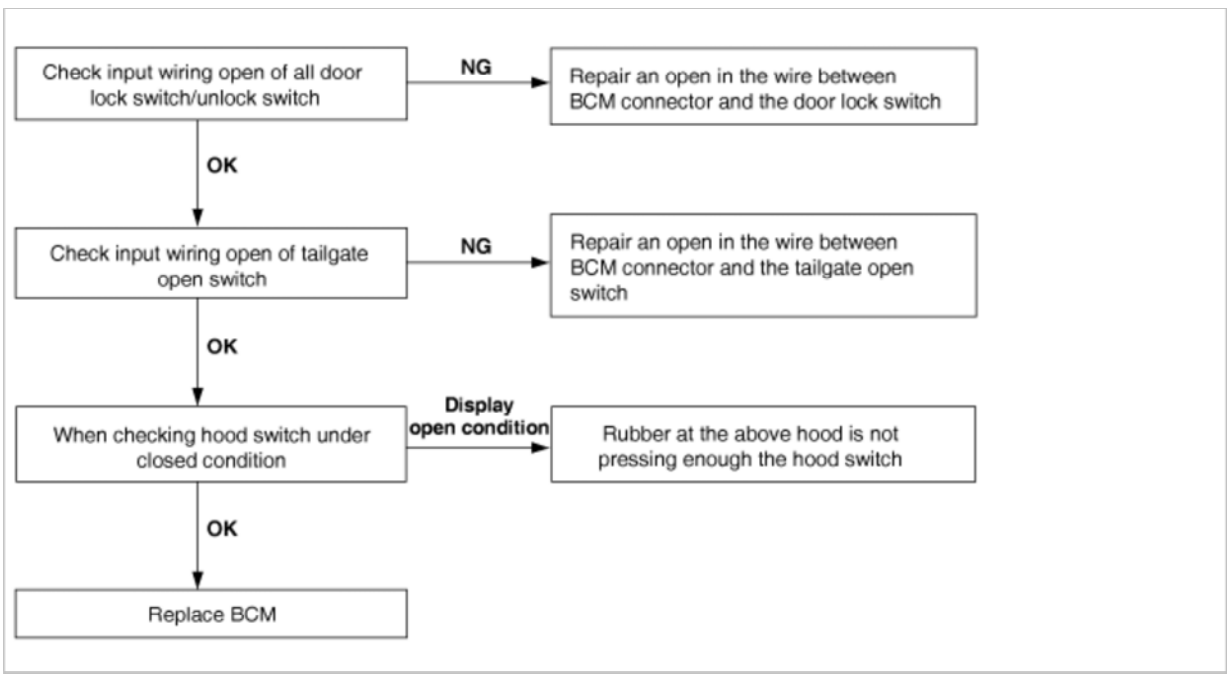
3. When door is opened, burglar alarm does not work. (If tailgate and hood is opened, alarm works)



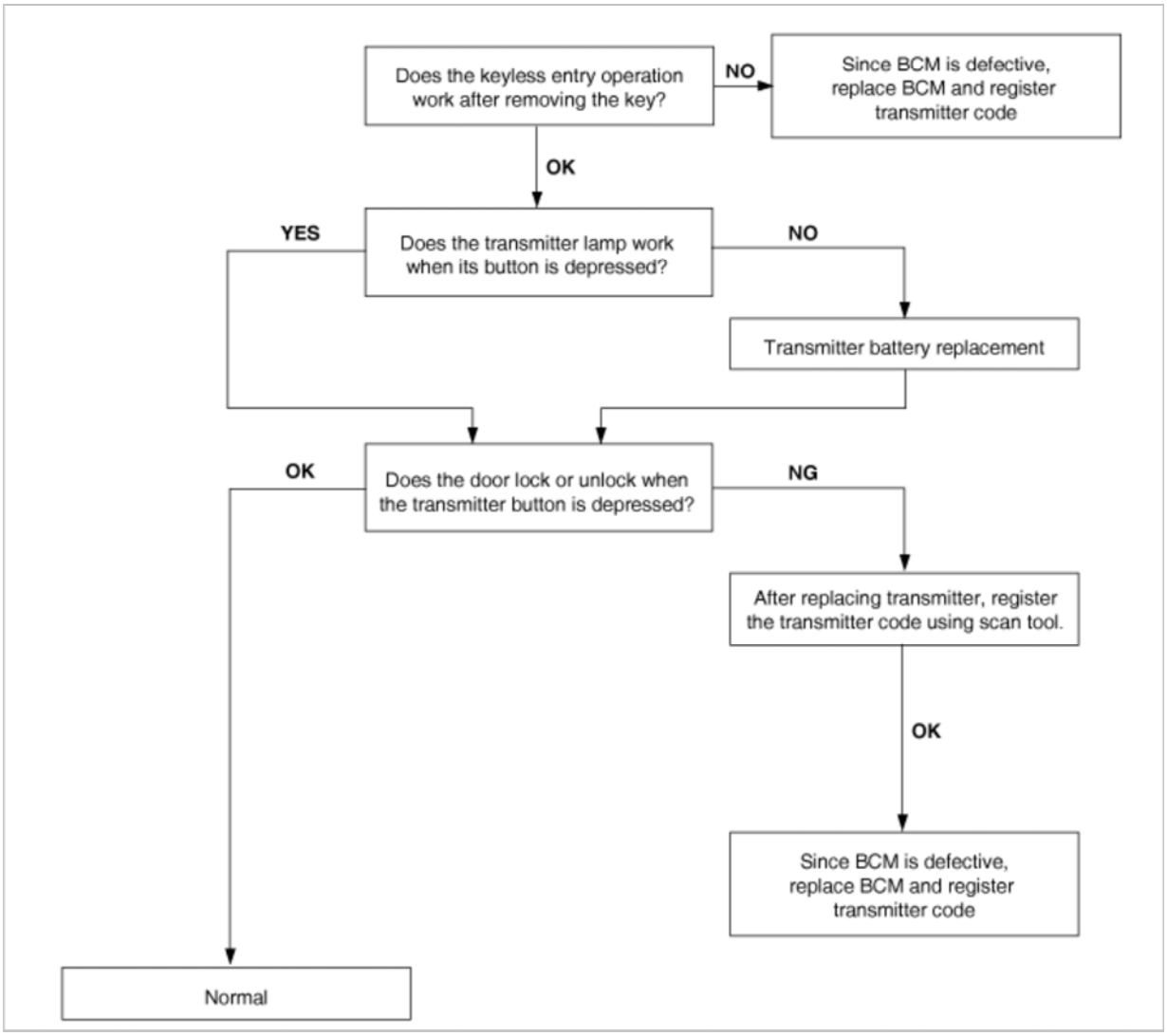
4. When tailgate is opened in ARM mode, burglar alarm does not work.



5. When the vehicle is locked by the transmitter, central door lock function works but hazard lamp doesn't blink.



6. Central door lock function works, but keyless entry system does not work.



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

Specifications

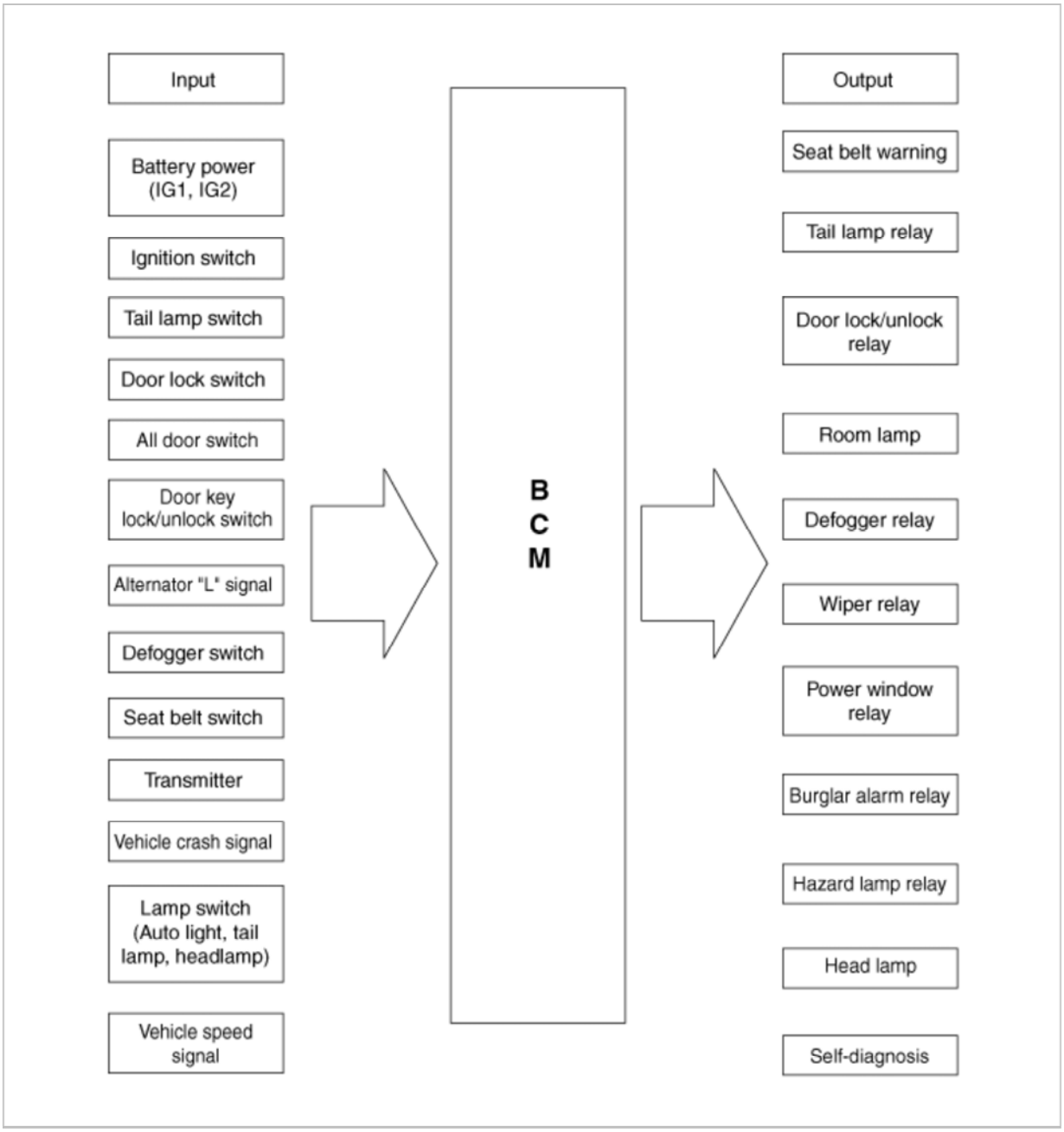
Item	Requirement	Remark
Rated voltage	DC 12V	Shall activate normally in these range.
Operating voltage range	DC 9 ~ 16V	
Operating temperature range	-30°C ~ +80°C	
Storage temperature range	-40°C ~ +85°C	
Max humidity in use	95%	
High voltage resistance	24V	
Insulation resistance	100Mohm or more (measured with 500V MEGGER)	Specify as well as parts that insulation like PCB, moisture-proof COATING is required
Dark Current	Max 4mA (KEYLESS) Max 3mA (NON-KEYLESS)	Measure when the state, all output loads are OFF and there are no Input SW(including TX operation) changes, continues 2sec.
Voltage drop	1.2V or less	Output terminals for Tail Lamp Relay, Power Window Relay, Safety Power Window, Burglar Alarm Relay shall be 2.0V or less

Rated Load

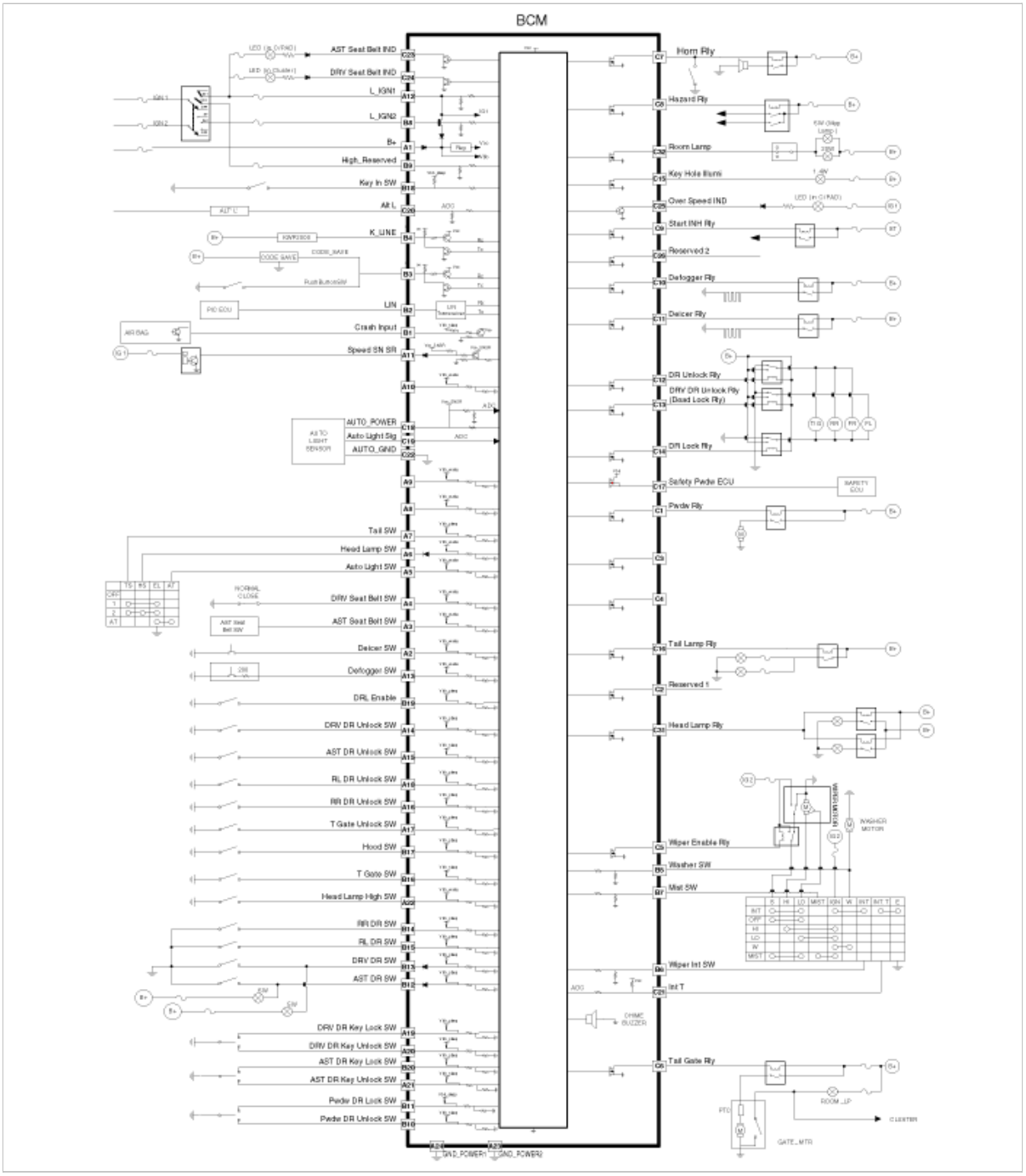
Item	Rated load
Room lamp	DC 12V 25W (Lamp load)
Key hole illumination	DC 12V 1.4W (Lamp load)
Seat belt indicator (Driver / Passenger)	DC 12V 1.2W (LED load)
Hazard relay	DC 12V 200mA (Inductive load)
Wiper relay	DC 12V 200mA (Inductive load)
Defogger relay	DC 12V 200mA (Inductive load)
Tail lamp relay	DC 12V 200mA (Inductive load)
Head lamp relay	DC 12V 200mA (Inductive load)
Front deicer relay	DC 12V 200mA (Inductive load)
Front fog relay	DC 12V 200mA (Inductive load)
Horn relay	DC 12V 200mA (Inductive load)
Start inhibit relay	DC 12V 200mA (Inductive load)
Central door unlock relay	DC 12V 200mA (Inductive load)
Central door lock relay	DC 12V 200mA (Inductive load)
Power window relay	DC 12V 200mA (Inductive load)
Tailgate unlock relay	DC 12V 200mA (Inductive load)

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

Circuit Diagram



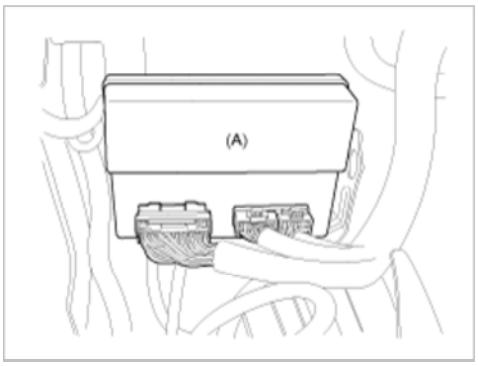
System Diagram



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

Description

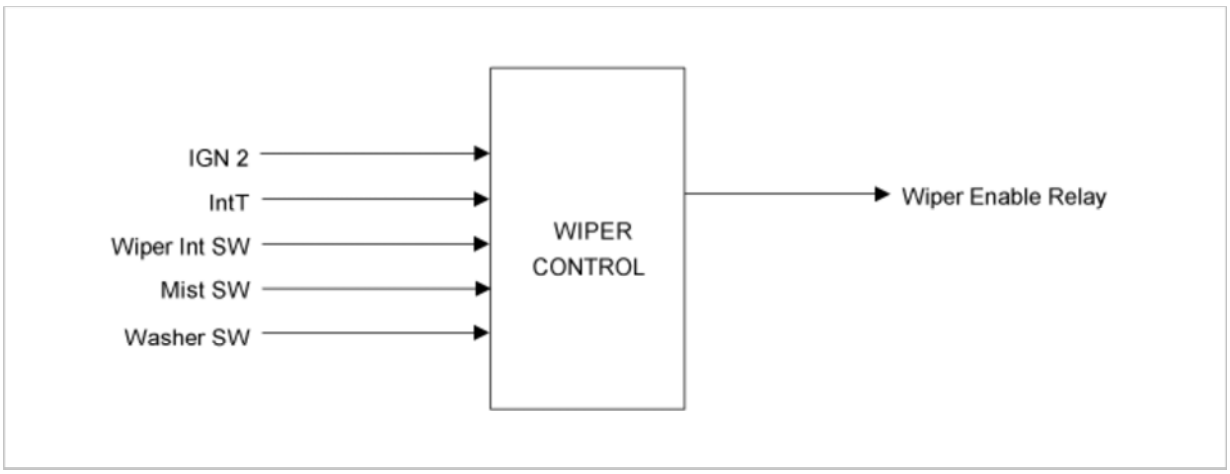
Body control module (A) receives various input switch signals controlling time and alarm functions for tail lamp, rear fog lamp, wiper control, buzzer warning, front deicer timer, tail lamp auto cut, central door lock, seat belt warning, key operated warning, over speed warning, ignition key hole illumination, room lamp control, power window timer, keyless entry control, burglar alarm control, crash door unlock, key reminder.	



Function

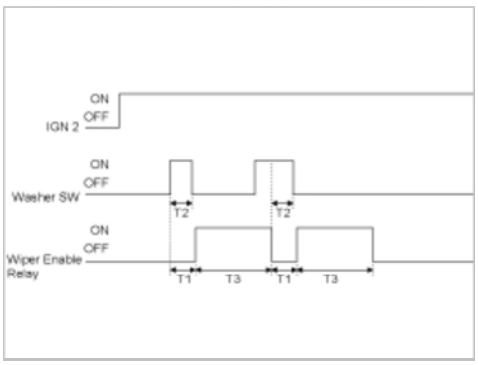
Wiper Control

1. WIPER DATA FLOW



2. WASHER INTERLOCKING WIPER

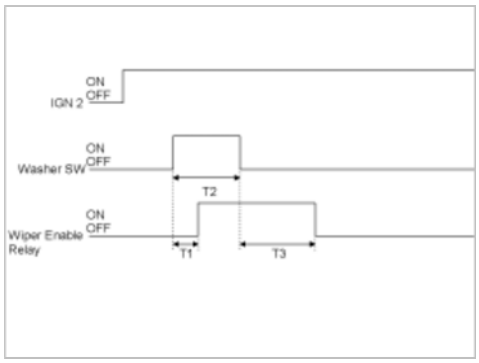
Turn Wiper Enable Relay ON after T1 when turning Washer SW ON at the status of IGN2 ON and if the input of Washer SW is between 0.06 and 0.2sec, turn the output of Wiper Enable Relay OFF after T3.But, ignore the input of Washer SW occurred while Wiper Enable Relay is being operated and accept it from the input of Washer SW after operating Wiper Enable Relay.



T1 : 0.2 ± 0.03sec, T2 : 0.06 ~ 0.2sec, T3 : 0.7 ± 0.1sec

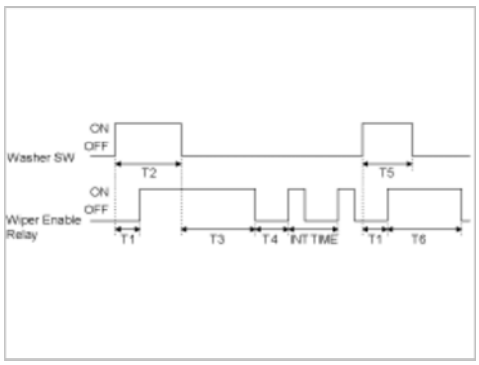
T3 = 0 (In case of T2 ≤ 0.06 sec.)

(1) Turn Wiper Enable Relay ON after T1 when turning Washer SW ON at the status of IGN2 ON and if the input of Washer SW is more than 0.2sec, turn the output of Wiper Enable Relay OFF for 2.5~3.8sec after turning Washer SW OFF. But, ignore the input of Washer SW occurred while Wiper Enable Relay is being operated and accept it from the input of Washer SW after operating Wiper Enable Relay.



T1 : 0.3 ± 0.03s, T2 : over 0.6s, T3 : 2.5 ~ 3.8s

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

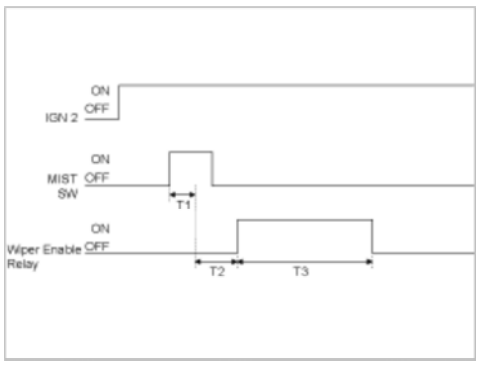


T1 : 0.3 ± 0.03s, T2 : over 0.6s,
T3 : 2.5 ~ 3.8s, T4 : INT TIME - 0.7s,
T5 : 0.2 ~ 0.6s, T6 : 0.7 ± 0.1s

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

3. MIST INTERLOCKING WIPER

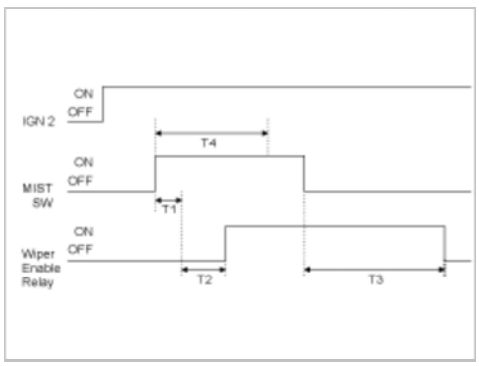
(1) Turn the output of Wiper Enable Relay for 700ms when turning Mist SW ON at the status of IGN2 ON.



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

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

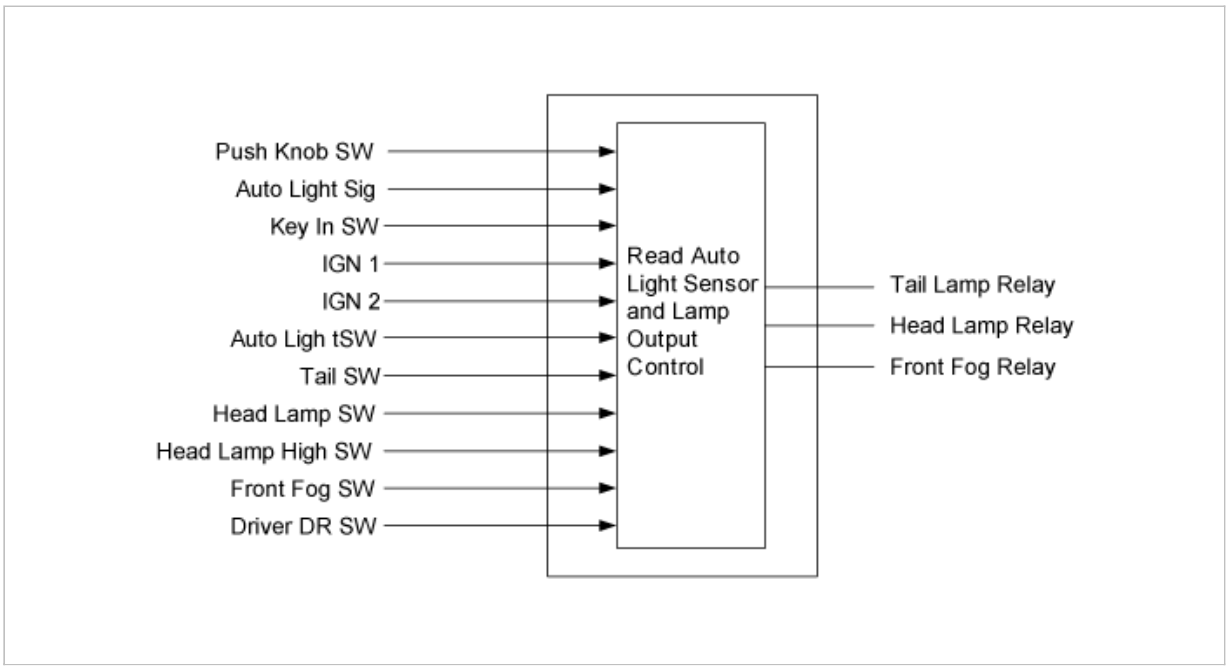
(3) Ignore the input of Mist SW while operating Wiper by INT Wiper, WASHER Interlocking Wiper.



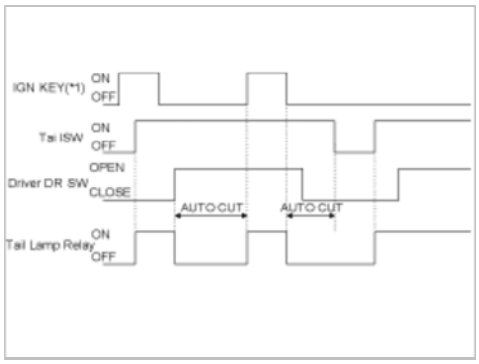
T1 : Min 60 ms, T2 : Max 100ms,
T3 : 700 ± 100ms, T4 : 700ms

Lamp Control

1. EXTERIOR LAMP CONTROL DATA FLOW



2. TAIL LAMP AUTO CUT
   (1) Turn IGN KEY OFF when turning Tail SW ON after turning IGN KEY ON and turn Tail Lamp Relay OFF (automatic blackout) when opening Driver door SW.
   (2) Also, turn Tail Lamp Relay OFF (automatic blackout) even though IGN KEY is turned OFF after opening Driver door SW at the condition that IGN KEY is ON.
   (3) When turning Tail SW ON again from OFF after the automatic blackout, Tail Lamp Relay will be turned ON and AUTO CUT function will be cancelled.
   (4) When turning IGN KEY ON after the automatic blackout, Tail Lamp Relay will be turned ON and AUTO CUT function will be cancelled.
   (5) AUTO CUT will be kept when removing or installing B+ at the status of AUTO CUT.
   (6) Tail Lamp Relay will be kept turning OFF though Driver door SW is closed from opened at the status of AUTO CUT.



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

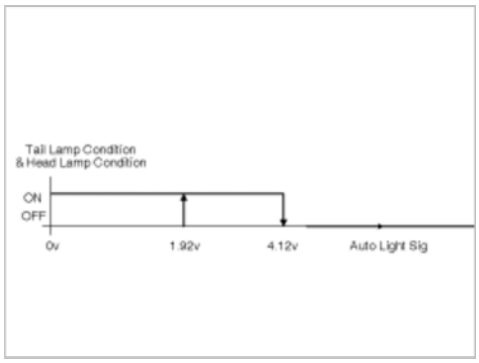
3. AUTO LIGHT CONTROL
   (1) If the service voltage of Auto Light SENSOR is less than 4v or more than 6v at the status of IGN1 ON, it means it has defects. Always turn Tail Lamp Relay and Head Lamp Relay ON regardless of the value of SENSOR when turning Auto Light SW ON with trouble. The FILTERING time for defects and recovery of the service voltage is 300msec each.
   (2) If the value of Auto Light Signal is input value of LIGHT ON at the status of IGN1 ON and Auto Light SW ON, turn the LIGHT ON in 2.5sec ± 100msec.
   (3) If the value of Auto Light Signal is input value of LIGHT OFF at the status of LIGHT ON, turn the LIGHT OFF in 2.5sec ± 100msec.

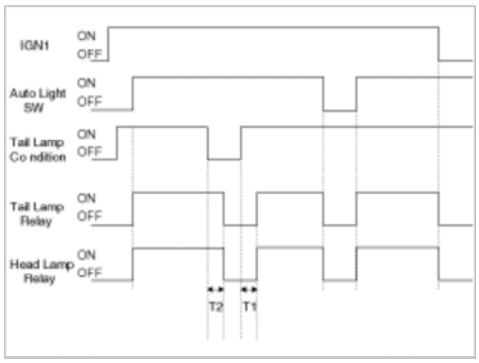
(4) If the value of Auto Light Signal is input value of Tail Lamp ON, turn Tail Lamp Relay ON only and if it is input value of Head Lamp ON, turn Tail Lamp Relay and Head Lamp Relay ON.

(5) Turn the proper LIGHT ON immediately when turning Auto Light SW ON in the condition of LIGHT ON and turn the LIGHT OFF when turning Auto Light SW OFF.

(6) Follow the table below for each value of LIGHT ON for Auto Light Signal.

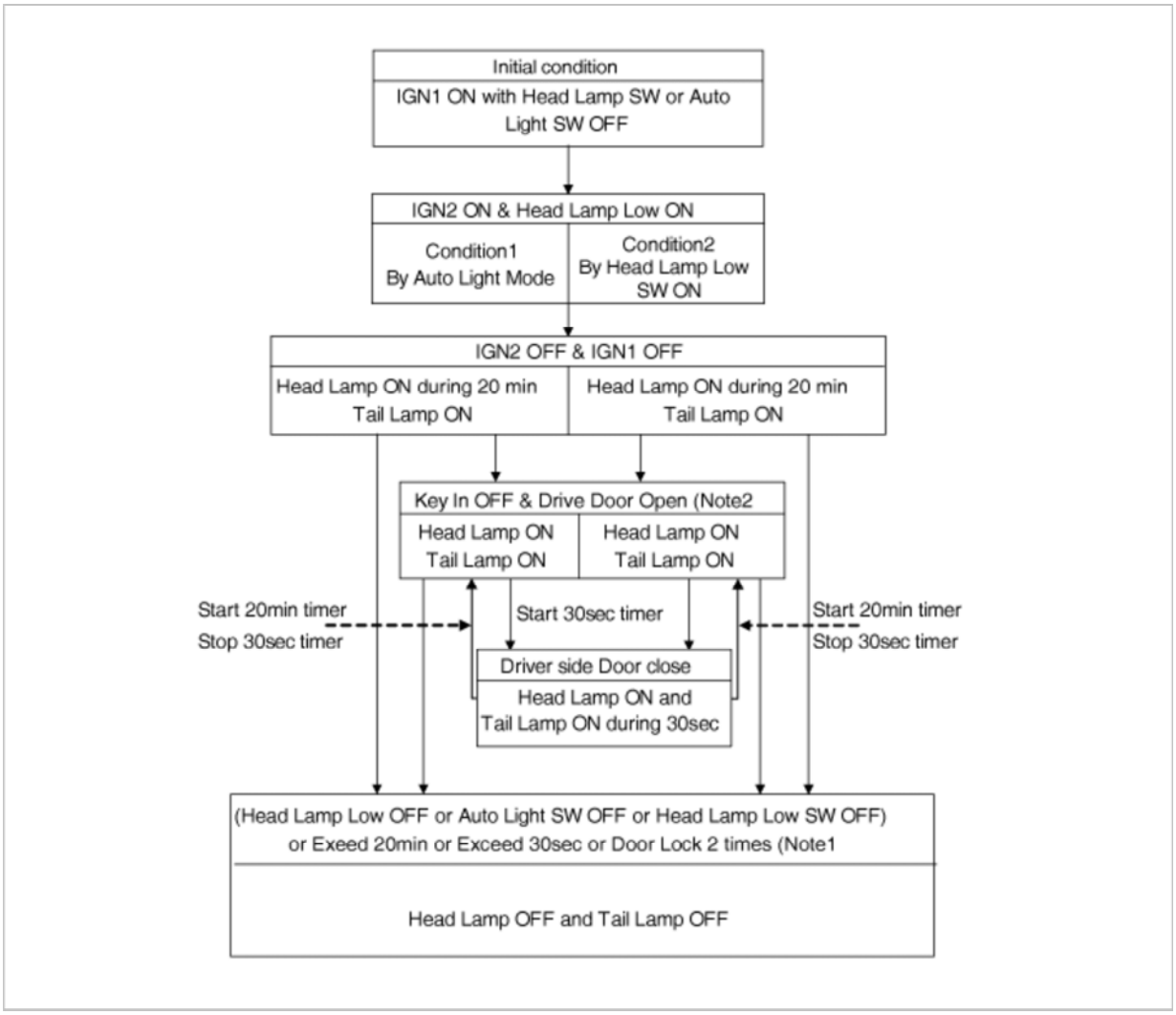
	Tail Lamp	Head Lamp
ON	1.92±0.05V	1.92±0.05V
OFF	4.12±0.05V	4.12±0.05V





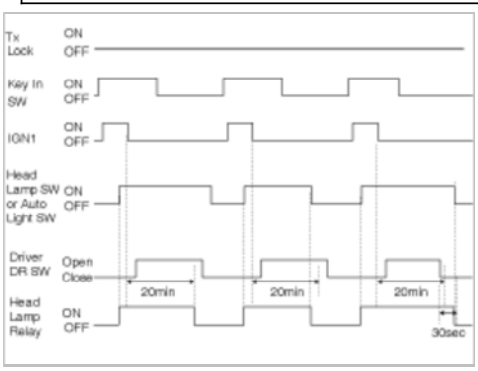
T1 : 12 ± 0.2s, T2 : 12 ± 0.2s

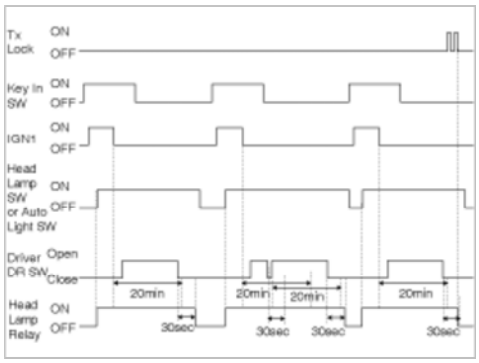
4. ESCORT



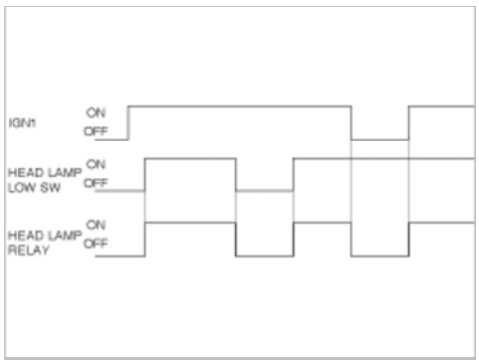
NOTE

1. Door Lock 2 times : Tx(Transmitter) Door Lock 2 times
2. When Open the Driver door, former 2 times lock counter is cleared, and Start new 2 times lock counting.
   During active the Escort function(counting 30sec), if Driver door is re-opened, re-start 20min counter and if Driver door is re-close, re-start 30sec counter.

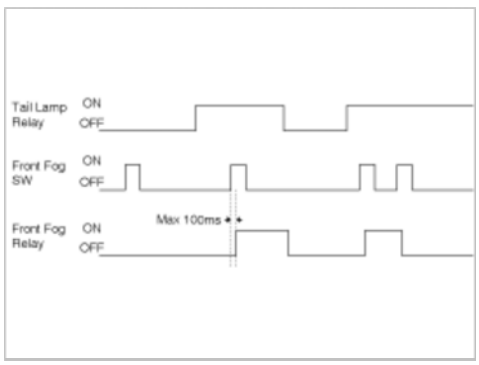




5. HEAD LAMP LOW
   (1) Turn Head Lamp Relay ON when turning Head Lamp SW ON while IGN1 is ON.
   (2) Turn Head Lamp Relay OFF if IGN1 OFF or Head Lamp SW is OFF.
   (3) Do not control things above if Head Lamp Relay can be controlled by Escort / Auto Light / DRL function.



6. FRONT FOG LAMP
   (1) Turn Front Fog Relay On when turning Front Fog SW ON while Tail Lamp Relay is ON.
   (2) Turn Front Fog Relay OFF when turning Front Fog SW ON while Front Fog Relay is ON.

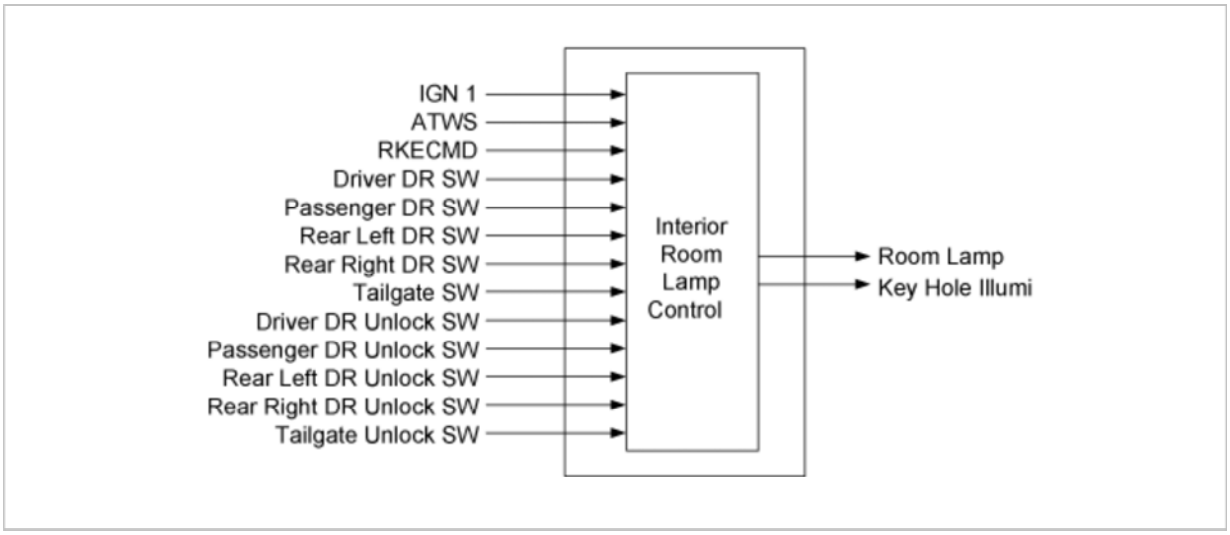


NOTE

Front Fog Lamp SW is Self-Return Type

Interior Room Lamp

1. INTERRIOR ROOM LAMP DATA FLOW



ATWS : Logic signal of ATWS
RKECMD : RKE LOCK/Unlock signal

2. ROOM LAMP DECAYING & KEYLESS UNLOCK TIMER
When removing or installing the Battery
(1) Start Room Lamp on the state of 20min, if the Door is Opened.
(2) Start Room Lamp when it is OFF if the Door is CLOSED.

3. ROOM LAMP OFF
(1) Condition 1

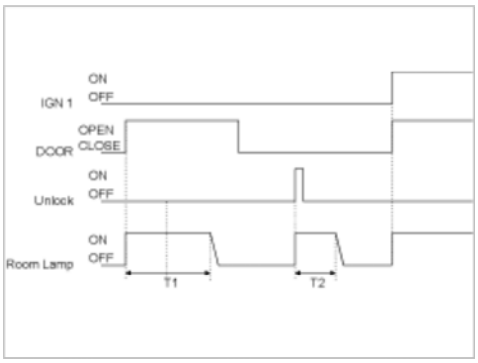
State	Description
Initial condition	Room Lamp OFF and Door CLOSE
Event	Unlock by TX(Transmitter)
Action	Room Lamp ON for 30± 3 sec.

(2) Condition 2

State	Description
Initial condition	Room Lamp OFF
Event	Any Door Open for over 0.1 sec. when ALL Doors are closed
Action	Room Lamp ON for 20 min

(3) Condition 3

State	Description
Initial condition	Room Lamp OFF and IGN1 OFF
Event	IGN1 ON and Door Open for over 0.1 sec.
Action	Room Lamp ON



T1 : 20 ± 1min, T2 :30 ± 3sec

4. ROOM LAMP ON FOR 30S

(1) Condition 1

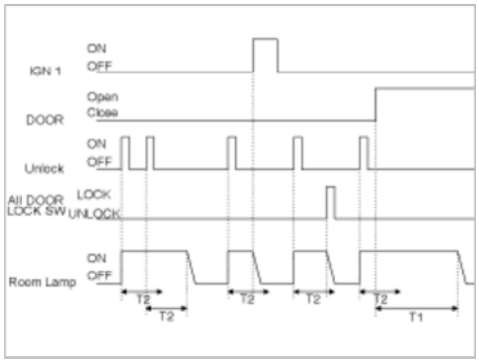
State	Description
Initial condition	Room Lamp ON for 30s and IGN1 OFF
Event	Door Open for over 0.1 sec. when ALL Doors are closed.
Action	Room Lamp ON for 20min

(2) Condition 2

State	Description
Initial condition	Room Lamp ON for 30s and IGN1 OFF
Event	Unlock by TX
Action	Room Lamp ON for 30s

(3) Condition 3

State	Description
Initial condition	Room Lamp ON for 30s and IGN1 OFF
Event	IGN1 ON, after 30sec, entering ARM state or ALL Door Lock
Action	The state go to Room Lamp DECAYING state Room Lamp decaying for 2 ± 0.2 sec and OFF



T1 : 20 ± 1min, T2 : 30 ± 3sec

5. ROOM LAMP ON FOR 20MIN

(1) Condition 1

State	Description
Initial condition	Room Lamp ON for 20min and IGN1 OFF
Event	IGN1 ON
Action	Room Lamp ON

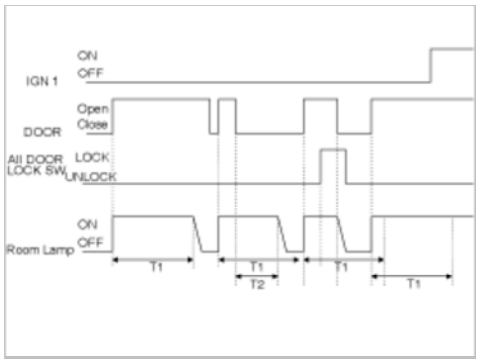
(2) Condition 2

State	Description
Initial condition	Room Lamp ON for 20min and IGN1 OFF
Event	Door CLOSE and ALL Door Lock Or after 20min
Action	Room Lamp DECAYING for 2 ± 0.2 sec and OFF

(3) Condition 3

State	Description
Initial condition	Room Lamp ON for 20min and IGN1 OFF
Event	Door CLOSE

Action	Room Lamp ON for 30s



T1 :20 ± 1min, T2 : 30 ± 3sec

6. ROOM LAMP DECAYING

(1) Condition 1

State	Description
Initial condition	Room Lamp DECAYING and IGN1 OFF
Event	Door Open for over 0.1 sec. when All Doors are closed
Action	Room Lamp ON for 20min

(2) Condition 2

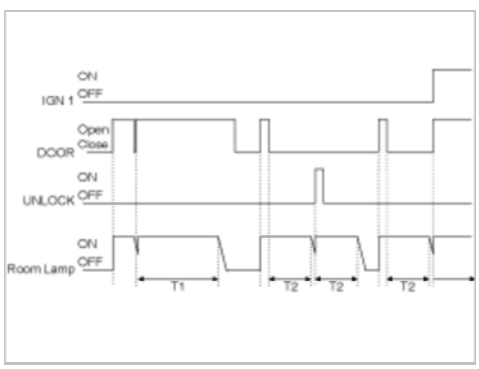
State	Description
Initial condition	Room Lamp DECAYING and IGN1 OFF and Door CLOSE
Event	Unlock by TX
Action	Room Lamp ON for 30s

(3) Condition 3

State	Description
Initial condition	Room Lamp DECAYING
Event	After decaying
Action	Room Lamp OFF

(4) Condition 4

State	Description
Initial condition	Room Lamp DECAYING
Event	IGN1 ON and Door Open for 0.1 sec.
Action	Room Lamp ON



T1 : 20 ± 1min, T2 : 30 ± 3sec.

7. ROOM LAMP ON

(1) Condition 1

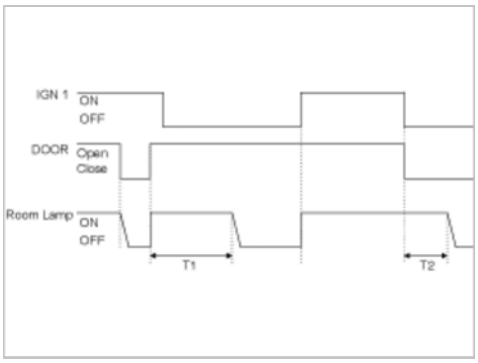
State	Description
Initial condition	Room Lamp ON and IGN1 ON and Door Open
Event	Door CLOSE
Action	Room Lamp DECAYING for 2 ± 0.2 sec. and OFF

(2) Condition 2

State	Description
Initial condition	Room Lamp ON and IGN1 ON and Door Open
Event	IGN1 OFF
Action	Room Lamp ON for 20min

(3) Condition 3

State	Description
Initial condition	Room Lamp ON and IGN1 ON and Door Open
Event	Door CLOSE and IGN1 OFF
Action	Room Lamp ON for 30s



T1 : 20 ± 1min, T2 : 30 ±3sec

NOTE

1. Room Lamp should not be flickered when turning IGN1 ON.
2. Exposure for the Room Lamp should be more than 32 steps.

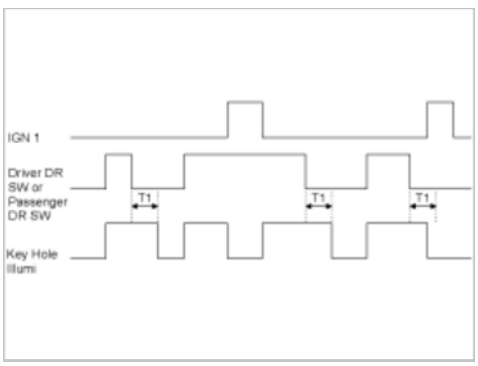
8. IGN KEY HOLE ILLUMINATION

(1) Turn Key Hole Illumination On when opening Driver door SW (Or Passenger Door SW) at the status of IGN1 OFF.

(2) Turn the Key Hole Illumination lamp ON for 30sec and then OFF when closing Driver Door SW (Or Passenger Door SW) at the condition of (1).

(3) Turn Key Hole Illumination OFF right after IGN1 or IGN2 turns ON during the operations of (1) and (2).

(4) However, turn Key Hole Illumination OFF immediately at Rearm, ARMWAIT and Alarm MODE.

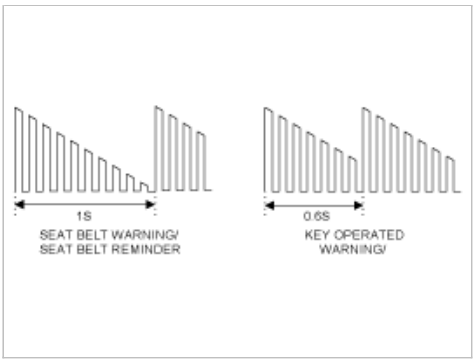


T1 : 30 ± 1sec

9. BUZZER CONTROL

(1) Specification of BUZZER SOUND

	Frequency	Frequency Duty	Cycle	Sound pressure	Remark
Seat Belt Warning/ Seat Belt Reminder	800Hz	50%	1.0s	70±10dB	Decreasing sound
Key Operated Warning	800Hz	50%	0.6s	70±10dB	Decreasing sound



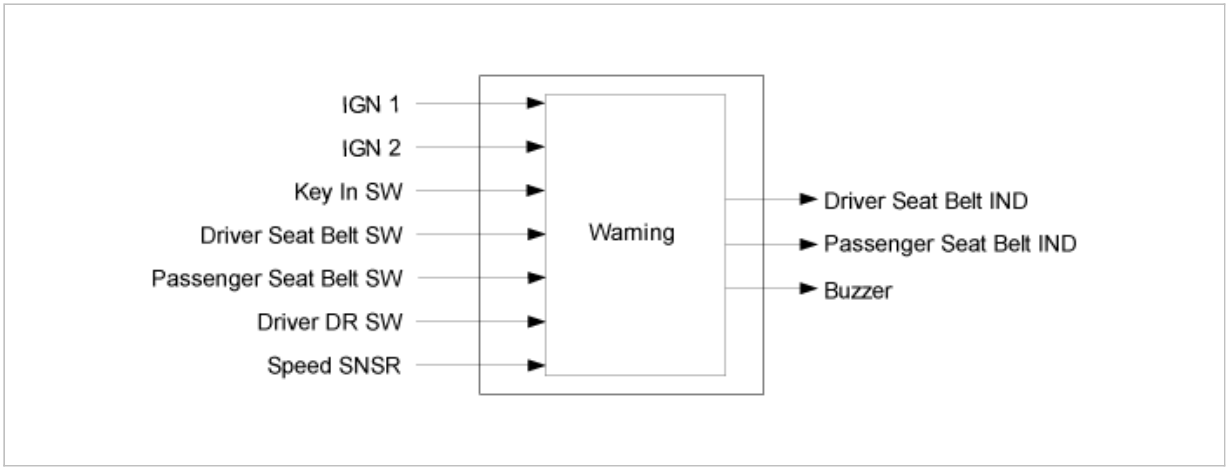
(2) Priority :
S/BELT WARNING/SEAT BELT REMINDER & KEY OPERATED WARNING

(3) Keep the output up to the OFF cycle when turning the output OFF.

(4) Measurement distance for sound pressure: 1.0 m

Warning Control

1. Warning Control DATA FLOW



2. SEAT BELT REMINDER

* Definition of terms

(1) Bulb check 6s driver indicator blinking :In case of IGN1 0 → 1, the indicator will be outputted.

(2) Bulb check 6s buzzer: In case of IGN1 0 → 1 when it is unbelted, the buzzer will be outputted. will be outputted.

(3) Normal 6s driver indicator blinking: In case of Belted → Unbelted at the status of IGN 1, the indicator will be outputted.

(4) Normal 6s buzzer: In case of Belted → Unbelted at the status of IGN 1, the buzzer will be outputted.

(5) ALT L 6s indicator blinking: In case of ALT L 0 → 1, the indicator will be outputted.

(6) ALT L 6s buzzer: In case of ALT L 0 → 1 when it is Unbelted, the buzzer will be outputted. Unbelted

**6s driver Indicator blinking : it flickers for 6sec with the cycle of 1sec.

From State Ign1 Off (Default State)

State	Description
Initial condition	IGN1 OFF

Event	Driver side seat belt is belted and IGN1 ON
Action	- Start Bulb check 6 seconds driver indicator blinking - The automaton state is changed to IGN1 ON DRIVER BELTED

State	Description
Initial condition	IGN1 OFF
Event	Driver side seat belt is unbelted and IGN1 ON
Action	- Start Bulb check 6 seconds driver indicator blinking - Start Bulb check 6 seconds buzzer warning - If ALT'L ON then start ALT L 6s indicator blinking & ALT L 6s buzzer - The automaton state is changed to IGN1 ON DRIVER UNBELTED

From State Ign1 On Driver Belted

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	IGN1 OFF
Action	- Stop Bulb check 6 seconds driver indicator blinking - Stop ALT L 6 seconds driver indicator blinking - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	Driver side seat belt is unbelted
Action	- Start Normal 6 seconds driver indicator blinking - Start Normal 6 seconds buzzer warning - The automaton state is changed to IGN1 ON DRIVER UNBELTED

State	Description
Initial condition	IGN1 ON DRIVER BELTED
Event	ALT L 0 -> 1
Action	- Start ALT L6 seconds driver indicator blinking

From State IGN1 On Driver Unbelted

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	IGN1 OFF
Action	- Stop Bulb check 6 seconds driver indicator blinking - Stop Normal 6 seconds driver indicator blinking - Stop ALT L 6 seconds driver indicator blinking - Stop ALT L 6 seconds buzzer warning - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	Driver side seat belt is belted
Action	- Stop Normal 6 seconds driver indicator blinking - Stop ALL 6 seconds buzzer warning - The automaton state is changed to IGN1 ON DRIVER BELTED

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED

Event	Vehicle Speed >= 10km/h
Action	- Start buzzer and driver indicator Pattern (10 times (6sec ON/24sec OFF) + 6sec ON) - The automaton state is changed to PATTERN

State	Description
Initial condition	IGN1 ON DRIVER UNBELTED
Event	ALT'L 0->1
Action	- Start ALT L 6seconds driver indicator blinking & ALT L 6seconds buzzer warning

From State Pattern

State	Description
Initial condition	PATTERN
Event	IGN1 OFF
Action	- Stop Buzzer and driver indicator Pattern - Stop ALL 6s driver indicator blinking - Stop ALL 6s buzzer warning - The automaton state is changed to IGN1 OFF

State	Description
Initial condition	PATTERN
Event	Driver side seat belt is belted
Action	- Stop Buzzer and driver indicator Pattern - Stop Normal 6s driver indicator blinking - Stop ALL 6s buzzer warning - The automaton state is changed to IGN1 ON DRIVER BELTED

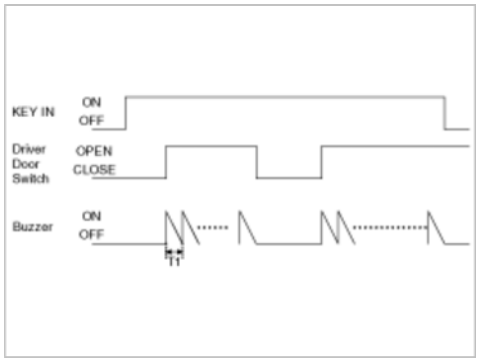
State	Description
Initial condition	PATTERN
Event	Vehicle Speed <= 5km/h
Action	- Stop Buzzer and driver indicator Pattern - If 6s buzzer period, after 6s warning stop Pattern - The automaton state is changed to IGN1 ON DRIVER UNBELTED

3. KEY OPERATED WARNING

(1) When Driver Door SW is ON at the status of KEY IN ON, Buzzer will be outputted per 0.6sec continuously.

(2) If KEY IN turns OFF or Driver Door SW is CLOSED during Buzzer output, the output will turn OFF.

(3) When IGN1 turns ON while outputting, the output will be stopped.



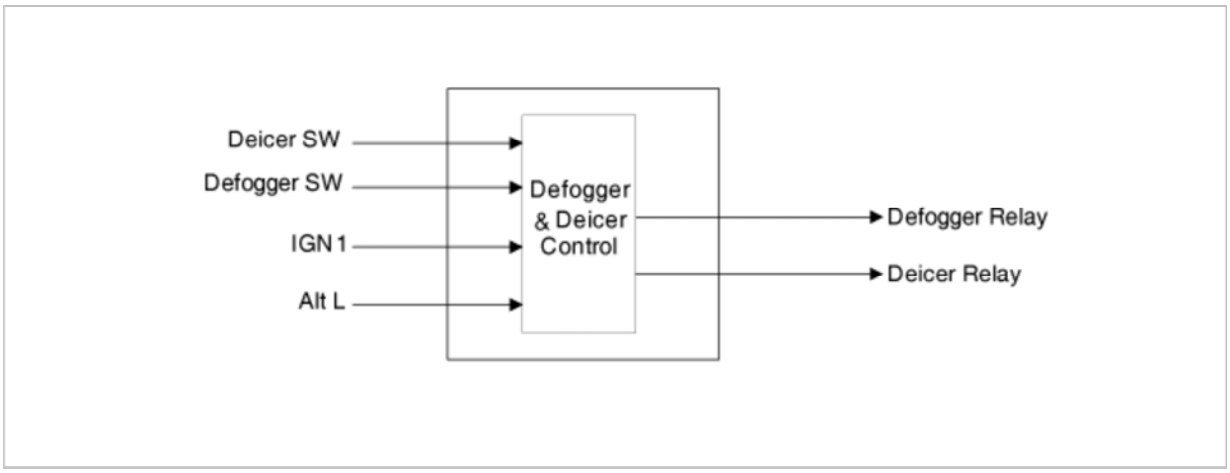
T1 : 0.6 ± 0.1sec

NOTE

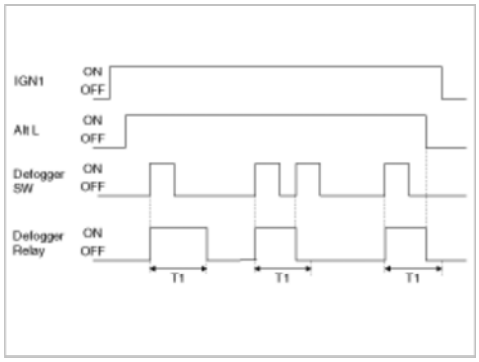
KEY IN ON : Key In ON
KEY IN OFF : Key In OFF

Defogger & Deicer Timer Control

1. Defogger & DEICER Control DATA FLOW

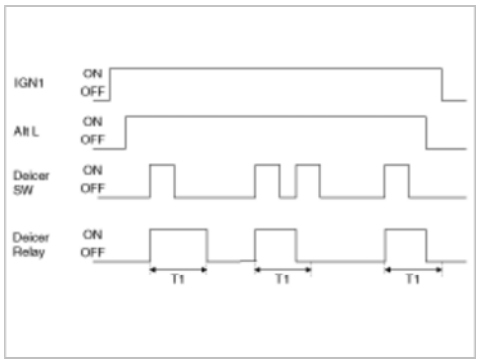


2. Defogger TIMER
   (1) If Defogger SW turns ON after Alt L is ON while IGN1 is ON, turn Defogger Relay output ON for 20min. (It is operated while ENGINE is RUNNING)
   (2) If Defogger SW turns ON again while Defogger Relay output is ON, turn Defogger Relay output OFF.
   (3) Also turn Defogger output OFF in case of Alt L OFF or IGN1 OFF while Defogger Relay output is ON.
   (4) If Alt L is over 10 Volts ENGINE is RUNNING (Alt L ON) and if Alt L is less than 5 Volts ENGINE is STOPPED (Alt L OFF). Also, Alt L is between 5 and 10 Volts, keep the previous condition.
   (5) Defogger Relay should not be outputted when turning Alt L ON while Defogger SW is pressed.



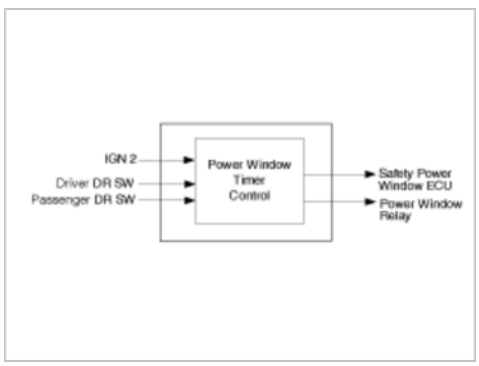
T1 : 20 ± 1min

3. Front Deicer Timer
   (1) Turn Deicer Relay output ON for 20min when turning Deicer SW ON after turning Alt L ON while IGN1 is ON (It is operated while ENGINE is RUNNING.)
   (2) Turn Deicer Relay output OFF if Deicer SW turns ON again while Deicer Relay output is ON.
   (3) Also Deicer Relay output OFF when turning ALT “L” or IGN1 OFF while Deicer Relay output is ON.
   (4) If Alt L is over 10 Volts ENGINE is RUNNING (Alt L ON) and if Alt L is less than 5 Volts ENGINE is STOPPED (Alt L OFF). Also, Alt L is between 5 and 10 Volts, keep the previous condition.
   (5) Deicer Relay should not be outputted when turning Alt L ON while Deicer SW is pressed.



T1 : 20 ± 1min

4. Power Window Timer



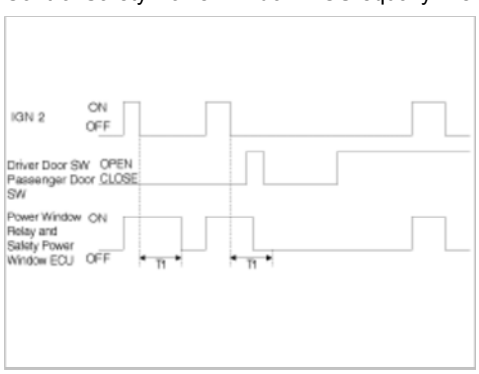
(1) Turn Power window Relay output ON when turning L_IGN2 ON.

(2) Turn Power window Relay output OFF after keeping Power window Relay output for 30sec when IGN2 is OFF.

(3) Turn Power window Relay OFF immediately when opening Driver Door SW or Passenger Door SW within the condition (2) above.

(4) Turn Power window Relay output OFF when IGN2 is OFF while Driver Door SW or Passenger Door SW is open.

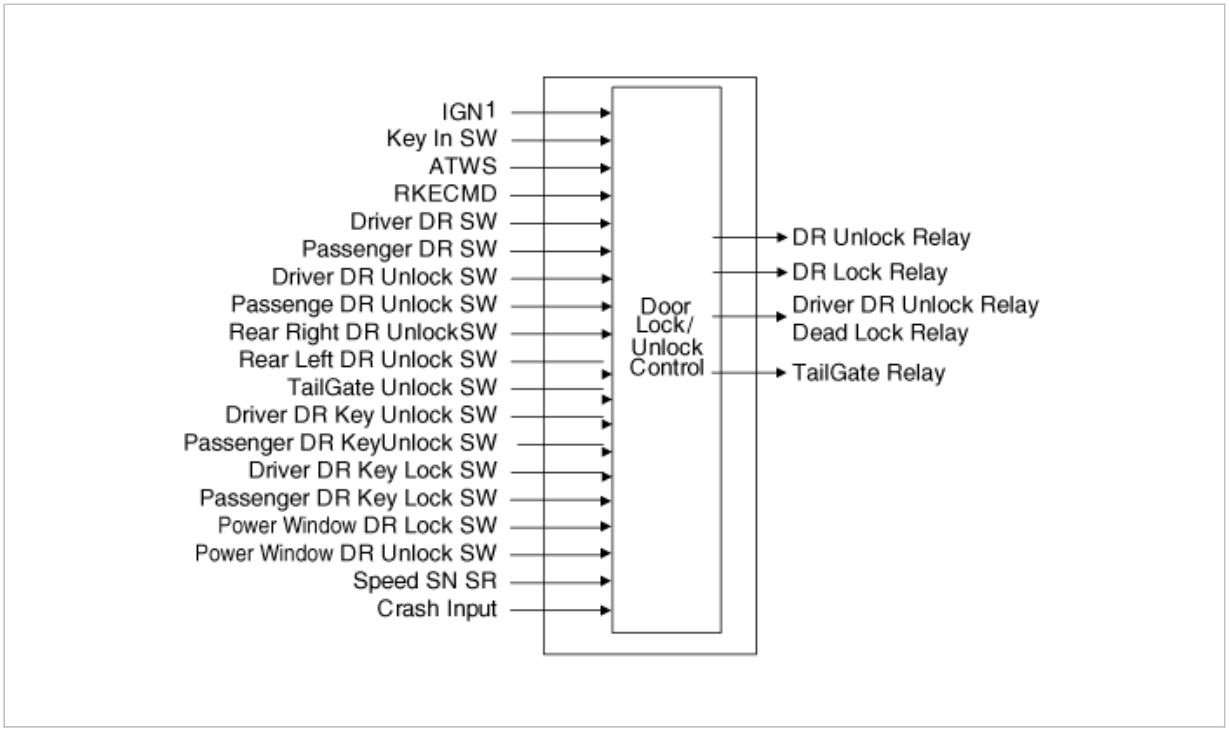
(5) Control Safety Power window ECU equally like Power window Relay.



T1 : 30 ± 3sec

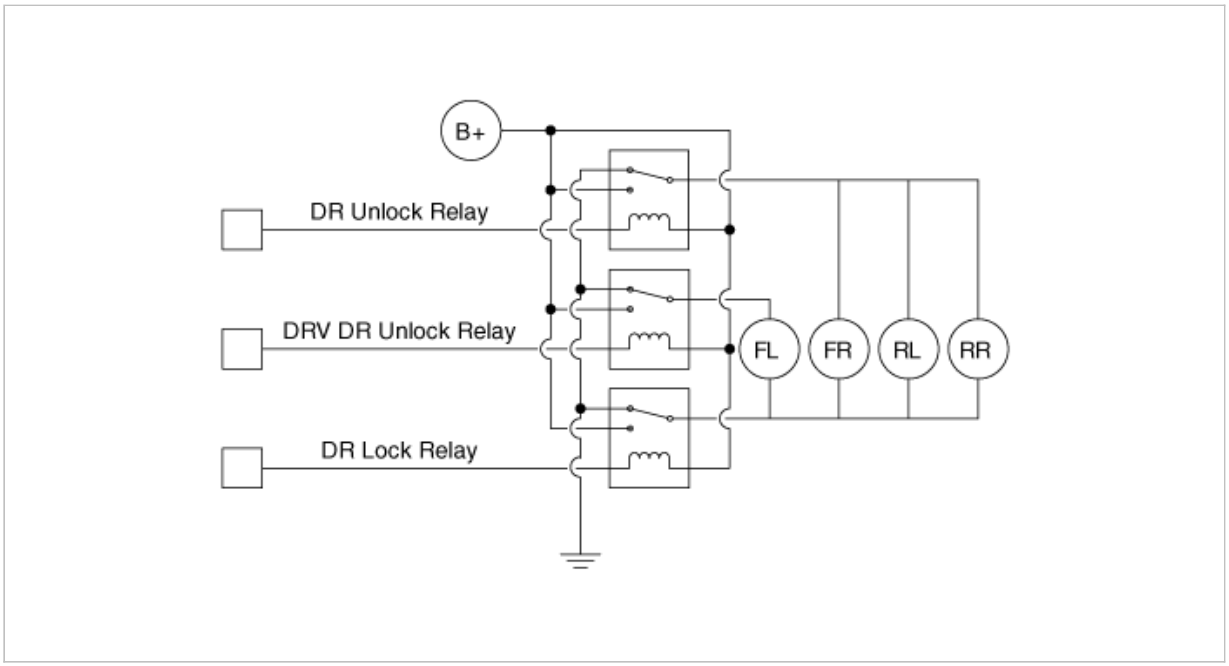
Door Lock/Unlock Control

1. DOOR LOCK/UNLOCK CONTROL DATA FLOW



2. DOOR LOCK/UNLOCK RELAY CONTROL

2-TURN UNLOCK SPEC.



Mode	DR Unlock Relay	DRV DR Unlock Relay	DR Lock Relay
CENTRAL LOCK	OFF	OFF	ON
CENTRAL UNLOCK	ON	ON	OFF
DRIVER UNLOCK	OFF	ON	OFF

3. DOOR KEY LOCK/UNLOCK
   (1) In case of Door KEY LOCK (Unlock) signal of driver's seat, handle as KEY LOCK (Unlock) of driver's seat is inputted if the knob in the driver's seat is LOCKED (Unlocked) after checking it for 3s.
   (2) In case of Door KEY LOCK (Unlock) signal of the passenger seat, handle as KEY LOCK (Unlock) of the passenger seat is inputted if the knob in the passenger seat is LOCKED (Unlocked) after checking it for 3s.

4. CENTRAL DOOR LOCK/UNLOCK

(1) If Driver Door Key Lock SW or Passenger Door Key Lock SW turns ON, turn Door Lock Relay output ON during T1. But prohibit the output when KEY IN ON *2) and IGN1 are ON.

(2) When Driver Door Key Unlock and Passenger Door Key Unlock turn ON, turn Door Unlock Relay and Driver Door Unlock Relay output ON during T1.

(3) Turn CENTRAL LOCK *3) ON during T1 when receiving TX LOCK signal.
But ignore LOCK input when Driver Door SW or Passenger Door SW is ON.

(4) Turn CENTRAL Unlock *4)ON during T1 when receiving TX Unlock signal.

(5) Turn Door Lock Relay output ON during T1 when Power window Door Lock SW turns ON.

(6) Turn CENTRAL Unlock output ON during T1 when Power window Door Unlock SW turns ON. But prohibit the operation by Power window Door Unlock SW at the condition of ARM, ARMWAIT, Rearm and Alarm.

(7) LOCK/Unlock by Safety KNOB is not interlock (Mechanical operation).

(8) Malfunction should be free when joining BATTERY (Also malfunction should be free at the location of Key In SW ON).

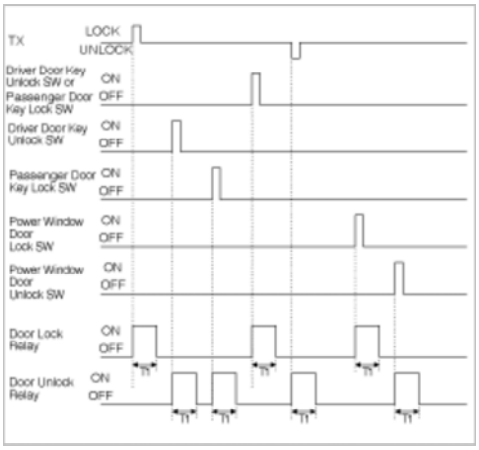
(9) Input which is less than 60msec should not be received (KEY LOCK/Unlock SW).

(10) Do not execute the output of Door Lock (Unlock) by KNOB change.

*2) KEY IN ON : Key In ON

*3) CENTRAL LOCK : Refer to control mode for each Spec.

*4) CENTRAL LOCK : Refer to control mode for each Spec.



T1 : 0.5 ± 0.1sec

5. 2-TURN UNLOCK

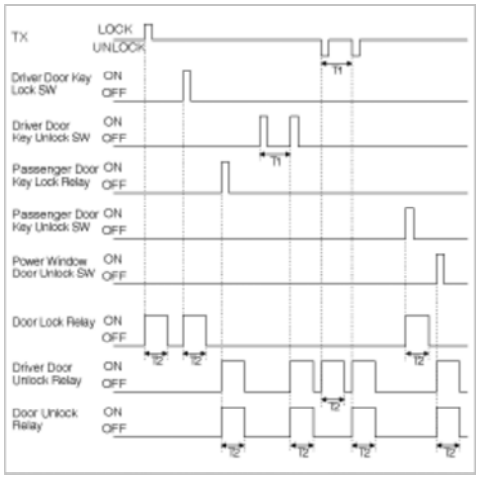
(1) If Driver Door Key Unlock SW turns OFF from ON within T1 after Driver Door Key Unlock SW turns ON from OFF (Driver Door Unlock SW becomes Unlocked mechanically and does not output BCM.), turn Door Unlock Relay output ON during T2.

(2) If TX Unlock is received within T1 after Driver Door Key Unlock SW turns ON from OFF (Driver Door Unlock SW becomes Unlocked mechanically and does not output BCM.), turn Driver Door Unlock Relay and Door Unlock Relay output ON during T2.

(3) Turn Driver Door Unlock Relay output ON during T2 when receiving TX Unlock signal. However, turn Driver Door Unlock Relay and Door Unlock Relay output during T2 if TX Unlock is received within T1.

(4) Also, turn Driver Door Unlock Relay and Door Unlock Relay ON during T2 in case that Driver Door Key Unlock SW turns ON from OFF within T1 after receiving TX Unlock.

(5) Regard as the same TX even though different signal which is registered within T1 is received.



T1: 4 ± 1sec, T2 : 0.5 ± 0.1sec

6. IGN KEY REMINDER

(1) This function will not be operated if the speed of cars exceed 3km/h.

(2) Perform DR Unlock Relay output for 1s after 0.5s when the condition becomes to be KEY IN ON & DRV DR SW OPEN & DRV DR Unlock SW LOCK.

(3) Perform DRV Unlock Relay output for 1s after 0.5s when the condition becomes to be KEY IN ON & DRV DR SW OPEN & DRV DR Unlock SW LOCK.

(4) Perform DR Unlock Relay output for 1s in 0.5s when the condition becomes to be KEY IN ON & AST DR SW OPEN & AST DR Unlock SW LOCK.

(5) Output CENTRAL UNLOCK for 1s in 0.5s based on (4) if (2) and (4) are satisfied.

(6) Output UNLOCK up to 3 times(excluding output for 1s) if LOCK condition is maintained though UNLOCK output is performed for 1s by (2), (3) (cycle for 1s: 0.5s ON/OFF).

(7) Try unlocking once when DOOR is CLOSED while keeping LOCK condition after performing (5) and (6).

(8) Output DR Unlock Relay once for 1s when DRV DR SW is closed within 0.5s since DRV DR Unlock SW is changed from UNLOCK to LOCK during KEY IN ON.

(9) Output DRV Unlock Relay once only for 1s when DRV DR SW is closed within 0.5s since DRV DR Unlock SW is changed from UNLOCK to LOCK during KEY IN ON.

(10) Output CENTRAL UNLOCK once only for 1s when AST DR SW is closed within 0.5s since AST DR Unlock SW is changed from UNLOCK to LOCK during KEY IN ON.

(11) Output DR Unlock Relay once only for 1s if DRV DR Unlock SW becomes LOCK from UNLOCK within 0.5s since DRV DR SW is changed from OPEN to CLOSE during KEY IN ON

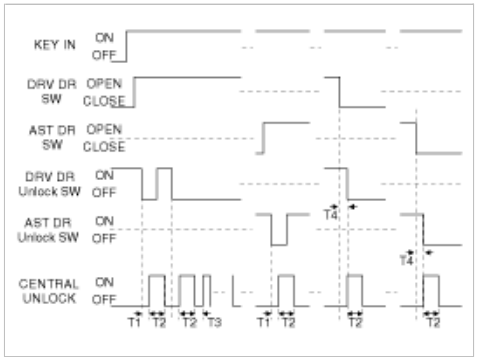
(12) Output DRV Unlock Relay for 1s when DRV DR Unlock SW becomes LOCK from UNLOCK within 0.5s since DRV DR SW is changed from OPEN to CLOSE during KEY IN ON

(13) Output CENTRAL UNLOCK once only for 1s if AST DR Unlock SW becomes to be LOCK from UNLOCK within 0.5s since AST DR SW is changed from OPEN to CLOSE during KEY IN ON.

(14) Perform the function of KEY REMINDER when turning Power window DR Lock SW ON after opening DRV DR SW or AST DR SW during KEY IN ON.

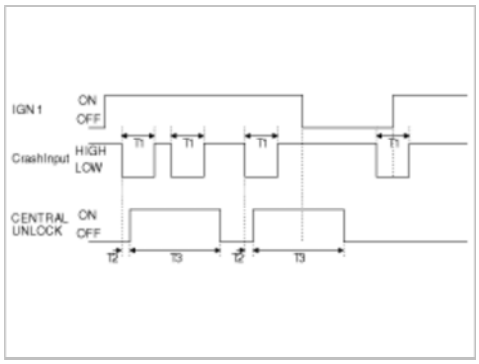
(15) Judge if RETRY output is performed or not at the point of the beginning of RETRY output (in 1.5s from the initial UNLOCK output).

(16) Output UNLOCK though the condition is not kept for 0.5sec after realizing that of UNLOCK. But, do not output UNLOCK in case that KEY IN is OFF at the point of 0.5s passed after realizing the condition by the change of UNLOCK -> LOCK in DRV DR Unlock SW or AST DR Unlock SW.



T1, T3 : 0.5 ± 0.1sec, T2 : 1 ± 0.1sec, T4 : 0.5 sec Max
**KEY IN ON : Key In ON or IGN1 ON or IGN2 ON
KEY IN OFF: Key In OFF and IGN1 OFF and IGN2 OFF

7. CRASH DOOR UNLOCK
   (1) Always perform CENTRAL Unlock *9) output whenever Crash Input signal is inputted while IGN1 is ON.
   (2) Keep CENTRAL Unlock output for the time left though IGN1 turns OFF from ON while outputting CENTRAL Unlock.
   (3) Do not output CENTRAL Unlock if IGN1 SW turns ON from OFF after Crash Input signal is already inputted.
   (4) Output CENTRAL Unlock during T3 if Driver Door Unlock SW or Passenger Door Unlock SW or Rear Right Door Unlock SW or Rear Left Door Unlock SW turns to LOCK from Unlock after outputting CENTRAL Unlock.
   (5) Do not perform AUTO Door Lock function at the condition of CRASH Unlock.
   (6) CRASH Door Unlock function has priority to LOCK/Unlock control by other functions.
   (7) Ignore the request for LOCK/Unlock by other functions while or after outputting CRASH Door Unlock. But, control LOCK/Unlock by other functions if IGN1 SW becomes OFF.

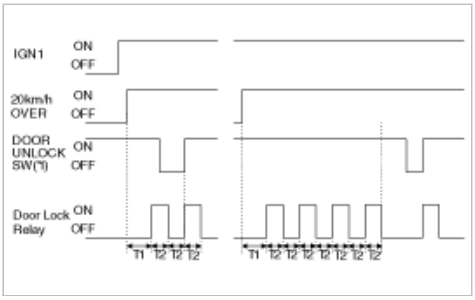


T1 : 0.2sec, T2 : 40msec,
T3 : 5 ± 0.5sec

8. AUTO DOOR LOCK
   (1) AUTO Door Lock is classified into non-activation/20km actiovation/40km actiovation. And follow the table below for the basic value and selected value of the regional operation SPEC.

Item	Description
Standard	Disable
Option 1	20km/h

   (2) On condition of IGN1 SW ON, turn Door Lock Relay output ON within T1 when keeping more than setting speed in (1). But, do not output LOCK if all Doors are LOCKED or FAIL at first.
   (3) Perform outputting LOCK up to 3 times (cycle for 1s) if either of Doors is Unlocked after outputting LOCK in (2). But, ignore the Door that has changed to LOCK condition from Unlock during the output 3 times.
   (4) Regard the respective Door FAILED if it is Unlocked after outputting 3 times.
   (5) Output LOCK once only if the Door is Unlocked after the failed Door changes(Unlock→LOCK).
   (6) Output LOCK once only if Door which was LOCKED after outputting LOCK in (2) becomes to be Unlocked. But, output LOCK once for the respective Door although it keeps Unlock after LOCK output.
   (7) Clear the FAILED Door when L_IGN1 SW is OFF.
   (8) Do not perform AUTO Door Lock function on condition of CRASH Unlock.



T1 : Max 1.5sec, T2 : 0.5 ± 0.1sec

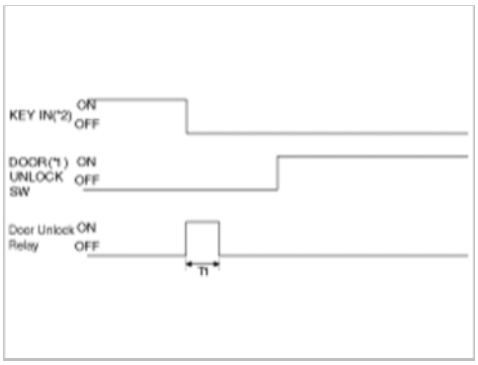
*1 ON (Unlock) : Driver DR Unlock SW│Passenger DR Unlock SW│Rear Right DR Unlock SW│Rear Left DR Unlock SW UNLOCK

OFF (LOCK) : Driver DR Unlock SW│Passenger DR Unlock SW│Rear Right DR Unlock SW│Rear Left DR Unlock SW LOCK

9. AUTO DOOR UNLOCK

(1) AUTO Door Unlock is classified into non-activation and activation and activated for domestic ones only but not activated for others.

(2) If it is set up to be activated, turn DR Unlock relay ON when turning KEY IN OFF after KEY IN is ON.
[(But, if all conditions for KNOB are Unlock, it will not output.) AUTO Door Unlock should operate after outputting AUTO Door Lock (Unlock OUTPUT will not occur though the key is removed later if LOCK OUTPUT did not occur because all KNOBS are already LOCKED even though it reached to the operating speed of AUTO Door Lock.)]



T1 : 0.5 ± 0.1sec

*1 ON (Unlock) : Driver DR Unlock SW│Passenger DR Unlock SW│Rear Right DR Unlock SW│Rear Left DR Unlock SW UNLOCK

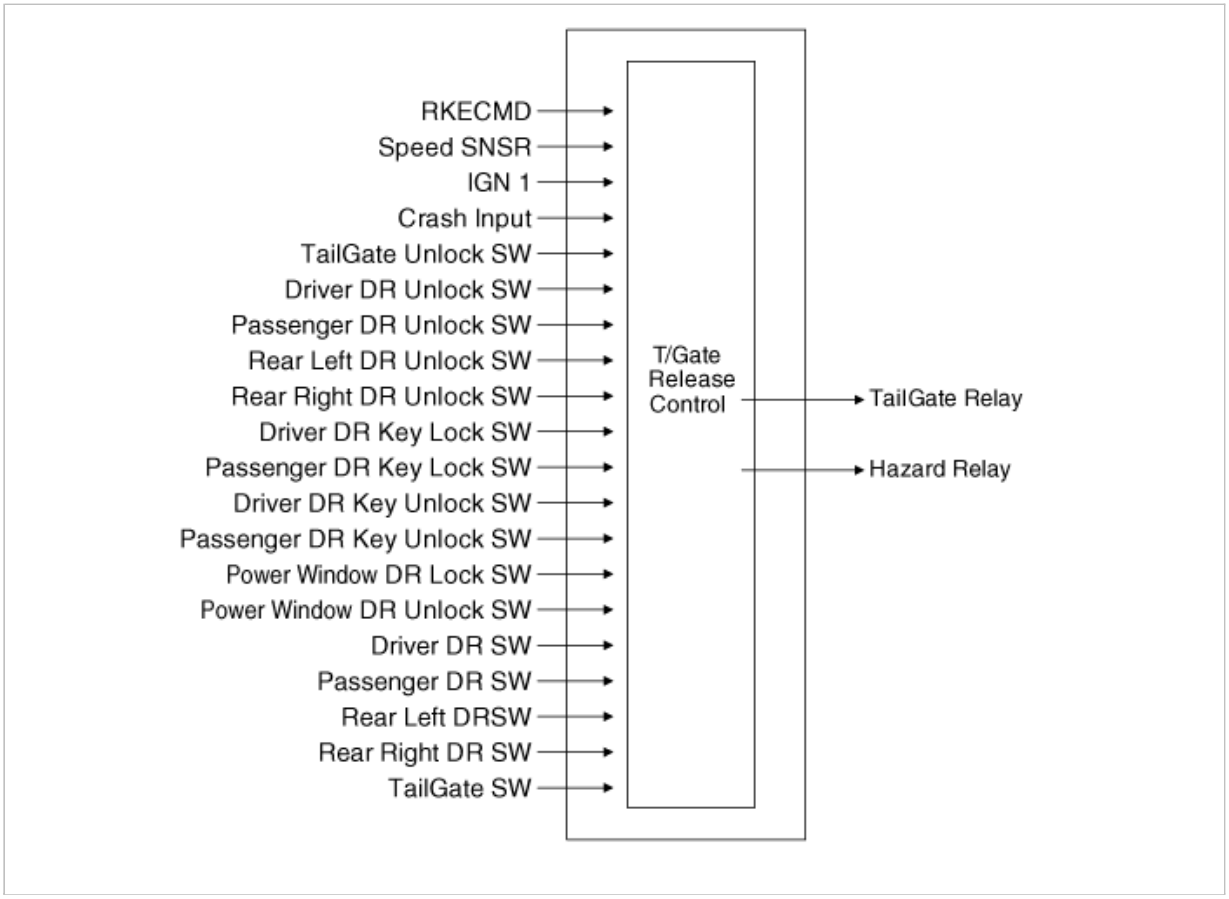
OFF (LOCK) : Driver DR Unlock SW│Passenger DR Unlock SW│Rear Right DR Unlock SW│Rear Left DR Unlock SW LOCK

*2 KEY IN ON : Key In ON or IGN1 ON or IGN2 ON

KEY IN OFF : Key In OFF and IGN1 OFF and IGN2 OFF

T/Gate Release Control

1. T/GATE RELEASE CONTROL DATA FLOW



RKECMD : TX LOCK, TX Unlock, Tailgate Unlock

(1) Permission mode State

State	Description
Initial condition	Permission mode State
Event	Tailgate Unlock (or RKE_Unlock)
Action	Keep Permission mode Hazard Relay 2times FLASHING

State	Description
Initial condition	Prohibition mode State
Event	1. TX Unlock (or RKE Unlock) 2. Driver Door Key Unlock SW or Passenger Door Key Unlock SW ON 3. Power window Door Unlock SW ON (Except ARM, ARMWAIT, Rearm and Alarm mode) 4. AUTO Door Unlock 5. KEY REMINDER Unlock (IGN) 6. CRASH Unlock 7. ANY KNOB Unlock
Action	Go to Permission mode State 5. Tailgate Relay ON for 0.5S

State	Description
Initial condition	30s Permission mode State
Event	1. TX Unlock (or RKE Unlock) 2. Driver Door Key Unlock SW or Passenger Door Key Unlock SW ON 3. Power window Door Unlock SW ON (Except ARM, ARMWAIT, Rearm and Alarm mode) 4. AUTO Door Unlock

	5. KEY REMINDER Unlock (IGN) 6. CRASH Unlock 7. ANY KNOB Unlock
Action	Go to Permission mode State

State	Description
Initial condition	Permission mode State
Event	Tailgate SW ON at below 5km/h
Action	Tailgate Relay for 0.5 sec. Go to Permission mode State

(2) 30s Permission mode State

State	Description
Initial condition	Prohibition mode State
Event	Tailgate Unlock
Action	START Tailgate TIMER Hazard Relay 2times FLASHING Go to 30s Permission mode State

State	Description
Initial condition	30s Permission mode State
Event	Tailgate Unlock
Action	RESTART Tailgate TIMER Hazard Relay 2times FLASHING Go to 30s Permission mode State

State	Description
Initial condition	30s Permission mode State
Event	Tailgate SW ON at below 5km/h
Action	Tailgate Relay for 0.5sec. Go to 30s Permission mode State

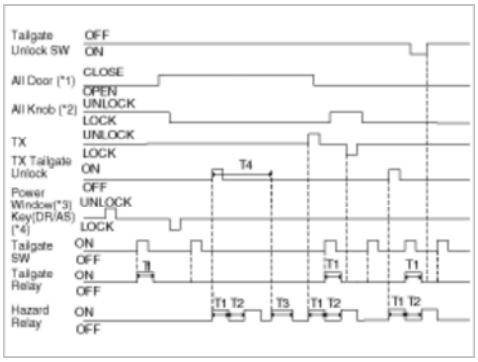
(3) Prohibition mode State

State	Description
Initial condition	30s permission mode state
Event	1. TX LOCK(RKE_LOCK) 2. Driver Door Key Lock SW ON 3. Power window Door Lock SW ON 4. AUTO Door Lock 5. RELOCK 6. Tailgate SW Open → CLOSE 7. Go to ARMWAIT
Action	Go to prohibition mode state

State	Description
Initial condition	30s permission mode state
Event	Tailgate TIMER IS EXPIRED
Action	Go to prohibition mode State

State	Description

Initial condition	Permission mode state
Event	1. TX LOCK(RKE_LOCK) 2. Driver Door Key Lock SW ON 3. Power window Door Lock SW ON 4. AUTO Door Lock 5. RELOCK 6. Go to ARM WAIT 7. ALL KNOB LOCK
Action	Go to prohibition mode state

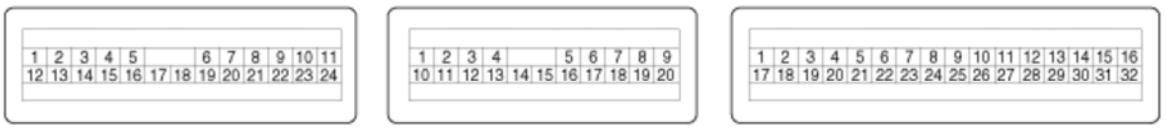


T1,T2 : 0.5 ± 0.1s, T3 : 1 ± 0.2s
T4 : 30 ± 3s
*1 ALL Door : Driver DR SW, Passenger DR SW, Rear Left DR SW, Rear Right DR SW
*2 ALL KNOB : Driver DR Unlock SW, Passenger DR Unlock SW, Rear Left DR Unlock SW, Rear Right DR Unlock SW
*3 P/Window(*3) : Power Window DR Lock SW, Power Window DR Unlock SW
*4 KEY(DR/AS)(*4) : Driver DR Key Lock SW, Passenger DR Key Lock SW, Driver DR Key Unlock SW, Passenger DR Key Unlock SW

Body Electrical System > BCM (Body Control Module) > Body Control Module (BCM) > Repair procedures

Inspection

BCM Connectors



PIN NO.	Connector A	Connector B	Connector C
1	B+	CRASH INPUT	Power Window Relay
2	Front DEICER SW	-	-
3	Passenger Seat Belt SW	SAVE CODE	Front FOG Relay
4	Driver Seat Belt SW	K_LINE	-
5	Auto Light SW	WASHER SW	Wiper Relay
6	Head Lamp SW	Wiper INT SW	Tail GATE Relay
7	Tail SW	MIST SW	Horn Relay
8	Rear FOG SW	IGN2	Hazard Relay
9	Front FOG SW	-	START INHIBIT Relay
10	RR SBR BUZZER SIGNAL	Power Window Door Unlock SW	Defogger Relay
11	SPEED SENSOR	Power Window Door Lock SW	DEICER Relay

12	IGN1	Passenger Door SW	Door Unlock Relay
13	Defogger SW	Driver Door SW	-
14	Driver Door Unlock SW	Rear RIGHT Door SW	Door Lock Relay
15	Passenger Door Unlock SW	Rear LEFT Door SW	KEY HOLE ILLUMINATION
16	Rear RIGHT Door Unlock SW	Tailgate SW	Tail Lamp Relay
17	Tailgate Open SW	HOOD SW	Safety Power Window ECU
18	Rear LEFT Door Unlock SW	KEY IN SW	Auto Light Power
19	Driver Door KEY LOCK SW	-	Auto Light SIGNAL
20	Driver Door KEY Unlock SW	Passenger Door KEY LOCK SW	ALT_L
21	Passenger KEY Unlock SW		INT T
22	-		Auto Light GROUND
23	Power2 GROUND		Passenger Seat Belt INDICATOR
24	Power1 GROUND		Driver Seat Belt INDICATOR
25			OVER SPEED INDICATOR
26			-
27			-
28			-
29			-
30			-
31			Head Lamp Relay
32			Room Lamp

Terminal Voltage

Function	Pin Name	State	Voltage Level	
			Low Level	High Level
Analog Input	B+	8V ~ 16V	-	-
	Auto Light Signal	0V ~ 5V	-	-
	Int T	0V ~ 5V	-	-
	IGN1	8V ~ 16V	-	-
Logic Input	IGN2	OPEN/ON	Below 1V	Over 8V
	Washer SW	OPEN/ON	Below 1V	Over 8V
	Wiper Int SW	OPEN/ON	Below 1V	Over 8V
	Mist SW	OPEN/ON	Below 1V	Over 8V
	Key In SW	OPEN/ON	Below 1V	Over 6V
	Driver Door Unlock SW	OPEN/ON	Below 1V	Over 6V
	Passenger Door Unlock SW	OPEN/ON	Below 1V	Over 6V
	Rear Left Door Unlock SW	OPEN/ON	Below 1V	Over 6V
	Rear right Unlock SW	OPEN/ON	Below 1V	Over 6V
	Tailgate Unlock SW	OPEN/ON	Below 1V	Over 6V
	Hood SW	OPEN/ON	Below 1V	Over 6V
	Tailgate open SW	OPEN/ON	Below 1V	Over 6V
	Rear Left Door SW	OPEN/ON	Below 1V	Over 6V
	Rear Right Door SW	OPEN/ON	Below 1V	Over 6V
	Driver Door SW	OPEN/ON	Below 1V	Over 6V
	Passenger Door SW	OPEN/ON	Below 1V	Over 6V
	Driver door Key Lock SW	OPEN/ON	Below 1V	Over 6V

	Driver door Key Unlock SW	OPEN/ON	Below 1V	Over 6V
	Passenger Door Key Lock SW	OPEN/ON	Below 1V	Over 6V
	Passenger Door Key Unlock SW	OPEN/ON	Below 1V	Over 6V
	Power window Door Lock SW	OPEN/ON	Below 1V	Over 6V
	Power window Door Unlock SW	OPEN/ON	Below 1V	Over 6V
	Defogger SW	OPEN/ON	Below 1V	Over 6V
	Deicer SW	OPEN/ON	Below 1V	Over 6V
	Passenger Seat Belt SW	OPEN/ON	Below 1V	Over 6V
	Driver Seat Belt SW	OPEN/ON	Below 1V	Over 6V
	Auto Light SW	OPEN/ON	Below 1V	Over 6V
	Head Lamp SW	OPEN/ON	Below 1V	Over 6V
	Tail SW	OPEN/ON	Below 1V	Over 6V
	Front Fog SW	OPEN/ON	Below 1V	Over 6V
	Crash Input	OPEN/ON	Below 1V	Over 6V
	Push Knob SW	OPEN/ON	Below 1V	Over 4V
Frequency	Speed Sensor	OPEN/ON	Below 1V	Over 6V
Communication	CODE_SAVE	OPEN/ON	Below 1V	Over 4V
	K LINE	OPEN/ON	Below 1V	Over 6V

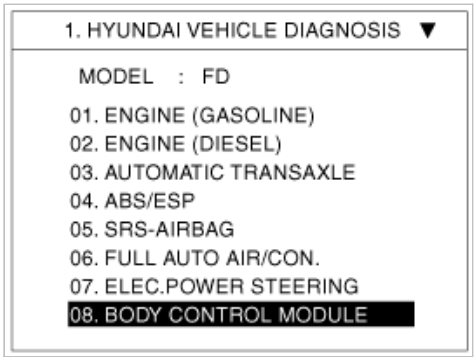
BCM Actuator Operation

SCAN tool can operates all actuators controlled by BCM by force.

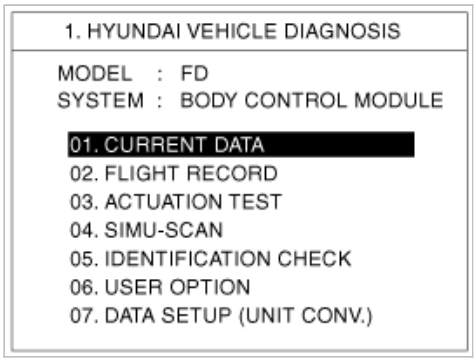
NO.	BCM
1	Door Lock Relay
2	Door Unlock Relay
3	Tailgate Release Relay
4	Power Window Relay
5	Wiper Relay
6	Hazard Relay (+RK)
7	Burglar Horn Relay (+RK)
8	Starter Inhibit Relay (+RK)
9	Tail Lamp Relay
10	Head Lamp Relay
11	Front Deicer Relay
12	Rear Defogger Relay
13	Driver Seat Belt Indicator
14	IGN Key Hole Illumination
15	Room Lamp

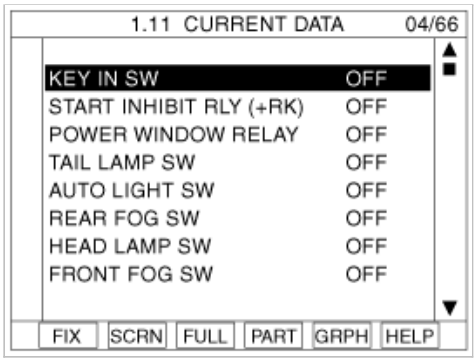
BCM Diagnosis With Scan Tool

1. It will be able to diagnose defects of BCM with scan tool quickly. Scan tool can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select model and menu.

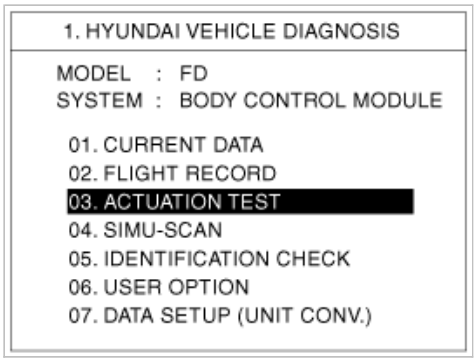


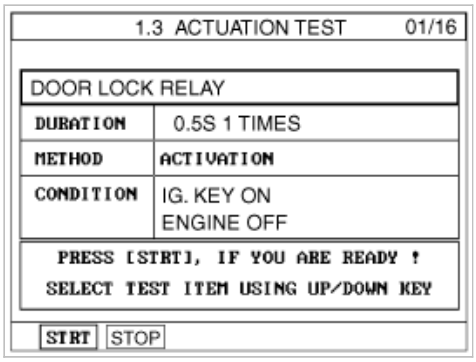
3. Select "Current data", if you will check current data of BCM. It provides power supply status, multi function status, lamp status, door status, lock system status, wiper, auto light status and so on.





4. If you will check BCM data operation forcefully, select "Actuation test".



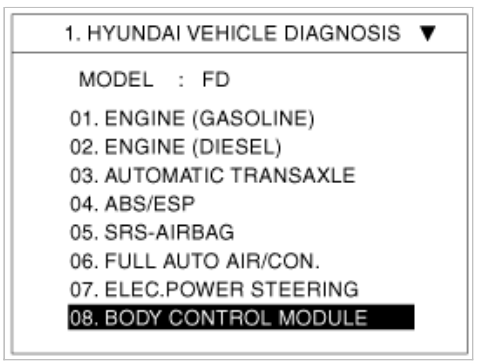


5. You can turn ON/OFF as below option function with the user option program.
   (1) LOCK / Unlock comfirming alarm: Alarm sound ON/OFF control when you LOCK/Unlock doors with transmitter.
   (2) Mechanical LOCKING system: Arm/Disarm ON/OFF when you lock the door with the mechanical key.
   (3) AUTO Door Lock/Unlock system ON/OFF.
      A. Vehicle speed gearing AUTO Door Lock (more than 20km/h)
      B. AUTO Door Lock non application
      C. Shift lever gearing AUTO Door Lock
      D. Driver seat AUTO Door Lock
      E. AUTO Door Unlock non application
      F. All doors Unlock in the case of driver door Unlock
      G. All doors Unlock in the case of IGN key separation.
   (4) Riding & Getting off gearing
      A. Seat installation state ON/OFF
      B. Seat riding & getting off gearing ON/OFF
      C. Column installation state ON/OFF
      D. Column riding & getting off gearing ON/OFF

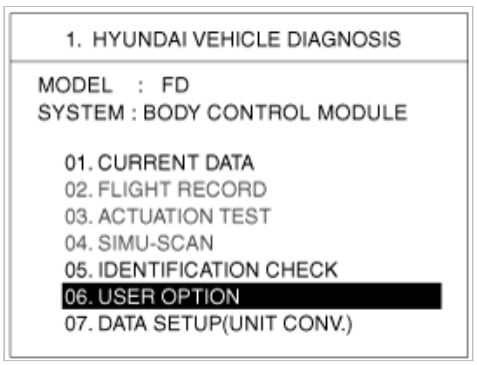
User Option Mode

The BCM offers 3 items user option mode for a user convenience (AUTO Door Lock/Unlock, Door KEY ARM/Disarm
- It is able to set up the enable or disable of AUTO Door Lock function or AUTO Door Lock operation when using it.
- It is able to set up the enable or disable of AUTO Door Unlock function or AUTO Door Lock operation when using it.
- It is able to set up the enable or disable of burglar alarm mode when using door lock by the key.

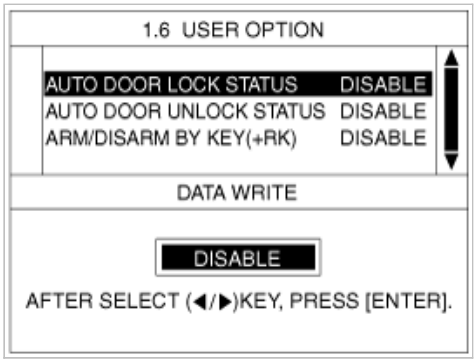
1. Select option "FD" and press ENTER.
2. Select option "BODY Control MODULE" and press ENTER.



3. Select option "USER OPTION" and press ENTER.



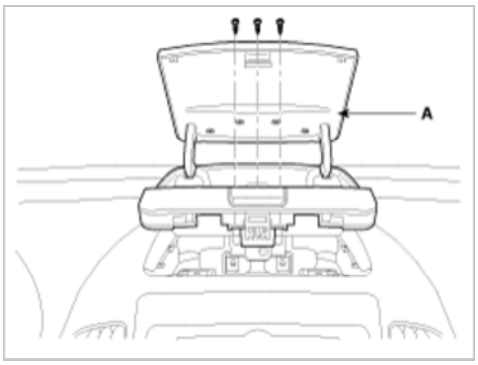
4. Select option "AUTO Door Lock STATUS by using the direction button(▲ / ▼).
5. Select the parameter by using the direction button(◂ / ▸) and press ENTER to save it.
   (Disable / FIXING)



6. Select option "AUTO Door Unlock STATUS" by using the direction button(▲ / ▼).
7. Select the parameter by using the direction button(◂ / ▸) and press ENTER to save it.
   (Disable / Enable)
8. Select option "Door KEY ARM/Disarm" by using the direction button(▲ / ▼).
9. Select the parameter by using the direction button (▲ / ▼) and press ENTER to save it (Disable/Enable)

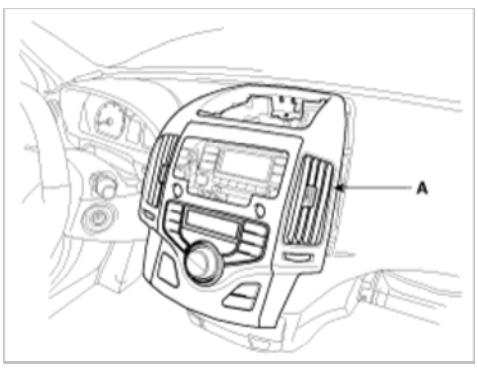
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the upper tray (A).
   (Refer to the Body group - Crash pad)

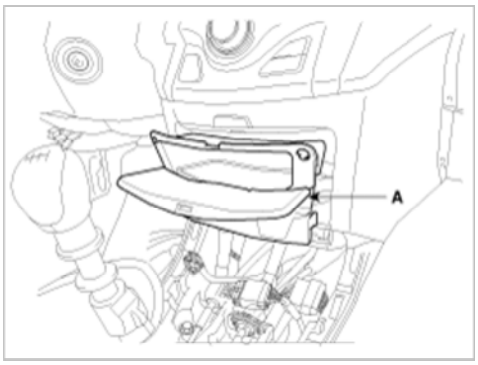


3. Remove the crash pad center facia panel (A).

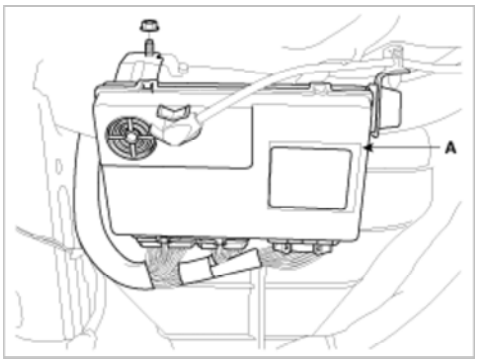
> NOTE
>
> Take care not to scratch the crash pad and related parts.



4. After loosening the mounting clips, then remove the center fascia lower tray (A).



5. Remove the body control module (A) after loosening 1 bolts and disconnecting connector.

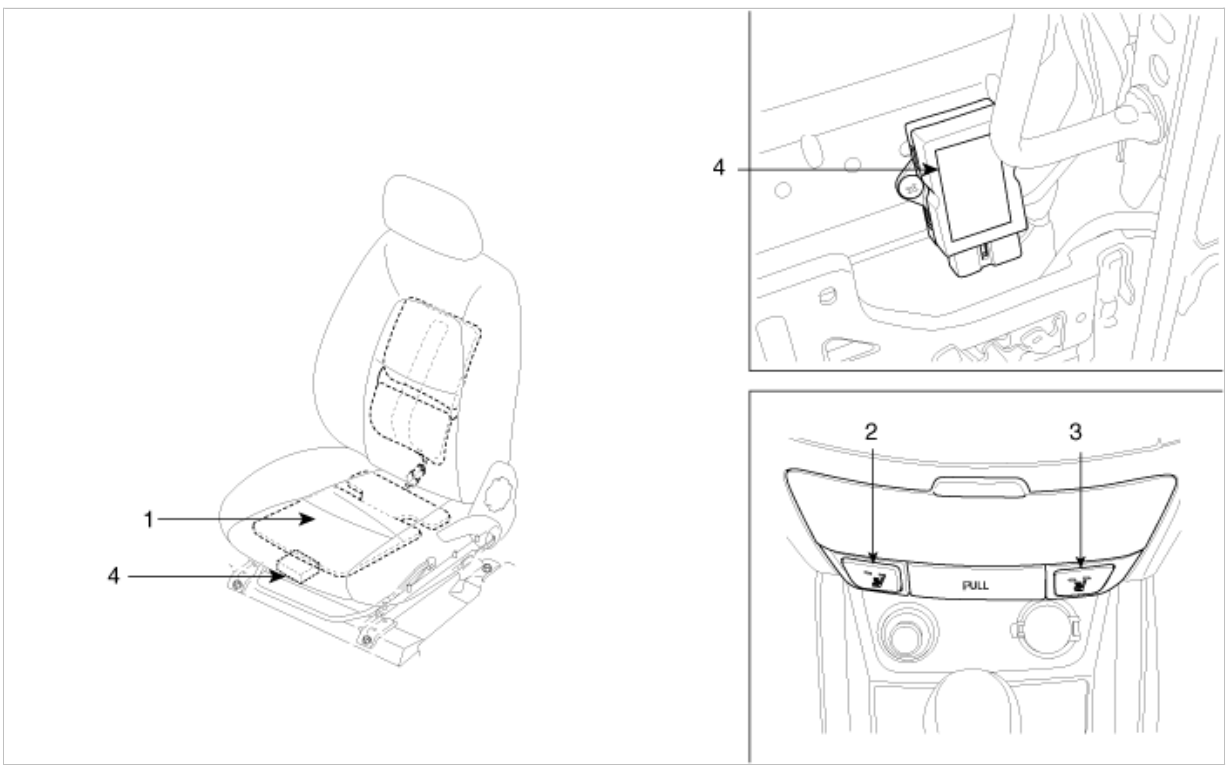


Installation

1. Install the body control module.
2. Install the center facia lower try.
3. Install the center fascia panel.
4. Install the upper tray.

Body Electrical System > Seat Electrical > Components and Components Location

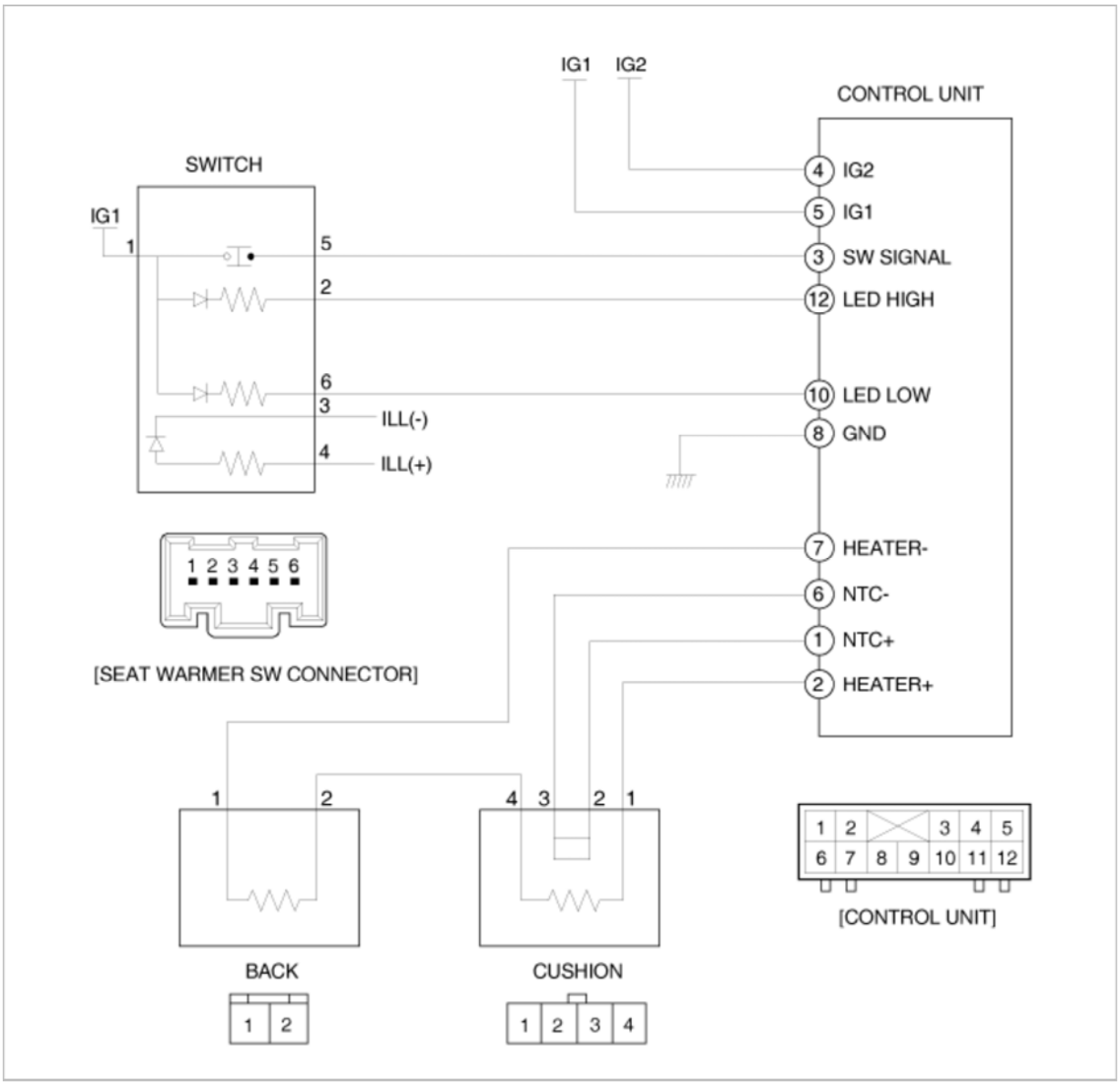
Component Location



1. Seat warmer 2. Seat warmer switch (LH)	3. Seat warmer switch (RH) 4. Control unit

Body Electrical System > Seat Electrical > Schematic Diagrams

Circuit Diagram

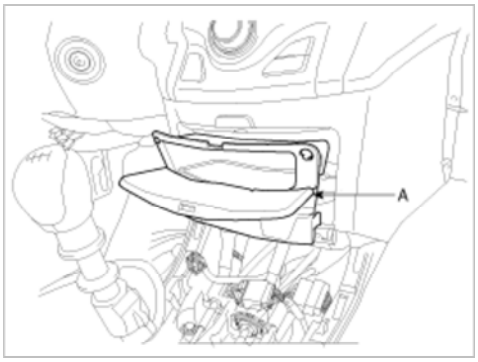


Body Electrical System > Seat Electrical > Seat Heater Switch > Repair procedures

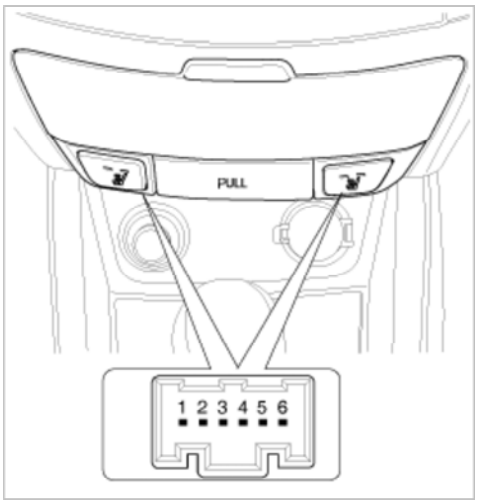
Inspection

Front Seat Warmer Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia lower tray(A) after loosening the mounting clips.
   (Refer to the Body group - "Crash pad")



3. Disconnect the seat warmer switch connector.



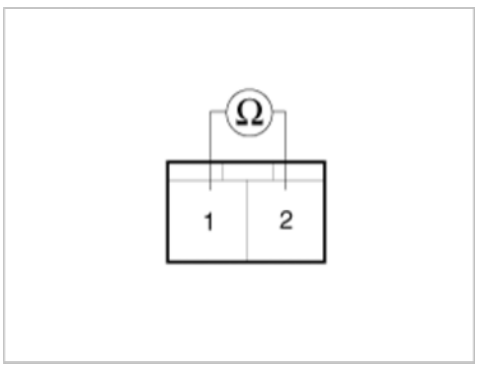
4. Check that continuity exists between the terminals.

Direction	Terminal	1	5
Front	ON	○—○	
	OFF		

Body Electrical System > Seat Electrical > Seat Heater > Repair procedures

Inspection

1. For back side of seat warmer, check for continuity and measure the resistance between No.1 and No.2 terminal of back connector.



Standard value
Cushion : 1.32Ω ± 10%, Back : 1.30Ω ± 10%

2. Operate the seat warmer after connecting the connectors, and then check the NTC(Negative Temperature Coefficient) thermostat by measuring the temperature of seat surface.
Standard value

Item	Cushion	Back	Remark

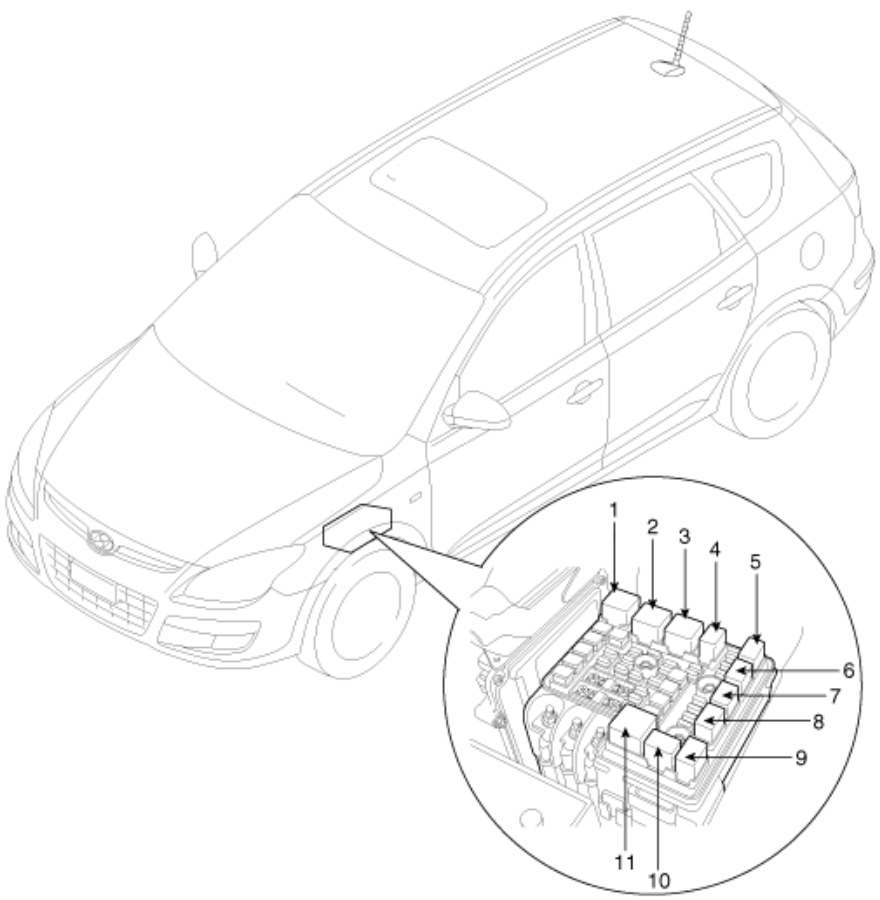
LOW	97°F (36°C)	104°F (40°C)	±36°F (±2°C)
HIGH	104°F (40°C)	115°F (46°C)	±36°F (±2°C)

(Back high only : +36°F, -34°F(+2°C, -1°C))

Body Electrical System > Fuses And Relays > Components and Components Location

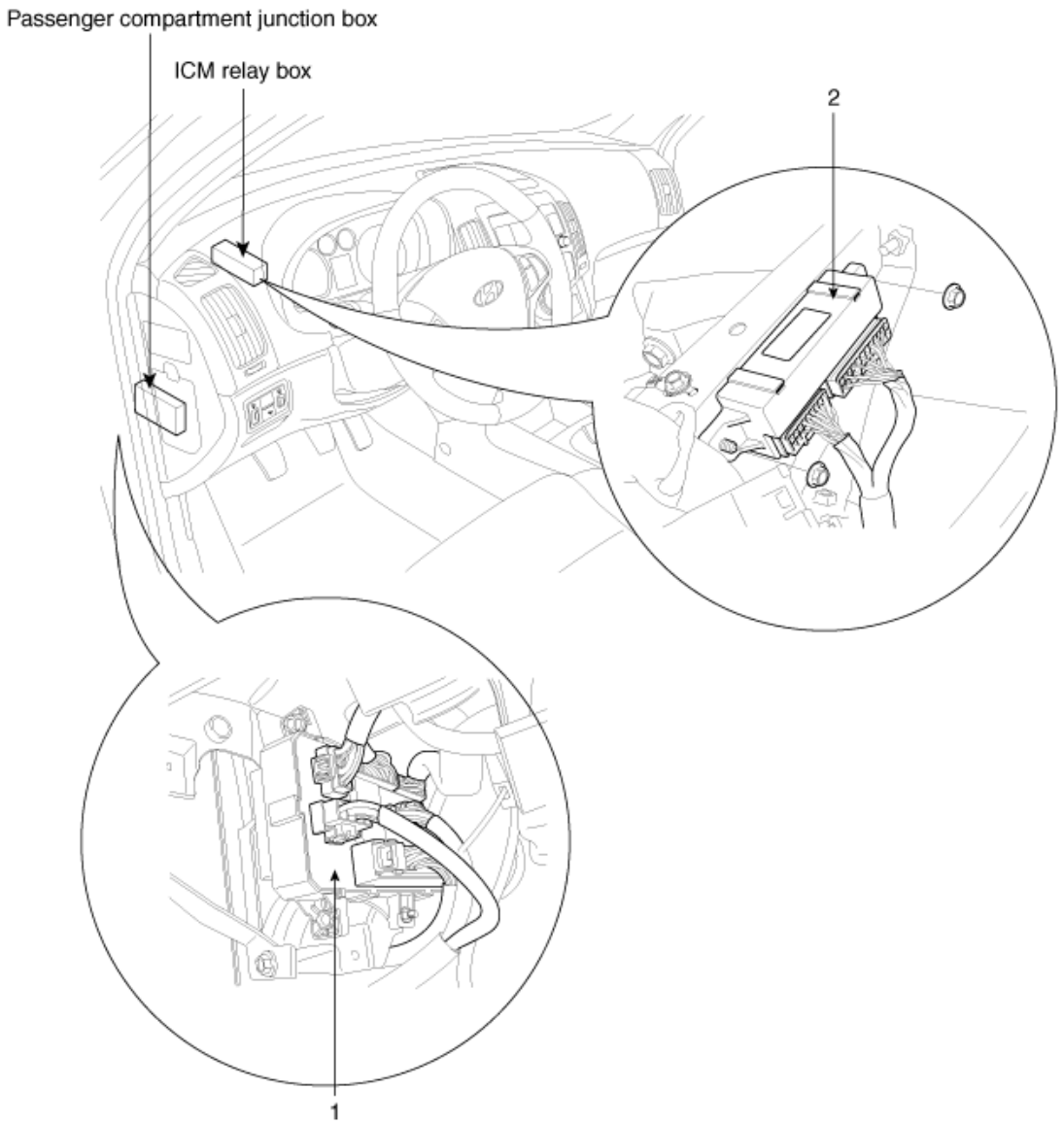
Component Location

[Engine room relay box]



1. Condenser fan 2 relay	7. Horn relay
2. Condenser fan 1 relay	8. Head lamp relay (High)
3. Start relay	9. Front fog lamp relay
4. Fuel pump relay	10. Wiper relay
5. A/C relay	11. Main relay
6. Head lamp relay (Low-left side)	

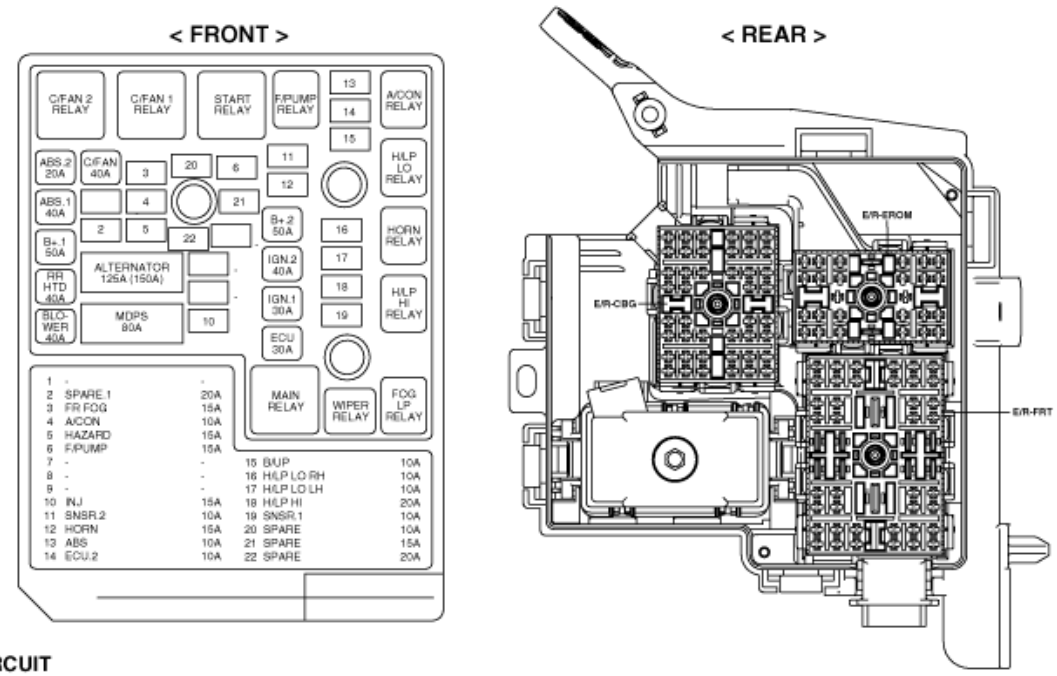
[Passenger compartment relay]



1. Tail lamp relay, Power window relay, Rear heater relay, Trunk lid relay (Built-in-Junction box)
2. Door unlock relay, Door lock relay, Front deicer relay, Burglar alarm horn relay, Burglar alarm relay, Hazard relay (Built-in-ICM relay Box)

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Components and Components Location

Component Location



CIRCUIT

Description		(A)	Circuit Protected
FUSIBLE LINK	ALTERNATOR	125A	Generator
	MDPS	80A	EPS Control Module
	ABS.2	20A	ESC Control Module, ABS Control Module, Multipurpose Check Connector
	ABS.1	40A	ESC Control Module, ABS Control Module, Multipurpose Check Connector
	B+.1	50A	I/P Junction Box (Tail Lamp Relay, Power Window Relay,WCS Fuse, Safety P/WDW LH Fuse, Safety P/WDW RH Fuse)
	RR HTD	40A	I/P Junction Box (Rear Defogger Relay)
	BLOWER	40A	Blower Relay
	C/FAN	40A	Condenser Fan #1 Relay (Low), Condenser Fan #2 Relay (High)
	B+.2	50A	I/P Junction Box (Audio Fuse, Room LP Fuse, Deicer Fuse, T/Gate Fuse, Stop Fuse, DR Lock Fuse, RR P/Outlet Fuse)
	IGN.2	40A	Ignition Switch, Start Relay
	IGN.1	30A	Ignition Switch
	ECU	30A	Main Relay, PCM
FUSE	FR FOG	15A	Front Fog Lamp Relay
	A/CON	10A	A/Con Relay
	HAZARD	15A	Hazard Switch, ICM Relay Box (Hazard Relay)
	F/PUMP	15A	Fuel Pump Relay
	INJ	15A	A/Con Relay, Fuel Pump Relay, Injector #1, 2, 3, 4, PCM, Canister Close Valve, Purge Control Solenoid Valve Idle Speed Control Actuator,Oil Control Valve
	SNSR.2	10A	Pulse Generator 'A', 'B' , PCM, Stop Lamp Switch, Vehicle Speed Sensor
	HORN	15A	Horn Relay, ICM Relay Box (Burglar Alarm Horn Relay)
	ABS	10A	ESC Control Module, ABS Control Module, Yaw Rate Sensor, Mutipupose Check Connector
	ECU.2	10A	PCM
	B/UP	10A	Back-up Lamp Switch, Multifunction Switch, Cruise Control Module, Transaxle Range Switch
	H/LP LO RH	10A	Head Lamp RH
	H/LP LO LH	10A	Head Lamp LH, Instrument Cluster
	H/LP HI	20A	Head Lamp Hi Relay
	SNSR.1	10A	Immobilizer Module, Oxygen Sensor (DOWN/UP), Camshaft Position Sensor, Crankshaft Position Sensor

※USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

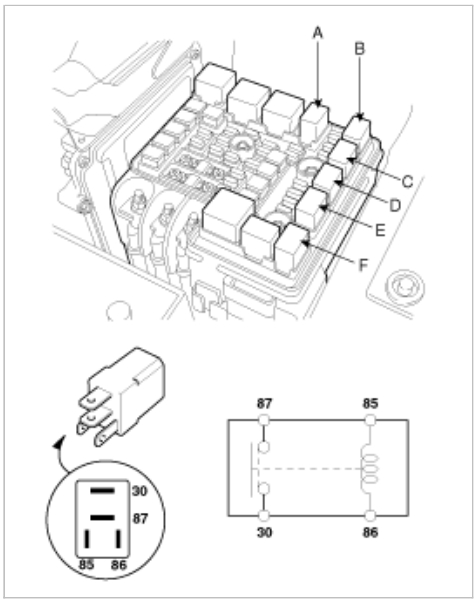
Inspection

1. Disconnect the negative (-) battery terminal.
2. Pull out the relay from the engine compartment relay box.

Power Relay (Type A)

Check for continuity between the terminals.
A : Fuel pump relay
B : A/C relay
C : Head lamp relay (Low)
D : Horn relay
E : Head lamp relay (High)
F : Front fog lamp relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



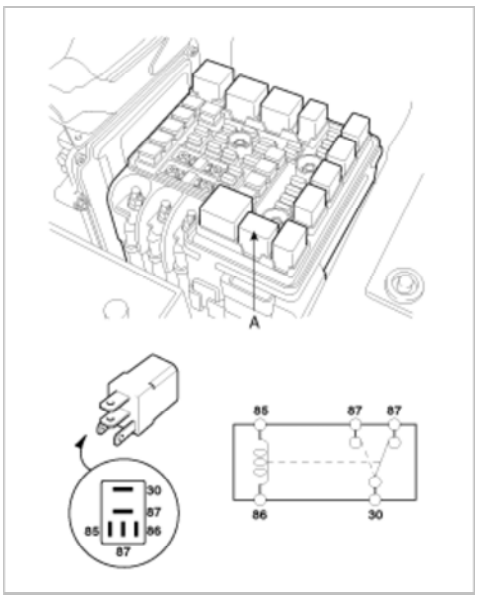
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Power Relay (Type B)

Check for continuity between the terminals.

A : Wiper relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be continuity between the No.30 and No.87 terminals when power is disconnected.



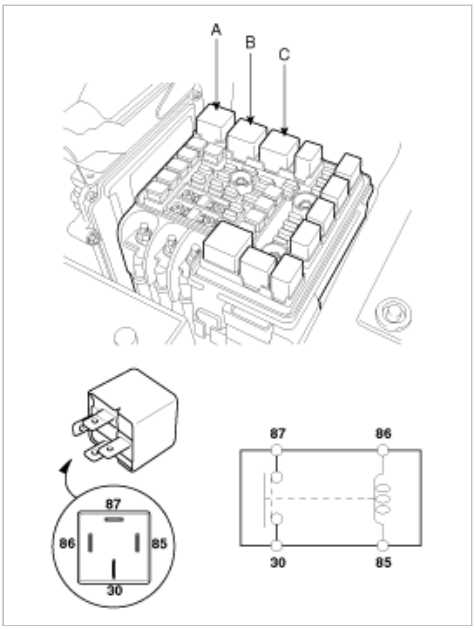
Terminal / Power	85	86	30	87	87
Disconnected			○		○
Connected	⊖	⊕	○	○	

Power Relay (Type C)

Check for continuity between the terminals.

A : Condenser pan2 relay
B : Condenser pan 1 relay
C : Start relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.

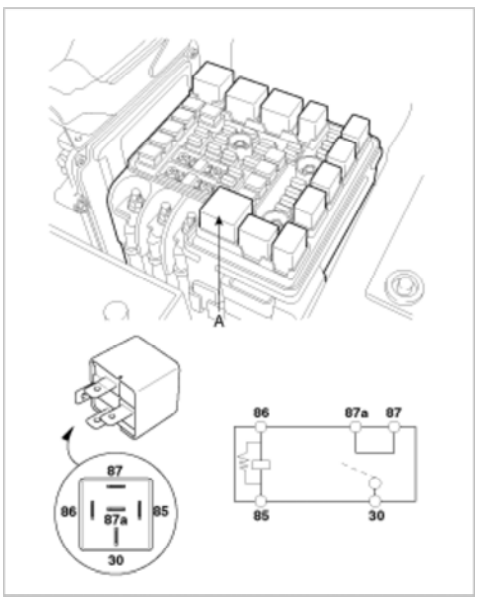


Terminal / Power	86	85	87	30
Disconnected	○	○		
Connected	⊖	⊕	○	○

Power Relay (Type D)

Check for continuity between the terminals.
A : Main relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be continuity between the No.30 and No.87 terminals when power is disconnected.



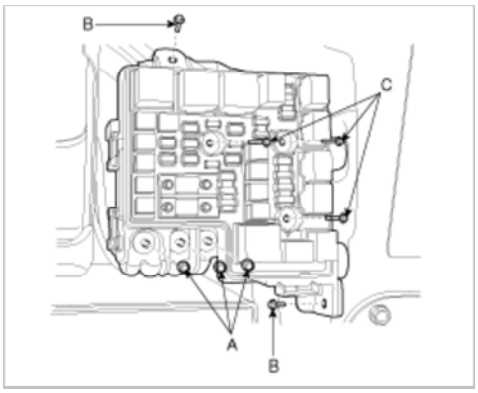
Terminal / Power	86	85	87	87a	30
Disconnected	○	○			
Connected	⊖	⊕	○	○	○

Fuse

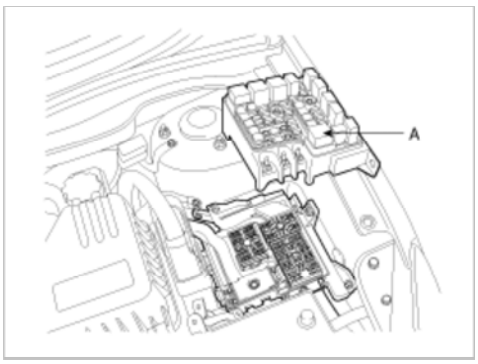
1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the engine room junction box upper cover.
3. Loosen the ring terminal mounting 3 nuts(A) then remove the ring terminal cables.
4. Loosen the body and lower cover 2 bolts(B).
5. Loosen the connector 3 bolts(C).



6. Remove the fuse and relay box(A) from the lower cover.



7. Remove the lower cover and mating connectors after loosening the box mounting 2 bolts.

Installation

1. Install the lower cover.

TORQUE : 10 ~ 12Nm (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lbf.ft)

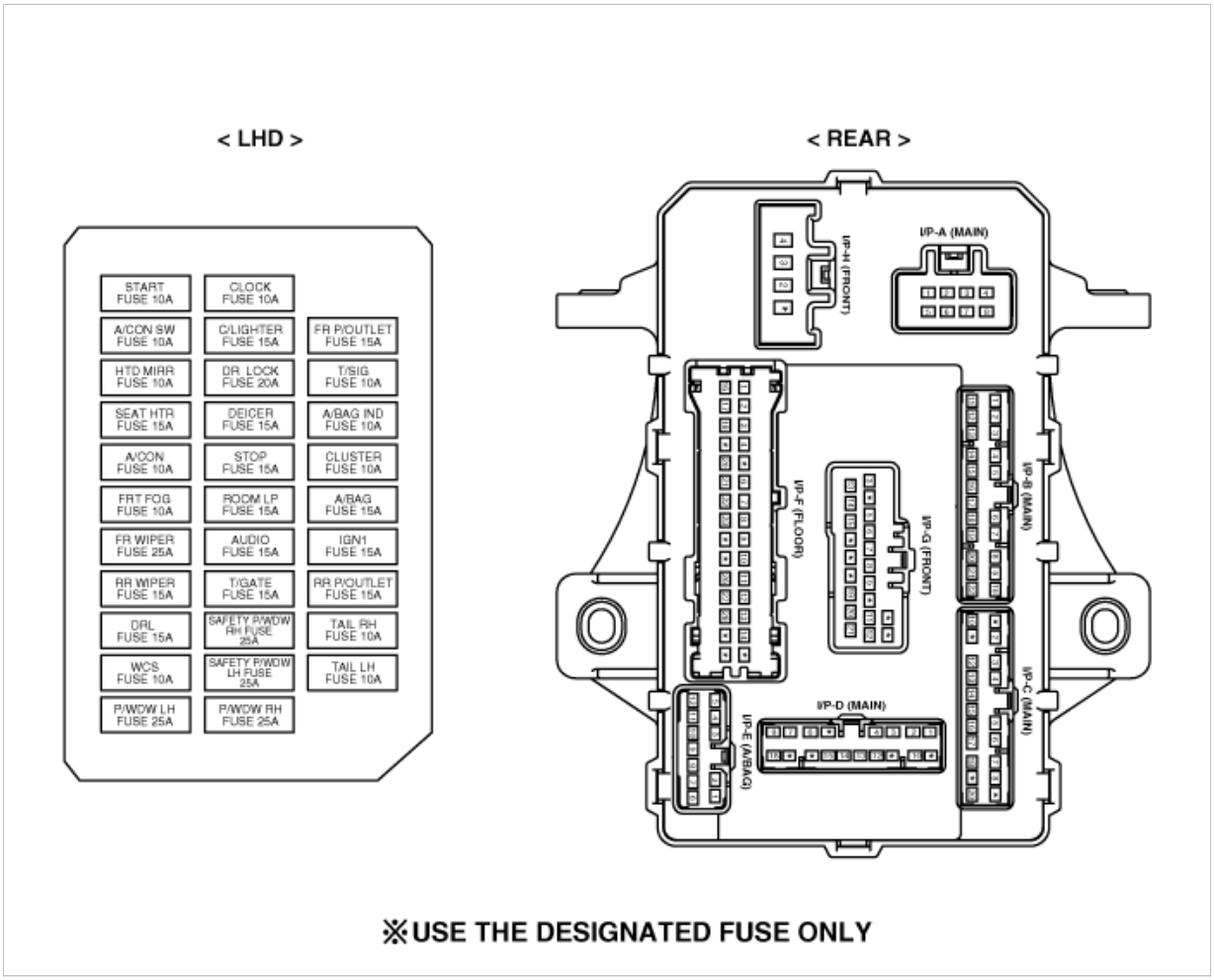
2. Install the fuse and relay box to the lower cover.

TORQUE :
Connector bolt : 10 ~ 12Nm (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lbf.ft)
Ring terminal mounting nut : 10 ~ 12Nm (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lbf.ft)
Body and lower cover bolt : 10 ~ 12Nm (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lbf.ft)

3. Install the junction box upper cover.

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Components and Components Location

Component Location



CIRCUIT

FUSE		(A)	Circuit Protected
START		10A	Ignition Lock Switch, ICM Relay Box (Burglar Alarm Relay), E/R Junction Box (Start Relay), Transaxle Range Switch
A/CON SW		10A	A/C Control Module, FET(Field Effect Transistor)
HTD MIRR		10A	A/C Control Module, Driver/Passenger Power Outside Mirror, Passenger Air Bag SBR
SEAT HTR		15A	Front Seat Heater Switch LH/RH, Front Seat Heater Control Module LH/RH
A/CON		10A	A/C Control Module, BCM, Incar Temperature Sensor, Rain Sensor, Blower Relay, Home Link ECM Sunroof Control Module, Electro Chromic Mirror, ICM Relay Box (Rain Sensor Relay)
H/LP		10A	Front Fog Lamp Relay, DRL Control Module
FR WIPER		25A	Multifunction Switch, E/R Junction Box(Front Wiper Motor, Front Wiper Relay)
RR WIPER		15A	Multifunction Switch, Rear Wiper Control Module, Rear Wiper Motor
DRL		15A	DRL Control Module
WCS		10A	Weight Classification Sensor
P/WDW LH		25A	Power Window Main Switch, Rear Power Window Switch LH
CLOCK		10A	Audio, ATM Key Lock Control Module, Power Outside Mirror Switch, Digital Clock
C/LIGHTER		15A	Cigarette Lighter
DR LOCK		20A	Sunroof Control Module, ICM Relay Box (Door Unlock/Lock Relay, Driver Door Unlock Relay)
DEICER		15A	ICM Relay Box (Front Deicer Relay)
STOP		15A	ATM Shift Lever Switch, Stop Lamp Switch, Key Solenoid
POWER CONNECTOR	ROOM LP	15A	Luggage Lamp, Data Link Connector, Instrument Cluster, Room Lamp, Vanity Lamp Switch LH/RH, A/C Control Module BCM, Ignition Key ILL. & Door Warning Switch, Sunroof Switch, Tire Pressure Monitoring Module, Map Lamp Rear Parking Assist Buzzer, Digital Clock, Home Link ECM
	AUDIO	15A	Audio
T/GATE		15A	Tail Gate Actuator, BCM, Tail Gate Relay
SAFETY P/WDW RH		25A	Rear Safety Power Window Module RH, AMP, Passenger Safety Power Window Module Rear Power Window Switch RH/LH, Safety Power Window Main Switch
SAFETY P/WDW LH		25A	Rear Safety Power Window Module LH, Driver Safety Power Window Module
P/WDW RH		25A	Power Window Main Switch, Rear Power Window Switch RH, Passenger Power Window Switch
FR P/OUTLET		15A	Front Power Outlet
T/SIG		10A	Hazard Switch
A/BAG IND		10A	Instrument Cluster
CLUSTER		10A	Instrument Cluster,BCM, ATM Key Lock Control Module, Front Seat Heater Control Module LH/RH Tire Pressure Monitoring Module
A/BAG		15A	SRS Control Module, A/C Control Module, Weight Classification Sensor, Telltale Lamp
IGN1		15A	ESC Switch, EPS Control Module
RR P/OUTLET		15A	Rear Power Outlet, E/R Junction Box (Head Lamp Lo/Hi Relay)
TAIL RH		10A	Rear Combination Lamp RH, Glove Box Lamp, Head Lamp RH, Shunt Connector, Side Marker Lamp RH
TAIL LH		10A	Head Lamp LH, Rear Combination Lamp LH, Side Marker Lamp LH, Rear Side Marker Lamp RH

※ USE THE DESIGNATED FUSE ONLY

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Repair procedures

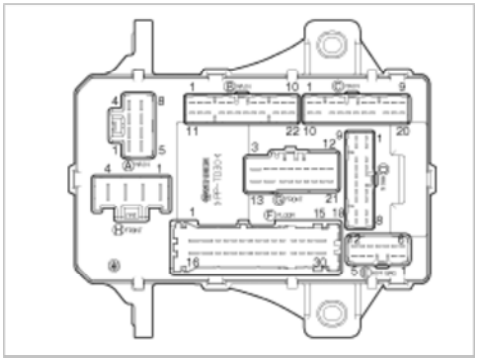
Inspection

Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew first and completely eliminate the problem before installing a new fuse.

Passenger Compartment Relay

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the junction box.



Power Window

Check for continuity between the terminals.

1. There should be continuity between the No.2 terminal in the I/P-H and the No.16 or 17 terminal in the I/P-F when power and ground are connected to the No.2 terminal in the I/P-H and the No.17 terminal in the I/P-B.
2. There should be no continuity between the No.2 terminal in the I/P-H and the No.16 or 17 terminal in the I/P-F when power and ground are connected to the No.2 terminal in the I/P-H and the No.17 terminal in the I/P-B.

Tail Lamp

Check for continuity between the terminals.

1. There should be continuity between the No.2 terminal in the I/P-H and the No.15(LH) or 4(RH) terminal in the I/P-G when power and ground are connected to the No.2 terminal in the I/P-H and the No.6 terminal in the I/P-D.
2. There should be no continuity between the No.2 terminal in the I/P-H and the No.15(LH) or 4(RH) terminal in the I/P-G when power and ground are connected to the No.2 terminal in the I/P-H and the No.6 terminal in the I/P-D.

Tailgate Lid Open

Check for continuity between the terminals.

1. There should be continuity between the No.3 terminal in the I/P-H and the No.2 terminal in the I/P-D when power and ground are connected to the No.3 terminal in the I/P-H and the No.28 terminal in the I/P-F.
2. There should be no continuity between the No.3 terminal in the I/P-H and the No.2 terminal in the I/P-D when power and ground are connected to the No.3 terminal in the I/P-H and the No.28 terminal in the I/P-F.

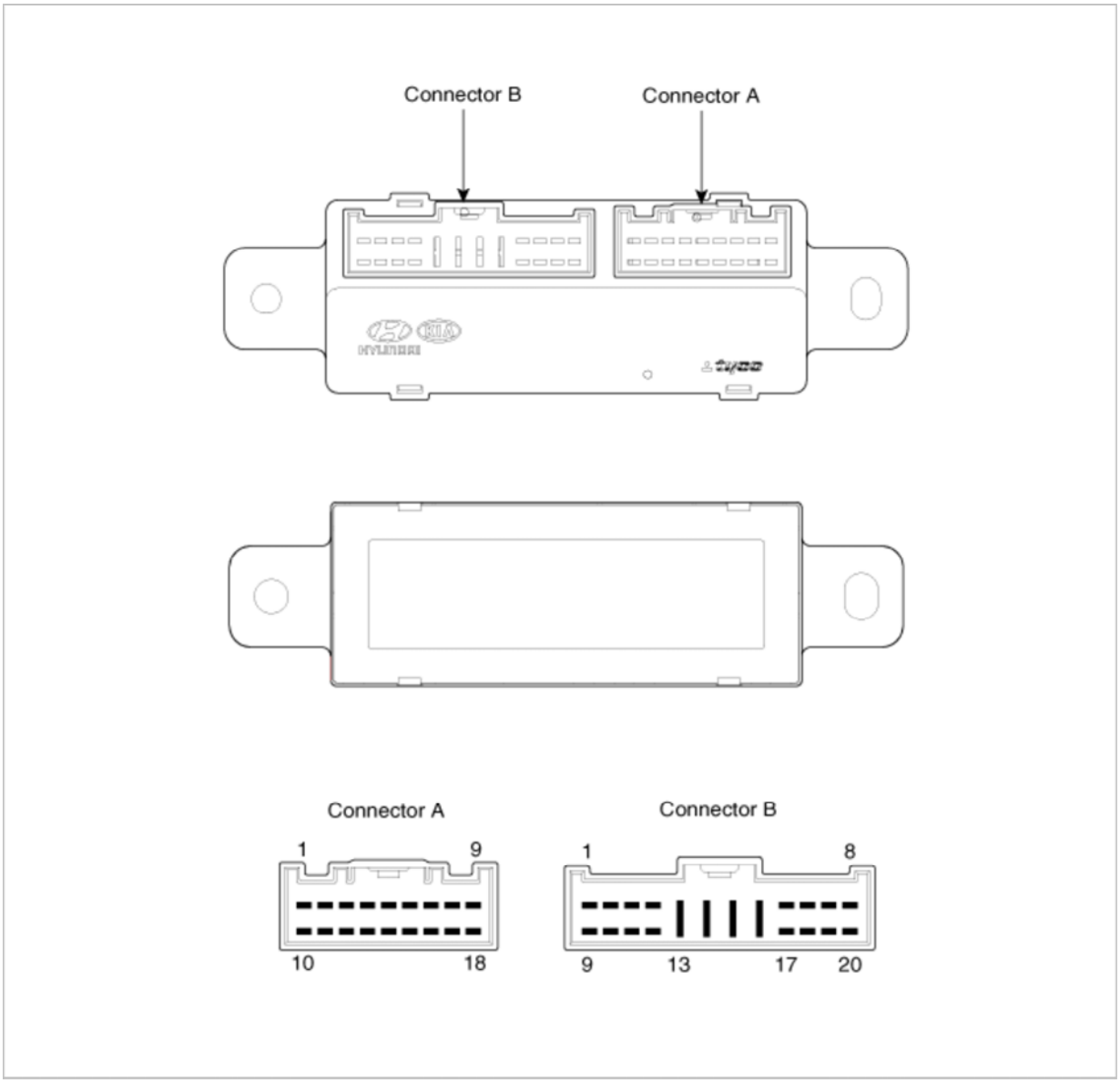
Rear Heater

Check for continuity between the terminals.

1. There should be continuity between the No.3 terminal in the I/P-G and the No.2 or 4 terminal in the I/P-F when power and ground are connected to the No.3 terminal in the I/P-G and the No.16 terminal in the I/P-B.
2. There should be no continuity between the No.3 terminal in the I/P-G and the No.2 or 4 terminal in the I/P-F when power and ground are connected to the No.3 terminal in the I/P-G and the No.16 terminal in the I/P-B.

Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Components and Components Location

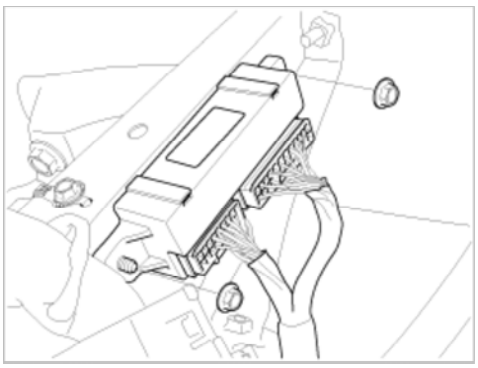
Component



Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Description and Operation

Description

The ICM is united with many kinds of relays and installed over the instrument panel box.



Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Repair procedures

Inspection

1. Disconnect the negative(-) battery terminal.
2. Remove the ICM relay box.

Door Lock

Check for continuity between the terminals.

1. There should be continuity between the No.5 and No.14 terminals when power and ground are connected to the No.11 and No.13 in the ICM-B.
2. There should be no continuity between the No.5 and No.14 terminals when power is disconnected.

Door Unlock

Check for continuity between the terminals.

1. There should be no continuity between the No.4 and No.14 terminals when power and ground are connected to the No.10 and No.13 in the ICM-B.
2. There should be continuity between the No.4 and No.14 terminals when power is disconnected.

Burglar Alarm Horn

Check for continuity between the terminals.

1. There should be continuity between the No.8 and No.18 terminals when power and ground are connected to the No.6 and No.19 in the ICM-B.
2. There should be no continuity between the No.8 and No.18 terminals when power is disconnected.

Burglar Alarm

Check for continuity between the terminals.

1. There should be continuity between the No.3 and No.10 terminals when power and ground are connected to the No.1 and No.11 terminals in the ICM-A.
2. There should be no continuity between the No.3 and No.10 terminals when power is disconnected.

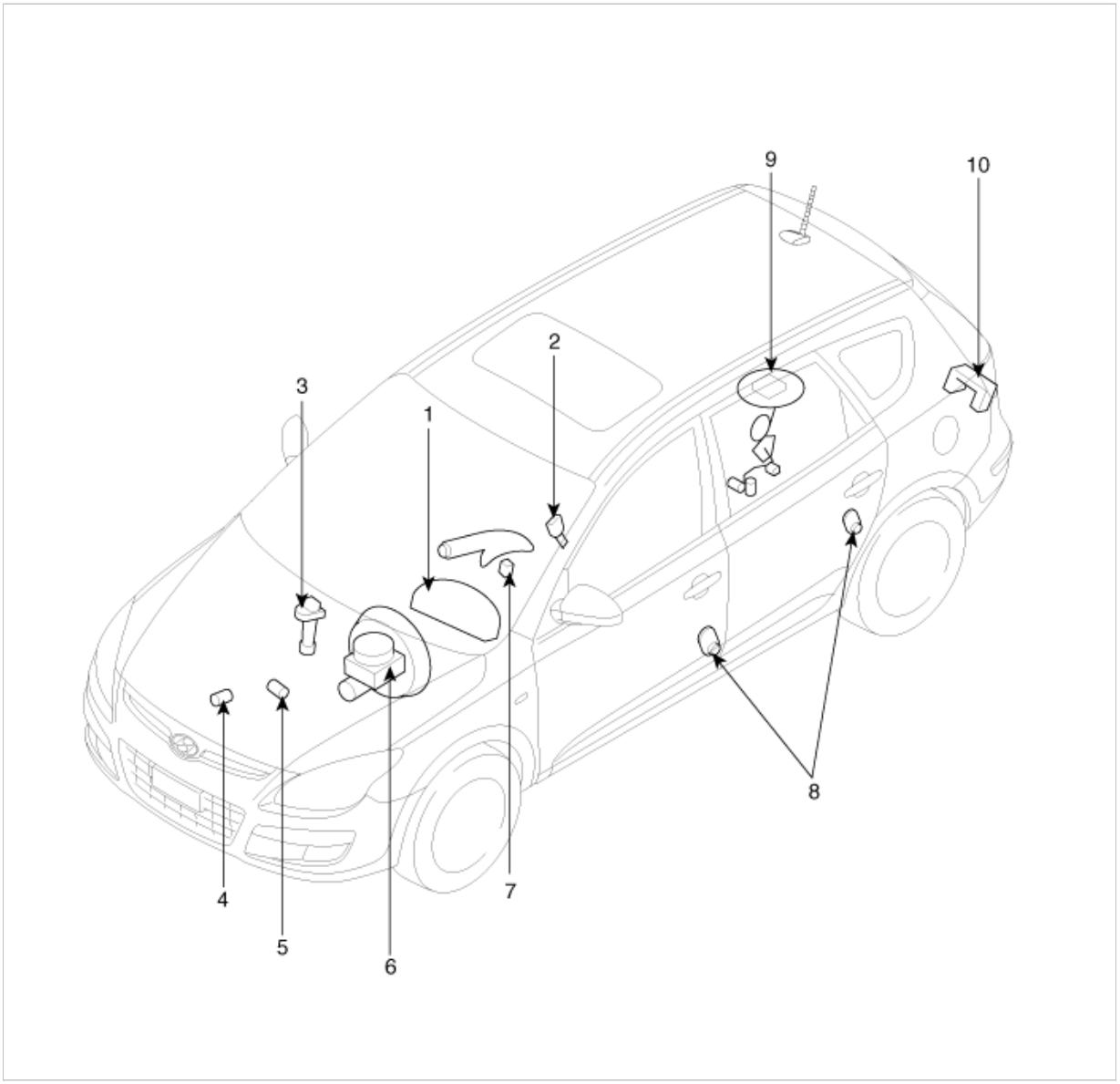
Hazard Lamp

Check for continuity between the terminals.

1. There should be continuity between the No.3 and No.12 terminals when power and ground are connected to the No.3 and No.17 terminals in the ICM-B.
2. There should be no continuity between the No.3 and No.12 terminals when power is disconnected.

Body Electrical System > Indicators And Gauges > Components and Components Location

Component Location

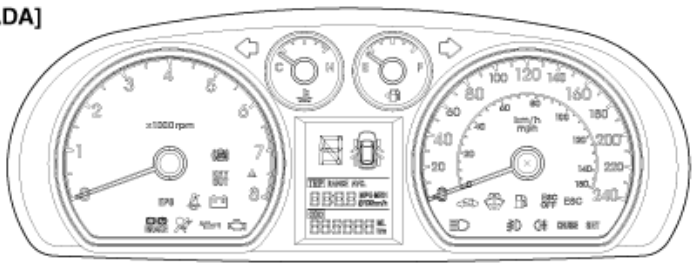


1. Cluster assembly	6. Brake fluid level warning switch
2. Seat belt switch	7. Parking brake switch
3. Vehicle speed sensor	8. Door switch
4. Engine coolant temperature sender	9. Fuel gauge sender
5. Oil pressure switch	10. Tailgate switch

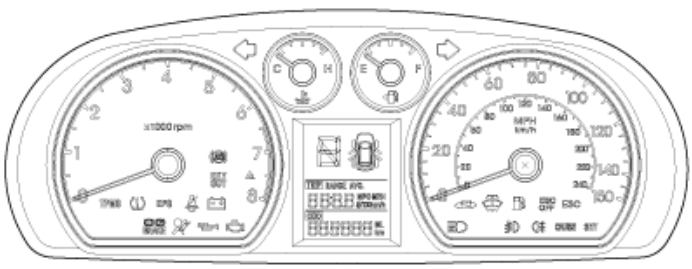
Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location

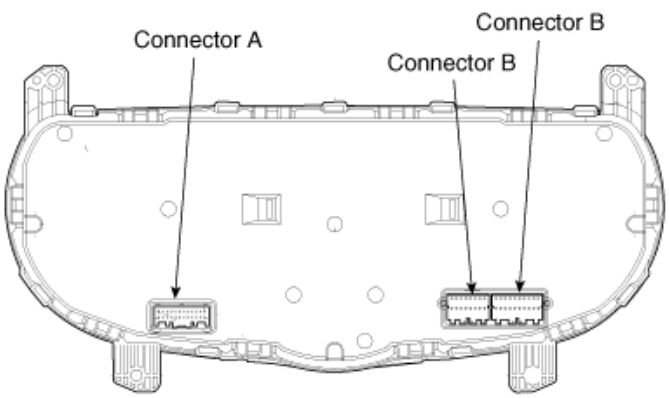
Components

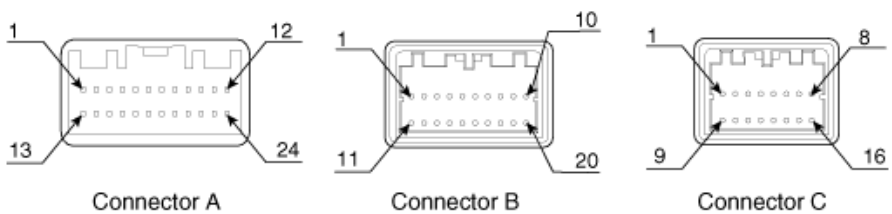
[CANADA]



[USA]







Instrument Cluster

	Connector A	Connector B	Connector C
1	-	BRAKE	P
2	-	ABS	R(+)
3	Oil Pressure	EBD	N
4	CHARGE	TURN-L	D
5	Seat Belt	TURN-R	PWM SIGNAL(A/T)
6	CAN HI	Power GROUND	-
7	CAN LOW	HIGH SPEED Warning	-
8	MODE SW	AIR/BAG(+)	WATER SEPARATOR
9	IMMOBILIZER	AIR/BAG(-)	-
10	-	LOWER WASHER	Door Open(FL)

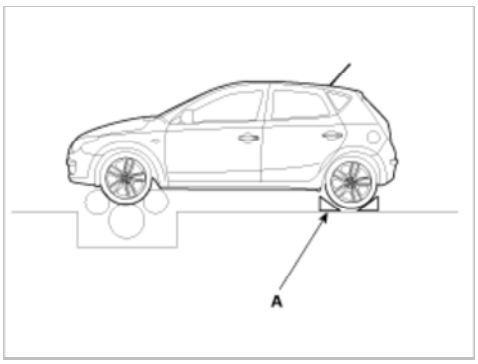
11	CHECK ENGINE	-	Door Open(FR)
12	FUEL Sender	ESC	Door Open(RL)
13	B+	ESC OFF	Door Open(RR)
14	-	HIGH BEAM(+)	TRUNK Open
15	IGN+	HIGH BEAM(-)	Lamp FAIL(L)
16	-	SET	Lamp FAIL(R)
17	ILLUMINATION(+)	CRUISE	
18	ILLUMINATION(-)	-	
19	SPEED SIGNAL	Front Fog Lamp	
20	TACHO SIGNAL	-	
21	TEMPERATURE Sender		
22	INJECTION SIGNAL		
23	SIGNAL GROUND		
24	FUEL GROUND		

Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

Inspection

Speedometer

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks(A) as appropriate.



3. Check if the speedometer indicator range is within the standard values.

> CAUTION
>
> Do not operate the clutch suddenly or increase/ decrease speed rapidly while testing.

> NOTE
>
> Tire wear and tire over or under inflation will increase the indication error.

[km/h]

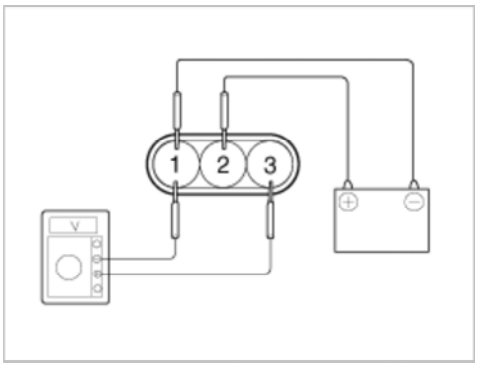
Velocity (km/h)	20	40	60	80	100
Tolerance (km/h)	+3.1 +0.4	+2.7 +0.2	+3.4 +0.9	+3.8 +1.3	+4.6 +1.6
Velocity (km/h)	120	140	160	180	220
Tolerance (km/h)	+4.9 +1.9	+6.2 +2.2	+6.5 +2.5	+7.8 +2.8	+9.0 +4.0

[MPH]

Velocity (MPH)	20	40	60	80
Tolerance (MPH)	+2.0 +0.2	+2.1 +0.4	+2.2 +0.5	+3.1 +1.3
Velocity (MPH)	100	120	140	-
Tolerance (MPH)	+4.0 +1.6	+4.9 +1.9	+5.2 +2.2	-

Vehicle Speed Sensor

1. Connect the positive (+) lead from battery to terminal 2 and negative (-) lead to terminal 1.
2. Connect the positive (+) lead from tester to terminal 3 and the negative (-) lead to terminal 1.
3. Rotate the shaft.
4. Check that there is voltage change from approx. 0V to 11V or more between terminals 3 and 1.
5. The voltage change should be 4 times for every revolution of the speed sensor shaft.
   If operation is not as specified, replace the sensor.



Tachometer

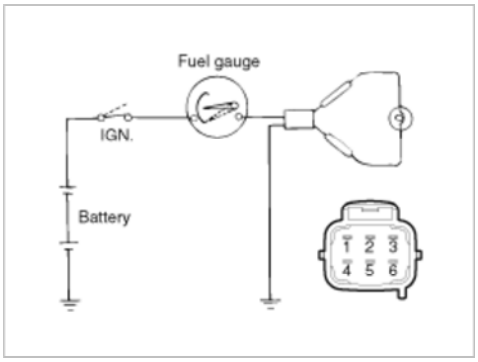
1. Connect the scan tool to the diagnostic link connector or install a tachometer.
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

> **CAUTION**
>
> 1) Reversing the connections of the tachometer will damage the transistor and diodes inside.
> 2) When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution (rpm)	1,000	2,000	3,000	4,000	Remark
Tolerance (rpm)	±100	±125	±150	±150	Gasoline
Revolution (rpm)	5,000	6,000	7,000	-	Remark
Tolerance (rpm)	±150	±180	±210	-	Gasoline

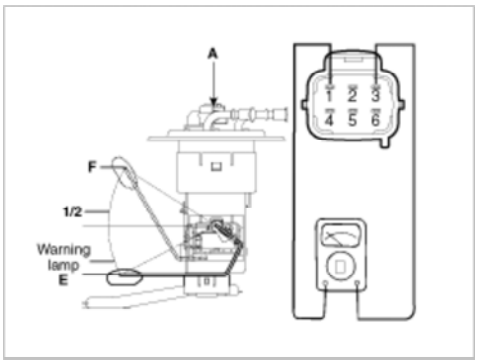
Fuel Gauge

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 wattages, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



Fuel Gauge Sender

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

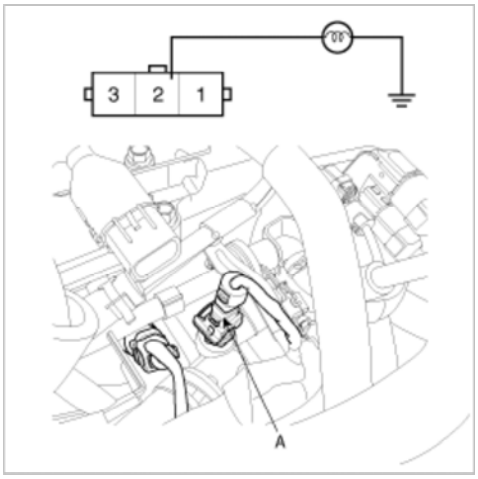
Position	Resistance(Ω)
E	184 ± 1Ω
Warning lamp	170 ± 1Ω
1/2	66 ± 1Ω
Sender (F)	15 ± 1Ω

3. If the height resistance is unsatisfied, replace the fuel sender as an assembly.

> **CAUTION**
>
> After completing this test, wipe the sender dry and reinstall it in the fuel tank.

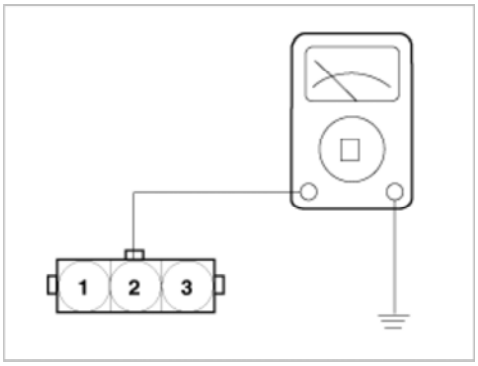
Engine Coolant Temperature Gauge

1. Disconnect the wiring connector (A) from the engine coolant temperature sender in the engine compartment.
2. Connect a 12V, 3.4 wattages test bulb between the harness side connector 2 terminal and ground.
3. Turn the ignition switch ON.
4. Verify that the test bulb flashes and that the indicator moves to HOT position.
   If operation is not as specified, replace the cluster (Engine coolant temperature gauge). Then recheck the system.



Engine Coolant Temperature Sender

1. Using an ohmmeter, measure the resistance between the terminal 2 and ground.

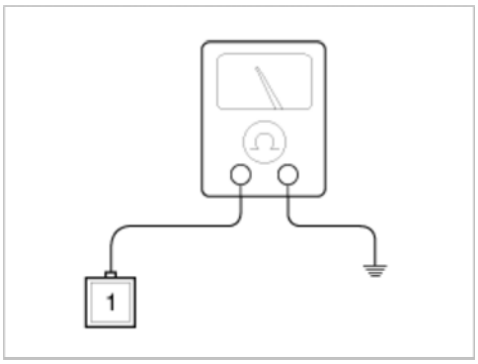


2. If the resistance value is not as shown in the table, replace the temperature sender.

Temp °F(°C)	131 (55)	185 (85)	230 (110)	257 (125)	E/G
Resistance (Ω)	155	53.8	22.5	16.1	Gasoline
Temp °F(°C)	113 (45)	160 (71)	230 (110)	257 (125)	E/G
Resistance (Ω)	242	86.5	22.5	16.1	Diesel

Oil Pressure Switch

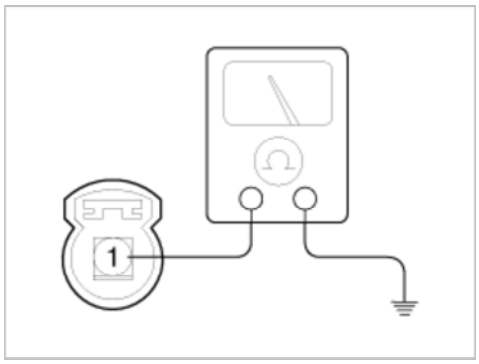
1. Check that there is continuity between the oil pressure switch terminal and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.



Oil Pressure Warning Lamp

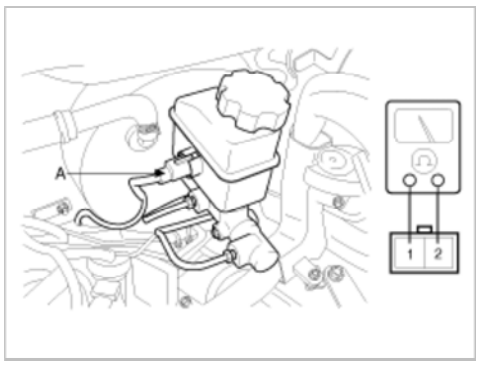
1. Disconnect the connector from the warning switch and ground the terminal on the wire harness side connector.

2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect the wire harness.



Brake Fluid Level Warning Switch

1. Remove the connector (A) from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



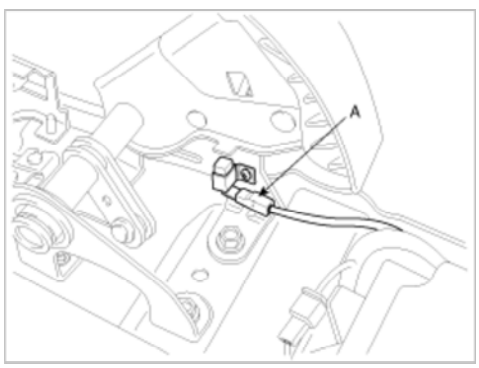
Brake Fluid Level Warning Lamp

1. Ignition "ON".
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

Parking Brake Switch

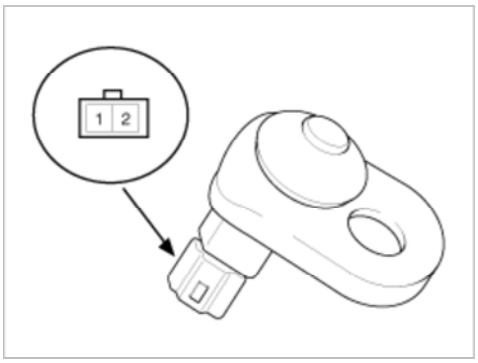
The parking brake switch is a pull type. It is located at the side of the parking brake lever.

1. Check that there is continuity between the terminal and switch body with the switch (A) ON.
2. Check that there is no continuity between the terminal and switch body with the switch OFF.
   If continuity is not as specified, replace the switch or inspect its ground connection.



Door Switch

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

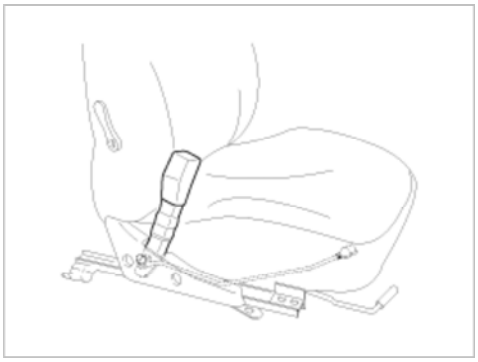


Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

Seat Belt Switch

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



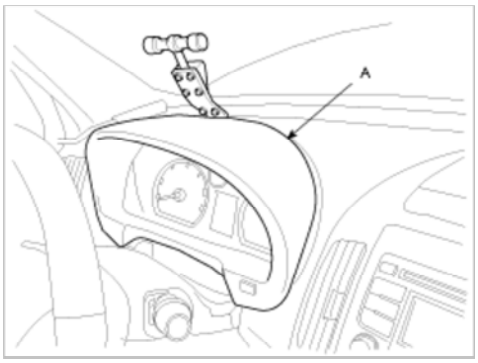
Seat Belt Warning Lamp

With the ignition switch turned ON, verify that the lamp glows.

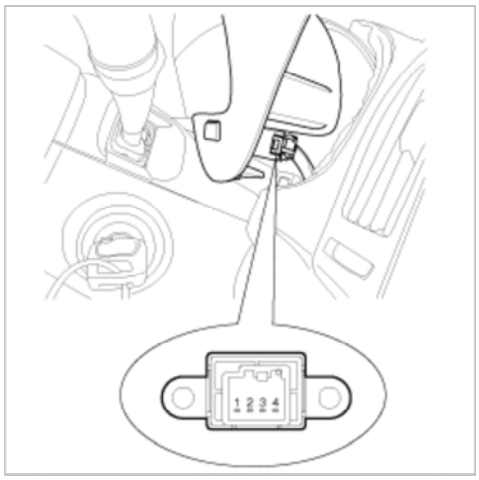
Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

Trip Switch

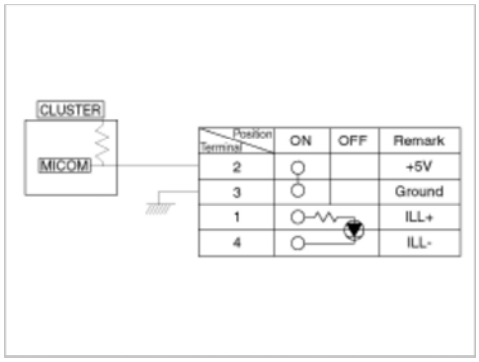
1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel (A).(Refer to the Body group - " Crash pad")



3. Remove the trip switch (A) from the cluster facia panel (B).

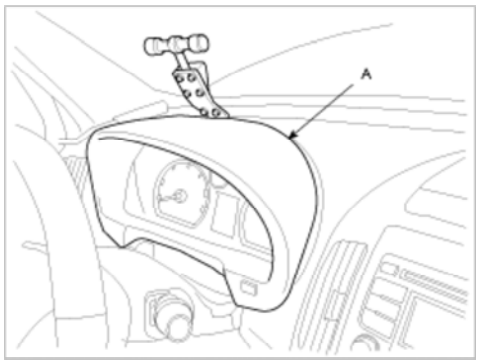


4. Check for continuity between the terminals in each switch position according to the table.

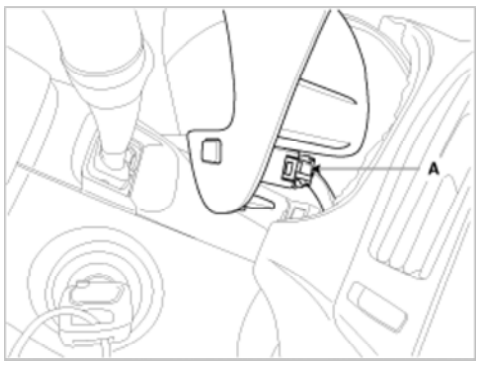


Removal

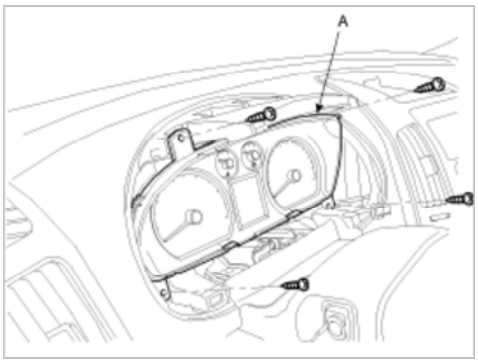
1. Disconnect the negative (-) battery terminal.
2. Remove the cluster fascia panel (A).
   (Refer to the Body group - "Crash pad")



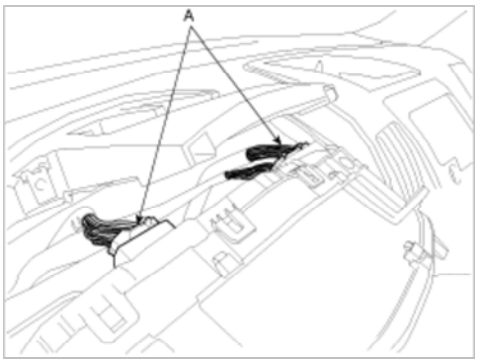
3. Disconnect the trip computer switch connector (A) from the cluster fascia panel.



4. Remove the cluster fascia (A) from the housing after removing 4 screws.



5. Disconnect the cluster fascia connecters(A) and then remove the cluster.



Installation

1. Connect the cluster connector.
2. Install the cluster assembly.
3. Connect the trip switch connector.
4. Install the center facia panel.

Body Electrical System > Indicators And Gauges > Troubleshooting

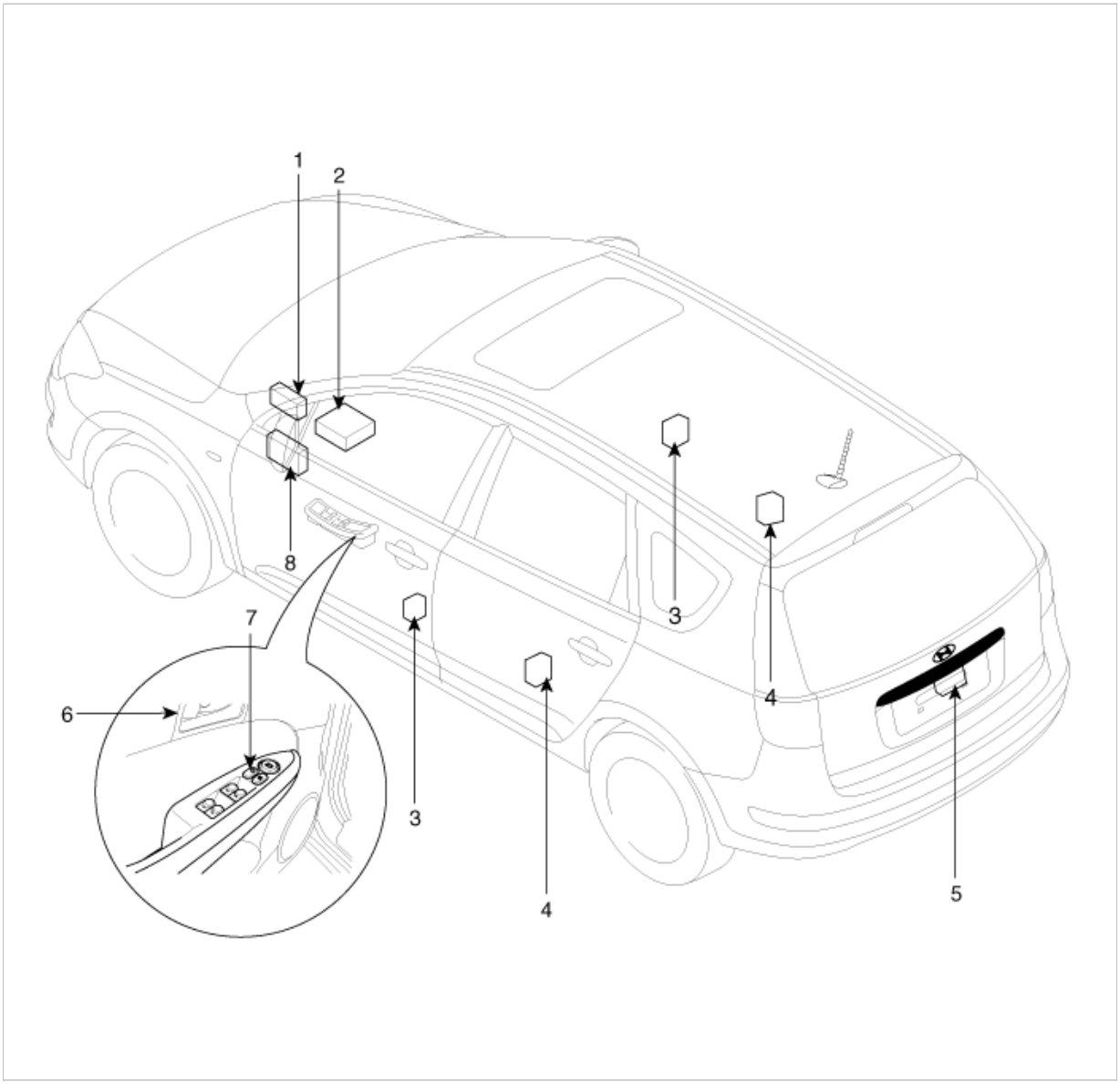
Troubleshooting

Symptom	Possible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	Vehicle speed sensor faulty	Check vehicle speed sensor
	Wiring or ground faulty	Repair if necessary
Tachometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge

	Water temperature sender faulty	Check sender
	Wiring or ground faulty	Repair if necessary
Oil pressure warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Parking brake warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Open door warning lamp and tailgate warning lamp do not light up	Memory fuse (15A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Body Electrical System > Power Door Locks > Components and Components Location

Component Location



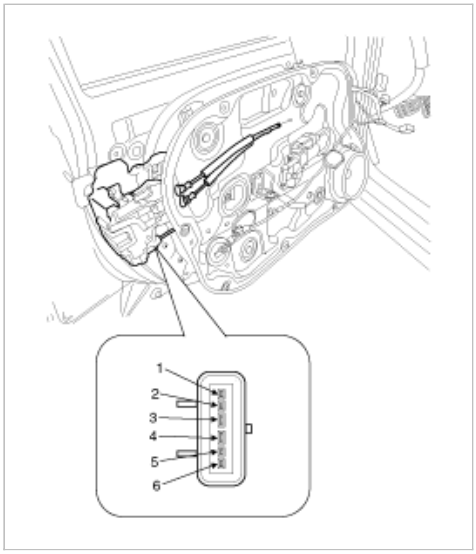
1. ICM relay box (Door lock/unlock relay)	5. Tailgate actuator & switch
2. Body control module (BCM)	6. Door lock knob
3. Front door lock actuator & switch	7. Door lock switch
4. Rear door lock actuator & switch	8. Passenger compartment junction box (Tailgate relay)

Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

Inspection

Front Door Lock Actuator

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



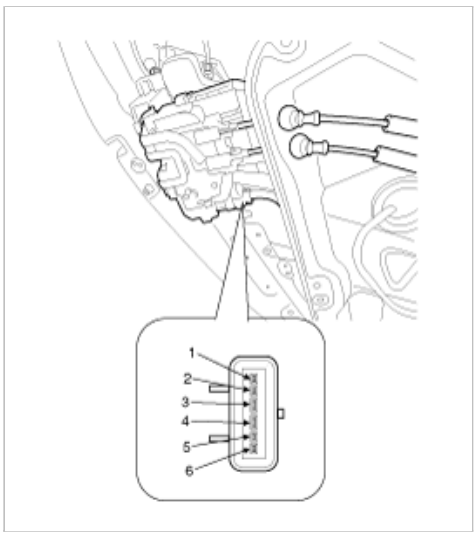
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

[Central Lock]

Position \ Terminal		4	3
Front left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		3	4
Front right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Rear Door Lock Actuator

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



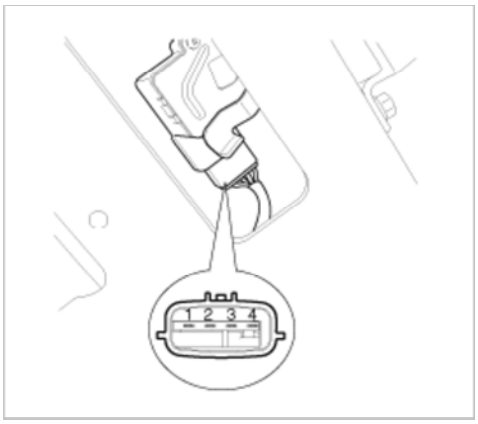
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

[Central Lock]

Position \ Terminal		4	3
Rear left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		3	4
Rear right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Tailgate Lock Actuator Inspection

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

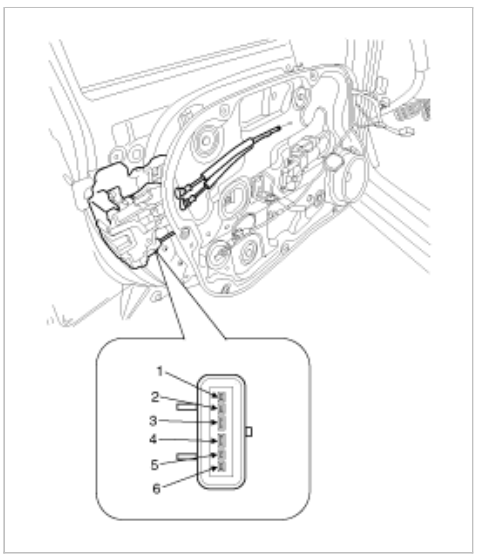


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

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



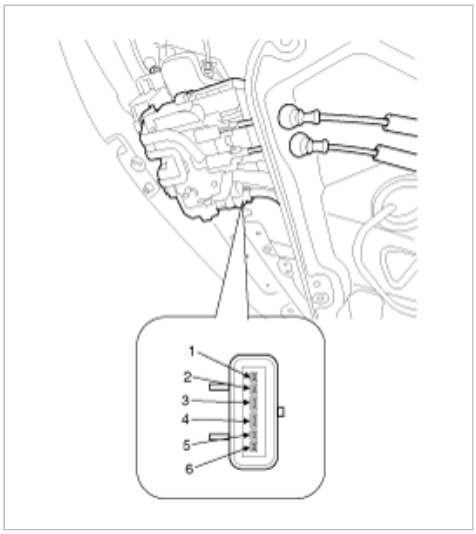
4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

[CENTRAL LOCK]

Position		Terminal 2	5	1
Front left	Clockwise	○—○		
	Counter-clockwise		○—○	
Position		Terminal 5	2	6
Front right	Clockwise	○—○		
	Counter-clockwise		○—○	

Rear Door Lock Switch

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



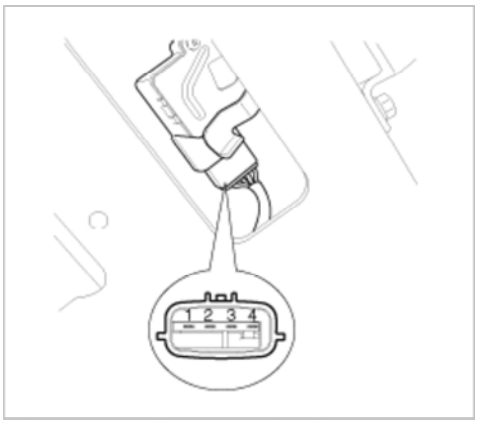
4. Check for continuity between the terminals in each switch position according to the table.

[CENTRAL LOCK]

Position		Terminal 5	6
Central door lock	Rear left	Lock	
		Unlock	○—○
Position		Terminal 2	1
Central door lock	Rear right	Lock	
		Unlock	○—○

Tailgate Switch

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

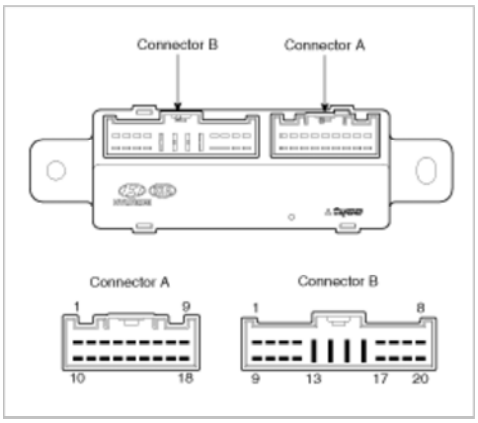


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	2
Lock		
Unlock	○———	———○

Body Electrical System > Power Door Locks > Power Door Lock Relay > Repair procedures

Inspection



Door Lock

1. Disconnect the negative (-) battery terminal.
2. Remove the ICM relay box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.5 terminal and No.4 terminals in the ICM-B when power and ground are connected to the No.11 terminal and No.13 terminal in the ICM-B.
5. There should be no continuity between the No.5 terminal and No.14 terminal in the ICM-B when power is disconnected.

Power \ Terminal	ICM-B (5)	ICM-B (14)	ICM-B (11)	ICM-B (13)
Disconnected			○———	———○
Connected	○———	———○	⊖———	———⊕

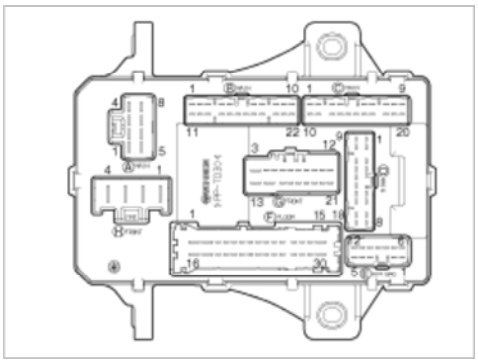
Door Unlock

1. Disconnect the negative (-) battery terminal.
2. Remove the ICM relay box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.4 terminal and No.14 terminal in the ICM-B when power and ground are connected to the No.10 terminal and No.13 terminal in the ICM-B.
5. There should be no continuity between the No.4 terminal and No.14 terminal in the ICM-B when power is disconnected.

Terminal / Power	ICM-B (4)	ICM-B (14)	ICM-B (10)	ICM-B (13)
Disconnected			○	○
Connected	○	○	⊖	⊕

Tailgate Open

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger compartment junction box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.3 terminal in the I/P-H and the No.2 terminal in the I/P-D when power and ground are connected to the No.3 terminal in the I/P-H and the No.28 terminal in the I/P-F.
5. There should be no continuity between the No.3 terminal in the I/P-H and the No.2 terminal in the I/P-D when power and ground are connected to the No.3 terminal in the I/P-H and the No.28 terminal in the I/P-F.



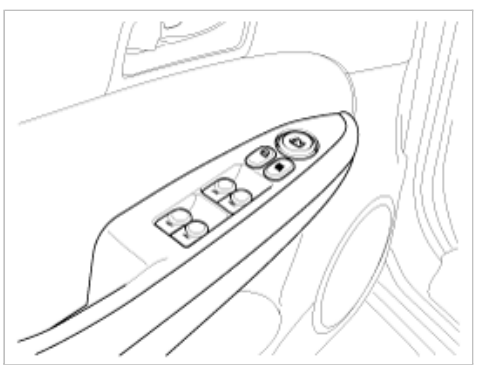
Terminal / Power	H-3	F-28	H-3	D-2
Disconnected			○	○
Connected	○	○	⊕	⊖

Body Electrical System > Power Door Locks > Power Door Lock Switch > Repair procedures

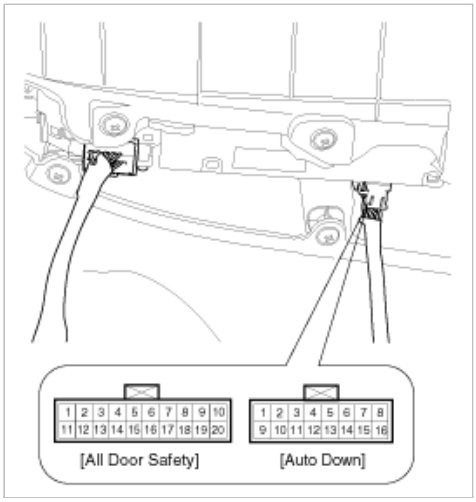
Inspection

Driver Door Lock Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch. (Refer to the Body group - "front door")



3. Disconnect the connector from the switch.



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

[Auto down]

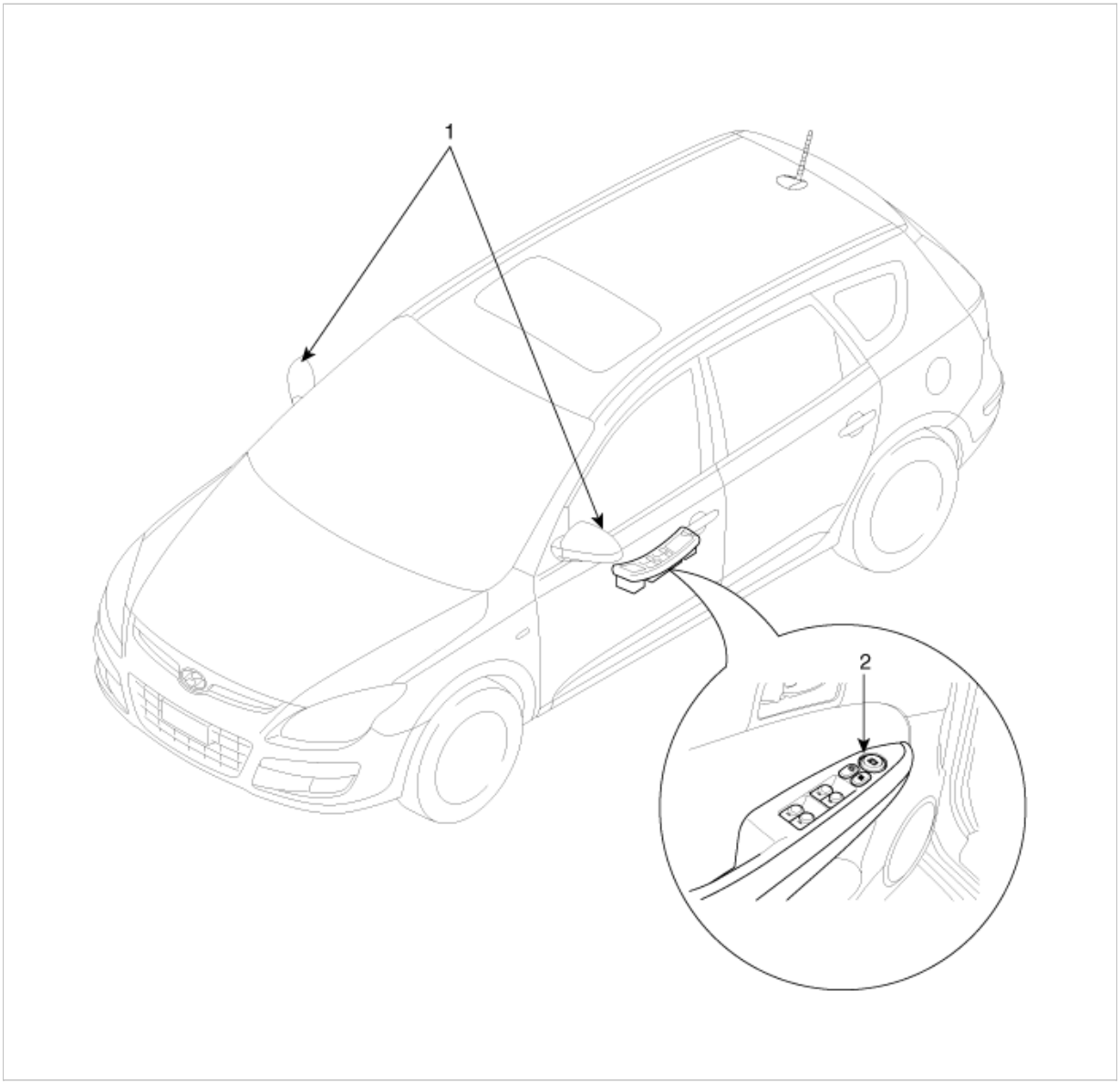
Position \ Terminal	11	5	4
LOCK		○——	——○
UNLOCK	○——	——○	

[All safety]

Position \ Terminal	11	15	1
LOCK		○——	——○
UNLOCK	○——	——○	

Body Electrical System > Power Door Mirrors > Components and Components Location

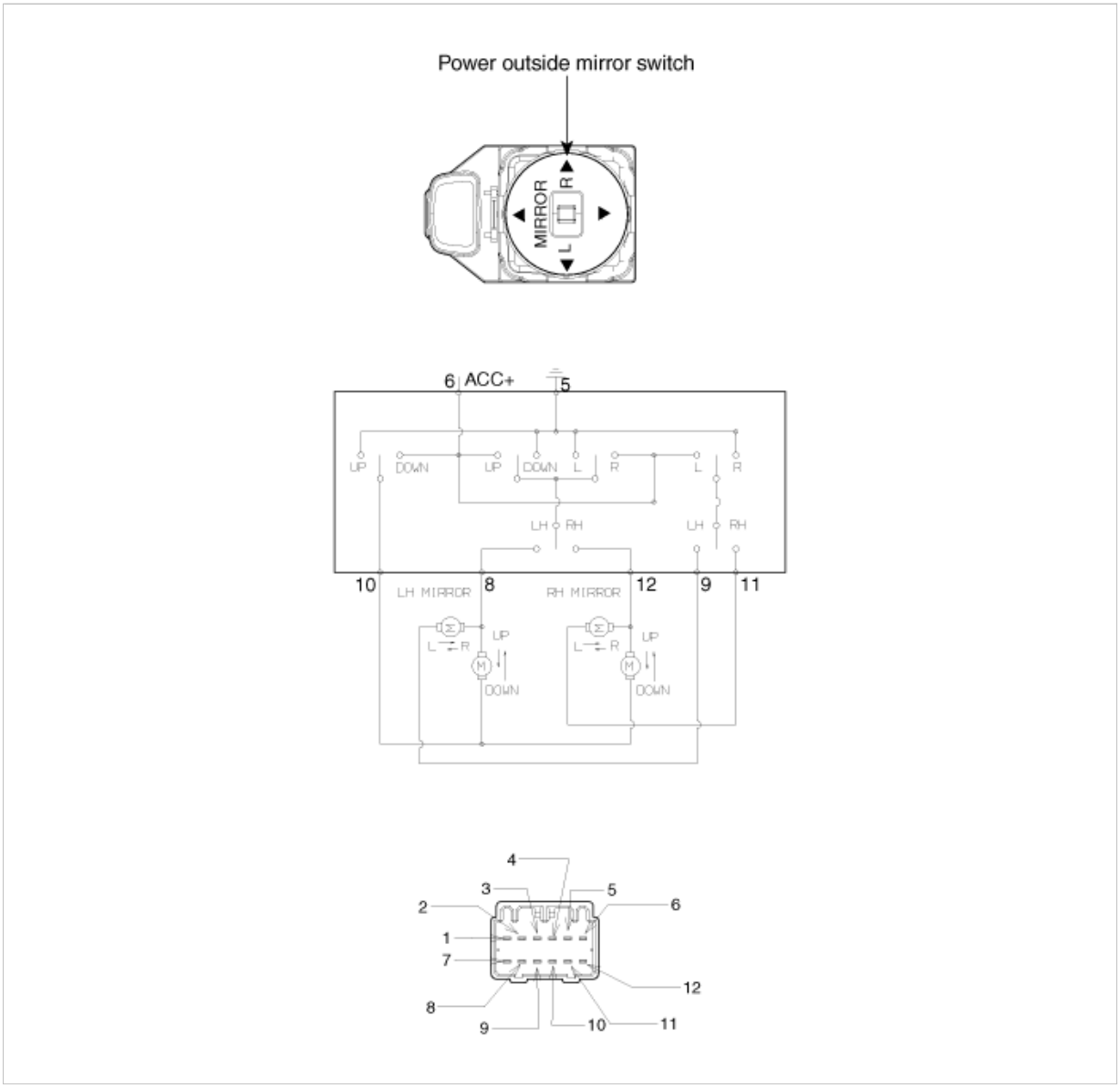
Component Location



1. Power door mirror	2. Power door mirror switch

Body Electrical System > Power Door Mirrors > Power Out Side Mirror Switch > Components and Components Location

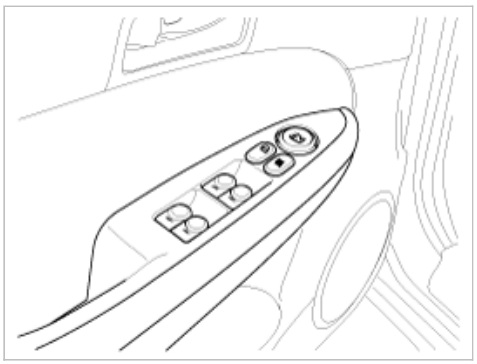
Components



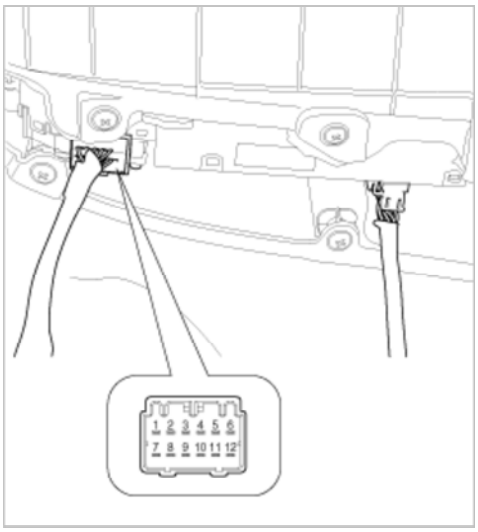
Body Electrical System > Power Door Mirrors > Power Out Side Mirror Switch > Repair procedures

Inspection

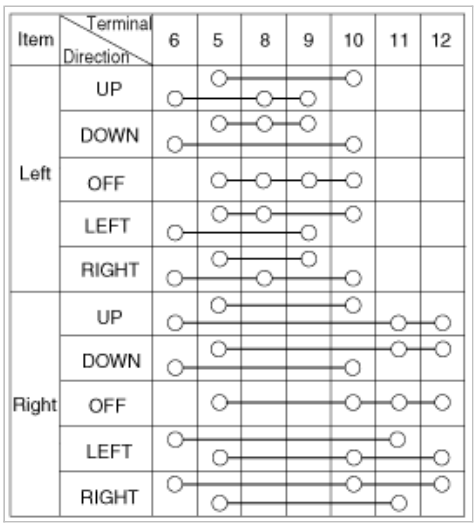
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch module. (Refer to the Body group-front door)



3. Check for the continuity between terminals of power door mirror switch according to the table.



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



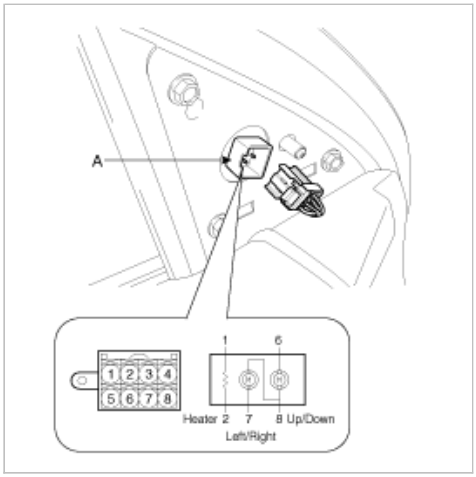
Item	Terminal / Direction	6	5	8	9	10	11	12
Left	UP	○	○	○	○	●		
	DOWN	○	○	○	○	●		
	OFF		○	○	○	○		
	LEFT	○	○	○	○	●		
	RIGHT	○	○	○	○	●		
Right	UP	○	○	○	○	●	○	○
	DOWN	○	○	○	○	●	○	○
	OFF		○	○	○	○	○	○
	LEFT	○	○	○	○	○	●	○
	RIGHT	○	○	○	○	○	●	○

Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

Inspection

1. Remove the front door quadrant inner cover (A). Take care not to damage fixing clips. (Refer to the Body group - front door)

2. Disconnect the power door mirror connector from the harness.
3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



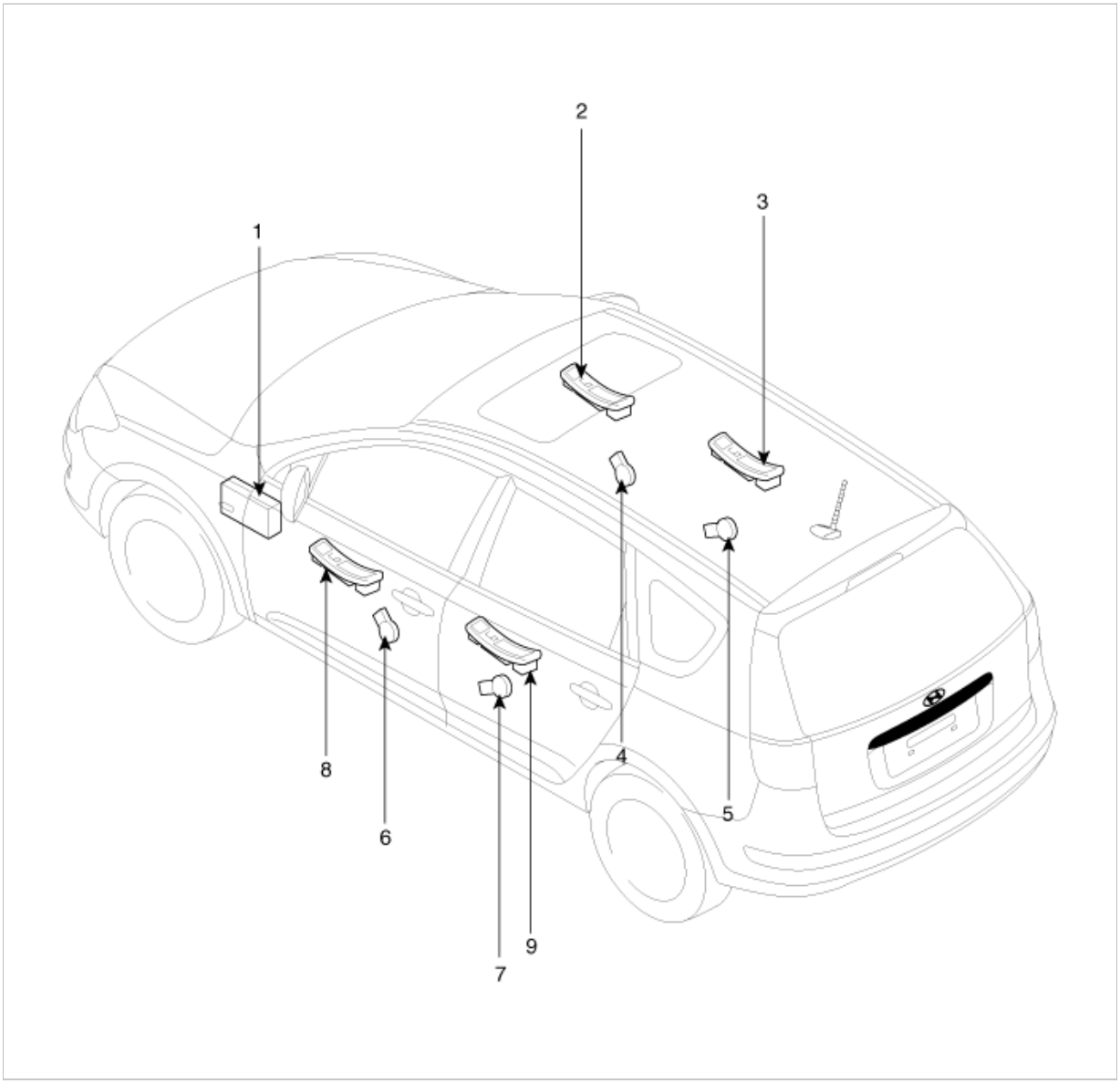
Terminal / Position	8	7	6	1	2
UP	○	○		○	
			○		○
DOWN			○	○	
	○	○			○
OFF	○	○		○	
RIGHT	○		○	○	
		○			○
LEFT		○		○	
	○		○		○

Mirror Heater

Terminal / Position	1	2
Heater	○	○

Body Electrical System > Power Windows > Components and Components Location

Component Location



1. Instrument panel junction box (Power window relay) 2. Passenger window switch 3. Rear window switch 4. Front window motor & Safety power window unit 5. Rear window motor & Safety power window unit	6. Front window motor & Safety power window unit 7. Rear window motor & Safety power window unit 8. Driver power window main switch 9. Rear window switch

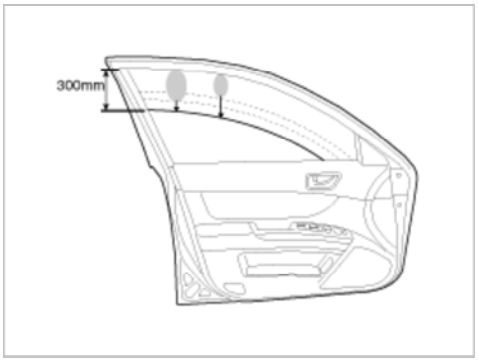
Body Electrical System > Power Windows > Description and Operation

Operation

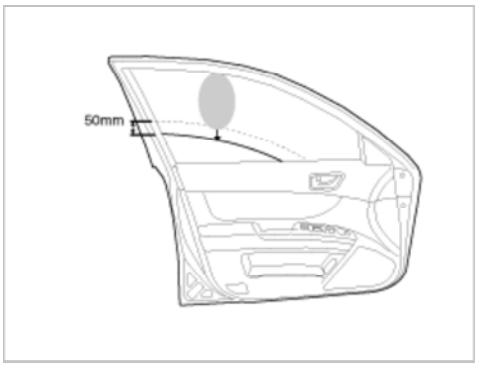
Function Of Safety Power Window

When all door (Front, Rear) power window auto-up switch is operated, safety function is activated.

1. Safety function condition
   When detect the force of 100N during the window rising, window is reversed.
2. Length of window reversing (except holding the auto-up switch)
   A. When detect the jamming during the 4mm ~ 250mm from top of the door.
   → Window is reversed until 300mm from top of the door.

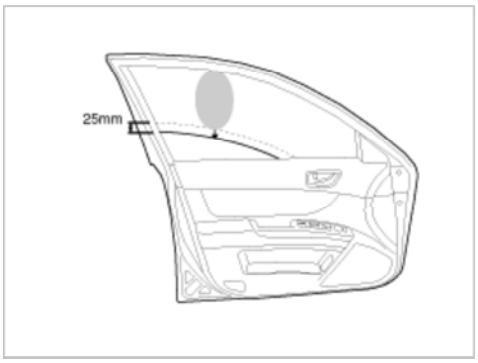


B. When detect the jamming over the 250mm from top of the door.
→ Window is reversed until 50mm from jamming position.
→ Window is reversed 50mm or bottom position in case of 50mm reversing distance.



C. When detect the jamming over 300mm from top of the door.
→ Window stops at reverse point.

3. Length of window reversing (holding the auto-up switch)
A. When detect the jamming during holding the auto-up switch.
→ Window is reversed until 25mm from jamming position.
B. Auto-up function is not available during the 5 seconds from above condition.
→ When holding the auto-up switch, window is operated as a manual-up function. (Safety function is not activated.)
C. When detect the jamming during holding the auto-up switch again.
→ Window is reversed until 25mm from jamming position.
D. When holding the auto-up switch after 5 seconds from above condition.
→ Window is reverse until 25mm from jamming position.



4. Safety function is not available area
Safety function is not available during the 4mm from top of the door.

Initializing Method Of The Safety Power Window

1. Position counter and position initialization
(1) Position counter
Window position counting is implemented by use of one Hall Effect sensor (HEF) connected to timer capture unit of the Controller with a resolution of 180° electrical.
Even the battery was separated from the car, it must keep the window position information.

(2) Position initialization
For position initialization, position counter detect the upper mechanical stop and lower mechanical Position. Motor control unit (MCU) allow only Manual mode activity (without ASD Anti-Squeeze Detection algorithm) feature) before to be

initialized.
Initialization means the condition to move the window system with full anti-pinch function and related functions by detecting the window travel distance (Upper/Lower mechanical limits).
Conditions for initialization are

A. de-initialized position counter
B. Power window switch Up activated
C. block condition detected
(no motor movement of more than 1 count during 1sec/ SW dependent)

Switch action with De-initialized condition :

A. Up direction : Manual & Auto P/WDW sw input → manual mode;
B. Down direction : Manual P/WDW sw input → manual mode, + Auto s/w input → auto mode

(3) Re-initialization
During re-initialization, position counter is set to "zero" at upper block position to compensate counting errors by software, mechanical tolerances or physics. Conditions for re-initialization are

A. initialized position counter.
B. window at upper block position (capture range EEPROM programmable)
C. block condition detected
(no motor movement of more than 1 count during 1 sec/ SW dependent)

(4) De-initialization
The system initialization/calibration will be lost in the following cases:

A. After parameter modification via diagnostic
B. Wrong EEPROM checksum at ECU wake-up or power-on
C. Movement outside predefined window stroke (above learned top position, below predefined bottom position)
D. De-initialization after a defined number (EEPROM) of reversals without re-initialization in the upper seal (activation /de-activation controlled by EEPROM value). A window down movement or switching off the window lifter permission resets the reversal counter value(activation by EEPROM bit).
E. De-initialization after a defined number of movements (EEPROM) without re-initialization in the upper seal (activation /de-activation controlled by EEPROM value)
F. Special de-initialization procedure :
The special window lifter de-initialization procedure works as follows:
- System is initialized
- Move window below soft-stop position (position EEPROM adjustable)
- Press MANU-down switch and keep it pressed
- Apply permission signal (serial-link = PIN 6) ON → OFF → ON within 2 seconds (time EEPROM adjustable)

(5) Soft stop function
In order to reduce noise and mechanical stress, the window movement is stopped under control of the ECU before the bottom position is reached.
The clearance is 0 / +10 mm (at 11.5 V to 14.5 V).
To activate the soft bottom stop function, the top reference position and bottom reference position have to be initialized. Therefore, the window is lifted into the top position until the block condition is detected. This position is taken as top reference position.
Afterwards, the window is moved to the bottom position until the block condition is detected (mechanical stop). This position is taken as bottom reference position.
The bottom reference position is re-initialized :

A. When window is operated down starting from soft stop position
B. Every "9" stops at soft stop position.

(6) Thermal protection
Thermal protection by software module is implemented to prevent from destruction of motor during overload condition. Motor temperature is estimated by integrating squared motor current as an estimate for heating power integral. When estimated motor temperature exceeds EEPROM programmable upper limit, motor is deactivated for fixed delay time (default value = 30 sec.)
Thermal shutdown during a window operation will not interrupt the operation due to safety reasons.

(7) Operation time limiter
Maximal operation time of power window motor is limited to 15 sec (EEPROM programmable).

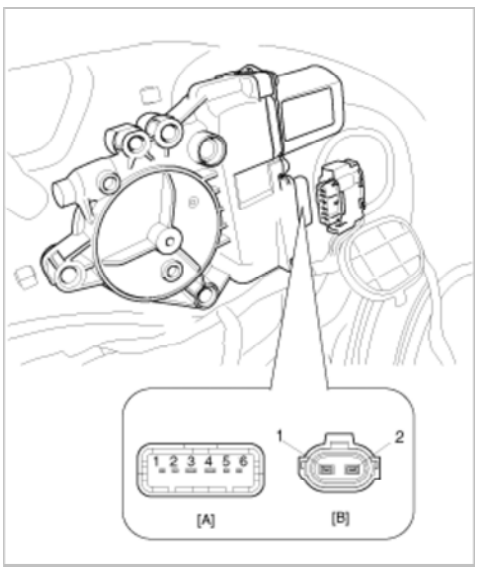
(8) Continuous reverse
Current Number of Continuous reverse of window is 5. With the below condition, this counter Will be initialized.

A. IG OFF
B. DOWN signal ON
C. Window CLOSE

Inspection

Front Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the front door trim. (Refer to the Body group-front door)
3. Disconnect the connector from the motor.
   (A : Safety, B : Standard)



4. 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.

[STANDARD]

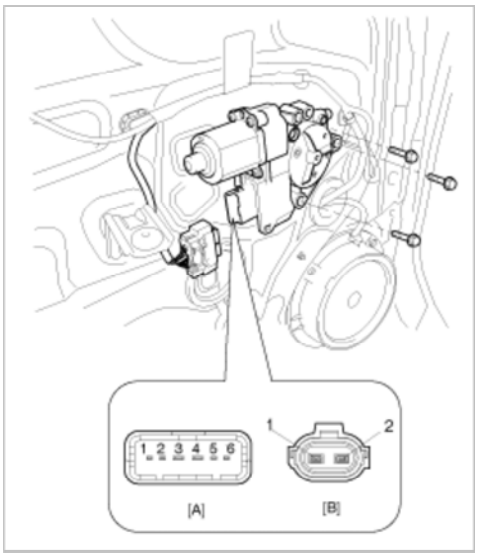
Position \ Terminal			1	2
Left	UP	Clockwise	⊕	⊖
	DOWN	Counter-clockwise	⊖	⊕
Right	DOWN	Clockwise	⊖	⊕
	UP	Counter-clockwise	⊕	⊖

[SAFETY]

Position \ Terminal			1	6
Left	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖
Right	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕

Rear Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the rear door trim. (Refer to the Body group-rear door)
3. Disconnect the connector from the motor.
   (A : Safety, B : Standard)



4. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

Position \ Terminal			1	2
Left	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕
Right	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖

[SAFETY]

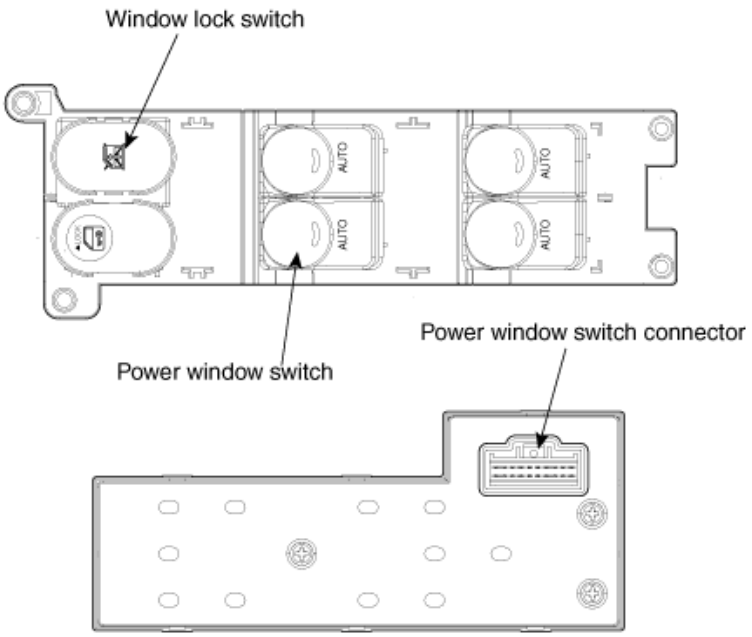
Position \ Terminal			1	6
Left	DOWN	Clockwise	⊖	⊕
	UP	Counter-clockwise	⊕	⊖
Right	UP	Clockwise	⊕	⊖
	DOWN	Counter-clockwise	⊖	⊕

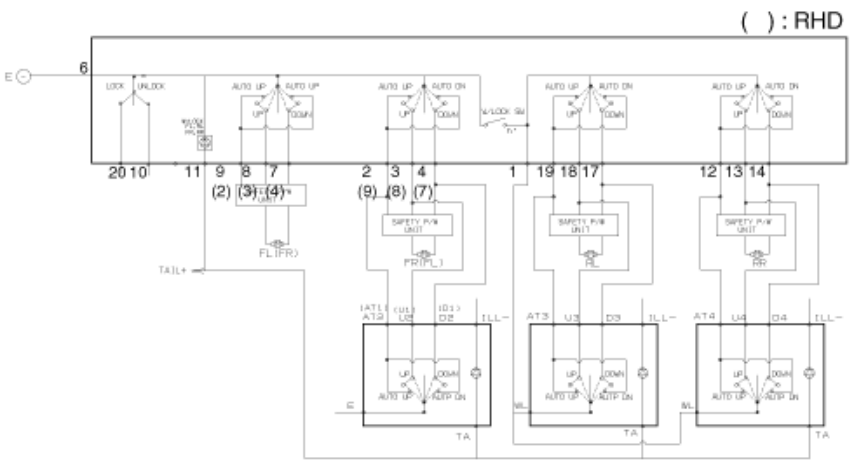
Body Electrical System > Power Windows > Power Window Switch > Components and Components Location

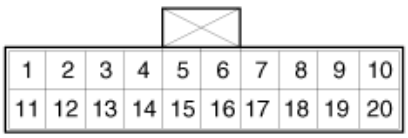
Components

Power Window Main Switch

[ALL SAFETY POWER WINDOW]

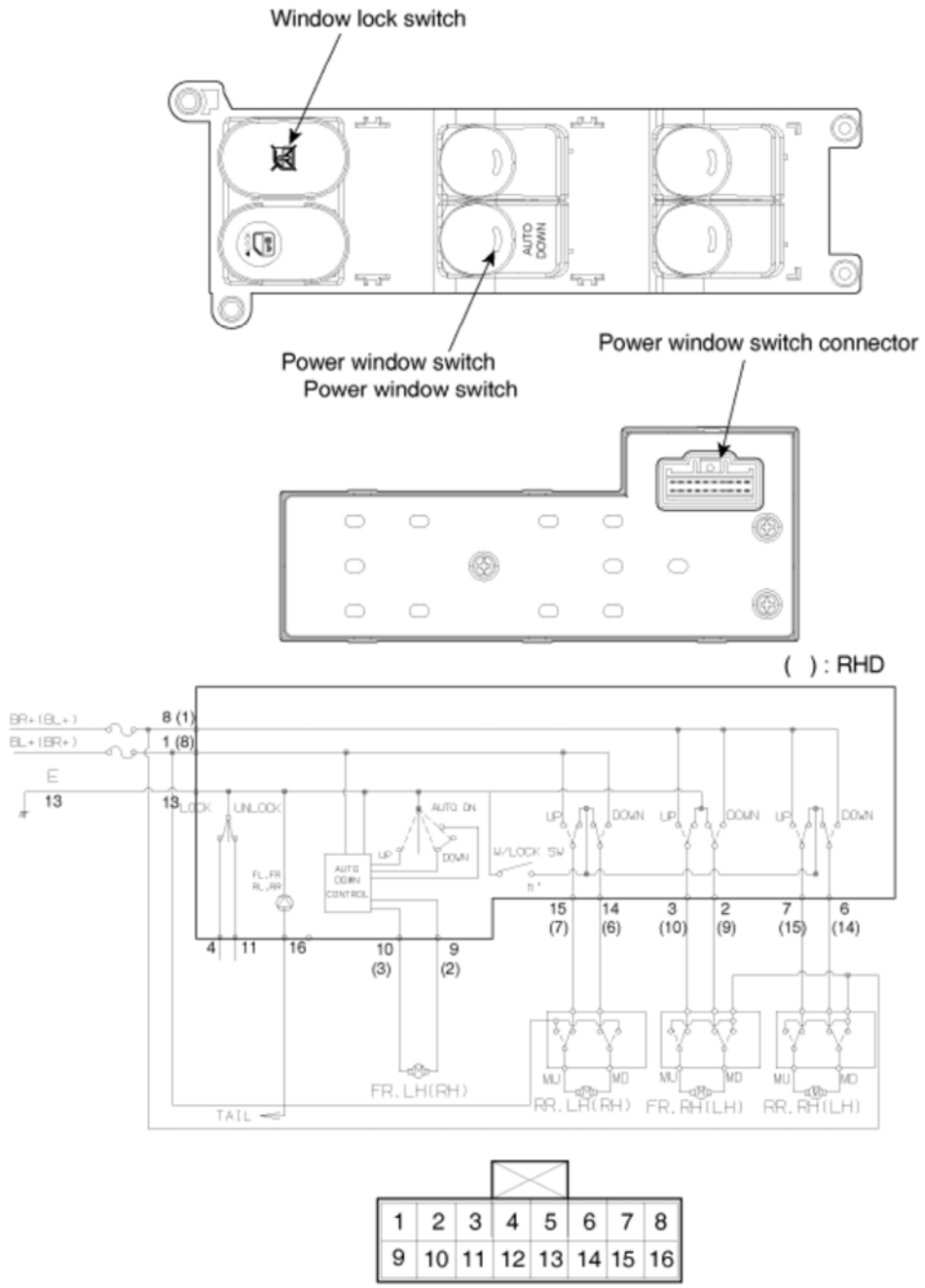




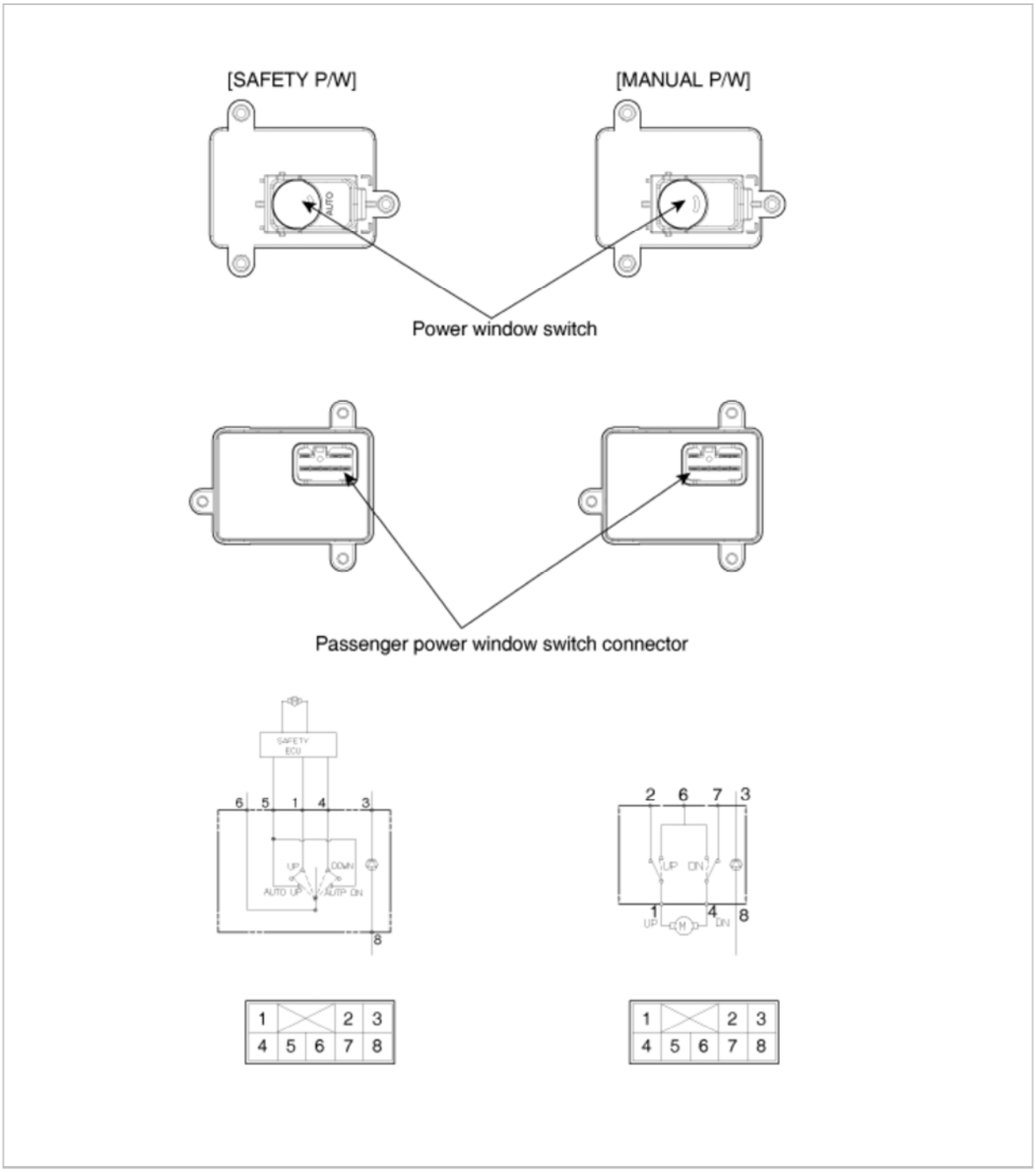


1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

[AUTO DOWN POWER WINDOW]



Passenger/Rear Power Window Switch

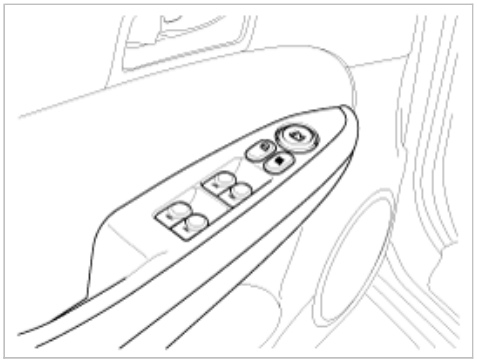


Body Electrical System > Power Windows > Power Window Switch > Repair procedures

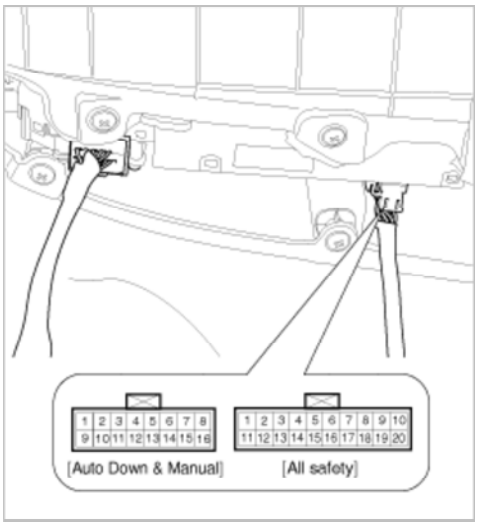
Inspection

Power Window Main Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to the Body group - "Front door")
3. Disconnect the connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.



[ALL SAFETY]

Terminal / Position	20	6	10
Lock	○	○	
Unlock		○	○

[AUTO DOWN]

Terminal / Position	4	13	11
Lock	○	○	
Unlock		○	○

[ALL SAFETY WINDOW]

Terminal / Position	Front left				Front right			
	9	8	7	6	3	4	2	6
AUTO UP	○	○		○	○		○	○
UP		○		○	○			○
OFF								
DOWN			○	○		○		○
AUTO DOWN	○		○	○		○	○	○
Terminal / Position	**Rear left**				**Rear right**			
	6	18	17	19	6	13	14	12
AUTO UP	○	○		○	○	○		○
UP	○	○			○	○		
OFF								
DOWN	○		○		○		○	
AUTO DOWN	○		○	○	○		○	○

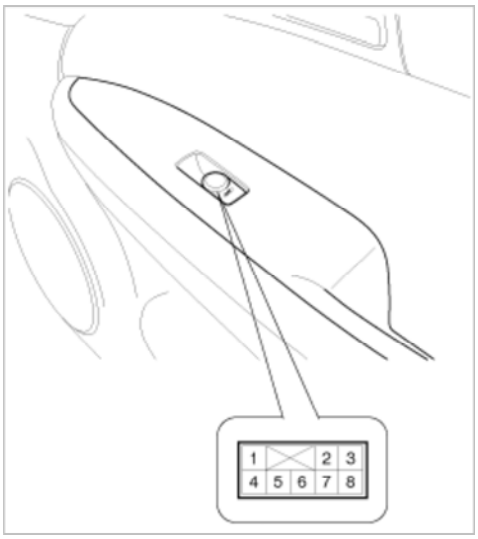
[AUTO DOWN POWER WINDOW]

Terminal / Position	Front left				Front right			
	10	9	13	1	3	2	8	13
UP	○		○	○	○		○	○
OFF	○	○	○		○	○		○
DOWN	○		○	○	○		○	○

Terminal / Position	Rear left				Rear right			
	13	15	14	1	8	7	6	13
UP	○		○	○	○		○	
OFF	○	○	○			○	○	○
DOWN	○	○	○	○	○		○	○

Passenger Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to the Body group - "Front door")
3. Disconnect the 8P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

[Safety Window]

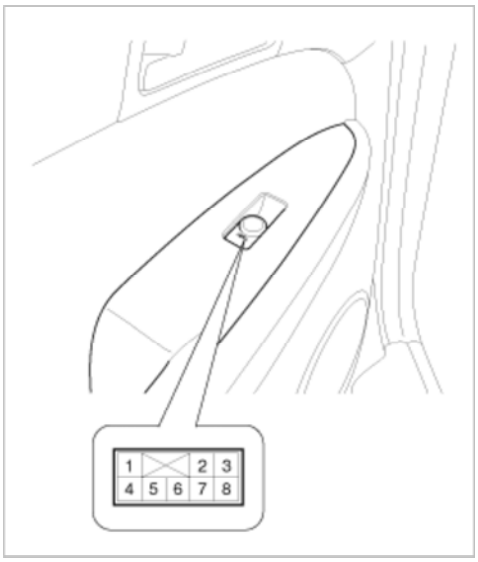
Terminal / Position	6	4	1	5
AUTO UP	○		○	○
UP	○		○	
OFF				
DOWN	○	○		
AUTO DOWN	○	○		○

[Manual Power Window]

Terminal / Position	6	1	2	7	4
UP	○	○		○	○
OFF		○	○	○	○
DOWN	○		○		○

Rear Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim.
   (Refer to the Body group - "Rear door")
3. Disconnect the 8P connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

[Safety Window]

Terminal / Position	6	4	1	5
AUTO UP	○	—	○	○
UP	○	—	○	
OFF				
DOWN	○	○		
AUTO DOWN	○	○	—	○

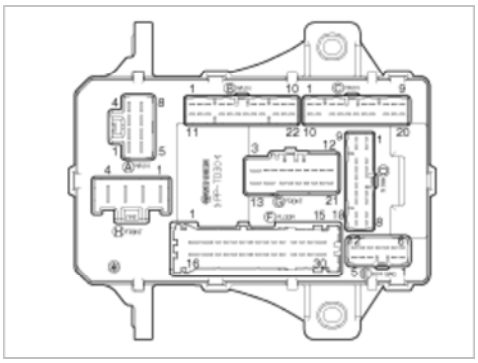
[Manual Power Window]

Terminal / Position	6	1	2	7	4
UP	○	○		○	○
OFF		○	○	○	○
DOWN	○	○	○		○

Body Electrical System > Power Windows > Power Window Relay > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body group - "Crash pad")
3. Remove the junction box.
4. Check for continuity between the terminals.
5. There should be continuity between the No.2 in the I/P-F and No.17 terminal in the I/P-B when power and ground are connected to the No.2 terminal in the I/P-H and No.17 terminal in the I/P-B.
6. There should be no continuity between the No.2 terminal in the I/P-F and No.17 terminal in the I/P-B when power is disconnected.

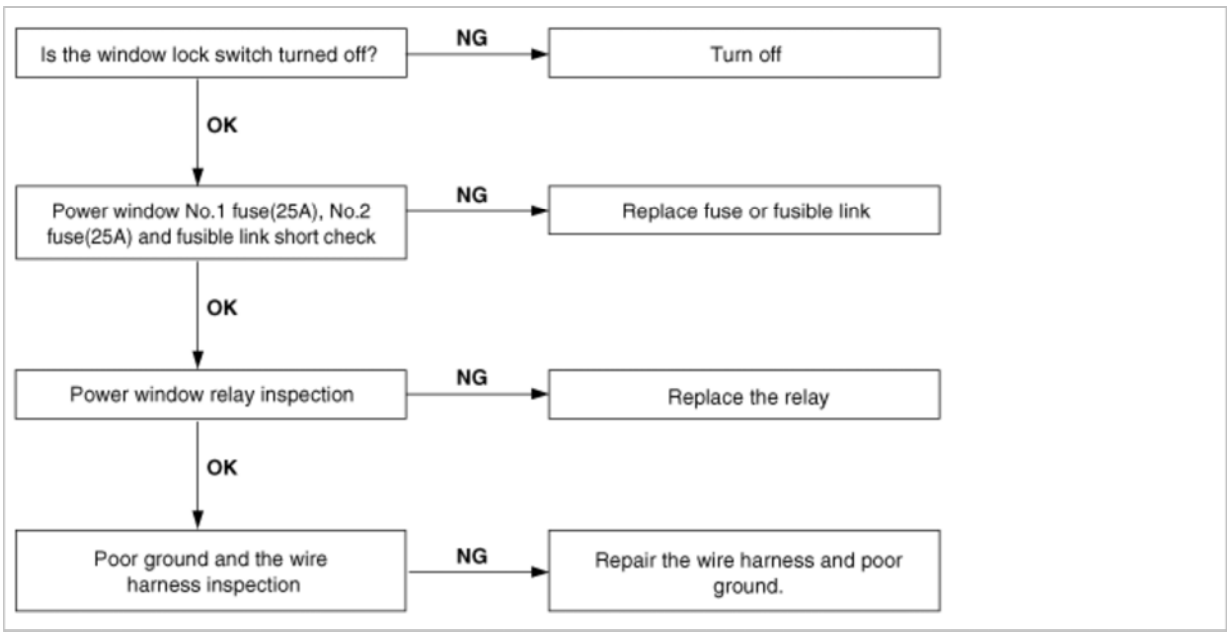


Terminal / Power	I/P-H (2)	I/P-F (17)	I/P-H (2)	I/P-B (17)
Disconnected			○	○
Connected	○	○	⊕	⊖

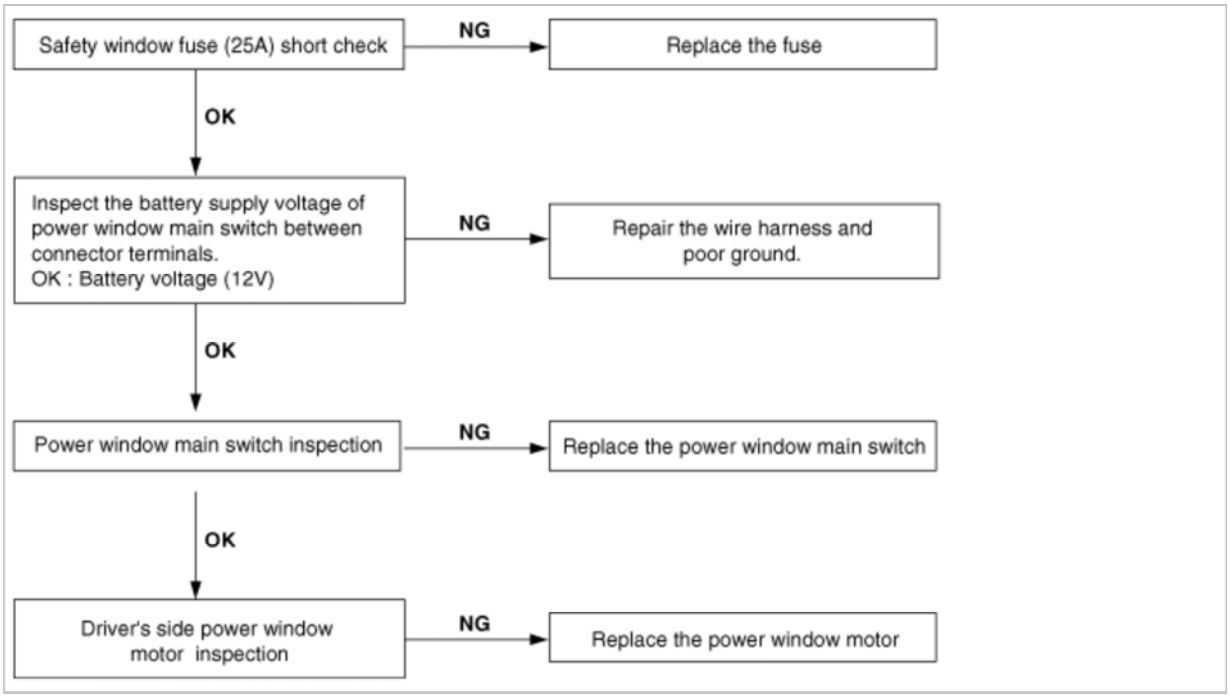
Body Electrical System > Power Windows > Troubleshooting

Troubleshooting

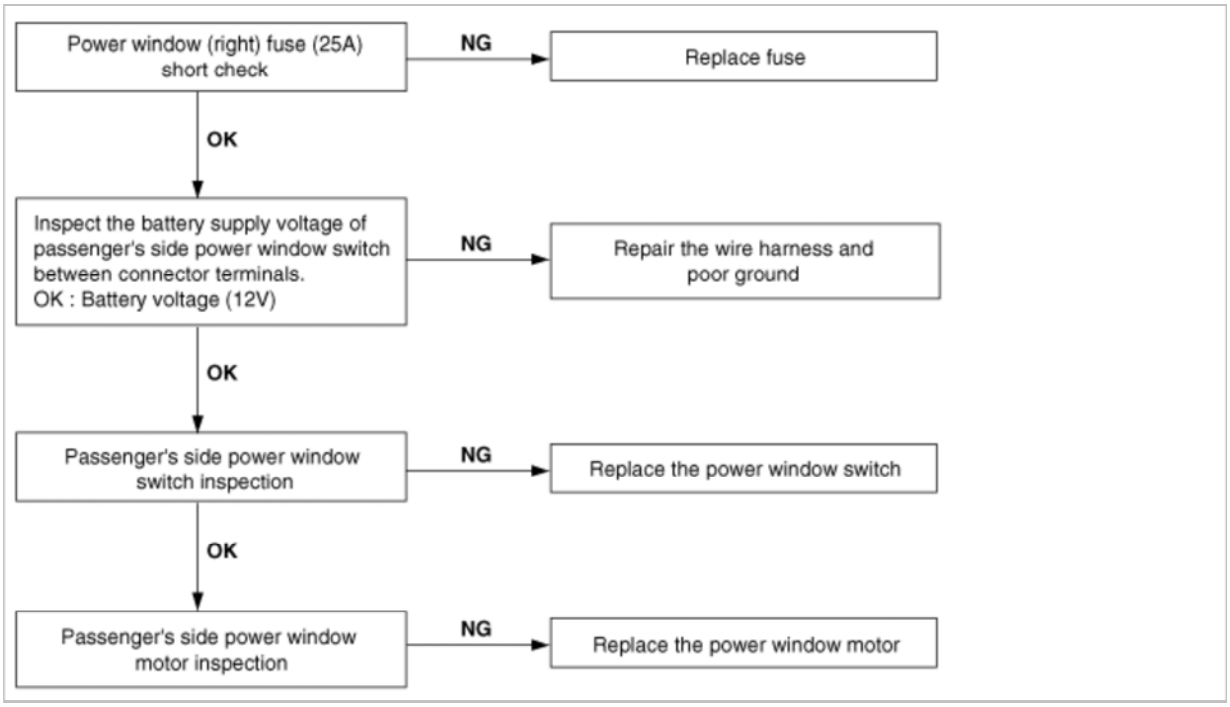
1. No windows operate from the main switch on the driver's door.



2. Driver's side window does not operate.

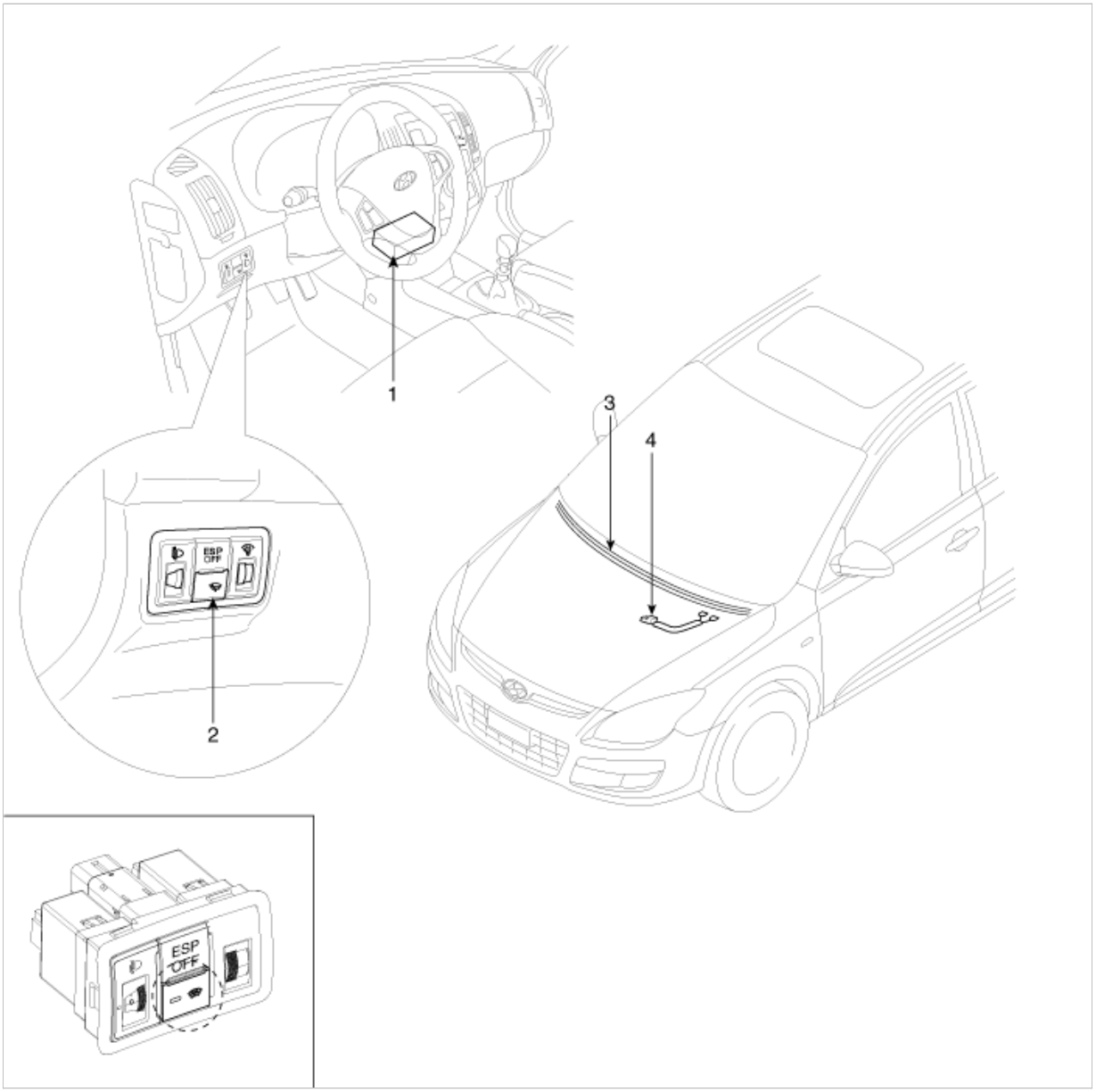


3. Passenger's side window does not operate.



Body Electrical System > Windshield Deicer > Components and Components Location

Component Location



1. Body control module 2. Windshield deicer switch	3. Windshield deicer 4. Deicer connector

Body Electrical System > Windshield Deicer > Description and Operation

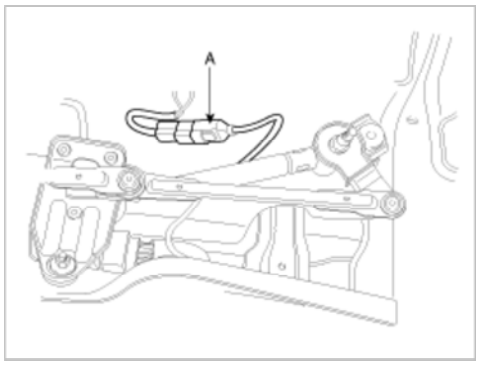
Description

Windshield deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the lower part of windshield, switch and relay. Body control module receives an input signal from the deicer switch, then controls relay.
Since the generator "L" is switched ON, if the deicer switch is ON, then deicer output is ON for 20 minutes.

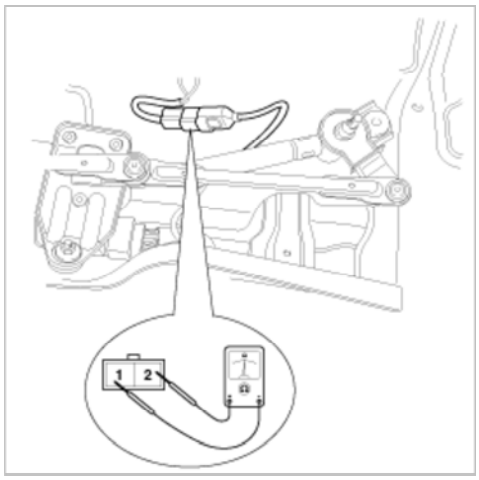
Body Electrical System > Windshield Deicer > Windshield Deicer > Repair procedures

Inspection

1. Remove the cowl top cover.(Refer to the wiper)
2. Disconnect the windshield deicer connector (A) from the wiper motor linkage.

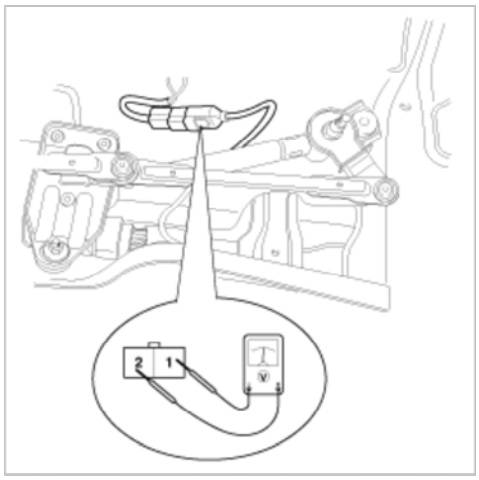


3. Check for continuity between the terminals of deicer lines.



4. Turn the ignition switch ON and the windshield deicer switch ON, then measure the voltage between the terminals of harness side deicer connector.

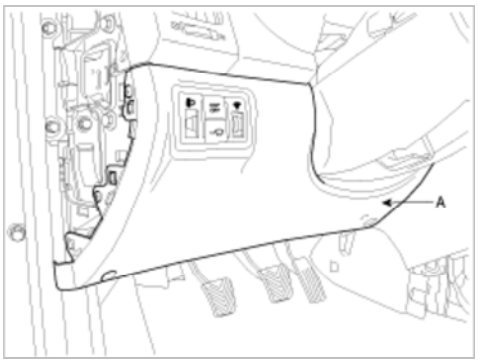
O K : approx. Battery voltage (12V)



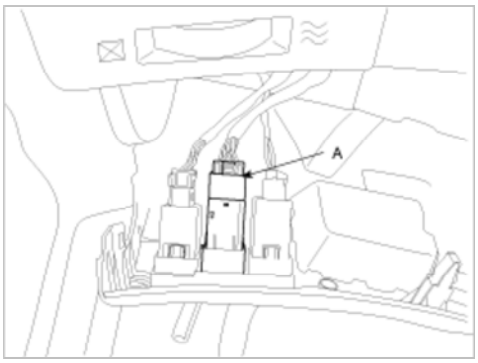
Body Electrical System > Windshield Deicer > Windshield Deicer Switch > Repair procedures

Inspection

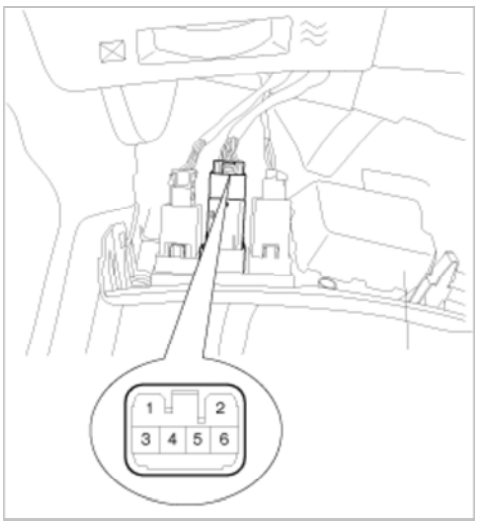
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A).
   (Refer to the Body group - "Crash pad")



3. Disconnect deicer switch connectors.



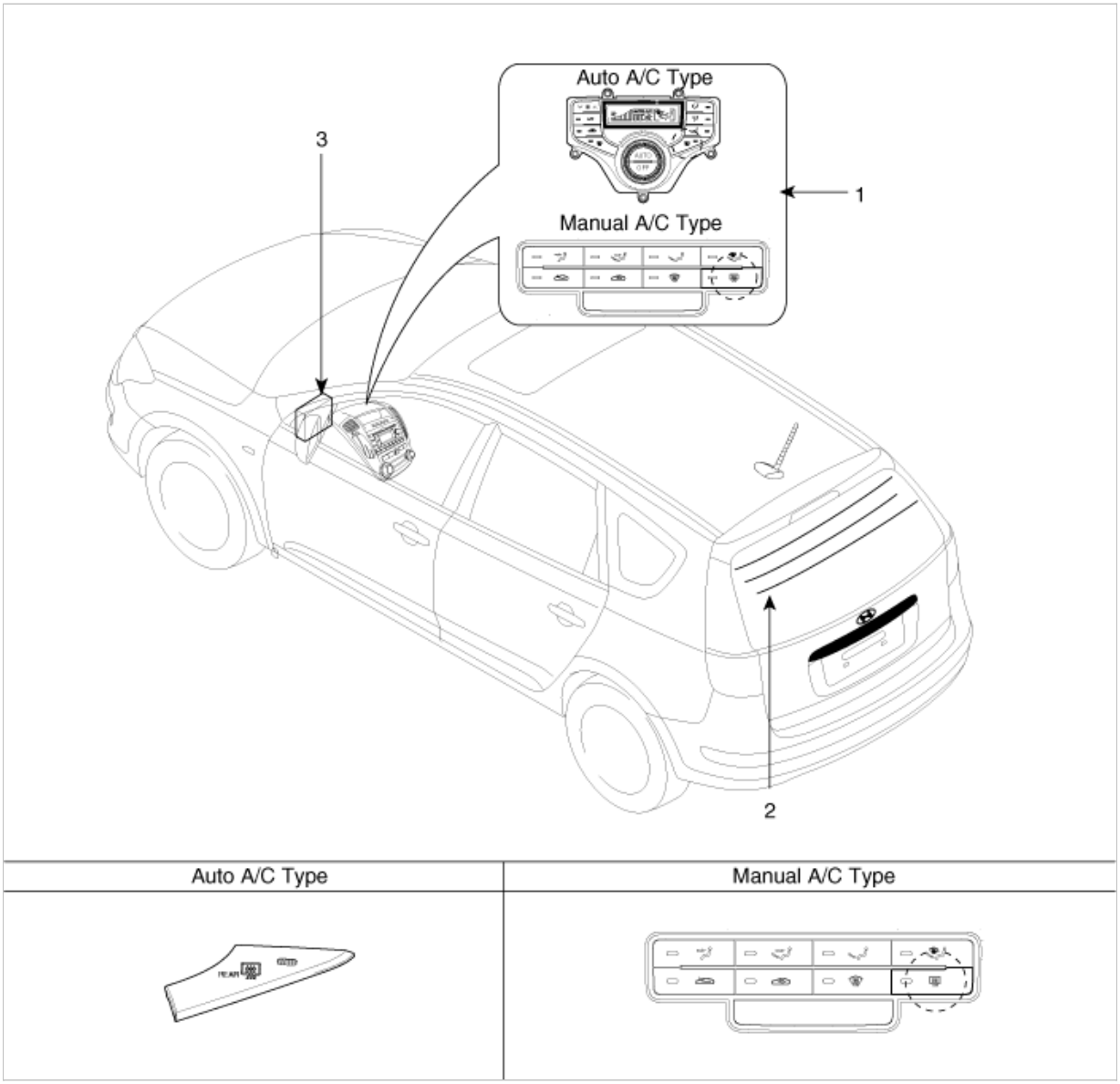
4. Using an ohmmeter, inspect the continuity between the terminals.



Position / Terminal	ON(PUSH)	OFF(FREE)	Remark
3			GND
6			BCM
4			
1			IND+
5			ILL-
2			ILL+

Body Electrical System > Rear Glass Defogger > Components and Components Location

Component Location



Auto A/C Type	Manual A/C Type

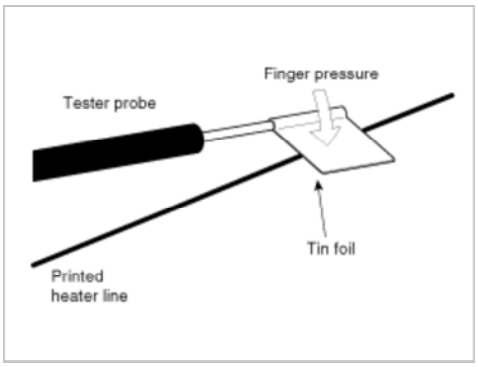
1. Rear window defogger switch 2. Rear window defogger	3. Body control module

Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Printed Heater > Repair procedures

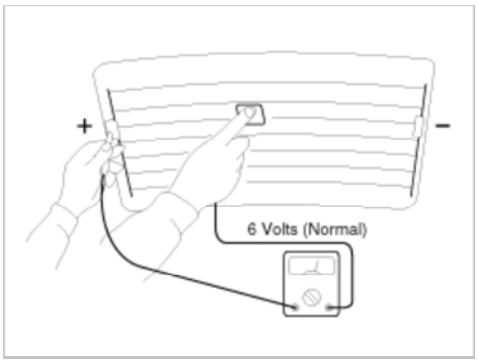
Inspection

CAUTION

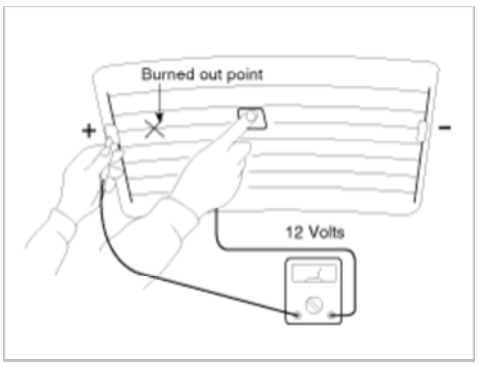
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



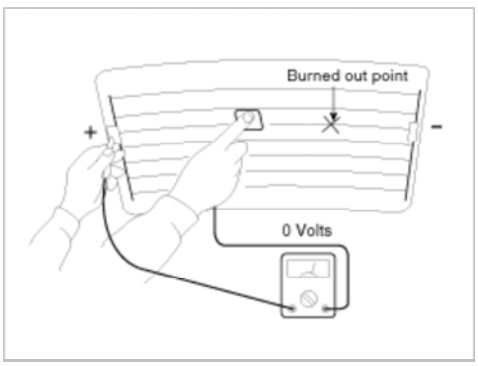
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



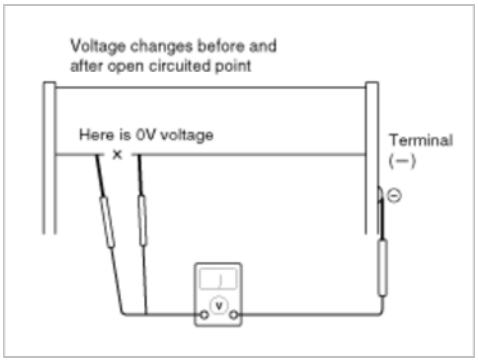
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



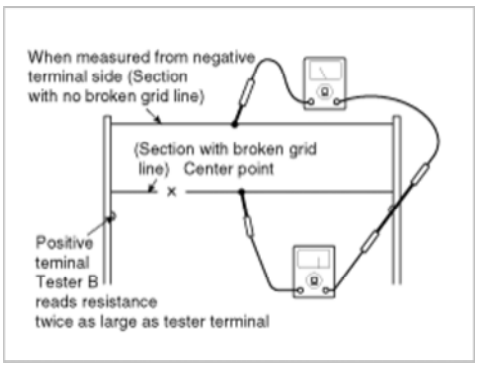
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



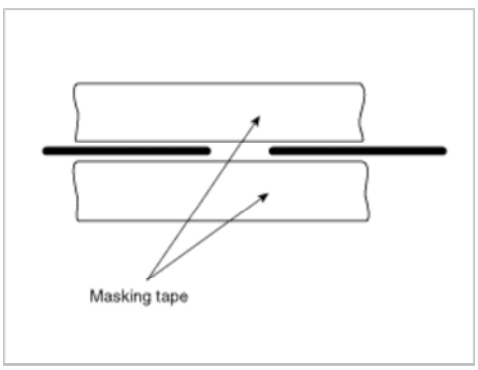
5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, and between the same terminal and the center of one adjacent heater line. The section with a broken heater line will have a resistance twice as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.



Repair Of Broken Heater Line

Prepare the following items :

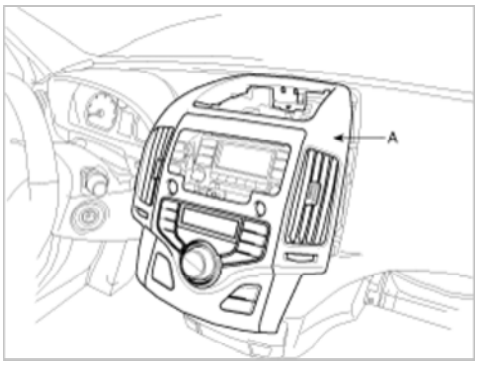
1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Using a thin brush :
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).



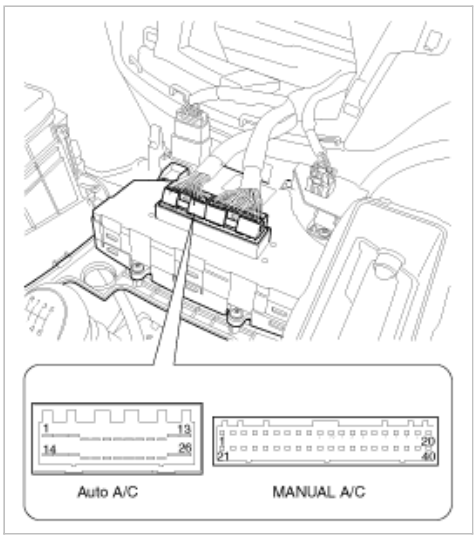
Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Switch > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the center facia panel(A) after removing upper tray. Take care not to damage fixing clips.
   (Refer to the Body group - "Crash pad")



3. Disconnect connectors.
4. Using an ohmmeter, inspect the continuity between the terminals after removing controller.



[Manual A/C]

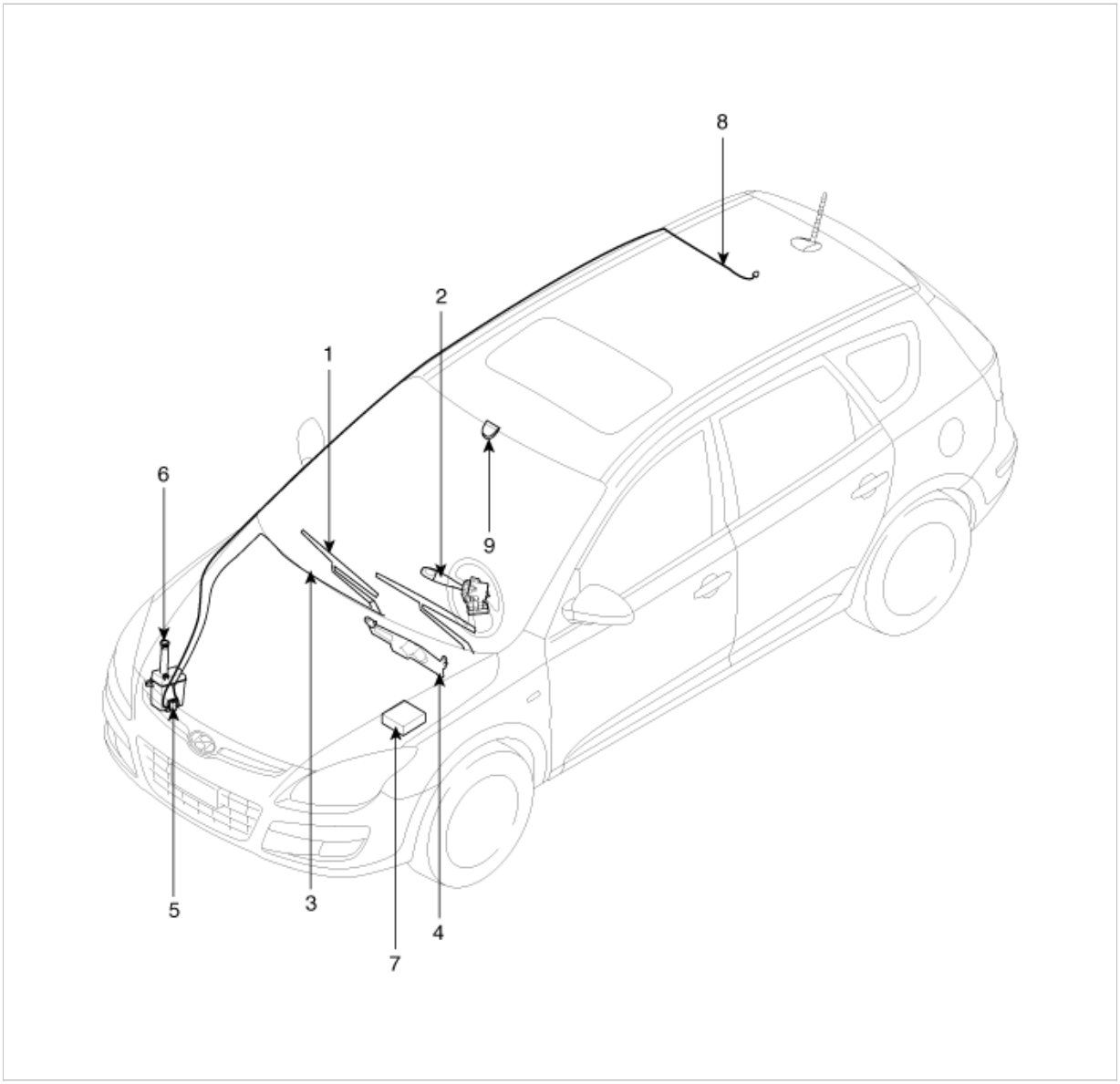
Terminal / Position	3	GND
ON(PUSH)	○———	———○
OFF(FREE)		

[Auto A/C]

Terminal / Position	10	GND
ON(PUSH)	○———	———○
OFF(FREE)		

Body Electrical System > Windshield Wiper/Washer > Components and Components Location

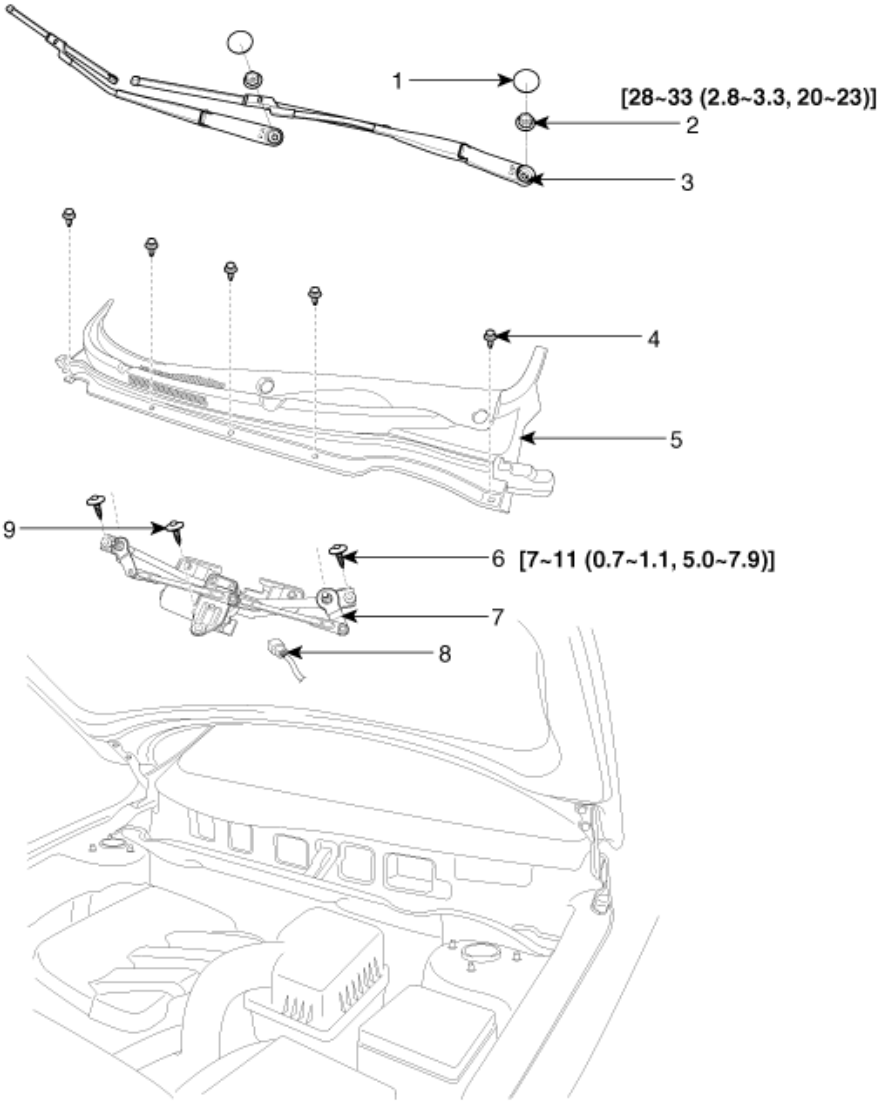
Component Location



1. Windshield wiper arm & blade	6. Washer reservoir
2. Wiper & washer switch	7. Wiper relay (Engine room relay box)
3. Windshield washer hose	8. Rear washer hose
4. Windshield wiper motor & linkage	9. Rain sensor
5. Washer motor	

Body Electrical System > Windshield Wiper/Washer > Windshield Wiper-Washer Switch > Components and Components Location

Component Location



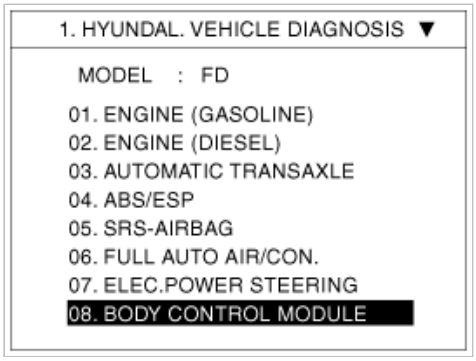
TORQUE : N.m (kgf.m, lbf.ft)

1. Cap 2. Nut 3. Wiper arm & blade 4. Retainer 5. Cowl top cover	6. Bolt 7. Wiper motor & linkage assembly 8. Wiper motor connector 9. Nut

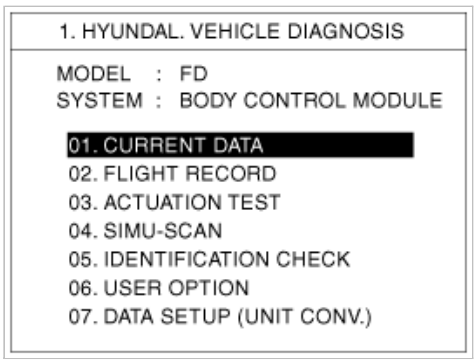
Body Electrical System > Windshield Wiper/Washer > Windshield Wiper-Washer Switch > Repair procedures

Inspection

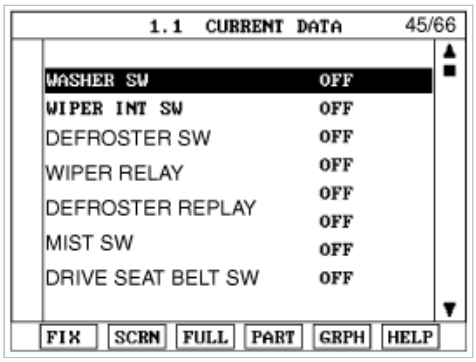
1. Multifunction switch operates head lamps and wiper by communicating with BCM through LIN communication.
2. Check BCM input/output value of each position of multifunction switch when you inspect the module whether faulty or not.
3. Select model and BCM menu.



4. Select "Current data" and wiper.

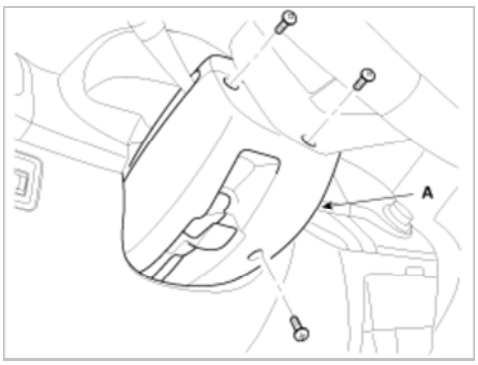


5. Check input/output value of washer & wiper switch.

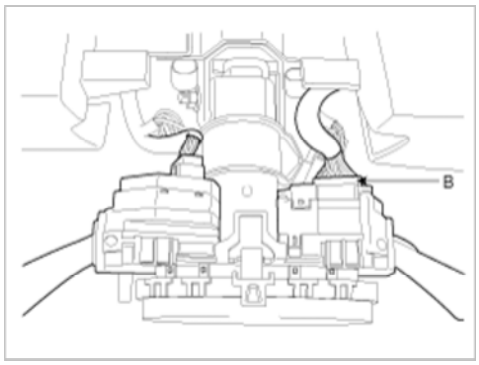


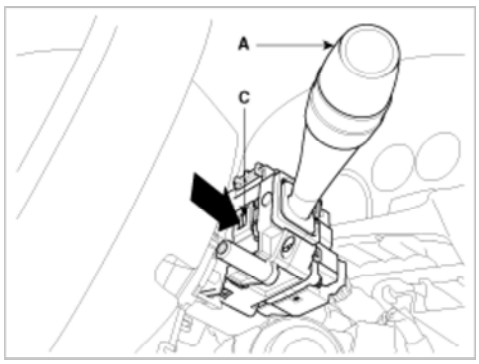
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds(A) after loosening 3 screws.



3. Remove the wiper switch (A) after disconnecting the connector(B) with pushing the lock pin (C) and loosening 2 screws.





Installation

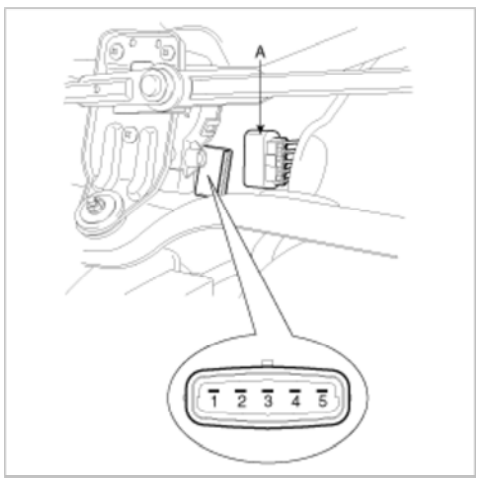
1. Install the windshield wiper switch.
2. Connect the wiper switch connector.
3. Install the steering column upper and lower shrouds.

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures

Inspection

Speed Operation Check

1. Remove the connector(A) from the wiper motor.

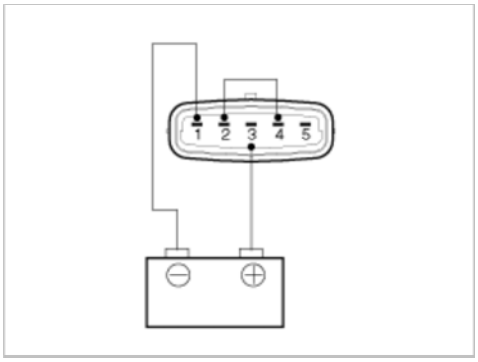


2. Attach the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 2.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 5 and the negative (-) lead to terminal 2.
5. Check that the motor operates at high speed.

Automatic Stop Operation Check

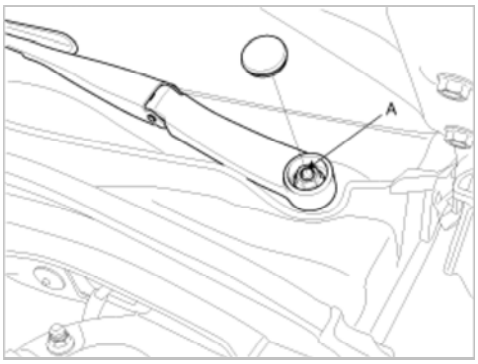
1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 4.

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.

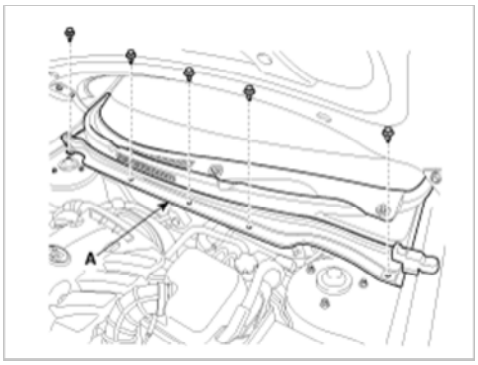


Removal

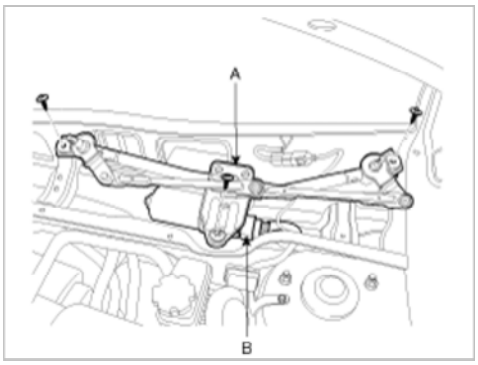
1. Remove the windshield wiper arm and blade after removing a nut (A).



2. Remove the weather strip and the cowl top cover (A) after removing 5 retainers.



3. Remove the windshield wiper motor and linkage assembly(A) after removing 3 bolts. Disconnect the wiper motor connector (B) from the wiper motor & linkage assembly.



Installation

1. Install the wiper motor and linkage assembly and then connect the wiper motor connector.

TORQUE : 7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)

2. Install the cowl top cover.
3. Install the windshield wiper arm and blade.

TORQUE : 28~33 Nm (2.8~3.3 kgf.m, 20~23.1 lbf.ft)

NOTE

- The windshield wiper motor must be cycled to make sure that it is in the park position. If necessary, adjust the wiper arm and blade.

Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

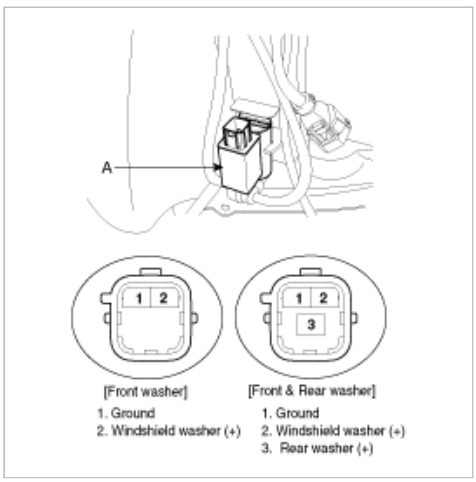
Inspection

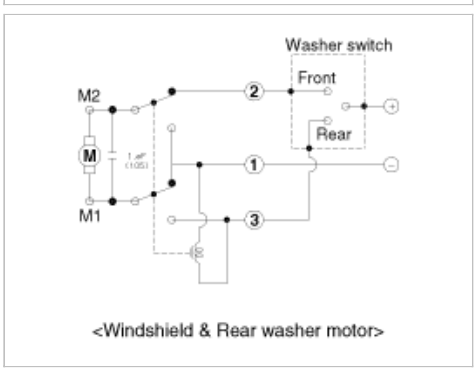
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

NOTE

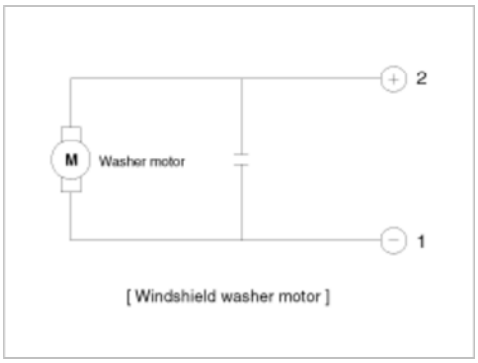
Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Connect positive (+) battery cables to terminal 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 (A).





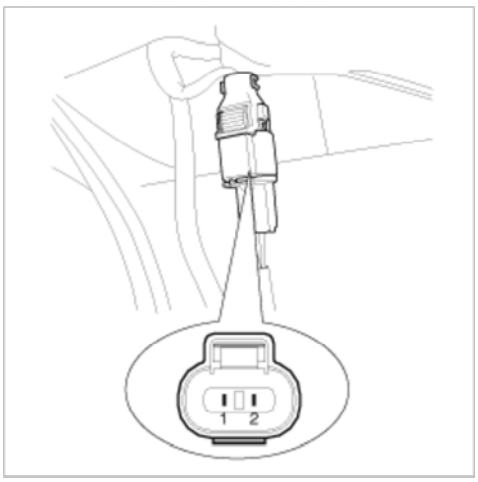
<Windshield & Rear washer motor>



[Windshield washer motor]

Washer Fluid Level Sensor Switch

1. Disconnect the negative(-) battery terminal.
2. Drain the washer fluid less than 700 cc.
3. Check for continuity between the No. 1 and No.2 terminal in each float position.
   There should be continuity when the float is down.
   There should be no continuity when the float is up.
4. If the continuity is not as specified, replace the washer fluid level switch



Terminal / Position	1	2
Over 700cc		
Under 700cc	○	○

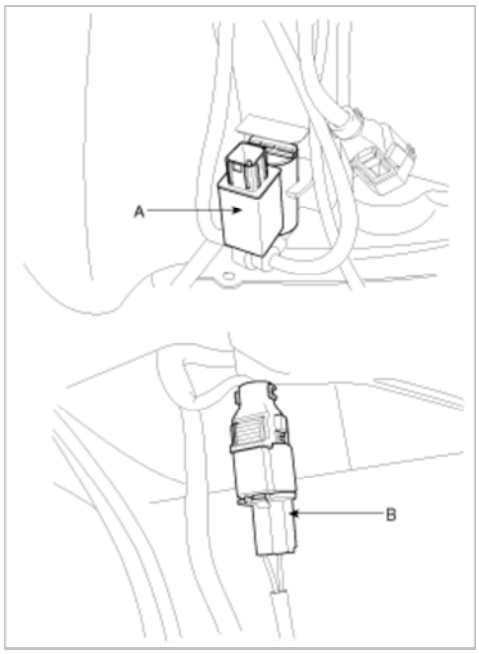
(Tolerance : -50cc ~ +100cc)

Removal

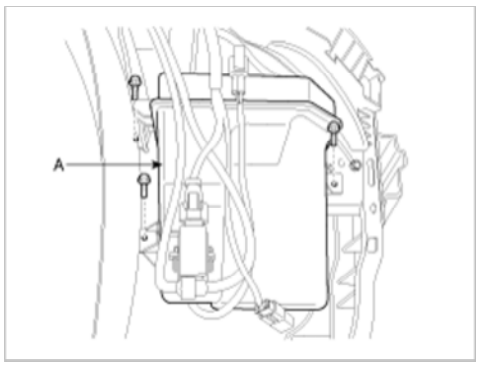
CAUTION

- When servicing the washer pump, be careful not to damage the washer pump seal.
- Do not operate the washer pump before filling the washer reservoir.
  Failure to do so could result in premature pump failure.

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover. (Refer to Body group - Front bumper)
3. Remove the washer hose and the washer motor connector (A) and level sensor connector(B).



4. Remove the washer reservoir (A) after removing 3 bolts.



Installation

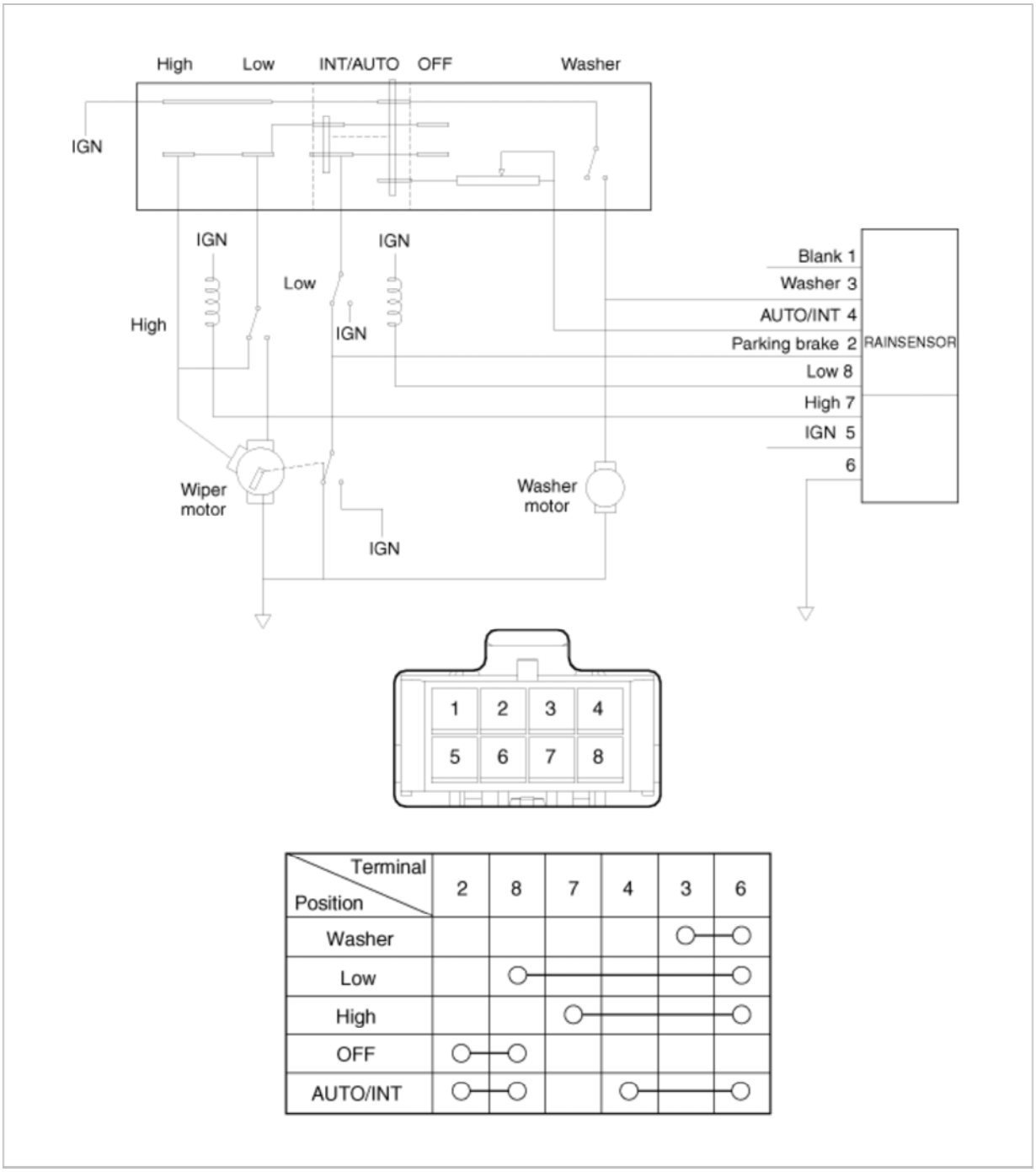
1. Install the washer reservoir.

> NOTE
>
> Before installing the pump motor, check the filter for foreign material or contamination. if necessary, clean the filter into the pump motor.

2. Install the washer motor and connect the washer hose, the motor and level sensor connector.
3. Install the front bumper cover.

Body Electrical System > Windshield Wiper/Washer > Rain Sensor > Schematic Diagrams

Circuit Diagram

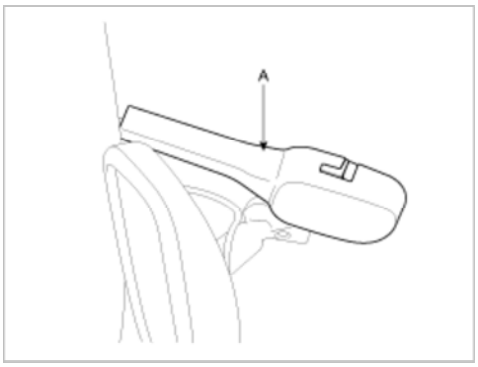


Terminal / Position	2	8	7	4	3	6
Washer					○—○	
Low		○	—	—	—	○
High			○	—	—	○
OFF	○—○					
AUTO/INT	○—○			○	—	○

Body Electrical System > Windshield Wiper/Washer > Rain Sensor > Description and Operation

Description

The Rain sensing windshield wiper system is a wiper system that, in addition to providing normal wiper functions off, mist, manual low speed, manual high speed, and wash, provides automatic control of automatic intermittent, automatic low, and automatic high speeds.
When the ignition key is in the ON position, the rain sensor (A) will be activated.



Operating Modes - Rain Sensing Windshield Wiper System

MULTI FUNCTION SWITCH POSITION	RAINSENSOR OPERATING MODE	SENSOR ACTION
MIST	MIST	Mist is controlled by the column switch. The sensor has no affect on this function
OFF	OFF	If not already parked, wiper motor runs in low speed until blades are in the depressed park position.
LOW SPEED	MANUAL	Wiper motor runs continuously in low speed, for example 45 wipes/minute. The sensor has no affect on this function
HI SPEED	MANUAL	Wiper motor runs continuously in high speed, for example 60 wipes/minute. The sensor has no affect on this function
WASH - DEMAND WASHER SW ≥ 0.6 SEC	WASH	If washer sw on after 0.6 sec then wipes during 2.5 to 3.8 sec. The rain sensor enables the wipers and controls the after wipes.
WASH - DEMAND WASHER SW < 0.6 SEC	WASH	If washer sw on less than 0.2 to 0.6 sec then once wipes

Off Mode

With the wipe switch in the OFF position and the ignition switch in the ON positions, the rain sensor is considered to be in "OFF" mode. In this mode, the sensor commands the wiper to be off.
The rain sensor monitors the state of the windshield during OFF mode so that knowledge of the state of the windshield is present when the Multi Function Switch is moved to any SENSITIVITY setting. This optimizes the performance of the sensor when moving from the OFF condition to an AUTOMATIC mode. The algorithm assumes the nominal sensitivity setting when in the OFF mode.

Automatic Low

AUTOMATIC LOW SPEED operation is utilized when the amount of precipitation impinge on the windshield exceeds the AUTOMATIC INT TO AUTOMATIC LOW threshold. This threshold includes sufficient hysterics to prevent cycling between AUTOMATIC INT and AUTOMATIC LOW SPEED operation with a steady amount of precipitation accumulation on the windshield.

Automatic High

AUTOMATIC HIGH SPEED operation is utilized when the amount of precipitation impinge on the windshield exceeds the AUTOMATIC LOW to AUTOMATIC HIGH threshold. This threshold includes sufficient hysterics to prevent cycling between AUTOMATIC LOW to AUTOMATIC HIGH operation with a steady amount of precipitation accumulation on the windshield.

Wash Mode

The rain sensor monitors the Multi Function Switch to determine if the wash Function is selected. rain sensor enables the wiper motor to run in low speed during the wash mode and performs follow up wipes during 2.5 to 3.8 sec.

Manual Mode

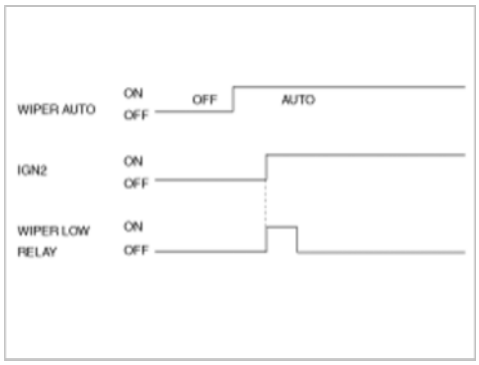
The rain sensor determines when a manual mode such as manual low, Mist, Off or manual high is selected. The column switch performs these modes and the rain sensor has no affect.

Body Electrical System > Windshield Wiper/Washer > Rain Sensor > Repair procedures

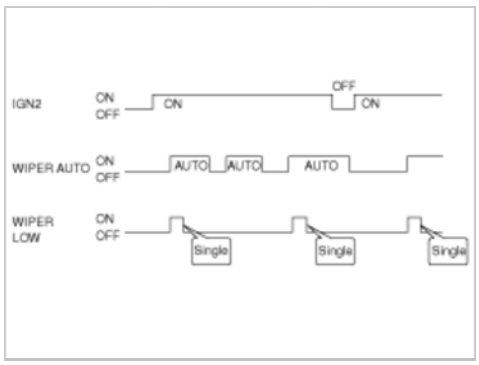
Inspection

Rain Sensing Wiper

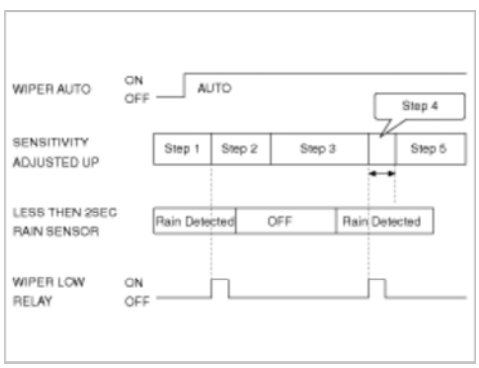
1. In IGN2 ON state, if auto switch input (LIN communication) is ON then both wiper low relay and wiper high relay outputs are controlled by the rain sensor input signal.
2. If the wiper switch has been left in automatic mode with the vehicle ignition OFF, and then the vehicle ignition switch is turned on, a single wipe will be performed.



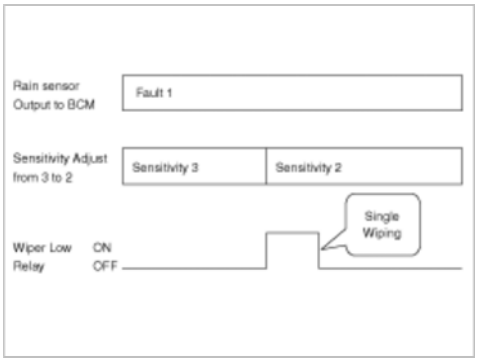
3. A single wipe will be performed whenever rain has been detected (Rain Detected signal from Rain sensor) and the wiper switch is moved to the AUTO position. But a single wipe will not be performed when the wiper switch is moved to the AUTO position and OFF signal is being received from Rain sensor. But if the wiper switch is moved to AUTO position for the first time since vehicle ignition switch is turned on then a single wipe will be performed regardless of Rain Detected or OFF signal.



4. The drive may adjust the rain sensor performance by adjusting the sensitivity input. When in automatic mode, the BCM will perform a single wipe each time the sensitivity is adjusted upward to a more sensitive setting (downward more then one step). This single wipe will only be performed if Rain Detected signal is being received from the Rain sensor. If the sensitivity adjustment is adjusted upward more than one sensitivity, the BCM will only perform a single wipe unless the time between Increases is more than 2 seconds.



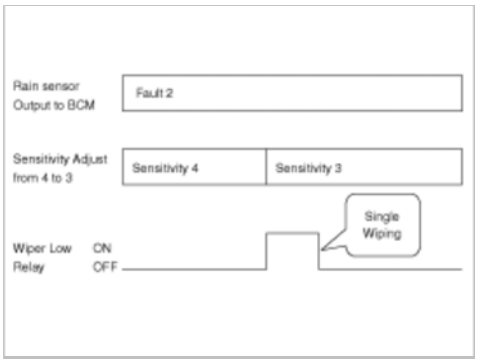
5. Fault strategy for the rain sensor
   Rain Sensor Fault 1 - Internal Fault Detected
   This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 1. The confirmation delay for the failure is of 1 sec.
   When this failure is detected, the wiper outputs are OFF and the wiper will also do a wipe in slow speed on the transition from sensitivity 3 to sensitivity 2 (Step 2 to 3) in order to signal the presence of this fault. If another sensitivity is set, the wiper won't make any additional wipe.



Rain Sensor Fault 2 - Glass Attachment Fault Detected

This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 2. The confirmation delay for the failure is of 1 s.

When this failure is detected, the wiper outputs are OFF and the wiper will also do a wipe on the transition from sensitivity 4 to sensitivity 3 (Step 1 to 2) in order to signal the presence of this fault. If another sensitivity is set, the wiper won't make any additional wipe.



Rain Sensor Fault 3 - No Input Signal Present

This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 3 or in case the duty cycle of the input faulty rain sensor is 0% or 100%. The confirmation delay for the failure is of 1 s. When this failure is detected, the wiper outputs are OFF.

Removal

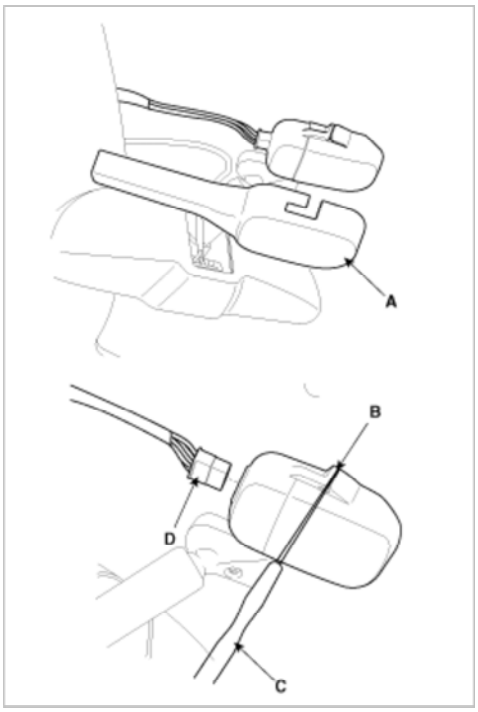
CAUTION

The dust or foreign substance on the rain sensor have a bad effect upon the rain sensor capability, so protect the sensor surface with protection cover until installing the rain sensor to bracket for accurate function.

The coupling pad on the rain sensor surface has adhesive strength, so the coupling pad could stick to the windshield by environment condition during the using time.

If separate it by force, it could be damaged. So make sure to separate the rain sensor from the windshield carefully.

1. Remove the rain sensor cover(A) first. Be careful not to damage the cover latch by applying excessive force. To remove the latch, pull aside the latch using the cover hole (B) with the little (-) screwdriver (C).



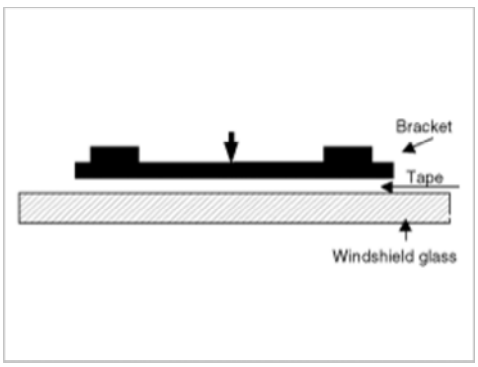
2. Remove the wiring harness connector (D) from sensor.
3. Rain sensor module is attached to the front windshield by glue replacing the front windshield, remove the rain sensor module from the existing front windshield and install on the new front windshield.

Installation

NOTE

- In case of the windshield with reflection layer which reflects the infrared rays in sensing field, should install the rain sensor into the field removed the reflection layer.
- Install the rain sensor after some time and be care not to be settled the dust after installation.

1. Install the rain sensor bracket to the windshield glass using the tape.



CAUTION

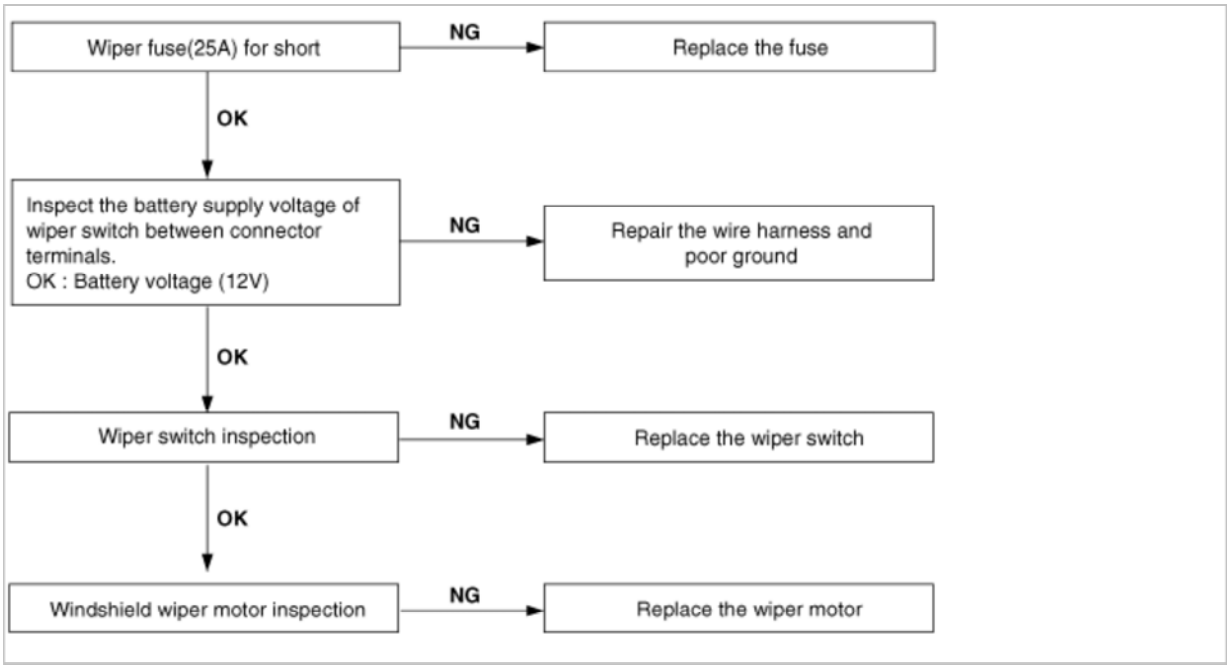
It is very important that the coupling pad pushes the windshield completely to stick to each other without bubbles.

2. Connect the rain sensor connector, and then install the sensor cover.

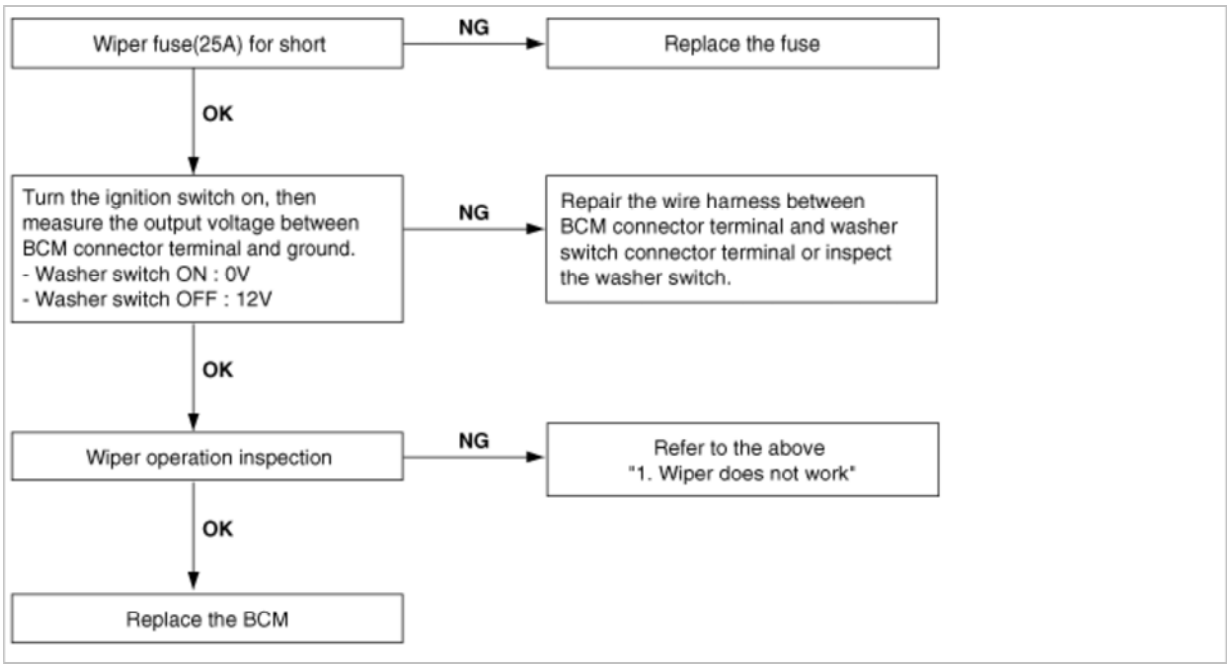
Body Electrical System > Windshield Wiper/Washer > Troubleshooting

Troubleshooting

1. Wiper low and wiper high do not work.

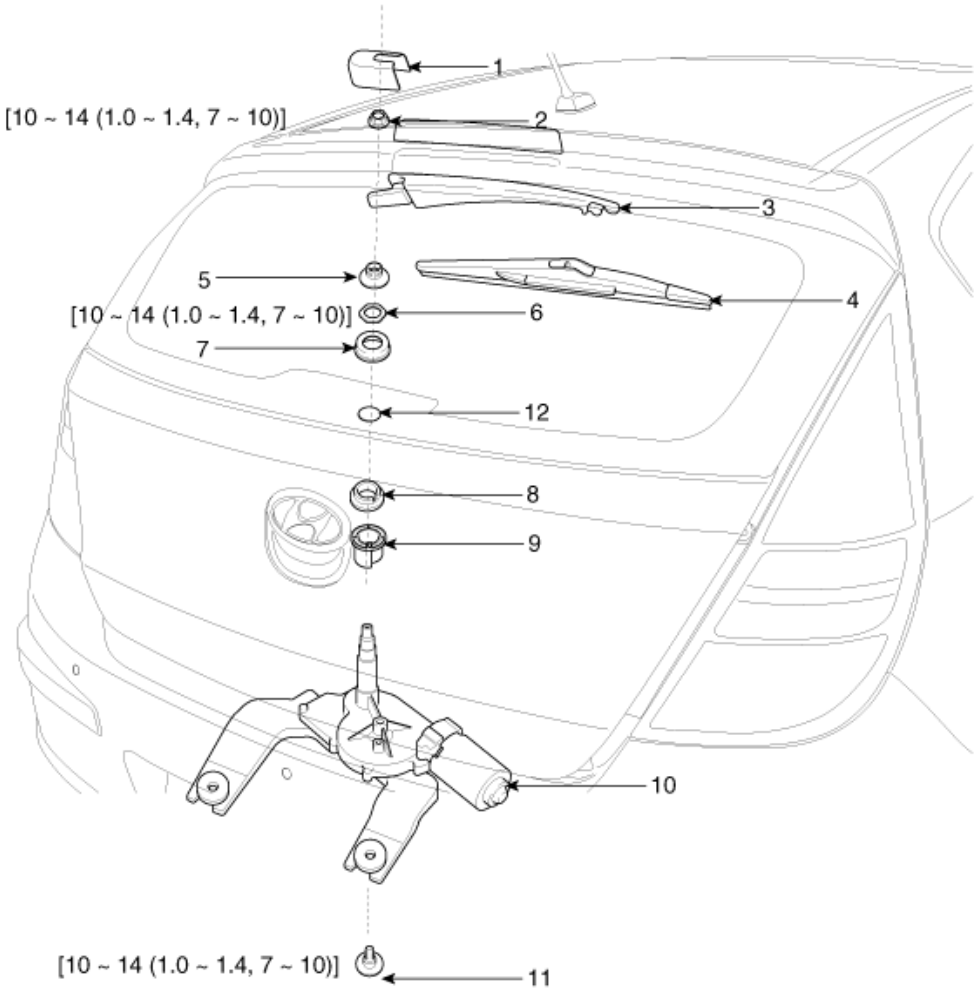


2. When washer switch is on, wiper does not work.



Body Electrical System > Rear Wiper/Washer > Components and Components Location

Component Location



TORQUE : N.m (kg.cm, lb.ft)

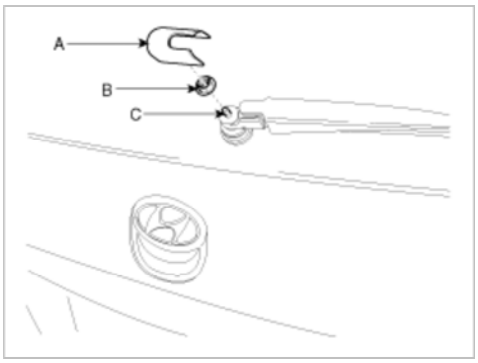
1. Head cap	7. Rear wiper cap & Pad
2. Nut	8. Pad
3. Rear wiper arm	9. Support
4. Rear wiper blade	10. Rear wiper motor assembly
5. Cover	11. Bolt
6. Nut	12. Glass hole

Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Repair procedures

Replacement

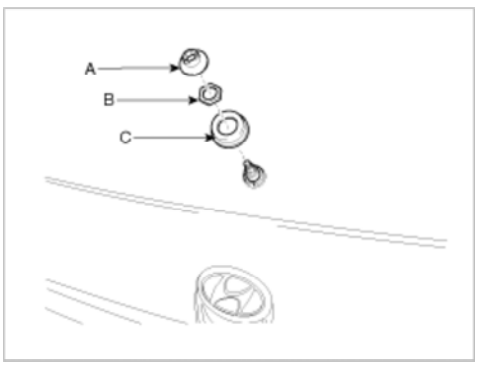
1. Detach the wiper cap (A), then remove the rear wiper arm (C) after removing a nut (B).

Tightening torque Nut(B) :
10~14 Nm (1.0~1.4 kgf.m, 7~10 lbf.ft)



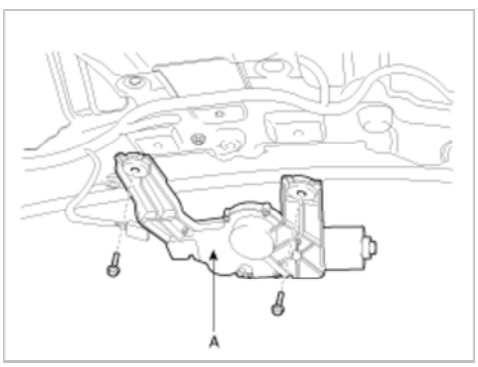
2. Remove the rear wiper cap & pad (C) after removing a nut (B) and cover (A).

Tightening torque Nut (A) :
10~14 Nm (1.0~1.4 kgf.m, 7~10 lbf.ft)



3. Open the tailgate then remove the tailgate trim.
4. Disconnect the rear wiper motor connector then remove the rear wiper motor (A) after removing 2 bolts.

Tightening torque Nut :
10~14 Nm (1.0~1.4 kgf.m, 7~10 lbf.ft)



5. Installation is the reverse of removal.

NOTE

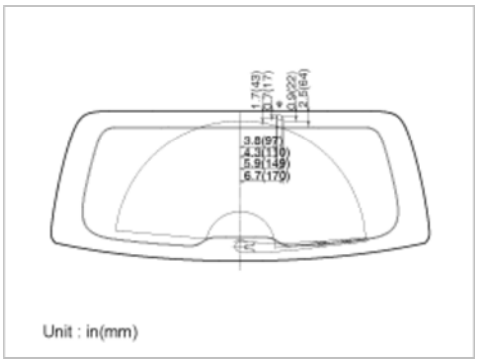
Before installation, be sure that the rear wiper motor is in the park position.
Turn the wiper switch ON and OFF to allow the rear wiper motor to cycle and stop in the park position.

Inspection

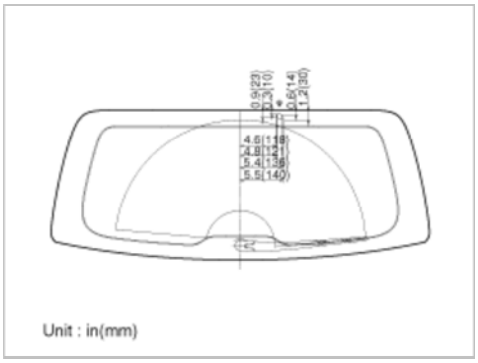
Rear Wiper And Nozzle Setting

1. Set the rear washer nozzle on the specified spray position.

[5DOOR]



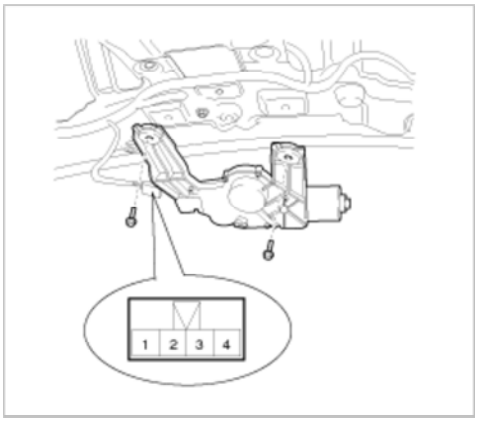
[WAGON]



2. Set the rear wiper blade and to the lowest defogger heat line and tailgate glass.

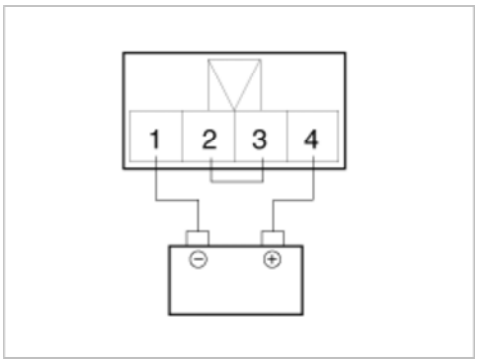
Rear Wiper Motor

1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 4 and 1 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.
   (1. GND, 2. Switch, 3. Parking, 4. B+)



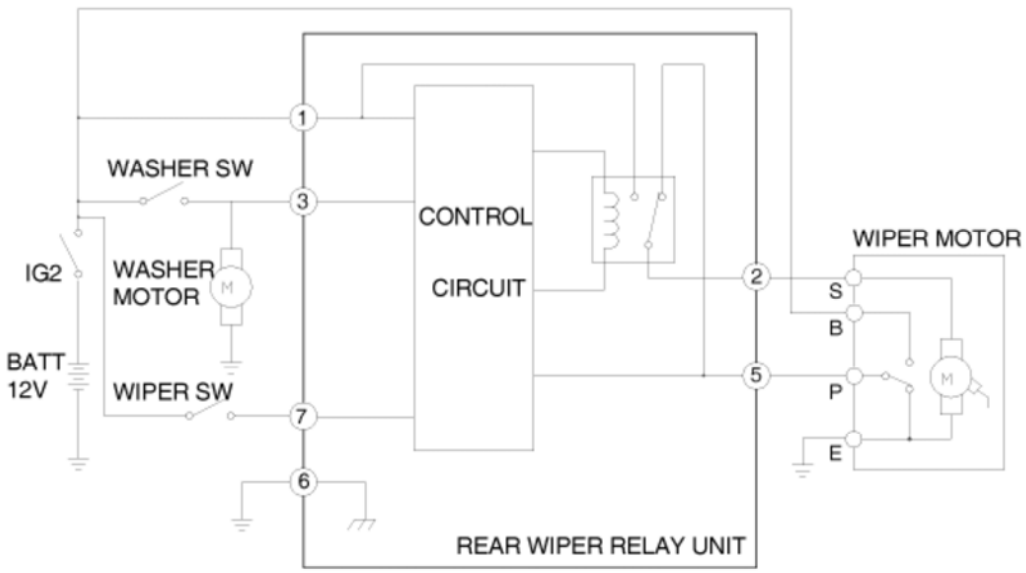
Automatic Stop Operation Check

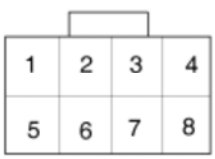
1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 2.
3. Connect terminals 2 and 3.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 1.
5. Check that the motor stops running at the off position.



Body Electrical System > Rear Wiper/Washer > Rear Wiper Relay > Schematic Diagrams

Circuit Diagram





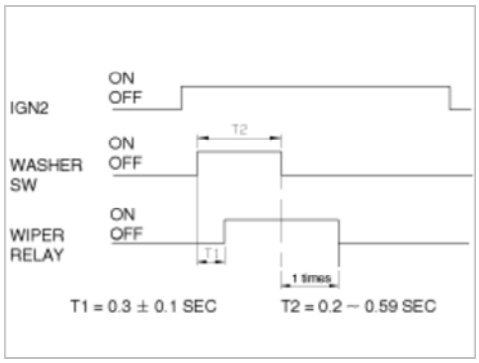
PIN NO.	NAME
1	IG2
5	PARK ING
2	WIPER OUT PAT
6	GND
3	WASHER SW
7	INT SW
8	NO

Body Electrical System > Rear Wiper/Washer > Rear Wiper Relay > Repair procedures

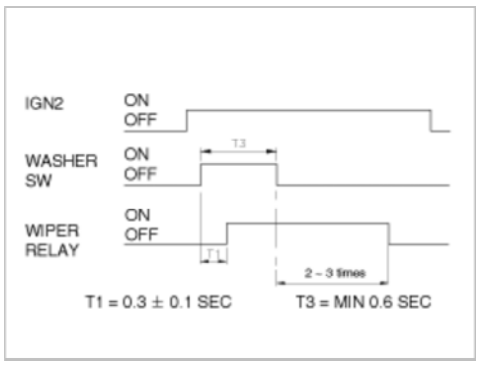
Inspection

1. Washer interlocking must conform to the mode shown in figure.
   This function shall be operated preferentially if wiper is operating.

[Washer SW input more than 0.6 sec.]

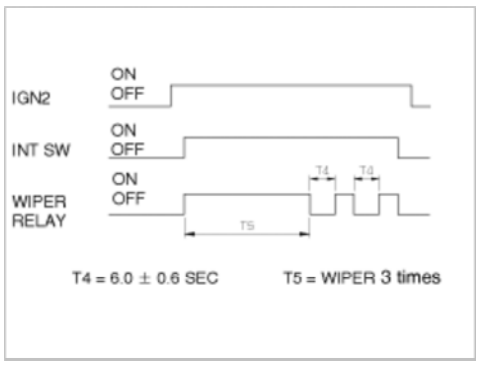


[Washer SW input less than 0.6 sec.]



2. Wiper operation must conform to the mode shown in figure.

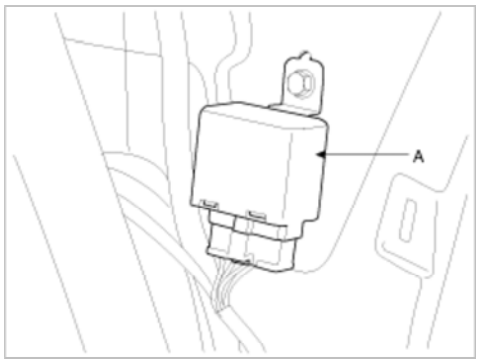
[INT Mode]



Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear left pillar lower trim (A).

3. Remove the rear wiper relay (A) after loosening a bolt and disconnecting the rear wiper relay connector.



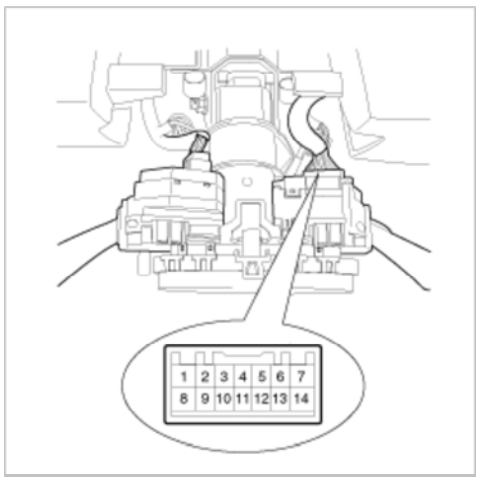
Installation

1. Install the rear wiper relay.
2. Install the rear left pillar lower trim.

Body Electrical System > Rear Wiper/Washer > Rear Washer Switch > Repair procedures

Inspection

1. With the rear wiper & washer switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



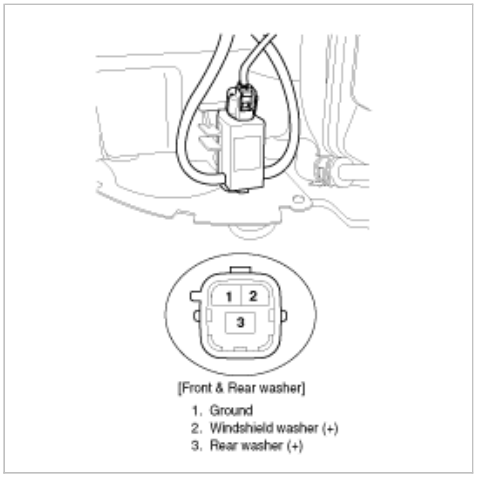
Rear Wiper & Washer Switch

Terminal / Position	4	3	1
WIPER	○		○
OFF			
ON	○	○	
WASHER	○		○

Body Electrical System > Rear Wiper/Washer > Rear Washer Motor > Repair procedures

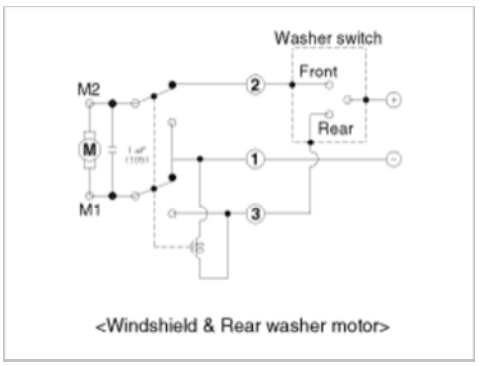
Inspection

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 Body group- Front bumper)
3. Connect positive (+) and negative (-) battery cables to terminals 3 and 1 respectively to see that the washer motor runs and water is pumped.
4. Check that the motor operates normally.
   Replace the motor if it operates abnormally.



[Front & Rear washer]

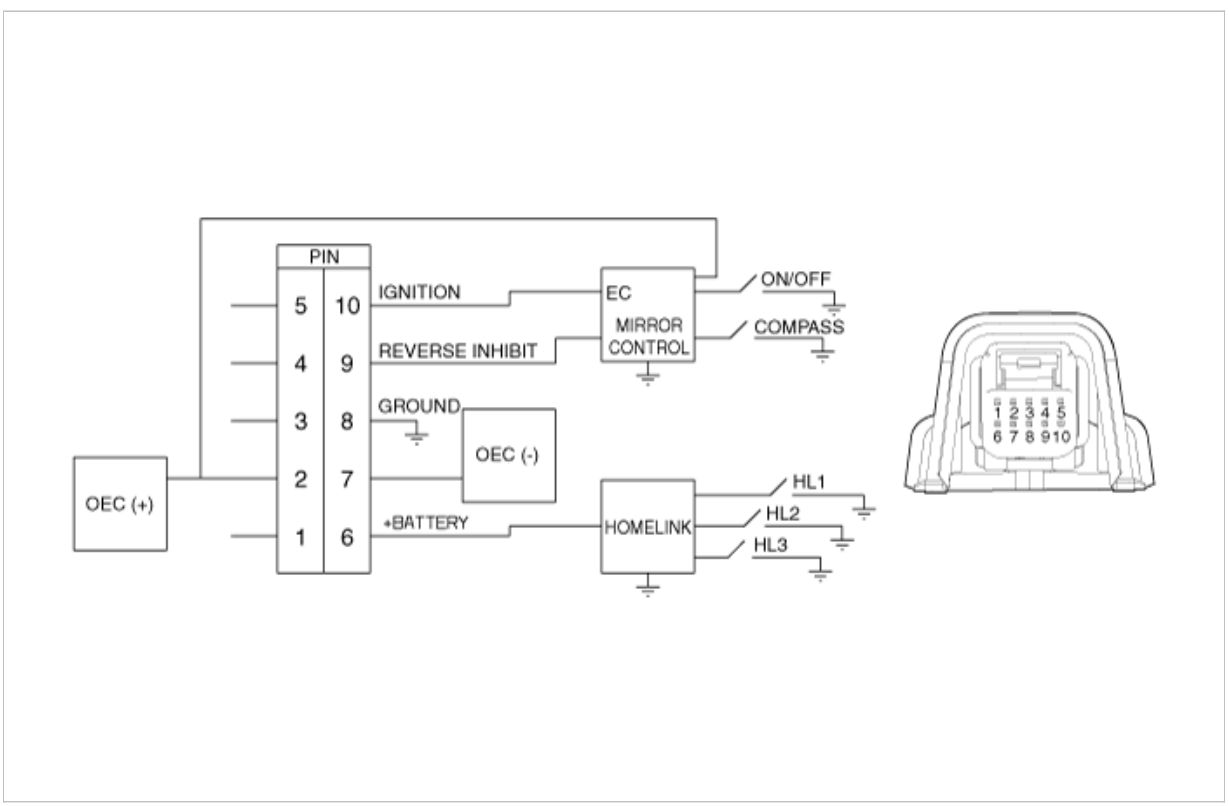
1. Ground
2. Windshield washer (+)
3. Rear washer (+)



<Windshield & Rear washer motor>

Body Electrical System > Electro chromic Inside Rear View Mirror > Schematic Diagrams

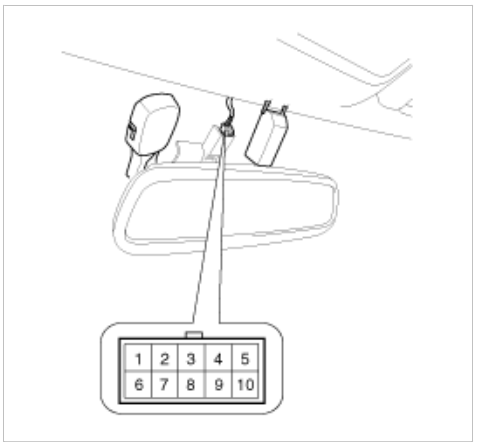
Circuit Diagram



Body Electrical System > Electro chromic Inside Rear View Mirror > Description and Operation

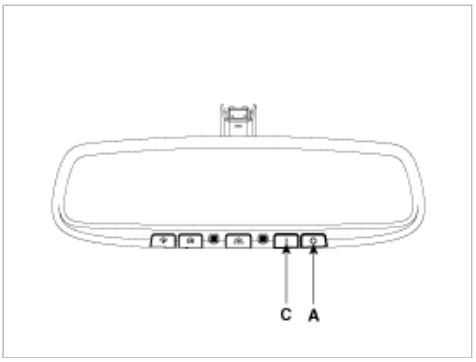
Description

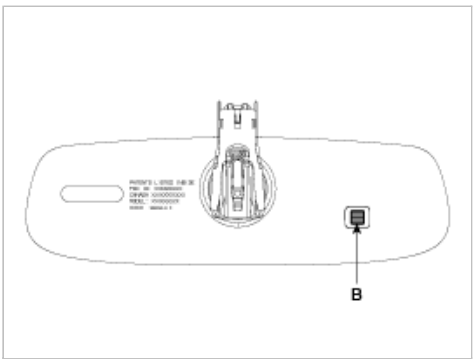
The ECM (Electro Chromic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night, in order the user not to be dazzled by the light. The front looking sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 10~70%. But, when the reverse gear is engaged, it stops functioning.



(6. Home link power(12V), 8. Ground,
9. Reverse gear signal, 10. IGN(12V))

1. The front looking sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.
   (A : ON/OFF Button, B : Forward looking sensor, C : Rearward looking sensor)





4. For Home link function, button priorities are as follow.
   A. 1 Dot - Priority #3
   B. 2 Dot - Priority #2
   C. 3 Dot - Priority #1

Automatic-dimming Function

To protect your vision during nighttime driving, your mirror will automatically dim upon detecting glare from the vehicles traveling behind you. The auto-dimming function can be controlled by the Dimming ON/OFF Button :

1. Pressing and holding the Feature Control button for more than 3 but less than 6 seconds turns the auto-dimming function OFF which is indicated by the green Status Indicator LED turning off.
2. Pressing and holding the Feature Control button again for more than 3 but less than 6 seconds turns the auto-dimming function ON which is indicated by the green Status Indicator LED turning on.

NOTE

The mirror defaults to the "ON" position each time the vehicle is started.

Body Electrical System > Electro chromic Inside Rear View Mirror > Repair procedures

Inspection

Check it by the procedure below to see if the function of the ECM is normal.

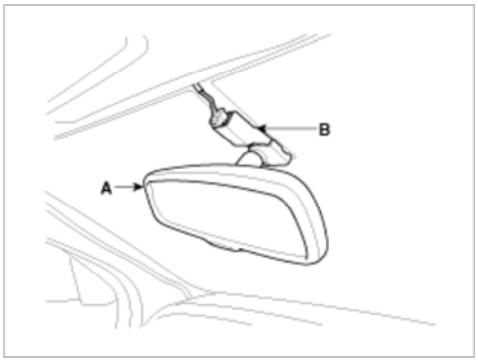
1. Turn the ignition key to the "ON" position.
2. Press the (A) button to turn the automatic dimming function ON/OFF.
3. Cover the forward looking sensor(B) to stop functioning.
4. Head a light to the rearward looking sensor(C).
5. The ECM should be darkened as soon as the rearward looking sensor detects the light.

NOTE

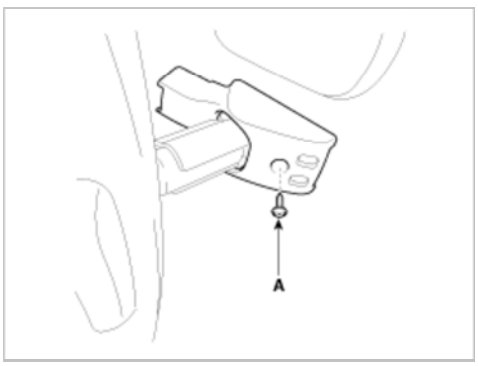
If this test is performed in daytime, the ECM may be darkened as soon as the forward looking sensor is covered.

Removal

1. Remove the mirror wire cover(A).



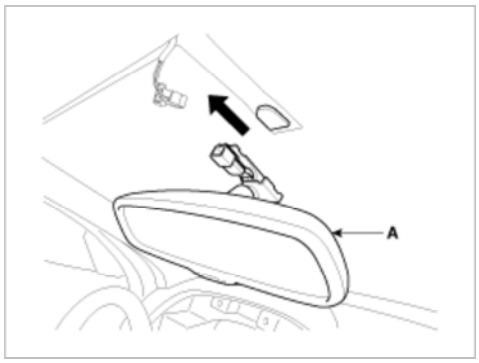
2. Disconnect the inside rear view mirror connector(B).
3. Loosen the mirror mounting screw(A).



4. Remove the inside rear view mirror(A) pulling it upside carefully.

NOTE

Make sure the mounting bracket of the mirror not to be damaged.

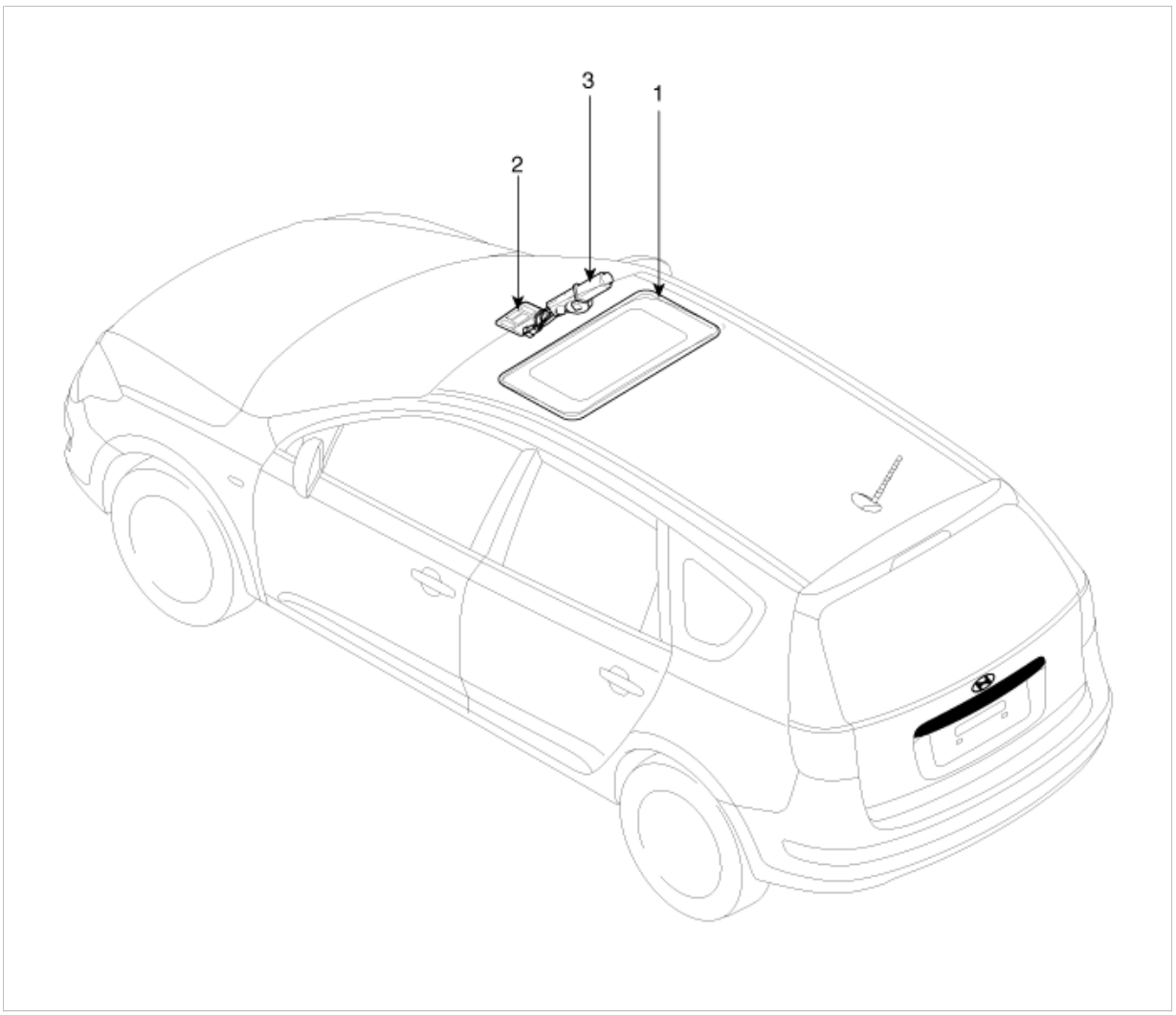


Installation

1. Install the inside rear view mirror.
2. Connect the inside rear view mirror connector.
3. Install the mirror wire cover.

Body Electrical System > Sun Roof > Components and Components Location

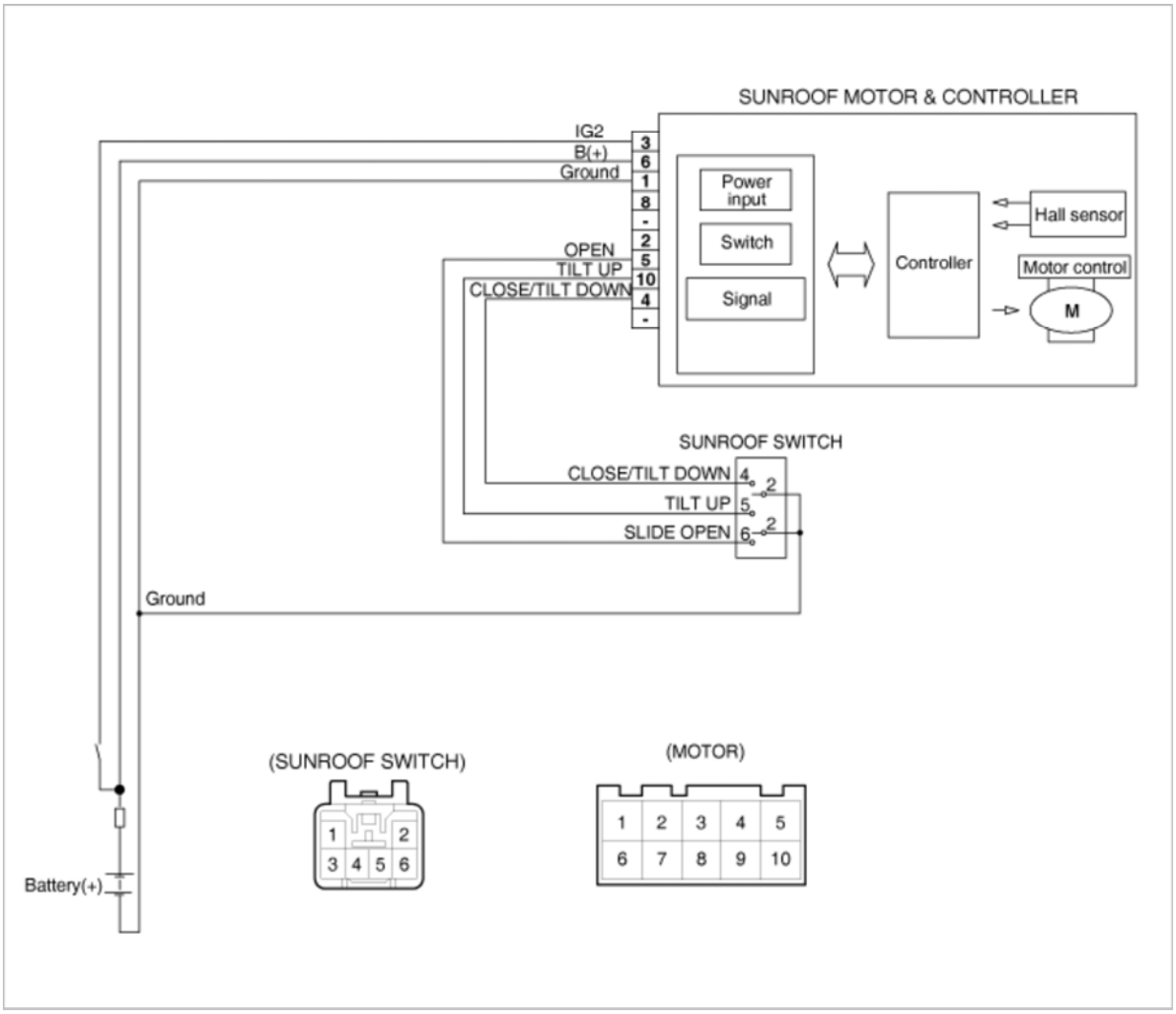
Component Location



1. Sunroof 2. Sunroof switch	3. Sunroof motor & controller

Body Electrical System > Sun Roof > Schematic Diagrams

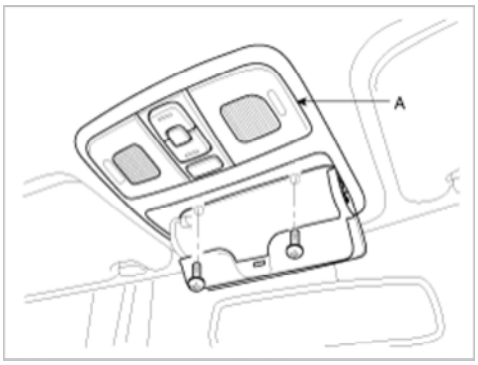
Circuit Diagram



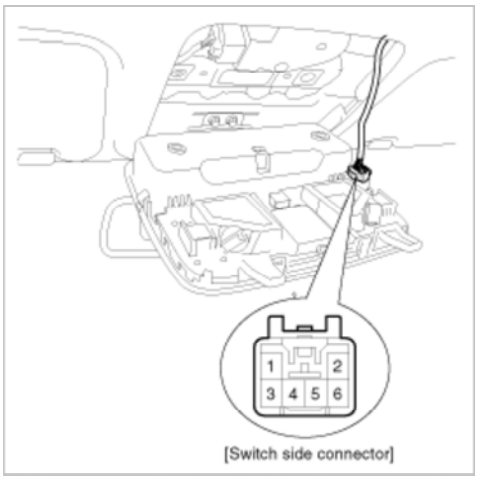
Body Electrical System > Sun Roof > Sunroof Switch > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console. Disconnect the switch connector and then remove the overhead console lamp (A).



3. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.



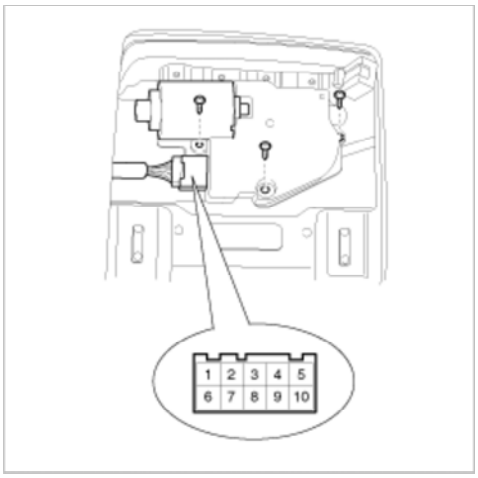
[Switch side connector]

Position \ Terminal	2	6	4	5
TILT UP	○			○
CLOSE/ TILT DOWN	○		○	
SLIDE OPEN	○	○		

Body Electrical System > Sun Roof > Sunroof Motor > Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console then remove the sun roof motor mounting screws (3EA). And then remove the sunroof motor after disconnecting the connector (10 Pin).



3. Ground the terminals as below table, and check that the sunroof unit operates as below table.

Position \ Terminal	3	4	5	10
TILT UP	⊕			⊖
SLIDE CLOSE/DOWN	⊕	⊖		
SLIDE OPEN	⊕		⊖	

4. Make these input tests at the connector
   if any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the sunroof motor must be faulty; replace it.

Terminal	Test condition	Test : Desired result
3	IG2 ON	Check for voltage to ground : There should be battery voltage
1	Under all conditions	Check for continuity to ground : There should be continuity.

6	Under all conditions	Check for voltage to ground : There should be battery voltage.

Resetting The Sunroof

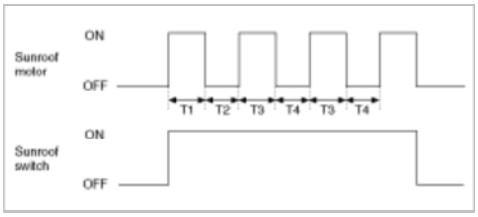
Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows :

1. Turn the ignition key to the ON position and then close the sunroof completely.
2. Release the sunroof control lever.
3. Press and hold the CLOSE button for more than 10 seconds until the sunroof closed and it has moved slightly.
4. Release the sunroof control lever.
5. Press and hold the CLOSE button once again within 5 seconds until the sunroof do as follows;
   A. Tilt → Slide Open → Slide Close
   Then release the lever.
6. Reset procedure of panorama system is finished.

Protecting Motor From Overheating

In order to protect the sunroof motor from overheating from continuous motor operation, the sunroof ECU controls the Run-time and Cool-time of the motor as follows:

1. The Sunroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st run-time(120 ± 10sec.).
3. The continuous operation of motor stops after the 1st Run-time(120 ± 10sec.).
4. Then Motor is not operated for the 1st Cool-time(18 ± 2sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2sec.) at the continued motor operation after 1st Cool-time(18 ± 2sec.)
6. The continuous operation of motor stops operating after the 2nd Run-time(10 ± 2sec.)
7. Motor is not operated for the 2nd Cool-time(18 ± 2sec.).
8. Motor repeats the 2nd run-time and 2nd cool-time at the continued motor operation.
   A. In case that motor is not operated continuously, the run-time is increased.
   B. The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

Body Electrical System > Lighting System > Specifications

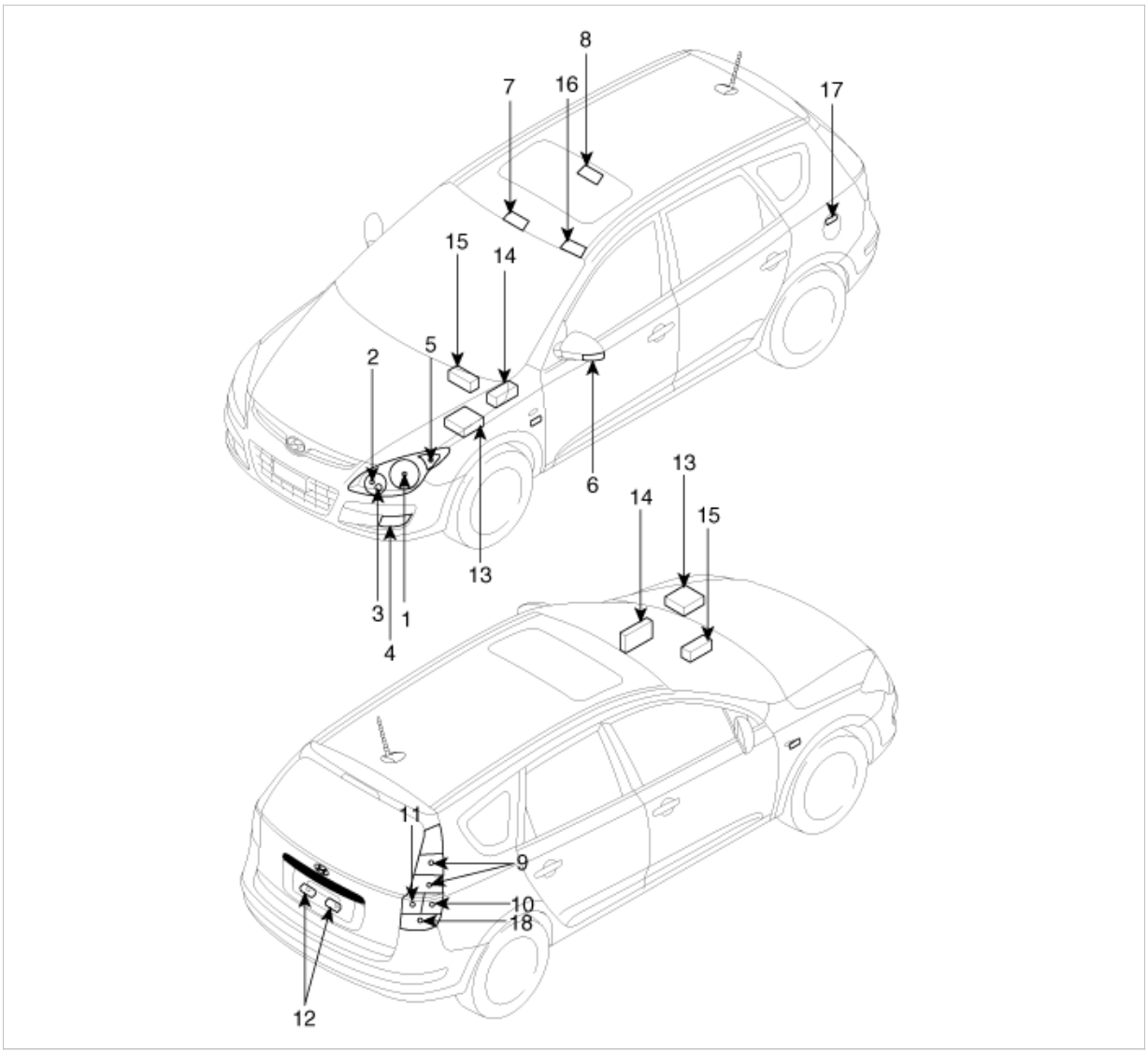
Specification

Items	Bulb Wattage (W)
Head lamp (High)	55
Head lamp (Low)	55
Front turn signal lamp	28
Front position lamp	8
Luggage lamp	5
Front fog lamp	27
Rear stop/tail lamp	28/8
Back up lamp	16
Rear turn signal lamp	27
License plate lamp	5

Side repeater(With outside mirror)	2 (LED)
Side marker lamp(Frt/RR)	5/5
Room lamp	10
Overhead console lamp	10
High mounted stop lamp	2.4 (LED)
Glove box lamp	5
Map lamp	10

Body Electrical System > Lighting System > Components and Components Location

Component Location

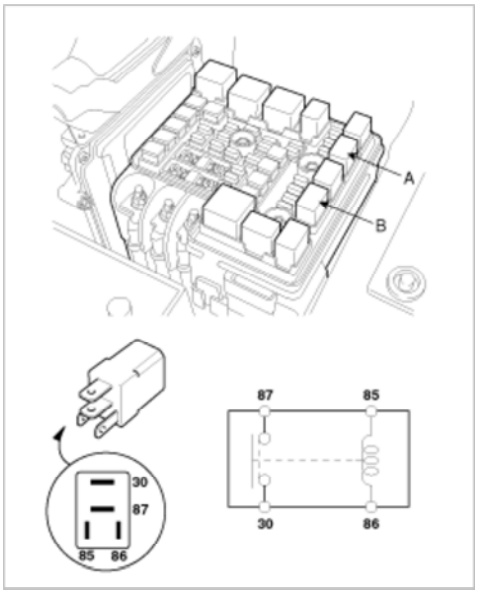


1. Head lamp (Low) 2. Head lamp (High) 3. Position lamp 4. Front fog lamp 5. Front turn signal lamp 6. Side repeater 7. Over head lamp 8. Room lamp (Center) 9. Tail lamp	10. Rear turn signal lamp 11. Back up lamp 12. License plate lamp 13. Engine room junction box (Head lamp Low/High, Fog lamp relay) 14. Passenger compartment junction box (Tail lamp relay) 15. ICM relay box (Hazard relay) 16. Vanity lamp 17. Luggage room lamp 18. Stop lamp

Inspection

Head Lamp Relay / Front Lamp Relay

1. Disconnect the negative(-) battery terminal.
2. Pull out the relay from the engine compartment relay box.
   A : Head lamp(Low) relay
   B : Head lamp (High) relay

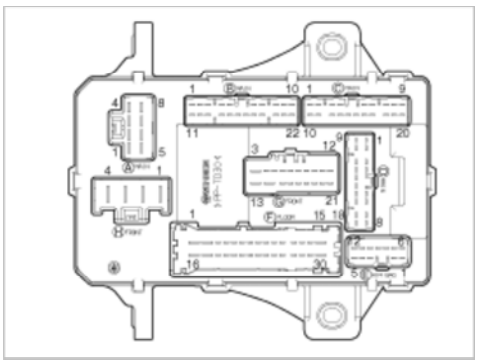


3. Check for continuity between terminals. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.86 and No.85 terminals.
4. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.

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

Tail Lamp

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the junction box.



4. Check for continuity between the terminals.
   (1) There should be continuity between the No.2 terminal in the I/P-H and the No.15(LH) or 4(RH) terminal in the I/P-G when power and ground are connected to the No.2 terminal in the I/P-H and the No.6 terminal in the I/P-D.
   (2) There should be no continuity between the No.2 terminal in the I/P-H and the No.15(LH) or 4(RH) terminal in the I/P-G

when power and ground are connected to the No.2 terminal in the I/P-H and the No.6 terminal in the I/P-D.

Adjustment

Head Lamp Aiming Instructions

> **CAUTION**
>
> Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

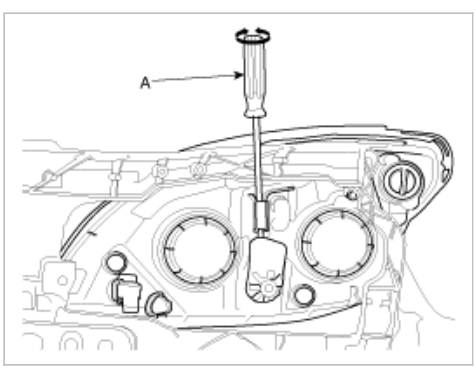
The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

> **NOTE**
>
> If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.
4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the horizontal and vertical lines.
   Make vertical(A) adjustments to the lower beam using the adjusting wheel.

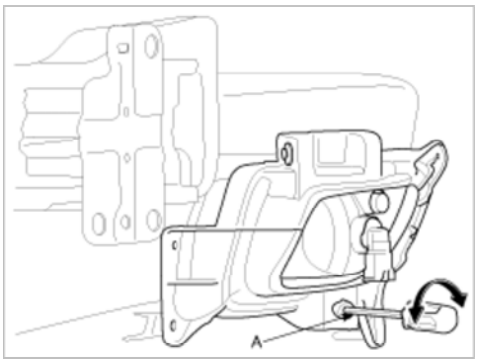
Condition	Aiming Direction	
	A	
Turning Clockwise	UP	LEFT
Turning Counter clockwise	DOWN	RIGHT



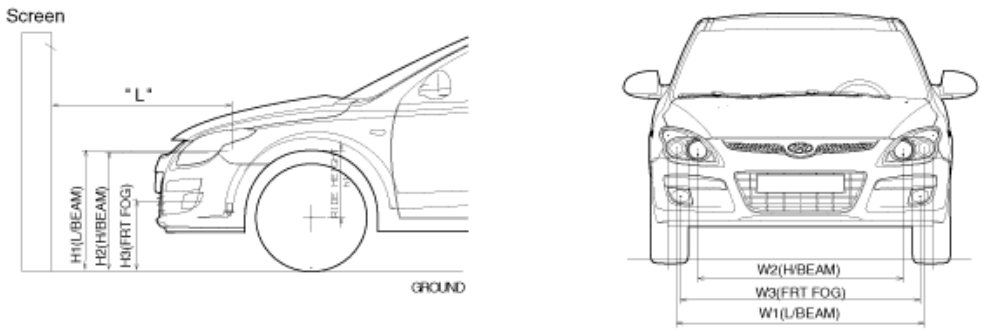
Front Fog Lamp Aiming

The front fog lamps should be aimed as the same manner of the head lamps aiming.
With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear (A).

Condition	Aiming Direction
Turning Clockwise	DOWN
Turning Counter clockwise	UP



Head Lamp And Fog Lamp Aiming Point

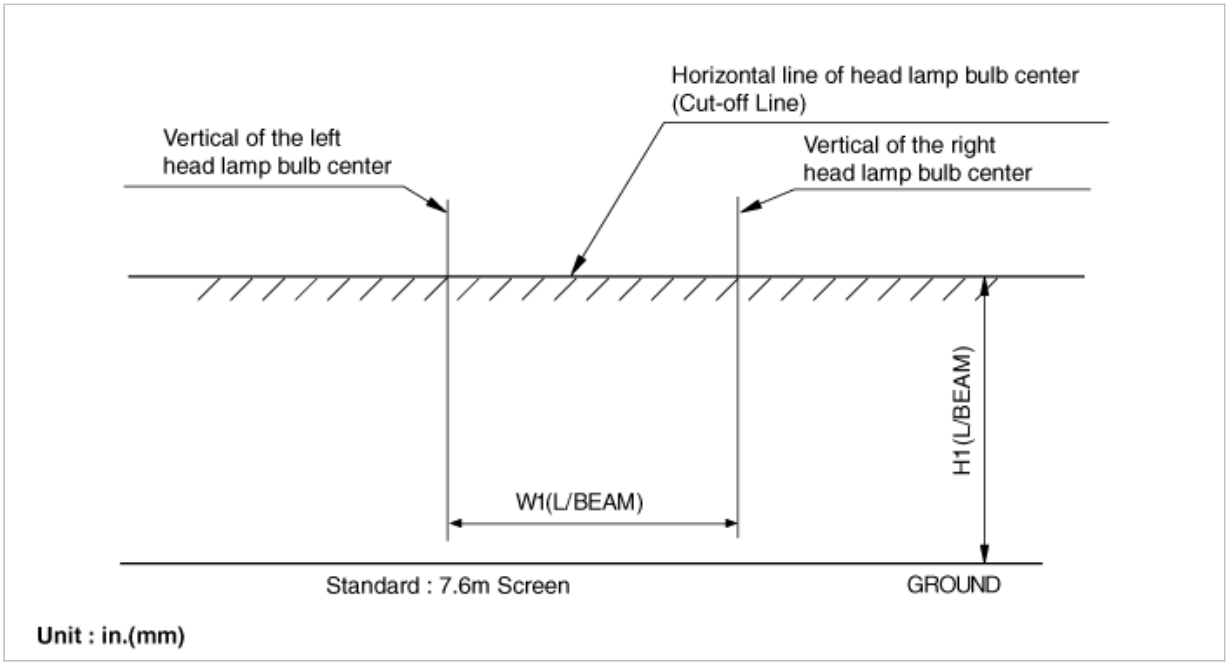


H1 : Height between the head lamp bulb center and ground (Low beam)
H2 : Height between the head lamp bulb center and ground (High beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (Low beam)
W2 : Distance between the two head lamp bulbs centers (High beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen
h1 : Ride height

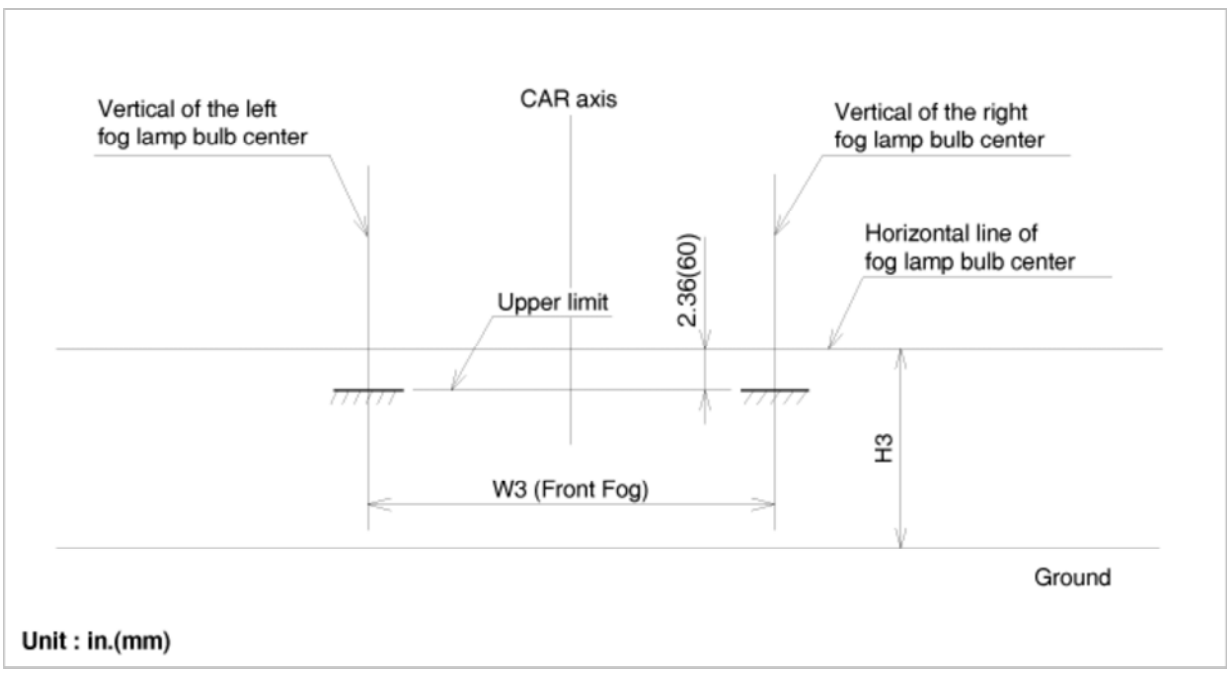
Unit : in (mm)

Vehicle condition	H1	H2	H3	h1	W1	W2	W3	L
Without driver	25.9(658)	25.5(648)	14.6(370)	15.3(388)	56.7(1,440)	47.0(1,194)	54.9(1,395)	118(3,000)
With driver	25.6(651)	27.2(641)	14.3(363)	15.0(381)				

1. Turn the low beam on with driver.
   The cut-off line should be aligned to cut-off line in the picture.



2. Turn the front fog lamp on with driver.
   The cut-off line should be projected in the allowable range shown in the picture.



Removal

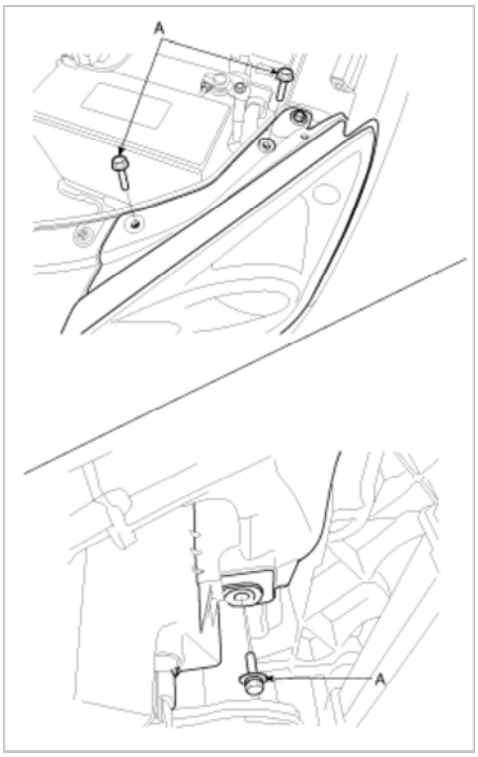
CAUTION

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

NOTE

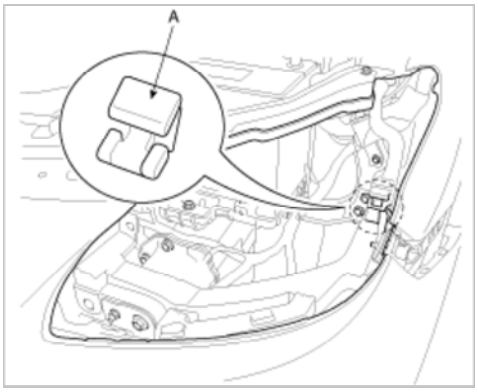
The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.
Removing bulb for an extended period of time may affect headlamp bulb performance.
Contaminants may enter the headlamp assembly where they can settle on the lens and reflector.
Never turn on the head lamps with the bulb removed from the headlamp assembly.

1. Disconnect the negative (-) battery terminal.
2. Loosen the mounting bolts (3EA) of head lamp. Remove the head lamp assembly (A) after disconnecting the lamp connectors.

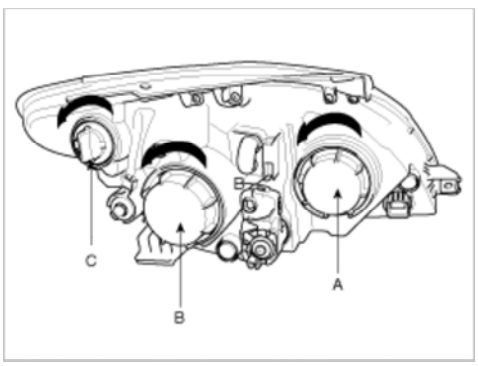


NOTE

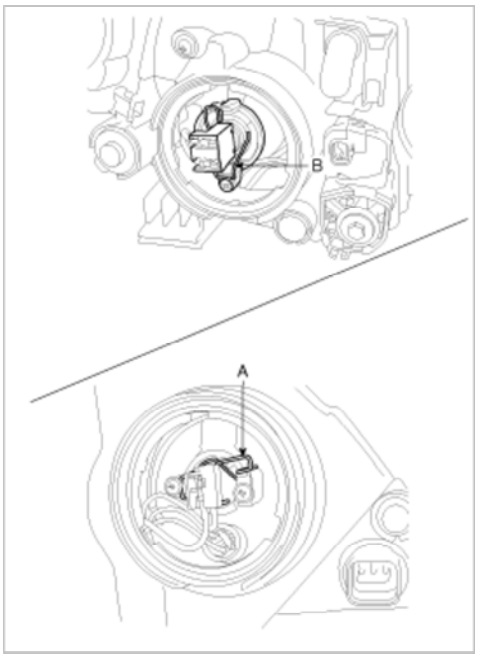
Take care that retaining clip (A) is not to be damaged.



3. Remove the bulb caps from the head lamp assembly after turning in the counter clock-wise direction.
   A : Head lamp high bulb & position bulb cab
   B : Head lamp low bulb cab
   C : Turn signal bulb cab



4. Remove the head lamp bulbs after releasing the lock of the set spring.
   A : Head lamp high bulb, B : Head lamp low bulb.



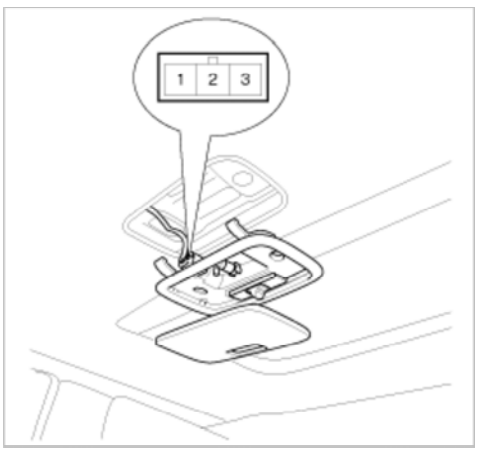
Installation

1. Install the head lamp bulbs.
2. Install the head lamp bulb caps.
3. Install the head lamp assembly after connecting the lamp connector.

Body Electrical System > Lighting System > Room Lamp > Repair procedures

Inspection

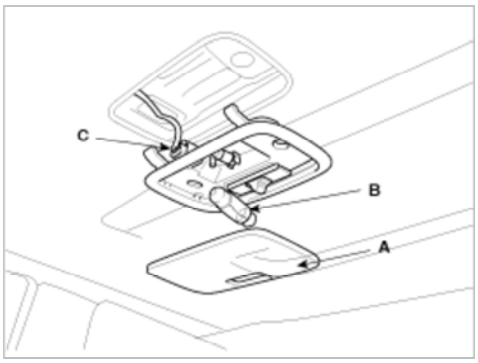
1. Remove the room lamp assembly then check for continuity between terminals.



Terminal / Position	1	3	2
DOOR		○—(W)—○	
ON	○—(W)—○		
OFF			

Removal

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver then remove the bulb (B).



3. Loosen the fixing screw (2EA) and disconnect the 3P connector(C). And then remove the room lamp assembly.

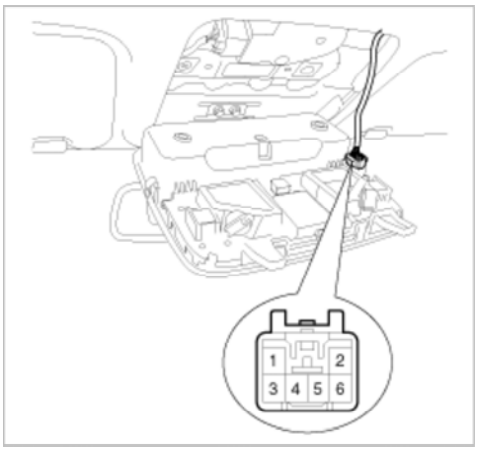
Installation

1. Install the room lamp assembly after connecting the lamp connector.
2. Install the lamp lens after assembling the bulb.

Body Electrical System > Lighting System > Overhead Console Lamp > Repair procedures

Inspection

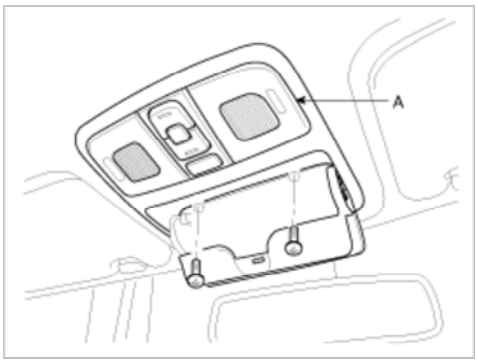
Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.



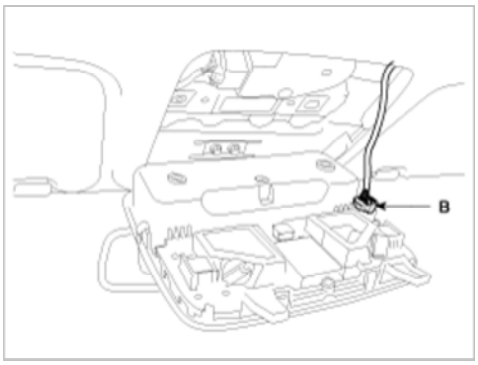
Sort / Position / Terminal	Map lamp switch				DOOR Switch	
	LH		RH			
	ON	OFF	ON	OFF	ON	OFF
1	●		●		●	
2	●		●		●	
3					●	

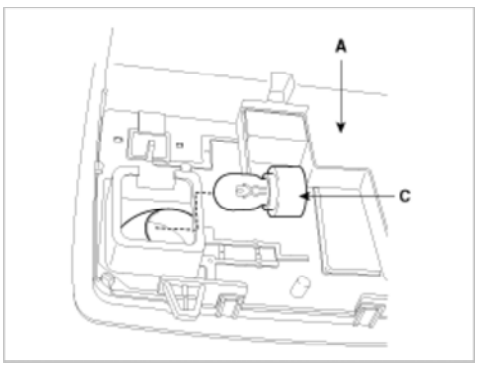
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console lamp(A) after loosening the overhead console lamp screw(2EA).



3. Disconnect the sunroof switch and lamp connector (B) and then remove the overhead console (A) lamp (C).





Installation

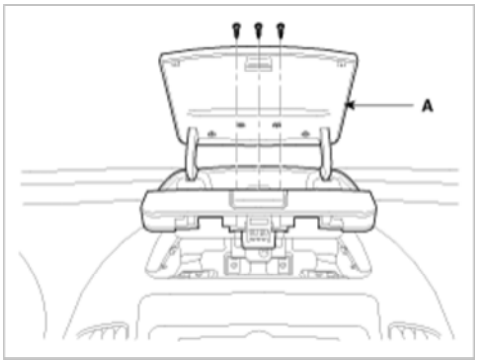
1. Install the overhead console lamp after connecting the sunroof switch and lamp connector.
2. Install the lens after tightening 2 screws.

Body Electrical System > Lighting System > Hazard Lamp Switch > Repair procedures

Inspection

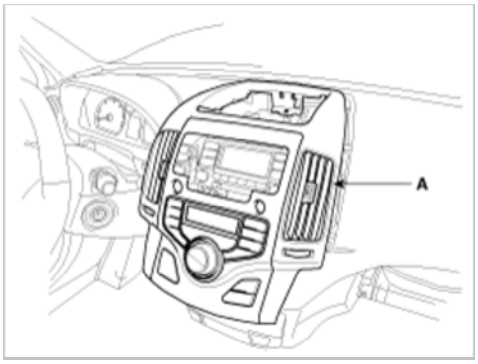
Hazard Lamp Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia upper tray(A)
   (Refer to the Body group - Crash pad)



3. Remove the crash pad center facia panel (A).

> NOTE
>
> Take care not to scratch the crash pad and related parts.



4. Disconnect the hazard lamp switch connector.

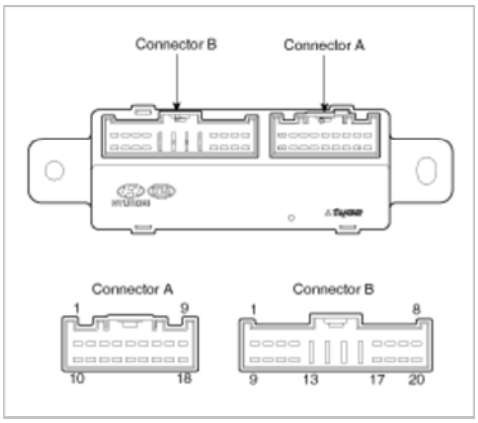
5. Operate the switch and check for continuity between terminals with an ohmmeter.

Terminal / Position	OFF	ON	Remark
5	○		IGN
7		○	Battery
8	○	○	Common
6		○	F BATT
10		○	Right
9		○	Left
2	○		Illumination +
3	○		Illumination -

Hazard Lamp Relay

1. Disconnect the negative (-) battery terminal.
2. Disconnect the ICM relay box connector.

3. Check for continuity between terminals. There should be continuity between the No.3 and No.12 or No.7 of ICM-B terminals when power and ground are connected to the No.3 and No.17 of ICM-B terminals.
4. There should be no continuity between the No.3 and No.12 or No.7 of ICM-B terminals when power is disconnected to the No.3 and No.17 of ICM-B terminals.

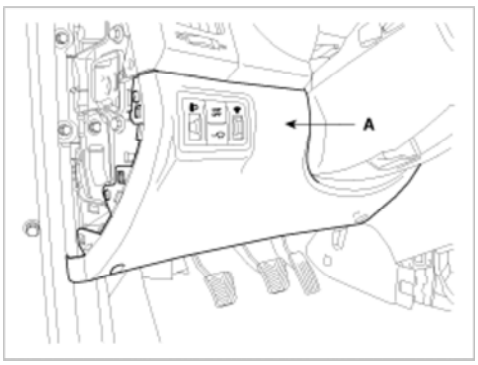


Terminal / Position	ICM-B (3)	ICM-B (7 or 12)	ICM-B (3)	ICM-B (17)
Power off			○	○
Power on	○	○	⊖	⊕

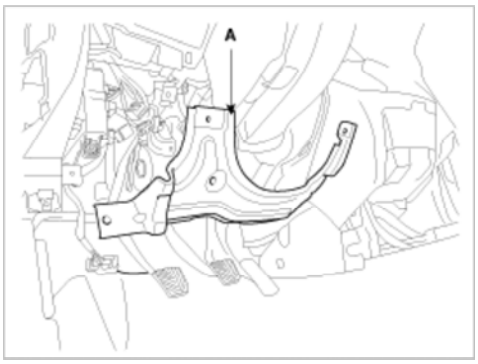
Body Electrical System > Lighting System > Flasher Unit > Repair procedures

Inspection

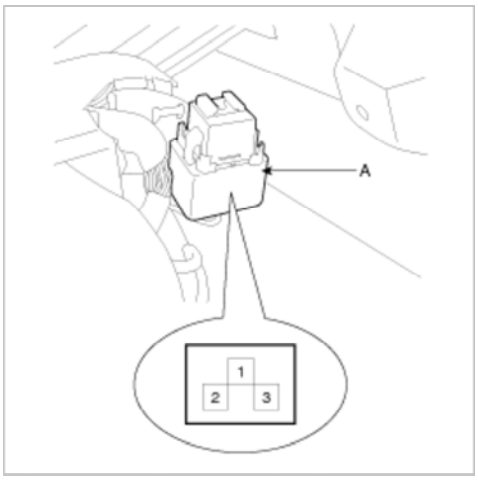
1. Disconnect the negative (-) battery terminal.
2. Remove the driver crash pad lower panel (A).



3. Remove the driver crash pad reinforcing panel (A) after loosening 5 bolts.



4. Remove the flasher unit (A) after loosening the bolt and disconnecting the connector.



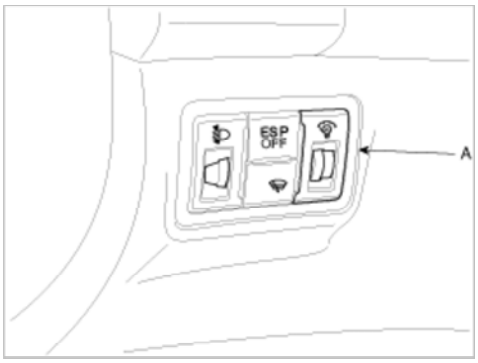
5. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 3.
6. Connect the two turn signal lamps in parallel to terminals 1 and 3. Check that the bulbs turn on and off.

> **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 flash unit.

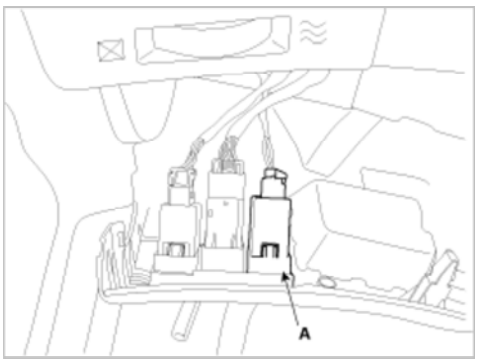
Body Electrical System > Lighting System > Rheostat > Repair procedures

Inspection

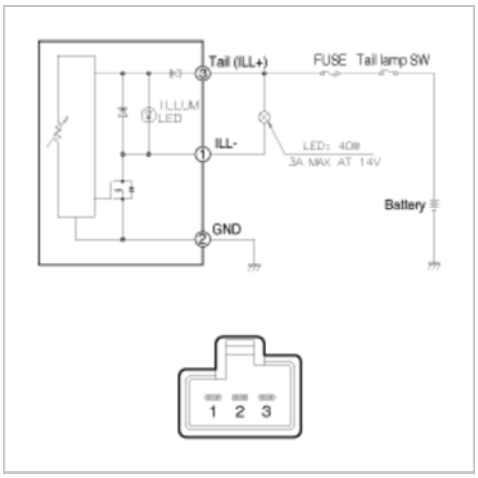
1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad switch assembly (A) by using the trim remover tool.



3. Disconnect the rheostat switch connector (A).



4. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is operating normally.

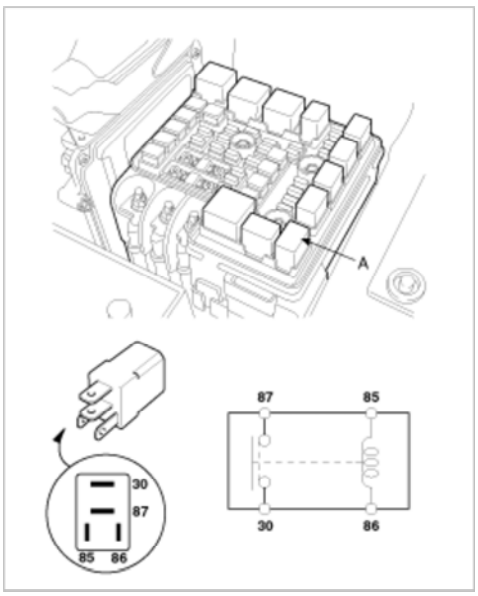


Body Electrical System > Lighting System > Front Fog Lamps > Repair procedures

Inspection

Front Fog Lamp Relay

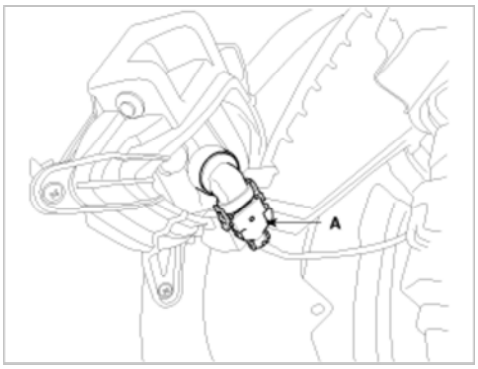
1. Disconnect the negative(-) battery terminal.
2. Pull out the front fog lamp relay(A) from the engine compartment relay box.
3. Check for continuity between terminals. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.85 and No.86 terminals.
4. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.



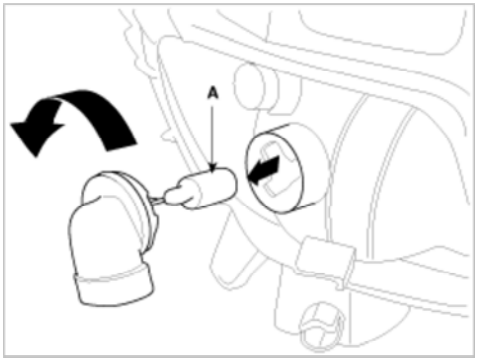
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front side cover screw.
3. Remove the front fog lamp assembly connector (A).



4. Remove the front fog lamp bulb (A) turning in the counter clock-wise direction.



Installation

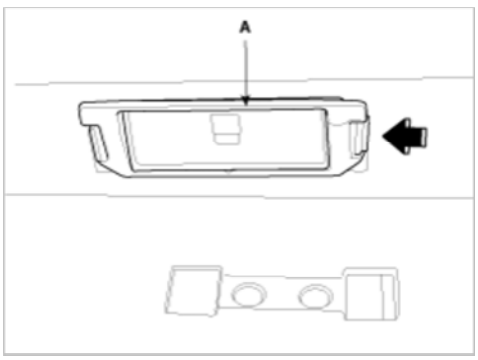
1. Install the front fog lamp bulb.
2. Connect the front fog lamp connector.
3. Install the front side cover.

Body Electrical System > Lighting System > License Lamps > Repair procedures

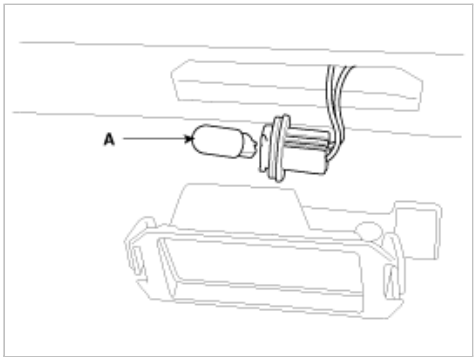
Removal

License Lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens (A) by using the remover tool

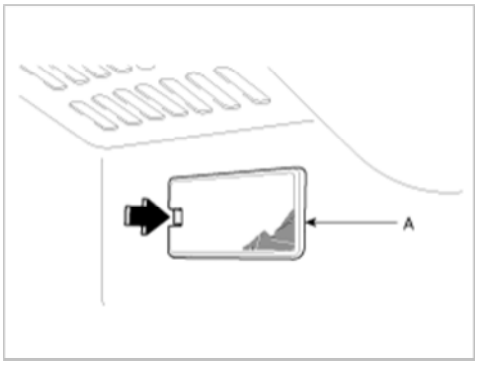


3. Replace the bulb (A).

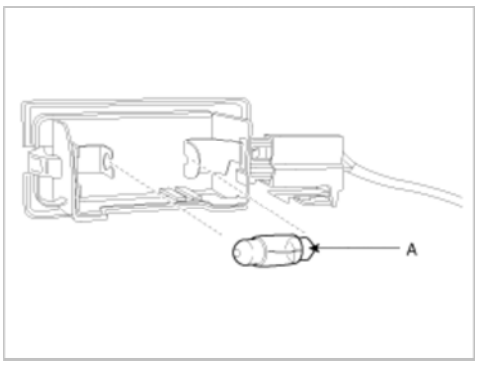


Tailgate Room Lamp

1. Disconnect the negative(-) battery terminal.
2. Remove the tailgate room lamp len(A) from the luggage side trim.



3. Remove the bulb(A).



Installation

License Lamp

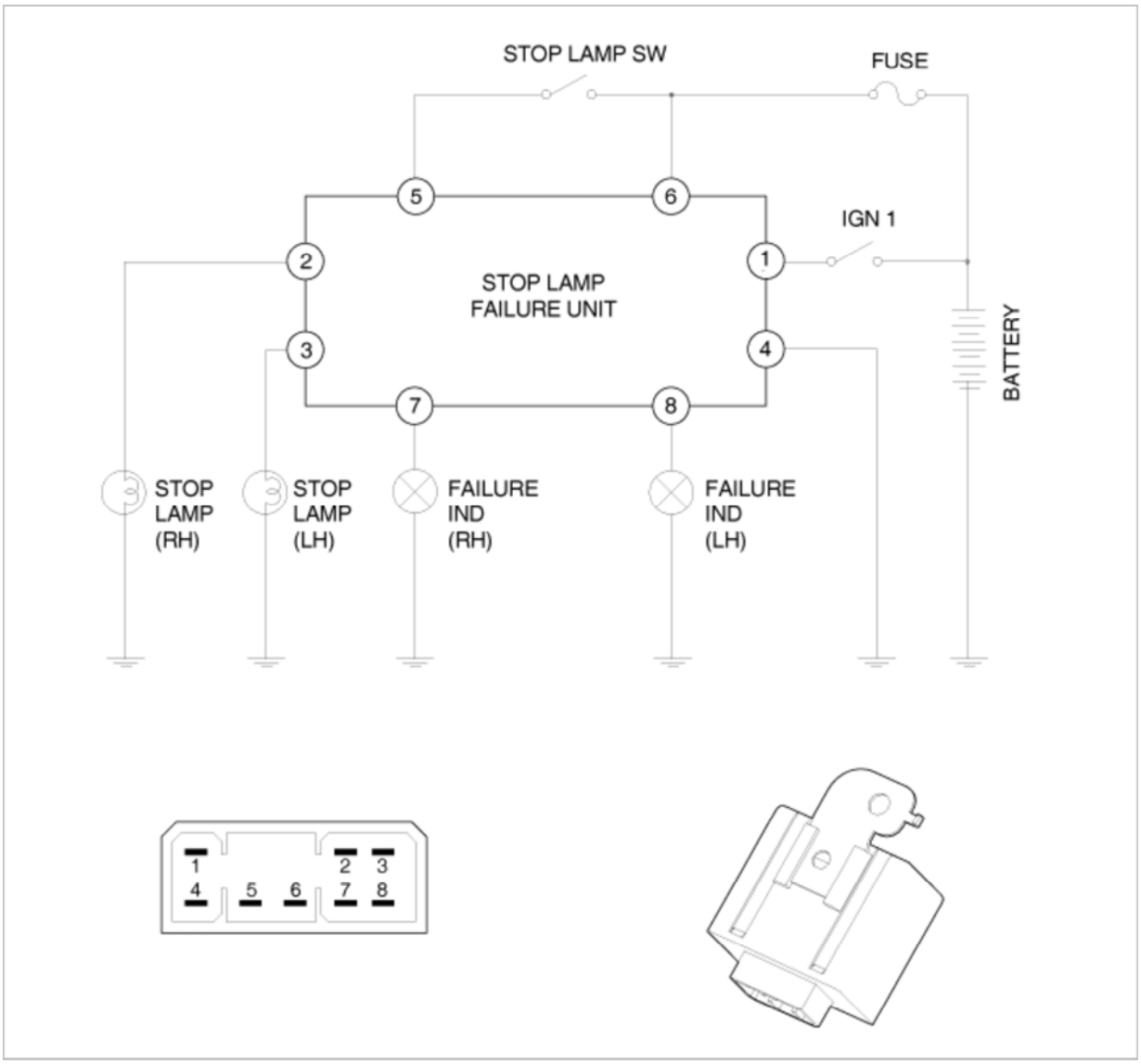
1. Install the bulb.
2. Install the license lamp lens.

Tailgate Room Lamp

1. Install the bulb.
2. Install the tailgate room lamp len.

Body Electrical System > Lighting System > High Mounted stop lamp > Schematic Diagrams

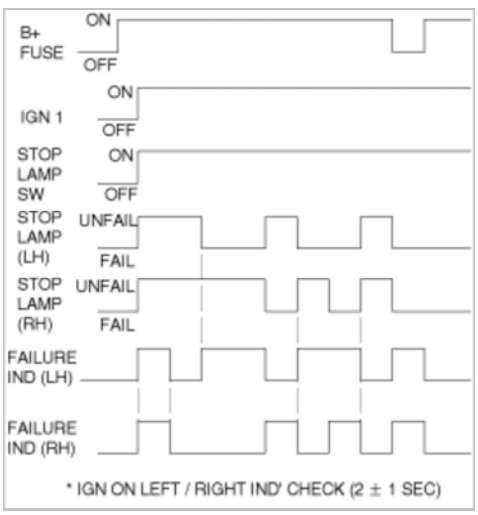
Circuit Diagram



Body Electrical System > Lighting System > High Mounted stop lamp > Repair procedures

Inspection

1. First make sure that the stop lamps come on when the brake pedal is pressed.
   If necessary, replace the bulb.
2. Check for operation of this function properly as shown in figure.



3. Remove the rear right pillar lower trim.

(Refer to Body Group - "Interior trim")

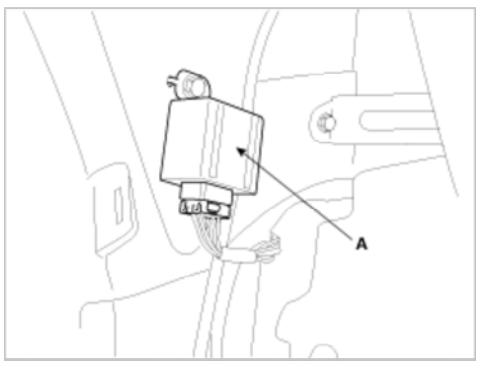
4. Check the voltage between NO.1 terminal of harness connector and ground when the IG is turned on and the brake pedal is pressed.

Standard value : 12V (for 2 ± 1sec.)

Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the rear right pillar lower trim(A).
   (Refer to Body Group - "Interior trim")

3. Remove the stop lamp failure unit (A) after loosening a bolt and disconnecting the unit connector.



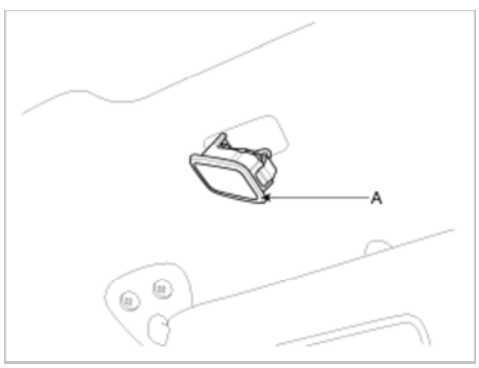
Installation

1. Install the stop lamp failure unit.
2. Install the rear right pillar lower trim.

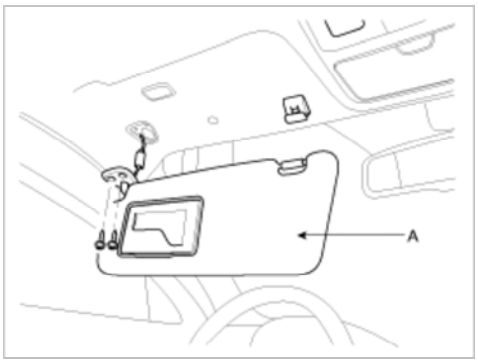
Body Electrical System > Lighting System > Personal Lamp > Repair procedures

Removal

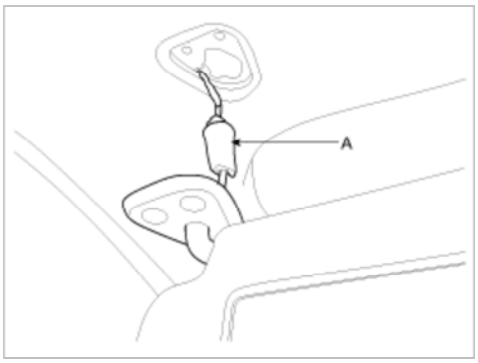
1. Disconnect the negative(-) battery terminal.
2. Remove the vanity lamp lens(A) and then remove the bulb.



3. Remove the sunvisor(A) after loosening the screws(2EA).



4. Disconnect the sunvisor connector(A).



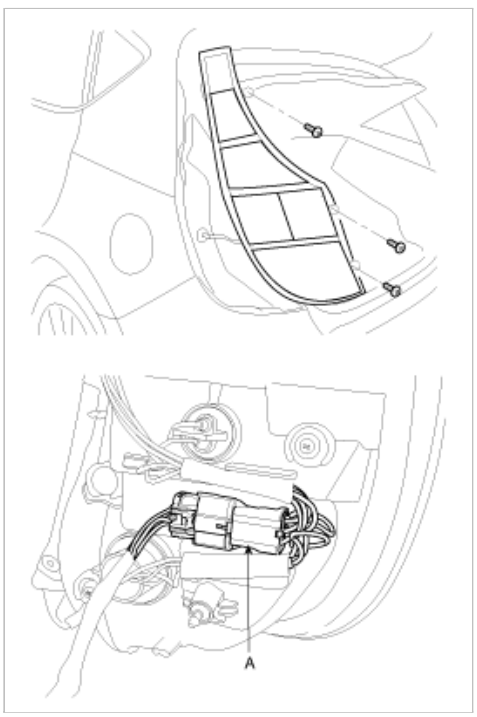
Installation

1. Install the vanity bulb.
2. Install the vanity lamp lens.
3. Install the sunvisor assembly.

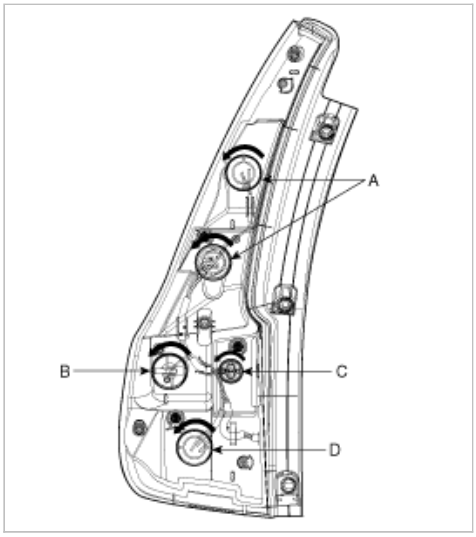
Body Electrical System > Lighting System > Rear combination lamp > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Loose the screws (3EA) holding the rear combination lamp then disconnect the connector (A) then remove the rear combination lamp.



3. Replace the bulbs (4EA) turning in the counter clockwise direction.
   A : Tail lamp
   B : Rear turn signal lamp
   C : Back up lamp
   D : Stop lamp



Installation

1. Connect the lamp connector after assembling the bulb.
2. Install the rear combination lamp assembly.

Body Electrical System > Lighting System > Troubleshooting

Troubleshooting

Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Head lamp fuse (LOW:10A, HIGH:20A) blown	Check for short and replace fuse
	Head lamp fuse (10A) blown	Check for short and replace fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	Tail lamp fuse (10A) blown	Check for short and replace fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (15A) blown	Check for short and replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
Instrument lamps do not light (Tail lamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary

Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (15A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
	Flasher unit faulty	Check flasher unit
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (15A) blown	Check for short and replace fuse
	Room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (15A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Rear fog lamps do not light	Bulb burned out	Replace bulb
	Rear fog lamp fuse (10A) blown	Check for short and replace fuse
	Rear fog lamp fuse (10A) blown	Check for short and replace fuse
	Rear fog lamp switch faulty	Check switch
	Rear fog lamp relay faulty	Check relay
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tailgate room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Tailgate room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

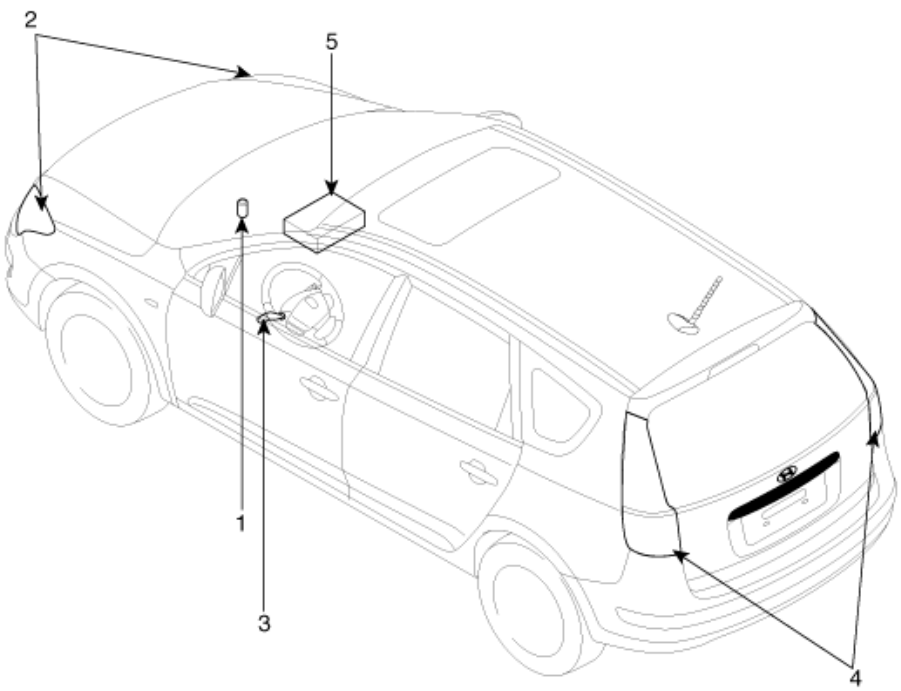
Body Electrical System > Auto Lighting Control System > Specifications

Specifications

Item			Specifications
Rated voltage			5V
Operating current			Max. 1mA
Signal output	Head lamp	ON	0.81±0.05V
		OFF	1.41±0.05V
	Tail lamp	ON	0.81±0.05V
		OFF	1.41±0.05V

Body Electrical System > Auto Lighting Control System > Components and Components Location

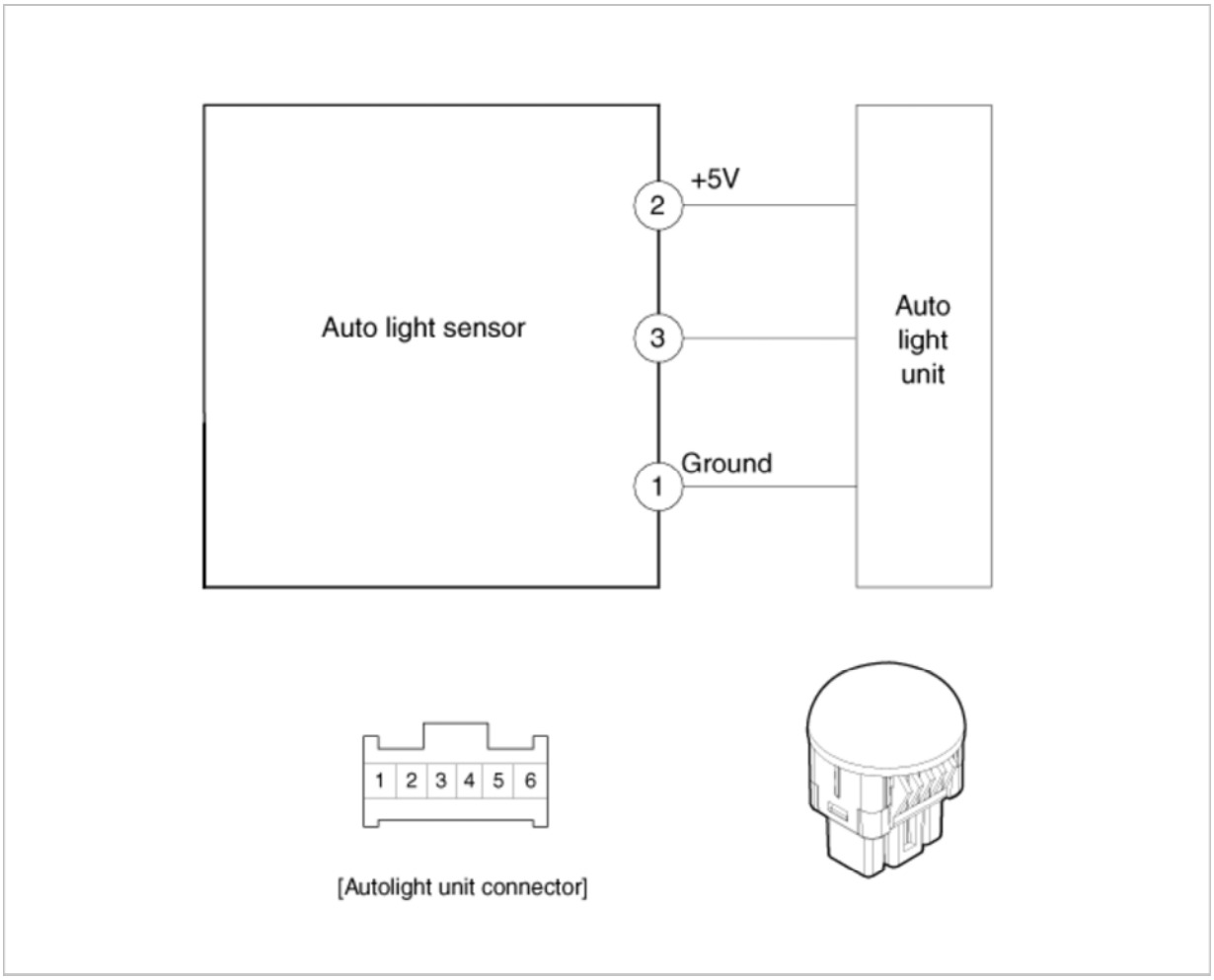
Component Location



1. Auto light sensor unit 2. Head lamps 3. Lighting switch (Auto)	4. Tail lamps 5. Body control module

Body Electrical System > Auto Lighting Control System > Schematic Diagrams

Circuit Diagram



Body Electrical System > Auto Lighting Control System > Description and Operation

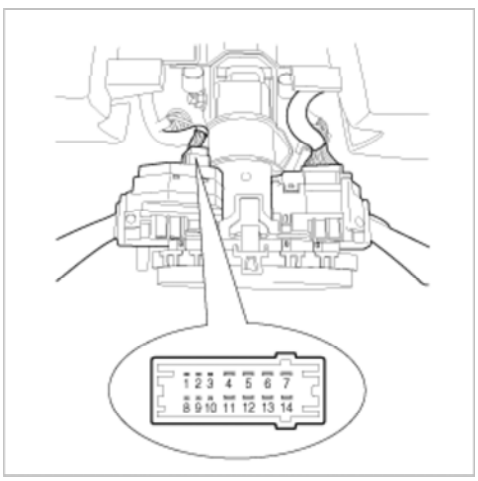
Description

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 > Auto Light Switch > Repair procedures

Inspection

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



Lighting Switch (Auto Light)

Terminal / Position	8	9	10	1
OFF				
I	○	—	—	○
II	○	○	—	○
AUTO			○	○

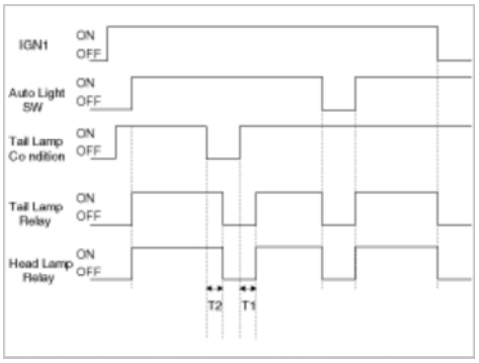
Body Electrical System > Auto Lighting Control System > Auto Light Sensor > Repair procedures

Inspection

1. Auto Light SENSOR value is always read at IGN1 ON.
2. LIGHT is turned ON after 2.5sec±0.1sec when Auto Light SENSOR value is same as LIGHT ON input value.
3. LIGHT is turned OFF after 2.5sec±0.1sec when Auto Light SENSOR value is same as LIGHT OFF input value.
4. LIGHT ON value of SENSOR is based on the below table.
5. Head Lamp signal is output when Head Lamp OUTPUT is ON.
6. After Head Lamp is turned OFF, Head Lamp signal output is kept if Head Lamp&Tail Lamp ON.
   luminance condition is met at Auto Light SW ON.
7. After Head Lamp is turned OFF, Head Lamp signal output is immediately stopped if Head Lamp&Tail Lamp OFF luminance condition is met at Auto Light SW ON.
8. After Head Lamp is turned OFF, Head Lamp signal output is immediately stopped at Tail SW signal input.
9. After Head Lamp is turned OFF, Head Lamp signal output is stopped if there is no input of Auto Light SW or Tail SW. (shall be no flashing of Head Lamp)
10. Head Lamp signal output is stopped when SW position is changed from AUTO to Head Lamp SW during Head Lamp ON with Auto Light. (shall be no flashing of Head Lamp)

Light Sensor Reading

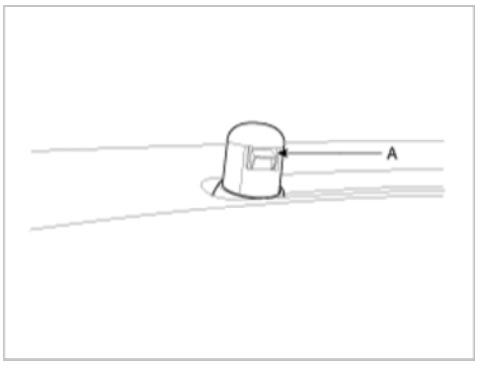
	Head lamp	Tail lamp
ON	18.5 ± 4(Lux),0.81 ± 0.05V	74 ± 16(Lux), 0.81 ± 0.05V
OFF	37 ± 8(Lux), 1.41 ± 0.05V	148 ± 32(Lux), 1.41 ± 0.05V



T1 : 12 ± 0.25
T2 : 12 ± 0.25

Replacement

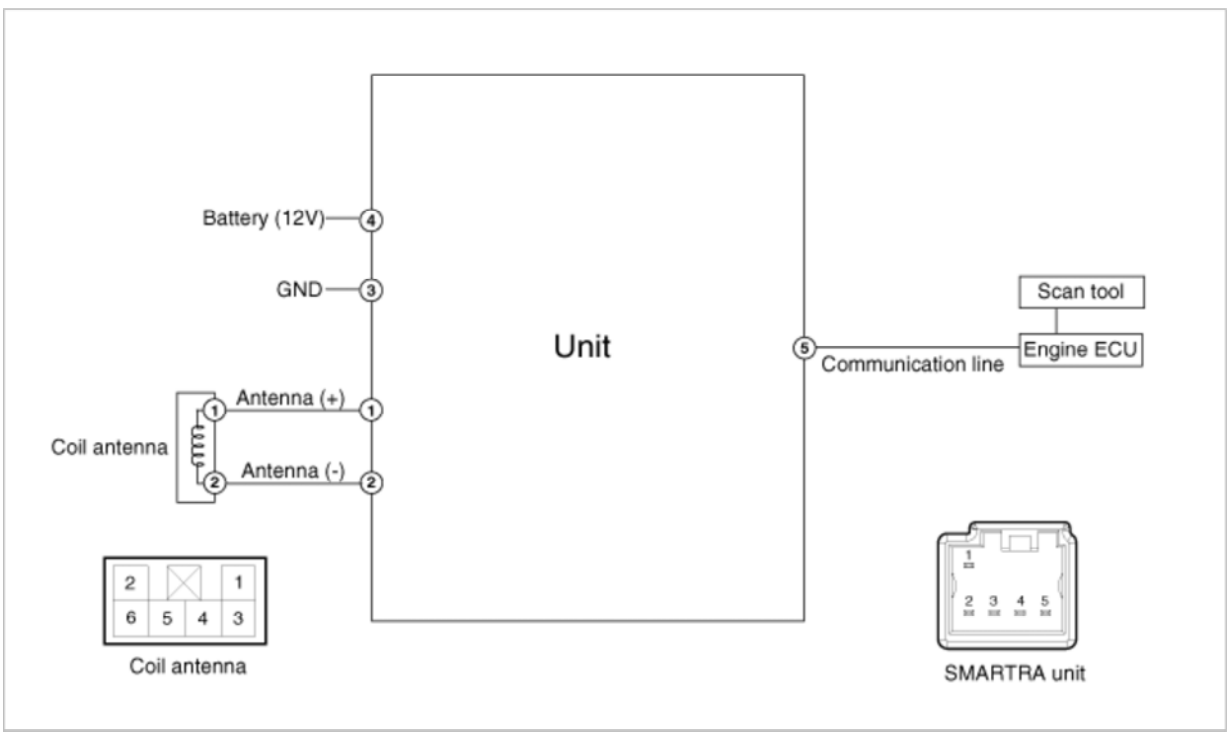
1. Disconnect the negative (-) battery terminal.
2. Remove the Photo & auto light sensor (A) using screw (-) driver.



3. Remove the auto light connector.
4. Installation is the reverse of removal.

Body Electrical System > Immobilizer System > Schematic Diagrams

Circuit Diagram



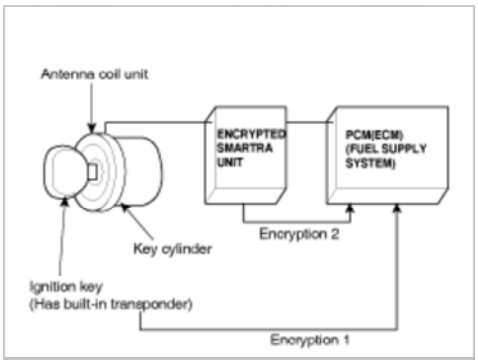
Body Electrical System > Immobilizer System > Description and Operation

Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. Encrypted SMARTRA type immobilizer
   A. The SMARTRA system consists of a passive challenge - response (mutual authentication)transponder located in the ignition key, an antenna coil, an encoded SMARTRA unit, an indicator light and the PCM(ECM).
   B. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.
   C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit to the PCM(ECM).
   D. If the proper key has been used, the PCM(ECM) will energize the fuel supply system. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the SMARTRA unit has recognized the code sent by the transponder.
   E. If the wrong key has been used and the code was not received or recognized by the PCM(ECM) the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.

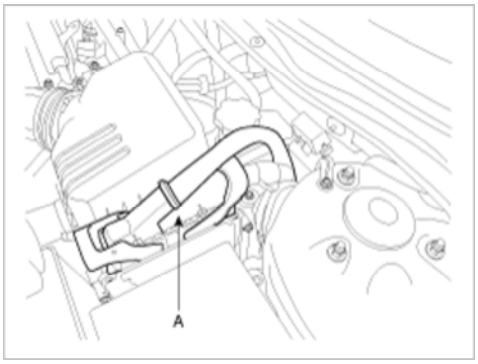
F. If it is necessary to rewrite the PCM(ECM) to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
G. The immobilizer system can store up to eight key codes.
H. If the customer has lost his key, and cannot start the engine, contact Hyundai motor service station.



Components Operations

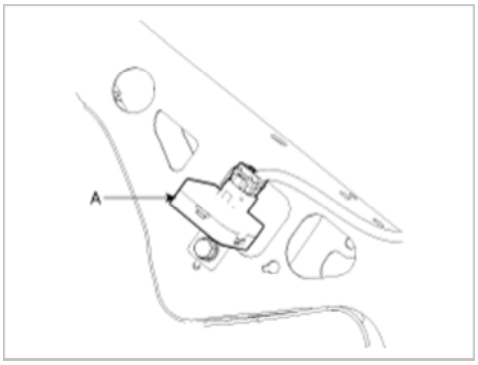
PCM (Power Train Control Module)

1. The PCM(ECM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the PCM(ECM).
   ERN (Encrypted Randorn Number) value between EMS and encrypted smartra unit is checked and the validity of coded key is decided by EMS.



Encrypted Smartra unit (A)

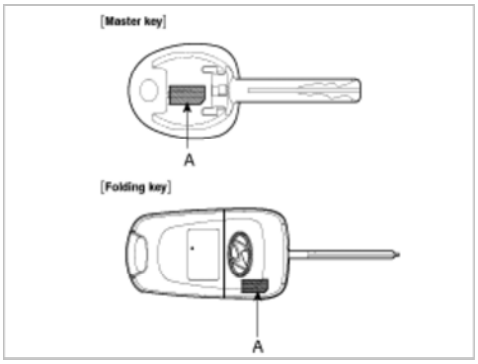
The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad close to center cross bar.
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.
The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.



Transponder (Built-in keys)

The transponder (A) has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is

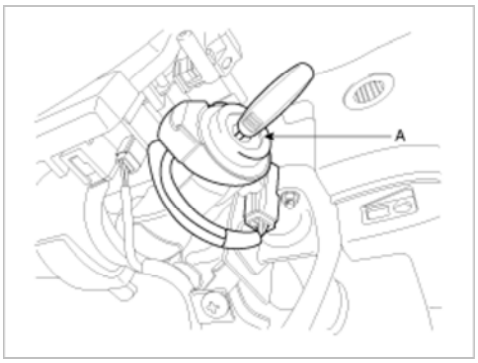
once only; therefore, the contents of the transponder can never be modified or changed.



Antenna coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA.
  It is located directly in front of the steering handle lock.

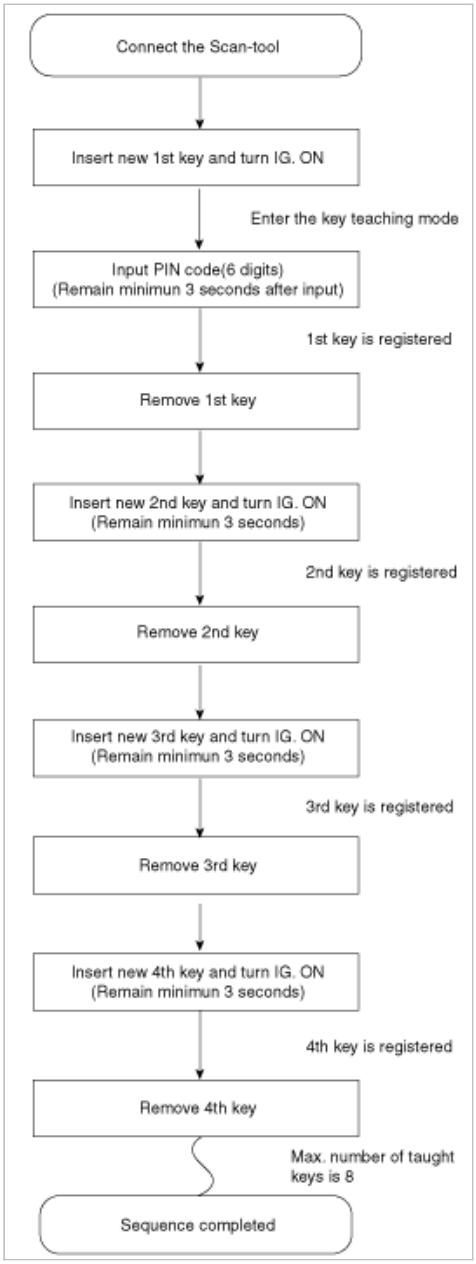


Body Electrical System > Immobilizer System > Repair procedures

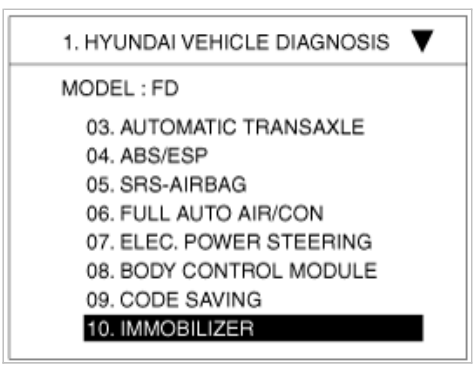
Teaching Procedures

1. Key Teaching Procedure
   Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehicle owner.
   The procedure starts with a PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" PCM (ECM) stores the vehicle specific data and the key teaching can be started. The "learnt" PCM(ECM) compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.
   If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.
   The key teaching is done by ignition on with the key and additional tester commands. The PCM(ECM) stores the relevant data in the EEPROM and in the transponder. Then the PCM(ECM) runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.
   If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and 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 PCM(ECM). This rejects the key and a message is sent to the tester.
   The PCM(ECM) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the PCM(ECM) detects different authenticators of a transponder and a PCM(ECM), the key is considered to be invalid.
   The maximum number of taught keys is 8
   If an error occurs during the Immobilizer Service Menu, the PCM(ECM) status remains unchanged and a specific fault code is stored.
   If the PCM(ECM) status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at PCM(ECM).

> NOTE
>
> When teaching the 1st key, Smartra regists at the same time.



(1) PCM(ECM) learnt status.



1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : FD
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL

1.3 TEACHING

MODEL : FD
SYSTEM : IMMOBILIZER
STATUS : LEARNT

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

CODE : 234567

1.3 TEACHING

MODEL : FD
SYSTEM : IMMOBILIZER
STATUS : LEARNT

1st KEY TEACHING
ARE YOU SURE ? [Y/N]

CODE : 234567

1.3 TEACHING

MODEL : FD
SYSTEM : IMMOBILIZER
STATUS : LEARNT

1st KEY TEACHING
COMPLETED

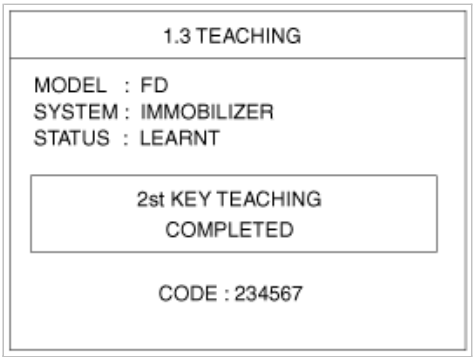
CODE : 234567

1.3 TEACHING

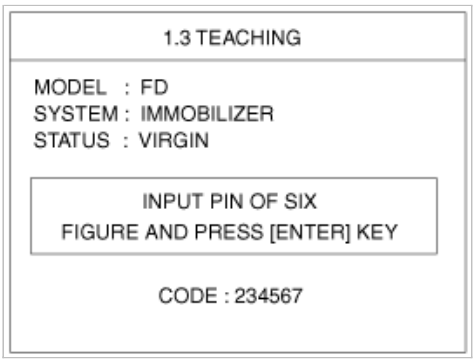
MODEL : FD
SYSTEM : IMMOBILIZER
STATUS : LEARNT

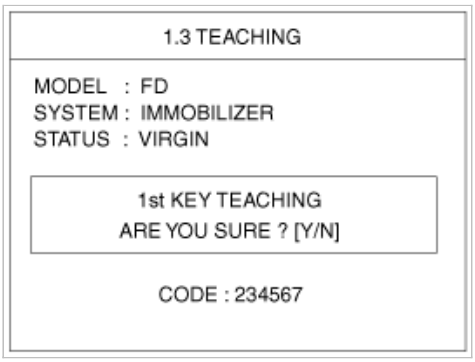
2st KEY TEACHING
ARE YOU SURE ? [Y/N]

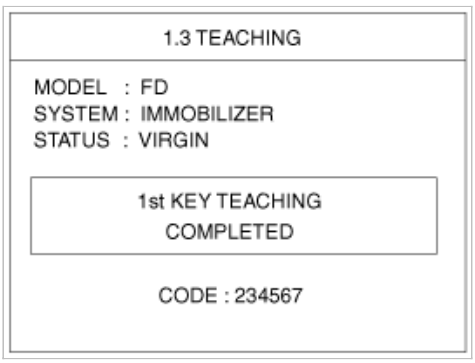
CODE : 234567

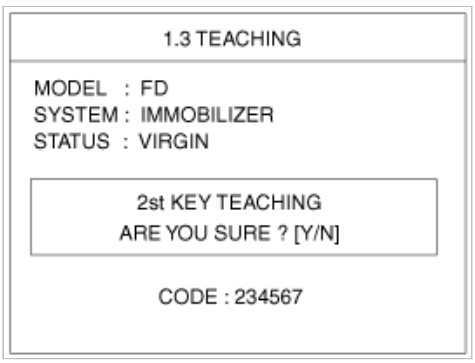


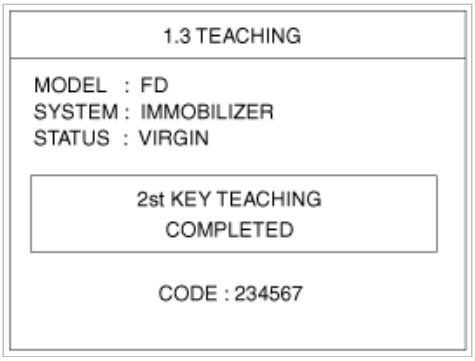
(2) PCM(ECM) virgin status.
After replacing new "PCM(ECM)" scan tool displays that PCM(ECM) is virgin status in Key Teaching mode.
"VIRGIN" status means that PCM(ECM) has not matched any PIN code before.



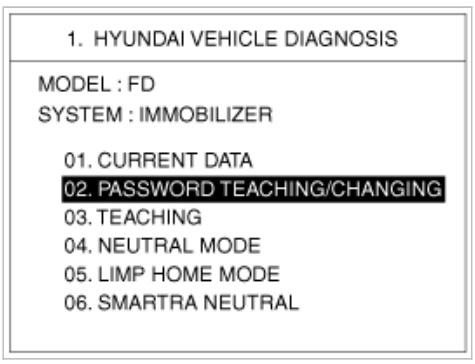


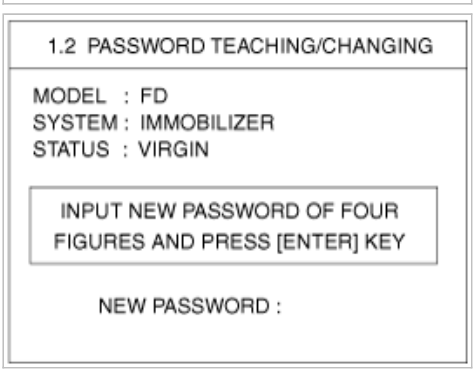


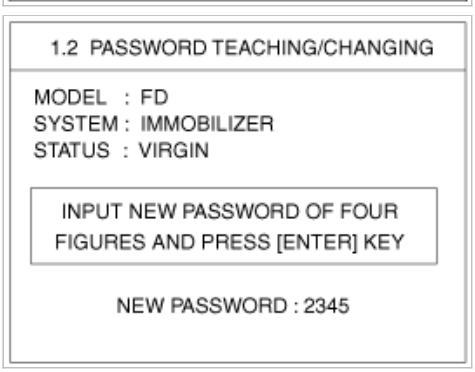


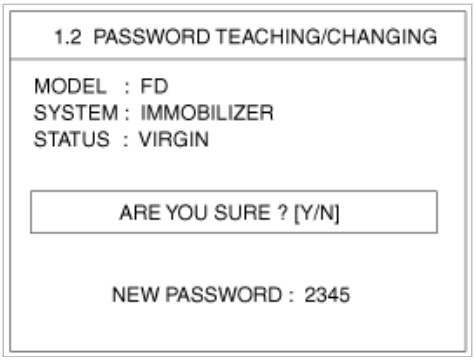


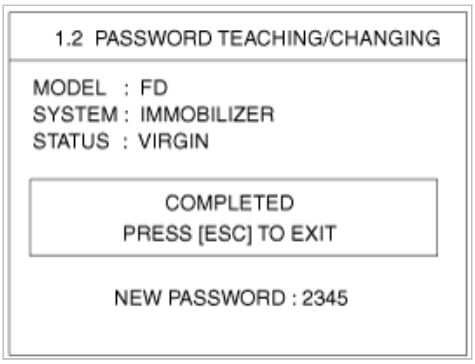
2. User Password Teaching Procedure
   The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.
   The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to a PCM (ECM), the status of the password is "virgin" No limp home function is possible.
   The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"
   The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.
   If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuously or intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.
   (1) User password teaching





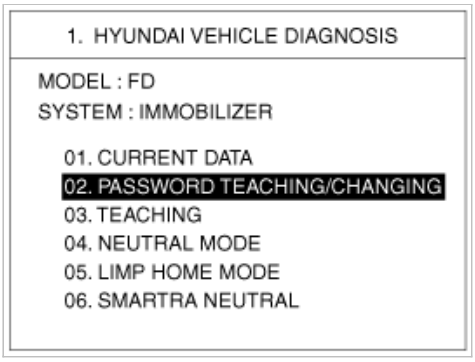


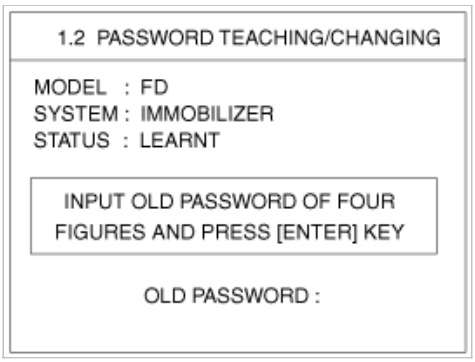


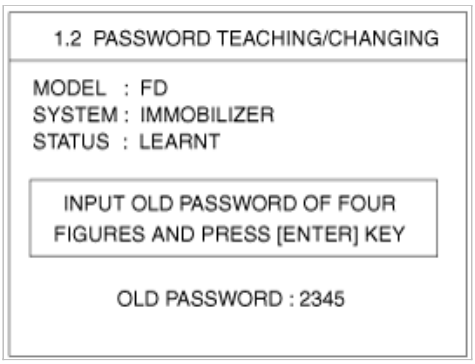


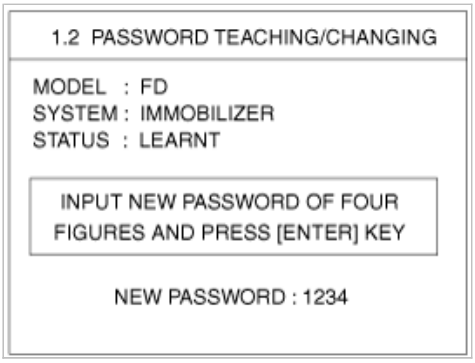
※ In case of putting wrong password, retry from first step after 10 seconds.

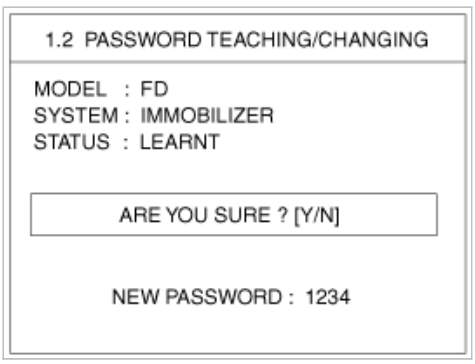
(2) User password changing

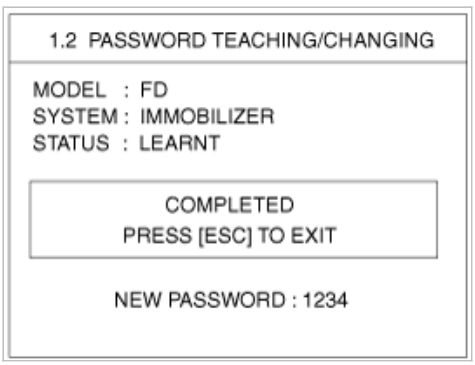






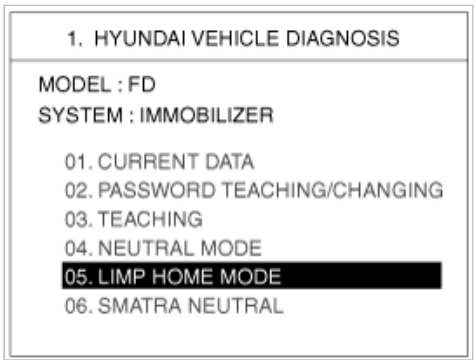


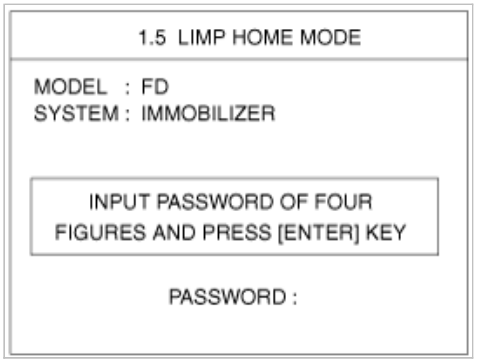


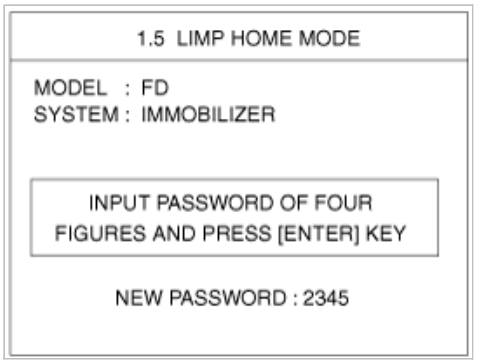


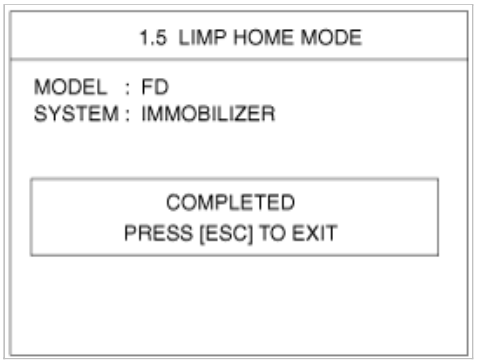
Limp Home Function

1. LIMP HOME BY TESTER
   If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) before. This password can be selected by the vehicle owner and is programmed at the service station.
   The user password can be sent to the PCM(ECM) via the special tester menu.
   Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM (ECM) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.
   If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the PCM(ECM), the timer starts again for one hour.

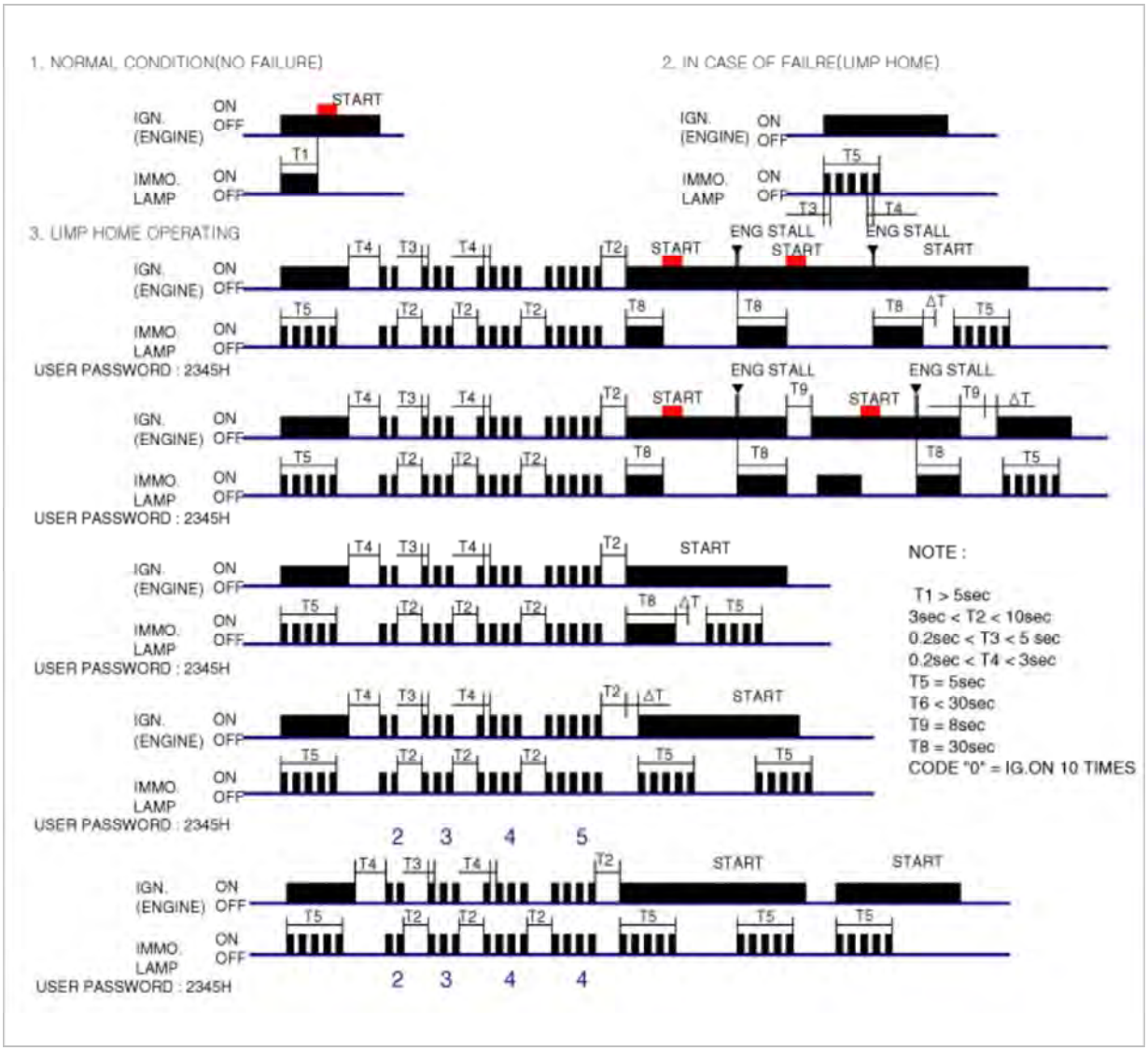








2. LIMP HOME BY IGNITION KEY
   The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.
   Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM (ECM) will be unlocked for a period of time (30 sec.).
   The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.
   After ignition off, the PCM(ECM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



Replacement

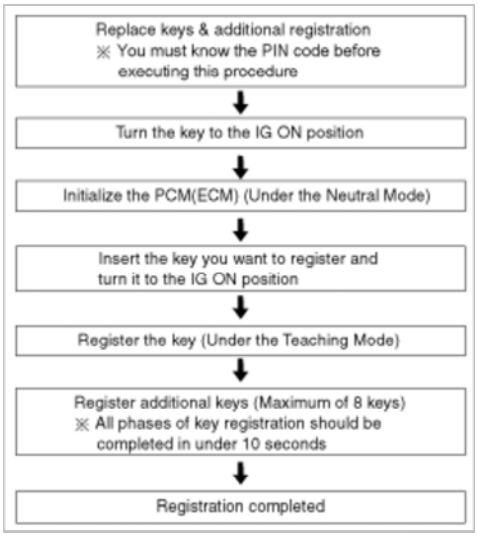
Problems And Replacement Parts:

Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	PCM(ECM)	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, PCM(ECM)	YES
SMARTRA unit does not work	SMARTRA unit	YES

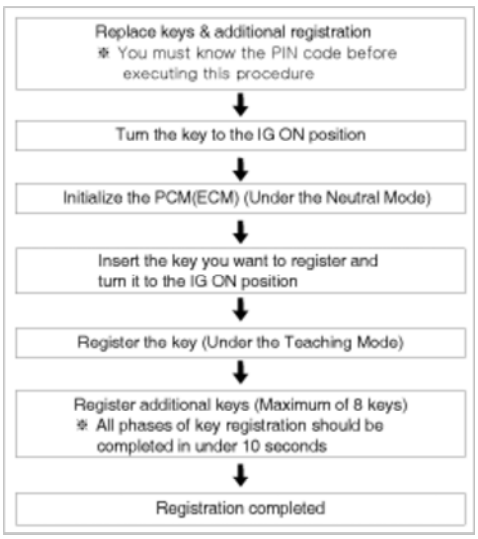
Replacement Of Ecm And Smartra

In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.
In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one and smartra need teaching.

1. Things to remember before a replacement (PCM(ECM))



2. Things to remember before a replacement (Keys & Additional registration)



NOTE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
   (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
   Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

Neutralizing Of ECM

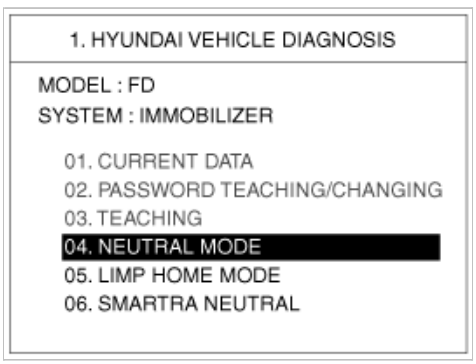
The PCM(ECM) can be set to the "neutral" status by a tester.
A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.
The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM(ECM).
The teaching of keys follows the procedure described for the virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.
This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach keys.
(Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner. If wrong vehicle

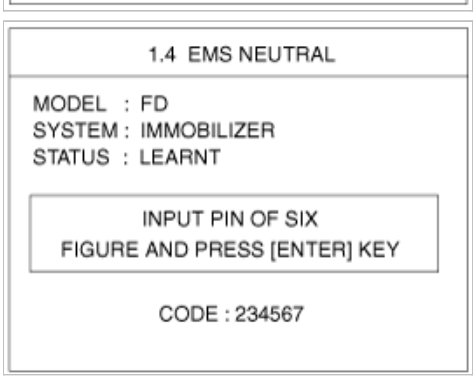
specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

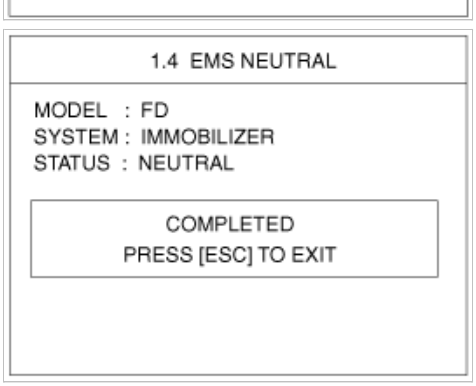
NOTE

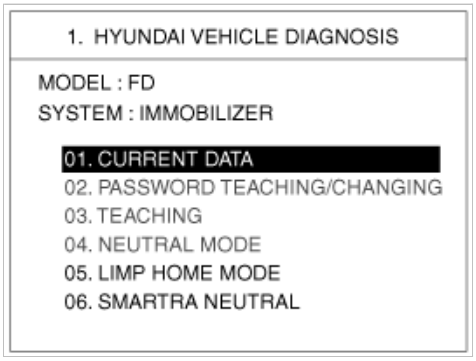
- Neutralizing setting condition
  - In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
    : PIN code (6) & user password (4) deletion.
    : Locking of ECM (except key teaching permission)
- Neutralizing meaning:
  - PIN Code(6) & User P/Word(4) deletion
  - Locking of EMS(except Key Learning permission)

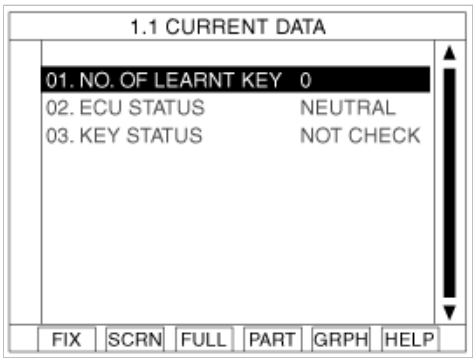
Function / EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No











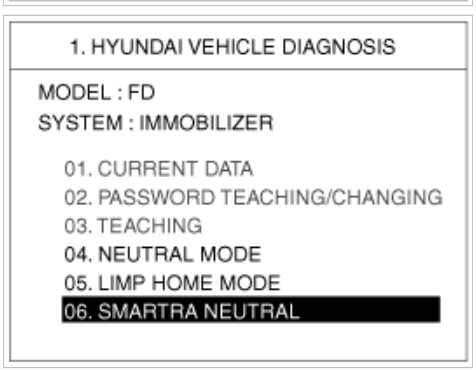
Neutralizing Of Smartra

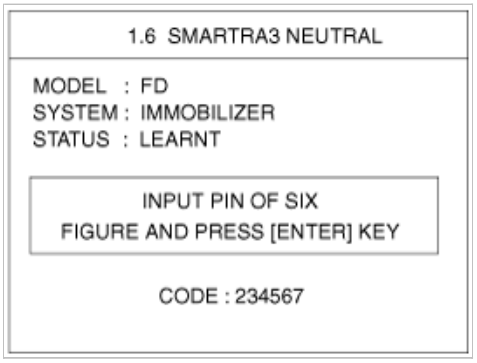
The EMS can be set to the status "neutral" by tester
Ignition key (regardless of key status) is inserted and after IGN ON. If receiving the correct vehicle password from GST, SMARTRA can be neutralized. The neutralization of SMARTRA is possible if DPN is same as the value inputted by GST.
In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice ignition".
In case of changing the vehicle password, new virgin transponder must be only used. And in case of virgin key, after Learning the key of vehicle password, it can be used.
If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

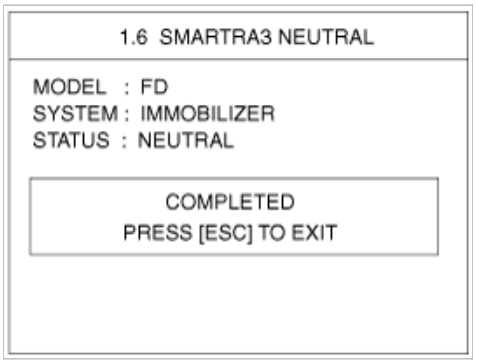
NOTE

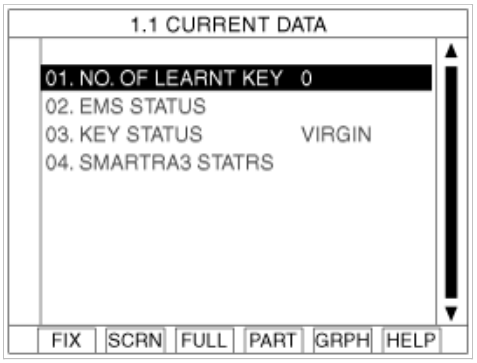
- Neutralizing Setting condition :
  - In case of "SMARTRA status", "Learnt"
  - Input correct Pin code by tester
- Neutralizing meaning :
  - Vehicle password(DPN Code) & SEK Code deletion.
  - Permission of New DPN Learning.

Function / SMARTRA	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	Yes (EMS learnt)	No	Yes	No









Body Electrical System > Immobilizer System > Troubleshooting

Diagnosis Of Immobilizer Faults

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data stored in the ECM related to the immobilizer function.

The following table shows the assignment of immobilizer related faults to each type :

Immobilizer Related Faults	Fault types	Diagnostic codes
PCM(ECM) fault	1. Non-Immobilizer-EMS connected to an Immobilizer	P1610
Transponder key fault	1. Transponder not in password mode 2. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	1. Transponder programming error	P1675 (Transponder programming error)
SMARTRA fault	1. Invalid message from SMARTRA to PCM(ECM)	P1676 (SMARTRA message error)
SMARTRA fault	1. Virgin SMARTRA at learnt EMS 2. Neutral SMARTRA at learnt EMS 3. Incorrect the Authentication of EMS and SMARTRA 4. Locking of SMARTRA	P169A (SMARTRA Authentication fail)
SMARTRA fault	1. No response from SMARTRA 2. Antenna coil error	P1690

	3. Communication line error (Open/Short etc.) 4. Invalid message from SMARTRA to PCM(ECM)	(SMARTRA no response)
Antenna coil fault	1. Antenna coil open/short circuit	P1691 (Antenna coil error)
Immobilizer indicator lamp fault	1. Immobilizer indicator lamp error (Cluster)	P1692 (Immobilizer lamp error)
Transponder key fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the magnetic field (Antenna coil)	P1693 (Transponder no response error/invalid response)
PCM(ECM) fault	1. Request from PCM(ECM) is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (PCM(ECM) message error)
PCM(ECM) internal permanent memory (EEPROM) fault	1. PCM(ECM) internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1695 (PCM(ECM) memory error)
Invalid key fault	1. Virgin transponder at PCM(ECM) status "Learnt" Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail)	P1696 (Authentication fail)
Hi-Scan fault	1. Hi-Scan message error	P1697
Locked by timer	1. Exceeding the maximum limit of Twice IGN ON (≥ 32 times)	P1699 (Twice IG ON over trial)

Body Electrical System > Immobilizer System > P1610 Non-Immobilizer-EMS Connected to an Immobilizer

General Description

The immobilizer system consists of a passive challenge-response (mutual authentication) transponder inside the key head, the encoded SMARTRA3 unit /key and the EMS can decode the secret code stored in the SMARTRA3.
The EMS carries out the immobilizer function, the SMATRA3 management and the key management. The immobilizer function is the unlocking of EMS only after detection of a valid ignition key /the SMATRA3 and the locking of EMS after switching off the engine. The EMS communicates the encoded messages to the SMARTRA3 via a dedicated communication line and confirms the key with the SMARTRA3.
The EMS related to immobilizer has the 3 kinds of software. At the first IGN on, the EMS concludes the software of each option (smart key, non-encoded SMARTRA3, encoded SMARTRA3) by communication. It is called “The autodection for EMS”The EMS keeps the previous option before being neutral when it is setted to each option.

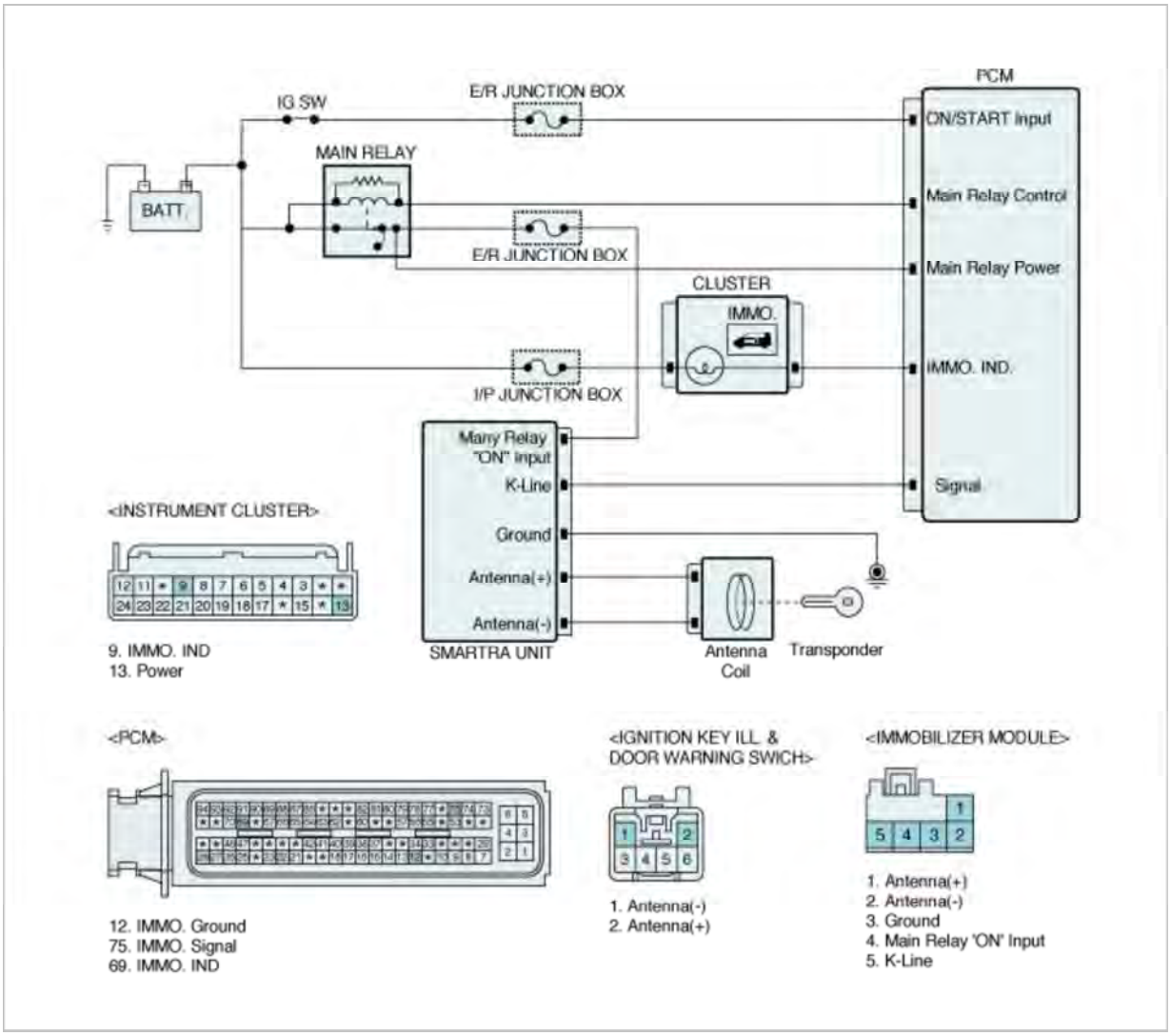
DTC Description

The PCM/ECM sets DTC P1610 if Non Immobilizer EMS is installed on vehicle equipped with Immobilizer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Invalid PCM/ECM
Enable Conditions	• IG ON	
Threshold value	• Non Immobilizer PCM/ECM connected	
Detecting time	• Immediately	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Check status
   (1) IGN "ON" & Engine "OFF"
   (2) Monitor the "ECM Status" Parameter on the Scantool.

Specification : 'LEARNT'

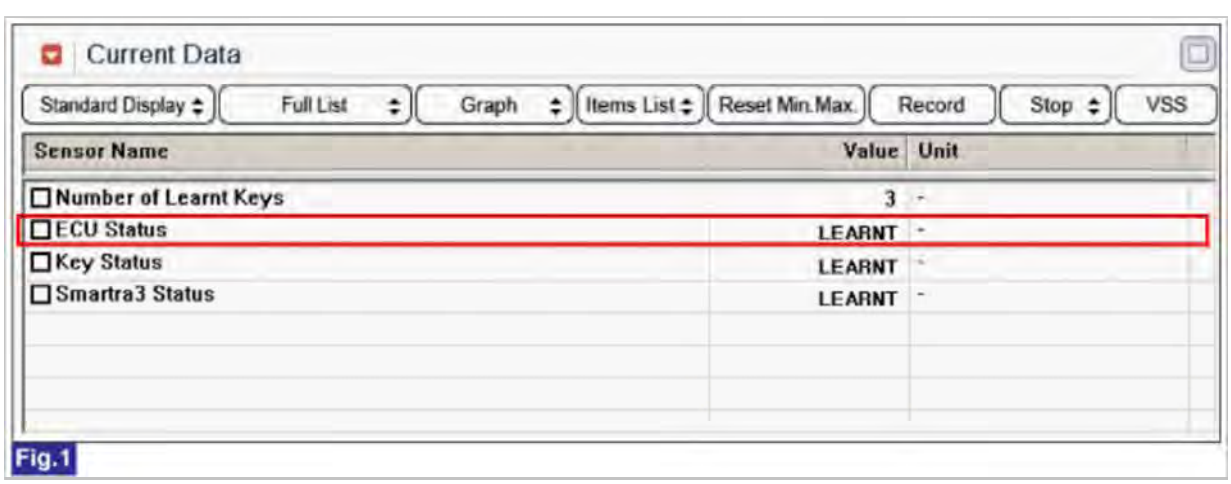


Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt.

(3) Has the ECM been learnt ?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a ECM equipped with Immobilizer and perform the Key teaching procedure with scantool and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure. NOTE If the EMS is only replaced using an existing key and SMARTRA3, after replacing the “virgin” or “ neutral” EMS, reteaching is possible by key Learning mode of scanner.When the same PIN used in existing vehicle is only inputted, the SMARTRA3 Learning and key Learnings are possible.

Verification of Vehicle Repair

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

1. Connect scantool and selet "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.

Body Electrical System > Immobilizer System > P1674 Immobilizer-Transponder status Error

General Description

The vehicle immobilizer system consists of the ECM, the SMARTRA3 and ignition keys with built-in transponder.
The ECM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder. The encryption algorithm (between ECM and SMARTRA3) is the one offered from BOSCH. The encryption algorithm (between ECM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the ECM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.
The Key teaching procedure starts with ECM request of PIN from Scanner. The "virgin“ECM stores the PIN and the key Learning can be started. The "learnt“ECM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.
Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by ECM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the ECM. In this case,The ECM can’t excute the key learning process.

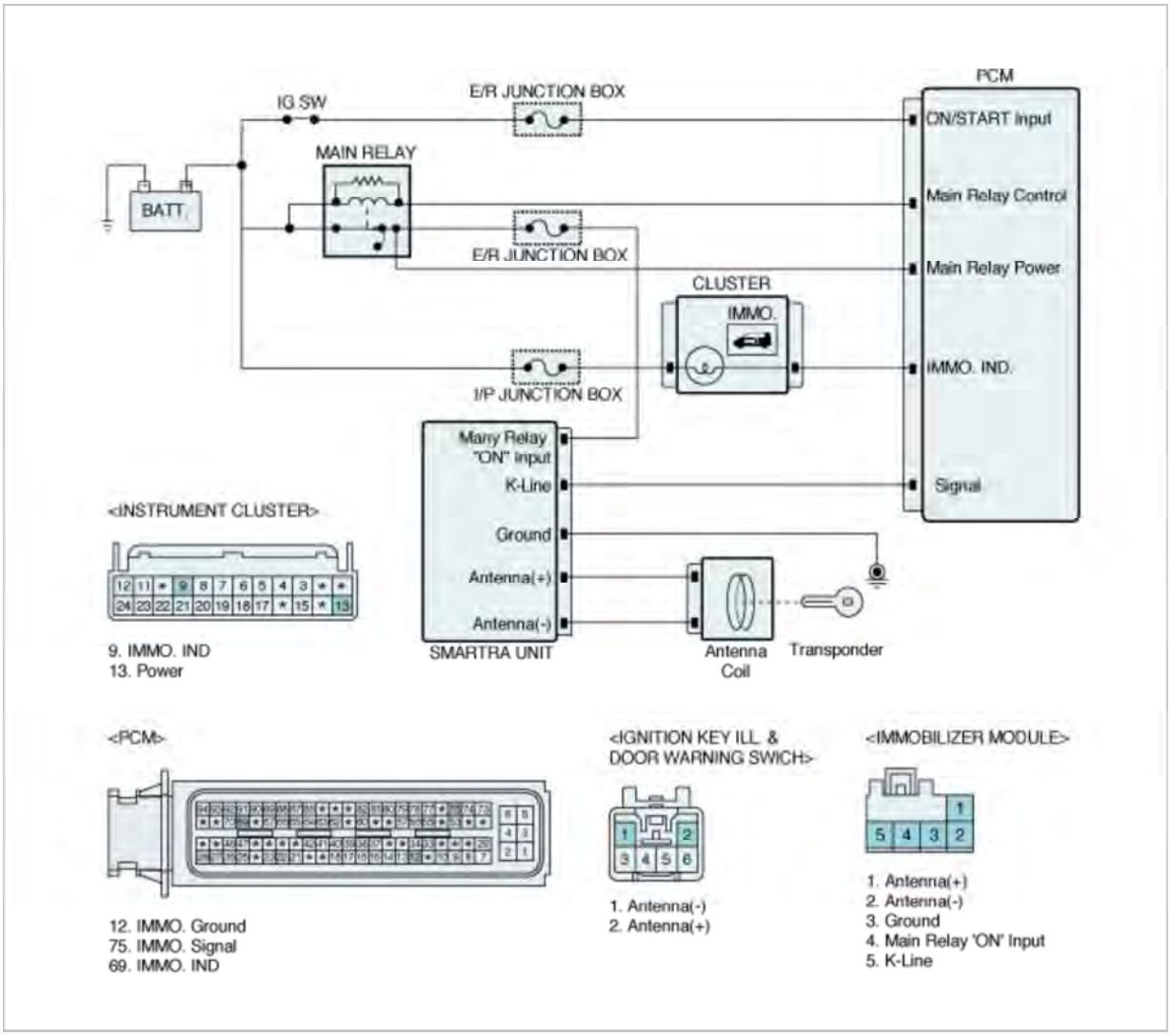
DTC Description

The ECM sets DTC P1674 if transponder key that can't be register(Transponder not in the password mode or whose transport data has been changed) is inserted for registration procedure.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Invalid transponder.
Enable Conditions	• IG ON (On Registering TP Procedure)	
Threshold value	• Key not in 'VIRGIN' Status or with invalid ID code	
Detecting time	• Immediately	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Check transponder status
   (1) IGN "ON" & Engine "OFF" with key intended to register
   (2) Monitor the "KEY STATUS" Parameter on the Scantool.

Specification : 'VIRGIN' or 'LEARNT'

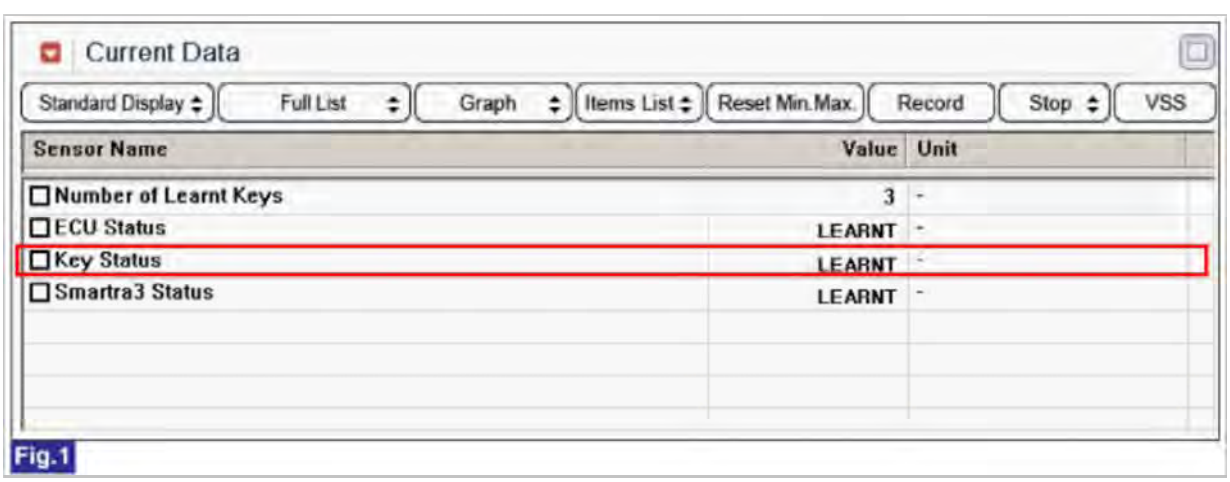


Fig.1) The current data in abnormal state

(3) Is the measured voltage within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good transponder and check for proper operation. If the problem is corrected, replace transponder 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.

Body Electrical System > Immobilizer System > P1675 Immobilizer-Transponder Programming Error

General Description

The vehicle immobilizer system consists of the ECM, the SMARTRA3 and ignition keys with built-in transponder.
The ECM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder. The encryption algorithm (between ECM and SMARTRA3) is the one offered from BOSCH. The encryption algorithm (between ECM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the ECM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.
The Key teaching procedure starts with ECM request of PIN from Scanner. The "virgin“ECM stores the PIN and the key Learning can be started. The "learnt“ECM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.
Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by ECM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the ECM. In this case,The ECM can’t excute the key learning process.

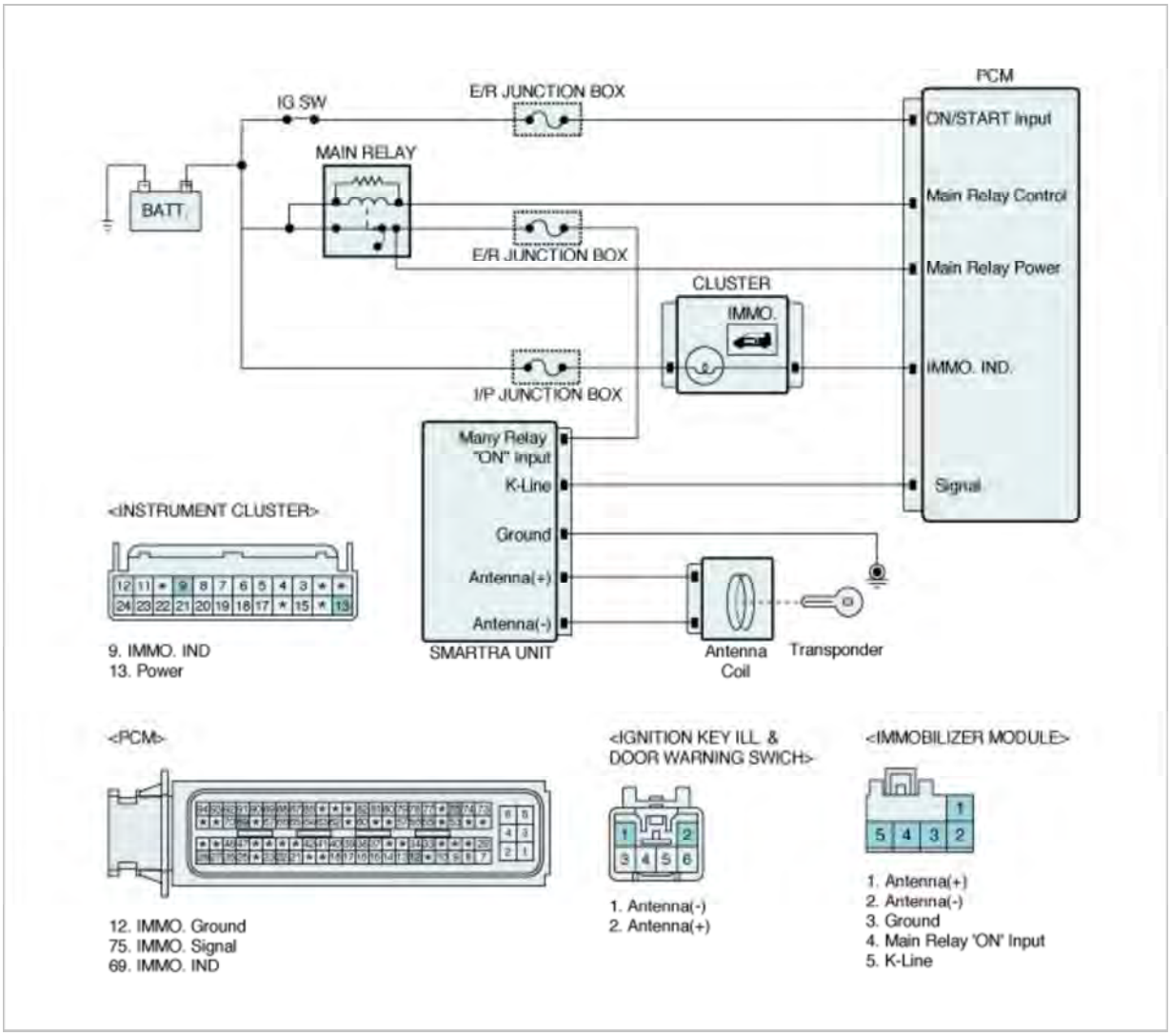
DTC Description

The PCM/ECM sets DTC P1675 if characteristic data of transponder doesn't coincide with that of PCM/ECM owing to transponder programming error.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Invalid transponder.
Enable Conditions	• IG ON(During the authentification)	
Threshold value	• Invalid characteristic data • No transponder or more than two transponder is detected by coil antenna	
Detecting time	• Immediately	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Check transponder and ECU status
   (1) IGN "ON" & Engine "OFF" with key intended to register
   (2) Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

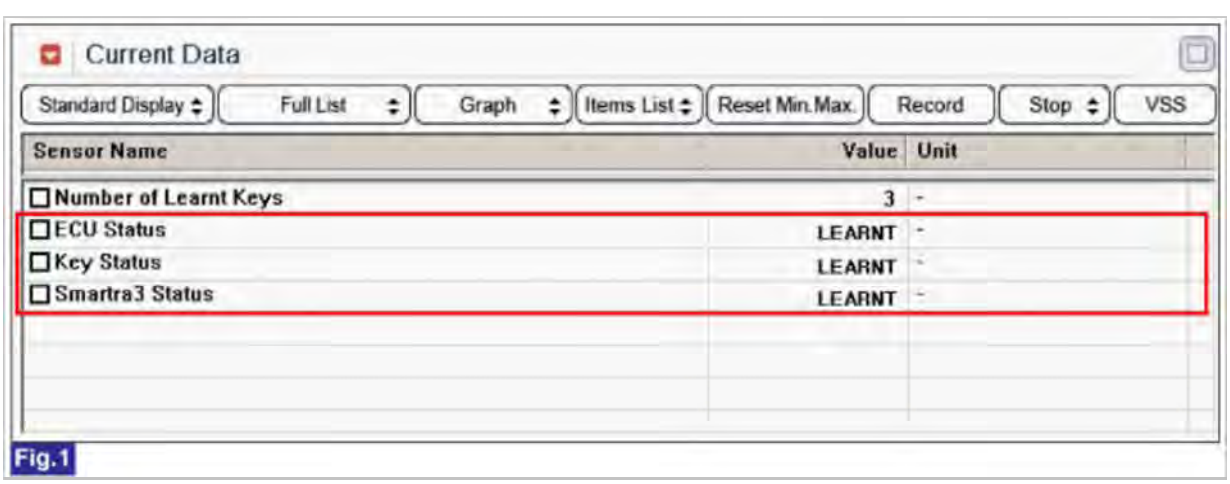


Fig.1) The current data in normal state.

(3) Is the measured voltage within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Check transponder" procedure

2. Check transponder
   (1) IGN "ON" & Engine "OFF"
   (2) Neutralize PCM and Register transponder key by scantool.

> NOTE
>
> Pin code is requied to Neutralize PCM and to Register transponder key

   (3) Are Neutralizing and Registering completed normally ?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good transponder and check for proper operation. If the problem is corrected, replace transponder 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.

Body Electrical System > Immobilizer System > P1676 Immobilizer-Smartra Message Error

General Description

1. The sequences of the PIN code storage are as follows.
   (1) Input the PIN code into the scanner when key teaching process.
   The scanner transmits the Encrypted Code to the ECM after converting the PIN code into Encrypted Code.
   (2) When the ECM gets the firtst key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3
   (3) If the SMARTRA3 statue is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage. (If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the ECM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to ECM)
   (4) If the SMARTRA3 is learnted normally or the Encrypted Code of the registered SMARTRA3 is the same as the ECM, the ECM begins operation the Transponder Learning.
   (5) If the learning of the first transponder, the ECM stores the Encrypted Code in its EEPROM and converts state into learnt state.

2. The SMARTRA3 learning :
   (1) starts with EMS request of PIN from scanner through the key teaching procedure.
   (2) is possible in case that the status of SMARTAR is “virgin” or “neutral “.
   (3) In case that the SMARTRA3 is “learnt”, the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.
   (4) is possible regardless of key status.

3. The sequence of the SMARTRA3 confirms are as follows.
   (1) After communication with the SMARTRA3, the ECM transmits the random number with requirement of the TP ID information.

(2) The SMARTRA3 encryptes the random number and transmits the result(Encrypted Random Number) to the ECM with TP ID information.

(3) The ECM compares the result transmitted from the SMARTRA3 with the result calculated by ECM. And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

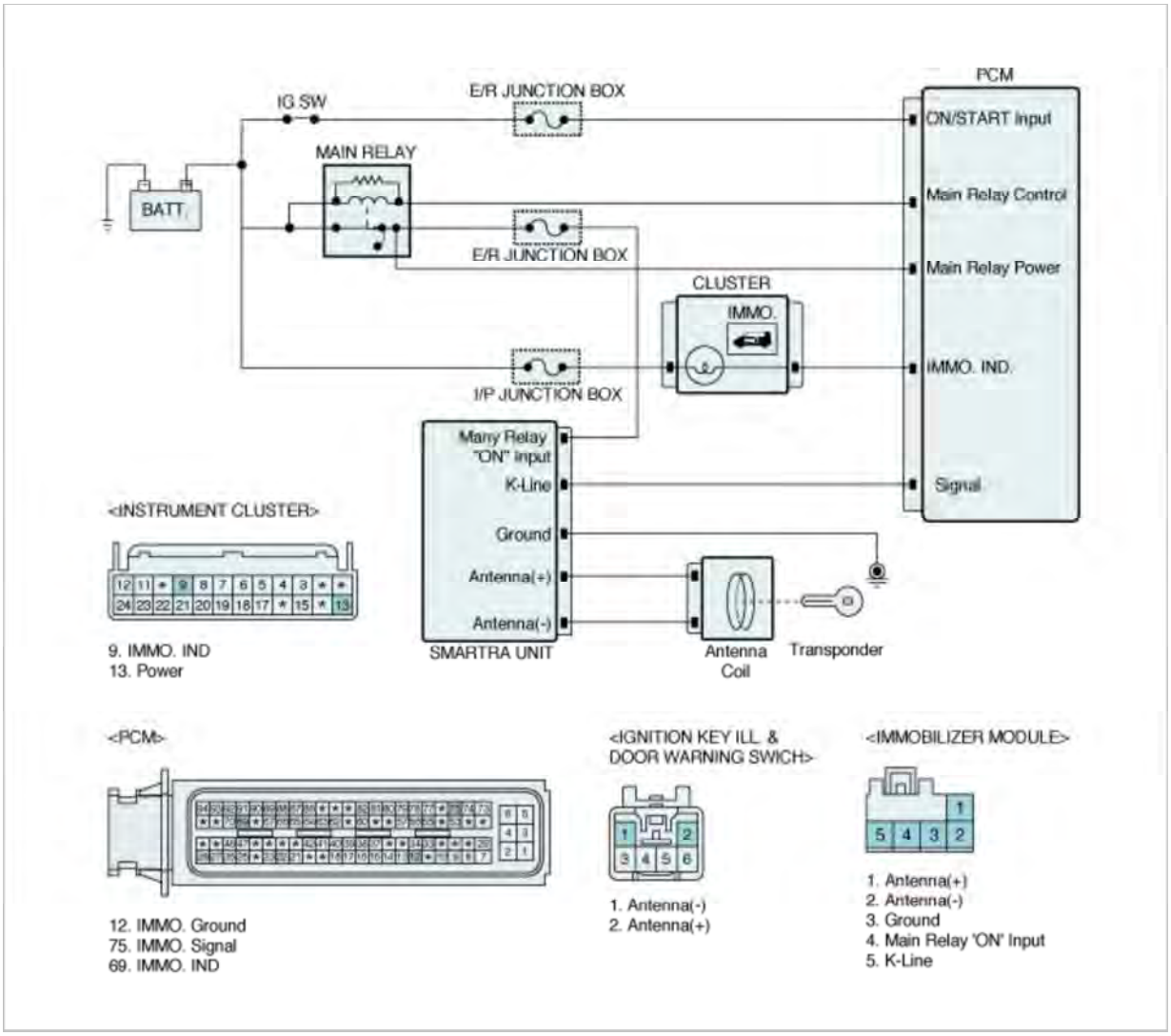
DTC Description

The PCM sets DTC P1676 if there's any fault in message from SMARTRA to PCM.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Faulty SMARTRA
Enable Conditions	• IG ON	
Threshold value	• SMARTRA Message error	
Detecting time	• Immediately	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Check transponder and ECU status
   (1) IGN "ON" & Engine "OFF" with key intended to register

(2) Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

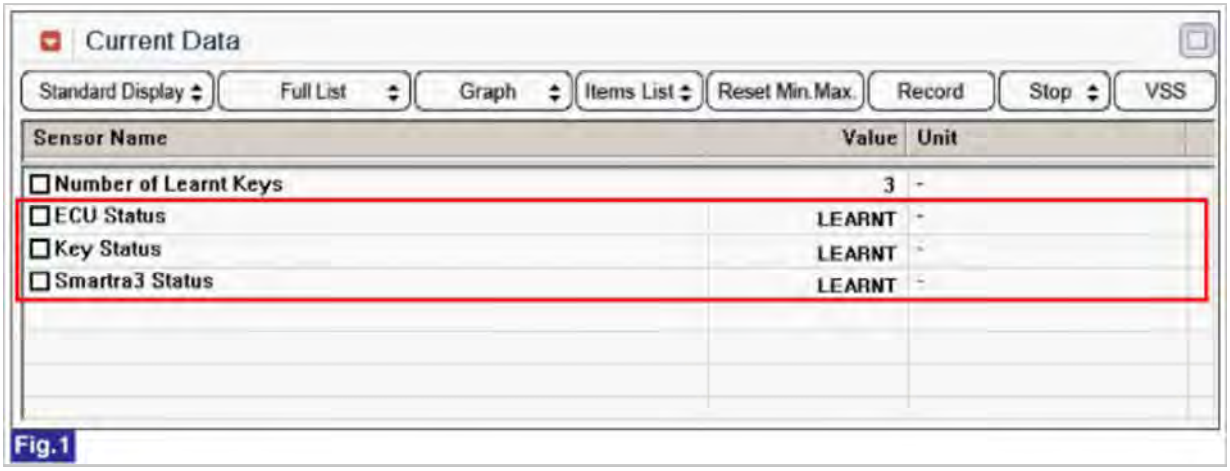


Fig.1) The current data in normal state.

(3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Check SMARTRA" procedure

2. Check SMARTRA

(1) IGN "ON" & Engine "OFF"

(2) Neutralize PCM and Register transponder key by scantool.

NOTE

Pin code is requied to Neutralize PCM and to Register transponder key

(3) Are Neutralizing and Registering completed normally ?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good SMARTRA and check for proper operation. If the problem is corrected, replace SMARTRA 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.

Body Electrical System > Immobilizer System > P1690 Immobilizer-Smartra No Response

General Description

1. The sequences of the PIN code storage are as follows.

(1) Input the PIN code into the scanner when key teaching process.

he scanner transmits the Encrypted Code to the ECM after converting the PIN code into Encrypted Code.

(2) When the ECM gets the firtst key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3

(3) If the SMARTRA3 statue is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage.
(If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the ECM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to ECM)

(4) If the SMARTRA3 is learnted normally or the Encrypted Code of the registered SMARTRA3 is the same as the ECM, the ECM begins operation the Transponder Learning.

(5) If the learning of the first transponder, the ECM stores the Encrypted Code in its EEPROM and converts state into learnt state.

2. The SMARTRA3 learning :
(1) starts with EMS request of PIN from scanner through the key teaching procedure.

(2) is possible in case that the status of SMARTAR is “virgin” or “neutral “.

(3) In case that the SMARTRA3 is “learnt”, the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.

(4) is possible regardless of key status.

3. The sequence of the SMARTRA3 confirms are as follows.
(1) After communication with the SMARTRA3, the ECM transmits the random number with requirement of the TP ID information.

(2) The SMARTRA3 encryptes the random number and transmits the result(Encrypted Random Number) to the ECM with TP ID information.

(3) The ECM compares the result transmitted from the SMARTRA3 with the result calculated by ECM.
And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

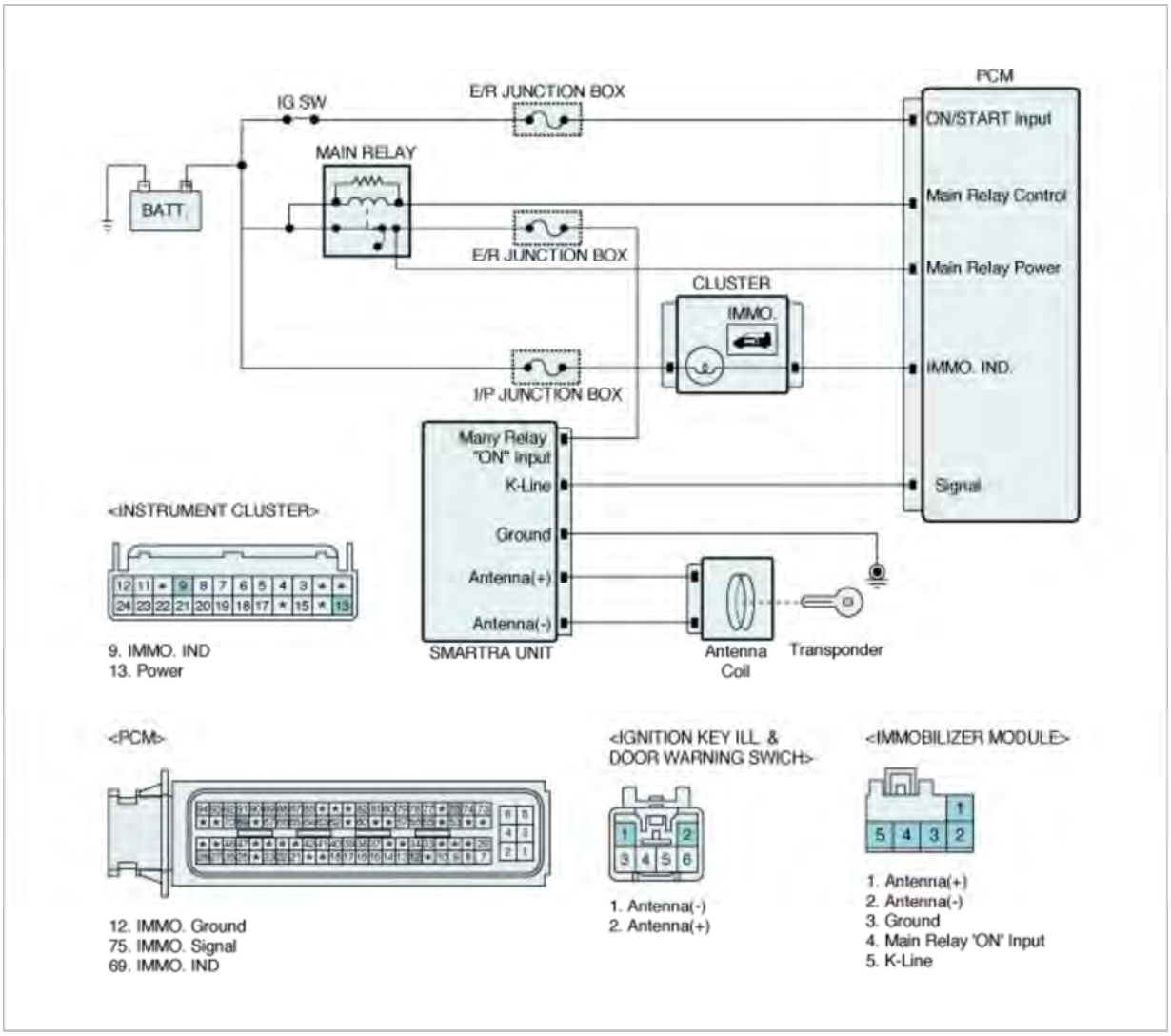
DTC Description

The PCM sets DTC P1690 if there's No Response from SMARTRA.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Open Circuit in signal harness • Short Circuit in signal harness • Faulty SMARTRA
Enable Conditions	• IG ON	
Threshold value	• No signal from SMARTRA	
Detecting time	• -	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IGN "ON" & Engine "OFF"
3. Monitor the "KEY STATUS","SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

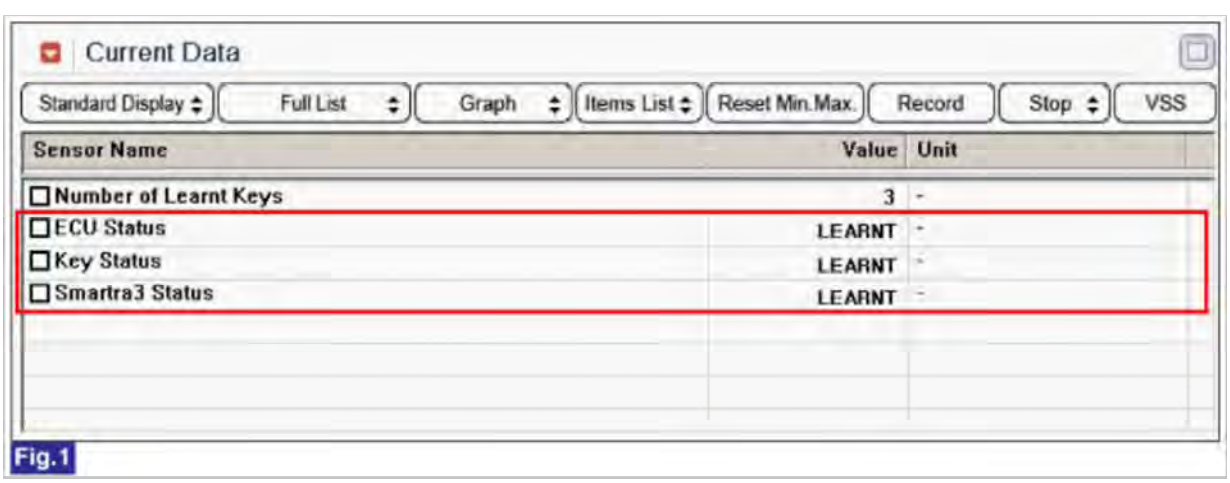


Fig.1) The current data in normal state

4. Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Inspection & 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 Vehicle Repair" procedure.
NO	▸ Go to "W/Harness Inspection" procedure.

Power circuit Inspection

1. Check for open in harness
   (1) Ignition "OFF"
   (2) Disconnect SMARTRA Connector.
   (3) Ignition "ON" & Engine "OFF"
   (4) Measure voltage between Engine Control Relay Power of SMARTRA harness connector and chassis ground.

   Specification : 9~16V

   (5) Is the measured voltage within specifications?

YES	▸ Go to "Signal circuit Inspection" procedure.
NO	▸ Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   (6)

Signal circuit Inspection

1. Check for open in harness
   (1) Ignition "OFF"
   (2) Disconnect SMARTRA connector.
   (3) Measure voltage between harness side signal terminal of SMARTRA and harness side IMMO signal terminal of PCM/ECM.

   Specification : 1 Ω or less

   (4) Is the measured resistance within specifications?

YES	▸ Go to "Check for short in harness" procedure.
NO	▸ Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short in harness
   (1) Ignition "OFF"
   (2) Disconnect SMARTRA.
   (3) Ignition "ON" & Engine "OFF"
   (4) Measure voltage between harness side signal terminal of SMARTRA and chassis ground.

   Specification : Approx. 5.48V

   (5) Is the measured voltage within specifications?

YES	▸ Go to "Signal 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 SMARTRA connector.
   (3) Measure resistance between ground terminal of SMARTRA harness and chassis ground.

   Specification : 1 Ω or less

   (4) Is the measured resistance within specifications?

YES	▸ Go to 'Component Inspection" procedure.
NO	▸ Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Check SMARTRA
   (1) IG"ON" & Engine "OFF"
   (2) Neutralize Both "SMARTRA" and "ECM" and Register transponder key by scantool.

   NOTE

   Pin code is required to Neutralize SMARTRA and to Register transponder key

   (3) Are Neutralizing and Registering completed normally ?

YES	▸ Perform all the key teaching procedure with scantool. (All the keys must be retaught) and then, go to "Verification of Vehicle Repair" Procedure.
NO	▸ Substitute with a known-good SMARTRA and Perform Key teaching procedure. ▸ If the problem is corrected, replace SMARTRA 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.

Body Electrical System > Immobilizer System > P1691 Immobilizer-Antenna Coil Error

General Description

This wireless communication runs on RF (Radio frequency of 125 kHz). The antenna coil is mounted on the top of ignition lock 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.

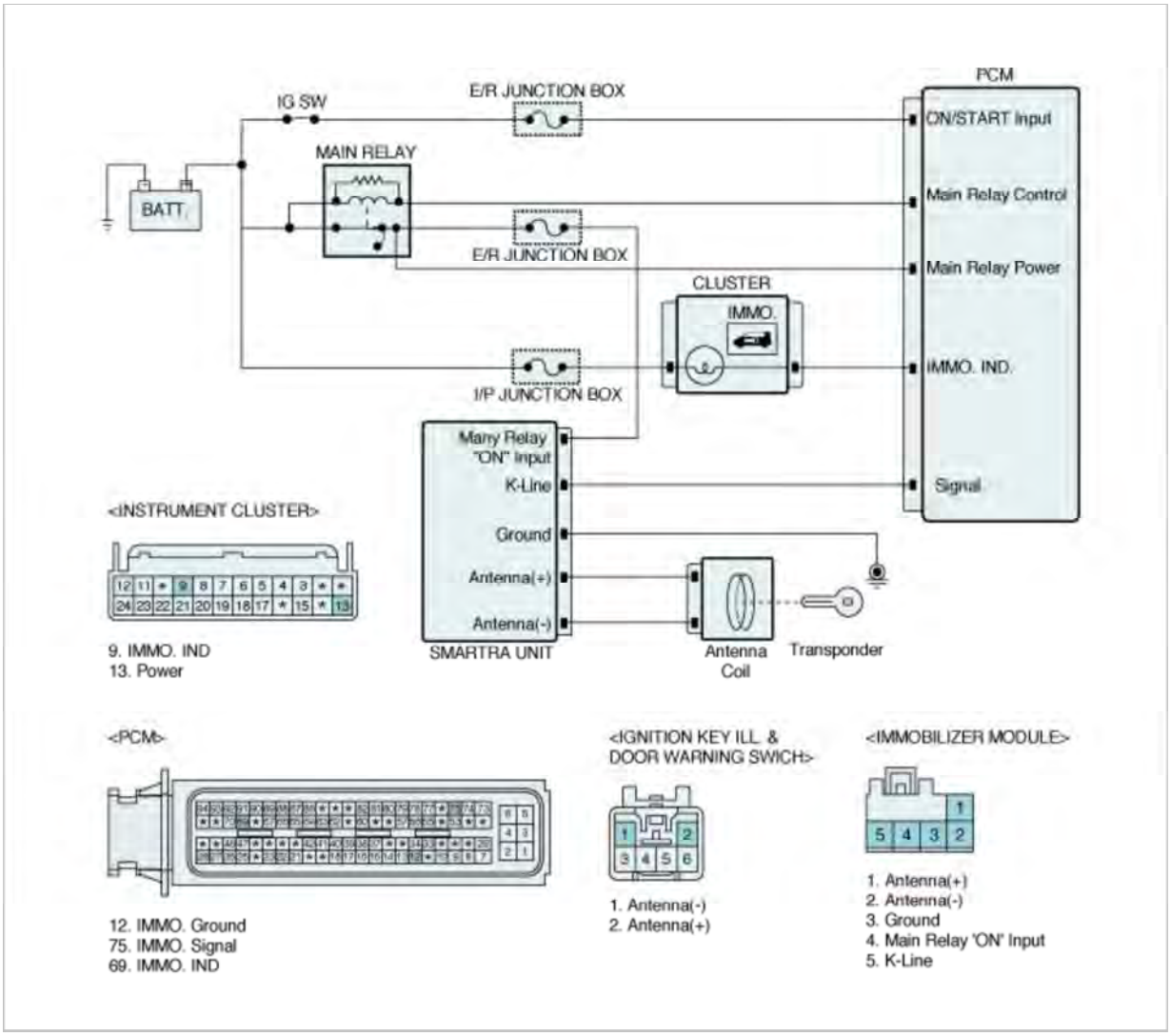
DTC Description

The PCM/ECM sets DTC P1691 if there is faulty in immobilizer antenna coil.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Open Circuit in antenna coil • Short Circuit in antenna coil • Faulty antenna coil
Enable Conditions	• IG ON	
Threshold value	• Error in antenna coil signal	
Detecting time	• -	

Diagnostic Circuit Diagram



Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & Engine "OFF"
3. Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

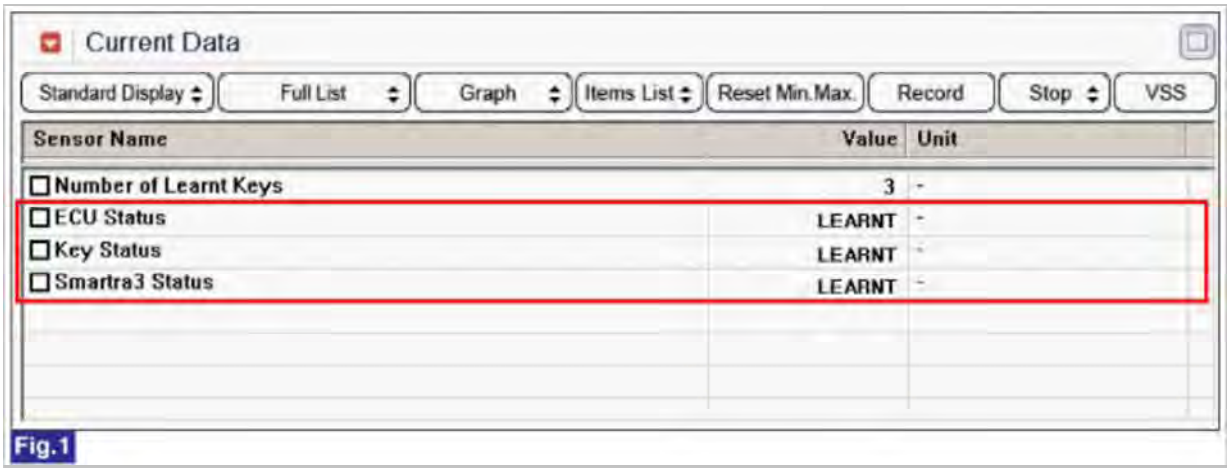


Fig.1) The current data in normal state

4. Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Inspection & 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 Vehicle Repair" procedure
NO	▸ Go to "W/Harness Inspection" procedure

Power circuit Inspection

1. Check for open in harness
   (1) IG KEY OFF
   (2) Disconnect ANTENNA COIL.
   (3) IG KEY ON
   (4) Measure voltage between harness side power terminal of ANTENNA COIL and chassis ground.

   Specification : Approx. 3.4V

   (5) Is the measured voltage within specifications?

YES	▸ Go to "Ground circuit Inspection" procedure
NO	▸ Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground circuit Inspection

1. Check for open in harness
   (1) IG KEY OFF
   (2) Disconnect ANTENNA COIL.
   (3) Disconnect SMARTRA UNIT.
   (4) Measure resistance between ground terminal of ANTENNA COIL and chassis ground.

   Specification : 1 Ω or less

(5) Is the measured resistance within specifications?

YES	▸ Go to "Component Inspection " procedure
NO	▸ Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Check coil antenna.
   (1) Ignition "OFF"
   (2) Disconnect ANTENNA COIL connector
   (3) Measure resistnace between harness side two terminal of coil antenna.

Specification : Approx 8.5 Ω

(4) Is the measured resistance within specifications?

YES	▸ Go to "Check SMARTRA" procedure
NO	▸ Check for open or short in antenna coil. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check SMARTRA
   (1) IG "ON" & Engine "OFF"
   (2) Neutralize Both "SMARTRA" and "ECM" and Register transponder key by scantool.

NOTE

Pin code is required to Neutralize SMARTRA and to Register transponder key

(3) Are Neutralizing and Registering completed normally ?

YES	▸ Perform all the key teaching procedure with scantool. (All the keys must be retaught) and then, go to "Verification of Vehicle Repair" Procedure.
NO	▸ Substitute with a known-good SMARTRA and Perform Key teaching procedure. If the problem is corrected, replace SMARTRA 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.

Body Electrical System > Immobilizer System > P1692 Immobilizer Indicator Lamp Error

General Description

When driver inserts key and IGN "ON", Immobilizer informs status of system and result of Authentication by blinking of immobilizer lamp on instrument cluster. Through Authentication procedure immobilizer lamp keep lighting up till engine starts. In normal status. Immobilizer lamp lights up for 30sec Right after ignition "ON". If there's any fault in immobilizer system or in Authentication, lamp blinks 5 times after ignition "ON"

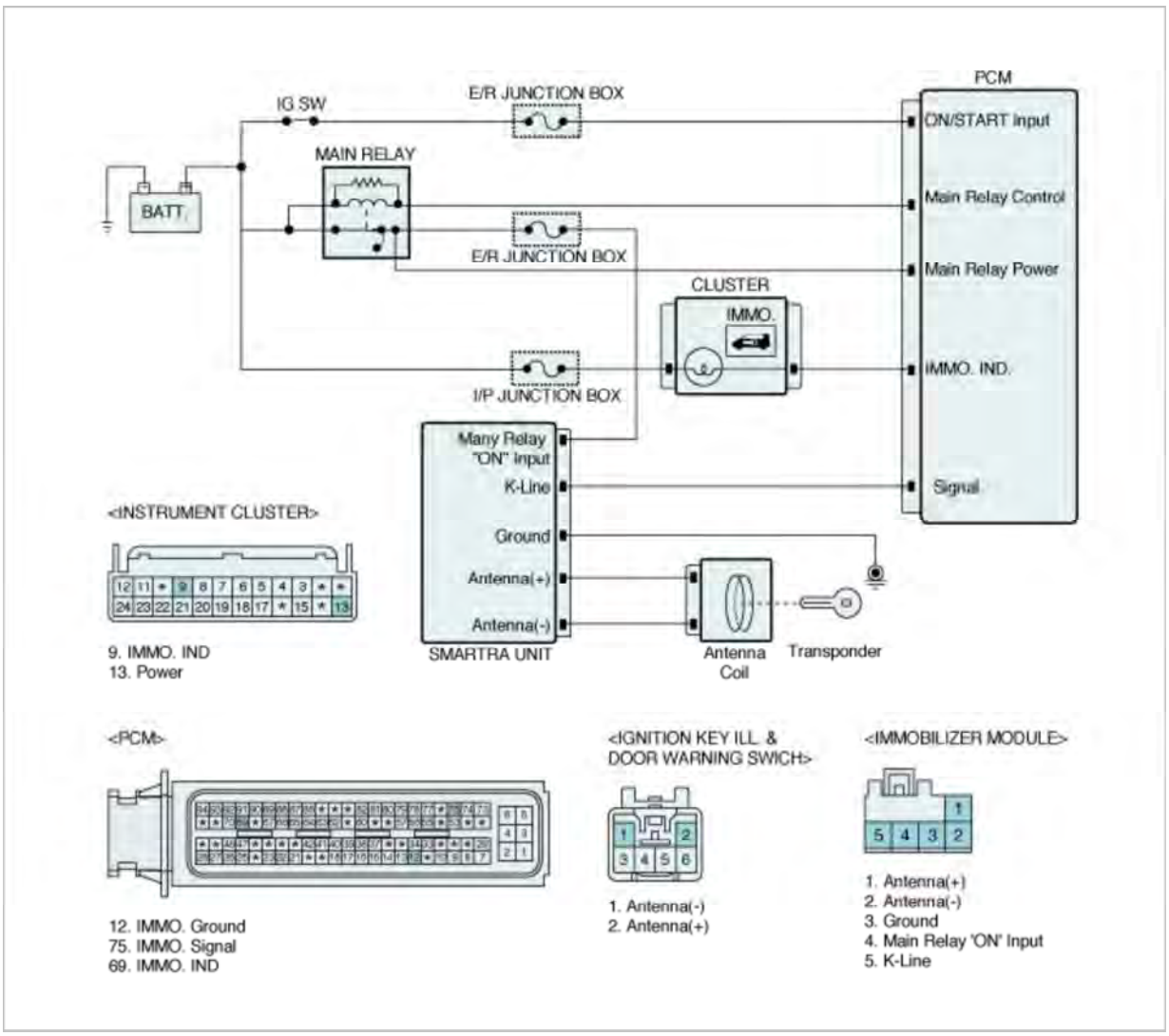
DTC Description

The PCM sets DTC P1692 if there's short circuit in immobilizer lamp circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Short Circuit in immobilizer lamp circuit. • Open/Short in control harness • Faulty PCM/ECM
Enable Conditions	• IG ON	
Threshold value	• Short to GND, Wiring open	
Detecting time	• -	

Diagnostic Circuit Diagram



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 Vehicle Repair" procedure
NO	▸ Go to "W/Harness Inspection" procedure

Control circuit inspection

1. Check for open in harness
   (1) IG KEY OFF.
   (2) Connect SMARTRA connector and disconnect PCM connector .
   (3) IG KEY ON & Engine "OFF".
   (4) Measure voltage between indicator terminal of PCM harness connector and chassis ground.
   (5) Is the measured voltage within specifications?

YES	▸ Go to "Component Inspection" procedure.
NO	▸ Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual/Physical Inspection

1. Check immobilizer lamp circuit.
   (1) Ignition "ON" & Engine "OFF"
   (2) Check if immobilizer lamp operates properly.

> NOTE
>
> Right after ignition "ON", Immobilizer lamp lights up for 30sec. If lamp blinks 5 times after ignition "ON", there's any fault in immobilizer system.

   (3) Is immobilizer lamp operates properly?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Component Inspection" procedure.

Component Inspection

1. Check immobilizer lamp.
   (1) IG KEY OFF.
   (2) Connect SMARTRA connector and disconnect PCM connector.
   (3) Ground indicator terminal of PCM harness connector with wire.
   (4) IG KEY ON & Engine "OFF".

Specification : Immobilizer lamp "ON"

   (5) Is the Immobilizer lamp "ON"?

YES	▸ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure. NOTE PCM/ECM substitued for old one must be in "Virgin" or "Neutral" status and Pin code is requied to Neutralize PCM/ECM and to Register transponder key
NO	▸ Check that fuse has blown off and harness between ECM connector and Battery is in normal condition. And. 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 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.

Body Electrical System > Immobilizer System > P1693 Immobilizer-Transponder Error

General Description

The vehicle immobilizer system consists of the ECM, the SMARTRA3 and ignition keys with built-in transponder.
The ECM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder. The encryption algorithm (between ECM and SMARTRA3) is the one offered from BOSCH.The encryption algorithm (between ECM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the ECM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.
The Key teaching procedure starts with ECM request of PIN from Scanner. The "virgin“ECM stores the PIN and the key Learning can be started. The "learnt“ECM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.
Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by ECM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the ECM. In this case,The ECM can’t excute the key learning process.

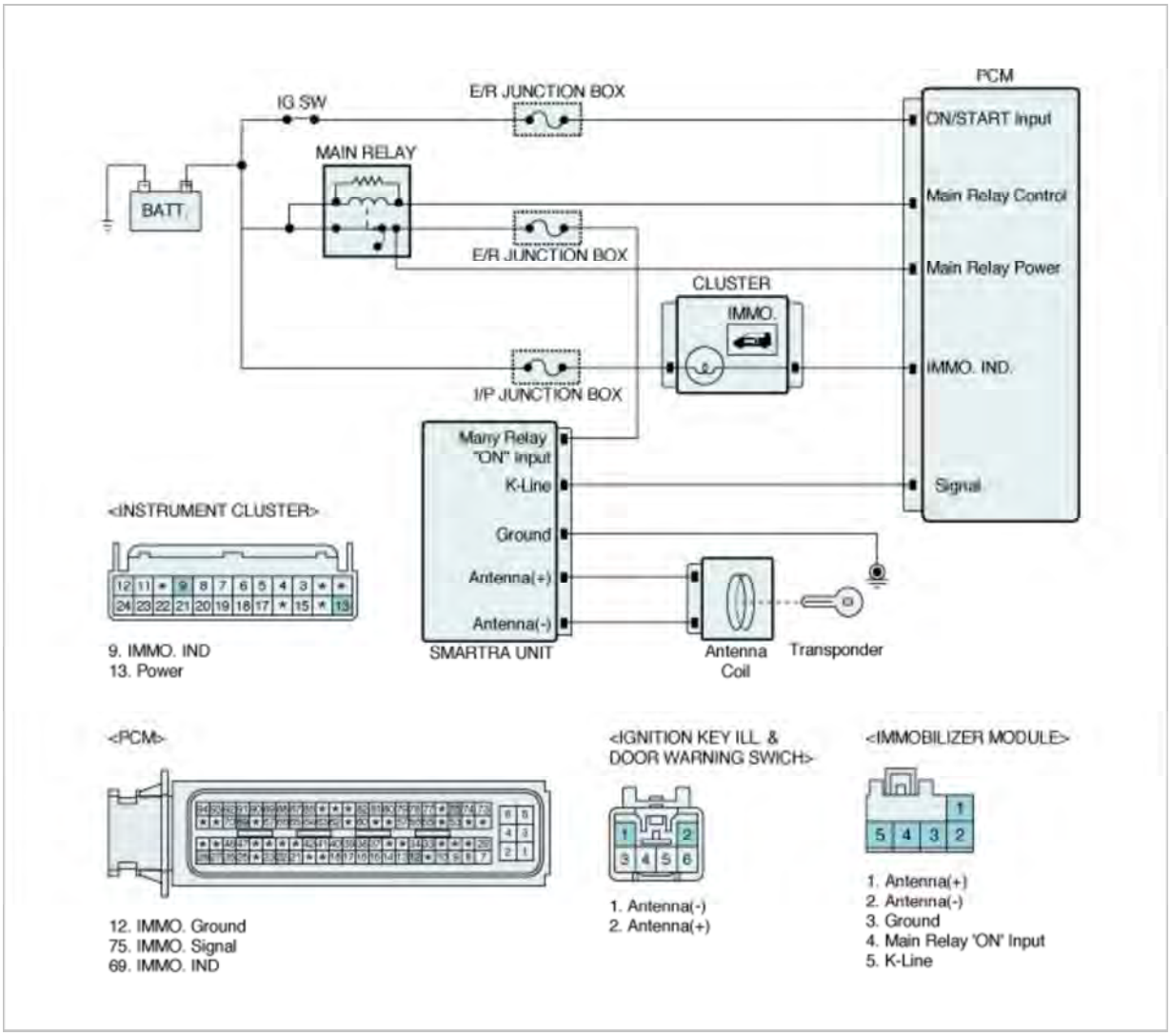
DTC Description

The PCM sets DTC P1693 if there's abnormal response from transponder.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Invalid transponder.
Enable Conditions	• IG ON	
Threshold value	• Corrupted data from Transponder • More than one TP in the magnetic field • No TP(Key without TP) in the magnetic field	
Detecting time	• -	

Diagnostic Circuit Diagram



Component Inspection

1. Check transponder and ECU status
   (1) IGN "ON" & Engine "OFF"
   (2) Monitor the "KEY STATUS", " SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

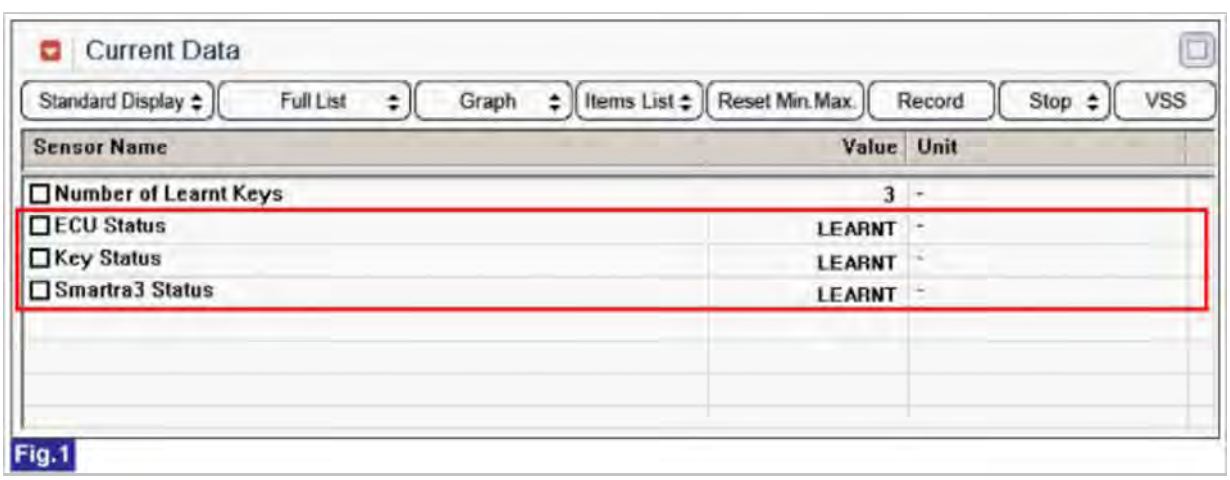


Fig.1) The current data in normal state

(3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Check transponder" procedure

2. Check transponder
   (1) IGN "ON" & Engine "OFF"
   (2) Neutralize ECM and Register transponder key by scantool.

> NOTE
>
> Pin code is required to Neutralize ECM and to Register transponder key

   (3) Are Neutralizing and Registering completed normally ?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good transponder and perform the key teaching precedure. If the problem is corrected, replace transponder 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.

Body Electrical System > Immobilizer System > P1694 Immobilizer-EMS Message Error

General Description

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 H/W.

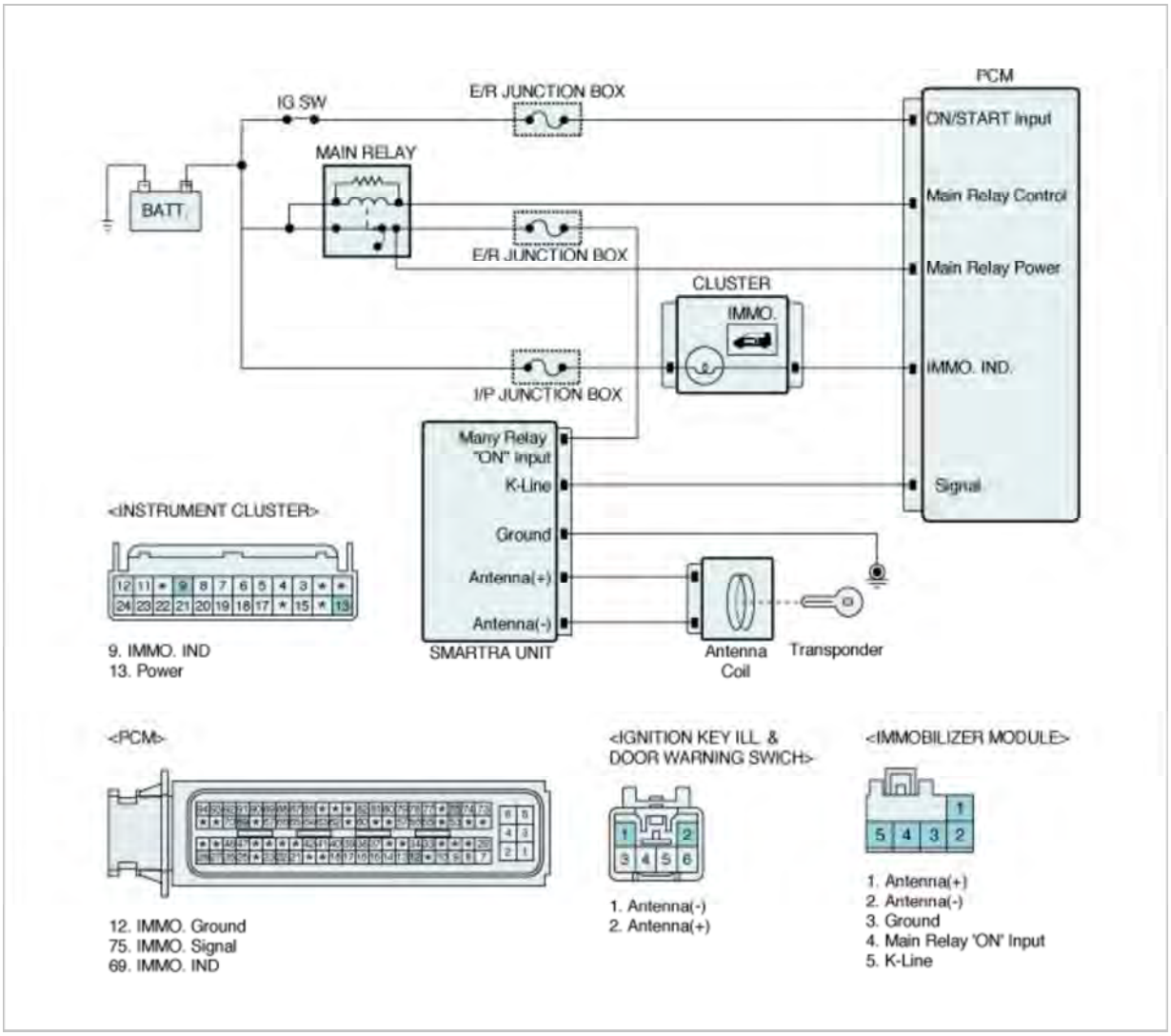
DTC Description

The ECM sets DTC P1694 if Request from EMS is invalid.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Faulty PCM
Enable Conditions	• IG ON	
Threshold value	• Protocol layer violation - Invalid request - Check sum error	
Detecting time	• -	

Diagnostic Circuit Diagram



Component Inspection

1. Check transponder and ECU status
   (1) IGN "ON" & Engine "OFF"
   (2) Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

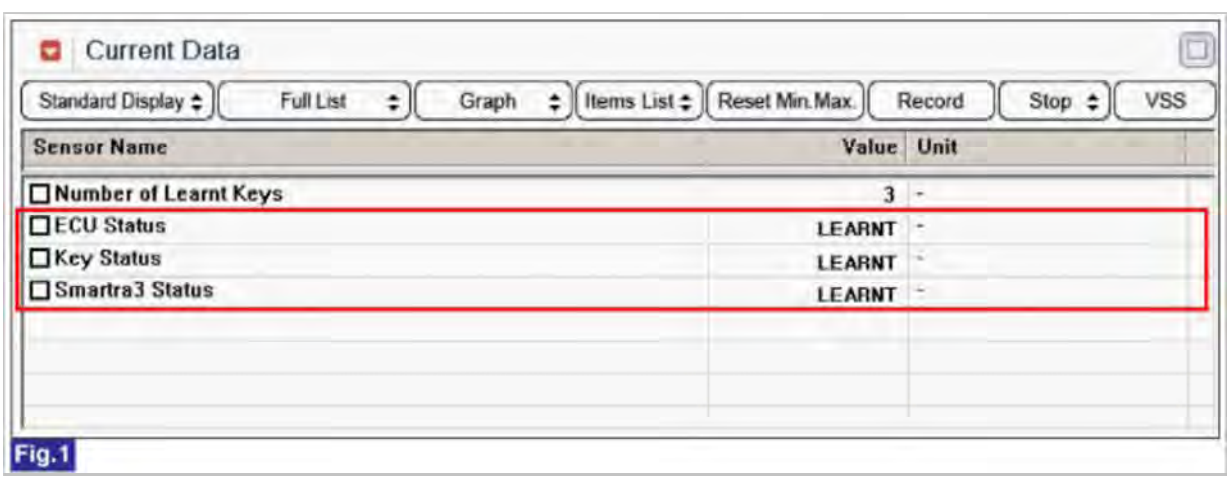


Fig.1) The current data in normal state

(3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Check transponder" procedure

2. Check PCM
   (1) IGN "ON" & Engine "OFF"
   (2) Neutralize ECM and Register transponder key by scantool.

> NOTE
>
> Pin code is required to Neutralize ECM and to Register transponder key

   (3) Are Neutralizing and Registering completed normally ?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good ECM and perform key teaching procedure. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure. NOTE ECM substitued for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize ECM and to Register transponder key

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.

Body Electrical System > Immobilizer System > P1695 Immobilizer-EMS Memory Error

General Description

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).
The immobilizer data are stored by three independent entries.
The data from EEPROM are evaluated by "2 of 3 decision“. That means all three entries are read and the content is compared before authentication process.
If the contents of all entries are equal, the authentication will run without additional measures.If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective“ is stored at ECM.
If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective“ will be stored. The limp home function cannot be activated.
The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

DTC Description

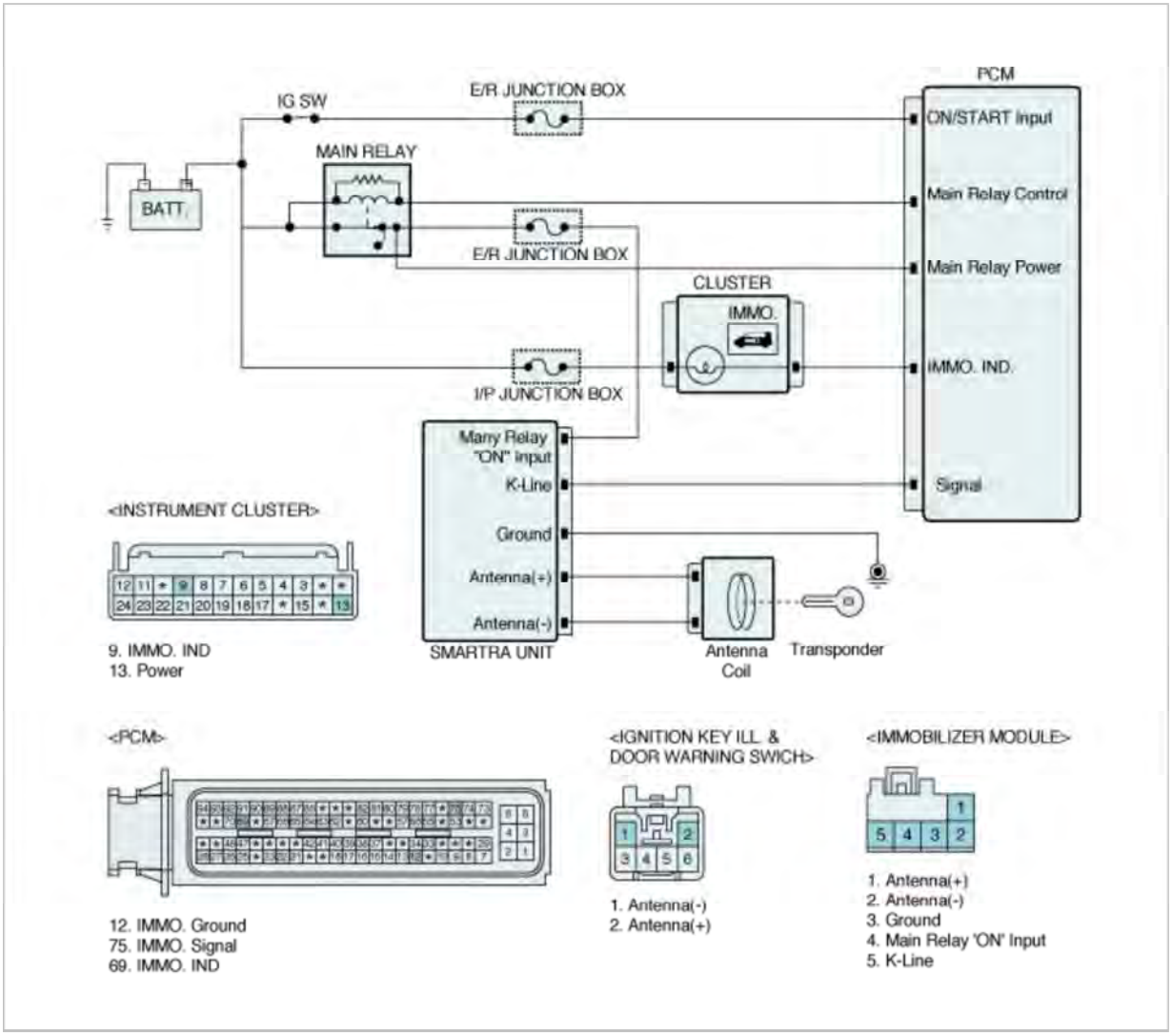
The ECM sets DTC P1695 if there's any fault in EMS internal permanent memory(EEPROM or Flash etc.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Faulty PCM/ECM
Enable Conditions	• IG ON	
Threshold value	• PCM MEMORY Error	

Detecting time	• -	

Diagnostic Circuit Diagram



Component Inspection

1. Check transponder and ECU status
   (1) IGN "ON" & Engine "OFF"
   (2) Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

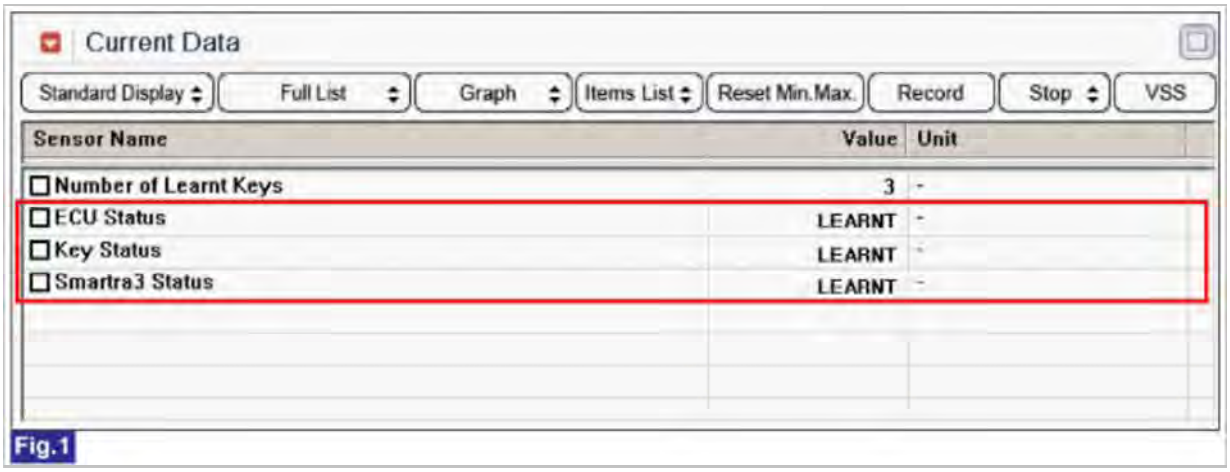


Fig.1) The current data in normal state

(3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Go to "Check transponder" procedure

2. Check PCM

(1) IGN "ON" & Engine "OFF"

(2) Neutralize ECM and Register transponder key by scantool.

> NOTE
>
> Pin code is required to Neutralize ECM and to Register transponder key

(3) Are Neutralizing and Registering completed normally ?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Substitute with a known-good ECM and then key teaching procedure. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure. NOTE ECM substitued for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize ECM and to Register transponder key

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.

Body Electrical System > Immobilizer System > P1696 Immobilizer-Authentication Fail

General Description

The vehicle immobilizer system consists of the ECM, the SMARTRA3 and ignition keys with built-in transponder.
The ECM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.
The encryption algorithm (between ECM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between ECM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the ECM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.
The Key teaching procedure starts with ECM request of PIN from Scanner. The "virgin“ECM stores the PIN and the key Learning can be started. The "learnt“ECM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.
Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by ECM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the ECM. In this case,The ECM can’t excute the key learning process.

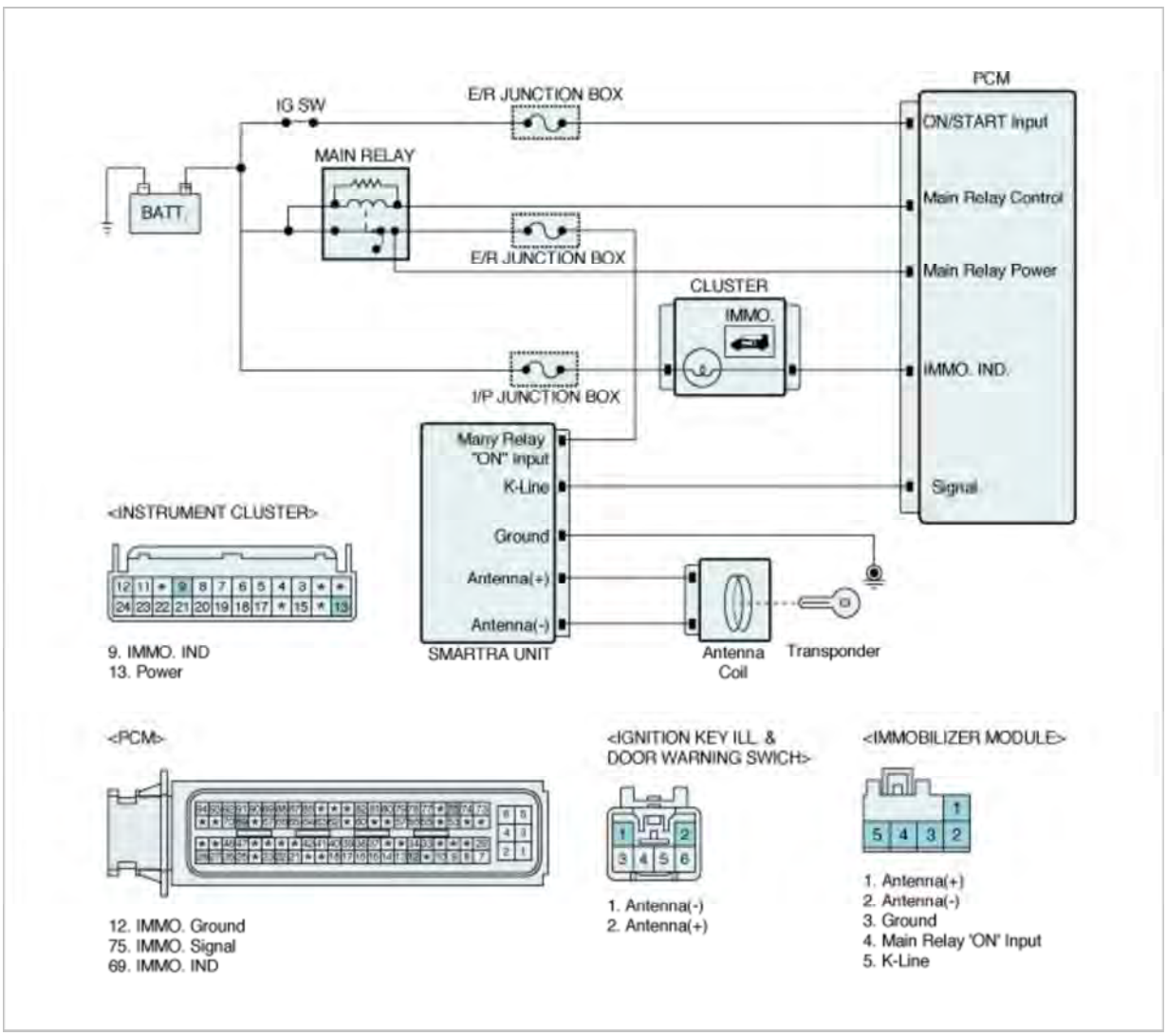
DTC Description

The PCM sets DTC P1696 if invaild key is inserted into key hole for starting.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Invalid transponder.
Enable Conditions	• IG ON	
Threshold value	• Virgin TP at PCM/ECM status “Learnt” • Learnt(Invalid) TP at PCM status “Learnt”	
Detecting time	• Immediately	

Diagnostic Circuit Diagram



Component Inspection

1. Check transponder and ECU status
   (1) IGN "ON" & Engine "OFF"
   (2) Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

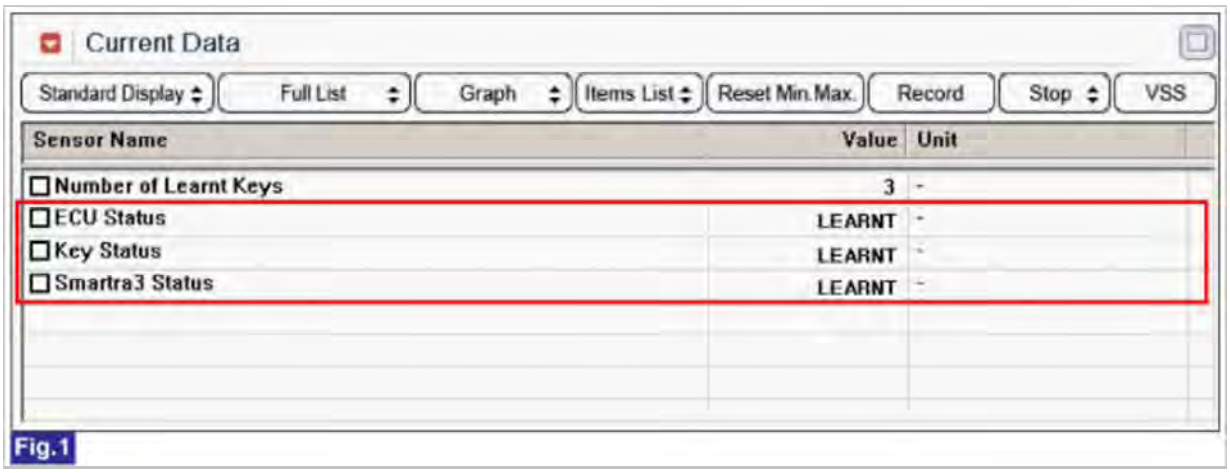


Fig.1) The current data in normal state

(3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES	▸ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO	▸ Register as necessary and then go to "Verification of Vehicle Repair" procedure. CASE 1. KEY STATUS "VIRGIN" : Register transponder key now inserted CASE 2. KEY STATUS "INVAILD" : Register all transponder key

Verification of Vehicle Repair

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

1. Connect scantool and selet "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.

Body Electrical System > Immobilizer System > P1699 Immobilizer-Twice Overtrial

General Description

This is a special function for engine start by vehicle manufacturer. The engine can be started for moving from the production line to an area where the key teaching is conducted.

DTC Description

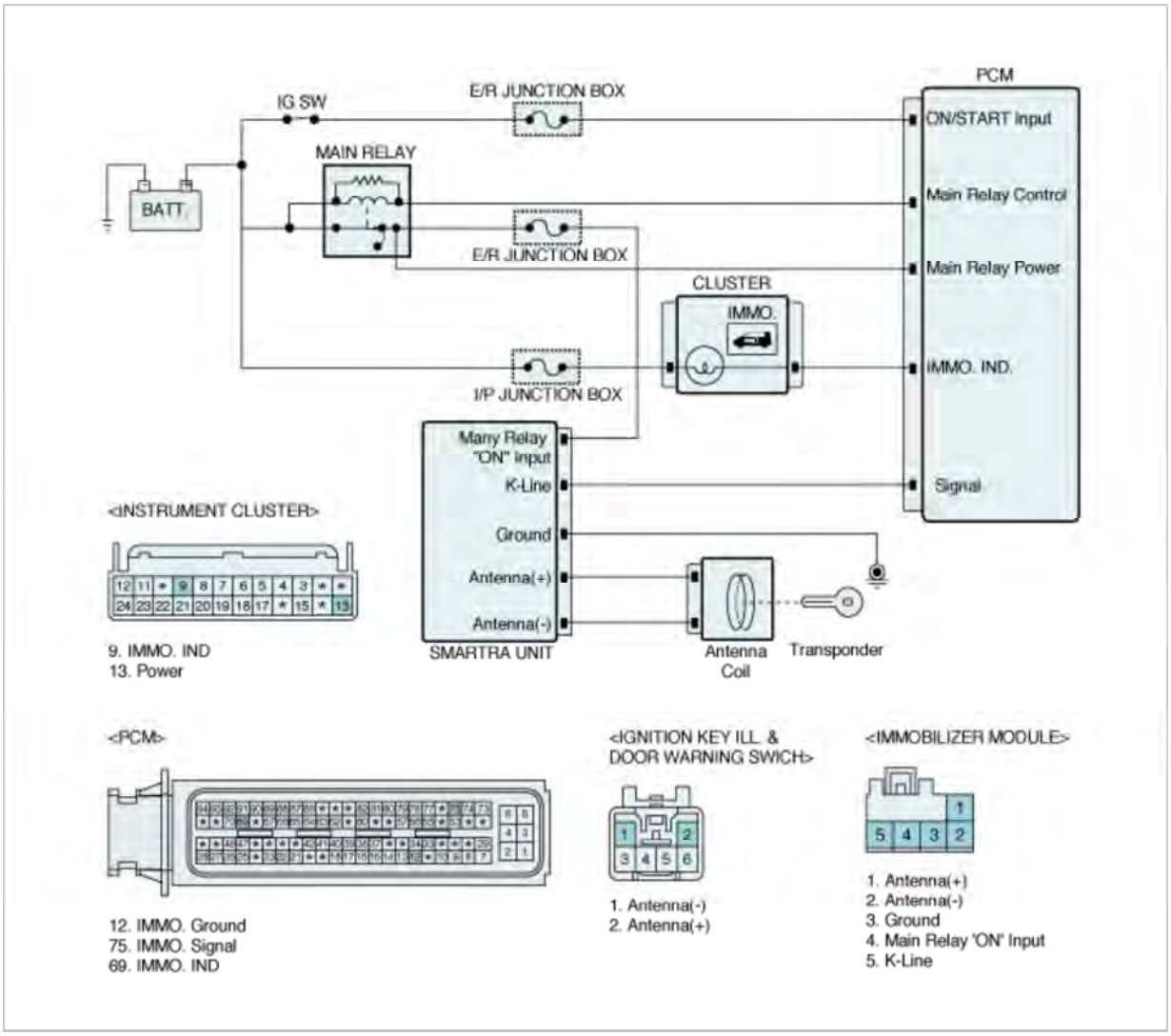
The PCM sets DTC P1699 if the maximum limit of Twice IGN is Exceeded.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Over time trial of Twice IGN
Enable Conditions	• IG ON	

Threshold value	• Twice IGN ≥ 32 times	
Detecting time	• -	

Diagnostic Circuit Diagram



Component Inspection

1. Check transponder and ECU status
   (1) IGN "ON" & Engine "OFF"
   (2) Connect scantool to Data Link Connector(DLC).
   (3) Erase the DTC and Monitor the "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

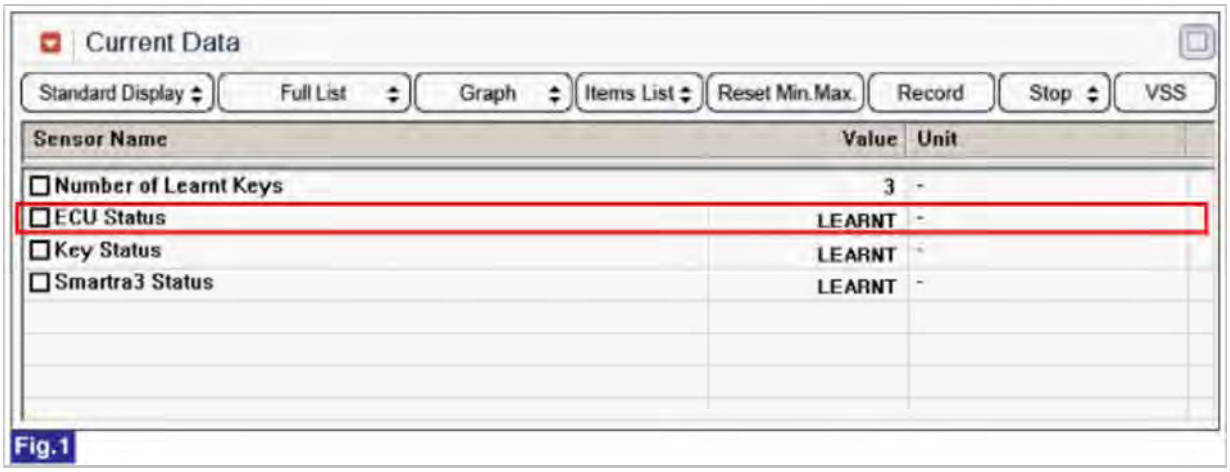


Fig.1) The current data in normal state

(4) Is "ECU STATUS' Parameter "Locked"?

YES	▸ Keep "KEY ON" status for 1 hours to withdraw "Locked by Timer" status. Then register transponder and go to "Verification of Vehicle Repair" 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.

Verification of Vehicle Repair

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

1. Connect scantool and selet "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.

Body Electrical System > Immobilizer System > P169A Immobilizer-SMARTRA Authentication Fail

General Description

1. The sequences of the PIN code storage are as follows.
   (1) Input the PIN code into the scanner when key teaching process.
   The scanner transmits the Encrypted Code to the ECM after converting the PIN code into Encrypted Code.
   (2) When the ECM gets the firtst key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3
   (3) If the SMARTRA3 statue is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage.
   (If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the ECM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to ECM)
   (4) If the SMARTRA3 is learnted normally or the Encrypted Code of the registered SMARTRA3 is same as the ECM, the ECM begins operation the Transponder Learning.
   (5) If the learning of the first transponder, the ECM stores the Encrypted Code in its EEPROM and converts state into learnt state.
2. The SMARTRA3 learning :
   (1) Starts with EMS request of PIN from scanner through the key teaching procedure.
   (2) Is possible in case that the status of SMARTAR is “virgin” or “neutral “.
   (3) In case that the SMARTRA3 is “learnt”, the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.

(4) is possible regardless of key status.

3. The sequence of the SMARTRA3 confirms are as follows.
   (1) After communication with the SMARTRA3, the ECM transmits the random number with requirement of the TP ID information.
   (2) The SMARTRA3 encryptes the random number and transmits the result(Encrypted Random Number) to the ECM with TP ID information.
   (3) The ECM compares the result transmitted from the SMARTRA3 with the result calculated by ECM. And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

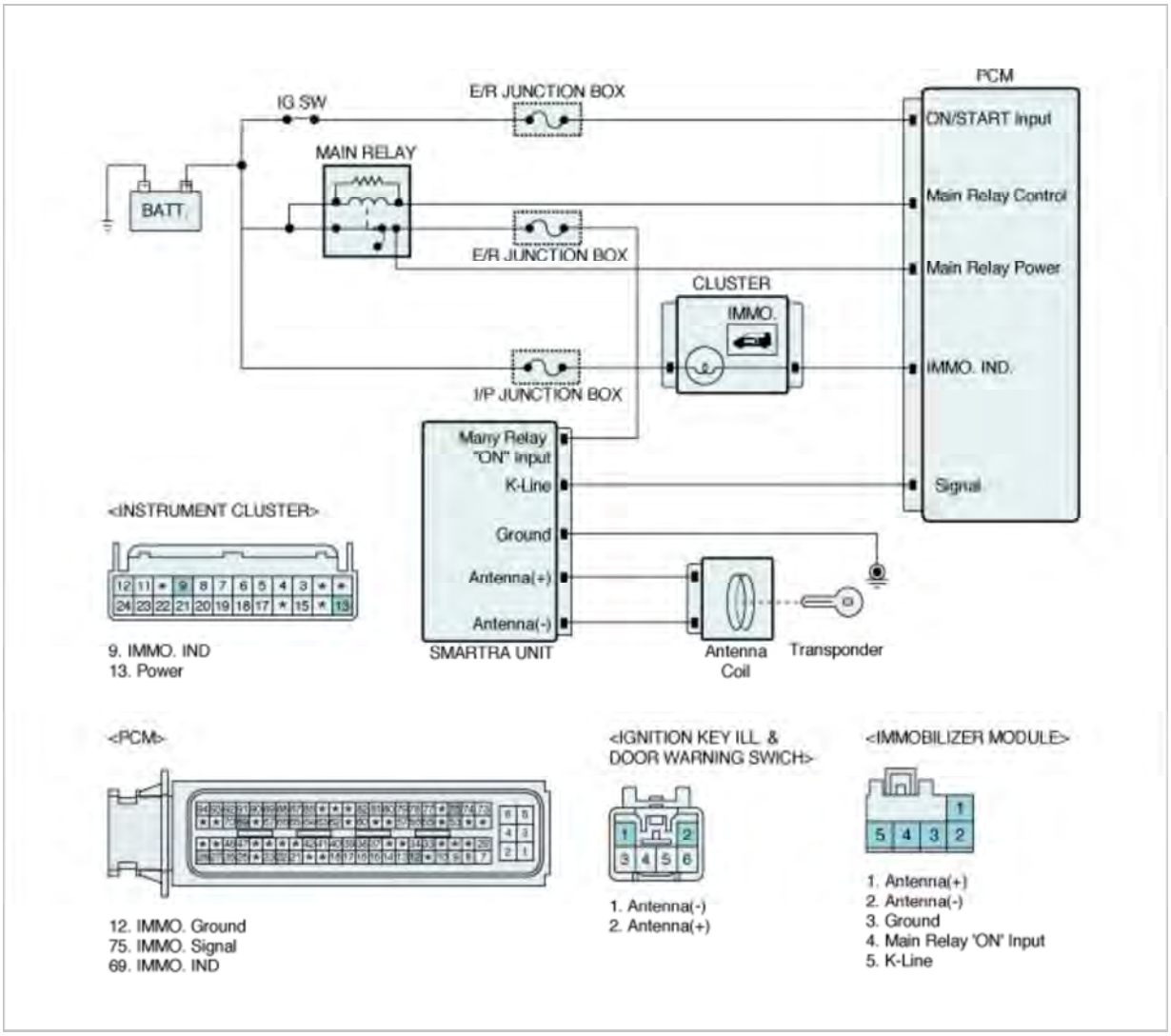
DTC Description

The PCM sets DTC P169A if authentication between PCM and SMARTRA has been failed

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	•	• Locking of SMARTRA
Enable Conditions	• IG ON	
Threshold value	• Virgin SMARTRA at Learnt EMS • Neutral SMARTRA at Learnt EMS • Incorect the Authetication of EMS and SMARTRA • Locking of SMARTRA	
Detecting time	• -	

Diagnostic Circuit Diagram



Monitor Scantool data

1. Connect scantool to Data Link Connector(DLC).
2. IGN "ON" & Engine "OFF"
3. Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

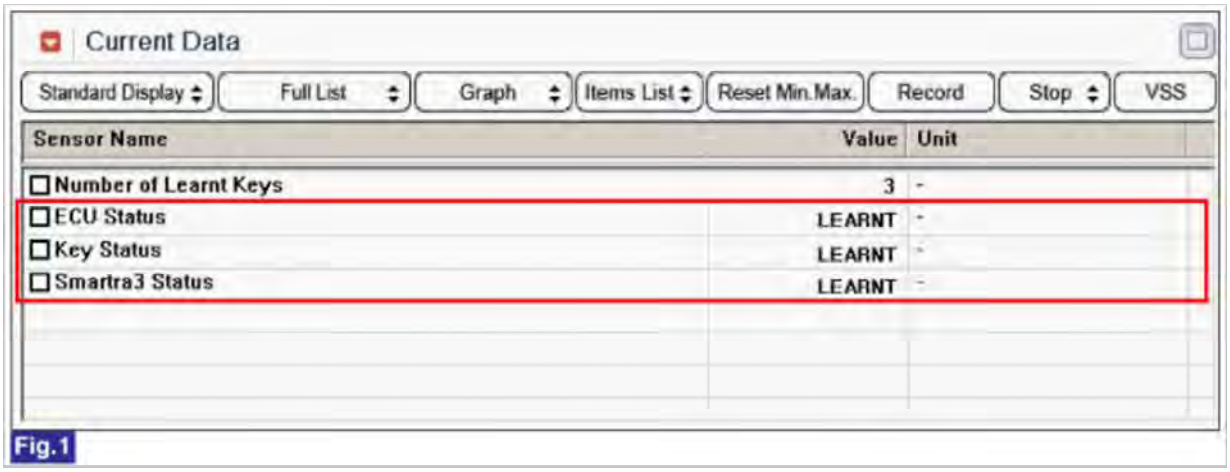


Fig.1) The current data in normal state

4. Is "ECU STATUS' Parameter "Locked"?

YES	▸ Keep "KEY ON" status for 1 hours to withdraw "Locked by Timer" status. Then register transponder and go to "Verification of Vehicle Repair" 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.

Verification of Vehicle Repair

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

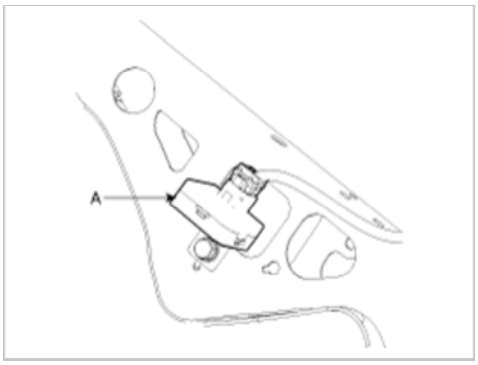
1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES	▸ Go to the applicable troubleshooting procedure
NO	▸ System is performing to specification at this time.

Body Electrical System > Immobilizer System > Immobilizer Control Unit > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad.
   (Refer to the Body group - "Crash pad").
3. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening a nut.



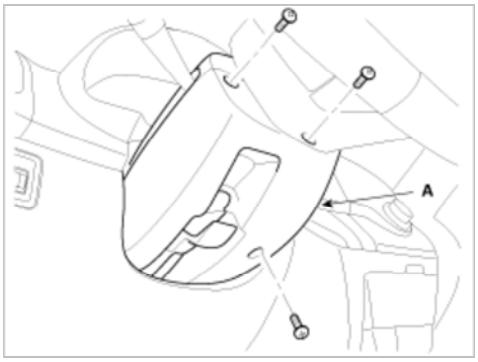
Installation

1. Install the immobilizer control unit after connecting the unit connector.
2. Install the crash pad.

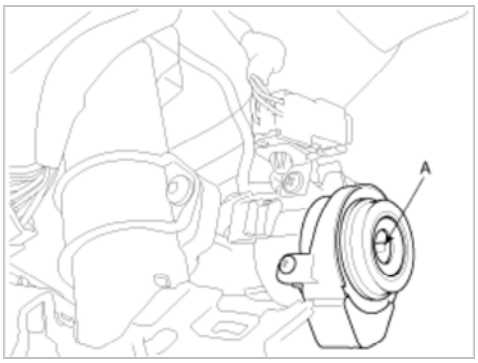
Body Electrical System > Immobilizer System > Antenna Coil > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds(A).
   (Refer to the ST group - "Steering column and shaft").



3. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A) after loosening the screw.



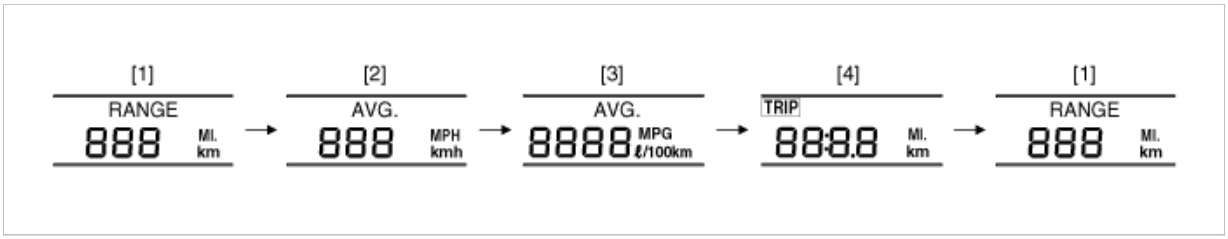
Installation

1. Install the coil antenna and connect the 6P connector.
2. Install the steering column upper and lower shrouds.

Body Electrical System > Trip Computer > Description and Operation

Description

The trip computer displays information related to driving, including distance to empty, average speed and average fuel consumption on this display.
To change the function as described below, push the mode button less than 2 second.
Distance to empty [1] → Average fuel consumption [2] → Average speed [3] → TRIP [4] → Distance to empty [1].

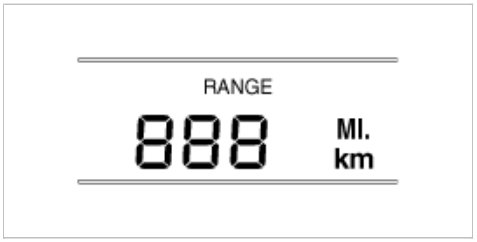


Operation

Function

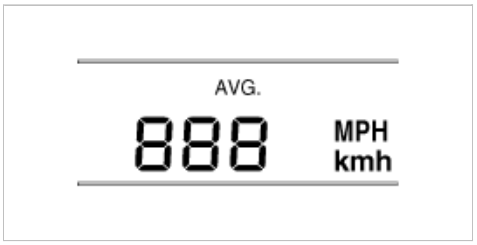
Item	Function	Detection	Remark
Distance to empty	The estimated distance indication to empty	Fuel sender	1Km(1mile)
Average fuel consumption	The average fuel consumption indication since the last driving time reset	Fuel sender	0.1L
Average speed	The average speed indication since the last driving time reset	Speed sensor	1Km/h(1MPH)

Distance to empty mode



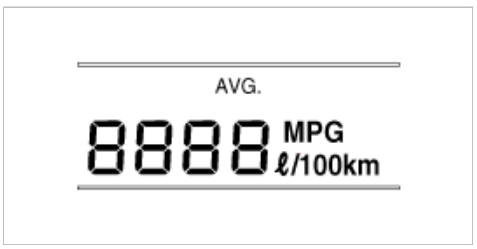
1. Description
   This mode indicates the estimated distance to empty based on the current fuel in the fuel thank and the amount of fuel delivered to the engine.
2. Indication range : 50Km ~ 999Km(30miles ~ 999miles)
3. Indication division : 1Km(mile)
   When the remaining distance is below 50Km (30miles), a blinking "---" symbol will be displayed. (Blinking interval : 1.0sec.)
4. Data clear : at battery + off

Average fuel consumption mode



1. Description
   This mode calculates the average fuel consumption from the total used fuel and the distance after reconnecting the batter or resetting the data.
2. Indication range : 0.1L ~ 199.9L/100Km or MPG(mile per gallon)
3. Indication division : 0.1L/100Km(MPG)
   When there is no pulse signal on vehicle speed after reconnecting the battery or resetting the data, "---L/100Km (MPG)" symbol will be displayed.
4. Indication interval : 10 sec.
5. Data clear: press the reset button for more than 1 sec. or Battery + on

Average speed mode

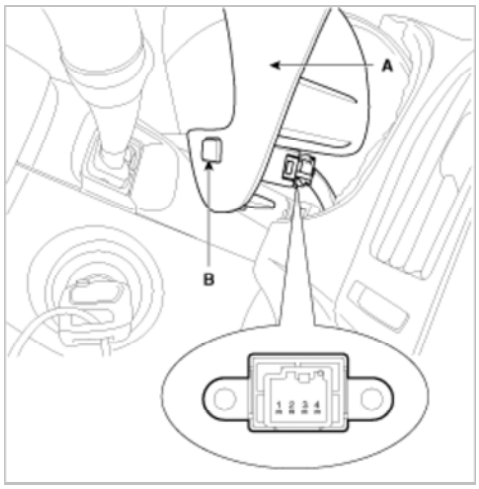


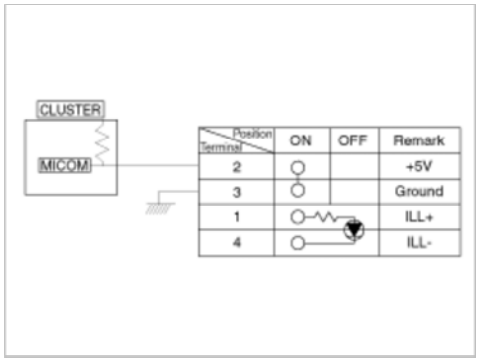
1. Description
   This mode indicates the estimated speed by the driving distance to the indication timing after reconnecting the batter or resetting the data.
2. Indication range : 0 Km/h(MPH) ~ 999 Km/h(MPH)
3. Indication division : 1Km/h(MPH)
   When the battery is reconnected or the data are reset, "---" symbol will be displayed until display timing.
4. Indication interval : 10 sec.
5. Data clear: press the reset button for more than 1 sec. or Battery + on

Body Electrical System > Trip Computer > Repair procedures

Inspection

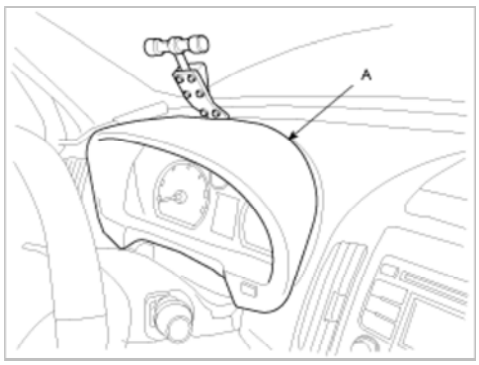
1. Remove the cluster facia panel (A).
2. Operate the switch (B) and check for continuity between terminals with an ohmmeter.



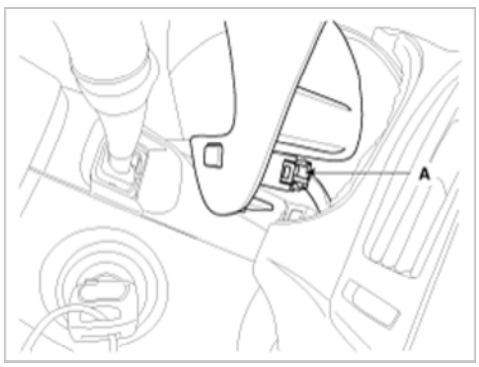


Removal

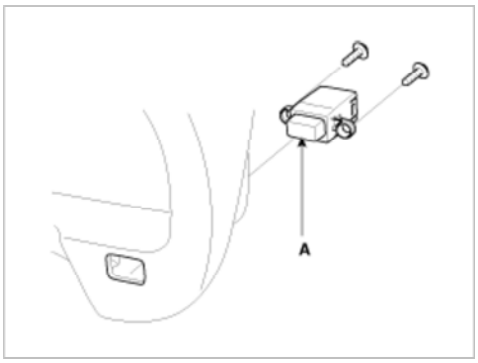
1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel (A) after loosening 2 screws.



3. Disconnect the trip computer connector (A).



4. Remove the trip computer switch (A) from the cluster facia panel after loosening 2 screws.



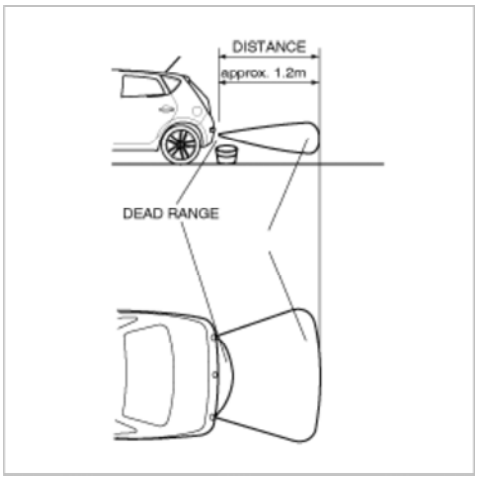
Installation

1. Install the trip computer to the cluster facia panel.
2. Install the cluster facia panel.

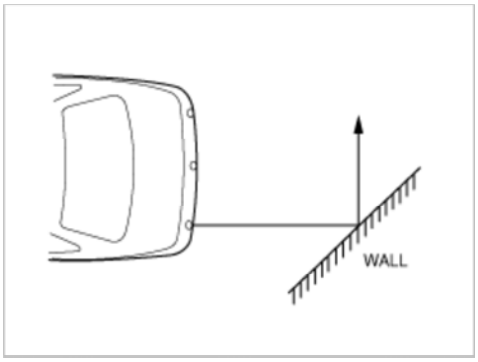
Body Electrical System > Rear Parking Assist System > General Safety Information and Caution

Warning

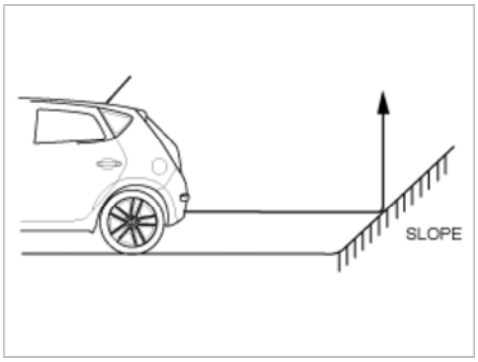
1. Range detected by back sensors is limited.
   Watch back before reversing.
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.
3. Besides there are some materials unable to be detected even in detection range as follows.
   (1) Needles, ropes, rods, or other thin objects.
   (2) Cotton, snow and other material absorbing ultrasonic wave(for example, fire extinguisher device covered with snow)



4. Reversing toward the sloped walls.



5. Reversing toward the sloped terrain.



6. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Be sure to check for the safety.
   Ultrasonic sensor cannot discriminate among glass, stake, and rock.
7. Sensors may not operate correctly in the below conditions.
   Ensure sensors clean from mud or dirt.
   (1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water.
   Do not wipe or scrape sensor with a rod or a hard object.
   (2) If the sensor is frozen, alarm may not operate until sensor thaws.
   (3) If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.
   (4) When heavy cargo is loaded in tailgate, it changes the vehicle balance, which reduces the detection range.
   (5) When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.
   (6) Under heavy rain.
   (7) When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite of no barrier)
   (8) If radio antenna is installed at the rear.
   (9) If the vehicle rear wiring is re-routed or electrical component is added at the rear part.
   (10) Vehicle balance is changed due to the replacement of the rear spring.
   (11) The unit will operate normally when the vehicle speed is 5km/h or less. Above the speed, the unit may not operate normally.
8. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.
9. Be careful not to apply shock during sensor installation on the transmission or reception unit.
10. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not the change the transmission and reception unit wiring. Tagging the transmission side and reception side, it may cause malfunction.
11. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.
12. Be careful that heating or sharp objects shall not touch ultrasonic sensor surface.
    Besides do not cover the sensor opening or press the sensor.

Body Electrical System > Rear Parking Assist System > Specifications

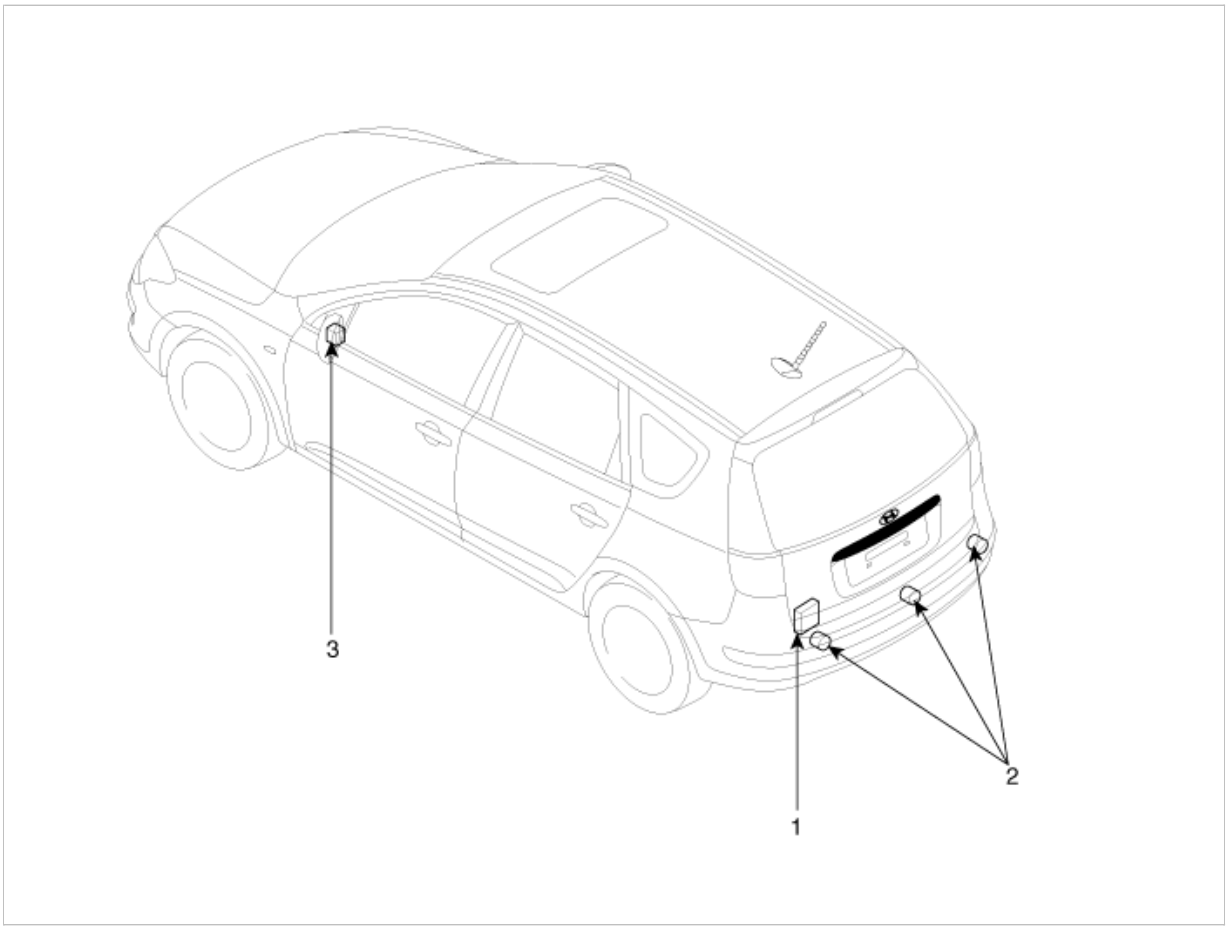
Specification

Item		Specification
Rear parking assist system control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 500 mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage rating	DC 8 V

	Detecting range	40 cm ~ 120 cm
	Operation voltage	DC 9 ~ 16 V
	Operation current	MAX 20 mA
	Operation temperature	-30°C ~ + 80°C
	Beam width	Horizontal : 100±5°(70cm), Vertical : 60±5°(50cm)
	Number of sensors	3 (Right, center, Left)
Piezo buzzer	Voltage rating	DC 12 V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30°C ~ + 80°C
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.2±0.5 KHz
		Sound level : MIN 65 dB (DC 13V /m)

Body Electrical System > Rear Parking Assist System > Components and Components Location

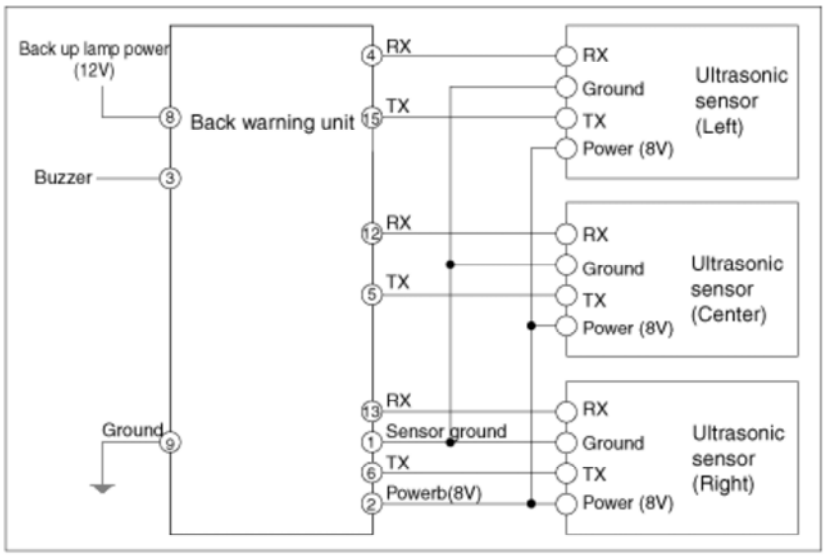
Component Location



1. Rear parking assist system control unit 2. Ultrasonic sensor	3. Buzzer

Body Electrical System > Rear Parking Assist System > Schematic Diagrams

Circuit Diagram



(Rear parking assist system control unit connector)

(Ultrasonic sensor connector)

Pin configuration

Pin No.	Signal	Test : Desired result
1	Sensor ground	0V
2	Sensor power	8V (While operating)
3	Buzzer	0V (While operating)
4	RX - Sensor(Left)	0~1V voltage change (Inspect waveform)
5	TX - Sensor(Center)	0~3V voltage change (Inspect waveform)
6	TX - Sensor(Right)	0~3V voltage change (Inspect waveform)
8	Back up lamp power	12V (While shifting to "R")
9	Ground	0V
12	RX - Sensor(Center)	0~1V voltage change (Inspect waveform)
13	RX - Sensor(Right)	0~1V voltage change (Inspect waveform)
15	TX - Sensor(Left)	0~3V voltage change (Inspect waveform)

PIN NO	SIGNAL
1	TX
2	RX
3	8V
4	GND

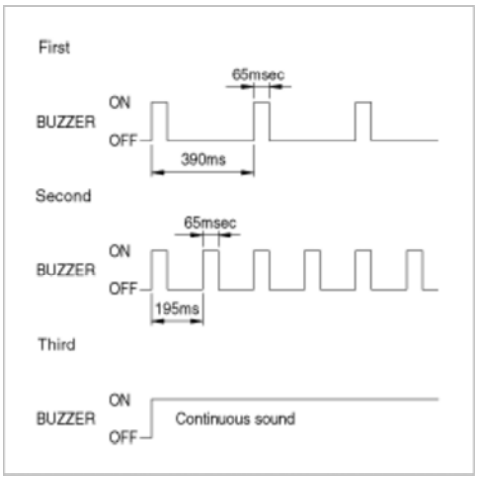
Body Electrical System > Rear Parking Assist System > Description and Operation

Description

When reversing, the driver usually cannot see objects in the blind spots and cannot determine the distance from the object. In order to provide the driver safety and convenience, rear parking assist system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third alarm).

Alarm Range

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.
First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm ± 15cm
Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm ± 10cm
Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm ± 10cm



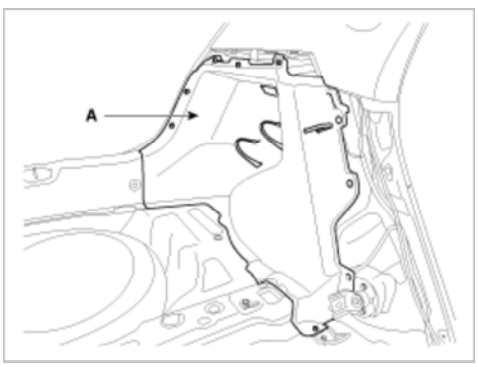
NOTE

1. Time tolerance of the above waveform : Time ± 10%
2. At nearer distance than 40cm, detection may not occur.
3. Alarm will be generated with vehicle reversing speed 10km/h or less.
   For moving target, maximum operation speed shall be target approach speed of 10km/h.
4. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
5. Misalarm may occur in the following conditions.
   - Irregular road surface, gravel road, reversing toward grass.
   - Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
   - When a wireless transmitter is used near to the sensor.
   - Dirt on the sensor.
   - Sequential alarm may not occur due to the reversing speed or the target shape.

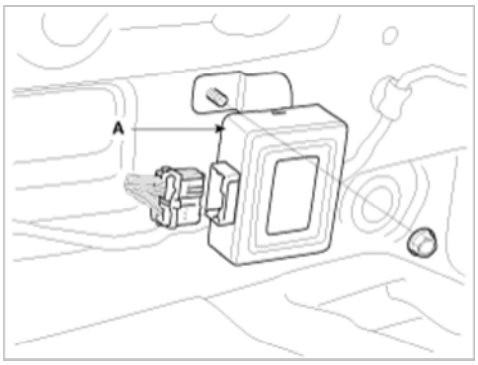
Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the left side trim(A) of the trunk room.
   (Refer to the Body group - "Interior trim")



3. Loosen a mounting nut and disconnect the connector.
4. Remove the rear parking assist system control unit (A).



5. Installation is the reverse of removal procedure.

Body Electrical System > Rear Parking Assist System > Parking Assist Sensor > Description and Operation

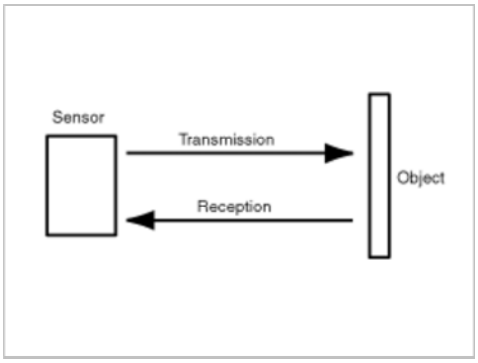
Operation Principle

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

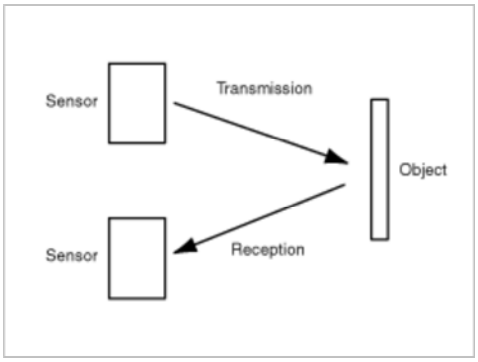
Distance Detection Type

Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.

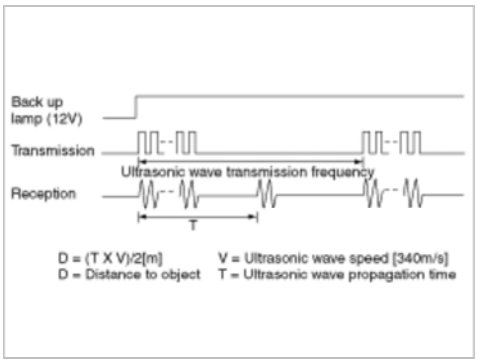


2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



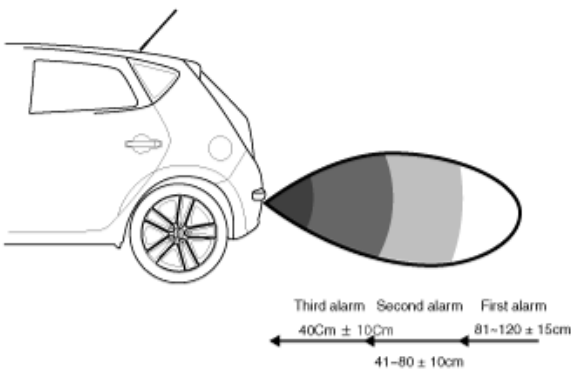
Measurement Principle

Rear parking assist system is a complementary device for reversing. Rear parking assist system detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.
The propagation speed formula of ultrasonic wave in air is following :
v=331.5 + 0.6t (m/s)
v=ultrasonic wave propagation speed
t=ambient temperature
The basic principle of distance measurement using ultrasonic wave is :



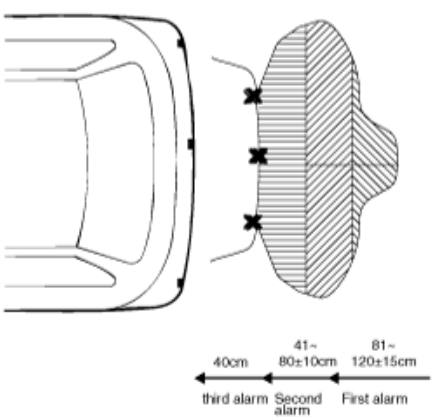
Sensor detection range

[Vertical range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10Cm
2. Detection tolerance
   At 40cm :45˚ ± 15˚
   At 80cm : 30˚ ± 15˚
   At 120cm : 20˚ ± 15˚
3. At nearer distance than 40cm detection may occur.
4. Measurement condition : Room temperature (20℃), 140mm diameter, 1m length rod.

[Horizontal range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10cm
2. Detection tolerance
   At 80cm : 90˚ + 20˚
   At 120cm : 10˚ + 20˚
3. At nearer distance than 40Cm detection may occur.
4. Measurement condition : Room temperature (20℃), 140mm diameter, 1m length rod.

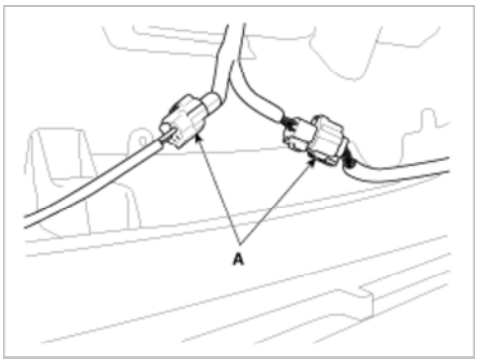
NOTE

1. 14cm (dia.) plastic rod is used for the test target.
2. The test result may differ by a different target object.
3. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
4. The following object may not be detected.
   - Sharp object or thin object like rope.
   - Cotton sponge, snow or other materials absorbing sonic wave.
   - Smaller objects than 14cm (dia.), 1m length.

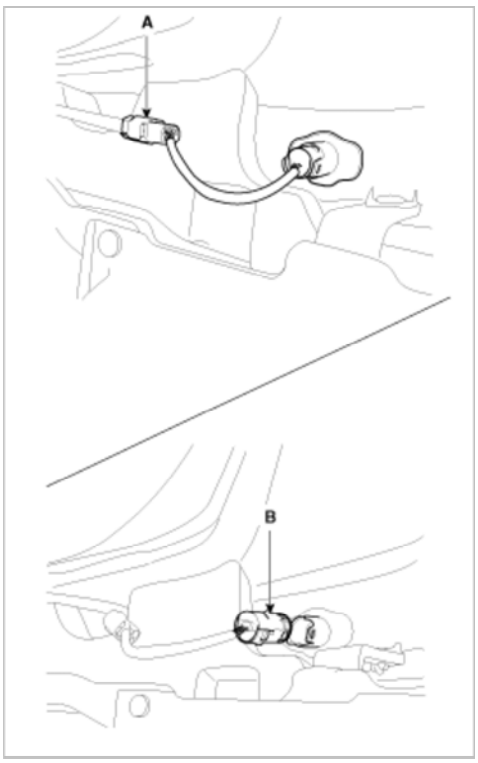
Body Electrical System > Rear Parking Assist System > Parking Assist Sensor > Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to the Body group - "Rear bumper")
3. Disconnect the connectors (A) from the rear bumper.



4. Disconnect the sensor connector (A) at the inside of the rear bumper, and then remove the sensor (B) from the housing.



5. Installation is the reverse of removal procedure.

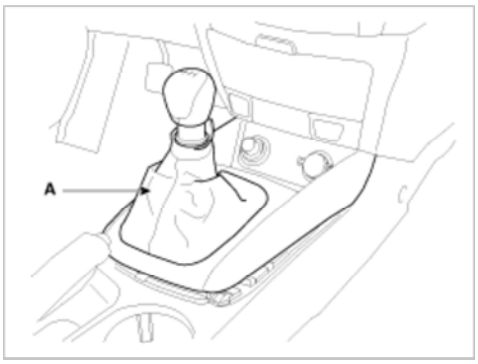
Body Electrical System > Rear Parking Assist System > Buzzer > Repair procedures

Inspection

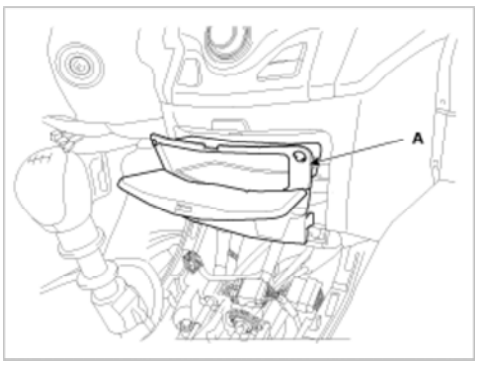
Test the buzzer by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The buzzer should make a sound. If the buzzer fails to make a sound, replace it.

Replacement

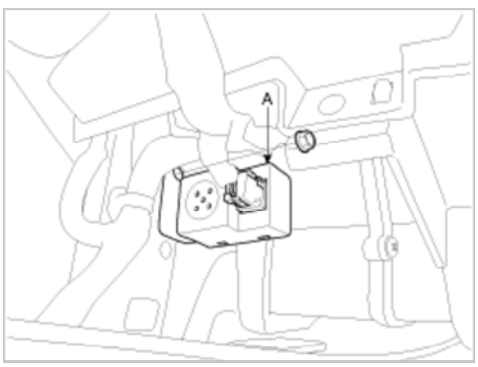
1. Disconnect the negative (-) battery terminal.
2. Remove the center console upper cover (A).
   (Refer to the Body group - "Crash pad")



3. Remove the center facia lower tray (A) after loosening 2 screws and disconnecting the connectors.



4. Remove the buzzer (A) after loosening the nut and disconnecting the 2P connector.

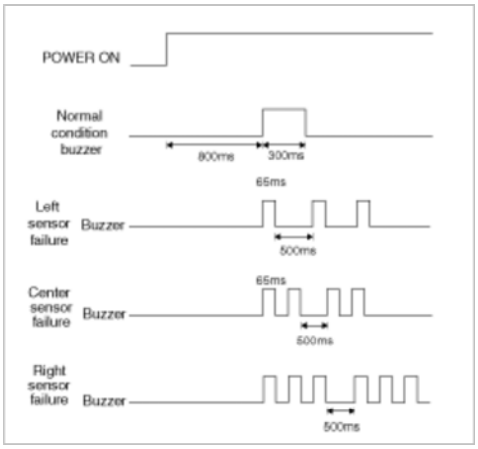


5. Installation is the reverse of removal procedure.

Body Electrical System > Rear Parking Assist System > Troubleshooting

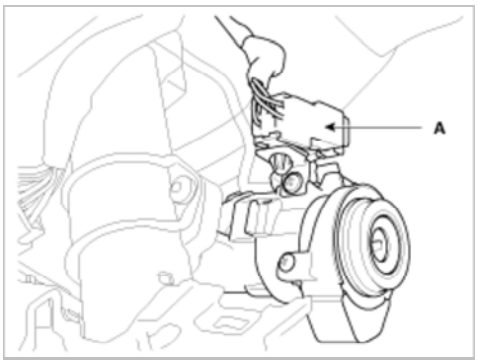
Diagnosis

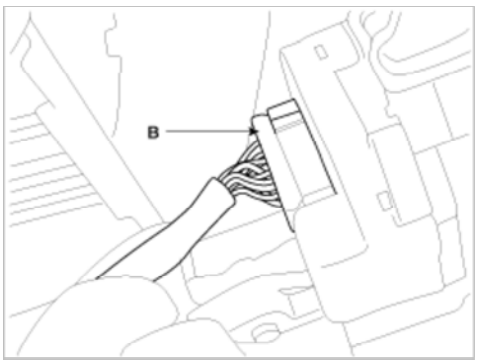
1. Operate with ignition switch on and shift the lever to position "R"
2. Then it checks the system condition.
   If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.8 seconds from power approval. In case of system failure, then it indicates the failed point as follows.
   A. Left sensor failure : beep-beep-beep
   B. Center sensor failure : beep beep-beep beep-beep beep
   C. Right sensor failure: beep beep beep-beep beep beep-beep beep beep
3. Alarm is generated 3 times sequentially.
4. Effective operation range is 10km/h or less for the vehicle speed.



Body Electrical System > Ignition Switch Assembly > Repair procedures

Inspection





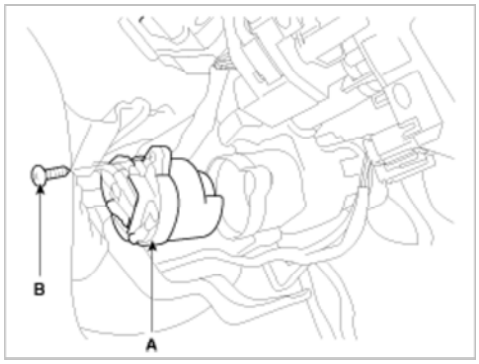
1. Disconnect the ignition switch connector (B) and key warning switch connector (A) from under the steering column.
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

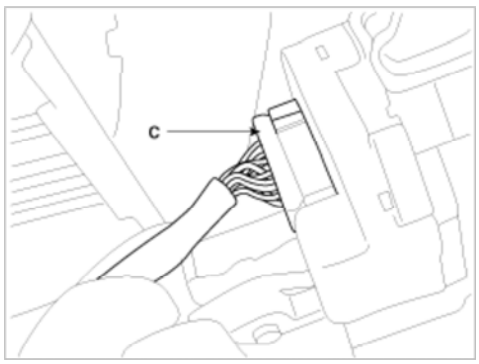
TERMINAL / POSITION	KEY	IGNITION SWITCH (B) 2	4	6	5	3	1	STEERING TRAVEL	TRAVEL	KEY WARNING SWITCH (A) 5	6	KEY HOLE ILLUMINATION(A) 3	4
LOCK	REMOVAL							LOCK					
	INSERT							LOCK	UNLOCK				
ACC		○—○						UNLOCK		○—○			
ON		○—○	○	○	○—○								
START		○	○	○	○	○	○						

Removal

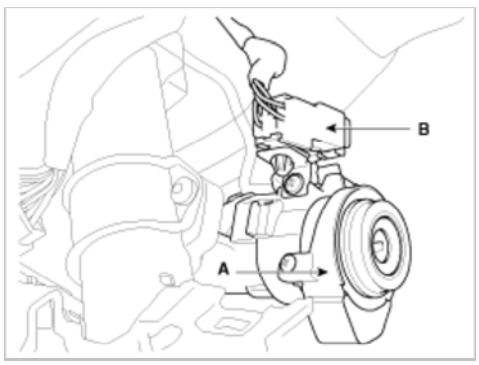
1. Disconnect the negative (-) battery terminal.

2. Remove the steering column upper and lower shrouds.
   (Refer to ST group - "Steering columin and shaft").
3. Remove the ignition switch (A) after loosening the screw (B) with IG ON and disconnecting the 6P connector (C).

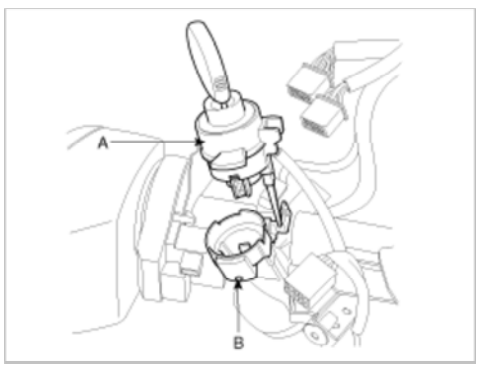




4. Remove the door warning switch and key illumination lamp (A) after loosening the screw and disconnecting the 6P connector (B).



5. If it is necessary to remove the key lock cylinder (A), Remove the key lock cylinder after pushing lock pin (B) with key ACC.



Installation

1. Install the key lock cylinder.
2. Install the door warning switch and key illumination lamp.
3. Install the ignition switch.
4. Install the steering column cover.